

Optical links

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Product specialist



Introduction



Introduction

- What is an optical link

“An optical link is a communication connection that employs optical fibers to transmit data using light signals”

~Chat GPT

Basically: It is just an expensive (coaxial) cable

Introduction

- Why use an optical link
 - Low losses
 - Attenuation: 0,35 - 0,5 dB/Km
 - Coupling set: 0,75 - 1,0 dB

Table 2. Average Fiber Loss Table

Wavelength/ Mode	Fiber Core Diameter	Attenuation per Kilometer*	Attenuation per Splice	Attenuation Per Connector	Modal Bandwidth (MHz-km)
850 nm multi-mode	50 µm	2.40 dB	0.1 dB	0.75 dB	500
850 nm multi-mode	62.5/125 µm	3.00 dB	0.1 dB	0.75 dB	200
1300 nm multi-mode	50 µm	0.70 dB	0.1 dB	0.75 dB	500
1300 nm multi-mode	62.5/125 µm	0.75 dB	0.1 dB	0.75 dB	500
1310 nm single-mode	9 µm	0.35 dB	0.01 dB	0.75 dB	n/a
1550 nm single-mode	9 µm	0.22 dB	0.01 dB	0.75 dB	n/a

■ Analogue laser

■ Digital data communication (BIDI)

<https://www.advantech.com/en/resources/white-papers/024e7c77-bc88-40f7-bc81-33c5a6d62dc3>

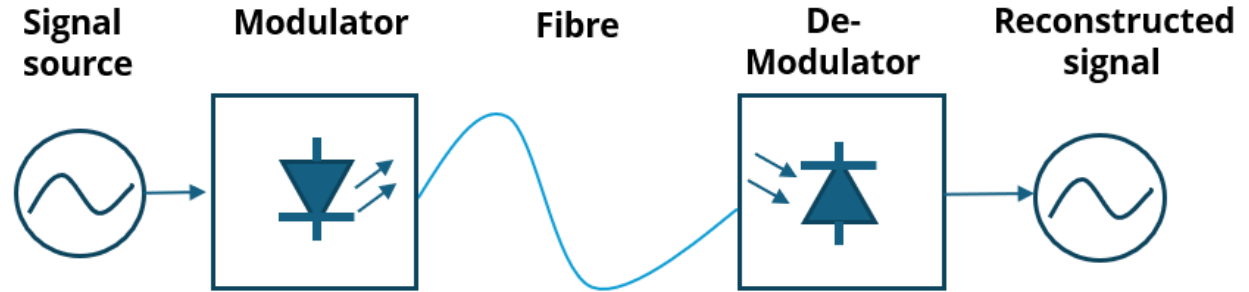


Introduction

- Why use an optical link
 - No electrical connection
 - Immune to Radiated fields
 - Full isolation (Galvanically isolated)
 - No common mode currents
 - No oxidization

Introduction

- How does an optical link work





Introduction

- Typical applications
 - Communication systems
 - Internet
 - Automotive
 - Antenna testing
 - Military
 - Remote communication towers
 - EMC testing
 - Medical
 - Endoscopes (tiny fibre cores)



Raditeq's Optical link(s)



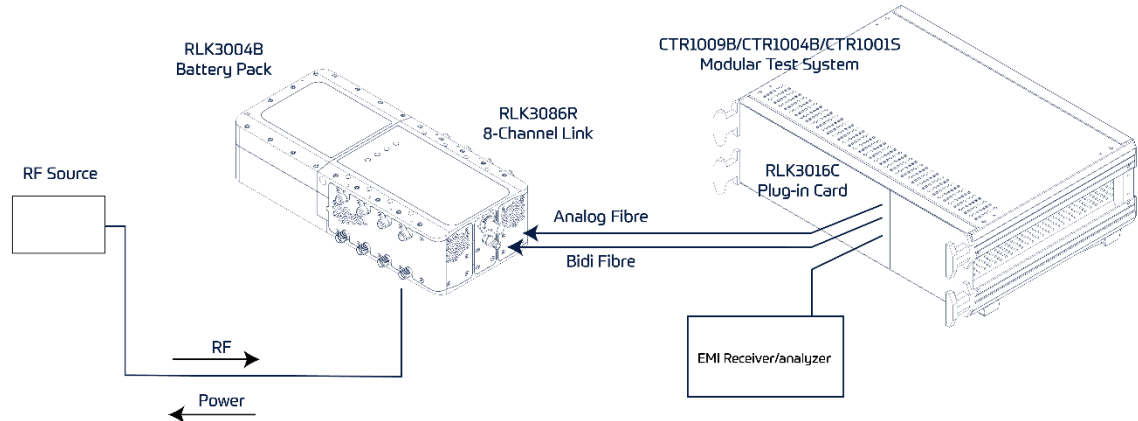
RadiLink 8

- Aimed at automotive industry
 - 8 RF channels
 - CISPR 25 (vehicle antenna testing)
 - 150kHz AM
 - 7,125 GHz WiFi 6E (not yet described in the CISPR)
 - Active antennas
- Other applications
 - EUT monitoring
 - Current sensing
 - Etc.



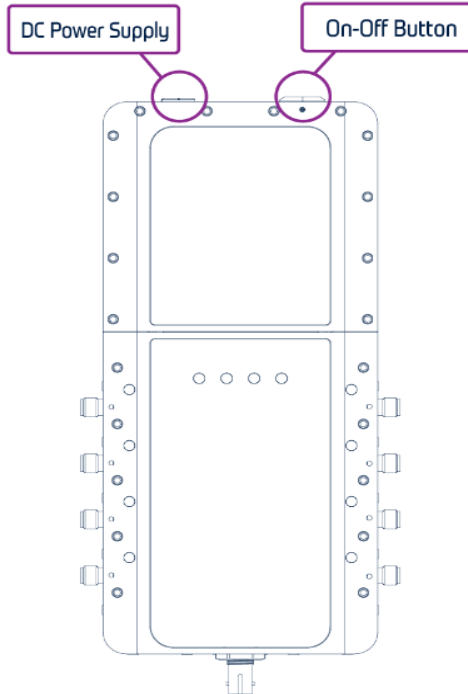
RadiLink 8

- RadiLink 8
 - Modulator >> remote stand-alone unit
 - Demodulator >> RadiCentre plugin card
- RF and controlling the modulator over fibres

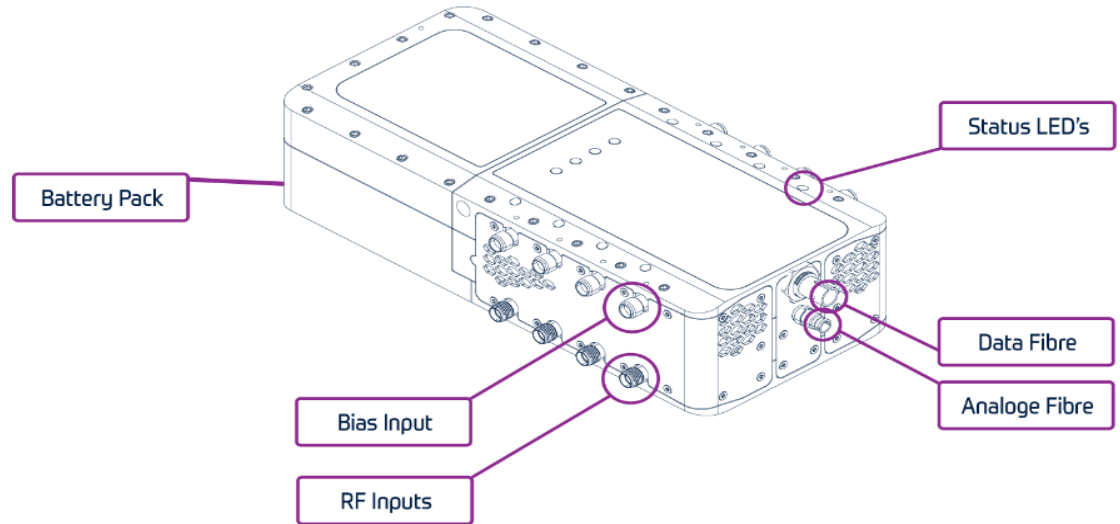


RadiLink 8 RLK3086R (Modulator)

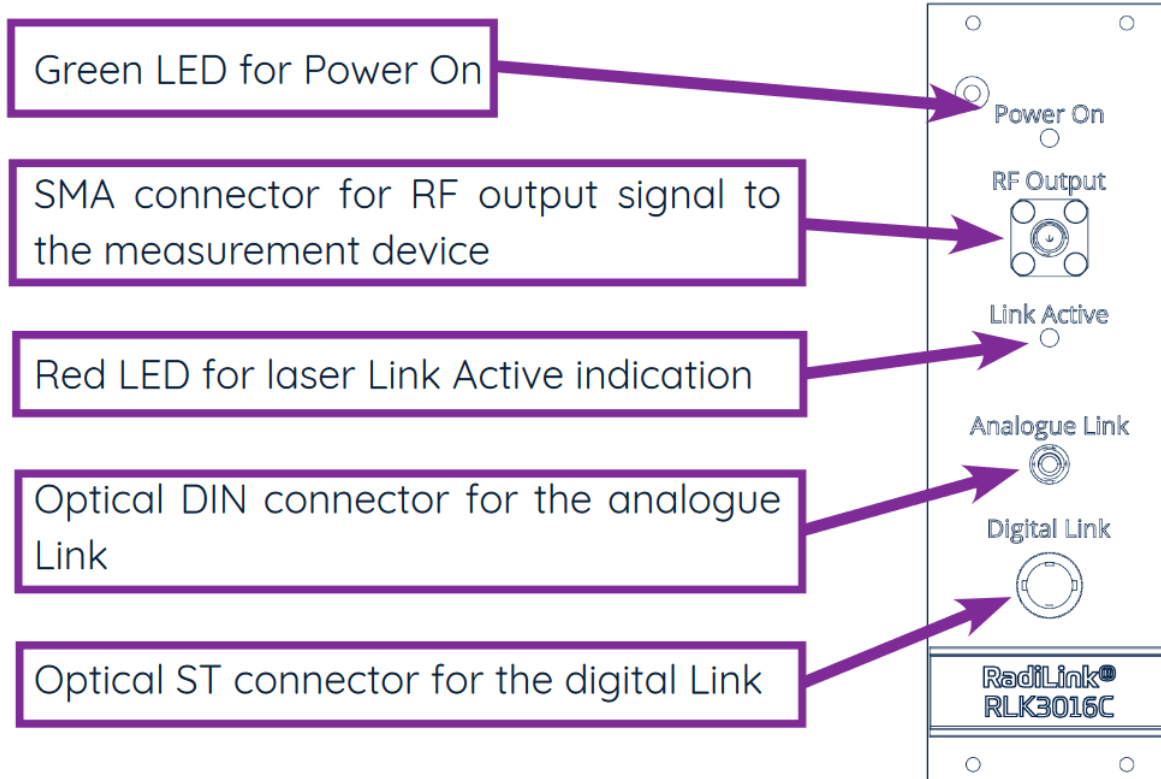
Top View



Side View



RadiLink 8 RLK3016C (De-Modulator)





RadiLink 8 Requirements

- High dynamic range
- Wide (instantaneous) bandwidth
- Phantom power (i.e. to supply antenna pre-amp's)
- 8 Channels
- Continuous testing
- Shielded remote unit
- Compact

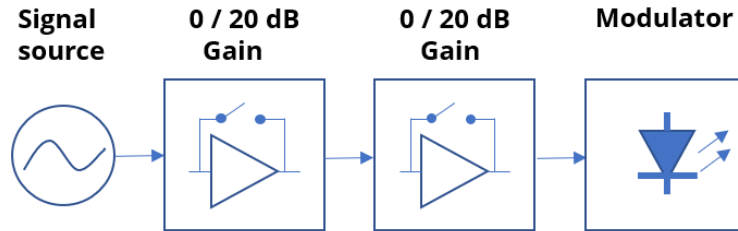


RadiLink Requirements

- **Dynamic range**
 - Low noise floor for small signals
 - High compression for large signals

RadiLink Requirements

- Switchable amplifiers
 - 0, 20 and 40 dB gain



- NF of $>3\text{dB}$ (thermal noise floor)
 - $\text{P1dB} < 0\text{dBm}$
- Instantaneous dynamic range 150dB
- Total dynamic range 170dB

