

TCRA

CDMA Spectrum Considerations and Recommendations

1 March 2006





Worldwide Spectrum Allocations & Equipment Availability

- **GSM & WCDMA**

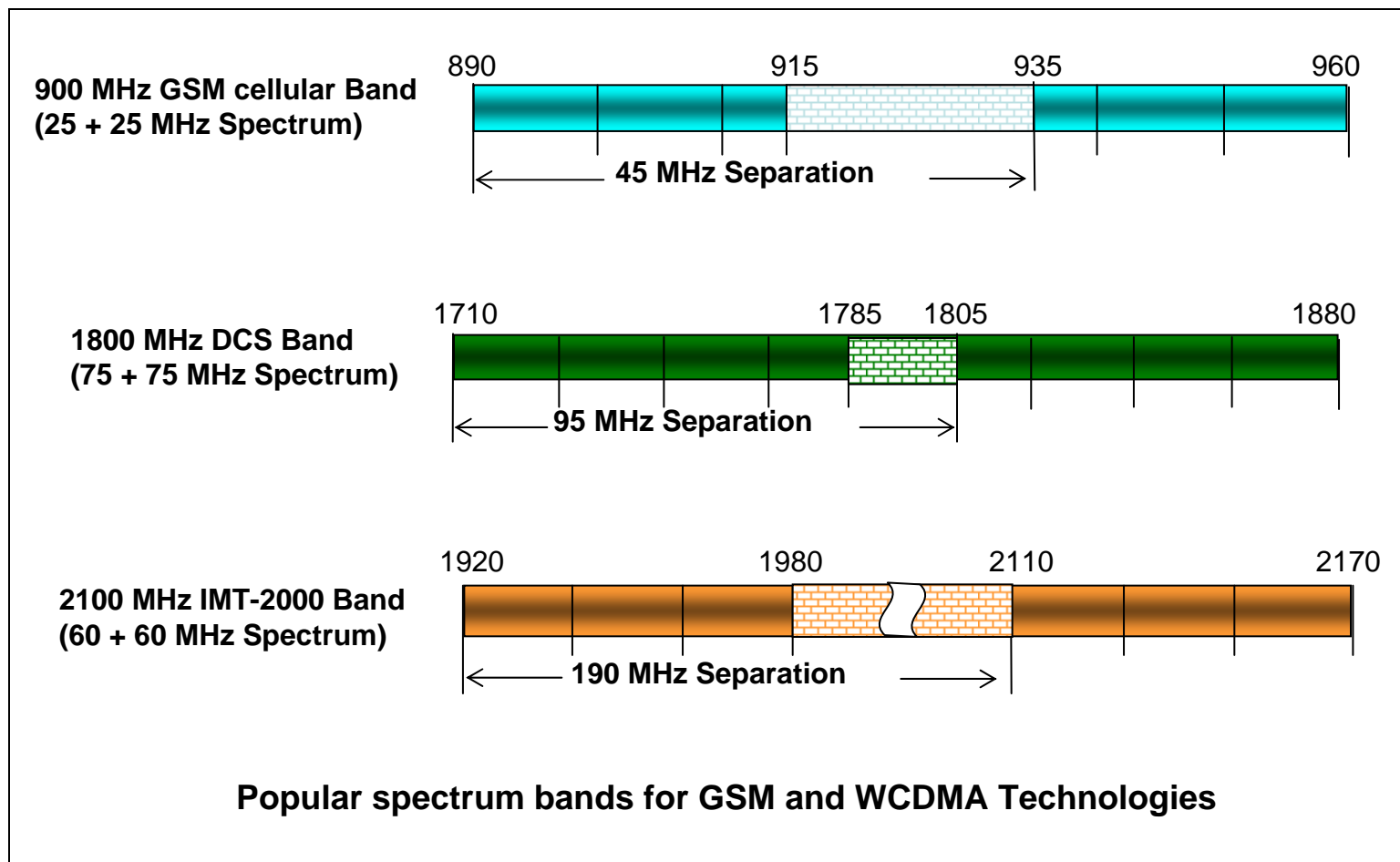
- **900 MHz cellular band**
 - 890 to 915 MHz for uplink
 - 935 to 960 MHz for downlink
- **1800 MHz DCS band**
 - 1710 to 1785 MHz for uplink
 - 1805 to 1880 MHz for downlink
- **2100 MHz IMT-2000 band**
 - 1920 to 1980 MHz for uplink
 - 2110 to 2170 MHz for downlink
- **900 MHz E-GSM band**
 - 880 to 890 MHz for uplink
 - 925 to 935 MHz for downlink

