EUROPEAN STYLE MARKETS
INTEROPERABILITY TEST 2013
IEC 62325-451-4
AND IEC 62325-451-5

2013-12-16

VERSION 1.0
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REVISION HISTORY

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<th>Release</th>
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<th>Paragraph</th>
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<td></td>
<td>Document created</td>
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<td>1</td>
<td>2014-01-16</td>
<td></td>
<td>Review by WG EDI</td>
</tr>
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<td>0</td>
<td>2014-02-04</td>
<td></td>
<td>Approved by the Market Committee on 2014-02-04</td>
</tr>
</tbody>
</table>
REFERENCE DOCUMENTS

5. IEC 62325-451-5 draft CD: Problem statement and status request business processes, contextual and assembly models for European market.
ENTSO-E would like to begin by recognizing the work of the members of ENTSO-E Working Group EDI. The common information model (CIM) interoperability (IOP) test held in 2013 on the “European style market profile” would not have been possible without the harmonization work carried out by these experts.

ENTSO-E would like to acknowledge the persons who have contributed to make the ENTSO-E IOP test “European style market profile” a success; not all people who contributed can be named here. However, ENTSO-E would like to give special recognition to:

- Maurizio Monti (RTE), Ioannis Daoutidis and Ioannis Retsoulis (ENTSO-E), in relation to the IOP test, for directing and witnessing it, preparing the test procedure, drafting the final report and advertising it.
- ENTSO-E WG EDI members for drafting, reviewing and supporting the work on IEC 62325 “European style market profile” standards;
- Antonio Lopez (ENTSO-E) for hosting in ENTSO-E premises on the 2013-12-16/17 the IOP tests on IEC 62325-451-4 and IEC 62325-451-5.
- Chavdar Ivanov (ENTSO-E) for his support to advertise the IOP test.
- For providing XML instances of ENTSO-E Settlement, Problem Statement and Status Request documents, so that the IOP test be carried out:
  - Julien Gaudin, (RTE)
  - Gunter Schlesinger (swissgrid)
  - Benoit Marie and Mathieu Mann (Alstom)

In addition, ENTSO-E acknowledges IEC TC 57 Chairman, Thierry Lefèbvre, and IEC TC 57 WG16 members that provided assistance and supported ENTSO-E work and IOP test in various ways.
Executive Summary

ENTSO-E conducted on 2013-12-16/17 the fourth IOP test on the CIM extension for the electricity market (IEC 62325), in its premises.

The test aimed to demonstrate that the IEC 62325-451-4 and IEC 62325-451-5 standards satisfy the information requirements for the settlement and reconciliation process, the problem statement and the status request processes in the European style market profile.

The test assessed the compliance of work carried out in IEC 62325-451-4 and IEC 62325-451-5 versus the business requirements defined by ENTSO-E’s settlement, problem statement and status request processes. Its main objective was to determine whether current ENTSO-E compliant XML instances related to these three different documents can be processed using the XML Schema Definitions (XSD) defined in IEC 62325-451-4 and IEC 62325-451-5.

This “proof of concept” was a success, it can thus be stated that:

- The work carried out on the IEC 62325-301, IEC 62325-351 and IEC 62325-451-4 and IEC 62325-451-5 is in line with the business requirements;

- There is no deficiency in the standards;

- The standard versions include all the capability needed to support the already implemented exchanges for the settlement and reconciliation process, the problem statement and the status request processes in the European style market profile.
1. **INTRODUCTION**

1.1 **ABOUT ELECTRICITY MARKET INTEROPERABILITY (IOP) TEST**

On 2013-10-17, an announcement was published on ENTSO-E web site stating that an IOP test on IEC 62325-451-4 and IEC 62325-451-5 will be carried out in December 2013 and that the registration had opened. The objectives of this IOP test were the same as for all the previous IOP tests on electricity market, i.e. to assess the compliance of the standards with the business requirements. For this IOP test, and for all interested parties, ENTSO-E has allocated a dedicated generic e-mail address for contact purposes, iop.cim_market@entsoe.eu.

On 2013-12-16/17, ENTSO-E conducted a common information model (CIM) IOP test of the IEC 62325-451-4 and IEC 62325-451-5 standards in ENTSO-E premises.

This IOP test is the fourth one carried out on CIM extension for electricity market (IEC 62325).

