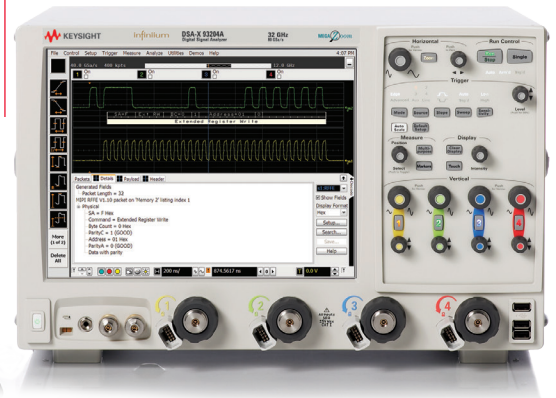
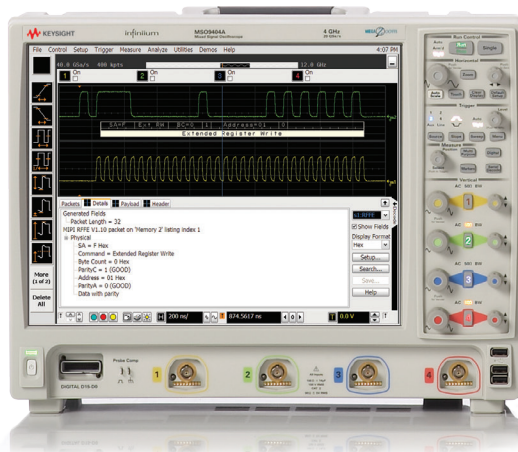


# Keysight Technologies

## MIPI RF Front-End Control Interface (RFFE) Protocol Triggering and Decode For Infiniium Oscilloscopes

Data Sheet



## MIPI RFFE

The MIPI Alliance Specification for RF Front-End Control Interface (RFFE) was developed to offer a common and widespread method for controlling RF front-end devices. Since this protocol transfers bits serially, using a traditional oscilloscope has limitations. Manually converting captured 1's and 0's to protocol requires significant effort, cannot be done in real-time, and includes potential for human error. In addition, traditional scope triggers are not sufficient for specifying protocol-level conditions.

Extend your oscilloscope capability with the Keysight Technologies, Inc. MIPI RFFE (M-PHY) triggering and decode application. This application makes it easy to debug and test designs that include MIPI RFFE buses using your Infiniium Series oscilloscope.

- Set up your oscilloscope to show MIPI RFFE protocol decode in less than 30 seconds.
- Get access to a rich set of integrated protocol-level triggers.
- Save time and eliminate errors by viewing packets at the protocol level.
- Use time-correlated views to quickly troubleshoot serial protocol problems back to their timing or signal integrity root cause.

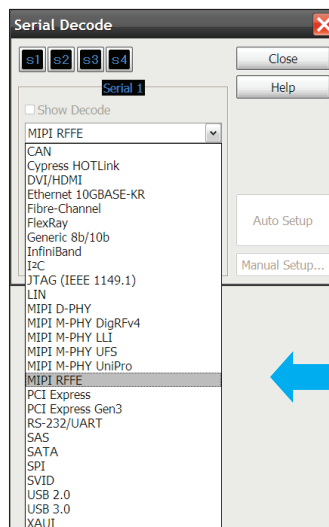
The following are MIPI RFFE protocol decode features the application will support.

- Supports the MIPI RFFE specification v1.10 decode and trigger
- Decodes traffic between multiple masters and slaves
- Parity check on traffic to ensure data accuracy
- Supports search capability for various frames, sequences and errors



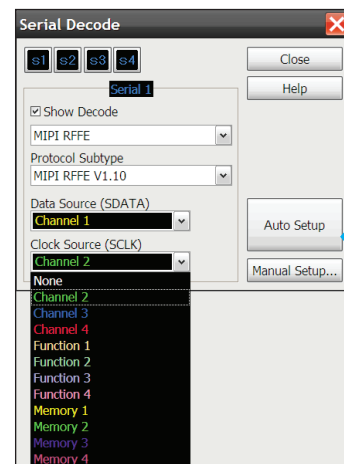
### Easy to find

Turn decode on/off via the “Serial Decode” button or in the “Setup” menu of 9000A and 9000 H-Series oscilloscopes. View decode embedded on the waveform display or in the protocol viewer listing window. (See pages 4-5.)



### Support for live and saved waveforms

Perform and view decode information on both live and saved waveforms. Decode up to any combination of four live or saved waveforms.



