ELVA-1

Millimeter Wave Division

COMMUNICATION EQUIPMENTS

PRODUCT CATALOGUE

MILLIMETER WAVE SYSTEMS AND COMPONENTS

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Sources, Frequency Multipliers and Amplifiers

Receiver Product and Control Components

Passive and Ferrite Waveguide Components

Antenna Products

Test Equipments

Radar Solutions

Telecom Solutions

Solutions for Scientific Application

- **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

G4-143x series

The G4-143x series is fully packaged sweeper source. The microcomputer is 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 built-in full band sweep time is 10 ms. User from front panel or 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. 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.

SGMW-x series

The SGMW-X series is fully packaged sweeper source. The sweeper consists of external module with BWO-X series and power supply. There are all the electronic circuitry and power supplies required to provide the operation of BWO. The sweeper self-tests at turn-on. BWO tube is fully protected against improper voltage connections. There are two inputs for external frequency and power control. Phase locking possibility is provided. Minimal built-in full band sweep time is 10 ms.

One power supply can be used with different BWO. Particularly, the remote module with BWO tube allows using it at hard-to-reach places and can be installed quite away, somewhere near a scientist's work desk. Another great advantage of this series of BWO sweepers is its power supply unit, that allows feed up to few BWO tubes even with different working frequencies.

Specifications

G4-143x	G4-143a	G4-143b	G4-143c	G4-143d	G4-143e	G4-143f	G4-143g
BWO modules for SGMW	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 type	WR22	WR19	WR15	WR12	WR10	WR8	WR6
Waveguide 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
Built-in Sweep Time, ms	10*
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	0–10…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 of G4-143x, mm	495×180×480
Size Power Supply SGMW, mm	490×240×270
Weight Power Supply SGMW, kg	25
Size BWO module for SGMW, mm	150×180×200
Weight BWO module for SGMW, kg	4
Length of connection cable for SGMW, m	1…2 (specify in order)

* Full one band sweep time: less then 200 microseconds with external frequency control.
** Uncontrolled (not specified) parameter.

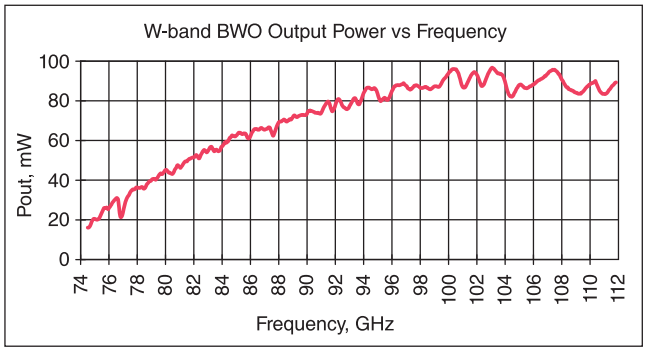
How to Order

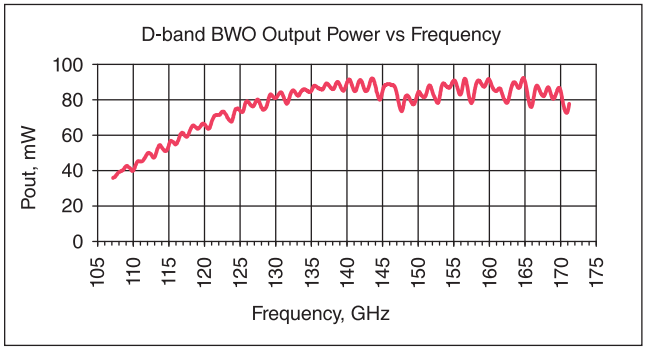
Specify Model Number SGMW-X-A, where
- **X** — type of BWO tubes
  W — power supply with BWO-W, WD — power supply with BWO-W and BWO-D
- **A** — length of cable in meters.

Example

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

Typical Data.





Phase Locked BWO Source
SGMW-PLL Series 33–170 GHz

ELVA-1 Millimeter Wave Division

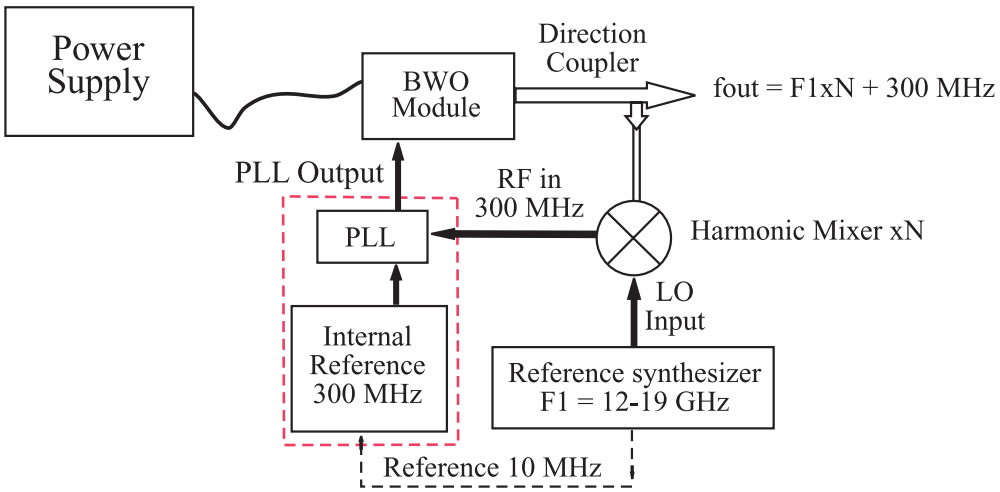
- **37–170 GHz in 7 bands**
- **Quartz Frequency accuracy and stability**
- **Full waveguide sweep in all bands**
- **Program from front panel or GPIB bus**
- **Remote controlled, phase lockable**
- **High output power**

Applications

- Instrumentation automated subsystems
- Laboratory measurement and test equipment
- Source for Vector Analysers
- Antenna design and measurement

Description

Phase lockable SGMW-PLL series is based on standard SGMW series. External PLL circuit with reference synthesizer 12–19 GHz allow to get full waveguide tunable synthesizer with high output power. Block diagram of SGMW-PLL system is presented below:



Block-scheme of SGMW-PLL unit set up.

Specifications

BWO modules for SGMW	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 type	WR22	WR19	WR15	WR12	WR10	WR8	WR6
Waveguide 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	45	85	20	20	20	30	22
Typical peak power, mW	135	170	70	70	80	90	70

How to Order

Specify Model Number SGMW-PLL-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.

Submillimeter Wave Broadband BWO Sources 180–1110 GHz

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

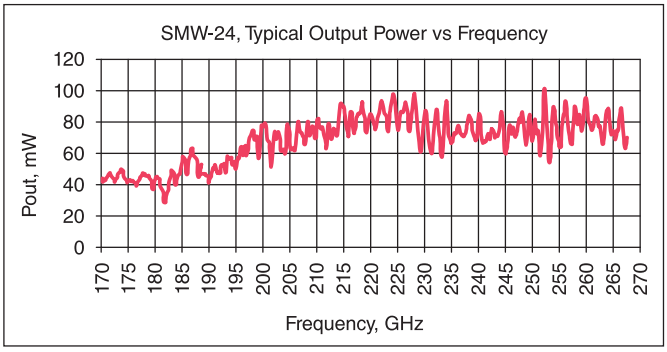
Applications

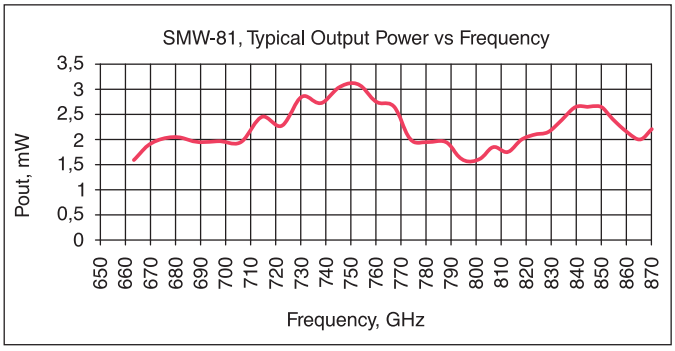
- Instrumentation automated subsystems
- Laboratory measurement and test equipment
- Source for Network Analysers
- Plasma diagnostics and spectrometry
- Sweeping Heterodyne Receivers
- frequency and spectrum analysis for gyrotrons

Description

ELVA-1 series **SMW-XX** is fully packaged sweeper. It consists of BWO **OB-XX** series, permanent, tube alignment mechanical system and power supply. Optionally fully closed water cooling system would be supplied. On the photo power supply with BWO tube is shown installed in the permanent magnet 0.8 T. The device contains all the electronic circuitry and power supplies required to provide the operation of BWO. BWO tube is fully protected against mistake of all operation voltage applications. Water flow alarm system provides trouble-free operation. High voltage monitor is built-in. There is input for control of frequency by means of an external voltage. Phase locking possibility is provided.

We supply each device with a personal calibration for output power and frequency. Typical dependencies are presented on the plot below for **SMW-24** and **SMW-81** models:





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

Specifications

Model	SMW-24	SMW-30	SMW-32	SMW-80	SMW-81	SMW-82	SMW-83
BWO tube model	OB-24	OB-30	OB-32	OB-80	OB-81	OB-82	OB-83
Operating range, GHz	179–263	258–375	370–535	526–714	667–857	789–968	882–1111
Output power, typ, mW	20–50	10–20	4–10	4–6	2–5	1–3	1–2
Power difference in the range, max, dB	13	13	10	10	10	6	6

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

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Common specifications

Frequency accuracy in the CW mode, %	±0.01
Frequency stability for 15 min**	10^{-4}
AM stability**, max, %	1
Residual FM, max	$\pm 5 \cdot 10^{-5}$
Sweep time, min, ms	0.2–0.5*
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	300×250×300
power supply	495×380×480
Weight total, kg	45

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

Controller for PC microcomputer and software are available upon request.

Phase locked version upon request.

Power supply Specifications.

High voltage output:

Output Voltage range	-1000 V to -6000 V
Maximum current	59 mA
Long term voltage stability	10^{-5}
Ripples and noise	< 10 mV
Discretization when setting the voltage	10 mV
Uncertainty of the output voltage measurement	< 0.002 %
Overload protection response time	< 30 μs
External Analog signal for output voltage control	0 to +10 V
High voltage monitor	0 …+10 V

Both the voltage and the current are displayed on LCD
Voltage adjustment: direct keyboard entry or pseudo-Analog rotary adjustment
Operational modes: fixed output voltage and sweeping output voltage
IEEE 488 interface

Cathode heater current output:

Current control range	0 to 2 A
Maximum voltage	7 V
Long term current stability	5×10^{-3}
Ripples and noise	< 2 mA
Discretization when setting up the voltage	10 mV
Uncertainty of the output current measurement	0.5 %
Overload protection response time	< 20 ms

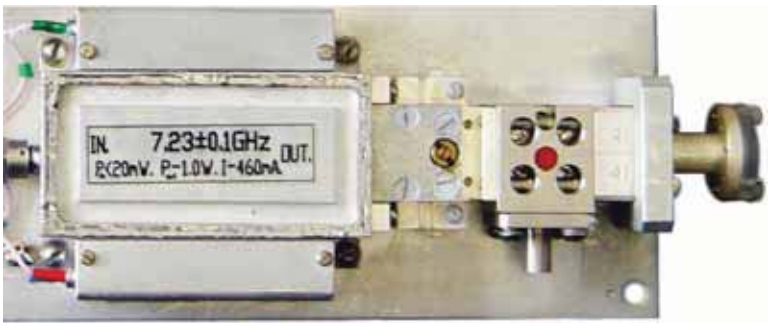
Both the voltage and the current are displayed on LCD

IMPATT Active Frequency Multipliers 26–180 GHz

- **Multiplication factor up to 25**
- **High efficiency**
- **High power output levels**
- **Low spurious harmonic content**
- **Fast switching**
- **Low phase and AM noise**

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 180 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 (20 mW, 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 centimeter-wave high power preamplifier, 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.

Specifications

Model Number	IAFM-28	IAFM-22	IAFM-19	IAFM-15	IAFM-12	IAFM-10	IAFM-08	IAFM-06
Frequency Band	Ka	Q	U	V	E	W	F	D
Frequency Range, GHz*	26.5–40	33–50	40–60	50–75	60–90	75–110	90–140	110–180
Maximum Power Output**	150	150	120	100	50	30–50	15–30	10–20
Input signal power, mW	30–50	30–50	30–50	30–50	30–50	30–50	30–50	30–50
Multiplication factor	5–8	6–10	7–10	8–13	10–15	14–18	18–24	19–25
DC Power, V/A	+12/0.6 -12/0.01 +50/0.15	+12/0.6 -12/0.01 +45/0.15	+12/0.6 -12/0.01 +45/0.15	+12/0.2 -12/0.01 +35/0.15	+12/0.6 -12/0.01 +35/0.2	+12/0.6 -12/0.01 +27/0.2	+12/0.6 -12/0.01 +24/0.2	+12/0.6 -12/0.01 +24/0.26

* Operation bandwidth 3–5 %. Upon request 10 % version is available.
** Values are presented for the middle frequency of the frequency band.

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Common specifications

Output power flatness within the 1 % band width (max)	1.5 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 +20 Lg(N) dB/Hz. For example, if 7 GHz pumping source has -120 dB/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 -120 dB/Hz + 20 Lg(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 consists of the following:
  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.
  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.
- IMPATT Injection-Locked Amplifiers of IILA series can be used to increase output power.
- Phase or amplitude modulators on base PIN switches of SPST series provides fast modulation.
- Amplitude regulator on base Voltage Controlled Attenuator of VCVA series makes smooth attenuation of output power up to 60 dB.
- Power supply for AC Input Voltages 110 V, 60Hz; 220 V, 50 Hz can be supplied.

How to Order

Specify Model Number IAFM-XX/CF/BW, where
-XX — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
-CF — central frequency of operating bandwidth in GHz
-BW — operating bandwidth in GHz

Example

IAFM-10/94/2 (W-band active frequency multiplier with output waveguide WR-10, central frequency 94 GHz, operating bandwidth2 GHz (+/–1GHz).

Cavity Stabilized IMPATT Millimeter Wave Oscillators 26–150 GHz

- **26–150 GHz**
- **High output power up to 50 mW**
- **Frequency accuracy +/- 10 MHz**
- **Frequency stability — $5*10^{-6}$ 1/deg C**
- **Low phase noises**
- **Compact package**
- **Low cost**

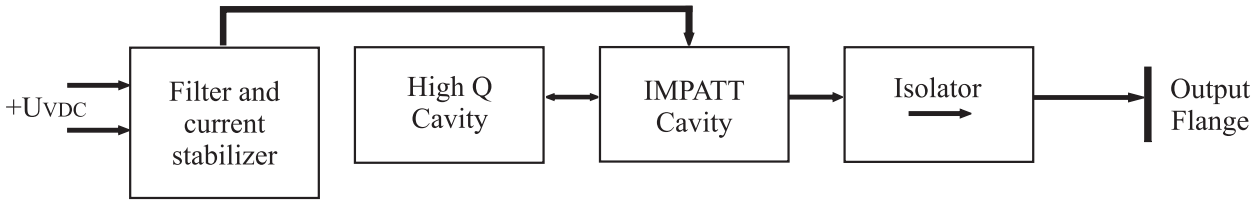
Applications

- Laboratory measurement and test equipment
- Source for Plasma diagnostics and spectrometry
- LO for mm-wave mixers
- Stable LO with fixed frequency
- Communication systems

Description

ELVA-1 presents mm-wave oscillators of CIDO-XX family operating at fixed frequency. The CIDO-XX are cavity-stabilized IMPATT diode oscillators. They provide high frequency stability and low phase noise capability. 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. The CIDO-XX sources are available in 8 waveguide bands covering 26 to 150 GHz. The CIDO-XX 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 heat sink. 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 CIDO - XX oscillator

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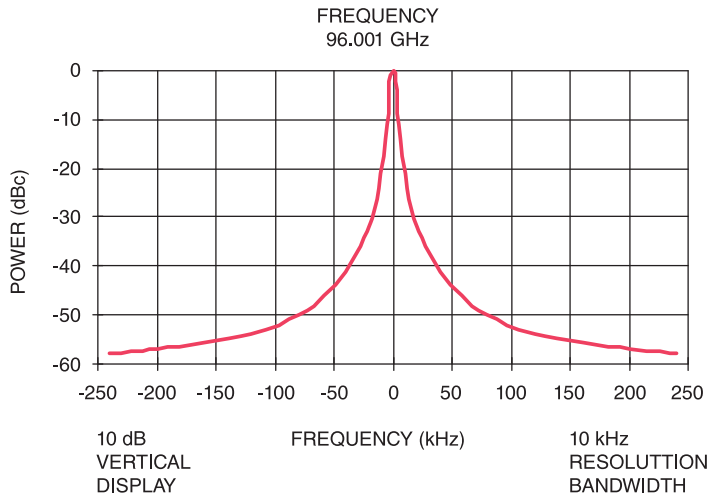
Specifications

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
Output Power (typ), mW	50	40	30	30	30	30	20	10
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 Stability, 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	+24/0.25	+24/0.25

Accuracy of frequency adjustment is about few MHz. The adjustment is provided in 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 **SPST** series;
3. Amplitude regulator on the base of Voltage Controlled Attenuator **VCVA** series;
4. Power supply for AC Input Voltages 110 V, 60 Hz; 220 V, 50 Hz.

How to Order

Specify Model Number CIDO-XX/F/P, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **F** — operating frequency in GHz
- **P** — output power (nom).

Example

CIDO oscillator with the following specification: operation frequency 94.0 GHz, output power 20 mW, output waveguide WR-10 has p/n **CIDO-10/94/20.**

- **High power output levels**
- **Ultra Low phase and AM noise**

Applications

- Power sources
- Spectroscopy / Radiometry
- Digital Radio

Description

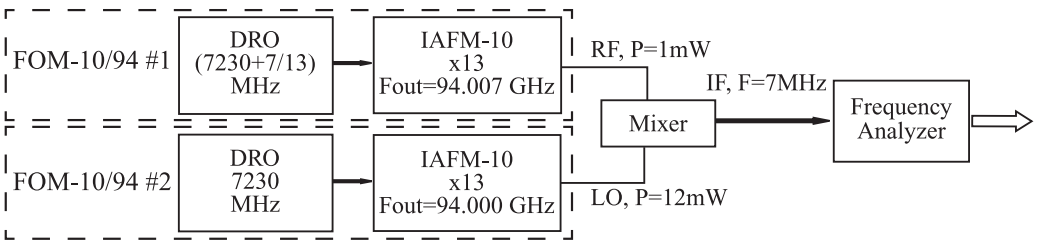
Complete High performance fixed IMPATT oscillators are very stable solid state millimeter wave source with ultra low phase AM noise. The oscillator (FOM) consists of transistor Oscillator, power amplifier and IMPATT frequency Multiplier. The 6-8 GHz, 20-50mW transistor oscillator is stabilized with dielectric resonator (DRO), has narrow spectrum and ~10^{-6} frequency stability. The stability would be increased upon request using a temperature stabilization scheme.

Specifications

Model Number	FOM-28	FOM-22	FOM-19	FOM-15	FOM-12	FOM-10	FOM-08	FOM-06
Frequency Band **Frequency 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 110–180
Maximum Power Output**	150	150	120	100	50	30–50	15–30	10–20
Input signal power, mW	30–50	30–50	30–50	30–50	30–50	30–50	30–50	30–50
Multiplication factor	5–8	6–10	7–10	8–13	10–15	14–18	18–24	19–25
DC Power, V/A	+12/0.6 -12/0.01 +50/0.15	+12/0.6 -12/0.01 +45/0.15	+12/0.6 -12/0.01 +45/0.15	+12/0.2 -12/0.01 +35/0.15	+12/0.6 -12/0.01 +35/0.2	+12/0.6 -12/0.01 +27/0.2	+12/0.6 -12/0.01 +24/0.2	+12/0.6 -12/0.01 +24/0.26

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

There is a block-scheme of phase noises measurements of FOM-10/94 oscillator at 94 GHz below.



See on picture, at 10 kHz offset, the difference in power between carrier and 10kHz offset marker is -69.6 dBc. Taking into account that bandwidth is 1 kHz, the spectrum density of noise is -99.6 dBc/Hz. Assuming that we have two equivalent sources the noise power of each source is 3 dB less, i. e. -102.6 dBc/Hz.

How to Order

Specify Model Number FOM-XX/F, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **F** — operating frequency (fixed) in GHz.

Example

FOM-10/94 - Fixed frequency oscillator based on multiplier with output waveguide WR-10, operating frequency 94 GHz.

Voltage Controlled IMPATT Oscillators 26–180 GHz

ELVA-1 Millimeter Wave Division

- **High power output levels**
- **Wide tuning range**

Applications

- Sweepable Power sources
- Spectroscopy / Radiometry
- Reflectometer, Interferometer
- FMCW radars

Description

Complete sweepable IMPATT oscillators consist of VCO 6–8 GHz, 50 mW output and IAFM multiplier. The stability would be increased upon request using a temperature stabilization scheme.

