7~8 GHz band

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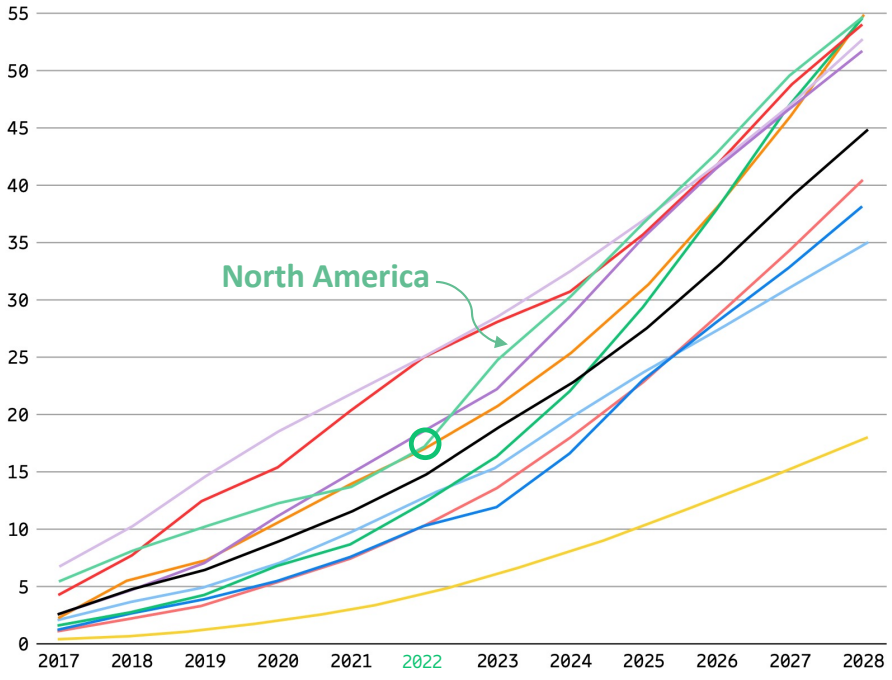
Topics

1. Need for “extended mid-band” spectrum
2. Background on the band
3. Characterization / coexistence studies
4. Desirable outcomes
5. Next steps

Enhanced mobile broadband (eMBB) won't quit

Figure 20: Mobile data traffic per smartphone (GB per month)



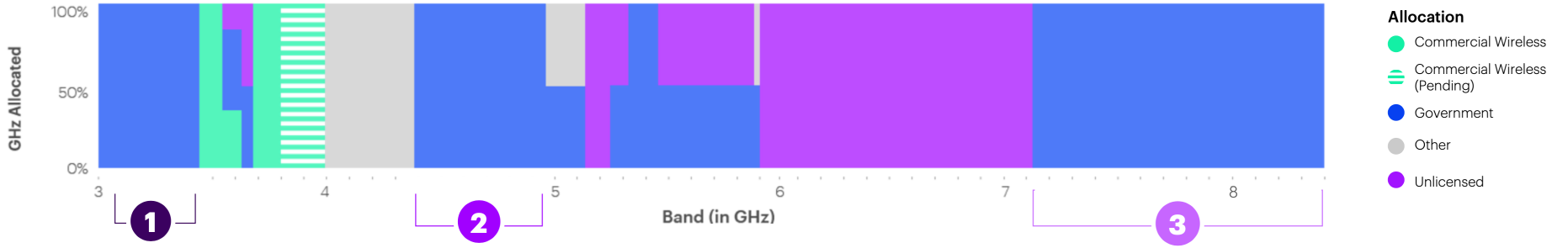
Regions	2022	2028	CAGR 2022–2028
North America	17.4	55	21%
North East Asia	17	55	21%
South East Asia and Oceania	12.5	54	28%
India, Nepal, Bhutan	25	54	14%
GCC	25	53	11%
Western Europe	19	52	18%
Global average	15	46	21%
Latin America	10.5	41	25%
Middle East and North Africa[1]	11	38	24%
Central and Eastern Europe	13	35	18%
Sub-Saharan Africa	4.6	18	26%

