Keysight Technologies

Managing Wireless Medical Applications with FieldFox Handheld RF and Microwave Analyzers (Part 1)

There are many radio frequency (RF) and wireless applications in the medical industry. They range from diagnostic imaging maintenance to shielding tests, which help prevent interference from consumer wireless products to medical implants or medical devices in healthcare facilities. Challenges range from finding unexpected interference and device co-existence to choosing suitable tools to address these issues.

This application brief explores how Keysight FieldFox handheld RF and microwave analyzer is used in the Magnetic Resonance Imaging (MRI) medical environment.

Keysight FieldFox

- Operates in magnetic environment
- Battery-operated and does not require an AC outlet
- Reduces MRI out-of-service time
- Document coil performance and tuning directly to the external memory

Figure 1. Keysight FieldFox Handheld RF and Microwave Analyzer

Keysight Solutions

Maintenance – MRI RF Coil Tune Up

When tuning the MRI RF coil, technicians need to read the instrument's display, however the instrument must be far away from the magnetic fields of the MRI machine. This problem is easily solved by increasing the font size of the instrument display. Hence technicians who perform maintenance and adjustments can check the shape of S11 trace and value of Z, P and Q factors when he repeatedly changes the properties of the RF coil.

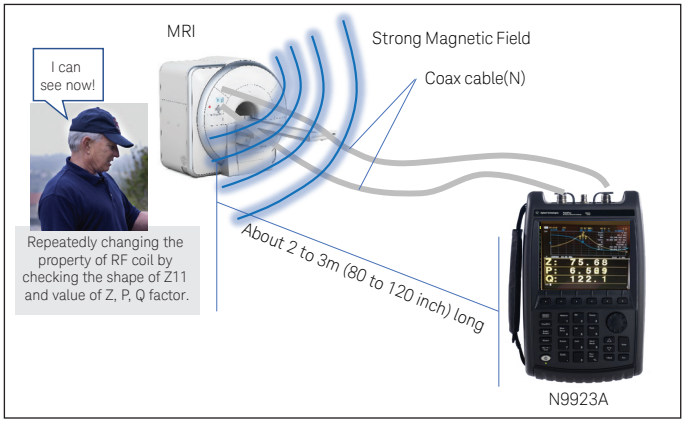

Figure 2. This diagram illustrates the challenges and resolution to the service technician with the implementation of BIG Readout features in FieldFox RF and Microwave Analyzer.

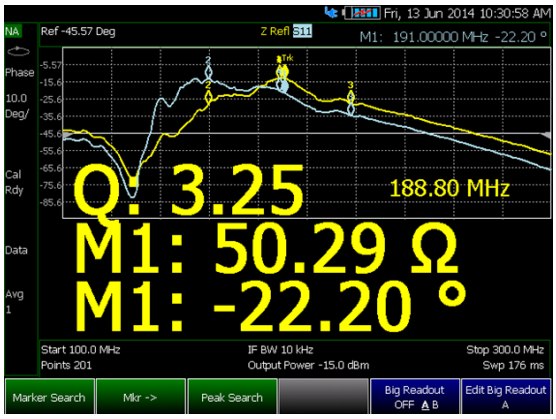

Figure 3. BIG Readout mode. M1: 50.29Ω represents the impedance value (Z) and M1: -22.20° represents Phase (P). The Q factor is defined as peak value of Z to 70% down position of Z.

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RF Shielding – Site Survey and Shield Test

MRI systems use radio frequency (RF) waves to construct soft tissue images. It is important to prevent stray RF waves from entering the MRI room. RF shielding prevents exterior radio frequency interference (RFI) from negatively affecting the MRI operation and digital image production. RFI sources include FM broadcast radios, two-way radio communication systems (from ambulance and wireless LAN signals), and cellular towers. MRI machines have highly sensitive sensors that pick up minute RF signals. These sensors can be overridden by external RF noise generated by a variety of electronic applications.

Most MRI manufacturers will require 100 dB of RF attenuation at the sense frequency, although the requirements vary by manufacturers. RF survey is made easier with a portable instrument capable of accurate measurements inside and outside the shielded area.

Shielding and conditions may change over time, and checking shielding effectiveness periodically is advisable. Failure to do so can result in image artifacts, leading to limited diagnostic value and rescheduled image retakes.

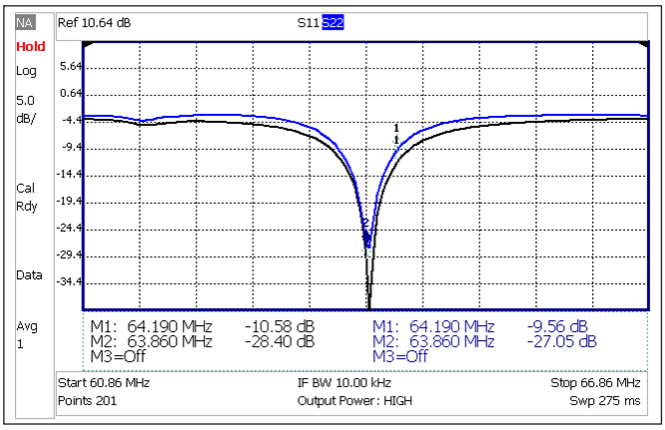

Figure 4. Spectral screenshot of FM frequencies

Specification in A Glance

Function	Keysight N9914A FieldFox RF and Microwave Combination Analyzer
Vector Network Analyzer	
Frequency	30 kHz to 6.5 GHz
Dynamic range	Up to 100 dB
Output Power	Up to +1 dBm
Spectrum Analyzer	
Frequency	5 KHz to 6.5 GHz
Spur-free dynamic range	≥105 dB
Phase Noise	-111 dBc at 10 KHz offset
General	
Test Port Connectors	Type-N (f)
Non Volatile Memory	Internal: Minimum 4 GB, up to 1000 traces and states External: Support USB 2.0 and SD/SDHC memory cards
Dimensions:	11.5 in x 7.4 in x 2.8 in (292 mm x 188 mm x 72 mm)
Weight:	3.0 kg or 6.6 lb including battery

Literature

Managing Wireless Medical Application	Publication Number
FieldFox RF Vector Network Analyzer Data Sheet	5990-9783EN
Techniques for Precise Interference Measurements in the Field Using FieldFox Handheld Analyzer Application Note	5991-0418EN
Solving Design and Test Challenges for Medical Devices Brochure	5991-2240EN

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