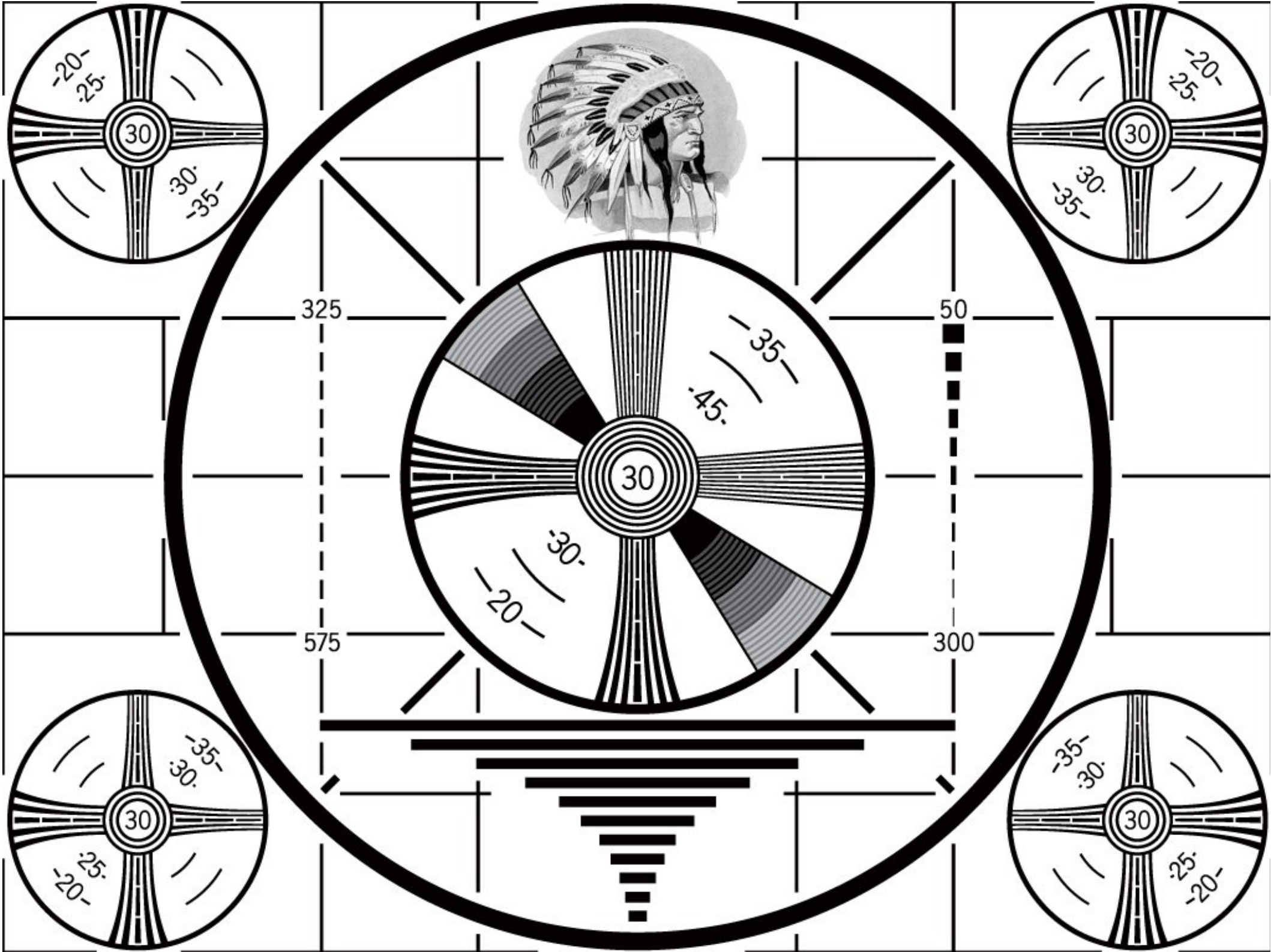
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300

From Galenium to GaAs - A Little Radio History

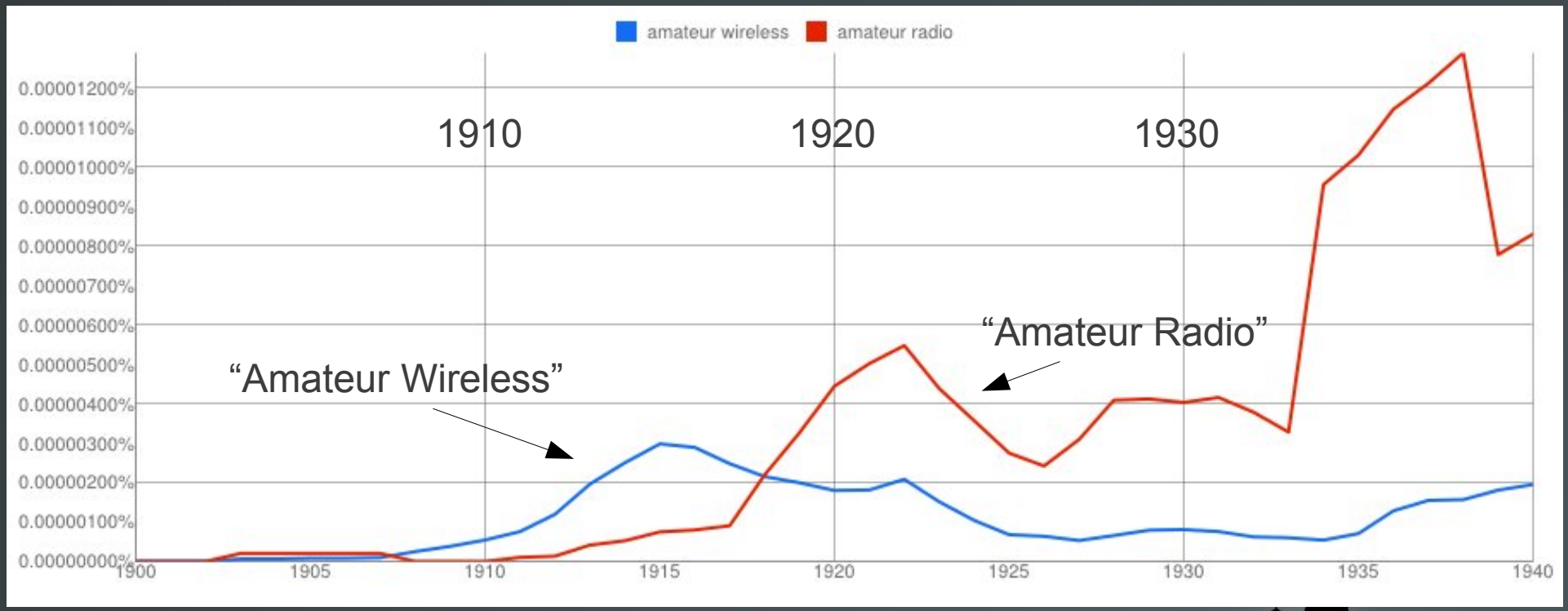
"100 Years of Amplitude", or

"The Most Important Radio Feature You've Never Heard of"

Martin Ewing, AA6E
ARRL Technical Advisor &
ARRL Laboratory Volunteer

When did Amateur Radio Begin?

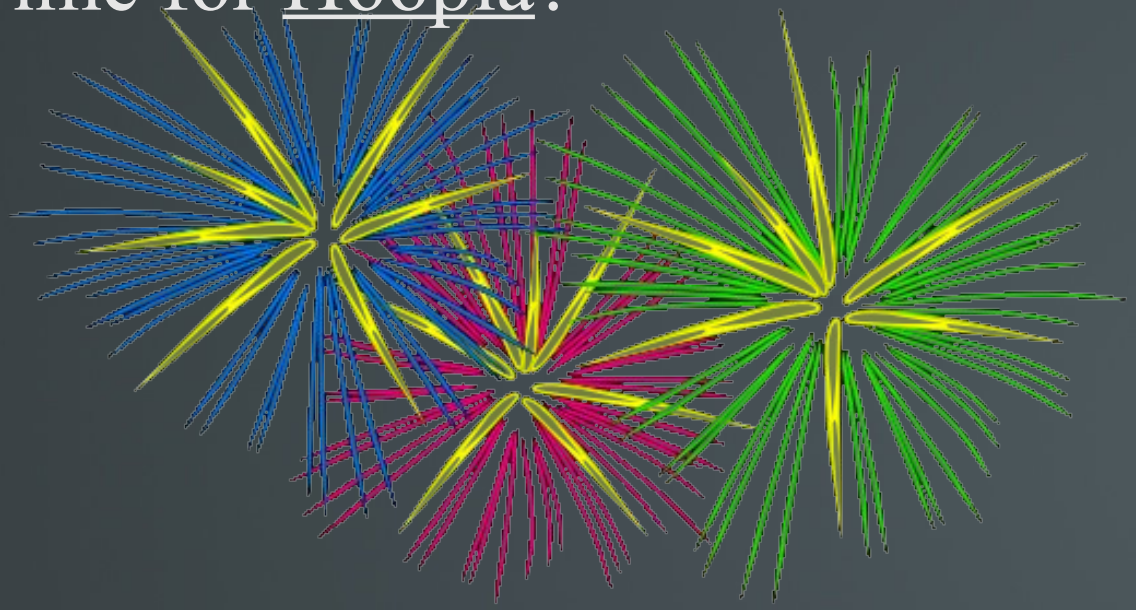
Google Ngram: “Amateur Wireless”, “Amateur Radio”

