

Test Report

No. 4306756-04

Date: 18/OCT/2017

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Robert Bosch GmbH
Mr. Oliver Preusch
RtP1/QMM-RP
Tübingerstr. 123
72703 Reutlingen
GERMANY



The following samples were submitted and identified by/on behalf of the client as

Order date : 26/SEP/2017
Order number : AE 47839627 – Z4T
Sample receiving Date : 27/SEP/2017
Testing period : 27/SEP/2017 – 18/OCT/2017

Sample ID	Sample designation
171040337	Type: BMA280 Equivalent material composition to BMA2xx Type No.: Batch No SG0SPVK.1 Date-Code: 16/34 Packager: ASE-KR

Summary of assessment

Parameter	Basis of assessment	Limits	Assessment
Pb, Cd, Hg, Cr(VI), PBB/PBDE	RoHS-Directive Dir. 2011/65 EU	Cd 100 mg/kg Pb, Hg, Cr(VI) 1000 mg/kg Sum of PBB or PBDE 1000 mg/kg	Pass
Pb, Cd, Hg, Cr(VI)	Customer requirement BOSCH Norm N2580-1 (2015)	Sum of Cd, Pb, Hg and Cr(VI) < 100 mg/kg Cd < 50 mg/kg Valid exemptions acc. dir. 2011/65 EU apply	Pass
Halogenes	Customer requirement BOSCH Norm N2580-1 (2015) Limits with reference to requirements acc. IEC 61249-2-21:2003	Chlorine or Bromine < 0,09% per homogeneous material; Sum of Chlorine and Bromine < 0,15% per homogeneous material; "homogeneous material" as defined by dir. 65/2011 EU) Iodine not specified Fluorine not specified	Pass
Tetrabromobisphenole A (TBBPA)	Customer requirement BOSCH Norm N2580-1 (2015)	1000 mg/kg	Pass
Antimony (Sb) and its compounds	Customer requirement BOSCH Norm N2580-1 (2015)	1000 mg/kg	Pass
Beryllium (Be) and its compounds	Customer requirement BOSCH Norm N2580-1 (2015)	1000 mg/kg (declaration requirement)	Pass

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SGS INSTITUT FRESenius GmbH | Im Maisel 14 | D-65232 Taunusstein | t +49 6128 744 - 0 | f +49 6128 744 - 130 | www.institut-fresenius.sgsgroup.de

Member of the SGS Group (Société Générale de Surveillance)

Die Prüfergebnisse beziehen sich auf die untersuchten Proben. Die Veröffentlichung und Vervielfältigung unserer Prüfberichte und Gutachten zu Werbezwecken sowie deren auszugsweise Verwendung in sonstigen Fällen bedürfen unserer schriftlichen Genehmigung. Alle Dienstleistungen werden auf Grundlage der anwendbaren Allgemeinen Geschäftsbedingungen der SGS, die auf Anfrage zur Verfügung gestellt werden, erbracht.

Geschäftsführer: Stefan Steinhardt, Aufsichtsratsvorsitzender: Dirk Hellemans, Sitz der Gesellschaft: Taunusstein, HRB 21543 Amtsgericht Wiesbaden

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Parameter	Basis of assessment	Limits	Assessment
Bismuth (Bi) and its compounds	Customer requirement BOSCH Norm N2580-1 (2015)	1000 mg/kg (declaration requirement)	not analysed
Phthalate-Plasticizers	BOSCH Norm N2580-1 (2015)	1000 mg/kg (declaration requirement)	Pass
Phthalate-Plasticizers: BBP, DBP, DEHP, DIBP	Commission Delegated Directive 2015/863 (EU)	1000 mg/kg	Pass
Perfluorooctane sulfonate (PFOS) + perfluorooctanoic acid (PFOA)	BOSCH Norm N2580-1 (2015) and Reg. 2004/850 (EU)	1000 mg/kg	Pass

Test(s) requested : In accordance with the RoHS Directive 2011/65/EU and subsequent amendments
Testing for Halogenes, Tetrabromobisphenole, Antimony, Beryllium, Phthalate-Plasticizers, Perfluorooctane sulfonate (PFOS) + perfluorooctanoic acid (PFOA)

Conclusion acc. RoHS-directive : Based on the performed tests on submitted sample(s), the test results of Lead, Mercury, Cadmium, hexavalent Chromium, Polybrominated Biphenyls(PBB) and Polybrominated Diphenyl Ethers (PBDE) **comply with** the limits as set by RoHS Directive 2011/65/EU, Annex 2 and subsequent amendments

