

FCC 10/17 Mobile 24+ GHz NOI

Michael J. Marcus, Sc.D., F-IEEE

FCC/OET (1979-2004)

Adjunct Professor of ECE, Virginia Tech

Chair, IEEE-USA Committee on Communications Policy (2012-3)

mjmarcus@marcus-spectrum.com

www.marcus-spectrum.com

301-229-7714



Docket 94-124 60 GHz NPRM 10/20/94



<http://youtu.be/0lvL4SGHY5Y>

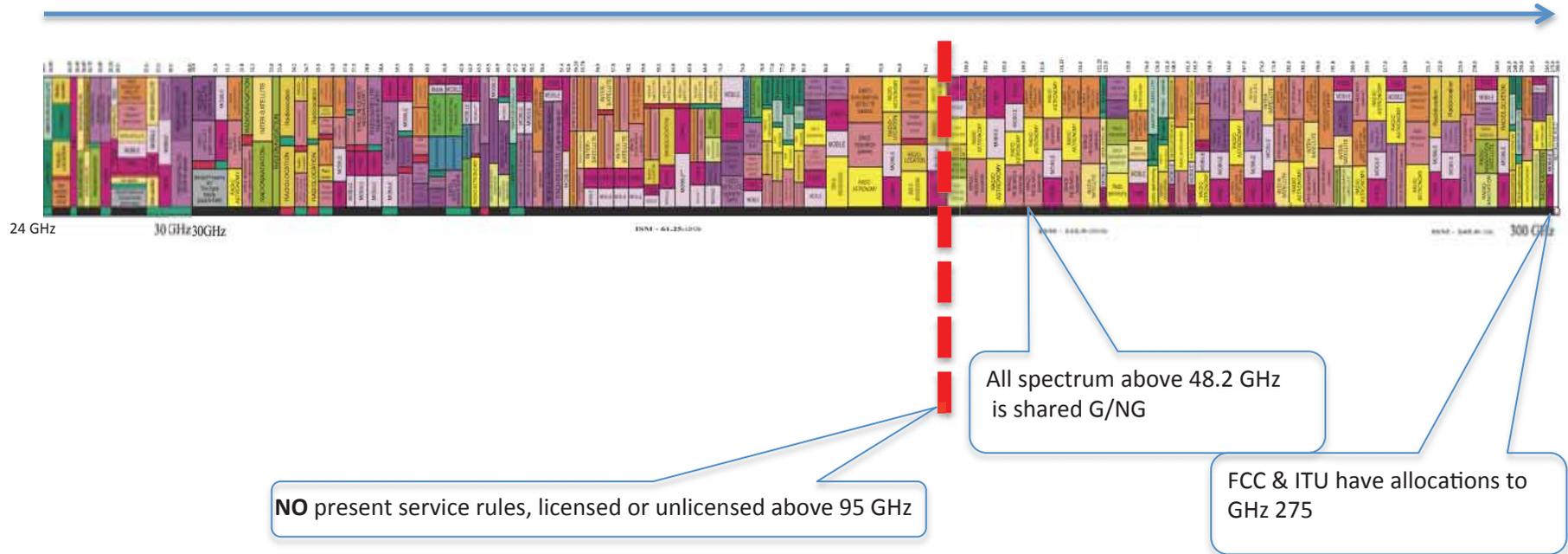
<http://youtu.be/wMC4wLFCLlc>

Statutes

- **47 U.S. Code § 157 - New technologies and service**
 - (a) It shall be the policy of the United States to encourage the provision of new technologies and services to the public. Any person or party (other than the Commission) who opposes a new technology or service proposed to be permitted under this chapter shall have the burden to demonstrate that such proposal is inconsistent with the public interest.
 - (b) The Commission shall determine whether any new technology or service proposed in a petition or application is in the public interest within one year after such petition or application is filed. If the Commission initiates its own proceeding for a new technology or service, such proceeding shall be completed within 12 months after it is initiated.
- **47 U.S. Code § 303 - Powers and duties of Commission**
 - (g) Study new uses for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest;

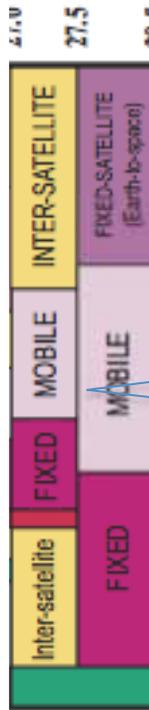
“The Neighborhood”

NOI on “use of millimeter wave spectrum above 24 GHz for mobile wireless services”



Where does RF spectrum, ITU jurisdiction, and Title III end? No clear consensus but somewhere in 300-3000 GHz range where infrared begins.
No yet an important issue.

