

Title	General Specification for the Environment (GSE)		
Originator	Chan Gum Meng	Date Created	06/03/2006
Document Number	(5972-2881-85)	Revision	(013)
ER	28		
Responsible TIS	<input checked="" type="checkbox"/> Malaysia <input type="checkbox"/> Singapore		
Site Using This Doc	<input type="checkbox"/> ALL <input type="checkbox"/> Fort Collins <input type="checkbox"/> San Jose <input type="checkbox"/> Turin <input checked="" type="checkbox"/> Malaysia <input checked="" type="checkbox"/> Singapore <input type="checkbox"/> Other (please specify) :		
PL (Product Line) / Dept (Fab/Service)	Cross-Functional		

Rev	Change/Reasons	Date Updated	Originator
A	New Creation	06 March 2006	Chan Gum Meng
B	Revised Para 12.2.3 and added Para 12.2.4 ; added in ODS Class II identification on page 13; added ODS Class I in title and resize the Table C.1; Revised Section 12 to exclude Form B; Revised Class B is optional for lab test; Remove Form B and replaced new Form A	30 May 2006	Kwok Vern Jui
003	Added new references in Para 3.0; Added new definition in Para 4.0; Revised the Role & Responsibility in Para 5.0; Added Battery Content Restrictions in Para 6.0; Added list of EU RoHS Exemption in Para 7.7; Added Battery Content Restriction requirement in Para 8.0; Added Battery labeling requirement in Para 11.3, 11.4 & 11.5; Removed yearly GSE Declaration and replaced with product transfer CM to CM shall declare GSE compliance in Para 13.1.3 ; Removed yearly test report submission and replaced by per customer specific requirement in 13.2.3 & 13.2.4; Added Testing Method & Measurement Equipment in 13.3; Added in packaging material restriction in Para 13.6; Revised to End of life plus ten years in Para 13.7; Added New Product Introduction in Para 13.12 Modified the Form A and change to revision C in APPENDIX B; Added in APPENDIX C.	06 June 2007	Chan Gum Meng
004	Update missing Avago Technologies Restricted label .No content changes	4 Sept 2007	Low Swee Thoe
005	Update Avago Technologies confidential FOOTER label	31 Mar 2008	Tajul Arosh
006	Added new references in Para 3 (A) and added internal specification references in Para 3 (B). Added new substances added into General Restrictions section under Class B. Revised Para 7.2 to include new category Added new clause in Para 7.5 Added new category in Para 7.6 Added new substance into Specific Application in Para 7.7 Added new clause in Para 13.1.6 Added new clause in Para 13.4.3 where supplier shall keep the GSE related records at least 5 years. Added new Form B for suppliers to declare on specific customer requirement (in Appendix B). Added new clause in Para 13.6.2 Revised Para 13.7 to include Form B	8 May 2008	Chan Gum Meng

Doc Num: (5972-2881-85)	Revision : (013)	Page 1 of 17
---------------------------	--------------------	--------------

BROADCOM INC CONFIDENTIAL

THIS DOCUMENT AND ANY ASSOCIATED DATA CONTAIN CONFIDENTIAL INFORMATION THAT IS BROADCOM INC PROPERTY. ONLY DISCLOSE OR DUPLICATE FOR OTHERS AS AUTHORIZED BY BROADCOM INC.

	Added new column (AN) in Form A in Appendix B. Added new detail substances reference with CAS# in Appendix A		
007	Revise Para 7.5 - Add reference to 7.6.1 and responsibility of Supplier/CM/ODM/OEM Revise Para 7.6 & 7.6.1 Table - Add effective date	22 May 2008	Chan Gum Meng
008	Added new clause in Para 2.1 Added REACH into Para 3.0 Reference Added new definition of Accredited laboratory in Para 4.0 Revise 5.2 – added (NPI & GSO) in the paragraph Added new clause in Para 7.6 Revise table 7.8.1 – correct the Bisphenol A limit & remove unwanted substances Added new clause in Para 7.10.12 Added REACH Requirement in Para 7.11 Added PVC & REACH-SVHC into Para 9 Added clause in Para 13.1.7 to include form B & REACH-SVHC form Added IEC62321 as recognizes test method in Para 13.3.1 Revised Para 13.6.1 Revise 13.7 – change the record retention period to permanent & added REACH-SVHC form as record Added 13.13 – Control of Non Conformance Products Revised substances name & CAS# in Appendix A Update URL link, revise GSE Form A & Form B & added REACH-SVHC declaration form in Appendix B	3 Feb 2009	Chan Gum Meng
009	Revise Para 5.2 to include ensure product compliance if there is any change qualification & obtained latest revision of GSE declaration form Revise table 7.8.1 - Effective Date of Bromine, Chlorine & Total Bromine & Chlorine to Restriction per specific Customer Requirement Remove the expired exemption of "Lead as impurity in RIG Faraday rotators.." in Para 7.10 (RoHS Exemption) Revise Para 7.10.8 to include the expired date of the exemption Add 14 REACH-SVHC substances into table 7.11.5 Add Halogen Test Method & Measurement Equipment in table 13.3.1 Add clause in Para 13.4.4 Revise Para 13.5.1 & 13.5.4 to include REACH-SVHC form Update new GSE REACH-SVHC form revision 2 in Appendix B	20 Jan 2010	Chan Gum Meng
010	Revised Para 7.1, 7.4 & 7.5 Removed Table 7.7.1 and 7.7.2; Added Para 7.7.1 Removed Table 7.8.1; Added Para 7.8.1 Removed Table 7.9.1; Added Para 7.9.1 Removed Table 7.11.5; Added Para 7.11.5 Removed Table 8.0; Revised Para 8.1; Removed Table 9.0; Revised Para 9.1; Removed All Appendix A tables; Added statement in Appendix A Removed document of GSE Form A, Form B & REACH-SVHC form in Appendix B Add in Halogen Free requirements Para 7.12 Add spec 5971-5507-82 to ref table B.	29 Oct 2010	Chan Gum Meng Tajul Arosh

