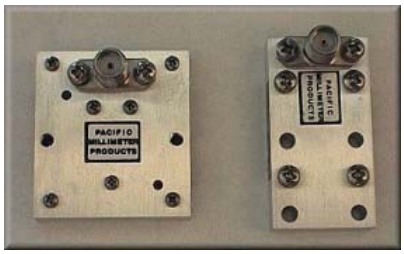
FREQUENCY MULTIPLIERS

A series of broadband frequency multipliers is available with output frequencies between 18 and 110 GHz. The use of GaAs diodes on a suspended substrate circuit allows an extremely compact device. Circuit symmetry is used to enhance either even or odd harmonics while suppressing unwanted odd or even harmonics. These devices can be used as higher order even or odd harmonic multipliers with reduced efficiency. All of these multipliers have maximum input power +23 dBm for temperature less than +50°C.



SPECIFICATIONS **WITH INPUT POWER +20 dBm**

MODEL	OUTPUT FREQUENCY	INPUT FREQUENCY	OUTPUT WAVEGUIDE	OUTPUT POWER (MINIMUM)	FLANGE COMPATIBILITY	INPUT CONNECTOR	SIZE (INCHES) EXCLUDING CONNECTOR
K2	18-26.5 GHz DOUBLER	9-13.25 GHz	WR-42	+8 dBm	UG-595/U	SMA female	2.0 X .875 X.320
Kb2	22-33 GHz DOUBLER	11-16.5 GHz	WR-34	+7 dBm	UG-595/U	SMA female	1.8 X .875 X .30
Ka2	26.5-40 GHz DOUBLER	13.25-20 GHz	WR-28	+7 dBm	UG-599/U	SMA female	1.41 X .75 X .24
Ka3	26.5-40 GHz TRIPLER	8.67-13.33 GHz	WR-28	+4 dBm	UG-599/U	SMA female	1.41 X .75 X .24
Q2	33-50 GHz DOUBLER	16.5-25 GHZ	WR-22	+7 dBm	UG-383/U	K female	1.225 X 1.125 X.23
Q3	33-50 GHz TRIPLER	11-16.67 GHZ	WR-22	+3 dBm	UG-383/U	SMA female	1.225 X 1.125 X.23
U2	40-60 GHz DOUBLER	20-30 GHZ	WR-19	+7 dBm	UG-383/U (MOD)	K female	1.250 X 1.125 X.240
U2LF	37.5-57.5 GHz DOUBLER	18.75-28.75 GHZ	WR-19	+7 dBm	UG-383/U (MOD)	K female	1.250 X 1.125 X.240
U3	40-60 GHz TRIPLER	13.33-20 GHZ	WR-19	+2 dBm	UG-383/U (MOD)	SMA female	1.125 X 1.125 X .23
V2 **V2WO**	50-75 GHz DOUBLER	25-37.5 GHz	WR-15	+7 dBm	UG-385/U	K female * or WR-28**	1.3 X .9 X .24 1.55 X .75 X .24
V3	50-75 GHz TRIPLER	16.67-25 GHz	WR-15	+1 dBm	UG-385/U	K female *	1.3 X .9 X.24
E2LF	55-85 GHz DOUBLER	27.5-42.5 GHz	WR-12	+6 dBm	UG-387/U	K female *	1.3 X .9 X.24
E2WO	60-90 GHz DOUBLER	30-45 GHz	WR-12	+6 dBm	UG-387/U	WR-22	1.55 X .75 X .24
E3	60-90 GHz TRIPLER	20-30 GHz	WR-12	0 dBm	UG-387/U	K female *	1.3 X .9 X .24
W2WO **W2WOB**	75-110 GHz DOUBLER	37.5-55 GHz	WR-10	+6 dBm	UG-387/U (MOD)	WR-19	1.55 X .75 X .24 1.74X1.125X.24
W3 **W3WO**	75-110 GHz TRIPLER	25-36.67 GHz	WR-10	-3 dBm	UG-387/U (MOD)	K female * or WR-28**	1.3 X .9 X .24 1.55 X .75 X .24

* K male connector available on request

** Input and output waveguides can be on either the same side or on opposite sides of the wafer. Please specify. Example W3WS for same side, W3WO for opposite side.

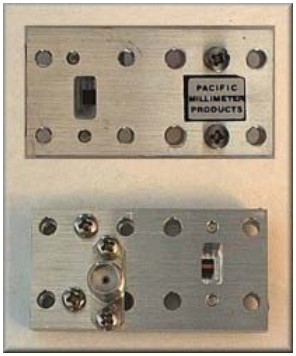
BANDPASS FILTERS

These bandpass filters utilize a suspended stripline design to obtain a very compact configuration. Applications include wideband receiver input preselection and output filtering of frequency multiplied RF power sources. Model 5510 and 9010 filters are often used to extend the dynamic range of scalar network analyzer measurements made using Hewlett-Packard 83557A and 83558A millimeter wave source modules. Many frequencies and bandwidths are available. A partial list is shown below, and custom designs can be accommodated.