Specifications

Model Number	VCOM-28	VCOM-22	VCOM-19	VCOM-15	VCOM-12	VCOM-10	VCOM-08	VCOM-06
Frequency Band **Frequency 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 110–180
Maximum Power Output**	150	150	120	100	50	30–50	15–30	10–20
Input signal power, mW	30–50	30–50	30–50	30–50	30–50	30–50	30–50	30–50
Multiplication factor	5–8	6–10	7–10	8–13	10–15	14–18	18–24	19–25
DC Power, V/A	+12/0.6 -12/0.01 +50/0.15	+12/0.6 -12/0.01 +45/0.15	+12/0.6 -12/0.01 +45/0.15	+12/0.2 -12/0.01 +35/0.15	+12/0.6 -12/0.01 +35/0.2	+12/0.6 -12/0.01 +27/0.2	+12/0.6 -12/0.01 +24/0.2	+12/0.6 -12/0.01 +24/0.26

* Operation bandwidth up to 10 % is available.
** Values are presented for the middle frequency of the frequency band.

Common specifications

Output power flatness within the 1 % band width (max)	1.5 dB
Rejection of adjacent harmonics (min)	40 dB
VSWR	1 : 1.3
AM noise inserted (max)	-130 dB/Hz (white noise)
Sweep time, min	5 μs
Control voltage	+2…+22 V

How to Order

Specify Model Number VCOM-XX/CF/BW/P, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **CF** — central frequency of operating bandwidth in GHz
- **BW** — operating bandwidth in GHz
- **P** — max output power in mW.

Example

VCOM-10/94/2/20 - Voltage controlled oscillator based on multiplier with output waveguide WR-10, central frequency 94 GHz, operating bandwidth 2 GHz, max output power 20 mW.

High Power Voltage Controlled Oscillators

- **High output power**
- **Digital / Electrical Frequency control**
- **High power and frequency stability**
- **Digital / Electrical control of output power level**
- **Ability of long-term frequency stability**
- **Stable spectrum**
- **Ability of remote control / diagnostics through internet**
- **Long life time**

Applications

- Laboratory measurement and test equipment
- Mm-wave source of high power
- EPR spectrometer bridge
- DNP polarizer source
- Plasma diagnostics
- FMCW radar module

Description

Millimeter-wave oscillators of **VCOM-XX** series originally was designed for purposes of EPR spectroscopy and plasma diagnostics. It provides electromagnetic energy within some 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 requested frequency range. It can be 200 mW at 94 GHz, 50 mW at 140 GHz and 10 mW at 170 GHz.

Output power and frequency are controlled by means digital code signal (symbol D at end of p/n: VCOM-…-DD, VCOM-…-DA, VCOM-…-DP models) or with external DC or pulse voltages (VCOM-…-T, VCOM-…-DA, VCOM-…-DP models). Digital control models of VCOM-XX have built in frequency counter what allows providing high long-term stability of output frequency. Also remote control and diagnostics of operation through internet is admissible.

Reliable work of **VCOM-XX** oscillators allows using them in scientific experiments which last for long time, a few weeks or even months.

There are set of standard models of the **VCOM-XX** oscillators now.

- T-analogue control of frequency and power level
- DD-digital control of frequency and power level
- DA-analogue and digital control (switchable modes)
- DP-digital control of output frequency, digital and analogue control of power level (up to 5 kHz pulse modulation of power level available)

Custom designed VCOM models can be produced by special order.

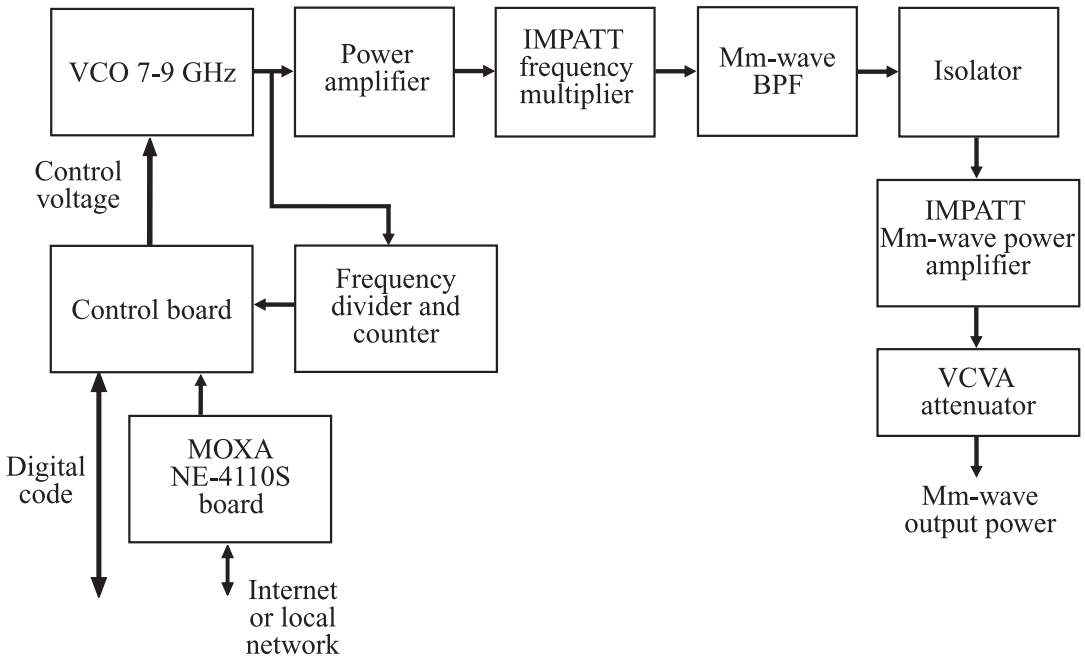
www.elva-1.com
e-mail: sales@elva-1.com

Specifications

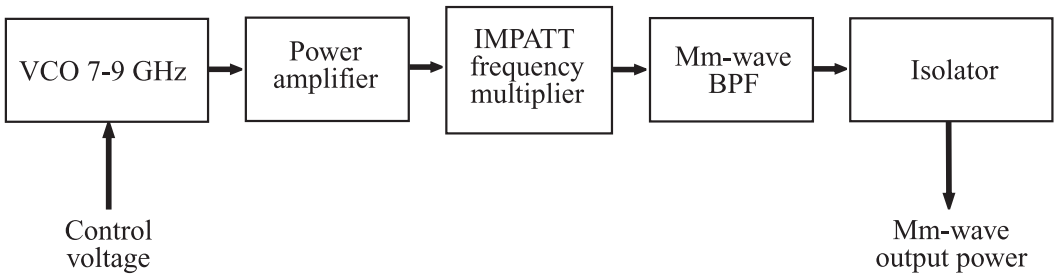
Model	VCOM-10/94/0.5/200-XX	VCOM-06/140/2/20-XX	VCOM-06/170/2/10-XX
Central frequency	94 GHz	140 GHz	170 GHz
Bandwidth	500 MHz	2 GHz	2 GHz
Frequency Range (controlled)	93.75–94.25 GHz	139–141 GHz	169–171 GHz
Output power (controlled)	0–200 mW	0–20 mW	0–10 mW
Spectrum line width at -3 dBc	100 kHz max	100 kHz max	100 kHz max
Control attenuation	0…50 dB	0…50 dB	0…40 dB
Flange / Waveguide	UG-387/U-M /WR-10	UG-387/U-M /WR-06	UG-387/U-M /WR-06
Operating Humidity at Temp range +10 to +40 deg °C	< 70 % (non-condensing)	< 70 % (non-condensing)	< 70 % (non-condensing)
For models with digital control			
Frequency Step (max)	250 kHz	350 kHz	500 kHz
Power Level Step	< 1mW	< 0.1mW	0.05mW
Absolute accuracy of set: Frequency within +10 to +40 deg °C	< 0.5M Hz	< 0.7 MHz	< 1 MHz
Settling time to major frequency step within 0.5 MHz	less than or equal to 500 msec (max)	less than or equal to 500 msec (max)	less than or equal to 500 msec (max)
Long term stability of reference crystal oscillator: at constant temperature	+/- 1 ppm per month	+/- 1 ppm per month	+/- 1 ppm per month
Output Frequency / Power Control connector	RS232/DB-9 Plug	RS232/DB-9 Plug	RS232/DB-9 Plug
Remote Diagnostic Protocol	Ethernet / SNMP v1	Ethernet / SNMP v1	Ethernet / SNMP v1
Ethernet port	RG-45 Socket	RG-45 Socket	RG-45 Socket

Basic block-schemes of VCOM oscillator:

A. High power VCOM…-DD with digital control and remote control / diagnostics



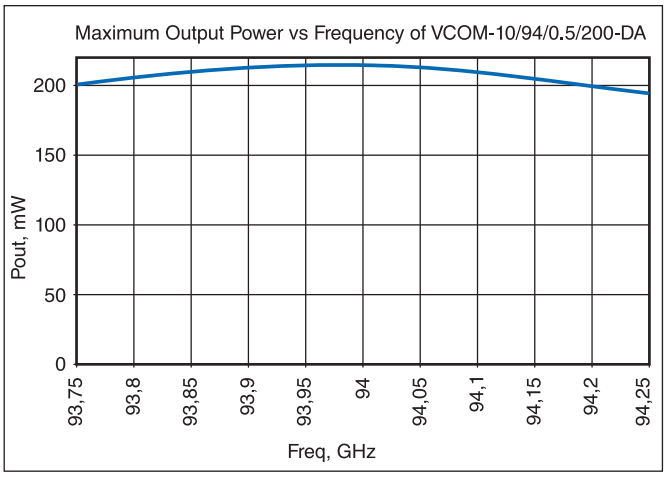
B. Wideband VCOM…-T (does not have powerful output power amplifier which limits operating bandwidth)

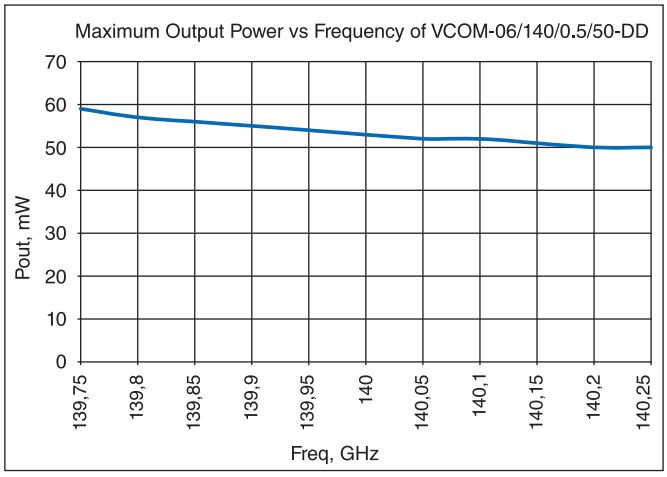


a) b)

Control panel of VCOM-10/94/0.5/200-DA (a) and VCOM-06/140/0.5/50-DD oscillators (b)

Typical measured data of W- and D-band VCOM-XX oscillators:





How to Order

Specify Model Number VCOM-XX/CF/BW/P-AB, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **CF** — central operating frequency in GHz
- **BW** — operating bandwidth, GHz
- **P** — output power (nom), mW
- **AB** type of output frequency and power control: **-T** or **-DD**, or **-DA** or **-DP**

Standard flange is **UG-XXX/U-M** round.

Example

VCOM-10/94/0.5/200-DD (W-band oscillator, WR-**10** waveguide, Central frequency **94** GHz, Bandwidth **0.5** GHz, Output power **200** mW (typ), Digital control of output power and frequency).

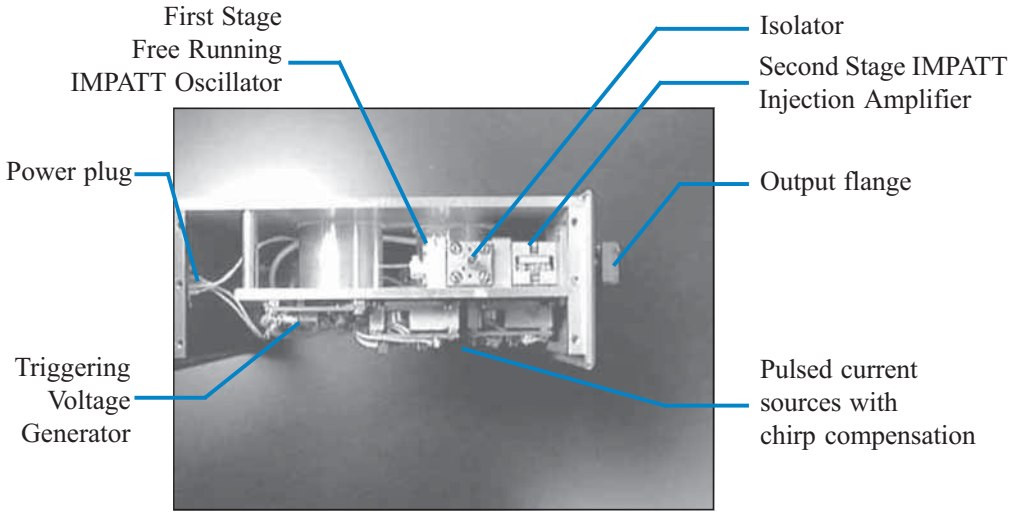
- **High power output levels 3–30 W**
- **High efficiency**
- **Low spurious harmonic content**
- **Low phase and AM noise**

Applications

- Power sources
- Radars
- Spectroscopy

Description

The power oscillator 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.



Common specifications

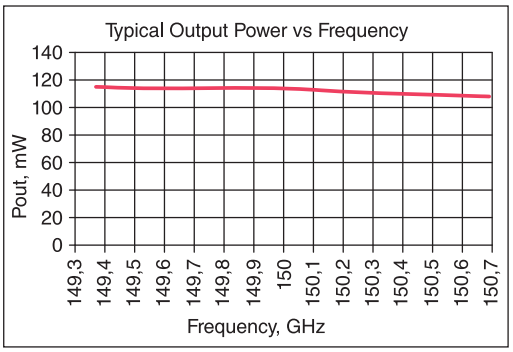
Fixed Operation Frequency in range, GHz	40–150*
Output pulsed power, W	30–3*
Pulse width, ns	80
Chirp bandwidth, GHz	0.4
Repetition Frequency, kHz	50
Output	Standard waveguide with UG series flange
DC Power	+48…+56 V DC / 100 mA, +12±0.5 / 100 mA

* Typical performance: 20W at 94 GHz, 3.5W at 140 GHz.

How to Order

Specify Model Number PSFR-xx-A, where
- **XX** — center frequency
- **A** — AC voltage power supply
  0 = no power supply, **1** = 110 VAC / 60 Hz, **2** = 220 VAC / 50 Hz, **3** = 100 VAV / 50 Hz.

• Voltage controlled oscillator at 150 GHz with high output power



• Free running Pulse Source 140 GHz @ 3.6 W with control output

	Data
Operating Frequency, GHz	140
Output Power, W	3.6
Pulse width, ns	80
Repetition Frequency, kHz	50
Phase Noise, dBc / Hz at 10 kHz	-65
Biasing Voltage, V	+27
Waveguide, flange	WR-08, UG-387 / U-M

• Fixed oscillator at 130 GHz, Pout = 130 mW

	Data
Operating Frequency, GHz	130
Frequency stability, 1 / °C	$5*10^{-6}$
Output Power, mW	130
Power Stability, dB / °C	0.02
Phase Noise, dBc / Hz at 10 kHz	-65
Biasing Voltage, V	+24, +12
Waveguide, flange	WR-06, UG-387/U-M

• Fixed oscillator at 77 GHz, Pout = 15 mW

	Data
Operating Frequency, GHz	77
Frequency stability, 1 / °C	$5*10^{-6}$
Output Power, mW	15
Power Stability, dB / °C	0.02
Phase Noise, dBc / Hz at 10 kHz	-65
Biasing Voltage, V	+27
Waveguide, flange	WR-12, UG-387/U-M

IMPATT
Injection-Locked Amplifier

ELVA-1 Millimeter Wave Division

- **High output power**
- **CW and Pulse operation modes**
- **Current stabilizer included for reliable operation**
- **High power and frequency stability**
- **Digital / Electrical control of output power level**
- **Low amplitude noises due to saturation regime**
- **Long life time**

Applications

- Laboratory measurement and test equipment
- Mm-wave source of high power
- EPR spectrometer bridge
- DNP polarizer source
- Plasma diagnostics
- FMCW radar module
- Communication systems

Description

ELVA-1 Injection-locked Amplifiers **IILA-XX** series are intended for high-power amplification of CW and pulse mm-wave signals. They are offered in the frequency range from 26 to 150 GHz in five waveguide bands. They can operate from power level as low as 2–3 mW which can be obtained directly from Up-Converter or frequency multiplier. When IILA-XX amplifier is injection locked FM noise of the output is the same as the input 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 operational heater is available for better temperature stability. To achieve higher gain, broader locking bandwidth and higher output, multistage and multi-diode configurations are also available.

Reliable work of **IILA-XX** oscillators allows using them in scientific experiments which last for long time, a few weeks or even months.

Custom designed **IILA-XX** models can be produced by special order.

Specifications

Model	IILA-22	IILA-15	IILA-10	IILA-06
Central frequency from range (specify), GHz	40–50	50–75	75–110	110–150
Max CW power (typ), mW	200	200	200	100
Max pulse power, W	15	15	10	2
Injection locked bandwidth at -1dB level, MHz	300	400	500	500
Input injection power level range, dBm	+5…+10	+5…+10	+5…+10	+5…+10
Power output flatness (max), dB	+/-1	+/-1	+/-1	+/-1
DC power (IMPATT bias), V/A	+45/0.4	+32/0.4	+27/0.4	+24/0.4
Flange / Waveguide	UG-383/U /WR-22	UG-385/U /WR-15	UG-387/U-M /WR-10	UG-387/U-M /WR-06

Typical measured data of IILA-94/1.0/200/15 amplifier:

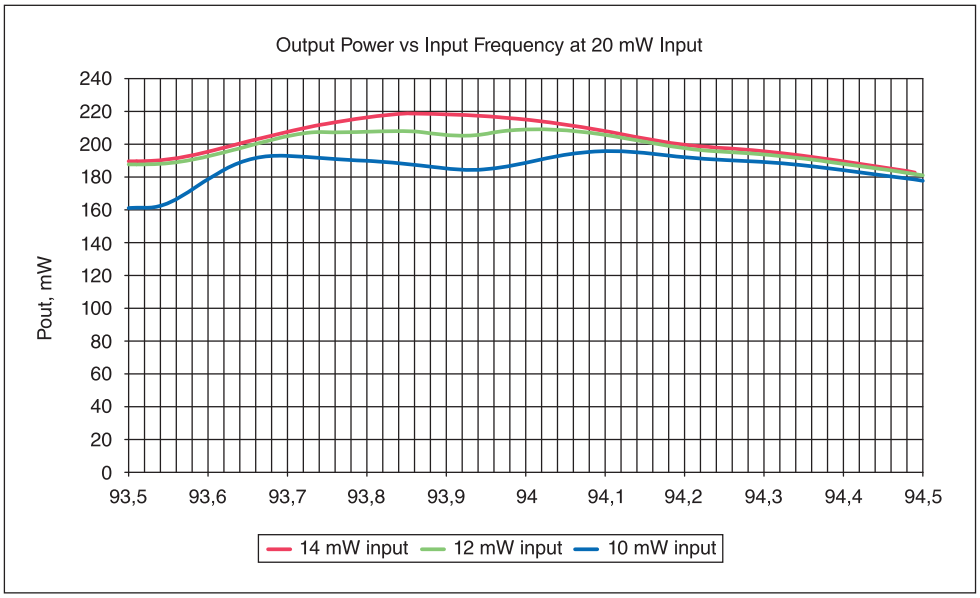


Photo of 400 mW power amplifier produced for special request
Input power 160 mW, output power 400 mW, F = 90 GHz

How to Order

Specify Model Number IILA-XX/CF/BW/P/I, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **CF** — central operating frequency in GHz
- **BW** — operating bandwidth, GHz
- **P** — output power (nom), mW.

Example

IILA-10/94/0.5/200/20 (W-band IMPATT injection locked amplifier, WR-**10** waveguide, Central frequency **94** GHz, Bandwidth **0.5** GHz, Output power **200** mW (typ), Input signal **20** mW.

