SPACE SOLUTIONS

Booklet

SIMPLIFICATION IS OUR INNOVATION

Radiall™

- *GEO/MEO Satellites*
- *LEO Satellites Constellations*
- *Payloads*
- *Equipment*
- *Launchers*
- *Ground Testing*

FOREWORD

Radiall is the preferred choice across the globe when quality, reliability and performance are mission critical. With involvement in more than 300 GEO satellite and LEO constellation programs since 1974, our competitive solutions have established a strong reputation.

Our complete range of space-qualified products with a frequency range up to Q-band includes:

- *RF Connectors*
- *RF Cable Assemblies*
- *Microwave Components*
- *Microwave Switches*
- *Optical Interconnect Systems*
- *Multipin Connectors*

SPACE EXPERTISE

All of Radiall's space products are designed by space engineers at our state-of-the-art plant in L'Isle-d'Abeau, France. Our 600 m² ISO 7 and ISO 8 clean rooms are among several in-house capabilities that allow us to guarantee that our customers are receiving the highest quality components on the market.

DESIGN

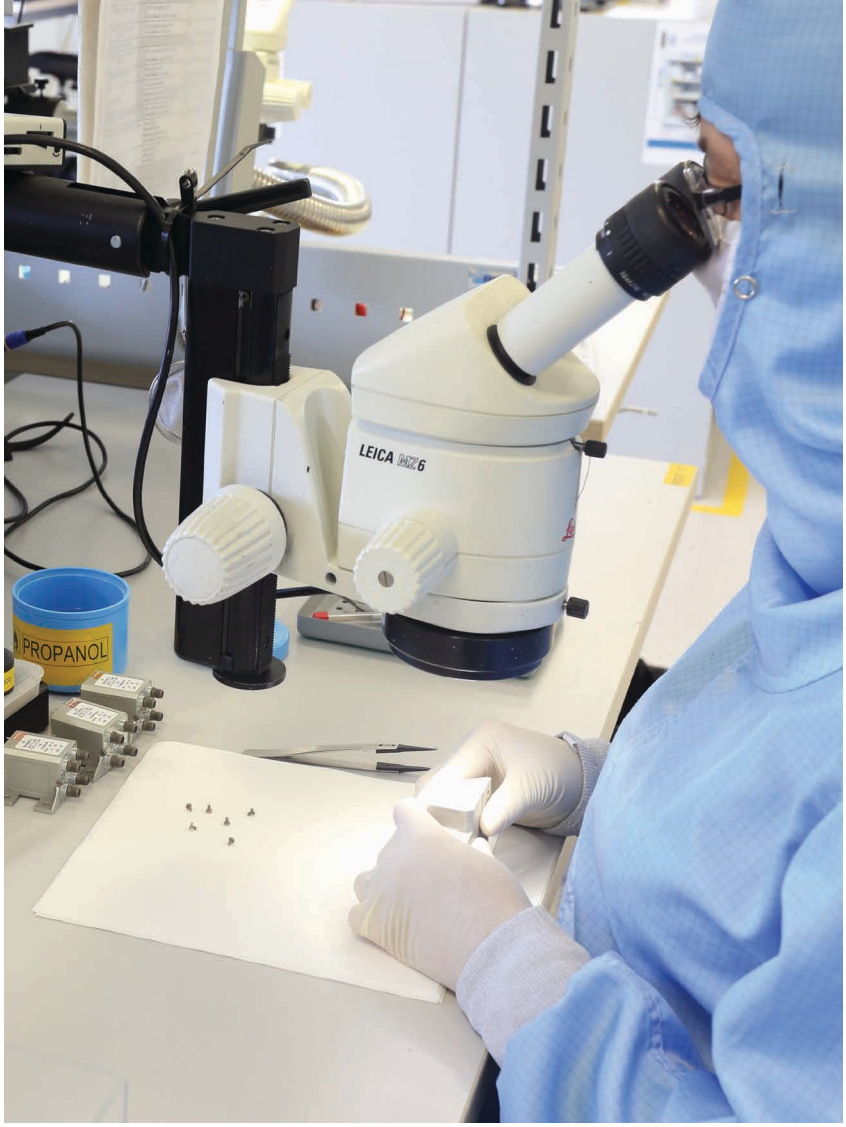
To ensure that customers' specific needs for dedicated applications are met, our engineers use the following tools to design and model components:

- *ANSYS*
- *SolidWorks*
- *CST Microwave Studio*
- *COSMOSWorks*
- *HFSS*

TESTS

At Radiall, we understand the importance of products that meet environmental and space specifications. We use the following in-house test equipment to ensure that customers receive high performance and qualified components:

- *Vector Network Analyzers*
- *Thermal chamber with nitrogen injection*
- *Thermal vacuum chambers*
- *Automatic test benches for electrical switch parameters*
- *X-ray equipment*
- *Multipaction and power handling test benches*
- *Vibration shakers*
- *Half sine shock machine*
- *Reverberation chamber for EMC measurements*



Radiall presence for all space grades:

FM GRADE

Flight Models include products tested for flight acceptance. Radiall products for FM are also space-qualified and are assembled in appropriate conditions with respect to the relevant space standards. Radiall delivers components ready to integrate into Flight Model satellites.

