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Mobile TV Network Design

Maurizio Montagna

Director

Media Broadcasting and Mobile TV

Alcatel – Lucent

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Agenda

1. Objectives of Mobile TV Network Design

2. Requirements

3. Mobile TV network architecture

4. Network Design process

5. Radio Network Planning Tools

6. Example of Mobile TV Network Design

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Objectives of Mobile TV Network Design

General

- To support the definition of the Network Architecture
  - Number and location of broadcasting sites
  - Coverage plan
  - Power distribution
- To optimise capex and opex for a given quality of service
- To give guidelines for the proper implementation of the transmitters (e.g. radiating part)

Specific to Mobile TV

- To guarantee the proper coverage at ground level and indoor

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Typical Requirements

- **Service modeling**
  - Target Service level : Deep Indoor, Indoor, In-car, Outdoor (parameters from BMCO forum)
  - Target Coverage Probability : 95%, 90%, 85%
  - Target Population Coverage: Areas to be covered
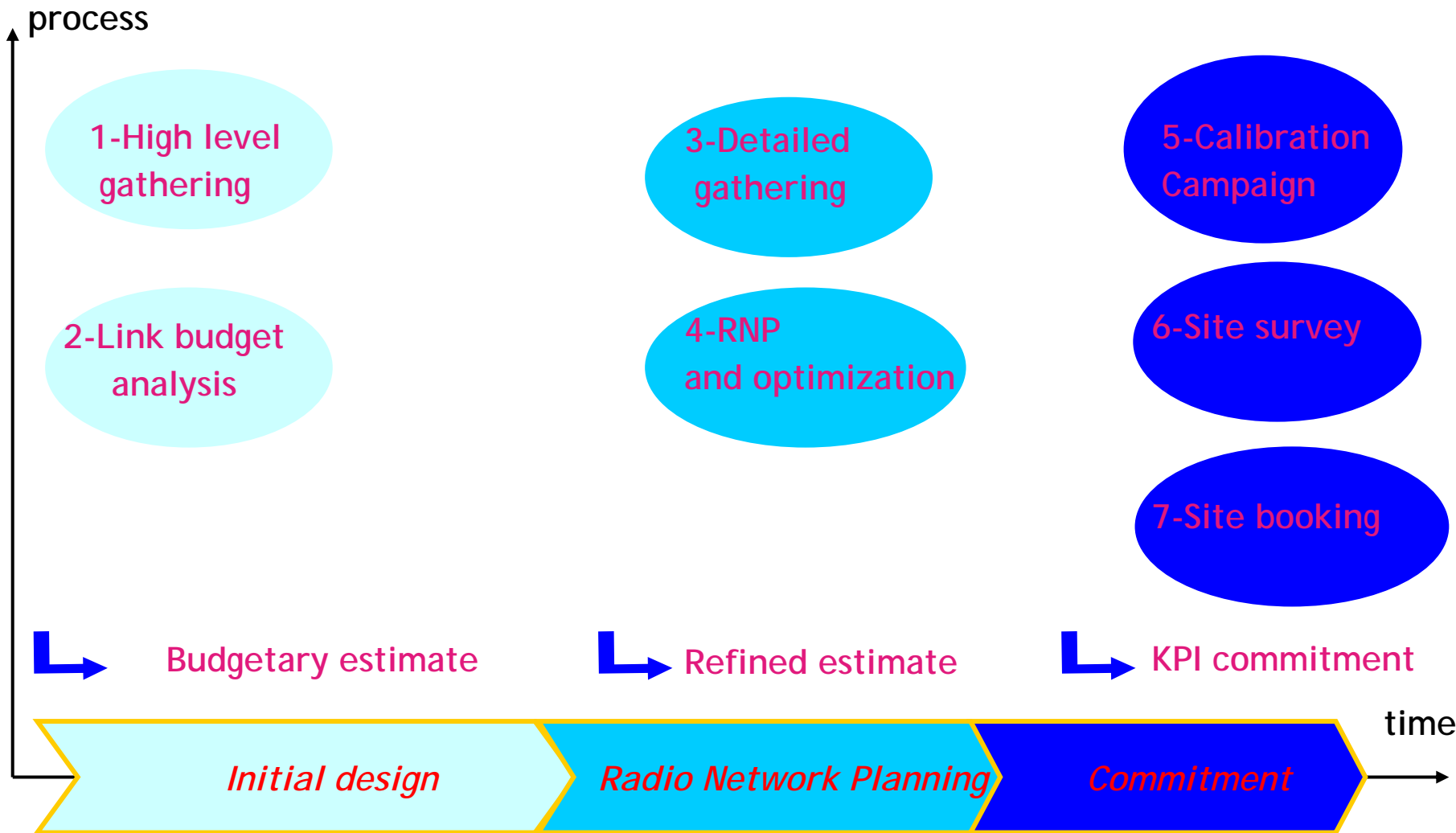 - Number of channels to be broadcasted
- **Area modeling**
  - Digital Terrain Modeling, clutter and vector databases
 - existing 2G/3G broadcast sites to be reused

