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**SCALAR NETWORK ANALYZER**



This picture is for reference only

- ◆ Automated scalar measurements from 110 to 325 GHz
- ◆ PC based Instrument
- ◆ ETHERNET programmable

The **R2XXE** Scalar Network Analyzers provide both manual and automated VSWR, insertion and return losses' measurements in rectangular waveguide bands from 110 to 325 GHz. The system consists of the G44XE sweep generator, frequency doubler, waveguide reflectometer, network analyzer.

Model number	Frequency range, GHz	Frequency accuracy, %	VSWR meas range	VSWR meas accuracy, %	Transmission loss meas. range, dB	Transmission loss meas. accuracy, dB
<b>R2402E</b>	110 - 170	±0.2	1.1-5.0	±(5K+6) for K=1.1-2.0	0-35	±(0.6+0.06A) A=0-25 dB;
<b>R24015E</b>	150 - 220	±0.2	1.1-5.0	±(5K+6) for K=1.1-2.0	0-30	±(0.6+0.06A) A=0-25 dB;
<b>R26015E</b>	150 - 220	±10 <sup>-7</sup>	1.1-5.0	±(5K+6) for K=1.1-2.0	0-60	±(0.6+0.06A) A=0-25 dB;
<b>R26010E (not available)</b>	220 - 325	±10 <sup>-7</sup>	1.1-5.0	±(5K+6) for K=1.1-2.0	0-60	±(0.6+0.06A) A=0-40 dB;
Operating temperature range			5-40 °C			
Mains power source requirements:			220±20 V, 50-60 Hz			
Power consumption			400 V·A			
Remote programming			ETHERNET			

**DIRECT READING ATTENUATOR**



The **DA-XXE** Millimeter-Wave Direct Reading Attenuators are rotary-vane type attenuators. The value of attenuation is determined by the angle of rotation of a resistive film with respect to the waveguide. Attenuation level is not frequency dependent within the operation frequency range.

The Attenuators are provided in waveguide bands between 110 GHz and 325 GHz.

Model number	Frequency range, GHz	Waveguide type	Waveguide flange	Attenuation accuracy	Insertion loss, dB, max	VSWR, max
<b>DA-02E</b>	110 - 170	WR - 06	UG 387/UM	±0.2dB for A=0÷10dB; ±0.02·A for A=10÷50dB; ±[1+0.08·(A-50)]dB for A=50÷60dB, where A is attenuation in dB.	3.0 (110-114 GHz) 2.5 (114-120 GHz) 2.0 (120-170 GHz)	1.3 (110-114 GHz) 1.2 (114-170 GHz)
<b>DA-015E</b>	140 - 220	WR - 05	UG 387/UM	±0.3dB for A=0÷10dB; ±0.02·A for A=10÷40dB;	3.0	1.3
<b>DA-010E</b>	220 - 325	WR - 03	UG 387/UM	±0.4dB for A=0÷10dB; ±0.06·A for A=10÷40dB;	≤5.0 @ 220-230 GHz ≤4.0 @ 230-325 GHz	1.55
Attenuation range:		0 ÷ 60 dB for WR-6 model; 0 ÷ 40 dB for WR-5 model; 0 ÷ 40 dB for WR-3 model.				
Power rating (CW, max):		35 mW for WR-06 model; 20 mW for WR-05 model; 10 mW for WR-03 model.				

**DIRECT READING ATTENUATOR with remote control**



- ◆ High resolution
- ◆ High accuracy

The **DAD-XXE** Millimeter-Wave Direct Reading Attenuators are rotary-vane type attenuators. The value of attenuation is determined by the angle of rotation of a resistive film with respect to the waveguide. Attenuation level is not frequency dependent within the operation frequency range.

The Attenuators are provided in waveguide bands between 110 GHz and 325 GHz.

The Attenuators can be controlled locally, via manual front panel controls, and remotely via USB interface.

Model number	Frequency range, GHz	Waveguide type	Waveguide flange	Attenuation accuracy	Insertion loss, dB, max	VSWR, max
<b>DA-02E</b>	110 - 170	WR - 06	UG 387/UM	±0.2dB for A=0÷10dB; ±0.02·A for A=10÷50dB; ±[1+0.08·(A-50)]dB for A=50÷60dB, where A is attenuation in dB.	3.0 (110-114 GHz) 2.5 (114-120 GHz) 2.0 (120-170 GHz)	1.3 (110-114 GHz) 1.2 (114-170 GHz)
<b>DA-015E</b>	140 - 220	WR - 05	UG 387/UM	±0.3dB for A=0÷10dB; ±0.02·A for A=10÷40dB;	3.0	1.3
<b>DA-010E</b>	220 - 325	WR - 03	UG 387/UM	±0.4dB for A=0÷10dB; ±0.06·A for A=10÷40dB;	≤5.0 @ 220-230 GHz ≤4.0 @ 230-325 GHz	1.55

Attenuation range:                    0 ÷ 60 dB for WR-6 model  
     0 ÷ 40 dB for WR-5 model  
     0 ÷ 40 dB for WR-3 model

Power rating (CW, max):            35 mW for WR-06 model;  
     20 mW for WR-05 model;  
     10 mW for WR-03 model.

**CALORIMETRIC POWER METER**



- **High Accuracy**
- **High Sensitivity**
- **Automated Measurements**
- **Full Waveguide Frequency Band**

The Calorimetric Power Meter M1-25M/XX is a high precision broadband calorimetric microwave power measurement instrument operating in sub-millimeter wave range.

The Instrument has a waveguide type Calorimetric Sensor for corresponding frequency ranges. The sensor has a self compensation transistor transducers that substitute the absorbed microwave power with direct current power. The five sensors' models provide accurate absolute power measurement in single mode waveguides, and one – in multimode Metal-Dielectric Waveguide (MDW). The last model could be a priority for terahertz (THz) physics and technology.

The Calorimetric Power Meter M1-25M provides PC connection via RS-232 interface.

Sensor Model	Frequency range, GHz	Input Waveguide Port	Power measurement range, mW	Power measurement error	VSWR, max
<b>M1-25M/025E</b>	90 - 140	WR-08, UG387/UM	0,020-20	3%+2μW	1.1
<b>M1-25M/02E</b>	110 - 170	WR-06, UG387/UM	0,020-20	3%+2μW	1.1
<b>M1-25M/015E</b>	140 - 220	WR-05, UG387/UM	0,020-20	5%+2μW	1.15
<b>M1-25M/012E</b>	170 - 260	WR-04, UG387/UM	0,020-20	5%+2μW	1.2
<b>M1-25M/010E</b>	220 - 325	WR-03, UG387/UM	0,020-20	5%+2μW	1.25
<b>M1-25M /008E</b>	260 – 400	WR-2.8 (0,711 x 0,356)	0,020-20	10%+2μW	-
<b>M1-25M /006E</b>	325 – 500	WR-2.2 (0,559 x 0,279)	0,020-20	10%+2μW	-
<b>M1-25M /MDW</b>	170 - 2500	10 x 10 (mm)	0,020-20	10%+2μW	-

**WAVEGUIDE SWITCH**

- Precision flanges (optional)
- Low VSWR
- Low insertion losses



These pictures are for reference only.

