National HRO Receivers

Presented to the Ozaukee Radio Club

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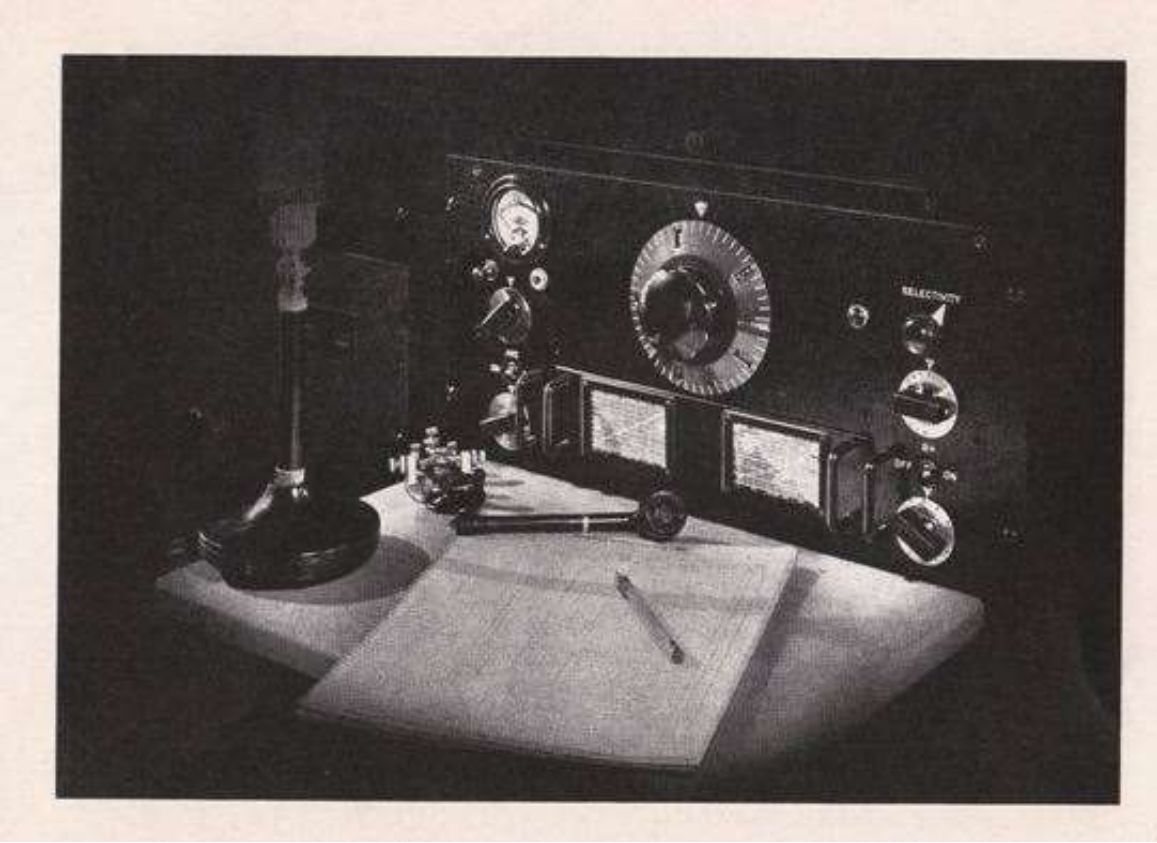
Why the HRO?



