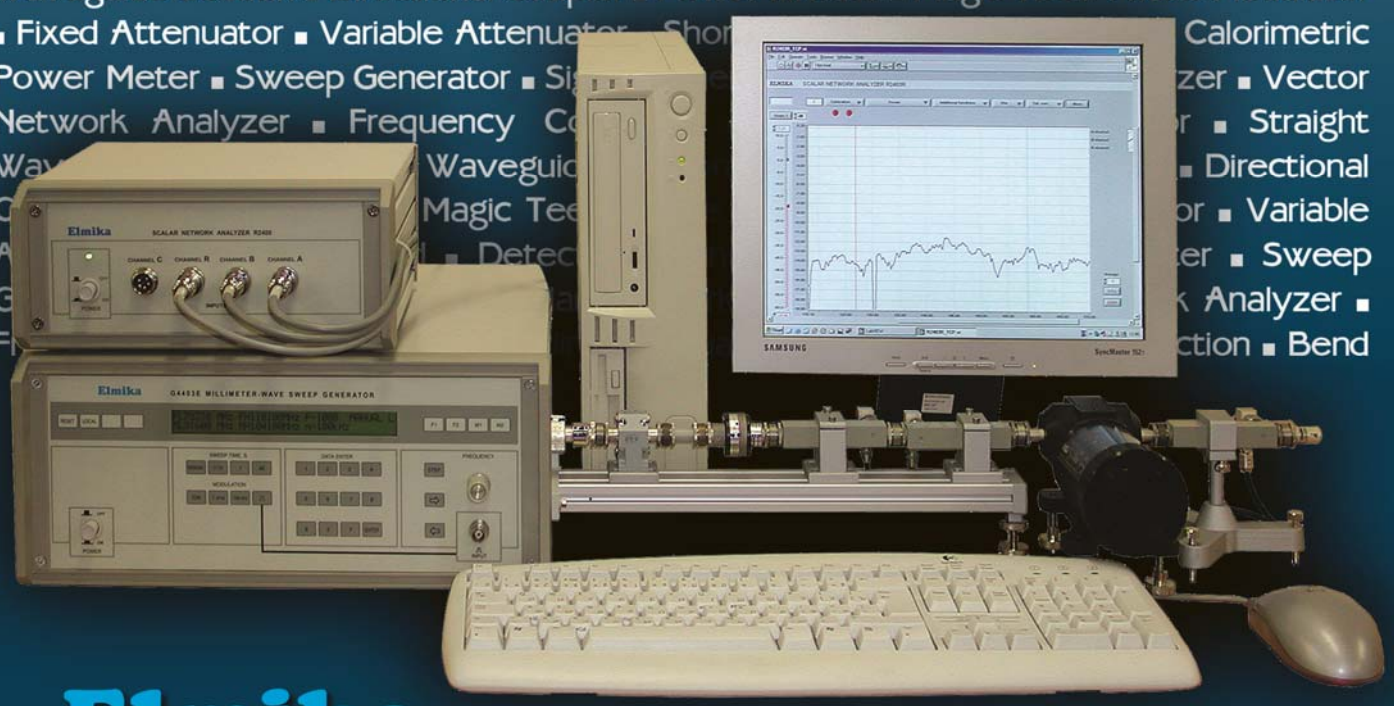
TEST AND MEASUREMENT INSTRUMENTS FOR MILLIMETER WAVES

Catalog



Elmika

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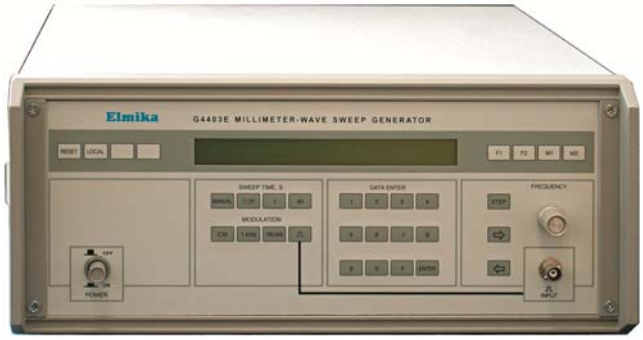
SWEEP GENERATOR



- **Full waveguide bandwidth**
- **BWO source**
- **High output power**
- **GPIB, USB, RS-232 programmable**

The **G440XE** Sweep Generators are a portable powerful wideband general-purpose sources for swept and CW microwave measurements local, remote, manual or automated testing. It incorporates the efficiency of micro-processing control with state-of-the-art BWO oscillator to produce a high performance sweep generator system suited for either manual or automatic measurements.

