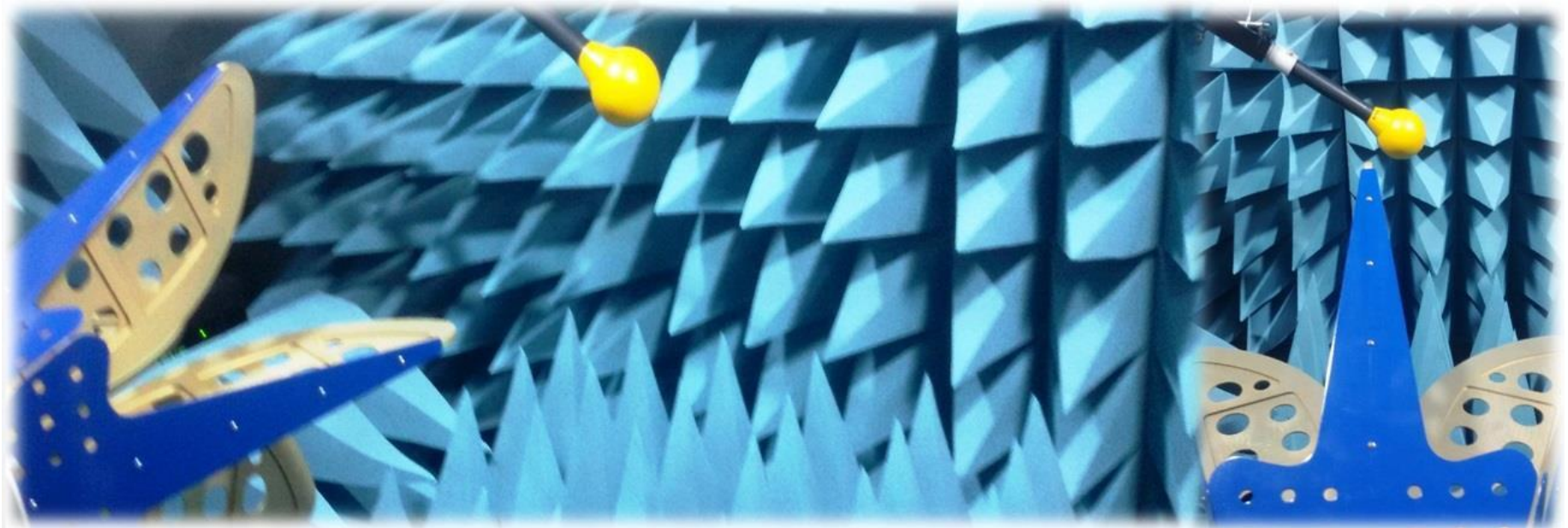


# Measurement of Shielding Effectiveness

Nikhil Jain +91 9873274076 (India)



# Outline

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- ***Introduction***
- ***Scope***
- ***Equipment***
- ***Measurement Process***
- ***Test Report***
- ***Testing at DoT/TEC***
- ***Other Activities***
- ***Conclusion***



# About BNN Communication Engineers

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- **Offering Wireless Services since 1995**
  - *Network Planning & Optimization, EMF Measurement and Compliance,*
  - *Interference Analysis, Spectrum scanning, Regulatory Liaison Services*
  - *Setting up of turnkey SAR Laboratories (TEC, BNNSPEAG, TUV Rhineland, Intel)*
  - *Shielded Chamber Testing (TEC and BNNSPEAG)*
- **Set up EMR Division as an independent Laboratory**
  - *Offer Shielding Effectiveness Measurement Services*
  - *17025 accreditation obtained from NABL*

# BNNEMR - Scope

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## ***Measuring / testing of Electromagnetic Shielding between frequency range 9 KHz – 40 GHz***

- *Electromagnetic Shielding Enclosures - IEEE 299: 2006.*
- *Enclosures and boxes (0.75m to 2m) - IEEE 299.1: 2013.*
- *Ground based C4I facilities for protection against High Altitude Electromagnetic Pulse (HEMP) - MIL Std. 188-125.2: 3 Mar 1999.*

# Equipment

## Signal Generator, Keysight

- **N5173B**
- **9 kHz to 40 GHz**



## Spectrum Analyser, Keysight

- **FireFox N5173B**
- **Integrated VNA and SA**
- **9 kHz to 44 GHz**



## Amplifiers/Preamplifiers

- **Amp (DC – 200MHz MiniCircuits)**
- **Pre-Amp (20MHz – 2GHz) AH systems, USA**



