GB3EDN Edinburgh 23 cm Beacon Update

Brian Flynn

GM8BJF

GB3 EDN Specifications

- Output frequency 1296.990 MHz
- Output power ~5 watts
- Keying F1A
- Callsign only once per minute

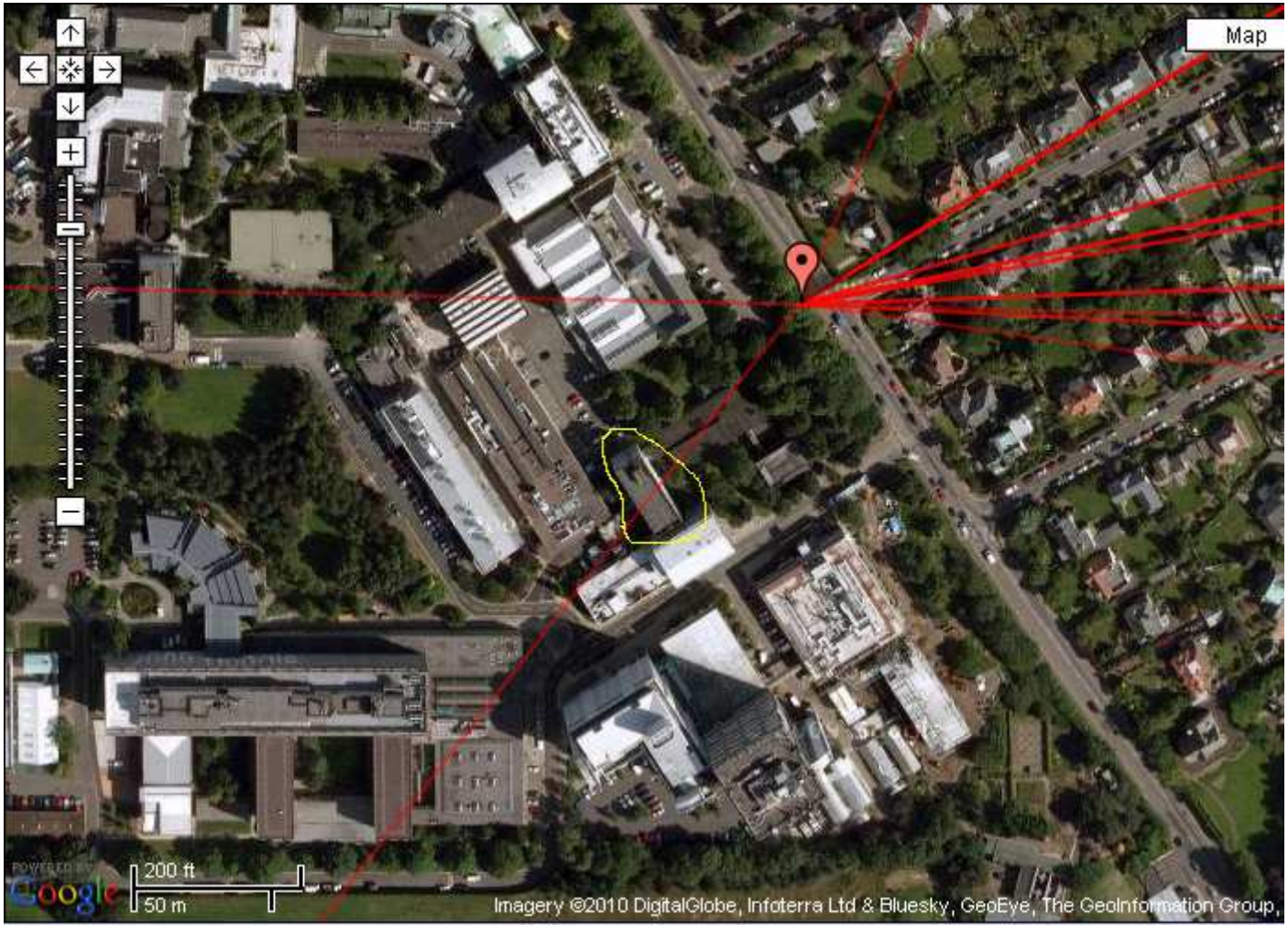
GB3EDN Location

- University of Edinburgh
- Kings Buildings Campus
- Antenna on top of the Faraday Building
- (four storey block)
- IO85JW91

GB3EDN History

- Original hardware
- Installed in 1977
- Licence received and turned on in 1978
- Run continuously with 2 short outages since then
- Hardware very reliable
- Simple!
- ~32 years in virtually continuous operation!

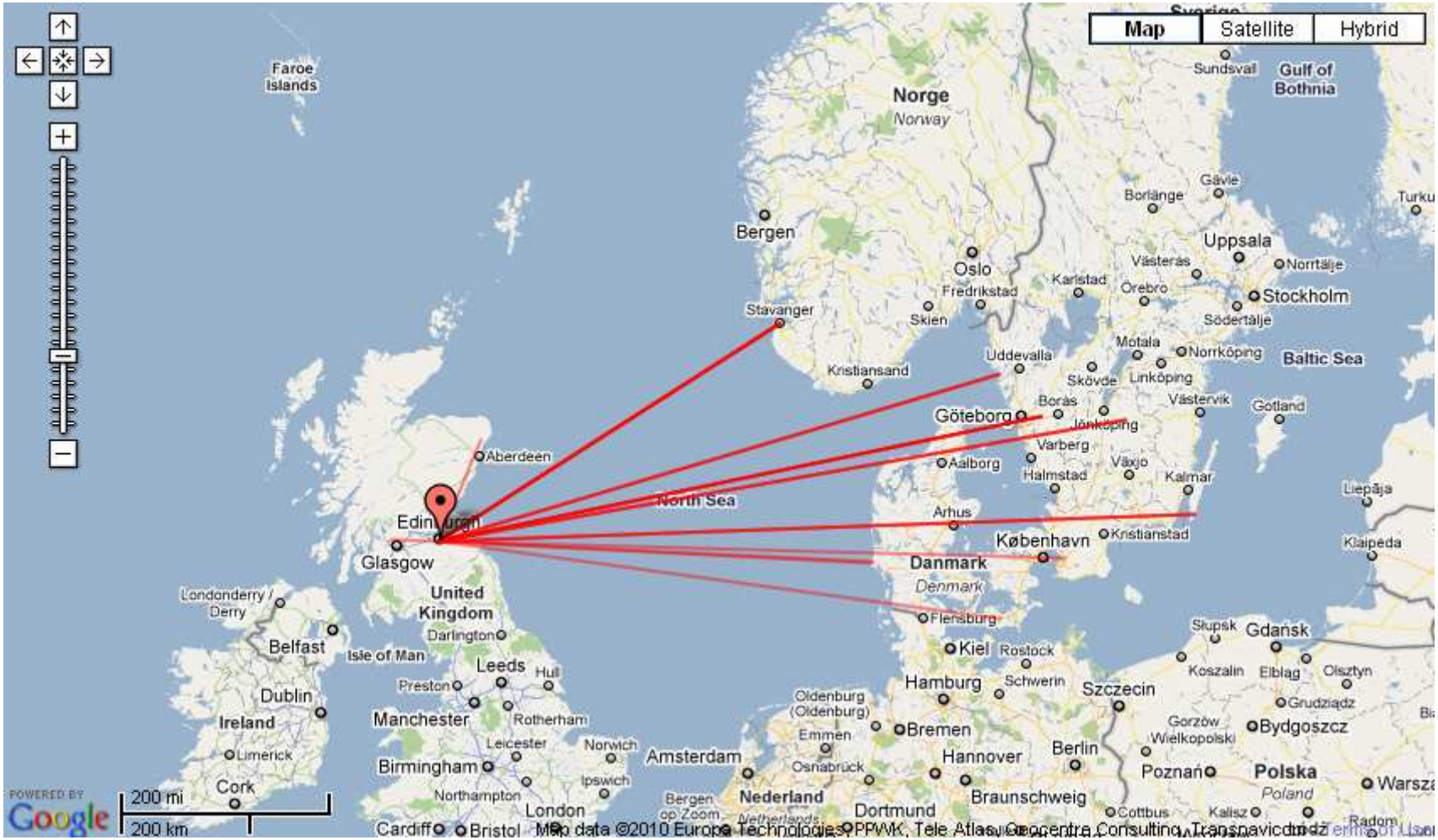
Googlemap


Map
200 ft
50 m
Imagery ©2010 DigitalGlobe, Infoterra Ltd & Bluesky, GeoEye, The GeoInformation Group,