- **KPI definition**
  - Agreement with the customer on Key Performance Indicators (KPI)
    - KPI on Mobile TV service
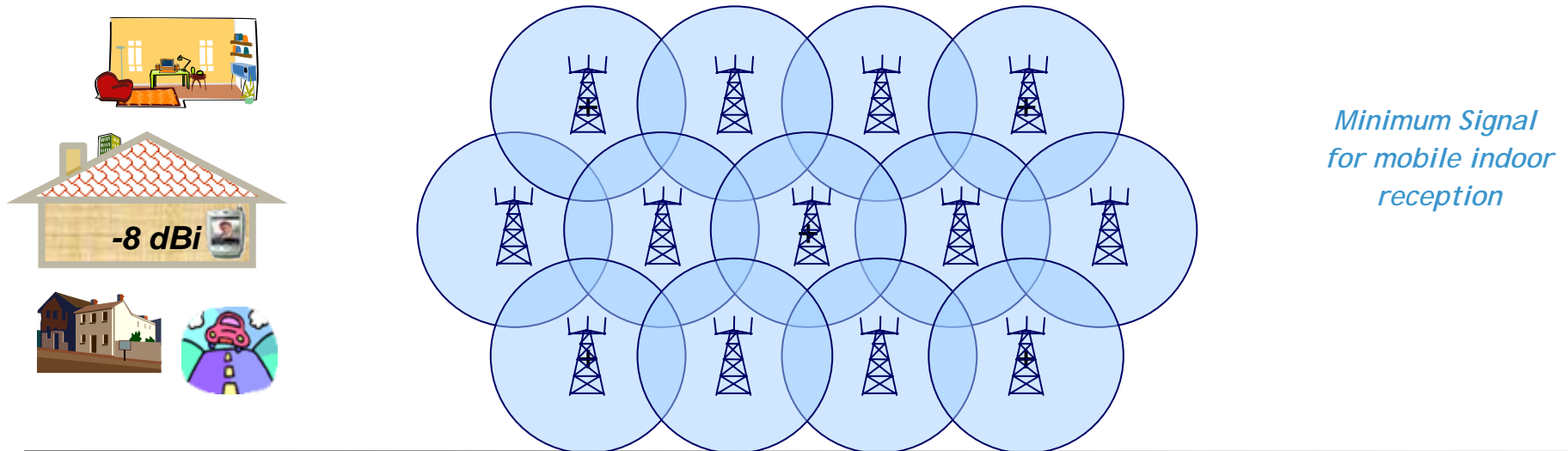   - KPI on coverage (area, population)

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Network Design full process

process

1-High level gathering

2-Link budget analysis

3-Detailed gathering

4-RNP and optimization

5-Calibration Campaign

6-Site survey

7-Site booking

Budgetary estimate

Refined estimate

KPI commitment

time

Initial design

Radio Network Planning

Commitment

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Network Design *Two Options to Deliver Broadcast Mobile TV...*

OPTION 1) BROADCAST NETWORK: FROM FIXED TV ...

