

QS2-1500

QS2-1500 BWO Hybrid Overview

The QS2-1500 backwards wave oscillator is based on the QS2-180 BWO with the addition of Schottky diodes that act as frequency multipliers to extend the available operating range to include 200 to 350 GHz, 300 to 500 GHz, 700 to 1000 GHz, and 1000 to 1500 GHz.



Pictured above is a lower powered passively cooled QS2-180. Air Cooling not shown.

The QS2-180 is a permanently magnet mounted, air cooled BWO operating from 100 to 180 GHz. The QS2-180 air cooled has between 50 and 100 mW output. This output is then passed through a waveguide adapter (included and not shown.) for use with the Schottky diode frequency multipliers.

This BWO operates in the 400 to 2600 Volt range and can be operated with the VR-3M power supply. The datasheet provided with your BWO gives the relevant power and voltage to frequency conversion coefficients.

This BWO works well with the DAC-16 digital to analog control unit and our relevant software. A Labview driver is available and free to control the DAC 16 as well. If you wish to use computer control of the power supply to scan through the available frequency range and do conversions please refer to your power supply manual.

Schottky Diode Overview

The frequency multiplying Schottky diodes have a waveguide designed to match up to the WR type circular flange on the wave guide adapter provided with the QS2-1500 quasi-optical source. The input waveguide terminates in a dipole antenna connected to a Schottky diode array designed to do frequency multiplication providing output to another dipole antenna feeding a different waveguide designed for the frequency range of the diode multiplier output.



Primary Frequency Doubler pictured above

The appropriate diode multiplier(s) must be attached to the waveguide adapter with the correct face in.

NOTE: The diodes are static sensitive parts. ALWAYS use a static discharge line attached to an appropriate metal ground whenever handling the Schottky diodes.

NOTE: Always make sure the BWO is off when attaching or detaching a Schottky diode.

VR-3M Power Supply Overview

The VR-3M power supply operates from 300 to 3000 volts at a load between 0 and 40 mA. It uses a High power Vacuum Triode and provides a well regulated output (less than



10 mV of noise). There are additional voltage feeds on it for the cathode heater element. An initial warm up time with the BWO switch off is necessary to bring this precision instrument up to full operating temperature before switching the BWO output on. An additional modulation circuit is added to aid in the prevention of standing waves.

By use of the modulation voltage the frequency can be varied across a very small range (2.5KHz: 0-50 V) This provides a system with a narrow line width (<1 MHz) while avoiding dangerous feedback to the tube via standing waves.

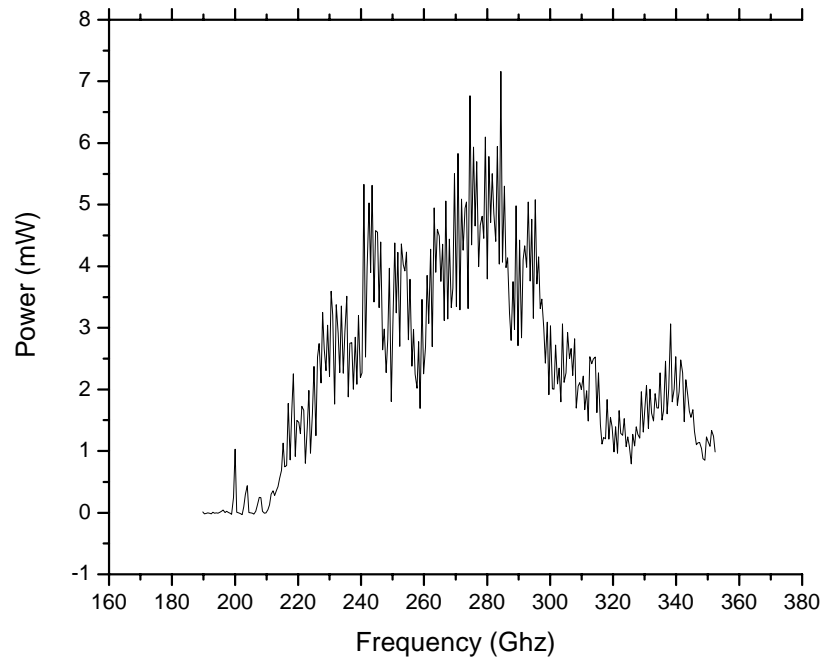
General Information

Backwards wave oscillators are a vacuum diode tube with a periodically stepped deceleration grid. This grid causes a stepped deceleration in the electron velocity which results in a standing wave inside the tube. A waveguide is placed on the back of the tube to allow the back propagating wave to exit the tube.

