RF Explorer Near Field Antenna Kit Datasheet

Description

The RF Explorer Near Field Antenna Kit is a set of 4 high performance antennas designed for the most demanding RF diagnosis tasks:

- RFEAH-25 – H-Loop magnetic 25mm diameter
- RFEAH-15 – H-Loop magnetic 15mm diameter
- RFEAH-5 – H-Loop magnetic 5mm diameter
- RFEAE-10 – E-Field stub 10mm length

The low loss design of these antennas exhibits at least 10dB more sensitivity than other near field antennas in the market, at a much lower cost. Compared with other near field antennas, RF Explorer are smaller and lighter, exactly what fits best when space is constrained in a PCB.

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Features

- Robust calibrated near field low cost 3x H-Loop and 1x E-Field antenna
- Can work with RF Explorer Spectrum Analyzer, Signal Generator and other RF instruments and devices
- Easy to use, reliable to find interference sources with high accuracy and resolution
- Can be used to detect hidden bugs and transmission sources with remarkable spatial resolution
- Feasible to generate interferences with Signal Generator and confirm RF circuit sensitivity
- Capable of pre-EMC compliance tests
- Include semi-rigid RF cable with coupled Push-ON SMA for easy operation and antenna selection
- Protected by custom-designed, wooden box case with quality foam protection inside.

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Specification

- Antenna Connector: SMA female
- High frequency RF SMA Male-Male cable included
- SMA Push-On adapter included
- Type: E-Field and H-loop near field antennas
- Characterized response: 1MHz to 7Ghz
- RoHS compliant

Package contents

- 3 x H-loop near field antenna (RFEAH-25, RFEAH-15, RFEAH-5)
- 1x E-field near field antenna RFEAE-10
- 1 x Semirigid SMA Male-Male RG402 10cm 6GHz cable
- 1x SMA Push-On adapter (already coupled to the cable)
- 1x Wooden box protection case

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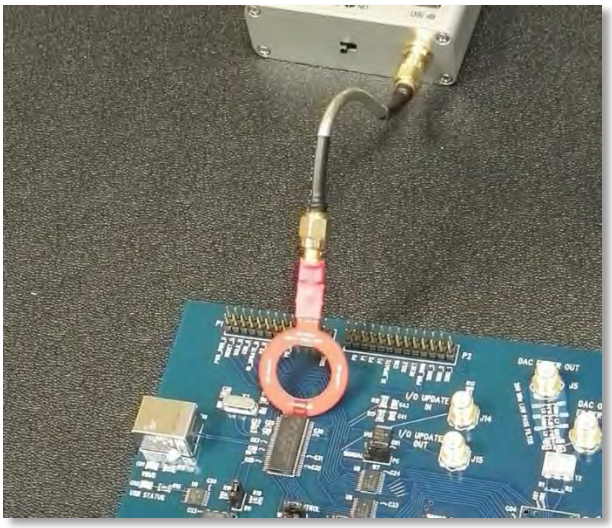
Magnetic H-Loop description

The three magnetic H-Loop antennas are very sensitive, compact and easy to use antennas for all sort of radiation sources.



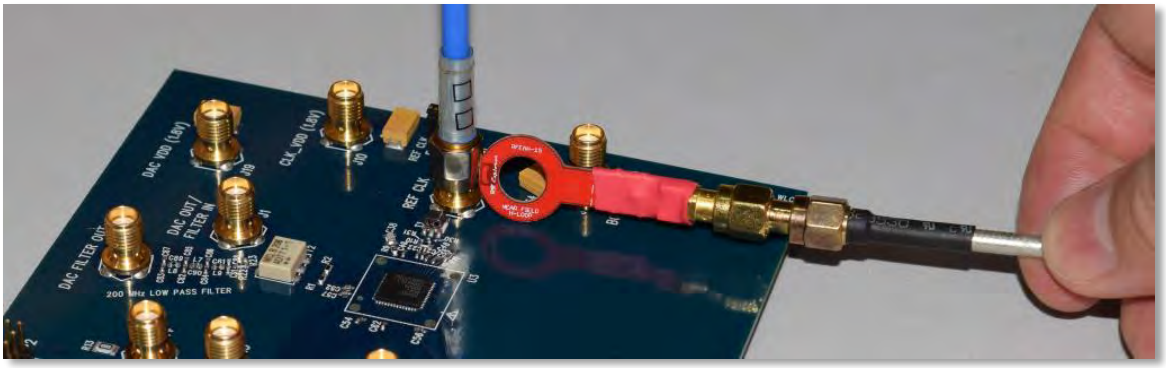
Compared with other near field antennas, RFEAH are smaller and lighter, exactly what fits best when space is constrained in a PCB.

Included with the antenna is high quality semi-flexible RF cable, this cable works as the handler of the antenna.

The big advantage of this approach: you can shape the cable the way you want for the antenna to be located exactly where you need it, in most cases with no need to hold it in your hand.

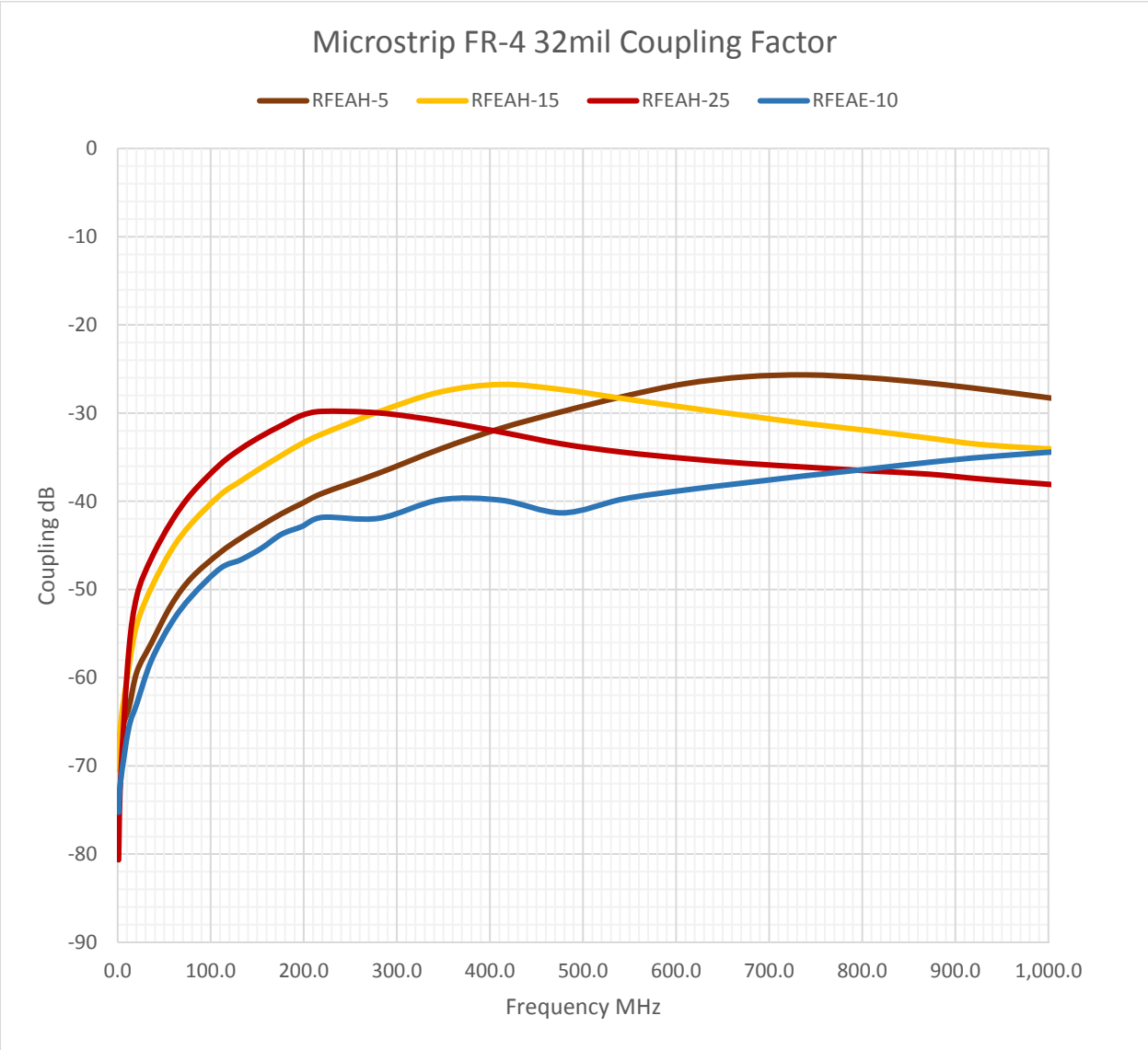
Nevertheless, in many cases you need a quick measurement done in a unique orientation or location, just use the semi-rigid cable has the holder of the antenna.

