



SPACE

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Introduction

GENERAL INFORMATION



Radiall Hi-Rel switches are manufactured based on over 40 years of experience and thousands of products that have been designed, qualified, and delivered for both commercial and military applications. With a space heritage of over 25 years and products in flight on over 300 satellites around the world, Radiall guarantees the highest level of manufacturing, quality and reliability.

Radiall Hi-Rel coaxial switches have been fully evaluated and approved by the European Space Agency for Space use according to the generic specification ESCC3603. Radiall offers products tested at several levels based on the same hardware including:

- EM: Engineering Model
- QM: Qualification Model
- PFM: Proto Flight Model

Radiall also provides a full range of low cost Hi-Rel switches for space applications. These products meet the requirements for communication satellite applications according to RAD-GEN-SWIT-001 and follow detailed specifications according to the Radiall part number list (see page 7-3).

ENVIRONMENTAL CHARACTERISTICS

		QUALIFICATION LEVEL
Operation temperature range		- 30°C/+ 85°C
Non operation temperature range		- 40°C/+ 85°C
Vibration	Sinus	5 – 100 Hz/20 g
	Random	20 – 2,000 Hz/28.57 g
Shocks	-	½ sinus / 1200 g / 0.25 ms
Pressure	-	Free space vacuum

Introduction

RADIAL SPECIFICATIONS

RADIAL BEST RUNNERS PART LIST (FM P/N)

DETAIL SPECIFICATION	PRODUCT	POWER CAP.	CONNECTORS	RADIAL P/N FM	DESIGNATION
RAD - DET - SPDT - 001	SPDT	Low power	SMA	R571 492 601	Fixing plate with pins
				R571 472 601	Lay down with pins
				R571 471 601	Lay down with D-sub
			SMA 2.9	R571 892 601	Fixing plate with pins
				R571 872 601	Lay down with pins
				R571 871 601	Lay down with D-sub
RAD - DET - SPDT - 002	SPDT	High power	TNC	R565 271 601	Lay down with D-sub, High Cavity
				R565 371 601	Lay down with D-sub, Standard Cavity
RAD - DET - DPDT - 006	DPDT	Low power	SMA	R578 483 601	Stand up with D-sub
				R578 472 601	Lay down with pins
				R578 482 601	Stand up with pins
			SMA 2.9	R578 872 601	Lay down with pins
				R578 883 601	Stand up with D-sub
				R578 882 601	Stand up with pins
RAD - DET - TSSD - 002	T-Switch Sequential	Low power	SMA	R587 432 601	Lay down with pins
				R587 443 601	Stand up with D-sub
				R587 442 601	Stand up with pins
			SMA 2.9	R587 832 621	Lay down with pins
				R587 842 621	Stand up with pins
				R587 843 621	Stand up with D-sub
RAD - DET - TRSD - 002	T-Switch	High power	TNC	R588 371 601	Lay down with D-sub
				R588 381 611	Stand up with D-sub
RAD - DET - TRSD - 003	T-Switch Random	Low power	SMA	R587 492 601	Fixing plate with pins
				R587 472 601	Lay down with pins
				R587 482 601	Stand up with pins
			SMA 2.9	R587 872 601	Lay down with pins
				R587 882 601	Stand up with pins
				R587 883 601	Stand up with D-sub
RAD - DET - DP3T - 001	DP3T	Low power	SMA	R586 471 601	Lay down with D-sub
			SMA 2.9	R586 871 601	Lay down with D-sub
RAD - DET - DP3T - 002	DP3T	High power	TNC	R564 271 601	Lay down with D-sub, High Cavity
				R564 371 601	Lay down with D-sub, Standard Cavity
				R564 372 601	Lay down with pins, Standard Cavity

LOW POWER COAXIAL SPDT SWITCH



Low power latching Coaxial SPDT Switch according to Radiall specification RAD-DET-SPDT-001:

- DC to 22 GHz with SMA connectors
- Up to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Lay down or Fixing plate
- 44 grams and up

GENERAL SPECIFICATIONS

	UNIT	MIN	TYPICAL	MAX
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V	-	-	+20.5
Actuation Current	mA	-	-	-
at +29 V, +25 °C		-	129	139
at +29 V, -30 °C		-	164	176
at +29 V, +85 °C		-	105	113
Switching Time	ms	-	-	20
Pulse Duration	ms	20	-	1,000
Coil Resistance (at +25 °C)	Ω	210	225	-
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact Closed	mΩ	-	-	1,000
Contact Open	MΩ	10	10	-
Contact Current	mA	-	-	100
Coil Isolation at 500 VDC	MΩ	10	-	-
Dielectric Withstanding at 50 or 60 Hz	Vrms	500	-	-
Mass	g	-	-	-
Variant 001-004: SPDT, Fixing Plate, Pins		-	-	44
Variant 002-005: SPDT, Lay down, Pins		-	-	62
Variant 003-006: SPDT, Lay down, D-Sub		-	-	72
Torque Screws for:	N.m	-	-	-
Fixing unit		-	-	2.0
DC connector		0.8	1.1	0.44
SMA connector		-	-	1.15

RF PERFORMANCE

DC to 22 GHz SMA

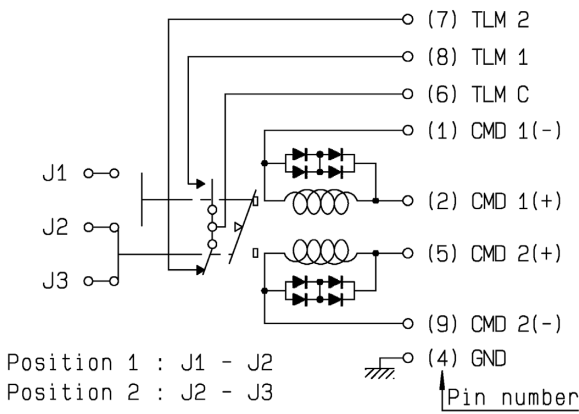
FREQUENCY	GHZ	DC - 4.2	4.2 - 10.7	10.7 - 12.75	12.75 - 14.5	14.5 - 22
Insertion Loss (max)	dB	0.12	0.20	0.25	0.30	0.35
VSWR (max)		1.20	1.20	1.20	1.25	1.33
Return Loss (min)	(dB)	(21)	(21)	(21)	(19)	(17)
Isolation (min)	dB	70			65	
E-Field Shielding Effectiveness (min)	dB	75	70			

Ka – band SMA 2.9

FREQUENCY	GHZ	17.5-21.5	21.5 - 27.5	27.5 - 31
Insertion Loss (max)	dB	0.45	0.45	0.50
VSWR (max)		1.33	1.35	1.40
Return Loss (min)	(dB)	(17.0)	(16.5)	(15.6)
Isolation (min)	dB	65	60	55
E-Field Shielding Effectiveness (min)	dB	70	60	
Power Handling (max)	W	10	5	

SCHEMATICS & DRAWINGS

SDPT, LAY DOWN, PINS:



SPDT, fixing plate with pins



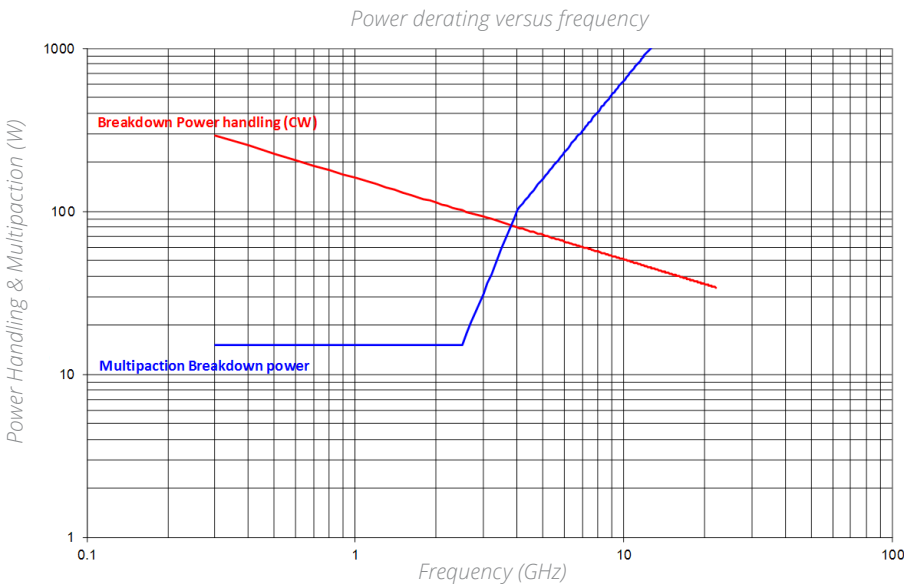
SPDT, lay down with D-sub



SPDT, lay down with pins

POWER DERATING GRAPH

VARIANT 001 TO 003: DC TO 22 GHz SMA



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	292.1	15.2
2.3	105.5	15.2
2.4	103.3	15.2
2.5	101.2	15.2
2.6	99.2	17.8
2.7	97.4	20.7
2.8	95.6	23.9
2.9	94.0	27.5
3.0	92.4	31.5
4.0	80.0	101.6
5.0	71.6	158.8
6.0	65.3	228.6
7.0	60.5	311.2
8.0	56.6	406.4
9.0	53.3	514.4
10.0	50.6	635.0
12.0	46.2	914.5
14.0	42.8	1244.7
16.0	40.0	1625.7
18.0	37.7	2057.5
20.0	35.8	2540.2
22.0	34.1	3073.6

Flight Models

LOW POWER COAXIAL DPDT SWITCH



Low power latching Coaxial DPDT Switch according to Radiall specification RAD-DET-DPDT-006:

- DC to 22 GHz with SMA connectors
- Up to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Lay down or Stand up
- 57 grams and up

GENERAL SPECIFICATIONS

	UNIT	MIN	TYPICAL	MAX
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V	-	-	+20.5
Actuation Current	mA	-	-	-
at +29 V, +25 °C		-	129	139
at +29 V, -30 °C		-	164	176
at +29 V, +85 °C		-	105	113
Switching Time	ms	-	-	25
Pulse Duration	ms	20	-	1,000
Coil Resistance (at +25 °C)	Ω	210	225	-
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact Closed	mΩ	-	-	1,000
Contact Open	MΩ	10	-	-
Contact Current	mA	-	-	100
Coil Isolation at 500 VDC	MΩ	10	-	-
Dielectric Withstanding at 50 or 60 Hz	Vrms	500	-	-
Mass	g	-	-	-
Variant 001-005: C-Switch, Stand up D-Sub		-	-	80
Variant 002-004: C-Switch, Lay down Pins		-	-	57
Variant 003-006: C-Switch, Stand up Pins		-	-	63

RF PERFORMANCE

DC to 22 GHz SMA

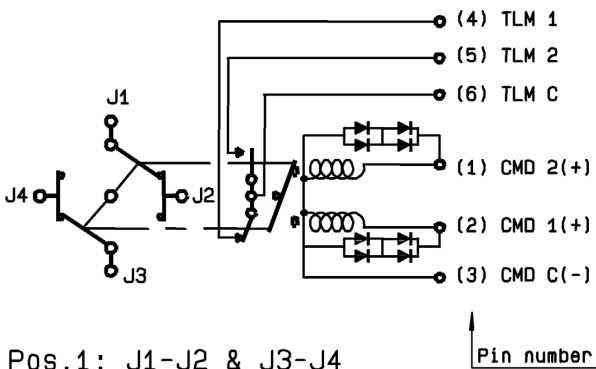
FREQUENCY	GHZ	DC - 4.2	4.2 - 8.4	8.4 - 14.5	14.5 - 18	18 - 20	20 - 22
Insertion Loss (max)	dB	0.15	0.25	0.30	0.40	0.50	0.50
VSWR (max) Return Loss (min)	(dB)	1.20 (21)	1.25 (19)	1.25 (19)	1.33 (17)	1.33 (17)	1.40 (15.6)
Isolation (min)	dB	70				65	
E-Field Shielding Effectiveness (min)	dB	75	70	68	65	60	

Ka - Band SMA 2.9

FREQUENCY	GHZ	17.5-21.5	27.5 - 31
Insertion Loss (max)	dB	0.50	0.65
VSWR (max) Return Loss (min)	(dB)	1.33 (17.7)	1.40 (15.6)
Isolation (min)	dB	65	60
E-Field Shielding Effectiveness (min)	dB	60	60
Power Handling (max)	W	10	5

SCHEMATICS & DRAWINGS

C-SWITCH, SMA, LAY DOWN PINS:



C-Switch, stand up with pins



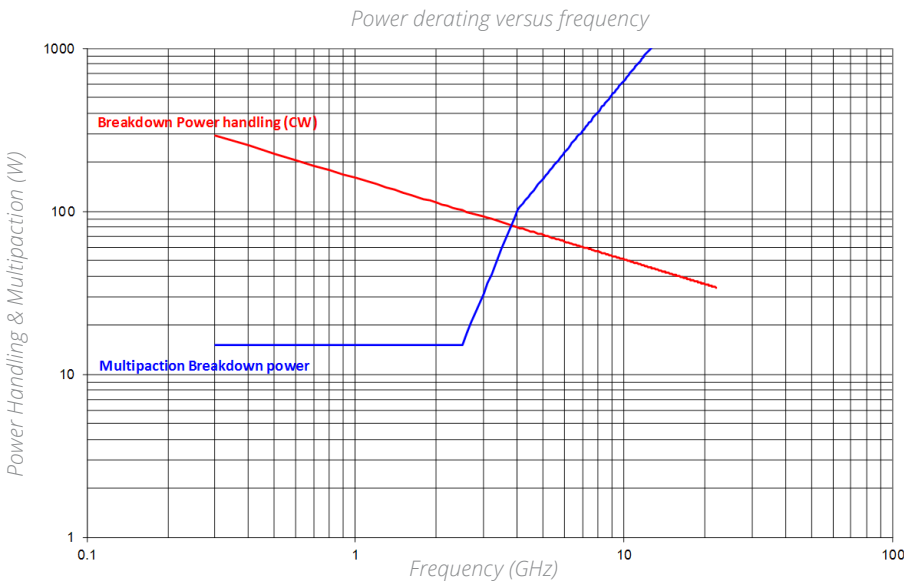
C-Switch, lay down with pins



C-Switch, stand up with D-sub

POWER DERATING GRAPH

VARIANT 001 TO 003: DC TO 22 GHz SMA



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	292.1	15.2
2.3	105.5	15.2
2.4	103.3	15.2
2.5	101.2	15.2
2.6	99.2	17.8
2.7	97.4	20.7
2.8	95.6	23.9
2.9	94.0	27.5
3.0	92.4	31.5
4.0	80.0	101.6
5.0	71.6	158.8
6.0	65.3	228.6
7.0	60.5	311.2
8.0	56.6	406.4
9.0	53.3	514.4
10.0	50.6	635.0
12.0	46.2	914.5
14.0	42.8	1244.7
16.0	40.0	1625.7
18.0	37.7	2057.5
20.0	35.8	2540.2
22.0	34.1	3073.6

