Transverter Microstrip 5,76 GHz — 435 MHz

Transverter is built on a classical scheme with synthesizer usage. The distinctive feature – lack of customizable components (which means that he is ready to work immediately).

Specifications

- Model: TR-6cm-70cm-IF
- Frequency coverage: 5650 — 5850 MHz, LO: 5325 MHz (by default)
- Reference oscillator frequency stability (0 … 70 °C): 0.2ppm max
- PLL SSB PN @ 10 kHz Offset: -109 dBc/Hz
- Output power: 13 dBm
- IF input power: 2 Watt (max 5 Watt SSB, CW)
- Noise figure: < 1.6 dB
- RF path gain: 22 dB
- DC power: + 9 – 13,8 V
- DC current: 0.7 A (TX) / 0.8 A (RX)
- Connectors type: SMA-female, 50 Ohms
- Dimensions: 165 x 65 x 28 mm (with connectors)
- Weight: 0.2 kg
- Assembled in Ukraine

Package includes

- 1 x TR-6cm-70cm-IF

Transverter’s block scheme is shown on Fig. 1

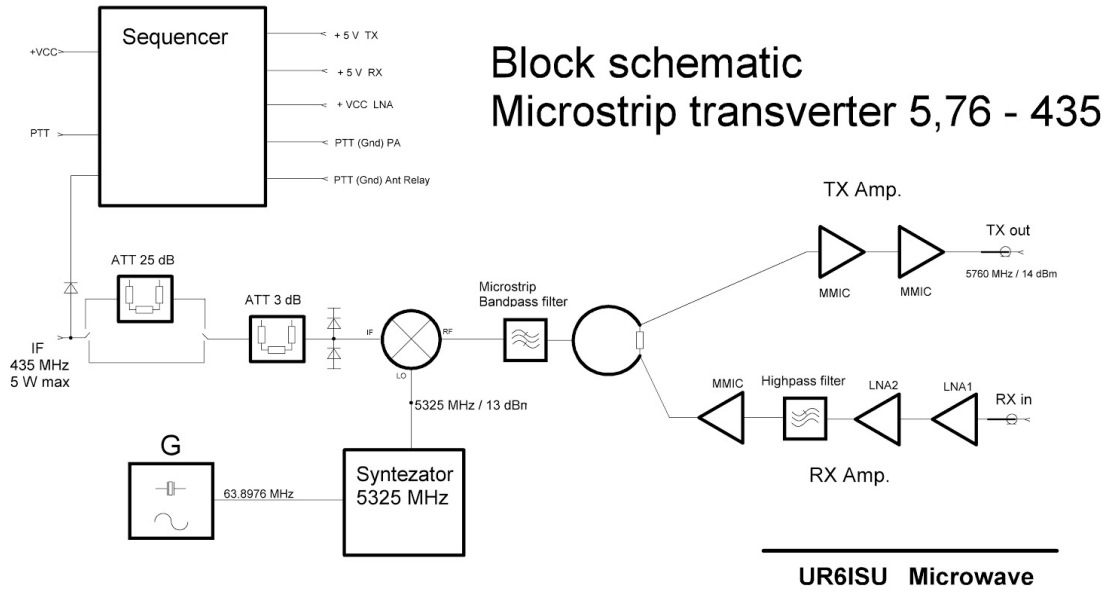


Fig. 1 Transverter’s Microstrip 5,76 GHz — 435 MHz block scheme

How it works

Possible IF frequencies: 430/432/435 MHz (435 MHz by default). In RX Mode signal goes to high frequency amplifier that built on three active elements: 2 x HMC717 and GVA-84+. Before third cascade goes HPF HFCN-5500, which additionally allows to suppress the specular channel.

High frequency amplifier’s parameters the following

- Gain: 45 dB
- Noise figure: < 1.6 dB
- OIP3: 32 dBm

Then signal goes to the Wilkinson’s bridge, which provides RX and TX paths decoupling and then goes through a 6th order microstrip filter to the passive double mixer HMC219, where he mixed with a synthesizer’s signal (5325 MHz). Dedicated IF signal (435 MHz) goes through the 3dB attenuator and relay to the transverter’s output. Relay is switched ON.

In TX Mode signal goes to the transverter’s input. Relay is switched OFF. IF signal goes to the powerful attenuator (25 dB, 5 Watt), which made on six SMD resistors (300 Ohms, 1 Watt). After this IF signal through the protection circuit (3 dB attenuator, LL4148 diodes) goes to HMC219 mixer, where he is mixed with frequency synthesizer. Microstrip filter

allocates 6 cm band signal, which goes through the Wilkinson's bridge to two-cascade RF amplifier, consisting of GVA-83+ and GVA-84+.