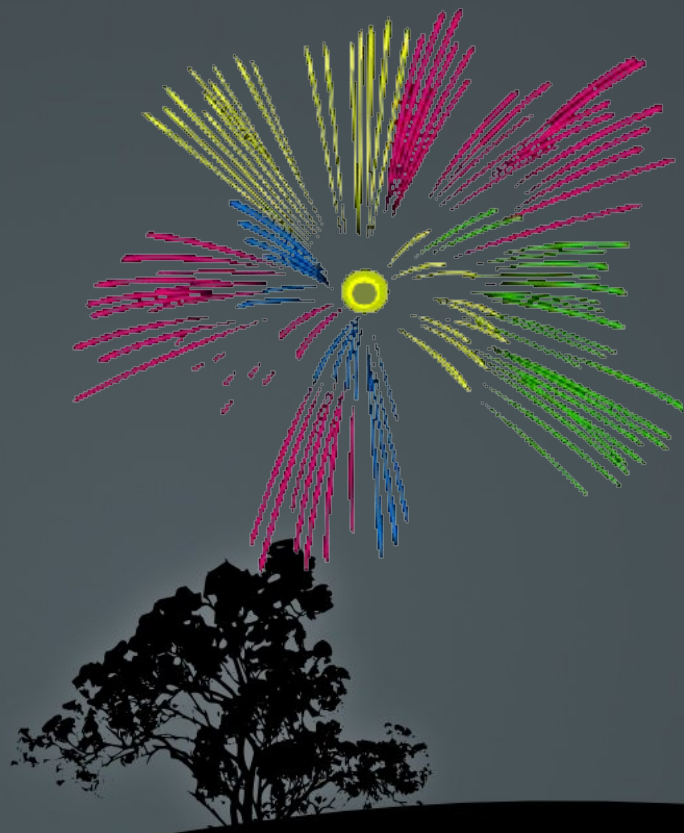


ARRL QST

Bring in the Historians!

- The Centennial of Radio & Amateur Radio
  - 1912 – First US Radio Act
    - Defined a place for Amateurs: 200 meters and down!
  - 1914 – Founding of ARRL
- Time for Hoopla?





A Provocative Statement

Some things never change:

The old-timer's lament:
"Nobody builds stuff any more!..."

"In those days nothing could be bought — everything had to be made, ..."

A Provocative Statement

- Some things never change:

- The old-timer's lament:
"Nobody builds stuff any more..."

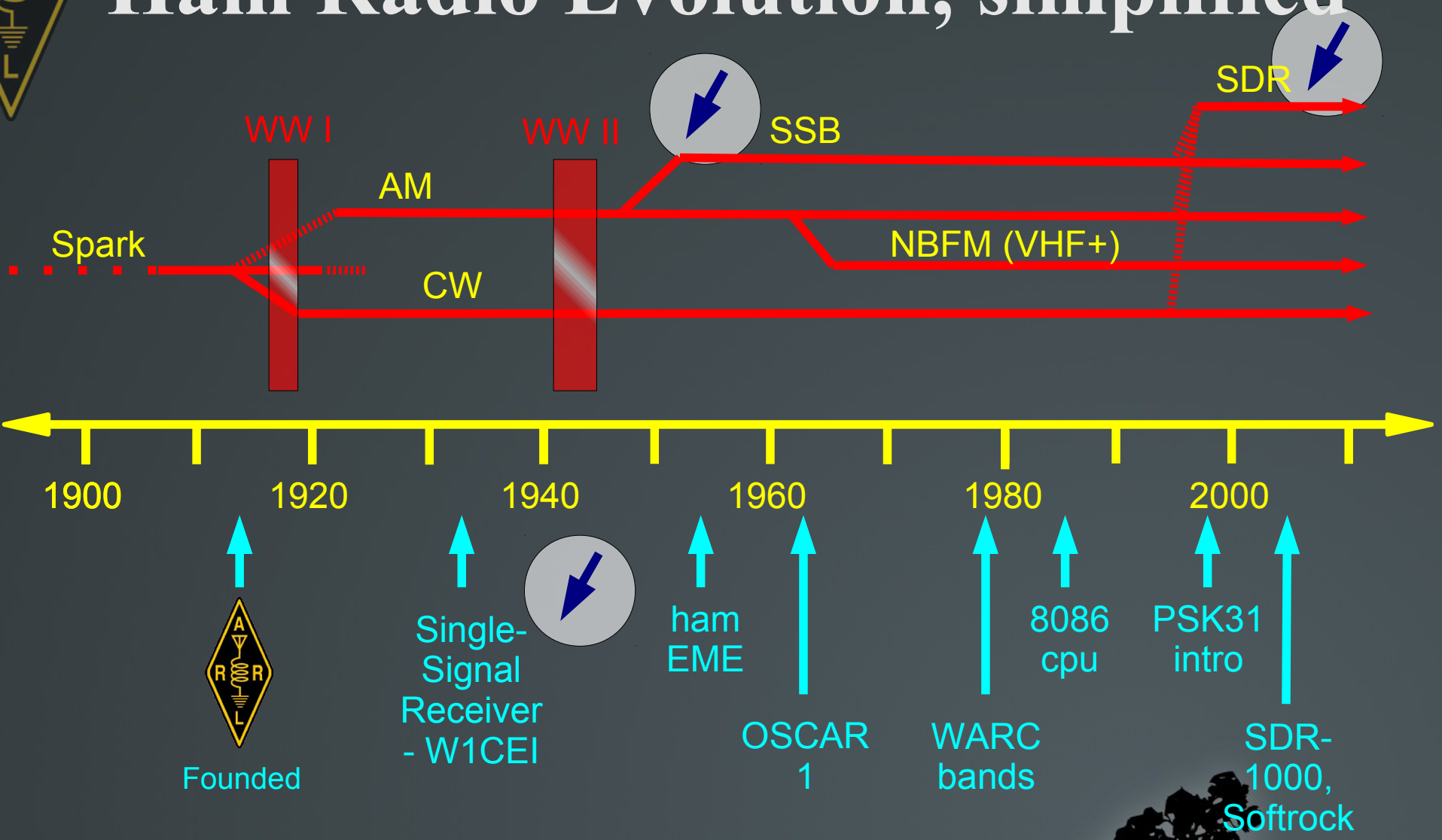
- "In those days nothing could be bought — everything had to be made, ..."

- – Lloyd Manuel, QST, March, 1916, speaking of his younger days.

Principle of Historic Invariance

- The World is Going to the Dogs.
- Kids these days don't know what ham radio is all about.
- Hams these days are just appliance operators.
- <u>But it has always seemed that way!</u>

Ham Radio Evolution, simplified



The HQ Technical Library

ARRL Forum
Dayton 2012

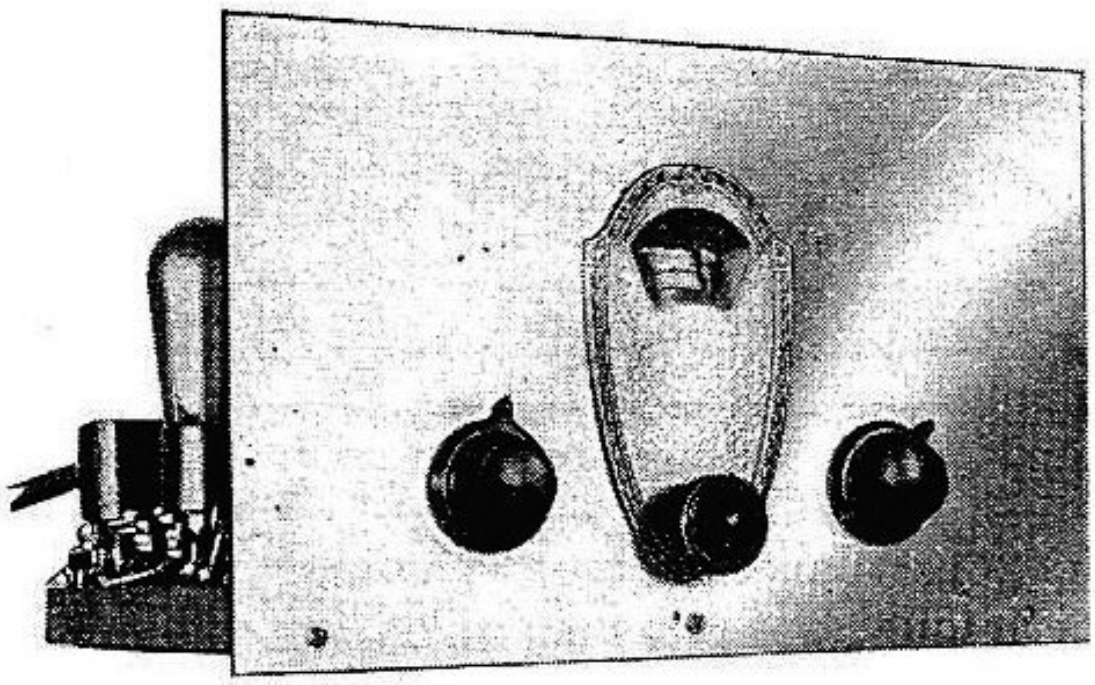
The Single-Signal Problem

- The problem in the early 1930's
  (James J. Lamb, W1CEI, QST, 1932)
  - What's Wrong With our C.W. Receivers?
  - Short-Wave Receiver Selectivity to Match Present Conditions
  - An IF and Audio Unit for the Single-Signal Superhet
- An early SSB exciter for the Amateur (1949)
- How to do it in SDR (2009)

In the Early 1930's

- CW / ~~Spark~~ / AM 'phone
  - Many operators, much QRM
- Vacuum Tubes: Triodes, Tetrodes, Pentodes
  - Quality = Number of Tubes?
  - Typical: RF Amp, Regenerative Detector
  - Advanced: Superheterodyne sets

Handbook Project
1930: 4-Tube Receiver



THE FOUR-TUBE PEAKED-AMPLIFIER RECEIVER

The drum dial in the center is, of course, the main tuning control. The knob on the left is the volume control while that on the right is for adjustment of regeneration. The 'phone jack is mounted on the baseboard near the rear left corner instead of on the panel.

