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Homebrew DCF-77 Signal Generator

Time machine without the (difficult to obtain) flux capacitor

WARNING - TRANSMITTING YOUR OWN TIME-SIGNAL IS EVIL.

Well, our meetings take place on wednesdays at 10:30 (sharp). A radio controlled clock is used to determine whether you are late (and must bring a cake next time) or not. Unfortunately the identical radio controlled clock in ***my*** office always shows a different time :-(

After baking a lot of cakes, I thought about synchronising these disreputable clocks ...

Approach

The straight approach would be to have a crystal oscillator, amplitude modulated by a microprocessor.

As we did promise (2859!) not to abuse the donated crystals for ***that*** reason, another approach is used here - which makes the system even more flexible.

To generate a stable frequency, usually a PLL is used (or DDS). In order to gather some insight in the nature of a PLL, a small PLL-Demoboard (including a small PLL-Seminar) was designed.

Callsign	Frequency	Modulation	Location
MSF	60 kHz	-	Anthorn (United Kingdom)
HBG	75 kHz	ASK	Prangins (Switzerland)
DCF77	77.5 kHz	ASK	Frankfurt (Germany)
TDF	162 kHz	-	Allouis (France)
HBCZ77	77.5 kHz	ASK	unknown :-)

Table above : some frequencies, generated easily with jumpers on the PLL-Demoboard ...

The project uses three PCB's, one for generating the carrier (PLL-Demoboard) and one for the correct (!) modulation of the carrier and one for the Power Supply. As radio controlled clocks use some kind of checking the received codeword (30th of February will never be accepted :-) there must be a microprocessor, assuring that

เราจะทำแบบวิศวกรผู้ยิ่งใหญ่


PROJECT DETAILS
- Schematics
- Placement
- Copper
- Frontpanel
- Target 3001 File
- ATMEGA 8
- AD 811
- EADIP081-CNLED
- Mini PLL Seminar #1
- Mini PLL Seminar #2
- Mini PLL Seminar #3

NICE TO KNOW
- Calc. day of the week
- Time Signal
- Gregorian Calendar
- Daylight saving time
- Patent

LIMITATIONS
Due to our Software License we must not allow to use the Target 3001 File for commercial use !
- Target 3001 Website

YOUR VALUABLE OPINION :

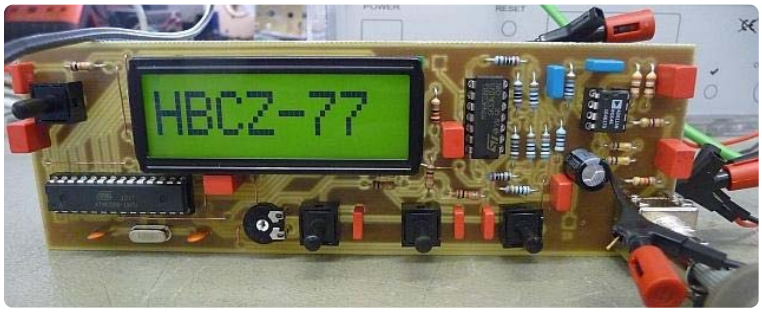
Avg. 1.00 from 1 votes.
1 2 3 4 5 6
COUNT YOUR OPINION

the ~~sent~~ generated codeword is valid.

• PCB#1 may be any clock source of the carrier of your choice. We use the PLL-Demoboard.

• PCB#2 is the Frontpanel, containing the Microprocessor and ASK Modulator. (Picture below)

• PCB#3 is some kind of Power Supply, delivering +12V...+30V/200 mA and + 5V/100 mA.



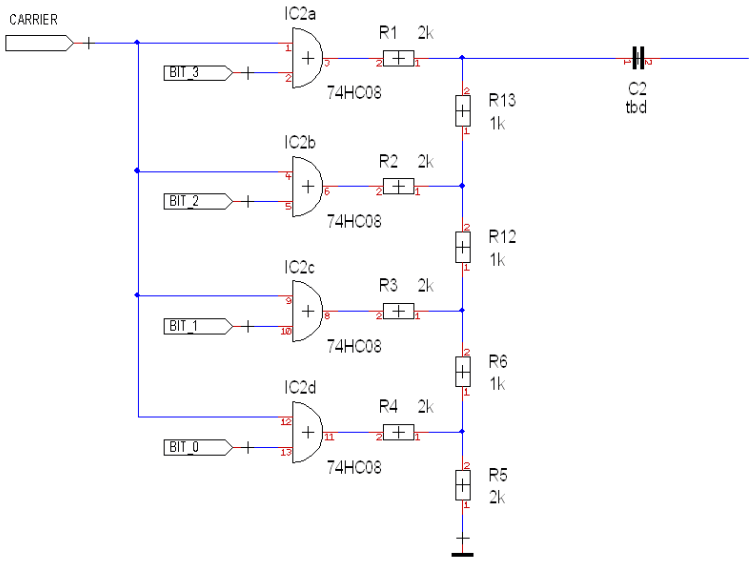
Picture above : The Mainboard, assembled, behind the Frontpanel.

Modulation

The Amplitude Modulation is done with 4 AND-Gates and a R-2R Network. It is therefore possible to modulate the TTL Signal with 16 Steps.

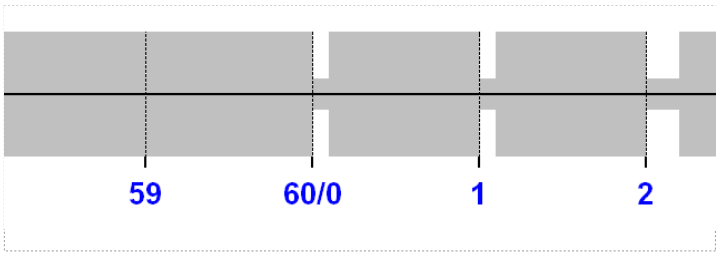
This is somehow cracking a nut with a sledgehammer, but we wanted to present something nifty to comply with the 'educational aspect'.

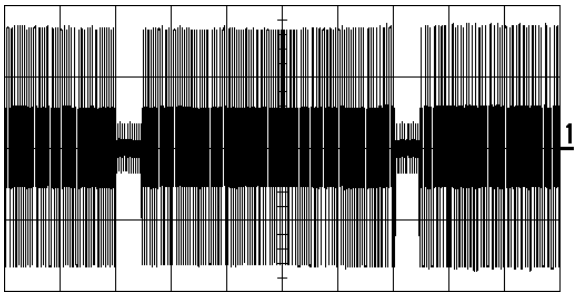
Note: As we wanted to have a single sided PCB, we reduced this later to 3 Bit.



... and what you see on a Scope

Where a '0' is represented by a 100 ms drop to 25% Amplitude and a '1' drop lasts 200 ms.





Picture above : Horizontal: 200 ms/DIV, Vertical: 1 V/DIV

DCF77 Time Code (similiar to HBCZ77 Time Code :-)

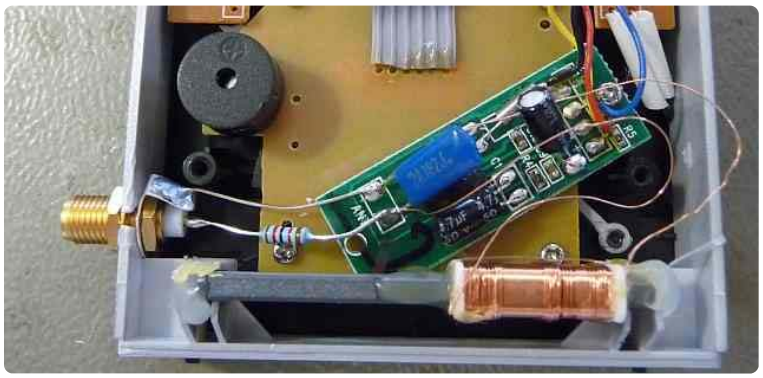
Bit/Sec.	Meaning	Remarks
0	Start of a Minute	always = 0
1-14	reserved / for future use	
15	0=Normal Antenna, 1=Backup Antenna	
16	Summer Time Announcement	Set 1 hour before
17	Summer Time 0=No, 1=Yes	
18	Winter Time 0=No, 1=Yes	
19	Leap Second announcement	Set 1 hour before
20	Startbit encoded Time	always = 1
21	Minutes, weight = 1	
22	Minutes, weight = 2	
23	Minutes, weight = 4	
24	Minutes, weight = 8	
25	Minutes, weight = 10	
26	Minutes, weight = 20	
27	Minutes, weight = 40	
28	Parity Bit Minutes (even)	Bits 21 - 28
29	Hours, weight = 1	
30	Hours, weight = 2	
31	Hours, weight = 4	
32	Hours, weight = 8	
33	Hours, weight = 10	
34	Hours, weight = 20	
35	Parity Bit Hours (even)	Bits 29 - 34
36	Day of the Month, weight = 1	
37	Day of the Month, weight = 2	
38	Day of the Month, weight = 4	
39	Day of the Month, weight = 8	
40	Day of the Month, weight = 10	
41	Day of the Month, weight = 20	
42	Day of the Week, weight = 1	Monday = 1
43	Day of the Week, weight = 2	Tuesday = 2
44	Day of the Week, weight = 4	Wednesday = 3
45	Number of the Month, weight = 1	
46	Number of the Month, weight = 2	
47	Number of the Month, weight = 4	
48	Number of the Month, weight = 8	
49	Number of the Month, weight = 10	

50	Year, weight = 1	(00 - 99)
51	Year, weight = 2	
52	Year, weight = 4	
53	Year, weight = 8	
54	Year, weight = 10	
55	Year, weight = 20	
56	Year, weight = 40	
57	Year, weight = 80	
58	Parity Bit Date (even)	Bits 36 - 57
59	Minute Sync	Carrier unmodulated

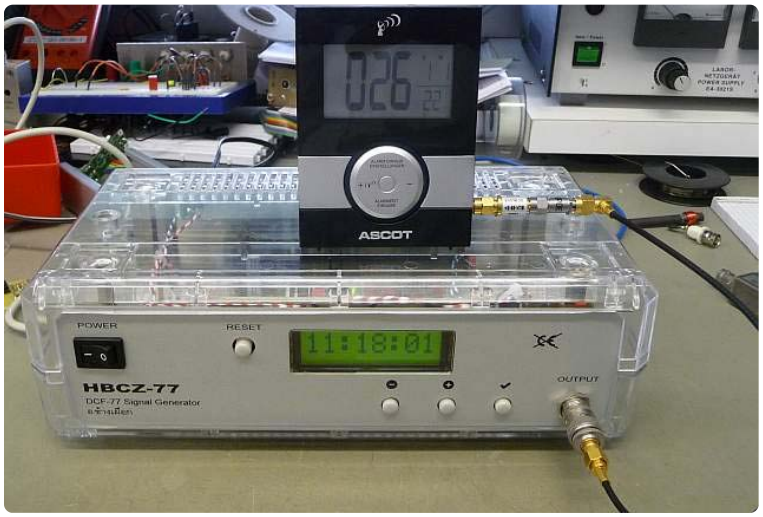
Putting it all together ...

A radio controlled clock is modified therefore, that the generated Signal is fed directly into the Amplifier following the Antenna. (Decoupling with an 1 kΩ Resistor).