The sequencer is assembled on LM224D operational amplifier. He allows to provide switching sequence for RX/TX path, PA and ant. relay. For power switching of receiving and transmitting paths IRF7316 twin key is used. He is able to pass a current up to 3 A without appreciable case heating.

RF VOX delay in the transition to the TX mode based on NE555 timer. Thus, when telegraph key is accidentally pressed and IF goes to transverter input he automatically switches to transmit mode (RX VOX triggered) and will stay in this state for about 0.5 seconds.

RF Path and sequencer's schematic circuit is shown on Fig. 2

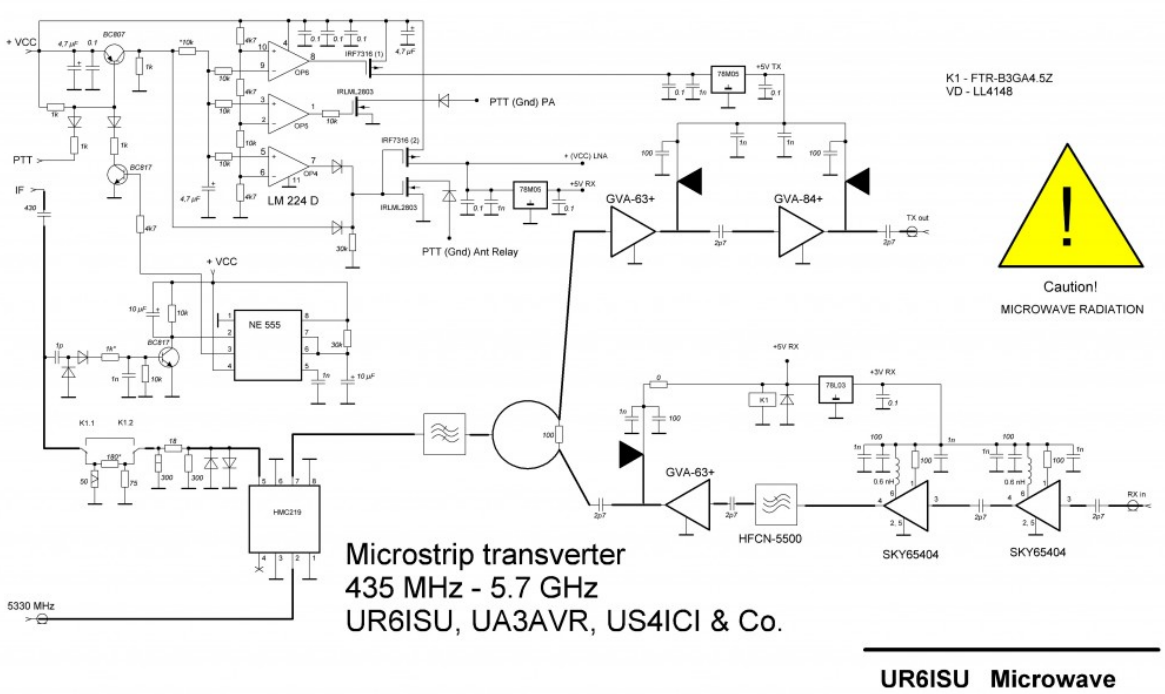


Fig. 2 RF path and sequencer's schematic circuit

In case of PTT input absence (in your PA) you need to assemble external PA's power switching circuit. For this purpose it is desirable to use p-type MOSFET, IRF9540N for example, with 20 A maximum current.