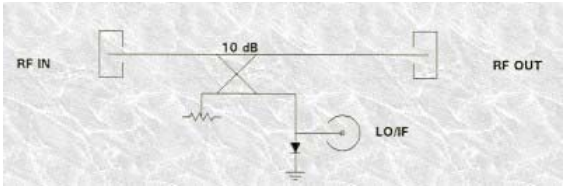
MODEL	PASSBAND (WAVEGUIDE)	PASSBAND INSERTION LOSS	40 dB REJECTION FREQUENCIES	SIZE (INCHES)
5510 **5510H**	55-65 GHz (WR-15)	2.0 dB maximum	48 GHz min 70 GHz max	1.35 X .75 X .18
6530	65-95 GHz (WR-12)		105 GHz max	1.25 X .75 X .18
7010	70-80 GHz (WR-12)		64 GHz min 86 GHz max	
9010 **9010H**	90-100 GHz (WR-10)		84 GHz min 106 GHz max	1.25 X .75 X .18

(Model designations ending in H are gold plated)

INTEGRATED COUPLER/HARMONIC MIXERS



These waveguide bandwidth integrated coupler/mixers are designed to allow phase locking or signal monitoring of compact millimeter wave systems. RF inputs and outputs are on opposite sides of a thin wafer to obtain minimum insertion length. These devices use silicon Schottky barrier beam-lead diodes on a rugged stripline circuit. Nominal coupling value is 10 dB. For coupling values greater than 10 dB, non-directional coupler models are available (consult factory).



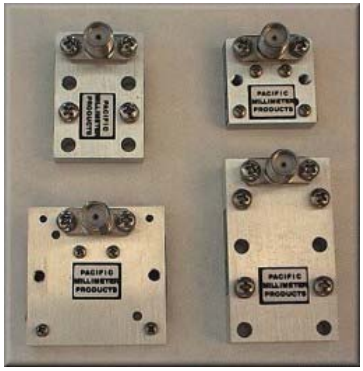
SPECIFICATIONS

MODEL	FREQUENCY (GHz)	INSERTION LOSS	Minimum detectable signal* (dBm)	WAVEGUIDE	FLANGE COMPATIBILITY	DIMENSIONS (INCHES)
CKaM	26.5-40	2.0 dB MAX. 1.0 dB TYP.	-75	WR-28	UG-599/U	1.6x.82x 24
CQM	33-50		-70	WR-22	UG-383/U	1.9x1.125x.22
CUM	40-60		-68	WR-19	UG383/U (MOD)	1.9x1.125x.22
CVM	50-75		-65	WR-15	UG-385/U	1.5x.75x.2
CEM	60-90		-62	WR-12	UG-387/U	1.5x.75x.2
CWM	75-110		-60	WR-10	UG387/U (MOD)	1.35x.75x.18

LO Power requirement +15 dBm maximum, +6 dBm typical
Bias requirement: See application note MIXER DIPLEXER AND DIODE BIAS. Typically operates self biased with DC return to ground.
LO & IF frequencies to 18 GHz
*Minimum detectable signal in 1 KHz bandwidth, measured with Tektronix 492 or 494 Spectrum Analyzer.

HARMONIC MIXERS

These waveguide bandwidth harmonic mixers are designed for use with spectrum analzyers with diplexers, such as the Tektronix 492 and 494 and the Hewlett-Packard 8555A, 8565A and 8569A. They are also used as phase locking and receiver mixers for antenna measurement systems such as the Scientific Atlanta wide range receivers. When used with an external diplexer*, these harmonic mixers can be used to phase lock millimeter wave sources.
The mixer contains a rugged stripline mounted silicon beam-lead Schottky barrier diode (Models FM and DM use a GaAs diode). The small physical dimensions of these mixers make them ideal for use in lightweight, compact equipment. Two diode, balanced harmonic mixers optimized for even or odd harmonic mixing are also available. Consult factory.



SPECIFICATIONS

MODEL	FREQUENCY (GHz)	Minimum detectable signal (in 1 KHz bandwidth)**	WAVEGUIDE	FLANGE COMPATIBILITY	Dimensions (excluding SMA female connector, inches
KM	18-26.5	-95 dBm	WR-42	UG-595	.875 x 1.5 x .3
KaM	26.5-40	-85 dBm	WR-28	UG-599	.750 x 1.1 x .24
QM	33-50	-80 dBm	WR-22	UG-383	1.125 x 1.125 x .2
UM	40-60	-78 dBm	WR-19	UG383 (MOD)	1.125 x 1.125 x .2
VM	50-75	-75 dBm	WR-15	UG-385	.75 x .75 x .24
EM	60-90	-72 dBm	WR-12	UG-387	.75 x .75 x .23
WM	75-110	-70 dBm	WR-10	UG387 (MOD)	.75 x .75 x .21
FM	90-140	-68 dBm	WR-8	UG-387 (MOD)	.75 x .75 x .2
DM	110-170	-64 dBm	WR-6	UG-387 (MOD)	.75 x .75 x .21