- eMBB data traffic continues to grow
  2022 ~ 17 GB/month/sub
  2028 ~ 55 GB
  ~21% CAGR in NA
- eMBB prefers
  exclusive license
  high power
  wide channels
  simple OoBE mask
- New applications like XR and FWA demand upto 10x this traffic
- Before 6G!

source: "Ericsson Mobility Report", November 2022

Mid-band keeps getting higher in frequency

All needed for 5G and 5G Advanced



Lower 3 GHz
3.1~3.45 GHz
350 MHz

4.4 GHz
4.4~4.94 GHz
540 MHz

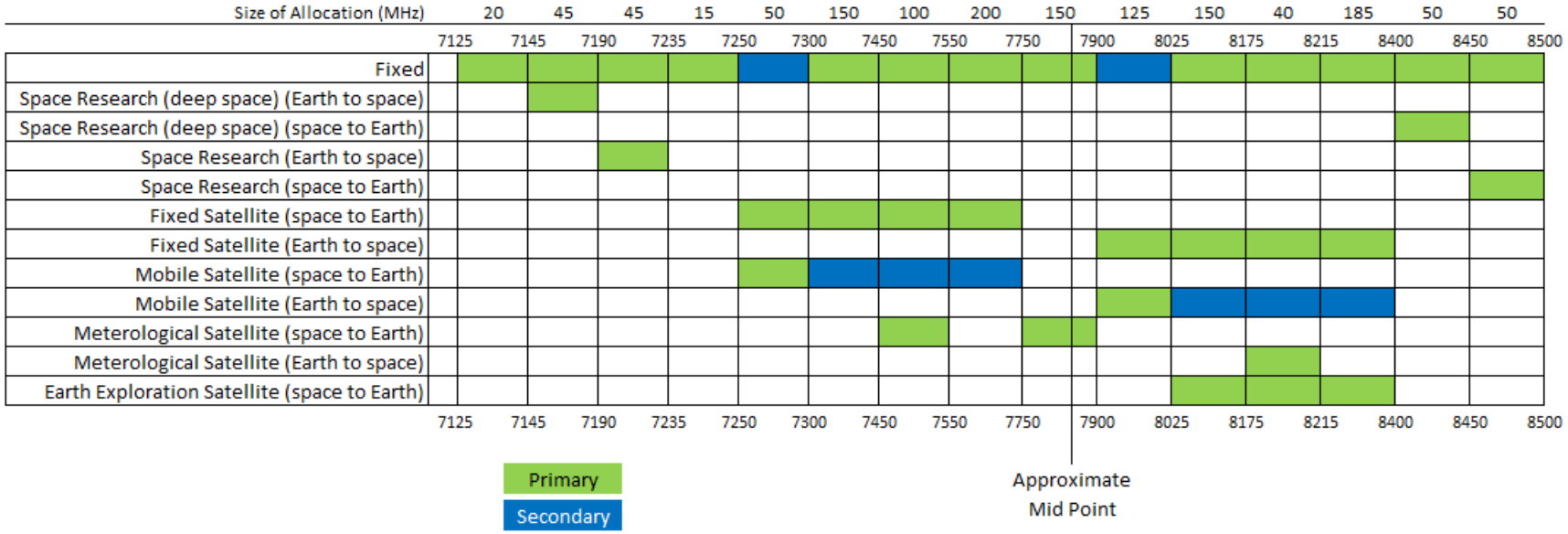
7~8 GHz
7.125~8.5 GHz
1375 MHz

- "mid-band" used to be anything above 2 GHz, then became 3.5 GHz, now . . .
- 7~8 GHz is really "extended mid-band"
- 7~8 GHz is one of 3 potential bands for 5G and 5G Advanced "flexible use" commercial applications
- Needed before 2027
- Federal use currently dominates

figure source: "Spectrum Allocation in the United States" Accenture report for CTIA, September 2022

