

AMATEUR RADIO: WHAT IS IT AND WHY DO I CARE?

Prof. Zory Marantz, PhD, P.E.

Electrical and Telecommunications Engineering Department

NYC College of Technology

OUTLINE

- History – The short, short version.
- Radio is for Amateurs?
- Volunteerism
- Anything else?
- 73

HISTORY – IN THE BEGINNING...

$$\nabla \cdot \mathbf{D} = \rho$$

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$$

HISTORY – HAM RADIO

- Marconi (or is it Loomis?) – First wireless communications
 - Created his own company
 - Ships used his proprietary equipment and custom signals
- It was unregulated. Interference galore!
- Ham - a poor operator. A 'plug'.¹
- Regulations: You need a license, but it's good for life.
- WWI – everyone quiet!
- After WWI – vets successfully brought Amateur radio back to life.

1. <http://www.arrl.org/ham-radio-history>

THE BOSS'

- FCC – Federal Communication Commission
- NTIA – National Telecommunications and Information Administration
- ARRL – Amateur Radio Relay League

SPECTRUM

- International conferences were established to define specific band allocations.
 - Military/marine
 - Cellular
 - Satellite
 - FRS – Family radio service
 - GMRS – General Mobile Radio Service
 - CB – Citizen's band

UNITED STATES FREQUENCY ALLOCATIONS THE RADIO SPECTRUM

RADIO SERVICES COLOR LEGEND

- | | | |
|--------------------------------|---------------------------|---|
| AERIAL MOBILE | AERIAL SATELLITE | AERONAUTICAL MOBILE |
| AERIAL MOBILE SATELLITE | LAND MOBILE | AERONAUTICAL MOBILE SATELLITE |
| AERONAUTICAL MOBILE NAVIGATION | LAND MOBILE SATELLITE | NAVIGATION |
| MARITIME | MARITIME MOBILE | NAVIGATION SATELLITE |
| MARITIME SATELLITE | MARITIME MOBILE SATELLITE | RADIO NAVIGATION |
| BROADCASTING | MARITIME RADIO NAVIGATION | RADIO NAVIGATION SATELLITE |
| BROADCASTING SATELLITE | METEOROLOGICAL AIDS | SPACE OPERATION |
| EARTH EXPLORATION SATELLITE | METEOROLOGICAL SATELLITE | SPACE RESEARCH |
| FIXED | MOBILE | STATIONARY FREQUENCY AND THE SIGNAL |
| FIXED SATELLITE | MOBILE SATELLITE | STATIONARY FREQUENCY AND THE SIGNAL SATELLITE |

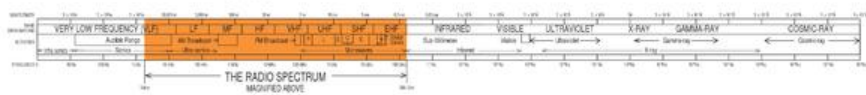
- ## ACTIVITY CODE
- | | |
|--------------------------|----------------------------------|
| GOVERNMENT EXCLUSIVE | GOVERNMENT NON-GOVERNMENT SHARED |
| NON-GOVERNMENT EXCLUSIVE | |

ALLOCATION USAGE DESIGNATION

SERVICE	EXAMPLE	DESCRIPTION
Primary	F-1.5D	Capital Letters
Secondary	M-1.6	1st Capital with lower case letters

Also refer to a printed copy of the publication of the Table of Frequency Allocations over the 3000 and 30000 MHz. For more information, visit the website: www.ntia.doc.gov

U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Office of Spectrum Management
October 2003



PLEASE NOTE: THE OPERATIONAL FREQUENCY SERVICES BY SPECIFIC BANDS ARE LISTED IN THE FREQUENCY ALLOCATION TABLE ATTACHED TO THIS PUBLICATION.

US Amateur Radio Bands

US AMATEUR POWER LIMITS

FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

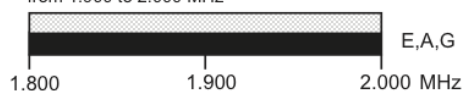
Effective Date
March 5, 2012

Published by:
ARRL The national association for
AMATEUR RADIO[®]
www.arrl.org
225 Main Street, Newington, CT USA 06111-1494

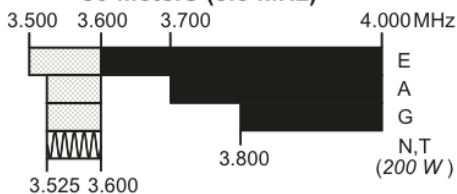


160 Meters (1.8 MHz)

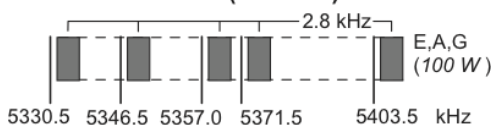
Avoid interference to radiolocation operations from 1.900 to 2.000 MHz



