Radio Network Tuning and Optimization UMTS

Differences compared to 2G

- **In General**

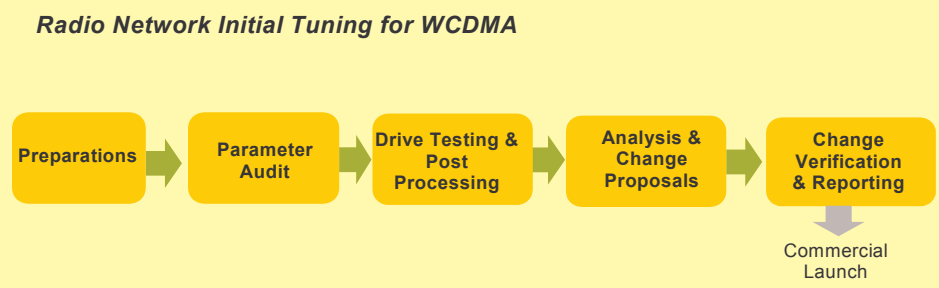
- The Technology is more complicated (Overlapping cells, soft hand over, power control, cell breathing etc)
- High performance requirements on products (UE & Network nodes)
- **In Particular for Tuning & Optimization**
- Co-located GSM/3G sites
- Shared Antenna System
- Inter-working with GSM

Tuning or Optimization, What is the difference

- **During Tuning**
  No traffic in the network, No subscribers
  Network tuned only based on drive test data
  Labour intensive with repeated drive test
  All is about Pre-launch activities
- **During Optimization**
  Commercial traffic, subscribers using the network
  Statistics used widely to monitor network performance
  Drive testing just in case
  All is about Post–launch activities

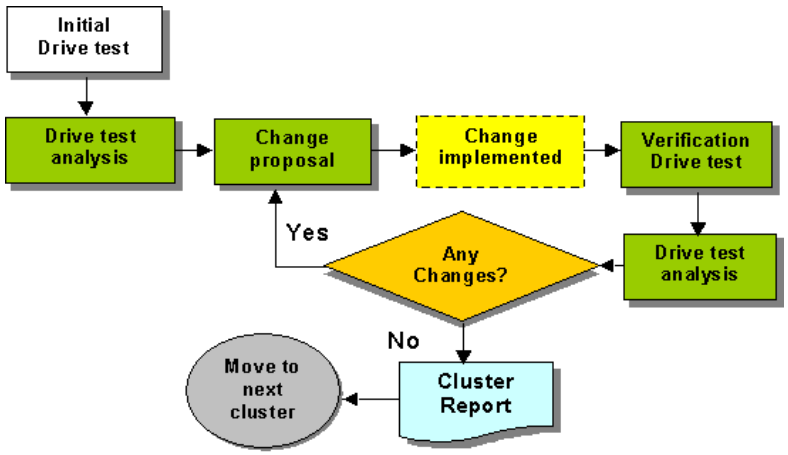
3

Tuning Process Flow



4

Tuning Process Flowchart



5

Tools For Tuning/Optimization & Data Post Processing

Active measurement needed due to lack of statistics

- TEMS Investigation for WCDMA (Software)
- TEMS Scanner (Software + HW)
- External GPS
- User Equipment (UE)
- TEMS DeskCat for post processing
- MCOM3g/Mapinfo
- MS Access/Excel based tools