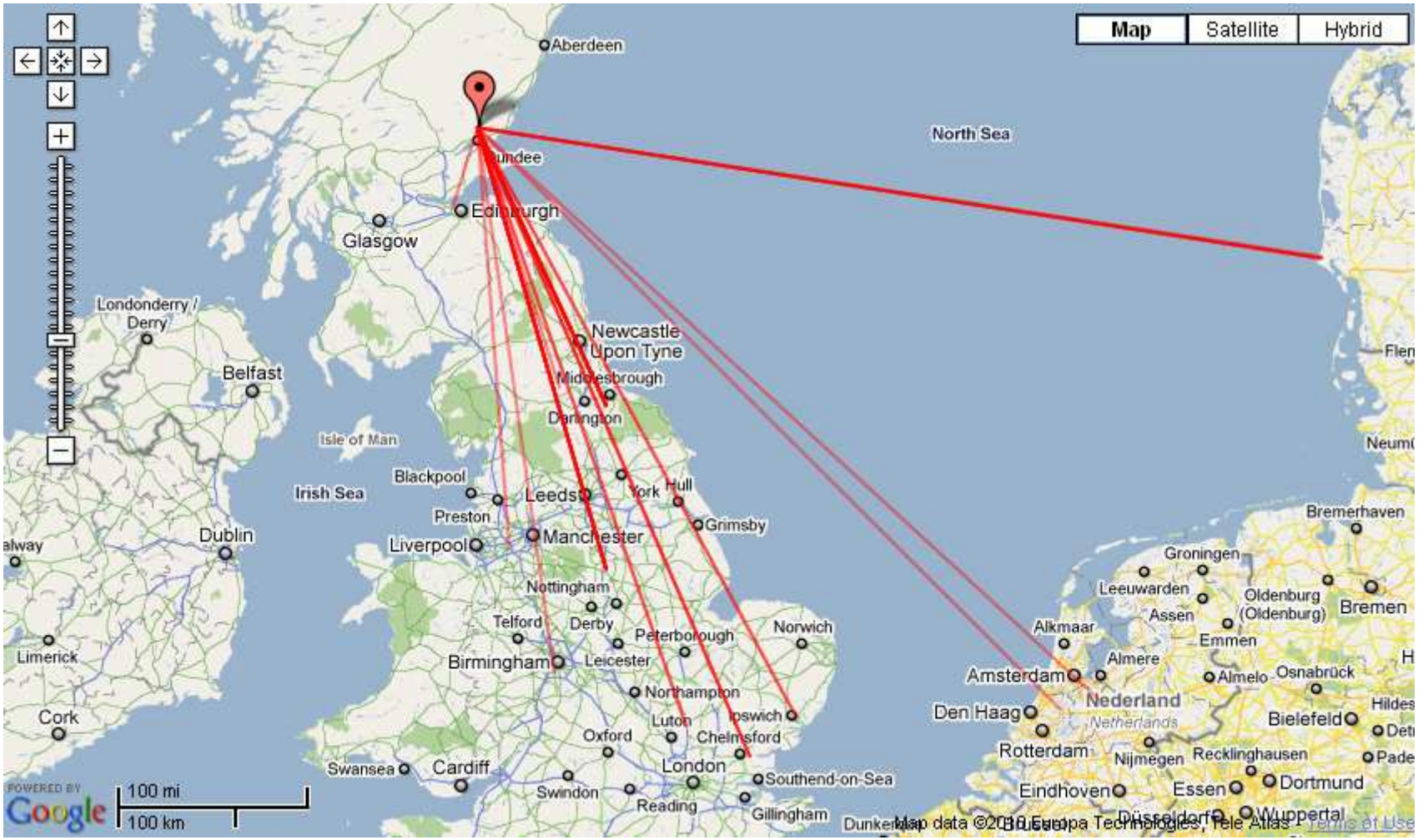
Coverage

- Originally licensed for 2 x Corner reflector
- NE and NW
- Good coverage of Central belt and north
- Clear path to north sea

