The measuring device for the interference capability in the metric wave-band (30 ... 300, 1000 MC respectively) of mainsoperated electrical appliances

In connection with a measuring receiver according to CISPR, Publ.16, the absorbing clamp MDS enables to measure the interference capability of radio interferers, such as domestic appliances, electric tools etc. directly; viz. by measuring the power generated by the interferer and fed to its supply cable.

At the plenary meeting in Stresa in 1967, the International Special Committee on Radio Interference (CISPR) adopted the measuring method developed by Mr. Meyer de Stadelhofen and his staff in the department for research and development of the Swiss PTT (1) as a standard method for the metric wave-band. It has decided to insert same as paragraph 4.1.3 in its Publ. 2. The relevant text makes part of Doc. CISPR (Bureau Central) 338 published in January 1968, describing the new measuring device as well as the method of calibrating it. Exact instructions for procedure are given as well. In addition to that, Doc. CISPR (Secretariat) 727 states the history of the development of this new device and also mentions the investigations made in various countries.

The measurement of the interference power is substituted for the measurement of the interference voltage at the terminals of the interferer connected to an artificial mains network, and for the field-strength measurement respectively.

Measuring with the absorbing clamp MDS is simple, reliable and, if the interference source is constant, well reproducible. It is easier to measure the power generated by the interferer than the field-strength. As the absorbing clamp MDS is not influenced by the presence of stray interference from other sources, no screening cabin is necessary. It is especially noteworthy that a changement of the surroundings of the appliance to be measured, which was essential for the previous procedures, is no longer influencing the test results.
Principle

The interference energy is mainly radiated from that part of the mains cable which is next to the interferer. By convention, the interference capability is defined in terms of the power which would be radiated by a tuned aerial located in the same place as the mains cable.

This power is almost equal to that fed to an absorbing device joined to the mains cable and distanced from the interference source so that it absorbs the maximum power at the specific frequency the receiver is set at.

When a generator with a source impedance of 50 ohms supplies a suitable load, its terminal voltage expressed in dB (µV) has the same numerical value as the power input in dB (pW) increased by the constant 17. If the measuring device between interference source and receiver effects a damping of 17 dB over the whole measuring range the power generated by the interferer can be read in dB (pW) directly an the measuring receiver calibrated in dB (µV).

The absorbing clamp MDS is based on these considerations and enables to measure the interference power in the frequency range from 30 to 300 (1000 respectively) MC directly. The exactitude is within ± 3 dB, which ± 5 sufficient in most cases. Whenever an especially exact measuring is necessary, a correction can be taken out of the calibration curve supplied together with the device.

The absorbing clamp is calibrated in accordance with the substitution method.

Construction

The device consists of a great number of ferrite rings surrounding the interferer’s mains cable. These rings are arranged in a straight row, and some of them are components of the coupling transformer. The output voltage is proportional to the high-frequent current in the cable. The voltage is measured by an interference measuring receiver. The result is uninfluenced by the operating current in the mains cable as the currents, being in opposite directions, compensate. A coaxial filter stops the high-frequent interference currents which could circulate via the screen of the cable between the absorbing clamp and the receiver.

The ferrite rings are split into half-rings, one half being fitted into the lower part of the body of the device and thus forming a channel in which the mains cable of the appliance can be laid. The other half of the rings are arranged in the hinged top part of the clamp. Each half-ring is set in a resilient plastic-holder moving in guide slots. As soon as the clamp is locked with the handy eccentric closures providing the necessary pressure, the magnetic circuits around the cable are closed. The clamp is equipped with four rollers which guarantee a slight shifting for regulating to the maximum.
Other possibilities of application

The absorbing clamp MDS can also be used for investigating the effectiveness of the screening on coaxial cables (2)

Moreover, it can be used in the reverse direction to inject a jamming signal into the screening of a receiving aerial cable in order to measure its immunity to external fields.

1. Technical Information PTT 3-1969

J. Meyer de Stadelhofen / Bersier: The absorbing clamp - a new method of measurement for the interference in the metric wave-band. (Original in French)

2. Technical Information PTT 5-1971

R. Bersier: Measurement of the electrical immunity of coaxial cables in the metric wave-band by means of the absorbing clamp MDS. (Original in French)

Type MDS 21

Device in the form of a clamp. It is suitable for interference measuring services and laboratories which have to measure the interference capability of numerous various appliances. The hinged top part of the clamp can be opened and the mains cable of the interferer be laid in the channel formed by the split half-rings. After locking the device the magnetic circuits are closed, and the arrangement is ready for measuring. For regulating to the maximum the clamp is equipped with four rollers for a slight shifting.
Instruction for use

1. The bipartite guide for centering fastened to the absorbing clamp has to be removed for measuring interferers with a mains cable whose diameter exceeds 10 mm. This guide for centering increases the exactitude when measuring interferers with thin cables.

2. The interferer 1 is placed on an insulating base (measuring bench). The mains cable 2 has to be extended to the length of at least \( L_1 \) according to the lowest interference frequency to be measured and most be laid in a straight line. It must be located at a distance of at least 0.7 m from any conducting wall or above conducting floors. After having laid the cable into the channel of the absorbing clamp 3, the latter is locked with the two eccentric closures. Turn the transformer side (green mark, red mark, guide for centering, CRP) towards the interferer.

3. Set the measuring receiver 4 at the relevant frequency (for example the lowest) and set the interferer in operation.

4. Move the absorbing clamp away from the interferer until the greatest deflection is obtained on the indicator of the receiver.

The person who is moving the clamp will grip same at the side turned away from the interferer. In case of a permanent installation it is recommendable to move the clamp in wooden guide rails by the help of a string.
5. On principle, the first maximum observed on the way from the interferer ought to be measured. At frequencies exceeding about 150 MC, however, the maximum often occurs in the handle of the interferer. In this case the distance $L_2$ is adjusted to the second maximum, provided that this results in a higher value than the measurement with the absorbing clamp pushed close to the interferer.

6. Read the interference capability on the instrument at the receiver.

6.1 If the receiver is calibrated in dB ($\mu$V):

\[
\text{Interference capability} = \text{reading} + \text{correction according to calibration curve}
\]
\[
\begin{array}{ccc}
\text{dB (pW)} & \text{dB ($\mu$V)} & \text{dB} \\
\end{array}
\]

6.2 If it is calibrated in $\mu$V:

\[
\text{Interference capability} = 20 \log_{10} \cdot U + \text{correction according to calibration curve}
\]
\[
\begin{array}{ccc}
\text{dB (pW)} & \text{$\mu$V} & \text{dB} \\
\end{array}
\]

**Kindly note:** When not in use the eccentric closures should not be locked.

7. **Practical directions**

7.1 Measurement of an interferer whose interference voltage is unstable or discontinuous.

In this case the mains cable of the interferer must be inductively coupled with an auxiliary interference source of a continuous and constant interference voltage. A battery-operated shaver 5, for example, is suitable for this purpose.

The auxiliary source of interference is installed at a distance of about 15 cm from the mains cable and about 10 cm from the interferer.

After having adjusted the receiver to the frequency to be measured, the distance $L_2$ of the absorbing clamp is set for the maximum interference. For this purpose the mains plug of the interferer has to be removed from the mains socket.

Switch off the auxiliary source and set the interferer in operation. Carry out the measurement of interference in accordance with Point 6.
7.2 For measurements to serve as a general guide where space is limited the interferer's mains cable is pulled through the stationary clamp, and the lengths of the cable an both sides which cannot be straightened are put together to form tangled heaps (this means to say that no coil must be formed). Using this method the measuring result is between 0 and 3 dB too high depending on the frequency.

If a mains plug connection or a coupling prevents the determination of the maximum two measurements are carried out: once with the plug close to the right, then to the left side of the clamp. The interference capability corresponds to the higher reading increased by 2 dB.