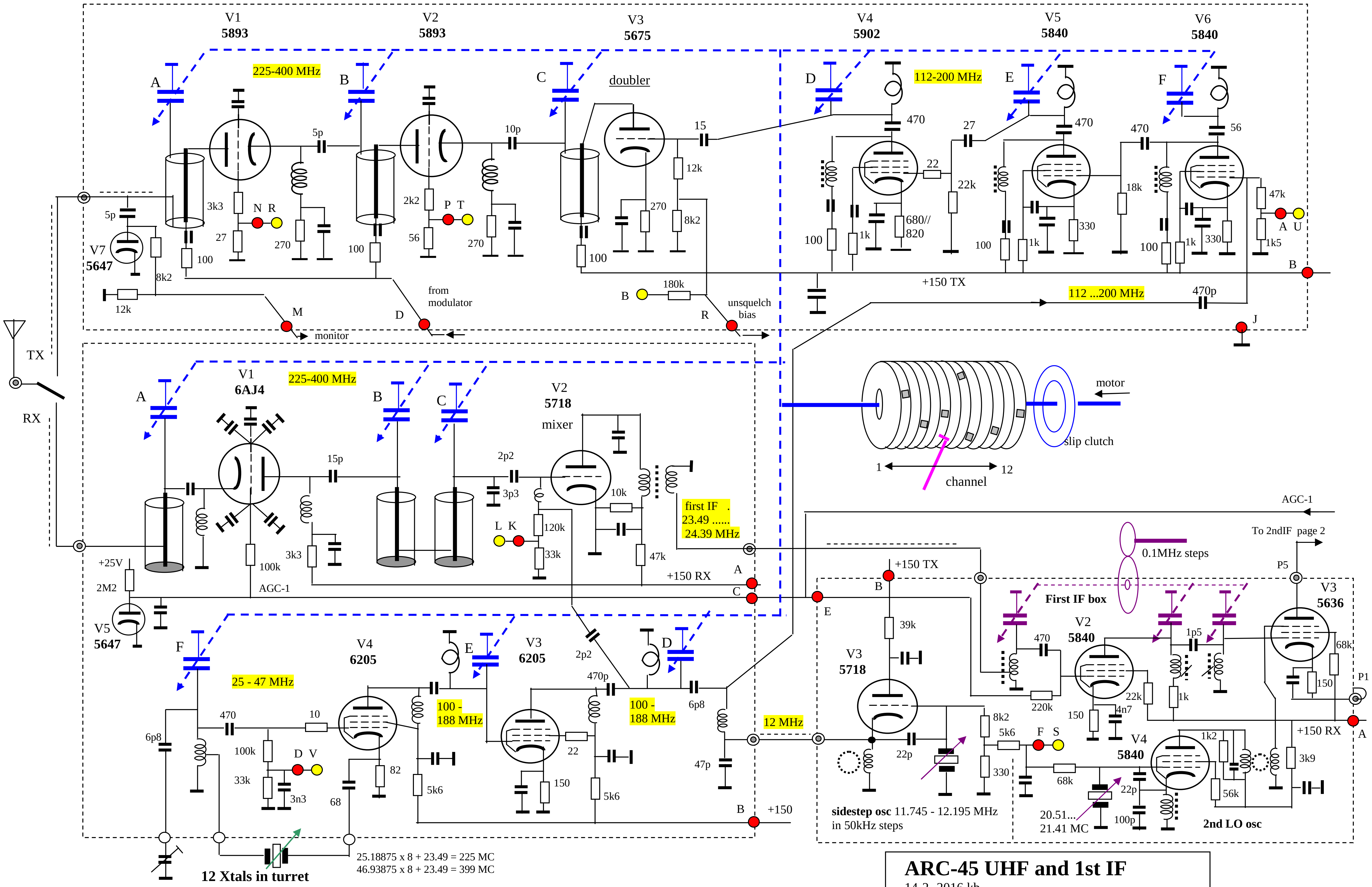
