

New Handheld Spectrum and Cable & Antenna Analyzer Overview

SH-75S-TC Overview, New Features
SK-9000-TC Overview, New Features



SignalHawk New Features



SH-75S-TC

9 kHz – 7.5 GHz



9 kHz – 7.5 GHz

Expanded Wi-Fi 6 testing in the 6GHz Bands
 Gate Scanning (Uplink slot interference analysis) for 4G LTE and 5G NR networks
 Interference Mitigation in the 6GHz Band

NEW
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 Gate Scanning (Uplink slot interference analysis) for 4G LTE and 5G NR networks
 Interference Mitigation in the 6GHz Band

Adjacent Channel Power Ratio (ACPR)
 Occupied bandwidth (OBW)
 Channel Power (CH Power)
 N dB Down Bandwidth
 GNSS Signal Quality
 FM Demodulation
 Field Strength
 Spectrum Mask
 Spectrogram/Waterfall

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 GNSS Signal Quality
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 Spectrum Mask
 Spectrogram/Waterfall



Interference Analysis
 (Triangulation overlaid on map)

Mapping provided by OpenStreetMap



SH-75S-AOA



SignalHawk Spectrum Analyzer



What's included?



Both models come with: SH-75S-TC
and SH-75S-AOA

1. Spectrum Analyzer
2. Rugged Hard case
3. Soft case
4. AC Adapters
5. Stylus pen
6. USB drive
7. USB adapter

3-Year Warranty!



SH-75S-TC and AOA



SignalHawk Spectrum Analyzer



What's new for the SH-75S-?

- 5G NR Uplink interference hunting utilizing a gated trigger or **Gate Scanning** mode.
- **Extended frequency range.** Now covering 9KHz to 7.5 GHz.

In addition, new **KEY MEASUREMENTS** also include:

- CNR (Carrier To Noise) Loss
- Frequency Check
- CDD (Cyclic Delay Diversity)
- Background Spectrum



Who are the Customers?

Public Safety

Land Mobile Radio

Transportation

Military-Aerospace and
Defense

IT & Telecommunications

Security/Surveillance

**Mobile Network
Operators**

**Mobile Network
Contractors**

**Field Service
Technicians**

Wireless Communications Systems
Service providers, Cellular and Mobile Network Carriers



5G Field Testing Challenges



5G is presenting new challenges for **mobile network operators, contractors and field service technicians** to validate networks.

The separation between fiber and RF environments is becoming blurry; **it's less clear where one ends and the other starts.**

- Analyzing spectrum can be difficult because of the **wider bandwidths and more interference falling inside the channel**, making troubleshooting a longer process.

WHY? Intermittent signals such as TDD add complexity to the spectrum analysis

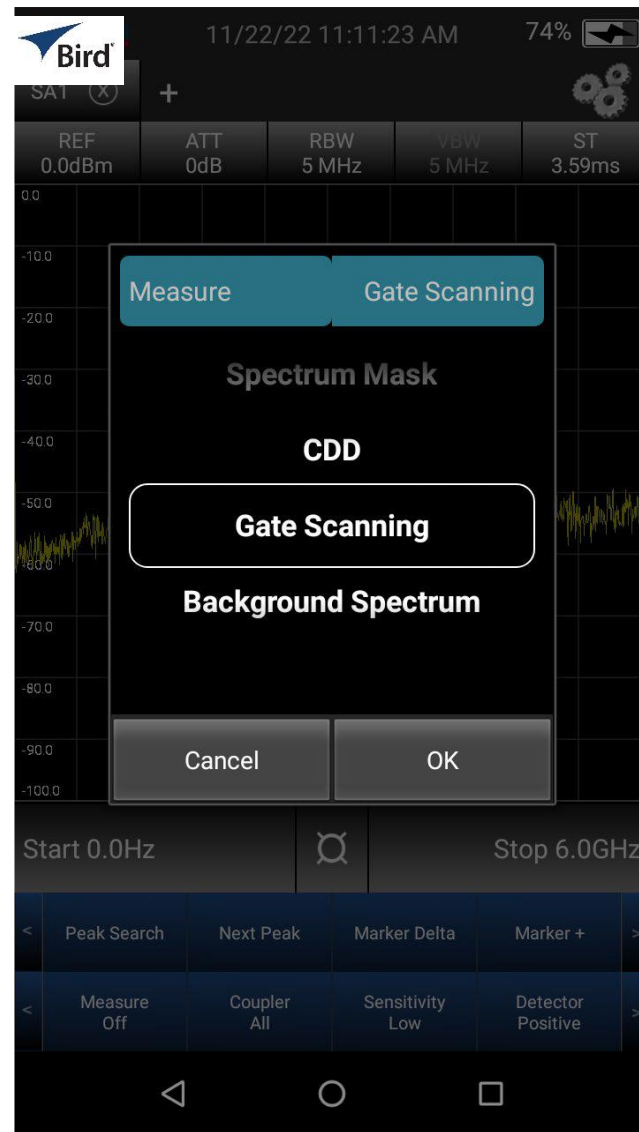
WHERE? 5G or LTE networks

HOW? GATE SCANNING



Base operation – Gate Scanning

- **Gate Scanning** is preloaded and easily accessible via the Measure menu.
 - Enter the spectrum interface, click "Measure", and select the Gate Scanning mode



Once selected, the Display Interface is divided into two sections:

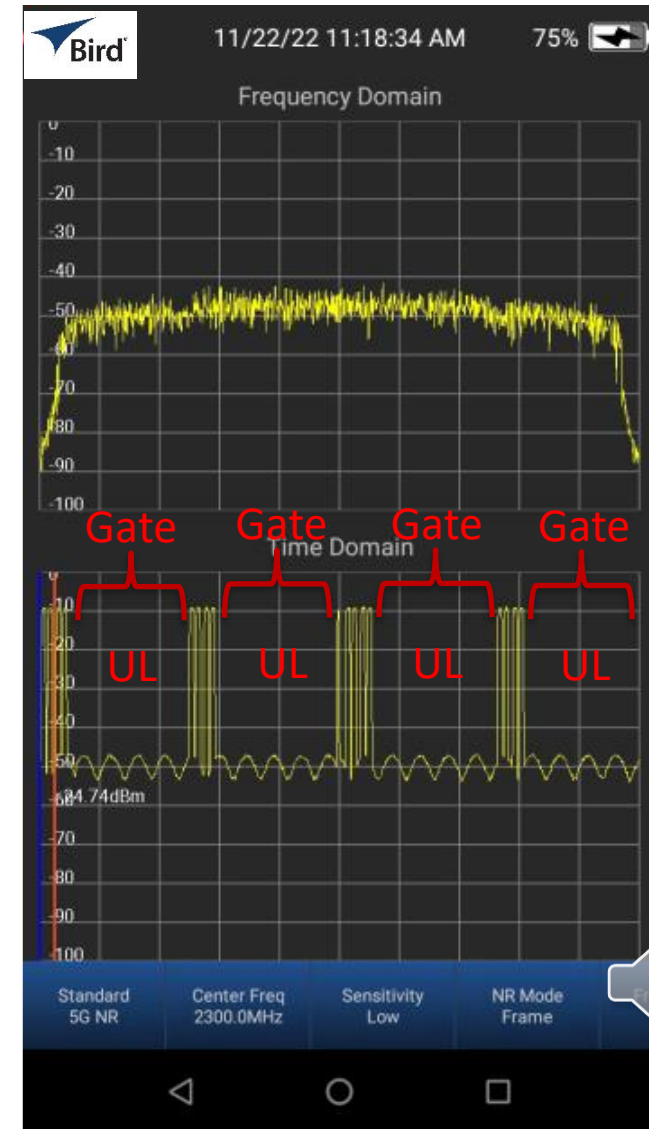
1. Frequency domain
2. Time domain



Gated Trigger or Gate Scanning

What is Gate Scanning?