80 Meters (3.5 MHz)

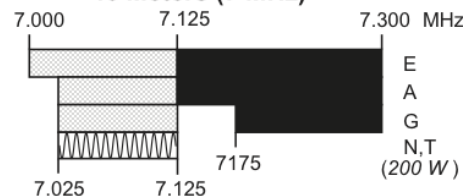


60 Meters (5.3 MHz)



General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated output of 100 W PEP. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as PACTOR III as defined by the FCC Report and Order of November 18, 2011. USB is limited to 2.8 kHz centered on 5332, 5348, 5358.5, 5373 and 5405 kHz. CW and digital emissions must be centered 1.5 kHz above the channel frequencies indicated above. Only one signal at a time is permitted on any channel.

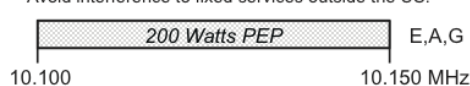
40 Meters (7 MHz)



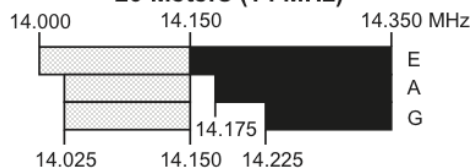
Phone and Image modes are permitted between 7.075 and 7.100 MHz for FCC licensed stations in ITU Regions 1 and 3 and by FCC licensed stations in ITU Region 2 West of 130 degrees West longitude or South of 20 degrees North latitude. See Sections 97.305(c) and 97.307(f)(11). Novice and Technician licensees outside ITU Region 2 may use CW only between 7.025 and 7.075 MHz and between 7.100 and 7.125 MHz. 7.200 to 7.300 MHz is not available outside ITU Region 2. See Section 97.301(e). These exemptions do not apply to stations in the continental US.

30 Meters (10.1 MHz)

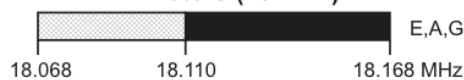
Avoid interference to fixed services outside the US.



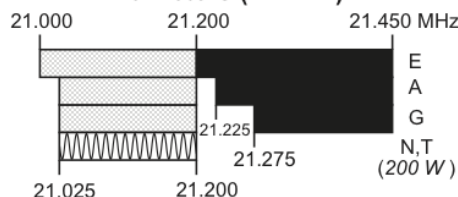
20 Meters (14 MHz)



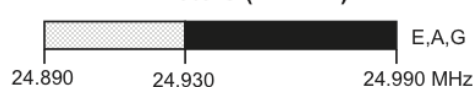
17 Meters (18 MHz)



15 Meters (21 MHz)



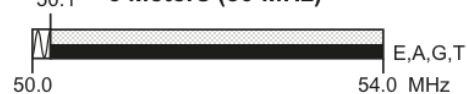
12 Meters (24 MHz)



10 Meters (28 MHz)



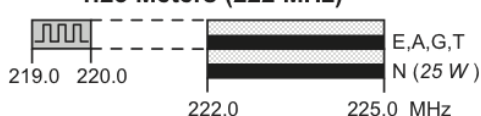
6 Meters (50 MHz)



2 Meters (144 MHz)



1.25 Meters (222 MHz)



*Geographical and power restrictions may apply to all bands above 420 MHz. See *The ARRL Operating Manual* for information about your area.

70 cm (420 MHz)*



33 cm (902 MHz)*



23 cm (1240 MHz)*



All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz *	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

* No pulse emissions

KEY

Note:

CW operation is permitted throughout all amateur bands.

MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.

Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data.
- = Fixed digital message forwarding systems *only*

- E** = Amateur Extra
- A** = Advanced
- G** = General
- T** = Technician
- N** = Novice

See *ARRLWeb* at www.arrl.org for detailed band plans.

ARRL We're At Your Service

ARRL Headquarters:
860-594-0200 (Fax 860-594-0259)
email: hq@arrl.org

Publication Orders:
www.arrl.org/shop
Toll-Free 1-888-277-5289 (860-594-0355)
email: orders@arrl.org

Membership/Circulation Desk:
www.arrl.org/membership
Toll-Free 1-888-277-5289 (860-594-0338)
email: membership@arrl.org

Getting Started in Amateur Radio:
Toll-Free 1-800-326-3942 (860-594-0355)
email: newham@arrl.org

Exams: 860-594-0300 email: vec@arrl.org

RADIO IS FOR AMATEURS?

