



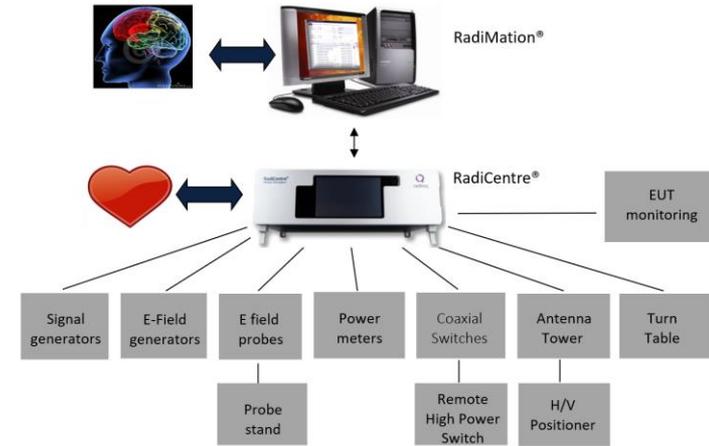
# RadiMation®

## the brains of the automation



# RadiMation

- Device drivers
- RadiMation 2023.1
- RadiMation 2023.2
- RadiMation 2024.1
- RadiMation 2024....
- Integration with other systems
- Lab management





# Device drivers

- Auto detect device drivers
- Checking device drivers
- Rigol RSA-series (GPSA- and EMI-mode)
- Gauss Instruments TDEMI
- New R&S, AR, Maturo, ... devices
- +250 drivers. In total 6135 drivers





# Auto detect device drivers

- Wizard for adding devices to configuration
- Scans VXI-11 (LAN), GPIB, USB
- Raditeq devices
  - Directly connected to PC
  - Single slot RadiCentre 1
  - Multislot RadiCentre
  - RadiCentre Ultra
- Also other brands that support ‘\*IDN?’
- Automatic creation of device driver



# Checking device drivers

- Ensures that correct device is controlled
- Option detection
- Checks system errors
- Checks if the setting is correctly set
- Verifies that device is in correct state
  - 'EUT ON' / Turntable referenced
- Workaround for known problems
- Ensures quality of automated test



# RadiMation 2023.1

- EUT status controller interface 
- Calibration import tool
- Speed improvement of cable corrections
- Parallel measurement of field probes
- Separate X-, Y- and Z-axis correction 
- Total: 205 improvements, including 20 drivers



# EUT status controller

- Provides information over TCP/IP to program
- Example Python script available on GitHub
- Changes in frequency, start of dwell time
- EUT information provided
- Test information can be updated
  - Operating mode
  - Temperature / humidity / pressure

# Separate X-, Y- and Z-axis correction

Correction File

Frequency (M...	X-axis correct...	Y-axis correct...	Z-axis correct...
300 MHz	1.01	1	1
350 MHz	0.98	0.99	0.98
400 MHz	0.99	1	0.99
450 MHz	1.02	1.04	1.02
500 MHz	1.04	1.05	1.04
550 MHz	0.99	1	0.99
600 MHz	1	1.01	1
650 MHz	1.01	1.03	1.02
700 MHz	1.03	1.01	1.02
750 MHz	1	0.99	0.98
800 MHz	0.99	1	0.99
850 MHz	1.03	1.05	1.05
900 MHz	1.05	1.04	1.04
950 MHz	1.02	1.03	1.02
1 GHz	1	1	1
1.2 GHz	1.01	1.06	1.02
1.4 GHz	1.01	1.04	1.03
1.6 GHz	1.02	1.04	1.03
1.8 GHz	0.93	0.94	0.92
2 GHz	0.93	0.96	0.93
2.2 GHz	0.95	0.95	0.95
2.4 GHz	0.92	0.92	0.93
2.6 GHz	0.92	0.99	0.94

Frequency Interpolation:  Logarithmic  Linear

Value Interpolation:  Logarithmic  Linear

- Correction file with X-, Y- and Z-axis factors
- Correction with single column still working
- Select as correction in driver settings
- Working in multiband and singleband
- Additional graphs and table for axis values
- Drivers optimized to use single request



# RadiMation 2023.2

- Increased average noise floor
  - Probe positioner for UFA
  - UFA calibration export tool
  - Application notes
  - Total: 324 improvements, including 47 drivers
- 

