



# Introducing the New Microwave FieldFox Analyzers

*Carry Precision with You*

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April 2013



# Agenda

## *Carrying precision into the field*

- Typical field challenges, applications, and gaps in today's solutions
- The new microwave FieldFox analyzers
  - ✓ Accurate, rugged, portable, and flexible
- Additional information



# Challenges in the Field

*Carrying precision into difficult environments*

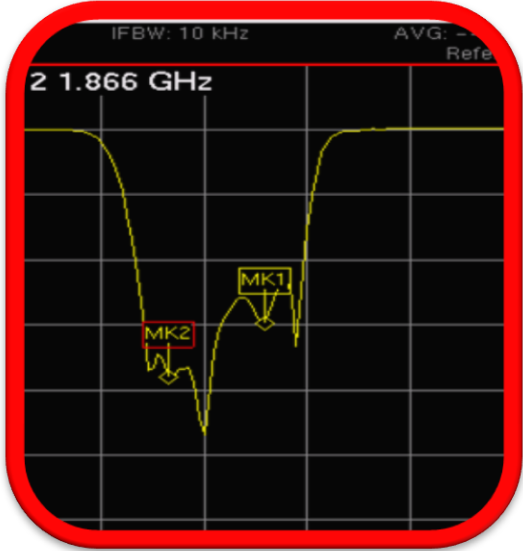
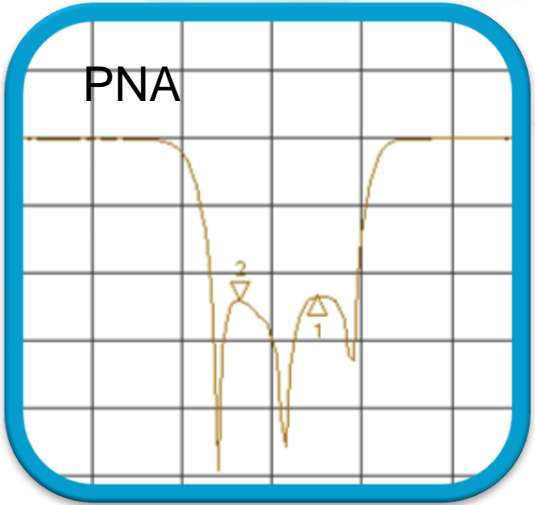


Unpredictable situations	Mission critical	Crowded conditions	Harsh environments
<ul style="list-style-type: none"><li>• Unforgiving conditions</li><li>• Unknown hazards</li></ul>	<ul style="list-style-type: none"><li>• Mission critical decisions based on measured data</li><li>• High pressure &amp; time sensitive</li></ul>	<ul style="list-style-type: none"><li>• Tight quarters</li><li>• No room for error</li></ul>	<ul style="list-style-type: none"><li>• Dark, rainy, windy, dusty, slippery, glaring, scorching</li><li>• Fluctuating &amp; extreme temperatures</li></ul>

“The technology Agilent has developed is simply superior.”

- Major aerospace/defense prime contractor

# Why customer needs to have a truck load of ...



# Who Needs Precision in the Field?

## RF and microwave engineers working in

- Aerospace and defense
- Commercial communications

Who make measurements in the field for installation, routine maintenance, operations etc.—where there are no AC outlets.



**“I need a lightweight tool that is versatile and durable to handle the measurements I need to make in the field.”**



**Microwave engineers: “I need to make accurate measurements quickly in harsh conditions and hard to reach locations.”**



**RF engineers: “I need to get right to work and do more in less time.”**

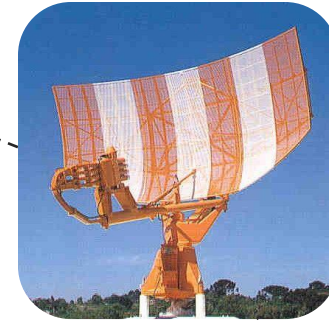
# Wide Range of Applications



**Communications test**



**MW backhaul**



**Radar I&M**



**Frequency management**

- Key applications**
- Cable and antenna analysis
  - Interference detection
  - Signal monitoring/verification
  - Transmitter and receiver test



**SAT ground station I&M**



**EW system support**



**R&D bench/Education**

# Gaps in Today's Handheld Instruments



## Accuracy – measurements are not precise

- Field measurements are not consistent with lab benchtop instruments
- Difficult to make accurate signal power measurements in the field due to changing ambient temperatures

## Rugged – low confidence

- Instruments have fans and vents and are not designed to handle tough environments, such as rain, dust, moisture, humidity, rapid temperature changes etc.
- Only 1-year warranty

## Portability – limits time in the field

- Short battery life

## Flexibility – less functionality

- Key functions are not available such as an independent source – which makes it difficult to generate a verification signal in the field

# Leverage our Legacy of Measurement Leadership

FieldFox analyzers are the handheld extension of the best network and spectrum analyzers.



“FieldFox’s result is almost identical to my PNA. I want one of these for all of my engineers.”

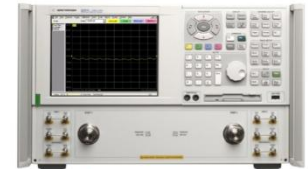
-Senior calibration engineer from spacecraft research and development center.



2012 FieldFox microwave handheld analyzer



2001 PSA spectrum analyzer



2000 PNA vector network analyzer



2009 PXA X-Series signal analyzer



1984 8510A vector network analyzer



2007 PNA-X vector network analyzer



1978 HP 8566B spectrum analyzer

# 14 New FieldFox Handheld Analyzers

4, 6.5, 9, 14, 18 and 26.5 GHz



## RF and microwave combination analyzers

**Base:** Cable and antenna analyzer

**Key options:**

- Spectrum analyzer
- Vector network analyzer
- Vector voltmeter
- Built-in power meter

**All FieldFox options are available and upgradeable.**



## Microwave vector network analyzers (VNA)

**Base:** Transmission/reflection VNA

**Key options:**

- Full 2-port S-parameters
- Two-port QuickCal
- Time domain
- Cable and antenna analyzer
- Vector voltmeter
- Built-in power meter



## Microwave spectrum analyzers (SA)

**Base:** Spectrum analyzer

**Key options:**

- Full-band tracking generator
- Full-band preamplifier
- Interference analyzer & spectrogram
- Reflection measurements
- Built-in power meter

# Agilent Expands Handheld Portfolio

26.5 GHz

**14 new models  
Aug 31st**

- Accurate
- Rugged
- Portable
- Flexible

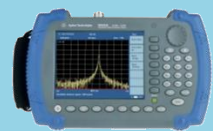
18 GHz

14 GHz

9 GHz

6 GHz

4 GHz



N9330B



N9912A-106



N9912A-104



N9918A



N9917A



N9916A



N9915A



N9914A



N9913A



N9928A



N9927A



N9926A



N9925A



N9923A-106



N9923A-104



N9938A



N9937A



N9936A



N9935A



N9344C



N9343C



N9342C



N9340B

20 GHz

13.4 GHz

7 GHz

3 GHz

CAT only

Combination analyzer

VNA

Spectrum analyzer

HSA

# Taking a Closer Look

## FieldFox - the new industry-standard

### Accurate

- **Get precise measurements that agree with benchtop results**
- Industry-leading amplitude accuracy of  $\pm 0.5$  dB
- Low trace noise of  $\pm 0.004$  dB and superior dynamic range of 94 dB
- InstAlign, CalReady, and QuickCal

### Rugged

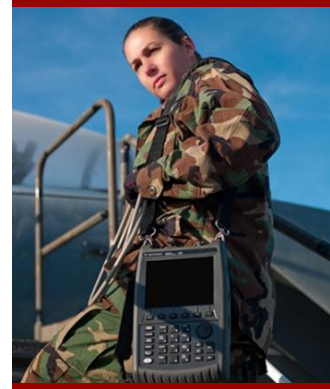
- Dust-free design with no fans or vents
- Water-resistant
- **3-year warranty ensures field confidence**
- Viewable in direct sun/darkness
- **MIL-spec durability**

### Flexible

- Configure as cable and antenna analyzers, vector network analyzers, spectrum analyzers, or all-in-one combination analyzers
- **Choose the right frequency, functionality, and price**
- Easily add extra options later by simply adding a license key – no extra hardware required

### Portable

- **Compact and lightweight** (3.0 kg or 6.6 lbs), long battery life (3.5 hrs)
- Wide operating temperature -10 to +55 °C (14 to 131 °F)
- Vertical orientation and large buttons make it easy to operate with one hand – even with gloves



# Carry Benchtop Accuracy into the Field with *InstAlign, CalReady, and QuickCal*

New

## InstAlign – automatic amplitude alignment

- Provides industry-leading amplitude accuracy of  $\pm 0.5$  dB at power-up, no warm up required
- Allows field users to instantly and precisely characterize transmitter power
- Power measurements agree benchtop instruments
- As environment conditions change, such as temperature, alignment automatically adjusts without user intervention

