Introduction to the request for exemptions to apply to category 9

Exemption for ": Lead in glass of electronic components and fluorescent tubes, or in electronic ceramic parts (including dielectric ceramic capacitors) used in industrial monitoring & control instruments (only sub-category 9 industrial); exemption to expire in 2024" (17a)

Background

Due to the process by which the exemptions were expired in 2011, the Test & Measurement coalition only became aware of the need to transition these components at the beginning of this year. Due to their ubiquity in Test & Measurement equipment this poses particular problems which are outlined below. The T&M Coalition does not contest that alternatives have been developed that might work as replacements for these parts, simply that the task to transition them before 2017 is impossible to meet due to specific constraints in the sector. The expiry date is based on the calculation in this submission that indicates a minimum 11 year transition time is required even if resources are allocated to resolve this issue immediately.

The Test & Measurement sector

The Test & Measurement coalition represents over half of the world's industrial / professional test and measurement equipment manufacturers, including Agilent, Anritsu, Fluke, Keithley, National Instruments and Tektronix. The coalition members specialize in high end, very complex test and measurement instruments, classified under RoHS as industrial monitoring and control instruments, which are designed for exclusively industrial or professional use. The complex, advanced technology of the components present in this sector's product renders the transitioning to new RoHS compliant parts more difficult than for other companies in the electronics market as outlined below and confirmed by numerous parliament sectioned RoHS consultants:

1) The coalition members' products are used to design and build cutting edge technological equipment and are themselves therefore one step more advanced and complex than any product developed or manufactured utilizing our Industrial monitoring and Control instruments. This places extraordinary constraints as regards to reliability, performance and quality, quite unlike consumer equipment;
2) Unlike most commonly available electronics, approximately 15-20% of all parts used in instruments manufactured by the Coalition members are custom made. Redesign is therefore both specific and does not benefit from any efficiencies of scale such as manufacturers of mass-produced parts enjoy;

3) As measurement equipment, many of the coalition member's products need to undergo formal third-party qualification and / or certification. This process is lengthy and bureaucratic and requires additional review upon any material change to the instrument;
4) Test & Measurement equipment have an average life span of 10 years with some products sold with guarantees to operate correctly for as long as 30 years;
5) Test & Measurement equipment, because of its longevity and complexity, goes through less frequent and slower redesign cycles than typical consumer electronics. Normally a full redesign isn't done for a minimum of 3 years, and 7 year redesign intervals are not unusual. Once undertaken, the time required to redesign and fully requalify a product can take two to three years. For a more limited enhancement of a product a year is not unusual. A ground-up development and design of a completely new product can take even longer, on the order of 3 - 5 years. The Coalition member's companies have specialized resources in place to deal with such cycles under normal conditions but would not be able to undertake unplanned rapid redesigns of existing equipment driven by unexpected exemption withdrawals;
6) Unlike other sectors, Coalition members produce a huge quantity of different kinds of products in rather low volumes (sometimes as few as one instrument sold a year). The extremely high technical level at which these instruments are manufactured and the limited pool of specialized engineers compared to the number of products results in further slowing the redesign cycles. By way of example – Agilent, the largest manufacturer produces approximately 27,000 different types of instruments compared for example to Nokia, a well-known consumer goods manufacturer, who has no more than 30[1] different product subject to REACH but ten times the number of engineers. The seeming slowness in transitioning by industrial category 9 is therefore not due to a lack of effort or willingness but simply by the sheer scale and limited human, technical and financial resources available to make the transition;
7) Test and Measurement product complexity is reflected in part count, which can be several thousands of components in a single instrument. This adds to the burden of developing appropriate materials compliance systems that provide reconcilable proof of compliance. Furthermore, many parts have multiple suppliers to assure production. This multiplies the number of suppliers' declarations required;

[1] From Nokia's corporate website: http://investors.nokia.com/phoenix.zhtml?c=107224&p=irol-productPortfolio

Exemption 17a

This exemption is needed for virtually all equipment. Due to the changed scope of the revised exemption language used in Annex III of the recast Directive, it is not possible to map suppliers' data previously collected for these components into the new exemption structure without the inclusion of the above exemption in Annex IV. As a consequence, omission of this exemption would require the recollection of approximately 60% of all part data that utilizes any exemption that has been collected to date. Continuing to allow industrial and professional monitoring and control instruments to utilize all capacitors that contain lead in dielectric ceramic also avoids the need to review and redesign products in development, or already released to the market, which were expected to meet the RoHS Substance Restrictions utilizing the original exemptions. The effort and costs required to recollect part data, review and redesign products is disproportionate compared to gains that can be obtained in other areas.

Socio-economic effects if exemptions are not granted

The loss of expected exemptions has four key socio-economic impacts to the Measurement and Control industry due to rework of previously completed activities:

1. Compliance IT Systems for data storage and product-level compliance analysis must be reviewed and potentially reconfigured to account for unexpected exemption withdrawals.

2. Renewal of Supplier's declarations for any part relying on an expired exemption where there is no clear mapping or equivalent in the new exemption structure.

3. Products developed and released to the market which were expected to meet the RoHS Substance Restrictions will have to be re-evaluated after new part compliance data has been obtained.