Based on the performed tests on submitted sample(s), the test results of Bis(2-ethylhexyl) phthalate (DEHP), Butyl benzyl phthalate (BBP), Dibutyl phthalate (DBP), and Diisobutyl phthalate (DIBP) **comply with** the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

Sample contains Lead (Pb).The sample contains seal-glass acc. to client's declaration.
The use of lead is explicitly allowed acc. Directive 2011/65/EU, Annex 3 no. 7(c I) and an elevated content non objectionable for application as follows: 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

Test Result(s) : Please refer to next page(s)

For more information please refer to the next pages.

SGS INSTITUT FRESenius GmbH

i.V.

Wera Leonhard /tp
Projektleiterin / Project Manager

i.A.

Annkatrien Kuhl
Projektleiterin / Project Manager

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Test results (Unit: mg/kg)

Sample ID.		171040337		
Test Item(s):	Method (refer to)		RL	RoHS Limit
Cadmium(Cd)	Determination of Cadmium, Lead, Chromium (total) by ICP-OES with reference to IEC 62321-5:2013	n.d.	2**	100
Lead (Pb)		3370#	10	1000
Mercury (Hg)		n.d.	0,5	1000
Chromium, total (Cr)	Determination of Mercury by CV-AAS with reference to IEC 62321-4:2013	n.d.	10	1000 (limit for hexavalent chromium)
Chromium, hexavalent (Cr(VI))	Testing with reference to IEC 62321: (non-metallic samples) Determination after alkaline extraction and derivatisation with 1,5-diphenyl-carbazide based on IEC 62321, Ed1, 2008, C5 (polymer and electronic samples), Ion chromatography	n.d.	1	1000
Sum of PBBs	Testing with reference to IEC 62321-6:2015	n.d.	-	1000
Monobromobiphenyl	Determination of PBB/PBDE by GC/MS	n.d.	50	-
Dibromobiphenyl		n.d.	50	-
Tribromobiphenyl		n.d.	50	-
Tetrabromobiphenyl		n.d.	50	-
Hexabromobiphenyl		n.d.	50	-
Pentabromobiphenyl		n.d.	50	-
Heptabromobiphenyl		n.d.	50	-
Octabromobiphenyl		n.d.	50	-
Nonabromobiphenyl		n.d.	50	-
Decabromobiphenyl		n.d.	50	-
Sum of PBDEs		n.d.	-	1000
Monobromodiphenyl ether		n.d.	50	-
Dibromodiphenyl ether		n.d.	50	-
Tribromodiphenyl ether		n.d.	50	-
Tetrabromodiphenyl ether		n.d.	50	-
Pentabromodiphenyl ether		n.d.	50	-
Hexabromodiphenyl ether		n.d.	50	-
Heptabromodiphenyl ether		n.d.	50	-
Octabromodiphenyl ether		n.d.	50	-
Nonabromodiphenyl ether		n.d.	50	-
Decabromodiphenyl ether		n.d.	50	-

Note:

mg/kg = ppm

n.d.= not Detected

RL = Report Limit

n.a.= not analyzed

Note: Sample contains Lead (Pb). The sample contains seal-glass acc. to client's declaration.

The use of lead is explicitly allowed acc. Directive 2011/65/EU, Annex 3 no. 7(c I) and an elevated content non objectionable for application as follows: 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

**= elevated reporting limit due to matrix interferences

Remark: Due to its highly reactive nature the concentration of Cr(VI) in a corrosion-protection changes drastically with time and storage conditions. The results obtained by IEC 62321-7-1:2015 can therefore only give an indication of the presence/absence of Cr(VI) within the limitations of the method at the time of testing.