## CalReady

- Instrument is already calibrated at power on or preset and is ready to go without additional steps to calibrate
- Immediately ready to make calibrated measurements at the test ports

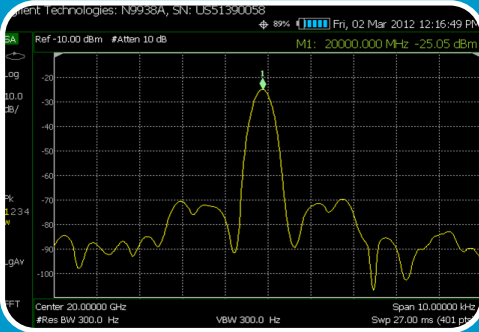
## QuickCal

- Built-in calibration - calibrate without a calibration (cal) kit
- With other instruments, adding devices such as jumper cables to the test port requires recalibrating with an external cal kit
- It automatically corrects for phase shift and loss of cables and adapters and electrically moves the calibration plane to the end of these components



# InstAlign: No Warm-up Required

## Industry-Leading Spectrum Analyzer Amplitude Accuracy



**FieldFox**  
marker reading: **-25.05**



**Agilent power meter**  
reading: **-25.04 dBm**

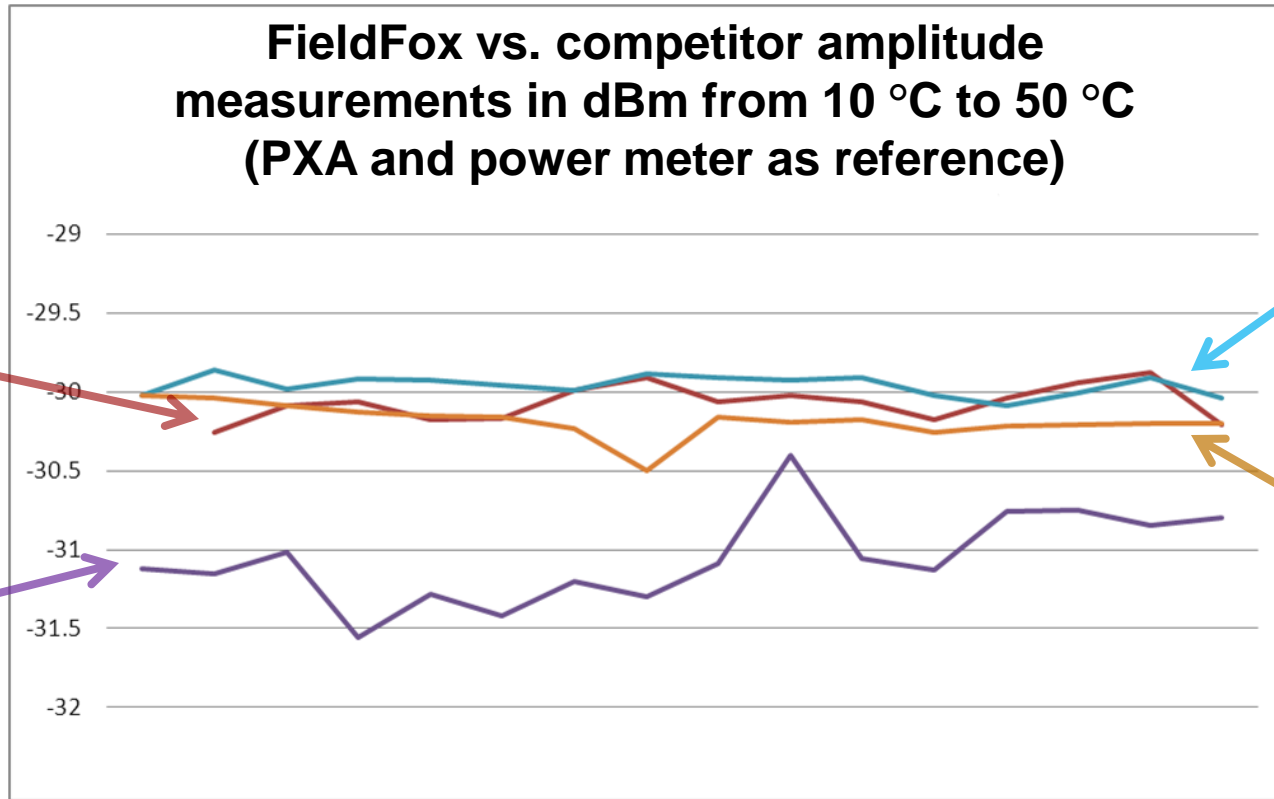
**Enables transmitter calibration in the field even during temperature variation.**

# InstAlign Provides Superior Accuracy Performance

*Matching high performance benchtop*

← ~ 2 hours →

**FieldFox vs. competitor amplitude measurements in dBm from 10 °C to 50 °C (PXA and power meter as reference)**



Agilent FieldFox microwave spectrum analyzer from cold start

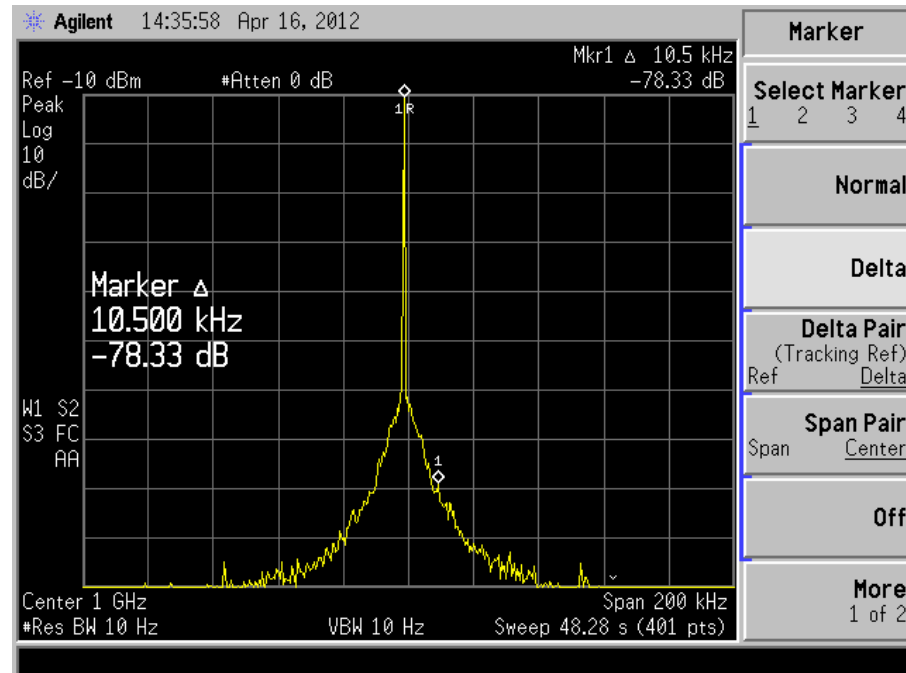
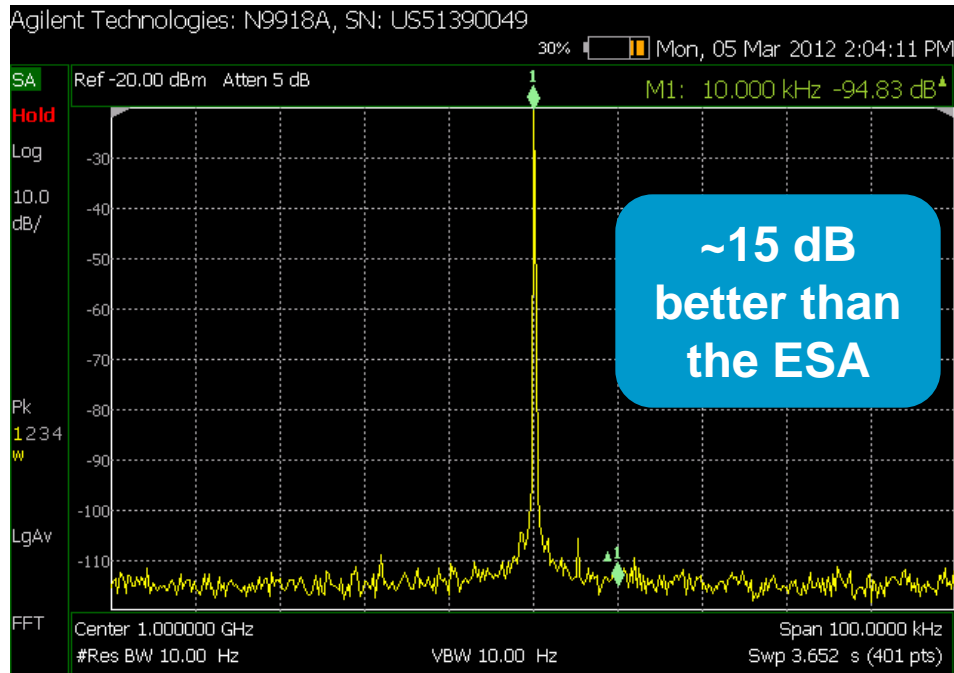
Competitor microwave spectrum analyzer from cold start

