ELVA-1
Millimeter Wave Division

MILLIMETER WAVE COMPONENTS AND SYSTEMS

2004

St. Petersburg, Russia

CONTENTS

About ELVA-1 Millimeter Wave Division

Millimeter Wave Division

http://www.elva-1.com, e-mail: sales@elva-1.com

Founded in 1993, the Millimeter Wave Division of ELVA–1 is a design and manufacturing company located in St.Petersburg, Russia. ELVA–1's headquarters are in Riga, Latvia (www.elva1.lv). ELVA–1 Millimeter Wave Division currently employs more than 30 people in the St.Petersburg facility. The Division is registered in Russia.

For the last 10 years, the Millimeter Wave Division has been engaged in development and production of scientific test and measurement equipment, industrial radars and radar front–ends, millimeter wave level sensors and wireless communication equipment operating in the millimeter and sub–millimeter wave frequency bands.

We maintain cooperative relationships with a variety of specialized manufacturing facilities within the former Soviet Union, each of whom possesses unique component technology. Our division combines this technology with our own to develop commercial products for customers around the world. ELVA–1 Millimeter Wave Division supplies high quality millimeter and sub–millimeter wave components, subsystems and laboratory equipment that operate at frequencies from 16GHz to 1800 GHz. Following is a list of our standard integrated products and equipment:

- Backward Wave Oscillator (BWO) Sweepers
- Power Supplies for BWO Tubes
- Scalar Network Analyzers
- Wideband Active Frequency Multipliers
- Digitally Controlled frequency Synthesizers
- Millimeter wave power meters
- Multichannel radiometers
- Sweeping heterodyne radiometers
- Real–Time Frequency Analyzers
- FMCW radars and front–ends
- Pulse–noise radar front–ends

ELVA–1 Millimeter Wave Division also serves the global millimeter wave market as an Original Equipment Manufacturer (OEM) component supplier. Many of the millimeter wave industry's leading companies use our OEM components to bring quality and cost effective product solutions to their own customer base. We produce large quantities of state–of–the–art millimeter wave components and equipment for businesses specializing in industry automation solutions. Following is a list of our standard passive and active mm–wave components that are available for use in your OEM products:

- IMPATT Diodes
- Cavity Stabilized IMPATT Sources
- Noise Sources
- Voltage Controlled Attenuators
- Cavity Stabilized Gunn Sources
- Ferrite Circulators and Isolators
- Directional Couplers
- Matched Loads
- Balanced Mixers
- Detectors
- Waveguide transitions, bends and complex shapes

Our customer list includes global leaders in science and research such as: JET (UK) – largest tokamak in the world, General Atomics (USA), National Institute of Standards and Technology (USA), TRW (USA), FOM Institute (The Netherlands), University of Kiel (Germany), Centre D'Etudes de Cadarache (France), Institute of Astronomy & Astrophysics (Taiwan), South–West Institute of Physics (China), Siemens, CERN – Accelerator in Switzerland, Max Planck Institut fur Plasmaphysik, Australian National University, Cornell University (USA), Rutherford Appleton Laboratory (UK). This list continues to grow each year.

Since 2001, we have aggressively expanded our product range to include millimeter wave telecommunications products such as 42GHz, 60GHz, 70/80GHz and 94GHz transmitters and receivers, high gain parabolic antennas and related telecommunications products. Applications for these products include 100Mbps Ethernet wireless LAN bridges, MVDS outdoor units (transmitters and receivers) and LMDS communication systems. For more information about our product lines, please visit the company website at www.elva–1.com .

BWO-Powered, GPIB Controlled mm-Wave Generator with Fast Sweep

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

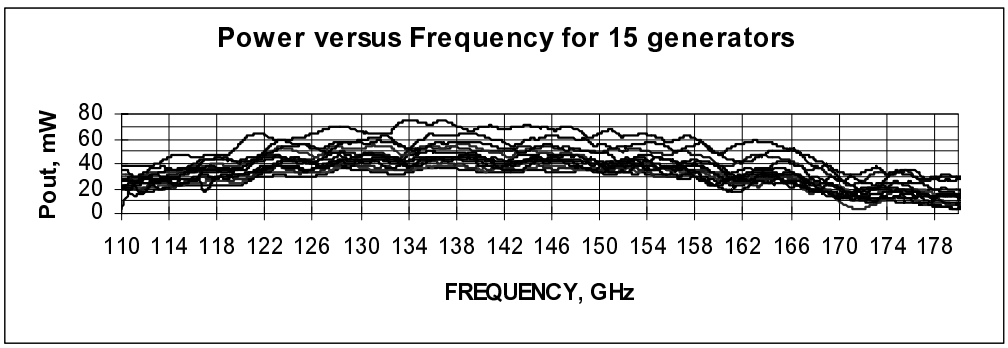
- 37–170GHz in seven bands
- <0.2 ms full waveguide sweep time
- Smooth power/frequency dependence
- Fully packaged
- Program from front panel or GPIB bus
- Frequency accuracy 0.01%
- High output power

Applications

- L.O. for sweeping receivers
- Laboratory measurement and test equipment
- Plasma diagnostics: ECE and ECA radiometers, broadband sweeping interferometers and reflectometers
- Source for Network Analyzers
- Spectrometry

Description

G4–143x series of BWO generators is a result of further developments of G4–141x/G4–142x (GPIB) generators family. PC compatible microcomputer integrated into the device provides total control of the system. The sweeper self–tests at turn–on. Two independent DAC's control frequency and output power. Minimal full band sweep time is 10 ms. Optionally 0.2 ms sweep time is available. User from front panel or RS–232 (optional GPIB) bus controls power, initial and final frequency, time of sweep, internal amplitude modulation. Various programs of power and frequency change are provided including 10 user–defined programs. There are two inputs for external frequency and power control, which allow to use the generator together with an external phase locking system or power stabilization one. The rugged High Voltage power supply is specially designed to withstand the rapid voltage changes inherent in BWO deceleration. Each generator is individually calibrated for output power versus frequency, with different power levels and frequency versus control voltage relationships. The resulting data supplied with the unit for 15 various generators of G4–143g model (110–170 GHz) are illustrated in the plot below:



These generators are completely self–contained, including all control and power supply systems required to drive the BWO tube. The BWO tube is fully protected against application of improper operating voltages. Generators are available in all standard waveguide frequency regions from 37GHz to 170 GHz. Models with not standard frequency ranges are discussible. These generators have high power output, for instance, G4–143e model for W–band has typical peak power up to 90 mW.

BWO-Powered, GPIB Controlled mm-Wave Generator with Fast Sweep

ELVA-1 Millimeter Wave Division

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Specifications

MODEL NUMBER	G4-143a	G4-143b	G4-143c	G4-143d	G4-143e	G4-143f	G4-143g
Frequency Range, GHz	37-54	40-60	50-75	60-90	75-110	90-140	110-170
Output waveguide size, mm	5.69x2.84 WR22	4.8x2.4 WR19	3.8x1.9 WR15	3.1x1.5 WR12	2.54x1.27 WR10	2.03x1.02 WR8	1.7x0.83 WR6
Wavequide Flange	UG-383/U	UG-383/U-M	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M
Minimum CW power, mW	20	20	20	20	15	15	10
Typical peak power, mW	40	40	40	40	60	60	40

Common Specifications

Frequency accuracy in the CW mode,%	±0.01
*Fullband Sweep Time, ms	10 (0.2)
Maximum CW frequency stability for 15 min	$\pm 2*10^{-4}$
Residual FM max	$\pm 5*10^{-5}$
***Output power regulation range, dB	0-20
Output VSWR	1.5
Internal square-wave modulation frequencies, kHz	1-100
Sweep time, mS	10 (0.2*)-40000
External square-wave modulation frequencies, kHz	1-100
Voltage for External Frequency Control, VDC	0 ... +10
**Voltage for External Power Control, VDC	0 ... +10
Operating temperature range, C°	5-40
*AC Input Voltages:	220 V, 50 Hz (110V/60Hz)
Consumed power, VA	400
Size, mm	495 x 180 x 480
Weight, kg	23

* These features are not included in basic models. Available optionally upon request.
** The Option "Bias tunable for AFC and phase-locked operation" is available upon request only.
*** Output power regulation range 0-20dB is uncontrolled (not specified) parameter

The G4-143x can be shipped as phase lockable device (optional). The Phase Looked Loop System for G4-143x Oscillators allows up to 1Hz accuracy of oscillator output on any of Ka, Q, U, V, E, W, F, D sub-band covering 26.5 GHz to 170 GHz frequency range. In fact, the accuracy of PLL-featured G4-143x Oscillator corresponds the accuracy of external microwave synthesizer. For example, if the synthesizer has 0.1Hz accuracy, the same one will be for PLL-featured G4-143x Oscillator. The external Locked Oscillator is not included to our shipment option. Researchers are advised to use one of the market-available branded microwave synthesizers as the reference unit. PLL-featured G4-143x Oscillator will keep the accuracy of the external Locked Oscillator, while delivers powerful output signal on upper frequency.

The advantage of PLL-featured G4-143x Oscillators on market-available third-party microwave oscillators with passive multipliers is in relatively high power output. With more than 10mW output power even for upper frequency 110-170GHz sub-band, PLL-featured G4-143G Oscillator delivers outstanding quality to microwave instrumentation servicing even great-demanding research projects. Ones of the most promised application for PLL-featured G4-143x Oscillators are an antenna measurement projects.

For an additional charge, customers may select the BWO tube for their generator from data on tubes in inventory. Power levels up to twice the stated specification are often available. A GPIB card and software for PC microcomputer operation are available at extra cost including driver for LabView program.

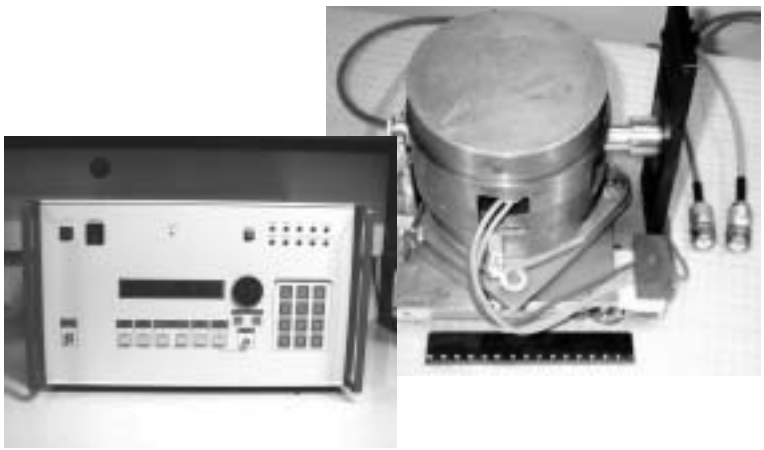
How to Order:

Specify Model Number **G4-143x-A**, where
X – frequency range,
A – AC input voltage.
Example: To order BWO sweeper with the following specification: operation frequency 110-170 GHz, input AC voltage 110ACV, it should be ordered as G4-143g-110

All ELVA-1 generators are warranted by the manufacturer for one year after receipt. Delivery within 10-12 weeks ARO.

Millimeter and Submillimeter Wave Wide-Range BWO Sweepers

http://www.elva-1.com, e-mail: sales@elva-1.com



Features

- 180–1110 GHz in 7 bands
- Full waveguide sweep in all bands
- Fast sweep possibility, 200 ms typical
- Fully packaged and automated
- Remote controlled, phase lockable
- High output power

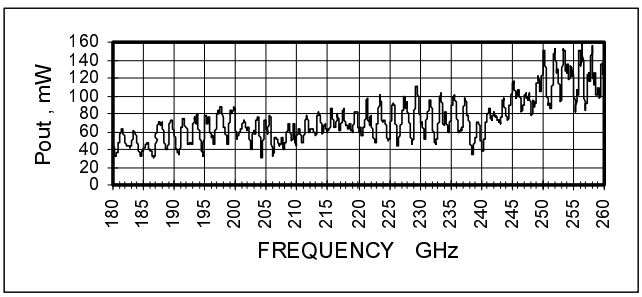
Applications

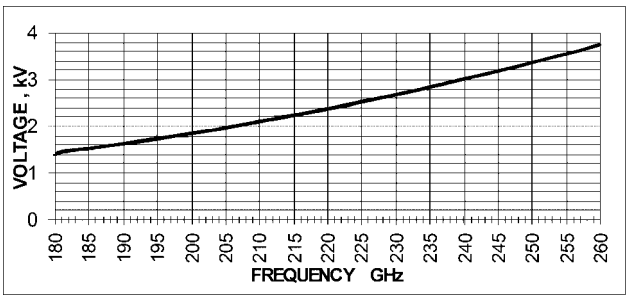
- Instrumentation automated subsystems
- Laboratory measurement and test equipment
- Source for Network Analysers, Plasma diagnostics and spectrometry
- Sweeping Heterodyne Receivers, frequency and spectrum analysis for gyrotrons

Description

SMW-XX series is a fully packaged swept signal generator. It consists of a BWO tube, **OB-XX** series, permanent or electric magnet, mechanical tube alignment system and power supply. An optional, fully closed water cooling system is available. On the photos above, the power supply and BWO tube are shown, where BWO installed in a 0.8T permanent magnet.

The sweeper contains all electronic circuitry and power supplies required to operate the BWO. The BWO tube is fully protected from application of improper operating voltages. Water flow alarm system provides protection from overheating, and the system includes a high voltage monitor. An input jack allows output frequency to be controlled by an external voltage, if desired, and the generator can be phase locked to other equipment. Each sweep generator is supplied with individual calibration data for control voltage vs. output power vs. frequency. Typical dependencies are shown in the plots below for 180–260 GHz model SMW–24:





The results presented above are obtained under the contract with JET (Joint European Torus, the largest tokamak in the world).

Millimeter and Submillimeter Wave Wide-Range BWO Sweepers

ELVA-1 Millimeter Wave Division

http://www.elva-1.com, e-mail: sales@elva-1.com

Specifications

Model	SMW-24	SMW-30	SMW-32	SMW-80	SMW-81
BWO tube model	OB-24	OB-30	OB-32	OB-80	OB-81
Operating range, GHz	179-263	258-375	370-535	526-714	667-857
Output power, typ, mW	20-50	10-20	4-15	4-15	4-15
Output power*, min, mW	1-10	1-10	1-5	1-5	1-5
Power difference in the range, max, dB	13	13	13	13	13

Model	SMW-82	SMW-83
BWO tube model	OB-82	OB-83
Operating range, GHz	789-968	882-1111
Output power, typ, mW	3-10	3-10
Output power*, min, mW	1-3	1-3
Power difference in the range, max, dB	13	13

* Minimal output power depends on the used tube and can be different for various tubes of the same model..

Common Specifications

Frequency accuracy in the CW mode, %	±0.01
Frequency stability for 15 min**	10^{-4}
AM stability**, max, %	1
Residual FM, max	$\pm 5*10^{-5}$
Sweep time, min, ms	0.2 - 0.5
Duration of Impulse Response Function (IRF) on the 3 dB level, max, ms	0.02
Delay to the peak of IRF, max, ms	0.006
Frequency control voltage, V	0-10
High voltage monitor, V	0-10
Operating temperature range, C°	5-40
AC Input Voltages:	220 VAC, 50 Hz or 110 VAC, 60 Hz
Consumed power, VA	600
Size, mm	
permanent magnet with BWO	300x250x300
power supply	495x380x480
Weight total, kg	45

** Stability is presented for the scheme with a permanent magnet.

Controller for PC microcomputer and software are available upon request

How to Order:

Specify Model Number **SMW-x-A**, where
x – frequency range
A – AC input voltage.

Example: To order BWO sweeper with the following specification: operation frequency 258–375 GHz, input AC voltage 110ACV, it should be ordered as ***SMW -30-110***

All ELVA-1 generators are warranted by the manufacturer for one year after receipt. Delivery within 10–12 weeks ARO.

Millimeter Wave Wide-Range BWO Sweepers

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- 37–170 GHz in 7 bands
- Frequency accuracy 0.01%
- Full waveguide sweep in all bands
- Fully packaged and automated
- Program from front panel or GPIB bus
- Remote controlled, phase lockable
- Bias tuneable for AFC
- High output power

Applications

- Instrumentation automated subsystems
- Laboratory measurement and test equipment
- Source for Network Analysers, Plasma diagnostics and spectrometry
- Sweeping Heterodyne Receivers, frequency and spectrum analysis for gyrotrons

Description

ELVA–1 recently designed this new series of BWO sweepers. The new device design has a number of advantages compare to its predecessor. Particularly, the remote module with BWO tube allows using it at hard–to–reach places within tokamaks and other types of huge equipment plant in research centers. With the remote BWO module, the ELVA–1 sweeper can be installed quite away, somewhere near a scientist's workdesk. Another great advantage of new series of BWO sweepers is its new power supply unit that allows feed up to few BWO tubes even with different working frequencies. Thanks to this new power supply, the total cost for wide–band sweeper can be well reduced.

The SGMW–X series is fully packaged sweeper series. The sweeper consists of external module with BWO–X series and power supply. The device contains all the electronic circuitry and power supplies required to provide the operation of BWO. PC compatible microcomputer integrated into the device provides operating control of the system. The sweeper self–tests at turn–on. BWO tube is fully protected against improper voltage connections. High voltage monitor is built–in. There is input for control of frequency by means of an external voltage. Phase locking possibility is provided. One power supply can be used with different BWO.

Millimeter Wave Wide-Range BWO Sweepers

ELVA-1 Millimeter Wave Division

http://www.elva-1.com, e-mail: sales@elva-1.com

Specifications BWO-X series

MODEL NUMBER	BWO-Q	BWO-U	BWO-V	BWO-E	BWO-W	BWO-F	BWO-D
Frequency Range, GHz	37-54	40-60	50-75	60-90	75-110	90-140	110-170
Output waveguide size, mm	5.69x2.84 WR22	4.8x2.4 WR19	3.8x1.9 WR15	3.1x1.5 WR12	2.54x1.27 WR10	2.03x1.02 WR8	1.7x0.83 WR6
Wavequide Flange	UG-383/U	UG-383/U-M	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M
Minimum CW power, mW	50	100	25	25	25	35	25
Typical peak power, mW	150	200	80	80	90	110	80

Common Specifications

Frequency accuracy in the CW mode, %	±0.01
Fullband Sweep Time, s	1
Maximum CW frequency stability for 15 min	$\pm 2 \cdot 10^{-4}$
Residual FM max	$\pm 2 \cdot 10^{-5}$
**Output power regulation range, dB	0–20
Output VSWR	1.5
Internal square–wave modulation frequencies, kHz	1–100
External square–wave modulation frequencies, kHz	1–100
Voltage for External Frequency Control, VDC	0 ... +10
Voltage for External Power Control, VDC	0 ... +10
Operating temperature range, C°	+5...+40
*AC Input Voltages:	220 V, 50 Hz (110V/60Hz)
Consumed power, VA	400
Size Power Supply, mm	490 x 240 x 270
Weight Power Supply, kg	25
Size BWO module, mm	150 x 180 x 200
Weight BWO module, kg	4
Length of connection cable, m	1...3 (specify in order)

* These features are not included in basic models. Available optionally upon request.
** uncontrolled (not specified) parameter

How to Order:

Specify Model Number **SGMW-X-A,** where
X – type of BWO tubes
W – power supply with BWO–W
WD – power supply with BWO–W and BWO–D
A – length of cable in meters.

Example: To order BWO sweeper meets the following specification: operation frequency 75–110 and 110–170 GHz 1.5m connection cable, should be ordered as **SGMW -WD-1.5**

Delivery time 8–12 weeks for all models.
All ELVA–1 sweepers are warranted for one year after receipt.

Mm-wave High Sensitive Power Meters

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- 0.01–170 GHz operating frequency
- High sensitivity
- up tp 60 dB dynamic range (0.1мW–100mW)
- small measuring time
- Compact size
- PC compatible (RS–232)
- Easy to use

Applications

- Measurements of high frequency and mm– power over wide frequency bands
- Test equipment

Description

Initially designed as accompanied product for G4–143x series of BWO generators, the DPM–xx Power Meter series is also available now as stand–alone product. This is single–channel average power meter intended for microwave–power measurements within 0.01GHz to 170GHz band. All modern features like easy–to–use operating, compact unit case and precise and reliable measurement are implemented in the DPM–xx Power Meter. This digital power meter has automatic zeroing. The DPM–xx Power Meter measures absolute power in Watts and it also displays signal frequency in GHz.

ZBD–series Zero–Biased Detectors (read more online http://www.elva–1.com/products/microwave/zero–based–detectors.html) are used as power sensors in the DPM–xx Power Meter. To cover 0.01–170 GHz band, there are a coaxial (0.01–26.5 GHz) and a series of 8 waveguide power sensors (26.5–170GHz). Based on Schottky Barrier Diode, the power sensors provide high sensitivity, fast measurement speed, and quicker response to changes of input power. To extend the dynamic range of diode power sensors above their square law region, the correction factor is used. The amplitude and frequency curves for each of individually calibrated power sensor shipped with DPM–xx Power Meter are stored in sensor's EEPROM. The typical curves for sensitivity and amplitude characteristics for W–band sensor are shown below.

Measured average power is displayed on 2–line LCD screen with measuring rate of 100 times per second. For input signals with more than 10mW power, the optional power dividers must be used. Typical specifications of DPM–xx power meters is shown below.