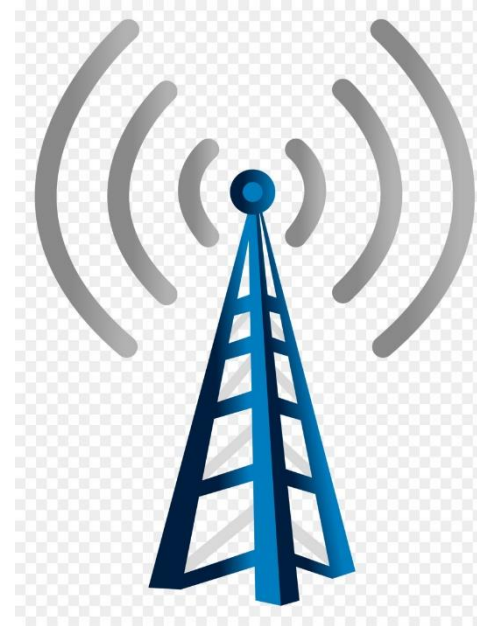
- It is a tool that will help distinguish the Uplink and Downlink timeslots in the time domain.
- It can be used to distinguish and observe spectrum in the specified timeslot or time segment and can be used to identify interference signals hidden within the uplink timeslots.
- A directional Antenna can be used to distinguish and analyze the Uplink slot interference.



Gate Scanning

Why is it needed?

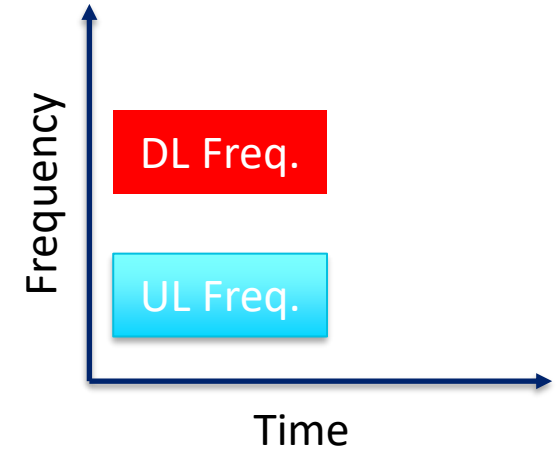
- To understand why, we first need to take a closer look at the communication technologies used by most commercial carrier systems.
- Two of the primary options being FDD and TDD technologies.
- FDD is short Frequency Division Duplex
- TDD is short for Time Division Duplex



Gate Scanning

FDD (Frequency Division Duplex)

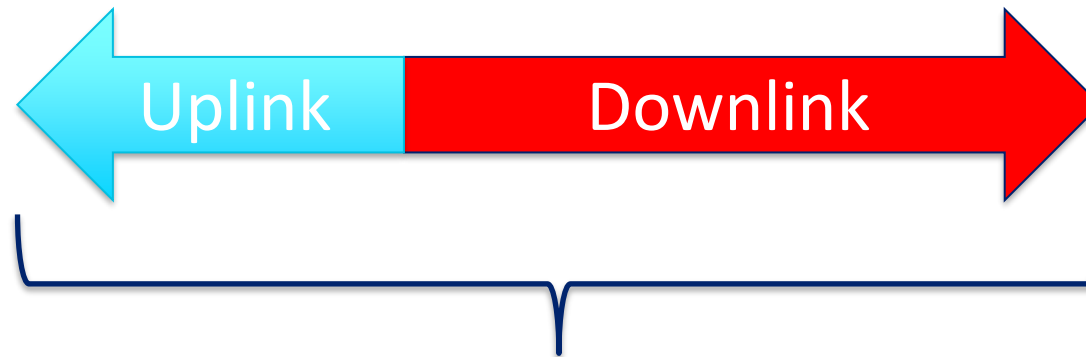
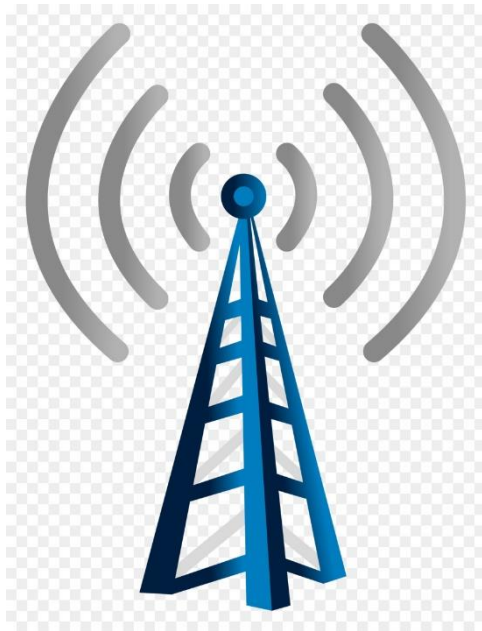
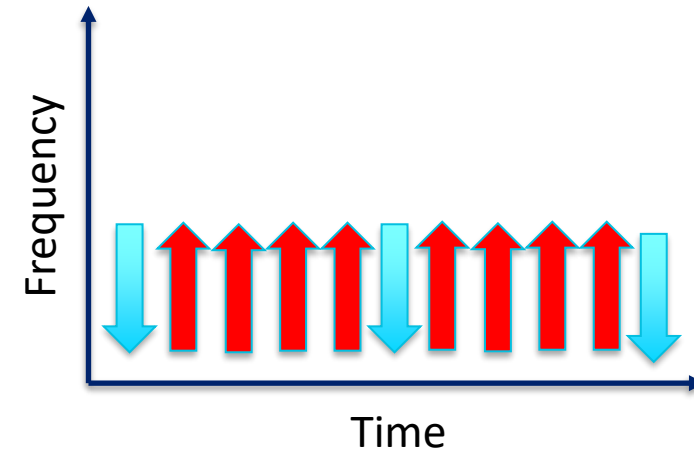
- Is a technique that uses separate frequency bands for uplink and downlink communication.
- It is a full-duplex method where the Transmit and Receive functions occur simultaneously and at different frequencies.



