Communications & Power Industries IOT Transmitter

CPI Beverly Microwave Division has delivered a 90 kW pulsed, 1.3 GHz IOT transmitter to Daresbury Lab for the EMMA Accelerator.

With a history of producing high quality products, we can help you with your IOT transmitter.

Contact us at BMDMarketing@cpii.com or call us at +1 978-922-6000.

Typical Operating Parameters

Frequency range	1.3 GHz
Bandwidth	5.5 MHz
Peak power	90 kW
Average power	6.4 kW
Gain	80 dB
Pulse length	1.6 µS
Repetition rate	1 to 20 Hz
Prime power	400 VAC
Prime power	3 phase
Prime power	50/60 Hz

FEATURES:

- Includes VKL9130B IOT
- Includes a 1.5kW solid state power amplifier
- Includes output circulator protection for IOT
- Contains an embedded processor that controls all internal functions
- Interfaces directly with EPICS control system
- Safety and IOT-protective interlocks are hard wired
- Local control or remote control via EPICS
- User control of IOT beam and grid bias voltages optimizes performance

BENEFITS:

- Very high power pulsed RF source
- Easy to operate and maintain
- Build-in diagnostic and test for local and remote troubleshooting

APPLICATIONS:

- Scientific superconducting accelerator

This integrated scientific microwave high power pulsed amplifier system uses a CPI-manufactured VKL-9130B IOT amplifier electron tube that is designed for scientific accelerator service. By using the high-efficiency, 1.3-GHz, 90 kW pulsed IOT in combination with modern solid state RF pre-amplifier, control and power-supply technology, CPI is able to furnish a compact, user-friendly, cost-effective high power scientific amplifier system.
The system's control center is an embedded microprocessor-based architecture which provides flexibility in selecting system operating parameters. Operation of the VIL-409 may be accomplished locally or remotely using a notebook computer or the accelerator system's controller via an Ethernet connection. Operation can be initiated (using default settings) by simply issuing an enable command and providing the RF signal that is to be amplified. Operational data is logged in the controller's on-board flash memory. The logged data may be uploaded to the external computer via the Ethernet connection for use in off-line troubleshooting or other purposes.

The high-voltage power supply (IOT Beam Supply) is a switching, capacitor charging type of supply with a relatively low-value smoothing/energy storage capacitor. A crowbar circuit is not required to divert stored energy during an internal IOT arc-event. System interlocks will remove the high voltage in less than 10 ms in the event of a normal-fault or less than 50 µS for faults requiring more rapid actions. Depending on the enclosure that is selected, cooling for the system is via a combination of both water and air or water only. The RF input power provided by the user is amplified more than 58 dB by a fully solid state RF power amplifier. The output of that amplifier provides the IOT's RF input power. The IOT gain exceeds 21 dB.

Instrumentation and Control

All operating, control, and data-collection functions are performed by the embedded controller. Critical interlocks, such as those required for system or personnel safety are hard-wired.

The control-center is a digital logic system that monitors and controls the performance of the high power microwave amplifier system. All system parameters, such as beam current, beam voltage, forward and reflected RF power and so on are displayed through a web-browser on the GUI (graphical user interface - monitor) of a remote computer via an Ethernet connection. Complete access to the status of each analog and digital input and output is also remotely available to the user. Alternative control and monitor systems are also available via a software change in the embedded controller. Rather than a remote GUI, the embedded controller can also interface directly to the accelerator controller.

The embedded controller uses flash-memory to log the status of each of its inputs and outputs in a rolling file system that makes the last several days of operating available to the user. This data is stored in a format that will load directly into many spreadsheet programs (i.e., CSV format) for ease of data manipulation. These files may be e-mailed to CPI for assistance in troubleshooting and trend analysis should that be desired.

Cabinetry

Several enclosure systems are available. These range from a NEMA 4X (completely sealed enclosure) type to a more conventional 3-bay laboratory 19 inch rack system (shown in picture). The beam (high voltage) power supply may also be remotely mounted from the main enclosure that houses the rest of the system if there is some advantage in doing that. As shown, the standard enclosure system consists of 3 enclosures. Two are 19 inch racks and one is 24 inches to accommodate the IOT and its support cart. The left bay houses the embedded controller, high voltage power supply, and solid state RF power amplifier. The middle bay contains the floating grid deck, IOT magnet power supply and several other lower voltage DC power supplies. The right bay houses the IOT, circulator (if purchased), and output waveguide. Internal air circulating fans move air through air-water heat exchangers located in the partition between the bays when using the NEMX 4X optional enclosure.