- **CDMA2000**

- **850 MHz US cellular band**
 - 824 to 849 MHz for uplink
 - 869 to 894 MHz for downlink
- **1900 MHz PCS band**
 - 1850 to 1910 MHz for uplink
 - 1930 to 1990 MHz for downlink
- **2100 MHz IMT-2000 band**
 - 1920 to 1980 MHz for uplink
 - 2110 to 2170 MHz for downlink
- **450 MHz NMT band**
 - 452.5 to 457.475 MHz for uplink
 - 462.5 to 467.475 MHz for downlink

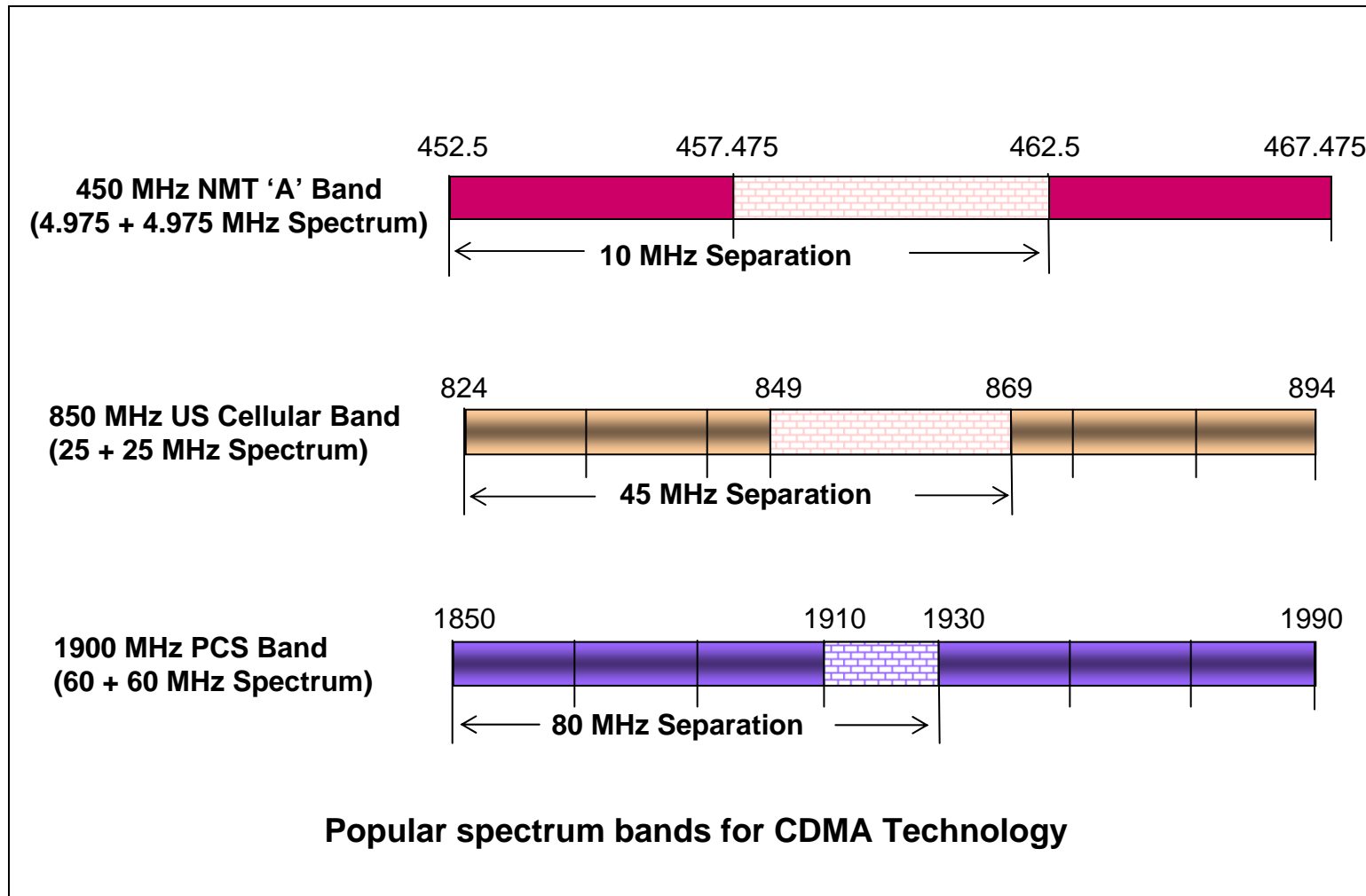


GSM/WCDMA Spectrum Allocations





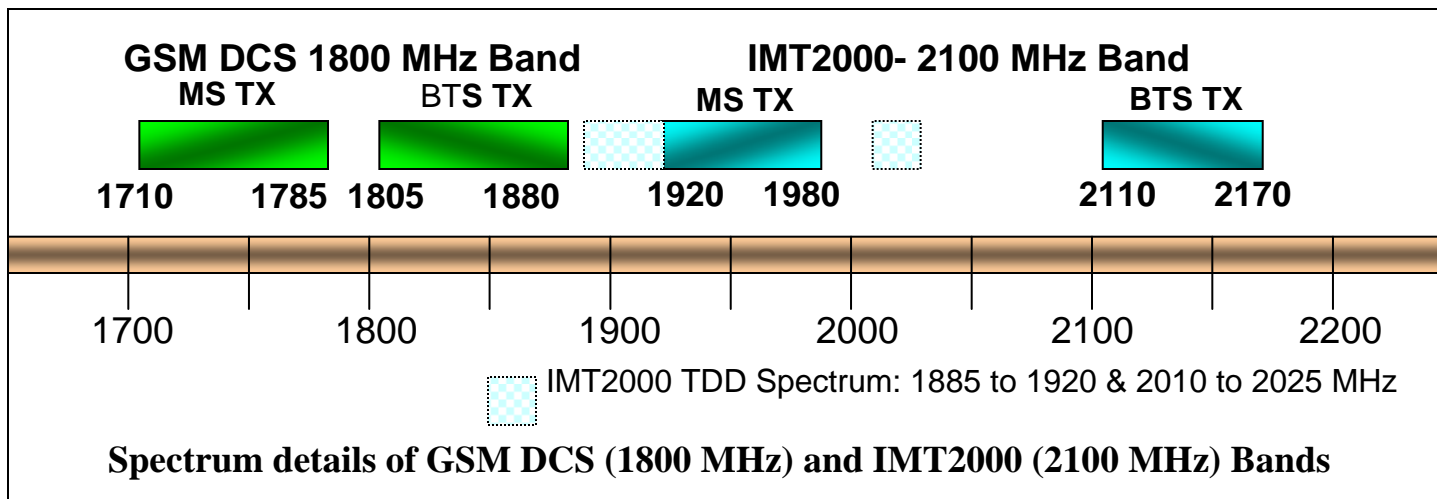
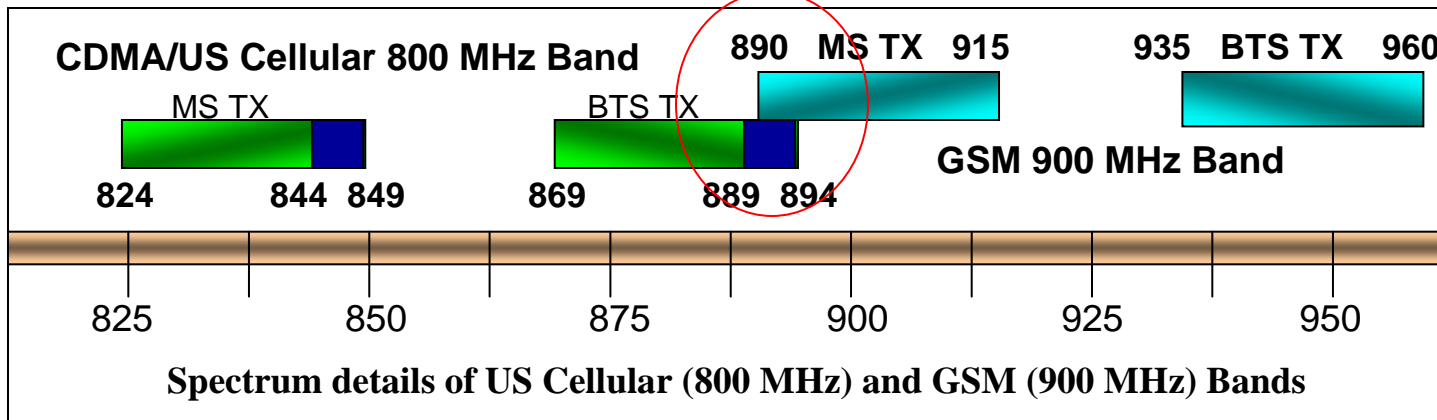
CDMA2000 Spectrum Allocations





