mmWave Prescan with Downconverters

ANSI C63 Millimeter Wave Joint Task Group (mmW JTG)

TCBC Workshop

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Traditional mmWave Prescan with Harmonic Mixers

- Poor Sensitivity
  - Must use very close measurement distance

- Hold Measuring Antenna very near the surface of EUT
  - Manually scan antenna around entire surface of EUT
    - Explores all possible source locations of emissions
      - 100% coverage of "sphere" around EUT

- Close Measurement Distance
  - Less than Far-field Boundary Distance of Antenna
    - Effective antenna gain drops
- Poor Sensitivity and Gain
  - System noise floor likely to be above the limit

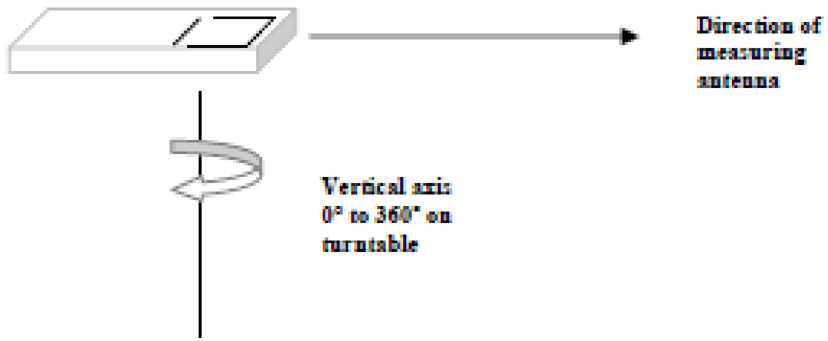
mmWave Prescan with Downconverters

- Good Sensitivity
  - Can test in Far Field
    - Maintains Antenna Gain
      - System noise floor below the limit

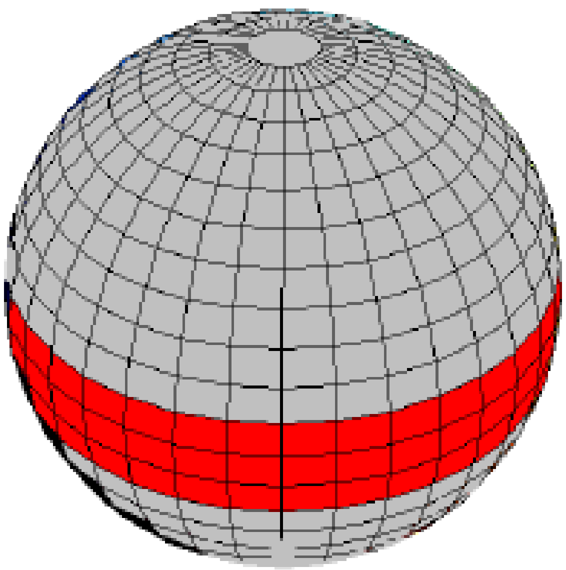
- Traditional Azimuth Scan will miss many possible source locations of emissions
  - Even a 3-Orthogonal-Axes Scan will miss many possible source locations

- Propose to adopt procedure from C63.10:2013 Clause 6.6.5 / Annex H
  - Figures and drawings below excerpted from ANSI C63.10:2013

Azimuth Scan



- Severely Limited Coverage
  - Misses large areas



a) Red cylinder around a sphere

Three-Orthogonal-Axes Scan

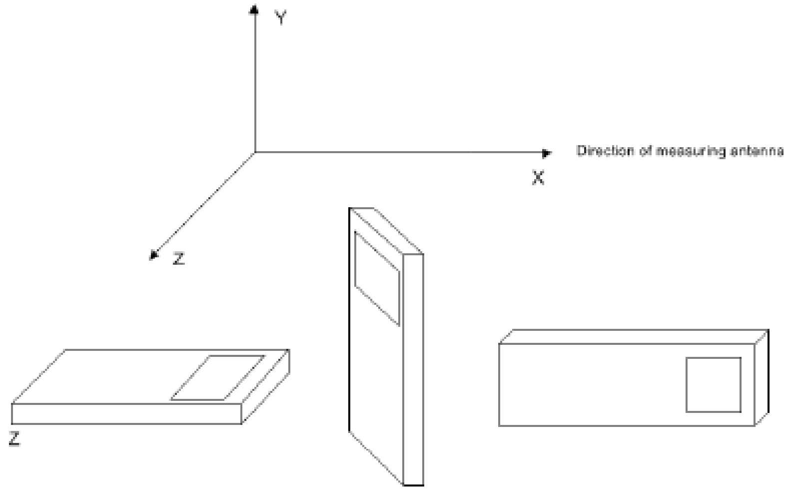
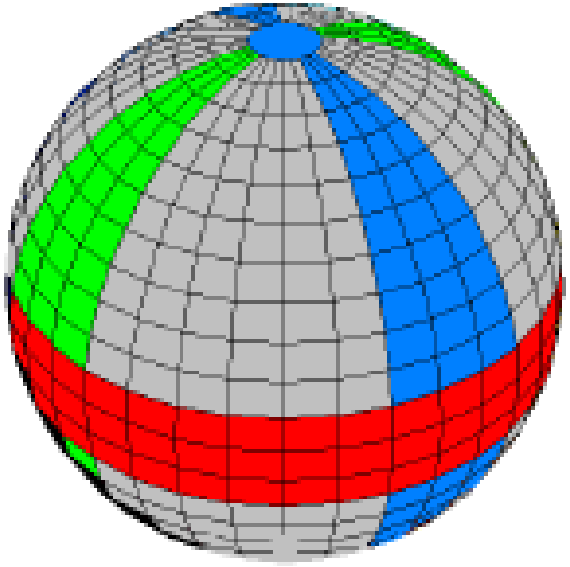


