



## **Inside MIPI RFFE v2.1: Enabling the 5G transformation**

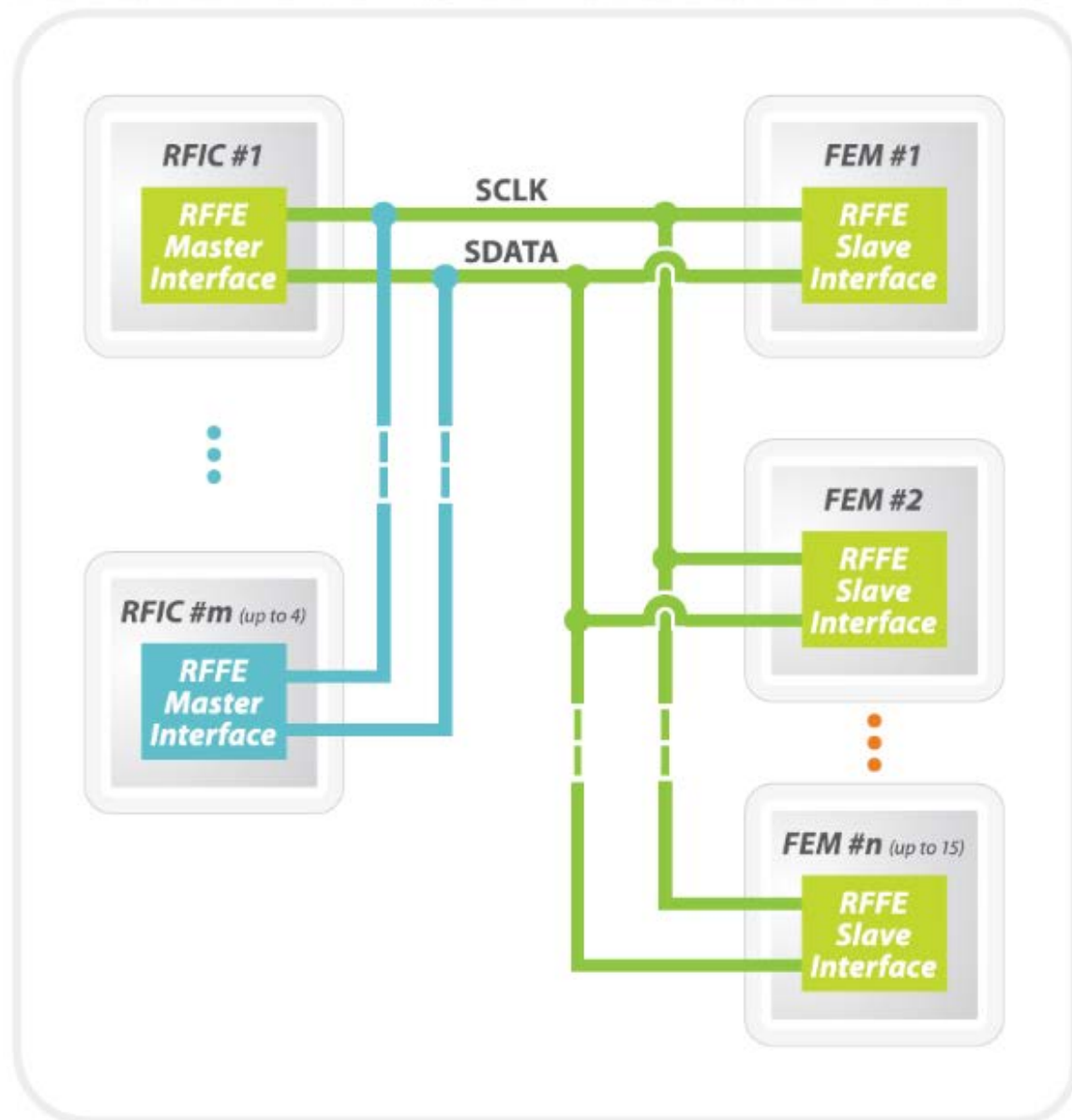
Jim Ross & Victor Wilkerson -April 30, 2018

MIPI RFFE v2.0 was originally released in December 2014. The new features in v2.1 reflect how both mobile technology and the marketplace have changed over the past several years. Just as important, the new features also anticipate how system designers' needs will evolve over the next few years as 5G evolves from the drawing board to commercial mainstream.

One example is the new master context transfer (MCT) RFFE command sequence, where one of the masters on a multi-master RFFE bus shuttles larger amounts of information from one master to another. This feature enables quick hops between radio technologies, which may be controlled via different radio chains.

The multi-master feature was introduced in RFFE v2.0, but the addition of MCT command sequences in RFFE v2.1 provides a means for more efficient master-to-master transfer when larger amounts of data are involved.

Multiple applications may benefit from multi-master functionality in RFFE, such as the monitoring of alternate bands, carrier aggregation applications, and others. A high-level view of an RFFE multi-master system configuration is illustrated in Figure 2 below.

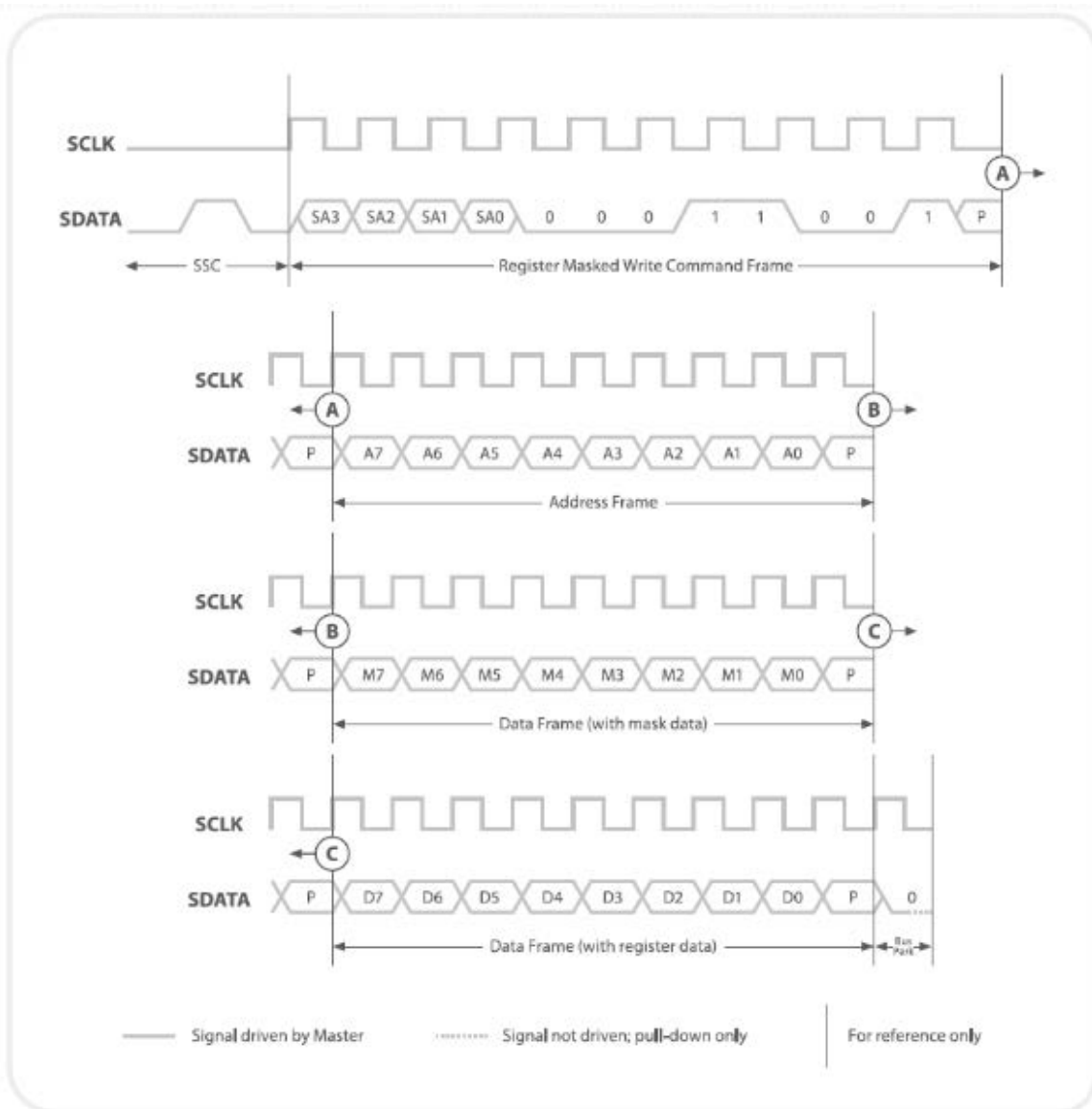


**Figure 2** A multi-master configuration

The MIPI RFFE v2.1 specification provides another additional capability called extended triggers. In essence this adds an additional number of assignable triggers to those already available in prior versions. Triggers are used to synchronize changes in register settings within a device. They may also be used to synchronize such events across multiple devices on the same RFFE bus instance. In RFFE v2.1, the total number of triggers was increased to eleven, from the three that were defined in previous versions.

Another new capability in MIPI RFFE v2.1 is the masked write command sequence, which enables a transceiver's software to control individual aspects of programmable content in a front-end device. This feature reflects the increasing hardware complexity by giving software developers more flexibility in how they apply configuration changes.

For example, if the software is multi threaded, the masked write command sequence allows changes that may be in one thread without affecting register data that may be controlled by other threads in the same register. This operation accomplishes in a single command sequence what previously required a read-modify-write set of operations requiring several RFFE command sequences. The RFFE masked write command sequence is depicted in Figure 3.



**Figure 3** The RFFE masked write command sequence

MIPI RFFE v2.1 also extends trace lengths of RFFE buses, up to 45 cm from the standard 15 cm. This enhancement reflects how cellular, Wi-Fi, and other wireless technologies are increasingly used in more than just handheld devices such as smartphones. A longer bus gives system designers more flexibility for devices such as laptops, where the antenna might be up in a corner of the lid and the transceiver may be underneath the keyboard, for example.

Longer trace lengths also are useful for large handheld devices, such as phablets, that have two antennas widely spaced to avoid detuning problems due to the user's head or hand. This benefit also is an example of how MIPI RFFE v2.1 helps system designers ensure that their devices provide market-differentiating reliability and performance with voice and data.

### **MIPI RFFE v3.0**

The MIPI RFFE specification v2.1 was just released, and will be used for initial 5G deployments. At the same time, work within the MIPI RFFE Working Group has already begun on many of the details for features planned to be in the next release -- RFFE v3.0.

As the requirements for 5G RF front-ends continue to evolve, the RFFE WG is incorporating in RFFE v3.0 many new features focused on those needs, particularly for devices that will operate in the traditional sub-6 GHz bands, where many of the earlier deployments are expected to be concentrated. MIPI RFFE v3.0 will also seek to improve the throughput and latency capabilities inherently available to help ensure that devices utilizing RFFE can provide the high-performance RF capabilities at the core of features that consumers and businesses need and want.

Find more information about MIPI RFFE v2.1 [here](#).

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