



# An introduction to Oscar100

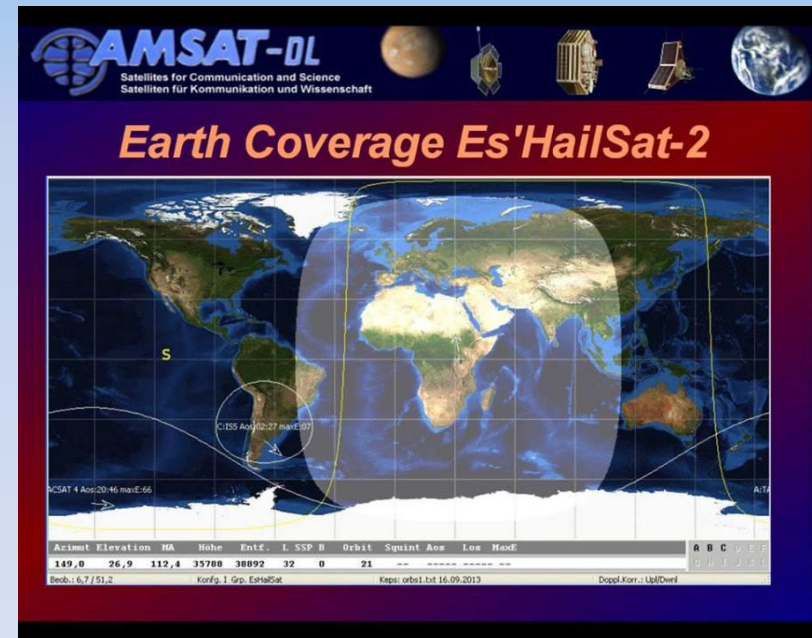
## Noel Matthews – G8GTZ










# Topics

- BATC Oscar 100 overview
- BATC Why is it a game-changer?
- BATC What does it offer?
- BATC How do I get started?
- BATC Narrow band operation
- BATC Wide band operation
- BATC The WebSDR



# What is Oscar 100

-  Oscar 100 is 2 amateur radio transponders hosted on the Es'hail-2 Direct Broadcast TV satellite at 26 degrees
-  Owned by Es'hailSat in Qatar.
-  Built by Mitsubishi Electric Company ( MELCO) in Japan.
-  Collaborative project with Es'hailSat / AMSAT-DL / Qatar ARS
-  The first ever amateur payload on a commercial geostationary satellite






BATC

# Oscar 100



 Project started in 2012  
by Qatar Amateur Radio  
Society and AMSAT DL

 Launched by SpaceX  
Falcon 9 from Cape  
Canaveral

– November 2018

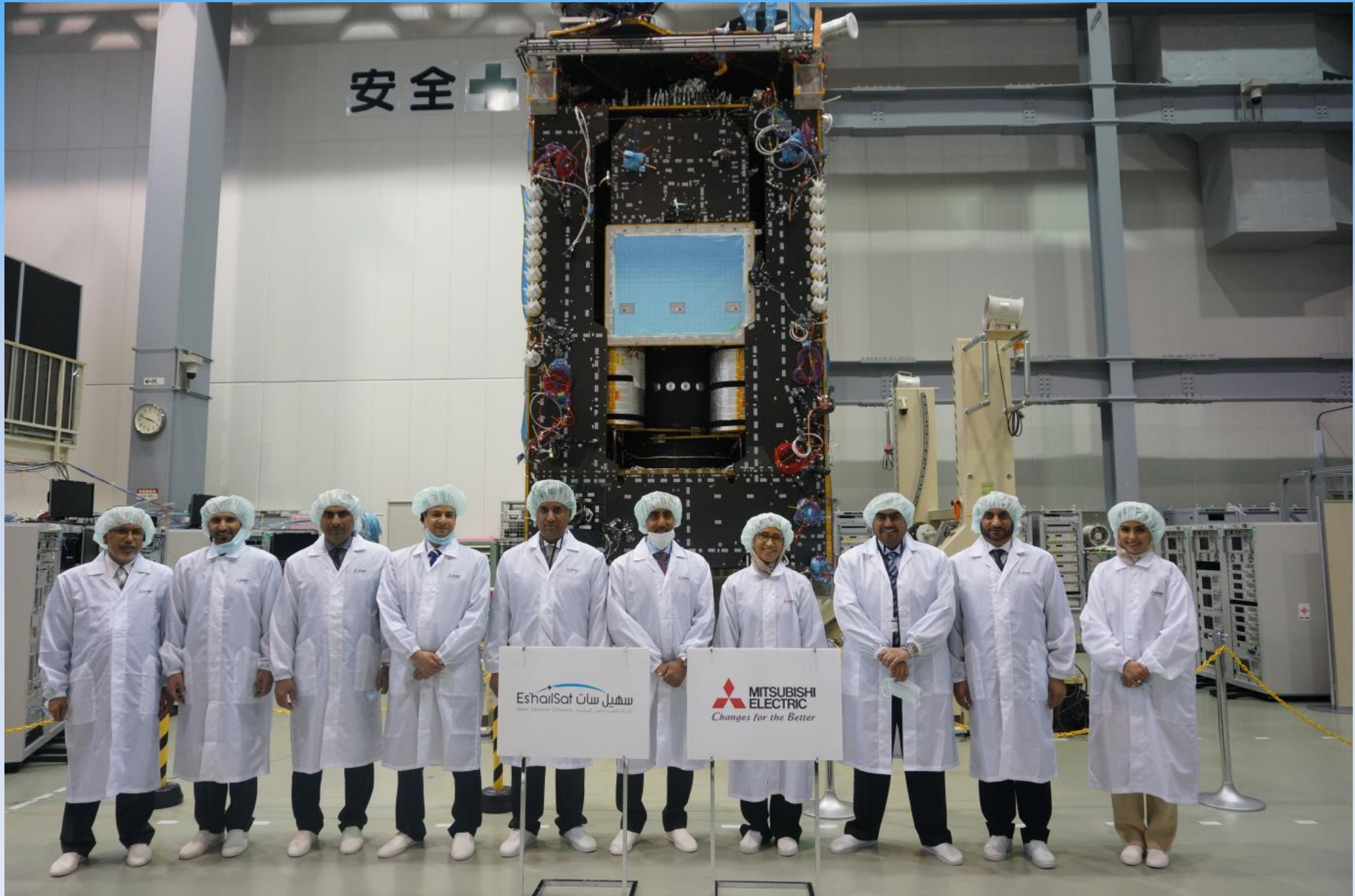
 Commissioned and ready  
for use in February 2019



*Es'hail (Canopus) is the name of a star which becomes visible in the night sky of the Middle East as summer turns to autumn.*