Model number	Frequency range, GHz	Frequency accuracy, %	Frequency stability	Residual FM	Min/Typ* output power, mW	Output VSWR
G4406E	33 - 50	±0.2	$2\cdot10^{-4}$	$2\cdot10^{-6}$	5/25	1.5
G4404E	50 - 75	±0.2	$2\cdot10^{-4}$	$2\cdot10^{-6}$	5/25	1.5
G4403E	75 - 110	±0.2	$2\cdot10^{-4}$	$2\cdot10^{-6}$	3/10	1.5
G4402E	110 - 170	±0.2	$2\cdot10^{-4}$	$2\cdot10^{-6}$	2/5	1.5
CW, internal square-wave modulation and external pulse modulation modes						
Internal square-wave modulation frequencies: 1 and 100 kHz						
External pulse modulation (with external pin modulator, optional) - pulse duration: 50 ns - pulse repetition rate: 1-10 kHz						
External square-wave modulation frequencies: 0.3-10 kHz						
Operating temperature range: 5-40 ºC						
Sweep time: 0.08, 1.0, 40 s						
Remote programming: IEEE-488, USB, RS-232C						
Mains power source requirements: 220±20 V, 50-60, 400 Hz						
Power consumption: 250 V·A						
Dimensions: 360 x 160 x 380 mm						
Weight: 12 kg						

* Required output power is a subject of negotiation with customer

SIGNAL GENERATOR

- **Full waveguide bandwidth ***
- **BWO source**
- Reference output power
- **GPIB, USB, RS-232 programmable**

The **G4-1XXM** series Signal Generator is general-purpose source for testing and verification of microwave equipment in industrial and laboratory conditions. The instrument provides high accuracy microwave signal level in wide attenuation range and can be integrated in manual or automatic measurement systems.

Model number	Operation frequency range, GHz *	Frequency accuracy, %	Frequency stability	Residual FM	Reference output power level, mW	Output VSWR
G4-178M	33 - 50	±0.2	$\pm 2\cdot 10^{-4}$	$2\cdot 10^{-6}$	0.5	1.5
G4-179M	50 - 75	±0.2	$\pm 2\cdot 10^{-4}$	$2\cdot 10^{-6}$	0.5	1.5
G4-199M	90 - 100	±0.2	$\pm 2\cdot 10^{-4}$	$2\cdot 10^{-6}$	0.1	1.5
G4-177M	129 - 142.8	±0.2	$\pm 2\cdot 10^{-4}$	$2\cdot 10^{-6}$	0.1	1.5

Reference power attenuation range: from 0 to minus 100 dB

Reference power level maintenance level error: ± 1.0 dB

Reference power attenuation level set accuracy: for 0÷20dB: not more than 0.4dB; for 20÷100dB: not more than 2%A; for 100÷120dB: 2dB+3%A-100dB; where A is set attenuation in dB

CW, internal square-wave modulation and external pulse modulation modes

Internal square-wave modulation frequencies: 1 kHz

External pulse modulation (with external pin modulator, optional)
- pulse duration: 50 ns ÷2μs
- pulse repetition rate: 0.1-20 kHz

External square-wave modulation frequencies: 0.3-10 kHz

Operating temperature range: 5-40 ºC

Microwave signal radiation level $5\cdot 10^{-5}$ W/m^2 at 1 m distance

Remote programming: IEEE-488 (IEC 625 part I), USB, RS-232C

Mains power source requirements: 220±22 and 110±11 V, 50-60, 400 Hz

Power consumption: 300 V·A

Size: 495x132x475 mm

Weight: 16.5 kg

* The Instrument operation frequency range should be specified separately (customised) for short pulse modulation.

