*Pioneers in Wireless Testing & Certification*

Prepared for:

# ASC C63 Subcommittee 8

Piscataway, NJ
April 21, 2009

## *HAC Testing Technology Developments at 700 MHz*

Prepared by:

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# Introduction

- Why the interest in 700 MHz?
  - New Technology, in particular, LTE, plans to be deployed on this new portion of spectrum from various carriers
- What is LTE?
  - **L**ong **T**erm **E**volution

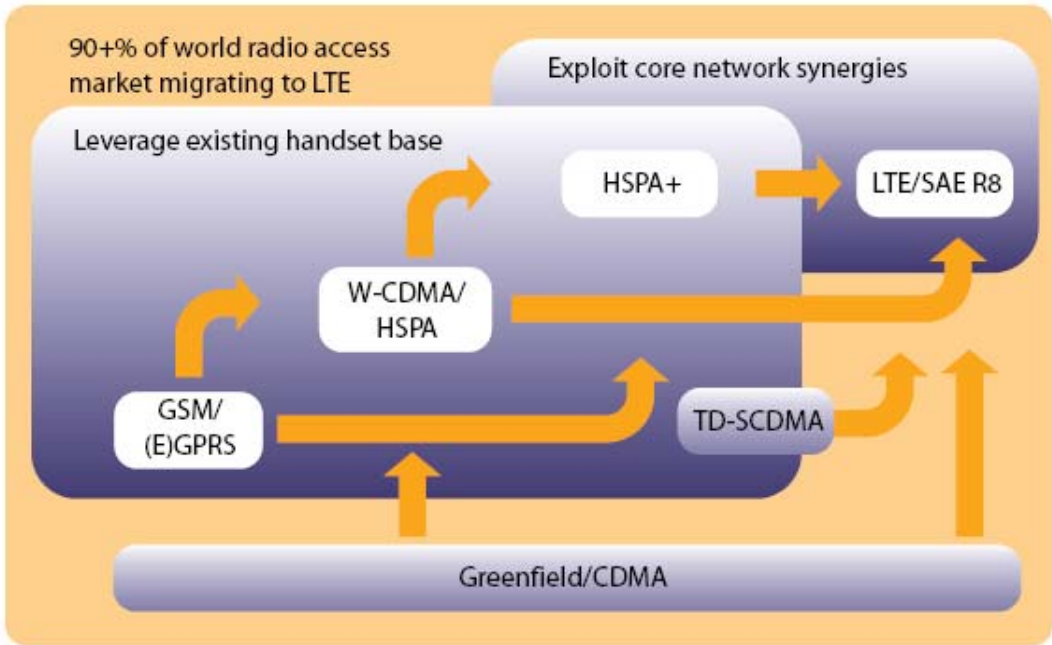
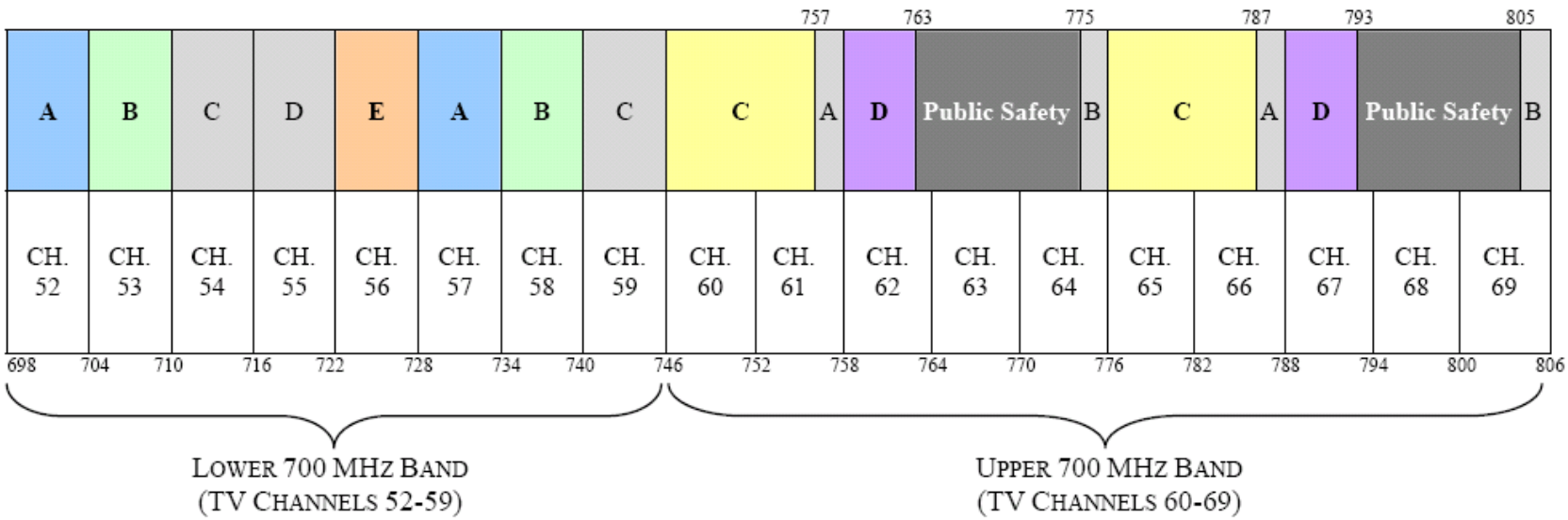