Scheme’s inclusion is shown in Fig. 3

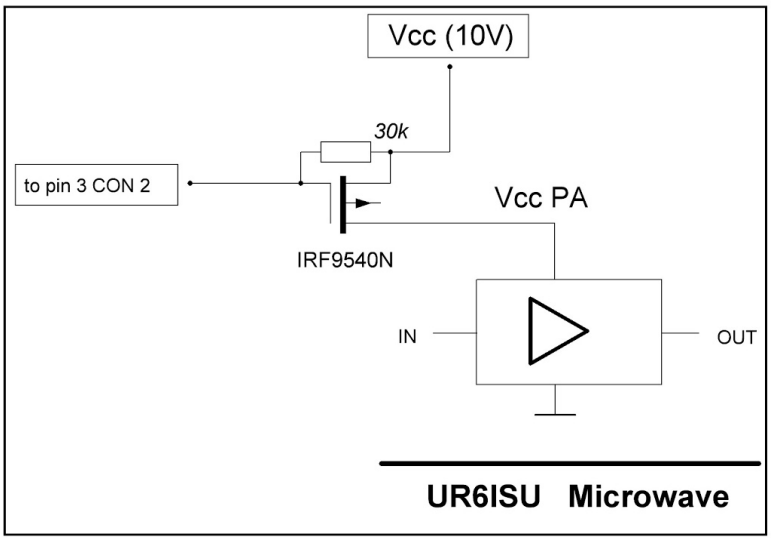


Fig. 3 PA’s commutation circuit

Under current commutation more than 2 A transistor must be installed on a small radiator. For example, PA consumes a current up to 5 A – aluminium plate (dimensions 80x50 mm) can be used as a radiator.

For synthesizer and local oscillator supply LP3878 stabilizers are applied. Schematic circuit is shown on Fig. 4

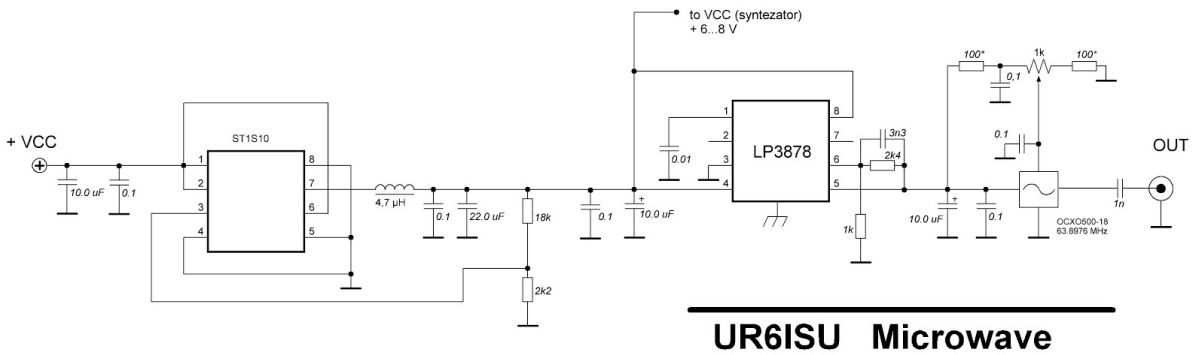


Fig. 4 Local oscillator’s supply circuit

Transverter's synthesizer is assembled on HMC840, US4ICI design. Schematic circuit is shown on Fig. 5

