



# **SPACE LABS INC.**

## **MM-WAVE TECHNOLOGY**

### **COMPONENT BROCHURE**

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A SELECTED SAMPLING OF  
OUR COMPREHENSIVE LINE OF  
MICROWAVE AND MILLIMETER-WAVE  
COMPONENTS AND SUBASSEMBLIES  
FROM 10 TO 110 GHz:

Mixers, Up/Down Converters

Block Converters

Mixer-Preamplifiers

Planar Mixers

Power Amplifiers

Low-Noise Amplifiers

Active Frequency Multipliers

Passive Frequency Multipliers

Broadband Detectors

Band-Pass, Low-Pass, High-Pass Filters

Waveguide/Coax Adapters

Gunn Oscillators

Phase-Lock Sources

Frequency Synthesizers





## Broadband Up/Downconverters

Our cross-bar mixer design uses two custom made hermetic point contact Schottky barrier diodes. We can make mixers with any combination of RF, LO and IF frequencies! These mixers can function as upconverters as well. We offer these mixers with DC bias option to allow LO input levels as low as 0 dBm.



Model Number	RF in (GHz)	IF out (GHz)	LO in (GHz)	Conv. Loss (dB) (typ/max)
MK-4	18-26.5	DC-8.5	18-26.5	6.0 / 7.0
M180-7	18-40	DC-14	18-40	6.5 / 8.5
MKa-1	26.5-40	DC-2	26.5-40	5.0 / 7.0
MQ-1	33-50	DC-2	33-50	6.5 / 8.5
MU-10	40-60	DC-20	40-60	7.5 / 9.0
MV-1	50-75	DC-2	50-75	6.0 / 8.5
M60-5	55-65	DC-10	55-65	5.0 / 7.0
ME-1	60-90	DC-2	60-90	7.0 / 10.5
MW-1	75-110	DC-3	75-110	7.5 / 11.5
M95-1	90-100	DC-3	90-100	6.0 / 7.5

This is not a complete list of our Up/Downconverters. Speak with one of our engineers to find the right model for your specifications.

## Planar Mixers

Spacek Labs' Planar mixers are both economical and high-performance. With high IF bandwidth capability, wide band RF and LO ranges are available in a single unit. Our balanced mixer design is optimized for flat-response conversion loss and excellent spurious rejection. This versatile design allows customization of this passive mixer to be equipped with active bias, amplification on any port, additional filtering and the option of coaxial or waveguide ports.



Model Number	RF in (GHz)	LO in (GHz)	IF out (GHz)	Conv. Loss (dB)	Spur Rejection (dBc) (min/typ*)
P1M-2208-2208S	18 - 26.5	18 - 26.5	1.5 - 8.5	8.0 ±1.5	33/40 @ -10dBm RF
P1M-2208-2802F	18 - 26.5	28.0	1.5 - 10	6.0 ±1.0	33/40 @ -10dBm RF
P1M-2208-2902F	18 - 26.5	29.0	2.5 - 11	6.0 ±1.0	33/40 @ -10dBm RF
P1M-2208-3002F	18 - 26.5	30.0	3.5 - 12	7.5 ±1.5	33/40 @ -10dBm RF
P1M-3314-44S	26.5 - 40	44.0	4 - 17.5	8.0 ±2.0	30/40 @ -10dBm RF
P1M-4117-44S	33 - 50	44.0	DC - 11.0	8.0 ±2.0	27/40 @ -10dBm RF

This is not a complete list of our Planar Mixers. Speak with one of our engineers to find the right model for your specifications.

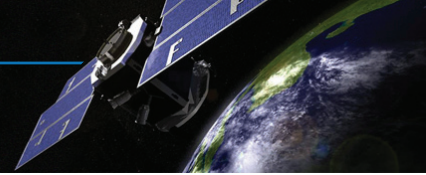
## Power Amplifiers

Available from 10 to 110 GHz with output power in excess of 1 Watt. Unconditionally stable with balanced circuitry and compact size. DC bias power from +7 to +15V or +5V regulated. Internal voltage regulator. MIL-spec or space-qualified units available.



Model Number	RF Freq (GHz)	P-1dB (dBm) (typ)	Gain (dB) (min)	VSWR in/out (typ)	Bias mA/VDC
SP155-35-37	13 - 18	+37/36 min	35/37 typ	2:1 max	2850 mA/+10
SPK-35-31	18 - 26.5	+31	35	2:1	1750 mA/+9 to 12
SP285-20-33	25 - 30	+34/33 min	20/23 typ	3:1/2:1	2400 mA/+9 to 10
SPKa-32-29	26.5 - 40	+29	30/32 typ	2:1 max	2400 mA/+8 to 12

This is not a complete list of our Power Amplifiers. Speak with one of our engineers to find the right model for your specifications.



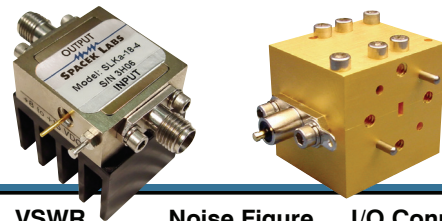
## Power Amplifiers (Continued)

Model Number	RF Freq (GHz)	P-1dB (dBm) (typ)	Gain (dB) (min)	VSWR in/out (typ)	Bias mA/VDC
SP435-33-31	39 - 44	+31/29 min	26/33 typ	2:1	2200 mA/+9 to 12
SPU-18-16W	40 - 60	+14	18.5/15 min	2:1	450 mA/+8 to 11
SP5816-28-20W	50 - 66	+17	28/37 typ	2:1	500 mA/+8 to 12
SP7610-20-18	68 - 78	+16	23/20 min	2:1	140 mA/+8 to 11
SP944-30-23	92 - 96	+19/18 min	28/30 typ	3:1/2.5:1	750 mA/+8 to 11
SPW-15-14	75 - 110	+14 Psat	15 typ	3:1	250 mA/+8 to 12

This is not a complete list of our Power Amplifiers. Speak with one of our engineers to find the right model for your specifications.

## Wide Band Low-Noise Amplifiers

Spacek Labs provides the best LNA's available in the industry. Below is a sampling of our models from across our spectrum of 10 to 110 GHz.

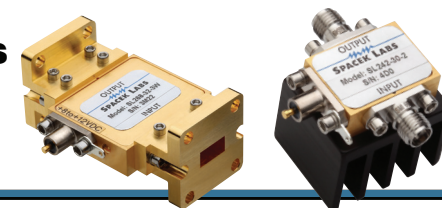


Model Number	Freq (GHz)	P1dB (dBm)(typ)	Gain (dB)	VSWR I/O (typ)	Noise Figure (dB)(typ/max)	I/O Conn.
SL1510-21-2	10-20	10	20 min/21 typ	2.0:1	2.2 / 2.6	K(f)
SLK-18-3	18-26.5	12	18	2.0:1	2.2 / 3.0	K(f)
SLK-35-3	18-26.5	18	35	2.2:1	2.2 / 3.4	K(f)
SLKka-30-6	18-40	17	30	1.8:1	4.5 / 6.0	K(f)
SLKa-18-4	26.5-40	5	17	2.0:1	2.5 / 3.5	K(f)
SLKa-35-4	26.5-40	17	35	2.0:1	3.5 / 4.0	K(f)
SLQ-15-4W	33-50	-3	15 min/18 typ	2.5:1	3.5 / 4.0	WR-22
SLU-17-4W	40-60	-4	17 min/20 typ	3.0:1	3.0 / 4.0	WR-19
SLV-20-4	50-75	-1	17	3.0:1	4.0 / 5.0	WR-15
SLW-15-5	75-110	-8	15	3.0:1	4.5 / 5.5	WR-10

This is not a complete list of our Low-Noise Amplifiers. Speak with one of our engineers to find the right model for your specifications.

## Moderate Band Low-Noise Amplifiers

Moderate bandwidth LNAs can provide better performance at a more cost effective price than our Wide Band LNAs. Below is a sampling of our models from across our spectrum of 10 to 110 GHz.



Model Number	Freq (GHz)	P1dB (dBm)	Gain (dB)	VSWR (typ)	Noise Figure (dB)(typ/max)	I/O Conn.
SL1916-15-4	12-26.5	12	15	2.0:1	3.5 / 4.5	K(f)
SL2518-15-3	17-33	8	18	2.2:1	2.5 / 3.0	K(f)
SL2518-30-3	17-33	17	30	2.2:1	2.5 / 3.0	K(f)
SL224-18-3	20-24	8	18	2.0:1	1.8 / 2.2	K(f)
SL224-35-3W	20-24	18	35	2.1:1	1.9 / 2.3	WR-42
SL242-30-2	23-25	12	30 min/32 typ	2.0:1	2.5 / 3.0	K(f)
SL294-40-2	27-31	12	40 min/43 typ	2.0:1	2.4 / 2.7	K(f)
SL3510-18-3	30-40	7	17 min/19 typ	2.0:1	2.5 / 3.0	K(f)

This is not a complete list of our Low-Noise Amplifiers. Speak with one of our engineers to find the right model for your specifications.



## Moderate Band Low-Noise Amplifiers (Continued)

Model Number	Freq (GHz)	P1dB (dBm)	Gain (dB)	VSWR (typ)	Noise Figure (dB)(typ/max)	I/O Conn.
SL391-53-2W	37.8-39.5	10	50	2:1	2.4 / 3.0	WR-22/V(f)
SL412-30-5	40-43	12	30	2.0:1	4.0 / 5.0	K(f)
SL4510-30-4V	40-50	10	30 min/35 typ	3.0:1/2.5:1	3.2 / 4.0	V(f)
SL535-25-5V	50-55		25 min/28 typ	2.0:1	4.0 / 5.0	V(f)
SL6010-15-6	55-65	10	15	2.2:1	4.5 / 5.5	WR-15

This is not a complete list of our Low-Noise Amplifiers. Speak with one of our engineers to find the right model for your specifications.

## Active Multipliers

Active frequency multiplication from 2X to 12X with output in bands from 18 to 110 GHz. Below is a small sampling of models from across our spectrum.



Model Number	RF Freq Input (GHz)	Input Pwr (dBm)	RF Freq Output (GHz)	Output Pwr min/typ (dBm)	Spur/Har (dBc) max	Bias mA/VDC
AKKa-2X	9 - 20	+10 - 17	18 - 40	+15 min	-15	360 mA/+8 to 12
AQ-4X-18	8.25 - 12.5	+12 - 18	33 - 50	+15/+18	-15	550 mA/+7 to 15
AU-4XW-17	10 - 15	+13	40 - 60	+17 typ	-15	640 mA/+8 to 12
AE-6XW	10 - 15	+15	60 - 90	+3/+5	-15	300 mA/+8 to 12
A944-12XW-10	7.66 - 8	+12 - 15	92 - 96	+13	-15	450 mA/+8 to 12

This is not a complete list of our Active Multipliers. Speak with one of our engineers to find the right model for your specifications.

## Passive Multipliers

As cost effective frequency extenders, Spacek Labs' passive multipliers are available from 18-110 GHz in complete waveguide bandwidths from K-band to W-band. All designs are a balanced configuration to suppress undesired harmonics, unconditionally stable for any input/output VSWR. To meet your needs, features can be added such as coaxial output and additional filtering. MIL-spec or space-qualified units available.



Model Number	Input Freq. (GHz)	Output Freq. (GHz)	Conv. Loss (dB)(max)	Input Power (dBm)(max)
K-2X	9-13.25	18-26.5	11.5	20
KKa-3X	6-13.3	18-40	18	20
Ka-2X	13-20	26-40	12	20
Q-2X	16.5-25	33-50	12.5	20
U-3X	13.33-20	40-60	18	20
V-2X	25-37.5	50-75	13	18
E-2X	30-45	60-90	15	1
W-2X	37.5-55	75-110	17	18
W-2X	46-48	92-96	12	18

This is not a complete list of our Passive Multipliers. Speak with one of our engineers to find the right model for your specifications.



## Broadband Detectors

Spacek Labs complete line of waveguide detectors come in full waveguide bandwidths from 18 to 110 GHz. These detectors are extremely rugged and compact. By replacing the zero bias detector diode with a GaAs beam lead mixer diode; these devices can be used as harmonic mixers to extend frequency counters to 110 GHz.



Model	DK-2	DKa-2	DQ-2	DU-2	DV-2	DE-2	DW-2
Freq. Range (GHz)	18-26.5	26.5-40	33-50	40-60	50-75	60-90	75-110
Sensitivity mV/mW (typ)*	3000	2800	2600	2200	2000	1700	1500
Waveguide	WR-42	WR-28	WR-22	WR-19	WR-15	WR-12	WR-10

\* Measured at -20 dBm

## Waveguide to Coax Adapters

Covering all the spectrum from 12 to 110 GHz in multiple bands, Spacek Labs' waveguide to coax adapters are available in full bandwidth or they can be tuned to meet your specific bandwidth. Some models are available in an in-line configuration where the input and output ports are on the same axis. Call and speak with an engineer for more details.



Model	T500-S	T42-K	T34-K	T28-K	T180-K	T22-V	T19-V	T15-V	T15-W	T12-W	T10-W
Freq (GHz)	6-18	18-26.5	22-33	26.5-40	18-40	33-50	40-60	50-65	50-75	60-90	75-110
VSWR (typ)	1.45	1.25	1.25	1.25	1.45	1.30	1.35	1.35	1.35	1.40	1.45

Model #: TXX-Y: XX = waveguide band designation and Y = coax output connector: S = 3.5mm, K = 2.9mm, V = 1.85mm, W = 1.0mm

## Waveguide Band-Pass, Low-Pass & High-Pass Filters

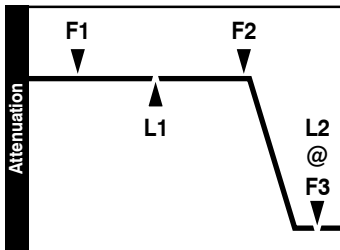
Spacek Labs offers a complete line of band-pass, low-pass and high-pass filters from 18-110 GHz. Bandwidths range from ultra-wide band to extremely narrow band. Filters can also be configured with coaxial connectors.



How to specify your filter:

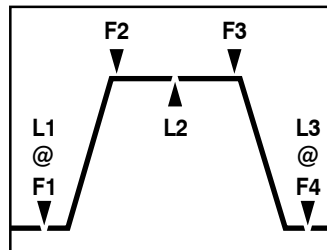
### Low-Pass Filters

1. Specify the passband (F1 to F2)
2. Specify insertion loss (L1)
3. Rejection point and loss (L2@F3)
4. Specify I/O connector/flange



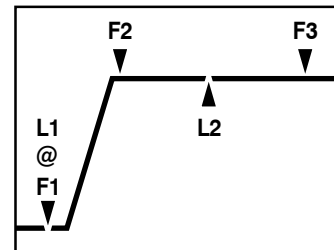
### Band-Pass Filters

1. Specify the passband (F2 to F3)
2. Specify insertion loss (L2)
3. Rejection points and loss (L1@F1, L3@F4)
4. Specify I/O connector/flange

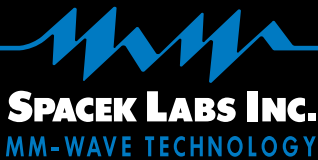


### High-Pass Filters

1. Specify the passband (F2 to F3)
2. Specify insertion loss (L2)
3. Rejection points and loss (L1@F1)
4. Specify I/O connector/flange



Frequency



Since 1982, Spacek Labs has been dedicated to providing the highest quality millimeter-wave and microwave components and subassemblies to private industry, research institutions, universities and government.

From commercial to military and space applications, Spacek Labs has a comprehensive product line which spans the frequency spectrum from 10 to 110 GHz. We have a select sampling of our standard products in this brochure; however, a large portion of our work is custom-designed for our customers to suit their applications of exacting specifications in performance or configuration.

Give us a call and send us your requirements, we would welcome the opportunity to design and build your perfect solution.

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