

## **iXblue Photonics**

Space grade solutions: from components to transceivers and receivers modules

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# Space market

## The context

### **The boom of the space Industry**

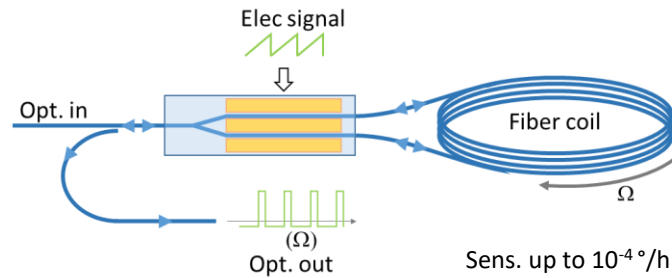
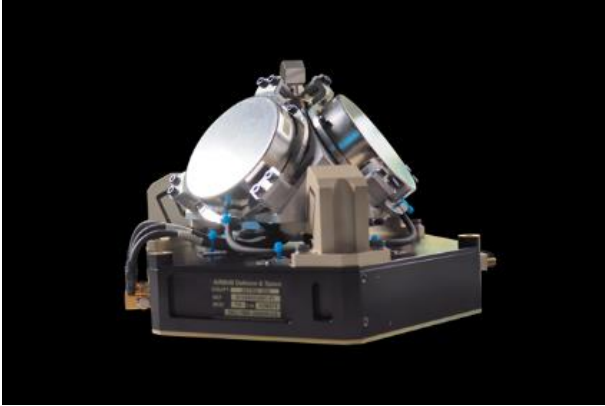
- Increasing demand of space activities since a few years
- New governmental projects for states and military communication programs
- Satellites constellation-based internet services
- New public and private actors boost the total investment

### **Space market segment and the drivers**

- Space applications: earth observation programs, telecommunications, satellite or launcher navigation.
- More compact, lighter and Cost effective satellites are required

# Space observation, telecom, and scientific

## Fiber Optics Gyroscope (FOG) on Space



- Fiber Optics Gyroscopes (FOG) for satellites
  - +20-years partnership between iXblue and Airbus Defence & Space
  - +30 satellites are equipped with iXblue Astrix
  - +2 million hours in orbit

➔ Read technical paper

### **ROBUSTNESS OF ASTRIX FIBER OPTIC GYROS IN SPACE RADIATIVE ENVIRONMENT**

A. Paveau, G. Cros, R. Mangeret, S. Mariojoulis & J.J. Bonnefois.

### **10th International ESA Conference on Guidance, Navigation & Control systems**

June 2017

*Development of radiation resistant passive and doped fibers started 10 years ago at iXblue. With tens of satellites flying using iXblue Optical Fibers, we now have access to data from real space environment – not only lab irradiation testing.*

# Space observation, telecom, and scientific

## TRL9 FOG, Fibers and LiNbO<sub>3</sub> Modulators

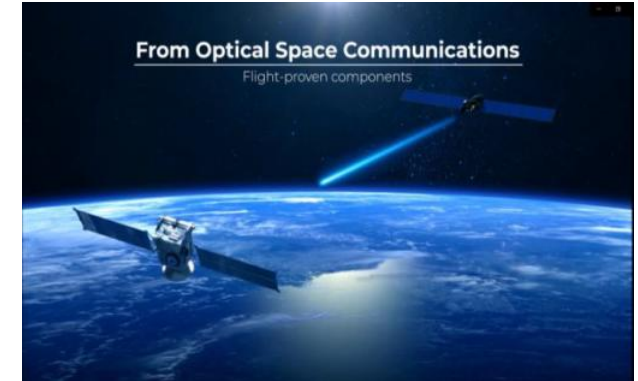


- Space Grade PM Gyro Fibers & Rad Hard Space Grade Doped Fibers
- +10 references in stock with guaranteed Radiation Induced Attenuation (RIA)
- + 1000 km space qualified fibers delivered
- Guaranteed RIGV (Radiation Induced Gain Variation) on Er, Yb and Er/Yb fibers