Waveguide Switches are used to make switchable connections between waveguide components or networks in waveguide systems without connecting or disconnecting of flanges. Various structures and combinations are available on special order. Waveguide Switch operates over the full waveguide frequency band (within 110-325 GHz) and can be remotely controlled via USB interface. Manually controlled waveguide switch versions are also available.

Model number	Frequency range, GHz	Waveguide size	VSWR	Insertion loss, dB	Isolation, dB
WS-02E	110 - 170	WR-6	1,1	0.7	50
WS-015E	140 - 220	WR-5	1,1	1.0	50
WS-012E	170 - 260	WR-4		1.3	50
WS-010E	220 - 325	WR-3		1.5	50

**WAVEGUIDE TAPERED TRANSITION**



- Low VSWR
- Low insertion losses

Waveguide Tapered Transitions are used to make low VSWR connections of various size waveguides in one network. Lengths and ports' combinations are available on special order. Transitions are available from 110 to 750 GHz range.

Model number	W/G Port 1	W/G Port 2
WTT-02E/015E	WR-6, UG387/UM	WR-5, UG387/UM
WTT-015E/014E	WR-5, UG387/UM	WR-4, UG387/UM
WTT-012E/010E	WR-4, UG387/UM	WR-3, UG387/UM
WTT-010E/008E	WR-3, UG387/UM	WR-2.8, UG387/UM
WTT-008E/006E	WR-2.8, UG387/UM	WR-2.2, UG387/UM
WTT-006E/005E	WR-2.2, UG387/UM	WR-1.9, UG387/UM
WTT-005E/004E	WR-1.9, UG387/UM	WR-1.5, UG387/UM



**RECTANGULAR TO CIRCULAR WAVEGUIDE TAPERED TRANSITION**



- Low VSWR
- Low insertion losses

Rectangular to Circular Waveguide Tapered Transitions are used to make low VSWR connections of various sizes rectangular with circular waveguides in one network. Custom combinations of rectangular and circular ports are available on special order. Transitions are available from 110 to 750 GHz range.

Model number	W/G Port 1	W/G Port 2
WRCT-02E	WR-6, UG387/UM	Ø1.5-1.85 mm*, UG387/UM
WRCT-015E	WR-5, UG387/UM	Ø1.14-1.47 mm*, UG387/UM
WRCT-012E	WR-4, UG387/UM	Ø1.25 mm, UG387/UM
WRCT-010E	WR-3, UG387/UM	Ø0.99 mm, UG387/UM

\*circular waveguide diameter can be selected depending on the required operation frequency band

**RECTANGULAR HORN ANTENNA**



- Low VSWR
- Custom gain

Rectangular Horn Antennas are used to radiate signals into opened air or to receive radio signals which should be introduced into waveguide network. Standard Gain Horns (SGH) of 24 dBi gain, as well as length and aperture combinations are available on special order depending on required specifications (gain, pattern diagram). Antennas are available over the full waveguide frequency band in 110-325 GHz.

Model number	Frequency range, GHz	Waveguide size
RHA-02E	110 - 170	WR-6
RHA -015E	140 - 220	WR-5
RHA -012E	170 - 260	WR-4
RHA -010E	220 - 325	WR-3

**CONICAL HORN ANTENNAS**



- Low VSWR
- Custom gain

Conical (or circular) Horn Antennas are used to radiate signals into opened air or to receive radio signals which should be introduced into waveguide network. Standard Gain Horns (SGH) of 21 dBi gain, as well as length and aperture combinations are available on special order depending on required specifications (gain, pattern diagram). Antennas are available over the full waveguide frequency band in 110-325 GHz.

Model number	Frequency range, GHz	Waveguide size
CHA-02E	110 - 170	Ø1.5-1.85 mm*, UG387/UM
CHA -015E	140 - 220	Ø1.14-1.47 mm*, UG387/UM
CHA -012E	170 - 260	Ø1.25 mm, UG387/UM
CHA -010E	220 - 325	Ø0.99 mm, UG387/UM

\*circular waveguide diameter can be selected depending on the required operation frequency band

**STRAIGHT WAVEGUIDE SECTION**



- Low VSWR
- Low insertion losses

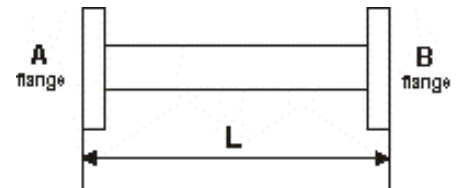
Straight sections are used to make connections between components in waveguide systems. Various lengths are available on custom request. Straight sections operate over the full waveguide frequency band (within 110-750 GHz). **Flanged waveguide tube**, rigid flanged waveguide tube or **split-block** design can be ordered on request.

Model number	Frequency range, GHz	Waveguide size
SW-02E	110 - 170	WR-6
SW-015E	140 - 220	WR-5
SW-012E	170 - 260	WR-4
SW-010E	220 - 325	WR-3
SW-008E	260 - 400	WR-2.8 (0.711x0.356 mm)
SW-006E	325 - 500	WR-2.2 (0.559x0.279 mm)
SW-005E	400 - 600	WR-1.9 (0.48x0.24 mm)
SW-004E	500 - 750	WR-1.5 (0.38x0.19 mm)

**ORDER INFORMATION**

- XX Operation range wave length, mm
- L Waveguide length, mm
- Finish code (flanges):
- F S – silver
- gold

G



SW-XXE/L-F

**Example: SW-02E/50-S**

Straight section for 110 - 170 GHz frequency range, 50mm length, silver plated.

