FiberLink-CompactLine RFoF

Application-Note

1. Introduction

Modern RF transmission systems require maximum availability, flexibility, and ease of maintenance. The CompactLine platform from RF-Design addresses these requirements through scalable redundancy concepts and integrated system features.
This application note describes:

- Redundancy concepts: 2+1, 4+1, 1:1
- Variants of the 1:1 architecture with independent Monitoring Links for UpLink Observation
- Flexible redundancy activation for upgrade from single to redundant operation
- Integrated testing and commissioning features
- Intelligent switchover criteria and automatic parameter takeover during failover
- Continuous rf and optical power monitoring
- Integrated RF test mode generator for easy link setup
- Optical interface options SC/APC and E2000
- Modular hardware design & hot-swapable components
- Flexible redundancy architecture
- Integrated test capabilities
- Reduced downtime & Simplified maintenance
- Fast commissioning
- Investment protection
- Scalable growth path
- Lower lifecycle costs
- Compact 1U 19” Design

2. Overview of Redundancy Concepts

Concept	Description	Main Objective
2+1	Two active modules + one backup module	Cost-efficient redundancy
4+1	Four active modules + one backup module	High availability
1:1	Full duplication of one signal link	Maximum protection

3. Intelligent Redundancy Switching

Automatic Switchover Criteria - Redundancy switchover can be triggered by:

- Link Failure Detection - Automatic transfer in case of complete signal path failure
- RF Level Drop Detection - Switchover can also be triggered by an RF level reduction below a user-defined alarm threshold.

Benefits

- Faster reaction to degradations
- Preventive failover before total loss
- Increased link availability
- User-adjustable operating thresholds

4. Automatic Parameter Transfer During Switchover

In the event of switchover, the settings of the operational link are automatically transferred to the backup link.

Transferred parameters may Include
- Gain settings and Attenuation settings
- Alarm settings
- Operational presets
- System configuration values

Benefits
- Seamless transition during failover
- No manual reconfiguration required
- Consistent RF performance after switching
- Reduced recovery time

5. Continuous RF Level and optical Power Monitoring

All CompactLine redundancy systems provide continuous signal level supervision.

Monitoring Functions
- RF and optical power measurement
- Alarm generation on threshold violations
- Trend detection and early warning
- Support for redundancy decision logic

Benefits
- Early fault detection
- Predictive maintenance support
- Improved operational reliability
- Full signal transparency

6. Test Mode – Integrated RF Generator on TX Side

All TX cards are optionally available with an integrated RF generator.
Test Mode: A test generator can be switched on in **Test Mode** to inject a local RF test signal detected by the RX.
Link Alignment: Used to align and calibrate the complete RF path.
Pre-Commissioning Test: Allows full system verification before live signals are available.
Backup Path Verification: Enables testing of backup links in 2+1 and 4+1 systems in operation

Benefits
- No external signal generator required
- Faster installation
- Easier commissioning
- Functional testing anytime

7. Optical Connector Options

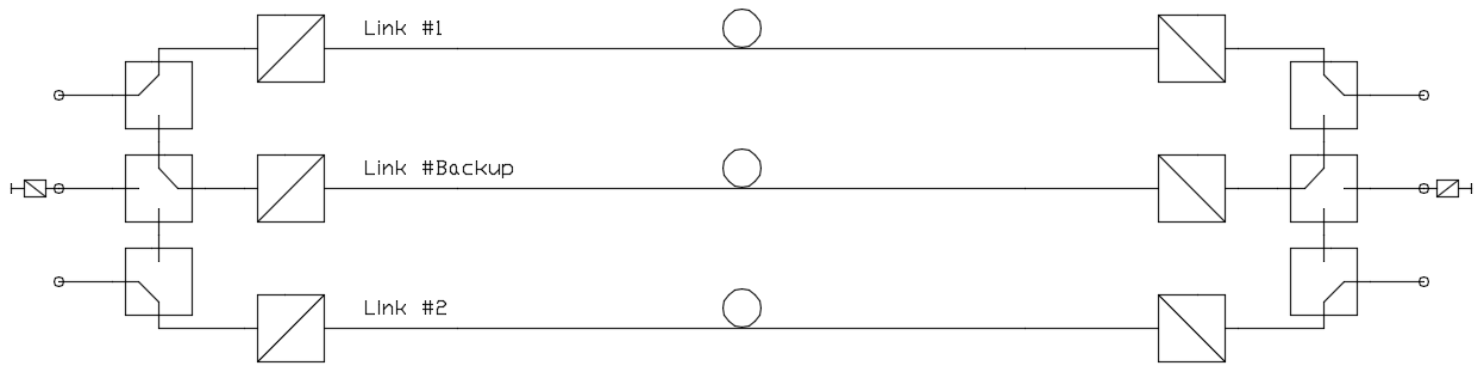
CompactLine systems are available with professional optical interfaces:
- SC/APC
- E2000

