THE SWATCH GROUP

16 JAN. 2006

A/1048

BY DHL
Ms Anna Passera
Commission Européenne
DG Environnement
Unité G4
Consultation directive 2002/95CE
1049 Bruxelles
Belgique

Biel, 12. Januar 2006
KLU/SPA

Subject: Requested Exemption from the requirements of Article 4(1) of Directive 2002/95/EC

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Avec nos compliments
Mit freundlichen Grüssen
With our compliments

On behalf of Jennifer Kluge
Renate Spahni, assistant
The Swatch Group Ltd – Legal Department

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REQUESTED EXEMPTION FROM THE REQUIREMENTS OF ARTICLE 4(1) OF DIRECTIVE 2002/95/EC

Part 1
Tin Whiskers Problem in Quartz Crystal Resonator used in the Swiss Watch Industry

Part 2
Tin Whiskers Risk in Fine Pitch Electronic Systems used in the Swiss Watch Industry

From:	The Swatch Group Ltd., Seevorstadt 6, CH-2501 Biel, Switzerland Person of contact: patrick.lederrey@qm.swatchgroup.com
To:	Öko-Institut, Freiburg, Deutschland Hr. Carl-Otto Gensch : Gensch-rohs@oeko.de
Copy to:	European Commission, Environmental Division, Brussel, Belgium Mrs Anna Passera : ENV-RoHS@cec.eu.int Bundesamt für Umwelt Wald und Landschaft, CH-3003 Bern, Switzerland Hr. Dr. Andreas Weber
Internal copy to:	N.G. Hayek, G.N. Hayek, M. Darwish, Th. Meier, H.R. Gottier, R. Dinger
Represented Companies :	ETA SA Manufacture Horlogère Suisse, CH-2540 Grenchen, Switzerland EM Microelectronic-Marin SA, CH-2074 Marin, Switzerland Micro Crystal, CH-2540 Grenchen, Switzerland
Place and date :	Biel, January 10th, 2006

1. Introduction:

The Swatch Group Ltd. is a leading group of companies in the watch making and electronic industry sector. Over 30 affiliated companies are developing, producing and distributing high quality watches, time movements and electronic components at international level.

Our products are taken as a reference for quality, precision, performance and reliability within their respective market segments. In addition to this, Swatch Group is committed to ensure consumer safety, environment protection and unconditional legal compliance.

2. Process flow for Swatch Group Watches:

Micro Crystal (MC) produces a principal share of our 32 kHz quartz crystal resonators and Microelectronic-Marin (EM) the Integrated Circuits and Micro Processors used in all of our quartz driven time movements.

ETA SA produces the complete quartz movement using the internal MC and EM electronic components on the Electronic Module of the quartz movements. These quartz movements are sold around the globe. The main customers are watch brands, mainly based in Europe. ETA as well is the principal quartz movement source for our own watch brands like Tissot and Swatch.

Tissot i.e. realizes the complete watch, using ETA quartz movements. From this stage onward, the product becomes an electronic consumer product subject to the provisions of the RoHS + WEEE directive.

3. Situation:

Since middle of 2003, our Swatch Group RoHS Task Force has intensively worked on the objective to fulfil, without any conditions, all criteria of the RoHS directive. It has taken us two year's to modify and test the new production processes, mainly the use of lead free soldering paste.

After the successful qualification of the various processes in June 2005, we introduced these new lead free operations and components at mass production level. Unfortunately we experienced serious problems with tin whiskers growing inside of our quartz crystal resonators, generating short circuits which end the watch's function.

ETA SA was forced to stop, for several weeks, the production of quartz movements due to this Whiskers problem identified inside of quartz crystal resonators. Deliveries as well have been temporary interrupted.

In addition to this experience and according to the reported experiences found on tin whiskers growing on fine pitch applications, even using the recommended tin-copper soldering paste, we recognised the tremendous risk for short circuits on all of our fine pitch electronic modules, having distances far below 800µm.

The only reported way to avoid such problems is to use a pitch with more than 800µm, to reduce the risk, or to use lead containing solder alloy that eliminates the risk. Due to the very limited dimension of the watches our designs need pitches of typically 200 – 300 µm. Therefore we are forced to use again lead containing soldering paste.

4. Conclusion

Concerning our quartz crystal oscillator, we today are forced to use the RoHS conform high temperature lead containing solder alloy which is RoHS conform. As reported we tried the lead free version at mass production level, but this operation definitely failed.
Concerning our fine pitch applications we identified very high risks of Whiskers with the actual lead free solder alloy. We decided to prepare the move toward the use of RoHS conform high temperature lead containing solder alloy.

As a consequence of these results we have two possibilities:

1. to introduce the RoHS conform high temperature soldering paste, having a lead concentration up to 90%. This will increase our lead consumption from actually 20.4 kg lead per year up to 229.3 kg lead per year.
2. to go back to our former standard processes and to use again lead containing solder alloy, having lead concentrations between 10% and 37%. The total lead consumption will be at the level of 90 kg lead per year only.

With respect to the environment we believe and strongly support the second possibility, where the overall lead consumption is at the lowest level. Unfortunately this solution does not respect the RoHS requirements.

