Metrology.NET™
- ISO 17025 Uncertainty Calculations

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About Presenter

SPARK

- B.Sc (2010) on electrical and electronics eng
- M.Sc (2013) on metrology and software
- Studying Ph.D on metrology and software

Master thesis:
- Software based calibration of high frequency test and measurement devices
- The measurements of power and frequency are modelled
- The models developed are used at the calibration software for uncertainty calculation
• The exclusive Keysight Technologies Authorized Service Provider in Turkey since 2011
• The Laboratory operates in accordance with ISO 17025 Standards and provides calibration, repair and maintenance services for RF and Microwave equipment up to 50 GHz
• The authorized technical service provider is updated per new models simultaneously with all Keysight Service Centers worldwide
• R&D activities with software development project for calibration procedures
• Separated measurement software and uncertainty calculations
• Difficulties of audit for automated calibration (uncertainty calculation per test point)
System Overview

- **TestProcess Type** - `TestProcess.Measure.Harmonics`
- **TestProcess Implementation** - `TestProcessMeasureHarmonics`
- **Uncertainty Calculator** - `MeasHarm.CalcUnc`
- **Parameters** - `Tp.ParameterArray`

- **TestPoint**
  - **TestResults** - Measured
    - Parameters – *ID, lower limit, nominal value, UoM...*
• Adapter Pattern
• Adapter Pattern

• The *Adaptee* is the existing class
• The *Target* is the interface defined in the existing library
• The *Adapter* is the class that you create, it is inherited from the *Adaptee* class and it implements the *Target* interface
• Adapter Pattern
• Can use Excel files and budgets in your system
• For Excel calculations, system back in POI
• Metrology.NET™ built-in standard
• Works with multiple software
User Interface

- Calculation method can be chosen
Calculation Method: Sheet

- Enables metrology engineer use his/her existing uncertainty calculation budgets with Metrology.NET™
- Easy to operate with its simple interface
- Allows the operator to follow the result and uncertainty for each of the test points
Calculation Method: Sheet
Metrology.NET™ Tab

- Tab «metrology.net» is the interface
How Do Excel Files Work?

Inputs

- Inputs are under «Contributors»
Output

- Output is presented as «Result»
How Does Metrology.NET™ Uncertainty Calculator Work?

User Interface

• Calculation method can be chosen
How Does Metrology.NET™ Uncertainty Calculator Work?

User Interface

• Sources of uncertainty can be identified
How Does Metrology.NET™ Uncertainty Calculator Work?

User Interface

- Built-in standard
How Does Metrology.NET™ Uncertainty Calculator Work?

Data About Your Budget

- Methodology
- Assumption
- References
- Notes
REST Call to Uncertainty Calculator

What is REST?

• REST: **Representational State Transfer**

• Uniform Interface
• Stateless
• Cacheable
• Client-Server
• Layered System
• Code on Demand (optional)
About JSON

- **JavaScript Object Notation**
- An open standard format that uses human-readable text to transmit data objects consisting of attribute–value pairs
- Allows more content to be transmitted using smaller packages
- Used primarily to transmit data between a server and web application, as an alternative to XML
Call from any software

Sample REST call:

http://mysite/calcUncVal.json?key=123456789

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured Power</td>
<td>9.65E-07</td>
</tr>
<tr>
<td>Measured Power Uncertainty</td>
<td>0</td>
</tr>
<tr>
<td>Resolution</td>
<td>1.00E-04</td>
</tr>
<tr>
<td>Unit</td>
<td>1.00E-06</td>
</tr>
<tr>
<td>Linearity</td>
<td>2.00E-02</td>
</tr>
<tr>
<td>CF</td>
<td>9.19E-01</td>
</tr>
<tr>
<td>CF Uncertainty</td>
<td>3.42E-02</td>
</tr>
<tr>
<td>ρSensor</td>
<td>1.48E-01</td>
</tr>
<tr>
<td>SG SWR</td>
<td>3.33E-01</td>
</tr>
</tbody>
</table>

Return message will contain this information:

statusCd: 0 (0 problem)
val: 1.9E-5
message: 00000000-0000-0000-0000-0000000000002
version: 1.0
action: NA (No Action)

If Not Agent Is Nothing Then  ' Check Agent Instance
    ' Login to the Server
    If Agent.LogIn("TestStation1", "Pass1234") = True Then

        ' Create Parameters List
        Dim Params As New List(Of Parameter)
        Params.Add(Parameter.NewParameter("Voltage", "10"))
        Params.Add(Parameter.NewParameter("Range", "10"))
        Params.Add(Parameter.NewParameter("Std", "0.000001"))

        ' Create Link to Specific Calculator
        Dim UncCal As New Uncertainty("1017e01a-f0e7-4928-9895-0a698da6f302", "1.0", Params)
        UncCal.Calculate()

        ' See the Unc Calculation
    Else
        Throw New Exception("Error Logging on to the Server!" & vbCrLf & "Unknown User Name and/or Password!")
    End If
Else
    Throw New Exception("No Connection to the Server!")
End If
Type-A Repeatability

Distribution

Measured Power 1: 9.975E-06
Measured Power 2: 9.978E-06
Measured Power 3: 9.981E-06
Measured Power 4: 9.982E-06
Measured Power 5: 9.984E-06
Measured Power 6: 9.987E-06
Measured Power 7: 9.986E-06
Measured Power 8: 9.987E-06
Measured Power 9: 9.988E-06
Measured Power 10: 9.989E-06

Mean Power: 9.9837E-06
Standard Deviation: 0.0046E-06
Uncertainty: 0.0015E-06
Multiple software support

We standardize the interface
   No matter the discipline, it is standardized

We provide Revision Control over the budgets

We can centralize storage

Organized storage and approved use
Thank You

Any Questions?