US11292349B2 **SYSTEM AND METHOD FOR POWERING OR CHARGING RECEIVERS OR DEVICES HAVING SMALL SURFACE AREAS OR VOLUMES**

This chart refers to various versions of the WPC Standard as part of its evidence of infringement. However, this should not be interpreted to limit Plaintiff's infringement contentions to products complying with any particular version of the WPC standard (or products complying with the standard at all).

1. A system for inductive power transfer comprising:

As detailed below by representative products, Samsung's smartphones and tablets which are 349 Accused Products can wirelessly transfer power to an S pen which is a 349 Accused Product; such S pens are configured to receive such inductive power. As such, the 349 Accused Products fit the description in this introductory part of the claim as each is capable of transferring power to/charging Samsung's S Pen and/or receiving inductive power as specified by this introductory part of the claim.

Samsung smartphones

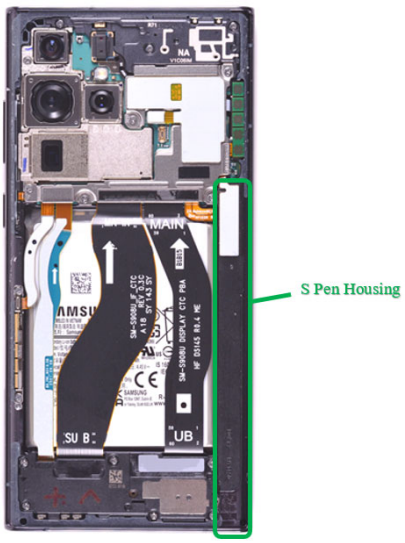
The Samsung Galaxy S22 Ultra smartphone is representative of the Samsung smartphones that are 349 Accused Products. The S22 Ultra is able to wirelessly/inductively charge the Galaxy S22 Ultra S Pen, as specified by claim 1.

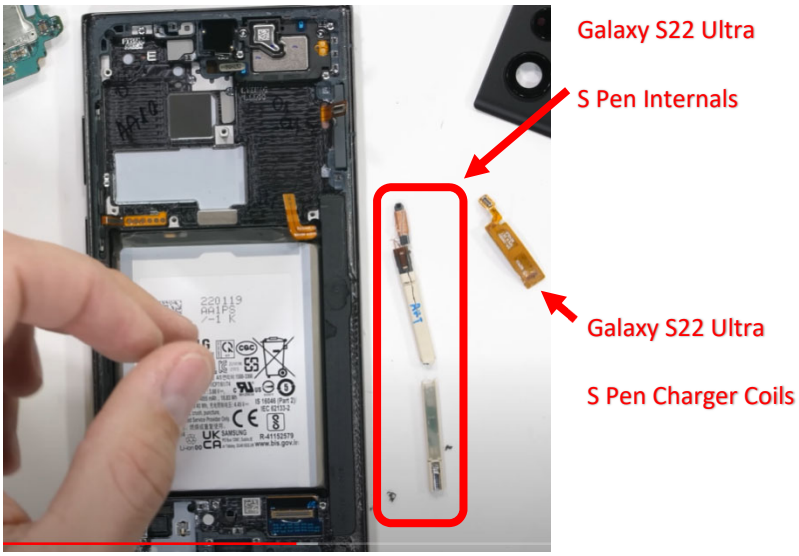
https://www.samsung.com/us/smartphones/galaxy-s22-ultra/buy/galaxy-s22-ultra-128gb-unlocked-sm-s908uzkaxaa/

https://www.samsung.com/uk/support/mobile-devices/how-to-check-the-battery-of-the-s-pen/



https://www.youtube.com/watch?v=NMnLzYWuLGo







Galaxy S22 Ultra S Pen



Galaxy S22 Ultra S Pen Charger coils

Samsung tablets

The Samsung Galaxy Tab S8 Ultra tablet is representative of the Samsung tablets that are the 349 Accused Products. The Tab S8 Ultra is able to wirelessly/inductively charge the S8 Ultra S Pen, as specified by this portion of Claim 1. On information and belief, the Tab S8 Ultra includes an S8 Ultra S Pen charger coil that is similar in form and function to the S22 Ultra S Pen charger coil, though the layout and shape of the coil is different.

https://www.samsung.com/us/support/answer/ANS00086982/

SAMSUNG Mobile TV & Audio Appliances Computing Displays #YouMake Discover Samsung Event Offers Explore Support For Business

Pair and charge the S Pen with your Galaxy tablet



One of the things that sets the Galaxy Tab S6, Tab S7, and Tab S8 apart from other tablets is the S Pen, which lets you draw, write, and perform Air actions. However, you'll need to charge the S Pen and connect it to your Tab before you can use it to its full potential. Don't worry, it's simple to pair, charge, and check the S Pen's battery percentage whenever you need to!

Pair the S Pen >

Charge the S Pen and check its battery level >

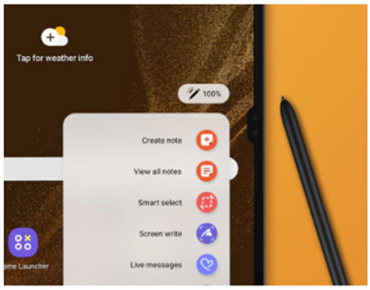
The S Pen is not pairing or charging >

Pair the S Pen >

Charge the S Pen and check its battery level

The slot on the back of your tablet isn't just for pairing the S Pen; it's also for charging it! Whenever you put the pen on the slot, it automatically charges the S Pen.

When it needs a charge, place the S Pen in the designated slot on the back of the tablet. It will begin charging right away. If you're using the Tab S6, make sure the pen's point is facing downward with the tip facing away from the cameras. On the Tab S7 and Tab S8, the pen's point must be facing upward with the tip facing toward the cameras.



To check the current battery level for the S Pen, unlock the tablet's lock screen and simply press the **Pen button** on the side of the S Pen while the pen is attached to the charging slot.

To check the battery level when the S Pen isn't attached, open the Air command menu by tapping the floating icon, or pressing the **button** on the S Pen. The battery percentage will appear at the top of the screen. You can also tap the **Settings** icon in the Air command menu, and then tap **Air Actions**. The battery level will also display here.

Note: The battery percentage may not appear if the S Pen is not connected to the tablet via Bluetooth.

The S Pen is not pairing or charging >

https://www.youtube.com/watch?v=EIjjpOJ0ghg&ab_channel=JerryRigEverything



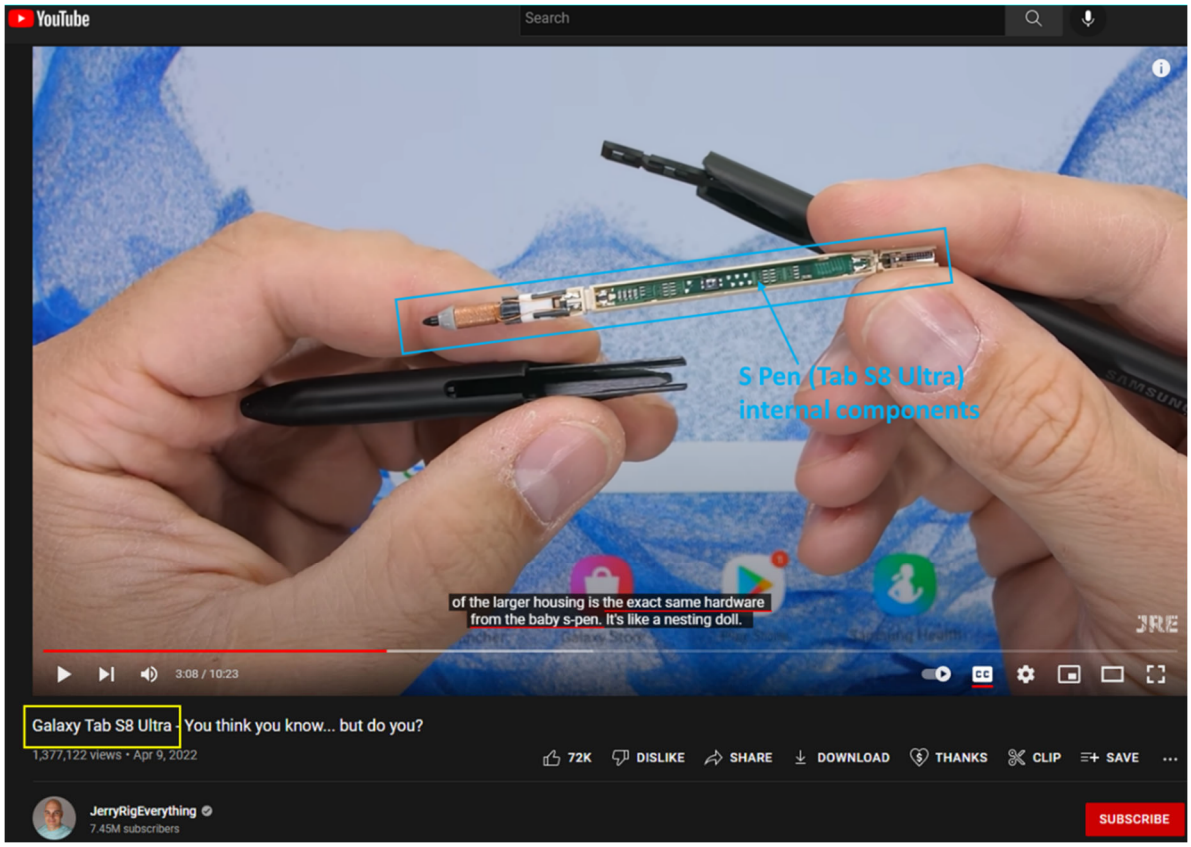
Galaxy Tab S8 Ultra - You think you know... but do you?

JerryRigEverything
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77K
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Download

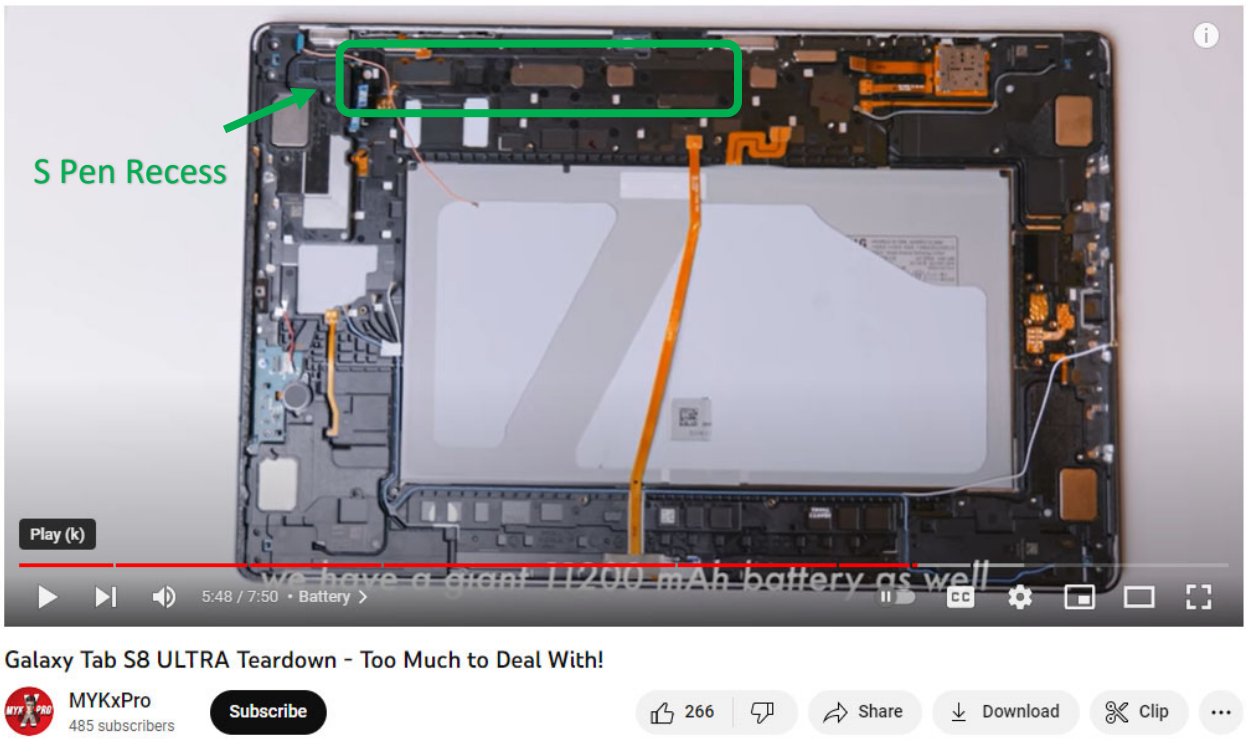


Galaxy Tab S8 Ultra - You think you know... but do you?

JerryRigEverything
7.53M subscribers
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https://www.youtube.com/watch?v=7AEoUVidJRw&ab_channel=MYKxPro



Samsung pens

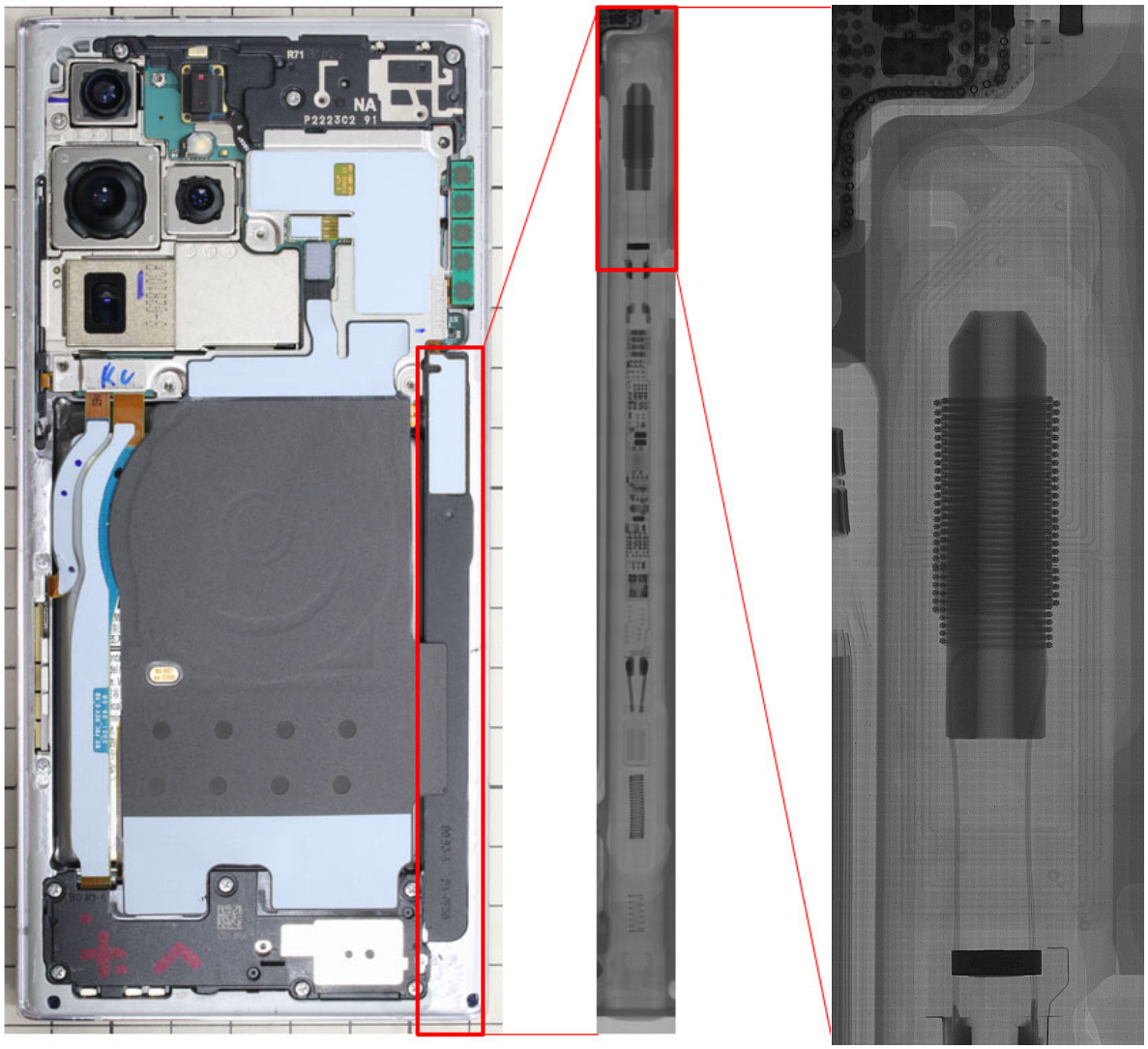
The Samsung Galaxy S22 Ultra S Pen and Samsung Galaxy Tab S8 Ultra S Pen are representative of the Samsung S Pens that are the 349 Accused Products. Each S Pen is able to receive wireless power and thus forms part of a system for inductive power transfer as specified by this introductory part of claim 1.

a charger, wherein the charger is an inductive charger, and the charger includes: a printed circuit board having a charger coil, wherein the charger coil has a substantially planar charger surface; a substantially planar magnetic layer under the charger coil opposite the charger surface; and a charger drive circuit, wherein the charger drive circuit includes a resonant capacitor and a FET switch to apply an alternating voltage to the charger coil; and

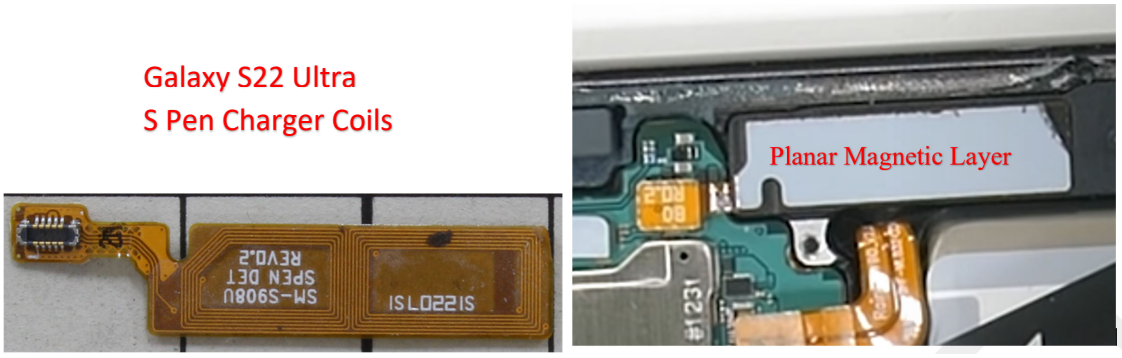
The 349 Accused Products each meet this part of claim 1 of the 349 as they each include a printed circuit board having a charger coil and charge drive circuitry with the above-described characteristics, as illustrated below.