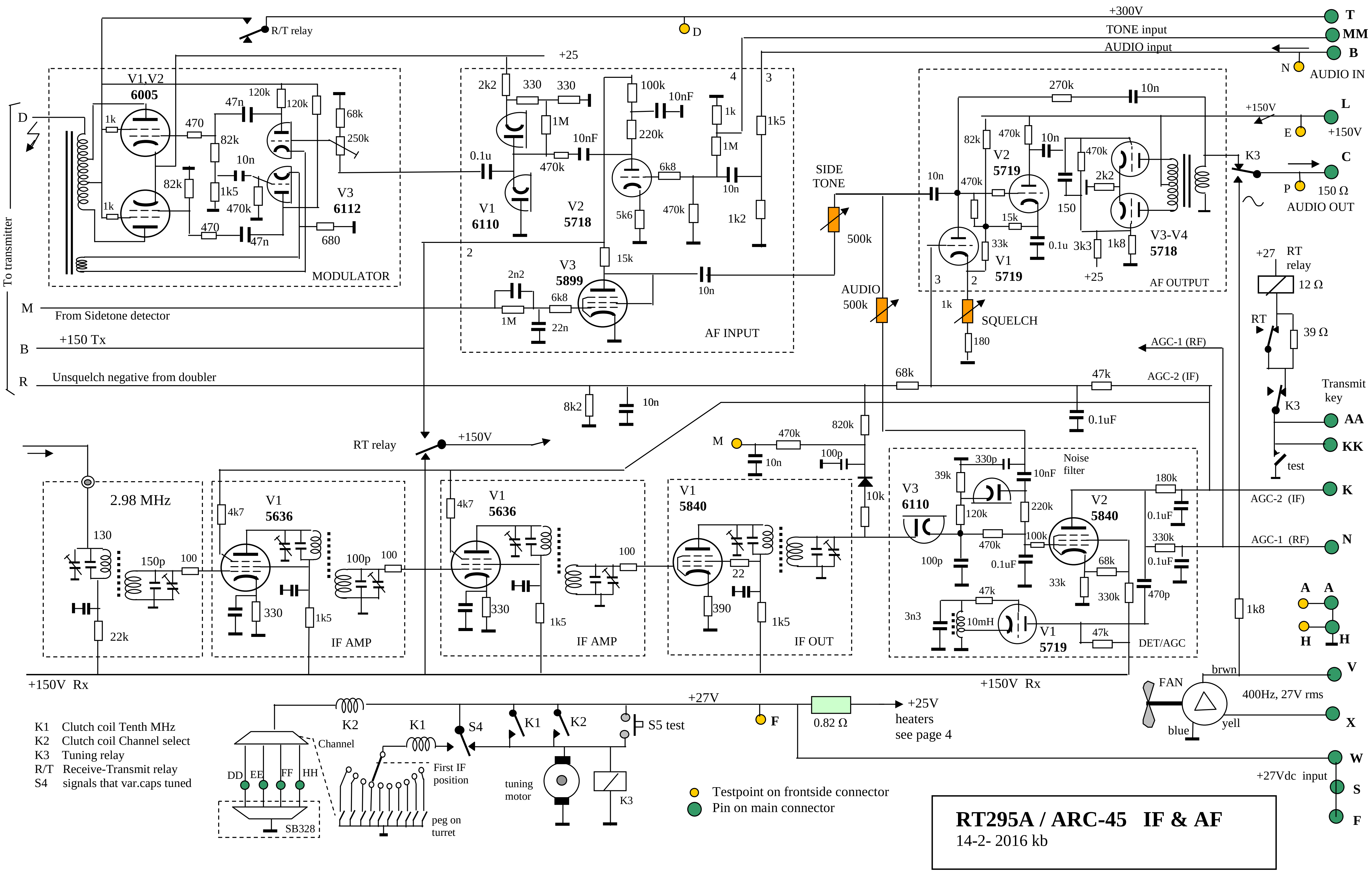


