



*Making Wireless Better*

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## TEMS Portfolio Advantages

- Market leaders – proven concept
- Products help improve QoS and reduce costs
- Strong R&D to support market demands
- 10+ years experience
- 400+ customers
- 5 different continents
- Multi-technology, 3G
- Multiple patents

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## Addressing Today's Market

- The operator's goal: growth and cost control
- TEMS has solutions to reach those goals
  - Improve efficiency – share data across organization
  - Collect enough data to take appropriate actions
  - Design smarter systems
  - Access information easily
  - Gauge true subscriber perspective & experiences
  - Integrate data from different sources
  - Do more with existing resources
  - Improve Quality of Service

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## Our Offerings

- Tools for every stage of a network's lifecycle
- Products for 2G, 2.5G, and 3G
- Support for all major technologies
- Exchange of data between products
- Services and solutions that
  - Leverage our wireless network expertise
  - Promote efficiency for operators
  - Provide valuable assistance and services

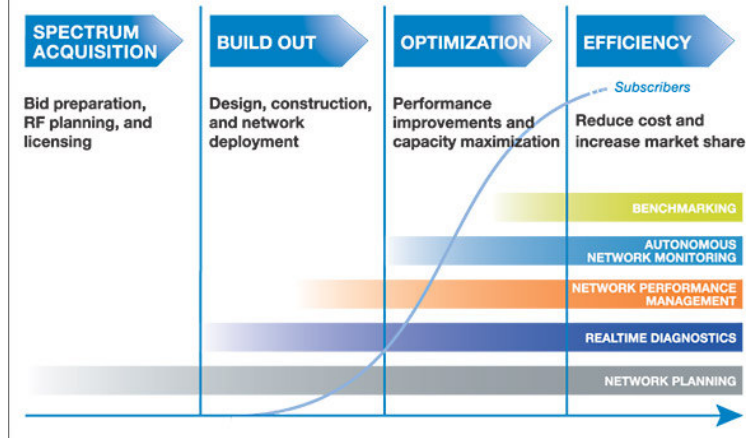
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# TEMS™ Optimization Solutions

TEMS – Addressing all phases of a network's lifecycle



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## Flexibility and Scalability

*allow networks to grow without growing pains*

- Reliable networks require good planning
  - Accurately predict the network's future
  - Simulate potential scenarios
  - Optimize the current service offering
  - Meet quality, availability, and cost objectives



**Solution:** Network Planning Tools from Ericsson TEMS  
*Tools for dimensioning, planning, and tuning*

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## Network Planning

*Tools for dimensioning, planning, and tuning*



- TEMS CellPlanner Universal
  - Ericsson's recommended WCDMA planning tool
  - Improved accuracy of the network plan
  - Reduced expenses
- TEMS LinkPlanner
  - Unique point-to-point and point-to-multi-point radio transmission network planning and management

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## Revenue and Customer Satisfaction

*are the goals of every network operator*

- Network quality generates revenue
  - Maintain and troubleshoot the network
  - Introduce high-quality services
  - Improve time-to market



**Solution:** Realtime tools from Ericsson TEMS  
*Tools for troubleshooting and on-the-spot analysis*

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## Realtime Diagnostics

*Tools for troubleshooting and on-the-spot analysis*

- TEMS Investigation
  - Industry-leading air interface test tool
  - Intelligent user interface
  - Complete system measurements
  - Constant R&D for cutting-edge performance
- TEMS DeskCat
  - Post-processing of critical data
  - Visualization of RF problems
  - Increased productivity



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## Realtime Diagnostics

- TEMS DriveTester
  - Optimized for in-vehicle testing
  - Powerful collection with an intuitive user-interface
  - Fully adjustable for safety and convenience
- TEMS Pocket
  - Truly portable air interface test tool
  - Always available, wherever you go



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# Knowledge

*is power, especially regarding network performance*

- Understanding network data leads to smooth operation
  - Foresee trends and make proactive plans
  - Identify, analyze, and present network problems
  - Handle huge amounts of data efficiently



