

# A Multipurpose Portable Setup

## Experiences with Portable Equipment for Working LEO Satellites



**AMSAT-UK Colloquium 2011  
Ivo Klinkert, PA1IVO**

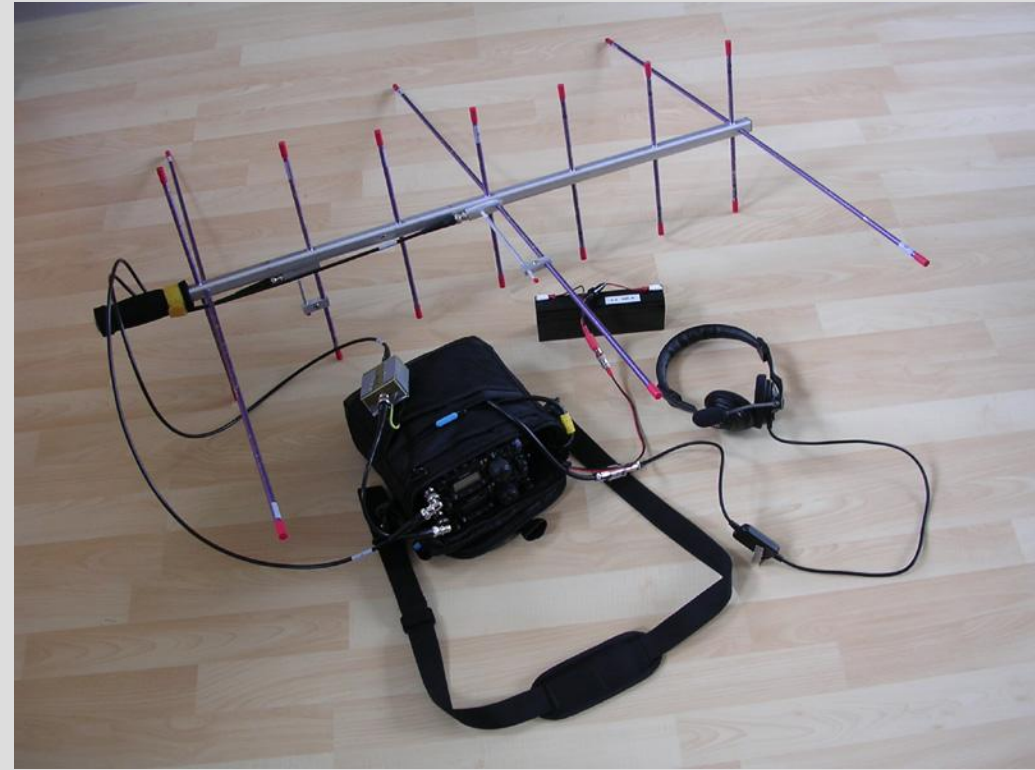
# Overview Presentation

- Demonstration of an optimized portable setup
  - Antenna considerations and calculations
  - S-band reception capabilities
  - Portable satellite demonstrations
  - Headsets
  - It fits in a bag
- 
- Maybe some inspiration for other people to start or improve a portable satellite setup.



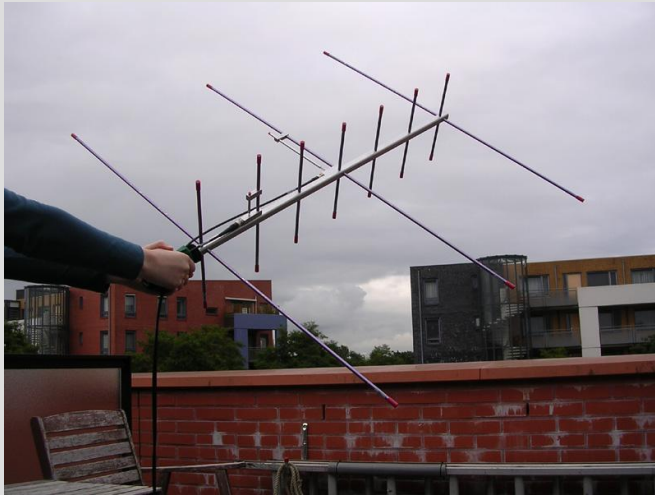
# A Portable Setup

- Full-duplex  
Very handy when QRP
- Both FM and SSB
- Truly portable  
Camping requirements
- 2 m / 70 cm / 13 cm
- Two times a FT-817ND  
All mode voice support as base for transceiver part
- Arrow / HB9CV  
Dual band antenna as base for antenna part  
No diplexer required when using separate transceivers



