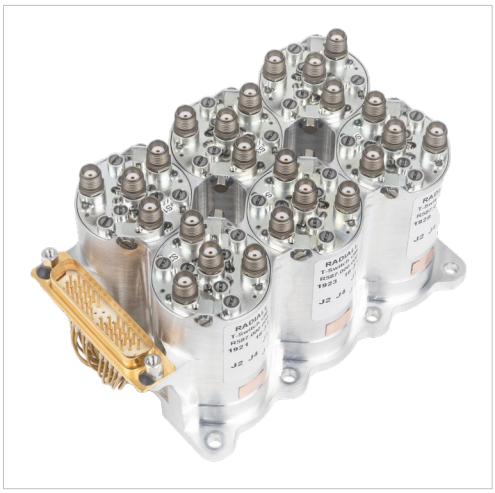
SPACE

Contents

General Information / Specifications



GENERAL INFORMATION/SPECIFICATIONS

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 – 2000 Hz / 28.57 grms
Schocks	-	½ sinus / 1200 g / 0.25 ms
Pressure	-	Free space vacuum

Radiall Specifications

RADIALL BEST RUNNERS PART LIST (FM P/N)

Detail specification	Product	Power cap.	Connectors	Radiall 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 Sequentiel	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				
@+29 V, +25°C	mA	-	129	139
@+29 V, -30°C		-	164	176
@+29 V, +85°C		-	105	113
Switching Time	ms	-	-	20
Pulse Duration	ms	20	-	1000
Coil Resistance (at +25°C)	Ω	210	225	
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit				
Contact Closed	mΩ			1000
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				
Variant 001-004: SPDT, Fixing Plate, Pins	grams	-	-	44
Variant 002-005: SPDT, Lay Down, Pins		-	-	62
Variant 003-006: SPDT, Lay Down, D-Sub		-	-	72
Torque Screws for				
Fixing unit	N.m	-	-	2.0
For DC connector		0.8	1.1	0.44
For 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)	dBi	75	70			

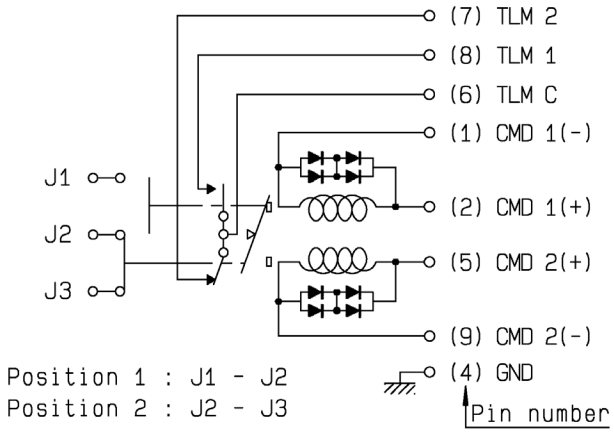
Ka – band SMA 2.9

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)	dBi	70	60	
Power Handling (max)	W	10	5	

Low Power Coaxial SPDT Switch

SCHEMATICS and DRAWINGS

SDPT, lay down, pins:



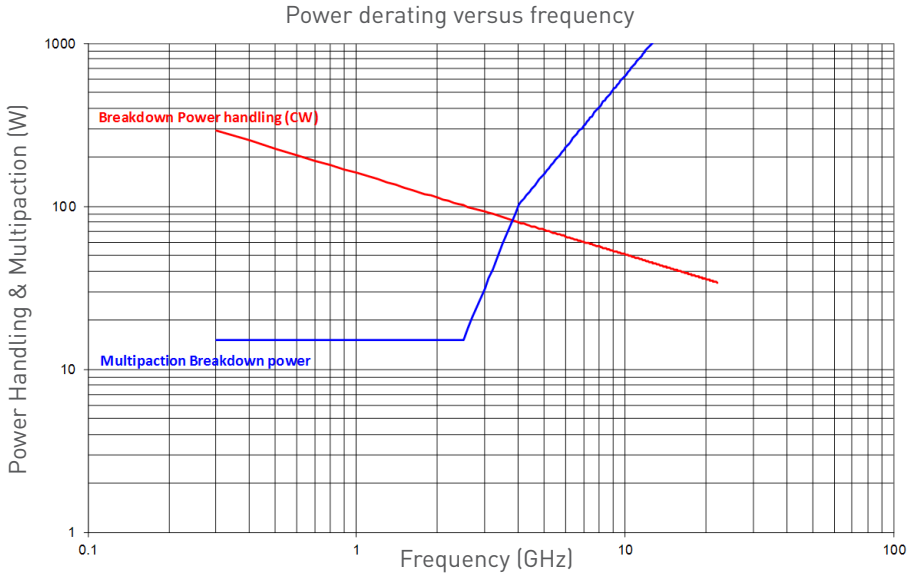
SPDT, Fixing plate with pins

SPDT, Lay down with pins

SPDT, Lay down 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 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				
@+29 V, +25°C	mA	-	129	139
@+29 V, -30°C		-	164	176
@+29 V, +85°C		-	105	113
Switching Time	ms	-	-	25
Pulse Duration	ms	20	-	1000
Coil Resistance (at +25°C)	Ω	210	225	-
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit		-	-	-
Contact Closed	mΩ	-	-	1000
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				
Variant 001-005: C-Switch Stand up D-Sub	grams	-	-	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)		1.20	1.25	1.25	1.33	1.33	1.40
Return Loss (min)	(dB)	(21)	(19)	(19)	(17)	(17)	(15.6)
Isolation (min)	dB	70			65		
E-Field Shielding Effectiveness (min)	dBi	75	70	68	65	60	

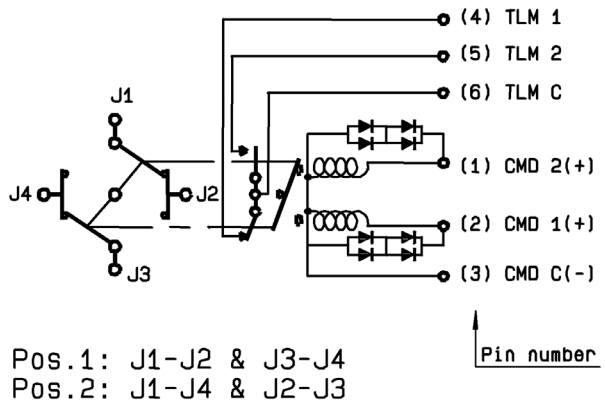
KA – BAND SMA 2.9

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

Low Power Coaxial DPDT Switch

SCHEMATICS and DRAWINGS

C-Switch, SMA ,Lay Down pins:



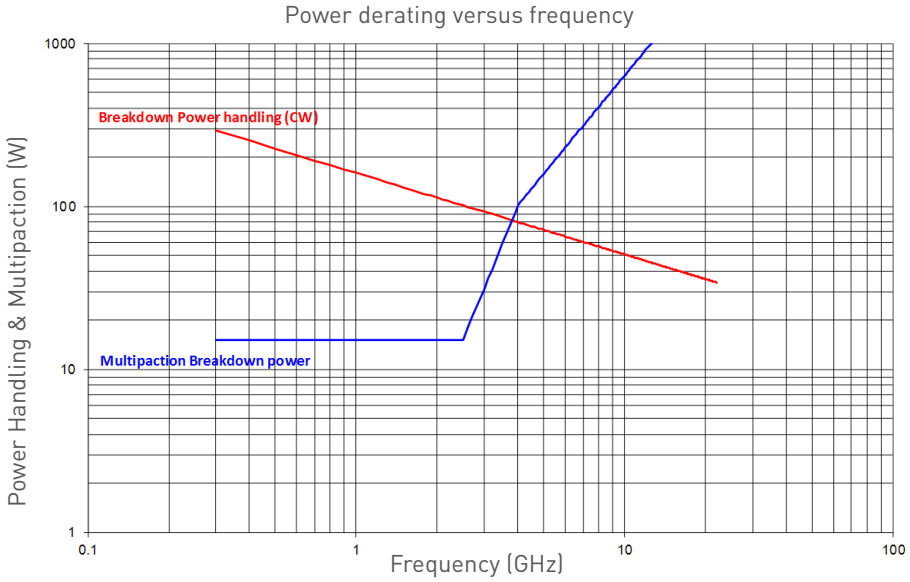
C-Switch, Lay down with pins

C-Switch, Stand Up 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 Sequential 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							
@+29 V, +25°C	mA	-	345	364	-	285	305
@+29 V, -30°C	mA	-	439	462	-	365	390
@+29 V, +85°C	mA	-	280	295	-	234	250
Switching Time	ms	-	-	25	-	-	20
Pulse Duration	ms	20		1000	20		1000
Coil Resistance (at +25°C)	Ω	79.8	84	-	88	95	-
RF Contact Resistance	mΩ	-	-	100	-	-	100
TLM Indicator Circuit	-	-	-	-	-	-	-
Contact closed	mΩ	-	-	1000	-	-	1000
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							
T-Switch, Lay Down Pins	grams	-	-	73	-	-	64
T-Switch, Stand Up D-Sub	grams	-	-	100	-	-	100
T-Switch, Stand Up Pins	grams	-	-	75	-	-	75
T-Switch, Fixing Plate	grams	-	-	-	-	-	58
Torque Screws for							
Fixing unit	N.m	-	-	2.0	-	-	2.0
For D-sub connector	N.m	0.27	-	0.44	-	-	N/A
For RF connector	N.m	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)		1.20	1.22	1.25	1.25	1.25	1.25	1.25	1.33	1.33	1.40
Return Loss (min)	(dB)	(21)	(20)	(19)	(19)	(19)	(19)	(19)	(17)	(17)	(15.6)
Isolation (min)	dB	70						65			
E-Field Shielding Effectiveness (min)	dBi	75			70		65	65			