**BEND WAVEGUIDE SECTION**



**Low VSWR; Low insertion losses**

E- or H-Plane Bends are essential parts of every waveguide systems. Standard E- or H-Plane bends are available with 90° angles. Ask us for other angles if required. c

Model number	Frequency range, GHz	Waveguide size
BE90D-02E BH90D-02E	110 - 170	WR-6
BE90D-015E BH90D-015E	140 - 220	WR-5
BE90D-012E BH90D-012E	170 - 260	WR-4
BE90D-010E BH90D-010E	220 - 325	WR-3
BH90D-008E	260 - 400	WR-2.8
BH90D-006E	325 - 500	WR-2.2 (0.56x0.28 mm)
BH90D-005E	400 - 600	WR1.9 (0.48x0.24 mm)
BH90D-004E	500 - 750	WR-1.5 (0.38x0.19 mm)

**ORDERING INFORMATION**

XX	Operation range wave length, mm	
L	Dimensions, (mm)	
E	E -plane bend	
H	H – plane bend	
F	Finish (flanges): S – silver G - gold	
YY	Degrees 90°, 45°, 30°, 15°, (and others)	<b>BEYYD-XXE/L-F</b>
		<b>Example: BE90D-02E/50-S</b>
		E-Plane Bend for 110 - 170 GHz frequency range, 50mm length, 90° angle, silver plated.

**TWIST WAVEGUIDE SECTION**



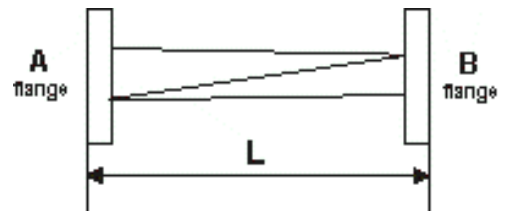
- Low VSWR
- Low insertion losses

Twist sections are used for connection of waveguide networks channels, turned on various angles. Twists with different angles are available on special request. Twist sections are available for the waveguides in the frequency range from 110 to 325 GHz.

Model number	Frequency range, GHz	Waveguide size
TW90D-02E	110 - 170	WR-6
TW90D-015E	140 - 220	WR-5
TW90D-010E	220 - 325	WR-3

**ORDERING INFORMATION**

- XX Operation range wave length, mm
- L Length, (mm)
- YY Twist angle  
90°, 45°, (and others)
- F Finish (flanges):  
S – silver  
G - gold



**TWYYD-XXE/L-F**

**Example: TW90D-012E/25-S**

Twist for 220 - 325 GHz frequency range, 25mm long, 90° twist angle, silver plated.

**DIRECTIONAL COUPLER**



- **High directivity**
- **Minimum coupling variation**
- **Low insertion loss**
- **Low VSWR**

The **DCZ-XXE/Y** directional couplers are used for extracting or introducing RF power flow in a transmission line without distortion of signal characteristics. The directional couplers are available in 3, 6, 10, 15, 20 & 30 dB coupling values and 25 - 35 dB directivities (for 110-325 GHz). 4-ports directional couplers are available in bi-directional (BDC4-XXE/Y) and dual-directional (DDC4-XXE/Y) configurations.

Model number	Frequency range, GHz	Waveguide size	Main line VSWR	Secondary line VSWR	Insertion loss, dB	Coupling accuracy, %
DCZ-02E/Y	110 - 170	WR-6	1,15	1,2	2,5	10
DCZ-015E/Y	140 - 220	WR-5	1.15	1.2	2,5	12
DCZ-012E/Y	170 - 260	WR-4				12
DCZ-010E/Y	220 - 325	WR-3				15
DCZ-008E/Y	260 - 400	WR-2.8				15
DCZ-006E/Y	325 - 500	WR-2.2				20
Coupling flatness	±0.7 dB for WR-06 model, ±1.0 dB for WR-5 & WR-4 models; ±1.2 dB for WR-3 model; ±1.5 dB for WR-2.8 & RW-2.2 models.					

\* ask for directivity specification in 140-325 GHz frequency range

**ORDERING INFORMATION**

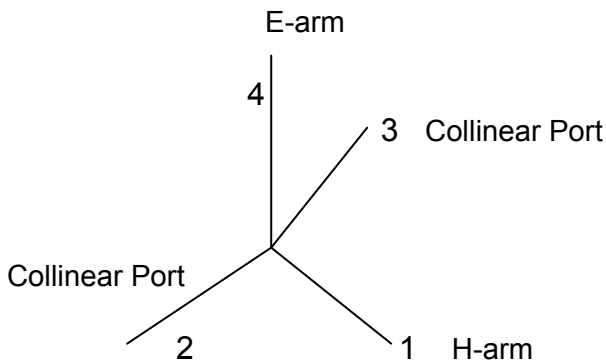
XX	Operation range wave length, mm	
Z	3 – 3 ports 4 – 4 ports	
Y	Coupling value 3, 6, 10, 15, 20 dB	
F	Finish: S - silver G - gold	<b>DCZ-XXE/Y-F</b>
		Example: DC3-012E/20-S
		3-ports Directional Coupler for 220 ÷ 325 GHz frequency range, 20dB coupling value, silver plated.

**MAGIC TEE**



- Low insertion losses
- High matching / high isolation
- Low power split unbalance

The **MHT-XXE** Magic Tee (Matched Hybrid Coupler) for millimeter wave is matched power divider for variety of applications (general purpose power splitters, power combining, phase measurement circuits, phase / frequency discriminators). The **MHT-XXE** Magic Tee Hybrid Couplers are available in waveguide bands between 110 and 220 GHz. These couplers are four-port transmission line components with a port configuration as shown in figure below. Operation bandwidth is limited to 20÷90% of waveguide operation frequency range depending on performance specifications.



$$S_{24} = -S_{34} \quad S_{22} = S_{33}$$

$$S_{24} = S_{34} \quad S_{14} = 0$$

Model number	Frequency range, GHz	Waveguide size	Insertion loss, dB	Isolation, (min) dB E-H/Col	VSWR max		Balance, dB
					E-arm	H-arm	
MHT-02E	110 - 170	WR - 6	1,5	30/20	1,6	1,6	±0,5
MHT-015E	140 - 220	WR - 5					

The above presented specifications can be reached in 60-90% of the full waveguide frequency band.

**ORDERING INFORMATION**

XX Operation wave length range, mm

F Finish:  
S – silver  
G - gold

**MHT-XXE/F**

**Example: MHT-02E/S**  
Hybrid coupler  
for 110 - 170 GHz frequency range,  
silver plated.



**FIXED ATTENUATOR**



- Full waveguide bandwidth
- High attenuation accuracy

The **FA-XXE** Fixed Attenuators are used to enter attenuation into the waveguide network or isolation between waveguide components. The attenuators are based on the submillimeter wave power coupling technology from input to secondary waveguide channel. 3, 6, 10, 15, 20, 30 dB attenuators are available in waveguide bands from 110 through 500 GHz.