# Antenna Selection for full-duplex 2 m / 70 cm

- Famous Arrow versus Wimo dual band HB9CV



Arrow

Gain 2 m:  $\pm 5.9$  dBd [1]

Gain 70 cm:  $\pm 8.2$  dBd [1]



HB9CV

Gain 2 m:  $\pm 5.5$  dBd [2]

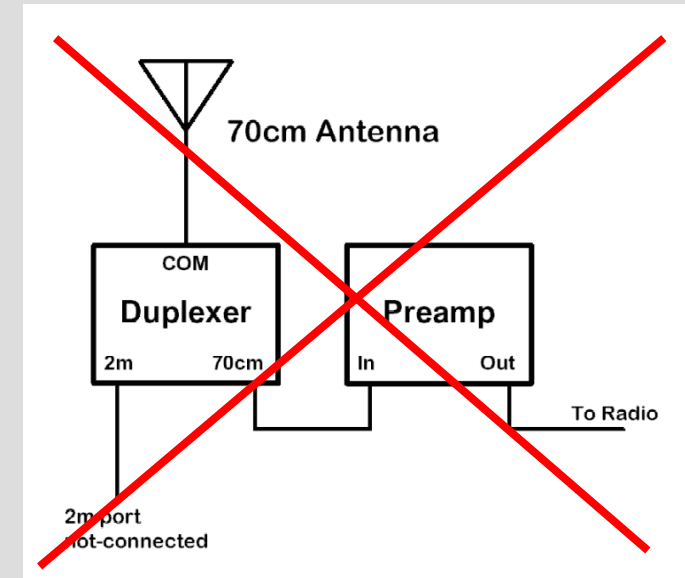
Gain 70 cm:  $\pm 5.5$  dBd [2]

- Both usable, but differences noticeable

[1] <http://www.csvhfs.org/ant/CSANT09.HTML>, [2] <http://www.wimo.de>

# Desensing issues

- Signals lost at TX in mode V/U  
When using two times a FT-817ND
- 'Standard solution' mode J filter  
does not work here
- Solution was a LPF for TX at VHF
- Suppression of 3rd harmonic necessary
- Some basic calculations in the next two slides



# Global Antenna Measurements

- Signal separation between 2m and 70 cm?
- Network analyzer between 2m and 70 cm port.

- Arrow

Separation 2 m:  $\pm 45$  dB

Separation 70 cm:  $\pm 23$  dB

- HB9CV

Separation 2 m:  $\pm 50$  dB

Separation 70 cm:  $\pm 8$  dB

# Global Desensing Calculations

- Effect of 2 m 3rd harmonic on 70 cm RX

2.5 W output power FT-817: 34 dBm

3rd harmonic suppression FT-817: 60 dB -26 dBm

Separation 70 cm Arrow: 23 dB -49 dBm

Dynamic range FT-817 receiver: 60 dB -109 dBm

- Impossible to receive weak signals

Signal between -105 and -117 dBm for AO-51 [1]

*[1] Calculating Link Budget for AMSAT-OSCAR 51*

# Global Desensing Solutions

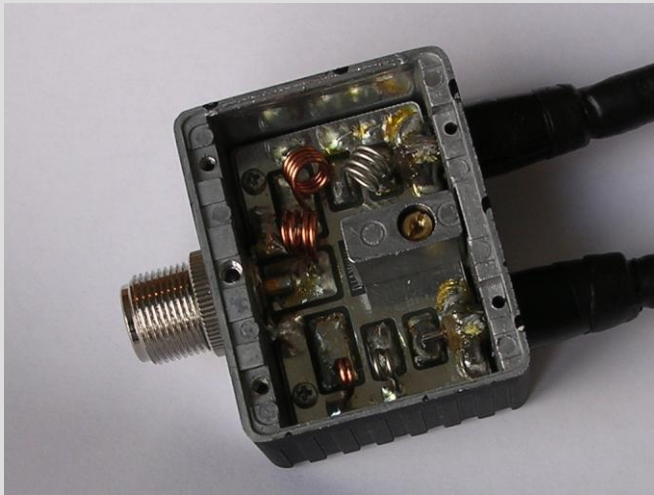
- Effect of adding a 2 m LPF

2.5 W output power FT-817:		34 dBm
3rd harmonic suppression FT-817:	60 dB	-26 dBm
Extra LPF:	50 dB	-76 dBm
Separation 70 cm Arrow:	23 dB	-99 dBm
Dynamic range FT-817 receiver:	60 dB	-159 dBm

