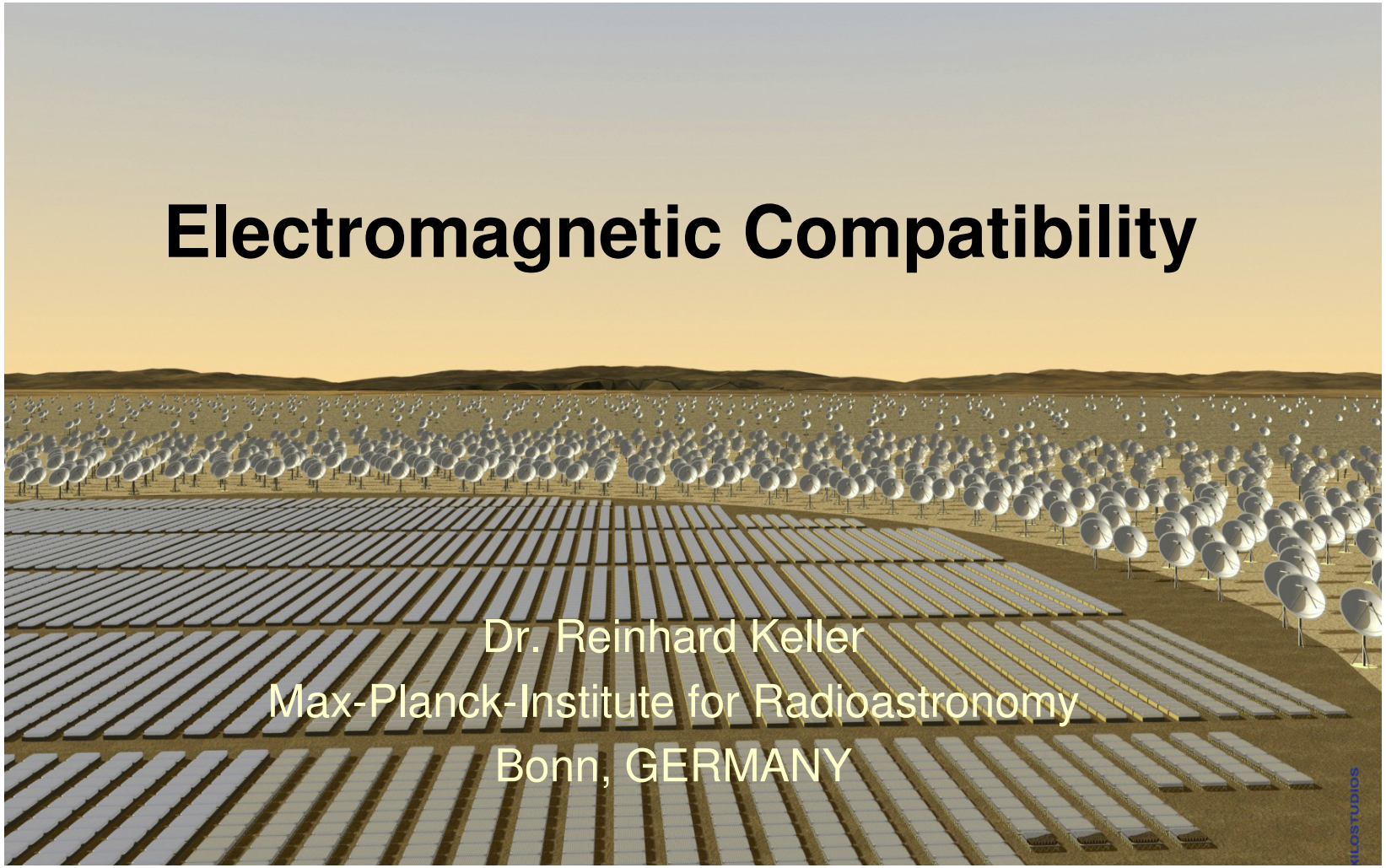
Electromagnetic Compatibility



Dr. Reinhard Keller
Max-Planck-Institute for Radioastronomy
Bonn, GERMANY

Content

- What is EMC?
- Motivation for MPIfR
- EMC in the radio astronomy context.
- Optimization components towards EMC.