*Figure 16: Operator migration paths to LTE*
*Source: Nokia Siemens Networks*

# Introduction

- FCC Spectrum Plan




Source: FCC PSHSB

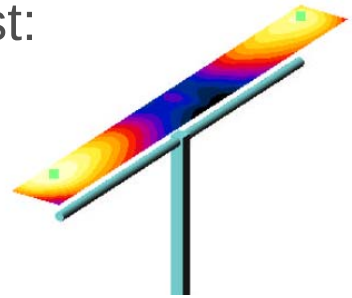
Last Reviewed/Updated 9/5/2007

# Introduction

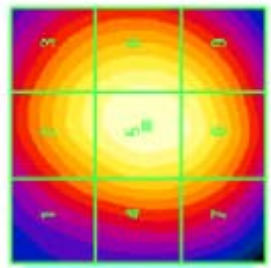
- When will it affect HAC?
  - First phase of LTE for data use only
  - Next phase for voice operations (2010+??)
    - Directly relevant for hearing impaired
    - Phones will be able to hand-off from traditional technologies (i.e. CDMA, GSM, WCDMA) to LTE, seamlessly.
- Hearing impaired user experience will need to be addressed for all air interfaces where voice communication is utilized via commercial radio networks

# HAC Testing

- Key Components of a HAC RF Emissions Test:



1. **System Validation**
   - Known reference (dipole)
   - Checks for accuracy of field measurements made above phones (E-field and H-field)

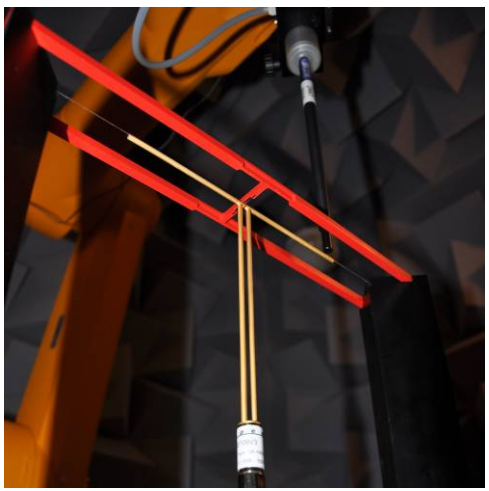


2. **Area scan**
   - (5cm x 5 cm) about the ear reference point of the phone

- Evaluation of all technology modes to determine worst-case field levels (FCC requirement to cover new technology complex characteristics)

