Renaissance Electronics and Communications

Space Product Capability

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Customers

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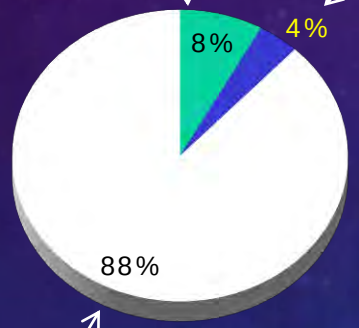
Markets Served 2012 - 2014

Commercial : 8%
- Wireless Telecom
- Point to point and multipoint
- Automated Test Equipment

Space : 4%
- Communications
- Transceivers
- Missile Defense



Aerospace & Defense : 88%

High Performance/High Reliability, Critical Missions

Communications, Data Links, Electronic Warfare, GPS Navigation & Surveillance, Radars

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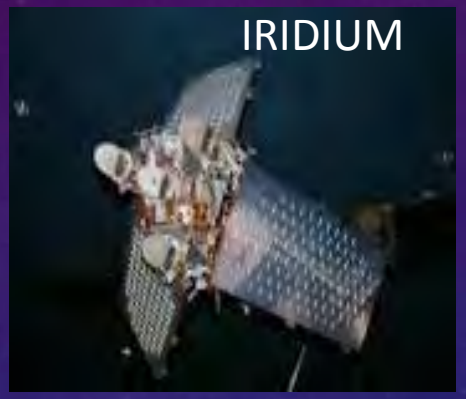
RF Integrated Solutions Space Heritage

Applications

- RF Switching and Attenuation
- Communication Data Links
- Conversion / Modulation
- Surveillance / Tracking
- Telemetry / Guidance
- Receiver Protection
- Imaging / Profiling
- Meteorological
- Scientific
- Military
- GPS



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Heritage / Current Space Programs

Satellites / Programs			
IRIDIUM	Sea Launch	MIPAD	GPS III
EchoStar XV	ARGON	NSTAR	LANDSAT
EUTELSAT	LEASAT	ASTRA	CHINASAT
ORION	MABUHAY	TELSTAR	Galileo

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Space Heritage / Current

Platform	Application	Frequency Band
WAAS	Navigation & Communication	L - X
GPS III	Frequency standard clock in navigation system	L
MIPAD	Communication	X
IRIDIUM	Communication	Ku, Ka
Meteorological Satellite*	Data Transmission	S
P142 classified Gov't satellite*	Power amp line up for communication	UHF
Galileo Constellation*	Navigation and communication, clock signal	UHF
Aquarius Satellite*	SSPA on scatterometer for measuring sea water salinity	L

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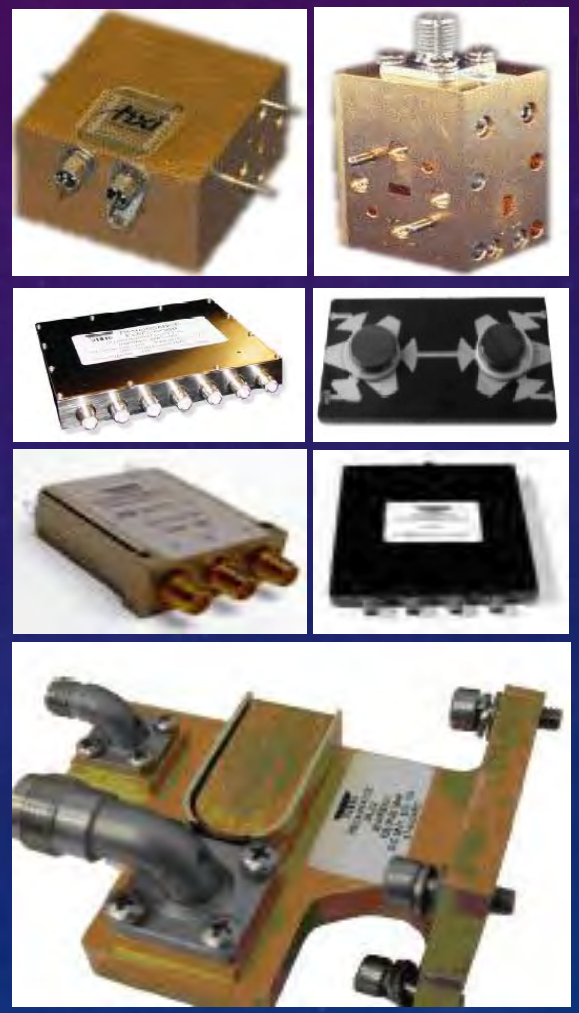
RENAISSANCE