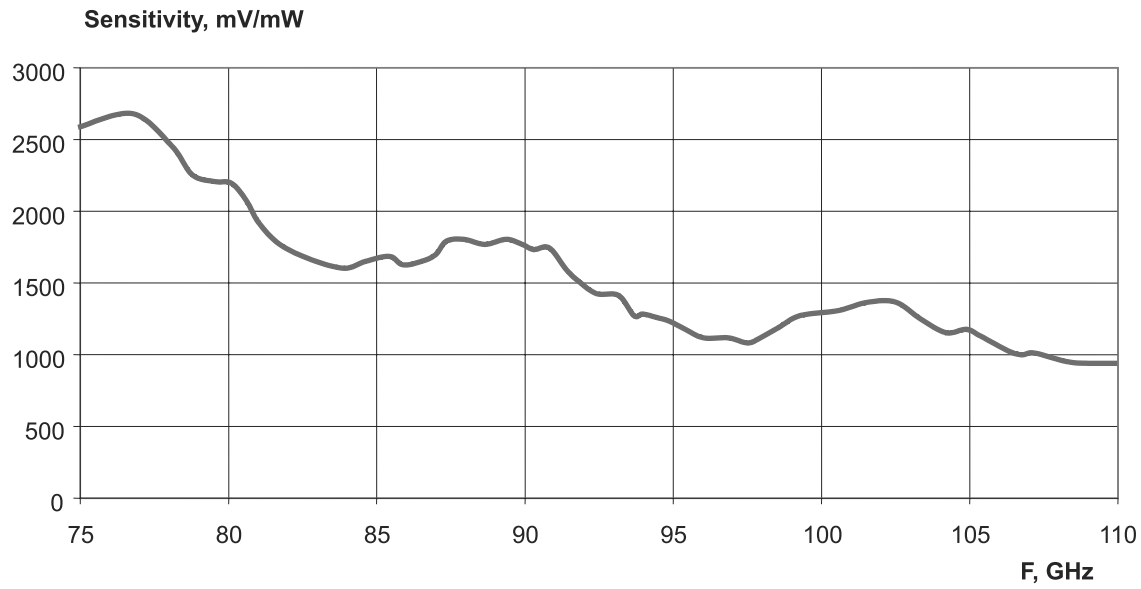
Note. In case you haven't entered the valid actual signal frequency when measuring mm–wave power, the max error will be ±1.5dB for Ka, Q, U, V bands, ±2.0dB for E, W bands, and ±2.5dB for F and D bands, based on flatness of calibration curves.

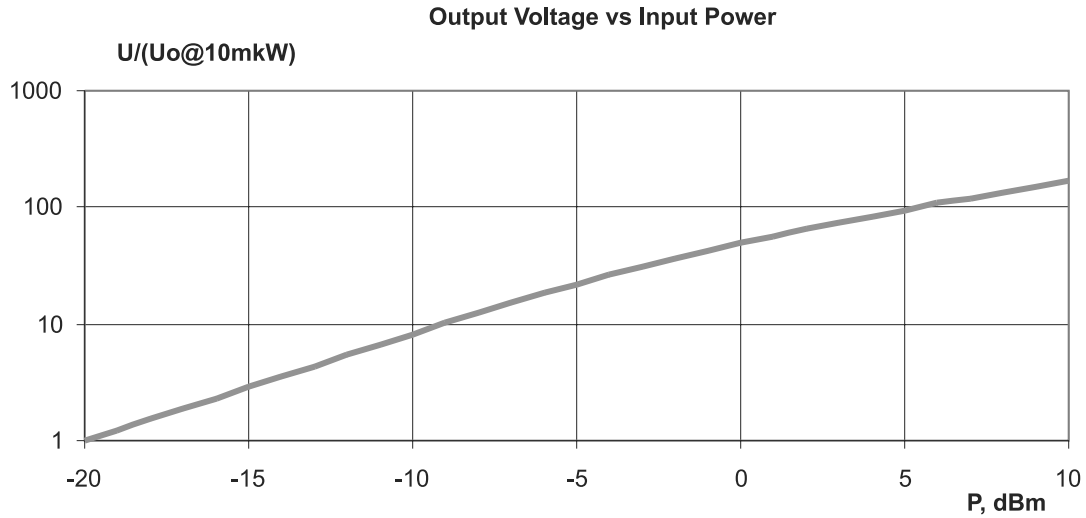
Mm-wave High Sensitive Power Meters

Specifications

MODEL NUMBER	DPM-C	DPM -28	DPM - 19	DPM - 15	DPM - 12	DPM - 10	DPM - 08	DPM - 06
Frequency Band and Range, GHz	0.01-26.5	Ka 26.5-40	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-170
Input waveguide/impedance	50 Ohm	WR28	WR19	WR15	WR12	WR10	WR8	WR6
Wavequide Flange/connector	SMA, male	UG-383/U	UG-383/U-M	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M
Dynamic range, dB (max)	55	60	60	60	60	60	60	55
Min measured power level, dBm	-33	-40	-40	-40	-40	-40	-40	-35
Min measuring time, sec	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
VSWR (power sensor)	1.2:1	1.3:1	1.3:1	1.3:1	1.4:1	1.4:1	1.4:1	1.4:1

Typical Sensitivity vs. frequency and Amplitude response for W-band power sensor





How to Order

Specify Model Number **DPM—X**
X – waveguide band (WR–Number) or **C** for coaxial sensor (0.01–26.5GHz)

Standard models are for min power level (default)
Higher power levels upon request
Standard flange is **UG-XXX/U** round

Example: DPM-**10** means W–band power meter, WR–**10**, 75–110GHz

To cover wider frequency range one display unit can be supplied with a few power sensors for different frequency bands. Please send order request to: sales@elva–1.com

Delivery time 4–8 weeks. All ELVA–1 power meters are warranted by the manufacturer for one year after receipt.

High Power Voltage Controlled Oscillators

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- High output power
- Voltage Frequency control
- High power and frequency stability
- Control of Output power level
- Stable spectrum
- Long life time

Applications

- Mm–wave source of high power
- EPR spectrometer bridge
- Plasma diagnostics
- FMCW radar module
- Instrumentation and test equipment

Description

Millimeter–wave oscillators **VCOM-X/CF/BW/P** series originally was designed for purposes of EPR spectroscopy and plasma diagnostics. It provides electromagnetic energy within approx +/– 200 MHz frequency range around of central frequency with high output power. Original design uses low frequency stable voltage controlled oscillator and frequency multiplier. To increase output power an IMPATT mm–wave power amplifier can be used. Max value of output power level depends on frequency range requested. It can be 200 mW at 94 GHz and 50 mW at 140 GHz. Output power and frequency are controlled by means of external DC and pulse voltages.

The **VCOM-X/CF/BW/P** generator can be supplied with power supply which fed only 220 VAC. The **VCOM-X/CF/BW/P** can have an option for remote control. Reliable work of **VCOM-X/CF/BW/P** oscillators allows using it in scientific experiments which last for long time, a few weeks or even months.

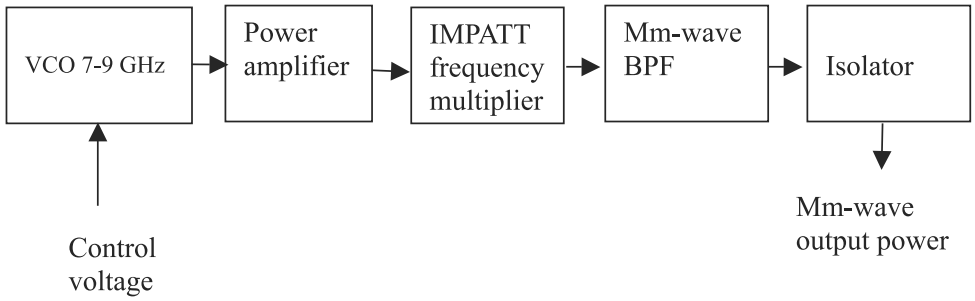
There are three standard models of the **VCOM-X/CF/BW/P** oscillators now. Custom designed VCOM devices can be produced by a special order.

Specifications

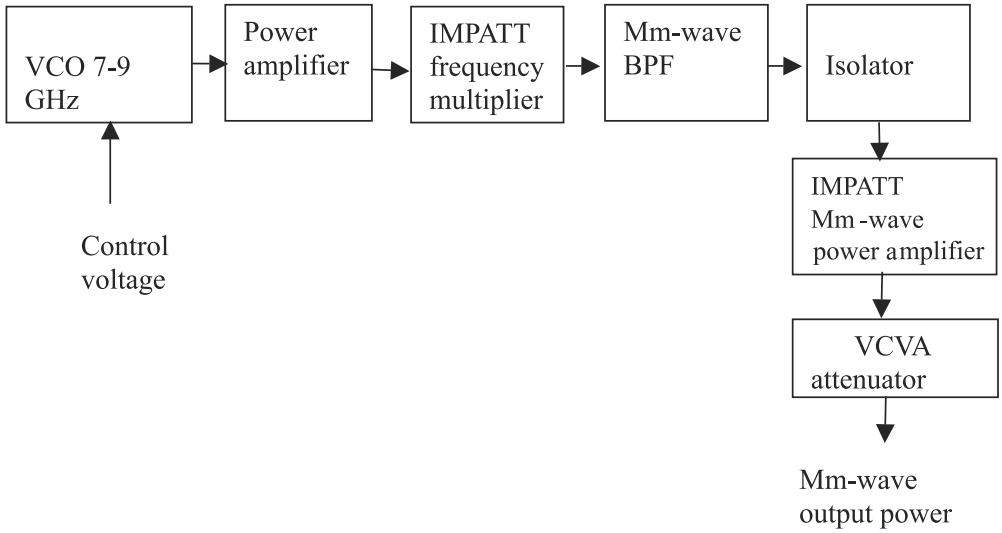
MODEL	VCOM-10/94/0.5	VCOM-06/140/2	VCOM-06/170/2
Central frequency	94 GHz	140 GHz	170 GHz
Bandwidth	500 MHz	2 GHz	2 GHz
Frequency Range (controlled)	93.75-94.25 GHz	139-141 GHz	169-171 GHz
Output power (controlled)	0- 200 mW	0- 10.. 20 mW	0-8 mW
Spectrum line width	100 kHz max	100 kHz max	100 kHz max
Control attenuation	0.. 55 dB	0.. 50 dB	0.. 45 dB
Flange/ Waveguide	UG-387/U-M /WR-06	UG-387/U-M /WR-06	UG-387/U-M /WR-06

Basic block-diagram of VCOM oscillators

A. Wideband VCOM



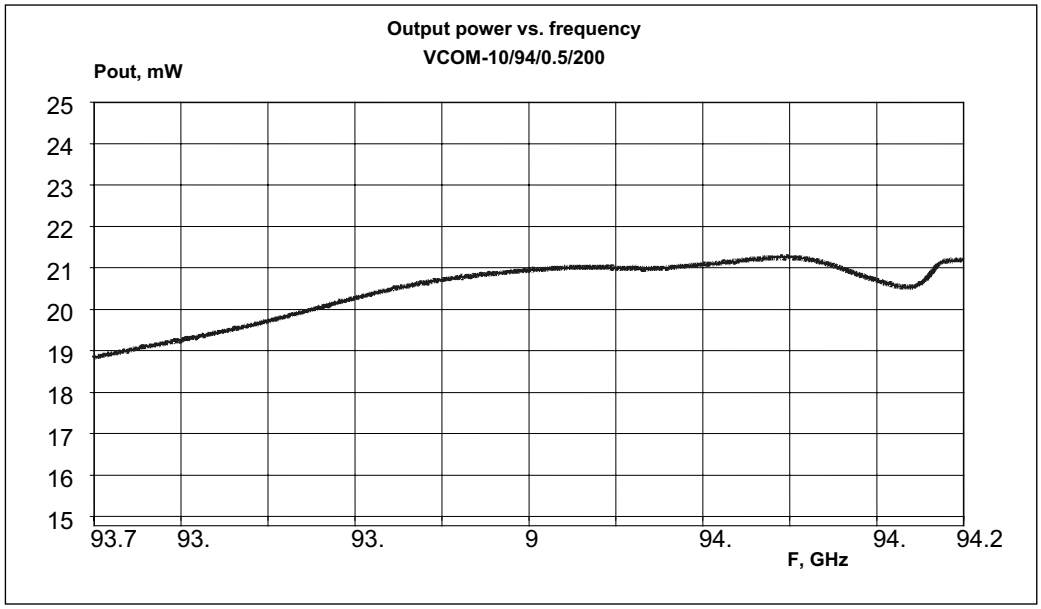
B. High power VCOM

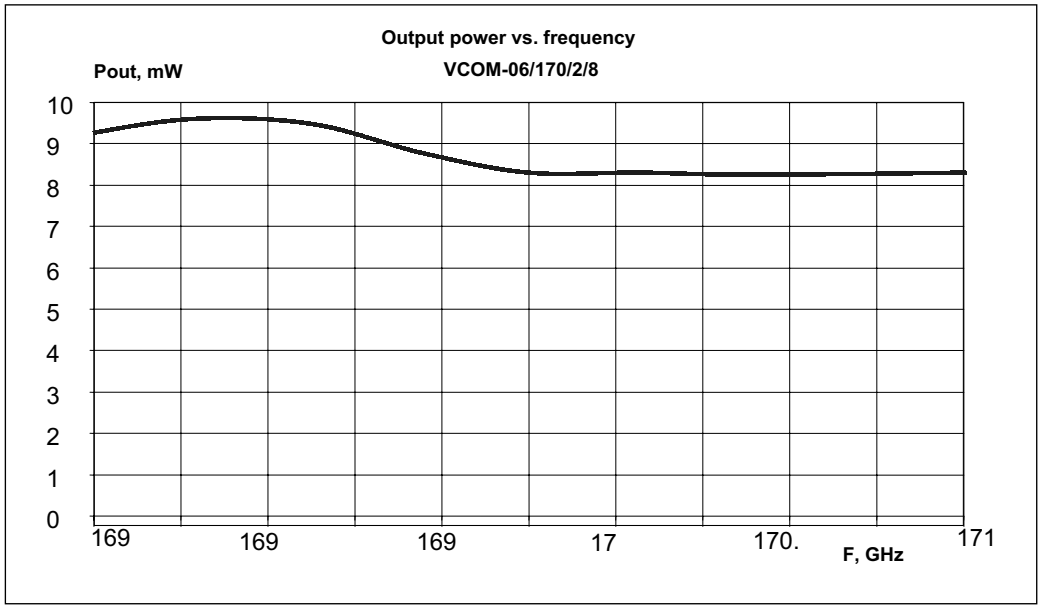


Delivery time for VCOM devices is 8–12 weeks depended on required specifications. All ELVA–1 VCOM oscillators are warranted by the manufacturer for one year after receipt.

High Power Voltage Controlled Oscillators

Typical measured data for W- and D- band VCOM oscillators





How to Order

Specify Model Number **VCOM— X/CF/BW/P**
X– waveguide band (WR–Number)
CF– Central frequency (in GHz)
BW – bandwidth (in GHz)
P– output power (typ) (mW)
Standard flange is **UG-XXX/U** round

Example: VCOM-**10/94/0.5/200** means W–band oscillator, WR–**10**, Central frequency **94**GHz, Bandwidth **0.5** GHz, Output power **200** mW (typical)

GPIB Controlled mm-Wave Frequency Synthesizer

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- 4 GHz Bandwidth
- Smooth power/frequency dependence
- High Frequency Stability
- Low phase noise
- High output power
- Fully packaged
- Designed for GPIB (HP-IB) Systems
- Easy operation from front panel

Applications

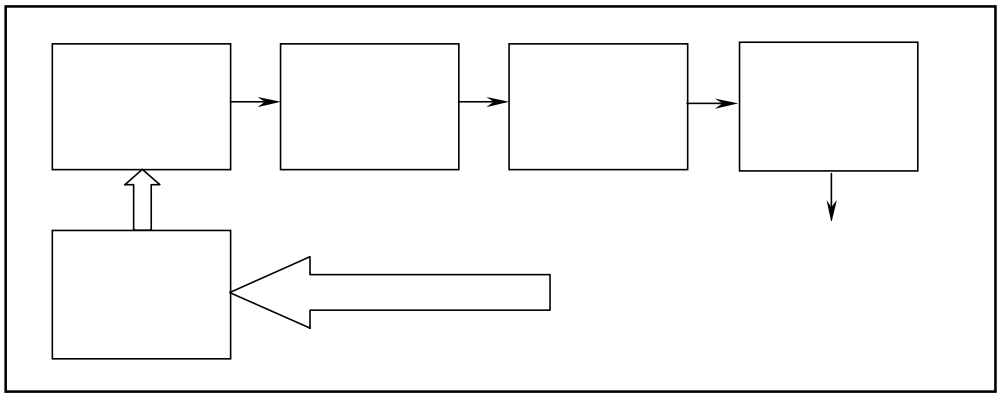
- High stability L.O. for receivers
- Laboratory measurement and test equipment
- Reference signal source
- GPIB (HP-IB) subsystem

Description

Elva-1 microwave synthesizer **PLS-1b (GPIB)** is intended to be used as a phase lockable signal source in the millimeter range of wavelengths. It is built on the base of cm-wave synthesizer using unique technology of IMPATT diode Active Frequency Multiplier (Elva-1 **IAFM** series) combining such features as:

High multiplication factor

Low insertion phase noise 20*log(M); M-multiplication factor.

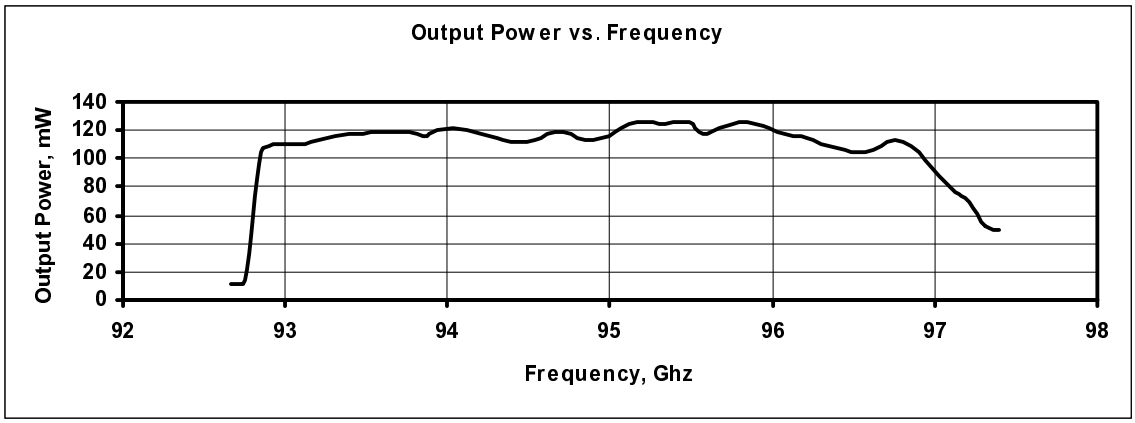


Additional IMPATT Injection Locked Power Amplifier provides more than 70 mw output power. That allows to produce cost effective powerful phase lockable source in millimeter range of wavelengths.

PLS-1b (GPIB) is IEEE 488.2/GPIH/HP-IB compatible device that can be easily integrated in HP-IB subsystems. Additional External reference input can be used to get frequency stability better then 10^{-6} per one degree C.

Each Synthesizer is individually calibrated for output power versus frequency. The resulting data (supplied with the unit) are illustrated on the plot below:

GPIB Controlled mm-Wave Frequency Synthesizer



These generators are completely self-contained, including all control and power supply systems required to drive the device. It can be produced for 220V/50Hz AC, or for 110V/60Hz AC primary power.

Electrical Specifications

Output Frequency Range (GHz)		93 – 97
Output Frequency Step Size (MHz)*		91
Output Power, (mW, min)		90
Output Frequency Stability per one degree C°		10^{-6}
Phase Noise (dBc/Hz, max)		
Offset =	1 kHz	-75
	10 kHz	-88
	100 kHz	-105
Input Reference Frequency (MHz)		10±0.001
Input Reference Signal Voltage pick to pick (V, max)		2

*Can be changed optionally

Common Specifications

Operating temperature range, C°	5-40
AC Input Voltages:	220 V, 50 Hz (110V/60 Hz)
Consumed power, VA	160
Size	48x48x17 cm
Weight	17 kg
Output Waveguide, Flange	WR-10, UG-387/U-M
Input Reference Connector	BNC

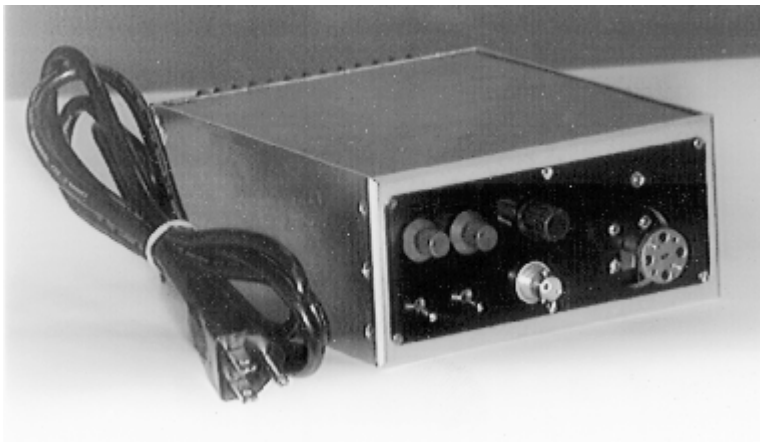
How to Order

Specify Model Number **PLS-1x-A**, where
x – digital interface
a – RS232
b – GPIB
c – Parallel digital interface
A – AC input voltage.

