

## Questionnaire 1 (Clarification) for Exemption III-15 (TMC)

### Current wording of the exemption III-15 series

Table 1: Currently valid wordings of exemptions III-15 and III-15(a)

No.	Current exemption wording	Current scope and dates of applicability
III-15	Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages	Applies to categories 8, 9 and 11. Expires on <ul style="list-style-type: none"> <li>- 21 July 2021 for category 8 other than in vitro diagnostic medical devices and category 9 industrial monitoring and control instruments;</li> <li>- 21 July 2023 for category 8 in vitro diagnostic medical devices;</li> <li>- 21 July 2024 for category 9 industrial monitoring and control instruments, and for category 11</li> </ul>
III-15(a)	Lead in solders to complete a viable electrical connection between the semiconductor die and carrier within integrated circuit flip chip packages where at least one of the following criteria applies: <ul style="list-style-type: none"> <li>- a semiconductor technology node of 90 nm or larger;</li> <li>- a single die of 300 mm<sup>2</sup> or larger in any semiconductor technology node;</li> <li>- stacked die packages with die of 300 mm<sup>2</sup> or larger, or silicon interposers of 300 mm<sup>2</sup> or larger.</li> </ul>	Applies to categories 1 to 7 and 10. Expires on 21 July 2021.

### Acronyms and Definitions

Cat.	Category, referring to the categories of EEE specified in Annex I of the current RoHS Directive 2011/65/EU
COM	European Commission
EEA	European Economic Area (EU 27 + Iceland, Liechtenstein and Norway)
EEE	Electrical and electronic equipment
EU	European Commission



- FCP          Flip chip package
- IMCI         Industrial monitoring and control instruments
- Lead-free    Not containing lead in the application in scope of the exemption to be reviewed

## 1. Background

Bio Innovation Service, UNITAR and Fraunhofer IZM have been appointed<sup>1</sup> by the European Commission through for the evaluation of applications for the review of requests for new exemptions and the renewal of exemptions currently listed in Annexes III and IV of the RoHS Directive 2011/65/EU.

TMC submitted a request for the renewal of the above exemption for cat. 9 industrial monitoring and control instruments (IMCI) with the wording, scope and validity period shown in the below table:

Table 2: Requested exemption renewal

No.	Requested exemption	Requested scope and dates of applicability
III-15	Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages	Applies to category 9 industrial monitoring and control instruments and expires on 21 July 2031 (2024 +7 years)

As result of a first review we identified that some information is missing. Against this background the questions below are intended to clarify some aspects concerning the request at hand.

We ask you to kindly answer the below questions until 27 September 2023 latest.

## 2. Questions

1. Could you please confirm that Table 2 correctly reflects the requested renewal of the exemption?

**TMC reply:**

TMC would like to reiterate that all submitted renewal applications, including the renewal application for RoHS exemption III-15, request the renewal of the exemption for category 9 industrial monitoring and control instruments in its existing wording with the subsequent maximum renewal period of 7 years.

<sup>1</sup> Implemented through the specific contract 070201/2020/832829/ENV.B.3 under the Framework contract ENV.B.3/FRA/2019/0017





Table 2 therefore correctly reflects TMC’s exemption renewal request.

2. In the last review by Deubzer et al. (2022)<sup>2</sup>, the applicants requested the renewal of exemption 15(a) in its current wording (see Table 1) for all categories of EEE, i.e. including cat. 9 IMCI. The applicants were of the opinion that cat. 9 IMCI can comply with the narrower and more specific scope of exemption 15(a). No scientific or technical objections were raised during the stakeholder consultation. If the renewal of the exemption for cat. 9 IMCI can be justified without infringing Art. 5(1)(a), we would recommend the COM the below wording and scope:

**Table 3: Renewal of exemption 15(a) for cat. 9 IMCI**

No.	Exemption	Scope and dates of applicability
15(a)	<p>Lead in solders to complete a viable electrical connection between the semiconductor die and carrier within integrated circuit flip chip packages where at least one of the following criteria applies:</p> <ul style="list-style-type: none"> <li>- a semiconductor technology node of 90 nm or larger;</li> <li>- a single die of 300 mm<sup>2</sup> or larger in any semiconductor technology node;</li> <li>- stacked die packages with die of 300 mm<sup>2</sup> or larger, or silicon interposers of 300 mm<sup>2</sup> or larger.</li> </ul>	<p>Applies</p> <ul style="list-style-type: none"> <li>- from [date of publication in Official Journal + 12 months + 1 day] on to cat. 9 industrial monitoring and control instruments</li> </ul> <p>Expires on 21 July [2024 + X]</p>

X ranges between > 0 to 7 years

Please let us know whether you agree to the above proposal. If not, please explain your objections.

**TMC reply:**

As outlined in the exemption renewal request and the annexed socio-economic analysis submitted to the European Commission by TMC on 20 January 2023, TMC **does not** agree with the proposal as outlined in table 3.

