

QO-100

Presentation

FRARS Hamfest

11/Aug/2019

A satellite with large solar panels is shown in orbit above the Earth's surface. The satellite is positioned diagonally across the frame, with its solar panels extending outwards. The Earth's blue and white surface is visible in the background, and the blackness of space is at the top.

All you need to know to get going on Qatar Oscar 100 geo-satellite

Presented By:

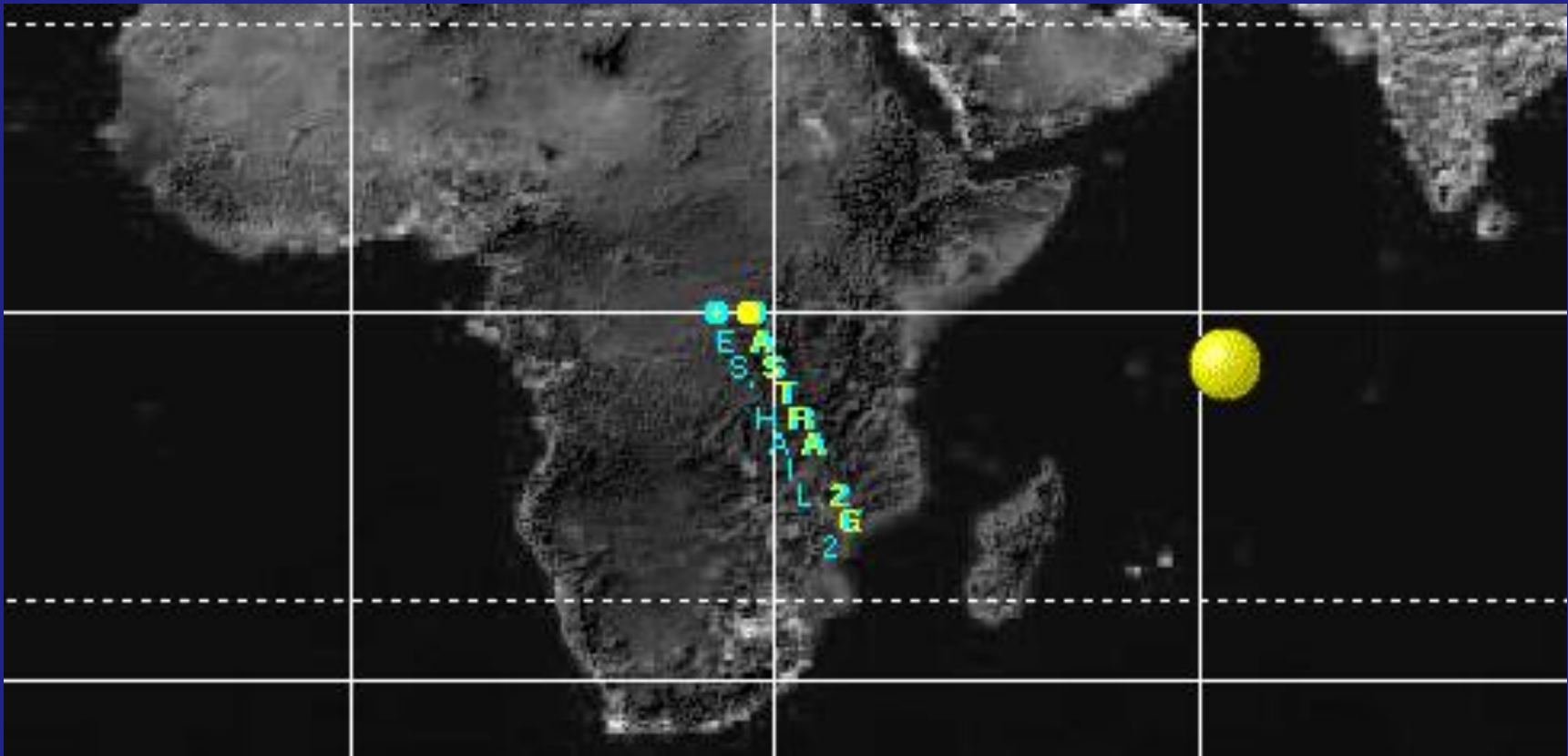
Paul MOEYT

What is QO100

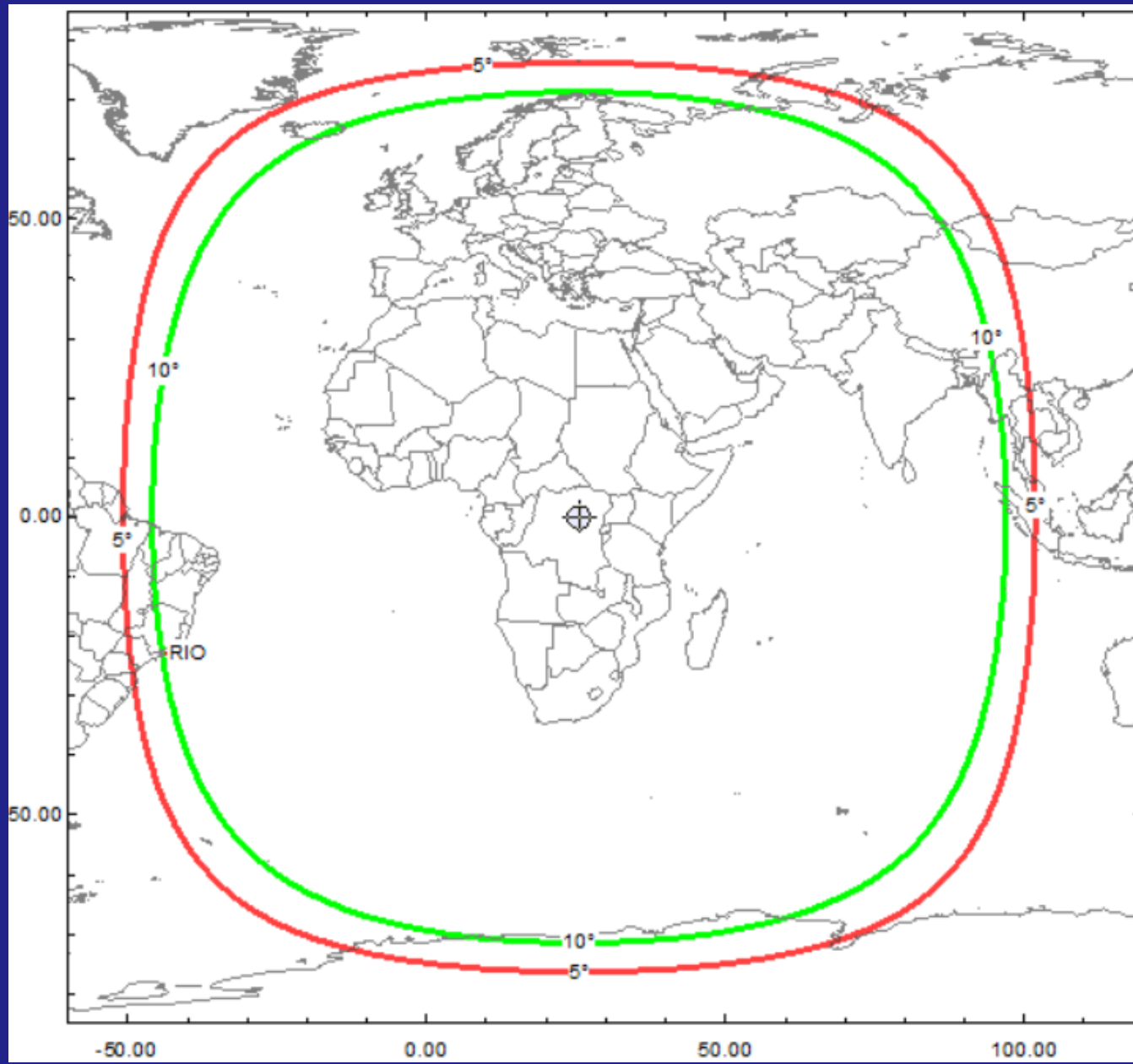
- Qatar / Oscar 100 - Es'hail-2 is a geostationary satellite much like Astra used for Sky satellite TV
- Amateur payload built by Mitsubishi Electric CO with input from QARS + Amsat-DL
- Narrow transponder is 250KHz wide (800KHz)
- Wideband transponder is 8MHz wide
- Basically a bent-pipe repeater that covers 1/3 of Earth, up on 2.4GHz, down on 10GHz

Where is QO100

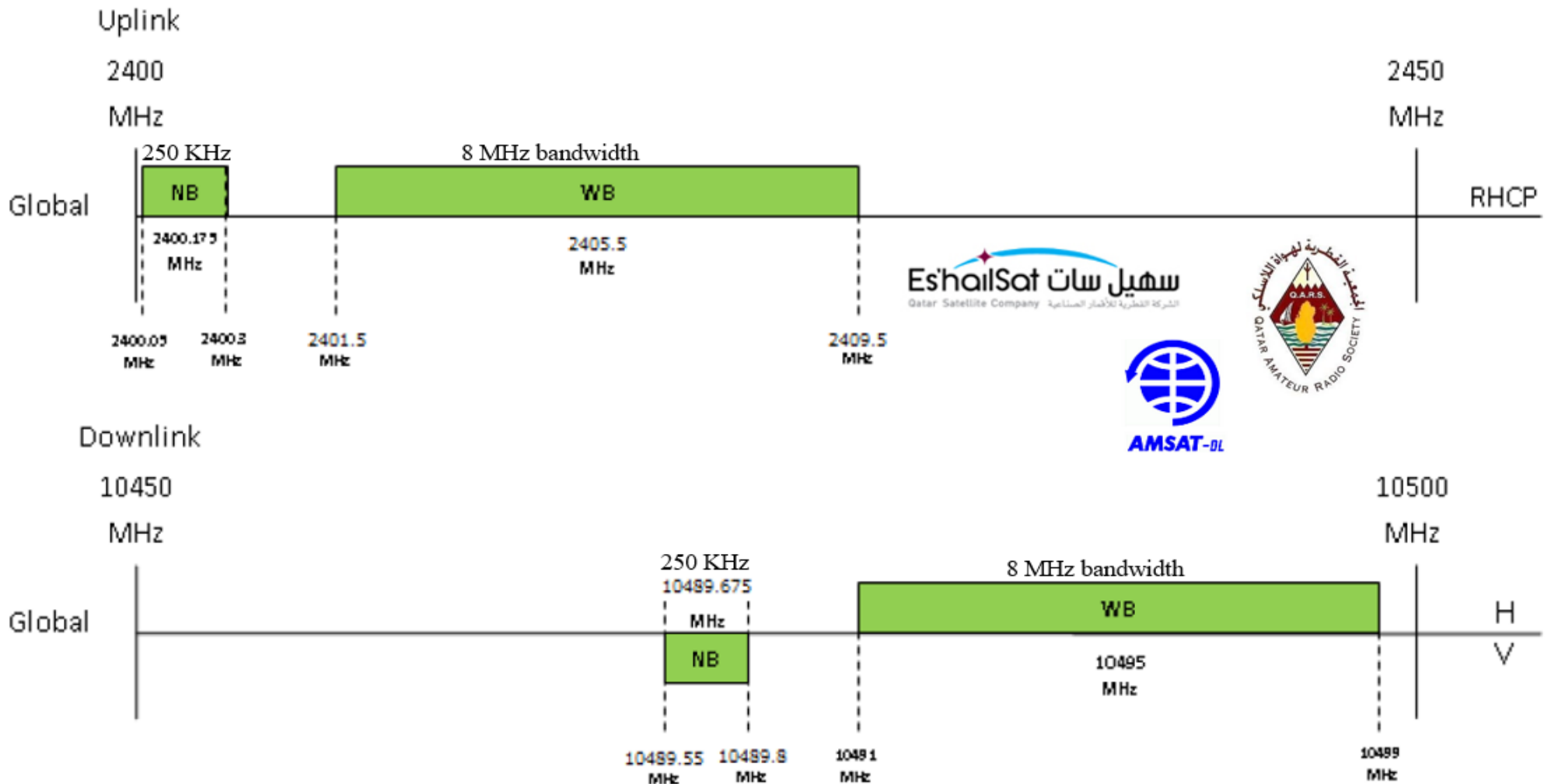
- Es'hail-2 is located at 25.9 east only a couple of degrees away from where a standard Sky-TV dish points, 38945Km away from us in the UK