Capabilities

- Coaxial Isolators and Circulators
- Micro-strip Isolators and Circulators
- Waveguide Isolators and Circulators
- Electromechanical Switches
- Power Dividers and Combiners
- LNAs



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Space Programs 2006 - 2014

- **Boeing** 2006

  SW-316 2.0-2.3 GHz RF Hermetic Switch, Pulse Latching, TNC

- **Samsung Thales Alenia JV** 2011

Korean Space Program	2A4NEX	2.2-2.3 GHz Coaxial Isolator
	2A7NFC-S	7.8-8.4 GHz Coaxial Isolator
	2A7NFD-S	7.8-8.4 GHz Coaxial Isolator

- **L-3 Communications** 2012 Space program

2W9NCB	29-31 GHz Isolator Micro-strip
2WR34NA-3	29.5-31 GHz Waveguide Isolator
2W9NCA	19-21 GHz Isolator Micro-strip
3A4NFB-DF	2.2 – 2.4 GHz Coaxial Circulator

- **Frequency Electronics** 2012 - 2014 Space program

2W9NBV	26.1 - 26.3 GHz, Micro-strip Isolator
2H7NDR-1S	6.6 – 6.73 GHz, Drop-in Isolator
2H6NBR-2S	5.014 – 5.114 GHz, Drop-in Isolator
2H6NBS-3S	5.4646 – 5.5646 GHz, Drop-in Isolator
2H3NCJ-4S	1.515 – 1.635 GHz, Drop-in Isolator
2H2NHI-5S	1.116 – 1.236 GHz, Drop-in Isolator

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Coaxial Circulator – 3A4NFB-DF

Electrical Specifications

Frequency Range	2.2 – 2.4 GHz
VSWR (Max)	1.25 : 1
Isolation (Min)	20 dB
Insertion Loss (Max)	0.5 dB
Power (CW)	75 W
Temperature Range	-45ºC to +90ºC

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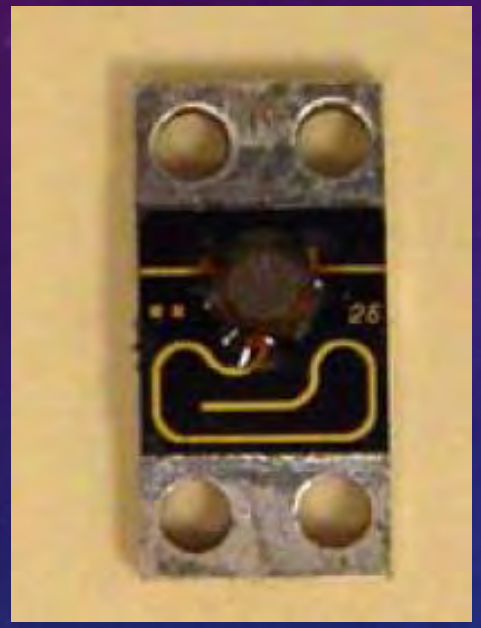
Micro-strip Isolator - 2W9NCB and 2W9NCA



Electrical Specifications

Frequency Range	19.0 - 21.0 GHz
VSWR (Max)	1.20 : 1
Isolation (Min)	19 dB
Insertion Loss (Max)	1.0 dB
Power (CW)	1 W
Temperature Range	-20ºC to +70ºC

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Hermetic Isolator - 2A4NEX

Electrical Specifications

Frequency Range	2.2 - 2.3 GHz
VSWR (Max)	1.25 : 1
Isolation (Min)	20 dB
Insertion Loss (Max)	0.6 dB
Power (CW)	100 W Peak, 75 W Avg
Power (CCW)	1 W
Temperature Range	-35ºC to +70ºC

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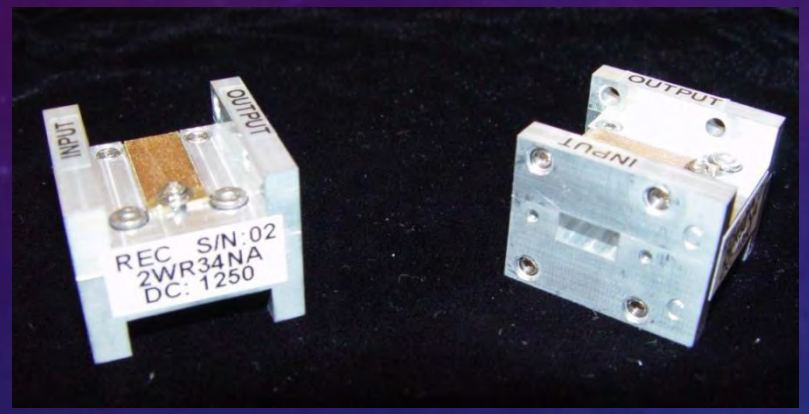
Waveguide Isolator – 2WR34NA



Electrical Specifications

Frequency Range	29.5 - 31.0 GHz
VSWR (Max)	1.20 : 1
Isolation (Min)	20 dB
Insertion Loss (Max)	0.15 dB
Power (CW)	1 W
Temperature Range	-20ºC to +70ºC

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RF Hermetic Switch SW-316

Electrical Specifications

Frequency Range	2.0-2.3 GHz
VSWR (Max)	1.25 : 1
Isolation (Min)	60 dB
Insertion Loss (Max)	0.25 dB
Impedance	50 Ohms
Switching Time (Max)	20
Life (Min)	1,000,000 Cycles
Operating Voltage	28VDC +/-6VDC
Pulse Width	50 mS Min, NTE 30 sec
Current (Max)	500 mA
Power (CW)	60 W (Max)
Temperature Range	-38ºC to +78ºC

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RSMH SERIES HERMETIC ELECTROMECHANICAL SWITCHES

RSM

RSMH HERMETIC SERIES SWITCHES
LASER WELDED, NO EPOXY

Renaissance Electronics RSMH series of switches offer the same dependability of our standard design in a truly **Hermetic Laser Welded** package. All seals are glass to metal or metal to metal, NO EPOXY used on these switches. These SPDT switches are sealed in a dry environment and will operate at -55° to +85°C in the most severe conditions. The RSHM series of switches are available in break before make, latching or failsafe configurations. They also offer low insertion loss minimal VSWR and high isolation.

FEATURES:

- No epoxy sealing: no failure over time because of epoxy deterioration.
- All seals are metal to metal and glass to metal: ensures minimum leak and thus integrity of the unit.
- Laser Welded in dry atmosphere (< 50 ppm moisture): prevents condensation over temperature.
- Maximum leak rate of 10^{-7} atm cc/sec: complies with MIL-STD-202F, 112E
- Standard mounting holes: fits conventional in-board and out-board footprints.

OPERATING MODES:

- Failsafe
- Latching
- Pulsed Latching
- Failsafe TTL / Latching TTL
- Higher Frequencies Available

SPECIFICATIONS:

Common Specifications	
Switch Type:	1 Pole, 2 Position
Frequency Range:	DC - 6 GHz
Impedance:	50 ohms
Connectors:	SMA Hermetic
Bias Connection:	Solder Terminals (Hermetic)
Switching Time:	20 milliseconds maximum
Life:	2,000,000 Cycles minimum
Operating Environment	
Operating Temperature:	-55° to +85°C
Storage:	-65° to +125°

RENAISSANCE ELECTRONICS CORPORATION

RENAISSANCE ELECTRONICS CORPORATION – ISO 9001 CERTIFIED
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Space Heritage

ferrite

"Military & Commercial Space Applications"

With Renaissance Electronics' acquisition of P&H Labs and MCCI Wireless, a significant portion of our broad Ferrite Products line has been qualified for both Military and Commercial Space applications. P&H Labs products have been an integral part of over 50 satellite and deep-space mission payloads, many of which have been in operational orbit for 8 to 10 years. Renaissance Electronics has been able to capture and retain the heritage processes and documentation systems needed to support S-Level and Hi-Rel requirements. Soldering operations and inspections of our Hi-Rel Space components are in full compliance with NASA specification NHB-5300.4 and all of our Hi-Rel assemblers and inspectors are regularly tested and recertified.

Renaissance Electronics' (through P&H Labs) extensive Ferrite Device Space Program heritage includes many well-known programs such as Echostar, Astra 1K, Globalstar, PanAmSat, Telstar-8, WildBlue, IP Star, DirectTV-7, GOES, SBIRS, TDRSS, Arabsat, Turksat, Intelsat VII/VIII, Ausat, Insat, Westar, and Intelsar VII.