8. 2+1 Redundancy

Architecture & Operating Principle

- Two active RF modules
- One standby backup module
- Automatic switchover in case of failure
- Quad 2+1 TX Link
- Quad 2+1 RX Link
- Mixed Operation for example 2 x 2+1 TX Link and 2 x 2+1 RX Link
- Backup path is available on the rear panel for test purposes in operation
- rf-generator option available for test and setup

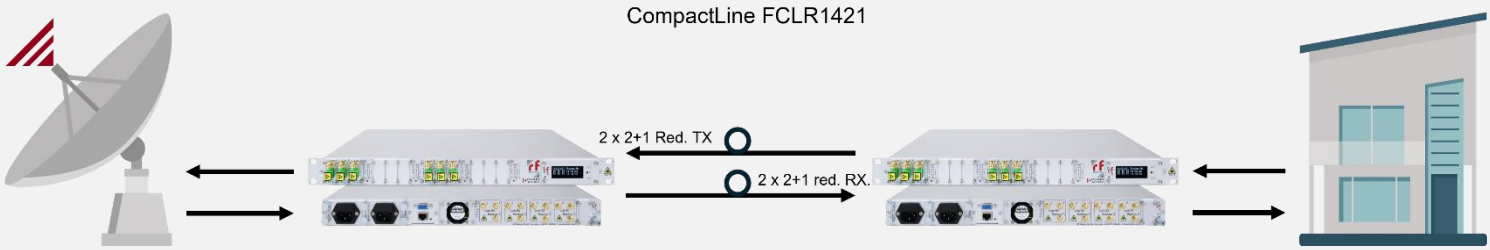
Up to four TX/RX 2+1 redundant links:



Benefits

- Excellent balance between cost and reliability
- Efficient hardware utilization
- Simple architecture

Typical Applications



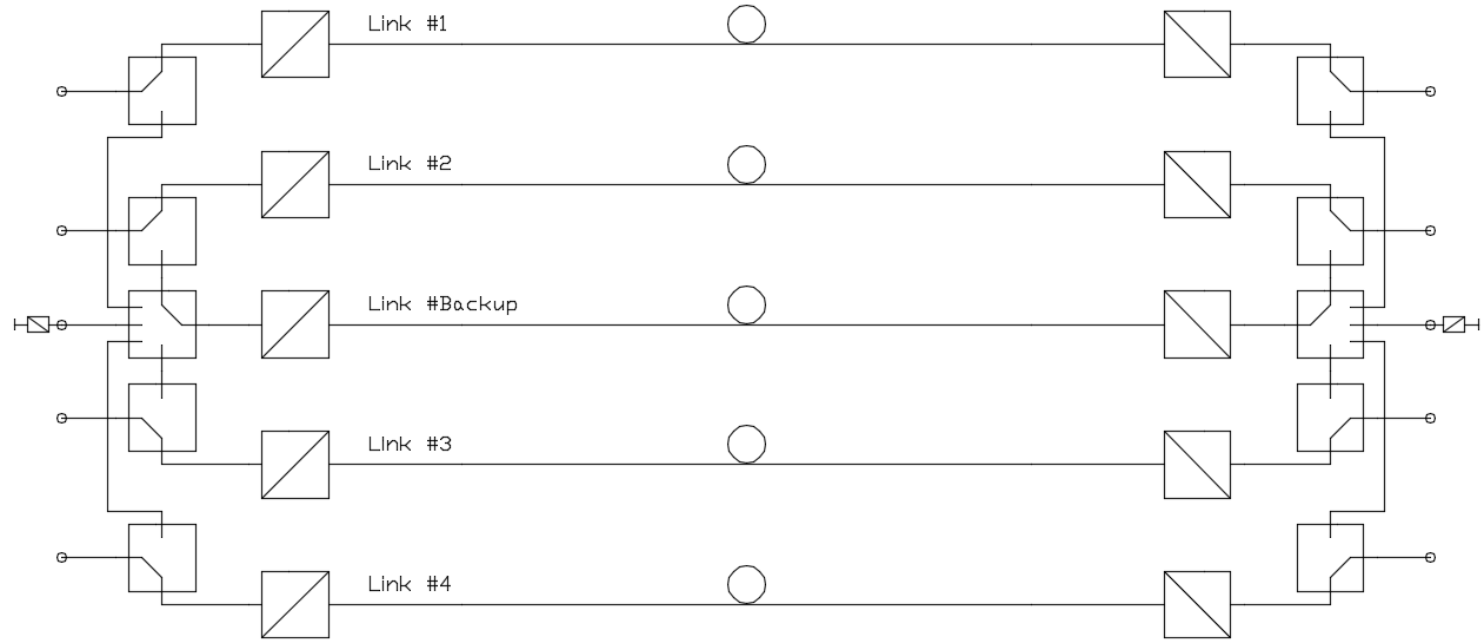
- Medium-size transmission systems
- Budget-sensitive projects requiring redundancy