+18 dBi

Tower A

Tower B

Minimum Signal for rooftop antenna reception
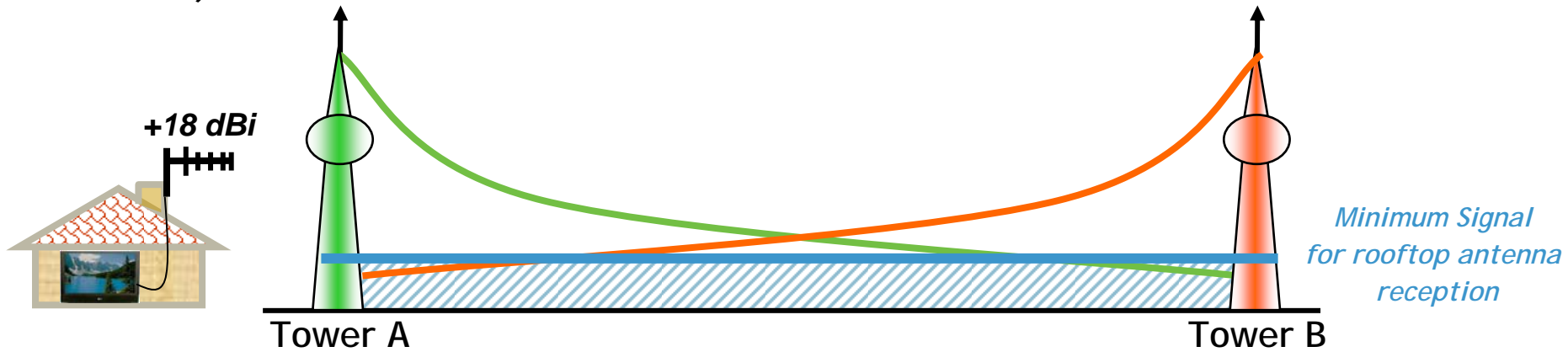
OPTION 2) MOBILE NETWORK: FROM MOBILE UNICAST ...

-8 dBi

Minimum Signal for mobile indoor reception

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Multi-layer solution, with mixed high power and low power sites

Higher signal level :
Good for Mobile TV in all conditions

-8 dBi

satellite

Low Power Sites

High/Mid Power Sites

Urban area

3 satellite distribution

Rural area Motorways

2 Mobile-like network

1 Broadcast-like network

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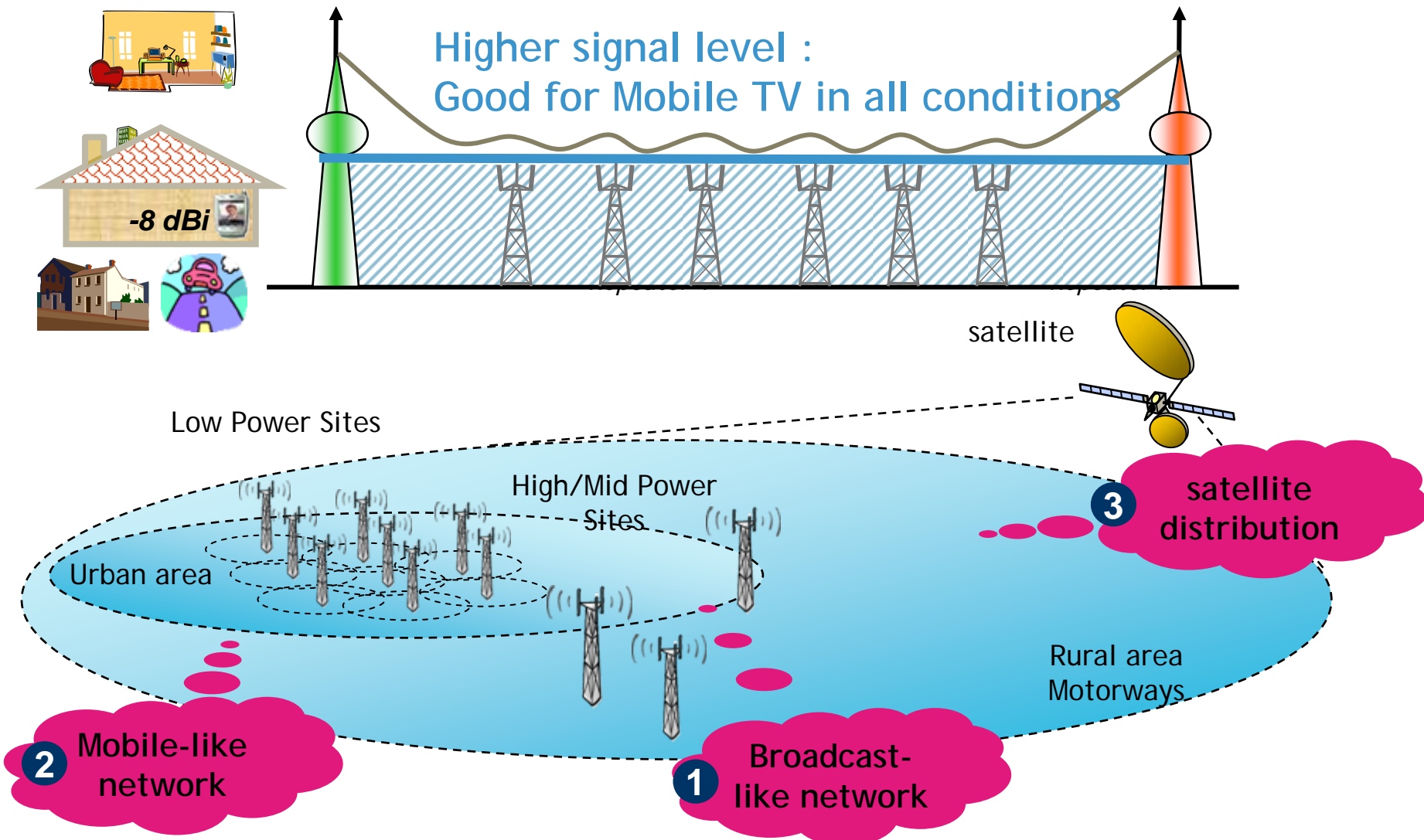
Network design DVB-H UHF on Berlin