Ad featuring James Millen's personal HRO receiver

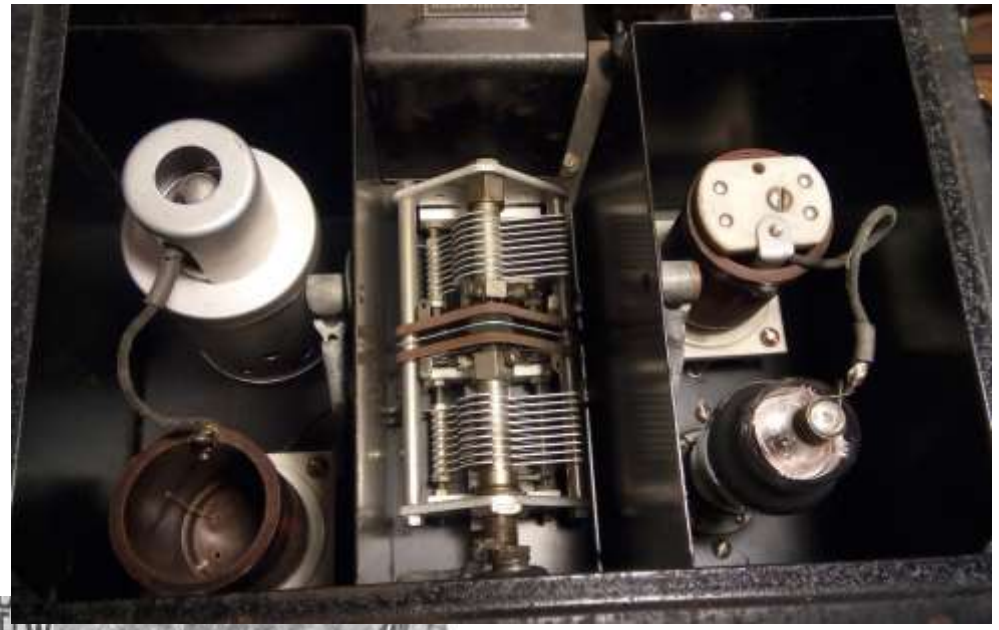
In the 1930's a superhetrodyne receiver was considered almost useless for shortwave work.

James Millen and the HRO changed that.

Today, the superhetrodyne is the most widely used type of radio in the world.

State of the Art?

National SW-3 Regenerative Receiver



W6FFW 1938 Shack
National SW5 Receiver

Evolution

QST June 1932 **What's Wrong With Our CW Receivers**?

Lamb developed the "single signal" receiver in the ARRL Lab.

James Lamb W1CEI

"A superhetrodyne receiver may be great for 'phone but it's no good for c.w."

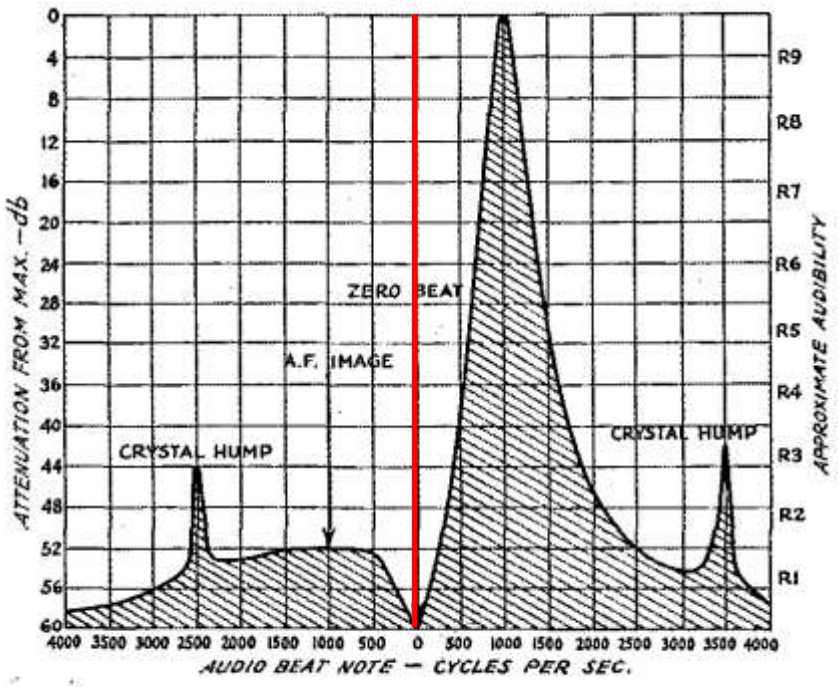


FIG. 5 — THE PICTURE OF SINGLE-SIGNAL C.W. SELECTIVITY

Lamb's prototype receiver is in the ARRL museum.