4. Exemption 17a is particularly important as it is a foreseeable certainty that products will need to be withdrawn from the marker prematurely without it. The amount of work involved would jeopardize the ability of the sector to meet the deadlines set in the directive for the coming into scope of the cat 9 industrial. Furthermore it requires the revision of about 25% of the product portfolio that has already been transitioned into ROHS compliance taking away valuable resources to address the products not already transitioned.

5. Given that the products have very long lifetimes and are only a tiny part of the total waste stream and in turn contain very low amounts of lead (see below), the environmental benefits that might be obtained are minimal whereas the economic and social negative effects of

product withdrawal and the lack of access to T&M equipment for EU industries would be tremendous.

These impacts cannot be resolved simply by adding more engineering effort. All five aspects would take away existing resources from planned new product development activities. This effectively penalizes manufacturers who invested resources in developing RoHS compliant products in parallel to the regulations development to bring them into scope.

Rationale for the exemption request

As mentioned above the cost of revisiting and requalifying equipment already made ROHS compliant is a serious waste of money and resources that could be better spent. In particular as we will show below it is impossible to meet the 2017 transition target anyhow.

1) The big issue here is that the use of these parts is ubiquitous – it is used in practically all of the equipment currently produced in cat.9 industrial and usually in larger numbers. Our current low end estimate is that 80% of products make use of the dielectric ceramic capacitors rated < 125 VAC/250VDC. There is no way to restrict the application of this exemption by function or type of the product as its use is truly generic;
2) Due to the ubiquity of the parts, very substantial resources (see below) would need to be diverted to meet the substitution targets – this effectively makes meeting ROHS targets impossible for category 9. i.e. the shift in priorities would jeopardize the ability to meet the other ROHS compliance targets;
3) Due to the nature of T&M equipment, each product needs to be qualified as performing exactly according to published specifications. A normal process for qualification requires 6 months to a year. Accelerated aging tests frequently need to be done to prove long-term reliability. Using a compression factor of 7, products with our typical 10-year life require such tests to be performed for 17 months to simulate this duration. In the event the solution proves unsatisfactory this evaluation needs to be restarted;
4) Even if the replacement capacitor is a drop in replacement (working immediately) the equipment must nevertheless be requalified against published specifications or it cannot be marketed as each specification is warranted and to assure the product remains fit for purpose;

5) We refer to the chart submitted earlier in the consultation process (and not contested by Oeko) giving average times to transition a particular product. Agilent has given an estimate (with statistical variances) below

6) **data based on Agilent inventory of use of the capacitors**

The total amount of different products[2] to be checked at Agilent is 5,000 (Coalition total ~ 20,000) – of which it is known about 80% contain the dielectric ceramic capacitors rated < 125 VAC/250VDC – i.e. 4,000:

i. 5% worst case = 200 products @ 36 Months = 7,200
ii. 15% Med case = 600 products @ 18 Months = 10,800
iii. 80% Best case = 3200 products @ 3 months = 9,600

Total 27,600 months given a portfolio of 5000 products

Agilent has about 25 sites with 200 FTE (Full time equivalent engineers who have the skill and knowledge to work on this) who can perform 2,400 working months in a year. According to the estimated work time calculated above it will take 11.5 years to complete the task.

7) The calculation made for Agilent is likely too optimistic as regards the other members of the coalition at large seeing as they tend to have fewer engineers available. However in the given time span it wasn't possible to poll the other members in detail however we have a high degree of certainty they will not be able to do it faster if only for the simple reason they have even fewer engineers per piece of equipment than

[2] With different products we really mean different products i.e. something with a different function and purpose. This is not the same thing as a variant of the same product: say a portable version of a test product but that is otherwise identical to a stationary version or an new upgraded product with extra features than another. We underline that quite unlike any other electronics manufacturing business test and measurement companies carry a vast array of dissimilar products with consequently far longer turn around times than in classic electronics.

Agilent has available and as smaller companies lower flexibility in diverting resources to address the issue.

8) The question can be raised why the exemption is needed when there are other exemptions that cover (part) of the needs of the industrial cat.9 equipment[3]. The request we submit only applies to 7(c) III which expires in 2013 and is therefore of no practical use to cat. 9 industrial. In practice however the capacitors used by the category 9 which need this exemption are all of the low voltage variety (unless covered by other exemptions). As an alternative to the suggested wording of the exemption we have requested it would also be sufficient to use the language from that exemption instead for example as follows:
    a. *Lead in dielectric ceramic in capacitors for a rated voltage of less than 125 V AC or 250 V DC for Industrial Monitoring and Control Instruments, exemption to expire in 2024*
9) The amount of lead and the products involved is very modest the mass of the average capacitor is 0.00017 g. Every product contains on average 100 capacitors although this will vary depending on the amount of parts of the product in question (usually between 5,000 to 30,000 components). The coalition estimates a maximum of 240,000 cat 9 industrial devices containing the capacitors cat 9 are sold in the EU

[3] Table **Fehler! Nur Hauptdokument**: Exemptions 5(a), 5(b) and 7(c) in Annex III of the RoHS Directive (2011)

Exemption		Scope and date of applicability
5(a)	Lead in glass of cathode ray tubes	
5(b)	Lead in glass of fluorescent tubes not exceeding 0.2% by weight	
7(c)-I	Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectronic devices, or in a glass or ceramic matrix compound	
7(c)-II	Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher	
7(c)-III	Lead in dielectric ceramic in capacitors for a rated voltage of less than 125 V AC or 250 V DC	Expires on 1 Jan 2013 and after that date may be used in spare parts for EEE placed on the market before 1 Jan 2013

every year representing 23% of global sales. This means that at most 400 grams of lead are but on the market through the maintenance of the exemption across the EU.