# Probe positioner for UFA

Bands



Location type: Field-Distribution

Frequency Range

Start: 80 MHz

Stop: 1 GHz

Forward Backward

Frequency Step

Stepsize: Logarithmic: 1 %

Config

Dwell Time

Dwell time: 2 s

Frequency Change Mode

Change mode: Constant

Config

Modulation

Modulation: None

Config

Test Site

Test Equipment: FAR 3 - RI (80 - 1000 MHz)

Location Settings

Antenna

Distance: 3 m

Antenna Polarization: Both

Antenna Tower

Max Height: 1.55 m

Min Height: 1.55 m

Steps: 1

Probe positioner

Start X: -75 cm

End X: 75 cm

Steps X axis: 4

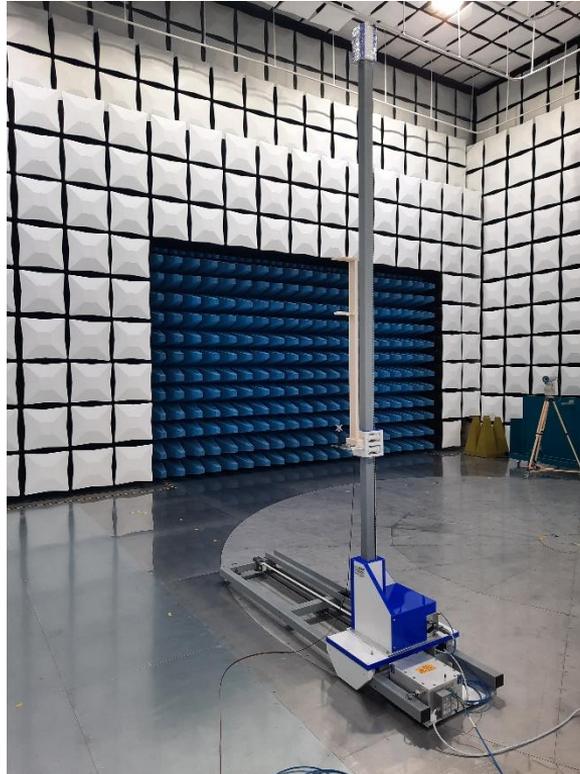
Start Y: 80 cm

End Y: 2.3 m

Steps Y axis: 4

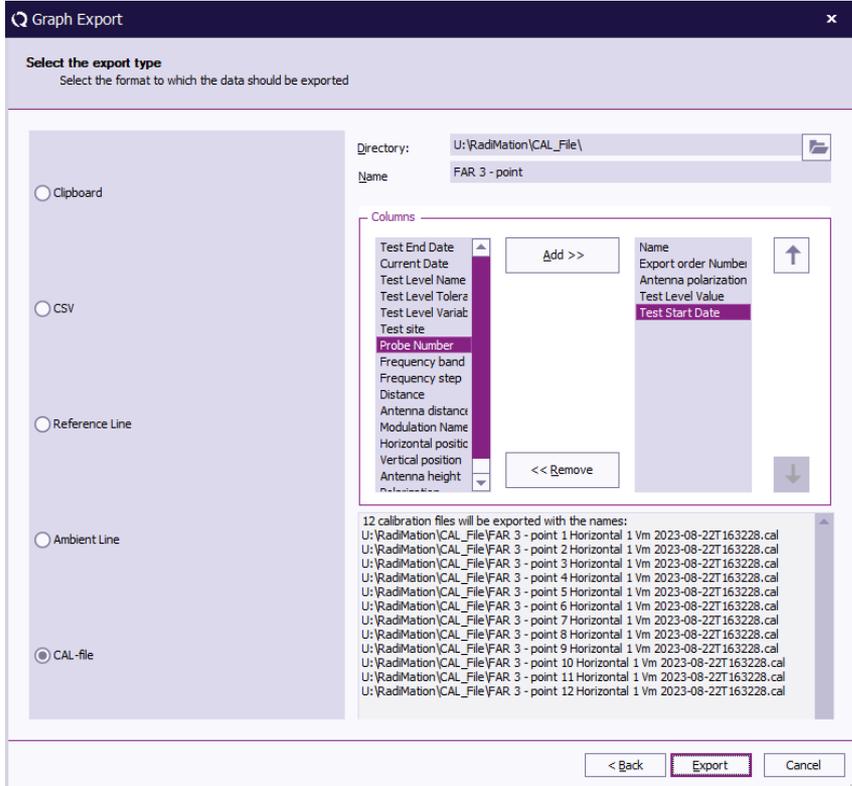
- Automatic movement of probe
- For example 16 point calibration
- Other than 4x4 layouts possible
- Horizontal and/or vertical polarization
- Multiple probes in positioner
- Export of all CAL files at once

