# Test Report:
**ATEMC000028**

# Applicant:
**Arrista Technologies Inc.**
**5-55 Henlow Bay**
**Winnipeg, MB, CA**
**R3Y 1G4**

# Equipment Under Test (EUT):
**Performance of the**
**ARRISTA TECHNOLOGIES, INC.**
**3M Semi-Anechoic Chamber**
**as tested May, 2003**

# In Accordance with:
**ANSI C63.4:1992 requirements.**

Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

## TEST LAB PERSONNEL:

| Test Performed by: | Date | Signature |
|---|---|---|
| **Paul Eberling, CNA Electronic Technologist** | **May, 2003** | |
| **Elwood Friesen, Electronic Technologist** | **May, 2003** | |

**All information contained in and/or disclosed in this document is considered confidential information of Arrista Technologies Incorporated. Reproduction and distribution of this document in whole or part is strictly prohibited without the written consent of Arrista Technologies Incorporated.**

## APPROVALS:

| Date | Name | Title | Signature |
|---|---|---|---|
| May, 2003 | Roman Wroczynski | **Director,** Development & Test | |


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

# Table of Contents

1. INTRODUCTION ..... 5
1.1. Introduction to the Arrista Technologies, Inc. 3m Chamber ..... 5
1.2. Location of the Arrista Technologies, Inc. 3m Chamber ..... 5
1.3. PHYSICAL LAYOUT AND THE SITE DESCRIPTION ..... 6
1.4. Shielded Enclosures ..... 6
1.5. Fire Protection System ..... 7
1.6. Turntable and Ground Plane ..... 7
1.7. Antenna Mast ..... 7
1.8. Power Facilities ..... 8
1.9. Control Area ..... 8
1.10. Anechoic Absorbers ..... 8
1.11. Quiet Zone and Test Range Position ..... 8
2. NORMALIZED SITE ATTENUATION TEST METHOD PER ANSI C63.4-1992 ..... 9
2.1. 3.1 Test Method ..... 9
2.2. Measured Data ..... 9
3. TEST EQUIPMENT LIST ..... 10
4. Test Results ..... 12
5. Appendix A – Site Photos ..... 16
6. Appendix B – Lab Floor Plan ..... 22


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

# Table of Figures

Article 01 - Photo of Arrista Facility ..... 6
Article 02 - Table  Test Equipment ..... 10
Article 03 - Test Setup, NSA, Horizontal Polarization ..... 11
Article 04 - Table – Primary 3m Range; Measured NSA Results, Vertical Polarization ..... 12
Article 05 - ..... 13
Article 06 - ..... 13
Article 07 - Table– Primary 3m Range; Measured NSA Results, Horizontal Polarization ..... 14
Article 08 - ..... 15
Article 09 - ..... 15
Article 10 - 3m Semi-anechoic chamber, Exterior view ..... 16
Article 11 - 3m semi-anechoic chamber, interior view ..... 17
Article 12 - Turntable Location ..... 17
Article 13 - EMCO Turntable with wooden tabletop ..... 18
Article 14 - Power Filters ..... 18
Article 15 - EMCO Mast Detail ..... 19
Article 16 - Adjacent Shielded Control Room ..... 20
Article 17 - Pre-Action Fire Protection System ..... 21


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

# 1. INTRODUCTION

## 1.1. INTRODUCTION TO THE ARRISTA TECHNOLOGIES, INC. 3M CHAMBER

In May of 2003, Arrista Technologies, Inc. (Arrista) in Winnipeg, Manitoba, Canada, completed the Normalized Site Attenuation measurement on the 3m indoor, shielded, semi-anechoic chamber. The chamber was constructed by Rantec Division of EMC Test Systems, L.P., with the capability of measuring Class B electronic devices that must comply with FCC Rules Part 2 section 2.948 and Industry Canada Interference-Causing Equipment Standard ICES-003.

This report describes the evaluation of the Arrista Technologies Inc. 3m Semi-anechoic chamber located at 5-55 Henlow Bay, Winnipeg, Manitoba. It is used to measure radiated emissions from electrical and electronic equipment.

This site complies with the requirements of Radio Standard Procedure 100, Issue 7. The Normalized Site Attenuation measurements were made during May of 2003.

## 1.2. LOCATION OF THE ARRISTA TECHNOLOGIES, INC. 3M CHAMBER

The 3m Chamber of Arrista Technologies, Inc. is located at:

5-55 Henlow Bay
Winnipeg, Manitoba
Canada R3Y 1G4
Attn: Mr. Roman Wroczynski
Tel: 204-489-3200
Fax: 204-489-8300

The floor space is comprised of three bays (bays 4, 5 & 6) of the 6 bay building, with approximately 12,600 sq. ft. of manufacturing and laboratory space, and 7,800 sq. ft. of office space. The facility is located in the southwest corner of Winnipeg, east of Route 90 and north of Bishop Grandin Blvd., and is 15 minutes from the Winnipeg International Airport.


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 01 - Photo of Arrista Facility**

The Product Compliance and Test (PCT) Lab occupies 2500 sq. ft of floor space in Bay 6 of the building. The lab includes a 3m semi-anechoic shielded chamber and control room as well as test benches, environmental chambers and equipment racks and storage.

## 1.3. PHYSICAL LAYOUT AND THE SITE DESCRIPTION

## 1.4. SHIELDED ENCLOSURES

The EMC radiated test facility consists of a RF-shielded enclosure. The interior shield to shield dimensions of the indoor semi-anechoic chamber are approximately 28 feet long by 20 feet wide by 18 feet high and consist of rigid, steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. The framing/joining system channels are made of 1/8 inch zinc plated steel, and have serrations running lengthwise along each side of the contacting surface. Screw fasteners, 4 inches on center, are zinc-plated and fasten the steel framing to the modular panels, thus forming the shielded enclosure. At all corner intersections of walls, floor or ceiling, a specially fabricated one-piece corner section completes the assembly. See Appendix A – Site Photos.


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

Lighting in the semi-anechoic chamber within the shielded enclosure is RF-filtered. In the semi-anechoic chamber, lighting consists of four (4) corner-mounted incandescent floodlight fixtures. A swing type shielded door is provided for personnel and equipment access into the semi-anechoic chamber. Door specifications are:

- Chamber door 4' X 7' Brass Knife 100 dB Swing (single leaf)
- Control room door 3' X 7' Brass Knife 100 dB Swing (single leaf)

HVAC is provided by four honeycomb wave-guide air vents mounted in the chamber's ceiling. The semi-anechoic chamber is capable of meeting RF attenuation levels of over 100dB throughout the frequency range of 30 MHz to 10 GHz, so that testing performed within the chamber does not interfere with other testing activities at the facility, and vice-versa.

