Exemption Request Form – Exemption 7(c)-II

Date of submission: January 16, 2015

1. Name and contact details

1) Name and contact details of applicant:

American Chamber of Commerce to the European Union (AmCham EU) ID number: 5265780509-97	AmCham EU	**European Garden Machinery Industry Federation (EGMF)** ID number: 82669082072-22	EGMF	**Japan Business Council in Europe (JBCE)** ID number: 68368571120-55	Japan Business Council in Europe
DIGITALEUROPE ID number: 64270747023-20	DIGITALEUROPE	**European Partnership for Energy and the Environment (EPEE)** ID number: 22276738915-67	EPEE	**LIGHTINGEUROPE** ID number: 29789243712-03	LIGHTINGEUROPE
European Passive Components Industry Association (EPCIA) ID number: 22092908193-23	EECA EPCIA	**TechAmerica Europe (TAE)** ID number: 2306836892-93	TechAmerica Europe	**Zentralverband Elektrotechnik- und Elektronikindustrie e. V. (ZVEI)** ID number: 94770746469-09	ZVEI: Die Elektroindustrie
European Ceramic Industry Association (Cerame-Unie) ID number: 79465004946-12	Cerame-Unie	**European Semiconductor Industry Association (ESIA)** ID Number: 22092908193-22	ESIA		
European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry (COCIR); ID Number: 05266527746-69	COCIR	**Information Technology Industry Council (ITI)** ID number: 061601915428-87	Information Technology Industry Council	**Avago Technologies Ltd**	Avago Technologies
European Committee of Domestic Equipment Manufacturers (CECED) ID number: 04201463642-88	ceced	**IPC – Association Connecting Electronics Industries**	IPC		

With support from:

Japan Electronics and Information Technology Industries Association (JEITA) ID number: 519590015267-	JEITA	**Japan Electrical Manufacturers´ Association (JEMA)**	JEMA	**Japan Business Machine and Information System Industries Association (JBMIA)** ID number: 246330915180-10	JBMIA	**Communications and Information network Association of Japan (CIAJ)**	CIAJ

2) Name and contact details of responsible person for this application (if different from above):

Company: Murata Elektronik GmbH	Tel.: +49 (0) 911 6687 141
Name: Walter Huck	E-Mail: whuck@murata.com
Function: General Manager Quality & Environment	Address: Holbeinstr. 23; D-90441 Nuernberg Germany

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2. Reason for application:

Please indicate where relevant:

☐ Request for new exemption in:

☐ Request for amendment of existing exemption in

☒ Request for extension of existing exemption in

☐ Request for deletion of existing exemption in:

☐ Provision of information referring to an existing specific exemption in:

☒ Annex III ☐ Annex IV

No. of exemption in Annex III or IV where applicable: 7(c)-II

Proposed or existing wording:

In the existing wording electronic components expressed as “capacitors” are precisely speaking “discrete capacitor components”. We propose the underlined additions to the current wording for clarification of the technical scope of 7(c)-II. Our proposal does not have the intention to enlarge the technical scope of 7(c)-II.

Existing wording:

“Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher”

Justification for proposing additions:

Lead-containing dielectric ceramic other than that in discrete capacitor components (e.g. lead-containing dielectric ceramic incorporated in ICs, boards, etc.), having the capacity of storing and releasing electricity, which is technically determined as capacitance, is already covered by the technical scope of exemption 7(c)-I.

We propose the addition of wording that clarifies the technical scopes of 7(c)-I and 7(c)-II.

The technical scope applicable to exemption 7(c)-II is prescribed by the rated voltage of discrete capacitor components, however the current wording does not clearly determine the

limits with respect to 125 V AC and 250 V DC resulting in an ambiguous expression of the current wording. Wording is added in order to clearly determine those limits.

Proposed additions (underlined):

"Lead in dielectric ceramic in **discrete** capacitor **components** for a rated voltage of 125 V AC **or higher**, or **for a rated voltage of** 250 V DC or higher**."**

Note: Our proposal does not have the intention to enlarge the technical scope of 7(c)-II, it has the only intention to revise the current wording into a more precise, unambiguous meaning.