The technical impracticability of the transition so far can be explained by the fact there is no real evaluation of these components for the circumstances and lifetimes they are used in cat 9 equipment. While it is accepted that dielectric ceramic capacitors for a rated voltage of less than 125 V AC or 250 V DC are available on the market that do not require the use of Exemption 7(c) III today; it has not been possible to exhaustively evaluate their performance in Industrial Monitoring and Control products. These products have warranted performance specifications that have to be evaluated and proven on a product-by-product basis during the substitution evaluations. Only after a successful evaluation can the products be resubmitted for their regulatory approvals and for customer acceptance.

Furthermore, the reliability of these substitutions must be assured in Monitoring and Control Instruments. As part of the substitution evaluation, extended life testing will be required to assure the product will perform to specification across its typical lifetime of 10 years.

It also has been argued that given the coming into scope by July 2017 – there is ample time for the sector to adapt. First of all we refer to the table above that shows that the transition is not a trivial exercise and involves thousands of man-hours of work. Furthermore the following aspects need to be considered, evaluated and proven before completing substitution of parts within our products. It is not possible to “simply” substitute components from a purchasing perspective and have this change roll through the value chain into each product. This extends beyond a simple form, fit, and function evaluation. These reassessment and redesign activities can take weeks to many months to complete, particularly where PCA (printed circuit assembly) changes are involved. Where there is a high business impact (resource and cost) product withdrawal from the market is a distinct possibility where there is a limited return on the investment forecast.

- Availability of substitute RoHS-compliant components:

  - Identification of alternative parts available from existing suppliers, or
  - Identification of alternative parts from a new supplier
    - Supplier assessment
    - Supplier acceptance and set-up
    - Supplier management
- Product Complexity – product changes need to be considered from five key perspectives:
  - Impact on published specifications
  - Impact on reliability
  - Impact on regulatory compliance (Safety, EMC, as well as Environment)
    - Manufacturer's ability to self certify
    - Engagement with third-party certification bodies
  - Impact on customer acceptance/approvals
  - Impact on business performance
    - Cost of scrapping old material
      - Especially important if "Life Time Buy" (LTB) had been made for material - potentially many €k impact
    - Cost of re-design
    - Cost of re-work
    - Benefit of continued market access

Changes for specific components need to consider the following attributes. This evaluation tends to be product-specific although results for one product can be leveraged ***for other applications only where*** the component is found to have direct form, fit, and function equivalence.

- Technical Equivalence – tight tolerance of key specifications are required to allow Cat 9 equipment to continue to meet published specifications
  - Electrical Performance
  - Optical Performance (if applicable)
  - Range of operating and storage temperatures
  - Tolerance to physical shock and vibration
  - Specification for operating altitude

  - Specification for operating and storage humidity
  - Availability of appropriate third-party safety certifications (if safety critical)
  - MTBF
- Physical Equivalence – physical size and pin layout must be equivalent to allow drop-in replacement for a specific component. Where this is not possible, the following two considerations also need to be taken into account:
  - PCA complexity – the vast majority of printed circuit assemblies are highly complex with 8~16 layers widely utilized. Any change in the printed circuit board to accommodate a revised component footprint or layout is non-trivial from a layout perspective. Any change in PCA requires a full re-qualification of the product
  - Instrument layout – Any change in physical size of a component also needs to consider the available space around the component. In addition to the obvious issue of physically fitting in the available space, the following impacts need to be considered:
    - Product safety creapage and clearance distances;
    - Impact on airflow through the product and the resulting impact on cooling, and corresponding long-term reliability

Once changes have been designed, the following sequence of evaluations is required before the product change can be introduced into the market:

- Compliance with published specifications. The Test and Measurement sector produces highly complex, multi-function products. Re-creating NPI-Qualification test systems that exercise and measure the product's parameters is a highly skilled body of work. It should be noted that simply reusing or re-applying production test and calibration systems is not an option as these test a limited set of the product’s parameters.
  - Even apparently simple substitutions need to have the relevant parameters associated to the circuit changes proven to meet published specifications
  - Testing per product – can range from weeks to months depending on complexity of product and scope of changes

- Assure Reliability is not impacted – Run through an environmental test suite for weeks to months depending on product complexity
- Long-term reliability of a specific application – life testing: months if accelerated testing to years for critical applications where acceleration is not possible.
- Regulatory compliance evaluations
    - EMC – weeks
    - Safety evaluation – weeks
    - Third-party certifications – weeks to months depending on Agency used.