Problem: Electro Magnetic Compatibility EMC

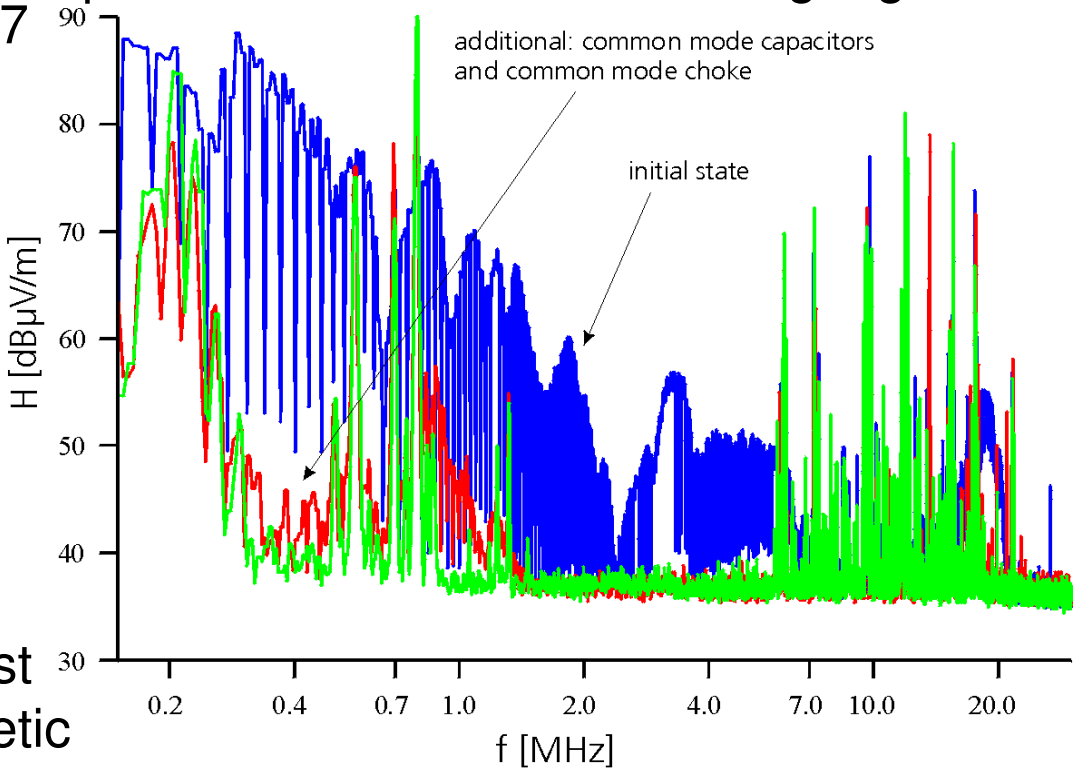
- „The goal of EMC is the correct operation, in the same electromagnetic environment, of different equipment which use electromagnetic phenomena, and the avoidance of any interference effects. .“ (Source: Wikipedia)

- Industry products:
  EN55011
  VDE 0878-1

Source: left: Dr. Hj. Biener / right: RP online

EMC of PV Components at FhG/ISE

- Untersuchung der elektromagnetischen Eigenschaften des Solar-generators in netzgekoppelten photovoltaischen Stromversorgungs-anlagen, BMBF 1994 – 1997



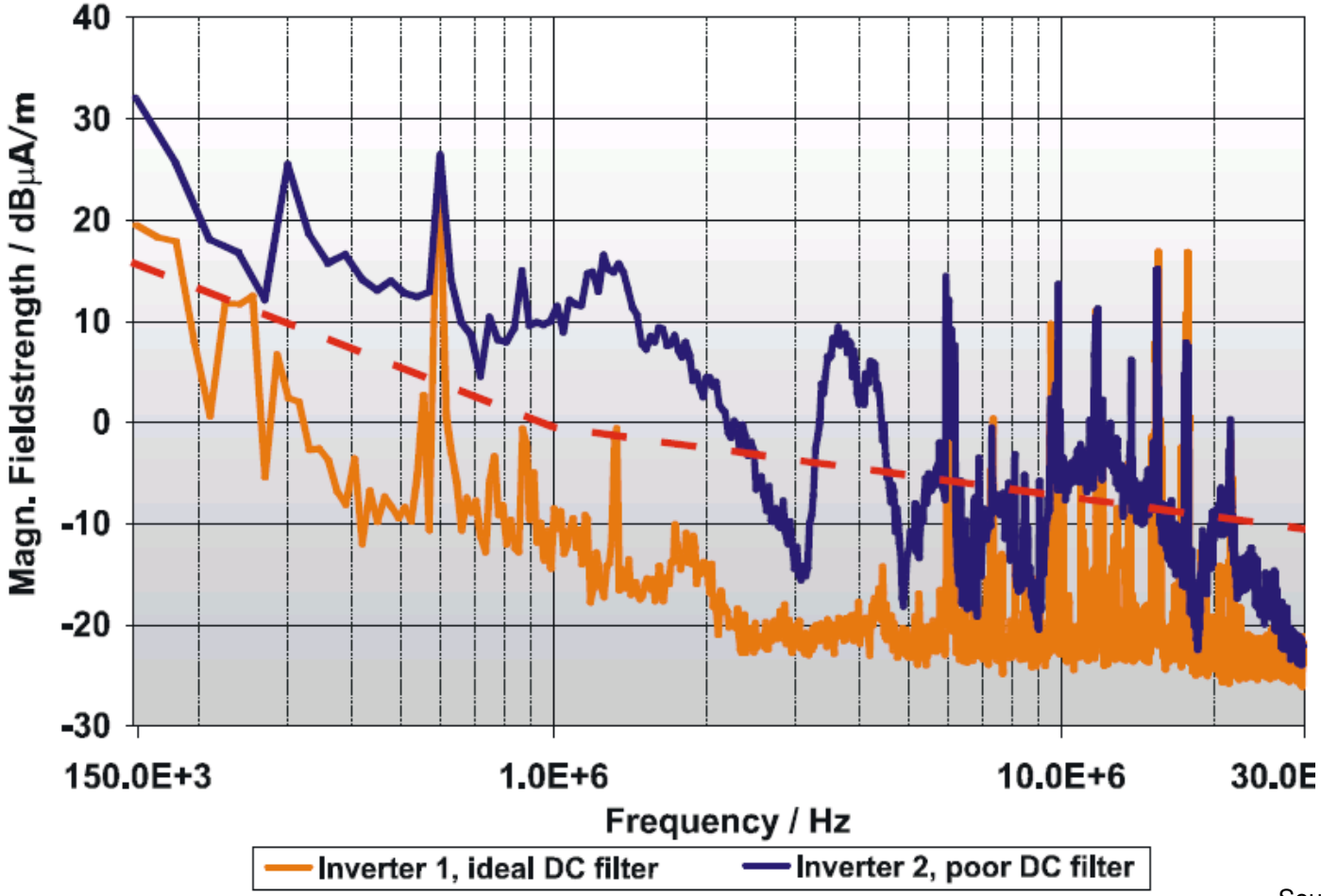
- Development of standard test procedures for electromagnetic interference tests and evaluations on photovoltaic components and plants, EC, 1998 – 2000

