Test Report

No. : CE/2019/72814 Date : 2019/08/16

HERAEUS DEUTSCHLAND GMBH & CO. KG
HERAEUSSTRASSE 12-14; 63450 HANAU; GERMANY

The following samples was/were submitted and identified by/on behalf of the applicant as :

Sample Submitted By	:	HERAEUS DEUTSCHLAND GMBH & CO. KG
Sample Description	:	LEAD-FRAME MOA8 N (Ag-PLATED)
Ident No.	:	5050516 (81094361 OLD)
Sample Receiving Date	:	2019/07/15 and 2019/08/12
Testing Period	:	2019/07/15 to 2019/07/19 and 2019/08/12 to 2019/08/16

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Test Requested :

(1) As specified by client, with reference to RoHS 2011/65/EU Annex II and amending Directive (EU) 2015/863 to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP contents in the submitted sample(s).

(2) Please refer to next pages for the other item(s).

Test Result(s) : Please refer to following pages.

Conclusion : (1) Based on the performed tests on submitted sample(s), the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

Troy Chang / Manager - Tech
Signed for and behalf of
SGS TAIWAN LTD.
Chemical Laboratory - Taipei

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Test Result(s)

PART NAME No.1 : PLATING LAYER OF SILVER COLORED METAL
PART NAME No.2 : BASE MATERIAL OF SILVER COLORED METAL
PART NAME No.3 : SILVER COLORED METAL (INCLUDING THE PLATING LAYER)

Test Item(s)	Unit	Method	MDL	Result			Limit
				No.1	No.2	No.3	
Cadmium (Cd)	mg/kg	IEC 62321-5 (2013) application of modified digestion by surface etching and performed by ICP-AES.	2	n.d.	---	---	100
Lead (Pb)	mg/kg	IEC 62321-5 (2013) application of modified digestion by surface etching and performed by ICP-AES.	2	n.d.	---	---	1000
Mercury (Hg)	mg/kg	IEC 62321-4:2013+AMD1:2017 application of modified digestion by surface etching and performed by ICP-AES.	2	n.d.	---	---	1000
Hexavalent Chromium Cr(VI)(#2)	µg/cm²	With reference to IEC 62321-7-1 (2015) and performed by UV-VIS.	0.10	n.d.	n.d.	---	-
Cadmium (Cd)	mg/kg	With reference to IEC 62321-5 (2013) and performed by ICP-AES.	2	---	n.d.	---	100
Lead (Pb)	mg/kg	With reference to IEC 62321-5 (2013) and performed by ICP-AES.	2	---	19.0	---	1000
Mercury (Hg)	mg/kg	With reference to IEC 62321-4:2013+ AMD1:2017 and performed by ICP-AES.	2	---	n.d.	---	1000
Sum of PBBs	mg/kg	With reference to IEC 62321-6 (2015) and performed by GC/MS.	-	---	---	n.d.	1000
Monobromobiphenyl	mg/kg		5	---	---	n.d.	-
Dibromobiphenyl	mg/kg		5	---	---	n.d.	-
Tribromobiphenyl	mg/kg		5	---	---	n.d.	-
Tetrabromobiphenyl	mg/kg		5	---	---	n.d.	-
Pentabromobiphenyl	mg/kg		5	---	---	n.d.	-
Hexabromobiphenyl	mg/kg		5	---	---	n.d.	-
Heptabromobiphenyl	mg/kg		5	---	---	n.d.	-
Octabromobiphenyl	mg/kg		5	---	---	n.d.	-
Nonabromobiphenyl	mg/kg		5	---	---	n.d.	-
Decabromobiphenyl	mg/kg		5	---	---	n.d.	-

