





Applications and Trends for 2021 and beyond

How NFC is Advancing Wireless Power

Your Webinar Hosts



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Company Highlights

- Wireless power expert with over 500M products using company's technology
- Mass production experience with Fortune 500 companies
- Over 100 patents granted and pending globally
- Contributor to industry standards in Qi, AirFuel and NFC
- NXP Gold Partner



Agenda

1. Overview: Near-Field Communications (NFC)
2. Introduction: NFC Charging
3. Qi vs. NFC Charging
4. Special advantages of NFC Charging
5. NFC WLC & NuCurrent NFC Charging performance capabilities
6. NFC Charging system architecture
7. How Power + Data work in NFC Charging System
8. Current products that use NFC Charging
9. Future products and the Ki Cordless Kitchen
10. Evaluation: Is NFC Charging right for your product?
11. How to get started with NuCurrent
12. Q&A



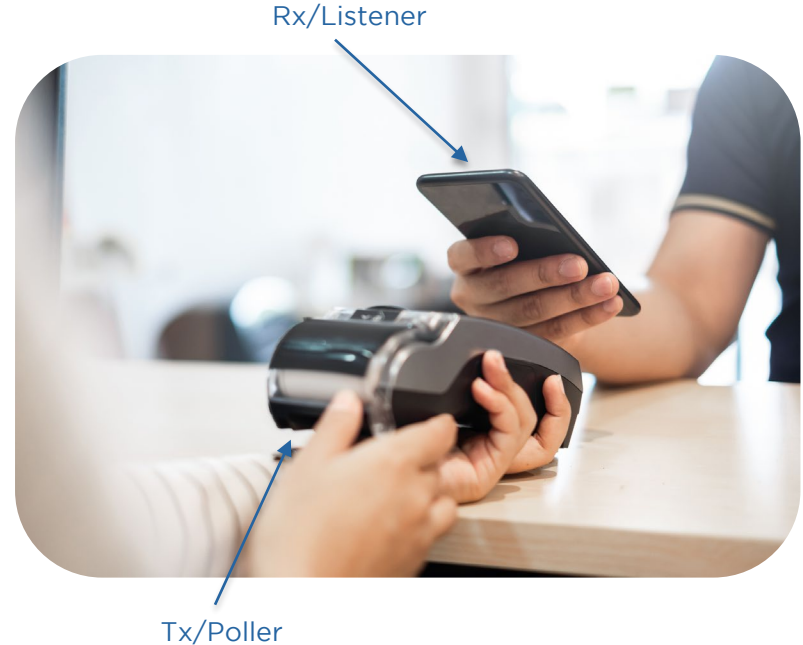


What is Near-Field Communications?



Near-Field Communication

- NFC is a data protocol that allows two devices to communicate over a distance of 4cm or less
- Key Benefits
 - Security
 - Speed
 - No Cross Talk
 - Low Power
- Common applications include: Tap & Pair, Payment, Access Control, Zero-Touch Deliveries

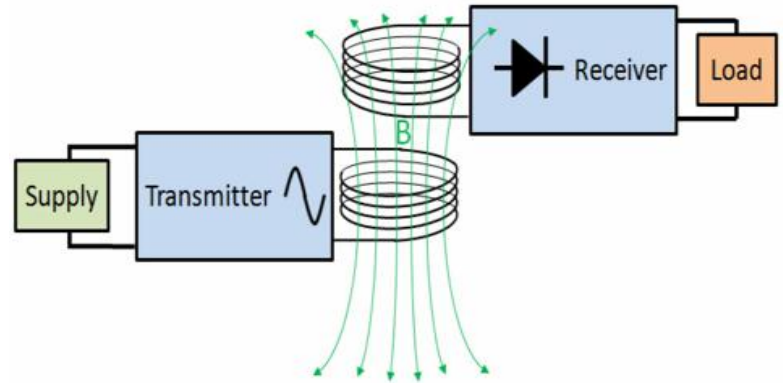


What is NFC Charging?



Adding Charging to NFC

- NFC Charging is an extension of the NFC data protocol that now allows devices using NFC to transfer **data and power**
- The NFC Charging specification (WLC) allows wireless power in-band communication and general secure NFC data transfer
- Originally supported <100mW power transfer from energy harvesting, but new standard supports up to 1W transmitted



May 2020: NFC
WLC is Ratified



What products currently use NFC Charging?