# Probe positioner for UFA



- Maturo FPP
- Manual controlled
- Others
  - Innco FSM
  - MVG FPP

# UFA calibration export



- Using the 'Export' wizard
- Directory location can be specified
- Name can be specified
  - Fixed part
  - 'variables' related to actual data
- All CAL files exported at once
- Export settings are remembered



# RadiWiki application notes

- Explain specific tests
- [145](#): MIL-STD-461 RE102
- [147](#): MIL-STD-461 RE101
- [148](#): MIL-STD-461 CE101
- [149](#): MIL-STD-461 CE102
- [154](#): MIL-STD-461 CS114
- [155](#): MIL-STD-461 CS109
- [157](#): MIL-STD-461 RS103

# RadiWiki application notes

- Explain general topics
- [150](#): UFA with field probe positioner
- [151](#): Graph export to CAL files
- [152](#): Backup of important RadiMation files
- [153](#): Multi axis field corrections
- [156](#): Radiated emission substitution method
- Summary of standard, link to application note

# RadiMation 2024.1

- Reverberation chamber
- UFA (G)TEM
- Fixes red-cross controls
- On/Off button not toggling
- General fixes and speed improvements





# Reverberation

- Tuned mode and stirrer mode (with multiple stirrers)
- Multiple standards
  - IEC 61000-4-21
  - MIL-STD-461G
  - RTCA DO-160G
  - ISO 11452-11 / ISO 11451-5
- Multiband immunity, supporting multiple bands



# Reverberation

- Unloaded and loaded calibration
  - IL – Insertion Loss
  - AVF – Antenna Validation factor
  - LUF – Lowest Usable Frequency
- Loaded validation
  - CVF – Chamber Validation Factor
  - CLF – Chamber Loading Factor
  - Q – chamber Quality factor
  - Chamber time constant
- Substitution

# Reverberation calibration



600 MHz-2 GHz, 12 tuned moded - Radiated Immunity reverberation chamber calibration

Description: 600 MHz-2 GHz, 12 tuned moded

**Bands**

+ Add  
Duplicate  
Remove

**Frequency Range**

Start: 600 MHz  
Stop: 2 GHz

Forward Backward

**Frequency Step**

Stepsize: Logarithmic: 2% Config

**Test Site**

Test Equipment: Reverb Chamber 3

**Location Settings**

Stirrer

Start Mode: 0 degrees  
End Mode: 360 degrees  
Steps: 12

**Fieldprobe**

Positions: 8

**Allowed deviation**

U:\...\Allowed R...n deviation.COR

**Test Level**

Description	Type
100W forward	Testlevel

+ Add Edit Delete

**Inputs**

Description	Type
Electrical Field probe	Input
received Power	Input

+ Add Edit Delete

Start Test  
Cancel  
Environment  
Note  
Units  
Reporting  
General Info  
Limit lines



# Reverberation validation

600 MHz-2 GHz, 12 tuned moded validation - Radiated Immunity reverberation chamber validation

Description: 600 MHz-2 GHz, 12 tuned moded validation

**Bands**

+ Add  
Duplicate  
Remove

**Frequency Range**

Start: 600 MHz  
Stop: 2 GHz

Forward Backward

**Frequency Step**

Stepsize: Logarithmic: 2 % Config

**Test Site**

Test Equipment: Reverb Chamber 3

**Location Settings**

Calibration: U:\...\Reverberati...2 stirrer, 2.CAL

**Stirrer**

Start Mode: 0 degrees  
End Mode: 360 degrees  
Steps: 12

**Fieldprobe**

Positions: 8

**Allowed deviation**

U:\...\Allowed R...n deviation.COR

**Chamber size**

Width: 90 cm  
Length: 90 cm  
Height: 1.5 m

**Test Level**

Description	Type
100 forward	Testlevel

+ Add Edit Delete

**Inputs**

Description	Type
Electrical Field probe	Input
received Power	Input

+ Add Edit Delete

Start Test  
Cancel  
Environment  
Note  
Units  
Reporting  
General Info  
Limit lines