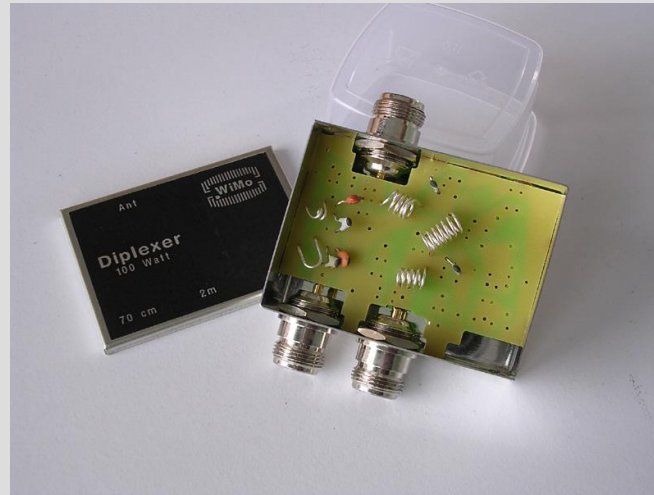
- No desensing due to LPF
- A home-made LPF was added to the setup
- 'Mode J' (145 MHz notch) filter effect not noticeable

# Some low-pass filters

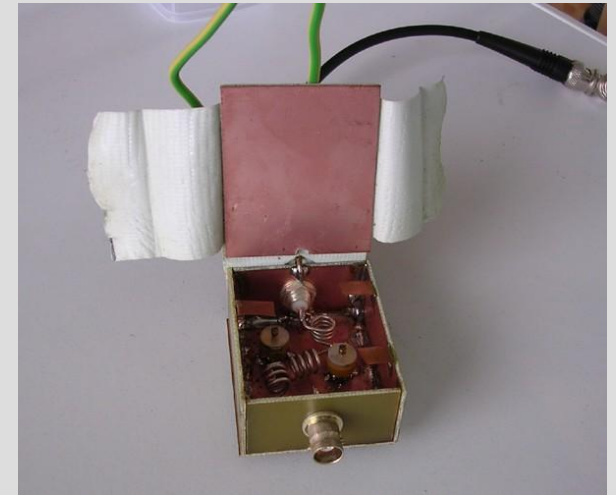
- Several diplexers available to serve as LPF
- A home-made LPF was added to my setup