011	<p>Updated Para3: Reference with latest WEEE Directive Recast and RoHS Recast & Amendment.</p> <p>Updated the Para 4. Definitions/Glossary with REACH-SVHC Form, PCBA Form, REACH, SVHC, XRF, PCBA.</p> <p>Added PCBA Form requirement into 7.5, 13.5.1, 13.5.4, 13.6.1, 13.7 & Appendix B for Board products.</p> <p>Updated the Para 7.12 customer specific requirements URL link.</p> <p>Updated URL link in Para 7.7.1, 7.8.1, 7.9.1, 7.11.5, 8.1, 9.1, Appendix A & B</p> <p>Added & Removed RoHS Exemption list at Para 7.1 0</p> <p>Added Para 13.1.8 & Para 13.2.5 for Board product requirement.</p> <p>Removed Para 13.5.6 Guideline for Analysis Disclosure report.</p> <p>Updated the test method in Para 13.3</p> <p>Changed MSDS to SDS in Para 13.10</p> <p>Added Para 11.6 and Appendix D for China RoHS Product Marking Requirements</p>	21 Aug 2015	Chan Gum Meng
012	<p>Added Conflict Minerals in Para 3.0 Reference.</p> <p>Added Conflict Minerals Requirement in Para 2.6, 5.6, 7.13</p> <p>Added Note: European Court of Justice (ECJ) ruled in Para 7.11.1</p> <p>Added its amendment Directive (EU) 2015/863 of 31 March 2015 in Para 7.10</p> <p>Revised to refer Appendix A in Para 7.7.1, 7.8.1, 7.9.1, 7.11.5, 7.12.1, 8.1, 9.1</p> <p>Added 7.8.2 for customer specific requirements.</p> <p>Revise Para 13.3.3 records keeping change from 5 years to 10 years.</p> <p>Amended Para 13.2.1 & 13.2.2</p> <p>Revised Appendix A and Appendix B web links.</p> <p>Change Avago Technologies to Broadcom name.</p> <p>Change to Broadcom Limited document template.</p>	7 Mar 2016	Chan Gum Meng
013	To change to Broadcom Inc template as well changing Broadcom Limited to Broadcom	24 Aug 2018	Tie YC

1. Purpose

- 1.1. This specification establishes Broadcom general requirements for purchased parts, components, materials and products that are incorporated into Broadcom's products.

The requirements described in this specification represent restrictions imposed on Broadcom's end products, which need to be reflected in the materials that constitute those products. The restrictions related to Broadcom's products may be different than those imposed on the individual parts and components, and in some cases exceed regulatory requirements.

2. Scope

- 2.1. This specification provides Broadcom general requirements for restricting or prohibiting certain substances as constituents of parts, components, materials, and Board products purchased by Broadcom worldwide. Military products are not in the scope of RoHS directive and EU REACH requirement hence these products are not obligated to be compliance to RoHS and REACH requirements in this specification.

- 2.2. This specification is not intended to be a listing of all product content limitations or restrictions that may be established as a matter of law. Seller's compliance with this specification does not relieve or diminish Seller's obligation to comply with all applicable laws.

2.2.1. Precedence: Should a conflict occur between this specification and a Broadcom's family or individual product environmental information specification (PEIS), the Broadcom's family or individual PEIS shall prevail.

2.2.2. Exception: Legal and/or regulatory requirements for the countries where these purchased parts, components, and products are to be used take precedence over this specification.

2.2.3. Waiver: Exceptional case of non-compliance with GSE specification requirement, waiver shall be issued with business division and Quality approval and documented in Product datasheet and PEIS. The waiver process shall refer to Broadcom's waiver procedures.

- 2.3. This specification is in addition to and does not in any way limit or supersedes any other product specifications that may be established by Broadcom.

- 2.4. Ozone Depleting Substances (ODS) shall not be used in the manufacturing process of parts, component materials, or products sold to Broadcom.

- 2.5. This specification also provides Broadcom's general requirements for transport or recycling/disposal marking and labeling, and classification or registration requirements of Broadcom purchased parts, components, materials and products.

- 2.6. Besides substances and chemicals restrictions, Broadcom is also committed to source raw materials in a manner consistent with our fundamental support for human rights, labours, ethics, environment, health and safety; more specifically to comply with US SEC's Dodd-Frank Wall Street Reform and Consumer Protection Act that imposes reporting requirements on publicly traded companies (in the US) to report annually the presence of conflict minerals (tin, tantalum, tungsten and gold) from Democratic Republic of Congo (DRC) or adjoining countries in the products

they manufacture or contract to manufacture whereby conflict minerals are necessary to the functionality or production of a product. Broadcom is committed to taking all steps to comply with the legislation and is implementing a comprehensive due diligence process (according to OECD Guidance) to meet our obligations.

