18 CHANGES OF THE CONSUMER PROTECTION IN LEGAL METROLOGY AS A RESULT OF NEW TECHNOLOGIES

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My presentation describes the technical development of measuring instruments as far as they have an influence on consumer protection. In this connection also the maximum permissible errors for verification and in service will be discussed. New technologies require new conformity assessment procedures. Here the limits of existing verification procedures and future modifications are pointed out. With the initial verification carried out in many countries by the manufacturers, market surveillance becomes more and more important, which is however only part of the metrological surveillance. Finally my proposals will be summarized with an outlook in the future.

In legal metrology it is assumed that the measuring instrument is a complete unit from the sensor up to the display of the measuring result. There is a tendency, for example in utility companies, that peripheral equipment is integrated which is not verified. Therefore the consumer obtains measurement results relevant for the price to pay from devices not subject to mandatory control. In the future, the internet will be used for the transmission of measurement results from the measuring instrument to the remote display.

The function of measuring instruments will increasingly be influenced by software. Often this software is not testable because there is no clear separation of the software which is subject to legal control and the other part of the software which is modifiable and changeable by the user. Furthermore there is a trend that the users would like to modify the software by download so it has to be granted that the modification concerns only the permitted part of the software. Only restricted tests with classic instruments such as type approval, initial verification, re-verification and inspection can be carried out with these electronic modern instruments. Furthermore, in utility companies, the measurement results are connected with prices or tariffs so that the customer is not always in the position to check whether the measurement result, which forms the basis for the price to pay, arises *de facto* from a verified instrument.

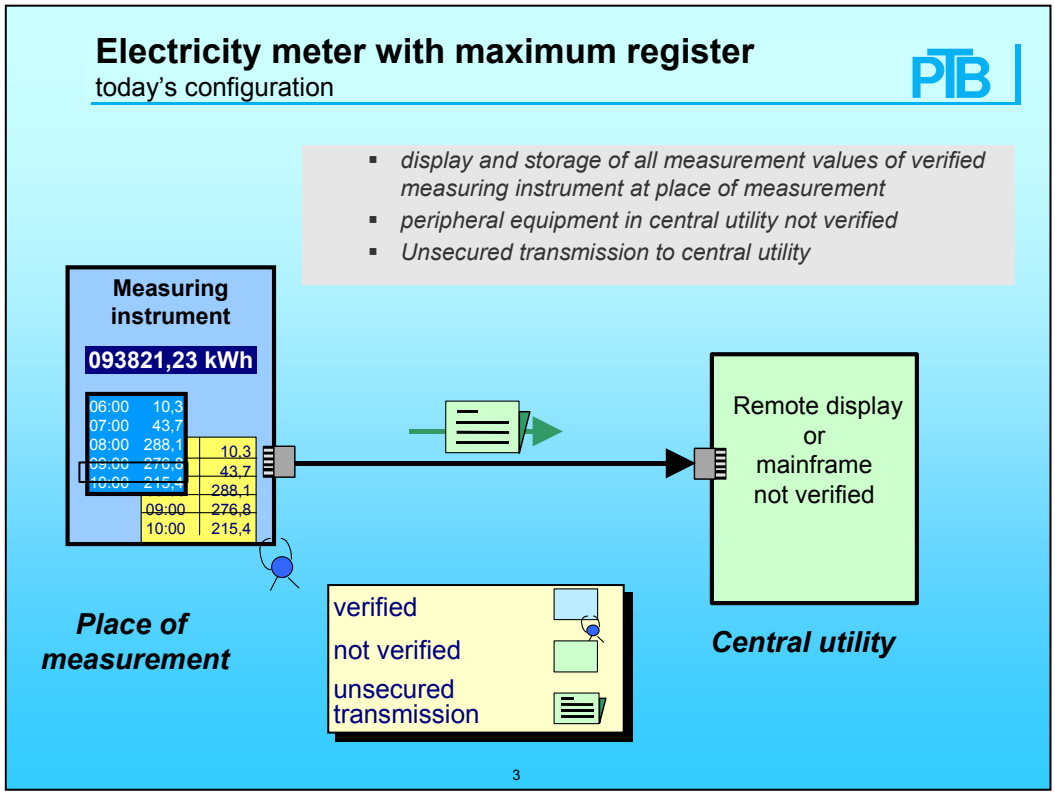

Figure 1

Figure 1 shows a today's configuration of an electricity meter with additional measurement of the load (maximum register). All measurement values are saved and displayed in the measuring instrument at the place of measurement. The transmission to peripheral equipment or central mainframes is carried out unsecured. In case of doubt the customer can check the results at the measuring instrument and this is our understanding of legal metrology today.

