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Functional Product Qualification and Integration Tests

Flextronics Manufacturing

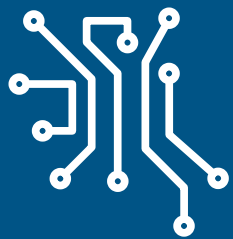
November 11th, 2024

CONFIDENTIAL

End-to-End Supply Chain in Optics

FLEX Trieste Optical Center of Excellence

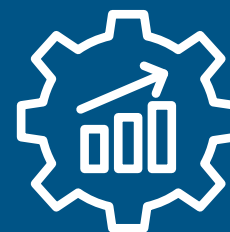
- Contract Manufacturing Services
- DWDM optical circuit packs manufacturing since 1998
- Continuous evolution from 2.5 Gb/s to coherent 1.2 Tb/s
- Integration of Submarine Line Terminals and Terrestrial Networks
- End-to-End approach from NPI to DOF and Field repair allowing a holistic view of the process



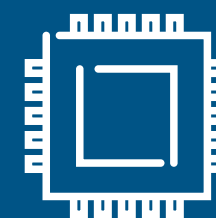
New
Technologies
Introduction



Automatic Test
Solutions
Development



Manufacturing
Services



Repair Services



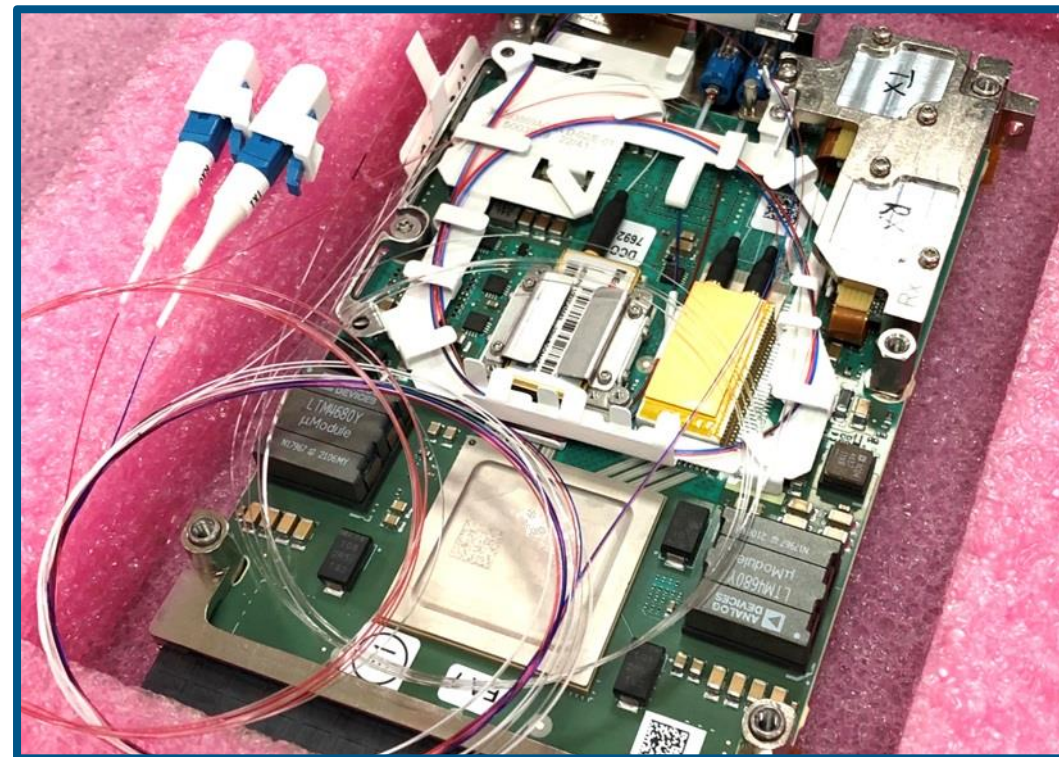
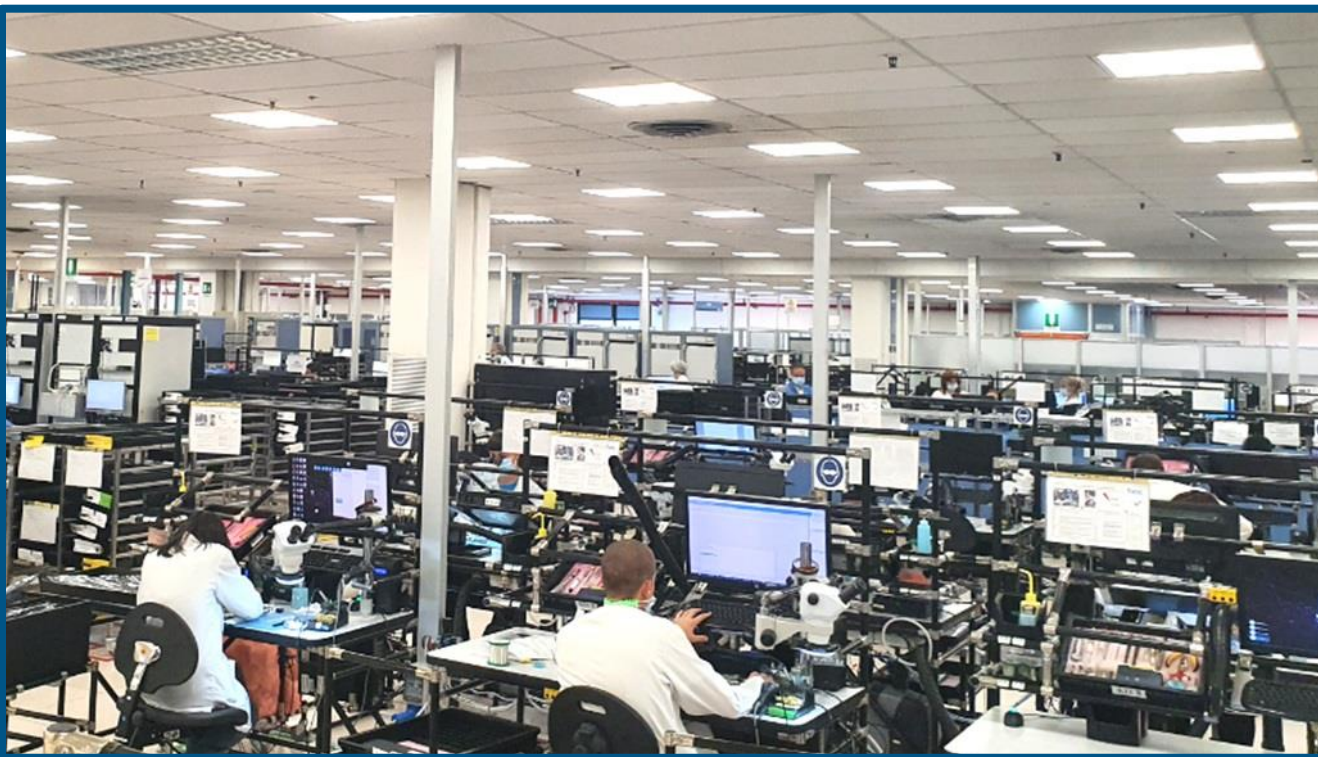
Supply Chain
and Logistic
Services