LOW POWER COAXIAL T-SWITCH



Low power latching Coaxial Switch according to Radiall specification
RAD-DET-TSSD-002 and RAD-DET-TSRD-003:

- Random or Sequential drive
- DC to 22 GHz with SMA connectors
- Up to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Stand up or Lay down or fixing plate
- 58 grams and up

GENERAL SPECIFICATIONS

	RAD - DET - TSSD - 002 Requential Drive				RAD - DET - TSRD - 003 Random Drive		
	UNIT	MIN	TYPICAL	MAX	MIN	TYPICAL	MAX
Actuation Voltage	V	+22	+26	+29	+22	+26	+29
Pick-Up Voltage	V	-	-	+20.5	-	-	+20.5
Actuation Current	mA	-	-	-	-	-	-
at +29 V, +25 °C		-	345	364	-	285	305
at +29 V, -30 °C		-	439	462	-	365	390
at +29 V, +85 °C		-	280	295	-	234	250
Switching Time	ms	-	-	25	-	-	20
Pulse Duration	ms	20	-	1,000	20	-	1,000
Coil Resistance (at +25 °C)	Ω	79.8	84	-	88	95	-
RF Contact Resistance	mΩ	-	-	100	-	-	100
TLM Indicator Circuit	-	-	-	-	-	-	-
Contact Closed	mΩ	-	-	1,000	-	-	1,000
Contact Open	MΩ	10	-	-	10	-	-
Contact Current	mA	-	-	100	-	-	100
Coil Isolation at 500 VDC	MΩ	10	-	-	10	-	-
Dielectric Withstanding at 50 or 60 Hz	Vrms	500	-	-	500	-	-
Mass	g	-	-	-	-	-	-
T-Switch, Lay down Pins		-	-	73	-	-	64
T-Switch, Stand up D-Sub		-	-	100	-	-	100
T-Switch, Stand up Pins		-	-	75	-	-	75
T-Switch, Fixing Plate		-	-	-	-	-	58
Torque Screws for:	N.m	-	-	-	-	-	-
Fixing unit		-	-	2.0	-	-	2.0
D-sub connector		0.27	-	0.44	-	-	N/A
RF connector		0.8	1.1	1.15	0.8	1.1	1.15

RF PERFORMANCE

DC to 22 GHz SMA

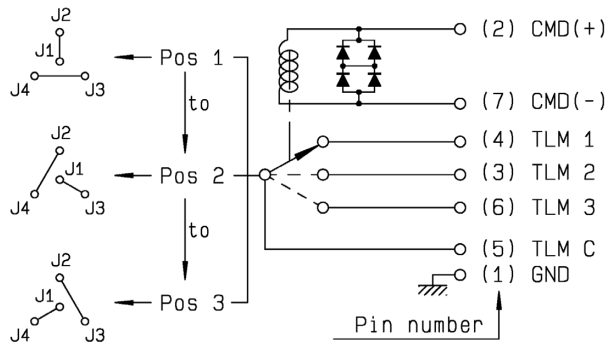
FREQUENCY	GHZ	DC-4.2	4.2-5.5	5.5-6.6	6.6-7.7	7.7-8.8	8.8-10.5	10.5-14.5	14.5-17.8	17.8-20	20-22
Insertion Loss (max)	dB	0.15	0.17	0.18	0.21	0.24	0.30	0.35	0.45	0.50	0.50
VSWR (max) Return Loss (min)	(dB)	1.20 (21)	1.22 (20)	1.25 (19)	1.25 (19)	1.25 (19)	1.25 (19)	1.25 (19)	1.33 (17)	1.33 (17)	1.40 (15.6)
Isolation (min)	dB	70						65			
E-Field Shielding Effectiveness (min)	dBi	75			70		65	65			

Ka – Band SMA 2.9

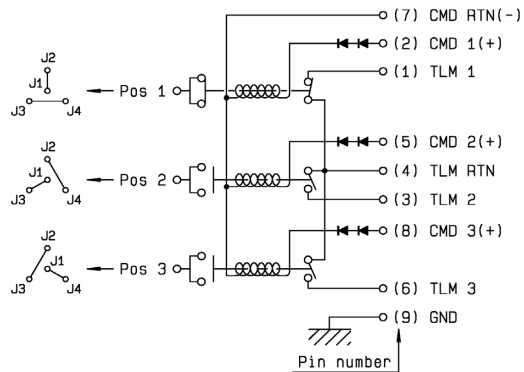
FREQUENCY	GHZ	17.5-21.5	27.5 - 31
Insertion Loss (max)	dB	0.50	0.65
VSWR (max) Return Loss (min)	(dB)	1.33 (17)	1.40 (15.6)
Isolation (min)	dB	65	60
E-Field Shielding Effectiveness (min)	dBi	60	60
Power Handling (max)	W	10	5

SCHEMATICS & DRAWINGS

SEQUENTIAL DRIVE



RANDOM DRIVE



T-Switch, lay down with pins



T-Switch, stand up with D-Sub

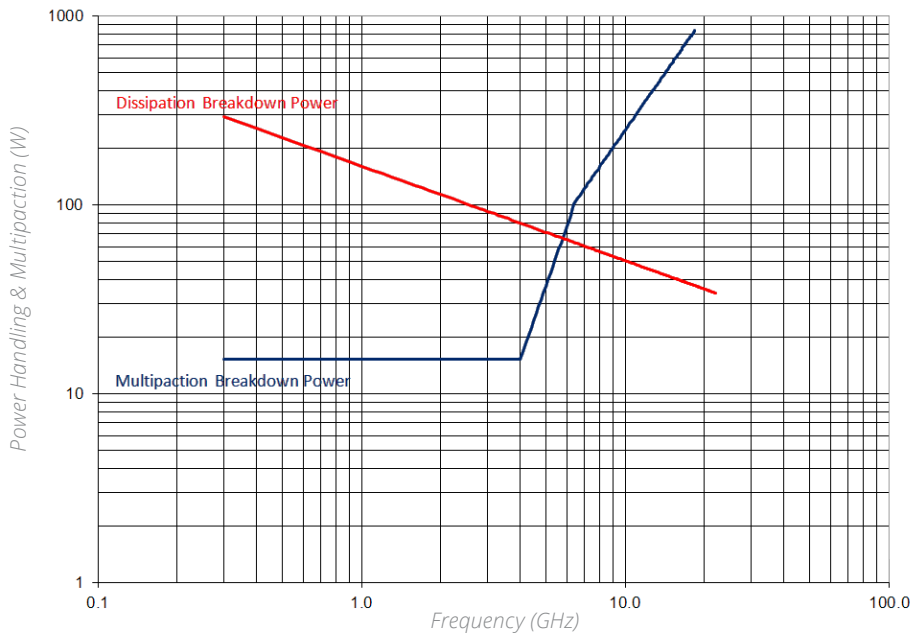


T-Switch, fixing plate with pins

POWER DERATING GRAPH

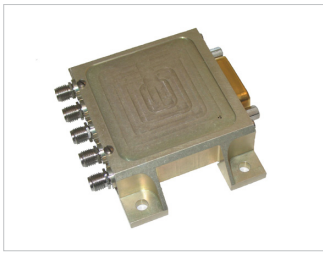
VARIANT 001 TO 003: DC TO 22 GHz SMA

Power derating versus frequency



Frequency (GHz)	Dissipation Breakdown Power (W)	Multipaction Breakdown Power (W)
0.3	292.1	15.2
0.4	253.0	15.2
0.5	226.3	15.2
0.6	206.6	15.2
0.7	191.2	15.2
0.8	178.9	15.2
0.9	168.7	15.2
1.0	160.0	15.2
2.0	113.1	15.2
3.0	92.4	15.2
4.0	80.0	15.2
5.0	71.6	37.1
6.0	65.3	77.0
7.0	60.5	121.6
8.0	56.6	158.8
9.0	53.3	200.9
10.0	50.6	248.1
12.0	46.2	357.2
14.0	42.8	486.2
16.0	40.0	635.0
18.0	37.7	803.7
20.0	35.8	992.3
22.0	34.1	1200.6