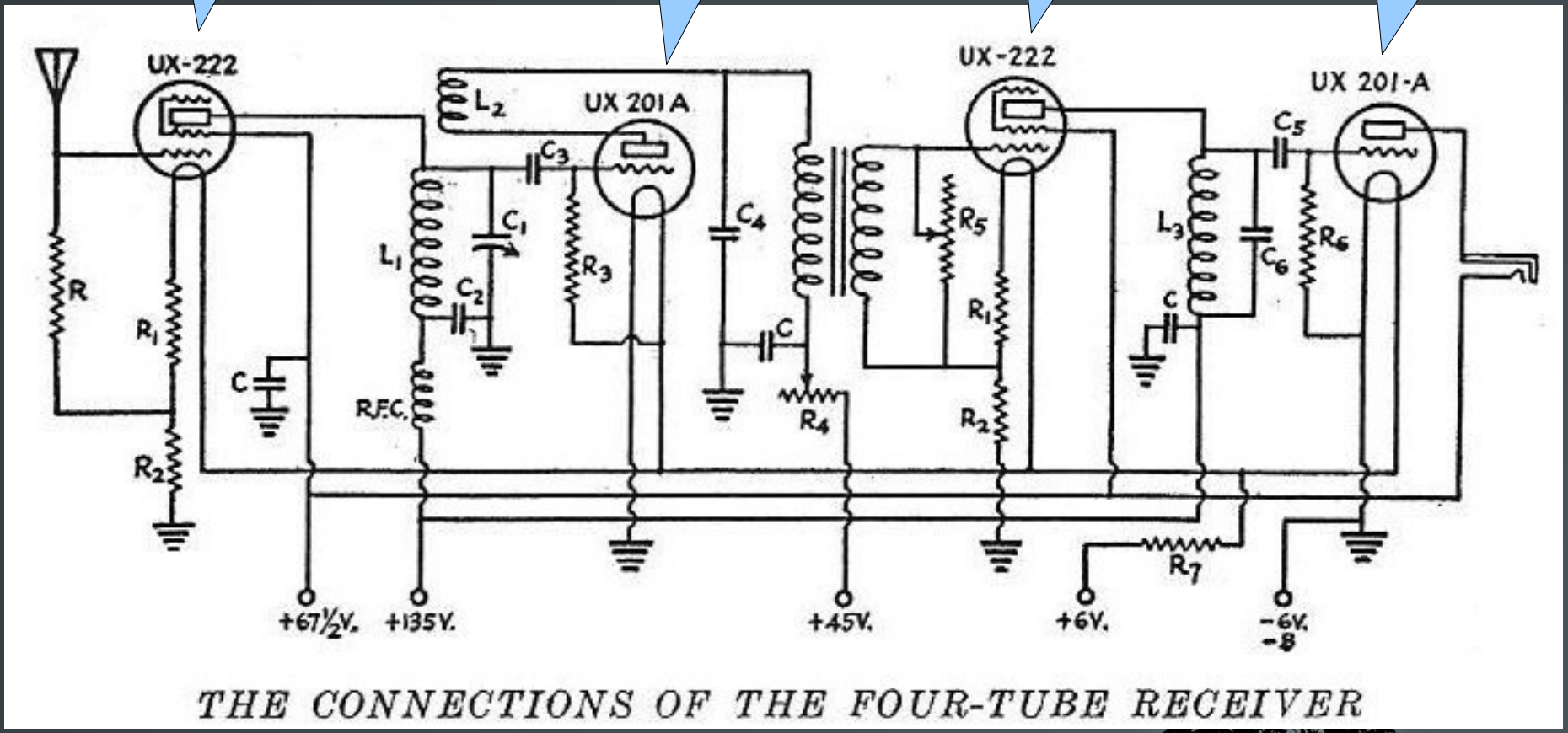
4-Tube Receiver

Untuned RF Amp

Regenerative Detector

Audio

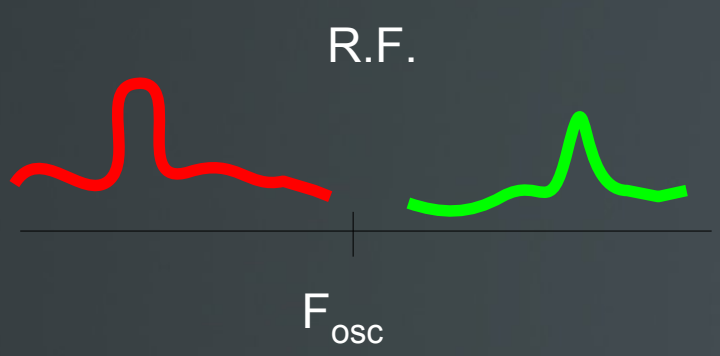
Audio

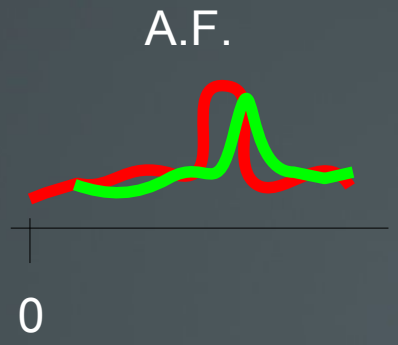


THE CONNECTIONS OF THE FOUR-TUBE RECEIVER

Regenerative Receivers

- Advantages
  - Simplicity, Sensitivity, CW or Voice
- Problems
  - Instability, Low Selectivity, Double Signal



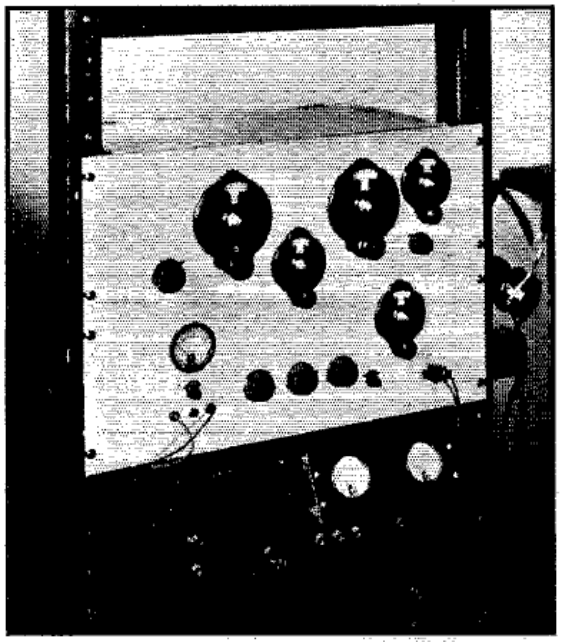


The First Single-Signal Rx

- James Lamb, W1CEI ~1930: It all came together in the ARRL Lab.
  - Superheterodyne Design
    - Bandpass filter, detector, BFO at Intermediate Freq.
  - Tuned RF Amplifier (pre-selector)
  - Stable VFO, BFO
  - Shielded construction
  - IF crystal filter

(Also, see Brian Page N4TRB, *"The National HRO Receiver: A Historical Reconstruction"*, QST, Jan., 2011.)

