

UTILIZING THE INHERENT ADVANTAGES OF LOWER FREQUENCY BANDS FOR ADVANCED COMMUNICATIONS SYSTEMS

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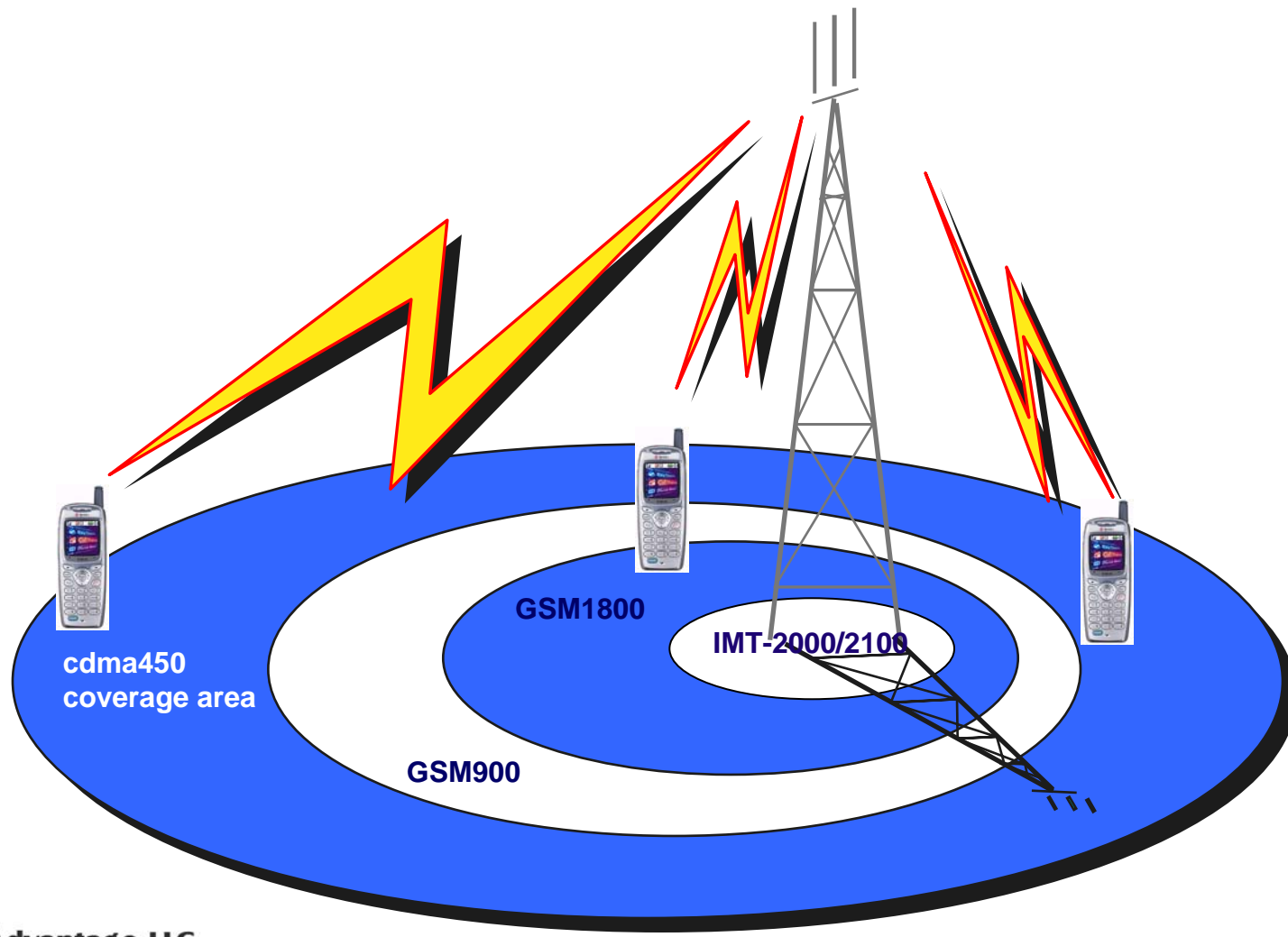
Addressing Real World Challenges...

■ Challenges

- Combined cost of IMT-2000 licenses and infrastructure
- Competition for scarce financing
- Delayed promises
- Need to support sparsely populated areas with basic and advanced telephony
- eEurope compliance



Using RF Propagation to its best advantage to Serve Humanity



What are the alternatives?