ARC-45 UHF and 1st IF

14-2 -2016 kb



RT295A / ARC-45 IF & AF
14-2- 2016 kb
MODULATOR
AF INPUT
AF OUTPUT
IF AMP
IF AMP
IF OUT
DET/AGC
2.98 MHz
V1,V2 6005
V3 6112
V1 6110
V2 5718
V3 5899
V2 5719
V1 5719
V3-V4 5718
V1 5636
V1 5636
V1 5840
V3 6110
V2 5840
V1 5719
+300V
TONE input
AUDIO input
AUDIO IN
+150V
150 Ω
AUDIO OUT
R/T relay
RT relay
+25
SIDE TONE
AUDIO
SQUELCH
Noise filter
AGC-1 (RF)
AGC-2 (IF)
To transmitter
From Sidetone detector
+150 Tx
Unsquelch negative from doubler
+150V Rx
+27V
+25V heaters see page 4
0.82 Ω
Transmit key
test
RT relay 12 Ω
39 Ω
FAN
400Hz, 27V rms
brwn
blue
yell
+27Vdc input
S5 test
tuning motor
Channel
First IF position
peg on turret
SB328
K1 Clutch coil Tenth MHz
K2 Clutch coil Channel select
K3 Tuning relay
R/T Receive-Transmit relay
S4 signals that var.caps tuned
Testpoint on frontside connector
Pin on main connector

ARC-45 Circuit description

Frequency selection

The ARC-45 supports 12 channels out of the 1750 that are possible in 100kHz steps between 225 and 400MHz. Each of the 12 channels can be set -for the whole MHz with a crystal of frequency F_1, and for the tenth-MHz with a peg sliding over 10 positions. The relation of F_1 to whole MHz is:

$$F = 8x\ F_1 + 23.49 \quad \text{(MHz)}$$

There are 175 possible F_1 crystals; 12 are mounted in the turret.

The first IF amplifier is tuned to 23.49..24.39 MHz. With the second local oscillator at 20.51... 21.41 MC in ten 0.1MHz steps, the second IF amplifier operates at a fixed 2.98 MHz.
In order to make the transmit frequency equal to the receive frequency, a side step oscillator is used, with frequency Fss= 11.745 ...12.195 MHz in 50kHz steps
The transmit frequency is:

$$F = 2x\ (4xF1 + Fss)$$

Channel selection mechanism.

On the SB328 control, *Channel* is a 4-wire code:

Pin/ CH	1	2	3	4	5	6	7	8	9	10	11	12
DD	x	x	x				x			x	x	
EE		x	x	x				x			x	x
FF	x		x	x	x				x			x
HH	x	x		x	x	x				x		

x= connected to ground, blank=interconnected. For instance channel 5 is selected when DD and EE are interconnected, and FF and HH are tied to ground.

An unidirectional dc motor in the ARC-45 drives 3 things via electromagnetic clutches:
a) First, the turret is set to the *Channel*.
The turret has 12 crystals with trimmers for the first LO, pegs to select the tenth MHz, and a lever to select one of 12 variable capacitor (varco) discs;
b) Then, the 2x6 section varco in the UHF part rotates until the disc arrived at the notch. Then S4 is set to release step c)
c) This moves the first IF varco, and a selector switch until the program peg interrupts the motor. This selects the crystals for the sidestep and second LO. The whole tuning can take 7 seconds.

Transmitter audio circuits

The microphone signal is pre-amplified in the SB-329 cockpit-based panel, ending with a cathode follower. The cathode circuit is completed in the RT-295A/ . A 400Hz signal from the dynamotor is added as long as the TONE button on the control panel is pushed. The resulting audio signal is clipped and fed to the modulator, a balanced class B amplifier. Without signal, the current is zero. The 7W peak output modulates the anode voltage of the RF pencil triodes.

Transmitter RF part

The superimposed signals from the crystal oscillators at 4x F1 and from the sidestep oscillator enter the mixer V6. The product at 112-200 MHz is filtered out and amplified in V5 and V4. The frequency is doubled to 225-400MHz in the pencil triode V3, and applied to the final amplifier with pencil triodes V1 and V2. The CW output is 2W.

Receiver RF part

Starts with a low noise triode 6AJ4, followed by a band filter to reject the mirror frequency. After mixing with twice the first local oscillator signal we get the first IF.

First IF between 23.49 and 24.39 MHz in one stage is situated in a closed box, together with a selector switch for the 10 crystals of the second local oscillator, and 10 crystals for the sidestep oscillator.

