Getting started on 10 GHz

Release 5
Overview

This Powerpoint is explaining my first steps in the choice of a 10 GHz transverter found on the market. On the side it gives some hit and kinks about:

- The locator grid squares reached within a 2 month period with only 1W !!
- How to make the FT-817nd compatible (best TRx choice associated with transverters)
- Prime-focus and offset dishes – solving the 0° elevation
- Monoband and multiband feedhorns
- A final overview about setups of some well known french hams
Abstract 1/2

1- 10 GHz beacons, SCPs and QSOs from JN18gr

2- 10 GHz SSB-Electronic transverter (<1995)

3- 10 GHz DB6NT transverter
   - Version 1:
     - schematics & practical
     - LO frequency drift
   - Versions 2 and 3: Rx Nf and principally LO stability improvements

4- Indoor, then outdoor operations with a single 49 cm Procom dish

5- FT-817nd modifications
   - Positive voltage added on Tx mode to the 144 MHz coaxial cable for PTT purposes
   - S-meter desensibilisation

6- Prime-focus & offset dish gain comparison

7- Offset dish mounting problems

8- IK1GEX 5.7 / 10 GHz double horn
   - S11 and isolation measures between both bands

9- SQG 10 GHz horn
   - Adjusting and S11 measures

10- Visiosat SATTV horn
Abstract 2/2

11- Improvement ideas of actual personal setup

12- Antenna settings of well known french « hyper » dXers

13- Acknowledgements
1- 10 GHz beacons and QSOs with 1W
### French 10 GHz beacon list

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Sponsors</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10368.053</td>
<td>F5XBD</td>
<td></td>
</tr>
<tr>
<td>10368.108</td>
<td>F1XAP</td>
<td></td>
</tr>
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<td>10368.282</td>
<td>F5ZPS</td>
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<td>10368.825</td>
<td>F1XAU</td>
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<td>10368.842</td>
<td>F5ZTR</td>
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</tr>
<tr>
<td>10368.850</td>
<td>F1BDB</td>
<td></td>
</tr>
<tr>
<td>10368.859</td>
<td>F1DLT</td>
<td></td>
</tr>
<tr>
<td>10368.863</td>
<td>F5XAD</td>
<td></td>
</tr>
<tr>
<td>10368.865</td>
<td>F1XAI</td>
<td></td>
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<td>10368.884</td>
<td>F1XAF</td>
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<td>10369.900</td>
<td>F5XAY</td>
<td></td>
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<td>10369.919</td>
<td>F5ZWM</td>
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<td>10368.928</td>
<td>F1URI</td>
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<td>10368.950</td>
<td>F5ZTT</td>
<td></td>
</tr>
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<td>10368.983</td>
<td>F5ZWZ</td>
<td></td>
</tr>
<tr>
<td>10368.994</td>
<td>F5XBG</td>
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</table>

### French 10 GHz beacon list (continued)

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Sponsors</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10368.073</td>
<td>F5BVA</td>
<td></td>
</tr>
<tr>
<td>10368.076</td>
<td>F1LHC</td>
<td></td>
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<td>10368.083</td>
<td>F5BEC</td>
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<td>10368.086</td>
<td>F1MFE</td>
<td></td>
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<tr>
<td>10368.090</td>
<td>F2SF</td>
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<tr>
<td>10368.093</td>
<td>F1BDE</td>
<td></td>
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<tr>
<td>10368.096</td>
<td>F1DLT</td>
<td></td>
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<tr>
<td>10368.100</td>
<td>F2SF</td>
<td></td>
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<tr>
<td>10368.103</td>
<td>F1AAM</td>
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<td>10368.106</td>
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<td></td>
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<tr>
<td>10368.109</td>
<td>F5KKT</td>
<td></td>
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<tr>
<td>10368.112</td>
<td>F5BVA</td>
<td></td>
</tr>
<tr>
<td>10368.115</td>
<td>F6FAT</td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:
- **Constantly**
- **50% time**
- **Occasionally (RS)**

