

CDMA 2000 and CDMA 450

Colin Chandler

Vice Chairman

International 450 Association

Presentation Summary

- Introduction to the International 450 Association (IA 450)
- Spectrum and Standards for CDMA 450
- Industry commitment to CDMA 450
- Summary

International 450 Association

International 450 Association History

- NMT MoU was an operator only organization with the roles of maintaining the analog NMT Specifications and facilitate roaming between NMT operators
- In 1998 NMT MoU started the Digital Interest Group to consider future digital standards for use In the NMT frequency band
- Selected CDMA and GSM as the standards to develop at a memorable meeting in New York
- NMT Association formed in 1999 from membership of the NMT MoU, plus additional members from suppliers and other organizations interested in NMT
- IA 450 launched in St Petersburg in September 2003 focusing on digitalization of 450 MHz band

International 450 Association Membership

- Membership of 25
 - 10 Operator members,
EuroTel Praha, Iberiatel, PTK Centertel, RTC MOBIKOM,
Skylink, SOTEL, Telemobil S.A., Telenor Mobile AS, Telia
Sonera, Mobisel
 - 14 Supplier members
Airvana, Benefon OY, EMS Wireless, Ericsson Radio
Systems, Huawei Technologies Co. Ltd., Hyundai Syscomm
Inc., Hyundai Curitel, Lucent Technologies, MTT, Nokia
Mobile Phones, Nortel Networks, QUALCOMM Europe,
Synertec Inc., ZTE
 - Observers
Douglas C Lane and Associates

IA 450 Mission Statement

Support the members in developing their cellular business in the 450 MHz band including migration to the digital standard, and to maintain the analogue NMT Standard

Regulatory

- Promote 450MHz band for cellular services
- Represent the IA 450 at ITU to ensure that CDMA 450 is considered in ITU committees
- Represent the IA 450 in CEPT on 450 MHz band
- Support members in influencing National Authorities for use of 450MHz band in Europe and worldwide for cellular applications

Technology

- Provide operators considering using CDMA with the technical information required to implement CDMA including migration from NMT
- Provide support to operators already using CDMA with additional technical information to improve CDMA 450 networks
- Encourage Network and Terminal vendors to develop, manufacture and market products for use with CDMA 450

Services

- NMT Association will support members in developing services including
 - Mobile telephony (voice)
 - Mobile data communications
 - PAMR Services
 - Wireless Local Loop

Public Relations

- Promote the continued use of cellular telephony in the 450 MHz band
- Cooperate with CDMA Development Group and other relevant industry groups
- Market the use of 450 MHz frequency band for CDMA 450

Operational considerations

- Ensure Roaming can be established between CDMA 450 Operators
- Ensure Roaming can be established between CDMA 450 and other technologies
- Ensure Roaming can be established with other frequency bands using CDMA
- Migration from Circuit switched to Packet switched protocols
- Prepare common recommendations for billing and customer care

