



KISS CONNECTIVITY WHITE PAPER



INTRODUCTION

Unlike almost every other aspect of mobile and computer hardware design, the connector has remained undisrupted for decades. Product designers struggle with delicate metal connectors that put unsightly holes in otherwise beautiful products. And, the EMI, RFI, and ESD design issues with connectors have only gotten worse as communications speeds have increased over time.

Wireless communications eliminated many of those connector design issues but added new ones like cost, antenna design complexity, major power consumption and customer frustration with slow wireless networks, managing passwords, and pairing issues.

With Kiss Connectivity, a solid-state connectivity solution, Keyssa has reinvented the connector and designed a new category of contactless connectivity to solve the manufacturing and consumer challenges of today's wired and wireless-network options for connecting devices.

This White Paper documents Keyssa's Kiss Connectivity solution, explaining why it offers a dramatic improvement over current wired and wireless technologies, and how it enables OEMs to easily differentiate their product offerings.

ABOUT KISS CONNECTIVITY

Kiss Connectivity, Keyssa's tiny solid-state connectivity solution enables users to transmit huge amounts of data and video rapidly and securely between two devices that are in close proximity to one another. Just kiss and the devices connect automatically.

Kiss Connectivity uses Extremely High Frequency (EHF) signals to transmit information using standard protocols, like USB 3.0, DisplayPort, SATA or PCIe.

When built into tablets, laptops, smartphones or docks, this solution saves space and frees product designers to create sleeker yet rugged form factors currently constrained by today's large, delicate, mechanical connectors. It is easy for OEMs to design-in now with current products because Kiss Connectivity supports standard protocols and does not require software drivers. Kiss Connectivity unleashes industrial designers from the cost and design constraints of implementing wired and wireless connectivity in their devices.

KISS CONNECTIVITY VS. WIRED COMMUNICATIONS

Kiss Connectivity not only changes the design of connectors, it changes the way products are designed.

Additionally, wired communications have a number of limitations, including limited placement options, a relatively large footprint, low mechanical reliability, and poor signal integrity. Kiss Connectivity overcomes these limitations with a smaller physical footprint that can be embedded anywhere, with higher mechanical and electrical reliability.

Innovative Design Possibilities

The typical mechanical connector needed to move data from one device to another takes up significant space inside mobile and computing devices. These types of connectors also need to be placed at the outer edge of any device, in order to create a port or contact surface.

What sets Kiss Connectivity apart is the design innovation it enables by allowing product designers to embed a Keyssa connector inside their product, on any surface, and not just along the outer edges. By eliminating unsightly holes in otherwise beautiful products, Kiss Connectivity ushers in a new age in product innovation.

Size

Almost every part and component of mobile and computing devices has seen major innovation over the past decades, except for the metal connector.

Many of today's connector types are too large for modern mobile and computing devices, such as smartphones. With data usage increasing, it becomes a challenge to make mechanical connectors in an acceptable form factor and still maintain signal integrity. Connectors that can support higher data rates often require differential pins, more pairs of pins and more shielding, driving up their size.

Kiss Connectivity reinvents the connector by creating a tiny solid-state coffee bean-sized connector that can be embedded anywhere along the surface of a device. Kiss Connectivity is no longer visible as the connection is made by an Extremely High Frequency (EHF) signal over a very short distance.

Mechanical Reliability

Kiss Connectivity is a solid-state solution which eliminates the metal contacts which are prone to wear-and-tear from repeated consumers' physical connecting and disconnecting traditional connectors.

With Kiss Connectivity, no physical interconnection is required to transfer data, resulting in near-zero wear, near-zero potential for corrosion, and near-zero sensitivity to vibration. Unlike a metal connector with precise pin to pin alignment, Kiss Connectivity does not need to be perfectly aligned, or inserted carefully in order to make a connection.

Kiss Connectivity permits hermetic sealing of a device against humidity, moisture and electro-static discharge (ESD). It co-exists with all wireless power standards and will have configurations that integrate wired power. Combining Kiss Connectivity with wireless power solutions allows our customers to design a fully contactless system for data and power, and enables device manufacturers to design completely sealed devices.

Signal Integrity Issues

As the demand for higher data rates increases, mechanical connectors are often susceptible to signal integrity issues. Connector signal integrity increasingly has become a performance and reliability limiter. Connectors and cables add discontinuities in transmission paths which in turn introduce signal loss and reflections, causing increased jitter and puts an upper limit to data transfer speeds. With Kiss Connectivity, these signal integrity issues are mitigated by the contactless channel and the elimination of the mechanical connector.