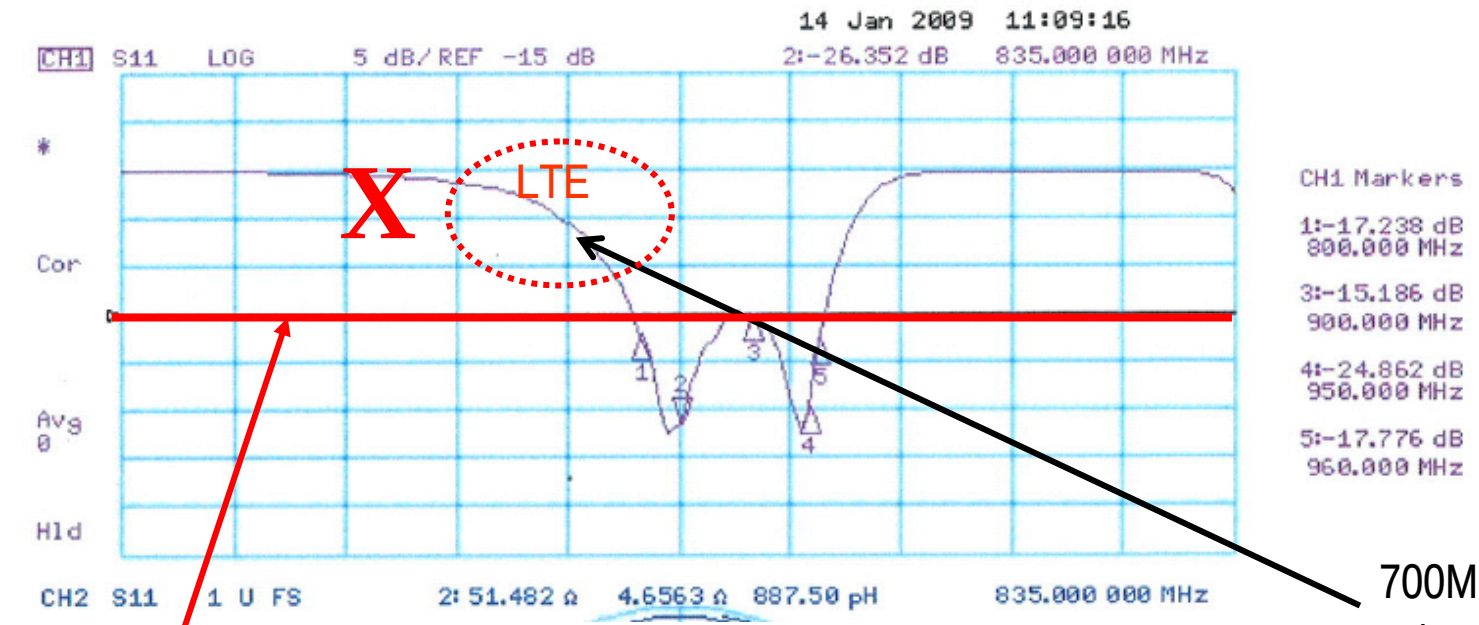
# HAC Testing: Challenges for 700 MHz

- Limitation of test equipment
  - Reference Dipoles (initial availability as of 2008)
  - Call Simulator equipment (not available, esp. for voice capability)
- Limitation of expertise
  - New technology → lack of test expertise



