

# Amateur Extra License Class



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### **Class Procedures**

- Each class session will begin with questions about the previous week's material.
- Them opportunity for a minute break will be provided about half-way through the session.
- Feel free to ask questions at any time about the material being covered.
- Class dismissal time will vary depending on material covered.







## **Before the Class**

 Throughout the book there are references to question numbers (e.g. – [E1A1]). These refer to the question(s) being discussed at that point in the text.







## **Contact Info**

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## **Amateur Extra Class**

## Chapter 1 Introduction





### The Extra Class License and Amateur Radio

**Call Signs** 

- Exclusive call signs.
  - 1x2.
  - 2x1.
  - 2x2 (1<sup>st</sup> letter "A").

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## The Volunteer Testing Process

Volunteer Examiner (VE)

- A team of at least 3 VEs is required.
- The team conducts local exam sessions in accordance with policies adopted by the coordinating VEC.
- The team forwards all exam session paperwork to the VEC for processing.





## How to Use the Book

- Web site URL's will be in **bold** print.
- Important words or phrases will be in *italics*.
- Sidebars are in blue boxes which contain interesting information or tell how the current material relates to amateur radio.
- Throughout each chapter, there will be lists of question numbers.
  - Go to the back of the book & review those questions.
  - Write down any questions you have trouble with.





**Extra Class HF Frequencies** 

- 80m CW: 3.500 MHz to 3.525 MHz
- 75m SSB: 3.600 MHz to 3.700 MHz
- 40m CW: 7.000 MHz to 7.025 MHz
- 20m CW: 14.000 MHz to 14.025 MHz
- 20m SSB: 14.150 MHz to 14.175 MHz
- 15m CW: 21.000 MHz to 21.025 MHz
- 15m SSB: 21.200 MHz to 21.225 MHz









#### DXing

- DX operating techniques
  - Listen before you transmit!
  - "You can't work 'em if you can't hear 'em!"
  - Use your full call once or twice.
  - Use standard (ICAO) phonetics.





#### DXing

- Confirming DX Contacts.
  - Traditional paper QSL cards.
    - Direct
      - Mail your card directly to the DX station.
    - QSL Managers
      - Amateurs who act as "brokers" for one or more DX stations.
    - QSL Bureaus.
      - Not all countries have QSL bureaus.
      - Must not use for US-to-US contacts, including US territories.





#### DXing

- Pileup Productivity.
  - DX stations can have hundreds or even thousands of stations calling at once. This is called a "pile-up".
  - If you hear a pile-up, make certain that you can hear the DX station before you call.
    - If you can't hear 'em, you can't work 'em.
  - DX stations use a couple of techniques to "thin out" the pile-up & make it easier to pick out individual stations.





#### DXing

- Pileup Productivity.
  - "By-the-Numbers" The DX station announces that they will only accept calls from stations with a specified number in their call.
    - Fewer stations are calling at any given time.
  - Sometimes a DX station may be operating both split & calling by-the-numbers at the same time.







#### E2C08 -- Which of the following contacts may be confirmed through the Logbook of The World (LoTW)?

- A. Special event contacts between stations in the US
- B. Contacts between a US station and a non-US station
- C. Contacts for Worked All States credit
- D. All these choices are correct

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- A. Send your full call sign once or twice
- B. Send only the last two letters of your call sign until you make contact
- C. Send your full call sign and grid square
- D. Send the call sign of the DX station three times, the words "this is", then your call sign three times





#### Contesting

- Why contest?
  - Contesting provides excellent training for emergency communications.
    - In emergency communications you must:
      - Exchange specific information accurately and as efficiently as possible.
    - In contesting you must:
      - Exchange specific information accurately and as efficiently as possible.





#### Contesting

- No contesting on 60m, 30m, 17m, or 12m.
- VHF/UHF contest activity is normally found in the weak signal portion of each band near (but not exactly on) the calling frequency.
  - No repeater contacts allowed.













Contesting (a.k.a. – Radiosport)

- Spotting networks.
  - When a station works another station they report the contact to an internet-based "spotting network".
  - Spotting yourself, known as "self-spotting", is prohibited in most contests.
  - The use of a spotting network is not allowed in some contests.
  - If a spotting network is used, it puts you into the multi-op or assisted category.





#### Contesting

- Submitting logs.
  - Paper logs.
    - Generally discouraged.
    - May be prohibited for large logs.
    - Not accepted at all by some of the larger contests.
  - Electronic logs.
    - Cabrillo format.
    - E-mail or website applet.
  - Do **NOT** have to submit log to participate.