Green: Noise floor
Blue: unmodified power inverter
Red: EMC optimized power inverter

Source: FhG/ISE

EMC policy

- EMC compliance by filtering



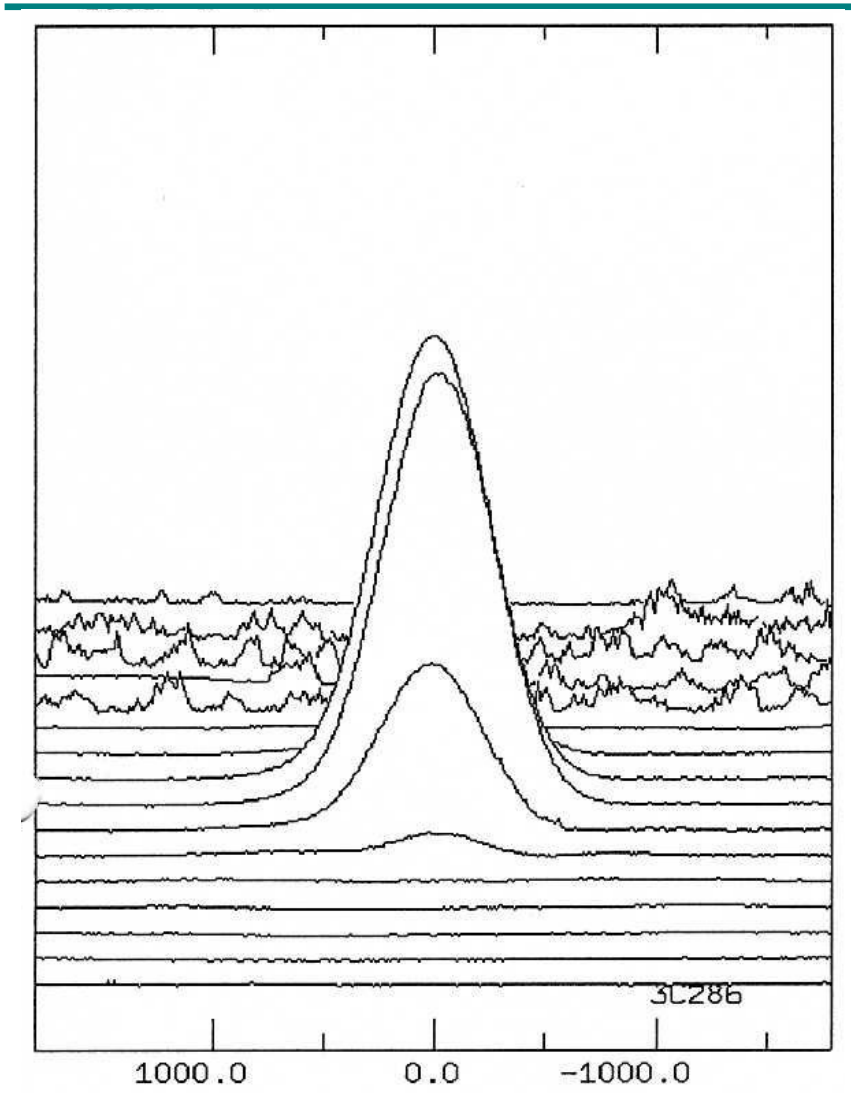
Source: FhG/ISE

Motivation

Max-Planck-Institut for Radioastronomy & EMC

- Long (and bad) experience with Radio Frequency Interference (RFI)
- Measurement equipment and experience for RFI
- Extremely sensitive astronomical instruments
- Telescopes as test beds for EMC measurements
- Electromagnetic compatibility of all SKA equipment

