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VNA Tools V2.8.1 (2.7.8664.20301) - 21.09.2023
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- Uses improved METAS UncLib V2.8.1:
  - DependsOn class improved:
    - GetInputStdUnc internal static method improved
(StudentTFromSamplesDistribution).
    - GetInputIDof internal static method improved
(StudentTFromSamplesDistribution).
  - Python wrapper improved:
  - use_linprop(dofmode=DofModeType.WelchSatterthwaite,
fromsamplesmode=FromSamplesModeType.ExpandInputCovariance)
  - LinPropGlobalDofMode.m added.
  - LinPropGlobalFromSamplesMode.m added.
  - Metas.UncLib_Web.shfbproj added, https://wollmich.github.io/metas-
unclib-programming-reference/.
- Metas.Vna_Web.shfbproj added, see https://wollmich.github.io/metas-vna-
tools-programming-reference/.
- Sandcastle bug fixed, see
https://github.com/EWSoftware/SHFB/issues/1006.
- GuiVnaFreqConvSettings improved (only update frequency list if needed).
- Bug in GetStdUnc method fixed of UncHelper class. The bug occurred when
data was loaded which was generated with V2.8.0 and the the user selected
only some uncertainty influences.


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VNA Tools V2.8.0 (2.7.8578.19660) - 27.06.2023
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- Uses improved METAS UncLib V2.8.0:
  - LinProp.Misc.DependsOn class improved:
    - InputDistribution used as generic type.
    - InputIsLegacy, InputStdUnc, InputIDof read-only properties added.
    - Constructors added.
  - LinProp.UncNumber struct improved:
    - InputDistribution used.
    - The internal class Dependencies stores the jacobi times the input
standard uncertainty. This has the benefit when an input gets redefined
with the same id but with a different standard uncertainty that the
uncertainty of the previous generated object stays the same and its
jacobi value get rescaled.
    - Support for input distributions added to binary (version 2) and XML
file formats.
  - LinProp.UncList class improved:
    - Support for input distributions added to binary file format
(version 2).
  - Distribution, InputValue, InputStdUnc, Sensitivity and Dof properties
added to FlatUncBudgetItem class.
  - ComputeFlatUncBudget method improved.
  - ConvertToTree method improved.
  - Distribution, Value, Standard Unc, Sensitivity and Dof columns added
to GuiUncBudget.
  - MyBinaryReader class added which supports 7-bit encoded integers.
  - MyBinaryWriter class added which supports 7-bit encoded integers.
- Data Explorer improved:
  - Exception handling improved when loading data files.
- OpenLogger and GetLoggerData methods added to Script class.
- Bug in VnaDataMath.IsValid fixed.
- .NET target framework version changed to V4.6.2.
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VNA Tools V2.7.1 (2.7.8560.19925) - 09.06.2023
================================================


