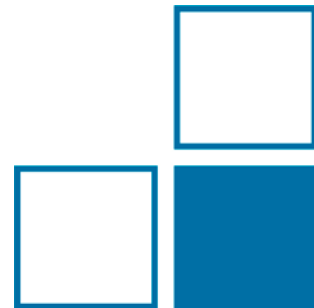


CCEM meeting GT-RF report

March 2025

Karsten Kuhlmann (GT-RF interim chair)



Outline

- Actions from 2023
- Meetings
- New chair
- Comparisons
- RF topics for CCEM webinar

Action items 2023

1. Draft A for the pilot study on EM properties of material will be provided in March 2023 by NMIJ. **OK**
2. The first draft of the technical protocol for the antenna gain comparison will be distributed by NIST in June 2023. **OK**
3. NPL will continue the technical discussion about most appropriate setup for the next field strength comparison. **OK**
4. INRIM will continue the technical discussion about frequency range and interface for a new comparison in attenuation. **OK**
5. CMI will report back to GT-RF chair after completion of questionnaire about the S-parameter comparison in waveguide. **OK**
6. Based on continued discussion by email or poll, the chairman will make a proposal to the CCEM president for an RF&MW webinar. **OK**
7. The chairman will probe interest in virtual/physical informal GT-RF meeting closer to CPEM and make a decision based on feedback. **OK**

GT-RF Meetings

- 27th meeting (7 March 2023)
 - Report approved and published
- No other (informal) meetings in between
- 28th meeting (6 March 2025)
- Probably online meeting in 2026
- 29th meeting (March 2027)

GT-RF chair

Former chair: Paul Hale (NIST)

Handover: At the 2025 GT-RF meeting

Formal approval: CCEM meeting (now)

One Candidate:

- Jae-Yong Kwon (KRISS)

Finished comparisons

Finished 1/3 CCEM.RF-K26

Attenuation measurements, 18 GHz, 26.5 GHz and 40 GHz,
step attenuator 2.4 mm, NMIJ, Anton Widarta

The results were approved for equivalence. The final report is
published as Metrologia 2024, 61, Tech.Supp. 01001

Finished 2/3 CCEM.RF-K5c.CL

S parameters in 3.5 mm, 50 MHz to 33 GHz

The final report has been submitted to KCDB.

Finished 3/3 CCEM.RF-P1

Pilot Study on EM properties of material

Traveling standard for 8-12 GHz

20-60 GHz

The final report has been submitted to CCEM and is available from the CCEM web pages in the section on “Final reports”. To distinguish from possible future pilot studies, it was assigned the identifier CCEM.RF-P1.

Ongoing comparisons

Ongoing 1/2 CCEM.RF-K28.W

RF Power in WR 42 (18-26.5 GHz)

Presentation from NIM, Xiaohai Cui

- Good progress, very little delay
- Only data from last participant (2024-12) missing
- preliminary measurement results and Draft A soon

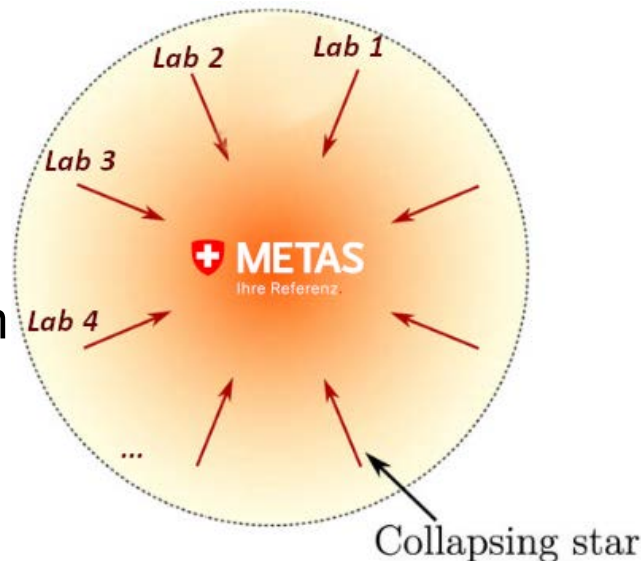
Ongoing 2/2 CCEM.RF-K5.d.CL

S-parameter in 2.4 mm

18 participants, 10 (12) traveling standards

Presentation by METAS, Marko Zeier

- Comments to the collapsing star-type comparison
 - Fast method for comparisons
 - But good planning is essential
- Participants must submit data before middle of March 2025



Planned comparisons

Planned 1/4 Noise in 3.5 mm (up to 26 or 33 GHz)

Participants

- Pilot: INTA
- with CMC: KRISS, METAS, INTA, NIST
- without CMC: UME

Questions:

- Can INTA (as a DI) act as pilot laboratory? **YES**
- Other participants? **Not at the moment**

Participants and pilot will continue the discussion

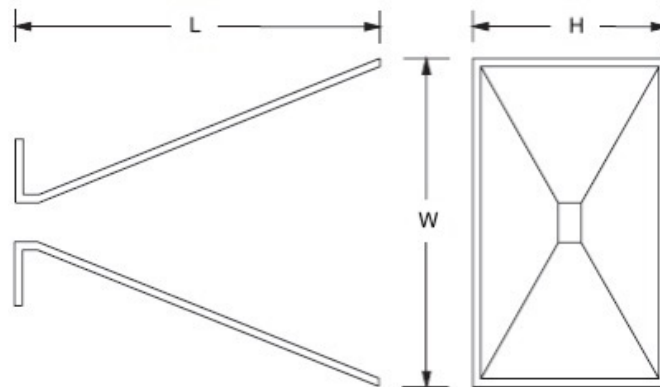
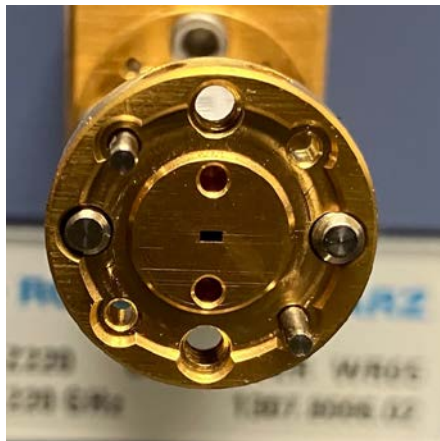
Planned 2/4 Antenna gain

Coordinator: NIST

- Distributed draft protocol

Participations: NPL, PTB

Frequency range: 140-220 GHz



Rectangular standard gain horn

Planned 3/4 Field strength

Pilot: NPL

1. High frequency E-field strength 18-60 GHz

- Pilot: ?
- Key parameter: E-field correction factor
- NIM have offered to potentially supply a comparison artifact

2. H-field 10 kHz to 120 MHz

- Pilot: NPL (possible)
- Key parameter: H-field antenna factor

3. Wire antenna (LPDA) 500 MHz to 6 GHz

- Pilot: NPL (possible)
- Key parameter: E-field correction factor

NMI	Comp. 1	Comp. 2	Comp. 3
NIST	X		
KRISS	X	X	X
METAS			
RISE	X	X	X
NPL	X	X	X
AIST			
CMI	X	X	
PTB	X		X
UME	X		
NIM	X	X	
NSC		X	X

Planned 4/4 RF power comparison

Presentation by Xiaohai Cui, NIM

Traditional comparison: thermistor mount traveling standards

- Preliminary comparison protocol for WR 10 (75-110 GHz)
- Participation: all with CMCs (NIM, NMIJ, LNE, NPL, PTB, ...)

Change traveling standards to thermal sensors (thermocouple)

- Commercially available by Keysight and Rohde & Schwarz
- Perhaps do a pilot study at a lower frequency

Potential future comparisons

Future 1/4 Attenuation

Presentation by Luca Oberto (INRIM)

- Statistics show much interest
- Probably both scalar set-ups and VNAs will be used
- Interface: 3,5 mm has never been used
- Pilot position still available

Discussion ongoing

Future 2/4 S-Parameter in rectangular WG

Presentation CMI, Martin Hudlicka

- Interest from many NMIs
- Overlapping frequency range at 50 GHz or below
- Pilot position still available
- Martin will repeat survey (some CMCs and NMI interest changed)

Future 3/4 S-Parameter in planar structures

PTB still only NMI with CMC entries

PTB and NIST thinking about doing comparisons experiment

Also interested:

KRISS, NIM and maybe NPL, LNE, and VSL

Discussion ongoing:

- Perhaps a pilot study before a Key comparison

Future 4/4 Voltage/Waveform

Electro optical Setup (EOS) required:

PTB, NIST, NIM, KRISS

Perhaps comparison with new interface for higher frequencies

Discussion ongoing

GT-RF webinars so far

2024-01 Introduction to RF and microwave metrology

- S-parameter Metrology, Markus Zeier (METAS)
- RF Power Measurements, Christian J. Long (NIST)

Open GT-RF webinar

6G presentation by Taro Eichler (Rohde & Schwarz)

- Contact initiated between Taro, Paul and Marko in June/July 2023
- Karsten contacted Taro last week, still open to the idea
- Hopefully webinar (one long talk) in 2025

GT-RF topics for webinars

- Metrology challenges for 6G development
- Traceability of RF on-wafer measurements (e.g. PTB/NMIJ)
+ Industry speaker
- RF measurements traceable to SI (via Rydberg constant)
 - NIST will discuss internally
- RF measurements at cryogenics
 - NPL will discuss internally

About



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[RF Base Quantities](#)



March 2025