

VDE Testing and Certification Institute • Merianstr. 28 • 63069 Offenbach • Germany

Date: February 25<sup>th</sup>, 2024  
From: Dr. Michael Riess, VDE  
To: Motorola/Lenovo

Subject: **Recyclability and Recoverability Report by VDE Testing and Certification Institute**

## **Earbuds + Charging Case**

### Description of Methodology


The calculation is based on a disassembly assessment of the product. The disassembly is done down to the level of “functional units” similar to what is done in recycling facilities. Based on Material Assessment data the composition of each functional unit is evaluated regarding compatibility of the overall material composition of the functional unit with material fractions, similar to the requirements of the European WEEE directive 2012/19/EU.

The functional unit material compatibility assessment allows the calculation of the recyclability and recoverability<sup>1)</sup>. Formulas for calculation:

$$\text{recyclability} = \sum(\text{mass of recyclable product fractions/materials}) \div (\text{total mass of product}) \times 100$$

$$\text{recoverability} = \sum(\text{mass of recyclable product fractions/materials} + \text{mass of further serving useful purpose product material-mixes}) \div (\text{total mass of product}) \times 100$$

<sup>1)</sup> Percentage of materials that are compatible with materials recycling processes or that can go into energy recovery process

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## Annex

Based on Testreports 315052-TL7-1 and 315052-TL7-2 the product achieves a recycling quote of 87.56 % and a recovery quote of 97.84 %.

### Required Records:

1. Total weight of Ear buds and Charging case (with Battery): 50.396 g = 0.111 lbs
2. Fraction Assessment for recycling:

Fraction Name	Sample No.	Description	Total Mass in [g]	Recycled or Reused Mass in [g]	Factor Recycling	Compatibility Recycling	Why not recyclable
Battery	GC2079-00	23-341 Motorola Charging case, Battery	8,068	8,068	100%	YES	
Copper Alloy	GC2071-00	23-341 Motorola Charging case, Charging coil	2,014	2,014	100%	YES	
Ferrous Alloy	GC2072-00	23-341 Motorola Charging case, Metal hinge	3,482	3,482	100%	YES	
Ferrous Alloy	GC2081-01	23-341 Motorola Charging case, Black screws 1	0,123	0,123	100%	YES	
Ferrous Alloy	GC2081-02	23-341 Motorola Charging case, Black screws 2	0,123	0,123	100%	YES	
Ferrous Alloy	GC2081-03	23-341 Motorola Charging case, Black screws 3	0,124	0,124	100%	YES	
Ferrous Alloy	GC2090-00	23-341 Motorola Charging case, Spring	0,035	0,035	100%	YES	
Non recyclable	GC2062-00	23-341-1 Motorola Left ear bud, Rubber bud	0,319	0	0%	NO	Non remeltable
Non recyclable	GC2063-00	23-341-1 Motorola Left ear bud, Black net	0,003	0	0%	NO	Material Mix more than 5% differing materials
Non recyclable	GC2065-00	23-341-1 Motorola Right ear bud, Rubber bud	0,317	0	0%	NO	Non remeltable
Non recyclable	GC2066-00	23-341-1 Motorola Right ear bud, Black net	0,005	0	0%	NO	Material Mix more than 5% differing materials
Non recyclable	GC2073-00	23-341 Motorola Charging case, Top housing	5,043	0	0%	NO	Material Mix more than 5% differing materials