SCALAR NETWORK ANALYZER

- **Automated scalar measurements from 33 to 170 GHz**
- **Full waveguide bandwidth**
- **PC based Instrument**
- **ETHERNET programmable**

The **R24XE** Scalar Network Analyzers provide both manual and automated VSWR, insertion and return losses' measurements in five rectangular waveguide bands from 33 to 225 GHz. The system consists of the G44XE sweep generator, waveguide reflectometer, network analyzer and personal computer*.

Model number	Frequency range, GHz	Frequency accuracy, %	VSWR meas range	VSWR meas accuracy, %	Transmission loss meas. range, dB	Transmission loss meas. accuracy, dB
R2406E	33 – 50	±0.2	1.1-5.0	±(5K+5) for K=1.1-2.0	0-35	±(0.6+0.06A) A=0-30 dB
R2404E	50 - 75	±0.2	1.1-5.0	±(5K+5) for K=1.1-2.0	0-35	±(0.6+0.06A) A=0-30 dB
R2403E	75 - 110	±0.2	1.1-5.0	±(5K+6) for K=1.1-2.0	0-35	±(0.6+0.06A) A=0-25 dB; ±(0.4+0.1A) A>25 dB
R2402E	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; ±(0.8+0.08A) A>25 dB
R24015E	170 - 225	±0.2	1.1-5.0	±(5K+6) for K=1.1-2.0	0-30 @ 170-215 GHz 0-20 @ 215-225 GHz	±(0.6+0.06A) A=0-25 dB; ±(0.8+0.08A) A>25 dB

Operating temperature range	5-40 ºC
Mains power source requirements:	220±20 V, 50-60 Hz
Power consumption	400 V·A
Remote programming	ETHERNET

* PC is not included into delivery set of the Instrument

VECTOR NETWORK ANALYZER

- **Automated vector measurements in frequency range from 33 to 170 GHz**
- **Full waveguide frequency bandwidth**
- **PC based Instrument**
- **ETHERNET programmable**

The **R44XXE** Vector Network Analyzers are designed for measuring of S-parameters, VSWR and impedance of waveguide networks in the full frequency ranges of rectangular waveguides between 33 and 170 GHz. Frequency accuracy is ±0.2%. The measurement range of reflection factor modulus is from 0 to 1. The measurement range of reflection factor phase is from 0 to ±180° for 0.1< $|\mathbf{G_X}|$<1 with accuracy ±7.5° in 18-75 GHz frequency range and ±9.6° in 75-170 GHz frequency range.

The measurement range of transmission factor phase is from 0 to ±180° with accuracy ±(5+0.1 $|\mathbf{A_X}|$)° for $\mathbf{A_X}$ >-50 dB in frequency range to 75 GHz, for $\mathbf{A_X}$ >-30 dB - to 170 GHz. Data can be displayed in the rectangular, Smith or polar diagrams.

Model number	Frequency range, GHz	VSWR measur. range	Attenuation meas. range, dB	VSWR measur. accuracy, %	Reflection factor modulus meas. accuracy	Attenuation meas. accuracy, dB
R4406E	33 - 50	1.03 - 5	+10 ÷ -60	±10 for K=1.03-2	±0.044 for $\lvert\Gamma_X\rvert$ =0.33	±(0.2+0.03$\lvert A_X\rvert$) K < 1.2
R4404E	50 - 75	1.03 - 5	+10 ÷ -60	±10 for K=1.03-2	±0.044 for $\lvert\Gamma_X\rvert$ =0.33	±(0.2+0.03$\lvert A_X\rvert$) K < 1.2
R4403E	75 - 110	1.03 - 5	0 ÷ -50	+13.5 -11.5 for K=1.03-2	±0.056 for $\lvert\Gamma_X\rvert$ =0.33	±(0.3+0.04$\lvert A_X\rvert$) K < 1.2
R4402E	110 - 170	1.03 - 5	0 ÷ -50	+13.5 -11.5 for K=1.03-2	±0.056 for $\lvert\Gamma_X\rvert$ =0.33	±(0.3+0.04$\lvert A_X\rvert$) K < 1.2
Operating temperature range				5-40 ºC		
Mains power source requirements:				220±20 V; 50-60 Hz		
Power consumption				400 V·A		

DIRECT READING ATTENUATOR

- **High resolution**
- **High accuracy**

The **DAXE** 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 and thus is independent of frequency.

The Attenuators are provided in seven waveguide bands between 18 GHz and 225 GHz.

Model number	Frequency range, GHz	Waveguide type	Waveguide flange	Attenuation accuracy	Insertion loss, dB, max	VSWR, max
DA12E	18 – 26.5	WR - 42	UG 595/U	±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.	0.5	1.15
DA08E	26.5 - 40	WR - 28	UG 599/U		0.6	1.15
DA06E	33 - 50	WR - 22	UG 383/U		0.8	1.15
DA04E	50 - 75	WR - 15	UG 385/U		1.0	1.15
DA03E	75 - 110	WR - 10	UG 387/UM		1.5	1.2
DA02E	110 - 170	WR - 06	UG 387/UM		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)
DA015E	170 - 225	WR - 05	UG 387/UM	±0.3dB for A=0÷10dB; ±0.02·A for A=10÷30dB;	3.0	1.3

Attenuation range 0 ÷ 60 dB for WR-42, WR-28, WR-22, WR-15, WR-10, WR-6 models
Attenuation range 0 ÷ 30 dB for WR-5 model

Power rating (CW, max): 0.5W – WR-42, WR-28;
0.3W – WR-22, WR-15;
0.2W – WR-10,
0.1W – WR-6, WR-5.

STRAIGHT WAVEGUIDE SECTION

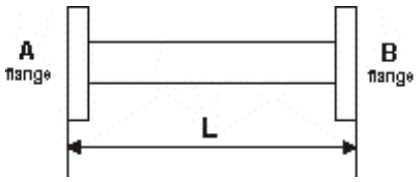
- **Precision flanges**
- **Low VSWR**
- **Low insertion losses**

Straight sections are used to make connections between components in waveguide systems. Lengths and combinations are available on special order. VSWR is 1.1 or better over the full waveguide frequency band.

Model number	Frequency range, GHz	Waveguide size	VSWR
SW06E	33 - 50	WR-22	1,1
SW04E	50 - 75	WR-15	1,1
SW03E	75 - 110	WR-10	1,1
SW02E	110 - 170	WR-6	1,1
SW015E	170 - 225	WR-5	1,1

ORDER INFORMATION

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

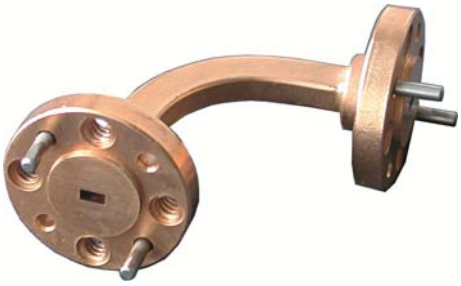


SWXXE - L - F

Example: SW06E - 50 - S

Straight section for 33 - 50 GHz frequency range, 50mm length, silver plated.

BEND WAVEGUIDE SECTION



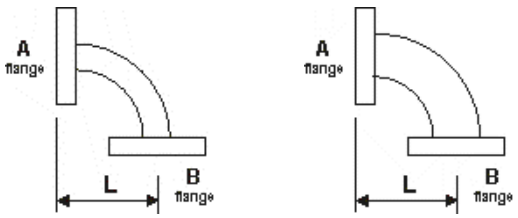
- **Precision flanges**
- **Low VSWR**
- **Low insertion losses**

E- or H-Plane Bends are essential parts of every waveguide systems. E- or H-Plane formed bends are available with angles of 15º, 30º, 45º, 90º. Maximum VSWR is 1.1. The sizes and combinations are available on request.

Model number	Frequency range, GHz	Waveguide size	VSWR
BE90D06E BH90D06E	33 - 50	WR-22	1,1
BE90D04E BH90D04E	50 - 75	WR-15	1,1
BE90D03E BH90D03E	75 - 110	WR-10	1,1
BE90D02E BH90D02E	110 - 170	WR-6	1,1

ORDERING INFORMATION

XX	Operation wave length range, mm
L	Dimensions, (mm)
E	E -plane bend
H	H – plane bend
F	Finish (flanges): S – silver G - gold
YY	Degrees 90º, 45º, 30º, 15º, (and others)



BEYYDWXXE - L - F

Example: BE90DW06E - 50 - S

E-Plane Bend for 33 - 50 GHz frequency range, 50mm length, 90° angle, silver plated.

