

Receiving Envisat DDS and EUMETCast using 1 antenna, 1 cable and 1 PC

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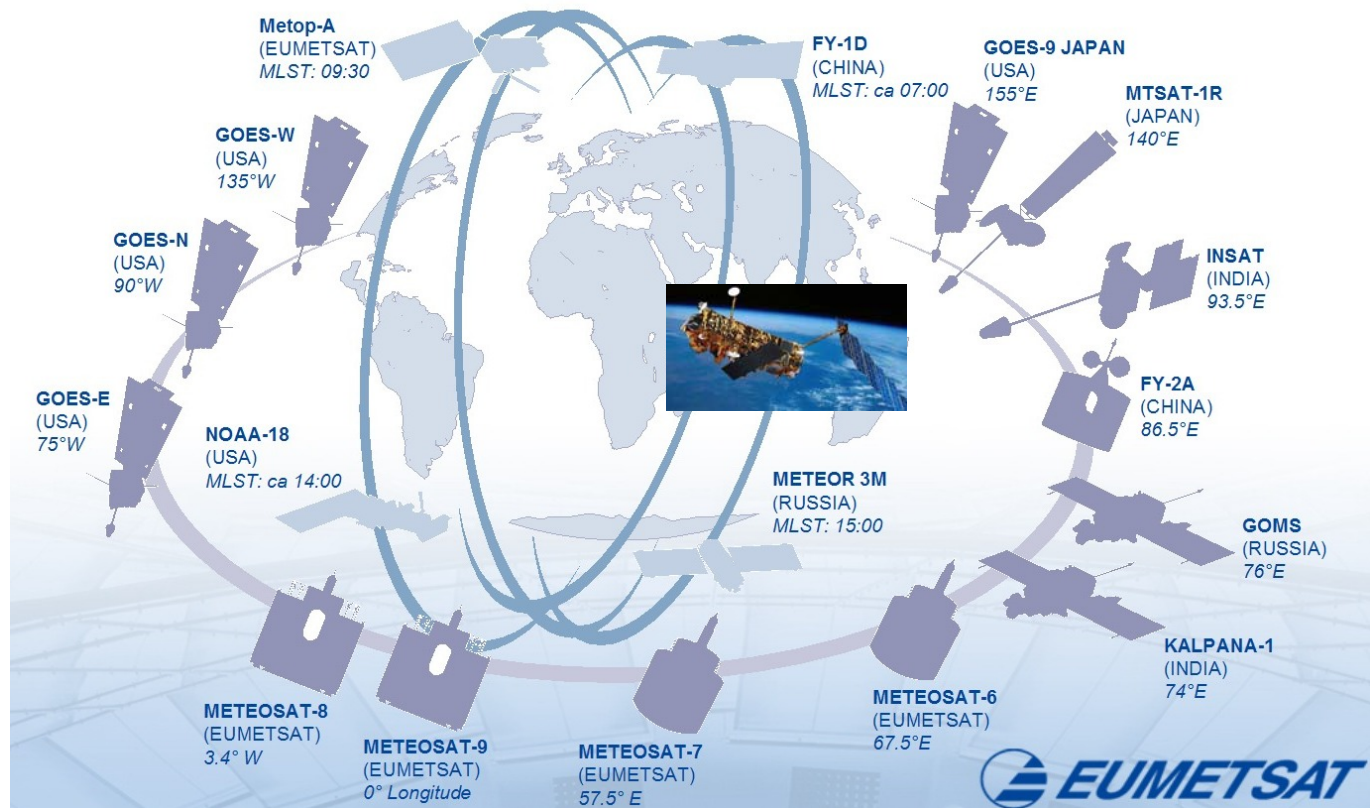
Werkgroep Kunstmanen (workgroup man-made moons)

The Netherlands

www.kunstmanen.net

Why receive Envisat DDS and EUMETCast ?

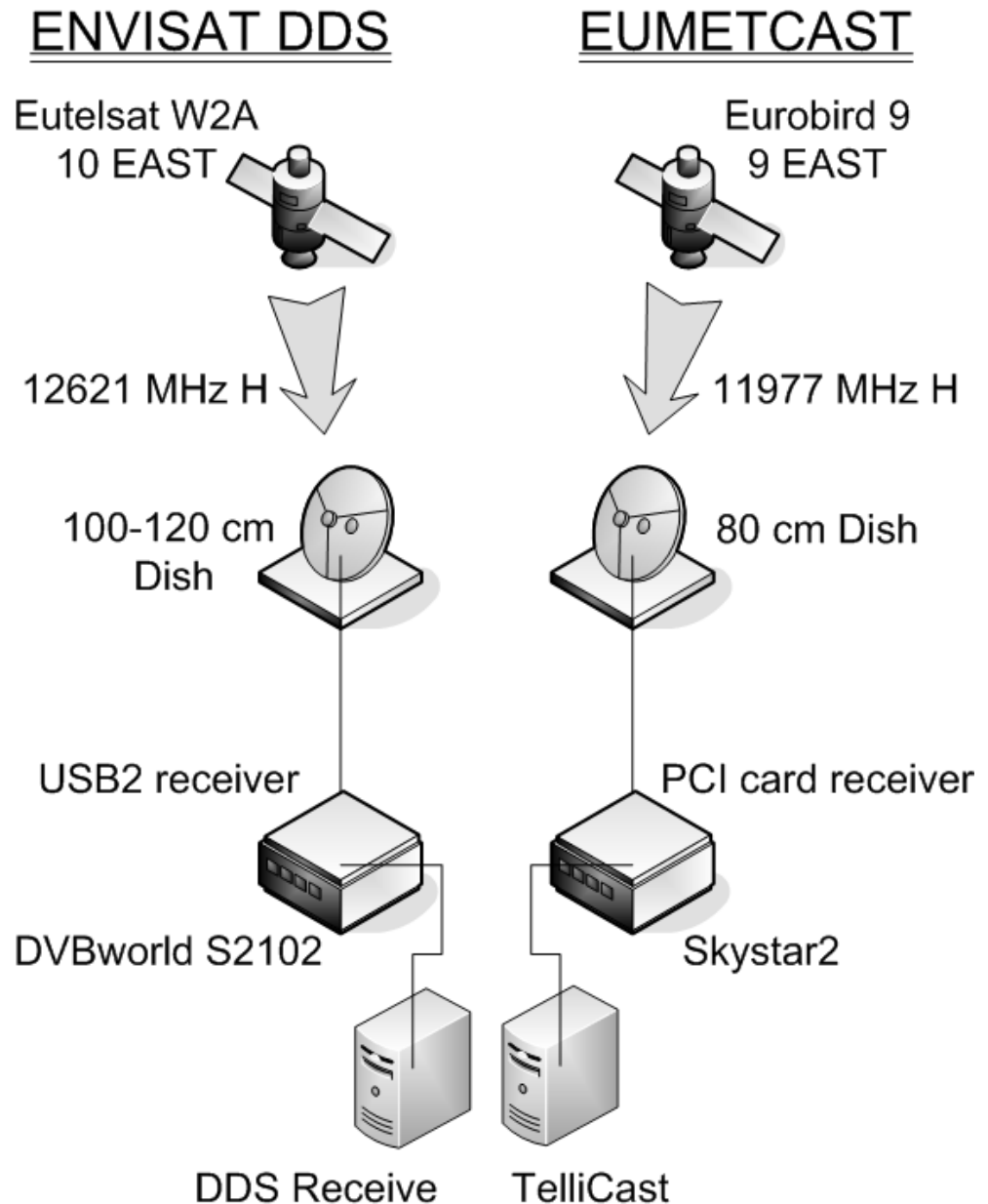
- EUMETCast delivers images and data from geostationary and polar weather satellites all around the world, ideally suited for overview and animations.



