

VLA-VLBA Interference Protection Memo #39

VLA Control Building West Shielded Room Shielding Test Report

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Abstract

Measurements of the VLA CB West Shielded Room shielding from 50 MHz to 6 GHz are described and compared to the 2002 test results documented in VLA IP Test Memo #28.

1. Test Results Summary

The VLA Control Building (CB) West Shielded Room (WSR) shielding ranged from a low of 50 dB at 250 MHz, through the north wall bulkheads, to as much as 75 dB in mid L-band at the chamber door.

The results from these tests were significantly (typically 20 dB) better than those obtained by Chris Patscheck in 2002 (Ref. VLA Interference Memo # 28).

2. Test Description

Shielding measurements of the CB WSR north-facing wall were performed on 20180509 by Skylar Fennell and Dan Mertely at 3 positions most likely to exhibit RF leakage:

Position 1: the vestibule dual doors,

Position 2: the under-floor bulkhead 9.5 ft. west of the center of the door, and

Position 3: the eye-level fiber optic bulkhead 22.5 ft. west of the door.

At each position measurements were made at 50, 250, 350, 500, 1000, 1500, 2500, 4000, and 6000 MHz. An open-door and a closed door measurement was made at Position 1. The open-door measurement was used as the calibration reference for calculating the shielding effectiveness at all 3 test positions. Only the inner door was shut for the Position 1 closed door measurements. At Positions 1 & 3 the transmit (TX) and receive (RX) antennas were mounted 55 inches above the computer floor. The TX antenna was always positioned 4 ft. from the inside of the north wall. The RX antenna was always positioned 8 ft. from the outside of the north wall, in-line with the TX antenna. At Position 2, the TX antenna was center-fitted in the crawl-space between the metal WSR floor and the raised computer floor (the 2x2 ft. modular floor block above the TX antenna was removed for Position 2 tests), and the RX antenna was handheld in the catwalk area above the CB FE/LOIF lab.

For each position and each frequency, the synthesizer CW source was set to transmit a +20 dBm tone. The RX antenna was then pointed and waved toward the TX antenna. RX power measurement values were recorded with the spectrum analyzer receiver set as follows:

- RX BW: 30 Hz
- RX Span: 1 KHz
- 10 sweep averaging on
- Max hold on after locating and centering signal.

- Pre-amp on for door closed measurements

(When The TX signal was not within the RX 1 KHz sweep window, the RX sweep range was widened to 100 KHz to find signal, the signal peak frequency was then set to the display center and the sweep was narrowed back to 1 KHz for data logging.)

A list of the equipment used follows:

TX = Agilent/Keysight E8257D PSG

TX Antennas:

<= 1 GHz: 200-1200 EMC conical log spiral (Altech Model 93490-1, SN 0805)

> 1 GHz: 1-18 GHz dual ridged feedhorn (Emco Model 3115, SN 9703-5144)

TX Feedline: Teledyne Storm PhaseMaster 190E (Model 874-0404-098)

RX = Agilent N9342CN spectrum analyzer

RX Antennas:

<= 1 GHz: 200-1200 EMC conical log spiral (Singer Model 93490-1, SN 165)

> 1 GHz: 1-18 GHz dual ridged feedhorn (Com-Power Model AH-118, SN 071044)

RX Feedline: Teledyne Storm PhaseMaster 190E (Model 975-0404-098)

3. Data Collected

Hand recorded power levels at all 9 frequencies at each of the 3 positions (twice at Position 1, the door—open and closed).

The emissions test data files, the spreadsheet analysis of the files, and this test report file are located at: <\\filehost\evla\techdocs\RFI\propagation-tests\CB-west-shielded-room\20180509>.

4. Data Analysis

For each of the 3 positions tested, shielding values were derived by subtracting the recorded power levels for each of the closed-door measurements from the initial open-door calibration power measurements taken at all 9 frequencies.

5. Detailed Data Presentation

The test layout diagram is presented as **Figure 1**.

The shielding results are presented as a graph in **Figure 2**.

The VLA Control Building (CB) West Shielded Room (WSR) shielding ranged from a low of 50 dB at 250 MHz, through the north wall bulkheads, to as much as 75 dB in mid L-band at the chamber door. The data show shielding improved from the 2002 test results at the WSR door, Position 1. Both the inner and outer doors had been re-adjusted and cleaned in 2017 and it is believed that this contributed to the 15 to 20 dB improvement. (Prior to the door repair of 2017 neither door would fully seal—even at maximum rotation of the door handles.) The under-floor bulkhead at Position 2 had also been reworked during the prior couple of years, with the removal of unfiltered LAN STP cables and the addition of bulkhead filters for the fire-alarm circuitry. A waveguide cut-off port for multi-mode fiber optic cables entering the WSR at that bulkhead was also installed at that time.