If we do not receive an exemption for the second possibility we are forced to use the RoHS conform high temperature solder alloy for both applications, which in fact will increase our lead consumption by 255%.

5. Requested exemption:

Swatch Group kindly requests an exemption from the European Commission which allows us to implement our standard, previously used solder alloy containing 10% to 37% of lead for the complete electronic modules used in our quartz movements and watches.
This will allow us to keep the high quality standards of our products, to reduce the waste and the overall lead consumption in our production.

As a consequence of our negative experience we made with lead free solder alloys, our request for an additional RoHS exemption is submitted very late, we are aware of this. Nevertheless we count on the comprehension of the TAC and the European Commission to support our proposed solution where the lead consumption is lowest.

We are just six months away from the RoHS due date. Our ongoing production processes need to be changed by middle of February 2006 at the latest. Therefore we highly depend on the fast and hopefully positive reply of the TAC and of the European Commission.

Our Swatch Group RoHS Task Force is dedicated and ready to provide any additional information the TAC or the European Commission needs to take their decision. The person to contact is mentioned on the front page.

Please accept, Ladies and Gentlemen, our respectful and kind regards.

The Swatch Group Ltd.

E. Geiser
CFO, Member of the Executive Management Board

Dr. H.P. Rentsch
CLO, Member of the Executive Management Board

(PDF document without signatures, forwarded by E-Mail. The original and signed document are forwarded by regular post)

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
ENVIRONMENT
ENV.G - Sustainable Development & Integration
ENV.G.4 - Sustainable Production & Consumption

DIRECTIVE 2002/95/EC ON THE RESTRICTION OF THE USE OF CERTAIN HAZARDOUS SUBSTANCES IN ELECTRICAL AND ELECTRONIC EQUIPMENT (ROHS).
CHECK LIST FOR REQUESTS FOR ADDITIONAL EXEMPTIONS

Industry has sent to the Commission's services a number of requests for exemptions from the requirements of the RoHS Directive that are additional to those currently covered by the study and the stakeholder consultation. In most cases these are not substantiated by scientific and technical evidence. The proposed check-list will enable the Technical Adaptation Committee (TAC) to carry out a first screening of the requests received. Proposals that successfully pass the screening process will then be considered for a possible exemption.

Article 4(1) of Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment[1] provides 'that from 1 July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, PBB or PBDE.' The Annex to the Directive lists a limited number of applications of lead, mercury, cadmium and hexavalent chromium, which are exempted from the requirements of Article 4(1).

Adaptation to scientific and technical progress is provided for under Article 5 of the Directive. Pursuant to Article 5(1): "Any amendments which are necessary in order to adapt the Annex to scientific and technical progress for the following purposes shall be adopted in accordance with the procedure referred to in Article 7(2):"

Article 5(1)(b) allows the exempting of materials and components of electrical and electronic equipment from Article 4(1) if their elimination or substitution via design changes or materials and components which do not require any of the materials or substances referred to therein is technically or scientifically impracticable, or where the negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh the environmental, health and/or consumer safety benefits thereof;

In order to allow the TAC to consider submissions for additional exemptions, the information in Table I should be provided as a first step. The request for submissions should fulfil the criteria of Article 5(1)(b). The information provided should be supported, as far as possible, with relevant technical and scientific evidence.

[1] OJ L 37, 13.2.2003, p. 19

TABLE I – CHECK LIST
PROPOSALS FOR FURTHER EXEMPTIONS FROM THE REQUIREMENTS OF ARTICLE 4(1) OF DIRECTIVE 2002/95/EC FOR SPECIFIC APPLICATIONS OF LEAD, MERCURY, CADMIUM, HEXAVALENT CHROMIUM.