- Envisat DDS disseminates Envisat images with a stunning 260x290 meter resolution from certain areas that allow you to zoom in endlessly and show details that EUMETCast lacks.

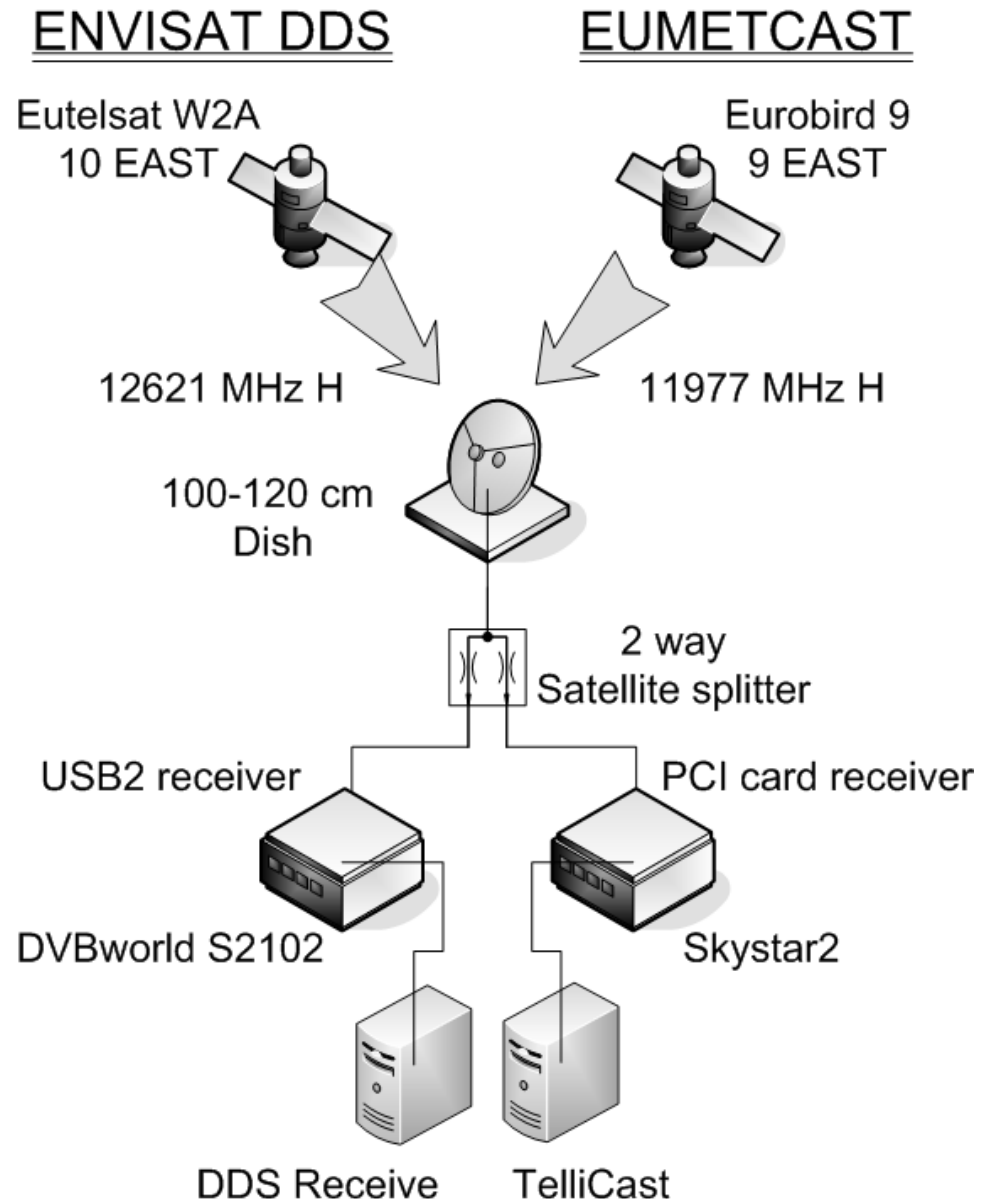
Why use 1 antenna ?

- Receiving Envisat DDS and EUMETCast normally requires installing two satellite dish antennas, routing two cables, having two receivers connected to two separate PCs.
- Amateur users living in residential areas may not have space for 2 dish antennas. In some areas only 1 dish is allowed.



Why use 1 PC ?

- If you do not want to miss any images, you receive around the clock.
- Running 2 PCs does increase electricity costs and generate more heat and noise.
- Nowadays PCs have enough performance to receive and process both services simultaneously !
- But receiving around 30 GB (Envisat) + 40 GB (EUMETCast) per day is quite a challenge !

