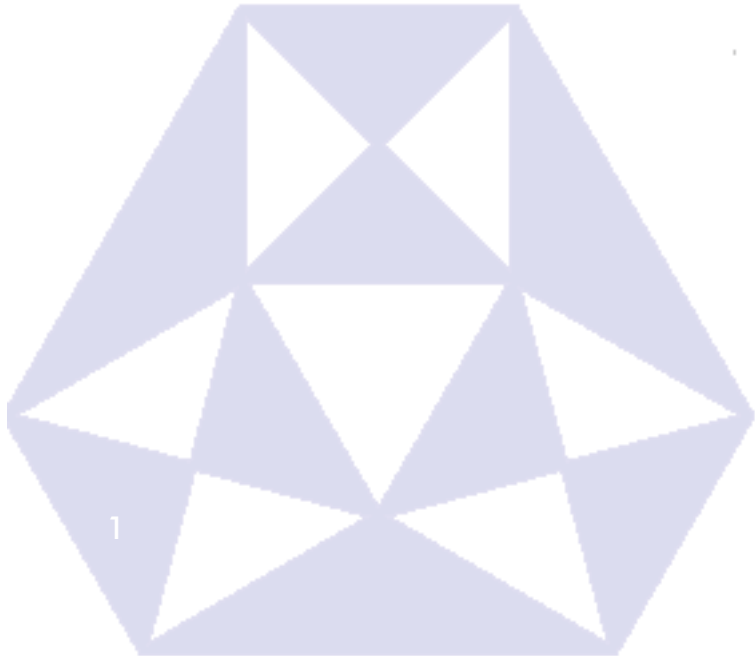


The Effect of Height on Chamber Performance

Presented by

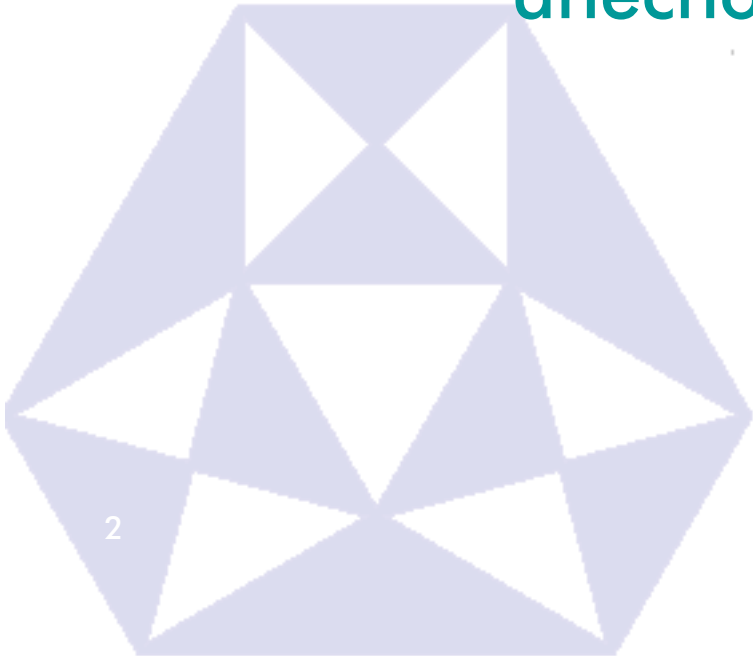
TDK RF Solutions Inc.



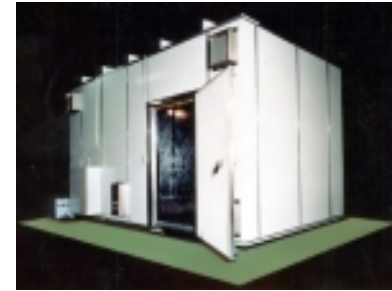
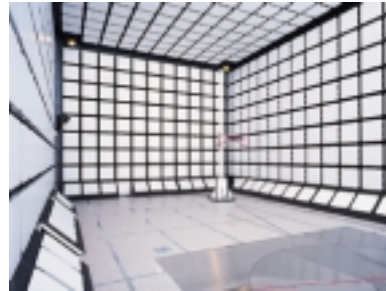
Jim Ott
Sales Manager
Chamber Group

Topics

- Why own an anechoic chamber
- Does the chamber height matter
- How does chamber height affect anechoic performance



Various EMC Chambers



10m Chamber:

- High Spec
- Offset
- Standard
- EMS Performance

3m/5m Chamber:

- Partially Lined
- Fully Lined
- EMS Performance

Compact Chamber:

- EMI Performance
- EMS Performance



OATS vs. Chamber

Open Area Test Site : OATS (Standard Test Site)

Problems

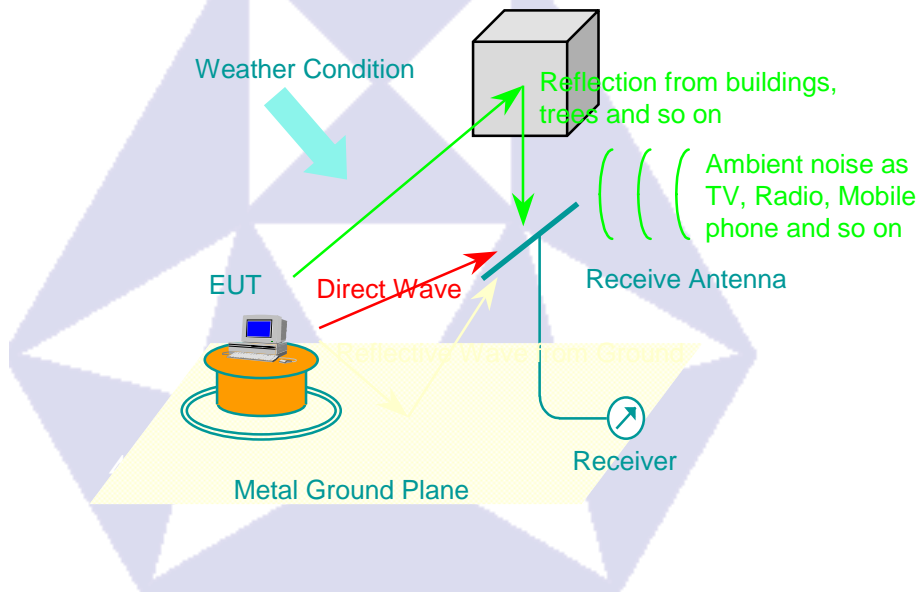
Influence from the ambient noise
Influence from the nearby structures
Influence from the weather conditions
Impossible to conduct high power tests