- On-board Amplitude and Phase LiNbO<sub>3</sub> modulators



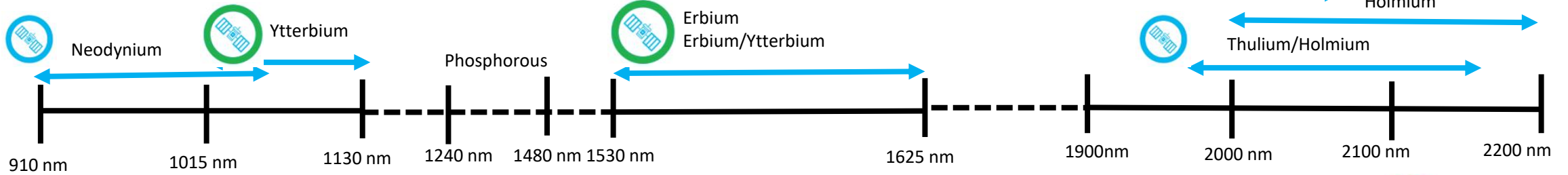
- Near-Infra Red & 1550 nm TRL9 modulators
- 20 on-going projects involved
- +200 Flight Models modulators delivered



# Space products portfolio



## RadHard fibers and FBGs



Space ref. available  
 Upon Request

Standards Fibers from stock  
3 days delivery

Custom fiber  
Master in-house the entire fiber manufacturing process

Fiber Type  
Single, Double, Triple Clad, All Glass, Multicore

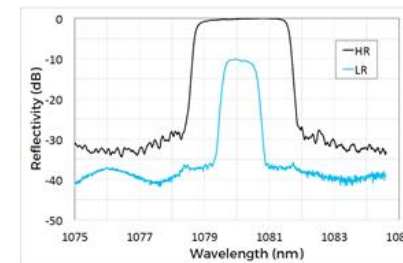
High reliability Coating  
High temperature coating available