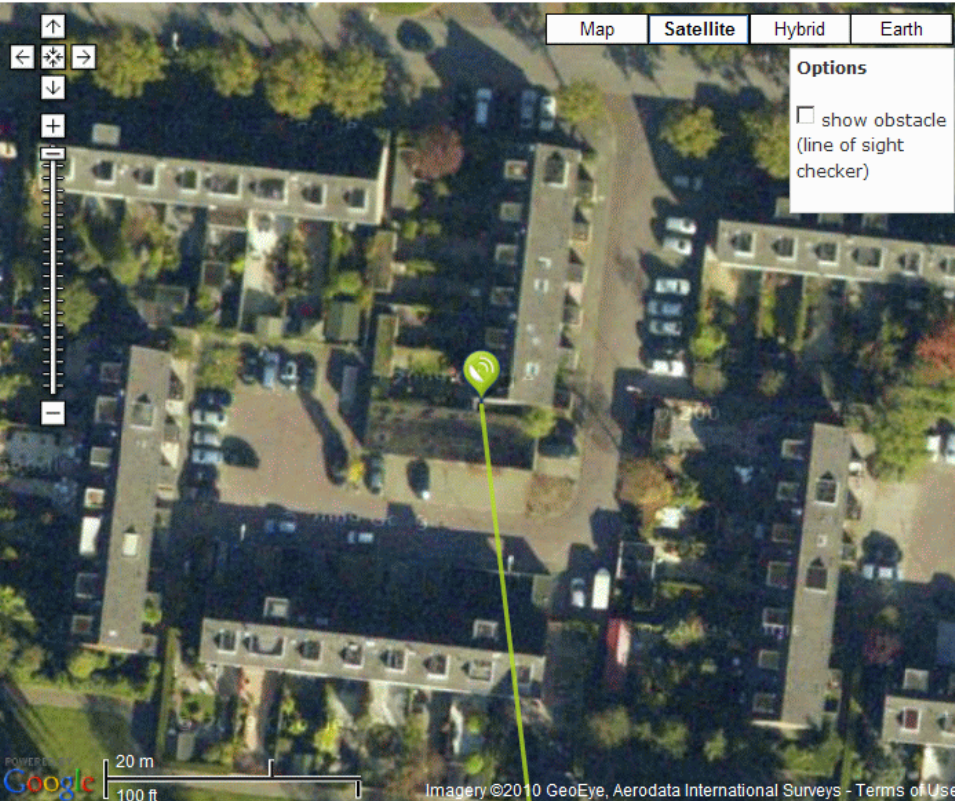


Can we receive both services using one dish ?

- Check to see if you have a free line of sight to both satellites.

www.dishpointer.com is a tool that overlays on Google Earth.

- Envisat DDS:
Eutelsat W2A 10 degrees East
Ku high band 12621 MHz
- EUMETCast:
Eurobird 9A 9 degrees East
Ku high band 11977 MHz
- Envisat DDS and EUMETCast
both use Horizontal polarization
!



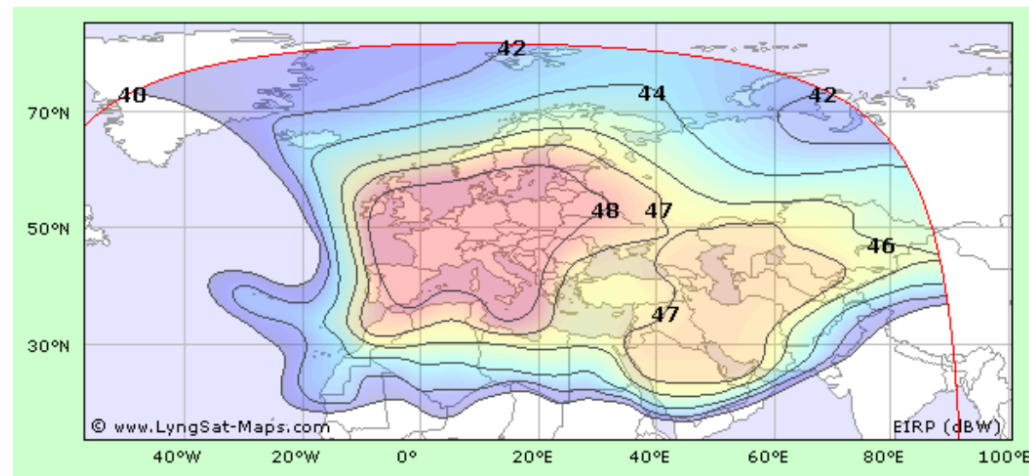
The screenshot shows a Google Earth interface with a satellite view of a residential area. A green satellite dish icon is placed on a building, and a green line of sight checker is drawn from it. The interface includes a top menu bar with 'Map', 'Satellite', 'Hybrid', and 'Earth' tabs. An 'Options' panel on the right shows a checkbox for 'show obstacle (line of sight checker)' which is checked. A scale bar at the bottom left indicates 20 m and 100 ft. The bottom of the screen displays three data sections: 'Your Location', 'Satellite Data', and 'Dish Setup Data'.

Your Location	Satellite Data	Dish Setup Data
Latitude: 51.7741° Longitude: 4.6121°	Name: 10E EUTELSAT W2A Distance: 38565km	Elevation: 30.5° Azimuth (true): 173.1° Azimuth (magn.): 173.2° LNB Skew [?]: -4.2°

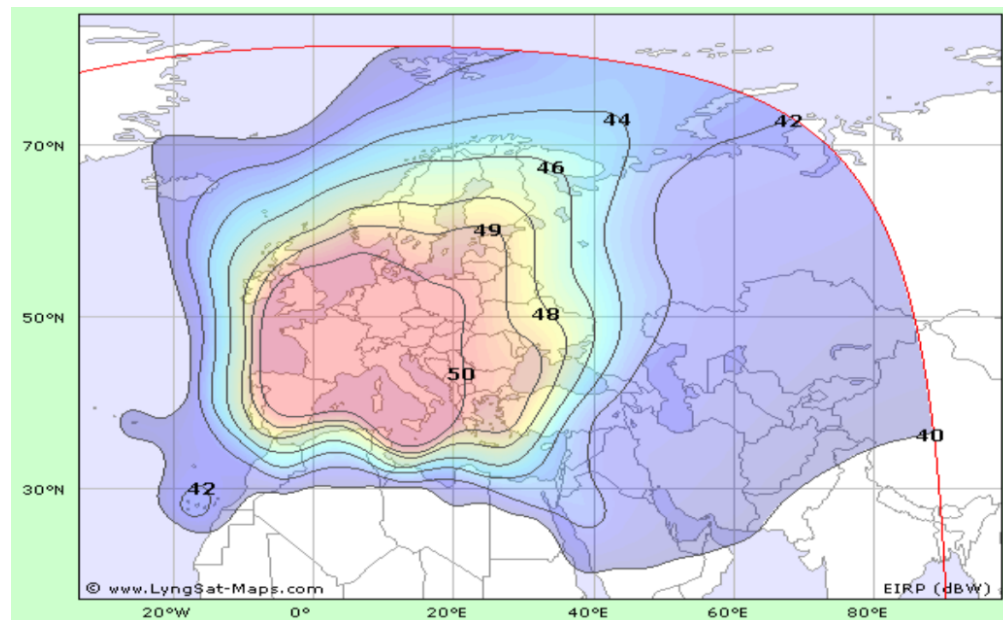
Can we receive both services using one dish ?

