Radio Interference Voltage measurements as per the ANSI or the CISPR Standard

RIV Testing of Electrical Power Equipment as per the ANSI or CISPR Standards and their differences.

When partial discharge measurements were started on a wide scale in the 1940’s, only sensitive radio noise meters were generally available. As there was practically no alternative, they were used in for partial discharge measurements also, according to the NEMA 107 standard [1].

Two principal types of RIV-meters were developed namely the American and the CISPR radio noise meter. They indicate a “weighted” voltage, which means, that the reading of the meter for an impulse (remaining unchanged in size and shape) increases with its repetition rate. But the relative increase of the meter reading is different according to the two standards. Figure 1 compares the response of the RIV meter as per ANSI C63.2 [2] and CISPR 16-1-1 [3] standards. The response of Stoddart RIV meter widely used in the USA and other international markets is overlaid for comparison. Stoddart type RIV meters have a quasi-peak detector time constants of 1 ms charge and 600 ms discharge, and 6 dB bandwidths of 4.5 kHz. CISPR 1-1 standard calls for a quasi-peak detector time constants of 1 ms charge and 160 ms discharge, and 6 dB bandwidths of 9 kHz. The response of DDX 9121a, Stoddart and XYZ make device (based on CISPR) was established using the Agilent 33220A function generator as per the criteria defined in the concerned standards [2][3].

Figure 1 clearly shows that that the response of the RIV meters based on CISPR standard is higher than ANSI or Stoddart type devices above 100Hz repetition rate (1 pulse for every half cycle of the 50Hz test voltage waveform. This is acknowledged in section 10.1.1 of the ANSI C63.2 standard – “that for most electrical discharges associated with power apparatus, measurements with either the US or CISPR instruments will yield almost identical results at pulse repetition rates close to the power frequencies (50/60–180 Hz). At other pulse repetition rates there will be a difference between the two instruments as demonstrated by figure
For example at a pulse repetition rate of 1 kHz or 10 pulses in every half-cycle of the 50Hz waveform, the RIV meter as per the CISPR standard can read twice the value of ANSI / Stoddart type devices.

**What is The Right Choice?**

The acceptance limits specified in the relevant IEEE or IEC standards have been established based on the empirical data collected over a period of several years and almost all of these limits (RIV) were set by the users / standard committees based in the North-American continent.

Since the 1940s the widely used RIV meter in this continent and elsewhere has been the different variants of the Stoddart NM-21 FFT type RIV meters. This is acknowledged in section 10.1.1 of the ANSI C63.2 standard – “In the United States, radio-interference meters operating at a frequency near 1 MHz are used for quality control and radio-interference measurements from high-voltage (hv) electrical power apparatus, such as extra-high-voltage (ehv) power lines, power transformers and switchgear. The most common interference instruments used in the power industry in the past had quasi-peak detector time constants of 1 ms charge and 600 ms discharge, and 6 dB bandwidths of 4.5 kHz. In contrast, CISPR requirements have quasi-peak detector time constants of 1 ms charge, 160 ms discharge, and a 6 dB bandwidth of 9 kHz." As shown in Figure 1, for PD pulse rates above 100 Hz, CISPR RIV meter would read higher than an ANSI 4.5 kHz RIV meter (aka Stoddart type RIV meters). In case that the electrical power equipment under test shows even a very slight trace of discharges, CISPR RIV meter could potentially fail the test.

For the manufacturers and users of the electrical power equipment who are obliged to comply to the RIV acceptance limits in the ANSI / IEEE / IEC standards, it is recommended to choose an instrument complying to ANSI standard and preferably the 4.5 kHz bandwidth (also referred to as Stoddart type response in the ANSI) for the reasons outlined in the preceding paragraph and also because the RIV acceptance limits mentioned in the standards were largely established by the users of the Stoddart type RIV meter.

**DDX 9121b RIV Module**

With the foregoing in consideration, DDX 9121b is designed as per the ANSI standard and figure 1 shows how its RIV response compares to CISPR and XYZ make RIV devices.

For RIV calibration, the multiplexer function of the DDX 9121b allows convenient determination of the correction factors according to NEMA 107-1987, without the need for multiple connection, disconnection and reconnection. This greatly simplifies the test procedure.

**References**

2. ANSI C63.2-1996: American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz Specifications.

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