ICRAR

International
Centre for
Radio
Astronomy
Research

Curtin University of Technology

THE UNIVERSITY OF WESTERN AUSTRALIA
Achieve International Excellence

ICRAR is a partnership between Curtin University of Technology and The University of Western Australia

EMC ?

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Research Engineer / EMC

International Centre for Radio Astronomy Research

My Background

- *Master in Electrical Engineering*: 1988 from Technical University, Munich; *PhD in Engineering*: 1994 from Technical University, Hamburg-Harburg
- 1993 – 1999*: Manager EMC laboratory at MAZ Hamburg GmbH* – accreditation through DAR (German Accreditation Council); *Technical Manager of EMC and Systems Integration Pty Ltd, Melbourne* : EMC tests, EMC product assessment, numerical field simulation, EMC analysis for defence projects
- 2000 – 2010*: Senior Research Fellow with UWA*: lecturing electromagnetic theory and electromagnetic compatibility; PhD student supervisor; numerical field simulation; EMC workshops for industry; industry projects (EMC and wind turbines; electric field around HF antenna on a submarine; path loss around dielectric bodies; numerical field simulation
- *Since March 2010: Research Engineer with ICRAR:* Test methodologies
- *Activities within EMC Community:* National Council Member of Australian EMC society; technical chairman for Australian EMC symposia in 2009 (Adelaide) and 2010 (Melbourne); technical committee member for international EMC symposia (Asia-Pacific EMC Symposium, EMC Wroclaw); NATA accredited inspection body for EMC and electromagnetic modeling; Standards Australia technical committee member; IEC working group member; IEEE Distinguished lecturer for EMC in 2007/2008

EMC Management for the SKA

Top level document: EMC_CoDR_20090121

1. Introduction
2. Terminology
3. **Management**
4. **Standards and specifications**
5. EMC Zones and SKA configuration
6. Design of SKA Hardware
7. Commercial off the shelf (COTS) hardware
8. Support equipment and services
9. **Measurement**
10. RFI Mitigation
11. EMC Costing

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Management

- Establish EMC group
- Investigate suitability of existing standards
- Draw up EMC requirements and communicate to all stakeholders
- Development of test systems
- Development of EMC plan
- EMC plan to be tied with existing Systems Engineering approach

What is needed?

EMC Program Plan
EMC Control Plan(s)
EMC Test Plan(s)

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Standards and specifications

- CENELEC, ETSI, EN, IEC, CISPR, AS/NZS, SANS, CSA, MIL-STD, IEEE, ISO

What is needed?

- Distinguish between ‘test methods’ (set up, test environment), ‘parameters’ (resolution bandwidth, measurement time etc), and ‘limit values’
- Pay attention to system-level and non-conventional (newer) standards, e.g.
  - MIL-HDBK-237: Guidance for controlling Electromagnetic Environmental Effects on Platforms, Systems and Equipment
  - EN 50370: Electromagnetic Compatibility – Product Family: Standard for Machine Tools
  - IEC 61000-4-21: Reverberation Chamber test methods
- Tailor test methods (type of receivers, measurement parameters) with respect to radio astronomy needs (Commercial and Military emission standards are typically meant to protect communication signals)

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Measurement

Measurement at as low a level as possible

What is needed?

- Test plans for the different levels
- Acceptance criteria for test reports (accreditation of laboratories)
- A strategy how to act on test results
- Test results are evidence for COMPLIANCE, not for COMPATIBILITY
- Measurements are only a part (but an extremely important one) of the EMC verification process

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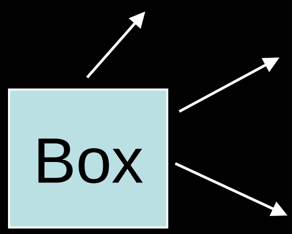
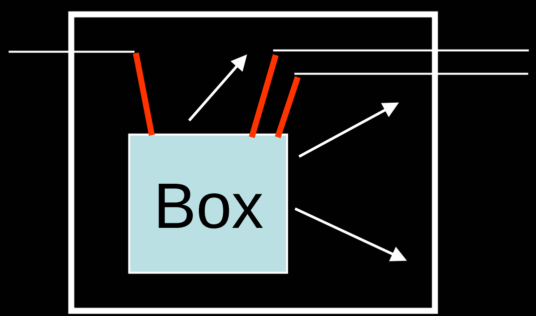
Measurement

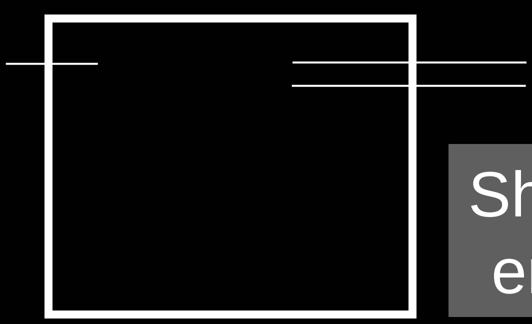
Design test methods



Radiation from a box: PSD_{box}



Radiation from the shield: PSD_{box}-a_S ?



Shielding of an enclosure: a_S

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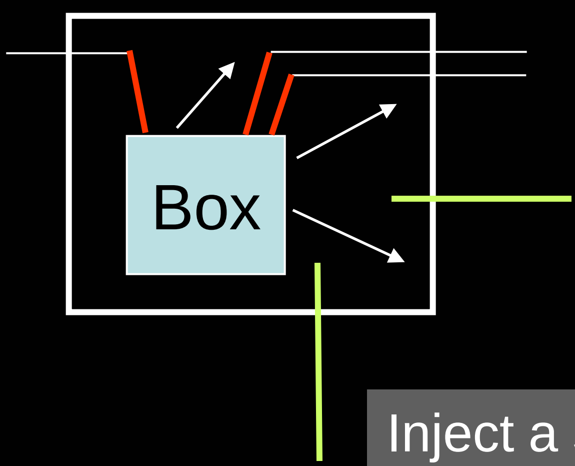
Is the radiation from enclosure a_S dB lower than the radiation from the 'box' itself?

Equivalent: What would be the radiation from the enclosure be, if the 'box' would emit a noise signal a_S dB higher?

Measure radiation from enclosure



Measure signal at probe inside enclosure due to 'box' V_{box}

Inject a signal until V_{box} is reached at the probe
Increase signal by desired shielding efficiency
Is radiation from enclosure still below limit value?

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Benefits of **having** an adequate EMC Management

- EMC issues are identified early in the process and can be dealt with during the design and production phase in a timely manner
- Clear specification for providers of infrastructure can be made
- Less effort required during the construction and installation phase in remote areas
- Avoid the stress of having to come with last minute EMC fixes
- Reduce costs by solving problems while there are still options available

Benefits of **providing** an adequate EMC Management

- ?
- Designing antennas, building new receivers, optimizing correlators, handling the data flow, writing new software … Now, THAT’s cool!
- Anybody COULD write up all the EMC plans; so how can one possibly score with doing it?
- So why would anybody in his/her right mind bother with EMC management?
- Who gets the credit if everything works fine at the end?