Coaxial Models

Frequency (GHz)	Qualified Designs	Frequency (GHz)	Qualified Designs
L-Band:		C-Band:	
1.670 -1.695	3	3.70 - 4.2	3
1.677 - 1.694	1	3.90 - 4.2	1
1.7 - 1.8	1	5.00 - 5.3	7
S-Band:		5.70 - 6.45	1
2.75 - 2.85	1	5.75 - 6.725	1
3.40 - 3.55	1	5.75 - 6.75	1
3.40 - 3.70	1	5.80 - 6.65	1
3.40 - 3.85	2	7.20 - 7.5	2
3.46 - 3.71	4	7.20 - 7.8	1
3.62 - 4.20	2	7.20 - 8.9	1
3.65 - 3.95	1	7.50 - 7.8	1
3.70 - 3.95	4		

RENAISSANCE®
ELECTRONICS CORPORATION
12 LANCASTER COUNTY ROAD
HARVARD, MA 01451
978-772-7774
WWW.REC-USA.COM

The New Thinking in Wireless Technology

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Coaxial Models (continued)

Frequency (GHz)	Qualified Designs	Frequency (GHz)	Qualified Designs
X-Band:		Ku-Band:	
8.4 - 8.9	1	12.50 - 12.75	1
9.4 - 10.3	1	12.75 - 13.25	2
10.20 - 10.95	1	13.75 - 14.50	3
10.45 - 11.2	2	14.00 - 14.50	1
10.55 - 11.2	1	13.75 - 14.00	1
10.70 - 11.45	5	14.00 - 14.50	1
10.70 - 11.7	4	17.30 - 17.80	1
10.90 - 12.8	2		
10.95 - 11.70	2		
11.40 - 11.75	1		
11.40 - 12.2	5		
11.45 - 12.75	1		
11.70 - 12.2	1		
11.70 - 12.5	5		
11.70 - 12.7	4		
11.70 - 12.75	4		
12.20 - 12.75	6		
12.20 - 12.9	5		

Waveguide Models

Frequency (GHz)	Qualified Designs	Frequency (GHz)	Qualified Designs
Ku-Band:		X-Band:	
12.50 - 13.50	2	10.35 - 10.70	1
12.75 - 13.25	1	10.95 - 11.20	3
12.75 - 14.00	1	11.20 - 11.45	4
13.75 - 14.50	3	11.45 - 11.70	1
14.00 - 14.50	2	Ka-Band:	
17.30 - 17.80	1	28.00 - 30.25	1
17.30 - 17.85	1	28.50 - 30.25	1
K-Band:		29.25 - 30.25	1
19.00 - 21.00	3		

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Hi Rel Coax & Waveguide Ferrite Components For Military/Defense, Commercial & Space!

In-House Capabilities Range From Fast Turnaround R&D To High Volume & Test!

Computer-aided engineering and design concepts — pushing miniaturization of hi rel ferrite devices and sub-systems to 40 GHz and beyond — are P&H capabilities available now to solve your most difficult design problems. Call us today about your special requirements!

DIFFERENTIAL PHASE CIRCULATORS
Designed primarily for high-power applications in frequencies from S Band to 40 GHz, these devices feature low loss and excellent isolation in a lightweight package.

LATCHING CIRCULATORS
The P&H family of low-loss, high-power latching circulators features the capability of switching under power at speeds as low as 5 microseconds.

CO-WAVE DEVICES
Used in many different system applications, from 1.2 GHz to 40 GHz, P&H's low-loss co-wave units are customized and manufactured in a variety of unique configurations.

WAVEGUIDE CIRCULATORS
Low to medium power waveguide circulators, in dozens of different configurations, have been designed and built by P&H for applications from S Band to 60 GHz.

ISOLATORS
The wide range of ISO filters built by P&H demonstrates our proven capabilities to design and build integrated systems and sub-systems in all types of transmission media.

COAXIFORM CIRCULATORS
Miniaturized coaxial isolators/circulators, ranging from 100 MHz to 40 GHz, feature low loss and excellent isolation in a broad range of standard and custom sizes.

DROP-IN ISOLATORS/CIRCULATORS
P&H's broad-band, drop-in isolators/circulators offer excellent loss, VSWR and isolation over the 100 MHz to 40 GHz range in miniature, tab-mounted packages.

BROAD-BAND DROP-IN ISOLATORS/CIRCULATORS
P&H broad-band drop-ins, available with tabs, are used in integrated assemblies for both MIC and balanced striplines from 100 MHz to 40 GHz.

MICROSTRIP ISOLATORS/CIRCULATORS
P&H's proven clean room capabilities are demonstrated by systems-oriented microstrip devices which offer unequaled electrical performance from S Band to 18 GHz.