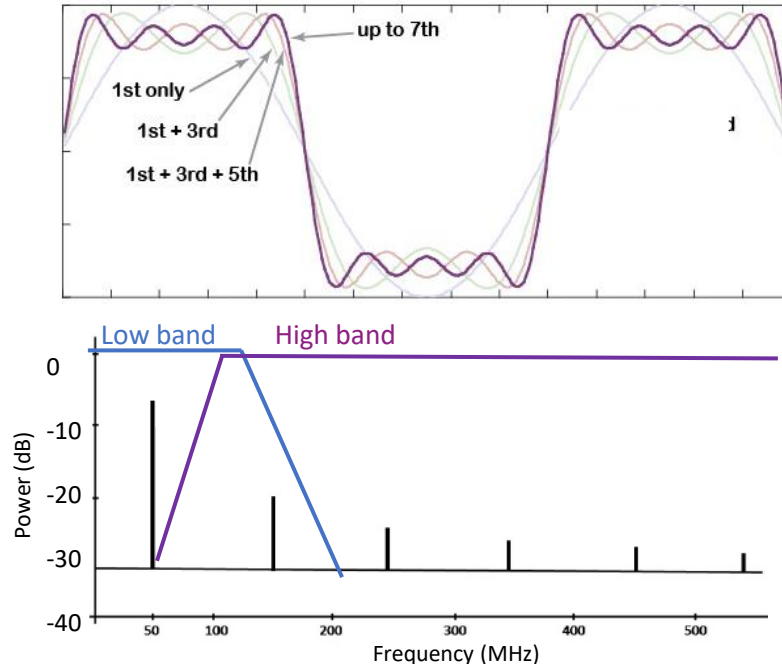


RadiLink Requirements

- **Wide instantaneous bandwidth**
 - No band switching (No low band / high band)
 - All signals follow the same RF stages
 - All the content at the input is present on the output
 - What will happen with a square wave?

RadiLink Requirements

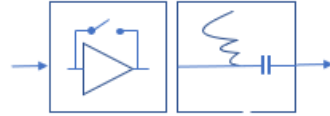
- **Wide instantaneous bandwidth**



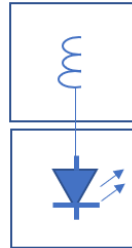
If band switching is used,
or system bandwidth is poor,
Measurement errors occur!

RadiLink Requirements

- Selecting very broadband devices
- RF stages with complex bias Tee designs



- Extending lasers LF response





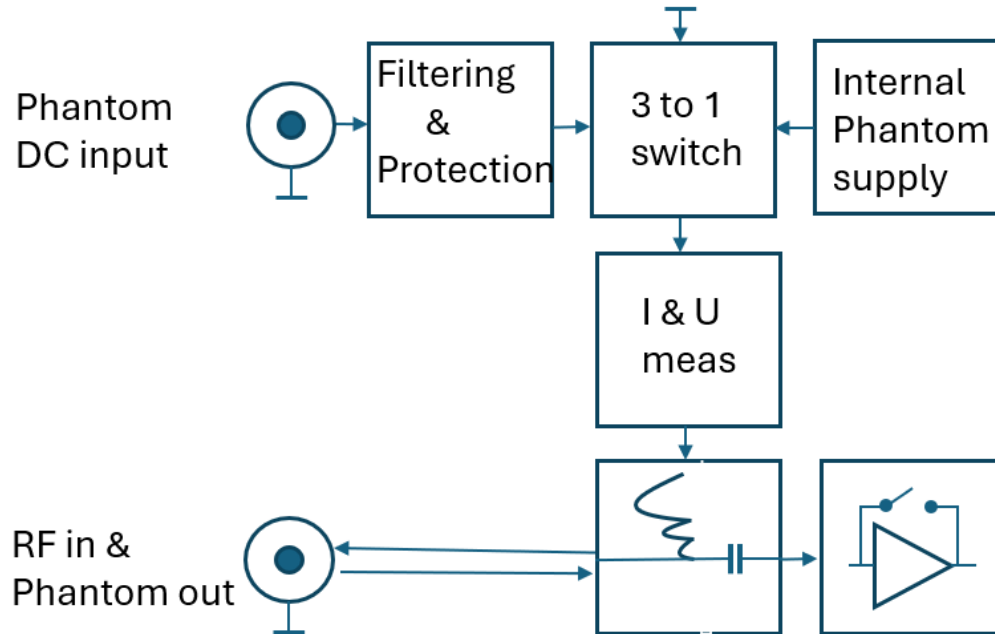
RadiLink Requirements

- **Phantom power**
- Power active antennae over the coax
- DC externally applied or internal generated
- Compensate for internal losses
 - Bias Tee losses
 - Protection losses
 - Trace losses



RadiLink Requirements

- Phantom power



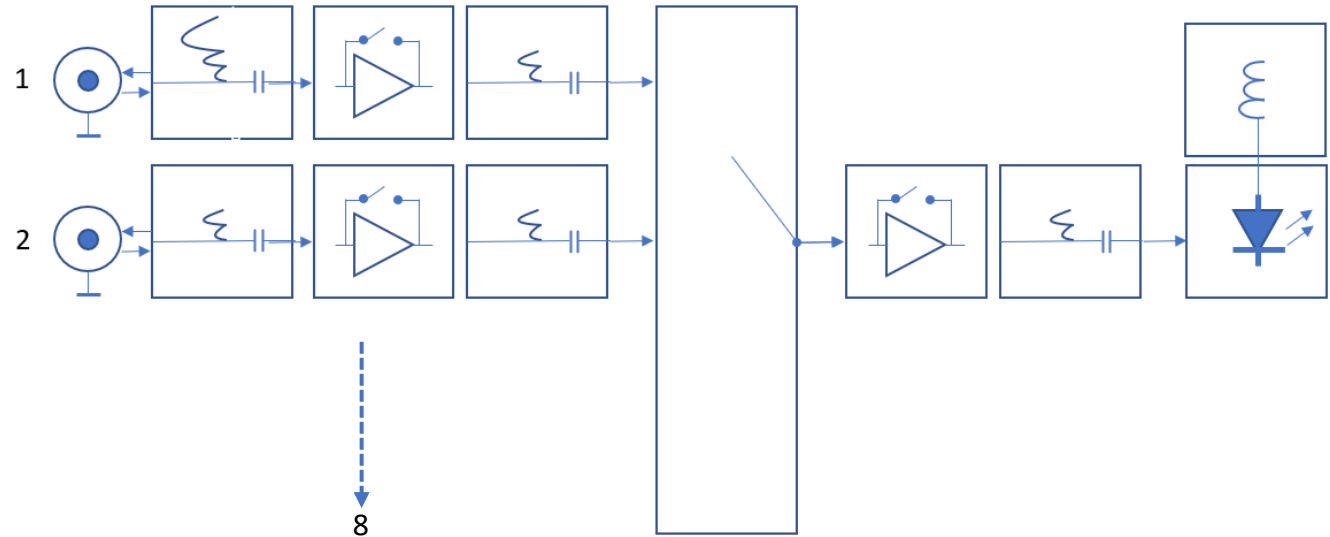


RadiLink Requirements

- **Multiple channels**
- Multiple antennae in a car
- Setup different measurements in 1 go
- 1 RF channel, all phantom power

RadiLink Requirements

- 8 Channels





RadiLink extra Requirements

- **Excellent signal tracking between channels**
 - Length matching all the RF traces
 - Same bend radius on all traces
- **High isolation** (no disturbance from other channels)
 - Minimize coupling between channels
 - Minimize magnetic coupling in the inductors
 - Turn off Rf amplifiers in non-used paths
- **Flat frequency response**
 - Hardware correction networks



RadiLink Requirements

- **Continuous testing**
- Relative high-power consumption
- Even higher with phantom power enabled
- Laser supply undesirable
 - Many lasers required (like lumiloop)
 - Cost
 - Heat dissipation
 - Burning fibres (avalanche effect)



RadiLink Requirements

- **Continuous testing**
- **Solutions:**
 - exchangeable battery pack
 - External supply
- **Features:**
 - Battery power or external power (manual selectable)
 - Internal protections
 - Active cell balancing and protections
 - Constant output voltage
 - Buck-boost converter



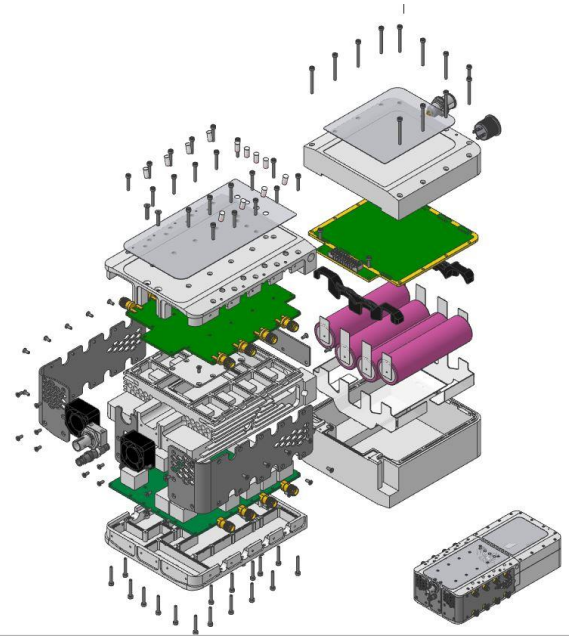
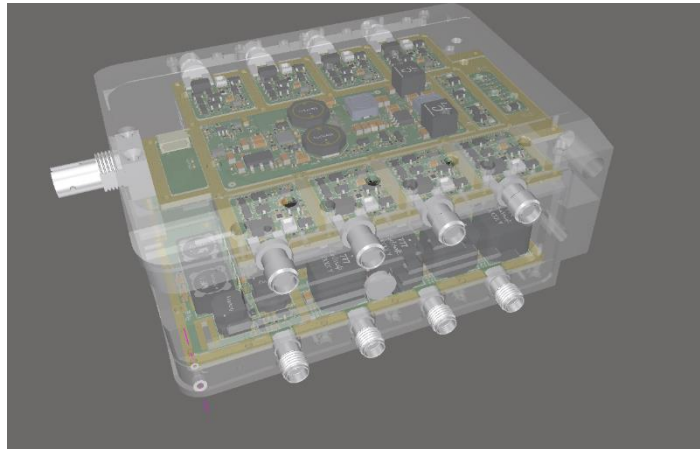
RadiLink 8 Requirements

- **Shielded & compact**
- External shielding
 - Shield system from external (high) field strengths
 - Prevent radiation in the environment
- Internal shielding
 - Shield internal parts from each other
 - sensitive RF board
 - Power supplies
 - Processor
 - Communication



RadiLink 8 Requirements

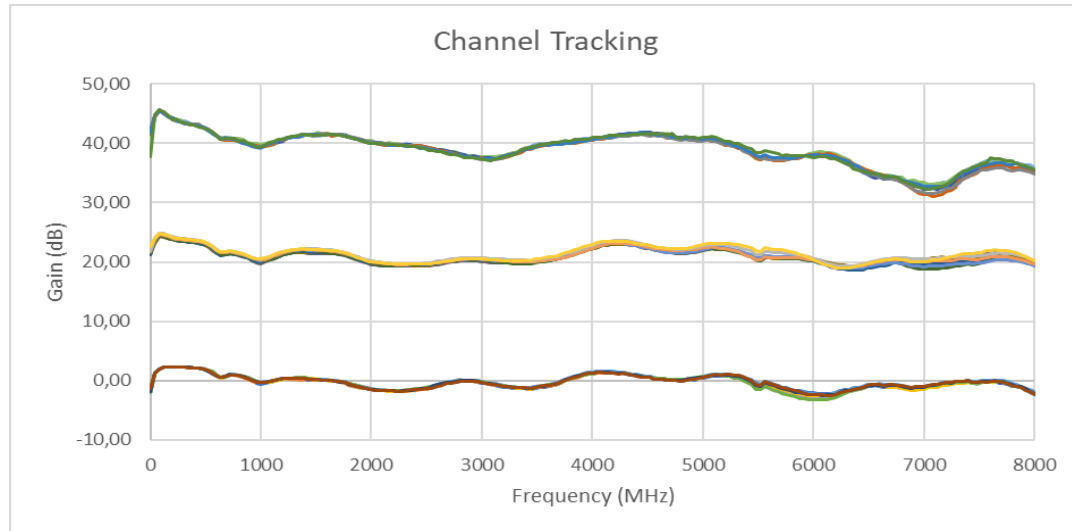
- **Shielded & compact**





RadiLink 8 upgrades

- 2GHz Bandwidth increase (now up to 8 GHz)
- Better signal tracking





RadiLink 8 upgrades

- Higher isolation
 - > 60dB. 0dB gain (20dB more than specified)
 - > 80dB. 20dB and 40dB gain (40dB more than specified)
- Improved output VSWR
 - 20dB return loss (14 dB above specified)
- Higher communication speed
 - Up to 200 commands per second (40x times faster)



RadiLink 8 upgrades

- Improved user experience
 - Improved sticker labels
 - Added text on side skirts
 - Improved RadiMation drivers
 - Improved RadiCentre touch control





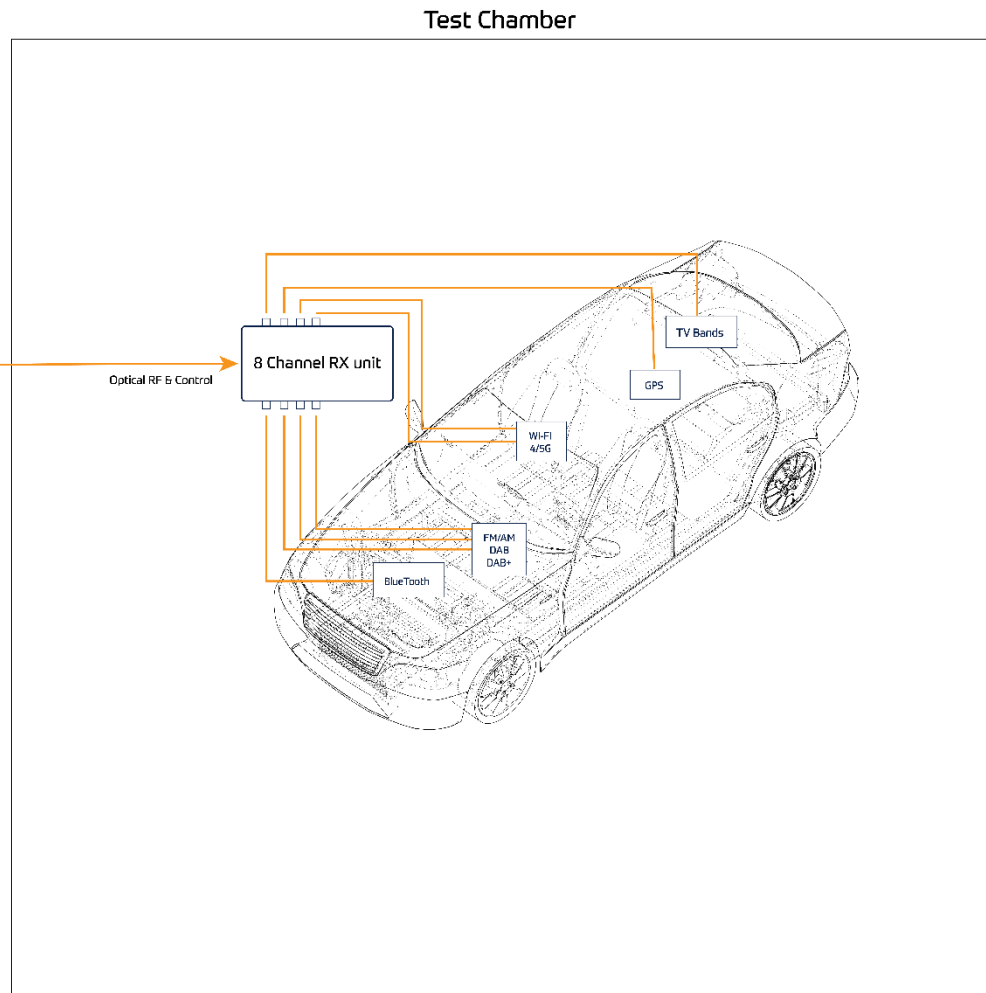
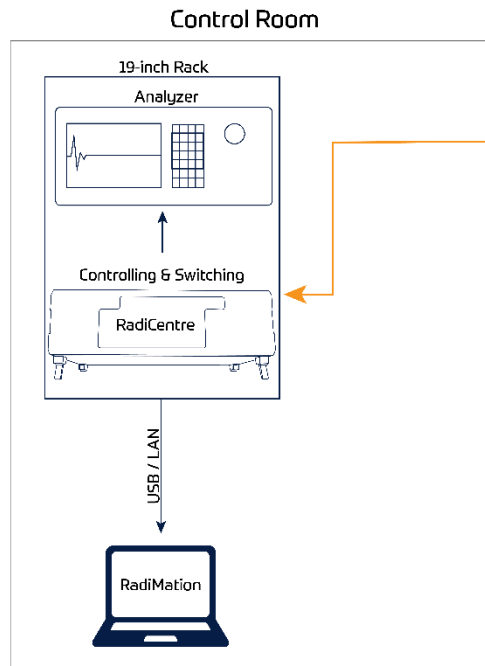
RadiLink Key Specs

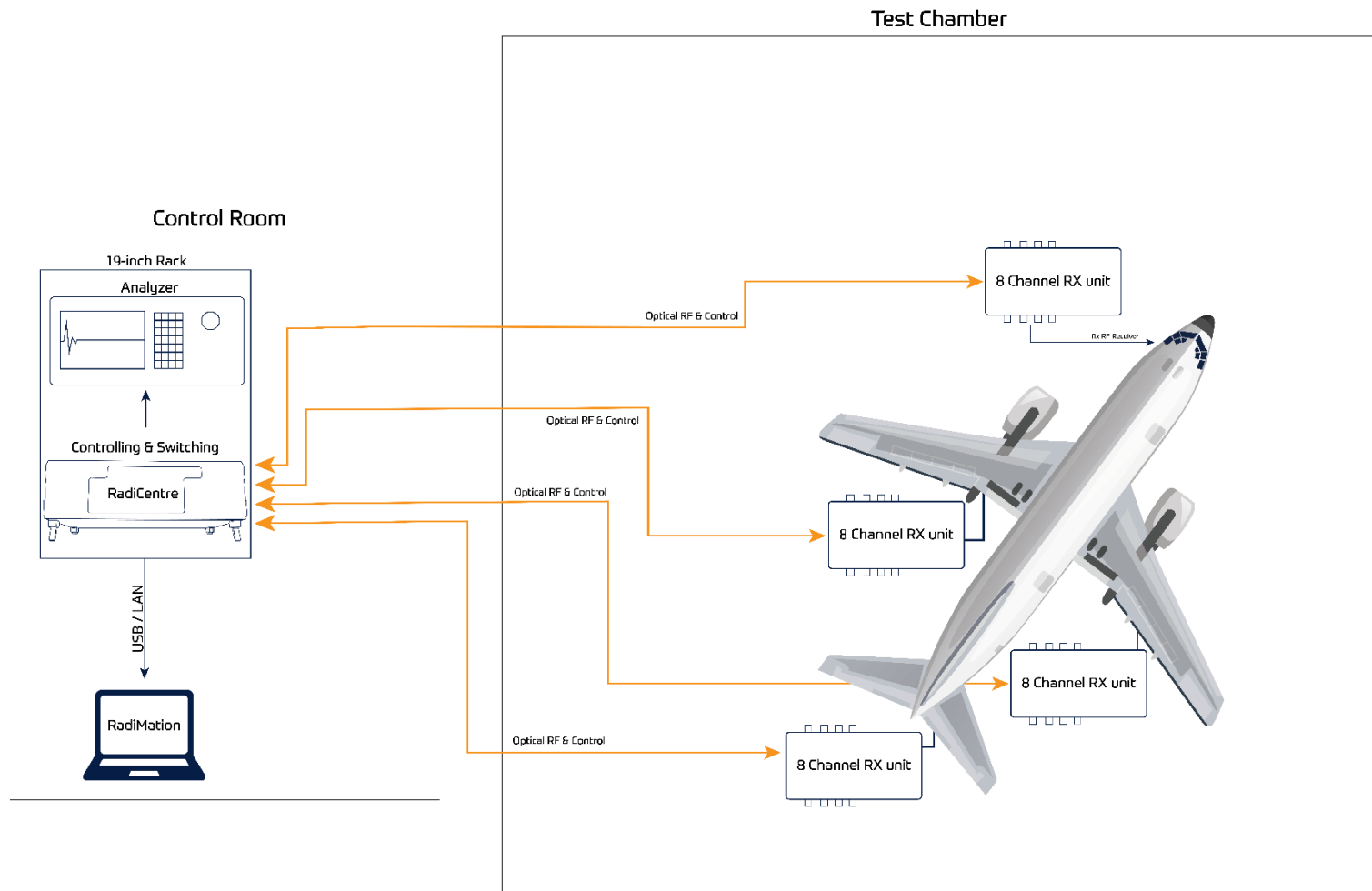
- 9kHz – 8GHz bandwidth single band (-3dB)
- 8 full band RF inputs
 - Excellent tracking
 - High isolation
- > 170dB total dynamic range
- Phantom power
- Continuous testing



RadiLink 8 Applications

- Automotive testing
- Antenne testing (multiple channels)
- Transporting multiple RF signals over fibre
 - Antenna remoting
 - Current sensing
 - EUT monitoring
 - Etc.







RadiLink 8 Applications

- Transporting multiple RF signals over fibre
 - Meet us at our stand this week 😊



RadiLink 1 channel



RadiLink 1

- If you can build 8 channels you can build 1 😊
- Basic idea:
 - Remove the switch and the 7 other channels
 - Same specs as the 8 channel



RadiLink 1 Requirements

- Same specs or better
- Modulator
 - Compact form factor (less electronics)
- De-modulator changes
 - Module (same form factor as modulator)
 - Fully shielded



RadiLink 1 Design

- Master - Minion principle
- Each module can be controller or remote unit
 - Receive RF from the EUT over fibre
 - Send RF to the EUT over fibre
- With 2 sets you can build a full bidirectional analogue link



RadiLink 1 impressions

- Each module
 - Fully shielded
 - USB-C communication port
 - Precision N-type connector (field replaceable connector)





RadiLink 1 impressions

Modulator

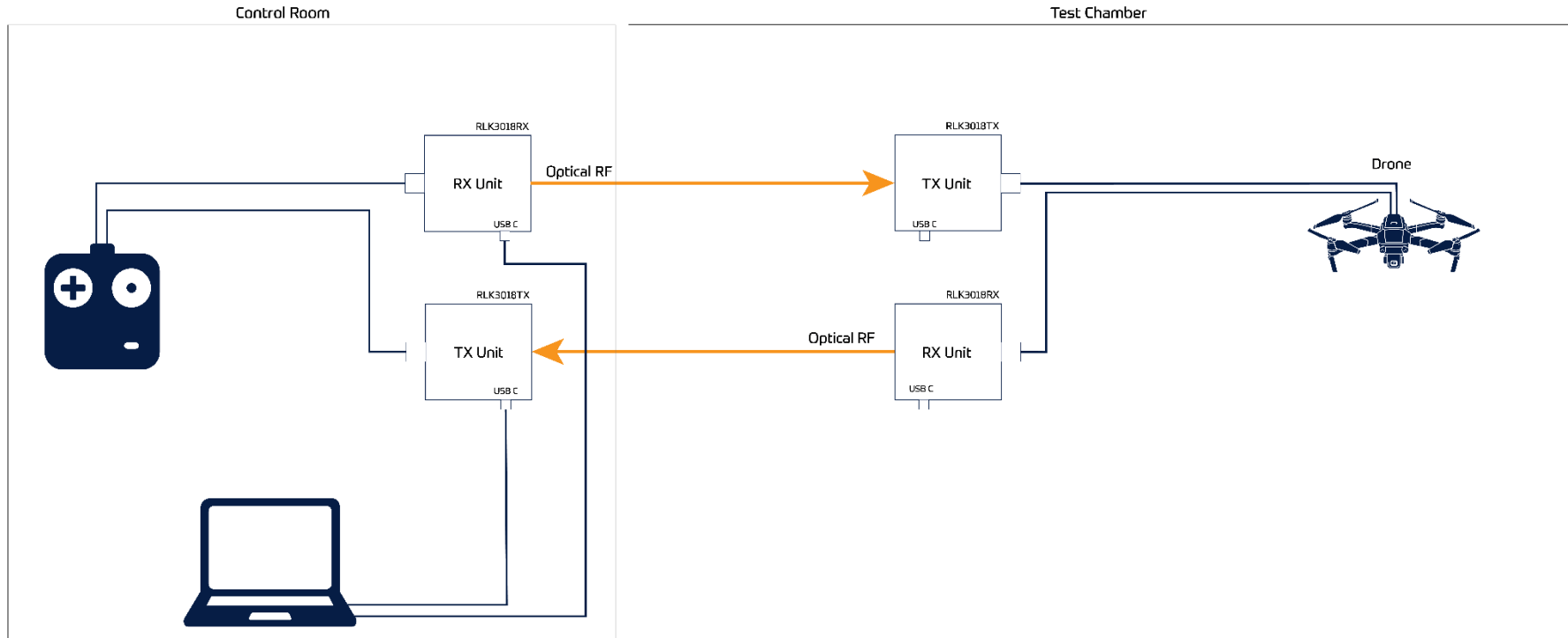


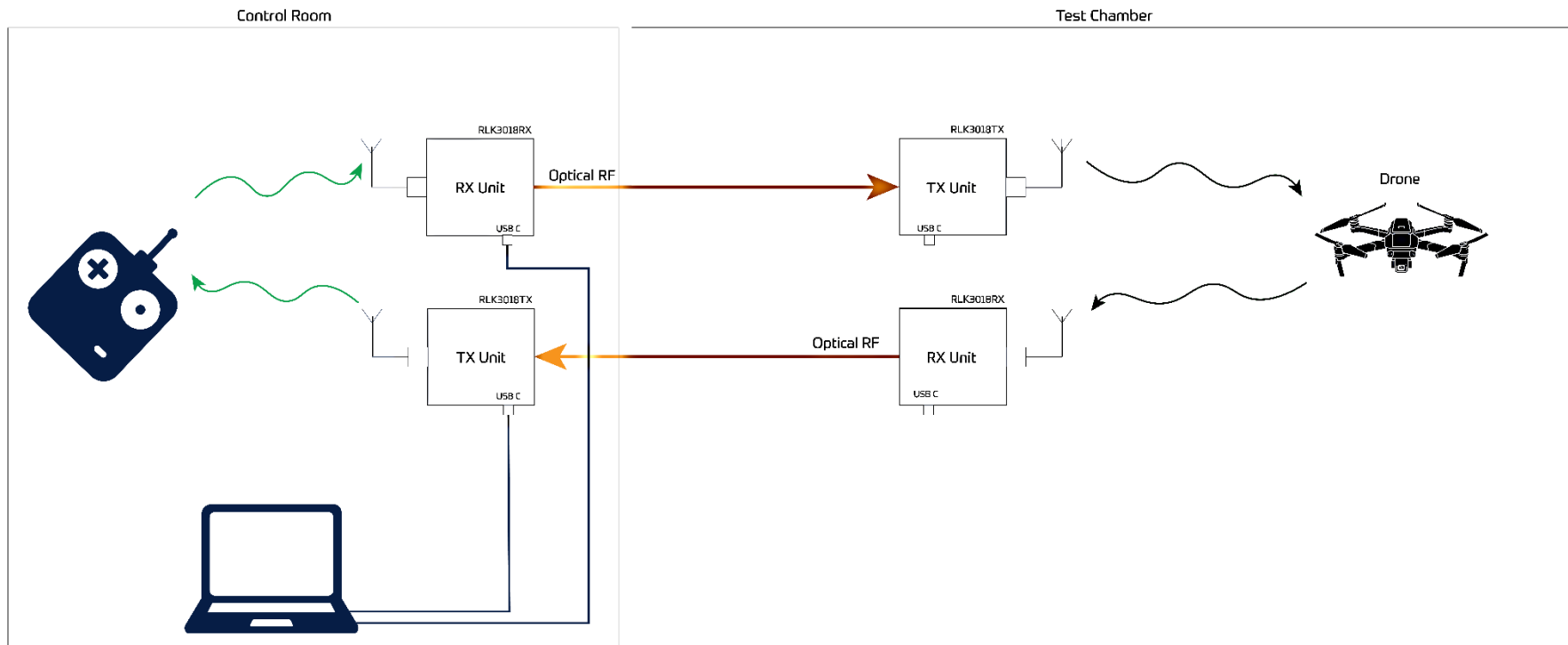
De-modulator



RadiLink 1 Applications

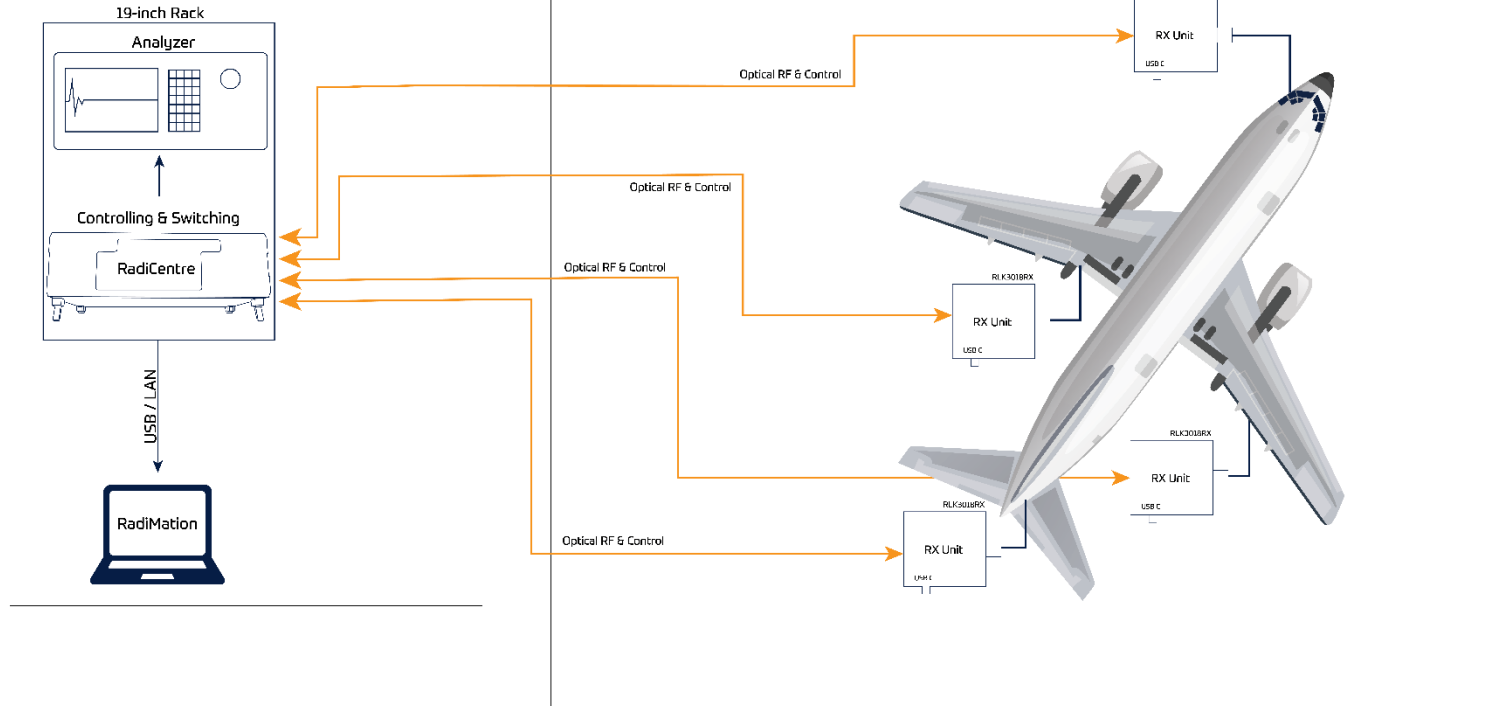
- Applications
 - EUT monitoring
 - EMC testing
 - Antenna remoting
 - Drone testing
 - Airplanes testing
 - Etc.

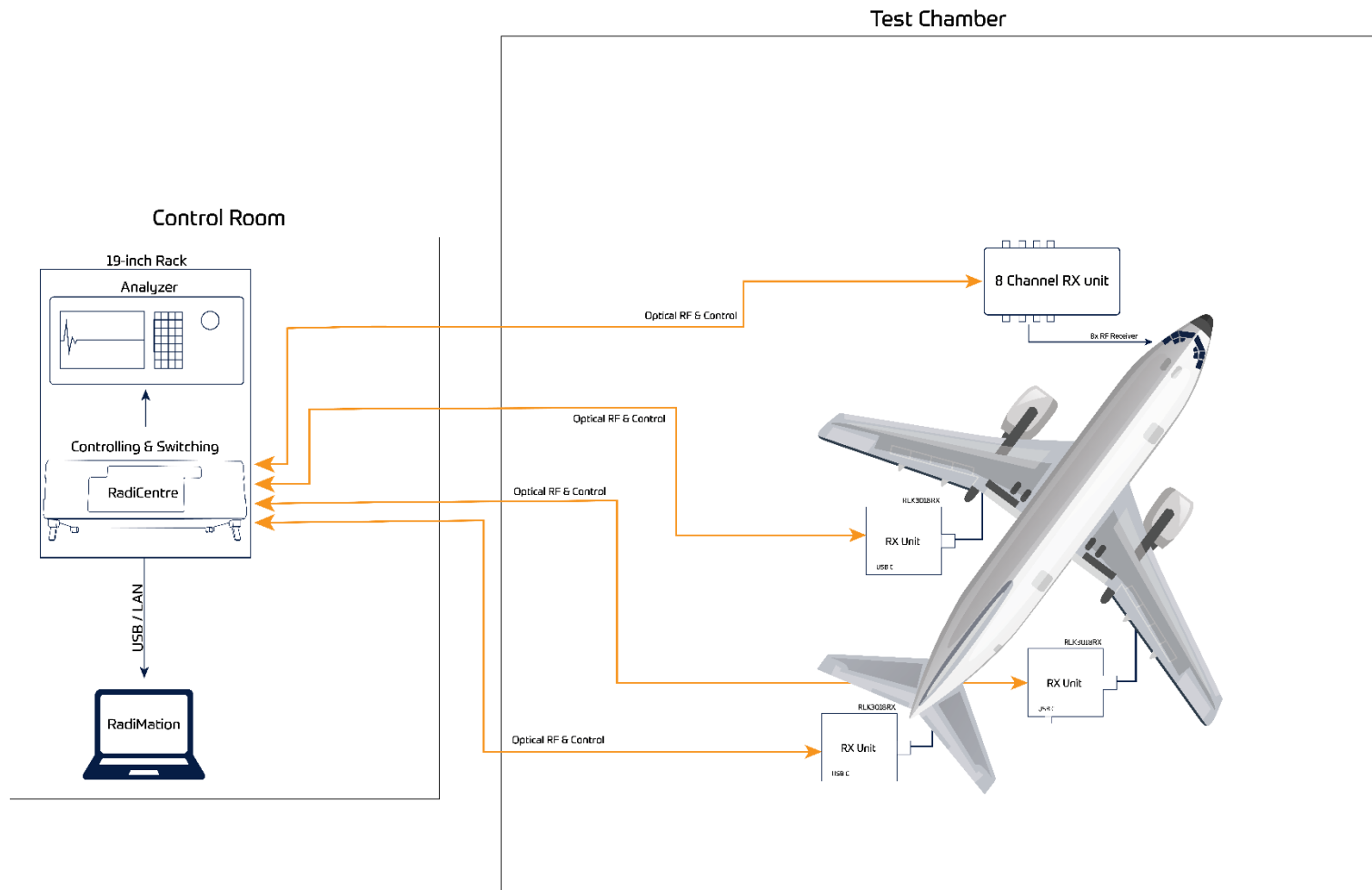




Test Chamber

Control Room







RadiLink, what to choose



RadiLink

- 2 or more signals must be transmitted to the control room >> 8 channel RadiLink
- Multiple devices must be phantom powered >> 8 channel Radilink
- A signal must be transmitted to the control room >> 1 channel RadiLink
- A single RF source must be transmitted to a chamber >> 1 channel RadiLink
- Fully isolated RF connections >> multiple 1 channel RadiLink

Any questions or more information?



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