## 1.5. FIRE PROTECTION SYSTEM

Arrista has implemented a high volume pre-action fire suppression system for the protection of the test chamber as well as equipment and occupants. The chamber is a self-contained fire protection zone with two stages of warning before the sprinkler system discharges. This ensures the safety of employees and customers of the laboratory. In order to isolate the chamber from the grounding problems associated with connecting to the city water supply, dielectric fittings were used to isolate the fire suppression system from the main water feed. See Appendix A – Site Photos.

## 1.6. TURNTABLE AND GROUND PLANE

The turntable is an electrically driven EMCO Model 2081-2.03 metal top turntable with two-meter diameter and capable of supporting a uniformly distributed load of up to 3300 lb. The turntable is grounded around its circumference with continuous metallic brush to the semi-anechoic chamber floor by a grounding ring. The electrically driven turntable does not introduce conducted or radiated electrical noise above the ambient levels existing with the chamber. The turntable rotation is controlled by an EMCO Model 2090 Multi-device Controller with IEEE-488 data/control for automation.

Interconnecting cables may be routed along an access area through the turntable's center bearing. A sleeve is provided to prevent the cables from rubbing against the main bearing when the turntable is in motion. The chamber's sixteen inch raised ground plane consists of a continuous metallic surface with vinyl top surface finishing. See Appendix A – Site Photos.

## 1.7. ANTENNA MAST

An EMCO Model 2075-2 electrically powered, air-polarized, antenna tower mast is used in the chamber. This mast features computerized remote control of both the scanning height


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

and the antenna polarization. The EMCO Model 2090 Multi-device Controller controls the mast manually or with IEEE-488 data/control for automation. See Appendix A – Site Photos.

## 1.8. POWER FACILITIES

Power is supplied on separate circuits to the chamber and control area. All power filters provide a minimum of 100 dB attenuation over a frequency range of 14 kHz to 10 GHz when tested per MIL STD 220A. Seven (7) ULW-2x30 amp, 60 Hz, UL-listed power-line filters are provided for the chamber and control room. See Appendix A – Site Photos.

## 1.9. CONTROL AREA

The control area is a shielded enclosure made of the same construction as the semi-anechoic chamber with dimensions of 10 feet by 10 feet by 8 feet. Three shielded conduits provide access for RF, fiber optic and control cables to enter the chamber. See Appendix A – Site Photos.

## 1.10. ANECHOIC ABSORBERS

Rantec Division of EMC Test Systems provided anechoic treatment for the chamber sufficient to achieve the requirements of ANSI C63.4 1992 at 3 meter distance. The anechoic design consists of broadband hybrid EMC absorber, *FerroSorb*⇔, designated as *FS-400* by Rantec, covering the endwall behind the turntable and a specular region of the ceiling and *FS-600* covering a specular region of each sidewall. The absorbing material is a combination of dielectric foam absorber and magnetic ferrite tile materials. The remaining wall and ceiling areas are treated with Rantec's *FT-1000 and FT-1500* ferrite tile absorber material.

## 1.11. TEST RANGE POSITION

The axis of the chamber's primary 3 meter test range is positioned from the turntable's center to a point 8 feet 4 inches from the chamber's wall (door side).


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

# 2. NORMALIZED SITE ATTENUATION TEST METHOD PER ANSI C63.4-1992

## 2.1. 3.1 TEST METHOD

The received signal is maximized while the receive antenna is scanning from 1 to 4 meters. The maximum received signal during height scan is used to compute the Normalized Site Attenuation.

$$NSA(dB) = V_{direct} - V_{max\ received} - AF_{Tx} - AF_{Rx}$$

Where:

$V_{direct}$ = *reference signal level in dBµV/meter with cables connected directly*
$V_{max\ received}$ = *maximum received signal level in dBµV/meter during height scan*
$AF_{Tx}$ = *antenna factor of the transmitting antenna in dB / meter.*
$AF_{Rx}$ = *antenna factor of the receiving antenna in dB / meter.*

## 2.2. MEASURED DATA

The measurement is performed using the discrete frequency method. Vdirect is obtained with the two coaxial cables connected to each other. Vsite is obtained with each dipole antenna tuned to the applicable test frequency and with the receive antenna adjusted for maximum received signal. The 6 dB padding attenuators are used to minimize impedance mismatch.
The test data for the primary test range at 3m test distance with two (2) meter diameter test volume showed a better than ±2.5dB normalized site attenuation deviation from the theoretical NSA derived from an ideal open test site. All normalized site attenuation test data at all test positions derived from the measurements in the semi-anechoic chamber are within ±4 dB deviation from theoretical NSA derived from an ideal open test site.


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

# 3. TEST EQUIPMENT LIST

Test equipment for conducting normalized site attenuation test is shown in the following table. All instrumentation is calibrated on a yearly basis, usually by manufacturers. The antennas are calibrated in accordance with ANSI C63.5-1988. All instrument and antenna calibrations are traceable to NIST.

Test equipment used for measuring Normalized Site Attenuation:

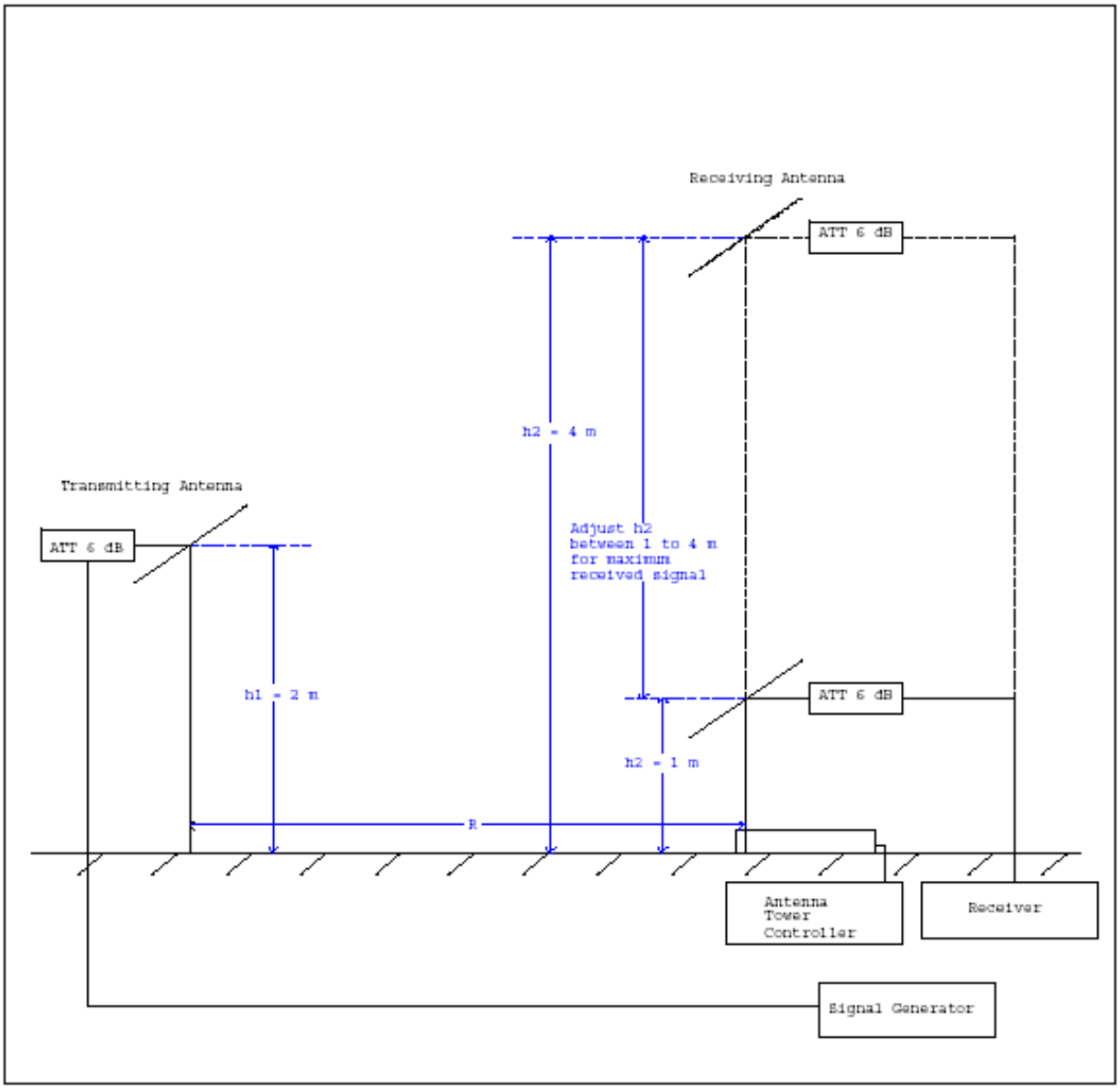
**Article 02 - Table Test Equipment**

| Manufacturer | Model Number | Description | Serial No. | Last Cal Date | Cal Interval |
|---|---|---|---|---|---|
| EMCO | 2090 | Turntable and Mast Controller | 9812-1384 | NCR | NCR |
| EMCO Mini-Mast | 2075-2 | Antenna Mast | 9812-2208 | NCR | NCR |
| Schaffner-Chase | CBL6112A | Bilog EMC Antenna (30-2000MHz) | 2308 | 01/29/2003 | Annual |
| EMCO | 2081-2.03 | Metal Top Turntable | N/A | NCR | NCR |
| Hewlett Packard | 8648C | Signal Generator (9kHz to 3200MHz) | 3623A0420B | 07/04/2001 | Bi-Annual |
| EMCO | 3121C | Dipole Antenna | 9809-1407 | NCR | |
| Hewlett Packard | HP8560E | Spectrum Analyzer | 385057F | 08/13/2002 | Bi-Annual |

NCR: No Calibration Required


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 03 - Test Setup, NSA, Horizontal Polarization**





Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

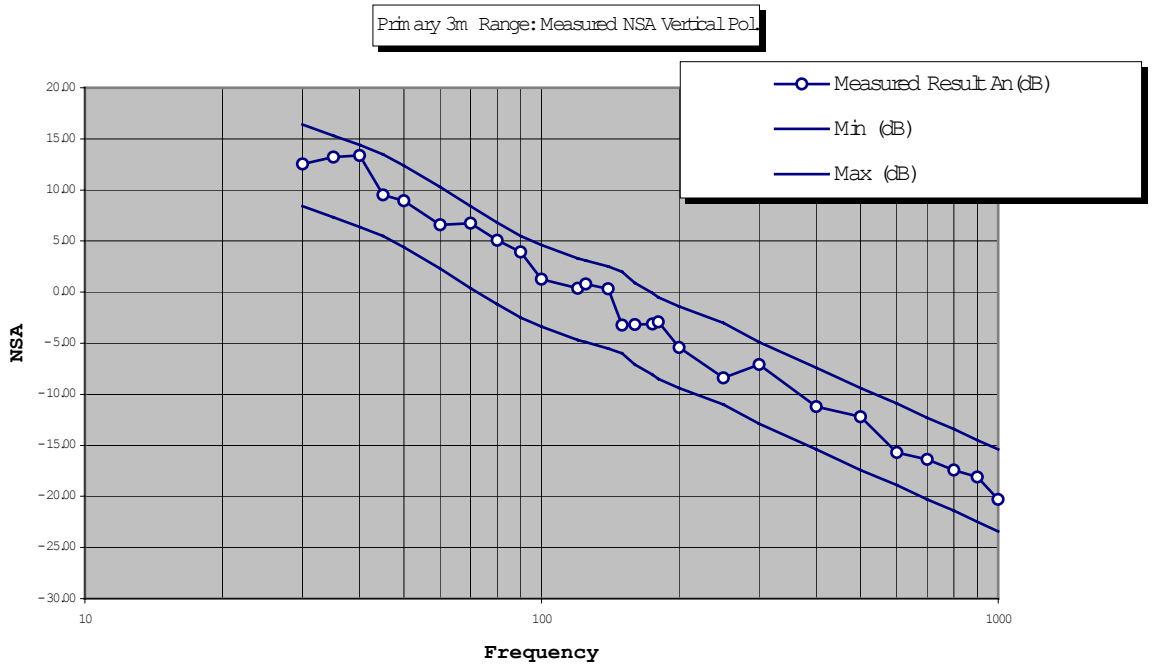
# 4. TEST RESULTS

**Article 04 - Table – Primary 3m Range; Measured NSA Results, Vertical Polarization**

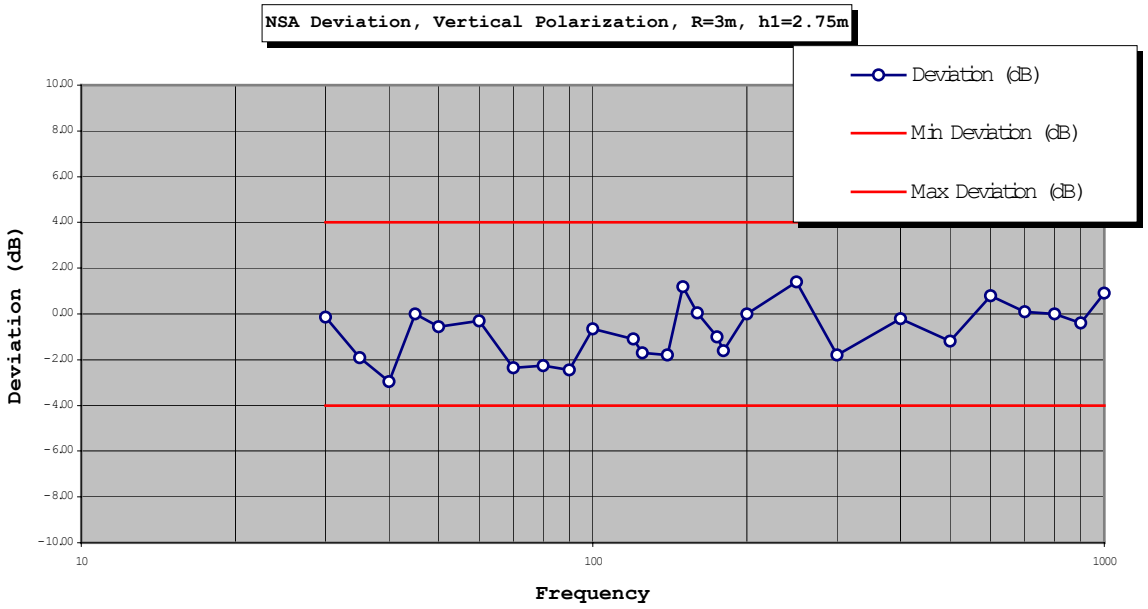
| Freq (MHz) | Vdirect (dBuV) | Vmax (dBuV) | AFTx (dB) | AFRx (dB) | AFCorr (dB) | Measured Result An(dB) | Ideal NSA (dB) | Deviation (dB) | Min (dB) | Max (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 30.00 | 93.30 | 63.50 | -2.50 | 18.30 | 2.90 | 12.55 | 12.40 | -0.15 | 8.40 | 16.40 |
| 35.00 | 93.20 | 65.10 | -1.30 | 14.90 | 2.60 | 13.20 | 11.30 | -1.90 | 7.30 | 15.30 |
| 40.00 | 93.10 | 66.70 | -0.30 | 12.30 | 2.10 | 13.35 | 10.40 | -2.95 | 6.40 | 14.40 |
| 45.00 | 93.00 | 71.50 | 1.10 | 10.10 | 1.60 | 9.50 | 9.50 | 0.00 | 5.50 | 13.50 |
| 50.00 | 93.00 | 73.40 | 1.80 | 8.10 | 1.50 | 8.95 | 8.40 | -0.55 | 4.40 | 12.40 |
| 60.00 | 92.80 | 74.70 | 4.50 | 6.00 | 2.00 | 6.60 | 6.30 | -0.30 | 2.30 | 10.30 |
| 70.00 | 92.40 | 75.20 | 4.20 | 5.50 | 1.50 | 6.75 | 4.40 | -2.35 | 0.40 | 8.40 |
| 80.00 | 92.30 | 74.00 | 5.70 | 7.10 | 0.90 | 5.05 | 2.80 | -2.25 | -1.20 | 6.80 |
| 90.00 | 92.30 | 71.50 | 7.20 | 9.30 | 0.70 | 3.95 | 1.50 | -2.45 | -2.50 | 5.50 |
| 100.00 | 92.10 | 70.30 | 9.20 | 11.30 | 0.10 | 1.25 | 0.60 | -0.65 | -3.40 | 4.60 |
| 120.00 | 91.80 | 68.00 | 10.50 | 13.00 | -0.20 | 0.40 | -0.70 | -1.10 | -4.70 | 3.30 |
| 125.00 | 91.80 | 67.50 | 10.60 | 13.00 | -0.20 | 0.80 | -0.90 | -1.70 | -4.90 | 3.10 |
| 140.00 | 91.50 | 67.00 | 11.30 | 12.80 | 0.20 | 0.30 | -1.50 | -1.80 | -5.50 | 2.50 |
| 150.00 | 91.30 | 70.50 | 11.80 | 12.00 | 0.40 | -3.20 | -2.00 | 1.20 | -6.00 | 2.00 |
| 160.00 | 91.30 | 70.80 | 12.30 | 11.10 | 0.50 | -3.15 | -3.10 | 0.05 | -7.10 | 0.90 |
| 175.00 | 91.30 | 71.00 | 12.70 | 10.80 | -0.20 | -3.10 | -4.10 | -1.00 | -8.10 | -0.10 |
| 180.00 | 91.20 | 70.80 | 13.00 | 10.50 | -0.40 | -2.90 | -4.50 | -1.60 | -8.50 | -0.50 |
| 200.00 | 91.00 | 71.80 | 14.30 | 10.30 | 0.00 | -5.40 | -5.40 | 0.00 | -9.40 | -1.40 |
| 250.00 | 90.50 | 69.50 | 16.90 | 12.50 | 0.00 | -8.40 | -7.00 | 1.40 | -11.00 | -3.00 |
| 300.00 | 90.20 | 66.00 | 17.80 | 13.50 | 0.00 | -7.10 | -8.90 | -1.80 | -12.90 | -4.90 |
| 400.00 | 89.30 | 63.50 | 21.10 | 15.90 | 0.00 | -11.20 | -11.40 | -0.20 | -15.40 | -7.40 |
| 500.00 | 88.70 | 61.20 | 22.40 | 17.30 | 0.00 | -12.20 | -13.40 | -1.20 | -17.40 | -9.40 |
| 600.00 | 88.00 | 60.00 | 24.50 | 19.20 | 0.00 | -15.70 | -14.90 | 0.80 | -18.90 | -10.90 |
| 700.00 | 87.50 | 58.90 | 25.70 | 19.30 | 0.00 | -16.40 | -16.30 | 0.10 | -20.30 | -12.30 |
| 800.00 | 87.00 | 57.70 | 26.80 | 19.90 | 0.00 | -17.40 | -17.40 | 0.00 | -21.40 | -13.40 |
| 900.00 | 86.50 | 56.50 | 27.70 | 20.40 | 0.00 | -18.10 | -18.50 | -0.40 | -22.50 | -14.50 |
| 1000.00 | 85.80 | 56.00 | 29.10 | 21.00 | 0.00 | -20.30 | -19.40 | 0.90 | -23.40 | -15.40 |