Duration where applicable:

We apply for renewal of this exemption for categories 1 to 7, 10 and 11 of Annex I for an additional validity period of 5 years. For these categories, the validity of this exemption may be required beyond this timeframe. Although applications in this exemption renewal request may be relevant to categories 8 & 9, this renewal request does not address these categories. Further, categories 8 & 9 have separate maximum validity periods and time limits for application for renewals.

☐ Other: _____

3. Summary of the exemption request / revocation request

We investigated the substitution of lead in lead-containing dielectric ceramic in discrete ceramic capacitor components[1] for a rated voltage of 125V AC or higher, or for a rated voltage of 250V DC or higher before the last review and have continued the investigation after 2009 as well, nevertheless substitution technology has not been found up to the present day and there are no prospects of finding it within the foreseeable future. The reason for the exemption presented by the stakeholders in 2009 is still valid. Consequently, it is necessary to extend the exemption.

Lead-containing dielectric ceramic, having the capability of storing and releasing electricity, is also used in structures integrated into ICs, boards, etc., which is technically determined as capacitance, however this technical scope is covered by exemption 7(c)-I.

In the current wording, the criteria for determining the technical scope applicable to exemptions 7(c)-I and 7(c)-II are not sufficiently described.

The exemption's wording should be one that clearly indicates its technical scope. The technical scope applicable to exemption 7(c)-II is limited to discrete capacitor components only. It is also unclear about the voltage range covered under this exemption. The recommended changes clarify this within the technical scope and make it more easily understood.

[1] Technical scope specified on page 188 "Shapes and manufacturing of capacitors" of "Adaptation to scientific and technical progress of Annex II to Directive 2000/53/EC (ELV) and of the Annex to Directive 2002/95/EC (RoHS) final report"

4. Technical description of the exemption request / revocation request

(A) Description of the concerned application:

1. To which EEE is the exemption request/information relevant?

Name of applications or products:

All types of electrical and electronic equipment (EEE) (Large and small household appliances; IT and telecommunications equipment; consumer equipment; lighting equipment; electrical and electronic tools; toys, leisure and sports equipment; medical devices; monitoring and control instruments (including industrial monitoring and control instruments); automatic dispensers and other EEE categories not covered by any of the categories above) .

a. List of relevant categories: (mark more than one where applicable)

☒ 1	☒ 7
☒ 2	☐ 8
☒ 3	☐ 9
☒ 4	☒ 10
☒ 5	☒ 11
☒ 6	

b. Please specify if application is in use in other categories to which the exemption request does not refer:

Although applications in this exemption renewal request may be relevant to categories 8 & 9, this renewal request does not address these categories. Therefore, we have not completed section 4(A)1.c. Further, categories 8 & 9 have separate maximum validity periods and time limits for application for renewals.

c. Please specify for equipment of category:

The requested exemption will be applied in

☐ monitoring and control instruments in industry

☐ in-vitro diagnostics

☐ other medical devices or other monitoring and control instruments than those in industry

2. Which of the six substances is in use in the application/product?

(Indicate more than one where applicable)

☒ Pb ☐ Cd ☐ Hg ☐ Cr-VI ☐ PBB ☐ PBDE

3. Function of the substance: Control of electrical properties, in particular capacitance and dielectric loss.

4. Content of substance in homogeneous material (%weight): 0.1 – 40 wt%

5. Amount of substance entering the EU market annually through application for which the exemption is requested: 11.9t (see estimate in Section7(A) below.)
   Please supply information and calculations to support stated figure.
   Please refer to 7(A).

6. Name of material/component:

Dielectric ceramic in discrete capacitor components for a rated voltage of 125 V AC or higher, or for a rated voltage of 250 V DC or higher.

7. Environmental Assessment:

LCA: ☐ Yes
☒ No

(B) In which material and/or component is the RoHS-regulated substance used, for which you request the exemption or its revocation? What is the function of this material or component?

Lead-containing dielectric ceramic in discrete ceramic capacitors for a rated voltage of 125 V AC or higher, or for a rated voltage of 250 V DC or higher.
Discrete ceramic capacitors bear the capability of storing and releasing electric charges (electrostatic capacitance) and are incorporated into high voltage circuits in a wide variety of electrical and electronic equipment.
Discrete ceramic high voltage capacitors are used in various electronic applications in, for example, the following markets:

- Social infrastructure system, industry automation, oil and mineral exploration, power conversion, high power supply, telecommunication and medical...etc.

