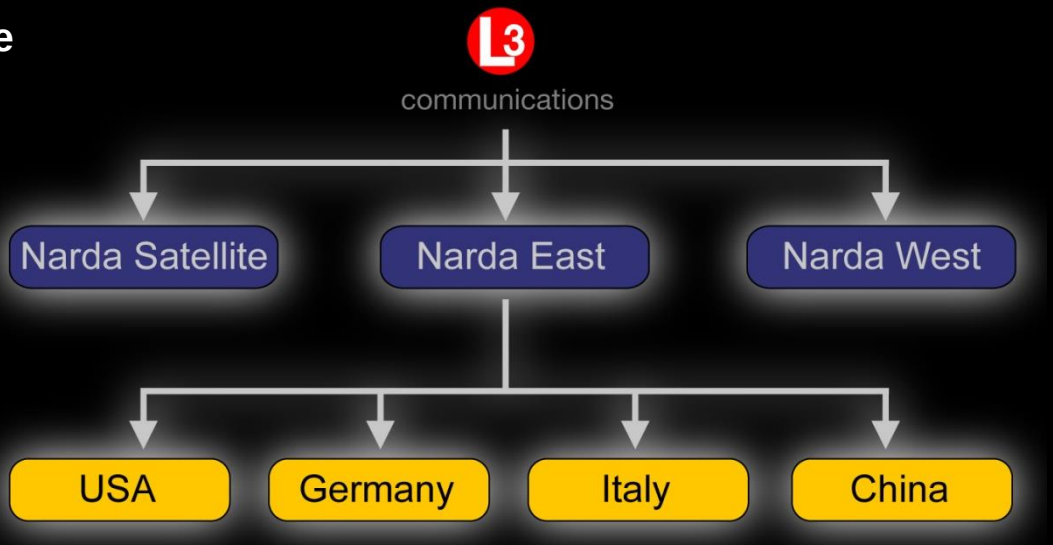
Enterprise

Group



L-3 Technologies
- Established 1997
- 75 Business Units Worldwide
- Billion 15US$ Sales
- 62.000 Employees

Narda Group
- 10 Divisions
- 80 Years in Business
- 2.800 Employees
- Core Competence in
  - Microwave Components
  - Antennas
  - Satellite Communications

Narda Test Solutions
- 3 Facilities
- 90 Employees
- Specialized in
  - Spectrum Analyzers
  - EMC Receivers
  - Broadband RF Meters
  - Remote Monitoring Stations

Fundamentals of pre-compliance and compliance in EMC emission tests

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Definition of «compliance»:

- Total adherence to a law, standard, etc.
- …?

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Definition of precompliance - 1

Method and/or measuring equipment deviating in some amount from the standards' requirements

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Definition of pre-compliance - 2