NFC Charging In Production



Samsung Galaxy Fit
Fitness Band
~170mW received



Huawei X Gentle Monster
Smart Glasses
~150mW received
106 kb/s



Microsoft Slim
Stylus/Pen
~50mW received
106 kb/s



Nov. 2020: MOU with
Universal Stylus Initiative



What challenges did NFC Charging solve for those products?



Form Factor

Thin, small, space-constrained designs, with metallic housings



Huawei case charging



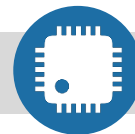
UX

Freedom of placement and convenient charging



GalaxyFit wired charging

GalaxyFit (NFC) wireless charging



Data Transfer

Bi-directional communication and system pairing



Microsoft Surface Pen





How does NFC Charging differ from Qi charging?



How does NFC Charging differ from Qi charging?



	Qi	NFC WLC
Overview	Established wireless power standard. New standards working groups in higher powers and functionality. Power transfer specification that featured in-band communications to provide charging data.	Industry standard data specification now including power transfer.
Frequency of Operation	100 - 200 kHz	13.56 MHz
Power Levels:	Up to 15W (received) for mobile devices	100mW - 1W (transmitted)
Data Rate	2 kb/s	Up to 106 kb/s
Coupling	Tight	Loose and tight coupling
Space constraints	Larger magnetics	Smaller magnetics: FPC/PCB for both Tx & Rx



What are the specified performance capabilities of NFC Charging? What are NuCurrent capabilities?



What are the specified performance capabilities of NFC Charging? What are NuCurrent capabilities?

- NFC Specified Transmitter Power Levels*
 - 250mW, 500mW, 750mW, 1000mW
- Current promoted received power**
 - ~250mW
- Current promoted data speed**
 - 106kbps

	Power Received	Data Speed
NFC Charging Standard	0.5 W	106 Kbps
NuCurrent Enabled	1 W	848 Kbps
NuCurrent Enabled	3 W	424 Kbps

*Source - NFC Forum Specification

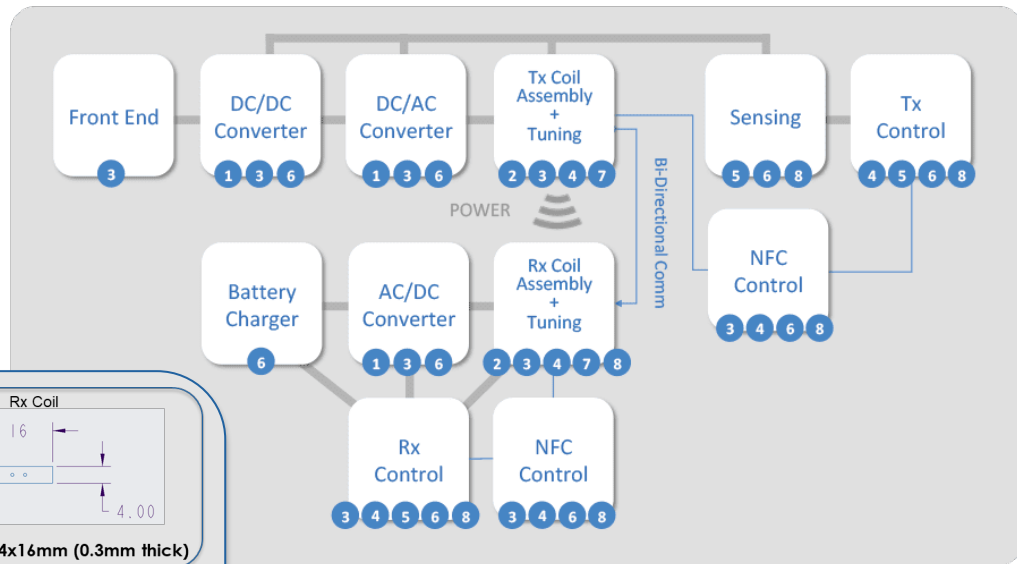
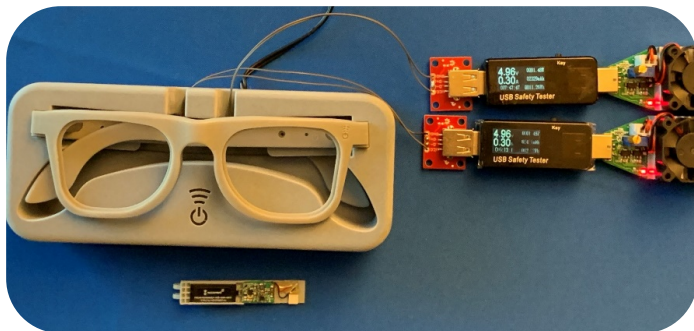
**Source - NXP