Waveguide System

The components in the output waveguide system include a dual-directional coupler and an optical arc detector. Should an arc occur in the waveguide run, the arc detector circuitry will remove the RF drive power to the IOT in less that 10 microseconds after the arc is detected.

The dual-directional coupler provides a calibrated sample of both the RF power generated by the system and the RF power reflected back to the IOT. These samples are fed to the embedded controller where this information is used in process control as well as system protection.

System control will prevent damage to the IOT from the excessive reflected power by reducing or removing the RF drive to it. System control also shuts off the IOT beam power supply for a IOT arc-event.

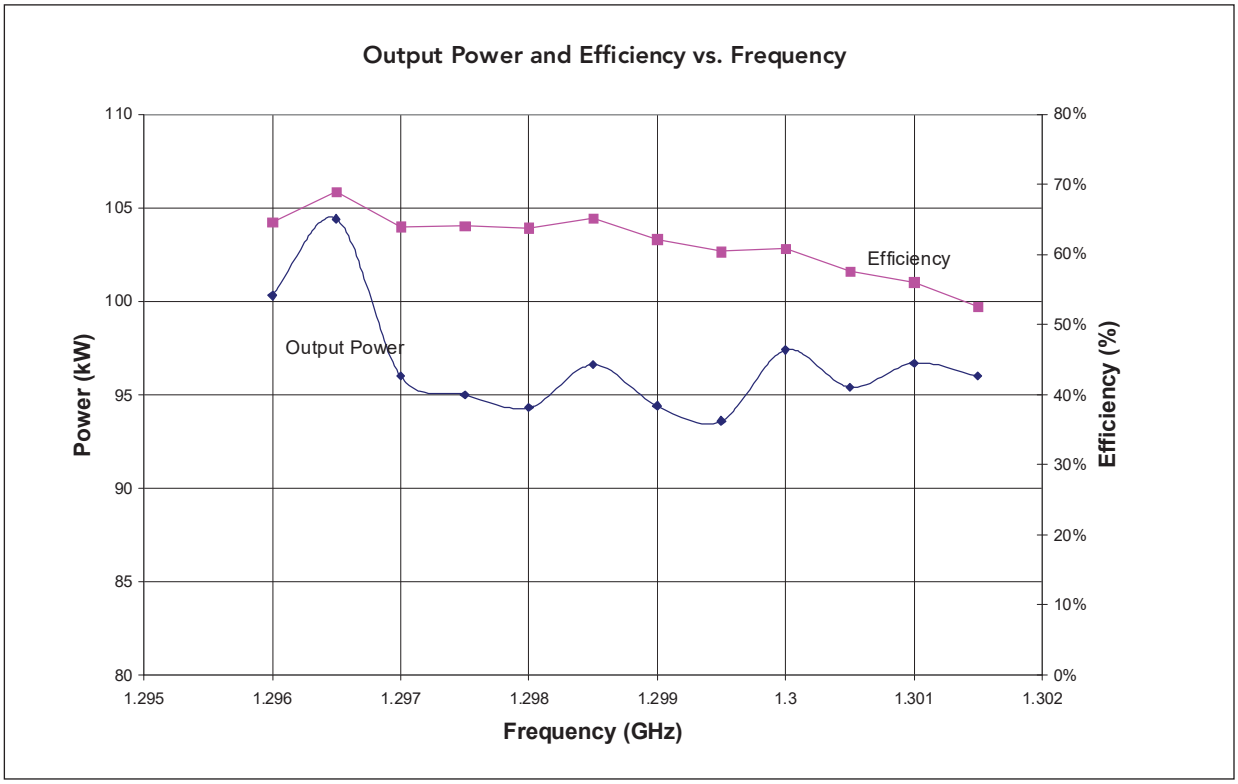
The WR-650 waveguide is typically brought out through the top, or back-right of the cabinet for the NEMA 4X enclosure option, but custom configurations are available for the waveguide interface point on the enclosure.

