OPTIMIZATION OF A SPHERICAL NEAR-FIELD SYSTEM FOR MEASUREMENTS IN THE UHF FREQUENCY RANGE

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AMTA 2006
October 22-27, 2006
Austin Texas USA
Outline

- Introduction
  - Types of UHF Antennas Measured
- DFL Facilities
  - Chamber
  - Instrumentation
- Measurement Optimization
  - Multi-Path
  - Mutual Coupling
  - Range Configuration
  - Software Techniques
- Conclusions
UHF Antennas in Space

- **Mobile communication satellite systems**
  - Reliable voice or low-data-rate
  - Users with limited terminal capability, antenna size, environment, etc.

- **Global Earth coverage**
  - Geosynchronous Orbit
  - Medium Gain Antennas
  - Large size
UHF Antennas characteristics

- Medium Gain Antennas
  - Helical Antennas (traditionally)
  - Phased Array Antennas (recently)
  - 12 to 14 dBi gain
  - 230 and 400 MHz
  - 3 to 5 meter size
UHF Pattern Measurements at DFL

Antenna Test Facility 2 (12x24)
Chamber size: 12 x 24 x 20 m (h)
Absorber : Variable Height 30 -180 CM
Foam Window
9000 Kg overhead crane

Pattern Measurements
Probe Horn : 2.2m x 1.5m
OEWG : 0.76m x 0.38
Linear Polarized

Near Field Measurements
Spherical Near Field
CASAMS and NSI
Helical Antenna Pattern Measurements
Positioning System
Multi-path Sources in Chamber

Top View in Anechoic Chamber

Center of Range

Side Wall

L₀ = 7.8 m

L₂ = 13.4 m

L₃ = 12.7 m

L₄ = 11.0 m

Az Axis

Coupling

Side Wall

Baffle

Ceiling

Floor

L = 15.3 m

L = 10.4 m

Roll Positioner

Az Positioner

L-bracket
Position of Baffles
OEWG Data with and without Baffles

FL SGH 6.34m OEWG as Probe with and without Baffles Co-Pol

HCUT No Baffles
HCUT With Baffles

"L SGH 6.34m OEWG as Probe with and without Baffles Cross-Pol

HCUT XPOL No Baffles
HCUT XPOL With Baffles
Probes

- **Standard Gain Horn** used as a Probe
  - 2.2m x 1.5m Aperture
  - Linear Polarization

- **OEWG** used as a Probe
  - 0.76m x 0.38m Aperture
  - Linear Polarization
DFL UHF Horn Using HORN and OEWG as Probe Directivity vs. Frequency
Effect of MARS Processing

F for CSA SGH at 0.24515 GHz, No MARS Processing

F for CSA SGH at 0.24515 GHz, With MARS Processing
DFL Horn Directivity with and Without MARS
Horn Probe vs. OEWG Probe

Frequency in MHz

Directivity in dB

- Horn No MARS
- Horn MARS
- WG No MARS
- WG MARS
Error Signal (MARS Processing)
Concluding Remarks

- Optimization of Spherical Near-Field facility for UHF measurements
  - Range Baffles
    - Minimal Impact
  - OEWG Probe
    - Significantly Reduced Mutual Coupling
    - Reduced Gain Ripple
    - Increased Multi-path Levels
  - MARS Software
    - Significant Multi-path Reduction
    - Smoothing of Gain Response vs. Frequency
The authors wish to acknowledge help provided by Daniel Van Rensburg and Allen Newell of NSI in providing the MARS data analysis.

The help provided of MDA Corporation in the design of the probe antenna and absorber baffles is acknowledged as well.

Much of the work was initiated and carried out under the supervision of the late Mr. Yves Patenaude, Former Manager, Radio Frequency Qualification Facilities, David Florida Laboratory, Canadian Space Agency.