**Solution:** Network Performance Management tools from Ericsson TEMS  
*Facilitates optimal planning and resource utilization*

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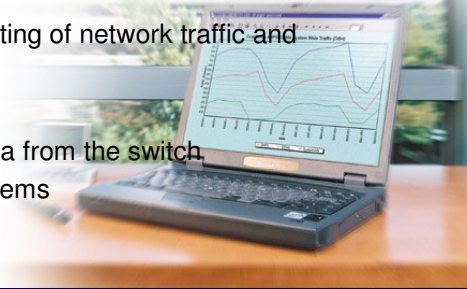
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# Network Performance Management

*Facilitates optimal planning and resource utilization*

- TEMS CellSight
  - Automatic collection of large volumes of data from network infrastructure
  - Flexible and scalable data handling from even the largest networks
  - Trouble resolution and forecasting of network traffic and capacity
- TEMS Visualization
  - Post-processing of R-PMO data from the switch
  - Support for Ericsson OSS systems



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## Quality of Service

*is the difference between a satisfied customer and a former customer*

- Ensure QoS from the subscriber's perspective
  - Proactive measurements
  - System-wide, 24/7 measuring and testing
  - Reduced costs and more efficient use of highly-trained personnel
  - Information for every level of the organization



**Solution:** Autonomous Monitoring systems from Ericsson TEMS  
*Systems for continuous network-wide measurements and analysis*

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## Autonomous Network Monitoring

*Systems for continuous network-wide measurements and analysis*

- TEMS Automatic
  - Completely automated
  - MTU-based to cover the whole network
  - Around-the-clock, end-to-end measurements
  - Analyses for the whole organization



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## Conclusion

- TEMS measures QoS from a subscriber's perspective
- The most complete product portfolio on the market for planning and optimization of 2G, 2.5G, and 3G networks
- Multi-vendor, multi-technology
- Ericsson commitment, strength, and future direction

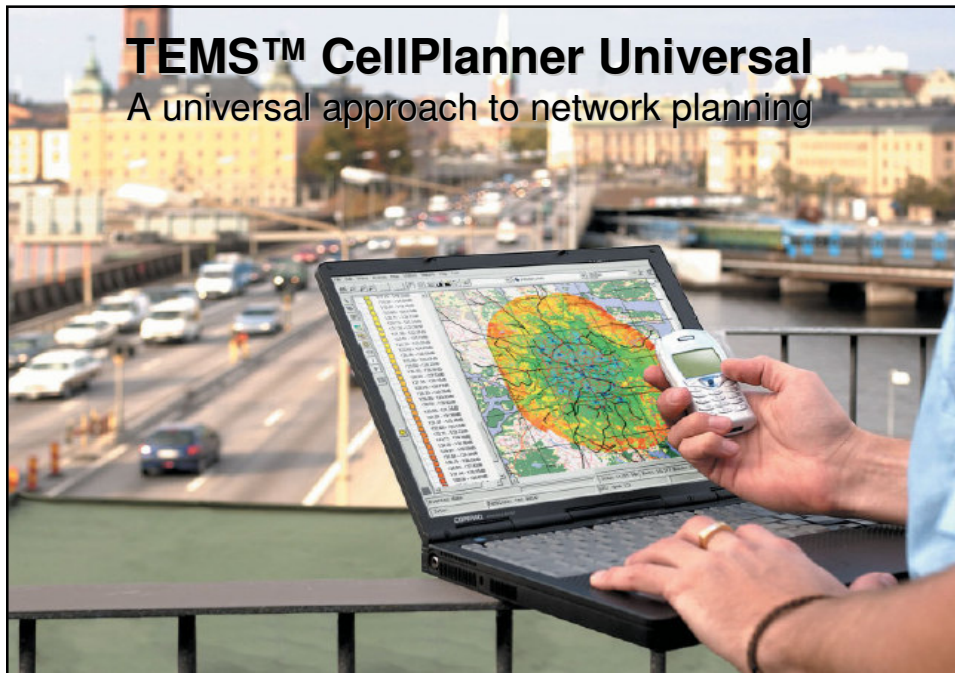
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## TEMS™ CellPlanner Universal