Diamond MX-72A  
41 Euros



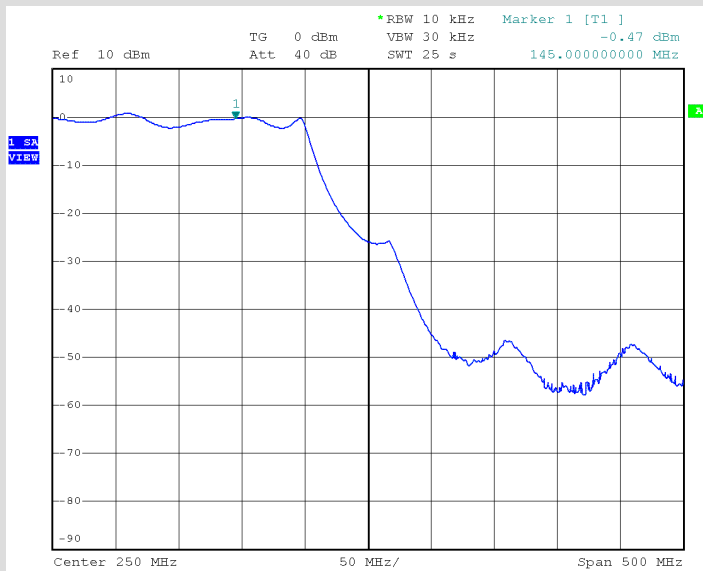
Wimo diplexer  
45 Euros



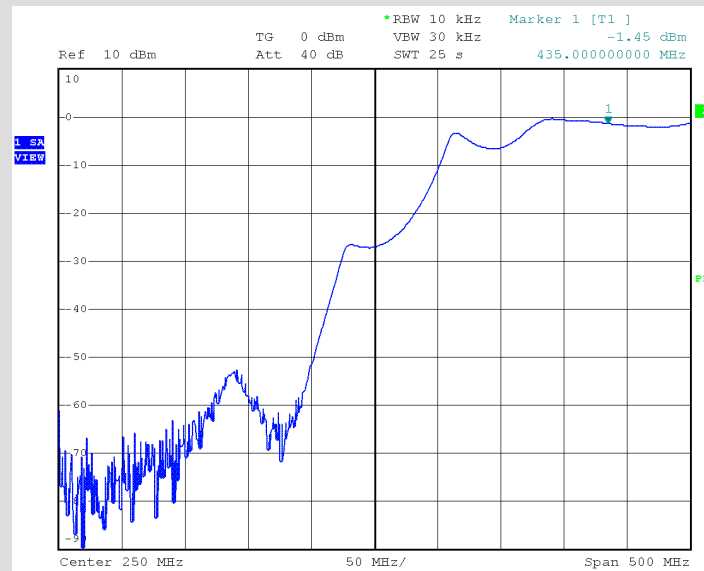
Home-made LPF  
Few Euros  
With handy clip!

# Global Measurement Wimo Diplexer

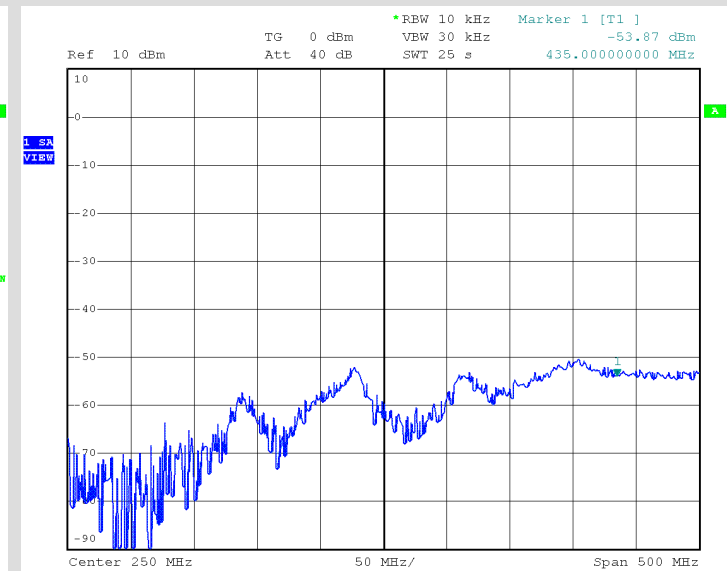
- $\pm 50$  dB attenuation as LPF
- $\pm 50$ -60 dB separation between VHF and UHF



VHF - common



UHF - common



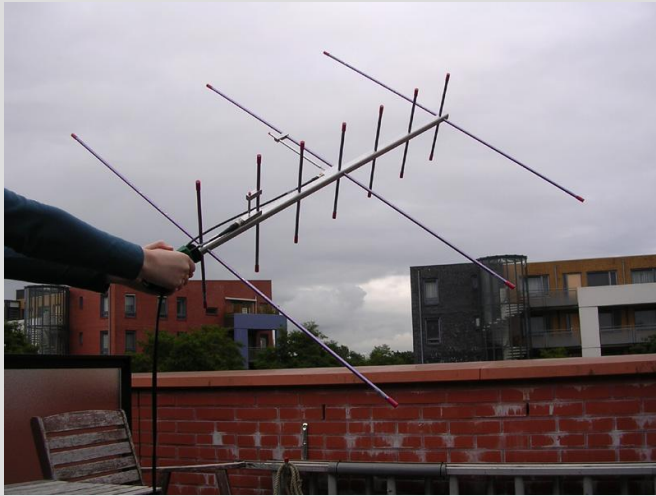
VHF - UHF

# Elk 2m/70cms Log Periodic Antenna?

- Not tested by me, I do not own one.
- The ever-lasting diplexer dilemma:  
Arrow / HB9CV DO NOT require one for separate TRXs  
Arrow / HB9CV DO require one for separate single TRX  
Elk DOES NOT require one for single TRX  
Elk DOES require one for separate TRXs (!)
- Antenna separation Elk  
Determined by worst of  
diplexer or antenna itself  
Not measured by me



