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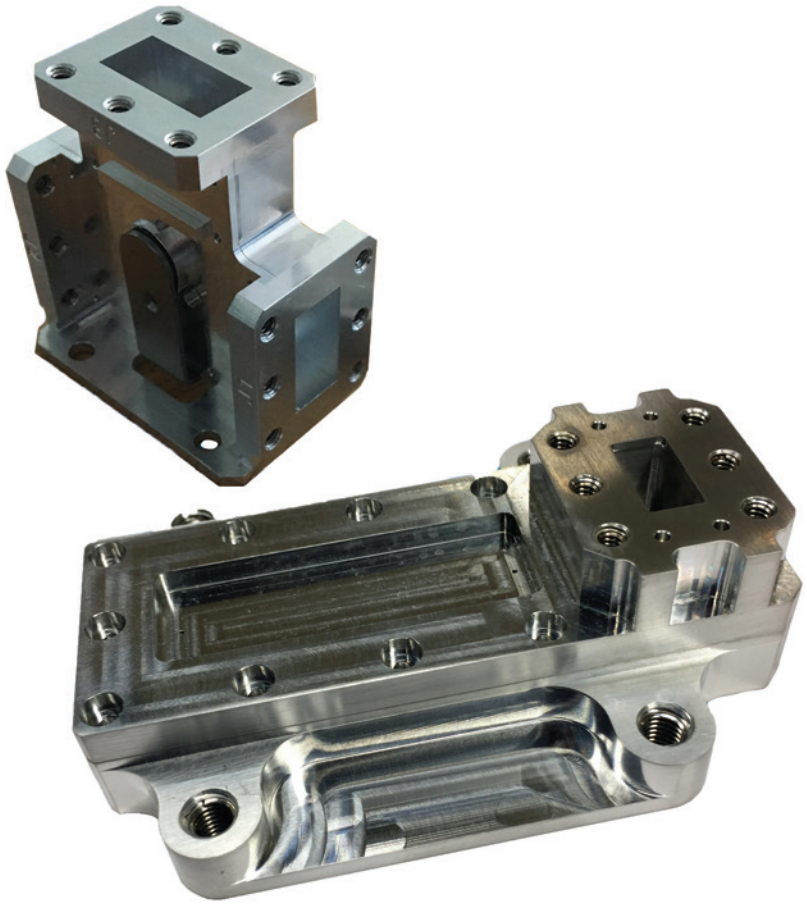
SpaceNXT™ Ku Series

Ku-Band WR75 High Power Waveguide Circulators & Loads



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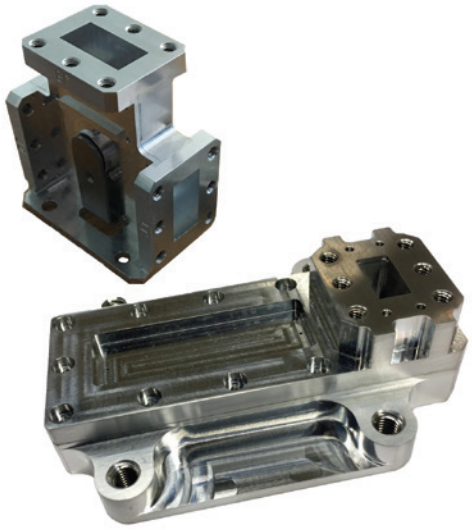


Specifically designed and tested for Space applications.

Smiths Interconnect's SpaceNXT™ product portfolio is specifically designed and tested for critical space applications. It provides customers with a combination of highly reliable technology and lower cost of ownership that enables operators to overcome potential market entry barriers while enjoying the benefits of an established technology partner.

The SpaceNXT™ Ku-Band High Power family of passive waveguide components are part of Smiths Interconnect's overarching initiative to create a broad range of readily accessible space qualified waveguide isolators, circulators, terminations, transitions, hybrids and couplers operating in assigned bands from X to V-Band.