indoor coverage required

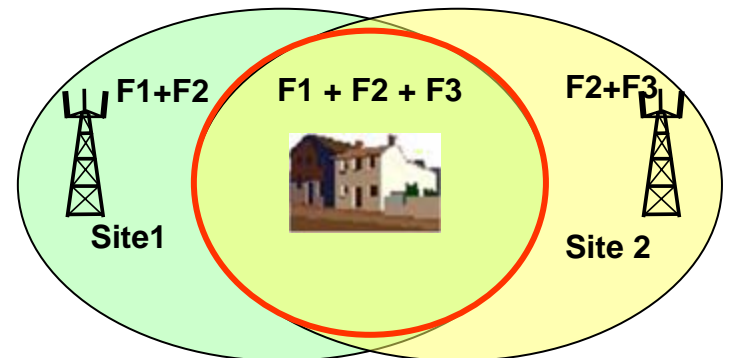| Scenario	N. of High Power	N. Of Low Power
Low power only	_	265 x LP transmitters
Low Power plus High Power	2 x HP transmitters	165 x LP transmitters
Mixed	3 x HP transmitters	66 x LP transmitters

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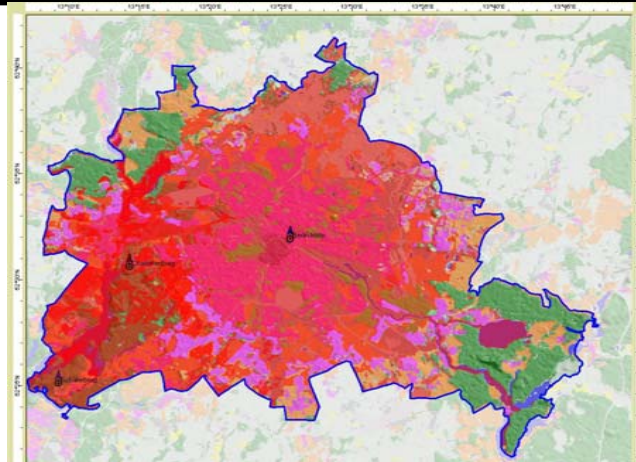
Field feedback: *Pau trial SFN Gain Measurements*

- **Extended tests in 2 different locations**

Very deep indoor

Deep indoor

IUFM

La Pépinière

SFN Gain [dB]