EM GRADE

Engineering Models are representative of Flight Models in form-fit-function. Lower standards of components, materials and processes may be used with limited screening to performance verifications. Radiall is well-equipped to design, manufacture and deliver products that conform to this requirement.

QM OR EQM GRADE

Qualification Models and Engineering Qualification Models are built to full standard in accordance with the requirements imposed on Flight Models. Radiall provides components for QM and EQM with the same requirements as Flight Models.

PFM GRADE

Proto-Flight Models are equivalent to FM and are acceptable for flight use. Radiall products for PFM are submitted to an extended screening test. For example, Radiall switches are tested at the maximum qualified temperature range and vibration level in a vacuum chamber.

TVAC GRADE

Radiall has a wide range of standard products that are compatible with vacuum environments.

ORBIX NEW SPACE RANGE

With over 50 years of experience in the space environment, Radiall has developed Orbix, the New Space offer. Orbix includes a range of connectors and cable assemblies specifically designed to endure the demanding conditions of space, while offering a cost-effective solution suitable for large-scale production.

- *Designed for space environment compatibility*
- *Scalable for mass productions*
- *Competitive and reliable performance*

GEO SATELLITES

Our connectors, attenuators, switches, couplers and cable assemblies are designed and qualified to withstand the high requirements of GEO satellites. Radiall also provides qualified optical solutions for payload applications to address the need for higher bandwidth and large amounts of data.

RF SWITCHES

Radiall has more than 40 years of experience in designing and manufacturing electromechanical switches. The space-qualified range, SPDT, DPDT, DP3T and T switches, can be fitted with SMA, SMA 2.9, SMP-LOCK or TNC interfaces, depending on frequency band and power requirements. We offer individual switches with D-SUB, external pins or flying leads for CMD and TLM controls, as well as interconnected, compact switch matrices, from 2 to 8 switches.

- *Excellent RF performances: VSWR and EMC*
- *Lightweight*
- *High density switch matrix*
- *Random or sequential T-switches*

RF COUPLERS & DIVIDERS

Our product range has recently been completely redesigned to offer the best RF performances in VSWR, amplitude balance and EMC. We also optimized the design to guarantee glitch-free products.

- *3 dB hybrid power dividers*
- *Directional couplers, 5 to 30 dB*
- *Dividers, 2 ways to 8 ways*
- *From L-band to Ka-band*

RF CABLE ASSEMBLIES

Our range of space-qualified, low loss flexible coaxial cable assemblies and semi-rigid cable assemblies is entirely customizable. We offer several cable diameters and various configurations of connectors. Length and shape can also be adapted to equipment.

- *Technical support to define the best configuration*
- *ETFE jacket available for better radiation tolerance*
- *Compliance with ESCC 3408 specification*
- *Phase-matched option available*

RF CONNECTORS

Radiall's space offering includes a wide range of coaxial connectors with a frequency range up to Q-band. This includes SMA, SMA 2.9 and Very High Power TNC connectors that are ESA qualified, as well as TNC, 2.4 mm and SMP/SMP-LOCK connectors.