You can also connect this semi-rigid cable to any external SMA Cable of any additional length to couple it to a distant instrument.



There are three different magnetic antenna options: As the antenna diameter gets shorter, the spatial resolution increases at the cost of some sensitivity loss at low frequencies, but best response at high frequencies; you should select RFEAH-25 for best sensitivity with connectors, large ICs and isolated signal traces, whereas RFEAH-5 works best for very narrow selective work in a populated PCB with close-by signal traces. RFEAH-15 is a good in-between compromise.

Below comparison table shows how RFEAH antennas with higher diameter have better sensitivity at low frequencies, and smaller diameter antennas have better sensitivity at high frequencies.



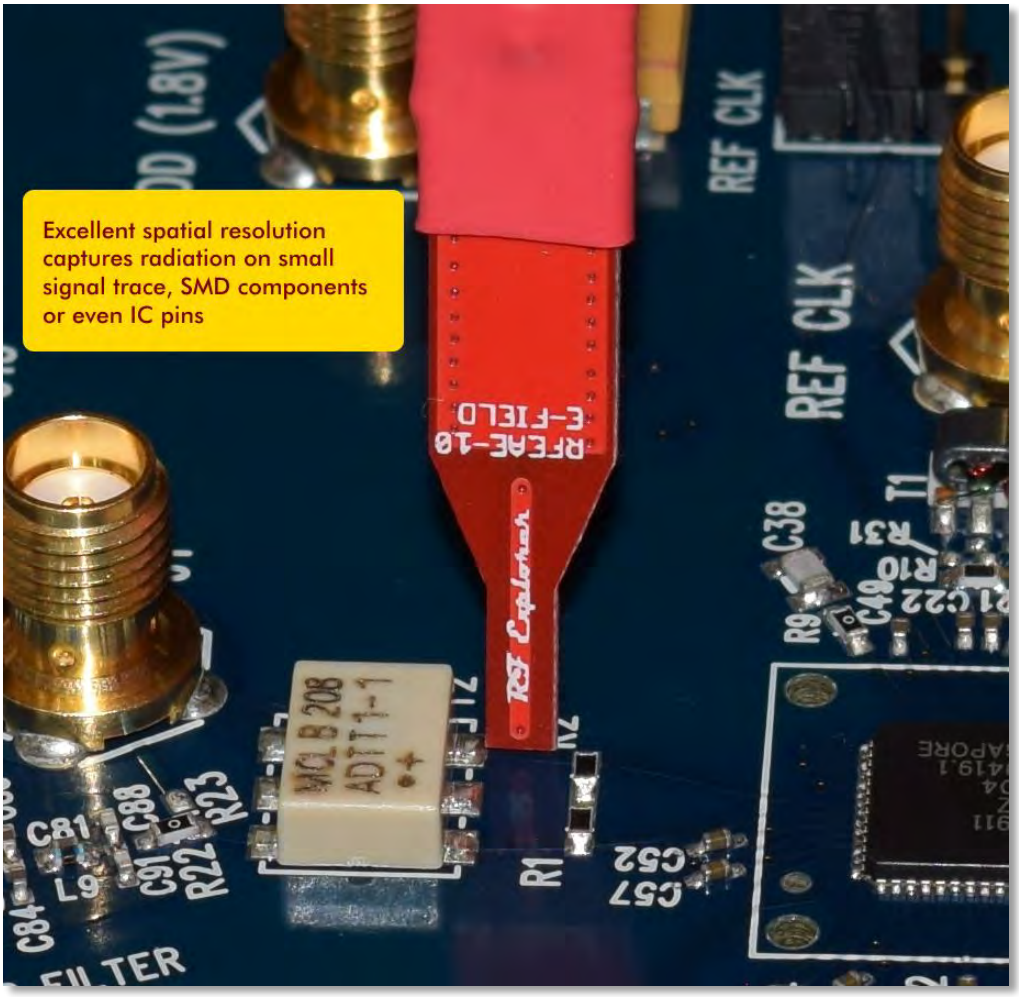
From the response graph above, covering 1GHz band – usually the most used for EMC and sniffing diagnosis:

- RFEAH-25: best option for **1-300MHz**
- RFEAH-15: best option for **300-550MHz**
- RFEAH-5: best option for **>550MHz**
- RFEAE-10: lower sensitivity at low frequencies than all H-loop models. However it improves at higher frequencies and exhibits better space resolution

Stub E-Field description

The electric field RFEAE-10 stub antenna offers a remarkable spatial resolution to determine the exact component in the PCB causing a problem, no matter how small it is.

You can easily determine signal level at the input and output of a filter, amplifier, mixer, etc in a tight SMD assembly as picture below.



Using the antennas

Included with the antenna is high quality semi-rigid RF cable; this cable works as the handler of the antenna. The big advantage of this approach: you can shape the cable the way you want for the antenna to be located exactly where you need it, in most cases with no need to hold it in your hand.

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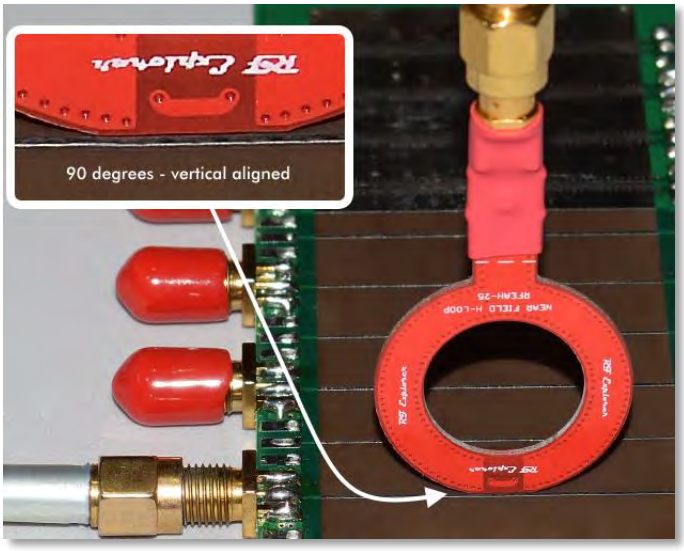
The RF cable is coupled with an easy to use SMA Push-On adapter; therefore the different antenna models can be easily plugged in/out as required for the task. There is no need to deal with SMA nuts, just plug-n-play antennas.

To correctly use the magnetic antennas and produce maximum sensitivity, please observe the following suggestions:



The H-Loop antenna works basically as an inductive coil, capturing magnetic flux. Therefore, it should be oriented in such a way the maximum magnetic field is captured.

In most cases, that means you should place the antenna vertical to the signal trace, as show in this picture.

Avoid using the antenna orthogonally to a signal trace, as otherwise will mostly miss the magnetic field involved and will present very low sensitivity.

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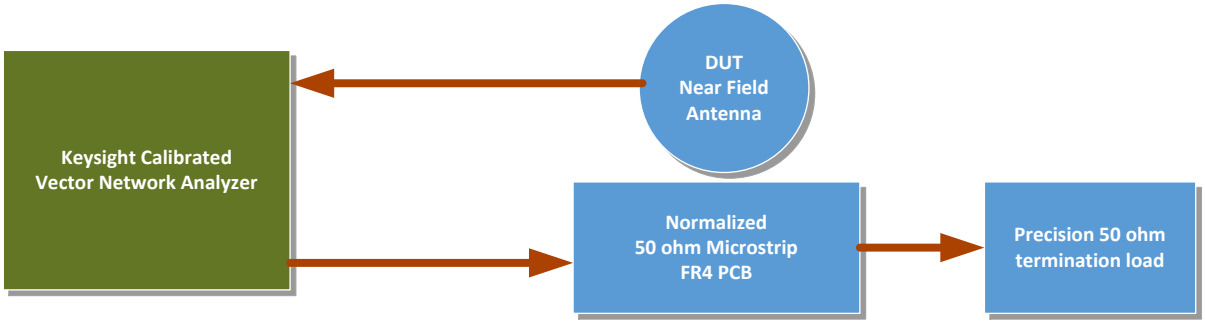
Applications

- **Detect radiation**: Easily determine the electronic component or PCB signal track creating a wanted or unwanted RF radiation.
- **Sniff and measure**: Follow signal path in any RF or high speed digital circuit, with no need to actually contact the circuit itself.
- **Find bugs**: Thanks to great spatial resolution, it is ideal antenna to check for RF bugs such as hidden cameras or microphones in a room.
- **Diagnose EMI**: Check any electronic device for RF radiation limits. This may include a connector with leakage, a module creating interference in a drone or RC plane, an oscillator or crystal that may not be working at the right frequency, etc.
- **Pre-compliance EMC testing**: Help on finding possible sources of interference in a design before passing an expensive EMC lab test for approval EU / FCC.
- **Create interference**: it can be used to introduce RF interference in specific areas of a circuit or device, to check on side effects as well as diagnose root cause of intermittent problems. Connect it to a Signal Generator and use CW or Frequency Sweep to check how your circuit respond.