Currently, the IEC 62325 series of standards is composed of:

- IEC 62325-450 “Profile and context modelling rules” in IS\(^1\) status;
- IEC 62325-301 “Common information model (CIM) extensions for market” in CDV\(^2\) status;
- IEC 62325-351 “CIM European market model exchange profile” in IS status;
- IEC 62325-451-1 “Acknowledgement business process and contextual model for CIM European market” in IS status;
- IEC 62325-451-2 “Scheduling business process and contextual models for CIM European market” in CDV status;
- IEC 62325-451-3 “Transmission capacity allocation business process (explicit or implicit auction) and contextual models for European market” in CDV status;
- IEC 62325-451-4: Settlement and reconciliation business process, contextual and assembly models for European market in CD\(^3\) status;

Business processes either already defined (Reserve Resource Process, etc.) or under development by ENTSO-E, such as the ones for market transparency (European Regulation on Market Integrity and Transparency – REMIT – Regulation 1227/2011 and on submission

\(^1\) IS International Standard

\(^2\) CDV: Committee Draft for vote

\(^3\) CD: Committee Draft
and publication of data in electricity market - Regulation 543/2013), will be developed based on the profile defined in IEC 62325-351 standards.

1.2 ENTSO-E INVOLVEMENT

Interest of European TSOs in CIM started before the establishment of ENTSO-E. In particular, the following activities were carried out in a former European TSOs organization, i.e. UCTE (Union for Co-ordination of Transmission of Electricity):

- Work on IEC 61970-301, “Common information model”, IEC 61970-452, “CIM static transmission network model profiles” and IEC 61970-552-4 “CIM XML model exchange format” for the UCTE CIM model exchange profile;
- CIM IOP tests organized by UCTE, directed by EPRI and hosted by RTE in March 2009.

In 2009, ENTSO-E and all its members strongly expressed their intention to implement the international standards of the International Electrotechnical Commission (IEC) Technical Committee 57 on “Power systems management and associated information exchange” and in particular the common information model (CIM) as well as to promote their wider development and usage across industry.

Liaisons were officially established with:
- IEC TC 57 Working Group 13 “Energy management system application program interface”,
- IEC TC 57 Working Group 16 “Deregulated energy market communication”.

ENTSO-E is also a member of Electric Power Research Institute (EPRI) where it is working on the development of “CIM for Dynamics”, i.e. to extend CIM to dynamic modelling of the power system.

The ENTSO-E support is founded:
- not only on a strong cooperation of ENTSO-E experts within the IEC TC 57 Working Groups and in particular:
  - Working Group 13 on IEC 61970;
  - Working Group 10 “Power system IED communication and associated data models” on IEC 61850;
  - Working Group 16 on IEC 62325.
- but also, on the organisation by the ENTSO-E Secretariat of IOP Tests to demonstrate the compliance of off-the-shelf products with these standards and in particular with the CIM European profiles

In July 2010, ENTSO-E led and conducted its first CIM IOP test on IEC 61970 and in particular on CIM-based data exchange format.

Since 2010, ENTSO-E carried out every year IOP tests on IEC 61970.
In 2012, for the first time, ENTSO-E led and conducted its first IOP test on IEC 62325 series and since then, four IOP tests on IEC 62325 CIM market extension have already been conducted.
2. IOP TEST PROCEDURE

2.1 OBJECTIVE OF THIS IOP TEST

The IEC TC 57 series IEC 62325 covers the needs for market exchanges, and IEC 62325-301 describes the CIM (common information model extensions for market).

The parts related to “European style market profile”, i.e. IEC 62325-351 and IEC 62325-451-n, contribute to the further development of the IEM (Internal European Market) by actively supporting market harmonization.

The objective of this IOP test for market exchanges is to demonstrate that:

- The IEC 62325-451-4 standard satisfies the information requirements for settlement business process in the European style market profile.
- The IEC 62325-451-5 standard satisfies the information requirements for the problem statement and status request business processes in the European style market profile.

As these processes are already operational within the European markets, this IOP test provides a unique opportunity:

- to identify any deficiencies in the standard,
- to assess that the standard versions of IEC 62325-451-4 and IEC 62325-451-5 include all the capability needed to support the already implemented exchanges.

This IOP test will also enable to validate the development carried out and to finalise the comments for the IEC 62325-451-4 and IEC 62325-451-5 documents in CD status in order to improve the standards and also their acceptance for all the market participants in Europe.

