SEAPAC INTRO

Mark Breakey KB7RHI

SEAPAC

Primary Questions We Want To Ask Ourselves

- How much **POWER** does my radio station require?
- How much **POWER** can my battery supply?
- How much **POWER** can I get from solar?

Four Steps To Adding Solar Power To Your Radio Station

- 1) Determine the power needs of your radio station (Load)
- 2) Determine Battery size needed for backup power
- 3) Select a solar panel(s)
- 4) Select a solar charge controller
- Then put it all together

STEP ONE...Power Needs Of Your Radio

- First step is to learn the power needs of your radio?
- Three parts to know

1) What is the **voltage** range of my radio?

2) How many **amps** does my radio need when in receive mode and when transmitting?

3) How much **energy** do I need every 24 hours?

Voltage Needs Of Your Radio

- Check the **specifications** section of your radio manual for the radio **voltage** needs
- Many radios are listed as needing 13.8 volts +/- 15%
- Which is **11.7** to **15.9** volts, less than **11.7** volts could mean your radio does operate properly
- Some radios are listed as needing 13.8 volts +/- 10%
- Which is **12.4** to **15.2** volts

Amperage Needs Of My Radio

- Would recommend using a DC inline power meter such as the RC Electronics WattsUp DC Power Analyzer…this particular model is easiest to read in full sunlight
- Place the meter with Anderson Power Pole Connectors directly inline with your radio station “Load”
- https://www.rc-electronics-usa.com/docs/watts-up-meter-manual.pdf

DC Inline Meter

- The meter provides a constant reading of **AMPS**, **VOLTS** and **WATTS**
- It also provides five other readings in a **display queue** that repeats every two seconds
- Use the inline meter to show a reading of the radio receive current (Rx) and the radio transmit current (Tx)

Upper Left = **Amps**, Upper Right = **Volts**, Lower Right = **Watts**, Constant Display

Lower Left Has 5 Different Parameters That Rotate In A Queue, Ap = Amp Peak

Next Value Is Vm = Voltage Minimum, Queue Rotates Over About 2 Seconds

Next Value Is Wp = Watt Peak

Next Value Is Ah = Amp-Hours…Shows Amp-Hours Since Load Connected

Next Value Is Wh = Watt Hours

DC Inline Meter Demonstration

- Notice that there is a **SOURCE** side and **LOAD** side of the meter.
- The direction where the power is coming from is the **SOURCE** side.
- The direction the power going to is the **LOAD** side.

Amperage Needs Of My Radio

- Hook up your radio to an antenna or dummy load
- Place the inline meter between a 12 volt power source and your radio
- Turn on the radio and note what the inline meter amperage reading is while the radio is in receive mode
- For example Rx = 0.48 amps

Amperage Needs Of My Radio

- If using a battery, start with the low power setting and take a reading for each power setting up to the high power setting
- For example
- Low PWR = 3.1 amps (VHF RF PWR = 5 watts)
- Med PWR = 4.2 amps (VHF RF PWR = 10 watts)
- High PWR = 8.4 amps (VHF RF PWR = 50 watts)

Hooking Your Radio Up To A Battery

- You now know how much power you need to provide from a battery source

More Information About The RC Electronics 12 Volt Watts Up Meter

- https://www.rc-electronics-usa.com/meter-faq.html#faq2b

Calculate The **Energy** Needs Of Your Station

- Example of **energy** needs, (**power over time**)
- Rx (Radio receive current) = 0.48 amps
- Tx (Radio transmit current) = 4.2 amps for medium power
- Determine the percentage of time you will just be **listening each hour** and approximate time you will be **transmitting each hour**

SEA PAC

Energy Expressed As **Amp/Hours**

- If I say I have a 4.2 amp load, that is showing a **rate**
- One way to express a **rate** of power **over time** = **amp-hour**
- 4.2 amps for one hour = 4.2 amp-hours (Ah)
- Constant load of 2 amps for 24 hours = 2 x 24 = 48Ah
- When choosing a battery you will see energy capacity listed in amp-hours, more on that later

Calculate The Energy Needs Of Your Station

- One way to estimate energy needs is to determine your overall average current per hour
- If my radio load is **10 amps** for 30 minutes, followed by **5 amps** for an additional 30 minutes
- My overall average amps is (10 + 5)/2 = 7.5 average amps, **simple average**, **radios can be more complex**
- Another way to find the answer is multiply Load x %Time in Transmit, add to Load x %Time in Receive per hour

Calculate The Energy Needs Of Your Station

- 10 amps x 0.5(50%)= **5**, the first half of the hour
- 5 amps x 0.5(50%)= **2.5**, the second half of the hour
- Now add **5 + 2.5 = 7.5** overall average amps per hour
- Tx amps x %Time= (weighted average), + Rx amps x %Time…then add the total for 100% of the hour
- Tx amps = Transmit amps
- Rx amps = Receive amps

Calculate The Energy Needs Of Your Station

- Example…Estimate Rx 90% of the time and Tx 10% of the time
- Rx current of 0.48 amps x .90 = 0.43 amps (90%)
- Tx current of 4.2 amps x .10 = 0.42 amps (10%)
- Rx 0.43 + Tx 0.42 = 0.85 overall average amps per hour
- Load = 0.85 average amps per hour x 24 hours = ~20.4 amp-hours needed from the battery every day

Power And Energy Needs Of Your Radio

- **Voltage** = 11.7 volts to 15.9 volts
- **Peak amperage** = 8.4 amps on high power
- **Energy** = ~20.4 amp-hours every 24 hours

- Next go to STEP 2, Battery Basics

SEA PAC