What is the coverage

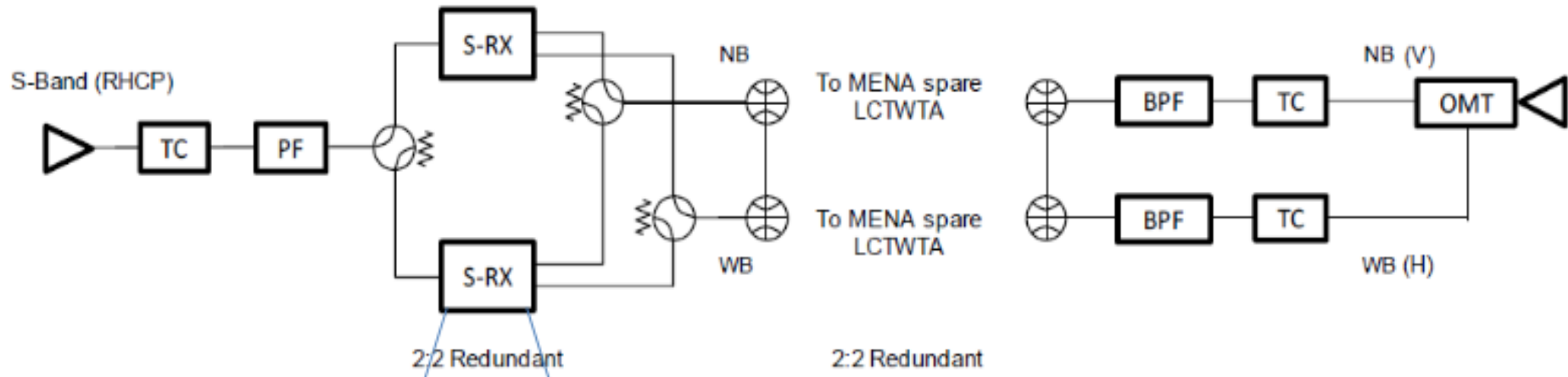


Frequencies / Band Plan

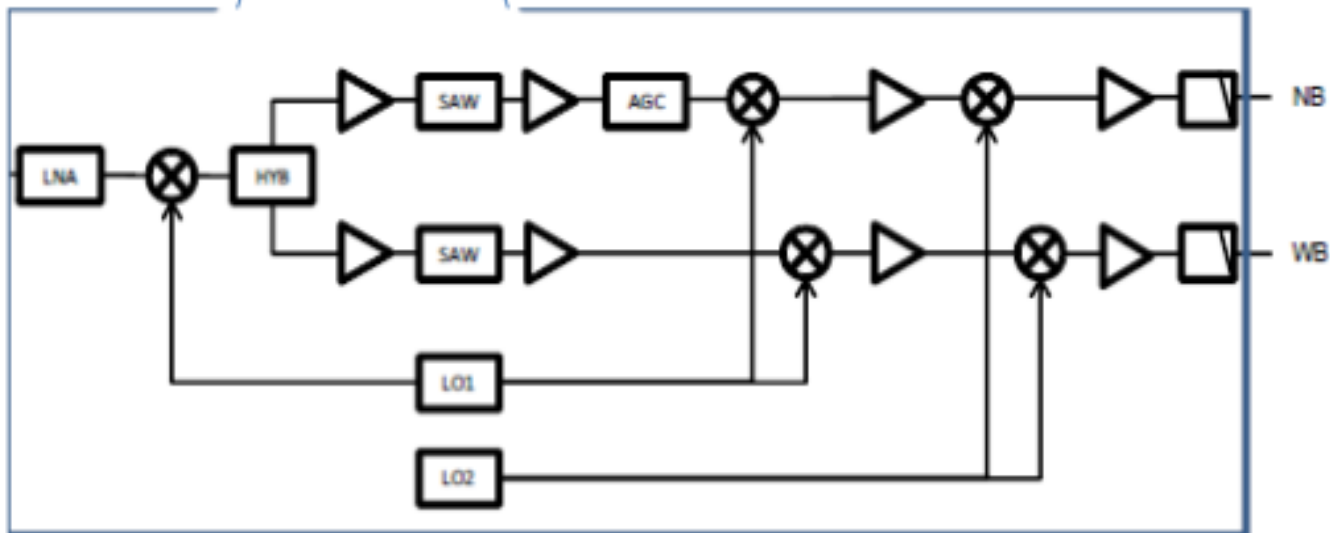


Xpdr	U/L FREQUENCY (MHz)				D/L FREQUENCY (MHz)				LO (MHz)	BW (MHz)
	No	Pol	Begin	Center	End	Pol	Begin	Center		
NB	RHCP	2400.05	2400.175	2400.3	V	10489.55	10489.675	10489.8	8089.5	0.25
WB	RHCP	2401.5	2405.5	2409.5	H	10491	10495	10499	8089.5	8

What is the transponder

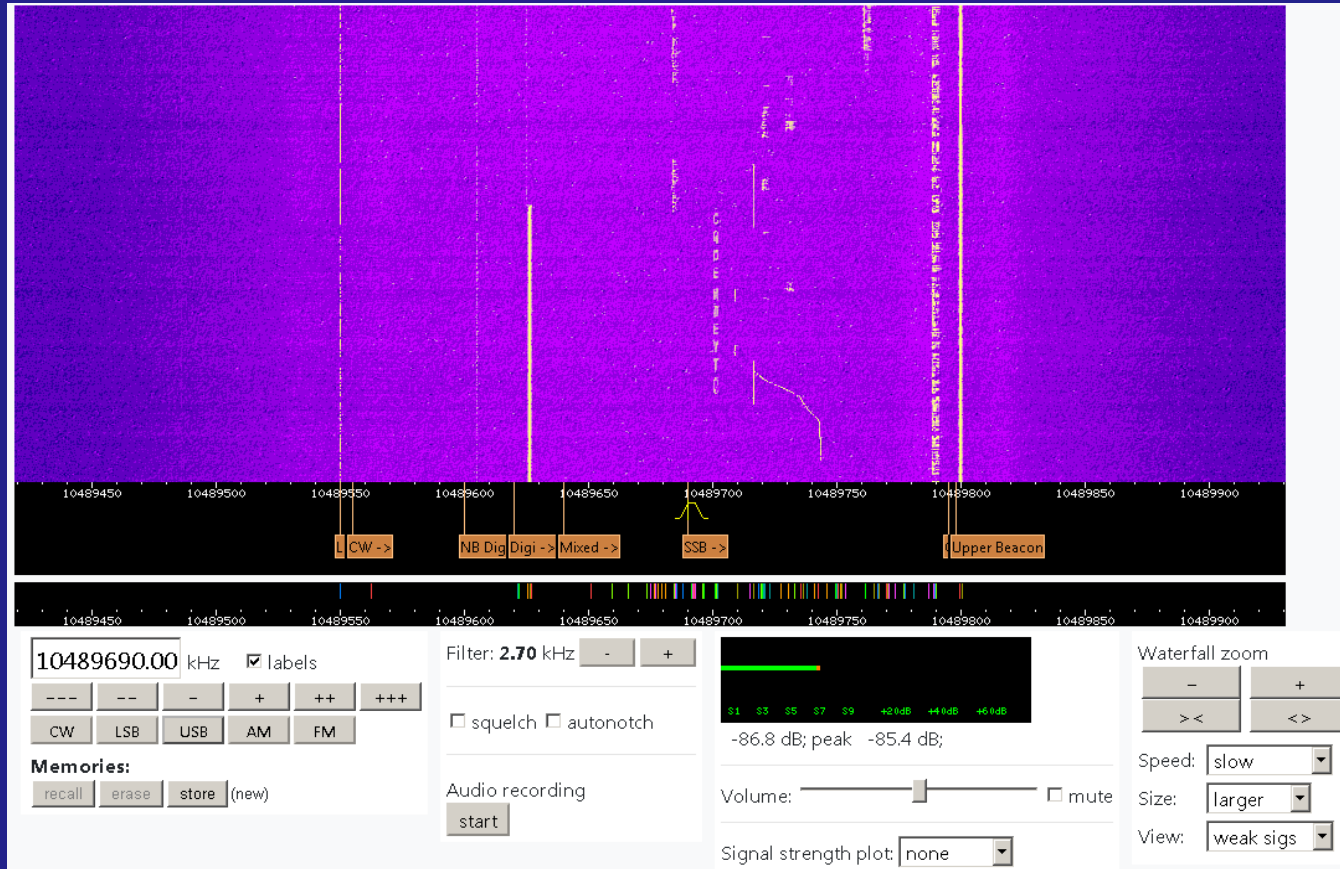


AMSAT Payload Block Diagram



How do you RX it

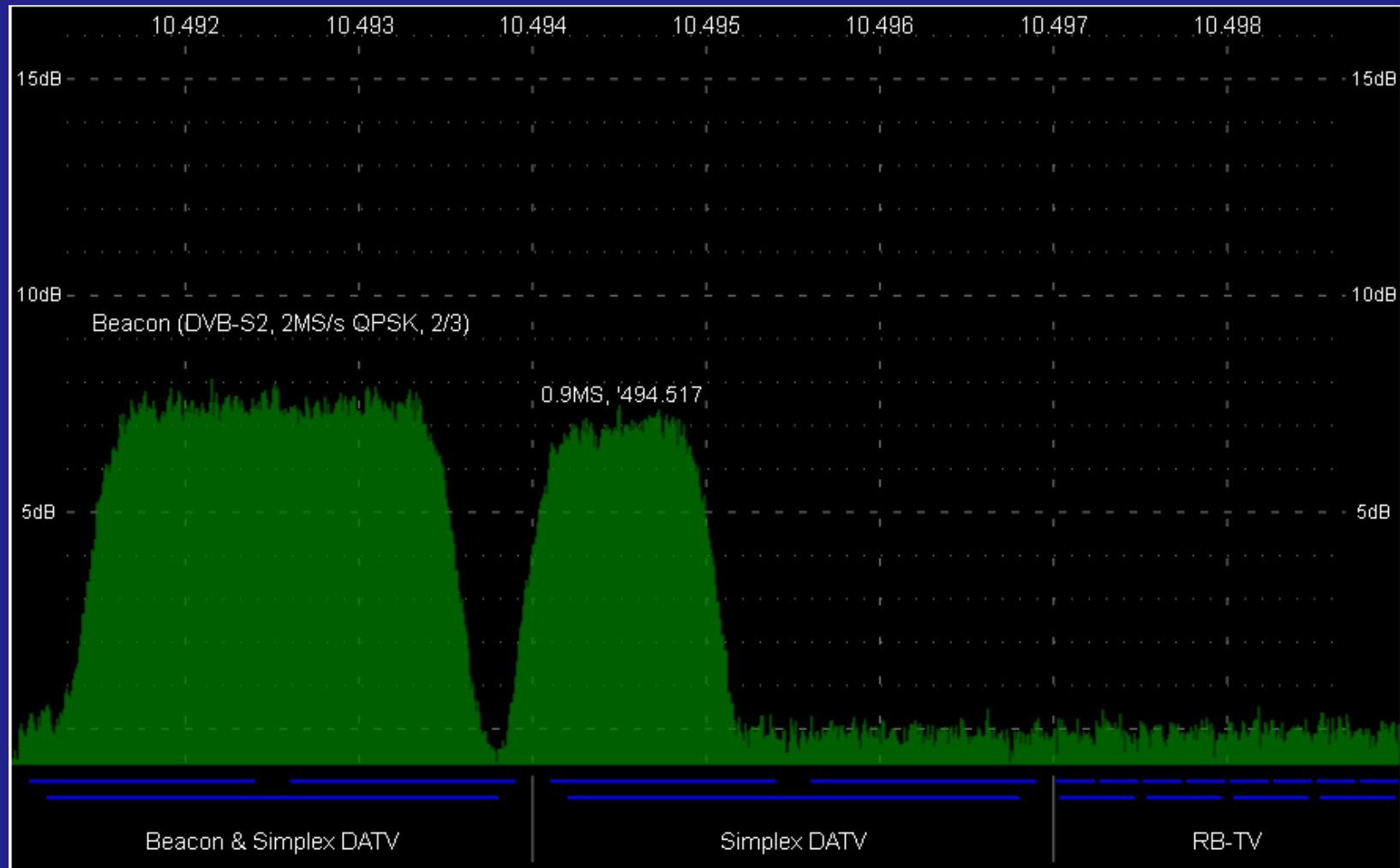
- Use the Goonhilly Down Web SDR narrow band