Model	Frequency range, GHz	Waveguide size	Attenuation, dB
FA-02E	110 - 170	WR - 6	3, 6, 10, 20, 30
FA-015E	140 - 220	WR - 5	3, 6, 10, 20
FA-012E	170 - 260	WR - 4	3, 6, 10, 20
FA-010E	220 - 325	WR - 3	3, 6, 10, 20
FA-008E	260 - 400	WR-2.8	
FA-006E	325 - 500	WR-2.2	

**ORDERING INFORMATION**

XX      Operation range wave length, mm

F      Finish:  
S – silver  
G - gold

A      Attenuation, dB

**FA-XXE/A-F**

**Example: FA-015E/15-S**

15 dB fixed attenuator for 140 - 220 GHz frequency range, silver plated.

**VARIABLE ATTENUATOR**



- **Wide attenuation range, Low VSWR, Low insertion losses, Full waveguide bandwidth**

The **VA-XXE** Variable Attenuators are used for level-setting. The Attenuators consist of a waveguide section with a resistive film evaporated on the mica surface, which can be inserted into or removed from the waveguide channel.

The Attenuators has 0÷30 dB typical attenuation range. The **VA-XXE** Attenuators are available in waveguide bands between 110 GHz and 325 GHz. Versions with scale or with micrometric screw are available.

Model number	Frequency range, GHz	Waveguide size	Attenuation range, dB
VA-02E	110 - 170	WR - 06	0÷30
VA-015E	140 - 220	WR - 05	0÷30
VA-012E	170 - 260	WR - 04	0÷30
VA-010E	220 - 325	WR - 03	0÷30

**ORDERING INFORMATION**

XX      Operation wave length range, mm

F      Finish:  
S – silver  
G - gold

**VA-XXE/F**

**Example: VA-02E/S**

Variable attenuator for 110 - 170 GHz frequency range, silver plated.

**VARIABLE PHASE SHIFTER**



- Wide phase shifting range,
- Low VSWR,
- Low insertion losses,
- Full waveguide bandwidth.

This picture is for reference only

The **VPS-XXE** Variable Phase Shifters are used to introduce phase variation for research and tuning of the waveguide networks. The Phase Shifter consists of waveguide section with a dielectric vane, which can be inserted into or removed from the waveguide channel by micrometer screw.

The Phase Shifters has 0 ÷180° minimum phase shift range. The **VPS-XXE** Phase Shifters are available in waveguide bands between 110 GHz and 325 GHz.

Model number	Frequency range, GHz	Waveguide size	Phase shift range, deg., min	VSWR	Insertion loss, dB
VPS-02E	110 - 170	WR - 06	0÷180°	1,2	1,0
VPS-015E	140 - 220	WR - 05	0÷180°		
VPS-012E	170 - 260	WR - 04	0÷180°		
VPS-010E	220 - 325	WR - 03	0÷180°		

**ORDERING INFORMATION**

XX      Operation wave length range, mm

F      Finish:  
S – silver  
G - gold

**VA-XXE/F**

**Example: VA-02E/S**

Variable attenuator for 110 - 170 GHz frequency range, silver plated.

**FIXED SHORT**



**Fixed waveguide short**

The **FS-XE** Fixed Waveguide Shorts are designed to create the shorts circuit condition in waveguide network.

The **FS-XE** can be provided for standard UG387/UM flange for all waveguide bands between 110 and 325 GHz.

Model number	Frequency range, GHz	Waveguide size	VSWR
FS-02E	110 - 170	WR - 6	100
FS-015E	140 - 220	WR - 5	100
FS-012E	170 - 260	WR - 4	100
FS-010E	220 - 325	WR - 3	100

**ORDERING INFORMATION**

XX      Operation wave length range, mm

**FS-XXE/F**

F      Finish:  
S – silver  
G- gold

**Example: FS-02E/S**

Fixed short  
for 110 - 170 GHz frequency range,  
silver plated.

**TUNABLE SHORT**



**TS-XE** Tunable Shorts are designed to create the shorts circuit conditions with variable phase in waveguide networks.

The **TS-XE** Tunable Waveguide Shorts are movable shorts, adjustable through at least 0.6 of a wavelength at the low frequency end of the band. The **TS-XE** Short consists of movable non-contacting choke plunger inside a straight section of a waveguide.

**TS-XE** Tunable Shorts are provided in waveguide bands between 110 and 325 GHz.

Model number	Frequency range, GHz	Waveguide size	VSWR
TS-02E	110 - 170	WR - 6	20
TS-015E	140 - 220	WR - 5	20
TS-012E	170 - 260	WR - 4	15
TS-010E	220 - 325	WR - 3	10

**ORDERING INFORMATION**

XX      Operation wave length range, mm

F      Finish:  
S – silver  
G- gold

**TS-XXE/F**

**Example: TS-02E/S**

Tunable short  
for 110 - 170 GHz frequency range,  
silver plated.

**MATCHED LOAD**



**ML-XXE** fixed Matched Load (or **Termination**) consists of tapered absorber inside a waveguide section, which reflection is minimized within the operation frequency range.

The **ML-XXE** Terminations are provided in waveguide bands between 110 GHz and 325 GHz.

Model number	Frequency range, GHz	Waveguide size	VSWR
ML-02E	110 – 170	WR - 6	1,05
ML-015E	140 - 220	WR - 5	1.07
ML-012E	170 – 260	WR - 4	1.1
ML-010E	220 - 325	WR - 3	1.2

**ORDERING INFORMATION**

XX      Operation wave length range, mm

F      S – silver  
 G - gold

**ML-XXE/F**

**Example: ML-02E/S**  
 Matched Load for 110 - 170 GHz frequency range, silver plated.

**SLIDING MATCHED LOAD**



The **SML-XXE** Sliding Matched Loads consist of tapered absorber inside a waveguide section and utilize a micrometer tuning mechanism, allowing the microwave absorber to be positioned within the waveguide while maintaining a minimum VSWR.

