

Just the Basics

**Amateur
Radio
Repeater
Technician**



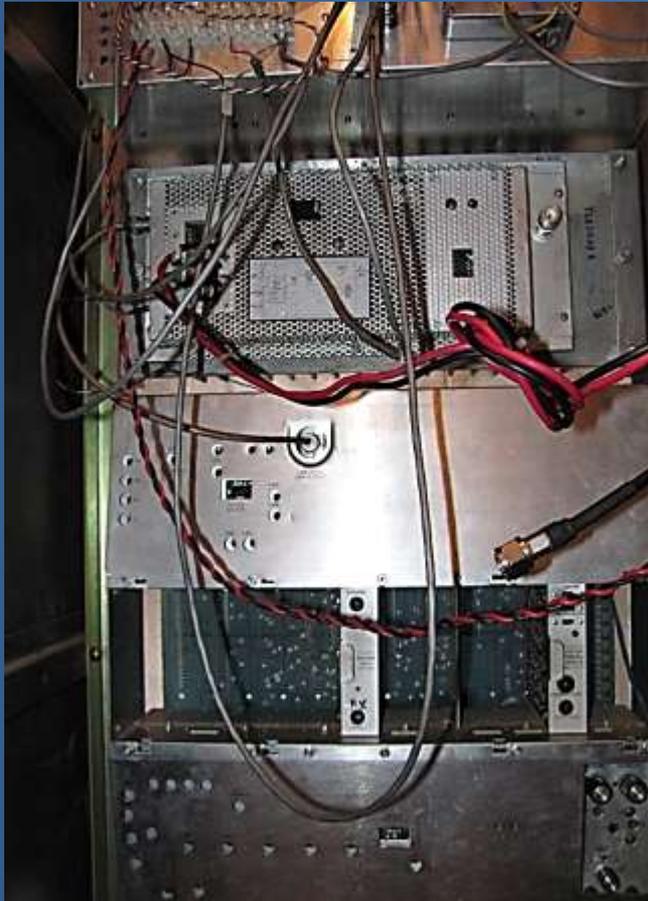
The K7RPT Technical Team





The South Saddle Repeater System

147.320 and 442.325



Shown left is the 147.320 Repeater. This is a 30 y/o Motorola Micor Unichassis model that will be retired in March 2018.

Shown right is the 442.325 Repeater. This is a 35 y/o homebrew repeater, built out of two Motorola Micor mobiles and is set to be retired in May 2018.



