

# RANGE TO FAULT (RTF)

## PIM & Return Loss Measurement



Range to Fault (RTF) Module

Range To Fault (RTF) is an exciting new technology from Kaelus that enables operators to accurately measure the location of PIM and Return Loss faults in their RF infrastructure. Reflection data together with PIM data provides an unmatched level of clarity for identifying the location of faults in the RF path.

The RTF system consists of an RTF Module, interconnecting cables and a “RTF Enabled” iQA series PIM test instrument. Customers can purchase a new “RTF Enabled” PIM test analyzer from Kaelus or upgrade their existing A or B-series iQA test equipment to support RTF measurements. Please contact your local Kaelus representative for additional information.

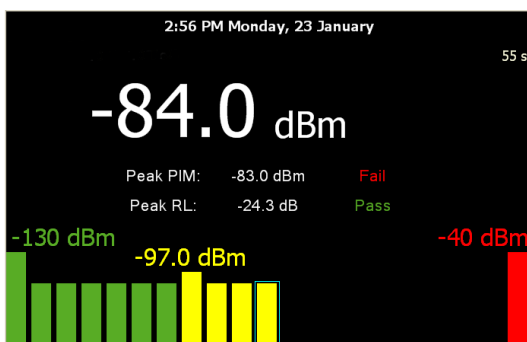


## PRODUCT FEATURES

- Accurately identify the location of PIM and Return Loss faults in the RF path
- Overlay PIM and Return Loss vs. distance data for enhanced troubleshooting capability
- Compatible with any “RTF Enabled” iQA series PIM test instrument from Kaelus
- Factory upgrades available for existing A and B-series iQA test instruments
- Simple to operate, highly intuitive touch screen user interface
- Quickly switch between different test modes without disconnecting the line under test
- Speeds site repairs by guiding operators to the location of PIM faults
- Before PIM testing, the RTF Module performs a Return Loss safety check to warn the operator before transmitting high RF power into a poor match



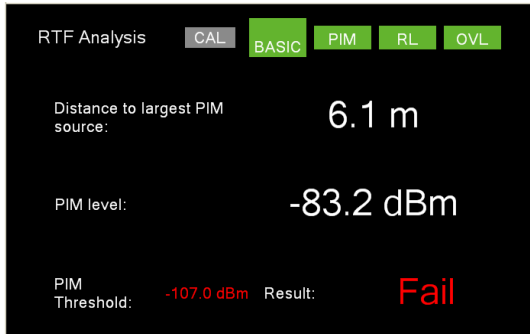
## RETURN LOSS |



## PEAK RETURN LOSS

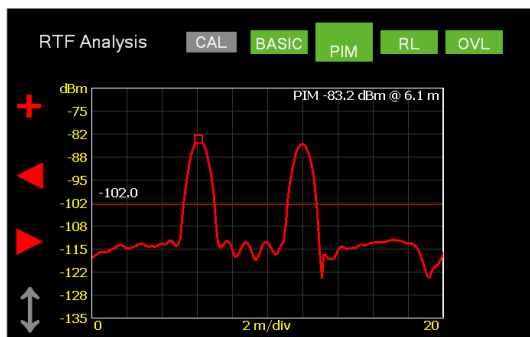
When the RTF module is attached a low power Return Loss vs. distance measurement will be made prior to activating the high power PIM test tones. If the peak calculated Return Loss is greater than a user specified value a warning will be presented to the operator along with the distance to the failing location. The operator has the option at this point to either abort the test or continue with the PIM measurement. This safety feature has been added to help prevent accidental high power RF transmissions while the feed system is open for repairs.

## RTF ANALYSIS |



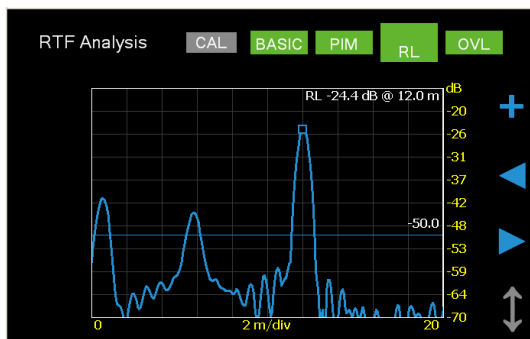
### DISTANCE TO LARGEST PIM SOURCE

With an RTF Module attached the iQA user software provides four different views the operator can use to analyze PIM faults at the cell site. The “Basic” view clearly identifies the distance and magnitude of the largest static PIM fault on the line. For fastest results, Kaelus recommends methodically eliminating the largest PIM fault and repeating until all static PIM sources have been removed. Once the static PIM sources are removed, the operator can proceed to dynamic PIM testing to certify that the PIM performance is stable and robust.



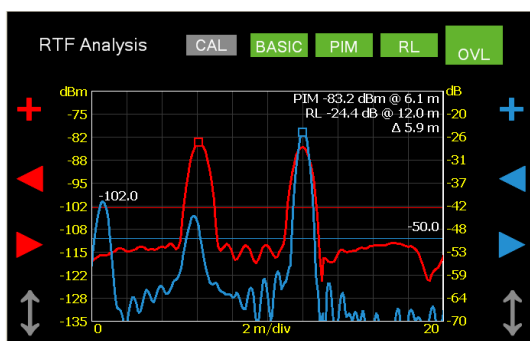
### PIM VS. DISTANCE

With a single button push, the operator can switch to “PIM” view to see the relative magnitude of all PIM sources on the line. A marker function is provided allowing the user to jump from peak to peak displaying the magnitude and distance to each PIM fault. Kaelus’ RTF solution utilizes proprietary enhanced resolution algorithms that enable the user to resolve closely spaced PIM faults that a standard FFT analysis can not see.



