

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.1101

(03/2014)

SERIES L: CONSTRUCTION, INSTALLATION AND
PROTECTION OF CABLES AND OTHER ELEMENTS OF
OUTSIDE PLANT

Measurement methods to characterize rare metals in information and communication technology goods

Recommendation ITU-T L.1101

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Measurement methods to characterize rare metals in information and communication technology goods

Summary

Information and communication technology (ICT) goods, which consist of many parts and modules, are comprised of relatively small quantities of rare metals and larger quantities of major materials (e.g., iron, nonferrous metals, plastics, glasses, and engineering ceramics). They are usually produced through complex production procedures. To achieve successful recycling systems, the rare metals information provided by manufacturers should be accurate. However, many measurement and characterization methods may be used to obtain information on rare metals for elements of ICT goods. Each method has its own intrinsic advantages and disadvantages in the analysis of the information of such elements.

The element separation capabilities and quantitative resolutions differ according to the measurement methods used and there are no standardized measurement methods to define the quantities and qualities of rare metals. However, IEC 62321 provides some guidelines for X-ray fluorescence (XRF) and inductively coupled plasma mass spectrometry (ICP-MS) measurement methods to perform qualitative and quantitative analysis of unknown samples and harmful materials.

Based on the guidelines of IEC 62321, Recommendation ITU-T L.1101 provides reference characterization procedures for efficient recycling of rare metals by using XRF and ICP-MS measurement methods.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T L.1101	2014-03-22	5	11.1002/1000/12134

Keywords

Climate change, element measurement, ICT goods, quantitative resolution, rare metals.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Measurement methods to characterize rare metals in information and communication technology goods

1 Scope

This Recommendation explains the measurement methods for rare metals contained in Information and Communication Technology (ICT) goods. The measurement method may affect the interpretation of the results.

This Recommendation specifies measurement methods to determine types and associated quantities of the rare metals of ICT goods.

This Recommendation covers:

- an overview of rare metals measurements;
- the reference rare metals recycling procedure; and
- recommended measurement methods of rare metals of ICT goods.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T L.1100] Recommendation ITU-T L.1100 (2012), *Procedure for recycling rare metals in information and communication technology goods*.

[IEC 62321] IEC 62321 ed 1.0 (2008), *Electrotechnical Products – Determination of levels of six regulated substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers)*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 information and communication technology (ICT) goods [b-ITU-T L.1400]: The tangible products deriving from, or making use, of technologies devoted to, or concerned with (a) the study and application of data and the processing thereof; i.e., the automatic acquisition, storage, manipulation (including transformation), management, movement, control, display, switching, interchange, transmission or reception of a diversity of data; (b) the development and use of the hardware, software, and procedures associated with this delivery; and (c) the representation, transfer, interpretation, and processing of data among persons, places, and machines, noting that the meaning assigned to the data must be preserved during these operations.

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4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

At%	Atomic per-cent
AED	Atomic Emission Detector
AES	Auger Electron Spectroscopy
CD-ROM	Compact Disk – Read-Only Memory
EDS	Energy Dispersive X-ray Spectroscopy
FTIR	Fourier Transform Infrared spectroscopy
HF	Hydrofluoric
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometer
ICT	Information and Communication Technology
LA	Laser Ablation
LA-ICPMS	Laser Ablation Inductively Coupled Plasma Mass Spectrometry
LCD	Liquid Crystal Display
LEXES	Low Energy X-ray Emission Spectrometry
PC	Personal Computer
PCB	Printed Circuit Board
ppm	parts per million
ptt	parts per trillion
RBS	Rutherford Backscattering Spectrometry
SEM	Scanning Electron Microscopy
SIMS	Secondary Ion Mass Spectrometry
STEM	Scanning Transmission Electron Microscopy
TOF-SIMS	Time-of-flight Secondary Ion Mass Spectrometry
TXRF	Total reflection X-Ray Fluorescence
Wt%	weight per-cent
XPS/ESCA	X-ray Photoelectron Spectroscopy/Electron Spectroscopy for Chemical Analysis
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence
XRR	X-Ray Reflectivity

5 Introduction of rare metal measurement in ICT goods

5.1 Overview of rare metals in ICT goods

Rare metals are essential to obtain high performance and high functionality in ICT goods. As global awareness on environmental problems is on the rise, the concern in the ICT industry on the recycling of electric and electronic goods is increasing. Nowadays, there is an increased emphasis on the