A universal approach to network planning



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## Key Features

- Support for GSM/GPRS/EDGE, TDMA, CDMA, WCDMA
- All technologies coexist in the same session
- Advanced HSDPA and EV-DO functionality
- Access to drive test data through TEMS Investigation and TEMS Automatic
- Multi vendor support
- Advanced neighbor analysis

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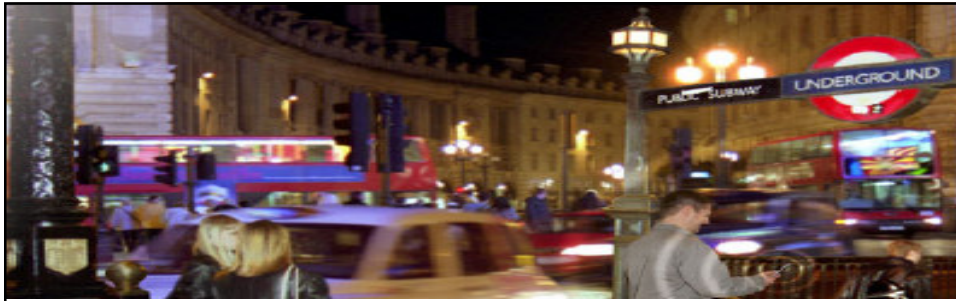
## Additional Features

- Multi raster support
- Advanced Monte Carlo simulations for both, WCDMA and CDMA
- AFP from Ericsson TEMS
- Best in class prediction models
- Generic import interface
- Scripting Support
- Large network support

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## 2G And 3G Co-planning

- The only tool created to plan both networks in the same project
- Sharing of network data between two systems
- Inter-system handover planning and analysis
- Advanced neighbor list generation and analysis

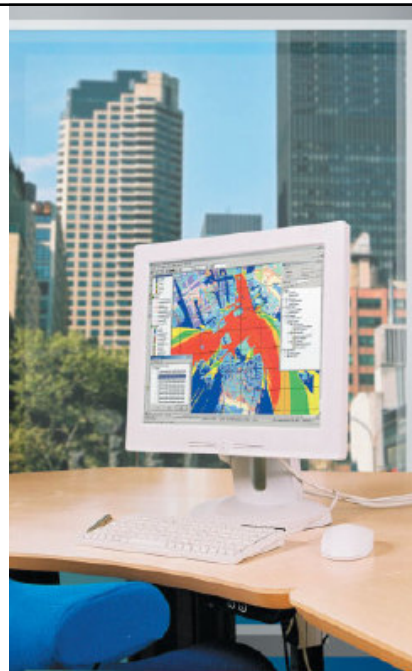
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## Measurement Integration and Propagation Modeling

- Supports
  - 9999
  - Okumura Hata
  - Urban Model
    - Half Screen
    - Recursive Microcell Model
    - Walfisch-Ikegami
- TEMS Investigation files used for model tuning
- Combining of predicted and measured data to improve the accuracy of path loss prediction



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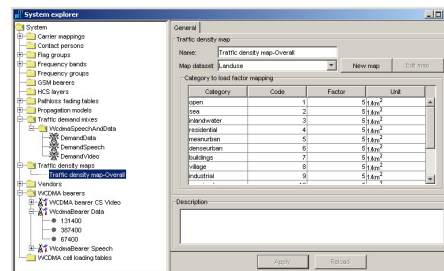
# Configuration Management and Scalability

- Provides complete interfaces to network infrastructure, including Ericsson's OSS-RC for GSM and WCDMA networks and RNM for CDMA systems
- Designed to meet any requirements regardless of network size
- Analysis calculation and handling for large networks is optimized to secure good usability