7~8 GHz band - existing US federal allocations

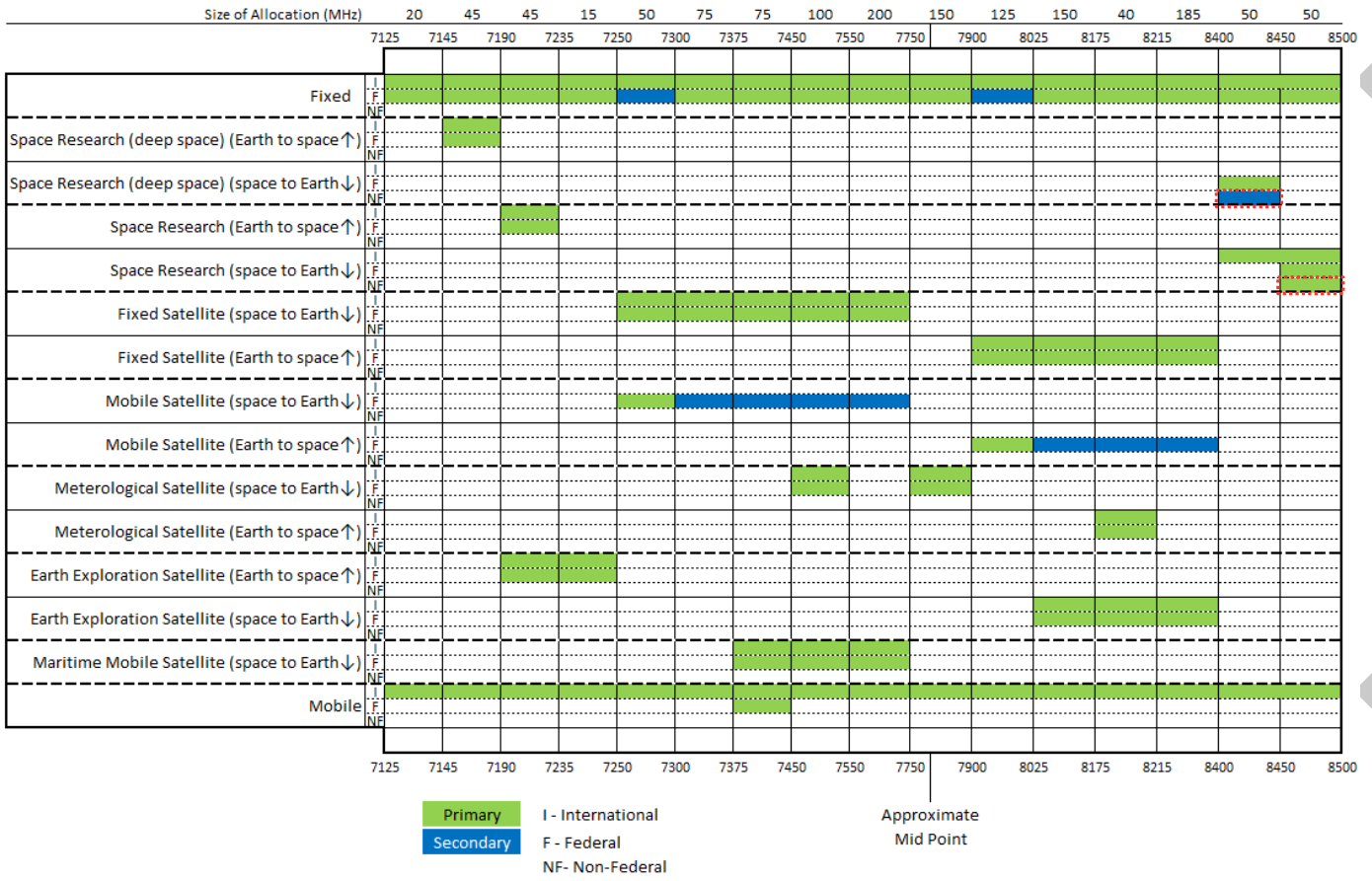
1375 MHz in 16 segments varying from 20~200 MHz



