

Applied Research Associates, Inc. – FRN 0027803881
Application for Special Temporary Authorization (STS) to Perform MIL-STD-188-125
Continuous Wave Immersion Testing at White Sands Missile Range

Purpose of Special Temporary Authorization Application

This Special Temporary Authorization (STA) application is for the purpose of conducting MIL-STD-188-125 Volume 2 Continuous Wave Illumination Testing (CWI). The proposed CWI testing will be conducted at the AFEMPS and VEMPS facilities at White Sands Missile Range (WSMR). A map of the test location is shown below in Figure 1. As can be seen, the transmission will take place at coordinates 32° 20' 45.24"N, 106° 26' 59.85"W.



Figure 1: Location of temporary transmission site.

Our antenna system is fixed – we will only be transmitting at the location given in Figure 1.

There is a nearby airport, Condon AAF, located 3.5 km east of the test site. According to skyvector.com, this airport is “Closed Permanently” and “Unattended” so we have concluded Las Cruces International Airport is the nearest active air traffic. Figure 2 shows a screen capture from SkyVector giving the status of Condon AAF.

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Figure 2: Screen capture of skyvecotr.com listing for Condron AAF showing that it is "Closed Permanently" and "Unattended"

Testing at any given facility will be limited to 2 months in duration. Testing may be conducted during extended normal working hours from about 7:00 AM to 7:00 PM local time. However, hours may be adjusted to accommodate facility or spectrum management operational requirements.

This testing will be conducted under a U.S. Government Contract with the Defense Threat Reduction Agency. The following are the contractual details:

Contract Number: HDTRA1-14-D-0003-HDTRA1-18-F-0059

Contracting Officer Representative (COR):

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CWI TEST OVERVIEW

Continuous Wave Immersion (CWI) testing is a component of MIL-STD-188-125 Volume 1 and Volume 2 Verification Testing. CWI measures the attenuation of external electromagnetic fields by the facility's electromagnetic shield and/or its construction materials. CWI characterizes both the free field electromagnetic environment inside the facility and the currents coupled on facility cabling from that environment. It also provides a transfer function of the facility shielding for use in performing threat level extrapolations and other analysis.

The MIL-STD-188-125 Appendix C CWI test method shown in Figure 2 is essentially an insertion loss or attenuation measurement technique. A list of typical equipment used is shown in Table 1, and links to the manufacturers data sheets can be found in Section 4 Appendix A.

An initial measurement is made of the signal level from a receive sensor (B-dot or D-dot) positioned at a known distance in free space (over ground) from a transmitting antenna. This measurement of free field path loss becomes the "Reference" or "Calibration" measurement. The receive sensor is then placed within the facility under test and the measurement is repeated, keeping the same equipment configuration, transmit power, and transmit/receive antenna/sensor orientation and spacing as with the "Reference" measurement. The quotient of the "Reference" signal power over the measured facility internal signal power represents the attenuation or transfer function of the facility.

Testing is conducted in both the horizontal and vertical polarizations of the transmitting antenna, which remains pointed at the ground.

MIL-STD-188-125 Requirements

Table 1 describes the basic CWI testing requirements from MIL-STD-188-125-2 C. More information is given on page 110 of this standard.

Table 1: CWI testing requirements from MIL-STD-188-125-2 Appendix C. This is a copy of table C-I on page 110 of the standard.

Equipment	Characteristics
Network Analyzers or Equivalent	100 kHz - 1 GHz; minimum sensitivity as required for measurement sensitivity
Power Amplifiers ¹	100 kHz - 1 GHz; power output as required for dynamic range
Antennas ²	100 kHz - 1 GHz
Sensors	100 kHz - 1 GHz; free-field, surface current density, and current
Preamplifiers ³	100 kHz - 1 GHz; amplification and noise figure as required for measurement sensitivity
Data Recorder	Multichannel
Computer and GPIB Control Interfaces ⁴	As required
Fiber Optic Links ⁵	100 kHz - 1 GHz; up to 100 m in length
Instrumentation Shield (or Van) and Power Supplies	As required
Miscellaneous Cables, Attenuators, and Coaxial Switches	As required

The transmitting antennas will be mounted to a telehandler that will be rented onsite. A diagram of this is setup is shown in Figure 3.