# WCDMA – Traffic data input

- Traffic demands in (milli-)Erlangs for CS and kB/hour for traffic PS traffic.
- Total number of subscribers,  $N$ , given
- Traffic demand is split over different areas.
- In TCPU the traffic demand per service & Per clutter (sub/km<sup>2</sup>/clutter)



## Traffic Density Maps

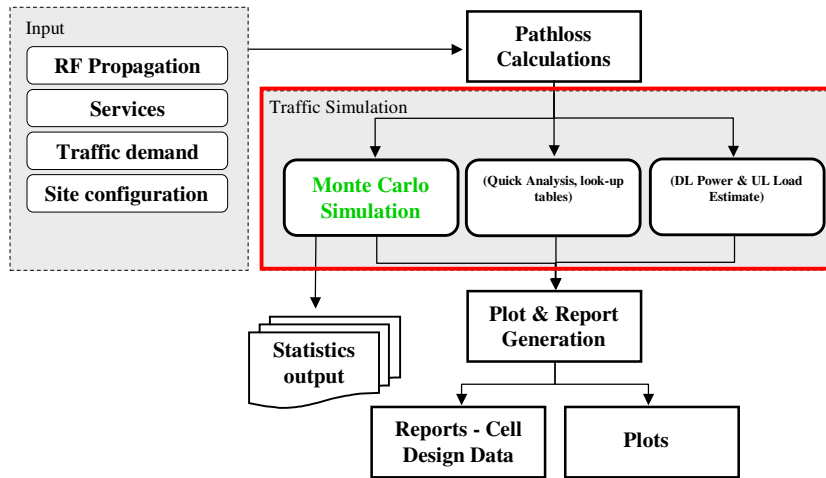
- Density of users/km<sup>2</sup> per bearer
- Set density per landuse or uniform

## Traffic Demand Mixes

- Mix of all bearers to be simulated
- Define scale factor per bearer - load
- Define distribution between terminals supporting multiple bearers

- All services can be assumed to have the the same number of subscribers/sqkm/clutter
- Each service has different traffic demand (Erlang/sub)

## Coverage, Capacity and Quality Traffic simulations



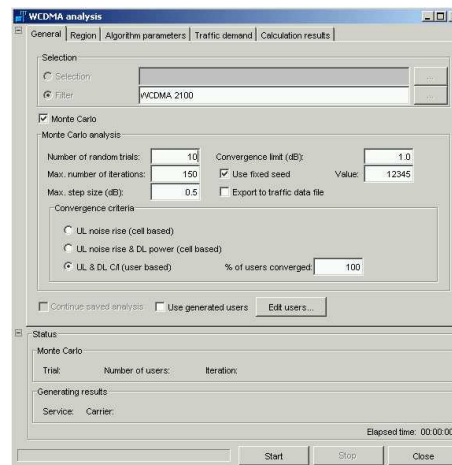
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## Coverage, Capacity and Quality WCDMA Traffic Simulations