Fraction Name	Sample No.	Description	Total Mass in [g]	Recycled or Reused Mass in [g]	Factor Recycling	Compatibility Recycling	Why not recyclable
Non recyclable	GC2084-01	23-341 Motorola Charging case, Black glue strip	0,009	0	0%	NO	Material Mix more than 5% differing materials
Non recyclable	GC2084-02	23-341 Motorola Charging case, Yellow strip	0,024	0	0%	NO	Material Mix more than 5% differing materials, Phthalate
Non recyclable	GC2084-03	23-341 Motorola Charging case, White glue strip	0,056	0	0%	NO	Phthalate
Non recyclable	GC2085-01	23-341 Motorola Charging case, Black shock pad 1	0,005	0	0%	NO	Material Mix more than 5% differing materials
Non recyclable	GC2085-02	23-341 Motorola Charging case, Black shock pad 2	0,037	0	0%	NO	Material Mix more than 5% differing materials
Non recyclable	GC2086-00	23-341 Motorola Charging case, Humidity indicator	0,001	0	0%	NO	Material Mix more than 5% differing materials
Non recyclable	GC2087-00	23-341 Motorola Charging case, Gray thermal paste	0,451	0	0%	NO	Non remeltable
PWB and mixed Electronics	GC2064-00	23-341-1 Motorola Left ear bud	3,263	3,263	100%	YES	
PWB and mixed Electronics	GC2064-33	23-341-1 Motorola Left ear bud, PWB 2	0,366	0,366	100%	YES	
PWB and mixed Electronics	GC2064-34	23-341-1 Motorola Left ear bud, Flex 3	0,227	0,227	100%	YES	
PWB and mixed Electronics	GC2067-00	23-341-1 Motorola Right ear bud	3,268	3,268	100%	YES	
PWB and mixed Electronics	GC2067-35	23-341-1 Motorola Right ear bud, Flex 1	0,230	0,230	100%	YES	
PWB and mixed Electronics	GC2067-38	23-341-1 Motorola Right ear bud, PWB 1	0,350	0,350	100%	YES	
PWB and mixed Electronics	GC2070-00	23-341 Motorola Charging case, Carging PWB	1,036	1,036	100%	YES	
PWB and mixed Electronics	GC2074-00	23-341 Motorola Charging case, Black connection cable	0,036	0,036	100%	YES	
PWB and mixed Electronics	GC2075-00	23-341 Motorola Charging case, Red connection cable	0,030	0,030	100%	YES	
PWB and mixed Electronics	GC2076-00	23-341 Motorola Charging case, Connection flex	0,102	0,102	100%	YES	
PWB and mixed Electronics	GC2077-01	23-341 Motorola Charging case, Charging Contact flex 1	0,117	0,117	100%	YES	

Fraction Name	Sample No.	Description	Total Mass in [g]	Recycled or Reused Mass in [g]	Factor Recycling	Compatibility Recycling	Why not recyclable
PWB and mixed Electronics	GC2077-02	23-341 Motorola Charging case, Charging Contact flex 2	0,117	0,117	100%	YES	
PWB and mixed Electronics	GC2078-00	23-341 Motorola Charging case, Main PWB	2,606	2,606	100%	YES	
Rare earth Magnet material	GC2082-01	23-341 Motorola Charging case, Magnets 1	0,234	0,234	100%	YES	
Rare earth Magnet material	GC2082-02	23-341 Motorola Charging case, Magnets 2	0,197	0,197	100%	YES	
Rare earth Magnet material	GC2082-03	23-341 Motorola Charging case, Magnets 3	0,648	0,648	100%	YES	
Rare earth Magnet material	GC2082-04	23-341 Motorola Charging case, Magnets 4	0,267	0,267	100%	YES	
Rare earth Magnet material	GC2082-05	23-341 Motorola Charging case, Magnets 5	0,255	0,255	100%	YES	
Recyclable Plastic	GC2068-00	23-341 Motorola Charging case, Top plastic inlay	3,220	3,220	100%	YES	
Recyclable Plastic	GC2069-00	23-341 Motorola Charging case, Bottom housing	8,054	8,054	100%	YES	
Recyclable Plastic	GC2080-00	23-341 Motorola Charging case, Inner bottom housing	5,456	5,456	100%	YES	
Recyclable Plastic	GC2083-01	23-341 Motorola Charging case, Red glue 1	0,010	0,010	100%	YES	
Recyclable Plastic	GC2083-02	23-341 Motorola Charging case, Red glue 2	0,037	0,037	100%	YES	
Recyclable Plastic	GC2088-01	23-341 Motorola Charging case, White glue 1	0,012	0,012	100%	YES	
Recyclable Plastic	GC2088-02	23-341 Motorola Charging case, White glue 2	0,011	0,011	100%	YES	
Recyclable Plastic	GC2088-03	23-341 Motorola Charging case, White glue 3	0,007	0,007	100%	YES	
Recyclable Plastic	GC2089-00	23-341 Motorola Charging case, Black plastic rings	0,001	0,001	100%	YES	
			50,396	44,126			