7.00
6.50
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
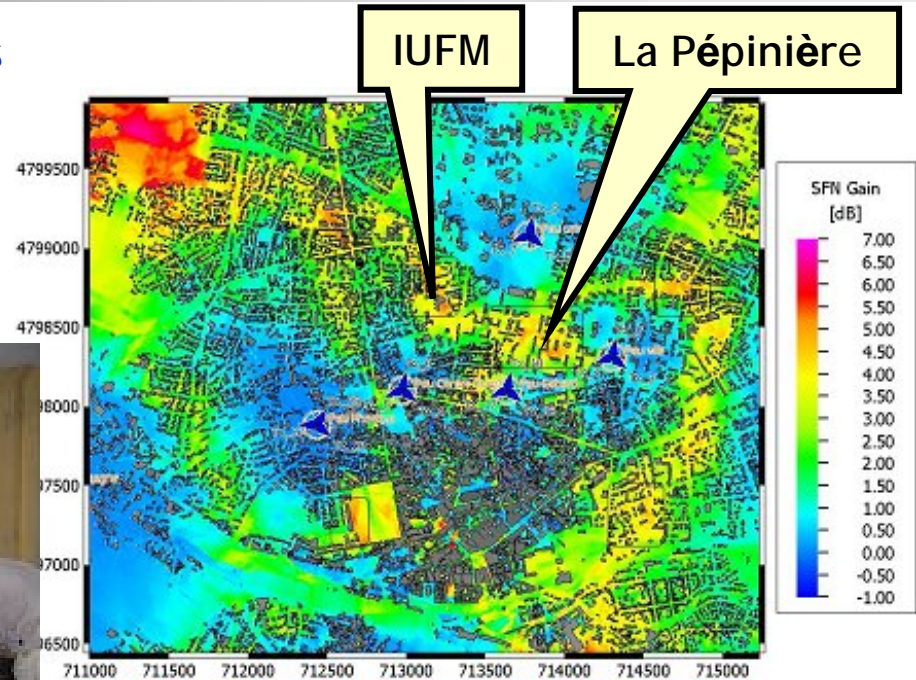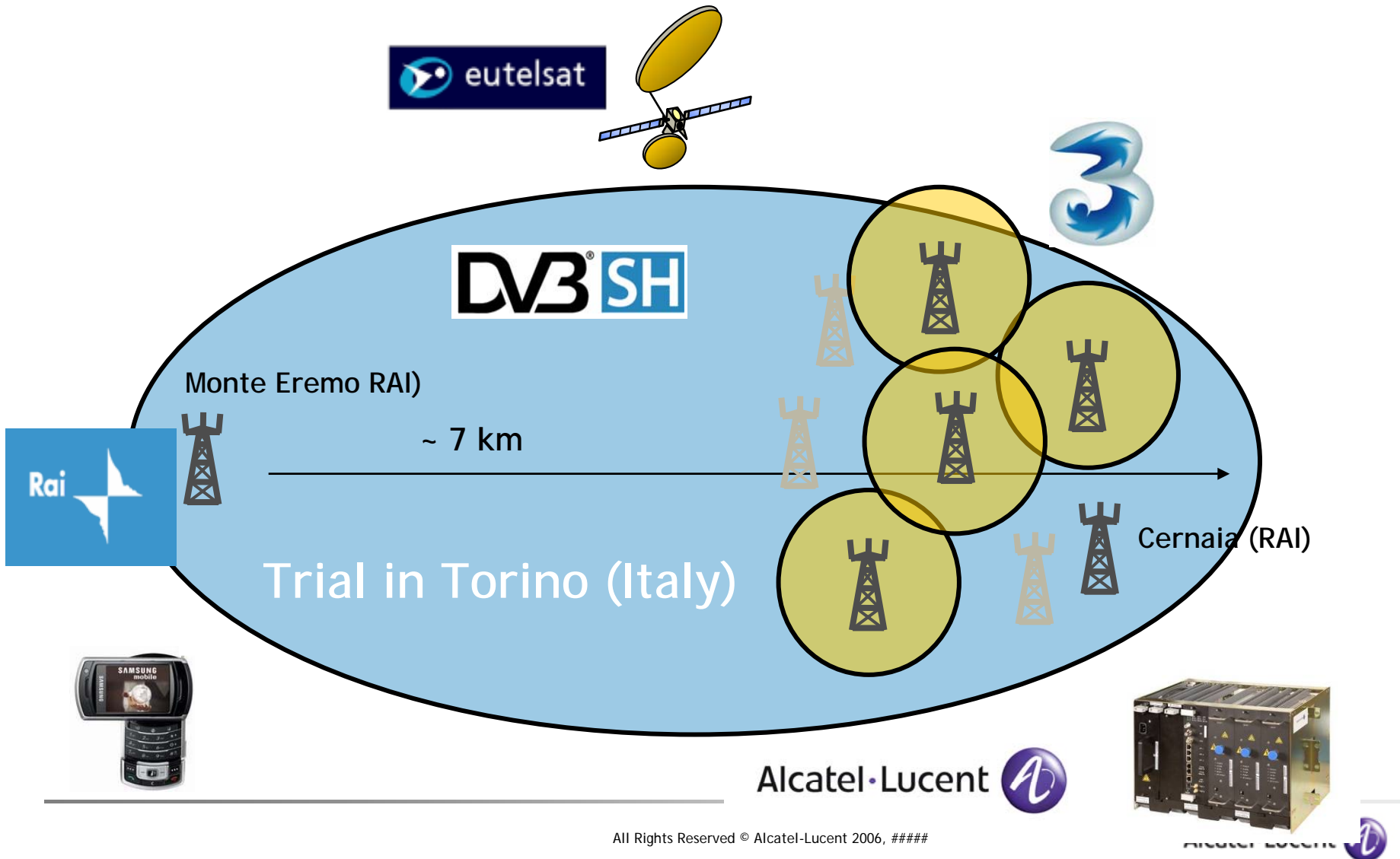
- **Reference measurements**
  - Site 1 repeater broadcasts two identical DVB-SH signals on F1+F2
  - Site 2 repeater broadcast on F2+F3