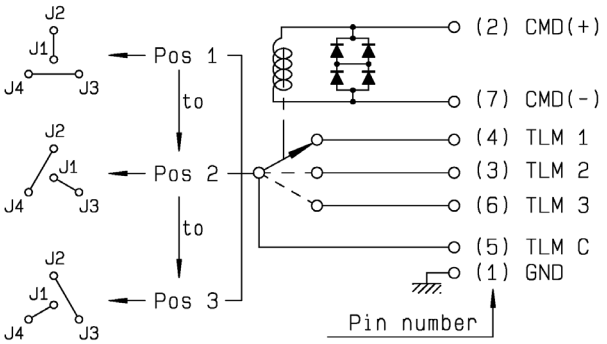
KA – BAND SMA 2.9

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

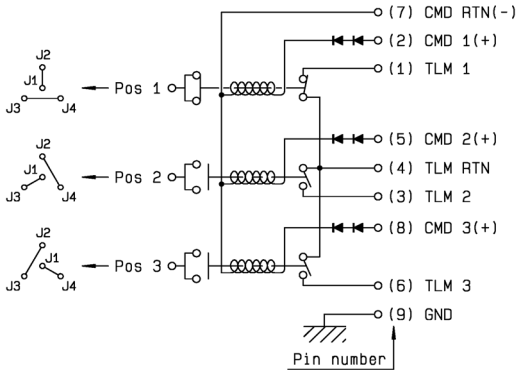
Low Power Coaxial T Switch

SCHEMATICS and DRAWINGS

Sequential Drive:



Random Drive:



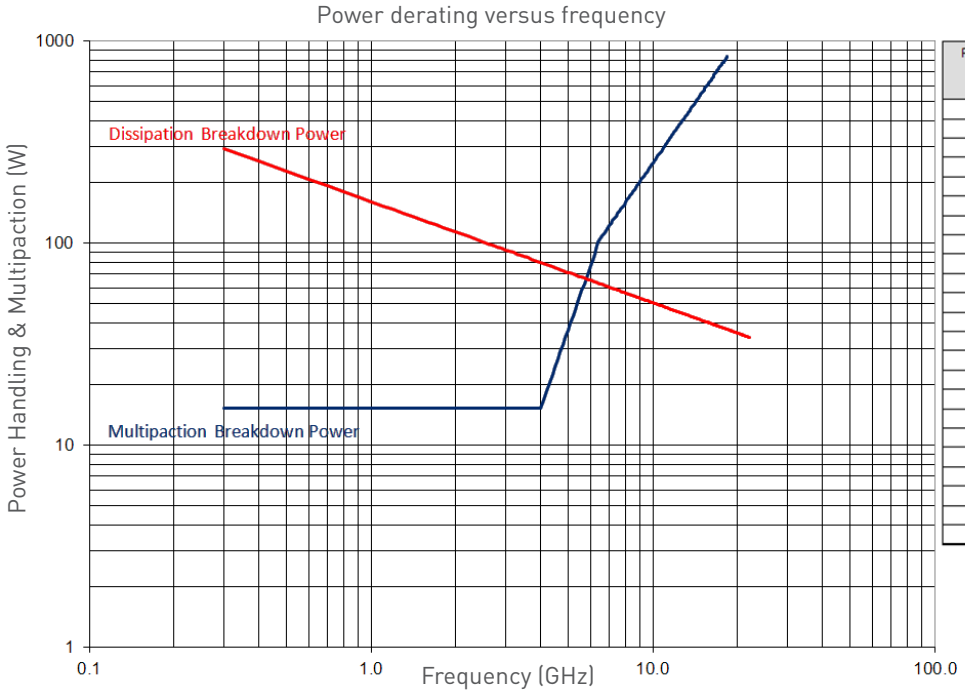
T-Switch, Lay Down with pins

T-Switch, Stand Up with D-Sub

T-Switch, Fixing plate with pins

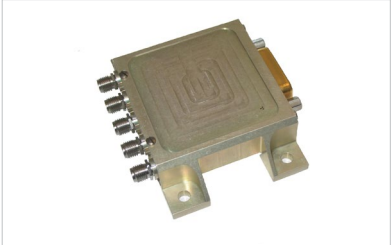
POWER DERATING GRAPH

Variant 001 to 003: DC to 22 GHz SMA



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				
@+29 V, +25°C	mA	-	129	139
@+29 V, -30°C		-	164	176
@+29 V, +85°C		-	105	113
Switching Time	ms	-	-	20
Pulse Duration	ms	20	-	1000
Coil Resistance (at +25°C)	Ω	210	225	-
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact closed	mΩ	-	-	1000
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	grams	-	-	106
Torque Screws for				
Fixing unit	N.m	-	-	2.0
For D-sub connector		0.27	-	0.44
For RF connector		0.8	1.1	1.15

RF PERFORMANCE

DC to 22 GHz SMA

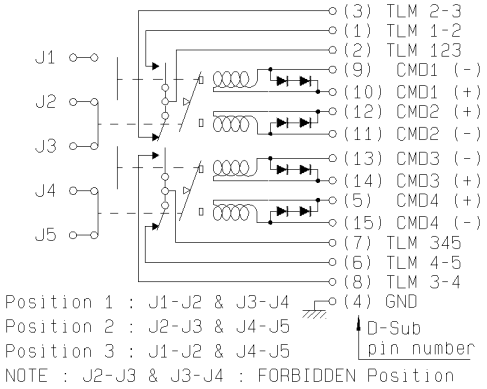
Frequency	GHz	DC - 4.2	4.2 - 10.7	10.7 - 12.75	12.75 - 14.5	14.5 - 22
Insertion Loss (max)	dB	0.12	0.20	0.25	0.30	0.35
VSWR (max)		1.20	1.20	1.20	1.25	1.33
Return Loss (min)	(dB)	(21)	(21)	(21)	(19)	(17)
Isolation (min)	dB	70			65	
E-Field Shielding Effectiveness (min)	dBi	75	70			

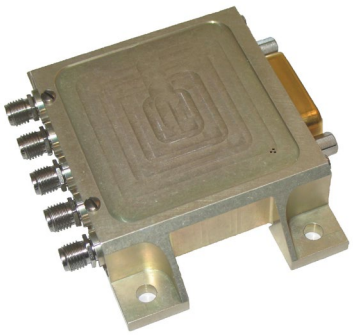
KA – BAND SMA 2.9

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)	dBi	70	60	
Power Handling (max)	W	10	5	

