

TECHNICAL SPECIFICATION

IEC
TS 61587-3

First edition
1999-10

Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 –

Part 3: Electromagnetic shielding performance tests for cabinets, racks and subracks

*Structures mécaniques pour équipement électronique –
Essais pour la CEI 60917 et la CEI 60297 –*

*Partie 3:
Essais de fonctionnement de blindage électromagnétique
pour baies, bâts et bacs à cartes*



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CONTENTS

	Page
FOREWORD	3
Clause	
1 Scope and object	5
2 Normative references	5
3 Electromagnetic shielding performance tests	6
3.1 Electromagnetic shielding performance tests for cabinets and subracks	6
3.2 Test conditions	6
3.3 Test configuration	6
3.4 Test requirements	7
3.5 Test results	8
Figure 1 – Typical test equipment configuration (as detailed in figures 3 to 8)	9
Figure 2 – Example of measurement data presentation (typical graph showing plot from test results)	9
Figure 3 – Set-up for measurement of reference field strength E1	10
Figure 4 – Set-up for measurement of leakage field strength E2 (cabinet)	10
Figure 5 – Set-up for measurement of leakage field strength E2 (subrack)	10
Figure 6 – Set-up for measurement of reference field strength E1	11
Figure 7 – Set-up for measurement of leakage field strength E2 (cabinet)	11
Figure 8 – Set-up for measurement of leakage field strength E2 (subrack)	11
Table 1 – Electric field attenuation requirements	8

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MECHANICAL STRUCTURES FOR ELECTRONIC EQUIPMENT –
TESTS FOR IEC 60917 AND IEC 60297 –
Part 3: Electromagnetic shielding performance tests
for cabinets, racks and subracks**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 61587-3, which is a technical specification, has been prepared by subcommittee 48D: Mechanical structures for electronic equipment, of IEC technical committee 48: Electro-mechanical components and mechanical structures for electronic equipment.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
48D/151/CDV	48D/183/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that this publication remains valid until 2003.

At this date, in accordance with the committee's decision, the publication will be:

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

A bilingual version of this Technical Specification may be issued at a later date.

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MECHANICAL STRUCTURES FOR ELECTRONIC EQUIPMENT – TESTS FOR IEC 60917 AND IEC 60297 –

Part 3: Electromagnetic shielding performance tests for cabinets, racks and subracks

1 Scope and object

This part of IEC 61587 specifies the test of empty cabinets and subracks concerning electromagnetic shielding performance, in the frequency range of 30 MHz to 1 000 MHz. Stipulated attenuation values are chosen for the definition of the shielding performance level of cabinets and subracks as per the IEC 60297 and IEC 60917 series. The shielding performance level of the referenced product will support the measures to achieve electromagnetic compatibility of the finished equipment but cannot replace final testing of compliance.

The purpose of this technical specification is to ensure physical integrity and environmental performance in cabinets and subracks, taking into account the need for different levels of performance in different applications. It is intended to give the user a level of confidence in the selection of products to meet his specific needs. This specification, in whole or part, applies only to the mechanical structures for electronic equipment practices according to IEC 60297 and IEC 60917, and does not apply to electronic equipment or systems.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61587. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61587 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60297-1:1986, *Dimensions of mechanical structures of the 482,6 mm (19") series – Part 1: Panels and racks*

IEC 60297-2:1982, *Dimensions of mechanical structures of the 482,6 mm (19") series – Part 2: Cabinets and pitches of rack structures*

IEC 60297-3:1984, *Dimensions of mechanical structures of the 482,6 mm (19") series – Part 3: Subracks and associated plug-in units*

IEC 60297-4:1995, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19") series – Part 4: Subracks and associated plug-in units – Additional dimensions*

IEC 60917-1:1998, *Modular order for the development of mechanical structures for electronic equipment practices – Part 1: Generic standard*

IEC 60917-2:1992, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice*

IEC 60917-2-1:1993, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 1: Detail specification – Dimensions for cabinets and racks*

IEC 60917-2-2:1994, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 2: Detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 61000-4-3:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test*

CISPR 16-1:1993, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

3 Electromagnetic shielding performance tests

3.1 Electromagnetic shielding performance tests for cabinets and subracks

Various levels of shielding performance can be achieved depending upon the construction of the cabinet or subrack. Although shielding performance measurements are of limited value in predicting the final overall system performance, consistent measurement techniques are vital to ensure any measure of repeatability. The test result is valid only for the measured cabinet or subrack and the result cannot be used to compare different cabinets or subracks. The following test technique shall be used for all shielding performance testing. The aim of this technical specification is to provide comparable shielding performance testing results from one test laboratory to another (see IEC 61000-4-3).

3.2 Test conditions

All testing shall be performed in a semi-anechoic or full anechoic chamber, or open field test site as illustrated in the figures. When the semi-anechoic chamber or the open field test site is used, the chamber shall meet the vertical and horizontal site attenuation test described in CISPR 16-1.

3.3 Test configuration

3.3.1 Calibration of the reference antenna

The purpose of calibration is to check the characteristics of the reference antenna, which are the output level of the transmitting antenna and the sensitivity level of the receiving antenna.

The test shall be performed by setting the transmitting antenna facing the receiving antenna.

The direction of the transmitting antenna is at 0° and the radiated field strength is maximum. The height of the transmitting antenna shall be set at 1,1 m.

The receiving antenna shall be positioned 1 m high and 3 m in distance from the transmitting antenna. The frequency is 100 MHz and 500 MHz.

Calibration shall be made using both horizontal and vertical antenna polarities.

3.3.2 Transmitting antenna

The transmitting source shall be a spherical dipole antenna (SDA) or similar (see note 3 in 3.5). The size of the transmitting antenna should be equal to or smaller than 150 mm in diameter.

The transmitting antenna link to the outside of the test specimen shall be such that the shielding integrity of the test specimen shall not be effected.

3.3.3 Receiving antenna

The receiving antenna shall be of one of the following types:

- 30 MHz to 200 (300) MHz: biconical antenna;
- 200 (300) MHz to 1 000 MHz: log periodic antenna.

The change from the biconical antenna to the log periodic antenna may be at 200 MHz or 300 MHz (see note 1 in 3.5).

3.3.4 Reference measurements

Reference measurements E1 are made without the test specimen. The transmitting antenna shall be placed at the position in which it will be once the test specimen is present. The transmitting antenna shall be positioned at 3 m distance from the receiving antenna and the two antennas shall face each other in the same direction as that of the calibration.

Measurements shall use both horizontal and vertical polarities. The transmitting and receiving antennas shall be polarized in the same manner. Frequency sweeps shall be in increments not greater than 5 MHz between 30 MHz and 100 MHz, and not greater than 50 MHz between 100 MHz and 1 000 MHz. The receiving antenna shall be swept through heights of 1 m to 4 m. The greatest signal strength E1 for each frequency shall be recorded (see figures 3 and 6).

3.3.5 Transmitting antenna set-up

The transmitting antenna shall be placed in the centre inside of the test specimen, in the same direction as that of the reference measurement and suspended by non-conductive material (see note 1 in 3.5).

3.3.6 Test specimen set-up

In the case of a floor-standing cabinet, there shall be an insulation between the cabinet and the reference plane of the chamber of 100 mm ($\pm 5\%$). A table top test specimen shall be placed at a height of 800 mm ($\pm 5\%$) from the reference plane.

3.4 Test requirements

Measurements shall be made using both horizontal and vertical antenna polarities. Both transmitting and receiving antennas shall be polarized in the same manner. Frequency increment measurements shall be made.

The equipment under test shall be rotated 360° through its vertical axis (via a turntable or other means) and the maximum signal strength determined in increments of 90°, i.e. minimum four reading points.

Frequency sweeps shall be made in increments not greater than 5 MHz between 30 MHz and 100 MHz, and not greater than 50 MHz between 100 MHz and 1 000 MHz. The receiving antenna shall be swept through heights of 1 m to 4 m. The greatest signal strength E2 from the combined sweep of the turntable and antenna height shall be recorded for each frequency.

3.5 Test results

The cabinet shielding performance is the difference between the appropriate reference measurement (figure 3 or 6) and the associated measurement with the spherical dipole antenna within the cabinet or subrack. Refer to table 1 for the appropriate test results.

The shielding performance is calculated, in decibels, as the difference between E1 and E2.

NOTE 1 The distance between the spherical dipole antenna (SDA) and the receiving antenna is measured from the centre of the SDA to the centre of the biconical antenna or the front of the log periodic antenna.

NOTE 2 The minimum shielding performance excludes cavity resonance.

NOTE 3 This technical specification is based on the SDA. Other transmitting antennas may be used but equivalency to the SDA must be established.

