INTERNATIONAL ELECTROTECHNICAL COMMISSION

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AMENDMENT 2
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INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

Amendment 2

Specification for radio disturbance and immunity measuring apparatus and methods –

Part 1: Radio disturbance and immunity measuring apparatus

Amendement 2

Spécifications des méthodes et des appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques –

Partie 1: Appareils de mesure des perturbations radioélectriques et de l'immunité aux perturbations radioélectriques

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FOREWORD

This amendment has been prepared by CISPR subcommittee A: Radio-interference measurements and statistical methods.

The text of this amendment is based on the following documents:

FDIS	Report on voting
CISPR/A/434/FDIS	CISPR/A/441/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until 2004. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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CONTENTS

Replace, on page 5, the existing title of Annex Q by the following new title:

Annex Q (normative) Example and measurement of the parameters of an asymmetric artificial network (AAN)

Add, on page 5, the titles of Annex Y and Annex Z as follows:

Annex Y (normative) Performance check of the exceptions from the definitions of a click according to 4.2.3 of CISPR 14-1

Annex Z (normative) Example and measurement of the parameters of the AN for coaxial and other screened cables

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2 Normative references

Insert, in the existing list, the title of the following standard:

CISPR 14-1:2000, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission*

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3 Definitions

Add, on page 23, the following definitions:

3.20
asymmetric artificial network (AAN)
network used to measure (or inject) asymmetric (common mode) voltages on unshielded symmetric signal (e.g. telecommunication) lines while rejecting the symmetric (differential mode) signal

NOTE The term "Y-network" is a synonym for AAN.

3.21
impedance stabilization network (ISN*)*
generally an artificial network that provides a stabilized impedance to the EUT; often (e.g. in CISPR 22) used as a synonym for AAN

3.22
coupling/decoupling network (CDN)
artificial network for the measurement or injection of signals on one circuit while preventing signals from being measured or injected on another circuit

3.23
longitudinal conversion loss (LCL)
in a one- or two-port network, a measure (a ratio expressed in dB) of the degree of unwanted transverse (symmetric mode) signal produced at the terminals of the network due to the presence of a longitudinal (asymmetric mode) signal on the connecting leads
(definition from ITU-T Recommendation O.9[1)])

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5.4 Disturbance analyzers

Replace the existing text of 5.4 and its subclauses by the following:

Disturbance analyzers are used for the automatic assessment of amplitude, rate and duration of discontinuous disturbances (clicks).

A 'click' has the following characteristics:

a) the QP amplitude exceeds the quasi-peak limit of continuous disturbance,

b) the duration is not longer than 200 ms,

c) and the spacing from a preceding or subsequent disturbance is equal to or more than 200 ms.

A series of short pulses shall be treated as a click when its duration, measured from the start of the first to the end of the last pulse, is not longer than 200 ms and conditions a) and c) are fulfilled.

The time parameters are determined from the signal which exceeds the IF reference level of the measuring receiver.

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1) ITU-T Recommendation O.9, *Measuring arrangements to assess the degree of unbalance about earth*.

NOTE 1 Definition and assessment of clicks are in compliance with CISPR 14-1:2000.

NOTE 2 Current analyzers are designed to be used with a quasi-peak measuring receiver of the type which works with a limited internal signal level. As a result, such analyzers may not interface correctly with all receivers.

5.4.1 Fundamental characteristics

a) The analyzer shall be equipped with a channel to measure the duration and spacing of discontinuous disturbances; the input of this channel shall be connected to the IF output of the measuring receiver. For these measurements, only the part of the disturbance has to be considered which exceeds the IF reference level of the receiver. The accuracy of duration measurements shall be not worse than ±5 %.

NOTE 1 The IF reference level is the corresponding value in the IF output of the measuring receiver to an unmodulated sinusoidal signal, which produces a quasi-peak indication equal to the limit for continuous disturbances.

b) The analyzer shall be equipped with a channel to assess the quasi-peak amplitude of a disturbance.

c) The amplitude in the quasi-peak channel shall be measured 250 ms after the last falling edge in the IF channel.

d) The combination of both channels shall comply in all respects with the requirements of 4.1.

e) The analyzer shall be capable of indicating the following information:

- the number of clicks of duration equal to or less than 200 ms;
- the duration of the test in minutes;
- the click rate;
- the incidence of disturbances other than clicks which exceed the QP limit of continuous disturbance.

NOTE 2 An example of a disturbance analyzer is shown in form of a block diagram in Figure 11.

f) For validation of the fundamental characteristics the analyzer has to pass the performance check with all the wave forms (test pulses) in Table 13.

Figure 12 presents in a graphical form the waveforms listed in Table 13.

Figure Y.1 presents in a graphical form all the waveforms listed in Table Y.1 for the performance check of the exceptions from the definitions of a click according to 4.2.3 of CISPR 14-1.

**Table 13 – Disturbance analyzer performance test –
Test signals used for the check against the definition of a click**

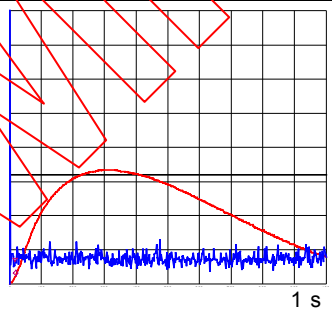
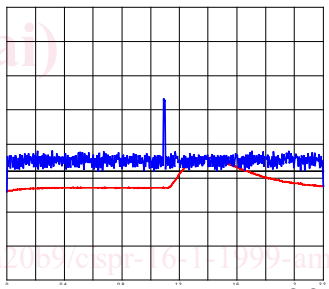
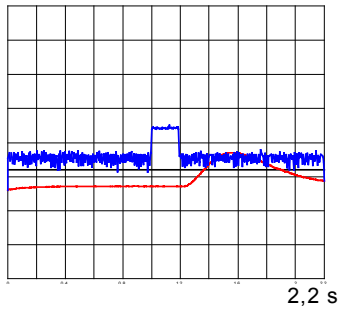
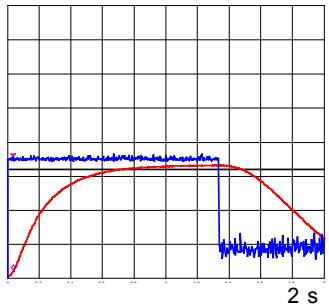
Test No.	Test signal parameters						
	1		2		3	4	5
	QP amplitude of impulses adjusted individually relative to QP reference indication of the measurement receiver dB		Duration of impulses [f] adjusted in the intermediate frequency output of the measurement receiver ms		Separation of impulses or periodicity (IF-output) ms	Evaluation by the analyzer	Graphical presentation of the test signal measured in the IF-output and the associated QP signal relative to the reference indication of the measurement receiver
	Pulse 1	Pulse 2	Pulse 1	Pulse 2			
1	1		0,11			1 click	 1 s
2 [a]	1		9,5			1 click	 2,2 s
3 [a]	1		190			1 click	 2,2 s
4	1		1 333 [b]			Other than click	 2 s

Table 13 (*continued*)

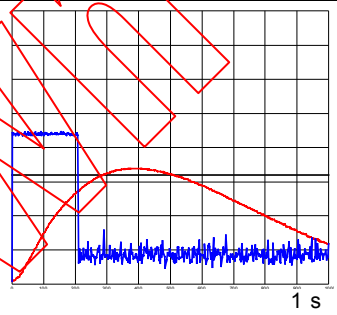
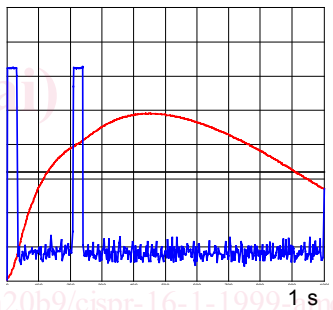
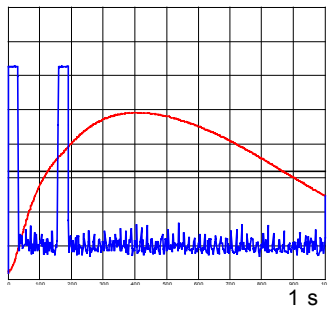
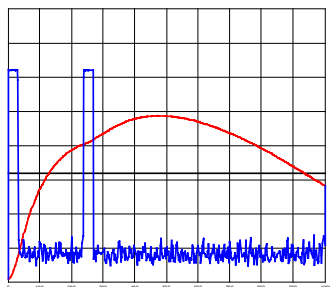
Test No.	Test signal parameters						
	1		2		3	4	5
	QP amplitude of impulses adjusted individually relative to QP reference indication of the measurement receiver dB		Duration of impulses [f] adjusted in the intermediate frequency output of the measurement receiver ms		Separation of impulses or periodicity (IF-output) ms	Evaluation by the analyzer	Graphical presentation of the test signal measured in the IF-output and the associated QP signal relative to the reference indication of the measurement receiver
	Pulse 1	Pulse 2	Pulse 1	Pulse 2			
5	1		210			Other than click (210 ms)	
6	5	5	30	30	180	Other than click (240 ms)	
7	5	5	30	30	130	1 click	
8	5	5	30	30	210	2 clicks	

Table 13 *(continued)*

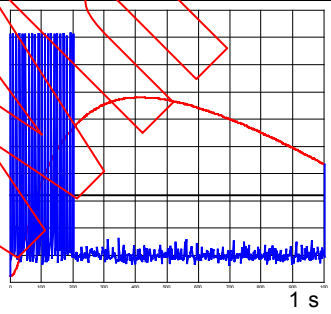
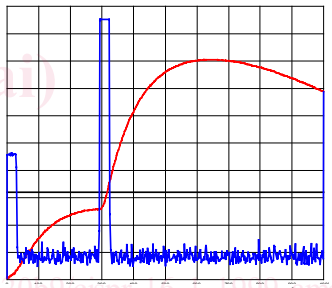
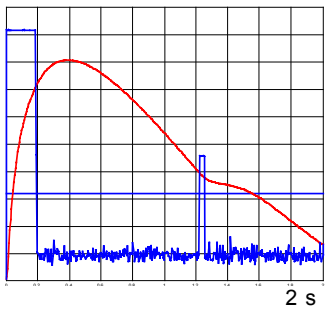
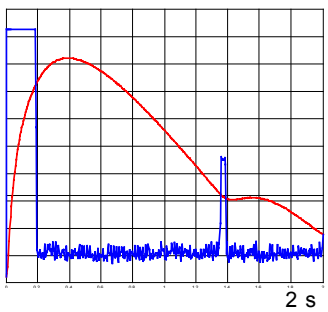
Test No.	Test signal parameters						
	1		2		3	4	5
	QP amplitude of impulses adjusted individually relative to QP reference indication of the measurement receiver dB		Duration of impulses [f] adjusted in the intermediate frequency output of the measurement receiver ms		Separation of impulses or periodicity (IF-output) ms	Evaluation by the analyzer	Graphical presentation of the test signal measured in the IF-output and the associated QP signal relative to the reference indication of the measurement receiver
	Pulse 1	Pulse 2	Pulse 1	Pulse 2			
9	1		0,11		Periodicity 10, min. 21 pulses	Other than click	
10	–2,5	25	30	30	265	1 click	
11	25	–2,5 [c]	190	30	1 034 [e]	2 clicks [d]	
12	25	–2,5 [c]	190	30	1 166 [e]	1 click	

Table 13 *(continued)*

[a] To be performed with background noise consisting of 200 Hz CISPR pulses at a level 2,5 dB below the quasi-peak threshold level. These pulses should be present commencing at least 1 s before the test pulse and lasting until at least 1 s after the test pulse.

Observations:

1) The graphical representation is done with peak measurements of a very short hold time (<1 ms) of the test receiver which show the 200-Hz pulse. When the pulse-modulated sine wave arrives, the 200-Hz-pulse is no longer visible (as seen in the graph for test no. 3) but still present during the event of the click disturbance

2) The very narrow responses at the origin in the graphs are due to a firmware imperfection.

[b] The 1,333 s impulse checks the threshold of the analyzer for impulses, which are only 1 dB above the quasi-peak threshold level.

[c] These lower levels shall be set such that the intermediate frequency threshold is exceeded but the quasi-peak threshold is not exceeded

[d] If these two pulses were to be measured as separate disturbances, only one click would be registered.

[e] The correspondent values for the frequency range above 30 MHz are under consideration and will be revised after further investigations.

[f] The rise times of the pulses shall not be longer than 40 µs.

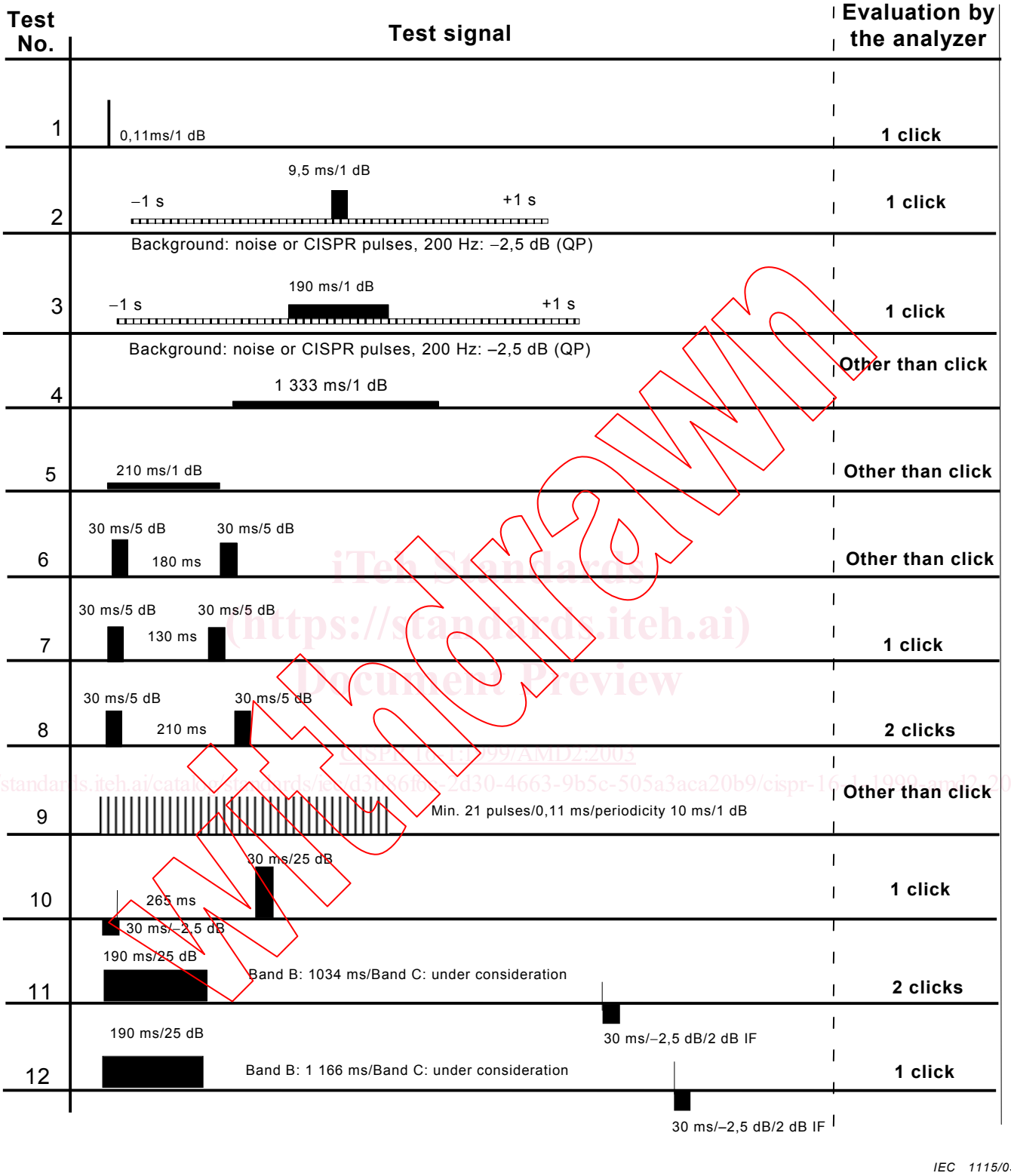


Figure 12 – A graphical presentation of test signals used in the test of the analyzer for the performance check against the definition of a click according to Table 13

5.4.2 Test method for the validation of the performance check for the click analyzer

5.4.2.1 Basic requirements

The disturbance analyzer is connected to the quasi-peak measuring receiver and tuned to a convenient frequency.

A CW signal and a pulsed CW signal both at the tuned frequency of the receiver are required. A signal generated by CISPR pulse generator, as defined in Annex B, with a 200 Hz PRF covering the receiver bandwidth at the tuned frequency is also required for tests No. 2 and 3.

The pulsed CW signal source shall provide two independently variable pulses. The rise time of the pulses shall be not longer than 40 μs. The pulse duration shall be variable between 110 μs and 1,3 s and the amplitudes variable over a 44 dB range. Any background noise of the pulsed CW signal source shall be at least 20 dB below the reference level used in step a) in the test measured on the receiver's quasi-peak meter.

The test procedure is as follows:

a) The CW signal is connected to the input of the measuring receiver used in conjunction with the disturbance analyzer. The amplitude of the CW signal is adjusted to bring the meter indication to the reference (zero) point on the meter scale of the measuring receiver equal to a value identical to the QP-limit for continuous disturbance. The receiver RF sensitivity (attenuator) control is adjusted to a level above the receiver noise but below the limit for continuous disturbance used as threshold in the IF channel. The corresponding level of the CW signal at the IF output of the receiver constitutes the IF reference level.

b) The pulsed CW signal is connected to the input of the measuring receiver. For test number 2 and 3 the signal from the CISPR pulse generator is added to the pulsed CW signal. The parameters of the signal are given in Table 13. The amplitudes of the pulses shown in column 1 of Table 13 are adjusted individually relative to the indication of the limit (QP) for continuous disturbance used as threshold in the IF channel. The levels shall be relative to the respective RF and IF reference levels established in the previous paragraph.

5.4.2.2 Additional requirements

The test method is identical to the one described in 5.4.2.1.

The parameters of the signal are given in Table Y.1.

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5.5.3.2 Magnetic antenna

Add, after the existing paragraph, the following new paragraph:

Tuned electrically balanced loop antennas may be used to make measurements at lower field strengths than untuned electrically-screened loop antennas.

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Replace subclause 5.5.4.2 by the following new subclause:

5.5.4.2 Balance of antenna

5.5.4.2.1 Introduction

In radiated emission measurements, common-mode (CM) currents may be present on the cable attached to the receiving antenna (the antenna cable). In turn, these CM currents create EM fields which may be picked up by the receiving antenna. Consequently, the radiated emission measuring results may be influenced.

The major contributions to the antenna cable CM currents stem from

a) the electric field generated by the EUT, if that field has a component parallel to the antenna cable, and

b) the conversion of the differential mode (DM) antenna signal (the desired signal) into a CM signal by the imperfection of the balun of the receiving antenna.

This subclause considers the balun contribution. Contribution a) is under consideration (see last sentence of NOTE 1 of 5.5.4.2.2).

In general, log-periodic dipole array antennas do not exhibit significant DM/CM conversion and the following check applies to dipoles, biconical antennas and bicone/log hybrid antennas.

5.5.4.2.2 Balun DM/CM conversion check

The following method describes the measurement of two voltages, U_1 and U_2, in the frequency range for which the receiving antenna is to be used. The ratio of these voltages, both expressed in identical units (e.g., dBµV), is a measure for the DM/CM conversion.

1) Set the receiving antenna under test vertically polarized with its centre at a height of 1,5 m above the ground plane. Lay the cable horizontally for 1,5 m ± 0,1 m behind the rear active element of the antenna and then drop it vertically by a height of at least 1.5 m to the ground plane.

2) Place a second (transmitting) antenna vertically polarized at a horizontal distance of 10 m from the centre of the antenna under test with its tip 0,10 m from the ground plane. If the range of the site used for emission testing is 3 m, do this check using a distance of 3 m (if the conversion check has already been made at 10 m distance and shows a change of less than ±0,5 dB, it is not necessary to take a separate measurement at 3 m). The specification of the transmitting antenna shall include the frequency range of the antenna under test.

3) Connect the transmitting antenna to a signal source, for example, a tracking generator, set the level of that generator in such a way that, over the frequency range of interest, the signal-to-ambient noise at the receiver is larger than 10 dB.

4) Record the voltage U_1 at the receiver over the frequency range of interest.

5) Invert the receiving antenna (rotate that antenna through 180°) without changing anything else in the set-up, in particular the receiving antenna cable, and without changing the setting of the signal source.

6) Record the voltage U_2 at the receiver over the frequency range.

7) The DM/CM conversion is sufficiently low if $|20 \log (U_1/U_2)| < 1$ dB.

NOTE 1 If the DM/CM conversion criterion is not met, ferrite rings around the antenna cable may reduce the DM/CM conversion. The addition of ferrites on the antenna cable may also be used to verify whether contribution a) has a non-negligible effect. Repeat the test with four ferrites spaced approximately 20 cm apart. If the criterion is met by using these rings, they shall be present in the actual emission measurement. Likewise, the interaction with the cable can be reduced by extending the cable several metres behind the antenna before dropping to ground.

NOTE 2 If the receiving antenna is to be used in a fully anechoic chamber, the DM/CM check may be performed in that room with the receiving antenna at its usual location and the transmitting antenna in the centre of the test volume of that room. The room must comply with the ±4 dB criterion

NOTE 3 The measuring site of which the ground plane forms a part, or the fully anechoic room, should comply with their respective NSA requirements.