# Antenna Overview



## Arrow

Gain 2 m:  $\pm 5.9$  dBd [1]

Gain 70 cm:  $\pm 8.2$  dBd [1]



## HB9CV

Gain 2 m:  $\pm 5.5$  dBd [2]

Gain 70 cm:  $\pm 5.5$  dBd [2]



## Elk

Gain 2 m:  $\pm 6.6$  dBd [3]

Gain 70 cm:  $\pm 7.0$  dBd [3]

Choose the antenna which fits you best:

*Gain - price - weight - size - purpose - availability - personal taste  
(Elks available at the AMSAT-UK shop)*

[1] <http://www.csvhfs.org/ant/CSANT09.HTML>, [2] <http://www.wimo.de>, [3] <http://www.elkantennas.com>

# Portable Demonstration in Groups

- Full-duplex is best for successful QSOs
- Full-duplex limits easy listening for spectators  
Audio feedback can be a problem

- A car radio FM transmitter

Belkin Tunecast II

Wireless sharing of audio

Blocks FT-817 receiver when connected



- Mini jack splitter

Belkin Rockstar

“Share your iPod” (or FT-817ND)

Works like a charm

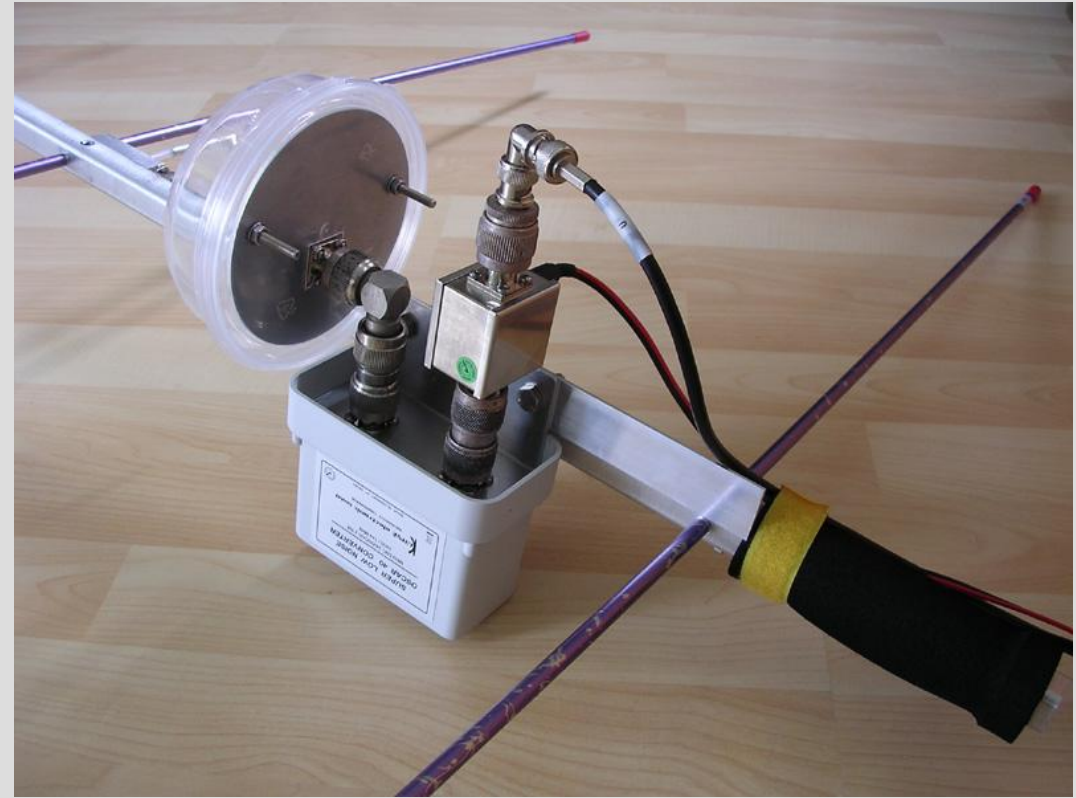