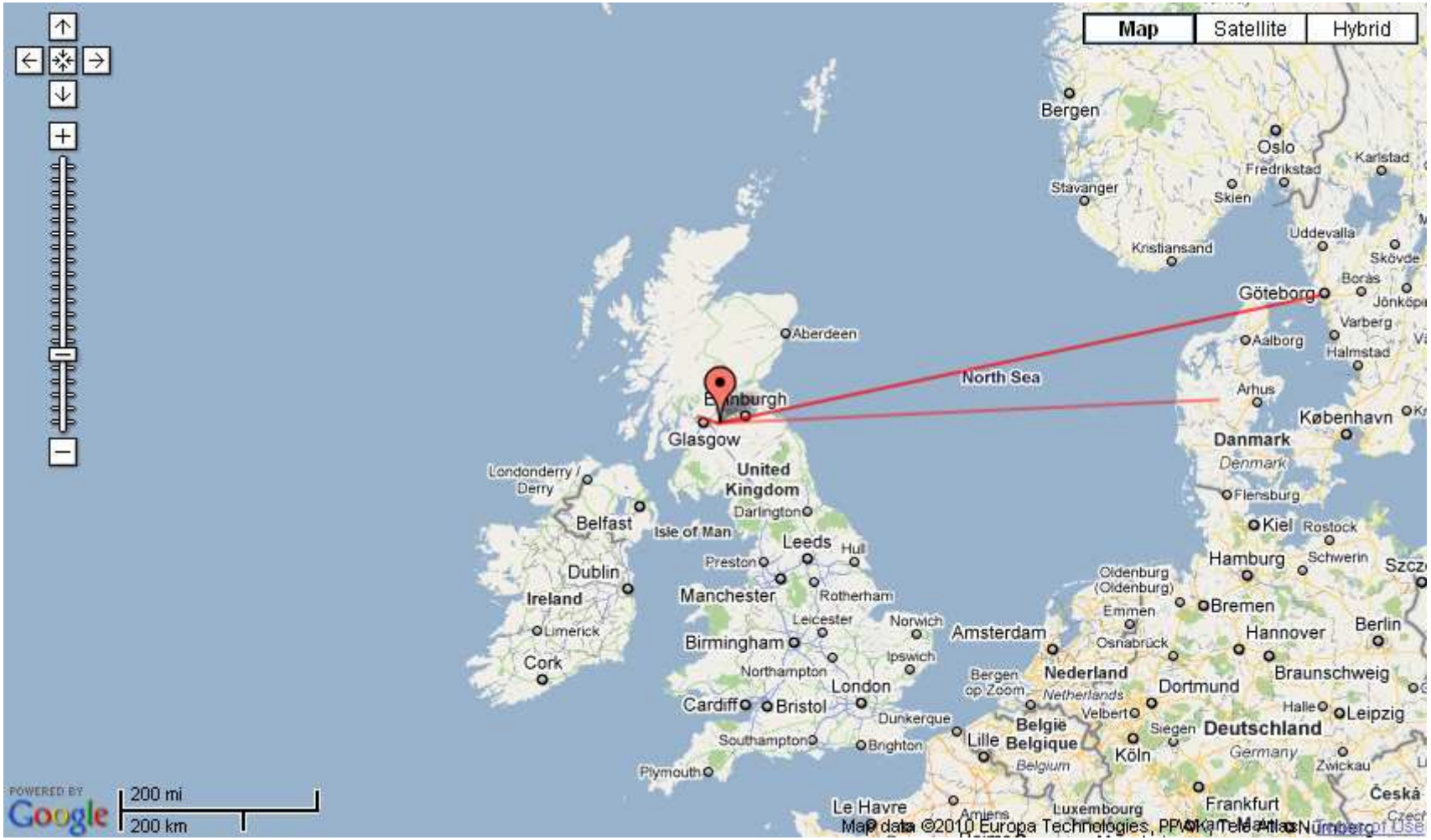
Beaconspot.eu spots since 2008



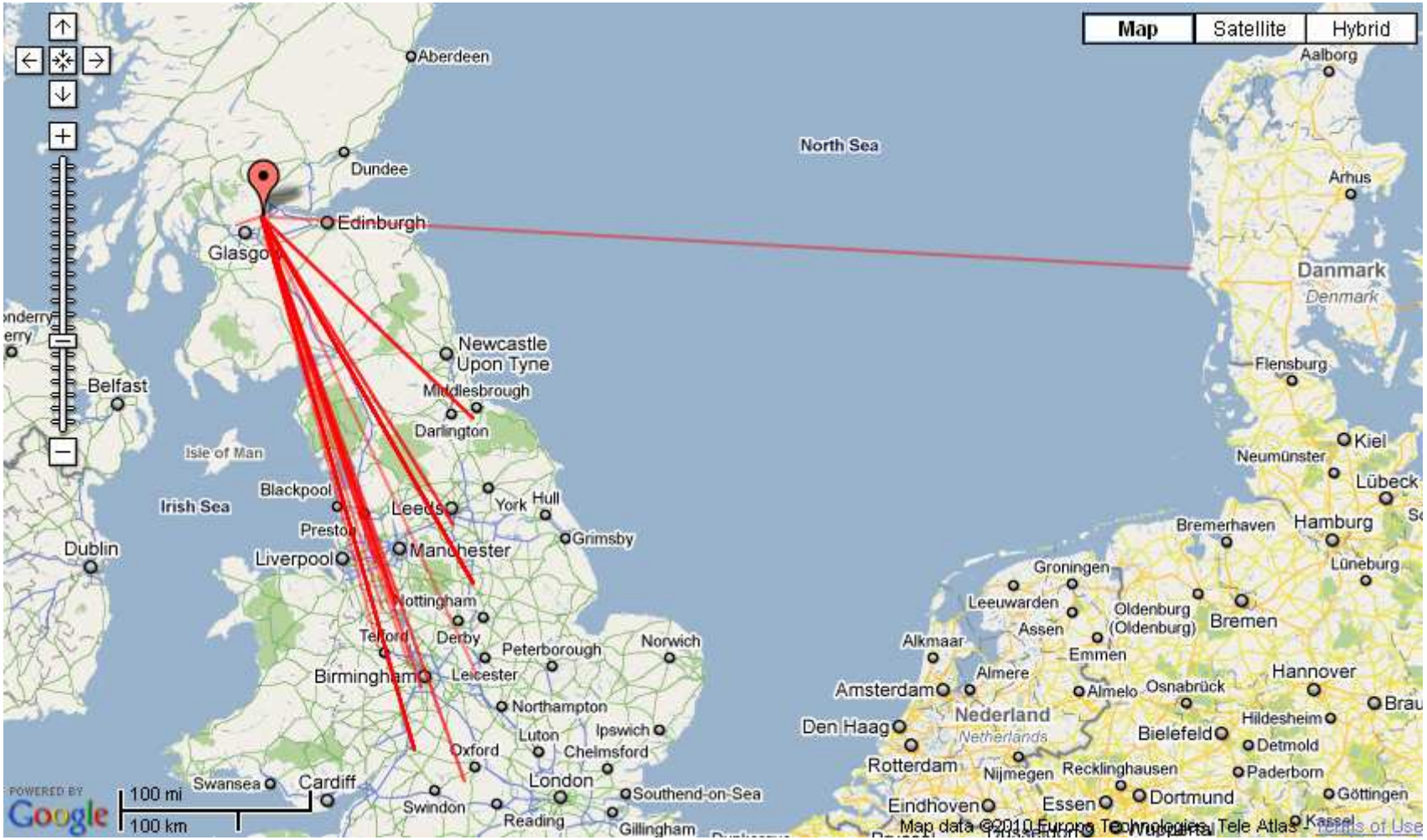
GB3ANG Spots



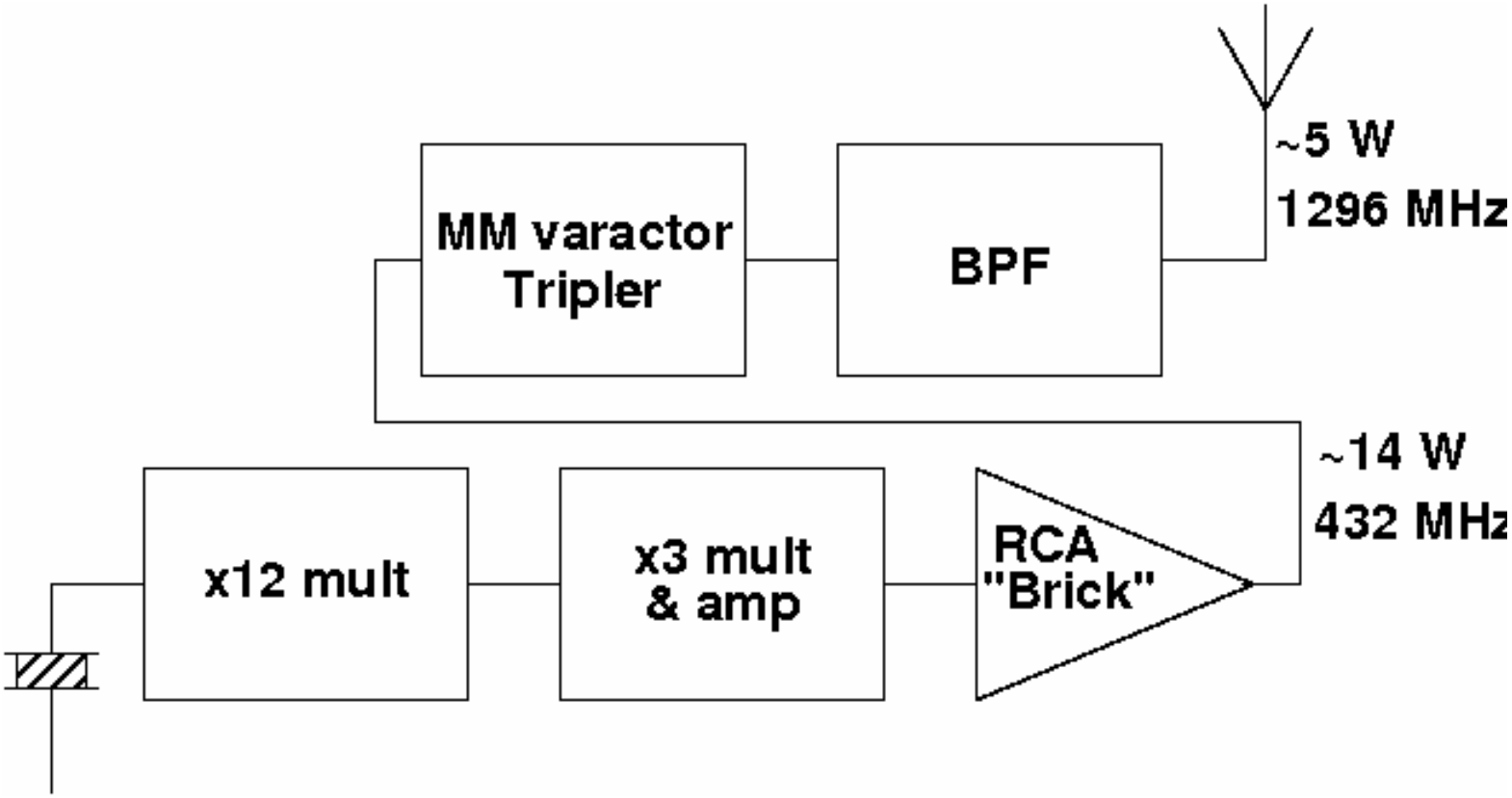
GM6BIG spots



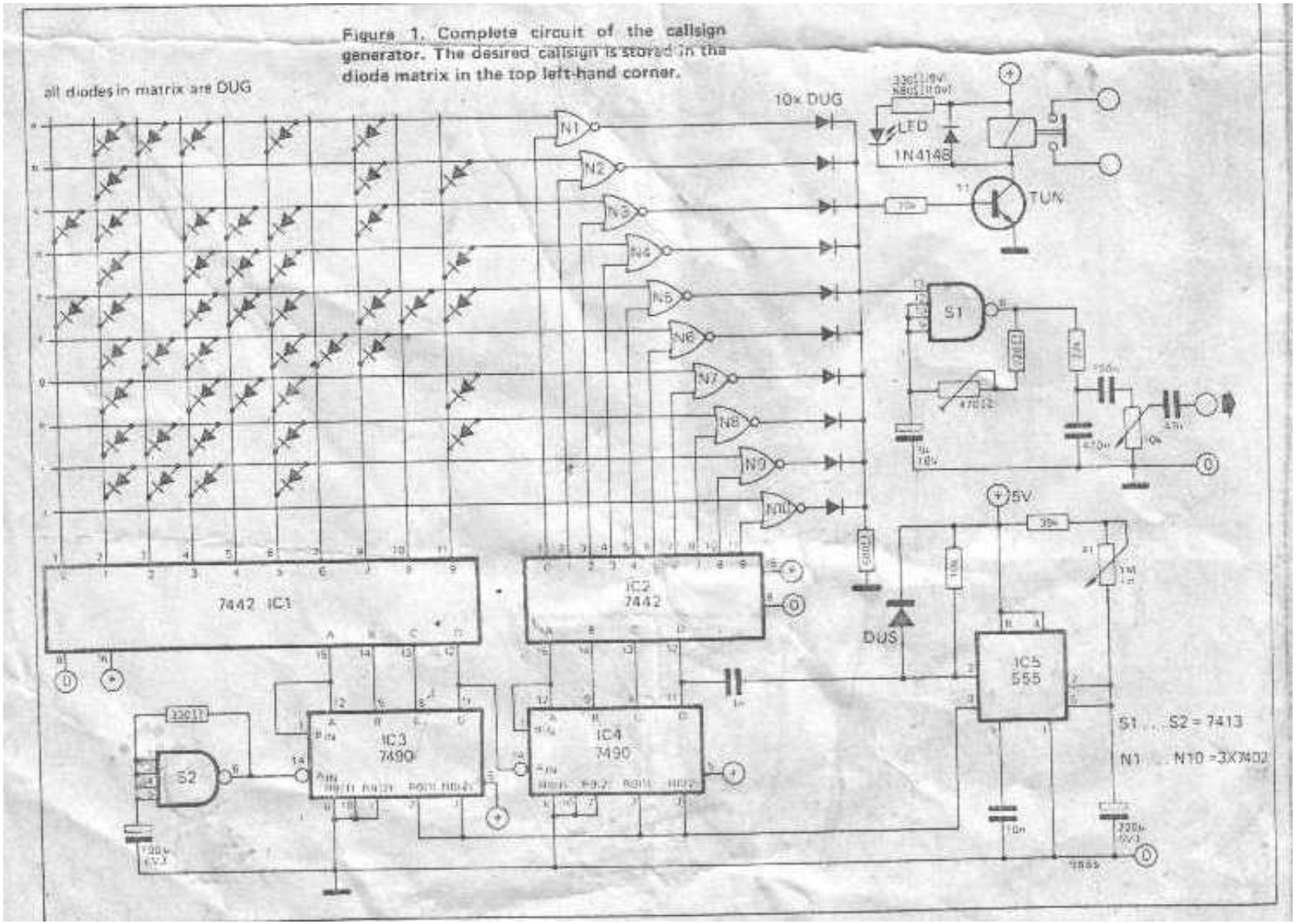
GB3CSB Spots



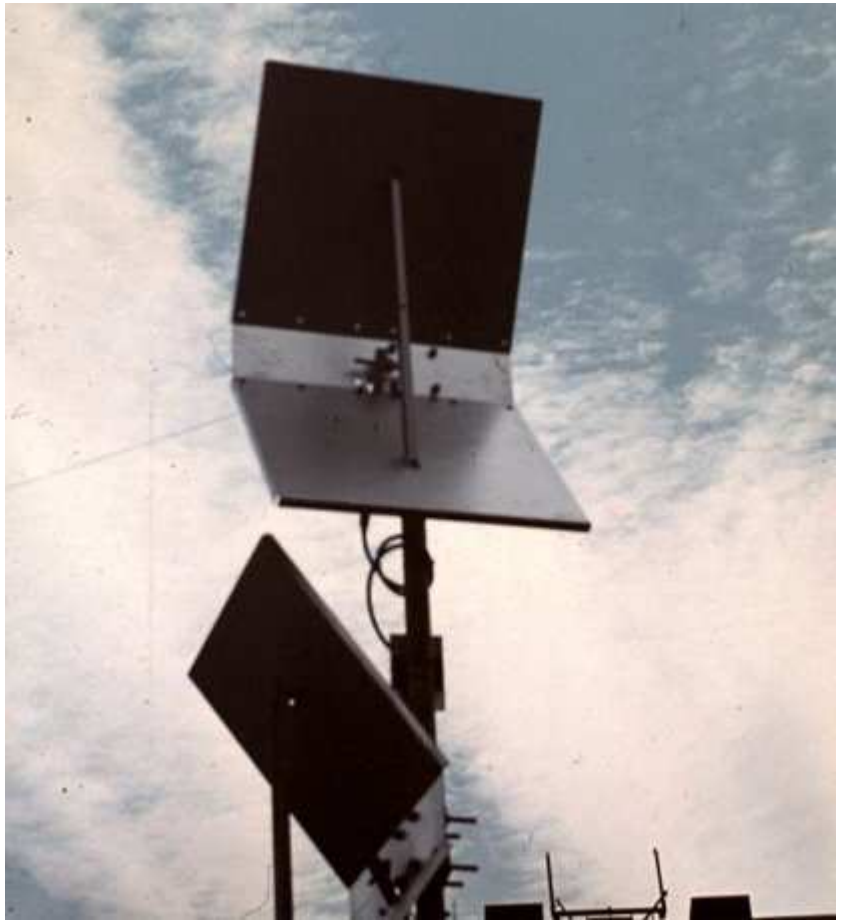
Existing hardware



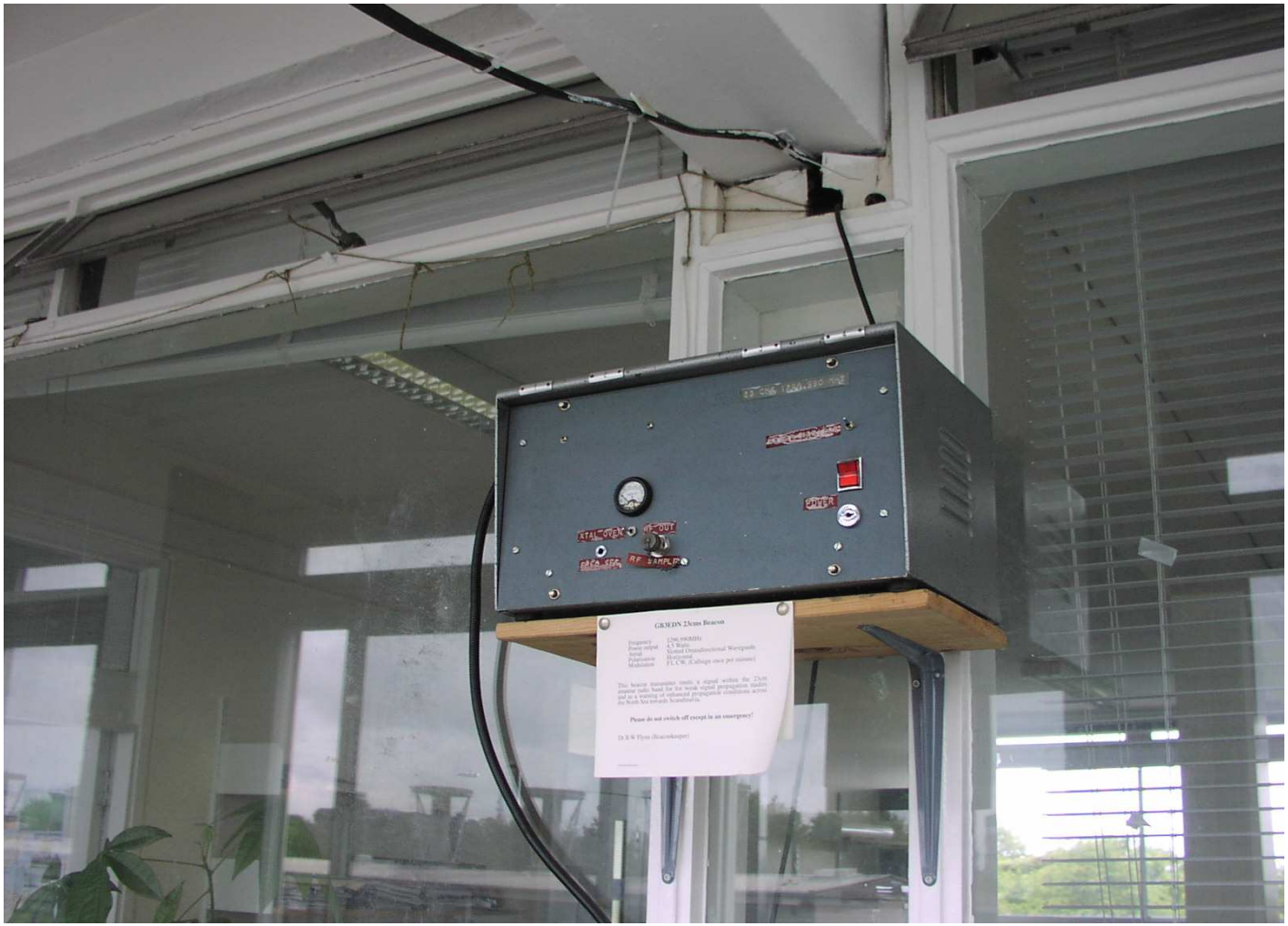
Existing TTL Keyer



Corner Reflectors: 1978 -1986



Existing Hardware



Antenna 2010

Antenna just after installation

Close-up of antenna

Another view

General View