Superhetrodyne design changes

- Preselector – tuned RF amplifier
- Crystal filter - between mixer & 1st I.F. stage
- Stable oscillators – Local Oscillator and BFO
- Shielded construction

“World’s Best Superhet”

National AGSx Receiver 1934

1930 – National radio network of beacons and voice communication proposed

National wins the contract for the receiver

National FB-7 Receiver 1934

National HRO Receiver - 1935

Features

- 9 tubes, 2.5 volt filament
- 2 RF Amps – Improved image rejection & sensitivity
- 2 IF amplifier stages
- Crystal filter
- Separate mixer & local oscillator
- AVC and BFO
- 2 Audio Amplifier stages
- External power supply
- Sold with 4 Plug-in coil set
- Bandspread on all bands
- Welded steel chassis, laced wiring

HRO Junior – 1936
A lower priced alternative

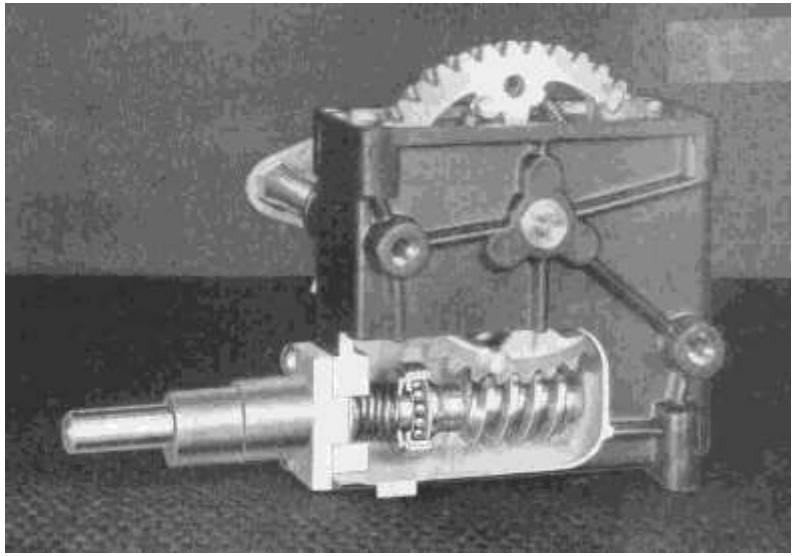
Millen removed the features that some hams didn't use:

- No crystal filter
- No S-Meter
- General coverage coils (no bandspread, sold with 1 coil)
- $99 (HRO Senior was $179)
- Not a big seller, perceived as poor value by hams