Samsung smartphones

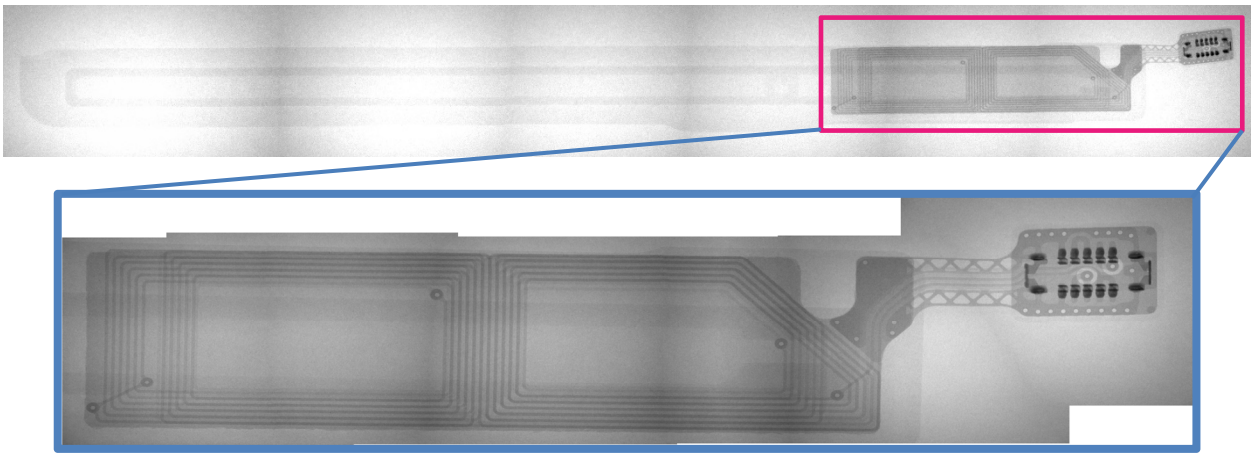
The Galaxy S22 Ultra smartphone includes an inductive charger for the Galaxy S22 Ultra S Pen. The charger includes a printed circuit board charger coil with a planar charger surface for the Galaxy S22 Ultra S Pen and a planar magnetic layer under the charger coil opposite the charger surface.



The substantially planar magnetic layer under the charger coils opposite the charger surface is labeled in the image below as the "Planar Magnetic Layer."



The x-ray below reveals the position of the S Pen charger coils in the Galaxy S22 Ultra smartphone.



See also https://www.youtube.com/watch?v=NMnLzYWuLGo.

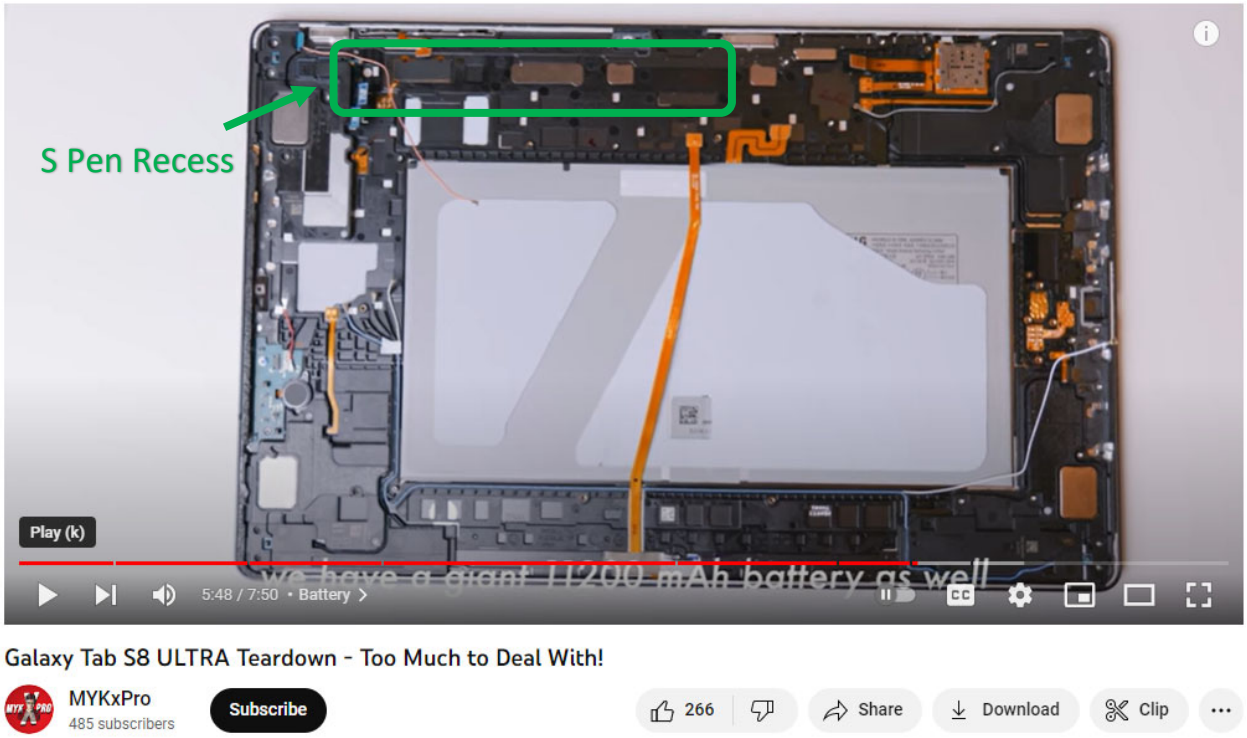
Further, as a non-limiting example, and on information and belief, the charger includes a charger drive circuit with a resonant capacitor and a FET switch to apply an alternating voltage to the charger coil.

See https://www.youtube.com/watch?v=NMnLzYWuLGo

Samsung tablets

The Galaxy Tab S8 Ultra includes an inductive charger for the S8 Ultra S Pen. The charger includes a printed circuit board charger coil with a planar charger surface for the S8 Ultra S Pen and a planar magnetic layer under the charger coil opposite the charger surface.

https://www.youtube.com/watch?v=7AEoUVidJRw&ab_channel=MYKxPro



https://www.youtube.com/watch?v=EIjjpOJ0ghg&ab_channel=JerryRigEverything

On information and belief, the image above showing the S8 Ultra S Pen recess area also reveals the relative position of the S Pen charger coils in the Tab S8 Ultra. An enlarged portion of the image is shown below.



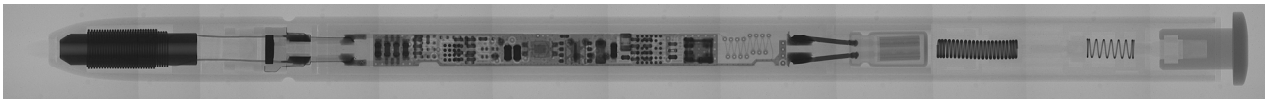
Further, as a non-limiting example, and on information and belief, the charger includes a charger drive circuit with a resonant capacitor and a FET switch to apply an alternating voltage to the charger coil.

a first mobile device that includes a receiver to inductively receive power for the first mobile device, wherein the receiver includes: a solenoid, wherein the solenoid includes: a magnetic core having a relative magnetic permeability exceeding 1 and having first and second ends; and Litz wire wrapped around a section of the magnetic core forming a wire wound section around the magnetic core, with the magnetic core extending beyond the wire wound section; and a receiver electronic circuit, wherein the receiver electronic circuit includes a resonant capacitor and a rectifier; and

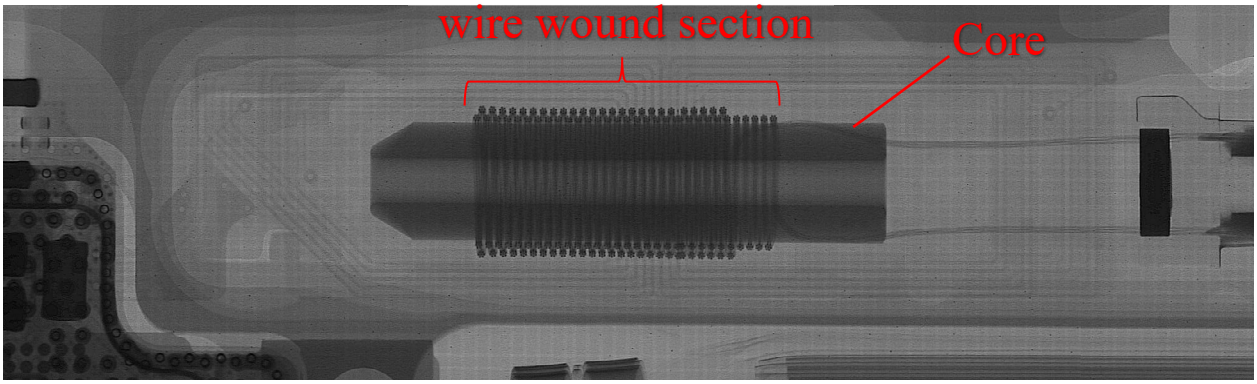
The 349 Accused Products each meet this part of claim 1 of the 349 as both the S Pen system for the S22 Ultra and the S Pen system for the Tab S8 Ultra include a first mobile device including the inductive receiver described in this portion of the claim.

Samsung smartphones

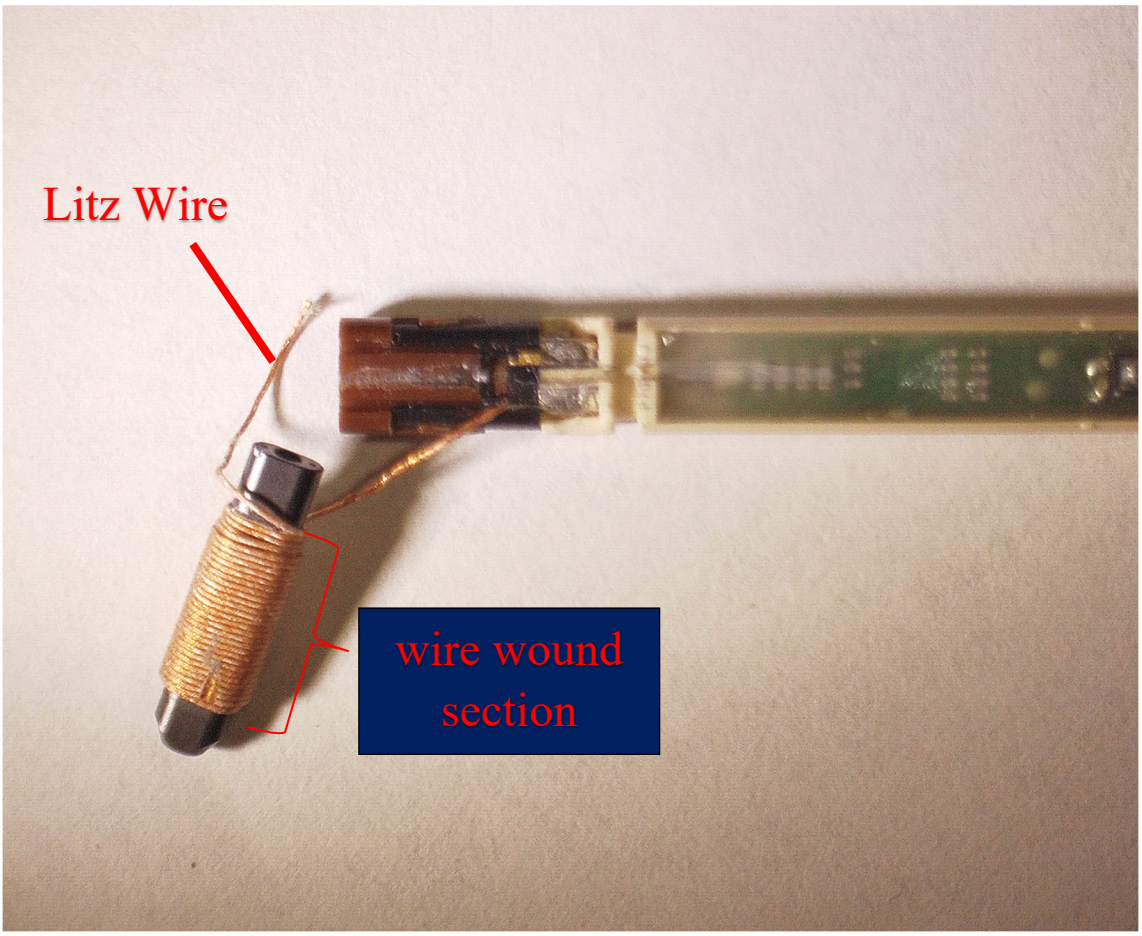
The Galaxy S22 Ultra S Pen included with the Galaxy S22 Ultra is a first mobile device including a receiver that inductively receives power. As illustrated in the x-ray images below, the Galaxy S22 Ultra S Pen includes the claimed solenoid with a magnetic core having a permeability exceeding 1 having a first and a second end, and a Litz wire wrapped around a section of aforementioned magnetic core forming a wire wound section. As can be seen in the x-rays and the optical image below, the magnetic core extends beyond the wire wound section.



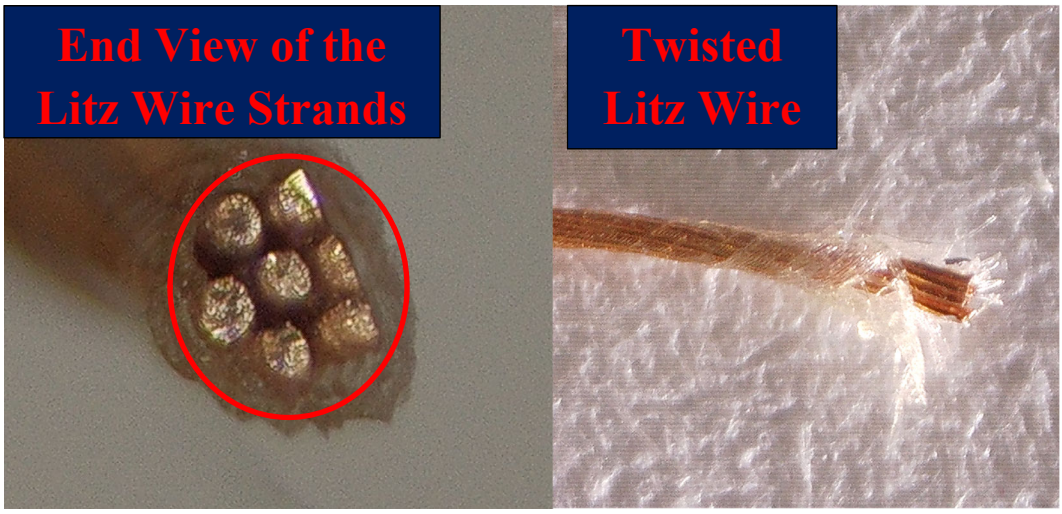
A zoomed-in x-ray image of the tip of the S22 Ultra S-pen is shown below in the charging position:



An image of the tip of the Galaxy S22 Ultra S pen with the outer plastic shell removed and one end of the Litz wire winding disconnected from the circuit board is shown below.



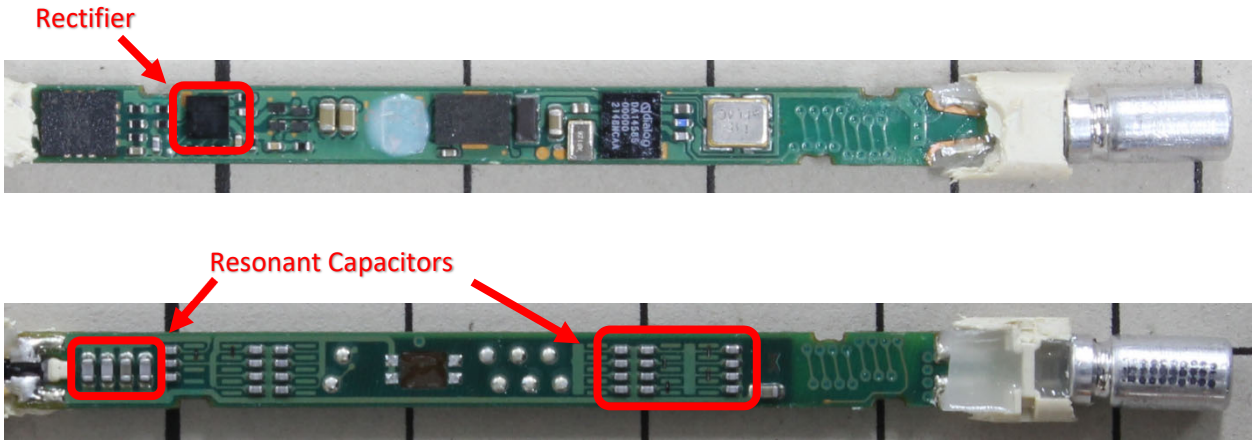
The multiple strands of twisted Litz wire can be seen below on the right image and an end-on view of the Litz wire on the left shows the strands of the Litz wire and the outer transparent coating / cover for outer insulation.