Smiths Interconnect is well equipped with the design and manufacturing experience, analysis tools and testing equipment to qualify and produce flight tested products that demonstrate compliance to customer and national space agency standards. Smiths Interconnect Dundee is an accredited AS9100 site with 25 years' experience supplying waveguide passive microwave components delivering space qualified products to more than 600 GEO/LEO/MEO payloads and deep space probes.

The following pages summarize the qualification status and performance of a high power WR75 circulator and remote termination. Additional supporting information is available and may be provided in complete of redacted form to suitable parties.

Features and Benefits

- Guaranteed low and stable insertion loss under maximum power:
  - Circulators: 0.11 dB insertion loss with 20 dB minimum Return Loss over -25˚C to +125˚C
  - Loads: 20 dB minimum Return Loss over -25˚C to +135˚C
- Low Mass – Aluminum Housing with Chromate Finish
- Multipaction and Corona Test Reports available
- Proven Circulator design tested to 350 Watts CW Power
  Unconditionally linear
- Proven Load design tested to 267 Watts average CW Power
- Tested to meet Electro Magnetic Compatibility (EMC) specification to -80 dBi
- All testing in compliance with generic space qualification flow, incorporating industry standard power and environmental requirements
- 40 years of unrivalled Space Heritage

Applications

- Satellite Payloads
- GEO Satellites
- MEO Satellites

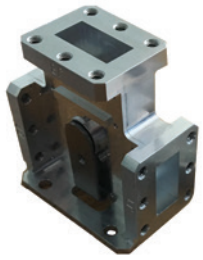
For more information on this product please contact our Dundee, UK Office +44 1382 427 200 email: info.dundee@smithsinterconnect.com

Technical Characteristics

WR75 Circulator

Specifications

Electrical



Frequency	10.70 - 12.75 GHz
Isolation	20 dB min
Insertion Loss	0.11 dB max (over operating temperature & power)
Return Loss	20 dB min
Power	275 Watts CW (tested to +1 dB 350 Watts CW)
EMC	-80 dBi
Mass	76 grams (2.70 ounces)
Material / Finish	Aluminum housing, clear chromate or low emissivity paint

Environmental

Operating Temperature	-25˚C to +125˚C
Storage Temperature	-45˚C to +135˚C

Qualification

Random Vibration (3-Axis)	**Frequency**	**Level**
	20 - 50 Hz	+6.0 dB/Octave
	50 - 600 Hz	0.5 g^2/Hz
	600 - 2000 Hz	-4.5 dB/Octave
	Overall	23.6 g_{RMS}
	Duration	180 seconds in each of 3 mutually perpendicular axes

Sine Vibration (3-Axis)	**Frequency**	**Level**
	5 - 22.6 Hz	6.4 mm (0–peak)
	22.6 - 50 Hz	13.0 g
	50 - 100 Hz	10.0 g
	Sweep rate 2 octave/min, 3 mutually perpendicular axes	

Mechanical Shock	**Frequency (Hz)**	**Level [SRS Q = 10]**
	200	280 g
	850	1,260 g
	4,000	4,200 g
	10,000	4,200 g
	Number of events	3 shocks per axis (18 in total)

Multipactor Test		
	Pressure	< 1.5 x 10^{-5} mbar
	Baking Temperature	+85˚C
	Seeding	One strontium 90 (90Sr)
	Test Temperature	+22˚C
	Frequency	10.70 GHz
	Pulse Repetition Frequency	1,000 Hz
	Pulse Width	20 µs
	Duty Cycle	2%
	Max. RF Power (Peak)	1,320 Watts for forward configuration 612 Watts for full short circuit at any phase