Agilent PXA in cal, warmed up

Agilent U2002A microwave power sensor

**FieldFox delivers benchtop accuracy to the field.**

# Deliver Superior Phase Noise than mid range bench tops (FieldFox vs ESA)

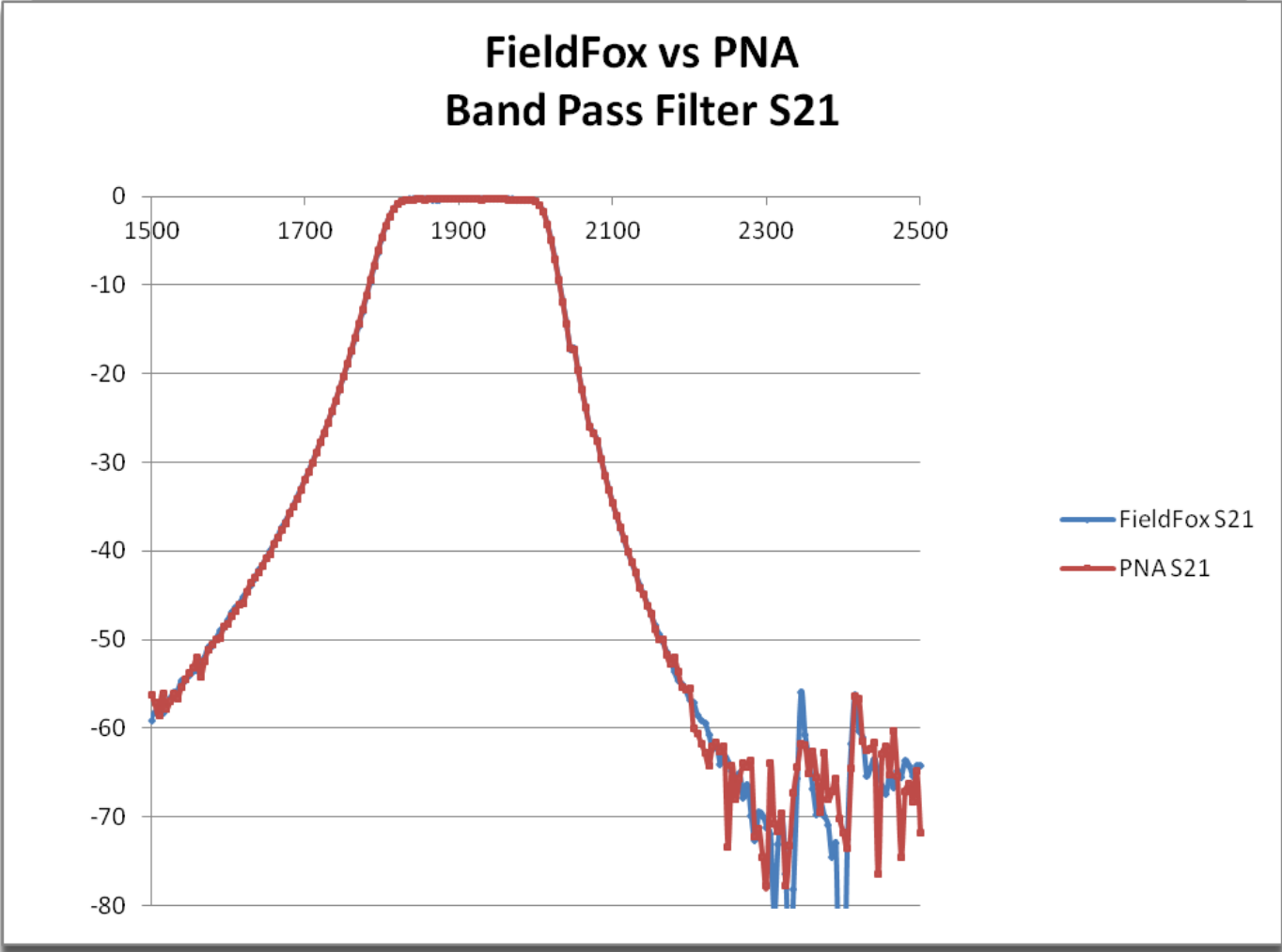


**FieldFox**  
Phase Noise @ 10kHz: -105dB/Hz

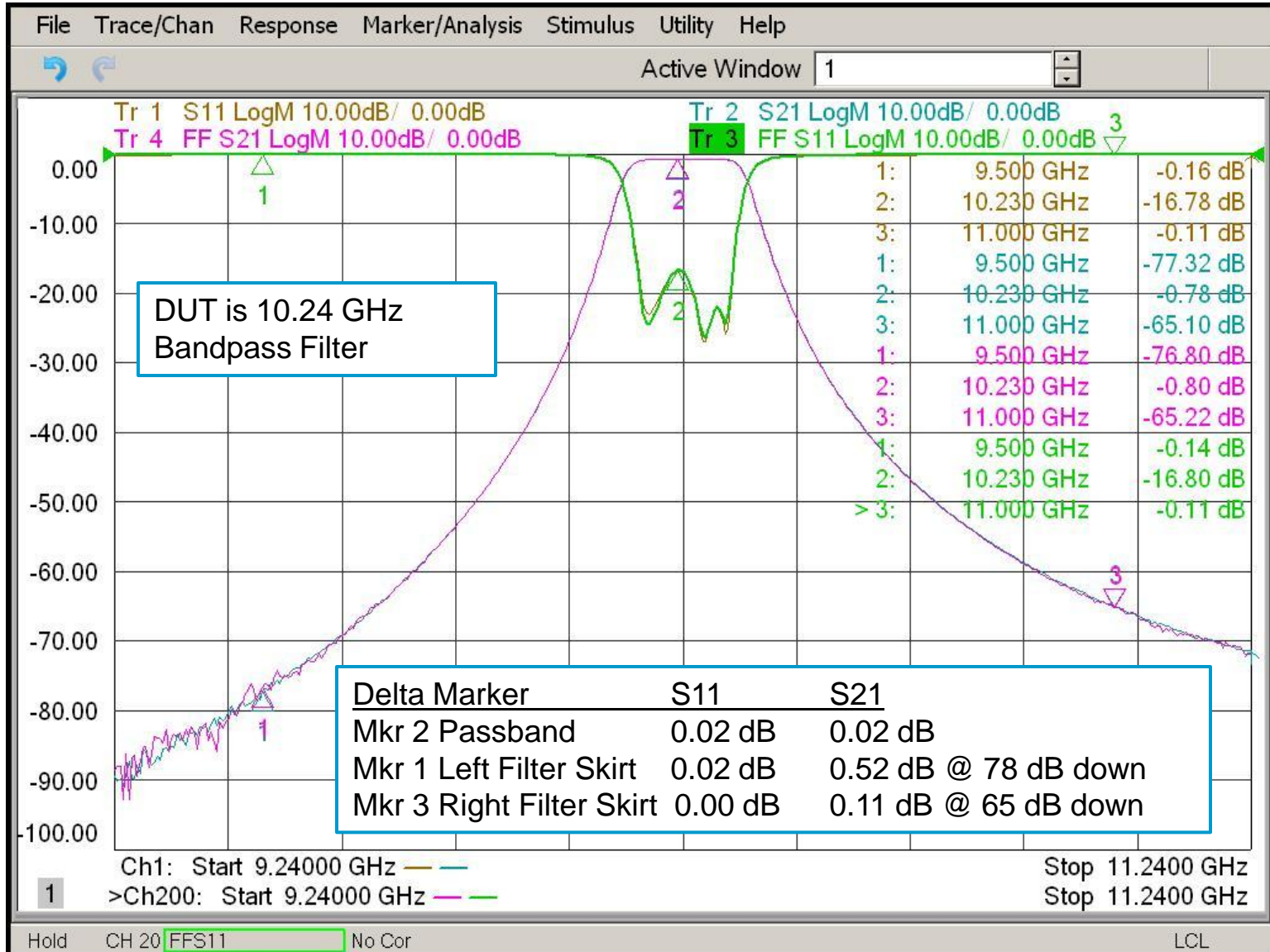
**ESA**  
Phase Noise @ 10kHz: -88 dB/Hz

**Allow user to detect close-in low level signals, usually was only detectable by high end bench top instrument.**

# Carry VNA Benchtop Accuracy into the Field



# Microwave FieldFox Compared to PNA-X



# Rugged Enough to Meet MIL-PRF-28800F Class 2

## MIL-spec durability

Meets **MIL-PRF-28800F Class 2** requirements

New

Type tested and meets MIL-STD-810G, Method 511.5 Procedure I requirements for operation in **explosive environments**



## Field-proof

Completely sealed instrument enclosure provides **measurement stability in harsh environments**

New

**3-year warranty** ensures field confidence (standard on all FieldFox analyzers)

**Water-resistant** chassis, keypad, and case withstand wide temperature ranges, and salty, humid environments

- Case withstands shock and vibrations
- **Wide operating temperature** -10 to +55 °C (14 to 131 °F)
- Wide storage temperature -51 to +71 °C (-60 to 160 °F)



# Portable - Pick up FieldFox for its Ergonomics

Vertical portrait orientation makes FieldFox comfortable to hold, and the keypad layout lets you easily operate it with your thumbs

Bright, low-reflective display and backlit keys enable easy viewing in darkness or direct sunlight

Large keys are easy to operate, even when wearing gloves



Weighing just 3.0 kg (6.6 lbs) FieldFox is easier to carry than similar analyzers

One-button measurements simplify complex setups and ensure quick, accurate results

The intuitive user interface is designed for the work you do every day, enabling measurements in just a few key presses

“I really like the packaging, and you’ve done a lot to simplify the controls and menus.”

- DoD technical lead for military contracts

# ...and Depend on its Durability

Specially designed connector bay protects connectors from damage due to drops or other external impacts



Keep going with the easily replaceable Lithium Ion battery



Transfer and archive data through LAN, USB and SD card

Gasketed doors protect connectors from dust and moisture

Rubber doors protect connectors from dust and moisture



# Combination Analyzer: 10 Instruments in 1

Cable and antenna analyzer  
30 kHz to 26.5 GHz

Full 2-port vector network  
analyzer with time domain  
analysis, 30 kHz to 26.5 GHz

Spectrum analyzer, with full-  
band tracking generator  
5 kHz to 26.5 GHz

Power meter  
5 kHz to 26.5 GHz

Built-in GPS receiver



Light weight: 6.6 lbs (3.0 kg)  
Long battery life: 3.5 hrs  
Bright display: 6.5 inch TFT  
MIL-PRF-28800 F Class 2  
MIL-STD-810G, 511.5, Proc 1

Independent signal generator  
30 kHz to 26.5 GHz

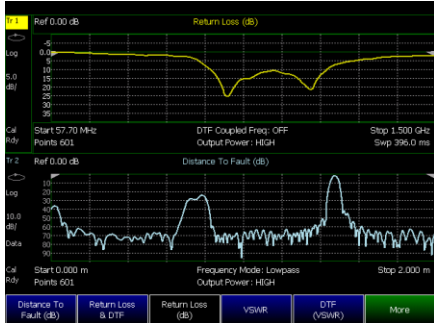
Vector voltmeter, 2-port  
30 kHz to 26.5 GHz

Interference analyzer

Variable DC source and  
current monitor

Frequency counter

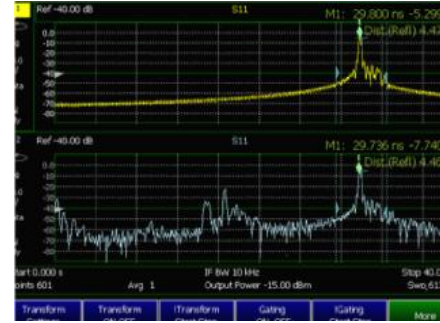
# Get a Wide Range of Precise Field Measurements



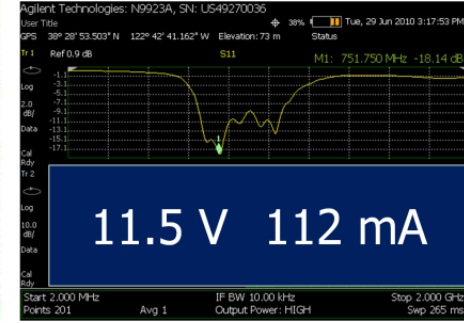
**Cable and antenna analysis**



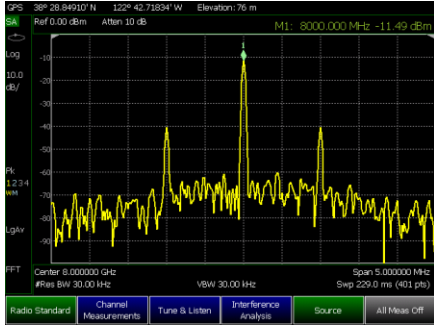
**Vector network analysis**



**Time domain**



**DC source & current monitor**

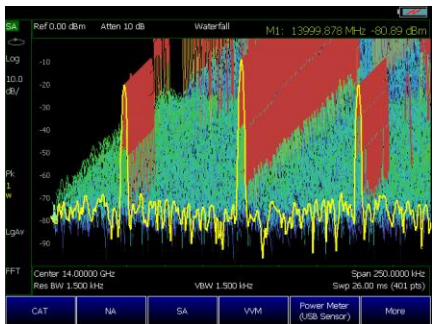


**Spectrum analysis**

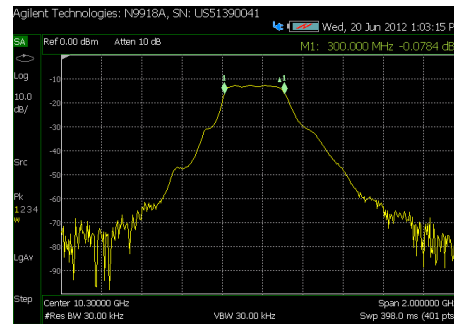
**Plus:**  
**Built-in GPS**  
**Independent source**  
**Full-band preamplifier**  
**SA frequency counter**



