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Topics

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

Oscar 100 is 2 amateur radio transponders hosted on the Es’hail-2 Direct Broadcast TV satellite.

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.
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

Apx 3000kg   Produces 15kW of electrical power has 35 transponders
“Normal” amateur satellites

FUNcube-1 CubeSat AO-73
European Student Earth Orbiter (ESEO)

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

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° → ~20dB Antenna Gain !!
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

- CW only
- NB digital modes
- Digital modes
- Mixed modes
- SSB only
## Wideband band plan

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<td>Downlink (MHz)</td>
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<td>333KS</td>
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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
The NB transponder is VERY sensitive
- Transvert up from a VHF or UHF rig
- 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
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

- Downlink frequency is 10,491 – 10,499 MHz and within pass band of standard consumer LNB.
- PLL LN Bs should be used to give stability for Reduced Bandwidth TV signals.
- Locking can cause phase noise problems.
- However, 9,750 MHz LO puts IF outside consumer set top box tuning.
- 90% of signals are Reduced Bandwidth (RB-TV) and cannot be received on a consumer STB.
MiniTiouner USB tuner

A wide frequency range tuner
  – 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/
Receiving DATV

- Aim for a 1m dish
- Check your dish direction using
  - [https://eshail.batc.org.uk/point](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)

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<th>Dish size</th>
<th>Received MER</th>
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<tbody>
<tr>
<td>1.8m</td>
<td>10dB</td>
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<tr>
<td>1.2m</td>
<td>8dB</td>
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<tr>
<td>1m</td>
<td>6dB</td>
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<tr>
<td>80cm</td>
<td>5dB</td>
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DATV transmit system

- PC or Portsdon
- LimeSDR or DATV Express
- Variable Attenuator
- Optional Transverter
- Cable Driver Amplifier

- Camera
- USB
- RF at 0 – 10 dBm
- RF
- 2.4 GHz RF

- PTT Line
- PA to Dish Feeder
- Long Feeder to PA and dish

- Power Amplifier
- 2.4 GHz Filter
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
G4EML ~ 300kHz
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
Located at Goonhilly Earth Station

- Quiet secure location (IO70JB)
- Excellent network connectivity
- Scaled for 500+ users
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 into the satellite and microwave communities

As well as providing 24/7 communications to 1/3rd 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
  - More than 150 systems around the world
- https://eshail.batc.org.uk/nb/
- Wideband spectrum monitor
  - https://eshail.batc.org.uk/wb/