However, it is in the interest of industry to simplify the measuring instruments and not to store all the measurement results in the register for a long time. In the future this can lead to a configuration demonstrated in the next figure.

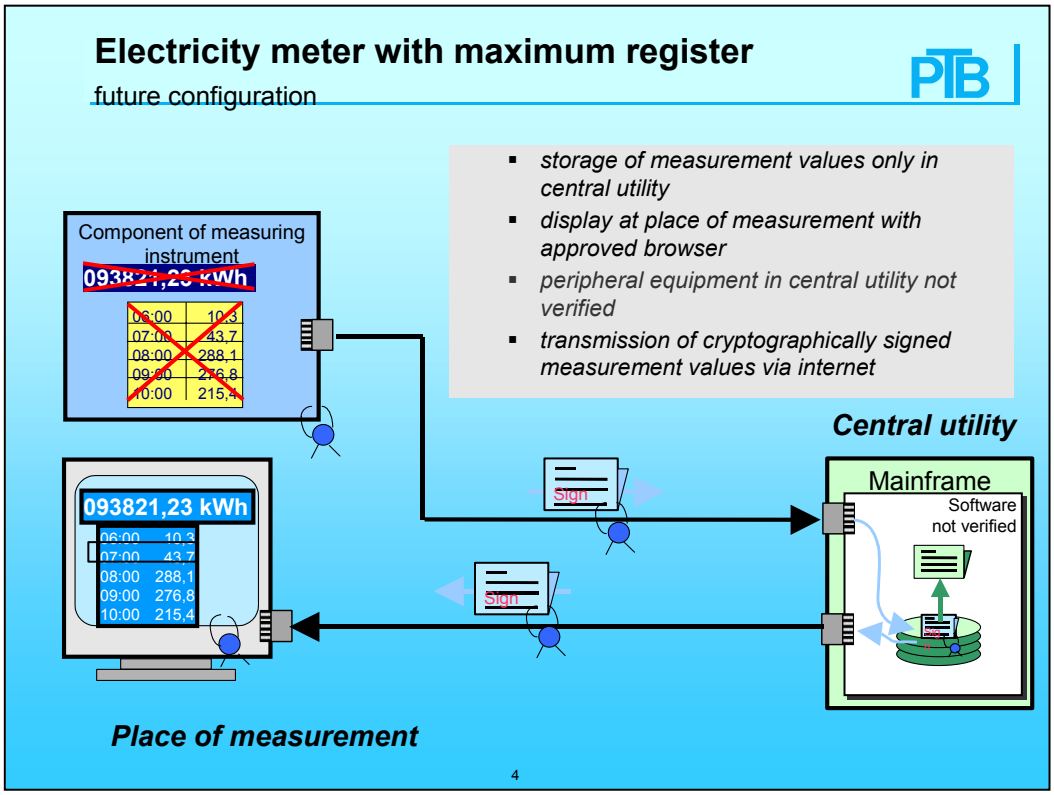

Figure 2

Figure 2 shows that at the place of the measurement, the customer has not a complete electricity meter but just a component without storage and display. The measurement results are signed cryptographically via opened networks, for example internet, and transmitted to the central utility company. The mainframe and all the software are not subject to legal control.

At the place of the measurement, the customer may use a computer and an approved software and has the possibility in this way to access all signed measurement results via internet at the place of measurement or even at other places. In this way he can check the invoice of the utility company.

The development of cryptographic codification technologies will lead to the fact that, in the future, distributed measuring systems will be developed with parts which are not subject to legal control but nevertheless with a safe data transfer for the purpose of consumer protection.

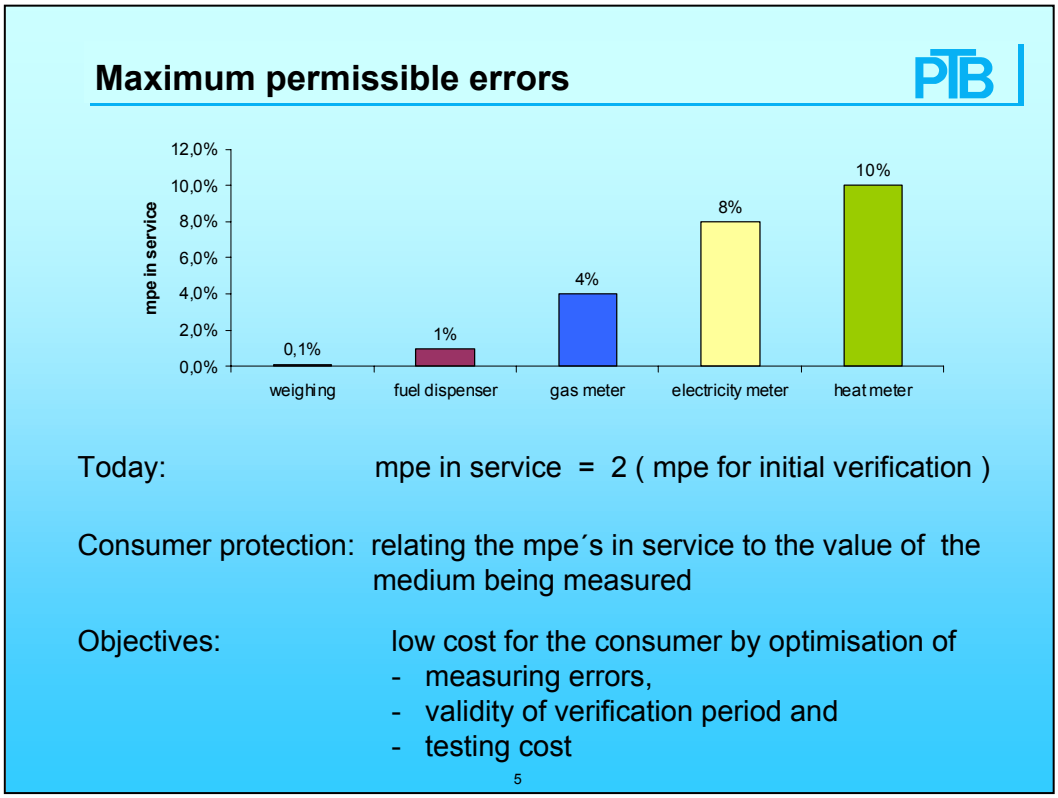

Figure 3

To a great extend the maximum permissible errors of measuring instruments depend on the measurand but also on the used technology. As Figure 3 above shows, the mpes in service may varies from 0.1 % for weighing instruments to 10 % for heat meters but in all cases we speak of consumer protection at the same level. Today we differentiate between mpe for initial verification and mpe in service, which as a rule is twice the mpe for initial verification, so that measuring instruments can be used for a longer period without exceeding the tolerance limited by the mpes in service.

With the introduction of new technologies, the mpes decrease for some kinds of measuring instruments. But better accuracy does not always mean better consumer protection. We must realize that the price to be paid by the consumer also depends on the cost of the measurement. These costs can be very high for instruments of the utility companies because these instruments have to be re-assembled for re-verification. Since today electronic devices very often have a shorter lifetime with shorter validity of verification, it may be reasonable to define higher mpes in service for such devices which are very accurate when they are new. An optimization of the cost for the consumer might make it more reasonable to apply a factor higher than 2 between mpes for initial verification and mpes in service. In particular this applies to measuring instruments with a small economic impact to the consumer.

In the future the assessment procedure will change.