Anechoic Chamber (Alternate Test Site)

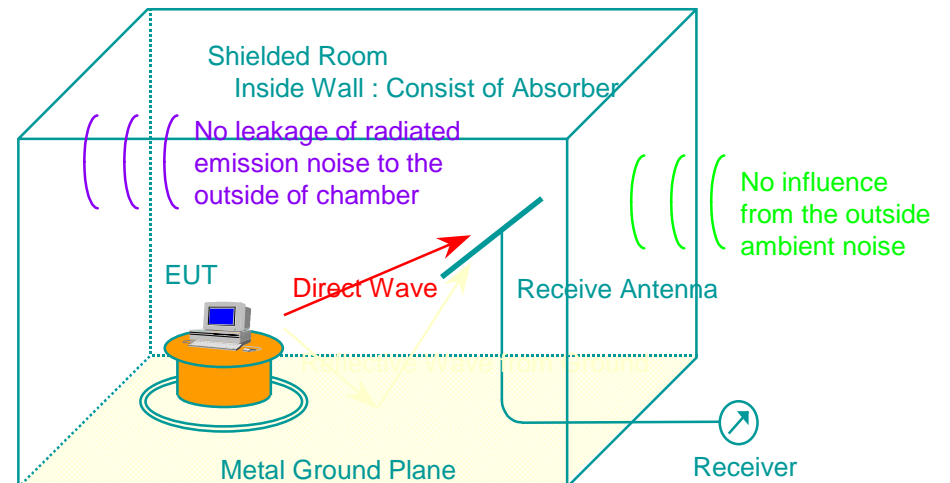
Solution

No influence from the ambient noise
Realize a stable/repeatable measurement environment
No leakage of radiated energy outside of chamber
Possible to conduct high power radiation test
Keep products and testing confidential / secret

Measurement at the OATS



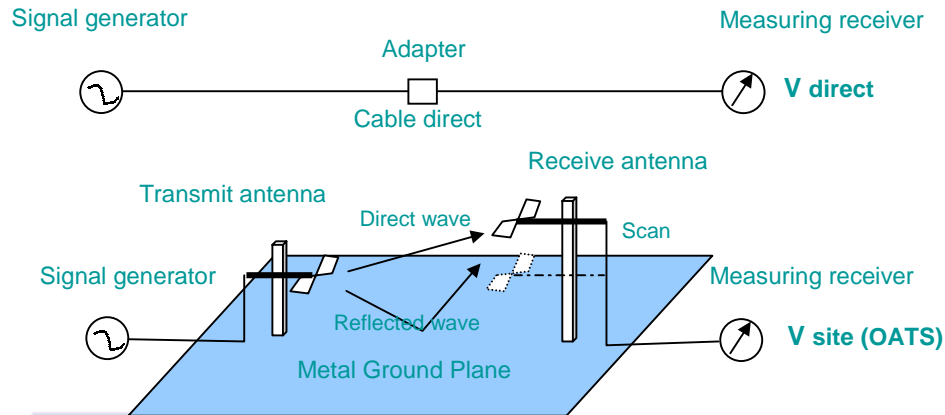
Measurement in the Anechoic Chamber



OATS vs. Chamber

Ideal OATS* (Reference site) ex. NPL, ARC Seibersdorf, NIST, Liberty Labs

as CALTS (Calibration Test Site)



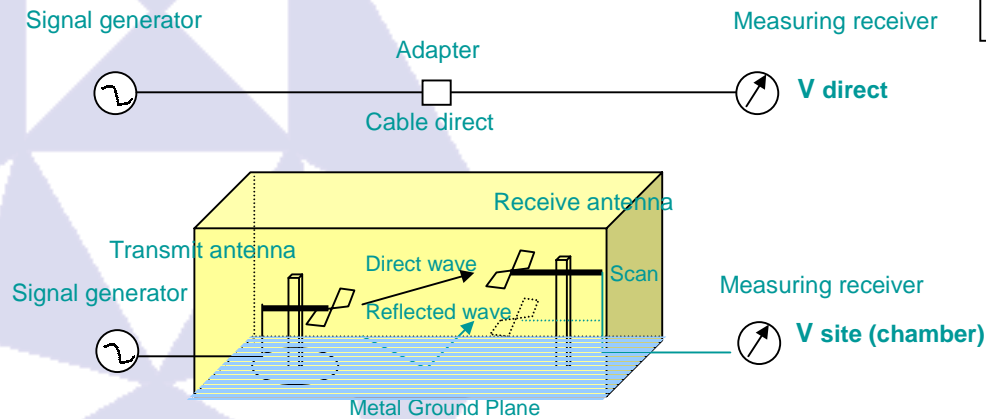
$$CSA (OATS) = V_{direct} - V_{site (OATS)}$$

Reference value at ideal OATS

* OATS : Open Area Test Site

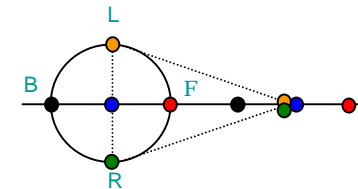
It is important how to qualify a test site as a reference => CALTS