Mobile Allocations



Mobile allocations exist, BUT are all shared with other services

- Interservice sharing much easier than lower bands due to propagation and ability to use small narrow beam antennas because of small wavelength
- No present mobile service rules even though technology appears to be at edge of commercial viability

Passive Service Allocation Impact

114.25	116.0	122.25
EARTH EXPLORATION-SATELLITE (passive)	EARTH EXPLORATION-SATELLITE (passive)	
RADIO ASTRONOMY	SPACE RESEARCH (passive)	
SPACE RESEARCH (passive)	INTER-SATELLITE	

- Generous passive service allocations dating from times when FCC WRC process focused on needs of key incumbents who had little interest in mmW bands and little review of NOAA and NSF “requirements” coming through NTIA/IRAC

- Provision adopted in Part 5 Rulemaking apparently by accident:

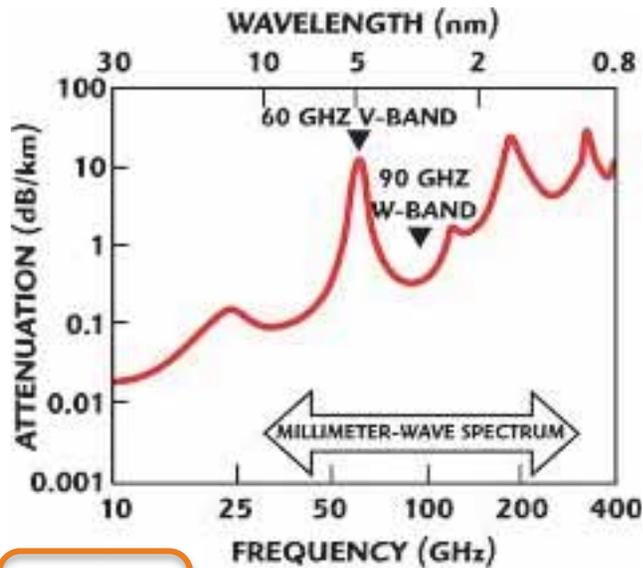
“§5.85 Frequencies and policy governing frequency assignment.

Stations operating in the Experimental Radio Service may be authorized to use any Federal or non-Federal frequency designated in the Table of Frequency Allocations set forth in part 2 of this chapter, provided that the need for the frequency requested is fully justified by the applicant, except that experimental stations may not use any frequency or frequency band exclusively allocated to the passive services (including the radio astronomy service).

- No US radio astronomy use >60 GHz east of Mississippi R. due to physics:

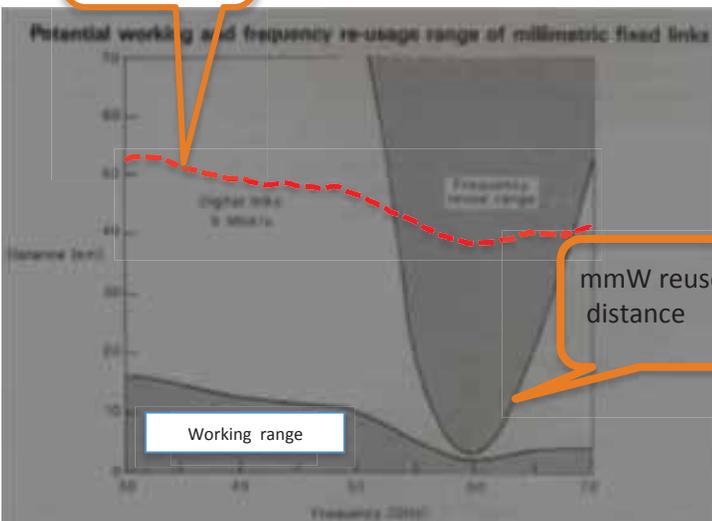
- 2 in AZ, 1 in CA, 1 in HI, none in Europe

The Physics



Typical cellular reuse at UHF: 3-4d

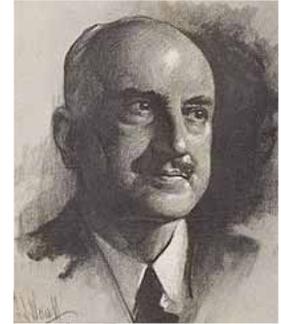
- Unlike at lower bands, in mmW there can be significant absorption of RF by air and water vapor
- Enabled decision for unlicensed at 60 GHz
- Greatly facilitates sharing compared to other bands by decreasing reuse distance
- Facilitates BOTH interservice sharing AND interuser sharing
- Many concepts and assumptions of VHF licensing need to be revalidated at mmW and should not be assumed



- See OET Bulletin No. 70, "Millimeter Wave Propagation: Spectrum Management Implications"

http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet70/oet70.pdf

Learning From the Past



“Those who cannot remember the past are condemned to repeat it.” -- George Santayana

- Both 60 GHz rules and 70/80/90 GHz rules were burdened by provisions demanded by a major corporation as a price for it to develop equipment –the 2 corporations got their wish but never developed equipment!
 - Technology moves at Internet speed
 - Regulations move at government speed
 - Internet speed >> government speed
- ➔ For rapidly evolving technology, try to make regulations with “ease” to allow flexibility in case of unanticipated developments

Finished Measurements	Your Measurements
Bust - 49 1/2"	Bust - 45 1/2"
Waist - 44 1/2"	Waist - 40 1/2"
Hip - 50"	Hip - 47"
FM - YM = WE	
Total Wearing Ease	
Bust = 4"	
Waist = 4"	
Hip = 3"	

In mmW case propagation facilitates sharing and make interference difficult!