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Test Item(s)	Unit	Method	MDL	Result			Limit
				No.1	No.2	No.3	
Sum of PBDEs	mg/kg	With reference to IEC 62321-6 (2015) and performed by GC/MS.	-	---	---	n.d.	1000
Monobromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Dibromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Tribromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Tetrabromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Pentabromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Hexabromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Heptabromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Octabromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Nonabromodiphenyl ether	mg/kg		5	---	---	n.d.	-
Decabromodiphenyl ether	mg/kg		5	---	---	n.d.	-
BBP (Butyl Benzyl phthalate) (CAS No.: 85-68-7)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	---	---	n.d.	1000
DBP (Dibutyl phthalate) (CAS No.: 84-74-2)	mg/kg		50	---	---	n.d.	1000
DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 117-81-7)	mg/kg		50	---	---	n.d.	1000
DIBP (Di-isobutyl phthalate) (CAS No.: 84-69-5)	mg/kg		50	---	---	n.d.	1000
Halogen							
Halogen-Fluorine (F) (CAS No.: 14762-94-8)	mg/kg	With reference to BS EN 14582 (2016). Analysis was performed by IC.	50	---	---	n.d.	-
Halogen-Chlorine (Cl) (CAS No.: 22537-15-1)	mg/kg		50	---	---	n.d.	-
Halogen-Bromine (Br) (CAS No.: 10097-32-2)	mg/kg		50	---	---	n.d.	-
Halogen-Iodine (I) (CAS No.: 14362-44-8)	mg/kg		50	---	---	n.d.	-
Antimony (Sb)	mg/kg	With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES.	2	---	---	n.d.	-
Arsenic (As)	mg/kg	With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES.	2	---	---	n.d.	-
Beryllium (Be)	mg/kg	With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES.	2	---	---	n.d.	-

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Note :

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. MDL = Method Detection Limit
3. n.d. = Not Detected = less than MDL
4. " - " = Not Regulated
5. "---" = Not Conducted
6. (#2) =
   a. The sample is positive for Cr(VI) if the Cr(VI) concentration is greater than 0.13 µg/cm². The sample coating is considered to contain Cr(VI)
   b. The sample is negative for Cr(VI) if Cr(VI) is n.d. (concentration less than 0.10 µg/cm²). The coating is considered a non-Cr(VI) based coating
   c. The result between 0.10 µg/cm² and 0.13 µg/cm² is considered to be inconclusive - unavoidable coating variations may influence the determination.

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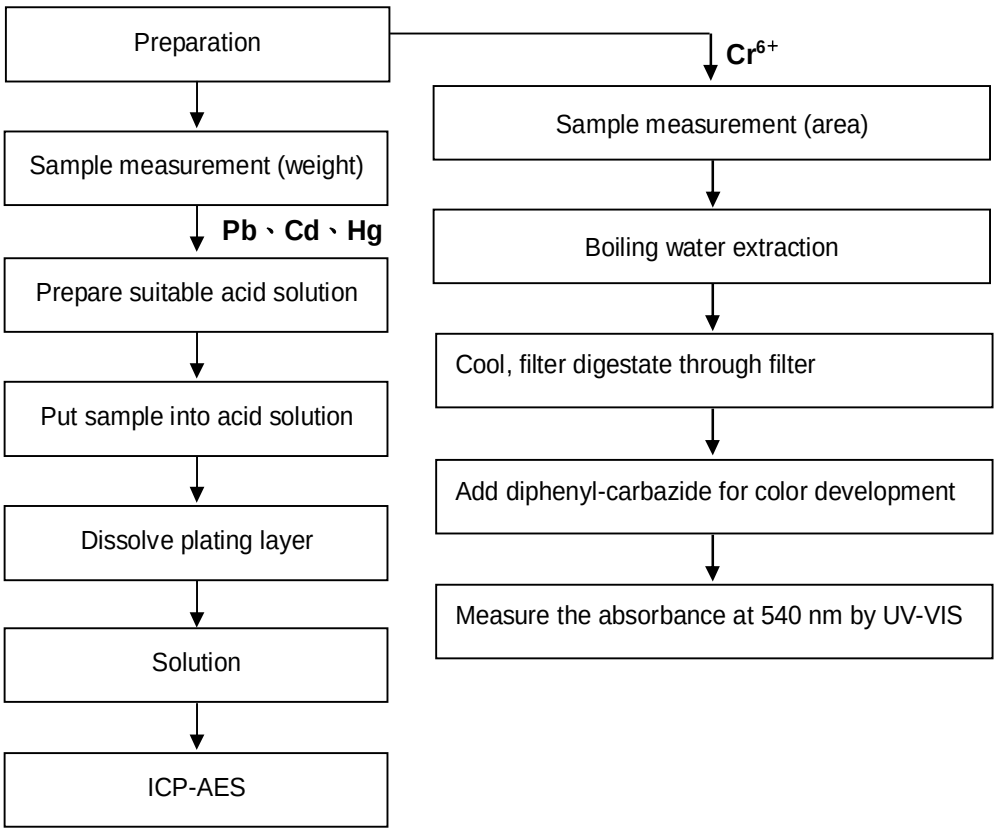
No.1

The plating layer of samples were dissolved totally by pre-conditioning method according to below flow chart.（Cr^{6+} test method excluded）

- Technician: Rita Chen
- Supervisor: Troy Chang

Flow Chart of Stripping method for metal analysis



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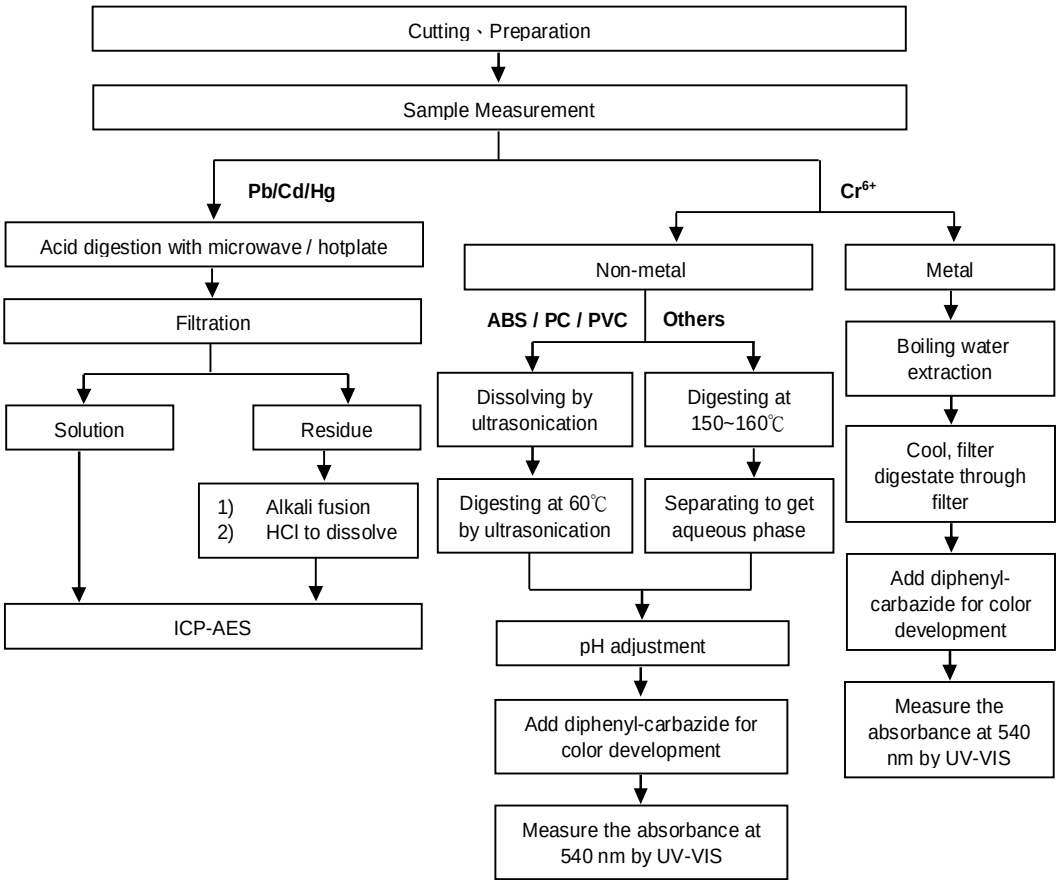
No.2

Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart.（Cr^{6+} test method excluded）

- Technician : Rita Chen
- Supervisor: Troy Chang



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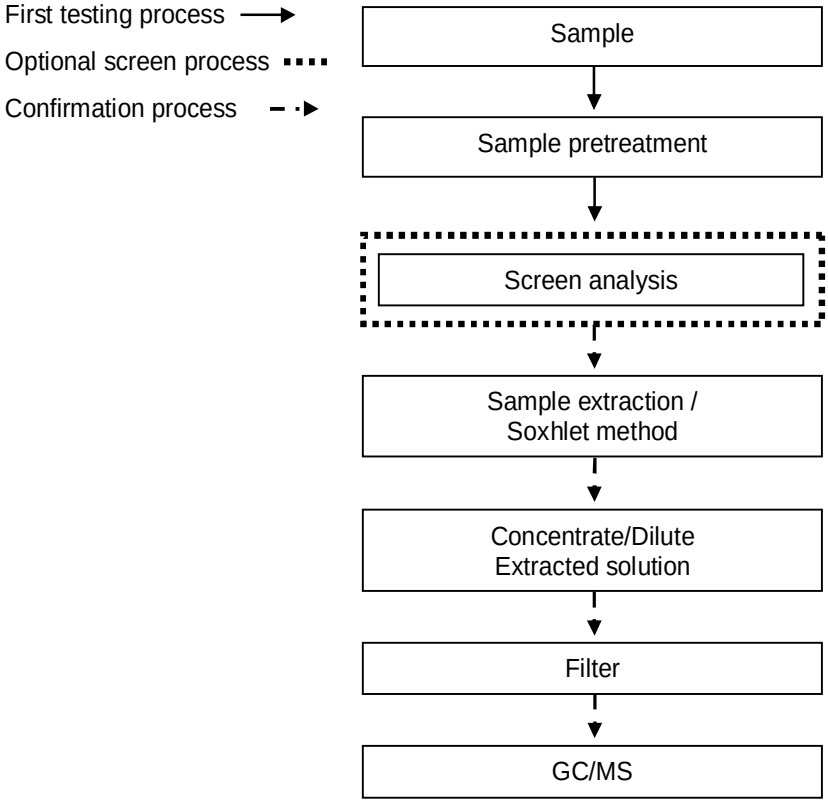
Analytical flow chart – PBB / PBDE

- Technician : Yaling Tu
- Supervisor: Troy Chang



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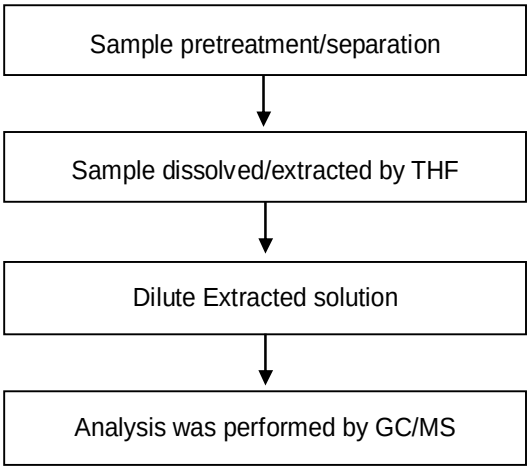
Analytical flow chart - Phthalate