It is assumed, that the portion radiated through the Antenna is very small, as we use an Attenuator of 30 dB. (and of course operate it in a fully shielded room :-)

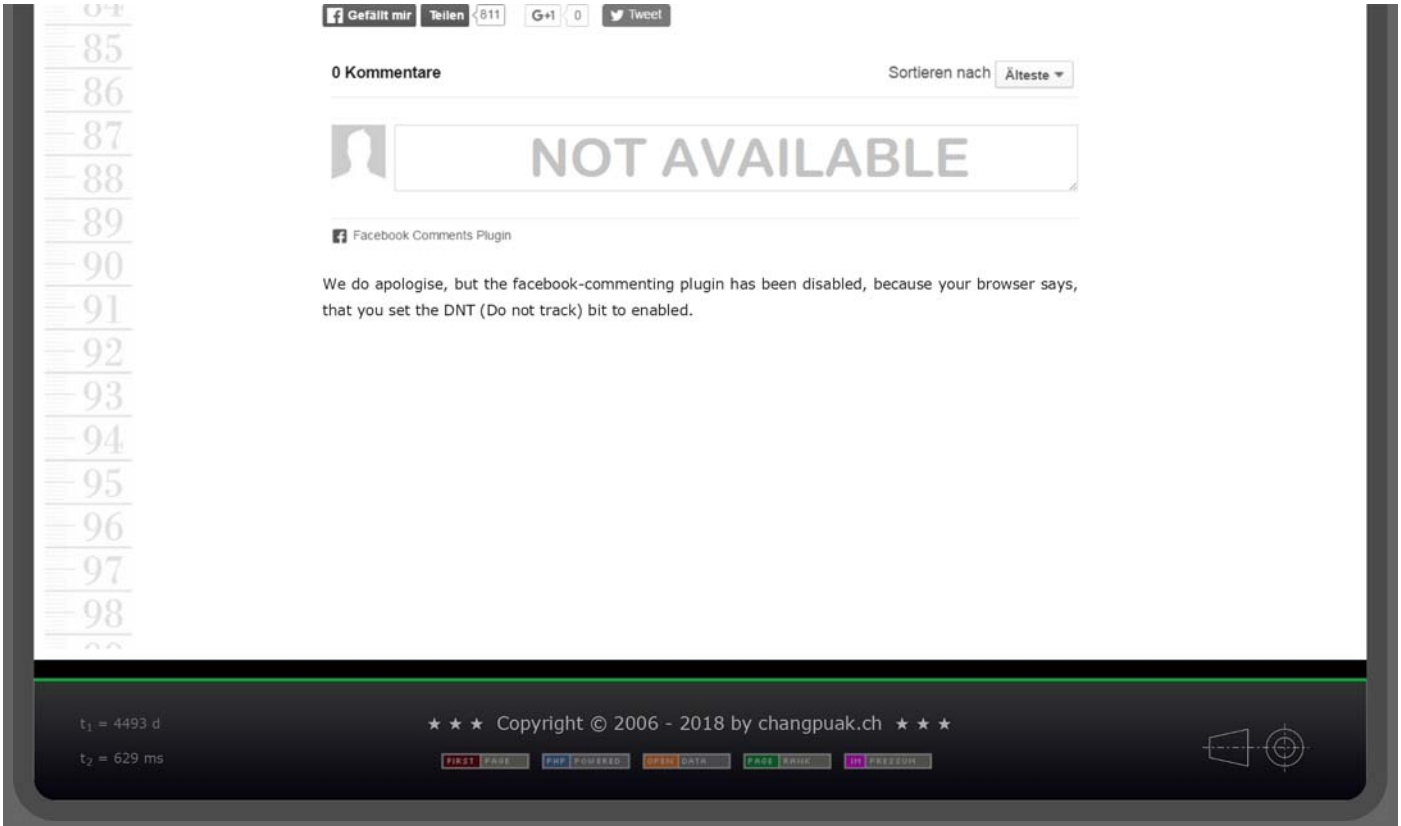


Connecting the Signal Generator to the Clock - using a DC-Block and a 30 dB Attenuator from Mini Circuits - the Situation is as follows :



✈ Share your thoughts

✈ Nothing more to be seen below this point ? Maybe your browser blocks the facebook iframe.
✈ The webmaster does not read the comments regularly. Urgent questions should be send via email.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t1 = 4493 d
t2 = 629 ms
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