<https://eshail.batc.org.uk/nb/>

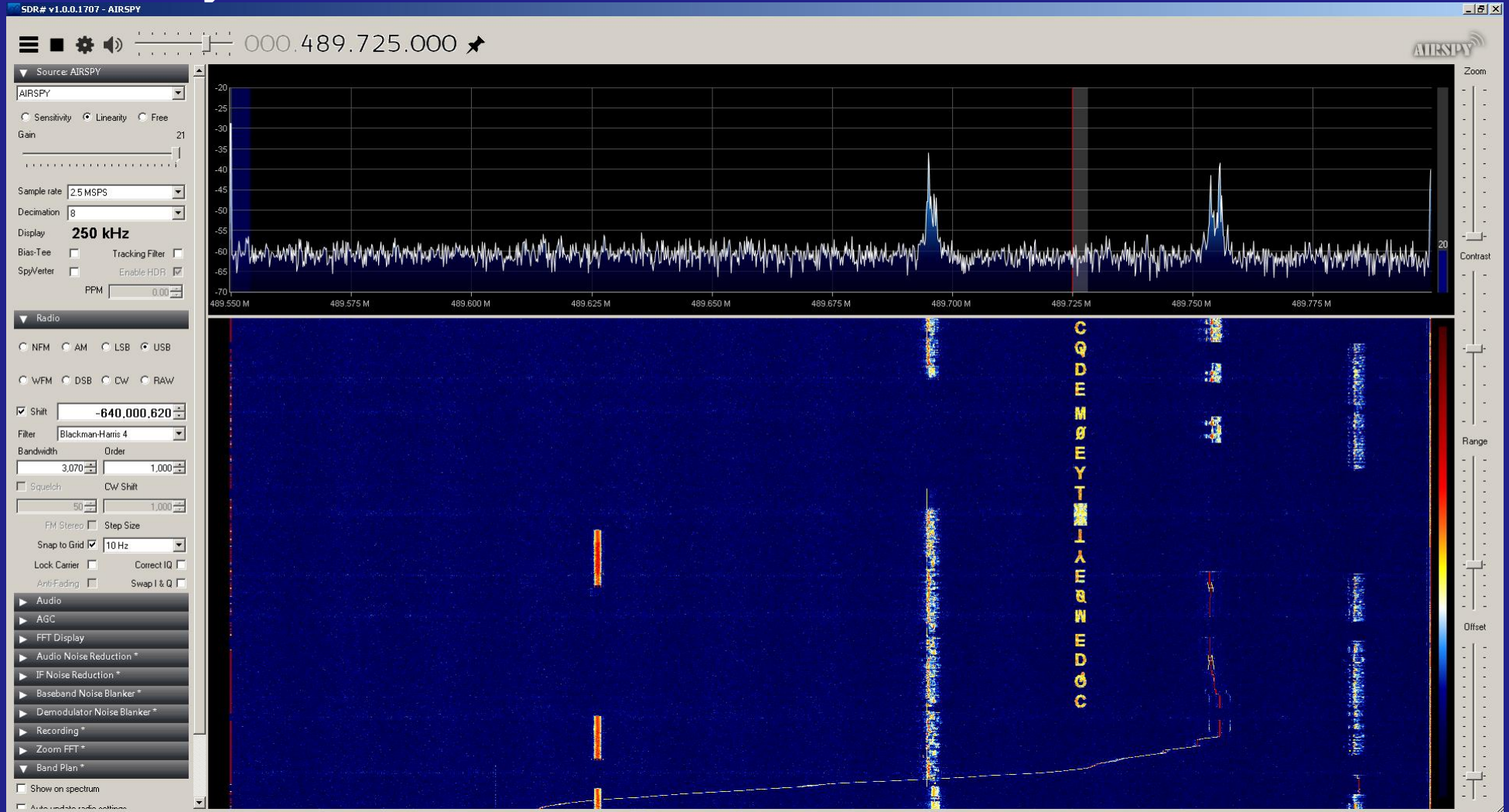
How do you RX it

- Use the Goonhilly Down Web SDR wide band



What equipment do you need to RX it

- Use your own RX, dish and LNB;



What equipment do you need to RX it

- Standard 80cm dish will give excellent RX!



What equipment do you need to RX it

- A modern LNB (without frontend filter)

(Use a 'PLL' LNB which is more stable than the typical DRO TV LNB)

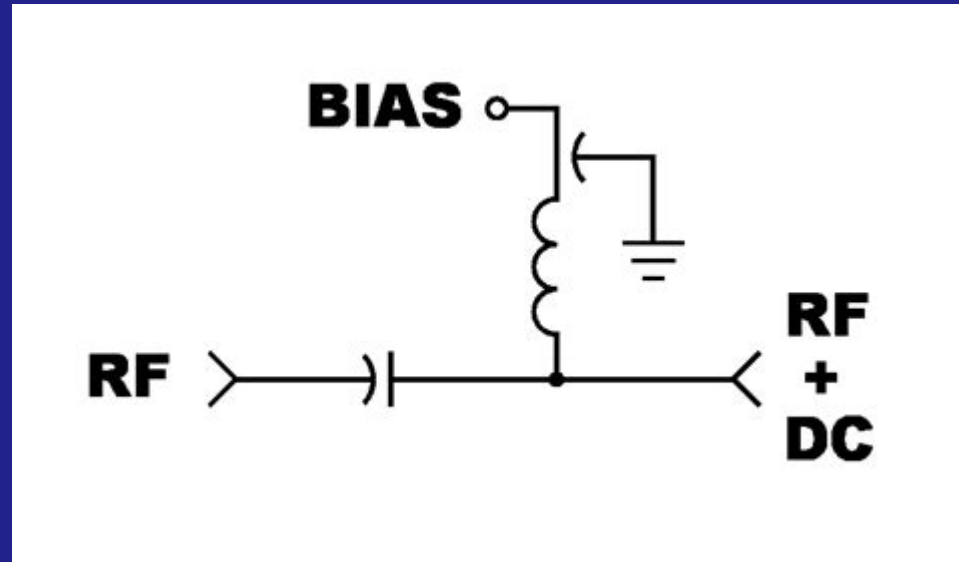


What equipment do you need to RX it

- LNB stability:
 - Use a PLL LNB instead of a DRO LNB
 - Lock the reference crystal (25/27 MHz) to 10 MHz frequency reference (GPS, Rubidium or TCXO)
 - Not needed for DATV
 - You can use software frequency correction if you are brave!

What equipment do you need to RX it

- a DC power inserter



- 10-14V = vertical polarisation (narrow band)
- 15V+ = horizontal polarisation (wide band)
- 22KHz = Low/High band (LO 9750 / 10600mhz)

What equipment do you need to RX it

- A Receiver:
 - RTL-SDR, RSP, Airspy, HackRF, any SDR covering 600MHz-1.5GHz + suitable software
 - 2M / 70cm transceiver
 - Additional IF down converter (739MHz > 2M / 70cm)
 - A ready out of the box solution DB6NT (not recommended)

What equipment do you need to RX it

- Receive IF frequency calculation:
 - NB transponder CW beacon 10489.550 MHz
Vertical polarisation
 - $10489.550 \text{ MHz} - \text{standard LNB LO } 9750 \text{ MHz} = 739.550 \text{ MHz IF (25MHz xtal)}$
 - $10489.550 \text{ MHz} - \text{LNB LO } 9360 \text{ MHz} = 1129.550 \text{ MHz IF (24MHz xtal)}$
 - 10V-14V LNB power for vertical polarisation, 22 KHz off

Remember;

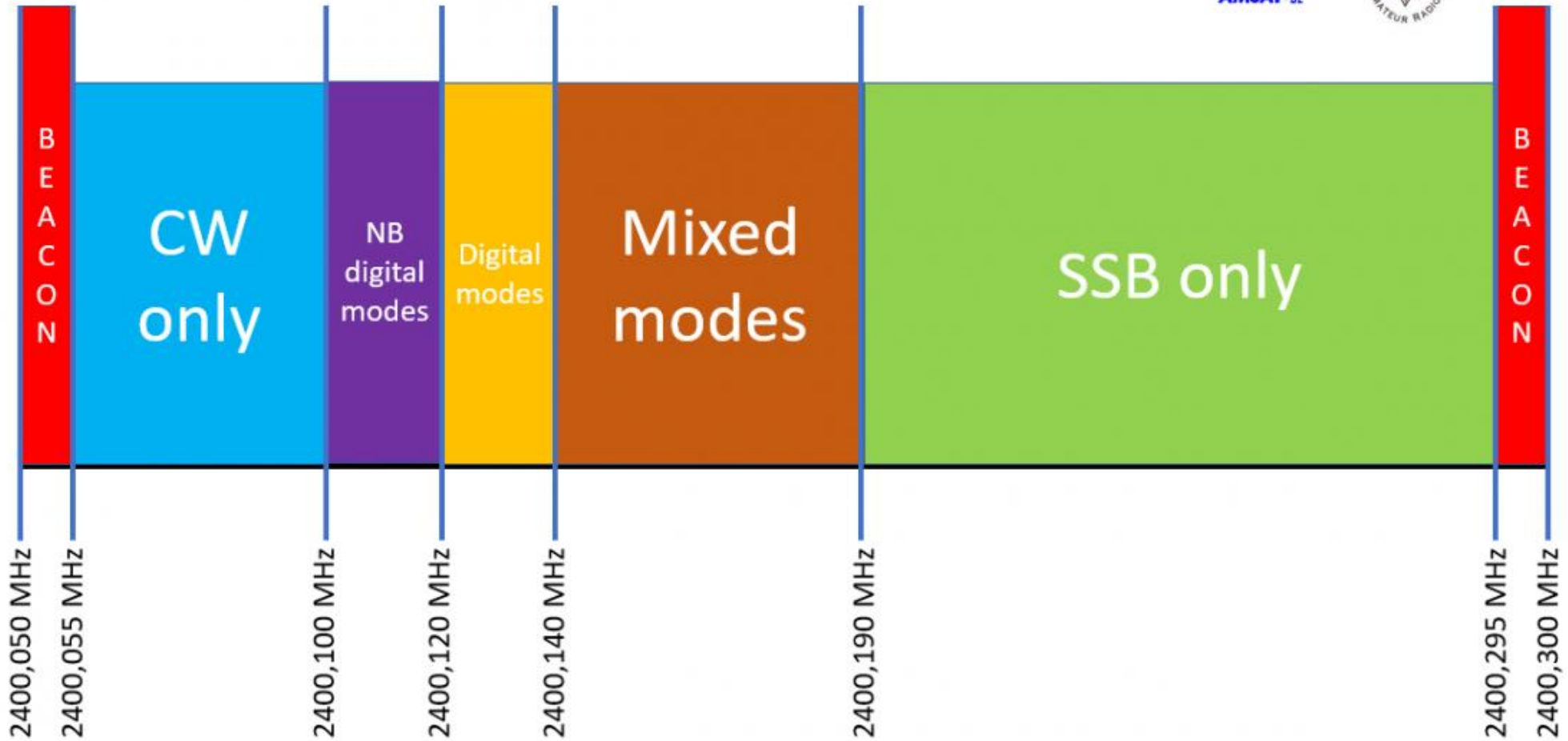
- If using a 'web SDR' then your QSO **will not be valid!**
- For a valid QSO you will need to have QO100 TX/RX at your location

How do you TX into it

- A multimode driver rig 2M / 70cm (or SDR exciter)
- A transverter to produce 2.4GHz output.
- A suitable 2.4GHz power amplifier to give a few watts at the feed
- 60cm+ dish with LHCP feed
- Use 2400.050MHz to 2400.300MHz segment