- Uses improved METAS UncLib V2.7.1:
  - BinarySetDataFrom method of UncNumber struct improved (checks
dependencies data version).
  - MATLAB Wrapper improved:
    - Bugs fixed in additional constructors.
    - unc_budget.m improved (High DPI support).
  - Python Wrapper improved:
    - metas_unclib.py improved (High DPI support).
    - Update arithmetic special methods.
    - https://github.com/wollmich/metas-unclib-python-wrapper/pull/15
- Time Domain Impedance conversion added.
- Time Domain Admittance conversion added.
- IsFrequencyDomain and IsTimeDomain read-only properties added to
GuiVnaGraph, GuiVnaPlot, GuiVnaPoint and GuiVnaTable classes.
- Power Sensor Test Panel added to Calibration Standard Editor.
- Exception handling improved of MeasureEachFrequencyCW and
MeasureFirstFrequencyCW methods of VnaHelper class.
- Exception handling improved when testing measurement times in
GuiJournalMeasurementPowerSensor.
- DefaultFrequency property added to IWaveParamCalibrationStandard
interface.
- DefaultFrequency property added to WaveParamCalibrationStandard
abstract class.
- DefaultFrequency property added to CascadedPowerSensor class.
- DefaultFrequency control added to GuiPowerSensorTableStandard,
GuiPowerSensorDatabasedStandard and GuiCascadedPowerSensorStandard.
- GuiCalStdModelFit improved:
  - Bug fixed (intermediate results were sometimes reported as final
results).
  - The Agilent, Anritsu and Rohde & Schwarz models yields now in the
same result (all models support now Offset Z0).
- Bug in optimization calibration fixed (id different than 1 for known
standards without unknown parameters).
- FlatVectorFromBinaryReader method of UncHelper class improved (checks
version).
- GuiPrimaryCalStdConnector improved (2-slot connector added).
- GuiPrimaryCalStdMaterialParameters improved (units).
- GuiUnknownLoadStandard improved (units).
- Drivers improved:
  - Support for Option 400 of 8722ES:
    - Bug fixed when measuring switch terms:
      - w1 = r1r2 * r2r2br * r1r1ar / s12
      - w2 = r2r1 * r1r1ar * r2r2br / s21
  - Rohde_Schwarz_ZNx_Logger driver added.
  - Set source power permanent only if needed to avoid error messages on
the ZNA without 3rd and 4rd source.
  - IPowerMeter interface modified:
    - Init method modified (optional default frequency parameter added).
    - DefaultFrequency read-only property added.
  - GuiPowerMeter and GuiPowerMeterForm added.
  - Keysight_EPM_Series driver improved:
    - Use FETC SCPI command in TriggerSingleWait method instead of *OPC?.
  - Rohde_Schwarz_NRP driver improved:
    - Support for USB connected to USB port of NRX added (Sensor 5,
Channel 1).
    - Support added for USB NRP sensors connected directly to PC.
```

- ToString method of LoggerData class improved.
- Metas.Instr.VisaExtensions improved:
  - WaitOnEventBW method added to IBackgroundWorkerExtension interface and to MessageBasedSessionBW class.
  - ISrqExtension interface inherits from IBackgroundWorkerExtension interface.
  - SrqMessageBasedSession class inherits from MessageBasedSessionBW class and uses WaitOnEventBW method in the SrqEnd method.
  - IMessageBasedSessionBW interface added which inherits from IMessageBasedSessionNS and IBackgroundWorkerExtension.
  - ISrqMessageBasedSession interface added which inherits from IMessageBasedSessionBW and ISrqExtension.
  - MessageBasedSessionBW class inherits from IMessageBasedSessionBW.
  - SrqMessageBasedSession class inherits from ISrqMessageBasedSession.
  - ISrqExtension2 interface added with EnableDisableSrqEventOnlyOnce property.
  - ISrqMessageBasedSession inherits from ISrqExtension2.
  - EnableDisableSrqEventOnlyOnce property added to SrqMessageBasedSession class.
  - SrqQuery methods are using SrqWrite methods.
  - SrqMaskSeparator property added to ISrqExtension2 interface and to SrqMessageBasedSession class.
  - SrqWrite method of SrqMessageBasedSession class improved.
- Agilent_ENA_Series driver improved:
  - EnableDisableSrqEventOnlyOnce set to true to avoid Keysight's DisableEvent bug over VXI-11 which takes about 500 ms each time.
  - SrqMaskSeparator set to ";" to same save some additional time.
- String2Range static method added to AdvFormatter class which support the following range inputs:
  - start:stop
  - start:step:stop
- AdvDataGridView improved:
  - Send keyboard shortcuts to editing control when displayed.
  - Support for range inputs (start:stop or start:step:stop) added.
  - Insert Rows and Delete Rows improved (selected cells).
  - Fill Down added.
  - Find and Replace added.
  - Short cuts modified.
- Find and Replace Dialog added.

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VNA Tools V2.7.0 (2.7.8479.32251) - 20.03.2023
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- Uses improved METAS UncLib V2.7.0:
  - Distributions added:
    - StandardNormalDistribution()
    - NormalDistribution(mu, sigma)
    - StandardUniformDistribution()
    - UniformDistribution(a, b)
    - CurvilinearTrapezoidDistribution(a, b, d)
    - TrapezoidalDistribution(a, b, beta)
    - TriangularDistribution(a, b)
    - ArcSineDistribution(a, b)
    - ExponentialDistribution(mu)
    - GammaDistribution(a, b)
    - ChiSquaredDistribution(k)
    - StudentTDistribution(mu, sigma, dof)
    - StudentTFromSamplesDistribution(samples)
    - RandomChoicesFromSamples(seed, samples)

- Multivariate T distribution is generated using a multivariate normal distribution and a chi-squared distribution.
  - GetJacobi2 and GetUncComponent methods implemented for DistProp and MCProp based on covariance matrix.
  - GetJacobi method implemented for DistProp and MCProp based on covariance matrix.
  - Bug in PseudoInv fixed (rcond set to 1e-15), see https://github.com/wollmich/metas-unclib-python-wrapper/issues/13#issuecomment-1434613721.
  - Bug in Interpolation2 method fixed, see https://github.com/wollmich/metas-unclib-matlab-wrapper/issues/79.
  - MATLAB wrapper improved:
    - Distribution wrappers added, see above.
    - u = DistProp(distribution, [id], [description]) constructor added.
    - u = LinProp(distribution, [id], [description]) constructor added.
    - u = MCProp(distribution, [id], [description]) constructor added.
    - MCProp wrapper improved:
      - get_values(x)
      - get_coverage_factor(x, cv, p)
      - get_expanded_covariance(x, p)
    - xMC = LinProp2MCProp(x) function added.
    - y = MCProp2LinProp(yMC, xMC, x) function added.
  - Python wrapper improved:
    - Distribution wrappers added, see above.
    - ufloatfromdistribution(distribution, id=None, desc=None)
    - ufloatarray(values, covariance, idof=0.0, id=None, desc=None)
    - ucomplexarray(values, covariance, idof=0.0, id=None, desc=None)
    - ufloatfromrandomchoices(samples, id=None, desc=None)
    - ucomplexfromrandomchoices(samples, id=None, desc=None)
    - ufloatarrayfromrandomchoices(samples, id=None, desc=None)
    - ucomplexarrayfromrandomchoices(samples, id=None, desc=None)
    - ucomplex(value, imag=0.0, covariance=None, idof=0.0, id=None, desc=None)
    - xmc = uspecial.linprop2mcprop(x)   : Converts LinProp objects to MCProp objects
    - y = uspecial.mcprop2linprop(ymc, xmc, x) : Converts MCProp objects back to LinProp objects
    - add __get/setstate__
    - https://github.com/wollmich/metas-unclib-python-wrapper/pull/14
- Change reference impedance dialog improved:
  - 1 Ohm toolstrip button added.
  - Transmission line junction button added:
    - If checked the reference impedance is changed by cascading transmission line junction to each port.
    - If not checked only the reference impedance is changed without changing the S-parameters or the wave-parameters.
- Compute normalized error checks if the value of all differences are zero when the covariance is 0.
- Port assignment bug fixed in SwitchErrorTerms method of SParamTools class.
- LXI Device Web Page added to VNA Device Editor and to Calibration Standard Editor.
- Remote Desktop Connection added to VNA Device Editor and to Calibration Standard Editor.
- Manual_Switch driver added.
- Agilent PNA Driver improved (support for point average added).

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VNA Tools V2.6.2 (2.6.8412.15485) - 12.01.2023
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- Uses improved METAS UncLib V2.6.2:
  - New .NET ChainRule, ChainRuleAdd, ChainRuleSubtract methods added
which are as fast as the MKL chain rule methods.
  - LinProp.Misc.Global.UseIntelMKL property added used for chain rule
(default: false).
  - IsOne method added to IComparable interface.
  - Fsub method improved (check diagonal elements of L matrix).
  - LinAlg static class improved:
    - ComplexMatrixToMatrixRepresentation method added.
    - MatrixRepresentationToComplexMatrix method added.
    - ComplexColumnVectorToMatrixRepresentation method added.
    - MatrixRepresentationToComplexColumnVector method added.
    - Code simplified for getting the number of columns of a matrix.
    - LstSqrSolve methods for IRealNumber<T> and Complex<IRealNumber<T>>
added.
    - LstSqrSolve method for INumber<T> removed.
  - The above change affect the following methods of the NumLib static
class:
    - PolyFit
    - Interpolation
    - Integrate
    - Integrate2
  - Hilbert method added to Array class. The Hilbert matrix can be used
for unit testing.
  - NumLib2 used for interpolation and polyfit. This is change is needed
because the LinAlg and NumLib classes of METAS UncLib have been improved.
  - QR Decomposition with Householder-Transformations A = Q x R added to
LinAlg class.
  - Single Value Decomposition A = U x diag(W) x V' added to LinAlg
class.
  - LstSqrAlgorithm enumeration added with the following items:
    - NormalEquation
    - QR
    - SVD
  - LstSqrSolve, WeightedLstSqrSolve and GeneralLstSqrSolve methods
improved:
    - Optional parameter algorithm added with default value set to QR.
  - Cholesky decomposition for complex matrices added to LinAlg class.
  - QR decomposition for complex matrices added to LinAlg class.
  - DefaultAlgorithm constant added to LinAlg class.
  - MATLAB wrapper improved:
    - lscov(A, y, w) : Weighted least square solve over determined
equation system
    - lscov(A, y, V) : General least square solve over determined
equation system
    - [L, U, P] = lu(M)  : LU decomposition of matrix
    - R = chol(M)        : Cholesky decomposition of matrix
    - [Q, R] = qr(M)     : QR decomposition of matrix
    - [U, S, V] = svd(M) : Single value decomposition of matrix
  - Python wrapper improved:
    - ulinalg.weightedlstsqrsolve(A, y, w) : Weighted least square solve
over determined equation system
    - ulinalg.generallstsqrsolve(A, y, V)  : General least square solve
over determined equation system
    - L, U, P = ulinalg.lu(M)  : LU decomposition of matrix
    - L = ulinalg.cholesky(M)  : Cholesky decomposition of matrix
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    - Q, R = ulinalg.qr(M)      : QR decomposition of matrix
    - U, S, V = ulinalg.svd(M) : Single value decomposition of matrix
  - Extended documentation
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/51
  - Change occurrences of type to isinstance
  - https://github.com/wollmich/metas-unclib-python-wrapper/pull/12
- Support added for loading cable files which were created with Maury
Insight. This was working in the past and it has been broken in VNA Tools
V2.6.0 and V2.6.1.
- Performance improved.
- Measurement series improved (mode: switch states):
  - Support for SCPI states added.
  - Support for multiple equal states added.
- Script engine improved (traceback is written to console on exceptions).
- GuiDropDownUncIdDefs improved (show all uncertainty influences grouped
like in the uncertainty budget).
- Typos fixed.
- Test Device added to Calibration Standard Editor for power sensors.
- NI-VISA Test Panel added to Calibration Standard Editor for power
sensors.
- Test VISA Performance added to VNA Device Editor and to Calibration
Standard Editor.
- Keysight_EPM_Series driver improved:
  - Support added for E4418B and E4419B.
  - Support added for N1913B and N1914B.
- Manual_Power_Meter moved from Metas.Instr.Driver.PowerMeter to
Metas.Instr.Driver.


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VNA Tools V2.6.1 (2.6.8357.16137) - 18.11.2022
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- Uses improved METAS UncLib V2.6.1:
  - GeneralLstSqrSolve method added to LinAlg class.
  - GeneralLstSqrSolve method added to RealLinAlg and ComplexLinAlg
classes.
  - ufloat and ucomplex only define __repr__().
  - https://github.com/wollmich/metas-unclib-python-wrapper/pull/5
  - Using isinstance() instead of type().
  - https://github.com/wollmich/metas-unclib-python-wrapper/pull/9
  - Bug in GuiUncBudget user control fixed (copy exception).
  - See https://github.com/wollmich/metas-unclib-python-wrapper/issues/10
  - Bug fixed (_UncNumber() replaced with _UncNumber(0)).
  - Change constants to be properties of classes instead of struct
arrays.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/78
- One Path Two Ports incomplete calibration improved (support for power
calibration added).
- Obsolete property RootPathDatabase removed from Journal class.
- Obsolete defaultRootPathDb parameter removed from SaveJournal method.
- MaterialParamTools.TransmissionOnly method added.
- GuiMaterialParamDataDialog improved (Transmission Only method added).
- GuiMaterialParamDataTable improved (n3 added to numerical format and
code clean up).
- Bug in GuiDropDownUncIdDefs fixed (unknown ids).
- ConvertTo method added to IVnaData interface and to VnaData class.
- Bug in loading obsolete cable files which were created with VNA Tools
V1.7.0 to V1.8.2 fixed.
- https://groups.google.com/g/vnatools/c/xqkxMEvjdGI
- Bug in Expand2NPto4NP method of SParamTools class fixed.
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- Create Screenshots menu item added to VNA Data Explorer.
- IFreqPort and IFreqPortZr interfaces improved (SamePortModes methods added).
- FreqPort and FreqPortZr abstract classes improved (SamePortModes methods added).
- Port assignment of Cascade improved:
  - Example 1:
    - A: 1, 2, 3, 4
    - B: 5, 6
    --> AB_new: 1, 2
    --> AB_old: 5, 6
  - Example 2:
    - A: 1, 2, 3d, 3c
    - B: 1d, 1c
    --> AB_new: 1, 2
    --> AB_old: 1d, 1c <-- wrong
- Port assignment of De-cascade improved:
  - Example 1:
    - A: 1, 2, 3, 4
    - AB: 5, 6
    --> B_new: 1, 2
    --> B_old: 5, 6
  - Example 2:
    - A: 1, 2, 3d, 3c
    - AB: 1, 2
    --> B_new: 1d, 1c
    --> B_old: 1, 2 <-- wrong
- UncDefinition and UncReceiverDefinition properties improved (port assignment).
- Data Explorer improved:
  - Bug in change reference impedance of wave parameters fixed (do not force diagonal S-matrix).
  - Bug in cascade or de-cascade of wave parameters fixed (do not force diagonal S-matrix).
- GuiVnaChangePortAssignmentDialog improved:
  - Index columns added.
  - Possibility added to not sort the new ports.
- Optional sort parameter added to SParamTools.SubsetAndChangePortAssignment and SParamTools.ChangePortAssignment methods.
- ParameterMatrixFromVnaData method does not sort ports (used in the auto setup in the graph).
- SubsetAndChangePortAssignmentWithoutSorting and ChangePortAssignmentWithoutSorting methods added to script class.
- IDevice interface improved:
  - Preset method added.
- ITriggerSingleDevice interface added with the following methods:
  - TriggerSingleStart
  - TriggerSingleWait
  - TriggerSingle
- ITriggerSingleDevice interface inherits from IDevice interface.
- ITriggerSingleContHoldDevice interface added with the following methods:
  - TriggerCont
  - TriggerHold
- ITriggerSingleContHoldDevice interface inherits from ITriggerSingleDevice interface.
- IPowerMeter interface inherits from ITriggerSingleDevice interface.
- IVna interface inherits from ITriggerSingleContHoldDevice interface.

- Bug in PathTools.MakeRelativePath method fixed (returns in all cases an implicit file path).
- Typos fixed.

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VNA Tools V2.6.0 (2.6.8222.29654) - 06.07.2022
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- Uses improved METAS UncLib V2.6.0:
  - Physical constants added (CODATA 2014 and 2018), see Const and Const<T> classes.
  - IRealNumber<T> interface split up into IRealNumber and IRealNumber<T> interfaces.
  - IRealNumber2<T1, T2> interface added.
  - Real<T> generic struct added to capsule an IRealNumber<T> because interfaces do not support operator overloading and implicit type conversion.
  - Physical constants use Real<T> generic struct.
  - IRealUncNumber<T> interface split up into IRealUncNumber and IRealUncNumber<T> interfaces.
  - Made display() respect current format and removed non-ascii characters from source code.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/58
  - Fixes issue #61. Error displaying scalars with very large or very small components.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/64
  - Proposed fix for issue #62. get_stdunc and get_value sometimes return real-valued even though IsComplex is true. Reverting now obsolete check in display().
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/63
  - Added isreal() method.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/66
  - Statistics class improved:
    - Mean methods replaced by generic Mean methods.
    - Exception added to Std method.
    - MovMean method added.
  - AbsSqr method added to Math static class.
  - LinProp dft and idft added to setup.
  - Fixed a bug in string() that caused the method to return incorrect data for matrices.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/67
  - Added test to throw error with non-real valued inputs.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/69
  - Added static method empty().
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/70
  - Modified dispAsPages to always print complex numbers as complex.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/74
  - Added complex(a, b) signature.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/72
  - Added support for Real<UncNumber>.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/75
  - Added read-only properties Const2014, Const2014_90, Const2018 and Const for physical constants.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/77
  - Added uconst2014, uconst2014_90, uconst2018 and uconst for physical constants.
  - https://github.com/wollmich/metas-unclib-python-wrapper/pull/3.
- Physical constants (CODATA 2018) from METAS UncLib used.
- VNA noise characterization per port.
- Cables from Maury Microwave added to the Database.

- CableElectricalSpec modified:
  - Obsolete properties StabilityMag and StabilityPhase removed.
  - IXmlSerialize interface implemented to be compatible with old file format (two-way cable stability).
- XML schema improved:
  - Receiver noise floor and trace noise added.
  - Unknown error terms added to VNA device.
- Bug in create screenshots fixed (directory separator added).
- IsWaveParameter read-only property added to IVnaParameter interface and to VnaParameter class.
- Unit for wave parameters changed from V/sqrt(kOhm) to sqrt(mW).
- Rohde & Schwarz drivers improved (factor for wave parameters (V @ Zr to V/sqrt(kOhm)).

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VNA Tools V2.5.4 (2.5.8168.18795) - 13.05.2022
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- Uses improved METAS UncLib V2.5.4:
  - Performance improvements.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/48
  - Reworked subsref to remove most of the MATLAB overhead.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/49
  - Performance improvements for subsasgn().
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/50
  - Removed incorrect reshape operation from integrate2 and splineintegrate2.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/52
  - Fixed a rare bug in horzcat() and vertcat(), added cat().
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/53
  - Constructor with generic ids.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/54
  - Metas.UncLib.LinProp.Ndims.RealUncNumLib class added.
  - Metas.UncLib.LinProp.Ndims.ComplexUncNumLib class added.
  - LinProp dft and idft added.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/55
  - Local Convert2UncArray and Convert2LinProp functions removed.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/56
  - LinProp dft and idft added.
  - https://github.com/wollmich/metas-unclib-python-wrapper/pull/1
  - Added rad2deg and deg2rad.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/57
  - Ellipk and Ellipe methods added to IRealMath interface.
  - Ellipk and Ellipe static methods added to Math static class.
  - Ellipk and Ellipe methods added to RealNArray class.
  - Ellipk and Ellipe methods added to Number and UncNumber structs.
  - function [k,e] = ellipke(x) added.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/59
  - ellipk and ellipe methods added to ufloat class and umath static class.
  - https://github.com/wollmich/metas-unclib-python-wrapper/pull/2
  - Typos fixed.
- Bug in VnaDataMath fixed (unit for S/S' and Time Domain).
- Bugs in GuiXYPlot fixed (RoundToSignificantDigits and Exponent).
- GuiVnaPlot improved (default plot range).
- Unknown IDs are decoded by `Metas.UncLib.LinProp.UncBudget.ComputeFlatUncBudget`.
- https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/46#issuecomment-1091129624

- Set examples directory as startup directory for Data Explorer improved (common or personal documents).
- Code clean up of VnaToolsPath class.
- High DPI support improved.
- Error handling for computing linearity uncertainty improved.
- Copy Absolute Path and Copy Relative Path added to content menu of Data Explorer.
- Roman struct added, see https://gist.github.com/wollmich/fb85d529b195a8008e940e488cb739be.
- VnaPortDescription struct improved:
  - Index field added.
  - IsIndexZero read-only property added.
  - AreAllPortIndicesZero static method added.
  - Constructors with index parameter added.
  - Constructor with string parameter improved.
  - ToString method improved.
  - ToByte method improved.
  - Operators + and - improved.
  - ReadXml and WriteXml methods improved.
  - CompareTo method improved.
  - Equals method improved.
  - Regular expression pattern and check added.
- VnaParameter class improved:
  - FromString static method improved to support port indices.
- IFreqPort interface improved (ArePortIndicesUsed and AreAllPortIndicesZero read-only properties added).
- FreqPort abstract class improved (ArePortIndicesUsed and AreAllPortIndicesZero read-only properties added).
- Support for port indices added.
- Binary class modified (MixedModeBinaryVersion renamed to MixedModeOrPortIndicesBinaryVersion).
- SParamData, VnaData, GenericCalibrationModel, SwitchedCalibrationModel and OptCalibration classes improved to support port indices.
- VnaPortDescription struct improved (BinaryWriteDataTo and BinarySetDataFrom methods improved to support port indices).
- Bug in TableFreqInfo fixed.
- GuiVnaChangePortAssignmentDialog improved to support port indices.
- GuiVnaParameter improved (port indices added).
- GuiVnaGraphCustomSetUp improved (layout changed for port indices).
- GuiVnaGraph improved (support for port indices added).
- GuiSplitButtonVnaParameterSetUp improved (port indices added).
- Calibration configuration improved:
  - A measurement (*.sdatb, *.vdatb), a generic calibration (*.calb) or a non-leaky switched calibration (*.calb) can be given for the switch terms.
  - Interpolation of switch terms is not allowed, only subset.
- Bug in OnlyCWTimeData read-only property of GuiVnaPlot class fixed.
- OnWafer standard improved (uses Ellipk and Ellipe methods from METAS UncLib).
- Custom actions of installer modified (uses installer class).
- Custom action moved from installer class to command line, due upgrade bug in MSI and remove exiting product (1410).
- Agilent PNA driver improved (SrqQuery replaced by Query).
- Rohde_Schwarz_ZNx_ZVx driver improved (SrqQuery replaced by Query).
- Rohde Schwarz Cal Unit over ZNx ZVx improved (SrqQuery replaced by Query).
- AgilentECalOverPNA driver improved (SrqQuery replaced by Query).
- Agilent ENA driver improved (SrqQuery replaced by Query).
- Agilent ENA and Agilent ENA No SRQ drivers improved (performance of GetData improved).

- Agilent_8720_53_Series driver improved (HP8753B/C are not supporting
the OutputState property).
- Agilent PNA Driver improved (number of test ports =
SYST:CAP:HARD:PORT:COUN? only with firmware A10.60 or newer).
- VnaHelper class improved: GetFrequencyList from VnaSettings method
added.

```
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VNA Tools V2.5.3 (2.5.8091.31424) - 28.02.2022
==================================================
```

- Uses improved METAS UncLib V2.5.3:
  - AbsSqr method added to IComplexMath interface.
  - AbsSqr method added to Complex and ComplexNArray classes.
  - Typo fixed (dependencies).
  - Replaced the incorrect keyword/function 'throw' with 'error'.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/45
  - plus, minus, and divide now replicate singleton dimensions.
  - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/43
- Bug in CascadedPowerSensor fixed (set phase of calibration factor to
0).
- Bug in PowerUncContributions method fixed (use power sensor id and not
cascaded power sensor id for aging, linearity and power meter
uncertainties).
- Bug in CalConfigStd.UncDefinition fixed (power sensor as reflection
standard).
- Formatting of uncertainty budget improved (frequency info and
linearity).
- VerificationTools class improved (no common frequency points exception
added).
- TableColumnHeader improved (non-breaking space for unit).
- DriverFolder changed from "$(Public)\Documents\Metas.Instr\Drivers\" to
"$(Public)\Documents\Metas.Instr\Drivers\Release\".
- New measurement series dialog is used when a power sensor needs to be
connected or reconnected. The dialog shows the raw data in a graph.
- Graphics.DrawLines performance issue in GuiXYPlot fixed (line width set
to 1 for more than 2500 data points, see
https://stackoverflow.com/q/70653334/7556646).
- IFreqPort interface improved (IsCWTime read-only property added).
- FreqPort abstract class improved (IsCWTime read-only property added).
- GuiXYPlot improved:
  - Optional parameter xInfoOnly added to PlotXY methods.
  - Optional parameter onlyPoints added to PlotCartesian methods.
  - Point style changed:
    - Solid circle for less or equal than 2500 data points.
    - Plus for more than 2500 data points.
- GuiXYPlotAdvanced improved:
  - Optional parameter xInfoOnly added to UncPlotXY methods.
  - Optional parameter onlyPoints added to UncPlotCartesian methods.
- GuiVnaPlot improved:
  - OnlyCWTimeData read-only property added.
  - Plot CW time data vs measurement and not vs frequency.
  - Plot CW time data as points in the complex plane (Cartesian plot).
- Error in equation (wavelength in an empty cell) of section material
parameters of math reference fixed. The source code of VNA Tools was not
affected by this error.
- Bug in GuiVnaTable fixed (time unit of phase delay and group delay in
column header).
- GuiXYPlot and GuiXYPlotSimple improved:
  - Axis format set to fixed point or engineering notation.

- Cursor format set to fixed point or engineering notation.
  - The maximum number of significant digits in the fixed point notation
is computed based on the axis range.
  - The number of digits of digits after the decimal point in the
engineering notation is computed based on the axis range.
- Format of frequency info changed to FFF (SI prefix, unnecessary zeros
at the end are removed in groups of 3).
- GuiVnaFreqPortZrFreqConv user control improved (auto size frequency
information columns).
- High DPI improved for GuiJournalCableConnectorTable.
- New project dialog improved (logger device added).
- Bug in HP8751A and Rohde_Schwarz_ZVC_M_R drivers fixed
(Source1PowerSlope property changed from NaN to 0). The power slope is
used to compute the noise floor uncertainty and can't be NaN.
- Agilent PNA driver improved (performance of GetData improved by adding
the 'fast' optional argument which requires firmware A.09.90 or newer).

===
VNA Tools V2.5.2 (2.5.8021.19907) - 17.12.2021
===

- New measurement series dialog added which is shown when a DUT needs to
be connected or reconnected. The dialog shows the raw data in a graph.
- Cascaded Power Sensor added.
- Verification Result Dialog improved (frequency info in plot of
normalized error).
- GuiJournalMeasurementPowerSensor improved (Test Measurement Times
button added).
- MeasureFirstFrequencyCW method added for testing VNA and power meter
measurement times.
- Agilent PNA Driver improved (number of test ports =
SYST:CAP:HARD:PORT:COUN?).
- Agilent ENA Driver improved (number of test ports =
SERVICE:PORT:COUNT?).
- GuiXYPlot and improved (cursor format set to fixed point or engineering
notation).
- GuiVnaGraph improved (NormToMean method added).
- Reset window layout when starting with a different DPI setting.
- Set examples directory as startup directory for Data Explorer.
- DropDownFolderBrowser improved (prevent ToolStripMenuItems from jumping
to second screen).
- MyFormStatus improved (replace unit separators for console write line).
- MessageBoxTools improved (FlashWindow and StopFlashingWindow methods
added).

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VNA Tools V2.5.1 (2.5.8000.26816) - 26.11.2021
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- GuiXYPlot and GuiXYPlotSimple improved (axis format set to fixed point
or engineering notation).
- Group delay algorithm changed (same as groupdelay function of RF
toolbox of MATLAB).
- Unknown mixer calibration improved:
  - Frequency conversion unknown mixer calibration replaced by frequency
conversion unknown phase mixer calibration.
  - Frequency conversion unknown mixer mag phase calibration added.
  - Unknown mixer uncertainty added.
  - UnknownMixer class replaced by UnknownMixerMagPhase and
UnknownMixerPhase classes.

- GuiUnknownMixerMagPhaseStandard added.
  - GuiUnknownMixerPhaseStandard added.
- Power sensor measurement improved:
  - Support for software zero added.
  - Support for zero delay added.
  - Dialog layout improved.
  - Allow negative power levels.
  - Power sensor readings setting added to journal.
  - Power sensor VNA sweep points setting added to journal.
  - Power sensor uncertainties improved (scale noise).
  - SoftwareZeroBeforeFirstFrequencyPoint property added to
PowerMeterSettings class.
  - MeasureEachFrequencyCW method improved (support for software zero of
power sensor added).
  - ZeroDelay property added to PowerMeterSettings class.
  - MeasureEachFrequencyCW method improved (support for zero delay added,
software zero with default frequency of power sensor).
- GSOLT calibration improved (two cases for computing the switch terms
added):
  - Without crosstalk: only the reflection measurements of the
transmission standard are used.
  - With crosstalk: the reflection and transmission measurements are
used.
- SParamTools.SwitchedErrorTerms improved (norm to 1 if no power
calibration applied).
- SwitchedCalibrationModel improved (compute generic error terms and
switch terms from switched error terms).
- List calibration file subitems improved (generic error terms and switch
terms of non-leaky switched calibrations).
- Initialize optimization calibration improved (start calibration can be
either a generic model type or a switched model type).
- GuiFrequencySettings improved (support for frequency conversion added).
- GuiCalibrationStandardEditor improved (uses frequency conversions of
frequency list file if number of ports agree).
- Support for reading embedded data files in PTB DCC added (see
https://ptb.de/dcc).
- Bug fixed in Graph of Data Explorer (* in Norm when turning frequency
list on or off).
- High DPI support improved (scaling).
- RohdeSchwarz_ZVC_M_R driver improved:
  - TurnOffFactoryCalibration and TurnOnFactoryCalibration methods
modified:
    - 'factory.cac' (factory calibration) file is renamed.
    - 'factory.pcc' (power calibration) file is not renamed.
- Rohde_Schwarz_NRP driver improved (workaround for NRPX firmware bug):
  - Init continuous off removed.
  - Trigger simplification reverted:
    - visa.Write("TRIG" + Channel.ToString() + ":SOUR BUS");
    - visa.Write("INIT" + Channel.ToString());
    - visa.Write("*TRG");
- Bugs in Manual_PowerMeter_GetValue fixed.
- AdvFormatter improved: NaN and Infinity.
- MyNumericEdit improved (select all text on got focus).
- AdvFormatter improved (String2Double method added, allow SI prefixes).
- MyNumericEdit improved (parse text using AdvFormatter.String2Double).
- AdvDataGridView improved (parse text using AdvFormatter.String2Double
for cells of type double).
- FolderTreeView improved (use the file extension of the file sub item
for the icon).

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VNA Tools V2.5.0 (2.5.7935.30849) - 22.09.2021
=================================================


- Uses improved METAS UncLib V2.5.0:
  - Bug in InputId.ToUintArray fixed (round up uint length integer).
  - Typos fixed.
  - IArrayAritmetic interface renamed to IArrayArithmetic.
  - DblAritmetic static class renamed to DblArithmetic.
  - Optimizer status reporting improved.
  - Monte Carlo module improved:
    - Performance of Randn method improved.
    - Uniform and Gaussian static methods with seed argument added to
Random class.
    - UncNumber improved (uses Gaussian static method).
    - MKLRandom class added with Uniform and Gaussian static methods with
seed argument.
    - Order of Randn values modified (same as MKL).
    - Vector math methods added:
      - Negative
      - Add, Subtract, Multiply, Divide
      - Abs, Sqrt
      - Pow, Exp, Log, Log10
      - Sin, Cos, Tan, Asin, Acos, Atan, Atan2
      - Sinh, Cosh, Tanh, Asinh, Acosh, Atanh
    - UncNumber performance improved (uses MKL for vector operations).
    - UseIntelMKL static property added to Global class.
    - Monte Carlo Atan2 improved (unwrap values to avoid uncertainty
spikes).
    - Coverage interval cache added.
    - UncNumber performance improved (precompute mean, std and coverage
interval for arithmetic operations with a constant).
  - MATLAB Wrapper improved (thanks to dion.timmermann@ptb.de):
    - Considerably improved performance of times() by ensuring expensive
calls to size and reshape are only made when necessary.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/29
    - Unwrap added.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/31
    - Added support for array creation functions.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/32
    - Added fix for newly discovered bug in plus() and minus().
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/30
    - Fixing issues #33 and #35:
      - #33 subsasgn throws an error if indices are empty, i.e. a([]) =
b;
      - Constructor LinProp(a)/DistProp(a)/MCProp(a) returns variable of
incorrect size if a is an empty numerical.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/38
    - Fixes issue #34, which was based on a bug in subsref.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/39
    - Unc-Budget windows are automatically brought in focus.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/40
    - 'close all' also closes unc_budget windows.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/41
    - Prevented the hidden figure from interfering with plot commands.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/42
- Monte Carlo Number of Samples added to VNA Tools Option dialog.
- GuiVnaGrpah, GuiVnaTable and GuiVnaPoint improved (support for Monte
Carlo added).
- GuiMonteCarloHistogram and GuiMonteCarloHistogram2 added.
```

- CmcRange struct improved (Slope field added).
- CmcEntry class improved (compute slope in CmcReflectionSummary and CmcTransmissionSummary methods).
- NI-VISA Test Panel added to VNA Device Editor.
- Output state property added to VNA settings.
- Drivers improved (try to find out number of test ports).
- Bug in GuiJournalEditor fixed (Rename disabled).
- Decascade2PNP added to SParamTools class.
- Status and error reporting improved.
- METAS VNA Tools MATALB Wrapper improved:
  - PlotSParamData windows are automatically brought in focus.
  - 'close all' also closes PlotSParamData windows.

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VNA Tools V2.4.9 (2.4.7898.19887) - 16.08.2021
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- Uses improved METAS UncLib V2.4.9:
  - Complex(double r, double i = 0) constructor added.
  - DoubleHelper class improved (IsApproximatelyEqual method for array arguments added).
  - NumLib class improved (Interpolation methods return y if xx is equal to x).
  - MATLAB Wrapper improved (thanks to dion.timmermann@ptb.de):
    - Use builtin in subsref.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/9
    - Fixed error in subsasgn when the different dimensions of the index use different data types or ':' and non-double.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/13
    - Store internal arrays as matrices.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/17
    - Added support for more than 2 dimensions for horzcat and vertcat.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/15
    - subsref fixed when addressing more than 2 dimensions of a scalar.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/issues/18
    - Reworked size() to also work with nargout > 1 and numel(varargin) > 1.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/16
    - Removed side effects in reshape() by using the copy operator.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/21
    - Added error messages to mtimes that match those for mtimes with doubles in MATLAB 2021a.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/24
    - Make .* multiplication (times) replicate singleton dimensions when necessary.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/23
    - Added handling for subscript indexes that are not vectors. (Adds support for repmat(a, ...), where a is an unc matrix.)
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/26
    - Added the copy function to some methods, to prevent them from sometimes returing a reference and sometimes a copy / new data.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper/pull/27
- Unit separator changed to description / unit.
- '/ Ohm' replaced by '/ Ω'.
- XML comments modified (unit separator changed to description / unit).
- Typos fixed.
- VNA Tools - User Manual modified (unit separator changed to description / unit).
- Data Explorer - User Manual modified (unit separator changed to description / unit).

- Screen shots updated.
- Test Panel added to VNA Device Editor.
- SHA-256/28 hash algorithm added (it's a truncated version of SHA-256).
- Frequency conversion scalar mixer calibration added.
- Frequency conversion unknown mixer calibration added.
- UnknownMixer class added.
- GuiCmcEntryEditor improved (Graphs Freq log button added).
- GuiCmcEntry improved (GraphsFreqLog property added).
- GuiVnaDeviceEditor improved (Graphs Freq log button added).
- GuiVnaDevice improved (GraphsFreqLog property added).
- GuiCalibrationStandardEditor improved (uses DefinitionFrequencyConversions for IDatabasedCalibrationStandard).
- FreqConvHelper improved (Intersection improved for same value multiple times).
- GetParameterFrequency method improved (if denominator type is one it returns the frequency of the numerator or vice versa).
- Calibration classes improved (support for frequency conversions added).
- ICalibration interface improved (FrequencyConversions property added).
- GenericCalibrationModel and SwitchedCalibrationModel abstract classes improved (FrequencyConversions property added).
- WaveParamCalibrationHelper class improved (support for frequency conversions added).
- SParamTools class improved (ExpandOrSubset method added and Subset method modified).
- WaveParamTools class improved (ExpandOrSubset method added and Subset method modified).
- VerificationTools class improved (support for frequency conversions added).
- FreqConvHelper improved (Intersection method added).
- ComputeCalibrationZ0andGamma method improved (support for frequency conversions added).
- DefinitionFrequencyConversions property added to IDatabasedCalibrationStandard interface and to all classes which implement this interface.
- MeasurementUnc and ExperimentUnc classes improved (support for frequency conversions added).
- OptCalibration and OptCalibration2 classes improved (support for frequency conversions added).
- UncDefinition and UncReceiverDefinition properties improved (support for frequency conversions added).
- NFreq, Frequency, Frequency Conversions and FrequencyAtPorts read-only properties added to ICalibrationStandard interface and CalibrationStandard abstract class.
- Init method which supports frequency conversions added to ICalibrationStandard interface and to all classes which implement this interface.
- SParamTools class improved (Interpolation method added which support frequency conversion).
- FrequencyConversion and FrequencyConversionSub struct improved (ToString method overloaded).
- FreqConvHelper improved (ComputeFreqConv methods added).
- FrequencyConversionSub struct improved (Equals method compares ratio).
- NPorts read-only property added to ICalibrationStandard interface and CalibrationStandard abstract class.
- ComputeErrorCorrectionInit method improved to add support for frequency conversion.
- ICalibration interface improved (additional Init method added).
- GenericCalibrationModel and SwitchedCalibrationModel abstract classes improved (additional Init method added).
- MeasurementInfo class improved (initialize improved).

- IFreqPortFreqConv and IFreqPortZrFreqConv interfaces improved (FrequencyConversionAtPortIndex and FrequencyAtPortIndex methods added).
- FreqPortFreqConv and FreqPortZrFreqConv abstract classes improved (FrequencyConversionAtPortIndex and FrequencyAtPortIndex methods added).
- WaveParamData class improved (additional constructor added).
- SParamData class improved (additional constructor added).
- SParamTools class improved (Ideal2Port method added which support frequency conversion).
- IFreqPortFreqConv and IFreqPortZrFreqConv interfaces improved (additional Init method added).
- FreqPortFreqConv and FreqPortZrFreqConv abstract classes improved (additional Init method added).
- MeasurementInfo class inherits from FreqPortFreqConv abstract class to add support for frequency conversion.
- Init method which supports frequency conversions improved for PowerSensor class to add support for a power sensor as a verification standard.
- DatabasedStandard, DatabasedStandard2 and PowerSensorDatabased classes improved (Zr property is read-only and Zr from data file).
- IFreqPortZr interface improved (CommonPortZr method added).
- FreqPortZr abstract class improved (CommonPortZr method added).
- CalibrationStandard abstract class improved (comments field set to private. Comments property is used).
- CalibrationStandard abstract class improved (zr field set to private. Zr property is used).
- Agilent ENA driver improved (Bug in TriggerHold method fixed).
- Agilent ENA No SRQ driver added to workaround a firmware bug of the E5061B/E5071C (runtime of 500 ms for each viDisableEvent).
- Rohde_Schwarz_ZNx_ZVx driver improved (demo option K0 supported).
- Rohde_Schwarz_ZNx_ZVx_OptK4 driver improved (uses user ratios for S-parameters, workaround to support frequency converting reflection S-parameters).
- Rohde_Schwarz_ZNx_ZVx_OptK4 driver improved (uses 2nd LO for frequency converting measurements).
- Rohde_Schwarz_ZNx_ZVx_OptK4 driver improved (uses coherence phase mode for frequency converting measurements).
- Rohde_Schwarz_ZNx_ZVx driver improved (ZNx state file location changed).
- Rohde_Schwarz_ZNx_ZVx driver improved (set CW frequency before sweep mode in SetSingleFrequency method).
- TestVNA improved (uses SParamTools.ExpandOrSubset method).
- MeasureEachFrequencyCW improved (support for frequency conversions added).
- Refresh frequency conversion settings on preset or set instrument state.
- GuiVnaForm improved:
  - Driver and Resource properties added.
  - OpenDevice and CloseDevice methods added.
- Bug in compute error correction fixed (debug option checked and vdatb files).
- Bug in GraphYLabel fixed.
- Bug in GuiVnaForm fixed (refresh only status strip).
- Bug in GuiSwitchForm fixed (refresh only status strip).
- Bugs in Struct2SParamData.m and Struct2VNAData.m fixed.
- High DPI scaling improved.
- Typos fixed.

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VNA Tools V2.4.8 (2.4.7832.24150) - 11.06.2021
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- Uses improved METAS UncLib V2.4.8:
  - MATLAB Wrapper improved (thanks to dion.timmermann@ptb.de):
    - Reshape method supports single and vector notation for the size
argument.
    - Changed ndims to return at least 2, like MATLAB does.
    - Removed seemingly unnecessary check and reshape in Convert2*Prop.
    - Bugfixed and new features for subsasgn and subsref to make these
functions behave the same way as they do with double varaibles in matlab.
The tests used can be found in https://github.com/DionTimmermann/metas-
unclib-matlab-wrapper-tests.
    - Practically complete rewrite of subsasgn:
      - Fixed several bugs that were caused by the assumption that the
indexes (S.subs) and B would always have the same shape/dimension.
      - Removing these bugs also adds support for (partial) linear
indexing
      - Added support for logical indexes.
      - Added support for null assignment (a(2:3) = [];).
      - Added several error messages.
      - Removed support for dot indexing, as this seemed to only result
in internal errors.
      - Some optimizations to prevent repeated calls of
size/numel/isvector and unnecessary typecasts. With these optimizations
the new implementation is as fast as the old, even though it tests for
several errors.
      - With these changes, subsasgn now behaves the same for double and
LinProp/DistProp/MCProp variables (except for some error messages in
special cases).
    - Major update to subsref:
      - Fixed a bug where the size of the matrix returned was not always
as expected (special cases for linear indexing and the orientation of
vectors).
      - Added support for (partial) linear indexing.
      - Added support for logical indexes
      - Fixed a bug, where only one trailing singleton dimension was
removed, instead of all.
      - Added several error messages.
      - Removed support for dot indexing, as this seemed to only result
in internal errors.
      - Some optimizations to prevent repeated calls of
size/numel/isvector. With these optimizations the new implementation is
as fast as the old, even though it tests for several errors.
      - With these changes, subsref now behaves the same for double and
LinProp/DistProp/MCProp variables (except for some error messages in
special cases).
    - Added special case for the multiplcation with a scalar.
    - Fixed bug in subsref, where the colon could only be used for
dimensions that existed.
    - Added support for dot indexing and multiple index levels using
recursion.
    - https://github.com/wollmich/metas-unclib-matlab-wrapper
- GuiCmcEntryEditor improved (Save Summary to LaTeX File added).
- Bug in GuiVnaDeviceCharacterizeNoise fixed (Frequency List as default
file filter).
- GuiMaterialParamDataGraph remember cursors when updating cursor states.
- MoveCursor methods improved (move cursor 1 to first point and cursor 2
to last point when index is out of range).
```

- MoveCursor methods improved (set trace index when index is out of range).
- Bug in SetCursorLabelFormat method fixed (null exception).
- Bug in GuiVnaForm fixed (refresh only status strip).
- Bug in GuiSwitchForm fixed (refresh only status strip).
- Rohde_Schwarz_ZNx_ZVx driver improved (demo option K0 supported).
- Rohde_Schwarz_ZNx_ZVx_OptK4 driver improved (uses user ratios for S-parameters, workaround to support frequency converting reflection S-parameters).
- Agilent ENA No SRQ driver added to workaround a firmware bug of the E5061B/E5071C (runtime of 500 ms for each viDisableEvent).
- Agilent ENA driver improved (Bug in TriggerHold method fixed).
- High DPI scaling improved.
- Typos fixed.

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VNA Tools V2.4.7 (2.4.7811.23486) - 21.05.2021
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- GuiJournalVnaSettingsEditor improved:
  - Source port settings added.
  - Frequency conversion settings added.
- Measurement series improved (source port settings).
- Characterize noise improved (ports property added).
- Load journal improved (convert obsolete VNA settings journal entries).
- Uncertainty calculation get power from new source ports property.
- Frequency conversion improved (support different settings for test receiver, reference receiver and source).
- GuiVnaFreqPortZrFreqConvDialog improved (supports different settings for test receiver, reference receiver and source).
- AreReceiversEqualToSource and AreReceiversNotEqualToSource read only properties added to FrequencyConversion struct.
- IsFrequencyConvertingAndReceiversEqualToSource and IsFrequencyConvertingAndReceiversNotEqualToSource read only properties added to IFreqPortFreqConv interface.
- Binary file formats are storing the frequency conversions property (freq conv binary version 4 or 5).
- VnaToolsDataFormats.xsd changed to support FrequencyConversion (receivers != source).
- VNA Tools MATLAB functions improved to support frequency conversion (receivers != source).
- Show frequency info in cursor text of GuiVnaPlot for frequency converting data improved (show source frequency if not equal to receiver frequency).
- Show frequency info in column headers of GuiVnaTable for frequency converting data improved (show source frequency if not equal to receiver frequency).
- Show frequency and frequency conversion information in uncertainty budget improved (show source frequency if not equal to receiver frequency).
- GuiVnaFreqPortZrFreqConvDialog improved (different colors for frequency information):
  - Green : Default
  - Blue : Receivers == Source
  - Gray : Receivers != Source
- Bug in GuiXYPlot fixed (custom cursor labels when cursor was not visible).
- GuiVnaFreqPortZrFreqConv user control added.
- GuiVnaFreqPortZrFreqConvDialog improved (uses GuiVnaFreqPortZrFreqConv user control).

- Frequency information improved (numerator equal to zero, only offset is shown).
- EquationInfo read-only property added to FrequencyConversionSub struct.
- IFreqPortFreqConv interface improved (FrequencyEquationInfoAtPortIndex method added).
- FreqPortFreqConv and FreqPortZrFreqConv abstract classes improved (FrequencyEquationInfoAtPortIndex method added).
- Instrument identification query passed message box improved (identification).
- GuiXYPlotAdvanced bug fixed (numerator, denominator and source null exception).
- IDevice interface improved:
  - Open method with optional argument idName.
  - Identification read-only property added.
- IDevice2 interface removed.
- IVna improved:
  - TriggerSingle method with optional arguments.
  - TriggerSingleWait method with optional arguments.
- OpenDevice error message box improved.
- InstrumentIdentificationQueryFailedException class added.
- FrequencyList and NTestPorts read-only properties moved from IVna2 interface to IVna interface.
- Planar804 driver improved (GetTraceData method improved).
- VnaSourcePortSettings struct added with the following fields:
  - PortPower
  - PortSlope
  - PortAttenuator
- VnaSourceSettings struct marked as obsolete.
- VnaPortSettings struct marked as obsolete.
- VnaSettings struct improved (SourcePorts field added).
- IVna interface improved (SourcePorts property added).
- VnaHelper class improved:
  - GetVnaSettings method modified.
  - GetVnaSourcePortSettingsFromObsoleteProperties method added.
  - SetVnaSourcePortSettingsToObsoleteProperties method added.
- TestVna improved (SourcePorts implemented).
- Drivers improved (SourcePorts property implemented).
- GuiVnaSourcePortSettings user control added.
- GuiVnaSettings user control modified (uses GuiVnaSourcePortSettings).
- GuiVna and GuiVnaForm modified (width increased).
- VnaSourcePortState enum added (Auto, On or Off).
- VnaSourcePortSettings struct improved (PortState property added).
- GuiVnaSourcePortSettings improved (state column added).
- XML schema updated (LoggerDevice, SourcePorts and FreqConvSettings).
- High DPI scaling improved.
- Typos fixed.

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VNA Tools V2.4.6 (2.4.7734.25705) - 05.03.2021
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```

- AdvFormatter localization bug fixed (don't change the number decimal separator of the current culture).
- ResistanceSeriesInductance and ResistanceParallelCapacitance calibration standard classes added.
- Power meter drivers improved:
  - Trigger simplified.
  - Do not query the unit as it is initialized to W
- Bug in GuiCalStdModelFit fixed (change port assignment to 1 for a one-port and to 1, 2 for a two-port).

- Bug in GuiXYPlot fixed (call MoveCursorSafe only once when cursor not visible).
- Bug in GuiVnaTable fixed (null exception).

==
VNA Tools V2.4.5 (2.4.7724.19584) - 23.02.2021
==

- Show frequency info in cursor text of GuiVnaPlot for frequency converting data.
- Show frequency info in column headers of GuiVnaTable for frequency converting data.
- Show frequency and frequency conversion information in uncertainty budget when double clicking a cell in GuiVnaTable.
- FolderTreeView improved (multiple file system watchers for each directory instead of a single file system watcher which includes subdirectories).
  The pros are:
    - Don't miss events of subfolders on a Samba share (Linux).
    - Less events due not monitoring unopen subdirectories.
  The cons are:
    - Renaming a directory were a subdirectory is watched is not possible (except on a Samba share). Workaround: Close and stop watching directory which you want to rename.
    - Deleting a directory were a subdirectory is watched is not possible. Workaround: Close and stop watching directory which you want to delete.
- Code cleanup.
- PostInit bug fixed (PreInit method added).
- Bug in compute calibration fixed (Ports must be the same).
- Bug in GuiVnaTable fixed (null exception).
- VnaToolsRealTimeProject class improved: (do not check if temp dut file exists because file will be overwritten anyway, see https://stackoverflow.com/questions/50295265/file-exists-returns-true-after-file-delete).

==
VNA Tools V2.4.4 (2.4.7698.21153) - 28.01.2021
==

- GUI VNA Table improved (number group separator support added).
- GUI VNA Point improved (frequency format change to SI prefix).
- GUI VNA Covariance improved (frequency format change to SI prefix).
- Data Explorer improved: Frequency and Port Descriptions menu item added to content menu.
- GuiVnaFreqPortZrFreqConvDialog added.
- IFreqPort and IFreqPortZr interfaces added.
- FreqPort and FreqPortZr abstract classes added.
- IFreqPortFreqConv and IFreqPortZrFreqConv interfaces added.
- FreqPortFreqConv and FreqPortZrFreqConv abstract classes added.
- SParamData, VnaData and WaveParamData classes use FreqPortZrFreqConv as base class.
- YParamData and ZParamData use FreqPortFreqConv as base class.
- SParamTools, VnaDataTools and WaveParamTools classes improved (SameFrequencyPoints, SamePorts and SamePortZr methods are used).
- SParamTools, VnaDataTools and WaveParamTools classes improved (support for frequency conversion added).
- Binary file formats are storing the frequency conversions property (freq conv binary version 4).

- A GZIP stream is only used for binary formats which are not uncertainty numbers, not mixed-mode and not frequency converting.
- VnaToolsDataFormats.xsd changed to support FrequencyConversion.
- SParamTools class improved (bug in MergeNPNP fixed).
- VNA Tools MATLAB functions improved to support frequency conversion.
- SParamToolsCOM2 class added. The following methods were added:
  - AddDCPoint1P
  - AddDCPoint2P
  - Reciproc

```
==================================================
VNA Tools V2.4.3 (2.4.7661.25994) - 22.12.2020
==================================================
```

- Uses improved METAS UncLib V2.4.3:
  - Interpolation improved (use epsilon for extrapolation check).
  - Numeric format control added to toolstrip of GuiUncBudget and GuiUncListBudget.
  - GuiUncListBudget improved (the largest uncertainty of the list is 100%, before each item of the list was 100%).
  - License modified (NZ 512212 patent removed).
- Agilent PNA Series driver improved:
  - Support for Keysight USB VNAs (P937x) added.
- VnaToolsRealTime class improved and VnaToolsRealTimeCOM4 class added. The following methods were added:
  - SaveSParamDataAsXml
  - SaveSParamDataAsCovarianceText
  - SaveSParamDataAsTouchstone
  - SaveSParamDataAsTouchstoneV2
  - SaveSParamDataAsFrequencyList
  - SaveVnaDataAsXml
  - SaveVnaDataAsCovarianceText
  - SaveVnaDataAsCiti
  - SaveVnaDataAsFrequencyList
  - LoadCollectionItemAsVnaData
  - SaveVnaDataCollectionAsBinary
  - SaveVnaDataCollectionAsCovarianceText
- License modified (NZ 512212 patent removed).

```
==================================================
VNA Tools V2.4.2 (2.4.7633.29769) - 27.11.2020
==================================================
```

- Uses improved METAS UncLib V2.4.2:
  - User references updated.
- Reflection Normalization incomplete calibration added.
- Transmission Normalization incomplete calibration added.
- One Path Two Ports incomplete calibration added.
- Unknown Error Terms added to VNA Device.
- SOLT_RawData added to SParamTools.
- SOLT_RawData added to WaveParamTools.
- AddNPNP and MultiplyNPNP added to WaveParamTools.
- Constants replaced with Const.c0, Const.u0 and Const.E0.
- Support for Rohde & Schwarz NRX improved (resolution).
- Anritsu_ShockLine_Socket driver added.
- Anritsu ShockLine drivers improved (timeout increased to 5s and trigger hold before setting sweep mode or segment table).
- VnaDeviceDatabaseItemCOM2 class improved. The following property and method were added:
  - UnknownErrorTerms

```
    - InitUnknownErrorTermsElectricalSpec
- VnaUnknownErrorTermsElectricalSpecCOM class added.
- Typos fixed.


=================================================
VNA Tools V2.4.1 (2.4.7591.29500) - 13.10.2020
=================================================

- Uses improved METAS UncLib V2.4.1:
  - Bug in DLLPath fixed (Intel MKL DLL Path METAS UncLib Installation
64-bit).
- Help button added to VNA Tools. It contains the following items:
  - User Manual
  - Math Reference
  - Data Formats
  - Programming Reference
  - Website
  - Forum
  - License
  - About
- Help button added to Data Explorer. It contains the following items:
  - User Manual
  - Data Formats
  - Website
  - License
  - About
- Data Explorer improved: Make Reciprocal menu item added to content
menu.
- Phase Delay improved (unwrapped phase starts at DC between -90 deg and
90 deg). This works for opens, shorts and transmission measurements.
- Unwrap method improved (remove NaNs for linear fit to DC).
- Unwrap, Phase Delay and Group Delay methods improved (try to find out
cutoff frequency).
- VnaToolsRealTimeCOM3 class added. The following methods were added:
  - NewProject2
  - NewVnaData
  - LoadVnaData
  - SaveVnaData
  - ConvertSParamData2VnaData
  - ConvertVnaData2SParamData
  - NewVNADevice2
  - LoadVNADevice2
  - SaveVNADevice2
  - NewPowerSensorDatabased
  - LoadPowerSensorDatabased
  - SavePowerSensorDatabased
  - NewPowerSensorTable
  - LoadPowerSensorTable
  - SavePowerSensorTable
- VnaToolsRealTimeProjectCOM2 class added. The following properties and
methods were added:
  - TempDUTFileName_sdatb
  - TempDUTFileName_vdatb
  - AddMeasurement (VnaDataCOM)
  - AddMeasurementAndComputeErrorCorrection (VnaDataCOM)
  - AddTempDUTMeasurementAndComputeErrorCorrection (VnaDataCOM)
  - AddPowerSensorMeasurement (VnaDataCOM)
  - AddPowerSensorMeasurementAndComputeErrorCorrection (VnaDataCOM)
  - AddTempDUTPowerSensorMeasurementAndComputeErrorCorrection
(VnaDataCOM)
```

- VnaDataCOM, VnaParameterDataCOM and VnaDataToolsCOM classes added.
- PowerSensorDatabasedDatabaseItemCOM, PowerSensorTableDatabaseItemCOM,
PowerSensorTableItemCOM and PowerSensorUncertaintiesCOM classes added.
- COM Wrapper improved (initialize .NET objects).
- VnaData added to Metas.Vna.RealTime.
- Check file extensions added to Metas.Vna.RealTime.
- AddPowerSensorMeasurement added to Metas.Vna.RealTime.
- PowerSensorDatabased and PowerSensorTable added to Metas.Vna.RealTime.
- AddPowerSensorMeasurements, SplitVnaDataAndPowerSensorMeasurements and
ContainsPowerSensorMeasurements methods improved (allow multiport VNA
measurements with a common source port).
- GetCommonSourcePort method added to VnaDataTools class.
- OpenPowerMeter and OpenPowerMeterDB methods added to script class.
- Script improved (don't show background worker helper dialog).
- Variable Gamma property added to line section of primary airline and
offset short standards.
- PrimaryCalibrationStandard ComputeLine method improved (single z-
Position and no z-Position).
- PrimaryCalibrationStandard Zr bug fixed (change reference impedance of
simulated data to Zr).
- Support for CITI dat and unc files added.
- Agilent ENA driver improved (E5063A doesn't support FrequencyCW,
Source1PowerSlope, Port1Attenuator and Port2Attenuator).
- Support for Rohde & Schwarz NRX improved.
- LRRM Calibration bug fixed (additional boundary condition added for
unknown reflect 2 standard).
- Bug in GuiVnaCovariance fixed (null data).
- Bug in GuiVnaPlot fixed (only update plot when parameter is changed).
- Bug fixed in PowerSensor.Uncertainties (default value).
- Bug when opening a file from the command prompt fixed.
- Validate Option Dialog.

==
VNA Tools V2.4.0 (2.4.7541.23214) - 24.08.2020
==

- Support for wave parameters added:
  - Power calibration standard types added:
    - Power Sensor Table
    - Power Sensor Databased
  - Measurement of a power sensor added to measurement journal.
  - Power calibration added.
  - Error correction improved (including wave parameters).

==
VNA Tools V2.3.2 (2.3.7541.19337) - 24.08.2020
==

- Uses improved METAS UncLib V2.4.0:
  - DoubleHelper class improved (Intersection method added).
  - ComputeJacobiEig improved (limit set to 1e-15 * largest eigenvalue,
return number of non-zero eigenvalues).
  - ComputeInvJacobiEig added.
- Small Unc Limit added to VNA Tools Options dialog.
- Reflection submenu improved (e.g.: S1,1 and S2,2 added).
- IDatabasedCalibrationStandard interface added with DefinitionFrequency
read-only property.
- Interpolation property added to FileVerificationConfigStd class.
- Interpolation column added to verification config.
- VerificationTools.Compute improved:

- Databased standard and no interpolation --> use common frequency
list.
      - Model standard or frequency interpolation --> use measurement
frequency list.
- CreateScreenshots method modified.
- New Calibration Dialog: Tool tips added.
- AddFirewallRule method added (Metas.Vna.Tools.exe -firewall).
- Shortcuts added:
   - New Project   (Ctrl+Shift+N)
   - Options   (Ctrl+Shift+O)
   - Measurement Series   (Ctrl+M)
   - Measurement Last Setup (Ctrl+L)
   - New Item   (Ctrl+N)
   - Open Item   (Ctrl+O)
   - Save Item   (Ctrl+S)
   - Save Item As   (Ctrl+Shift+S)
   - Run / Start   (Ctrl+R)
   - Cancel / Abort (Ctrl+T)
- Compute normalized error using the eigenvalue decomposition (fixes the
problem with covariance matrices which are not positive definite).
- Verification result improved (tiny differences smaller than 1e-15 are
set to zero which yields to a normalized error of 0).
- Compare cal config standard description method improved (optional
ignoreVarIdAndWeights argument added).
- Rohde_Schwarz_ZNx_ZVx driver improved:
   - Support improved for ZNL and ZNLE (identification strings).

===
VNA Tools V2.3.1 (2.3.7440.18717) - 15.05.2020
===

- 'METAS VNA Tools II' renamed to 'METAS VNA Tools'.
- License modified.
- Third party licenses added to License folder.
- Uses improved METAS UncLib V2.3.1:
   - NumLib.Fft and NumLib.Ifft methods improved:
      - Optional argument withoutUnc = false added.
      - Intel.MKL FFT used for the case without uncertainties.
   - diag function improved (support from vector to diagonal matrix
added).
   - mpower function improved (support for matrix power and matrix
exponent added).
   - MATLAB wrappers improved (mlint warnings).
- Data Explorer improved:
   - Mag^2 format added.
   - Units (V/sqrt(kOhm), mW and dBm) added for single receiver values
(wave parameters).
   - Single receiver values are formatted in log (similar to transmission
S-parameters).
- Time gating dialog improved:
   - Uncertainty option added.
   - Warning for time gating and uncertainty propagation with more than
1000 data points added.
   - Use Intel MKL FFT for time gating without uncertainties.
   - Minimum timespan set from 100 ps to 1 ps.
- Bug (er) in compute gamma of a rectangular waveguide fixed.
- GuiJournalEditor improved (Measurement Last Setup).
- GuiLoggerDevice improved:
   - Uses DataGridViewComboBoxDropDownColumn for driver.
   - Uses DataGridViewComboBoxVisaResourceColumn for resource.

- Check if form is visible on screen added before resetting the old
window location and size.

==
VNA Tools V2.3.0 (2.3.7347.23243) - 12.02.2020
==

- Uses improved METAS UncLib V2.3.0:
  - High DPI scaling improved.
- Agilent PNA Series driver improved:
  - Support for Keysight PXI VNAs (M937x, M948x and M980x over HiSLIP)
added.
  - Support for Keysight USB VNAs (P50xx) added.
  - Workaround for bug in set up parameters (delete all traces) added.
- Rohde_Schwarz_ZNx_ZVx driver improved:
  - Support added for ZNL and ZNLE.
- EcologNetLogger driver improved.
- IVna interface changed: SetSingleFrequency(double freq) and
SetSingleFrequency(double[] freq, int index) methods added.
- VnaHelper class modifed: InitSingleFrequency(IVna vna, double[] freq,
out bool cwmode, out double zerospan) and SetSingleFrequency(IVna vna,
double[] freq, int index, bool cwmode, double zerospan) methods added.
- VNA Characterize Noise uses new IVna.SetSingleFrequency method.
- Reference impedance bug fixed in SOLT calibration without
uncertainties.
- On-Wafer Heinrich model modified (FORTRAN code from Heinrich 1993 is
newer than paper from 1993).
- GuiJournalMeasurementSeries improved (set VNA parameter matrix only
when changed).
- Add items only to look up table when they are stored inside the
database root path.
- VnaDataTools.NormPhaseToReferenceReceiverOfSourcePort added.
- High DPI scaling improved.
- Licenses modified (redistribution, RTI).

==
VNA Tools V2.2.7 (2.2.7258.29341) - 15.11.2019
==

- Uses improved METAS UncLib V2.2.7:
  - Error function added (Erf28 class changed from internal to public).
  - Optimizer Levenberg-Marquardt improved:
    - Stores recovery state every 12 hours.
    - Stores temp debug information every 12 hours.
    - Auto restores recovery state after restart.
    - Deletes recovery state after optimizer finished.
  - OptimizerLevenbergMarquardt and OptimizerTrustRegion use Cholesky
decomposition and solve a triangular matrix equation (faster than
inverting the triangular matrix) for covariance weighting.
  - OptimizerLevenbergMarquardt and OptimizerTrustRegion performance
improved (faster user weighting, faster compute covariance).
- Linearity uncertainty generator improved:
  - Old version was uniform distributed +-0.05 dB (sigma of 0.0289) with
5 x 0.02 dB bins. Correlation of 1 to 0 (0.2 steps) for a power offset of
0 to 0.1 dB.
  - New version is normal distributed with sigma of 0.01 dB using 11 x
0.02 dB bins. Correlation of 0.5 for a power offset of 0.05 dB.
- OptimizationCalibration2 (all frequencies at once) and
OptimizationCalibrationBigShaker (all frequencies at once and multiple

calibration configurations) use the improved Levenberg-Marquardt
optimizer:
  - Store recovery state every 12 hours.
  - Store temp debug information every 12 hours.
  - Auto restore recovery state after restart.
  - Delete recovery state after optimizer finished.
- Static constructor added to script class which loads the settings from
the registry (this is used when calling the script class from e.g.:
CPython over pythonnet).
- GuiCalibrationConfig, GuiSlidingLoadConfig and GuiVerificationConfig
improved (browse dialog file filter).
- Dialog New Calibration Config improved (Optional Standards renamed to
Isolation Calibration).
- Slot Chamfer added to connector model (METAS Standard Computer).
- GuiSplitButtonVnaParameterSetUp improved:
  - Reference Receiver added.
  - Test and Reference Receivers added.
- GuiJournalEditor improved:
  - Reference Receiver added.
- VnaData improved:
  - IsOnlySwitchTerms read-only property added.
  - IsSParamDataAndSwitchTerms read-only property added.
  - IsSParamDataAndReferenceReceiver read-only property added.
  - IsSParamDataReferenceReceiverAndSwitchTerms read-only property added.
- VnaParameter improved:
  - IsSwitchTerm read-only property added.
  - VnaParameter.SwitchTerms method added.
  - VnaParameter.SParameterMatrixAndReferenceReceiver method added.
  - VnaParameter.SParameterMatrixReferenceReceiverAndSwitchTerms method
improved (parameter order changed).
  - VnaParameter.TestAndReferenceReceivers method added.
  - VnaParameter.ParameterMatrixFromVnaData method improved.
  - VnaParameter.Info method improved.
- Convert.Object2SParamData and Convert.Object2VnaData methods added.

==
VNA Tools V2.2.6 (2.2.7220.27700) - 08.10.2019
==

- Bug in HP8510C, HP8751A, HP87xx drivers fixed (buffer size when reading
trace data or instrument state set to 1024 kByte).
- Default buffer size when reading a byte array increased to 16 kBytes
(old VisaNS value was 16 kBytes, new Ivi.Visa value was 1 kBytes).
- AlmemoLogger driver improved (works with A809 and A2890-9).
- VnaToolsRealTime class improved and VnaToolsRealTimeCOM2 class added.
The following methods were added:
  - ListCollectionItems
  - LoadCollectionItemAsSParamData
  - SaveSParamDataCollectionAsBinary
  - SaveSParamDataCollectionAsCovarianceText
  - NewVerificationConfig
  - LoadVerificationConfig
  - SaveVerificationConfig
- VerificationConfigCOM and VerificationConfigStdCOM classes added.
- Script class improved. The following methods were added to support data
collections:
  - ListCollectionItems
  - LoadCollectionItemAsSParamData
  - LoadCollectionItemAsVnaData
  - SaveSParamDataCollectionAsBinary

- SaveSParamDataCollectionAsCovarianceText
    - SaveVnaDataCollectionAsBinary
    - SaveVnaDataCollectionAsCovarianceText

==
VNA Tools V2.2.5 (2.2.7200.25240) - 18.09.2019
==

- Uses improved METAS UncLib V2.2.5:
  - Bug when loading read-only files fixed (FileAccess mode set to Read).
  - DoubleHelper class improved:
    - IsLessOrApproximatelyEqual method added.
    - IsGreaterOrApproximatelyEqual method added.
  - Interpolation improved (uses IsLessOrApproximatelyEqual).
- Agilent ENA driver improved (multiport supported added).
- Error message of setting up VNA improved (inner exception message added).
- Juroshek calibration Zr bug (VNA Zr != calibration standard defintions Zr) fixed.
- Bug in measurement series fixed (transmission S-parameter series).
- Databased standard: error message added in case the data file does not exist.
- Waveguide bug fixed (uses DoubleHelper.IsLessOrApproximatelyEqual).

==
VNA Tools V2.2.4 (2.2.7172.23772) - 21.08.2019
==

- Uses improved METAS UncLib V2.2.4:
  - Bug in the algorithm solving a nonlinear least squares problem with linear (bound) constraints using the Levenberg-Marquardt fixed. Details: The Jacobian matrix is not manipulated anymore to achieve the boundaries, the algorithm takes care about. --> smaller residuals at the point of the solution.
  - Performance of interpolation improved.
  - Interpolation improved (PolyFitData x shifted to -xx, avoids matrix is singular, higher accuracy).
  - Fatal error message added: same internal uncertainty id.
- Data Explorer improved:
  - Passivity Check added.
  - Bug in method SameFrequencyPoints fixed (uses DoubleHelper.IsApproximatelyEqual).
  - Performance of method CommonFrequencyPoints improved (uses DoubleHelper.Union).
  - Transforms.PreProcessFreqList improved (numerical problems fixed).
- Console output of optimization calibration improved:
  - Standard numbering changed (start from 01).
- NationalInstruments.VisaNS replaced by Ivi.Visa:
  - Metas.Instr.VisaExtensions.VisaNS.MessageBasedSessionNS class added (replaces the superseded NationalInstruments.VisaNS.MessageBasedSession class).
  - Works with the following IO libraries:
    - National Instruments VISA
    - Keysight IO Libraries Suite
    - Rohde & Schwarz VISA (requires National Instruments VISA)
- Sweep timeout increased from 30 minutes to 120 minutes.
- Performance of method UpdateView (GuiJournal) improved.
- SParamTools improved (check for same frequency points and not only for same number of frequency points).
- Bug in SParamTools.ShuntImpedance fixed.

- Bug in RemoveDependenciesFromDataset2 fixed.
- Fatal error fixed in ComputeLinearity fixed (same ids, double rounding
problem).
- Write complete error message to console (background worker).
- IronPython 2.7.7 replaced by IronPython 2.7.9
- Show stack size during start up.
- Stack size changed to 16 MB.

==
VNA Tools V2.2.3 (2.2.7062.28513) - 03.05.2019
==

- Uses improved METAS UncLib V2.2.3:
  - Python wrapper improved.
  - Optimizers improved (CSRDot for weighting without covariance and
support for HugeMatrix added).
  - OptimizerLevenbergMarquardt and OptimizerTrustRegion use Cholesky
decomposition to compute weighting matrix.
- The noise characterization wizard tries to perform the measurements
like that:
  1. Set same start and stop frequency (in linear sweep mode) and check
if span frequency is zero. If the span frequency is zero the noise
measurements are performed in this mode. That's the case for all HP,
Agilent and Keysight VNAs.
  2. If the span frequency was not zero the measurements are performed in
CW mode. That's the case for Anritsu VNAs and Rohde Schwarz ZNA, ZNB,
ZVA, ZVB and so on.
  3. If the VNA doesn't supported the CW mode (with multiple measurement
points) the measurements are done with a slightly different (0.001 Hz)
start and stop frequency in linear sweep mode. That's the case for the
Rohde Schwarz ZVC, ZVM, ZVK, ZVR and ZVRE. The reason for that is that
the firmware of those VNAs are not supporting setting the same start and
stop frequency.
- Noise characterization improved:
  - Workaround for Anritsu VNAs added (a CW entry will be coerced to the
nearest point in the linear frequency list).
- Store debug information of optimization calibration improved:
  - Report progress.
  - Remove old existing files.
  - Standard numbering changed (start from 01).
- Primary female open standard added.
- DC resistance and variable DC resistance properties added to primary
offset/flush short standard.
- Support for sub folders added for the following database entries:
  - VNA Device
  - Cable
  - Connector
  - DUT Uncertainty
  - Logger Device
- Performance of VNAData2Struct.m improved.
- Bug in Journal Editor fixed (inside measurement series experiment -->
no error correction until end experiment).

==
VNA Tools V2.2.2 (2.2.6997.19301) - 27.02.2019
==

- Uses improved METAS UncLib V2.2.1:
  - Python wrapper added.

- Agilent ENA driver modified (allow Keysight and Agilent as identification string, bug fixed).
- Database / Calibration Standard editor bug fixed (new ID for calibration standards with different file path).
- SParamTools.Interpolation uses NumLib.Interpolation2 (quadratic).
- VnaDataTools.Interpolation uses NumLib.Interpolation2 (quadratic).
- Metas.Vna.Data.SignalProcessing.Transforms uses NumLib.Interpolation2 (quadratic).
- GuiMaterialParamDataGraph.InterploateData uses NumLib.Interpolation2 (quadratic).
- SParamTools.SplineInterpolation added.
- VnaDataTools.SplineInterpolation added.
- Script.SplineInterpolation added.
- ThreePortTools.ComputeThreePort improved (use all equations s11, s21, 12 and s22 from all 3 calibration standards).

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VNA Tools V2.2.1 (2.2.6956.17676) - 17.01.2019
=================================================
```

- Support for material parameters added. The following algorithms are supported:
  - Nicholson-Ross-Weir
  - NIST Iterative
  - New Non-Iterative
  - Direct
- Data Explorer improved:
  - Auto set up parameter matrix added to graph.
  - Bug in GuiXYPlotAdvanced fixed (GetUncNumberAndDescription method and second Y-axis).
  - Bug in GuiXYPlot fixed (xyCursor.GetCurrentIndex < 0).
- Time domain improved:
  - Compute gating improved (shift frequency domain data to -meanGroupDelay if abs(meanGroupDelay) > 2 * stdGroupDelay).
  - Mag log property added to graph and table in time domain.
- Unwrap method modified (linear fit to DC):
  - Phase should start at DC between +90 deg and -270 deg for a negative slope.
  - Phase should start at DC between -90 deg and +270 deg for a positive slope.

```
=================================================
VNA Tools V2.2.0 (2.2.6908.27056) - 30.11.2018
=================================================
```

- Support for mixed-mode S-parameters added.