# Es'hail-2

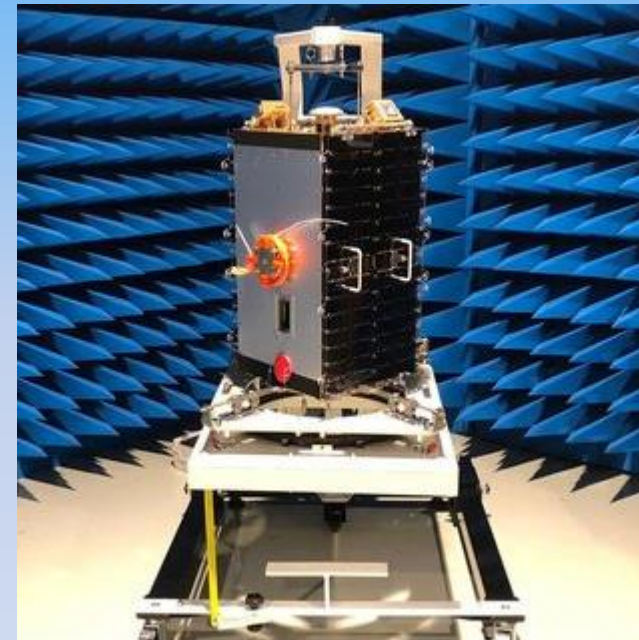


FUNcube-1 CubeSat AO-73




Based on a 10cm x 10cm x 10cm format.  
- approximately 900g

European Student Earth Orbiter ( ESEO )



MicroSat - 50kg

# Orbits and coverage

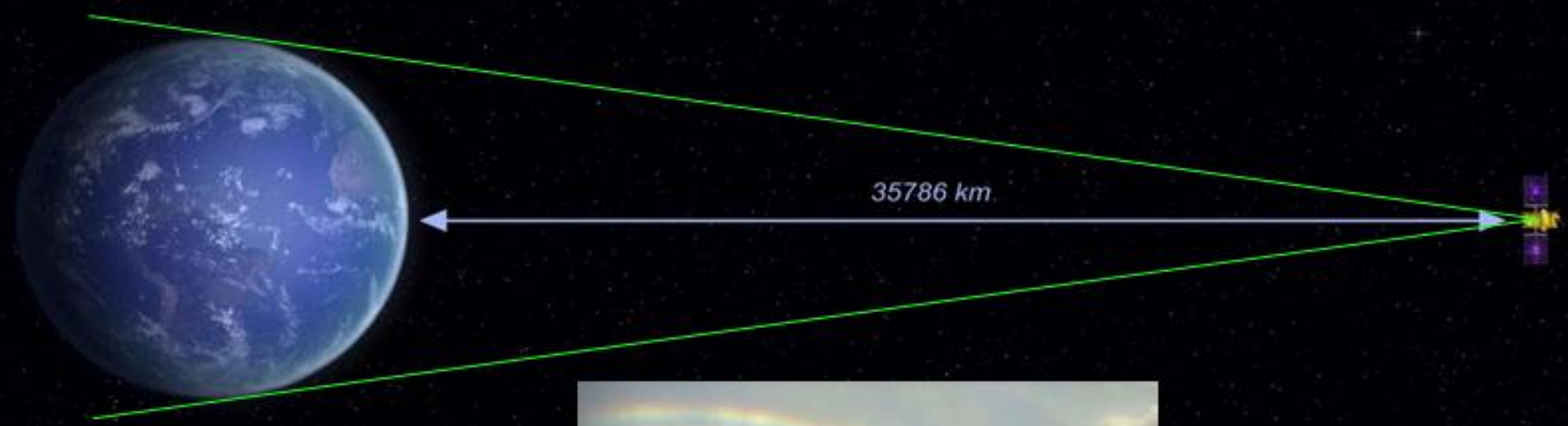
-  **Low Earth Orbit**
  - Typically 400 – 700km altitude
  - Orbit once every 90 minutes = tracking
  
-  **Medium Earth Orbit**
  - 8000km - 20,000km
  - Used by navigation satellites
  - No amateur satellites
  
-  **Geostationary**
  - 36,000km altitude
  - large coverage area – 40% of the earth and 60% of population
  - No antenna tracking needed
  - Where all broadcast TV satellites are





# 36,000 Km altitude

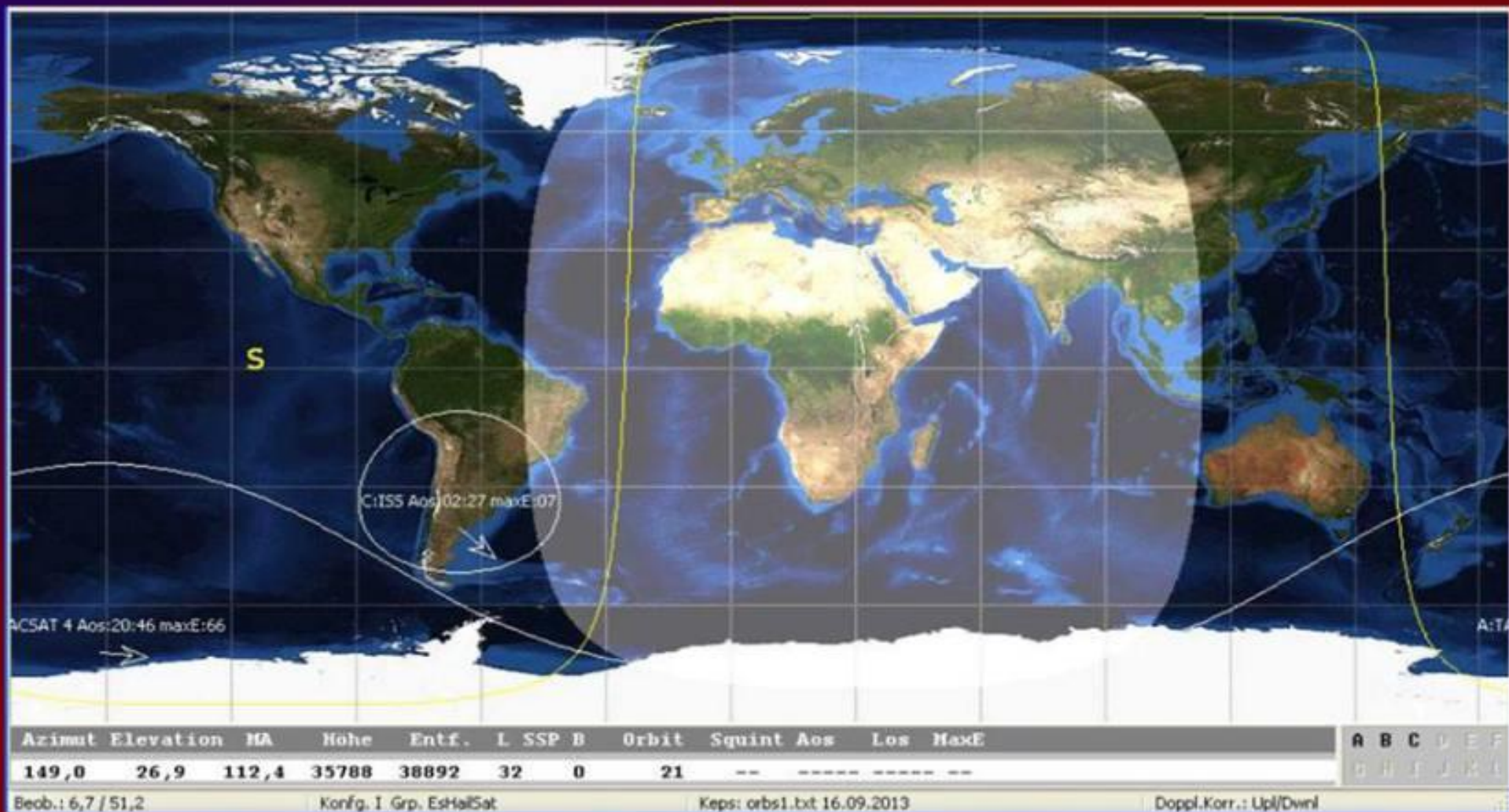
-3dB Beamwidth =  $17.4^\circ$  → ~20dB Antenna Gain !!