Example: To order Synthesizer meets the following specification: operation with input AC voltage 110ACV and controlled via RS232, should be ordered as **PLS-1a-110**

MMW Sources with Power Modulation

http://www.elva-1.com, e-mail: sales@elva-1.com



Features

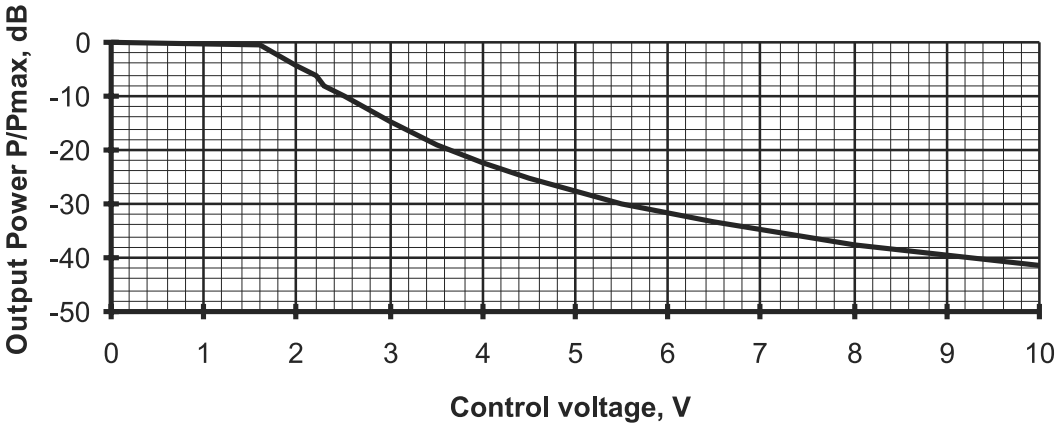
- 26.5–150 GHz operation frequency
- High output power IMPATT diode source
- High frequency stability
- Fine spectrum
- Built-in generator for the sinusoidal output power modulation
- External control of output power

Applications

- Instrumentation subsystems
- Laboratory test equipment
- General purpose source
- MMW channels testing
- MMW receivers testing
- Lock-in detection systems

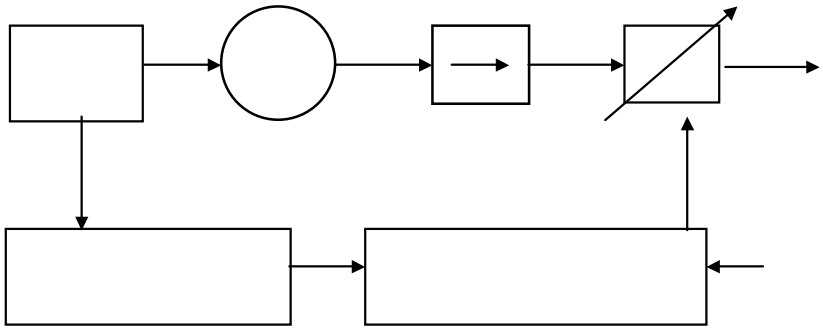
Description

ELVA-1 series **SPM** provide the whole range frequency sources with internal and external controllable amplitude modulation. The standard model uses Cavity Stabilized IMPATT Diod Generators **CIDO** series as MMW signal source, and Voltage-Controlled Variable Attenuators **VCVA** series as an output power modulator. Voltage Controlled sweepers are available optionally on the base of Active Frequency Multipliers with 6–8 GHz pumping VCO or Voltage Controlled IMPATT Oscillator **VCIO**. Each model has built-in controllable signal generator for the output power modulation and a plug for an external modulation signal. We supply each device with a personal calibration characteristic for output power versus external control voltage. Typical dependence is as follows:



MMW Sources with Power Modulation

SPM devices can be produced with integrated power supplies. The block–diagram of the typical SPM device is presented below



Using an external Modulation Input one can control the output power by means of different power supplies, voltage generators and digital–analog converters (DAC). DAC card for standard PC microcomputer with software is available optionally. External modulation up to 20 kHz rate may be applied to switch the attenuator between its high and low insertion loss states, or optionally to vary the attenuation with the external voltage applied. The device contains all the electronic circuitry and power supplies required to bias the attenuator. Built–in Generator can be produced according customer specification. Typical version provides sinusoidal modulation of output power with 10 dB depth and modulation frequencies 0.02–12.5 kHz with a correction of nonlinear characteristic of attenuation/voltage dependence. Depth and frequency of modulation are controlled manually from the front panel of the device.

Electrical Specifications

Model Number	SPM–28	SPM–22	SPM–19	SPM–15	SPM–12	SPM–10	SPM–8	SPM–6
Fixed Frequency within the Band and Range, GHz	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-150
Maximum Power Output*	150	150	100	100	100	70	50	30
Relative Frequency Stability (30 min)	$5{\cdot}10^{-6}$	$5{\cdot}10^{-6}$	$5{\cdot}10^{-6}$	$5{\cdot}10^{-6}$	$5{\cdot}10^{-6}$	$5{\cdot}10^{-6}$	$5{\cdot}10^{-6}$	$5{\cdot}10^{-6}$
Power Modulation Depth, dB	40	40	40	40	40	40	40	38
Rise Time*, 10-90%, ms	0.1	0.05	0.05	0.025	0.025	0.01	0.01	0.01
Line Width max, kHz	1	1	1.5	1.5	2	3	5	5

*Values are presented for the middle frequency of the frequency band.

Size:	150x180x70 mm
AC Input Voltages:	110 V, 60 Hz; 220 V, 50 Hz
Input Voltage for Variable Attenuation:	0 to +10 V
Switching Voltage for External Modulation:	0 to +5 V

Model with 60 dB power modulation depth is available optionally on the base of new improved **VCVA**. The modulation depth would be significantly increased using two attenuators connected in series. The device would be optionally equipped by phase modulator or fast P–I–N modulator (5 ns, 40 dB).

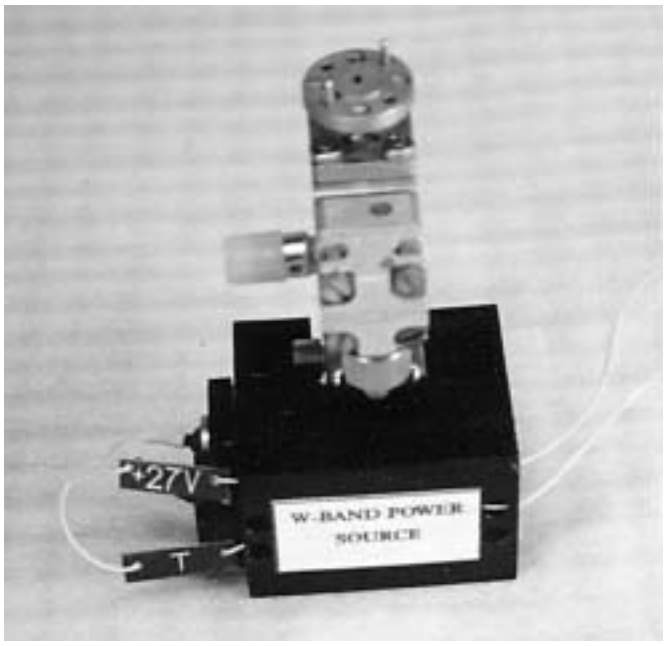
How to Order

Specify Model Number **SPM-xxA-B-C-D**
XX – waveguide band (WR–Number)
A – flange type : **R** = round or **S** = square (**WR-28** only)
B – operating frequency in GHz
C – output power in mW
D – AC voltage power supply options
0 = no power supply, **1** = 110 VAC/60Hz, or **2** = 220 VAC/50Hz, or **3** = 100VAC/50Hz power supplies

Example: To order oscillator meets the following specification: waveguide WR–10, round flange, operation frequency 94 GHz, output power 20mW, input AC voltage 110ACV, should be ordered as **SPM-10R-94-20-1**

The 26-150 GHz Cavity Stabilised IMPATT Millimeter Wave Oscillators

http://www.elva-1.com, e-mail: sales@elva-1.com



Features

- Very high frequency stability
- High output power
- Low phase noise
- Fine spectrum
- Precision frequency adjustment
- Weak temperature dependence
- Compact, low cost

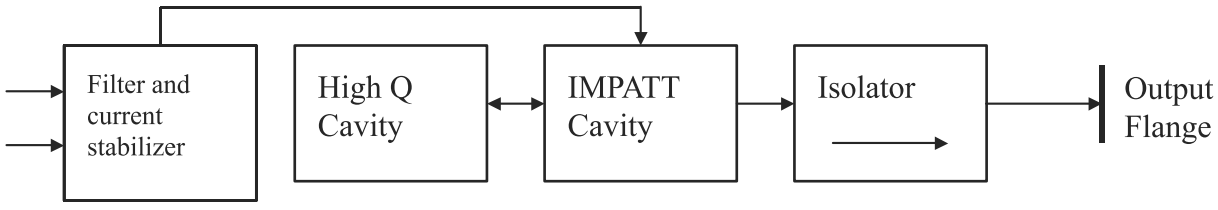
Applications

- Stable fixed frequency LO
- Communication systems
- Instruments and test equipment
- Space and Hi-Rel systems

Description

ELVA-1 series **CIDO-XX** cavity-stabilized IMPATT diode oscillators provide high frequency stability and low phase noise capabilities. They combine the extended frequency range and high output power of IMPATT oscillators with stability and phase nose capabilities provided by cavity-stabilized Gunn oscillators. These sources are available in 8 waveguide bands covering 26 to 150 GHz. The source consist of a waveguide cavity IMPATT oscillator which is coupled to a high Q, high order mode cylindrical cavity. The cylindrical cavity is made of Invar to improve the frequency stability over a broad temperature range. Operating temperature range is -50 to +80 °C. Low pass EMI filter and current stabilizer included for reliable, trouble-free operation. The device supplied with an integral isolator.

Standard **CIDO-XX** models are supplied mounted on a finned heatsink These oscillators can maintain their operating frequency within few megahertz over the normal operating temperature range without a temperature controller or heater. An optional built-in temperature controlled heater can be supplied to maintain the oscillator within a narrow operating temperature range. The frequency can be held in a much narrower range. Custom configurations and performance characteristics different from standard models are available.



Scheme of oscillator

The 26-150 GHz Cavity Stabilised IMPATT Millimeter Wave Oscillators

ELVA-1 Millimeter Wave Division
http://www.elva-1.com, e-mail: sales@elva-1.com

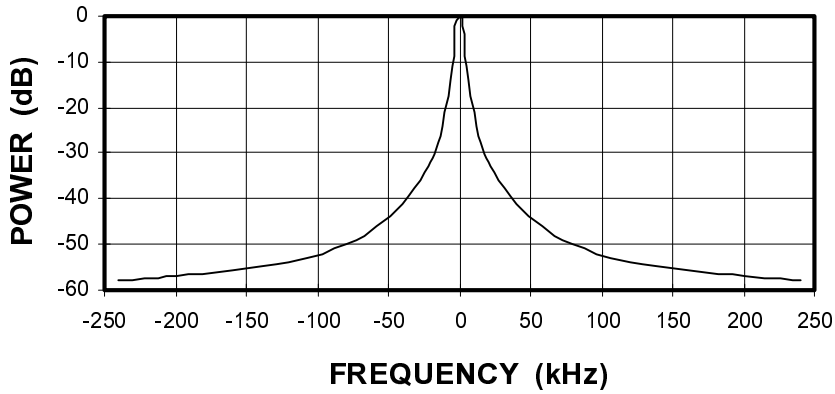
Specifications

Model Number	CIDO – 28	CIDO – 22	CIDO – 19	CIDO – 15	CIDO – 12	CIDO – 10	CIDO –8	CIDO –6
Frequency Band and Range, GHz	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-150
Maximum Power Output*	150	150	120	120	120	100	60	40
Frequency Stability, 1/°C (typ)	10^{-5}	$8 \cdot 10^{-6}$	$8 \cdot 10^{-6}$	$6 \cdot 10^{-6}$	$5 \cdot 10^{-6}$	$5 \cdot 10^{-6}$	$5 \cdot 10^{-6}$	$5 \cdot 10^{-6}$
Amplitude Stabil., dB/°C (typ)	0.01	0.01	0.015	0.015	0.015	0.02	0.02	0.02
DC Power (IMPATT Bias), V/A (max)	+50/ 0.15	+45/ 0.15	+45/ 0.15	+35/ 0.15	+35/ 0.2	+27/ 0.2	+24/ 0.26	+24/ 0.26

*Maximum achievable power level for the middle frequency of the frequency band.

Accuracy of frequency adjustment is about few MHz. The adjustment is provided on the factory according to customer requirements.

Typical Performance

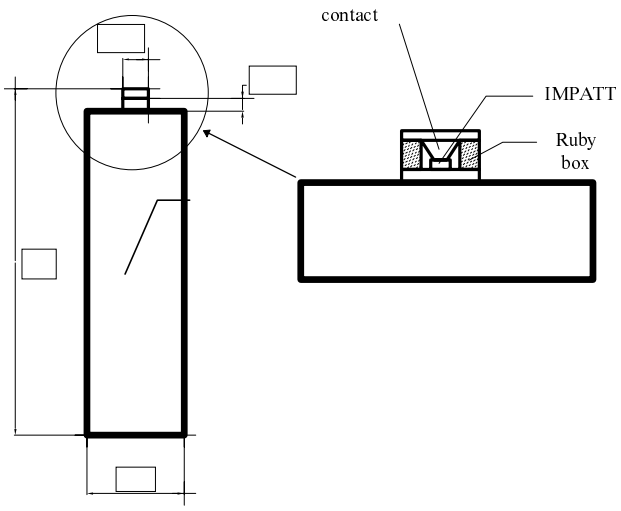


Optionally the following items would be supplied to meet customer requirements:
1. IMPATT Injection–Locked Amplifiers **IILA** series to increase the output power;
2. Phase or amplitude modulator on the base of fast P–I–N switch **FPS** series;
3. Amplitude regulator on the base of Voltage Controlled Attenuator **VCVA** series;
4. Power supply for AC Input Voltages 110 V, 60Hz; 220 V, 50 Hz

How to Order

Specify Model Number **CIDO-xxA-B-C-D**
XX – waveguide band (WR–Number)
A – flange type : **R** = round or **S** = square (**WR-28** only)
B – operating frequency in GHz
C – output power in mW
D – AC voltage power supply options
0 = no power supply, **1** = 110 VAC/60Hz, or **2** = 220 VAC/50Hz, or **3** = 100VAC/50Hz power supplies

Example: To order oscillator meets the following specification: waveguide WR–10, round flange, operation frequency 94 GHz, output power 20mW, input AC voltage 110ACV, should be ordered as **CIDO-10R-94-20-1**



Features

- 25–155 GHz frequency range
- Pulse and CW version
- 20W pulse, 200 mW CW operation
- Delivery from stock
- Low cost

Power Output Available

Frequency (GHz)	33-37	42-46	54-62	92-96	135-155
CW, mW	200	200	200	150	50
Pulse ,W	20	Call	20	20	2

Description

ELVA–1 series of IMPATT diodes are silicon double drift diodes mounted in hermetically sealed packages and supplied mounted to a copper heat sink. Standard products are offered with power outputs tested in specific frequency windows.

IMPATT diode products for millimeter–wave applications are realized on the basis of the symmetrical double–drift structure. The layers in double–drift diodes are: a heavily doped (p+)–region, a moderately doped p–region, a moderately doped n–region, and a heavily doped (n+)–region. The (p+)– and (n+)– regions allow ohmic electrical contacts to be made to the external circuit. Two p– and n–layers are grown in sequence on a low resistivity (n+) arsenic doped silicon substrate by vapor–phase low–pressure epitaxy. This technique provides sharp grading profiles at both the (p+)– and (n+)–interfaces and at the p–n–junction.

More then 10 years history of application of the same diodes coupled with failure analysis has enabled us to achieve very high mean–time–to–failure (MTBF) rates.

A microwave cavity test fixture is offered for both CW and pulsed IMPATT diodes. Purchase enables the user to verify ELVA–1 test data.

CW IMPATT Diode Specifications

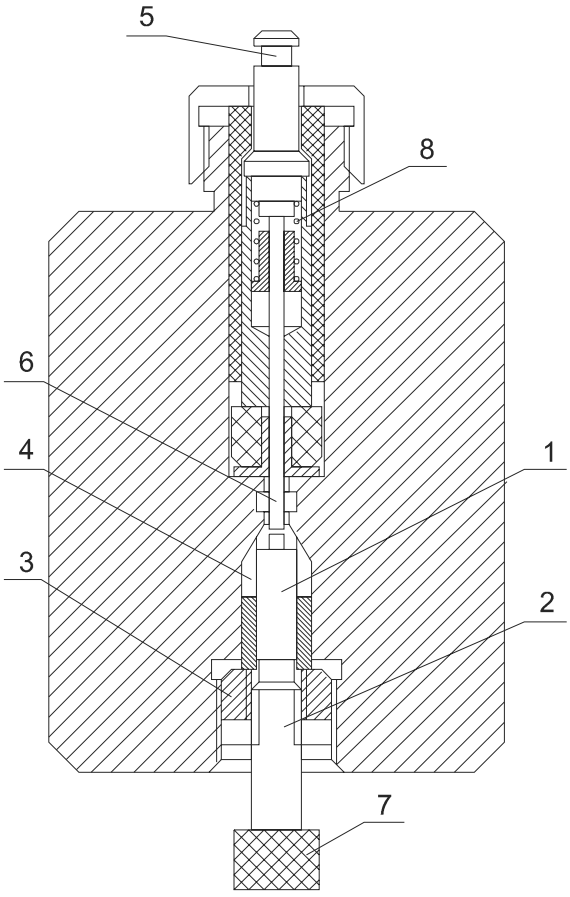
Model	IC-02K	IC-02Q	IC-02U	IC-02V	IC-015W	IC-005D
Test Circuit Waveguide Band (GHz)	Ka (26.5-40)	Q (33-50)	U (40-60)	V (50-75)	W (75-110)	D (110-170)
Test Frequency Range (GHz)	33-37	42-46	54-58	58-62	92-96	135-155
Power Outputs Available (W, min)	0.2	0.2	0.2	0.2	0.15	0.05
Brake Voltage Range (V)	32-40	30-38	20-26	20-26	12-15	10-12
Operating Voltage Range (V)	38-46	36-44	26-32	26-32	18-31	16-18
Operating Current, mA	80-150	80-150	100-150	100-150	150-200	180-260
Total Capacitance at V=0 (pF)	1.3-1.8	1.2-1.6	1.1-1.4	0.9-1.2	0.7-1.1	0.7-1.1

IMPATT Diodes and Test Fixtures

CW IMPATT Diode Specifications

Model	IM-10PK/ IM-20PK	IM-10PV/ IM-20PV	IM-10PW/ IM-20PW	IM-01PD/ IM-02PD
Test Circuit Waveguide Band (GHz)	Ka (26.5-40)	V (50-75	W (75-110)	D (110-170)
Test Frequency Range (GHz)	33-37	58-62	92-96	135-155
Peak Power Outputs Available (W, min) Free Running / Amplification Modes	10/20	10/20	10/20	1/2
Break Voltage, V	35-40	21-28	13-16	10.5-12.5
Operating Current, A	8-15	10-12	10-18	2-5
Total Capacitance at V=0 (pF)	10-26	8-12	6-8	2-6

Pulse width is 50-100 nS, repetition rate is not more then 100 kHz.



Test fixture for the testing of IMPATT Diodes for 150 GHz is designed as a coaxial–waveguide transition. IMPATT Diode (1) is installed into the coaxial line that crosses a waveguide cavity. Output of the cavity is a waveguide WR–6 with 387/U–M flange. Movable short circuit is installed on the other side of the cavity. The biasing current is applied by means of a central wire of the coaxial line (6). The construction of the test fixture allows to adjust the position of the diode in respect to the waveguide using an adjustment screw (7). The central coaxial wire is movable. There is a spring (8) that keeps a contact between the wire and the Diode during the adjustment. After the adjustment the Diode position should be fixed by means of the fixing screw (3). Adjustment of the frequency and output power should be carried out by means of two screws: micro–metric screw, that moves the short circuit, and the screw, that changes the position of the diode.

The microwave test fixture is supplied with biasing current stabilizer to provide a reliable, trouble–free operation

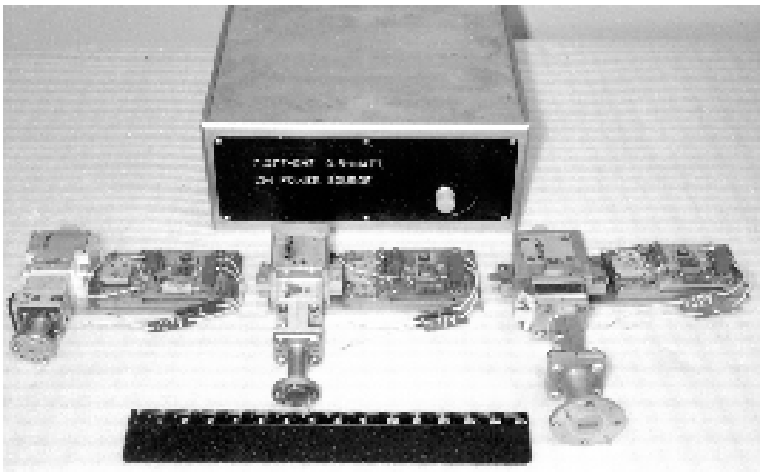
Optionally we propose power supply for CW and pulsed Test Fixture 110VAC, 60Hz, or 220VAC, 50Hz.
The following products are available as examples of IMPATT diode application:

1. Cavity Stabilized IMPATT diode Oscillators **CIDO** series.
2. Pulsed IMPATT Power Sources **IPSP** series.
3. IMPATT Active Frequency Multipliers **IAFM** series.
4. Pulsed and CW IMPATT Injection–Locked Amplifiers **IILAP** and **IILA** series.

Voltage Controlled IMPATT Oscillators **VCIO** series.