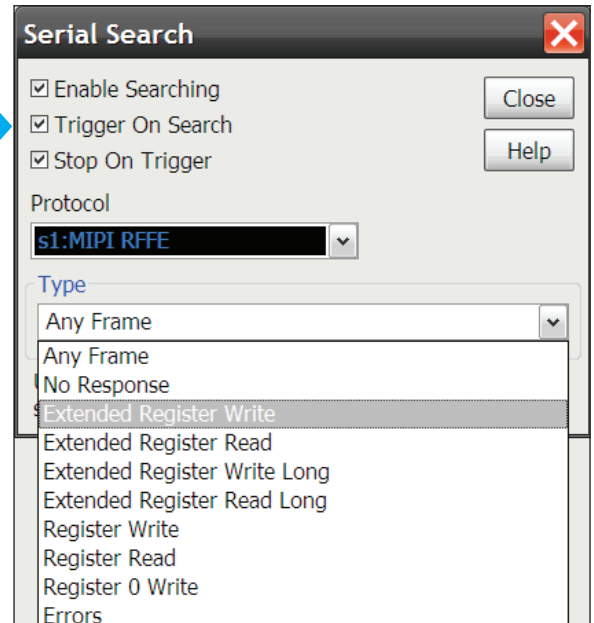
### 30-Second MIPI Setup

Configure your oscilloscope to display protocol decode in less than 30 seconds. Use “Auto Setup” to automatically configure sample rate, memory depth, threshold and trigger levels.

## MIPI RFFE setup, protocol triggering, and search capabilities

Get access to a rich set of integrated protocol-level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to MIPI RFFE. When serial triggering is selected, the application uses software-based triggering.

With software-based protocol triggering, the oscilloscope takes signals acquired using either an oscilloscope or digital channels and reconstructs protocol frames after each acquisition. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.



### MIPI trigger and search setup

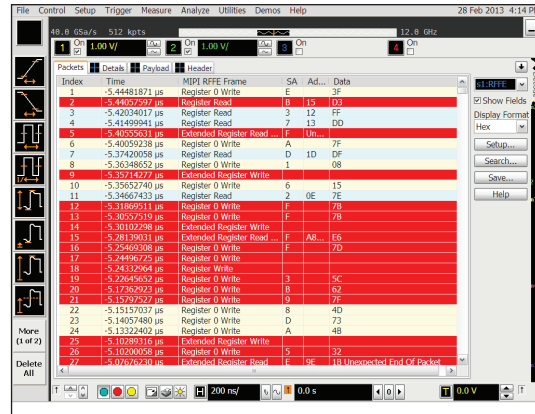
Quickly access the software-based trigger via the trigger or search menus. Software-based triggering enables quick setup of data, remote, or error frames.

## MIPI RFFE protocol decode

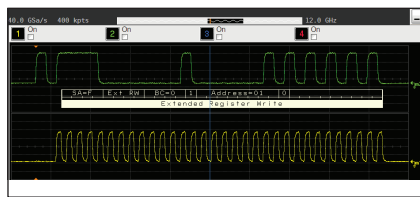
Get access to a rich set of integrated protocol-level triggers. The application includes a suite of configurable protocol-level trigger conditions specific to MIPI RFFE. When serial triggering is selected, the application uses software-based triggering. With software-based protocol triggering, the oscilloscope takes signals acquired using oscilloscope channels and reconstructs protocol frames after each acquisition. It then inspects these protocol frames against specified protocol-level trigger conditions and triggers when the condition is met.



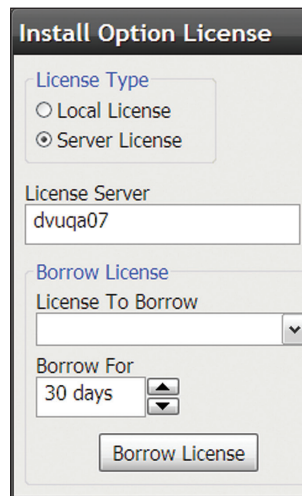
Quickly move between physical and MIPI RFFE protocol layer information using the time-correlated tracing marker. Display protocol content using embedded decode in the waveform area, or see protocol events in a compact listing format. Minor tick marks indicate clock transitions. Major tick marks indicate segments of the serial packet MIPI RFFE measurements and are automatically time-correlated with measurements on other oscilloscope channels.



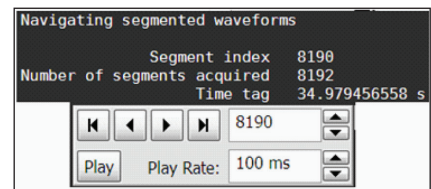
Compact protocol using the full screen listing. The protocol viewer window shows the index number, time stamp value identifier, packet type, and data values for each MIPI RFFE packet. Data in the listing window can be saved to a .csv or .txt file for offline viewing.