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 05 -**




**Article 06 -**





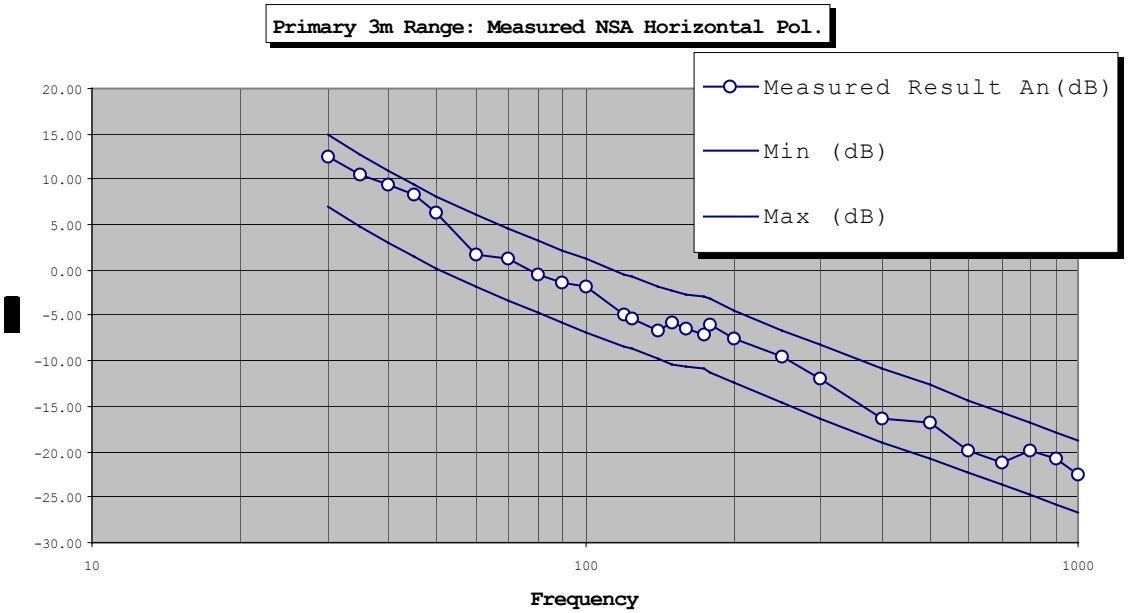
Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 07 - Table– Primary 3m Range; Measured NSA Results, Horizontal Polarization**

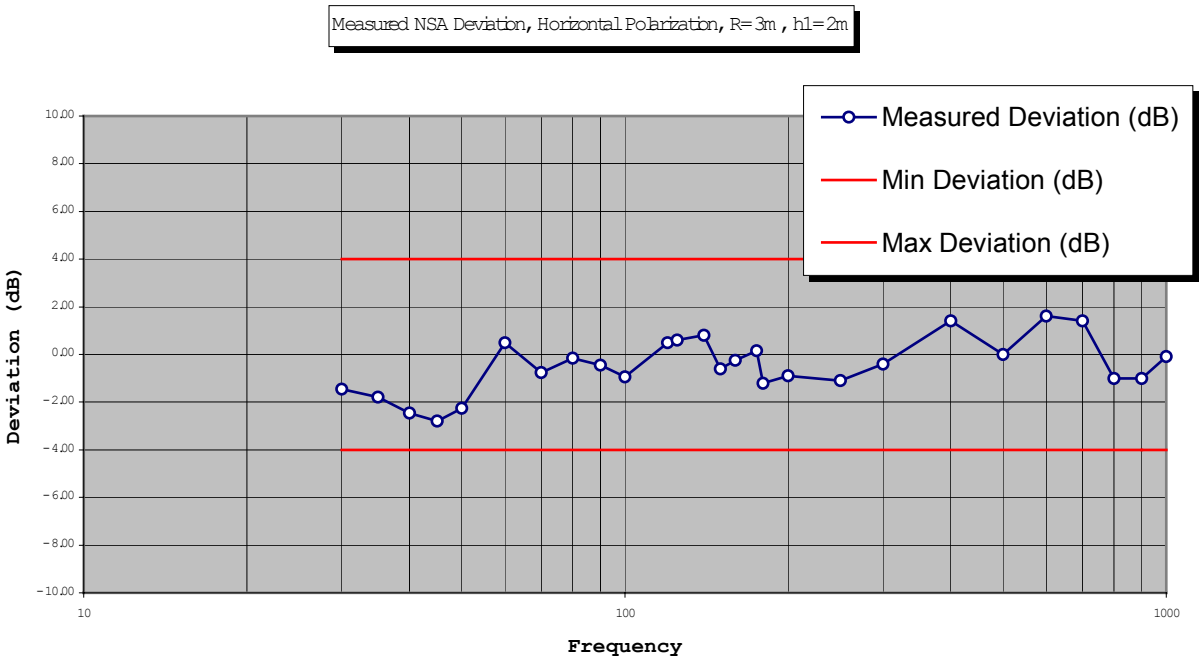
| Freq (MHz) | Vdirect (dBuV) | Vmax (dBuV) | AFTx (dB) | AFRx (dB) | AFCorr (dB) | Measured Result An(dB) | Ideal NSA (dB) | Measured Deviation (dB) | Min (dB) | Max (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 30.00 | 93.30 | 62.40 | -2.50 | 19.50 | 2.90 | 12.45 | 11.00 | **-1.45** | 7.00 | 15.00 |
| 35.00 | 93.20 | 65.30 | -1.30 | 17.30 | 2.60 | 10.60 | 8.80 | **-1.80** | 4.80 | 12.80 |
| 40.00 | 93.00 | 68.50 | -0.30 | 14.30 | 2.10 | 9.45 | 7.00 | **-2.45** | 3.00 | 11.00 |
| 45.00 | 93.00 | 71.30 | 1.10 | 11.50 | 1.60 | 8.30 | 5.50 | **-2.80** | 1.50 | 9.50 |
| 50.00 | 92.90 | 75.00 | 1.80 | 8.90 | 1.50 | 6.45 | 4.20 | **-2.25** | 0.20 | 8.20 |
| 60.00 | 92.80 | 79.00 | 4.50 | 6.60 | 2.00 | 1.70 | 2.20 | **0.50** | -1.80 | 6.20 |
| 70.00 | 92.50 | 79.50 | 4.20 | 6.70 | 1.50 | 1.35 | 0.60 | **-0.75** | -3.40 | 4.60 |
| 80.00 | 92.30 | 78.80 | 5.70 | 7.90 | 0.90 | -0.55 | -0.70 | **-0.15** | -4.70 | 3.30 |
| 90.00 | 92.30 | 77.20 | 7.20 | 8.90 | 0.70 | -1.35 | -1.80 | **-0.45** | -5.80 | 2.20 |
| 100.00 | 92.10 | 74.00 | 9.20 | 10.70 | 0.10 | -1.85 | -2.80 | **-0.95** | -6.80 | 1.20 |
| 120.00 | 91.80 | 73.60 | 10.50 | 12.70 | -0.20 | -4.90 | -4.40 | **0.50** | -8.40 | -0.40 |
| 125.00 | 91.80 | 74.00 | 10.60 | 12.60 | -0.20 | -5.30 | -4.70 | **0.60** | -8.70 | -0.70 |
| 140.00 | 91.50 | 74.50 | 11.50 | 12.00 | 0.20 | -6.60 | -5.80 | **0.80** | -9.80 | -1.80 |
| 150.00 | 91.30 | 73.50 | 11.80 | 11.50 | 0.40 | -5.70 | -6.30 | **-0.60** | -10.30 | -2.30 |
| 160.00 | 91.30 | 74.30 | 12.30 | 10.90 | 0.50 | -6.45 | -6.70 | **-0.25** | -10.70 | -2.70 |
| 175.00 | 91.30 | 75.50 | 12.75 | 10.20 | -0.20 | -7.05 | -6.90 | **0.15** | -10.90 | -2.90 |
| 180.00 | 91.20 | 74.50 | 13.00 | 9.90 | -0.40 | -6.00 | -7.20 | **-1.20** | -11.20 | -3.20 |
| 200.00 | 91.00 | 74.00 | 14.30 | 10.20 | 0.00 | -7.50 | -8.40 | **-0.90** | -12.40 | -4.40 |
| 250.00 | 90.50 | 70.50 | 16.90 | 12.60 | 0.00 | -9.50 | -10.60 | **-1.10** | -14.60 | -6.60 |
| 300.00 | 90.20 | 70.00 | 17.80 | 14.30 | 0.00 | -11.90 | -12.30 | **-0.40** | -16.30 | -8.30 |
| 400.00 | 89.30 | 68.50 | 20.80 | 16.30 | 0.00 | -16.30 | -14.90 | **1.40** | -18.90 | -10.90 |
| 500.00 | 88.70 | 65.10 | 22.40 | 17.90 | 0.00 | -16.70 | -16.70 | **0.00** | -20.70 | -12.70 |
| 600.00 | 88.00 | 64.10 | 24.50 | 19.30 | 0.00 | -19.90 | -18.30 | **1.60** | -22.30 | -14.30 |
| 700.00 | 87.50 | 62.80 | 25.60 | 20.20 | 0.00 | -21.10 | -19.70 | **1.40** | -23.70 | -15.70 |
| 800.00 | 87.00 | 59.50 | 26.80 | 20.50 | 0.00 | -19.80 | -20.80 | **-1.00** | -24.80 | -16.80 |
| 900.00 | 86.50 | 57.80 | 27.70 | 21.80 | 0.00 | -20.80 | -21.80 | **-1.00** | -25.80 | -17.80 |
| 1000.00 | 85.80 | 57.00 | 29.10 | 22.30 | 0.00 | -22.60 | -22.70 | **-0.10** | -26.70 | -18.70 |


Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 08 -**




**Article 09 -**





Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

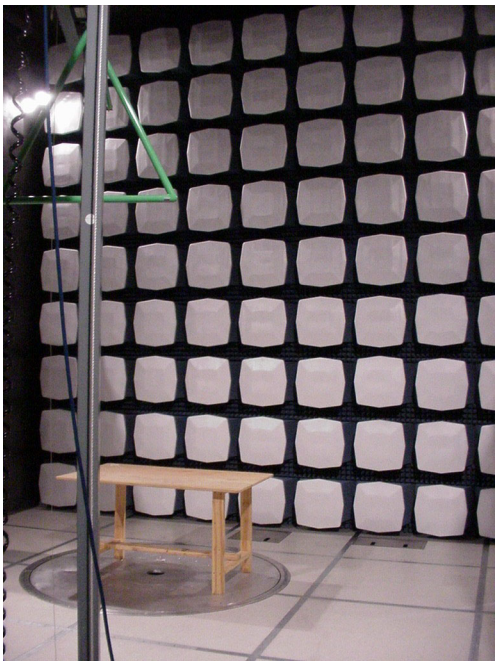
## 5. APPENDIX A – SITE PHOTOS

**Article 10 - 3m Semi-anechoic chamber, Exterior view**

Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

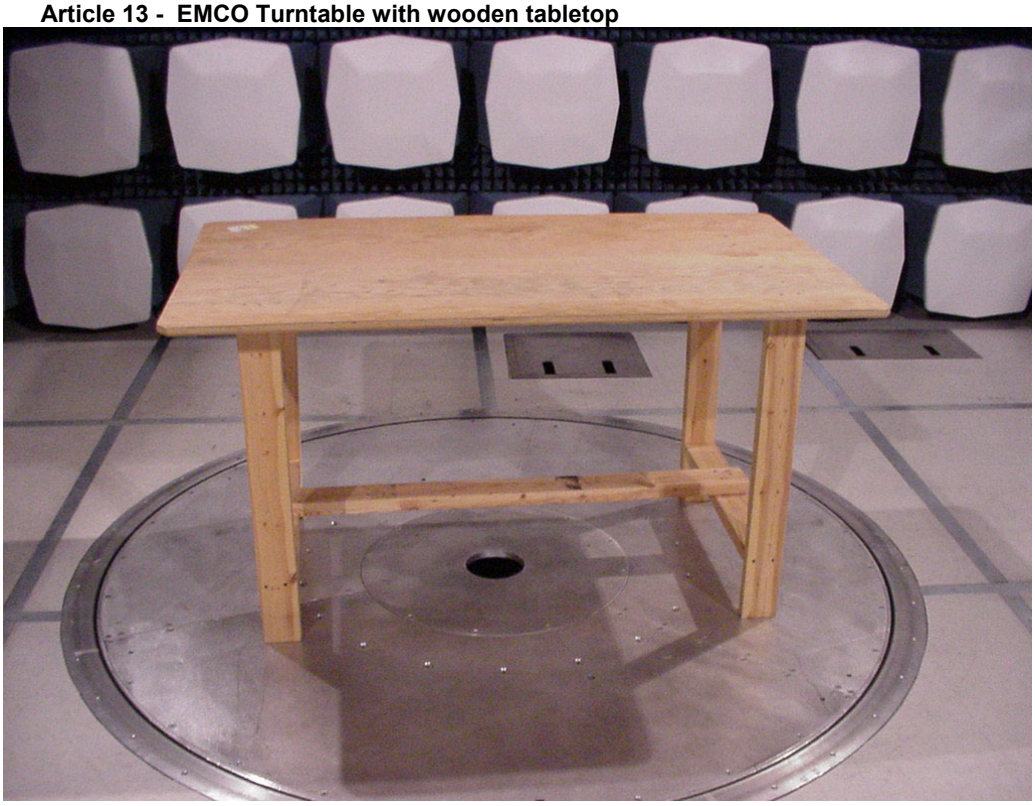
**Article 11 - 3m semi-anechoic chamber, interior view**