# Earth Coverage Es'HailSat-2



# What is on Oscar100?

## 2 transponders dedicated to Amateur Radio

- 13cms (2400MHz) uplink
- 3cms (10GHz) downlink

## Narrow band transponder 250kHz wide

- CW, SSB data modes etc
- AGC and Leila over power warning system
- CW and BPSK beacons

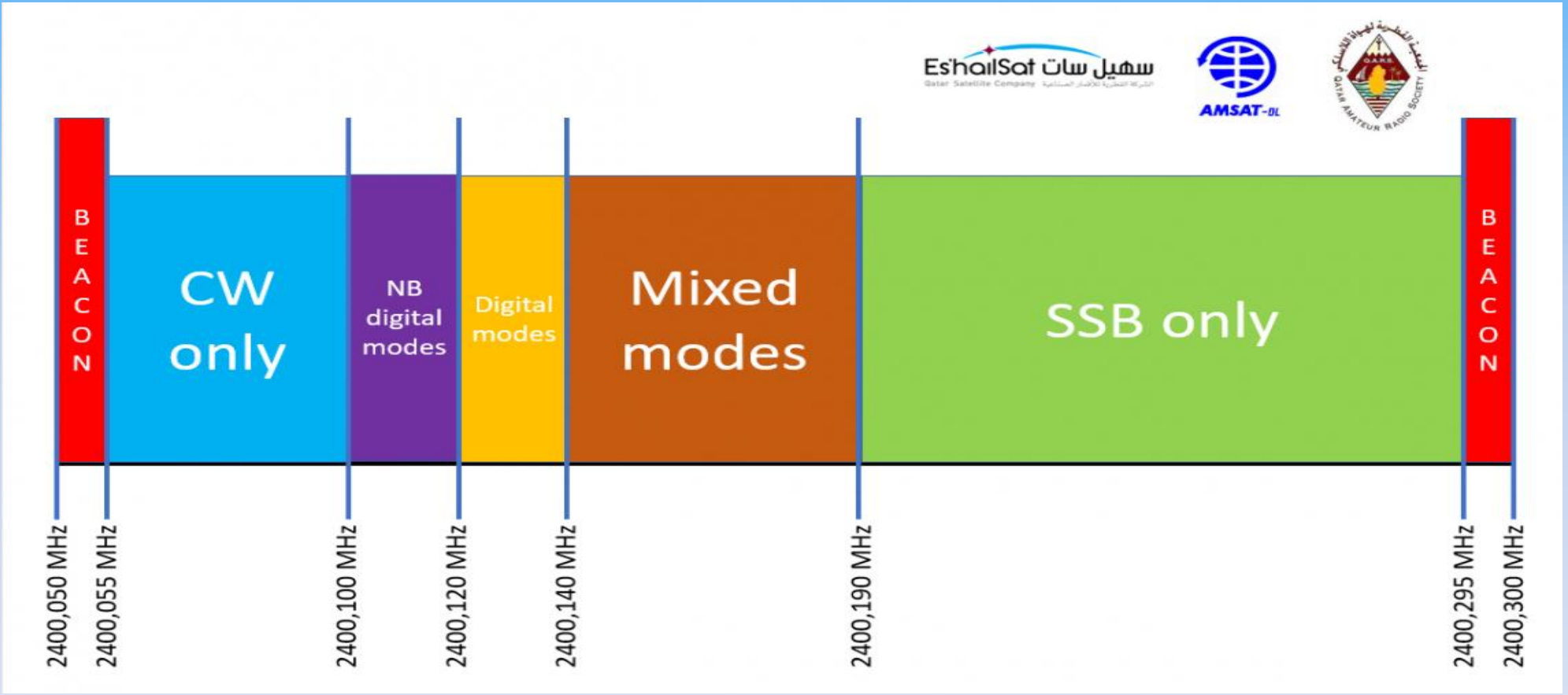
## Wide band transponder 8MHz wide

- Dedicated to Digital modes
- Primarily Digital Amateur Television
- Up to 8 DATV signals simultaneously
- HD beacon channel