PART 1: TIN WHISKERS PROBLEM IN QUARTZ CRYSTAL RESONATOR

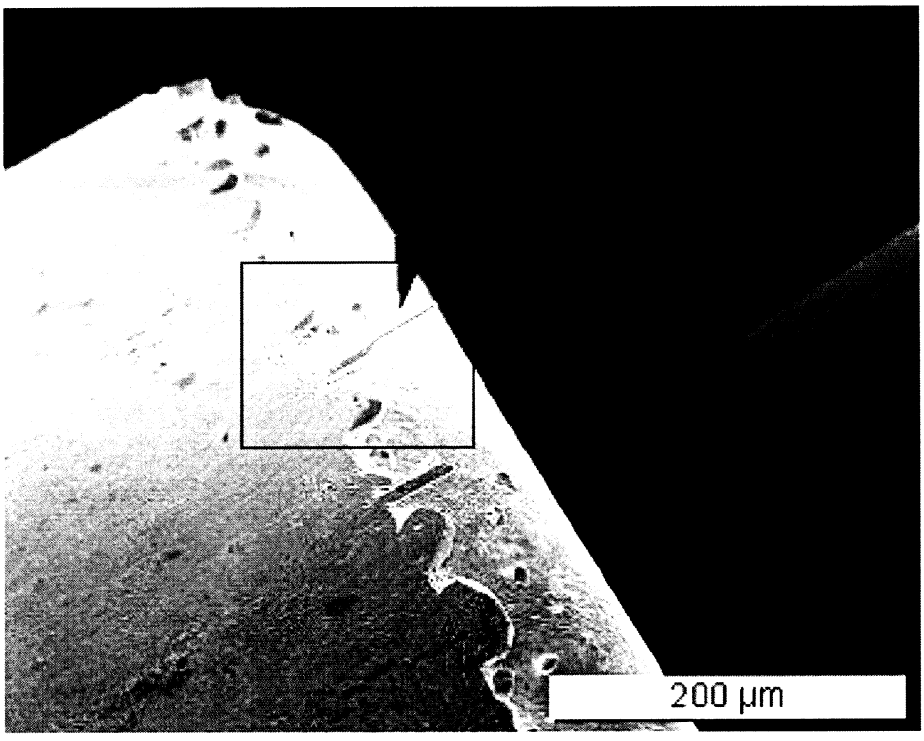
Criteria	Information Please provide supporting technical and scientific evidence
1. Please describe the material / component of the electrical and electronic equipment that contains the hazardous substance. Please indicate the type and quantity of the hazardous substance used in the homogenous material. Please indicate the quantity of the substance in absolute numbers and in percentage by weight in homogenous material. Please indicate the functionality of the substance in the material of the equipment. Please also provide an estimate of the annual quantities of the hazardous substance used in this particular application.	Quartz crystal resonators are mechanically resonating within a metal can under sealed vacuum. To maintain this vacuum, a high temperature solder alloy containing 90% of lead (Pb) and 10% of tin (Sn) is used. (90Pb10Sn) The dimensions as well as the lead consumption of our different quartz crystal resonators are represented by this average value: 0.5 ± 0.2 mg Pb / piece We cannot consider the complete quartz crystal resonator as being a homogenous material. Therefore the calculation in percentage by weight is not possible. A metallic soldering material is needed to maintain a hermetic vacuum seal. Other sealing materials cannot guarantee a hermetic vacuum seal over a long period of time (years). For a total yearly production of quartz crystal oscillators the quantity of lead used is: 1. With current 90Pb10Sn solder alloy we have a total (RoHS conform) lead consumption of: 20.4 kg lead per year 2. With the former used 90Sn10Pb alloy we can reduce the total lead consumption down to: 8.2 kg lead per year

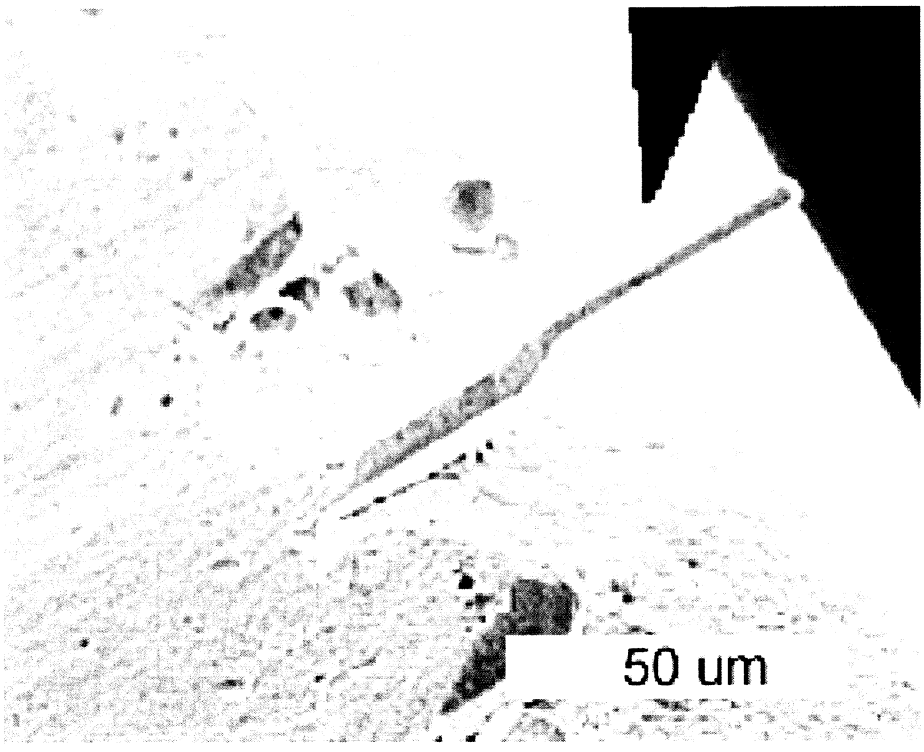
2. Please explain why the elimination or substitution of the hazardous substance via design changes or materials and components is currently technically or scientifically impracticable.	The use of lead free solder alloy results in tin Whiskers growing. Mechanical tensions, the absence of lead and the vacuum atmosphere generate tiny, monocrystalline tin Whiskers, growing up to a length of several millimetres (see appendix). We identified up to 30% of the quartz crystal oscillators having growing Whiskers within weeks already. Up to 5% already created short circuits. A shorted quartz crystal oscillator stops working, the connected electronic system is dead, the watch is stopped and the battery is drained. The entire movement as well as the battery must be exchanged. The only known alternative is the addition of at least 10% of lead within the solder alloy or to use high temperature solder alloy, containing 90% of lead.
3. Please indicate if the negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh the environmental, health and/or consumer safety benefits. If existing, please refer to relevant studies on negative impacts caused by substitution.	No negative impact on the health and on the consumer safety is possible. The quartz crystal oscillator is part of the inside components of the watches and therefore never in contact with the consumer's skin. Concerning the environment, the application of the WEEE will ensure that hazardous substances will be recycled. The production waste is recycled to 100%.
4. Please indicate if feasible substitutes currently exist in an industrial and/or commercial scale. Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.	The only substitute to the currently used 90Sn10Pb solder alloy is the high temperature version. As reported already, this substitute 90Pb10Sn solder alloy contains much more lead. With respect to the environment, Swatch Group is not willing to increase the lead concentration from currently 10% up to 90%. Therefore this high temperature substitute is not practicable in view of the environment protection. The lead free solder alloys available on the market are not practicable because they can not stop whiskers growth phenomena. Other developments and tests are ongoing and followed by our companies, but they will not be available until July 1st 2006. Currently we cannot give an estimate if and when substitutes will be available.
5. Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.	To our knowledge, the directive 2002/95/EC is the only restriction.