TWIST WAVEGUIDE SECTION

- **Precision flanges**
- **Low VSWR**
- **Low insertion losses**

Twists of 90º and 45º are used for changing of polarization in waveguide networks. Twists with different angles and combinations of bends are available on special order. Maximum VSWR is less than 1.10 over the full frequency range.

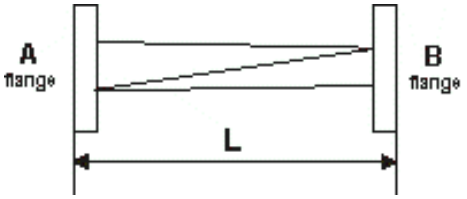
Model number	Frequency range, GHz	Waveguide size	VSWR
TW90D06E	33 - 50	WR-22	1,1
TW90D04E	50 - 75	WR-15	1,1
TW90D03E	75 - 110	WR-10	1,1
TW90D02E	110 - 170	WR-6	1,1

ORDERING INFORMATION

XX Operation wave length range, mm
L Length, (mm)

YY Twist angle
90º, 45º, (and others)

F Finish (flanges):
S – silver
G - gold



TWYYDXXE - L - F

Example: TW90D06E - 50 - S

Twist for 33 - 50 GHz frequency range, 50mm length, 90° twist angle, silver plated.

DIRECTIONAL COUPLER

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

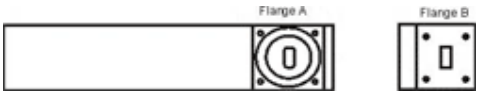
The **DC3-XE/Y** and **DC4-XE/Y** directional couplers are used for extracting or introducing RF power flow in a transmission line without distortion of signal characteristics. The directional couplers are available in 3, 6, 10, 15, 20 dB coupling values and 30 - 35 dB minimum directivities*. 4-ports directional couplers are available in bi-directional and dual-directional configurations.

Model number	Frequency range, GHz	Waveguide size	Main line VSWR	Secondary line VSWR	Insertion loss, dB	Coupling accuracy, %
DCZ-12E/Y	18 – 26,5	WR-42	1,05	1,1	0,8	7
DCZ-08E/Y	26,5 - 40	WR-28	1,05	1,1	0,8	7
DCZ-06E/Y	33 - 50	WR-22	1,05	1,1	0,8	7
DCZ-04E/Y	50 - 75	WR-15	1,08	1,1	1,1	7
DCZ-03E/Y	75 - 110	WR-10	1,1	1,15	1,5	10
DCZ-02E/Y	110 - 170	WR-6	1,15	1,2	2,5	10
DCZ-015E/Y	170 - 225	WR-5	1.15	1.2	2,5	12

Coupling flatness ±0.7 dB

* for 170-225 GHz frequency range directional couplers 35dB directivity could be not in full frequency range

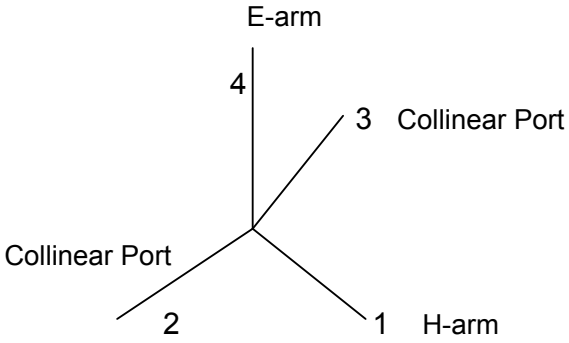
ORDERING INFORMATION

XX	Operation wave length range, mm	
Z	Directivity 3 – 3 ports 4 – 4 ports	
Y	Coupling value 3, 6, 10, 15, 20 dB	
F	Finish: S - silver G - gold	**DCZ-XXE/Y - F**
		Example: DC3-06E/20-S
		3-ports Directional Coupler for 33 ÷ 50 GHz frequency range, 20dB coupling value, silver plated.