LOW POWER COAXIAL DP3T SWITCH



Low power latching Coaxial Switch according to Radiall specification

RAD-DET-DP3T-001:

- DC to 22 GHz with SMA connectors
- DC to 31 GHz with SMA 2.9 connectors
- Telemetry circuit
- Suppression diodes
- D-Sub
- Lay down
- 106 grams

GENERAL SPECIFICATIONS

	UNIT	MIN	TYPICAL	MAX
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V	-	-	+20.5
Actuation Current	mA	-	-	-
at +29 V, +25 °C		-	129	139
at +29 V, -30 °C		-	164	176
at +29 V, +85 °C		-	105	113
Switching Time	ms	-	-	20
Pulse Duration	ms	20	-	1,000
Coil Resistance (at +25 °C)	Ω	210	225	-
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact Closed	mΩ	-	-	1,000
Contact Open	MΩ	10	-	-
Contact Current	mA	-	-	100
Coil Isolation at 500 VDC	MΩ	10	-	-
Dielectric Withstanding at 50 or 60 Hz	Vrms	500	-	-
Mass	g	-	-	106
Torque Screws for:	N.m	-	-	-
Fixing unit		-	-	2.0
D-sub connector		0.27	-	0.44
RF connector		0.8	1.1	1.15

RF PERFORMANCE

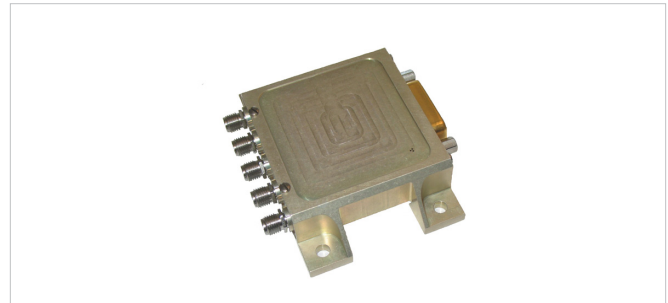
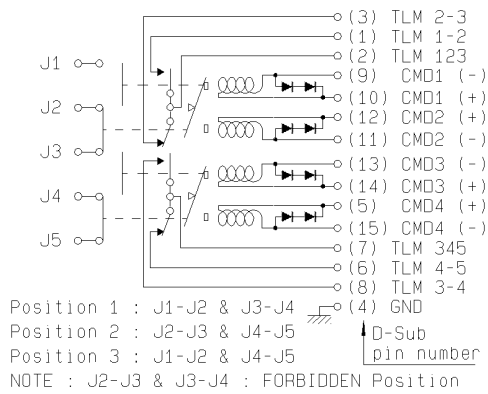
DC to 22 GHz SMA

FREQUENCY	GHZ	DC - 4.2	4.2 - 10.7	10.7 - 12.75	12.75 - 14.5	14.5 - 22
Insertion Loss (max)	dB	0.12	0.20	0.25	0.30	0.35
VSWR (max)		1.20	1.20	1.20	1.25	1.33
Return Loss (min)	(dB)	(21)	(21)	(21)	(19)	(17)
Isolation (min)	dB	70			65	
E-Field Shielding Effectiveness (min)	dB <i>i</i>	75	70			

Ka – Band SMA 2.9

FREQUENCY	GHZ	17.5-21.5	21.5 - 27.5	27.5 - 31
Insertion Loss (max)	dB	0.45	0.45	0.50
VSWR (max)		1.33	1.35	1.40
Return Loss (min)	(dB)	(17)	(16.5)	(15.6)
Isolation (min)	dB	65	60	
E-Field Shielding Effectiveness (min)	dB	70	60	
Power Handling (max)	W	10	5	

SCHEMATICS & DRAWINGS

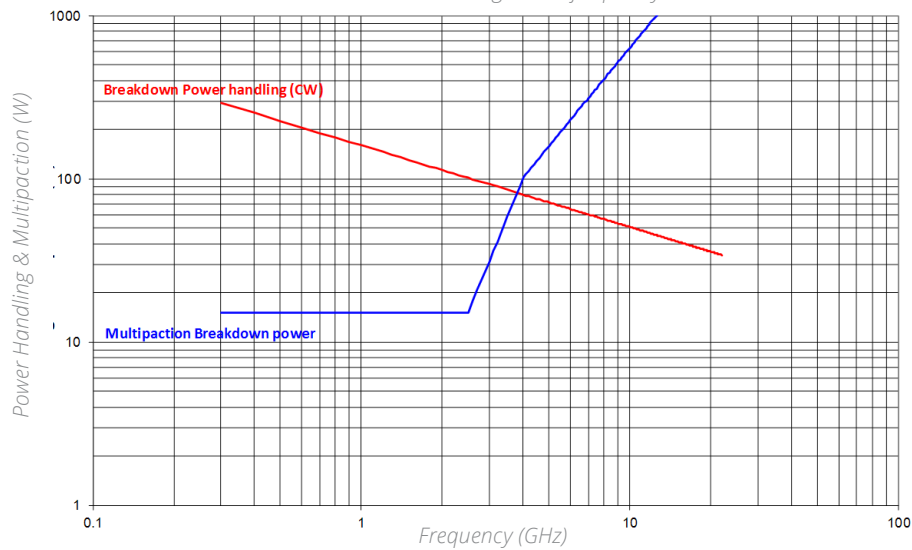


DP3T, lay down with D-sub

POWER DERATING GRAPH

VARIANT 001: DC TO 22 GHz SMA

Power derating versus frequency



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	292.1	15.2
2.3	105.5	15.2
2.4	103.3	15.2
2.5	101.2	15.2
2.6	99.2	17.8
2.7	97.4	20.7
2.8	95.6	23.9
2.9	94.0	27.5
3.0	92.4	31.5
4.0	80.0	101.6
5.0	71.6	158.8
6.0	65.3	228.6
7.0	60.5	311.2
8.0	56.6	406.4
9.0	53.3	514.4
10.0	50.6	635.0
12.0	46.2	914.5
14.0	42.8	1244.7
16.0	40.0	1625.7
18.0	37.7	2057.5
20.0	35.8	2540.2
22.0	34.1	3073.6

HIGH POWER COAXIAL SPDT SWITCH



High power latching Coaxial SPDT Switch according to Radiall specification RAD-DET-SPDT-002::

- TNC connectors
- Up to 2.2 GHz, with 160 Watts CW
- Up to 4.8 GHz, with 150 Watts CW
- Telemetry circuit
- Suppression diodes
- D-Sub
- Lay down
- 275 g