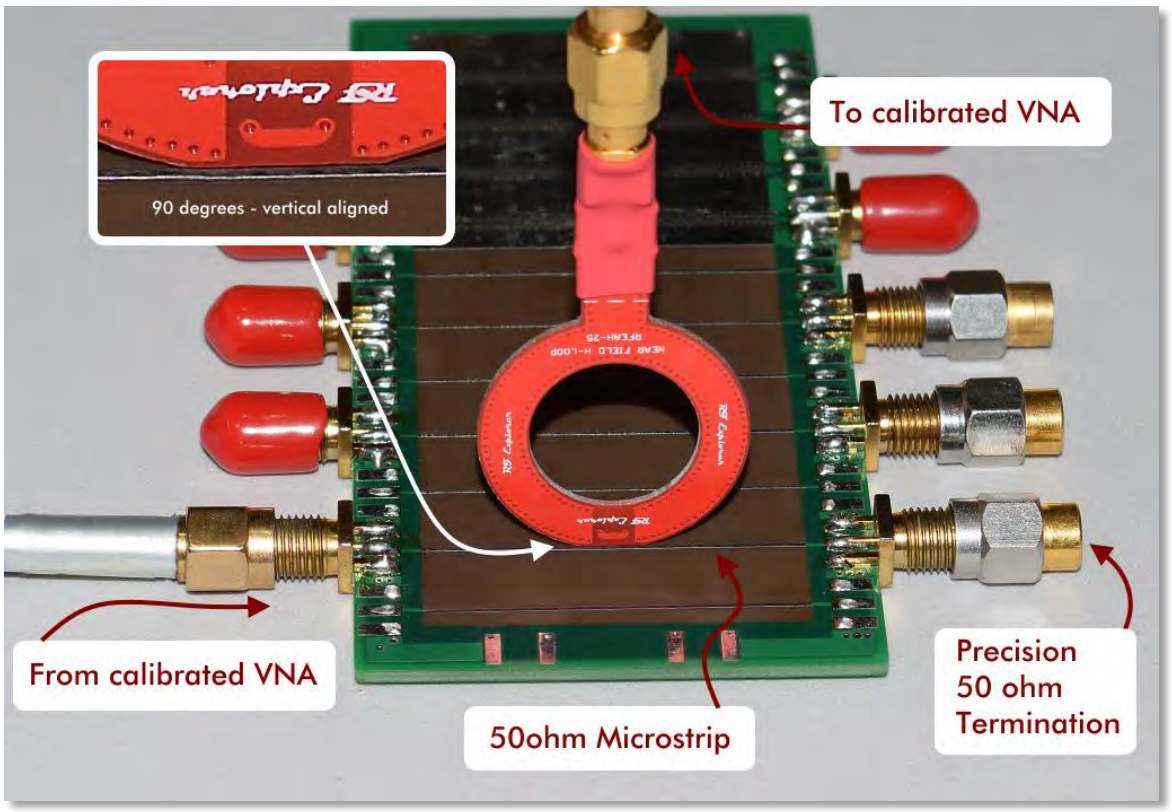
Multi-tool: These near field antennas can be used with RF Explorer Spectrum Analyzer and Signal Generator. But it can be used with any spectrum analyzer brand, as well as oscilloscopes. It is DC decoupled up to 25V so pretty much risk free if makes contact with the PCB circuit under test.

Characterized Frequency Response

Coupling data graph provided include response for FR4 PCB thickness (0.010”, 0.020”, 0.032” and 0.064”), tested and calibrated with a 50ohm impedance Microstrip signal trace, using SOLT calibrated VNA. This approach provides a repeatable, quality coupling calibration data set to efficiently use the antenna for PCB signal measurements.



The antenna must be vertical 90 degrees against PCB signal trace, at 0mm distance, parallel horizontal orientation to signal trace for maximum sensitivity of the magnetic flux, as depicted below.



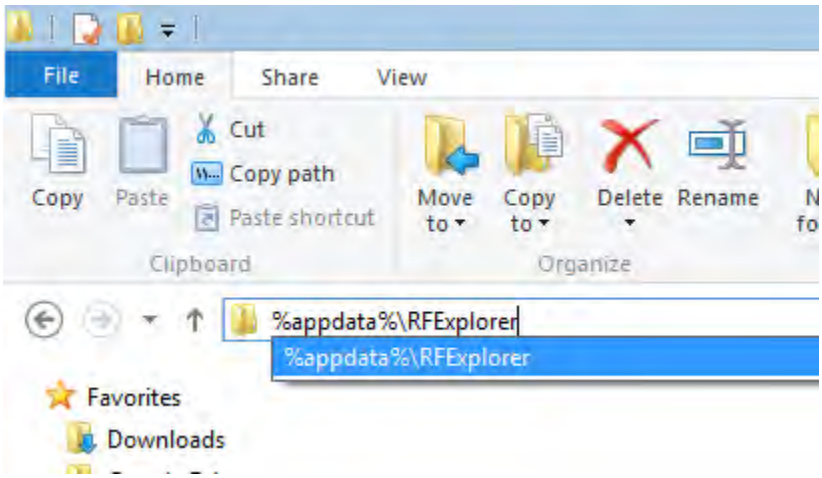
Using coupling amplitude calibration files with RF Explorer for Windows

One important advantage of using calibrated antennas is the automatic adjustment available in RF Explorer for Windows application.

Using this feature and calibration files provided, the application will automatically display the real signal power level in the Microstrip trace.

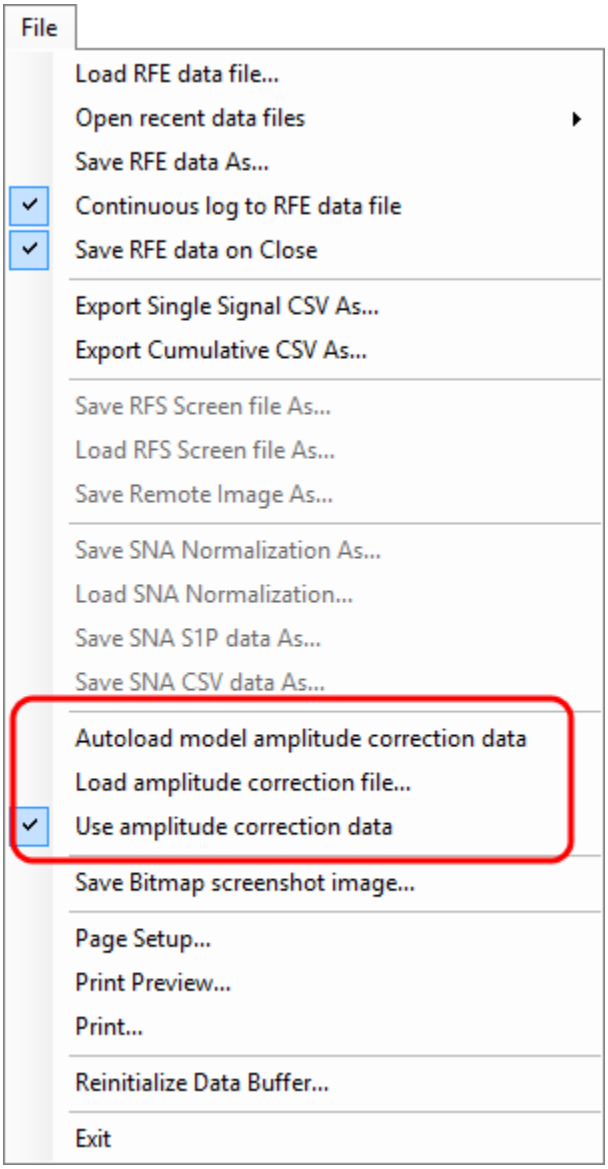
Calibration files are available for download and are very easy to use:

- Download files from www.rf-explorer.com/downloads
- Decompress file contents and store all *.RFA files in a folder of your choice. The recommended path is the folder directly pointed by %appdata%\RFExplorer – this is the same folder used by other calibration files.