Frequency (MHz)	Cell radius (km)	Cell area (km ²)	Relative Cell Count
450	48.9	7521	1
850	29.4	2712	2.8
950	26.9	2269	3.3
1800	14.0	618	12.2
1900	13.3	553	13.6
2500	10.0	312	24.1

Source: Qualcomm ITU 8/F Submission, June 11, 2001, "COVERAGE COMPARISON OF IMT-2000 SYSTEMS AT VARIOUS FREQUENCY RANGES, INCLUDING 450 MHZ"



Expected structure of a UMTS/IMT-2000 network

Cell type	rural	macro	micro	pico
Cell Radius	8 km	2 km	0.5 km	0.125 km
Application	high mobility	high mobility	low mobility/pedestrian	indoor/pedestrian
Offered capacity per cell in 5 MHz	400 kbps	400 kbps	1000 kbps	1000 kbps

Source: Germany (Federal Republic of), ITU 8/F Submission, March 3, 2000, "PROCEDURES FOR SIMULATING MATURE DEPLOYMENT OF CELLULAR NETWORKS IN THE MOBILE SERVICE"

UMTS/IMT-2000 ITU Example Network

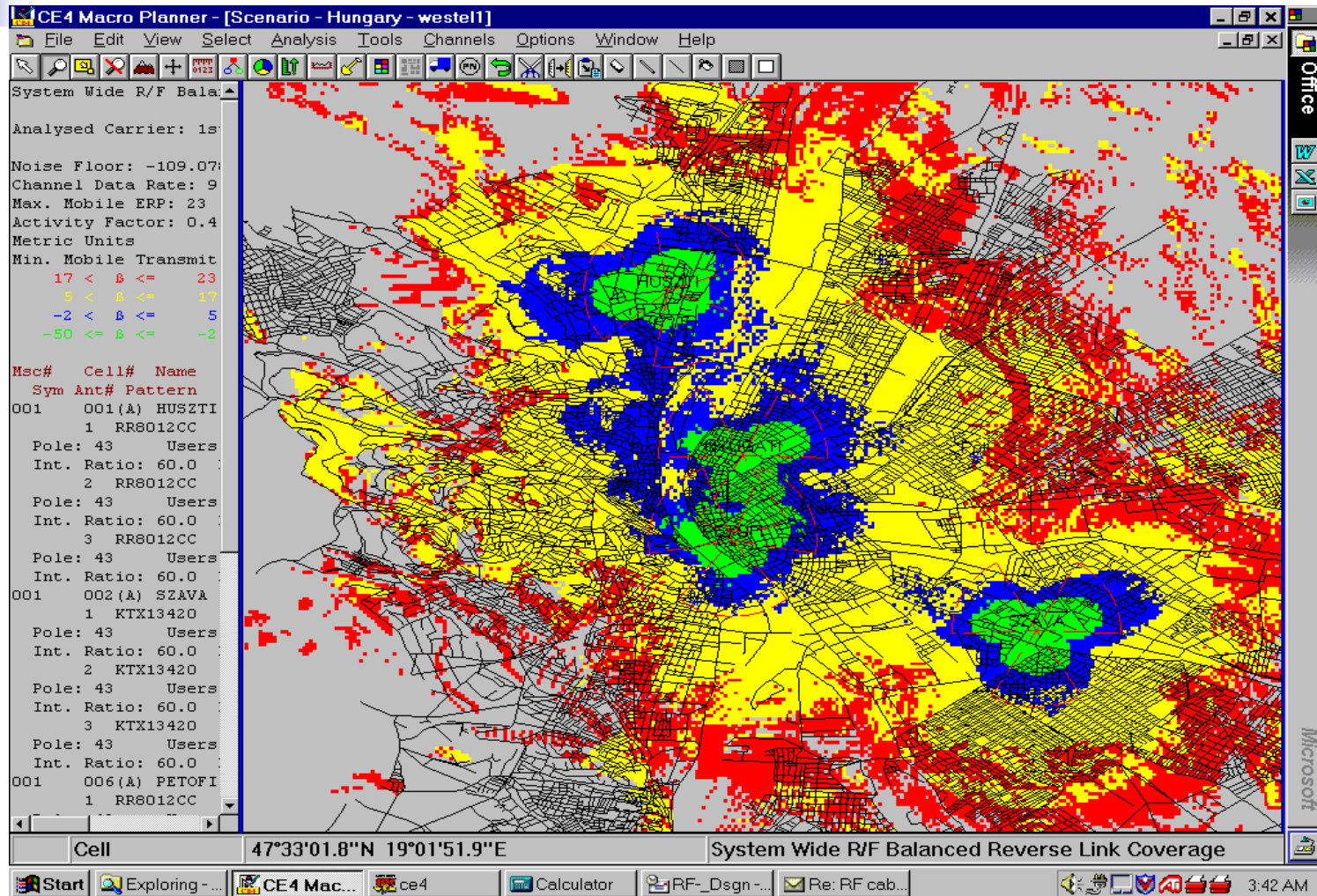
Area	Berlin	Frankfurt	Münster/ Osnabrück
Size	60 x 60 km	60 x 60 km	60 x 60 km
Inhabitants	4.0 Mio.	2.0 Mio	0.75 Mio
Total Capacity	9200 Mbps	5000 Mbps	1450 Mbps
Transmitters using the same frequency channel			
- Rural Cells	23	23	23
- Macro Cells	339	352	270
- Micro Cells	1980	1508	673
- Pico Cells	7170	2822	761
Total:	9512	4705	2727

**Total 3G cell
count for one
Operator in
3 cities of 7M**

15,944

Source: Germany (Federal Republic of), ITU 8/F Submission, March 3, 2000, "PROCEDURES FOR SIMULATING MATURE DEPLOYMENT OF CELLULAR NETWORKS IN THE MOBILE SERVICE"

Four Basestations covered most of Budapest.