The South Saddle Repeater System

147.320 MHz

Motorola Quantar Repeater



The Portland Sylvan Repeater System

147.040 and 442.225

Sylvan Hill – KOIN Transmitter Tower

147.040 + 100.0Hz

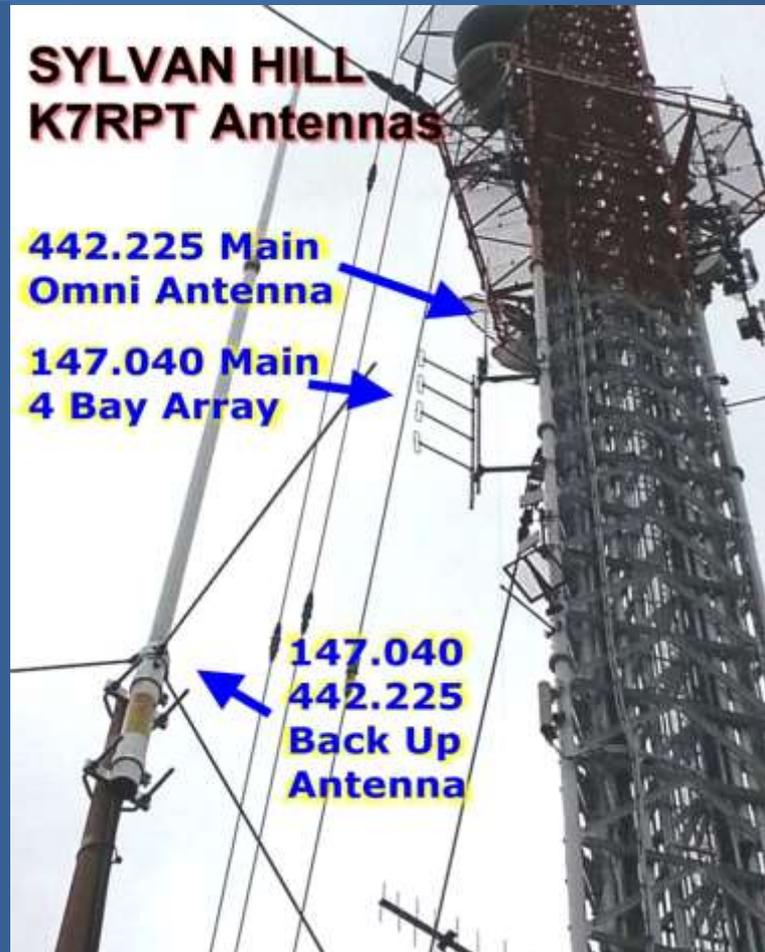
IRLP node 7959

Carries the ARES District 1 Net daily
at 1930hrs

442.225 + 100.0Hz

Analog/C4FM digital

- Both Repeaters are equipped with a full duplex autopatch system
 - Generator backed up
- Wide Area Portland Metro Area
 - Site Elevation 1100'
 - Tower Height 920'



The Sylvan Repeater's at KOIN

147.040 and 442.225

Sylvan Hill Transmitter Tower





Marc Douglas, AE7KK prepping hardline for 442.225 Antenna

The Timberline System on Mt. Hood

147.120 and 444.225



Marc Douglas, AE7KK and
Jim Campbell, N7QME

147.120 + 100.0Hz
444.225 + 100.0Hz
Elevation 7100'