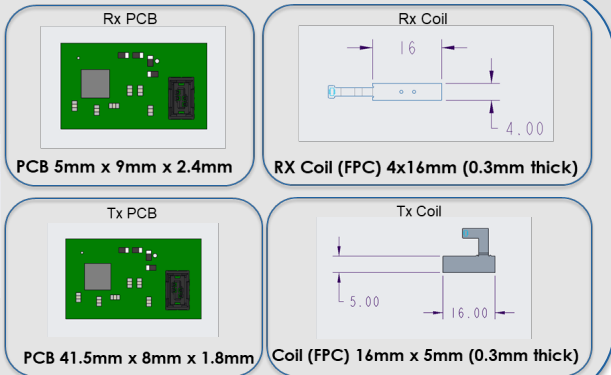
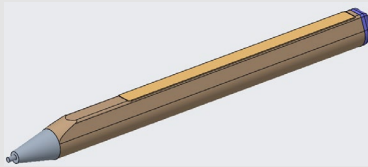
What does an NFC Charging system look like?



What does an NFC Charging system look like?



NuCurrent Stylus Demo: 390mW Rx



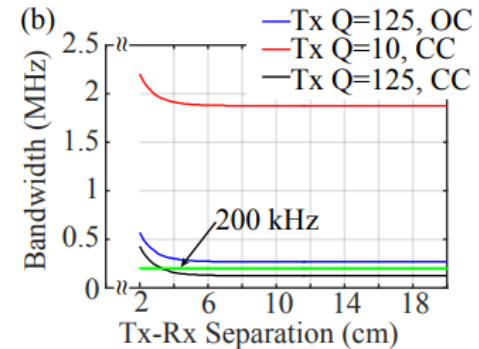
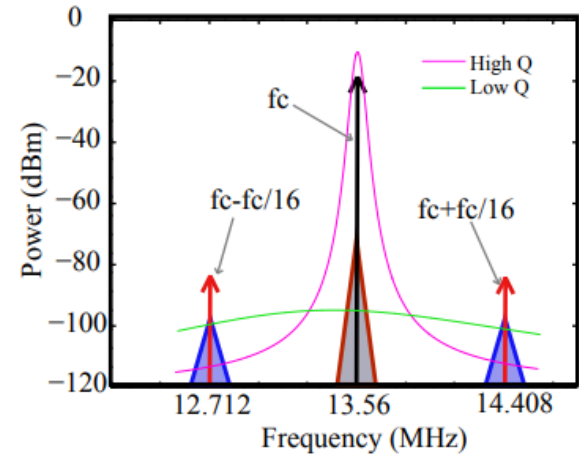
How do power and data work together in an NFC Charging system?



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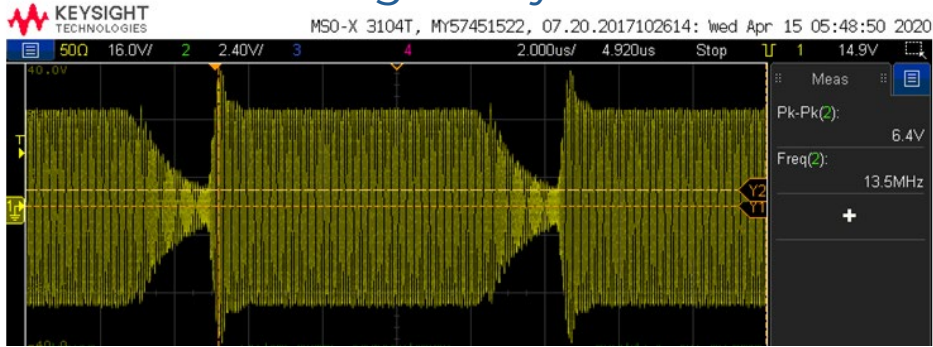
- High Q – Allows for low loss in power transfer applications
- Low Q – Prevents attenuation of side-band subcarriers
- NFC Charging – Finding the balance between power loss and data integrity
 - Works well for high k, needs additional help for lower k

M. Shahmohammadi, M. Chabalko and A. P. Sample, "High-Q, over-coupled tuning for near-field RFID systems," *2016 IEEE International Conference on RFID (RFID)*, Orlando, FL, 2016, pp. 1-8.

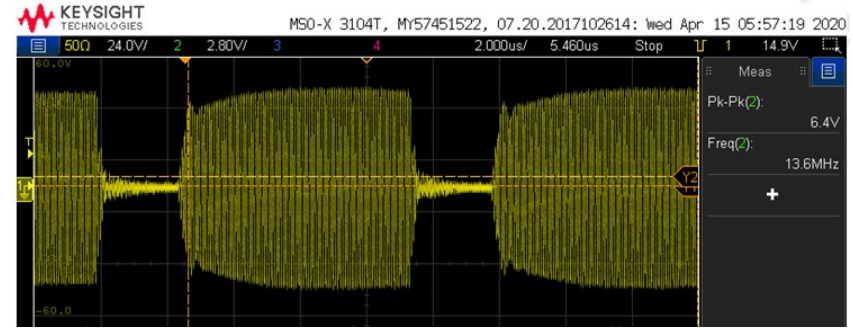


Low Q vs High Q systems in Time domain

High Q system



Low Q system



- Systems that are not optimized for data transfer, may perform as the High Q system shown above.
- However, efficient wireless power systems need High Q for efficient wireless power transfer
- NFC data only systems, typically add a resistive load in the receiver path to decrease the Q factor of the system, for WLC+ data application this solution is not viable

- High Q systems can also enhance overshoots caused by reflections of the overall system manifested as Ringing
- Ringing increases as the Quality factor increases since the circuit takes longer to “die away”



What does this mean for product developers?



What does this mean for product developers?

Technical Benefit

Optimized Power and Data

- Up to 3W received with up to 424kb/s in space constrained devices or 1W at 848kb/s

NFC + WiCo solution operating as UART (115.2k 8-N-1)

- No software protocols needed
- Removal of debug port and contacts
- Increase manufacturing test effectiveness

Product Benefit

Removal of Traditional Connectors

- Improved and differentiated industrial design
- Improved user experience for charging and transferring data
- Sealing devices for protection on foreign material and water ingress
- Lower 'Total Cost of Ownership'
 - Cheaper and faster systems
 - More robust testing
 - No more returns for failed



Questions?



What products will use NFC Charging in the future?



NFC Charging Applications

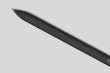
Current



Wrist Wearables



Smart Glasses



Stylus

Future



Consumer / Industrial Wearables



Hearables



Small Kitchen Appliances



NFC in High Power Applications



Benefits of NFC in High Power

Reliable and Secure

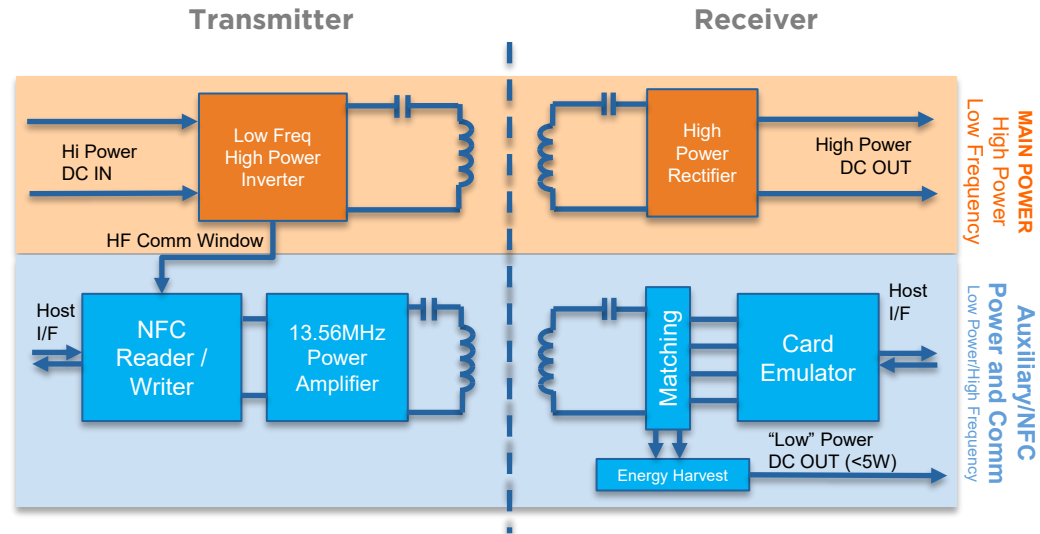
- Established, cost-effective technology
- Short range (No cross-connection concerns; intrinsically safe)

Both Power and Data Capable

- 3W of power can be wirelessly received while transmitting data
- Up to 848Kbs of data throughput
- Enables wake-up from extreme low power stand by

Standards Backed

- NFC Standard adopted power transfer in February 2020
- Adopted communication method by the Wireless Power Consortium for Ki Cordless Kitchen (2.3kW) and Medium Power applications



NFC in the Ki Cordless Kitchen



NFC in the Ki Cordless Kitchen

- Standards body: WPC
- Ki Cordless Kitchen: up to 2300 Watts
- TX: Kitchen Hob, Induction Cooktop or Under Counter Hob
- RX: Small kitchen appliances (Airfryers, Blenders, Rice Cookers, etc.)
- Use Case for NFC with High Power:
 - Enables auxiliary power and bi-directional data path
 - Provides advanced features via connectivity
 - Essential for interoperability and safety

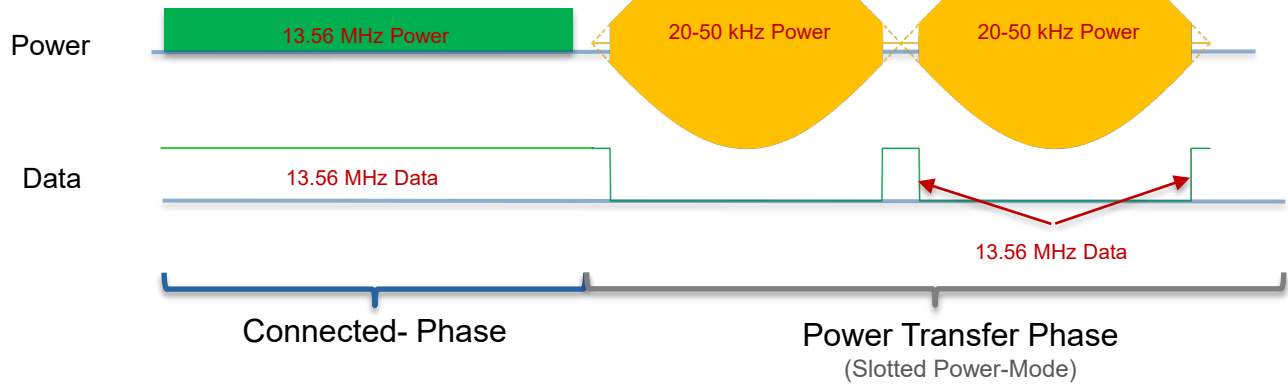


Slotted Communication & Auxiliary Power in Ki

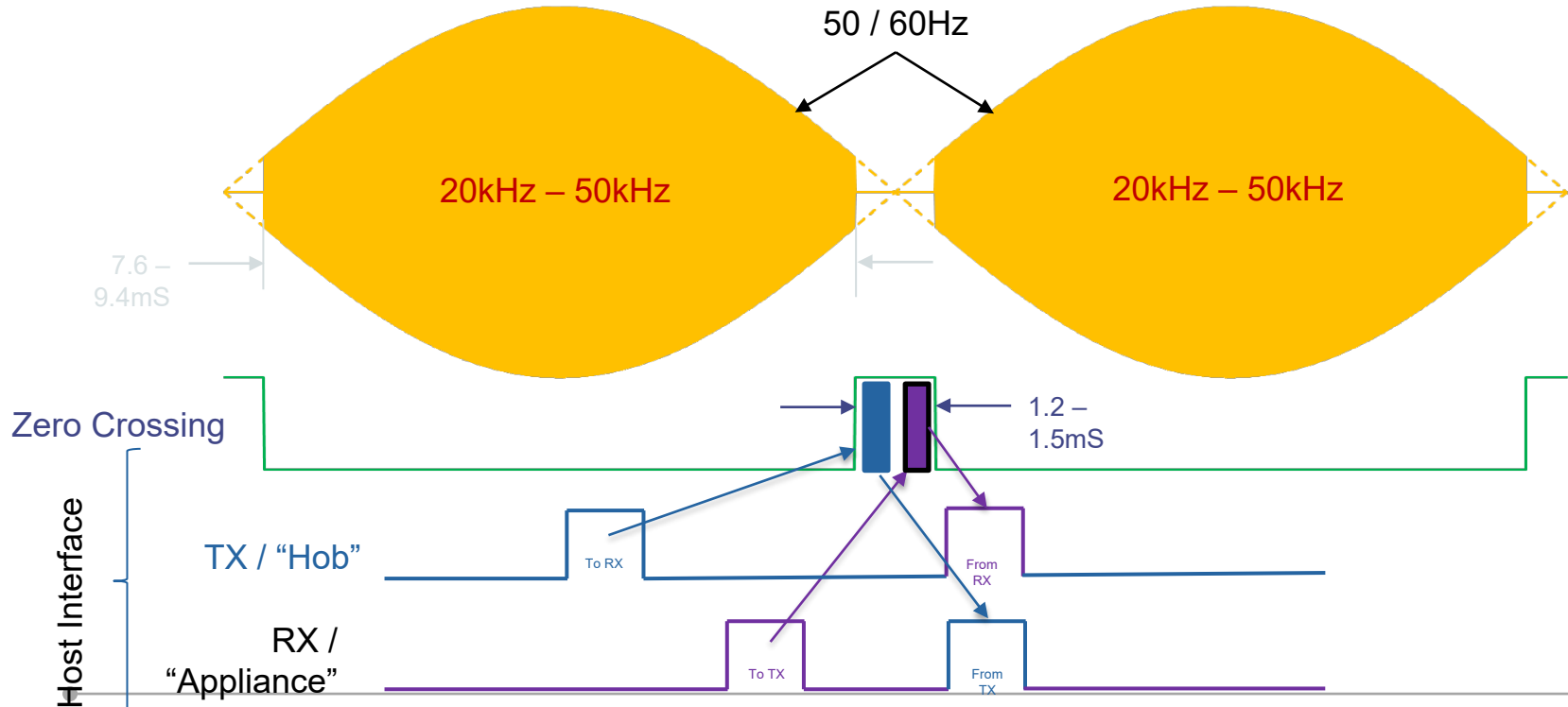


NFC Power and Data
High Frequency (NFC), Low Power & Data

High Power - Main
Low Frequency, High Power Only



Slotted Communication & Auxiliary Power in Ki



Benefits of NFC in the Ki Cordless Kitchen

Function	Benefits
Start-up/Initialization	<ul style="list-style-type: none">• Sufficient power (> 500mW) to establish proper placement and initiate appliance user interface• Quick Pairing without worry of cross talk• No power storage device required
Safety	<ul style="list-style-type: none">• Enhanced FOD• Product Authentication before high power transfer