QST, September, 1932

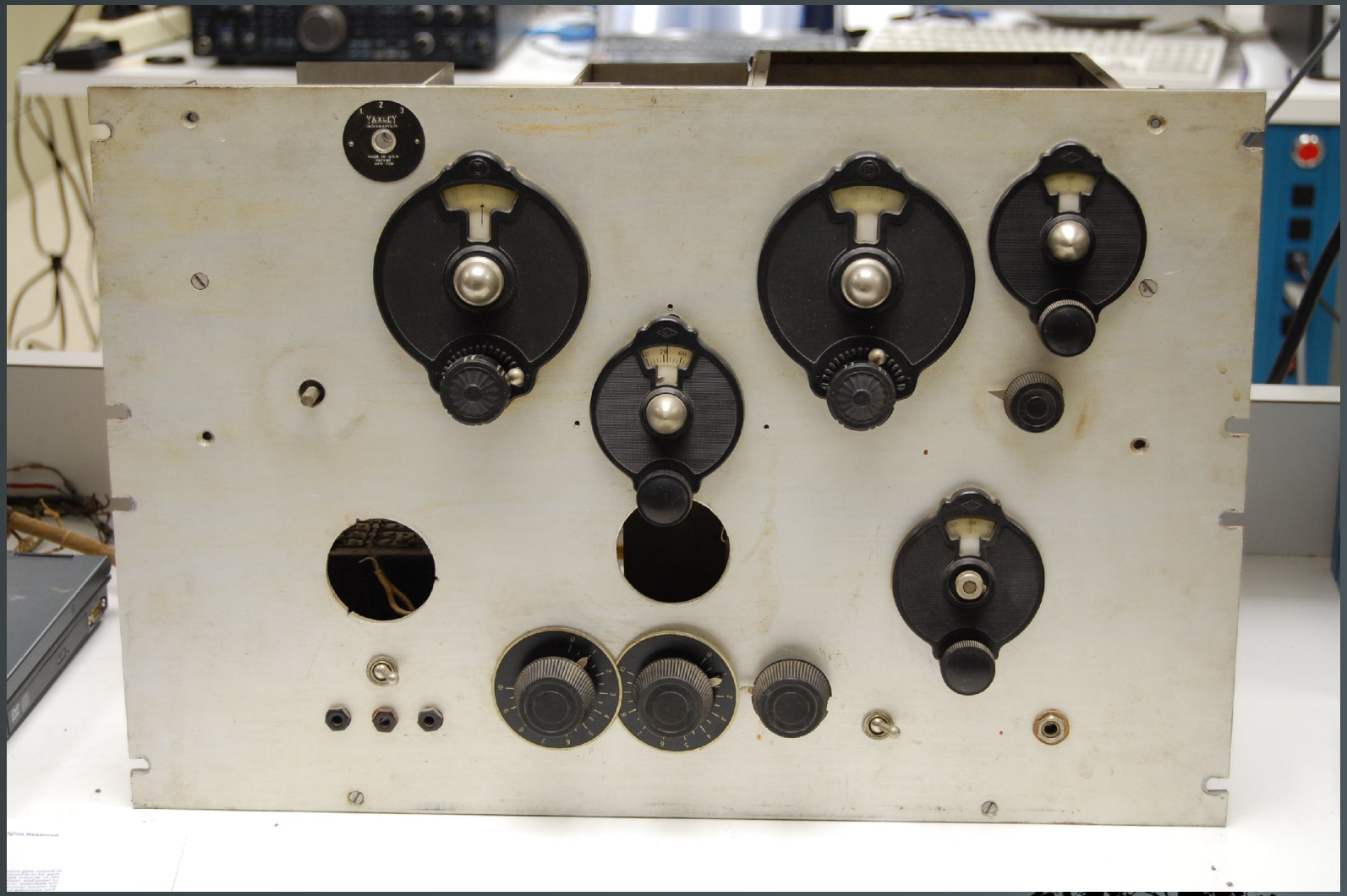


THE RELAY-RACK MOUNTED MODEL OF THE S.S. RECEIVER IN THE QST LABORATORY

The controls of the high-frequency and i.f. filter unit are at the top, the large dials being r.f.-detector tuning (left) and h.f. oscillator tuning (right). Between these is the selectivity control. The small dial at the upper right is for the oscillator padding condenser and below it is the knob of the oscillator coil switch. The knob at the extreme left is the antenna trimmer adjustment. The lower controls are, left to right, manual-automatic gain switch, manual r.f. gain, audio gain, tone control, and beat-oscillator switch. Above and to the right is the oscillator beat control. The 'phone jack is to the right of the tone control and tip-jacks for power stage output are at the left, below the detector plate milliammeter. As is pointed out in the text, several of the controls can be eliminated.

The mechanical construction is the work of QST's laboratory assistant R. B. Parmenter, better known to hamdom as chief operator "RP" of W1MK.

ARRL Lab, 2012



Single Signal Rx, Block Diagram

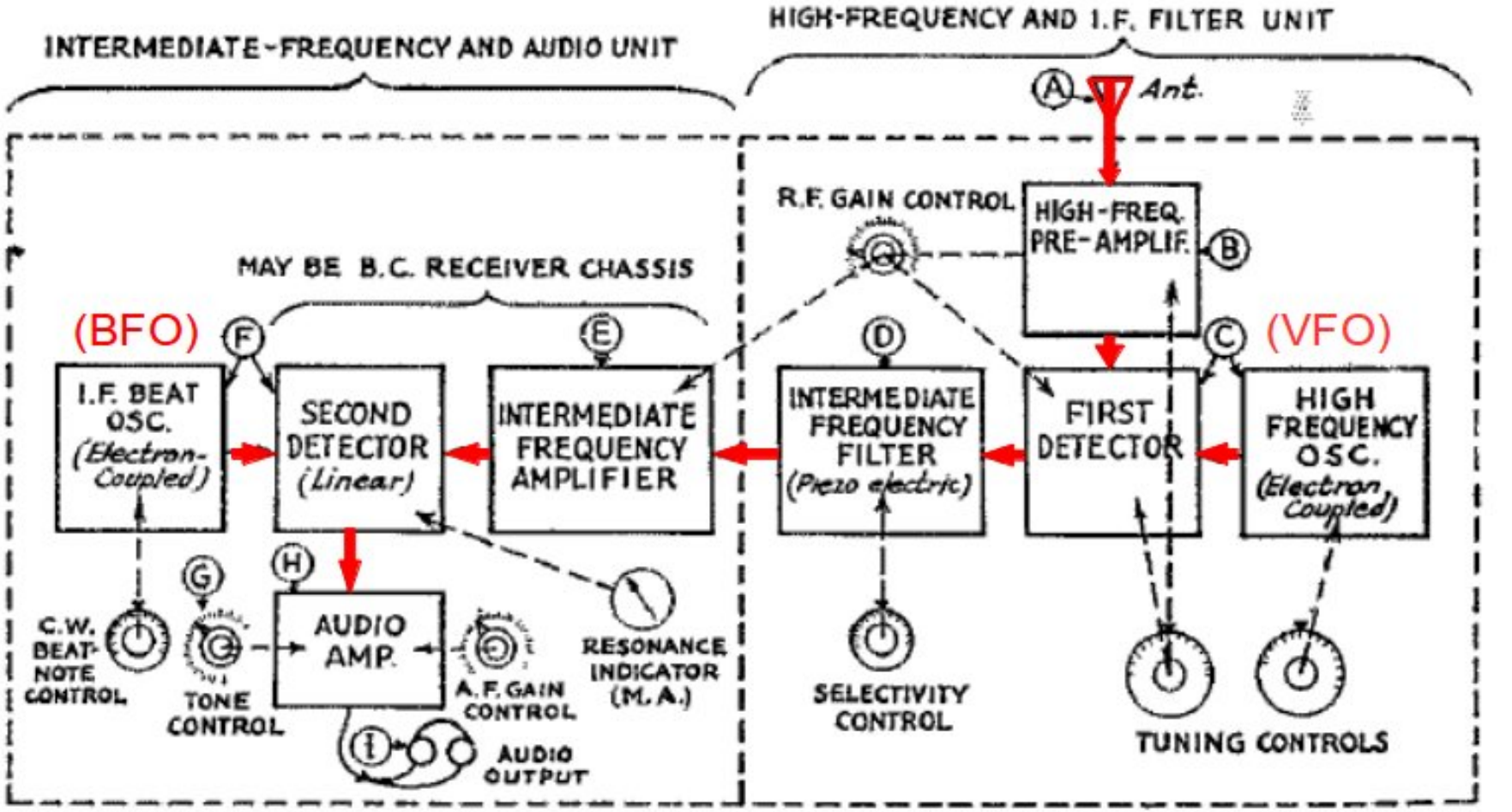
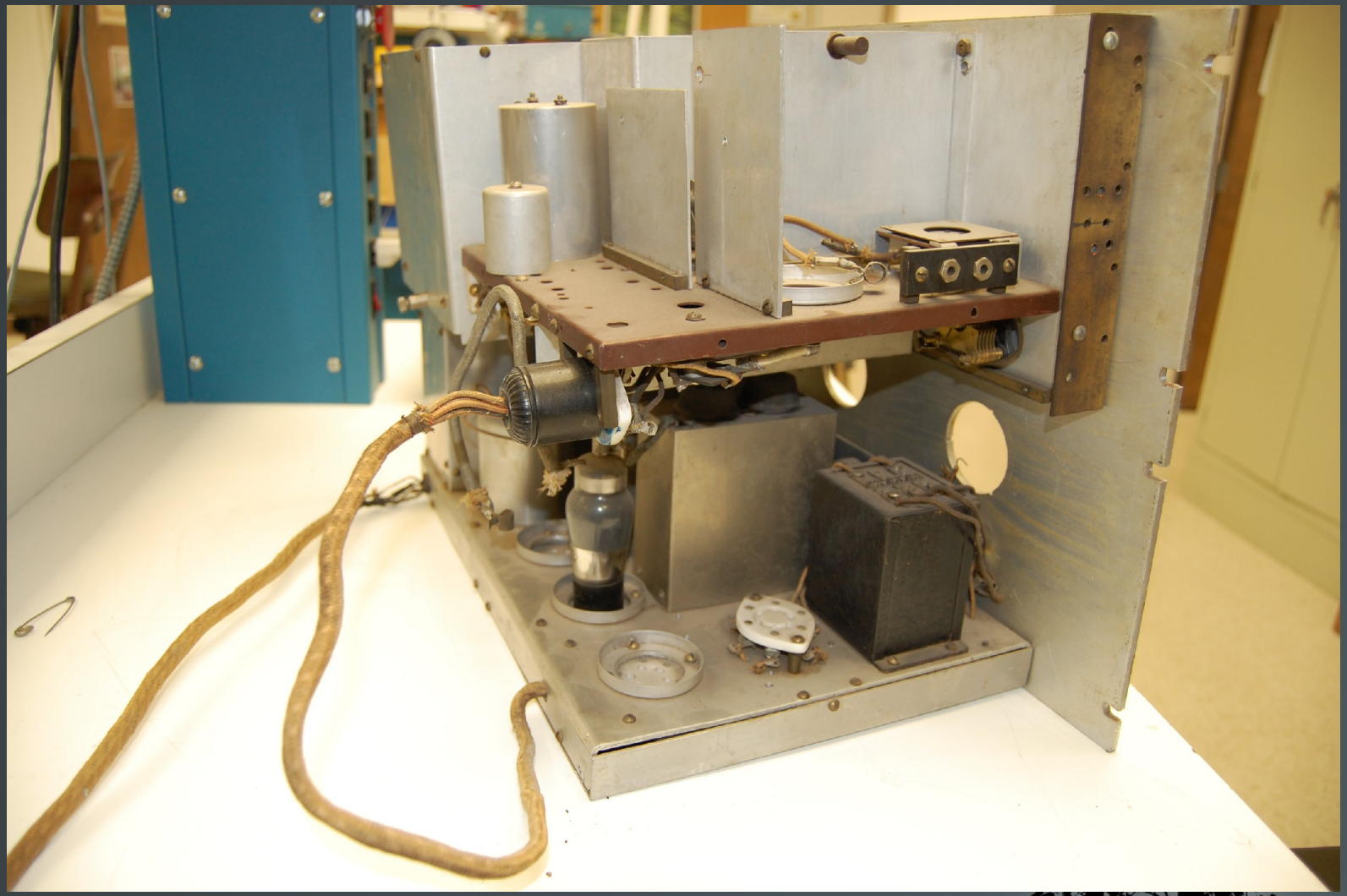


FIG. 2 — BLOCK DIAGRAM OF THE ESSENTIAL ELEMENTS OF THE SINGLE-SIGNAL SUPERHET SHOWING HOW THEY ARE RELATED AND CONTROLLED

Modular, Shielded Construction

Lower Deck: IF, Audio



Single Signal: Results!