How do you TX into it

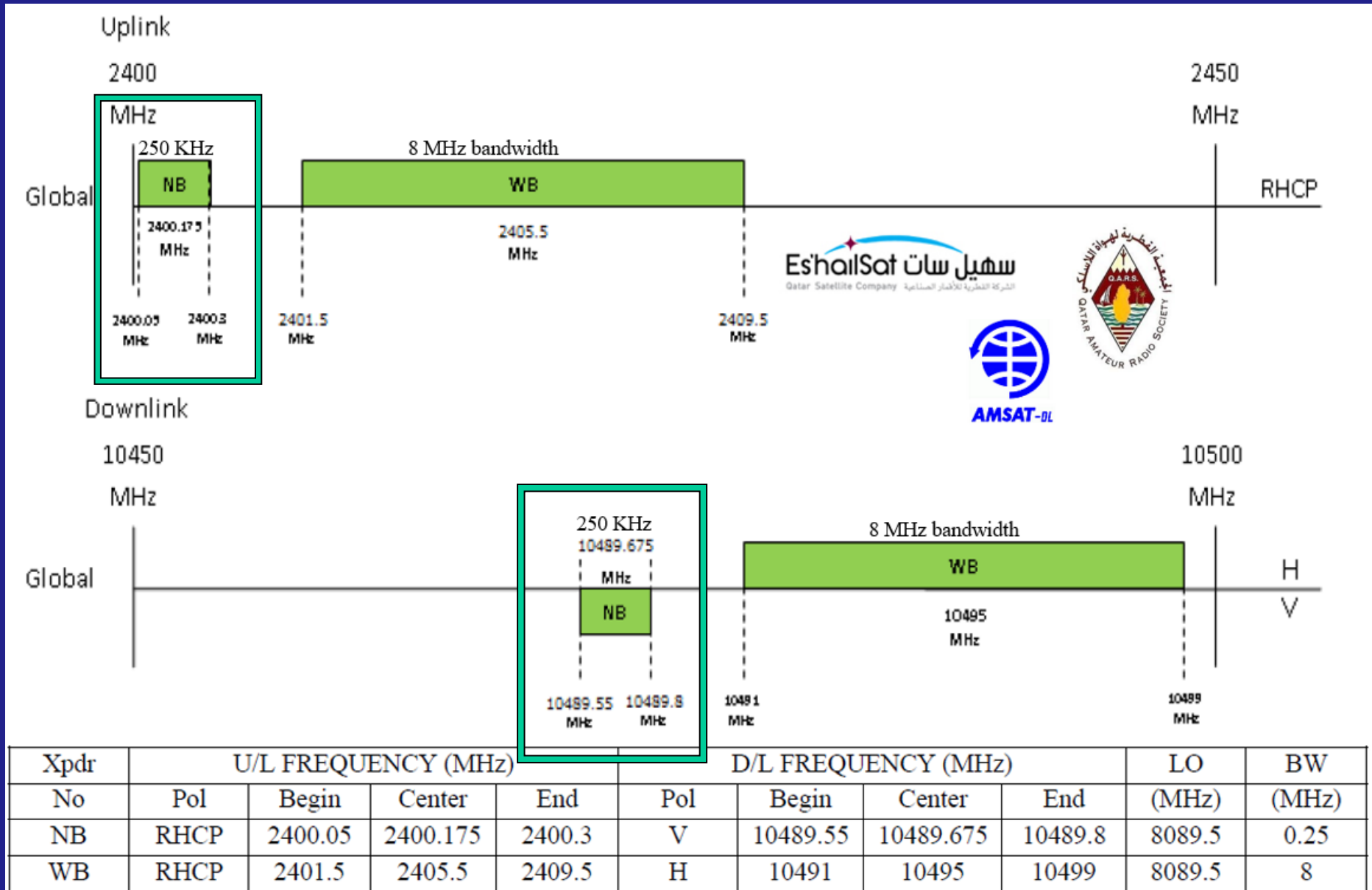
EshailSat ساهيل سات
Qatar Satellite Company الشركة القطرية للأقمار الصناعية



How do you TX into it

Uplink (EOC, SFD = -106 dBW/m ²)			Downlink (EOC)		
Freq	2.4	GHz	Freq	10.5	GHz
Dish size	0.75	m	TWTA output power	100	W
Ant gain	23.64	dBi	OBO	6	dB
HPA Output Power	10	W	On-board losses	1.5	dB
Uplink path losses	1.5	dB	S/C Ant. Gain	17	dBi
Ground EIRP	32.14	dBW	S/C EIRP	29.5	dBW
			Power sharing	50	channels
			S/C EIRP per channel	12.5	dBW
Earth-S/C distance	41126	Km			
Free Space Loss	192.3	dB	Free Space Loss	205.1	dB
95% availability att	0.12	dB	95% availability att	0.55	dB
S/C G/T	-12	dB/K	Ground Sta. G/T	13.98	dB/K
C/N ₀	56.3	dBHz	C/N ₀	49.4	dBHz
Channel Bw	2.5	KHz	Channel Bw	2.5	KHz
C/N per user (PEP)	22.3	dB	C/N per user (Avg.)	15.4	dB

How do you TX into it - Frequencies / Band Plan



How do you TX into it

- A 2M or 70cm multi-mode rig



How do you TX into it

- A 2400 MHz up-converter or transverter



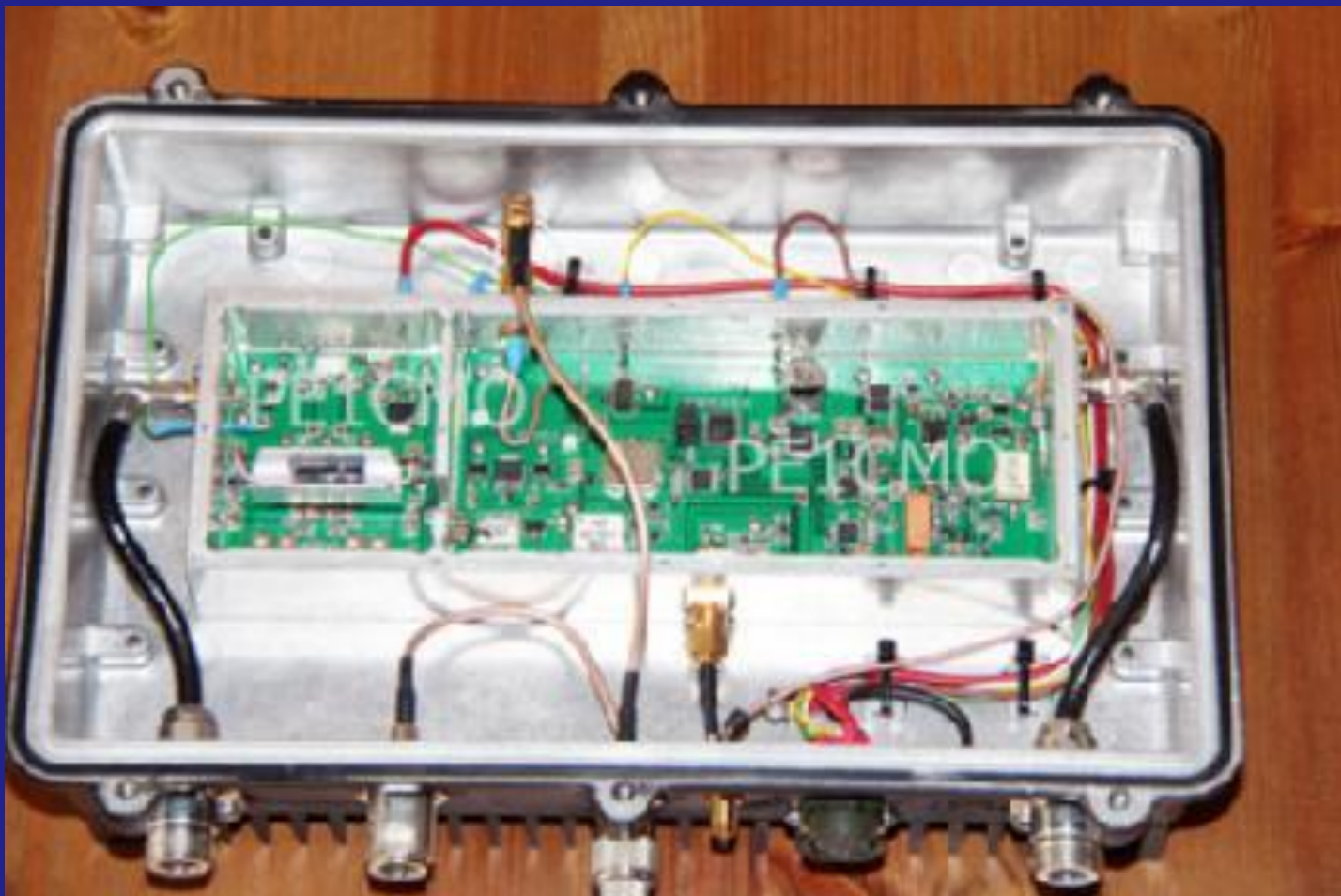
How do you TX into it

- A 2400 MHz up-converter or transverter



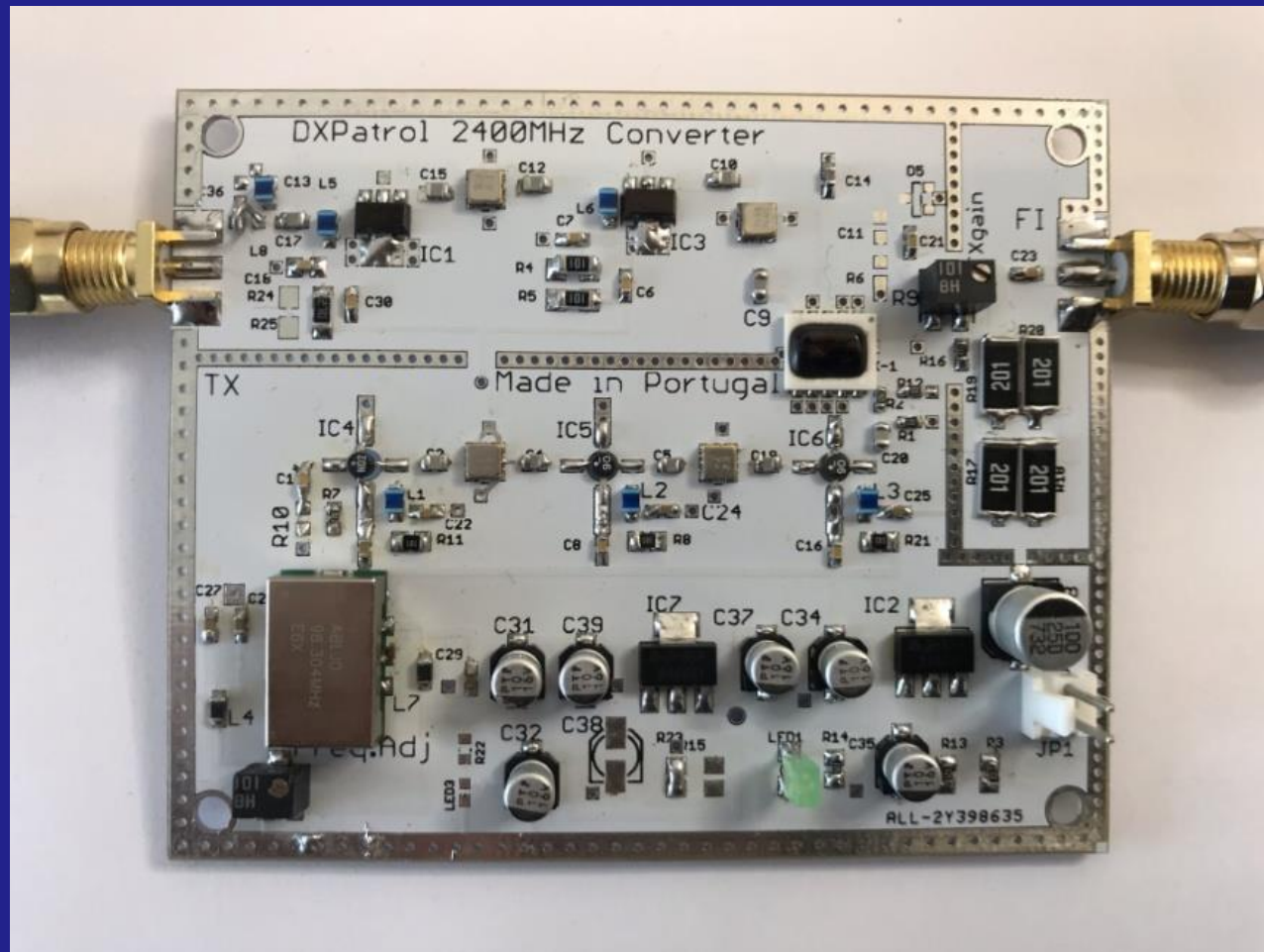
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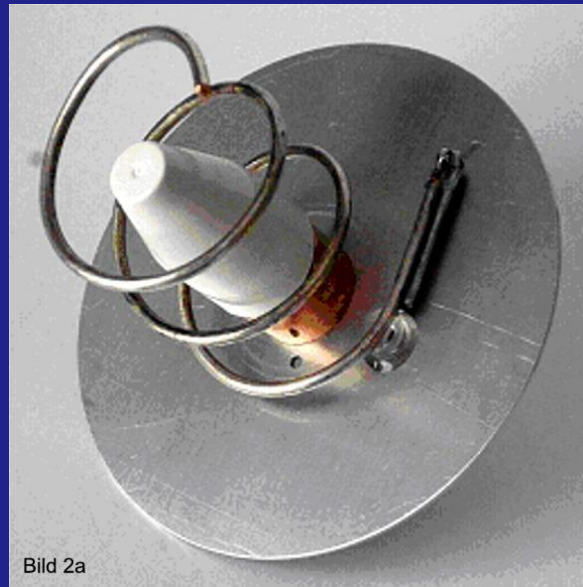
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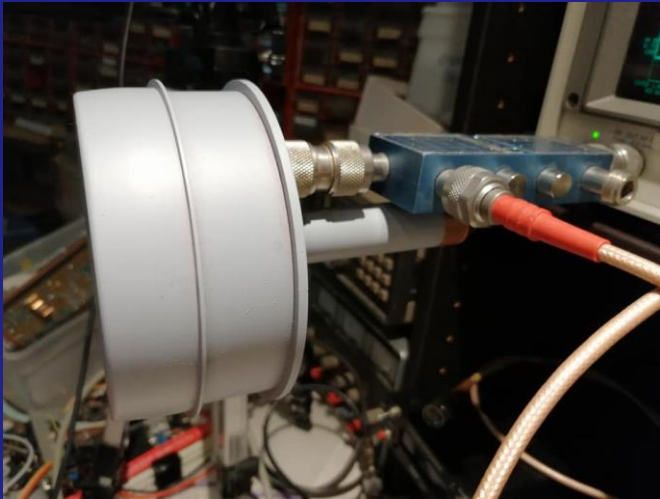
How do you TX into it