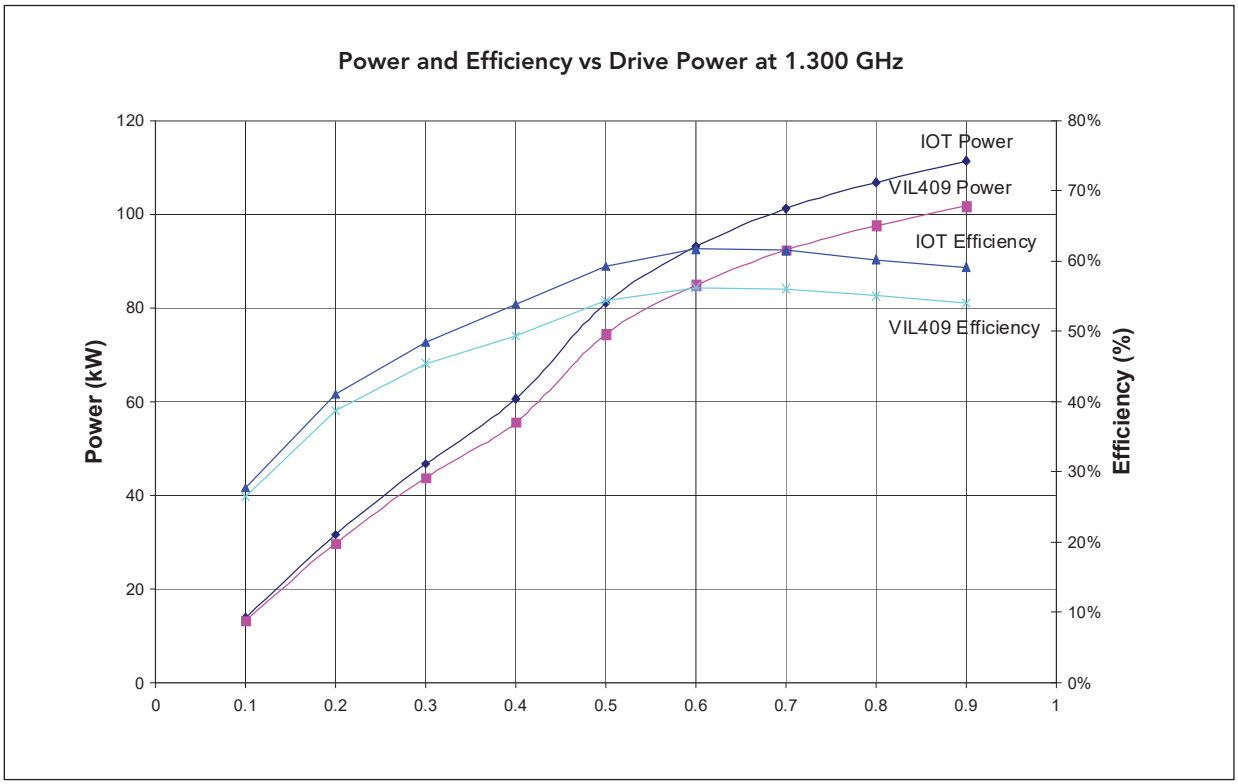
TECHNICAL CHARACTERISTICS

Output	Description
Pulsed RF power:	Adjustable to 90 kW, maximum peak power. Continuous control range in excess of 27 dB.
Operations frequency:	1.3 GHz nominal. Electronically tunable over a 5.5 MHz bandwidth
Waveguide:	WR-650
Waveguide arc detector:	Standard. The IOT's output waveguide is protected by the control system, which will interrupt the RF drive power if arcs occur in the waveguide near the IOT.
Forward and reflected Power monitor:	A directional coupler at the klystron output is included. Excessive reflected power will also interrupt the RF drive power. A liquid-cooled, waveguide circulator capable of dissipating the energy reflected by a 4:1 VSWR is included.
Input power	
Voltage:	400Y230 volt, 5-wire (wire per phase, neutral wire plus ground), 50/60 Hz. Other voltages available.
Line current:	Approximately 30 Amp per phase at 90 kW peak output power, 3.2% duty.
Cooling	For the standard laboratory rack-mount enclosure option, clean water from an external source capable of 30 GPM at 60 PSIG, 10 to 40 degrees Centigrade. Laboratory air is also force-circulated through the enclosure. In the NEMA 4X enclosure option, cooling is via water only with 35 GPM being required at 60 PSIG.
Size and weight	
Weight:	Approximately 1,500 pounds
Approximate dimensions:	80 in wide X 80 in high X 40 in deep maximum
Other features:	The unit has lifting eyes on the top surface for pick-up via an overhead crane. and is easily moved by fork lift or pallet jack.

Characteristics, dimensions and operating values are based upon design calculations and performance tests. The information in this technical data sheet may change without notice as the result of additional data or product refinement. Beverly division of CPI should be consulted before using this information for final equipment design.

CPI IOT Transmitter: VIL409





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For more detailed information, please refer to the corresponding CPI technical description if one has been published, or contact CPI. Specifications may change without notice as a result of additional data or product refinement. Please contact CPI before using this information for system design.

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