Radio Frequency Interference

In an attempt to meet the ever-increasing market demand to move more data more quickly, some smartphone manufacturers have incorporated USB 3.0 in their products. However, this protocol is often disabled due to potential interference between the USB 3.0 and the 802.11 Wi-Fi standard. The USB 3.0 connector radiates within the 802.11 frequency band. As such, mobile devices are not often able to take advantage of the increased data rates offered by USB 3.0.

By replacing the metal USB connector with a contactless interface, Kiss Connectivity removes this potential interference while enabling full USB 3.0 protocol speeds to be achieved.

ESD Considerations

Due to the contactless nature of Kiss Connectivity, the connection has inherently high isolation properties and potential electrostatic discharge (ESD) issues are mitigated due to the elimination of exposed pins in metal connectors. In addition, Kiss Connectivity can be electrically isolated in plastic or other non-conductive materials to further mitigate ESD.

Cost Efficient

Metal connectors inherently have extra fabrication and manufacturing costs. For example, the physical limitations of placing connectors along the outer edges of a device requires machining chassis with tight tolerance for connector cutouts. The size of Kiss Connectivity's solid-state solution embeds the connector anywhere along a surface of a device, allowing for integration into even the most area- constrained devices. This means Kiss Connectivity can be integrated into products using cost efficient standard fabrication processes.

KISS CONNECTIVITY VS. WIRELESS COMMUNICATIONS

Wireless communications have many shortcomings, including limited data security, low data rates, unreliable connections, shared bandwidth amongst users, difficult setup, high power and potential high cost of transferring data over a wireless network. Kiss Connectivity addresses each of these shortcomings, by enabling a simple, private, secure, and high performance data connection between two devices. With Kiss Connectivity, users can bypass the cellular networks for high-speed, localized data transfers that can be up to 95% faster than wireless networks.

Secure Point-to-Point Data Connection

Typical wireless networks provide public, multi-point connections that are not necessarily the most secure.

Kiss Connectivity provides a private point-to-point connection. Due to the low radiated power and limited range of the transmission, the links are nearly impossible to tap. This ensures secure and reliable high-speed data transfers between a pair of devices in close proximity.

Ease of Use

Kiss Connectivity allows users to transfer data much more quickly and easily than wireless networks. Kiss Connectivity does not require any setup in order to perform a data transfer. Simply place the two devices together, and initiate the transfer of selected data. Kiss Connectivity, using the USB 3.0 protocol, can transfer a 1 GByte movie in 2 seconds.

Consistently High-Speed Data Rates

Typical wireless networks provide connections with inconsistent data transmission rates. The rate at which data is transferred across current Wi-Fi or WiGig networks is proportional to the number of users on the network and the environmental conditions of the network. The more users connected, the slower the network.

Kiss Connectivity provides a private point-to-point data transmission of up to 6 Gbit/s depending on the data transmission protocol implemented. This provides consistent high-speed data transfers between a pair of mated devices, regardless of the number of other devices present in a given area (such as airports, shopping malls). This is illustrated in [Table 1](#).

Table 1: Data Transfer Rates and Associated Power Consumption

Technology	Effective Data Rate (1)	Time to Transfer 1 GByte (2 users)	Time to Transfer 1 GByte (16 users)	Power Consumption
Keyssa	4 Gbit/s	2 s	2 s	50 mW
Desktop WiGig	2 Gbit/s	4 s	>64 s	2500 mW
Mobile WiGig	0.5 Gbit/s	16 s	>256 s	500 mW

Notes:

1. Effective data rate is measured using a USB 3.0 connection over the Keyssa connection. The raw data rate for USB 3.0 is 5 Gbit/s and the effective data rate is 4 Gbit/s after 8b/10b decoding.
2. For LTE and wireless see [Table 2 on page 6](#).

For example, the current WiGig technology theoretically scales with the number of channels up to 7 Gbit/s, but uses significant amounts of power relative to Kiss Connectivity in order to reach this

limit. In addition, approximately one-third of the aggregate WiGig data rate of 7 Gbit/s is dedicated to coding overhead. As such, the effective real-world data rate is a fraction of the theoretical rate. This issue is nearly eliminated with Kiss Connectivity and more of the data rate is available.

Kiss Connectivity scales linearly depending on the number of devices implemented. For example, using the USB 3.0 protocol, which has a 5 Gbit/s data rate, the following data rates can be achieved:

- 1 pair of connectors supports data rates up to 5 Gbit/s
- 2 pairs of connectors support data rates up to 10 Gbit/s
- 4 pairs of connectors support data rates up to 20 Gbit/s

Consistent Upload and Download Data Rates

In the current transfer protocols listed in [Table 2](#), there is often a dramatic difference between upload and download rates. For example, the effective transmission rate on Wi-Fi network for uploading data is 20 Mbit/s, and for downloading is 40 Mbit/s. With LTE cellular networks, the upload rate is approximately 5 Mbit/s, and 20 Mbit/s for downloading.