F1+F2

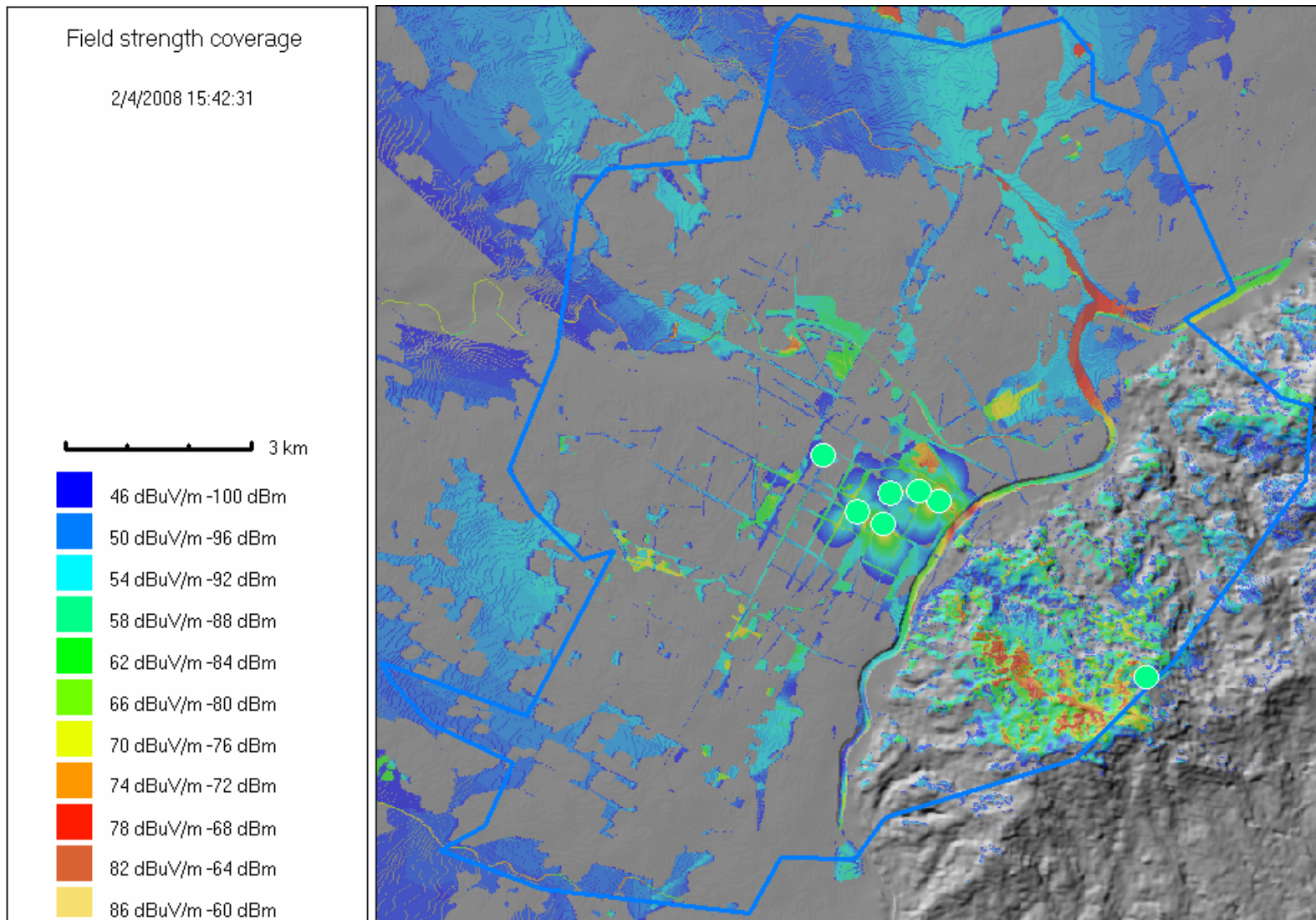F1 + F2 + F3

F2+F3

Site1

Site 2

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Alcatel testing DVB SH with H3G and RAI in Torino

eutelsat

DVB SH

Monte Eremo RAI)

~ 7 km

Trial in Torino (Italy)

Cernaia (RAI)

Rai

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DVB SH Network Design of Torino

2 Rai sites plus 5 H3G sites Study Results for QPSK1/3

Field strength coverage

2/4/2008 15:42:31

3 km

46 dBuV/m -100 dBm	
50 dBuV/m -96 dBm	
54 dBuV/m -92 dBm	
58 dBuV/m -88 dBm	
62 dBuV/m -84 dBm	
66 dBuV/m -80 dBm	
70 dBuV/m -76 dBm	
74 dBuV/m -72 dBm	
78 dBuV/m -68 dBm	
82 dBuV/m -64 dBm	
86 dBuV/m -60 dBm	

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Comparing Network Design
DVB-SH = DVB-H x 2

REDUCED CAPEX, SAME SERVICE
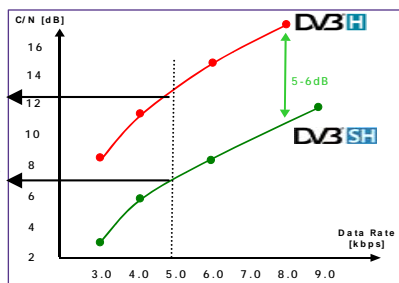
• Up to CAPEX÷2
• Competitive price
• Better margin

SAME CAPEX, BETTER SERVICE

• up to x2 more channels
• Better (indoor) coverage