Acceptable deviation from compliance

Based on facts

Aimed to ease passing final tests

not easily and directly correlable to measurement uncertainty

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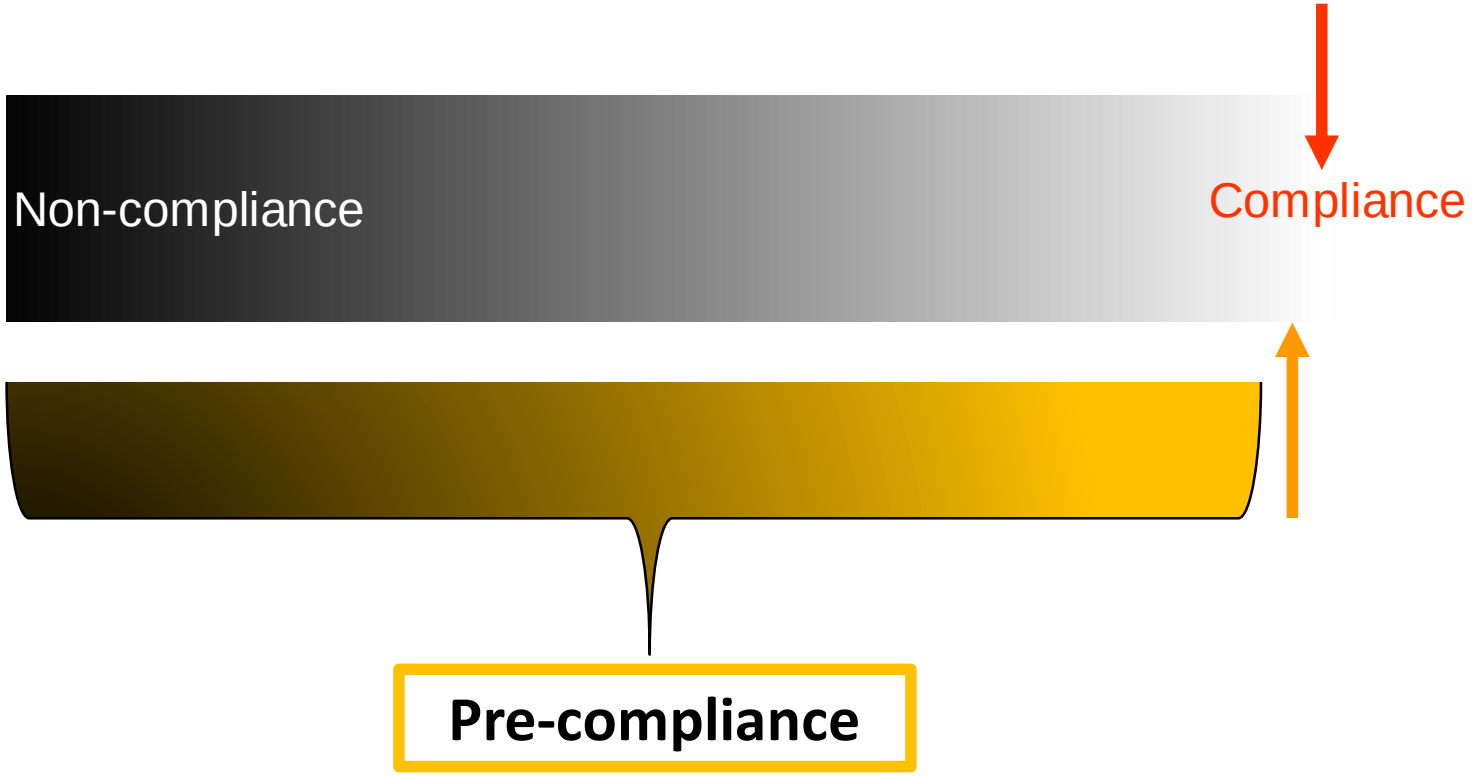
Compliance levels



Considerations for effective Pre-compliance:

- Defined purpose: design, prototyping, pre-testing
- Knowledge of the physics
- Consistence with the EUT characteristics
- Test environment capabilities
- Impact on products development and time-to-market
- Available budget

In EMC the measurement results are:
- *absolute*, in terms of quantities and limits to respect
- *relative*, in reference to methods, equipment and environment that may be not standards compliant

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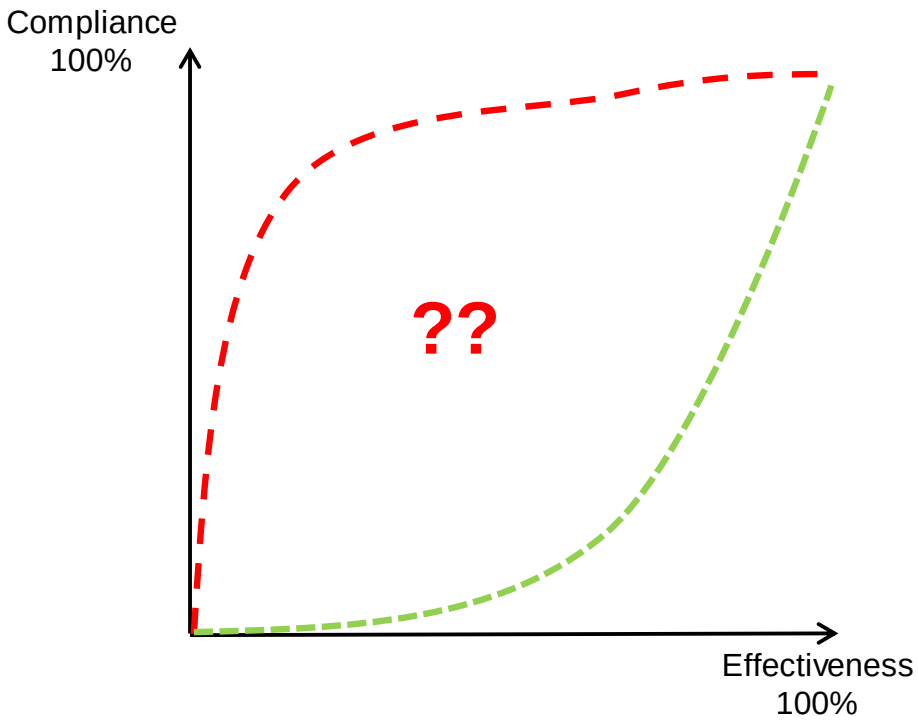
Pre-compliance ok but… how much?