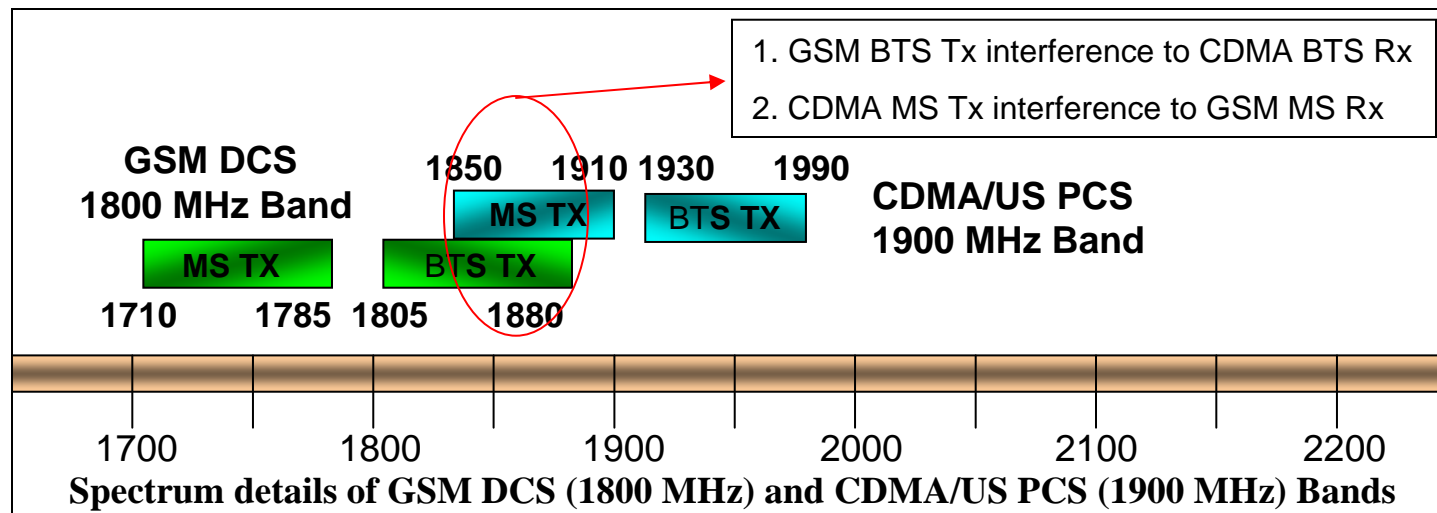
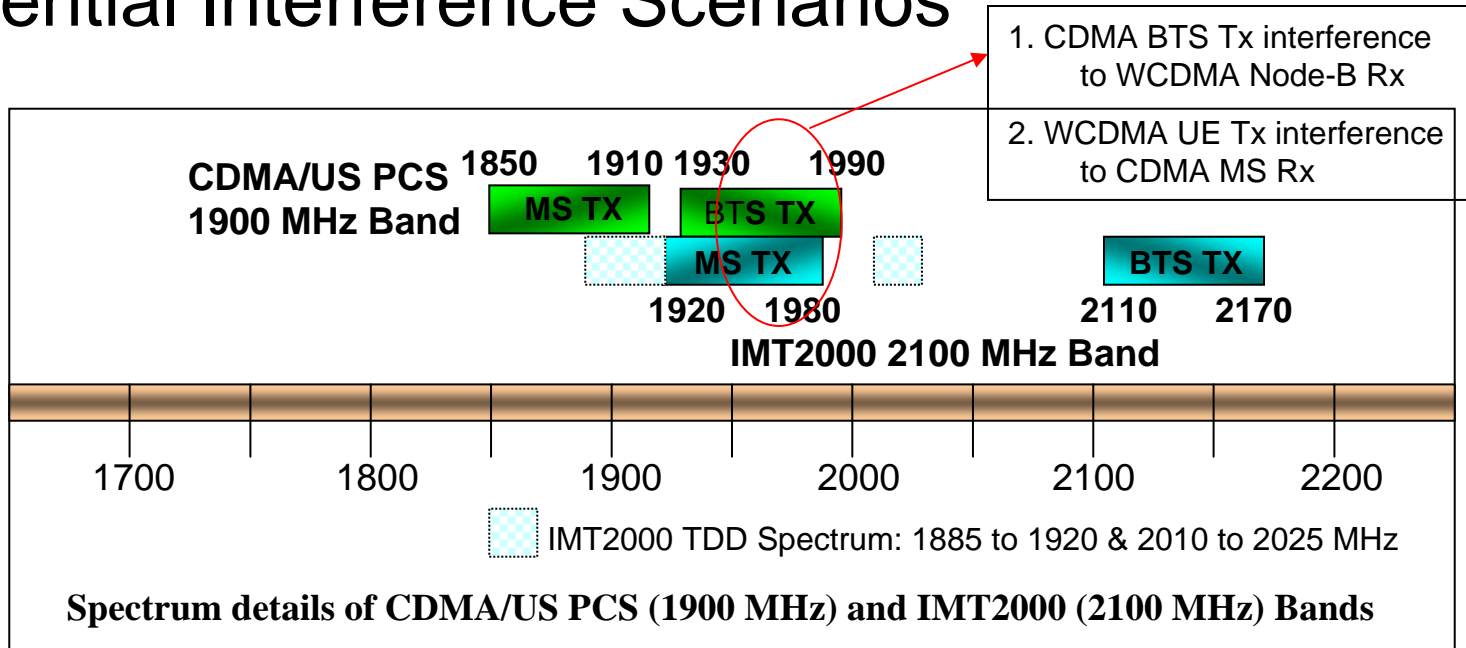
Potential Interference Scenarios