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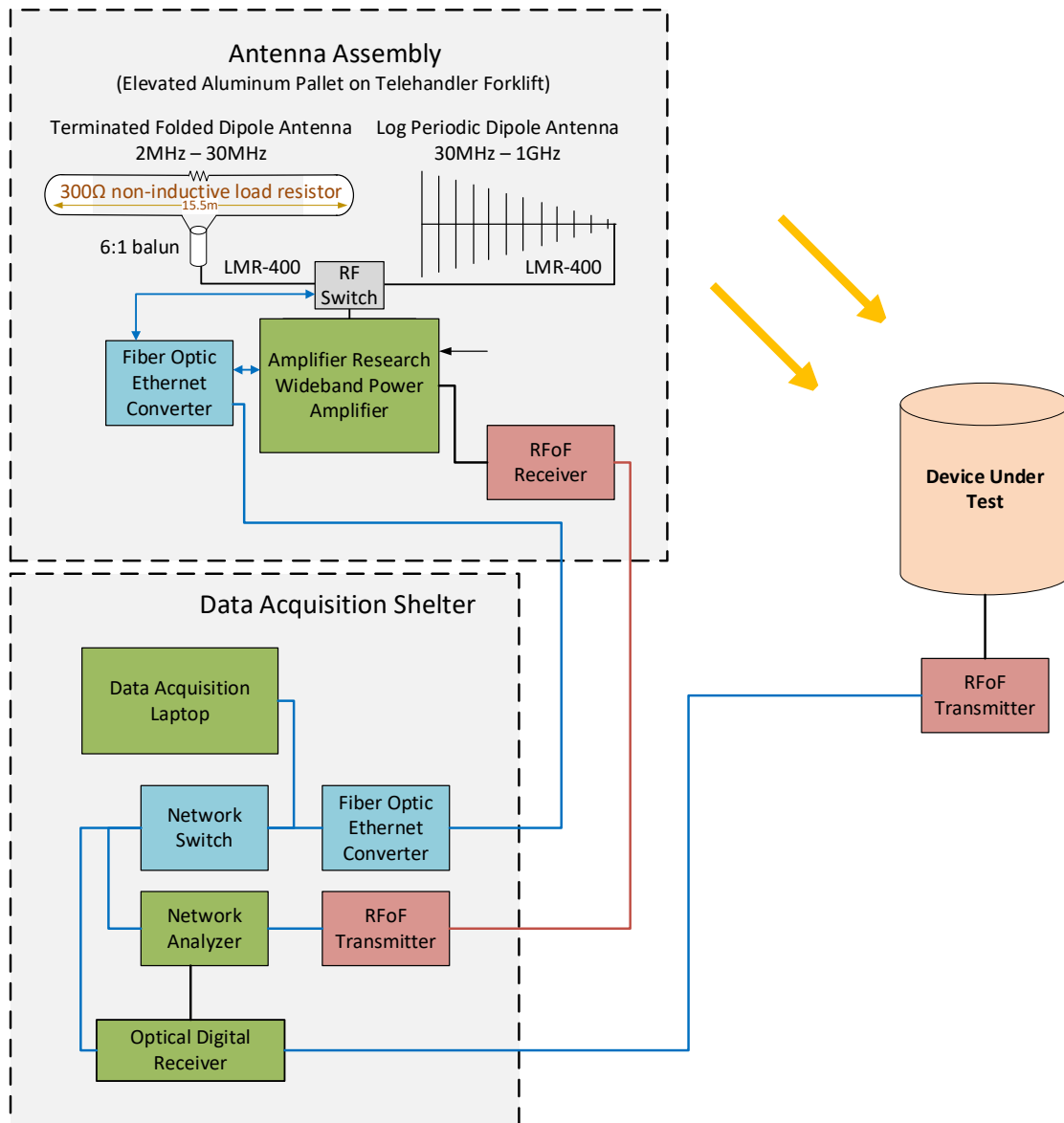


Figure 3: Simplified diagram of the CWI experimental setup.

The radiated frequencies are logarithmically spaced between 100 kHz and 1 GHz. This range may be further divided into two or more ranges, each typically composed of 1601 discrete frequencies. The time spent transmitting at any one frequency is small, typically tens of milliseconds. The ERP of the antenna is 650 watts. Table 2 gives an example of two frequency ranges that may be used during testing and estimates the dwell time per frequency. The FCC emission type is NON.

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Table 2: Example frequency bands for CWI testing and maximum number of frequencies in each band (4 band case). Measured “sweep” times using Rohde&Schwarz ZNBT 8 VNA using 1601 stepped frequency points, 30Hz IF bandwidth and automatic sweep time (based on IF bandwidth).

