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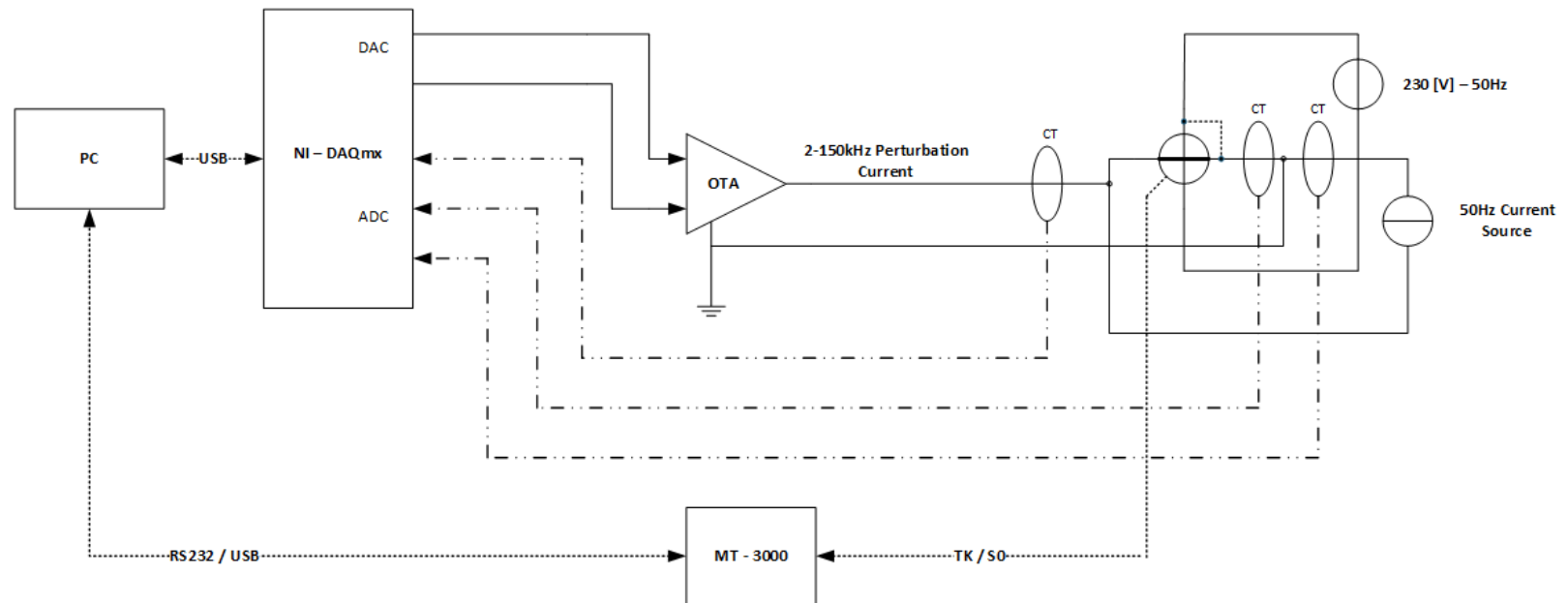


Meter EMI - A test bed based on the IEC61000-4-19 immunity apparatus

Jonathan Braun, Karel Pitaš

Split signal test bed principle

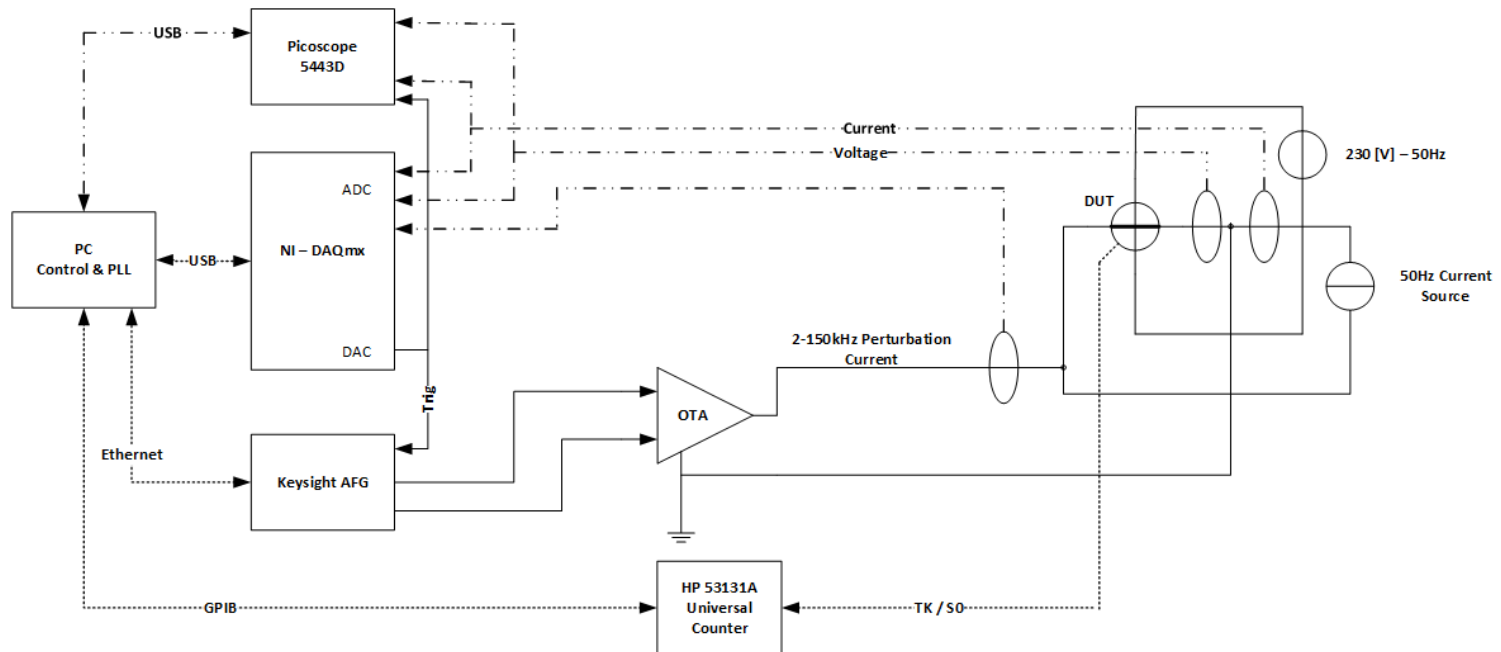
- Existing IEC 61000-4-19 setup at METAS



- 2 sinewave sources: 50 Hz and HF perturbations
- Up to 10 A perturbations
- Error measurement with MT3000 system
- Only sinewave, no synchronisation

Split signal test bed principle

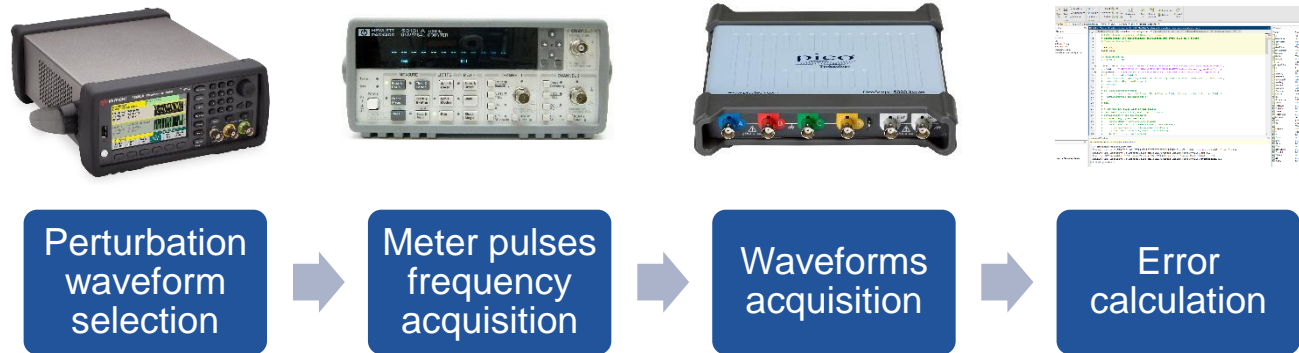
- Adapted arbitrary waveform setup



- 50Hz source + arbitrary source
- Up to 100 A perturbations
- Perturbation synchronized to the 50 Hz source
- Voltage and current reacquisition for error calculation

Split signal test bed principle

- Methodology



- Sources



METAS AGM 77 – 50 Hz
Voltage & Current Source



Clarke-Hess 8100
Transconductance amplifier
current perturbation source

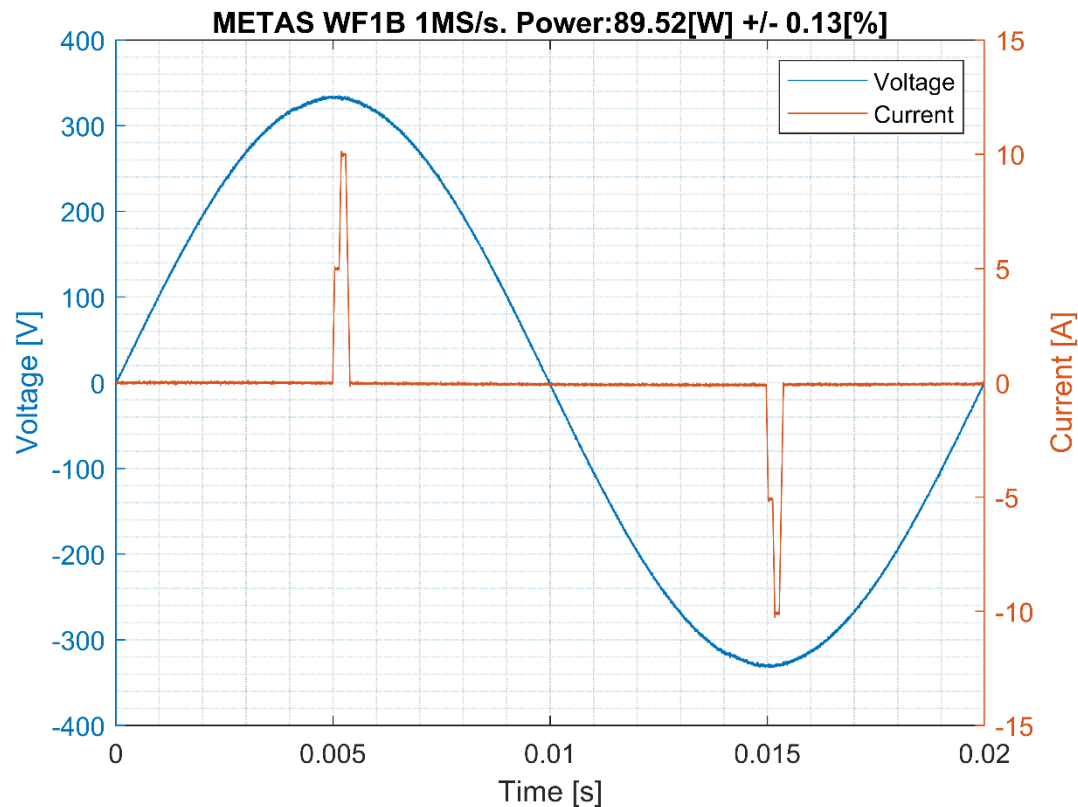
Split signal test bed principle

- Current system limitations
 - Limited to current perturbations
 - Precise reproducibility of arbitrary waveforms is limited by the trigger system

- Current system advantages:
 - Relatively easy to adapt from an IEC 61000-4-19 setup
 - Perturbation can be superposed to a sinewave if higher currents are needed

Split signal test bed results

- Typical recorded waveform (WF1B)
 - Current probe: Pearson 110A
 - Voltage probe: Pico TA043

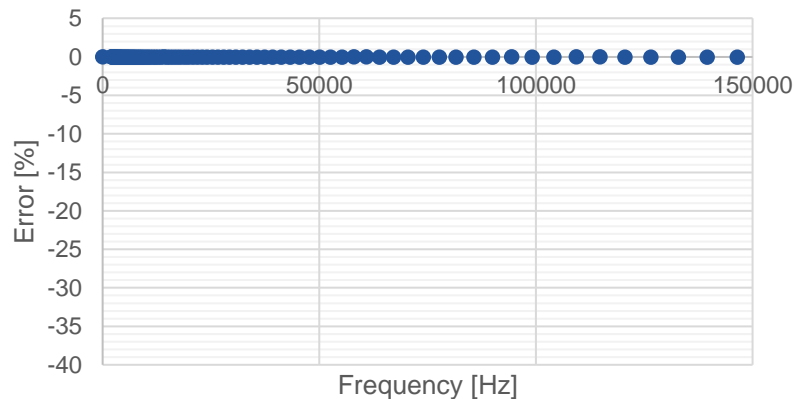


Split signal test bed results

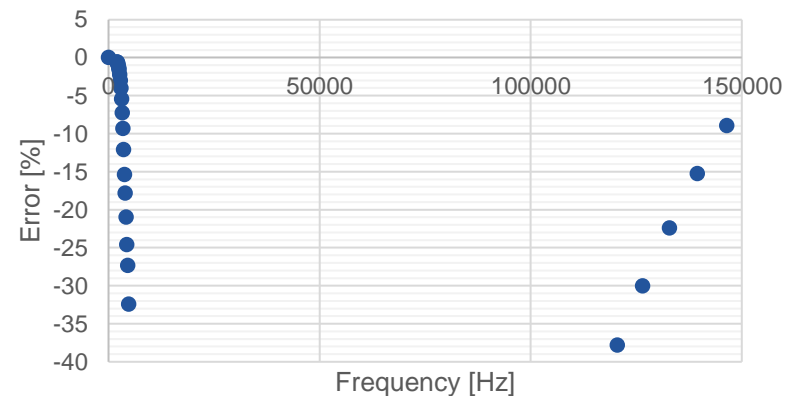
- Meter A and B were tested with the same methodology

	Signal																							
	CL50	CL75	R0	R50	R75	WF1A	WF1B	WF2A	WF2B	WF3A	WF3B	WF4A	WF4B	WF5A	WF5B	WF10B	WF11B	WF16A	WF17A	WF18A	WF19A	WP1	WP4	Sine
Measured power [W]	353	322	815	451	71	253	90	240	76	238	75	238	74	237	57	25	24	43	42	41	41	27	49	1175
Meter A error [%]	-65.8	37.1	0.2	-0.7	-2.1	0.1	0.3	-1.4	0.2	-1.5	0.2	-1.6	0.1	-1.5	5	-1.8	-1.3	-5.8	-6.7	-7.2	-7.4	1048.7	729.7	0.1
Meter B error [%]	-73.5	137.1	0.2	-6.9	199.5	0.7	-25.7	0.6	-15.1	0.4	-14.2	-0.2	-13	0.2	-70.1	-55.4	-54.1	-25.7	-25.3	-23.4	-23.3	2122.2	1094.7	0.2

Meter A 2-150 kHz results



Meter B 2-150 kHz results



Split signal test bed uncertainty

- Uncertainties sources in the METAS split signal test bed are the following:
 - Pearson 110A current probe
 - Relative uncertainty on amplitude: ± 1 [%]
 - Pico TA043 voltage probe
 - Relative uncertainty on amplitude: ± 2 [%]
 - HP 5131A frequency counter
 - Relative uncertainty on frequency: $\sim \pm 10^{-9}$ [%] → **Neglected**
 - Picoscope 5443
 - Relative uncertainty on amplitude: ± 0.5 [%]

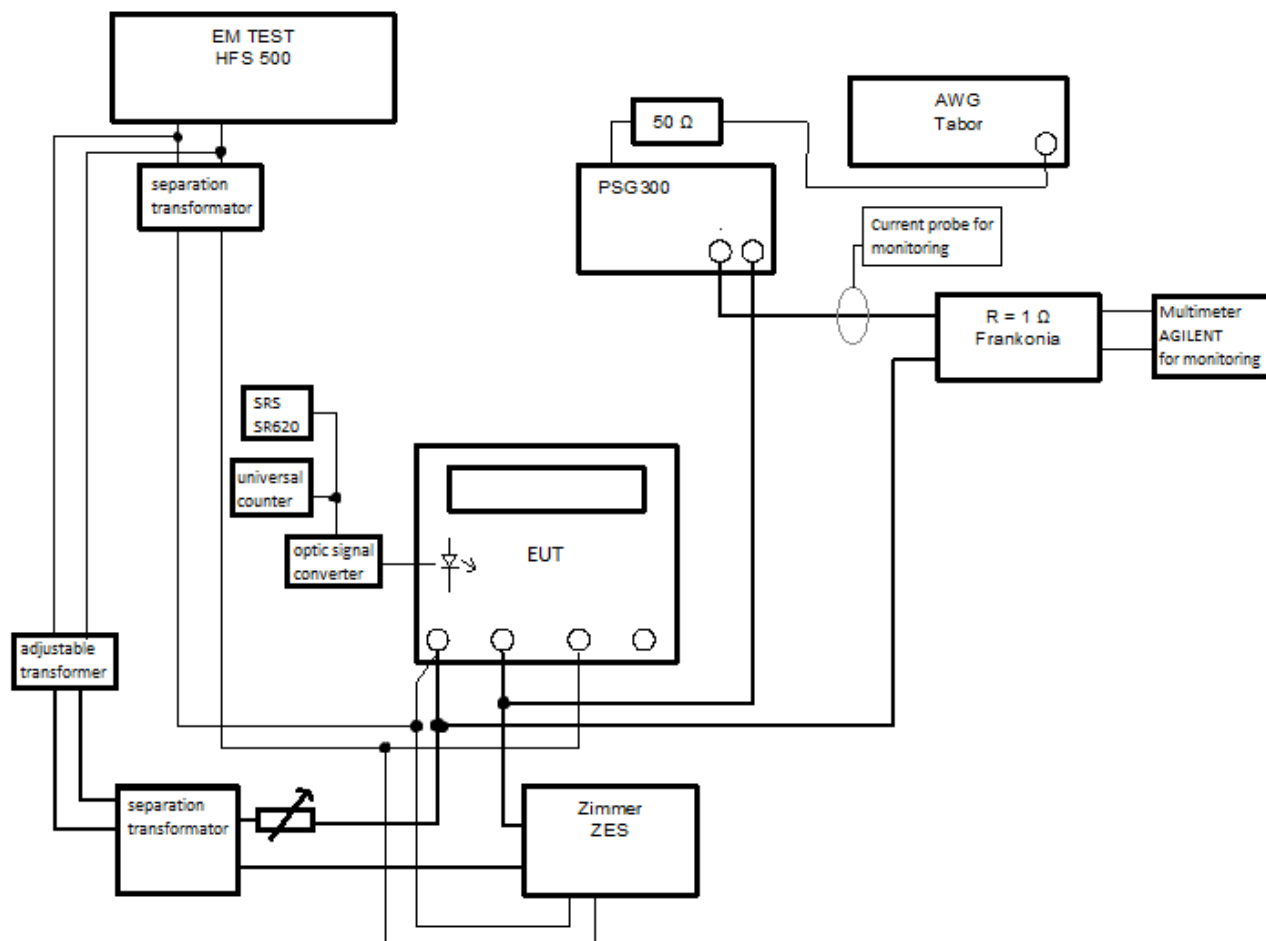
Calculated relative uncertainty on waveform power:

max ± 1 [%]

typ ± 0.2 [%]