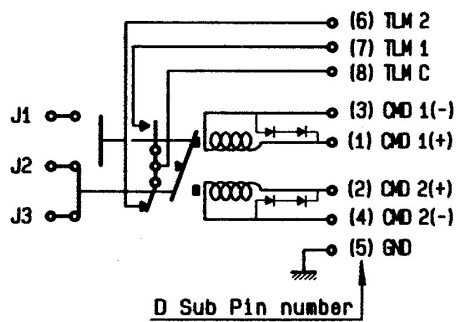
GENERAL SPECIFICATIONS

	UNIT	MIN	TYPICAL	MAX
Actuation Voltage	V	+20	+26	+30
Pick-Up Voltage	V	-	-	+19
Actuation Current	mA	-	-	-
at +29 V, +25 °C		178	188	198
at +29 V, -30 °C		227	239	251
at +29 V, +85 °C		145	153	161
Switching Time	ms	-	25	35
Pulse Duration	ms	50	-	1,000
Coil Resistance (at +25 °C)	Ω	152	160	168
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact Closed	mΩ	-	-	1,000
Contact Open	MΩ	2	-	-
Contact Current	mA	-	-	100
Coil Isolation at 500 VDC	MΩ	1	-	-
Dielectric Withstanding at 50 or 60 Hz	Vrms	500	-	-
Mass Variants 001 and 002	g	-	-	275
Torque Screws for:	N.m	-	-	-
Fixing unit		-	-	2.0
D-sub connector		0.27	-	0.44
RF connector		1.7	-	2.65

RF PERFORMANCE

		DC - 2.2 GHz Variant 001			DC - 4.8 GHz Variant 002			
FREQUENCY	GHZ	0.04 -1.0	1.0 - 1.6	1.6 - 2.2	0.04 - 1.0	1.0 - 1.6	1.6 - 2.2	2.2 - 4.8
Insertion Loss (max)	dB	0.12			0.12			0.22
VSWR (max)		1.20			1.20			1.38
Return Loss (min)	(dB)	(20.8)			(20.8)			(15.9)
Isolation (min)	dB	70						
E-Field Shielding Effectiveness (min)	dB	70						60

SCHEMATICS & DRAWINGS



Position 1 : J1 - J2

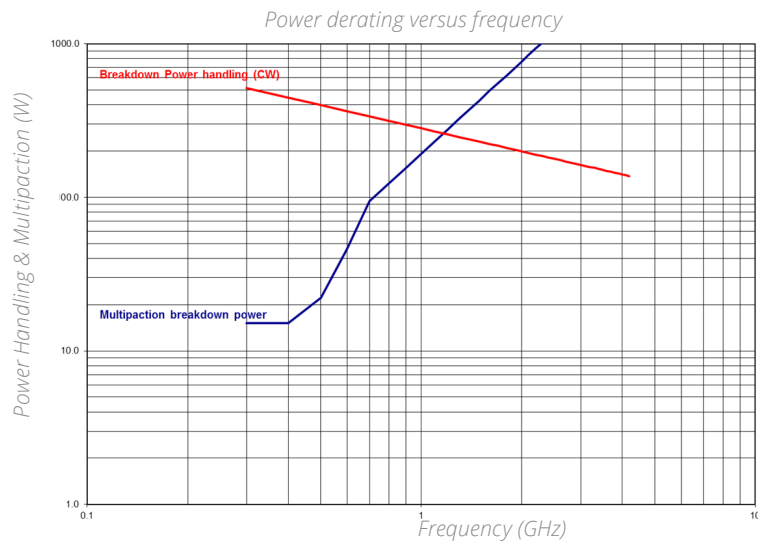
Position 2 : J2 - J3



SPDT lay down with D-sub, variant 001 and 002

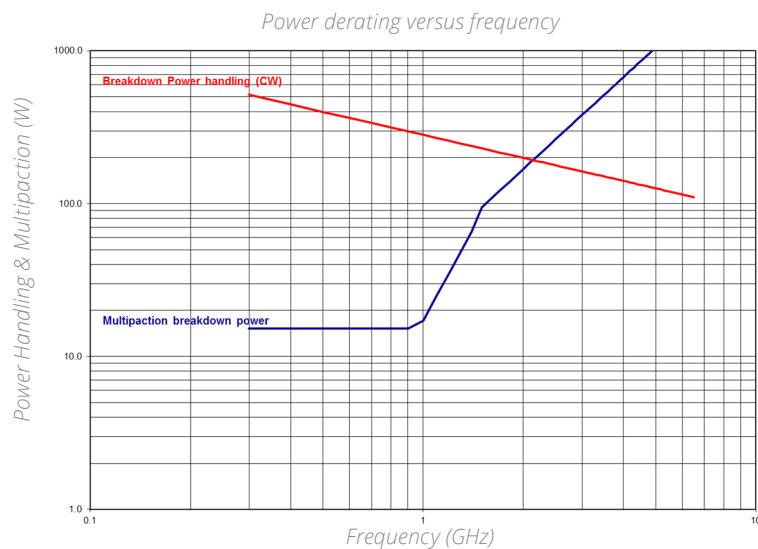
POWER DERATING GRAPH

VARIANT 001, HIGH CAVITY



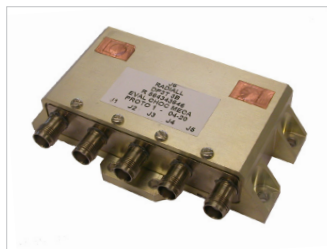
Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.4	445.8	15.2
0.5	398.7	22.3
0.6	354.0	46.2
0.7	337.0	94.1
0.8	315.2	122.9
0.9	297.2	155.6
1.0	281.9	192.1
1.1	268.8	232.4
1.2	257.4	276.6
1.3	247.3	324.6
1.4	238.3	376.5
1.5	230.2	432.2
1.6	222.9	491.8
1.7	216.2	555.2
1.8	210.1	622.4
1.9	204.5	693.5
2.0	199.4	768.4
2.2	190.1	929.8
2.4	182.0	1106.5
2.6	174.8	1298.6
2.8	168.5	1506.1
3.0	162.8	1728.9
3.5	150.7	2353.2
4.0	141.0	3073.6
4.2	137.6	3388.6

VARIANT 002, STANDARD CAVITY



Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.9	297.2	15.2
1.0	281.9	17.1
1.1	268.8	25.1
1.2	257.4	35.5
1.3	247.3	48.9
1.4	238.3	65.8
1.5	230.2	94.7
1.6	222.9	107.8
1.7	216.2	121.7
1.8	210.1	136.4
1.9	204.5	152.0
2.0	199.4	168.4
2.2	190.1	203.8
2.4	182.0	242.5
2.6	174.8	284.6
2.8	168.5	330.1
3.0	162.8	379.0
3.2	157.6	431.2
3.4	152.9	486.8
3.6	148.6	545.7
3.8	144.6	608.0
4.0	141.0	673.7
4.2	137.6	742.8
4.4	134.4	815.2
4.6	131.4	891.0
4.8	128.7	970.1
5.0	126.1	1052.7
5.5	120.2	1273.7
6.0	115.1	1515.9
6.5	110.6	1778.0

HIGH POWER COAXIAL DP3T SWITCH



High power latching Coaxial DP3T Switch according to Radiall specification
RAD-DET-DP3T-002:

- TNC connectors
- Up to 2.2 GHz, with 160 Watts CW
- Up to 4.8 GHz, with 150 Watts CW
- Telemetry circuit
- Suppression diodes
- D-Sub or pins
- Lay down
- 390 g and up