Typical applications are:

- power electronic inverters, pulsed power electronics, pulse forming networks, capacitive discharge units, transient high voltage suppression, magnetization/demagnetization devices, plasma generators, high-energy flash lamps, radio frequency interference suppression and electrical safety...etc.

The above are nothing more than representative examples only partially showing markets and applications in which the exemption is used.
Discrete ceramic high voltage capacitors are used in ALL types of markets and applications and thus it is impossible to mention all of them.

(C) What are the particular characteristics and functions of the RoHS-regulated substance that require its use in this material or component?

The major trend is miniaturization, which is partly due to low voltage rating, and low power. However, for the high voltage rating ceramic capacitors, other optimization parameters are often required, as for example the need for high capacitance at high voltage and high power.
The function of lead in the dielectric ceramic is to obtain:

(a) High dielectric constant at high operating voltage
(b) High energy storage capability (also at high temperatures),
(c) Low leakage at high voltage and high temperatures,
(d) Low loss at high current, frequency, and temperatures.

These are all parameters frequently called upon by design engineers in meeting technical requirements.
Lead-containing dielectric ceramic has the outstanding feature of stably bringing out the functions shown in (a)-(d). Even for use at the condition of a rated voltage of 125 V AC or higher, or 250 V DC or higher, lead elimination can be achieved in practice for some partial applications, nevertheless in applications requiring all of the functions (a)-(d) the addition of lead is indispensable.

For example, in ceramic capacitors composed of barium titanate these functions cannot be achieved without the addition of lead. If high voltage is applied to electrical and electronic equipment containing barium titanate capacitors, the equipment becomes unstable and even breaks down in the worst cases due to heat dissipation through energy loss (electrical energy is lost in the form of heat) and mechanical distortion due to electrostriction (electric energy is converted into mechanical distortion).
To cope with that, lead is added to suppress energy loss and electrostriction at the time when high voltage is applied.

Ceramic capacitors having a material composed of strontium titanate, etc. show low energy loss and low electrostriction characteristics when high voltage is applied and functions (b)-(d) can be achieved. In spite of that, function (a) cannot be achieved due to a small dielectric constant, and so addition of lead becomes indispensable in order to increase the dielectric constant and have such capacitors operable in practice.

Comprehensive information was already provided during the 2008 consultation on exemption 7 (see Final Report available under below link):

http://ec.europa.eu/environment/waste/weee/pdf/report_2009.pdf

and the stakeholder input from Japan Business Council Europe:

http://rohs.exemptions.oeko.info/index.php?id=21

5. Information on Possible preparation for reuse or recycling of waste from EEE and on provisions for appropriate treatment of waste

1) Please indicate if a closed loop system exist for EEE waste of application exists and provide information of its characteristics (method of collection to ensure closed loop, method of treatment, etc.)

None

Note: Discrete ceramic high voltage capacitors are incorporated into EEEs and at the end of life, such WEEEs are collected and treated according to the WEEE directive. No closed loop system exists exclusively for capacitors, due to the very large variety of final applications for capacitors.

2) Please indicate where relevant:

☐ Article is collected and sent without dismantling for recycling

☐ Article is collected and completely refurbished for reuse

☐ Article is collected and dismantled:

- ☐ The following parts are refurbished for use as spare parts: _____
- ☐ The following parts are subsequently recycled: _____

☐ Article cannot be recycled and is therefore:

- ☐ Sent for energy return
- ☐ Landfilled

Note: Electrical and electronic equipment using capacitors is not separately collected or recycled from other types of electrical and electronic equipment and so it is recycled using the same procedures as for other WEEE.

3) Please provide information concerning the amount (weight) of RoHS substance present in EEE waste accumulates per annum:

☐ In articles which are refurbished _____

☐ In articles which are recycled _____

☐ In articles which are sent for energy return _____

☐ In articles which are landfilled _____

Note: EU industry complies with all applicable waste legislation.
The industry refurbishes EEE where this is practical, recycles materials where possible and uses landfill only as a last resort.
No data is available on the quantities of capacitors separately from whole EEE, which are refurbished, recycled or landfilled.
Energy recovery from capacitors is not applicable.

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6. Analysis of possible alternative substances

(A) Please provide information if possible alternative applications or alternatives for use of RoHS substances in application exist. Please elaborate analysis on a life-cycle basis, including where available information about independent research, peer-review studies development activities undertaken

As described below in 7(A), there is no suitable substance for substituting lead. Therefore, such information and analysis are not applicable for this case.

(B) Please provide information and data to establish reliability of possible substitutes of application and of RoHS materials in application

As described below in 7(A), lead-containing dielectric ceramic in discrete capacitor components for certain rated voltage level (see 2) is an essential element of EEE and

there is no suitable lead-free substitute for it. Therefore, such information is not applicable for this case.

7. Proposed actions to develop possible substitutes

(A) Please provide information if actions have been taken to develop further possible alternatives for the application or alternatives for RoHS substances in the application.

- **Minimum criteria that must be met by the any Lead-free solution**

Lead-containing dielectric ceramic used in ceramic capacitors for utilization at the condition of rated voltages of 125 V AC or higher, or 250 V DC or higher, must have a high dielectric constant capable to produce the required electrical capacitance in circuits of electrical and electronic equipment, as well as low energy loss and low electrostriction characteristics when high voltages are applied.
For particular use conditions, the required functions can be achieved with lead-free dielectric ceramic, however as described in 4(C), lead-containing dielectric ceramic is indispensable in applications for which it is necessary that multiple parameters coexist.

- **Examples of Lead-free solutions**

Barium titanate, which is known for its high dielectric constant, shows high energy loss and high electrostriction when high voltage is applied, therefore it cannot be utilized under high voltages without the addition of lead.
Strontium titanate, whose utilization was investigated as a “lead-free” dielectric ceramic with low energy loss and no electrostriction, shows a dielectric constant of only a few tenths of a fraction of that of barium titanate and therefore cannot fulfil the required functionality.
If an additive element is added to strontium titanate and the dielectric constant is increased by controlling the crystal structure, it can be used as a capacitor for high voltage applications. However, the only additive element that can be used for such applications is lead.

- **Additives that are environmentally worse than lead**

According to Pauling’s rules, in order to form the same crystal structure the constituent elements of ceramic which can substitute lead are restricted to those having a divalent valence and an ionic radius of 0.93-1.81 Å.The elements which meet these conditions are restricted to cadmium and alkaline-earth metals. Among those, **cadmium** has a higher toxicity than lead, and thus is not appropriate as a substitute material.
In the case of alkaline-earth metals other than strontium (calcium, barium) are added, energy loss and electrostriction increase and therefore they cannot be used as substitute materials.

Summary for the need of lead

As described above, lead is indispensable for the stable achievement of excellent functionality (high dielectric constant, low energy loss) over a wide range of use conditions (temperature, voltage, frequency). Moreover, as these use conditions vary during the use of electrical and electronic equipment, it is impossible to specify a technical range for elimination of lead with values based on a single condition. Consequently, there are no technical prospects for the general elimination lead from dielectric ceramic materials in high voltage capacitor applications.

Technical advances requiring less use of lead even the component complexity is increasing

On the other hand, with the advance of IT/wireless technology in recent years and the increase of high-frequency equipment associated with it, the number of units of electrical and electronic components per unit of electrical and electronic equipment has drastically increased. With that, the electrical and electronic equipment industry has enhanced the performance of discrete ceramic capacitors for high voltage applications in relation to their size. This has been achieved by improving the dielectric constant through the addition of lead, by using the multilayer technology (which takes advantage of the characteristic that lead-containing ceramic can be densely sintered over a wide range of sintering conditions) and by actively promoting miniaturization.
By doing so, in spite of the negative condition represented by the increase of the number of components per unit of equipment, industry has been successful in reducing the total amount of lead included in the ceramic of discrete ceramic capacitors for high voltage applications placed on the world market, including Europe.

Table summary

In the table below, we show a rough estimate of the total amount of lead included in glass/ceramic of the main electrical and electronic components. These figures were estimated from the production and sales results of electrical and electronic component manufacturing companies from Japan and Europe.

Estimate of Lead Use Amount in Dielectric Ceramic in Discrete Capacitor Components for High Voltage Applications

2007					2013				
Number of pieces placed on the market (G[*5] pcs)		Lead use amount[*2] / Per piece unit (mg)	Lead use amount (t) / Total amount placed on the market		Number of pieces placed on the market (G[*5] pcs)		Lead use amount[*2] / Per piece unit (mg)	Lead use amount (t) / Total amount placed on the market	
World[*1]	Europe[*4]		World[*3]	Europe[*4]	World[*1]	Europe[*4]		World[*3]	Europe[*4]
1.3	0.39	78	100	30	1.6	0.38	30	50	11.9

*1: Estimate by JEITA.