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Technical Characteristics

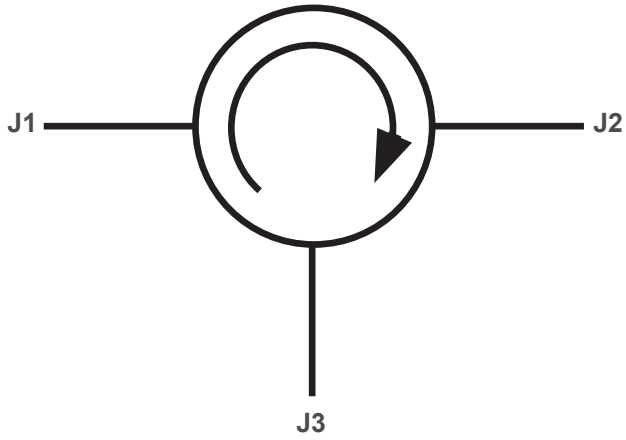
WR75 Circulator

Qualification

Corona Test		
	Pressure	Five pressure cycles in the range 0.26-26 mbar
	Seeding	None
	Test Temperature	+22˚C
	Frequency	10.70 GHz
	Pulse Repetition Frequency	1,000 Hz
	Pulse Width	20 µs
	Duty Cycle	2%
	Max. RF Power (Peak)	400 Watts for forward configuration 100 Watts for full short circuit at any phase

Thermal Analysis

Low Power TVAC Test at Operational Min. Temperature, -25˚C		
	Pressure in TVAC chamber to	1 x 10^{-6} Torr
	Low Power Baseplate Temperature	-25˚C and +125˚C
	Low Power	100m Watts CW
High Power TVAC Test at Operational Max. Temperature, +125˚C		
	Pressure in TVAC chamber to	1 x 10^{-6} Torr
	High Power Baseplate Temperature	+125˚C
	High Power	346m Watts CW
Thermal Cycle (Non-Operating Temperature Limits)		
	Conditions	-45˚C to +135˚C 1 Hour at each temperature extreme
	Transition Rate	4˚C per minute nominal
	Number of Cycles	13



Schematic of WR75 Circulator

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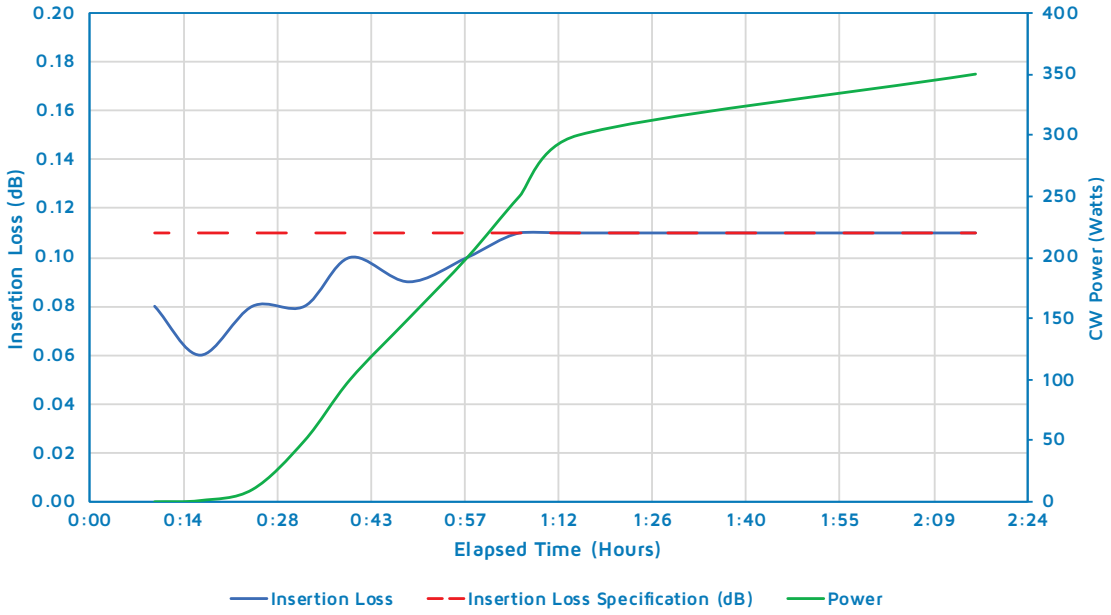
Technical Characteristics