- A dish feed for 2400 MHz LHCP (single or separate RX/TX antenna)



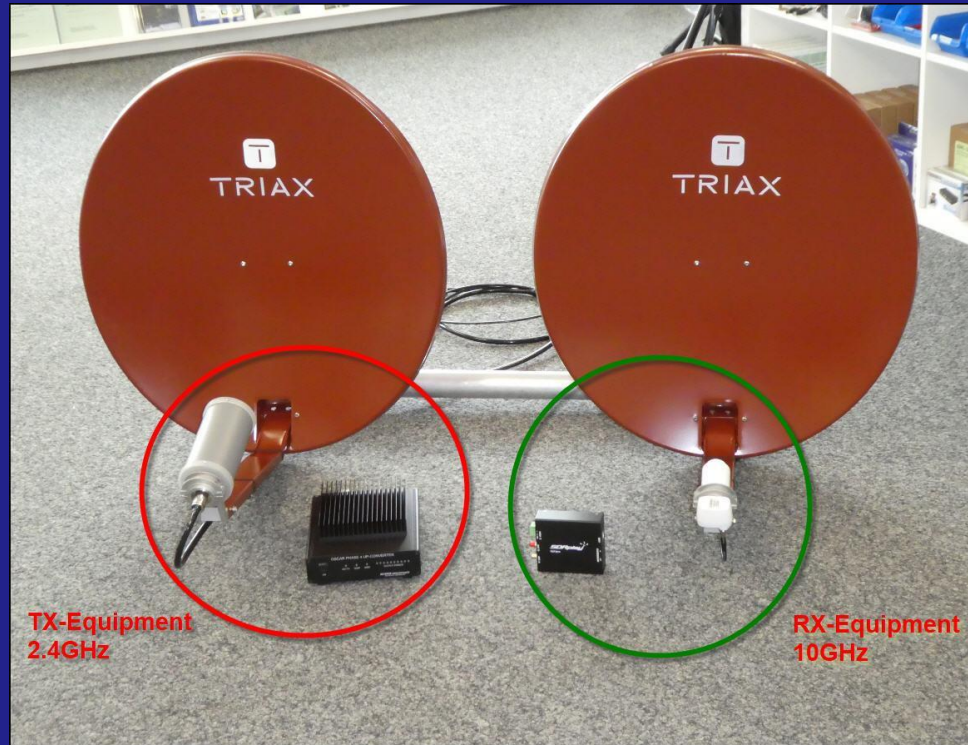
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(single or separate RX/TX antenna)



How do you TX into it

- A feed for 2400 MHz LHCP
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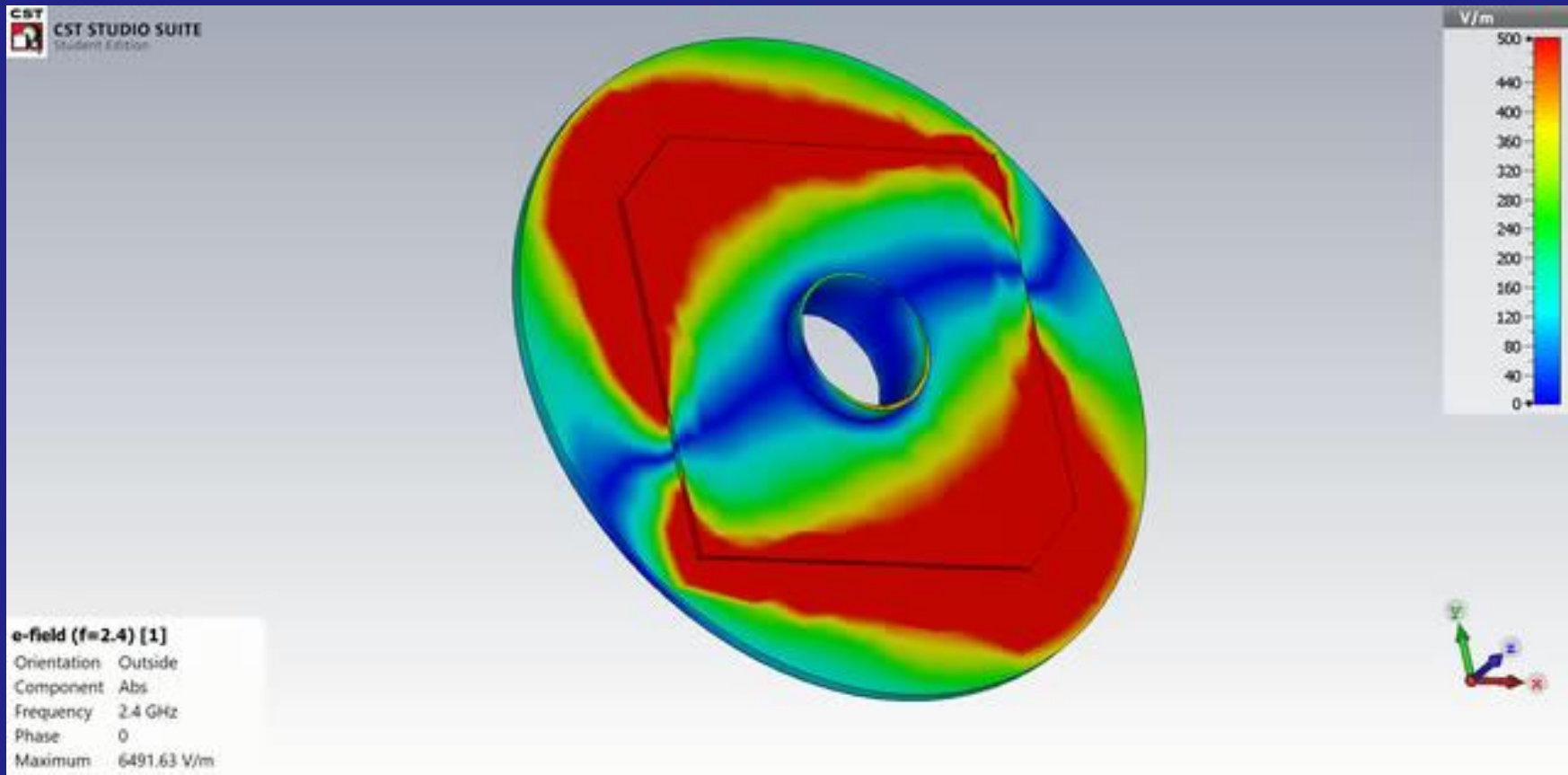
How do you TX into it

- A feed for 2400 MHz RHCP
(single or separate RX/TX antenna)



How do you TX into it

- Dish feed needs to be LHCP for best results



How do you TX into it

- Few watts power amplifier to >60cm dish



How do you TX into it

- Few watts power amplifier to >60cm dish

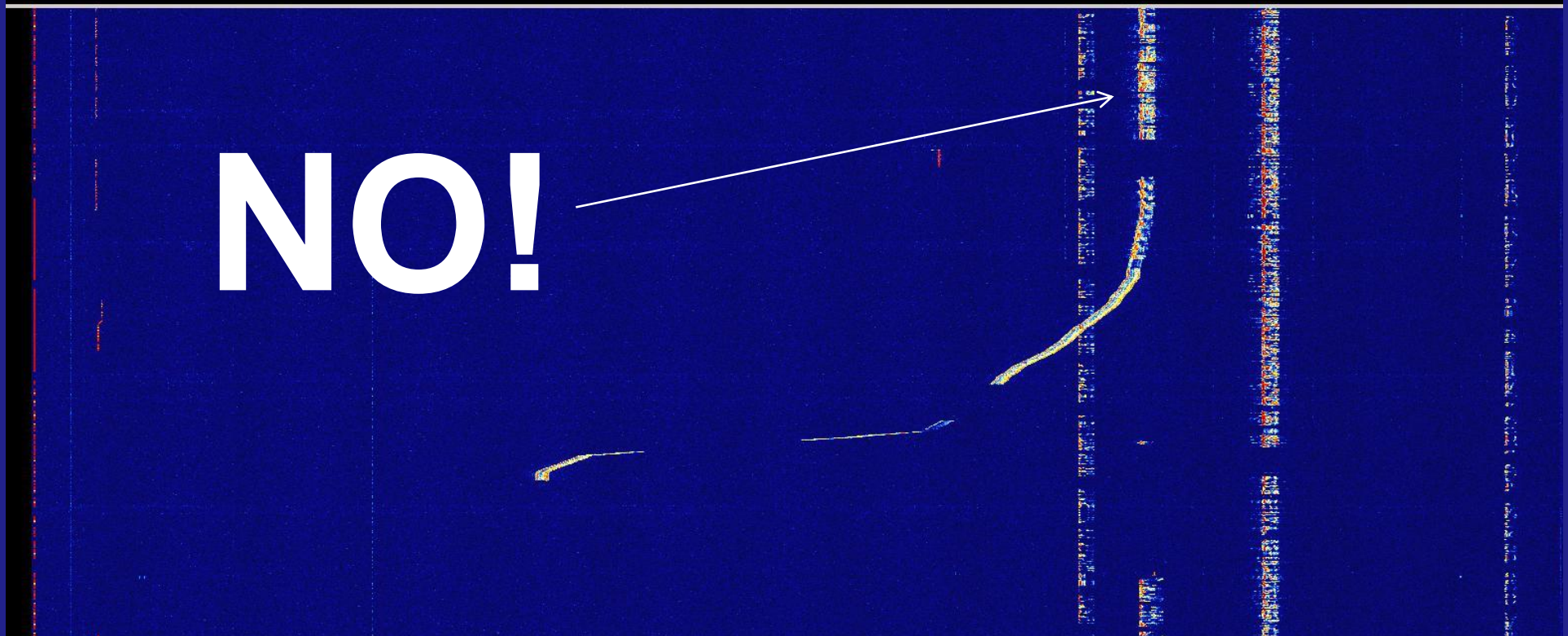
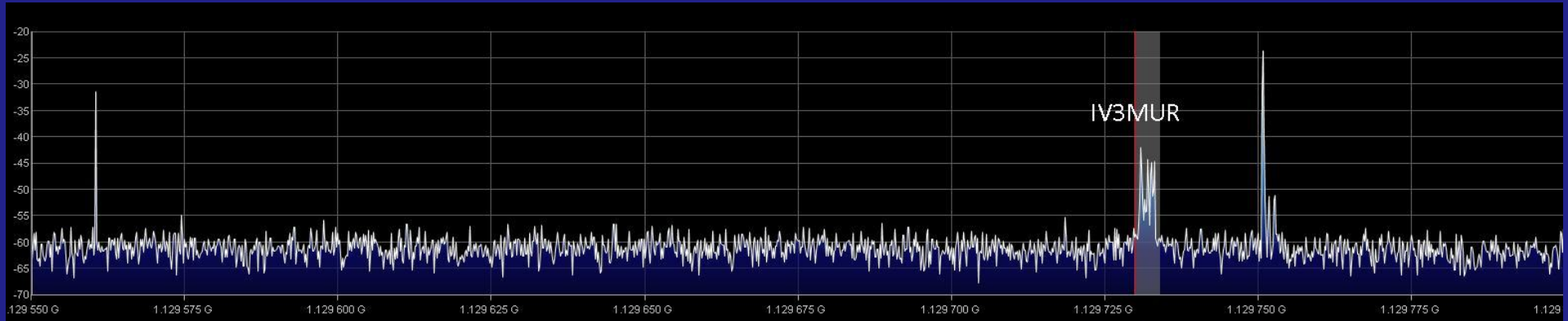