Remark: Please note that acc. to IEC the testing of metals for PBB/PBDE is gratuitous

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Test results (continued) (Unit: mg/kg)

Sample ID.	171040337			
Test Item(s):	Test Method	Results [mg/kg]	RL [mg/kg]	Customer specification
Fluorine (F)	Oxygen bomb combustion according to BS EN 14582:2007, ion chromatography (cooperation with SGS Asia)	n.d.	50	not specified
Chlorine (Cl)	Oxygen bomb combustion according to BS EN 14582:2007, ion chromatography (cooperation with SGS Asia)	n.d.	50	900/Sum Br, Cl :1500
Bromine (Br)	Oxygen bomb combustion according to BS EN 14582:2007, ion chromatography (cooperation with SGS Asia)	n.d.	50	900/Sum Br, Cl :1500
Iodine (I)	Oxygen bomb combustion according to BS EN 14582:2007, ion chromatography (cooperation with SGS Asia)	n.d.	50	not specified
Tetrabromobisphenole A (TBBPA)	High-resolution gas chromatography with mass-selective detector after soxhlet extraction with toluene	n.d.	50	1000
Antimony (Sb)	ICP-OES with reference to DIN EN ISO 11885	n.d.	50	1000
Beryllium (Be)	ICP-OES with reference to DIN EN ISO 11885	n.d.	50	1000 (declaration requirement)
Bismuth (Bi)	ICP-OES with reference to DIN EN ISO 11885	n.a.	50	1000 (declaration requirement)
Di-n-butylphthalat (DBP) (84-74-2) #	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Benzylbutylphthalat (BBP) (85-68-7) #	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-(2-ethylhexyl)phthalat (DEHP) (117-81-7) #	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-isononylphthalat (DINP) (28553-12-0)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-n-octylphthalat (DNOP) (117-84-0)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Diisodecylphthalat (DIDP) (26761-40-0)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-isobutylphthalat (DIBP) (84-69-5) #	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di(C7-C11 alkyl) Phthalates linear + branched (DHNUP) calculated as DUDP (68648-91-9)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000

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Sample ID.	171040337			
Test Item(s):	Test Method	Results [mg/kg]	RL [mg/kg]	Customer specification
Di-iso-heptylphthalat (DIHP) (90937-19-2)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-n-pentylphthalat (DnPP) (131-18-0)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
n-pentyl-iso-pentylphthalate (nPiPP) (776297-69-9)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-iso-pentylphthalat (DIPP) (605-50-5)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
1,2-Benzenedicarboxylic acid, dipentylester, branched and linear (84777-06-0)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-2-Methoxyethylphthalat (DMEP) (117-82-8)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-n-hexylphthalat (DnHP) (84-75-3)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Di-hexylphthalate (branched and linear) (68515-50-4)	Gas chromatography with mass selective detector after extraction with toluene	n.d.	100	1000
Perfluorooctane sulfonate (PFOS)	LC -MSMS after extraction with methanol	n.d.	1	1000
Perfluorooctanoic acid (PFOA)	LC -MSMS after extraction with methanol	n.d.	1	1000

Note: mg/kg = ppm n.d.= not Detected RL = Report Limit n.a.= not analyzed (**) = elevated reporting limit due to matrix interferences

Note: Commission Delegated Directive (EU) 2015/863 of 31 March 2015 amending Annex II to Directive 2011/65/EU as regards the list of restricted substances: addition of four phthalates **BBP, DBP, DEHP, DIBP**