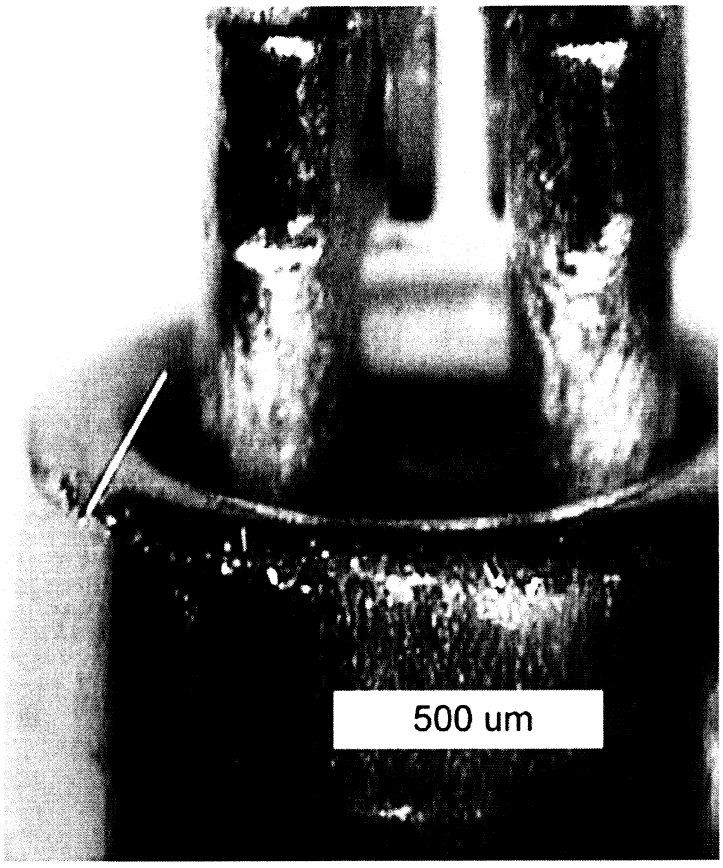
6. Please indicate the costs and benefits and advantages and disadvantages of such substitutes. If existing, please refer to relevant studies on costs and benefits of such substitutes.	In terms of production costs, there are no benefits or advantages resulting from the choice of any solder alloy. Due to the very low amount of solder alloy used per year and per piece, the small differences on the solder alloy prices are insignificant. If we receive the exemption of the TAC and the European Commission to use our standard 90Sn10Pb alloy, we can reduce the lead consumption by 12.2 kg per year.
7. Please provide any other relevant information that would support your application for an additional exemption.	

Appendix to: Part 1, Tin whiskers on quartz crystal resonators

We present you some Whisker examples, at different stages of growth. The parts analysed are taken out of the production we had to stop.