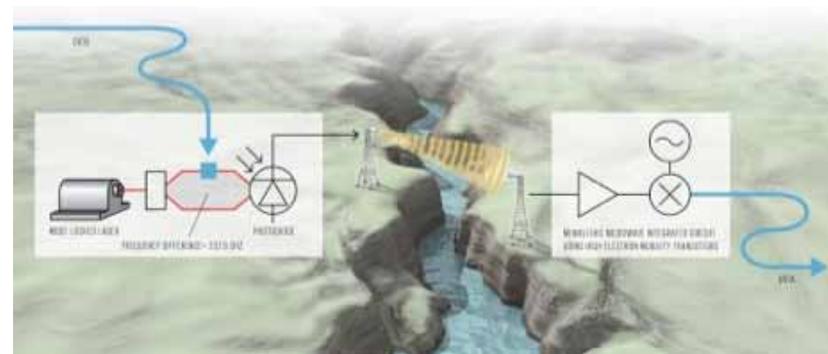
FCC's War on Millimeterwaves

<http://www.marcus-spectrum.com/Blog/files/category-mmw.html>

- Inaction in 3 pending FCC proceedings damage US competitiveness in mmW technology
 - Docket 10-236
 - Docket 13-84
 - Docket 13-259



Japanese 125 GHz system
used at 2008 Olympics



German 237 GHz System exceeding 100 Gbits/s

Docket 10-236

- Was intended to encourage wireless experimentation BUT had the apparently unintended effect of complicating millimeter waver research
- Change to §5.85(a) forbids all experiments in passive bands
 - >95 GHz passive bands are many and component availability now very limited
 - Passive uses also limited by small number of radio telescopes and present satellite sensors
 - Not discussed in NPRM text nor in NPRM comments
 - Text in R&O mentioned it only in the contest of new “program licenses”
 - No one opposed its deletion in recon petition comments
 - Best explanation is that provision was intended for program licenses only and was inserted in the wrong paragraph!
- MSS recon petition supported by Battelle for mmW reasons and by Boeing for unrelated reasons

Docket 13-84

- Revision of 20+ year old RF safety rules
- Maintains old upper quantitative limit of 100 GHz
 - Note: present service rules end at 95 GHz
 - NPRM is based on IEEE standard that now actually goes to 300 GHz
- Creates regulatory uncertainty for mmW developers and denies them defense with neighbors and permitting officials - used by cellular firms - that transmitters meets explicit federal safety standards

Docket 13-259

- IEEE-USA petition for declaratory ruling that technology >95 GHz is “new technology” in the context of § 7
 - >95 GHz is virgin spectrum and the “next frontier”
 - Use does not raise issues of interference to incumbents except passive services
 - Physics limits interference and facilitates sharing
 - Foreign competitors actively pursuing in “state capitalism” mode

Noncommunications >95 GHz Products in Actual Use but in Legal Limbo Due to FCC Inattention

- These products are now being sold:
 - <http://www.emcore.com/wp-content/uploads/PB7200.pdf>
 - http://www.z-thz.com/index.php?option=com_content&view=article&id=51&Itemid=59
 - http://www.vadiodes.com/index.php?option=com_content&view=article&id=378
 - <http://www.teraview.com/products/index.html>
 - <http://www.teraphysics.com/applications-by-industry.php>
 - http://www.traycer.com/wp-content/uploads/2014/09/THOR_200B_20140909.pdf
 - <https://www.advantest.com/US/products/Terahertz/WEBDEV004885>
- Dale Hatfield: " If you are looking for new approaches to spectrum policy, look at what people are doing illegally that is not causing problems, and make it legal!"
- **Legal ambiguities complicate capital formation for these firms and damage US international competitiveness in RF technology**
 - Why is Shure, the wireless mic manufacturer, privately owned? Until recently most of its products were sold in "legal limbo"! Capital formation for such firms is difficult.



Recommendations

- Approve 24+ GHz NOI – it is needed
 - Is it subject to §7 (b)?
- Use occasion to recognize other pending mmW issues
 - Set a schedule for action on mmW issues in Dockets 10-236, 13-84, & 13-259
 - Start dialogue with NTIA on >95 GHz sharing framework
 - Initiate a rulemaking to legitimize existing low power noncommunications products >95 GHz
 - Consider asking Congress to make §7 more practical to implement and administer