- Technician: Yaling Tu
- Supervisor: Troy Chang

【Test method: IEC 62321-8】



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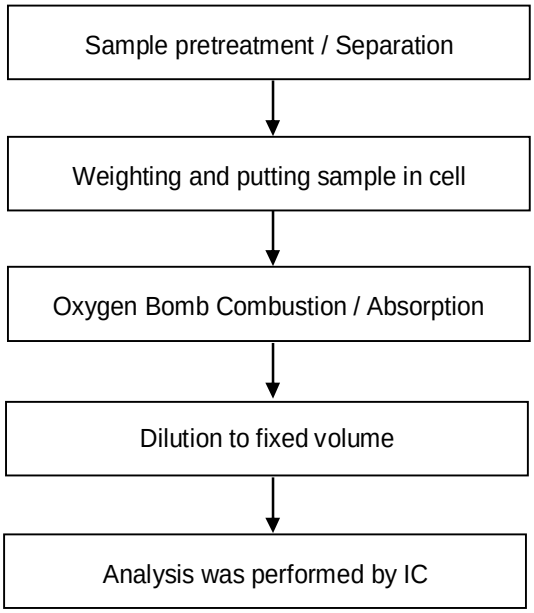
Analytical flow chart - Halogen

- Technician: Rita Chen
- Supervisor: Troy Chang



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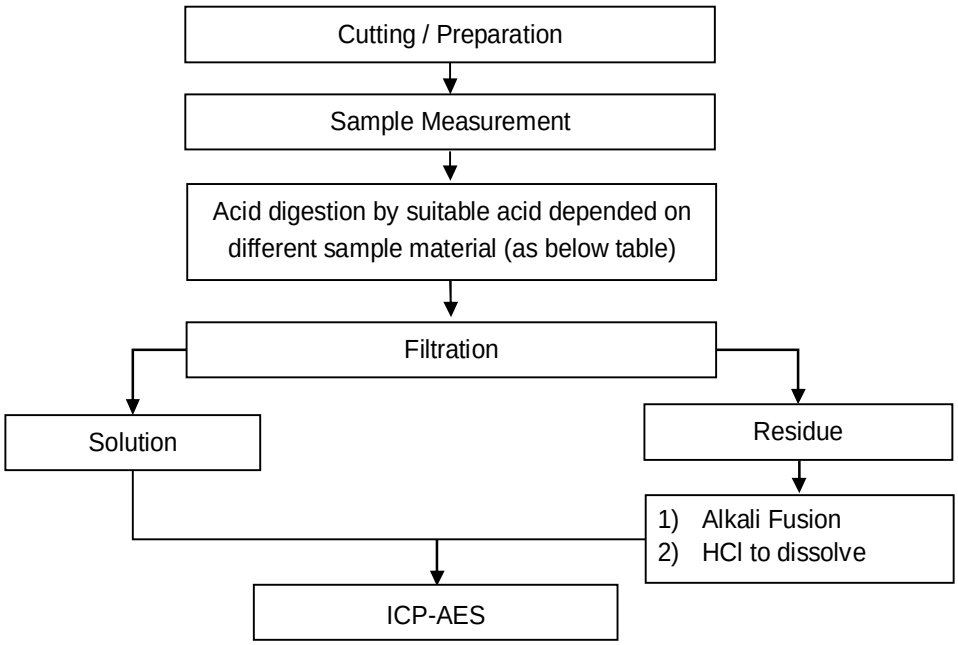
These samples were dissolved totally by pre-conditioning method according to below flow chart.

- Technician: Rita Chen
- Supervisor: Troy Chang

Flow Chart of digestion for the elements analysis performed by ICP-AES



Steel, copper, aluminum, solder	Aqua regia, HNO_3, HCl, HF, H_2O_2
Glass	HNO_3/HF
Gold, platinum, palladium, ceramic	Aqua regia
Silver	HNO_3
Plastic	H_2SO_4, H_2O_2, HNO_3, HCl
Others	Added appropriate reagent to total digestion