3. Fraction Assessment for recovery:

Fraction Name	Sample No.	Description	Total Mass in [g]	Recovered Mass in [g]	Factor Recovery	Compatibility Recovery	Why not recoverable
Battery	GC2079-00	23-341 Motorola Charging case, Battery	8,068	8,068	100%	YES	
Copper Alloy	GC2071-00	23-341 Motorola Charging case, Charging coil	2,014	2,014	100%	YES	
Ferrous Alloy	GC2072-00	23-341 Motorola Charging case, Metal hinge	3,482	3,482	100%	YES	
Ferrous Alloy	GC2081-01	23-341 Motorola Charging case, Black screws 1	0,123	0,123	100%	YES	
Ferrous Alloy	GC2081-02	23-341 Motorola Charging case, Black screws 2	0,123	0,123	100%	YES	
Ferrous Alloy	GC2081-03	23-341 Motorola Charging case, Black screws 3	0,124	0,124	100%	YES	
Ferrous Alloy	GC2090-00	23-341 Motorola Charging case, Spring	0,035	0,035	100%	YES	
Non recoverable	GC2062-00	23-341-1 Motorola Left ear bud, Rubber bud	0,319	0	0%	NO	Non combustible
Non recyclable	GC2063-00	23-341-1 Motorola Left ear bud, Black net	0,003	0,003	100%	YES	
Non recoverable	GC2065-00	23-341-1 Motorola Right ear bud, Rubber bud	0,317	0	0%	NO	Non combustible
Non recyclable	GC2066-00	23-341-1 Motorola Right ear bud, Black net	0,005	0,005	100%	YES	
Non recyclable	GC2073-00	23-341 Motorola Charging case, Top housing	5,043	5,043	100%	YES	
Non recyclable	GC2084-01	23-341 Motorola Charging case, Black glue strip	0,009	0,009	100%	YES	
Non recyclable	GC2084-02	23-341 Motorola Charging case, Yellow strip	0,024	0,024	100%	YES	

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Non recyclable	GC2085-02	23-341 Motorola Charging case, Black shock pad 2	0,037	0,037	100%	YES	
Non recyclable	GC2086-00	23-341 Motorola Charging case, Humidity indicator	0,001	0,001	100%	YES	
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PWB and mixed Electronics	GC2064-00	23-341-1 Motorola Left ear bud	3,263	3,263	100%	YES	
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PWB and mixed Electronics	GC2067-38	23-341-1 Motorola Right ear bud, PWB 1	0,350	0,350	100%	YES	
PWB and mixed Electronics	GC2070-00	23-341 Motorola Charging case, Charging PWB	1,036	1,036	100%	YES	
PWB and mixed Electronics	GC2074-00	23-341 Motorola Charging case, Black connection cable	0,036	0,036	100%	YES	
PWB and mixed Electronics	GC2075-00	23-341 Motorola Charging case, Red connection cable	0,030	0,030	100%	YES	
PWB and mixed Electronics	GC2076-00	23-341 Motorola Charging case, Connection flex	0,102	0,102	100%	YES	
PWB and mixed Electronics	GC2077-01	23-341 Motorola Charging case, Charging Contact flex 1	0,117	0,117	100%	YES	
PWB and mixed Electronics	GC2077-02	23-341 Motorola Charging case, Charging Contact flex 2	0,117	0,117	100%	YES	
PWB and mixed Electronics	GC2078-00	23-341 Motorola Charging case, Main PWB	2,606	2,606	100%	YES	

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Rare earth Magnet material	GC2082-03	23-341 Motorola Charging case, Magnets 3	0,648	0,648	100%	YES	
Rare earth Magnet material	GC2082-04	23-341 Motorola Charging case, Magnets 4	0,267	0,267	100%	YES	
Rare earth Magnet material	GC2082-05	23-341 Motorola Charging case, Magnets 5	0,255	0,255	100%	YES	
Recyclable Plastic	GC2068-00	23-341 Motorola Charging case, Top plastic inlay	3,220	3,220	100%	YES	
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Recyclable Plastic	GC2088-02	23-341 Motorola Charging case, White glue 2	0,011	0,011	100%	YES	
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Recyclable Plastic	GC2089-00	23-341 Motorola Charging case, Black plastic rings	0,001	0,001	100%	YES	
			50,396	49,309			