# Reverberation substitution



600 Mhz-2GHz, 12 tuned moded substitution - Radiated Immunity reverberation chamber substitution

Description: 600 Mhz-2GHz, 12 tuned moded substitution

**Bands**

Description	Type
Electrical Field substitution method	Testlevel

+ Add Duplicate Remove

**Frequency Range**

Start: 600 MHz  
Stop: 2 GHz

Forward Backward

**Location Settings**

Stirrer

Start Mode: 0 degrees  
End Mode: 360 degrees  
Steps: 12

**Test Level**

Description	Type
Electrical Field substitution method	Testlevel

+ Add Edit Delete

**Frequency Step**

Stepsize: Logarithmic: 2 % Config

**Dwell Time**

Dwell time: 2 s

**Frequency Change Mode**

Change mode: Constant Config

**Modulation**

Modulation: PM: 50 %, 1 kHz Config

**Test Site**

Test Equipment: Reverb Chamber 3

**Inputs**

Description	Type
Electrical Field probe	Input

+ Add Edit Delete

Start Test

Cancel

Environment

Note

Units

Reporting

General Info

Limit lines



# Reverberation





# UFA (G)TEM

- Keep 75% of points is difficult for 5 points (keep 3.75 points??)
- IEC 61000-4-20: statistical: standard deviation
- Cross polarity requirement
  - Also 75% of points have a secondary field > 6 dB lower than primary field
  - Rayleigh distribution
- 5% of frequencies allowed to use extended tolerance



# UFA (G)TEM

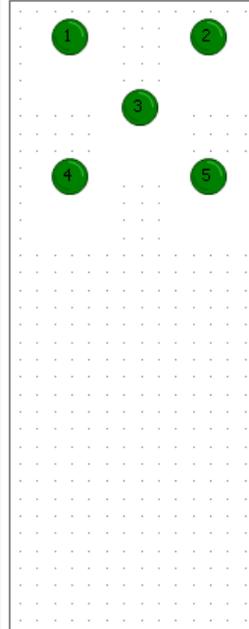
## 5 point GTEM calculation - Radiated Immunity Uniform Field Area calculation

Description: 5 point GTEM calculation

### Calibrations

Point	File	Status
1	Range 2 80MHz - 1GHz\Pos 1 80MHz - 1G...	✓
2	Range 2 80MHz - 1GHz\Pos 2 80MHz - 1G...	✓
3	Range 2 80MHz - 1GHz\Pos 3 80MHz - 1G...	✓
4	Range 2 80MHz - 1GHz\Pos 4 80MHz - 1G...	✓
5	Range 2 80MHz - 1GHz\Pos 5 80MHz - 1G...	✓

### Point Setup



### Point Settings

Calculation Method:  
IEC 61000-4-20:2022 (...)

Probability percentage  
75%

Accepted tolerance  
6 dB

Accepted extended tolerance  
10 dB

Extended tolerance percentage  
5%

### TEM mode verification

Cross-polar probability percentage  
75%

Cross-polar accepted tolerance  
6 dB

Cross-polar accepted extended tolerance  
2 dB

Cross-polar extended tolerance percentage  
5%



# UFA (G)TEM

Q Radiated Immunity Uniform Field Area calculation

Progress  
Remaining Calculation Time 00:00:00  
100%

Points

Frequency Point  
Frequency: 80 MHz  
Field: 10 V/m

Points Graphs  
 Power Graph  
 Field Graph

UFA Result

Result:	Pass
Percentage in accepted tolerance:	100 %
Frequencies in accepted tolerance:	255
Percentage in extended tolerance:	0 %
Frequencies in extended tolerance:	0
Percentage outside tolerance:	0 %
Frequencies outside tolerance:	0
Maximum deviation:	5.7 dB
Frequency of max deviation:	152.749 MHz

TEM mode verification

TEM mode verification result:	Pass
Percentage in accepted cross-polar tolerance:	100%
Frequencies in accepted cross-polar tolerance:	255
Percentage in extended cross-polar tolerance:	0
Frequencies in extended cross-polar tolerance:	0
Percentage outside cross-polar tolerance:	0
Frequencies outside cross-polar tolerance:	0
Maximum P-quantile:	0.32
Frequency of max P-quantile:	152.749 MHz