Core Diameter  
Up to 30  $\mu\text{m}$ , LMA

Matched Passive Fibers  
From 350 to 2200 nm

Polarisation Maintening  
Panda Design available  
Frequency doubling

FBG Lasers Mirros Pairs  
HR relectivity up to 99,99%  
HR FWHM from 0.5 to 2nm

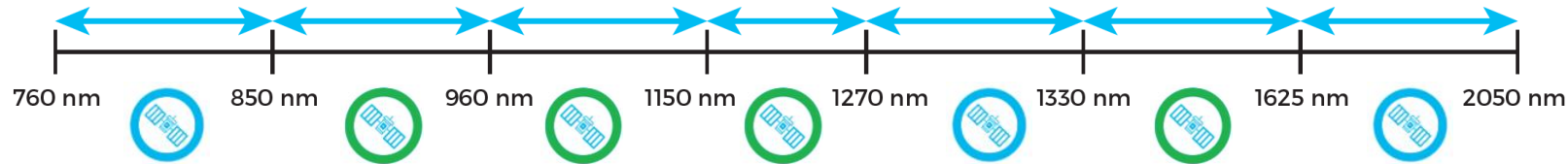




# Space products portfolio

Comprehensive range of LiNbO<sub>3</sub> COTS and FM modulators

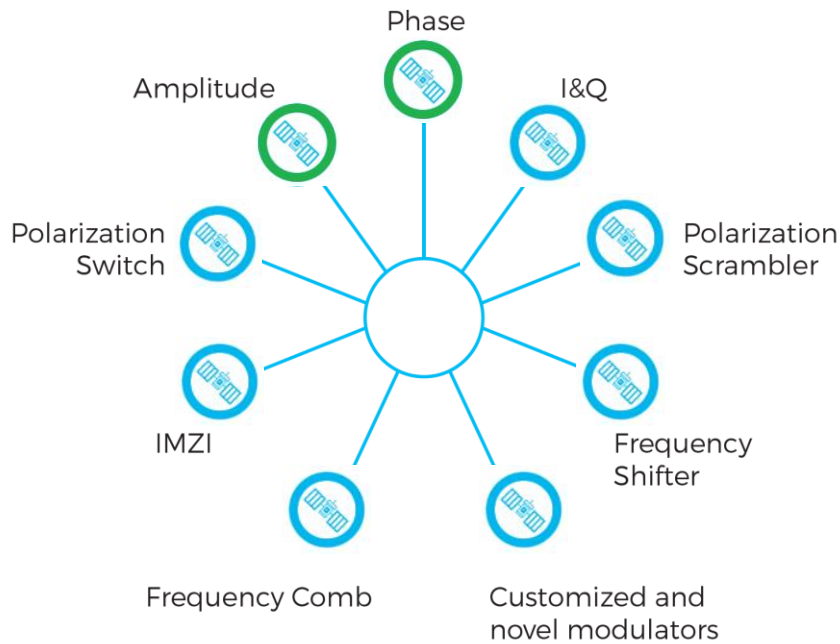


## Operating wavelength

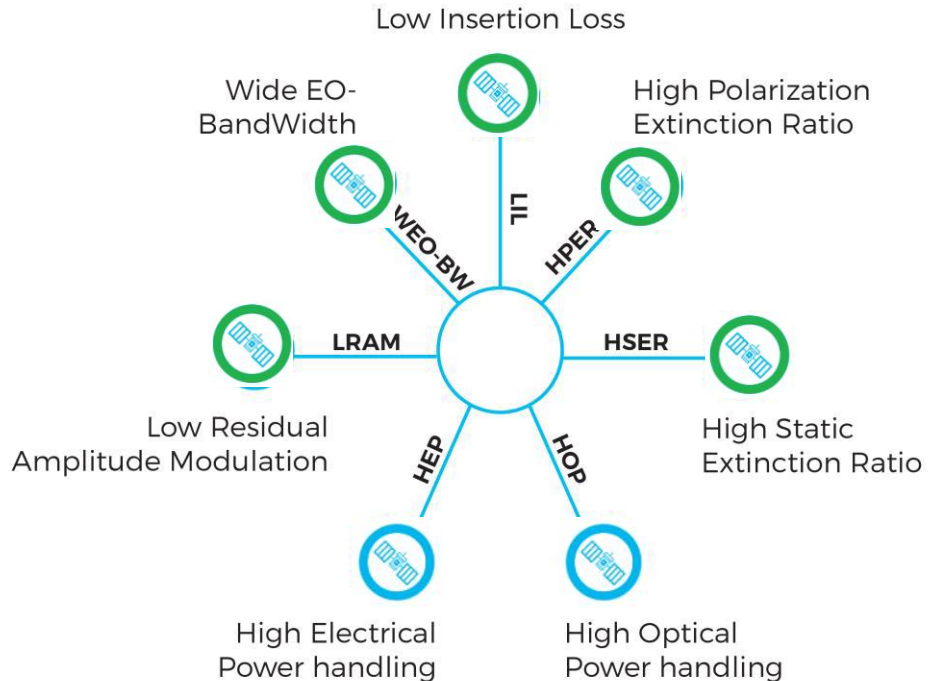


-  Space ref. available
-  Upon Request

## Modulator types



## Key Features



# From photonic components to transceivers

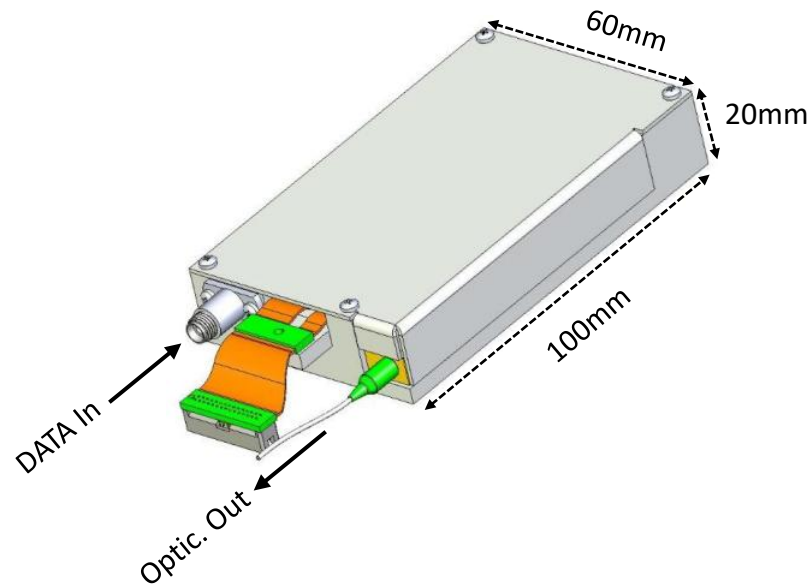