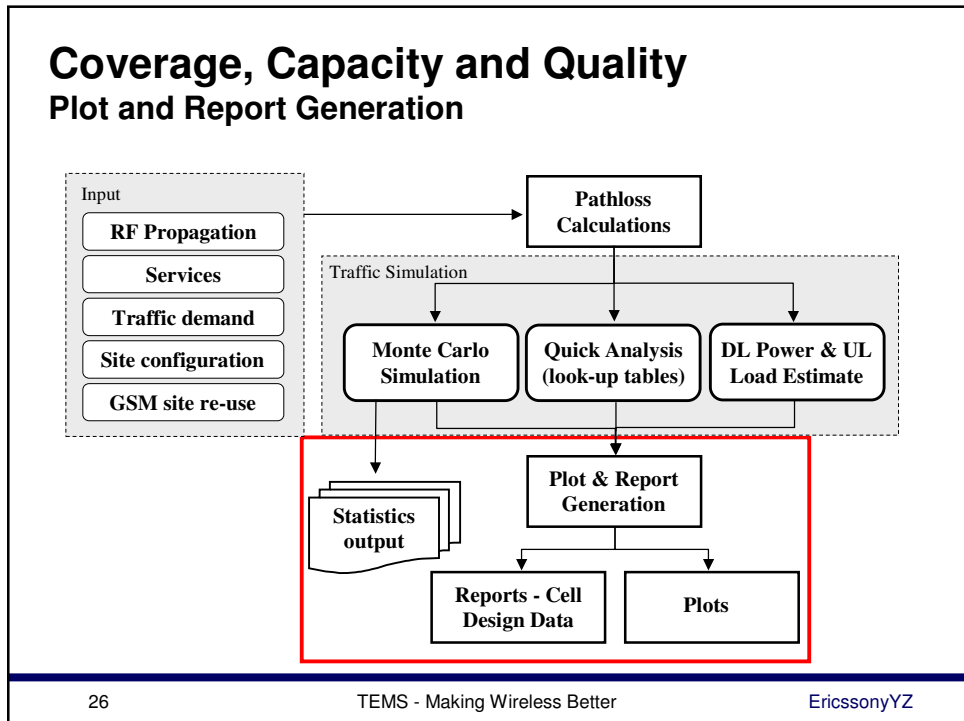
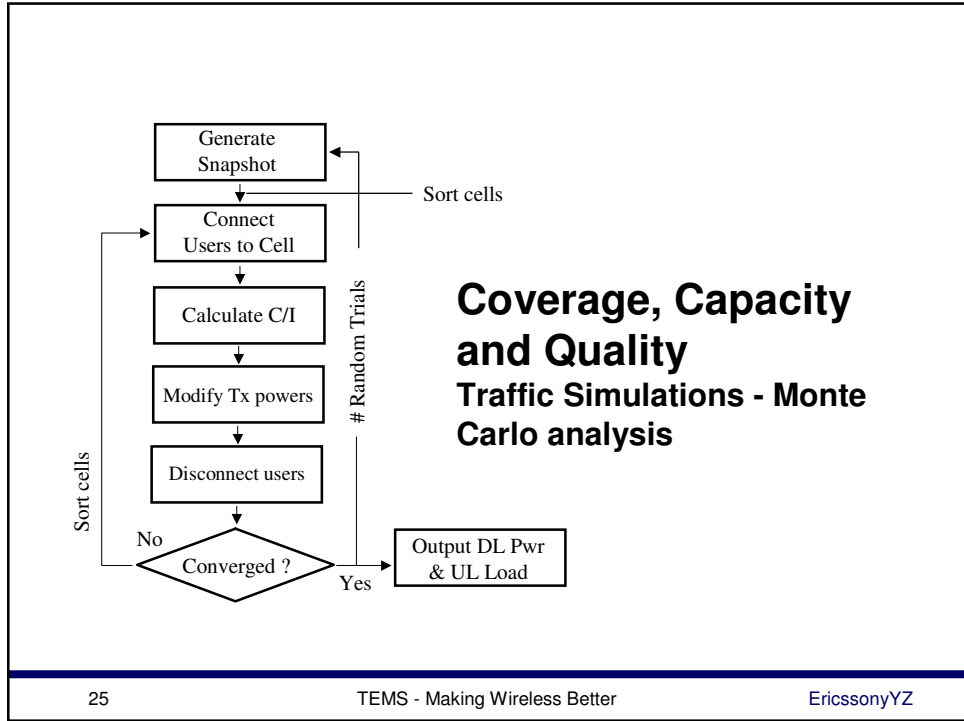
- Monte Carlo analysis GUI
  - General settings
  - Region settings
  - Algorithm parameters
  - Traffic Demand
  - Plot generation
- Monte Carlo Simulator with flexible allocation of convergence criteria
  1. UL Noise Rise based convergence on cell level – *Fast. Very low accuracy and reliability.*
  2. UL Noise Rise and DL Power based convergence on cell level – *More authentic than 1*
  3. UL and DL C/I based convergence on user level with a flexible assignment of percent of users to be converged – *Highest accuracy, best fit to reality. Slowest. Recommended.*