The 26-150 GHz IMPATT Active Frequency Multipliers

http://www.elva-1.com, e-mail: sales@elva-1.com



Features

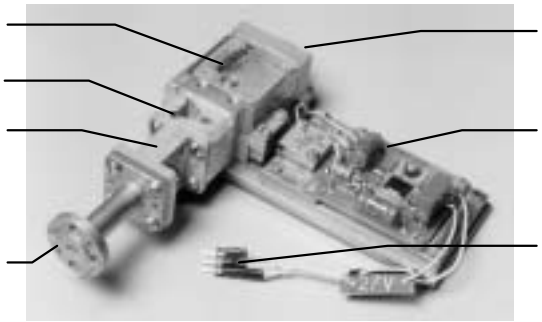
- Multiplication factor up to 25
- High efficiency
- High power output levels
- Low spurious harmonic content
- Fast switching

Applications

- Power sources
- Electronic tuned power sources
- Millimeter wave frequency synthesizers
- Spectroscopy/Radiometry
- Digital Radio

Description

ELVA–1 series IMPATT Active Frequency Multipliers **IAFM** are really unique devices providing an outstanding performance in terms of high efficiency and high output power. Available in multiplication factor up to 25 in one device they cover the output frequency range of 20 to 150 GHz using centimeter–wave range source. They are capable of handing very high input power without damage. Different IAFM's would operate with the same centimeter–wave range pumping source. For example, on the picture above you can see the pumping source (0.5W, 7.2775 GHz) and three different multipliers: IAFM–28 (5th harmonic, 36.3875 GHz), IAFM–15 (8th harmonic, 58.2200 GHz) and IAFM–10 (13th harmonic, 94.6075 GHz). The phase and amplitude stability of the output signal defined by the quality of the pumping source. It is possible to achieve Hz resolution on 150 GHz using state–of–the–art synthesized cm–wave source. The frequency multipliers are designed as a module that consists of a multiplier itself, band–pass filter and isolator. Current stabilizer included for reliable, trouble–free operation. The band–pass filter rejects the side band noise of the source on about –50 dB. That allows to use the device as low noise solid state LO, if intermediate frequency is higher then the frequency of rejection. The input of multiplier is a coaxial connector, and the output is a waveguide flange



The 26-150 GHz IMPATT Active Frequency Multipliers

Specifications

Model Number	IAFM – 28	IAFM –22	IAFM – 19	IAFM – 15	IAFM – 12	IAFM – 10	IAFM – 8	IAFM –6
Frequency Band and Range, GHz	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-150
Maximum Power Output*	150	150	120	100	50	30	25	20
Input signal power, mW	150-600	150-600	200-600	200-600	200-800	300-800	300-1000	400-1000
Frequency multiplication factor	5-8	6-10	7-10	8-13	10-15	14-18	18-24	19-25
DC Power (IMPATT Bias), V/A (max)	+50/ 0.15	+45/ 0.15	+45/ 0.15	+35/ 0.15	+35/ 0.2	+27/ 0.2	+24/ 0.26	+24/ 0.26

*Values are presented for the middle frequency of the frequency band.

Common Specifications

Output power flatness within the 1% band width (max) 3 dB
Rejection of adjacent harmonics (min) 40 dB
VSWR 1:1.3
AM noise inserted (max) –130 dB/Hz (white noise)

There is no additional noise produced by IAFM–XX in comparing with passive multipliers. It can be estimated using the formula: Noise of pumping source +20Lg(N) dB/Hz. For example, if 7 GHz pumping source has –120dB/Hz on 10 kHz offset from the carrier, after frequency multiplication on a factor of 20 the noise of 140 GHz source on 10 kHz offset will be –120dB/Hz+20Lg(20) = –94 dB/Hz.

Series **IAFM-XX** are designed for high reliability and applications in hard environments. The operating temperature range: minus 50 to plus 70 °C and life time is equal to 50000 hours. Each model may be produced with the possibility of the fast output power switching. 1 ns time of on/off switching is allowed.

Optionally the following items would be supplied to meet customer requirements:

· Complete very stable solid state millimeter wave source, that consist of the following:

1. Transistor oscillator stabilised by the dielectric resonator (DRO). 6–8 GHz, 10 mW output, 10^{-6} frequency stability. The stability would be increased upon request using a temperature stabilization scheme.

2. Transistor power amplifier that provides 6–8 GHz power sufficient for the normal operation of **IAFM-XX**.

3. **IAFM-XX**.

Accuracy of frequency adjustment is about 5–50 MHz. The adjustment is provided on the factory according to customer requirements.

· Millimeter wave sweeper on the base of Varactor Controlled Oscillator (6–8 GHz, 10 mW). Other elements of the scheme are the same as above. Typical bandwidth is 0.5–1%.

· The frequency bandwidth would be also increased upon request. The limit is the distance between nearest harmonics, so it is impossible to provide the bandwidth more than the pumping frequency. The real bandwidth would be about 50–80% of the initial (pumping) frequency. For example in the Correlation Reflectometer for JET (Joint European Torus) the device with 92–96 GHz frequency sweep was supplied.

· IMPATT Injection–Locked Amplifiers **IILA** series to increase the output power.

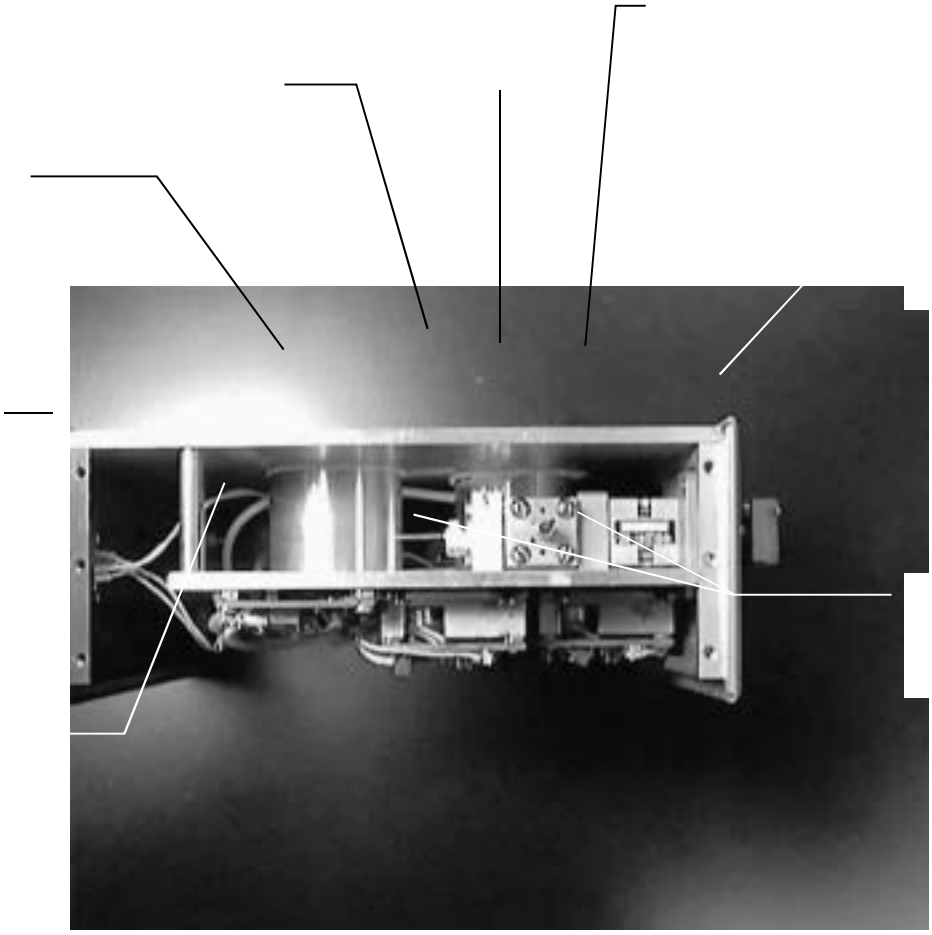
· Phase or amplitude modulator on the base of fast P–I–N switch **FPS** series.

· Amplitude regulator on the base of Voltage Controlled Attenuator **VCVA** series.

· Power supply for AC Input Voltages 110 V, 60Hz; 220 V, 50 Hz.

20W Pulsed Free Running W-Band Source

http://www.elva-1.com, e-mail: sales@elva-1.com



The power source consists of a pulsed IMPATT free-running oscillator, a pulsed IMPATT injection amplifier, two current modulators with chirp compensation and triggering voltage generator. Power output is a waveguide flange, triggering pulse output is a coaxial SMA connector.

Specifications

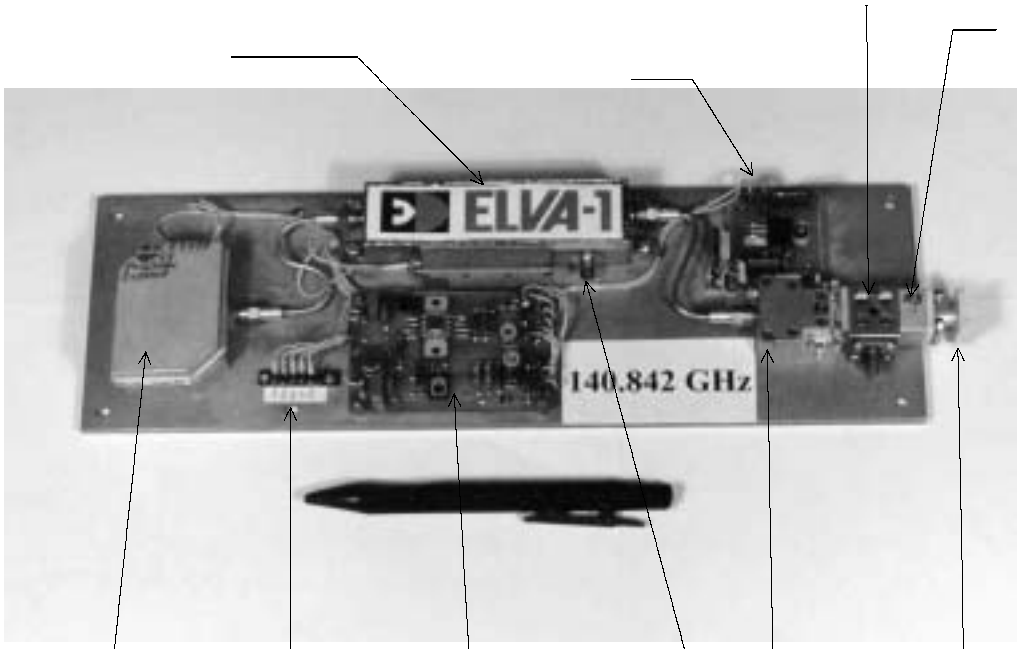
Operation Frequency, GHz	92.0
Output pulsed power, W	20
Pulse width, nSec	80
Chirp bandwidth, GHz	0.4
Repetition Frequency, kHz	50
DC Power V/mA, max	+48±5%/200, +12±5%/200
Output	WR10, UG387/U-M

How to Order

Specify Model Number **PSFR-xx-A**
XX – center frequency
A – AC voltage power supply options
0 = no power supply, **1** = 110 VAC/60Hz, or **2** = 220 VAC/50Hz, or **3** = 100VAC/50Hz power supplies

Example: To order radar meets the following specification: operation frequency 94 +/–2.5 GHz, input AC voltage 110ACV, should be ordered as **PSFR -94-1**

140 GHz CW Source based on Active Frequency Multiplier



±
-12 V
+27V
Ground for +27V

20 dB
Directional
Coupler

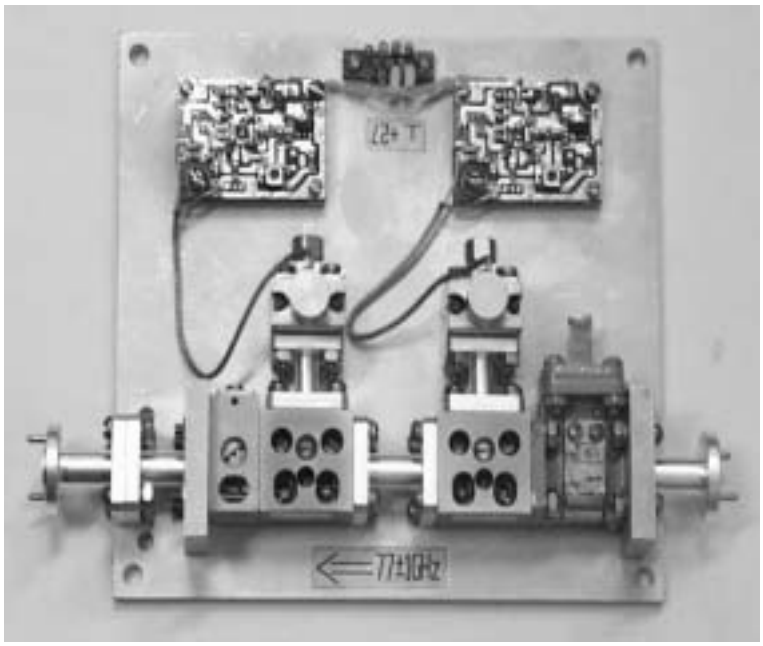
The source consists of CW Transistor DRO, Transistor Power Amplifier with about 0.5W output and Active Frequency Amplifier.

Specifications

Operation Frequency, GHz	140.842
Output CW power, mW	20
Stability	10^{-6}
Line width max, kHz	1
Output	WR6

IMPATT Injection-Locked Amplifiers

http://www.elva-1.com, e-mail: sales@elva-1.com



Features

- High output power
- CW and Pulse millimeter–wave application
- Current regulator included for reliable operation

Applications

- Instrumentation
- Communication systems
- Radars

Description

ELVA–1 injection–lock IMPATT Amplifiers **IILA** series are intended for high power amplification of CW and Pulse mm–wave signals. They are offered in the frequency range of 26–150 GHz in five wave–guide sizes. They can operate from power level as low as 2–3 mW, which can be obtained directly from Up Converter or Frequency Multiplier. When Amplifier is injection–locked, FM noise of the output is the same as the injection signal. In the absence of an in–band input signal of sufficient power to attain injection–lock, there is a free running output signal.

The amplifiers are provided with integral circulators and DC voltage regulator. An optional heater is available for better temperature stability. To achieve higher gain, broader locking bandwidth and higher output, multi–stage and multi–diode configurations are also available.

Specifications

MODEL NUMBER	Ka-band, WR-28	Q-band, WR-22	V-band, WR-15	W-band, WR-10	D-band, WR-06
Center frequency range, GHz (specify)	26.5-40	40-50	50-75	75-110	110-150
Maximum CW power output, mW	200	200	200	200	150
Maximum Pulse Power output, W	20	15	15	10	2
Injection-locking bandwidth at 1 dB point (min)	200 MHz	200 MHz	300 MHz	400 MHz	500 MHz
Range of input injection power level, dBm (1)	+2 to +6	+2 to +6	+2 to +6	+2 to +6	+2 to +6
Power output flatness, dB (max)	±1	±1	±1	±1	±1
DC power (IMPATT bias), V/A	+50/0.4	+45/0.4	+32/0.4	+27/0.4	+24/0.5

Notes: These specifications are presented for the middle frequency of the frequency band.

IMPATT Injection-Locked Amplifiers

How to Order

Specify Model Number **IILA-XX-MAABCC/F**

XX – waveguide band (WR–Number)

M – operating mode
P – pulse
C – CW

AA – output power option (output power in dBm)
23 – 23dBm(200mW)

B – injection–locking bandwidth option (bandwidth in hundreds of MHz)
2 – 200MHz
5 – 500 MHz

CC – input power option (input power in dBm)
05 – 5dBm
10 – 10dBm

Note: Specified parameters will be maintained for input injection power variations ± 2dB around this nominal input power level

F – center operating frequency

Example: To order amplifier meets the following specification: CW mode, in WR–06 waveguide band at 135 GHz center frequency, 100 mW output power in 300 MHz locking band with +6dBm input power, should be ordered as **IILA-06-C20306/135**

Delivery time 6–8 weeks for all models.
All ELVA–1 Injection Lock Amplifiers are warranted for one year after receipt.

Broadband Balanced Mixers Down Converters

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- 26.5–170 GHz operating frequency
- 6.5–10 dB conversion losses
- Good flatness
- up to 22 GHz IF
- Up to 40 dB balance
- required LO power 1...10 mW
- VSWR 2:1 (typ)

Applications

- Low noise Receivers of mm–wave power
- Down converters
- Instrumentation and test equipment

Description

Broadband balanced mixers are the key components of mm–wave receivers, down converters and test equipment. Standard line of ELVA–1's balanced mixers **BM-X/LO/IF** series provides low conversion losses and low noise figure of the devices within standard frequency bands from 26,5GHz to 170 GHz.

The **BM-X/LO/IF** mixers are based on Ga–As Schottky diodes of ELVA–1's manufacturing. They provide features within whole waveguide band of RF and LO frequencies. Using original design of the mixer allows reaching IF up to 18 GHz and LO/IF isolation up to 30...40 dB. Standard mixers demand about 10 mW LO power and work without external biasing.

ELVA–1 can also ship custom design balanced mixers in addition to the conventional product line. These custom design balanced mixers work with lower LO power levels at 1–2 mW and higher IF frequencies up to 22–26 GHz. Low LO power balanced mixers are biased and have the fourth coaxial input.

To provide even lower noise figure and higher RF to IF gain there are balanced mixers **BMA-X/LO/IF** series with built–in IF pre–amplifier.

There are two main designs of the balanced mixers: axed and angle ones, both are shown in the photos above. Typical specs of **BM-X/LO/IF** balanced mixers are given below.

Broadband Balanced Mixers Down Converters

Specifications

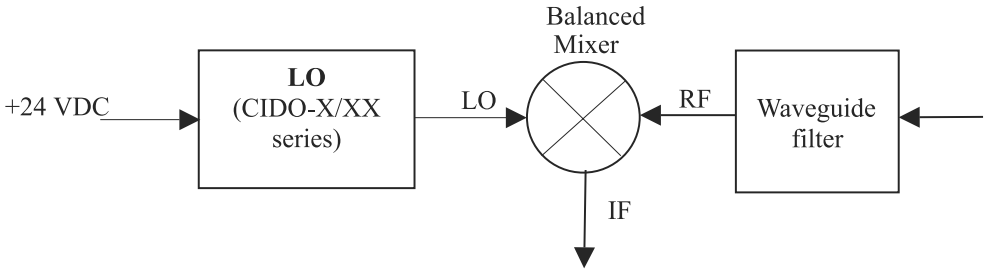
MODEL NUMBER	BM-28/XX	BM-22/XX	BM-19/XX	BM-15/XX	BM-12/XX	BM-10/XX	BM-08/XX	BM-06/XX
Frequency Band and Range, GHz	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-170
Input waveguide	WR28	WR22	WR19	WR15	WR12	WR10	WR8	WR6
Wavequide Flange	UG-599/U	UG-383/U	UG-383/U-M	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M
Conversion losses at RF LO over full waveguide band, IF: 0.01-8 GHz, dB (max)	8	8	8.5	9	9.5	10	---	---
Conversion losses at fixed LO, IF: 0.01-8 GHz, dB (max)	6.5	7	7	7.5	7.5	8	8	8.5
Conversion losses at fixed LO, IF: 8-18 GHz, dB (max)	7	7.5	7.5	8	8	8.5	9	9

Notes: 1. Maximum operating temperature is +60°C
2. Incident max CW RF power: 20 mW (typ)
3. RF power at 1 dB compression: 1 dBm (typ)
4. IF, bias connectors: SMA female

Delivery time 6–8 weeks for standard models. Custom designed mixers delivered 12 weeks ARO.
All ELVA–1 balanced mixers are warranted by the manufacturer for one year after receipt.

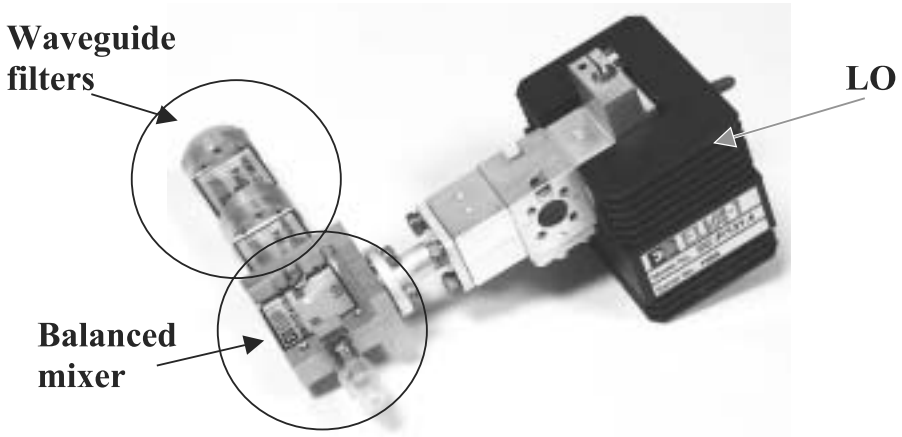
Typical Application: down converter

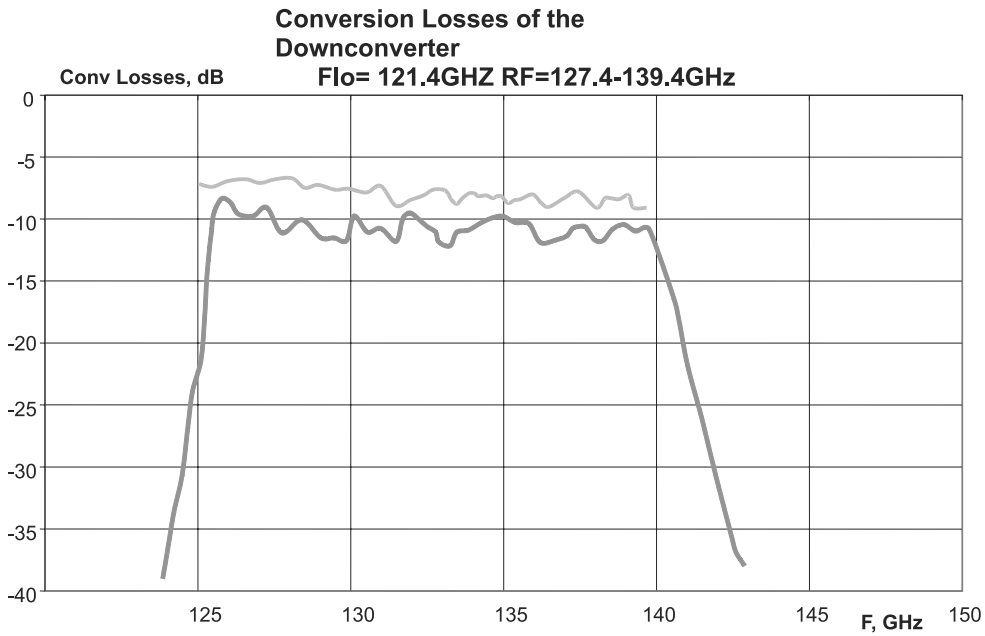
The balanced mixers are frequently used as components of down converters. Also ELVA–1 offers the rest components of the down converters: high stable local oscillator to drive balanced mixer and waveguide filters. Due to the down converters have two received frequency bands which are lower and higher LO frequency, some waveguide filters can set at RF port of the balanced mixer to suppress unnecessary signals.