- You can't use it to make a profit.
 - Professional – profit
 - Amateur – not for profit

VOLUNTEERISM

- Amateurs as professionals – get the job done efficiently!
- Emergency communications
 - FEMA – Federal Emergency Management Agency
 - SATERN – Salvation Army Team Emergency Radio Network
 - State and local emergency management
 - ARES – Amateur Radio Emergency Services
 - RACES – Radio Amateur Civil Emergency Services

CELL PHONES.... HELLO!

- Not good for broadcast!
- Ever try using your cell phone during a catastrophic event, i.e. 9/11, Blackout of 2003, Katrina, Sandy,?
- Any system requiring an infrastructure is risky during an emergency, i.e. blackout, flood, tornado, hurricane, etc.
- Amateur radio operators only need a source of power (battery/generator/photo-cell), a rig, an antenna... done!

HURRICANE KATRINA

- “On Monday, Aug. 29, a call for help involving a combination of cell telephone calls and amateur radio led to the rescue of 15 people stranded by floodwaters on the roof of a house in New Orleans. Unable to get through an overloaded 911 system, one of those stranded called a relative in Baton Rouge. That person called another relative, who called the local American Red Cross.
- Using that Red Cross chapter’s amateur radio station, Ben Joplin, WB5VST, was able to relay a request for help on the SATERN network via Russ Fillinger, W7LXR, in Oregon, and Rick Cain, W7KB, in Utah back to Louisiana, where emergency personnel were alerted. They rescued the 15 people and got them to a shelter.” - **Ham radio operators to the rescue after Katrina, By Gary Krakow, MSNBC.com**

9/11



HURRICANE SANDY

Ham Operators during Hurricane Sandy

JUST AUDIO?


- From the previous allocation chart many technologies may be used as well:
 - Voice
 - Video
 - Fax/data
 - Morse/RTTY (radioteletype)


KEY


Note:
CW operation is permitted throughout all amateur bands.


MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.


Test transmissions are authorized above 51 MHz, except for 219-220 MHz


 = RTTY and data

 = phone and image

 = CW *only*

 = SSB phone

 = USB phone, CW, RTTY, and data.

 = Fixed digital message forwarding systems *only*

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

See *ARRLWeb* at www.arrl.org for detailed band plans.

METHODS OF COMMUNICATION

- AM - SSB
- FM – audio/video (TV)
- Digital:
 - FSK
 - QPSK
 - Spread spectrum
 - Etc.
- VoIP... sort of.

CODES

- There are a lot of codes:
 - Morse
 - Q-codes – internationally agreed upon
 - Baudot
 - ASCII
 - RTTY

Letter	Word	Pronunciation	Letter	Word	Pronunciation
A	ALPHA	AL FA	N	NOVEMBER	NO VEM BER
B	BRAVO	BRAH VOH	O	OSCAR	OSS CAH
C	CHARLIE	CHAR LEE or SHAR LEE	P	PAPA	PAH PAH
D	DELTA	DELL TAH	Q	QUEBEC	KEH BECK
E	ECHO	ECK OH	R	ROMEO	ROW ME OH
F	FOXTROT	FOKS TROT	S	SIERRA	SEE AIR RAH
G	GOLF	GOLF	T	TANGO	TANG GO
H	HOTEL	HOH TELL	U	UNIFORM	YOU NEE FORM or OO
I	INDIA	IN DEE AH	V	VICTOR	NEE FORM VIK TAH
J	JULIETT	JEW LEE ETT	W	WHISKEY	WISS KEY
K	KILO	KEY LOH	X	XRAY	ECKS RAY
L	LIMA	LEE MAH	Y	YANKEE	YANG KEY
M	MIKE	MIKE	Z	ZULU	ZOO LOO

<http://www.tumblr.com/tagged/phonetic%20alphabet>

ANYTHING ELSE?

- It's fun!
- Field Day – go out, make contact, be prepared for an emergency
- Contesting – make as many contacts as possible over a fixed period of time
 - DX
 - HF Digital
 - Etc.
- Swap meets
- Meet people around the world!
- Make something!

HOW CAN I GET A LICENSE?

- Study for the exam!
- Question pool available online.
 - For Technician (Class 2) ~ 400 questions
 - Example
 - T5A01 (D)
 - Electrical current is measured in which of the following units?
 - A. Volts
 - B. Watts
 - C. Ohms
 - D. Amperes
- Find a volunteer examiner (VE).
- Take the exam.
- Get the license.

I WANT TO LEARN MORE

- www.arrl.org/
- www.fcc.gov
- http://wireless.fcc.gov/services/index.htm?job=service_home&id=amateur
- <http://www.gpo.gov/fdsys/pkg/CFR-2010-title47-vol1/content-detail.html>



73

Regards!

Thank you!

Questions/comments

TWO QUICK POLLS

If a radio club was established for operating a station and/or working on projects, would you be an active member?

Yes

No

Would you seriously be interested in obtaining an amateur radio license?

Yes

No