NAME : Gockenbach	GROUP REF. :	D1
COUNTRY : Germany	PREF. SUBJECT :	PS 1
REGISTRATION NUMBER : 7161	QUESTION N° :	2

There are two questions and I like to give some information concerning the first question. The EMPIR project 19NRM07 HV-com² supports the standardisation of high voltage testing with composite and combined wave shapes. There are many activities within the participation organisation like metrological institutes, universities and industrial laboratories.

They can be roughly divided in two parts: One part is the development of a suitable modular voltage dividers for composite voltage tests and the check of the reachable uncertainties in different laboratories under different voltage combinations. This part is undergoing and test results and reports are expected end of the year.

The other part is the generation of reference composite and combined waveshapes in the low voltage range in order to check the output of the voltage dividers and the uncertainty of the evaluation of the digital recorded voltages by using suitable software based on the IEC standard series 61083 where the requirements on hardware as well as software are defined, divided in hardware and software for impulse measurements and hardware and software for AC and DC measurements. But here exists a lack in the standardisation regarding combined and composite voltage measurement. Several examples of composite test voltages were distributed within the participating organisation to check the used evaluation software. At the same time a calibrator was developed for composite test voltages using calibrators for DC voltage and impulse voltage. Slide 2 shows a schematic circuit of a combination of DC calibrator and impulse calibrator in series (J. Havunen, J. Hällström, J. Meisner, F. Gerdinand, A.-P. Elg: Design and Verification of a Calculable Composite Voltage Calibrator, Nordis 22, Trondheim) and on the righthand side an example of a composite test voltage with DC and impulse. The same combination can be used for the composite voltage of AC and impulse, but then the trigger point of the impulse is important and should be controlled by the calibration devices.

Slide 3 shows the steps of the evaluation of the two voltage components of a composite test voltage. On the left-hand side the recorded signal is shown as an example for the composition of AV voltage and switching impulse. On the righthand side in the upper part the Levenberg-Marquardt-Algorithm is used for the reconstruction of the sinusoidal AC voltage. This algorithm is also proposed in the revision of IEC 60060-1 for the evaluation of the parameter of lightning impulses. If the AC voltage component is known, then the impulse voltage component can be calculated, which is shown in the lower part of the righthand side. The oscillation at the end of the switching impulse indicates that the AC voltage component contains some harmonics.

The exemplarily shown evaluation procedure can be used for combined and composite test voltage to evaluate the two voltage components. A so-called Transient Data Generator (TDG) is then required to check the automated evaluation procedure regarding the uncertainty and the contribution to the uncertainty budget.

Slide 4 shows a summary regarding voltage divider for combined and composite test voltages and test data generator for checking the software used in the above-mentioned tests.