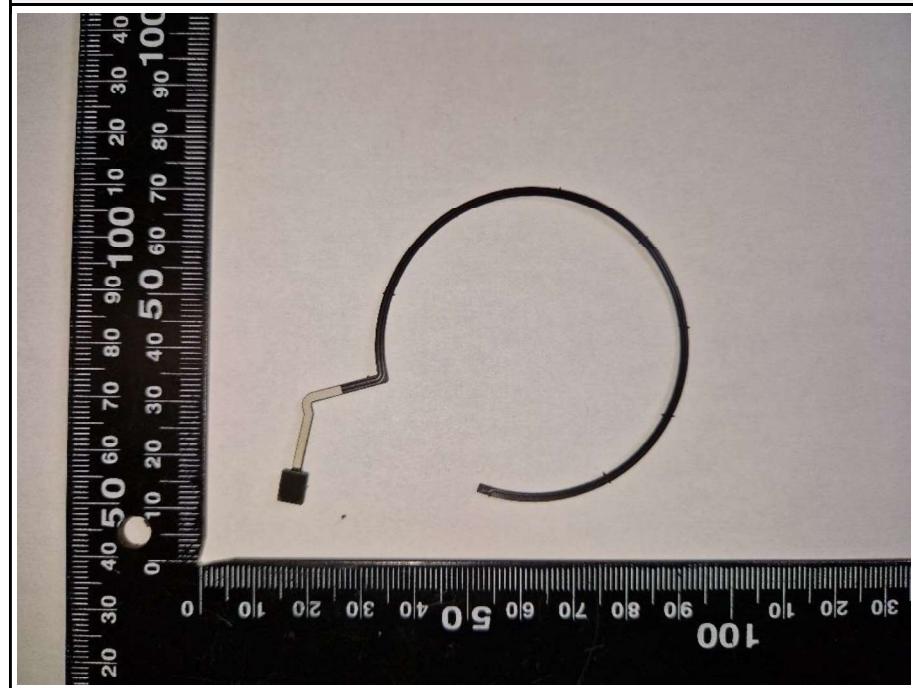
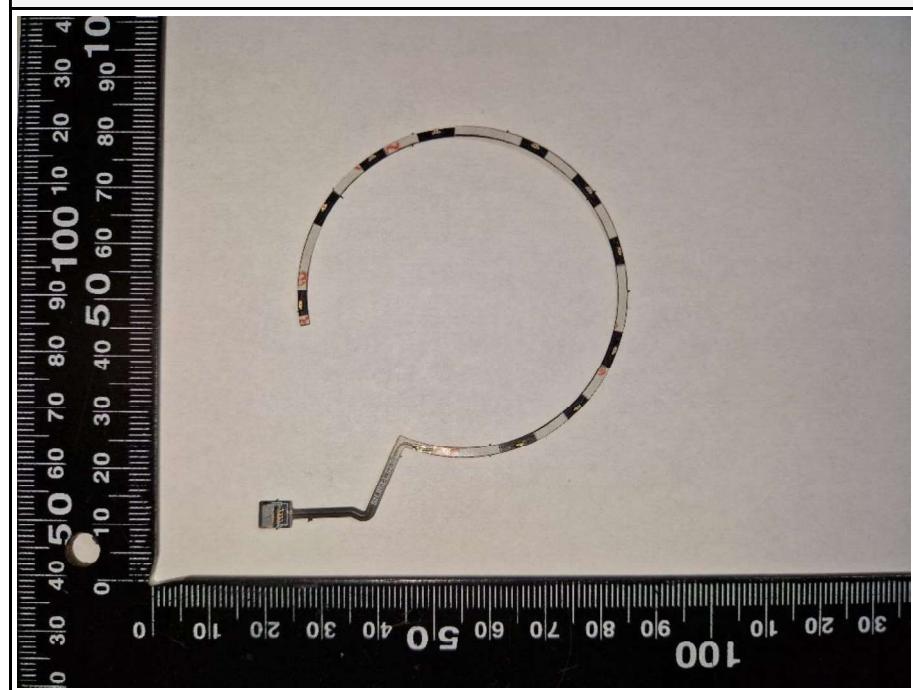
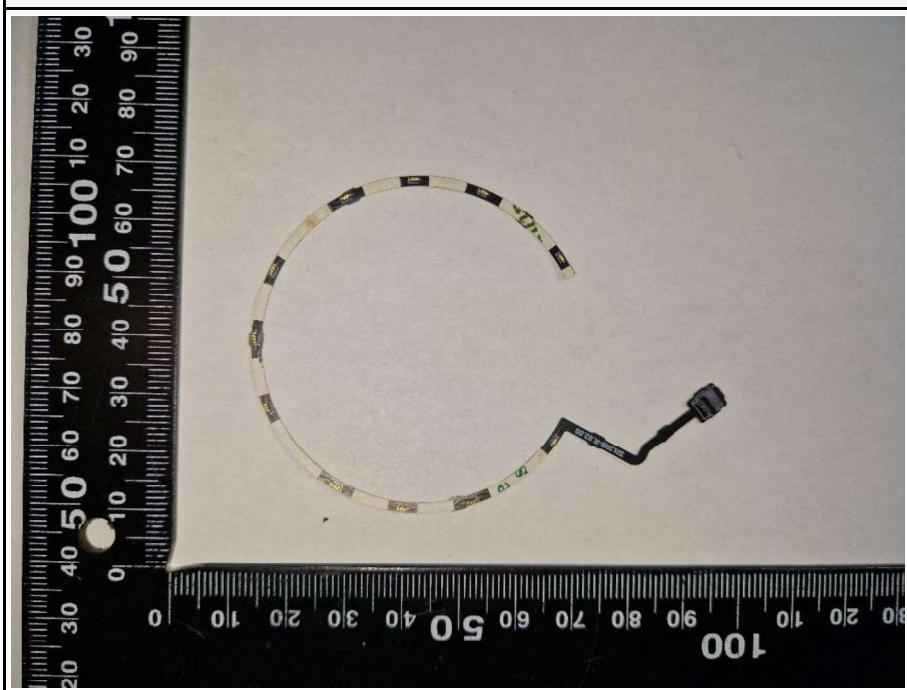
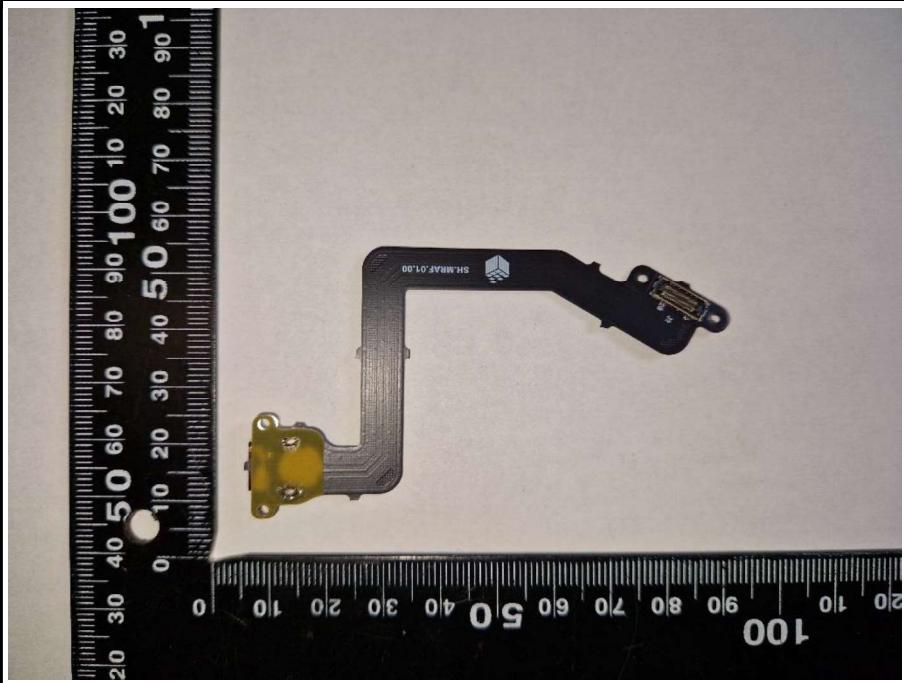
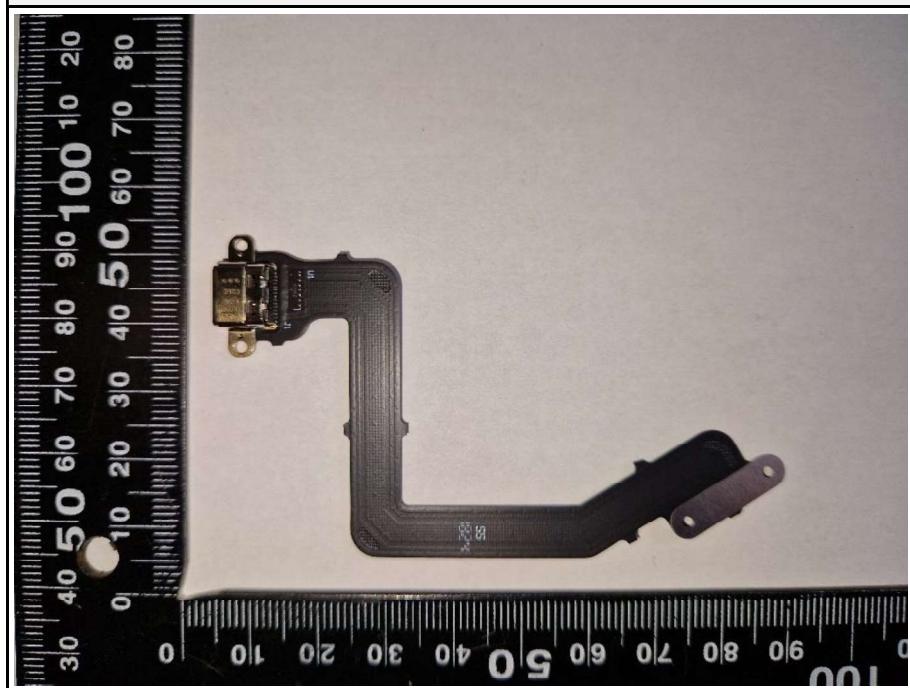