### 10 GHz beacons

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Sponsor</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10368.840</td>
<td>F1XAI + 29 kHz</td>
<td></td>
</tr>
<tr>
<td>10368.862</td>
<td>F1XAI + 29 kHz</td>
<td></td>
</tr>
<tr>
<td>10368.863</td>
<td>F1XAI + 29 kHz</td>
<td></td>
</tr>
<tr>
<td>10368.865</td>
<td>F1XAI + 29 kHz</td>
<td></td>
</tr>
<tr>
<td>10368.883</td>
<td>F1XAI + 29 kHz</td>
<td></td>
</tr>
<tr>
<td>10368.912</td>
<td>F1XAI + 29 kHz</td>
<td></td>
</tr>
</tbody>
</table>

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**F5DQK October 2012**

**Getting started on 10 GHz band -**

**HB9EME/b 10368.866 MHz**

**HB9G/b 10368.855 MHz**
10 GHz rXed beacons from JN18: geographical positions

- Constantly
- 50% time
- Occasionally (RS)

HB9G/b
10368.855 MHz
10 GHz SCPs for RS

RS map from http://home.hccnet.nl/uffe.noucha/weurope.htm

QSO examples with F6DRO or DB6NT via SCP’s

SCP = scatter point
RS = rain scatter (thick thunderstorm cumulonimbus)
Good SCP radius efficiency up to 400 Km
10 GHz SCPs for RS


- RS actualisation from 5 to 10 minutes
- Name of well known towns
- Far more details
- Different zoom scales

Own QTH in memory

Distance & bearing to mouse pointing
10 GHz QSO's

June to August 2008 from JN18gr via tropo & principally RS

1.2W + Procom dish
10 GHz QSO’s

Zoom on QSO’s from JN18gr in dir south of France

1.2W + Procom dish

F5DQQ October 2012

Getting started on 10 GHz band - release 5
10 GHz QSO's

May 25th 2009 RS report from OZ1FF in the DUBUS revue

F2CT: Many and very interesting RS qso's since April with some 25c and records up to 1092 km on 6 and 3 cm. On 24 GHz some untried tests up to 600 km led us to think that long distance qso's are possible with very strong atoms and very high clouds of ion.

Here is the report from Kjeld OZ1FF:

Hello Guy: your prediction in DUBUS 2008 that RS QSOs in the 1000 km range would be reached was right. On May 25 2000 at 07:43z I worked F6APE on 10 GHz RS. IN9TQ over 1090 km from JO0GMO for a new RS world record. The old RS WR was 1080 km and held by AG7/40. The scatter point was located over JO0GMO about 80 km away and could be reached with the help of super reflexion over the North Sea indicated by the reception of PS79NB in JO0GMO. Exchanged reports was 513 in both directions. A sound clip is at: www.oz1ff.du/Pages/News/News.htm

F6APE: reg: D88NT exeter, 69 cm dish/W and here: D88NT xeverst, 65 cm offset dish 25 m AGUSON. The RS/47 tested the early evening making 10 GHz RS QSOs with 4 different F-stations possible (F6APE, F6DQK, F6GCW, F6DJX, F4BUCP, F6ACA, F1HM, F1TVK), F1TVK/P, F1UXP/P, F5PEJ/P). Before ending I worked F6DQG also on 5.7 GHz RS, 804 km and 1. F to UZ on this band. 200 TRX QSOs with an average of 760 km and 5 new squares. Really an exciting day. Now off for the record on 24 GHz (+) Vy 73 de OZ1FF - Kjeld

RS QSOs on 3cm by OZ1FF

Path of the 1999km Rainscatter QSO on 3cm

Reports from F2CT:

5.7 GHz > 500 km, Tropo
May 31st, F2CT/P IN9TPX 1500 m asl, wkld:
- F5ZJPJ/IN3GMO 2km
June 20th, F2CT/P IN93H0 330 m asl, wkld:
- F6DQG/P/IN9350 92km
July 15th, F2CT/P IN29HG 530 m asl, wkld:
- F4CC/PJ/IN3GMO 53km
July 29th, F2CT/P F5A/JWP F6CC/P IN92PX 1600m:
- F5I/XOP IN78/B44km
- F6DQG/P/IN3GMO 94km
- F5I/XOP IN72/T6km
- F4CC/PJ/IN3GMO 18km
- F1JP/N87/IN760km
- F9K/PJ/IN90/58km
August 1st, F2CT/P IN93HG 330 m asl, wkld:
- F4CC/PJ/IN3GMO 53km

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Getting started on 10 GHz band - release 5
Whole 10 GHz overview year 2010 (1W + Procom dish)
10 GHz transverter overview

On 10 GHz, not many hams are manufacturing transverters on industrial scale.

