Getting started on **Ö**GHz

Release 5

F5DQK October 2012

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 <u>only 1W</u> !!! -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 comparaison

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- Aknowledgements

1-10 GHz beacons and QSOs with 1W

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10 GHz beacons

French	10 GF	lz beaco	on lis	t <u>La Crau</u>		<u>F6BVA</u>	Puissance : 1000 Watts PIRE Antenne : Parabole Orientation : Nord Ouest	
10368.053	F5XBD	JN18JS	77	<u>Favières</u>	10368	.073 MH	ssance : 60 Watts enne : Fentes	
10368.108	F1XAP	<u>IN88HL</u>	22	<u>Plougonver</u>	326	F1LHC	Puissance : 10 Watts Antenne : Fentes	Constantly
10368.282	F5ZPS	<u>IN94QT</u>	33	Talence	83	F6CBC	Puissance : 20/800 Watts Antenne : Cornet Orientation : Nord Est / Sud Est	50% time
10368.825	F1XAU	<u>JN271H</u>	21	Sombernon	516	F1MPE	Puissance : 13 Watts Antenne : Fentes	Occasionally (PS)
10368.842	F5ZTR	<u>IN09VVI</u>	60	Beauvais	10368	.840 MH	[z - 325° ₅s →1	0368.836 MHz
10368.850	F1BDB	<u>JN33KQ</u>	06	<u>Doublier</u>	1200	F1BDB	8 nov de retour	
10368.859	F1DLT	<u>JN27UR</u>	70	La Roche		<u>F1DLT</u>	Puissance : 15 Watts Antenne : Cornet Orientation : Nord Ouest	
10368.863	F5XAD	JN12LL	66	Pic Neulos	1100	F2SF	Puissance : 2 Watts Antenne : Fentes	
10368.865	<u>F1XAI</u>	JN07VVV	45	Orléans	10368	.862 MH	z - 207° ^{Watts}	-
10368.884	F1XAE	JN24PE	84	Mont Ventoux	1910	F1AAM	Puissance : 5 Watts	
10369.900	F5XAY	JN06wd	23	XXXXX	888 01	1 892 MF	Hz - 199° piaule =F1Σ	KAI + 29 kHz
10369.919	F5ZWM	JN05VE	19	Sainte Fortunade	10368	.883 MH	z - 188° coupure porteus	se
10368.928	<u>F1URI</u>	JN35FU	73	<u>via Mont Blanc</u>	1660	F1URI	Puissance : 2200 Watts Antenne : Parabole Orientation : >JN35KT	
10368.950	F5ZTT	JN14EB	81	Lacapelle	10368	.948 MH	Ssance : 10 Watts Zenne : Fentes	
10368.983	F5ZWZ	JN23XE	83	Grand Cap	780	<u>F6BVA</u>	Puissance : 10 Watts Antenne : Fentes En cours de réalisation	
10368.994	F5XBG	<u>JN26KT</u>	71	<u>Chalon</u>		F6FAT	Puissance : 5 Watts Antenne : Fentes	

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HB9EME/b 10368.866 MHz

Getting started on 10 GHz band - HB9G/b 10368.855 MHz



10 GHz SCPs for RS



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10 GHz SCPs for RS

<u>New :</u> RS map from http://tk5ep.free.fr/rsmap/rsmap.php



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10 GHz QSO's



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10 GHz QSO's



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10 GHz QSO's

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



Path of the 1099km Rainscatter QSO on 3cm

F2CT: Many and very interesting RS qsos since April with some Dx and records up to 1093 km on 6 and 3 cm. On 24 GHz some unilateral tests up to 600 km let us to think that long distance qsos are possible with very strong storms and very high clouds of ice.

Here is the report from Kjeld OZ1FF:

Hello Guy, your prediction in DUBUS 2/2009 that RS QSOs in the 1000 km range would be reached was right. On May 25 2009 at 07:43z I worked F6APE on 10 GHz RS, IN97QI over 1099 km from JO45BO for a new RS world record. The old RS WR was 1008 km and held by AF1T/W4DEX. The scatter point was located over JN09 about 800 km away and could be reached with the help of super refraction over the North Sea indicated by the reception of PI7EHG/B in JO22HC. Exchanged reports was 51S in both directions. A sound clip is at: www.oz1ff.dk/Pages/News/News.htm. F6APE rig: DB6NT xverter, 60 cm dish/6 W and here: DB6NT xverter, 65 cm offset dish 25 m ASL/3,5W. The RS/TR lasted until the early evening making 10 GHz RS QSOs with 10 different F-stations possible (F6APE, F6DKW, F6DWG, F5DQK, F4BUC/P, F6ACA, F1ISM, F1PYR/P, F1NXP/P, F5PEJ/P). Before ending I worked F6DWG also on 5,7 GHz RS, 804 km and 1. F to OZ on this band, 20 TR/RS OSOs with an average of 750 km and 6 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

Reports from F2CT:

5,7 GHz > 600 km, Tropo May 31st, F2CT/P IN92PX 1600 m asl, wkd: - F9ZG/P/JN36/652 km June 20th, F2CT/P IN93HG 930 m asl, wkd: F6DWG/P/JN19/729 km July 16th, F2CT/P IN93HG 930 m asl, wkd: F4CKC/P/JN26/653 km July 26th F2CT/P F6AJW/P F6CBC/P IN92PX 1600m: F5LWX/P/IN78/644 km F6DWG/P/JN19/744km F5IGK/JN09/727km F4CKC/P/JN19/715km F1JGP/JN17/600km F6KPL/IN99/738km August 1st F2CT/P IN93HG 930 m asl, wkd: F4CKC/P/JN27/635 km