Designed by National engineer William Graden Smith

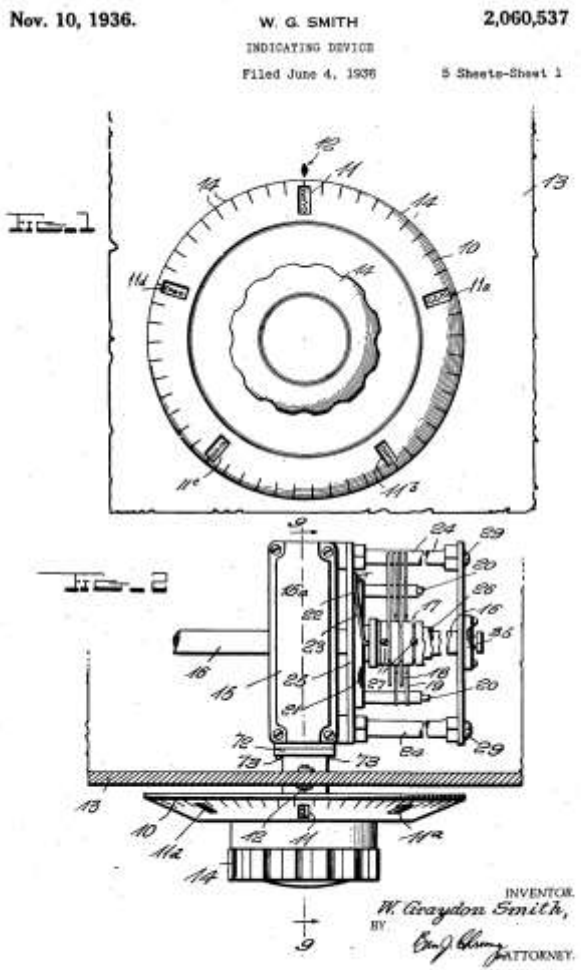
HRO Dial Mechanism

PW Dial Gearbox



- 20:1 Vernier Drive
- Direct reading to 1 part in 500
- 10 turns stop to stop
- Readable to within 1 KHz

National Micrometer Dial



HRO Coils

Coils individually calibrated for each receiver

Four coils supplied with receiver – A,B,C,D

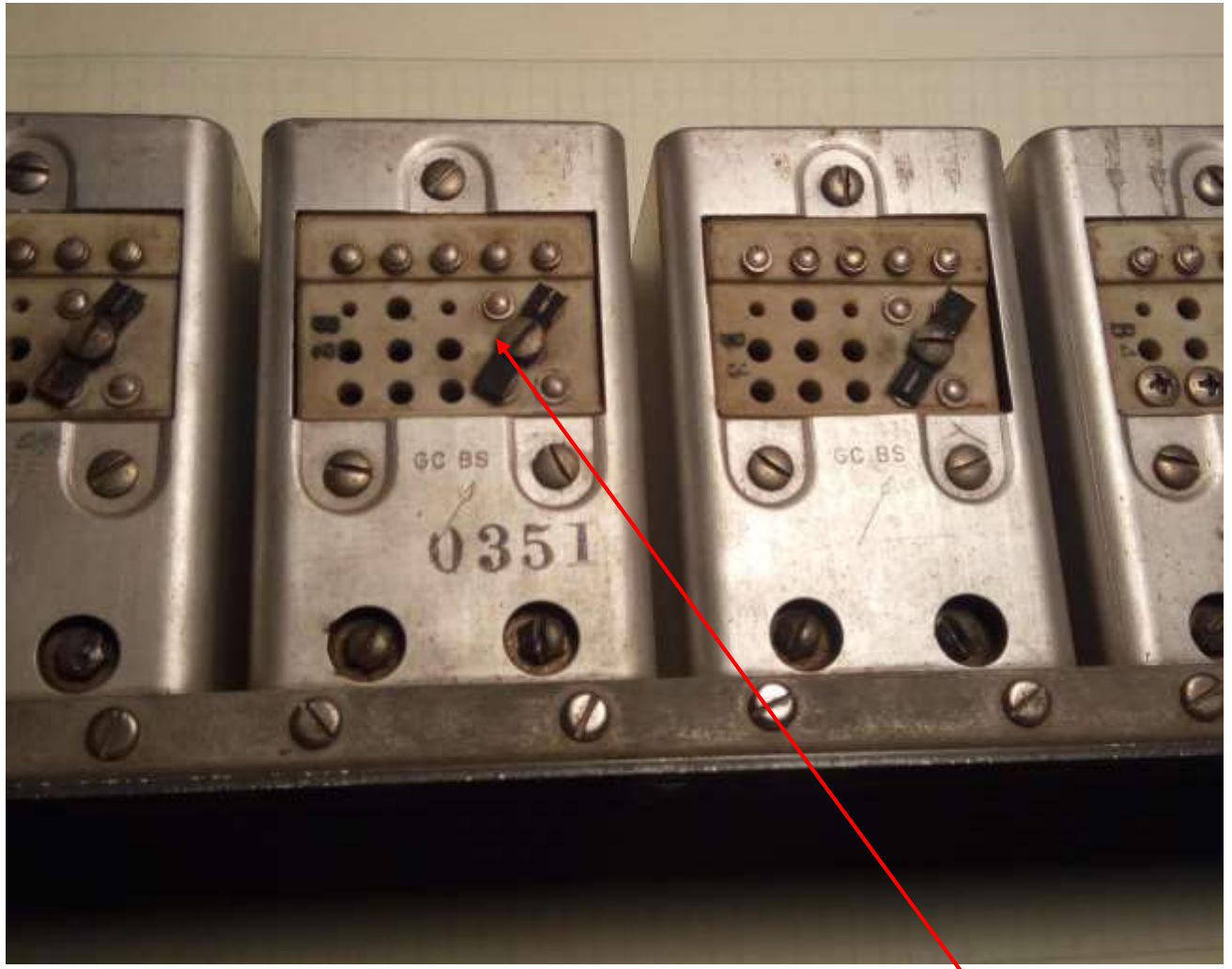
Two frequency ranges for each coil:

<u>Bandspread</u> and <u>General Coverage</u>

- General Coverage - 1.7 to 30 MHz
- Bandspread – 80, 40, 20 and 10 meters

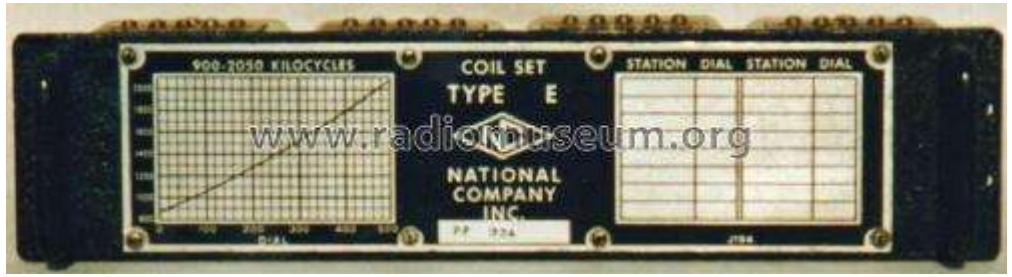
Coil compartment provides thermal isolation for greater stability

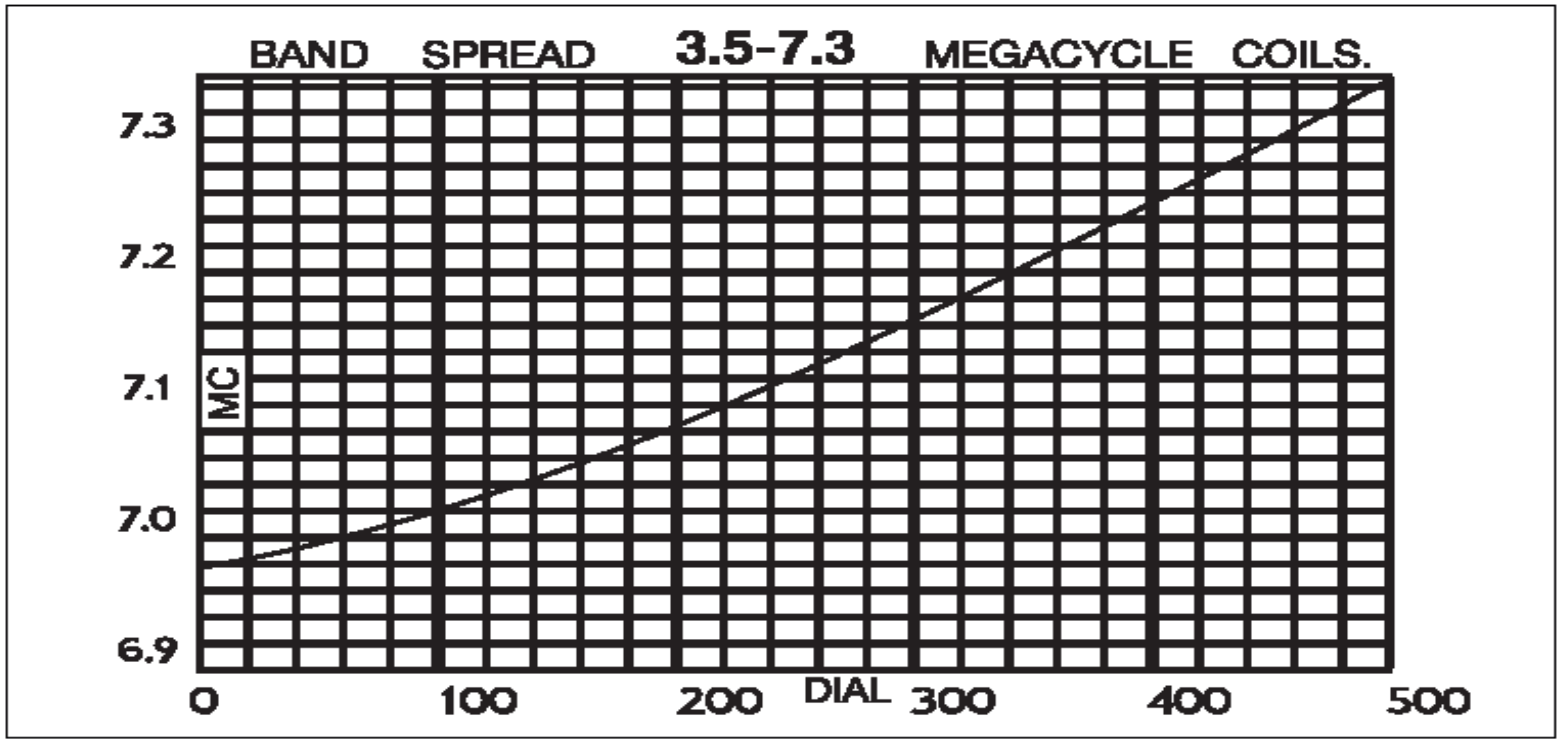
Coil storage box



Bandspread Switch