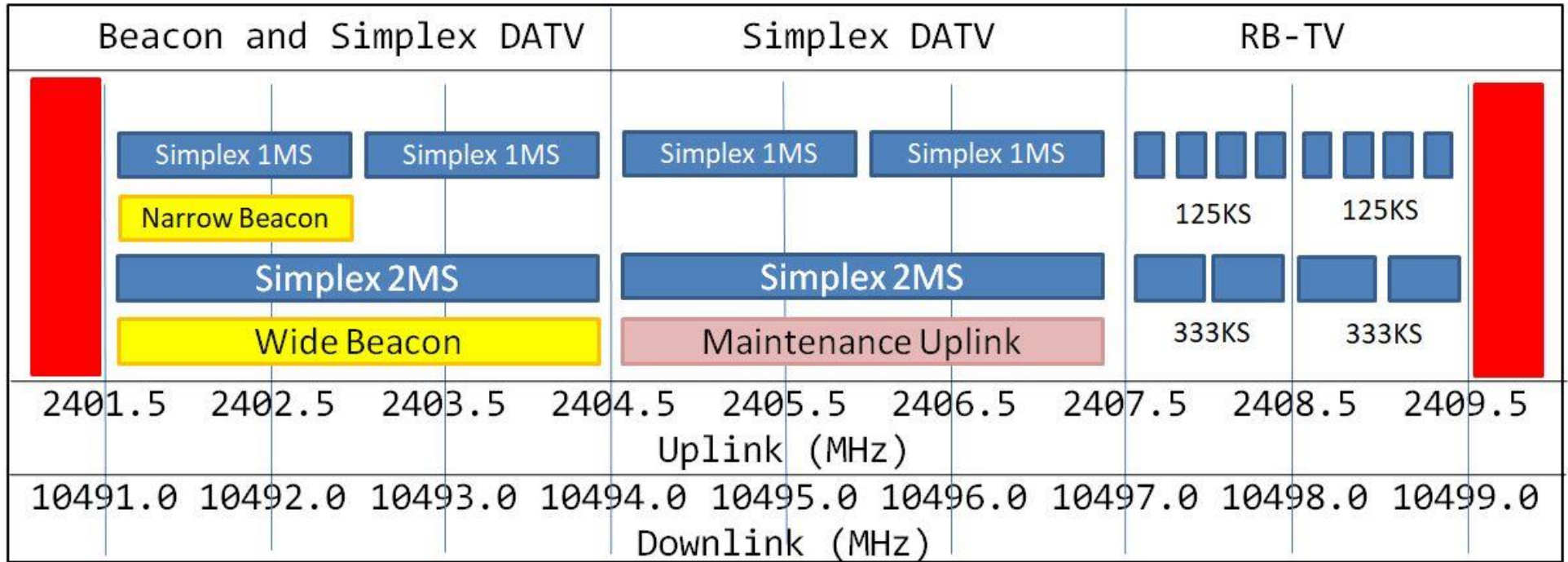


# Narrowband Band plan









# Wideband band plan







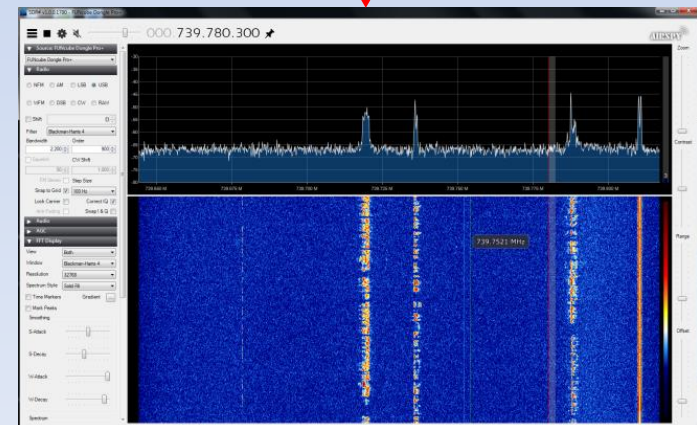
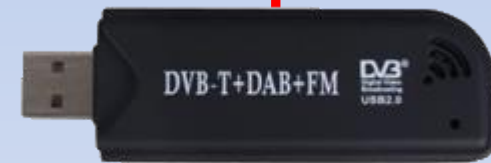
# How do I get started?

-  Whether going for Narrow band or Wide Band DATV – start with receive...
-  Satellite dish pointing at 26 degrees
  - 60cms (Sky) for NB
  - 90cm - 1.2m for DATV
-  <https://eshail.batc.org.uk/point/>
  - Just south of Sky/Freeview
-  Use a new PLL LNB for greater stability
  - Available for approximately £10



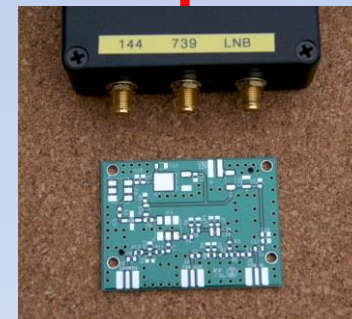
# Is it this simple?

-  Yes!
-  A simple NB rx system is:
  - Sky dish
  - New PLL LNB
  - ~ £10 RTL dongle or Funcube, LimeSDR or Pluto
-  Bias Tee to supply 12v
-  Free SDR software
  - SDR#
  - SDR Console
-  Tune to the IF frequency of 739 MHz



# Can I use a VHF / UHF rig?

- Yes – but...
- The output from the LNB is 739MHz
- A downconverter will shift this to 432 or 144MHz
- Frequency stability is an issue
  - Lock all oscillators to external ref
  - Use SDR locking



# NB Transmitting - 1

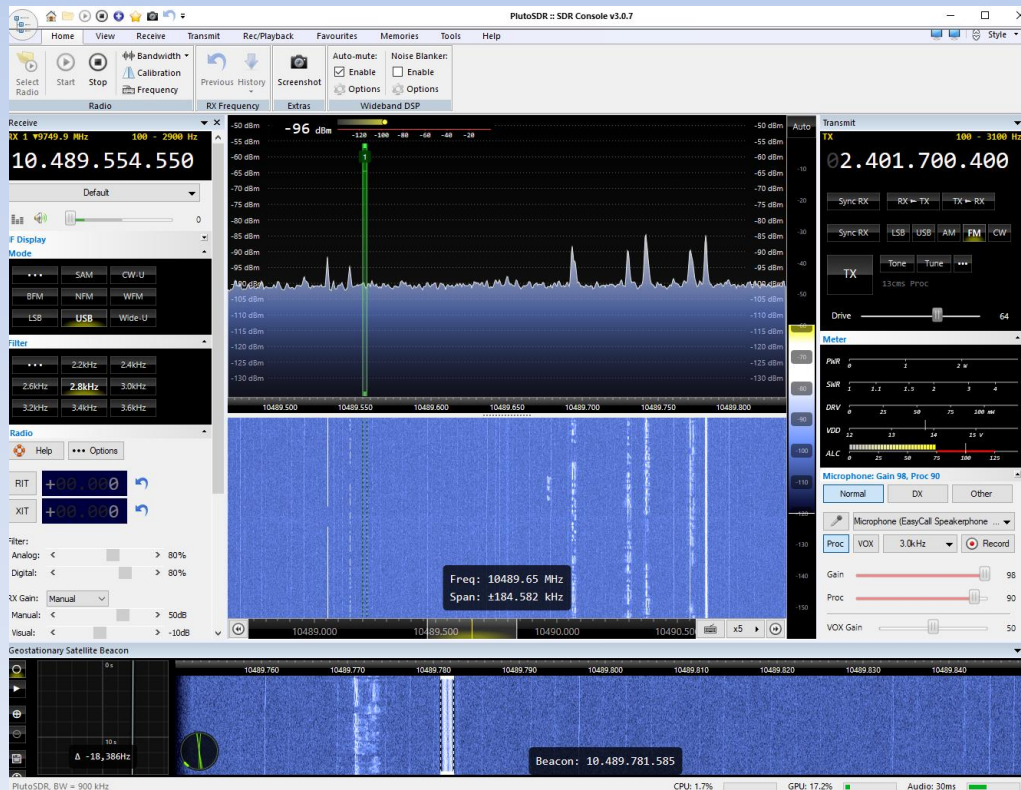
- The NB transponder is VERY sensitive
- Transvert up from a VHF or UHF rig
  - Dxpatrol converter
- Small PA ~ 4 watts
  - wi-fi booster
- LHCP helix dish feed
- Separate dish or dual band patch feed








# NB transmitting - 2

- SDRconsole by G4ELI
- Tx and Rx via Pluto or LimeSDR
  - Full duplex
  - Frequency lock to BPSK beacon for rx

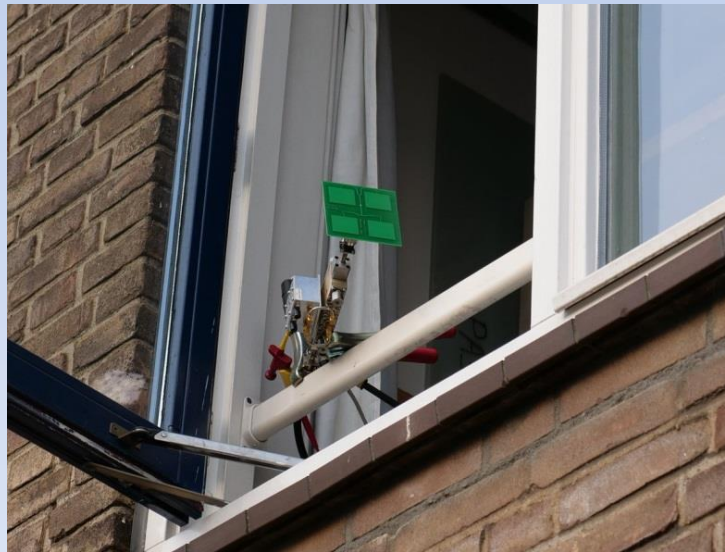


# NB operation

-  All modes permitted
-  Digital, SSB, CW, Hellschreiber....
-  Great for experimentation and easy to receive

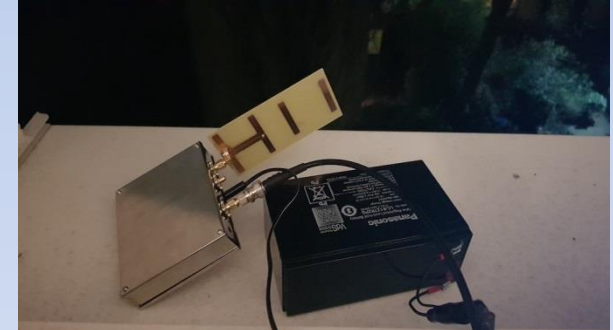
 DL7NX

- 1 watt to 4 ele PCB Yagi.








