

Radair Identification Set RT-82 / APX-6

The APX-6, introduced in WWII, was the first widely used aircraft transponder, operating in the L band, between 960MHz and 1250MHz. Its purpose was to identify an aircraft as friendly.

Part 1 : RF circuits and power supply

Note: The *coder* circuits in the APX-6 chassis are described in a different pdf file on this website.

Transmitter

The transmitter is a self-oscillating lighthouse tube 2C42. It gets 2kV anode voltage from the modulator for 1 μ s. The maximum duty cycle is specified as 0.0025, and assuming that mostly single pulses are transmitted, the pulse repetition rate should be less than 2.5 kHz.

The peak power output is 1kW into 50 Ω , which is a sinewave of 316V peak at 6.3A peak.

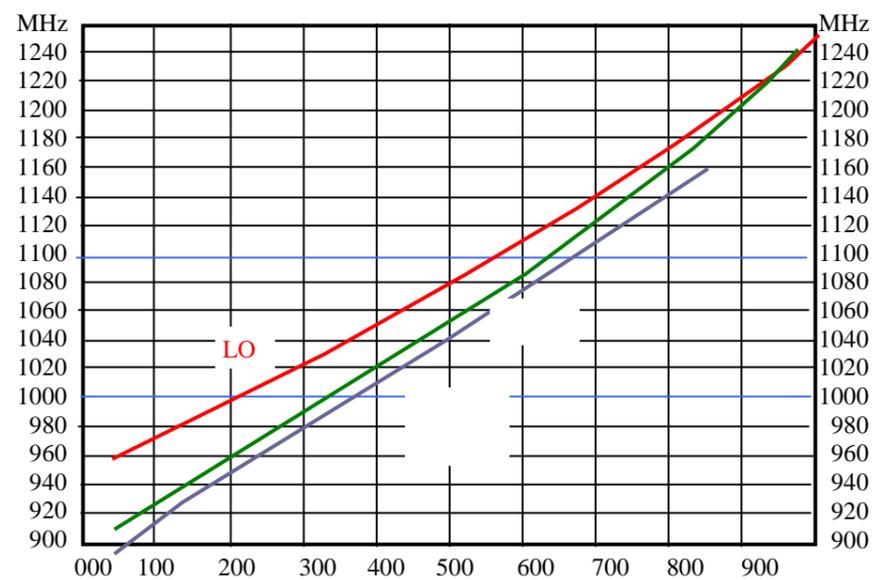
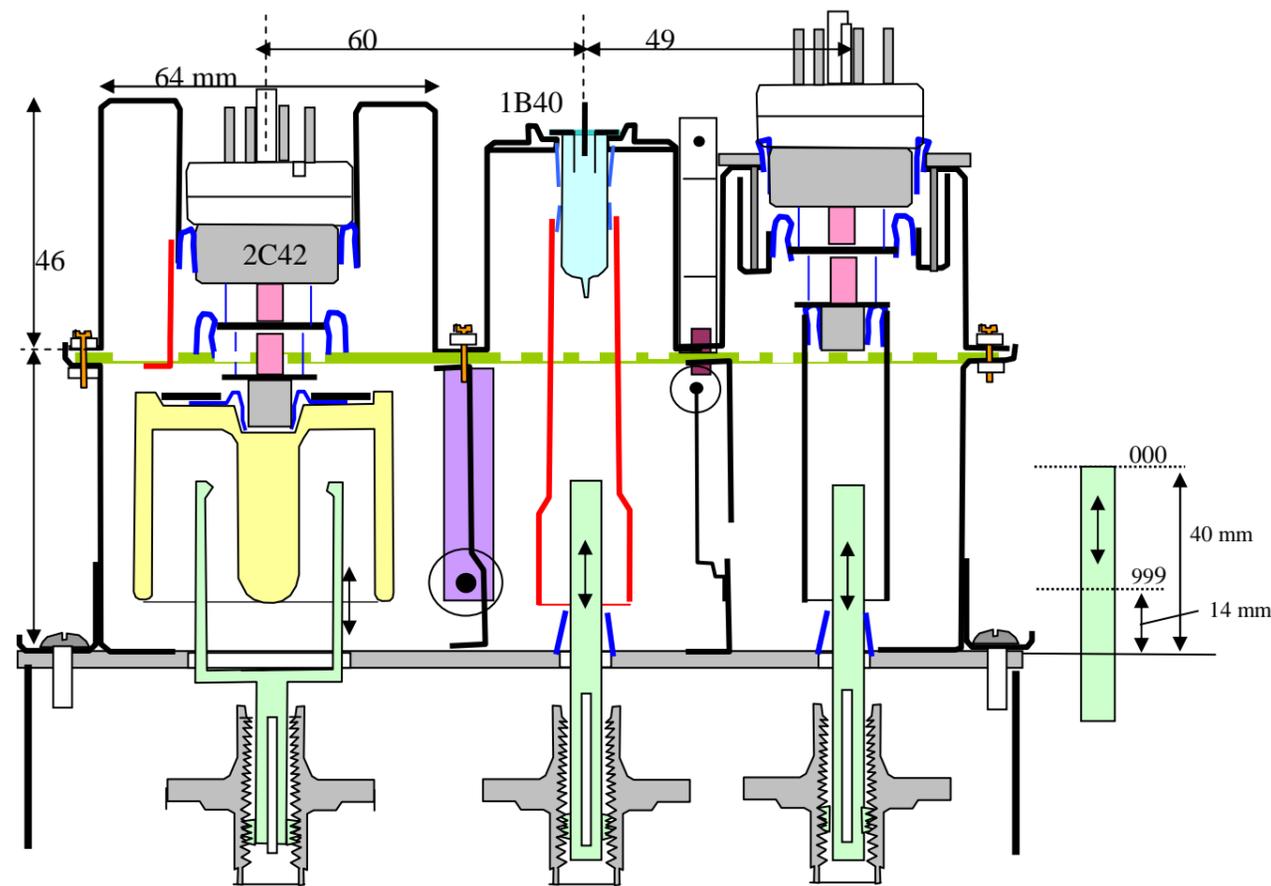
Cavity