Table 1 – Electric field attenuation requirements

Performance level	Minimum shielding performance	
	Frequency range 30 MHz to 230 MHz	Frequency range 230 MHz to 1 000 MHz
1	20 dB	10 dB
2	40 dB	30 dB
3	60 dB	50 dB

Attenuation requirements are based upon the final subrack/cabinet configuration with all vents, panels, openings, etc., present. For a definition of the minimum shielding performance, see note 2 above.

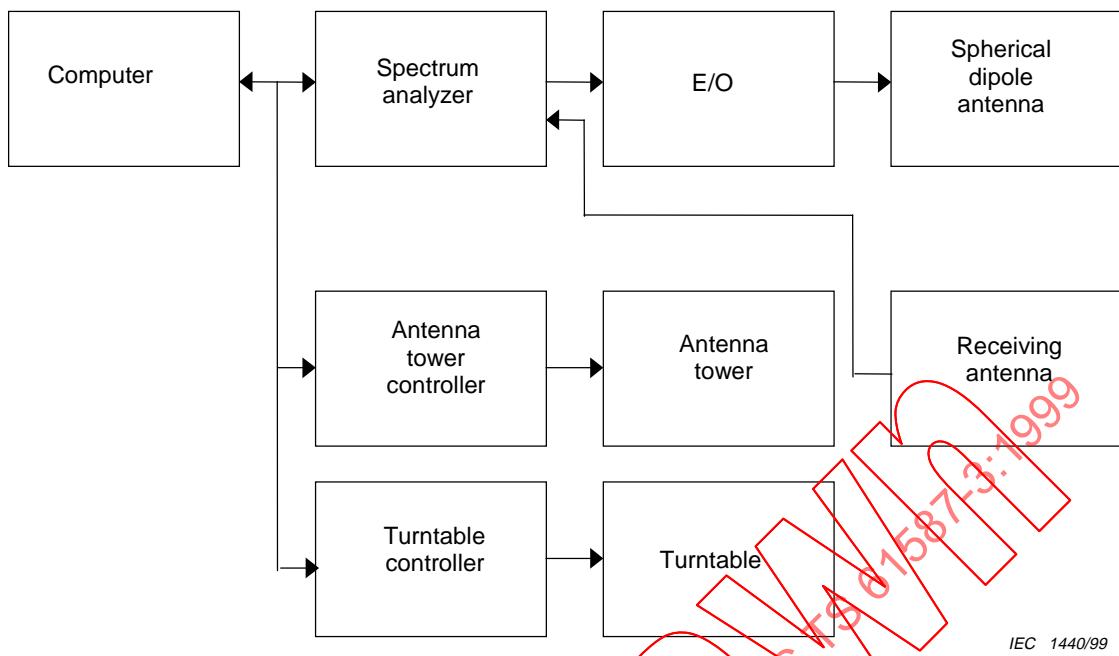


Figure 1 – Typical test equipment configuration (as detailed in figures 3 to 8)

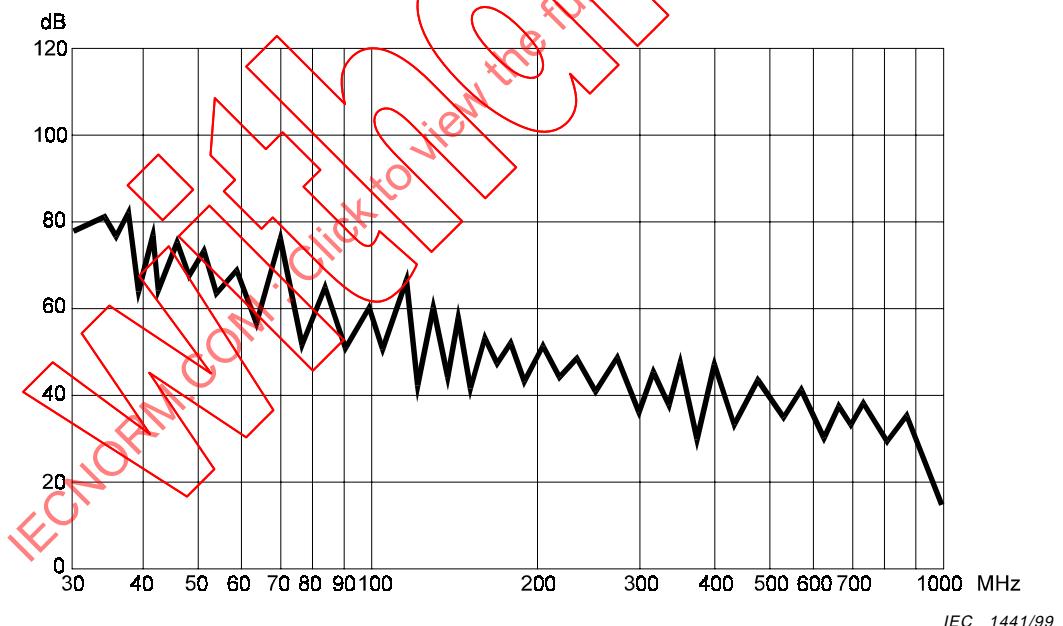


Figure 2 – Example of measurement data presentation
(typical graph showing plot from test results)

3.5.1 Open field test sites

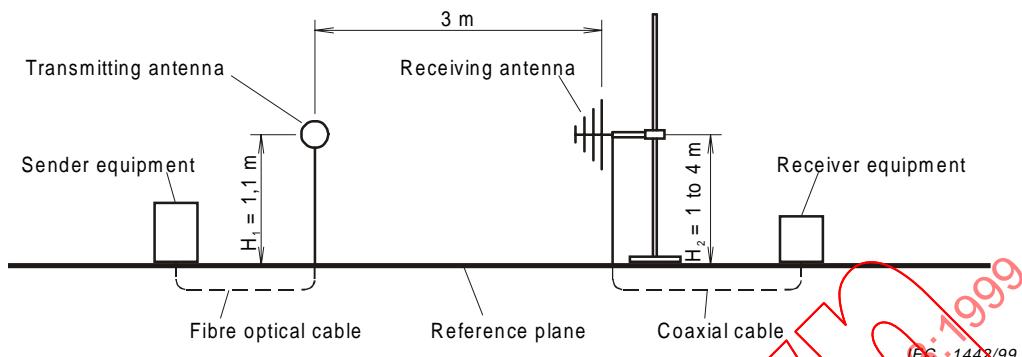


Figure 3 – Set-up for measurement of reference field strength E1

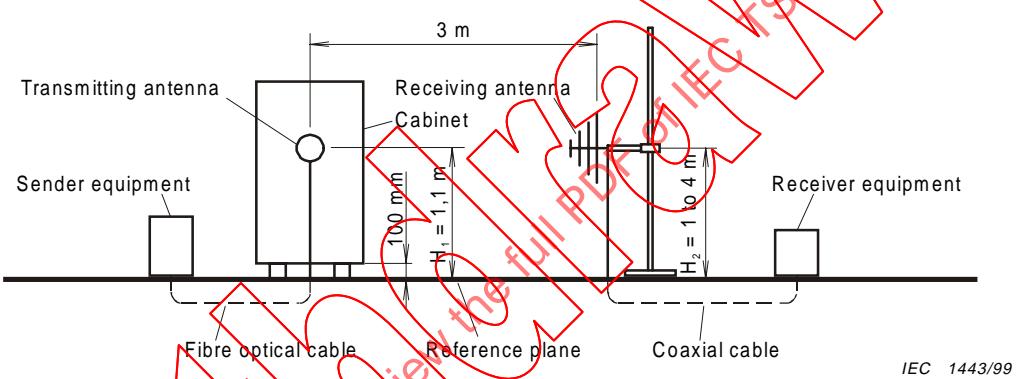


Figure 4 – Set-up for measurement of leakage field strength E2 (cabinet)

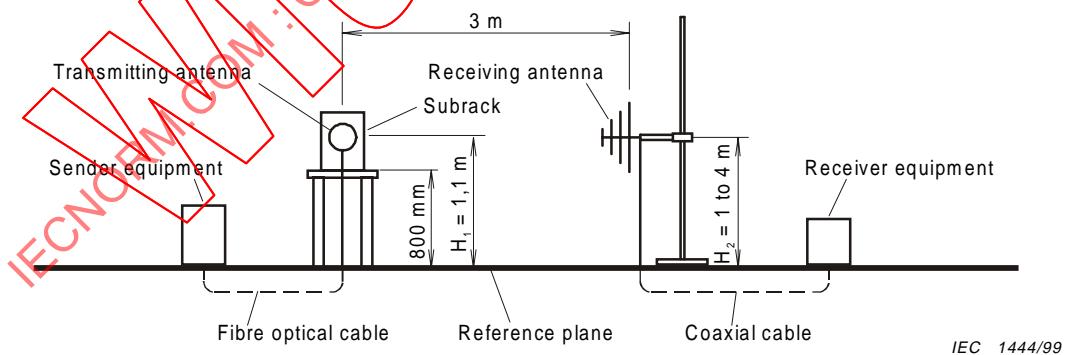


Figure 5 – Set-up for measurement of leakage field strength E2 (subrack)