- **Multiplication factor up to 9**
- **High efficiency**
- **Broad band operation**
- **Low spurious harmonic content**
- **Low phase and AM noise**
- **Small size, Compact design**
- **High reliability, rugged construction**

Applications

- Laboratory measurement and test equipment
- Sources of mm-wave power
- AM / PM possibility
- Electronic tuned power sources
- Spectroscopy / Radiometry

Description

Diode frequency multipliers are widely used in small size solid-state signal sources for use in mm-wave range. Step-recovery and Schottky diodes are used as non-linear elements in the BFM-XX frequency multipliers. The frequency multipliers have multiplication factor 2 or 3 and can be assembled in series. To increase output power an intermediate power amplifier can be used between two multiplier stages. The highest operating frequency reaches 170 GHz at multiplication factor 9. Nominal input frequency is within 11–20 GHz frequency range and input power level up to 100 mW. The phase and amplitude stability of the output signal are defined by the quality of the pumping source. The input of a multiplier is a coaxial connector, and the output is a waveguide flange.

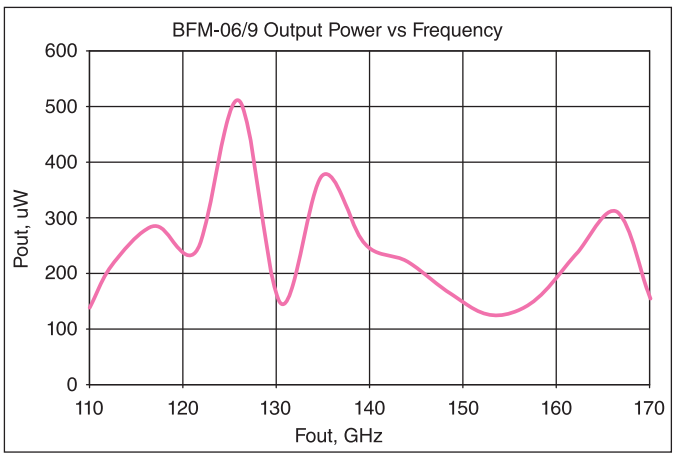
A broad band millimeter-wave voltage controlled oscillator (mm-wave VCO) can be assembled using a BFM-XX multiplier and 11–20 GHz VCO.

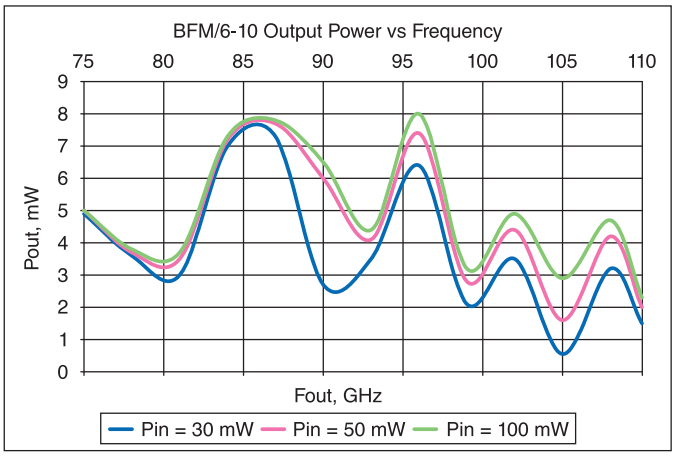
Specifications

Model Namber	BFM-28/2	BFM-22/3	BFM-15/4	BFM-10/6	BFM-06/9
Frequency Range (GHz)	26.5–40 GHz	33–50 GHz	50–75 GHz	75–110 GHz	110–170 GHz
Input Waveguide	WR-28	WR-19	WR-15	WR-10	WR-06
Waveguide Flange	UG-599/U	UG-383/U	UG-385/U	UG-387/U-M	UG-387/U-M
Total multiplication factor (first X second stages)	2	3	4(2×2)	6(2×3)	9(3×3)
Signal purity, dBc	> 25 dB	> 20 dB	> 20 dB	> 20 dB	> 10 dB
Output power (typ, mW)	7–11	3–6	2–5*	1–3*	0.1–0.5
Input power (nom, mW)	100	100	1	1	1
Input frequency (GHz)	13.25–20	11–16.66	12.5–18.75	12.5–18.33	12.22–18.88

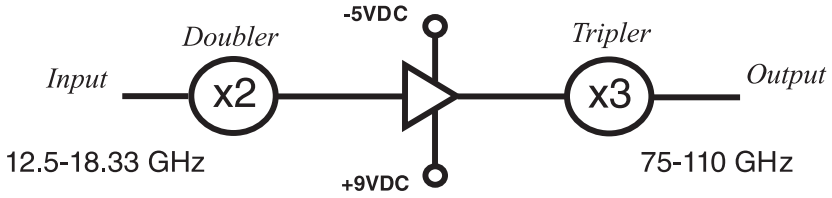
* An intermediate power amplifier is installed between two multiplication stages.

Typical data of output frequency are presented in the plots below.



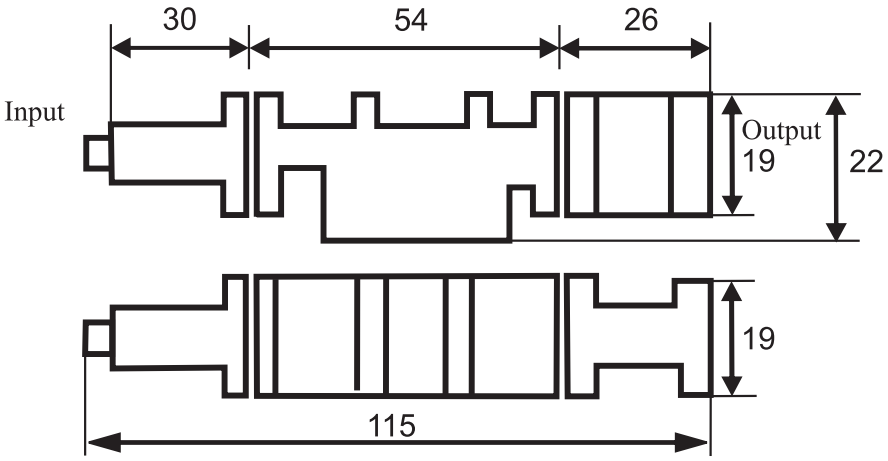


Amplifier



Schematic diagram of BFM-10/6

Amplifier



Outline drawing of BFM-10/6 multiplier (mm)

How to Order

Specify Model Number BFM-**XX/M**, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **M** — multiplication factor.

Example

BFM-10/6 (W-band sextupler)
BFM-06/9 (D-band nanupler).

- **ENR 12…15 dB typical**
- **High stability**
- **Good flatness**
- **No high voltage supply required**
- **Compact solid state source**
- **High reliability, rugged construction**

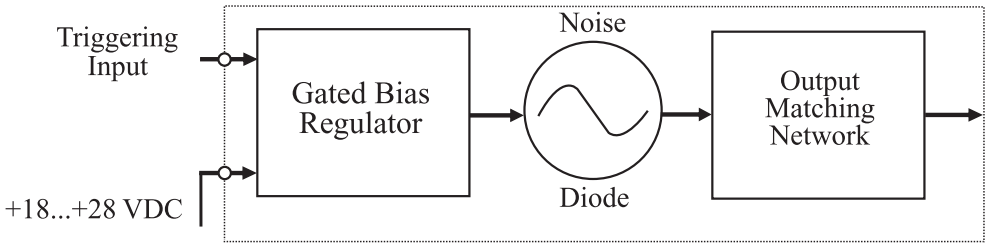
Applications

- Laboratory measurement and test equipment
- Mm-wave noise source
- Calibration
- Noise figure measurement

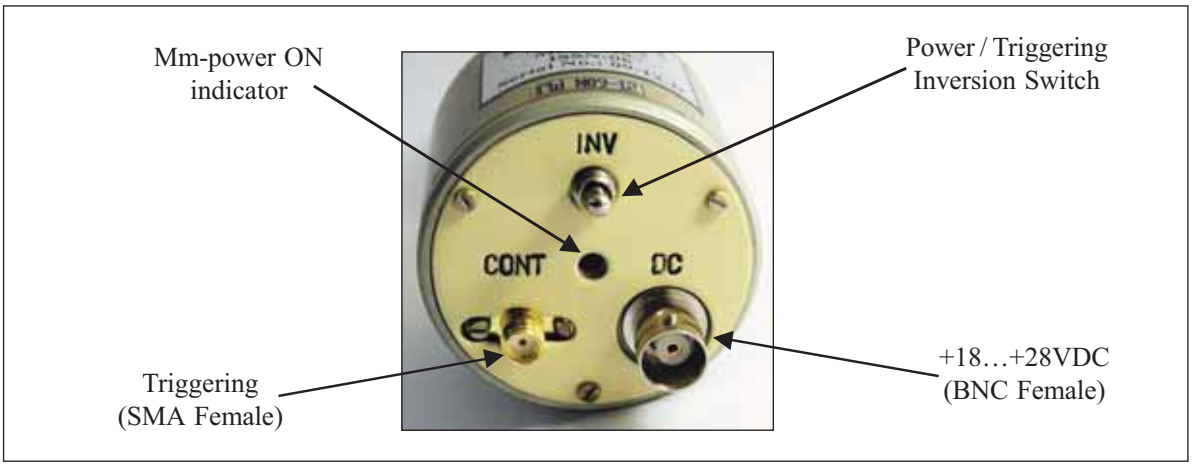
Description

ELVA-1 solid-state noise source **ISSN-XX** 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.

Block Diagram:



Inputs and Controls:

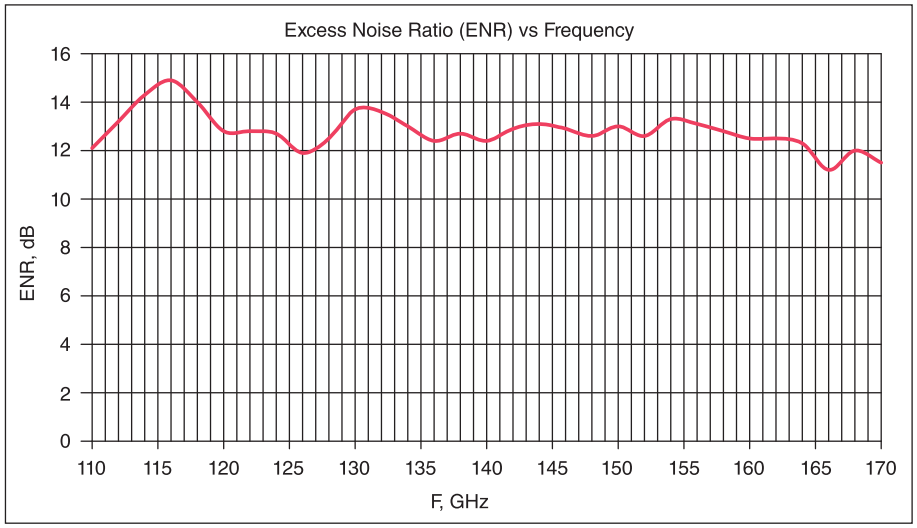


Notes:
Power / Triggering Inversion Switch can be used for manual ON/OFF. "INV" position is ON.
Microwave power can be switched with TTL-level control voltage.
If Triggering Inversion Switch is in OFF (Down) position active level is high, otherwise (INV position) — active level is low.

Specifications

Model Namber	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…+28							
Sizes, mm Cylinder diameter / length (without isolator)	50/75	50/75	50/75	50/75	50/60	50/60	50/60	50/60

Notes:
Maximum operating temperature is +60 °C.
Diode operating current is 50…100 mA.
A limiting value of modulation frequency is 1 kHz (external triggering).
Triggering signal amplitude is TTL level.
Bias voltage is +18 V It is possible to supply the noise source with +28 VDC biasing for the compatibility with commonly used noise meters.
External triggering connector is SMA female.
ENR would be increased for narrower bandwidth. Please contact factory.



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

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

How to Order

Specify Model Number ISSN-XX/BW/V, where

- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **BW** — operating bandwidth in GHz (nothing if full band)
- **V** — type of power supply: **18** or **28** if external power supply +18 VDC or +28 VDC of customer's lab will be used (specify voltage), 110 or 220 if external 110 VAC or 220 VAC power supply is requested together with noise source.

Example

ISSN-10/28 — W-band noise source with output waveguide WR-10, full band 75–110 GHz, external power supply +28 VDC not requested

ISSN-06/110–140/220 — D-band noise source with output waveguide WR-06, operating frequency 110–140 GHz, external 220 VAC power supply requested as well.

High Power Pulsed Noise Sources

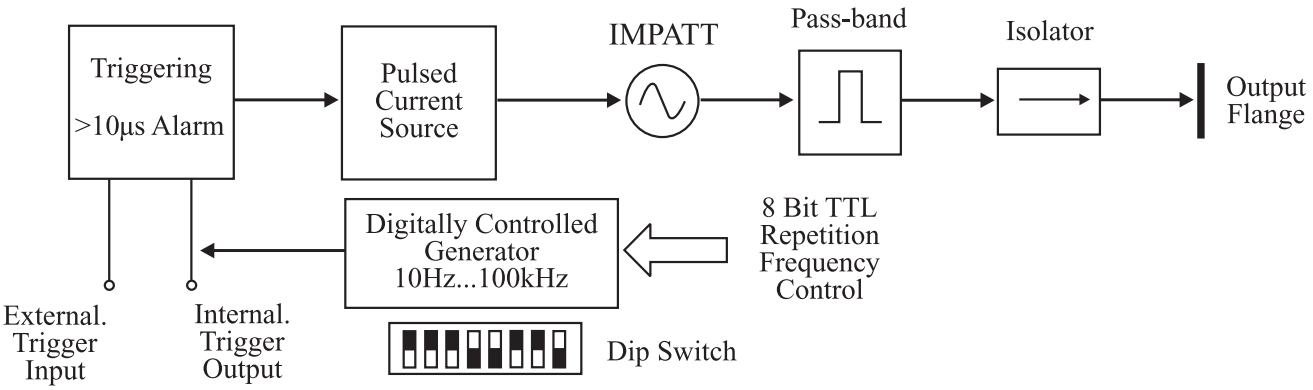
- **Powerful incoherent source**
- **1 Watt typical output power in W-band**
- **High stability**
- **Good flatness**
- **5 GHz white noise spectrum**
- **No high voltage supply required**
- **Compact solid state source**
- **High reliability, rugged construction**

Applications

- 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.



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e-mail: sales@elva-1.com

Specifications

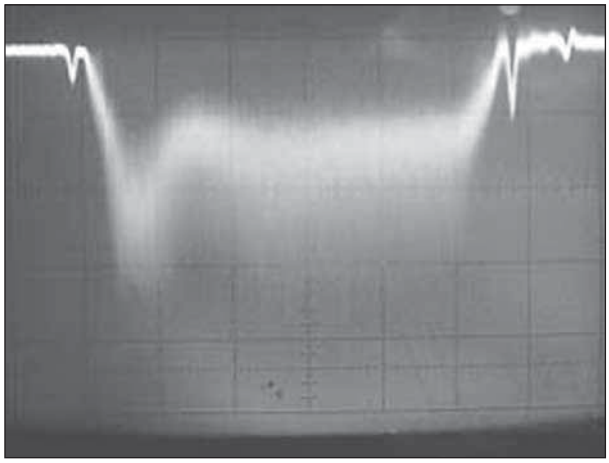
Model Number	PNS-28	PNS-10	PNS-08	PNS-06
Frequency Band **Frequency Range, GHz**	Ka 26.5–40	Q 75–110	F 90–120	D 120–140
Pulse Power Output, W	1	0.7	0.5	0.5
ENR flatness, dB	±1.5	±1.5	±1.5	±1.5
Pulse width, ns	60–100	60–100	60–100	60–100
Duty factor	> 100	> 100	> 100	> 100
Biasing voltages, VDC	100	48	56	56

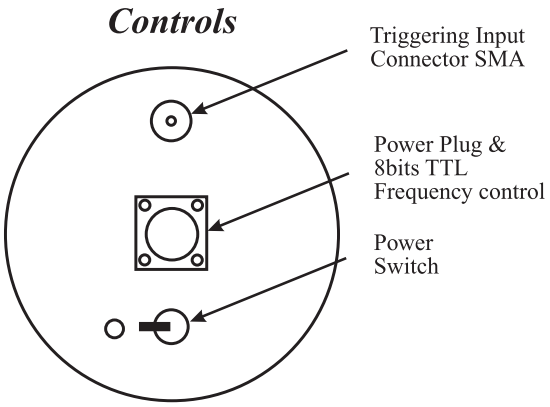
VSWR of the load should not exceed 2:1. Operating temperature range -40…+50 °C. Specifications would be adjusted according to customer's requirements. Please contact factory for other frequency ranges, bandwidths, pulse lengths and others. Device is designed in cylinder 120 mm length and 70 mm diameter.

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

The device is supplied with built-in digitally controlled triggering generator with variable repetition frequency within 10 Hz… 100 kHz. 256 values of repetition frequency are available. The desired frequency would be installed by dip switches or by 8 bit 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:



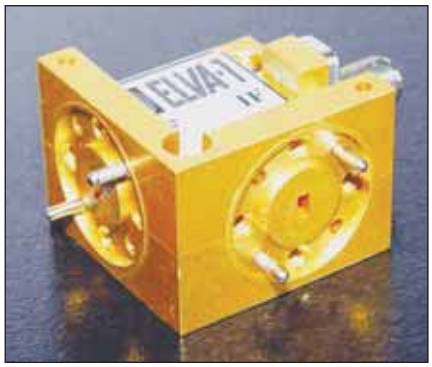


Integration time of the detector is about 3 ns, scale is 20 ns per division.

How to Order

Specify Model Number PNS-XX-ABBC
- **XX** — waveguide band (WR-Number)
- **A** — flange type
  R = round, S = square (WR-28 only)
- **BB** — pulse duration in nanoseconds.
  Consult ELVA-1 for another pulse duration
- **C** — AC voltage power supply options
  1 = 110 VAC / 60 Hz, **2** = 220 VAC / 50 Hz, **3** = 100 VAV / 50 Hz.

- **26.5–220 GHz operating frequency**
- **6–12 dB conversion losses**
- **Good flatness**
- **Up to 22 GHz IF**
- **Up to 40 dB balance**
- **Required LO power 1…20 mW**
- **VSWR 2:1 (typ)**



Applications

- Low noise Receivers of mm-wave signal
- Down converters
- Instruments and test equipment

Description

Broadband balanced mixers are the key part of mm-wave receivers, down converters numerous instruments and test equipment. Standard line of ELVA-1's balanced mixers **BM-XX/LO/IF/N** series provide low conversion losses and low noise figure of the devices within wide frequency band from 26,5 GHz to 220 GHz.

The **BM-XX/LO/IF/N** mixers are based on Ga-As Schottky diodes of ELVA-1 own manufacturing. They provide their features within whole waveguide band of RF and LO frequencies. Using original design of the mixer allows reaching IF up to 22 GHz and LO/IF isolation up to 30…40 dB. Standard mixers demand about 10 mW LO power and work without external biasing.

There are Balanced Mixers producing on custom design together with standard product line. They can work with lower LO power levels at 1–2 mW and higher IF frequencies up to 22 GHz. Low LO power Balanced mixers are biased and have the fourth coaxial input.

Harmonic mixers are also available for producing. The harmonic mixers have a bit worse conversion losses then mixers working at fundamental harmonic. The advantage of the harmonic mixers is they can be used in the receivers which do not have a LO source with as high operating frequency as RF signal.

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

Two main designs of the balanced mixers: axed and angle ones, are shown in the pictures above.

Typical specifications of **BM-XX/LO/IF/N** balanced mixers is given below.

Specifications

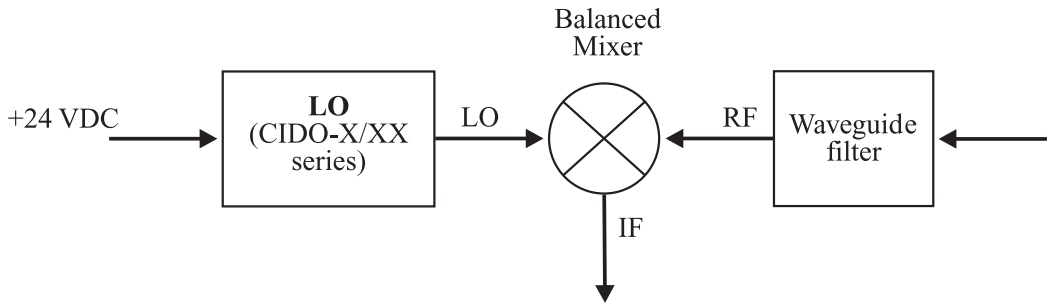
Model Namber	BM-28/XX	BM-22/XX	BM-19/XX	BM-15/XX	BM-12/XX	BM-10/XX	BM-08/XX	BM-06/XX
Frequency Band and Range, GHz	Ka 26.5–40	Q 33–50	U 40–60	V 50–75	E 60–90	W 75–110	F 90–140	D 110–170
Input waveguide	WR28	WR22	WR19	WR15	WR12	WR10	WR8	WR6
Waveguide Flange	UG-599/U	UG-383/U	UG-383 /U-M	UG-385/U	UG-387/U	UG-387 /U-M	UG-387 /U-M	UG-387 /U-M
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	7	7	7.5	7.5	8	8	8.5
Conversion losses at fixed LO, IF: 8–18 GHz, dB (max)	7 IF < 13.5 GHz	7.5 IF < 17 GHz	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.
5. BM-05 mixers are available upon request.

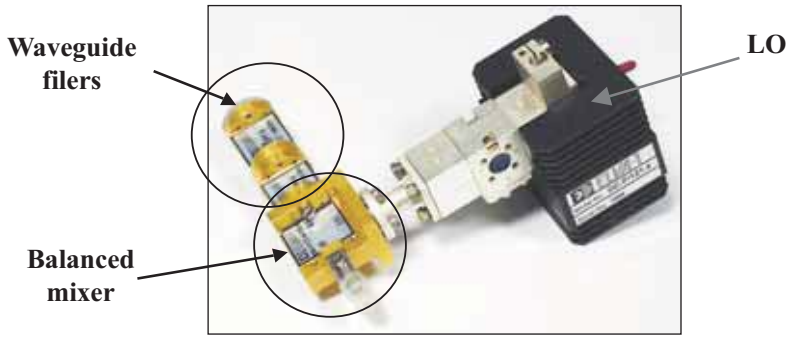
Typical Application: mm-wave receiver / down converter

The Balanced mixers are frequently used as a part of a mm-wave receivers / 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 lower and higher LO frequency some waveguide filters can be installed at RF port of the Balanced mixer to suppress needless signals.

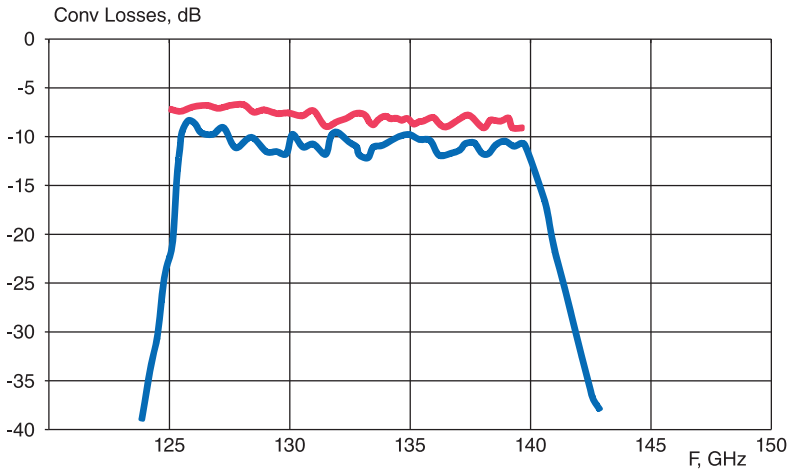


Typical outward view and measured data of a receiver / down converter are presented below:

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



Conversion Losses of the Downconverter
Flo = 121.4 GHz RF = 127.4–139.4 GHz



How to Order

Specify Model Number BM-**XX/LO/IF/N/A/B**, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **LO** — LO frequency (or operating range), **F** — if full band
- **IF** — intermediate frequency range
- **N** — number of operating harmonic, nothing if **N** = **1**
- **A** — with built-in power amplifier at output, nothing if without output power amplifier
- **B** — requires bias, nothing if no bias.

Example

BM-10/F/4 — W-band mixer, LO = 75–110 GHz, IF = 4 GHz
BM-06/142/6–18 — D-band mixer, LO = 142 GHz, IF = 6–18 GHz
BM-10/12–18/1/6 — W-band mixer, LO = 12–18 GHz, IF = 1 GHz, harmonic number 6
BM-10/94/0.5–1.5/A — W-band mixer, LO = 94 GHz, IF = 0.5–1.5 GHz, harmonic number 1, with built-in output power amplifier.

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

- **26.5 to 220 GHz**
- **High sensitivity**
- **No bias**
- **Compact design**
- **High reliability, rugged construction**

Applications

- Laboratory measurement and test equipment
- Sensors of mm-wave power

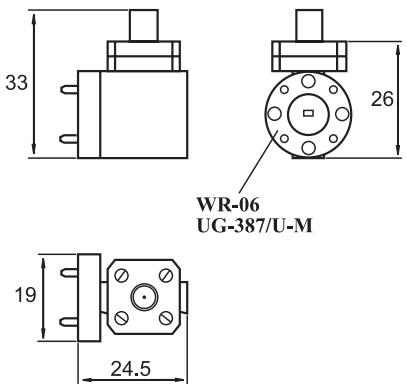
Description

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 -15 dBm.

Specifications

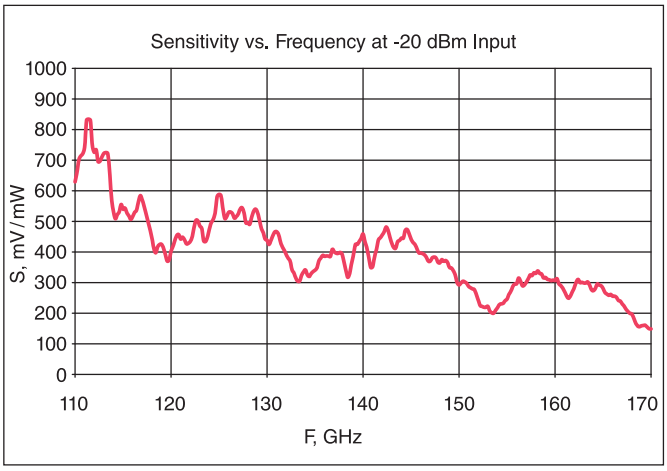
Model Number*	ZBD-28	ZBD-22	ZBD-19	ZBD-15	ZBD-12	ZBD-10	ZBD-08	ZBD-06
Frequency Range (GHz)	26.5–40	33–50	40–60	50–75	60–90	75–110	90–140	110–170
Input Waveguide	WR-28	WR-22	WR-19	WR-15	WR-12	WR-10	WR-08	WR-06
Waveguide Flange	UG-599/U	UG-383/U	UG-383 /U-M	UG-385/U	UG-387/U	UG-387 /U-M	UG-387 /U-M	UG-387 /U-M
Typical / Min Video Sensitivity at -20 dBm Input (mV/mW)	3500/ 2000	3000/ 1500	2500/ 1300	2000/ 1000	1700/ 800	1500/ 700	1300/ 500	500/ 200
Typical Flatness (dB)	±1.5	±1.5	±1.5	±1.5	±2.0	±2.0	±2.5	±2.5
Typical Video Output Load (MOhm)	1	1	1	1	1	1	1	1
Typical Video Bandwidth (MHz)	10	10	10	10	10	10	10	10
Incident CW RF Power (typ, dBm)	+10	+10	+10	+13	+13	+15	+15	+17

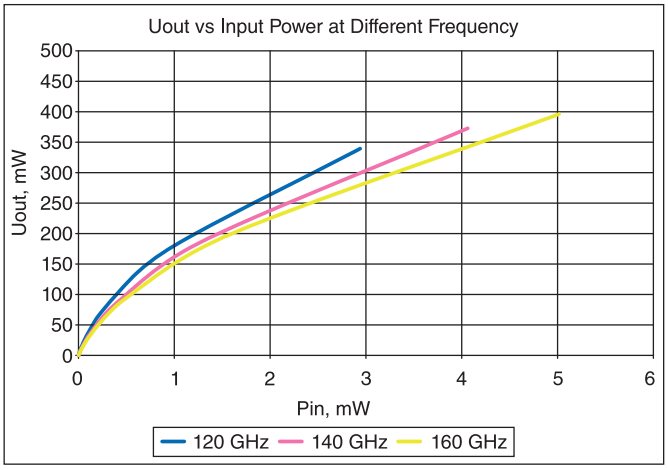
* ZBD-05 detectors can be produced by special request.



Outline drawing of ZBD-06 detector

Typical sensitivity and linearity data presented in the plot below.





Detectors of ZBDA-XX series supplied with built-in buffer amplifier at ZBD output. The amplifier protects Schottky diode against wrong actions (short circuit at output, static electricity) and helps increase reliability of ZBDA-XX detectors. The ZBDA-XX detectors are fed with DC bias voltage (+5 VDC…+10 VDC).

How to Order

Specify Model Number ZBD(**A**)-**XX/F/P**, where
- symbol **A** means output power amplifier exists
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **F** — central frequency (or operating range), nothing if full band
- **P** — max input power level in mW.

Example

ZBD-10/20 (W-band detector, full operating bandwidth, max input power 20 mW
ZBD-10/92–96/10 (W-band detector, operating bandwidth 92–96 GHz, max input power 10 mW
ZBDA-06/140/70 (D-band detector with built-in power amplifier, central frequency 140 GHz, max input power 70 mW.

Solid-State Electrical Controlled Attenuators up to 170 GHz

ELVA-1 Millimeter Wave Division

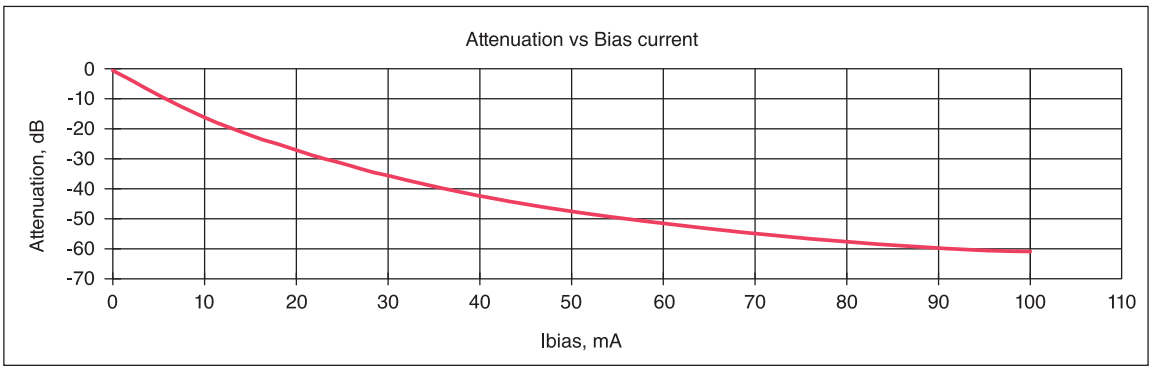
- **Low insertion losses**
- **High isolation**
- **Low cost**
- **Low switching time**
- **Full band operation**
- **Easy to use**

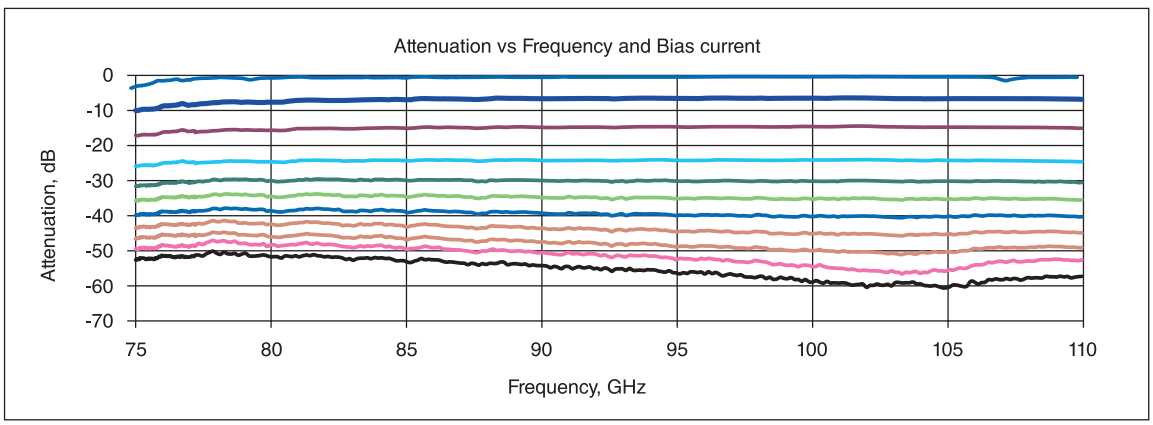
Applications

- Alternative for polarization attenuators
- Alternative for p-i-n modulators
- AM of microwave signals.
- Power control
- Lock-in detection systems

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. Full band 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.





Specifications

Model	VCVA-42	VCVA-28	VCVA-22	VCVA-19	VCVA-15	VCVA-12	VCVA-10	VCVA-08	VCVA-06
Frequency Band Range, GHz	K 18–26.5	Ka 26–40	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 (typ)	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*
Peak Power, 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, mA	100	100	100	100	100	100	100	100	100
Full band Version									
Bandwidth, %	100	100	100	100	100	100	100	100	100
Insertion Loss	0,7	1,8	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*
Peak Power, 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, mA	100	100	100	100	100	100	100	100	100

* The models with 60 dB Isolation are available upon request.

** 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.

Mechanical Specifications.

ELVA-1 provides different issues:

- Flat mount flanges

- With extension waveguides

ELVA-1 offers drivers series for control of Solid-State electrical controlled attenuators.

• Analog Linear Driver, Part No. ADL-10/100.

This deriver converts 0…+10 V input volts to 0…+100 mA biasing current for feeding of attenuator.

Specifications

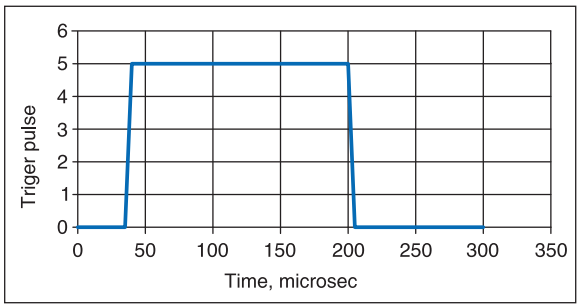
Input signal	0..+10 V
Output current	0…100 mA
Power supply	+/-12 VDC 120 mA(max)
Control Input / Output connectors	SMA female

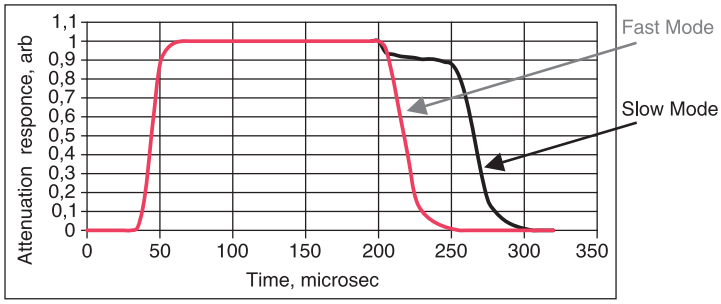
• Analog Linear Driver with fast switching mode, Part No. ADLFM-10/100.

This deriver provides two modes of operation: 'slow mode' and 'fast mode'. In 'slow mode' driver operates as a linear converter voltage to current and provides 0…+10 V input voltage range volts to 0…+100 mA output current. Second mode allows to use VCVA as "on/off" fast modulator. In "fast mode" the driver applies a short negative voltage pulse to accelerate the fall time. Typical Response Function of the attenuation for VCVA is shown on the plot below.

Specifications for 'slow mode'

Input signal	0..+10 V
Output current	0…100 mA
Power supply	+/-12 VDC 120 mA (max)
Control Input / Output connectors	SMA female





Attenuation response function for 'slow' and 'fast' modes

• GPIB and RS-232 Driver, Part No. GPDVC-15/100/RS.

This deriver can operate via GPIB and RS-232 interfaces. User should send 12 bits code for setting desired attenuation. The driver converts sent code in biasing current in range 0–100 mA.

Specification

Input range	12 bits
Output current	0…100 mA
Power supply	100–240 V AC
Control Output connectors	SMA female

• Digital Drivers.

Upon request Elva-1 can design driver with any digital interface. Please contact with factory.

Fast SPST Switches up to 150 GHz

- **Low insertion losses**
- **High isolation**
- **Low cost**
- **Fast switching time**
- **More then 10 % bandwidth operation**
- **Easy to use**

Applications

- Radars
- Fast protection system
- AM of microwave signals
- Lock-in detection systems

Description

ELVA-1 series fast SPST switches is built on slim film PIN diodes. Built-in driver provides switching time 4–6 ns and unique technology allows to get more then 10 % operation with small insertion losses and isolation more then 30 dB.

Specifications

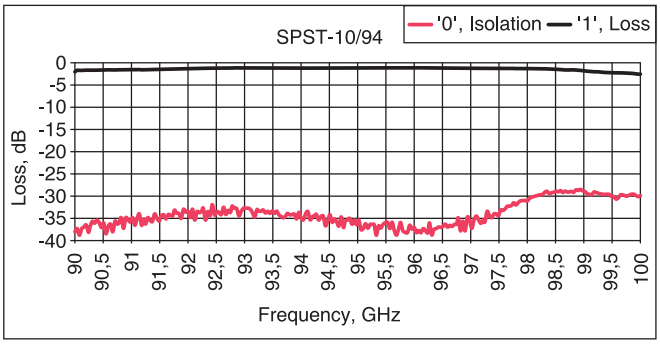
Model	SPST-42	SPST-28	SPST-22	SPST-19	SPST-15	SPST-12	SPST-10	SPST-08	SPST-06
Frequency Band Range, GHz	K 18–26.5	Ka 26–40	Q 33–50	U 40–60	V 50–75	E 60–90	W 75–110	F 90–140	D 110–150
Insertion Loss, dB (typ)	0,7	0,7	0,8	0,8	0,8	1,0	1,0	1,5	1,5
Isolation, dB (min)	30*	30*	30*	30*	30*	30*	30*	30*	30*
Peak Power, W (max)	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	0,8
Switching Time, nsec**	4–6	4–6	4–6	4–6	4–6	4–6	4–6	4–6	4–6

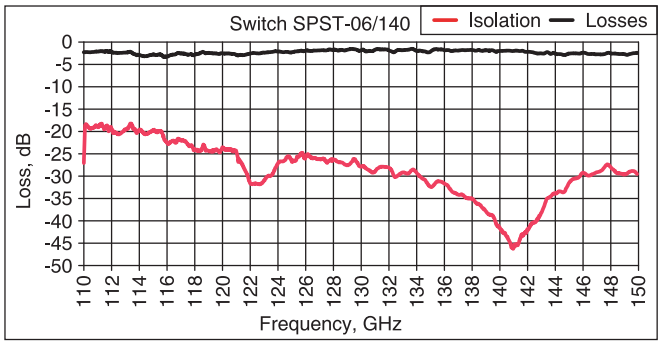
* The models with 60 dB Isolation are available upon request.
** Guaranteed for Rise Time 0–90 % RF and Fall Time 100–10 % RF.

Common specifications

Supply	+/-5V DC
Control signal	TTL
Control Input impedance	50 Ohm

Typical data for different models are presented below.





How to Order

Specify Model Number SPST-XX/AA/BB
- **XX** — waveguide band (WR-Number)
- **AA** — Center operation frequency (fo), GHz
- **BB** — Operation bandwidth (fo +/-BB), GHz.

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- **26.5–220 GHz operating frequency**
- **Low Insertion loss**

Applications

- Mm-wave components assembling
- Subsystems

Description

Different waveguide parts like straight waveguide sections (**SWG-XX/L**), bends (**WB-XX/E/A**), tapered transitions / adapters (**WGT-XX/YY/L**) are used for assembling of mm-wave components. ELVA-1 produce all the list of necessary elements.

Straight waveguide sections have flanges at ends and can vary in length.

Twists and bends are used for connection of mm-wave components which has different waveguide orientation. They are short sections and have standard waveguide flanges at ends.

Tapered transitions are intended for connection of mm-wave devices with different waveguide dimensions and flange types. Can be produced also in accordance with custom design.

The waveguide components use standard rectangular cupper tube with standard waveguide dimensions or are made using electroforming technologies.

Standard components are silver plated.

Custom requests are acceptable for the waveguide components.

How to Order

Specify Model Number

- straight waveguide sections: **SWG-XX/L**
- bends: **WB-XX/E/A**
- twists: **TW-XX/A**
- tapered transitions / adapters: **WGT-XX/YY**, where

- **XX** and **YY** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **L** — length
- **E** — can be **E** for E-plane bend or **H** for H-plane bend
- **A** — bend angle, empty if 90 degrees.

Example

SWG-10/20 (Straight W-band waveguide section with flanges, WR-**10** waveguide. Length **20** mm
WB-12/H (E-band waveguide bend with flanges, WR-**12** waveguide, **H**-plane, **90** degrees angle
WB-06/E/45 (D-band waveguide bend with flanges, WR-**06** waveguide, **E**-plane, **45** degrees angle.

- **50–220 GHz operating frequency**
- **Low Insertion loss**
- **High directivity**

Applications

- Power sampling
- Test equipment
- Subsystems

Description

ELVA series **DC-XX** 3-port directional couplers are available in six waveguide bands from 50 to 220 GHz. The standard coupling levels are 3, 6, 10, 20, 30 and 40 dB with full waveguide operational bandwidth. ELVA directional couplers have directivity of up to 40 dB for frequencies below 110 GHz and 30 dB for upper frequencies.

Directional couplers are in common use for the purpose of transmitting power into a waveguide circuit without perturbing the operating characteristics of the circuit. These couplers are particularly suitable for frequency monitoring and measurement of RF power (transmitted or reflected) in circuits. Directional couplers are used for scalar network analyzers, and for signal sampling in instruments or subsystems.

The directional couplers can be used in different high-frequency equipments. They are used for dividing input signals into multiple output signals with minimum loss of power (forward direction). The standard directional couplers have 3 ports.

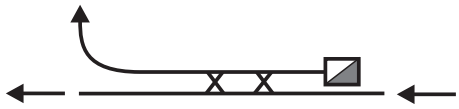


Fig. Scheme of 3-port directional coupler

Producing of other directional couplers is possible upon special request. Energy transfer can be done from any port to any directions (it depends on the purpose of the device). The examples are the following:

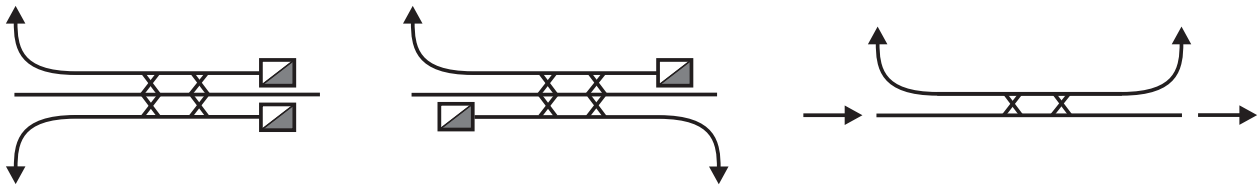
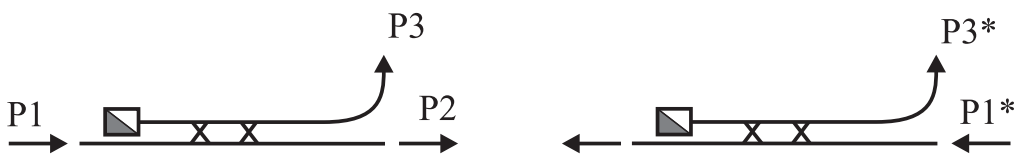


Fig. Scheme of 4-port directional couplers of different design

In practice, the most popular models have 3 ports. The basic function of a 3-port directional coupler is to operate on an input (P1) so that two output signals (P2 and P3) are available. The output signals are unequal in amplitude. The larger signal is at the mainline output port (P2). The smaller signal is at the secondary port (P3).

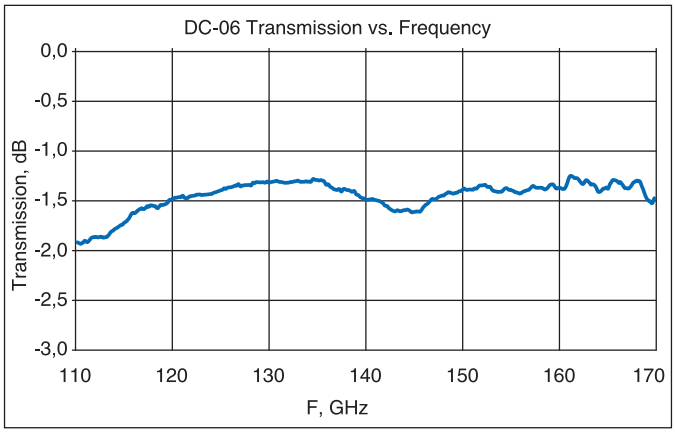


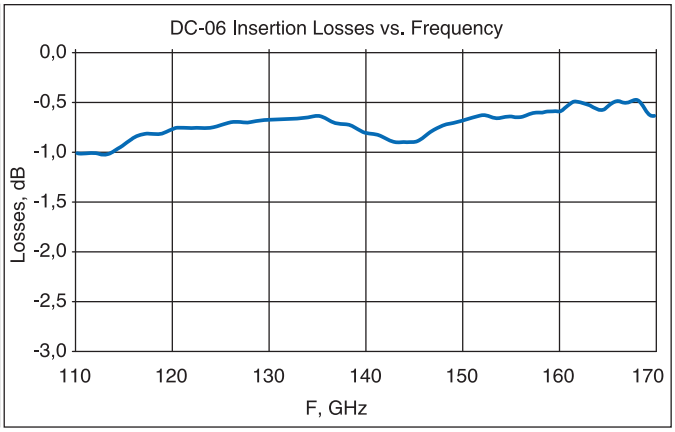
If the input signal (P1*) is applied to the opposite port (power is transmitted in the back direction) some part of the power is reflected to the opposite direction in secondary waveguide. It is possible to measure it as P3*. The difference in dB of the output power P3 and P3* is called directivity.

Main characteristics of the directional couplers

Transmistion	= 10Log(P2/P1)
Coupling value	= 10Log(P3/P1)
Insertion losses	= 10Log((P2+P3)/P1)
Directivity	= 10Log(P3/P3*), P1* = P1

Typical directional couplers data presented in plots below.





Model Number	DC-15	DC-12	DC-10	DC-08	DC-06	DC-05
Frequency band, GHz	50–75	60–90	75–110	90–140	110–170	140–220
Waveguide	WR-15	WR-12	WR-10	WR-08	WR-06	WR-05
Coupling value, dB	3, 6, 10, 20, 30, 40	3, 6, 10 20, 30, 40	3, 6, 10 20, 30, 40	3, 6, 10 20, 30, 40	3, 6, 10 20, 30	3, 6, 10 20
Insertion losses, dB	0.8	0.9	1.0	1.2	1.4	1.5
Directivity, dB	30–40	30–40	30–40	30–35	30–35	25–30
VSWR	1.08:1	1.1:1	1.15:1	1.2:1	1.25:1	1.4:1

How to Order

Specify Model Number DC-**XX/C**, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **C** — coupling value.

Example

DC-10/10 (W-band directional coupler, WR-**10**, coupling value 10 dB
DC-06/20 (D-band directional coupler, WR-**06**, coupling value 20 dB.

- **26.5–220 GHz operating frequency**
- **Narrow band and full band types**
- **Low insertion losses**
- **High isolation**
- **Compact size**

Applications

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

Description

26.5–220GHz Circulators and Isolators are ferrite waveguide components. There are two kinds of the products operating within narrow frequency band (1–4 GHz) and full waveguide band. Junction circulators / isolators are narrow band. Wideband devices base on Faraday rotation effect. Used in many waveguide schemes for junction their parts and for matching different components and protecting against reflected mm-wave power.

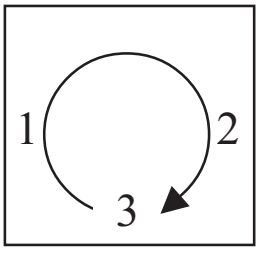
Standard line of ELVA-1's circulators CR-XX/CF/BW series provide low insertion losses and high isolation for all three ports. They have operation frequency band up to 4 GHz. Better performances of the circulators can be provided within narrow frequency band.

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

Full band isolators IF-XX have good performances within full waveguide range. Mainly used in wideband sources or receivers for suppression mm-wave power propagating in one fixed direction. Have small insertion losses.

Specifications

Narrow band circulators **CR-XX/CF/BW** series:



	CR-XX/CF/BW			
Central frequency:	Fixed from 26.5–110 GHz		Fixed from 110–170 GHz	
Bandwidth:	2-4 GHz	1 GHz	2-4 GHz	1 GHz
Insertion losses: **1 to 2, 2 to 3, 3 to 1**	0.7 dB	0.5 dB	1 dB	0.7 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)		1.3 (typ)	

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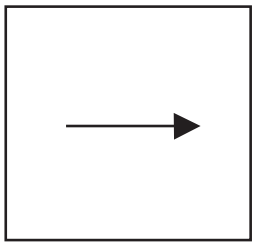
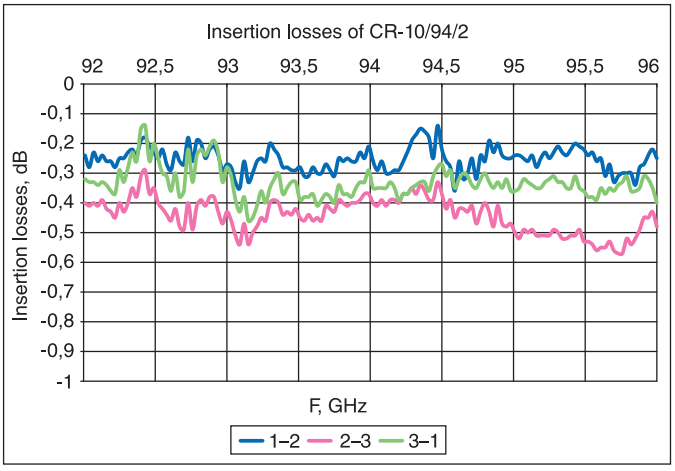
Narrow band isolators **IS-XX/CF/BW** series:

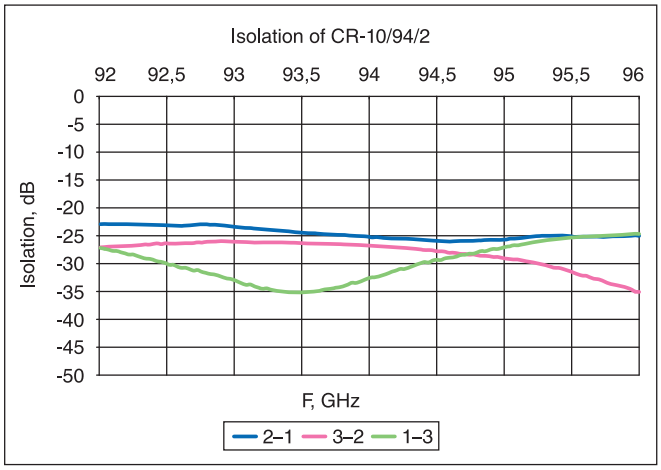


	IS-XX/CF/BW			
Central frequency	Fixed from 26.5–110 GHz		Fixed from 110–170 GHz	
Bandwidth	2-4 GHz	1 GHz	2-4 GHz	1 GHz
Insertion losses	0.7 dB	0.5 dB	1 dB	0.7 dB
Isolation	23 dB (min)	30 dB	20 dB (min)	25 dB
VSWR	1.2 (typ)		1.3 (typ)	

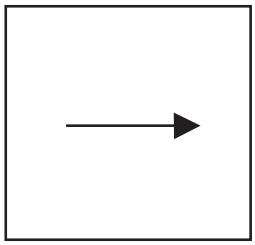
Note: CR/IS-05 circulators / isolators can be produced upon special request.

Typical data of circulators / isolators presented in the plots below.





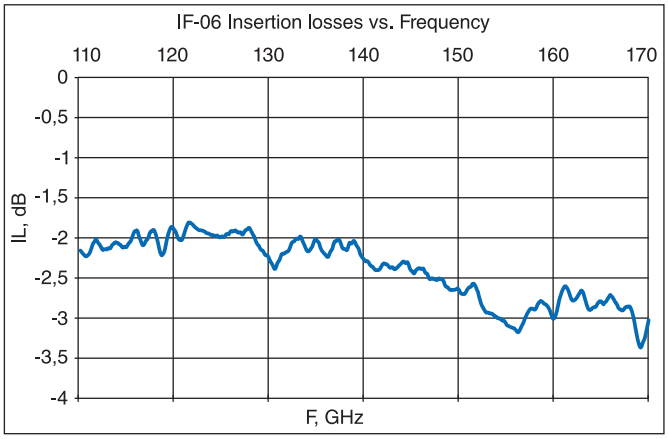
Full band Faraday Isolators **IF-XX** series:

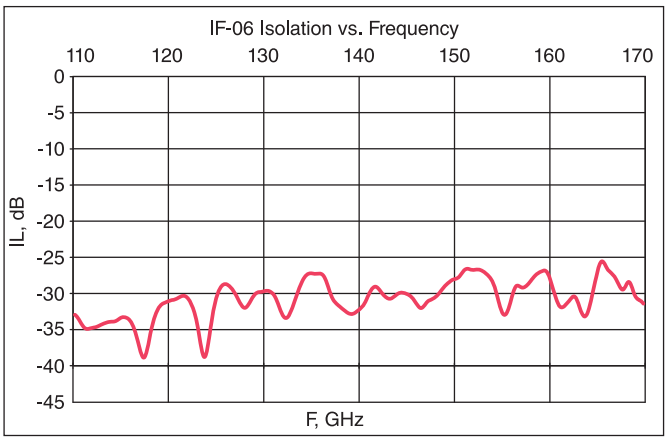


Model	IF-15	IF-12	IF-10	IF-08	IF-06
Operating bandwidth, GHz	50–75	60–90	75–110	90–140	110–170
Insertion losses	1.7 dB	1.8 dB	2.2 dB	2.7 dB	3.3 dB
Isolation	25 dB	25 dB	25 dB	25 dB	25 dB
VSWR	1.3:1	1.3:1	1.4:1	1.4:1	1.5:1
Waveguide	WR-15	WR-12	WR-10	WR-08	WR-06
Flange	UG-385/U	UG-387/U	UG-387/U-M	UG-387/U-M	UG-387/U-M

Note: IF-28/22/19/05 Faraday isolators can be produced upon special request.

Typical data of circulators / isolators presented in the plots below.





How to Order

Specify Model Number CR/IS/IF-**XX/CF/BW**, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **CF** — central frequency (GHz), nothing if full band
- **BW** — or operating range (GHz), nothing if full band.

Example

IS-10/94/1 (W-band isolator, WR-**10**, Central frequency **94** GHz, Bandwidth **1** GHz)
CR-06/140/2 (D-band circulator, WR-**06**, Central frequency **140** GHz, Bandwidth **2** GHz)
IF-06 (D-band Faraday isolator, WR-**06**, full band 110–170 GHz).

- **Up to 220 GHz operating frequency**
- **(1.03…1.15) : 1 load VSWR**
- **> 20 : 1 Short VSWR**
- **Wide band and narrow band units**
- **Compact size**
- **Easy mounting**

Applications

- Easy mounting
- Laboratory measurement and test equipment
- 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-XX/CF/BW** series provide low level of reflected power within a narrow or full waveguide band.

Cryogenic loads **CL-XX/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-XX** tunable shorts ideally suit for precise adjusting of waveguide path length. Joined with circulators **CR-XX/CF/BW** series create tunable phase shifter **PS-XX/CF/BW**.

How to Order

Specify Model Number **ML/CL/SC — XX/CF/BW**, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **CF** — central frequency (in GHz)
- **BW** — bandwidth (in GHz), are **empty** for full waveguide band.

Example

ML-10/94/2 (W-band matched load, WR-**10**, Central frequency **94** GHz, Bandwidth **2** GHz).

All ELVA-1 loads / shorts are warranted by the manufacturer for one year after receipt.

- **High gain**
- **High efficiency**
- **Wide band operation**
- **Low VSWR**

Applications

- PtP and PMP radio links
- Radars
- Radio Astronomy

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 26.5 GHz to 140 GHz with reflector diameters ranging from 100 mm to 600 mm. The gain is up to 53 dBi 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 18 dB). 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 3 dB 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

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

Q band. 33–50 GHz*

Part No	Diameter of main reflector (mm)	Gain dB, (typ)	Bandwidth in deg. at 3 dB 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

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

U band. 40–60 GHz*

Part No	Diameter of main reflector (mm)	Gain dB, (typ)	Bandwidth in deg. at 3 dB 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

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

V band. 50–75 GHz*

Part No	Diameter of main reflector (mm)	Gain dB, (typ)	Bandwidth in deg. at 3 dB 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

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

E band. 60–90 GHz*

Part No	Diameter of main reflector (mm)	Gain dB, (typ)	Bandwidth in deg. at 3 dB 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

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

W band. 75–110 GHz*

Part No	Diameter of main reflector (mm)	Gain dB, (typ)	Bandwidth in deg. at 3 dB 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
ECA-W-X-450	450	48.0	0.5	1.25
ECA-W-X-600	600	50.0	0.4	1.25

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	75–100	WR-10	UG-387/U-M

F band. 90–140 GHz*

Part No	Diameter of main reflector (mm)	Gain dB, (typ)	Bandwidth in deg. at 3 dB 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
ECA-F-X-450	450	48.0	0.5	1.25

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

*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.
**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 300 mm of main reflector, should be ordered as **ECA-W-10–300.**

All ELVA-1 antennas are warranted for one year after receipt.

- **High performance**
- **Low VSWR**
- **Rectangular or Circular Waveguide**
- **Compact size**

Applications

- Antenna test system
- Radiometry
- Radars

Description

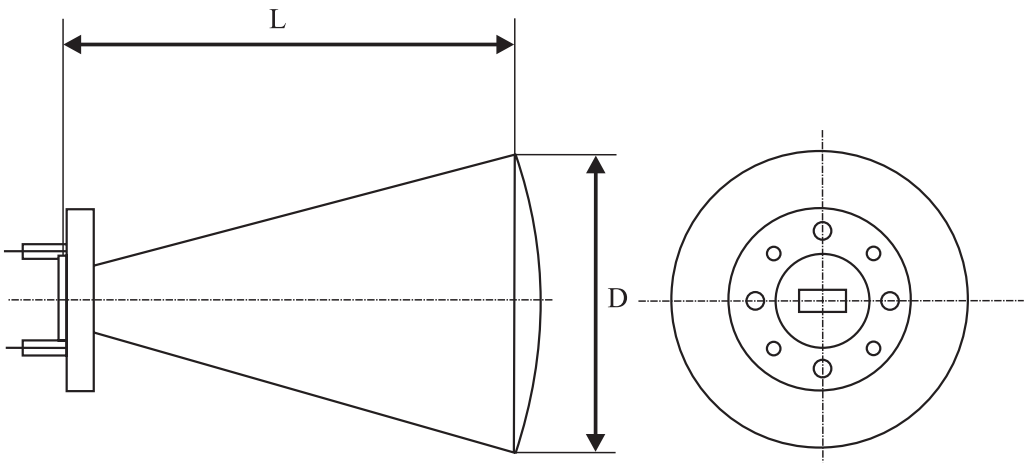
Elva's SLHA series of standard gain lens horn antennas cover the frequency range of 18 to 220 GHz in ten waveguide bands. They can be issued with rectangular or circular waveguide. Lens technology significantly allows decreasing mechanical sizes of horns and correcting beam for the best performance. These horns are ideal solution for measurement gain of other antennas, short range radars and radiometers.

Specifications

Part No.	Frequency GHz	Waveguide	Flange	Gain, dB	Return loss, dB	D, mm	L, mm
SLHA-K	18–26,5	WR-42	UG-595/U	> 25	20	118	165
SLHA-Ka	26,5–40	WR-28	UG-599/U	> 25	20	80	115
SLHA-Q	33–50	WR-22	UG-383/M	> 25	20	66	95
SLHA-U	40–60	WR-19	UG-383/U-M	> 25	20	53	76
SLHA-V	50–75	WR-15	UG-383/U-M	> 25	20	42	59
SLHA-E	60–90	WR-12	UG-387/U	> 25	20	35	50
SLHA-W	75–110	WR-10	UG-387/U-M	> 25	20	28	40
SLHA-F	90–140	WR-08	UG-387/U-M	> 25	20	22	32
SLHA-D	110–170	WR-06	UG-387/U-M	> 25	20	19	27
SLHA-G	140–220	WR-05	UG-387/U-M	> 25	20	17	23

Note: The models up to 400 GHz are available upon request.

Outline Drawing.



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Custom-Designed Horns up to 400 GHz

ELVA-1 Millimeter Wave Division

- **High performance**
- **Low VSWR**
- **Corrugated**
- **Lens solution**
- **GOLA**
- **Rectangular or Circular Waveguide**

Applications

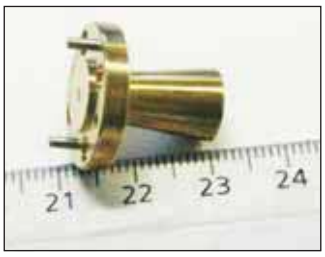
- Antenna test system
- Radiometry
- Radars

Description

Elva-1 would offer different antennas upon custom's request. Please specify parameters below and we propose you optimized solution for your task.

- Operation frequency
- Gain
- Side lobs level
- E&H matching
- Beam width at 10 dB level
- Cross polarisation

• Horn antennas



• Lens horn Antennas

• Gauss Optic Lens Antennas

• Corrugated horns

• Focused Lens Antennas

Mm-Wave High Sensitive Power Meters

- **0.01–220 GHz operating frequency**
- **High sensitivity**
- **Up to 55 dB dynamic range (0.1uW–30mW)**
- **Small measuring time (< 1 sec)**
- **RS-232, GPIB interface**
- **SCPI protocol**

Applications

- Measurements of power level of mm-wave signal
- Test equipment

Description

The DPM-xx is a single-channel average power meter for RF to millimeter wave frequencies that measures absolute power from 10 MHz to 220 GHz.

DPM-xx Power Meters display measured power in milliWatts, microWatts or dBm, and also display the user-entered signal frequency in GHz. Easy operation is ensured with automatic zeroing, automatic sensor recognition and a calculation factor table stored in the memory of each power sensor.

Their compact size, precise accuracy, reliability and inexpensive pricing make our DPM-xx Power Meters attractive assets for design engineering, equipment manufacturing, field engineering and research.

ELVA-1's ZBD-series Zero-Biased Detectors are used as the power sensors for our DPM Power Meters. To cover the range from 10 MHz to 220 GHz band, we offer one coaxial (10 MHz — 26.5 GHz) and 9 waveguide power sensors (26.5–220 GHz in waveguide bands), sold separately.

Based on Schottky Barrier Diode technology, our ZBD power sensors provide high sensitivity, fast measurement speed and quick response to changes of input power. To extend the dynamic range of diode power sensors above their square law region, a correction factor is used. The amplitude and frequency curves for each individually-calibrated power sensor are stored in the sensor's EEPROM. When a sensor is connected to a DPM control / display unit, the control / display unit automatically recognizes that sensor's characteristics. The typical curves for amplitude and frequency transfer characteristics at W-band are shown on the reverse.

Measured average power is displayed on a 2-line LCD screen, at a measurement rate of 2 times per second or faster. For power measurements below 10–100 mW (depending on frequency band), each sensor is supplied with a full-band isolator. For power measurements above those levels (as high as 300 mW — 1 Watt), optional directional couplers are available.

Every DPM-xx is equipped with an RS-232 port for control and measurement data exchange with a PC. An internal GPIB interface board is available as an added option. On special request we can also provide a dual channel power meter of DPMD-XX series with two independent measurement channels.

Since the control / display unit and power sensors are sold separately, customers only need one DPM control / display unit to interface with all 10 of our sensors. To obtain power measurements over a multi-waveguide frequency range, order one DPM control / display unit and several adjacent-band sensors. Because the standard ELVA-1 DPM control / display unit is a single-channel meter, only one power sensor can be used at one time.

www.elva-1.com
e-mail: sales@elva-1.com

DPM-XX Key Features and Specifications

- Display readings: milliWatts, microWatts or dBm.
- Maximum measuring rate: up to 50 times per second, default 2 times per second (set at factory).
- Frequency Range: 10 MHz to 220 GHz.
- Min. measured Power: 0.1 microWatt (depending on frequency band).
- Dynamic Measurement Range: 55 dB max. (depending on frequency band).
- Frequency step: 10 MHz.
- SCPI or ELVA's command protocol.
- RS-232, GPIB interface.
- Calibration accuracy ±0.04 dB (log) or ±1 %.
- Power Sensor Calibration: Individually calibrated, with amplitude and frequency curves in flash memory.
- If a valid signal frequency is not entered before measuring power, maximum measurement error will be ±1.5 dB for Ka, Q, U, V bands, ±2.0 dB for E, W bands, and ±2.5 dB for F, D bands, based on calibration curve flatness.

Model Namber	DPM-C	DPM-28	DPM-22	DPM-19	DPM-15	DPM-12	DPM-10	DPM-08	DPM-06	DPM-05
Frequency Band and Range, GHz	0.01–26.5	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	G 140–220
Input Waveguide / Impedance	50 Ohm Coaxial	WR-28	WR-22	WR-19	WR-15	WR-12	WR-10	WR-08	WR-06	WR-05
Wavequide Flange / Connector	SMA, male	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	UG-387 /U-M
Dynamic Range, dB (max)	50	55	55	55	55	55	55	50	50	40
Min Measured Power Level, dBm	-33	-43	-43	-43	-43	-43	-40	-38	-35	-25
Measurement Rate (default), times per sec	2	2	2	2	2	2	2	2	2	2
VSWR (power sensor)	1.2:1	1.3:1	1.3:1	1.3:1	1.3:1	1.4:1	1.4:1	1.4:1	1.4:1	1.7:1

Available operating power options: 220 VAC, 110/100 VAC, or battery power (for portable version).

How to Order

Specify Model Number DPM-**XX/P/V**, where
- **XX** — number of waveguide standard (Ex. 10 for WR-10 and 06 for WR-06)
- **P** — max input power (mW), exceeded power level can burn a sensor
- **V** — power supply voltage (Volts) or B if portable version with batteries.

Example

DPM-10/20/220 (W-band power meter, WR-**10**, operating frequency band 75–110 GHz, max power level 20 mW, 220 VAC supply voltage)
DPM-15/10/110 (V-band power meter, WR-**15**, operating frequency band 50–75 GHz, max power level 10 mW, 110 VAC supply voltage)
DPM-06/30/B (D-band power meter, WR-**06**, operating frequency band 110–170 GHz, max power level 30 mW, portable version).

Real Time Mm-Wave Frequency Analyzers up to 180 GHz

- **High performance**
- **Real time measurement**
- **GPIB control**
- **Original Software**
- **Full waveguide frequency operation**
- **Time window analyze 10 ms**

Applications

- Gyrotron frequency measurement
- Plasma diagnostics

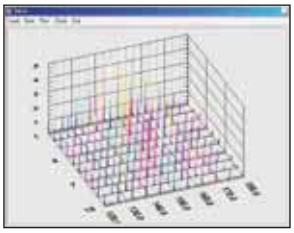
Description

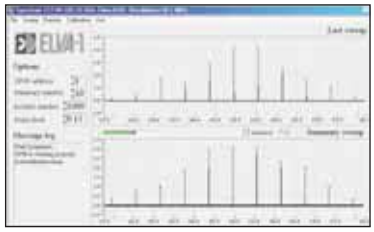
When millimeter-wave applications came into many domains of human activity, a need for precise measurements of signal frequency spectrum has become critical. This need is quite understandable when, for example, it concerns to exploring extraterrestrial radio-sources or micro / mm-wave background emission in radio-astronomy, or measuring chemical composition of the atmosphere through the molecular emission of different its components, plasma diagnostics or many military applications. Moreover, in some cases the spectrum measurements have to be implemented in the real time scale. For example, the high temperature plasma physics research is just the case because of short plasma life time in experimental devices and poor plasma parameter reproducibility from discharge to discharge; also it is important for plasma feedback control purposes. As well, the real time spectrum measurements are very needed in electronic warfare applications, such as object recognizing or electronic countermeasures to millimeter-wave weapons. However, real time broad band analyzers with direct frequency spectrum measuring continue to be a rare bird in catalogues of leading world manufacturers of mm-wave products.

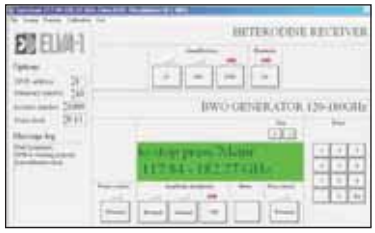
Common specifications

Operation frequency range, GHz	V, W, F or D band
IF Bandwidth, MHz	4–16.5
Basic frequency resolution, MHz	operation bandwidth / 4096
Minimum time of the spectrum analysis, ms	10
Minimum time of single frequency measurement, ms	0.0024
Power of the input signal, mW	1 to 1000
Quartz Calibrator Frequencies	built-in
Calibrator Stability	1 ppm
Voltage of the output video signal, V	0 to 5
Input waveguide	standard according to frequency
Input waveguide flange	standard UG-series
Supply	100–240 V AC

Software short screens.







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- **GPS stability and accuracy**
- **Compact sizes**

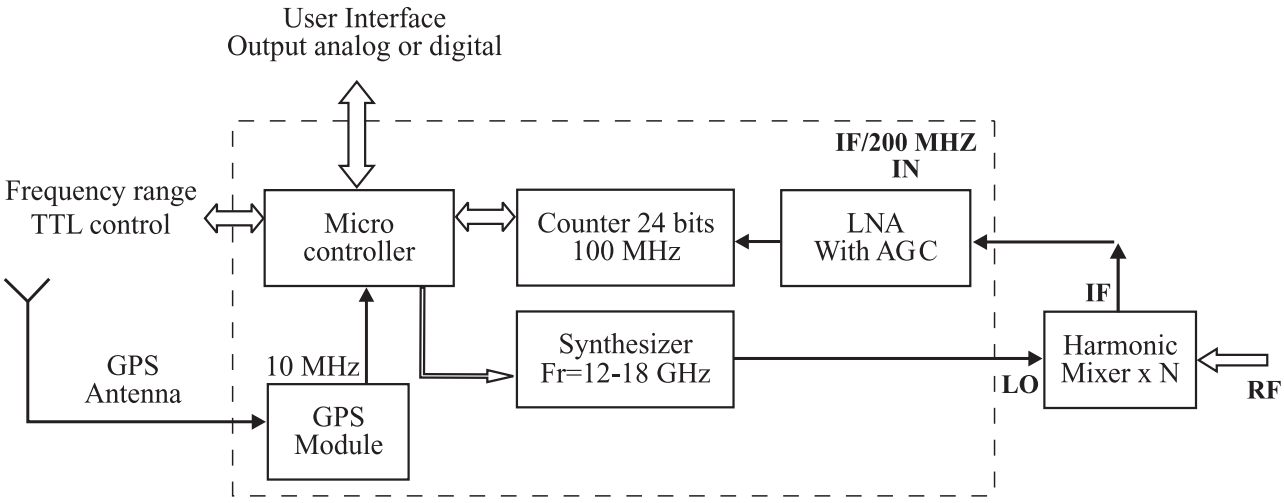
Applications

- High precision frequency measurement
- World standard frequency references

Description

Elva-1 specially designed GPS synchronized mm-wave frequency meter GPSFC-xx series. This solution allows to provide independent frequency measurement in different laboratories with absolute accuracy.

Block-diagram of the frequency meter.



Specifications

Mm-wave frequency meter GPSFC-xx series can be designed for operation in 26–170 GHz frequency range. Frequency window analyze for one frequency point of reference synthesizer 12–18 GHz is (Fr × N)+/-0.1 GHz. By switching the reference synthesizer user could cover all desired frequency band. User control and output interfaces could be adapted according to customer's specification.

As an example below specification for GPSFC-94/0.1 with analog output is presented:

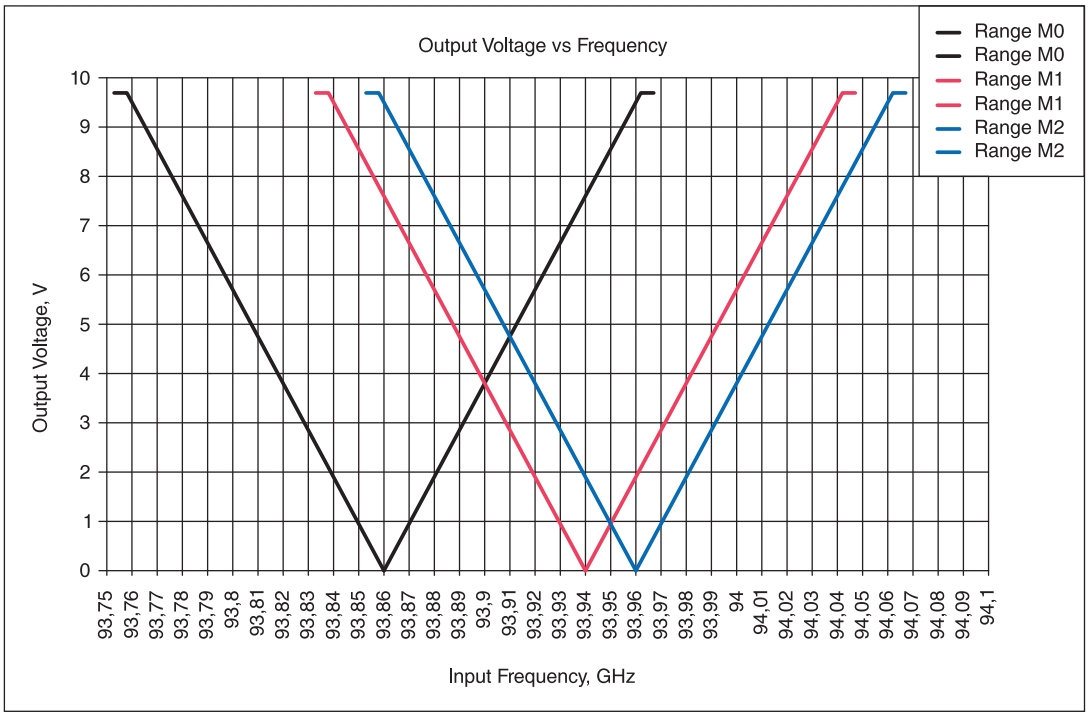
Electrical Specifications

• Input frequency range 'M0'	93.86 +/- 0.102 GHz
• Input frequency range 'M1'	93.94 +/- 0.102 GHz
• Input frequency range 'M2'	93.96 +/- 0.102 GHz
• Frequency Control	2 bits
• Control signal	TTL
• Input power	-10…+3 dBm
• Input w/g	WR-10, UG-387/U-M
• Output	0 — +10 V (see measured data)
• Sensitivity (typ)	0,010524 GHz/V
• Integration time	1 sec
• Output connector	BNC
• Input / output for HM	SMA(f) / BNC
• Supply	+9…+18 VDC @ 1.5 A
• Operation temperature	-25… +60°C

Mechanical Specifications

• Size	220×145×55 mm
• Weight	2 kg

Plot with dependence Output voltage vs Input frequency and switched range



Industrial Distance Meter FMCW 94/10/x at 94 GHz

ELVA-1 Millimeter Wave Division

- **Narrow beam**
- **Operation into dusty and smog**
- **Distance operation up 500 m**
- **High resolution**

Applications

- Mines
- Cement and other dusty manufactories
- Ground control in airports and other facilities
- Avoid collision systems

Description

FMCW 94/10/x Millimeter Wave Distance Sensor (option X: 100–600 mm Cassegain antenna) is a high-accuracy non-contact level measurement of large volumes of bulk materials in hoppers and silos at minerals and chemical industries. The examples of use are hard-rock mines, cement hoppers, and other bunkers with adverse environmental conditions such as dust, corrosive gas, fog, high level noise. The Distance Sensor can also be used for liquid level measurement at huge industrial tanks where there is a fuzzy edge of liquid because of foam or vapor. The example of that application is volume measurement in tanks at large breweries.

The Distance Sensor is based on millimeter wave FMCW (frequency-modulated continuous wave) radar principles. It 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 94 GHz FMCW radar operational frequency that is equivalent to 3 mm wave length, the sensor provides an excellent penetration of dust and water vapour. 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 500 m, that allowing using it at deep mines, where typical passes are up to 300 m 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 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.

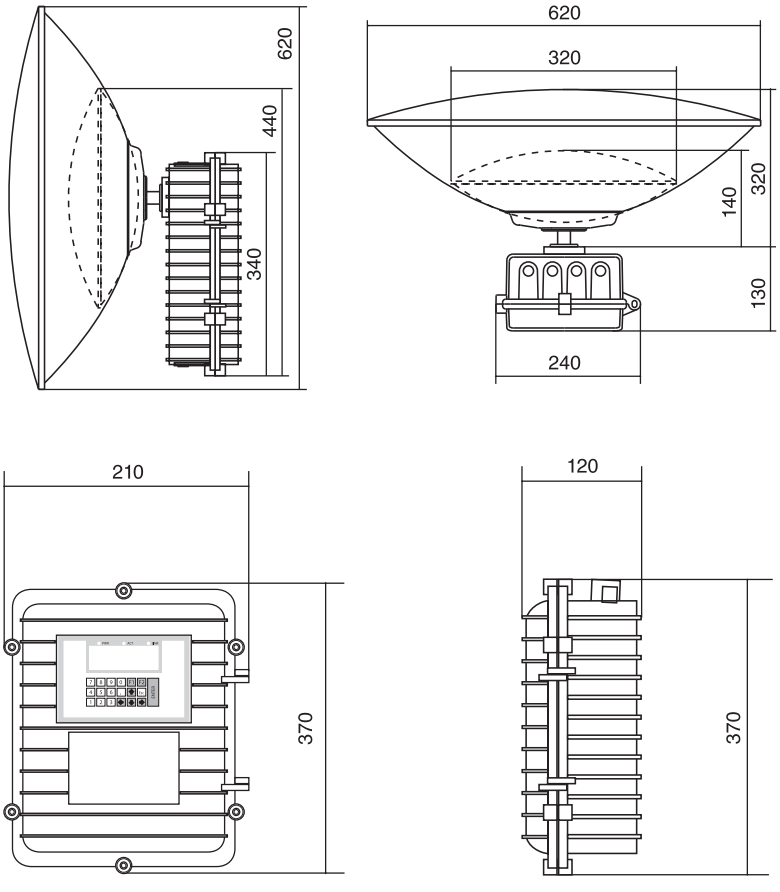
To use Distance Sensor within complete data acquisition system on an enterprise, the sensor has RS-485 interface using MODBUS protocol RJ-45 socket made in dust and moisture-proof embodiment. The radar transmitter at the Distance Sensor complies with international safety regulations.

Specifications

Distance Sensor Performance	
Distance Sensor resolution	0.005 m
Range of heights of Sensor position above the surface of material	0.6 to 500 m
Main reflector diameter size	300 and 600 mm
Distance Sensor radar transmitter emission power	10 mW
Distance Sensor radar operating frequency	94 GHz
Power supply voltage	+18…+36 DCV opt. 110/220V AC
Distance Sensor radar power consumption	20 W
Operation mode	CW

Distance Sensor Head Specification	
Sweep Range, MHz	505.472 962686326
Sweep time, ms	12.285
Interface protocol	IP 192.168.1.1
Sampling rate	4096 points per 12.285 ms
Data range	14 bits
Power supply voltage	External Power supply
Enclosure	IP65
Communication connector	RJ-45
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 5 Hz to 25 Hz band, no more than	0.1 mm
Controller NZ6100 Specifications	
Display	20 digits, 4.75 mm height 4 lines Liquid Crystal Display
Indicators	Power LED
Control Unit Power Supply	85–265 VAC, 47–63Hz, 15W optionally +18…+36 DCV
Membrane Keypad	27 keys including 8/18 function keys
Communications	RS-485 or TBD
Communication protocols	MODBUS RTU

Outline Drawing.



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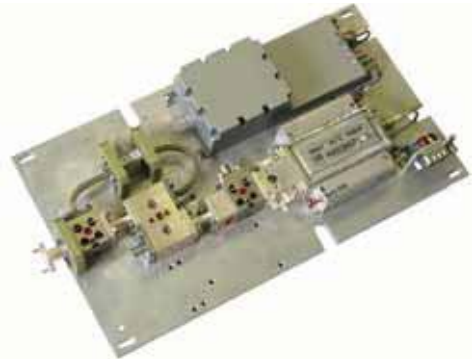
FMCW Radar Front-end
FMCW 10/94/200/10 at 94 GHz

ELVA-1 Millimeter Wave Division

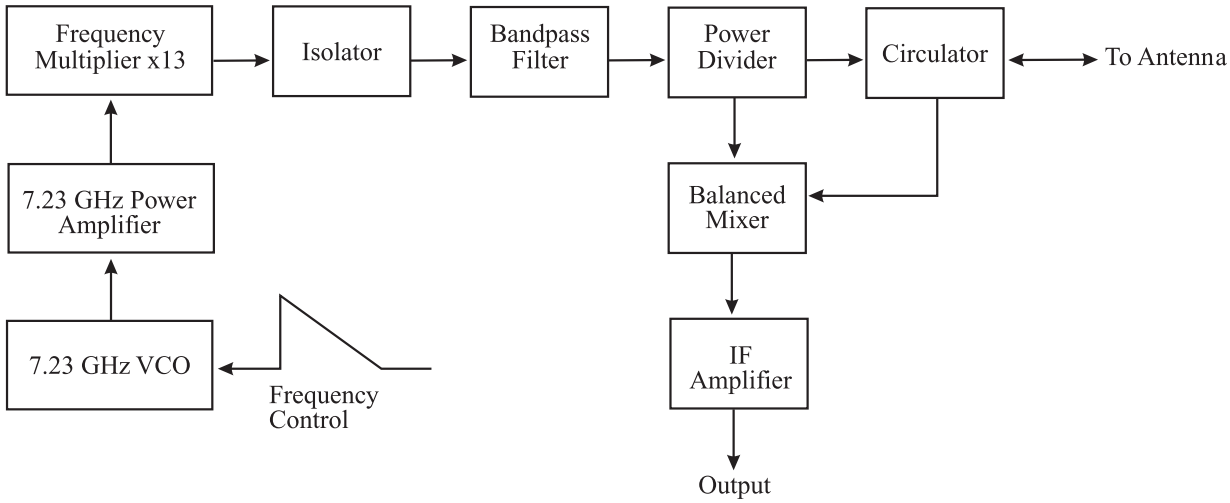
- **High accuracy**
- **On-line measurement**
- **High directivity with small antennas**
- **Portability**
- **Environmental safety**
- **Equipped with antennas by customer's choice**

Applications

- Ground control in airports and other facilities
- Avoid collision systems
- Precise distance measurement in dusty and / or humid atmosphere
- Level sensing for any materials and liquids in huge tanks with foam / vapour
- Robotic sensors



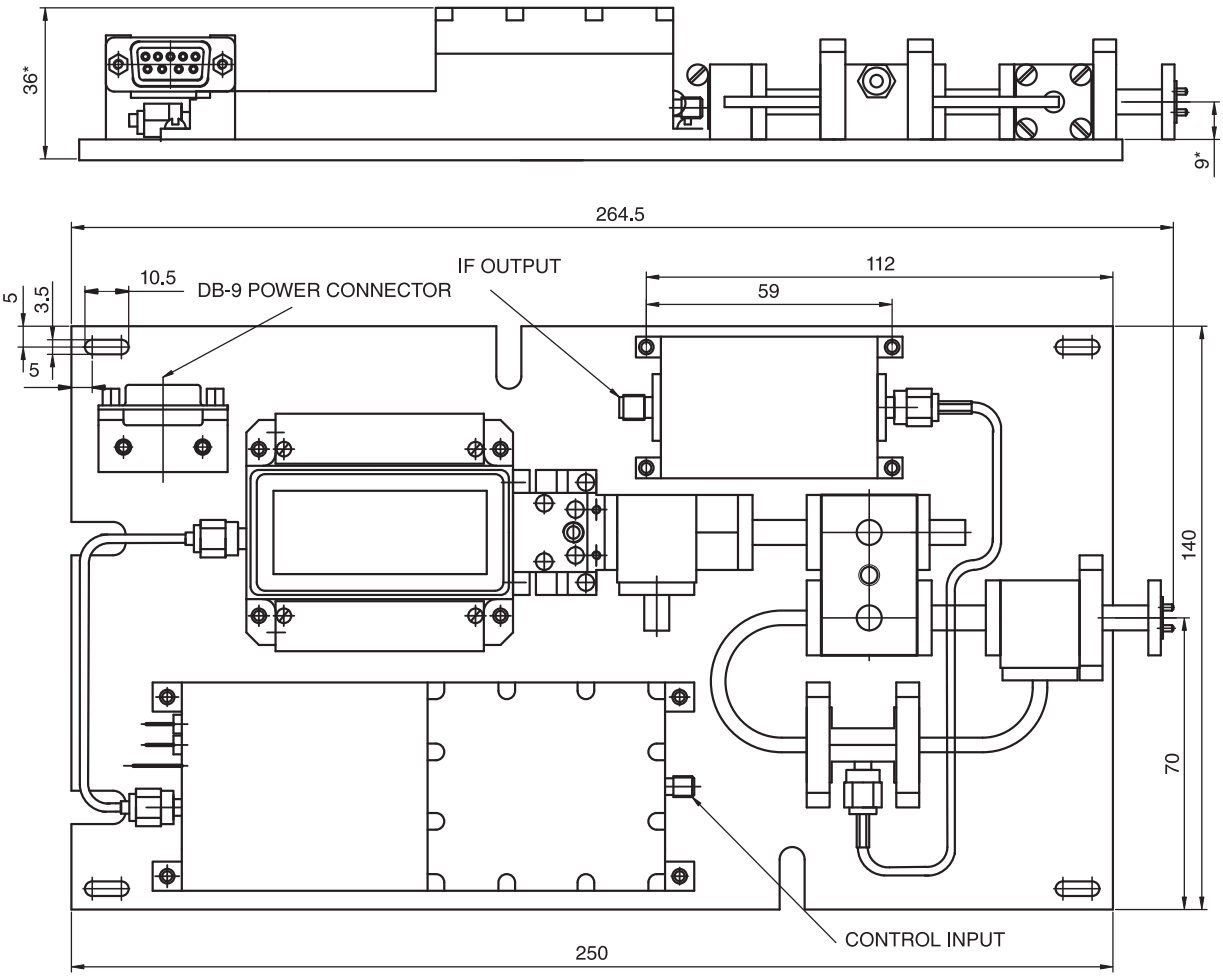
Block Diagram of FMCW-10/94 front end module.



Specifications

Centre Frequency	94 GHz
Radar front-end wattage	10 mW
Frequency Stability	$5*10^{-6}$ 1 / °C
Sweep Range	200 MHz (min)
Minimal Sweeping Time	100 µSec
Linearity	0.7 % (max)
Tuning Sensitivity	> 50 MHz/V
Output RF Power	+10 dBm (min)
Reverse Isolation	17 dB (min)
IF Frequency	4 kHz to 2 MHz
RF to IF Gain	32 dB (typ)
Waveguide / Flange	WR-10 / UG-387 / U-M
IF and Frequency Control Connector	SMA (f)
DC Power	+12V / 300 mA, -12V / 50 mA +27V / 200 mA / (+500 mA heater)
Mass	1200 gram (max)
Operating Temperature	-40 to +70 deg

Outline Drawing.



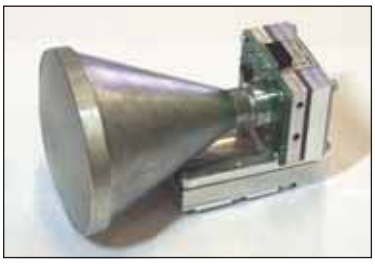
Doppler Radar Front-end Modules at 24 GHz and 94 GHz

ELVA-1 Millimeter Wave Division

- **High accuracy**
- **Compact sized**
- **High directivity with small antennas**
- **Equipped with antennas by customer's choice**

Applications

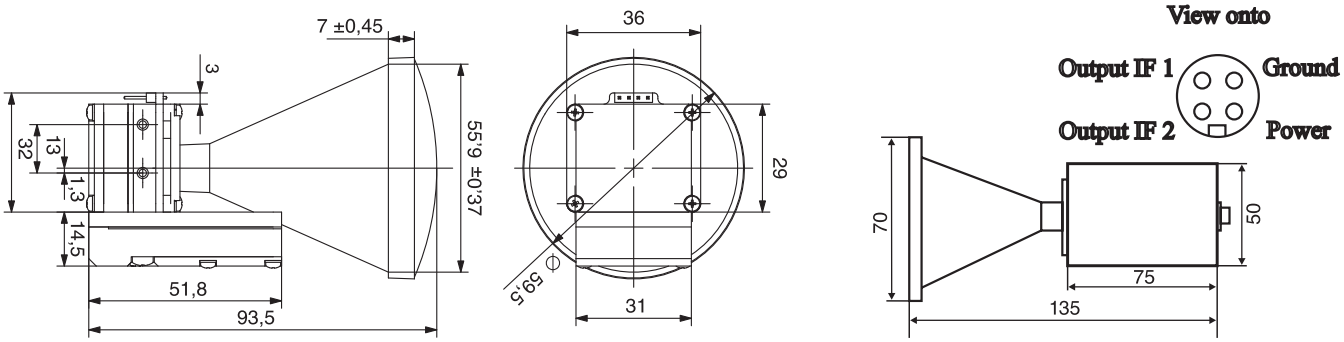
- Robotic sensors
- Instruments and test equipment
- Subsystems and assembles
- Industrial quality assurance and process controlling systems



Specifications

Model Namber	DSP-24/30	DSP-24/100	DSP-94/5
RF frequency	24.150 GHz	24.150 GHz	94.0 GHz
Transmitter output power	30 mW	100 mW	5 mW
Receiver conversion loss	5 dB (typical)	5 dB (typical)	12 dB (typical)
Noise figure	8 dB	9 dB	20 dB
IF bandwidth	0.1 to 700 kHz	0.1 to 700 kHz	0.1 to 700 kHz
Outputs	IQ	IQ	IQ
IF LNA gain	20 dB	20 dB	20 dB
Antenna 3 dB beamwidth	12 degrees	12 degrees	Upon request
Antenna gain	18 dB	18 dB	—
Antenna side lob level	-22 dB (maximum)	-22 dB (maximum)	—
Polarization	right hand circular	right hand circular	linear
Spurious and harmonics	-40 dBc	-40 dBc	-60 dBc
ΔF/ΔT	0.10 MHz / °C	0.10 MHz / °C	0.10 MHz / °C
ΔP/ΔT	0.01 dB / °C	0.01 dB / °C	0.01 dB / °C
DC bias	+5.0 V / 100 mA	+5.0 V / 120 mA	+12V / 100 mA + 24 V / 250 mA
Operation Temperature	-20…+65°C	-20…+65°C	-20…+65°C
Dimensions	See drawing	See drawing	Cylinder 50/75 mm

Outline Drawing of DSP-24/xx.



Pulsed Noise Radar Front-end Module at 94 GHz

- **Powerful incoherent source**
- **1 Watt typical output power**
- **High stability**
- **5 GHz white noise spectrum**
- **No high voltage supply required**
- **Compact solid state source**

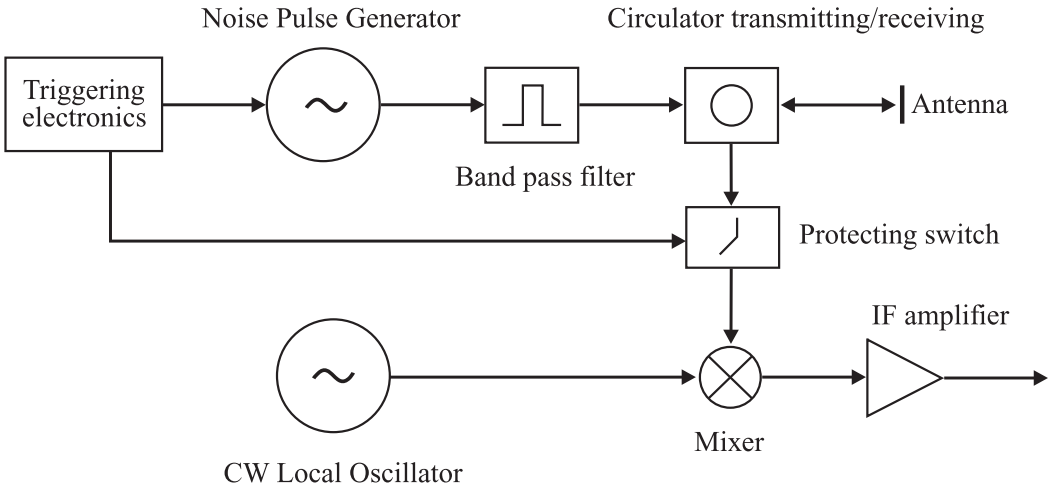
Applications

- Ground control in airports and other facilities
- Avoid collision systems
- Precise distance measurement in dusty and / or humid atmosphere
- Level sensing for any materials and liquids in huge tanks with foam / vapour
- Robotic sensors

Description

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.

Block Diagram front end module.



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 bandwidth, dB	ENR Flatness within launched	Receiver noise factor, dB
80÷100	5.0	50–100	> 100	30	500	±1.5	7–9

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PPC-1000 Series 1.25 Gbps Gigabit Ethernet Mm-Wave Link

ELVA-1 Millimeter Wave Division

- **Frequency band: 71–76 / 81–86 GHz; 40.5–43.5 GHz**
- **1250 Mbps Gigabit Ethernet Interface**
- **True Full Duplex Operation**
- **Secure communication due inability to intercept the laser-like beam transmission at free air**
- **Solid reliability with Fiber-like Performance**
- **Distance ranges of up to 4.5 mile (7.2 km) at 10 mm/h rain for 71–76 / 81–86 GHz frequency band**
- **Distance ranges of up to 5.8 mile (9.3 km) at 10 mm/h rain for 40.5–43.5 GHz frequency band**
- **Easily installed, Zero maintenance**
- **Compact Cassegrain type antennas**
- **Quasi-optical (laser-like) propagation of millimeter wave emission**
- **EMI interference free**

Applications

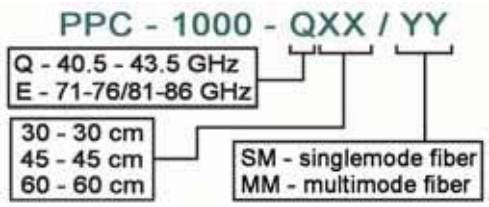
- Wi-Fi or mobile network backhaul
- Business WAN
- FSO backup
- IP telephony gateway connections
- Metropolitan area networks
- Rapid-deployment emergency communications

Description

Elva's full-duplex Gigabit point-to-point link provides interconnection between remote LAN segments at ultra high speed and utilizes Gigabit Ethernet protocol, which is the evolving standard for switches and routers available from a variety of telecommunication equipment manufacturers. The PPC-1000 product has 1000Base-SX (1000Base-LX, 1000Base-Tx) connections at each end of the wireless link and transparently establishes the link outputs. The resulting connection can replace a fiber-optics cable physically connected end-to-end. The wireless mm-wave Gigabit link provides fiber equivalent performance, reliability and security but with no high deployment cost associated with outdoor fiber installations.

How to Order

Specify Model Number



Example

PPC-1000 link with 60 cm antenna diameter and single mode fiber optic cable for 40.5–43.5 GHz frequency band has product code PPC-1000-Q60/SM.

Specifications

Frequency Band	E-band	Q-band
Bandwidth	71–76 / 81–86 GHz	40.5–43.5 GHz
Capacity	1250 Mbps Full duplex	
Modulation Type	QPSK	
Allocated Bandwidth	1250 MHz	
Rx Sensitivity at BER 10^{-6}	-97 dBW (-67dBm)	-97 dBW (-67 dBm)
Output Power	-10 dBW (20 dBm, 100 mW)	-8 dBW (22 dBm, 150 mW)
Max Distance with 600 mm antenna in clear sky	15 km (9.3 mile)	> 20 km (12 mile)
Max Distance with 600 mm antenna at 10 mm/h rain	7.2 km (4.5 mile)	9.3 km (5.8 mile)
Link budget 300 / 450 / 600 mm	177 / 185 / 189 dB	165 / 173 / 177 dB
SNMP version	v.1; v.2; v.3	
SNMP MIB	MIB-II and DOK Enterprise MIB	
Ethernet Interface	1000Base-SX or 1000Base-LX or 1000Base-Tx	
Connector Type	Hermetical cord installed (optional: Harting hybrid 2× fiber + 4× power)	
Diagnostics Port	100Base-Tx (RJ-45)	
Forward Error Correction	RS (204, 188)	
Latency	50 µs	
Polarization	Vertical / horisontal — optional	
MTBF	150 000 hours	

Antenna

Antenna Type	Cassegrain type antenna with radome	
Antenna Gain / Beamwidth		
30 cm	45 dB / 0.7°	38 dB / 1.5°
45 cm	49 dB / 0.5°	42 dB / 1°
60 cm	51 dB / 0.35°	44 dB / 0.7°

Power / Environment

Power Supply AC	Input 88–132 / 176–264 Volts, 50 / 60 Hz (with manual voltage range switch)
Transceiver Power Consuption	35 W (+60 W when heater is switched on)
DC Power	36 to 60 Volts DC
Power Connection Ethernet / Power connector	IP-65 [optional IP-68]
Operational Temperature	-50 °C to 60 °C / -58 °F to 140 °F
Humidity	Any Rate

Physical Dimensions

Outdoor unit size w/o antenna	340 × 230 × 120 mm	
Weight (ODU w/o antenna)	6 kg max	
Complete set	2 ODU + 2 antennas	2 ODU + 2 antennas

PPC-350 Series
350 Mbps Ethernet Mm-Wave Link

ELVA-1 Millimeter Wave Division

- **Frequency band: 40.5–43.5 GHz, 71–76/81–86 GHz**
- **True Full Duplex Operation**
- **Secure communication due inability to intercept the laser-like beam transmission at free air**
- **Solid reliability with Fiber-like Performance**
- **Distance ranges of up to 5 mile (7.9 km) at 350 Mbps and 6.8 mile (10.9 km) at 80 Mbps at 10 mm/h rain for 40.5–43.5 GHZ frequency band**
- **Distance ranges of up to 3.4 mile (5.5 km) at 350 Mbps and 4.6 mile (7.5 km) at 80 Mbps at 10 mm/h rain for 71–76 / 81–86 GHz frequency band**
- **Easily installed, Zero maintenance**
- **Compact Cassegrain type antennas**
- **Quasi-optical (laser-like) propagation of millimeter wave emission**
- **EMI interference free**

Applications

- Wi-Fi or mobile network backhaul
- Business WAN
- FSO backup
- IP telephony gateway connections
- Metropolitan area networks
- Rapid-deployment emergency communications

Description

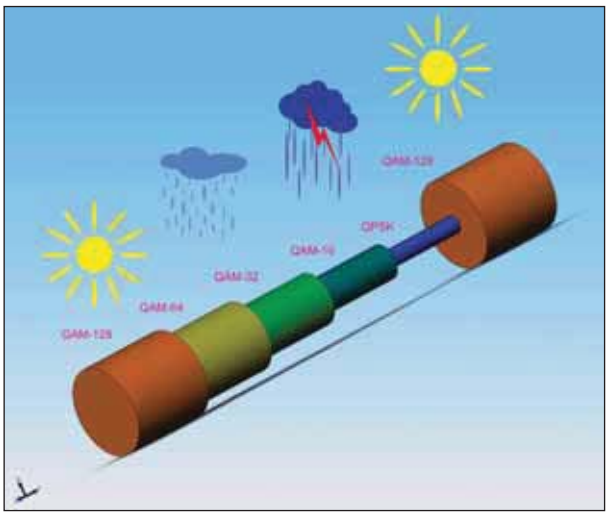
PPC-350 was specifically designed according to European ECC and US FCC performance requirements.

Main feature of PPC-350 consists in possibility to adapt its data transmission speed to the current weather conditions.

PPC-350 supports Adaptive Code and Modulation (ACM) in which changers of coding rate and modulation are set in real time, based on the link conditions. This feature enables to increase radio link availability.

When the link's SNR (Signal to Noise Ratio) is high (during good weather conditions), operation at full capacity is enabled, reaching the maximum speed of 350 Mbps. In case that the link's SNR drops significantly (during heavy rain), the channel capacity is reduced up to 80 Mbps.

The figure shows radio bridge capacity varies due to changers in SNR level.



Specifications

Frequency Band	E-band		Q-band	
Bandwidth	71–76 / 81–86 GHz		40.5–43.5 GHz	
Capacity	up to 350 Mbps Full duplex			
Allocated Bandwidth	56 MHz			
Modulation Type	from QPSK to QAM-256			
Rx Sensitivity at BER 10^{-6}	-67 dBm at 350 Mbps	-77 dBm at 80 Mbps	-69 dBm at 350 Mbps	-79 dBm at 80 Mbps
Output Power	13 dBm (20 mW) at 350 Mbps	20 dBm (100 mW) at 80 Mbps	13 dBm (20 mW) at 350 Mbps	20 dBm (100 mW) at 80 Mbps
Max Distance with 60 cm antenna in clear sky	10 km (6.2 mile) at 350 Mbps	> 20 km (12 mile) at 80 Mbps	15 km (9.3 mile) at 350 Mbps	> 20 km (12 mile) at 80 Mbps
Max Distance with 60 cm antenna at 10 mm/h rain	5.5 km (3.4 mile) at 350 Mbps	7.5 km (4.6 mile) at 80 Mbps	7.9 km (5 mile) at 350 Mbps	10.9 km (6.8 mile) at 80 Mbps
Link budget 300 / 450 / 600 mm	170 / 178 / 182 dB at 350 Mbps	187 / 195 / 199 dB at 80 Mbps	158 / 166 / 170 dB at 350 Mbps	175 / 183 / 187 dB at 80 Mbps
SNMP version	v.1; v.2; v.3			
SNMP MIB	MIB-II and DOK Enterprise MIB			
Ethernet Interface	1000Base-SX or 1000Base-LX or 1000Base-Tx			
Connector Type	Hermetical cord installed (optional: Harting hybrid 2× fiber + 4× power)			
Diagnostics Port	100Base-Tx (RJ-45)			
Forward Error Correction	LDPC; Reed Solomon			
Latency	200 µs			
Polarization	Vertical / horisontal — optional			

Antenna

Antenna Type	Cassegrain type antenna with radome	
Antenna Gain / Beamwidth		
30 cm	45 dB / 0.7°	38 dB / 1.5°
45 cm	49 dB / 0.5°	42 dB / 1°
60 cm	51 dB / 0.35°	44 dB / 0.7°

Power / Environment

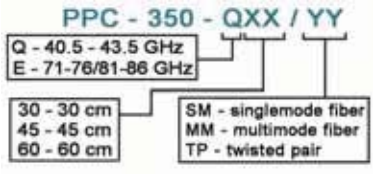
Power Supply AC	Input 88–132 / 176–264 Volts, 50/60 Hz
Transceiver Power Consuption	35 W (+60 W when heater is switched on)
DC Power	36 to 60 Volts DC
Power Connection Ethernet / Power connector	IP-65 [optional IP-68]
Operational Temperature	-50 °C to 60 °C / -58 °F to 140 °F
Humidity	Any Rate

Physical Dimensions

Outdoor unit size w/o antenna	340 × 230 × 120 mm
Weight (ODU w/o antenna)	6 kg max
Complete set	2 ODU + 2 antennas

How to Order

To choose the right model by its product code please use the following encoding schema:



Mm-Wave TV / IP Broadcasting System (City-1)

ELVA-1 Millimeter Wave Division

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

Applications

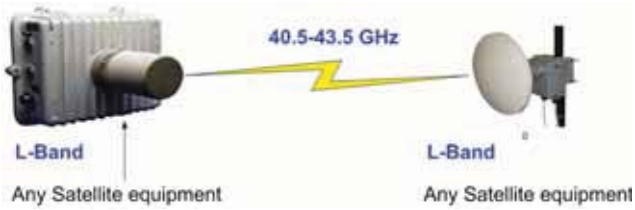
• Digital TV and / or IP broadcasting in urban areas

Description

City-1 operates in mm-wave frequencies, from 40.5 to 43.5GHz.

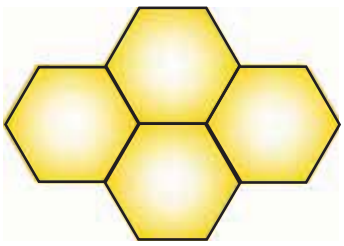
Operation principle

The City-1 system is based on DVB-S standard as in satellite. TV/IP broadcasting. The only difference 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.

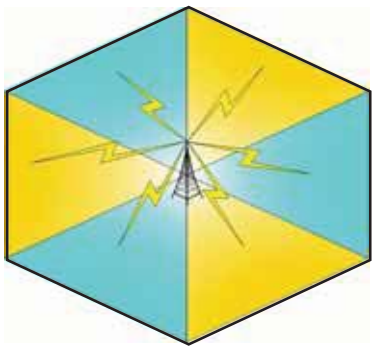


Network topology

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 statistic 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 cell 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 his needs. It is important that due to quasi-optical propagation in 40 GHz, 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 40.000 Mbps. The total capacity of the system depends on cell quantity.

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 mentioned that increasing carrier number leads to decreasing of cell radius (due to decreasing of power / carrier ratio and a crosstalk). So if you need to maximize the cell radius, it is better to use separate transmitter for each DVB-S stream.

Transmitter is supplied with horn antenna of 30, 45, 60 or 90 degrees beam width. Transmitter powered with 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 completely 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

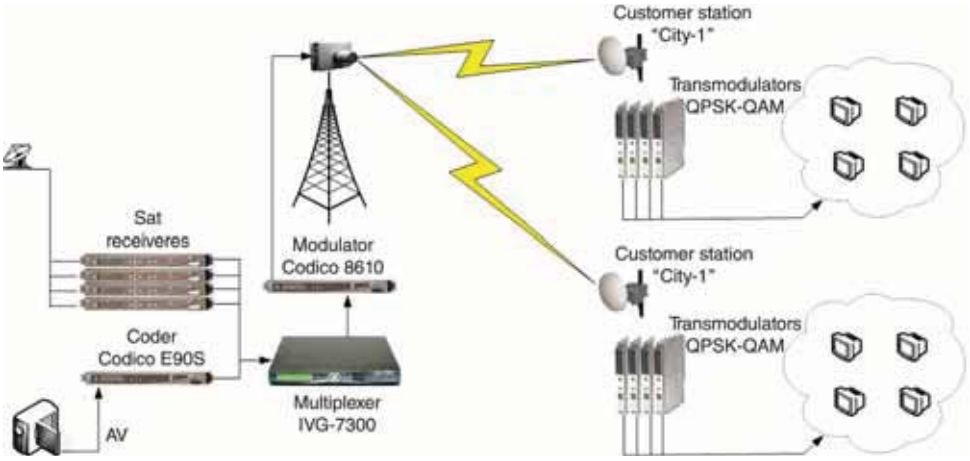
DVB-S standard is used in City-1 for IP broadcasting.

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 Lband input and Fast Ethernet output. It can be connected to LAN directly. A return channel to Internet in City-1 can be organized in any alternative manner.

TV-broadcasting: Choice 1

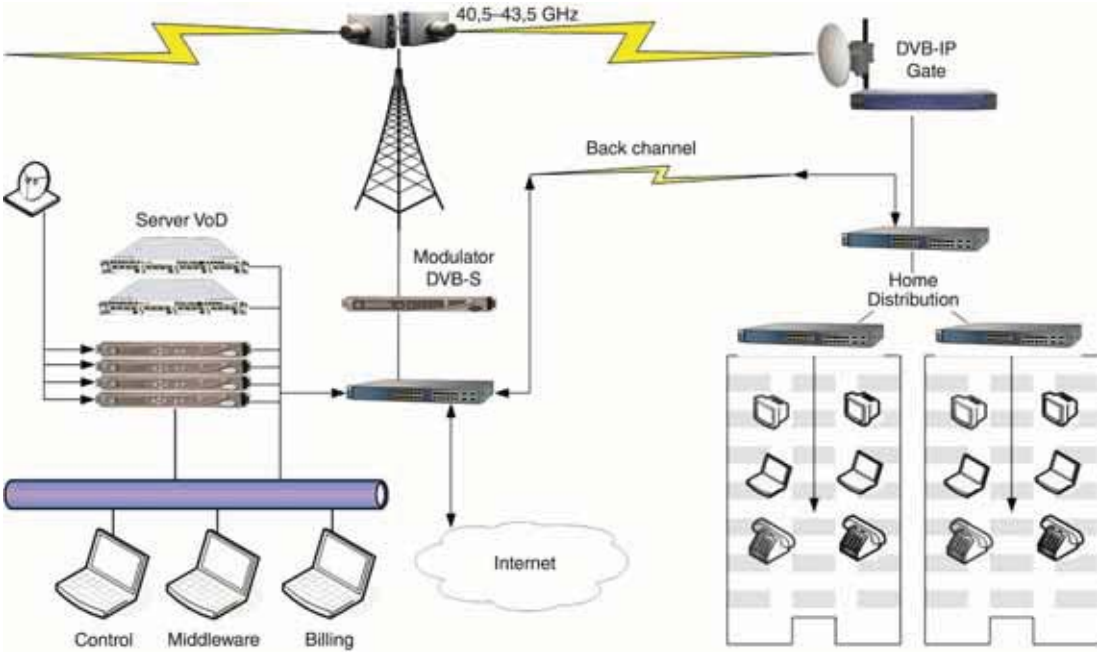
An operator can use 2 different ways to broadcast TV in City-1. The simplest one is TV over DVB, like in satellite TV. To retransmit a Satellite transponder you can take it from any standard satellite converter, single out one transponder with, for example, ALCAD converter, and forward it directly to City-1 transmitter. To receive DVB stream, a customer 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 trans modulators 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 TVbroadcasting is TV over IP over DVB. In this case TV is transmitted like other data. If digital TV to broadcast is available in Internet, IPencapsulator and DVB-S modulator should be installed at the base station.

At a customer side any standard Satellite data receiver can be used to extract TV/IP stream from DVB and forward it to LAN. Customers should use TV/IP receivers to view a TV on their TVsets. This way simplifies a house distribution system. 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 on a disk array. After IP-encapsulation and DVB-S modulation, Video forwards to a City-1 transmitter. At customer side video converts to an IP-stream, that can be viewed on a computer or with a help of TV/IP receiver.

Specifications

General

Frequency range	40.5–43.5 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, 5 mmph 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. 75×150 mm
Weight	2 kg
Alignment: — vertical — horizontal	+/-20° 360°

Transmitter

RF Bandwidth	39 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 GHz 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, 8PSK modulation N-type connector
Antenna	90°×10°, 16 dB 60°×10°, 17 dB 45°×10°, 18 dB 30°×10°, 20 dB
Power	54 VDC, 2 A
Dimensions	288 × 242 × 120 mm, antenna: 140 × diam. 85
Weight	5 kg
Mounting	On vertical pipe 40~70 mm diameter
Alignment: — vertical — horizontal	+/-25° 360°

How to Order

Please apply with your request to ELVA- 1 office: **sales@elva-1.com**

High Sensitive Mm-Wave Radiometers for Plasma Diagnostics

ELVA-1 Millimeter Wave Division

- **Up to 220 GHz operating frequency**
- **High sensitivity**
- **Low noise factor**
- **Multi channel radiometers**
- **Sweeping radiometers**
- **Custom design**

Receiver module of Radiometer

Inside view of E-band front-end of Radiometer for Castor Tokamak

Description

ELVA-1 radiometers for plasma diagnostic are worldwide known product. The custom designed ECE radiometers have been installed at lots of Tokamaks:

- JET Tokamak, UK;
- TCV Tokamak, Switzerland;
- TCABR Tokamak, Brazil;
- FTU Tokamak, Italy;
- CASTOR Tokamak, Czech Republic;
- Southwestern Institute of Physics, China.

Specifications

Parameter / Tokamak	JET/KK3	JET/KK3	TCV	TCABR	FTU
Type	Front-End	Front-End	Multi-channel	Sweeping	Multi-channel
Operating frequency, GHz	69–139	139–206	78–114	52–85	113–153
Channel Number	6	6	24	1	32
Noise factor, dB (typ)	9–12	12–15	15–20	15	15–22
Output frequency	6–18 GHz	6–18 GHz	40 kHz	1 MHz	1 MHz
Putting into operation	2001	2008	2000	2002	2000

How to Order

Please apply with your request to ELVA-1 office: **sales@elva-1.com**

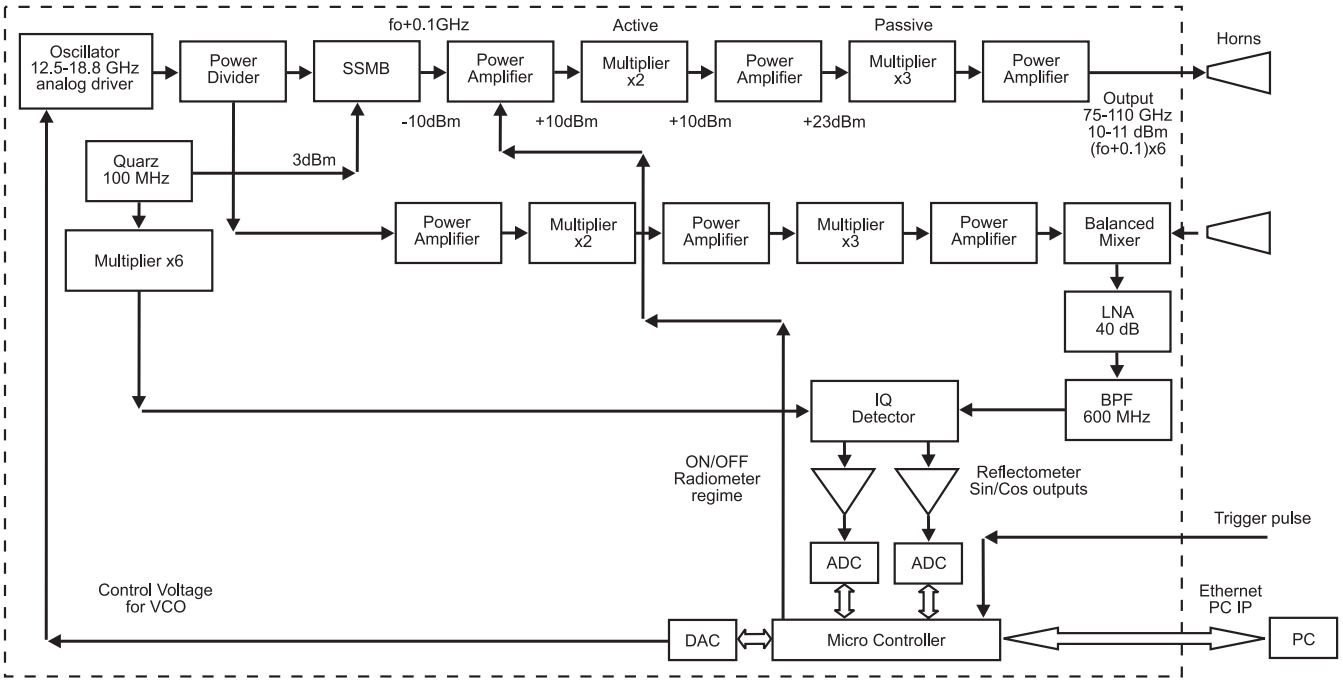
Interferometers and Reflectometers for Plasma Diagnostics up to 170 GHz

- **High performance**
- **High sensitivity**
- **Fixed frequency**
- **Ultrafast scan 10 mks**
- **Full band operation**
- **Original software for temperature profile**

Description

Elva-1 supplies different solutions for measurement density and temperature profiles of plasma. Our systems are installed practically on all TOKAMAKs over the World.

Below presented typical solution for ultrafast 10 mks full W-band scan reflectometer.



Please send request to sales@elva-1.com and we propose you optimized solution.

www.elva-1.com
e-mail: sales@elva-1.com

- **Up to 170 GHz operating frequency**
- **High sensitivity**
- **High frequency stability**
- **Low phase noises**
- **Amplitude / phase modulation**
- **Custom design**

Description

ELVA-1 produces mm-wave bridges and components for EPR spectrometers. Lots of scientific laboratories in the world use ELVA-1's products in their EPR experiments:

- Cornell University, USA;
- Free University, Germany;
- Osnabrueck University, Germany;
- Weizmann Institute, Israel;
- Ioffe FTI, Russia.

Specifications

CW: (CW + AM (amplitude modulation))

N	Specs Parameters	W-band	D-band
1	Central frequency	95 GHz	130 GHz
2	Central frequency stability	30 kHz / hour (using DRO)	30 kHz / hour (using DRO)
3	Operating frequency range (any fixed frequencies for DROs and tunable frequencies for VCO)	400 MHz (95 GHz+/-0.2 GHz)	400 MHz (130 GHz+/-0.2 GHz)
4	Frequency stability	10^{-6} per °C	10^{-6} per °C
5	Spectrum width @ -3 dB level	< 1 kHz	<1 kHz
6	Max mm-wave power	Up to 250 mW	Up to 50 mW
7	Power stability	0.02 dB per °C	0.02 dB per °C
8	FM noise @ 10 kHz	-100 dBc / Hz max	-100 dBc / Hz max
9	AM noise @ 10 kHz	-140 dBc / Hz max	-140 dBc / Hz max
10	Attenuation of output power	60 dB	50 dB
11	Min switching time of amplitude modulation of output signal (10 % to 90 % and 90 % to 10 % power level)	5 nsec ($5*10^{-9}$ sec) max, 3–4 ns typical	5 nsec ($5*10^{-9}$ sec)
12	Noise figure of receiver section	12 dB	14 dB
13	Max gain of receiver section	50 dB	50 dB
14	Receiver section bandwidth	200 MHz	200 MHz

Pulse: (CW + AM + PM 0–90 deg., 0–180 deg. (phase modulation))

N	Specs Parameters	W-band	D-band
1	Central frequency	95 GHz	130 GHz
2	Central frequency stability	30 kHz / hour	40 kHz / hour
3	Operating frequency range	400 MHz (95 GHz+/-0.2 GHz)	400 MHz (130 GHz +/-0.2 GHz)
4	Spectrum width @ -3 dB level	< 1 kHz	1 kHz
5	Power of amplitude noise	-140 dBc / Hz @ 100 kHz offset	-140 dBc / Hz @ 100 kHz offset
6	Max power	Up to 250 mW	Up to 50 mW
7	Changing of pulse output power	60 dB	50 dB
8	Changing of output power of CW channel	120 dB	100 dB
9	Min duration of output pulses at amplitude modulation of output power	10 nsec (10^{-8} sec)	10 nsec (10^{-8} sec)
10	Min switching time by 2PSK modulation of output signal	5 nsec ($5*10^{-9}$ sec)	5 nsec ($5*10^{-9}$ sec)
11	Accuracy of 180 deg phase shift keeping for 2PSK	1 degree	1 degree
12	Microwave power suppression during a pause between pulses	100 dB	100 dB
13	Switching time up to max suppression level	< 10 nsec	10 nsec
14	Noise figure of receiver section	12 dB	14 dB
15	Max gain of receiver section	50 dB	50 dB
16	Receiver section bandwidth	200 MHz	200 mHz
17	Total phase drift	5 degrees / 15 min	5 degrees / 15 min

EPR spectrometer life time (projected): about 30 000 operating hours

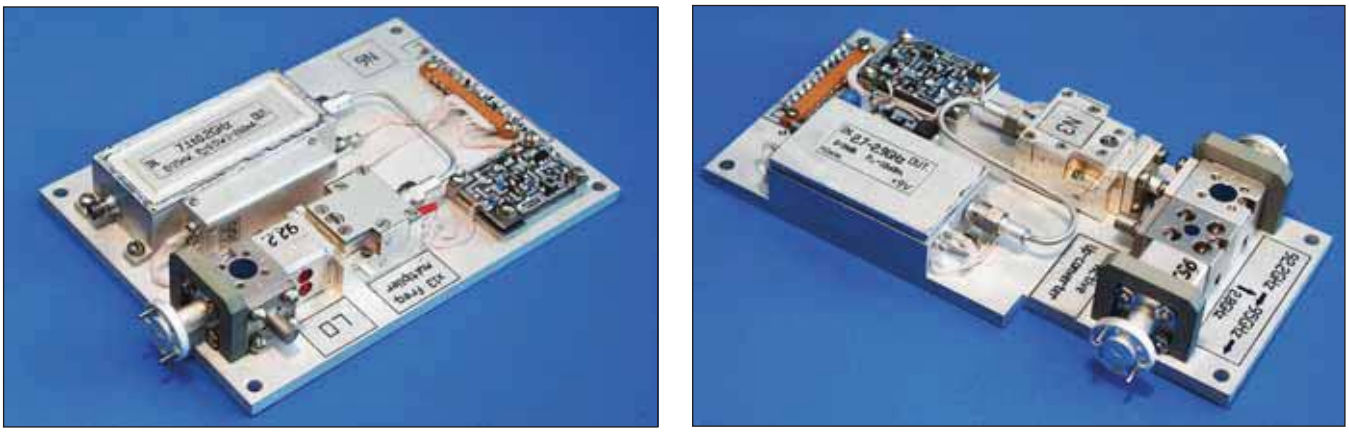


Fig. The **92.2 GHz frequency multiplier and up-converter** below are key parts of high stable low phase noise mm-wave source for EPR spectrometer

How to Order

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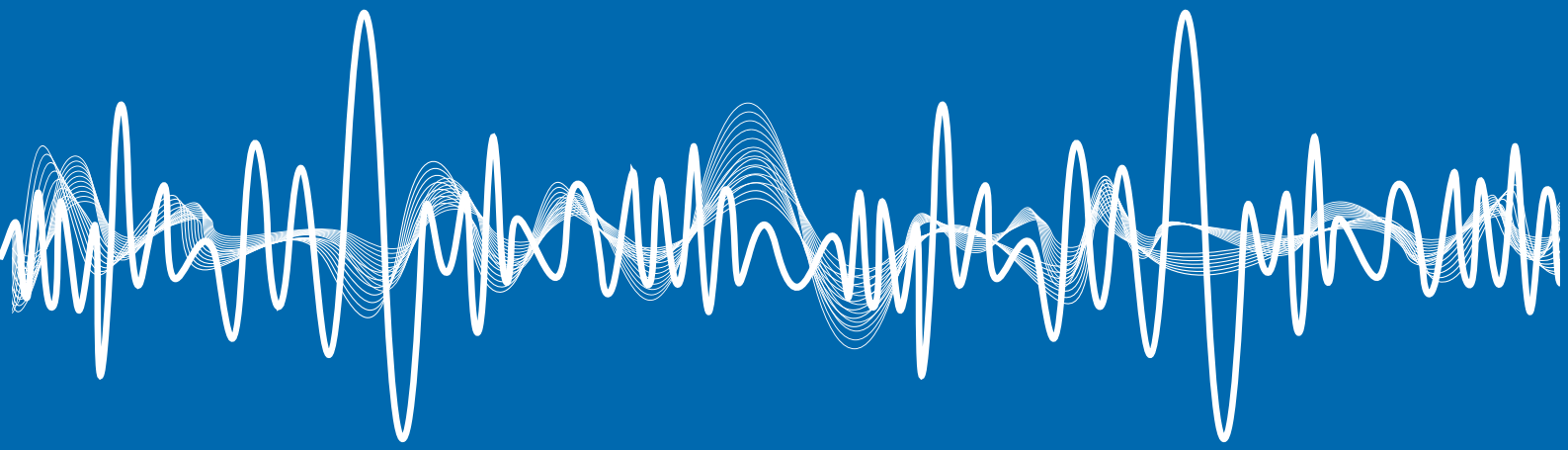

ELVA-1 Millimeter Wave Division

2 Voroshilova, OHTA Business Centre
Saint Petersburg, 193318, Russia
Tel. +7 812 326 5924
Fax +7 812 326 1060
www.elva-1.com
sales@elva-1.com