- Before year 1995 the only choice was the 10 GHz SSB-Electronic transverter Kits. The number of total « on shelf » ready assemblies were really limited.

- After year 1997, DB6NT did really democratise the SHF transverter world. Not only on 23 cm but up to 24 GHz and above.

- In 2008 the 3rd generation with a 106.5 MHz self Quarz oscillating LO is replaced by a ocxo (oven oscillator) locked to a 10 or 100 MHz ultra high precision oscillator (eventually also GPS referenced).
2- 10 GHz SSB-Electronic  (1988)

- 2 separate Rx and Tx mixers boxes
- 2.556 GHz separate LO with 106.5 MHz quarz
- Pout > +20 dBm or 100 mW (option 1 = 200 mW)
- Nf<2.5 dB
- Need of 2 coaxial relays on both RF and IF sides
10 GHz SSB-Electronic Transverter

Rx converter scheme
10 GHz SSB-Electronic Transverter

Rx converter layout
10 GHz SSB-Electronic Transverter

Tx converter scheme
10 GHz SSB-Electronic Transverter

Tx converter layout
10 GHz SSB-Electronic Transverter

2.556 GHz XLO-1/01 local oscillator

Option 01 = stability better than 5ppm
10 GHz SSB-Electronic Transverter

A boxed transverter (sold for 290€ in Weinheim)
3a- 10 GHz DB6NT transverter vers 1

- Rx and Tx in « all in one » box
- same 2.556 GHz self oscillating LO with 106.5 MHz quarz
- PTT : only positive Voltage applied on 144 MHz coax
- Pout = +7 dBm or 5 mW

That was my choice
Transverter version 1
(1991)

10 GHz DB6NT Transverter

2.556 GHz
10mW

LO 10.224 GHz

10.368 GHz

144 MHz

10 GHz Transverter

V1: Pout 10 à 15mW, NF=3dB
10 GHz DB6NT Transverter

Transverter version 1 layout

NF = 3 dB

Pout 10 à 15 mW

10.368 GHz resonators

5.112 GHz resonator
10 GHz DB6NT Transverter

Transverter version 1 hardware

2.556 GHz LO in
10 GHz DB6NT Transverter

Outside 2.556 GHz MKU25 LO with 106.5 MHz quartz (x96 multiplier)

Pout = +13 dBm

Buffer

inside v1 transverter
10 GHz DB6NT Transverter

1st alternative to constant LO drift with temperature: JWM Model 2556-ALN phase locked oscillator, with 10 MHz external disciplined LO

2.556 GHz Pout= +17 dBm
Requires a 10 to 12 dB attenuator

I=140 mA

Price 289.95 $ = 197 €

http://www.jwmeng.com/model2556ALN.html
10 GHz DB6NT Transverter

2nd cheaper alternative to constant LO drift with temperature: the 2556 MHz DF9NP phase locked oscillator with 10 MHz internal or external locked LO

Compared with a normal 106.5 MHz PLVCXO, when locked with a 10 MHz OCXO it has a 24 times better stability versus temperature

Either both locking possibilities were tried specifically with this PLL:
- internal TXCO: perfect for portable operation

Or
- external OXCO or GPSDO: perfect for indoor beacon monitoring

Never connect both 10 MHz outputs together!

More infos? Dleupold at t-online.de

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Getting started on 10 GHz band - release 5
10 GHz DB6NT Transverter

DF9NP’s measures with internal TXCO

- Ref: 15 dBm
- Att: 30 dB
- SWT: 2 s
- RBW 1 kHz
- VBW 10 kHz
- Span: 25 kHz
- Center: 2.556 GHz
- Frequency offset: 11 dB
- LVL: dB

Date: 3.OCT.2012 03:18:38
10 GHz DB6NT Transverter

5 to 200 mW first amp
16 dB gain
10 GHz DB6NT Transverter

HEMT Nf=1 dB, gain=24 dB DG1VL preamp

Measured

22.8 / 1.15 dB à 10.37 GHz
10 GHz DB6NT Transverter

DG1VL HEMT preamp, gain=24 dB, Nf=1.3 dB
10 GHz DB6NT Transverter

Principle of my assembly

- **2.556 GHz LO**
- **DB6NT transverter**
- **144 MHz in/out**
- **SMA relay**
- **DC relay**

**Specifications:**
- **Rx**
  - 15 dB
  - 15 mW
  - +12V
- **Tx**
  - 23 dB
  - 200 mW
  - +12V

**Power Levels:**
- **Rx**
  - 1.3W
- **Tx**
  - 1.3W
10 GHz DB6NT Transverter

10 GHz transverter inside view

LO = 2.556 GHz soit (106.5 x 24), P=10 mW

Rx 12V 180 mA, Tx 1.15 A

DB6NT transverter V1, Pout=15 mW

+12V DC relay

+12V TRx relay

DG1VL preamp 23 dB, Nf=1.3 dB

-0.7 dB !!