Low Power Coaxial DP3T Switch

SCHEMATICS and DRAWINGS

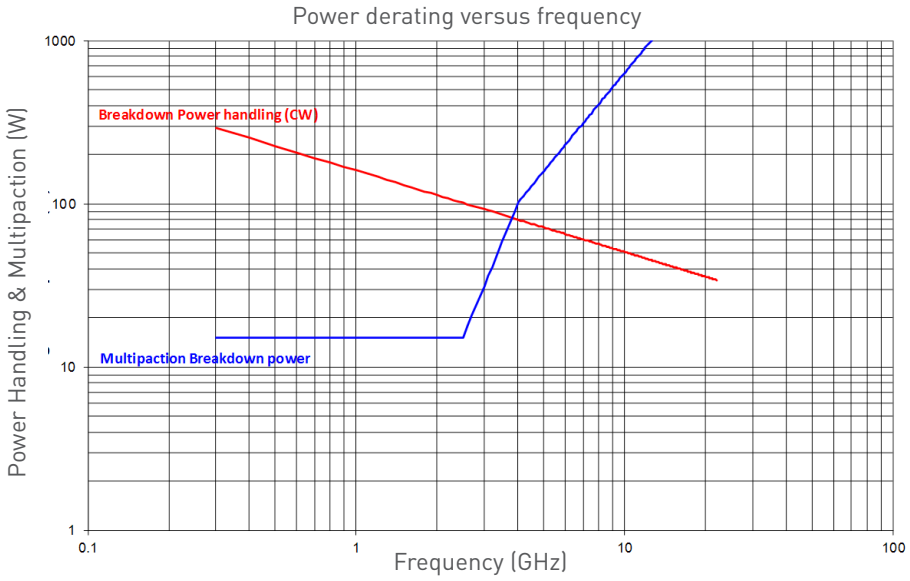




DP3T, Lay down with D-sub

POWER DERATING GRAPH

Variant 001: 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

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 grams

GENERAL SPECIFICATIONS

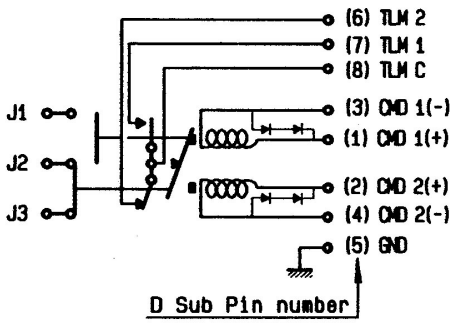
	Unit	Min	Typical	Max
Actuation Voltage	V	+20	+26	+30
Pick-Up Voltage	V	-	-	+19
Actuation Current				
@+29 V, +25°C	mA	178	188	198
@+29 V, -30°C		227	239	251
@+29 V, +85°C		145	153	161
Switching Time	ms	-	25	35
Pulse Duration	ms	50	-	1000
Coil Resistance (at +25°C)	Ω	152	160	168
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit		-	-	-
Contact closed	mΩ	-	-	1000
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 & 002	grams	-	-	275
Torque Screws for				
Fixing unit	N.m	-	-	2.0
For D-sub connector		0.27	-	0.44
For 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)	dBi	70						60

High Power Coaxial SPDT Switch

SCHEMATICS and DRAWINGS



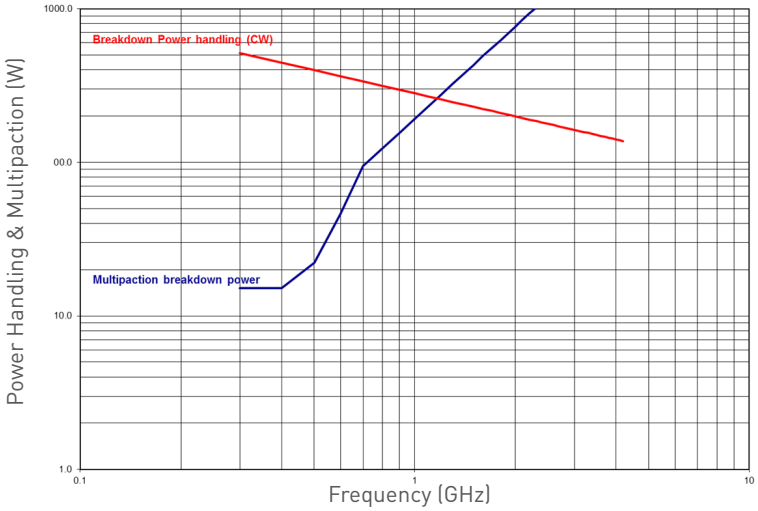
Position 1 : J1 - J2
Position 2 : J2 - J3

SPDT Lay down with D-sub, variant 001 and 002:

POWER DERATING GRAPH

Variant 001, High Cavity

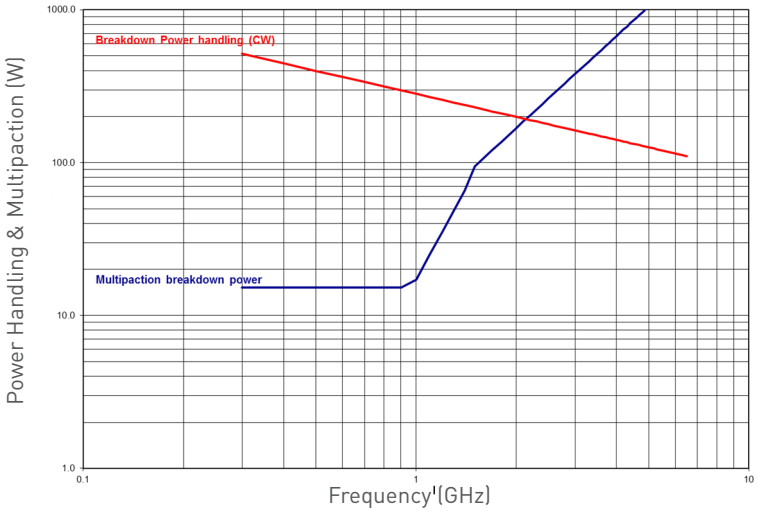
Power derating versus frequency



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	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

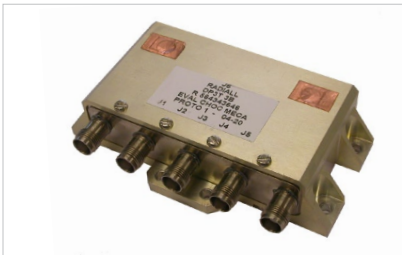
Variant 002, Standard Cavity

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 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 grams and up