3. Reference

A) Countries Legislation / Regulation References

RoHS/2002/95/EC	Restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment
RoHS/2011/65/EU	RoHS Recast of the European Parliament and of Council of 8 June 2011.
2015/863/EU	Amendment to 2011/65/EU, added 4 Phthalates as restriction substances.
WEEE/2002/96/EC	Waste Electrical and Electronic Equipment
2012/19/EU	WEEE Recast of the European Parliament and of the Council of 4 July 2012
91/338/EEC	10 th Amendment to 76/769/EEC, added Cadmium
76/769/EEC	Marketing and Use of Dangerous Substance
83/264/EEC	4 th Amendment to 76/769/EEC, added PBB, Tris (2,3 dibromopropyl)-phosphate
93/478/EEC	5 th Amendment to 76/769/EEC, added Asbestos
85/610/EEC	7 th Amendment to 76/769/EEC, Asbestos
91/659/EEC	Amendment to 76/769/EEC, Asbestos
2002/91/EC	Amendment to 76/769/EEC, Azocolorants
2037/2000	EC regulation on substances that deplete the Ozone layer
82/828/EEC	3 rd Amendment to 76/769/EEC. PCT (Polychlorinated biphenyls)
85/467/EEC	Amendment to 76/769/EEC, PCT and PCB (Polychlorinated)
89/677/EEC	8 th Amendment to 76/769/EEC, Added Hg, Arsenic, tin compounds
2002/45/EC	Amendment to 76/769/EEC, added short chain Paraffins (SCCPs)
CH stoV Anh 3.1	Swiss Ordinance on environmentally hazardous substances
EU 94/62/EEC	Packaging and packaging waste directive
Order 39	People's Republic of China's Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation, Ministry of Information Industry
SJ/T 11365-2006	Testing Methods for Hazardous Substances in Electronic Information Products
SJ/T 11363-2006	Requirement on concentration Limit to Toxic and Hazardous substances in Electronic Information Products of People's Republic of China.
76/769/EEC	Amending for the 30th time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (perfluorooctane sulfonates)
2005/84/EC	Amending for the 22nd time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (phthalates in toys and childcare articles)
Germany Law	PAH (Polycyclic Aromatic Hydrocarbons) shall not use in electrical products in Germany
PoHS Norway Law	Prohibited on certain Hazardous Substances in Consumer Products in Norwegian
EC 1907/2006 (EU REACH)	REACH is a new European Community Regulation on chemicals and their safe use. It deals with the R egistration, E valuation, A uthorization and R estriction of C hemical substances.
Conflict Minerals	US Dodd-Frank Consumer Protection Act. Section 1502.

B) Internal Specification References

5957-0292-80	Record Retention for Broadcom Malaysia
5957-0153-80	Record Retention for Broadcom Singapore
5957-0258-80	Product Change Control and Customer Notification for Broadcom Malaysia
5962-6052-80	Product Change Control and Customer Notification for Broadcom Singapore
5971-5507-82	WSD Product Change Control and Customer Notification
5961-6844-80	Control of Non Conformance Products for Broadcom Malaysia
5961-4657-80	Control of Non Conformance Products for Broadcom Singapore
5972-4220-80	Conflict Mineral Procedure

4. Definitions/Glossary

Homogenous Material	Homogenous material means a material that cannot be mechanically disjointed into different materials
Sub-part	A sub-unit of a product
Impurities	Substances that are contained in a natural material and cannot be eliminated during manufacturing process to product
Residues	Substances that are remained and not eliminated during manufacturing process to product
Maximum Concentration Value	Concentration level (ppm) which defines the limit, above which the presence of a substance defined in this specification by weight of a homogenous material in a product, is not allowed.
PPM	Parts per million (ppm) is used to express the maximum concentration value. The ppm is $1,000,000 \times \text{mass substance} / \text{mass of the homogeneous material}$. Concentrations are unit-less, for example $100 \text{ ppm} = 0.01\% = 100 \text{ mg/kg}$.
CM	Contract Manufacturer
OEM	Original Equipment Manufacturer
ODM	Original Design Manufacturer
P/N	Part Number
Form A	Analysis Disclosure Report and substances declaration of GSE form
Form B	Broadcom GSE Customer Specific Requirement Declaration form
REACH-SVHC Form	REACH SHVC Substances Declaration form
PCBA Form	PCBA declaration form for Printed Circuit Board Assemblies product
NPR	New Part Number Request
AVL	Approved Vendor List
GC-MS	Gas Chromatography/Mass Spectrometry
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometry
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectrometry
XRF	X-ray Fluorescence Test
CAS number	Chemical Abstracts Service (CAS) registration number for chemical substances
Accredited Laboratory	The testing laboratories are accredited to ISO/IEC17025 standard.
ECHA	European Chemical Agency
REACH	R egistration, E valuation, A uthorization and R estriction of C hemical substances
SVHC	Substances of Very High Concern
PCBA	Printed Circuit Board Assemblies

5. Roles and Responsibilities

- 5.1 Broadcom Product Steward lead is responsible for the governance and document control of GSE. Product Steward is also responsible to review the GSE regularly to ensure document is complying with existing legislations and regulations. He/she needs to develop compliance strategies for restricted materials including, but not limited to, labeling, reporting, or restrict sales to certain countries or markets. He/she will communicate latest development of country legislations, regulations & customer requirement to division product steward team.
- 5.2 Appointed division (NPI or GO) product steward to ensure that all products within the division are consistently conforming to GSE requirements and any other customer specific requirement. He/she reviews & approves the NPI Environmental check sheet. He/she to ensure product compliance if there is any change qualification related material and/or suppliers change. He/she is responsible to ensure every product part number has Product Environmental Information Sheets (PEIS) for existing parts and new parts. He/she ensures all parts are tested or declared for restricted substances per GSE and any customer specific requirement, when required. He/she is also responsible to ensure all products have obtained latest revision of GSE declaration form from their suppliers/ CMs/ OEMs/ ODMs. He/she will keep laboratory test reports and GSE declarations per records retention requirements.
- 5.3 NPI / Product manager/engineer to ensure every new product conforms to GSE requirements and completes the NPI Environmental check sheet. They are responsible to generate Product Environmental Information Sheets (PEIS) and parts are tested for the restricted substances. They are also responsible to obtain and ensure the data integrity from their suppliers/ CMs/ OEMs/ ODMs GSE declarations when any new part or supplier is introduced and used. They will keep laboratory test reports and GSE declarations per records retention requirements
- 5.4 Material Engineers are responsible to review and ensure the accuracy of data in the supplier declaration. Material Engineers are also responsible to ensure material under Broadcom AVL is consistently in compliance to the GSE and other customer specific requirements. They are to work with suppliers on GSE declaration and laboratory test reports for all direct purchase piece-parts supplier under Broadcom AVL. They are responsible for these records per records retention requirements. For turnkey CM, division product steward is responsible to update and keep the material piece part list or BOM for material engineer to obtain GSE declaration and test report from the Broadcom AVL supplier only, excluding CM owned supplier. Materials use in ODM product is not under material department responsibility.
- 5.5 WWO is responsible to liaise with CMs/ODMs/OEMs on GSE requirements and act as facilitator between division product steward and CMs/ODMs/OEMs to enable division product steward to obtain GSE declaration and test report from CMs/ODMs/OEMs (for ODM products only, excluding products with turnkey materials). WWO will handle escalations involving CM/ODMs/OEMs for any GSE related issue.
- 5.6 For Conflict Minerals compliance, a working team will survey the suppliers annually at the minimum using CMRT form developed by Conflict Free Sourcing Initiative or CFSI. (Refer to Conflict Minerals Procedure # 5972-4220-80 for more detail process).

6. Environmental Requirements

- 6.1 In this specification, environmental requirements are defined for the following:
- ☐ Product content and ODS use restrictions
 - ☐ Battery Content Restrictions
 - ☐ Packaging content restrictions
 - ☐ Phytosanitary measures for solid wood packaging materials
 - ☐ Product labeling and marking requirements

- ☐ Product end of life labeling requirements
- ☐ Chemical registration requirements
- ☐ Halogen Free requirements

7. Product Content Restrictions

- 7.1 The general restrictions substances listed in Class A and Class B are ***prohibited*** for use in raw materials, piece parts, components, or products. The maximum concentration value (ppm) by weight in subpart is only allowable to impurities and residues.
- 7.2 Restrictions are divided into three categories: General Restrictions (Class A and Class B), Country/ Regional/ Customer Restrictions and Specific Applications.
- 7.3 For the category of General Restrictions, Class A consists of restricted substances of (EU) RoHS and Class B consists of other substances that are prohibited or not to be used for any application.
- 7.4 For the category of Specific Applications, substances are only restricted for the list of applications (please refer to Para 7.9).
- 7.5 For the category of Country/Regional/Customer Restrictions, substances are only restricted for product go to this specific country, regional & customer per Effective Date indicated (refer to Para 7.8). However, suppliers and CMs/ODMs/OEMs are required to declare the presence of all these substances in Form A or PCBA Form (refer to Appendix B).
- 7.6 For the REACH requirement, suppliers and CMs/ODMs/OEMs are required to report the presence of all these substances in REACH-SVHC declaration Form (refer to Appendix B).

7.7 General Restrictions

- 7.7.1 The Substances listed in Class A and Class B shall be restricted or not be use in raw materials, piece parts, components, or products that supply to Broadcom in clause 7.7. Details of the restricted substances refer to Appendix A.

7.8 Country/Regional/Customer Restrictions

- 7.8.1 The substances shall be restricted or not be use in raw materials, piece parts, components, or products that supply to Broadcom as per Effective Date in the Clause7.8. Details of the restricted substances refer to Appendix A.
- 7.8.2 Customer specific requirements are reviewed by relevant product lines/divisions for compliance. Customer specifications or documents are available in Broadcom intranet.
(http://prodsteward.product.avagotech.net/Customer_Requirements/Customer_Req.htm).

7.9 Specific Applications

- 7.9.1 The substances shall only be restricted for those applications listed in the Clause7.9. Details of the restricted substances refer to Appendix A.