#### Contesting

- Amateur Data Interchange Format (ADIF).
  - A specially-formatted text file which allows transferring contact data between different programs or websites.
    - Header section contains general information:
      - Call sign, program that created the file, etc.
    - Contacts records contain the individual contact information.
    - Date, time, band, exchange, etc.
  - Designed so that widely different programs can interchange contact data.
    - Logging programs, LoTW, QRZ.com logs, eQSL.cc, etc.





#### Contesting

- Finding contests.
  - WA7BNM website.
    - http://hornucopia.com/contestcal
  - ARRL website.
    - http://www.arrl.org/contest-calendar
  - CQ Magazine website.
    - http://www.cq-amateur-radio.com
  - National Contest Journal (NCJ) website.
    - http://www.ncjweb.com/contests.php













#### **Remote Stations**

- Used to be the fairly rare.
  - Link to radio was usually limited to wires, phone line, or radio.
- With advances in technology, not as unusual as it used to be.
  - Nearly all remote operations now use the internet or the cellular phone network.





#### **Remote Stations**

- Station Identification.
  - Remote station identification depends on the transmitter location and what country issued the operator's license.
  - For an operator licensed by the FCC:
    - If the remote transmitter is located in the US or its territories, there are no special identification requirements.
    - If the remote transmitter is not located in the US or its territories, you must add the prefix of the country where the transmitter is located before your US call sign.
      - e.g. PJ2/K9DUR



E2C12 -- What indicates the delay between a control operator action and the corresponding change in the transmitted signal?

- A. Jitter
- B. Hang time
- C. Latency
  - D. Anti-VOX









#### **Understanding Satellite Orbits**

- Newton's First Law of Motion (inertia) causes a satellite to try to keep moving in a straight line.
  - Commonly referred to as centrifugal force.
  - The higher the speed, the stronger the centrifugal force.
  - The sharper the turn (satellite closer to earth), the stronger the centrifugal force.
- Gravity tries to pull the satellite towards the primary.
  - The closer the satellite is to the primary, the stronger the pull of gravity.
- An orbit is stable if the centrifugal force equals the pull of gravity.











#### Understanding Satellite Orbits

- Kepler's 3rd Law.
  - The square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit.
    - In plain English The farther a planet is from the Sun, the longer it takes to complete one orbit around the Sun.
    - Low Earth Orbit (LEO) satellites typically have orbital periods of about 90 minutes.
    - Satellites at about 25,000 miles above the Earth have orbital periods of about 24 hours and are called geosynchronous or geostationary satellites.









#### **Understanding Satellite Orbits**

- Orbital definitions.
  - Ascending pass.
    - The pass of a satellite over a location while traveling from south to north.
  - Descending pass.
    - The pass of a satellite over a location while traveling from north to south .









#### Spin Modulation

- Satellites are usually stabilized by having them spin about their axis like a gyroscope.
  - The spin causes amplitude changes and polarization changes of the received signal.
- Effects of spin modulation are minimized by using circular polarization.













# E2A11 -- What type of antenna can be used to minimize the effects of spin modulation and Faraday rotation?

- A. A linearly polarized antenna
- B. A circularly polarized antenna
  - C. An isotropic antenna
  - D. A log-periodic dipole array

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#### Satellite Operation

- Repeaters.
  - FM voice repeaters on satellites function exactly like repeaters on the surface of the Earth.
  - Typically satellite repeaters are cross-band repeaters.
    Repeater input & output frequencies are on different bands.
  - Repeaters are installed on the International Space Station (ISS), AO-27, AO-85, & other satellites.





#### Satellite Operation

- Transponders.
  - A linear translator that receives a range of frequencies in one band & shifts it to a range of frequencies in a different band.
  - Many stations can communicate through the satellite simultaneously using different modes.





#### Satellite Operation

- Transponders.
  - An inverting linear transponder inverts the uplink signals before retransmitting them on the downlink frequency.
    - Uses the mixer's difference  $(f_1 f_2)$  products rather than the sum  $(f_1 + f_2)$  products.
    - A USB signal is converted to LSB and vice versa.
    - Increasing your signal's frequency on the uplink results in a decrease of your signal's frequency on the downlink and vice versa.
    - A signal's position in the band is reversed.
    - Negates the effects of Doppler shift.















## E2A07 -- Which of the following types of signals can be relayed through a linear transponder?

- A. FM and CW
- B. SSB and SSTV
- C. PSK and Packet
- D. All of these choices are correct



# E2A09 -- What do the terms "L band" and "S band" specify regarding satellite communications?

- ➡ A. The 23- and 13-centimeter bands
  - B. The 2-meter and 70-centimeter bands
  - C. FM and digital store-and-forward systems
  - D. Which sideband to use

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