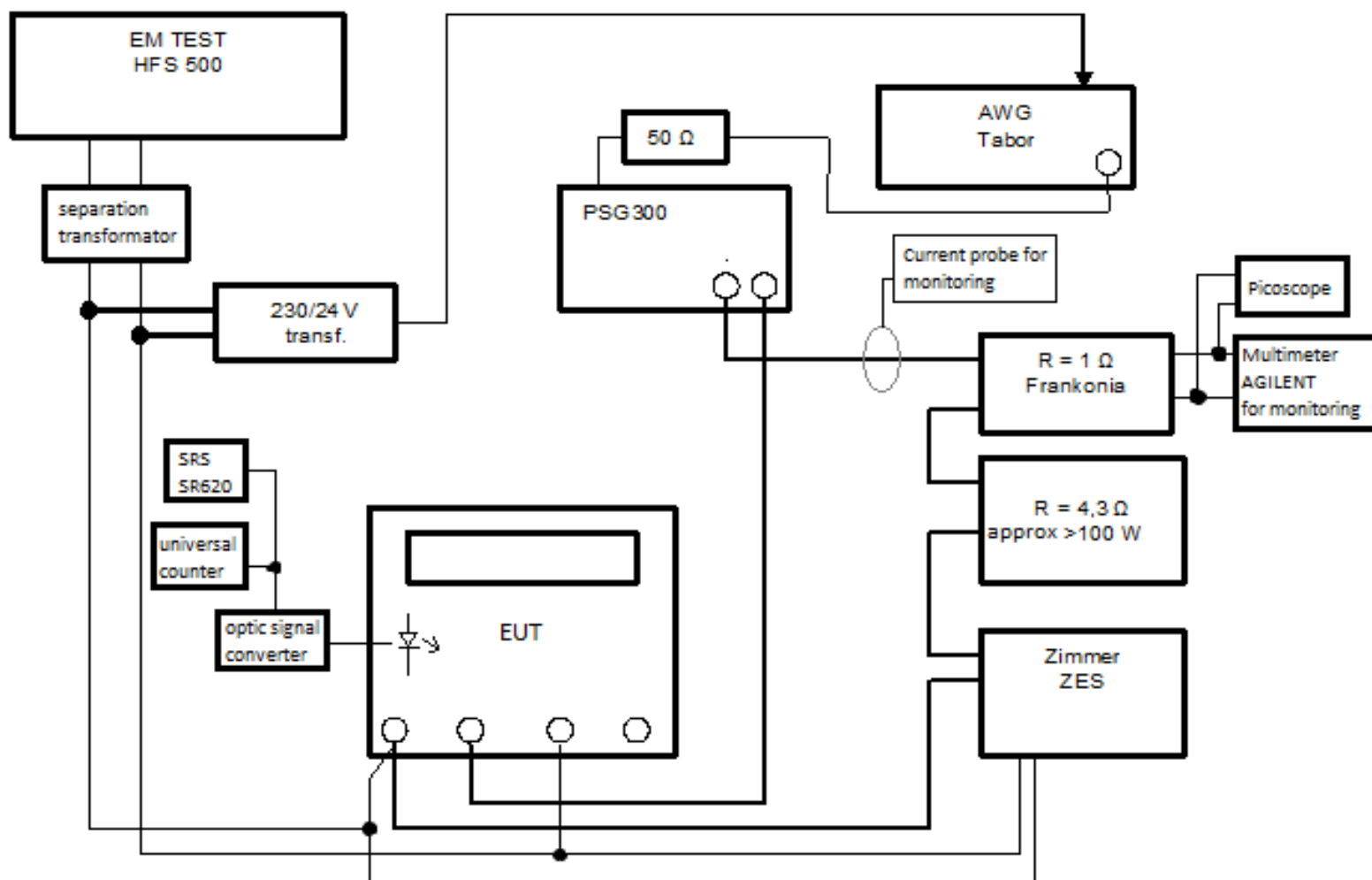
Split signal test bed principle

- Existing IEC 61000-4-19 setup at CMI



Split signal test bed principle

- Adapted arbitrary waveform setup



Split signal test bed principle

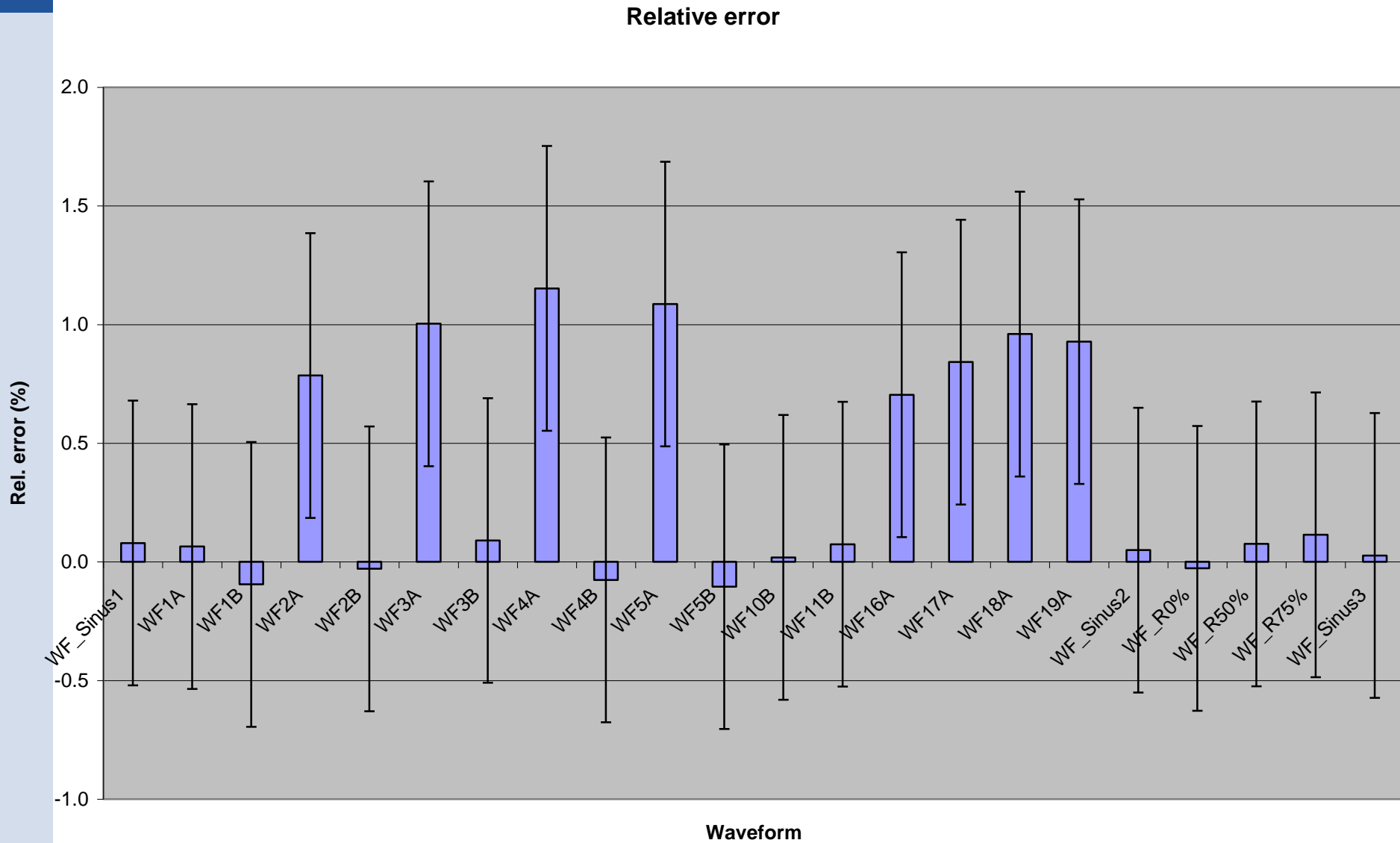
- Current system limitations
 - Current generator limitation
 - Precise reproducibility of arbitrary waveforms is limited by the AWG Tabor and by Picoscope

- Current system advantages:
 - Easy to adapt from an IEC 61000-4-19 setup

Split signal test bed results

Waveform	Average relative power error (%)			Mean value
	Meas. 1	Meas. 2	Meas. 3	(%)
WF_Sinus1	-0.17	0.29	0.12	0.08
WF1A	0.17	0.20	-0.18	0.06
WF1B	-0.03	-0.21	-0.04	-0.10
WF2A	0.81	0.72	0.83	0.79
WF2B	0.05	-0.06	-0.09	-0.03
WF3A	0.96	1.09	0.96	1.00
WF3B	0.13	-0.04	0.18	0.09
WF4A	1.15	1.16	1.15	1.15
WF4B	0.01	-0.07	-0.17	-0.08
WF5A	1.11	1.06	1.09	1.09
WF5B	-0.13	-0.02	-0.16	-0.10
WF10B	-0.04	0.01	0.09	0.02
WF11B	0.08	0.02	0.12	0.07
WF16A	0.57	0.84	0.71	0.70
WF17A	0.84	0.85	0.84	0.84
WF18A	0.92	0.90	1.05	0.96
WF19A	1.06	0.91	0.81	0.93
WF_Sinus2	0.10	0.08	-0.03	0.05
WF_R0%	-0.11	-0.06	0.09	-0.03
WF_R50%	-0.05	0.25	0.03	0.08
WF_R75%	-0.08	0.18	0.24	0.11
WF_Sinus3	0.06	0.00	0.02	0.03

Split signal test bed results



Split signal test bed uncertainty

Uncertainties sources in the CMI split signal test beds are the following.

- Setting interference:
 - Triggering of AWG Tabor
 - Frankonia 1ohm shunt
 - Picoscope
- Measuring:
 - ZES Zimmer LMG450 (best accuracy 0,11%)
 - Optic converter
 - SRS SR620 (best accuracy 0.3 %)



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Thank you very much for your attention