7.10 RoHS Exemption

The list of the exemptions is subject to change with respect to changes of the EU RoHS (2011/65/EU) and its amendment Directive (EU) 2015/863 of 31 March 2015 and WEEE (2012/19/EU) legislation. The following list is applicable to Broadcom. Refer to EU RoHS directive and WEEE legislation for the complete list.

In summary, they are listed below for quick reference.

- 7.10.1 (6a) Lead as an alloying element in steel for machining purposes and in galvanized steel containing up to 0.35 % lead by weight
- 7.10.2 (6b) Lead as an alloying element in aluminum containing up to 0,4 % lead by weight
- 7.10.3 (6c) Copper alloy containing up to 4% lead by weight
- 7.10.4 (7a) Lead in high melting temperature type solders (i.e. lead-based alloys containing 85% by Weight or more lead)
- 7.10.4 (7b) Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signaling, transmission, and network management for telecommunications. (Will expire on 22 July 2016)
- 7.10.5 (7c- I) Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezo-electronic devices, or in a glass or ceramic matrix compound.
- 7.10.6 (7c-II) Lead in dielectric ceramic in capacitors for a rated voltage of 125V AC or 250V DC or higher
- 7.10.7 (8b) Cadmium and its compounds in electrical contacts
- 7.10.8 (13a) Lead in white glasses used for optical applications
- 7.10.9 (13b) Cadmium and lead in filter glasses and glasses used for reflectance standards
- 7.10.10 (15) Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages
- 7.10.11 (23) Lead in finishes of fine pitch components other than connectors with a pitch of 0.65mm and less
- 7.10.12 (34) Lead in cermet-based trimmer potentiometer elements
- 7.10.13 Lead used in products for military purposes
- 7.10.14 Product that fall under large scale stationary industry tools category

(See link: <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1438145701924&uri=CELEX:32011L0065>)

7.11 REACH Requirement

7.11.1 REACH is stands for Registration, Evaluation, Authorization and Restriction of Chemical substances. The law entered into force on 1 June 2007. First phase of the regulation (~Nov 2010) is to have all the chemical manufacturer & importers that meet both the following conditions shall register with EU agency:-

(a) the substance is present in those articles in quantities totaling over 1 tonne per producer or importer per year to EU

(b) the substance is intended to be released under normal or reasonably foreseeable conditions of use. (eg. ink cartridge, detergent agent, flux, perfume & etc)

Any producer or importer of articles must provide information for the safe use of the articles to the customers if:

- the article produced/placed in the EU market contains “substances of very high concern” (SVHC) listed on Annex XIV above the permitted levels (concentration $\geq 0.1\%$ w/w or 1000PPM and quantity above 1 tonne per year)

Note: European Court of Justice (ECJ) ruled, on 10 September 2015, that each of the articles incorporated as a component of a complex product (like the notebook computer) is covered by the relevant duties to notify and provide information when they contain a substance of very high concern in a concentration above 0.1% of their weight. This is what the "dissenting Member States" termed "Once An Article, Always An Article", or OAAAAA.

7.11.2 Broadcom as a component producer, whose products (Articles) do not intend to release substances under normal use conditions, has no obligation to register the chemicals or substances we use in the products. However, the content of articles can still be restricted or banned if using any substances listed in Substances of Very High Concern (SVHC) list (or Candidate List) as showed in Table 7.11 and need to notify ECHA (European Chemical Agency) the presence of the substances.

7.11.3 The following SVHC substances are to date officially published by ECHA. The list may expand gradually according to ECHA publication. Latest candidate list of SVHC are available in URL below :-
(<http://echa.europa.eu/web/guest/candidate-list-table>)

7.11.4 As a user of substances and chemicals, Broadcom should communicate REACH requirements to our piece-part, material and chemical suppliers to ensure the chemicals or substances they use that require authorization are registered.

7.11.5 For clause 7.11, details of the restricted substances refer to Appendix A.

7.12 Halogen Free Requirements

7.12.1 Definition

A Halogen free or low halogen product is one, for each plastic (including PCB laminates) within the product, that contains less than maximum allowed concentration of Bromine and Chlorine per IEC 61249-2:

Chlorine: 900ppm

Bromine: 900ppm

Total Bromine + Chlorine: 1500ppm

For customer specific requirements, details of the restricted substances refer to Appendix A.

7.13 Conflict Mineral Requirements

7.13.1 Supplier to provide, and expects its suppliers to cooperate in providing, due diligence information, to assist Broadcom in confirming that any Conflict Minerals in our supply chain are “conflict free”.
Suppliers are expected to have Conflict Minerals Policy.

7.13.2 Supplier to work with its suppliers and others on industry-wide solutions to enable products that are DRC conflict free, including: (a) encouraging its suppliers to purchase materials from smelters who are listed on the Conflict-Free Smelter Program Compliant Smelter List and have been certified as conflict-free by an independent auditor through the Conflict-Free Smelter Program administered by the Electronic Industry Citizenship Coalition ("EICC") and the Global e-Sustainability Initiative ("GeSI"); and (b) supporting industry efforts to expand the smelter certification program.

7.13.3 Broadcom’s Conflict Minerals Policy can be downloaded from following web link address.
(https://www.broadcom.com/corporate_responsibility/environment.php)

8. Battery Content Restrictions

8.1 The substances listed in clause 8.0 shall be prohibited for use in batteries. Details of the restricted substances refer to Appendix A.