- Eutelsat's W2A EIRP is 2 dBW lower for Europe compared to Eurobird 9A.
- Envisat DDS requires a minimum of 1.0 meter dish (1.2 meter recommended)
- EUMETCast is received using a 0.85 meter dish.

Can we use a 1.0 meter dish pointed halfway between 9 and 10 East ?



Eutelsat W2A

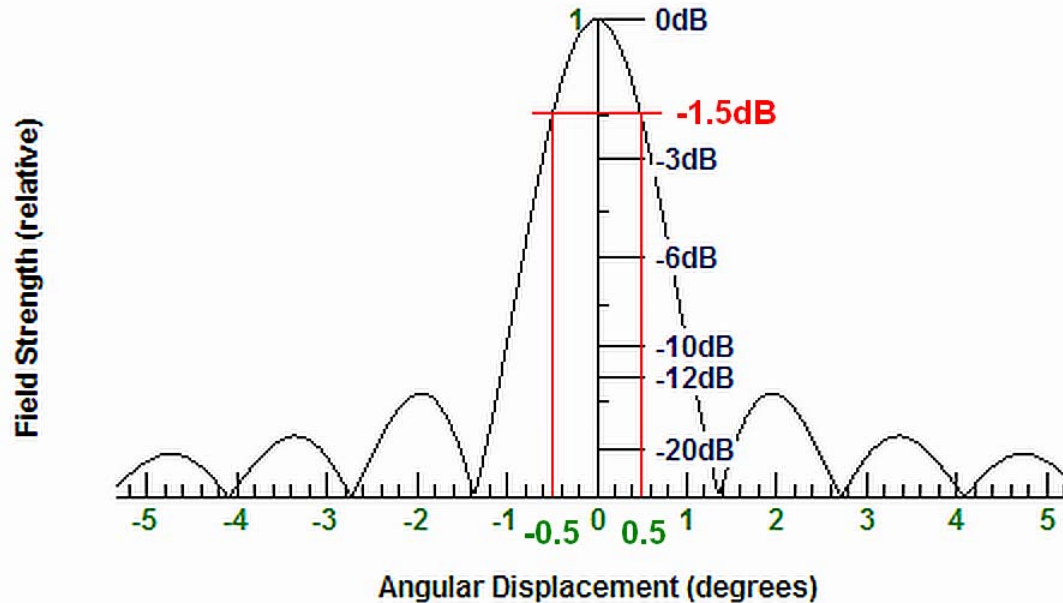


Eurobird 9A

Can we receive both services using one dish ?

Rectangular Aperture Beam Pattern

Produced using Satmaster Pro



Uniform Illumination
Antenna Aperture = 1.00 metres
Frequency = 12.621000 GHz

- Satmaster Pro calculation shows that a 1.0 meter dish has sufficient beamwidth to receive both 9 and 10 East transponders using 1 LNB
- Some Off-axis Gain loss on both transponders.
Worst case = -1.5dB
- By aligning the dish carefully between 9.5 and 9.8 degrees east, signal levels from Envisat DDS and EUMETCast can be made equal.
- A larger dish has more gain but narrower beamwidth !

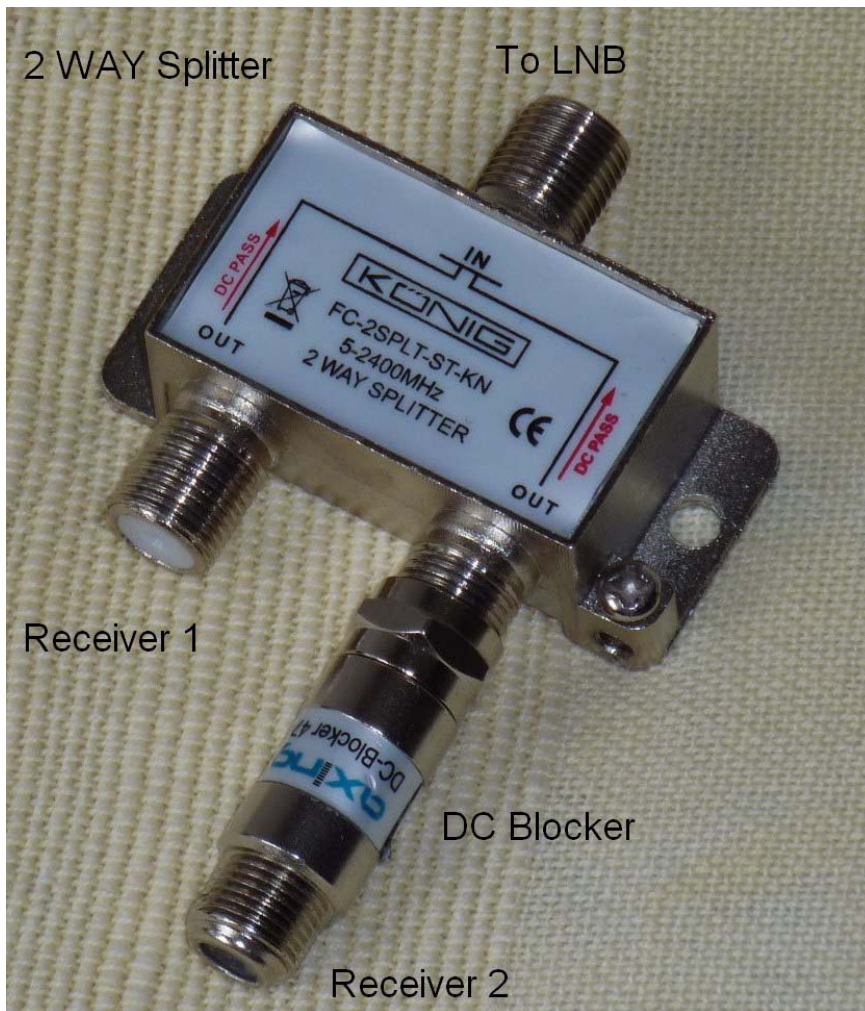
That was theory, now some practice !



Test set-up:

- 1.0 Meter offset dish on portable tripod
TRIAx TDS110
Gain 40.2 dBi @11.7GHz
- cheap LNB
FaVal Universal Single
Typical 0.2 dB Noise Figure
- Using 25 meters of good quality KOKA799 coaxial cable (at 12.621 GHz
IF= 2021 MHz !)