GENERAL SPECIFICATIONS

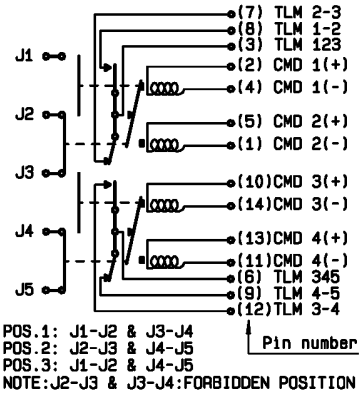
	Unit	Min	Typical	Max
Actuation Voltage	V	+20	+26	+30
Pick-Up Voltage	V	-	-	+19
Actuation Current				
@+29V, +25°C	mA	178	188	198
@+29V, -30°C		227	239	251
@+29V, +85°C		145	153	161
Switching Time	ms	-	25	35
Pulse Duration	ms	50	-	1000
Coil Resistance (at +25°C)	Ω	152	160	168
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact closed	mΩ	-	-	1000
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				
Variant 001: Lay Down D-Sub	grams	-	-	460
Variant 002: Lay Down D-Sub		-	-	445
Variant 003: Lay Down pins		-	-	390
Torque Screws for				
Fixing unit	N.m	-	-	2.0
For D-sub connector		0.27	-	0.44
For RF connector		1.7	-	2.65

RF PERFORMANCE

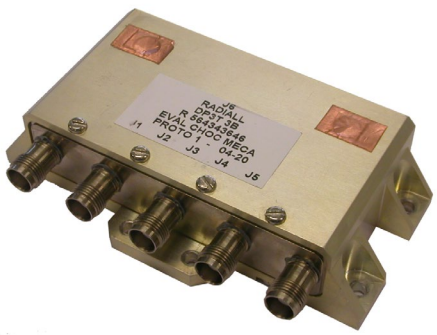
		DC - 2.2 GHz Variant 001			DC - 4.8 GHz Variant 002 and 003			
Frequency	**GHz**	**0.04 -1.0**	**1.0 - 1.6**	**1.6 - 2.2**	**0.04 - 1.0**	**1.0 - 1.6**	**1.6 - 2.2**	**2.2 - 4.8**
Insertion Loss (max)	dB	0.12			0.12			0.22
VSWR (max)		1.20			1.20			1.38
Return Loss (min)	(dB)	(20.8)			(20.8)			(15.9)
Isolation (min)	dB	70						
E-Field Shielding Effectiveness (min)	dBi	70						60

High Power Coaxial DP3T Switch

SCHEMATICS and DRAWINGS



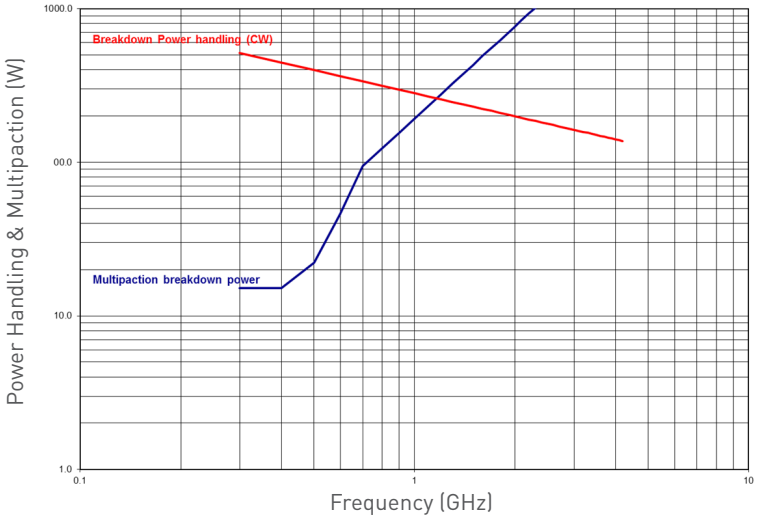
DP3T, Lay down with pins



POWER DERATING GRAPH

Variant 001, High Cavity

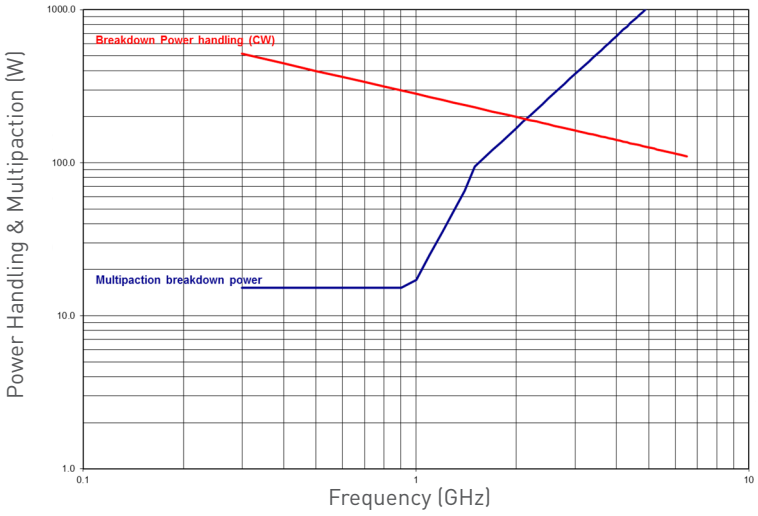
Power derating versus frequency



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	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