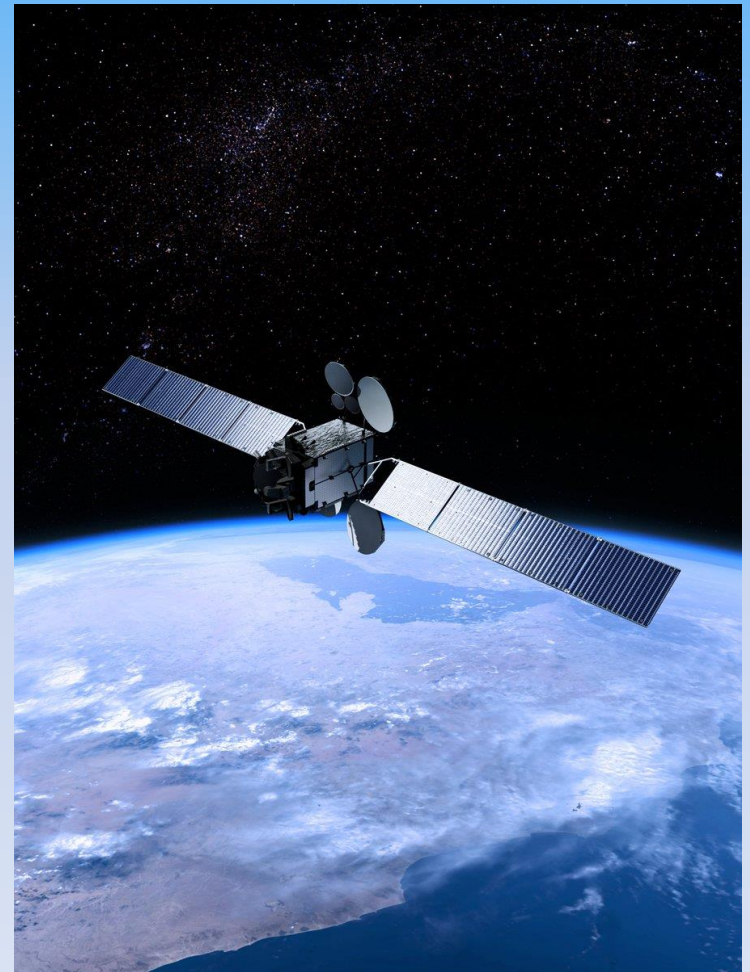
 PA3WEG

- 1 watt to a PCB quad patch



# Oscar 100 Wideband

-  Oscar 100 wideband is an “8 MHz bent pipe” transponder for wideband digital use
-  Occupied bandwidths can be 200 kHz – 8 MHz
-  Most signals are <1MHz wide
-  Some experiments below 100Khz
-  DVB-S2 with H264 / H265 video



# Receiving DATV





-  Aim for a 1m dish
-  Check your dish direction using
  - <https://eshail.batc.org.uk/point/>
-  Align using BADR-4 TV services
  - 12,597 MHz, 27500 Ms, Horizontal
  - ~11dB MER
-  Check the WB beacon
  - 2Ms DVB-S2
-  More details:  
[https://wiki.batc.org.uk/Receiving\\_Oscar\\_100\\_DATV\\_signals](https://wiki.batc.org.uk/Receiving_Oscar_100_DATV_signals)