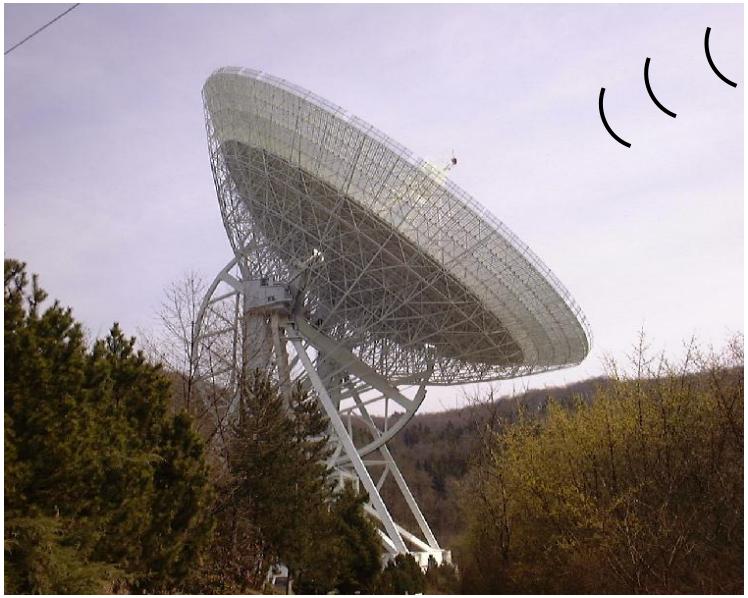
RFI in Radioastronomy

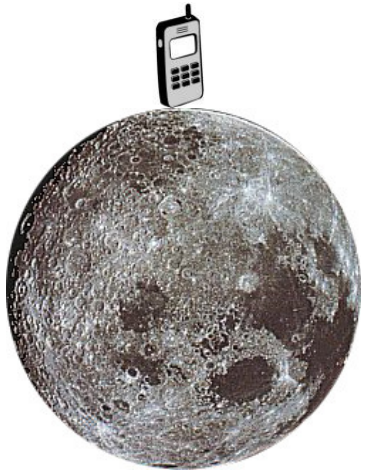


Performance Requirements of Radioastronomy

- Radioastronomy:
  ITU- Recommendation RA 769-2

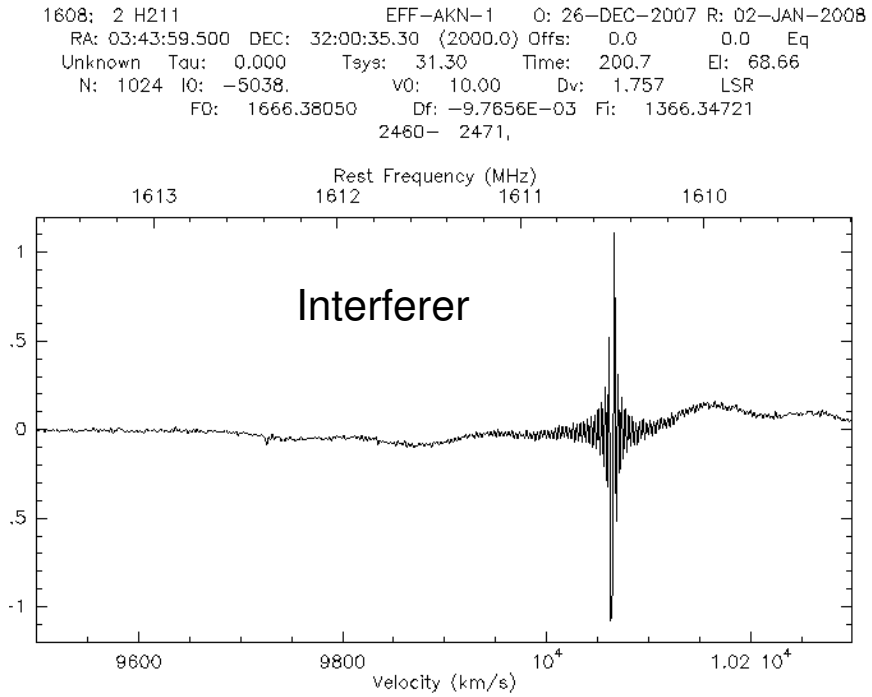
I.E.: Mobile phone on the moon
  * Distance abt. 400.000 km
  * Power 2 Watt