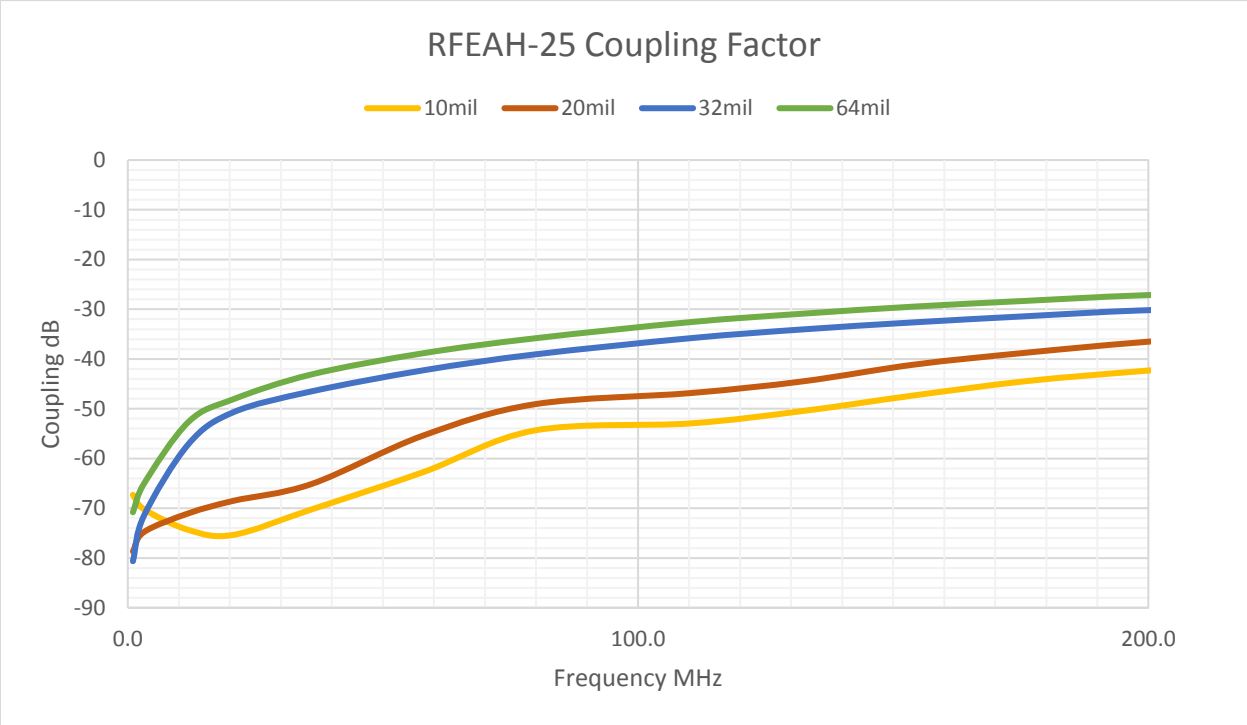
- To enable calibration of a specific antenna model in RF Explorer for Windows, open menu *File -> Load amplitude correction file…* and select it. For instance to use the RFEAH-25 antenna to detect a signal on a 32mil PCB (0.8mm) load file RFEAH25_32mil.rfa

- Make sure the *Autoload model amplitude correction data* option is **unchecked**, and *Use amplitude correction data* is **checked**.

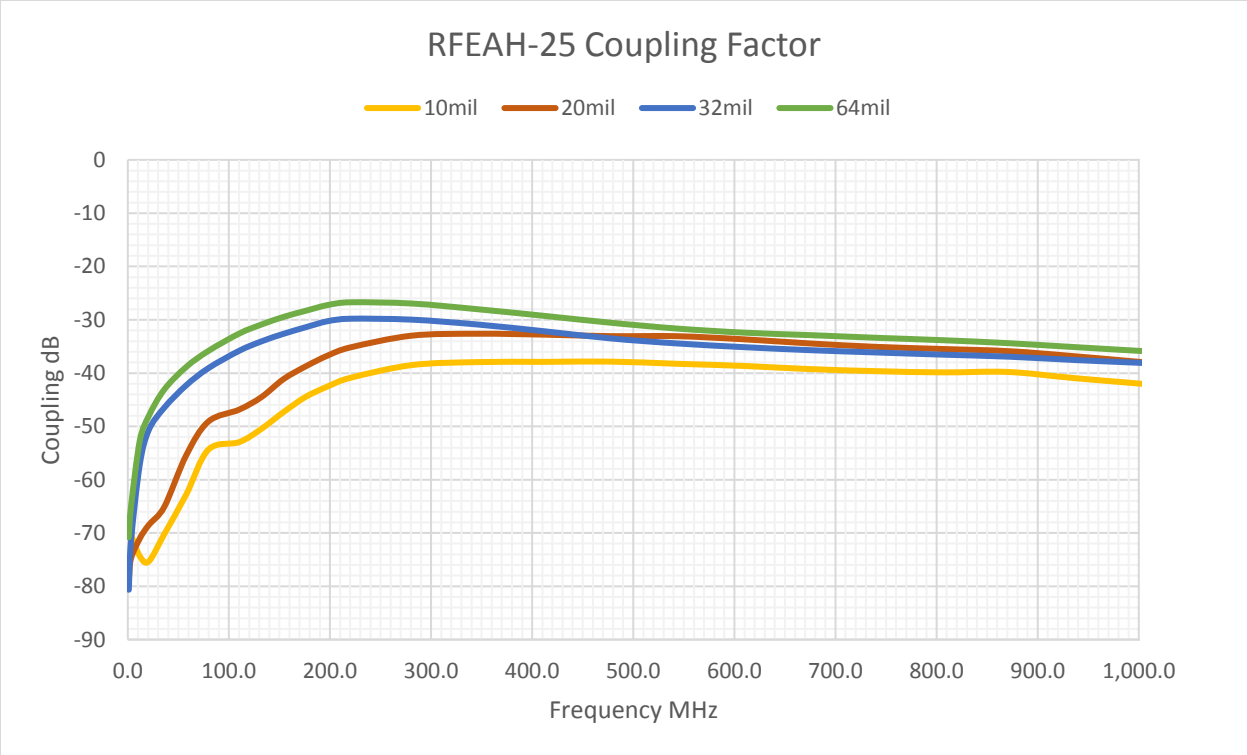


With this configuration, the noise floor will increase to adjust for actual reading. The sensitivity is also adjusted to that of the antenna, and therefore direct amplitude readings makes signal trace power measurement a breeze.
Note: several factor may add extra attenuation to the measurement, including trace length, antenna orientation, and trace impedance. All the antennas are calibrated using matched impedance traces but that is not always the case in a PCB under test. Additionally, grounded coplanar waveguide may produce different results than Microstrip, used for calibration.