Figure 8—EUT configuration positions (see 6.3.1)

- More Coverage than Azimuth Scan
  - Still misses large areas



c) Three axes x,y,z covering 66% of the area of the sphere

Multiple-Elevation Scan

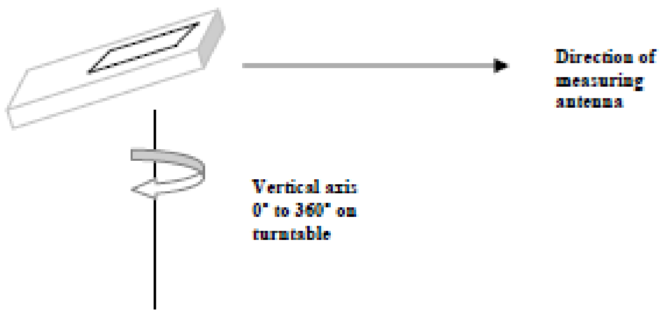


Figure 12—Elevation of EUT *y* axis to *z* axis, 0° to 150° end over end, at 30° (see 6.6.5.4)

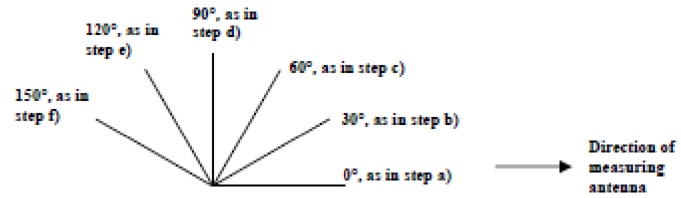
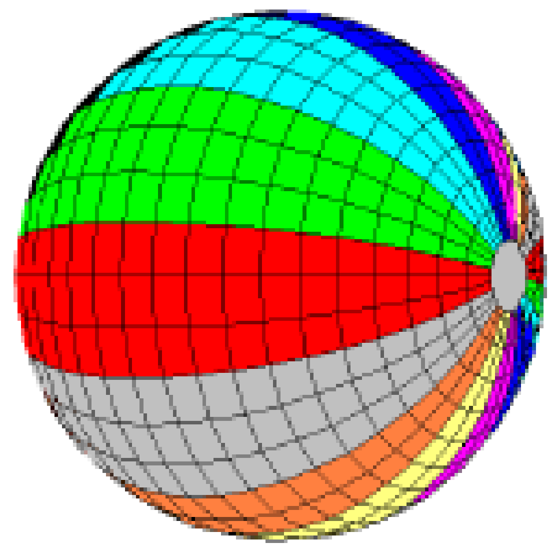


Figure 13—Total number of measurement positions (see 6.6.5.4)



f) Method of 6.6.5 - six step angles of search

- Full Coverage 100% of sphere
  - Assuming emissions are not extremely narrow beams
    - Valid for low-gain antenna structures

Multiple-Elevation Scan

- Continue to use both Vertical and Horizontal Rx Antenna Polarizations

- 1-4 meter Antenna Height Scan not specified above 40 GHz
  - Significant additional path loss due to slant-range distance
    - Slant-range distance at mmWave frequencies can have *many* more wavelengths than direct path, compared to lower frequencies
      - At lower frequencies slant-range (and/or reflected-path) distance may only have additional one-half wavelength than direct path

- Still required to maximize emissions
  - Limited height scan
    - Capture precise beam orientation

Multiple-Elevation Scan

- Align Rotation of Elevation Angle with Boresight of EUT TX Antenna
  - Investigate multiple, non-cardinal Polarizations of Main Beam
    - Can lead to TRP procedures
      - Without special chamber