PROCUREMENT TECHNICAL SPECIFICATION

For the:

C-BAND

KLYSTRON AMPLIFIER TRANSMITTER

IRAD Program

Prepared by:

PULSED C-BAND KLYSTRON

AMPLIFIER SPECIFICATION

1.0 General

This document describes the technical characteristics of a Pulsed Klystron Amplifier Assembly to be used for a pulsed Doppler radar system application. Hereafter this Program shall be referred to as the Internal Research & Development (IRAD) Klystron Transmitter.

2.0 Transmitter Description

The transmitter is a complete assembly that is capable of being integrated into a radar system. The transmitter shall have the following features and capabilities:

- Stand alone subsystem of the radar system that is housed in appropriate cabinets that contain the klystron amplifier and all of the supporting elements
- Capable of being operated and monitored locally from a control panel or entry panel & display and remotely (unattended operation) via a computer terminal.
- The transmitter shall employ modular construction, with built-in-test functions that are capable of diagnosing failures to the Line Replaceable Unit (LRU) without the use of extensive external test equipment. Preferably no external test equipment.
- The transmitter alignment, if required, shall be accomplished with the use of common test equipment
- The transmitter shall have built-in safety and protection circuits for equipment and personnel
- The transmitter control & monitor I/O panel shall provide for both serial (RS422) and parallel control and monitoring from a remote workstation computer
- The transmitter shall include a prime power panel with branch circuit protection.
- The transmitter shall operate in 3-phase 208/240 VAC, 50/60 Hz, with a power factor of better than 0.9. The transmitter will operate on a 25kVa UPS provided by the buyer.
- Subsystems of the transmitter may operate on 120/240 VAC single phase, 60/50Hz (US or European Power)
- The transmitter shall be of durable construction and capable of shipment by any method of commercial land, air or sea transportation
- The microwave input shall consist of a 0 to +10dBm RF pulse that is “nested” or coincident with the PRF pulses applied to the transmitter. The input circuit shall contain test points for monitoring the input signals and the appropriate isolator and amplifier circuits to protect and condition the signal input to the klystron
- The klystron microwave output shall consist of a dry air pressurized WR187 waveguide assembly that is pressure “leak tested” at 12 psig. The waveguide microwave assembly shall be provided by Baron Services
- The microwave assembly shall consist of an Arc Detector, forward power coupler, 4-port circulator with a -40dB reverse power coupler built-in the 4-port circulator dummy load arm.

The receive port of the 4-port circulator shall be equipped with a solid-state TR Limiter. The microwave assembly shall also include; double-stub tuner, 2nd forward power coupler, high power band pass filter, and if needed a harmonic filter. A waveguide pressure inlet shall be provided within the transmission line circuit.

- Provisions shall be made to allow the buyer to install a "RF Exciter & Receiver" in the near vicinity of the TR Limiter. Initially, the mounting attachments and space shall be planned for a 19" panel width chassis, 6U height and 20" deep. Exact size requirements TBD.
- Convenience power receptacles shall be supplied and installed in each of the Transmitter cabinets (120 or 250Vac described above)
- The transmitter cabinet shall be an integrated assembly, preferably with locking casters to allow the cabinet to be rolled into position.
- The klystron HV components shall be mounted in a bio-degradable HV insulation in which the container access has provisions for easy removal and replacement of the klystron and HV components (easily accessed connections).
- The klystron tube shall connect to the modulator via a rigid mounted HV socket connector
- Provisions shall be made for ease of removal and replacement of the klystron and solenoid, using techniques such as a separable "roll-out" HV assembly housing, at a minimum, the HV oil tank, solenoid and klystron. The transmitter shall be capable of disassembly and reassembly for transportation purposes
- Baron shall provide a "shaped RF pulse" to the PIN switch that is designed to minimize the transmitted "spectrum occupancy". The RF Pulse being supplied may be chirped with a linear or non-linear FM signal with up to 1MHz modulation (+/-0.5MHz).

3.0 Transmitter Functionality

The transmitter is a gain and phase stable, pulsed high power microwave amplifier (HPMA) employing solid-state construction. A modified air-cooled VKC8387 or similar klystron tube is employed as the microwave power amplifier. The transmitter shall be coherent and capable of operating over the PRF range of 300 to 1300pps, with a maximum duty cycle of .15%. The PRF input may be changed on a pulse-to-pulse basis. The microwave phase and amplitude stability of the transmitter shall be sufficient to enable clutter rejection in excess of 55dB, as defined by the "Radar Handbook", and when operated in a stable PRF/pulse width combination.

The transmitter shall be equipped with an extensive BITE/Fault Monitoring functions that are designed for long-term remote, unattended, operation.

4.0 Transmitter Characteristics

Item	Performance Characteristic
Transmitter Type	Coherent pulsed klystron amplifier

Klystron type	VKC8387 Modified to 1MW – New part number
Cooling Type	Forced Air-cooled
Prime Power Requirements	3-phase 208/240 Vac, 50/60Hz +/-10% Power Factor >.9 25KVA
BITE/Fault	Integral built-in circuits, Faults reported parallel via 15 pin "D Connector"
Transmitter Output	
Transmit Frequency	Klystron instantaneous, 5.6 – 5.65GHz
Peak Power	1000kW, typical
RF Phase Stability	0.09 degrees maximum, pulse to pulse
Item	**Performance Characteristic**
RF Pulse Width	Remotely controlled – 0.8 - 4.5 microseconds RF pulse widths & Cathode TTL gate for "nested RF"
PRF	Externally supplied, 250 – 1500pps, TTL compatible
PRF Stagger Ratio	Dual PRF – 3:2, 4:3 & 5:4, externally supplied
Input Signals Interface	
RS422	Connector (ETHERNET optional) TBD
Parallel Connector	25 pin D connector
PRF Pulse	**TTL compatible, 250 – 1500pps** **BNC Connector**
RF Pulse	Pulsed; Amplitude 0-10dBm, RF Frequency 5.6 – 5.65GHz Connector; SMA
Signal Conditioning	RF Pulse rise/fall time shall be adjustable to optimize the spectrum occupancy
Prime Power	3-phase, 4 wire with separate Ground, connector TBD
Output RF Signal Interface	WR187 Circular cover Flange
Environment	Ambient temperature, 0 to 50 degrees Celsius Humidity, 0 to 100%, non-condensing

Physical Size	
Height	72 inches (TBD)
Width	96 inches (TBD)
Depth	36 inches (TBD)
Weight	TBD

5.0 Testing

The transmitter supplier shall generate a Factory Acceptance Test procedure and perform Factory Acceptance Testing. The vendor shall submit the test procedures to Baron Services for approval, 90 days before testing begins. The test procedures will be approved or disapproved by Baron Services within 2 weeks after receipt. Baron Services, at our discretion, may choose to witness these tests at the vendor's facility.

6.0 Data

Milestone Schedule - The transmitter vendor shall provide Baron Services with a milestone schedule within 30 days of award that indicates the times of the program major events. The milestone schedule shall be updated and delivered to Baron Services on a quarterly basis. The transmitter Vendor agrees to notify Baron Services, by telephone, if problems arise and shall provide a recovery plan in writing within 10 days of the original problem notification.

Commercial Manuals – The transmitter vendor shall supply Baron Services with 2 hard copies and 1 soft copy (MSWord compatible) of the commercial Operations and Maintenance Manual. The vendor's format is acceptable. The Transmitter Manual shall contain safety information, installation procedures, theory of operation consistent with a journeyman electronics technician or junior engineer, alignment procedures, troubleshooting information, transmitter schematics including circuit boards with parts lists, annotated source code, and parts lists down to the level of Line Replaceable Unit (circuit cards, cables and modules). Drawings shall be native AutoCad or Vellum compatible. Manual drawings shall be no larger than "C" size format to allow readable text when reduced to 11 x 17 pdf format.

7.0 Quality Assurance

The transmitter vendor shall employ “best commercial practices” for the fabrication of the transmitter. ISO9000 is preferred.

7.1 Option

It would be extremely helpful for future sales of the transmitter to be “CE Tested and Compliant”. This will help future sales to the European Community. The cost of certifying for CE Compliance may be bid as a separate line item in your proposal, but the “design for” should be incorporated in the original design..

8.0 Delivery

The vendor shall package and ship the transmitter to Baron Services in Huntsville, Al, freight prepaid. Baron shall take ownership of the transmitter after in-house testing that insures the transmitter is functioning IAW vendor test data. Milestone payments are negotiable.

9.0 Customer Furnished Equipment

Baron shall provide the RVP8 Signal Processor, Radar Control Processor, Receiver Subsystem, Microwave Assembly-from the klystron tube to the output shown in the drawing, and the pressurizer/dehydrator. The supplier shall install these components in the Transmitter. All other items shall be supplied by the transmitter vendor.