Semi- Anechoic Chamber



$$CSA (chamber) = V_{direct} - V_{site (chamber)}$$

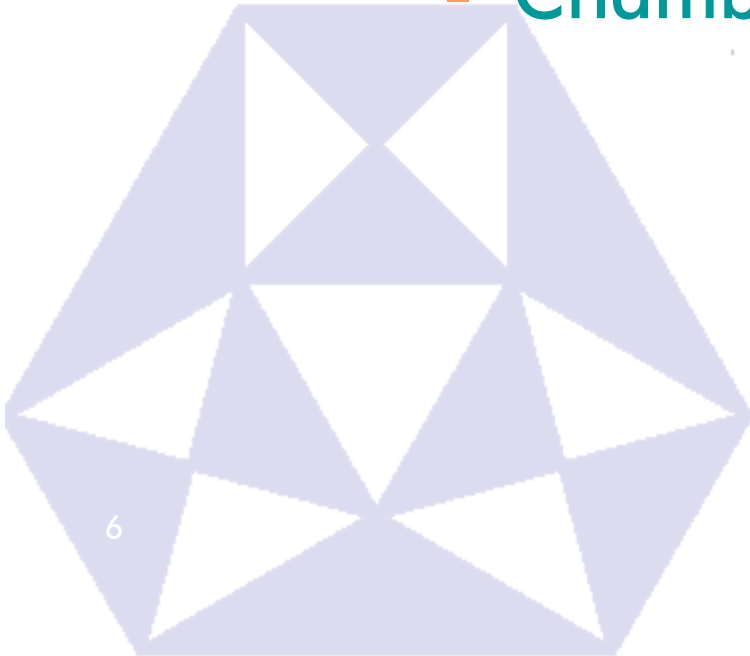
Measured value in Anechoic Chamber
CSA (chamber) is measured around EUT area



CSA (chamber) is compared with CSA (OATS)

Chamber Height Considerations

- Available Real Estate
- Building Cost Rises Exponentially with Ceiling Height
- Chamber Performance



