

NRL REQUIREMENTS
DOCUMENT FOR
PR# 57-6001-15
PULSE MAGNETRON TRANSMITTER

1. Scope

- a. This document establishes the performance, test and acceptance requirements for a compact, Ka-band magnetron transmitter, herein referred to as the KAM.

2. Requirements

a. Magnetron Mission Description

- i. The KAM shall be capable of installation, integration and operation in an airborne towed-body POD and is responsible for the synthesis of pulsed, high-power Ka-band transmissions. The various configurations of the towed-body POD are shown in Figure 1. The KAM shall provide status and shall receive and accept configuration and operation commands through a serial communications link.

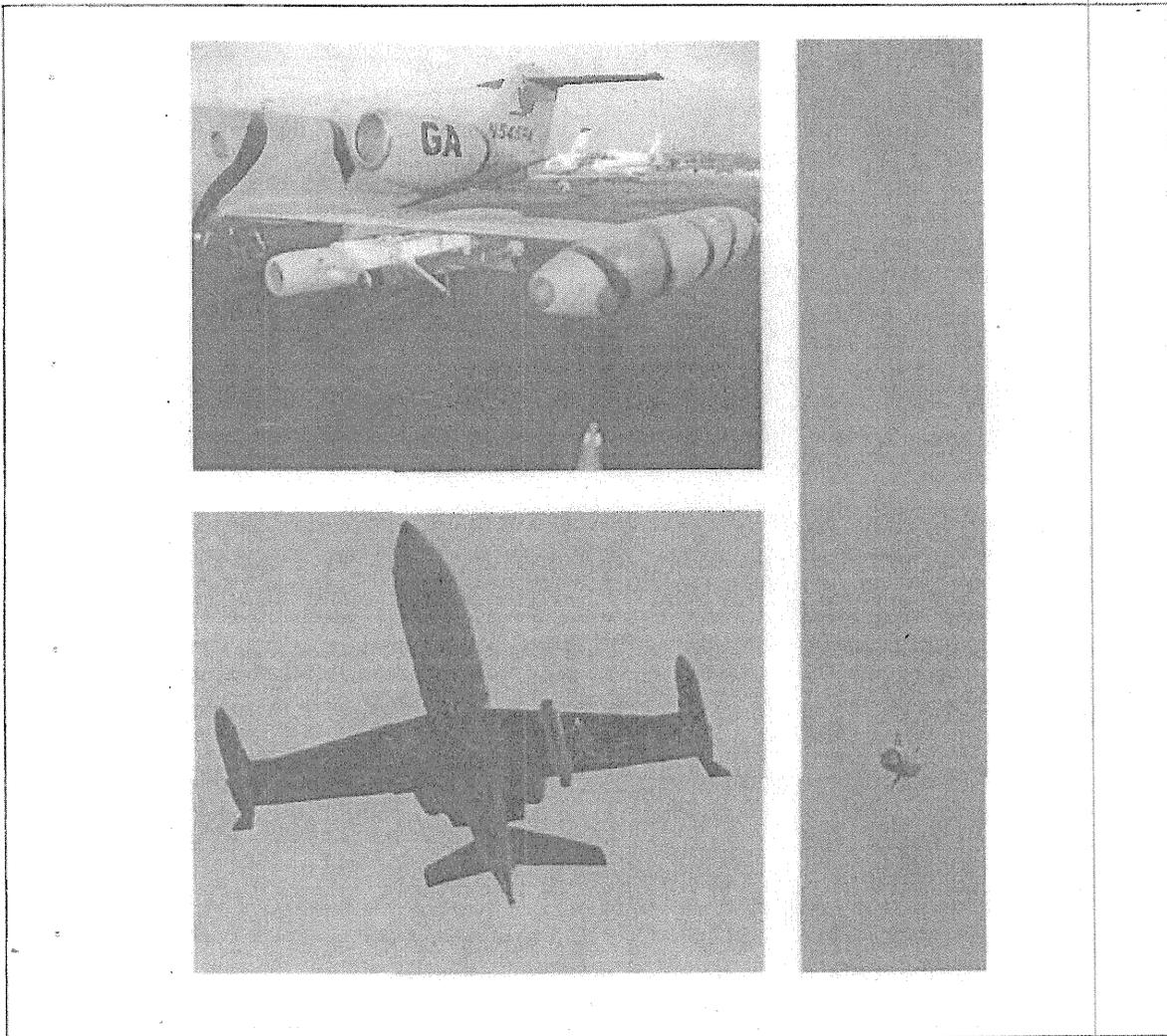


Figure 1 - Towed-body POD in pre-flight, stowed, and operational configurations

b. Interface

i. RF

1. The KAM shall couple its RF output transmissions to a WR-28 waveguide flange specified by NRL.

ii. Electrical

1. The KAM shall receive external power through a MIL-SPEC rated connector (e.g. MIL-DTL-38999 circular connectors).

iii. Communications

1. The KAM shall receive configuration and operation commands through a MIL-SPEC connector. These commands shall be conveyed via an RS-422 serial protocol. The configuration commands shall determine the pulse width and pulse repetition interval of the KAM RF output transmissions. The KAM shall report readiness and failure states through the RS-422 serial protocol. The KAM shall enable RF output transmissions through the RS-422 serial protocol. The KAM shall immediately respond to RS-422 commands to terminate RF radiation.

iv. External Mechanical

1. The external mechanical interface for the KAM shall conform to specifications provided by NRL. The mechanical interface shall enable direct installation into NRL selected platforms using existing mounting holes.

c. Performance Requirements

i. Frequency Range

1. The KAM shall be capable of generating RF transmissions at $35.0 \text{ GHz} \pm 0.5 \text{ GHz}$.

ii. Power

1. The KAM shall have a peak power of $20 \pm 2.5 \text{ kW}$.

iii. Pulse Width

1. The KAM shall generate pulsed RF transmissions with a pulse width of 500 ns. The rise and fall time of the pulse shall be consistent with typical magnetron standards.

iv. Pulse Repetition Interval

1. The KAM shall generate pulsed RF transmissions based on the response to an external LVTTTL signal trigger. The KAM shall support pulse repetition intervals between 600 and 1,000 μs . The KAM shall generate pulsed transmissions in a consistent fashion and the timing jitter with respect to pulse generation shall not exceed 50 ns.

d. Primary Power

- i. The KAM shall be capable of operating using $28 \pm 4 \text{ VDC}$ standard aircraft power. The KAM shall require less than 100 W to operate.
- ii. Low Voltage Protection

1. The KAM shall not be damaged by primary power voltages less than 23 VDC.

3. Physical Characteristics

- a. Weight
 - i. The KAM shall not exceed a total weight of 9.0 pounds.
- b. Dimensions
 - i. The KAM shall conform to and not exceed the outline and dimensions shown in Figure 2 (Figure units are in inches).
- c. Finish
 - i. The KAM shall incorporate corrosion preventative measures such as paint or surface treatment (conversion coating, anodize, passivation) to prevent base material oxidation or galvanic corrosion.
- d. Environmental Conditions
 - i. The KAM shall not exhibit any temporary or permanent degradation as the result of exposure to any of the following environments:
 1. Temperature-altitude: Barometric pressure reduced to the equivalent of 25,000 feet altitude and -40 degrees Celsius temperature.
MIL-STD-810G, METHOD 520.3
 2. Vibration: Random vibration at 10 to 2,000 Hz and +10 Gravity Units (g) Root Mean Square (RMS). Vibration isolators shall not be used.
MIL-STD-810G, METHOD 514
 3. Shock: Acceleration pulses at 15 g levels with a duration of 11 ms in all axes in both directions. Shock isolators shall not be used.
MIL-STD-810G, METHOD 516.6
 4. Humidity: An atmosphere containing 95% or greater relative humidity at temperatures ranging from +28 to +55 degrees Celsius temperature.
MIL-STD-810G, METHOD 504.1
 5. Storage Temperature: Temperatures ranging from -54 to +71 degrees Celsius.
 6. Operating Temperature: Temperatures ranging from -40 to +71 degrees Celsius.
 7. Thermal Shock: Temperatures ranging from -55 to +71 degrees Celsius.
MIL-STD-810G, METHOD 503.5