How do you TX into it

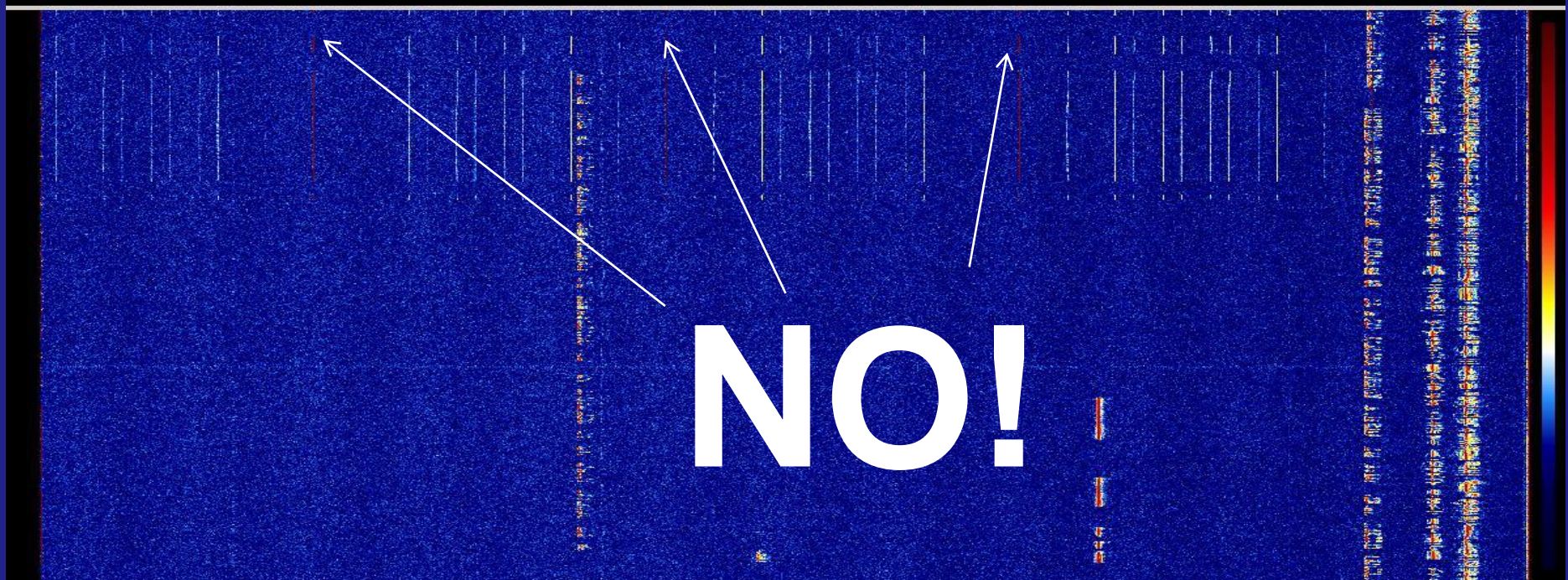
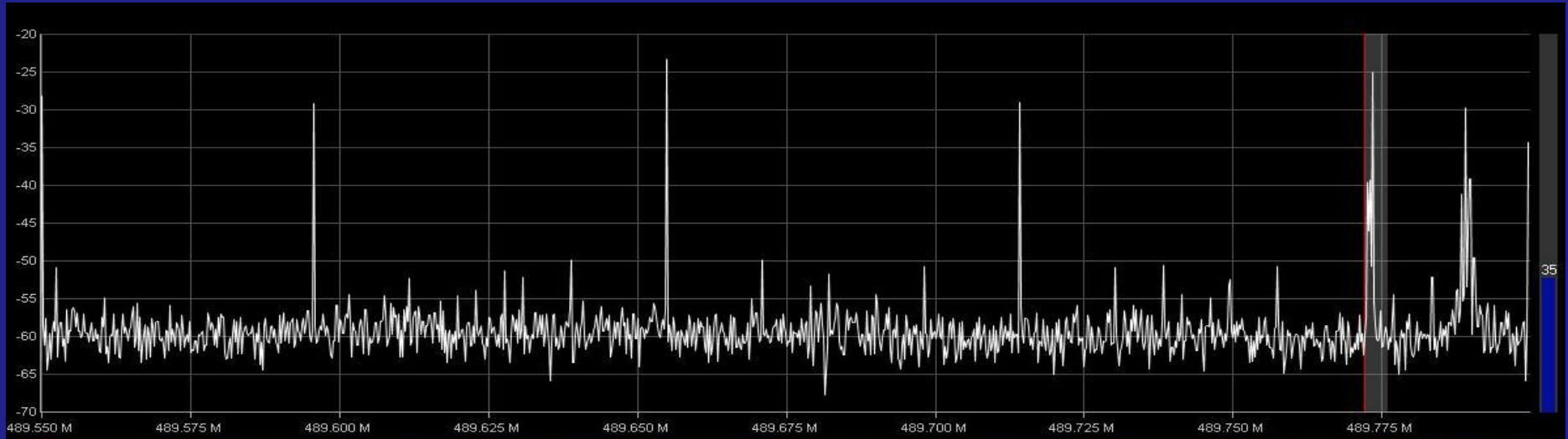
- Calibrate your TX so it reads the 10489.xxx MHz downlink, i.e. 489.xxx MHz
- Net onto others far more easily!
- “BE” on frequency
- **Do not under any circumstances tune during TX!**