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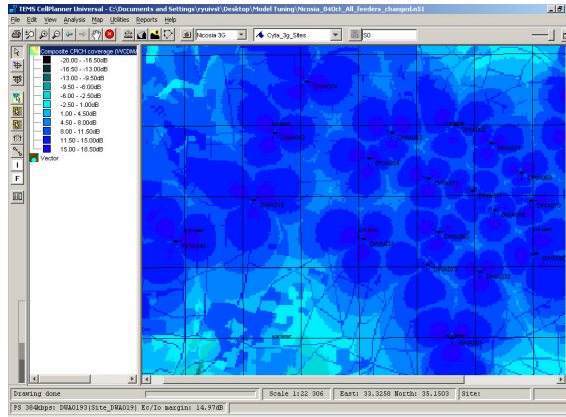
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## WCDMA Plots – CPICH Coverage

- Composite CPICH Coverage
- $E_c/I_0$  Margin towards target
- Indicates room for increased load
- $E_c/I_0$  target = - 16 dB, loaded network
- Coverage where  $E_c/I_0$  margin > 0 dB
- 3G Definition of coverage area.
- Not constant due to cell breathing.

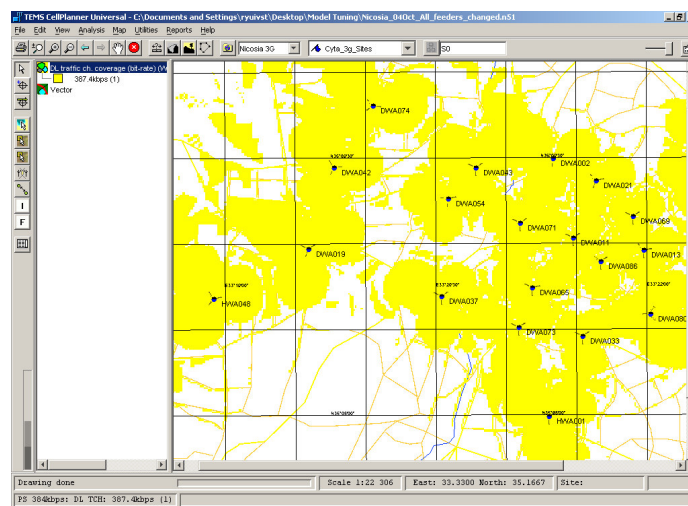


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## WCDMA Plots – DL Traffic Channel Coverage (Bit Rate)



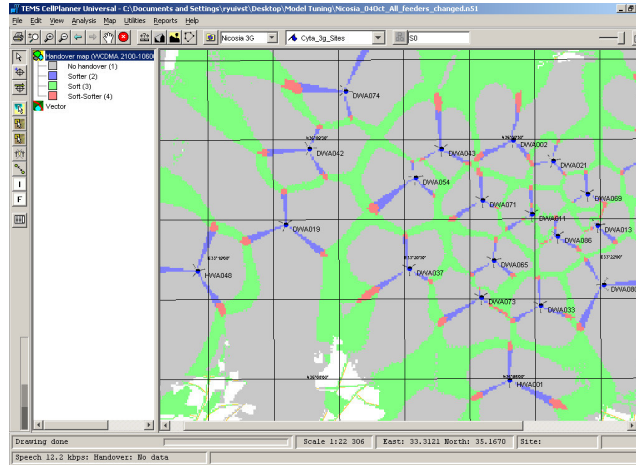
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## WCDMA Plots – Handover Map