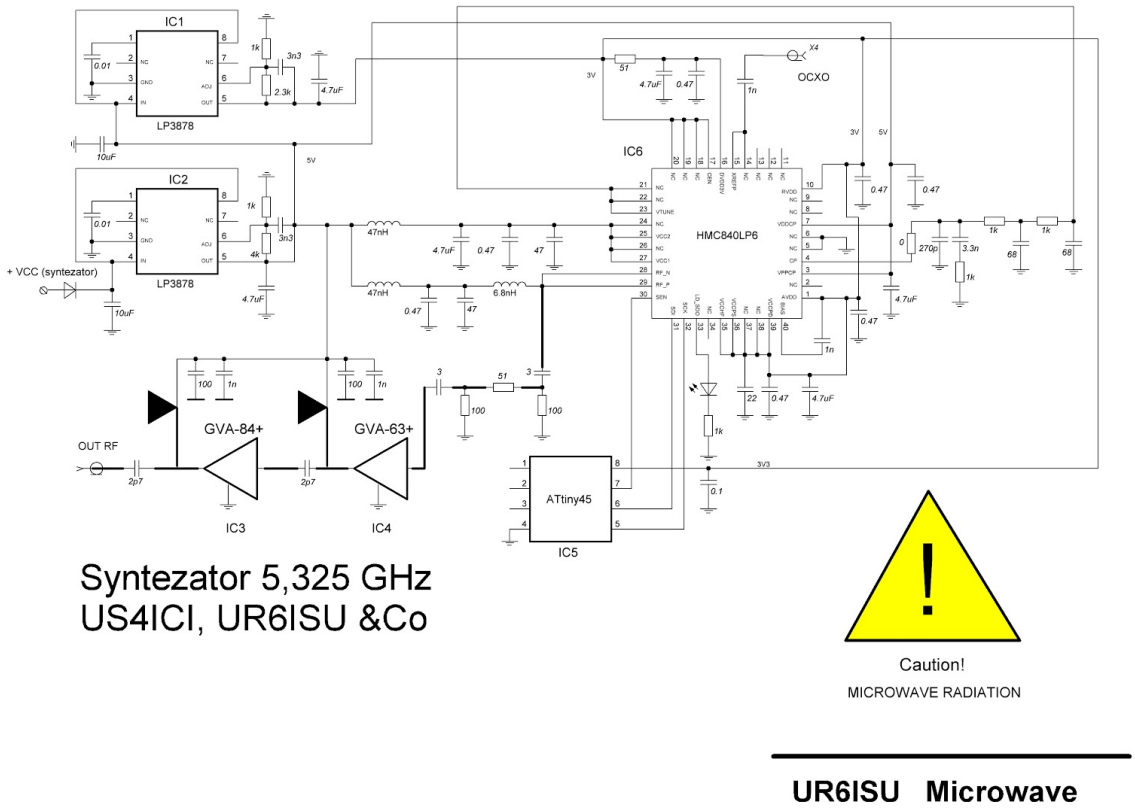


Fig. 5 Synthesizer's schematic

Synthesizer differs a low phase noise, that allows you to use transverter in a significant interference conditions. Synthesizer's signal is enhanced by two cascades: GVA-63+ and GVA-84+. Control is organized by using ATtiny45 microcontroller. The program allows to set one of three frequencies by sealing a jumper from 2nd and 3rd processor's legs.

Assembly options

- NO Jumper, 5325 MHz (IF = 435 MHz), default option;
- Jumper between 2nd processor's leg and GND, 5330 MHz (IF = 430 MHz);
- Jumper between 3rd processor's leg and GND, 5328 MHz (IF = 432 MHz).

We have come to the conclusion that the default IF frequency (435 MHz) is optimal, change isn't recommended.

The LED on the synthesizer's board under VCO frequency capture should light up.

Assembly materials

Main transverter's board (RF part) – Rogers RO4003C 0.508 mm. Schematic circuits of synthesizer, sequencer and local oscillator – FR4 1 mm (Fig. 6.1, Fig. 6.2, Fig. 6.3).

