



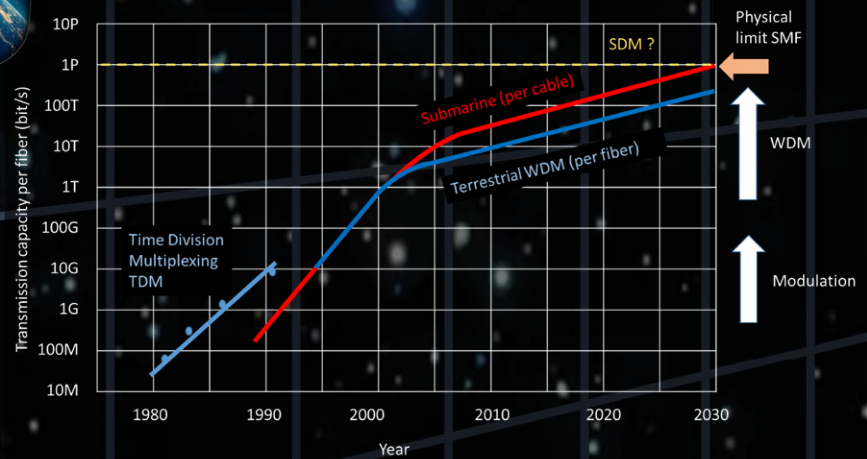
BKtel
photonics.

Space photonics – flying modules

Fiber amplifiers and lasers

Why free space optical communication?

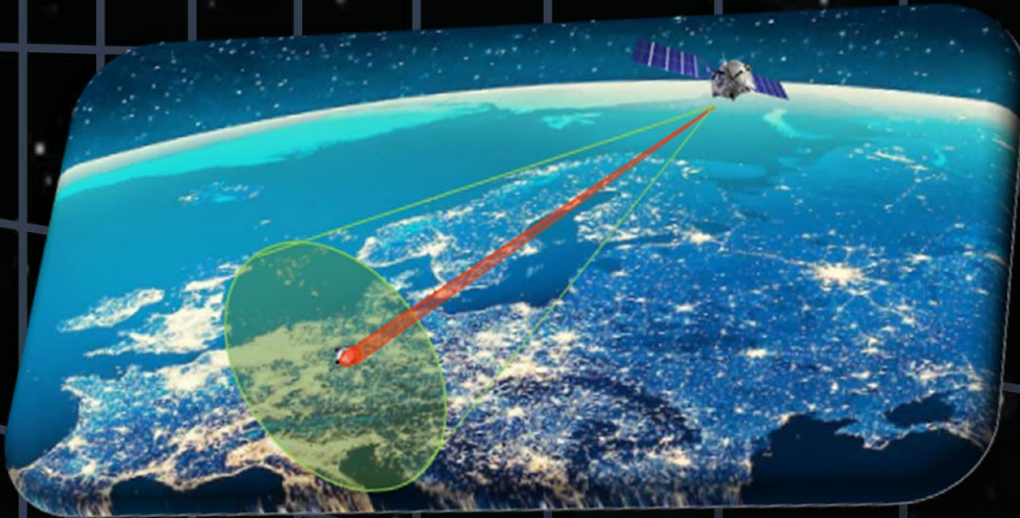
Terrestrial fiber optic networks are reaching their saturation point



- Space is the new massive telecommunication infrastructure deployment
- Satellite Constellations are now a reality
- Technology from the optical telecom industry serves as basis for the breakthrough in Satcom

Free-Space Optical Communication (FSOC)

Technology from the optical telecom industry serves as basis for the breakthrough in Satcom



- More concentrated communication power at the receiver
- Lower transmitted power required
- Lower size, weight and power requirement for emitting and receiving the signal
- Virtually no spatial overlap among various users
- FSOC is currently unregulated but it complies with laser safety recommendations

Space-grade pulsed laser



Space-grade pulsed laser for LIDAR application and satellite positioning

- Wavelength 1535–1565 nm
- Linear polarization
- Pulse Width: 1ns to 10ns
- Pulse Repetition Rate: 10kHz to 3MHz
- TRL6 (TVAC and radiation tests performed)

Series	CPFLS	HLF2S
Power	30 dBm average	37 dBm average, up to 73 dBm peak
Dimensions	50 × 80 × 12 mm	150 × 170 × 30 mm

Very high-power amplifiers for ground station



THPOA Series

High-power ground booster designed for earth-to-space communication (feeder link, beacon)

- Output power
 - Up to 46 dBm in C-band (1535 – 1565 nm)
 - Up to 40 dBm in L-band (1570 – 1605 nm)
- Input power: 10 dBm without preamplifier (optional)
- Noise figure < 8 dB
- Available in PM and non-PM versions
- Output options: end-cap or collimator
- Designed for a lifetime of 5 years