Fixed use:	primary except for 7250-7300 & 7900-8025
Deep Space Research paired:	7145-7190 (45 MHz, UL) / 8400-8450 (50 MHz, DL)
Space Research paired:	7190-7235 (45 MHz, UL) / 8450-8500 (50 MHz, DL)
Fixed Satellite paired:	7250-7750 (500 MHz, DL) / 7900-8400 (500 MHz UL)
Mobile Satellite primary paired:	7250-7300 (50 MHz, DL) / 7900-8025 (125 MHz, UL)
Mobile Satellite secondary paired:	7300-7750 (450 MHz, DL) / 8025-8400 (375 MHz, UL)
Meterological Satellite paired:	7450-7550 & 7750-7900 (250 MHz, DL) / 8175-8215 MHz (40 MHz, UL)
Earth Exploration Satellite (paired outside of 7~8 GHz)	8025-8400 (375 MHz, DL) / 25.5-27 GHz (1500 MHz, UL)

7~8 GHz band - existing allocations

More detail on International and Non-Federal



international Fixed allocation across whole band

international Mobile allocation across whole band

figure source: CommScope

7~8 GHz band - current primary usage examples

- NTIA showed 8713 assignments in August 2019 [1]
  - A, AF, AR, C, CG, DHS, DOE, FAA, I, J, MC, N, NASA, NSF,S, SI, TVA, VA
- Number of Fixed assignments is declining
- Approximately 20% of Fixed use is DoD
- Fixed Satellite use includes
  - Defense Satellite Communications Systems (DSCS)
  - Wideband Gapfiller Satellite (WGS)

A - Agriculture
AF - Air Force
AR - Army
C - Commerce
CG - Coast Guard
DHS - Department of Homeland Security
DOE - Department of Energy
FAA - Federal Aviation Administration
I - Interior
J - Justice
MC - Marine Corps
N - Navy
NASA - NASA
NSF - National Science Foundation
S - State Dept
SI - Smithsonian Institution
TVA - Tennessee Valley Authority
VA - Veterans Admin

[1] source: Diane Rinaldo memo to agencies - NTIA

7~8 GHz for commercial wireless

- Potential for multiple contiguous 100 MHz or more blocks, needed for 5G
- That would provide good capacity, especially needed in densely populated areas
- Reasonable coverage compared to above 10 GHz, but not as good as Lower 3
- FCC Chairwoman recently called out spectrum in the 7 to 15 GHz range for its ability to support faster speeds and wide coverage [1]
- FCC Commissioner acknowledged it would be well-positioned to reallocate blocks within this band to support 5G services [2]

[1] Rosenworcel, J. "Remarks of FCC Chairwoman Rosenworcel at Mobile World Congress 2022". Benton Institute for Broadband & Society, March 1, 2022. https://www.benton.org/headlines/remarks-fcc-chairwoman-rosenworcel-mobile-world-congress- 2022

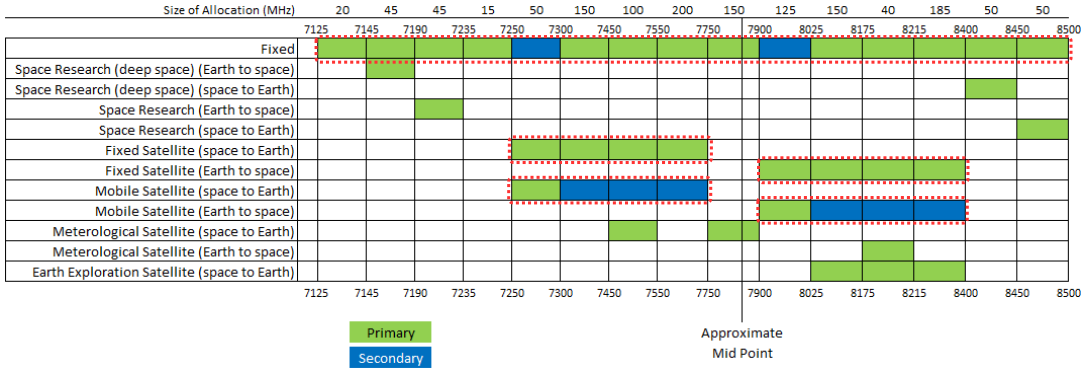
[2] Carr, F. "Carr AEI Keynote: Extending America's 5G Leadership". FCC, March 15, 2021 https://www.fcc.gov/document/carr-aei-keynote-extending-americas-5g-leadership