**Article 12 - Turntable Location**

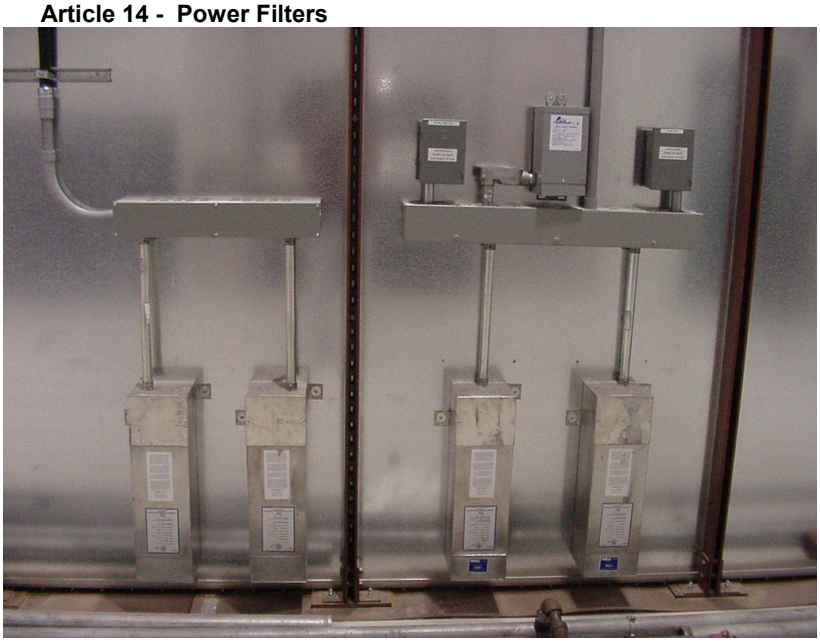



Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 13 - EMCO Turntable with wooden tabletop**