Monthly E1/T1 add to the cost of deployment

Country	Average Monthly E1/T1 costs
Brazil	\$450-500
Canada	\$185-475
EU average	\$850
India	Self deployed and maintained
Mexico	\$150-200
UK	\$750
US	\$100-750

Source: Author's informal survey of operators and network installers.

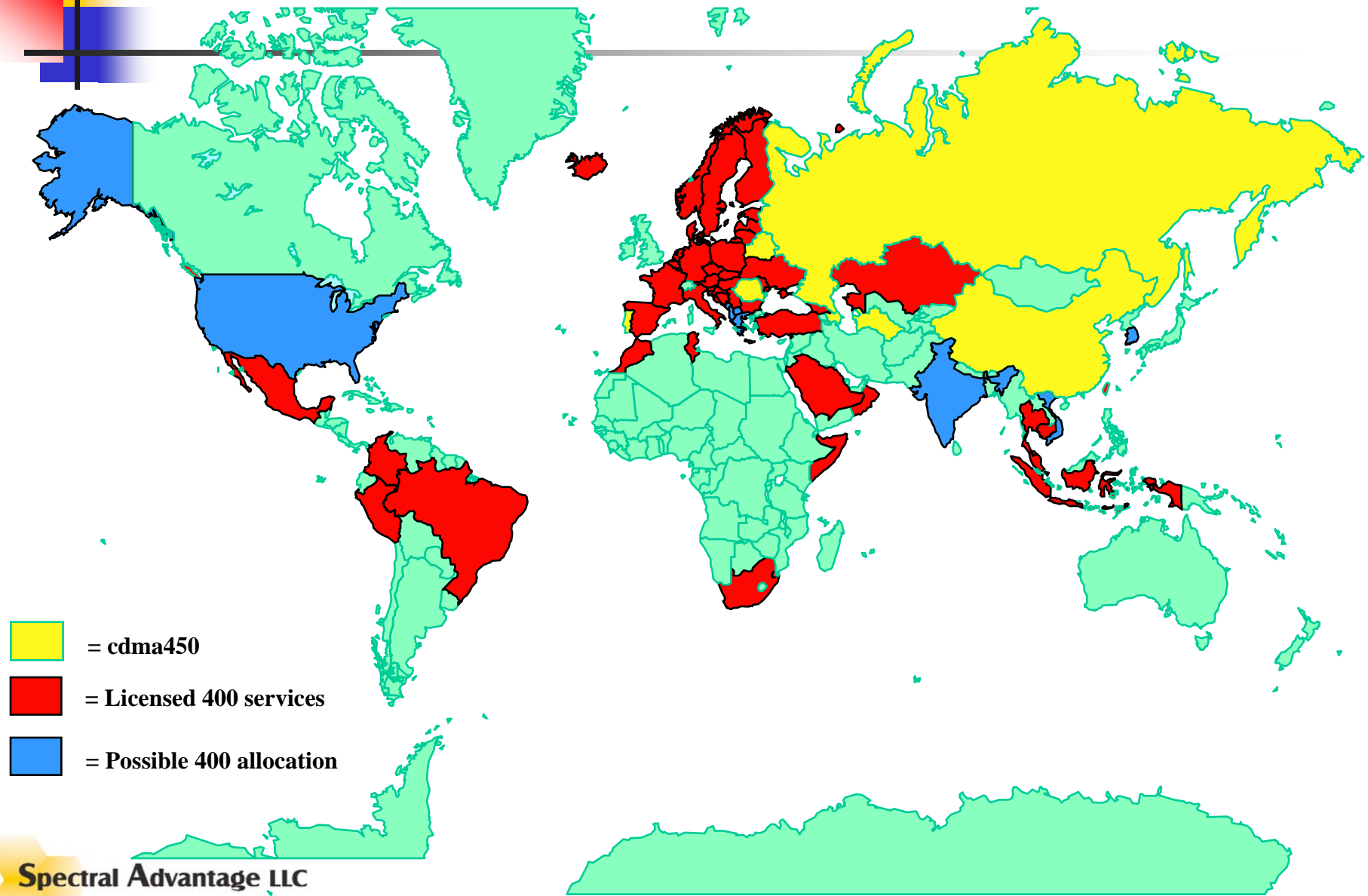


Hypothetical Comparison of E1/T1 costs

Examples at the extremes...