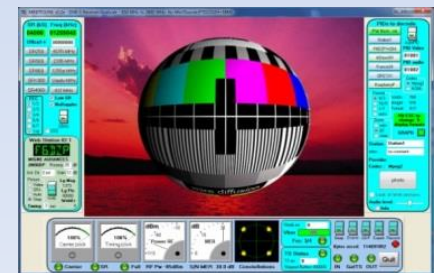


Dish size	Received MER
1.8m	10dB
1.2m	8dB
1m	6dB
80cm	5dB

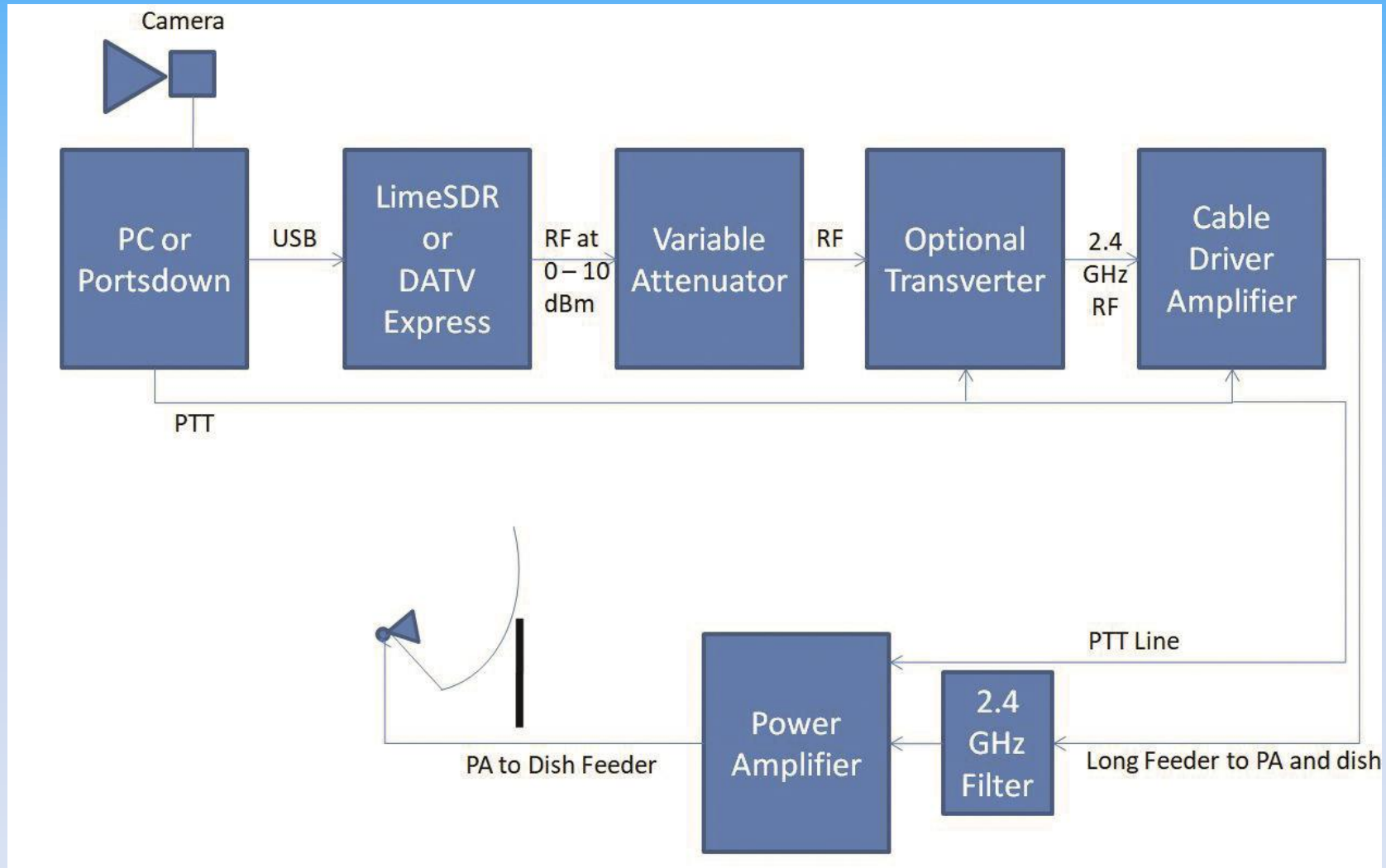


# MiniTioner USB tuner




-  You will need a special tuner to cover 741MHz IF and low bandwidth signals
  - Covers 143 – 2450 including 741 MHz
-  Available as kit or built unit
-  PC based with software by F6DZP
  - Gives totally flexible receive system
  - MPEG-2, H264 and H265
  - 33Ks to 27 Msymbols DVB-S, DVB-S2, for HD-TV, DATV and RB-TV
-  See <https://batc.org.uk/>



# DATV transmit system



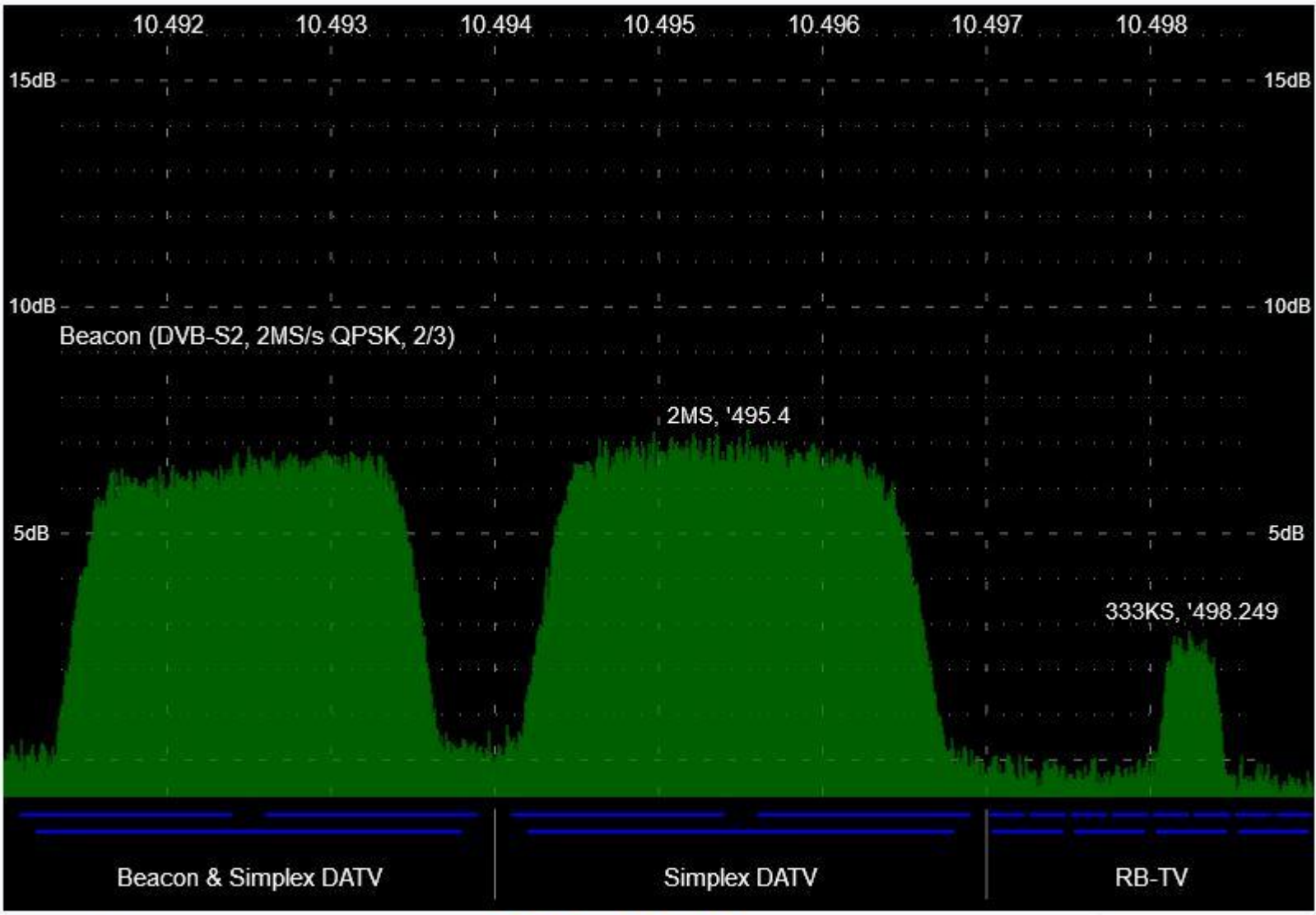
# DATV transmit

-  ~30 watts in to a 1.2m dish
-  PA at dish and VERY short feeder
-  Dual band dish feed
  - 2.4GHz patch
  - LNB 22mm waveguide





# 3 signals



Users: 149

[DATV Bandplan Link](#)

Open fullscreen





# F4HSL ~ 80KHz!

MINITIOUNE v0.9beta8\_9 - Receiver/Analyser DVB-S/S2 144 MHz to 2450 MHz - SRmini=32 kS/s - for MiniTouner/MiniTouner-Pro

**SR (kS) Freq (kHz)**  
**00066 10498250**  
**Offset-> - 09749918**

SR2000 Q-beacon  
SR1000 Q-4.75MHz  
SR500 Q-6.25MHz  
SR333 Q-7.25MHz  
SR250 Q-7.75 MHz  
SR125 Q-8.25 MHz  
SR66 Q-8.75 MHz  
SR27500 437MHz

Oscar 100

DVB mode:  DVB-S  DVB-S2  Auto  
FEC DVBS:  All  1/2  2/3  3/4  5/6  6/7  7/8

Wide scan  
 Low SR

Fplug:  A  B  
LNB volt:  0  13(V)  18(H)  
22kHz:  OFF  ON  TS

Store into Memory: M1 M2 M3

**PIDs**

Pid from .ini  
**F4HSL** Auto PID  
F6DZP-Mpeg  
HDlowSR  
France24  
QRZ DX  
RaspberyP