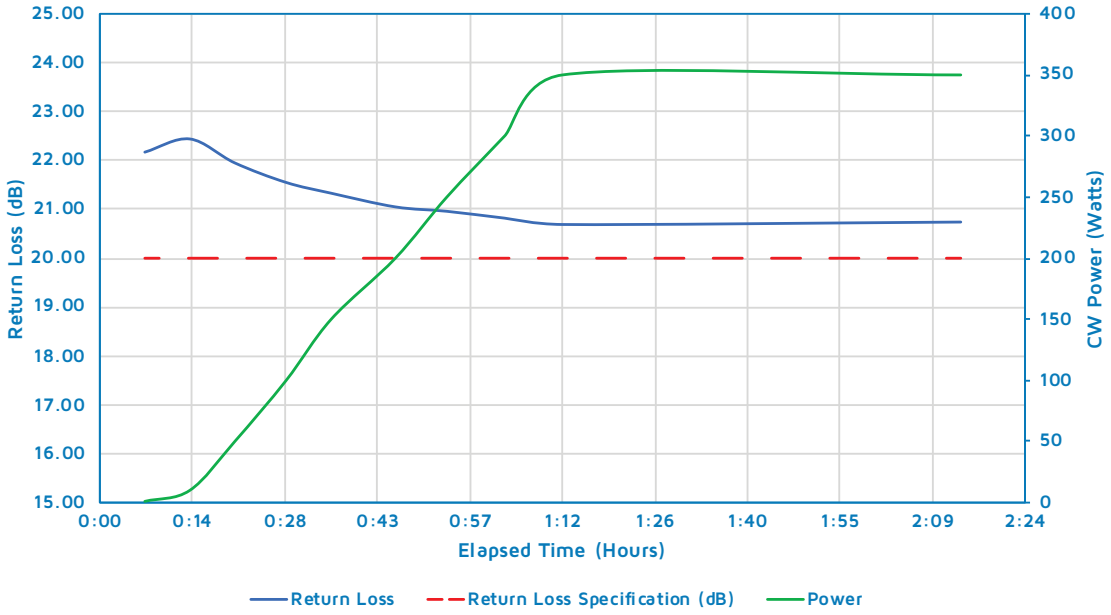
Test Results Power in Thermal Vacuum

Ku-Band WR75 Circulator Thermal Vacuum Testing (TVAC), 1 x 10^{-6} Torr
Insertion Loss & Power vs Time



Insertion Loss Versus Time, Power Applied J1 to J2, J3 terminated to a matched load

Ku-Band WR75 Circulator Thermal Vacuum Testing (TVAC), 1 x 10^{-6} Torr
Return Loss & Power Applied vs Time



Return Loss J1 Versus Time, Power Applied J1 to J3, J2

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Technical Characteristics

WR75 Termination (Load)

Specifications

Electrical

Frequency	10.70 – 12.75 GHz
Return Loss	21 dB min
Power	212 Watts CW (tested to +1 dB 267 Watts CW)
EMC	-80 dBi
Mass	121g (4.30 ounce)
Material / Finish	Aluminum housing, clear chromate or low emissivity paint

Environmental

Operating Temperature	-25 to +135˚C
Storage Temperature	-45 to +150˚C

Qualification

Random Vibration (3-Axis)	**Frequency**	**Level**
	20 - 50 Hz	+6.0 dB/Octave
	50 - 600 Hz	0.5 g^2/Hz
	600 - 2000 Hz	-4.5 dB/Octave
	Overall	23.6 g_{RMS}
Sine Vibration (3-Axis)	**Frequency**	**Level**
	5 - 22.6 Hz	6.4 mm
	22.6 - 50 Hz	13.0 g
	50 - 100 Hz	10.0 g
Mechanical Shock	**Frequency (Hz)**	**Level**
	200 Hz	280 g
	850 Hz	1,260 g
	4,000 Hz	4,200 g
	10,000 Hz	4,200 g
Multipactor Test	**Frequency (Hz)**	**Level**
	Pressure	< 1.5 x 10^{-5} mbar
	Baking Temperature	+85˚C
	Seeding Source	One strontium 90 (90Sr)
	Test Temperature	+22˚C
	Frequency	10.70 GHz
	Pulse Repetition Frequency	1,000 Hz
	Pulse Width	20 µs
	Duty Cycle	2%
	Max. RF Power (Peak)	1,700 Watts