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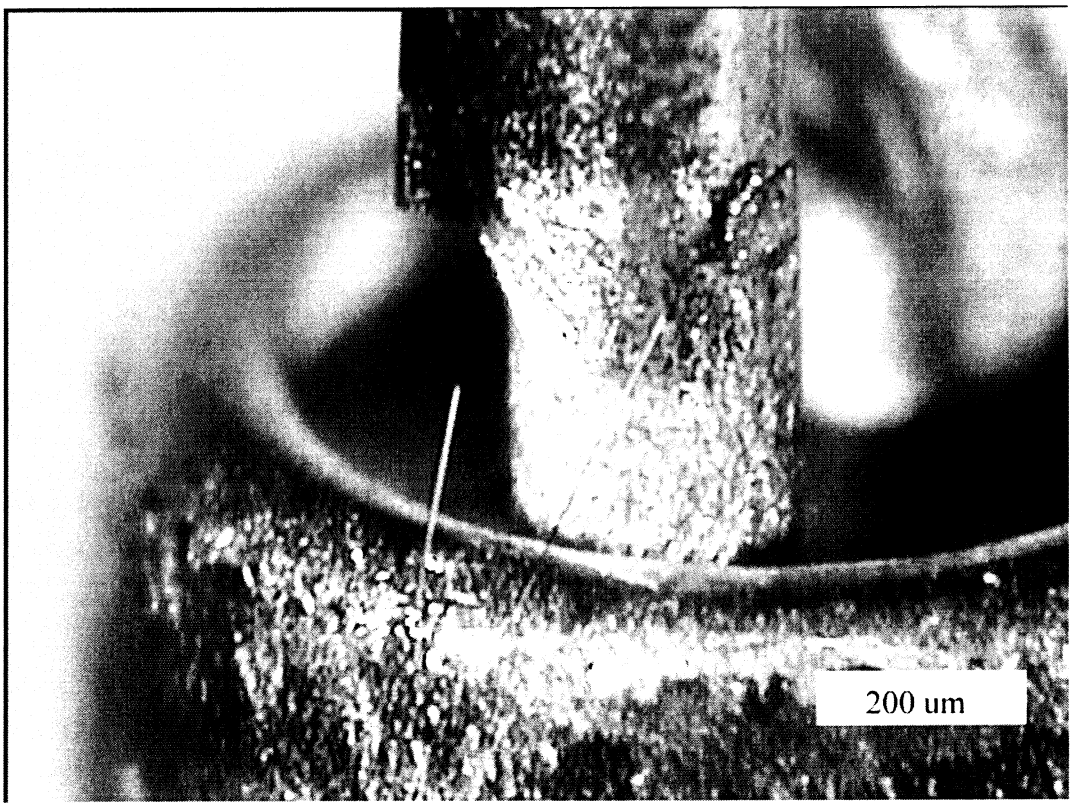
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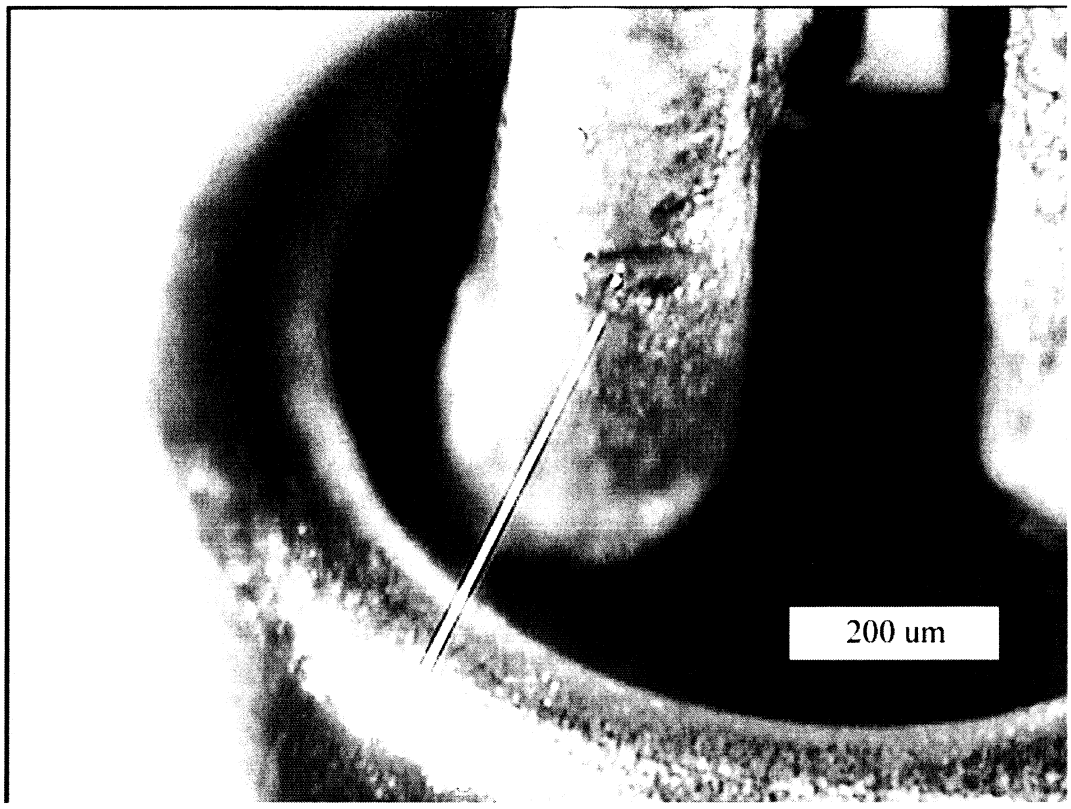
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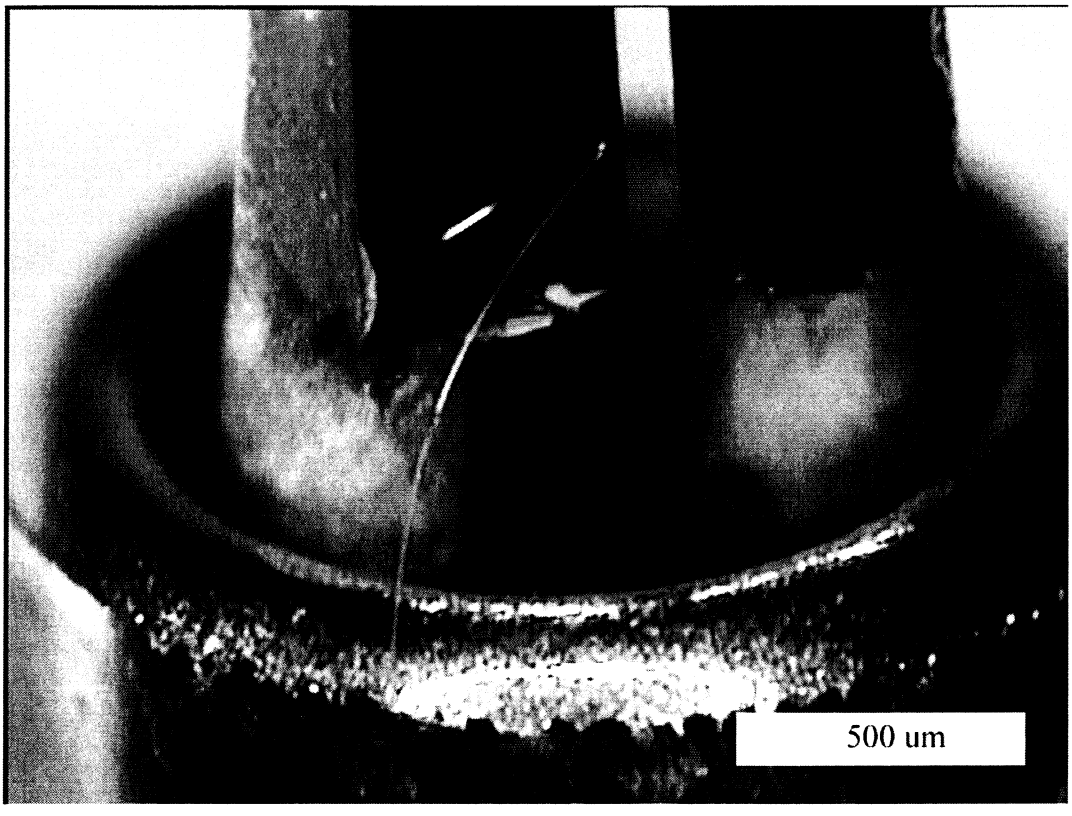
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EUROPEAN COMMISSION
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ENVIRONMENT
ENV.G - Sustainable Development & Integration
ENV.G.4 - Sustainable Production & Consumption