9. 4+1 Redundancy

Architecture & Operating Principle

- Four active RF modules
- One redundant backup module
- Automatic switchover in case of failure
- Dual 4+1 TX Link
- Dual 4+1 RX Link
- Mixed Operation 4+1 TX Link and 4+1 RX Link
- Backup path is available on the rear panel for test purposes in operation
- rf-generator option available for test and setup

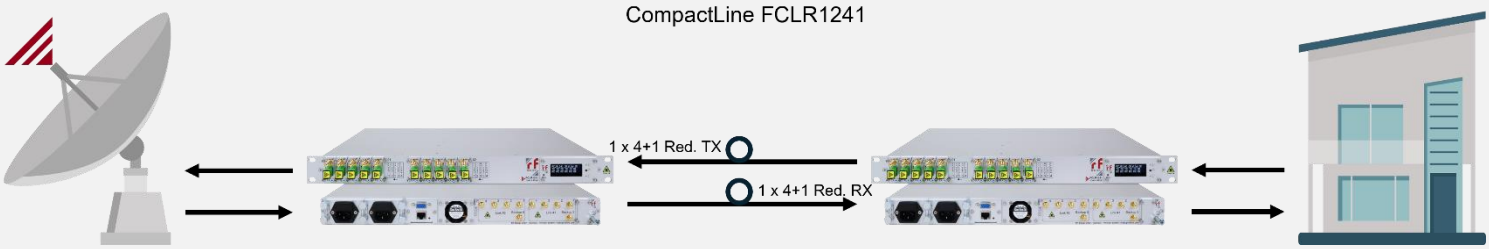
Up to two TX/RX 4+1 redundant links:



Benefits

- High system availability
- Maintenance possible during operation
- Highly scalable modular concept

Typical Applications



- Critical Infrastructure
- 4 x Antenne TX + 10MHz or
- 4 x Antenna RX + 10MHz
- Broadcast infrastructure
- 24/7 mission-critical installations

10.1. 1:1 Redundancy (Hot Standby)

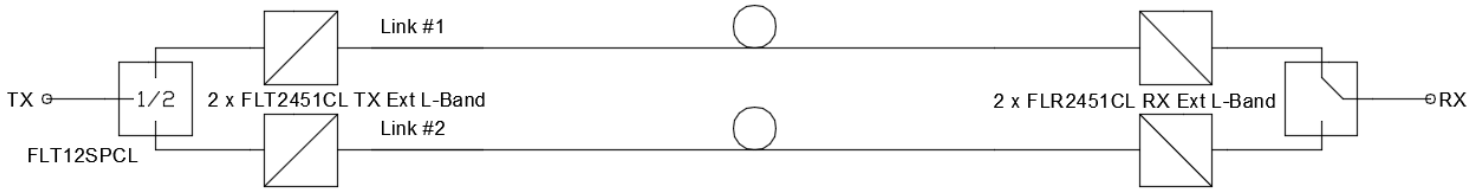
- One active signal path
- One identical standby path
- Near-seamless automatic switchover in case of failure

10.2. Variant A: 4 × 1:1 Fully Modular System

Architecture & Operating Principle

- Four independent 1:1 links
- Automatic switchover in case of failure
- TX side equipped with:
  - Replaceable RF splitter/controller
- RX side equipped with:
  - Replaceable RF switch/controller