The 3 cavities are manually tuned. Seen from the Transmit frequency, the Receive Frequency and the Local oscillator (LO) frequency. I have measured the relation between dial setting and frequency for my set, see the plot on this page. Red is the local oscillator, blue is the transmitter cavity, and green is the antenna cavity,

Modulator

Assuming 50% efficiency for the 2C42, the modulator must supply pulses of 2kV /1A on the secondary side of the modulator transformer. The modulator tube V111 (two tetrodes in parallel) operates on 1200V anode voltage, of which 1000V can be across the primary of the modulation transformer. So, the peak anode current for each section of the 3E39 (= 829B) will be 1A !

The modulator is enabled 1 minute after turn-on to guarantee that the 3E39 and 2C42 cathodes are properly heated up.



The receiver has the other lighthouse tube 2C46 as local oscillator. A silicon point contact diode 1N24 serves as mixer to the IF strip.

The sensitivity is approx. 100 uV

The middle cavity is the receiver antenna tuned circuit. This circuit is automatically shorted during the transmission pulse to protect the mixer diode.

Shorting is done with a small gas filled tube 1B40, which is kept near breakdown by +340V bias voltage, derived from a voltage divider in the modulator.

The IF strip has 6MHz bandwidth to accept 1us pulses, and the tolerance of all these free running oscillators. The center frequency is 60MHz. Six stages 6AK5 each have approx. 4x gain, so the input sensitivity is 100uV. The IF transformers are fixed and cannot be tuned.

The detected signal is amplified and pulses are limited in length to 2us to reduce the risk of jamming with random pulses or CW.

Tuning aid

A second detector with a much narrower bandwidth around 60MHz is included to drive the BNC plug J403. When an RF signal is applied to the antenna plug, dials REC and LO can easily be tuned for maximum output on J403.

Destructors

Three small explosive charges are inserted in the frontpanel. When triggered with > 5Vdc from plug J405 "destructor", they will distort the tuning head so the transmit and receive frequency are kept secret.

Power supply

The APX-6 is powered by 115Vac / 400Hz / 200W, and by 28Vdc / 0.6A for the relays.

There is a start-up time delay of 1 minute for the modulator. All other tubes get anode voltage as soon as the rectifier tubes are functioning.

Weight

Size

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