Use of Litz wire in this application allows the low loss and the high Quality factor for the receiver solenoid necessary at the operating frequency to achieve high efficiency in wireless power transfer in a geometry such as this where the area at the end of the receiver solenoid is much smaller than the charger coil area.

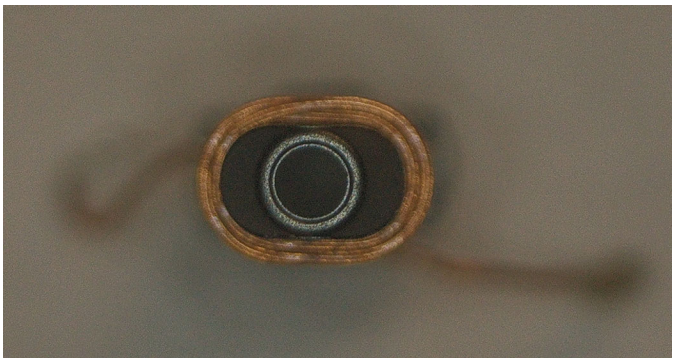
Further, the Galaxy S22 Ultra S Pen includes a receiver electronic circuit including the claimed resonant capacitor(s) and rectifier(s), as illustrated in the below images of a Galaxy S22 Ultra S Pen with its housing removed.

For example, *see*: https://www.youtube.com/watch?v=NMnLzYWuLGo



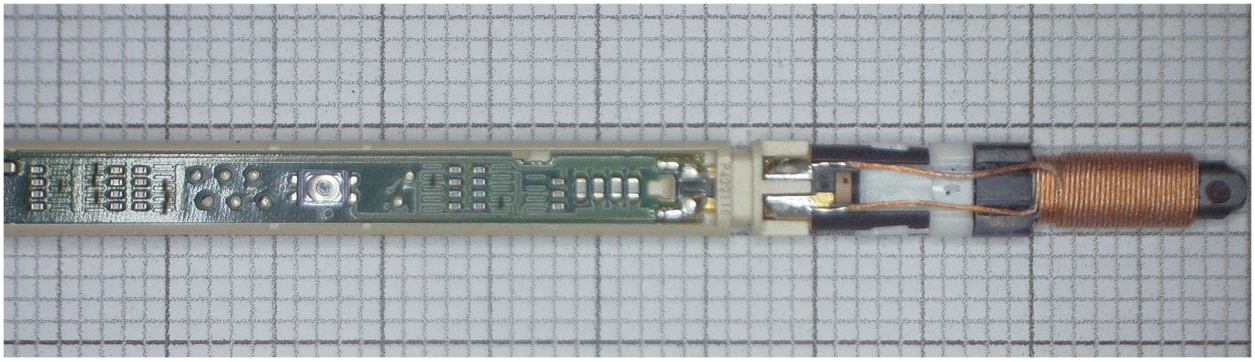
The Galaxy S22 Ultra S Pen included with the Galaxy S22 Ultra is a first mobile device including a receiver that inductively receives power. As illustrated in the x-ray images below, the Galaxy S22 Ultra S Pen includes the claimed solenoid, magnetic core having a permeability exceeding 1 having a first and a second end, and a Litz wire wrapped around a section of aforementioned magnetic core forming a wire wound section. As can be seen in the x-rays and the optical images above, the magnetic core extends beyond the wire wound section.

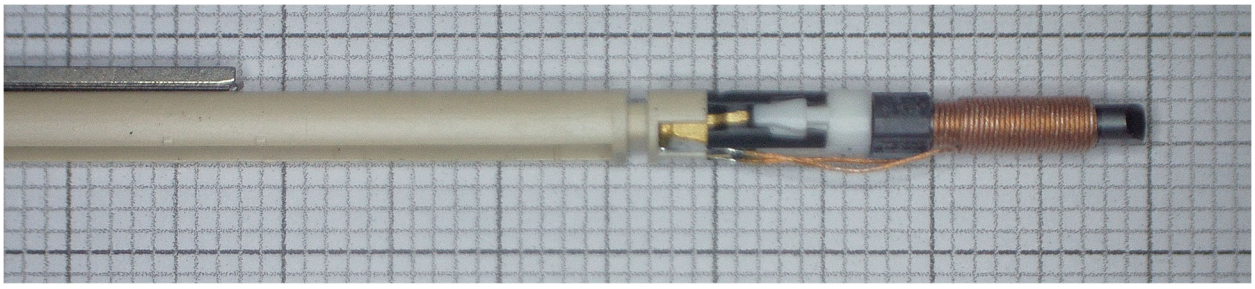
An end view image of the tip of the Galaxy S22 Ultra S pen with the outer plastic shell removed is shown below, showing the area of one end of the solenoid core with the Litz wire wrapped around the core (end-on view). The magnetic core is oval shaped in its main body and has a circular first end towards the pen tip wherein the first end has an outer circular diameter of ~ 1.68 mm.



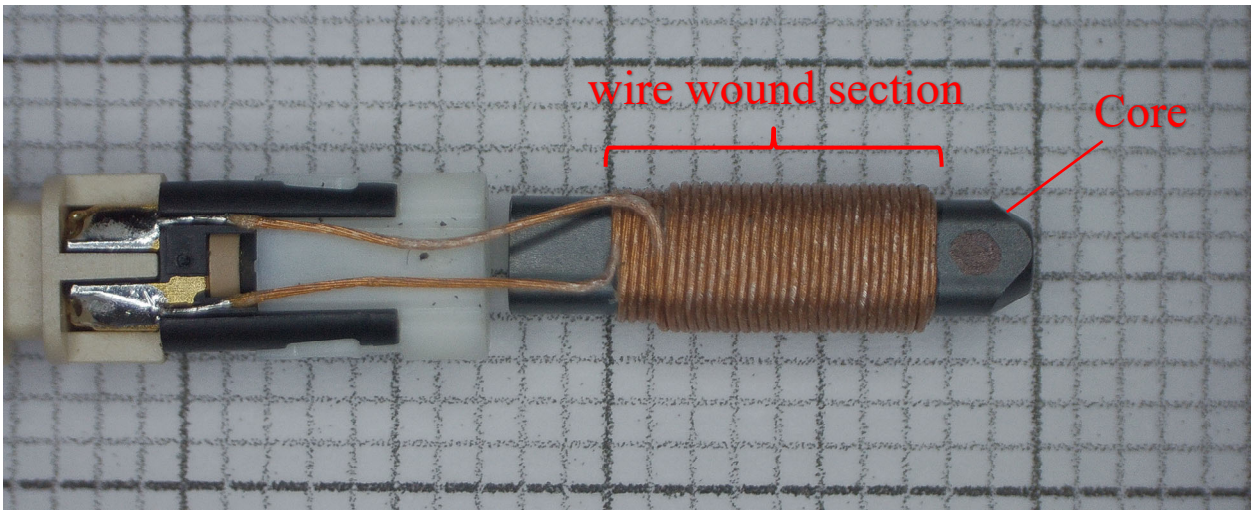
Samsung tablets

The S8 Ultra S Pen included with the Galaxy Tab S8 Ultra is a first mobile device including a receiver that inductively receives power. As illustrated in the images below, the S8 Ultra S Pen includes the claimed solenoid magnetic core having a relative permeability exceeding 1 and having a first and a second end, and a Litz wire wrapped around a section of aforementioned magnetic core forming a wire wound section. As can be seen in the images, the magnetic core extends beyond the wire wound section. In the figures below, each small unit in the grid is 1 mm.

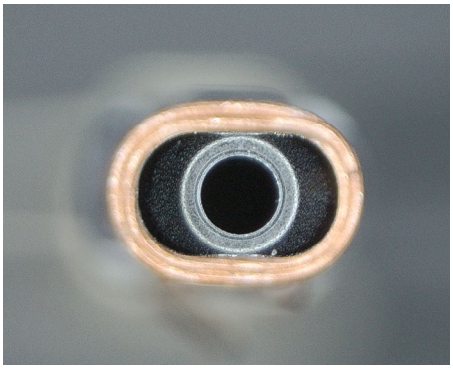




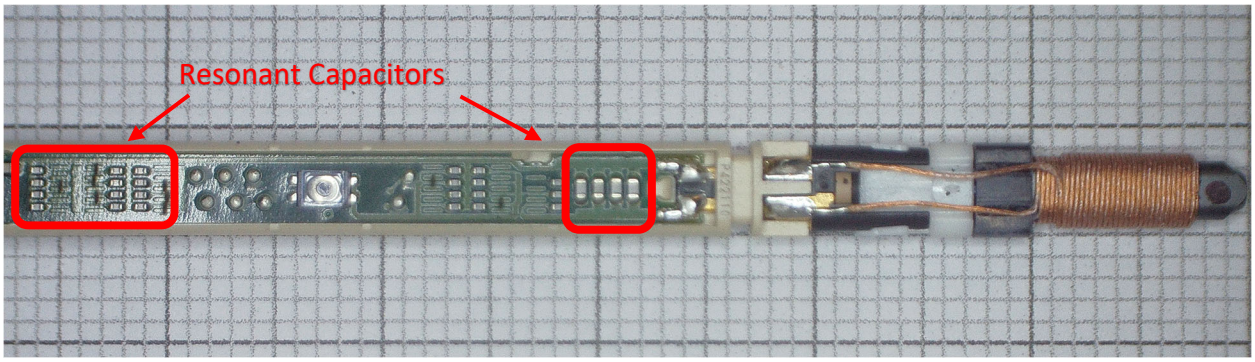
An image of the tip of the Galaxy Tab S8 Ultra S-pen is shown below which identifies the solenoid with the magnetic core extending beyond the wire wound section:



An end view image of the tip of the Galaxy Tab S8 Ultra S pen with the outer plastic shell removed is shown below, showing the area of one end of the solenoid core with the Litz wire wrapped around the core (end-on view). The magnetic core is oval shaped in its main body and has a circular first end towards the pen tip wherein the first end has an outer circular diameter of ~ 1.68 mm.



Further, the S8 Ultra S Pen includes a receiver electronic circuit including the claimed resonant capacitor(s) as illustrated in the below images of an S8 Ultra S Pen with its housing removed, and on information and belief a rectifier(s) on the opposite side of the board (not pictured).



Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet this part of claim 1 for the reasons stated above.

wherein: the charger further includes a means for positioning the receiver in a power transfer position, proximate to the charger surface, to inductively transfer power to the receiver of the first mobile device:

The 349 Accused Products meet this part of claim 1 of the 349 by way of a housing or recess and magnets, as described below.

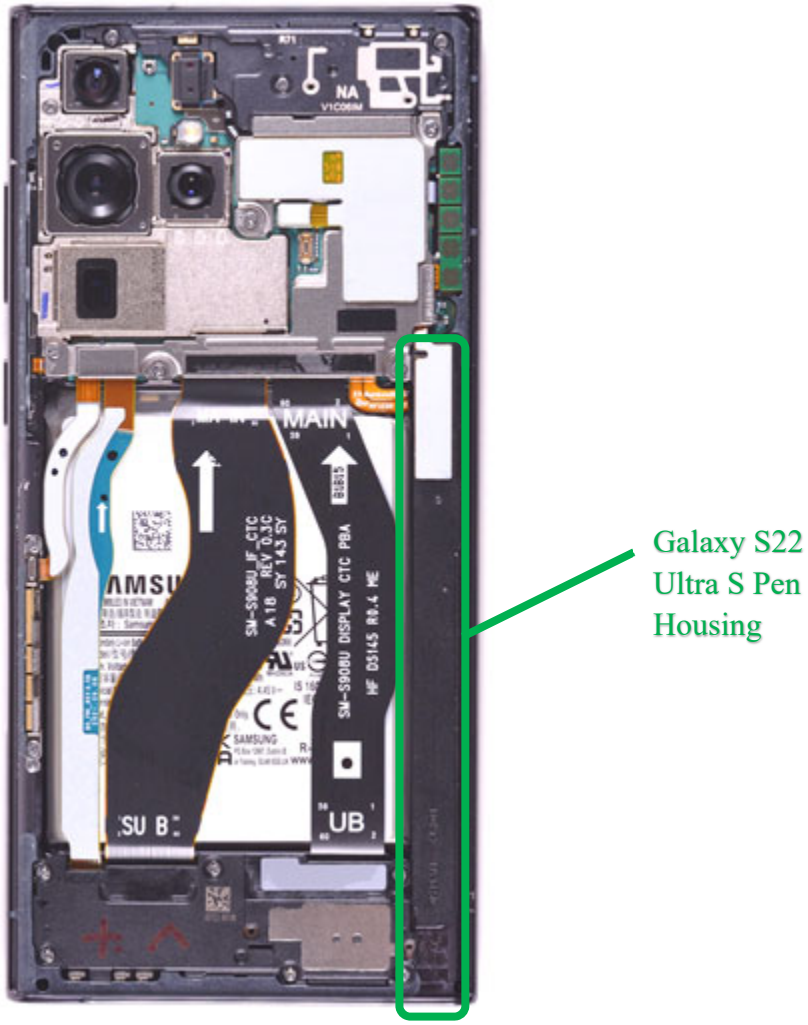
Samsung smartphones

The Galaxy S22 Ultra smartphone includes a housing for the Galaxy S22 Ultra S Pen in which the Galaxy S22 Ultra S Pen is mechanically held in position and wirelessly/inductively charged by the Galaxy S22 Ultra.

https://www.samsung.com/us/smartphones/galaxy-s22-ultra/buy/galaxy-s22-ultra-128gb-unlocked-sm-s908uzkaxaa/
https://www.youtube.com/watch?v=NMnLzYWuLGo



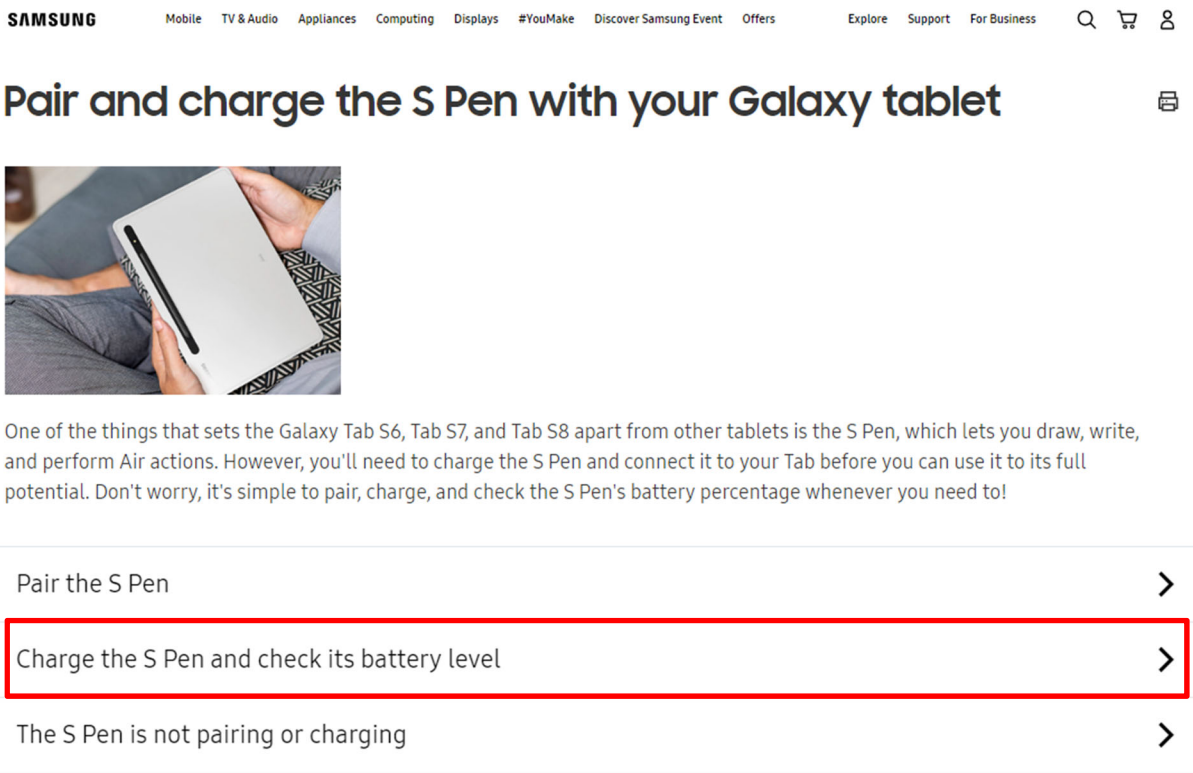
https://www.samsung.com/us/smartphones/galaxy-s22-ultra/buy/galaxy-s22-ultra-128gb-unlocked-sm-s908uzkaxaa/



Samsung tablets

Similarly, the Galaxy Tab S8 Ultra tablet includes a recess with magnets for holding the Tab S8 Ultra S Pen in a position in which the Tab S8 Ultra S Pen is magnetically attached to the recess area and is wirelessly/inductively charged by the Tab S8 Ultra.

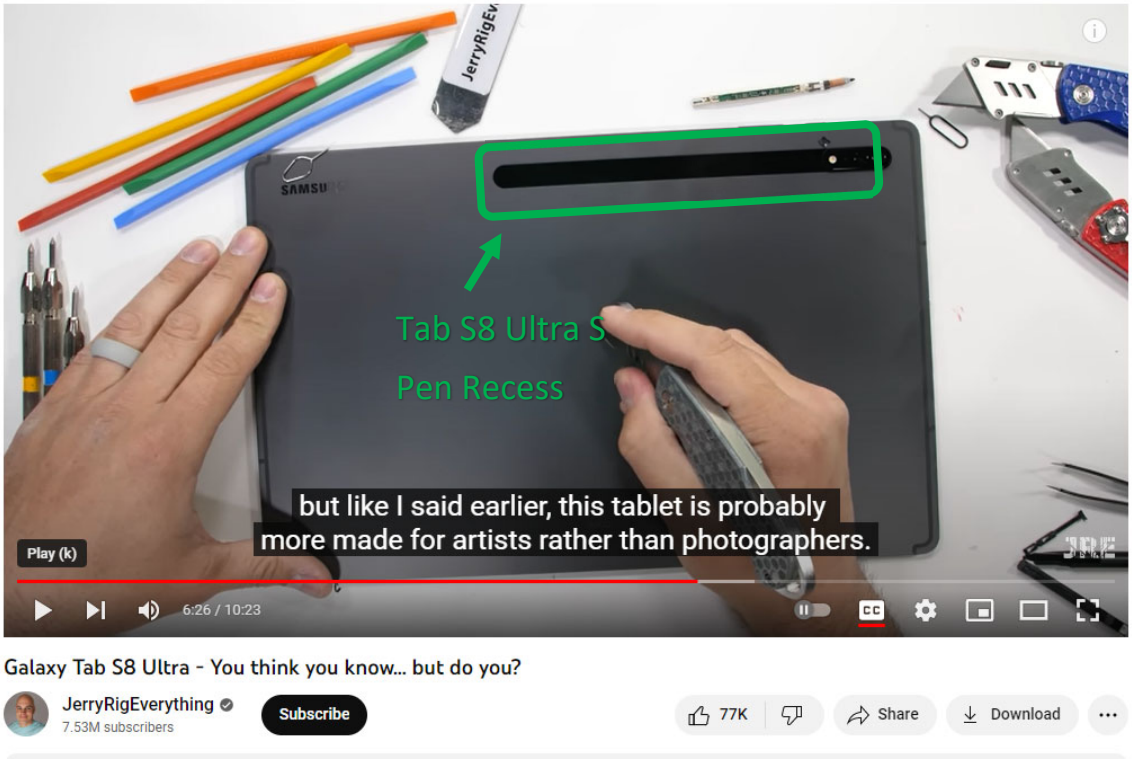
https://www.samsung.com/us/support/answer/ANS00086982/



https://www.samsung.com/ie/support/mobile-devices/tab-s7-s-pen/



https://www.youtube.com/watch?v=EIjjpOJ0ghg&ab_channel=JerryRigEverything



the charger drive circuit is configured to drive the charger coil at one or more operating frequencies to inductively transfer power from the charger to the receiver when the receiver is positioned in the power transfer position, wherein when the receiver is positioned in the power transfer position, a tuned circuit, including the charger coil and the resonant capacitor of the charger drive circuit and the solenoid and the resonant capacitor of the receiver electronic circuit, has a resonant frequency that allows the charger to transfer the power to the receiver at the one or more operating frequencies;

The 349 Accused Products meet this part of claim 1 of the 349 as they form a tuned circuit with the S Pen as specified, as described below.

Samsung smartphones

The Galaxy S22 Ultra provides wireless power transfer to the Galaxy S22 Ultra S Pen from a tuned circuit with a resonant frequency that allows for wireless/inductive power transfer to the Galaxy S22 Ultra S Pen at an operating frequency of the S Pen charger in the Galaxy S 22 Ultra. For example, *see* the following publicly available FCC test data for the Galaxy S22 Ultra. This shows frequency range of operation of 530-600 kHz for charging the Galaxy S22 Ultra S Pen.

https://fcc.report/FCC-ID/A3LSMS908U/5574740

FCC ID:	**A3LSMS908U**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-S908U
Additional Model(s):	SM-S908U1
EUT Type:	Portable Handset
Frequency Range:	110 – 148kHz 0.53 – 0.60MHz
FCC Classification:	Part 15 Low Power Transmitter Below 1705kHz (DCD)
FCC Rule Part(s):	Part 15 Subpart C
Test Procedure(s):	ANSI C63.10-2013

Section 7.1 of the same document defines the tests performed:

> This unit was tested while transferring maximum power wirelessly to a similar unit and also to a stylus pen (S-Pen).

Galaxy S22 Ultra smartphones are configured such that when the Galaxy S22 Ultra S pen is positioned in the housing, a tuned circuit, including the charger coil and resonant capacitor of the charger drive circuit of the Galaxy S22 Ultra and the solenoid and the resonant capacitor of the receiver electronic circuit of the Galaxy S22 Ultra S Pen, has a resonant frequency that allows the charger to transfer the power to the Galaxy S22 Ultra S Pen at the one or more operating frequencies.

Samsung tablets

The Galaxy Tab S8 Ultra and included Tab S8 Ultra S Pen similarly provide wireless power transfer to the Tab S8 Ultra S Pen from a tuned circuit with a resonant frequency that allows for wireless/inductive power transfer to the Tab S8 Ultra S Pen at an operating frequency of the S Pen charger in the Tab S8 Ultra. For example, *see* the following publicly available FCC test data for the Tab S8 Ultra (i.e. model number SM-X900) showing a similar operating frequency.

https://fcc.report/FCC-ID/A3LSMX900/5607936

1.3. SPOT CHECK VERIFICATION DATA

Mode	Test Item	Frequency	Original model SM-X906B Results FCC ID : A3LSMX906B	Spot check model SM-X900 Results FCC ID : A3LSMX900	Deviation	Remark
WPT	RSE	0.53104 MHz (S-pen)	19.63 dBuV/m	20.69 dBuV/m	1.06 dB	

Comparison of two models, upper deviation is within 3dB range and all test results are under FCC technical limits.

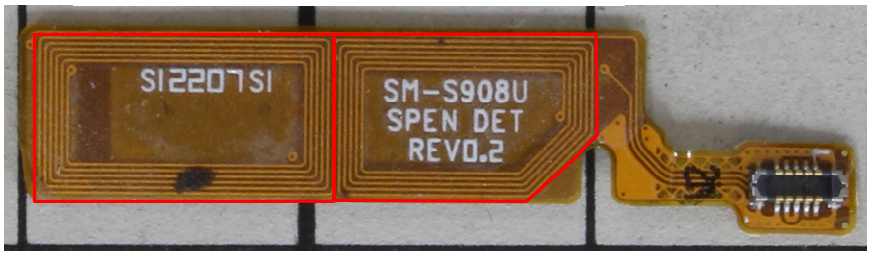
the charger coil includes a conductor patterned to include multiple, substantially concentric turns for generating a magnetic flux through a first end of the solenoid when the receiver is placed in the power transfer position, wherein an outermost of the concentric turns defines a perimeter of a charger coil area; the multiple concentric turns, when driven by the charger drive circuit, generate a magnetic field that is substantially perpendicular to the charger surface at a geometric center of the charger coil area, the charger coil area is larger than an area of the first end and larger than an area of the second end of the magnetic core of the solenoid;

The 349 Accused Products satisfies this part of claim 1 of the 349 as each of the accused products includes charger coils that include coil areas that are larger than an area of the first end and larger than an area of the second end of the magnetic core of the solenoid.

Samsung smartphones

Galaxy S22 Ultra charger coil areas for generating a magnetic field that is substantially perpendicular to the charger surface at a geometric center of each of the charger coil areas is shown below.

Galaxy S22 Ultra S Pen Charger Coil Areas



See Wireless Power Consortium Standard Version 1.2.4 Introduction, Page 9.

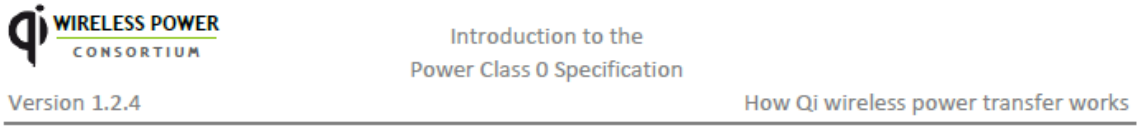
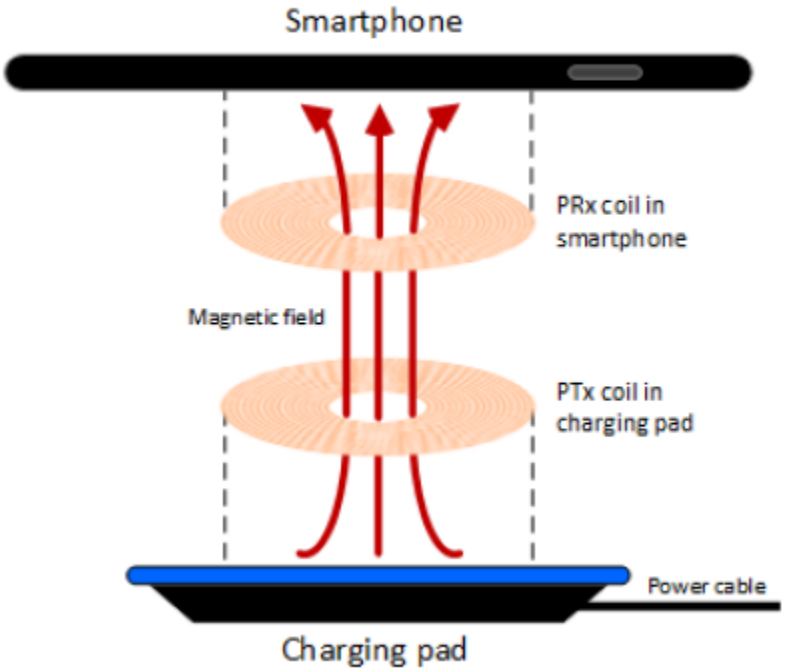
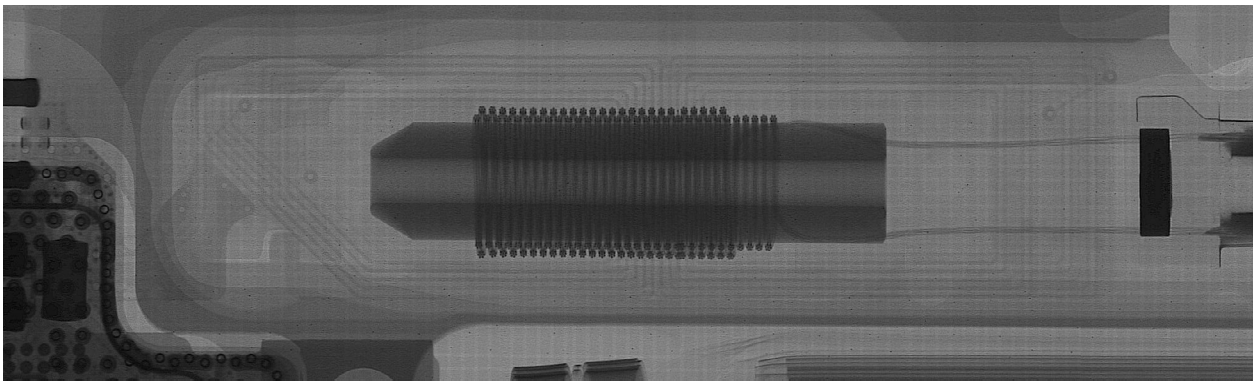


Figure 6. Qi wireless power transfer using magnetic induction

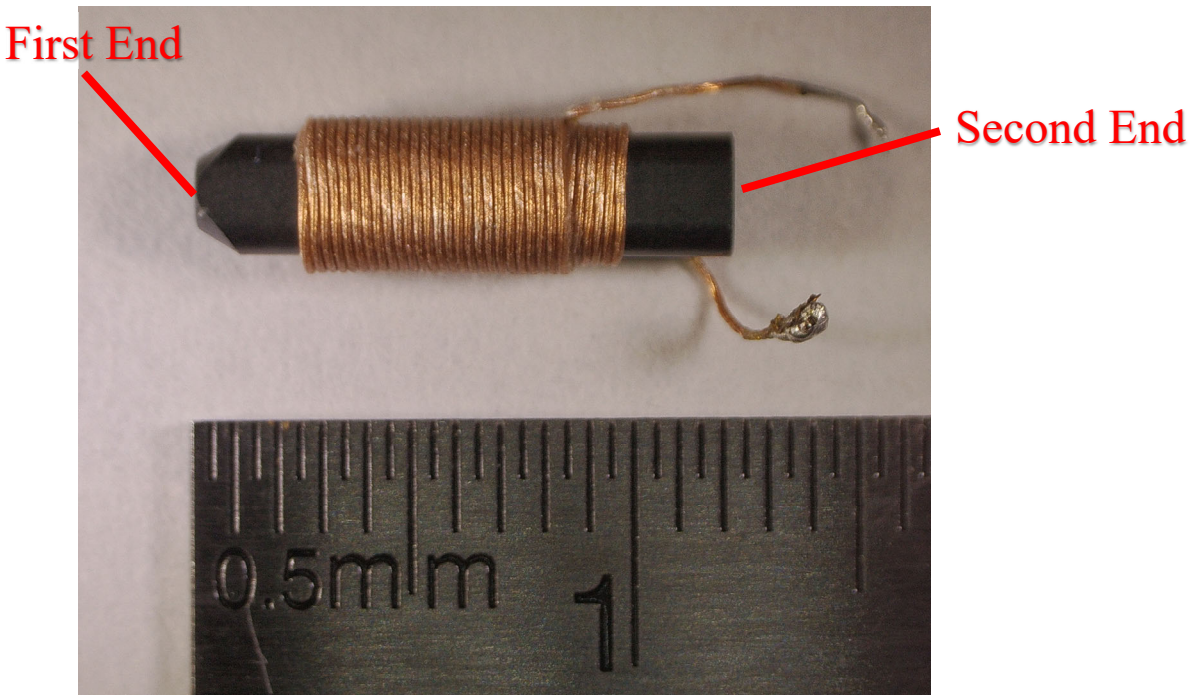


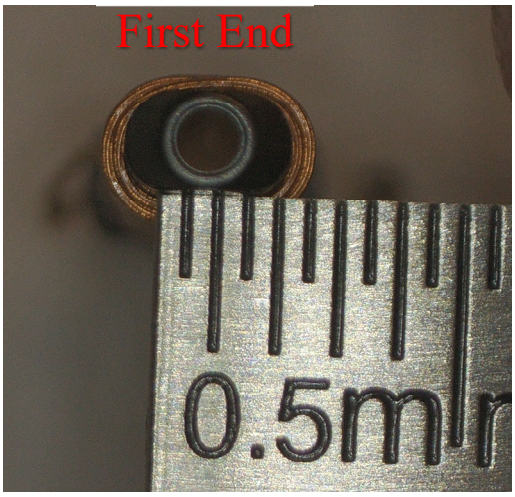
An x-ray image of the tip of the Galaxy S22 Ultra S pen when positioned above the Galaxy S22 Ultra S pen charger coils in its charging position is shown below. This shows a charger coil conductor patterned to include multiple, substantially concentric turns for generating a magnetic flux through a first end of the solenoid when the receiver coil is placed in the power transfer position.

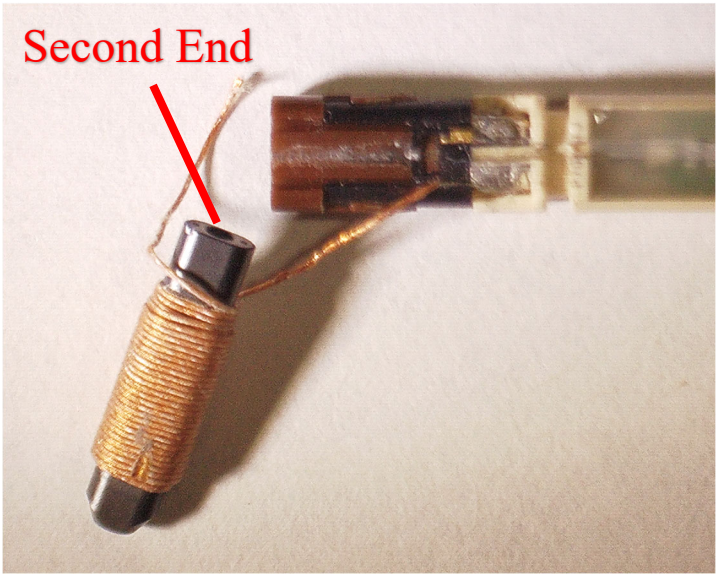


Moreover, the two areas shown above of the Galaxy S22 Ultra charger coil for charging the Galaxy S22 Ultra S Pen are each larger than an area of the first end and larger than an area of the second end of the magnetic core of the solenoid as shown above with the outlines of the two charger coil areas seen encompassing the ends of the magnetic core of the solenoid. Note that the magnetic core is circular at a

first end (the left side of the core in the x-ray image above and optical image below) and oval at the second end (right side) as shown above and below. The dimensions are shown below.