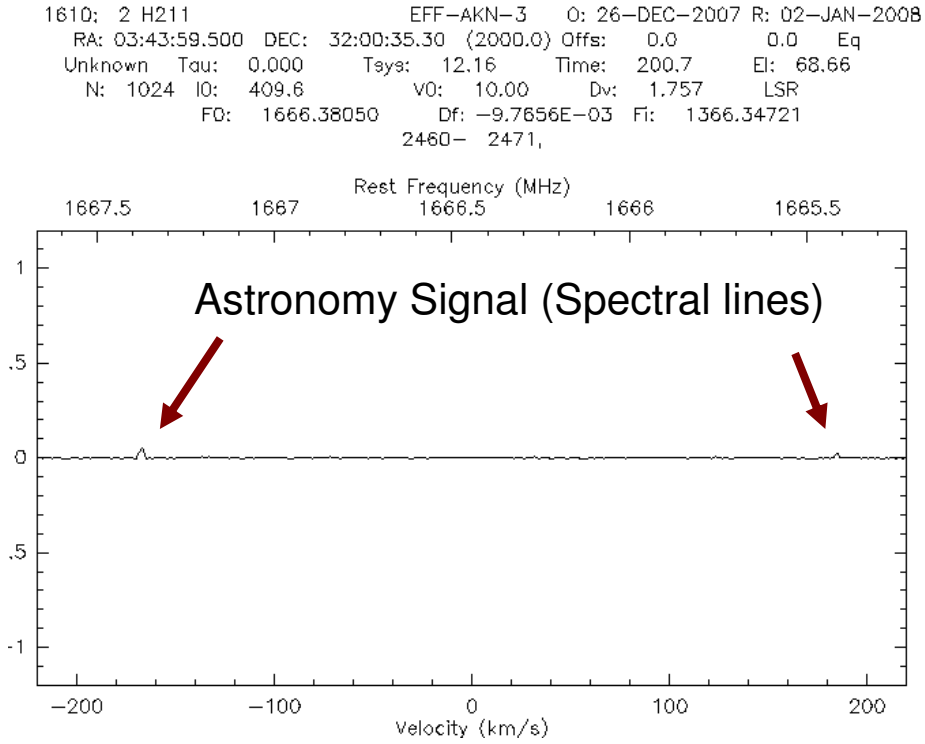




→ one of the strongest radio sources at the sky for the 100m radio telescope Effelsberg

