

Digital si5351-based VFO synthesizer + Decoder for Bandpass filters (9 bands support)

Technical features

- Two VFOs (Standard A/B arrangement) operating from 1 – 160MHz
- Rotary encoder tuning
- Selectable tuning steps – 5Hz, 50Hz, 100Hz, 1kHz and 10kHz
- VFO swap (A/B) and VFO memory (A=B) functions supported
- Selectable BFO/CIO offsets for USB, LSB and CW modes
- Receiver Incremental Tuning (RIT) with separate always-available RIT adjustment
- S-meter display function – Standard 0-5V DC input voltage from receiver
- VFO lock function – to prevent unwanted frequency shift due to vibration or knocks
- Band up/down selection – 9 bands – 160, 80, 40, 30, 20, 17, 15, 12 and 10 meters
- 4-bit BCD BPF/LPF select outputs
- Built-in menu: programmable
 - start-up frequency
 - si5351a reference crystal frequency
 - IF offset frequency (+IF, -IF, IF=0)
 - BFO frequency
 - Language English/Russian
- TX Reverse function
- Atmel Atmega328 processor using the internal 8MHz clock
- Nokia 5110 graphics display – 84 x 48 pixels
- Low current – Less than 40mA at 3.3V
- DC 5..12V

Description



The synthesizer supports to display of two frequencies: Active frequency of VFO is displayed in large characters on the screen, the value of alternative frequency is indicated below, in smaller characters. Switching between frequencies by swap button **SW4 “VFO A/B”**. In order to equalize the frequency of both values use the equal button **SW8 “VFO A=B”**.

Button **SW1 “RIT”** is responsible for enabling/disabling Receiver Incremental Tuning (RIT). Adjustment is performed by using the variable resistor 10K.

Band switching by **SW6 "Band Up"** and **SW7 "Band down"**. The ranges are switched in a circle 160, 80, 40, 30, 20, 17, 15, 12 and 10 meters.

SW3 button "Lock" allows you to lock the control of encoder. This feature is useful when traveling or moving with a transceiver, as well as to protect against accidental access.

SW5 button “Mode” toggles the synthesizer USB, LSB, CW.

Using the encoder produces frequency tuning with a specified step. **Encoder button** changes a step: 5 Hz, 50 Hz, 100 Hz, 1 kHz, 10 kHz.

On the bottom of the screen shows S-meter level (0..5V).

To toggle bands on band bandpass filters with a CPU is served the encrypted 4-bit signal. Encryption table the ranges indicated in the below diagram. To decode the signal into 9 bands for the bandpass filters used on the decoder chip K155ИД10 or K555ИД10. Scheme and principle of operation are listed below.

Decoders K155ИД10 (K555ИД10) convert the binary code coming to the inputs of the chip in a low-level signal appears at the decimal output. The state of these decoders correspond to the table on the diagram.

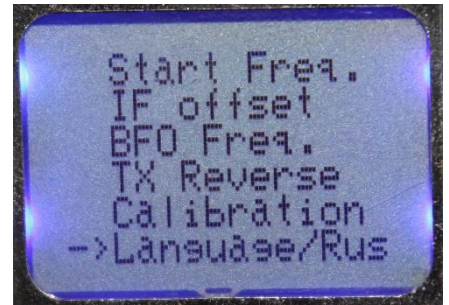
Decoders on the basis of K155ИД10 (K555ИД10) is applied with the load, the working current which can reach 80 mA. K155ИД10 K555ИД10 and outputs have open collectors. The time of signal propagation latency from address input to output 50 ns. The current consumption of the chip is 70mA

The decoder works correctly only when the load on the output.

Setting menu

The entrance to the settings menu by long hold (3 sec.) button **SW3 "Lock"**. Exit from the settings menu is also long-hold the button "Lock" or restart the device.

"Up" and "Down" selections - SW6 "BandUp" and SW7 "BandDown". To confirm the transition on the submenu - SW5 "Mode".



Menu Structure

- **"Start-up frequency"** - default 14.100 MHz – set start frequency that is displayed when you turn on the synthesizer. The frequency change is performed using the encoder (rotate "left" and "right") and click the encoder to change the step frequency. Set the frequency should correspond to one of nine pre-programmed ranges, otherwise the starting frequency will not be saved and will be set default frequency "14.100 MHz". Save the frequency and exit to the main menu by pressing the button **SW1 "RIT"**. Exit to the main menu without saving the setting by using the buttons **SW8 "VFO A=B"**
- **"IF Offset"** – default 8.867 MHz. Set the intermediate frequency. Add or subtract of the intermediate frequency +IF and –IF are automatically. The frequency change is performed using the encoder (rotate "left" and "right") and click the encoder to change the step frequency. The value is limited to 40 MHz. If the value is more than 40 MHz, the parameter will return to the default 8.867 Mhz. Save the frequency and exit to the main menu by pressing the button **SW1 "RIT"**. Exit to the main menu without saving the setting by using the buttons **SW8 "VFO A=B"**
- **"BFO Frequency"** – default value «0». Set of reference frequency on output J4. The frequency change is performed using the encoder (rotate "left" and "right") and click the encoder to change the step frequency. The value is limited to 40 MHz. If the value is more than 40 MHz, the parameter will return to the default 8.867 Mhz. Save the frequency and exit to the main menu by pressing the button **SW1 "RIT"**. Exit to the main menu without saving the setting by buttons **SW8 "VFO A=B"**
- **«TX Reverse»** – default "OFF". Function on the posted frequencies. To activate you should set the VFO frequency first and ON the function. Switching between "off" and "on" via SW6 "BandUp" and SW7 "BandDown". The function works according to the table

Output	RX	TX
J3 (VFO)	"VFO"	"BFO"
J4 (BFO)	"BFO"	"VFO"

Save the frequency and exit to the main menu by pressing the button **SW1 "RIT"**. Exit to the main menu without saving the setting by using the buttons **SW8 "VFO A=B"**
- **"Calibration"** – the default value 25 003 528. This parameter is used to calibrate the frequency 25 MHz crystal. It is recommended to use an accurate measuring device (e.g. frequency counter) or the receiver on a known frequency. The frequency change is performed using the encoder (rotate "left" and "right") and click the encoder to change the step frequency. Save the frequency and exit to the main menu by pressing the button **SW1 "RIT"**. Exit to the main menu without saving the setting by using **SW8 "VFO A=B"**
- **"Язык/English" (англ. «Language/Rus»)** – default is «Русский». Language. Switching between "off" and "on" via SW6 "BandUp" and SW7 "BandDown". Save the frequency and exit to the main menu by pressing the button **SW1 "RIT"**. Exit to the main menu without saving the setting by **SW8 "VFO A=B"**

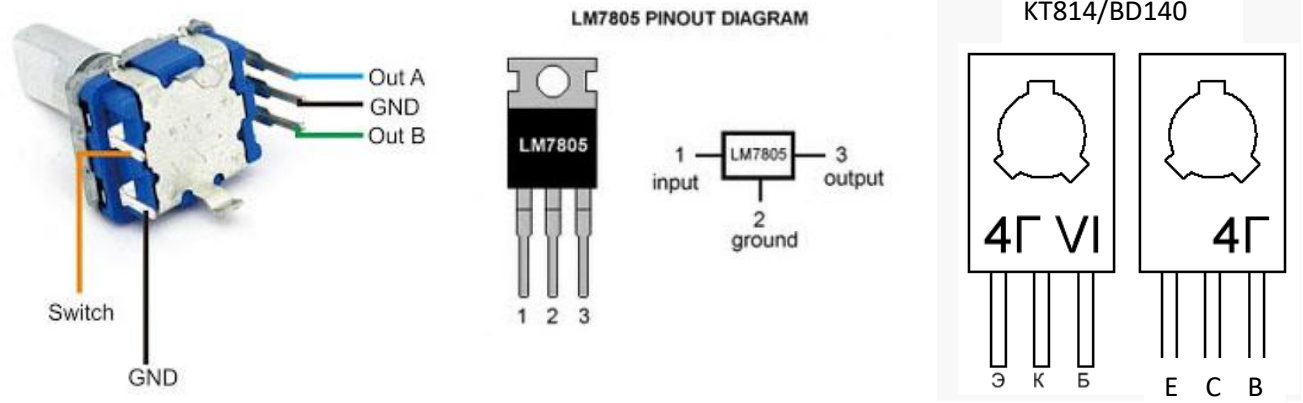
Outputs and Inputs of synthesizer

J1	Input «PTT», TX mode. While active the icon is shown on display. This input should be connected to TX of your TRX.
J2	+5..12V – DC

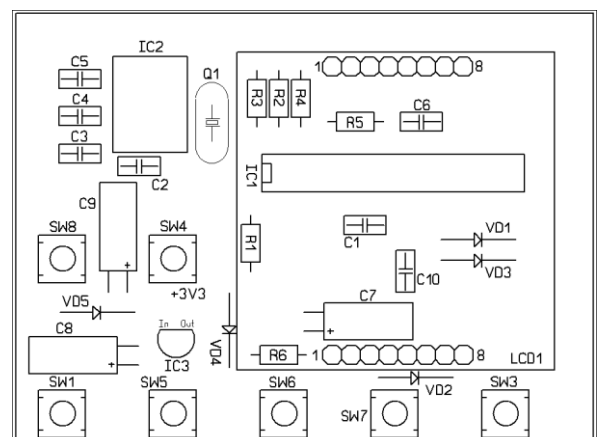
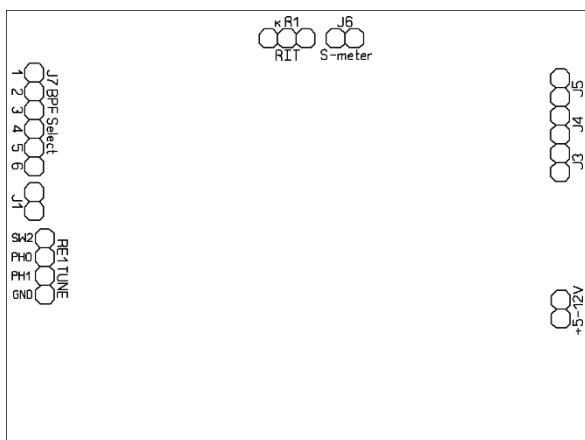
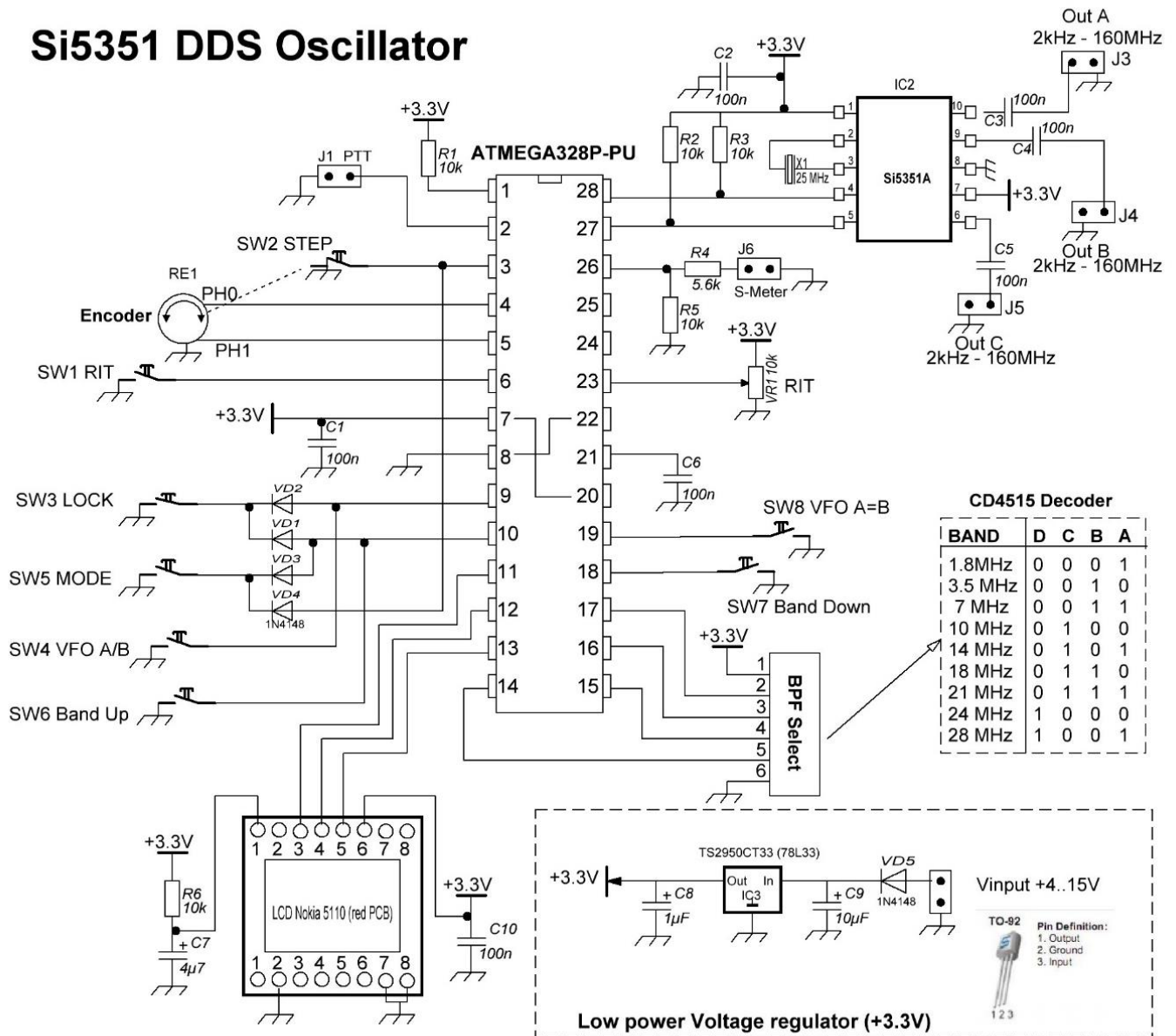
J3	Output CLK0 (main active output).
J4	Output CLK1 (reference frequency). Also used in TX Reverse
J5	Output CLK2 (OFF, does not use in current firmware)
J6	S-meter Input (0..5V).
PH0, PH1	Encoder input (“Right” and “Left”)
SW2	Encoder Button input
R1	RIT input for variable potentiometer 10K
1...6	2-bit outputs going to Decoder. PIN «1» does not in use. Do not connect to 3.3V.

Outputs and Inputs of Decoder

5, 3, 4, 2, 6	Inputs for 2-bit signal from synthesizer. The values of PINs are the same as on synthesizer PCB.
+12..18V	+12..18V – DC for Decoder.
1.8, 3.5, 7, 10, 14, 18, 21, 24, 28	Nine Outputs to bandpass filters. The values are 1.8Mhz, 3.5Mhz ...28Mhz.



Si5351 DDS Oscillator



Decoder diagram