**SML-XXE** Sliding Matched Loads can be provided in waveguide bands between 110 GHz and 325 GHz.

Model number	Frequency range, GHz	Waveguide size	VSWR
SML-02E	110 – 170	WR - 6	1,05
SML-015E	140 - 220	WR - 5	1.07
SML-012E	170 – 260	WR - 4	1.1
SML-010E	220 - 325	WR - 3	1.2

**ORDERING INFORMATION**

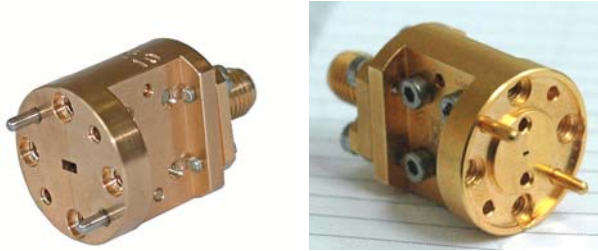
XX Operation wave length range, mm

**ML-XXE/F**

F S – silver  
G - gold

**Example: SML-02E/S**  
Sliding Matched Load  
for 110 - 170 GHz frequency range,  
silver plated.

**DETECTOR MOUNT**



- High sensitivity
- Millimeter and sub-millimeter wave detection
- Full waveguide bandwidth

The **DM-XXE** Detector Mounts are broadband devices designed for operation in millimeter and submillimeter wave ranges. The Detectors are optimized for broadband performance and are used in mm-wave test setups to detect, monitor and measure **modulated** signals.

The **DM-XXE** Detector Mounts use Schottky Barrier packaged diodes and are provided in five waveguide bands between 110 GHz and 220 GHz.

Model number	Frequency range, GHz	Waveguide size	Sensitivity, mV/mW	Maximum input, mW	Sensitivity flatness (Smax / Smin)
DM-02E	110 - 170	WR - 6	100	15	3.0
DM-015E	140 - 220	WR - 5	100	15	4.0

**ORDERING INFORMATION**

XX      Operation wave length range, mm

F      Finish:  
S – silver  
G - gold

**DM-XXE/F**

**Example: DM-02E/S**

Detector mount for 110 - 170 GHz frequency range, silver plated.



**BAND PASS, HIGH PASS AND LOW PASS WAVEGUIDE FILTERS**



- Custom design pass/rejection bands;
- Low Insertion Loss;
- Frequency Up to 400 GHz

High-Pass (HPF series), Low Pass (LPF series, corrugated) and Band Pass (BPF series resonator, corrugated or waffle type) Filters are available, providing desired skirt selectivity and rejection levels with minimum insertion loss in the pass band. The filters are offered in all standard waveguide bands covering 110 to 400 GHz depending on our possibility to fulfil the customers' requirements.

Dimensions of filters depends on required specifications. Please contact us for any questions.

Filter Model	Frequency range, GHz	Waveguide Ports
BPF-025E	90 - 140	WR-08, UG387/UM
BPF-02E	110 - 170	WR-06, UG387/UM
BPF-015E	140 - 220	WR-05, UG387/UM
BPF-012E	170 - 260	WR-04, UG387/UM
BPF-010E	220 - 325	WR-03, UG387/UM

**All filters are produced according to customers' requirements.**

**ORDERING INFORMATION**

XX	Operation range wave length, mm	BPF-XXE/S-F/P Example: BPF-015E/135-150S
S-F	Start-Finish frequencies of the pass band	Band Pass filter with the pass band of 135 - 150 GHz frequency range, silver plated.
P	Plating: S – silver G - gold	

GENERAL REFERENCE INFORMATION

Relative (dBm) vs absolute (W) power

Power							
dBm	$\mu$ W	dBm	$\mu$ W	dBm	$\mu$ W	dBm	W
-60	0.001	-30	0.001	0	1	30	1
-59	0.00126	-29	0.00126	1	1.2589	31	1.2589
-58	0.00158	-28	0.00158	2	1.5849	32	1.5849
-57	0.00200	-27	0.00200	3	1.9953	33	1.9953
-56	0.00251	-26	0.00251	4	2.5119	34	2.5119
-55	0.00316	-25	0.00316	5	3.1623	35	3.1623
-54	0.00398	-24	0.00398	6	3.9811	36	3.9811
-53	0.00501	-23	0.00501	7	5.0119	37	5.0119
-52	0.00361	-22	0.00631	8	6.3096	38	6.3096
-51	0.00794	-21	0.00794	9	7.9433	39	7.9433
-50	0.01	-20	0.01	10	10	40	10
-49	0.01259	-19	0.01259	11	12.589	41	12.589
-48	0.01585	-18	0.01585	12	15.849	42	15.849
-47	0.01995	-17	0.01995	13	19.953	43	19.953
-46	0.02512	-16	0.02512	14	25.119	44	25.119
-45	0.03162	-15	0.03162	15	31.623	45	31.623
-44	0.03981	-14	0.03981	16	39.811	46	39.811
-43	0.05012	-13	0.05012	17	50.199	47	50.199
-42	0.06310	-12	0.06310	18	63.096	48	63.096
-41	0.07943	-11	0.07943	19	79.433	49	79.433
-40	0.1	-10	0.1	20	100	50	100
-39	0.12589	-9	0.12589	21	125.89	51	125.89
-38	0.15849	-8	0.15849	22	158.49	52	158.49
-37	0.19953	-7	0.19953	23	199.53	53	199.53
-36	0.25119	-6	0.25119	24	251.19	54	251.19
-35	0.31623	-5	0.31623	25	316.23	55	316.23
-34	0.39811	-4	0.39811	26	398.11	56	398.11
-33	0.50119	-3	0.50119	27	501.19	57	501.19
-32	0.63096	-2	0.63096	28	630.96	58	630.96
-31	0.79433	-1	0.79433	29	794.33	59	794.33
-30	1	0	1	30	1000	60	1000

GENERAL REFERENCE INFORMATION

**Absolute (W) vs relative (dBm) power**

		Power					
mW	dBm	mW	dBm	mW	dBm	W	dBm
0.001	-60	0.001	-30	1	0	1	30
0.002	-56.99	0.002	-26.99	2	3.0103	2	33.010
0.003	-55.23	0.003	-25.23	3	4.7712	3	34.771
0.004	-53.98	0.004	-23.98	4	6.0206	4	36.021
0.005	-53.01	0.005	-23.01	5	6.9897	5	36.990
0.006	-52.22	0.006	-22.22	6	7.7815	6	37.782
0.007	-51.55	0.007	-21.55	7	8.4510	7	38.451
0.008	-50.97	0.008	-20.97	8	9.0309	8	39.031
0.009	-50.46	0.009	-20.46	9	9.5424	9	39.542
0.01	-50	0.01	-20	10	10	10	40
0.02	-46.99	0.02	-16.99	20	13.010	20	43.010
0.03	-45.23	0.03	-15.23	30	14.771	30	44.771
0.04	-43.98	0.04	-13.98	40	16.021	40	46.021
0.05	-43.01	0.05	-13.01	50	16.990	50	46.990
0.06	-42.22	0.06	-12.22	60	17.782	60	47.782
0.07	-41.55	0.07	-11.55	70	18.451	70	48.451
0.08	-40.97	0.08	-10.97	80	19.031	80	49.031
0.09	-40.46	0.09	-10.46	90	19.542	90	49.542
0.1	-40	0.1	-10	100	20	100	50
0.2	-36.99	0.2	-6.990	200	23.010	200	53.010
0.3	-35.23	0.3	-5.229	300	24.771	300	54.771
0.4	-33.98	0.4	-3.979	400	26.021	400	56.021
0.5	-33.10	0.5	-3.010	500	26.990	500	56.990
0.6	-32.22	0.6	-2.218	600	27.782	600	57.782
0.7	-31.55	0.7	-1.549	700	28.451	700	58.451
0.8	-30.97	0.8	-0.9691	800	29.031	800	59.031
0.9	-30.46	0.9	-0.4576	900	29.542	900	59.542
1	-30	1	0	1000	30	1000	60

GENERAL REFERENCE INFORMATION

Power ratio in times vs power ratio in dB.