MAGIC TEE

- **Full waveguide bandwidth**
- **Low insertion losses**
- **High matching / high isolation**
- **Low power split unbalance**

The **MHTXE** Magic Tee Hybrid Couplers for millimeter wave are matched power dividers for variety of applications (general purpose power splitters, power combining, phase measurement circuits, phase / frequency discriminators). The **MHTXE** Magic Tee Hybrid Couplers are available in four waveguide bands between 33 and 170 GHz. These couplers are four-port transmission line components with a port configuration as shown in figure.



$S_{24} = -S_{34}$ $S_{22} = S_{33}$
$S_{24} = S_{34}$ $S_{14} = 0$

Model number	Frequency range, GHz	Waveguide size	Insertion loss, dB	Isolation, (min)dB	VSWR max		Balance, dB
					E-arm	H-arm	
MHT06E	33 - 50	WR - 22	0,7	30	1,5	1,5	±0,5
MHT04E	50 - 75	WR - 15	1,0	30	1,5	1,5	±0,5
MHT03E	75 - 110	WR - 10	1,2	30	1,6	1,6	±0,5
MHT02E	110 - 170	WR - 6	1,5	30	1,6	1,6	±0,5

ORDERING INFORMATION

XX Operation wave length range, mm

F Finish:
S – silver
G - gold

MHTXXE - F

Example: MHT06E - S

Hybrid coupler for 33 - 50 GHz frequency range, silver plated.

FIXED ATTENUATOR

- **Full waveguide bandwidth**
- **High attenuation accuracy**

The **FAXE** Fixed Attenuators can be used as a lab standard against which other instruments or device are calibrated. The attenuators consist of the waveguide section with resistive plate in the waveguide diagonal plane. The **FAXE** 3, 6, 10, 15, 20, 30 dB attenuators are available in seven waveguide bands from 18 through 225 GHz.

Model	Frequency range, GHz	Waveguide size	Attenuation, dB	VSWR
FA12E	18 – 26.5	WR - 42	3±0.5 6±1.0 10±1.5 20±2.0 30±3.0	1.15
FA08E	26.5 - 40	WR - 28		1,15
FA06E	33 - 50	WR - 22		1,15
FA04E	50 - 75	WR - 15		1,15
FA03E	75 - 110	WR - 10	3, 6, 10, 20	1,15
FA02E	110 - 170	WR - 6	3, 6, 10, 20	1,15
FA015E	170 - 225	WR - 5	3, 6, 10	1,15

ORDERING INFORMATION

XX Operation wave length range, mm

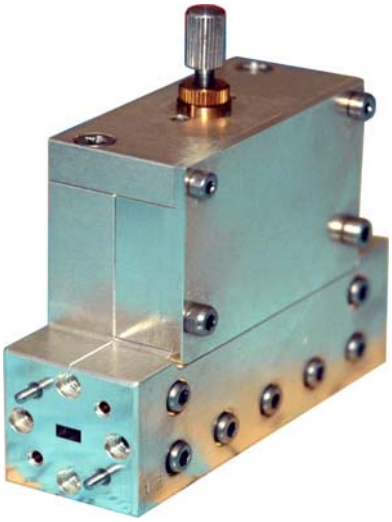
F Finish:
S – silver
G - gold

FAXXE - F

Example: FA06E - S

Fixed attenuator for 33 - 50 GHz frequency range, silver plated.

VARIABLE ATTENUATOR



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

The **VA3XE** Variable Attenuators are used for level-setting. The Attenuators consist of a section of waveguide with a resistive film evaporated on the mica surface.

The Attenuators has 0 ÷30 dB minimum attenuation range. The **VA3XE** Attenuators are available in four waveguide bands between 33 GHz and 170 GHz.

Model number	Frequency range, GHz	Waveguide size	Attenuation range, dB	VSWR	Insertion loss, dB
VA3-06E	33 - 50	WR - 22	0÷30	1,15	0,5
VA3-04E	50 - 75	WR - 15	0÷30	1,15	0,5
VA3-03E	75 - 110	WR - 10	0÷30	1,15	0,7
VA3-02E	110 - 170	WR - 06	0÷30	1,2	1,0

ORDERING INFORMATION

XX Operation wave length range, mm

F Finish:
S – silver
G - gold

VAXXE - F

Example: VA06E - S

Variable attenuator for 33 - 50 GHz frequency range, silver plated.

SHORT

Fixed waveguide short

Tunable waveguide short

The **FSXE** Fixed Waveguide Shorts and the **TSXE** Tunable Shorts are designed to create the shorts circuit conditions in waveguides.

The **TSXE** Tunable Waveguide Shorts are movable shorts, adjustable through at least half a wavelength at the low end of the band. The **TSXE** Shorts consist of movable noncontacting choke plungers within a straight section of waveguide.

The **FSXE** and **TSXE** Shorts are provided in five waveguide bands between 33 and 225 GHz.

Model number	Frequency range, GHz	Waveguide size	VSWR
FS06E	33 - 50	WR - 22	30
FS04E	50 - 75	WR - 15	30
FS03E	75 - 110	WR - 10	20
FS02E	110 - 170	WR - 6	20
FS015E	170 - 225	WR - 5	20
TS06E	33 - 50	WR - 22	30
TS04E	50 - 75	WR - 15	30
TS03E	75 - 110	WR - 10	20
TS02E	110 - 170	WR - 6	20
TS015E	170 - 225	WR - 5	20

ORDERING INFORMATION

XX Operation wave length range, mm

F Finish:
S - silver

TSXXE - F

Example: TS06E - S

Tunable short for 33 - 50 GHz frequency range, silver plated.

MATCHED LOAD

Sliding Matched Load

Matched Load

The **SMLXE** Sliding Matched Loads and the **MLXE** fixed Matched Loads consist of tapered absorber within a waveguide section. The **SMLXE** Loads utilize a metric micrometer tuning mechanism allows the microwave absorber to be positioned within the guide while maintaining a constant magnitude of reflection coefficient.

The **MLXE** Terminations and the **SMLXE** Sliding Matched Loads are provided in five waveguide bands between 33 GHz and 225 GHz.

Model number	Frequency range, GHz	Waveguide size	VSWR
SML06E	33 - 50	WR - 22	1,05
SML04E	50 – 75	WR - 15	1,05
SML03E	75 – 110	WR - 10	1,05
SML02E	110 – 170	WR - 6	1,05
SML015E	170 - 225	WR - 5	1.05
ML06E	33 – 50	WR - 22	1,07
ML04E	50 – 75	WR - 15	1,07
ML03E	75 - 110	WR - 10	1,07
ML02E	110 – 170	WR - 6	1,07
ML015E	170 - 225	WR - 5	1.07

ORDERING INFORMATION

XX Operation wave length range, mm

F S – silver
G - gold

MLXXE - F

Example: ML06E - S
Matched Load for 33 - 50 GHz frequency range, silver plated.

DETECTOR MOUNT

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

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

The **DMXE** Detector Mounts use Schottky Barrier packaged diodes and are provided in five waveguide bands between 33 GHz and 225 GHz.

Model number	Frequency range, GHz	Waveguide size	Sensitivity, mV/mW	Maximum input, mW	Sensitivity flatness (Smax / Smin)
DM06E	33 - 50	WR - 22	300	15	2,5
DM04E	50 - 75	WR - 15	300	15	2,5
DM03E	75 - 110	WR - 10	200	15	2,5
DM02E	110 - 170	WR - 6	100	15	2,5
DM015E	170 - 225	WR - 5	100	15	3,0

ORDERING INFORMATION

XX Operation wave length range, mm

F Finish:
S – silver
G - gold

DMXXE - F

Example: DM06E - S

Detector mount for 33 - 50 GHz frequency range, silver plated.

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 millimeter and 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
M1-25M/06E	33 - 50	WR-22, UG383/U	0,020-20	3%+2μW	1.1*
M1-25M/04E	50 - 75	WR-15, UG385/U	0,020-20	3%+2μW	1.1
M1-25M/03E	75 - 110	WR-10, UG387/UM	0,020-20	3%+2μW	1.1
M1-25M/02E	110 - 170	WR-06, UG387/UM	0,020-20	3%+2μW	1.1
M1-25M/015E	170 - 225	WR-05, UG387/UM	0,020-20	5%+2μW	1.1

* VSWR 1.2 max in 33-37.5 GHz frequency range;

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 staff welcomes your special requirements and the opportunity to be useful for your needs.

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