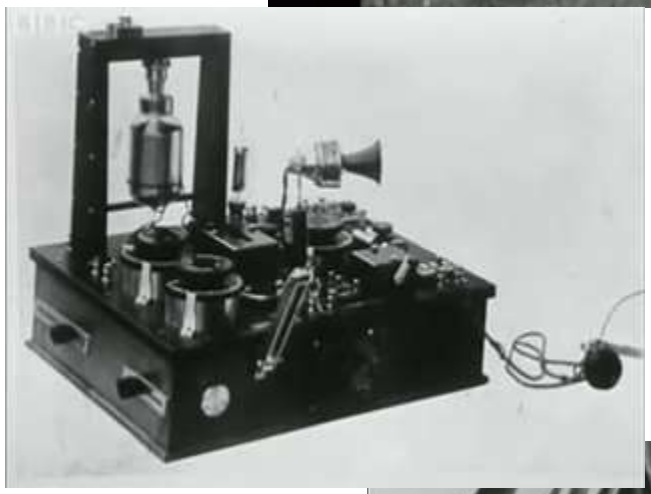
HRO Tuning Chart





British Signals Intelligence

- In 1916 some British amateurs picked up German naval transmissions.
- They convinced the Admiralty to set up a listening post.
- They were soon intercepting numerous message to ships, submarines and Zepplins.
- “Y-station” network begins