Characterization / coexistence studies

- **Characterize current operation and density of federal incumbent use in band**
  - 2014 ITS studies on utilization
  - Occupancy measurements for three cities indicated generally low usage
  - Need to be mindful of sensitive information, especially military
  - Sharing requires accurate real time usage information
- **Clarify potential mobile use cases**
  - Macro, small cell, indoor, FWA
- **Analyze existing coexistence studies between mobile and various federal incumbent systems**
  - Outdoor co- & adjacent channel coexistence between 5G Advanced Antenna Systems (AAS) and FS/FSS (ITU WP5D looking at FSS and IMT at 6GHz)
  - Probability of interference and acceptable interference level?
  - Coordination distances for typical deployments assuming full-power commercial operation?
  - Need for guard bands and filtering?
  - Possible mitigation techniques (antenna height and direction, power reduction, shielding, etc.)

Desirable outcomes

- Some band usage models could be . . .
  - Licensed exclusive use in (lower) part of band + shared use in other parts of band
  - Entire band shared
- Need simple, static sharing mechanisms in all cases
- Repack to enable multiple contiguous 100+ MHz blocks, preferably in lower portion of band
- Convert Fixed service to support both commercial and federal use equipment with wider bandwidth channels, carrier aggregation and higher modulation schemes, to deliver higher bit rates
- Relocate / re-tune / share some Fixed Satellite Services, within or to other bands?
- Relocate / re-tune some Mobile Satellite services?
- Identify simple Coordination Areas
  e.g. for Space Research



Next steps

- Identify and agree fora to perform studies
  - WInnForum, CSMAC, NSC, NDIA
- NTIA facilitate understanding of incumbent operations?
- Continue to meet with NTIA to update on efforts
- Approach FCC regarding any needed action on the band
- Phased approach?
  - Paper study vs deployment data
- Interested parties include
  - CTIA, Ericsson, Nokia, CommScope, others? . . .

Some references

- "Ericsson Mobility Report" November 2022
- "Spectrum Allocation in the United States" Accenture report for CTIA, September 2022
- "Broadband Spectrum Survey in the Denver and Boulder, Colorado, Metropolitan Areas" NTIA Report TR 13-496 August 2014
- "Broadband Spectrum Survey in the Chicago, Illinois, Area" NTIA Report TR-14-502 April 2014
- "Broadband Spectrum Survey in the San Diego, California, Area" NTIA Report TR-14-498 November 2014
- Annex 4.19 to Working Party 5D Chairman Report ITU Document 5D/1361 July 2022
- Annex 4.20 to Working Party 5D Chairman Report ITU Document 5D/1361 July 2022
- "Sharing and compatibility studies related to Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) in the frequency band 5925-6425 MHz" CEPT ECC 302 study May 2019
- "System parameters and considerations in the development of criteria for sharing or compatibility between digital fixed wireless systems in the fixed service and systems in other services and other sources of interference" ITU-R F.758 November 2019
- "Conservation Techniques for Fixed Microwave Systems (7125-8500 MHz)" NTIA report TR 89-243 May 1989
- "Interference Criteria for Microwave Systems" TIA report TIA-10 May 2019
- "Remarks of FCC Chairwoman Rosenworcel at Mobile World Congress 2022" Benton Institute for Broadband & Society link March 2022
- Carr AEI Keynote "Extending America's 5G Leadership" link March 2021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