

# The 26-150 GHz IMPATT Active Frequency Multipliers



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

## Applications

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

## Description

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

IMPATT Active Frequency Multiplier

SMA connector for cm-wave pumping power (not viewed on the photo)

Isolator

Narrow band-pass filter

Current

Output waveguide

Power plug

## Specifications:

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

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

### Common specifications

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

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

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

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

- Complete very stable solid state millimeter wave source, that consist of the following:
  1. Transistor oscillator stabilised by the dielectric resonator (DRO). 6-8 GHz, 10 mW output,  $10^{-6}$  frequency stability. The stability would be increased upon request using a temperature stabilization scheme.
  2. Transistor power amplifier that provides 6-8 GHz power sufficient for the normal operation of **IAFM-XX**.
  3. **IAFM-XX**.

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

- Millimeter wave sweeper on the base of Varactor Controlled Oscillator (6-8 GHz, 10 mW). Other elements of the scheme are the same as above. Typical bandwidth is 0.5-1%.
- The frequency bandwidth would be also increased upon request. The limit is the distance between nearest harmonics, so it is impossible to provide the bandwidth more than the pumping frequency. The real bandwidth would be about 50-80% of the initial (pumping) frequency. For example in the Correlation Reflectometer for JET (Joint European Torus) the device with 92-96 GHz frequency sweep was supplied.
- IMPATT Injection-Locked Amplifiers **IILA** series to increase the output power.
- Phase or amplitude modulator on the base of fast P-I-N switch **FPS** series.
- Amplitude regulator on the base of Voltage Controlled Attenuator **VCVA** series.
- Power supply for AC Input Voltages 110 V, 60Hz; 220 V, 50 Hz.