LZY-22+



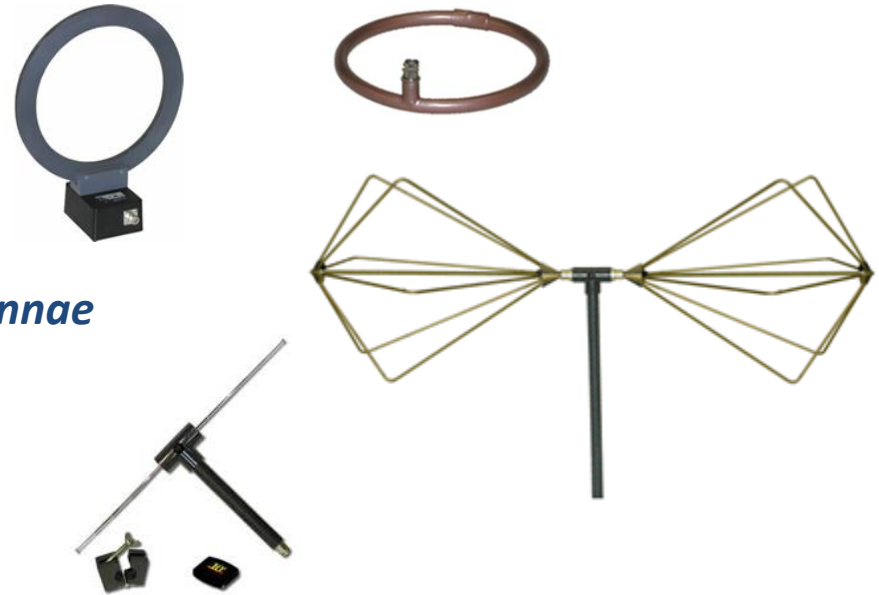
LZY-22X+



# Equipment

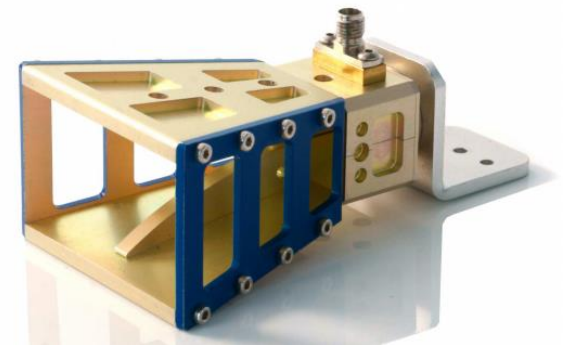
## **Antennae** (AH Systems, USA)

- **9KHz – 16 MHz Loop Antennae**
- **20MHz – 100MHz Bi Conical Antennae**
- **100MHz – 1GHz Dipole Antenna**



## **Horn Antennae** (Aaronia, Germany)

- **4GHz – 40GHz**



# Equipment

## **Horn Antennae** (Miscellaneous)

- **1.12GHz – 1.7GHz**
- **1.7GHz – 2.6GHz**
- **2.6GHz – 3.95GHz**
- **3.95GHz-5.85GHz**
- **5.85GHz-8.2GHz**
- **8.2GHz – 12.4GHz**
- **12.4GHz-18GHz**
- **18GHz-26.5GHz**
- **26.5GHz-40GHz**