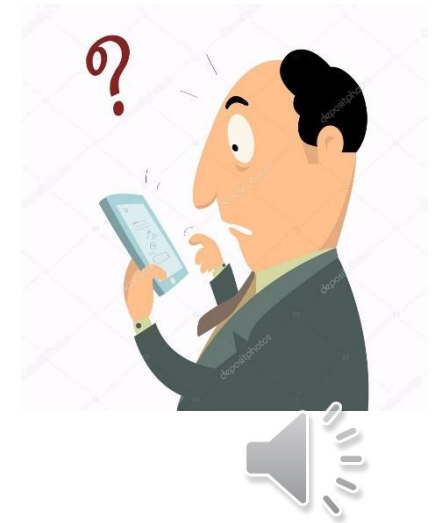
Gate Scanning

TDD (Time Division Duplex)

- Is a duplexing technique that employs a single frequency band for uplink and downlink, but two communications occur at different timeslots
- It is a half duplex method, Transmitting and Receiving across an entire band.
- Is the better choice for asymmetric systems where UL and DL capacity is constantly changing.



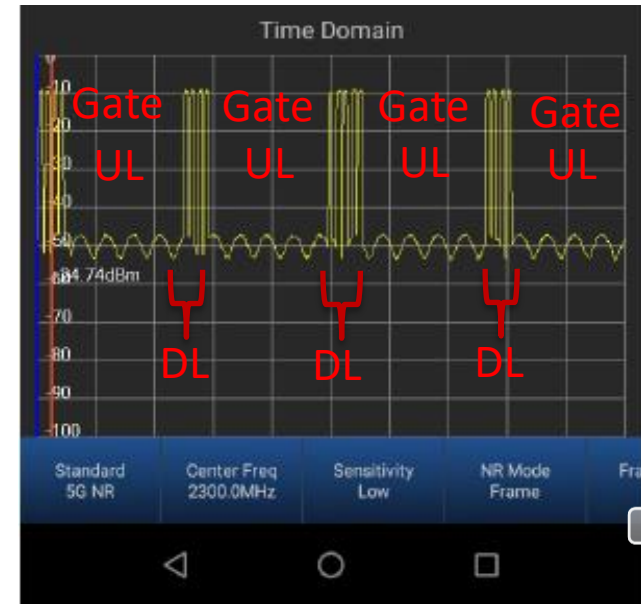
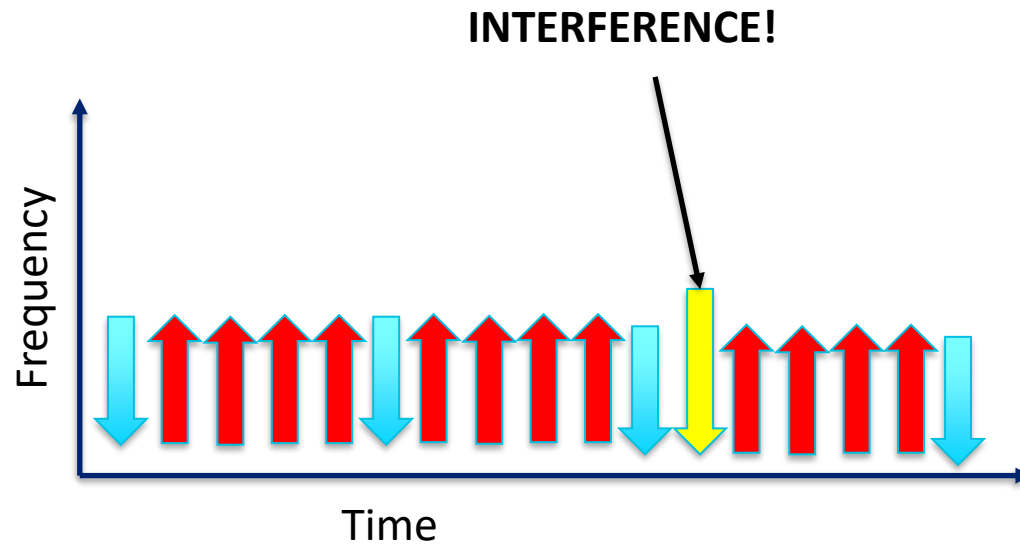
Single Broadband Frequency



Gate Scanning

TDD (Time Division Duplex) cont.

- With the ability view the spectrum in time, the user now can narrow in on specific UL Gates to analyze and identify interferers.
- Downlink time slots are "always on" and constantly transmitting signals, but uplink time slots may or may not have traffic, so signals are intermittent.



Expanded Range



Range now included frequencies up to 7.5 GHz

New applications for its use:

Wi-Fi 6E:

- In April of 2020, the Federal Communications Commission voted unanimously to open the 6GHz band for unlicensed use.
- Wi-Fi 6E adds support for 6 GHz spectrum
- The Wi-Fi Alliance allocated 1200 MHz of spectrum from 5.925 to 7.125 GHz for Wi-Fi applications.
- Wi-Fi 6E can operate using 14 additional 80 MHz channels and 7 additional 160 MHz channels
- All of this really means is more bandwidth for our devices to operate in!



SK-75S-XX and its expanded range can help users optimize networks in this range and could be a key to successful deployments.

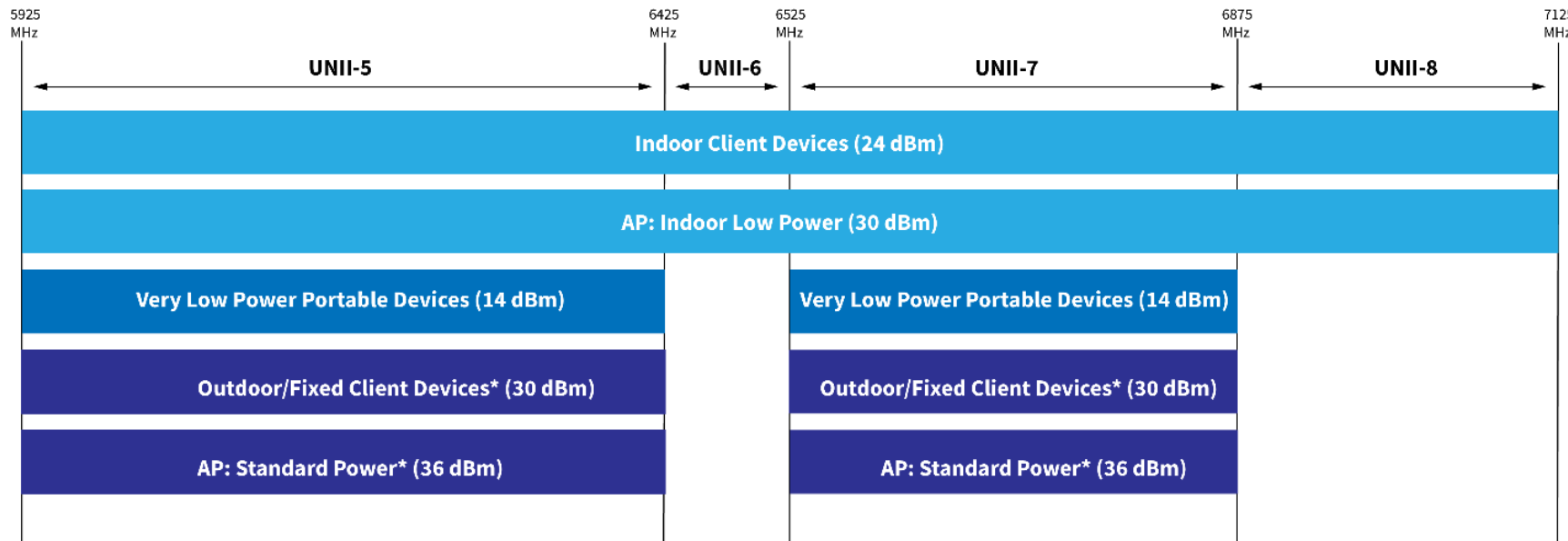


Expanded Range

New applications cont.:

Interference Mitigation in the 6 GHz Band:

- A major issue with the advent of Wi-Fi 6E is that many users already use this spectrum, including 5G cellular, satellite links, mobile TV broadcasts, and Utility communication links.
- Electric, water, and natural gas utilities, along with railroads and other critical infrastructure industries, use fixed wireless communications networks housed in the 6 GHz spectrum band for mission critical communications.



* Automated Frequency Coordination (AFC) required

Additional Applications

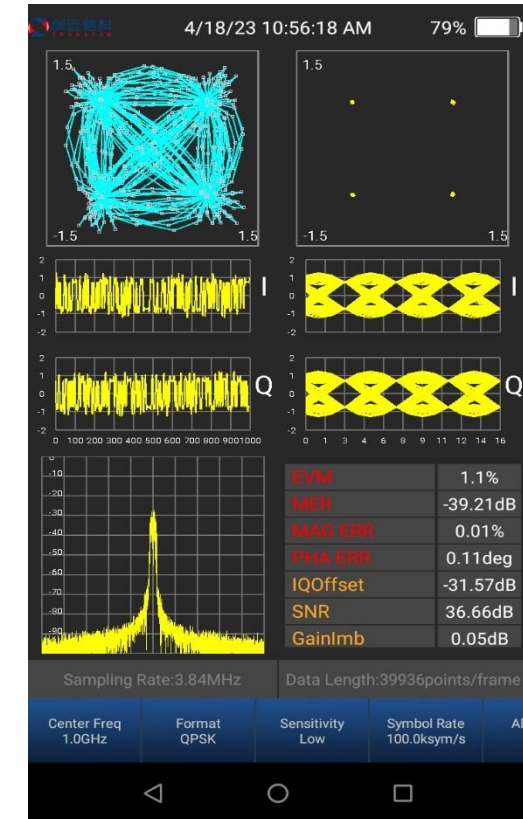
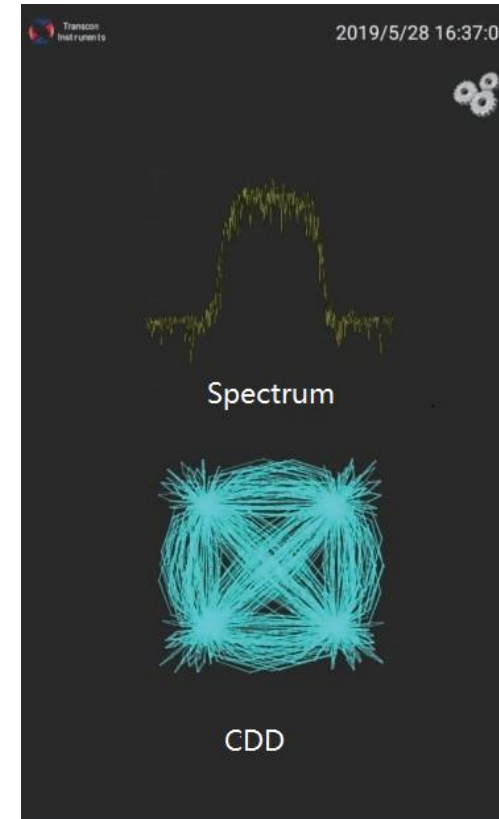
Indoor Coverage Testing

- **Indoor** signal quality test: - Simulate the CW signal source and tag along with spectrum analyzer then able to test the chamber link antenna port;
- **LTE/5GNR** indoor coverage test: Simulate the LTE/5GNR modulation signals, tag along with a spectrum analyzer to conduct room division signal quality coverage testing in indoor.



Digital Signal Demodulation

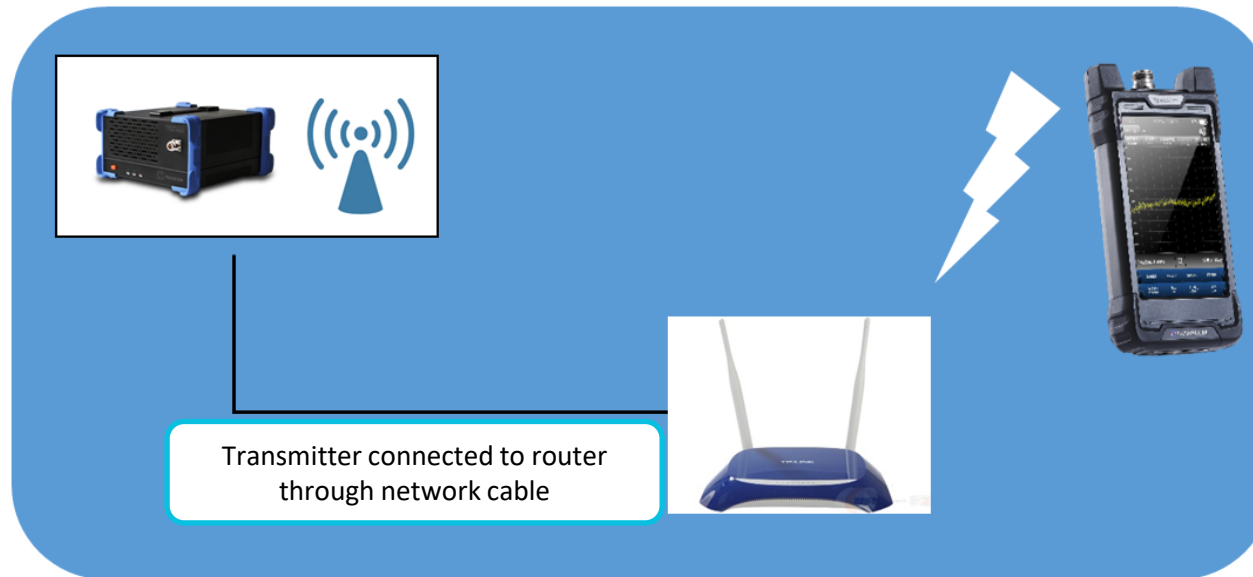
- The SH-75S supports a general digital demodulation function of a signal
- It can break down a signal into modulation domain, time domain, and frequency domain
- Test result can show in spectrum, IQ constellation, EVM, frequency error as well as other information
- It support multiple modulation methods such as BPSK, QPSK, OQPSK, 8PSK, 16QAM, 32QAM, 64QAM, etc.



Additional Applications

Chamber EMI monitoring

- Isolate external electromagnetic interference and ensure the normal operation of indoor electronic and electrical equipment;
- Block the diffusion of indoor electromagnetic radiation to the outside world;
- Prevent information leakage from electronic communication equipment and ensure information security



SiteHawk Handheld Cable and Antenna Analyzer 9 GHz



SK-9000-TC

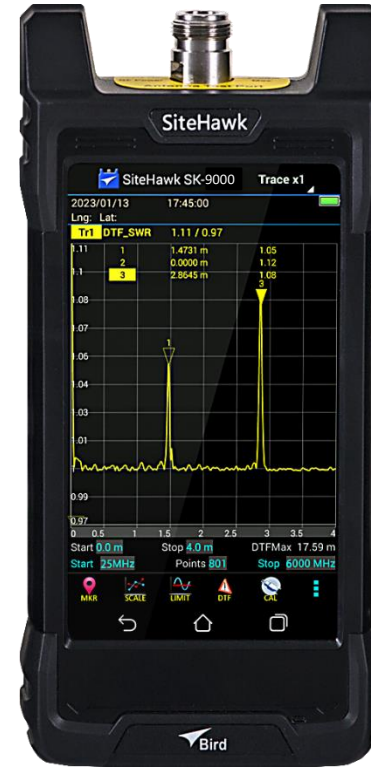


SiteHawk New Features



SK-4500-TC
SK-6000-TC

<p>1MHz – 4.5 GHz 1MHz – 6 GHz</p>		<p>1 MHz – 9 GHz</p>
	<p>NEW</p>	<p>Expanded testing up to 9 GHz Bands</p>
<p>Measure/Match Frequency Response Cable Loss DTF(Distance to Fault) Mode</p>	<p>Features</p>	<p>Measure/Match Frequency Response Cable Loss DTF(Distance to Fault) Mode</p>
<p>NEW</p> <p>Target Customers</p> <p>Cellular Networks 3G, 5G (2.4, 4.2 GHz & 600, 850 MHz) PCS/DCS, CDMA, GSM and LTE Protocols Broadcast Paging Government Tactical Military Microwave Public Safety Trunking, TETRA Network Coverage WLAN, WLL (802.11)</p> <p>*Hi-Accuracy RF Power (USB Sensor required)</p>	<p>NEW</p> <p>Target Customers</p> <p>Sat-Com (i.e., satellite uplink/downlink)</p> <ul style="list-style-type: none"> • C-Band FSS (Fixed Satellite Service) • Some X-Band <p>Military/Civilian Satellite Communications</p> <p>Cellular Networks 3G, 5G (2.4, 4.2 GHz & 600, 850 MHz) PCS/DCS, CDMA, GSM and LTE Protocols Broadcast Paging Government Tactical Military Microwave Public Safety Trunking, TETRA Network Coverage WLAN, WLL (802.11)</p> <p>*Hi-Accuracy RF Power (USB Sensor required)</p> 	<p>NEW</p> <p>Sat-Com (i.e., satellite uplink/downlink)</p> <ul style="list-style-type: none"> • C-Band FSS (Fixed Satellite Service) • Some X-Band <p>Military/Civilian Satellite Communications</p> <p>Cellular Networks 3G, 5G (2.4, 4.2 GHz & 600, 850 MHz) PCS/DCS, CDMA, GSM and LTE Protocols Broadcast Paging Government Tactical Military Microwave Public Safety Trunking, TETRA Network Coverage WLAN, WLL (802.11)</p> <p>*Hi-Accuracy RF Power (USB Sensor required)</p>



SK-9000-TC



SiteHawk Family



What's included?



SK-9000-TC

1. Cable and Antenna Analyzer
2. Rugged Hard case
3. Soft case
4. AC Adapters
5. Stylus pen
6. USB drive
7. USB adapter

3-Year Warranty!



New SiteHawk Addition



SK-9000-TC

9 GHz Handheld Cable and Antenna Analyzer

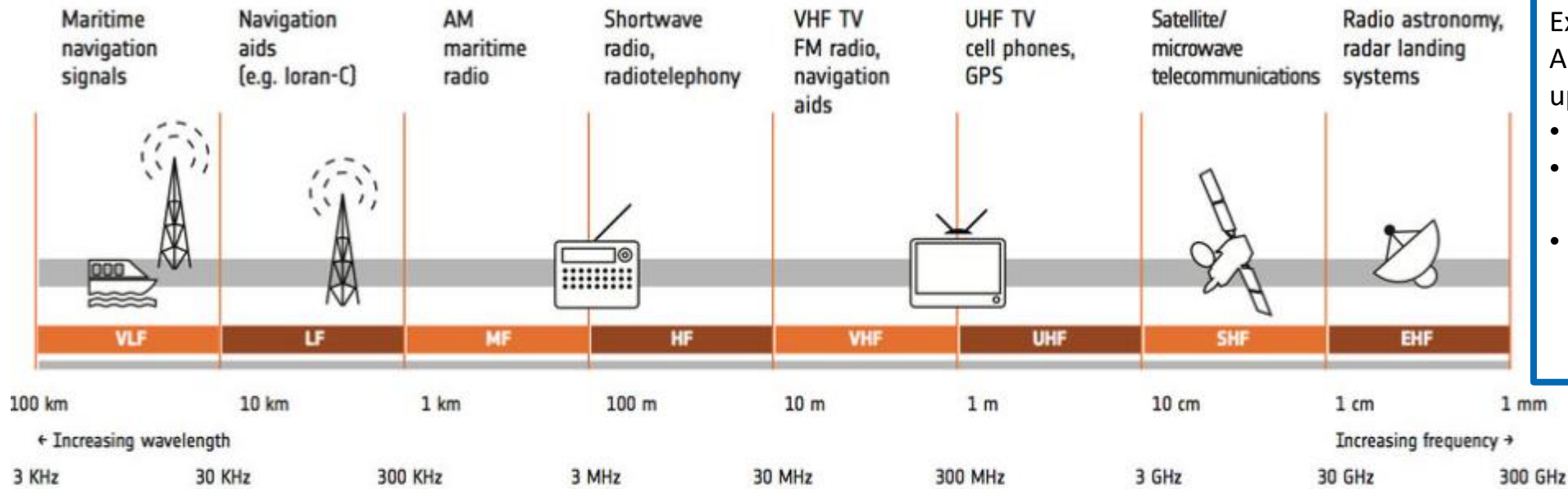
Expanding Coverage up to 9GHz

Application: Sat-Com (i.e., satellite uplink/downlink)

- C-Band FSS (Fixed Satellite Service)
- Some X-Band
- Target Customers: Military and Civilian that work in these frequency ranges.

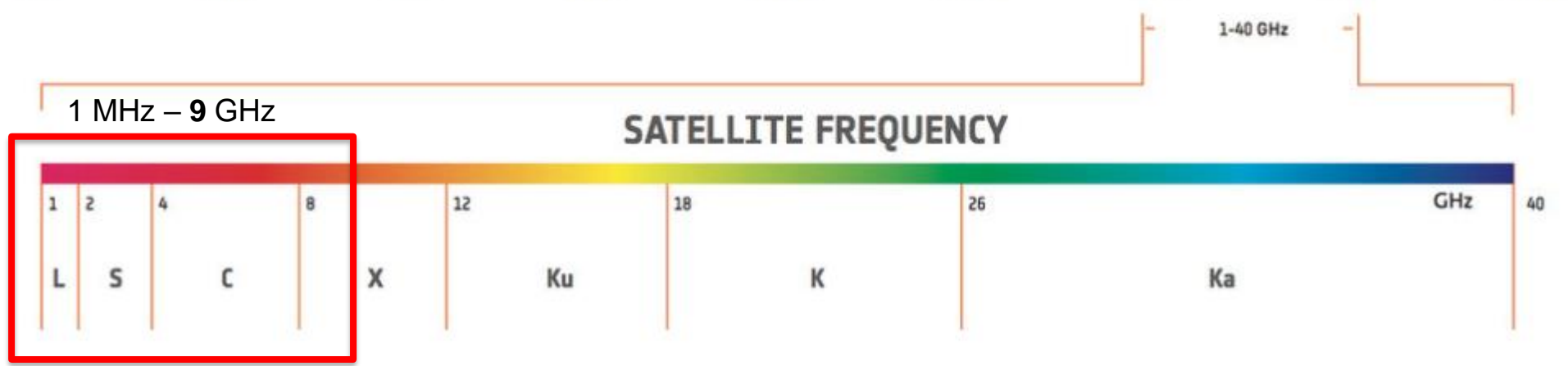


SK-9000-TC Coverage



Expanded Frequency Range to 9 GHz
 Application: Sat-Com (i.e., satellite uplink/downlink)

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SATELLITE SERVICES



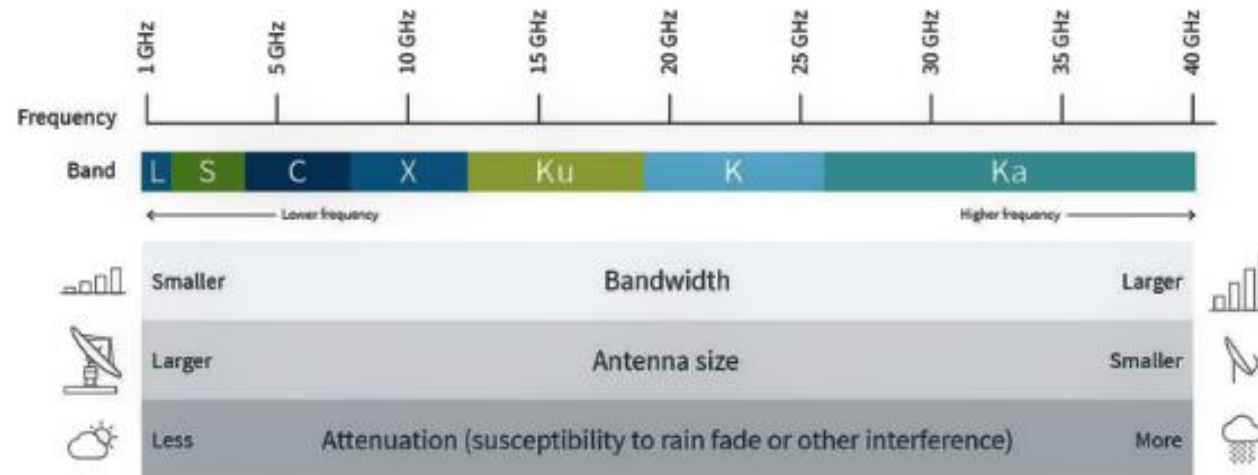
Satellite Communication Terminology

SATELLITE FREQUENCIES (Ghz)		
BAND	DOWNLINK	UPLINK
C	3.700 - 4.200	5.925 - 6.425
X (Military)	7.250 - 7.745	7.900 - 8.395

With current RF coaxial cable technology sufficiently serving lower bands [L, S, C] **Some coverage in X:** RF/Microwave coaxial cable technology is advancing to serve mid-range bands at higher frequencies [X, Ku, K, Ka].

The **C band** is a designation by the [Institute of Electrical and Electronics Engineers](#) (IEEE) for a portion of the [electromagnetic spectrum](#) in the [microwave](#) range of frequencies ranging from 4.0 to 8.0 [gigahertz](#) (GHz).^[1] However, the U.S. Federal Communications Commission C band proceeding and auction, designated 3.7–4.2 GHz as C band.^[2] The C band is used for many [satellite communications](#) transmissions, some [Wi-Fi](#) devices, some [cordless telephones](#), as well as some [Radar](#) and [weather radar systems](#).

Satellite spectrum properties



Who to Target?

Customers that Trouble Shoot up to 9GHz

Military and Civilian
Government
L, C Bands

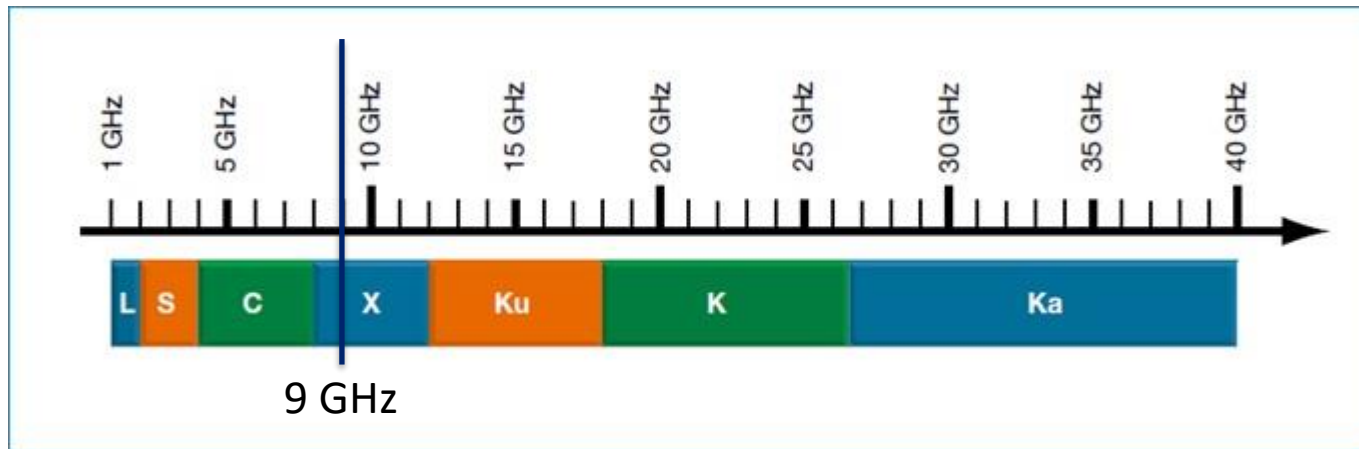
Government Satellite Network

Ground-based satellite control and mission planning capabilities, secure MAC1 satellite ground stations, data center, user devices and terminals, and interfaces to the US Department of Defense's Global Information Grid, plus security-cleared personnel, facilities, and technology to ensure your mission-critical data is safe.