Very variable in function of:

- Phenomena
- Environment
- Test type
- Equipment
- Skills
- …

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Pre-compliance and uncertainty

To remember

- The limits to respect (standards) are **absolute values**
- Too many uncertainties in the measurement chain make it useless

Target:

To be close to compliance as much as possible

How:

Validation of pre-compliance setup and procedure by comparison with a compliant Laboratory

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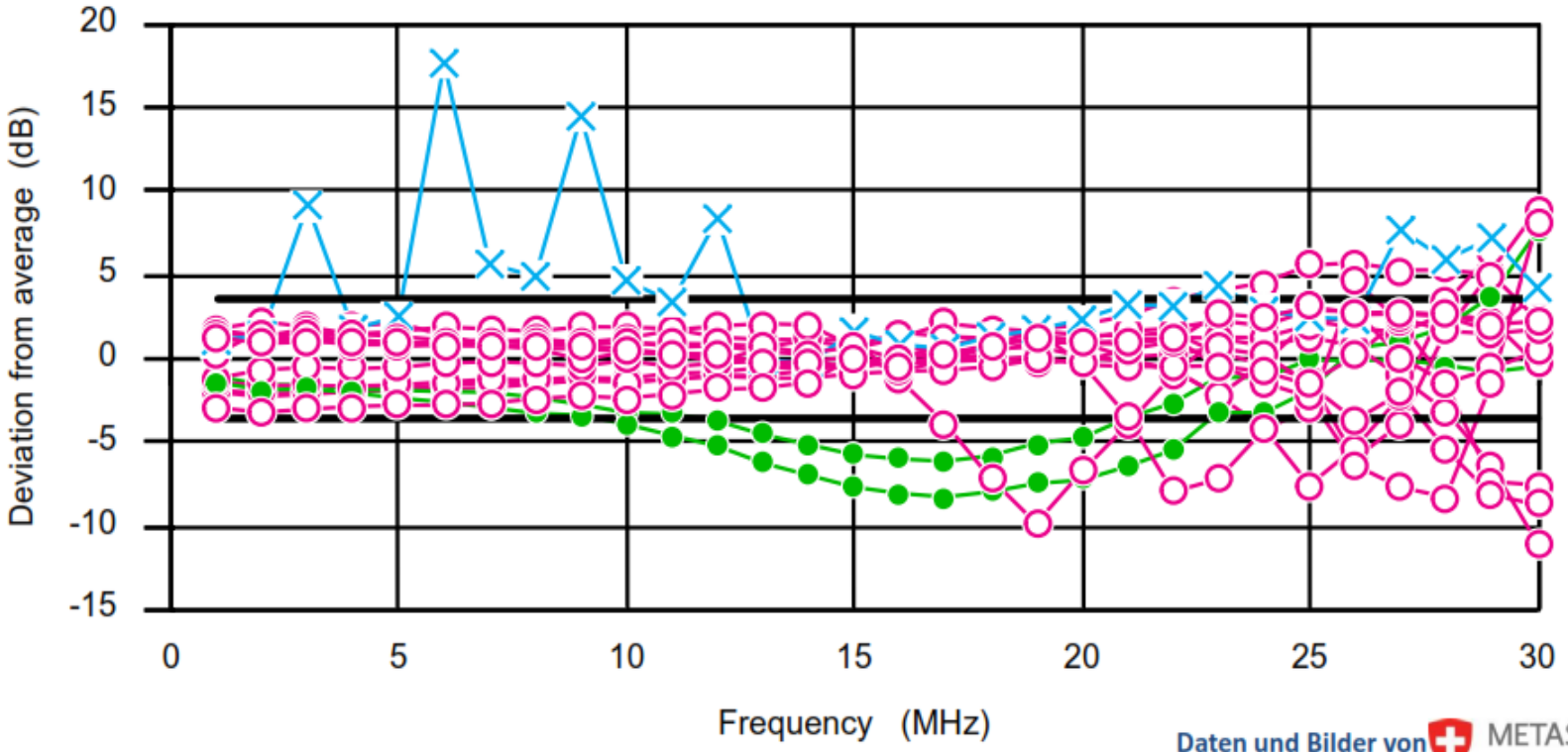
About uncertainty and comparisons

Messung des gleichen (stabilen) Prüflings am Netzanschluss 15 EMV Labors in der Schweiz