*2: There are components with several different shapes and masses. We have estimated the lead use amount of an average component.

*3: Rough estimate from *1 and *2.

*4: Estimated from the EU/World GDP ratio.

*5: G = 10^9 pieces.

[Disclaimer]

As discrete ceramic capacitors (for high voltage applications) for a rated voltage of 125 V AC or higher, or 250 V DC or higher, are used in large quantities in a wide range of final products, it is impossible to provide an actual estimate of the amount of lead included in dielectric ceramic entering the EU.

Here we present the results of an estimate concerning capacitors for high voltage applications and the dielectric ceramic included in them for which production figures are comparatively easy to obtain by JEITA.

It should also be noted that there may be capacitors for high voltage applications with lead-containing dielectric ceramic which are not mentioned here.

For this reason, although the estimates were done in good faith with the data resources available, the values shown here are provided strictly for reference purposes, and we shall bear no responsibility concerning their accuracy or enforceability.

Last statement for the need to continue the use of lead in discrete capacitors

As shown in the table above, the quantity of lead placed on the market in Europe through dielectric ceramic in discrete ceramic capacitors for high voltage applications has been reduced as a whole.

Although it is impossible to completely cease the use of lead under the scope of exemption 7(c)-II, improvements concerning its use have been implemented within our power, and industry is engaged in the reduction of the environmental burden as well as the amount of lead brought into the EU.

(B) Please elaborate what stages are necessary for establishment of possible substitute and respective timeframe needed for completion of such stages.

There are no prospects for substitution for the foreseeable future by the technical reasons explained above**.**

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8. Justification according to Article 5(1)(a):

(A) Links to REACH: (substance + substitute)

1) Do any of the following provisions apply to the application described under (A) and (C)?

☐ Authorisation

☐ SVHC ☐ Candidate list

☐ Proposal inclusion Annex XIV

☐ Annex XIV

☐ Restriction

☐ Annex XVII

☐ Registry of intentions

☐ Registration

2) Provide REACH-relevant information received through the supply chain.
Name of document: None

(B) Elimination/substitution:

1. Can the substance named under 4.(A)1 be eliminated?

☐ Yes. Consequences? _____

☒ No. Justification: Please see 4(C), 7(A) and 7(B).

2. Can the substance named under 4.(A)1 be substituted?

☐ Yes.

☐ Design changes:
☐ Other materials:
☐ Other substance:

☒ No.

Justification: Please see 4(C), 7(A) and 7(B).

As there are no substitutes, we are not able to provide “reliability and environmental assessment data for substitutes” in 3. and 4. below.

For the same reason, we are not able to evaluate “availability of substitutes” and “socio-economic impact of substitution” in (C) and (D) below.

3. Give details on the reliability of substitutes (technical data + information):
Not applicable

4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to
   1) Environmental impacts: Not applicable
   2) Health impacts: Not applicable
   3) Consumer safety impacts: Not applicable

⇨ Do impacts of substitution outweigh benefits thereof?
Please provide third-party verified assessment on this: _____

(C) Availability of substitutes:

a) Describe supply sources for substitutes: None
b) Have you encountered problems with the availability? Describe: Not applicable
c) Do you consider the price of the substitute to be a problem for the availability?
   ☐ Yes ☒ No
d) What conditions need to be fulfilled to ensure the availability? Unknown

(D) Socio-economic impact of substitution: Not applicable

⇨ What kind of economic effects do you consider related to substitution?

Not applicable

- ☐ Increase in direct production costs
- ☐ Increase in fixed costs
- ☐ Increase in overhead
- ☐ Possible social impacts within the EU
- ☐ Possible social impacts external to the EU
- ☐ Other: _____

⇨ Provide sufficient evidence (third-party verified) to support your statement: _____

9. Other relevant information

Please provide additional relevant information to further establish the necessity of your request:

None

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10. Information that should be regarded as proprietary

Please state clearly whether any of the above information should be regarded to as proprietary information. If so, please provide verifiable justification:

There is no information which should be regarded as proprietary information.