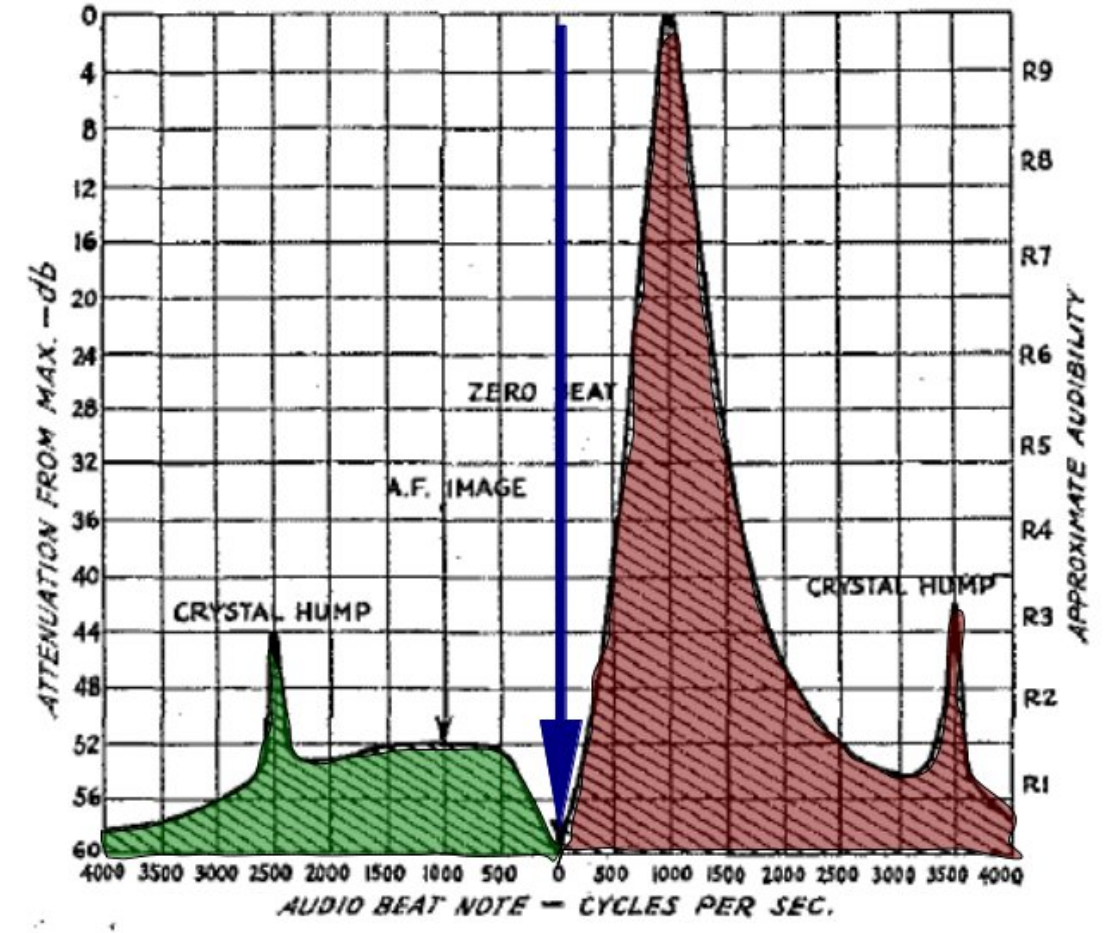


FIG. 5 — THE PICTURE OF SINGLE-SIGNAL C.W. SELECTIVITY

Phasing-Mode SSB Generation

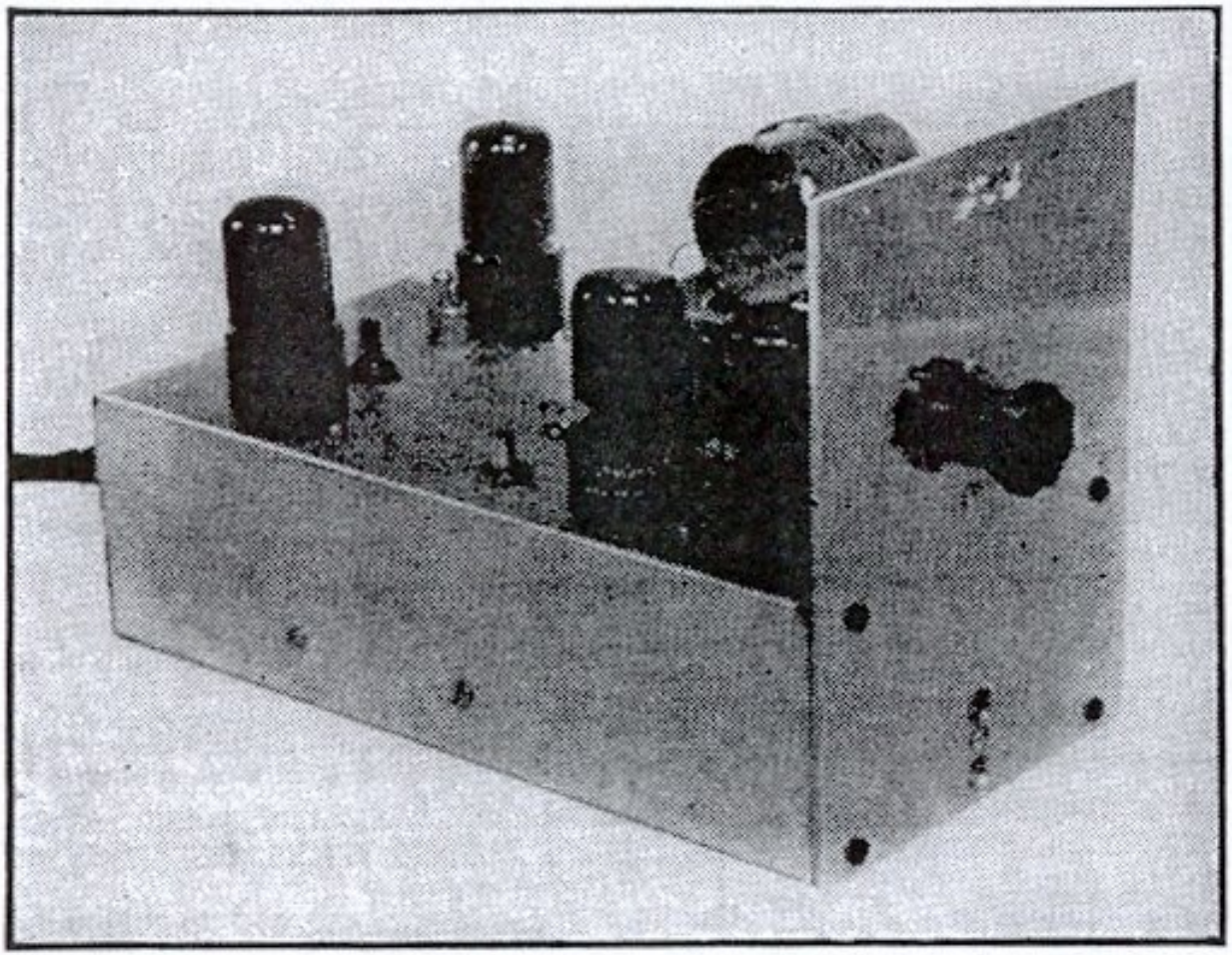
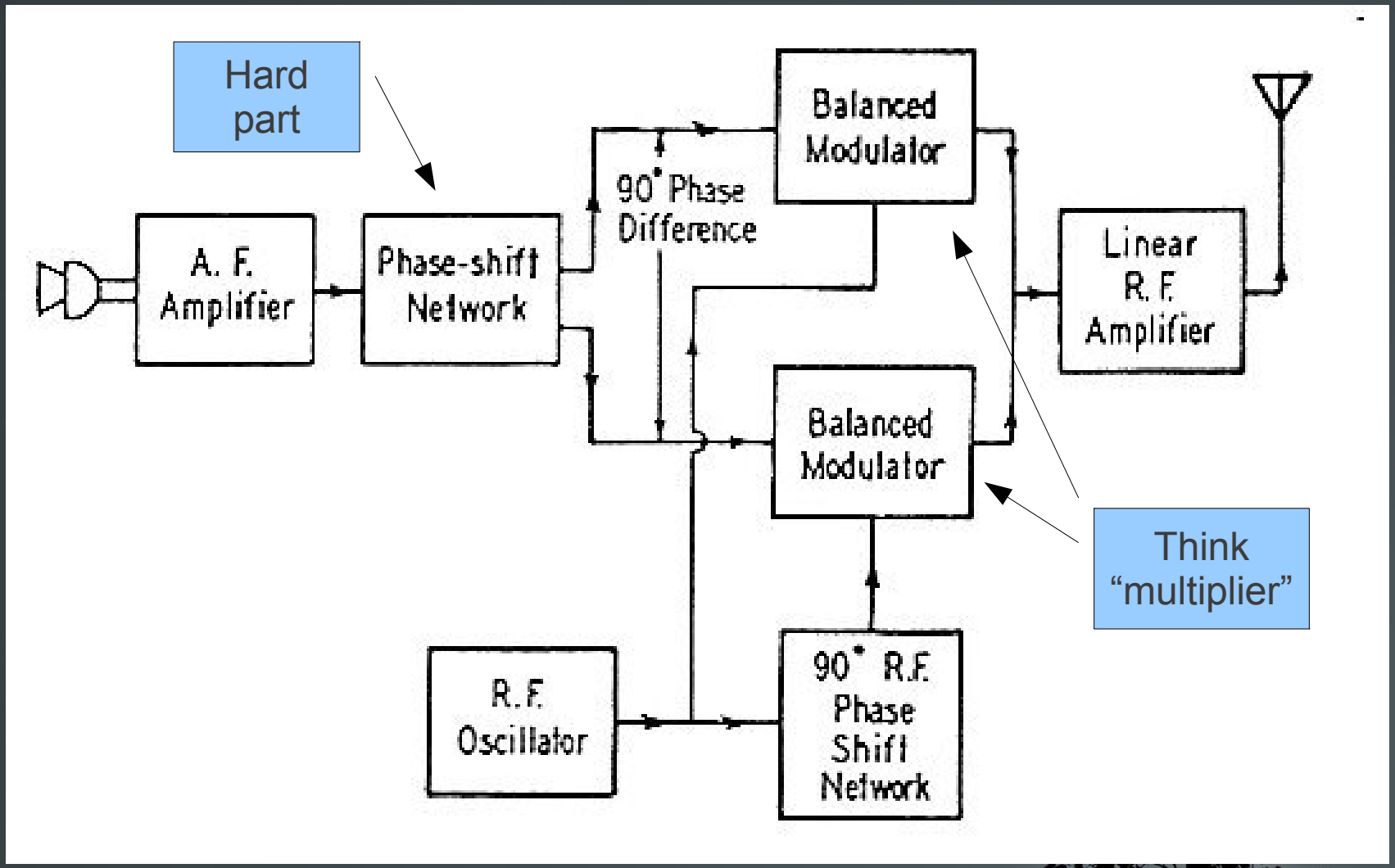
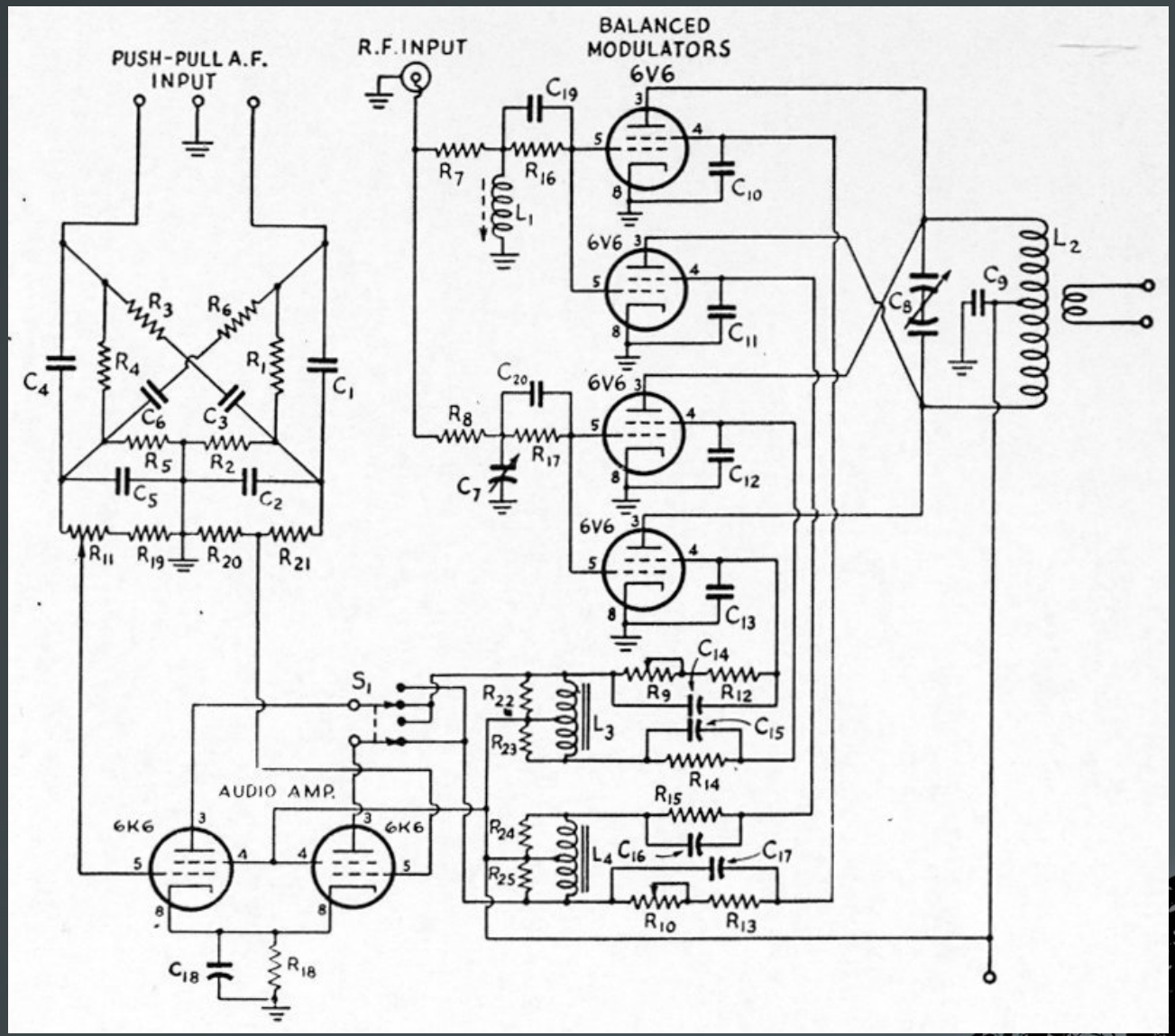


Fig. 9-60 — A small single-sideband exciter that can be used with practically any 75-meter 'phone rig. Receiving tubes are used. (W2UNJ, Aug., 1949, *QST*.)

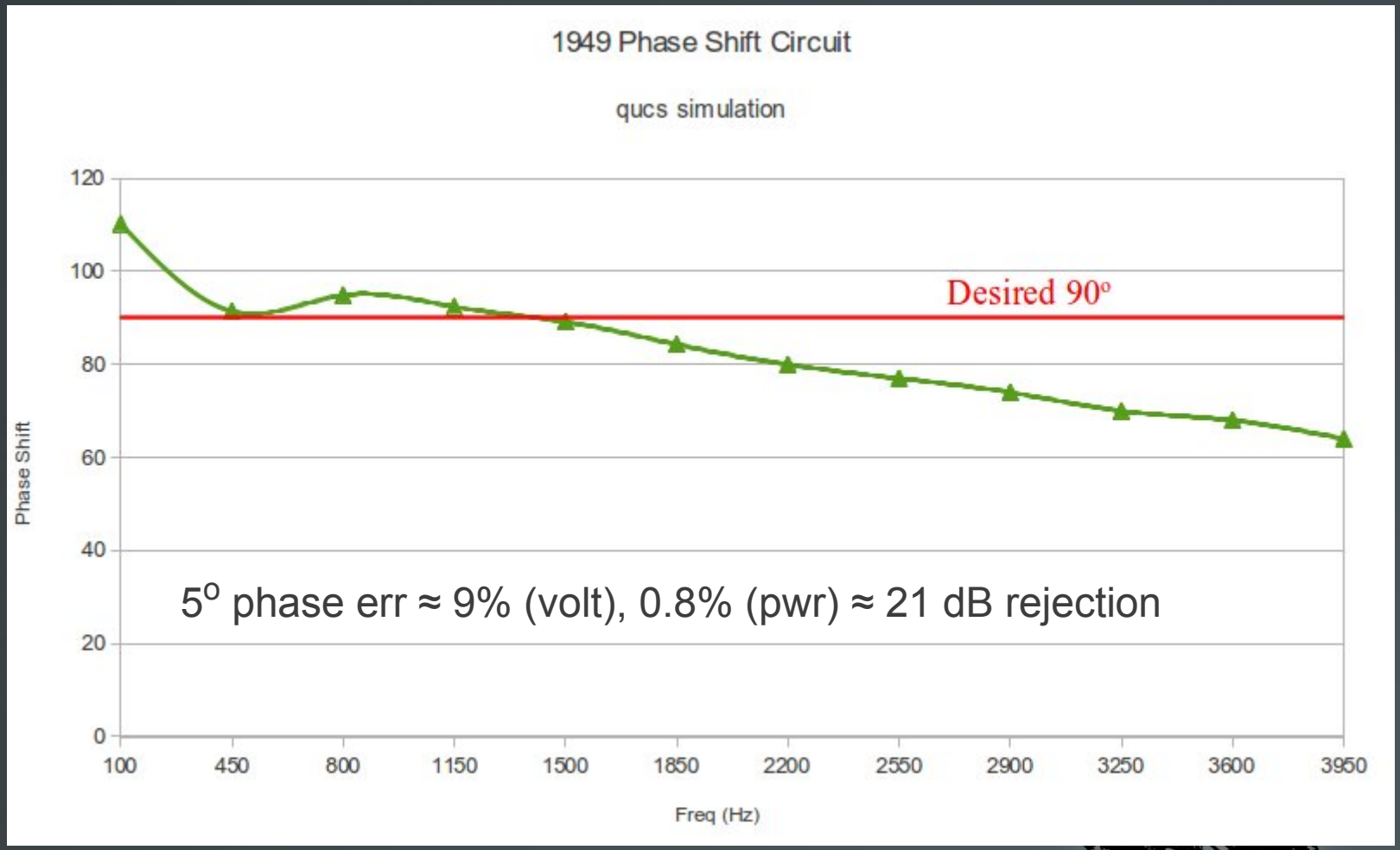
Phasing-Mode SSB Generation



Phasing-Mode SSB Generation



Modeled Phase Shift



SSB Phasing Rx Adapters

1948

GE Electronic TUBE

HAM NEWS

NOVEMBER-DECEMBER, 1948 VOL. 2—NO. 6

SINGLE SIDEBAND RECEPTION

AN ADAPTER TO CONVERT A SUPERHET INTO A TRUE SINGLE SIDEBAND RECEIVER

Materially Reduces QRM When Receiving AM, PM, CW or SSB Signals

Fig. 1. Rear View of SSB Adapter

The single-sideband adapter, shown in Fig. 1 from a rear view, when attached to a superhet re- not exist. Where qrm exists on both sidebands, one is selected which is qrm'ed the least.

