Minimum specifications for a
turn-key far-field millimeter wave antenna measurement system

1.0 BACKGROUND

The Naval Research Laboratory (NRL) supports Millimeter Wave Antenna and Radar Cross Section (RCS) measurements at their Millimeter Wave Chamber at the NRL Washington DC.

NRL's Millimeter Wave Chamber is a direct illumination chamber with a 20 foot path distance between the transmitter and AUT positioners. The far-field millimeter wave antenna measurement system (The system) must be compatible with the following equipment currently installed in the chamber.

Positioner Controller:	ORBIT/FR AL-4806-3C Opt.1
AUT Positioner:	Roll Axis: ORBIT/FR AL-560-1P with a 2-40 GHz Rotary Joint
	AZ/El Axis: Scientific Atlanta 53230
Feed Positioner:	Scientific Atlanta 56160A

NRL is seeking to procure a turn-key, far-field, Millimeter Wave Antenna Measurement System to instrument their Millimeter Wave Chamber. The system shall support an expansion capability to perform RCS measurements in the future.

2.0 FAR-FIELD MILLIMETER WAVE ANTENNA MEASUREMENT SYSTEM

2.1 The system components may be mounted inside or outside of the chamber, as required. However, if the system includes rack-mounted components to be housed outside the chamber, a rack shall be provided to house them and must include additional space for the government's positioner controller. The positioner controller is 7" H x 19" W x 20"D and weighs 60 lbs.

2.2 The system must provide a continuous capability for Ka-Band (26.5 – 40 .0 GHz) and W-Band (75-110 GHz).

2.3 The system must support one reference channel and at least one test channel.

2.4 The system must have a minimum instantaneous sensitivity of -95 dBm from 26.5 - 40 GHz and 75 - 110 GHz.

2.5 Isolation between the reference and test channel: 95 dB or more.

2.6 The system must have a dynamic range of at least 80 dB.

2.7 The system must support swept frequency measurements with a 5 millisecond switching speed between phase-locked frequencies.

2.8 The system must support measurement speeds of 5000 points per second.

2.9 The system must include antenna analysis software. This software shall be capable of at least calculating beam peaks, beamwidths, side-lobe levels, noise filtering, and comparison analysis.

2.10 If the system includes a Microsoft Windows XP based computer work station hosting antenna acquisition and analysis software, the computer must conform to USG security policies which require background anti-virus (Symantec Corporate Edition) scanning and constant patching of the operating system. Thus, the vendor shall provide a Dell Precision Workstation computer with a minimum of two processors (two single or a dual-core) and at least 4GB of RAM that will be able to handle the USG security policies in addition to the antenna measurement and analysis applications.

2.11 The system must include at least a three-year commercial warranty.

3.0 TEST AND ACCEPTANCE PROCEDURES

3.1 Performance Verification of the system:

3.1.1 Thirty (30) calendar days after contract award, the contractor shall develop a system performance verification procedure that will test the overall system and the individual hardware subsystems delivered under this contract to the hardware specifications in Section 2.0 and to the manufactures specifications on each subsystem proposed for this system. The manufacturer's specification on each subsystem must be submitted at this time for Government review. The final performance verification procedures shall be approved by government.

3.2 Interoperability

3.2.1 The system will be subject to the following tests to demonstrate integration with government equipment and software and the ability to perform turn key antenna measurements.

3.2.2 The system will be calibrated against an NRL standard gain horn by boresighting the standard gain horn and then performing a frequency sweep of the horn. To test the repeatability, of the

system, a second sweep of the horn shall be performed without moving any antennas. Measured data must agree with the calibration data by +/- 0.05 dB in amplitude.

KA- Band: Sweep 26.5 to 40 in 10 MHz steps
W-Band: Sweep 75 to 110 GHz in 10 MHz steps

3.2.3 The system must create a test sequence where the following four patterns are taken of a Standard Gain Horn Antenna without operator intervention using the above calibration data.

Segment 1: -180° to -10° @ 1.0° step,
Segment 2: -10° to 10° @ 0.05° step
Segment 3: 10° to 180° @ 1.0° step
Pattern 1: Clockwise – E-Plane Cut (Source Pol: V, AUT Pol: V)
Pattern 2: Clockwise – E Plane Cut (Source Pol: H, AUT Pol: V)
Pattern 3: Counter-Clockwise – H-Plane Cut (Source Pol: H, AUT Pol: H)
Pattern 4: Counter-Clockwise – H-Plane Cut (Source Pol: V, AUT Pol: H)

Ka-Band Horn:
Segment 1: 26.5 – 35GHz, 0.5 GHz Steps
Segment 2: 35 – 36 GHz, 0.1 GHz Steps
Segment 3: 36 – 40 GHz, 0.5 GHz steps.

W-Band Horn:
Segment 1: 75 – 94 GHz, 0.5 GHz Steps
Segment 2: 94 – 95 GHz, 0.1 GHz Steps
Segment 3: 95 – 110 GHz, 0.5 GHz steps.

3.2.4 These measurements shall be repeated and a comparison analysis of the patterns shall be done. The patterns must agree in amplitude +/- 0.2 dB and in phase +/- 5 degrees. Exceptions will be granted for the null regions of the patterns.

4.0 DELIVERABLES

4.1 Antenna measurement system

4.2 Manufacturers documentation on the overall system and subsystems contained in paragraph 4.1

4.3 Manufacturers specifications on all systems and subsystems contained in paragraph 4.1

4.4 Performance Verification Test procedures for the overall system and the subsystems of paragraph 4.1