Motivation for new Design

- Improved frequency accuracy
- Improved stability
- Reduced power consumption
- Existing hardware draws ~5 amps at 12 V and uses a linear power supply regulator
- Improved keying and QRA locator added

New design – Initial thoughts

- Want to generate signal from accurate standard
- Generally 5.0, 10.0, 12.4 or 15.0MHz
- Not harmonically related to 1296.990 MHz
- Ideally want to phase lock VHF xtal to standard

DDS techniques

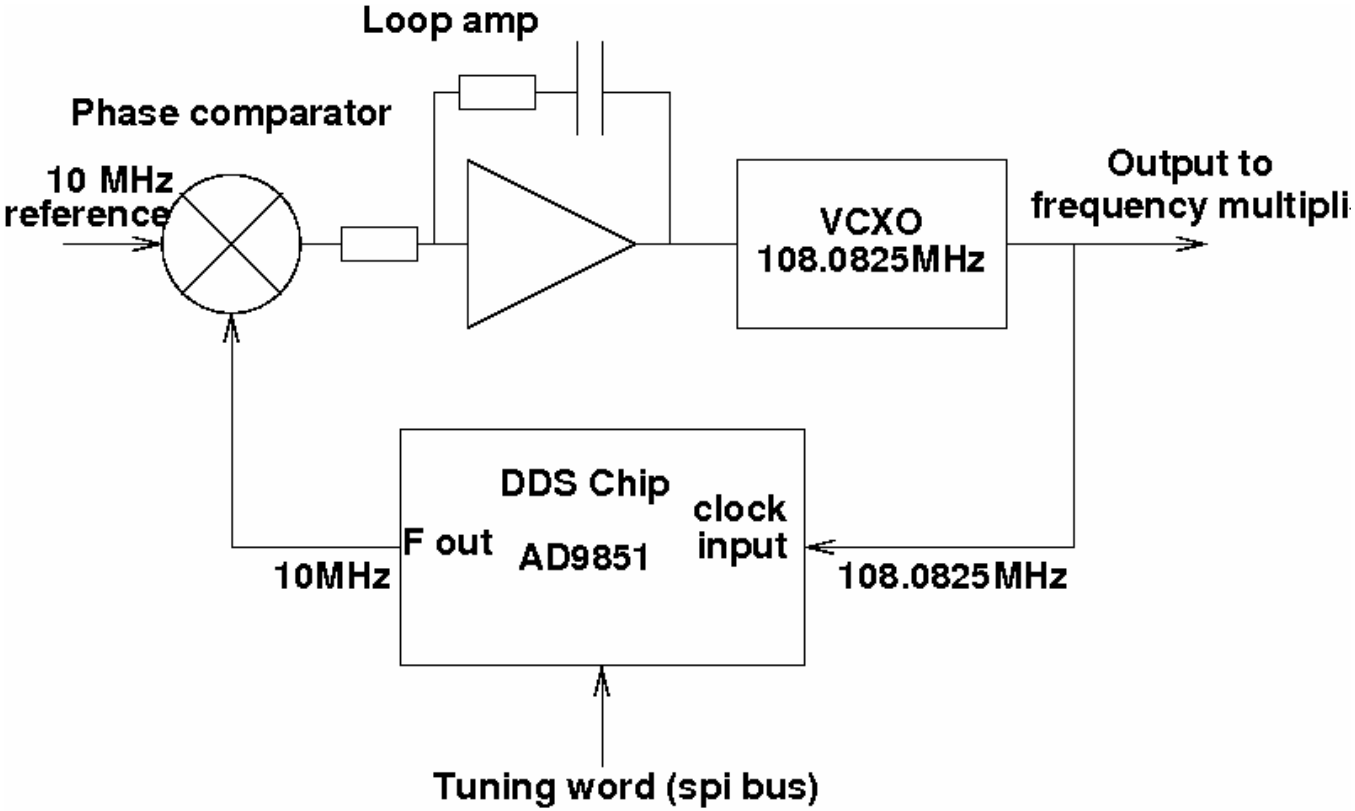
- In the last 15 years DDS ICs have become available from a few manufacturers notably Analog devices
- Normally used to generate arbitrary frequencies from a VHF clock typically 100 MHz
- Output frequency set by a 32 bit tuning word
- Output frequency step = 100MHz /2^32=23mHz!

DDS continued

- DDS allows the generation of virtually any frequency from a frequency standard
- The big drawback is that the outputs are relatively noisy with both spurs and phase noise
- Use of DDS to replace a crystal oscillator not the way to go.