Power ratio (times)	Power ratio (dB)	Power ratio (times)	Power ratio (dB)	Power ratio (times)	Power ratio (dB)
0.001	-30	0.1258	-9	12.589	11
0.00125	-29	0.1584	-8	15.848	12
0.0158	-28	0.1995	-7	19.952	13
0.00199	-27	0.251	-6	25.11	14
0.00251	-26	0.31622	-5	31.6227	15
0.00316	-25	0.3981	-4	39.8107	16
0.00398	-24	0.5011	-3	50.118	17
0.00501	-23	0.6309	-2	63.095	18
0.0063	-22	0.7943	-1	79.4328	19
0.00794	-21	1	0	100	20
0.01	-20	1.258	1	125.89	21
0.01258	-19	1.584	2	158.48	22
0.01584	-18	1.995	3	199.52	23
0.0199	-17	2.511	4	251.1	24
0.0251	-16	3.1622	5	316.22	25
0.03162	-15	3.981	6	398.107	26
0.03981	-14	5.0118	7	501.187	27
0.0501	-13	6.3095	8	630.957	28
0.0631	-12	7.9432	9	794.328	29
0.07943	-11	10	10	1000	30

**GENERAL REFERENCE INFORMATION**

**Standard circular waveguides**  
(IEC & EIA (Electronic Industries Association) version)

Waveguide freq. band	Circular waveguide undersize (L / M / S)	Freq.range, GHz (wave mode TE <sub>01</sub> )	Inner diameter of circular waveguide (inches / mm)
K	Large	17.5 - 20.5	0.455/11.56
	Middle	20.0 - 24.5	0.396/10.06
	Small	24.0 - 26.5	0.328/8.33
Ka	Large	26.5 - 33.0	0.315/8.0
	Middle	33.0 - 38.5	0.250/6.35
	Small	38.5 - 40.0	0.219/5.56
Q	Large	33.0 - 38.5	0.250/6.35
	Middle	38.5 - 43.0	0.219/5.56
	Small	43.0 - 50.0	0.188/4.78
U	Large	40.0 - 43.0	0.210/5.33
	Middle	43.0 - 50.0	0.188/4.78
	Small	50.0 - 60.0	0.165/4.19
V	Large	50.0 - 58.0	0.165/4.19
	Middle	58.0 - 68.0	0.141/3.58
	Small	68.0 - 75.0	0.125/3.18
E	Large	60.0 - 66.0	0.136/3.45
	Middle	66.0 - 82.0	0.125/3.18
	Small	82.0 - 90.0	0.094/2.39
W	Large	75.0 - 88.0	0.112/2.84
	Small	88.0 - 110.0	0.094/2.39
F	Large	90.0 - 115.0	0.089/2.26
	Small	115.0 - 140.0	0.075/1.91
D	Large	110.0 - 140.0	0.073/1.85
	Small	140.0 - 160.0	0.059/1.50
G	Large	140.0 - 180.0	0.058/1.47
	Small	180.0 - 220.0	0.045/1.14
H	—	170.0 - 260.0	0.049/1.25
J	—	220.0 - 325.0	0.039/0.99