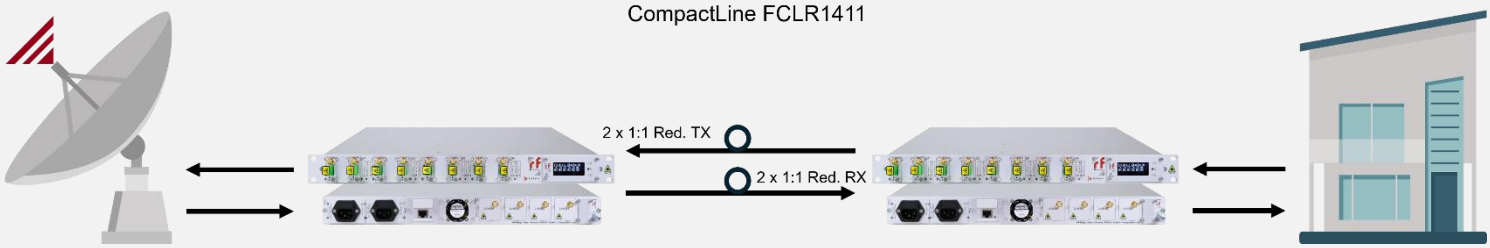
Up to four RX/RX 1:1 redundant links:



Benefits

- High serviceability
- Modular expansion capability
- Field-replaceable components
- Useable as non-redundant system
- Enable / Disable Backup Function for later expansion from non-redundant to 1:1 redundant system

Typical Applications



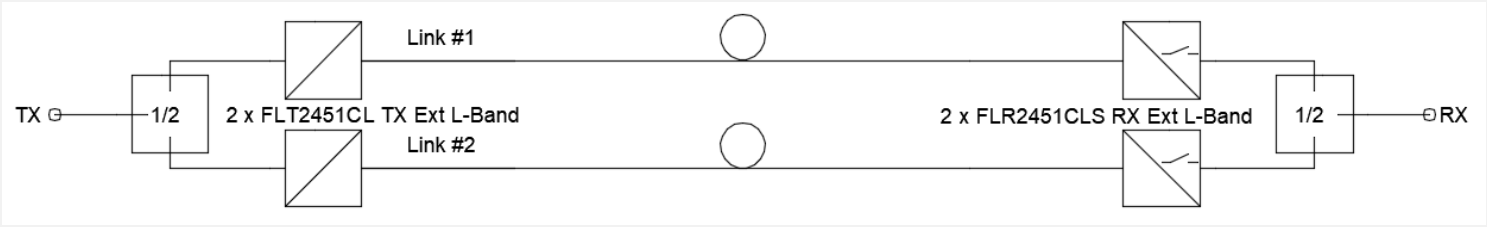
- Critical Infrastructure
- 4 x Antenne TX + 10MHz or
- 4 x Antenna RX + 10MHz
- Broadcast infrastructure
- 24/7 mission-critical installations

10.3. Variant B: 8 × 1:1 redundant Links with Additional four Monitoring Links

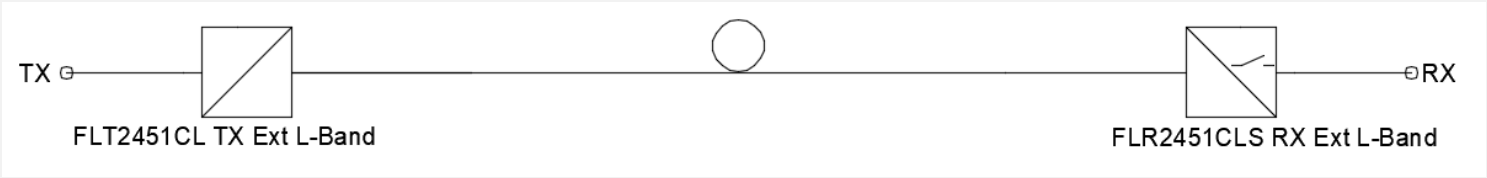
Architecture & Operating Principle

- Eight redundant 1:1 systems (8 RF links total)
- Automatic switchover in case of failure
- Plus four additional non-redundant monitoring links assembled on the rearside

Up to eight TX/RX 1:1 redundant links:



Up to four TX/RX non-redundant links:



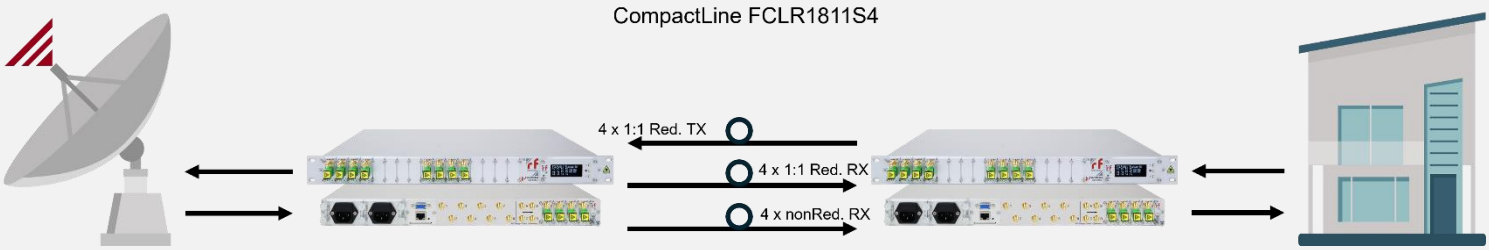
Monitoring Sources

- Direct signal tap at transmitter output
- Signal tap near antenna location Modular expansion capability

Benefits

- High serviceability
- Modular expansion capability
- Field-replaceable components
- Useable as non-redundant system
- Enable / Disable Backup Function for later expansion from non-redundant to 1:1 redundant system

Typical Applications



- Installations requiring easy maintenance
- Modular network infrastructures
- Critical Infrastructure
- Full TX/RX up- and downlink antenna support:
  - 4 x TX redundant
  - 4 x RX redundant
  - 4 x TX Monitoring Antenna

11. Flexible Redundancy Concept (1:1 Systems)

Each 1:1 link can operate as:
- Standalone link (without backup)
- Fully redundant 1:1 link (with backup enabled)
- Enable / Disable Backup Function

Upgrade Scenario / Initial Installation
- Single active link only
- Backup function disabled

Later Expansion
- Insert additional backup module
- Enable backup mode

Result
- Full 1:1 redundant system without redesign

Benefits
- Investment protection
- Pay-as-you-grow strategy
- No replacement of installed hardware
- Simple field upgrade path

12. Testing of Redundant Systems

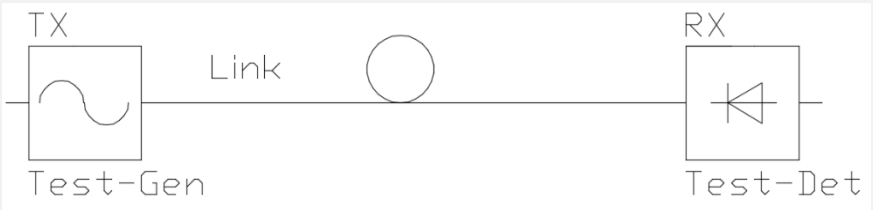
Capabilities
- Test of all RF paths
- Verification of backup modules
- Functional testing under simulated conditions

13. Pre-Commissioning System Test

Capabilities
- Full system verification before live operation
- No external RF source required
- End-to-end path validation

14. Level Alignment & Adjust

- Accurate level balancing of all paths
- Main vs. backup comparison
- Consistent system performance



Benefits of Integrated Test Generators
- No external test equipment required
- Faster commissioning & Simplified maintenance
- Increased operational confidence

15. Overview




FCLR1411	FCLR1421	FCLR1241	FCLR1811S4
1RU/19” (360mm deep)	1RU/19” (360mm deep)	1RU/19” (360mm deep)	1RU/19” (360mm deep)
85 – 265V, 50/60Hz, dual 1:1 redundancy (hot-swappable)	85 – 265V, 50/60Hz, dual 1:1 redundancy (hot-swappable)	85 – 265V, 50/60Hz, dual 1:1 redundancy (hot-swappable)	85 – 265V, 50/60Hz, dual 1:1 redundancy (hot-swappable)
8 x Ext. L- Band + 2 x 10MHz	8 x Ext. L- Band + 2 x 10MHz	10 x Ext. L-Band + 2 x 10MHz	16 + 4 Ext. L-Band
4 red. Links 1 red. Link 10MHz	4 red. Links 1 red. Link 10MHz	8 red. Links 1 red. Link 10MHz	8 redundant Links 4 single Links
Critical Infrastructure 4 x Antenne TX + 10MHz or 4 x Antenna RX + 10MHz	Critical Infrastructure Antenne TX path + 10MHz or Antenna RX path + 10MHz	Critical Infrastructure 4 x Antenne TX + 10MHz and 4 x Antenna RX + 10MHz	Critical Infrastructure Full TX/RX antenna support 4 x TX redundant 4 x RX redundant 4 x TX Monitoring Antenna
4x1:1 / 4 Main RF-Ports	4x2:1 / 8 Main RF-Ports 4 Backup Ports	2x4:1 / 8 Main RF-Ports 2 Backup Ports	8 Main RF-Ports 4 Single Ports
Yes	Yes	Yes	Yes
On request	On request	On request	On request
All Modules hot swap Free/mixed configurable	All Modules hot swap Free/mixed configurable	All Modules hot swap Free/mixed configurable	All Modules hot swap Free/mixed configurable

16. Call for Action and Support

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