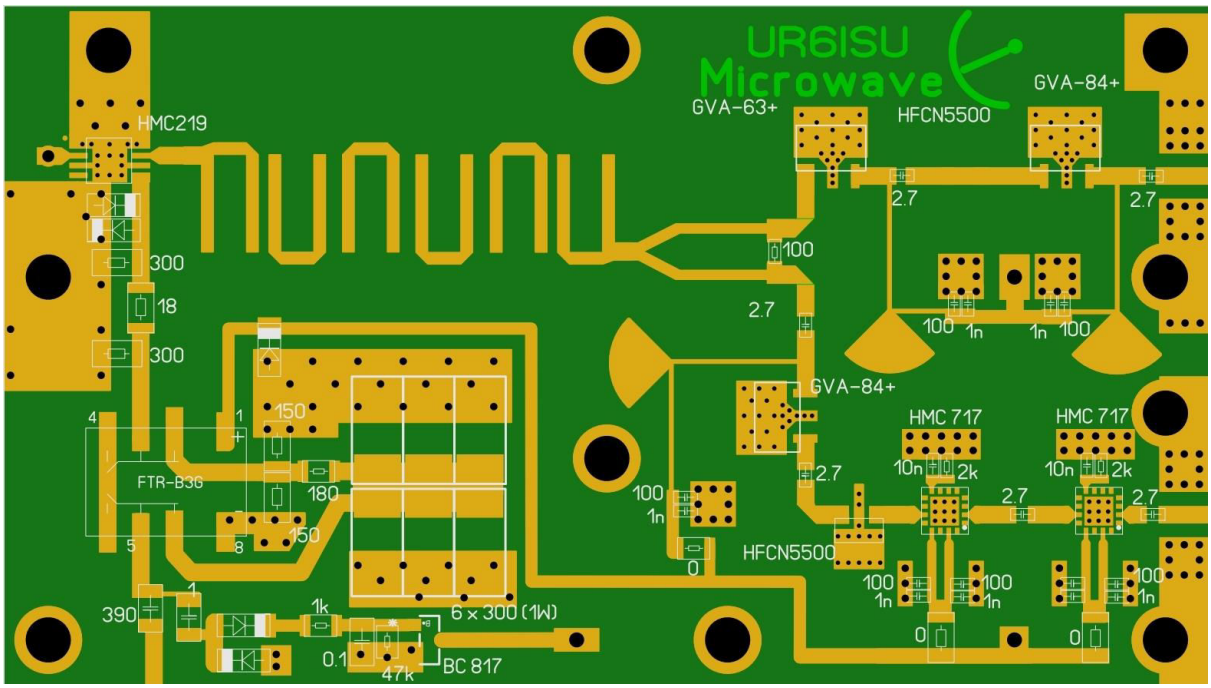


Fig. 6.1 Microwave's PCB

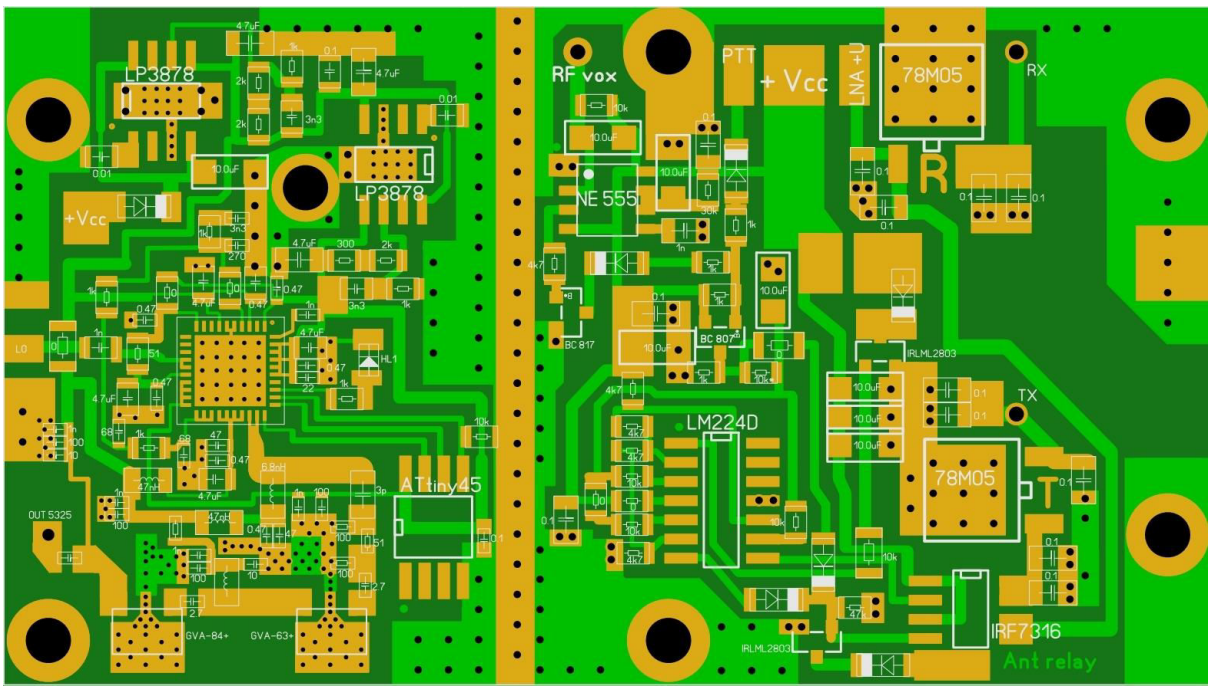


Fig 6.2 Synthesizer's and sequencer's PCB

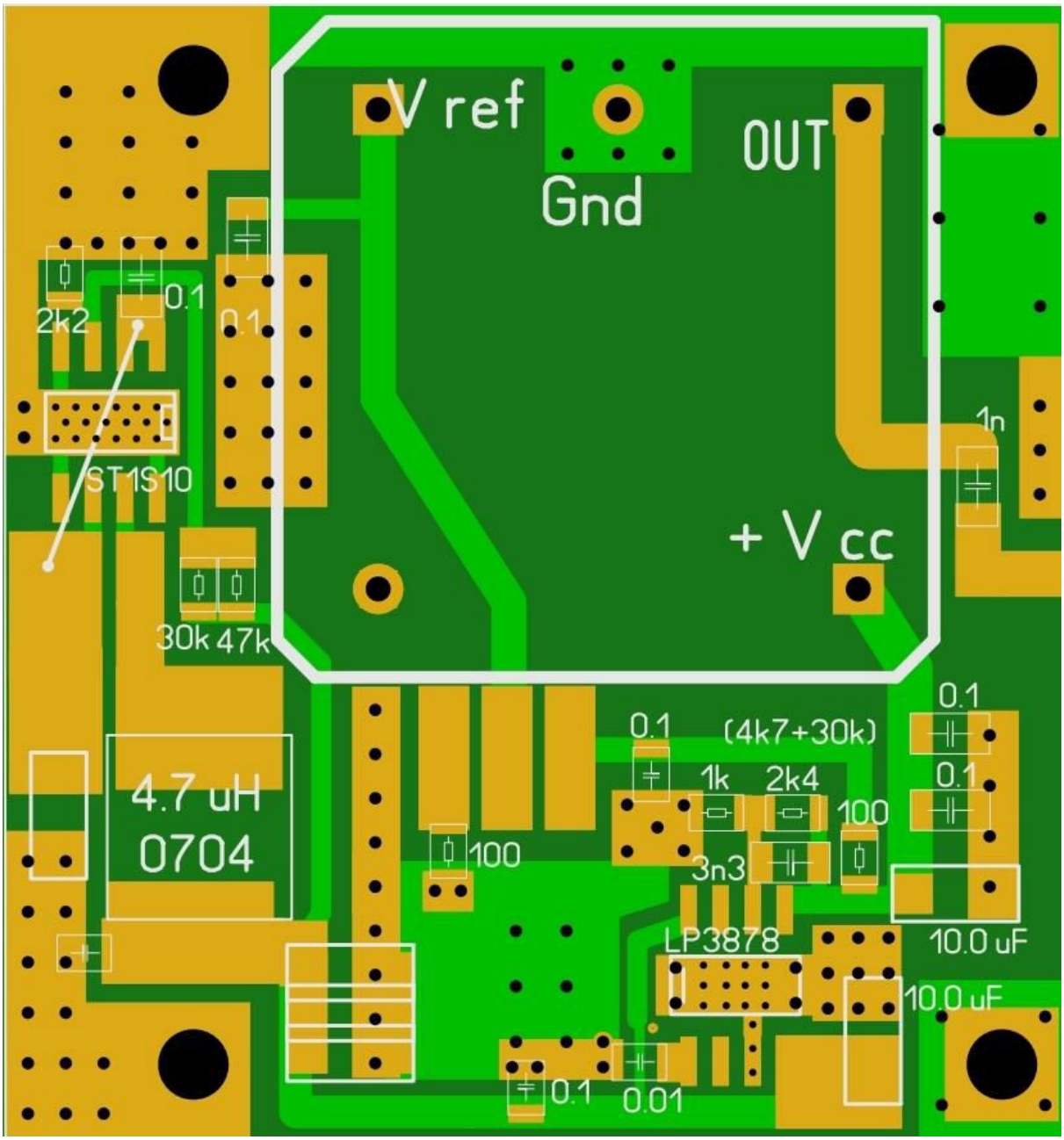


Fig 6.3 Local oscillator's and impulse stabilizer's PCB