- e. Shelf Life
 - i. The KAM shall be designed to function and operate as required herein, following a storage period of one year in normally available NRL storage facilities at temperatures varying from -54 to +71 degrees Celsius and relative humidity ranging from 15 to 95 percent.
 - f. Reliability
 - i. Reliability testing shall be conducted on the First Article Unit.
 - ii. Mean Time Between Failures (MTBF)
 - 1. The KAM shall have a MTBF exceeding 1,000 hours.
 - g. Design and Construction
 - i. Workmanship
 - 1. The contractor shall provide a quality assurance program for NRL approval. This method need not be complicated but shall describe how the contractor proposes to maintain control over the materials, processes, and workmanship in order to meet the performance requirements specified herein.
 - ii. Safety
 - 1. The KAM produced as specified in this document shall present no safety hazard to operating personnel.
 - iii. Human Performance and Human Engineering
 - 1. The KAM shall be constructed and configured to minimize human error during installation, operation, removal and maintenance.
4. Quality Assurance Provisions
- a. Responsibility for Inspection
 - i. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by NRL. NRL reserves the right to perform any of the inspections set forth in the requirements where such inspections are deemed necessary to assure the KAM conforms to prescribed requirements.
 - b. Inspection System
 - i. The contractor shall assure product conformance to the requirements, inspections and test specified herein.
 - c. Material Control Procedures
 - i. Material controls shall ensure that only conforming materials and articles are used. Materials and articles not conforming to or not required for the operation involved, shall be removed from the work operations. Positive action shall be taken to protect controlled processes or operations from contamination by residue from non-conforming materials and from previous operations.
 - d. Responsibility for Compliance

- i. The KAM shall meet all requirements of section 3. The inspection set forth in this document shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in this document shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to NRL for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit NRL to acceptance of defective or substandard material.
- e. Test Procedures
 - i. Separate test procedures shall be prepared for the first article and acceptance testing. The environmental and reliability test procedures shall be included as part of the first article test procedures as a separate section.
- f. Test Data
 - i. Detailed test data shall be prepared by the contractor. This data shall identify all rejections and corrective actions taken.
- g. First Article Tests
 - i. The first article sample shall be subjected to the inspections and tests agreed upon in the Acceptance Test Procedure (ATP) generated by the contractor and reviewed by NRL. All test shall be performed in the sequence specified in the approved test procedures. Unless specified in the approved test procedures, preventative maintenance or adjustments shall not be performed upon the KAM during the period of the test. The contractor shall prepare a first article test report.
- h. Quality Conformance Tests
 - i. Acceptance Tests
 - 1. Acceptance tests shall be conducted on each KAM offered for acceptance and agreed upon in the Acceptance Test Procedure (ATP) generated by the contractor and reviewed by NRL.
 - ii. Acceptance Test Data
 - 1. The contractor shall prepare acceptance test data sheets for each KAM offered for acceptance.
- i. Inspection and Test Methods
 - i. Details of methods and procedures shall be as specified in the approved test procedures.
 - ii. Performance Tests
 - 1. Performance tests shall be conducted on each KAM offered for acceptance and agreed upon in the Acceptance Test Procedure (ATP) generated by the contractor and reviewed by NRL.

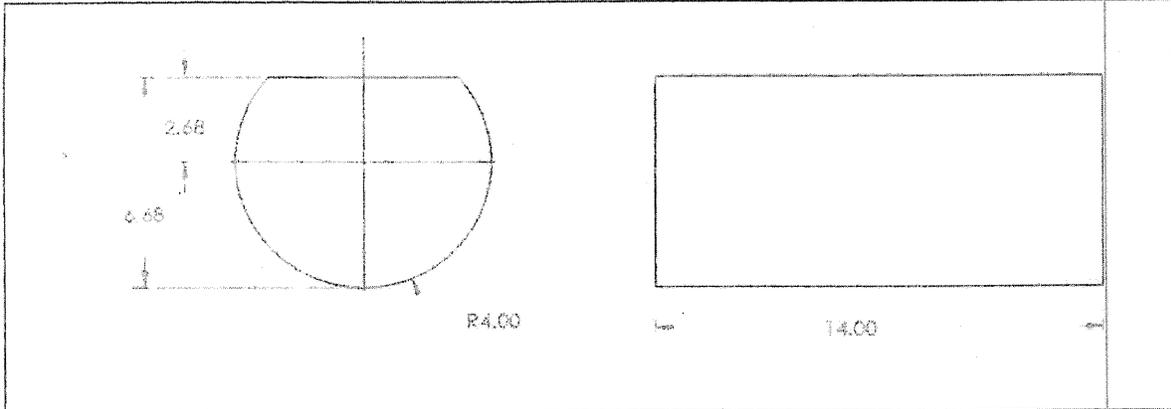


Figure 2 - Dimensions of Transmitter Enclosure (All Units in Inches)