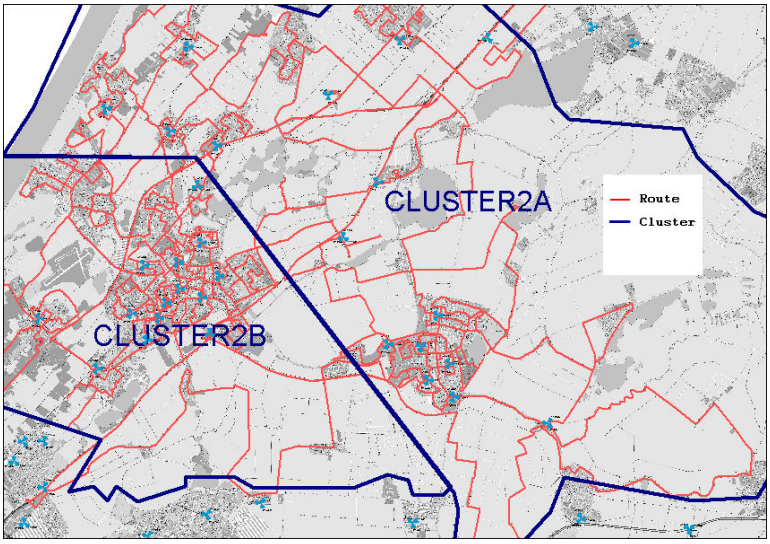
6

Drive test tools configuration

Drive Test Equipments for Voice, CS64 & PS call

7

Drive Test Routes



8

PILOT TUNING

The basic measurements of scanner are

- CPICH_RSCP (received signal code power)
- CPICH_Ec/No (received energy per chip divided by the power density in the band)
- RSSI (received signal strength indicator)

What can you achieve with scanner?

- Crossed feeder issues (DL)
- Coverage verification
- Interference problems (overshooting cell, pilot pollution)
- Missing neighbours

9

COVERAGE VERIFICATION - Primary Common Pilot Channel

Verify P-CPICH detection to minimize coverage holes

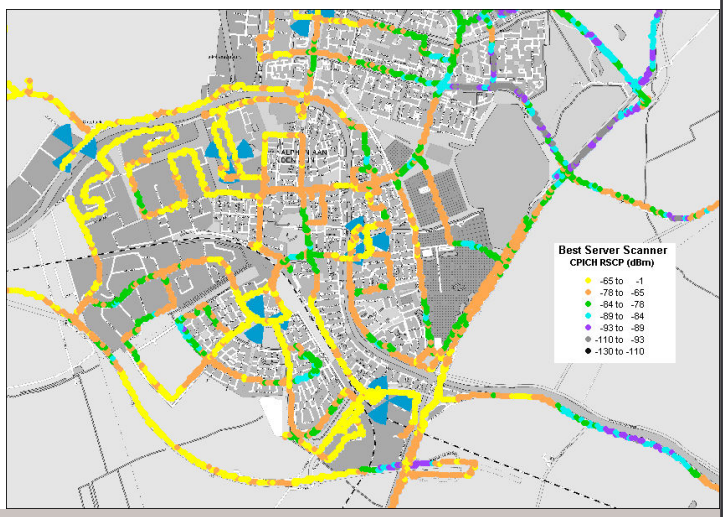
- **P-CPICH RSCP**
- **P-CPICH Ec/No**

Coverage level	*RSCP* [dBm]	E_c/N_0 [dB]
Sufficient	$RSCP \geq -100$	$E_c/N_0 \geq -14$
Poor	$-115 \leq RSCP < -100$	$-16 \leq E_c/N_0 < -14$
No coverage	$RSCP < -115$	$E_c/N_0 < -16$

10

Best Server Signal Strength (RSCP)