Close  
Save As...  
Note  
Units  
Report

# Calibration on specific axis

- 'Level on' axis can be specified
- Isotropic / X- / Y- / Z-axis
- No need anymore for multiple field probes

Q 1 point calibration - Radiated Immunity Calibration

Description: 1 point calibration

**Frequency**

Frequency Range

Start: 80 MHz

End: 1000 MHz

Frequency List

**Step**

Fixed: 2 MHz

Previous Frequency: 0 %

Starting From: 0 MHz

**Field**

Field: 3 V/m

Tolerance: 0.5 dB

Level on: Y-axis

**Calibration Method**

Signal Gen. Level (Pin)

Forward Power (Pfld)

Net-Power (Pfld - Prev)

Out Power

**Antenna**

Distance: 3 m

**Polarization**

Horizontal

Vertical

**Test site**

Test equipment: Immunity

Test engineer: Lab manager

Run Calibration

Cancel

Environment

Amplifier

Note

Field Probes

Units

General Info

# RadiMation 2024.....

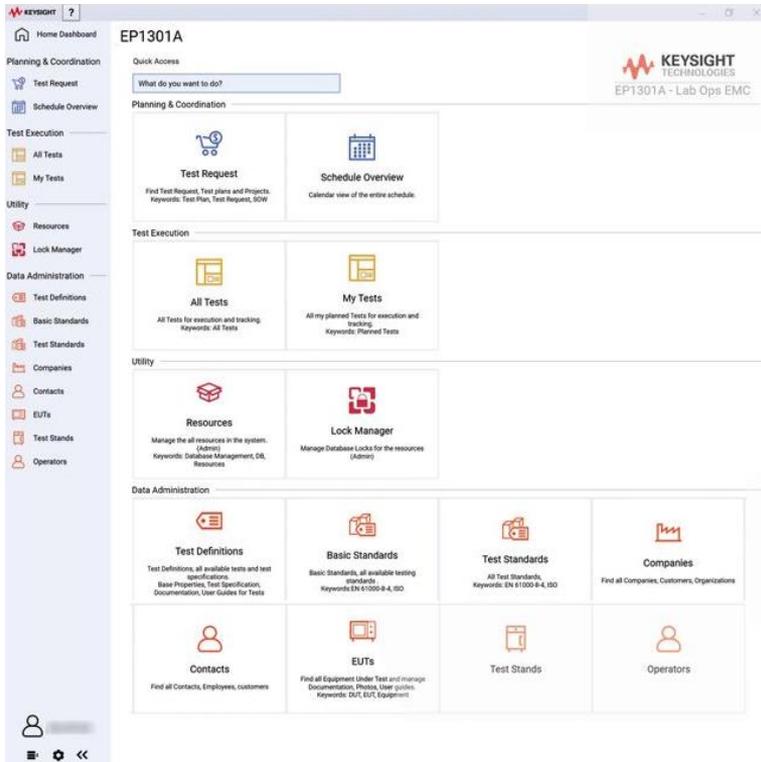
- Fast stirrer reverberation
  - ISO 11451-5
  - 8 field probes simultaneously
  - Closed loop field regulation
- Broadband noise
  - AWGN: Additive White Gaussian Noise
  - BL(W)N: Band Limited (White) Noise
  - IEC 61000-4-41



# Integration

- Exchange information with other systems
- Retrieve EUT information from database
- Communicate with EUT monitoring software
- Store raw measurement results in database
- Available solutions:
  - Configurable device drivers
  - EUT Controller Interface (ECI)
  - Command line: run sequence / generate report
  - C# API

# Keysight LabOps management



- EP1300A PathWave Lab Operations for EMC Test
- Quotation
- Resource and project planning
- Device management
- Automatically create EUT files
- Store test results
- Automatic report from RadiMation and LabOps



# RadiMation

- Stable and easy to use EMC test software
- Flexible in test configuration and procedure
- Better support of standards and methods
- Improved device drivers, optimal performance
- Documentation in application notes
- Powerful integration features other systems

**Constantly adding improvements for a  
flexible, powerful, full-compliant and  
easy to use EMC test automation software**