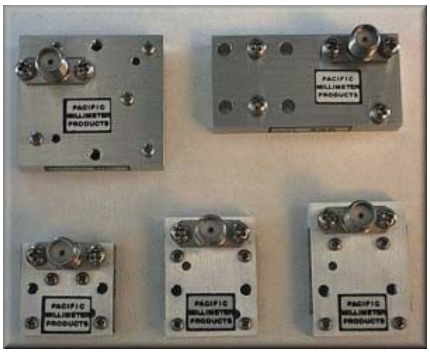
*LO/IF diplexers are available for IF & LO ranges shown below:

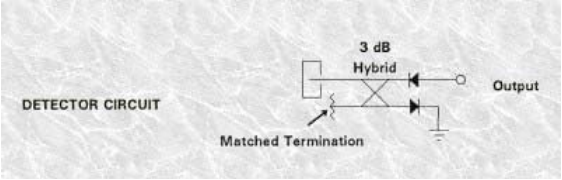
Diplexer model #	IF range	LO range	Diplexer Outline Drawing
MD1A	DC-1 GHz	1.8-7.5 GHz	
MD2A	DC-1 GHz	5-20 GHz	
MD4A	DC-2.5 GHz	5-20 GHz	

**Minimum detectable signal measured with Tektronix 492 or 494 Spectrum Analyzer
LO and IF frequencies to 18 GHz
LO power requirement +15 dBm maximum, +6 dBm typical
Total RF + LO power input 100 milliwatts maximum
Bias requirements: See application note MIXER DIPLEXER AND DIODE BIAS. Typically operates self biased with DC return to ground.
For recommended self bias circuit for models FM and DM, see application note SELF BIAS CIRCUIT FOR GaAs DIODE MIXERS.

BROADBAND DETECTORS

These waveguide bandwidth detectors use silicon beam lead diodes on a planar stripline circuit to obtain an extremely rugged and compact device. Most millimeter wave broadband detectors have very poor VSWR due to the difficulty in obtaining a good wideband impedance match to the diode. To overcome this problem, these detectors utilize two diodes and an internal matched termination and 3 dB hybrid as shown below. This circuit allows a VSWR of 2.0 or better over a full waveguide bandwidth for most of these detectors. Detectors for waveguides WR-8 and smaller use a single zero bias GaAs diode. The high sensitivity zero bias GaAs diodes can also be special ordered for use at lower frequencies when highest sensitivity is required.





SPECIFICATIONS

MODEL	FREQUENCY (GHz)	SENSITIVITY (mV/mW)min*	WAVEGUIDE	FLANGE COMPATIBILITY	DIM. (INCHES)	FLATNESS (+/- dB max)	VSWR (MAX)
KaD	26.5-40	1000	WR-28	UG-599/U	.8x.16x.24	2	2
QD	33-50	750	WR-22	UG-383/U	1.125x1.225x.2	2	2
UD	40-60	750	WR-19	UG-383/U (MOD)	1.125x1.125x.2	2	2
VD VDH	50-75	450	WR-15	UG-385/U	.8x1.1x.2 .8x1.1x.3	2	2
ED	60-90	250	WR-12	UG-387/U	.75x.1.0x.2	2	2
WD WDH	75-110	250	WR-10	UG-387/U (MOD)	.75x.98x.2 75x.98x.31	2	2.5
FD**	90-140	1100 (TYP)	WR-8	UG-387/U (MOD)	.75x.75x.2		
DD**	110-170	900 (TYP)	WR-6	UG-387/U (MOD)	.75x.75x.2		
GD**	140-220	250 (TYP, estimated)	WR-5	UG-387/U (MOD)	.75x.85x.2		
YD**	170-260	200 (TYP, estimated)	WR-4	UG-387/U (MOD)	.75x.75x.2		
HD**	220-325	150 (TYP, estimated)	WR-3	UG-387/U (MOD)	.75x.75x.2		

Maxumum RF input power 100 mW.

[1] Models VDH and WDH are ruggedized, gold plated detectors.

* Detector sensitivity is measured into 1 Megohm load and is measured in the square law region.

** These detectors are single diode detectors using a zero bias GaAs planar doped barrier diode. Sensitivities are estimated above 140 GHz due to lack of calibrated power sensors above 140 GHz.

A detector adapter (model DA) is available to match these detectors to the square law saturation characteristics of the Wiltron 560 and 562 Scalar Network Analyzers. These detectors also can be used with HP 8757 scalar network analyzers utilizing HP 85025C detector adapters.