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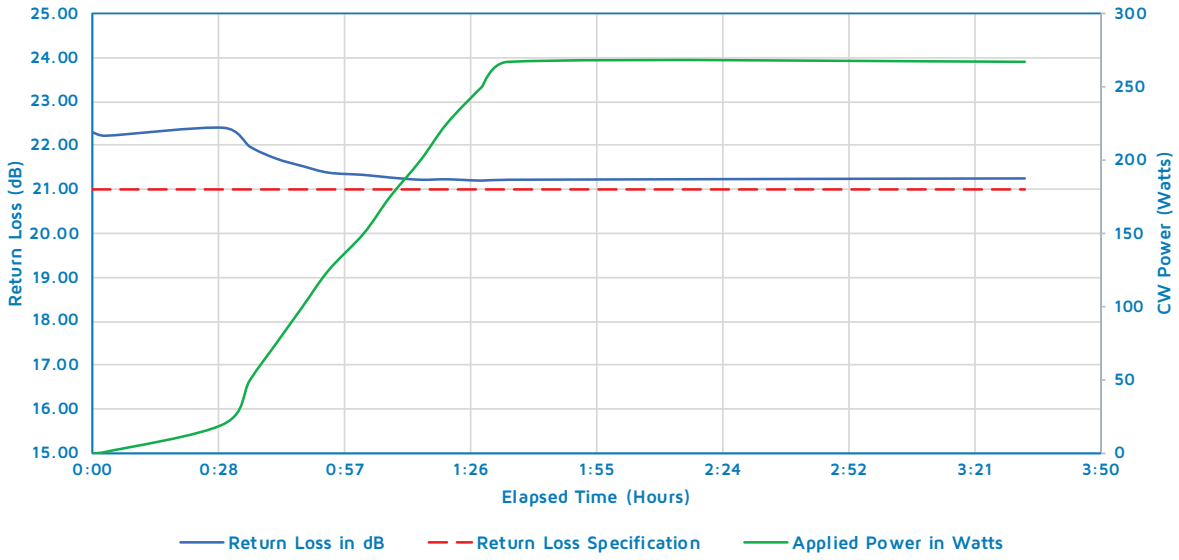
Technical Characteristics

WR75 Termination (Load)

Qualification

Corona Test		
	Pressure	Five pressure cycles in the range 0.26-26 mbar
	Seeding Source	None
	Test Temperature	+22˚C
	Frequency	10.70 GHz
	Pulse Repetition Frequency	1,000 Hz
	Pulse Width	20 µs
	Duty Cycle	2%
	Max. RF Power (Peak)	500 Watts
Thermal Analysis		
Low Power TVAC Test at Operational Min. Temperature, -25˚C		
	Pressure in TVAC chamber to	1 x 10^{-6} Torr
	Low Power Baseplate Temperature	-25˚C and +135˚C
	Low Power	100m Watts CW
High Power TVAC Test at Operational Max. Temperature, +135˚C		
	Pressure in TVAC chamber to	1 x 10^{-6} Torr
	High Power Baseplate Temperature	+135˚C
	High Power	267 Watts CW
Thermal Cycle (Non-Operating Temperature Limits)		
	Conditions	-45˚C to +150˚C 1 Hour at each temperature extreme
	Transition Rate	4˚C per minute nominal
	Number of Cycles	13

Ku-Band WR75 Load Thermal Vacuum Testing (TVAC), 1 x 10^{-6} Torr
Return Loss & Power Applied vs Time



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