Angle of Incident vs. Performance

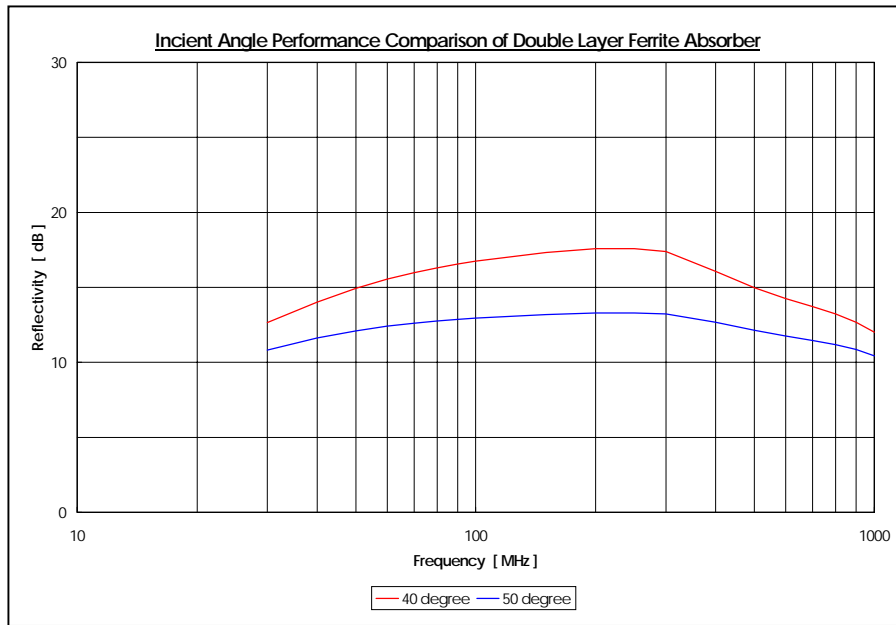


Figure 1-1
Double layer ferrite absorber performance

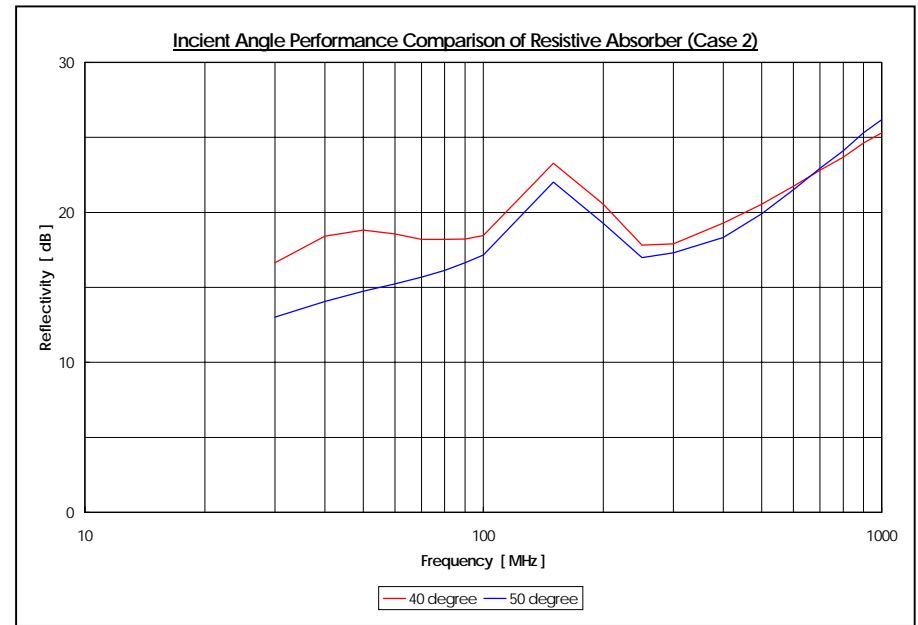
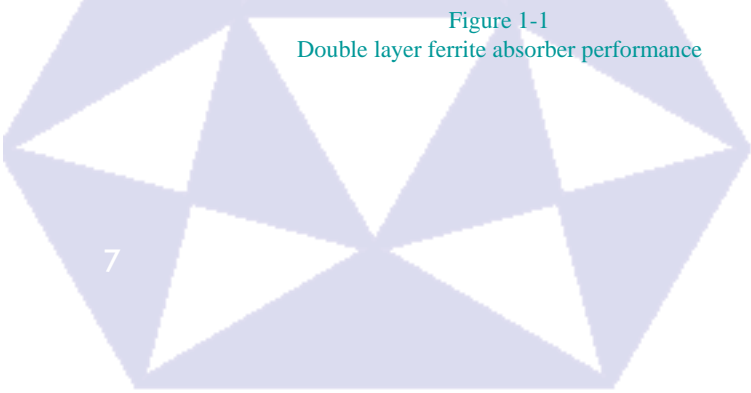
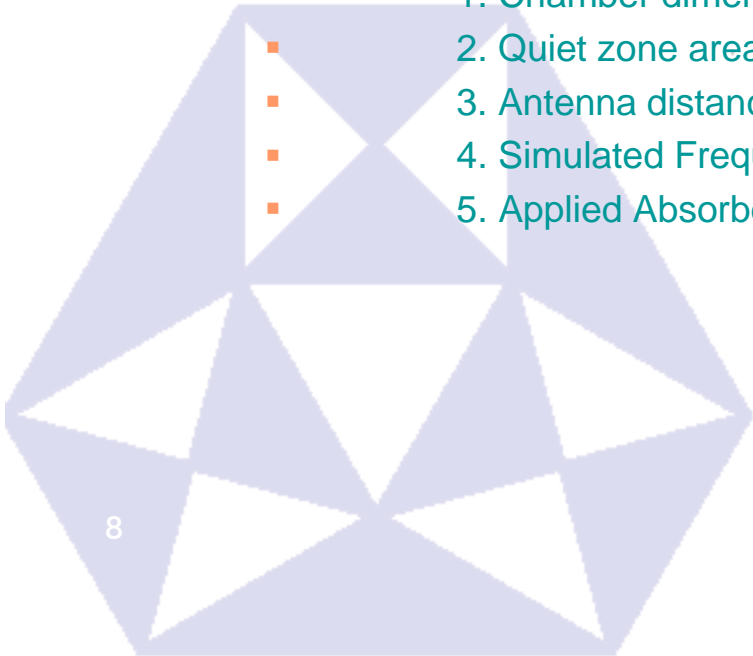