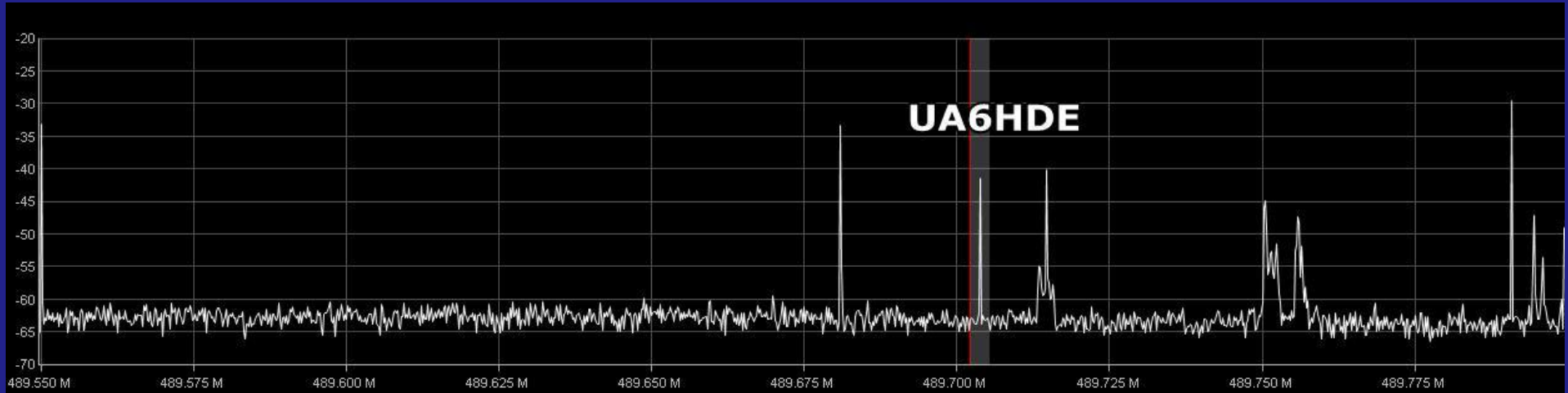
QO-100 - Gallery of shame



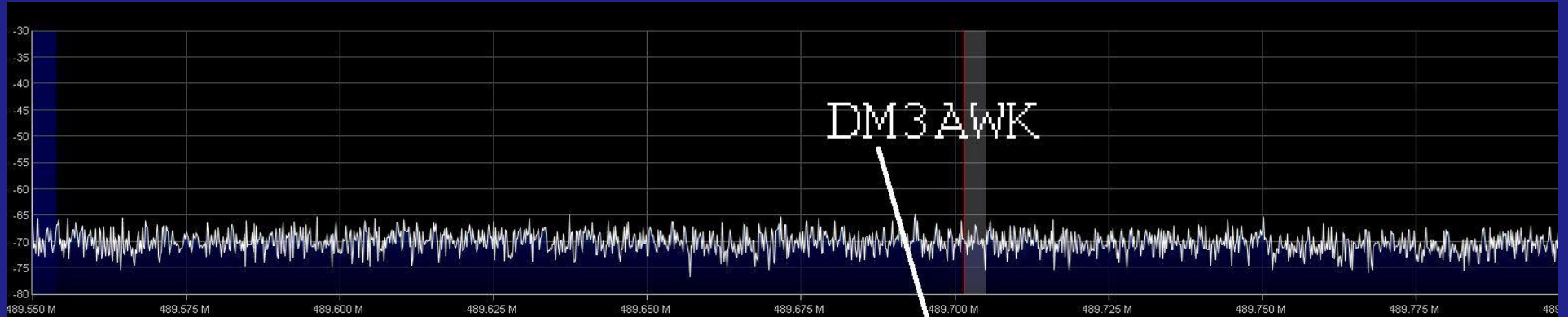
QO-100 - Gallery of shame



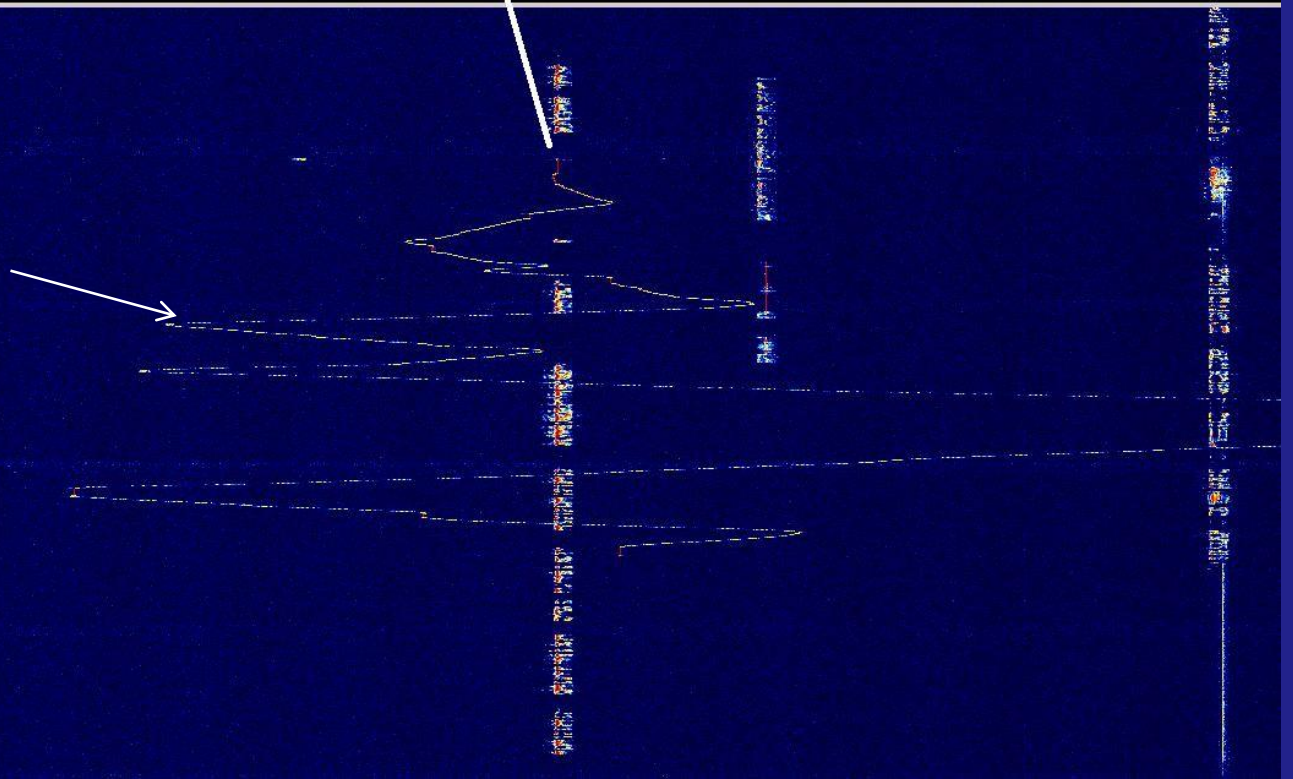
QO-100 - Gallery of shame



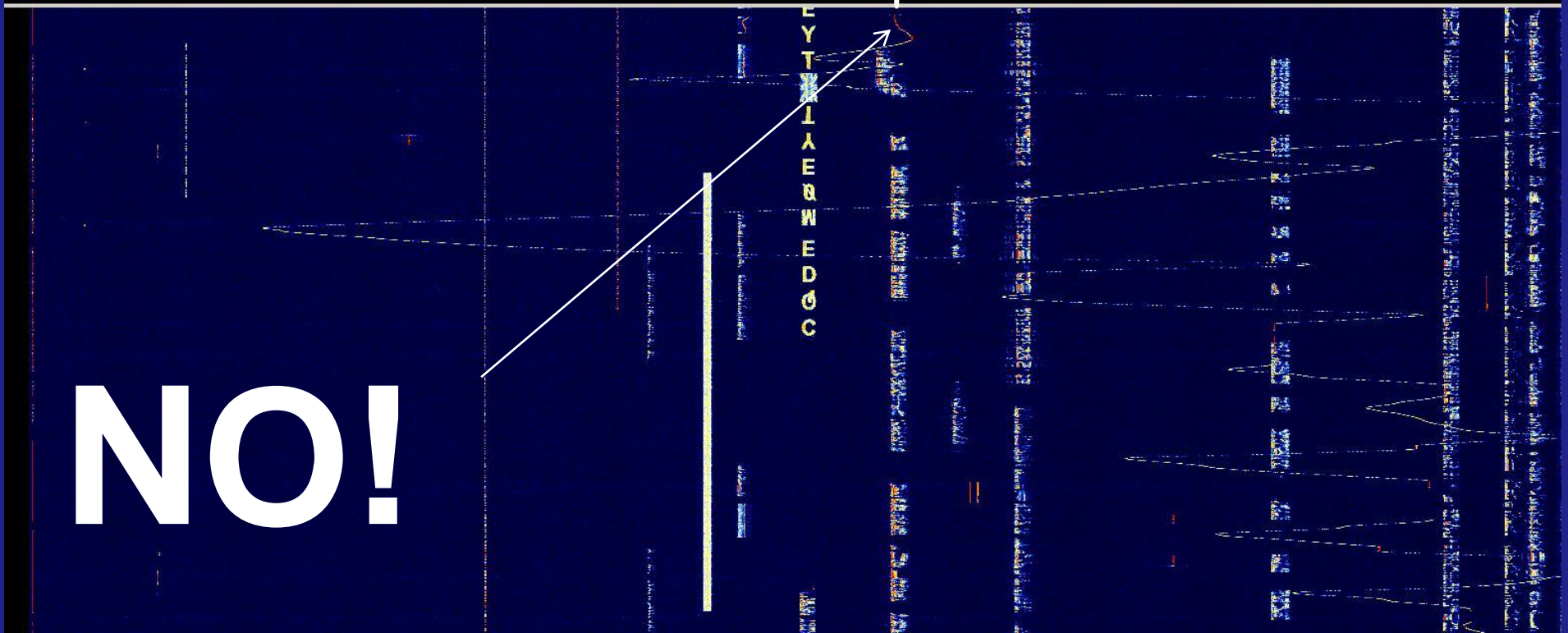
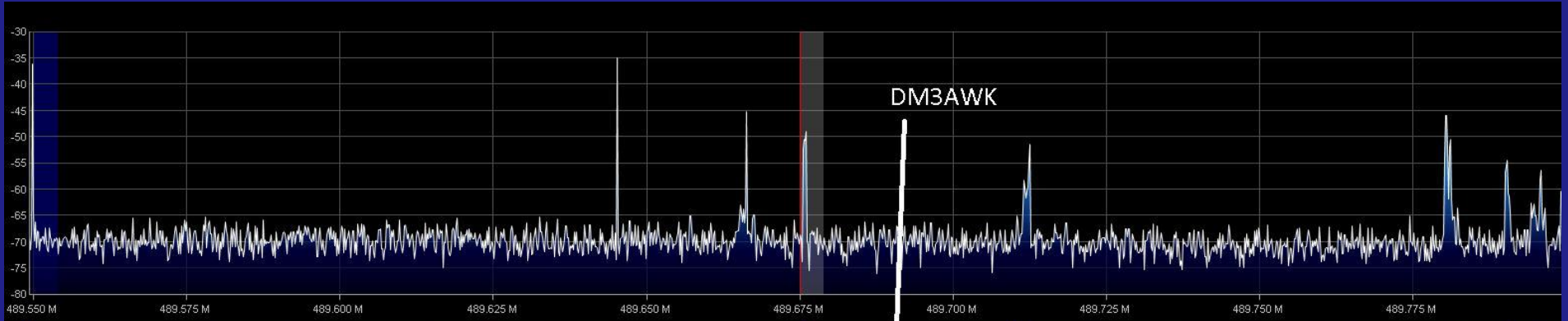
QO-100 - Gallery of shame



NO!



QO-100 - Gallery of shame



NO!

How do you TX into it

- Ensure **you can monitor** your own 2.4GHz uplink signal
- Cheap SDR's cover 2.4GHz, old Cal-Amp MVDS down converters cover the same band
- Don't use the transponder receiver as part of your test equipment!
- Set your signal peak to that of the CW beacon
- **Ensure your signals are clean and of good quality before transmitting into your antenna!**

Ground station enhancements

- Lock LNB to a GPSDO for frequency precision
- Lock your transverter to GPS as well
- Fit a TCXO in your driver rig or lock to GPS
- Add a power amplifier for DATV modes or use a bigger antenna
- Make a digital modes interface

DATV:

MINITIOTUNE v0.7b - Receiver/Analyser DVB-S/52 144 MHz to 2450 MHz - for MiniTioner (FTDI2232H+NIM)

SR (kS) Freq (kHz)
00333 **10497266**

Offset-> - **09360000**

SR2000 1255p MHz
SR125 10495 MHz
SR250 437za MHz
SR4000 437ae MHz
SR6500 437ve MHz

Low SR DVB mode
 FEC DVB-S
 1/2 3/5 DVB-S2
 2/3 3/4 AUTO
 4/5 5/6 1/4
 6/7 7/8 1/3
 8/9 9/10 2/5