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Customized strategies for Assembly and Test

Complex optical circuit packs process leverages:

- Mechanical **assembly** and optical devices **soldering** difficult to automate
- Fully automatic **functional test** at blade level, semiautomatic test at **equipment** level
- Tight **relationship with R&D** team to support Design for Manufacturing
- **Boost programs** in the R&D lab, to support prototypes' assembly and test with early stage learning for the manufacturing team
- Customized **test strategy**, adapted to the characteristics and age of the product



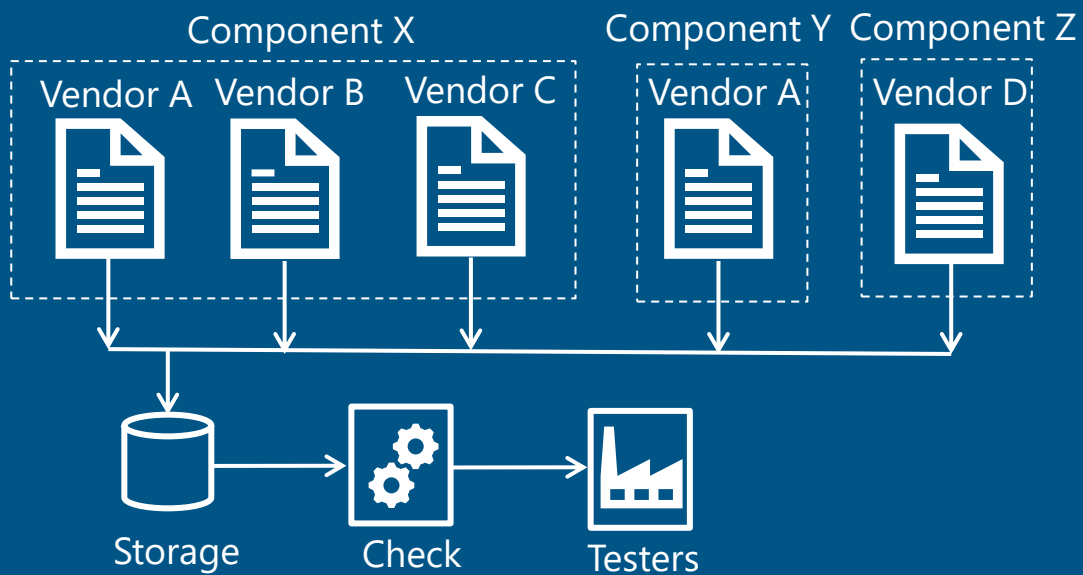
Functional Product Tests

Automatic functional test providing:

- Traceability of items
- Traceability of measuring instruments
- Statistical analysis on results

Electronic Data Files

Settings and adjustments of the optical devices mounted on the boards need to use parameters collected by vendors, during their internal production and test process.



Unit: ALLU18-0F33000465

Unit No.	Station	Start Time	End Time	Operator	Part	Production Order	Looper Count
102	Component Created	17/04/2018 13:35:08	17/04/2018 13:35:08	TRSLUNDA	ALC3H-3AL2040...		1
70100	Unit assigned to ...	07/05/2018 09:03:48	07/05/2018 09:03:48	Warehouse...	ALC3H-3AL2040...	P08242964	1
333100	[SYS - Test Res...	07/05/2018 09:37:32	07/05/2018 09:37:32	160_ATMP_S...	ALC3H-3AL2040...	P08242964	1
333120	[SYS - Chamber...	07/05/2018 09:37:32	07/05/2018 09:37:32	160_ATMP_S...	ALC3H-3AL2040...	P08242964	1
333600	[SYS - EQPST F...	07/05/2018 09:42:18	07/05/2018 09:42:20	190_ATMP_E...	ALC3H-3AL2040...	P08242964	1
333602	[SYS - EQPST F...	07/05/2018 09:42:20	07/05/2018 09:42:20	190_ATMP_E...	ALC3H-3AL2040...	P08242964	1
333650	[Peer Check Pa...	07/05/2018 09:46:22	07/05/2018 09:46:22	190_ATMP_F...	ALC3H-3AL2040...	P08242964	1
233198	Enabled to PQI	07/05/2018 09:46:22	07/05/2018 09:46:22	190_ATMP_F...	ALC3H-3AL2040...	P08242964	1
7014	[CTO - Final Qual...	07/05/2018 12:23:33	07/05/2018 12:23:37	310_FINQC (...)	ALC3H-3AL2040...	P08242964	1
80102	[FINQC Pass - In...	07/05/2018 12:23:37	07/05/2018 12:23:37	310_FINQC (...)	ALC3H-3AL2040...	P08242964	1
80440	[DBK - Visual Ins...	07/05/2018 14:49:38	07/05/2018 14:49:38	440_SBK - V...	ALC3H-3AL2040...	P08242964	1
80990	[DBK - ready to ...	07/05/2018 14:49:38	07/05/2018 14:49:38	440_SBK - V...	ALC3H-3AL2040...	P08242964	1

Integration Tests

- Tests inside **climatic chambers**, in **burn-in systems**, and **at link or network level** complete the verification of the product
- Properly equipped ESD **Integration test area allows** to integrate, wire and power supply the product cabinets
- Added value tests carried out on several network elements **building a real DWDM system** and replicating field span length, attenuation and chromatic dispersion.
- >15.000 km of real G.652-3-5 fiber spools available
- **Pre-staging tests** foresee cards slotting and provisioning, alarms check, redundancy, optical power levels, spectra acquisition, transmission test, APR test, stability test.