City	Cell count	Monthly E1 cost	Total E1 costs per month
Berlin 4M Pop.	9500 Wcdma Est.	\$850	\$8,075,000 \$2.00 per person per month
Bucharest 2M Pop.	40 Cdma450 actual	\$850	\$34,000 \$0.017 per person per month

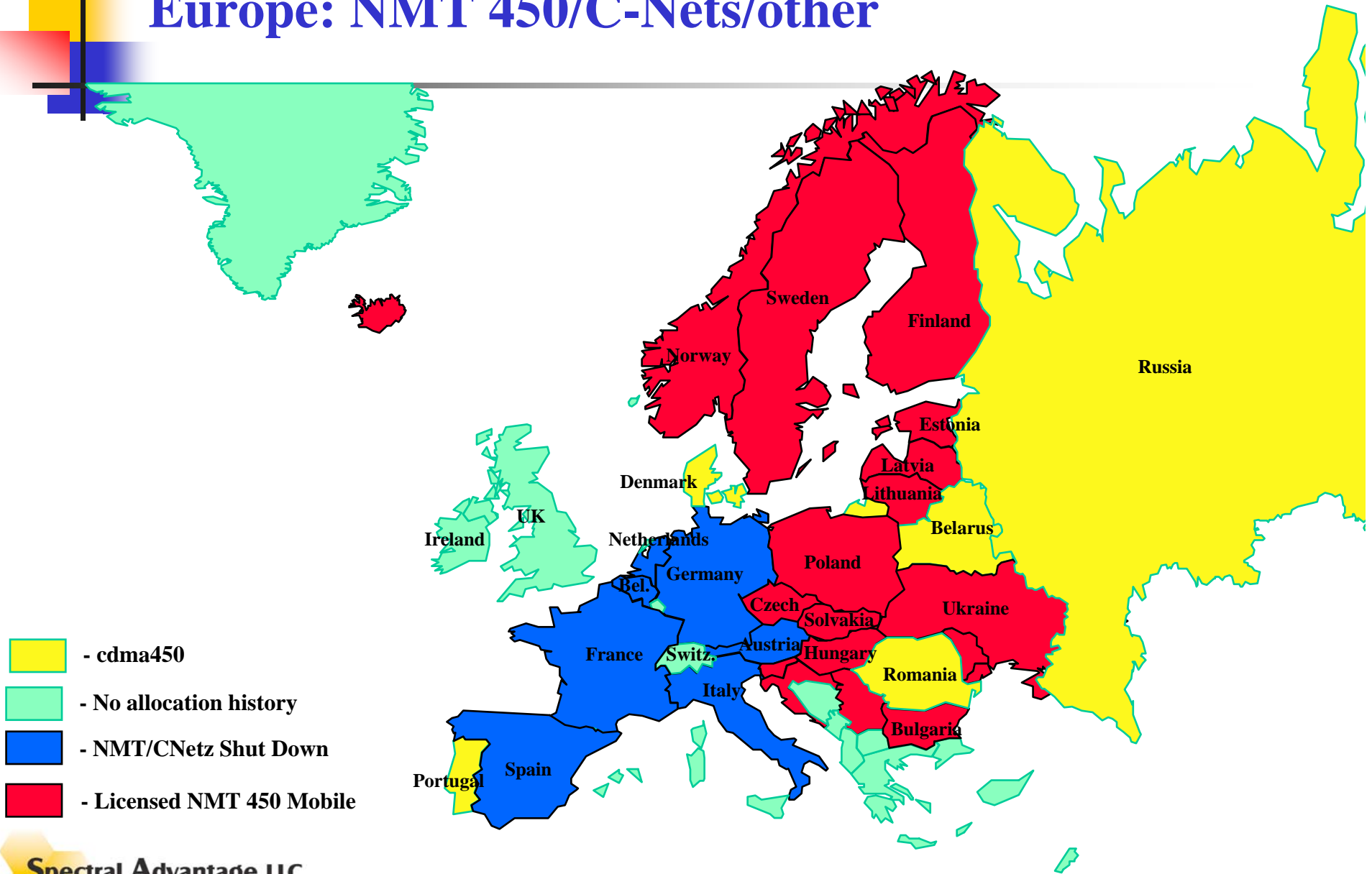
The 400 MHz Footprints: Past, Present, and Possible



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KKRRIT (June 26, 2003)