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 @ 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				
@+29 V, +25°C	mA	450	470	490
@+29 V, -25°C		555	585	610
@+29 V, -30°C		570	595	620
@+29 V, +80°C		360	385	405
@+29 V, -85°C		365	380	397
Switching Time	ms	-	-	35
Pulse Duration	ms	35	-	1000
Coil Resistance (at +25°C)	Ω	59.3	61.8	64.4
RF Contact Resistance	mΩ	-	-	100
TLM Indicator Circuit	-	-	-	-
Contact closed	mΩ	-	-	1000
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				
Variant 001: T-Switch, Lay Down, D-Sub	grams	-	-	360
Variant 002: T-Switch, Stand Up, D-Sub		-	-	355
Torque Screws for				
Fixing unit	N.m	-	-	2.0
For D-sub connector		0.27	-	0.44
For RF connector		1.7	-	2.65

RF PERFORMANCE

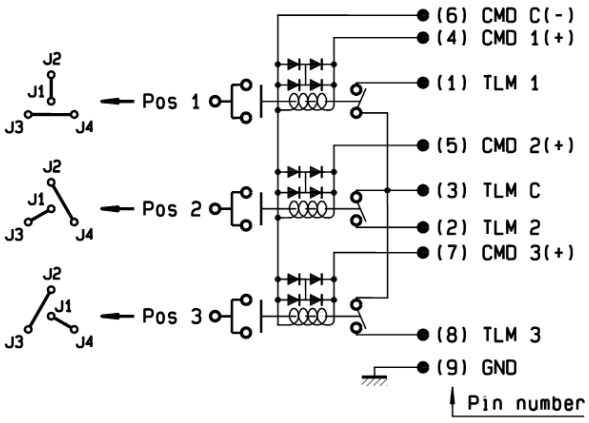
DC - 8 GHz Variants 001 and 002

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)		1.10	1.25	1.35	1.50
Return Loss (min)	(dB)	(26.4)	(19.1)	(16.5)	(14)
Isolation (min)	dB	70			
E-Field Shielding Effectiveness (min)	dBi	75			70

High Power Coaxial T Switch

SCHEMATICS and DRAWINGS

T-Switch, TNC, D-Sub, variant 001 & 002:

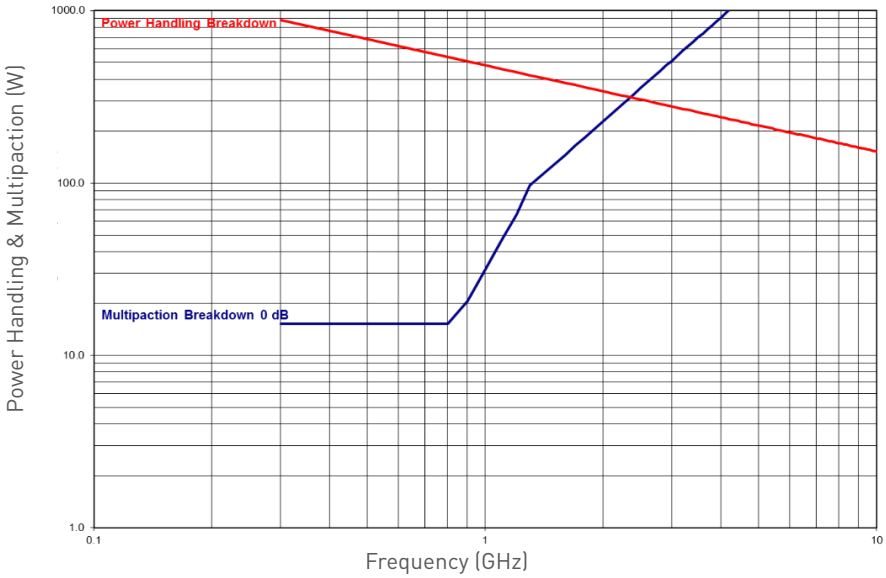


T-Switch, Lay down with D-sub, variant 001

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

POWER DERATING GRAPH

Power derating versus frequency



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

Thermal Vacuum Switches for Ground Segments

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**

Notes:
- Terminated models are also available
- SPnT models are only available with separated reset option