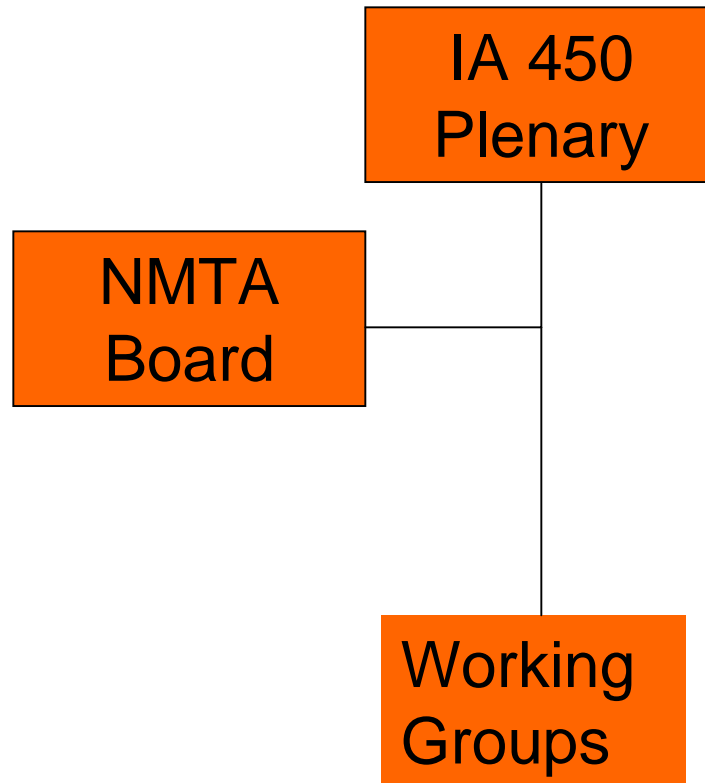
Business cases

- Provide current NMT operators and other operators using 400 to 500 MHz with a business case model for migrating to digital CDMA
- Provide new operators with a business case model for considering to use CDMA 450
- Assist network and terminal vendors to assess the market potential

NMT Analogue

- Continue support of NMT Standard and Reference Documents including
 - NMT Specifications
 - Security
 - International Roaming
 - Numbering Plans
 - Billing

IA 450 Organisation



**Chair: Yuri Dombrovsky,
Skylink**

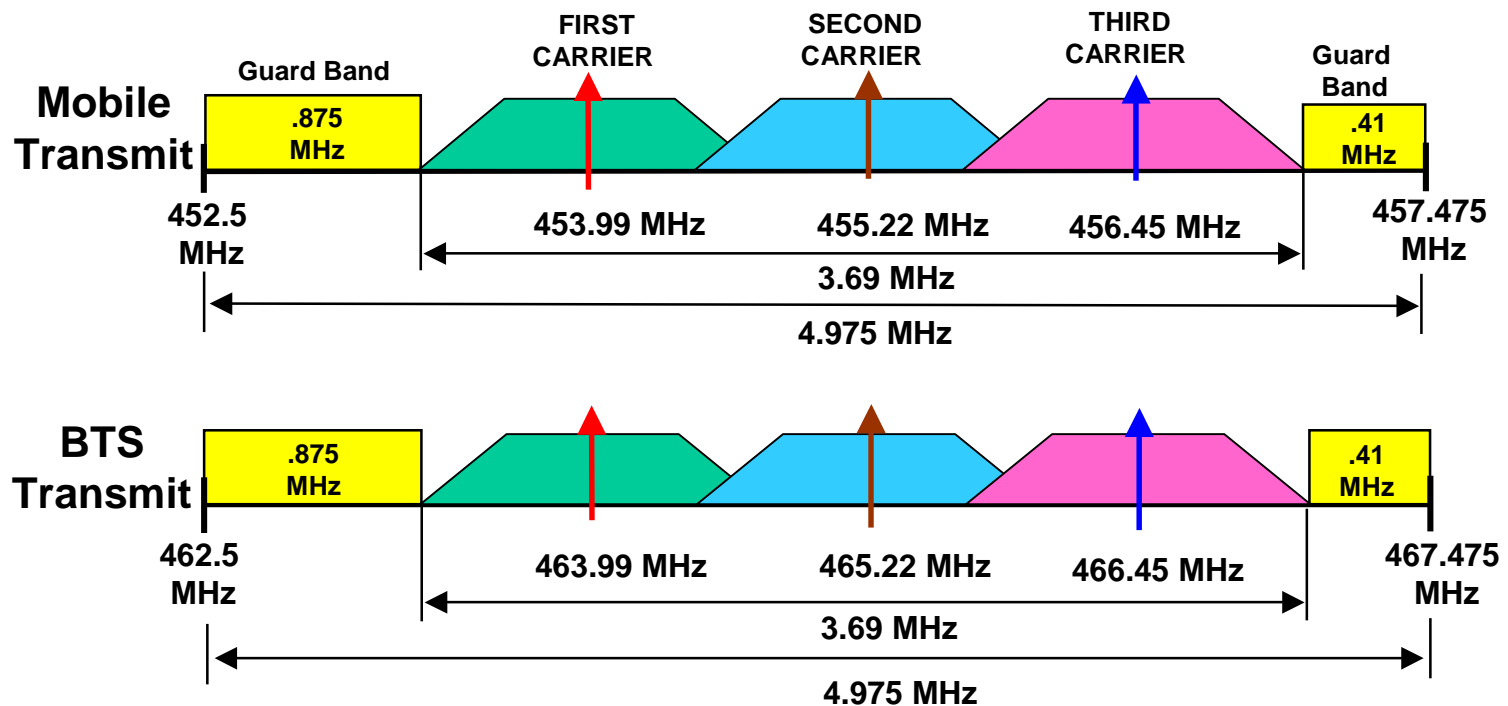
**Vice Chair: Colin
Chandler, QUALCOMM**