Aviation/Marine

Aircraft/Marine Satellite Networks

Staying connected in flight has become a necessity, but with communications, avionics, and network systems being more complex than ever, you can't always travel with your IT department to troubleshoot when problems occur



Military Application

C-band (4–8 GHz)

C Tx (5.6-6.4)

Primarily used for satellite communications, for full-time satellite TV networks or raw satellite feeds. Commonly used in areas that are subject to tropical rainfall, since it is less susceptible to rain fade than Ku band (the original Telstar satellite had a transponder operating in this band, used to relay the first live transatlantic TV signal in 1962).



X-band (8–12 GHz)

X Rx (7.25-7.75) X Tx(7.9-8.4)

Primarily used by the military. Used in radar applications including continuous-wave, pulsed, single-polarization, dual-polarization, synthetic aperture radar and phased arrays. X-band radar frequency sub-bands are used in civil, military and government institutions for weather monitoring, air traffic control, maritime vessel traffic control, defense tracking and vehicle speed detection for law enforcement.



Marine Application

C-Band (4-8GHz): Very Small Aperture Terminal (VSAT).

- Requires more power so larger (2.4m+), more expensive antennas are needed but bandwidth is relatively cost-effective.
- Frequencies in the C-band perform well under adverse weather conditions (rain fade) making it a very reliable solution. It's ideal for passenger vessels and business critical usage on offshore vessels that have the real estate available for the large antenna in addition to multi-user, high bandwidth requirements on board.
- C-band can cause microwave interference meaning that it cannot be used too close to shore in certain areas whilst the antenna size means that it cannot be installed on smaller vessels



Very little in X-Band (9-12GHz): Very Small Aperture Terminal (VSAT).

Reserved for government and naval use only, X-band offers similar throughput potential as C- and Ku-band, and good resistance to rain fade.



Product Line Up



Part Number	Description	List
SK-4500-TC	4.5 GHz Cable and Antenna Analyzer	\$4,589.00
SK-6000-TC	6 GHz Cable and Antenna Analyzer	\$5,359.00
SK-9000-TC	9GHz Cable and Antenna Analyzer	\$7,000.00

Part Number	Description	List
SH-60S-TC	6 GHz Spectrum Analyzer	\$9,554.00
SH-60S-AOA	6 GHz Spectrum Analyzer W/AOA	\$12,546.00
SH-75S-TC	7.5 GHz Spectrum Analyzer	\$10,750.00
SH-75S-AOA	7.5 GHz Spectrum Analyzer	\$13,750.00



SK-4500-TC
SK-6000-TC

SK-9000-TC



SH-60S-AOA SH-75S-AOA
SH-60S-TC SH-75S-TC



MRI3T

Medical MRI Test Kit



Medical Market Solutions-



RF Power plays a role in the **Medical Industry** that requires high precision RF power measurement. Most major manufacturers of **Magnetic Resonance Imaging (MRI)** machines purchase Bird equipment for the research and development and field calibration of their MRI's.

Bird has developed an MRI KIT specific for the medical industry

APPLICATIONS:

Magnetic Resonance Imaging (MRI)

Targeted Pain Points

- MRI equipment Calibration
- Service
- Promote Patient Safety

MRI Targeted Users

Diagnostic Imaging Equipment Repair Services
Medical Equipment Sales, Maintenance, Service & Parts
Hospitals, Urgent Care, Rehab
Medical Equipment refurb, installs and upgrades



Bird MRI3T RF Calibration KIT



The intent of the power measurement kit is to provide a means of measuring output power of RF amplifiers during the calibration process for 3T and 1.5T field strengths in MR.

Situation: Accuracy of RF power measurements delivered during clinical MRI testing ensuring safety and regulatory compliance with MRI equipment.

Goal: Test MRI safety for RF exposure levels and to make independent RF power measurements to test the accuracy of the specific absorption rate over the range of operating conditions encountered in MRI.

Need: A test kit that will measure the pulse power during MRI testing and calibration which is critical for patient safety in 1.5T and 3.0T MRI machines as RF burns do occur.

Solution: Utilize a Bird Wideband Power USB sensor paired with frequency specific elements and load that will accurately and independently measure RF power encountered. Determine if the equipment is not in the appropriate setting exposure limits during device or pulse sequencing test.

Who?

Service technicians to MRI Machines

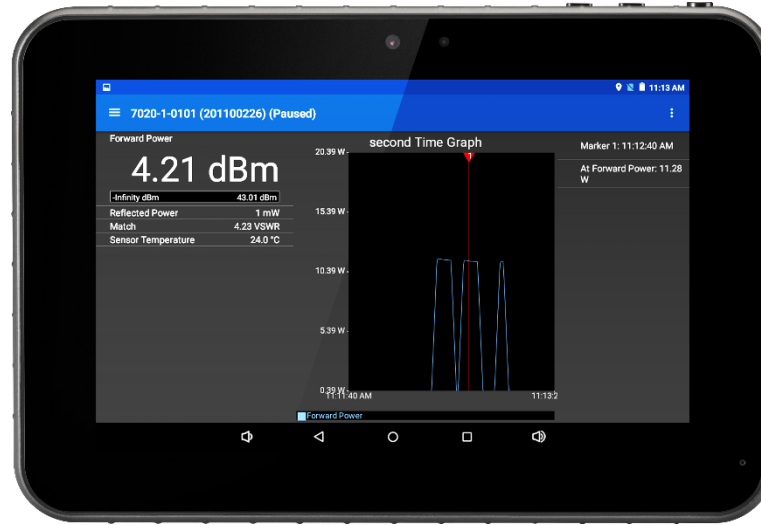
- Performs and documents planned maintenance and repair of medical diagnostic imaging equipment
- Possesses and demonstrates highly advanced knowledge and ability to the required test equipment and have the required electronic and mechanical knowledge and skills.