### RETURN LOSS VS. DISTANCE

With a second button push, the operator can switch to “RL” view to see Return Loss vs. distance. As with the PIM view, a marker function is provided to display the magnitude and distance of each Return Loss peak.



### PIM & RETURN LOSS OVERLAY

“OVL” view overlays Return Loss vs. distance and PIM vs. distance on a single screen. The user can independently set markers for both PIM peaks and Return Loss peaks and measure the relative distance between faults. Electrically long devices such as filters or TMAs, and changes in velocity factor caused by jumper cables vs. feeders can reduce the absolute accuracy of individual distance calculations. Since these errors impact both the PIM and Return Loss calculations equally, the relative distance between faults is typically more accurate than the individual distance calculations. Using the relative distance of a PIM problem to a known Return Loss peak allows users to locate faults on the line with more precision than with PIM vs. distance alone.

## TECHNICAL SPECIFICATIONS |

|                             |                                                                                                                                  |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| RTF analysis modes          | Numeric: Distance to maximum PIM + PIM Magnitude<br>Graphical: PIM vs. Distance, Return Loss vs. Distance, PIM + RL vs. Distance |
| Return Loss                 | Max Return Loss (from FFT analysis) is displayed on the iQA main PIM test screen when the RTF module is attached                 |
| Residual PIM                | < -115dBm/-158dBc max (<-125dBm/-168dBc typ) @2x +43dBm test tones                                                               |
| User interface ports        | 1x USB, 1x Auxiliary port (Type N female)<br>1x RF output (7-16 DIN female), 1x RF input (7-16 DIN male)                         |
| Power                       | +12V DC supplied via iQA auxiliary port                                                                                          |
| RF power (PIM)              | 2x +43dBm supplied by iQA                                                                                                        |
| RF power (Return Loss)      | -33dBm supplied by RTF module                                                                                                    |
| Dimensions                  | 5.0 x 3.5 x 2.9in (127 x 90 x 73mm)                                                                                              |
| Weight                      | 2.2lbs (1.0kg)                                                                                                                   |
| Operating temperature range | -10°C to +40°C                                                                                                                   |
| Storage temperature range   | -20°C to +60°C                                                                                                                   |
| Ingress protection (IP)     | IP50 (operating)                                                                                                                 |
| Relative humidity           | 5% to 95% RH non-condensing                                                                                                      |

## ORDERING INFORMATION |

### RTF MODULE

| MODEL     | DESCRIPTION                  | IQA MODELS SUPPORTED      |
|-----------|------------------------------|---------------------------|
| RTF-1000A | RTF Module , 698-960 MHz     | 700L, 700H, 850, 900, 901 |
| RTF-2000A | RTF Module , 1710 - 2170 MHz | 1800, 1900, 1921, 2101    |

- USB cable, Auxiliary port cable and carrying case included with RTF Module.
- A and B-series iQA PIM analyzers require a factory upgrade to be compatible with the RTF module. Contact Kaelus customer service to request an RMA number before returning equipment for upgrade. Upgrade part numbers are model and band specific. See list below for upgrade part number.



### iQA UPGRADE

| PART NUMBER | DESCRIPTION                        | PART NUMBER | DESCRIPTION                                     |
|-------------|------------------------------------|-------------|-------------------------------------------------|
| RTF-U700LA  | RTF upgrade for iQA-700LA analyzer | RTF-U901B   | RTF upgrade for iQA-901B analyzer               |
| RTF-U700LB  | RTF upgrade for iQA-700LB analyzer | RTF-U1800A  | RTF upgrade for iQA-1800A analyzer              |
| RTF-U700HB  | RTF upgrade for iQA-700HB analyzer | RTF-U1800B  | RTF upgrade for iQA-1800B analyzer              |
| RTF-U850A   | RTF upgrade for iQA-850A analyzer  | RTF-U1921A* | RTF upgrade for iQA-1900A & iQA-1921A analyzers |
| RTF-U850B   | RTF upgrade for iQA-850B analyzer  | RTF-U1921B* | RTF upgrade for iQA-1921B analyzers             |
| RTF-U900A   | RTF upgrade for iQA-900A analyzer  | RTF-U2101B  | RTF upgrade for iQA-2101B analyzers             |
| RTF-U900B   | RTF upgrade for iQA-900B analyzer  |             |                                                 |

\*The iQA1921 operates over the PCS and AWS bands; however the RTF function is limited to the PCS band only.

WARNING: Use of the portable PIM analyzer in a radiating mode, for example when connected to an antenna not enclosed in an anechoic environment, may be a violation of licensing regulations. Users should have permission in advance, from any licensed operators that might be affected by these tests. Furthermore, radiating high RF power can pose a personnel risk. Specifications subject to change without notice.