Web Station ID:1
MYCALL

MY CITY
JJ00PP Preamp 20 dB
Ant. Dir. East Gain 12 dB

Picture
 Video
 DSL
 Auto
 Stop

Lg Msg
Lg Pic 0000
WebEr

Timing 3 sec 00000 0

PIDs

Pid from .ini

M0EYT AutoPID
F6DZP-H264 PID Video **00256**
HDlowSR PID audio **00257**

France24
QRZ DX
RaspberryP

Codec
 Mpeg2
 H264
 H265

Format
 4/3 Width: 704
 16/9 Height: 576
 1/1
 auto
Audio
 MPA
 AAC
 AC3

Zoom
 adapt
 x1
 maxi

GRAPH

Station **M0EYT**
infos: DVB-S
Provider: **M0EYT**
Codec: **VH264 + AAC**

photo

Audio level

Info ISS

83% Carrier Lock
97% Timing Lock

dBm Power RF
dB MER

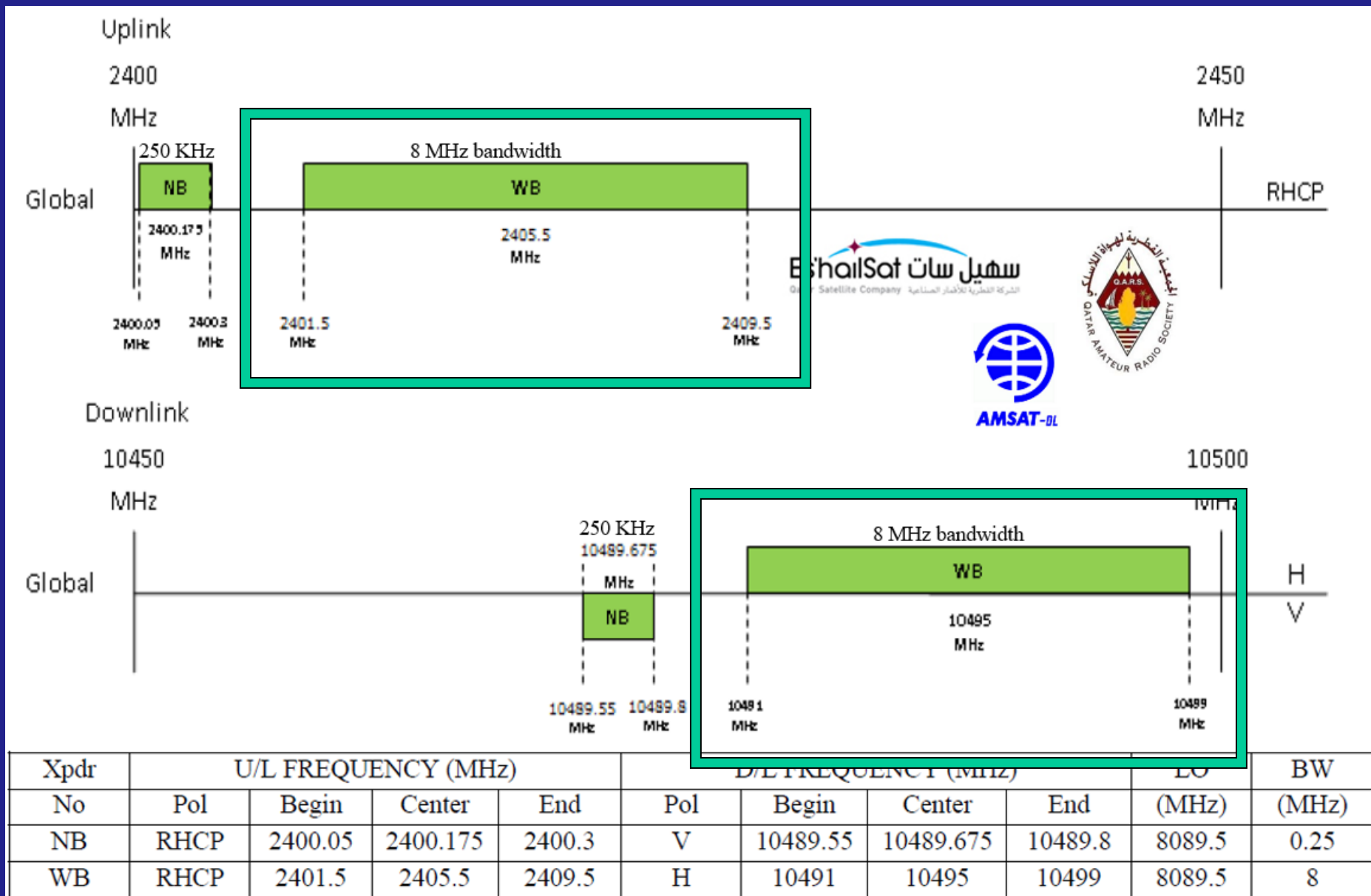
Constellations

Viterbi err: 2736
Vber: 16%
FEC 3/4
TS err: 0
Bytes recvd: 1952944

Carrier SR Full RF Pw -38dBm S/N MER 6 dB

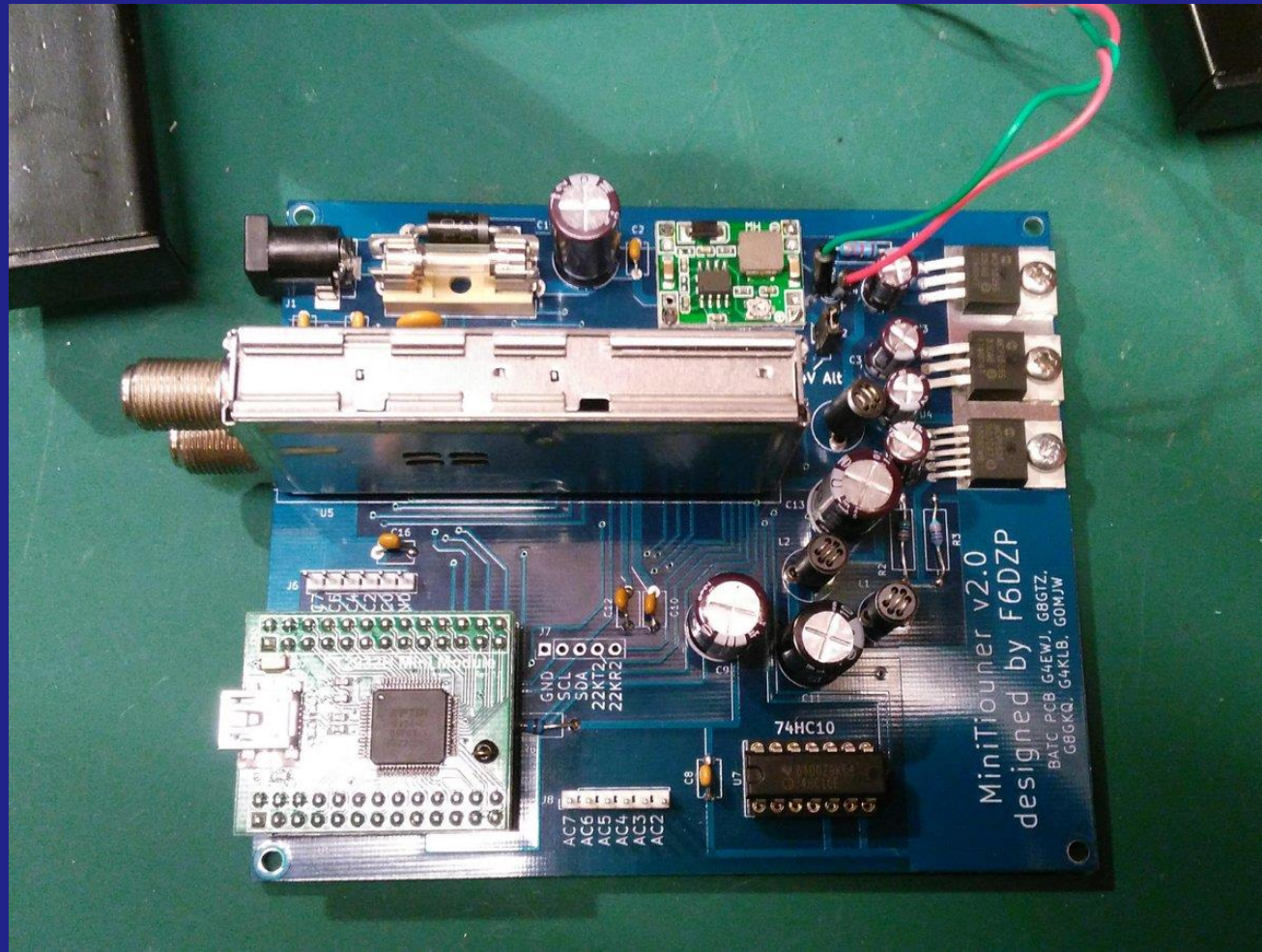
Beep Dsave UDP Record
Quit

DATV: Frequencies / Band Plan



DATV: Receivers

- RX: MiniTouner F6DZP direct receiving



DATV: Software

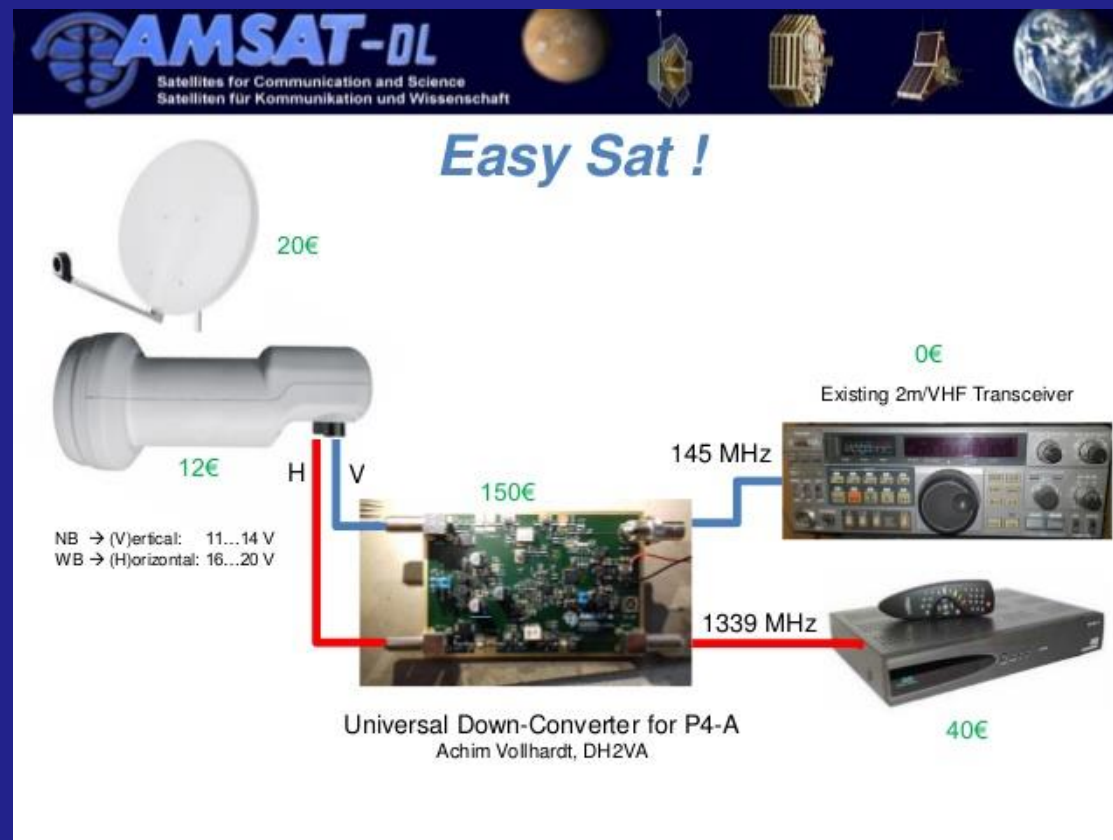
- RX: MiniTiouner F6DZP direct receiving

The screenshot displays the MiniTiouner v0.4c software interface, a DVB-S Receiver/Analyser for MiniTiouner(FTD232H+NIM). The interface is divided into several functional panels:

- Tuner:** Shows BaseBand Gain at 0 dB and Auto mode. The main display shows Frequency (kHz) set to 1255000 kHz, with a Target Freq of 1255000kHz and a current Freq of 1255167 kHz. The Target Dev is 0 and Deviation is 167 kHz.
- Scan strategy:** Includes scan mode (no loop, loop wide, loop narrow, chained), scan range (wide, narrow), PreLock (wide range 12, Timer1 8), and PostLock (narrow range 10, Timer2 3.0). It also features pll corr (1) and auto checkboxes.
- PIDs to decode:** Lists PIDs from .ini, including F6DZP-Mpeg, F6DZP-H264, HDlowSR, France24, QRZ DX, and RaspberryP. It shows AutoPID, PID Video (01001), and PID audio (01002) settings, along with Format (4/3, 16/9, 1/1, auto) and Width/Height options.
- Web Station ID:** Displays F6DZP and MIGNE-AUXANCES JN06DP. It includes Ant. Dir. (East), Gain (12 dB), Picture (Video, QSL, Auto, Stop), Lg Msg (0000), Lg Pic (0000), and WebEr (0000000) settings.
- Symbolrate (kS):** Shows SR set to 1987812S, Deviation: -10353S, and SR → 1977 kS/s. Carrier Width is 2684 KHz.
- IQ and Signal Processing:** Includes IQ Swap (x2) and x2 checkboxes, and I: 3 Q: 3, Equa, and Noise options.
- Station Information:** Station F6DZP-Mpeg2, no comment, Provider, and Codec: Mpeg2. It also features a photo button and Audio level control.
- Bottom Panel:** Contains Carrier Lock (29%), Timing Lock (0%), Power RF (-112dBm), S/N MER (0.0 dB), Constellations, Viterbi err, Vber (100%), Fec (??), Bytes recvd (????????), TS Status, TS err, and TS Buffer (7896 bytes). It also includes Beep, Dsave, UDP, Expert, Record, and Quit buttons.

DATV: Down Converter

- RX: DVBS/S2 RX (low symbol rate capable)
- Additional up-converter & LO



MOEYT QO100 setup:

RX:

- Golden Interstar GI202 LNB GPS locked 24MHz
- Single 1.2M offset dish + dual band feed
- Leo Bodnar GPSDO-mini (24MHz o/p)
- AR5000 (locked to 10MHz) for SSB / etc
- AirSpy on 1129.675MHz +- for pan-adapter
- BATC MiniTiouner for DATV

MOEYT QO100 setup:

TX:

- Elad FDM-DUO (GPS 10MHz)
- G4DDK 10M to 70cm transverter (GPS 101MHz)
- SG-Labs 70cm to 13cm transverter (GPS 10MHz)
- Leo Bodnar GPSSDO-mini (101MHz)
- PE1RKI 100W power amplifier (@3W o/p)
- Single 1.2M offset dish + dual band feed

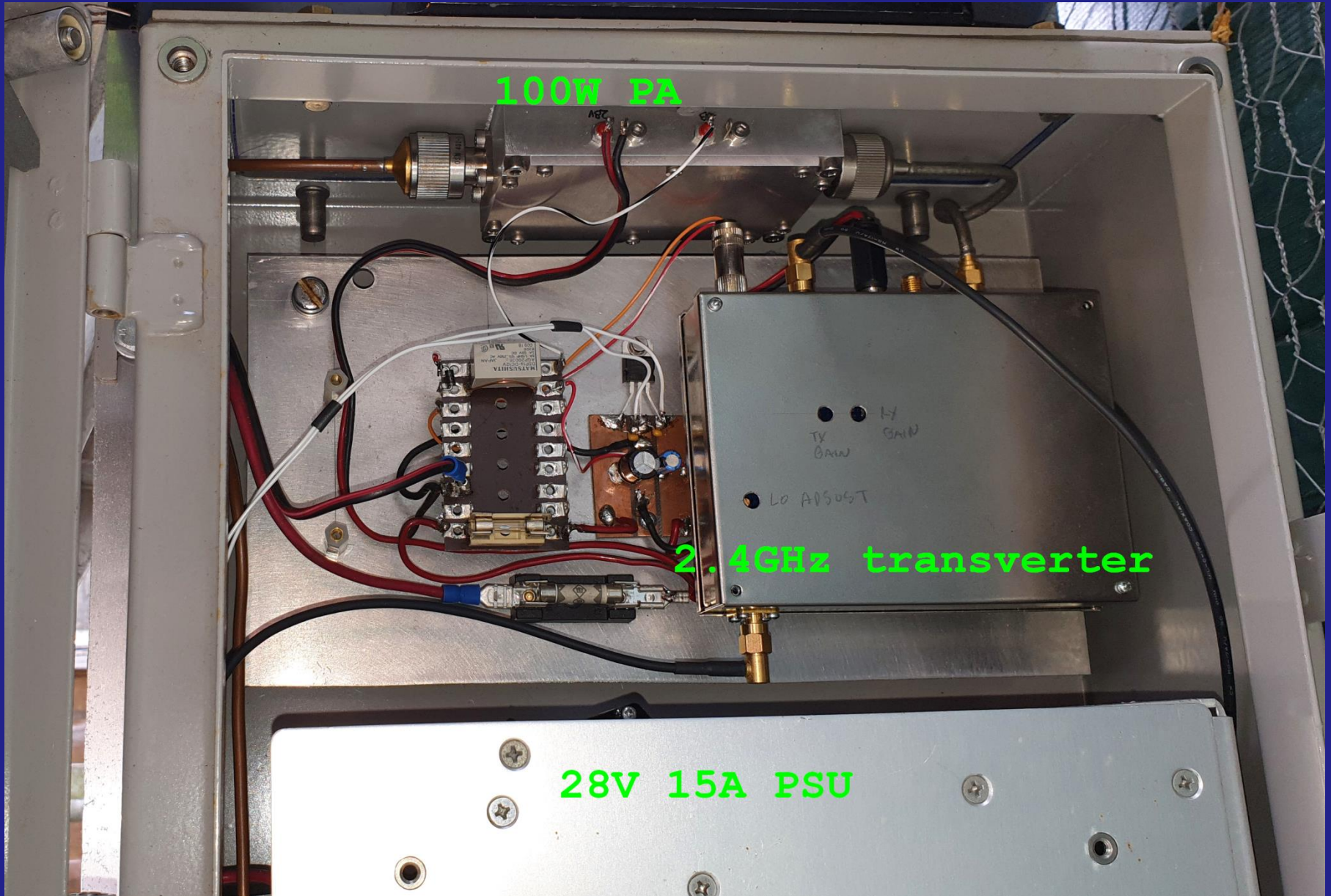
M0EYT QO100 setup:



M0EYT QO100 setup:



MOEYT QO100 setup:



M0EYT QO100 setup:



MOEYT QO100 setup:



That's all there is
to it! See you on
the satellite!

73's DE MOEYT

Credits:

Original Presentation : M0EYT

Updated by : ON4BCB

Tweaks for FRARS : M0EYT