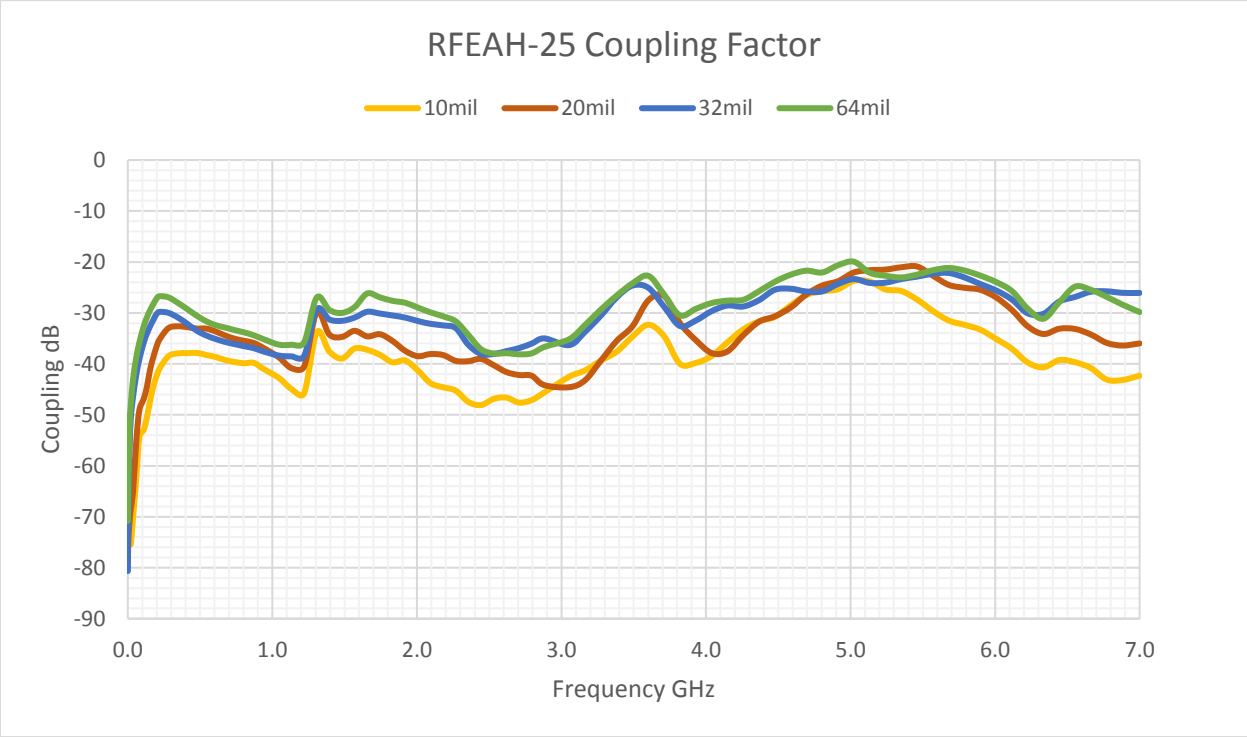
RFEAH-25 Coupling 1-250MHz



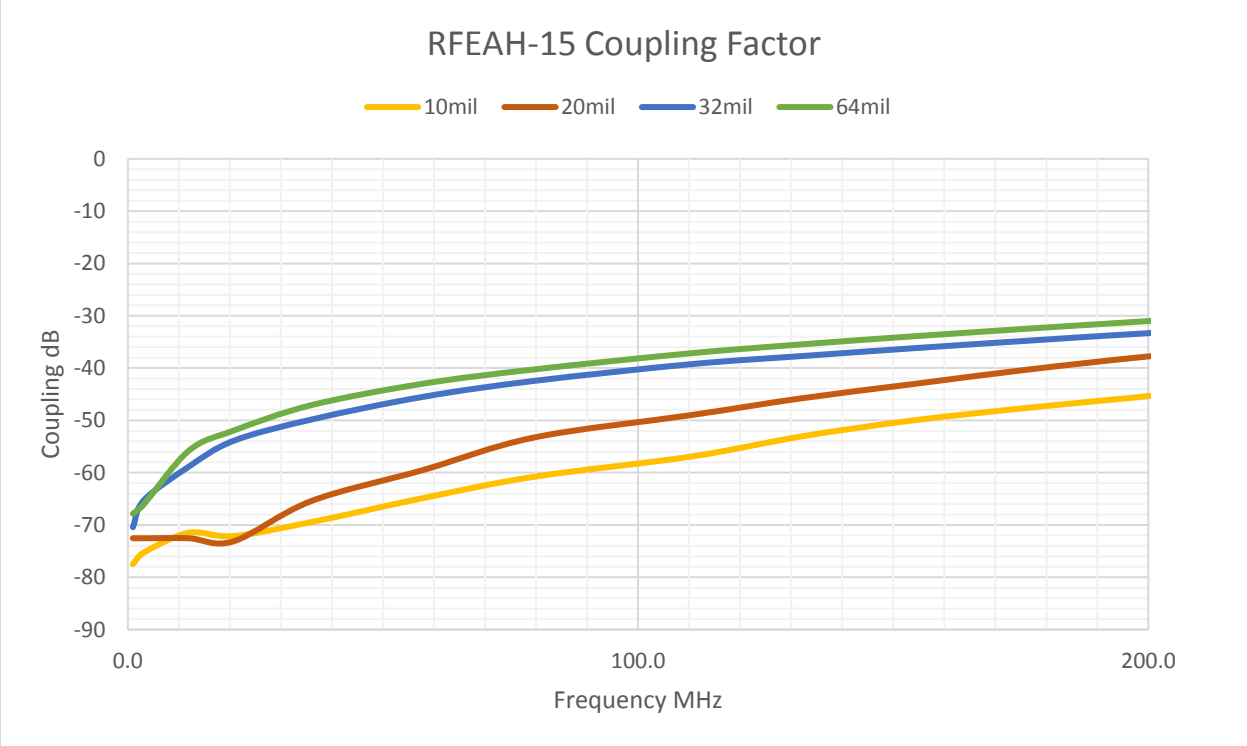
RFEAH-25 Coupling 1000MHz



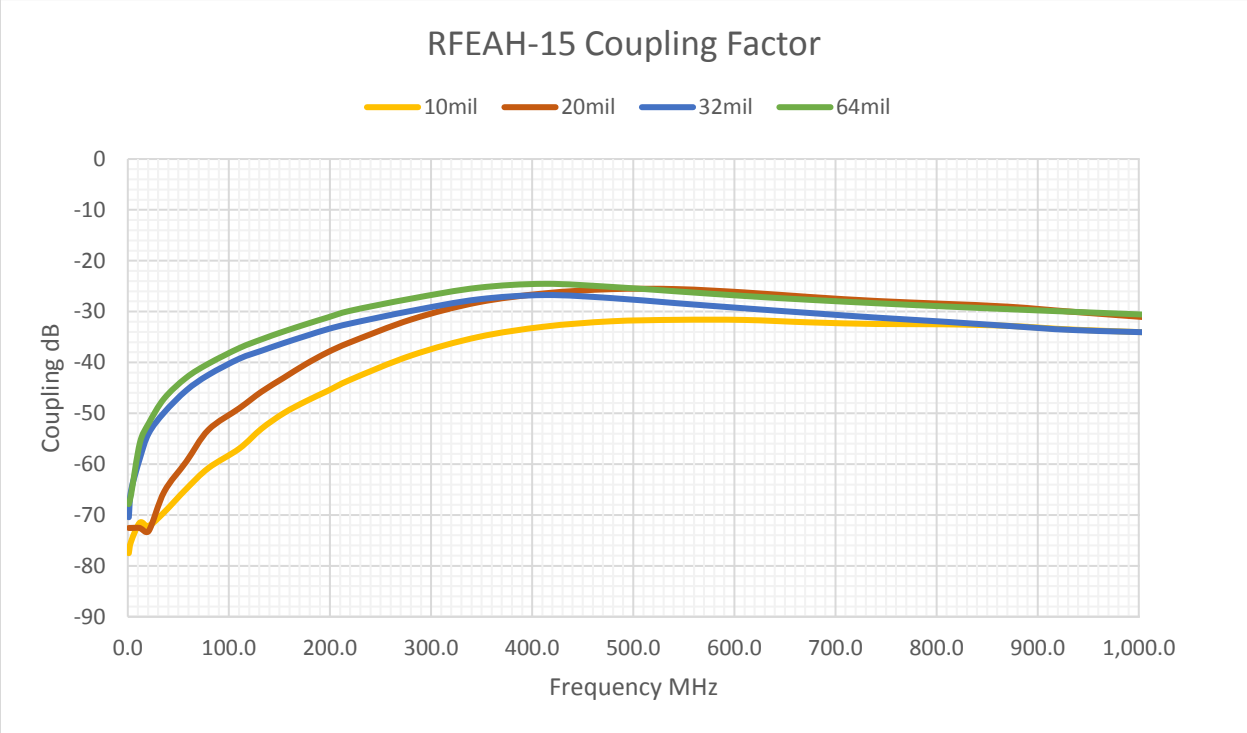
RFEAH-25 Coupling 7GHz



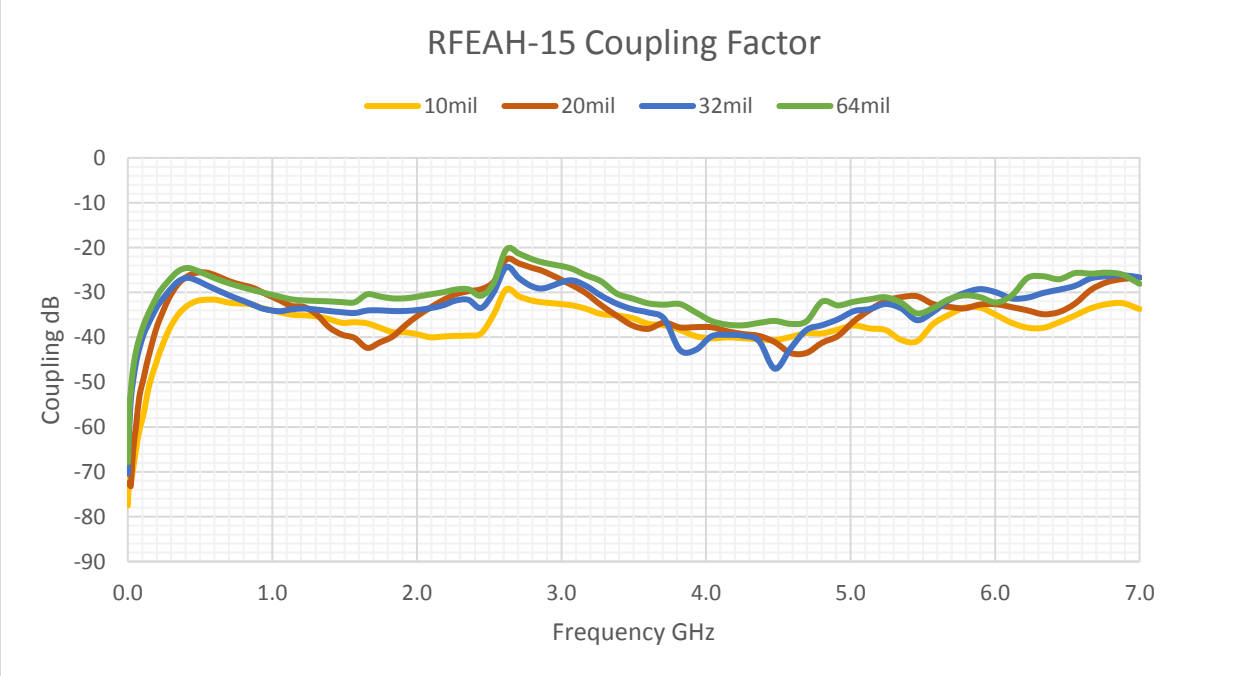
RFEAH-15 Coupling 1-250MHz