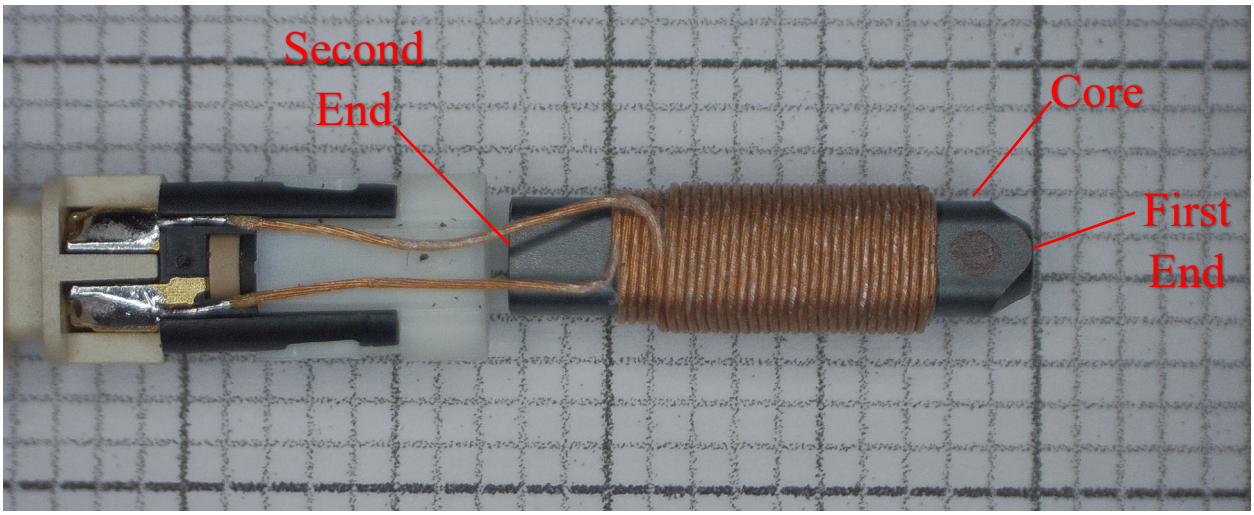




Samsung tablets

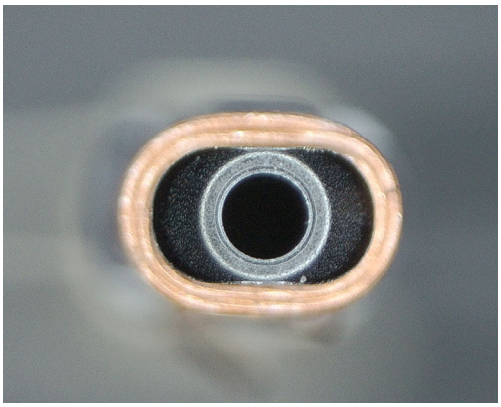
On information and belief, the Tab S8 Ultra has charger coils for generating a magnetic field that are substantially similar to the Galaxy S22 Ultra charger coils and generate magnetic fields perpendicular to the charger surface at a geometric center of each of the charger coil areas.

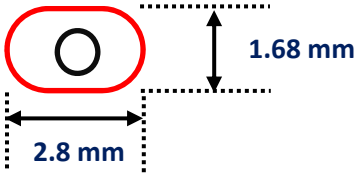
An image of the tip of the Galaxy Tab S8 Ultra S-pen is shown below which identifies the solenoid with the magnetic core and its two ends:



The magnetic cores for the Galaxy S22 Ultra and the S8 Ultra Tab S pens are circular shaped at the first end towards the pen tip and have outer circular diameters of ~ 1.68 mm. The oval shaped second end dimensions are shown below. The area of each of the charger coil areas is larger than an area of the first

end and larger than an area of the second end of the magnetic core of the solenoid for the S22 Ultra and the S8 Ultra Tab S pens.





the magnetic layer of the charger extends beyond the charger coil area; and

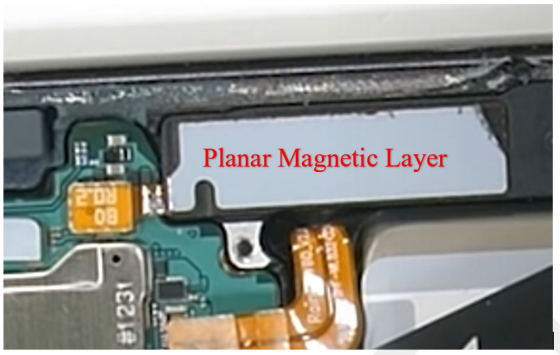
The 349 Accused Products satisfies this part of claim 1 of the 349, as they both include a magnetic layer under the charger coil that extends beyond the charger coil area.

Samsung smartphones

The Galaxy S22 Ultra includes a charger having a magnetic layer that extends beyond the charger coil area.

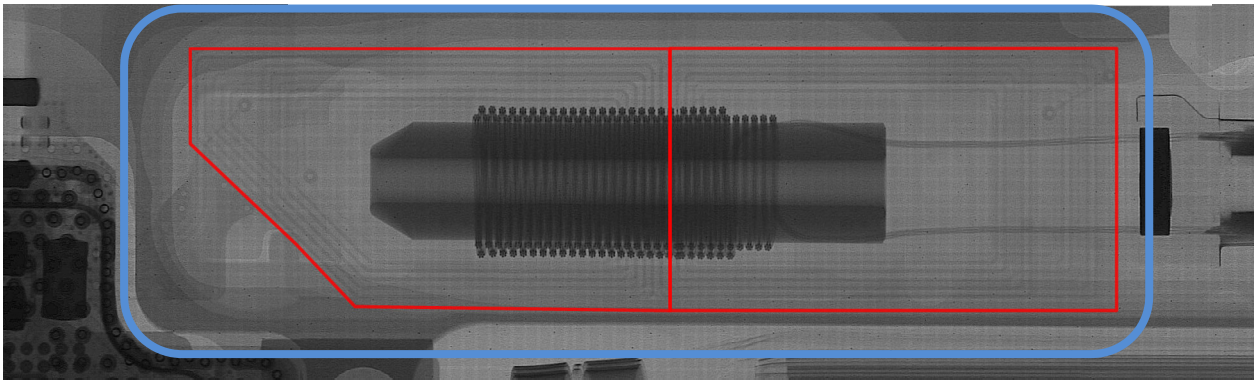
https://www.youtube.com/watch?v=-f7B9fBJJug





The x-ray below shows the S Pen of the Galaxy S22 Ultra in charging position, showing that the magnetic layer of the charger extends beyond each of the charging coil areas.

Galaxy S22 Ultra S Pen Charger Coil Areas (shown in red)



Magnetic Layer (shown in blue)

Samsung tablets

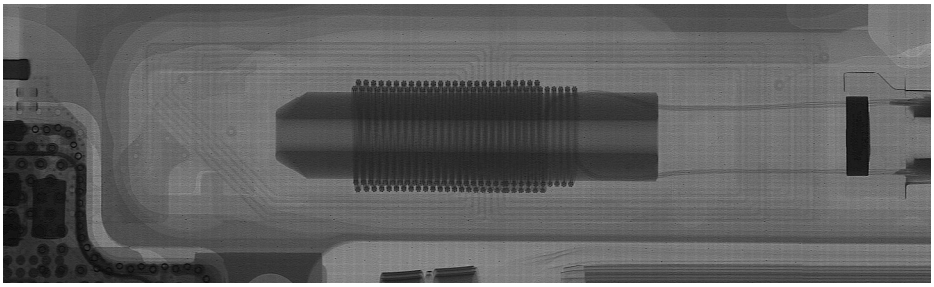
On information and belief, based on the dimensions of the Tab S8 Ultra S pen charger coil and Tab S8 Ultra S pen solenoid, the Tab S8 Ultra includes a charger having a magnetic layer that extends beyond the charger coil area.
https://www.youtube.com/watch?v=EIjjpOJ0ghg&ab_channel=JerryRigEverything

when the receiver is in the power transfer position, the first end of the magnetic core is located proximate to the charger coil area above the charger surface to receive magnetic flux from the charger coil area and guide the magnetic flux in a closed magnetic loop from the charger coil area through the solenoid and return through the charger magnetic layer to the charger coil area to form the closed magnetic loop.

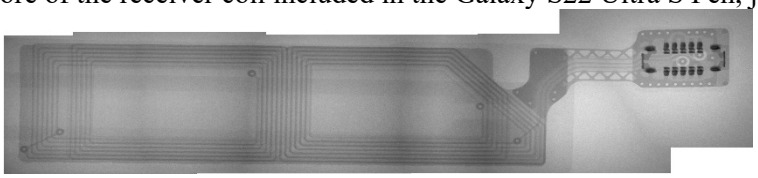
The 349 Accused Products each satisfy this part of claim 1 of the 349 patent as the charger coil and solenoid of the S Pen of the Galaxy S22 Ultra form a closed magnetic loop, as described below.

Samsung smartphones

The x-ray image below shows the tip of the Galaxy S22 Ultra S Pen in the charging position. As can be seen, the first end of the magnetic core is shown to be proximate to the charger coil area above the charger surface and receives magnetic flux from the charger coil area. The magnetic flux is guided by the first end of the magnetic core and traverses a closed magnetic loop from the charger coil area through the first end of the magnetic core, through the length of the solenoid, and returns through the second end of the magnetic core to the charger magnetic layer and to the charger coil to form the closed magnetic loop.



Another x-ray of the Galaxy S22 Ultra S Pen charging coil and images of the charging coils separated from the phone are shown below. The bottom right image shows the receiver coil of the Galaxy S22 Ultra S pen and the magnetic core of the receiver coil included in the Galaxy S22 Ultra S Pen, jacket removed.



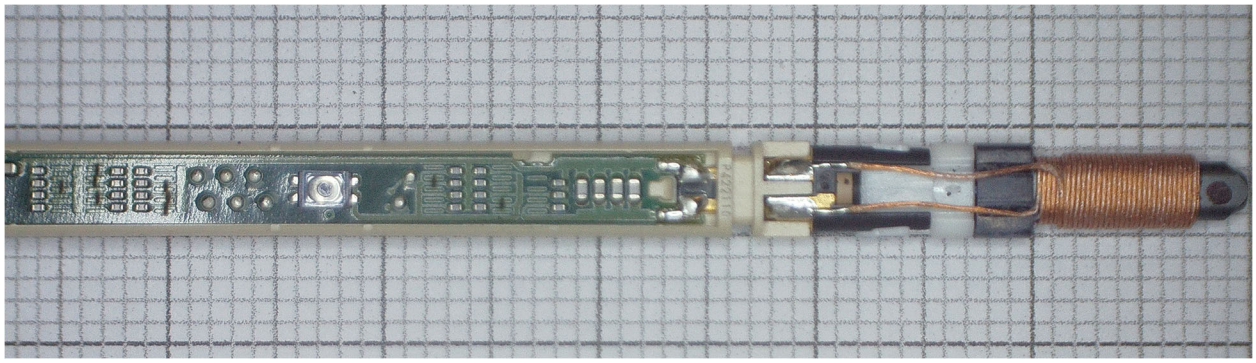


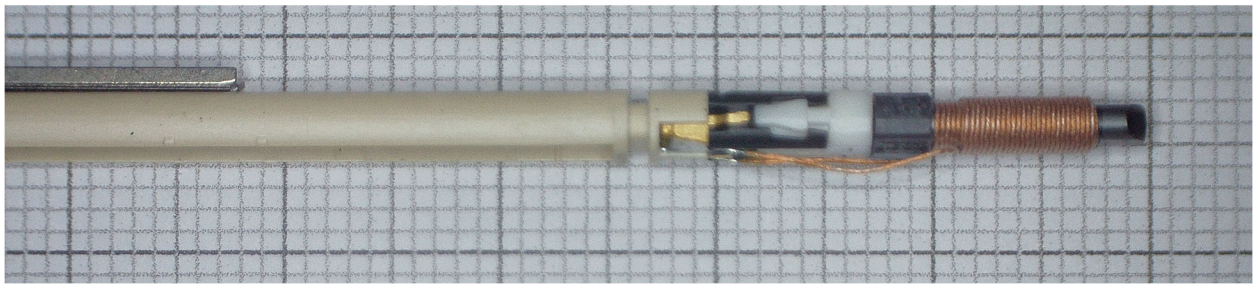
See also https://www.youtube.com/watch?v=NMnLzYWuLGo

Samsung tablets

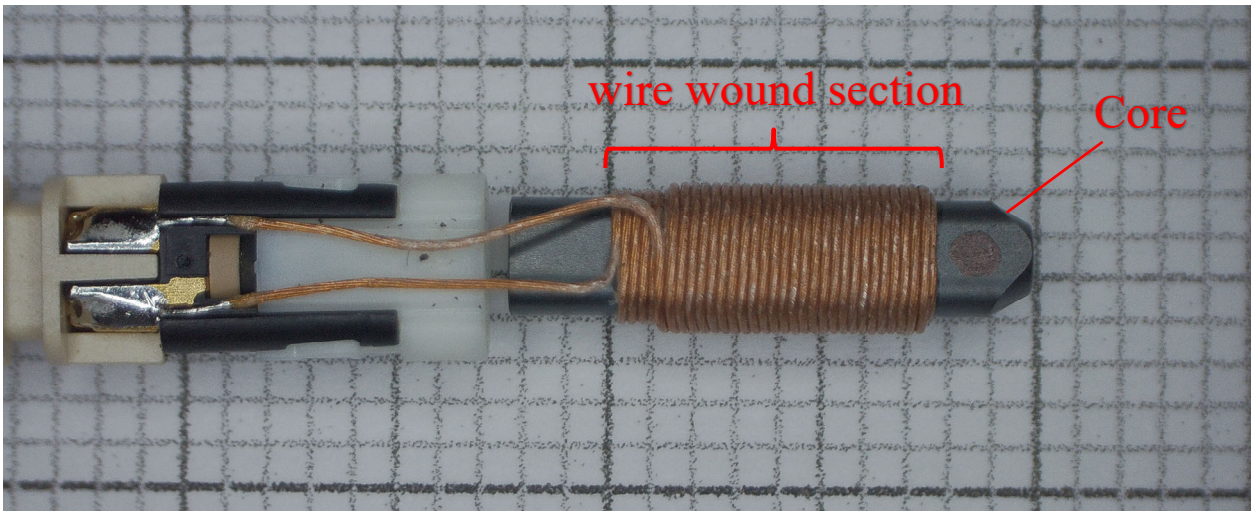
The images below show the Tab S8 Ultra S Pen receiver solenoid and Tab S8 Ultra charger coil. When the Tab S8 Ultra S Pen is in the charging position, the first end of its magnetic core is proximate to the charger coil area above the charger surface and receives magnetic flux from the charger coil area. The magnetic flux is guided by the first end of the magnetic core and traverses a closed magnetic loop from the charger coil area through the first end of the magnetic core, through the length of the solenoid, and returns through the second end of the magnetic core to the charger magnetic layer and to the charger coil to form the closed magnetic loop.

In the figures below, each small unit in the grid is 1 mm.





An image of the tip of the Galaxy Tab S8 Ultra S pen is shown below.



DEPENDENT CLAIMS WITH RESPECT TO CLAIM 1:

4. The system of claim 1, wherein when the receiver is positioned in the power transfer position and when the charger is operated at an operating frequency near the resonance frequency of the tuned circuit to inductively transfer power from the charger to the receiver, the transfer of power from the charger to the receiver has a power transfer efficiency that exceeds 50%, wherein the power transfer efficiency is defined by power out of a rectifier in the receiver electronic circuit divided by power into the charger drive circuit.

The 349 Accused Products set forth with respect to claim 1 each additionally infringe this dependent claim as they provide the recited power transfer efficiency.

Samsung smartphones

On information and belief, the Galaxy S22 Ultra S pen is inductively charged by the S22 Ultra near the resonance frequency of the charging circuit and achieves a charging efficiency that exceeds 50%, where the efficiency is defined by power out of a rectifier in the Galaxy S22 Ultra S pen divided by power into the charger drive circuit.

Samsung tablets

On information and belief, the Tab S8 Ultra S pen is inductively charged by the Tab S8 Ultra near the resonance frequency of the charging circuit and achieves a charging efficiency that exceeds 50%, where the efficiency is defined by power out of a rectifier in the Tab S8 Ultra S pen divided by power into the charger drive circuit.

Samsung pens

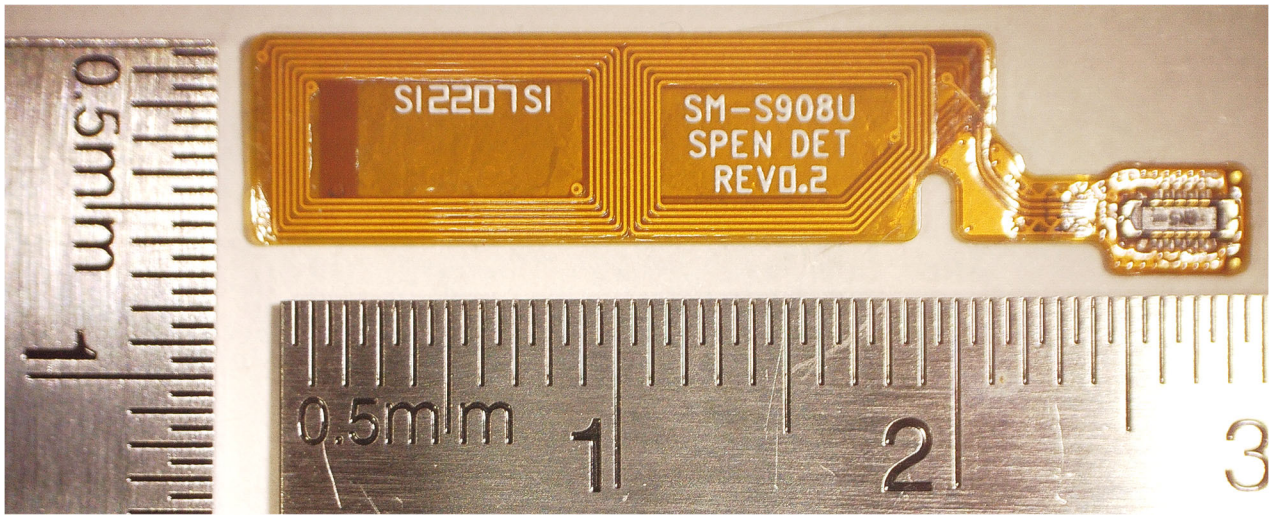
Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 4 together with the Galaxy S22 Ultra and Galaxy Tab S8 Ultra for the reasons stated above.

5. The system of claim 1, wherein the charger coil area is at least ten times larger than the area of each of the ends of the magnetic core of the solenoid.

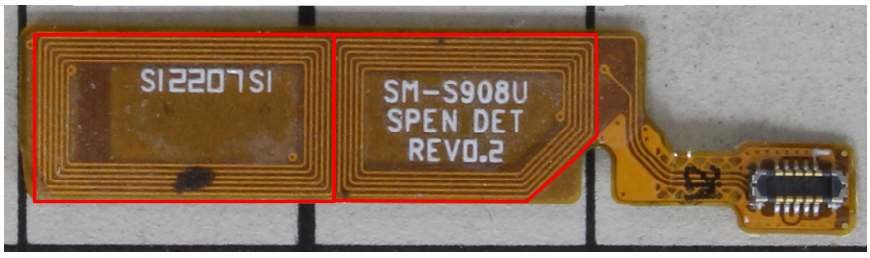
The 349 Accused Products include a charger coil area that is at least ten times larger than the area of each of the ends of the magnetic core of the solenoid, as shown below.

Samsung smartphones

The Galaxy S22 Ultra image below shows the charger coil with a ruler adjacent to it. The area of the coil on the left side as defined by the claim is approximately 11 mm x 7 mm = 77 mm^2. The area of the coil on the right side is ~ 61 mm^2.



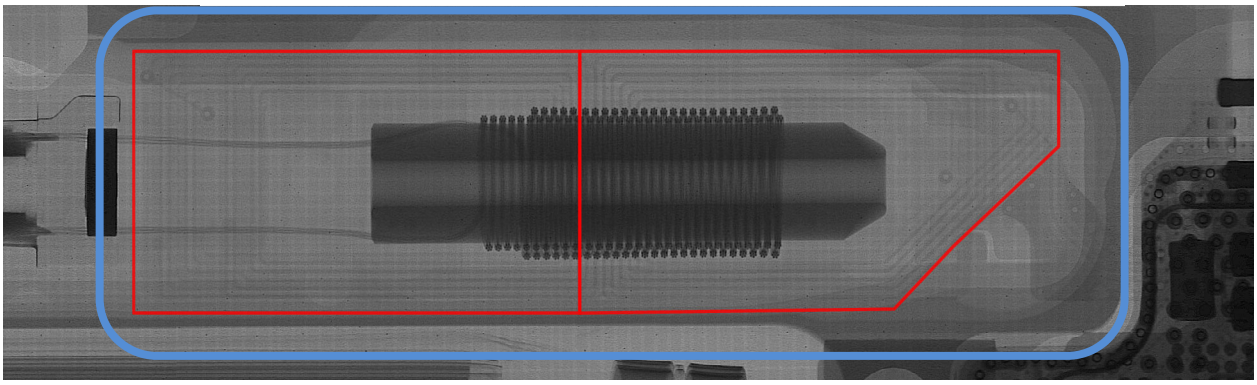
Galaxy S22 Ultra S Pen Charger Coil Areas



An x-ray image of the tip of the Galaxy S22 Ultra S pen when positioned above the Galaxy S22 Ultra S pen charger coils in its charging position is shown below. The first end of the solenoid core is above the

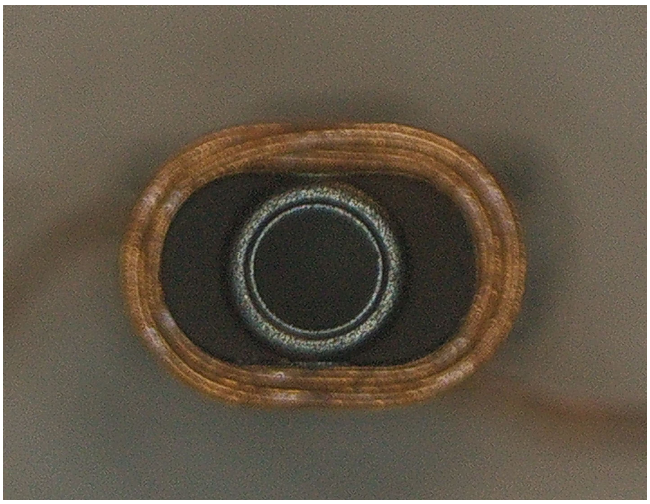
right charger coil area (with the rectangular corner) and the oval shaped second end of the solenoid core is located above the rectangular left charger coil area.

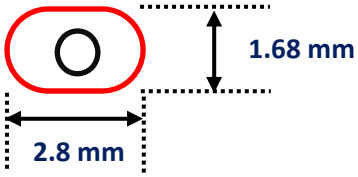
Galaxy S22 Ultra S Pen Charger Coil Areas (shown in red)



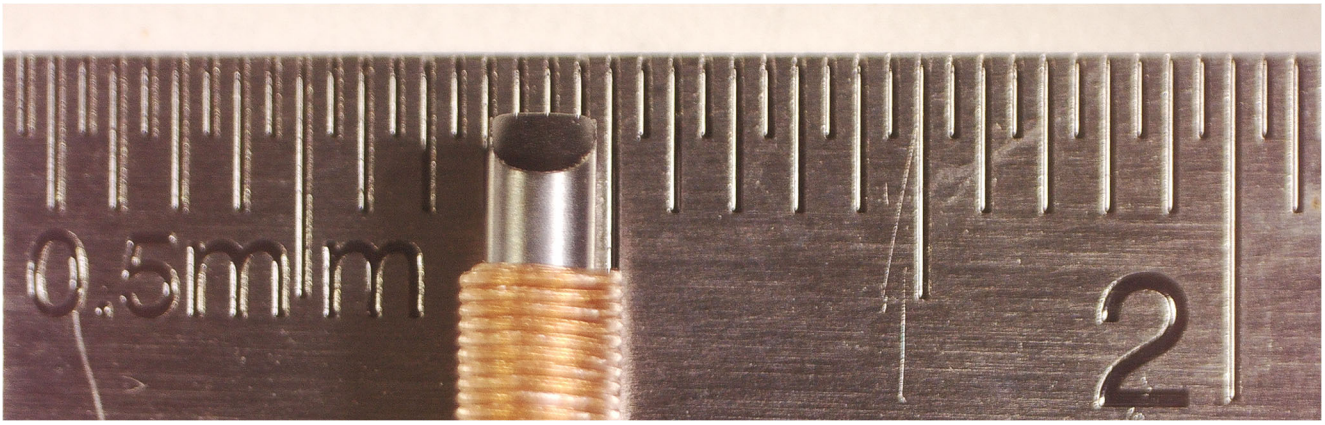
Images below show the end of the magnetic core of the solenoid in the Galaxy S22 Ultra S Pen looking end-on at the core (top) and placed sideways to measure the diameter of the circular end of the magnetic core with a ruler. This dimension of the circular first end was measured using a caliper to be ~1.68 mm in diameter resulting in an area of 2.22 mm^2. Using the right side coil area (the smaller coil area of the two) as the charger coil in this claim, The ratio of the right side charger coil area to the area of the first end of the magnetic core for the S22 Ultra is therefore approximately equal to 61 / 2.22 = 27.5, thereby meeting the requirement of the claim.

A drawing of the dimensions of the second end of the magnetic core is shown below. The area of the second end is ~ 4.1 mm^2. The ratio of the right side charger coil area to the area of the second end of the magnetic core for the S22 Ultra is therefore approximately equal to 61 / 4.1 = 14.9, thereby also meeting the requirement of the claim.





The image below shows the end of the solenoid on its narrow side.



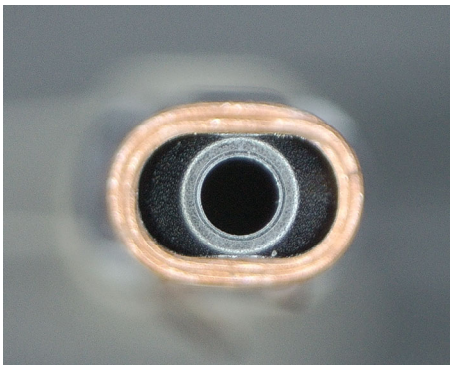
Samsung tablets

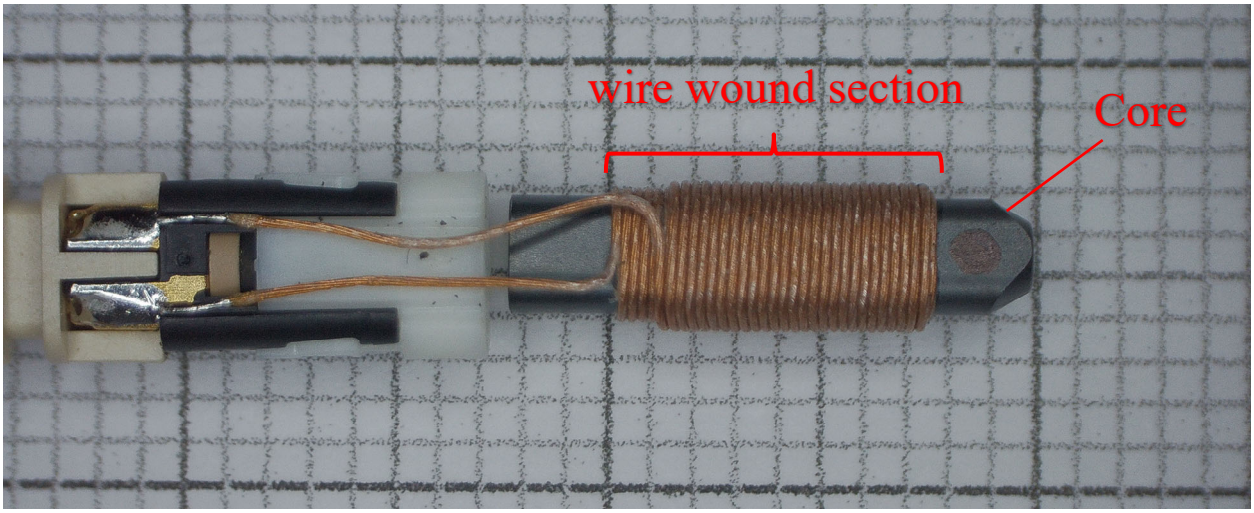
On information and belief, the Tab S8 has a charger coil area that is at least ten times larger than the area of each of the ends of the magnetic core of the solenoid.

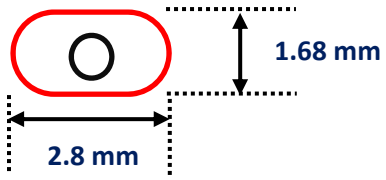
Images below show the end of the magnetic core of the solenoid in the Tab 8 Ultra S Pen looking at the core end-on (top) and placed sideways to measure the diameter of the circular end of the magnetic core with a ruler. This dimension of the circular first end was measured using a caliper to be ~1.68 mm in diameter resulting in an area of 2.22 mm^2.

A drawing of the dimensions of the oval-shaped second end of the magnetic core is shown below. The area of the second end is ~ 4.1 mm^2.

Upon information and belief, the charger coil area of the Tab S8 Ultra is at least ten times larger than the area of each of the first end and the second end of the magnetic core of the solenoid in the Tab S8 Ultra S pen.







Samsung pens

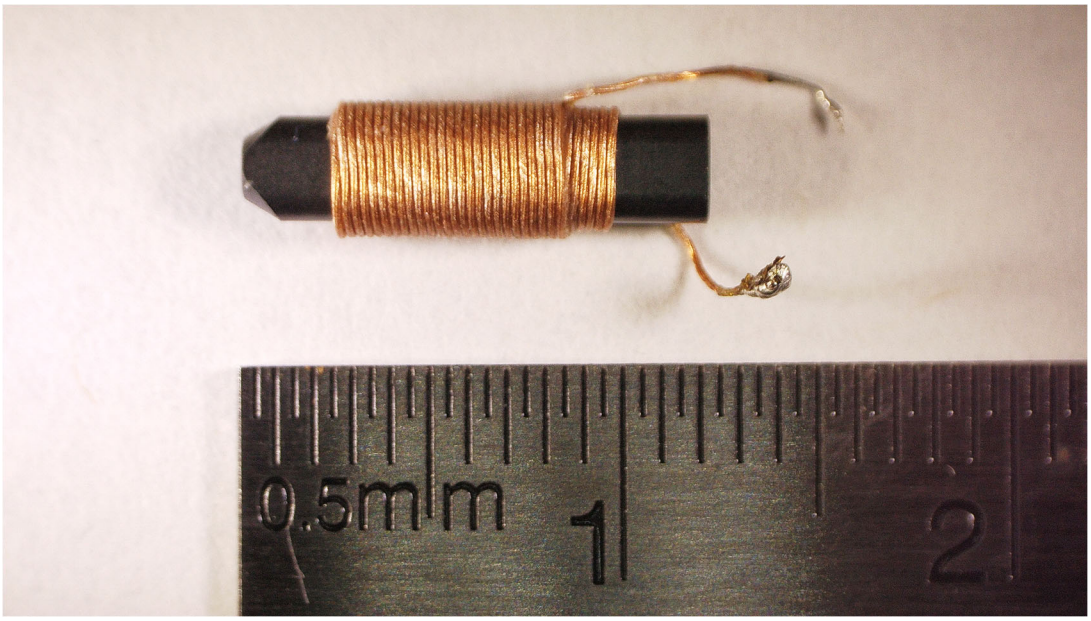
Galaxy S22 Ultra and Galaxy Tab S8 S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 5 together with the Galaxy S22 Ultra and Galaxy Tab S8 Ultra for the reasons stated above.

7. The system of claim 1, wherein the magnetic core of the solenoid has a cross sectional dimension in at least one end of 1 to 2 mm and has a length along a winding axis of 10 to 20 mm.

The 349 Accused Products include a magnetic core of the solenoid that has a cross sectional dimension in at least one end of 1 to 2 mm and has a length along a winding axis of 10 to 20 mm.

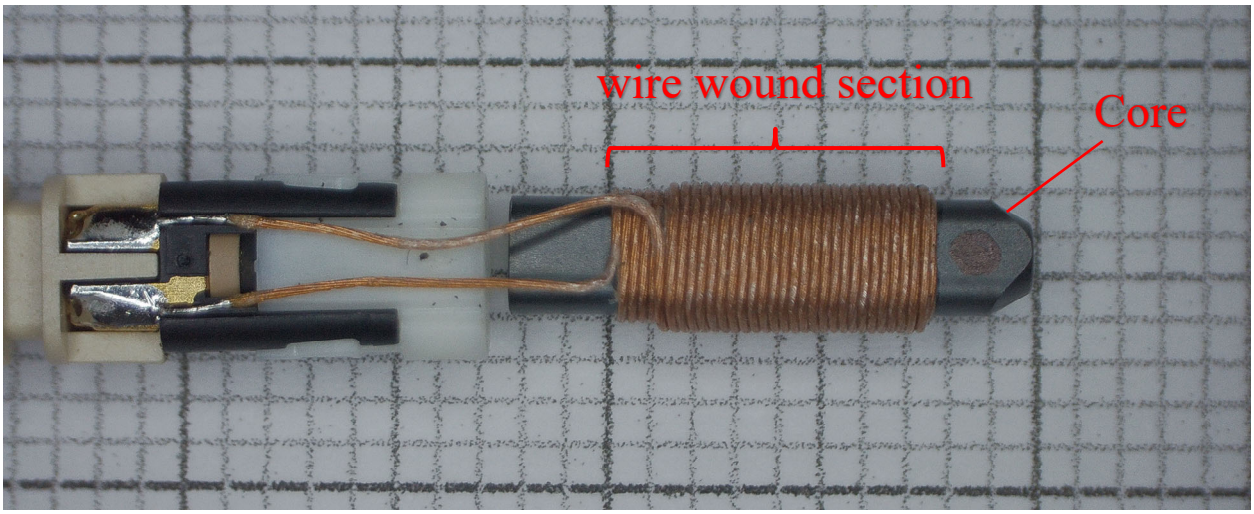
Samsung smartphones

The Galaxy S22 Ultra S Pen images below show the magnetic cores of the solenoid of the Galaxy S22 Ultra S Pen which has a cross sectional dimension in at least one end of 1 to 2 mm (as shown in claim 5 above) and has a length along a winding axis of 12 mm, as shown below.



Samsung tablets

The Tab S8 Ultra S Pen images below show the magnetic cores of the solenoid of the Tab S8 Ultra S Pen which has a cross sectional dimension in at least one end of 1.68 mm (as shown in claim 5 above) and has a length along a winding axis of 12 mm, as shown below.



Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 7 for the reasons stated above.

8. The system of claim 1, wherein the Litz wire is selected for operation at a frequency of greater than 205 kHz.

The S Pens which are 349 Accused Products each include Litz wire that is selected for operation at a frequency of greater than 205 kHz.

Samsung smartphones

The Galaxy S22 Ultra provides wireless power transfer to the Galaxy S22 Ultra S Pen at an operating frequency of 530 – 600 kHz that is greater than 205 kHz. The width of the Litz wire used for the Galaxy S22 Ultra S Pen is measured and shown to be selected for operation at a range of 350 kHz – 800 kHz consistent with the frequency of operation of the Galaxy S22 Ultra charger.

Use of Litz wire in this application allows the low loss and the high Quality factor necessary to achieve high efficiency in wireless power transfer in a geometry such as this where the area at the end of the receiver solenoid is much smaller than the charger coil area.

See https://www.newenglandwire.com/why-preformed-litz-wire-is-best-for-high-current-magnetic-devices/

Essential Characteristics

Litz wire consists of a number of individually insulated magnet wires twisted or braided int a uniform pattern. In some Litz constructions twisted bundles are joined with other bundles all of which are then twisted into the final product.