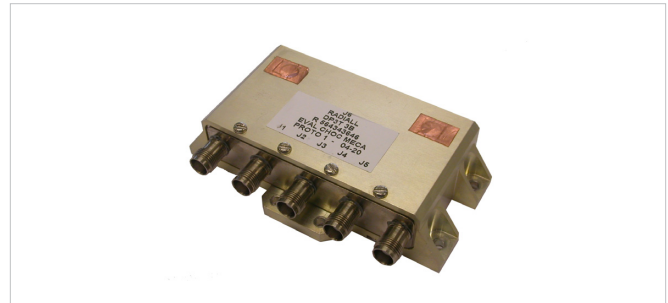
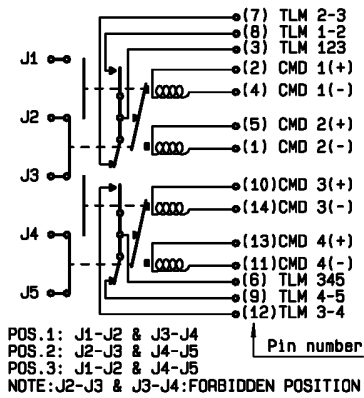
GENERAL SPECIFICATIONS

	UNIT	MIN	TYPICAL	MAX
Actuation Voltage	V	+20	+26	+30
Pick-Up Voltage	V	-	-	+19
Actuation Current	mA	-	-	-
at +29 V, +25 °C		178	188	198
at +29 V, -30 °C		227	239	251
at +29 V, +85 °C		145	153	161
Switching Time	ms	-	25	35
Pulse Duration	ms	50	-	1,000
Coil Resistance (at +25 °C)	Ω	152	160	168
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact Closed	mΩ	-	-	1,000
Contact Open	MΩ	2	-	-
Contact Current	mA	-	-	100
Coil Isolation at 500 VDC	MΩ	1	-	-
Dielectric Withstanding at 50 or 60 Hz	Vrms	500	-	-
Mass	g	-	-	-
Variant 001: Lay down D-Sub		-	-	460
Variant 002: Lay down D-Sub Variant		-	-	445
003: Lay down pins		-	-	390
Torque Screws for:	N.m	-	-	-
Fixing unit		-	-	2.0
D-sub connector		0.27	-	0.44
RF connector		1.7	-	2.65

RF PERFORMANCE

		DC - 2.2 GHz Variant 001			DC - 4.8 GHz Variant 002 and 003			
FREQUENCY	GHZ	0.04 -1.0	1.0 - 1.6	1.6 - 2.2	0.04 - 1.0	1.0 - 1.6	1.6 - 2.2	2.2 - 4.8
Insertion Loss (max)	dB	0.12			0.12			0.22
VSWR (max) Return Loss (min)	(dB)	1.20 (20.8)			1.20 (20.8)			1.38 (15.9)
Isolation (min)	dB	70						
E-Field Shielding Effectiveness (min)	dB <i>i</i>	70						60

SCHEMATICS & DRAWINGS

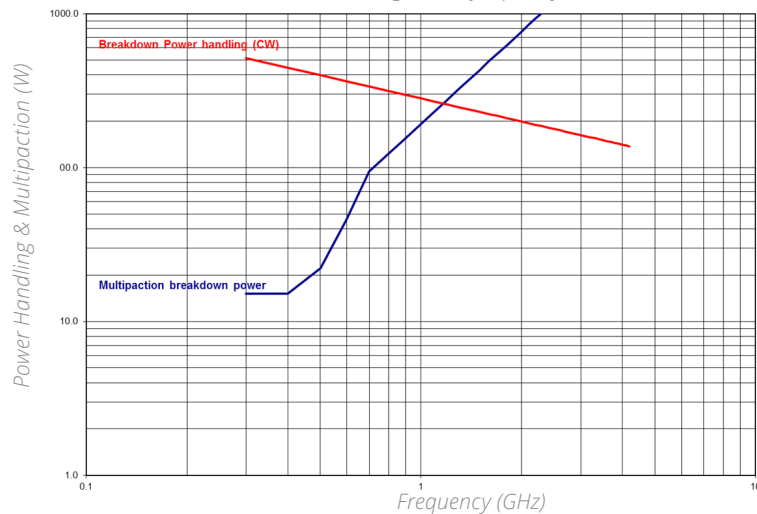


DP3T, lay down with pins

POWER DERATING GRAPH

VARIANT 001, HIGH CAVITY

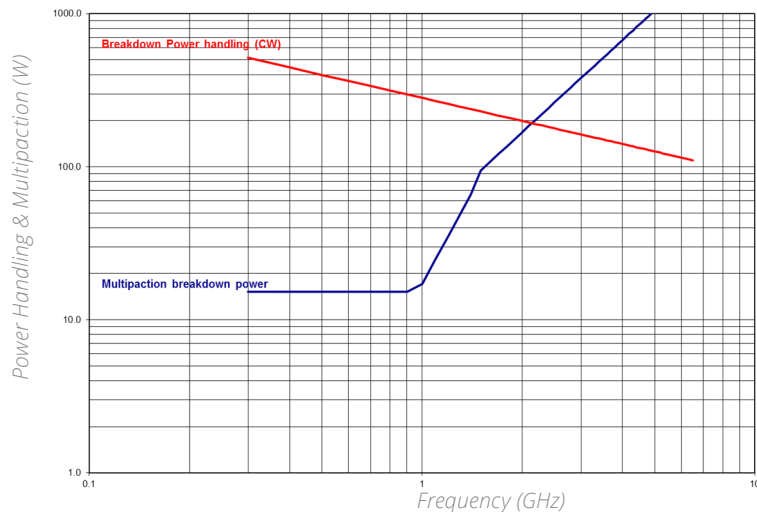
Power derating versus frequency



Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.4	445.8	15.2
0.5	398.7	22.3
0.6	364.0	48.2
0.7	337.0	94.1
0.8	315.2	122.9
0.9	297.2	155.6
1.0	281.9	192.1
1.1	268.8	232.4
1.2	257.4	276.5
1.3	247.3	324.6
1.4	238.3	376.5
1.5	230.2	432.2
1.6	222.9	491.8
1.7	216.2	555.2
1.8	210.1	622.4
1.9	204.5	693.5
2.0	199.4	768.4
2.2	190.1	929.8
2.4	182.0	1106.5
2.6	174.8	1298.6
2.8	168.5	1506.1
3.0	162.8	1728.9
3.5	150.7	2353.2
4.0	141.0	3073.6
4.2	137.6	3388.6

VARIANT 002, STANDARD CAVITY

Power derating versus frequency



Frequency (GHz)	Breakdown Power handling (W)	Breakdown Multipaction Power (W)
0.3	514.7	15.2
0.9	297.2	15.2
1.0	281.9	17.1
1.1	268.8	25.1
1.2	257.4	35.5
1.3	247.3	48.9
1.4	238.3	65.8
1.5	230.2	94.7
1.6	222.9	107.8
1.7	216.2	121.7
1.8	210.1	136.4
1.9	204.5	152.0
2.0	199.4	168.4
2.2	190.1	203.8
2.4	182.0	242.5
2.6	174.8	284.6
2.8	168.5	330.1
3.0	162.8	379.0
3.2	157.6	431.2
3.4	152.9	486.8
3.6	148.6	545.7
3.8	144.6	608.0
4.0	141.0	673.7
4.2	137.6	742.8
4.4	134.4	815.2
4.6	131.4	891.0
4.8	128.7	970.1
5.0	126.1	1052.7
5.5	120.2	1273.7
6.0	115.1	1515.9
6.5	110.6	1779.0