Daten und Bilder von Heinrich Ryser - METAS

METAS Federal Office of Metrology

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The way to effective Pre-compliance

Understand the severity of the EMC issues

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The way to effective Pre-compliance

Make use of the right tool

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The way to effective Pre-compliance

Minimize the variables

Environment

Equipment

Knowledge

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Most critical: radiated and conducted emissions

Why:

- «weighted» measurements = CISPR detectors (QP, C-Avg, RMS-AVG…)
- Disturbances of high spectral contents (energy)
- High measuring dynamic range required
- Severity of the meter validation (CISPR 16-1-1)

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CISPR detectors evolution

CISPR 16 Edition	**16-1** (1999)	**16-1-1 Ed.2** (2006)	**16-1-1 Ed.3** (2010)
Detectors & Frequency Range	QP (9k-1G) RMS (9k-1G) AVG (9k-1G) PK (9k-18G)	QP (9k-1G) RMS (9k-1G) AVG (9k-18G) **C-AVG (9k–18G)** PK (9k–18G) **RMS-AVG (9k-18G)** APD (1–18G)	QP (9k-1G) RMS (9k-1G) AVG (9k–18G) C-AVG (9k–18G) PK (9k–18G) RMS-AVG (9k–18G) APD (1–18G)

Red: not required by CISPR 16-1-1, still present in some Product Standards

QP = Quasi-Peak

RMS = Pure Root Mean Square

AVG = Arithmetic Mean

RMS-AVG = Combination of RMS and AVG @ corner Frequency

C-AVG = Max Hold Average

APD = Amplitude Probability Distribution

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Setup fixed elements:

Variable elements:

The Meter

Environment

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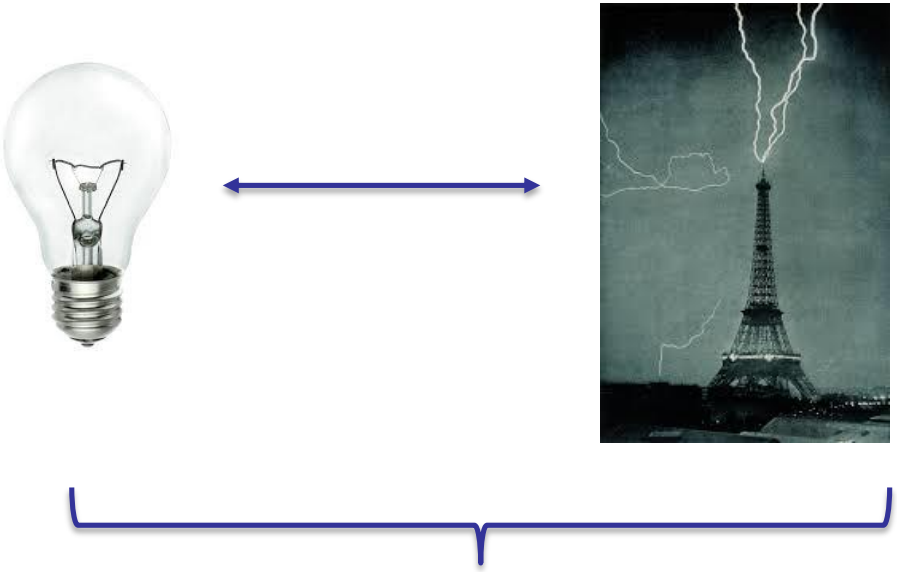
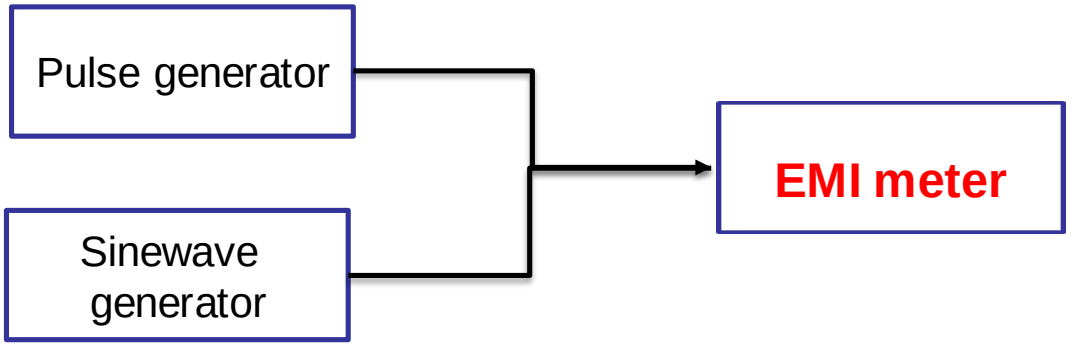
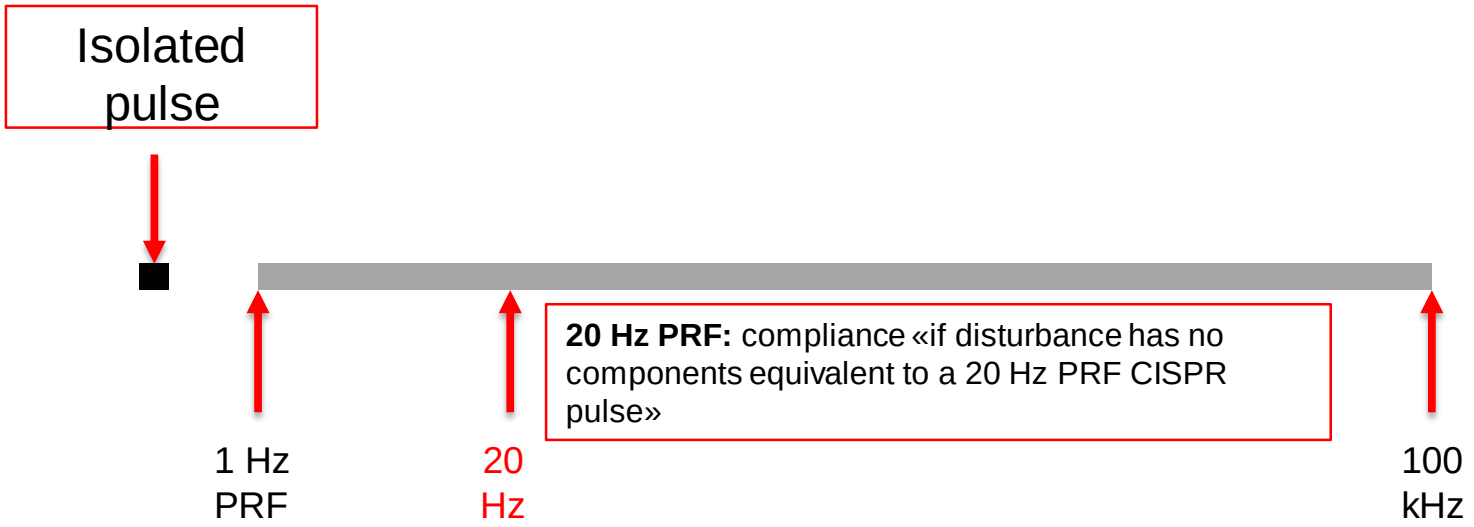
EMI – a very complex matter