MIPI RFFE decode embedded in waveform area. Utilize the oscilloscope waveform area to display decode information. Minor ticks indicate clock transitions and major ticks show segments in each MIPI RFFE packet.



Using multiple scopes? Server-based licensing allows users to borrow an application for a specified period of time.

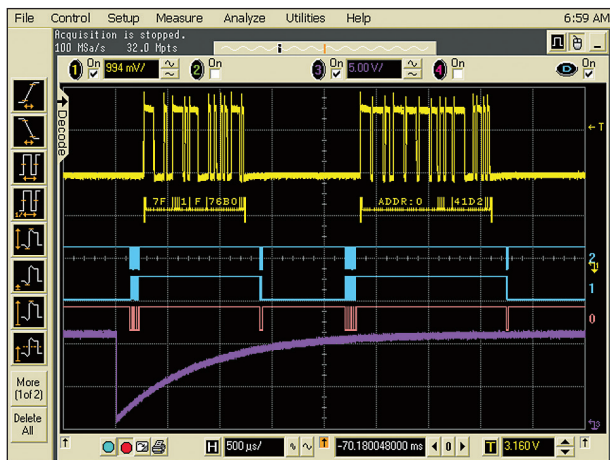


Long time captures using segmented memory. In this example, MIPI RFFE traffic was captured for almost 35 seconds. Segmented memory uses time tags to track time between segment acquisitions.

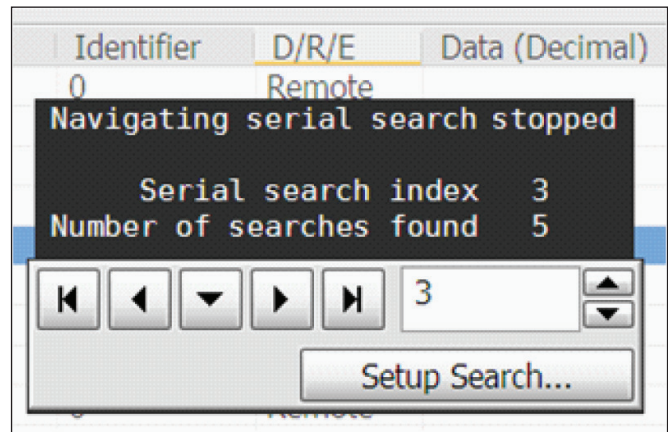
## MIPI RFFE protocol decode



**Time correlation with other system activity**  
Protocol measurements are automatically time-correlated with measurements taken on other analog or digital (on MSO models) channels.



**Precise MSO triggering and display**  
Mixed-signal oscilloscope measurement in a mobile system using both digital and analog acquisition channels.



**Post-acquisition searching**  
Search acquired protocol listings using a menu that is identical to the trigger menu. Quickly move to next occurrence of a specified event.

## MIPI RFFE application specifications and characteristics

<b>MIPI</b>	
MIPI sources	Analog channels 1, 2, 3, or 4 Any math functions and waveform memories The application relies on probing and trigger/measurement thresholds to properly condition the signal for triggering and decode. Differential probing may be required.
Data rate	Up to 26 MHz
Protocol type	RFFE v1.10
Auto setup	Automatically configures oscilloscope settings for proper MIPI RFFE decode and software-based protocol search including memory depth, edge triggering, holdoff, sample rate, and measurement thresholds
Decoded fields	All including extended frame format
Triggering (software-based)	Any frame Extended register read Extended register write Extended register read long Extended register write long Register write Register read Register 0 write Error

## Recommended oscilloscopes

The RFFE protocol decoder is compatible with Keysight Infiniium Series oscilloscopes with operating software revision 4.30 or higher. For oscilloscopes with earlier revisions, free upgrade software is available here: [www.keysight.com/find/scope-apps-sw](http://www.keysight.com/find/scope-apps-sw).

Data rate	Minimum bandwidth	Minimum channels	Compatible oscilloscopes
26 MHz	200 MHz	2	Infiniium 9000, S-Series, 90000 and Z-Series

## Ordering information

To purchase the RFFE protocol decoder with a new or existing Infiniium Series oscilloscope, order the following options.

### Software options

Application	License type		Infiniium Z-Series	Infiniium S-Series	Infiniium 90000 Series	Infiniium 9000 Series
RFFE protocol decoder	Fixed	Factory-installed	N8824A-1FP	N8824B-1FP	Option 075	Option 075
		User-installed	N8824A-1FP	N8824B-1FP	N8824A-1NL	N8824B-1NL
	Floating	Transportable	N8824A-1TP	N8824B-1TP	N8824A-1TP <sup>1,2</sup>	N8824B-1TP <sup>1,2</sup>
		Server-based	N5435A-072	N5435A-072	N5435A-072	N5435A-072
Serial data analysis with clock recovery (included in DSA model)	Fixed	Factory-installed	E2688A-1FP	N5384A-1FP	Option 003	Option 003
		User-installed	E2688A-1FP	N5384A-1FP	E2688A-1NL	N5384A-1NL
	Floating	Transportable	E2688A-1TP	N5384A-1TP	E2688A-1TP <sup>1,2</sup>	N5384A-1TP <sup>1,2</sup>
		Server-based	N5435A-003	N5435A-003	N5435A-003	N5435A-003

1. Requires software 5.00 and above.

2. Software 4.30 or above requires Windows 7. N2753A Infiniium Windows XP to 7 OS upgrade kit (oscilloscope already has M890 motherboard). N2754A Infiniium Windows XP to 7 OS and M890 motherboard upgrade kit (oscilloscope without M890 motherboard). Verify the M890 motherboard using the procedure found in the Windows 7 upgrade kit data sheet with the publication number 5990-8569EN.

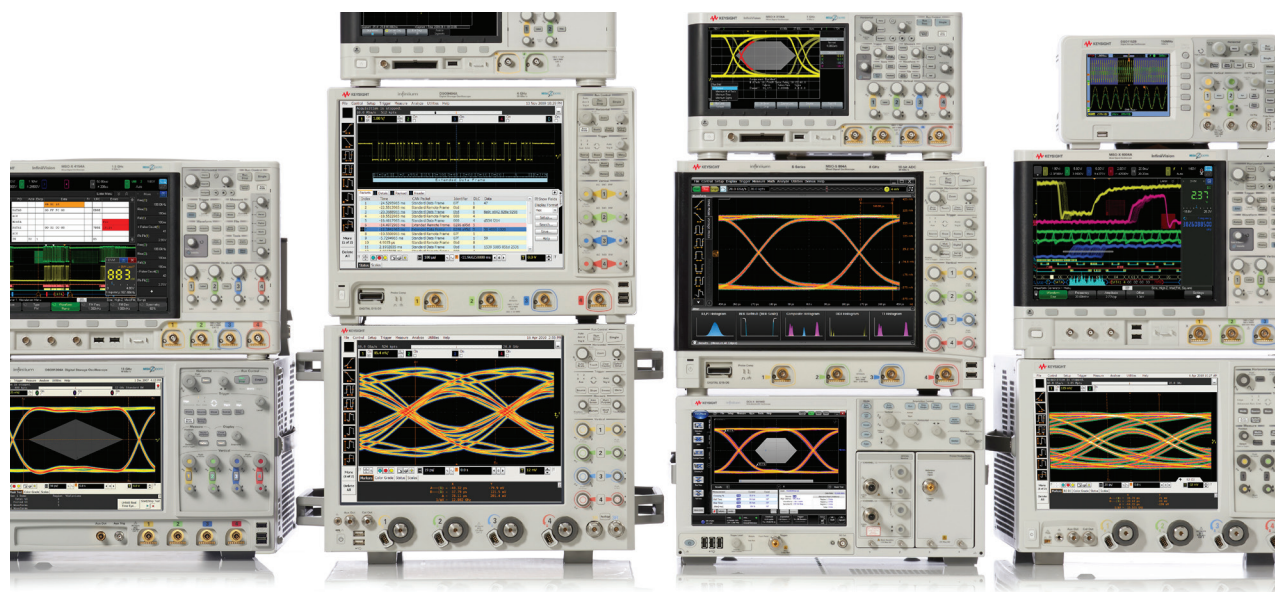
## Other hardware, probes, and accessories

Model number	Description	Quantity
1169A	InfiniiMax II 12-GHz differential probe amplifier	2
N5380B	InfiniiMax II SMA probe adapter	2
E2669A	Differential probe connectivity kit (contains needed probe heads)	1



## Related literature

Publication title	Publication type	Publication number
<i>Infiniium 9000 Series Oscilloscopes</i>	Data sheet	5990-3746EN
<i>Infiniium 9000 H-Series Oscilloscopes</i>	Data sheet	5991-1520EN
<i>Infiniium 90000 X-Series Oscilloscopes</i>	Data sheet	5990-5271EN
<i>Infiniium 90000 Series Oscilloscopes</i>	Data sheet	5989-7819EN
<i>Infiniium S-Series Oscilloscopes</i>	Data sheet	5991-3904EN
<i>Infiniium Z-Series Oscilloscopes</i>	Data sheet	5991-3868EN



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