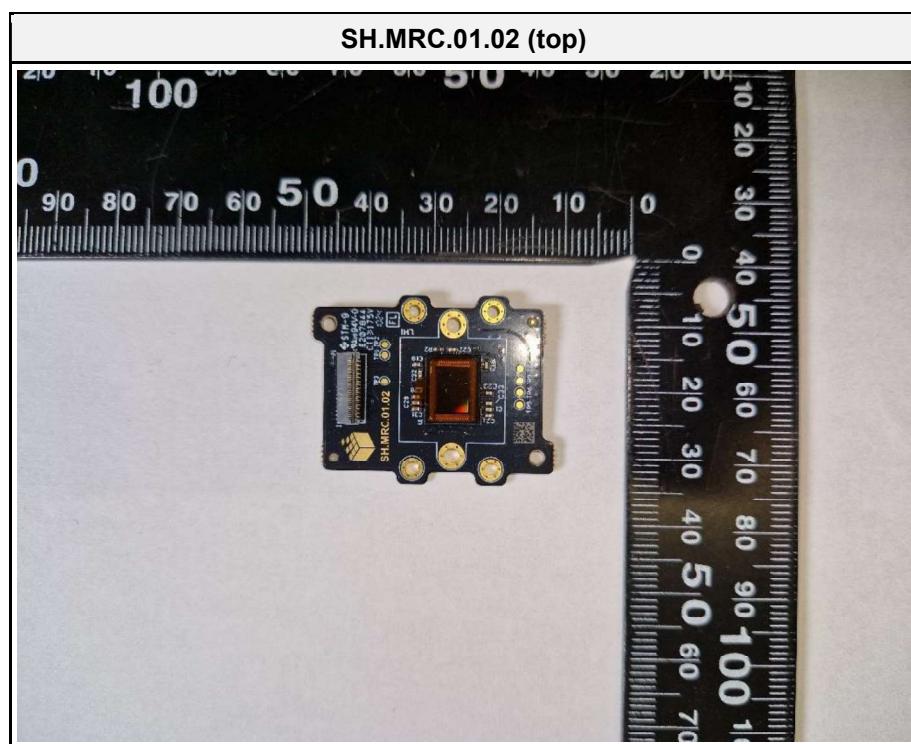
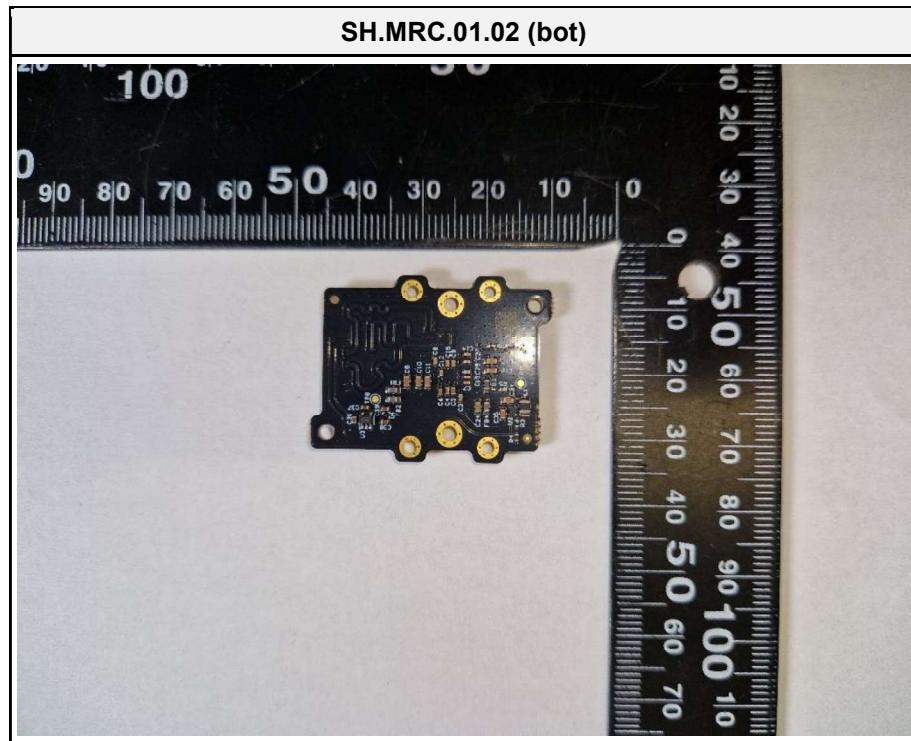
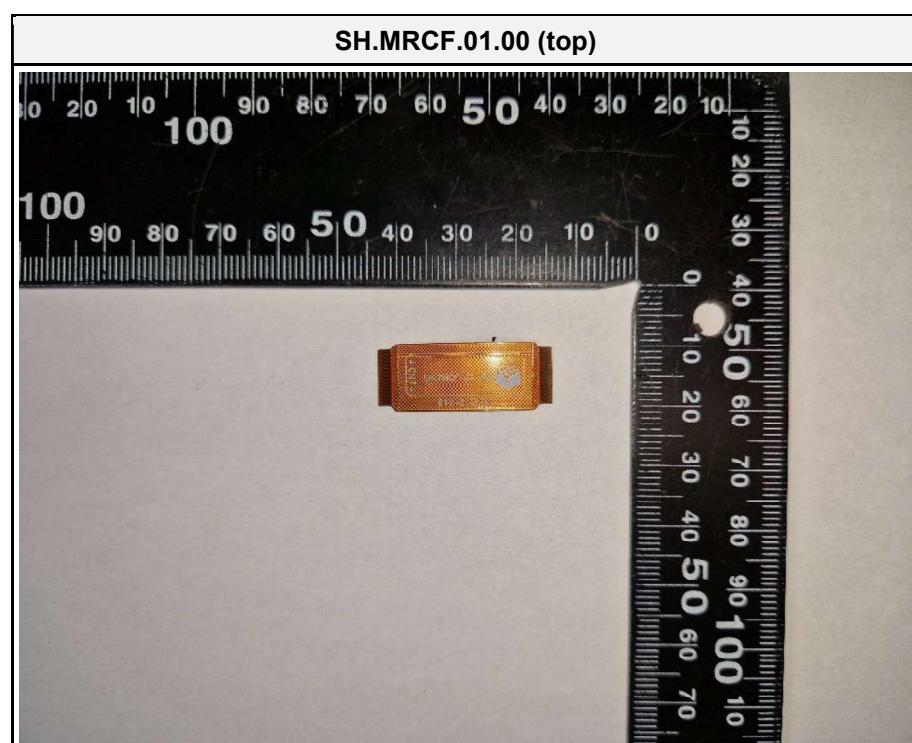
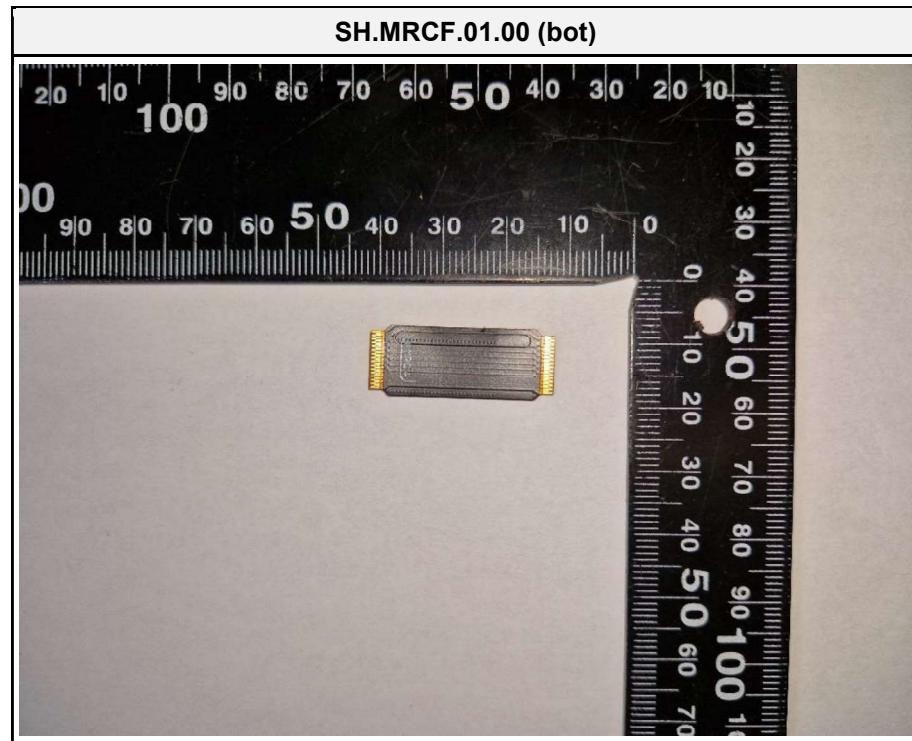