Second IF at 2.98 MHz has 3 stages. The band-width is 50kHz. Automatic gain control is applied to grid 3 of the first two stages..

Detector, noise limiter and AGC.

The IF signal is rectified and large peaks are limited in V3. The resulting audio signal is 2Vpp at 60% AM.
Tube V1 is an oscillator at 30kHz, producing a symmetrical squarewave of 60Vpp on the anode of the AGC tube V2. With higher received signal, tube V2 conducts more in the positive half, and the complete squarewave shifts down, making the average value more negative, up to -3.3V for AGC-1 and -5V for AGC-2

Audio amplifier

The audio amplifier has a triode preamplifier V2 and a balanced output amplifier (V3 and V4) to produce 10Vpp (50mW) into 150 Ω load. Only one grid of the output stage is driven, the other is grounded for signals. Because the triodes have a common cathode resistor, the sum of the anode currents is constant. If one rises, the other must decay.
The preamplifier stage has a high gain, so the heavy feedback makes the input a virtual ground for signals.
Two audio signals are fed to this input.:
- The signal from the AM detector, via the audio adj potmeter (in receive mode only), or
- The transmitted signal (in transmit only)

Squelch

The audio summing point can be grounded by the squelch tube (V1), which silences all audio as long as its grid voltage is above 2V below the cathode voltage (normally +1.5V).
Without input signal, the voltage from the AGC line is 0V, so the squelch tube conducts, blanking the signal. With 4uV input, the AGC drops to -2V, and the squelch tube blocks, so the signal is passed.
During transmit, the squelch tube is blocked by a large negative signal from the transmitter to enable the side tone.
There is no switch to overrule the squelch function.

Plate and negative supply

The external dynamotor supplies the +150V and +300V voltages. The automatic gain control (AGC) provides its own negative voltage.

Heater circuit

All 32 heaters are 6.3V types, and series/parallel connected for 4x 6.3 = 25.2V, consumption is 1.7A. A 0.82Ω series resistor matches the heater circuit to the 27.5Vdc aircraft dc bus.

TR relay

This relay has a coaxial part for the antenna and 3 leave contacts to switch the 300Vdc, 150Vdc, and one to reduce its own coil current once energized.
This boost contact should open as last. Otherwise the other contacts will not close fully. Adjustment of the timing of these contacts is rather tricky.

Testconnector and test switch

On the front side behind the door is a testconnector and a small toggle switch. This switch operates the TR relay, and hence the transmitter. When the door is closed, the switch returns to the receive position. The testconnector connects to the AN/ARM-8 test set, an analog voltmeter with a 20-way switch at its input. This unit is for the ARC-44 but also adequate here for most adjustments.

Fan

The fan has a 3-phase winding intended for 27Vac, 400Hz, and makes 9000 rpm.
Further data see ARC-44.

Versions

All versions including the control box and the dynamotor were made by Bendix Radio Corp.
The RTA-45 was also made by Telefunken.