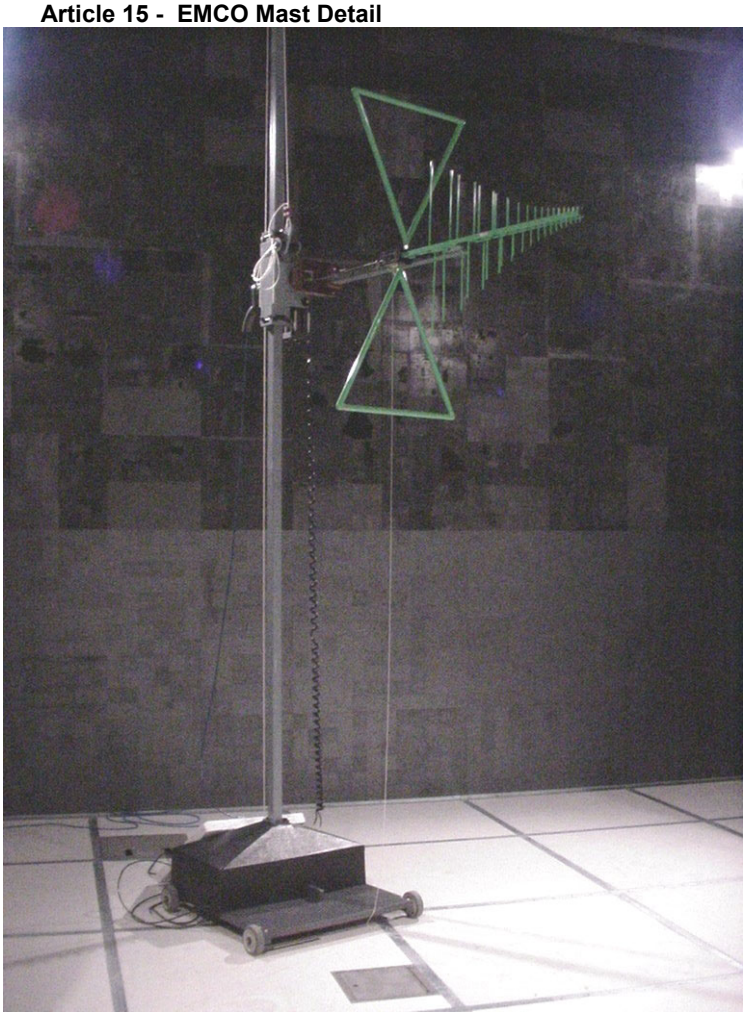


**Article 14 - Power Filters**




Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 15 - EMCO Mast Detail**

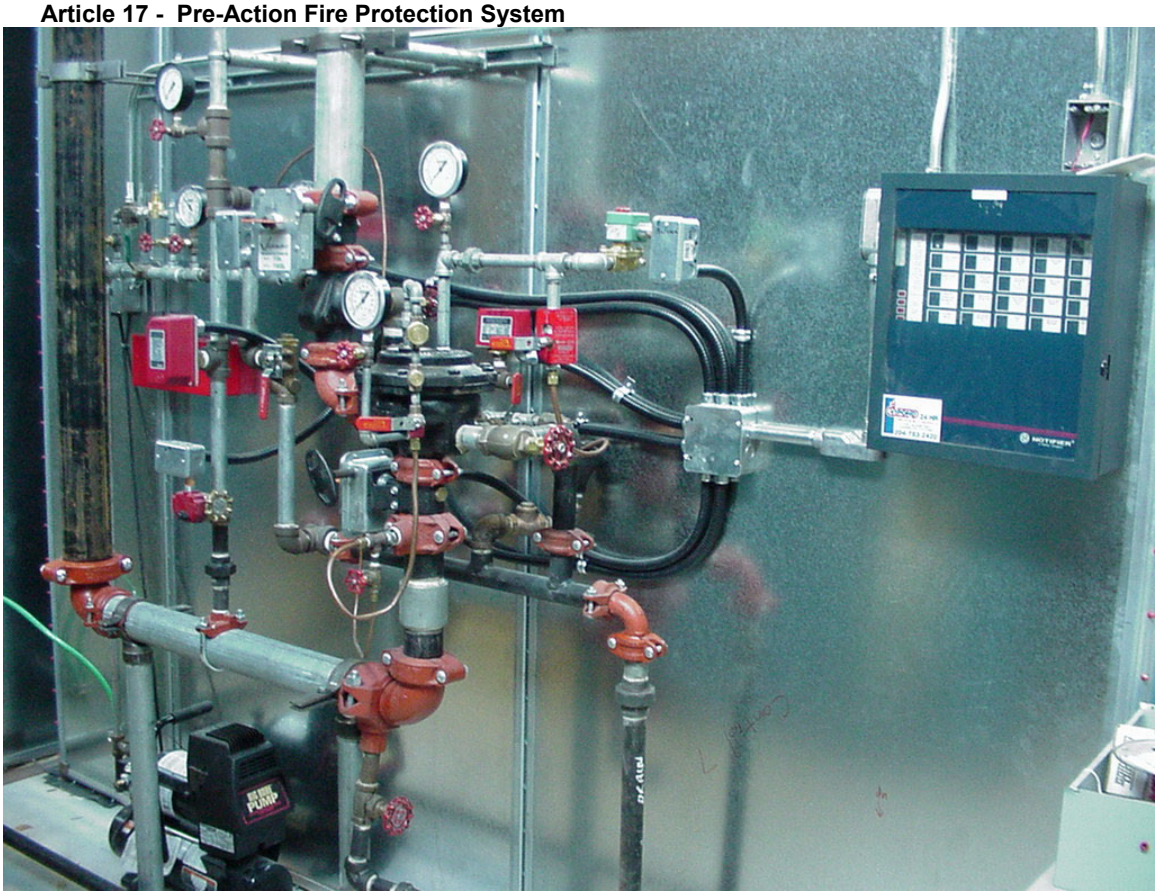



Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 16 - Adjacent Shielded Control Room**

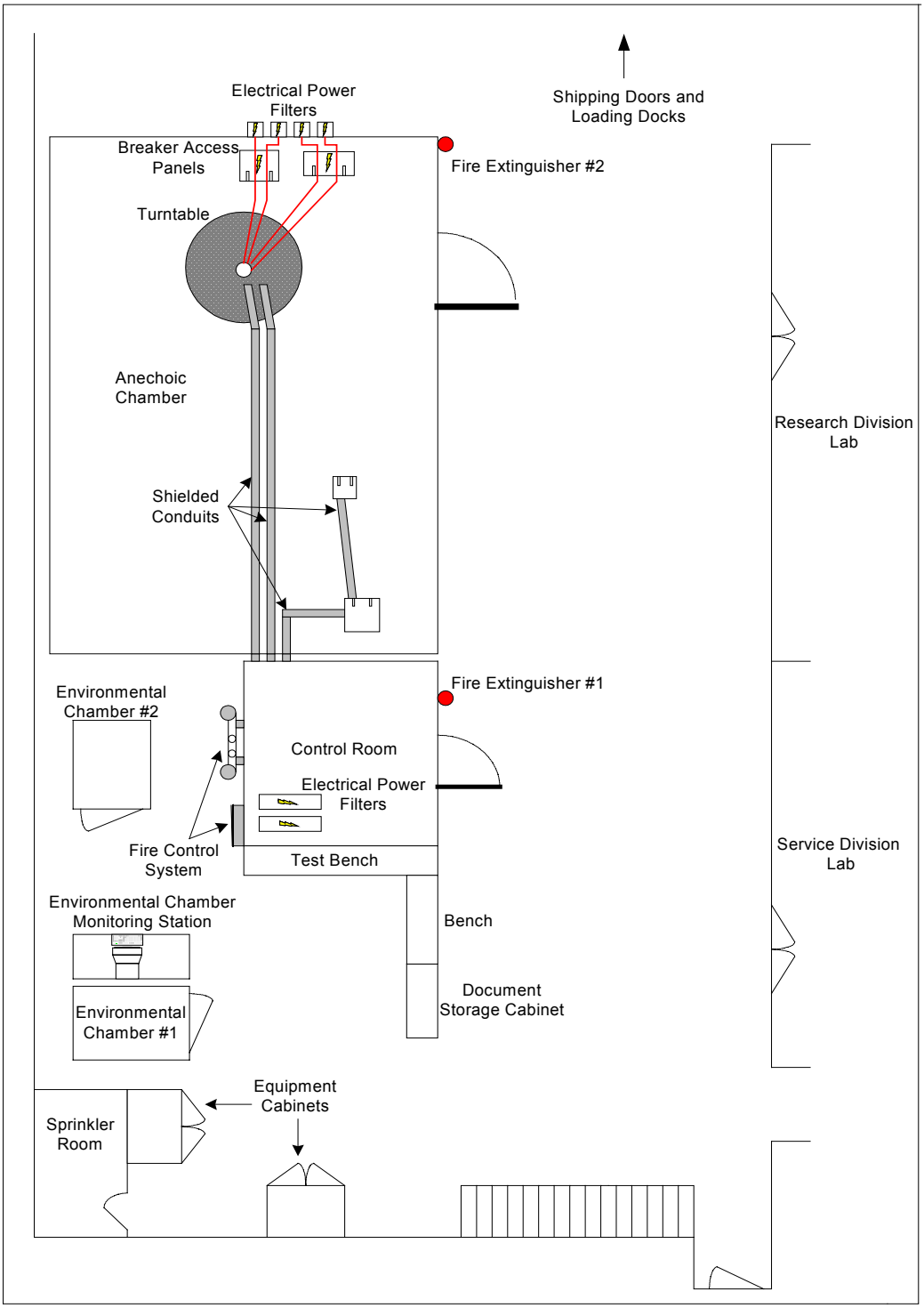
Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

**Article 17 - Pre-Action Fire Protection System**




Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.

# 6. APPENDIX B – LAB FLOOR PLAN





Copyright © 2000 Arrista Technologies Inc. This document contains confidential information.