9. Packaging Content Restrictions

9.1 The substances listed in clause 9.0, shall be prohibited for use in packaging materials purchased by Broadcom and used to package the products Broadcom sells. Details of the restricted substances refer to Appendix A.

10. Phytosanitary Measures for Solid Wood Packaging Materials

The following requirement applies to packaging materials used to package and ship the products Broadcom sells. This requirement also applies to Broadcom’s appointed forwarders and CM/ODMs.

Packaging wood shall be free from bark, insects and damage caused by them. Solid Wood Packaging Materials shall be heat-treated or kiln dried to a minimum core temperature of 56°C for at least 30 minutes in a closed chamber or kiln, which

has been tested, evaluated and approved officially for this purpose. In addition, the susceptible wood shall display an officially approved heat treated or kiln dried marking enabling the identification of where and by whom the above treatment has been carried out. A logo or mark, officially endorsed by the NPPO (National Plant Protection Organization) of the country from which the wood packaging materials originates must be permanently affixed to each unit of wood packaging material, and in a location that will remain visible and obvious when packaging is used for shipment of Broadcom's product(s). Fumigation, Chemical Pressure Impregnation (CPI) or other chemical means are not to be used.

11. Product Labeling and Marking Requirements

- 11.1 **Mercury Product Labeling Requirements:** All products containing mercury shall be labeled with information indicating that mercury is present and that the product should be properly disposed of or recycled in accordance with locally applicable regulations.

- 11.2 **Product End of Life Labeling Requirements:** All products requiring a European CE marking must also have the crossed-out wheelie bin label with bar.



- 11.3 **Battery Labeling Requirements:** Batteries, rechargeable consumer products, and their packaging must have a durable label with the symbol(s) and wording according to the requirements specified in Appendix C. Information should be supplied with products containing a battery to identify the hazardous nature of the battery. Products with user-removable batteries should be supplied with information on the safe insertion and removal of the batteries.
- 11.4 **Battery Declaration of Conformity Requirements:** Batteries, including those contained in parts, components and products, must comply with the China battery registration requirements for no mercury content. Suppliers' Declaration of the conformity issued by the battery manufacturer and Battery product description such as MSDS must be provided on request.
- 11.5 **Mercury Product Labeling Requirements:** All products containing mercury shall be labeled with information indicating that mercury is present and that the product should be properly disposed of or recycled in accordance with locally applicable regulations.
- 11.6 **China RoHS Product Marking Requirement:** For board products are require to be marked with either green e logo or orange Environmental Protection Use Period (EPUP) logo and Products with orange EPUP logo will be appended with a Toxic and Hazardous Substance Table indicating the component with the banned substance, detail shown in Appendix D.

12. Chemical Registration Requirements

- 12.1 Each chemical substance contained in parts, components, materials and products sold to Broadcom must comply with chemical registration and pre-manufacture notification requirements in those countries that have enacted such requirements (including but not limited to: Australia, Canada, China, Japan, South Korea, Switzerland, the United States, and the countries of the European Union). This is in order to permit import and sale of the parts, components, materials and products sold to Broadcom in all of these countries.

13. GSE Substance restriction compliance

Material substance compliance in supplied parts, components, material and products sold to Broadcom shall be documented, and supporting evidence required on a periodic basis. Supporting evidence may be in, but not limited to, one or more of the prescribed manner:

13.1 GSE Compliance Declaration

- 13.1.1 GSE compliance declaration consists of Form A (Appendix B), to be filled in together with lab test report and returned as supporting document on supplied material compliance.
- 13.1.2 Applies to new material/piece-part (including packaging material), new part number and any changes in the product and processes that reflect GSE requirement.
- 13.1.3 Applies to new supplier /CM/ODM/OEM and any transfer CM to another CM of the product and processes that reflect GSE requirement.
- 13.1.4 If there is any change within the year, like adding new part #, change in raw material/piece-part and material manufacturer/supplier, a GSE Form A resubmission together with lab test report as applicable is needed. Submission number in Form A has to be revised accordingly.
- 13.1.5 Any part # which fails the GSE specs shall not be used and must be immediately contained. A waiver must be raised to proceed.
- 13.1.6 Form B (Appendix B) shall be use if there is any customer specific requirement that Broadcom need to compliance.
- 13.1.7 REACH – SVHC declaration form (Appendix B) shall be completed by suppliers, CMs, ODMs, OEMs from time to time whenever ECHA publish new candidates list of SVHC substances.
- 13.1.8 PCBA Form (Appendix B) shall be completed by suppliers, CMs, ODMs, OEMs for Board product.

13.2 Laboratory Test Report

- 13.2.1 The laboratory test must be performed by accredited laboratories (i.e. certified to ISO17025 by National Accreditation Body) and recognized testing methods and measurement equipment as shown in Table 1 for all the raw materials (including packaging material), piece parts, components, or products.
- 13.2.2 The testing of specified hazardous substances for all materials in general restrictions of Class A substances are required (RoHS II substances are optional until 22nd July 2019) and Halogen substances (Chlorine & Bromine) are required as per customer specific requirement as shown in Table 1.

