Wireless Power Transfer

Measurement of Resonance Characteristics and Transmitting Efficiency of Components and Circuits

KEY WORDS

- Wireless power transfer using magnetic resonance • Resonance frequency • Transmitting efficiency
- High Q resonant circuits

PRODUCTS

Frequency Response Analyzer FRA5087/FRA5097

Wireless power transfer is the transmission of electrical energy from a power source without using interconnecting conductors. One of the methods used for transmission is the electromagnetic induction type, which can be seen in a growing number of short range low power practical applications such as portable devices. One field that is gaining momentum is Electric Vehicle (EV) charging; various devices that enable charging of a parked vehicle or allow easy and safe charging at general households are being developed. The major method of transmission used in these EV chargers is the magnetic resonance type. Currently, the development of a standard for magnetic resonance systems is underway, driving the transition from fundamental research to demonstration experiment and practical application.

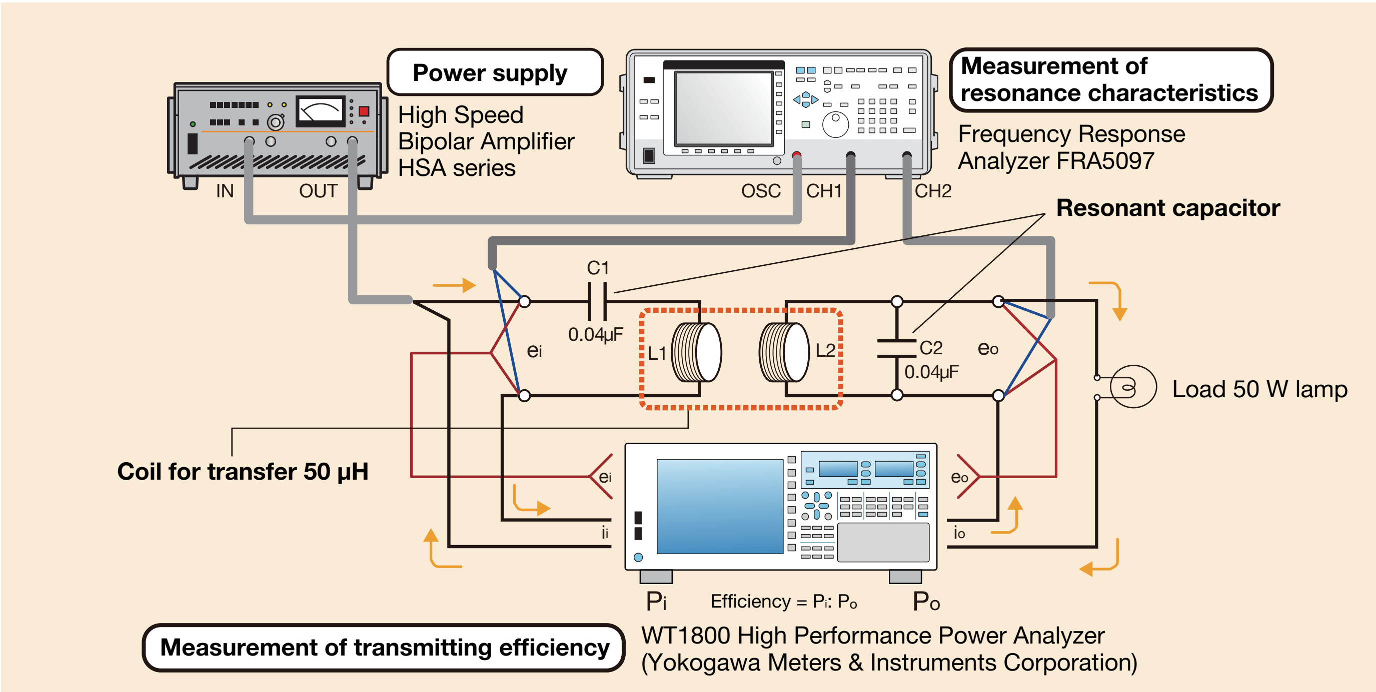
The frequency of the magnetic resonance system used in practical applications range between several kHz to just above 10 MHz. To achieve resonance frequency and perform its evaluation, measurement of the transfer characteristics of the components used in the system, such as coils and circuits, is required.

Generally, network analyzers and simulation software are used for such measurements. However, since power transmission is fairly high, ranging from several W to several kW, in magnetic resonance systems, data obtained from these measurements may deviate greatly from its actual performance in practice.

