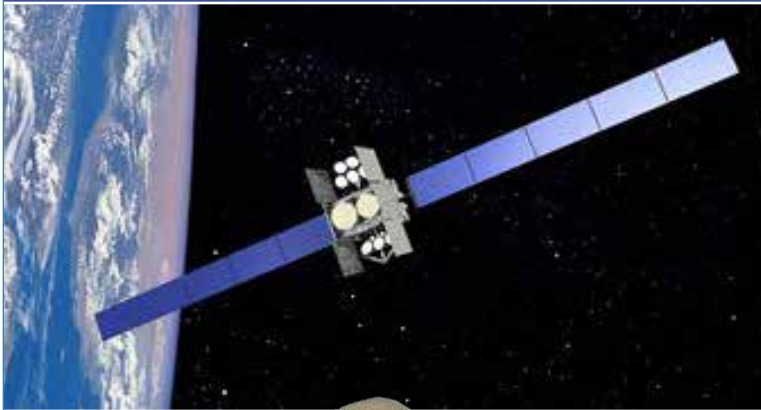


RF Products Space Heritage



Ducommun RF Space Heritage Overview

Since 1987, Ducommun's RF engineering and production team has been manufacturing coaxial SPDT and transfer switches for a variety of space and launch applications. Our qualified team has worked hard to design, engineer and manufacture components to withstand extreme environments with temperatures ranging from -55°C to 100°C. Frequency ranges for our heritage products have ranged from DC to 29 GHz utilizing either SMA, TNC or GPO.

Our switches are built to satisfy the stringent demands of today's space environment via extensive testing, manufacturing and quality procedures. A certified Class 10,000 clean room with Class 100 laminar flow benches is available to satisfy Hi-Rel requirements of missiles, satellites, commercial and military applications.

Space Heritage Programs

- LEO
- METOP
- GALEX
- C/NOFS TDRS
- SWIFT
- MATSAP
- GPS II
- International Space Station
- Hot Bird 6
- GLAST
- Samaritan

RF Space Heritage

Ducommun has a legacy of working with both government/defense and commercial space applications. Because of our heritage, we can offer a broad range of switching solutions to both communications link applications and redundancy applications.

Ducommun's RF coaxial space-qualified switches have been used in a variety of space applications where electrical performance, weight, size and reliability have been mission critical. Our heritage includes both S and K Level qualification testing and screening.

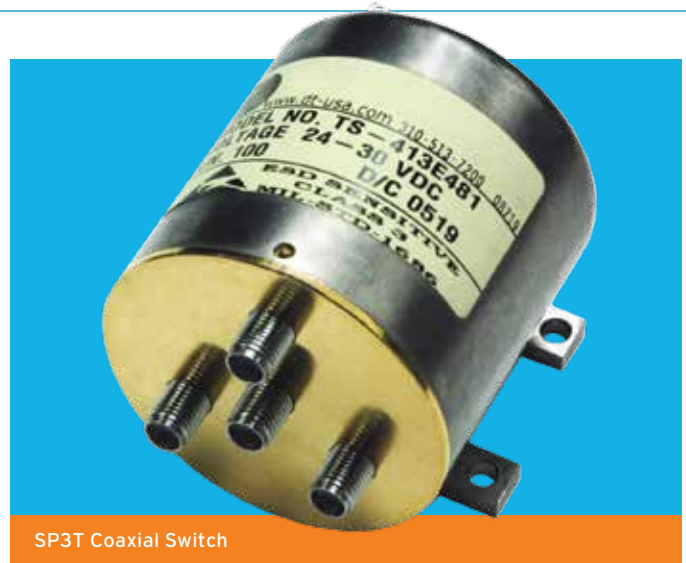
SPDT Space Product Heritage

Ducommun manufactures quality, reliable, high frequency SPDT switches that can operate from DC to 46 GHz with 55 dB minimum isolation. The DK series operates DC to 40 GHz and uses a K connector. The DL series operates DC to 46 GHz and uses a 2.4 mm connector.

SPDT Heritage Options

- Actuators
 - > Failsafe
 - > Latching
- Indicator circuitry
- Suppression diodes

Program	RF Conn	Range (GHz)	RF Power (wcv)
Classified	SMA	DC - 18	1
C/NOFS	SMA	DC - 3	50
MTSAT	SMA	22.5 - 29	52
SWIFT	SMA	2.1064 - 2.2875	10
METOP	SMA	0.4 - 0.41	30
Classified	SMA	9.4 - 9.8	5W avg 15W pk
GALEX	SMA	0.1 - 10	10
International Space Station	SMA	DC-3 11 - 13	50 W 10 W
GPS	TNC	0.1 - 2.0	160
GPSII	TNC	DC - 2.0	210
MTSAT	TNC	1.68 - 1.7	104
GPSII Stop Gap	TNC	1.15 - 1.605	275
Classified	SMA	DC - 16	N/A
Classified	SMA	DC - 18.0	40 - 10



SP3T Coaxial Switch

Transfer Switch Space Heritage

Ducommun manufactures quality, reliable, high frequency transfer switches that can operate from DC to 46 GHz with 55 dB minimum isolation. The TK series operates DC to 40 GHz and uses a K connector. The TL series operates DC to 46 GHz and uses a 2.4 mm connector.

Transfer Heritage Options

- Actuators
 - > Failsafe
 - > Latching
- Indicator circuitry
- Suppression diodes

Program	RF Conn	Range (GHz)	RF Power (wcv)
MTSAT	SMA	0.10 - 2.9	26
LEO	SMA	6.9 - 9.0	10
Hot Bird-6	SMA	10.5 - 12.7	10
METOP	SMA	10.95 - 12.75	10
SWIFT	SMA	2.1064 - 2.2875	20
GLAST	SMA	2.1 - 2.3 14.8 - 15.2	20.8 55.2
SAMARITAN Mission	SMA	6.0 - 8.0	2W avg.

DUCOMMUN SPACE CAPABILITIES

Engineering

- 25 designers and engineers
- Electrical and mechanical design capabilities
- Various CAD/CAM capabilities
- Spectral radiometry
- Dedicated teams for each product line

Mechanical

- Sheet metal stamping and forming
- Injection molding
- Tool making center
- Laser etching
- NASA certified soldering
- Material and component traceability
- CNC center

Testing

- Environmental
 - > Thermal
 - > Vacuum
 - > Humidity
- Corona
- High Power
- RF to 50 GHz

Assembly

- Dedicated assembly cells
- Class 10,000 clean rooms with 100 flow benches

Certifications

- ISO 9001
- AS9100 Rev C
- MIL-PRF-22885 QPL
- FAA (ACSEP) Part 21
- FAA Repair Station Part 145
- MIL-STD-3009



DPDT Transfer Switch



SPDT Switch



SP8T Switch



Switch Matrix

Additional Space Heritage

- Space Shuttle Orbiter
 - Motors and resolvers on the remote manipulator arm
 - Switches and data entry control panels
 - Lock mechanism for cargo bay door
- International Space Station
 - RF communications modules
 - UHF/VHF communication panels
 - Airlock control pushbutton switches
 - Robotic arm motors and resolvers
 - Solar array deployment motors
- Mars Exploration Rover
 - High gain antenna motors
 - Optics motors and resolvers
 - Jack screw mechanism
- Satellites
 - Solar array stepper motor and resolver
 - Solar array deployment motors
 - Antenna pointing system positioning motors



Mars Exploration Rover

Where We're Located