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PART 2: TIN WHISKERS RISK IN FINE PITCH ELECTRONIC SYSTEMS

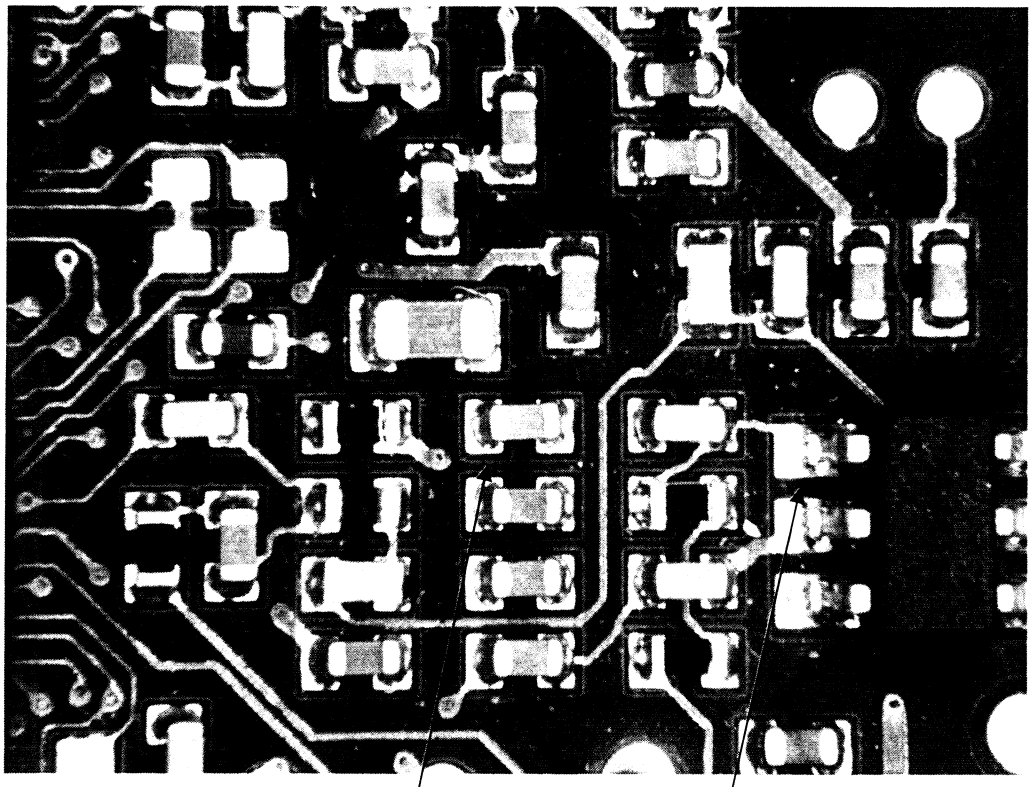
Criteria	Information Please provide supporting technical and scientific evidence
1. Please describe the material / component of the electrical and electronic equipment that contains the hazardous substance.	We use lead free solder alloy 99.5Sn0.5Cu to contact electronic components on our electronic modules. These components are assembled on the print using reflow, manual or flip chip soldering.
Please indicate the type and quantity of the hazardous substance used in the homogenous material. Please indicate the quantity of the substance in absolute numbers and in percentage by weight in homogenous material.	Our products use various types of electronic modules. The following figures are based on an average and representative calculation of the solder paste and lead used for one single electronic module, which we do not consider as being a homogenous material: Average weight per E-Module = 700 mg / piece Average solder paste / E- Module = 11 mg / piece
Please indicate the functionality of the substance in the material of the equipment.	The used solder paste has to ensure the electrical contact and the mechanical retaining force of the components.
Please also provide an estimate of the annual quantities of the hazardous substance used in this particular application.	The total quantity of lead free solder alloy 99.5Sn0.5Cu needed for our electronic modules are 221 kg per year. It is important to focus on the fact that lead free solder alloys (i.e. 99.5Sn0.5Cu) represent a concrete and very high potential risk to generate the Whisker's growth phenomena. See our explanations on the next section please.