Space-grade Series for Intersatellite, and Satellite ↔ Earth communication



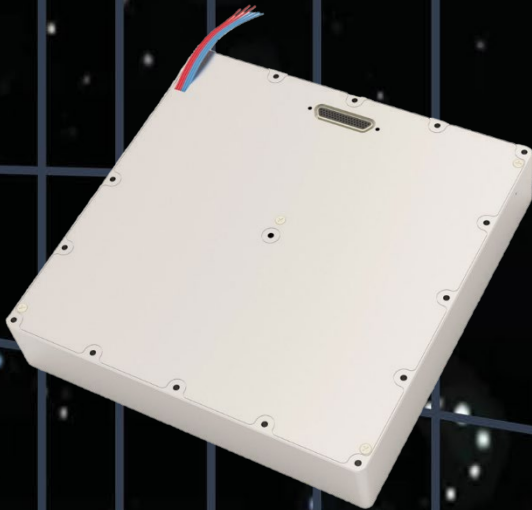
Space-grade optical amplifier

- Power control & current control modes

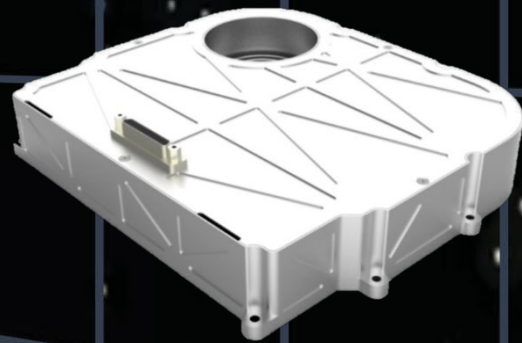
Series	MOAS	GOA2S	GOAS	CGOA2S		HPOAS
Input power (dBm)	0/10	-60/-10	-10/10			
Output power (dBm)	17	10	30	31	33	37
Polarization	Non-PM					PM or non-PM
Size (mm)	30x50x8	70x90x25	70x90x15	60x80x12	98x98x12	170x150x25
TRL	5	6	9	6	6	6



Space-grade dual optical amplifier



AOA6S series



AOA5S series

Dual amplifier = booster for transmitter path + preamplifier for receiver path

- Random polarization
- Compact housing (< 155x155x30 mm) with low power consumption
- Designed for a lifetime of 7 years
- TRL6 (TVAC and radiation tests performed)

	Preamplifier	Booster
Wavelength	1535–1565 nm	1540–1560 nm
Input power	–45 dBm	–7 dBm... +10 dBm
Output power	Up to 0 dBm	Up to 36 dBm
Noise figure	< 5 dB	< 7 dB
Gain	> 45 dB	> 25 dB

Qualifications for space optics

Mechanical shock and vibration

- GR-468 Issue 2, Section 3.3.1.1.1, Table 4-3

Temperature cycling

- GR-1312 Issue 3, Section 10.3.1, Table 10-3

Low and high temperature storage

- GR-468 Issue 2, 3.3.2.1, Table 4-4

High temperature operating life

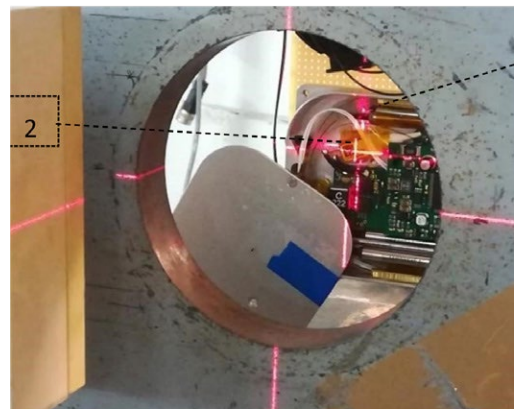
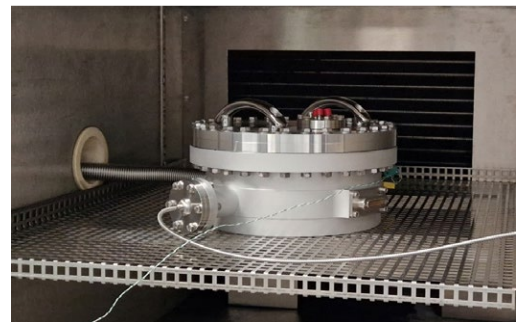
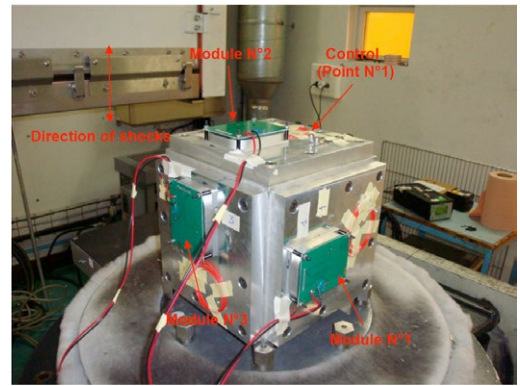
- GR-468 Issue 2, Section 3.3.3.1, Table 4-5

Thermal vacuum (operational range [0 to 50°C])

- According to ECSS-E-10-03A

Gamma-radiation up to 25 krad (while housing opened), Proton radiation up to 50 MeV, 2E8 part/s.cm²

- According to ESCC22900



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