Exemption III-15 permits lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip-

<sup>2</sup> C.f. BIO IS, [https://rohs.biois.eu/RoHS\\_Pack-23\\_Report\\_Final\\_20221220.pdf](https://rohs.biois.eu/RoHS_Pack-23_Report_Final_20221220.pdf)

chip packages and is currently in force for Industrial Monitoring and Control equipment. Alternatives have entered the market in recent designs and a change to 15(a) restricting Pb-containing solder by die and node size has occurred.

**However, there are still a significant number of suppliers that have not investigated or implemented these changes.** *(Please see also the answer to questions 3(a)-(c)).*

3. Exemption 15 was reviewed by Deubzer et al. (2022)<sup>3</sup>. They recommended not to renew the exemption since stakeholders did not provide the information to justify the renewal in line with Art. 5(1)(a). The below main questions remained open:

**TMC reply** *(joint reply for sub-questions 3(a)-(c)):*

The T&M Coalition acknowledges that there are suitable alternatives available to substitute lead in solders for *new* components into newly designed instruments. Indeed, industry has demonstrated a strong commitment to developing lead-free flip-chip devices as new technologies become available.

However, while exemption 15 will be designed out over time as new lead-free components become available, a continuation of exemption 15 for category 9 industrial test and measurement instruments is still warranted as these lead-free components cannot be used for existing TMC products. Additionally, given the long lifetime of T&M instruments as well as the greater inventory of older parts used for the repair of products currently placed on the market, a discontinuation of exemption 15 for category 9 products would counter the logic of an increased circular economy and create avoidable EEE waste.

As further outlined in the submission documents, components which benefit from exemption 15 typically do not have form-fit-function drop-in replacements that are either lead-free or can benefit from exemption 15(a). Older product designs utilizing exemption 15 components would therefore need to be redesigned to match new component parameters, including a revised layout for PCB. Such changes require product-by-product projects to manage the change, including verification of each product against published performance specifications. (Please also refer to the submitted documents outlining the challenges related to substitution for TMC category 9 industrial products).

Taking additionally into account the socio-economic consequences of a non-renewal of exemption III-15, which is monetised in the range of 309 million and

<sup>3</sup> C.f. BIO IS, [https://rohs.biois.eu/RoHS\\_Pack-23\\_Report\\_Final\\_20221220.pdf](https://rohs.biois.eu/RoHS_Pack-23_Report_Final_20221220.pdf)



442 million EUR (please consult the submitted socio-economic analysis for details), TMC considers that a continuation of exemption III-15 is warranted in accordance with RoHS art. 5(1)(a).

a. First clause of exemption 15(a):

Flip chip packages (FCPs) with technology nodes larger than 90 nm are still placed on the EEA market in new EEE. These older FCP models cannot be redesigned to enable the use of lead-free solders but smaller node lead-free FCPs have been available since 2007. Cat. 9 IMCI will have been in the scope of the RoHS Directive 2011/65/EU since 2011, i.e. for 13 years, when exemption 15 will expire in 2024.

Please explain why FCPs with technology nodes larger than 90 nm are still required in cat. 9 IMCI for another 7 years until 2031 in the presence of lead-free alternatives since 2007, and 20 years after cat. 9 IMCI were adopted to the scope of the RoHS Directive.

The consultants wish to add that this topic had already been addressed by Gensch et al. (2016), and it was recommended at that time to renew the exemption until 2019 only.

b. Second clause of exemption 15(a):

The applicants claim that the use of lead is scientifically and technically impracticable for FCPs with dies of 300 mm<sup>2</sup> or more, independently from the technology nodes. The review process revealed that larger die size FCPs (single dies and stacked) with smaller technology nodes can be produced with lead-free solders. The applicants did not provide information as to which die size (> 300 mm<sup>2</sup>) and technology nodes FCPs can be produced with lead-free solders.

Can you please answer this question?

c. Third clause of exemption 15(a):

The review of exemption 15/15(a) by Gensch et al. (2016) showed that using plastic/organic interposers instead of silicon interposers enables lead-free soldering of stacked die FCPs with interposers of 300 mm<sup>2</sup> and more. In the last review by Deubzer et al. (2022), applicants stated that the usability of plastics instead of silicon interposers has its limits and, among others, depends on the number of connections between adjacent dies in the FCP. The applicants failed, however, to explain the conditions and limitations for the use of organic interposers that why these conditions either cannot not be used to restrict the exemption

scope, or why such a scope restriction does not make sense. The actual scientific and technical practicability of lead-free soldering in FCPs with large ( $\geq 300 \text{ mm}^2$ ) interposers remained unclear.

Please explain the conditions – or sets of conditions - that require the use of silicon interposers for interposer sizes  $\geq 300 \text{ mm}^2$  instead of organic interposers. Please also take into account whether and how far the chiplet technology and/or the use of silicon bridges instead of silicon interposers enable the use of lead-free solders in such FCPs.

**Please note that answers to these questions will be published as part of the evaluation of this exemption request. If your answers contain confidential information, please provide a version that can be made public along with a confidential version in which proprietary information is clearly marked.**

**We ask you to kindly provide the information in formats that allow copying text, figures and tables so that they can be included into the review report.**