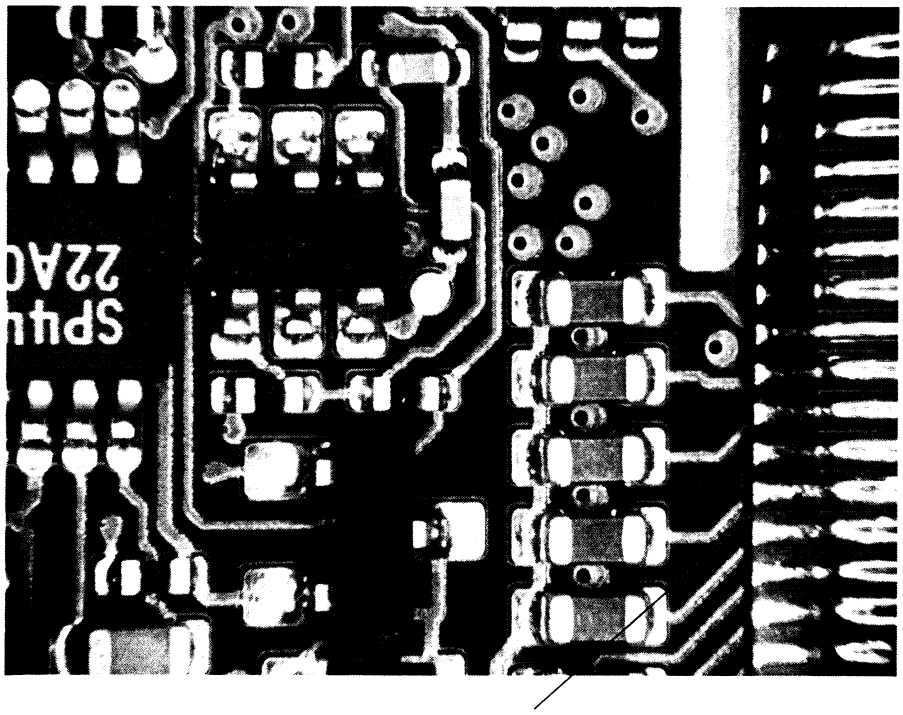
2. Please explain why the elimination or substitution of the hazardous substance via design changes or materials and components is currently technically or scientifically impracticable.	Watches are exposed to various constraints during usage. Mainly the temperature variations as well as vibrations and shocks generate mechanical tensions within the soldering area where the electronic components are mounted on the electronic modules. Two of the main factors to start Whiskers growth are the presence of mechanical tensions and the absence of lead in the solder alloy. In addition to this, various international studies came to the conclusion, that distances below of 800µm are exposed to the potential risk of Whiskers, causing electrical short circuits. Due to the limited dimensions of Watches, we are forced to use fin pitch technology. Our pitch distances can be as low as 120 µm. (see appendix) Based on these facts we cannot use lead free soldering alloy, without generating a tremendous risk of product failures. The lead free option is definitively impracticable for the long term. We prepare our production to change again the processes towards 63Sn37Pb solder alloy (if permitted). In the other case we will change our processes towards RoHS conforming 90Pb10Sn alloy. The following comparison shows the impact on the ecology: 1. If we are forced to use high temperature solder alloys 90Pb10Sn, being RoHS conform, we need as well 221 kg/year solder paste, but the total amount of lead used would be <u>198.9 kg lead per year</u> 2. If we receive the permission of the TAC and the European Commission to use our former, standard solder alloy 63Sn37Pb, we will only use <u>81.8 kg of lead per year</u>. In this case we can <u>reduce our lead consumption by 117 kg a year</u>.
3. Please indicate if the negative environmental, health and/or consumer safety impacts caused by substitution are likely to outweigh the environmental, health and/or consumer safety benefits. If existing, please refer to relevant studies on negative impacts caused by substitution.	No negative impact on the health and on the consumer safety is possible. The electronic module is part of the inside components of the watches and therefore is never in contact with the consumers skin. Concerning the environment, the application of the WEEE will give the guarantee, that hazardous substances will be recycled. The production waste is recycled to 100%.
4. Please indicate if feasible	The only known alternative is the addition of lead within