CISPR 16-1-1 defines the method representative of any kind of disturbance to be used for testing the «EMI meter»

Validation of CISPR 16-1-1 compliant meters





PRF: CISPR test Pulse Repetition Frequency

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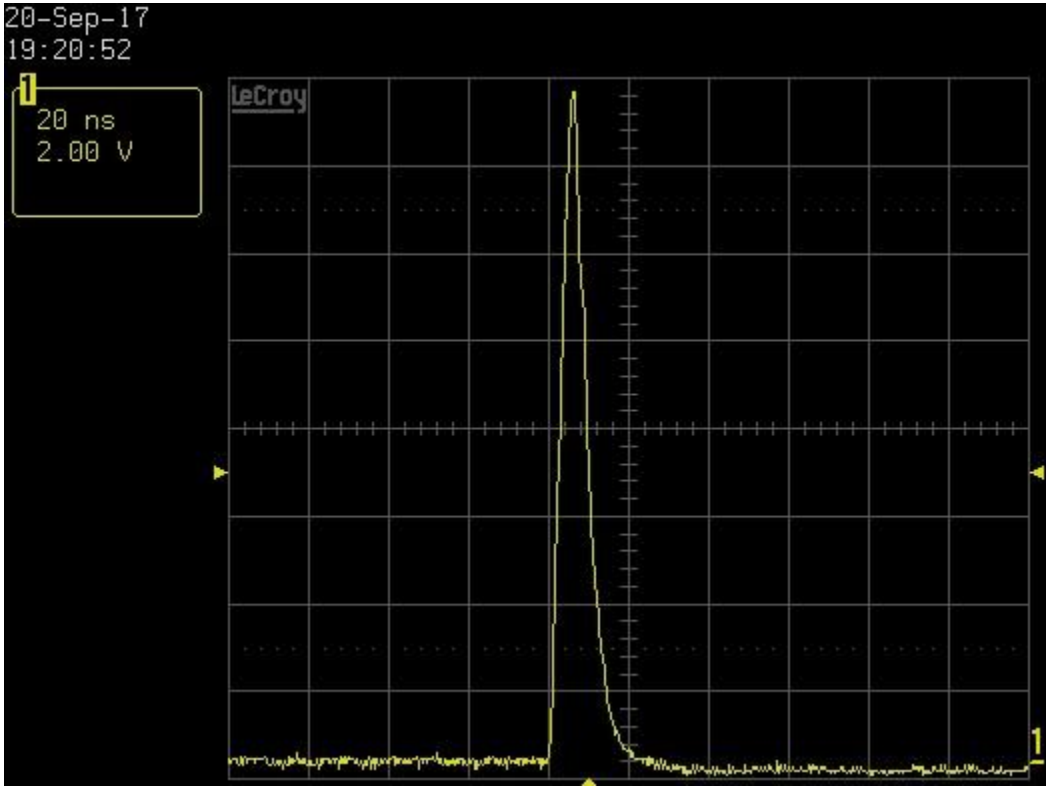
Example of CISPR pulse