In short, this IOP test on “European style market profile” is a “proof of concept” of the development carried out within the CIM.

2.2 IOP TEST PROCEDURE

To evaluate the conformity of the standard the following IOP test procedure was defined4:

- Step 1: From a set of XML ENTSO-E document instances, do the following checks using the relevant schema, core-components and codelist:
  - Well-formedness of the XML instance,
  - Validity of the XML instance.
- Step 2: Review any errors found, perform diagnosis and correct them.
- Step 3: Validate the corrected set of XML instances following step 2.

---

4 XML ENTSO-E document instances is one of the following types: settlement, status request and problem statement.
Step 4: Transform the set of XML ENTSO-E document instances with the corrections applied in step 2 into a set of XML CIM IEC 62325 instances.

Step 5: On the XML CIM IEC 62325 instances generated at step 4, do the following checks using the relevant IEC schema and codelist:

- Well-formedness of the XML instance;
- Validity of the XML instance.

Step 6: Review any errors found, perform diagnosis and correct them.

Step 7: Validate the corrected set of XML instances following step 6.

### 2.3 IOP TEST TOOLS

The tools used to carry out the IOP test are:

- Altova XMLSpy Standard Edition 2013 release 2, [http://www.altova.com/xmlspy.html](http://www.altova.com/xmlspy.html), for the XSLT transformations (step 4), i.e. to convert an ENTSO-E XML instance into the corresponding EIC 62325 XML instance;

- XML ValidatorBuddy Desktop version 4.4, [http://xml-tools.com](http://xml-tools.com), for well-formedness and validity of the XML instance versus the relevant schema (step 1, 3, 5 and 7).

As XMLSpy tool stops at each encountered error, it was thus more efficient to use a tool enabling the identification of all errors in a single run. This feature is provided by XML ValidatorBuddy.

The IOP test procedure as defined in §2.2 was carried out as follows:

#### Step 1
1. For a received set of XML ENTSO-E document instances, open with XML ValidatorBuddy the corresponding folder, assign the relevant ENTSO-E XSD schema:

**Figure 1:** Open folder of ENTSO-E XML instances
### Detailed procedure

1. **Open a folder of XML instances with namespace with XML ValidatorBuddy:**

   ![Figure 2: Detailed view of XML instances 1/2](image)

   ![Figure 3: Detailed view of XML instances 2/2](image)
<table>
<thead>
<tr>
<th>Step</th>
<th>Detailed procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3. Then validate using XML ValidatorBuddy.</td>
</tr>
</tbody>
</table>

![Figure 4: Validation using XML ValidatorBuddy](image1.png)

1. Display the errors identified by XML ValidatorBuddy

![Figure 5: Error message on XML instances](image2.png)
<table>
<thead>
<tr>
<th>Step</th>
<th>Detailed procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5. Generate a batch run with XML ValidatorBuddy</td>
</tr>
<tr>
<td>2</td>
<td>Correct any errors detected in the set of XML instances.</td>
</tr>
<tr>
<td>3</td>
<td>Validate the corrected ENTSO-E XML instances with XML ValidatorBuddy, if needed.</td>
</tr>
<tr>
<td>4</td>
<td>Transform the set of corrected XML ENTSO-E document instances into a set of XML CIM IEC 62325 document instances using XML Spy.</td>
</tr>
<tr>
<td>Step</td>
<td>Detailed procedure</td>
</tr>
<tr>
<td>------</td>
<td>--------------------</td>
</tr>
<tr>
<td>5</td>
<td>Validate the CIM XML instances with the relevant IEC XSD using XML ValidatorBuddy.</td>
</tr>
<tr>
<td>6</td>
<td>Correct any errors detected in the set of XML instances.</td>
</tr>
<tr>
<td>7</td>
<td>Validate the corrected CIM XML instances with XML ValidatorBuddy, if needed.</td>
</tr>
</tbody>
</table>
3. IOP TEST RESULTS

3.1 OVERVIEW OF THE IOP TEST

The IEC 62325-451-3 IOP test was carried out on the XML instances provided by:

- Swissgrid, Swiss TSO;
- RTE, French TSO;
- Alstom, SCADA/EMS/MMS software provider.

