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Position Papier

Application of the Triaxial Cell Measuring Method for Passive Components and Devices within Cable Networks

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Satellite & Cable Division

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I. Current situation

With regard to the radiation characteristics and immunity to electromagnetic disturbance of active and **passive** equipment which are intended for reception, processing and distribution of television, sound and interactive multimedia signals, the harmonized standard EN50083-2 applies. The standard EN 50083-2 is published in the list of titles and references for harmonized standards under the Directive 2004/108/EC for Electromagnetic compatibility (EMC).

Amongst others the standard EN 50083-2 specifies requirements for maximum allowed radiation, minimum immunity and minimum screening effectiveness for passive equipment with an operating frequency range up to 3,5GHz. Concerning the proof of mandatory limit values, the standard EN 50083-2 also specifies the applicable measurement procedures.

As part of the work of the ZVEI Satellite & Cable Division the draft for a so-called "Triaxial Cell" measurement method (draft DIN EN 62153-4-15) was examined. This draft was suggested as an alternative method for the measurement of **passive** equipment with an operating frequency range of between 5MHz and 3,5GHz. The advised procedure utilized in this method is that the device under test (DUT) must be placed in a so-called "Triaxial Cell". In particular, it was examined to what extent the "Triaxial Cell" measurement method is suitable as a substitute to the "Absorber Clamp" measurement procedure already defined in the standard EN 50083-2.

II. Justification

In the following the drawbacks of the "Traxial Cell" method of measurement are explained which speak against the use of this method for passive equipment used in CATV networks:

- **For many products subject to standard EN 50083-2, the "Triaxial Cell" testing method cannot be applied**

The "Triaxial Cell" represents a cavity resonator and therefore shows resonance frequencies [3, S.12 (11)] which depend on the geometrical dimensions of the "Triaxial Cell". The underlying natural resonance frequencies will also be changed on introducing a test object into the "Triaxial Cell". These resulting resonance frequencies will affect measurement results significantly [3, Kapitel 6.3]. To obtain reliable measurement results at frequencies of f=1GHz or f=2.5GHz, the "Triaxial Cell" must not be larger than 250mm or 100mm respectively. As a result, many products covered by the scope of EN 50083-2 cannot be inserted into a "Triaxial cell" with such dimensions.

- **The impedance of the secondary circuit[1] of the "Triaxial Cell" can affect the measurement result**

Only in the explicit event that the resistance of the secondary circuit is greater than the input resistance of the measurement

[1] outer shell of unit under test to the inner wall to the triaxial Cell.

receiver, the measurement result will not depend on the input resistance of the measurement receiver [2],[3]. However, dimensions and complex outlines of passive devices to be measured according to EN 50083-2 will cause this condition to be violated if the "Triaxial Cell" is not of sufficient dimensions. This requirement for a sufficiently large measuring cell is contrary to the requirement of a small cell, resulting from the measurement frequency to be considered e.g. f = 1GHz (see above).

- **Conflicting definition of correction factors**

The „raw measured data" for the screening effectiveness are normalized to a wave resistance of 150Ω (so-called a150). Contradictory formulas for the consideration of this normalization lead to different interpretation of the measurement results: [1, S.16 (19)] ≠ [1, S.24 (A.10)] and also [3, S.19 (17)] ≠ [3, S.23 (A.3)].

- **"Triaxial cell" measuring method means the introduction of an additional measurement method**

The "Triaxial Cell" measuring method would be introduced as an additional measuring method within its incorporation into EN50083-2, since the "Triaxial Cell" measuring method according to [1] or [3] respectively is limited to passive devices and components. For active devices, the radiated power must still be measured using the absorber clamp measuring method according to EN 50083-2.

- **Dimension of the „Triaxial Cell" measurement equipment**

The "Triaxial Cell" claims to use a space-saving testing method design. However, to obtain useful measurement results for the screening effectiveness at a frequency of 5MHz (according to the requirement of EN 50083-2), a triaxial measuring tube with a length of approximately 9m still is required [1, S.21 (A5)].

III. Conclusion

Due to the different problem areas described above, the ZVEI Satellite & Cable Division considers the introduction of the „Triaxial Cell" measuring method as not suitable as a measurement method for passive components and devices. The "Triaxial Cell" measuring method offers no benefits, rather the expected measurement uncertainties and higher measurement efforts associated with the measurement process lead to an unacceptable deterioration in results achieved in comparison to the proven "Absorber Clamp" measuring method.

IV. References of sources

[1] DKE Deutsche Kommission Elektrotechnik, „DIN EN 62153-4-7 Prüfverfahren für metallische Kommunikationskabel", Teil 4-7: Elektromagnetische Verträglichkeit (EMV)-Messverfahren zur Messung des Kopplungswiderstandes und der Schirmdämpfung oder der Kopplungsdämpfung - Rohr-im-Rohr-Verfahren, Deutsche Fassung EN62153-4-7: 2006.

[2] O. Breitenbach, T. Hähner und B. Mund, „Kabelschirmung im MHz bis GHz Frequenzbereich- Erweiterte Anwendung eines einfachen Messverfahrens."

[3] ENTWURF DKE Deutsche Kommission Elektrotechnik, „DIN EN 62153-4-15

Prüfverfahren für metallische Kommunikationskabel“ Teil 4-15: Elektromagnetisches Verhalten (EMV)- Prüfverfahren zur Messung von Kopplungswiderstand und Schirmdämpfung oder Kopplungsdämpfung mit der Triaxialen Zelle: 2013-06.

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