**Secretary: Dorota
Inkielman, PTK Centertel**

Spectrum and Standards for CDMA 450

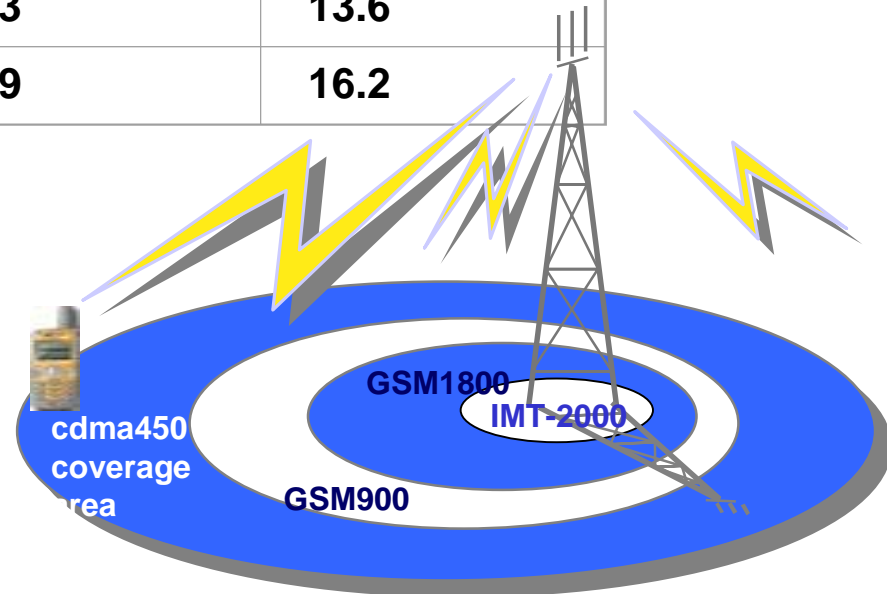
CDMA2000 1x at 450 MHz NMT 'A' Band

- Preferred CDMA450 Frequency bands



Comparing CDMA2000 Coverage At 450MHz

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
2100	12.0	449	16.2



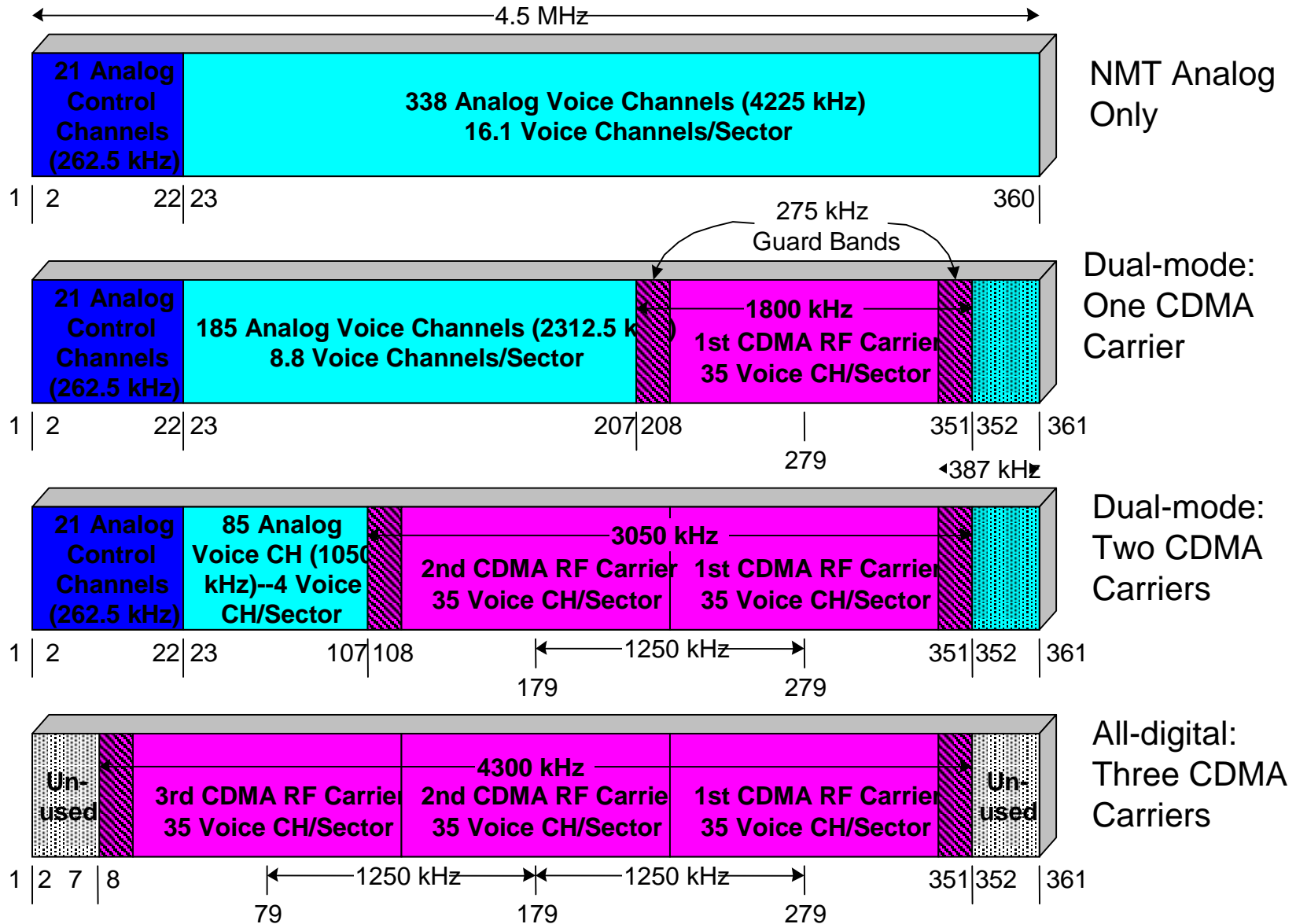
Spectrum Requirements for IS-2000-1x in 450 MHz NMT Bands

- Minimum clearing requirement 1.8 MHz for one carrier
- 2nd and 3rd carriers require additional 1.25 MHz each
 - 3.05 MHz for two carriers
 - 4.3 MHz for three carriers
- Significant flexibility in carrier placement within allocated band
 - FA's (available carrier frequencies) are spaced on a raster of 20 or 25 kHz, depending on IS-2000 Band Class 5 Band sub-class
 - Carrier frequencies can be chosen to avoid known interference issues
 - Carrier spacing can be modified somewhat, with minimal impact on performance