Litz wire's unique twisting places each strand at the outside periphery of the conductor anc at its center in equal measure. This unique twisting method, plus carefully selected wire diameter, gives Litz wire the ability to minimize losses from two sources: skin effect and proximity effect.

- **Litz Reduces Skin Effect Losses.** AC current flowing through a wire increasingly migrates toward the surface of the conductor as frequency increases. This skin effect increases the wire's AC resistance in direct proportion to the frequency of the current. For example, with a 5 kHz current flowing through a conventional wire, the current density is largely confined to the outer 42.3 mils of the conductor, while at 100 kHz it flows only through the outermost 9.46 mils. These measures are known as skin depth. At frequencies up to a few megahertz, the AC resistance in a single conductor can be 20 or more times greater than a Litz wire of the same diameter, resulting in heat losse which, in high current applications, can compromise the device.

Designers can virtually eliminate the skin effect with Litz wire. The key is to choose the diameter of individual wire strands twisted into the Litz construction that are similar to the skin depth for the given frequency. Doing so causes current to flow through nearly the entir cross section of each wire, thus minimizing AC resistance and heat losses.

- **Litz Also Reduces Proximity Effect Losses.** An alternating current flowing through each conductor in a coil or winding creates an alternating magnetic field around it. That field induces eddy currents in adjacent windings, altering the overall distribution of current flowing through them and creating losses that manifest as unwanted heat. The result is that the current is concentrated in the areas of the conductor farthest away from nearby conductors carrying current in the same direction. This proximity effect increases with frequency. At higher frequencies, the proximity effect can raise the AC resistance of a conductor to as much as ten times its DC resistance.

The unique Litz wire twisting pattern places each strand nearly equally at the inside and outside of the cable, which equalizes the flux linkages and reactances of the individual strands. This causes the current to spread uniformly throughout the conductor. The resistance ratio (AC to DC) then approaches unity, which is especially desirable in high-Q circuit applications.

On information and belief, each strand of Litz wire in the Galaxy S22 Ultra S Pen, including its enamel coating, is ~0.06 mm in diameter. The diameter of the copper strand without enamel is therefore slightly under 0.06 mm (i.e. 42-44 AWG Wire Gauge). The thickness of each strand of Litz wire for optimum performance is dictated by the intended frequency of operation due to the skin effect and proximity effect affecting operation at high frequencies. The number of strands is then optimized for the intended resistance / loss and the expected current through the bundle. The following table is a typical Litz Wire design guide from a Litz Wire vendor.

https://www.hflitzwire.com/frequency-as-per-awg-size/

> *AWG size is selected by 'Frequency Band' as following data and No. of strands are decided by current amount.*

Frequency	Recommended Wire Gauge	(mm)
60Hz to 1KHz	28AWG	0.32
1KHz to 10KHz	30AWG	0.25
10KHz to 20KHz	33AWG	0.18
20KHz to 50KHz	36AWG	0.12
50KHz to 100KHz	38AWG	0.10
100KHz to 200KHz	40AWG	0.08
200KHz to 350KHz	42AWG	0.06
350KHz to 850KHz	44AWG	0.05
850KHz to 1.4MHz	46AWG	0.04
1.4MHz to 2.8MHz	48AWG	0.03

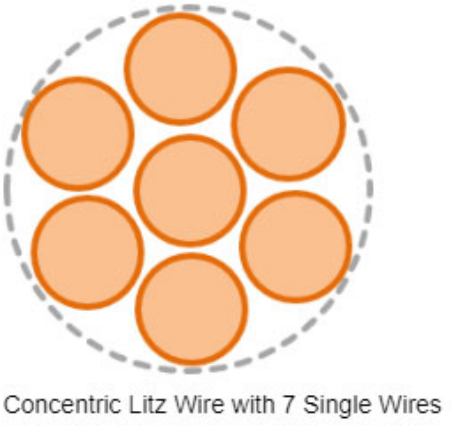
Remarks : AWG size is related with Skin effect & Proximity effect which means how much current could flow in the litz wire without resistance and how much effectiveness could influence the induction effect.

The strand thickness used in the Galaxy S22 Ultra S Pen is consistent with a frequency range in the 350 kHz to 850 kHz operation as indicated above. As shown further below from FCC data for operation of the S Pen charger, referenced in Claim 1, the frequency of operation is in the range of 530-600 kHz, consistent with the optimized diameter of the Litz wire strand considering skin effect and proximity effect of operation at this frequency.

The geometry of the 7- strand bundle is a typical twisted Litz Wire geometry as shown below on the left and the outside polymer (such as Nylon or Teflon) insulator is a typical Served Litz Wire geometry as shown on the right which is the type of the Litz wire used in the Galaxy S22 Ultra S Pen as shown below.

The type of Litz Wire used is known in the industry as a Round Type 1 Litz wire as shown below.

https://newtcdn.s3.us-east-2.amazonaws.com/wp-content/uploads/2017/12/02144706/NEWT-Litz-Book_FINAL.pdf; *See also* https://www.elektrisola.com/en-us/Litz-Wire/Info#litz-wire-types



Concentric Litz Wire with 7 Single Wires



Images of the Litz wire used for the Galaxy S22 Ultra S Pen are shown below.



Samsung tablets

The Tab S8 Ultra provides wireless power transfer to the Tab S8 Ultra S Pen at an operating frequency of around 531kHz (see claim 1 above) that is greater than 205 kHz, as shown above with respect to claim 1. On information and belief, and in similarity to the Galaxy S22 Ultra S Pen, the width of the Litz wire used for the Tab S8 Ultra S Pen is selected for operation at a range of 350 kHz – 800 kHz consistent with the frequency of operation of the Tab S8 Ultra charger. *See supra* citations from S22 Ultra section above.

Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 8 for the reasons stated above.

10. The system of claim 1, wherein the magnetic core of the solenoid comprises Ferrite material and the charger magnetic layer comprises Ferrite material.

On information and belief, the magnetic cores of the solenoid of the S Pens which are 349 Accused Products comprise Ferrite material and the charger magnetic layers of the S22 Ultra and Tab S8 Ultra comprise Ferrite material, as shown below.

Samsung smartphones

On information and belief, the magnetic core of the Galaxy S22 Ultra S Pen solenoid comprises ferrite material and the charger magnetic layer also comprises a ferrite material as evidenced by attraction to a magnet.

Samsung tablets

On information and belief, the magnetic core of the Tab S8 Ultra S Pen solenoid comprises ferrite material and the charger magnetic layer also comprises a ferrite material as evidenced by attraction to a magnet.

Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 10 together with the Galaxy S22 Ultra and Tab S8 for the reasons stated above.

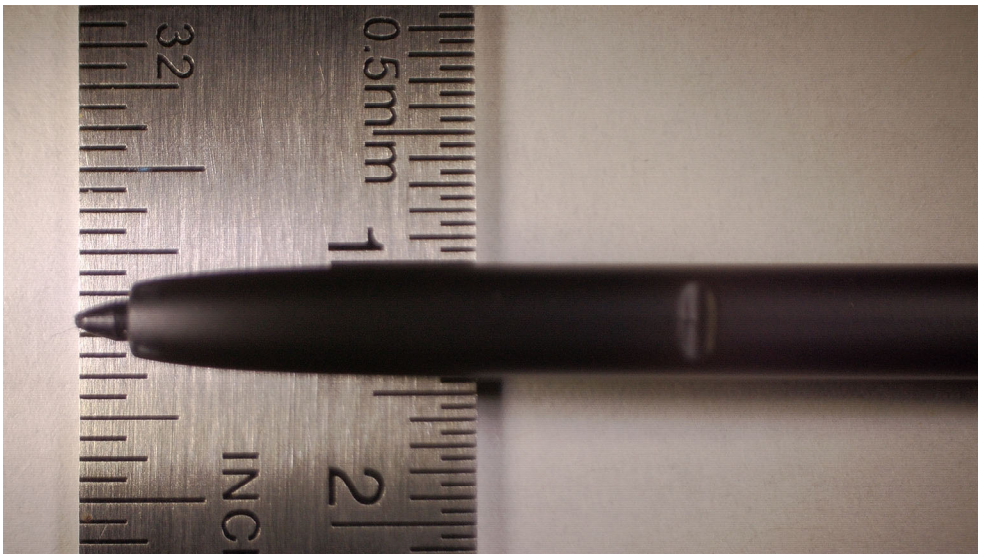
11. The system of claim 1, wherein a center of the first end of the solenoid is positioned 1 mm or more away from the charger surface when the receiver is positioned in the power transfer position.

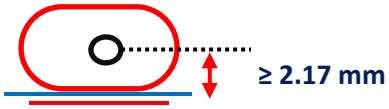
On information and belief, the center of each first end of each respective S Pen solenoid of the 349 Accused Products, is positioned 1mm or more away from the respective charger surface when the receiver is positioned in the power transfer position.

Samsung smartphones

The Galaxy S22 Ultra S Pens which are 349 Accused Products have an oval cross section (red shape below) with 4.35 mm x 5.9 mm outer dimensions. A side view of the narrow edge of the pen is shown against a ruler below.

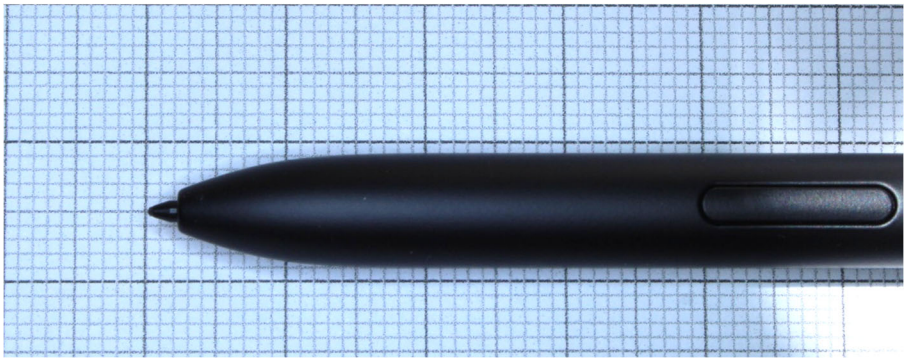
The cross section of the Galaxy S22 Ultra pen (red oval shape) is shown in a drawing below. The center of the first end of the solenoid (shown in claim 5 above) is at the center of the pen (i.e. center of the black circle below). The pen when inserted into the Galaxy S22 Ultra S pen charging housing is positioned against a pen housing wall as shown by the blue line below the pen. The charger surface is located below this wall as shown with a red line below the wall. Based on this geometry, the distance between the center of the solenoid to the top of the housing wall is ≥ 2.17 mm. The distance between the center of the solenoid and the charger surface is therefore expected to be even larger than this value meeting the requirement of this claim.



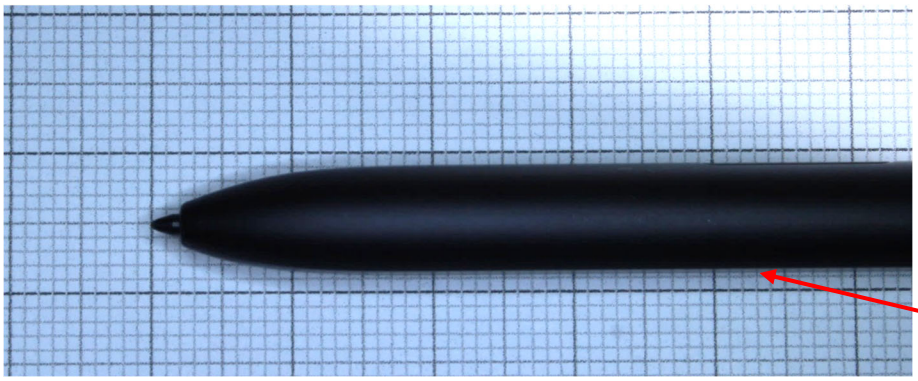


Samsung tablets

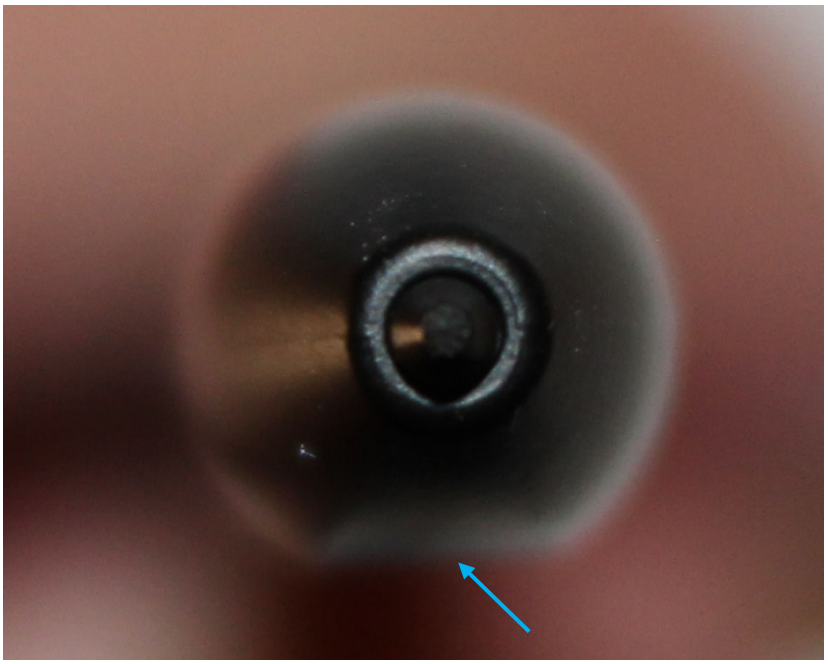
The Tab 8 Ultra S Pen for the Galaxy Tab S8 Ultra which are 349 Accused Products have a round cross section which is flat on one side (to be placed flat against the Tab recess and held there magnetically) with ~ 8.14 mm x 7.60 mm dimensions. A top view of the Tab 8 Ultra S pen (as it would be viewed from the top when attached to the recess on the Tab S8 Ultra) is shown against a grid paper below. Each small unit in the grid is 1 mm.



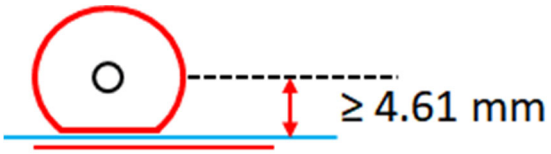
A side view of the top view of the Tab 8 Ultra S pen (with the flat side at the bottom of the picture) is shown against a grid paper below.



The end of the Tab 8 Ultra S pen (with the solenoid center being concentric with the tip of the pen) is shown below. The flat surface of the Tab 8 Ultra S pen that would magnetically attach to the surface of the pen recess in the Tab 8 Ultra is at the bottom side of the Tab 8 Ultra S pen as shown below with the blue arrow.



The cross section of the Tab 8 Ultra S pen (red shape) is shown in a drawing below. The center of the first end of the solenoid is at the center of the tip of the Tab 8 Ultra S pen as shown by the black circle. The Tab 8 Ultra S pen when placed on the Tab 8 Ultra charging recess is positioned against a Tab 8 Ultra recess wall as shown by the blue line below the pen. The charger surface is located below this wall as shown with a red line below the wall. Based on this geometry, the distance between the center of the solenoid to the top of the recess wall is ≥ 4.61 mm. The distance between the center of the solenoid and the charger surface is therefore expected to be even larger than this value meeting the requirement of this claim.



Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 11 together with the Galaxy S22 Ultra and Tab S8 Ultra for the reasons stated above.

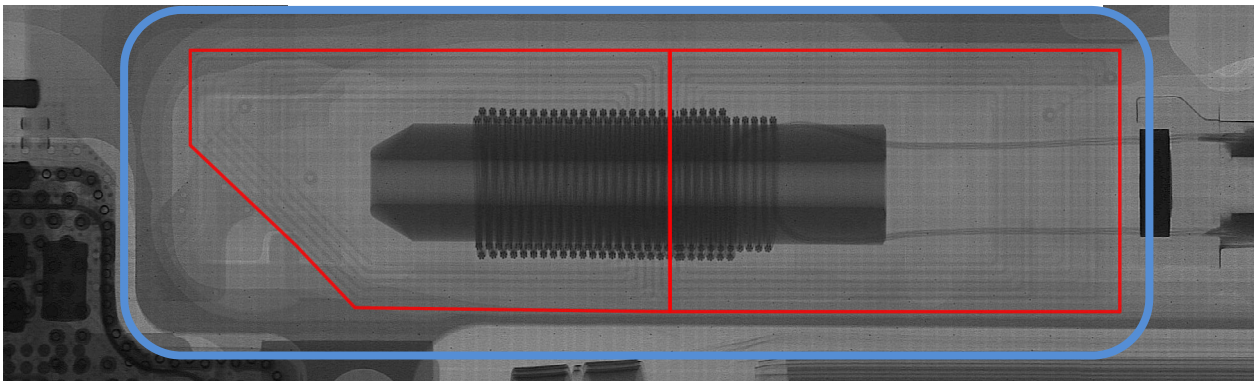
12. The system of claim 1, wherein when the receiver is positioned in the power transfer position, the magnetic core of the solenoid extends beyond the charger coil area in a preferential direction and the charger magnetic layer is also extended in the preferential direction so that the magnetic flux returned during the provision of power to the mobile device flows from the solenoid back to the charger coil to close the magnetic loop.

The S Pens which are 349 Accused Products have a magnetic core of the solenoid that extends beyond the charger coil area in a preferential direction when the S Pen of the device is in the power transfer position in the Galaxy S22 Ultra / Tab S8 Ultra, as shown below.

Samsung smartphones

The Galaxy S22 Ultra / S Pen images below show the magnetic core of the solenoid extending beyond the charger coil area in a direction that the charger magnetic layer is also extended so that the magnetic flux exiting the solenoid on top of the magnetic layer as described in claim 1 above in the extended region flows to the magnetic layer and back to the charger coil as specified by this claim.