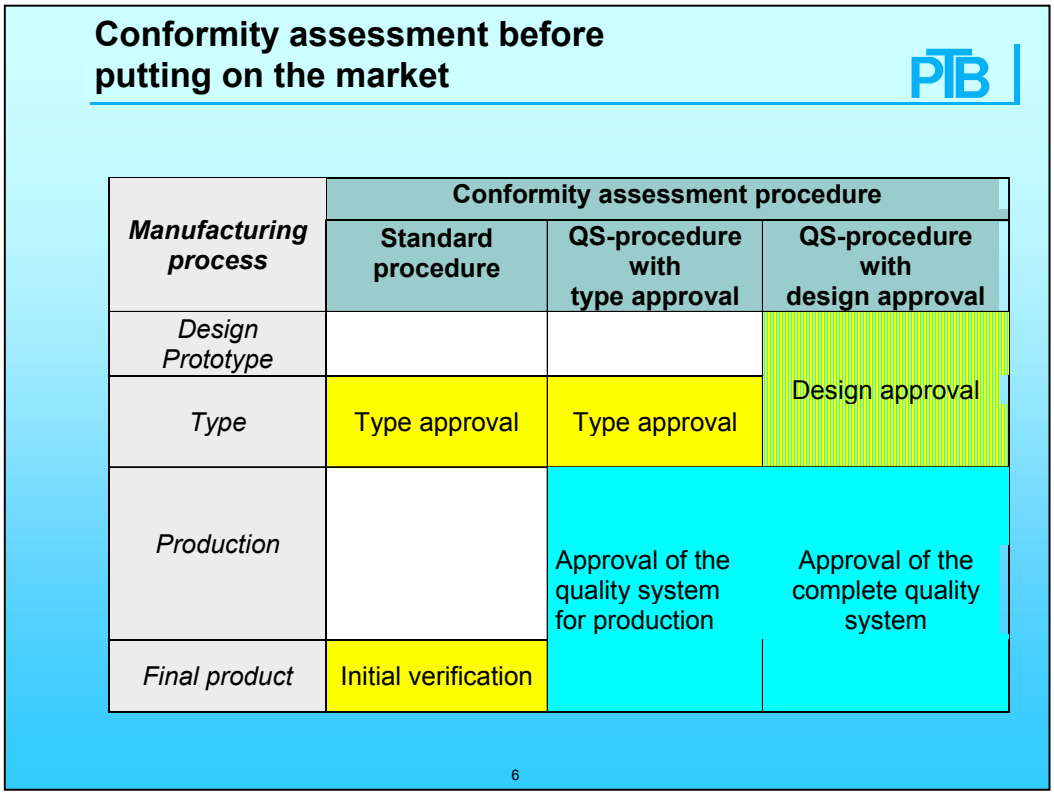

Figure 4

With series-produced instruments, it is reasonable to carry out a type examination and a simplified examination of the final products, called initial verification. However, the type approval procedure does not look at design, prototype and production stages and, in addition, only a limited number of produced instruments may be checked through initial verification. Therefore it may be reasonable to put the responsibility for this examination on the manufacturer on the basis of his quality system. This means that we do not apply the standard procedure but a quality system procedure with type approval. This quality system should be approved and under surveillance by an independent body. Sometimes this kind of examination is called manufacturer-verification or self-verification. However there is still a limitation concerning design and prototype stages.

It is advisable that software-controlled instruments are not only tested when they have become a complete type or black box, but already at the design stage so that it is easier for the manufacturer to carry out modifications in time so that the instrument meets legal requirements. The quality system of the manufacturer should not cover only the manufacturing and the final product testing, but also the design stage. So you can see that QS-procedure with design approval covers all relevant stages. Due to the experience with type examination, the same bodies should carry out the design examination. The same bodies should also be in charge with the approval and surveillance of the complete quality system of the manufacturer, because there is a very close interchange of this kind of quality system and the design requirements. In the

future in Europe, the manufacturers will have the possibility to choose between these three different conformity assessment procedures.