Figure 1-2
TDK resistive 0.95m absorber performance

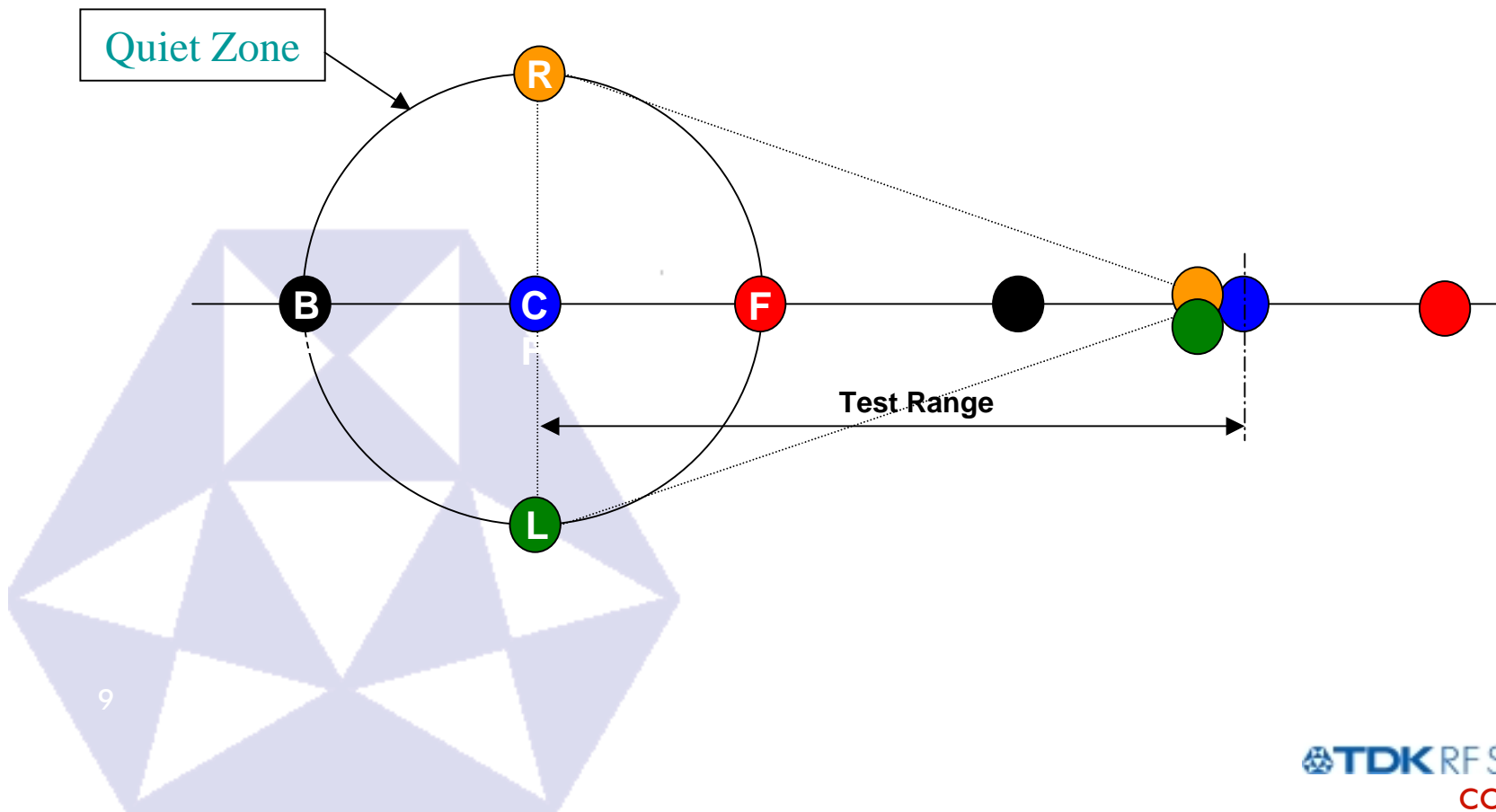


Chamber Height Considerations

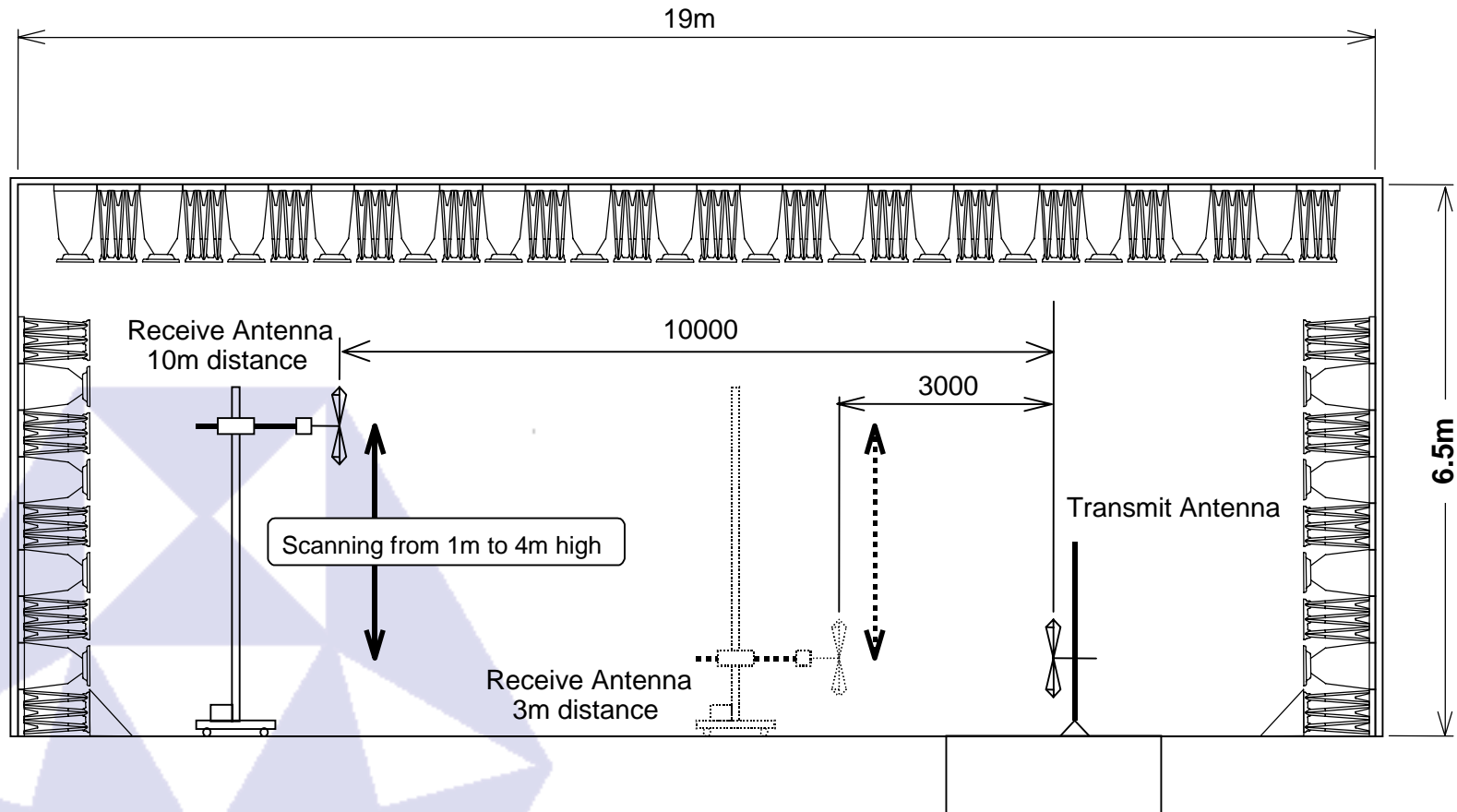
- Normally, the parameter of the chamber height is most influenced by the horizontal polarization.
- Therefore, we investigated the horizontal polarization at a 1.0m high transmit antenna height configuration.
- Simulated condition as;
 - 1. Chamber dimensions : 19.0m x 13.0m x 6.0m to 10.0m at 0.5m steps
 - 2. Quiet zone area : 3.0m diameter
 - 3. Antenna distance : 10m test distance
 - 4. Simulated Frequency : 30 MHz – 100 MHz
 - 5. Applied Absorber : TDK resistive 0.95m absorber



Verification Measurement Points

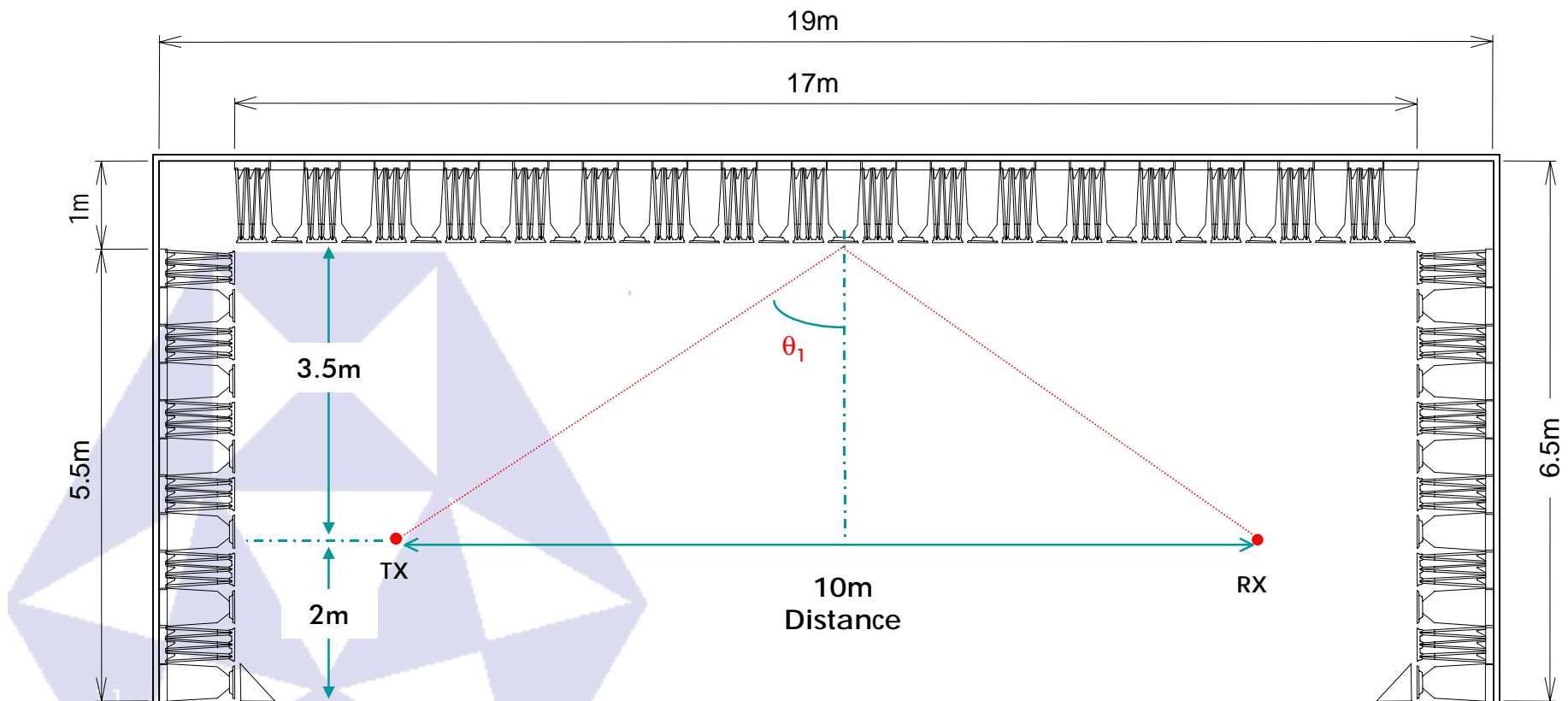


Height Study



Height Study

Horizontal Polarization - Oblique incidence at ceiling