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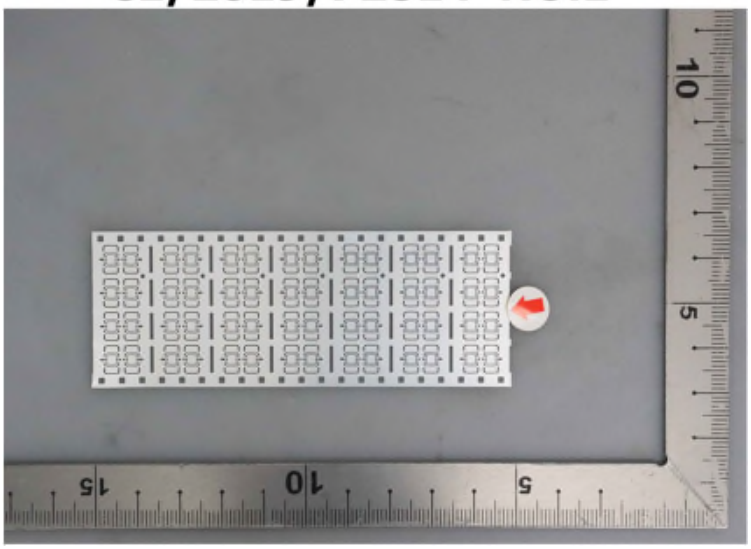
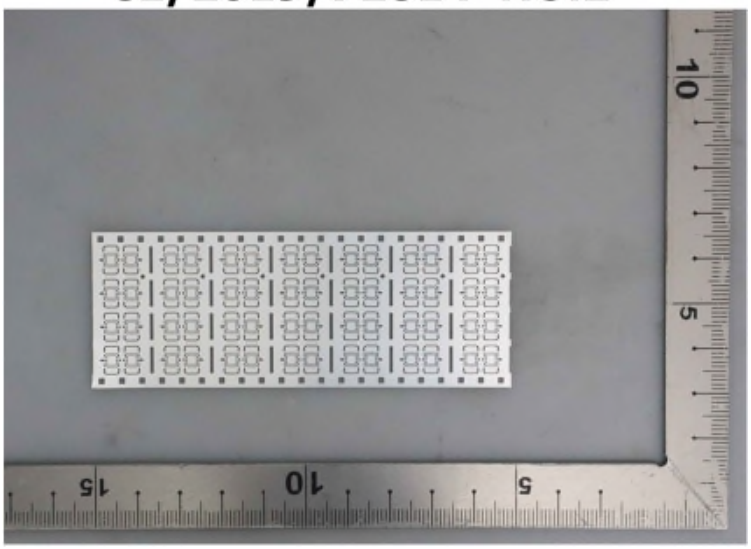
*** The tested sample / part is marked by an arrow if it's shown on the photo. ***

CE/2019/72814 NO.1



CE/2019/72814 NO.2



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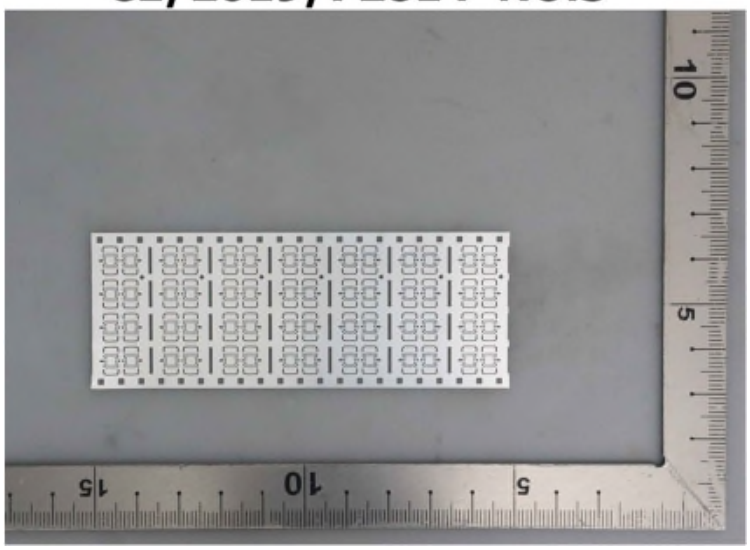
CE/2019/72814 NO.3



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