Kiss Connectivity's point-to-point data transmission rates are symmetric in either direction.

Power Reduction

Kiss Connectivity facilitates high-speed data transfers between devices. Since the overall data transmission time is dramatically reduced versus existing technologies, battery consumption is also reduced. Kiss Connectivity data transfers can occur nearly instantaneously while using a minimal amount of energy.

[Table 2](#) indicates the amount of time and associated battery power to transfer 1 GByte of data between two devices given various transmission protocols.

Table 2: Comparison of Mobile Connectivity Options

Technology	Transfer Medium	Time Required	Battery Usage
LTE	Wireless	1600 s	28%
WiFi	Wireless	400 s	3%
USB 2.0	Wired	32 s	1%
Kiss Connectivity using USB 3.0	Contactless	2 s	< 0.1%

Kiss Connectivity using USB 3.0 offers more than 50x improvement in power / performance over a typical wireless network.

Cost of Data Transfer

When traveling, international cellular data plans can be extremely expensive. Data plans in developing countries are not affordable for a lot of people. With Kiss Connectivity, users can use local data transfers between devices and avoid expensive costs related to cellular data transfers.

DIFFERENTIATION AND IMPLEMENTATION

Differentiation

It is a prerequisite in today's technology marketplace to innovate or get left behind.

The mobile and computing marketplace is particularly competitive as manufacturers race to differentiate their products with next-generation models. The challenge to innovate is increased by the fact that OEMs often use the same processor, screen, operating system and graphics as their competitors.

Differentiation in product design and consumer experience is a key driver for success, especially as low-end and mid-range devices start to function and feel like high-end products. Consumer demands for sleek industrial designs, as well as for creating and consuming media on all of their devices, have raised the stakes for every OEM.

Kiss Connectivity can give OEMs a competitive edge in today's crowded marketplace.

Implementation

Kiss Connectivity is easy for OEMs to design-in now with their current products.

- It is protocol agnostic and supports standard protocols like USB 3.0, DisplayPort, SATA, PCIe.
- Requires no programming overhead or software drivers.
- Co-exists with all wireless power standards and will have configurations that integrate wired power.
- New products with Kiss Connectivity will co-exist and transfer data with legacy devices through accessories.
- It is cost-effective in comparison to other connectors and systems that transfer high-speed data.

POTENTIAL APPLICATIONS

Kiss Connectivity can be implemented in a wide variety of ways to enhance the performance and user experience of mobile and computing devices. Kiss Connectivity has unlimited uses and here are four examples of potential product categories:

- Mobile Device to Mobile Device
- Mobile Device to Docking Station
- Mobile Device to Kiosk
- Mobile Device to 4K Display

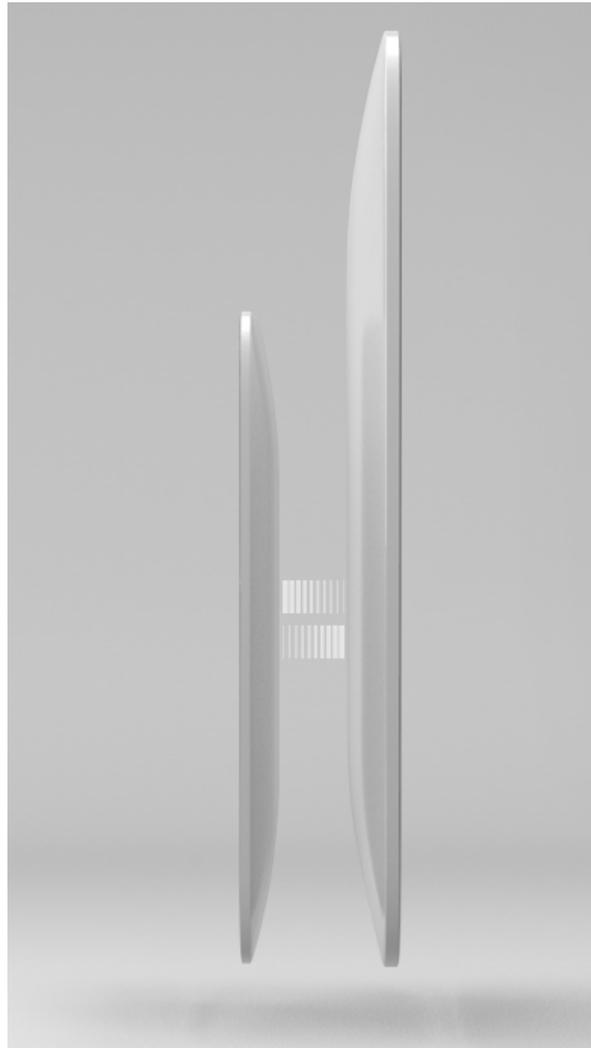
Mobile Device to Mobile Device

In the last few years, mobile devices have become mobile computing centers, helping us to manage everything in our daily lives such as business and personal communications, entertainment, banking and appointments. Kiss Connectivity allows for the quick and easy transfer of information between mobile devices, including movies, photos, music, sales presentations, and more.