How to feed two receivers from a single LNB and cable:



- Signal is applied to both receivers using a 2 way splitter.
Insertion loss < 6.5 dB @ 1750-2400 MHz
Isolation > 16 dB @ 1750-2400 MHz
- With both receivers applying power and 22kHz pulsed signal to the LNB (to activate high band), the 22 KHz signals from both receivers will cancel each other out causing periodical flipping of low and high band !
➔ a DC-blocker is used to block power supply and 22KHz pulse from one receiver.
- Alternatively find a splitter with only one “DC pass” port.

Using two different receivers to prevent conflicts:



- Technisat Skystar2 PCI card receiver used for EUMETCast, proven technology but doesn't handle weak signals and rain fades very well.
- Requires a 5 Volt PCI slot !

- DVB World external receiver used for Envisat DDS, excellent results on weaker signals.
- USB2.0 port required.
- External power supply (9V 2A).



Can we decode both streams on one system ?

- DDS Receiver and TelliCast (for EUMETCast) happily run together on the same PC as long as both receivers have their own fixed IP address.

Skystar2 / TelliCast	192.168.238.238
DVBworld / DDS receiver	192.168.238.239

- Receiving over 70 GB data per day needs a large and fast hard disk !
 - ➔ 1.5 TB disk with 32 MB cache
- Processing EUMETCast data and viewing the Envisat data requires processing power
 - ➔ Dual core Intel i3-530 or better
- Although Solid State Disks prices have come down, handling over 70 GB per day may wear them down very quickly.

Why not store temporary data on a large RAM disk ?

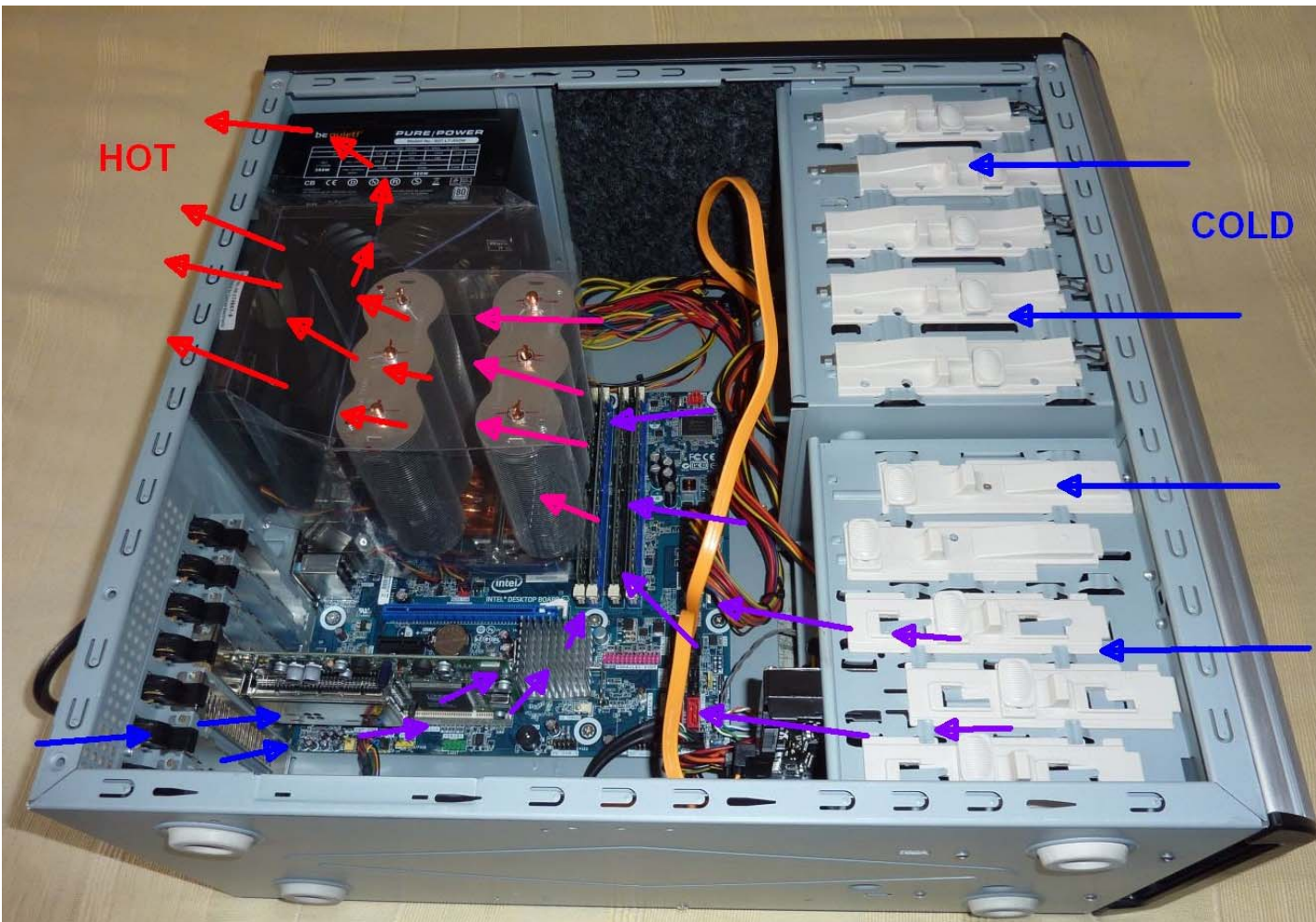
 - ➔ 4GB RAM for Windows + 4GB RAM disk for temporary storage
- The free DataRAM 4GB RAM disk offers a second and very fast storage path that is not easily “clogged” by Windows ! Can use the 4 to 8GB memory that XP cannot access.

- ➔ When the hard disk is heavily loaded, TelliCast and DDS Receiver continue to write to RAM disk, preventing data loss.

Housekeeping required !

- A simple DOS script checks DDS Received folder on RAM disk and moves completed data to disk at low priority.
- Another DOS script checks the EUMETCast Received folder on RAM disk and moves data that has not been processed within 10 minutes. Normally all EUMETCast data is processed from RAM disk and written to hard disk using David Taylor's MSG Data Manager, AVHRR Data Manager and MetOp Data Manager.
- Although you can additionally view all images on the receive PC, I prefer to do image processing and animations on a second PC that retrieves data over LAN.
- Without the need for an Internet connection I do not run virus scanner or firewall on the receive PC. My other system is well protected of course.
- As most receive and decode software is available for MS Windows only I use Windows XP, this offers all that is needed and does run stable if kept clean.
- A test using Windows 7 64bits is still going on. First results show that it needs more resources and lots of tweaking to prevent Window's scheduled maintenance tasks interrupting data reception !
- With up to 70 GB data per day, keeping your hard disk from overfilling is a challenge ! But tools are available to do this automatically.