Standardization	<ul style="list-style-type: none">• Ki and NFC allows for development of infrastructure
OEM added features	<ul style="list-style-type: none">• Add differentiation via bi-directional channel between Tx and Rx



Slotted Power Communication

NuCurrent's proprietary software and architecture for Slotted Power and Communication enables *real-time* NFC communication, taking advantage of the zero crossing in high power inductive systems.

In under 1.2 milliseconds, the Slotted Power system can complete both Tx and Rx data transfer enabling:

- Effective Power management
- Enhanced Foreign Object Detection
- Automatic Gain Control
- Authentication



Is NFC right for your product?



Is NFC right for your product?

- NFC may be right for your product if there is:
 - Low power requirement (<3W)
 - Power + data requirement
 - Unique form-factor
 - Space constraint



What should I do if I want to get started using NFC Charging?



Start Using NFC Charging

- Join NFC forum
- Consider products that currently have the technology
- **Engage the wireless power experts at NuCurrent**
 - NuEva platform for NFC charging, NuIQ for Hearables; NuIQ for Smartglasses; NuIQ for Wearables, and more

nu.eva

NFC CHARGING
DEVELOPMENT PLATFORM

nu.iq

AR AND SMARTGLASSES

nu.iq

HEARABLES

nu.iq

WRIST WEARABLES



Thank you!

To discuss a wireless charging solution, contact us.



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Final Questions?



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