S22 Ultra S Pen Charger Coil Areas (shown in red)



Magnetic Layer (shown in blue)

Samsung tablets

On information and belief, the Tab S8 Ultra / S Pen, being similarly configured to the S22 Ultra solenoid and coil as shown above, has a magnetic core of the solenoid extending beyond the charger coil area in a direction that the charger magnetic layer is also extended so that the magnetic flux exiting the solenoid on top of the magnetic layer as described in claim 1 above in the extended region flows to the magnetic layer and back to the charger coil as specified by this claim.

Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 12 together with the Galaxy S22 Ultra and Tab S8 Ultra for the reasons stated above.

13. The system of claim 1, wherein: the charger is incorporated into a second mobile device; the second mobile device includes an internal, rechargeable battery; the second mobile device uses the internal battery to transfer power to and operate the charger for a period of time; and the first and second mobile devices comprise Bluetooth communication systems to communicate with each other during non-power transfer operations.

The 349 Accused Products meet the additional limitations in this dependent claim, as the Galaxy S22 Ultra and the Tab S8 Ultra are themselves mobile devices that correspond to the claimed "second mobile device." They each further, as claimed, include an internal, rechargeable battery, which powers the Galaxy S22 Ultra / Tab S8 Ultra when not plugged in. When not plugged in, this internal battery is used to transfer power to and operate the S Pen charger. Moreover, as claimed, the Galaxy S22 Ultra / Tab S8 Ultra and their associated S Pen include Bluetooth communication systems to communicate with each other during non-power transfer operations, as described further below.

Samsung smartphones

The Galaxy S22 Ultra and Galaxy S22 Ultra S Pen each have Bluetooth communication functionality as is shown in the below images and documents.

https://www.samsung.com/us/support/answer/ANS00080375/#:~:text=Bluetooth%20devices%20give%20you%20tons,and%20customizable%20S%20Pens%20yet.

Pair and charge the S Pen with your Galaxy phone



Bluetooth devices give you tons of flexibility, and the S Pen and S Pen Pro are Bluetooth compatible! Devices like the Galaxy S22 Ultra, Note10, and Note20 have the most streamlined and customizable S Pens yet. These newer S Pen models use a special kind of Bluetooth that will let you use your phone's innovative S Pen to control your phone.

Note: The S Pen included with your phone is made to be used specifically with those model phones. Only the S Pen Pro can be used interchangeably between different models.

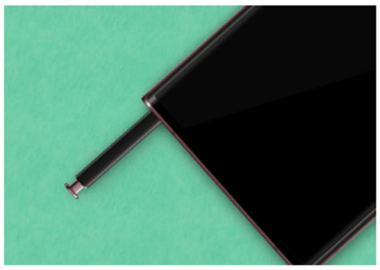
Pair the S Pen

Note: The operational limit of the S Pen is 30 feet. If you move outside of this range, the S Pen will disconnect from your phone.

The S Pen has a special kind of advanced Bluetooth that emits a signal at a very low frequency. Because of this, it doesn't have to be paired to your phone like traditional Bluetooth devices. The Bluetooth is strong enough to keep the S Pen and phone connected all the time, so you won't have to constantly pair and unpair it.

If the connection between the S Pen and your phone is lost, just insert the S Pen into the phone for a couple of seconds. It will pair quickly, and the connection will be reestablished. If you are using an S Pen Pro, you will need to press the **Pairing** button.

If you have any problems connecting your S Pen, or you see a connection error, check out our **troubleshooting guide**.



Samsung tablets

The Tab S8 Ultra and the Tab S8 Ultra S Pen each have Bluetooth communication functionality as is shown in the below images and documents.

Pair the S Pen

Just like the S Pen that comes with Galaxy Note phones, your tablet's S Pen constantly emits a Bluetooth signal at a very low power. In other words, you don't need to worry about turning Bluetooth on and off because the S Pen's signal will always be present.

When you want to pair the S Pen to your Tab S6, Tab S7, or Tab S8, just place it in the designated slot on the back of the tablet. The S Pen will pair instantly; that's all you have to do.

If you're using the Tab S6, make sure the pen's point is facing downward with the tip facing away from the cameras. On the Tab S7 and Tab S8, the pen's point must be facing upward with the tip facing toward the cameras.

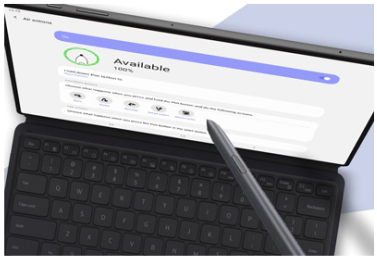


With a Tab S7 or Tab S8, you'll also be able to pair the S Pen Pro and use **additional features** as well!

CONTACT

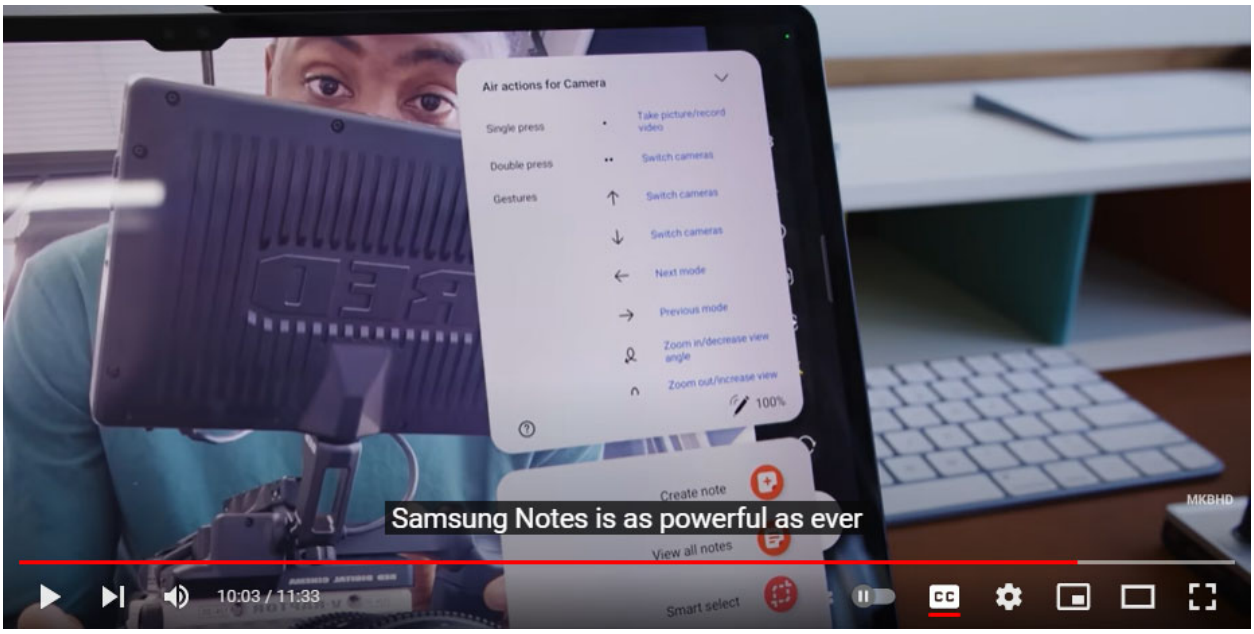
https://www.samsung.com/us/support/answer/ANS00086982/

Use Air actions with your Galaxy tablet's S Pen



If you've got a Galaxy tablet that comes with an S Pen, that means you can take advantage of the awesome Air actions feature. "Air actions" is an umbrella term for all of the remote controllability gestures you can use with the S Pen. There are App actions that let you control apps like Spotify or your camera, and Anywhere actions that let you navigate your tablet's interface with a few flicks.

https://www.samsung.com/us/support/answer/ANS00087382/



See "Galaxy Tab S8 Ultra: A Monster Tablet!" available at https://www.youtube.com/watch?v=bTYV7aFC6KE (showing Tab S8 Ultra S pen Bluetooth air actions for camera).

Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 13 together with the Galaxy S22 Ultra and Tab S8 Ultra for the reasons stated above.

15. The system of claim 13, wherein the second mobile device further includes: an additional inductive charger, wherein the additional inductive charger includes an additional charger coil to transfer power to additional mobile devices.

Samsung smartphones

The 349 Accused Products which are smartphones meet the additional requirements in this dependent claim as the representative Galaxy S22 Ultra includes an additional inductive charger for its Wireless PowerShare feature, so that it can wirelessly charge other mobile devices such as other smartphones, earbud cases, and smart watches, as seen in the Infringement Contentions for '440 and '942 claim 1.

https://screenrant.com/does-samsung-galaxy-s22-have-wireless-charging-support/

On top of that, all three models of the Galaxy S22 also support Wireless PowerShare. This is the feature that allows S22 owners to use their phone as a wireless charger to charge accessories and other phones. To enable Wireless PowerShare, open the Settings app on the Galaxy S22 and tap 'Battery and device care.' Tap 'Battery,' tap 'Wireless power sharing,' and tap the toggle to turn it on. Now, placing another device on the back of the S22 will allow it to refuel like it would on any other wireless charging pad. This works best with smaller gadgets like earbuds and **Samsung** smartwatches, but it can also be used to charge another smartphone if you're in a pinch.

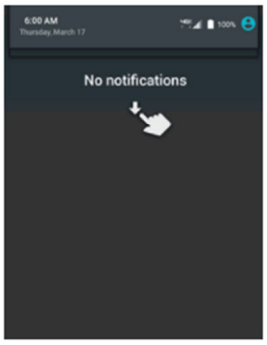
https://www.verizon.com/support/knowledge-base-300922/

Samsung Galaxy S22 / Galaxy S22 Ultra - Use Wireless PowerShare

NOTE

- Wireless PowerShare works with most wireless charging capable devices. Different devices may charge at different speeds.
- If unable to connect a device or charging is slow, remove any cover from each device.
  → For additional troubleshooting, refer to Wireless PowerShare Issues.
- Using Wireless PowerShare may affect call reception or data services, depending on network environment.

1. Swipe down on the **Status bar** (at the top) twice to expand the 'quick settings' menu.
   → The image below is an example.



2. Tap **Wireless power sharing**.
   → If unavailable, swipe left to view additional quick settings.
3. Place the center of your phone back to back with another PowerShare-capable device.

https://www.samsung.com/us/support/answer/ANS00082564/

What if you could charge all your devices on the fly, even if you forgot their chargers? It's not too good to be true. With the Wireless PowerShare feature, your phone can reverse charge another phone, watch, or Galaxy Buds. All you need to do is place the two devices together.

Note: Wireless PowerShare works with most Qi-Compatible devices. This feature may not work with some cases, accessories, or other manufacturers' devices.

Phones that can use and also be charged with Wireless PowerShare:

- Galaxy S22, S22+, and S22 Ultra
- Galaxy S21, S21+, and S21 Ultra
- Note20 5G and Note20 Ultra 5G
- Galaxy Note10, Note10+, and Note10+ 5G
- Galaxy Fold, Z Fold2, Z Fold3 and Z Fold4
- Galaxy Z Flip, Z Flip 5G, Z Flip3 and Z Flip4
- Galaxy S20 5G, S20+ 5G, S20 Ultra 5G, and S20 FE
- Galaxy S10e, S10, S10+, and S10 5G

Samsung pens

Galaxy S22 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 15 together with the Galaxy S22 Ultra for the reasons stated above.

16. The system of claim 13, wherein the receiver of the first mobile device is a first receiver, and the second mobile device includes a second receiver to inductively receive power to charge the internal, rechargeable battery of the second mobile device.

Samsung smartphones

The 349 Accused Products which are smartphones meet the additional requirements in this dependent claim as the representative Galaxy S22 Ultra includes a receiver to receive inductive power to charge its internal battery, as seen in the Infringement Contentions for ’440 claim 1.

Samsung pens

Galaxy S22 Ultra S Pens that are sold separately as replacement Galaxy S22 Ultra S Pens to the infringing devices have the same design and meet the additional limitation of claim 16 together with the S22 Ultra for the reasons stated above.

17. The system of claim 1, wherein: the receiver and the charger include communication and control electronics circuits to communicate, between the receiver and the charger, information associated with the transfer of power to the first mobile device; and the communication is through a charger antenna that includes the charger coil and a receiver antenna that includes the solenoid.

On information and belief, the 349 Accused Products meet the additional requirements of this dependent claim as the receiver and charger of each device includes communication and control electronics circuits that communicate between the receiver and charger. On information and belief, the communications include information associated with the transfer of power to the first mobile device and the communication is through a charger antenna that includes the charger coil and a receiver antenna that includes the solenoid.

Samsung smartphones

The 349 Accused Products which are smartphones meet the additional requirements in this dependent claim as the representative S22 Ultra includes communication and control electronics circuits that communicate between the receiver and charger. On information and belief, the communications include information associated with the transfer of power to the first mobile device and the communication is through a charger antenna that includes the charger coil and a receiver antenna that includes the solenoid.

Samsung tablets

The 349 Accused Products which are tablets meet the additional requirements in this dependent claim as the representative Tab S8 Ultra includes communication and control electronics circuits that communicate between the receiver and charger. On information and belief, the communications include information associated with the transfer of power to the first mobile device and the communication is through a charger antenna that includes the charger coil and a receiver antenna that includes the solenoid.

Samsung pens

Galaxy S22 Ultra and Galaxy Tab S8 Ultra S Pens that are sold separately as replacement S Pens to the infringing devices have the same design and meet the additional limitation of claim 17 together with the S22 Ultra and Tab S8 Ultra for the reasons stated above.

18. The system of claim 1, wherein the charger is incorporated into an enclosed volume for placement of the receiver in the power transfer position to receive inductive power.

The 349 Accused Products which are smartphones devices additionally infringe this dependent claim, as the Galaxy S22 Ultra S pen charger in the representative Galaxy S22 Ultra is incorporated into an enclosed volume that also holds the Galaxy S22 Ultra S Pen for power transfer to the Galaxy S22 Ultra S Pen, as shown further below.

Samsung smartphones

The Galaxy S22 Ultra and the Galaxy S22 Ultra S Pen are shown below. The Galaxy S22 Ultra includes an enclosed housing / slot for inserting the Galaxy S22 Ultra S Pen into an enclosed volume for holding and charging the Galaxy S22 Ultra S Pen as shown in the images below.



https://www.samsung.com/us/smartphones/galaxy-s22-ultra/buy/galaxy-s22-ultra-128gb-unlocked-sm-s908uzkaxaa/

Samsung pens

Galaxy S22 Ultra S Pens that are sold separately as replacement Galaxy S22 Ultra S Pens to the infringing devices have the same design and meet the additional limitation of claim 18 together with the S22 Ultra for the reasons stated above.

26. A charger for inductive charging, the charger comprising:

The 349 Accused Products are accused under this claim. The 349 Accused Products each meet this this introductory part of the claim, as each includes a charger for providing power inductively as specified by this introductory part of the claim.

a printed circuit board having a charger coil, wherein the charger coil has a substantially planar charger surface; a substantially planar magnetic layer under the charger coil opposite the charger surface; a charger drive circuit, wherein the charger drive circuit includes a resonant capacitor and a FET switch to apply an alternating voltage to the charger coil; and

The 349 Accused Products each meet this part of claim 26, as shown above with respect to the "a charger" part of claim 1.

means for positioning a receiver in a power transfer position, which is proximate to the charger surface, to inductively transfer power to the receiver, wherein the receiver is included in a mobile device to inductively receive power for the mobile device

The 349 Accused Products each meet this part of claim 26, as shown above with respect to the "means for positioning" part of claim 1.

, and the receiver includes: a solenoid, wherein the solenoid includes: a magnetic core having a relative magnetic permeability exceeding 1 and having first and second ends; and Litz wire wrapped around a section of the magnetic core forming a wire wound section around the magnetic core, with the magnetic core extending beyond the wire wound section; and a receiver electronic circuit, wherein the receiver electronic circuit includes a resonant capacitor and a rectifier; and

The 349 Accused Products each meet this part of claim 26, as shown above with respect to the "first mobile device" part of claim 1.

wherein: the charger drive circuit is configured to drive the charger coil at one or more operating frequencies to inductively transfer power from the charger to the receiver when the receiver is positioned in the power transfer position, wherein when the receiver is positioned in the power transfer position, a turned circuit, which includes the charger coil and the resonant capacitor of the charger drive circuit and the solenoid and the resonant capacitor of the receiver electronic circuit, has a resonant frequency that allows the charger to transfer the power to the receiver at the one or more operating frequencies;

The 349 Accused Products each meet this part of claim 26, as shown above with respect to the "charger drive circuit" part of claim 1.

the charger coil includes a conductor patterned to include multiple, substantially concentric turns for generating a magnetic flux through a first end of the solenoid when the receiver is placed in the power transfer position, wherein an outermost of the concentric turns defines a perimeter of a charger coil area; the multiple substantially concentric turns, when driven by the charger drive circuit, generate a magnetic field that is substantially perpendicular to the charger surface at a geometric center of the charger coil area, the charger coil area is larger than an area of the first end and larger than the area of the second end of the magnetic core of the solenoid;

The 349 Accused Products each meet this part of claim 26, as shown above with respect to the "charger coil" part of claim 1.

the magnetic layer of the charger extends beyond the charger coil area; and

The 349 Accused Products each meet this part of claim 26, as shown above with respect to the "magnetic layer" part of claim 1.

when the receiver is in the power transfer position, the first end of the magnetic core is located proximate to the charger coil area above the charger surface to receive magnetic flux from the charger coil area and guide the magnetic flux in a closed magnetic loop from the charger coil area through the solenoid and return through the charger magnetic layer to the charger coil area to form the closed magnetic loop.

The 349 Accused Products each meet this part of claim 26, as shown above with respect to the "when the receiver is in the power transfer position" part of claim 1.