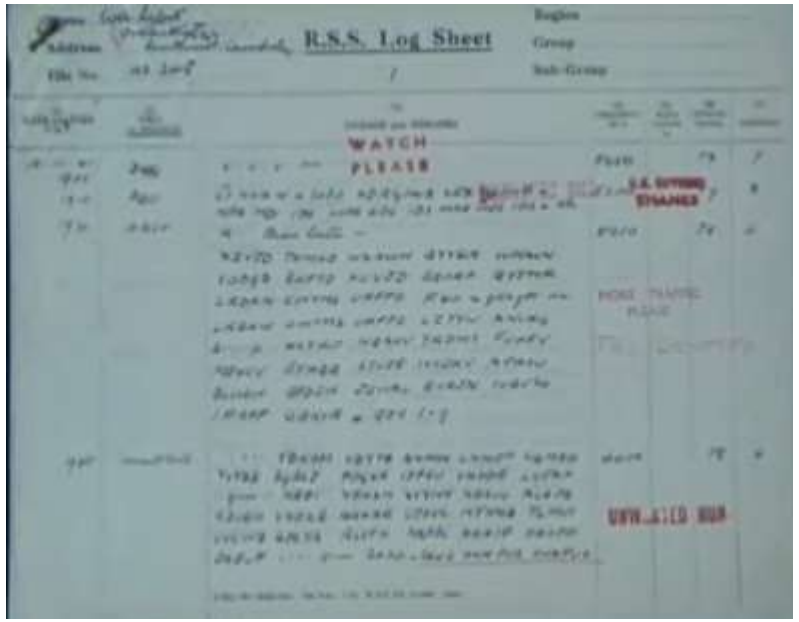


Battle of Jutland – May / June 1916

- British fleet engaged the German fleet before the Germans were ready due to intercepted signals.
- Largest naval battle of WW 1
- Admiralty is convinced of the value of wireless intercept

WW 2 Voluntary Interceptors

Britain had a military “Y-Services” but not enough trained operators
Hams were pressed into service as “Voluntary Interceptors” to monitor communications
Message logs were forwarded to Bletchley Park for analysis
Receiving equipment was generally of poor quality



Voluntary Interceptor Hugo Lawley and HRO Receiver

Better Equipment

- Large numbers of HRO Senior and HRO Junior receivers were used by the British and American services
- By the end of the war about 10,000 HROs were in use
- Mostly HRO-M and HRO-5 models

Key HRO Features

- Stability – stayed on frequency
- Repeatability – could return to the same frequency
- Ease of use – new operators could quickly learn
- Reliable & Rugged – used for mobile direction finding

Y-stations passed intercepted signals to Bletchley Park

Raw Material

- 1939 – England is given information on the Enigma cipher machine
- Late 1941 –Daily secret messages from German Intelligence
- Allowed complete picture of daily activity and structure of Abwher and Gestapo

The RSS, Amateurs and other Voluntary Interceptors supplied the raw material to Bletchley Park

Enigma cipher machine

RSS = Radio Security Services

Post War Receivers

HRO-50 – Introduced in 1949. Many significant changes:
Internal power supply
Direct reading slide rule dial
Modernized tube selection
Push-pull audio output, 6 watts

HRO-50-1 – 3 stage IF, improved selectivity

HRO-60 – Double conversion above 7 MHz

The HRO-60 was the last of the tube HRO receivers.
It was in production until 1964.

National HRO-60

On Display This Evening

Thank you to Bill Shadid W9MXQ for sharing this fine example of a vintage receiver with us.

National HRO-M-TM
The “M” means General Purpose Coils
The “TM” means Table Top Chassis
Manufactured in October or November 1939

Note the S-meter.

On Display This Evening

I bought this receiver from a young man in West Allis. When I asked him if the radio worked, he replied " I got it from a really old guy who's dead now".

W9JI

National HRO-50T-1
The "T" means Tabletop (not rackmount)
The "-1" means it's a later version with an 3rd IF stage
Manufactured in late 1951

Questions?

The HRO Did Have Competitors

- Hammarlund Super Pro Series (1936 – 1950s)
- Radio Manufacturing Engineer's RME-69 (1935)
- Hallicrafters SX-28 (1940)