**GENERAL REFERENCE INFORMATION**

**Transmitted and reflected power dependence on VSWR**

VSWR	Return loss (dB)	VSWR (dB)	K <sub>ref</sub> voltage	Transmission loss (dB)	Transmitted power (%)	Reflected power (%)	VSWR	Return loss (dB)	VSWR (dB)	K <sub>ref</sub> voltage	Transmission loss (dB)	Transmitted power (%)	Reflected power (%)
1.006	50.00	0.05	0.00	.0000	100.	0.00	1.31	17.45	2.35	0.13	0.08	98.20	1.80
1.01	46.06	0.09	0.00	.0001	100.	0.00	1.32	17.21	2.41	0.14	0.08	98.10	1.90
1.011	45.00	0.10	0.01	.0001	100.	0.00	1.329	17.00	2.47	0.14	0.09	98.00	2.00
1.02	40.09	0.17	0.01	.0004	99.99	0.01	1.33	16.98	2.48	0.14	0.09	97.99	2.01
1.020	40.00	0.17	0.01	.0004	99.99	0.01	1.34	16.75	2.54	0.15	0.09	97.89	2.11
1.03	36.61	0.26	0.01	.0009	99.98	0.02	1.35	18.54	2.61	0.15	0.10	97.78	2.22
1.036	35.00	0.31	0.02	.0014	99.97	0.03	1.36	16.33	2.61	0.15	0.10	97.67	2.33
1.04	34.15	0.34	0.02	.0017	99.96	0.04	1.37	16.13	2.73	0.16	0.11	97.56	2.44
1.045	33.15	0.38	0.02	.0021	99.95	0.05	1.377	16.00	2.78	0.16	0.11	97.49	2.51
1.05	32.26	0.42	0.02	.0026	99.94	0.06	1.38	15.94	2.80	0.16	0.11	97.45	2.55
1.06	30.71	0.51	0.03	.0037	99.92	0.08	1.39	15.75	2.86	0.16	0.12	97.34	2.66
1.065	30.00	0.55	0.03	.0043	99.90	0.10	1.40	15.56	2.92	0.17	0.12	97.22	2.78
1.07	29.42	0.59	0.03	.0050	99.89	0.11	1.41	15.38	2.98	0.17	0.13	97.11	2.89
1.08	28.30	0.67	0.04	.0064	99.85	0.15	1.42	15.21	3.05	0.17	0.13	96.99	3.01
1.09	27.32	0.75	0.04	.0081	99.81	0.19	1.43	15.04	3.11	0.18	0.14	96.87	3.13
1.10	26.44	0.83	0.05	.0099	99.77	0.23	1.433	15.00	3.12	0.18	0.14	96.84	3.16
1.11	25.66	0.91	0.05	.0118	99.73	0.27	1.44	14.88	3.17	0.18	0.14	96.75	3.25
1.119	25.00	0.98	0.06	.0138	99.68	0.32	1.45	14.72	3.23	0.18	0.15	96.63	3.37
1.12	24.94	0.98	0.06	.0139	99.68	0.32	1.46	14.56	3.29	0.19	0.15	96.50	3.50
1.13	24.29	1.06	0.06	.0162	99.63	0.37	1.464	14.50	3.31	0.19	0.16	96.45	3.55
1.135	24.00	1.10	0.06	.0173	99.60	0.40	1.47	14.41	3.35	0.19	0.16	96.38	3.62
1.14	23.69	1.14	0.07	.0186	99.57	0.43	1.48	14.26	3.41	0.19	0.17	96.25	3.75
1.15	23.13	1.21	0.07	.0212	99.51	0.49	1.49	14.12	3.46	0.20	0.17	96.13	3.87
1.152	23.00	1.23	0.07	.0218	99.50	0.50	1.499	14.00	3.51	0.20	0.18	96.02	3.98
1.16	22.61	1.29	0.07	.0239	99.45	0.55	1.50	13.96	3.52	0.20	0.18	96.00	4.00
1.17	22.12	1.36	0.08	.0267	99.39	0.61	1.536	13.50	3.73	0.21	0.20	95.53	4.47
1.173	22.00	1.38	0.08	.0275	99.37	0.63	1.55	13.32	3.81	0.22	0.21	95.35	4.65
1.18	21.66	1.44	0.08	.0297	99.32	0.68	1.577	13.00	3.96	0.22	0.22	94.99	5.01
1.19	21.23	1.51	0.09	.0328	99.25	0.75	1.60	12.74	4.08	0.23	0.24	94.67	5.33
1.196	21.00	1.55	0.09	.0346	99.21	0.79	1.622	12.50	4.20	0.24	0.25	94.38	5.62
1.20	20.83	1.58	0.09	.0360	99.17	0.83	1.65	12.21	4.35	0.25	0.27	93.98	6.02
1.21	20.44	1.66	0.10	.0394	99.10	0.90	1.671	12.00	4.46	0.25	0.28	93.69	6.31
1.22	21.08	1.73	0.10	.0429	99.02	0.98	1.70	11.73	4.61	0.26	0.30	93.28	6.72
1.222	20.00	1.74	0.10	.0436	99.00	1.00	1.725	11.50	4.74	0.27	0.32	92.92	7.08
1.23	19.73	1.80	0.10	.0464	98.94	1.06	1.75	11.29	4.86	0.27	0.34	92.56	7.44
1.24	19.40	1.87	0.11	.0501	98.85	1.15	1.785	11.00	5.03	0.28	0.36	92.06	7.94
1.25	19.08	1.94	0.11	.0540	98.77	1.23	1.80	10.88	5.11	0.29	0.37	91.84	8.16
1.253	19.00	1.96	0.11	.0550	98.74	1.26	1.851	10.50	5.35	0.30	0.41	91.09	8.16
1.26	18.78	2.01	0.12	.0579	98.68	1.32	1.90	10.16	5.58	0.31	0.44	90.37	9.63
1.27	18.49	2.08	0.12	.0619	98.59	1.41	1.925	10.00	5.69	0.32	0.46	90.00	10.00
1.28	18.22	2.14	0.12	.0660	98.49	1.51	2.00	9.54	6.02	0.33	0.51	88.89	11.11
1.288	18.00	2.20	0.13	.0694	98.42	1.58	2.50	7.36	7.96	0.43	0.88	81.63	18.37
1.29	17.95	2.21	0.13	.0702	98.40	1.60	3.00	6.02	9.54	0.50	1.25	75.00	25.00
1.30	17.89	2.28	0.13	.0745	98.30	1.70	3.50	5.11	10.88	0.56	1.60	69.14	30.86

GENERAL REFERENCE INFORMATION

Rectangular waveguides' specifications (IEC version)

Freq.band name	W/G size (EIA)	Freq. range (GHz)	Inner dimensions (inches / mm)	Cut off freq. TE <sub>10</sub> , GHz	Power limit		Insertion loss, dB/m
					P <sub>peak</sub> , MW (kW)	P <sub>ave</sub> , CW kW (W)	
R band	WR-430	1.70 - 2.60	4.300x2.150 / 109,22x54,61		18,230		
D band	WR-340	2.20 - 3.30	3.400x1.700 / 86,36x43,18		11,870		
S band	WR-284	2.60 - 3.95	2.840x1.420 / 72,14x34,04	2,08	7,64-10,85	13,4-19,6	0,03-0,02
E band	WR-229	3.30 - 4.90	2.290x1.150 / 58,17x29,08		7,65		0,05-0,03
G band	WR-187	3.95 - 5.85	1.870x0.940 / 47,55x22,15	3,155	3,30-4,69	5,2-7,4	0,06-0,04
F band	WR-159	4.90 - 7.05	1.590x0.800 / 40,39x20,19		3,30		0,09-0,05
C band	WR-137	5.85 - 8.20	1.370x0.690 / 34,85x15,80	4,285	1,97-2,53	2,08-3,70	0,12-0,06
H band	WR-112	7.05 - 10.00	1.120x0.560 / 28,5x12,62	5,26	1,28-1,70	1,61-2,07	0,14-0,11
X band	WR-90	8.2 - 12.4	0.900x0.450 / 22,860x10,160	6,56	0,76-1,12	0,86-1,25	0,21-0,15
	WR-75	10,0 - 15,0	0.75x0.375 / 19,050x9,525	7,847	0,62-0,90	0,66-0,95	0,25-0,17
Ku band	WR-62	12.4 - 18.0	0.622x0.311 / 15,799x7,899	9,49	0,46-0,63	0,45-0,61	0,32-0,23
K band	WR-51	15.0 - 22.0	0.510x0.255 / 12,954x6,477	11,54	0,31-0,43	0,29-0,40	0,43-0,31
K band	WR-42	18.0 - 26.5	0.420x0.170 / 10,668x4,318	14,08	0,17-0,25	0,16-0,21	0,68-0,50
	WR-34	22,0 - 33,0	0,340x0,170 / 8,636x4,318				
Ka band	WR-28	26.5 - 40.0	0.280x0.140 / 7,112x3,556	21,1	(96-146)	(110-160)	1,13-0,77
Q band	WR-22	33 - 50	0.224x0.112 / 5,690x2,845	26,3	(64-97)	(69-101)	1,6-1,1
U band	WR-19	40 - 60	0.188x0.094 / 4,775x2,388	31,4	(48-70)	(51-71)	1,3-0,94
V band	WR-15	50 - 75	0.148x0.074 / 3,759x1,880	39,9	(30-40)	(30-44)	1,98-1,35
E band	WR-12	60 - 90	0.122x0.061 / 3,099x1,549	48,4			
W band	WR-10	75 - 110	0.100x0.050 / 2,540x1,270	59,0	(14-20)	(15-21)	3,46-2,44
F band	WR-8	90 - 140	0.080x0.040 / 2,032x1,016	73,8			
D band	WR-6	110 - 170	0.0650x0.0325 / 1,651x0,826	90,8			
G band	WR-5	140 - 220	0.0510x0.0255 / 1,295x0,648	115,7			
	WR-4	170 - 260	0.0430x0.0215 / 1,092x0,546	137,2			
J band	WR-3	220 - 325	0.0340x0.0170 / 0,864x0,432	173,6			
	WR-2.8	260 - 400	0,0280x0,0140 / 0,711x0,356	210,8			
Y-band	WR-2	325 - 500	0.0200x0.0100 / 0,559x0,279	268,2			
	WR-1.9	400 - 600	0,0190x0,0095 / 0,483x0,241	310,6			
	WR-1.5	500 - 750	0.0150x0.0075 / 0,381x0,191	393,4			
	WR-1.2	600 - 900	0,0120x0,0060 / 0,305x0,152	491,8			
	WR-1	750 - 1100	0.0100x0.0050 / 0,254x0,127	590,1			