- Phone Patch
- ECHOLINK AC7QE-R
- Shore & Battery b/u

Covers Portland
Metro to Bend
Linked fulltime
to Redmond/Bend and Eagle
Butte



Custom built corner reflector
for 147.120 and 444.225

The Timberline System on Mt. Hood





442.225

KOIN

Transmitter

Tower

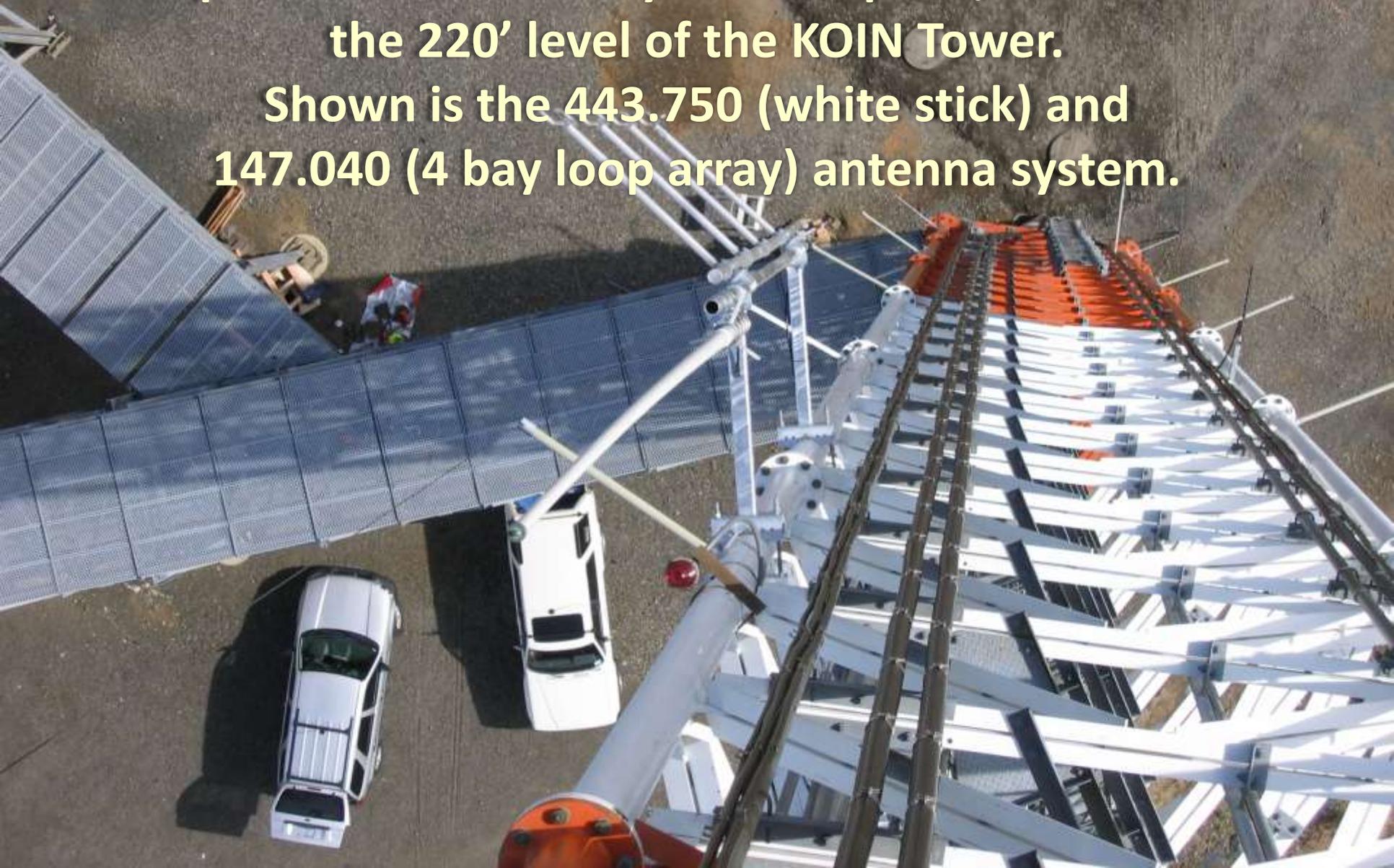
147.040

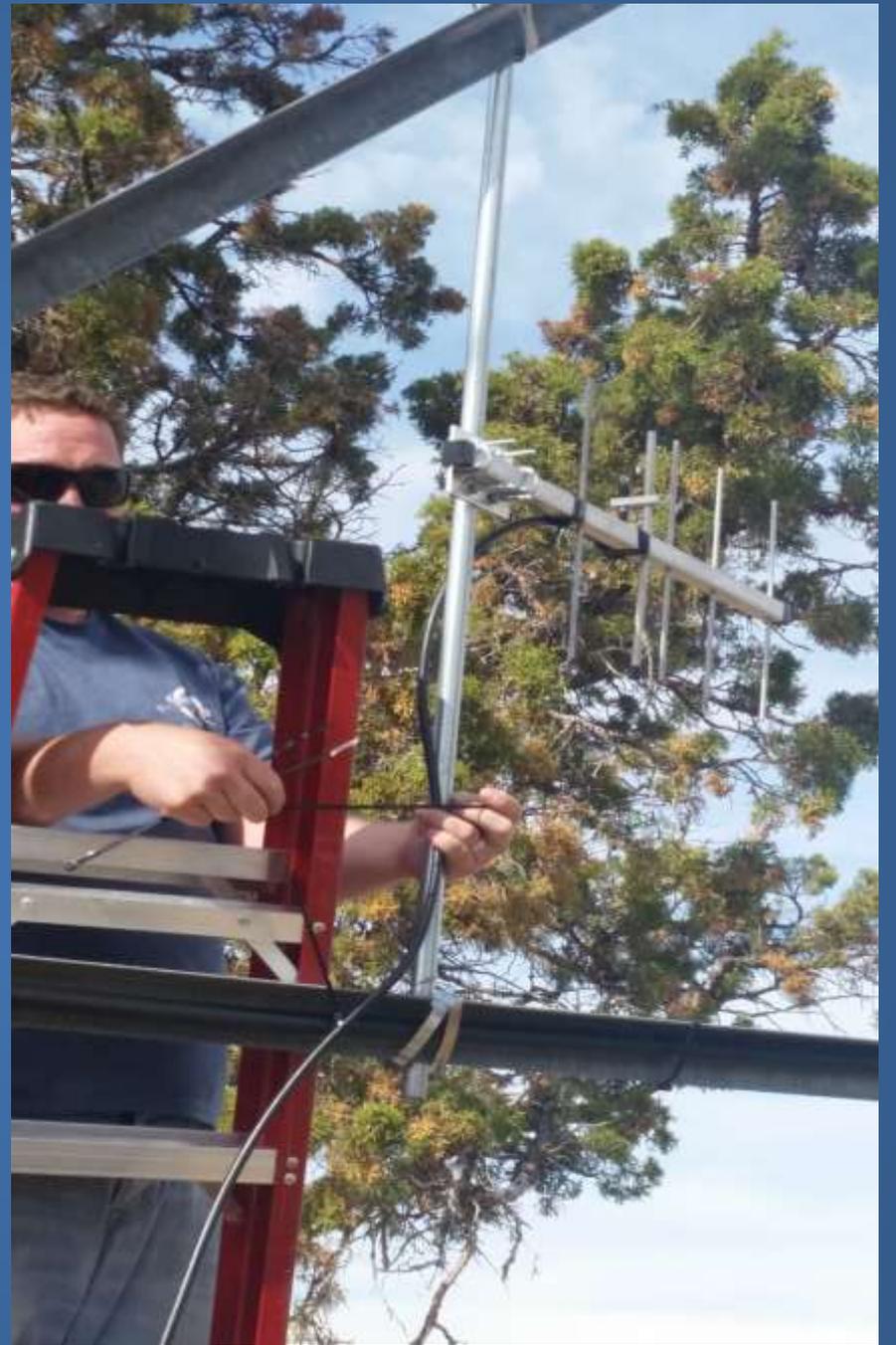
East

Technical team Moments

This picture was taken by Jim Campbell, N7QME from the 220' level of the KOIN Tower.

Shown is the 443.750 (white stick) and 147.040 (4 bay loop array) antenna system.





Where have all the Tech Savvy Ham's Gone?

Experienced Repeater Technicians are getting tough to find.

Many Club Repeater Techs are aging out and retiring, leaving club repeaters in possible disrepair.

New Amateur Radio Operators are simply not 'tech savvy' enough to take on the required rf diagnostics or even begin to repair of modern day repeater.

Those that seem willing to volunteer soon realize that they lack the basic tools, test gear or rf diagnostic equipment needed to effectively diagnosis and repair Amateur Radio repeaters.

Prospective Repeater Techs Need to Self Prepare

Investigate and Ask!

Find out what repeater models are in use by your repeater group.

Most Ham Groups use repurposed GE or Motorola repeaters obtained from local Public Safety Agencies.

Self Study!

Go to repeaterbuilder.com and find the make/model section of the repeater you wish to learn about.

It is here that you can read other Ham's articles about converting repeaters from Public Safety band to the Amateur Radio band.

Put together your own Electronics test bench

Tech Savvy Ham's
need a place to build,
repair and even create.

A well equipped starter
bench will have a good
13.8VDC Power Supply,
VOM, RF Wattmeter,
Frequency Counter and
Signal Generator.



We can't help out if we don't know how to use basic RF tools

Club's aren't going to be interested in you as a prospective tech if you don't already posses basic RF testing skills.

Basic level - get some gear:

Obtain and learn how to properly operate a Wattmeter, dummy load and SWR Meter.

More Advanced:

Obtain and then learn how to operate a Frequency Counter, Audio Generator, RF Generator which will be used to diagnose, align, crystal and tune repeater systems.

Advanced Tools

Communications Service Monitor