## Path to optical transceivers

### Compact Optical Channel Emitter: OCE-OOK25 / OCE-DPSK25

Combo DFB Laser, OOK/DPSK 25Gb/s Modulator + RF Driver in a single package

End of fab Q2-2021, End of Space Qualif End of 2021

First flight scheduled end of 2022

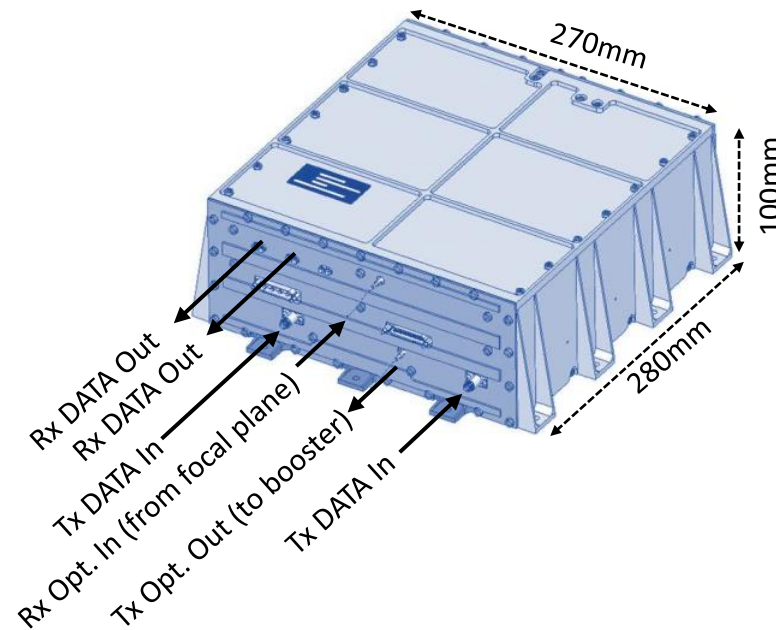


### Laser Com Equipment (LCE)

Tx: 3 OCE, Mux, MBC

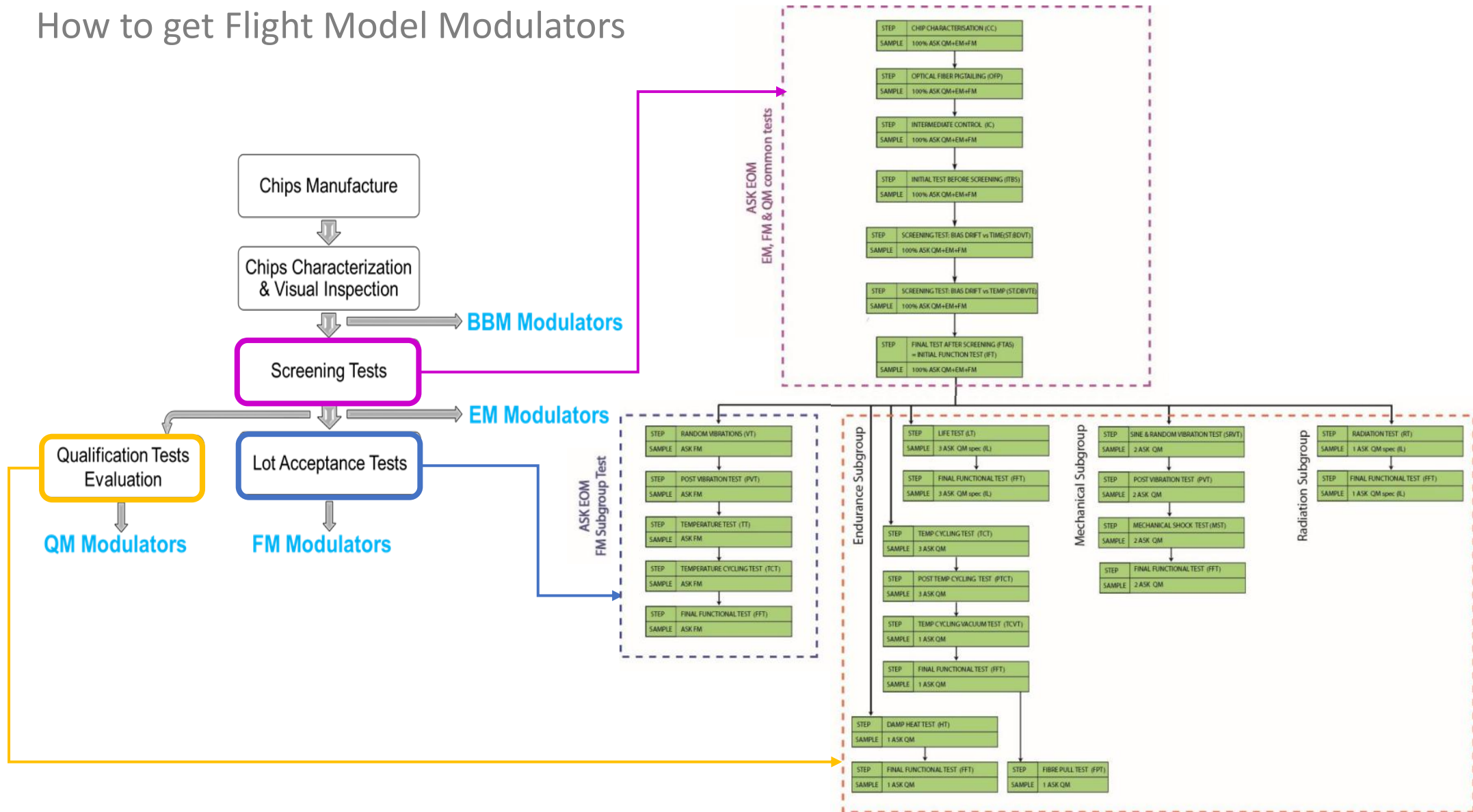
Rx: LNOA, DMux, Pds

CV Electronic Cards



# Space grade Modulators

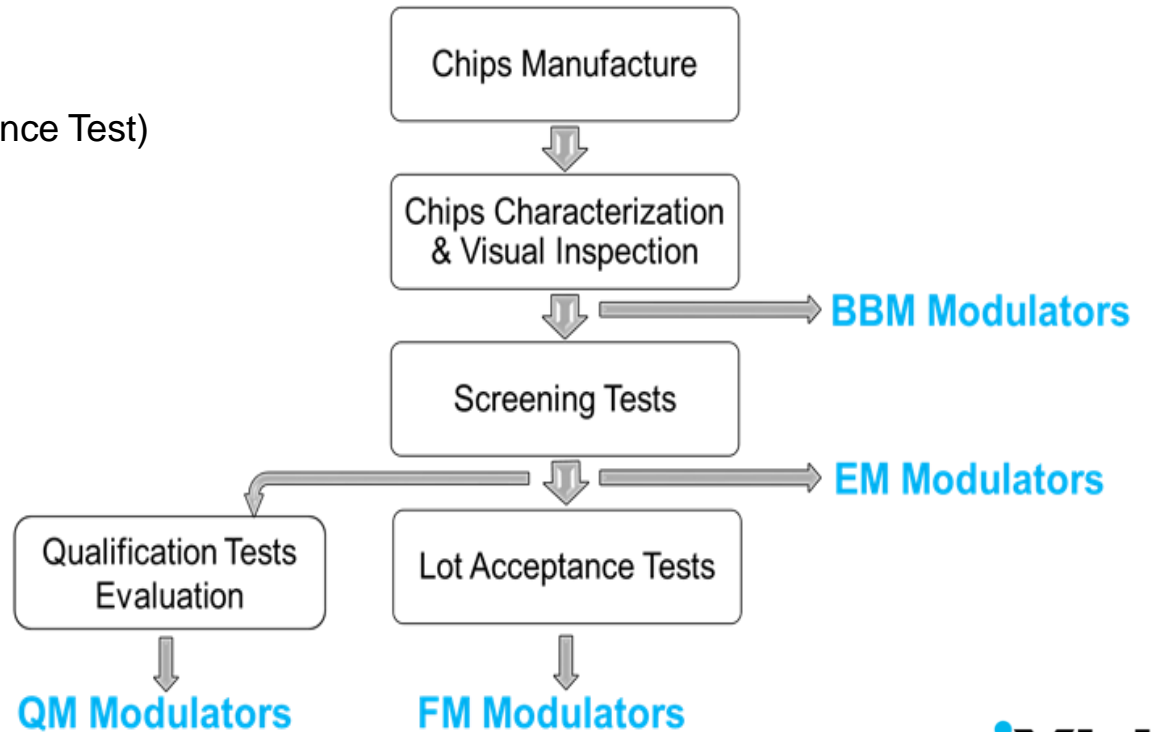