Frequency Range		Number of Points	Sweep Time (Linear)	Dwell Time / Frequency	Sweep Time (Log)	Dwell Time / Frequency
100kHz	30MHz	1601	52 seconds	32.5 ms	52 seconds	32.5 ms
30MHz	1GHz	1601	52 seconds	32.5 ms	52 seconds	32.5 ms

The CWI antenna assembly is raised such that the tip of the LPDA is 14 m above the ground, a distance of 38 m to the target on the ground, and a transmit angle of 20° is found. This is shown in Figure 4.

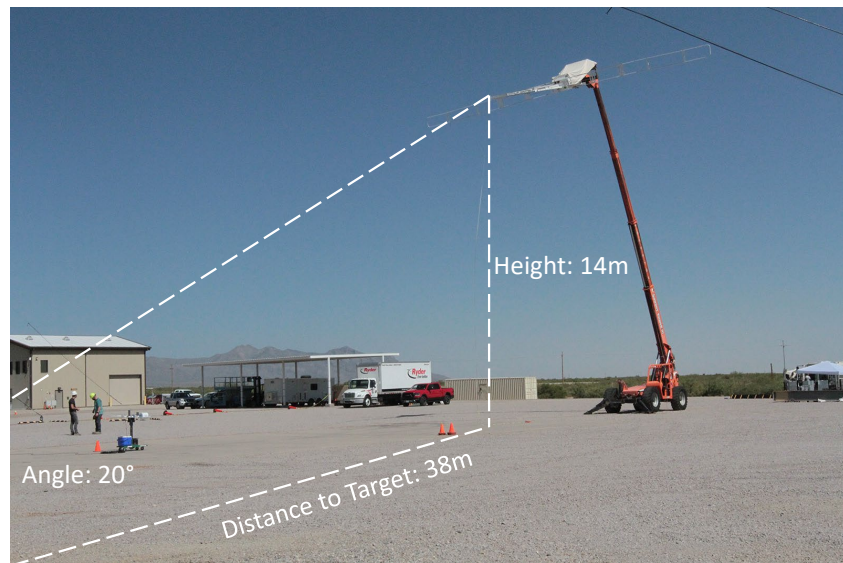


Figure 4: The tip of the CWI antenna is 14 m above the ground and 38 m away from the target on the ground. This yields an angle of 20 degrees.

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1. APPENDIX A MANUFACTURER'S DATA SHEETS FOR TRANSMITTER COMPONENTS

The manufacturer's data sheet for the Rohde&Schwarz ZNBT 8 VNA can be found [here](#).

The manufacturer's data sheet for the Amplifier Research 100U1000 power amplifier can be found [here](#).

The manufacturer's data sheet for the Amplifier Research 10W1000 power amplifier can be found [here](#).

The manufacturer's data sheet for the United States Antenna Products LP1018BA Log Periodic antenna can be found [here](#).

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2. APPENDIX B EXCLUSION FREQUENCIES

AFTRCC, AAG and MAG Exclusion Frequencies		
AFTRCC Individual Frequencies ($\pm 2.8\text{kHz}$ required, $\pm 5\text{kHz}$ proposed guard band)		
2.851MHz		
3.004MHz		
3.281MHz		
3.443MHz		
5.451MHz		
5.469MHz		
5.571MHz		
6.550MHz		
8.822MHz		
10.045MHz		
11.288MHz		
11.306MHz		
13.312MHz		
17.964MHz		
21.931MHz		
AFTRCC Frequency Bands ($\pm 12.5\text{kHz}$ required, $\pm 25\text{kHz}$ proposed guard band)		
From	To	
123.1125MHz	123.2875MHz	
123.3125MHz	123.5875MHz	
MAG Frequency Bands ($\pm 25\text{kHz}$ proposed guard band)		
From	To	
225.000MHz	328.600MHz	
335.400MHz	399.900MHz	
AAG Frequency Bands (+ 25kHz proposed guard band)		
From	To	
190kHz	285kHz	Inclusive
285kHz	435kHz	
510kHz	535kHz	Inclusive
74.800MHz	75.200MHz	
108.000MHz	122.6875MHz	Inclusive
123.5875MHz	128.8125MHz	Inclusive
132.0125MHz	137.000MHz	Inclusive
328.600MHz	335.400MHz	
978MHz	1020MHz	ARA will not transmit above 975MHz