Starter:

Motorola R-2001 Series with
Spectrum Analyzer. Used from
\$500-\$1500



Advanced:

HP Agilent 8935 CDMA with
Spectrum Analyzer and
tracking generator for
duplexer tuning. Used from
\$750-\$1700



Detailed list of tasks

Members must also be physically able to lift and move equipment that weighs at least 50 lbs. and with help, be able to safely move 100 lb. repeater cabinets, heavy AGM batteries and other large equipment as necessary.

Technicians need to be able to bench test radio gear, diagnose transmitter/receiver and audio problems and make corrective adjustments to stay within FCC modulation and frequency bandwidth requirements.

Technicians will be required to learn and operate PC based radio service software tools, electronic bench test gear, including the proper use of a SWR/Wattmeter and a Communication Service Monitor.

Using RF bench testing gear, technicians must be able to order and install proper TX/RX crystals, troubleshoot and completely align receivers, transmitters and audio circuits, adjust and program external computer-controlled Amateur Radio Repeater Controllers, including properly setting up and programming the operating principals of the repeater controller.

Even more list of tasks

Technicians need to be able to build repeater to controller 9 wire interface cables. These cables allow the controller to access proper signals to and from the repeater under construction. These include pulling TX/RX audio, COR, PTT and CTCSS signals from the repeater to the external repeater controller.

Technicians need to know about Antenna systems and proper feedline types and uses.

Technicians should also know about remote radio site tower systems and proper grounding techniques.

Technicians should be able to tackle a repeater conversion and upgrade project, which often include complete TX/RX programming and alignment.

The most important Repeater diagnostic tool

Test a repeaters transmitter and receiver.

Test the audio quality of the repeater.

Test to see if the repeater
transmitter or receiver is off frequency.

So, what is this important tool?



Dualband Walkie Talkie

A handheld radio is the most effective tool in diagnosing problems with your local repeater.

Questions?

Hands on Practical

- **Using Service Monitors**
- **Bird Wattmeter**
- **Antenna Analyzer**