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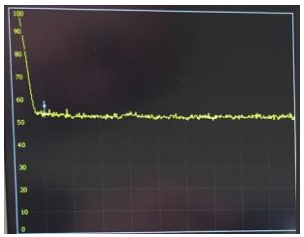
Importance of using an EMI-specifically designed meter in emissions testing

CISPR Pulse Generator



Spectrum Analyser with EMI option

Pre-compliance EMI receiver

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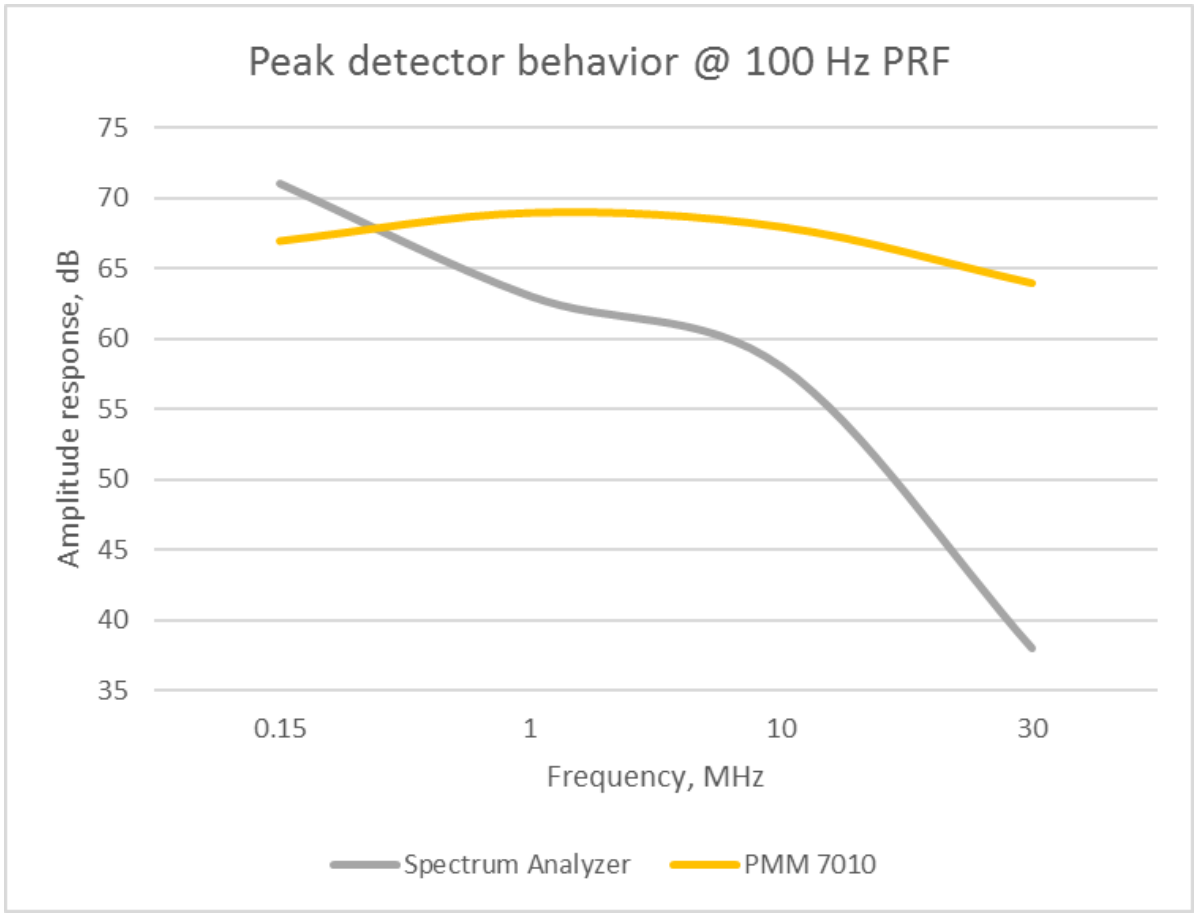

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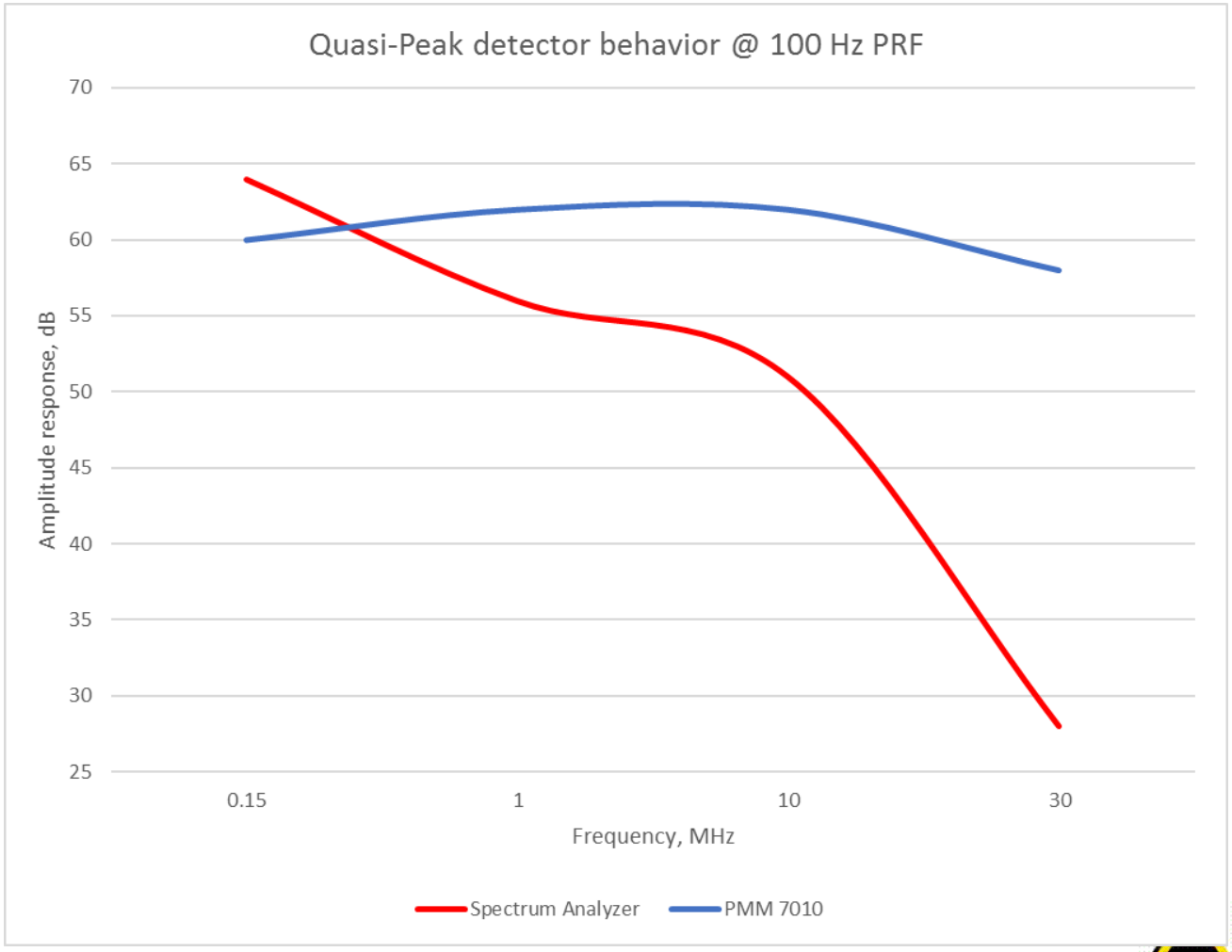

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Emission tests anywhere?

Question: is Ambient noise subtraction possible?