• Better QoE (higher data-rate): Higher image quality/ Larger screens / Multiple form factors
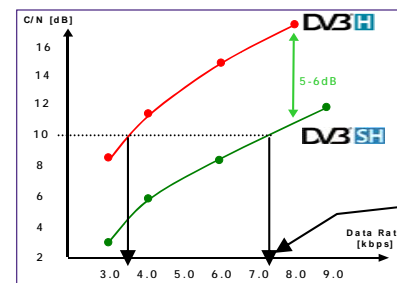
Service Provider Benefit

Same data-rate, 5-6dB less C/N requirements

DVB SH

vs.

DVB H

End-User Benefit

Same C/N, 2 times data-rate

➔ **DVB-SH offers more flexibility than DVB-H to balance service and/or cost advantages**

Conclusions

- Network Design in Mobile TV combines the requirements of Broadcasting fixed TV and Mobile Networks

- Multy layer Networks are needed: SFN gain is proven in the field

- DVB SH allows strong CAPEX savings v.s. DVB H thanks to the new features (both in UHF and in S band)

- DVB SH in band S allows cheaper coverage thanks to the satellite large footprint

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Backup

Example Deployment Scenario
Hybrid DVB-H in UHF and DVB-SH in S-Band deployment – Co-existence

1 ▪ Rural and Urban coverage with DVB-H in UHF High power transmitters
- Outdoor coverage

