



HELLENIC INSTITUTE OF METROLOGY  
EURAMET PROJECT No. 1364  
Bilateral comparison between EIM and IMBiH in voltage  
Calibration of Zener voltage standard of 10 V  
**TECHNICAL PROTOCOL**

Edition 7/10/2013

Page 1 of 9

**EURAMET PROJECT No. 1364**

**Bilateral comparison between EIM and IMBiH: Calibration of a  
Zener DC voltage standard of 10 V**

**Technical protocol**

**Table of Contents**

1.	Introduction .....	2
2.	Traveling standard and details of participants .....	2
3.	Organization .....	2
3.1.	Participants.....	2
3.2.	Travelling standard .....	3
3.3.	Time schedule .....	3
3.4.	Unpacking, handling, packing .....	4
3.5.	Financial aspects, insurance.....	4
4.	Conditions and methods of measurement .....	4
4.1.	Conditions.....	4
4.2.	Methods of Measurement .....	4
5.	Uncertainty .....	5
6.	Measurement report.....	5
7.	Final Report of the comparison (Pilot Lab) .....	5



**HELLENIC INSTITUTE OF METROLOGY**  
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Edition 7/10/2013

Page 2 of 9

## **1. Introduction**

The present intercomparison was proposed by the Institute of Metrology of Bosnia and Herzegovina (IMBiH), with the motive of supporting its CMCs in the quantity of voltage. The proposal was accepted by the laboratory of Low Frequency of the Hellenic Institute of Metrology (EIM), which assumes the role of the pilot lab. The scope of the intercomparison is the calibration of the 10 V output of a Zener type voltage standard which will be provided by IMBiH.

## **2. Traveling standard and details of participants**

The travelling standard will be a voltage standard of the Zener type provided by IMBiH. The voltage to be measured is the 10 V output of the Zener and the measurements will be performed by the two institutes EIM and IMBiH minimizing the time interval between them.

## **3. Organization**

### **3.1. Participants**

The pilot laboratory is:

#### **Pilot laboratory for the intercomparison:**

Low Frequency Laboratory  
Hellenic Institute of Metrology  
Ind. Area of Thessaloniki, Block 45  
Sindos 57022, Thessaloniki  
Greece

#### **EIM Contact person:**

Dr Myrto Holiastou  
Tel.: 2310 569 971, 2310-569999  
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e-mail: [holiastou@eim.gr](mailto:holiastou@eim.gr)



HELLENIC INSTITUTE OF METROLOGY  
EURAMET PROJECT No. 1364  
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**TECHNICAL PROTOCOL**

Edition 7/10/2013

Page 3 of 9

The participating institute is:

**Participating laboratory for the intercomparison:**

Institute of Metrology of Bosnia and Herzegovina (IMBiH)

Laboratory for electrical quantities and T&F

Augusta Brauna 2

71000, Sarajevo

Bosnia and Herzegovina

**IMBiH Contact person:**

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web: [www.met.gov.ba](http://www.met.gov.ba)

**3.2. Travelling standard**

The travelling standard has the following characteristics:

1. DC reference standard Zener

Manufacturer: **Fluke**

Type: **732B**

Serial number: **2231035**

2. External battery for DC standard Zener

Manufacturer: **Fluke**

Type: **732B-7001**

Serial number: **221002**

**3.3. Time schedule**

The time schedule for the bilateral comparison is given in the table below.



HELLENIC INSTITUTE OF METROLOGY  
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**TECHNICAL PROTOCOL**

Edition 7/10/2013

Page 4 of 9

Institute	Action	Date 2015	Document to send
IMBiH	Perform IMBiH measurements	15 June - 3 July	
IMBiH	Ship the travelling standard to EIM	6 July -8 July	Annex 2
EIM	Perform EIM measurements	13 July - 31 July	
EIM	Ship the travelling standard to IMBiH	3 August	
IMBiH	Receive the travelling standard		Annex 1

### 3.4. Unpacking, handling, packing

After arrival the travelling standard will be unpacked and inspected for possible damages. The indication light "INCAL" must be ON ensuring uninterrupted operation of the Zener. The form of Annex 2 should be completed and sent to the pilot lab. Should the travelling standard be damaged during the comparison the pilot laboratory must be informed immediately.