Combining the frequency response analyzer and bipolar power supply to measure resonance characteristics while current is being applied

- The High Speed Bipolar Amplifier, capable of signal amplification to high frequency range, directly drives the coils
- Measure while actual power consumption is applied to the resonant circuit, using a frequency response analyzer (FRA) that can measure impedance
- Assuming practical applications where power is transferred to moving objects such as EVs, evaluate the impact on transmitting efficiency based on the change in the resonance frequency with respect to the difference of position, distance, and angle

Measurement Block Diagram - Configuration Example of a Wireless Power Transfer Measurement System



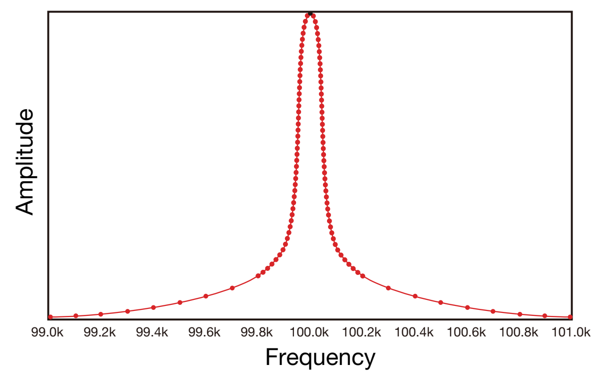
This solution addresses various problems related to efficiency. It is a useful solution that can increase the efficiency of components, increase the efficiency of the entire system including load, and avoid efficiency reduction due to change in impedance caused from effects from the surrounding environment.

Tips Advantages of Using FRA for High Q Resonant Circuit Measurements

High Density Sweep: Allows high resolution measurement limited to the vicinity of resonance frequency

High Density Sweep

The FRA monitors the input signal and automatically performs high density sweep when the change in signal levels or measured values (amplitude or phase) exceeds a predefined value (enabled when SLOW SWEEP AUTO mode is set; manual setting is possible as well).



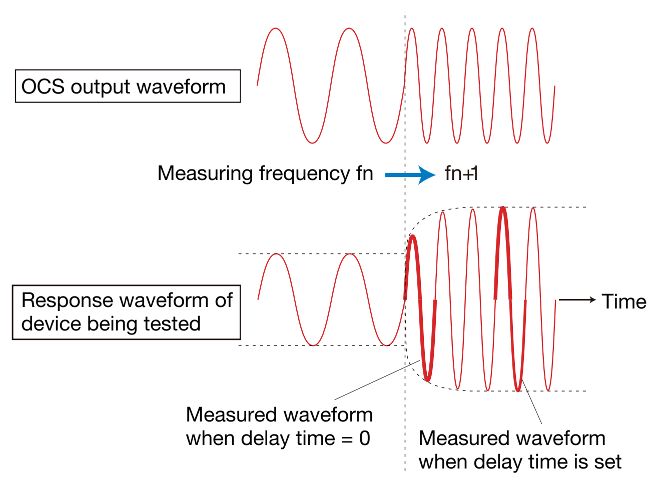
- High resolution measurement can be performed automatically, limited to the vicinity of the resonance point
  - ▶ Facilitates measurement and reduces measurement time
- Frequency measurement range can be set arbitrarily
- 0.1 mHz high resolution sweep over the entire frequency range
- Maximum of 20,000 points of frequency measurement
  - ▶ Allows measurement way over Q = 1000

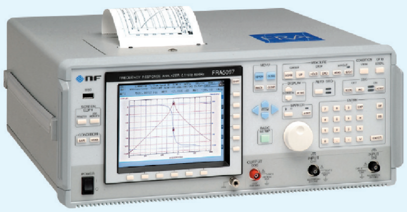
Measurement Start Delay: Avoids transient state caused by group delay

Measurement Start Delay

Allows setting of the measurement start delay time after change occurs in the measuring frequency.

- Transient state caused by group delay that occurs in high Q resonant circuits can be avoided to achieve measurement of a stabilized state.
  - ▶ Allows accurate measurement of high Q resonant circuits





FRA5097

FRA5087/FRA5097

- Frequency range — FRA5087: 0.1 mHz to 10 MHz; FRA5097: 0.1 mHz to 15 MHz
- Amplitude accuracy — ±0.05 dB
- Phase accuracy — ±0.3°
- Dynamic range — 140dB
- Isolation voltage — 250Vrms
- Auto ranging
- Features auto integration, amplitude compression, operation function, impedance display*, and much more

*Optional in FRA5087