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Titre : CISPR 16-1-4 A2 f3 Ed.1: Validation d'un emplacement au-dessus de 1 GHz

Title : CISPR 16-1-4 A2 f3 Ed.1: Site evaluation above 1 GHz

Note d'introduction

Introductory note

This circulation of this CDV was authorized by the subcommittee, in accordance with a proposal of CISPR/A/WG1, put forward at its last meeting in Shanghai/China on September 14, 2004 and at the mid-term WG1 meeting in Frankfurt on March 21/22, 2005. It addresses the comments and decisions documented in CISPR/A/550/CC.

ATTENTION	ATTENTION
CDV soumis en parallèle au vote (CEI) et à l'enquête (CENELEC)	Parallel IEC CDV/CENELEC Enquiry

Introduction

This CDV presents the radiated emissions site validation method for Above 1 GHz. This draft incorporates the results of comments submitted to A/531/CD (reported in A/550/CC) and discussions by CISPR SCA and CISPR SCA WG1 in Shanghai, China (Sept 2004) and Frankfurt, Germany (Mar 2005).

Note that this CDV includes informative Annex A through C which are provided for information only and will be considered by CISPR SCA for future inclusion as technical reports in CISPR 16-3 or 16-4.

Proposed amendment to CISPR 16-1-4 text:

Replace the present text of clause 8.2 by the following text:

8.2 Validation of the test site

A test site shall be considered acceptable for radiated electromagnetic field measurements between 1 and 18 GHz if it satisfies the criterion provided in section 8.2.1 below. Section 8.2.2 provides the site validation procedure. For the purposes of CISPR site acceptance according to this section, measurements are required to be performed from 1 GHz to the maximum frequency in use at the facility. The maximum frequency shall be at least 2 GHz.

The test site required for measurements between 1 and 18 GHz is one that minimizes the influence of reflections in the received signal (for example an anechoic chamber). If the site is not designed to provide anechoic conditions (for example a semi-anechoic chamber), it may be necessary to use absorbing material on the ground plane. Information on reducing the influence of the ground plane reflection by adding absorber to a semi-anechoic facility is provided in subclause 8.2.3 below.

The site validation is performed by measurement of the site voltage standing wave ratio (S_{VSWR}). The site validation method tests a specified test volume for the combination of site, receive antenna and absorbing material placed on the ground plane (if needed to meet the criterion). Influence of the receive antenna mast in the position used for the site validation and permanently fixed objects in the test volume (such as a permanently installed turntable) are included in the site validation procedure. The influence of removable objects from the test volume, such as a removable test table, do not need to be present during the site validation if its influence is to be determined by the additional procedures of CISPR 16-1-4, clause 5.8.

CISPR 16-2-3 provides a description of the EUT measurement method used for frequencies between 1 and 18 GHz. The purpose of the S_{VSWR} procedure is to check for the influence of reflections that may be present when an EUT of arbitrary size and shape is placed within the volume under investigation in this procedure.

S_{VSWR} is the ratio of maximum received signal to minimum received signal (E_{max}/E_{min}) caused by the interference of reflections with the direct (intended) signal :

$$S_{VSWR} = \frac{E_{max}}{E_{min}} = \frac{V_{max}}{V_{min}} \qquad \text{(ZZ.1)}$$

where E_{max} and E_{min} are the maximum and minimum received signals, and V_{max} and V_{min} are the corresponding measured voltages when a receiver or spectrum analyzer is used for detection.

For the procedures that follow, units in decibels (dB) are often employed for measurements and calculations. In this case, the following form of S_{VSWR} is useful :

$$S_{VSWR\,dB} = 20 \cdot \log\left(\frac{V_{\max}}{V_{\min}}\right) = V_{\max dB} - V_{\min dB} \qquad \text{(ZZ.2)}$$

Notes :

1. When decibels are employed, S_{VSWRdB} may be taken as the difference of maximum to minimum signal detected from units of dBm, dBμV, or dBμV/m as appropriate for the instrumentation or signal detector used.
2. The value of S_{VSWR} or S_{VSWRdB} is computed separately from the maximum and minimum signal obtained at each frequency and polarization for a set of six measurements as described in section 8.2.2 below.

8.2.1 Acceptance criterion for site validation

The site VSWR (S_{VSWR}) is directly related to the influence of undesired reflections.

Acceptance criterion for site validation: The site VSWR (S_{VSWR}) shall be ≤ 1.78:1 (S_{VSWRdB} ≤ 5.0 dB) when measured in accordance with the procedures of clause 8.2.2 below.

8.2.2 Site Validation Procedure

This sub clause describes the required procedure for evaluating S_{VSWR}.

8.2.2.1 Antenna Requirements

To provide illumination of all reflecting surfaces during this test, and to simulate possible low directional gains as exhibited by many actual EUTs, this paragraph provides criteria for the equipment used during the S_{VSWR} test. Manufacturer supplied data may be used to determine that the requirements of this section are met.

For the standard S_{VSWR} procedure (see Section 8.2.2.3 below) :

The receive antenna must be linearly polarized, and shall be the same type antenna that will be used for subsequent EUT emissions measurements. For the transmit antenna, the 0° reference angle for the pattern specifications is the angle where the antenna points to the receive antenna. This is also referred to as the "boresight". The antenna pattern data shall be normalized to 0 dB along the boresight.

The antenna used as a transmit source shall be linearly polarized and have a dipole-like radiation pattern with the following detailed characteristics. Radiation pattern data shall be available with a frequency step size less than or equal to 1 GHz[1]:

E-plane:
There is more than one possible plane to measure the E-plane pattern of an antenna. The manufacturer has to choose one and describe it well in the test report of the antenna. In particular, the plane that includes the input connector and routing of the cable stands out against all other possible planes.

1) Choose a center angle for the right and the left side of each pattern. This angle shall be 0° ±15° and 180° ±15° respectively.
2) Draw the forbidden area symmetrical to the center angles[2]
   - -3 dB for ± 15°
   - -5 dB for ± 30°
   - -7 dB for ± 45°
3) The E-plane pattern shall not enter the forbidden area.

H-plane:

There is only one possible plane in which to measure the H-plane pattern of a dipole antenna, which is orthogonal to the dipole and through the centre of the dipole. This plane may include a balun and an input connector and the input cable, depending whether a metal or optical fiber is used. The manufacturer of the antenna shall

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[1] It is assumed that the antenna fulfils the requirements also at other frequencies during S_{VSWR} test.
[2] This limit ensures a smooth pattern in the boresight region and an acceptable omnidirectional behaviour.

describe the setup used to measure pattern, including the feed cabling and connector locations, in the test report of the antenna.

1) Draw the forbidden area
   - -3 dB for ± 135°
2) The H-plane pattern shall not enter the forbidden area.

Note: Although the H-plane pattern is not specified outside of ±135°, it is desirable for the H-plane pattern not to show a null at ±180°, but to be omni-directional as best as possible. Guidance provided by the antenna manufacturer on the routing of the feed cabling and antenna mast should be followed, if available, to minimize the possible influence on H-plane pattern outside of ±135°.

FIGURE XX.1 : Source Antenna Pattern, E-Plane (Example, Informative)

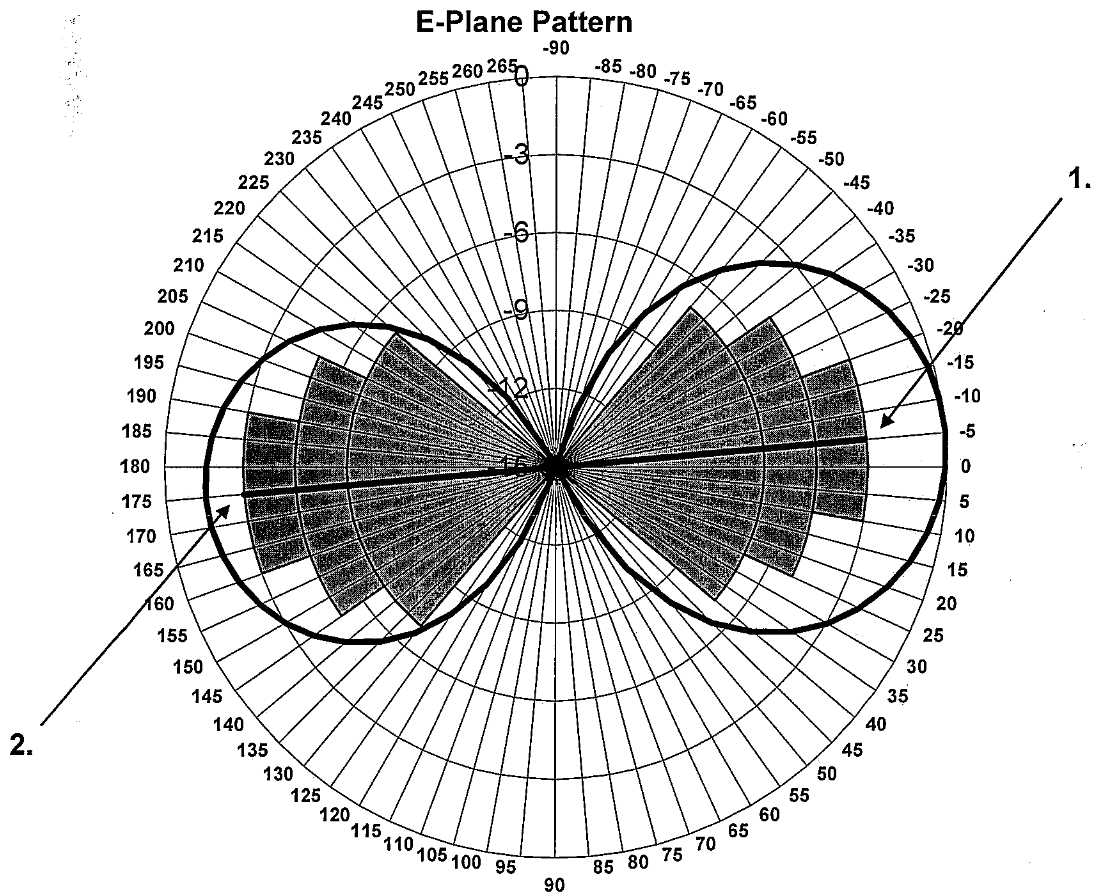
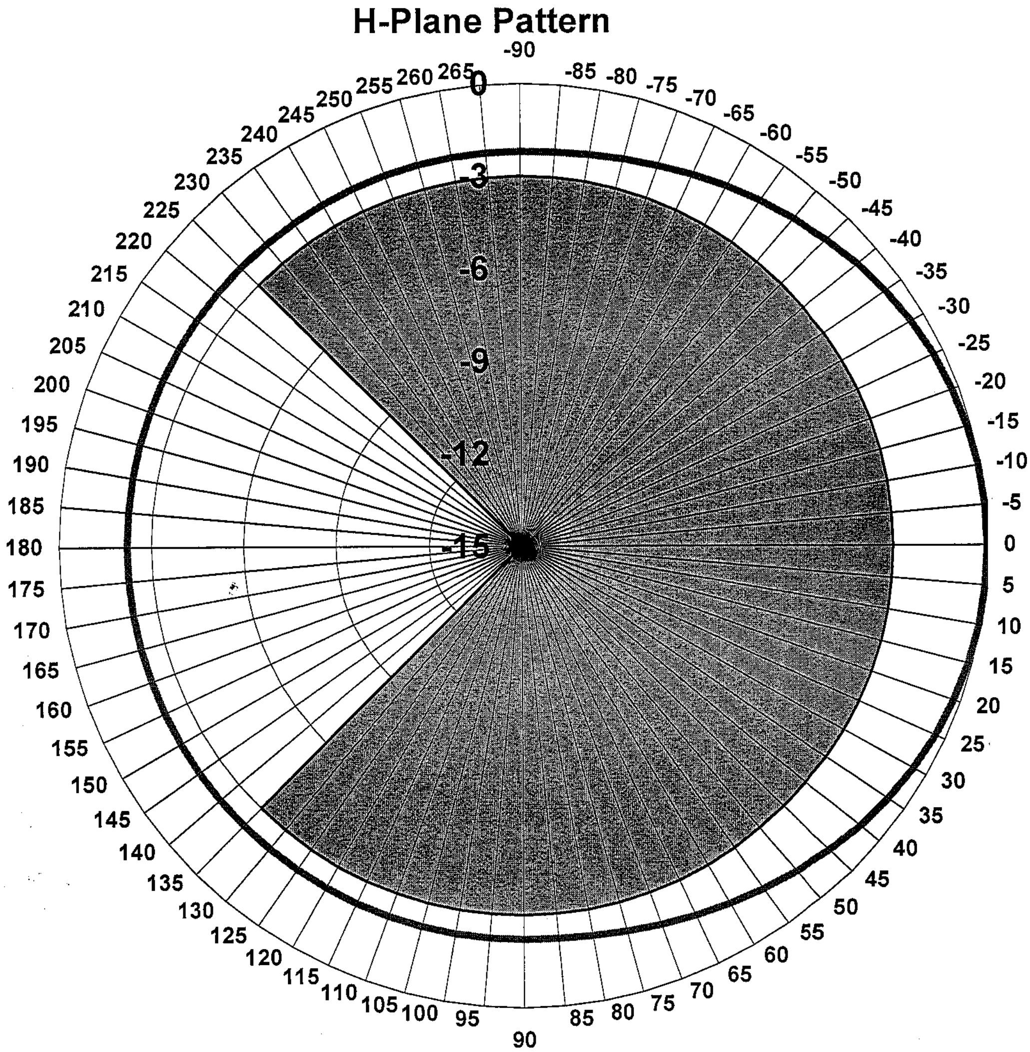


Figure XX.1 Notes (informative, example pattern, E-plane):

- A center angle of - 5° is chosen for the right side of the pattern (point 1). So the forbidden area is calculated with - 3 dB within - 20° and + 10°, -5 dB within – 35° and + 25° and – 7 dB within -50° and + 40°.
- A center angle of + 175° is chosen for the left side of the pattern (point 2). So the forbidden area is calculated with - 3 dB within + 160° and + 190°, -5 dB within °+ 145° and + 205° and – 7 dB within + 130° and + 220°.
- The pattern of the left side gets close to the forbidden area but does not enter it.

FIGURE XX.2 : Example Pattern Data (H-plane, informative)



- The pattern does not drop below -3 dB over ±135° from the maximum value. This meets the omni-directional requirement.

For the reciprocal S_{VSWR} procedure (see paragraph 8.2.2.4 below)

The antenna used to transmit at the test volume shall be the same type that will be used later for emissions measurements.

The isotropic field probe used shall be omni-directional with an isotropicity of 3 dB or better.

The recommended procedure to measure the isotropicity:

- Establish a well defined and stable field
- Rotate the field probe around all the axes that will be used for measurement (i.e for a single axis probe, rotate around the measurement axis; for a three axis probe, all three axes)

- Record the reading during turning
- The minimum reading shall not be below 71 % of the maximum reading (71% corresponds to - 3 dB)

8.2.2.2 Required Positions for Site Validation Test

The site validation test shall be performed within a volume in the shape of a cylinder. The bottom of the cylinder is established by the surface that is used to support the EUT. The top of the cylinder is chosen as the maximum height that an EUT and its vertical overhead cabling would occupy. The diameter of the cylinder is the largest diameter required to accommodate an EUT including cables. For cables that leave the test volume, a 30 cm section of these cables shall be accounted for to establish the dimensions of the volume. To accommodate floor standing equipment that cannot be raised from the supporting surface, illumination for a height of up to 30 cm from the bottom of the test volume may be obstructed by absorber placed on the ground plane. According to the procedure of section 8.2.2.3, the site VSWR (S_{VSWR}) is determined by placing the receive antenna at the position for which the volume shall be validated and varying the transmit source in the defined positions. Alternatively, using the reciprocal procedure of section 8.2.2.4 below, the positions described in this paragraph are used for the placement of the field probe in the test volume.

The required locations to perform the S_{VSWR} measurements depends on the dimensions of the test volume. Section 8.2.2.5 provides details of the conditional test position requirements. S_{VSWR} is determined for each required location and polarization by a sequence of six measurements on a line to the receive antenna reference point. Figure XX.3 and XX.4 illustrate all of the possible required locations, including the conditional locations of paragraph 8.2.2.5. The sequence of six measurements along the line to the receive antenna is indicated by dots in these figures :

FIGURE XX.3

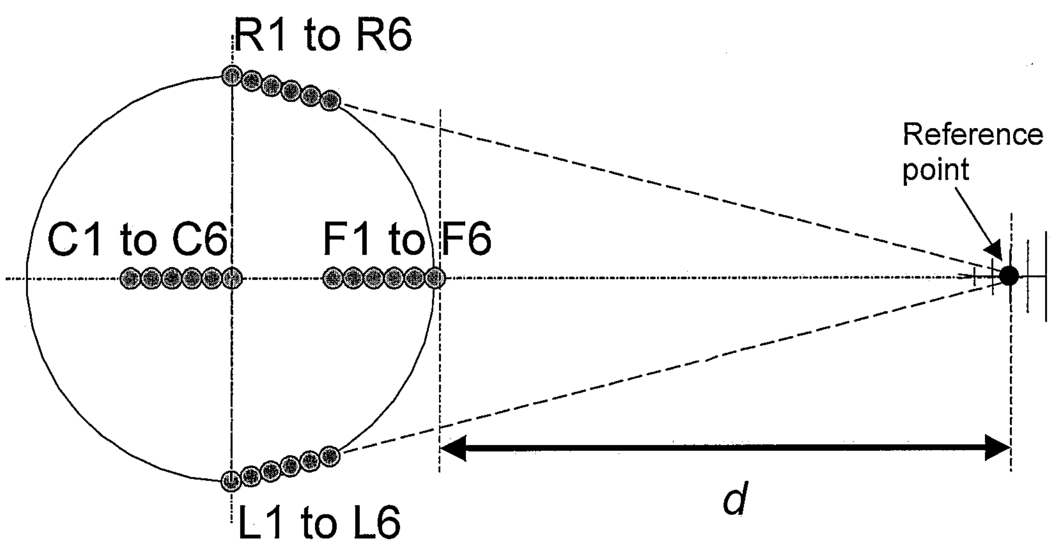


FIGURE XX.3 Notes :

F1 to F6 : Front positions 1 – 6. The front positions are on a line from the center of the test volume to the receive antenna reference point. To locate these positions, first locate F6 which is at the front extent of the test volume, on the measurement axis at the test distance, d, from the receive antenna.

F5 to F1 are measured relative to F6, moving away from the receive antenna as follows :

F5 = F6 + 2 cm away from the receive antenna
F4 = F6 + 10 cm away from the receive antenna
F3 = F6 + 18 cm away from the receive antenna
F2 = F6 + 30 cm away from the receive antenna
F1 = F6 + 40 cm away from the receive antenna

R1 to R6 : Right positions #1-#6. These positions are located relative to position R6. R6 is found by determining the right extent of the test volume (position R1), then moving on a line toward the receive antenna reference point 40 cm (see figure XX.3).

Positions R5 to R1 are measured relative to R6, moving away from the receive antenna as follows :

R5 = R6 + 2 cm away from the receive antenna
R4 = R6 + 10 cm away from the receive antenna
R3 = R6 + 18 cm away from the receive antenna
R2 = R6 + 30 cm away from the receive antenna
R1 = R6 + 40 cm away from the receive antenna

L1 to L6 : Left positions #1-6. These positions are located relative to position L6. L6 is found by determining the left extent of the test volume (position L1), then moving on a line toward the receive antenna reference point 40 cm (see figure XX.3).

Positions L5 to L1 are measured relative to L6, moving away from the receive antenna as follows :

L5 = L6 + 2 cm away from the receive antenna
L4 = L6 + 10 cm away from the receive antenna
L3 = L6 + 18 cm away from the receive antenna
L2 = L6 + 30 cm away from the receive antenna
L1 = L6 + 40 cm away from the receive antenna

C1 to C6 : Center positions #1-#6 : These positions are located relative to position C6. Position C6 is at the center of the test volume. Positions C1 to C6 are required to be tested when the test volume is greater than 1.5 m in diameter (see section 8.2.2.5).

C5 to C1 are measured relative to C6, moving away from the receive antenna as follows :

C5 = C6 + 2 cm away from the receive antenna
C4 = C6 + 10 cm away from the receive antenna

C3 = C6 + 18 cm away from the receive antenna
C2 = C6 + 30 cm away from the receive antenna
C1 = C6 + 40 cm away from the receive antenna

In addition to the locations indicated in Figure XX.3, an additional test at top of volume may be required for S_{VSWR} measurement depending on the height of the test volume.. The following Figure XX.4 illustrates the additional height requirement for S_{VSWR} measurement.

FIGURE XX.4 : S_{VSWR} Positions (Height Requirements)

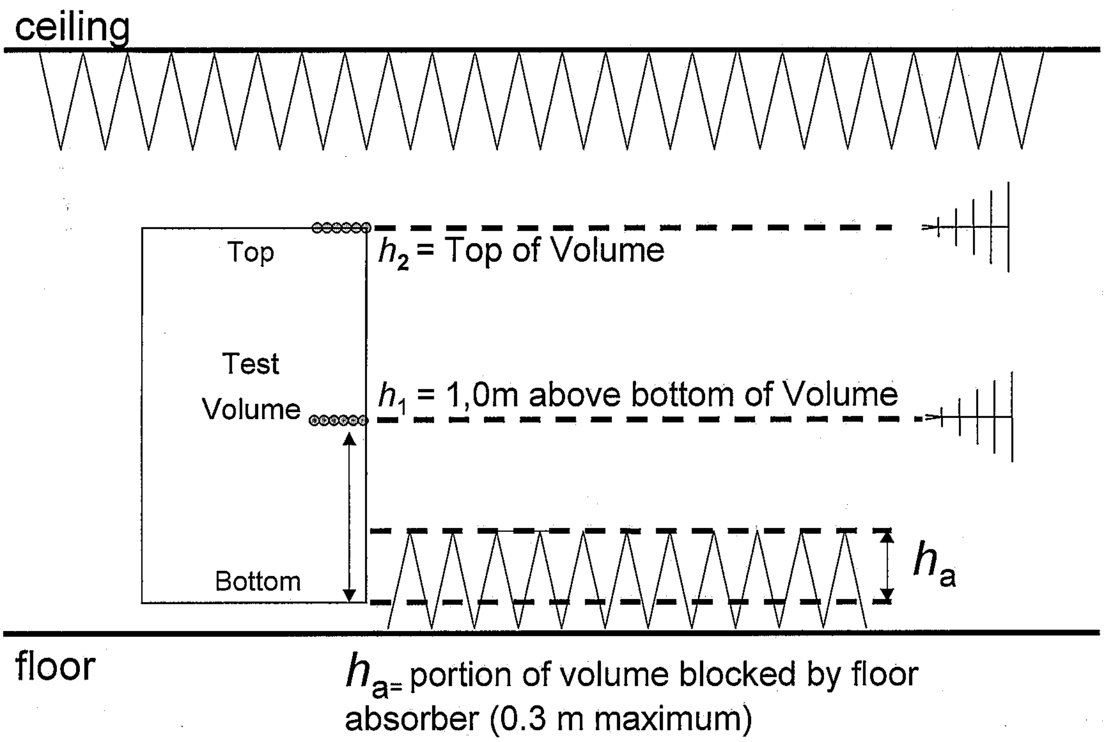


Figure XX.4 Notes :

h_a : The portion of the test volume that is be obstructed by absorber placed on the floor. (30 cm maximum)

h_1 : This height is located at the middle of the test volume, or 1.0 meter above the bottom of the Test Volume, whichever is lower.

h_2 : This height is located at the top of the test volume and is required to be tested when h_2 is separated by at least 0.5 m from h_1 (see section 8.2.2.5 for details).

The following Table YY.2 provides a summary of the test positions. The positions are grouped in Table YY.2 according to height (h_1, h_2) and location (front, left, right, center). For each location, a reference position is named for use in calculations required by equation ZZ.2