## How to get Flight Model Modulators





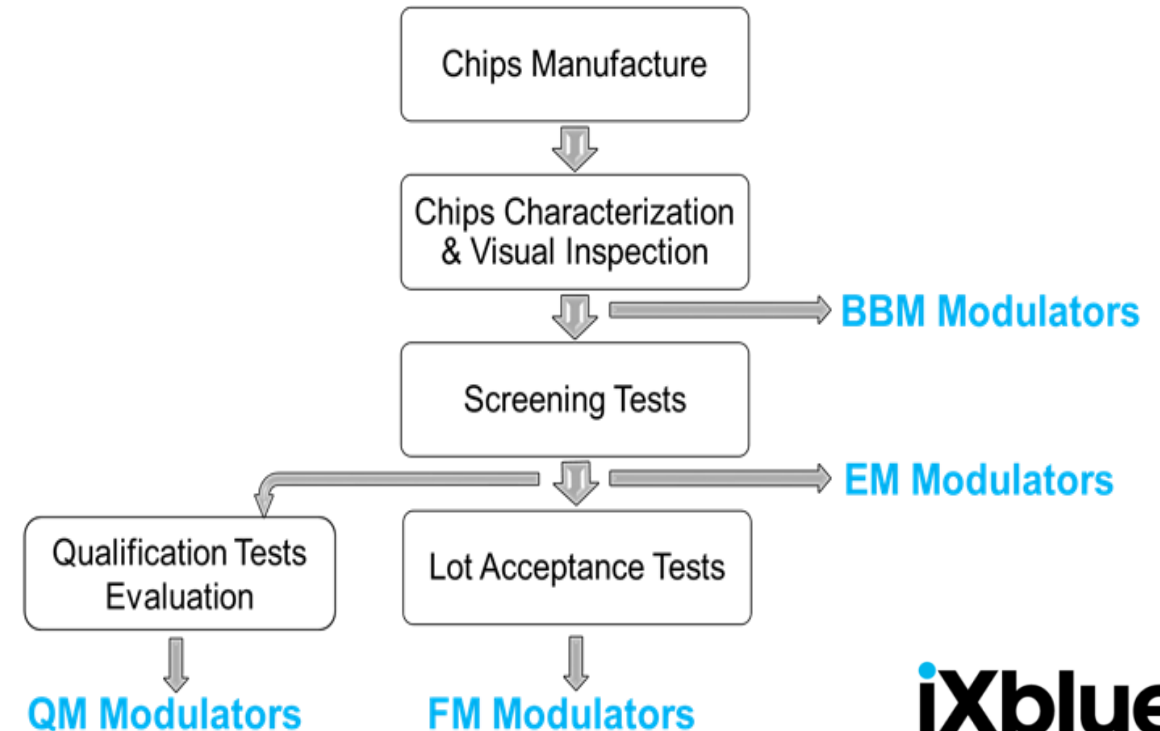
# The qualification: the conservative approach

- A full Qualification (Endurance, radiation, mechanical tests chart) is conducted on several QMs.
  - The tests conditions are defined by the mission (rocket type, orbit,...)
  - The QM are tested with an additional margin in comparison with the operating and storage conditions
- The FM are selected from EM batch
- The FMs are submitted to a relaxed tests program (Lot Acceptance Test)
- Dedicated to small volume modulators production project
- Expensive Project / FM delivery is more than 1 year.
- Approach dedicated to long-life satellite, etc...



# The qualification: the realistic approach

- Customer takes advantage of iXblue heritage and previous space projects success
- Based on iXblue heritage & background, **the number of QMs is reduced, and the qualification program is simplified**
- A Delta-qualification is performed only when new process or element are changed
- Dedicated to small up to large volume modulators production project
- Cost effective project / EM-FM delivery is 4 - 8 months



Thank you for your attention.

Questions ?

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