**PID Video**  
00256  
**PID audio**  
00257

Codec:  
 Mpeg2  
 H264  
 H265

Format:  
 4/3  
 16/9  
 1/1  
 auto

Width: 500  
Height: 375

Audio:  
 MPA  
 AAC  
 AC3

Zoom:  
 adapt  
 x1  
 maxi

**GRAPH**  
Reset

Program: **F4HSL**  
infos: DVB-S2  
Provider: **GO-100**  
Codec: **VH265 + AAC**

photo

Audio level

Info

Carrier Lock

SR Lock

Full RF Pw -45dBm

C/N MER 12.2dB

Constellations

BCH errors: 0

LDPC: 3% 205

FEC: 3/4 8PSK\_S35

C/N must be > 8.71 dB

**D3**

TS: 0 err 0

Bytes recvd: 155 kb/s 193ms

Beep

Dsave

UDP

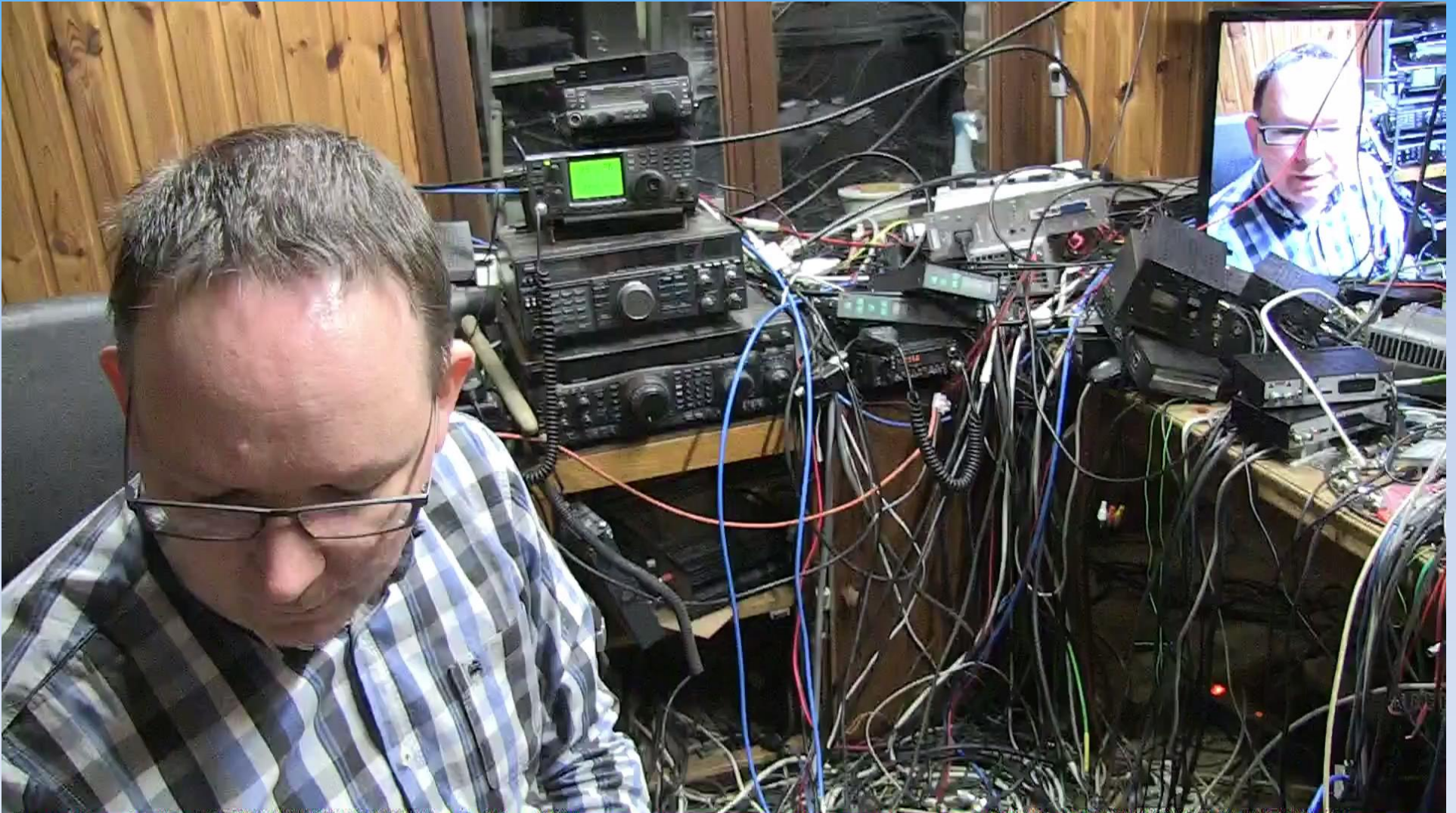
Record

Quit

Expert Web





BATC

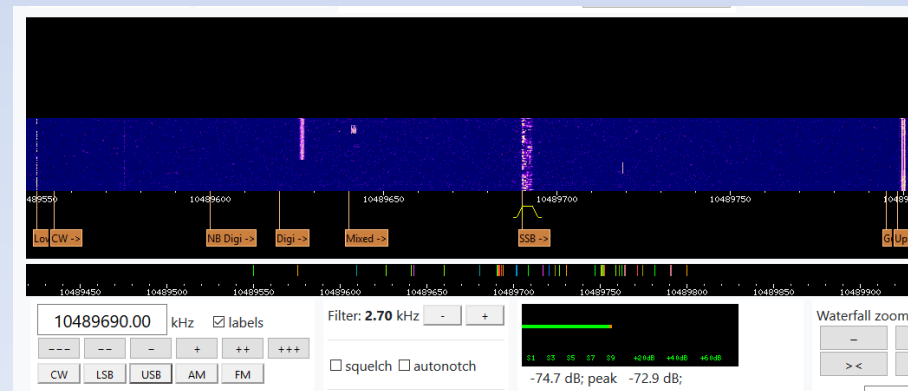
# ON4BHM ~ 2MHz





# The WebSDR

-  AMSAT-UK and BATC wanted to make Oscar 100 accessible to everyone
-  An on-line WebSDR which only needs a standard web browser
-  Full coverage of NB transponder with waterfall and full audio decode.
-  350+ users on first weekend





# Spectrum Monitor

## An essential tool to enable the Wide Band transponder usage

The screenshot displays the Spectrum Monitor interface. The main window shows a spectrum plot with a frequency range from 10.492 to 10.498 MHz. The plot shows three distinct signals: a wide band signal labeled 'Beacon (DVB-S2, 2MS/s QPSK, 2/3)' with a bandwidth of 0.9MS and a center frequency of 494.756 MHz; a narrower signal labeled 'Simplex DATV' with a bandwidth of 500KS and a center frequency of 496.249 MHz; and a very narrow signal labeled 'RB-TV' with a bandwidth of 250KS and a center frequency of 497.751 MHz. The vertical axis represents power in dB, ranging from 5dB to 15dB. Below the plot, there are three tabs: 'Beacon & Simplex DATV', 'Simplex DATV', and 'RB-TV'. At the bottom left, it shows 'Users: 169'. In the center, there is a link for 'DATV Bandplan Link'. At the bottom right, there is a button for 'Open fullscreen'.