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=================================================
VNA Tools V2.1.1 (2.1.6908.24816) - 30.11.2018
=================================================
```

- Uses improved METAS UncLib V2.1.5:
  - UncNumber (LinProp, MCProp and DistProp) improved:
    - Tan method improved.
    - Sinh, Cosh, Tanh methods improved.
  - Complex improved:
    - Sin, Cos, Tan methods improved.
    - Sinh, Cosh, Tanh methods improved.
- Data Explorer improved:

- Changing the x-axis scale will auto scale the y-axis to the visible
part.
      - Changing the x-axis scale in one plot will change the x-axis scale in
all other plots (except Cartesian).
- Support added for Touchstone V2.0 file format.
- Touchstone file format support improved:
   - New data line for each matrix row added when number of ports is
greater than 2.
      - Formatting improved (padding).
      - Port assignment added (comment line).
      - Assembly name and version added (comment line).
      - Creation date added (comment line).
- DataCovarText file format improved:
      - Assembly name and version added (comment line).
      - Creation date added (comment line).
- New Databased Standard Wizard improved (Source Ports added).
- Create Databased Standard added to content menu of Data Explorer.
- Fit Calibration Standard Model added to content menu of Data Explorer.
- Tabular page called Cal Std Model Fit removed from VNA Tools. It's now
part of the content menu of the Data Explorer.
- Measurement series added with experiment a several DUT measurements.
- Measurement series dialog remembers old settings.
- Global Root Path renamed to Root Path.
- Label Root Path not visible (Data Explorer and VNA Tools).
- Browse button not visible for Root Path (Data Explorer and VNA Tools).

===
VNA Tools V2.1.0 (2.1.6876.16039) - 29.10.2018
===

- Uses improved METAS UncLib V2.1.4:
   - Integrate method added to NumLib class.
   - SplineInterpolation added to NumLib class.
   - Bug fixed (deserialize a generic type from an older version).
- Data Explorer improved:
   - Bug in compare VnaParameters fixed (VnaReceiverType.one).
   - GuiVnaParameter improved (disable Port when VnaReceiverType.one is
selected).
- CmcTools improved (exceptions added):
   - Calibration Config must be two-port calibration.
   - First port of calibration config must be port 1.
   - Second port of calibration config must be port 2.
   - VNA Error Terms must be two-port calibration.
   - First port of VNA error terms must be port 1.
   - Second port of VNA error terms must be port 2.
- VNA Characterize Noise improved:
   - Default VNA Mode: Linear frequency with same start and stop
frequency.
   - If not supported CW VNA Mode.
- SParamTools.Interpolation uses NumLib.SplineInterpolation2.
- SParamTools.InterpolationReImMP uses NumLib.Interpolation2 (linear).
- VnaDataTools.Interpolation uses NumLib.SplineInterpolation2.
- VnaDataTools.InterpolationReImMP uses NumLib.Interpolation2 (linear).
- Metas.Vna.Data.SignalProcessing.Transforms uses
NumLib.SplineInterpolation2.
- PostProcessTimeDomainData improved (uses NumLib.Integrate for mode low
pass step).
- BeginExperimentJournalItem modified (default experiment type changed to
statistical).

```
==================================================
VNA Tools V2.0.4 (2.0.6814.27933) - 28.08.2018
==================================================


- Uses improved METAS UncLib V2.1.0:
  - Atan2 improved (Atan2(0, 0) --> 0, Atan2(NaN, x) --> NaN and Atan2(x,
NaN) --> NaN, sensitivities in all cases).
  - NonLinearEig method added to LinProp/UncLinAlg class.
  - Solve over-determined non-linear Eigenvalue problem improved (smaller
residuals):
    - new: over-determined non-linear system --> determined non-linear
system --> determined linear system
    - old: over-determined non-linear system --> over-determined linear
system --> determined quadratic system --> determined linear system.
- Data Explorer improved:
  - Legend added to Graph.
  - XY plot improved (show single point).
  - Cartesian plot improved (frequency information added).
  - MultiSelectTreeView HighDPI bug fixed (uses
TextRenderer.MeasureText).
- Measurement series with different VNA settings (e.g.: source power)
added.
- Port assignment column added to calibration config.
- Bug in renaming measurement journal item fixed (.vdatb extension).
- Bug when opening a vnalog, calcfg or vercfg file from command line or
windows explorer fixed.


==================================================
VNA Tools V2.0.3 (2.0.6785.14432) - 30.07.2018
==================================================


- Agilent ENA and PNA drivers improved (set byte order to normal).
- Anritsu ShockLine driver added.
- AnritsuAutocalOverShockLine driver added.
- Metas.Instr.Driver.Vna.AnritsuVectorStar.dll renamed to
Metas.Instr.Driver.Vna.Anritsu.dll.
- TestVna High DPI bug fixed.
- CmcCalculationMode (min, mean, max) added to Database / CMC Entry
(default: min).
- VnaErrorTermsCalibrationFile added to Database / CMC Entry (default:
none --> ideal VNA).
- Raw data in CmcTools are set to Port Zr of the VNA and not changed to
Port Zr of the VNA (using SParamTools.ChangeZr) --> ideal VNA error terms
in all cases.
- Fatal error fixed in ComputeLinearity fixed (same ids when measurement
level is NaN).
- Non leaky mask of error terms for a new configuration of an
optimization calibration.
- Time gating dialog improved: Conv enabled (without item Time Domain) in
frequency domain.
- Time gating dialog bug fixed (minimum value of time span set to 100
ps).
- InterpolationReImMP added to SParamTools and VnaDataTools.
- InterpolationMagPhase added to SParamTools and VnaDataTools.
- Atan2 improved (sensitivities in all cases).
```

```
==================================================
VNA Tools V2.0.2 (2.0.6732.13864) - 07.06.2018
==================================================


- On Wafer Offset Short Standard added.


==================================================
VNA Tools V2.0.1 (2.0.6724.25834) - 31.05.2018
==================================================


- .NET target version changed to V4.5.
- Support for vdatb files as raw data added.
- New switch term format (vdatb).
- Examples modified (new switch term format).
- Custom VNA Parameter Setup improved.
- Support for CITI files improved.
- Support for VNA Data Covariance Text files (*.vdatcv) added.
- Support for S-Parameter Data Collection Covariance Text files
(*.scolcv) added.
- Support for VNA Data Collection Covariance Text files (*.vcolcv) added.
- Support for S-Parameter Data Collection Binary files (*.scolb) added.
- Support for VNA Data Collection Binary files (*.vcolb) added.
- Support for ZIP files (*.zip) added.
- Save Collection As .. added to content menu of the Data Explorer.
- Check Connector Parameters added.
- Reciproc and OptReciproc methods added to Script class.
- MATLAB support improved.


==================================================
VNA Tools V2.0.0 (2.0.6667.33608) - 03.04.2018
==================================================


- Tool Tips added.
- Support for PDF files with embedded data files added to Data Explorer.
- Data Explorer improved: Open file menu item added to content menu.
- Number of Points added to VNA Device Characterize Noise dialog added
(before 801 points per frequency point was used).
- VNA Settings: default value of Zr changed to 50 Ohm.
- Journal VNA Settings: Zr enabled when no VNA session is open.


==================================================
VNA Tools V1.9.2 (1.9.6621.25325) - 16.02.2018
==================================================


- Time Domain added:
  - Frequency Domain to Time Domain
  - Time Gating


==================================================
VNA Tools V1.9.1 (1.9.6563.29785) - 20.12.2017
==================================================


- Data Explorer improved:
  - Auto Refresh
  - Auto Update Panel
  - Sort Selected Items
  - Update Icon Status
- Optimization calibration improved: up to 65535 objective functions.
- Interpolation improved: check if interpolation order out of range -->
NaN.
```

- LookUpId improved: return guid as string if not found.
- Improved time scale axis in Data Logger.
- ReplaceLaTeXCharacters method added. Fix bug with special characters,
e.g.: Omega.
- High DPI improved.

==
VNA Tools V1.9.0 (1.9.6491.14270) - 09.10.2017
==

- Uses METAS UncLib V1.9.0.
- Data Explorer improved:
  - Show reference impedance (Zr info) in column headers of GuiVnaTable.
  - ReIm, MP format added to graph and table (reflection: real and
imaginary parts, transmission: magnitude and phase).
  - Time format for phase delay and group delay added to table.
- Debug mode added to error correction (stores R, V, D and C uncertainty
influences for each measurement).
- Transmission connector repeatability added.
- CreateDatabaseStandard method added to script class.
- VNA Settings System Zr is read only.
- Complex reference impedance is not allowed for a VNA device.
- Metas.Vna.RealTime.COM.dll improved:
  - Evaluation key added which expires after 90 days.
  - VerificationToolsCOM class added with NormalizedError method.
  - Transmission uncertainty added for connector repeatability.
- Waveguide example added, see '08_Waveguide_Example_WR10'.
- On-Wafer example added, see '09_OnWafer_Example_GGB_CS-5'.
- Bug in GuiXYPlot fixed (BackgroundWorker).
- Bug in FindParameterIndex in VnaData class fixed (convert switch term
to S-parameter).
- Bug in drivers fixed (VISA Dispose added).

==
VNA Tools V1.8.6 (1.8.6430.18695) - 09.08.2017
==

- Data Explorer improved:
  - Z-parameter and Y-parameter data added:
    - VnaDataConv.Z_Parameter : Z-parameter
    - VnaDataConv.Y_Parameter : Y-parameter
    - VnaDataConv.Impedance   : Impedance (only reflection parameters,
other ports are terminated with an ideal load)
    - VnaDataConv.Admittance : Y-parameter(only reflection parameters,
other ports are terminated with an ideal load)
  - Conversion mode VSWR moved to magnitude format.
- LRRM calibration added.
- Agilent Model Standard improved:
  - Magnitude uncertainty added for Agilent model standard (open or
short).
  - Transmission uncertainty added for Agilent model standard (delay
thru).
- Bug in optimization calibration fixed (switch terms with noise,
linearity and drift).
- Bug in calibration cache fixed (do not add uncompress data to cache).

```
==================================================
VNA Tools V1.8.5 (1.8.6400.24590) - 10.07.2017
==================================================


- Bugs in GuiXYPlot fixed (ProcessSpecialValues, MoveCursorSafe).


==================================================
VNA Tools V1.8.4 (1.8.6400.16000) - 10.07.2017
==================================================


- Unknown series inductance and unknown capacitance calibration standards
added.
- Bugs in GuiCable, GuiConnector and GuiDUTUncertainty fixed.
- Bug in GuiXYPlot fixed (move cursor to NaN).


==================================================
VNA Tools V1.8.3 (1.8.6395.15968) - 05.07.2017
==================================================


- Database: Uncertainties are labeled with (k = 1) or (k = 2).
- Cable Transmission Stability is now one-way (Ct) and not two-way
(Ct*Ct).
- Cable Symmetry Stability is now one-way (Cs).
- Noise Floor (db rms) with k = 1.
- Characterization of noise floor changed:
  - new: 20*log10(max(std(syx_re), std(syx_im))
  - old: mean(20*log10(syx - mean(sxy)))
- Show uncertainty budget for cursors added.
- Cursors are coupled between plots.
- Verification added to VNA Tools.
- Agilent Model Standard extended for Waveguide.
- LHKM TRL LRL improved (choosing the eigenvalue for the unknown
reflection).
- Bug in save frequency list fixed.
- Logger Device added to Database and Journal.
- Reset states of step attenuator after measurement series has completed.
- On wafer line standard improved: frequency independent conductivity,
relative permittivity and tan delta added.


==================================================
VNA Tools V1.8.2 (1.8.6297.14029) - 29.03.2017
==================================================


- Uses METAS UncLib V1.8.2.
- Database / CMC Entry editor added.
- CMC Tools added to content menu of Data Explorer.
- Different hash algorithms to compute checksums.
- IronPython 2.7.7 used in Script editor.
- Bug in compute waveguide offset fixed.
- Database tab page order changed.