1951

GE Electronic TUBE

Ham News

Copyright 1951, by General Electric Company

JULY—AUGUST 1951 VOL. 6—NO. 4

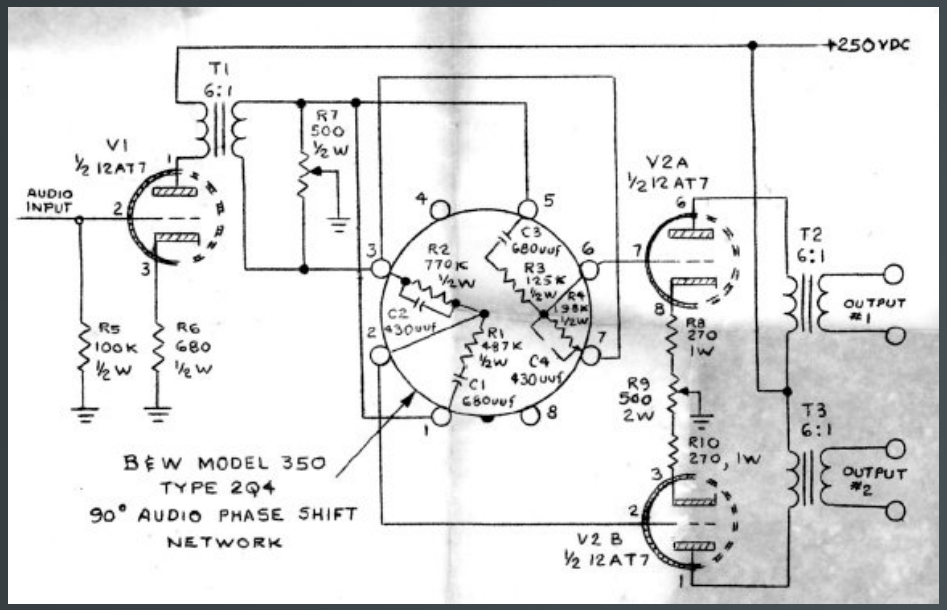
SIGNAL SLICER

Four Tube Receiver Adapter for Improved Reception of AM, NBFM, CW or SSB Signals

Fig. 1. Front view of the Signal Slicer. The input cable is at the left of the unit.

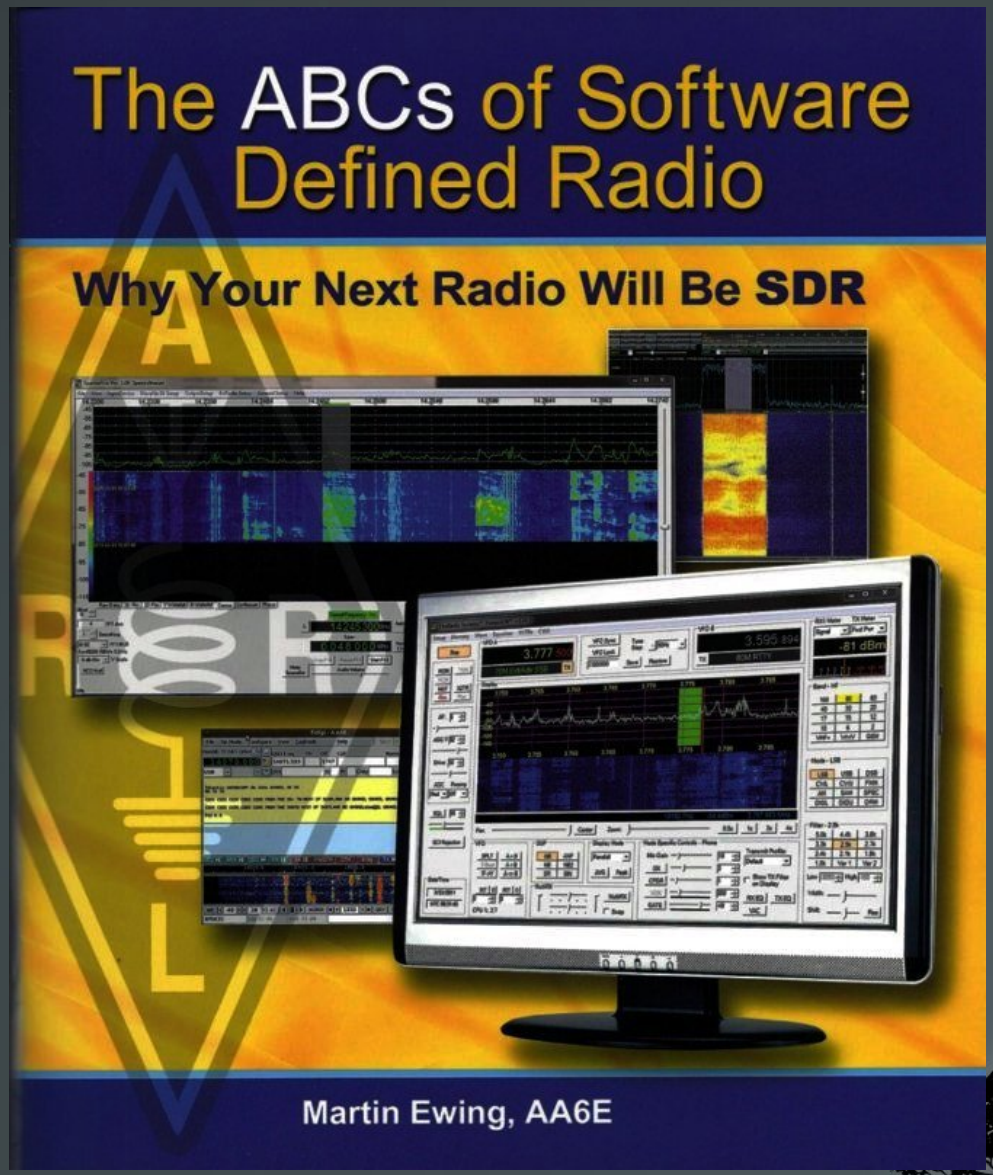
ARRL Forum
Dayton 2012

Phase Shift Module



- Millen 75012,
  B&W 350, etc
- Octal Plug-in (6J5)
- 300-3000 cps ± 1.5 deg
- ~1950

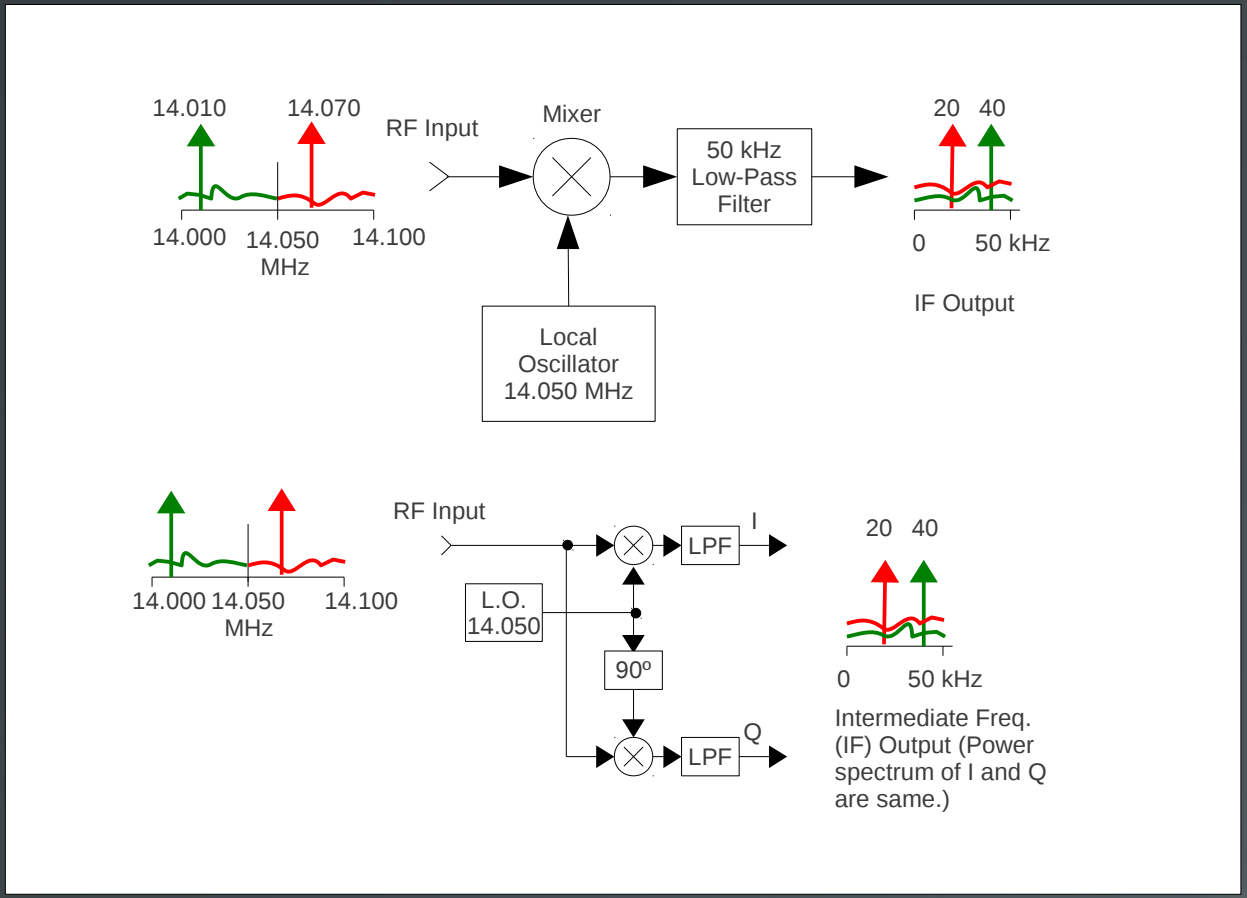
Fast Forward 60 years!