On the right side of the interface, there is a chat window with a list of users and a message input field. The chat history includes the following messages:

- 17:07 **i2NDT Claudio** OK DZP...I will wait :-)
- 17:07 **G7NTG\_JIM** haha don't look down the waveguide!
- 17:07 **F6DZP** thanks JIM
- 17:08 **G0MJW** I don't like the PTFE lens – its much worse than the recommended polyfeed.
- 17:09 **G7NTG\_JIM** looks like a nice kit – all you need is a blowlamp and solder
- 17:09 **i2NDT Claudio** by the way Jean Pierre myself and i2CIC are gorking on a very stable DRO LNB!
- 17:09 **i2NDT Claudio** working
- 17:09 **G7NTG\_JIM** would this be locked to a reference?
- 17:10 **G7NTG\_JIM** I use an octagon with a Leo Bodnar and it is great on the narrowband
- 17:11 **i2NDT Claudio** well...yes and no...just using a stable 10GHz external LO instead of the internal DRO
- 17:12 **on7ndr** nice pictures guy on the beacon frequency thanks
- 17:12 **G1LPS** KLB audio good
- 17:12 **G7NTG\_JIM** I tried the ptfе lens but it did not improve either dish – I use a rocket lens on the narrowband 80cm dish which gives me 3dB more signal
- 17:12 **G0MJW** Yes – nice kit and well priced too
- 17:12 **G7NTG\_JIM** I thought so
- 17:13 **G7NTG\_JIM** he is out of stock at the moment!

The chat window also shows a list of users: G8PEF, PA0BOJ-Jack, PE1BR, Marco, G3VZV\_Graham, g4bao, G8NOP-Pip, F1TE, GI3VAF\_Robert, M1CDQ, GI3VAF\_Robert, F6DZP, F6HDW, Simon\_G0FCU, G2DD\_Lauren, Andy\_M0MUX, PE1ASH, Renny, GU6EFB, Keith, pe2by-boele, 2E0XAY, DL0TP, and DD0KP.

At the bottom of the chat window, there is a text input field with the placeholder text 'Type a message here and press enter.'



# BATC + AMSAT-UK SDR

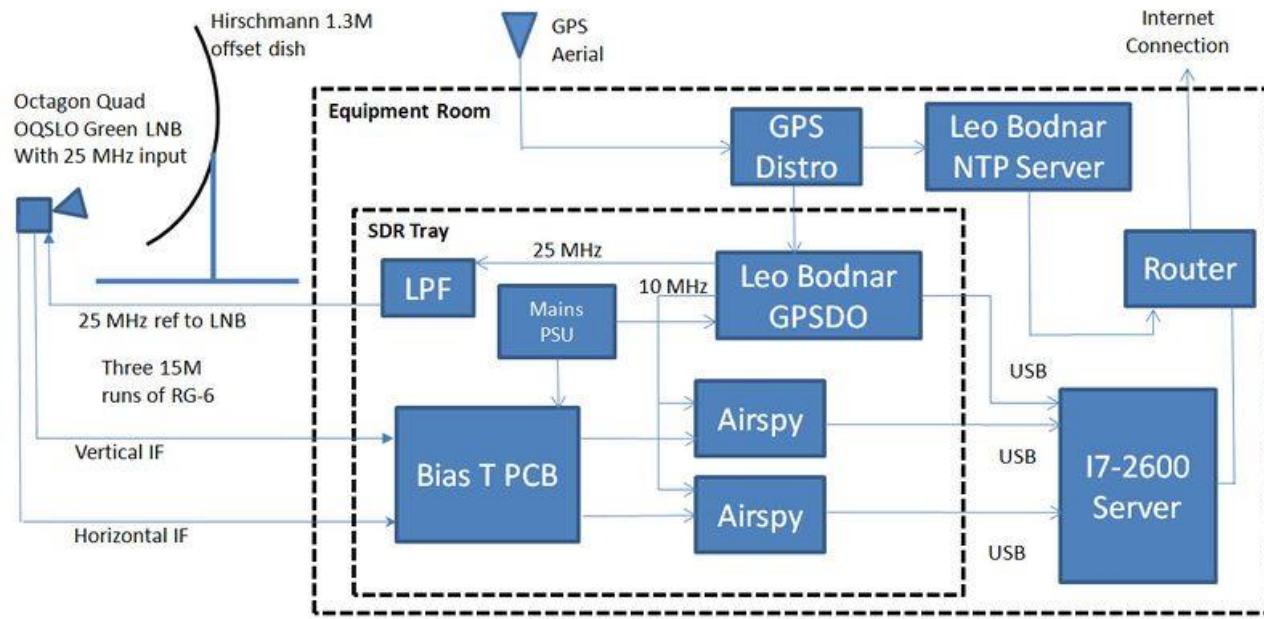


## Located at Goonhilly Earth Station




- Quiet secure location (I070JB)
- Excellent network connectivity
- Scaled for 500+ users



Goonhilly Es'hail-2 Spectrum Monitor and WebSDR - Hardware

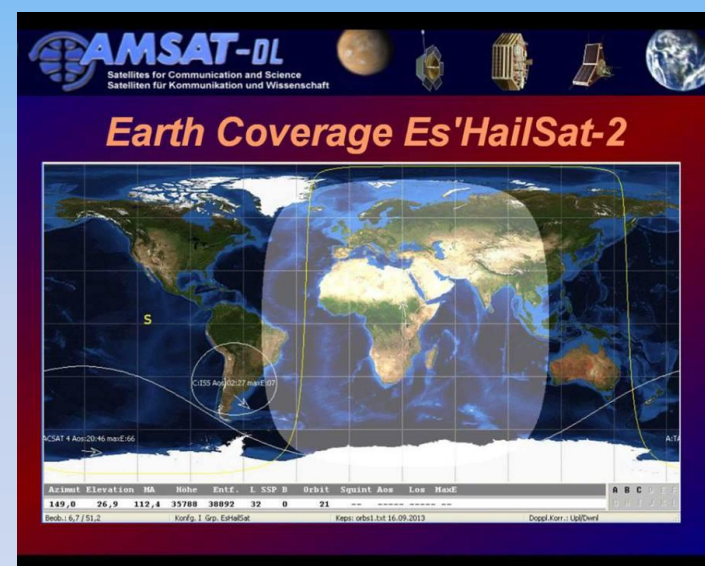


# Is it really amateur radio?

-  Absolutely - hundreds of people are engaged in that most vital aspect of amateur radio:
  - Self training in wireless telegraphy
-  It has breathed new life in to the satellite and microwave communities
-  As well as providing 24/7 communications to 1/3<sup>rd</sup> of the earth


# Conclusions

-  Oscar 100 is a fantastic opportunity for amateur experimentation
-  Receive is easy!
-  A good transmit capability is more of a challenge but not impossible!!
-  Start simple
  - Get a receiver working!





# WebSDR demo

-  Usable by anyone with a web browser
  - Scaled to support 500 simultaneous users
-  All listening to different frequencies and decoding different modes!
-  Runs s/w developed by [www.websdr.org](http://www.websdr.org)
  - More than 150 systems around the world
-  <https://eshail.batc.org.uk/nb/>
-  Wideband spectrum monitor
  - <https://eshail.batc.org.uk/wb/>