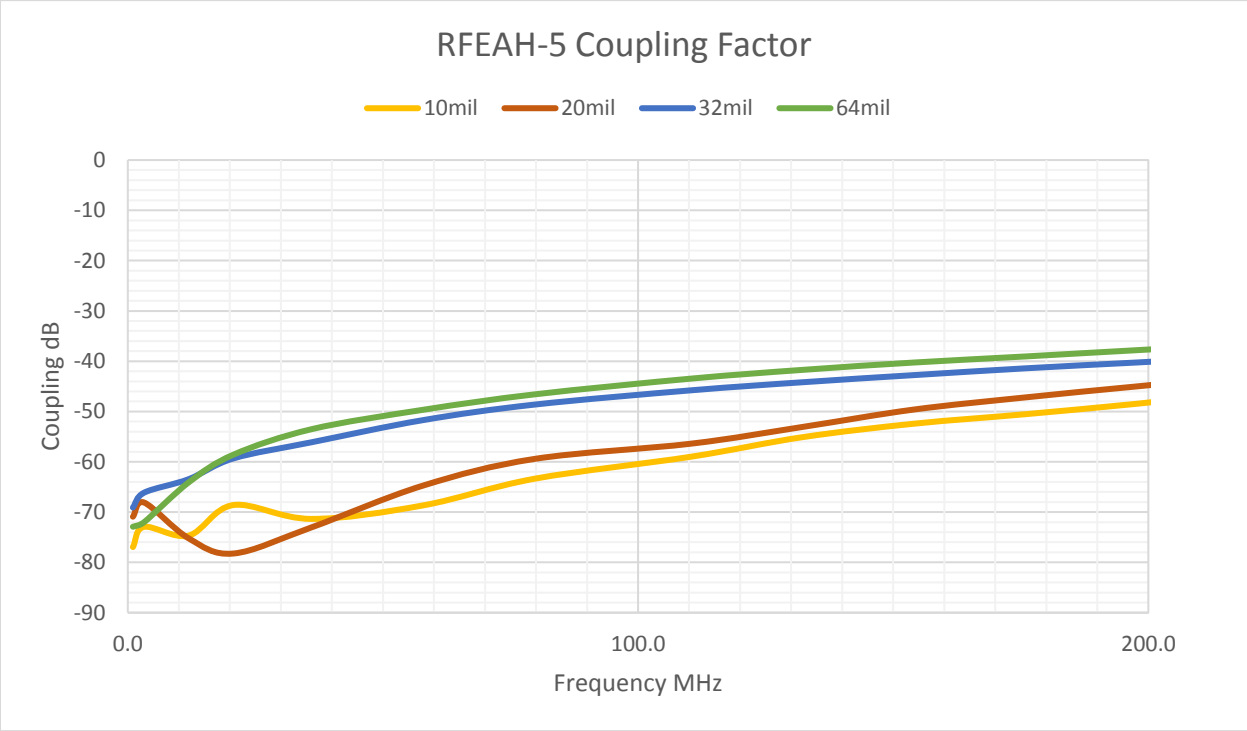
RFEAH-15 Coupling 1000MHz



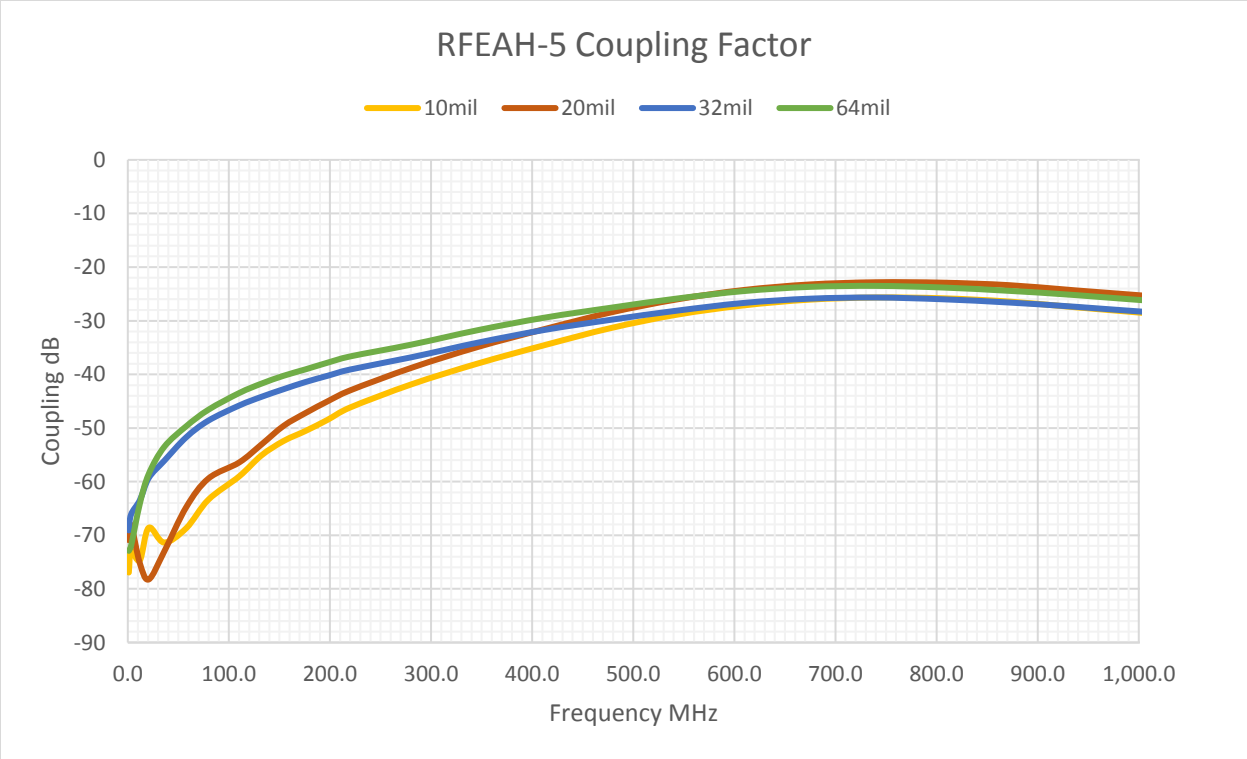
RFEAH-15 Coupling 7GHz



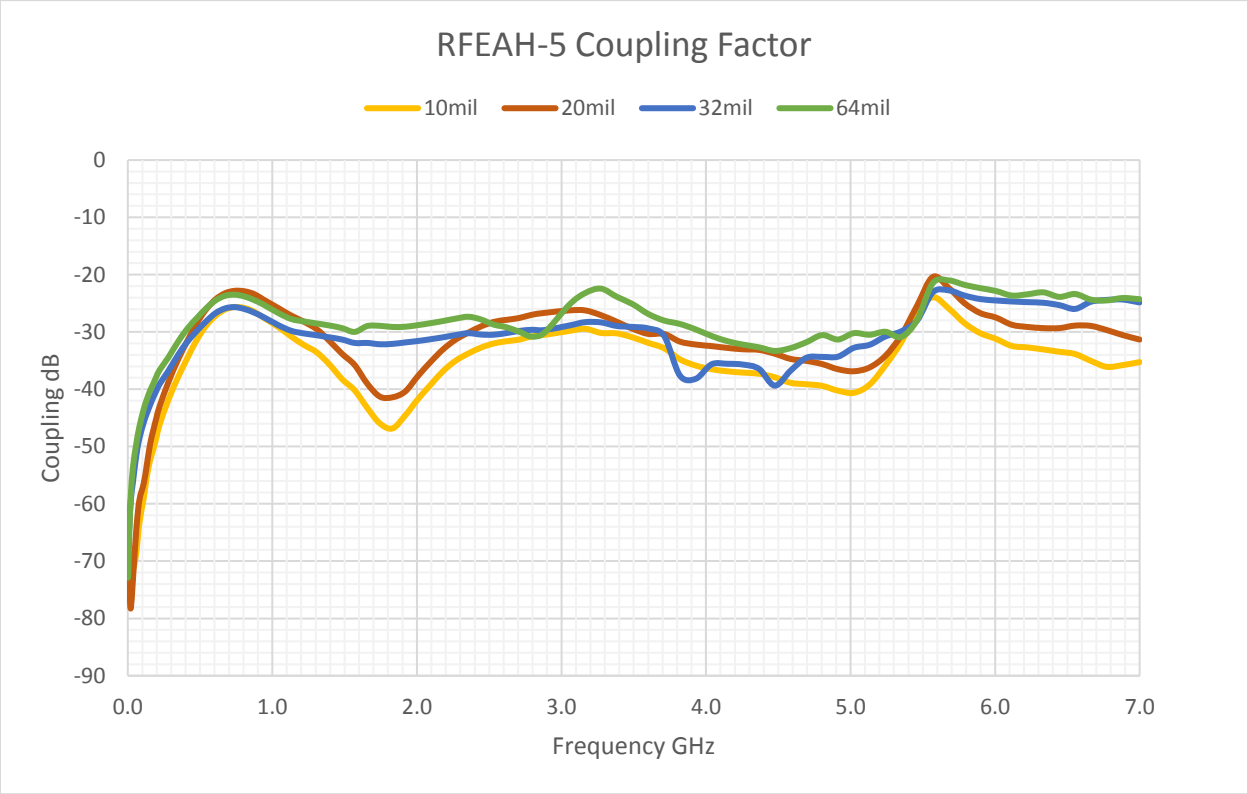
RFEAH-5 Coupling 1-250MHz



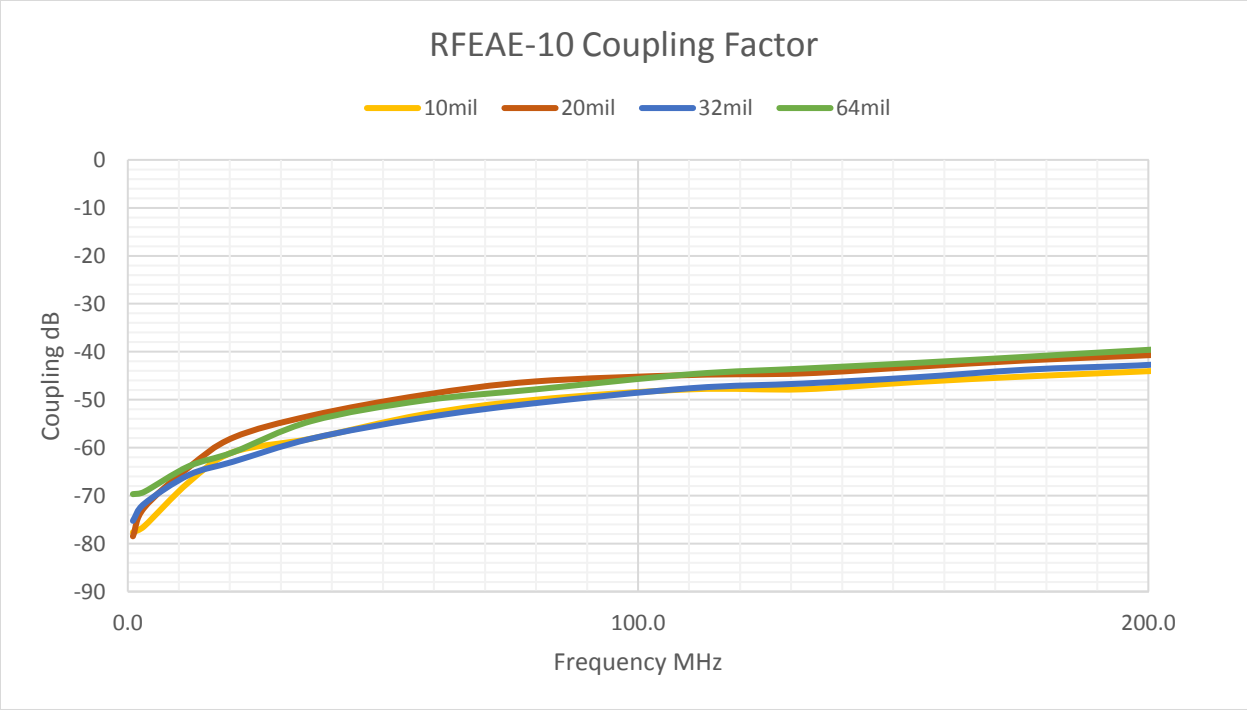
RFEAH-5 Coupling 1000MHz



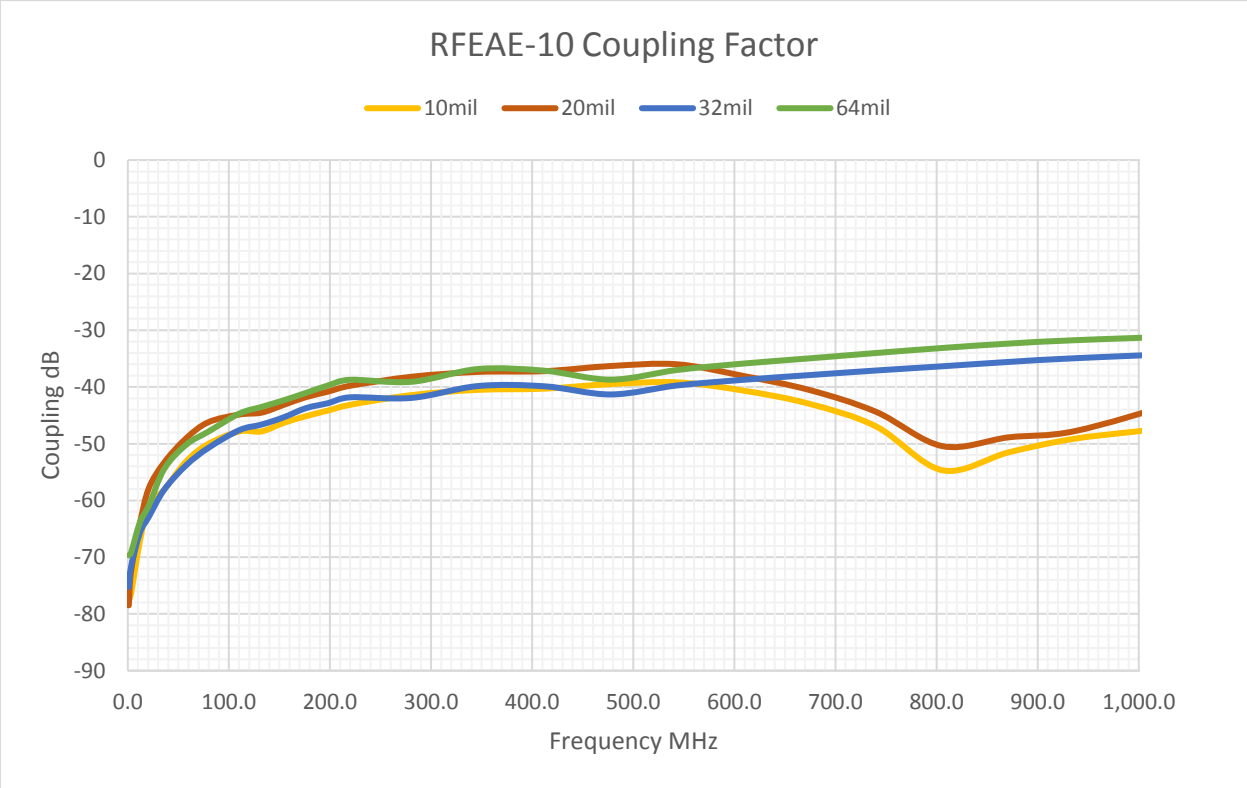