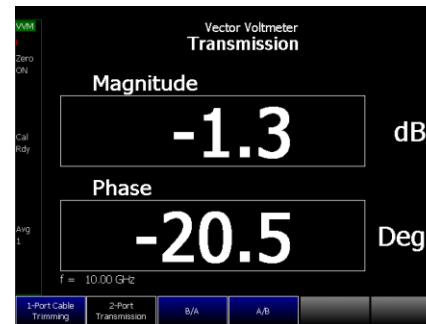
**Built-in power meter**



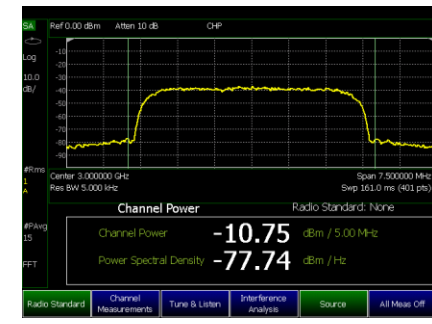
**Interference analysis**



**Full-band tracking generator**



**Vector voltmeter**



**Channel power measurement**

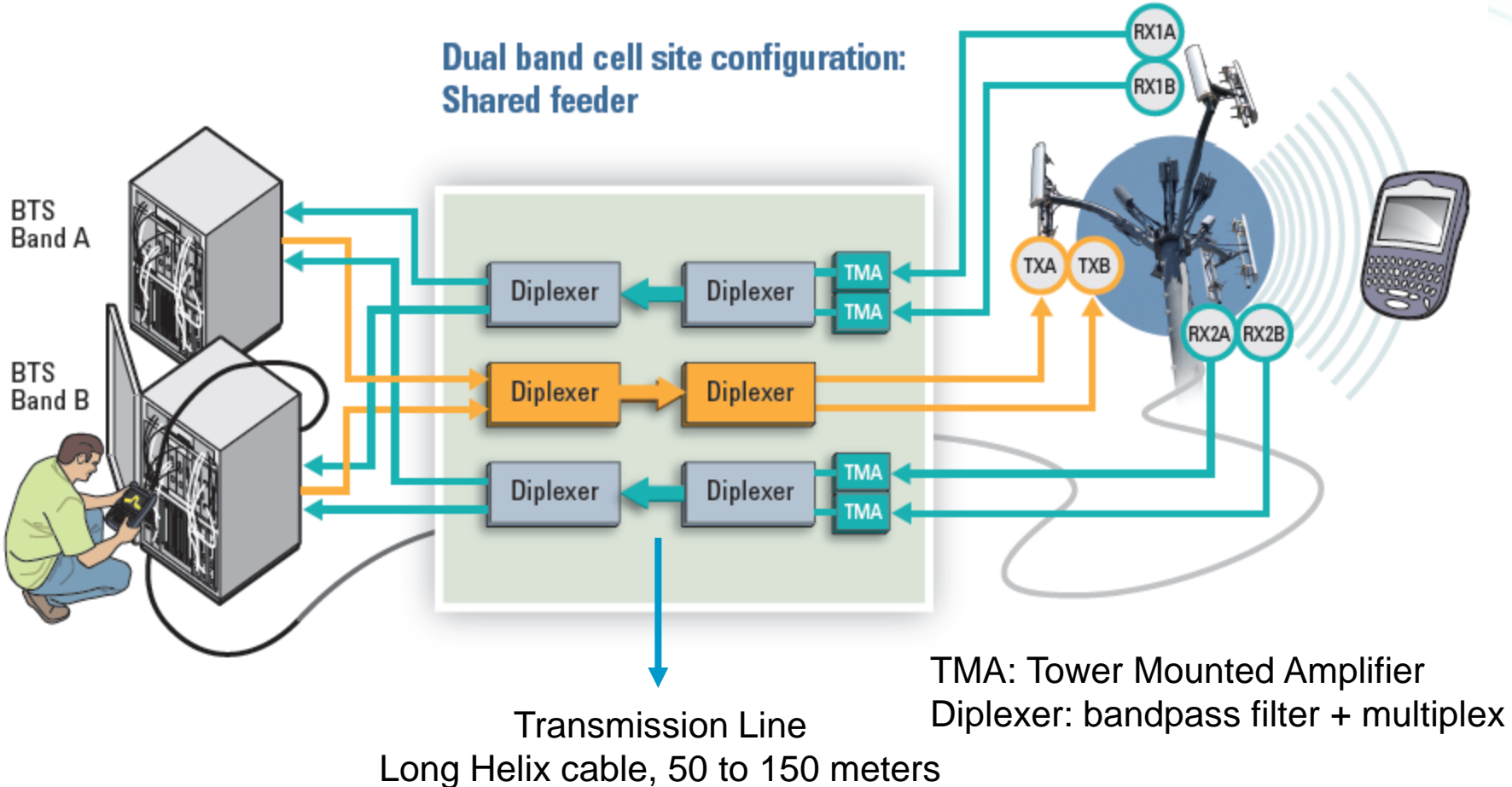
# Feature Comparison

*All features are license upgradeable*



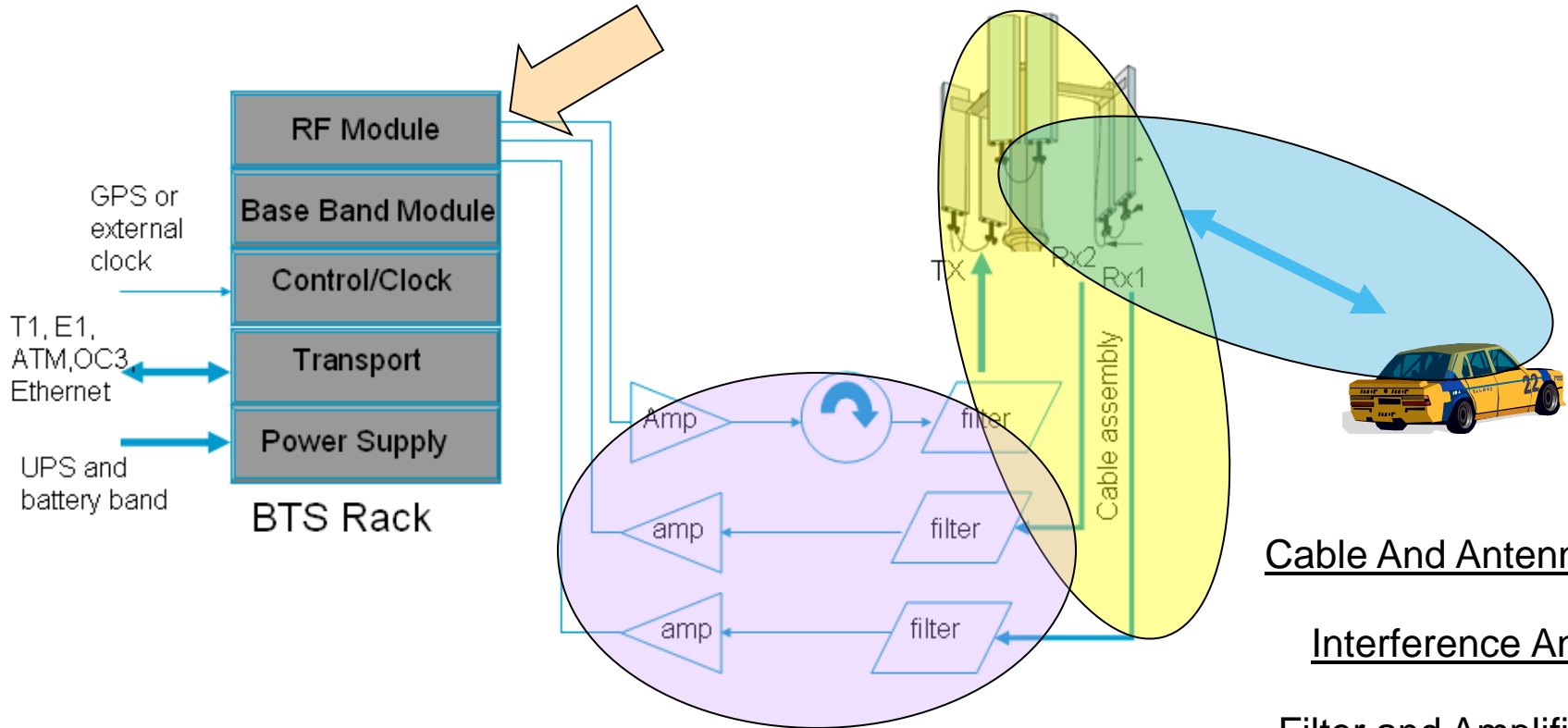
Available functions	Combination analyzers N991xA	Vector network analyzers N992xA	Spectrum analyzers N993xA
Cable and antenna analysis	✓	✓	
Vector network analysis	✓	✓	
Spectrum analysis	✓		✓
Interference analysis	✓		✓
Full-band preamplifier	✓		✓
Full-band tracking generator and independent source	✓		✓
Built-in power meter	✓	✓	✓
Vector voltmeter	✓	✓	
Built-in GPS receiver	✓	✓	✓

# Cell Site Configuration



# RF Issues need to be addressed in a cell site

## Cell Site Configuration



Cable And Antenna Test

Interference Analysis

Filter and Amplifier Test

TX Power Measurement

# Cable and Antenna Tests



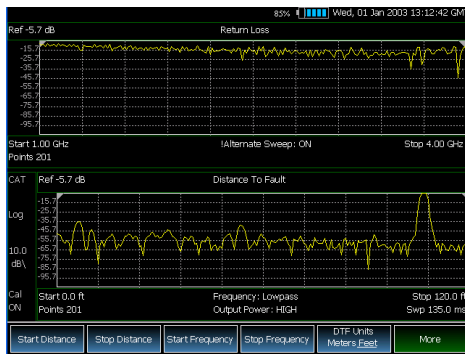
## Measurements

- Return loss
- Distance to fault
- Cable loss (1-port)
- Insertion loss
- Amplifier gain
- Isolation

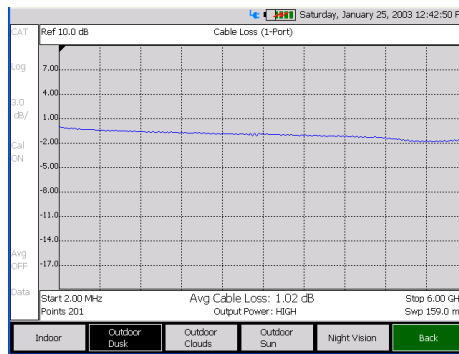


## Challenges:

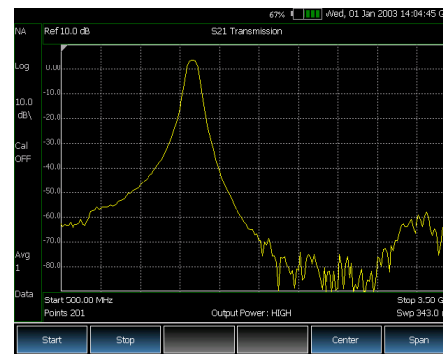
- Need fast sweep speed
- Measurement reliability



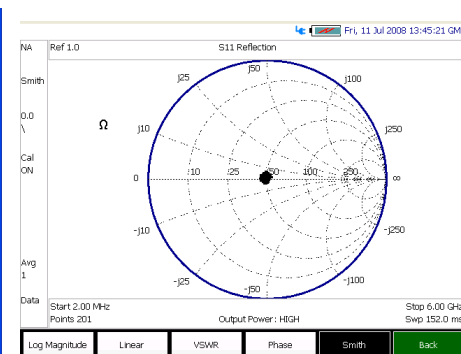
RL & DTF



Cable Loss



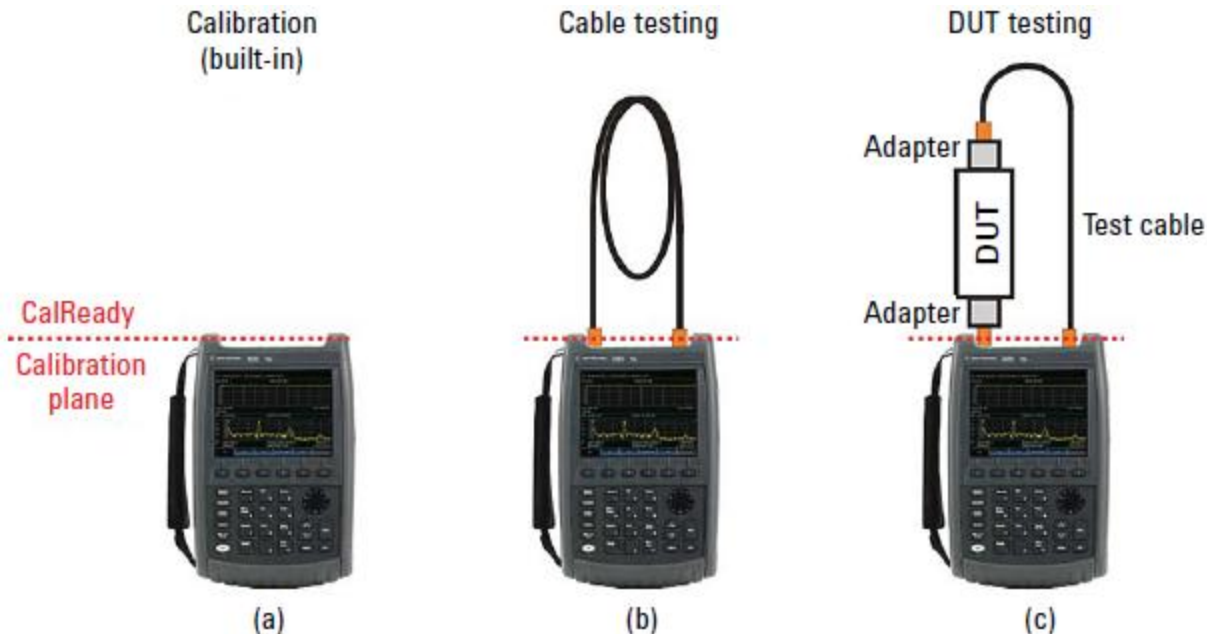
Insertion Loss



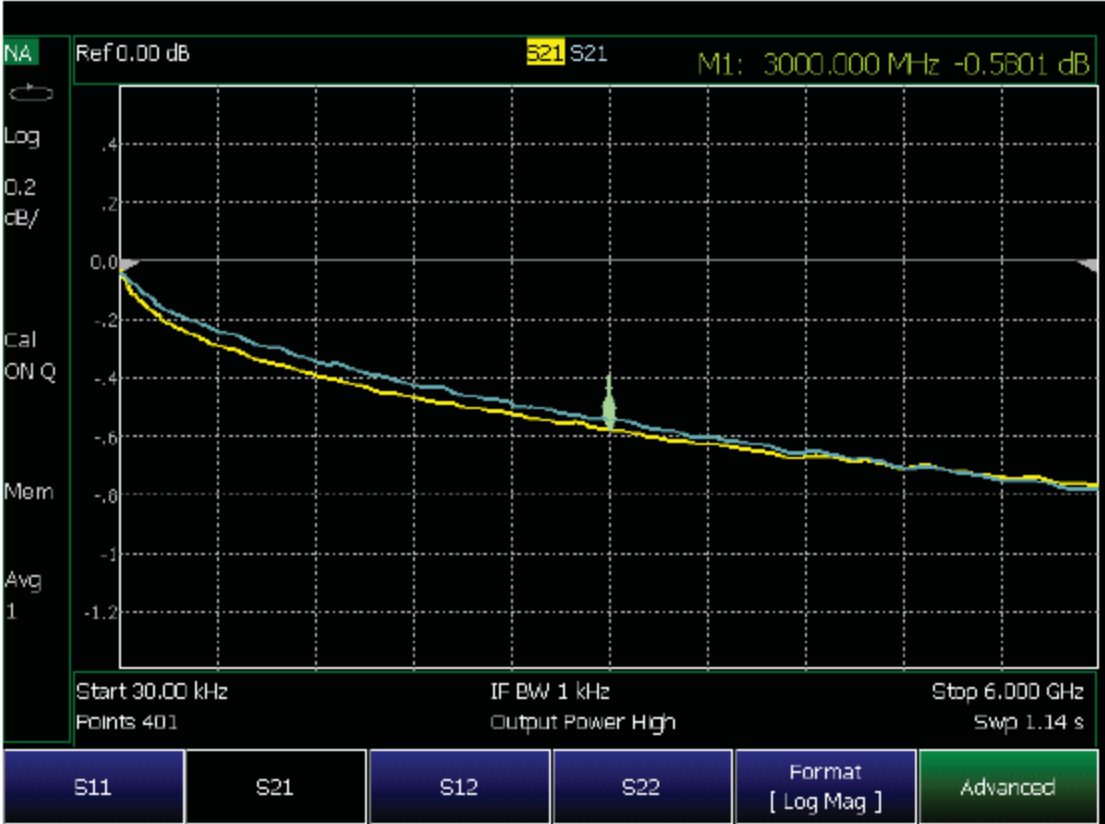
Smith Chart

# Innovative Cable and Antenna Measurements

- *CalReady* (at cable and antenna test port, **industry first**):
  - ❖ Calibration is done in factory at test port and saved as golden calibration.
  - ❖ It is calibrated as full span, box will automatically interpolate the data when frequency and/or resolution are changed.
- *QuickCal* (**industry first**):
  - ❖ No Cal kit needed, provides worry free measurement
  - ❖ Instrument will do auto port extension to any ref. plane.



# Quick Cal(yellow) vs Full 2-port Cal (blue)



# Interference Analysis



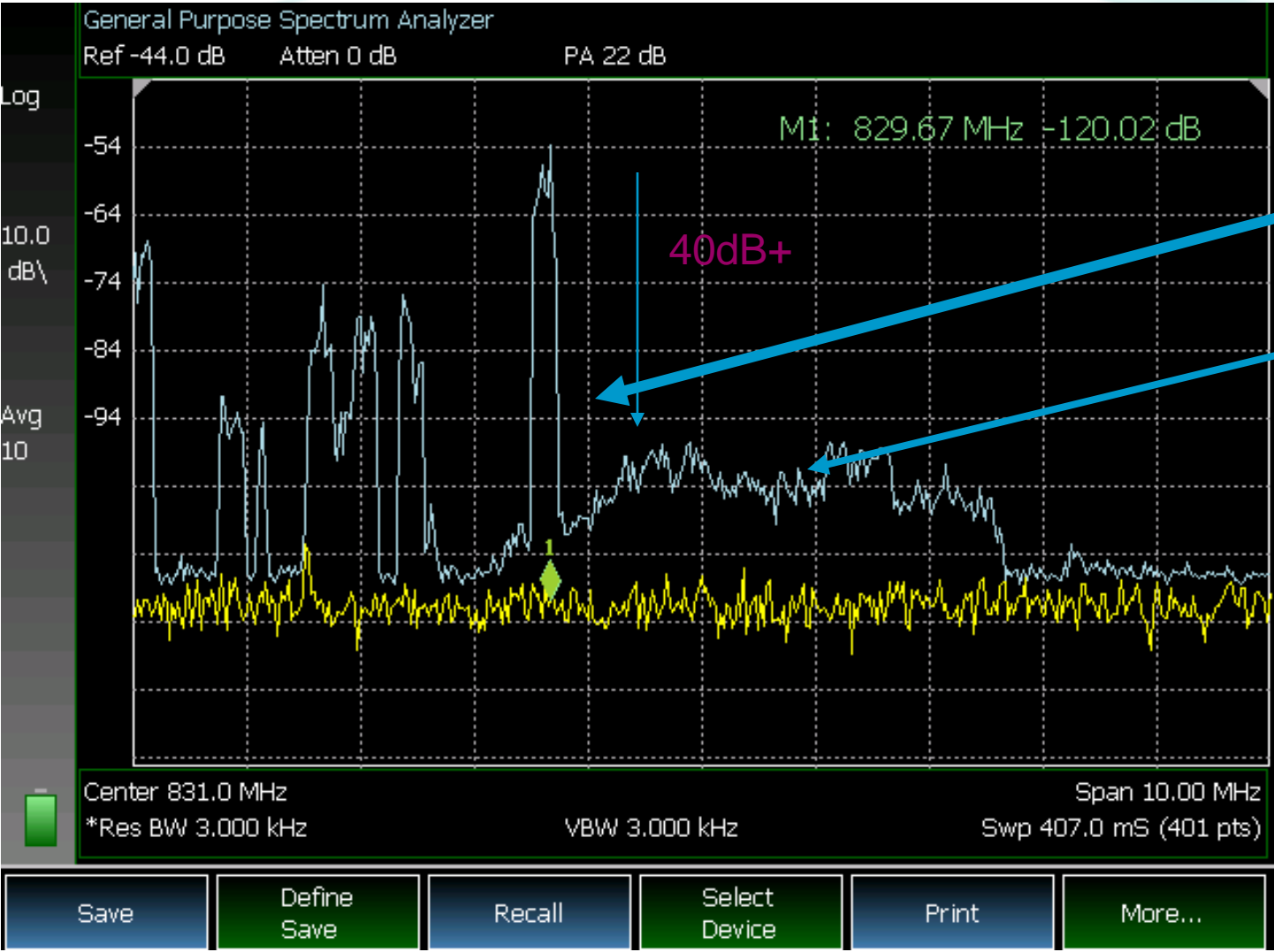
## Measurements

- Interference signal detection
- Signal monitoring
- Signal identification

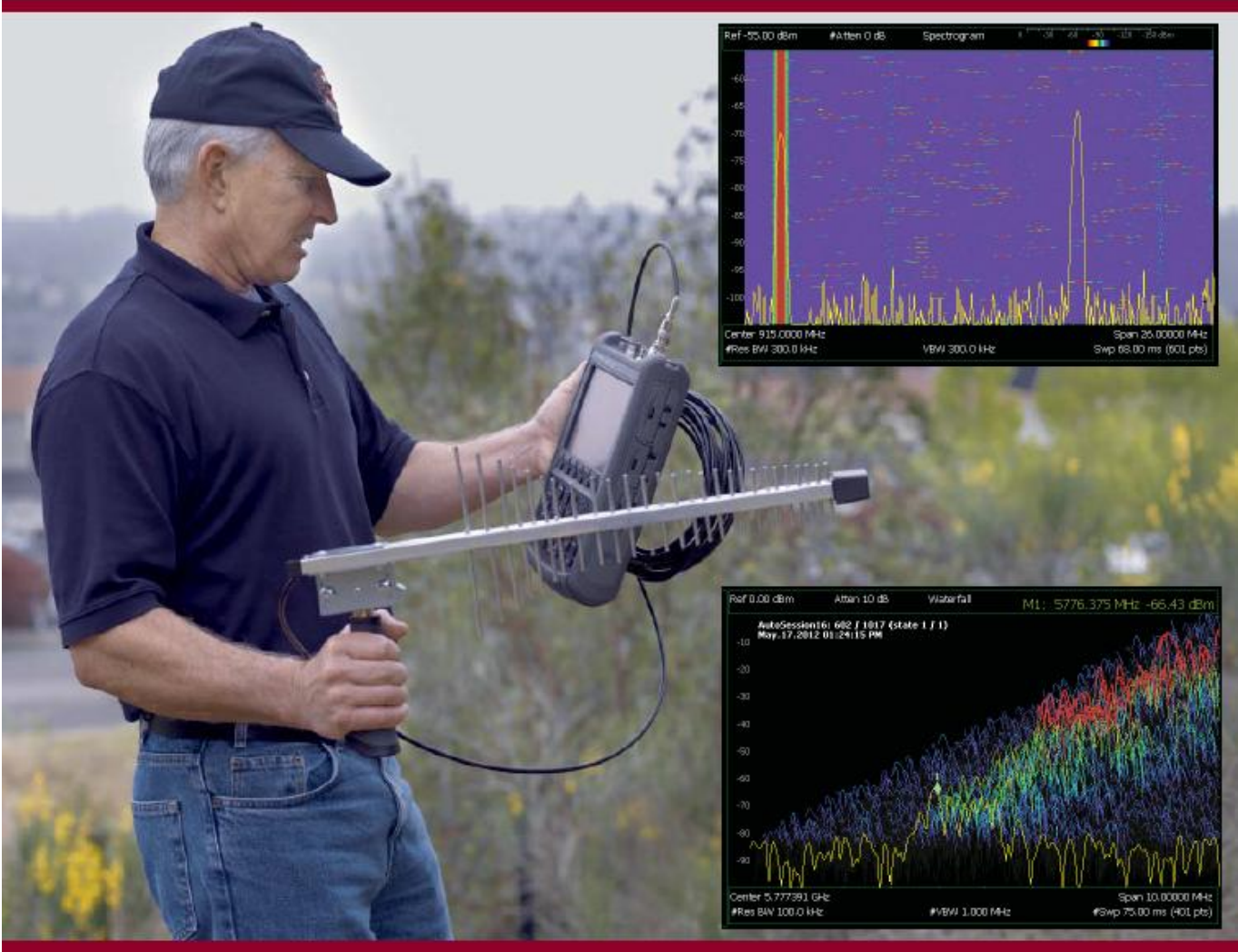
## Challenges

- Need fast sweep speed
- Higher dynamic range and superior sensitivity
- Ease of field use

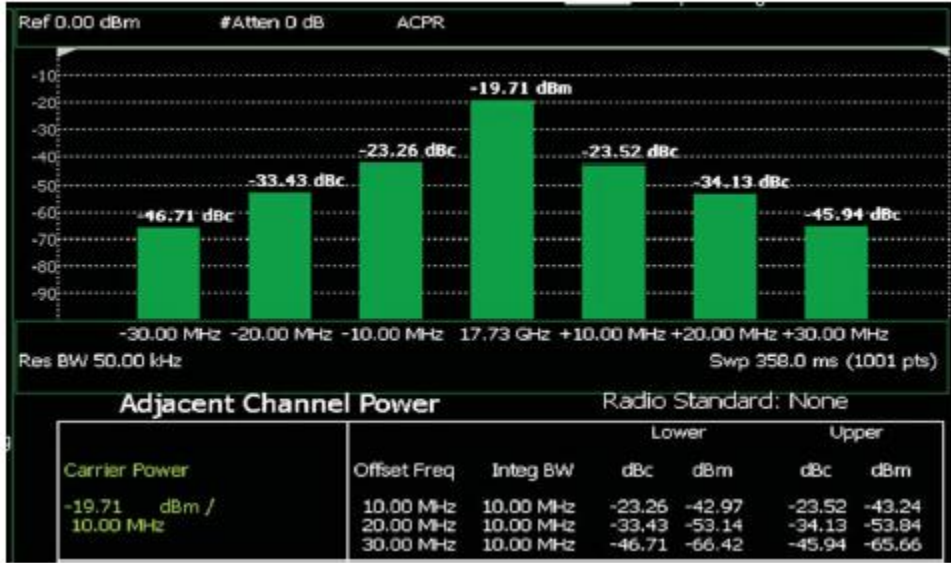
# GSM uplink signal interferes with UMTS uplink



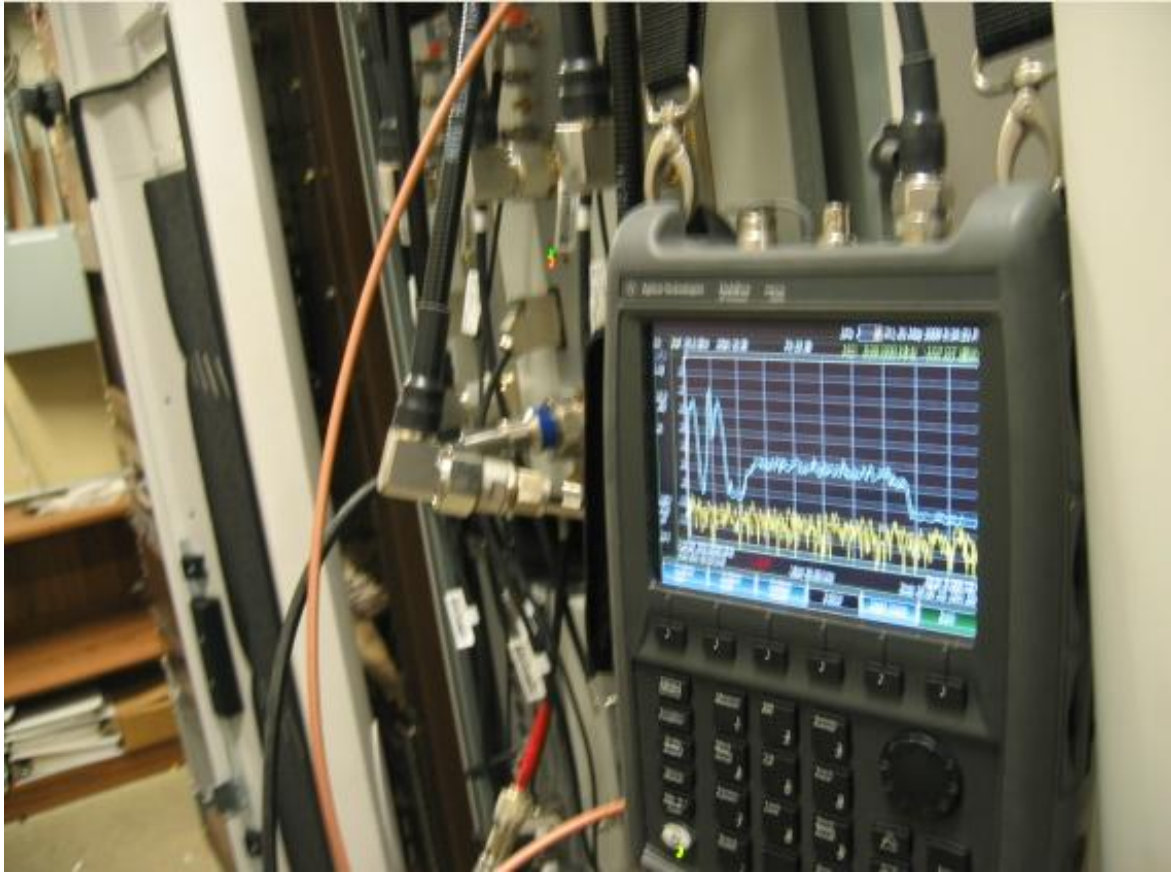
# Interference Analyzer: spectrogram, waterfall and record/playback