Answer:
Subtracting spectra could be of some consistency assuming the ambient noise and EUT emissions are both *narrowband*, supposing the ambient noise levels are stable.

When both ambient and EUT signale are *broadband*, spectra subtraction become unreliable at the point they don't even approximate to the actual EUT emissions.

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Oscilloscopes, Spectrum Analyzers, Field probes…

- Useful in debugging
- May be ineffective for pre-qualification:
  - Dynamic and sensitivity may be **inadequate**
  - Input may be not designed for EMC

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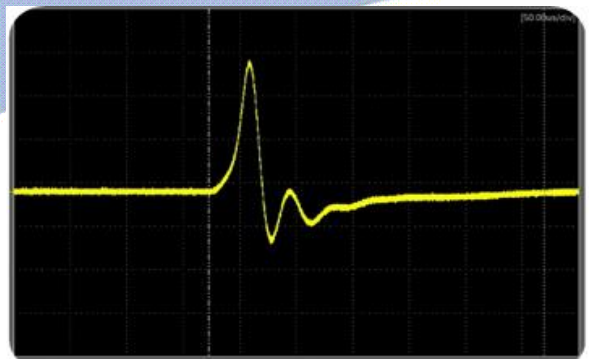
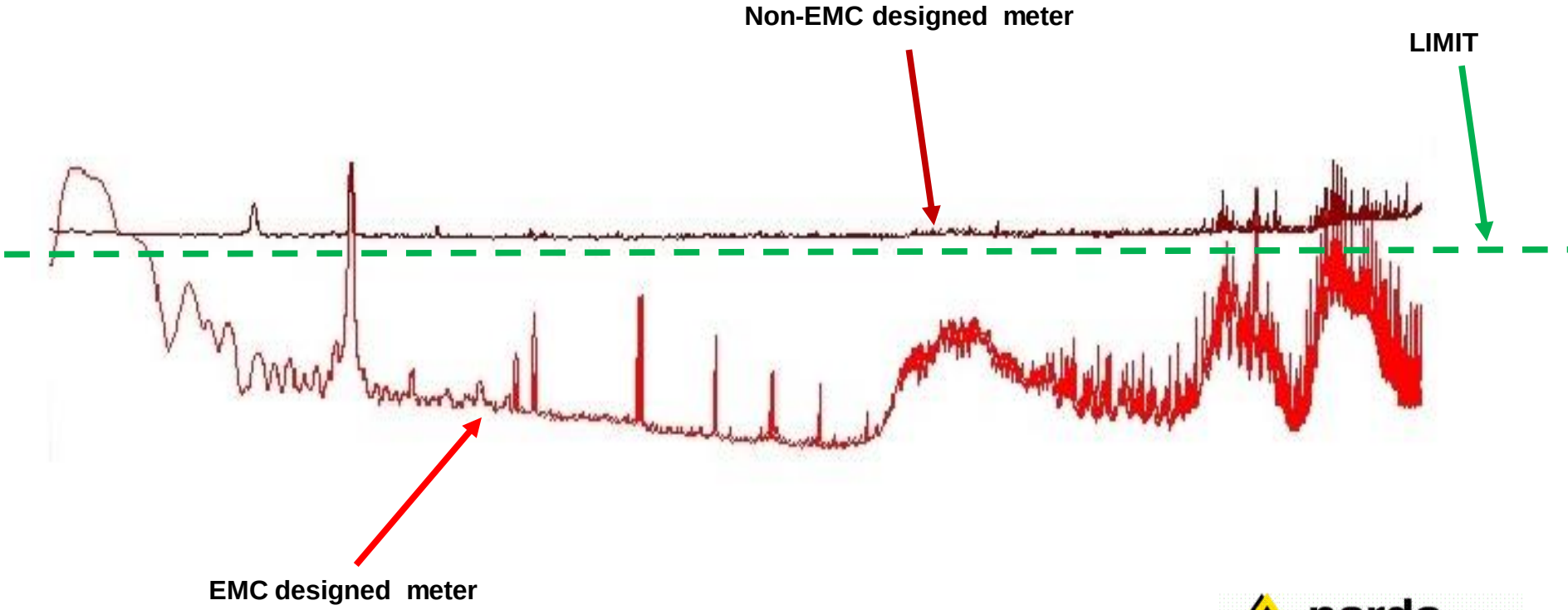
Example of inappropriate meter



Light dimmer noise pulse



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Correct Pre-compliance - advantages

- Better and earlier understanding of product's EMC issues
- Shorter time-to-market
- Increased confidence to pass the final tests
- Money saving

Thank you!

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