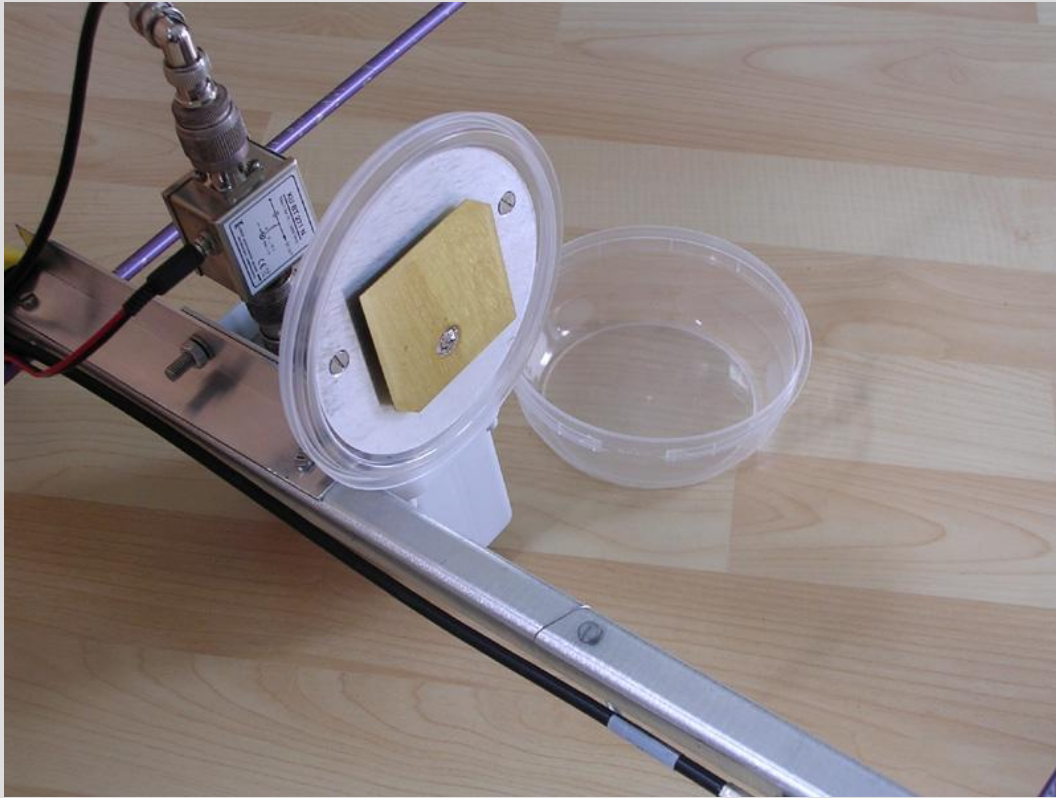


# Extra Portable Mode: S-band (13 cm)

- Extra equipment for AO-51 mode V/S
- S-band RX part consists of:
  - S-band patch antenna (kit John G7HIA), RHCP
  - Kuhne S-band down converter to 144 MHz
  - Bias T for powering down converter
  - Mounted on Arrow, 70 cm part removed for mode V/S
- S-band reception without problems
  - Extra attenuator necessary with down converter
  - TX and RX on 2 m gave no problems
  - High level of QRM at 2.4 GHz
  - Manual Doppler correction at 2.4 GHz is fun



# Extra Portable Mode: S-band (13cm)



# Headsets

- A headset is highly recommendable
  - For working linear transponders it is essential
  - VOX on SSB, PTT on FM
- Cheap computer headsets
  - Work for FM, insufficient drive for SSB
  - Prone to RFI problems
- Heil headsets
  - Powerful and clear audio, also with SSB
  - No signs of RFI
  - A bit expensive
  - Heil Traveller Dual (+ HSTA-YM) selected for my setup

