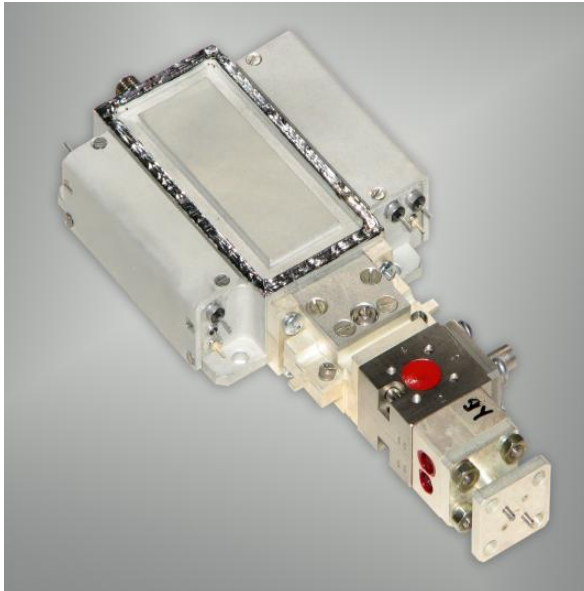




Active frequency multiplier with high multiplication factor in 80–150 GHz frequency range



APPLICATION

Active multiplier on IMPATT-diodes of CW and pulse mode, **M331003**, is intended for use, as in equipment of the general application, and onboard equipment in a frequencies range $F_0 = 80\text{--}150$ GHz.

It is widely applied at making coherent transceivers of W-range and the transceivers intended for use as a part of equipment of digital radio-relay stations with high rate of data transfer.

In operating frequency range the multiplier provides level of output power about 10–50 mW with multiplication factor $N=5\text{--}30$ that gives additional possibilities at a choice of equipment creation scheme in various applications.

DESCRIPTION

Functionally single stage active frequency multiplier converts signal frequency of centimeter wave length (5–15 GHz) to millimeter wave length (80–150 GHz) with high efficiency (conversion loss correspond to N^1) and without degradation of input signal phase. Level of added phase noise is defined by a ratio $20 \lg N$.



In multipliers special packaged silicon IMPATT-diodes made on a technological line of RI "Orion" are used as an active elements. Diode operates in avalanche breakdown mode and multiplication occurs on nonlinearity of an avalanche that provides high efficiency of signal conversion, especially at high multiplication factor.

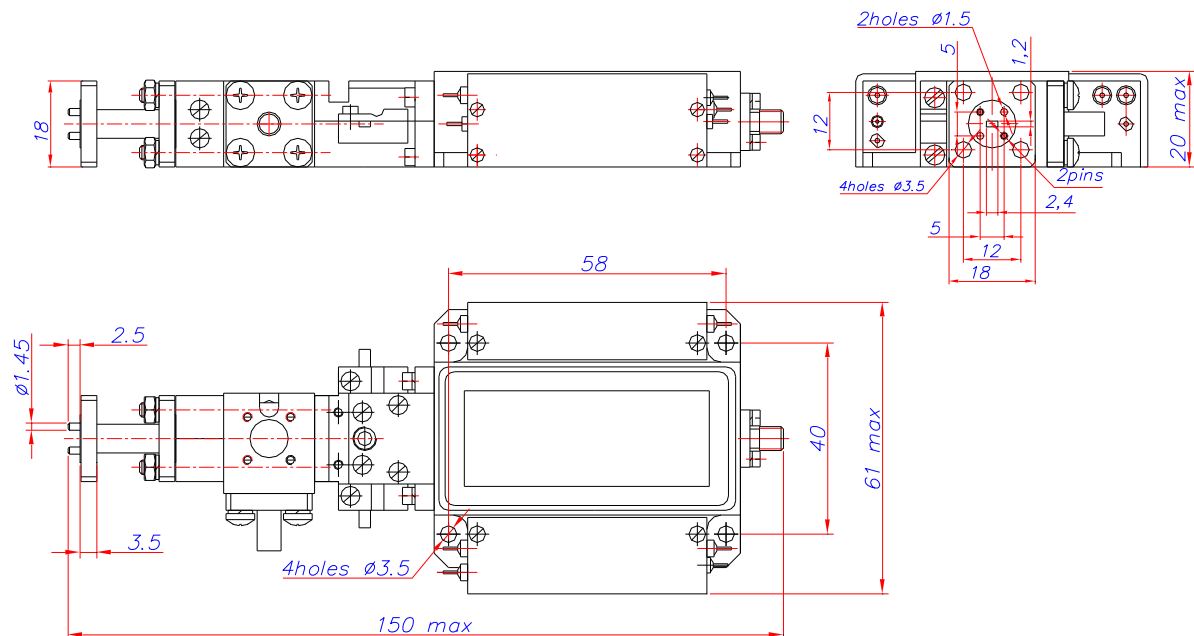
The multiplier consists of a waveguide multiplying chamber, transistorized amplifier of input signal of centimeter wavelength, waveguide isolator, waveguide bandpass filter and a driver.

Waveguide isolator protects output signal of the multiplier from external load influence. The bandpass filter provides suppression of the nearest harmonics in multiplier output signal at a level not less than 40 dB.

On modulating current of IMPATT-diode with the use of a driver, there is a synchronous modulation of multiplier output signal with modulation depth to 70 dB. The maximum modulation rate makes 100 MHz.

When using the multiplier as a receiver heterodyne at the output it is set a narrow-band filter which provides amplitude noise of output signal at a level of minus 180dB/Hz at offset carrier more than 1 GHz.