==================================================
VNA Tools V1.8.1 (1.8.6262.24056) - 22.02.2017
==================================================


- Uses METAS UncLib V1.8.1:
  - Chain Rule improved (faster).
  - LinAlg improved (Dot_invA_B and Dot_A_invB added).
  - Complex division improved.
- Parallelization of SParamTools (Cascade and Decascade).
```

- LHKM TRM LRL support for multiple lines added.
- Switched Error Terms normalized to 1.
- Helper methods added for Metas.Vna.RealTime.COM.dll.
- Metas.Instr.Driver.Logger.dll added.
- Rohde & Schwarz cables added.

==
VNA Tools V1.8.0 (1.8.6198.18768) - 20.12.2016
==

- Uses METAS UncLib V1.8.0.
- .NET target version changed to V4.0.
- High DPI scaling supported.
- Icons replaced with High DPI Icons.
- Bug with cursors fixed in XYPlot.

==
VNA Tools V1.7.10 (1.7.6177.29900) - 29.11.2016
==

- Support for waveguide standards with ratio not equal to two added
(simulation data updated).
- Bug in Journal Editor fixed. Add Measurement / Custom.
- Bug in RohdeSchwarz_ZNx_ZVx driver fixed: VnaParameter2String "S101" --
> "S1001".
- Clear cache method added.
- CmcTables supports specifying VNA Device.

==
VNA Tools V1.7.9 (1.7.6102.30094) - 28.09.2016
==

- Bugs in Metas.Vna.RealTime.dll fixed.
- Context menu for changing time stamp format added to header cell of the
time stamp column.
- DirectoryInfoExtensions added. Used to get directories and files
natural sorted by name.

==
VNA Tools V1.7.8 (1.7.6094.23660) - 07.09.2016
==

- Bugs in Metas.Vna.RealTime.COM.dll fixed.
- VnaToolsGuiCOM class added.
- Support for waveguide standards with ratio not equal to two added.
- Simulation data not yet updated.

==
VNA Tools V1.7.7 (1.7.6087.19110) - 31.08.2016
==

- User settings are stored to registry:
'HKEY_CURRENT_USER\Software\METAS\VNA Tools'.
- Metas.Vna.RealTime improved.

==
VNA Tools V1.7.6 (1.7.6082.14268) - 26.08.2016
==

- Data Explorer and VNA Tools: set root path from command prompt added.

- Remove small influences option added to optimization calibration.
- ECal renamed to ECU (Electronic Calibration Unit).
- Metas.Vna.RealTime.dll added.
- Metas.Vna.RealTime.COM.dll added.

==
VNA Tools V1.7.5 (1.7.6022.29592) - 29.06.2016
==

- Uses METAS UncLib V1.7.0.

==
VNA Tools V1.7.4 (1.7.6005.16561) - 21.06.2016
==

- Simple Line standard added.
- On-Wafer Line standard added.
- DUT Uncertainty added (can be used to represent on-wafer crosstalk).

==
VNA Tools V1.7.3 (1.7.5989.15887) - 25.05.2016
==

- Compress other frequency influences added for optimization calibration
over all frequency points.
- Show Journal Info in Unc Budget added.
- RemoveSmallUncInfluencesLimit changed from 1e-8 to 1e-7.

==
VNA Tools V1.7.2 (1.7.5952.18825) - 19.04.2016
==

- Error Model Zr bugs fixed:
  - Use Cable Zr for non-waveguide measurements.
  - Use Connector Zr for non-waveguide measurements.
  - Use VNA Zr for Drift for non-waveguide measurements.
- Shift reference plane:
  - Z_Y_Polynom added.
  - SParamTools: PolyFitZandY, PolyValZandY and MeanZandYPolynom added.
  - CalibrationTools: ComputeFitandMeanZ0andGamma using the Z_Y_Polynom
added.
- Copper Mountain Planar VNA driver added.

==
VNA Tools V1.7.1 (1.7.5924.24352) - 21.03.2016
==

- LHKM_TRL_LRL calibration added.
- LHKM_TRM_LRM calibration added.
- Bug (weighting with covariance) in optimization calibration fixed.
- Optimization calibration improved:
  - Variables of the calibration standards are stored in the calb file.
  - ComputeZ0andGamma method added.

==
VNA Tools V1.7.0 (1.7.5883.24145) - 09.02.2016
==

- New drift model: drift of ideal VNA.
- Symmetry drift added.

- Cable reflection stability added.
- Cable symmetry stability added.


```
=================================================
VNA Tools V1.6.5 (1.6.5854.25873) - 11.01.2016
=================================================
```

- Unknown Load calibration standard improved:
  - Fit uncertainty changed (random ID).


```
=================================================
VNA Tools V1.6.4 (1.6.5820.31869) - 08.12.2015
=================================================
```

- Unknown Load calibration standard improved:
  - Fit frequency added.
  - Fit uncertainty added.


```
=================================================
VNA Tools V1.6.3 (1.6.5813.20164) - 01.12.2015
=================================================
```

- User Weight Table added in standard description.
- Add Series Impedance and Shunt Admittance to SParamTools.
- Add Unknown Load as calibration standard.


```
=================================================
VNA Tools V1.6.2 (1.6.5801.18094) - 20.11.2015
=================================================
```

- More information during start up.
- Measure run time of VNA Tools.
- Upgrade Settings problem fixed.
- Add IronPython.Modules.dll.


```
=================================================
VNA Tools V1.6.1 (1.6.5777.20096) - 26.10.2015
=================================================
```

- Bug in new version 2 of calb fixed.
- Performance improvements.


```
=================================================
VNA Tools V1.6.0 (1.6.5773.34394) - 22.10.2015
=================================================
```

- New version 2 of sdatb and vdatb:
  - Smaller uncompressed file size.
  - GZIP not needed.
  - Faster loading and saving of files.


```
=================================================
VNA Tools V1.5.4 (1.5.5764.15746) - 13.10.2015
=================================================
```

- Complete rewrite of all GUI editors.
- Drag and drop support improved.
- Split View added.
- VNA Device added to measurement journal file.
- .NET target version changed to V3.5.

```
==================================================
VNA Tools V1.5.3 (1.5.5743.23902) - 22.09.2015
==================================================


- Bug in Agilent_8720_53_Series driver fixed.
- Alglib uses Intel MKL for Cholesky decomposition.
- Faster optimization calibration.


==================================================
VNA Tools V1.5.2 (1.5.5730.25433) - 15.09.2015
==================================================


- Experiment uncertainties:
    - Add support for independent S-parameters, e.g.: 2 one port
components measured at the same time.
- LHKM calibration added.


==================================================
VNA Tools V1.5.1 (1.5.5697.15735) - 07.08.2015
==================================================


- Improved Data Explorer:
    - Set as Root Path in content menu.
    - Root Path is expanded.
    - Add Plot Font Dialog.
    - Decascade changed. Now all four cases are supported.
    - No autoscale when setting interaction mode to none. Autoscale when
unchecking zoom button.
    - Bugs in PlotCartesian fixed.
- Covariance tab page in calibration standard editor.
- Renaming measurement journal item added.
- Import measurement in journal ignores time stamp of file.
- Add measurement: trigger cont when sweep is complete and file dialog is
shown.
- Bug in GuiJournalCableConnectorTable fixed.
- Bug in Waveguide Offset Short Standard fixed (length offset).
- Bug in Database / VNA Device / Update Linearity Plot fixed
(SetYRange(NaN, NaN)).
- Bug in compute noise factor fixed. Do not under estimate the
uncertainty if meas ifbw is smaller than spec_ifbw.
- New linearity model. The linearity is discretized in 0.02 dB steps over
all receiver values. The discretion points are correlated with the 10
neighbor points.
- Width offset and height offset added to waveguide shim section.
- Add Waveguide Connector Offset class which use COMSOL simulation data
- Add Anritsu 3650A, 3651A, 3652A, 3653A, 3654D calibration kits.
- Add Anritsu 3656B and 3659 calibration kits.
- Add 0.8 mm connector.
- Add Anritsu standard cables.
- Add Anritsu Autocal.
- First version of Agilent_8720_53_Series driver based on the HP8753D
driver.


==================================================
VNA Tools V1.5.0 (1.5.5595.21600) - 27.04.2015
==================================================


- Improved Data Explorer:
    - New possibility to expand Windows shortcuts (links) to drives,
directories, files and files with sub items
```

- New Folder dialog added,
        - New Shortcut dialog added,
        - the cursor label in the tabular page graph shows now to which trace
it's locked to.
        - Show properties in content menu of Data Explorer added.
- Primary Airline Standard and Primary Offset Short Standard changed.
Ideal line section for propagation constant has zero length now. This is
needed to couple offset shorts with different length.
- Covariance for experiment uses n - 1.
- Statistics: dof = n - 1 for coverage factor.
- Bug in time stamp of user comment fixed.
- Bugs in calibration standard fit for 2 ports fixed:
    - Offset Loss (Anritsu and Rohde Schwarz models) is divided by factor
two for two-ports.
    - Offset Delay (Anritsu model) has the correct unit now.
- Offset Loss (Anristu model) is fitted now.
- Equivalent Source Match Palmer added.
- Support for MMS4 DSD files (read only) integrated.
- Measurement Journal / Custom Cable and Custom Connector Plots added.
- VNA Device / Noise, Linearity and Drift Plots added.
- Database / Cable and Connector Plots added.
- Comments field in all calibration standard database items added.
- VNA Device / Noise Characterization added.
- Color for user comments in Journal editor changed (light cyan).
- Load and Save VNA Graph Settings added.
- Waveguide Shim Standard and Waveguide Offset Short Standard added.
- Uncertainty interpolation changed.
- Obsolete Tools tabular page removed.
- Support for Rohde & Schwarz ZVK (RohdeSchwarz_ZVC_M_R driver) added.
- Support for Keysight ENA E5080A (Agilent_PNA_Series driver) added.
- New Logo for VNA Tools II and Data Explorer.
- Strong names for all assemblies except driver and example assemblies.
- Digital signed installers.

==
VNA Tools V1.4.0 (1.4.5403.29510) - 20.10.2014
==

- CITI files with Mag Phase uncertainties supported.
- DC and HF conductivity for primary calibration standards.
- Optimization calibration supports different user weights for reflection
and transmission.
- Unknown Reflection Calibration Standard added (passive).
- Unknown Line Calibration Standard added (S11 = ?, S22 = ?, S21 = S12 =
e^(-(g1*f^0.5 + g2*f)).
- Juroshek calibration added for splitter characterization.
- METAS VNA Tools II help file added.

==
VNA Tools V1.3.2 (1.3.5238.16528) - 05.05.2014
==

- Data Explorer improved:
    - content menu for post-processing of data,
    - supports to show error terms of calibration binary files (*.calb),
    - colored icons in file explorer and
    - norm to value or to value and uncertainty.
- New primary airline and offset short standard in database.

- Optimization calibration can optimize all frequencies at once. This is
needed when calibration standards are used with unknown parameters which
are constant over frequency.
- It supports the following VNA's: Agilent ENA, PNA, Anritsu VectorStar,
Hewlett Packard 8510C, 8751A, 8753D and Rohde & Schwarz ZNB, ZNC,
ZVA, ZVB, ZVT, ZVC, ZVM, ZVR.

==
VNA Tools V1.2.1 (1.2.5042.15584) - 28.10.2013
==

- Multiport support in VNA drivers.
- Compute error correction for new measurements only if error correction
configuration is saved and calibration file exists.
- New Cable Connector Table in Journal Editor and Measurement Series to
support multiport measurements.
- TRL calibration works no right. Allows offset delay for thru connection
and definition for high reflect, used to choose the right square root.
- New Graph Custom Set Up dialog which allows to configure the
parameters.
- Norm in graph is not changed if number of measurements change.
- Metas.Vna.Matlab is now part of the installer.

==
VNA Tools V1.1.2 (1.1.4881.16734) - 13.05.2013
==

- sdatcv file specification. New ASCII file format.
- Covariance view for visualizing the covariance or correlation
  - between S-parameters at a single frequency point or
  - between all frequency points for a single S-parameter.
- Cartesian view for visualizing S-parameter in a complex plane.
- New wizards improve the usability of VNA Tools II.
  - New Project helps creating a new project.
  - New Databased Standard helps creating a new calibration standard in
the database.
- New linearity model improves the measurement model.
- New Tools: Change Port Assignment and Data Converter.
- Metas.Vna.Matlab provides some functions to interact with VNA Tools II
from MATLAB, e.g.: load and save sdatb files.

==
VNA Tools V0.9.1 (0.9.4617.19294) - 22.08.2012
==

- New drift model with correlation.
- More information in the measurement journal.
- Round up uncertainties in the data explorer.
- Bug fixes.

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Michael Wollensack METAS