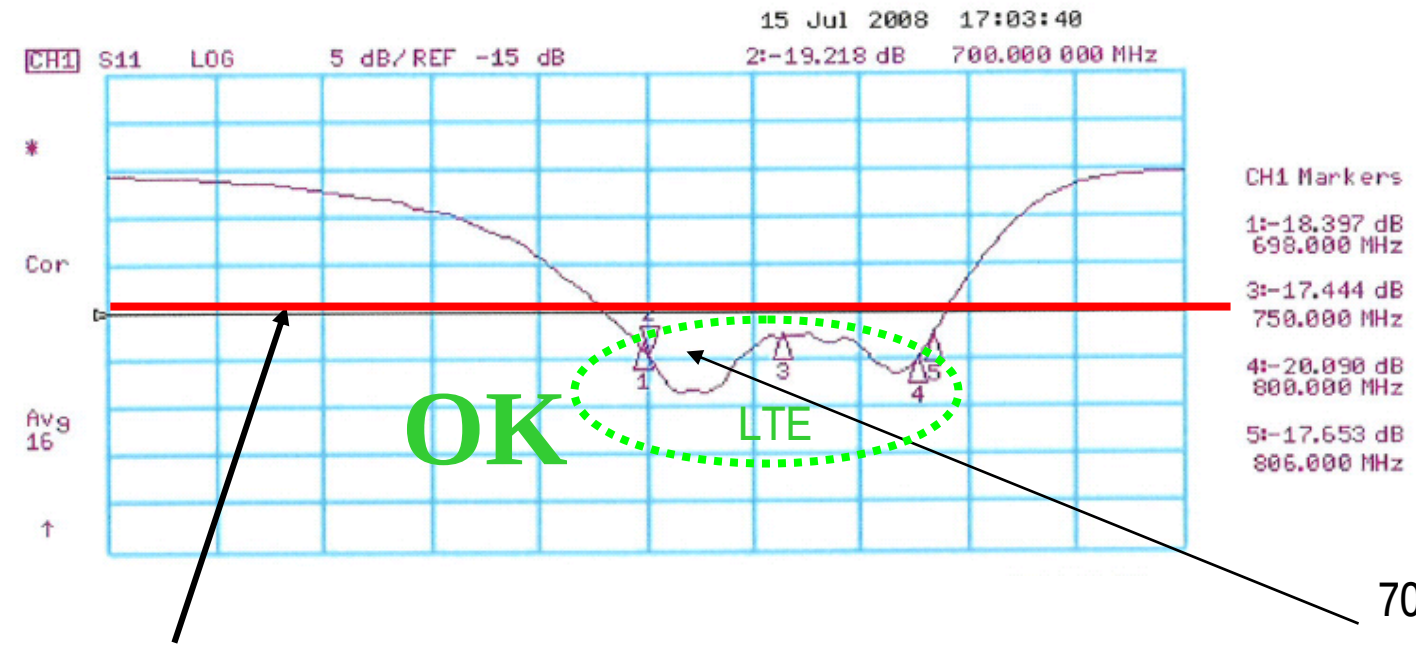
# Issues with Current Reference Dipoles

- Cannot use neighboring familiar 835 MHz Reference Dipoles



# Need for dedicated 700 MHz Dipole

- Covers new 700 – 800 MHz Band



# 700 MHz Reference Targets (1 cm)

**1 Measurement Conditions**

DASY system configuration, as far as not given on page 1.

| | | |
|---|---|---|
| **DASY Version** | DASY4 | V4.7 B71 |
| **DASY PP Version** | SEMCAD | V1.8 B184 |
| **Phantom** | HAC Test Arch | SD HAC P01 BA, #1070 |
| **Distance Dipole Top - Probe Center** | 10 mm | |
| **Scan resolution** | dx, dy = 5 mm | area = 20 x 220 mm |
| **Frequency** | **750 MHz** ± 1 MHz | |
| **Forward power at dipole connector** | 20.0 dBm = 100mW | |
| **Input power drift** | < 0.05 dB | |

**2 Maximum Field values**

Current: 1.0 cm distances

| **H-field 10 mm above dipole surface** | condition | **interpolated maximum** |
|---|---|---|
| Maximum measured | 100 mW forward power | **0.440 A/m** |

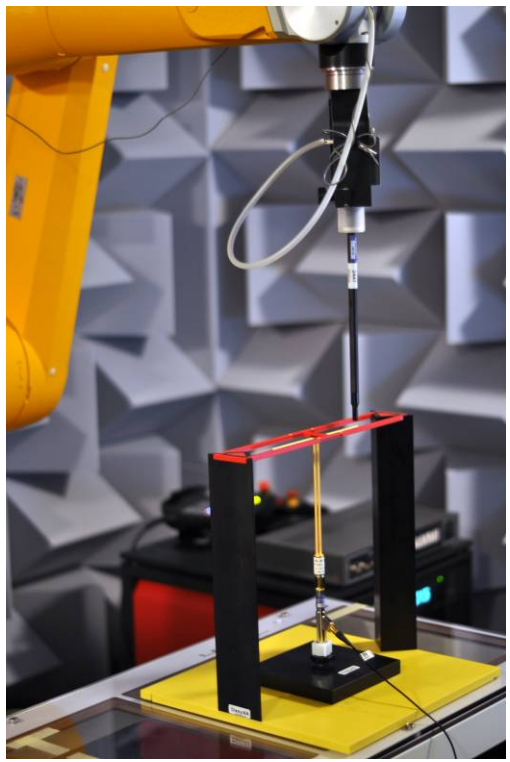
Uncertainty for H-field measurement: 8.2% (k=2)

| **E-field 10 mm above dipole surface** | condition | **Interpolated maximum** |
|---|---|---|
| Maximum measured above high end- | 100 mW forward power | 163.3 V/m |
| Maximum measured above low end | 100 mW forward power | [illegible] V/m |
| Averaged maximum above arm | 100 mW forward power | **162.4 V/m** |