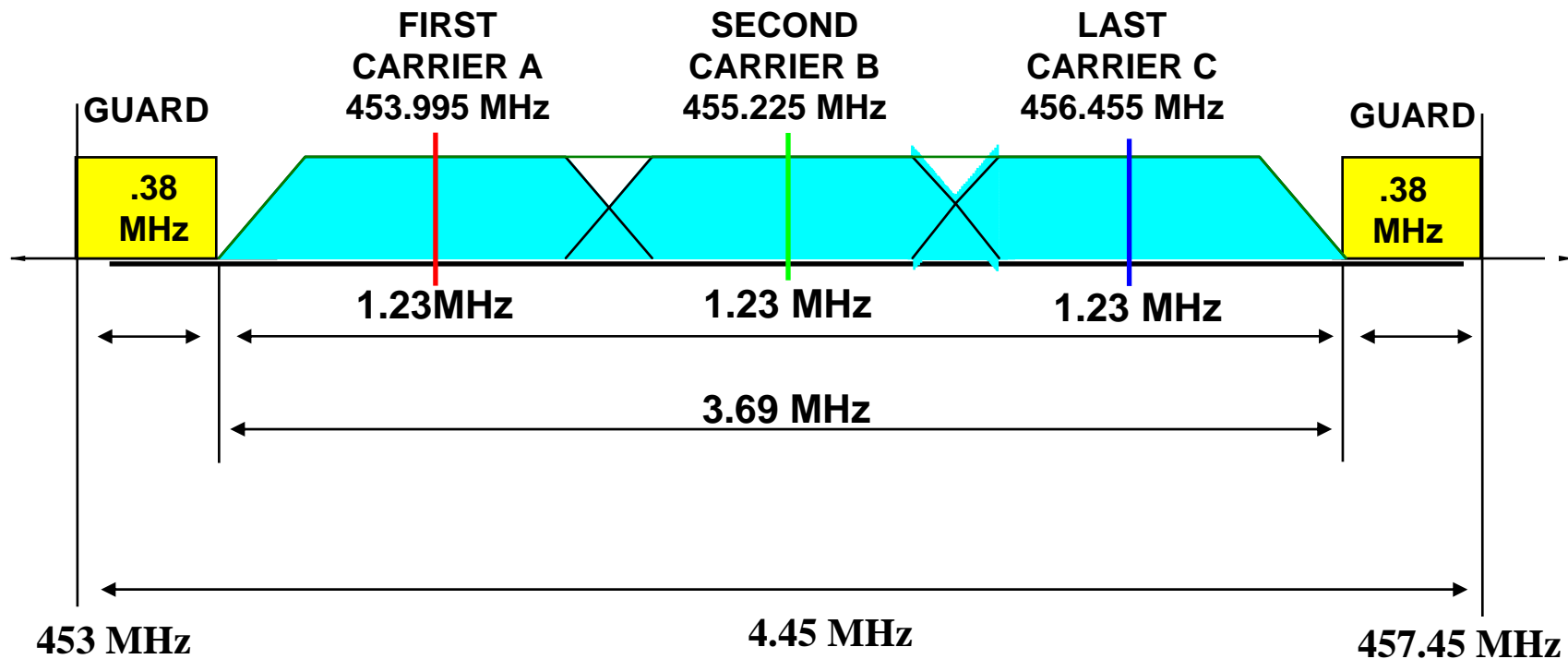
Europe: NMT 450/C-Nets/other



IS-2000 NMT-450 Band (Band Class 5) Frequency Plan

System Designator	Band Subclass	Transmit Frequency Band (MHz)	
		Mobile Station	Base Station
A*	0	452.500-457.475	462.500-467.475
B*	1	452.000-456.475	462.000-466.475
C	2	450.000-454.800	460.000-464.800
D	3	411.675-415.850	421.675-425.850
E	4	415.500-419.975	425.500-429.975
F	5	479.000-483.480	489.000-493.480
G	6	455.230-459.990	465.230-469.990
H*	7	451.310-455.730	461.310-465.730

Carrier Overlay on NMT Standard Band with 4.45 MHz



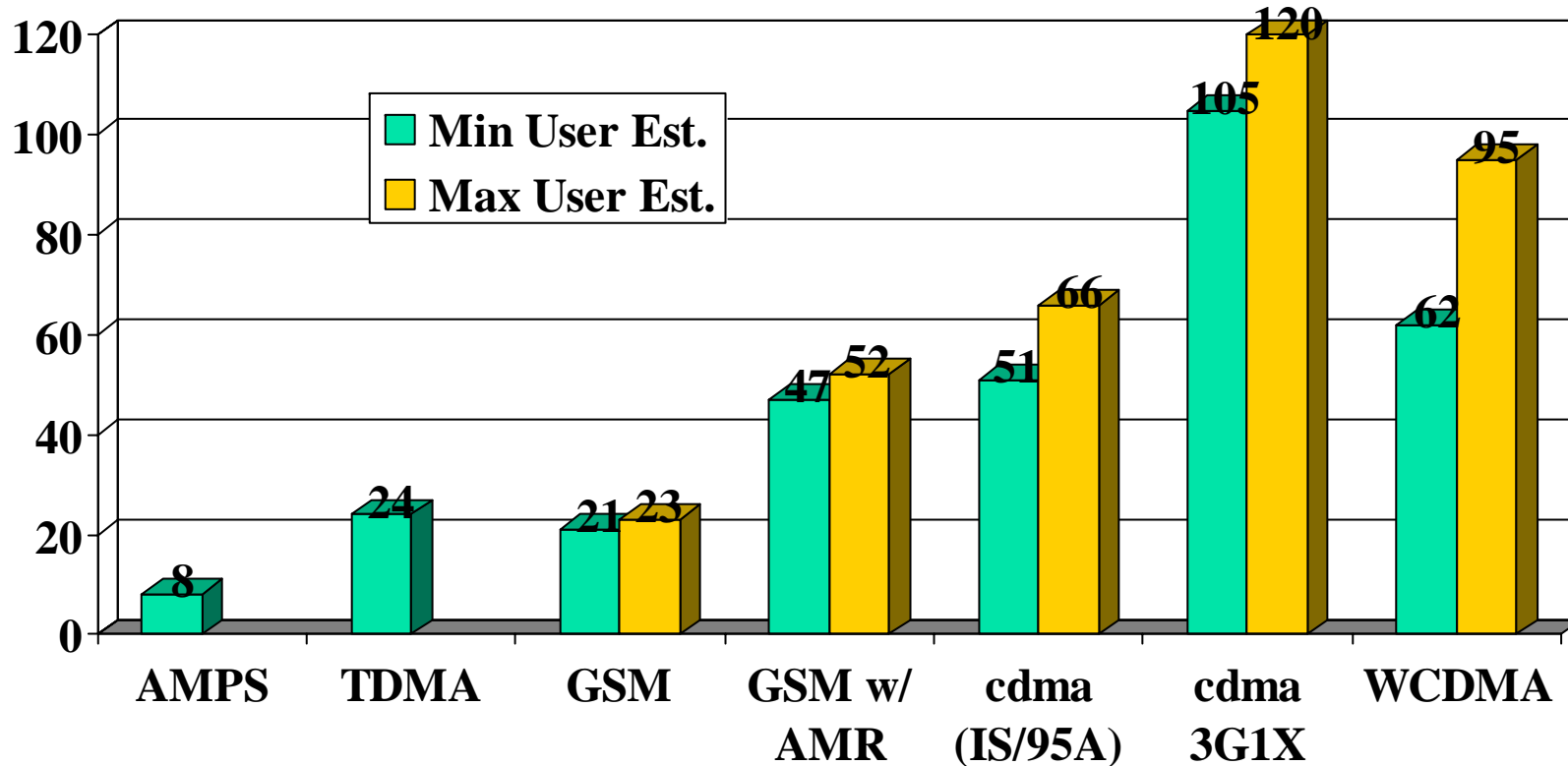
NMT/3G 1X Voice Capacity Comparison

Parameters	NMT 7/21 Reuse
Number of Channels	180
Channels/ Sector	8.5 Ave.
Total Erlangs/Sector	3.6
Erlangs/Site	10.8
Subs/Site (0.03 Erlangs)	360

Parameters	G3G 1X	NMT 7/21 Reuse
Erlangs/Sector/Carrier	26	NA
Total Erlangs/Sector	78	3.6
Total Erlangs/Site	234	10.8
Subs/Site	7800	360
Estimated Capacity Improvement over NMT with 7/21 Reuse	2,200%	

Note: NMT Figures provided by NMT MoU Digital Interest Group. The NMT figures do not include capacity increases achieved from interleaving (NMT-i)

Voice Capacity per 5MHz of Spectrum



Source: Deutsche Banc Alex. Brown estimates from various sources, "The Rise of the 3G Empire," Sept. 2001.

CDMA 450MHz



1) GSD-430



Target

Dual&4Gray LCD Clamshell

► Launch

- China : PP end – End. of Jul. '03.
- Russia : PP end – End. of Aug. '03.

► Sales Point

- Dual LCD Clamshell
- WAP, Dual LCD, 16Poly sound, 7color LED

Specifications

- | | |
|---|--|
| <ul style="list-style-type: none"> - 450MHz CDMA - Clam Shell Type - MSM 5105 - Dimension : 83*43*21mm - Weight : 78g - LCD : Dual LCD <ul style="list-style-type: none"> · Main : 4Gray, 8Line · Sub : Mono, 2Line - Memory : 32*8Mbit | <ul style="list-style-type: none"> - 5-way Navigation Key - 7 Color LED - Battery : Li-Ion 600mAh(Standard) - Antenna : Stubby |
|---|--|