Here comes the hardware:



Two 120 mm temperature controlled fans and a air duct around the CPU heatpipe cooler create sufficient cooling and allow around the clock, low noise, operation in the shack.

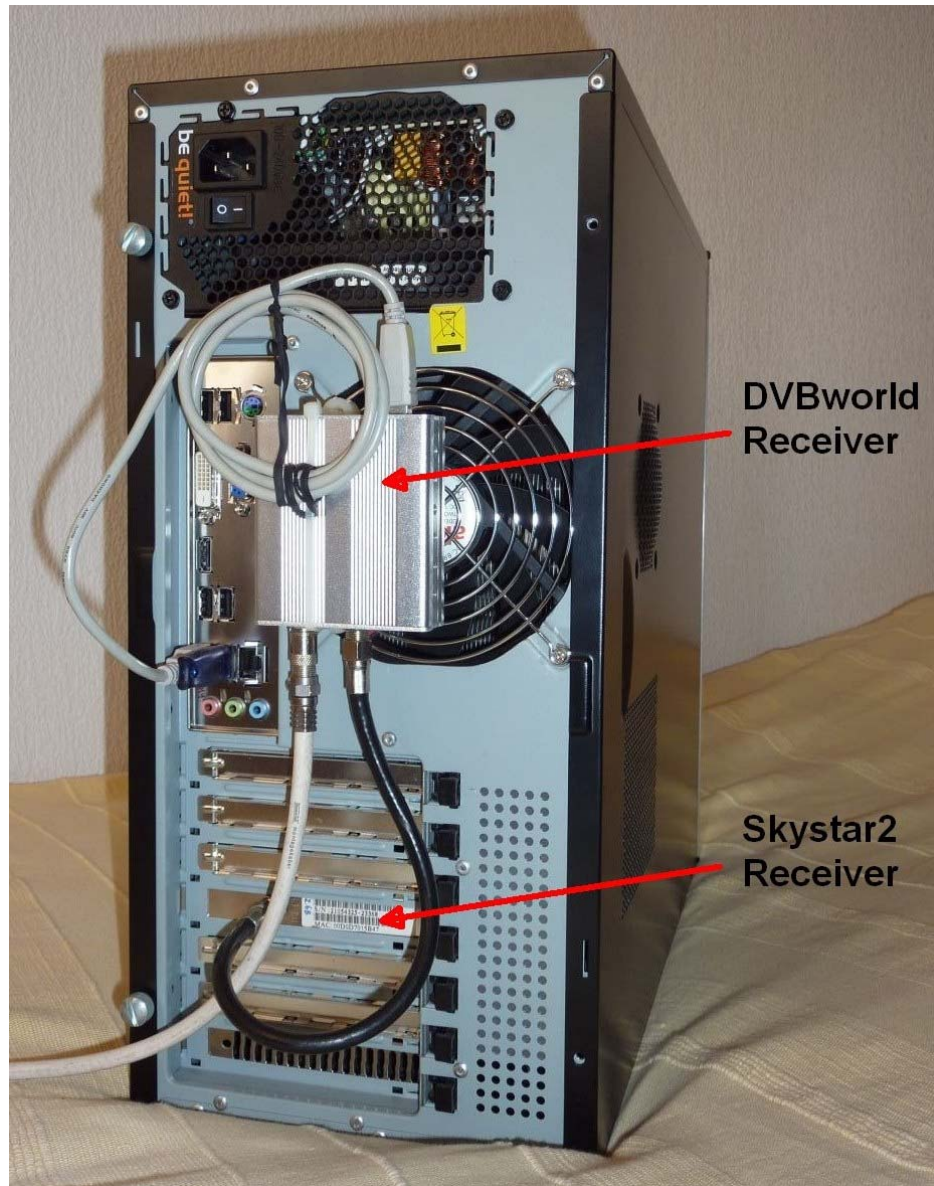


All mesh front takes in cold air.