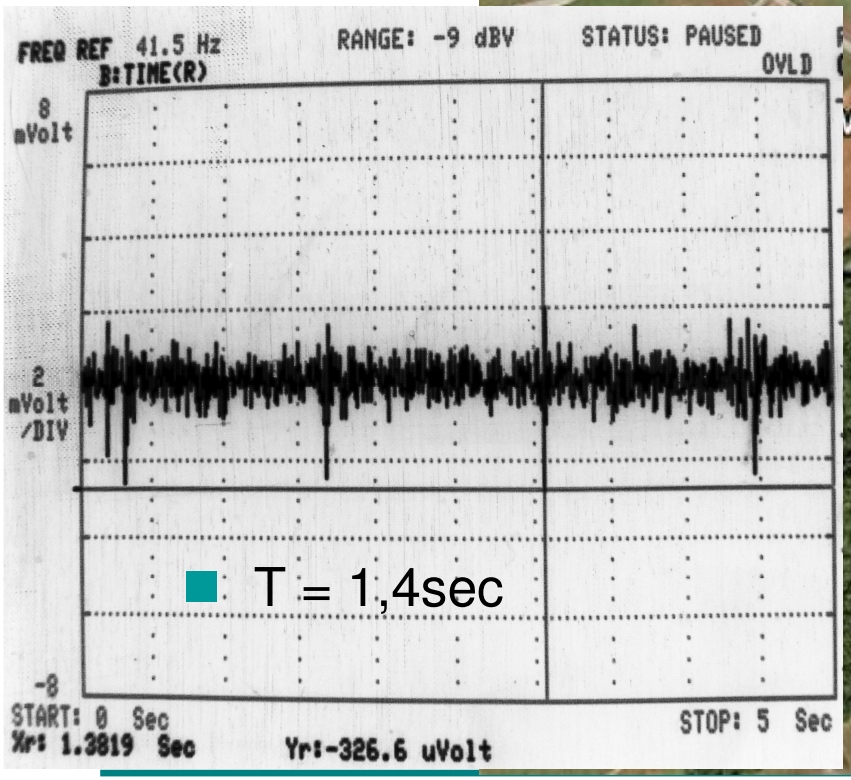
Signal / Noise



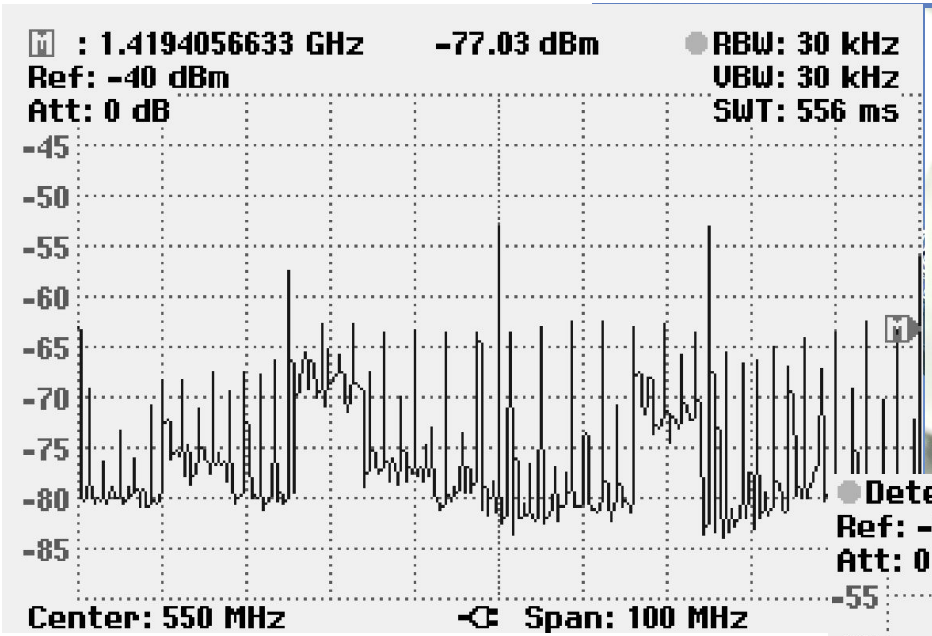


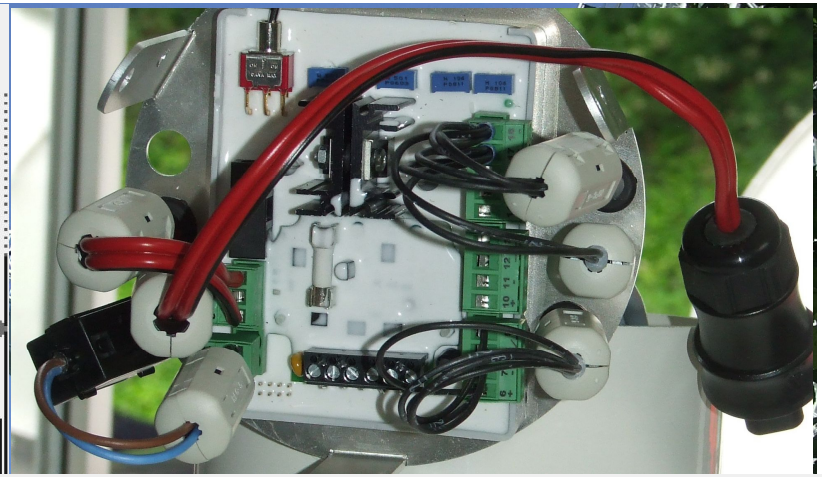
‚Pulsar‘

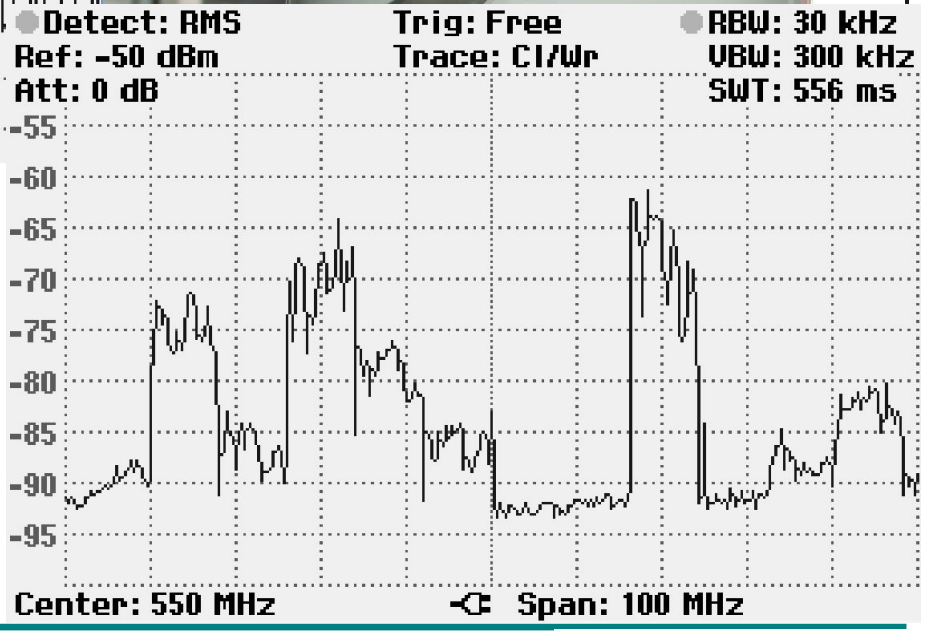
Am Birnbaum
Weidezaungerät 2
Weidezaungerät 1


FREQ REF 41.5 Hz
B:TIME(R)
RANGE: -9 dBV
STATUS: PAUSED
OVLD
8 mVolt
2 mVolt /DIV
-8
START: 0 Sec
STOP: 5 Sec
Xr: 1.3819 Sec
Yr:-326.6 uVolt
T = 1,4sec