Reverse DDS (RDDS)

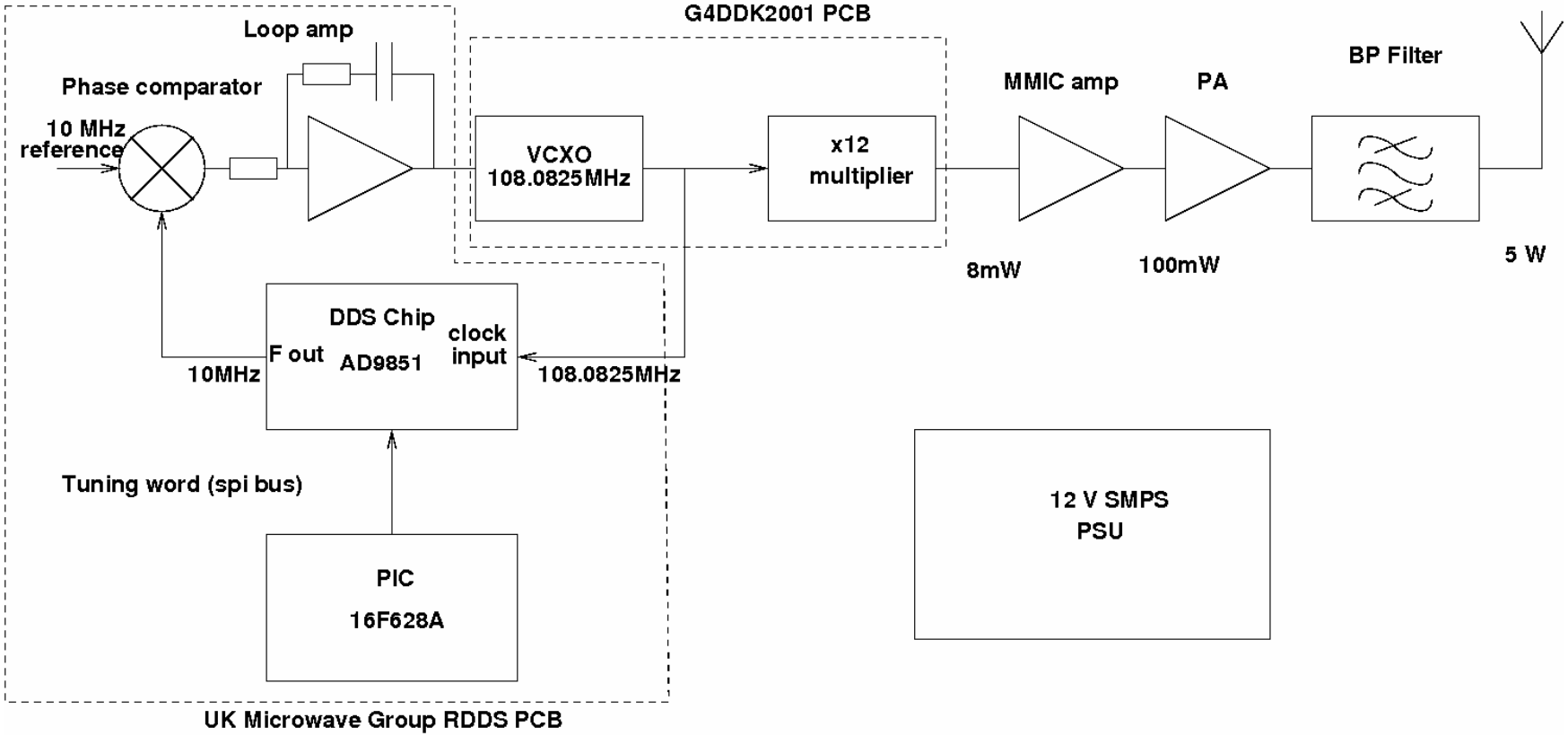
- An alternative is to use the DDS chip as the divider in a conventional PLL



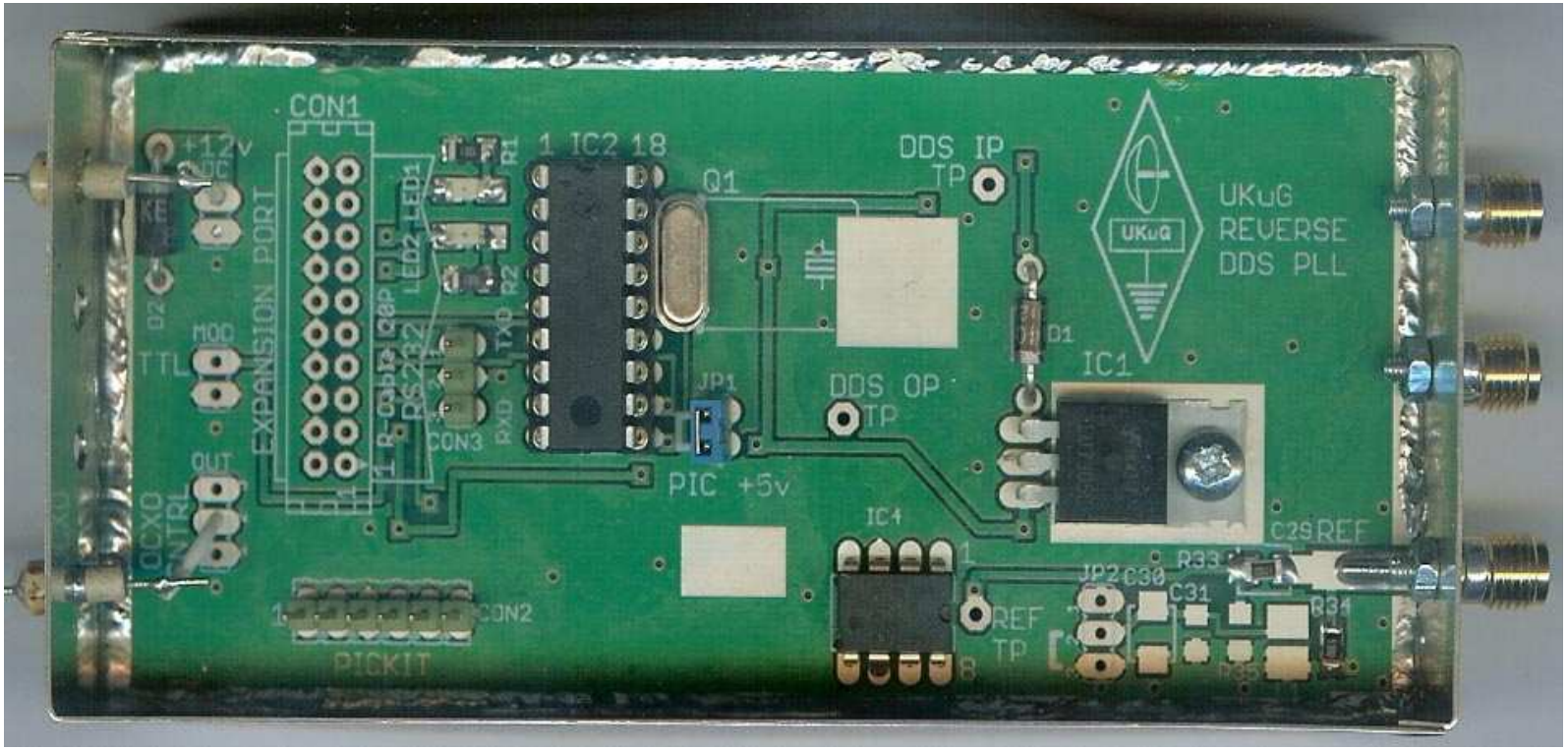
Advantages of RDDS

- Can use high reference frequency
- Phase noise and spur performance is good
- Narrow PLL bandwidth keeps output clean
- FSK can be implemented easily by changing tuning word
- UK Microwave group produce a PCB to implement circuitry!