Typical outward view and measured data for a down converter are shown below:

F-band Downconverter
LO= 121.4GHz RF=127.4-139.4GHz
IF=6…18GHz (LPF and BPF used)





How to Order

Specify Model Number **BM—X/XX/XXX**
X– waveguide band (WR–Number)
XX– LO central frequency (GHz) or F for full band
XXX – max IF frequency (GHz)
Standard flange is **UG-XXX/U** round
Default is **Axled** type

Example: **BM-10/94/4** means W–band mixer with WR–**10**, LO=**94**GHz, IF=**4**GHz.

Circulators/ Isolators

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- 26.5–170 GHz operating frequency
- Narrow band and fullband types
- Low insertion losses, high isolation
- High isolation
- Compact size
- Easy mounting

Applications

- Junction of some parts of sub–systems
- Matching of several waveguide components
- Base of multi–junction devices (injection–locked amplifier)
- Instrumentation and test equipment

Description

26.5–170GHz circulators and isolators are ferrite waveguide components. There are two kinds of the products operating within narrow frequency band (1GHz to 4GHz) and full waveguide band. Junction circulators /isolators are narrow band. Wideband devices are based on Faraday rotation effect. Circulators and isolators components are often used as components in many waveguide scheme for junction their parts and for matching different components and protecting against reflected mm–wave power.

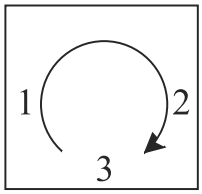
Standard line of ELVA–1's circulators **CR-X/CF/BW** series provide low insertion losses and high isolation for all three ports. They have operation frequency band up to 4 GHz. Better performances of the circulators can be provided within narrow frequency band.

The **IS-X/CF/BW** isolators are realized by terminating of one port of the junction circulators. The **IS-X/CF/BW** isolators ideally suit for suppression of reflected power coming from any waveguide devices with high VSWR.

Broadband isolators IF–X have good performance within full waveguide range. The IF–X isolators are mainly used in wideband sources or receivers for suppression mm–wave power propagating in one fixed direction. At the opposite direction IF–X isolators have small losses.

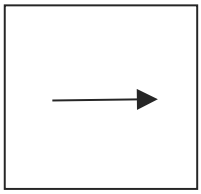
Specifications:

Narrow band circulators CR-X/CF/BW series:



	CR-X/CF/BW			
Central frequency:	Fixed from 26.5- 110 GHz		Fixed from 110- 170 GHz	
Bandwidth:	2.5 GHz	0.5 dB	2.5 GHz	0.5 dB
Insertion losses: 1 to 2, 2 to 3, 3 to 1	0.7 dB	0.5 dB	1 dB	0.8 dB
Isolation: 2 to 1, 3 to 2, 1 to 3	23 dB (min)	30 dB	20 dB (min)	25 dB
VSWR	1.2 (typ)		1.4 (typ)	

Narrow band isolators IS-X/CF/BW series

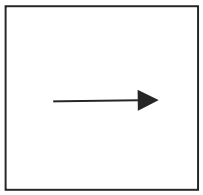


	IS-X/CF/BW			
Central frequency:	Fixed from 26.5- 110 GHz		Fixed from 110- 170 GHz	
Bandwidth:	2.5 GHz	0.5 dB	2.5 GHz	0.5 dB
Insertion losses:	0.7 dB	0.5 dB	1 dB	0.8 dB
Isolation:	23 dB (min)	30 dB	20 dB (min)	25 dB
VSWR	1.2 (typ)		1.4 (typ)	

Notes: 1. Maximum operating temperature for all series circulators and isolators is +60°C
2. Incident max CW RF power: 1 W (typ)

Circulators/ Isolators

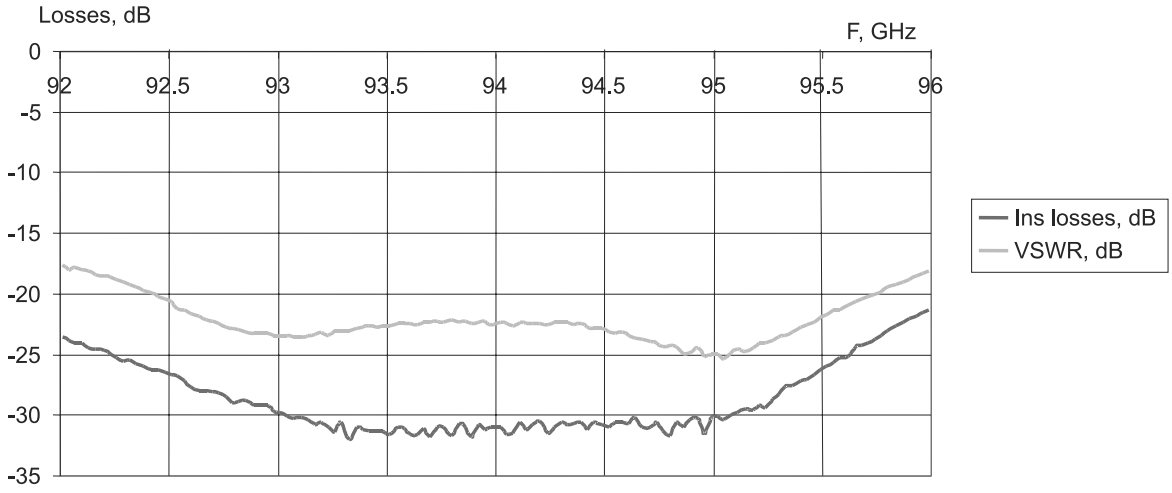
Full band isolators IF-X series



MODEL NUMBER	IF-28	IF-22	IF-19	IF-15	IF-12	IF-10	IF-08	IF-06
Frequency Band and Range, GHz	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-170
Input waveguide	WR28	WR22	WR19	WR15	WR12	WR10	WR8	WR6
Wavequide Flange	UG-599/U	UG-383/U	UG-383/U-M	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M
Insertion losses, dB (max)	1.5	1.5	1.6	1.7	1.7	2.2	2.5	3
Isolation, dB (max)	25	25	25	25	25	25	23	22
VSWR	1.3:1	1.3:1	1.3:1	1.3:1	1.4:1	1.4:1	1.4:1	1.4:1

Typical measured data for a narrow band circulator is presented below:

CR-10/94/3



How to Order

Specify Model Number **CR/IS— X/CF/BW**
X– waveguide band (WR–Number)
CF– Central frequency (in GHz)
BW – bandwidth (in GHz)
Standard flange is **UG-XXX/U** round
Example: **IS-10/94/1** means W–band isolator, WR–**10**, Central frequency **94**GHz, Bandwidth **1**GHz

Delivery time 6–8 weeks. All ELVA–1 circulators/isolators are warranted by the manufacturer for one year after receipt.

Precision Calibrated Solid State Noise Sources

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

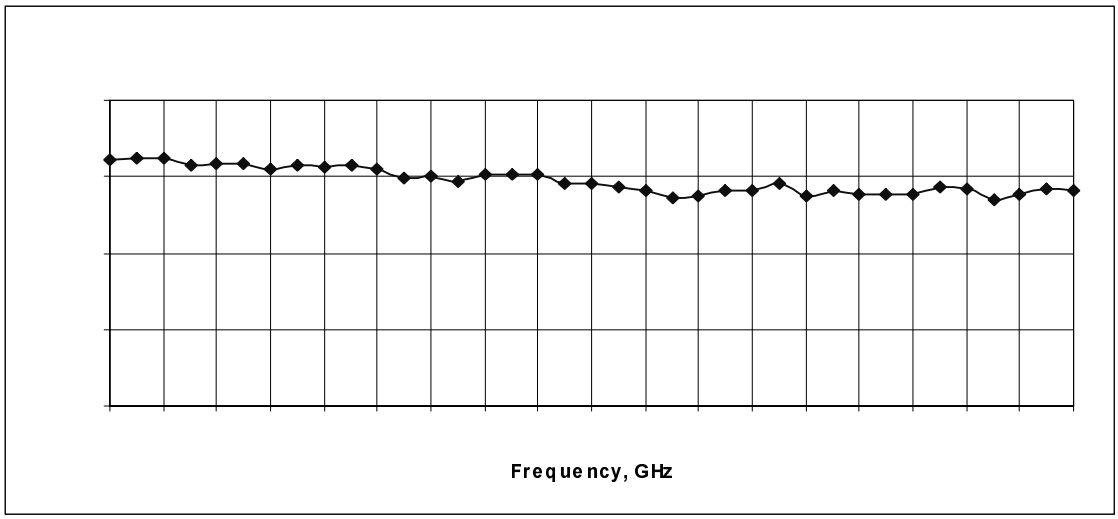
- ENR 15 dB typical
- High stability
- Good flatness
- No high voltage supply required
- Compact solid state source
- High reliability, rugged construction

Applications

- Calibration
- Noise figure measurement
- Instruments and test equipment
- Space and Hi-Rel systems

Description

ELVA-1 solid-state noise source **ISSN** series delivers a uniform level of noise power spectral density within the whole waveguide frequency range. Sources are available in eight waveguide bands covering 26.4-170 GHz. A Silicon IMPATT diode is employed as a fundamental building block of the source. High stability of the device allows it to be used for test and instrumentation applications in place of gas-tube noise sources. Low DC power requirements eliminate the need for complex high voltage supplies. There are two operation modes: CW mode and pulsed AM mode with modulation frequency up to 1 kHz. Typical value of excess noise ratio (ENR) as a function of frequency is given on the plot below



Precision Calibrated Solid State Noise Sources

ELVA-1 Millimeter Wave Division
http://www.elva-1.com, e-mail: sales@elva-1.com

Specifications

MODEL NUMBER	ISSN-28	ISSN-22	ISSN-19	ISSN-15	ISSN-12	ISSN-10	ISSN-08	ISSN-06
Frequency Band and Range, GHz	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-170
Input waveguide	WR28	WR22	WR19	WR15	WR12	WR10	WR8	WR6
Wavequide Flange	UG-383/U	UG-383/U	UG-383/U-M	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M
Bandwidth, GHz (min)	Full	Full	Full	Full	Full	Full	Full	Full
ENR, dB (nom)	15	14	13	13	13	12	12	12
Typical Flatness, dB	±1	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±2
Stability, dB/°C	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Stability/Day, dB (typ)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Biasing Voltage, V	+18	+18	+18	+18	+18	+18	+18	+18
Sizes, mm Cylinder diameter/length	70/70	70/70	70/70	50/60	50/60	50/60	50/60	50/60

Notes

1. Maximum operating temperature is +60°C
2. Diode operating current is 50 mA.
3. A limiting value of modulation frequency is 1 kHz (external triggering).
4. Triggering signal amplitude is TTL level.
5. Bias voltage is +18 V It is possible to supply the noise source with +28VDC biasing for the compatibility with commonly used noise meters.
6. External triggering connector is OSM(SMA)Jack.
7. ENR would be increased for narrower bandwidth. Please contact factory.

There are the following controls and plugs on the control panel of the device:

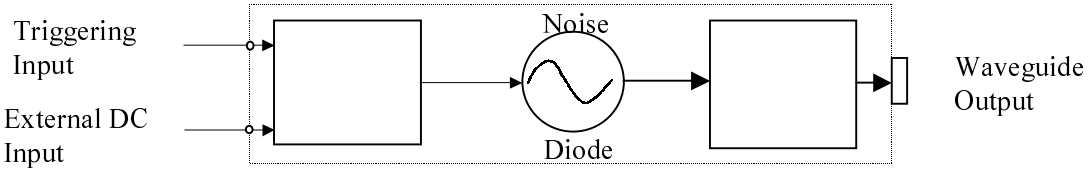
– Power connector. Specially supplied not SMA type to avoid possibility to change it with triggering plug. Few reply connectors are supplied together with the device.
– Triggering plug.
– Power switch.
– Power indicator.

Delivery time 6–8 weeks for all models. All ELVA–1 noise sources are warranted by the manufacturer for one year after receipt.

Power supply for input power 220VAC/50Hz, 110VAC/60Hz or 100VAC/50Hz are available optionally.

For the precision control and fast modulation of the output power of the source Voltage Controlled Attenuator VCVA series would be supplied optionally.

Typical Application



How to Order

Specify Model Number **ISSN-XX-ABBC**

XX– waveguide band (WR–Number)
A – flange type
R = **r**ound
S = **s**quare (WR–28 only)

C – AC voltage power supply options
1 = 110 VAC/60Hz,
2 = 220 VAC/50Hz,
3 = 100VAC/50Hz power supplies
BB – ENR options (ENR in dB)
Consult ELVA–1 for ENR higher 15 dB

High Power Pulsed Noise Sources

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

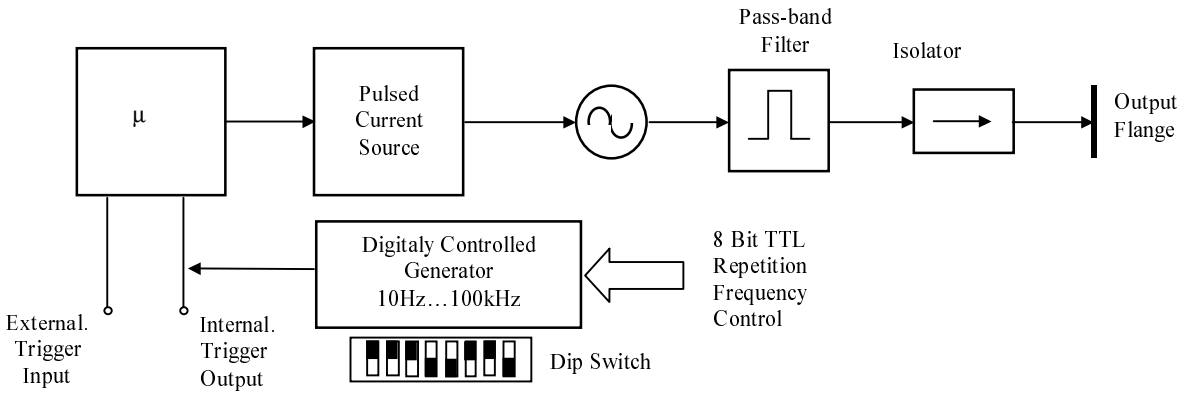
- Powerful incoherent source
- 1 Watt typical output power in W-band
- High stability
- Good flatness
- 5GHz white noise spectrum
- No high voltage supply required
- Compact solid state source
- High reliability, rugged construction

Applications

- High power noise source for target illumination in noise radar systems
- Concealed weapons detection systems
- Noise figure measurement
- Instruments and test equipment
- Space and Hi-Rel systems

Description

ELVA-1 high power noise sources employ specially designed silicon IMPATT diodes, operating in a pulse mode. It delivers the real incoherent radiation within 5 GHz bandwidth. 1 W level of output power allows to use the device for illumination of targets for the improvement of sensitivity of passive radiometers. The sources are available for all frequencies from 26 to 140 GHz. Low DC power requirements eliminate the need for complex high voltage supplies. The device is supplied with pulsed current source and triggering circuit. Both external and internal triggering modes are provided. Built-in digitally controlled generator allows to install repetition frequency within 10 Hz – 100 kHz range.



High Power Pulsed Noise Sources

ELVA-1 Millimeter Wave Division
http://www.elva-1.com, e-mail: sales@elva-1.com

Specifications

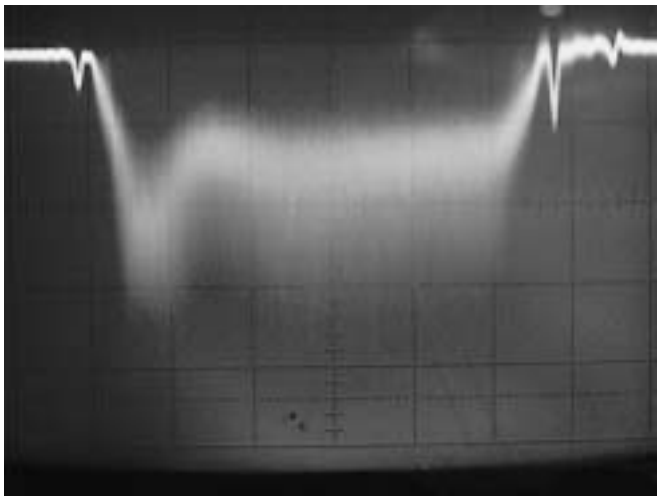
Model	Frequency range, GHz	Band width, GHz	Pulse Power, W (min)	ENR Flatness, dB	Pulse width, ns	Duty factor	Biasing Voltage
PNS-28	25.6-40	5.0	1	±1.5	50...200	>500 (200 ns Pulse Width) >100 (100ns Pulse Width)	90...100VDC
PNS-10	75÷110	5.0	0.7	±1.5	50...100	>100	36...48VDC
PNS-8	90-120	5.0	0.5	±1.5	50...100	>100	36...48VDC
PNS-6	120÷140	2.0	0.2	±1.5	50...100	>100	36...48VDC

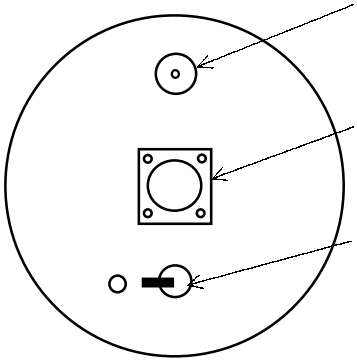
VSWR of the load should not exceed 2:1. Operating temperature range –40...+50 °C. Specifications would be adjusted according to customer's requirements. Please contact factory for other frequency ranges, bandwidths, pulse lengths and others. Device is designed in cylinder 120 mm length and 70 mm diameter.

Special protection scheme is integrated against an application of more then one triggering pulse within 10 ms. To protect the diode the system ignores all pulses during 10 ms period after the last triggering.

The device is supplied with built–in digitally controlled triggering generator with variable repetition frequency within 10Hz...100kHz. 256 values of repetition frequency are available. The desired frequency would be installed by dip switches or by 8bit TTL bus. Pulse duration would be decreased optionally up to 5 ns using fast PIN switch, FPS series. To control the amplitude of the source Voltage Controlled Attenuator VCVA series would be supplied optionally.

Typical picture of noise pulse measured on the output of detector with 50–Ohm load is presented below:





Integration time of the detector is about 3 ns, scale is 20 ns per division.

How to Order

Specify Model Number **PNS-XX-ABBC**
XX– waveguide band (WR–Number)
A – flange type
R = **r**ound,
S = **s**quare (WR–28 only)

C – AC voltage power supply options
1 = 110 VAC/60Hz,
2 = 220 VAC/50Hz,
3 = 100VAC/50Hz power supplies
BB – pulse duration in nanoseconds
Consult ELVA–1 for another pulse duration

Features

- Available frequency range 0.5 – 37.5 GHz
- Broad Bandwidth up to 4% approx.
- Narrow Bandwidth down to 0.1% approx.
- Low losses
- Coaxial, Microstrip and Waveguide design

Description

ELVA–1 YIG–tuned bandpass filters cover octave and multi–octave frequency band from 1 to 37.5 GHz. These YIG filters offer excellent tuning linearity, good frequency stability, excellent selectivity and off–resonance rejection. YIG filters with 3 dB bandwidths ranging from very narrow 0.1% from Central frequency to wide bandwidths up to 4%. Dual channel configurations of YIF filters with several MHz matching between channels are also available to order.

We supply YIG filters as components only, or assembled with Analog (0–10V) / Digital (12–bit TTL) drivers. Please keep in mind that in first case you need very stable current source to control YIG filter.

Basic YIG filter products are 4–stage filters, which have selectivity of 24dB/octave from 3dB BW. When you order YIG filter, please advise following terminology for YIG filters, that are represented on Fig. below.