Features

- | | |
|---|--|
| <ul style="list-style-type: none"> - WAP(UP4.1) - 16Polyponic Ringtone - 7 Color LED - Blue color sub LCD - Phonebook - Graphic & Animation UI - MT & MO SMS (Numeric, Text, Voice Mail) - T9 | <ul style="list-style-type: none"> - Game - Caller ID/ Call reject - Caller Sound ID - Voice Memo - Answering machine - Multi language - Chinese & English or Russian & English |
|---|--|



2) GSD-456



Target

1x Single&Color LCD Clamshell

► Launch

- China : PP end – Mid. of Sep. '03.
- Russia : PP end – Mid. of Oct. '03

► Sales Point

- 262K TFT Color, 40pol
- Slim folder

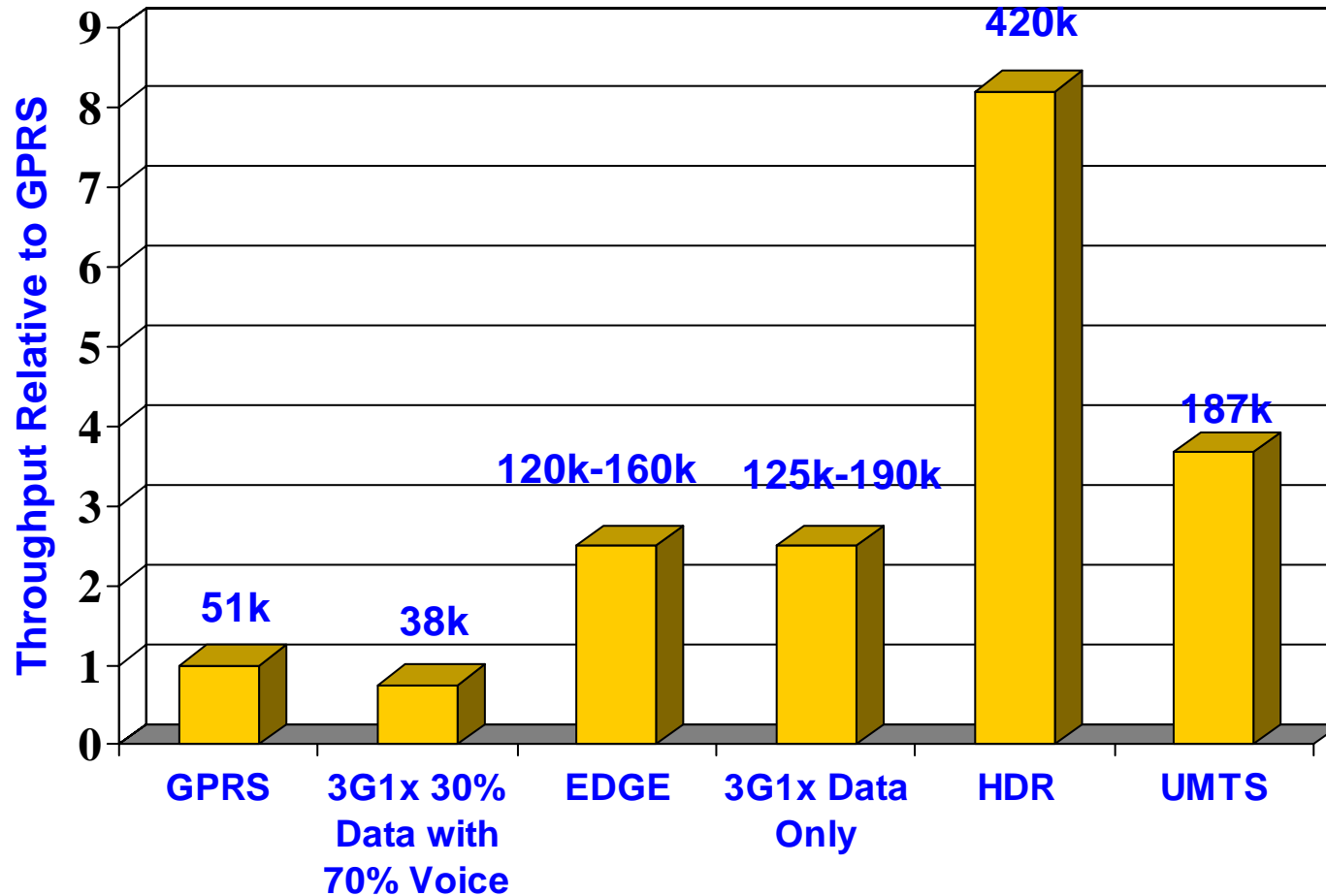
Specifications

- 450MHz CDMA
- Clamshell Type
- MSM 5105
- Dimension : 84*46*19 mm
- Display : 262K TFT Color(128*160)
- Memory : 64*32Mbit
- Antenna : Stubby
- 4-way Navigation Key + selection key
- Battery : Li-Ion 660mAh