Most digital devices (desktop PCs, laptop computers, LAN switches, etc.) have been found to emit broadband RFI no higher than mid S-band in tests in the EVLA/ALMA Reverberation Chamber. For this reason the WSR shielding was tested to only 6 GHz.

Figure 1: The shielding test layout.

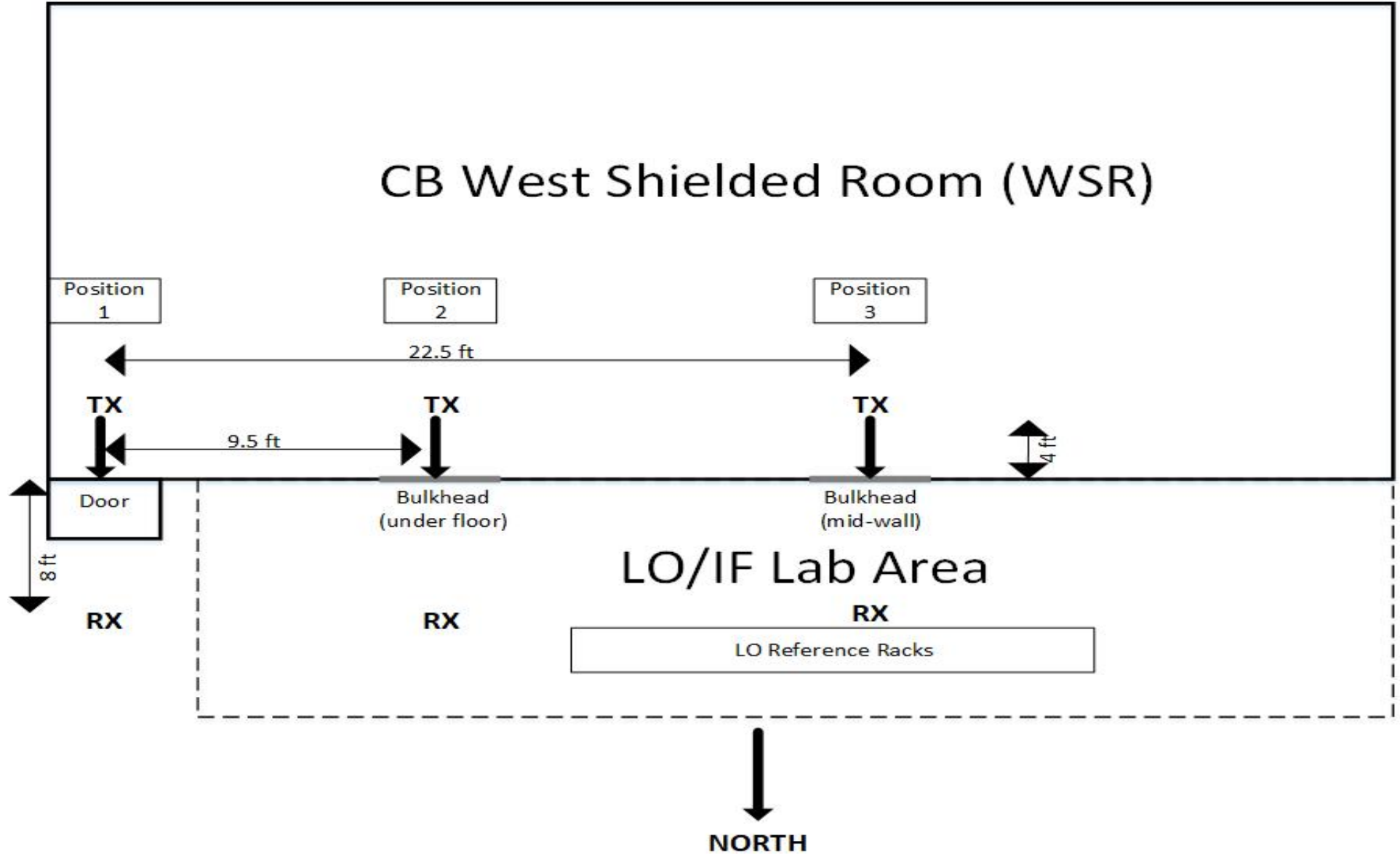


Figure 2: The shielding test data:

