Evaluating Uncertainty in Vector Network Analyser Measurements

# Introduction

# Sources of VNA Measurement Uncertainty

Reference Jack W.

## Calibration Standards

### Specification

### Connection repeatability

## General Sources of Random Error

### Connection repeatability

## Additional Sources

## NVNA uncertainty sources

### Power Meter

*Power meter study?*

### Phase Reference

*NIST phase reference characterisation*

# Propagating VNA Measurement Uncertainty to S-parameter Measurements

Cal equations quite large so software typically used to propagate VNA uncertainty.

## Standalone Vendor Tools

## Keysight PNA-X Dynamic S-Parameter Uncertainty Option

## METAS VNA Tools II

## NIST Microwave Uncertainty Framework

# Evaluation of Uncertainty in MHVNA Measurements

## Measurement Models

Blockley paper etc, jacobians for

## Input Quantities

## Processing Structure

## Results

# Conclusions