- Yellow is good
- Blue can generate problems
- Grey is bad



11

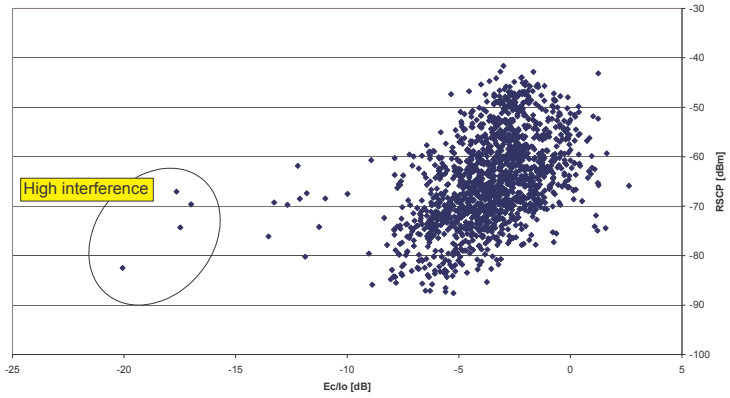
Pilot Ec/No Measurements

- Green is good
- Blue can generate problems
- Orange is bad

12

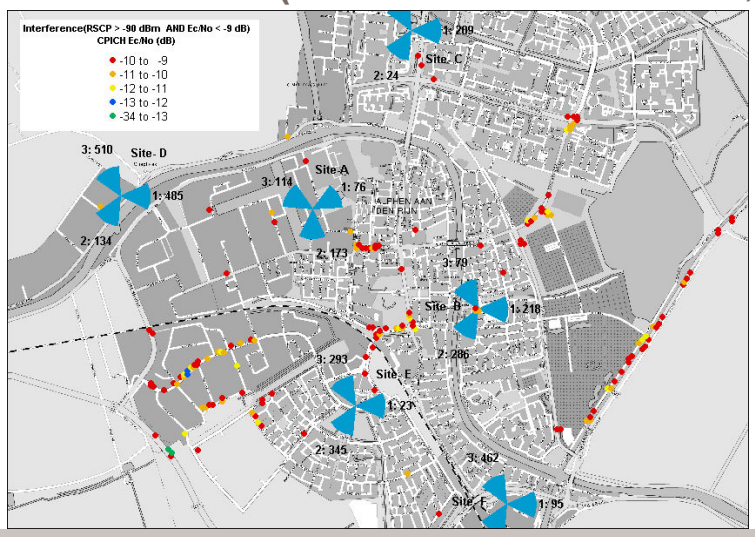
INTERFERENCE

By correlating low Ec/No with high RSCP, areas with high interference can be detected



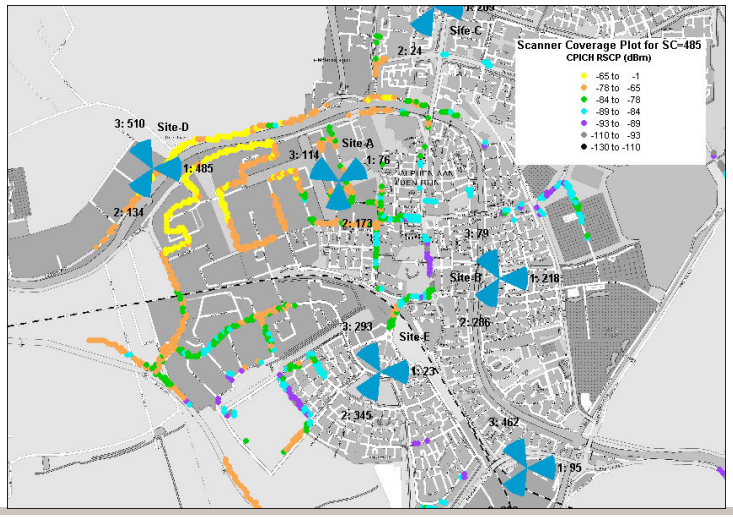
13

INTERFERENCE (RSCP > -90 dBm AND Ec/No < -9 dB)



14

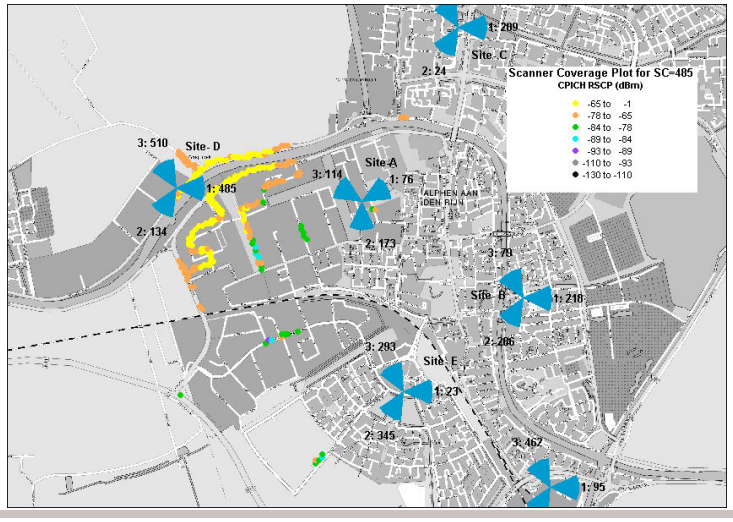
Primary Common Pilot Channel (P-CPICH) – OVERSHOOTING



15

OVERSHOOTING

Change Proposal: Site-D, Sector-1, Antenna Down-tilt 8 Degrees



16

Primary Common Pilot Channel (P-CPICH) – PILOT POLLUTION

High CPICH reception levels from many Cells, (more than MAX_ACTIVE_SET)

- P-CPICH RSCP
- P-CPICH Ec/No

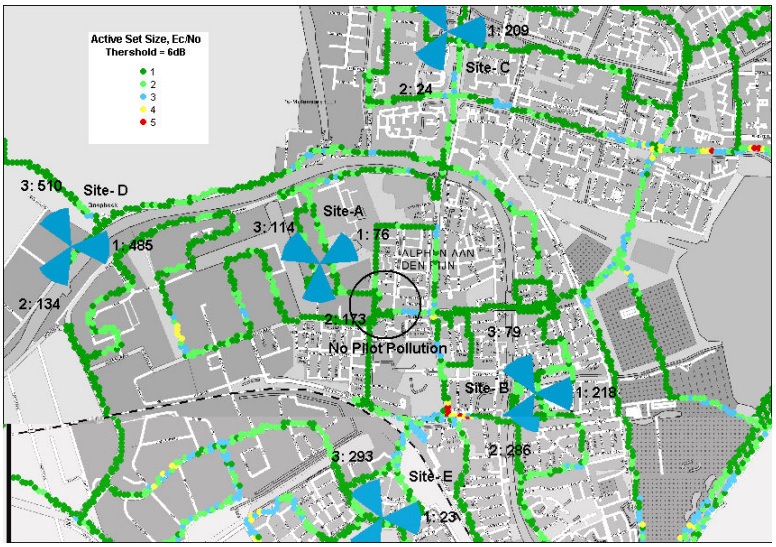
$$Pilot\ count(\frac{E_c}{N_0} \geq \frac{E_c}{N_{0\ serving}} - threshold) > AS_{size}$$

17

PILOT POLLUTION

18

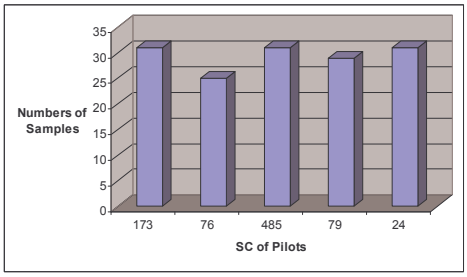
PILOT POLLUTION



PILOT POLLUTION
Change Proposals

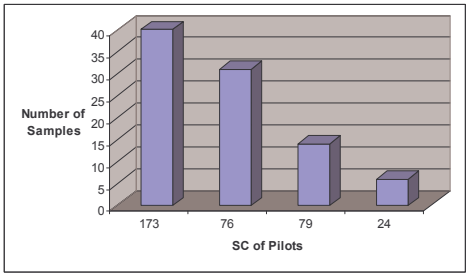
Site Name	Sector Number	SC of Pilot	Height of Antenna (meters)	Antenna Tilts (degree)	Proposed Antenna Tilts (degree)
A	1	173	38	2	5
A	2	76	38	2	4
D	1	485	47.3	2	8
C	2	24	39.2	3	5
B	3	79	27	2	3

PILOT POLLUTION



Initial Drive Test (before tuning)

Verification Drive Test (after tuning)



21

UE TUNING

- Voice /Video/PS calls
  - Long calls
  - short calls
- Identify problem areas
  - Blocked calls
  - Dropped calls
  - Delay/Throughput

22

Short Calls Analysis

Set-up a call and maintain it for a pre-defined time duration (for 15-60 s)

Call set-up failure and drops during short calls can be mainly used to analysis Accessibility failure due to:

- UE Failure
- Unsuitable Parameters Setting
- Coverage Problem
- Interference
- Others

23

Long Calls Analysis

Set-up a call and maintain it until it is drop (used for the analysis of Retainability performace)

Drops during long call can be used to identify:

- Missing Neighbor Relation
- Coverage Problem
- UE Problems
- Network Characteristics
- Best Parameter Setting
- Others

24

KEY PERFORMANCE INDICATORS

- Accessability (Call set-up success rate)
- Retainability (Dropped calls)
- Mobility (Handover success rate)
- Integrity (BLER and throughput)

25

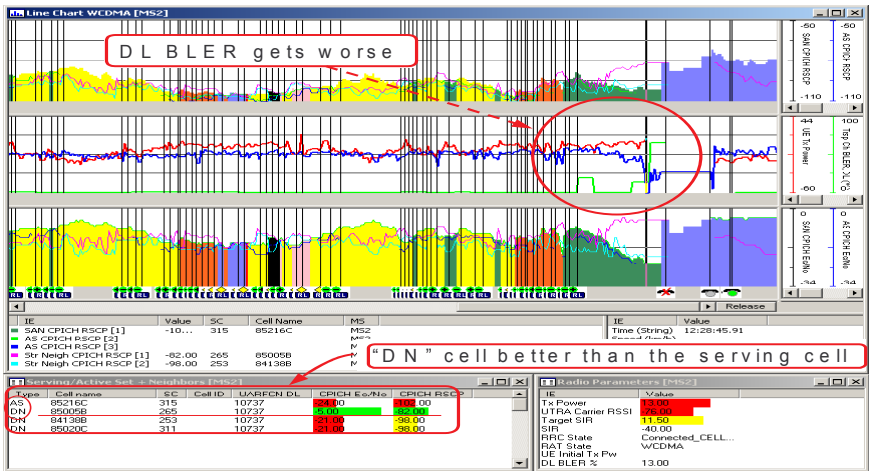
Case 1: Drop due to missing neighbor

Problem: Detected Neighbor (DN)

- UE sends a Measurement Report that contains an event1a means adding a new RL (cell) to Active Set
- If the reported cell is not in the current neighbor cell list and the reported Ec/No is better than the best serving cell Ec/No in AS by some dBs (set by a RNC parameter)
- If for any reason the new cell can not be added to AS, call will be released

26

Case 1: Drop due to missing neighbor



27

Case 2: Drop due to Poor Coverage (low RSCP)

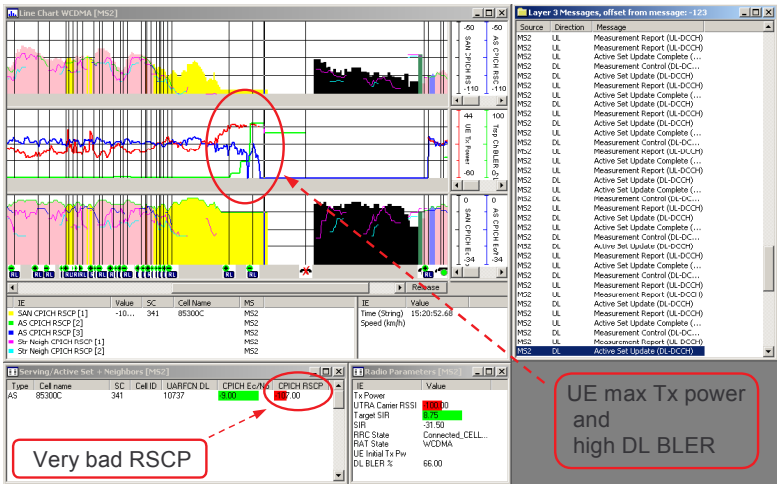
Problem: Poor DL coverage

When UE gets to an area with low RSCP (< -105 dBm) regardless Ec/No values there is high risk for drop.

UE will likely ramp up the transmitted power and reach its max power. The DL BLER will probably increase and SIR target cannot maintain anymore, finally the call drops.

28

Case 2: Drop due to DL Poor Coverage



29

Case 3:
PS: Session Error due to Poor DL Coverage

UE enters a very low coverage area (RSCP < – 105 dBm).

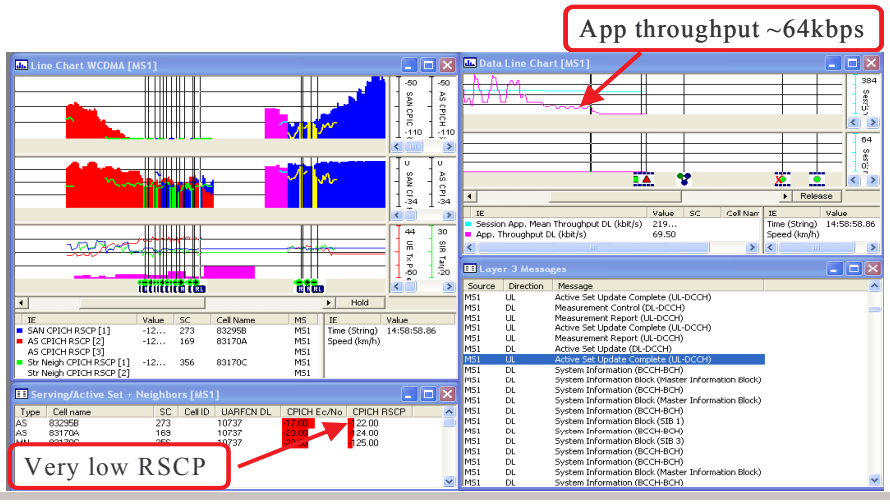
The packet connection is carried on a 64/64 DCH Channel as consequence of the low coverage conditions.

The UE will likely ramp up its power to the maximum, goes to Idle Mode and the Application and RLC throughputs go to zero.

At this point the RAS application will start the Session Timeout timer, if the throughput is not resumed the Session Error event is triggered with cause “session timeout”.

30

PS: Session Error due to Poor DL Coverage



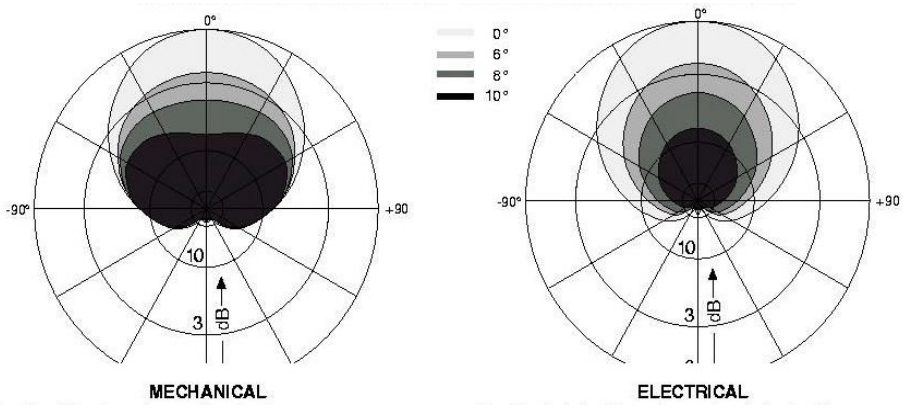
31

FINAL WORDS

- For network tuning, we need to relay on field measurements which require extensive drive tests
- Finding the best possible configuration for antenna heights, tilts, azimuths and parameter setting for all the present cells/sectors in the network and also for any new sites that might be needed to improve coverage
- Power adjustment can also be used for network tuning but can become complicated and result in poor network performance
- Use of Remote Electrical Tilt (RET) Antenna is preferred over mechanical tilt antenna
- Neighbour definition is of prime importance in UMTS network (Soft handover gain and interference reduction). Keep neighbour list upto 20.
- Automated tools are needed that could suggest the best possible neighbour relations, antenna heights and tilts by using both the field measurements and the propagation models & simulations
- Skilled people, right methods and advanced tools are needed to perform 3G tuning and optimisation

32

Comparison of Mechanical and Electrical Down-tilts



33