The results of this IOP test on IEC 62325-451-4 and IEC 62325-451-5 are summarized in the following table:

<table>
<thead>
<tr>
<th>Documents (ESP, ESPD, ESR)</th>
<th>ENTSO-E XML instances</th>
<th>IEC XML instances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well-formedness</td>
<td>Validity</td>
</tr>
<tr>
<td>swissgrid</td>
<td>😞</td>
<td>😞</td>
</tr>
<tr>
<td>RTE</td>
<td>😞</td>
<td>😞</td>
</tr>
<tr>
<td>Alstom</td>
<td>😞</td>
<td>😞</td>
</tr>
</tbody>
</table>

Legend: 😞: Test is successful, 😞: Test is not successful

The detail results and the errors issued by XML ValidatorBuddy are to be found in §4.1.

It can be stated that:

- the work carried on the IEC 62325-451-4 and IEC 62325-451-5 are in line with the business requirements;
- there is no deficiency in the standard;
- The standard versions include all the capability needed to support the already implemented exchanges for the settlement, problem statement and status request business processes.

3.2 DETAILED REVIEW OF ERRORS FOUND

The following table provides the list of all errors found during the IOP test and the development of the XSLT to transform the XML instances:
<table>
<thead>
<tr>
<th>Description of error</th>
<th>Correction applied</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settlement – Three submitted documents were not based on the ENTSO-E schema for the settlement process, i.e. RgceSettlementDocument and Measurement ValueDocument</td>
<td>None</td>
<td>Out of scope.</td>
</tr>
<tr>
<td>Problem statement document – Use of milliseconds in the DateTime attribute</td>
<td>Replace 2013-01-01T00:00.000Z with 2013-01-01T00:00Z</td>
<td>The XML instance shall respect the XSD syntax.</td>
</tr>
<tr>
<td>Status Request document – Use of milliseconds in the DateTime attribute</td>
<td>Replace 2013-01-01T00:00.000Z with 2013-01-01T00:00Z</td>
<td>The XML instance shall respect the XSD syntax.</td>
</tr>
</tbody>
</table>
4. ANNEX – XML Validator Buddy Outputs

4.1 Errors detected in ENTSO-E XML instances

The well-formedness and validity checks were carried out; the results are provided in the following table:

### 4.1.1 Settlement

Three XML instances were not processed, as they were not corresponding to the Settlement report document.

### 4.1.2 Problem Statement

No error was found on the instances.

### 4.1.3 Status Request

<table>
<thead>
<tr>
<th>XML instance name</th>
<th>valid</th>
<th>line</th>
<th>Error Description</th>
<th>Error Description</th>
<th>Action/Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESR3010361265.xml</td>
<td>FALSE</td>
<td>2</td>
<td>The XML instance is based on version 1 Release 1 of status request schema and not version 2 Release 0.</td>
<td>Convert XML instance from version 1 to version 2.</td>
<td></td>
</tr>
<tr>
<td>ESR3029823526.xml</td>
<td>FALSE</td>
<td>2</td>
<td>The XML instance is based on version 1 Release 1 of status request schema and not version 2 Release 0.</td>
<td>Convert XML instance from version 1 to version 2.</td>
<td></td>
</tr>
</tbody>
</table>

4.2 Validation of corrected ENTSO-E XML instances

Once the corrections have been applied, the status of the ENTSO-E XML instances is as follows:

<table>
<thead>
<tr>
<th>Document</th>
<th>XML instance name</th>
<th>Date and Time of Test</th>
<th>Valid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settlement</td>
<td>EAR-MAND-2.xml</td>
<td>12/16/13 09:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Settlement</td>
<td>EARMeterData.xml</td>
<td>12/16/13 09:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Settlement</td>
<td>SOAM_10YIT-GRTN----B_10YFR-RTE-------C_002.xml</td>
<td>12/16/13 09:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Settlement</td>
<td>SOVA_10YFR-RTE-----C_10YBE---------2_001.xml</td>
<td>12/16/13 09:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Problem Statement</td>
<td>EPSD312454821.xml</td>
<td>12/16/13 10:20:14</td>
<td>TRUE</td>
</tr>
<tr>
<td>Status Request</td>
<td>ESR3010361265.xml</td>
<td>12/16/13 10:59:02</td>
<td>TRUE</td>
</tr>
<tr>
<td>Status Request</td>
<td>ESR3029823526.xml</td>
<td>12/16/13 10:59:02</td>
<td>TRUE</td>
</tr>
<tr>
<td>Status Request</td>
<td>REQ_12XBMW-HANDELEX_10XFR-RTE------Q_1518.xml</td>
<td>12/16/13 10:59:02</td>
<td>TRUE</td>
</tr>
</tbody>
</table>
4.3  **CHECK TRANSFORMED IEC XML INSTANCES**

The XSLT transform was applied and the resulting files were checked versus the IEC schema.