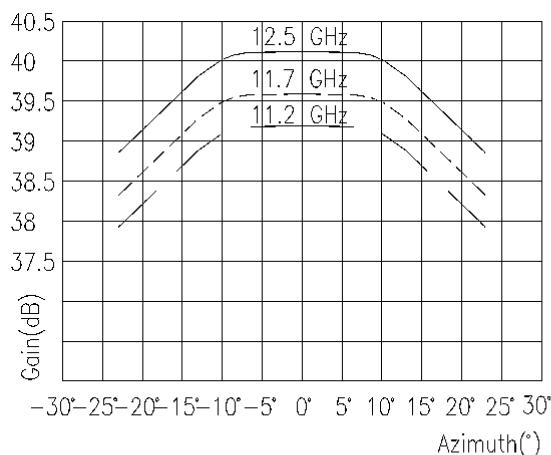
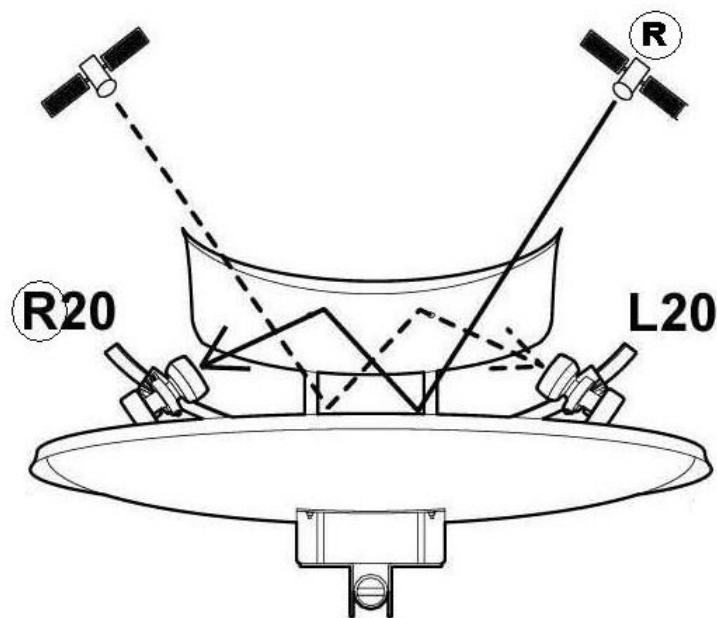
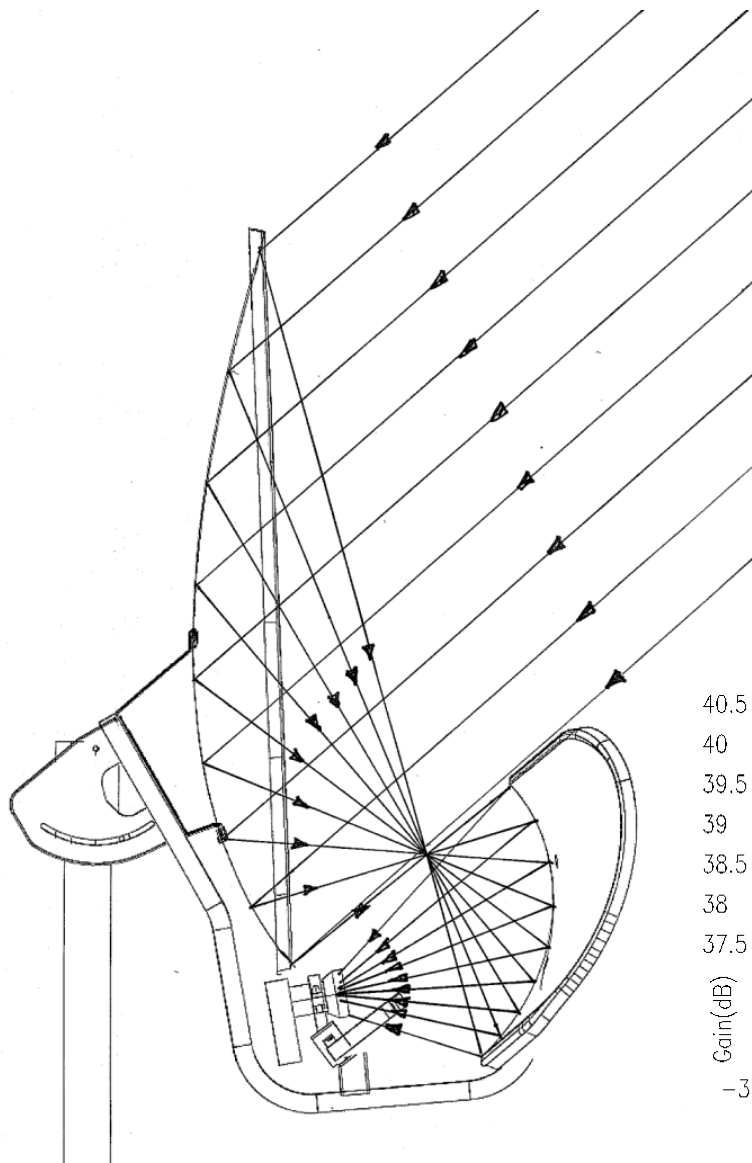
Carpet tile covering absorbs noise and dampens vibrations.

A custom built system that saves energy:



- Intel DH55TC mainboard with integrated graphics.
- Intel Core i3-530 CPU with heatpipe cooler + air duct
- 4 x 2 GB DDR3 RAM
- 1.5 TB hard disk with 32 MB Cache
- Be Quiet 350 Watts high efficiency power supply (85% efficiency)
- Coolermaster Midi tower case, all mesh front and 120 mm case fan
- 2x temperature controlled 120 mm fans with dual ball bearing
- Consumes only average of 56 Watts while receiving and decoding ! (including both receivers)

Using a Multi-LNB dish for Envisat DDS and EUMETCast



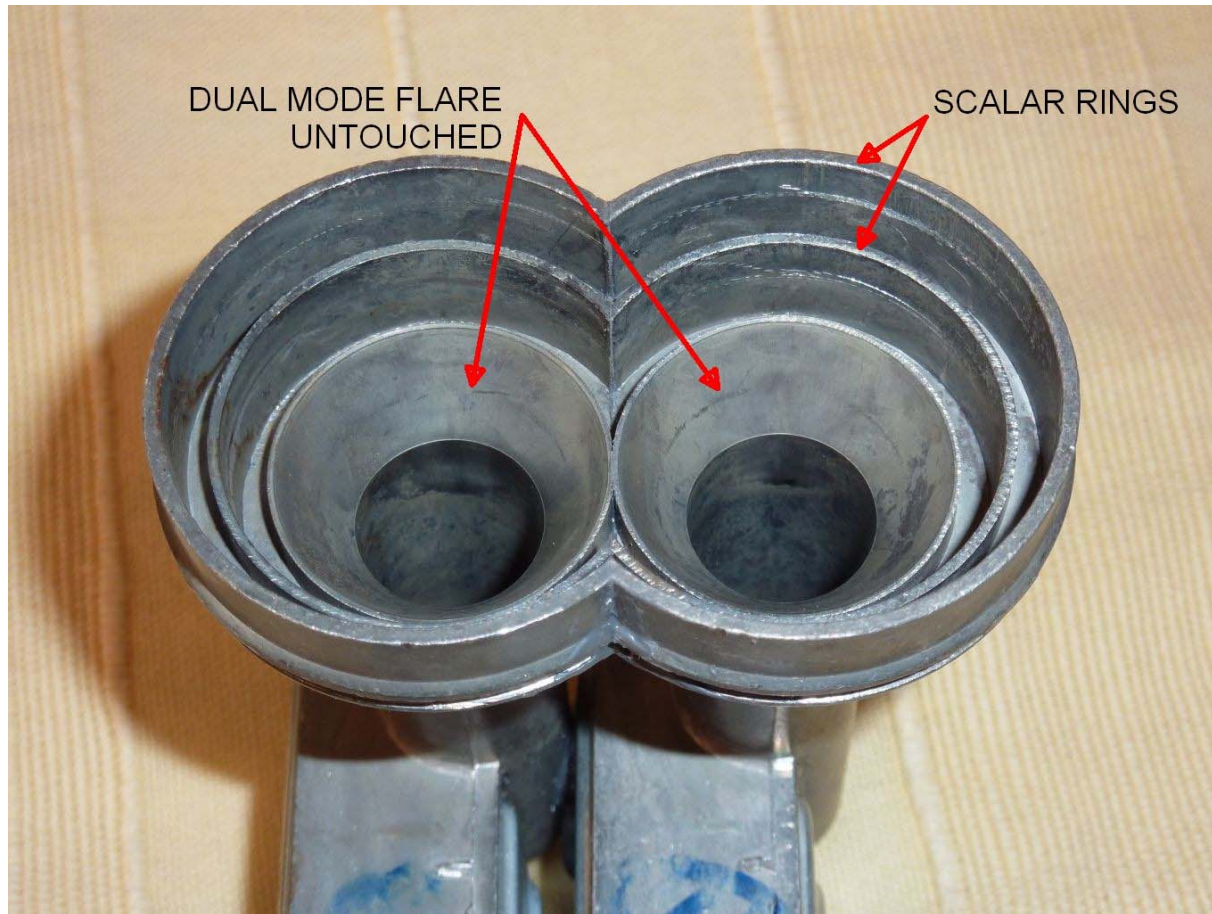
* Figures acquired through repeated field tests.