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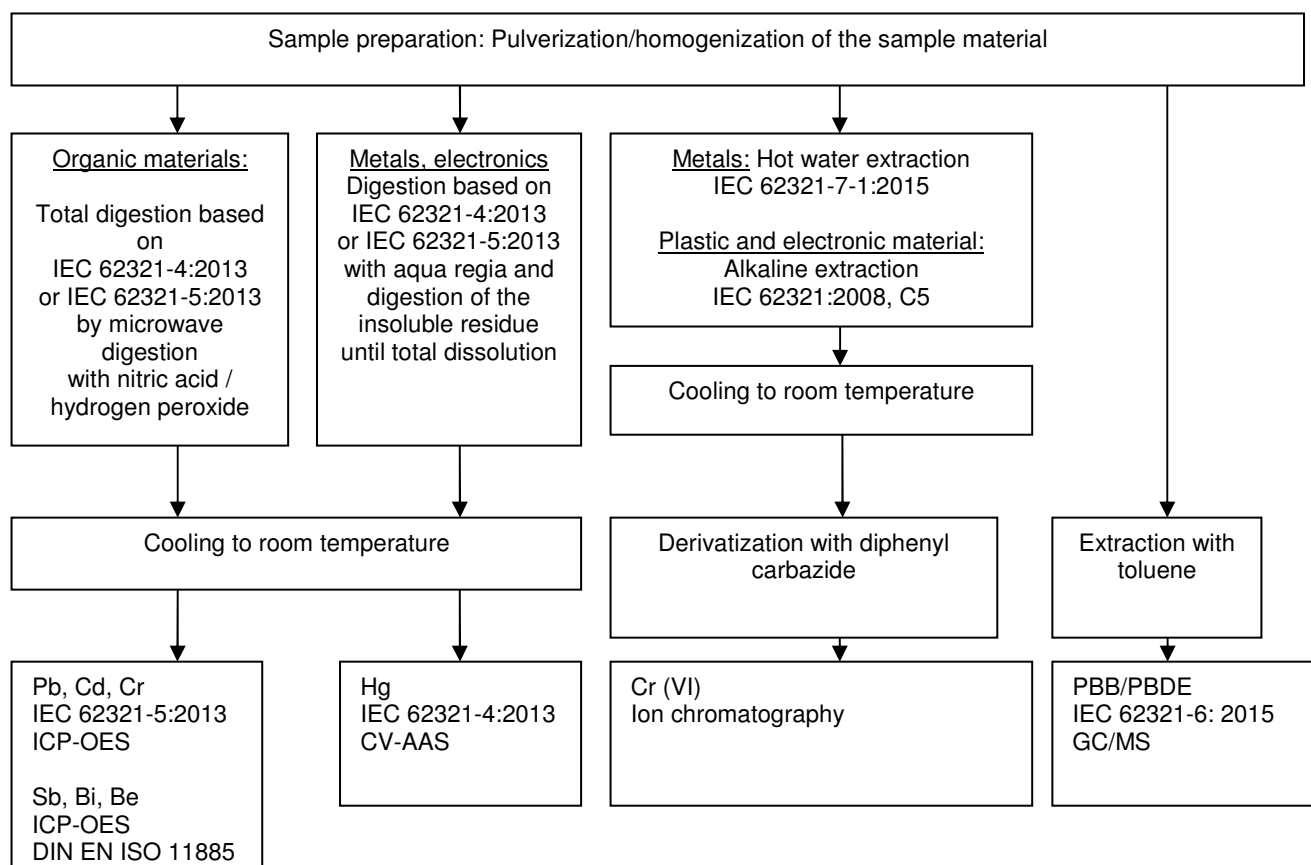
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Flow Chart for the working flow of the analysis acc. to RoHS Directive, Sb, Be and Bi



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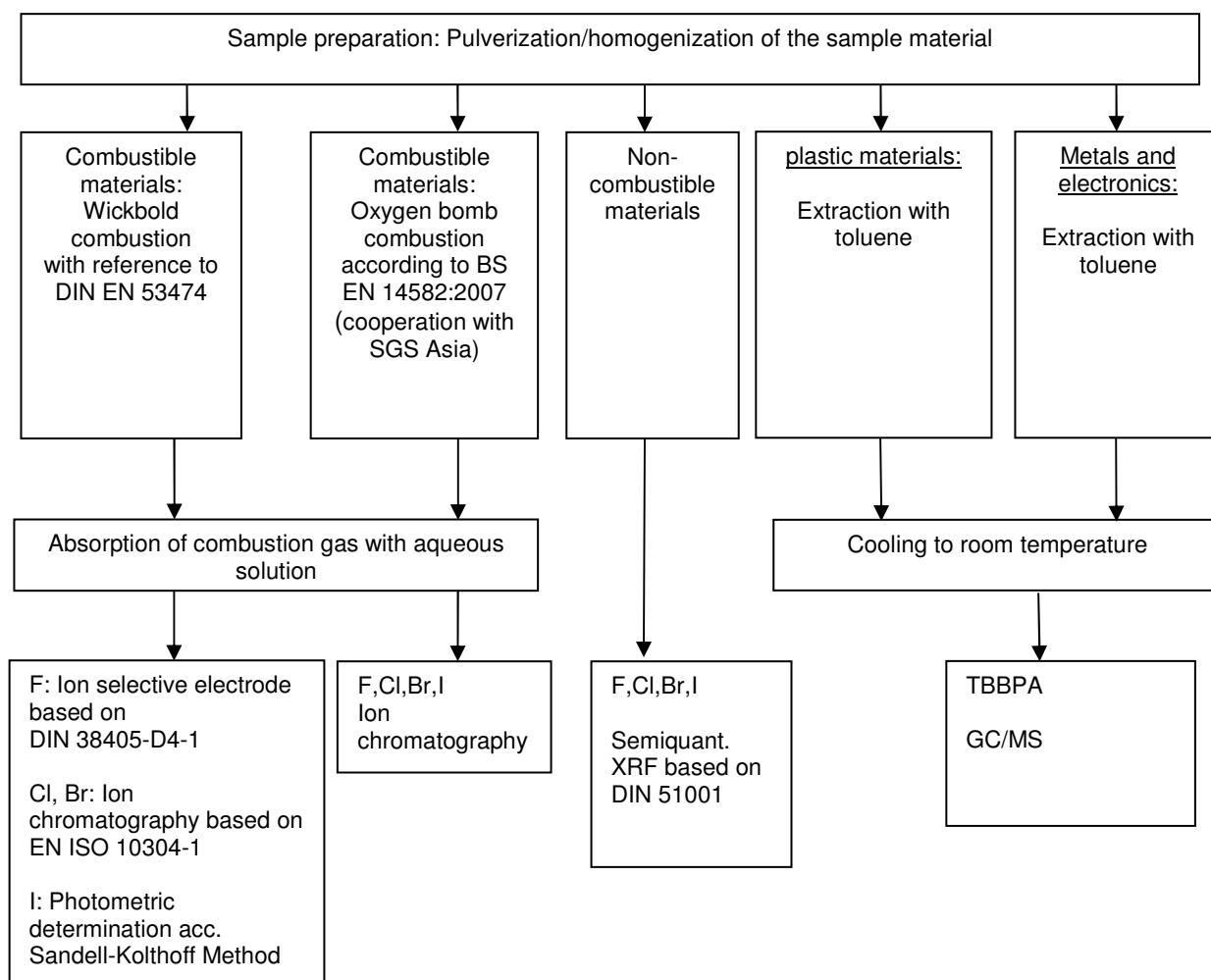
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Flow Chart for the working flow of the analysis: Halogenes and Tetrabromobisphenole A