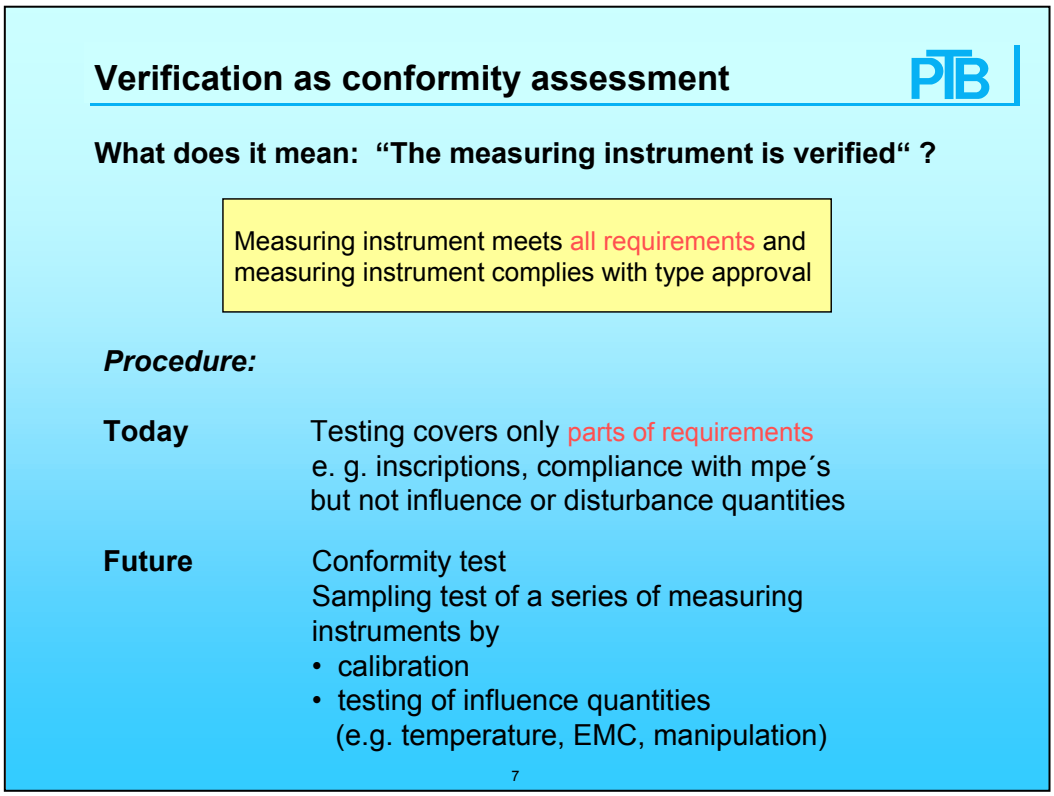

Figure 5

The verification should grant that that the measuring instrument meets all legal requirements but, in practice, the verification on site covers only parts of the instrument, for example inscriptions, installation and the compliance with maximum permissible errors, but not the influence of disturbances such as EMCs. Verification means testing of each measuring instrument so there is an economic limitation for an extension of the verification procedure with the aim of a conformity test.

In order to achieve a testing and certification procedure with measuring instruments meeting all requirements for type approval, series-produced measuring instruments should be tested only by sampling. With a limited number of specimen it is possible to extend the procedure of verification to the significant influence quantities. It would even be possible to apply a simplified EMC-test by using a mobile telephone near the measuring instrument under defined conditions written down in the type examination documents. The result of such simplified examinations at the level of verification cannot be compared with a pattern approval but provides more information than no examination at all, as it is the case today.

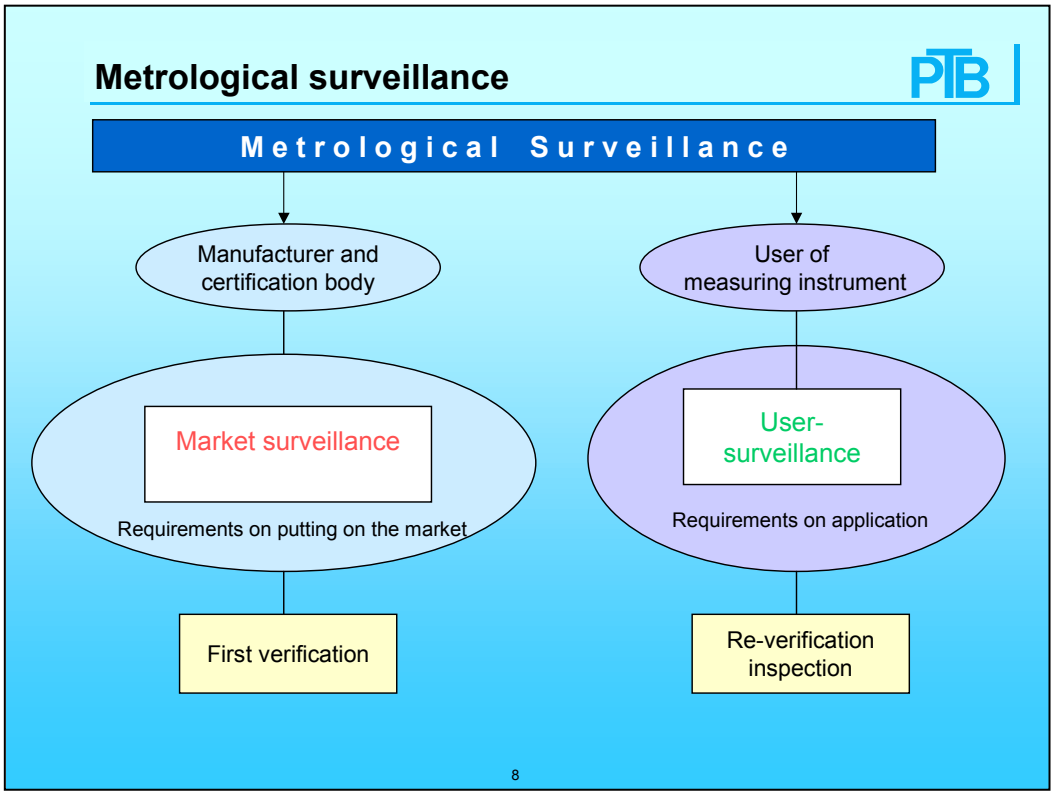

Figure 6

By introducing 'self-verification' performed by the manufacturer or verification by another private certification body, there is the necessity of metrological surveillance by the government. We should distinguish between the surveillance of the manufacturer and the surveillance of the user of the measuring instrument.

The ability of the manufacturer to put approved measuring instruments on the market has to be checked by market surveillance. The problem is that the market surveillance can only apply when the instruments are already on the market. A modified verification is a possible tool for this task. With this 'first verification', the instruments can be checked on the basis of requirements which are valid at the time of the putting on the market. This procedure should guarantee that the manufacturer has met the requirements for all of his instruments.

The surveillance of the user concerns the correct use of the measuring instrument and can be carried out by 're-verification' or 'inspection'. The requirements referring to this aim are not the same as at the time of putting on the market but on using the instrument. This procedure should mainly aim at the responsibility of the user.

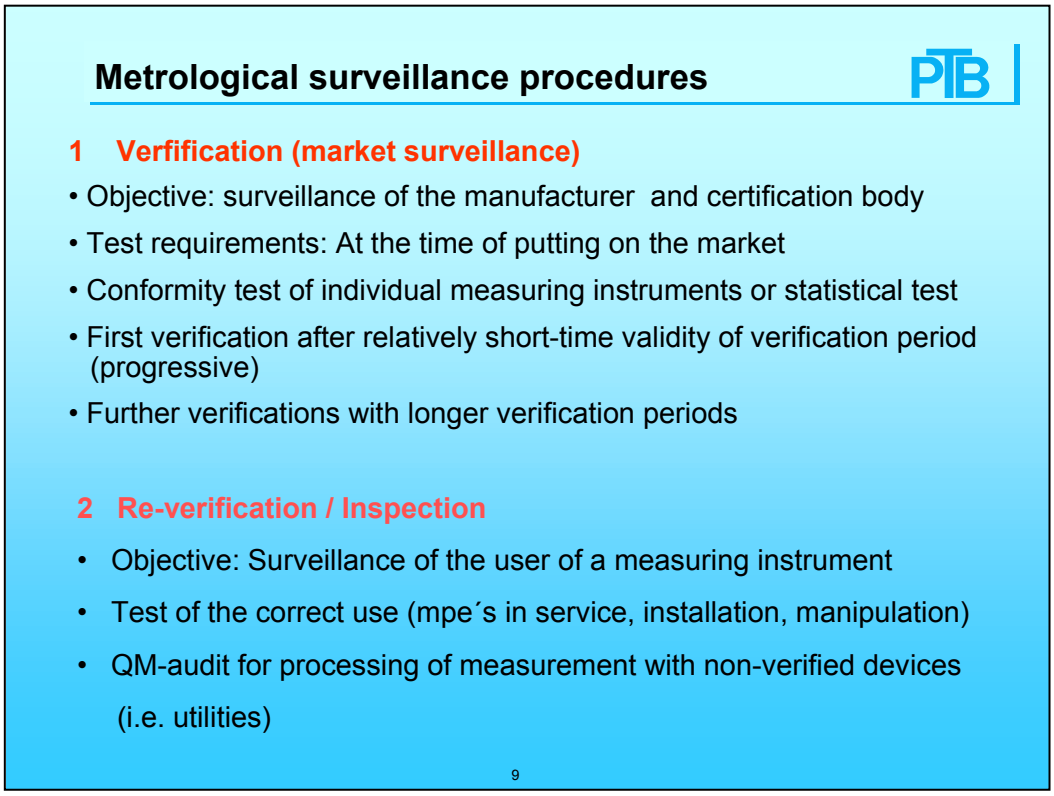

Figure 7

The figure above shows two surveillance methods.

The verification suitable for market surveillance concerns the surveillance of the manufacturer or that of the certification body. The requirements for this verification are those valid at the time of putting on the market. Should this verification be a conformity assessment of the measuring instrument, a modification must be made compared with the today's initial verification which has been already explained. Of particular significance is the statistical test for a series of measuring instruments. This verification could be carried out after a relatively short-time validity of verification period, for instance one year after putting into use. Later re-verifications would be possible after longer time intervals so that the cost for the first short-time validity of verification period would be compensated.

The re-verification or inspection serves the user-surveillance. Therefore the requirements have to be met on using. This concerns the maximum permissible errors in service, the installation and the possibilities of misuse. Furthermore it is reasonable to test the processing of the measurement results relevant to the charging of the customer.

This is important when the measurement results might be influenced by peripheral equipment which is not subject to legal control. Concerning utility companies or petrol stations, this test could be realized if a convenient quality system for this data procession would be required and if checks would be carried out in form of an audit of the relevant part of the quality systems.

Conclusion

In summary, it may be noted that a preferably quantitative definition of consumer protection is necessary and that the maximum permissible errors in service should be reconsidered in this connection. Furthermore the definition of a measuring result relevant to the price to pay is necessary so that the customer can check his bill on the basis of correct measurement result. Legal metrology not only means trade with instruments; it also means trade with measuring results.

The manufacturer has to develop the software in such a way that it may be tested. In addition, concerning modern measuring instruments, new conformity assessment procedures are required which make use of the manufacturer's quality system.

The introduction of progressive intervals of validity of verification period, starting with a short interval which is later extended, might contribute to an improved market surveillance of the manufacturer.

Concerning the surveillance of networked measuring systems, the internet should be used by the verification authorities in order to check these measuring systems e.g. for download activities.

As the quality of the measuring instruments is assessed by the manufacturer and/or by the certification body, also these bodies have to be monitored. In the future, the increasing privatization of the testing and certification bodies will become more and more a challenge for the legal metrology authorities.

Discussion

Comment: The figure on mpes shows a large difference between the values, this difference being even worse when considering that these mpes are in plus or minus. This may have no real consequence for e.g. petrol pumps since the mpe is rather small and that, when going to different petrol stations, you may hope to have plus and minus errors. The situation is critical for e.g. electricity meters where the mpe is not small, and when you have at home a meter which is 8 % wrong to you disadvantage, it will be for many years. On the other hand, which are the 'simple verification tests' you have mentioned? Do they alleviate the manufacturer's responsibilities?

Reaction: Simple tests are statistical test based on ISO standards which may give a good probability concerning the quality of a batch.

Comment: You spoke of 'trust in measurements', and it has been pointed out that measurements are more and more sophisticated. Don't you think that there is or will be a big gap between the knowledge of people carrying out market surveillance and new technologies? What about the possibility for local authorities to work in close cooperation with

specialized people who take care of the maintenance of measuring systems, of software, etc.?

Reaction: This gap already exists and people are aware of the technology, i.e. type approval people, must work in close cooperation with verification officers and develop training facilities especially on software.

Comment: The figure showing an electricity meter without any display directly accessible for the consumer is symptomatic of the current trends. Such a problem should not be discussed only between legal metrology authorities and manufacturers, but consumer associations and other bodies responsible for consumer protection should be involved. In the case of these electricity meters without display, provisions should exist so that the consumer may have access to the measurement results used for the transaction.

Reaction: This question is currently being discussed in Germany with manufacturers, so that the consumer may have access to this information through the internet. Of course, matters such as securing the information, or facilitating the use of internet by consumers, have to be solved. During discussions with manufacturers, PTB represents consumers' interests.

Comments from Mrs. Gaucher and Mr. Kildal, and the replies from Mr. Schulz, were unfortunately not recorded.