substitutes currently exist in an industrial and/or commercial scale. Please indicate the possibilities and/or the status for the development of substitutes and indicate if these substitutes will be available by 1 July 2006 or at a later stage.	the solder alloy, as we plan to do now with 63Sn37Pb (if permitted) or to use high temperature solder alloy 90Pb10Sn, containing much more lead. With respect to the environment, Swatch Group is not willing to increase the lead concentration from the planned 37% up to 90%. Therefore this high temperature substitute is not practicable in view of the environment protection. The lead free solder alloy 95Sn5Cu is not practicable for long term because of the high potential risks generated by the whiskers growth phenomena. To enlarge pitch distances is impracticable for us, because it would result in the enlargement (triple size at least) of the wrist watch dimensions. Other developments and tests are ongoing and followed by our companies, but they will not be available until July 1st 2006. Currently we cannot give an estimate if and when substitutes will be available.
5. Please indicate if any current restrictions apply to such substitutes. If yes, please quote the exact title of the appropriate legislation/regulation.	To our knowledge, the directive 2002/95/EC is the only restriction.
6. Please indicate the costs and benefits and advantages and disadvantages of such substitutes. If existing, please refer to relevant studies on costs and benefits of such substitutes.	In terms of production costs, there are no benefits or advantages resulting from the choice of any solder alloy. Due to the low amount of solder alloy used per year and per piece, the small differences on the solder alloy prices are insignificant. Without exemption from the European Commission, we are forced to use high temperature solder alloy which in fact increases our lead consumption by an additional 112.7 kg lead per year i.e. studies made by the US NASA (see http://nepp.nasa.gov/whisker/)
7. Please provide any other relevant information that would support your application for an additional exemption.	

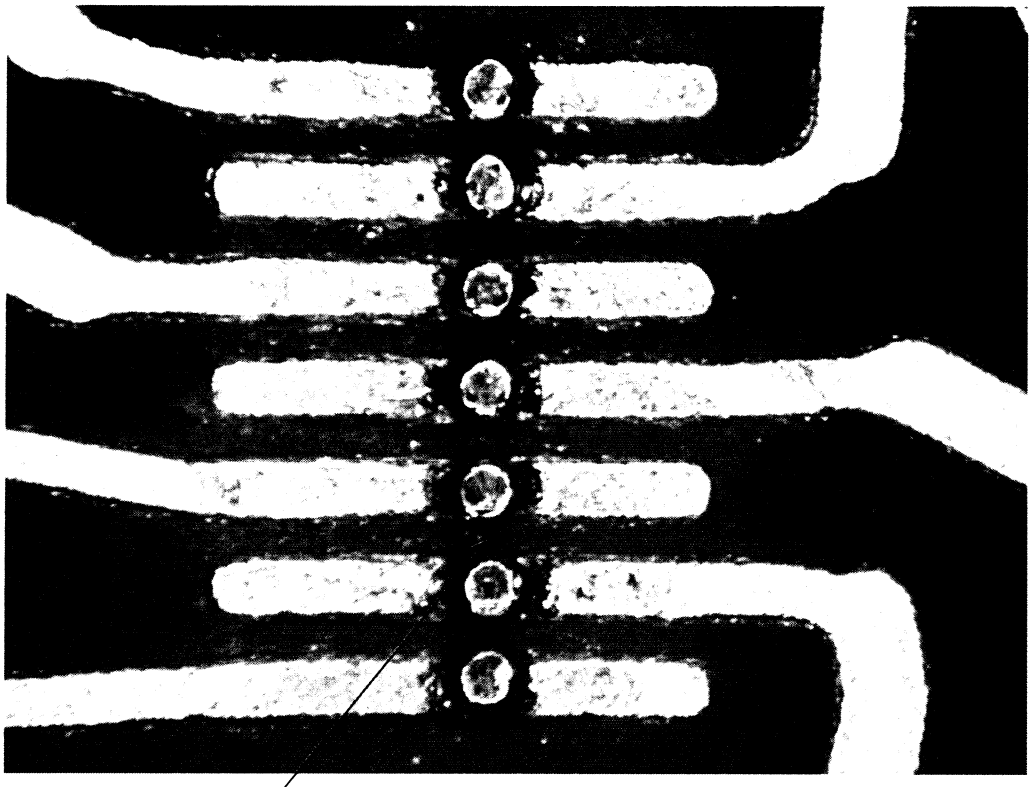
Appendix to: Part 2, Tin Whisker risk for fine pitch electronic systems

We present you some representative fine pitch examples we have in our E-modules. The dimensions mentioned are the free distances between the extremities of the soldering areas.





Fine pitch view after flip chip removal



Flip Chip with solder pumps