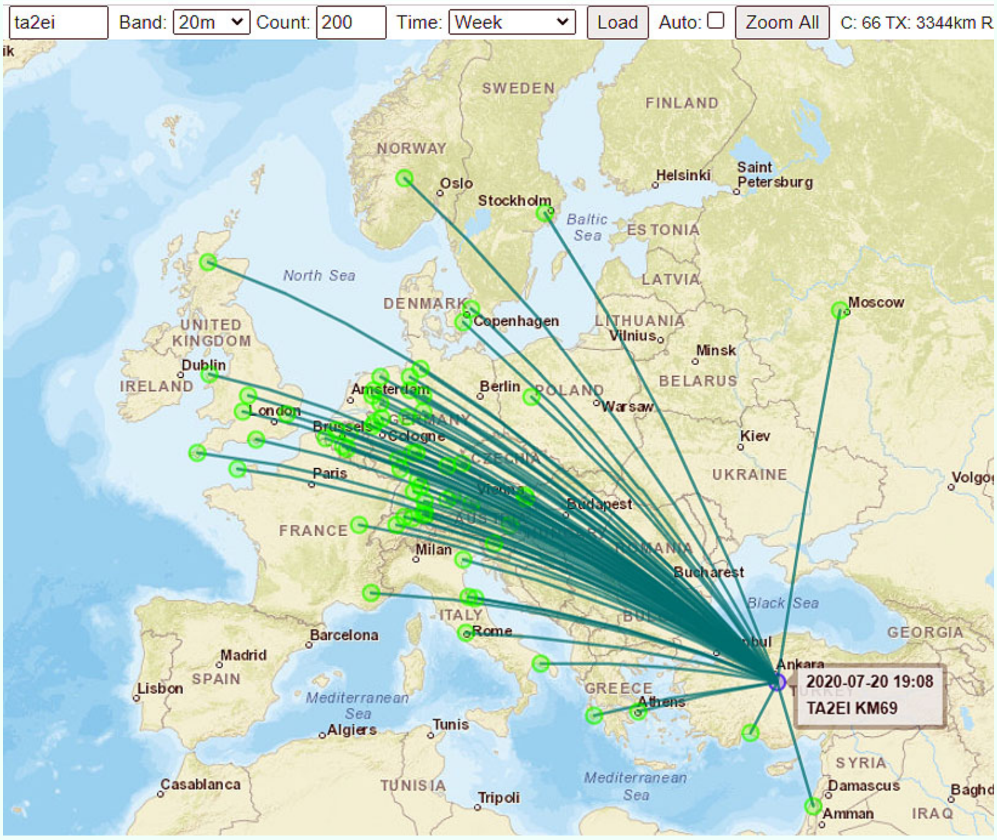
WSPR transmitter

WSPR , which **is** the acronym of **Weak** Signal Propogation Reporter, is the protocol designed by Joe Taylor with call sign **K1JT** to investigate potential propagation paths and distance with a very low power transmitter system [. Available at physics.princeton.edu/pulsar/K1JT/wspr.html]() . With 100 mW - even 10 mW - you can send your beacons thousands of kilometers away, so you can find out which time provides the most suitable propagation for the transmitter frequency. Below you see a map of where my beacon is reaching with a 100mW WSPR transmitter operating at 14 MHz.



There is information on many WSPR transmitter applications on the Internet. [At https://www.zachtek.com/]() , both the diagrams and software of the WSPR receiver and transmitter circuits are available, and you can also purchase them. Another address where you can get a WSPR transmitter is [QRP Labs]() . [Ultimate3S]() kit can work in QRSS, Hell, WSPR, Opera and PI4 slow-signal modes as well as WSPR from 2200m to 222 MH. This kit is a very professionally designed and multi-purpose circuit.

Boxed version of QRP Labs' Ultimate 3S QRSS/WSPR kit.

(Below is an image of this kit boxed up.)
Besides that, Zachtek ['s WSPR-TX_LP1 V1 circuit]()also intrigued me. In the circuit sold as a kit, it was difficult to find the TR1 transformer in Turkey, as there were many SMD elements, including the GPS module, 74AC244, TR1 transformer, and reference oscillator. So, I drew a new printed circuit to the circuit. Instead of a reference oscillator with low temperature sensitivity, I thought of firing the Si5351 module completely and added a furnace circuit. However, practice has shown that for operation at room temperatures, the oscillator of the Si5351 is quite stable and sufficient for wspr. Therefore, ignore the part that is squared as the OVEN CIRCUIT in the layout below. Since there is no oven circuit, there will be no need for a 7805 circuit. If you supply it with 5v from the outside, you connect the holes where the 1st and 3rd legs of the 7805 come from with a wire.
I used a commercially available GPS module and Arduino nano instead of the Arduino Pro in the original schematic for ease of programming. Thus, there is no need for a USB to serial converter circuit. Instead of the 74AC244 in the SMD SO sheath, I used the 74HC244 in the DIPsheath, provided that I am willing to operate at lower frequencies. Instead of TR1 I wound a transformer on the double hole BN43.

If the circuit you are using does not have a 1PPS output or you do not want to use it, do not install the orange led and the 1K resistor connected to it.
You can find the original **schematic** of this circuit here . I also did not draw a schematic for the circuit. Everything is pretty clear in the placement plan.

You can see the installation plan by clicking here.

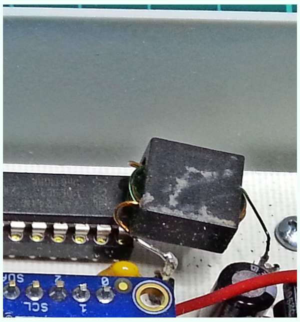
 You can view and download the printed circuit by clicking here.

You can follow two ways for the low pass filter at the output of the circuit. (actually three)
If you want, you can build a low-pass filter circuit consisting of 4 capacitors (C1, C2, C3 and C4) and 3 coils (L1, L2 and L3) depending on the frequency you will work with, or you can use a ready-made low-pass filter sold as a kit at QPR Labs. If you want to build the circuit yourself, you can wind the coils on the toroid, or you can fix the same inductance in other ways by making calculations. The printed circuit is designed in accordance with both the QRP Labs kit and low-pass filter construction with single elements.
The table showing the LPF values below will make your job easier.

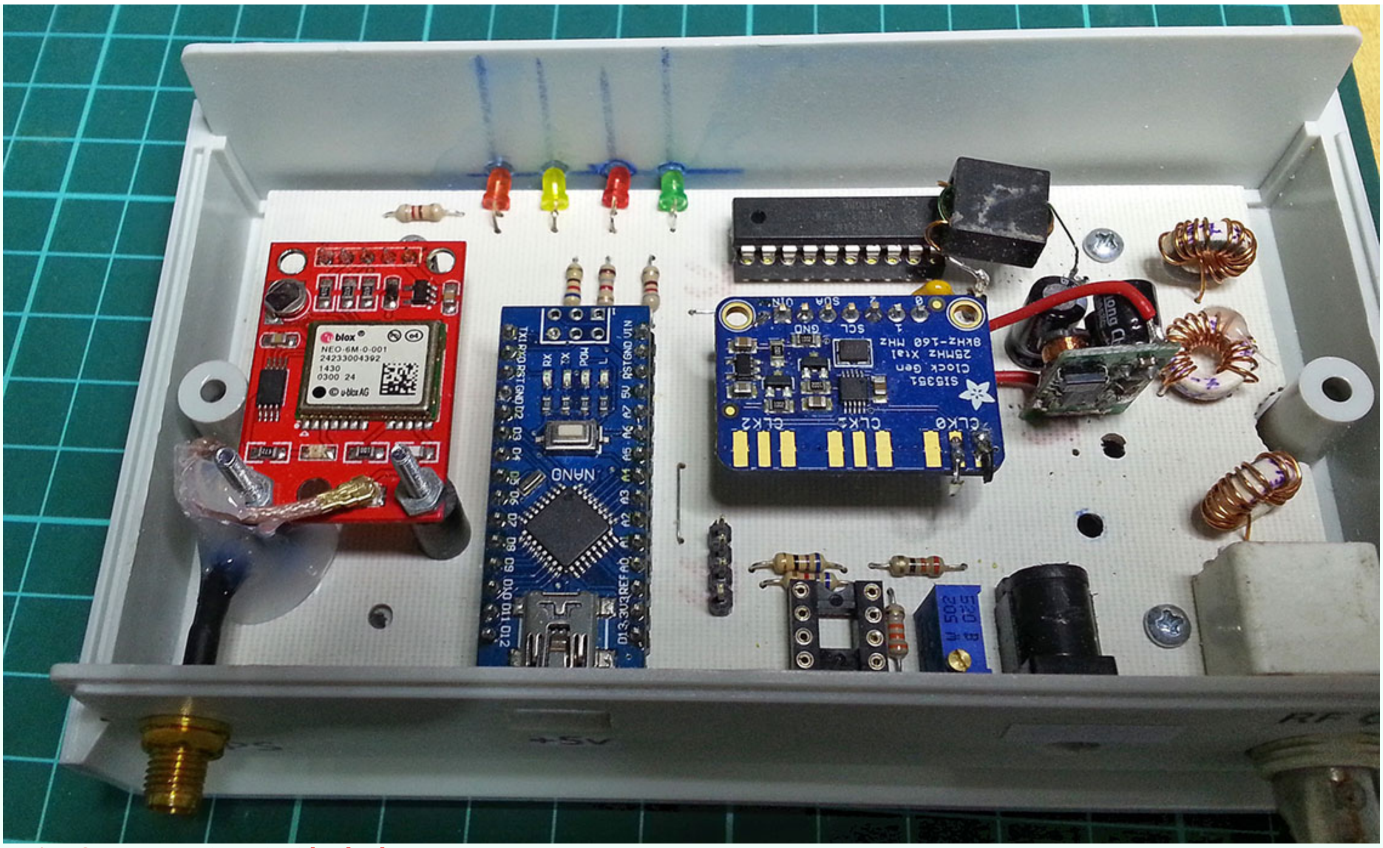
Component selection table for output low pass filter. Use either Amidon T37 or T50 Toroids							Amidon T37 Toroids			Amidon T50 Toroids		
Band Meter	Band MHz	-3dB MHz	C1,C4 pF	C2,C3 pF	L1, L3 uH	L2 uH	T37 Core	L1,L3 Turns	L2 Turns	T50 Core	L1,L3 Turns	L2 Turns
2190	0.137	0.20	6800	27000	52	83	FT37-61	31	39	FT50-61	27	35
630	0.475	0.66	2200	8200	15	24	FT37-67	27	35	FT50-67	26	33
160	1.84	2.76	820	2200	4.44	5.61	T37-2	33	37	T50-2	30	34
80	3.39	5.11	470	1200	2.43	3.01	T37-6	28	32	T50-6	22	25
40	7.04	9.04	270	680	1.38	1.7	T37-6	21	23	T50-6	17	18
30	10.4	11.62	270	560	1.09	1.26	T37-6	19	20	T50-6	15	16
20	14.1	16.41	180	390	0.773	0.904	T37-6	16	17	T50-6	12	13
17	18.1	22.89	110	270	0.548	0.668	T37-6	13	15	T50-6	10	11
15	21.1	27.62	82	220	0.444	0.561	T37-6	12	14	T50-6	9	10
12	24.9	28.94	100	220	0.438	0.515	T37-6	12	13	T50-6	9	10
10	28.1	40.52	82	150	0.303	0.382	T37-6	10	11	T50-6	8	9
6	50.3	62	36	100	0.197	0.248	T37-10	9	10	T50-10	8	9

Source = http://www.gqrp.com/harmonic_filters.pdf

T2-613 RF transformer produced by MCL was used to match the impedance between the output of the 74HC244 and the LPF circuit. Instead, after a few correspondences with Harry Zachrisson, owner of the Zachtek site, I came up with the following solution: I wound a transformer with (2) turns on the primary and (4) turns on the secondary (the part that connects to the LPF) on a two-hole core. As the core I used a dual-hole core from an old Racal HF device. But a kernel like 43-2402 can be used instead.



Transformer BN43-2402 core made using a double hole core that I extracted from the Racal HF device



TX1 WSPR transmitter inside the box

The small upright circuit seen to the right of the Si5351 module is a circuit that reduces 12 volts to 5 volts. I resorted to such a way to prevent overheating. The circuit was mounted in [Altınkaya's DT-085 coded plastic box and the PCB was prepared according to the dimensions of this box.](#) Some elements were installed in the furnace part, but this part was not used.

Front and rear view of the circuit.