Table 1

Test Item	Category	Laboratory Test Method	Measurement Equipment
Lead	Class A (RoHS)	IEC 62321	ICP-OES/AES machine XRF Machine (for Board only)
Mercury		IEC 62321	
Cadmium		IEC 62321	
Chromium VI *		IEC 62321	UV-Vis machine XRF Machine (for Board only)
PBDE/PBB **		IEC 62321	GC-MS machine
Phthalates (DBP, DEHP, BBP & DIBP)	Class A (RoHS II) 2015/863/EU	EN14372	GC-MS machine
Halogen (Chlorine & Bromine)	Customer specific Requirement	IEC61189-2 / EN14582	Ion Chromatography machine

Note (*): ISO 3613 shall use for metal material only

(): Not required for metal material**

- 13.2.3 Substances listed in Class B, Country/Regional/Customer Restrictions and REACH-SVHC substances are optional for piece part suppliers/CMs /ODMs /OEMs.
- 13.2.4 Yearly laboratory test report for Class A substances may be required per customer specific requirement. The yearly laboratory test report's validity is for 1 year from date of testing as trigger point.
- 13.2.5 Applies to any changes in the product and processes that reflect GSE requirement, Class A laboratory test report is necessary.
- 13.2.6 Laboratory test report may be required (per request basis) for the substances that listed in Class B, Country/Regional/Customer Restrictions, REACH-SVHC or even not covered in GSE but required by specific customers.
- 13.2.7 Sampling test on Board's components on Class A substances should be conducted using X-ray fluorescence (XRF) or other recognized testing method.

13.3 Supplier's and CM's Responsibility

- 13.3.1 To analyze, identify, declare and guarantee substances in parts or process to ensure they are complying with Broadcom's GSE requirements.
- 13.3.2 Shall not use any non-compliance materials unless specifically approved by Broadcom Senior management.
- 13.3.3 Shall keep the records (GSE declaration, test report & MSDS) at least 10 years.
- 13.3.4 When noncompliance material use in the same plant, Suppliers or CMs shall have proper control and / or segregation in the production line to prevent cross contamination. This shall be documented in respective process control procedure as appropriate.

13.4 Analysis Disclosure Certification

- 13.4.1 Supplier base – Different Analysis Disclosure Reports (GSE Form A, PCBA Form & REACH-SVHC form) is required for same p/n with different suppliers or CM.

- 13.4.2 One Lab Analysis Report for same composition – Only one report is required for different p/n with same composition from same raw material manufacturer. Example: Molded plastics from same resin grade.
- 13.4.3 Multiple GSE Form A– Multiple reports are required for different p/n with different composition.
- 13.4.4 New Part/Piece Part # - New GSE Form A, PCBA Form and REACH-SVHC form is required.
- 13.4.5 Analysis has to be broken down until subparts level (homogenous material) and to be done only by accredited laboratory.
- 13.4.6 Cross Reference Enabler - to minimize number of lab analysis required, perform analysis on piece part, which uses maximum if not all the relevant composition inside. Use “option ref.” Or “cross-ref. Piece-part #” of GSE Form A for disclosure report.
Example: For PCB manufacturer, select the multilayer boards with plugging epoxy for analysis.
- 13.4.7 Subpart with multiple material manufacturers needs to have analysis reports separated by materials manufacturers.
Example: Stiffener from DuPont and Microcosm need to have 2 lab reports.
- 13.4.8 A Part Number is considered NOT in compliance with GSE if any of the subpart fails GSE specs.

13.5 Change Control

- 13.5.1 Resubmission of GSE Form A, Form B (if any), PCBA Form, REACH-SVHC form and Class A laboratory test report are required if change in raw Materials, change in raw materials manufacturer, product transfer to new CM and added new part number. Originator (could be Broadcom, supplier or CM) of the change is responsible in ensuring the Forms are updated and submission # was revised accordingly. Form B are required for resubmission if impact customer specific requirement.
- 13.5.2 As and when there is a change in PPM level, or change in banned / restricted substances, a resubmission of disclosure and declaration reports are required. Only added banned / restricted substances require new lab analysis.
- 13.5.3 Resubmission of GSE form A and lab test report for any change in packaging material or/and supplier.

13.6 Records

The following owner shall keep the records listed below per Broadcom record retention procedure:-

Owner	Records to be kept	Retention period
Respective Divisions’ Product or process Engineering	-GSE Form A, Form B, PCBA Form & REACH-SVHC Form of CM/ODM/ OEM -Product & piece part laboratory test reports	Permanent
Material Engineering	-GSE Form A, Form B, PCBA Form & REACH-SVHC Form of direct or AVL Supplier -Piece part laboratory test reports	Permanent

13.7 Validation and Enforcement:

- 13.7.1 Broadcom may conduct random sample tests and suppliers/CMs site audit to validate the analysis report as well as process compliance.
- 13.7.2 If Broadcom’s finished product was confirmed failed GSE due to supplier/CM non-compliance to GSE, the supplier/CM is fully liable for all the cost incurred due to and not limited to actions taken such as screen, recall, stop production.

13.8 Supplier Own Declaration

Suppliers' own declaration may be accepted under specific conditions as agreed with attached laboratory test reports.

13.9 SDS (Safety Data Sheet)

SDS or other equivalent official document shall be made available for supplied material to indicate the qualitative and quantitative value of substances contained.