Connection example is shown on Fig. 7

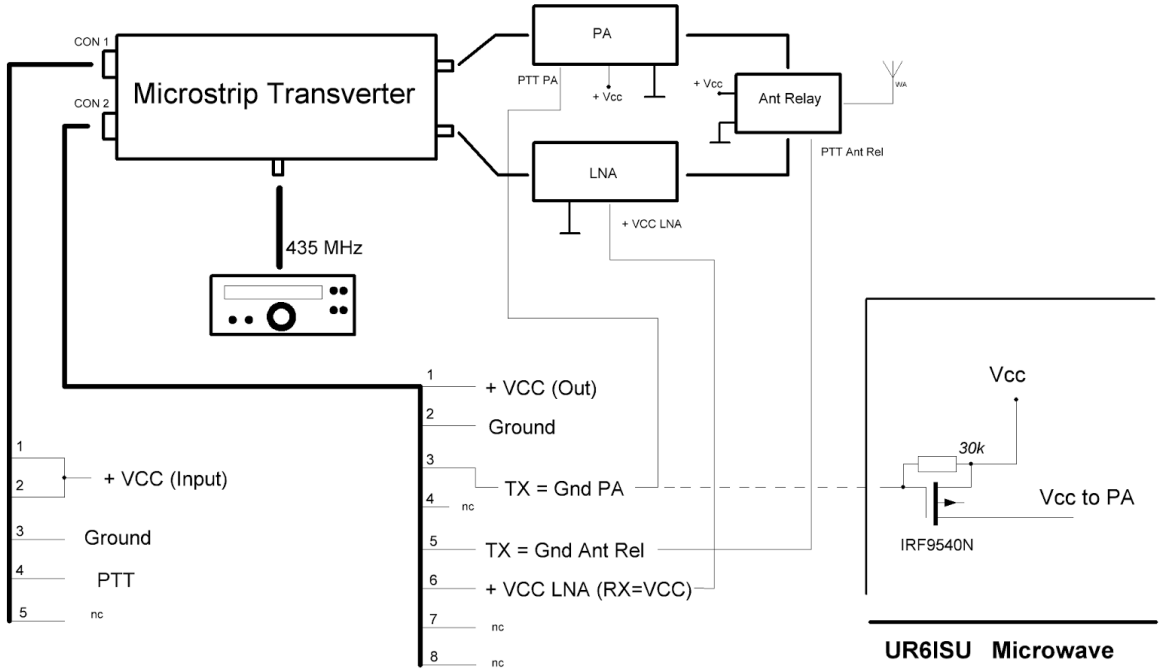


Fig 7 Transverter's connection example

Appearance

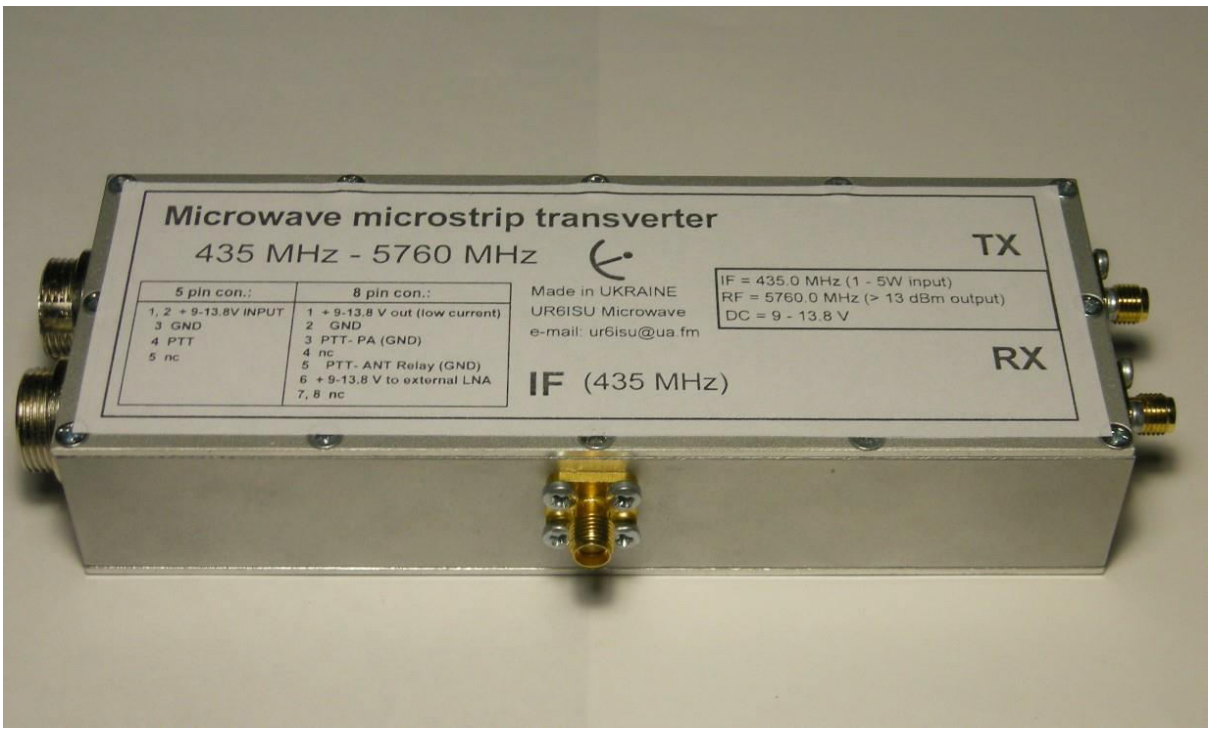


Fig 8.1 Transverter MICROSTRIP 5,76 GHz — 435 MHz in case