-0.3 dB

-0.3 dB

-0.3 dB

-0.08 dB

Measured 22.8 / 1.15 dB

0.1Win/1.3Wout 11 dB amp I=0.5A

5mWin/200mWout 15 dB amp

Pin 144 MHz <= 2W

Pout 10 GHz +29.8 dBm or 0.76W

Pout direct +31.02 dBm or 1.26W
10 GHz transverter: how getting 0.5 dB more on Tx

Transverter version 1

-0.18 instead of -0.7 dB
10 GHz DB6NT Transverter

10 GHz transverter : DC and RF measures

Oscillator drift after ½ hour heating compared to F5 XBD/b 77 frequency

<table>
<thead>
<tr>
<th>Température (°C)</th>
<th>10°</th>
<th>15°</th>
<th>20°</th>
<th>25°</th>
<th>30°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift compared to F5XBD/77 frequency (kHz)</td>
<td>?</td>
<td>?</td>
<td>+10</td>
<td>0</td>
<td>-10</td>
</tr>
</tbody>
</table>

$\Delta F = 2 \text{ kHz/°C}$

DC measures with $V=12$V and short DC cables

- Rx 180 mA
- Tx, 1.15A

DC measures after 25M DC of 2x1.5 mm2 cable in tx mode

$\Delta V = -0.52$V

RF measures

Pin 144 MHz $\leq 2$W
Pout before guide transition $+31.02$ dBm or 1.26W
3b- 10 GHz DB6NT transverter vers 2

- Totally indoor 10.224 GHz LO with 106.5 MHz quarz
- PTT : positive voltage on 2M coax and « normal » ground
- External 106.5 MHz LO input for far better stability
- Pout = +23 dBm or 200 mW
NOW: like V1 and
- Pout=200 mW, nF=1.2 dB
- LO totally on same board

Option 1 is:
- 106.5 MHz external ocxo fitting a subsidiary SMA connector
10 GHz DB6NT Transverter

Transverter version 2 hardware

106.5 MHz separate ocxo

LO feeding
10 GHz DB6NT Transverter

Transverter version 2: optional 106.5 MHz 60°C ocxo schematic (Eisch-Kafka)
3c- 10 GHz DB6NT transverter vers 3

- LO=106.5 MHz ocxo at 40°C
- External 10 MHz ref input for rock stability (ocxo, rubidium or GPS)
- Rx Nf improvement
10 GHz DB6NT Transverter

Transverter version 3 (2007)

NOW: like V2 and
- 106.5 MHz with internal PLL
- LO with internal oven
- Ext 10 MHz ref input for frequency stability like the GPS

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Getting started on 10 GHz band - release 5
4- 10 GHz indoor & outdoor tryings
10 GHz DB6NT Transverter

First RS tryings with open window in the shack room

- Alu fixation tube for definitive 3 to 5° elevation
- DC bias-tee for 1st Tx tries
- 25M DC wire for ∆V measures before future mast allocation
10 GHz DB6NT Transverter

Transverter DC pinning

![Diagram of DB6NT Transverter DC pinning](image)
10 GHz DB6NT Transverter

Summer configuration « complement »
10 GHz DB6NT Transverter

Zoom on 10 GHz ensemble

Procom Φ48 cm prime-focus dish
F/D=0.4
F=19.2 cm
Gain 27 dBi (37 dBi at 24 GHz)

Optional 3 to 5° elevation for
RS clouds at distance < 50 Km
10 GHz DB6NT Transverter

Procom dish: grasshopper breeding inside its waveguide!