Bandpass YIG tuned filters

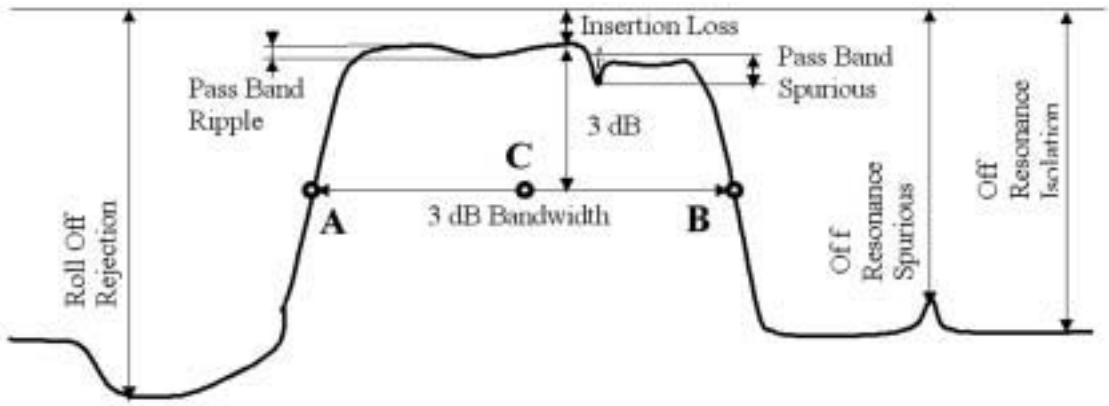


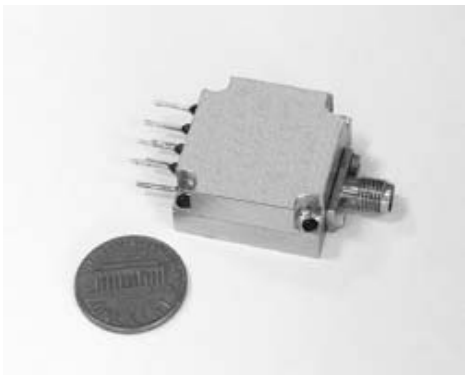
Fig. YIG Filter Terms and Definitions

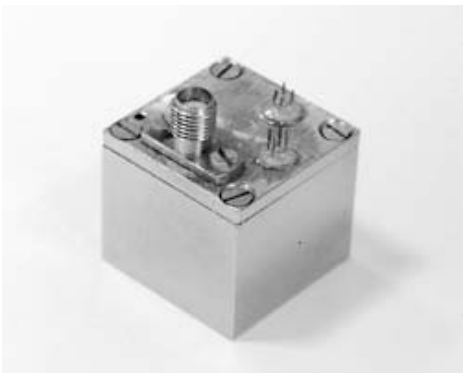
Model	Frequency range, GHz	Bandwidth 3dB MHz	Losses, dB	Isolation, dB	Spurious, dB	Temp. C	Dimension, mm
4-stage, SMA connectors, standard BW							
EYF-0.5-2.5	0.5 – 2.5	15 - 20	8.0	80	45	-10 ..+70 C	25*25*25
EYF-01-02	1.0 – 2.0	15 - 30	5.0	75	45	-10 ..+70 C	25*25*25
EYF-02-04	2.0 – 4.0	20 – 50	4.5	80	50	-10 ..+70 C	25*25*25
EYF-02-08	2.0 – 8.0	30 – 60	6.0	80	50	-10 ..+70 C	35*35*40
EYF-04-08	4.0 – 8.0	30 – 60	4.5	75	45	-10 ..+70 C	35*35*40
EYF-04-12	4.0 – 12.0	30 – 60	7.0	75	45	-10 ..+70 C	35*35*35
EYF-02-18	2.0 – 18.0	15 – 50	8.0	80	45	-10 ..+70 C	35*35*44
EYF-08-18	8.0 – 18.0	40 – 60	8.0	70	50	-10 ..+70 C	35*35*44
EYF-02-26	2.0 – 25.9	14 - 80	8.0	80	45	-10 ..+70 C	35*35*44
EYF-18-26	18.0 – 26.0	50 – 80	8.0	75	45	-10 ..+70 C	35*35*44
EYF-0.5-2.5	0.5 – 2.5	15 - 20	8.0	80	45	-10 ..+70 C	25*25*25
EYF-01-02	1.0 – 2.0	15 - 30	5.0	75	45	-10 ..+70 C	25*25*25
EYF-02-04	2.0 – 4.0	20 – 50	4.5	80	50	-10 ..+70 C	25*25*25
EYF-02-08	2.0 – 8.0	30 – 60	6.0	80	50	-10 ..+70 C	35*35*40
EYF-04-08	4.0 – 8.0	30 – 60	4.5	75	45	-10 ..+70 C	35*35*40
EYF-04-12	4.0 – 12.0	30 – 60	7.0	75	45	-10 ..+70 C	35*35*35
4-stage, Micro-strip, standard BW							
EYF-01-02M	1.0 – 2.0	15 – 30	7.0	70	45	+5 ..+55 C	30*30*20
EYF-02-04M	2.0 – 4.0	30 – 60	7.0	70	45	+5 ..+55 C	30*30*20
EYF-04-08M	4.0 – 8.0	40 – 80	7.0	70	45	+5 ..+55 C	30*30*25
2-stage, Waveguide, standard BW, WR-42 flange							
EYF-18-26W	18 – 26	40 – 80	7.0	50	25	-10 ..+75 C	75*75*90
4-stage, Waveguide, standard BW, WR-24 flange							
EYF-26-37W	25.9-37.5	40 – 80	8.0	65	40	-10 ..+75 C	50*50*60

All devices are supplied with SMA female connectors. Heater voltage is 24 V.
*The case dimension without connectors and driver are pointed.

YIG tuned Transistor Oscillators

http://www.elva-1.com, e-mail: sales@elva-1.com





Features

- Available frequency range 0,8–18 GHz
- Multi–octave tuning
- Frequency stability
- Excellent tuning linearity
- Low phase noise
- Fast tuning N– Outputs

Applications

- LO for sweeping receivers and spectrum analysers.
- Signal sources for sweep generators

Description

ELVA–1 YIG tuned oscillators offer excellent tuning linearity, good frequency stability,very low phase noise and phase lock / modulation capability. YIG oscillators can tune over operating frequencies of more YTO's can incorporate additions functions such as Filters, Buffer Amplifiers, Isolators and different active elements.

YTO's supply with Analog and Digital drivers.

YIG-tuned Transistor Oscillators (YTO's)

Model	Freq. Range GHz	Output power min dBm	Pow. deviation dB	Sweep nonlinearity MHz	Non harm. spur. dB	Harm. spur. dB	Phase Noise (10kHz off car.) dB/Hz	Op. Temp. °C	Case Dimension *mm
STANDARD 2 OUTPUTS YTO's									
EYO-0.8-3	0.8 - 3.5	13	4.0	5	-15	-15	-95	-40 +55	60dia 32h
EYO-1-4	1.0 - 4.0	13	4.0	5	-15	-15	-95	-40 +55	60dia 32h
EYO-2.2-8	2.2 - 8.0	12	4.5	8	-20	-20	-95	-40 +55	60dia 32h
EYO-10-16	10 - 16	15	4.0	20	-45	-20	-85	-40 +55	60dia 40h
EYO-12-18	12 - 18	10	6.0	30	-50	-20	-85	-40 +55	60dia 40h

YIG tuned Transistor Oscillators

http://www.elva-1.com, e-mail: sales@elva-1.com

Model	Freq. Range GHz	Output power min dBm	Pow. deviation dB	Sweep non-linearity MHz	Non harm. spur. dB	Harm. spur. dB	Phase Noise (10kHz off car.) dB/Hz	Op. Temp. °C	Case Dimension *mm
MICROSTRIP 2 0UTPUTS YTO's									
EYO-1-4MS	1.0 - 4.0	10	4.0	6	-25	-15	-95	-40 +55	45*45*20
EYO-3-6MS	3.0 - 6.0	12	4.0	6	-25	-15	-95	-40 +55	45*45*20
STANDARD 1 OUTPUT YTO's									
EYO-1-4	1.0 - 4.0	10	4.0	6	-25	-15	-95	-40 +55	25*25*25
EYO-2-8	2.0 - 8.0	10	5.0	6	-25	-15	-95	-40 +55	25*25*25
EYO-8-12	8.0 - 12	10	4.0	8	-25	-15	-85	-40 +55	35*35*35
EYO-12-18	12 - 18	13	6.0	10	-25	-15	-85	-40 +55	35*35*40
MINIATURE YTO's WITH PERMANENT BIAS MAGNET									
EYO-8-10M	8 - 10	13	3.0	4	-25	-15	-95	-10 +55	25*25*12.5
EYO-10-12M	10 -12	13	3.0	4	-25	-15	-95	-10 +55	25*25*12.5
EYO-12-14M	12 - 14		3.0	4	-25	-15	-95	-10 +55	25*25*12.5
EYO-14-16M	14 - 16	13	3.0	4	-25	-15	-95	-10 +55	25*25*12.5

Solid-State
Electronic Controlled Attenuators

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- Low insertion losses
- High isolation
- Low switching time
- Fullband operation
- Low cost

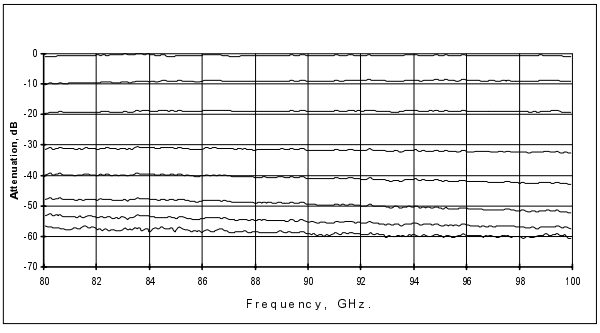
Applications

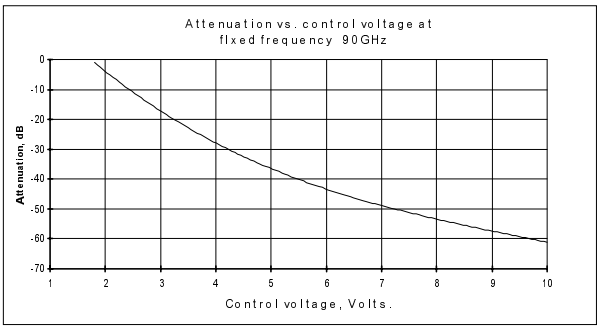
- Low cost alternative for p–i–n modulators and polarization attenuators
- AM of microwave signals.
- Power control
- Lock–in detection system

Description

ELVA–1 series Voltage–Controlled Variable Attenuators VCVA is built on the base of PIN diodes as an active element. Modern technology allows to combine advantages of different types of attenuators and modulators in one device. Fullband operation, accuracy, 60 dB attenuation range and small insertion losses are comparable with specification for polarization attenuators. On the other hand a small switching time allows to use the device instead Faraday rotation ferrite modulators or ON/OFF type p–i–n modulators. The attenuators are designed as a gold covered waveguide section and have a high reliability.

The basic unit is a current controlled attenuator. We propose also an external driver which provides a voltage–current conversion and a switching time up to the 25 μsec. We supply each device with personal calibration characteristics. Typical characteristics for the VCVA–10 model are shown on two plots below: attenuation versus control voltage with fixed frequency and attenuation versus frequency with different control voltages.





Solid-State Electronic Controlled Attenuators

ELVA-1 Millimeter Wave Division
http://www.elva-1.com, e-mail: sales@elva-1.com

Electrical Specificaions

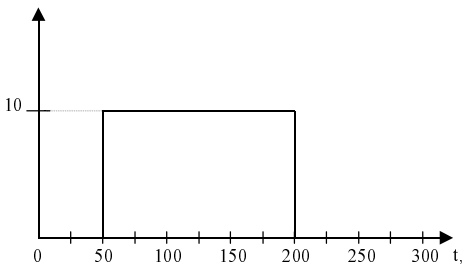
MODEL NUMBER	VCVA-42	VCVA-28	VCVA-22	VCVA-19	VCVA-15	VCVA-12	VCVA-10	VCVA-08	VCVA-06
Frequency Band and Range, GHz	K 18-26.5	Ka 26.5-40	Q 33-50	U 40-60	V 50-75	E 60-90	W 75-110	F 90-140	D 110-170
Wideband Version									
Bandwidth, %	20	15	15	15	15	15	15	15	15
Insertion Loss, dB (max)	0.7	0.7	0.8	0.8	0.8	1.0	1.0	1.0	1.0
Isolation, dB (min) *	50	50	50	50	50	50	50	50	50
Power Handing (peak), W (max)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Switching Time, µsec ***	100	50	50	50	50	50	25	25	25
DC Bias Input, V/mA	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/150 -15/40**	+15/150 -15/40**	+15/150 -15/40**
Control Voltage, V	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10
Fullband Version									
Bandwidth, %	100	100	100	100	100	100	100	100	100
Insertion Loss, dB (max)	0.7	1.6	2.0	2.0	2.0	2.0	2.0	3.0	3.0
Isolation, dB (min) *	50	50	50	50	50	50	50	50	45
Power Handing (peak), W (max)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Switching Time, µsec ***	100	50	50	50	50	50	25	25	25
DC Bias Input, V/mA	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/100 -15/40**	+15/150 -15/40**	+15/150 -15/40**	+15/150 -15/40**
Control Voltage, V	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10

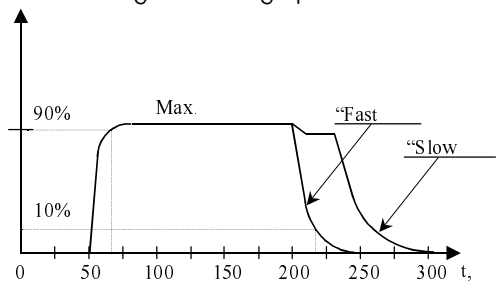
*The models with 60 dB Isolation are available upon request

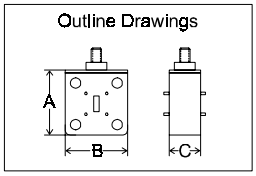
**Negative DC Power Source is needed only in fast switching mode (see below)

***Guaranteed for Rise Time 0–90% RF and Fall Time 100–10% RF. Models with twice lower switching time are available upon request for the 50–170 GHz frequency range.

External driver provides two modes of operation: "slow mode" (switch 3 in "down" position) and "fast mode" (switch 3 in "up" position). First one allows to change the attenuation with very high accuracy like a motorised polarization attenuator. Second one allows to use VCVA as "on/off" fast modulator. Typical Response Function of the attenuation for VCVA–08 model is shown on the left plot below. In "fast mode" the driver applies a short negative voltage pulse to accelerate the fall time.

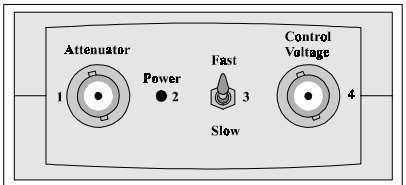






Mechanical Specifications

MODEL NUMBER	VCVA-42	VCVA-28	VCVA-22	VCVA-19	VCVA-15	VCVA-12	VCVA-10	VCVA-08	VCVA-06
A, mm	35	30	20	20	20	18	18	18	18
B, mm	35	30	20	20	20	18	18	18	18
C, mm	40	30	20	20	15	10	10	8	8
Weight, G	60	50	40	40	30	25	25	20	20
External Driver, mm (typical)	70x30x70								



1. Attenuator control current plug.
2. Power Indication LED.
3. Slow–Fast mode switch.
4. External control voltage plug.

Optionally each device may be supplied with a controller, that provides square–wave pulse or sinusoidal modulation with manually adjusted frequency and depth of modulation. Sinusoidal 10 dB modulation is provided with frequencies up to 10 kHz. A card of Digital Analog Converter for PC microcomputer with software for the precision control of attenuator is available optionally. It allows to control the attenuation with 0.05dB step.

Matched (Cryogenic) Loads, Tunable Shorts

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- Up to 170 GHz operating frequency
- (1.03...1.15) : 1 load VSWR
- >20:1 Shorts VSWR
- Wide band and narrow band units
- Compact size
- Easy mounting

Applications

- Test and measurements
- Subsystems and assembles
- Absolute calibration (cryogenic loads)

Description

Matched (Cryogenic) loads consist of tapered absorbers within a waveguide section. Tunable shorts have micrometer screw to move short circuits plane and vary path length.

Standard line of ELVA–1's matched loads **ML-X/CF/BW** series provide low level of reflected power within a narrow or full waveguide band. Cryogenic loads **CL-X/BW** are to be used for absolute calibration tests: radiometers, noise souses, receivers, noise figure measurements. They can be narrow or full band as well. The SC–X tunable shorts ideally suit for precise adjusting of waveguide path length. Joined with circulators **CR-X/CF/BW** series, the **SC-X** tunable shorts allows to assemble tunable phase shifter **PS-X/CF/BW**.

How to Order

Specify Model Number **ML/CL/SC— X/CF/BW**
X – waveguide band (WR–Number)
CF – central frequency (in GHz), **BW** – bandwidth (in GHz), are **empty** for full waveguide band
Standard flange is **UG-XXX/U** round

Example: **ML-10/94/2** – W–band matched load, WR–**10**, Central frequency **94**GHz, Bandwidth **2**GHz
Delivery time 4–8 weeks. All ELVA–1 loads, shorts are warranted by the manufacturer for one year after receipt.

Waveguide Band Pass Filter

ELVA-1 Millimeter Wave Division
http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- Low insertion loss
- High selectivity

Applications

- Instrumentation
- Pre-selector filter
- Spurious suppression

Description

ELVA-1 waveguide Band Pass Filters BPF-XX series are intended for signal filtration in frequency range of 18-110GHz and provide pass-bands of 2-10% from central frequency. These filters have low insertion loss in pass-band and high isolation in stop-band. They can be useful in huge amount of applications, such as transmitters, receivers, radars, up-converters etc. Filters have durable construction and high reproduction rate. When you order a filter, please keep in mind that there is a compromise between Bandwidth, Selectivity, Isolation and Insertion Loss parameters.

Specifications examples

MODEL NUMBER	BPF-12-76.5-2-20-1.5(PB)	BPF-10-85-4-40-1.5(PB)	BPF-10-100-5-40-1.5(PB)	BPF-06-146-10-30-1.5(PB)
Waveguide	WR-12	WR-10	WR-10	WR-06
Center frequency, GHz	76.5	85	100	146
PassBand (PB) (min)	2 GHz	4.2 GHz	5 GHz	10 GHz
Isolation at 1.5xPB, dB (min)	20	40	40	30
Insertion loss, dB (max)	2	1.5	1.5	1.5
VSWR in pass-band	1:1.5	1:1.5	1:1.5	1:1.5

How to Order:

Specify Model Number:
BPF-XX-FFF-PP-II-BB(PB)
XX – waveguide band (WR-Number)
FFF – frequency option (central frequency in GHz)
085 – 85GHz, 110 – 110GHz
PP – pass-band option (pass-band in GHz)
3.5 – 3.5GHz, 05 – 5GHz
II – isolation option (isolation in dB for BB bandwidth)
30 – 30dB, 10 – 10dB
BB(PB) – bandwidth option (bandwidth in GHz or in pass-bands)
10 – 10GHz, 1.5(PB) – 1.5xPassBand

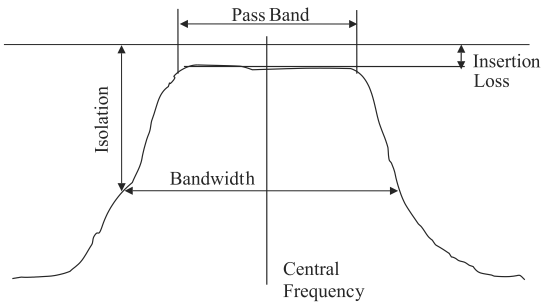
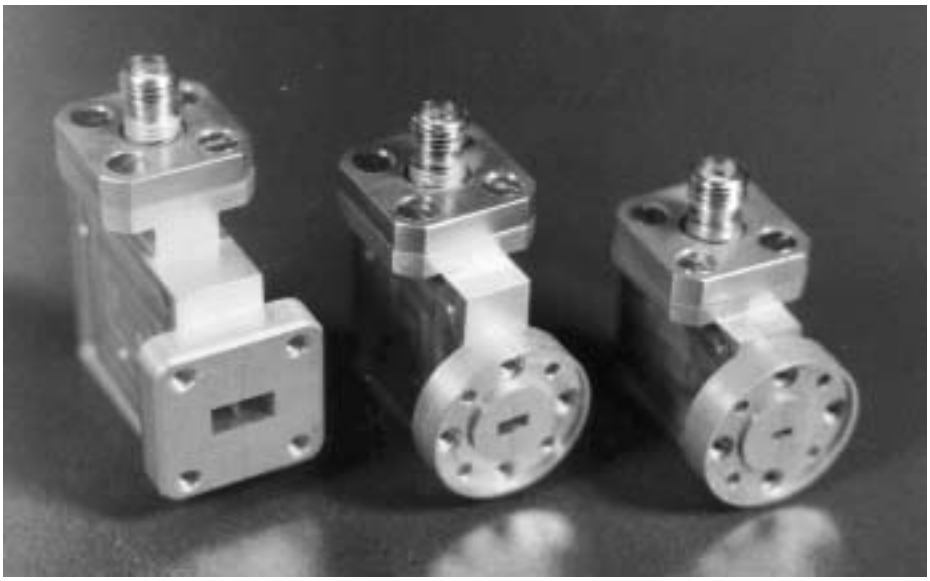


Fig. 1 Definitions for BPF

Example: To order waveguide filter meets the following specification: in WR-06 waveguide band at 146 GHz center frequency, with 10 GHz bandwidth with 30 dB isolation, should be ordered as **BPF-06-146-10-30-1.5(PB)**

Delivery time 6-8 weeks for all models.

All ELVA-1 Band Pass Filters are warranted for one year after receipt.



Typical Ka-band sensitivity 3,500 mV/mW.