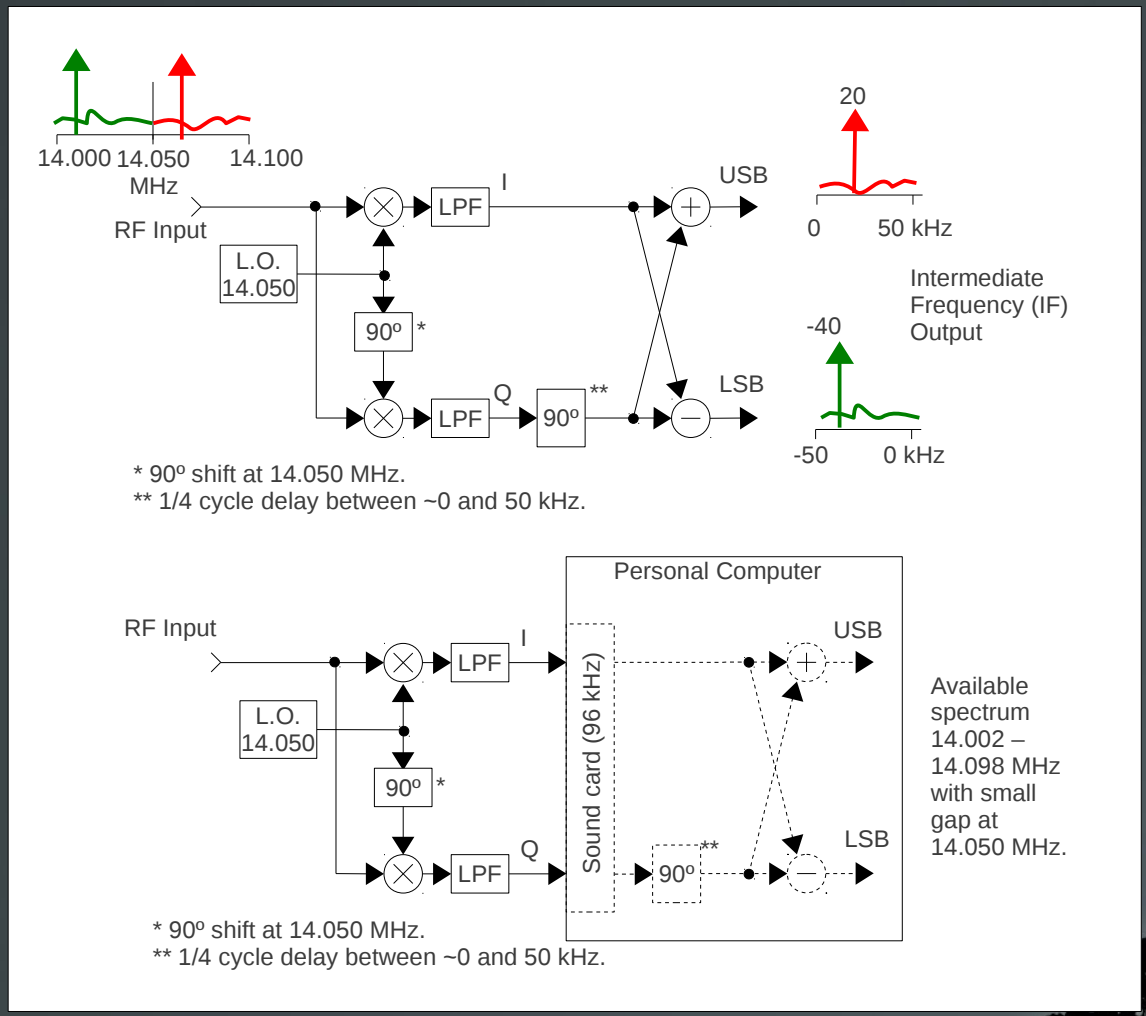
Today's Receivers

- They're almost all Software Defined Radios!
- The giveaway: "IF DSP"

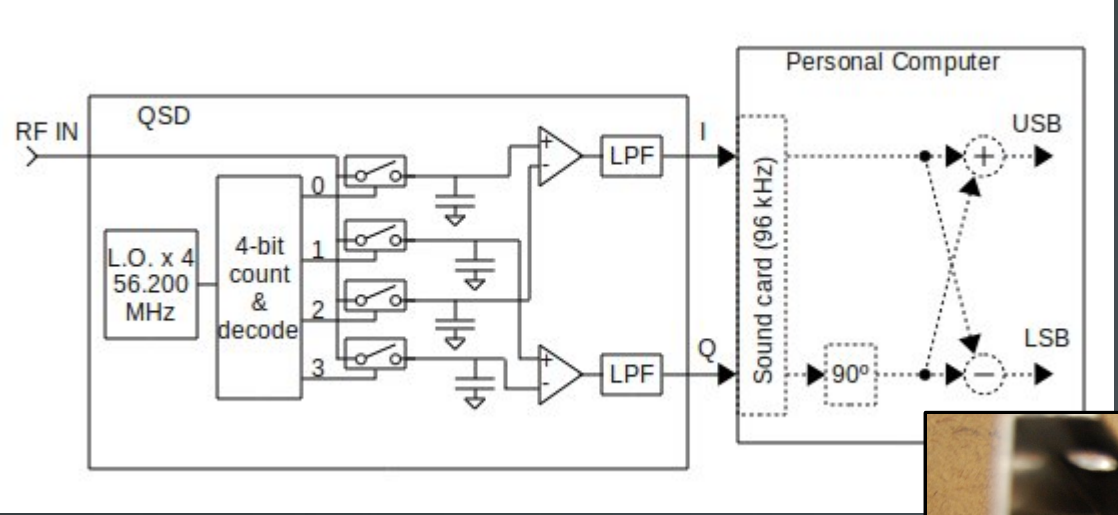
Single-Signal in Simple SDR

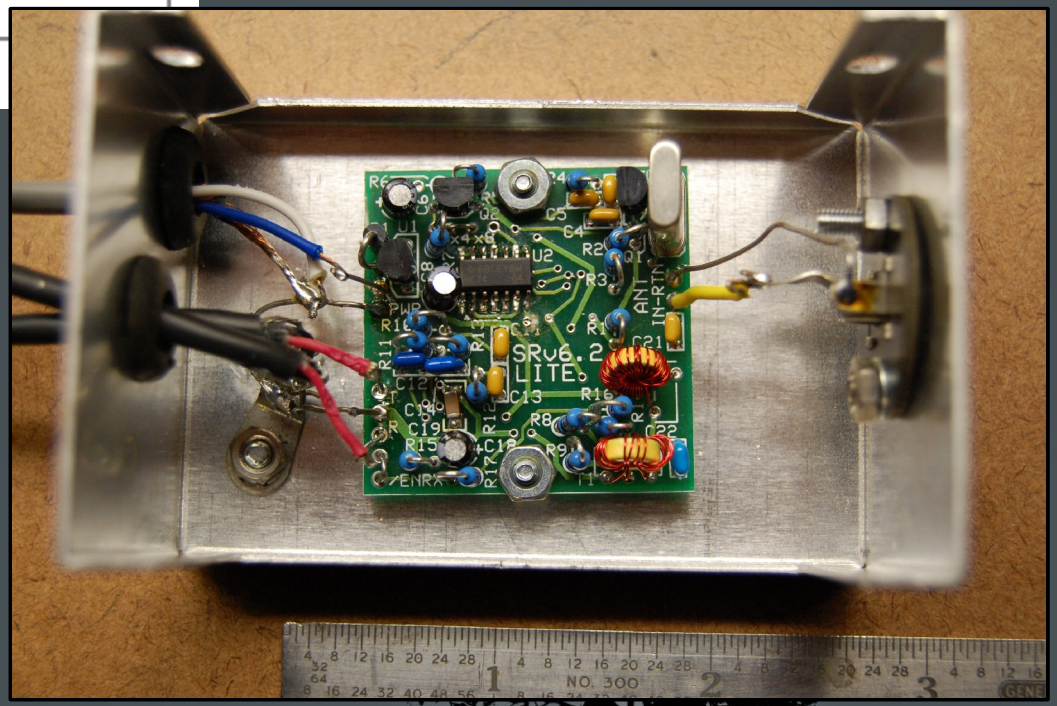


From 1950 (analog) to 2010 (SDR)



Softrock





Solving the Single-Signal problem for $10?
That's not the whole story!

The Next 100 years?

- Single Signal → Selectivity → Optimized filters
- More Commoditization (Chinese HTs, tablets, ...)
- Niches for Hams
  - Off-Grid Communication
    - Internet + "last mile" by RF (DSTAR, Echolink, etc.)
    - Survivalism?
  - Amateur Radio as a special social network
  - Tinkering, at ever higher abstraction? (Python!)
- What's in a ~~name~~ callsign? Befriend a Maker!

TU ES 73