OUTLINE DRAWING





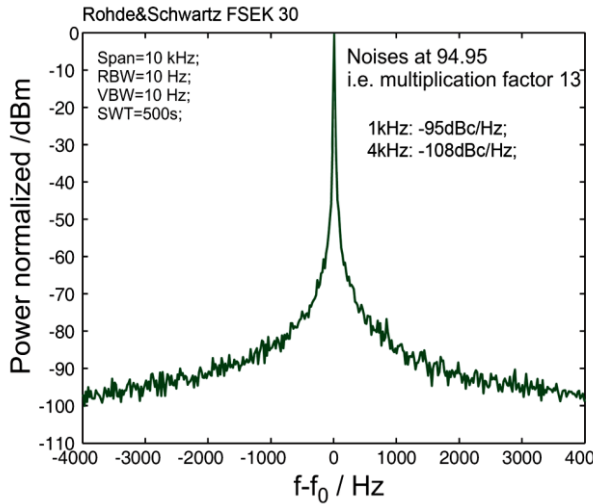
SPECIFICATIONS

Name of parameters, unit of measure	Typical values	
	Continuous mode	Pulse mode
Central operating output frequency F_{out} , GHz	80–150	80–150
Operating frequency band, GHz, no more	$F_{\text{ВЫХ.}} \pm 5$	$F_{\text{ВЫХ.}} \pm 2$
Output power in operating frequency range, mW		
80–110 GHz	10–50	30–50
110–150 GHz	10–30	10–30
Pulse width of output signal, nsec	–	3
Pulse ratio of output pulse signal, not less	–	2
Central operating input frequency of synchronization signal F_{in} , GHz	5–15	5–15
Power of input signal of synchronization, mW	20	20
Multiplication factor value N	5–30	5–30
Suppression of spectrum harmonic components, dBc, not less	-50	-50
Level of nonharmonic component of spectrum, dBc, no more	-90	-90
Type of input connector of synchronization signal	SMA	SMA
Type of connecting waveguide flanges according to ГОСТ 13317-89 or UG-387/U		
<i>Electrical characteristics of a control pulse of resolution</i>		
Input levels at 50 Ohm load, V		
low level	–	0–1,5
high level	–	3,5–5,0
Supply voltage, V/ current consumption, mA	+24/150	+24/150
	+12/1000	+12/1000
	-12/30	-12/30
Weight, g, no more	400	400

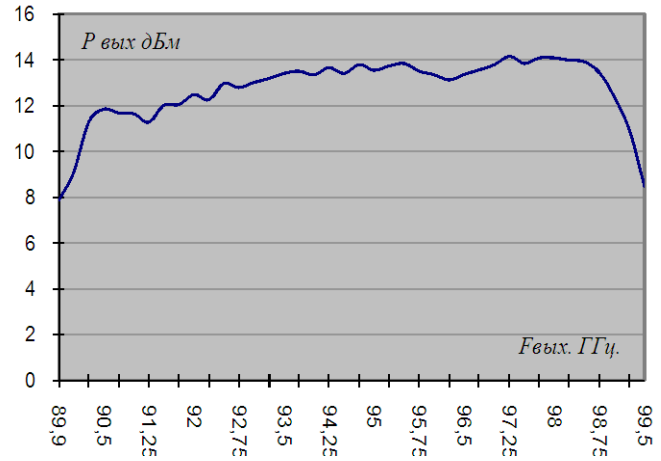
* F_{out} , F_{in} , values are specified by a customer.



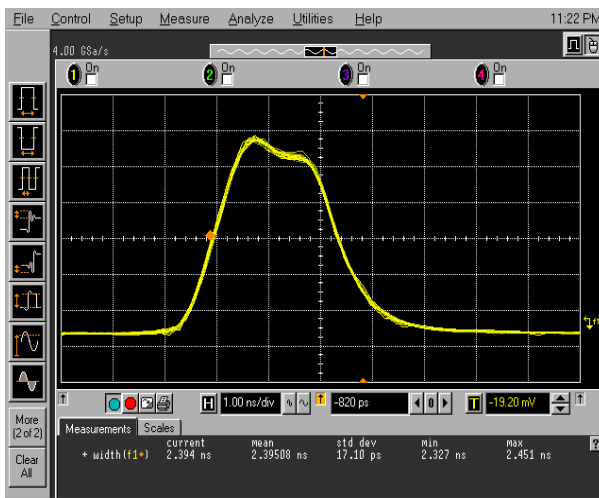
CHARACTERISTICS



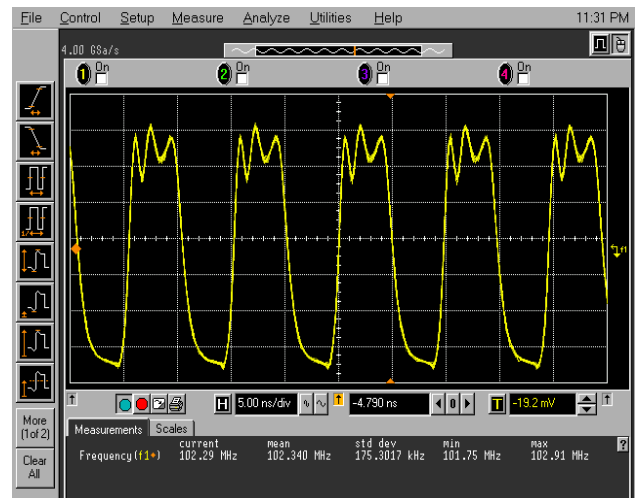
Typical spectrum of multiplier output signal



Frequency-response characteristic of multiplier output signal



Oscillogram of pulse envelope of multiplier output signal



Oscillogram of envelope of pulses of multiplier output signal