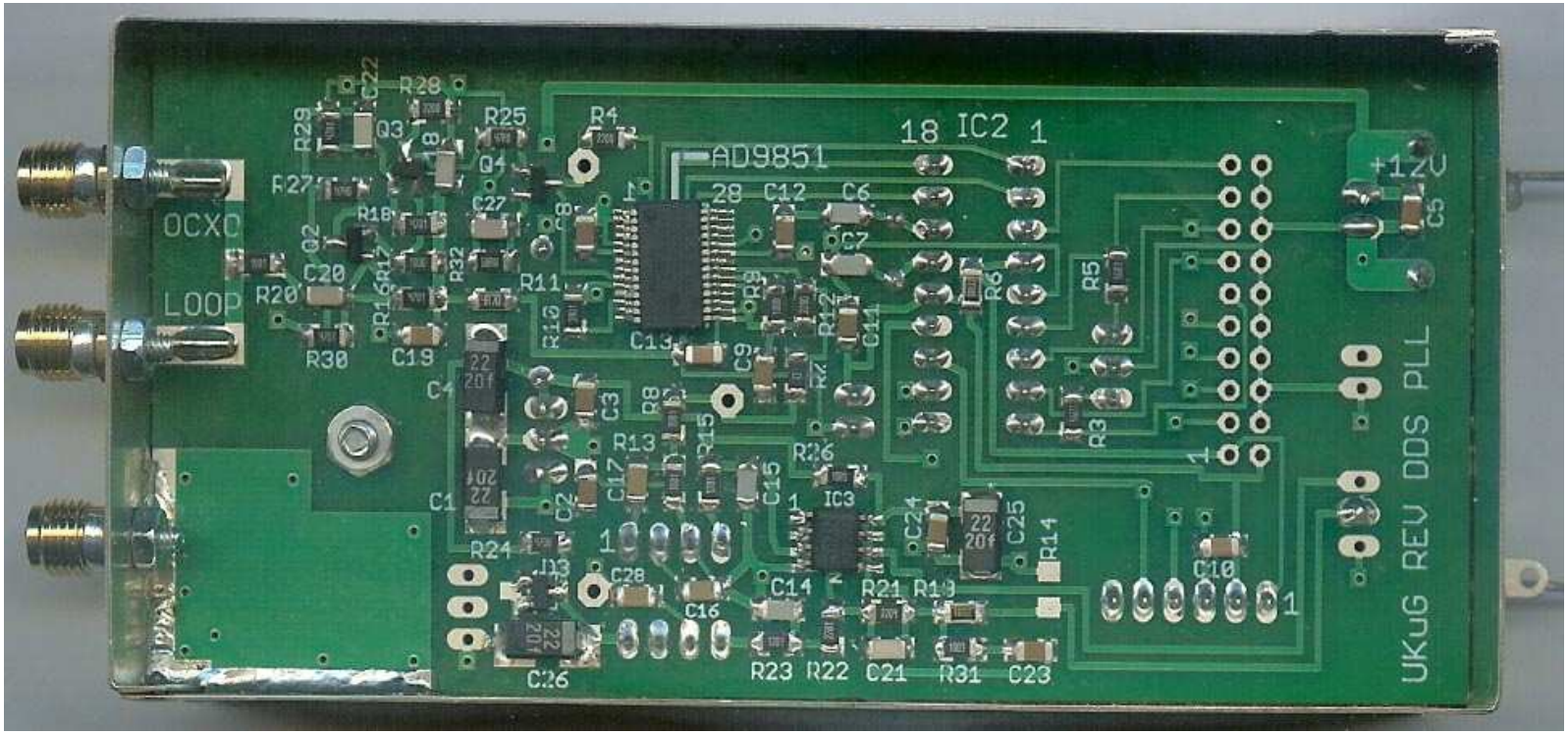
Complete Block Diagram



UK Microwave RDDS PCB (Top)

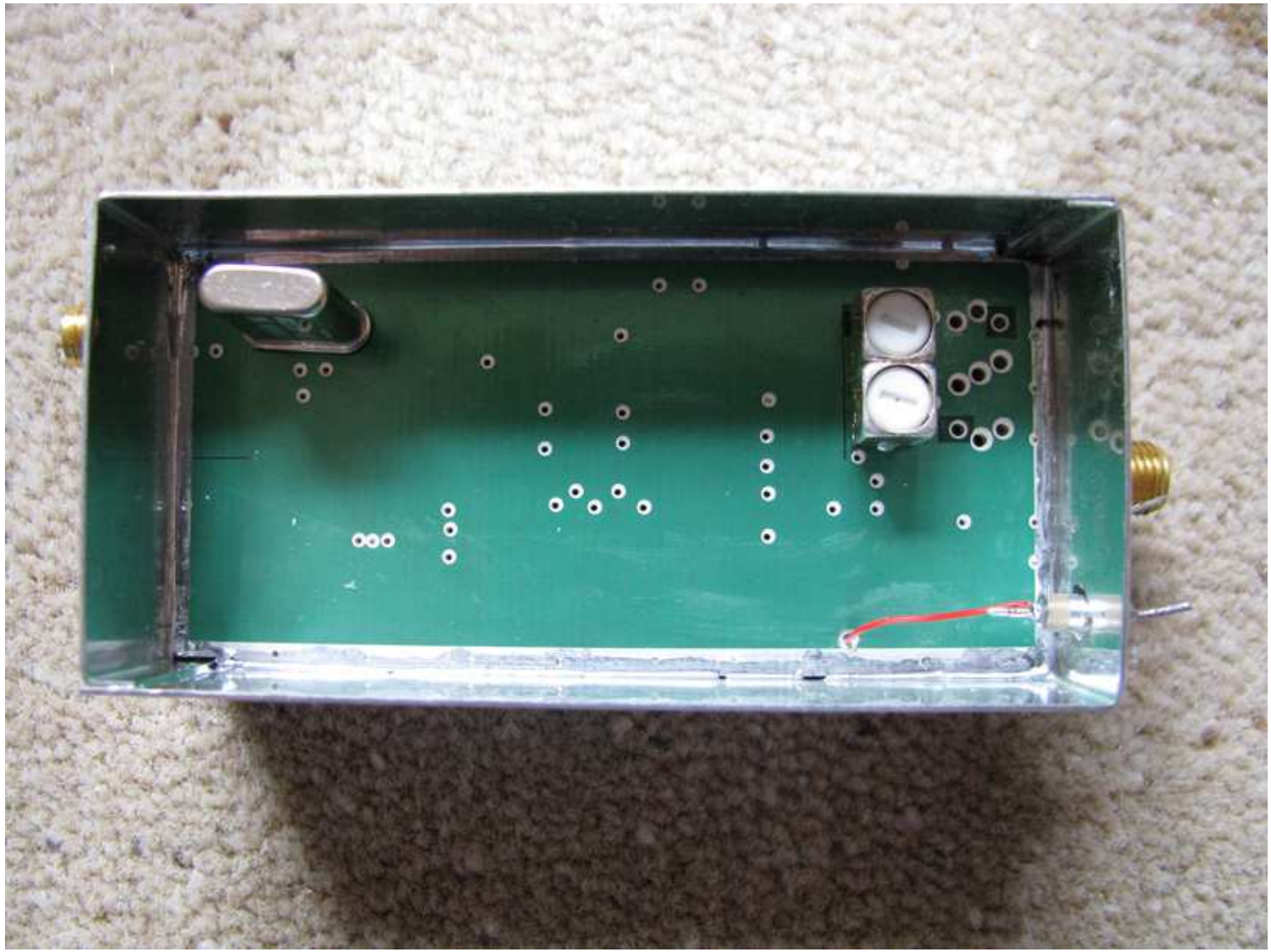


UK Microwave RDDS PCB (Bottom)