### 3.5. Financial aspects, insurance

This project is funded by the national metrology institute of Germany PTB, which covers the costs of the transport including insurance and customs formalities.


## 4 Conditions and methods of measurement

### 4.1. Conditions

After arrival in a laboratory the travelling standard should be allowed to stabilise at least one day before use. The ambient conditions for measurements are  $23\text{ °C} \pm 0.5\text{ °C}$  and relative humidity no greater than 70%.

### 4.2. Methods of Measurement

The pilot laboratory will use as method of measurement the comparison against the primary Josephson voltage standard. The participating laboratory can use any method and describe it in its results report. The traceability of the measurements must also be reported. For the estimation of the reproducibility, the measurements of both labs must be repeated in at least 5 different days in the time period of two weeks. Suggested number of repetitions is 10.

	<b>HELLENIC INSTITUTE OF METROLOGY</b> <b>EURAMET PROJECT No. 1364</b> <b>Bilateral comparison between EIM and IMBiH in voltage</b> <b>Calibration of Zener voltage standard of 10 V</b> <b>TECHNICAL PROTOCOL</b>	
	Edition 7/10/2013	Page 5 of 9

## 5. Uncertainty

The calculation and the report of the uncertainty must be done according to the method described in the international standard ISO "Guide to the Expression of Uncertainty in Measurement", 1995 and the standard EA-4/02. The expanded uncertainty is to be reported in the form of Annex 3.

## 6. Measurement report

The results of the participating laboratory should be reported to the pilot laboratory within *four weeks* after its measurements have been completed. The following should be sent:

- a) Report of the results in the form of a calibration certificate, which should include:
  - Description of the measurement method and the measurement setup
  - Traceability
  - Environmental conditions (Temperature, Humidity)
- b) Measurement results form (Annex 4)
- c) Uncertainty budget tables (Annex 3)

**It is preferable that the documents are sent electronically.**

## 7. Final Report of the comparison (Pilot Lab)

Within one month after completion of the measurements, the pilot laboratory will prepare a draft report and will send it to the participating laboratory for comments. Subsequently, the procedure outlined in the Euromet Guidelines will be followed.



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**TECHNICAL PROTOCOL**

Edition 7/10/2013

Page 6 of 9

**Receipt Form**

**Annex 1**

*To: Low Frequency Laboratory, EIM*

*Attention: Myrto Holiastou*

*Fax: 2310 569 996*

**Laboratory Name:** .....

The package was received in (date):

After a first inspection,

the package was found in: Good condition  With obvious damage

the INCAL led was: ON  OFF

**Comments:**

**Name of IMBiH Person Responsible:** .....

**Signature:** .....

Please, return this form immediately after the receipt of the package



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**TECHNICAL PROTOCOL**

Edition 7/10/2013

Page 7 of 9

**Send Form**

**Annex 2**

*To: Low Frequency Laboratory, EIM*

*Attention: Myrto Holiastou*

*Fax: 2310 569 996*

**Laboratory Name:** .....

The package was sent (date):

Name of courier company

Code of courier transport:

**Comments:**

**Name of IMBiH Person Responsible:** .....

**Signature:** .....

Please, return this form immediately after the transport of the package



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**TECHNICAL PROTOCOL**

Edition 7/10/2013

Page 8 of 9

**Annex 3**

**UNCERTAINTY BUDGET TABLE**

Quantity $X_i$	Estimate $x_i$	Relative standard uncertainty  $u(x_i)$	Probability distribution / method of evaluation (A, B)	Sensitivity coefficient  $c_i$	Relative uncertainty contribution  $u(R_i)$	Degree of freedom  $\nu_i$
$R_x$						
		Combined standard uncertainty:				
		Degrees of freedom:				
		Expanded uncertainty (coverage factor 95% ):				





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Edition 7/10/2013

Page 9 of 9

**Annex 4**

**RESULTS TABLE**

Date of measurement	Temperature	Humidity	Measurement result	Stdev