3.5.2 Semi-anechoic or full anechoic chambers

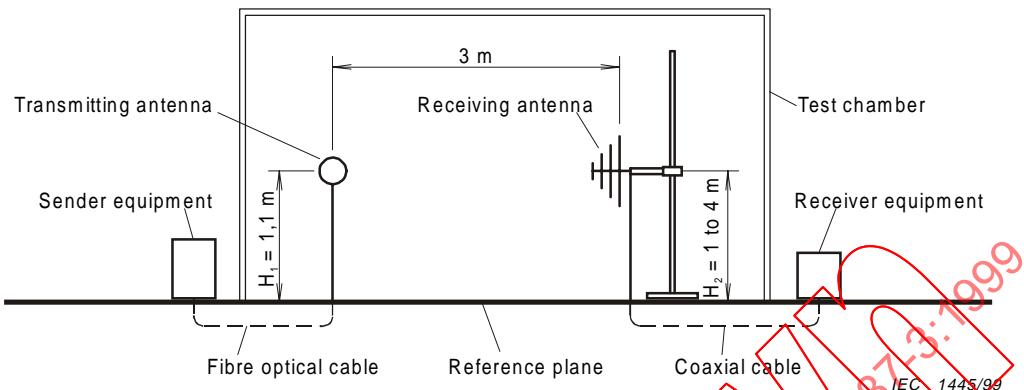


Figure 6 – Set-up for measurement of reference field strength E1

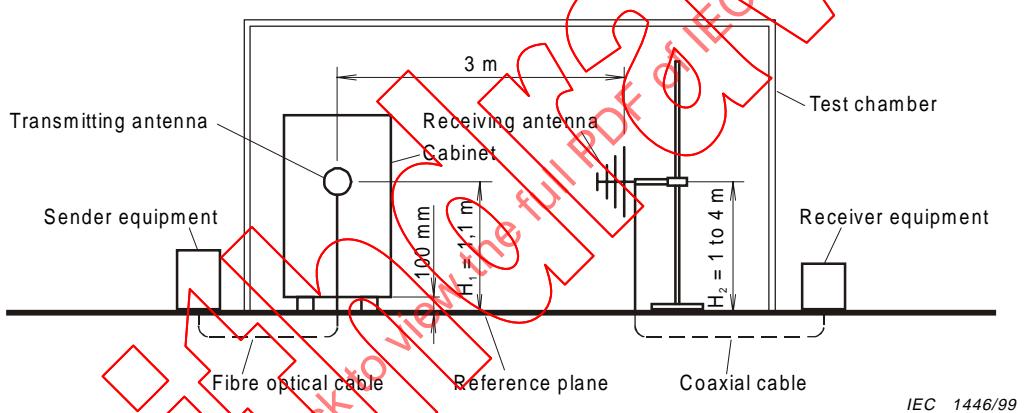


Figure 7 – Set-up for measurement of leakage field strength E2 (cabinet)

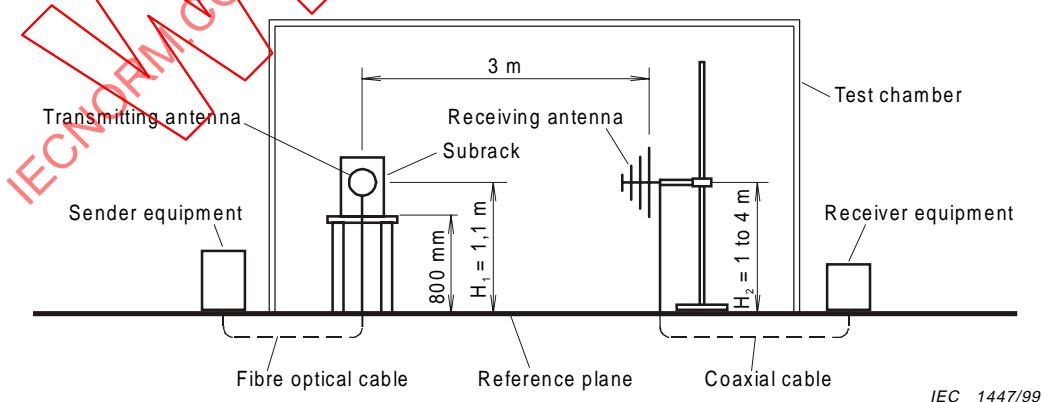


Figure 8 – Set-up for measurement of leakage field strength E2 (subrack)

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