RFEAH-5 Coupling 7GHz



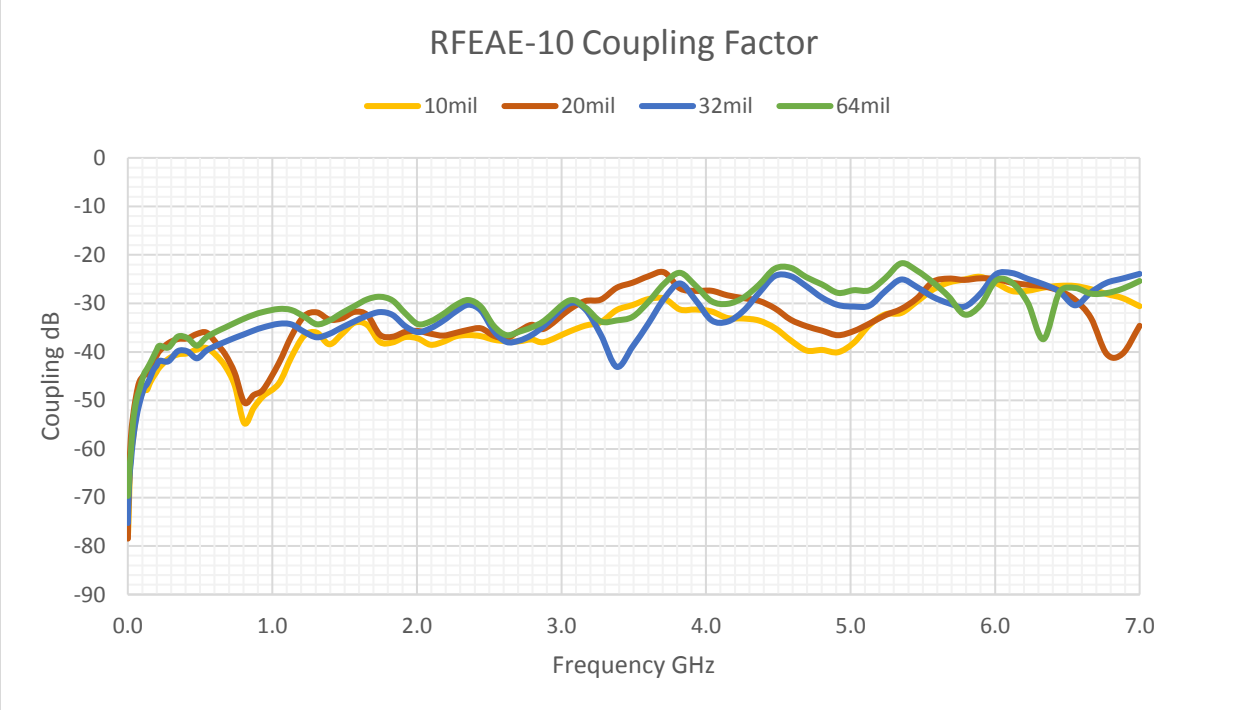
RFEAE-10 Coupling 1-250MHz



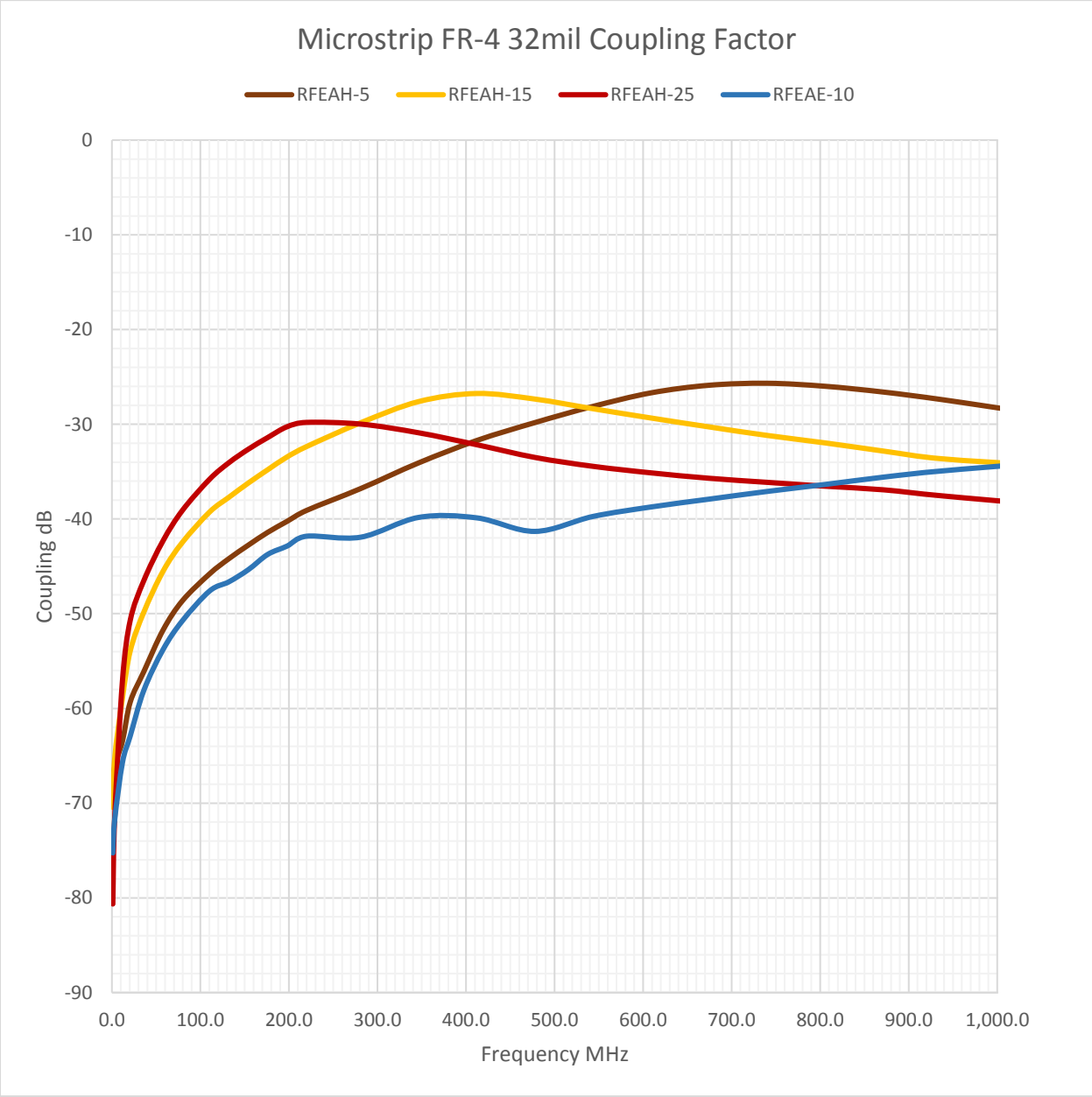
RFEAE-10 Coupling 1000MHz



RFEAE-10 Coupling 7GHz



Coupling 1GHz – combined comparison for 32mil FR-4 Microstrip



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Revision History

Version	Date	Comments
1.0	2017-01-12	Version with graphical chart data for 10mil PCB
1.1	2017-03-22	Updated averaged coupled reference chars for 10mil, 20mil, 32mil and 64mil FR-4 substrate Microstrip

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