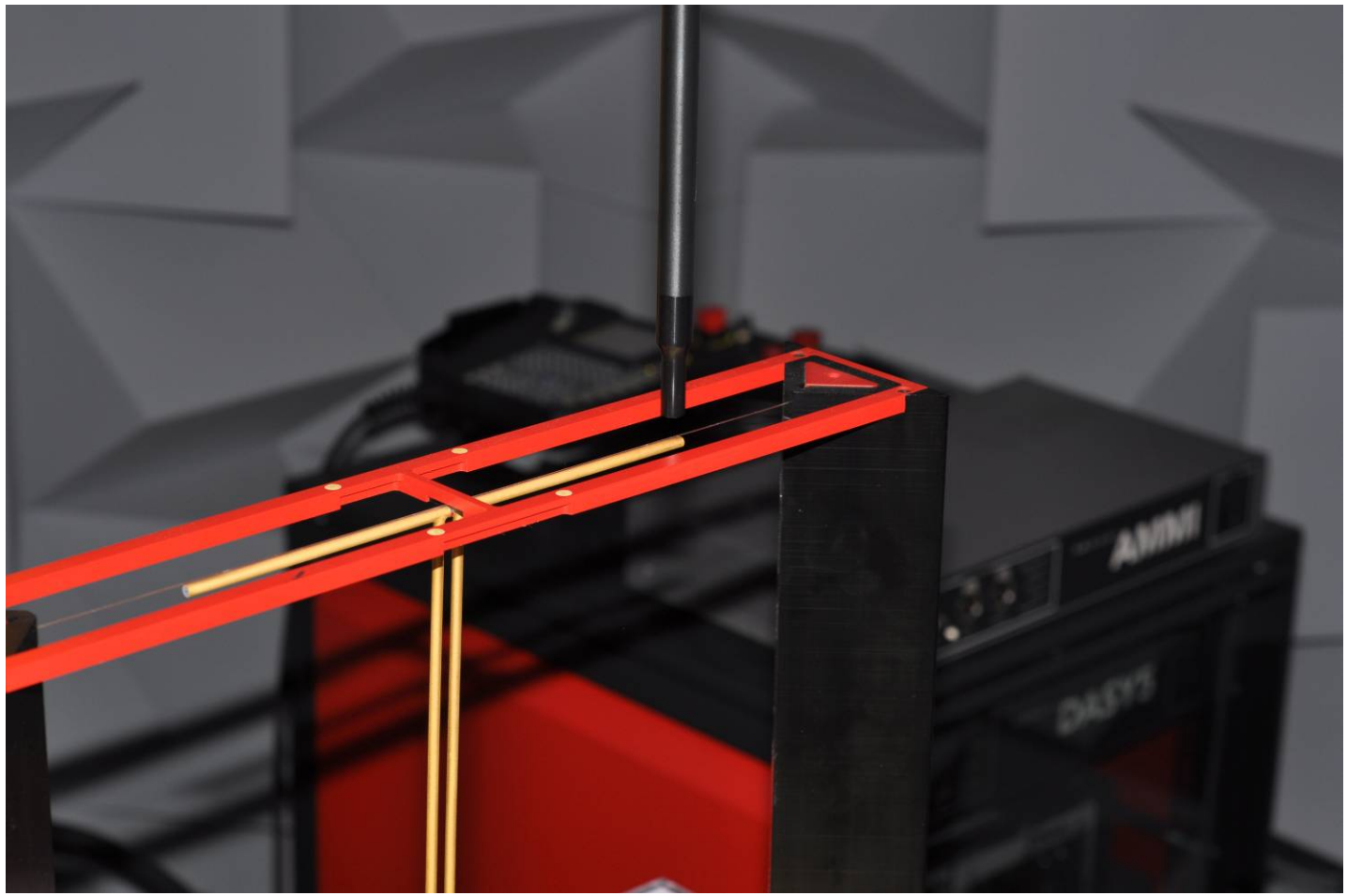
Uncertainty for E-field measurement: 12.8% (k=2)