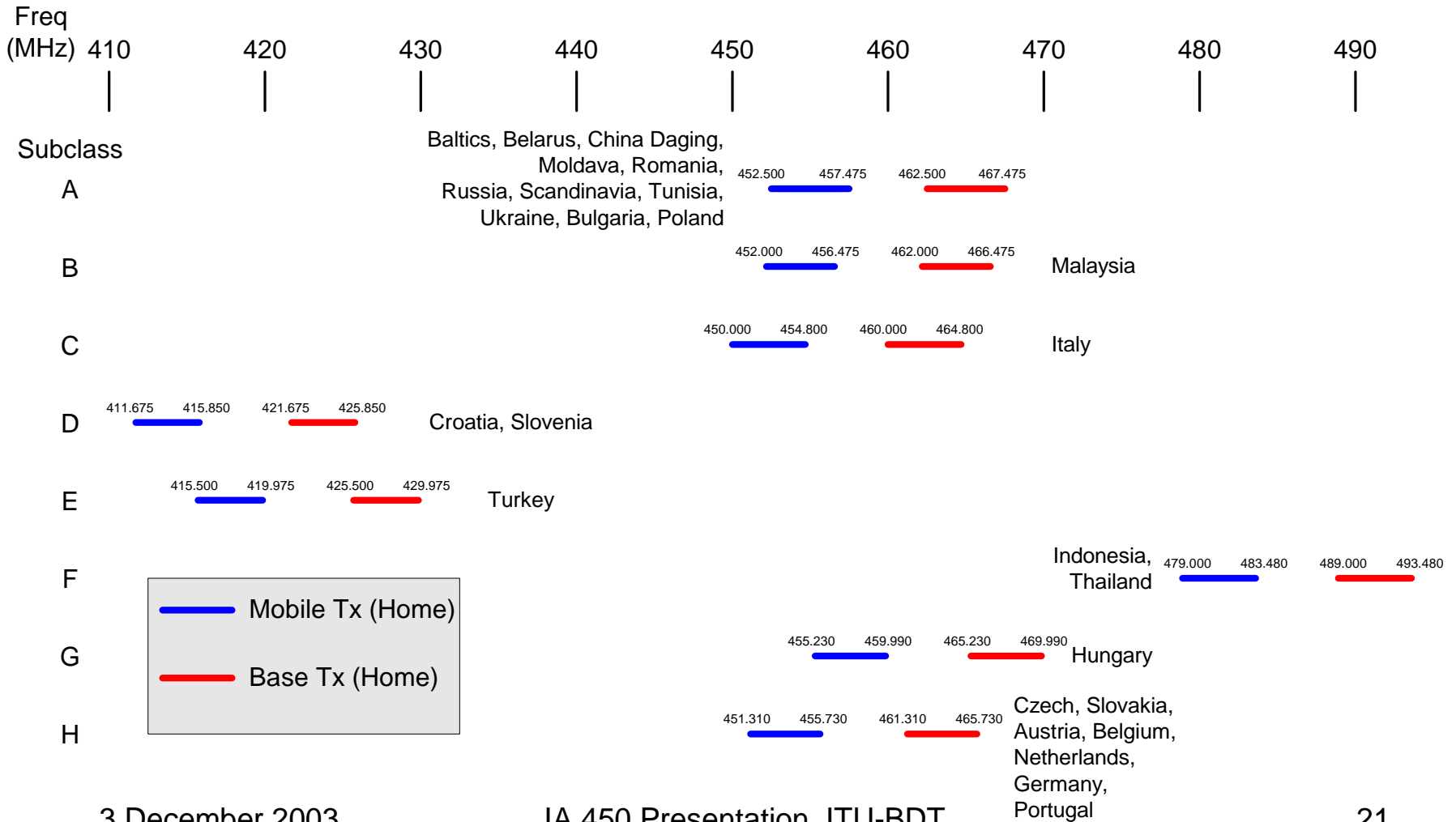
Band Class 5/Band Subclass A Example

- Channel numbers shown in figure are (non-standard) interleaved analog 12.5 kHz channel numbers, where $f = 453.000 + (n-1)*0.0125$ MHz
- CDMA carriers introduced are the preferred carriers specified in IS-2000 standards documents for Band Class 5 Band subclass A
 - Band Class 5 channel numbers 160, 210, and 260
 - Correspond to carrier frequencies: 453.975, 455.225, and 456.475 MHz ($f = 450.000 + (N-1)*0.025$ MHz)

Digital Transition Frequency Plan

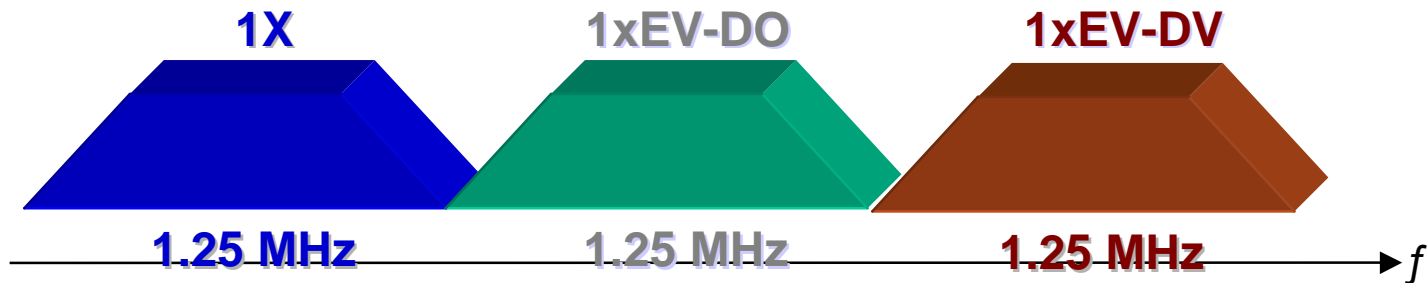


CDMA 450 Band Class and Subclasses



CDMA2000 Family of Standards

- 1xEV-DO and 1xEV-DV technologies fit seamlessly into IS-95/CDMA2000 1x networks:
 - Same chip rate, link budget, power requirements, and coverage area
 - Same network architecture and elements as CDMA2000
 - 1X/1xEV-DO together only use two 1.25 MHz carriers to offer services that exceed ITU 3G requirements, versus other technologies that require 5 MHz of spectrum



Can flexibly mix 1x, 1xEV-DO, 1x EV-DV in the spectrum allocation

Industry commitment to CDMA 450

Infrastructure Vendors for CDMA 450

- Lucent Technologies
- Huawei
- ZTE
- Nortel

Handset Vendors for CDMA 450

- Available today
 - Synertek
 - Hyundai Curitel
- Future terminals
 - Compal
 - AnyDATA (terminal and data card)
 - Giga
 - GTRAN
 - Huawei
 - ZTE
- Other vendors are also showing interest in developing CDMA 450 terminals



CDMA 450 Operators - 1

- Zapp Mobile (Telemobil), Romania
 - Opened service December 2001
 - 150,000 subscribers, October 2003
 - Expect 200,000 subs by end of 2003
 - 85% corporate users, ARPU \$33-\$34
- SkyLink, Russia
 - Currently comprising Delta, St Petersburg and Moscow Cellular Communications

CDMA 450 Operators - 2

- Delta
 - Opened December 2002 when Russian Ministry of Telecommunications granted CDMA450 federal status
 - 30,000 subscribers October 2003
 - ARPU \$67 per month, 64 % using data, with speeds in excess of 80 kbps
- MCC
 - Opened 1 November 2003

CDMA 450 Operators - 3

- BelCel, Belarus
 - Launched February 2003
 - Anticipate 100,000 subs by end of Q3 2004
- Iberiatel, Georgia
 - Currently operates NMT 450 WLL system
 - Launching CDMA 450 WLL system before end of 2003
- Uzbektelecom, Uzbekistan
 - Received licence for cdma450 in 2002 for WLL services and is operational

Future developments in CDMA 450

- Serious consideration of the technology in China
- Further expansion in CES
- PAMR and PPDR

Summary

- CDMA 450 is a commercially and technically viable technology in operation today providing cellular voice data and WLL services

International 450 Association

Contact details

- For more information on the International 450 Association please visit the International 450 Association web site at www.450world.org
- For membership information contact the International 450 Association Secretary at dorota.inkielman@centertel.pl