Jobs to be done

- Assembly and production of devices
- Testing and commissioning of devices after production or service
- Carrying out examinations, tests and troubleshooting on medical devices and documentation of the results
- Carrying out maintenance and repair work according to specifications



Bird MRI Service Test Kit Components



5000-NG Power Meter Display



5014M Power Sensor



- 4300A374-20** Element, 50kW Peak, 30-60 MHz(FWD)
- 4300A374-30** Element, 50kW Peak, 60-130 MHz(FWD)
- 4300A374-50** Element, 5kW Peak, 30-60 MHz (RFL)
- 4300A374-60** Element, 5kW Peak, 60-130 MHz(RFL)

8581A200-1 Dummy Load
Frequency: 10 MHz- 130 MHz
Average Power Max. 2.2 kW
Peak Power Max. 37kW
Pulse width, Max 10ms

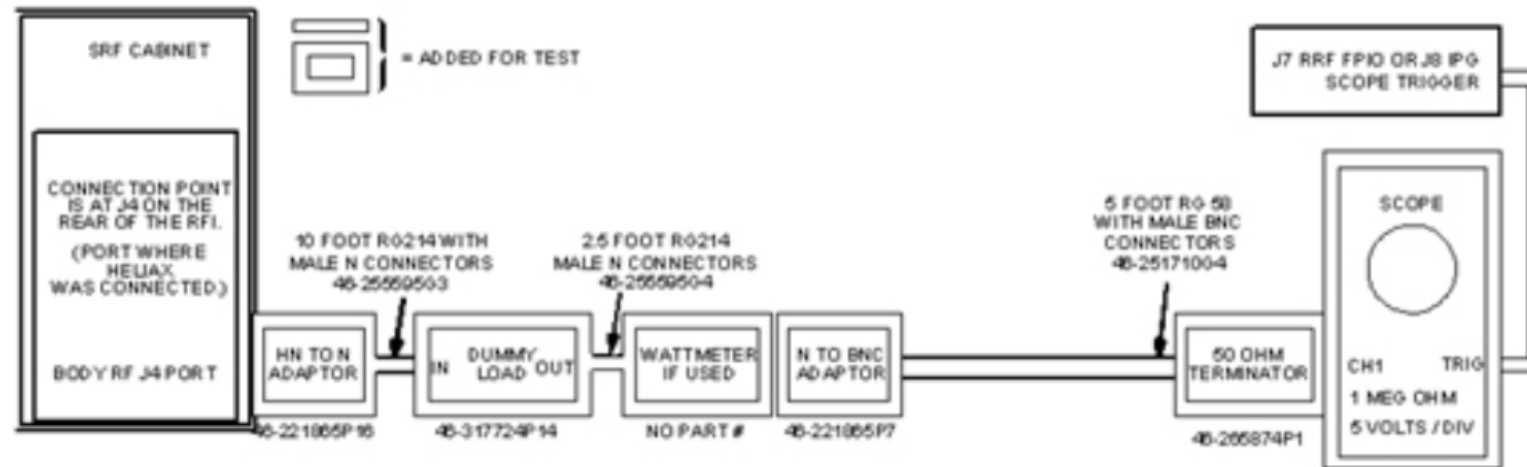


How is this done today?

Table 1: TOOLS AND INSTRUMENTS REQUIRED WITHOUT RF POWER MEASUREMENT KIT

Item	Description	Part Number
1.	RF Test Cables Kit	46-255816G1
2.	50 ohm, 200 Watt, 30 dB attenuator - Bird Model 8322	46-255837P10
3.	Oscilloscope	46-183029P61
4.	Laptop serial cable (optional)	2124497-46
5.	Wattmeter and appropriate elements (optional)	Not supplied

Illustration 1: ALTERNATE BODY EQUIPMENT SETUP FOR WATTMETER OR SCOPE MEASUREMENT



How and why do you measure pulse power during MRI?

- *Using a diode detection scheme that keeps the diode in its square-law region at high peak-power. The power is measured to ensure the MRI machine follows FDA regulations regarding RF exposure time & duration during a scan*

How is this method different from using an oscilloscope?

- *Our method is significantly more accurate and traceable vs. measurement with an oscilloscope. There are more components to an oscilloscope measurement (directional coupler, cable, scope impedance mis-match, scope accuracy, etc.) each of which add to the overall uncertainty budget. Our method directly samples & measures the RF power & all the additional sources of uncertainty are eliminated.*

Will this work on all MRI machines? What are my limitations - .5T, 1.0T, 1.5T etc.

- *The only limitation is the upper frequency range of the sensor & load. 7T is the highest field MRI machine & is currently only used in R&D applications. 7T Larmor frequency is ~300MHz. Lower frequencies simply need a means to determine the offset factors & require amplifiers capable of the lower frequencies used in 0.5T, 1T, etc.*



Summary Bird's MRI kit



The RF pulses are generated by specially designed RF amplifiers capable of extremely large peak-power, short duration pulses.

In order to make sure RF power limits are not exceeded, Bird manufactures a specially designed testing kit to measure the peak power delivered from the amplifier.

- We use a specially modified 5014 Sensor, specific 43 elements and special design load
- The Sensor package is calibrated using the same pulse amplifiers used for the MRI machine
- These kits are deployed to Hospitals all over the globe where technicians will disconnect the RF cabling connected to the MRI machine and use our test kit to determine the power output.
- The kit also contains diagnostic coupling elements & cabling to allow a technical to connect an oscilloscope to monitor the characteristics of the pulse.



Bird MRI Service Test Kit



- Kit calibration recommended every 12 months
- Available for Order – Now
- List price \$ 14,995.00

Bird RF Power Measurement Quick Reference Card for **MRI3T** Kit
Element Offset Factors

Description	Frequency (MHz)	Power Level (Watts)	Element	Offset
3 T G3 or DVMR Body Output	127.72	35000	4300A374-30	
3 T Dual Drive Body Output	127.72	15000	4300A374-30	
3 T G3 Head Output	127.72	4000	4300A374-60	
3 T DVMR Head Output	127.72	4500	4300A374-60	
3 T e2 Body Output	127.72	25000	4300A374-30	
3 T e2 Head Output	127.72	3300	4300A374-60	
1.5 T Body Output	63.86	16000	4300A374-20	
1.5 T Body Output (Value)	63.86	10000	4300A374-20	
1.5 T Head Output	63.86	2000	4300A374-50	
3 T MNS 4kW Output	51.70	4000	4300A374-50	
3 T MNS 8kW Output	51.70	8000	4300A374-20	
3 T MNS 2.5kW Output	51.70	2500	4300A374-50	

Place appropriate element in sensor. Enter Power Level (scale) and Offset value into meter display.
Refer to User Manual.



Accuracy Delivered

RF Power has been used in medical applications for many years and require high precision RF power measurements. Manufacturers of Magnetic Resonance Imaging (MRI) rely on Bird's RF expertise and test equipment for their research and development and field calibration of MRI equipment.

Accuracy of RF power measurements delivered during clinical MRI testing ensures safety and regulatory compliance. Under strict safety guidelines, this ensures that patients are scanned safely in both 1.5T and 3T systems and that no RF burns occur.

Bird's new MRI test kit provides a complete set of equipment to carry out precise and independent measurements of RF power encountered. It also determines if the equipment is not in the appropriate exposure limits during device or pulse sequencing test.

Technicians can have confidence when performing MRI safety measurements and test the accuracy of the specific absorption rate over the range of operating conditions encountered in MRI.



MRI3T KIT

PRODUCT FEATURES

APPLICATIONS



Questions