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	

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

Thermal Vacuum Switches

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	50	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	50	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	50	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	50	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	

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

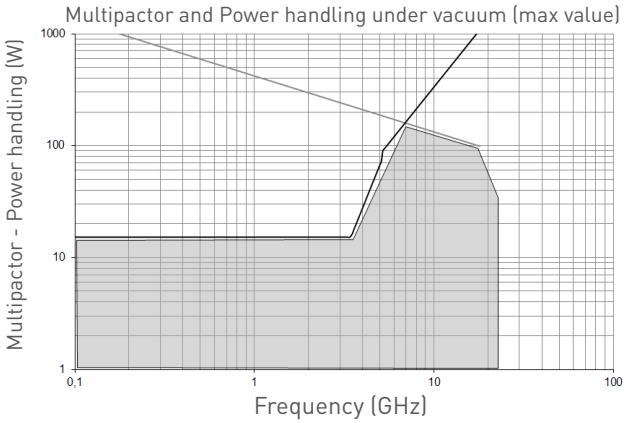
WHY A THERMAL VACUUM TEST BENCH?

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

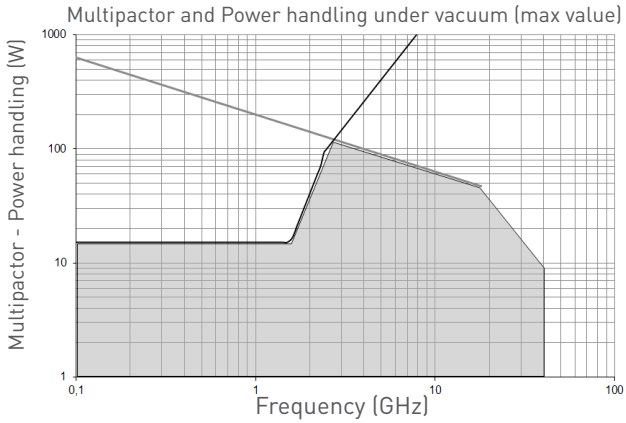
Thermal Vacuum Switches

POWER DERATING GRAPH

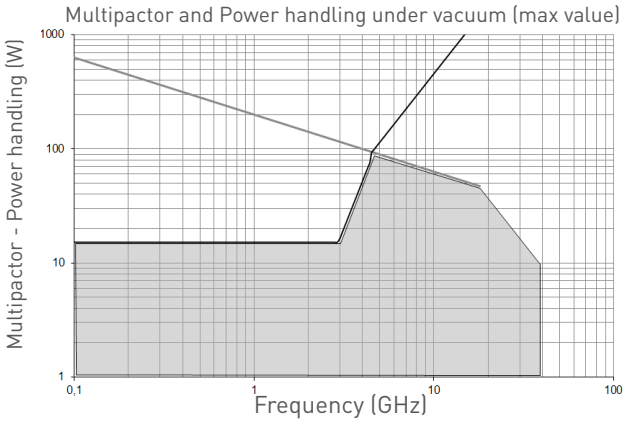
SPDT, DPDT AND SP6T SMA 22 GHz



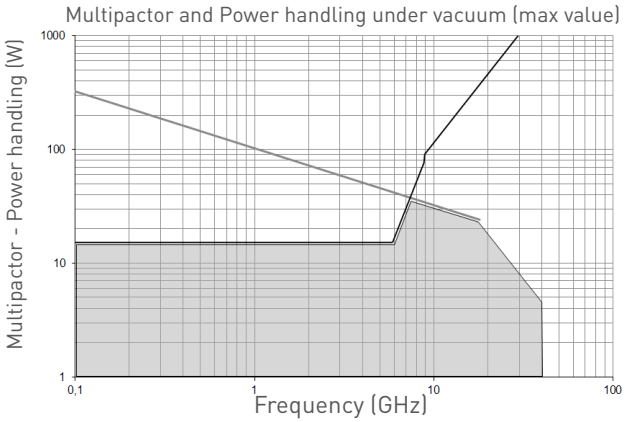
SPDT SMA 2.9 40 GHz



DPDT SMA 2.9 40 GHz



SP6T SMA 2.9 40 GHz



— Power Handling
— Multipactor
— Aver. Power Capability

HERMETIC FEMALE / FEMALE ADAPTATORS

Multipactor threshold			Max. tested values, pulse width 20 µs; PRF 1000 Hz
L Band 2 GHz	≥2000	Wpp	
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**