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Whole 10 GHz owerview year 2010 (1W + Procom dish)

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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

Rx converter scheme



Rx converter layout





Tx converter scheme



Tx converter layout





2.556 GHz XLO-1/01 local oscillator



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A boxed transverter (sold for 290€ in Weinheim)



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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



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Transverter version 1 hardware



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



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



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



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

<u>Or</u>

- 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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DF9NP's meases with internal TXCO



Date: 3.0CT.2012 03:18:38

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



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Principle of my assembly





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10 GHz transverter : DC and RF measures

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

Température (°C)	10°	15°	20°	25°	30°
Drift compared to F5XBD/77 frequency (kHz)	?	?	+10	0	-10

DC measures with V=12V and short DC cables

- Rx 180 mA

 $\Delta F = 2 \text{ kHz/}^{\circ}C$

- Tx, 1.15A

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

 $\Delta V = -0.52V$

RF measures

Pin 144 MHz <= 2W Pout before guide transition +31.02 dBm or 1.26W

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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





The voltage and power data, are measured voluce of the prototypes. The data can differ which due to component tolerances.

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Transverter version 2 hardware





Transverter version 2 : optional 106.5 MHz 60°C ocxo schematic (Eisch-Kafka)

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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



4-10 GHz indoor & outdoor tryings

First RS tryings with open window in the shack room



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Transverter DC pinning



Summer configuration « complement »



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Zoom on 10 GHz ensemble





Procom dish : Penny-feed protection with plumber special teflon



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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 <u>« reversal PPT</u> »



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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 \rightarrow 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 \rightarrow 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 mods with +12V in coax while tXing

FT-817nd automatic CW associated to MixW2 : configuration

F5DQK - Current log: MixW2.log - MixW												
QSO	Mode	Freq	Date	UTC	Call	Name	QTH	RST_Sent	RST_Recv	Notes		
31	RTTY	14078,900	21/02/07	18:21:40	IR7ANT	xxx		599	599	P		
32	BTTY	10141,648	23/02/07	10:38:57	DM5JL	0		599	599			
33	RTTY	50253,708	10/09/07	17:08:14	9A5CW			599	599			
34	CW	144105,23	23/1 💥 PTT	& CAT			×	599	599			
66°		 Faster I44105 I44105 	CAT Mode PTT [CC Sa I Sa I PT CV I CV I CV	YAESL I FT-817 & CAT Inte IM2 (38400 Ve frequen T via CAT / via CAT o / via CAT o / out <u>v</u> ia so / out <u>v</u> ia so	rface rface Detail cy on exit command undcard of FSK LSB 2210 for tuning Sensitivi	Is Disabled Diay zero beat frequence Cat correction (Hz) Global 0 USB 0 LSB 0 LSB 0 Digi 0 IX to RX: 0 ty, Hz/tick 500	y 39 . USB	FT-817nd en	ceny X 10 2/11 6 1 m 4 mode U	SB		

6-10 GHz prime / offset dish comparaison

Prime-focus and offset dish comparaison

Dish	Heigth (cm)	Width (cm)	Depth (cm)	Gain (dB)
Procom Prime-focus	49	49	na	32 calculated
Worldsat offset	80	73	6.4	36.1
Echostar offset	131	121	11.5	40.5

Gain comparaison of prime-focus and offset dishes

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

F1PDX home made tripod

Target : vertical inclination down to 0^{\circ} (not used in SATTV)



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Solving offset dishes 0° elevation



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Solving offset dishes 0° elevation



Solving offset dishes 0° elevation



8-10 and 5.7 GHz IK1GEX double horn

Double 5.7 and 10.4 GHz horn



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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





S11 measured here on both bands



Scalar analyser HP 8757a + sweep HP 8350b 10 MHz – 20 GHz

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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 !!



65 In GHz feeding – measures on 5.7 GHz SMA input 65 Getting started on 10 GHz band - release 5

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

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SQG 10 GHz Horn

Horn preparing

- Taking off the teflon surplus inside the cavity - SMA pin cutting $\rightarrow 6.2$ 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



SQG 10 GHz Horn



10- Visiosat SATTV horn

For comparaison with the precedent horns

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Visiosat SATTV Horn S11 measures CHI: A/R - 49.74 dB CH2: B/R - 13.89 dB 10.048/ REF - .00 dB 10.048/ REF + .00 dB **C** CRSR - 13.89 dB +10.350GHz CURSORA ON/OFF REF 12 CURSO MAX 1 CURSOR MIN 1 S11>10 dB on 4 GHz bandwidth ! CURSOR MIN 2 CRSR +10.350GHz STOP +14.000GHz STRT +9.0000GHz IM

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11- Improvement ideas
Improvement ideas of my setup

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

-<u>Better LO stabilisation</u> : 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



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12-10 GHz setup of some french dXers

Also great thanks to all of them for their given help

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F4DRU/p setup



F4AJS/p setup



F1BZG/45 setup



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HB9AFO/p setup



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F5HRY setup



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F6APE setup



F8BRK setup



F2CT/p setup



F6ETI setup



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F4BUC & F1PDX/p setup



ON5TA setup



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DF6NA setup



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DL7QY setup



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13- Aknowledgements

To the whole french « hyper ham » world, also to DD7PC and especially F1PDX for his great help.

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