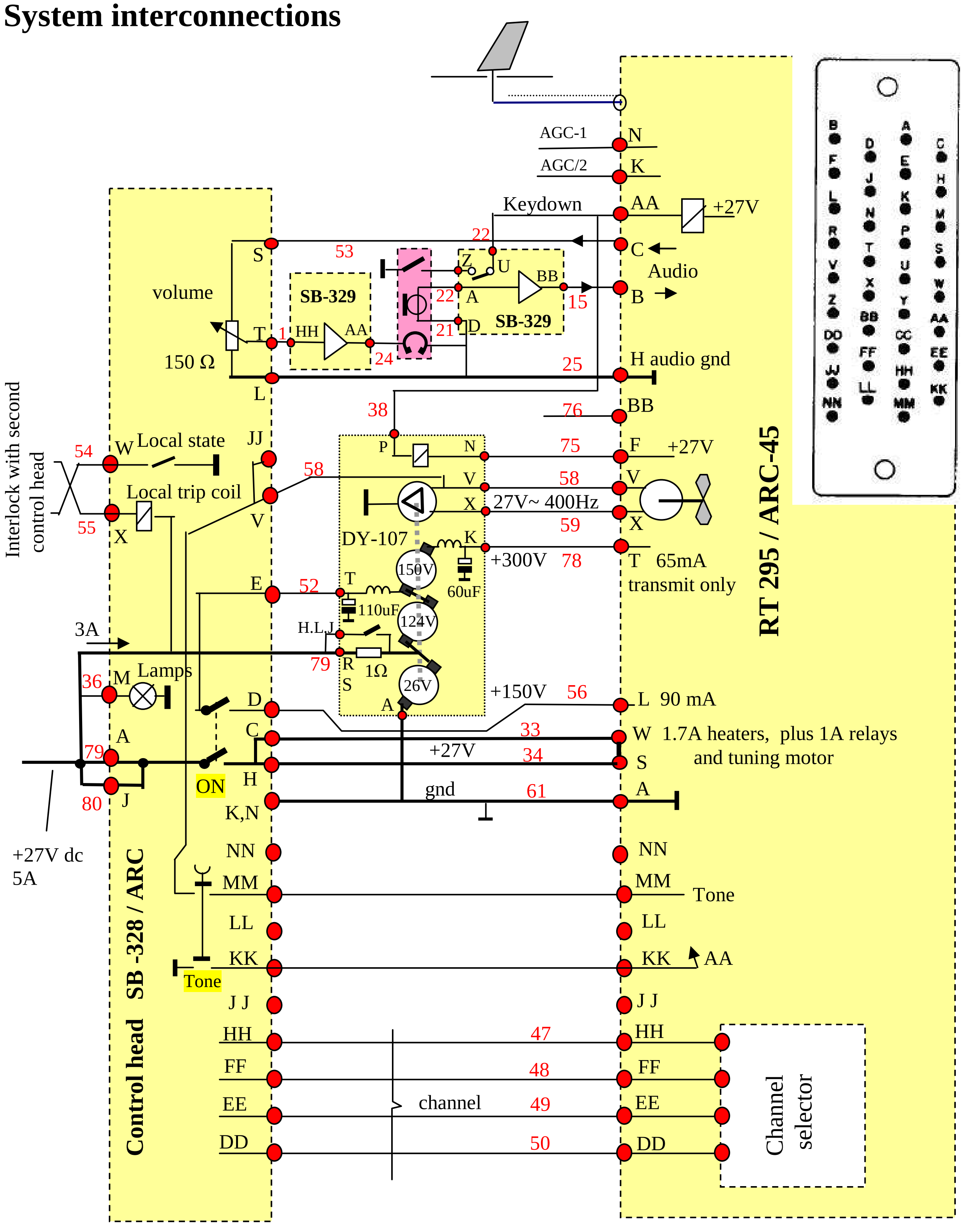
Unit	Original	Improved
System	ARC-45	RTA-45
Year	1958	1960
Transceiver	RT 295	RT 295A
Control	SB-328	CNA-45A
Dynamotor	DY 107	DY 107
Test unit	ARM-8	TEP 44/45

The differences are minor, and the parts are fully exchangeable. The original transceiver had a flat top, exactly as the ARC-44. The tenth-MHz was set with 12 thumbwheels. Output was 1W.

The improved version had a stepped top, the front most side higher than the ARC-44. The tenth-MHz is selected with pegs on the turret. Output was 2W.

a.k.bouwknegt@home.nl

System interconnections



RED numbers are terminals in terminal box J-562/AR

ARC-45 External wiring
14 jan-2016 kb

Heaters circuit

The UHF transceiver has 32 tubes and no semiconductors (in 1960 !)

```
3x 5636  0.15A  separated g3
2x 5647  0.15A
1x 5675  0.135A pencil triode RCA
5x 5718  0.15A
3x 5719  0.15A
6x 5840  0.15A
2x 5893  0.28A  pencil power triode
1x 5899  0.15A
1x 5902  0.45A  beam power
2x 6005  0.45A  beam power (EL90)
2x 6205  0.15A
2x 6110  0.15A  double diode
1x 6112  0.3 A  double triode
1x 6AJ4  0.225A
```