The Kiss Connectivity solution has significant benefits for personal storage and data movement between devices such as smartphones, tablets, laptops. The increasing bandwidth requirements of the typical user have rendered existing data transfer mechanisms inadequate, and there is a need to be able to transfer data quickly and easily.

For example, video, audio, or other data can be transmitted between two cellular phones by simply holding the phones back-to-back against one another (as illustrated below). With Kiss Connectivity using USB 3.0 even an entire movie can be transmitted in just a few seconds. This method allows almost instantaneous transfer of data with little battery usage.

Mobile to Mobile with Kiss Connectivity



Mobile Device to Docking Station and Peripherals

A mobile device with Kiss Connectivity can connect to a docking station enabled with Kiss Connectivity. That docking station can connect the mobile device to a wide range of legacy peripherals like monitors, storage devices, keyboard and mouse via data transfer protocols such as USB, DisplayPort, and Ethernet. Transfers are made between the mobile device and the docking station, and then routed to the appropriate peripheral.

Currently the most common way to connect a tablet computer to a keyboard is through a metal connector or wireless connection. Both of these transfer methods have limitations, namely form factor and data rate. Kiss Connectivity allows data to be transferred between these devices without the need for any type of metal or wireless connection. The data transfer can be accomplished by simply placing the devices in close proximity to one another.

Tablet to Keyboard with Kiss Connectivity



Mobile Device to Kiosk

Kiosks have become increasingly popular in places such as airports and shopping malls as a way for users to purchase movies or music. One potential barrier to the revenue stream for these systems is the amount of time it takes to transfer the data.

For example, it can take from 2 to 90 minutes to copy a 4 GByte movie to a smartphone using commonly available interfaces such as USB 2.0 or Wi-Fi. The higher speed USB 3.0 is often not available on mobile devices because it actually interferes with the signal to transfer data. In comparison, Kiss Connectivity does support USB 3.0 and can transfer the same 4 GByte movie in just 8 seconds. This allows even the busiest air traveler to quickly download a movie to their smartphone, tablet, or laptop to watch on the plane.

Kiosk with Kiss Connectivity



Mobile Device to 4K Display

Mobile and computing devices are getting lighter and thinner, and at the same time displays are becoming increasingly larger and with higher resolution. The best of both worlds is a mobile device which can quickly and automatically connect to larger 4K displays. Kiss Connectivity lets OEMs seamlessly and instantaneously connect their mobile devices to the newest high resolution 4K displays. The consumer experience is both simple and beautiful without unsightly metal connectors and the repetitive plugging / unplugging that leads to breakage. Kiss Connectivity enables new user experiences that are not only trouble-free but also have a modern clean look.

Mobile Device to 4K Display with Kiss Connectivity



CONCLUSION

Year over year, we have witnessed an increase in the number and variety of personal and professional mobile and computing devices on the market.

Additionally, the differences between devices have become blurred, with laptops transforming into tablets and tablets transforming into laptops. Tablets become phones and smartphones become computers. Smartphones become cameras. Tablets become televisions. Laptops become big data crunchers. External drives become safety deposit boxes.

We carry these devices everywhere, and in fact, they have become an extension of ourselves. They are workhorses, entertainers and connect us to one another. We stuff them with content, from personal and professional data and media. That content gets scattered in the cloud, trapped in our devices, and out of sync among our devices. The need to easily connect and transfer data between these devices has greatly increased over time, as has user requirements for faster and more secure data transfers.

With Kiss Connectivity, product designers and customers are now freed from the frustrations of wired and wireless communications.

Kiss Connectivity is an elegant, power-efficient solution that can meet the people's desire for faster and more secure ways to transfer data and video.

ABOUT KEYSSA

Founded in 2009, Keyssa, Inc. developed its breakthrough Kiss Connectivity solution, based on a proprietary solid-state connector that uses Extremely High Frequency (EHF) to provide low-power, high-speed data transfer – securely and simply. With over 100 patent filings, Keyssa has reinvented the connector. Managed by an experienced team of multidisciplinary technologists and standards experts with significant operating experience, Keyssa is backed by investors including Alsop Louie, Dolby Family Ventures, Intel Capital, Nantworks and Samsung Strategy and Innovation Center.

REVISION HISTORY

Rev. #	Date	Changes
01	12/23/2014	Initial release

Disclaimer

Electrical parameters, pin descriptions, and functionality of connector features and exact values shown in diagrams are subject to change. Additional content, clarifications and corrections may be required in future revisions of this document.

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