HIGH POWER COAXIAL T-SWITCH



High power latching Coaxial T-Switch according to Radiall specification RAD-DET-TSRD-002:

- TNC connectors
- DC to 8 GHz
- Up to 120 Watts CW at 4 GHz
- Random Drive
- Telemetry circuit
- Suppression diodes
- D-Sub or solder pins
- Lay down or Stand up
- 355 grams and up

GENERAL SPECIFICATIONS

	UNIT	MIN	TYPICAL	MAX
Actuation Voltage	V	+22	+26	+29
Pick-Up Voltage	V	-	-	+20.5
Actuation Current	mA	-	-	-
at +29 V, +25 °C		450	470	490
at +29 V, -25 °C		555	585	610
at +29 V, -30 °C		570	595	620
at +29 V, +80 °C		360	385	405
at +29 V, -85 °C		365	380	397
Switching Time	ms	-	-	35
Pulse Duration	ms	35	-	1,000
Coil Resistance (at +25 °C)	Ω	59.3	61.8	64.4
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact Closed	mΩ	-	-	1,000
Contact Open	MΩ	1	-	-
Contact Current	mA	-	-	100
Coil Isolation at 500 VDC	MΩ	1	-	-
Dielectric Withstanding at 50 or 60 Hz	Vrms	500	-	-
Mass	g	-	-	-
Variant 001: T-Switch, Lay down, D-Sub		-	-	360
Variant 002: T-Switch, Stand up, D-Sub		-	-	355
Torque Screws for:	N.m	-	-	-
Fixing unit		-	-	2.0
D-sub connector		0.27	-	0.44
RF connector		1.7	-	2.65

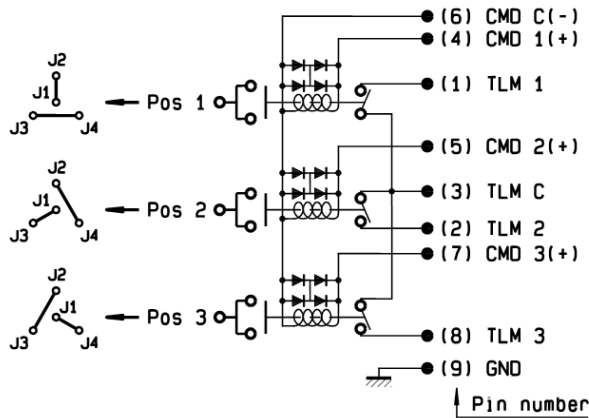
RF PERFORMANCE

DC - 8 GHz Variants 001 and 002

FREQUENCY	GHZ	DC - 2	2 - 4.8	4.8 - 6	6 - 8
Insertion Loss (max)	dB	0.17	0.20	0.30	0.40
VSWR (max) Return Loss (min)	(dB)	1.10 (26.4)	1.25 (19.1)	1.35 (16.5)	1.50 (14)
Isolation (min)	dB	70			
E-Field Shielding Effectiveness (min)	dB	75			70

SCHEMATICS & DRAWINGS

T-SWITCH, TNC, D-SUB, VARIANT 001 & 002:

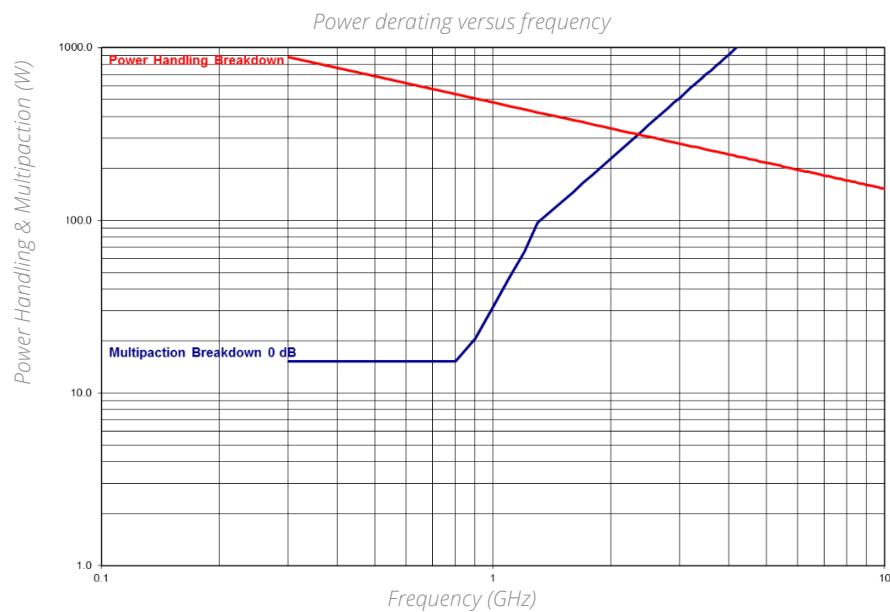


T-Switch, Lay down with D-sub, variant 001



T-Switch, Stand up with D-sub, variant 002

POWER DERATING GRAPH



Frequency (GHz)	Breakdown Power Handling (W)	Breakdown Multipaction Power (W)
0.3	880.0	15.2
0.4	762.1	15.2
0.5	681.6	15.2
0.6	622.3	15.2
0.7	576.1	15.2
0.8	538.9	15.2
0.9	508.1	20.7
1	482.0	31.5
1.1	459.6	46.2
1.2	440.0	65.4
1.3	422.7	96.6
1.4	407.4	112.0
1.5	393.5	128.6
1.6	381.1	146.3
1.7	369.7	165.2
1.8	359.3	185.2
1.9	349.7	206.3
2	340.8	228.6
2.1	332.6	252.0
2.2	325.0	276.6
2.3	317.8	302.3
2.4	311.1	329.2
2.5	304.8	357.2
2.6	298.9	386.4
2.7	293.3	416.6

GENERAL INFORMATION



With more than 25 years of experience in the space industry, Radiall has developed a product offering that emphasizes reliability and performance. The latest addition to the range includes SPDT, DPDT and SPnT RF switches designed to operate in thermal vacuum environments. These products can be mounted on ground based test benches, used in test equipment, and space vacuum conditions.

Tvac Series switches are designed in accordance with our standard RAMSES product offering and offer identical configurations with excellent performance.