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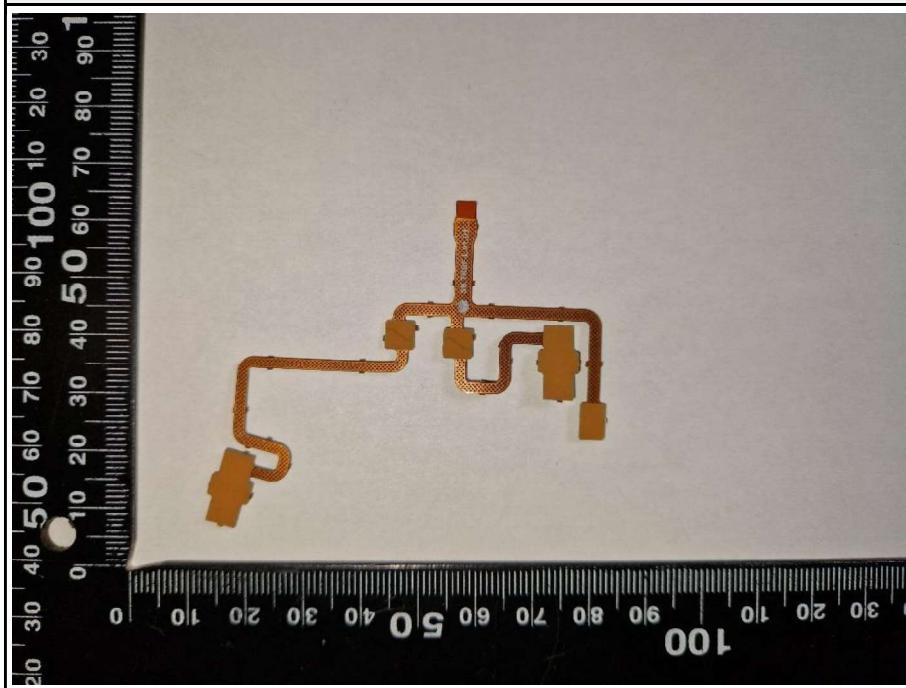
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SH.MRAF.01.01 (bot)**SH.MRAF.01.01 (top)**