Specifications

MODEL NUMBER	ZBD-28	ZBD-22	ZBD-19	ZBD-15	ZBD-12	ZBD-10	ZBD-08	ZBD-06
Frequency Range (GHz)	26.5-40	33-50	40-60	50-75	60-90	75-110	90-140	110-170
Input Waveguide	WR28	WR22	WR19	WR15	WR12	WR10	WR8	WR6
Waveguide Flange	UG-599/U	UG-383/U	UG-383/U-M	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M
Typical Video Sensitivity at – 20 dBm Input (mV/mW)	3500	3000	2500	2000	1700	1500	1300	500
Minimum Video Sensitivity (mV/mW)	2000	1500	1300	1000	800	700	500	200
Typical Flatness(dB)	±1.5	±1.5	±1.5	±1.5	±2.0	±2.0	±2.5	±2.5
Video Output Load (MegOhms)	1	1	1	1	1	1	1	1
Typical Video Bandwidth (MHz)	10	10	10	10	10	10	10	10
Incident max. CW RF Power (dBm)	+20	+20	+20	+20	+20	+20	+20	+20

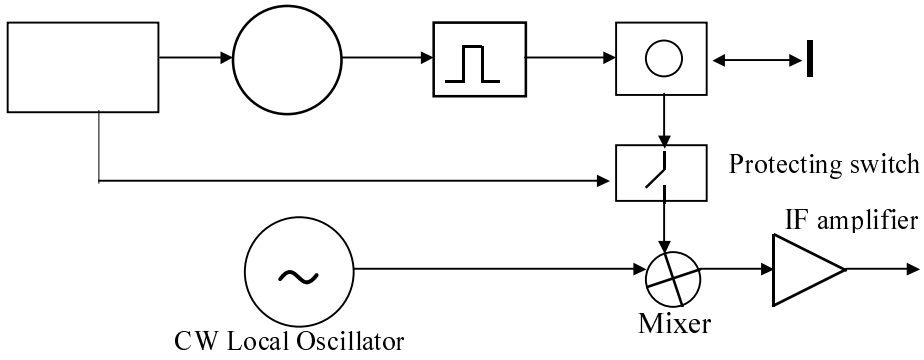
ZBD-series Zero-Biased Detectors are available in both polarities. Using a Schottky barrier beam lead diode design, these detectors offer a cost-effective solution for broadband power detection systems. They provide high sensitivity to small signals, and linear response up to -10 dBm

80-100 GHz Pulse Noise Radar Front-End

High power pulse noise source **PNS** series is used for the illumination of target. Noise nature of probing signal avoids the problem of interference. Image obtained by means of noise radar allows to recognize target better then the image obtained by means of coherent radar.

The entire radar front-end consists of the following elements:

1. Powerful pulse noise source;
2. Band pass filter (5 GHz typical);
3. Circulator of transmitting/receiving;
4. Switch for the receiver protection;
5. Balance mixer;
6. CW cavity stabilized IMPATT local oscillator;
7. IF amplifier;
8. Power supply and triggering electronics.



The device has a modular design fitted with waveguide flange

Specifications

Frequency range, GHz	Bandwidth of launched radiation, GHz	Pulse duration, ns	Duty factor	On/Off ratio of the receiver protecting switch, dB	Power of output pulse, mW	ENR Flatness within launched bandwidth, dB	Receiver noise factor, dB
80÷100	5.0	50-100	>100	30	500	±1.5	7-9

How to Order:

Specify Model Number **PNRFE-xx-A**
XX – center frequency
A – AC voltage power supply options
0 = no power supply, **1** = 110 VAC/60Hz, or **2** = 220 VAC/50Hz, or **3** = 100VAC/50Hz power supplies

Example: To order radar meets the following specification: operation frequency 94 +/-2.5 GHz, input AC voltage 110ACV, should be ordered as **PNRFE-94-1**

FMCW 94/10 Millimeter Wave Industrial Distance Sensor

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- High accuracy
- On–line measurement
- High directivity with small antennas
- Digitized output information
- Environmentally safe
- Could be equipped with various antennas by customer's choice

Applications

- Precise distance measurement in dusty and/or humid atmosphere (e.g. in hard rock mines), at bad weather conditions
- Level sensing for loose/granular materials in dusty hoppers
- Level sensing for liquids in tankers with foam/ vapour (e.g. at large breweries)

Description

The Distance Sensor is based on millimeter wave FMCW (frequency–modulated continuous wave) radar principles. The FMCW radar is the best choice for industrial sensors where signal linearity, high sensitivity, low cost and unprecedented reliability are a must.

The FMCW 94/10 Millimeter Wave Distance Sensor is free from laser, acoustic, and microwave radar shortcomings. It is characterized by a narrow beam that's good for enclosed areas like ore passes. Because of 94GHz FMCW radar operational frequency that is equivalent to 3mm wave length, the sensor provides an excellent penetration of dust and water vapor. The Distance Sensor works well even with a dust sticking on antenna. With a narrow beam, the Distance Sensor can build a precise surface profile at a hopper (mechanical scanning required). The operation range of Distance Sensor is 300m, that allowing using it at deep mines, where typical passes are 50–150m but rarely even longer.

To facilitate installation, mounting and alignment at field condition, the sensor is built as two modules; a front end and a separate signal processor connected by a 10m shielded cable. A local graphics display and keypad are incorporated into the control unit. The front end and antenna are housed in robust metal case. The signal processor and power supplies are built into a commercially available housing with signal access via cable glands. To allow for installation by a single technician, the weight of processor box is 1.5kg and the front end is 8kg.

To use Distance Sensor within complete data acquisition system on an enterprise, the sensor has 4–20mA current loop interface using MODBUS protocol. For more manageability the sensor has Ethernet 10BaseT socket made in dust and moisture–proof embodiment. Max UTP–cable length between Distance Sensor and control PC is up to 1000m for current loop and 100m for Ethernet signaling.

The radar transmitter at the Distance Sensor complies with international safety regulations. Its 10mW emission power is about ten times less than an emission of typical mobile phone.

FMCW 94/10 Millimeter Wave Industrial Distance Sensor

Specifications

Distance Sensor resolution	0.1m
Range of heights of Sensor position above the surface of material	0.6m to 300m
Deflection of the Sensor axis from the vertical line, no more than	1°
Distance Sensor radar transmitter emission power	10mW
Distance Sensor radar operating frequency	94GHz
Power supply voltage	110/220V AC
Distance Sensor radar power consumption	20W
Operation mode	CW
Weight, for FMCW radar and Control Unit	8kg and 1.5kg
Distance Sensor Operation Condition	
Ambient temperature	-30 to +50°C
Atmospheric pressure	84.0-106.7 kPa (630-800 Torr)
Relative humidity at 35°C and lower, no more than	95%
Vibration amplitude at 5Hz to 25Hz band, no more than	0.1mm
NZ6100 Control Unit Specifications	
CPU	486DX-100 CPU on board, embedded in ACC Maple chipset
RAM	16 MB of EDO DRAM
Watchdog Timer	10 sec
Flash Disk	8MB OnChip
Display	20 digits, 4.75 mm height 4 lines Liquid Crystal Display
Control Unit Power Supply	85-265 VAC, 47-63Hz, 15W
Membrane Keypad	27 keys including 8/18 function keys
Communications: 1xEthernet interface 1xCurrent Loop interface	- Realtek RTL8019 10Mbps Ethernet chip with RJ-45 connector - 60, 20mA selectable, up to 19.2Kbps under 1000 m (AWG 24, cable)
Communication protocols	MODBUS/TCP, MODBUS RTU
Dimensions	236,7mm W x 226,5 mm H x 136mm D

Delivery time 6–12 weeks for all models depending of required specs.
All ELVA–1 distance sensors are warranted for one year after receipt.

How to Order:

Specify Model Number **FMCW 94/10-A**
A – AC voltage power supply options
Specify in order **1** = 110 VAC/60Hz, or **2** = 220 VAC/50Hz, or **3** = 100VAC/50Hz power supplies

Example: To order radar meets the following specification: 110 VAC/60Hz, should be ordered as **FMCW 94/10-1**

Millimeter-wave FMCW Radar Front-end
FMCW-10/94/200/10

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- High accuracy
- On–line measurement
- High directivity with small antennas
- Portability
- Environmental safety
- Equipped with antennas by customer's choice

Applications

- Precise distance measurement in dusty and/or humid atmosphere
- Level sensing for loose/granular materials and liquids in huge tanks with foam/vapor
- Robotic sensors

Specifications

1.	Centre Frequency:	94 GHz
2.	Radar front–end wattage	10mW
3.	Frequency Stability:	5*10(–6) 1°/C
4.	Sweep Range:	200 MHz (min)
5.	Minimal Sweeping Time:	100 mSec
6.	Linearity:	0.7% (max)
7.	Tuning Sensitivity:	>50 MHz/V
8.	Output RF Power:	+10 dBm (min)
9.	Reverse Isolation:	17 dB (min)
10.	IF Frequency:	4 kHz to 2 MHz
11.	RF to IF Gain:	32 dB (typ)
12.	Waveguide/Flange:	WR–10 / UG–387/U–M
13.	IF and Frequency Control Connector:	SMA (f)
14.	DC Power:	+12 VDC/500 mA, –12 VDC/100 mA +27 VDC/200 mA, +27V/500 mA (heater)
15.	Dimensions:	200x100x50 mm (max)
16.	Mass:	1200 gram (max)
17.	Storage Temperature:	–40 to +85 deg
17.	Operating Temperature:	–40 to +70 deg

Delivery time 6–8 weeks for all models.
All ELVA–1 radar front–ends are warranted for one year after receipt.

How to Order:

Specify Model Number **FMCW-10/94/10** for 10 mW, or **FMCW-10/94/200** for 200 mW

Fast Ethernet MM-wave Radio of Point-to-multipoint Topology

ELVA-1 Millimeter Wave Division
http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- 200 Mbps total Capacity
- Non–collision operation
- Fast Ethernet interface
- Secure communication
- Carrier Class QoS (Quality of Service)

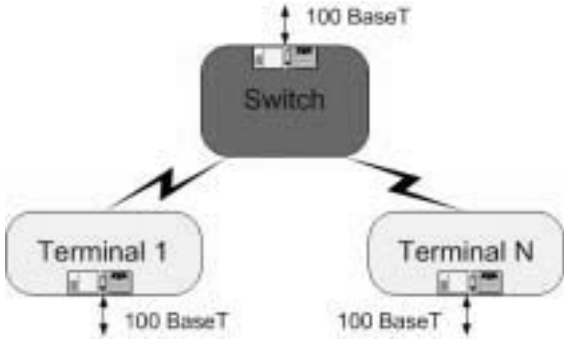
Description

City–A was designed to construct wideband IP–networks in urban areas. City–A is operating in 40.5–43.5 GHz band, allocated in EU for broadband communications.

How it works

City–A set consists of Switch and Terminals. The Switch is deployed on height dominating building. Terminals are deployed on line–of–sight positions within Switch service area. One terminal can serve a bunch of offices, apartments, houses etc.

City–A operates like a Fast Ethernet Router. IP–packets, incoming to Terminal, are forwarding to Switch or, via Switch, to Terminal front–end. IP–packets, incoming to Switch, are forwarding to Terminal of destination.



Interfaces

Both Switch and Terminals have Fast Ethernet interfaces. They can be connected to any network equipment directly.

Capacity

Downstream channel (Switch to Terminals) capacity is 100 Mbps. Total upstream channel capacity (Terminals to Switch) is 100 Mbps as well. There are no collisions in City–A system. The losses for system management in downstream are less than 0.5%, in upstream – less than 10%. So, the real City–A capacity is about 200 Mbps independently on any external circumstances.

Non-collision operation is provided by the following:

1. Downstream and upstream are operating in different frequency bands. Downstream capacity does not depend on the upstream channel load and vise versa.

2. Terminal dishes have very small beamwidth (0.7° to 2°). The data transmitting from one Terminal does not affect on the data receiving by other Terminals.

3. To eliminate collision at Switch receiver, all Terminals transmits in TDMA mode, one after another, according to instructions issued by Switch. Period and duration for any Terminal is assigned during the system configuration or automatically.

Secure communications

Is provided by 2 factors:

1. It is very difficult to find 40.5–43.5 GHz equipment on the market for spy data trapping.

2. Due to very small Terminal beamwidth (only 2 times more than in laser free optical systems) the data interception, even having appropriate equipment, is as difficult as in optical systems.

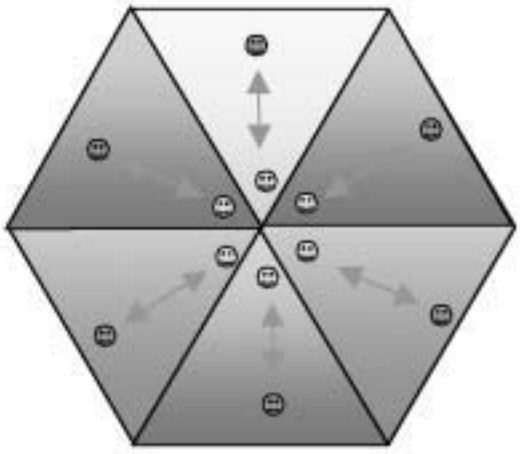
QoS

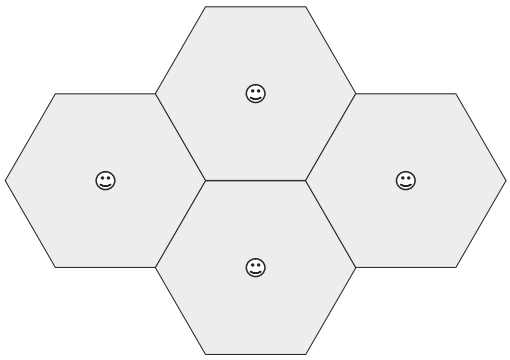
City–A was designed to provide a necessary quality in IP–phone communications. Downstream delay is less than 1 ms. Upstream delay is 0.5 .. 1 ms per operating Terminal.

Complex network topology

An Operator can deploy a number of City–A systems on the same territory.

City–A Switch is completed by 30, 45, 60 or 90° sector antenna. Accordingly, the operator can deploy 4, 6, 8, or 12 Switches in the same point (to eliminate interference, different polarizations are used in adjacent sectors). So the total network capacity can be increased up to 1.2 Gbps, full duplex.





To connect more terminals or cover wider area, several cells can be deployed.

City-A components

Cuty–A is designed based on 2 key components: Switch and Terminal.

The Switch consists of ODU and IDU. The ODU is a transceiver with sector antenna. IDU is built on the base of computer and installed in the office. ODU and IDU are connected with «twisted pair» cable.

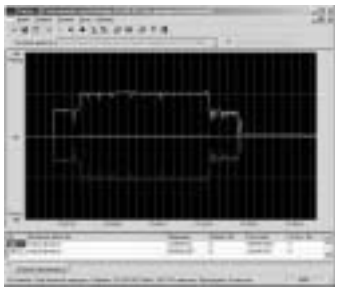
The Switch IDU can be connected to Internet router, Billing&Authorization system etc.

The Terminal is also consists of ODU and IDU, connected to each other by «twisted pair» cable. Terminal IDU is connected directly to LAN.

Fast Ethernet MM-wave Radio of Point-to-multipoint Topology

ELVA-1 Millimeter Wave Division

http://www.elva-1.com, e-mail: sales@elva-1.com



Capacity examples

The best way to demonstrate the system capacity – to transmit a file from the LAN, connected to one Terminal, to the LAN, connected to other terminal of City-A system. Here you can find how 2 movie files 700 MB each were transmitted. Upstream channel was split among both Terminals in equal parts (50 Mbps). Source and destination computers were run under WinXP, QoS was not off.

Phone communications in City-A

For phone communication, operator can use VoIP technology. Operator can also transmit E1 streams encapsulated in IP. It was demonstrated in actual tests that more than 20 non-compressed and more than 160 compressed E1 streams can be transmitted in City-A.

Software

Embedded software is operated under Linux both in Switch and Terminal IDUs. It provides:

- TDMA mode in data transmission from Terminals
- Terminal transmitter's dynamic power control to equalize a signal, received on Switch
- Automatic registration of Terminal, switched on
- Automatic stop of polling the Terminal, switched off

Monitoring and control are executing under TDMARemote software operating on any Windows-computer, having network access to the Switch. It provides:

Set up parameters of upstream channel TDMA
Set up parameters of Terminal transmitter's dynamic power control
Authorize Terminals
Disconnect Terminals
Monitor the Switch and Terminals
Logging the system to the file
Turn the Test mode to check the upstream and downstream channels quality

Monitor different City-A systems

System assembling and setup

Operator can deploy and set up the system on his own. He need to:

- fix Switch and Terminals ODU on vertical pipes, connect them to power source and to IDU
- direct Terminal antennas on the Switch transmitter
- assign IP-addresses to Switch and Terminal front-end interfaces
- create a Terminal list and configure TDMA parameters using TDMARemote software
- test upstream and downstream channels quality using TDMARemote

Specification

Frequency range	*40.5-43.5 GHz*
Frequency band	*500 MHz per channel, 1.5 GHz duplex separation*
Downstream capacity	*100 Mbps*
Upstream capacity	*100 Mbps*
Operation mode	*Full Duplex*
Maximum number of Terminals	*unrestricted*
Maximum number of Terminals in VoIP	*150*

The Switch sector width	*90, 60, 45, or 30°*
Sectors in the cell	*4, 6, 8, or 12*
Terminal antenna diameter	*30, 45, or 60 cm*
Cell radius (90° sector, 5 mmph rain rate)	
30 cm Terminal antenna	*1.9 km*
60 cm Terminal antenna	*3.1 km*
Environment	*-45 °C to +50 °C*
ODU Power	*54 VDC, 2 A*

Mm-wave TV/IP Broadcasting System (City1)

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

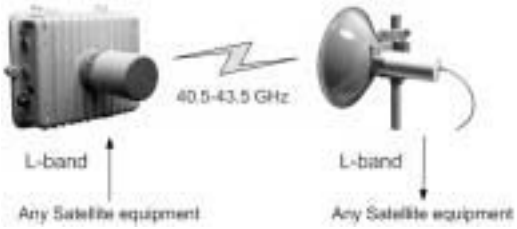
- 432 TV-programs of broadcasting quality
- 3.24 Gbps per cell sector
- DVB-S standard
- L-band interface

City-1 equipment was designed for wideband TV and/or IP broadcasting in urban areas. City-1 operates in two dedicated mm-wave frequency bands, allocated within 40.5 – 43.5 GHz and 92 – 95 GHz.

Description

Operation principle

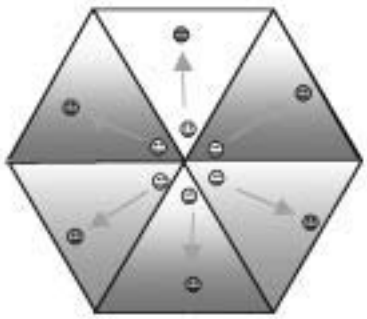
The City-1 system is based on DVB-S standard as in satellite TV/IP broadcasting. The only difference City-1 from satellite systems is a frequency range. For full compatibility to satellite equipment, City-1 transmitter and receiver have L-band interface (IF = 950 to 2150 MHz). This allows using any satellite equipment both at base station and receiver side.

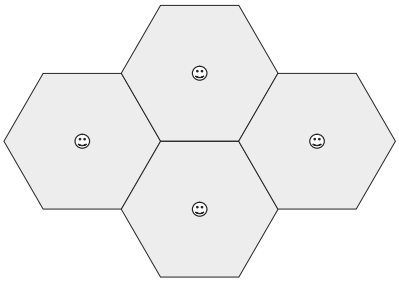


Network topology

City-1 transmitter can be deployed on TV tower or any high tall building. Transmitter range is up to 10 km, depending on a rain meteorology in an area.

TRx is equipped with 30, 45, 60, or 90° sector antenna. To cover all directions, the cell topology is used. Depending on antenna pattern, the cell can be formed from 4, 6, 8, or 12 sectors.





To cover larger territory, multiple cells can be deployed.

An example of frequency allocation plan

Let 40.5–43.5 GHz band is split in 39 MHz bands, like in Satellite broadcasting. We will have 72 bands of vertical polarization and 72 bands of horizontal polarization. Each 39 MHz band is equivalent to satellite "transponder", i.e. can carry 6 TV-channels of broadcasting quality or 45 Mbps data stream.

Operator can use from 1 to 72 bands in any sector, according to the needs. It is important that due to quasi-optical propagation in 40 GHz band, the same frequencies can be used in all cell sectors and in all cells. To avoid interference at sector margins, it is enough to use different polarization in adjacent sectors.

Capacity

As fixed polarization can be used in any cell sector, the sector capacity is 72*6 = 432 TV channels or 72*45 = 3240 Mbps. The capacity of 12-sector cell is more than 5000 TV-channels or 40000 Mbps. The total capacity of the system depends on cell quantity.

Mm-wave TV/IP Broadcasting System (City1)

http://www.elva-1.com, e-mail: sales@elva-1.com

Transmitter

City–1 Transmitter is a low–noise up–converter from 1500 MHz to 40.5–43.5 GHz band.

Transmitter can transmit up to 4 DVB–S streams. But it should be noted that increasing carrier number leads to decreasing of cell radius (due to decreasing of power/carrier ratio and a crosstalk). So to maximize a cell radius, it is recommended to use separate transmitter for each DVB–S stream.

Transmitter is supplied with horn antenna of 30, 45, 60 or 90 degrees beamwidth. Transmitter powering is 48–60 VDC, 2A.

Multi-channel transmitter

Multi–channel transmitter is to provide the maximum cell radius transmitting multiple DVB–S streams. It consists of multiple single–channel transmitters mounted in single case.

Receiver

City–1 Receiver is a down–converter from 40.5–43.5 GHz band to L–band (950–2150 MHz). It has exactly the same interface as Satellite converter (except it operates in fixed polarization). Receiver can be connected to any standard Satellite STB or receiver card with a coax cable. It consumes 18 VDC over a coax.

Receiver is supplied with 30, 45 or 60 cm reflector–type antenna.