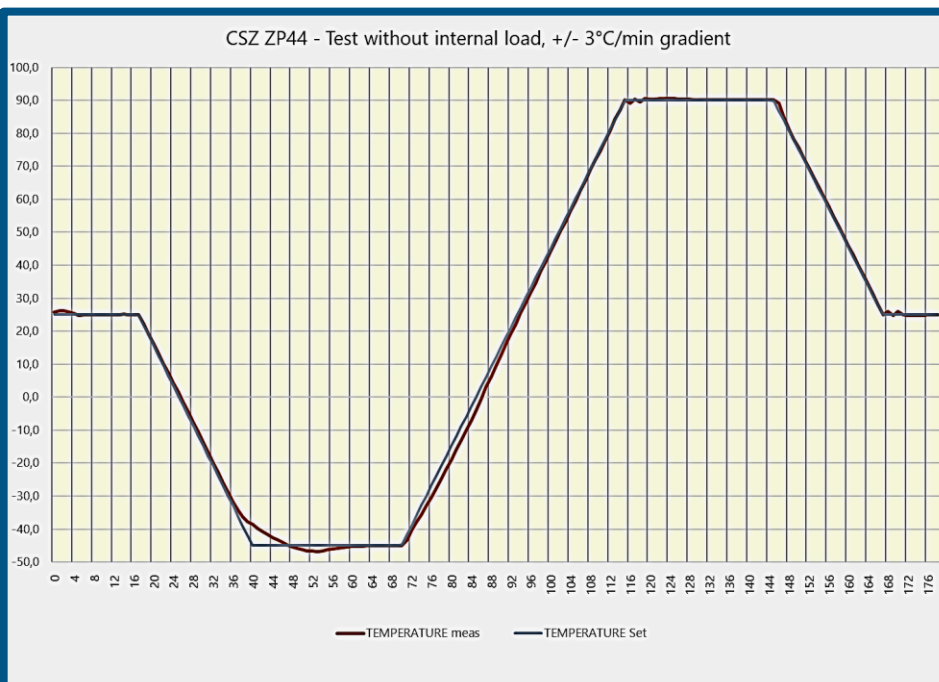


Integration Tests



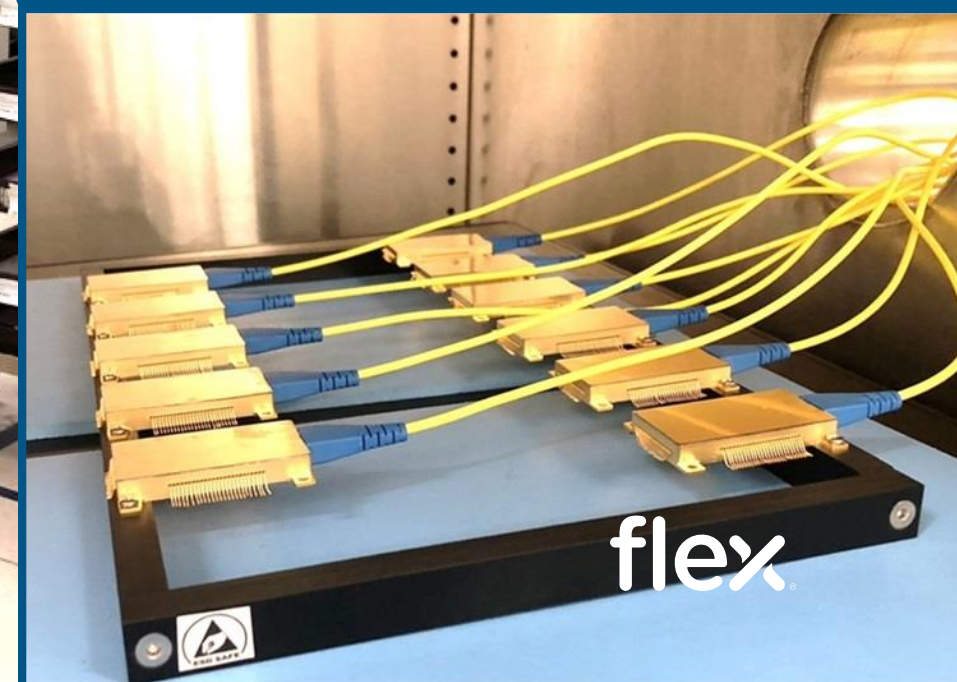
- Customer normally provides **test and quality check specifications** to apply in the manufacturing flow
- All tests and controls results are recorded by the **MES system**
- Visual Inspections may adopt **automated optical inspection systems** on high runner optical circuit packs, with robotized arm photo capturing and processing SW to detect cosmetic and mechanical failures.
- **Optical connectors inspection** with automatic IEC or IPC pass/fail criteria is still an important step

Product Climatic Qualification Tests



- Pool of 23 climatic chambers (1 to 16 m³) available for qualification tests on optical components and equipment
- Tests tailored to the customer requirements
- Proper tooling in terms of test instruments, real fiber availability, monitoring SW, UPS-protected power supply system.

- System Integration and Climatic Tests can be applied also on **multi-vendor equipment** to verify interoperability (e.g. Quantum Key Distribution and WDM products on the same optical line)



The logo for 'flex' is written in a white, lowercase, sans-serif font. The letter 'x' is stylized with a diagonal slash through it. A registered trademark symbol (®) is located at the end of the word.

flex®

Create the
extraordinary.

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