EMC of a Solar Lamp





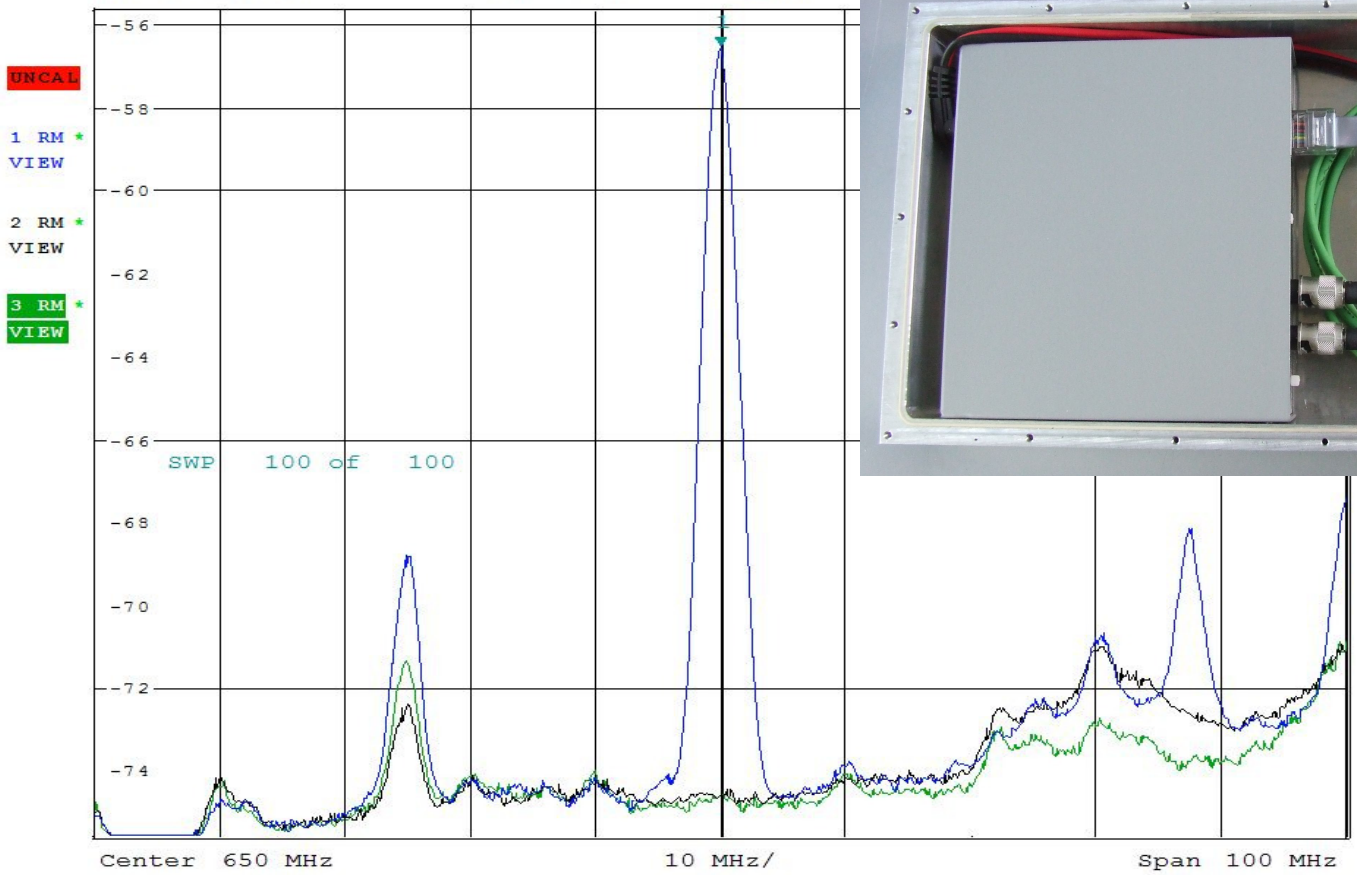


- Radiation of the shelf

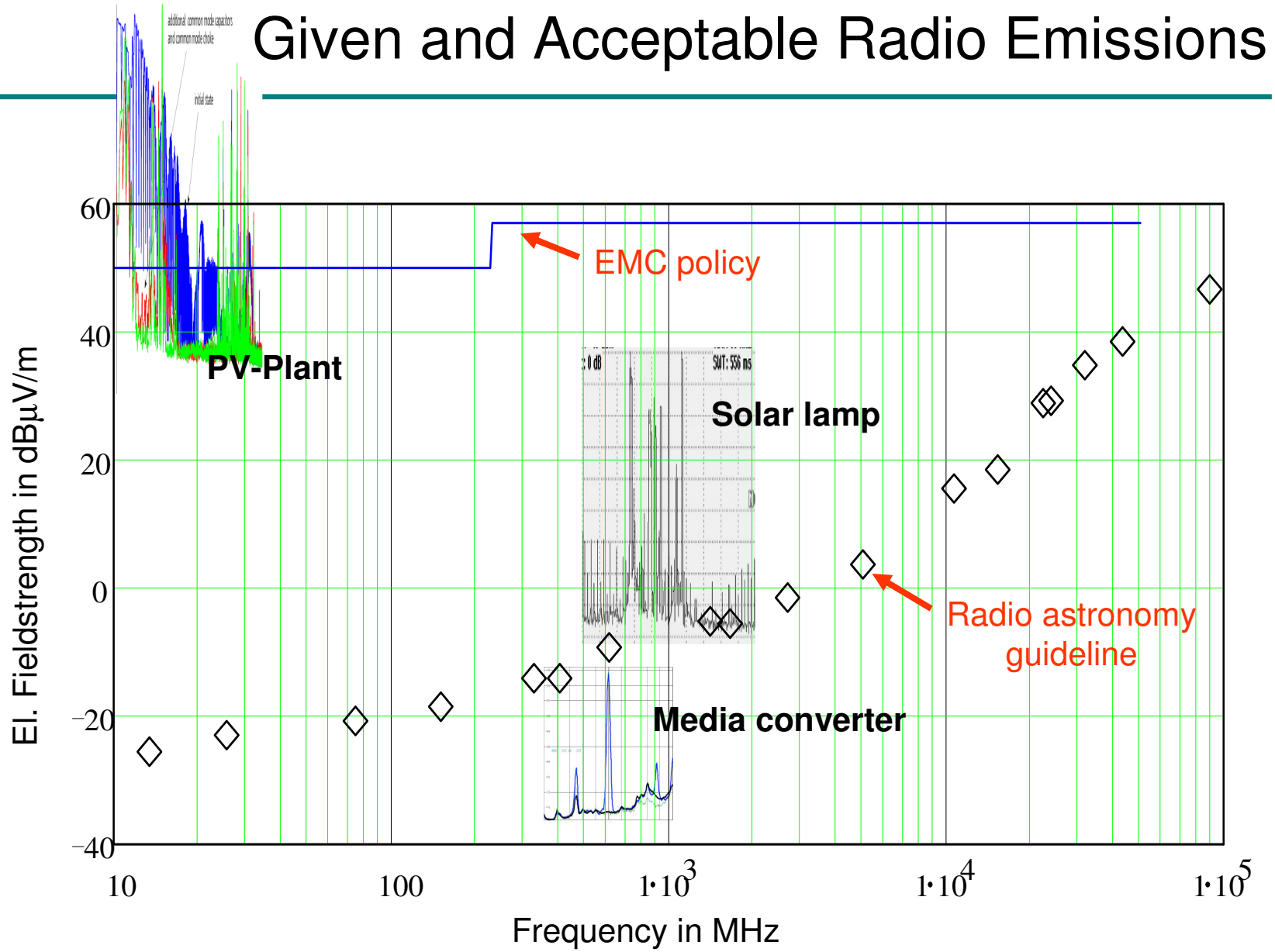
- Radiation with shielding and filtering
  - TV channels!

Ethernet Media Converter 100BaseT / Optical fibre

- Strong interferers, i.e. 650MHz — blue line
- In house shielding case with EMC filters — green line



Given and Acceptable Radio Emissions



Other Applications

- Sekundary A
  - EMC in Medical Technology:
    i.E. imaging procedures
    - Extremely high field strengt
    - High sensitivity sensors
      (croy HEMTs FhG/IAF?)