WaveFrontier Toroidal dish T90
Gain 39.6 dBi @11.7GHz

Model		TOROIDAL90
Main Reflector	Height	96.7 cm
	Width	108.6 cm
Sub Reflector	Height	36.1 cm
	Width	83.6 cm
Reception Frequency		10.70 ~ 12.75 GHz
Antenna Gain (at 12.5 GHz)		40.10dB (at 0 deg, Azimuth)
		39.20dB (at 20deg, Azimuth)
Azimuth (at Tilt 0 deg)		± 25 deg (Total 50 deg)
LNB Installation		1 ~ 14 EA
Efficiency		65% ~ 80%
Polarization		Linear & Circular
Material		Galvanized Steel
Finish Coating		Polyester powder coating
Operating Temperature		-30°C / +60°C
Relative Humidity		0% ~ 90%
Damage Winds		60 m/sec
Operating Winds		45 m/sec
Acceptable Pole Diameter		60 mm

Optimizing 9 and 10 east reception, creating a TwinSat LNB

- On the Wavefrontier T90 optimal distance between 9 and 10 east LNB is 24 mm compared to 17 mm for a 1.0 meter standard offset dish.
- ➔ While a single LNB is used on a standard dish, two LNBs are required on the T90.
- But on a standard LNB the feedhorn diameter is 50 to 60 mm !
- ➔ Modify two standard LNBs and glue them together into a “TwinSat” LNB !



The final result, an all-in-one satellite reception set-up



Single dish receives 28.5E, 23.5E, 19.2E, 16E, 13E, 10E, 9E, 5E, 1W and 5W

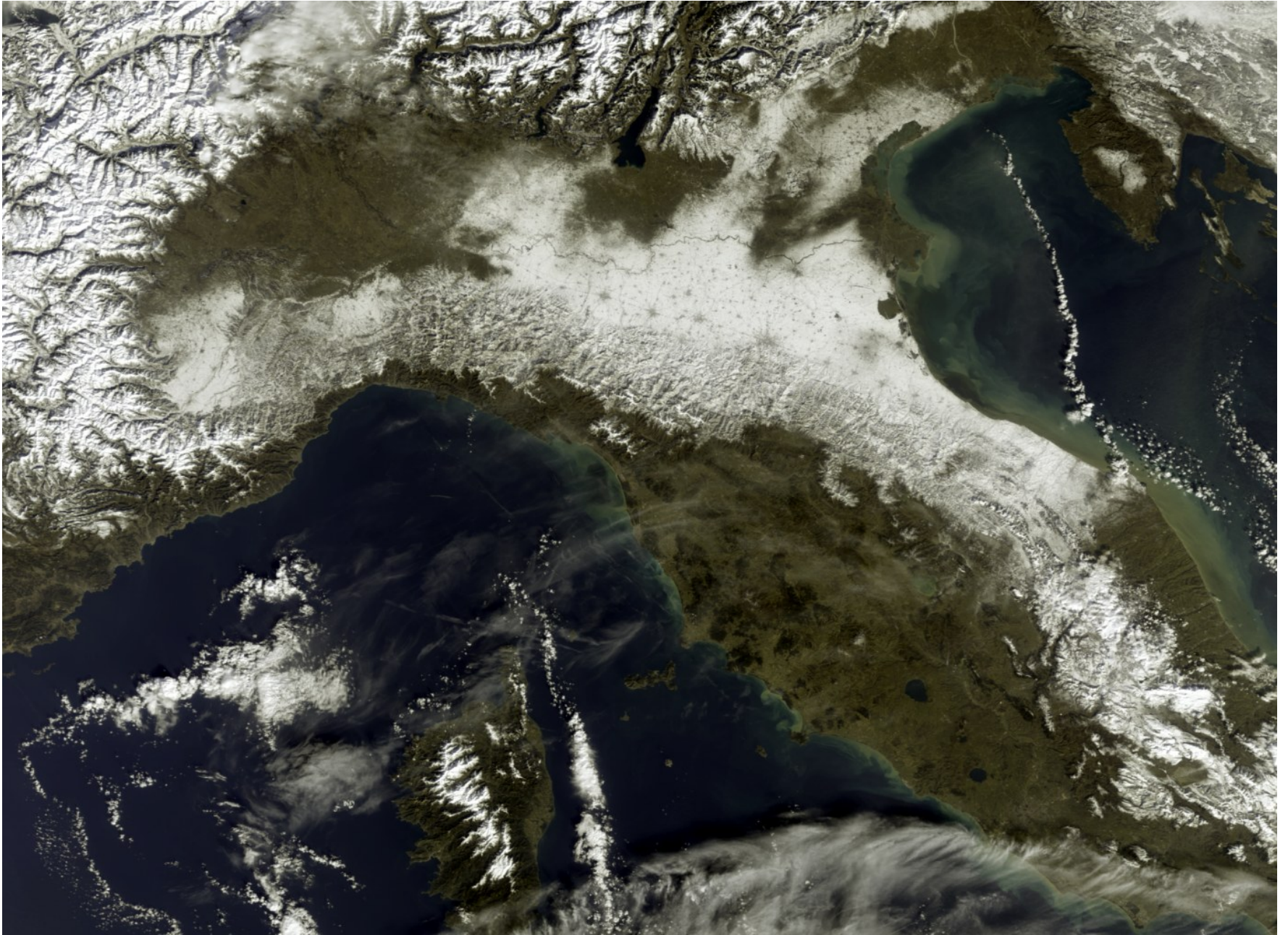
- Using quad output LNBs and multiple switches this dish supports Envisat DDS and EUMETCast on two PCs + another 3 Satellite TV receivers.
- Some cabling is required however !



Acknowledgements

- Thanks to AMSAT Italia for organising this meeting
- Thanks to Stefano for presenting on my behalf
- Thanks to ESA and Stefano for involving amateurs as co-investigators in the Envi-HAM Cat-1 project

Thank you for your attention!



Envisat MERIS image received over DDS showing Italy 2010-02-01_0950 UTC © ESA 2010