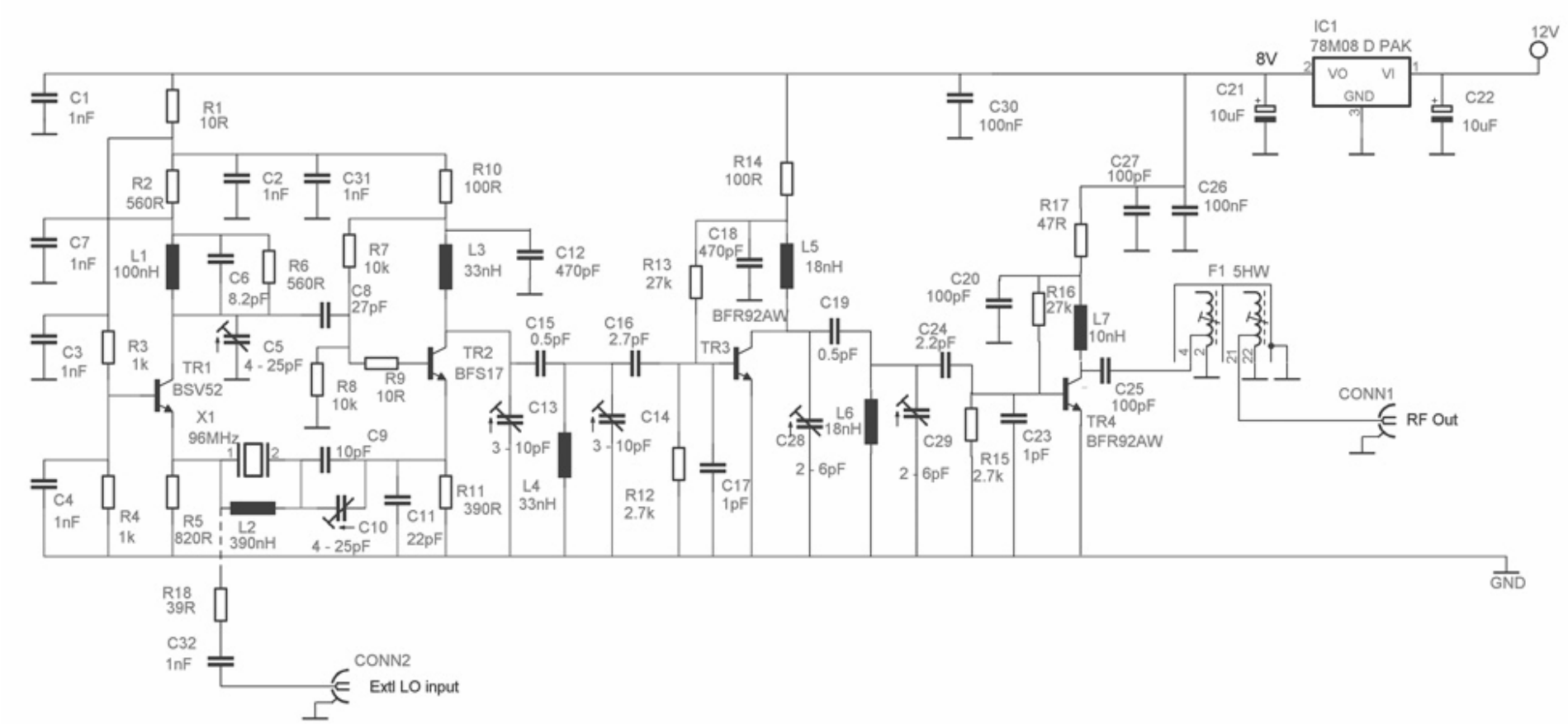


G4DDK2001 PCB (Top)

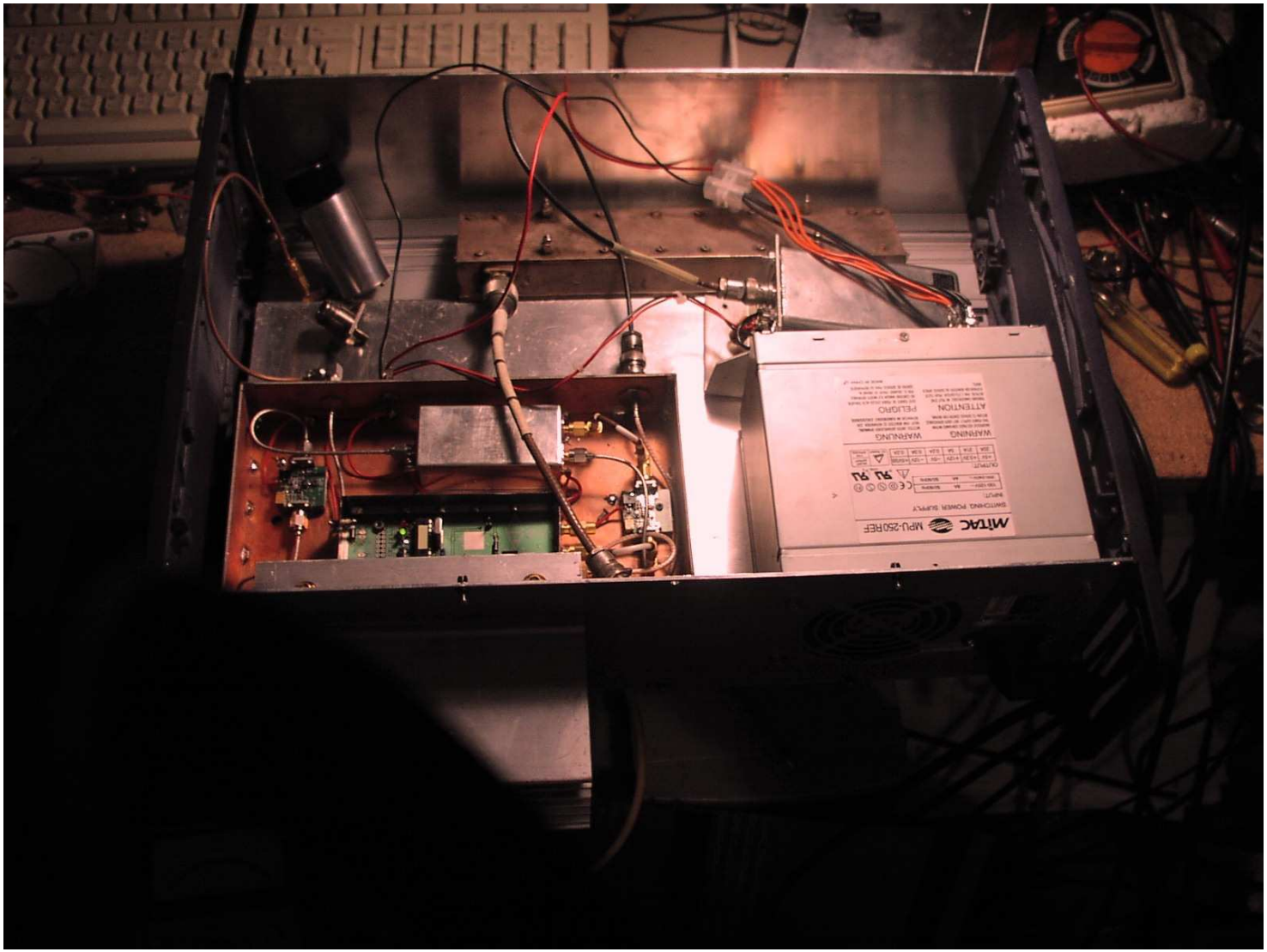
G4DDK2001 PCB (Bottom)



G4DDK2001 Circuit



Hardware


MITAC
MPU-250REF
SWITCHING POWER SUPPLY
WARNING
ATTENTION