$\theta_1 \sim 55^\circ$

Modeled vs. Empirical Performance

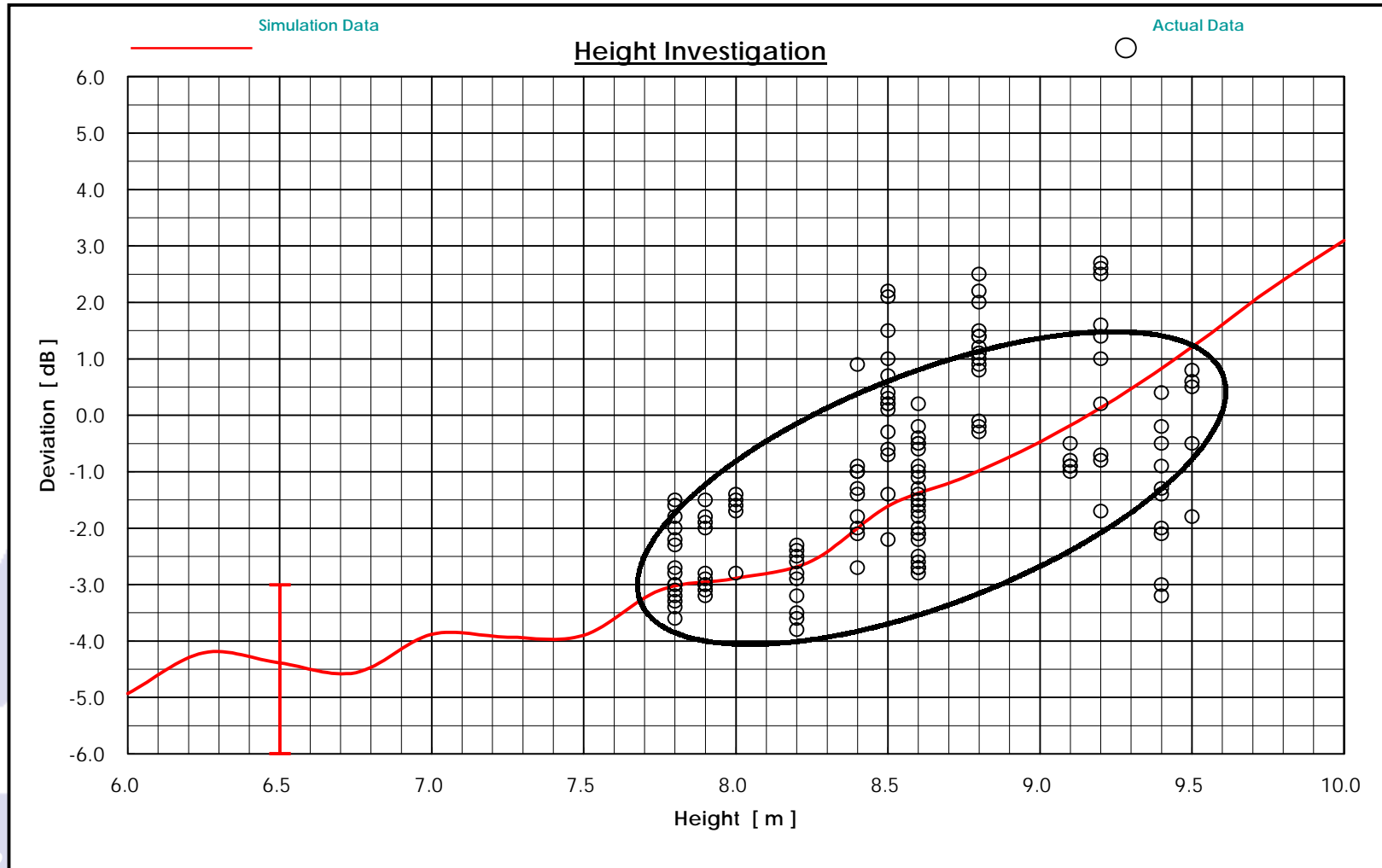
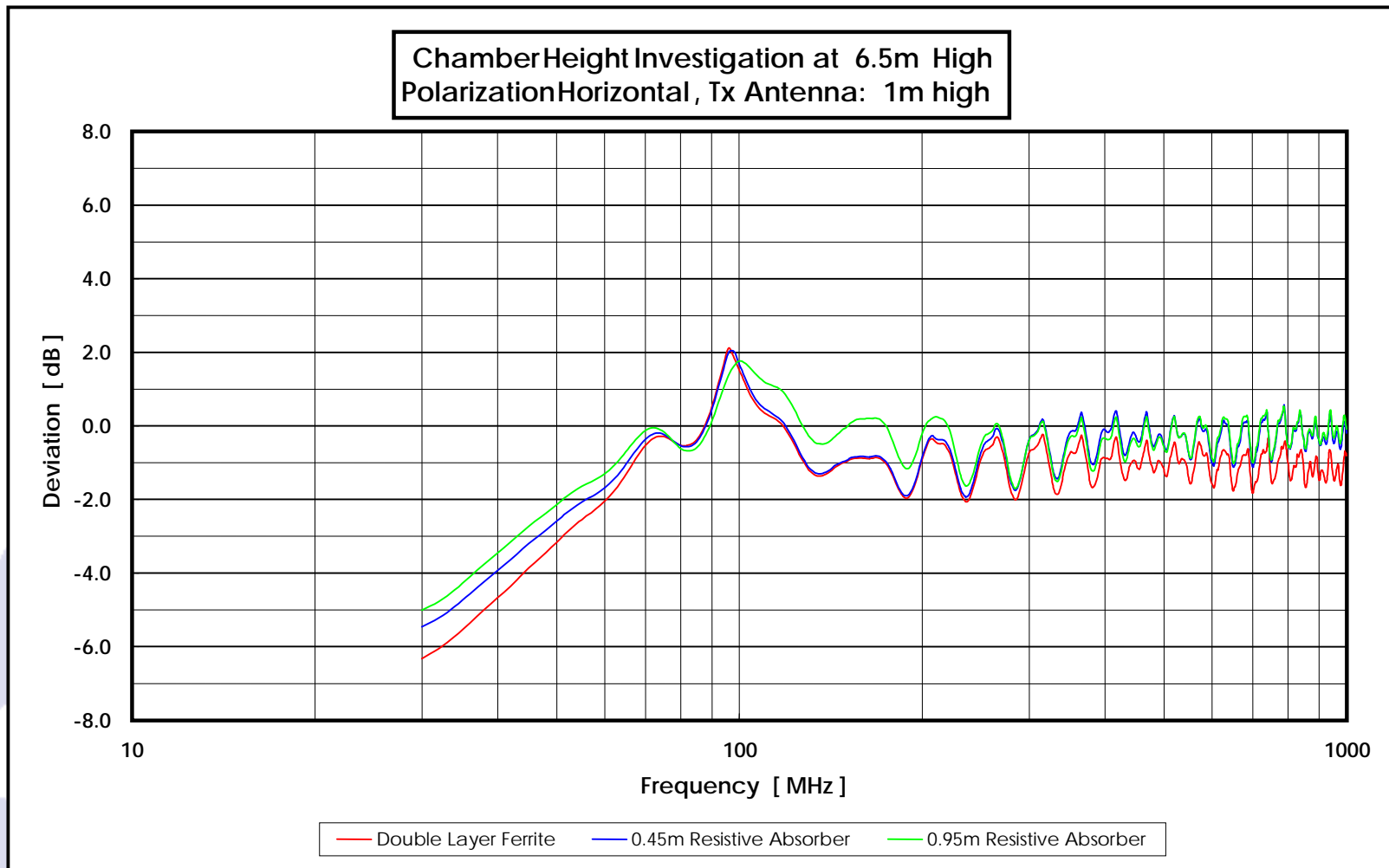


Figure 2-1

Results of Simulation with Actual Test Results of Past Project

Height Study



Result of Height Study

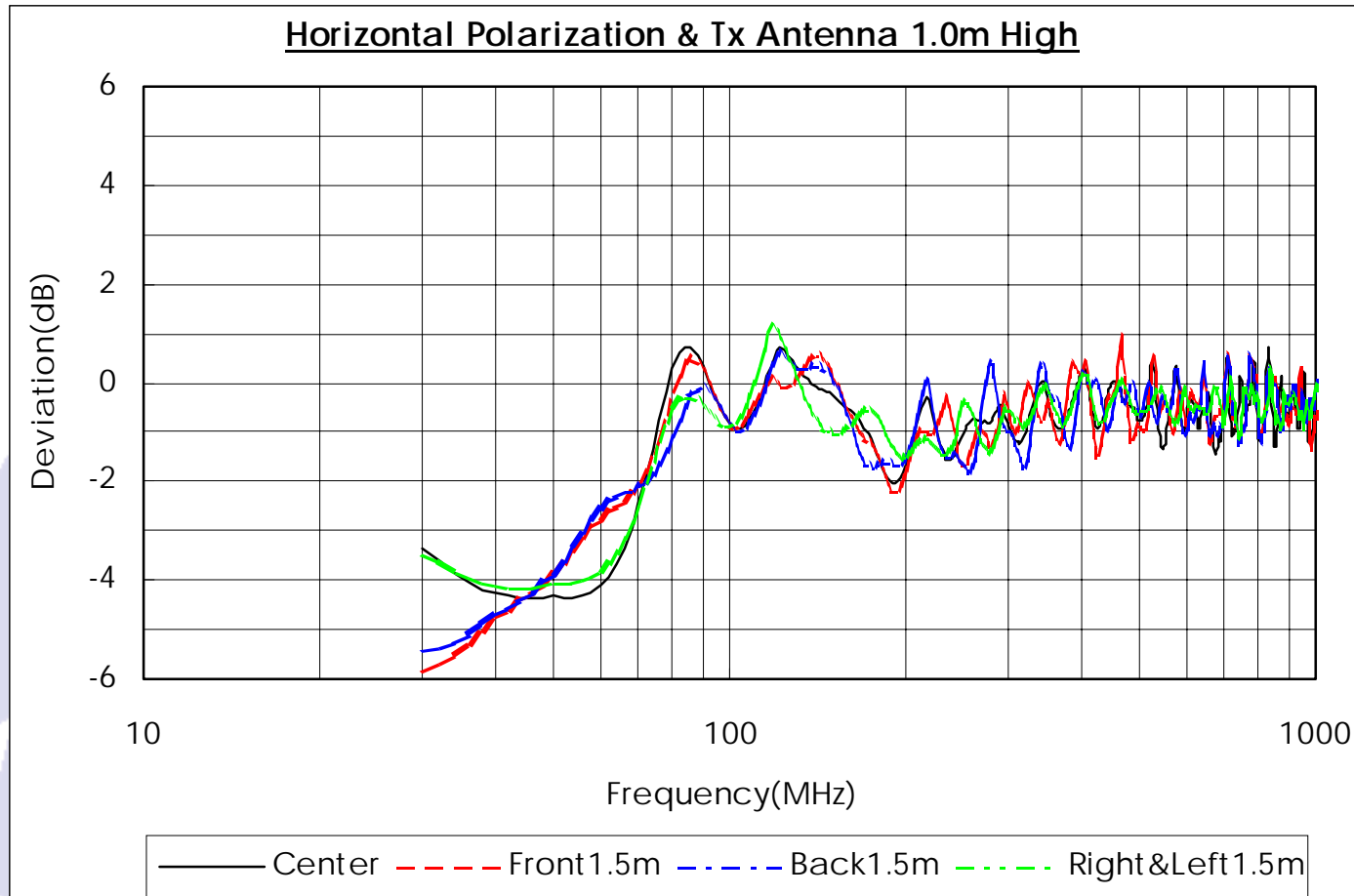
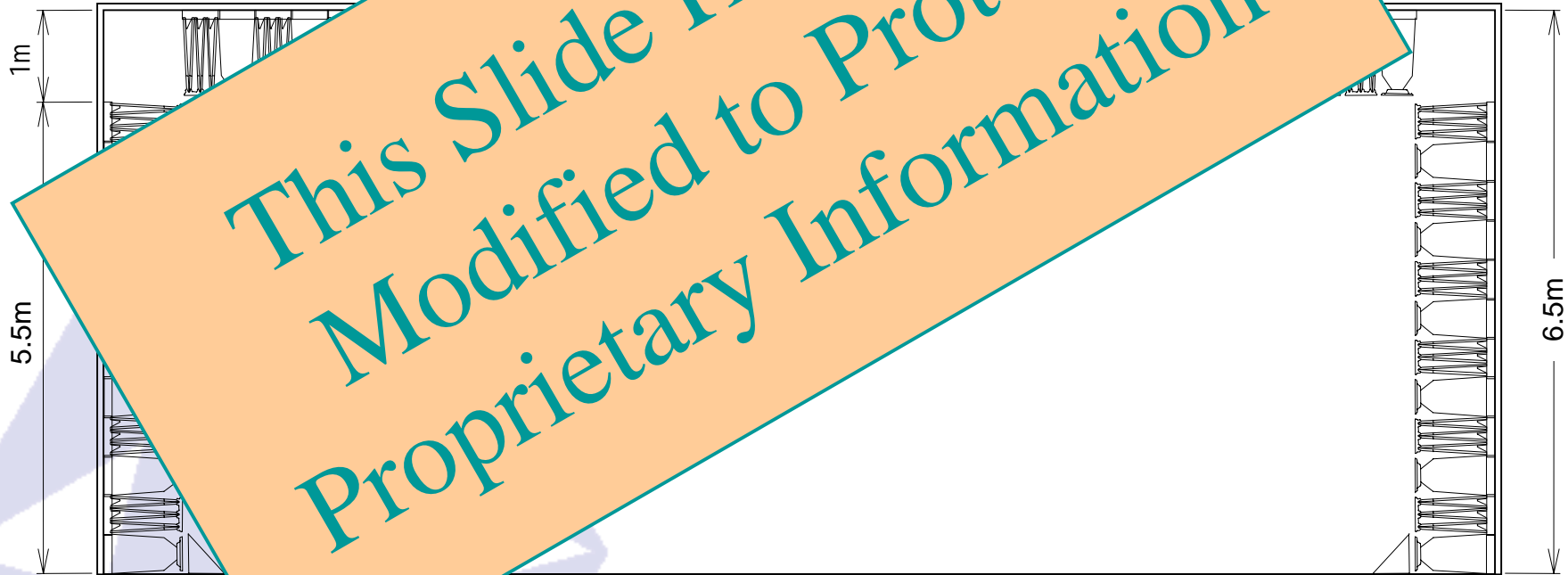


Figure 2-2-(1)
Simulation results at Horizontal & Tx 1.0m high

Potential Solutions?

This Slide Has Been Modified to Protect Proprietary Information



Summary

- Do you want to risk a large investment in un-proven theory
- It is recommended to understand the modeling data but you should rely on empirical data
- Truly understand the risk to benefit of “undersized” test facilities
- Alternate solutions without sacrificing chamber height