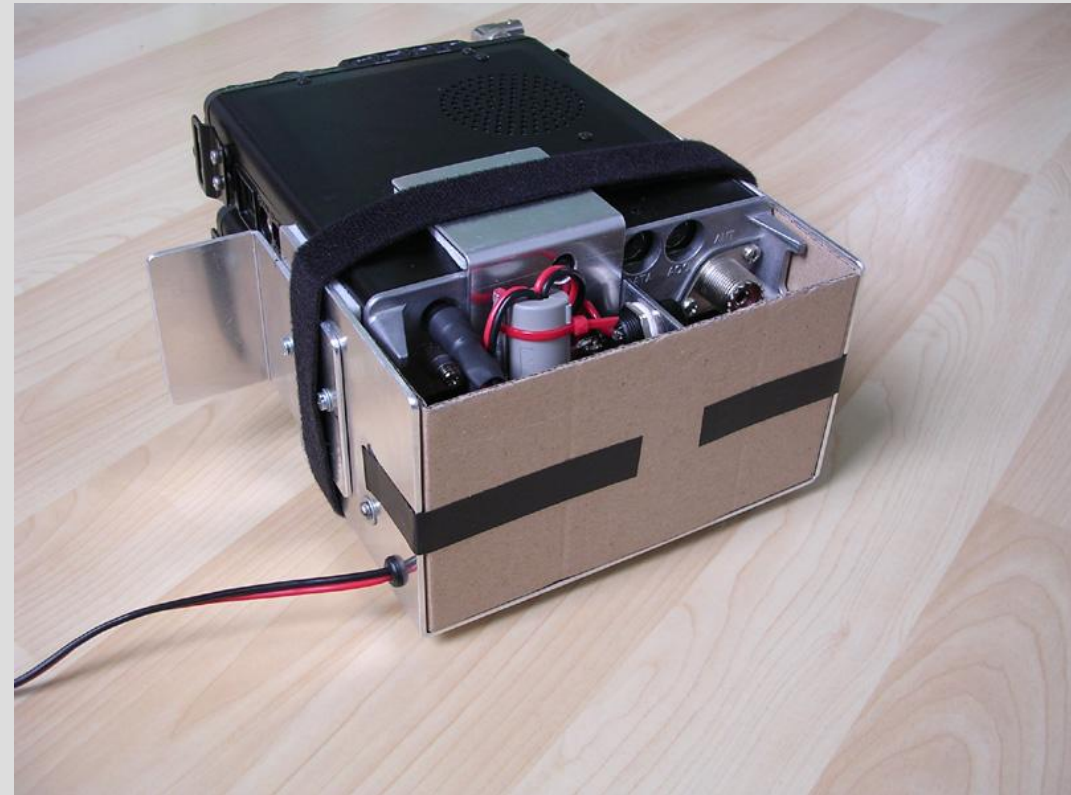


# FT817s conveniently mounted (1)



Photo bag fits two FT817 perfectly - Protection for cables by chassis  
Headset mounted in RX and TX - BNC angles for convenient cabling  
LPF mounted with clip - Bulky headset adapter in front of bag

## FT817s conveniently mounted (2)



Four fuses for safety 'in the field' - Two anti-parallel diodes  
Chassis prevents unwanted bending of cables, at the back and one side  
Data connection still reachable for PSK operation after all sat QSOs

# A Multipurpose Setup?

- Both FM and SSB QSOs possible
  - Single channel FM is convenient with preprogrammed memories
  - SSB transponder QSOs possible with manual Doppler correction
- Multimode capabilities
  - Modes V/U, U/V, V/S and U/S possible
- Many QSOs made with this setup
  - Both from home QTH JO22JL, as well on holidays
  - Cool e-mail report from Delfi-C3 command station (Wouter Jan):  
*“Hoorde je net CQ roepen .... via Delfi-C3. ... Ik zit remote mee te luisteren met de transponder... Goed signaal van jouw kant zelfs op deze omni antenne! Weer 2 keer 817 neem ik aan?”*



**MM/PA1IVO/P  
in IO78IE**

**Questions?  
Remarks?**



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**Thanks to PA0LEZ, OZ1MY, G7HIA, AMSAT-UK, and Linda.**