A Multipurpose Portable Setup

Experiences with Portable Equipment for Working LEO Satellites

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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

<table>
<thead>
<tr>
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<th>Arrow</th>
<th>HB9CV</th>
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<tbody>
<tr>
<td>Gain 2 m:</td>
<td>± 5.9 dBe [1]</td>
<td>± 5.5 dBe [2]</td>
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<tr>
<td>Gain 70 cm:</td>
<td>± 8.2 dBe [1]</td>
<td>± 5.5 dBe [2]</td>
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- Both usable, but differences noticeable

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: ± 45 dB
  - Separation 70 cm: ± 23 dB

- HB9CV
  - Separation 2 m: ± 50 dB
  - Separation 70 cm: ± 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]

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[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

- ± 50 dB attenuation as LPF
- ± 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: ± 5.9 dBi [1]
Gain 70 cm: ± 8.2 dBi [1]

HB9CV
Gain 2 m: ± 5.5 dBi [2]
Gain 70 cm: ± 5.5 dBi [2]

Elk
Gain 2 m: ± 6.6 dBi [3]
Gain 70 cm: ± 7.0 dBi [3]

Choose the antenna which fits you best:

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

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 font 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
dezelfe omni antenne! Weer 2 keer 817 neem ik aan?” 😎
Questions?
Remarks?

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