Fig 8.2 Transverter MICROSTRIP 5,76 GHz — 435 MHz without case

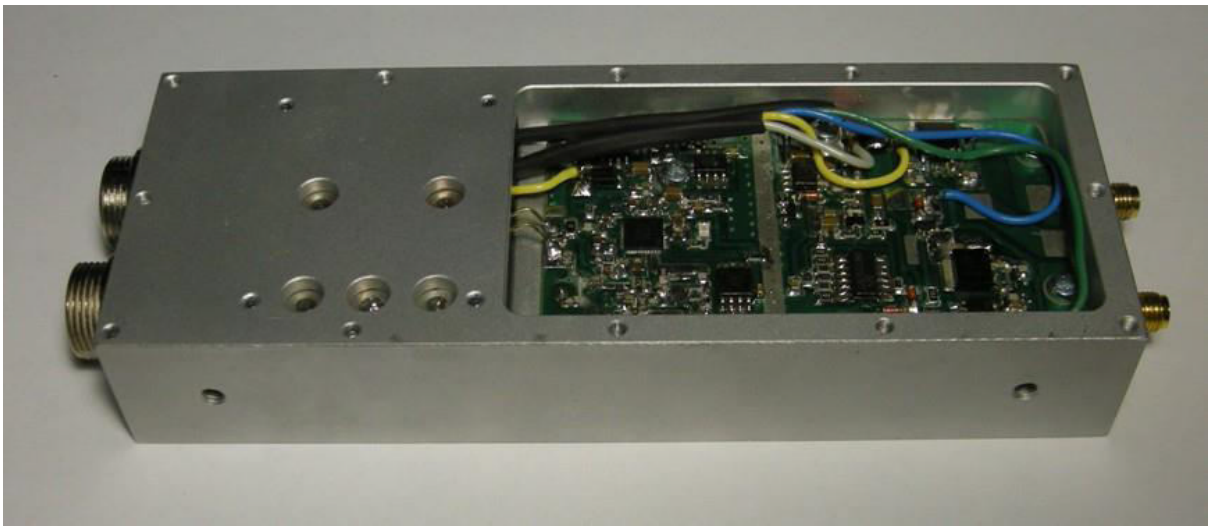
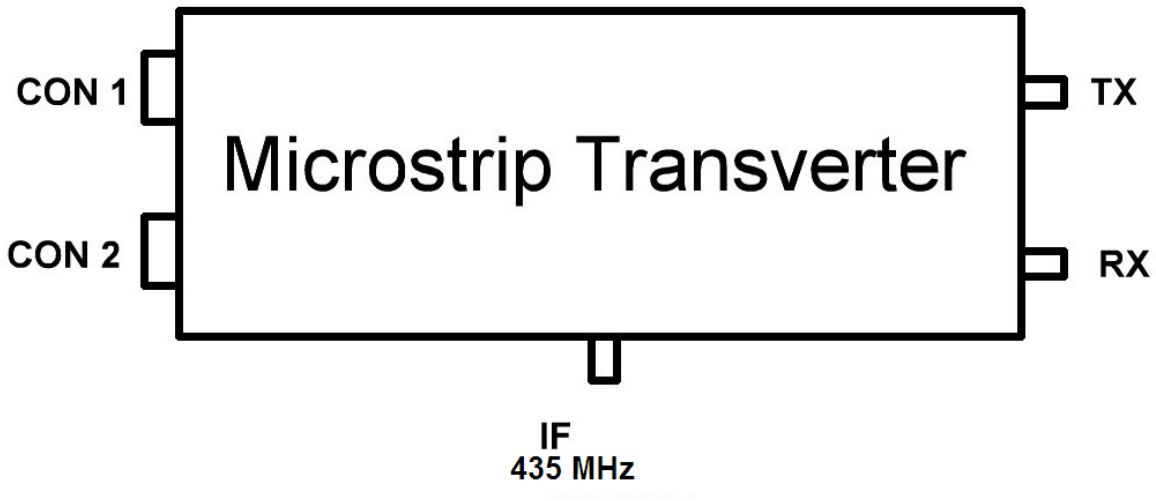


Fig 8.3 Transverter MICROSTRIP 5,76 GHz — 435 MHz without case (back side)

Annex 1. Supply and management pins assignment.



CON 1 (5 pin)	1	+9 … 13.8 V (power supply)
	2	
	3	GND
	4	PTT (GND = TX)
	5	Not used
CON 2 (8 pin)	1	+Vcc (for Ant. relay automatic board)
	2	GND
	3	TX GND — PA (PA control)
	4	Not used
	5	TX GND — Ant. relay control
	6	+Vcc LNA (LNA's supply + Vcc)
	7	Not used
	8	Not used