Features

- 262K Color & Windows UI
- 40Poly Ring tone (SMAF)
- WAP (UP4.1)
- Phonebook
- MT&MO SMS (Numeric, Text, Voice Mail)
- T9
- Game
- Caller ID/ Call reject
- Caller Sound ID
- Voice Memo
- Answering machine
- **Multi language**
Chinese & English or Russian

Summary of Data Capacity Comparison





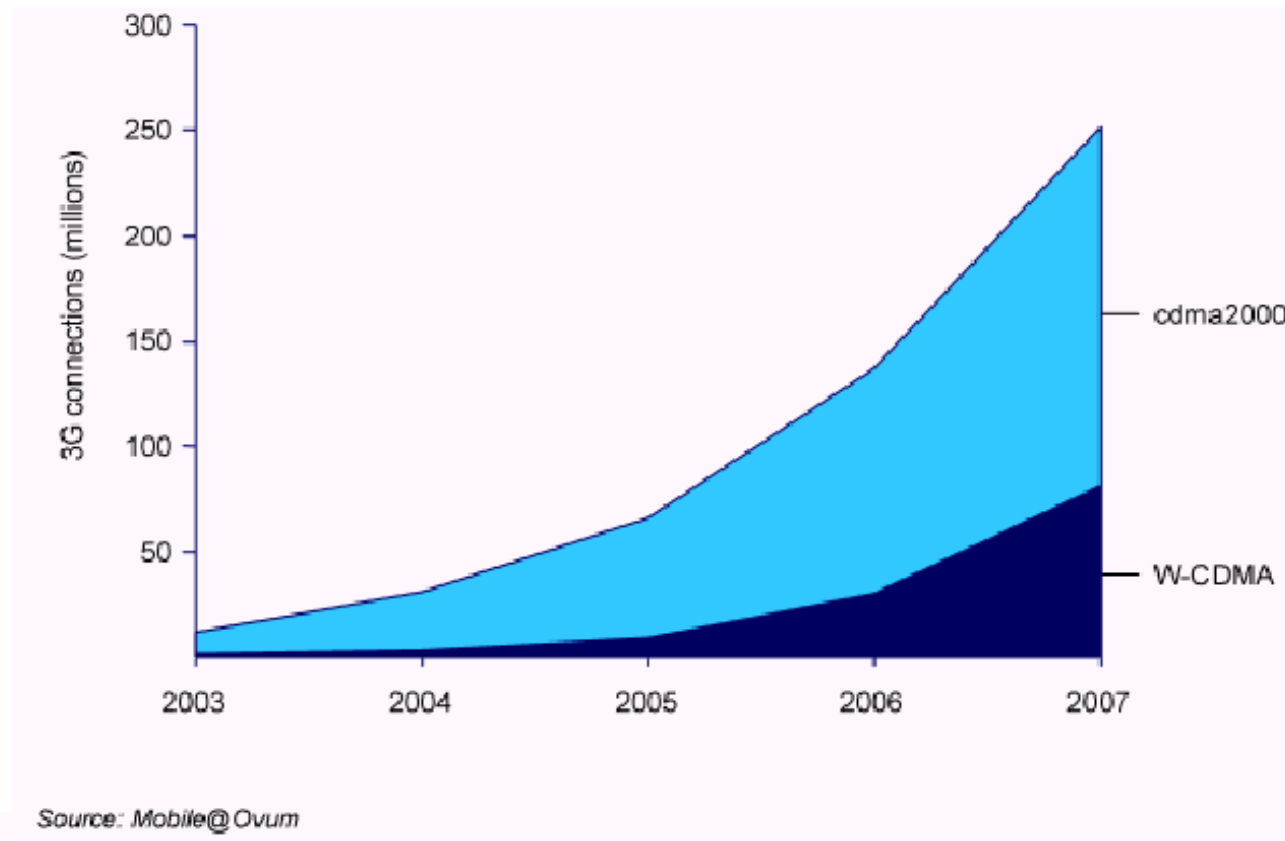
What are we to conclude?

- To achieve eEurope goals, all economical solutions should be explored.
- Efficient use of lower frequencies is an important key to reducing the costs for advanced communication solutions.
- cdma450 can help many countries economically and efficiently address the goals of eEurope.
- cdma450 has been licensed for use in a growing number of countries, including Western Europe.
- Poland can lower the cost of communications for its people while addressing the goals of eEurope using cdma450.



Backup Slides

3G Connections Worldwide (2003-2007) Ovum Study



New data from European industry consultants, Ovum, shows the potential growth of CDMA2000



Memorable Quote Regarding the 450 MHz Band

“The world is going in the wrong direction. We should be looking lower in the frequencies, not further up in the spectrum.”

Bengt Broman, former EVP and CTO of Telia Mobiles.

This statement was made in discussions shortly after Telia lost its 3G license attempt in Sweden, after arguing that it was far too expensive to cover Sweden at 2100MHz. The average winner committed to a deployment of 20,000 BTSs each to cover a country of 8 million people.