# Need 1.5 cm 700 MHz Reference Dipole Targets

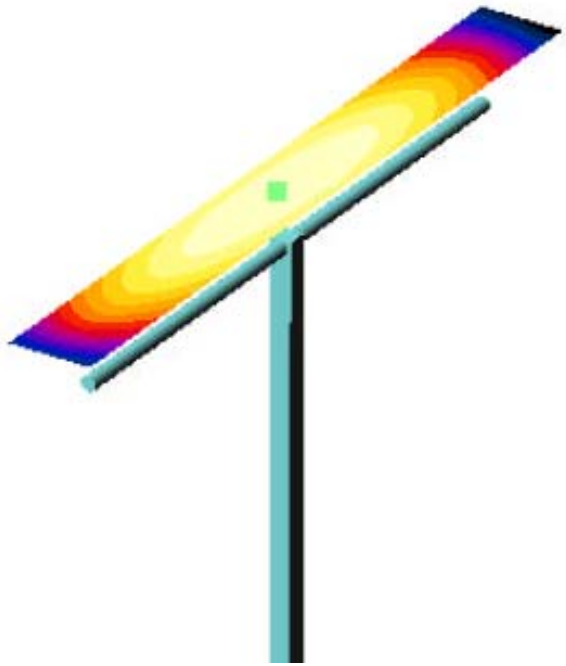
- In the next release of C63.19, **1.5 cm distance** will be standardized for reference dipoles, to better represent system verification at Wireless Device test distances.

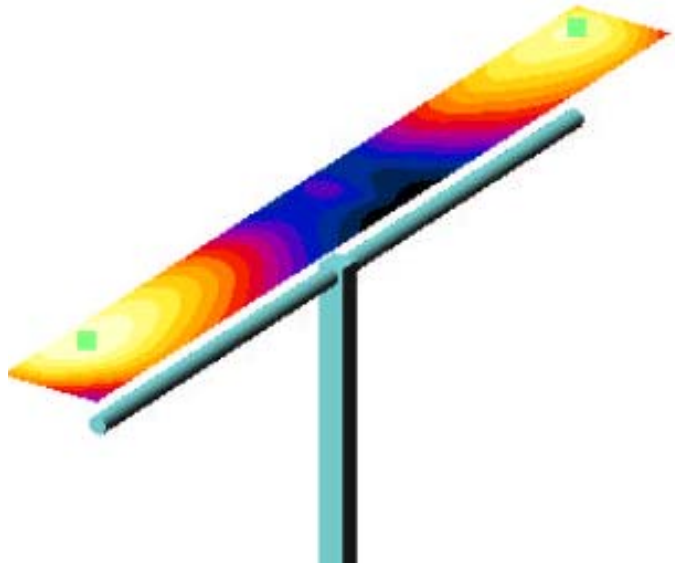


# 700 MHz assessments for the new C63.19 release



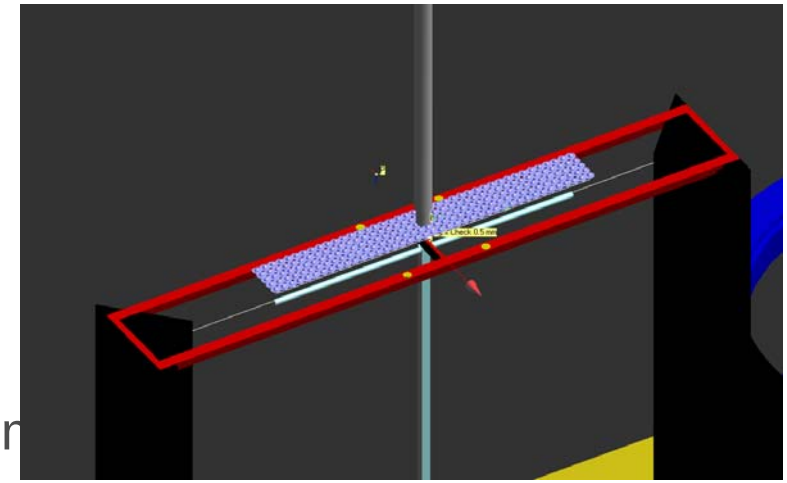
# HAC Dipole Sample Scan





# HAC 700 MHz Dipole Results

- E-field at 15mm:
  - 101.0 V/m
- H-field at 15mm:
  - 0.2772 A/m



- Compare to field strengths at 10 mm
  - E-field: 162.4 V/m
  - H-field: 0.440 A/m

# Conclusion

- Development in the “HAC Test System world” have started preparing for HAC in the LTE 700 MHz band since 2008.
- Some systems can now be validated for HAC RF Emissions Evaluation at 700 MHz bands
- Questions?