The detailed information is provided in the following table:

<table>
<thead>
<tr>
<th>XML instance name</th>
<th>valid</th>
<th>line</th>
<th>Error Description</th>
<th>Error</th>
<th>Action/Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPSD31245482_1.xml</td>
<td>FALSE</td>
<td>16</td>
<td>Use of milliseconds in the attribute</td>
<td>&lt;expected_MarketDocument.createdDateTime&gt;2014-02-13T13:00:00.000Z/&gt;</td>
<td>&lt;expected_MarketDocument.createdDateTime&gt;2014-02-13T13:00:00:000Z/&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Expected_MarketDocument.type</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3.2 **STATUS REQUEST**

<table>
<thead>
<tr>
<th>XML instance name</th>
<th>valid</th>
<th>line</th>
<th>Error Description</th>
<th>Error</th>
<th>Action/Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESR3029823526.xml</td>
<td>FALSE</td>
<td>9</td>
<td>Use of milliseconds in the attribute</td>
<td>&lt;CreationDateTime v=&quot;2012-01-03T13:00:00.000Z&quot;/&gt;</td>
<td>&lt;CreationDateTime v=&quot;2012-01-03T13:00:00:000Z&quot;/&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CreationDateTime</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3.3 **FINAL STATUS OF XML INSTANCES AFTER CORRECTIONS**

<table>
<thead>
<tr>
<th>Document</th>
<th>XML instance name</th>
<th>Date and Time of Test</th>
<th>Valid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settlement</td>
<td>EAR-MAND-2.xml</td>
<td>12/16/13 11:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Settlement</td>
<td>EARMeterData.xml</td>
<td>12/16/13 11:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Settlement</td>
<td>SOAM_10YIT-GRTN--B_10YFR-RTE------C_002.xml</td>
<td>12/16/13 11:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Settlement</td>
<td>SOVA_10YFR-RTE------C_10YBE--------2_001.xml</td>
<td>12/16/13 11:26:04</td>
<td>TRUE</td>
</tr>
<tr>
<td>Problem Statement</td>
<td>EPSD312454821.xml</td>
<td>12/16/13 12:20:14</td>
<td>TRUE</td>
</tr>
<tr>
<td>Status Request</td>
<td>ESR3010361265.xml</td>
<td>12/16/13 13:59:02</td>
<td>TRUE</td>
</tr>
<tr>
<td>Status Request</td>
<td>ESR3029823526.xml</td>
<td>12/16/13 13:59:02</td>
<td>TRUE</td>
</tr>
<tr>
<td>Status Request</td>
<td>REQ_12XBKW-HANDEL--X_10XFR-RTE------Q_1518.xml</td>
<td>12/16/13 13:59:02</td>
<td>TRUE</td>
</tr>
</tbody>
</table>
5. **ANNEX-LIST OF FOLDERS AND XML INSTANCES**

All the files used to carry out the IOP test (except the XMLSpy tool and XML ValidatorBuddy) are available on the ENTSO-E website, EDI Library page, section “CIM Market IOP”.

A zip file containing the information described hereafter is included.

### 5.1 CONTENT OF THE ZIP FILE

The zip file structure is the following one:

- **20131216_IOP**
  - 451-4
  - 451-5
  - CIM
  - ENTSOE
  - ENTSOE XML instances
  - XSLT

- **20131216_IOP\451-4**
  - EAR
    - Problem Statement
    - Status Request

- **20131216_IOP\451-5**
  - EAR
    - Problem Statement
    - Status Request

Example of the structure of one folder

- **20131216_IOP\451-4\EAR**
  - CIM_version
  - ENTSOE-E_input
  - ENTSOE-E_input

The XML instances after the XSLT transformation from ENTSOE-E to CIM

The ENTSOE-E XML instances including the corrections to validate them (input of XSLT transformation).

The erroneous ENTSOE-E XML instances.

Folder of ENTSOE-E XML instances
6. **ANNEX – XSLT USED TO CARRY OUT THE CONVERSION**

The stylesheets used to convert an ENTSO-E XML instance into an IEC 62325 XML instance can be found on the following page: