

On the “Simple Toasters” Discontinuous Disturbance Narda Click

Per definition, the measurement of “Discontinuous Disturbances” is a rather complex procedure. Apart from the method itself, more complexity is added according to the specific apparatus under test. We describe here a specific one.

Toasters

In the standard CISPR14-1 toasters are split into two categories: toasters and simple toasters. The first ones, just called “toasters”, are apparatus that may include a number of electronic/electro mechanic devices such as a temperature or PMM controller. For these apparatus, standard procedures shall be applied (rate based on clicks measured using the related exceptions if applicable).

The apparatus called “Simple toasters”, instead, are devices that:

- incorporate a manually operated switch for switching on the heating element at the start of the toasting cycle and which will switch off the heating element automatically at the end of a predetermined period, and
- incorporate no automatic control device to regulate the heating element during the toasting operation.

For these apparatus the rate N shall be calculated using a very specific way here below described. The distinction between the two groups is essential to understand why the method for calculating the rate for simple toasters is based only on the assumption that nothing, other than manual switching operation, can happen. We here concentrate only on this method to see how it is dealt with by the CA0010.



Simple Toasters

As with any other apparatus deemed to comply with the Discontinuous Disturbance standard, the complete assessment is made of two different steps: the calculation of the Rate N, normally called "RUN1", and then the regular click measurement based on the quartile method.

For simple toasters the standard reads that the rate N "shall be determined from three toasting operations" where each operation, aimed to get "golden brown toasts", is composed of a time t_1 , which is the time the heater is on, and a "rest time" which is, per definition, 30 second. As reported in the standard, the time t_1 must be the average of the three aforementioned operations. Then the formula for calculating N is:

$$N = \frac{2}{\frac{t_1}{60} + 0.5}$$

Thus expanding the time t_1 as the average of t_a , t_b , and t_c , where t_a , t_b , and t_c are the time the heater was ON in each operation, we obtain:

$$N = \frac{2}{\frac{t_a + t_b + t_c}{3} + 0.5}$$

Transforming the formula by the following simple steps it can be written as:

$$N = \frac{2}{\frac{t_a + t_b + t_c}{3} + 0.5} = \frac{2}{\frac{t_a + t_b + t_c + 90}{3}} = \frac{6}{t_a + t_b + t_c + 90} = \frac{6}{t_a + t_b + t_c + 30 + 30 + 30} = \frac{6}{T}$$

As it can be seen, T represents the total time elapsed starting from the beginning up to the end of the prescribed procedure. We here remind that after the end of the toasting of a slice of bread the rest time is a compulsory 30 seconds. Precisely after 30 seconds the new slice must be heated for a new operation.

Narda Click Meter using Switching Operation

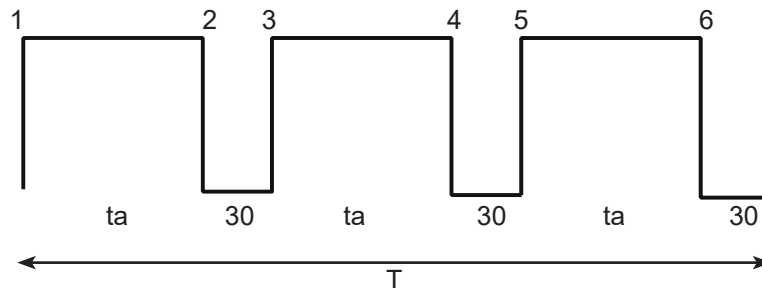
A Switching operation is considered to be an operated switch which turns a device ON or OFF. For example, the operations we have just described are effectively switching operations. This means that they can normally be visually counted and written down for a future use (for example for calculating the rate). It is not by chance that the numerator in the formula is "2". Indeed, to make a toasted slice the switch will operate twice: once to turn the heater ON and a second time to turn the heater OFF, producing thus two switching operations.

The Narda Click Meter uses a smart method for detecting a switching operation by measuring the current which flows in the mains. A wide selection of thresholds makes it possible to detect any kind of switching operation in a completely automatic way, hence relieving the operator of counting and taking note of them.

In the particular "simple toasters" test, the Narda Click Meter is totally capable of calculating the rate N fully compliant with the Standard CISPR 14-1. The following explanation clarifies the used method. If we look at the previous formulae we see the equivalence of the following:

$$N = \frac{2}{\frac{t_1}{60} + 0.5} \text{ and } N = \frac{6}{T} \text{ (with } t_1 = \frac{t_a + t_b + t_c}{3} \text{ and } T = t_a + t_b + t_c + 90)$$

If the click meter is started at the first operation, i.e. slice of bread in, heater ON (exactly as a stopwatch should be started in the manual way), and stopped after 30 seconds after the end of the third slice, then the rate is unquestionably calculated in the exact way the standard prescribes. Indeed, If we look at the diagram below we see how it works.



When the slice of bread is put in the toaster the switching operation “1” is detected and the timer starts counting. Then time elapses and after t_a , when the toast is ready, the switching operation “2” is detected. Then, after 30 seconds the operator starts the second slice and a further switching operation “3” is added. Similarly, switching operations and time are accumulated for the three slices as shown. The only intervention by the operator is to stop the meter 30 seconds after the end of the third slice. At this point the number of registered switching operations will be 6 (3 ON plus 3 OFF) and the timer will have counted T seconds which is the sum of all single contributions as shown in the diagram.

Therefore, the only operations the operator has to do is to start the click meter at the beginning and stop it at the end of the procedure: the rate will be automatically calculated as prescribed by the standard.

It is a completely automatic measuring procedure where the operator, in contrast to the manual way, does not have to activate a stopwatch six times, make note of each partial timing, make the average to get T_1 , calculate the rate N and, finally, manually insert the rate N in the meter. In the manual way, besides the many actions the operator has to do, all the tasks, being manual, are much more prone to additional errors. Moreover, the standard does not prescribe any specific way, either automatic or manual, but it only reports the way to calculate the rate.

Conclusion

It has been described how the Narda Click Meter makes, in a completely automatic way, the “RUN1” for simple toasters. No additional devices and actions are required (such as the use of a stopwatch, post-averaging calculation, rate calculation and manual insertion of data into the meter) apart from the compulsory ones (three consecutive operations of “golden brown toasts” respecting a 30 second rest period in between).

Yet, the rate N is perfectly compliant with the Standard CISPR 14-1.