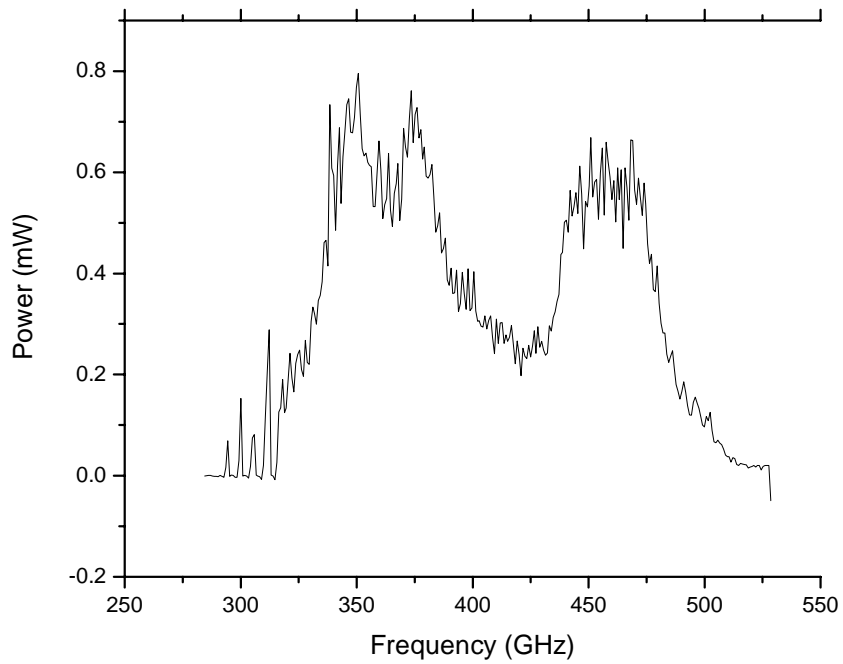
BWO's produce highly coherent CW radiation so standing waves can cause feedback that will damage your BWO. To prevent this we provide a modulation control on the power supply. There are times that the slight smearing this causes may be insufficient or undesirable so another technique that can be used is to slightly misalign one lens so that it is not at normal incidence to the beam. This technique may not prevent standing waves elsewhere in the system and so is not the preferred method. If you see erratic behavior in the measured output then please take immediate action to either add modulation or shutdown. Often, simply adding a small amount of modulation will remove the standing wave condition. One can then make fine adjustments to the optical system and attempt to reduce modulation to see if the output remains stable. By this method one can find and eliminate standing waves systematically from the system and obtain clean results.

Power Spectra

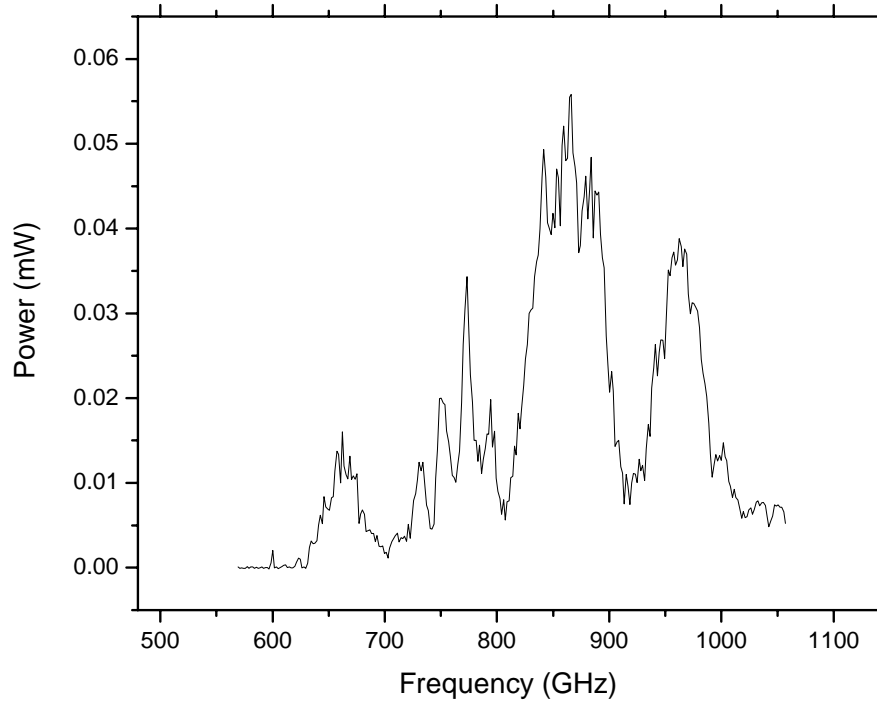
QS2-180 SN: 170456 in 2x Configuration Power Spectrum



QS2-180 SN: 170456 in x3 Configuration Power Spectrum



QS2-180 SN: 456 in 6x Configuration Power Spectrum



QS2-180 SN: 170456 in 9x Configuration Power Spectrum