  - Satellite - Technology: low noise energy supplies in space

magnetic resonance imaging apparatus (MRT) at the Uni-Klinik Freiburg with low noise amplifiers of FhG/IAF (f = 400 MHz)

Conclusion

We have:

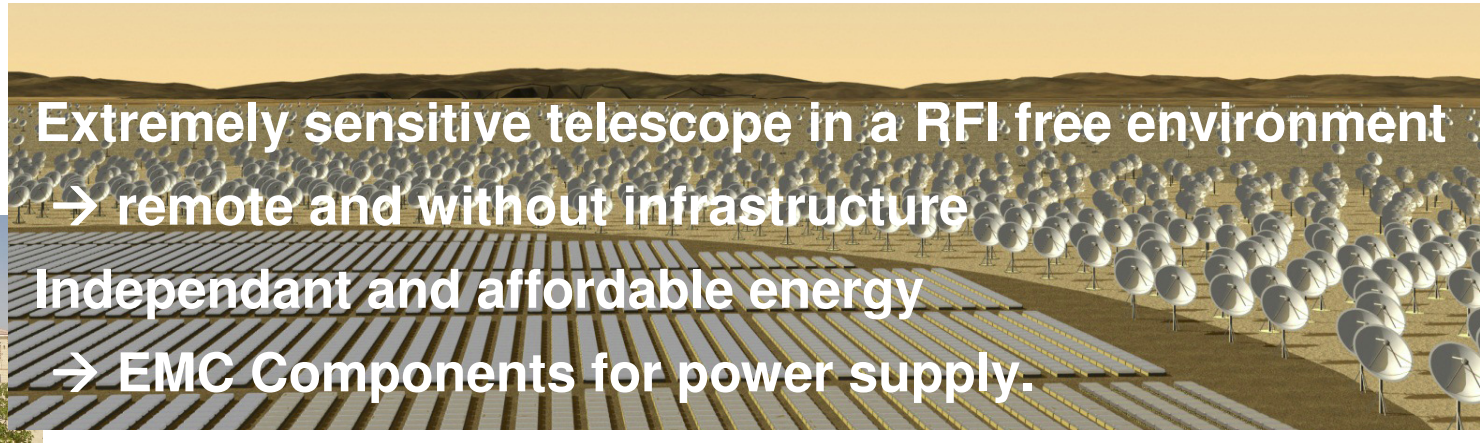
Expertise in EMC measurement techniques,

EMC-test bed (100m, LOFAR, ASKAP) for monitoring

Leadership in RFI mitigation

Strong partners

We need:



Extremely sensitive telescope in a RFI free environment

→ remote and without infrastructure

Independant and affordable energy

→ EMC Components for power supply.


Thank you for your attention!