PART NUMBER SELECTION

"6 standard models are available for test benches dedicated to space equipment in Thermal Vacuum environments"

- 22 GHz SPDT coaxial switch: R571 F63 121
- 22 GHz DPDT coaxial switch: R578 F63 121
- 22 GHz non-terminated SP6T coaxial switch: R583 F33 121
- 40 GHz SPDT coaxial switch: R571 863 121
- 40 GHz DPDT coaxial switch: R578 863 121
- 40 GHz non-terminated SP6T coaxial switch: R583 833 121

OPERATING MODE	LATCHING	
Nominal operating voltage (across operating temperature)	Vdc	28 (24/30)
Coil resistance (+/-10%)	Ω	DPDT and SP6T: 225 / SPDT: 350
Nominal operating current at 23°	mA	DPDT and SP6T: 125 / SPDT: 80
Average power (Thermal vacuum condition)	See power rating chart on page 7-20	
Switching time (max)	SPDT and DPDT: 10 ms / SP6T: 15 ms	
SMA - SMA 2.9	SPDT	10 million cycles
SMA - SMA 2.9	DPDT	2.5 million cycles
SMA - SMA 2.9	SP6T	5 million cycles / 2 million cycles
Connectors ^[1]	SMA / SMA 2.9	

Notes

Terminated models are also available

SPnT models are only available with separated reset option

1. Connector SMA 2.9 is equivalent to "K connector®", registered trademark of Anritsu.

Thermal Vacuum Switches for Ground Segments

ADDITIONAL SPECIFICATION

POLARITY		POSITIVE COMMON
Actuator terminals	SPDT	Solder Pins
	DPDT	Male 9 pins D-Sub connector
	SP6T	Male 25 pins D-Sub connector
Operating temperature range		-40 °C to 85 °C
Storage temperature range		-55 °C to 85 °C
Construction		Thermal vacuum compatible

SMA CONNECTOR

SWITCH MODEL	FREQUENCY RANGE GHz	V.S.W.R. (MAX)	INSERTION LOSS (MAX) dB	ISOLATION (MIN) dB	IMPEDANCE Ω	AVERAGE POWER ⁽¹⁾ W	REPEATABILITY
SPDT	DC - 22	DC - 3	1.20	0.20	80	240	0.03 dB peak change in Insertion Loss over 100 cycles
		3 - 8	1.30	0.30	70	150	
		8 - 12.4	1.40	0.40	60	120	
		12.4 - 18	1.50	0.50	60	100	
		18 - 22	1.70	0.70	55	40	
DPDT SP6T (non-terminated)	DC - 22	DC - 3	1.20	0.20	80	240	
		3 - 8	1.30	0.30	70	150	
		8 - 12.4	1.40	0.40	60	120	
		12.4 - 18	1.50	0.50	60	100	
		18 - 22	1.70	0.70	50	40	

SMA 2.9 CONNECTOR

SWITCH MODEL	FREQUENCY RANGE GHz	V.S.W.R. (MAX)	INSERTION LOSS (MAX) dB	ISOLATION (MIN) dB	IMPEDANCE Ω	AVERAGE POWER ⁽¹⁾ W	REPEATABILITY
SPDT DPDT	DC - 40	DC - 6	1.30	0.30	70	80	0.03 dB peak change in Insertion Loss over 100 cycles
		6 - 12.4	1.40	0.40	60	60	
		12.4 - 18	1.50	0.50	60	50	
		18 - 26.5	1.70	0.70	55	20	
		26.5 - 40	1.90	0.90	50	10	
SP6T (non-terminated)	DC - 40	DC - 6	1.30	0.30	70	40	
		6 - 12.4	1.40	0.40	60	30	
		12.4 - 18	1.50	0.50	60	25	
		18 - 26.5	1.70	0.70	55	15	
		26.5 - 40	1.90	0.90	50	5	

WHY A THERMAL VACUUM TEST BENCH?

- It limits the need of hermetic adaptors and cable assemblies
- It improves RF performance
- It decreases the complexity of the Test bench

Notes

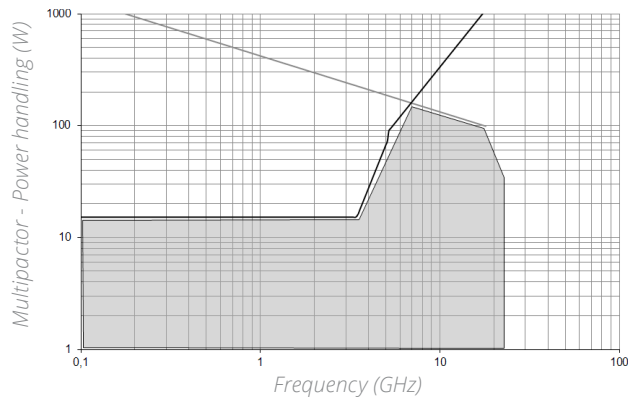
1. Average power at 25 °C per RF path / Sea level.

Thermal Vacuum Switches for Ground Segments

POWER DERATING GRAPH

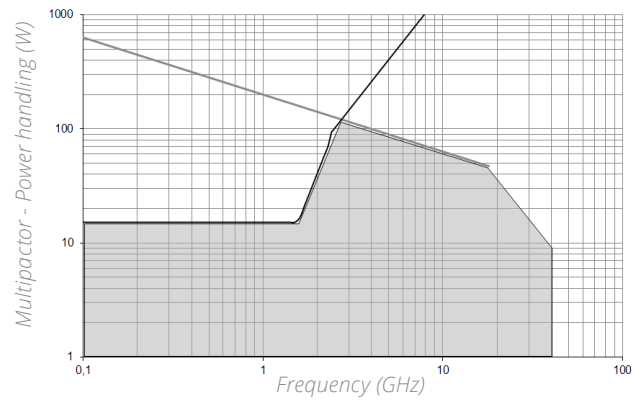
SPDT, DPDT AND SP6T SMA 22 GHz

Multipactor and Power handling under vacuum (max value)



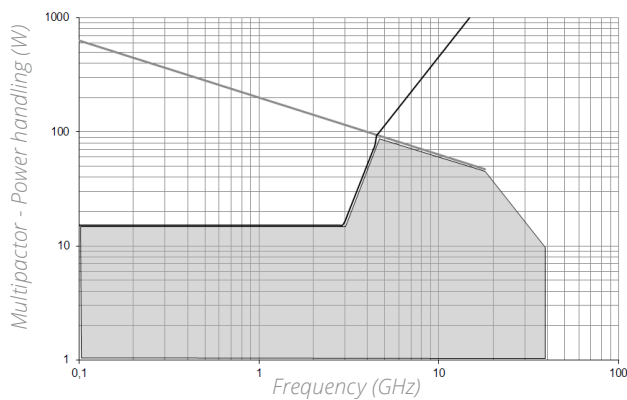
SPDT SMA 2.9 40 GHz

Multipactor and Power handling under vacuum (max value)



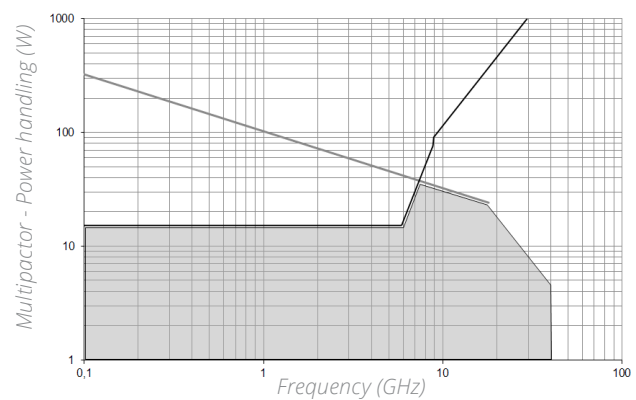
DPDT SMA 2.9 40 GHz

Multipactor and Power handling under vacuum (max value)



SP6T SMA 2.9 40 GHz

Multipactor and Power handling under vacuum (max value)



— POWER HANDLING
 - - MULTIPACTOR
 — AVER. POWER CAPABILITY

HERMETIC FEMALE/FEMALE ADAPTATORS



Multipactor threshold	-	-	-
L Band 2 GHz	≥2000	Wpp	Max. tested values, pulse width 20 μs; PRF 1,000 Hz
C Band 8 GHz	≥2000	Wpp	
Power handling	-	-	-
L Band 2 GHz	600	WCW	-
C Band 8 GHz	400	WCW	-

- SMA DC - 18 GHz
- VHP TNC DC - 8 GHz
- ESA qualified
- High reliability