IP-broadcasting

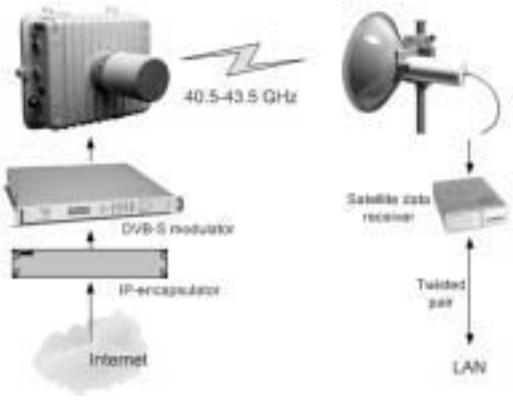
DVB–S standard is used in City–1 for IP broadcasting.

To create DVB/IP stream, IP–encapsulator and DVB–S modulator should be used at the base station.

To receive DVB/IP stream, any satellite data receiver can be used. For example, DVB–router, that has

L–band input and Fast Ethernet output. It can be connected to LAN directly.

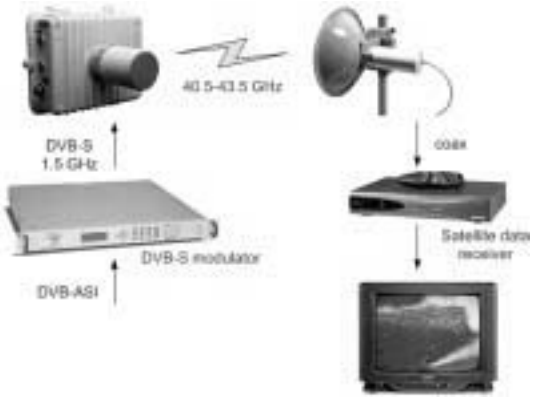
A return channel from client to the Internet ISP in City–1 can be organized in any alternative manner (dial–up, xDSL, etc).



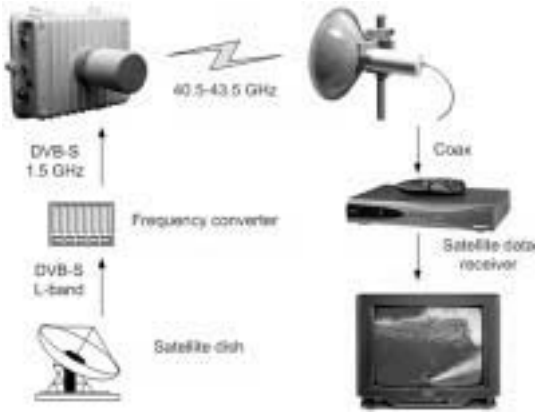
TV-broadcasting: Choice #1

An operator can use 2 different ways to broadcast TV in City–1. The simplest way is TV over DVB, like in satellite TV.

To retransmit a Satellite transponder you can take it from any standard satellite converter, single out one transponder with, for example, ALCAD converter, and forward it directly to City–1 transmitter.



To receive DVB stream, a client can use any standard satellite TV–receiver. To connect it to City–1 receiver, a coax cable with 2 GHz band should be used. To use existing narrow–band coax, QPSK/QAM or QPSK/PAL transmodulators should be installed at receiver side.



To broadcast DVB–ASI/SPI stream, DVB–S modulator should be used.

TV broadcasting. Choice 2.

An alternative way of TV–broadcasting is TV over IP over DVB. In this case TV is transmitted like other data.

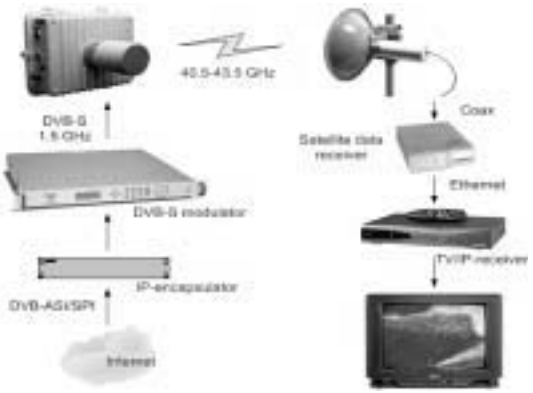
If digital TV to broadcast is available in the Internet, the

IP–encapsulator and DVB–S modulator should be installed at the base station.

At a client side any standard Satellite data receiver can be used to extract TV/IP stream from DVB and forward it to LAN.

Clients should use TV/IP receivers to view a TV on their TV–sets.

This way simplifies the way to distribute received data/TV over the client house. The simplest Fast Ethernet network provides both data and TV distribution.



Video on demand

VoD transmission is completely the same as TV over IP broadcasting.

Video can be stored in the central studio on a disk array. After IP–encapsulation and DVB–S modulation, the video signal is forwarded to a City–1 transmitter.

At client side video get to be converted to an IP–stream that can be viewed on a computer or with a help of TV/IP receiver.

Specification

General

Frequency range	*40.5-43.5 GHz 92-95 GHz*
Bandwidth	*39 MHz * channels number*
TV-channels	*Up to 432 per a cell sector*
Data capacity	*3240 Mbps per a cell sector*
Sectors in cell	*4, 6, 8, or 12*
Range (90° sector, 30 cm terminal antenna, 5mmph rain rate)	*7.5 km*
Environment	*-45 °C .. +50 °C*

Receiver

RF Bandwidth	*1200 MHz*
Polarization	*Vertical/Horizontal*
Cross-polarization factor	*20 dB*
Noise figure	*8 dB*
HF/RF gain	*35 dB*
IF	*950-2150 MHz*
LO stability	*+-2.5 MHz*
Antenna	*30 cm/38 dB/1.6° 45 cm/42 dB/1.0° 60 cm/44 dB/0.7°*
Power	*18 V, 250 mA*
Mounting	*On vertical pipe 40~70 mm diameter*
Dimensions (without antenna)	*Diam. 75x 150 mm*
Weight	*2 kg*
Alignment vertical horizontal	* +/-20° 360°*

Transmitter

RF Bandwidth	*200 MHz*
Output power	*22 dBm Psat min*
Polarization	*Vertical/Horizontal*
Phase noise	*<-51 dB/Hz at 1 kHz offset <-81 dB/Hz at 10 kHz offset*
Unwanted emission: 30 MHz .. 21.2 21.2 GHz .. 40.5 GHz 43.5 GHz .. 43.5 GHz 43.5 GHz .. 80 GHz	* < - 90 dBW < - 60 dBW < - 80 dBW < - 60 dBW*
IF	*1250-1750 MHz, 10 dBm QPSK modulation N-type connector*
Input noise	*<- 55 dBc in 4kHz band*
Antenna	*90°x10°, 16 dB 60°x10°, 17 dB 45°x10°, 18 dB 30°x10°, 20 dB*
Power	*54 VDC, 2A*
Dimensions	*288x 242x 120 mm, antenna: 140 x diam.85*
Weight	*5 kg*
Mounting	*On vertical pipe 40~70 mm diameter*
Alignment vertical horizontal	* +/-25° 360°*

100 Mbps Full Duplex Wireless Ethernet Bridge

Millimeter Wave Division

http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- 100 Mbps Full Duplex
- Frequency bands: 40.5–43.5 GHz, 57–64 GHz, 71–76/81–86 GHz, 92–95z GHz
- Quasi–optical propagation
- Cost effective direct modulation
- Compact Cassegrain type antennas
- "All outdoor" design
- Software free and SNMP versions

Applications

- LAN–to–LAN interconnection
- Backbone networks
- Secure communications
- ISP Last Mile
- FSO (Free Space Optics) Back–up

Description

Elva–1 produces millimeter wave LAN Bridges (PPC product line). PPC provides a cost–effective solution for broadband and/or crowded spectrum communications. The PPC wireless bridges are produced for 40.5–43.5 GHz, 57–64 GHz, 71–76/81–86 GHz, 92–95 GHz frequency bands.

PPC Bridges provides 100 Mbps Full Duplex connections. PPC designed as "all outdoor" unit, with 100BaseTX or 100BaseFX interface to connect directly to LAN.

PPC equipment is offered with antennas, mounting units and peripherals to allow a turnkey installation to the customer's communication system. These products are compact and lightweight. Elva–1's experienced staff is available to assist customers to select required parameters such as antenna size, transmitter power etc.

To simplify network management, PPC wireless bridge has a software–free design. To provide SNMP control, PPC is produced with embedded PC, operating under Linux.

Range*

		40.5-43.5 GHz	57-64 GHz	71-76/81-86 GHz	92-95 GHz
Antenna	30 cm	8000 m	1700 m	-	5500 m
	45 cm	11500 m	2100 m	-	6700 m
	60 cm	13200 m	2300 m	7800 m	8100 m

*) at 5 mm/hour rain rate

Specifications

Frequency range		40.5-43.5 GHz	57-64 GHz	71-76/81-86 GHz	92-94, 94.1-95 GHz
Capacity		100 Mbps Full duplex			
Data interface		Twisted pair / Fiber optic			
Antenna type		Cassegrain			
Output power*		50 mW	18-55 mW	50 mW	50 mW
Antenna gain/beamwidth	30 cm	38 dB/1,6°	42 dB/1,0°	43.5 dB/0,9°	45 dB/0,7°
	45 cm	42 dB/1,0°	45 dB/0,7°	46.5 dB/0,6°	48 dB/0,5°
	60 cm	44 dB/0,7°	47 dB/0,5°	50 dB/0,4°	50 dB/0,4°
Power		48-60 VDC, 20-35 W (+15 W heating)			
Dimensions (w/o antenna)		330 x 350 x 460 mm			
Weight		14 kg			
Operating temperature		-40° C to +50° C (-40° F to 122° F)			

*) for 60 GHz band 18/34/55 mW for 30/45/60 cm antennas respectively

How to Order

Specify Model Number **PPC-100-QXX-YY**

Q – 40.5 to 43.5 GHz
V – 57 to 64 GHz
E – 71–76/81–86 GHz
W – 93 to 96 GHz

Specify **XX** in order **30** = 30 cm, or **45** = 45 cm, or **60** = 60 cm antenna
Specify **YY** in order **TP** = Twisted Pair, **FO** = Fiber Optics interface

Example: To order link for **92-95 GHz** with **30 cm** antenna and **Twisted Pair** interface specify the following specification:
PPC-100-W30-TP

E1 mm-wave radio

ELVA-1 Millimeter Wave Division
http://www.elva-1.com, e-mail: sales@elva-1.com

Features

- Frequency bands:
  40.5–43.5 GHz, 59–64 GHz, 92–96 GHz
- Quasi–optical propagation
- Compact Cassegrain antennas
- "All outdoor" design

Applications

- Crowded spectrum communications
- Ultra–secure communications

Description

Elva–1 produces millimeter wave E1–capacity radio (PPC–E1). PPC–E1 is designed for crowded spectrum urban areas. Available frequency bands are 40.5–43.5 GHz, 59–64 GHz, 92–96 GHz.

PPC–E1 designed as "all outdoor" unit, with RJ45 interface to connect directly to E1 source. PPC stations are offered with antennas, mounting units and peripherals to allow a turnkey installation to the customer's communication system. These products are compact and lightweight. Elva–1's experienced staff is available to assist customers to select required parameters such as antenna size, transmitter power etc.

Range*

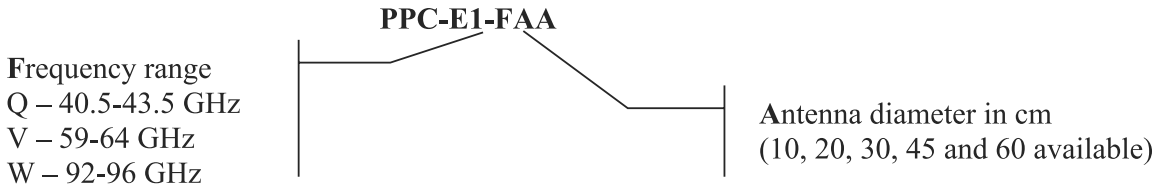
		40.5-43.5 GHz	59-64 GHz	92-96 GHz
Antenna	10 cm	9400 m	1600 m	5300 m
	20 cm	15000 m	2200 m	7900 m
	30 cm	17000 m	2400 m	8700 m
	45 cm	21500 m	2600 m	-
	60 cm	22800 m	2900 m	-

*) 5 mm/h rain rate

Specifications

		40.5-43.5 GHz	59-64 GHz	92-96 GHz
Data stream		E1, HDB3		
Data interface		Twisted pair		
Antenna type		Cassegrain		
Output power		150 mW	18 mW	70 mW
Antenna gain/beamwidth	10 cm	28 dB/4,8°	34 dB/3,1°	35 dB/2,1°
	20 cm	34 dB/2,3°	39 dB/1,5°	41 dB/1,0°
	30 cm	38 dB/1,6°	42 dB/1,0°	45 dB/0,7°
	45 cm	42 dB/1,0°	45 dB/0,7°	
	60 cm	44 dB/0,7°	47 dB/0,5°	
Power		48-75 VDC, 25 W		
Dimensions		330 x 350 x 460 mm		
Weight		14 kg		
Operating temperature		-40 to +50° C		

How to Order



Example: PPC-E1-Q30 – E1 wireless bridge operating in 40.5–43.5 GHz band with 30 cm antennas

26.5 - 140 GHz Cassegrain Antenna series for OEM Market

http://www.elva-1.com, e-mail: sales@elva-1.com

Description

ELVA–1 has developed a low cost high performance microwave antennas to meet needs of the broadband market. These antennas are dual reflector Cassegrain type ECA – XX series. Antennas of ECA – XX series are available for frequencies from 26.5GHz to 140GHz with reflector diameters ranging from 100mm to 600mm. The gain is up to 48dBi depending upon the frequency. The main reflector has a highly accurate surface and is designed from aluminium. The subreflector is a machined aluminium hyperboloid or ellipsoid, which is rigidly supported by special plastic cylinder.

These antennas are designed to have minimal cross–section to reduce aperture blockage, and hence produce low sidelobe levels (typically 18dB). Typical VSWR is 1.25:1. The gain of the antenna depends upon its diameter. The antenna feed is a circular waveguide of appropriate diameter with an optional circular–to–rectangular transition.

Custom band antennas for 110–170 GHz are also available by special orders. Each antenna can be shipped with antenna bracket and radome as standard options.

Specifications for Cassegrain antenna ECA - XX series

Ka band. 26,5-40 GHz

Part No	Diameter of main reflector (mm)	Gain dB,(typ)	Bandwidth in deg. at 3dB level (typ)	VSWR (typ)
ECA-Ka-X-100	100	26.3	6.0	1.40
ECA-Ka-X-200	200	32.7	2.9	1.35
ECA-Ka-X-300	300	36.4	2.0	1.25
ECA-Ka-X-450	450	40.9	1.3	1.25
ECA-Ka-X-600	600	42.9	0.9	1.25

Losses in a Protected cover is 0,7 dB (max)
Feed waveguide is circular or rectangular
Information for Ordering: X= Number for type of feed waveguide

Available types of Circular waveguides are:

Number	Frequency Band (GHz)	Diameter of Waveguide (inch)	Flange
X=0	26.0-28.5	0.328	UG-381/U
X=1	28.5-33.0	0.281	UG-381/U
X=2	33.0-38.5	0.250	UG-381/U
X=3	38.5-43.0	0.219	UG-381/U

Available type of Rectangular waveguide is:

X=28	26,5-40	WR-28	UG-599/U UG-381/U UG-600

Data for Gain and Bandwidth are typical for middle of frequency range

Q band. 33-50 GHz

Part No	Diameter of main reflector (mm)	Gain dB,(typ)	Bandwidth in deg. at 3dB level (typ)	VSWR (typ)
ECA-Q-X-100	100	28.3	4.8	1.40
ECA-Q-X-200	200	34.6	2.3	1.35
ECA-Q-X-300	300	38.5	1.6	1.25
ECA-Q-X-450	450	42.9	1.0	1.25
ECA-Q-X-600	600	44.9	0.7	1.25

Losses in a Protected cover is 0,7 dB (max)
Feed waveguide is circular or rectangular
Information for Ordering : X= Number for type of feed waveguide

Available types of Circular waveguides are:

Number	Frequency Band (GHz)	Diameter of Waveguide (inch)	Flange
X=0	33.0-38.5	0.250	UG-383/U
X=1	38.5-43.0	0.219	UG-383/U
X=2	43.0-50.0	0.188	UG-383/U

Available type of Rectangular waveguide is:

X=22	33-50	WR-22	UG-383/U TRG719

Data for Gain and Bandwidth are typical for middle of frequency range

U band. 40-60 GHz

Part No	Diameter of main reflector (mm)	Gain dB,(typ)	Bandwidth in deg. at 3dB level (typ)	VSWR (typ)
ECA-U-X-100	100	32.0	3.9	1.35
ECA-U-X-200	200	38.2	2.0	1.30
ECA-U-X-300	300	41.7	1.3	1.25
ECA-U-X-450	450	44.8	0.9	1.25
ECA-U-X-600	600	46.4	0.7	1.25

Losses in a Protected cover is 0,7 dB (max)
Feed waveguide is circular or rectangular
Information for Ordering : X= Number for type of feed waveguide

Available types of Circular waveguides are:

Number	Frequency Band (GHz)	Diameter of Waveguide (inch)	Flange
X=0	38.5-43.0	0.219	UG-383/U
X=1	43.0-50.0	0.188	UG-383/U
X=2	50.0-58.0	0.165	UG-383/U

Available type of Rectangular waveguide is:

X=19	40-60	WR-19	UG-383/U TRG720

Data for Gain and Bandwidth are typical for middle of frequency range

26.5 - 140 GHz Cassegrain Antenna series for OEM Market

V band. 50-75 GHz

Part No	Diameter of main reflector (mm)	Gain dB,(typ)	Bandwidth in deg. at 3dB level (typ)	VSWR (typ)
ECA-V-X-100	100	34.0	3.1	1.3
ECA-V-X-200	200	39.7	1.5	1.25
ECA-V-X-300	300	42.4	1.0	1.25
ECA-V-X-450	450	45.4	0.7	1.25
ECA-V-X-600	600	47.5	0.5	1.25

Losses in a Protected cover is 0,7 dB (max)
Feed waveguide is circular or rectangular
Information for Ordering : X= Number for type of feed waveguide

Available types of Circular waveguides are:

Number	Frequency Band (GHz)	Diameter of Waveguide (inch)	Flange
X=0	50.0-58.0	0.165	UG-385/U
X=1	58.0-68.0	0.141	UG-385/U
X=2	68.0-77.0	0.125	UG-385/U

Available type of Rectangular waveguide is:

X=15	50-75	WR-15	UG-385/U

Data for Gain and Bandwidth are typical for middle of frequency range

E band. 60-90 GHz

Part No	Diameter of main reflector (mm)	Gain dB,(typ)	Bandwidth in deg. at 3dB level (typ)	VSWR (typ)
ECA-E-X-100	100	34.4	2.6	1.30
ECA-E-X-200	200	39.9	1.3	1.25
ECA-E-X-300	300	43.5	0.9	1.25
ECA-E-X-450	450	46.6	0.6	1.25

Losses in a Protected cover is 0,7 dB (max)
Feed waveguide is circular or rectangular
Information for Ordering : X= Number for type of feed waveguide

Available types of Circular waveguides are:

Number	Frequency Band (GHz)	Diameter of Waveguide (inch)	Flange
X=1	68.0-77.0	0.125	UG-387/U
X=2	77.0-87.0	0.110	UG-387/U
X=3	87.0-100.0	0.094	UG-387/U

Available type of Rectangular waveguide is:

X=12	60-90	WR-12	UG-387/U

Data for Gain and Bandwidth are typical for middle of frequency range

W band. 75-110 GHz

Part No	Diameter of main reflector (mm)	Gain dB,(typ)	Bandwidth in deg. at 3dB level (typ)	VSWR (typ)
ECA-W-X-100	100	35.7	2.1	1.25
ECA-W-X-200	200	41.7	1.0	1.25
ECA-W-X-300	300	45.0	0.7	1.25

Losses in a Protected cover is 0,7 dB (max)
Feed waveguide is circular or rectangular
Information for Ordering : X= Number for type of feed waveguide

Available types of Circular waveguides are:

Number	Frequency Band (GHz)	Diameter of Waveguide (inch)	Flange
X=0	77.0-87.0	0.110	UG-387/U-M
X=1	87.0-100.0	0.094	UG-387/U-M
X=2	100.0-112.0	0.082	UG-387/U-M

Available type of Rectangular waveguide is:

X=10	75-110	WR-10	UG-387/U-M

Data for Gain and Bandwidth are typical for middle of frequency range

F band. 90-140 GHz

Part No	Diameter of main reflector (mm)	Gain dB,(typ)	Bandwidth in deg. at 3dB level (typ)	VSWR (typ)
ECA-F-X-100	100	37.0	1.7	1.25
ECA-F-X-200	200	42.6	0.9	1.25
ECA-F-X-300	300	45.9	0.6	1.25

Losses in a Protected cover is 0,7 dB (max)
Feed waveguide is circular or rectangular
Information for Ordering : X= Number for type of feed waveguide

Available types of Circular waveguides are:

Number	Frequency Band (GHz)	Diameter of Waveguide (inch)	Flange
X=0	87.0-100.0	0.094	UG-387/U-M
X=1	100.0-112.0	0.082	UG-387/U-M
X=2	112.0-125.0	0.075	UG-387/U-M
X=3	125.0-140.0	0.067	UG-387/U-M

Available type of Rectangular waveguide is:

X=8	90-140	WR-8	UG-387/U-M

Data for Gain and Bandwidth are typical for middle of frequency range

How to Order

Specify Model Number **ECA-A-X-BBB**
A – waveguide band
X – waveguide type
BBB – size of main reflector

Example: To order antenna meets the following specification: operation frequency 75–110 GHz, in WR–10 waveguide band with 300mm of main reflector, should be ordered as **ECA -W-10-300**

Delivery time 4–6 weeks for all models.
All ELVA–1 antennas are warranted for one year after receipt.