- Color codes indicates different handover regions and type of handover
- The plot is a good starting point to judge the design – find coverage holes, missing handovers, risk of pilot pollution
- Use plot together with Spider Cursor to indicate number of Handover legs in each area
- Use plot together with Handover statistics to judge percentage of area in handover



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## WCDMA – Coverage statistics report

- The report gives coverage percentage in total and per clutter for selected polygon area
- Only one margin can be selected
- WCDMA analysis needed prior to coverage report generation

BEST SERVER STATISTICS FOR GIVEN THRESHOLD			
Channel:	WCDMA 2100-10563		
Service:	WcdmaBearer Speech		
TOTAL AREA (km²)	9.1		
COVERAGE AREA (km²)	9.03		
COVERAGE AREA (%)	99.24		
Threshold DL CPICH	2		
Threshold DL TCH m<N/A>			
Threshold UL TCH m<N/A>			
CATEGORY	TOTAL AREA (km²)	COVERAGE AREA (km²)	COVERAGE AREA (%)
1 open	0.3	0.3	97.88
2 sea	0.12	0.12	95.48
3 inlandwater	0	0	0
4 residential	0.16	0.16	100
5 meanurban	1.69	1.66	99.15
6 denseurban	0	0	0
7 buildings	0	0	0
8 village	0	0	0
9 industrial	0.16	0.15	99.74
10 openurban	1.49	1.48	99.17
11 forest	0.03	0.03	98.69
12 parks	0.67	0.67	99.7
26 denseurbanhigh	1.32	1.31	99.36
27 blockbuildings	0	0	100
28 denseblockbuildin	3.15	3.13	99.39

**This is the coverage percentage of the pilot (using the speech link budget) with 2 dB margin (corresponding to  $E_c/N_0 \geq -16$  dB)**

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## WCDMA Coverage - Implications

- High Pilot Signal Strength  $\neq$  Guaranteed Coverage.
- Coverage defined by  $E_c/I_0$ .
- $E_c$  = RSCP – Received Signal Strength of own Pilot. Constant.
- $I_0$  = Interference from all other users , own cell + other cells.
- Interference increases when traffic increases.
- Cell coverage smaller when traffic increases.
- Cell Breathes.
- Target  $E_c/I_0$  = - 16 dB.
- $E_c/I_0$  below -16 dB => No channel estimation, No Coverage.

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## WCDMA – Statistics report

- Extensive connection statistics
- Reasons for not being admitted
- Users served in average per bearer – can be calculated

Service	#attempts	%served	simultaneous use	#insuff.CPI	#insuff.DL	#insuff.UL	#UL overLoaded	#Blocked Codes	#Blocked High Int.
RAB PS_TU50	712.43	47.36	2.00795003	6.1	50.1	7.03	24.97	36.6	251.07
RAB Voice_TU50	2308.87	90.48	12.43491414	28.67	20.77	13.13	12.9	4.23	137.53
RAB CS_TU50	366.17	75.74	1.605733083	3.1	50.3	4.6	2.8	0.83	24.47
Summary	3377.47	79.63	16.0490137	37.87	121.17	24.77	40.67	40.67	413.07

**Insufficient DL** = DL TCH power not enough to provide sufficient C/I  $\Leftrightarrow$  no DL coverage  
**Insufficient UL** = UL TX power not enough to provide sufficient C/I  $\Leftrightarrow$  no UL coverage  
**DL overload** = Total carrier TX power limit (15 W) exceeded  
**Blocked codes** = More than 179 SF=256 codes consumed  
**Blocked due to high interference** = UL noise rise limit (6 dB) exceeded

In this example users are blocked due to high interference

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## **TEMS – *Making Wireless Better***

- Industry leaders with years of experience
- World-wide sales and support
- Tools to support every major technology
- A complete path from 2G and 2.5G to 3G

Learn more about the TEMS portfolio at:

[www.ericsson.com/tems](http://www.ericsson.com/tems)

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