2 ▪ Urban coverage with DVB-H in UHF medium/low power transmitters
- Outdoor & indoor coverage

3 ▪ Coverage complement with DVB-SH in S-Band medium/low power transmitter
- Outdoor & Indoor coverage

4 ▪ Option: National coverage with DVB-SH in S-Band Satellite
- Outdoor coverage
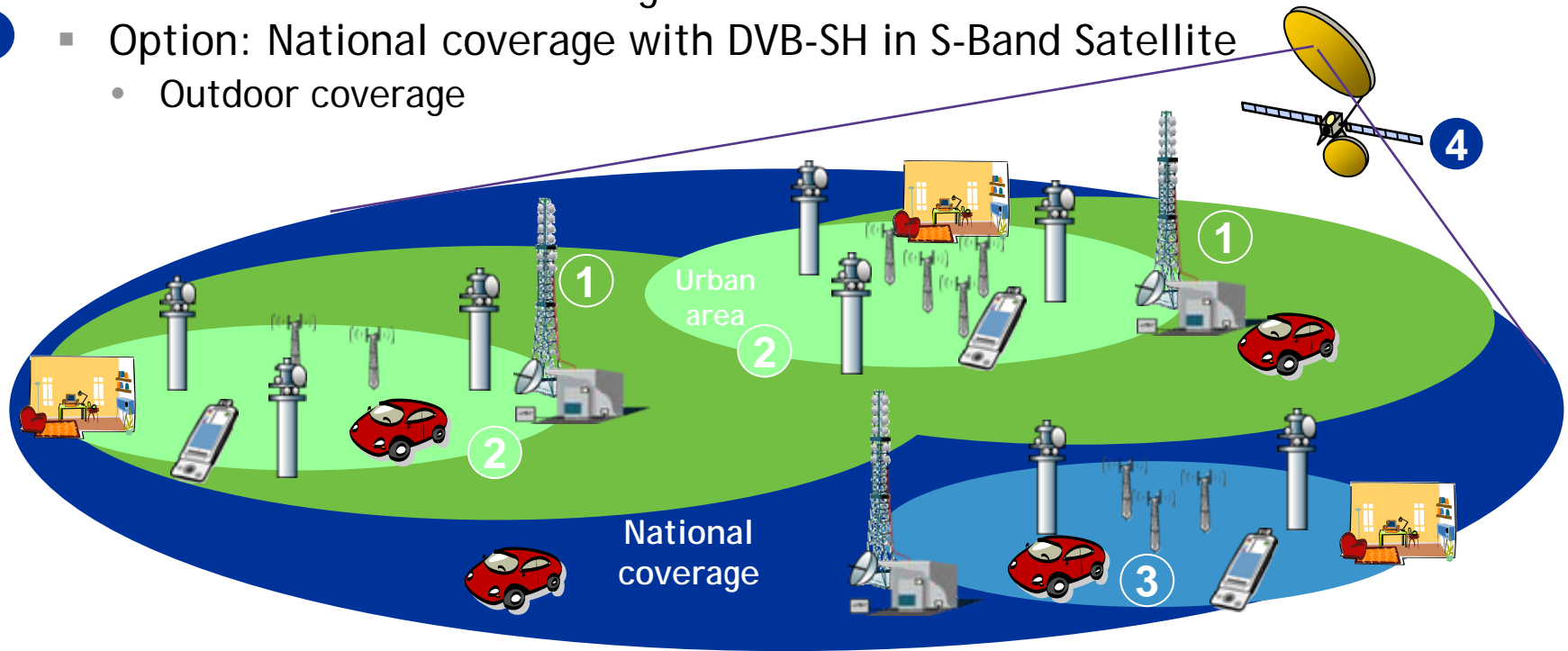
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Radio Network Planning Tool

- Alcatel-Lucent use of a combination of dedicated Network Planning tools for mobile TV:

- Satellite and Terrestrial Single Frequency Network full support
- SFN interferences maps allowing optimisation of the network

Broadcast oriented

- Inter-system interferences analysis : Other DVB-T/H or analog systems
- Calibrated propagation model

Reliability

- Automatic cell planning and network optimization (ACCO)

Optimized network

- Possible inputs: Clutter and Digital Terrain Model databases, 3D building

Accuracy

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