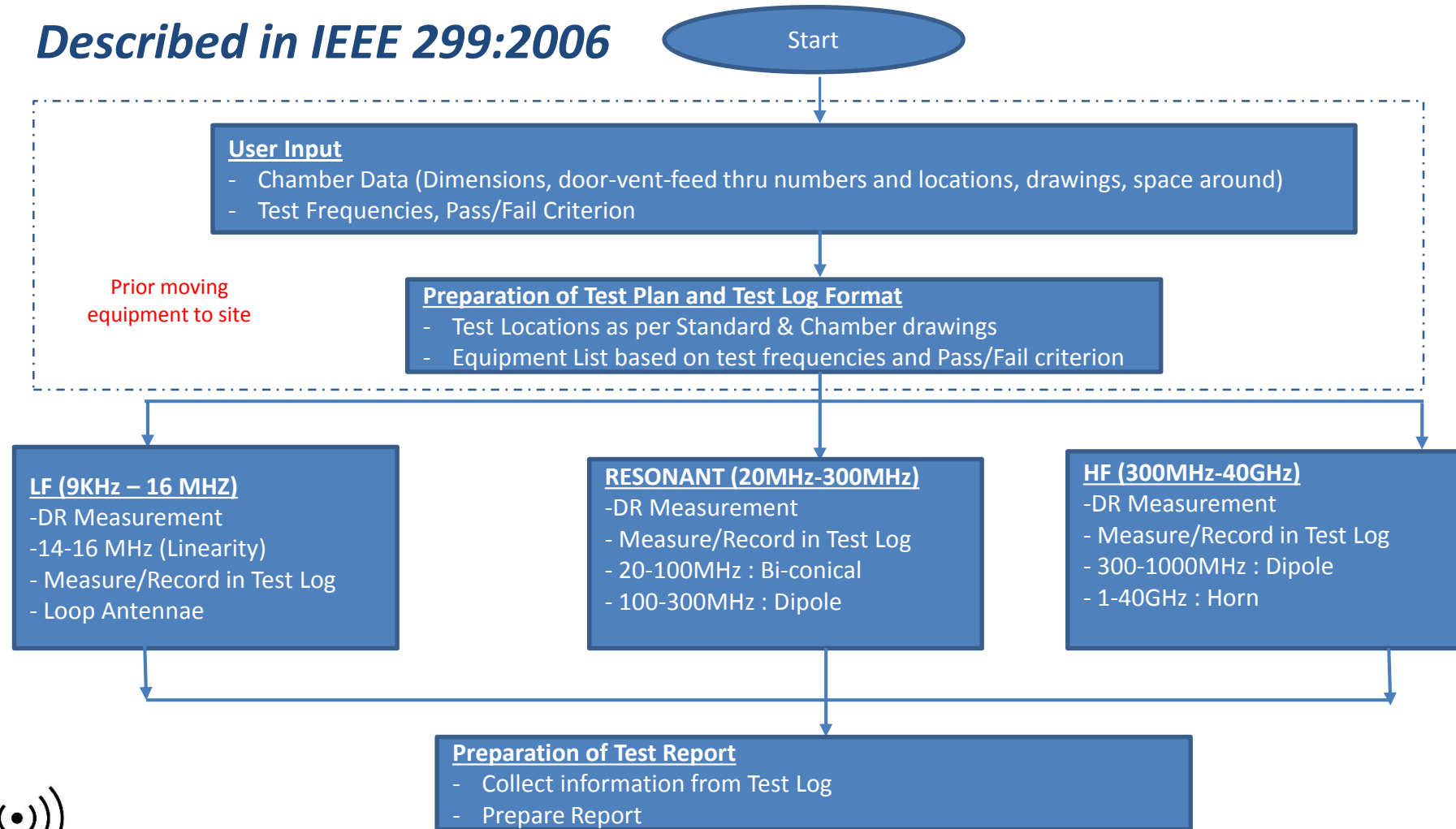
## • **Accessories**

- **Attenuators DC-40GHZ (Pasternack)**
- **40GHz Connecting Cables**
- **Adapters**



# Measurement Method/Process

*Described in IEEE 299:2006*





# Test Report : Contents

## Shielding Effectiveness Test Report

CUSTOMER :  
 OWNER :  
 TEST ENCLOSURE NAME / ID :  
 LOCATION OF T. ENCLOSURE :  
 TEST PERSONNEL NAME :  
 TEST METHOD :  
 TEST DATE(S) : |

The test results in this report apply exclusively to the tested Enclosure. Without written approval of BNN Communication Engineers Pvt. Ltd., the test report shall not be reproduced except in full.

Reviewed by:

Quality Manager

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# Testing at DoT/TEC



**Fig:** Reference Level Measurement Setup At 2100 MHz at outside chamber



**Fig:** Reference Level Measurement Setup At 2100 MHz at inside chamber



**Fig:** Reference Level Measurement Setup At 900 MHz at outside chamber



**Fig:** Reference Level Measurement Setup At 900 MHz at inside chamber

# Testing at DoT/TEC

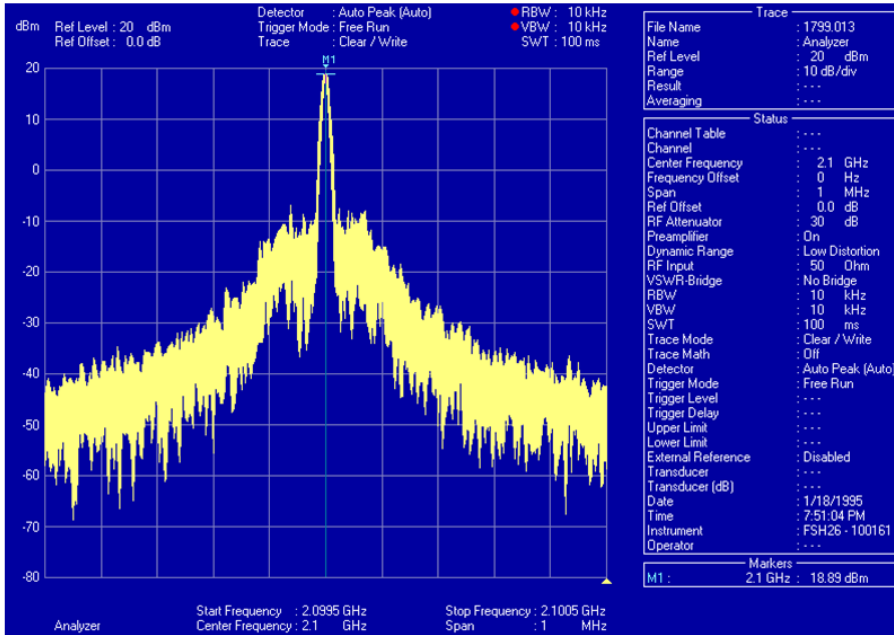


Fig: Spectrum Analyzer Screen Shot of Reference Level Measurement At 2100 MHz

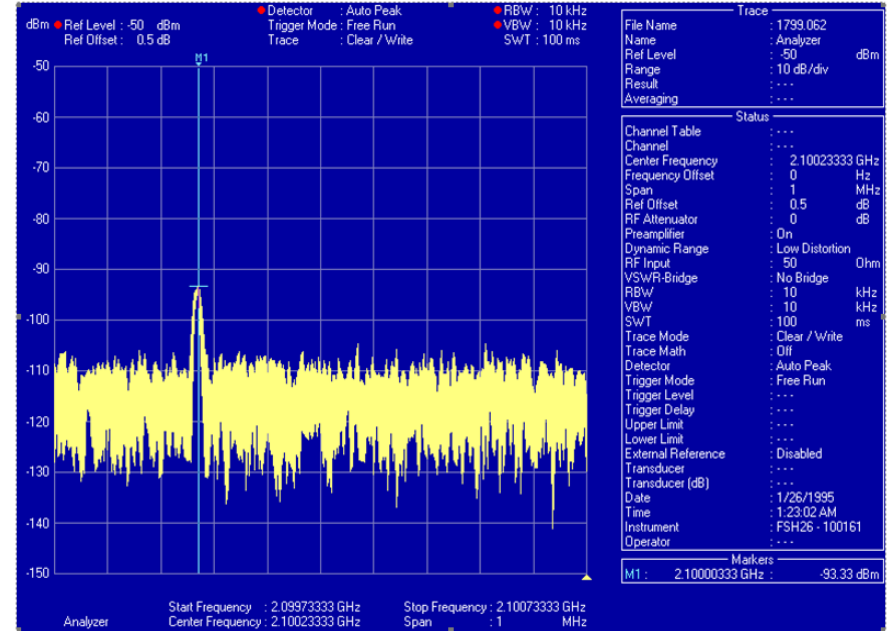


Fig: Spectrum Analyzer Screen Shot of Shielding Effectiveness Measurement At 2100 MHz – T1 Position

# Other Activities : BNN SPEAG Laboratory

## **Electric Field Calibration (ISO 17025) : Electric Field (V/m)**

- Calibration of EMF / EMC Probes & Sensors

## **RF Calibration (17025 accreditation A/F, EDC Nov 2018)**

- Spectrum Analyzers (R&S, Anritsu, Tektronix, Sitemaster)
- Multi-Band scanners, receivers, test mobile phones
- Signal Generators, Attenuators

## **RF Conformance Testing**

- RF measurements for GSM, EGPRS, WCDMA, HASPA, LTE(FDD0/TDD)
- Lab equipped with CMW500 BTS Simulator from R&S

## **EM Field Measurements**

- From electronic/electrical equipment
- DASY52 NEO Robot scanning system

## **SAR Measurements (ISO 17025 compliant)**

- Head and Body SAR Measurements for Mobile Phones, PDA's, Laptops
- Equipped with cDASY6 and cSAR3D Fast SAR system
- Primarily used for research / testing / development of the SAR measurement systems (cDASY6 / cSAR3D / DAK-TL etc.)



Certificate No: T-2510



Certificate No: C-1429



# Conclusion

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- ***Offering wireless services since 1995***
- ***Setup several SAR Labs both in India and abroad***
- ***Set up EMR Division***
  - ***Offers Shielding Effectiveness Measurement Services***
  - ***17025 accreditation obtained***
- ***Has all necessary equipment to undertake Testing/Measurements upto 40GHz***
- ***Has an established for testing/measurement and preparation of report in accordance with IEEE 299:2006***
- ***Offers several services including calibration of EMC probes, RF instruments etc***