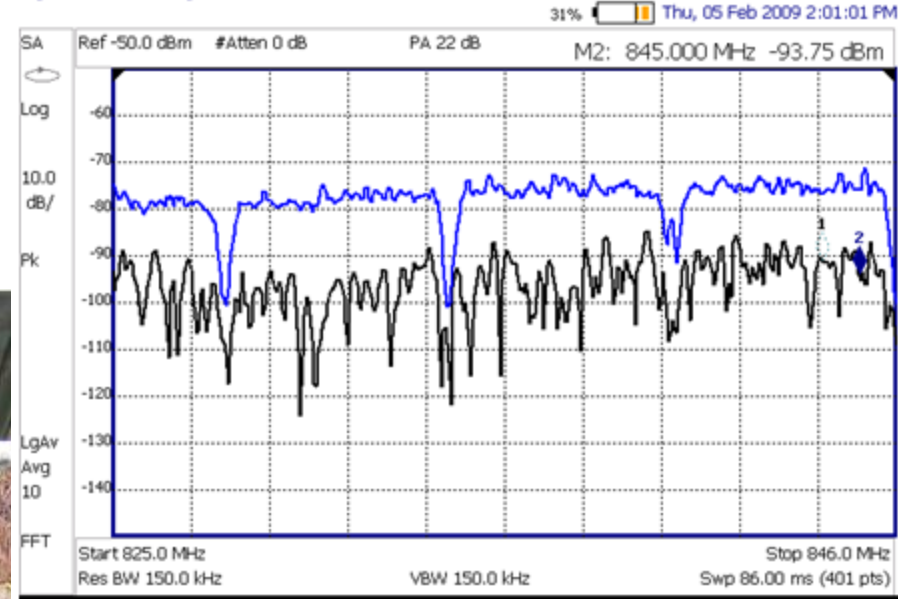
# Channel power, ACPR, OBW and AM/FM Tune/Listen



# Monitor uplink Signal from BTS



# Find a problematic CATV amplifier



CATV signal up to -75 dBm on 850 MHz band.

# New Microwave Accessories

Cal kits: 6, 9, 18 and 26.5 GHz



Yagi Antenna  
Cell and PCS

Waveguide cal kits



Microwave Test Cables



Trigger, IF, DC out cable



Adapters

# Summary

## Accurate

- **Get precise measurements that agree with benchtop results**
- Industry-leading amplitude accuracy of  $\pm 0.5$  dB
- Low trace noise of  $\pm 0.004$  dB and superior dynamic range of 94 dB
- InstAlign, CalReady, and QuickCal

## Rugged

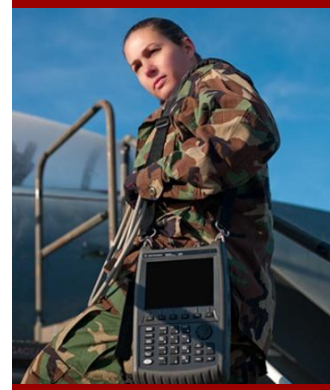
- Dust-free design with no fans or vents
- Water-resistant
- **3-year warranty ensures field confidence**
- Viewable in direct sun/darkness
- **MIL-spec durability**

## Flexible

- Configure as cable and antenna analyzers, vector network analyzers, spectrum analyzers, or all-in-one combination analyzers
- **Choose the right frequency, functionality, and price**
- Easily add extra options later by simply adding a license key – no extra hardware required

## Portable

- **Compact and lightweight** (3.0 kg or 6.6 lbs), long battery life (3.5 hrs)
- Wide operating temperature -10 to +55 °C (14 to 131 °F)
- Vertical orientation and large buttons make it easy to operate with one hand – even with gloves



# Additional Information



[www.agilent.com/find/FieldFox](http://www.agilent.com/find/FieldFox)

- **Application note series**
  - Interference analysis, cable and antenna analysis, calibration and alignment, time domain, power measurements, and site survey
- **Product literature**
  - Family brochure, technical overviews, data sheet, configuration guide, tri-fold photo card
- **Product introduction and demo videos**

## Webcasts

- Interference analysis, cable and antenna analysis, and more

# Precision. Readiness. FieldFox



**Count on the durability of FieldFox - designed to withstand the toughest working conditions.**

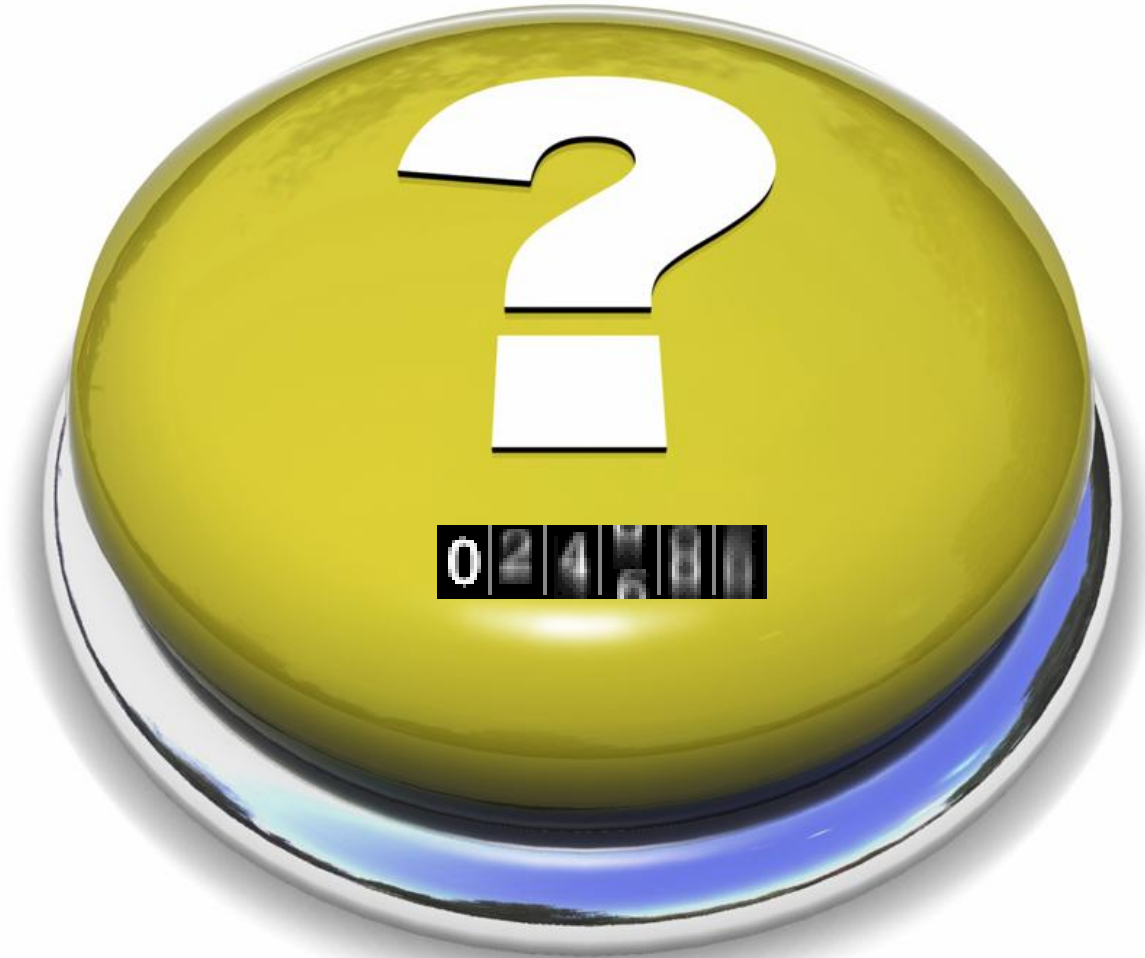
**Carry precision with you:** our microwave models deliver Agilent-quality measurements wherever you need to go.

**Boost your readiness:** with our RF units, every operating mode is flexible to meet the needs of novices and experts alike.

“The technology Agilent has developed is simply superior.”

- Major aerospace/defense prime contractor

# Thank you!



For further information, please contact Agilent Call Center.  
(080-769-0800, or e-mail to [korea\\_call@agilent.com](mailto:korea_call@agilent.com))