**GENERAL REFERENCE INFORMATION**

**Rectangular Russian/English waveguides' dimensions and operation frequency ranges**

Waveguide size a x b, mm (line №)	Freq.range, GHz	Waveguide type	Waveguide size a x b, mm	Freq.range, GHz	Flange type
by OST 4.206.000 edition 1-77		by EIA version			
0,7 x 0,35 (2)	258,4 - 405,1	WR-2.8	0.711x0.356	260-400	UG 387/UM
0,9 x 0,45 (1)	218,8 - 315,6	WR-3	0.864x0.432	220-325	UG 387/UM
1,1 x 0,55 (2)	178,4 - 258,4	WR-4	1.092x0.546	170 - 260	UG 387/UM
1,3 x 0,65 (1)	142,8 - 218,8	WR-5	1.295x0.648	140 - 220	UG 387/UM
1,6 x 0,80 (2)	118,1 - 178,4	WR-6	1.651x0.826	110 - 170	UG 387/UM
2,0 x 1,0 (1)	94,28 - 142,8	WR-8	2.032x1.016	90 - 140	UG 387/UM
2,4 x 1,20 (2)	78,33 - 118,1	WR-10	2.540x1.270	75 - 110	UG 387/UM
3,0 x 1,50 (1)	63,79 - 94,28	WR-12	3.099x1.549	60 - 90	UG 387/U
3,6 x 1,80 (2)	53,57- 78,33	WR-15	3.759x1.880	5 0- 75	UG 385/U
4,4 x 2,2 (1)	44,09 - 63,79	WR-19	4.775x2.388	40 - 60	UG 383/UM
5,2 x 2,60 (2)	37,50 - 53,57	WR-22	5.690x2.845	33 - 50	UG 383/U
6,2 x 3,1 (1)	30,91 - 44,09				
7,2 x 3,40 (2)	25,95 - 37,50	WR-28	7.112x3.556	26.5-40	UG 381/U UG 599/U
9,0 x 4,5 (1)	21,43 - 30,93	WR-34	8.636x4.318	22 - 33	UG 1530/U
11,0 x 5,50 (2)	17,44 - 25,95	WR-42	10.668x4.318	18 – 26.5	UG 595/U
13,0 x 6,5 (1)	14,71 - 21,43	WR-51	12.954x6.477	15 - 22	
16,0 x 8,00 (2)	12,05 - 17,44	WR-62	15.799x7.899	12.4 - 18	UG 419/U
(17,0 x 8,00) (2)	11,55 - 16,66				
19,0 x 9,5 (1)	9,93 - 14,71	WR-75	19.050x9.525	10 - 15	
23 x 10,0 (2)	8,15 - 12,05	WR-90	22.860x10.160	8.2 – 12.4	UG 39/U
		WR-102	25.908x12.954	7 - 11	
28,5 x 12,6 (1)	6,85 - 9,93	WR-112	28.499x12.624	7.05 - 10	UG 51/U
35 x 15,0 (2)	5,64 - 8,15	WR-137	34.849x15.799	5.85 – 8.2	UG 344/U
40,0 x 20,0 (1)	4,80 - 6,85	WR-159	40.386x20.193	4.9 – 7.05	UG 1730/U
48 x 24,0 (2)	3,94 - 5,64	WR-187	47.549x22.149	3.95 – 5.85	UG 149A/U
58,0 x 29,0 (1)	3,20 - 4,80	WR-229	58.166x29.083	3.3 – 4.9	UG 1726/U
72 x 34 (2)	2,59 - 3,94	WR-284	72,136x34,036	2.6 – 3.95	UG 53/U
90,0 x 45,0 (1)	2,14 - 3,20	WR-340	86,360x43,180	3.4 – 1.7	UG 1712/U
110 x 55 (2)	1,72 - 2,59	WR-430	109,22x54,610	1.7 – 2.6	UG 1716/U
(120 x 57) (2)	1,56 - 2,38				
130,0 x 65,0 (1)	1,45 - 2,14				
160 x 80 (2)	1,16 - 1,72				



## ABOUT US

"Elmika" Joint Stock Company was established in the 1993 as a former microwave division of Vilnius Scientific Research Institute of Radio Measurement Instruments.

Now "Elmika" is a research, development and manufacturing company, which works in the area of mm-wave and sub-mm wave (THz) measurement instruments.

We design and manufacture sweep and signal generators, scalar and vector network analyzers, power meters, direct reading attenuators, frequency measurement instruments.

"Elmika" also produces waveguides and waveguide components for measurement instruments and wireless applications.

At present, "Elmika" has about 50 employees, more than half of them are degreed scientists and engineers.

"Elmika" provides integration and test services to match individual customers' needs. Complete turnkey systems including installation services are offered. Custom design sub-systems and components are designed, developed, and manufactured at our facilities.

Our engineering and fine mechanics' staff welcomes your special requirements and the opportunity to be useful for your needs.

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