13.10 GSE Compliance Review Frequency

GSE and substance restriction compliance review shall be conducted on a regular frequency, including but not limited to

- a) as and when changes occur in governing requirements resulting in the need for a review.
- b) an updated substance verification is required as triggered by part of Broadcom's internal process

13.11 New Product Introduction

- 13.11.1 NPI Environmental Review Check sheet shall be completed during NPI. The latest check sheet can be downloaded from intranet product stewardship website.
- 13.11.2 Product Environmental Information Sheet (PEIS) shall be generated for all new products. The PEIS format and guide can be downloaded from intranet product stewardship website.

13.12 Control of Non Conformance Product

- 13.12.1 When any non-conforming products occur, respective department or division shall notify QA Product Steward and Division Product Steward immediately and the defective products shall be contained immediately until thorough investigation and root cause finding have been completed, with corrective actions implemented.
- 13.12.2 Refer to internal specification in Para 3 (References) for nonconforming product procedures.

APPENDIX A

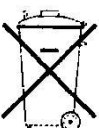










For Appendix A, please refer to latest version of document named Table of Restricted Substances in the Product Environmental Compliance of following web link address. (https://www.broadcom.com/corporate_responsibility/quality.php)

APPENDIX B

Latest versions of GSE specification, Form A, Form B, PCBA Form & REACH-SVHC declaration form documents are downloadable from in the Product Environmental Compliance of following web link address. (https://www.broadcom.com/corporate_responsibility/quality.php)

APPENDIX C

Labeling Requirements for Batteries, Consumer Products Containing Batteries, and their Packaging

PRODUCT TYPE	SYMBOL	WORDING ON LABEL
Alkaline batteries		-Manufacturer s name and address
Alkaline zinc-manganese and zinc-manganese batteries containing < 0.025% mercury (low mercury) or < 0.0001% mercury (mercury free)		-Manufacturer s name and address -low mercury content mercury free
Button cell batteries with mercury (<2% by weight)	 Hg	-Manufacturer s name and address Hg
Lead-acid (sealed) batteries and their packaging	  Pb	- Manufacturer s name and address - “Pb BATTERY MUST BE RECYCLED “ -“NON-SPILLABLE OR NON-SPILLABLE BATTERY”
Lithium and lithium ion batteries		-Manufacturer s name and address -Lithium or Lithium ion -Manufacturer s name and address
Nickel-Cadmium batteries and their packaging	  Cd	-“Ni-Cd” -“BATTERY MUST BE RECYCLED” OR - “DISPOSED OF PROPERLY”
Nickel metal hydride batteries		-Manufacturer s name and address - “CONTAINS NICKEL METAL HYDRIDE(NiMH) BATTERY”.
Rechargeable consumer products containing not easily removable sealed lead acid batteries	  Pb	-Manufacturer s name and address – “CONTAINS SEALED LEAD BATTERY”. -“BATTERY MUST BE RECYCLED”.
Rechargeable consumer products containing not easily removable Nickel-Cadmium batteries	  Cd	-Manufacturer s name and address -“CONTAINS NICKEL-CADMIUM BATTERY”. -“BATTERY MUST BE RECYCLED OR DISPOSED OF PROPERLY”.
Packaging of rechargeable consumer product Containing nickel-cadmium battery	  Cd	-Manufacturer s name and address -“CONTAINS NICKEL-CADMIUM BATTERY”. -“BATTERY MUST BE RECYCLED OR DISPOSED OF PROPERLY”.

APPENDIX D

China RoHS Product Marking Requirements

- The board products are required to be marked with either green e logo or orange Environmental Protection Use Period (EPUP) logo as shown below.



- Green logo is for products that do not contain any of the 6 banned substances.



- Orange logo is for products that contain any of the 6 banned substances.

- The number inside the logo is determined by respective product division.

- Need to be accompanied with Toxic and Hazardous Substance table.

- Products with orange EPUP logo will be appended with a Toxic and Hazardous Substance Table indicating the component with the banned substance.
- The symbols used are 'x' for present and 'o' for absent. An example is shown below.

Names and Contents of the Toxic and Hazardous Substances or Elements in the Products
产品中有毒有害物质或元素的名称及含量

Part Name 部件名称	Toxic and Hazardous Substances or Elements 有毒有害物质或元素					
	Lead (Pb) 铅 (Pb)	Mercury (Hg) 汞 (Hg)	Cadmium (Cd) 镉 (Cd)	Hexavalent (Cr(VI)) 六价 铬 (Cr(VI))	Polybrominated biphenyl (PBB) 多 溴联苯 (PBB)	Polybrominated diphenylether (PBDE) 多溴二苯醚 (PBDE)
Solder	x	o	o	o	o	o
I/O Pins	o	o	o	o	o	o

o: indicates that the content of the toxic and hazardous substance in all the homogeneous materials of the part is below the concentration limit requirement as described in SJ/T 11363-2006.
x: indicates that the content of the toxic and hazardous substance in at least one homogeneous material of the part exceeds the concentration limit requirement as described in SJ/T 11363-2006.
(The enterprise may further explain the technical reasons for the "x" indicated portion in the table in accordance with the actual situations.)

o: 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T 11363-2006 标准规定的限量要求以下。
x: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T 11363-2006 标准规定的限量要求。
(企业可在此处, 根据实际情况对上表中打"x"的技术原因进行进一步说明。)