P&H LABORATORIES

4496 Runway St., P.O. BOX 1800, Simi Valley, CA 93062-1800 • PHONE: (805) 584-1800 • TWX: 910-494-4867 • FAX: (805) 584-6253

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Engineering

- RF AND MICROWAVE CIRCUIT SIMULATION
  - ANSOFT HFSS
  - MICROWAVE OFFICE
  - EAGLEWARE
  - INTERNALLY DEVELOPED SOFTWARE
- MULTIPACTOR ANALYSIS
  - ESA/ESTEC
  - INTERNALLY DEVELOPED SOFTWARE
- 3D DESIGN AND MODELING
  - SOLIDWORKS
  - AUTODESK INVENTOR
- MECHANICAL AND THERMAL STRESS ANALYSIS
  - AUTODESK ALGOR

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Access to Clean Room Assembly

- ACCESS TO CLASS 100,000 CLEAN ROOM
- 10 ASSEMBLY STATIONS
- J-STD 001 AND IPC CERTIFIED ASSEMBLERS AND INSTRUCTORS
- FOD, FOE AND ESD AWARENESS PROGRAMS

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Access to Environmental Lab

- THERMAL SHOCK AND TEMPERATURE CYCLE
- TEMPERATURE-ALTITUDE
- THERMAL VACUUM
- PARTICLE IMPACT NOISE DETECTION
- MECHANICAL SHOCK AND VIBRATION
- CORONA
- MULTIPACTION
- HUMIDITY
- GROSS LEAK
- EMI
- DPA

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Capability to meet following specs:

- Screening: MIL-PRF-38534 Table C-III Passive Element Evaluation
- Specs:
  - MIL-STD-202 ENVIRONMENTAL TEST METHODS (IE VIBRATION, SHOCK, ETC.)
  - MIL-STD-810 ENVIRONMENTAL TEST METHODS (IE TEMPERATURE TEST, VIBRATION, SHOCK, ETC.)
  - MIL-STD-461 ELECTROMAGNETIC INTERFERENCE
  - MIL-STD-883 ENVIRONMENTAL TEST METHODS FOR MICROCIRCUITS IE. BAROMETRIC PRESSURE,VIB. ETC
  - MIL-I-45208 INSPECTION SYSTEM REQUIREMENTS (CANCELLED) (USING AS9100C)
  - MIL-STD-31000 TECHNICAL DATA PACKAGE
  - MIL-Q-9858 QUALITY PROGRAM REQUIREMENTS (CANCELLED) (USING AS9100C)
  - ISO 17025 CALIBRATION STANDARD
  - ESCC 3202 EUROPEAN SPACE COMPONENTS COORDIANTION (FERRITE MICROWAVE COMPONENTS)
  - MIL-R-10509 RESISTOR FIXED FILM (HIGH STABILITY)

Space Grade Capability

MIL-PRF-55342 is the military performance specification for surface mount and wire bondable, fixed film chip resistors.

MIL-PRF-32159 is the military performance specification for surface mount and wire bondable zero ohm resistors.

MIL-PRF-55342 resistors and MIL-PRF-55342 zero ohm resistors are used in mission critical avionic, satellite, space, biomedical, and military applications.

MIL-PRF-55342 includes two screening levels: established reliability failure rate level maintained on the basis of life testing, and space level T which includes 100% power conditioning and a full Group B.

Product levels M, P, R, S, U & V are established reliability (ER) failure rate product. ER products are subject to Group A, B, & C testing. Group A is performed on a manufacturing lot basis. Group B is performed on an inspection lot basis for ER levels M, P, R, & S and on a production lot basis for ER levels U & V. Group C is performed on an inspection lot basis for all ER levels.

Product level T is a space level resistor that includes power conditioning (burn-in) on a 100% basis as part of Group A to identify and screen any infant mortality defects from the manufacturing lot. Group B is performed on a production lot basis and Group C is performed on an inspection lot basis for product level T.

Testing

Group A Inspection
- Precap Visual Inspection
- 100% Thermal Shock
- 100% Power Conditioning (T level only)
- 100% D.C. Resistance
- 100% Visual (T level only)
- Visual Inspection
- Solderability
- Resistance to Solvents (marked parts)

Group B Inspection
- Resistance Temperature Characteristic
- Short Time Overload
- Mounting Integrity

Group C Inspection
- Life Test
- Thermal Shock
- Low Temp Operation
- Resistance to Soldering Heat
- Moisture Resistance
- High Temp Exposure

Thank You

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