- *Various interfaces available*
- *ESA qualification*

RF ATTENUATORS & LOADS

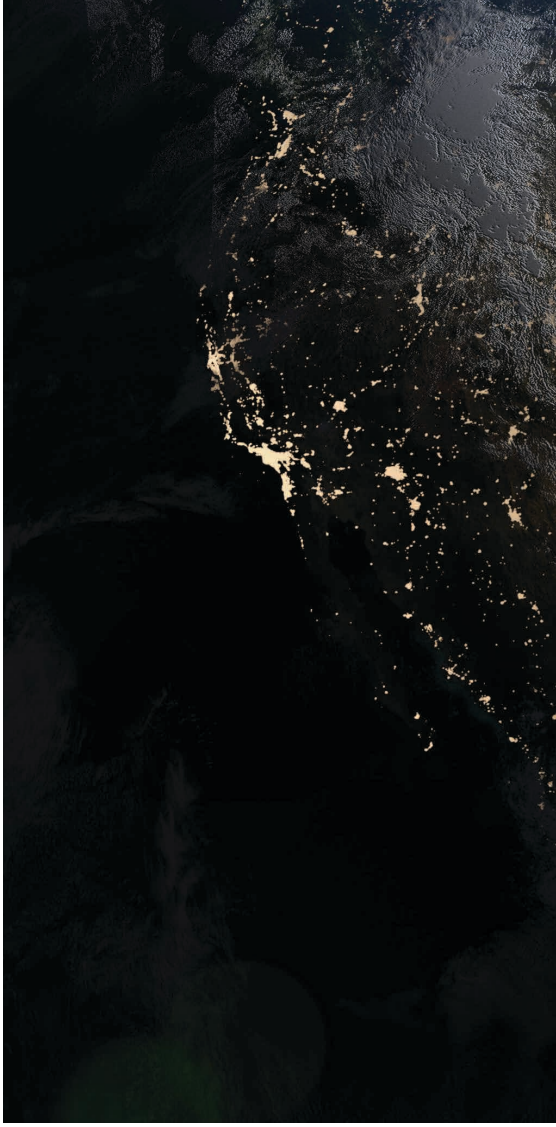
Radiall offers space-qualified low power attenuators (up to 2 W) and low or medium power terminations (up to 45 W). These are available with various interfaces: SMA, SMA 2.9, SMP-LOCK, 2.4 mm and TNC.

- *ESA qualification*
- *Attenuators are glitch-free*
- *Robust design*

Q-MTITAN™ WITH HDQX CONNECTORS

Radiall designs and delivers optical assemblies that are equipped with 12-fiber Q-MTitan™ contacts and HDQX connectors. The full optical links are qualified for use in stringent payload applications.

- *Random Vibration: 40 grms up to 2,000 Hz*
- *Sin Vibration: 20 G up to 100 Hz*
- *Shocks: 2,000 G*
- *Temperature Cycling: -55 °C/125 °C*
- *Temperature Storage: 1,000 h @ 125 °C*
- *Equipped with radiation-resistant fibers and low outgassing components*



LEO CONSTELLATION

LEO satellite constellations are transforming global connectivity by making communication more accessible worldwide. These ambitious projects demand cost-effective solutions that can be produced at scale, all while meeting the rigorous requirement for the space environment. That's why Radiall developed Orbix, our New Space product range—a reliable alternative to our traditional Space offerings.

ORBIX: THE NEW SPACE PRODUCT RANGE

With over 50 years of experience in the space industry, Radiall has developed Orbix, a new product range specifically designed for LEO satellite constellations.

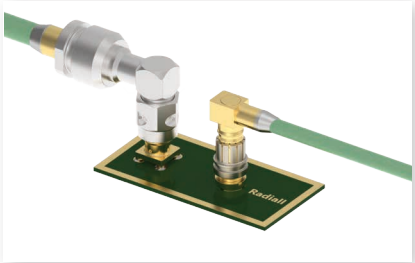
Orbix includes a range of connectors and cable assemblies engineered to meet the harsh demands of space, while delivering cost-effective, scalable solutions for high-volume production.

- *Built for space environment durability*
- *Optimized for large-scale manufacturing*
- *Cost-effective performance*

ORBIX COAXIAL CONNECTORS

Designed specifically for LEO constellations, Orbix coaxial connectors offer a wide variety of options, including panel receptacles, PCB receptacles and board-to-board solutions, to support flexible integration in satellite systems. The Orbix range also features an optional LOCK mechanism, enabling fast, secure and tool-less installation.

- *Wide frequency range: DC – 65 GHz*
- *Fast, secure and reliable connections*
- *Reduced integration time for efficient assembly*



ORBIX COAXIAL CABLE ASSEMBLIES

The Orbix range includes flexible coaxial cable assemblies with various low-loss cable options, designed to meet the demands of both intra-equipment and inter-equipment applications. An option LOCK mechanism ensures fast, secure integration, which makes it ideal for time-sensitive or high-reliability environments.

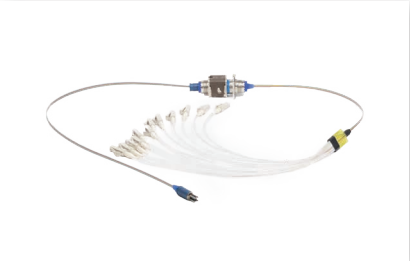
- *Frequency range up to 40 GHz (DC – 40 GHz)*
- *Fast and secure connections*
- *Minimal integration time*
- *Suitable for both intra- and inter-equipment use*

In addition to Radiall's global Space range of offerings, it continues to support traditional program with reliable FM and EM grade products. Learn more on page 6.

QUARTZ-S SMT RELAY

Quartz-S is a new Miniature Electro-Mechanical Relay (MEMR). This SMT (Surface Mount Technology) SPDT Switch is perfectly suited for HTS or VHTS satellite payloads with redundant systems. This cost effective solution, making integration into constellation easy, becomes the RF switch solution for LEO satellites.

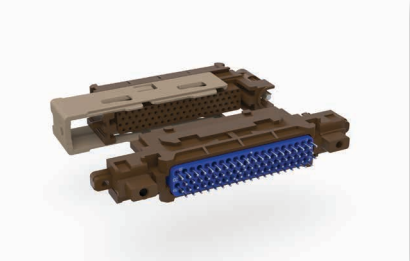
- *Small size, lightweight (10 g)*
- *High frequency: 32 GHz*
- *Life span: 1 million cycles guaranteed*
- *According to ESCC 3603 and 3603/007*



OPTICAL FIBER LINKS

We offer a wide range of configurations for space grade assemblies that are available with high-reliability connectors, cables and optical contacts, including legacy LC connectors, LuxCis® ARINC 801 contacts and space-qualified Q-MTitan™ contacts. They can be assembled on single or multifiber cables or optical flex circuits, and they maintain a high optical link budget.

- *Weight optimized, compact and robust optical interconnect solutions*
- *High volume capability*
- *High optical and environmental performances adapted to LEO environment*



QUICK INSTALL RADIALL CONNECTOR

The Quick Install connector is a revolutionary tool-less interconnect solution. It features a locking system to ensure instant manual mating and a slide lock with visual indicators to guarantee that the mating is secure.

- *Instant assembly: one-finger mating technology*
- *QR equipment for straight and right angle PC tail contacts*
- *High density and ultra-light connector*

GROUND TESTING

Ground testing components and systems is an essential stage in the satellite manufacturing process. It includes testing space equipment, payloads and satellites under simulated flight conditions. To optimize the cost of developing and testing space systems, Radiall offers product alternatives depending on the types of components used.

TVAC RF SWITCHES

With more than 25 years of experience in the space industry, Radiall has developed a product offering that emphasizes reliability and performance and operates in thermal vacuum testing environments. Designed in accordance with our standard RAMSES product offering, TVac series switches feature identical configurations with excellent performance.

- *SPDT, DPDT, SPnT*
- *Unterminated and terminated models*
- *Long life span: up to 10 million cycles*

TESTPRO RF CABLE ASSEMBLIES

TVac test assemblies offer excellent electrical performance and high mechanical endurance. Additionally, these ruggedized assemblies offer reliability and durability when it matters most. Despite high protection resistance, Radiall's range of TVac TestPro solutions remain exceptionally flexible and user-friendly with an extended life of more than 20,000 flex cycles.

- *DC – 67 GHz*
- *Phase and amplitude stability*
- *High flexibility and reliability*

RF CABLE ASSEMBLIES & CONNECTORS

Radiall designed a wide range of coaxial connectors and cable assemblies for space testing with various interfaces, configurations and types of cable. For ground applications, Radiall offers cable assemblies and connectors based on our commercial range. If required, Radiall can offer a complete set of phase-matched, time delay-matched or amplitude-matched SHF cable assemblies.

- *Low loss (SHF range), flexible and robust cables*
- *Customized offer depending on the application*
- *EM cable assemblies are also available for equipment qualification*
- *Quick lock solution connection*

MICROWAVE COMPONENTS

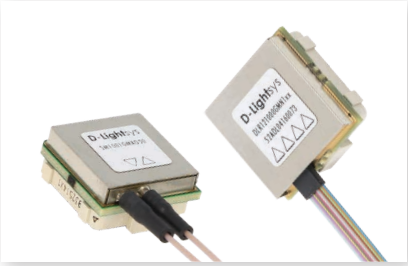
Radiall develops and manufactures a wide range of coaxial microwave components, including terminations, attenuators, couplers, power dividers, filters and other specialized components.

- *Frequency range: DC – 67 GHz*
- *Power range: 0 to 1,000 W*
- *Robust design*
- *Excellent electrical performance*
- *Impedance: 50 Ohms*

OPTICAL FIBER LINKS

The wide range of ruggedized and reliable interconnect solutions available at Radiall makes it possible to design and build assemblies with optimized fiber management solutions. Our optical contacts and connectors can be assembled on single or multifiber cables or optical flex circuits.

- *High reliability connectors, cables and optical contacts: LuxCis® ARINC 801, LC, C-MTitan™ and Q-MTitan™ ARINC 846*
- *High optical link budget*
- *EMI/EMC compliance*
- *High level of shock and vibration compliance*
- *-55/+125 °C operational temperature range*



OPTOELECTRONIC CONVERTERS

Radiall offers a complete range of high performance optoelectronic Active Optics by D-Lightsys® for harsh environments:
DO-160, MIL-STD, ARINC 804.

- *Lowest power consumption (<50 mW/ch Gbps)*
- *Smallest form factor for single channel and multichannel modules (6.5 mm²/ch/Gbps)*
- *Protocol-independent and large bandwidth per channel (from DC to 10 Gbps)*
- *Various packages and form factors available (LCC, Socketed, SFF, others)*
- *Free space version for board-to-board contactless data links*

LAUNCHERS

Vehicle launch systems require products that can withstand harsh environments due to the high levels of shock and vibration they experience. Our innovative range of products enables satellites to make safe connections in space orbits.

RF CABLE ASSEMBLIES

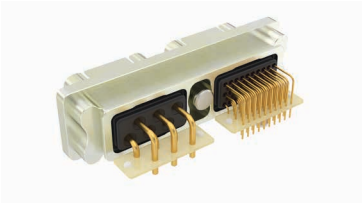
Various robust configurations with high resistance to mechanical shocks and vibrations are available. Our cable assemblies for launching applications are qualified to guarantee a secure connection during the launching process. We also offer a wide range of FM designed with venting holes for outgassing and to avoid Corona breakdown.

- *Random vibration up to 40 Grms*
- *Mechanical shock half sine 1,000 Grms*
- *Various diameters available*
- *Vacuum compatible option*
- *Specific screening and qualifications can be applied*

RF CONNECTORS

Compliant with the highest MIL standards, Radiall designs coaxial connectors that withstand high vibrations and shock levels.

- *Frequency up to 65 GHz*
- *Secured coupling mechanism available*
- *High corrosion resistance*
- *Temperature range up to 200 °C*



EPXB2 LIGHTWEIGHT DISCONNECT

With the increasing demand for weight-saving connection solutions, Radiall now offers an alternative EPXB2 with J plating and 21% weight savings compared to the standard EPXB2 aluminium connector.

- *Modular and user-friendly connector: fully intermateable*
- *Space-saving solution*
- *Cost-saving solution*
- *EN 4644 European standard*

RF COUPLERS & DIVIDERS

For over 30 years, Radiall has designed coaxial couplers and power dividers/ combiners for embedded RF systems. Our product offering includes directional and 3 dB 90° hybrid couplers, as well as power dividers used for signal measurement. Both products comply with MIL-STD-202G.

- *Couplers operating from 0.15 to 18 GHz*
- *3, 6, 10, 20, 30 dB standard coupling values*
- *Low insertion loss and VSWR*
- *High directivity*
- *Dividers operating from 0.22 to 26.5 GHz*
- *2, 3, 4, 6 and 8 way divisions available*
- *Power dividers can be used as combiners*

Q-MTITAN™ SPACE-QUALIFIED CONTACT

Q-MTitan™ is an optical contact designed and qualified for high density, high data rate applications in space environments. It can be used in existing size 8 Quadrax cavities of off-the-shelf multipin connectors that are available in the defense and aerospace markets, such as MIL-DTL-38999, QuickFusio™, NSX ARINC 600, EPX EN4644 and HDQX. Compatible with ribbon and round cable and radiation-resistant fibers, it offers excellent performances.

- *500 mating cycles*
- *Vibration 41.7 Grms*
- *Shocks 2,000 G*
- *-55/+125 °C*

OPTICAL FIBER LINKS

We offer high-quality harnesses and complex optical systems, including D-Lightsys® active devices, multipin connectors and ruggedized fiber optic interconnect solutions: LuxCis® ARINC 801, LC, C-MTitan™ and Q-MTitan™ ARINC 846.

- *Lightweight and small design*
- *Material with low outgassing*
- *Immunity to EMI and RFI*
- *Resistance to radiation*
- *Simplex and multichannel assemblies*

Compliant with European export control regulations and United States ITAR.

SIMPLIFICATION *is our* INNOVATION

We advance the design and engineering process for innovators, ground breakers and pioneers of technology. We reduce weight, improve durability and streamline installation to provide leading-edge connectors that drive product performance.

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GLOBAL PRESENCE

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