Beautiful attenuator in the whole guide length between Penny-feed and coax transition!
10 GHz DB6NT Transverter

Procom dish : Penny-feed protection with plumber special teflon

Pictures made by F6ETI

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5- FT-817nd mods for Tx purposes

Best TRx choice because fully compatible with the tranverter options of:
- the Ham Radio Deluxe logbook
- FT-817 commander (also from HB9DRV)

Target: positive voltage in the 144 MHz coaxial while tXing
FT-817nd mods with +12V in coax while tXing

FT-817nd mod for DC addition in coax while Txing (upper side) or « reversal PPT »

DB6NT transverters need +V in coax cable for switching in Tx mode !!

BNC socket

4.7 kΩ

1 nF serial cap
FT-817nd mods with +12V in coax while tXing

FT-817nd desensibilisation procedure

With only noise, the S-meter drops down from S8 to S1 to the 144 MHz Rx

-TX OFF
- appuyer simultanément sur A, B et C et conserver les 3 BP enfoncés
- mettre en marche le 817 envoie une série de bips et passe en mode config
- sélecteur à gauche pour faire défiler les menus
- choisir menu 5 VHF RXG (gain Réception en VHF) valeur initiale=128
- descendre à la valeur 56 S1 de QRM ce qui ne saturera plus le FT-817nd
- presser le bouton F pendant plus d’une seconde

Attenuation reached after decreasing S8 to S1 in the 144 MHz IF line : roughly 14 dB
FT-817nd automatic CW associated to MixW2 : configuration

FT-817nd mods with +12V in coax while tXing

FT-817nd en mode USB
6- 10 GHz prime / offset dish comparison
Prime-focus and offset dish comparison

Gain comparison of prime-focus and offset dishes

<table>
<thead>
<tr>
<th>Dish</th>
<th>Height (cm)</th>
<th>Width (cm)</th>
<th>Depth (cm)</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procom Prime-focus</td>
<td>49</td>
<td>49</td>
<td>na</td>
<td>32 calculated</td>
</tr>
<tr>
<td>Worldsat offset</td>
<td>80</td>
<td>73</td>
<td>6.4</td>
<td>36.1</td>
</tr>
<tr>
<td>Echostar offset</td>
<td>131</td>
<td>121</td>
<td>11.5</td>
<td>40.5</td>
</tr>
</tbody>
</table>

At same dims <100 cm, the offset gives far better results

That’s the best way to both improve Rx and Tx by a minimum of 3 to 4 dB
7- Offset mounting problems

Target: vertical inclination down to 0° (not used in SATTV)
Solving offset dishes $0^\circ$ elevation

1- The normal way (with much chance)
- Initial dish adjust angle setting down to $0^\circ$
- Slim dish mounting at its lower part

Roughly 26° / vert
Or 64° / hor

Optex $\Phi 75$ cm

Weight 4.5 Kg

0° setting possibility

Inclinometer 0.1° accuracy

5.7 GHz feed

Enough space for angle adjust

Optex $\Phi 75$ cm

Weight 4.5 Kg

0° setting possibility

Inclinometer 0.1° accuracy

5.7 GHz feed

Enough space for angle adjust
Solving offset dishes 0° elevation

2- Intermediate arm with angle

- Initial dish adjust angle only down to 10°
- Thicker dish mounting at its lower part

Worldsat Φ75 cm

5.7 / 10 GHz IK1GEX feed

Add arms for better rigidity

Roughly 58° / vert

Roughly 26° / vert

No place enough for angle adjust if directly fixed on the vertical mast

Weight 5.2 Kg

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Getting started on 10 GHz band - release 5
Solving offset dishes 0° elevation

3- Dish returning: the only way to reach the 0° tilt angle

- Initial dish adjust angle only down to 10°
- Dish mounting too thick at its lower part

Intermediate tube (not needed if the dish is alone)

Mounting bracket not returned

No place enough for tilt adjust

5.7 GHz feed

Weight 8 Kg

Tonna Φ90 cm

Roughly 26° / vert
8- 10 and 5.7 GHz IK1GEX double horn
IK1GEX 5.7 & 10 GHz double Horn

Double 5.7 and 10.4 GHz horn

10 GHz input

5.7 GHz input

Φ45
IK1GEX 5.7 & 10 GHz double Horn

S11 specs on both bands given by IK1GEX

Optimized for dishes with $0.55 < F/D < 0.75$ (principally offset designs)
NB: prime-focus dishes have $0.3 < F/D < 0.55$

5.7 GHz

10.4 GHz
IK1GEX 5.7 & 10 GHz double Horn

S11 measured here on both bands

Good bandwidth > 400 MHz at –10 dB
Sharp bandwidth < 200 MHz at –10 dB

Scalar analyser HP 8757a + sweep HP 8350b 10 MHz – 20 GHz
IK1GEX 5.7 & 10 GHz double Horn

10 to 5.7 GHz isolation

5.7 to 10 GHz isolation

Target: double 5.7 & 10 GHz feeding on one same 80 cm offset dish

Cure: far better isolation must be done on the 5.7 GHz Rx part

NB: in opposite side of a coax cable, the guide acts like a HIGHPASS filter !!

10 GHz feeding – measures on 5.7 GHz SMA input

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IK1GEX 5.7 & 10 GHz double Horn

Compromise of different phase center positions on each band

-Dixit F6DRO, the gain on each band cannot be optimised because the phasing center on every band is at 2 different locations.
-So a monoband horn has more the preference
-Discussion to be continued
9- 10 GHz SQG horn

Absolutely perfect for offset dishes

Max yield for offset dishes with f/d = 0.85
SQG 10 GHz Horn

Horn preparing
- Taking off the teflon surplus inside the cavity
- SMA pin cutting → 6.2 to 7 mm useful radiating part

- OZ8AFC Palle from Silverfox Technology Danemark sells it with the reference 10 GHz feedhorn for offset dish
- F4DRU did make the last grouped order

No central fixing part here
SQG 10 GHz Horn

S11 measures

S11 > 20 dB on 1 GHz bandwidth!
10- Visiosat SATTV horn

For comparison with the precedent horns
Visiosat SATTV Horn

S11 measures

S11 > 10 dB on 4 GHz bandwidth!
11- Improvement ideas
Improvement ideas of my setup

- **Better antenna yield**: substitution of the 48 cm prime-focus by a 80 cm offset dish (especially for tropo conditions) → directly better yield of 3 to 4 dB for both Rx & Tx modes

- **Better LO stabilisation**: substitution of the 2.556 GHz LO with a high stability OCXO, rubidium or GPS reference

- **Output amplifier**: Pout increase up to 3 - 5 Watts output

Max error expected on a 10.224 GHz LO 0.2 x 96 = 19.2 Hz

*No more temperature depending*
12- 10 GHz setup of some french dXers

Also great thanks to all of them for their given help
F4DRU/p setup

10 GHz/6W on Φ85 offset
F4AJS/p setup
F1BZG/45 setup

- 1296Mhz 4x35
- 50Mhz 5 élts
- 432Mhz 4x19
- 5.7Ghz 1M offset
- 10Ghz 1M Grégorienne
- 144Mhz 2x9 Grand espacement
HB9AFO/p setup
F5HRY setup

- 50 MHz DXSR 3 élts
- 1296 MHz F9FT 4 x 23 élts
- 432 MHz F9FT 9 élts
- 2300 MHz Wimo 2 x 40 élts 60W
- 5.7 GHz Prime focus Φ 70 9W
- 144 MHz 10 élts
- 24 GHz Andrew Φ 33 0.5W
- 10 GHz offset Φ 75 12W
F6APE setup

10 GHz Prime focus Φ 60
3 W
F8BRK setup

- Sequencer
- TRx relay
- DB6NT preamp
- 3 W out
- DB6NT 2W amp
- 8 W
  10 GHz Prime focus Φ 85
- 5.7 GHz Prime focus Φ 150
F2CT/p setup
F6ETI setup

5.7 / 10 GHz IK1GEX feed on prime focus Φ 90
F4BUC & F1PDX/p setup

Φ 74 offset on intermediate angle arm (slide 49)

Large home-made tripod
ON5TA setup

- 10 GHz Φ 70
- 2.3 & 5.7 GHz Φ 80
- Counterweight
- DD7MH double feed
- SQG feed
- 144 MHz feed
- OCXO locking
- 12V DC feed
DF6NA setup

25W amplifier
EGIS positioner
Guide feed
25W PA
DL7QY setup

The setup includes antennas for different frequency bands:
- 24GHz
- 76GHz
- 47GHz
- 23, 13, 9, 6cm
- 70cm
- 2m
- 6m

This setup is likely for high-frequency radio communications, possibly for amateur radio or specialized applications.
13- Acknowledgements

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