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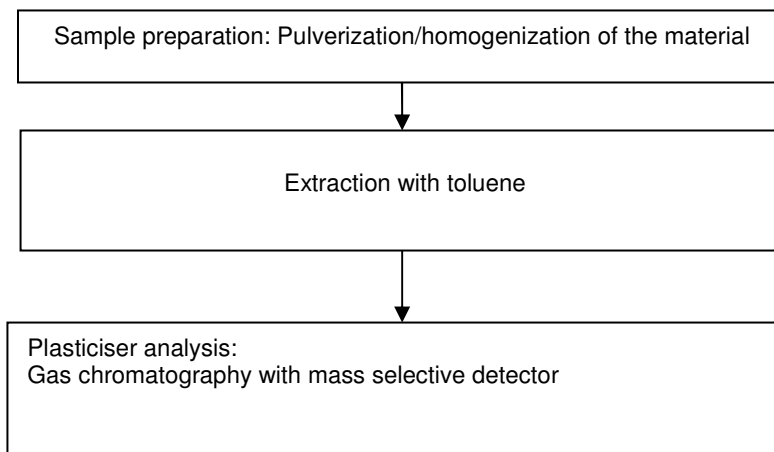
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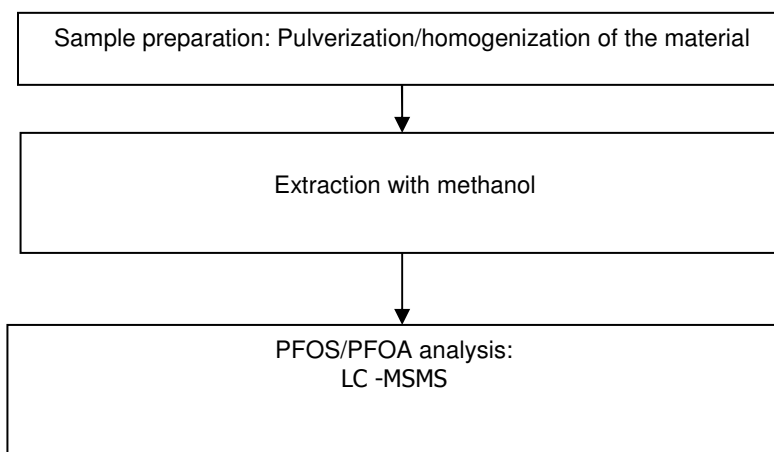
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Flow Chart for the working flow of the performed analysis: Plasticiser analysis



Flow Chart for the working flow of the performed analysis: PFOS / PFOA



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Sample Photo(s)



End of Report