CDMA2000 Tx to GSM Rx Interference at BTS





Potential Interference Scenarios





Tanzania - Possible Spectrum Allocations

- GSM & WCDMA
 - 900 MHz cellular band (25+25MHz)
 - 890 to 915 MHz for uplink
 - 935 to 960 MHz for downlink
 - 1800 MHz DCS band (75+75 MHz)
 - 1710 to 1785 MHz for uplink
 - 1805 to 1880 MHz for downlink
 - 2100 MHz IMT2000 band (60+60 MHz, shared with CDMA2000)
 - 1920 to 1980 MHz for uplink
 - 2110 to 2170 MHz for downlink
 - 900 MHz E-GSM band (in some markets) (10+10 MHz)**
 - 880 to 890 MHz for uplink
 - 925 to 935 MHz for downlink
- Spectrum for CDMA
 - 850 MHz US cellular band (20+20 MHz)**
 - 824 to 844 MHz for uplink
 - 869 to 889 MHz for downlink
 - 1900 MHz PCS band (10+10 MHz)
 - 1900 to 1910 MHz for uplink
 - 1980 to 1990 MHz for downlink
 - 450 MHz NMT band (~ 5+5 MHz)
 - 452.5 to 457.475 MHz for uplink
 - 462.5 to 467.475 MHz for downlink
 - 2100 MHz IMT-2000 band (60+60 MHz, shared with WCDMA)
 - 1920 to 1980 MHz for uplink
 - 2110 to 2170 MHz for downlink

****E-GSM allocations in Tanzania permit only 10+10 MHz of bandwidth
824 to 834MHz & 869 to 879 MHz for CDMA operators in 800 MHz band**

CDMA2000 – Subscriber Base & Economies of Scale

By Region	Sep-04	Sep-05	Y-o-Y Growth	% of Total (Jun-05)
Africa	192,750	350,030	82%	0.13%
Americas	38,610,300	55,308,800	43%	20.19%
Asia Pacific	93,509,040	110,776,610	18%	40.45%
Europe: Eastern	960,490	1,387,810	44%	0.51%
Europe: Western	2,078,000	2,500,370	20%	0.91%
Middle East	0	217,800	n/a	0.08%
USA/Canada	87,653,380	103,338,000	18%	37.73%
TOTAL CDMA	223,003,960	273,879,420	23%	

By Frequency Band	Sep-04	Sep-05	Y-o-Y Growth	% of Total (Jun-05)
CDMA-1700	17,542,540	18,567,460	6%	6.78%
CDMA-1900	33,961,180	40,534,230	19%	14.80%
CDMA-450	568,340	1,077,560	90%	0.39%
CDMA-800	106,838,970	137,833,970	29%	50.31%
CDMA-800/1900	64,092,930	75,948,300	18%	27.72%
TOTAL CDMA	223,003,960	273,961,520	23%	

CDMA 800 Makes for Nearly 78% of the Total CDMA Handsets/Subscribers – Sweet Spot for Coverage AND Economies of Scale



Conclusions

- 800 MHz is the Sweet-Spot - Most suitable band from coverage and device availability/cost standpoint
- With EGSM allocation, only 10 MHz possible for CDMA at 800 MHz
- With IMT2000 (3G) future allocations, only 10 MHz possible for CDMA at 1900 MHz
- Only 5 MHz possible for CDMA in 450 MHz
 - Splitting 5 MHz in multiple operators NOT recommended
- Weak business case for operators with only 1900 MHz allocation
- Expansion possibilities limited if allocated < 3 CDMA carriers (for any operator)



Recommendations

- Relocate EGSM incumbent or Re-assign (if not yet operational) to available DCS-1800 spectrum
 - Much more spectrum availability at DCS-1800 vs. CDMA-800
- Divide available 800 MHz (20 MHz possible) among no more than 4 operators
 - See allocation chart in next slides
 - $4+3+4+3 = 14$ CDMA RF Carriers possible with appropriate guard bands
- Possible to split the 800 MHz (20 MHz possible) into lesser # of operators if necessary
- Allocate 1900 MHz spectrum as “Overflow” or “Capacity” spectrum
- Allocate the 5 MHz available spectrum in 450 MHz to only one operator
 - Optimizes spectrum usage minimizing guard band requirements and interference possibilities

Recommendations

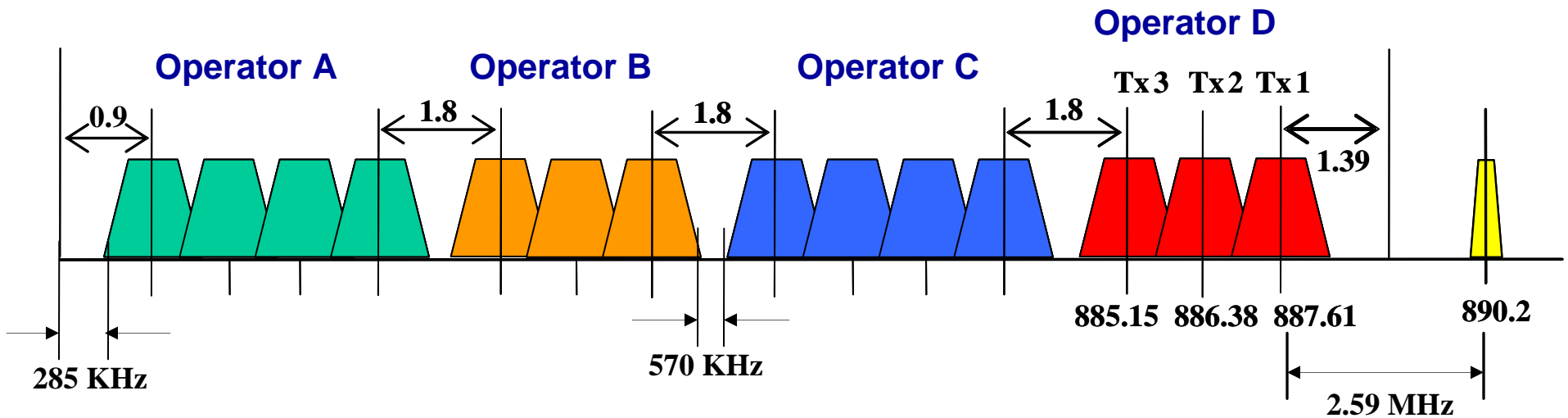
800 MHz – 4 Operators (14 CDMA RF Carriers)

824 MHz -Uplink

869 MHz - Downlink

849 MHz – Uplink

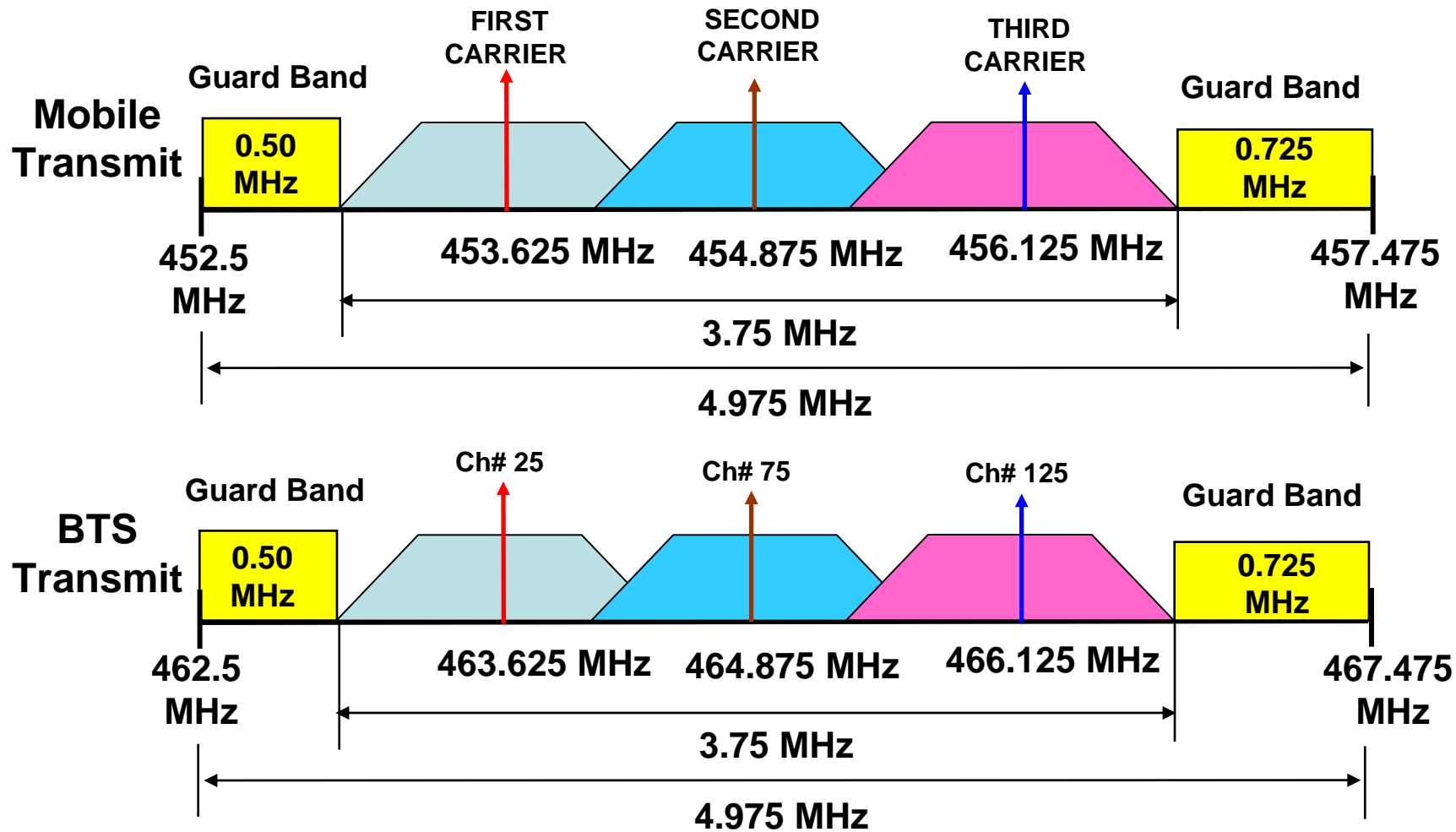
889MHz – Downlink



Guard band with GSM: 775 kHz + 1.1 MHz = 1.875 MHz
 Last CDMA carrier to first GSM carrier spacing: 2.59 MHz
 Guard band between two adjacent operators: 570 kHz
 CDMA carrier-to-carrier spacing between two adjacent groups: 1.8 MHz

Recommendations

450 MHz – 1 Operator (3 CDMA RF Carriers)



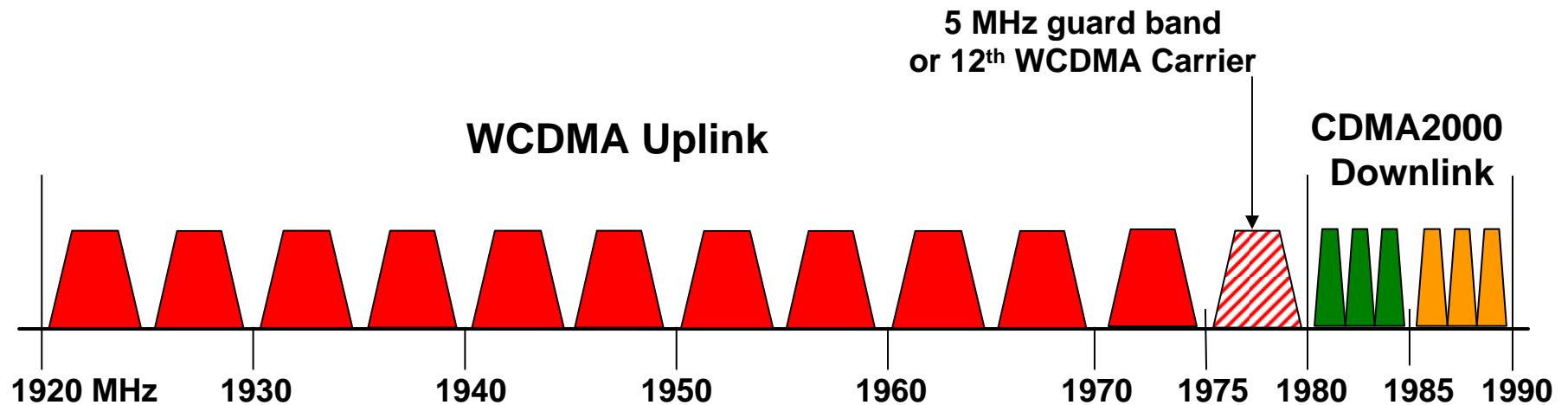
Note: Raster: 25 KHz and each CDMA carrier = 50 NMT Channels



Recommendations

1900 MHz – WCDMA (11 Carriers) and CDMA2000 – 2 Operators (6 Carriers)

Assuming 5 MHz allocation for each WCDMA carrier*
& full occupation of WCDMA spectrum



* Note: Alternative WCDMA carrier bandwidths (4.6 & 4.8 MHz) are also possible, but have not been considered in this assessment



Thank You!