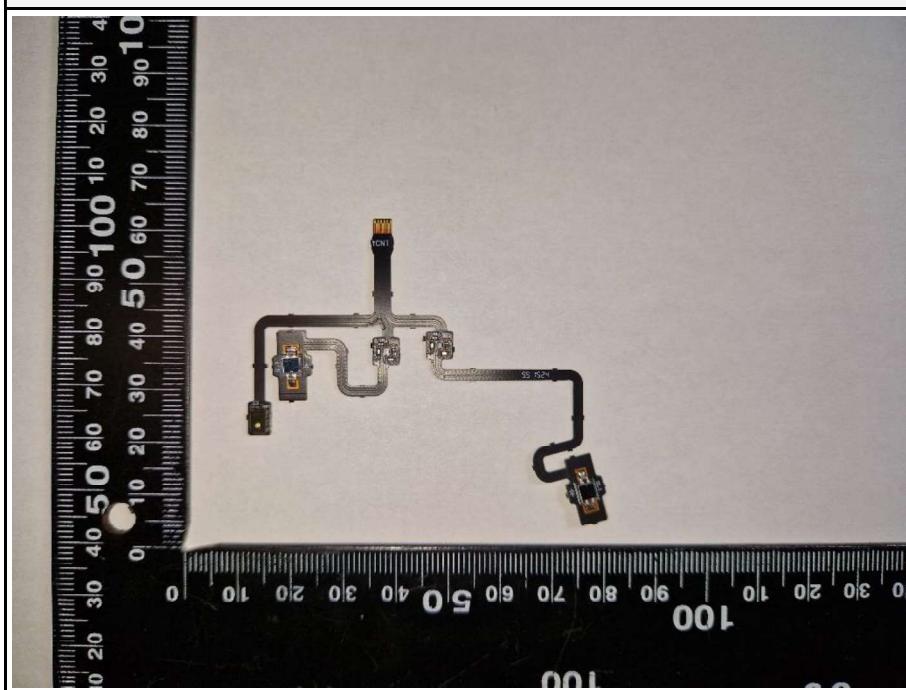


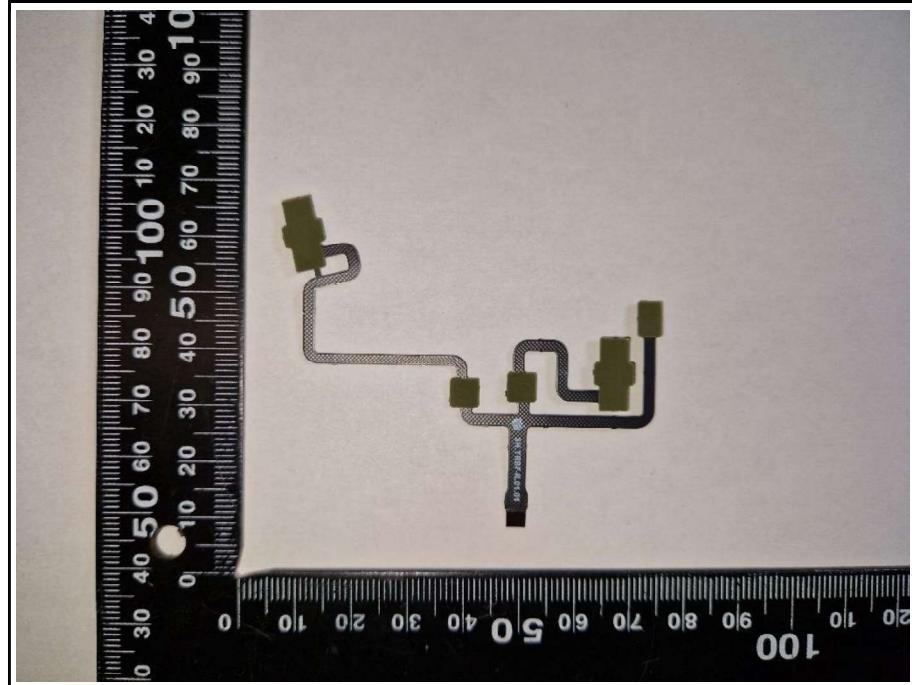
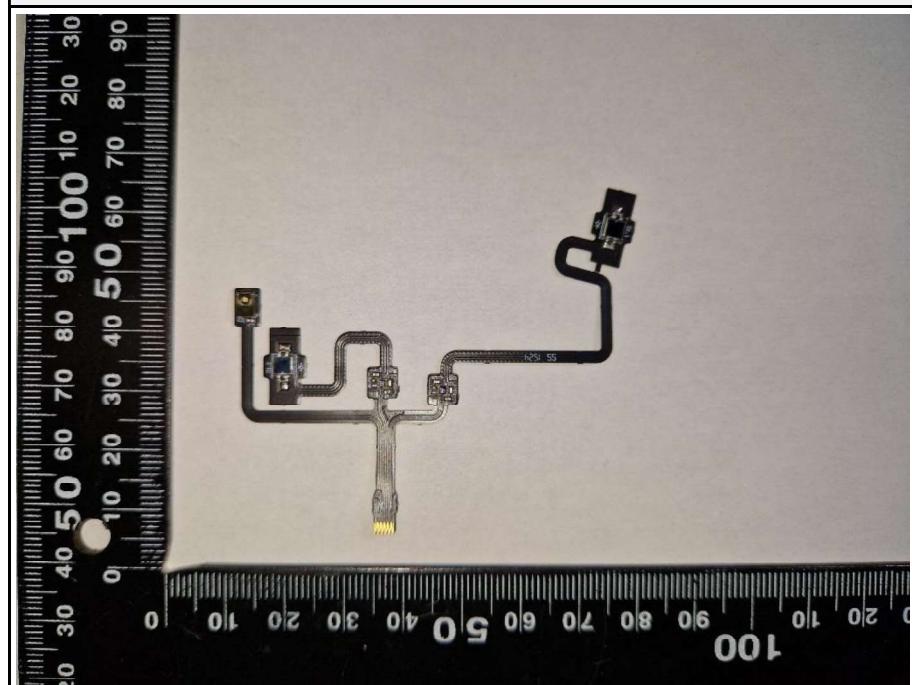


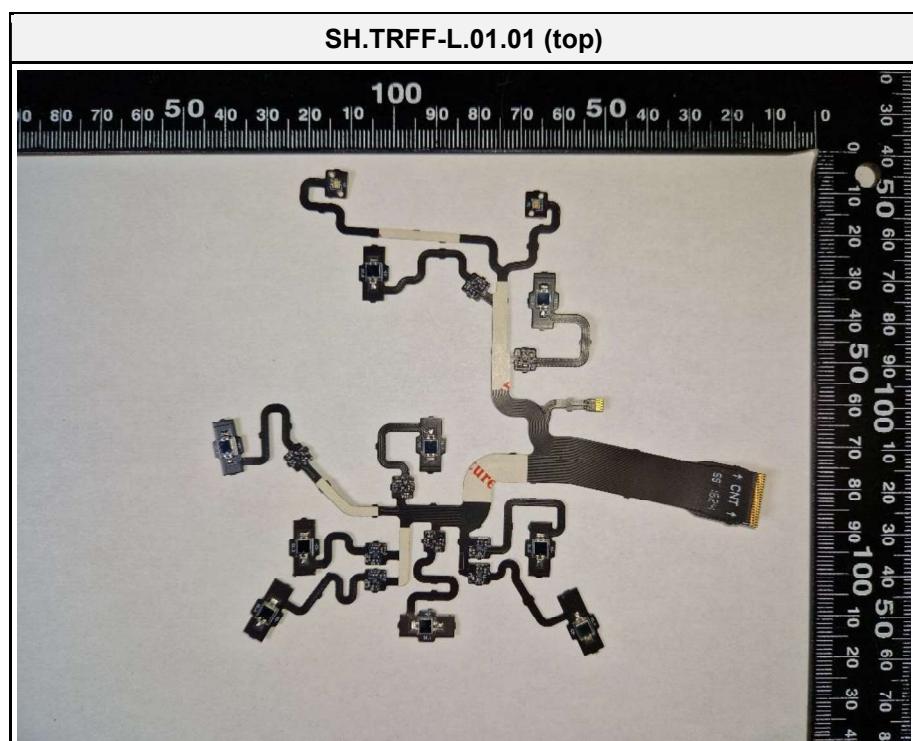
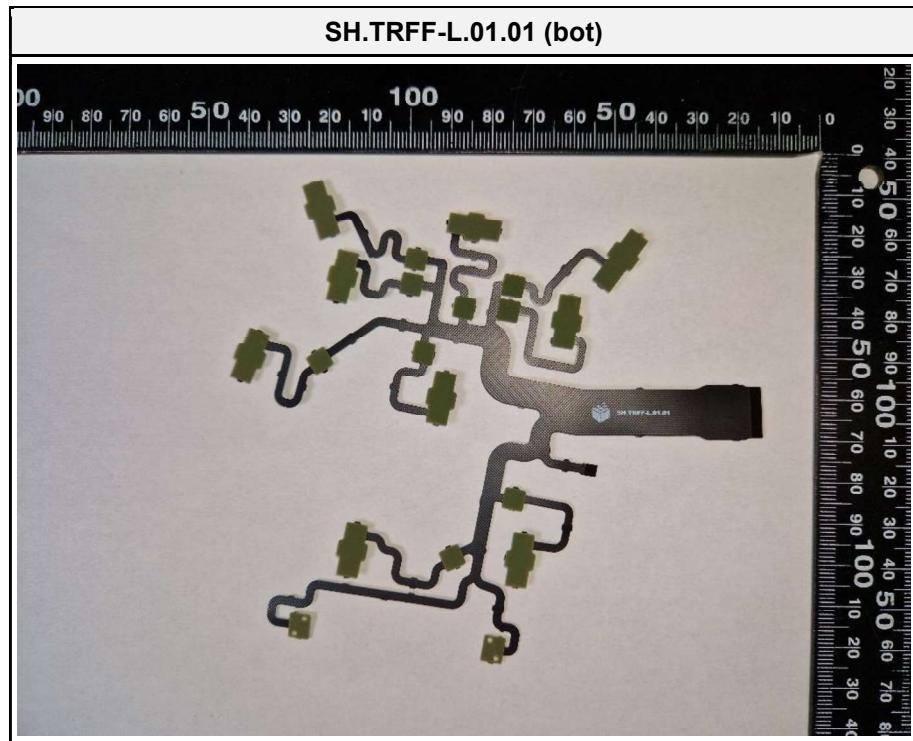
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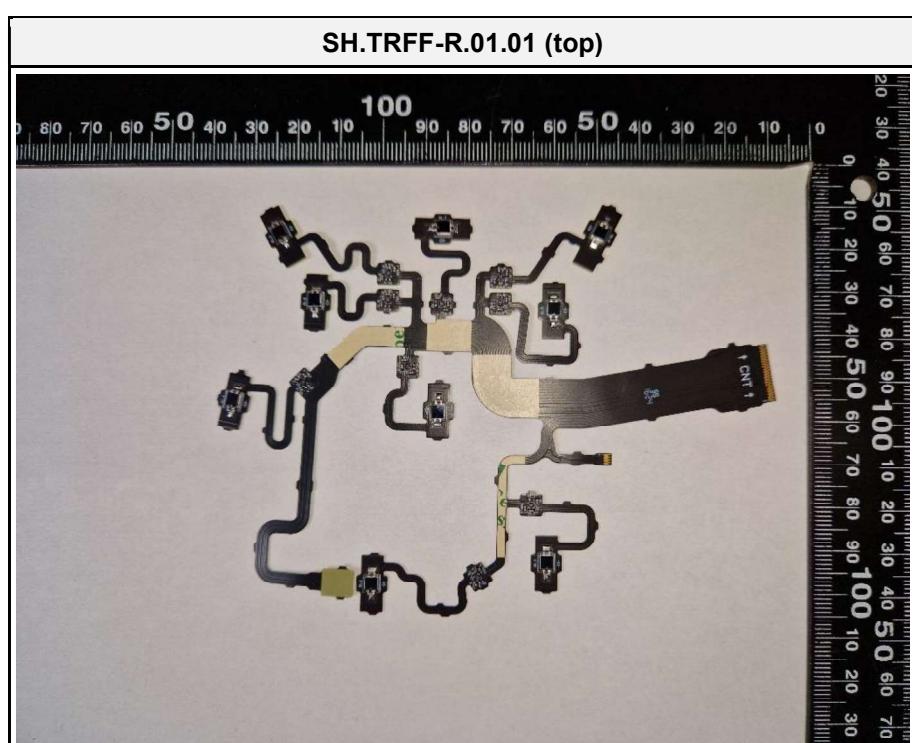
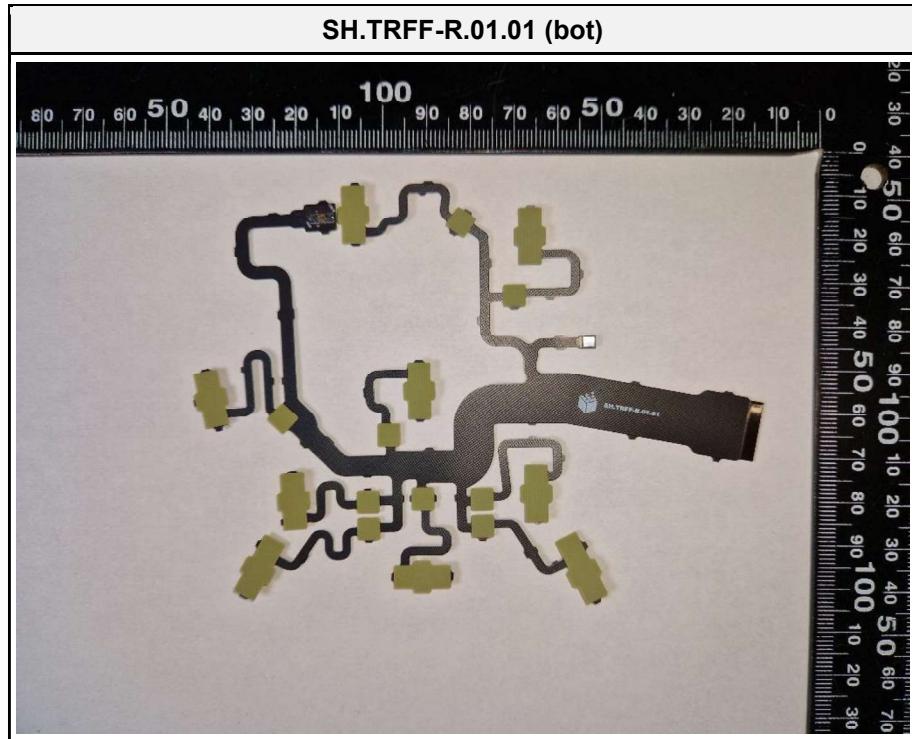


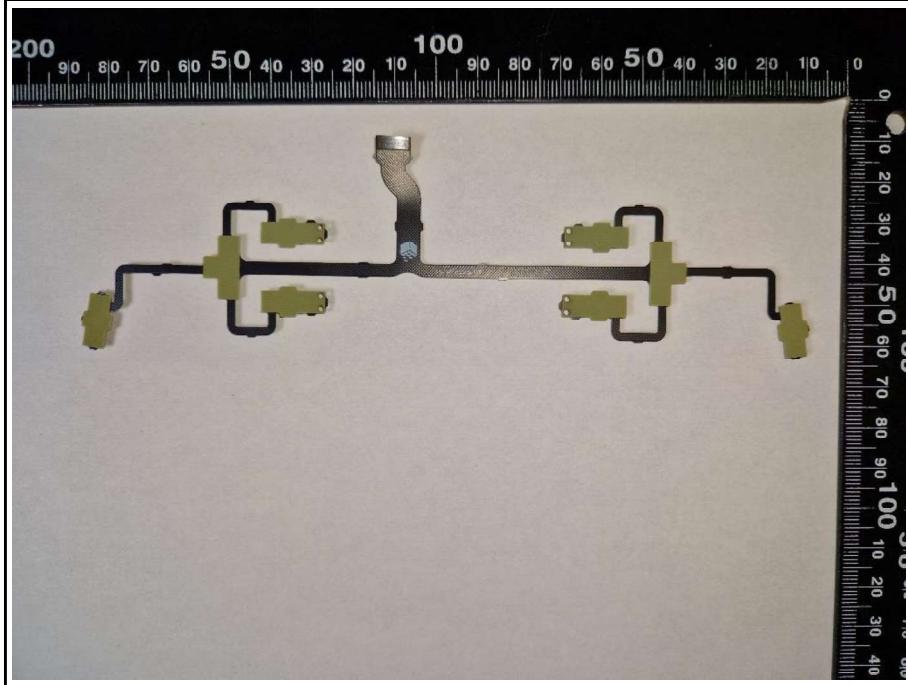
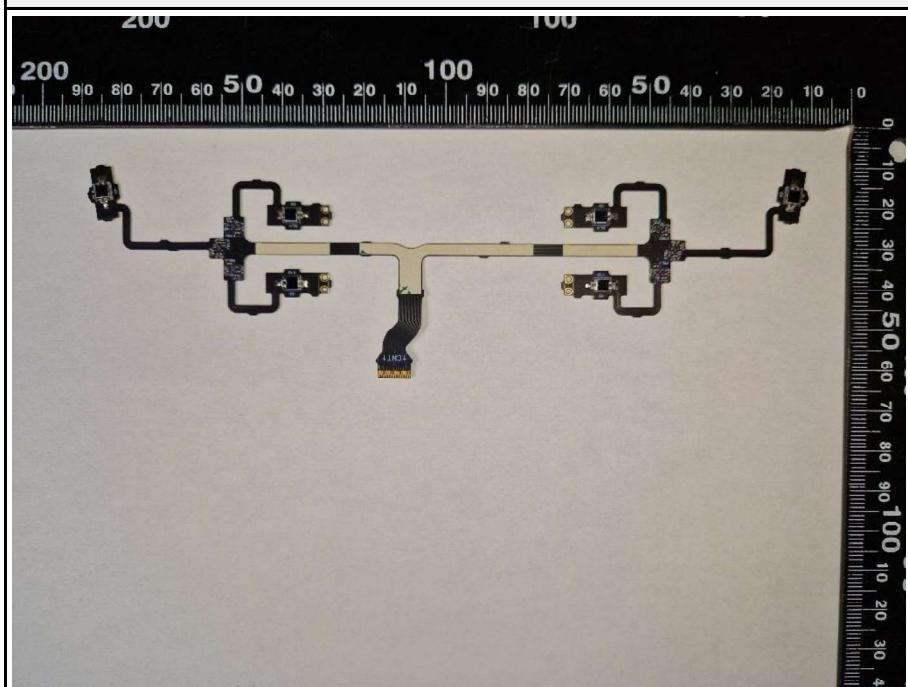
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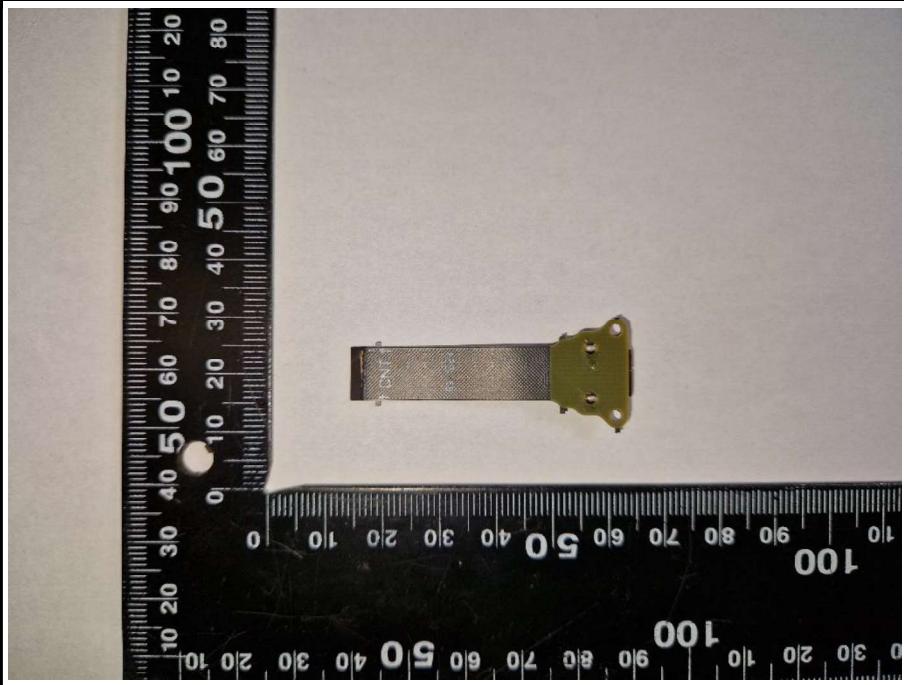
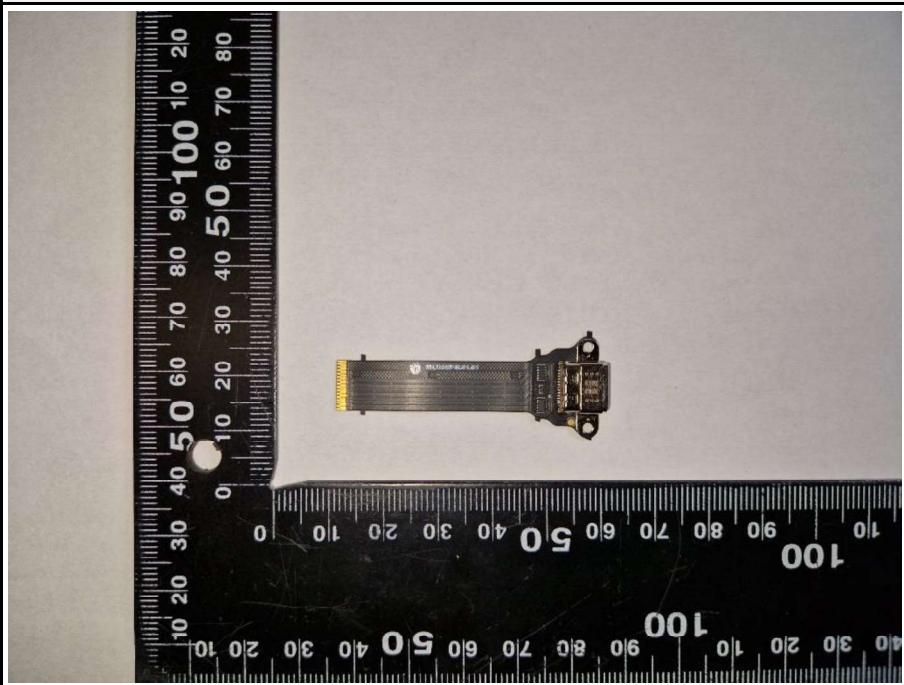


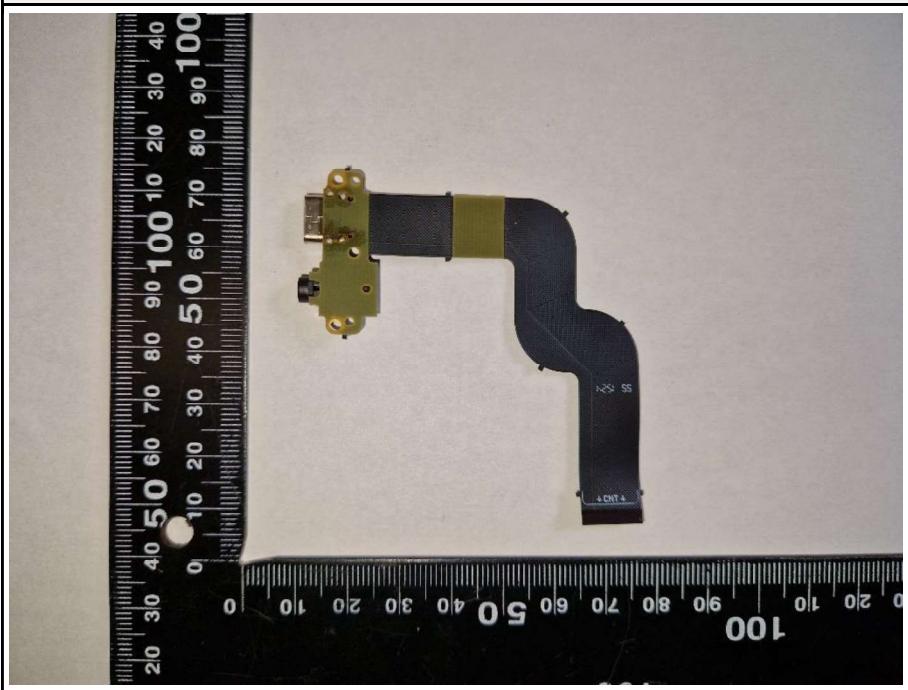
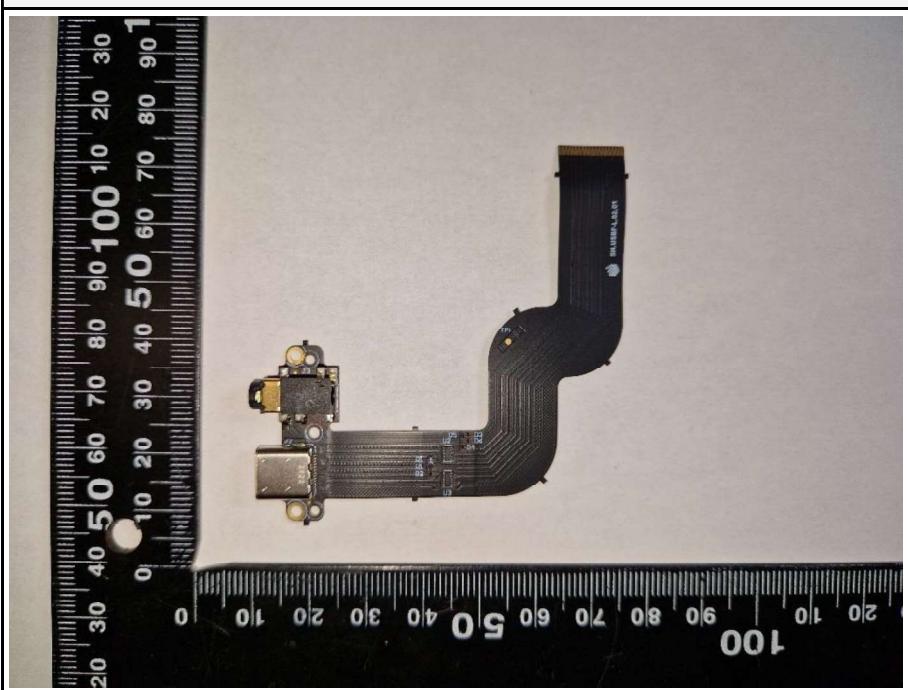
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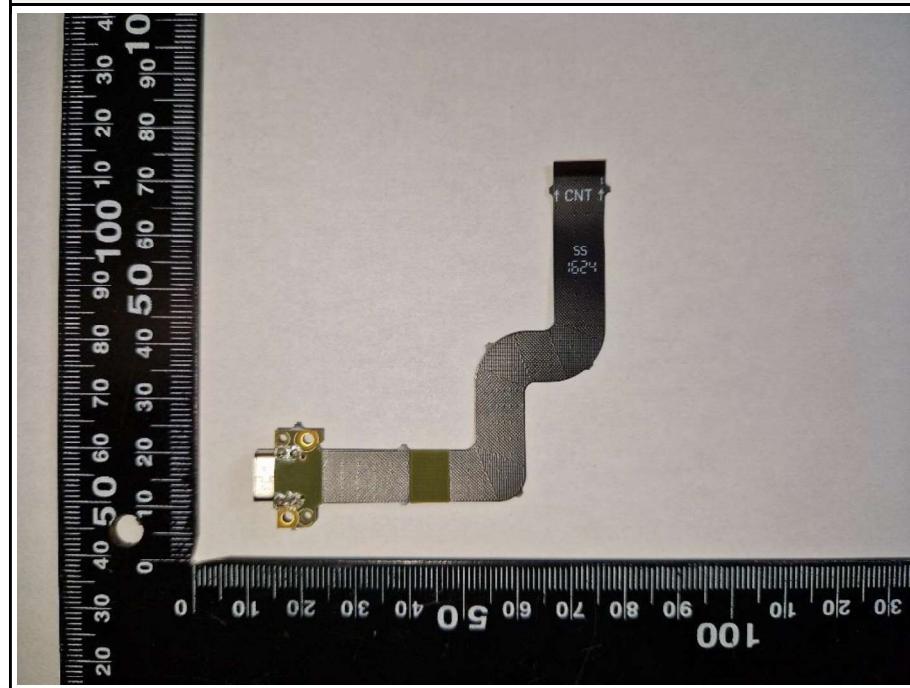
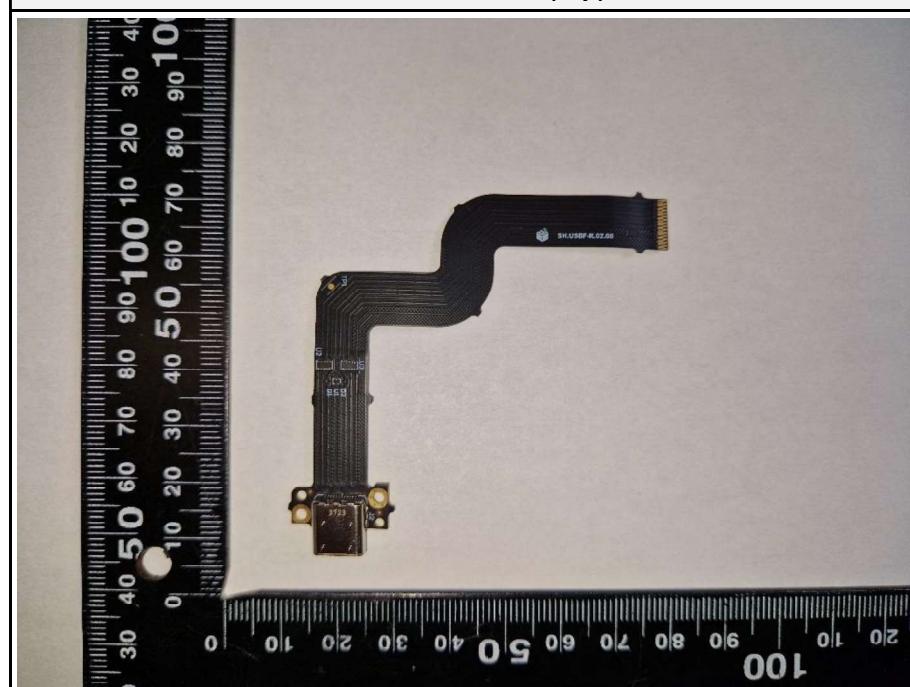


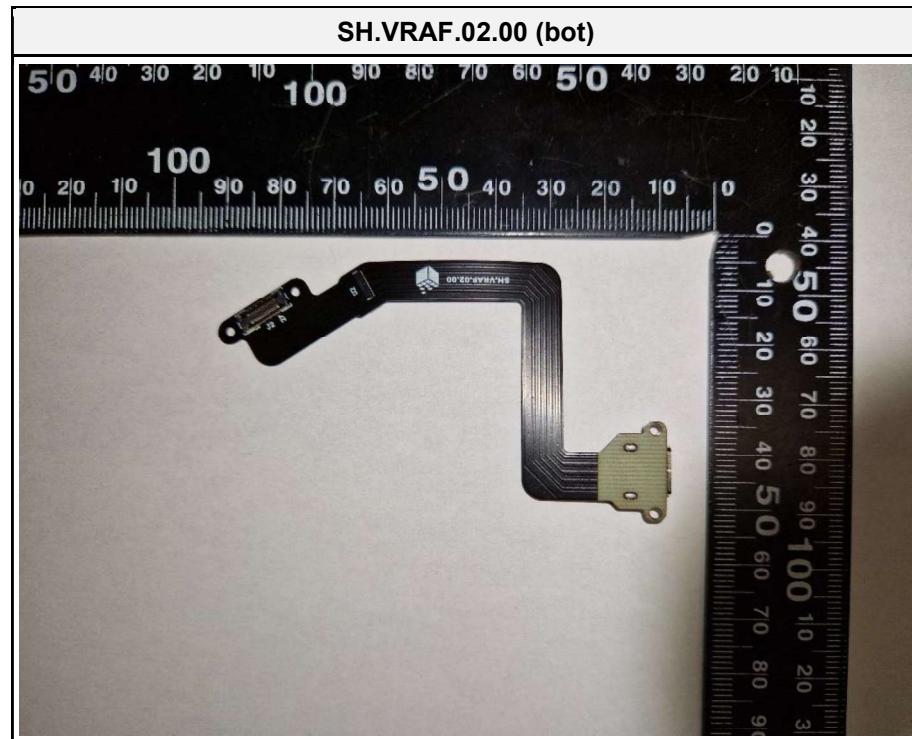


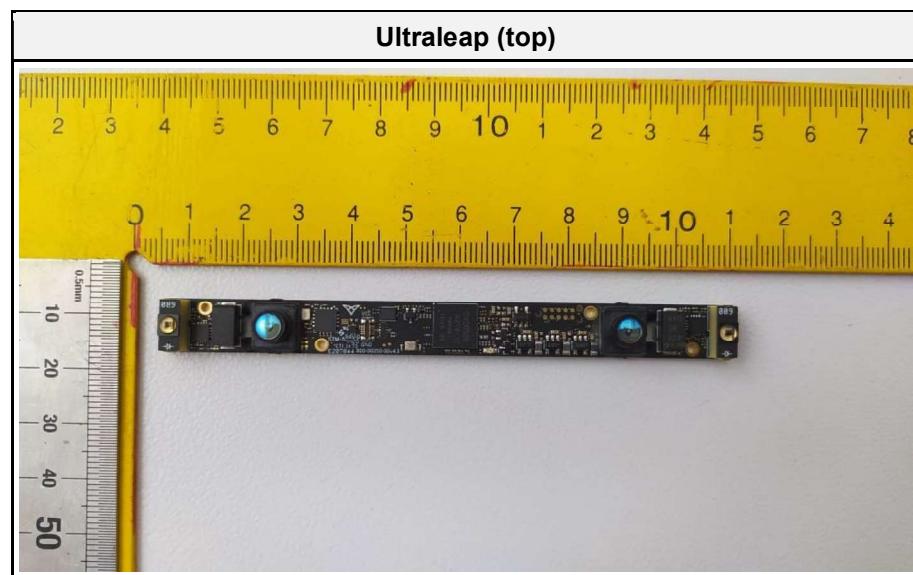
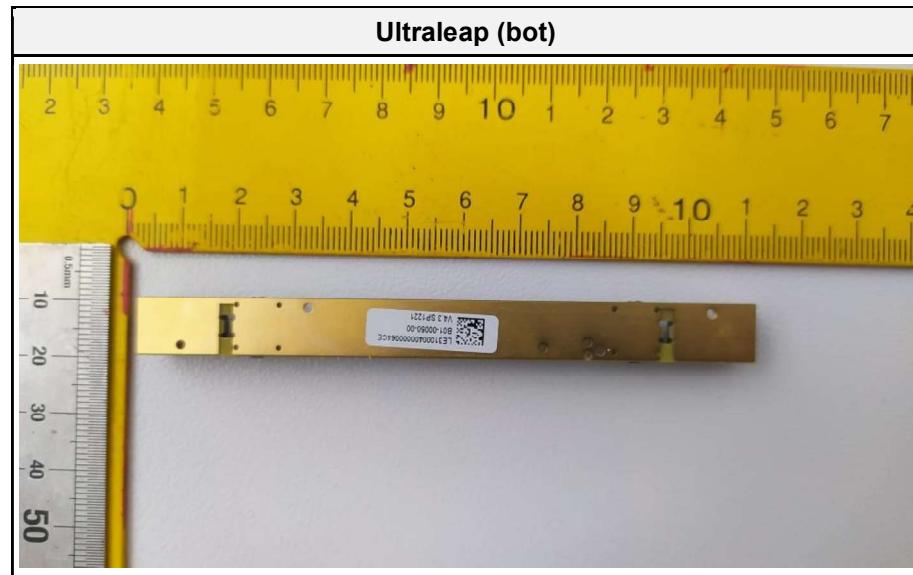
SH.TRTF.01.01 (bot)**SH.TRTF.01.01 (top)**

SH.USBF-B.01.01 (bot)**SH.USBF-B.01.01 (top)**

SH.USBF-L.02.01 (bot)**SH.USBF-L.02.01 (top)**

SH.USBF-R.02.00 (bot)**SH.USBF-R.02.00 (top)**





1.3 Reference Documents

Document Type	Document No.	Issued by	Date
Test Report	G0M-2406-2604-TFC247DT-V03	Eurofins Product Service GmbH	2024-12-10
Technical Data Sheet	W3008	Pulse/Larsen Antennas	Issue 1946

1.4 Standalone radiation sources

Standalone radiation sources					
Mode	Operating Frequency [MHz]	Maximum conducted power [dBm]	Maximum radiated power [dBm EIRP]	Maximum duty cycle [%]	Antenna distance to body [mm]
GFSK1	2402	1.953	3.053	100	5.0
	2440	1.677	2.777	100	5.0
	2480	1.097	2.197	100	5.0
GFSK2	2402	2.001	3.101	100	5.0
	2440	1.830	2.93	100	5.0
	2480	1.428	2.528	100	5.0

Comment: SAR test exclusion consideration acc. to FCC KDB 447498 D01. The 1g SAR threshold of 3 is used. For antenna distance to body is 5.0 mm used as the most conservatively assumption. The real minimum separation distance is higher than 5.0 mm and requirements will be also met for those cases.

1.5 Concurrent Sources

Concurrent operating conditions
GFSK1 + GFSK2
Comment: --

2 Result Summary

Standalone sources - FCC KDB 447498				
Product Standard Reference	Requirement	Reference Method	Mode	Verdict
KDB 447498	SAR Test Exclusion	KDB 447498 4.3.1	GFSK1	PASS
KDB 447498	SAR Test Exclusion	KDB 447498 4.3.1	GFSK2	PASS
Comment: --				

Concurrent operational modes - FCC KDB 447498				
Product Standard Reference	Requirement	Reference Method	Mode	Verdict
KDB 447498	SAR Test Exclusion	KDB 447498 4.3.2	GFSK1 + GFSK2	PASS
Comment: --				

3 RF-Exposure classification

RF-Exposure Categories	
Fixed	A fixed device is defined as a device physically secured at one fixed location and cannot be easily re-located.
Mobile	A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.
Portable	A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

RF-Exposure Categories	
Occupational / Controlled	Limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
General population / Uncontrolled	Exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

4 RF-Exposure limits and exclusion thresholds

4.1 SAR limits

SAR Limits		
Type	Occupational SAR values [W / kg]	General population SAR values [W / kg]
Whole-body SAR averaging mass = entire body	0.4	0.08
Partial-body Localized Head, Neck and Trunk SAR averaging mass = 1g	8.0	1.6
Hands, Wrists, Feet and Ankles Localized Limbs SAR averaging mass = 10g	20.0	4

4.2 SAR standalone test exclusion threshold

SAR test exclusion power acc. to FCC KDB 447498 D01 – Standalone operation

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm

$$\frac{\text{max. power of channel [mW]}}{\text{min. test separation distance [mm]}} \cdot \sqrt{f[\text{GHz}]} \leq \begin{cases} 3.0 & 1g \text{ SAR} \\ 7.5 & 10g \text{ SAR} \end{cases}$$

b) For 100 MHz to 6 GHz and test separation distances > 50 mm

1) For 100 to 1500 MHz

$$\left\{ \text{Power allowed at numeric threshold for } 50 \text{ mm in step a} + (\text{test separation distance} - 50\text{mm}) \cdot \frac{f(\text{MHz})}{150} \right\}, \text{mW}$$

2) for > 1500 MHz and ≤ 6 GHz

$$\left\{ \text{Power allowed at numeric threshold for } 50 \text{ mm in step a} + (\text{test separation distance} - 50\text{mm}) \cdot 10 \right\}, \text{mW}$$

c) for frequencies below 100 MHz:

1) test separation distances > 50 mm and < 200 mm:

the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by

$$\left(1 + \log \left(\frac{100}{f(\text{MHz})} \right) \right)$$

2) test separation distances ≤ 50 mm:

the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$

4.3 SAR concurrent test exclusion threshold

SAR test exclusion acc. to FCC KDB 447498 D01 – Concurrent operation

When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

For the test exclusion to apply, the maximum output power, duty factor, and other applicable parameters used in the standalone SAR tests, must be the same or more conservative than those required for simultaneous transmission.

When an antenna qualifies for the standalone SAR test exclusion and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

$$1) \frac{\text{max.power of channel,including tune-up tolerance,mW}}{\text{min.test separation distance,mm}} \cdot \frac{\sqrt{f(\text{GHz})}}{x}, \text{ for test separation distances} \leq 50 \text{ mm}$$

where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR

$$2) 0.4 \text{ W/kg for 1-g SAR and } 1.0 \text{ W/kg for 10-g SAR, when the test separation distance is} > 50 \text{ mm}$$

5 RF-Exposure Evaluation

Evaluation procedure acc. to FCC KDB 447498

Standalone operational modes

- 1) For each standalone operational mode the associated frequencies, radiated output power values, duty cycles and antenna separation distances to the human body are specified
- 2) From the radiated power and the duty cycle the source-based time averaged radiated output power is calculated
- 3) The transmission frequency, average power and separation distance is used to determine the SAR test exclusion power threshold value acc. to FCC KDB 447498 D01
- 4) If the time averaged output power of the transmission mode is lower than the SAR test exclusion power threshold value, the mode clarifies for SAR test exclusion and no further SAR evaluation is needed

Concurrent operational modes

- 1) For each operational mode that participates in the concurrent operational mode, the estimated SAR is calculated from the source-based time average conducted output power and the separation distance to the human body for each transmission frequency of the operation mode
- 2) The maximum estimated SAR value for each operational is determined
- 3) The sum of SAR values of the maximum estimated SAR values for each operational mode is calculated
- 4) If the sum of SAR values is below the corresponding SAR limit, the concurrent operational mode clarifies for SAR test exclusion and no further evaluation is needed

6 Single Source Evaluation Results - FCC

Results – Standalone Operational Modes							
Mode	Frequency [MHz]	Power [mW]	Duty Cycle	Average Power [mW]	Distance [mm]	SAR Exemption Power Limit [mW]	Verdict
GFSK1	2402	2.02	1.00	2.02	5.0	10	PASS
	2440	1.90	1.00	1.90	5.0	10	PASS
	2480	1.66	1.00	1.66	5.0	10	PASS
GFSK2	2402	2.04	1.00	2.04	5.0	10	PASS
	2440	1.96	1.00	1.96	5.0	10	PASS
	2480	1.79	1.00	1.79	5.0	10	PASS
Comment: --							

7 Concurrent Evaluation Results - FCC

Bluetooth + Bluetooth LE					
Mode	Frequency [GHz]	Average Power [mW]	Distance [mm]	SAR Exclusion Numerical Value	SAR Exclusion Ratio
GFSK1	2.402	2.02	5	0.63	0.21
GFSK2	2.402	2.04	5	0.63	0.21
Sum Exclusion Ratio					0.42
Exclusion Ratio Limit					1.0
Compliance					PASS
Comment: --					

==== End of test report ===