

WiFi Advisor

Wireless LAN Analyzer

User's Guide

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This product was tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this product in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment has been SAR-evaluated for use in hand. SAR measurements are based on a 10 mm spacing from the body and that compliance is achieved at that distance. Keep the device away from your body to meet the distance requirement.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The authority to operate this product is conditioned by the requirements that no modifications be made to the equipment unless the changes or modifications are expressly approved by JDSU.

Industry Canada Requirements

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with Industry Canada radiation exposure limits set forth for an uncontrolled environment.

Cet équipement est conforme à l'exposition aux rayonnements Industry Canada limites établies pour un environnement non contrôlé.

(i) the device for operation in the band 5150-5250 MHz is only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems;

(ii) This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment has been SAR-evaluated for use in hand. SAR measurements are based on a 0mm spacing from the body and that compliance is achieved at that distance. Keep the device away from your body to meet the distance requirement.

(iii) This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

(i) l'appareil pour fonctionner dans la bande 5150-5250 MHz est réservé à une utilisation en intérieur afin de réduire les risques d'interférences nuisibles à la co-canal avec les systèmes mobiles par satellite;

(ii) Cet équipement est conforme aux limites IC d'exposition aux radiations définies pour un environnement non contrôlé. Cet équipement a été SAR-évalué pour une

utilisation dans la main. Des mesures SAR sont basés sur un espacement 0 mm à partir du corps et qui est obtenue conformément à cette distance. Gardez l'appareil loin de votre corps pour répondre à l'exigence de la distance.

(iii) Cet appareil est conforme avec Industrie Canada exempts de licence standard RSS (s). Son fonctionnement est soumis aux deux conditions suivantes: (1) ce dispositif ne doit pas causer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

CE

R&TTE Directive Compliance. This product is in compliance with essential requirements and other relevant provisions of Directive 1999/5/EC.

EMC Directive Compliance

This product was tested and conforms to the EMC Directive, 89/336/EEC as amended by 92/31/EEC and 93/68/EEC for electromagnetic compatibility. A copy of the Declaration of Conformity is provided in printed form with the instrument.

Low Voltage Directive Compliance

This product was tested and conforms to the Low Voltage Directive, 73/23/EEC as amended by 93/68/EEC. Conformity with this directive is based upon compliance with the harmonized safety standard, EN61010-1:2010.

WEEE and Battery Directive Compliance

JDSU has established processes in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive, 2002/96/EC, and the Battery Directive, 2006/66/EC.

This product, and the batteries used to power the product, should not be disposed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations. In the European Union, all equipment and batteries purchased from JDSU after 2005-08-13 can be returned for disposal at the end of its useful life. JDSU will ensure that all waste equipment and batteries

returned are reused, recycled, or disposed of in an environmentally friendly manner, and in compliance with all applicable national and international waste legislation.

It is the responsibility of the equipment owner to return equipment and batteries to JDSU for appropriate disposal. If the equipment or battery was imported by a reseller whose name or logo is marked on the equipment or battery, then the owner should return the equipment or battery directly to the reseller.

Instructions for returning waste equipment and batteries to JDSU can be found in the Environmental section of JDSU's web site at www.jdsu.com. If you have questions concerning disposal of your equipment or batteries, contact JDSU's WEEE Program Management team at WEEE.EMEA@jdsu.com.

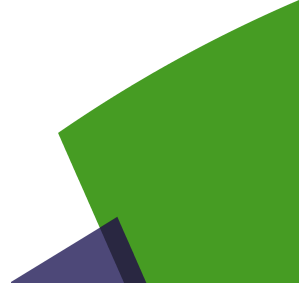


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About This Guide

This prefix explains how to use this manual. Topics discussed include the following:

- [“Purpose and scope” on page xii](#)
- [“Assumptions” on page xii](#)
- [“Safety and compliance information” on page xii](#)
- [“Conventions” on page xii](#)

Purpose and scope

The purpose of this guide is to help you successfully use the WiFi Advisor features and capabilities. This guide includes task-based instructions that describe how to install, configure, use, and troubleshoot the WiFi Advisor. Additionally, this guide provides a complete description of JDSU’s warranty, services, and repair information, including terms and conditions of the licensing agreement.

Assumptions

This guide is intended for novice, intermediate, and experienced users who want to use the WiFi Advisor effectively and efficiently. We are assuming that you have basic computer and iPad experience and are familiar with basic telecommunication and WiFi concepts and terminology.

Safety and compliance information

Safety and compliance information for the instrument are provided in printed form and ship with your instrument. Refer to 22073762, *WiFi Advisor Safety Information*.

Conventions

This guide uses typographical and symbols conventions as described in the following tables.

Table 1 Text formatting and other typographical conventions

Item(s)	Example(s)
Buttons, keys, or switches that you press or flip on a physical device.	Press the On button. – Press the Enter key. – Flip the Power switch to the on position.

Table 1 Text formatting and other typographical conventions (Continued)

Item(s)	Example(s)
Buttons, links, menus, menu options, tabs, or fields on a PC-based or Web-based user interface that you click, select, or type information into.	Click Start . – Click File > Properties . – Click the Properties tab. – Type the name of the probe in the Probe Name field.
Directory names, file names, and code and output messages that appear in a command line interface or in some graphical user interfaces (GUIs).	\$NANGT_DATA_DIR/results (directory) – test_products/users/default-User.xml (file name) – All results okay. (output message)
References to guides, books, and other publications appear in <i>this typeface</i> .	Refer to <i>Newton's Telecom Dictionary</i> .

Table 2 Symbol conventions



This symbol represents a general hazard. It may be associated with either a DANGER, WARNING, or CAUTION message.



This symbol indicates a note that includes important supplemental information or tips related to the main text.



This symbol, located on the equipment, battery, or the packaging indicates that the equipment or battery must not be disposed of in a land-fill site or as municipal waste, and should be disposed of according to your national regulations.

Table 3 Safety definitions

DANGER	Indicates a potentially hazardous situation that, if not avoided, <i>will</i> result in death or serious injury. It may be associated with either a general hazard, high voltage, or risk of explosion symbol.
WARNING	Indicates a potentially hazardous situation that, if not avoided, <i>could</i> result in death or serious injury. It may be associated with either a general hazard, high voltage, or risk of explosion symbol.
CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury and/or damage to equipment. It may be associated with either a general hazard, high voltage, or risk of explosion symbol. When applied to software actions, indicates a situation that, if not avoided, could result in loss of data or a disruption of software operation.

WiFi Advisor Overview

This chapter provides a general description of the WiFi Advisor. Topics discussed in this chapter include the following:

- [“About the Wireless LAN Analyzer” on page 2](#)
- [“Architecture” on page 2](#)
- [“About the WiFi Advisor” on page 3](#)
- [“About the WiFi Advisor app” on page 8](#)

About the Wireless LAN Analyzer

The Wireless LAN Analyzer provides a complete, multi-dimensional map of real WiFi performance, highlighting margin and resiliency of WiFi connections at multiple locations within a site (versus a simple signal strength icon). It includes intuitive tools to quickly optimize and troubleshoot the in-home WiFi network. After the test, it provides valuable performance information to the end-user to help reduce unnecessary trouble calls and repeats.

Architecture

The system architecture of the Wireless LAN Analyzer solution includes the following:

- 1 The WFED-300AC WiFi Advisor test device. Each WiFi Advisor contains an 802.11 radio, spectrum analyzer, and a network processor. The device is responsible for performing tests requested by the iOS WiFi Advisor iOS Application.



NOTE:

At least one WFED-300AC test device is required for single-ended troubleshooting, and two WFED-300AC test devices are required for Site Assessment testing.

- 2 The WiFi Advisor iOS Application. This software runs on an Apple iPad (iPad 2 or newer, with iOS 7.x.x or newer).

The application allows the user to set up WiFi tests, communicates test setups to the WFED-300AC WiFi Advisor test device(s) over Bluetooth, manages test execution, displays test results, and enables administration of job or work ticket related information.

About the WiFi Advisor

The WiFi Advisor, shown in [Figure 1](#), is a portable WiFi analysis solution that efficiently optimizes and troubleshoots 802.11 WiFi networks, provides a whole-home view of real WiFi performance / margin, and generates valuable information that can be given to the end user.

Figure 1 The WiFi Advisor



Features and capabilities

- Flexible
 - Battery powered WFED, configurable as Station or AP
 - Configurable radio from 802.11b/g to 802.11ac 3x3
 - WiFi and Ethernet test interfaces
- WiFi Advisor hardware:
 - 802.11a/b/g/n/ac, 3x3 (Broadcom 43460 chipset)
 - Built-in Spectrum Analyzer
 - User configurable as either Test Station or Test AP
 - 450 MBit/s packet processing engine
 - WiFi and Ethernet test I/F's
 - Battery powered

Quick tour

This section describes the buttons, indicators, and connectors for the WiFi Advisor WFED-300AC.

Top view

The top view is shown in [Figure 2](#).

Figure 2 WiFi Advisor top view



Power

The power button is the green button on the top of the instrument. Press and hold the button to power up or power down the instrument.

When the unit is powered up, the LED just above the button indicates the battery status.

- Solid green indicates the battery has greater than 10% charge or that the power adapter is plugged in
- Solid red indicates low battery, under 10% charge
- Flashing red indicates the battery is too low to start
- Flashing amber indicates shutting down
- Solid amber indicates the instrument “cannot talk to the battery” so it doesn’t know the charge level

Bluetooth

The Bluetooth button is the blue button on the top of the instrument. Press and hold the button for five seconds to make the WiFi Advisor ready to pair.

The LED located below the button indicates the Bluetooth status.

- Slow blinking blue (a short on every few seconds) indicates the instrument is trying to connect over Bluetooth
- Blinking blue (on but short off every few seconds) indicates the instrument is connected to the iPad but not currently being used
- Solid blue indicates the instrument is connected to the iPad and is being used by the iPad

Status

The Status LED indicates the status of the test.

- Blinking amber indicates a test is in progress at that location
- Solid green indicates the test is complete at that location and the test passed
- Solid red indicates the test is complete at that location and the test failed

Front view

The front view is shown in [Figure 3](#).

Figure 3 WiFi Advisor front view



USB

There are two USB connectors. They are used to connect host devices to the WiFi Advisor and as an alternative path for firmware download.

- The standard USB connector is a master/host interface.
- The mini-USB is a device/slave interface.

Ethernet

The RJ-45 connector interface is reserved for future Ethernet measurement functions.

Back view

The back view is shown in [Figure 4](#).

Figure 4 WiFi Advisor back view



DC Power input

The DC Power input, located on the back of the instrument, is used to connect the AC adapter.

Battery charge LED

The LED located next to the power input indicates that the adapter is connected. Red indicates the battery is charging; green indicates fully charged.

About the WiFi Advisor app

The WiFi Advisor iPad host app communicates with the WiFi Advisor instrument to run tests and manage devices. The application allows the user to set up WiFi tests, communicates test setups to the WFED-300AC WiFi Advisor test device(s) over Bluetooth, manages test execution, displays test results, and enables administration of job or work ticket related information.

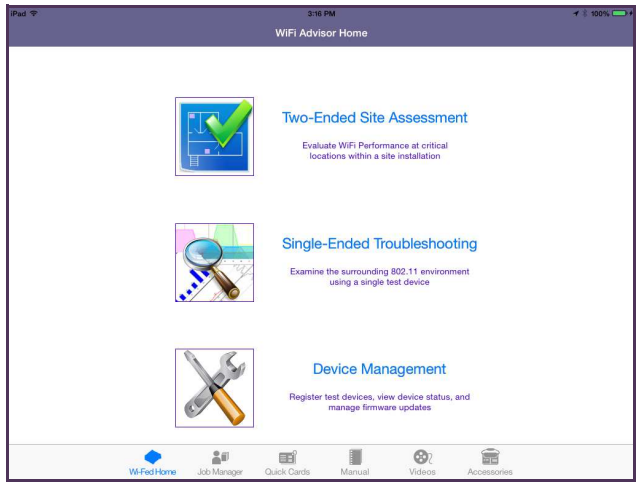
The icon for the WiFi Advisor is shown in [Figure 5](#). To launch the app, tap the icon.

Figure 5 WiFi Advisor iPad app icon



The Home screen appears, as shown in [Figure 6](#).

Figure 6 WiFi Advisor app Home screen



The application provides the following functions:

- **WiFi Advisor Home** – The main application that includes three selections:
 - Two-Ended Site Assessment
(Evaluate WiFi performance at critical locations within a site installation)
see [“Assessing WiFi performance throughout a site”](#) in [Chapter 3 “Testing”](#).
 - Single-Ended Troubleshooting
(examine the surrounding 802.11 environment using a single test device)
see [“WiFi Troubleshooting”](#) in [Chapter 3 “Testing”](#).
 - Device Management
(used to register devices, view device status, and manage firmware updates) see [Chapter 2 “Managing Devices”](#).

To launch an application, either touch the icon or touch the title (for example, touch the magnifying glass or touch “Single-Ended Troubleshooting”).

- **Job Manager** – For viewing and uploading of completed job files and customer PDF reports.
- **Quick Cards** – The WiFi Advisor Quick Start Guide and other helpful material.
- **Manual** – The WiFi Advisor User’s Guide
- **Videos** – Short videos describing “How-to” test with the WiFi Advisor
- **Accessories** – WiFi Advisor Accessory Guide

Chapter 1 WiFi Advisor Overview

About the WiFi Advisor app

Managing Devices

This chapter describes the Device Management menu which is used to register devices, view device status, and manage firmware updates. Topics discussed in this chapter include the following:

- [“Connecting a WiFi Advisor for the first time” on page 12](#)
- [“Registering and unregistering devices” on page 12](#)
- [“Changing the power off delay” on page 13](#)
- [“Updating the firmware” on page 14](#)
- [“Updating the iPad application software” on page 15](#)

Connecting a WiFi Advisor for the first time

Before any testing can begin, each WiFi Advisor must be paired with the iPad.

Pairing devices

- 1 On the iPad, select the **Settings** icon.
- 2 Verify that **Bluetooth** is set to On.
In the *Devices* section, the iPad detects and lists any devices within range.
- 3 Press and hold the blue button on the top of the WiFi Advisor for 5 seconds.
- 4 Verify that the blue LED on the WiFi Advisor is flashing slowly.
- 5 On the iPad, in the list of “My Devices”, select the WiFi Advisor with the serial number of your WiFi Advisor.
- 6 Label your WiFi Advisor with the letter designator of your choice from the sheet of ID Labels provided.

This label will be used during the registration process to provide a simple method to identify test devices for use in the iOS application

When pairing is complete, the status of the WiFi Advisor(s) indicates “Connected”.

Registering and unregistering devices

After pairing the device(s) with the iPad, they must be registered with the WiFi Advisor app, especially if this is the first time using this WiFi Advisor with this iPad.

To register WiFi Advisor devices with the iPad

- 1 From the WiFi Advisor app, select **Device Management**.
- 2 In the Unregistered Devices area, select the WiFi Advisor with the serial number of your device.
- 3 Enter the label letter for the WiFi Advisor.
- 4 Repeat [step 2](#) and [step 3](#) for each WiFi Advisor.

The registered devices appear in the Device Manager screen.

To unregister WiFi Advisor devices with the iPad

- 1 From the WiFi Advisor app, select **Device Management**.
- 2 Select the WiFi Advisor with the label (or serial number) of your device and swipe to the left.
A red **Delete** button appears.
- 3 Do one of the following:
 - If you do not wish to unregister the device, swipe to the right.
 - Tap the **Delete** button to unregister your device.

Changing the power off delay

The power off delay values associated with each registered WiFi Advisor are shown within the Registered Devices section of the Device Manager screen. These values define the amount of idle time that must transpire before the test device will automatically power down.

To change the power off delay for a WiFi Advisor

- 1 From the WiFi Advisor app, select **Device Management**.
- 2 Touch the **Power Off Delay** associated with that WiFi Advisor.
- 3 Select the power off delay.
Disable means it will not automatically power down regardless of expired time.
If you would like to dismiss the window without changing the current setting, touch outside of the window.

Updating the firmware

The firmware on the WiFi Advisor can be upgraded over Bluetooth using the iPad. The WiFi Advisor must be paired with the iPad and registered with the app.

To update firmware on a registered WiFi Advisor

- 1 In the WiFi Advisor app, select **Device Management**.
The menu reports all registered WiFi Advisor devices and the current firmware for each.
- 2 Find the WiFi Advisor you wish to update, and click on icon of the device with a down arrow.
- 3 A confirmation screen appears.
- 4 Select **Yes**.
The update begins. The status bar at the top indicates the update progress.



NOTE:

If you experience trouble, look at the number of Bluetooth devices in the area. Three to four devices is a practical limit, depending on the types of devices and profiles used. Some devices require more Bluetooth data, so they are more demanding than other devices. Data-intensive devices may reduce the total number of devices that can be active at the same time. If a Bluetooth device becomes slow to connect or does not perform reliably, reduce the total number of connected devices.

Updating the iPad application software

Updating the iPad host application software allows you to have the latest application, including new WiFi Advisor features and company-specific procedures or applications.

To update the host application software

- 1 To download the app, do one of the following:
 - a If your company has an enterprise network, connect to your company enterprise network with the iPad. If there is a new version, your app icon will include a badge (a circle in the upper corner that indicates updates are available). Using the browser, go to the site/location where the application is kept, then download the new version.
 - b Go to the Apple App Store.
- 2 As the process runs, the app icon has a circle inside that rotates.
- 3 When the update is finished, the rotating circle disappears and the icon has a “badge” (a blue dot in the upper left).

The host application software is updated.

Chapter 2 Managing Devices

Updating the iPad application software

Testing

This chapter provides task-based instructions for using the WiFi Advisor features. Topics discussed in this chapter are as follows:

- [“WiFi Troubleshooting” on page 18](#)
- [“Assessing WiFi performance throughout a site” on page 25](#)
- [“Managing jobs” on page 35](#)
- [“Troubleshooting Problems with Your WiFi Advisor” on page 41](#)

WiFi Troubleshooting

The single-ended troubleshooting test includes the following:

- Quick, visually intuitive assessment of critical WiFi network factors reduces troubleshooting time
- Spectral insight within the same tool allows identification and isolation of common, non-802.11 interferers
- Expert recommendations helps minimize the time spent to effectively optimize the network and reduces likelihood of repeat calls

The following procedure describes how to troubleshoot a single connection on a network. This test is typically run if the service is not working properly.

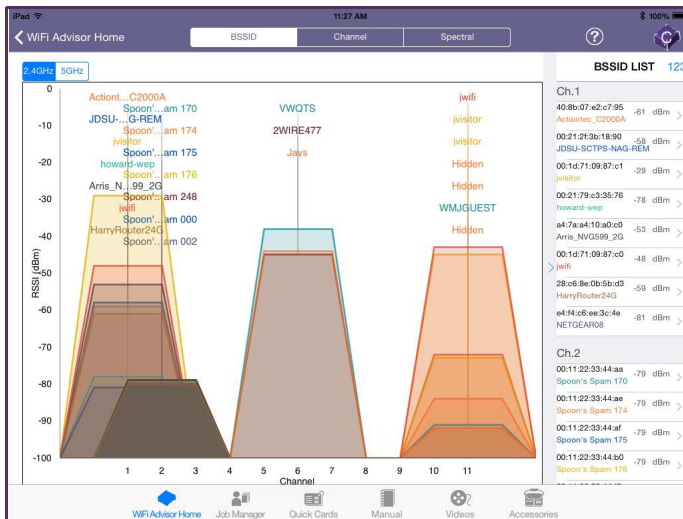
To troubleshoot a single connection

- 1 Bring the iPad and WiFi Advisor to the location experiencing problems.
- 2 Open the app on the iPad.
- 3 Select **Single-Ended Troubleshooting**.
- 4 Choose which WiFi Advisor device to use for the test.
If you have previously used a WiFi Advisor device with this iPad, it appears in the list of devices. If it does not appear, you may need to register the device with the iPad and pair to it. See ["Connecting a WiFi Advisor for the first time" on page 12](#) and ["Registering and unregistering devices" on page 12](#).
- 5 Select a result tab at the top: BSSID, Channel, or Spectral.

BSSID results

The BSSID results provide quick visibility into the wireless networks active in the current environment in both the 2.4GHz and 5GHz WiFi bands. The BSSID results report the RSSI per channel. A sample result is shown in [Figure 7](#).

Figure 7 BSSID results



This provides a visual representation of overlap in the channels to help identify problem spots.

The BSSID graph area shows each visible BSSID by channel and signal strength. This view is useful for understanding an existing Access Point's channel configuration and signal strength or for determining which channel to select for a new AP to be placed within the environment.

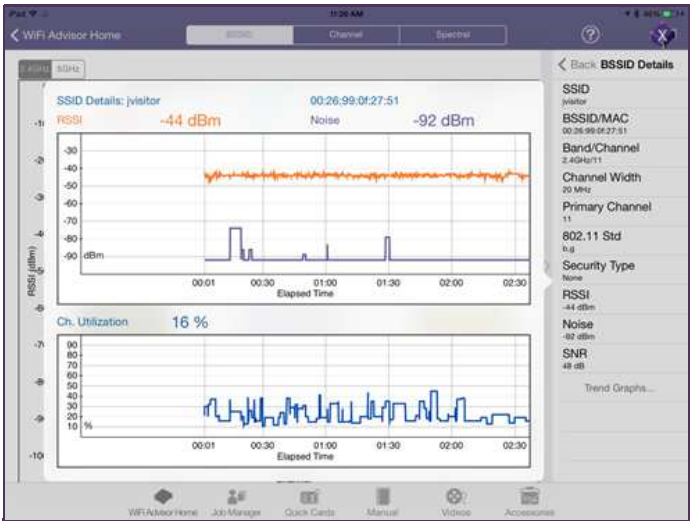
To toggle between 2.4GHz band and 5GHz band, touch the band toggle switch in the upper left of the graph.

The BSSID List view in the right pane provides a listing of all detected BSSIDs along with their channel setting, current signal strength, and MAC address. To change the order of the list, tap 123 (sort by channel) or ABC (sort by name). To view more details of a particular BSSID, touch the desired BSSID.

From the BSSID Details menu, touch **Trend Graphs**. Trend graphs show RSSI, Noise, and Channel Utilization over time for the selected BSSID. A sample graph is

shown in [Figure 8](#).

Figure 8 Trend Graphs



Channel view

The Channel view, shown in [Figure 9](#), shows utilization and noise per 802.11 channel in addition to co-channel or adjacent channel interferers. You can view the best channels per band, best channels per channel width, or overall channel score. This allows you to select the best channels available in the current environment.

Figure 9 Channel results



The **Utilization** graph in the top pane shows the channel utilization for all channels in the selected band. Touching a bar within the graph highlights the bar for that channel (the blue bar will turn green) and the “BSSID List” changes to the Channel Summary which includes values associated with that particular channel.

The **Noise** graph in the bottom pane displays the noise per channel.

Touching the band toggle switch in the upper left of the graph toggles between 2.4GHz band and 5GHz band views.

As in the BSSID view, the BSSID List view in the right pane provides a listing of all detected BSSIDs along with their channel setting, current signal strength, and MAC address. To change the order of the list, tap 123 (sort by channel) or ABC (sort by name).

Touching a specific BSSID from the BSSID list configures the Utilization bar graph to the channel associated with that particular BSSID and the “BSSID List” changes to the Channel Details view in the right hand pane. Touching a specific bar in the Utilization graph also changes the BSSID List view to the Channel Details for that

particular channel which includes the channel score, the channel utilization, noise, the BSSIDs resident in the channel, and the BSSIDs that are overlapping (adjacent to) that channel.

Touching **Best Channels** in the top right area of the Utilization graph displays a table that identifies the current top 3 best channels based on channel width for the band being viewed. Touching anywhere on the screen closes the table.

Spectral results

The Spectral results, shown in [Figure 10](#), provides a real-time spectral analyzer configurable by 802.11 band, channel, and channel width. It is helpful for finding signals that interfere with 802.11 networks by showing both 802.11 and non-802.11 RF signals within a given channel of interest.

Figure 10 Spectral results



The Spectral results screen has 3 main areas:

- The spectral graph area, where the real-time spectral data is displayed
- The controls area, where the user can configure the spectrum analyzer ranges and modes
- The BSSID List / Channel information pane

Navigating the Spectral result screen

As in the BSSID and Channel views, the BSSID List view in the right pane provides a listing of all detected BSSIDs along with their channel setting, current signal strength, and MAC address. To change the order of the list, tap 123 (sort by channel) or ABC (sort by name). The BSSID list is not continuously updated while spectral data is being displayed and is therefore labeled as SNAPSHOT as it represents a list of BSSIDs gathered over a finite period of time prior to turning on the Spectral Analyzer.

Touching a specific BSSID from the BSSID Snapshot List configures the Spectrum Analyzer to the channel(s) associated with the BSSID selected, and changes the BSSID Snapshot view in the right pane to the Channel Details for that particular channel which includes the channel score, the channel utilization, noise, the BSSIDs resident in the channel, and the BSSIDs that are overlapping (adjacent to) that channel. NOTE: This data is a snapshot. Live data may vary slightly.

The Spectrum Analyzer controls, located across the top of the graph, consist of the following:

- 1 Band toggle switch – selects 2.4GHz or 5GHz bands for analysis
- 2 Channel bandwidth selector – selects the width of the spectrum analyzer:
 - 20MHz
 - 40Hz, or
 - 80MHz (5GHz band only)
- 3 Channel up (+) or down (-) – touch to increment or decrement the 802.11 channel(s) being analyzed
- 4 Max Hold – turns the Max Hold trace on the spectral graph on or off. When Max Hold is on, a blue line appears above the standard spectral line that represents the peak value (in dBm) seen at each frequency point.

- 5** Clear – located under Max Hold, it resets the Max Hold trace and restarts the measurement.
- 6** Average – allows averaging of the real-time trace when on
- 7** Number of Samples – select the number of samples to be used for averaging of the real-time trace
- 8** World view – shows all channels. Changing the channel bandwidth changes how channels are represented in the world view.

To insert a vertical cursor within the real-time spectral plot, touch the graph where the cursor position is desired. The cursor readout box in the upper left reports the frequency at that position, in addition to the real-time and max hold signal levels at that frequency. The cursor can be moved by tapping anywhere on the graph within the channel width. By default, a cursor is located at the left edge of the view.

Troubleshooting Spectral measurements

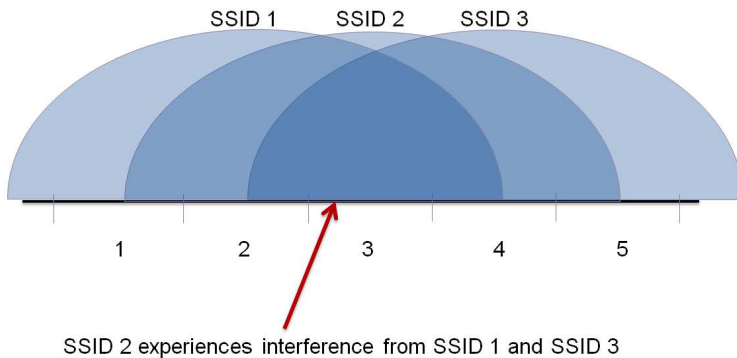
The following are some common interferers that could show up in a spectral measurement.

Microwave ovens can interfere with an 802.11 signal. They are most prevalent in channels 10 and 11. If possible, it is a good idea to look at the spectral response while the microwave is running to determine its impact.

Bluetooth devices appear as spikes and appear to “roll” through the spectral view. They are fast moving and you may only see them occasionally. The systems are designed to be interoperable, but Bluetooth will impact throughput.

Channels can “bleed over” into adjacent channels. The width of the signal (due to RF considerations) can affect nearby channels, as shown in [Figure 11](#).

Figure 11 Spectral view of channel overlap



Assessing WiFi performance throughout a site

The general procedure for a Site Assessment test is:

- 1 Place one WiFi Advisor in close proximity to where the Wireless Access Point (or Residential Gateway) will be installed.
- 2 Take a second WiFi Advisor along with your iPad to the location where WiFi performance is to be assessed. The test thoroughly evaluates WiFi performance between the two locations.
- 3 Move to the next location of interest and repeat the test to the Access Point.
- 4 Continue until all locations of interest have been performance tested.
- 5 If desired, the test results are saved to the active job or work ticket or associated with a new job. (See the [“Managing jobs”](#) section for more details regarding work flow with job / tickets).

The two-ended site assessment test includes the following features:

- Innovative TrueMargin™ performance test which thoroughly and simultaneously evaluates the physical layer, the 802.11 transport layer and the packet layer.
- BSSID / AP view snapshot for each test location
- Spectral snapshots at both ends of the wireless link
- Best Channel recommendations for 2.4G / 5G for the given test profile
- Ability to evaluate WiFi performance at multiple locations within the home
- WiFi Network Optimization recommendations

Getting started

In order to get started with site assessment test, you must have two registered WiFi Advisors connected over Bluetooth.

To get started

- 1 Launch the **WiFi Advisor** app.
- 2 Select **Two-Ended Site Assessment**.

Specifying settings

During Site Assessment test, up to five individual test profiles are configured that are repeated at each location. The test profiles run sequentially at each location, and always in the same order. Each Site Assessment configuration has a Primary Profile, with up to four additional profiles, known as Secondary Profiles. Only the Primary Profile is associated with Pass/Fail or Closeout testing. The Secondary Profiles are informational, rather than Pass/Fail. At the beginning of the Site Assessment, the Secondary Profiles can be enabled or disabled as a group. This allows for rapid Site Assessment testing if only the Primary Profile is desired.

Step 1: Selecting devices

The first setting to specify is selecting which device is the access point and which is the station.

To select devices

- 1 From the Site Assessment page, select **Devices**.

All registered devices are shown.

If not shown, you may need to pair with the device and then register it. See [“Connecting a WiFi Advisor for the first time” on page 12](#) and [“Registering and unregistering devices” on page 12](#).

- 2 Choose an AP (access point) Location.
- 3 Select a Station Location.

The Access Point device generally stays in one location (the desired location for the actual Access Point / Residential Gateway) and the Station device typically travels from test location to test location.



NOTE:

If you experience trouble, look at the number of Bluetooth devices in the area. Three to four devices is a practical limit, depending on the types of devices and profiles used. Some devices require more Bluetooth data, so they are more demanding than other devices. Data-intensive devices may reduce the total number of devices that can be active at the same time. If a Bluetooth device becomes slow to connect or does not perform reliably, reduce the total number of connected devices.

Step 2: Specifying the Broadband Service Rate

This setting specifies the broadband service rate that the customer is receiving from their internet provider. If not specified (left blank), the setting is ignored.

To specify the Broadband Service Rate

- 1 From the Site Assessment page, select **Broadband Service**.
- 2 Enter the rate in MBit/s.

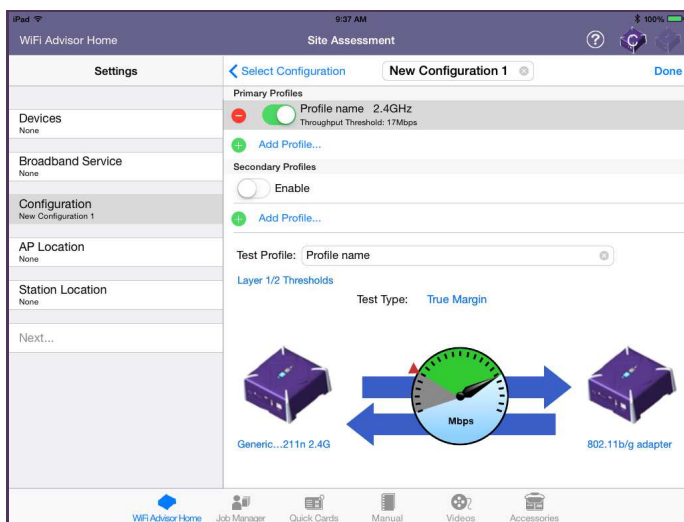
Step 3: Specifying the configuration

The configuration page specifies the profile(s).

To specify a configuration

- 1 From the Site Assessment page, select **Configuration**.
- 2 Do one of the following:
 - Select the pre-defined configuration that matches your needs or matches the equipment you are installing into the test site. Proceed to ["Step 4: Specifying the AP and Station Location"](#) on page 30.
 - If no pre-defined configuration matches your needs, touch **Add Configuration**.

The New Configuration page appears.



- 3 In the box at the top, specify a name for the configuration.
At the bottom, a graphical representation of the network appears.

- 4 If you wish to change the profile, do the following:
 - a In the Test Profile box, just above the network graphic, enter a name for the profile.
 - b Touch the instrument graphic on the left to specify the device that is operating as the access point.
 - i Do one of the following:
 - Select from the pre-defined devices that is operating as the access point.
 - If no pre-defined configuration matches your needs, touch **Add AP Device**.
 - ii Specify settings for the device, such as standard, band, channel width, number of antennas, and other configuration items.
 - c Touch the instrument graphic on the right and specify the device that is operating as the Station.
 - i Do one of the following:
 - Select from the pre-defined devices that is operating as the access point.
 - If no pre-defined configuration matches your needs, touch **Add Station Device**.
 - ii Specify settings for the device, such as name, standard, number of antennas, and other configuration items.
 - d Just above the instrument graphic on the left, select **Layer 1/2 Thresholds**.
 - i Specify the **Layer 1 Thresholds** for RSSI, Noise, count of BSSID's on a Channel, and count of BSSID's with Overlapping Channels.
 - ii Specify the Tx Failures, Retransmits, PHY rate, and Service Threshold for the **802.11 Thresholds**.
 - iii Touch the back arrow to return to the new configuration page.
- 5 If you wish to specify another Primary Profile, touch **Add Profile** located under Primary Profiles.
- 6 If you wish to include a **Secondary Profile**, move the button to **Enable** and follow [step 4](#) above.

7 If you wish to specify an additional secondary profile, touch Add Profile located under Secondary Profiles.

8 Touch the back arrow to return to the Select Configuration page.

The new configuration is saved and can be selected for future tests.

To delete a configuration

To delete a configuration, touch and hold the configuration until it is highlighted, and then swipe to the left. A Delete button appears. Tap the **Delete** button.

Step 4: Specifying the AP and Station Location

These settings specify the room where each WiFi Advisor is located.

To specify the AP and Station location

- 1 From the Site Assessment page, select **AP Location**.
- 2 Select the room where the Access Point is located. If the location you desire is not listed, select **Add Location**.
- 3 From the Site Assessment page, select **Station Location**.
- 4 Select the room where the Station is located. If the location you desire is not listed, select **Add Location**.

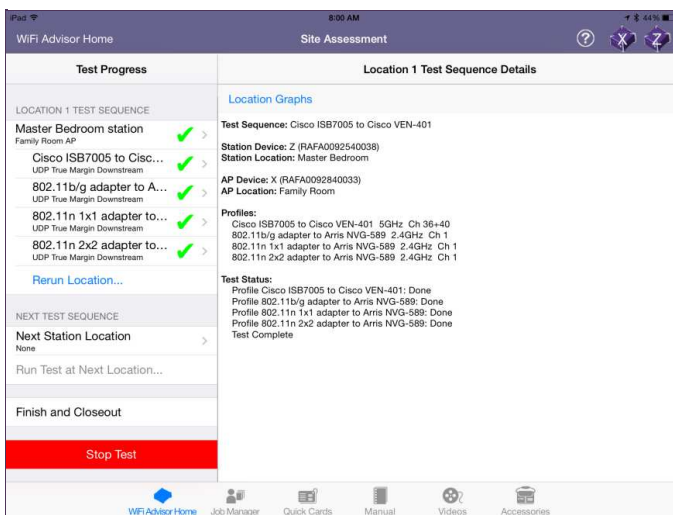
Assessing an installation site

Two-ended site assessment uses two WiFi Advisors to test connectivity and assess an installation site. The following procedure describes how to assess an installation site.

To assess an installation site

- 1 Bring an iPad and two WiFi Advisors to the site.
- 2 Open the WiFi Advisor app on the iPad.

- 3 Select **Two-Ended Site Assessment**.
The Settings page appears.
- 4 If needed, specify the settings as described in [“Specifying settings”](#).
- 5 Select **Next...** to initiate the Site Assessment test.
- 6 After the first location is tested, a green check mark or red “X” (a Go/No Go result) appears next to the access point and station.



- 7 If you have another station, select **Next Station** Location. If not, go to [step 8](#).
The other station must be another WiFi Advisor that is registered with the App.
- 8 When finished testing, select **Finish and Closeout**. The Finish Test window opens.
- 9 Enter the Customer Address. This appears in the closeout report.
- 10 To finish the closeout, save the results to a current job or a new job.
See [“Managing jobs” on page 35](#)

Interpreting Site Assessment results

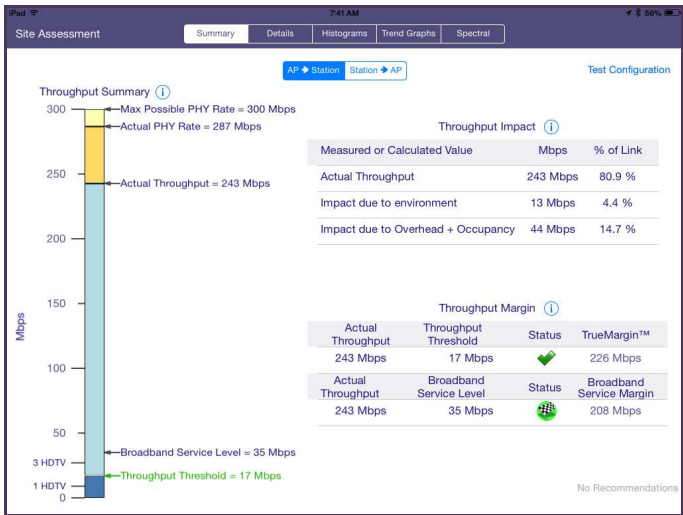
While the Site Assessment test is in progress, results for any completed profile test can be viewed by touching the completed profile in the Test Progress pane.

When a profile name is selected, the Site Assessment Results screen appears. This screen displays results for both the AP-to-Station direction and Station-to-AP direction. The menu has several result views:

- **Summary** – shows a summary of the throughput and throughput margin tests for the selected profile. This view includes the TrueMargin™ result to help understand the resiliency of the WiFi link under test.
- **Details** – shows the detailed statistics for the selected test profile in tabular form.
- **Histograms** – provides histograms of per-packet PHY rate and retransmission retries.
- **Trend Graphs** – time correlated view of critical test measurements and results.
- **Spectral** – snapshots for the channel used in the test profile. Shown at both AP and Station.

An example of the Summary Results is shown in [Figure 12](#).

Figure 12 Example of Site Assessment Summary Results



To return to the Site Assessment test, touch Site Assessment in the upper left.

Tips

If the rates you receive are not what you expected, review [Figure 13](#). It provides maximum rates available based on protocol.

Figure 13 Max possible rates per protocol

Protocol	Channel BW (MHz)	Antenna Configuration	Max Possible PHY Rate (Mbps)
802.11a	20	1x1	54
802.11b/g	20	1x1	54
802.11n	20	1x1	72
802.11n	40	1x1	150
802.11n	20	2x2	144
802.11n	40	2x2	300
802.11ac	20	1x1	96
802.11ac	40	1x1	200
802.11ac	80	1x1	433
802.11ac	20	2x2	192
802.11ac	40	2x2	400
802.11ac	80	2x2	866
802.11ac	20	3x3	288
802.11ac	40	3x3	600
802.11ac	80	3x3	1300

The table below shows the recommended minimum distance between WiFi equipment and household appliances to reduce interference.

Table 4 Recommended WiFi distance

Household Appliance	Recommended Minimum Distance (in feet and meters)
Microwave ovens	30 feet / 9 meters
Baby monitor - Analog	20 feet / 6 meters

Table 4 Recommended WiFi distance (Continued)

Household Appliance	Recommended Minimum Distance (in feet and meters)
Baby monitor - Digital	40 feet / 12 meters
Cordless phone - Analog	20 feet / 6 meters
Cordless phone - Digital	30 feet / 9 meters
Bluetooth devices	20 feet / 6 meters

Viewing Location Results

At the beginning of each location test, a BSSID graph is captured at both the Station and the AP, for both 2.4GHz and 5GHz bands. These location graphs apply to all profile tests at the location and are viewable by first pressing the Location name in the Test Progress bar to select the location test of interest, and then pressing **Location Graphs** in the top left pane of the Test Sequence window. To return to the Site Assessment test, touch Site Assessment in the upper left.

Managing jobs

The Job Manager is used to associate test results from a test to a single job. If any jobs have been saved, they appear in the list. The Job Manager allows you to setup a new job, edit an active job, activate a job, export a job, or delete a job.

When test results are associated with a job, the jobs are stored on the iPad. The last 50 jobs are stored; if you have more than 50 jobs, the oldest job is deleted automatically. JDSU recommends that jobs be exported to your external database before they are automatically deleted.

Creating a new job in Job Manager

Within the Job Manager application, you can create a new job.

To create a new job

- 1 From the main Job Manager screen, touch **New**.
- 2 In the Add Job screen, enter the job-related information such as Circuit ID, Work Ticket, and Tech ID. Touch **Use Current Location** if your iPad is equipped with GPS (Geo Tag) and you wish to capture the current GPS coordinates with your job data.
- 3 Touch **Accept** to create the new job.

The new job will be visible in the main Job Manager screen as the currently active job. New jobs are void of results, but once *activated*, results from a Site Assessment test can be associated with the job. The page icon with a “0” at the right side indicates that no results have yet been saved to this job. The job is now ready to accept results from the Site Assessment test as the Active Job.

Saving to a new job in the Site Assessment test

Within the *Site Assessment test* application, you can save results to a new job.

To save results to a new job

- 1 After running the test, select **Save to New Job**.
- 2 Go to the Job Manager and select the new job. The job details appear.
- 3 Touch **Edit** to add the job-related information such as Circuit ID, Work Ticket, and Tech ID. Touch **Use Current Location** if your iPad is equipped with GPS (Geo Tag) and you wish to capture the current GPS coordinates with your job data.

The new job will be visible in the main Job Manager screen as the currently active job.

Activating or deactivating jobs

There can be only one Active job at any point in time. Any stored job can be activated or deactivated. If a job already has results associated with it, activating the job and saving new results to it will replace the old results with the new.

To activate or deactivate a job

- 1 From the main Job Manager screen, touch **Manage**.
Active jobs are listed.
Note that the available options are dependent on which jobs have been selected for action by checking the job's corresponding check box on the left side of the screen.
- 2 Choose the desired job by selecting the box next to the job.
- 3 Touch either **Activate** or **Deactivate**.

Viewing job results

After running tests, you can view the job details.

To view job results

- 1 From the main Job Manager screen, touch the job that you are interested in viewing.

The results can be viewed in several ways.

- XML – shows results gathered in the Site Assessment Test in XML format.
- Details – shows results gathered in the Site Assessment Test in text format.
- Detailed Report – shows all results gathered in the Site Assessment Test, including the graphs, in PDF.
- Customer Report – shows the end-user facing PDF report. This report can be emailed by selecting **Send PDF** in the top right of the screen. An example of this report is shown in [Figure 14](#) and [Figure 15](#).
- Map – displays the map view based on the GPS location saved with the job-related data.

Figure 14 Customer Report example

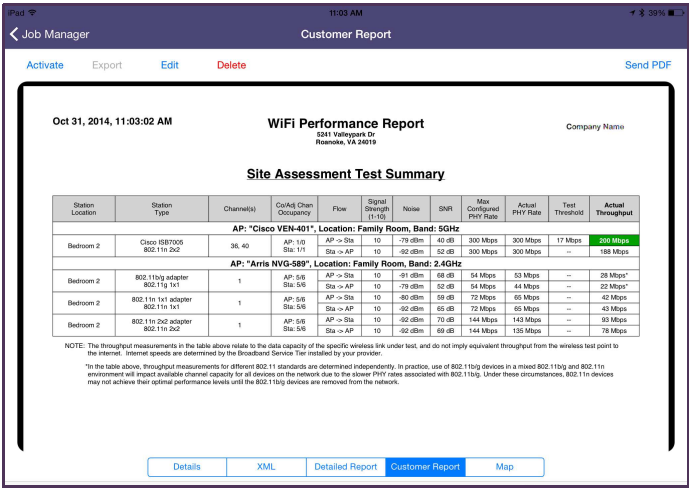


Figure 15 Customer Report example

Job Manager Customer Report

Activate Export Edit Delete Send PDF

2 of 6

Roanoke, VA 24019

Table of Common 802.11 Devices

Station Type / Name	Common Device Types
802.11b/g adapter (2.4 GHz)	Commercial 802.11b/g devices, such as USB adapters for PC's / laptops iPhone 3G/3Gs
802.11n 1x1 adapter (2.4 GHz)	iPhone 4/4s Google Nexus 7 Gen 1 Amazon Kindle HD 6/7
802.11n 1x1 adapter (5 GHz)	iPhone 5/5s/5c iPad 12/3/Retina/Mini Apple TV Samsung Galaxy S3 Samsung Galaxy Tab 4 7.0 Google Nexus 7 Gen 2
802.11n 2x2 adapter (5 GHz)	iPad Air / Mini Retina Google Nexus 10 Amazon Kindle HDX 7
802.11ac 1x1 adapter (5 GHz)	Samsung Galaxy S4 Samsung Galaxy Tab S 8.4 Samsung Galaxy Note 3 / Note 10.1 / Note Pro 10.1 Google Nexus 5
802.11ac 2x2 adapter (5 GHz)	Galaxy S5 Samsung Galaxy Note Pro 12.2 Samsung Galaxy Tab S 10.5 Amazon Kindle HDX 8.9

Details XML Detailed Report Customer Report Map

Exporting jobs

Jobs can be exported from the iPad to an external database using either FTP or HTTPS (if available).

To export a job

- 1 From the main Job Manager screen, touch **Manage**.
Active jobs are listed.
- 2 Choose the desired job by selecting the box next to the job.
- 3 Touch **Export**.
- 4 Touch the information icon (small “i” within a circle) at the bottom left corner of the Job Manager screen

- 5 The **Edit FTP Settings** menu appears.
If your version of software has both FTP and HTTPS export capability, touching the HTTPS button will exchange the *Edit FTP Settings* dialogue with the *Edit HTTPS Settings* dialogue.
- 6 Enter the URL, user name and password, and other information required to point the WiFi Advisor iOS application to your FTP or HTTPS site or database.
- 7 If any jobs have been exported, **Export History** appears in the lower right. Use the history to view previously exported jobs.

Deleting jobs

Jobs can be selectively deleted from the iPad.

To delete a job

- 1 From the main Job Manager screen, touch **Manage**.
Active jobs are listed.
- 2 Choose the desired job by selecting the box next to the job
- 3 Touch **Delete**.

Troubleshooting Problems with Your WiFi Advisor

Please refer to the following table if your WiFi Advisor does not seem to be performing correctly. If you still cannot solve your problem, please contact JDSU Technical Assistance on 1-855-ASK-JDSU (1-855-275-5378) or by email at: TAC@jdsu.com.

Problem	Action
Cannot connect the mobile app to the WFED-300AC	– Check that Bluetooth is ON (enabled) on your iPad. – Make sure that the iPad and WFED-3000AC are within reasonable Bluetooth range of each other (ideally 0 to 20 feet) – Look at the number of Bluetooth devices in the area. Three to four devices is a practical limit, depending on the types of devices and profiles used. Some devices require more Bluetooth data, so they are more demanding than other devices. Data-intensive devices may reduce the total number of devices that can be active at the same time. If a Bluetooth device becomes slow to connect or does not perform reliably, reduce the total number of connected devices.
The WFED-300AC is unresponsive (locked-up)	– Press and hold the power button for 5 seconds.

Chapter 3 Testing

Troubleshooting Problems with Your WiFi Advisor

Maintenance and Specifications

This chapter describes how to maintain your unit. Topics discussed in this chapter include the following:

- [“Charging the battery” on page 44](#)
- [“Replacing the battery pack” on page 44](#)
- [“Cleaning the instrument” on page 45](#)
- [“Specifications” on page 46](#)
- [“Getting Technical Assistance” on page 47](#)

Charging the battery

When the Batt LED lights red, the battery pack should be charged or replaced.



NOTE:

You can test a circuit and recharge the battery at the same time. If you do not want to interrupt the current test, you may leave the power on and connect the AC power adaptor.

To charge the battery

- 1 Connect one end of the AC adapter to the connector on the back of the WiFi Advisor.
- 2 Connect the other end of the AC adapter to an AC power supply.



WARNING: ELECTRICAL SHOCK

Electrical shock may result in serious injury or death. Be sure the AC Adapter is connected to the correct voltage mains. Do not use outdoors or in wet locations. Use only the AC Adapter supplied with the test set.

- 3 Let the WiFi Advisor charge for 5 hours for a fast charge; for maximum capacity, allow the WiFi Advisor to (trickle) charge overnight.
The charging time will be the same whether the power is on or off.
The **Batt** LED is amber when the unit is fast charging. The WiFi Advisor will trickle charge at other times when the charger is connected and the Batt LED is green.
After the Batt LED turns green (fast charge is complete), allow the unit to trickle charge overnight for maximum performance.

Charging the battery pack is complete.

Replacing the battery pack

The battery compartment is located on the bottom of the unit.

The following procedure describes how to replace the battery pack.

Before replacing the battery pack, verify that the replacement battery pack is JDSU part number 21108524.

To replace the battery pack

- 1 Turn the power off.



CAUTION: INSTRUMENT DAMAGE

Failure to turn the power off before removing the battery pack from the WiFi Advisor could damage internal components and/or corrupt the software. Always power down the unit before removing the battery pack.

- 2 Pull the two tabs to release the door.
- 3 Unplug the battery pack wiring.
- 4 Remove the old battery pack.
- 5 Insert the new battery pack, with the label facing up and aligning the wiring toward the connector.
- 6 Connect the new battery pack to the wiring.
- 7 Replace the battery compartment door.

Replacing the battery pack is complete.

Cleaning the instrument

The instrument itself does not require any specialized cleaning. An occasional wipe with a damp cloth is sufficient.



NOTE:

When cleaning the instrument, JDSU recommends a damp cloth and water only. Cleaning with chemicals could cause damage to the plastic case, buttons, or removal of markings.

Specifications

This section provides specifications for the WiFi Advisor.

Table 5 Physical specifications

Parameter	Specification
Height	6.1" / 155 mm
Width	7" / 178 mm
Depth	2.6" / 66 mm
Weight	1 lb. / 0.45 kg, with battery

Table 6 Operating and storage environment

Parameter	Specification
Operating Temperature	32° to 104° F (0° to +40° C)
Storage Temperature	-22° to 140° C (-30° to 60° C)
Humidity	10%-90% RH non-condensing
Vibration	3-Axis Vibration
Shock	±3 half-sinusoidal shock, 3-Axis Shock

Getting Technical Assistance

If you need assistance or have questions related to the use of this product, use the information in [Table 7](#) to contact JDSU's Technical Assistance Center (TAC) for customer support. For the latest TAC contact information, go to www.jdsu.com or contact your local sales office for assistance.

The regional sales office phone numbers are listed on the back of this manual.

Table 7 Technical assistance centers

Region	Phone Number	
Americas	1-855-ASK-JDSU (option #3) 1 301 353 1560	(1-855-275-5378, option #3) tac@jdsu.com
Europe, Africa, and Mid-East	+49 (0) 7121 86 1345 (JDSU Germany)	hotline.europe@jdsu.com
Asia and the Pacific	+852 2892 0990 (Hong Kong) +86 10 6655 5988 (Beijing-China)	

During off-hours, you can request assistance by doing one of the following: leave a voice message at the TAC for your region; email the North American TAC (tac@jdsu.com); submit your question using our online Technical Assistance request form at www.jdsu.com.

WiFi Fundamentals

This chapter provides a general description WiFi and 802.11. Topics discussed in this chapter include the following:

- [“WiFi deployment” on page 50](#)
- [“Network standard” on page 50](#)
- [“802.11 specifications” on page 51](#)
- [“Spectrum Differences” on page 51](#)

WiFi deployment

Successful WiFi service delivery is highly dependent on a vulnerable RF physical medium that is dynamically shared, along with complex L2 (i.e. 802.11) and supporting protocols. This makes installation of service a potentially complex task.

Reliance on simplistic installation methods that do not provide an indication of robust service level margin can impact QoE (quality of experience) as the RF environment / network changes, resulting in trouble calls, repeats and churn.

Inability to assess 802.11 performance and true throughput at critical locations throughout the home leaves the end user guessing as to how the installed network should perform, leading to trouble calls and truck rolls as the end user adds to / modifies the WiFi network.

Network standard

The network standard uses RF (radio frequency) spectrum as the physical layer. That means no wires, but can have issues with walls, mirrors and certain other building materials. The network standard has protocols to handle some interferers, such as:

- Co-channel (same channel) interferers can cooperate transmission (take turns).
- Burst interference mitigation by delayed transmission
- Adjacent Channel interferers are an issue
- Non-802.11 interferers are a big problem because they can appear as 802.11 but do not adhere to protocols. Your 802.11 radio will wait to get the “ok” to transmit, which may never come. It also can de-sensitize the receiver since the packets may not be received, the transmitter will keep sending the message “waiting for an acknowledgement”

802.11 specifications

802.11 is the “parent” of a family of Institute of Electronics and Electronic Engineering (IEEE) specifications for *wireless LAN*.

The standard has undergone several revisions:

Protocol	Main Frequency Band (GHz)	Max Data Rate (Mbps)	BW (MHz)	Modulation	MIMO Support?
802.11a	5	54	20	OFDM	No
802.11b	2.4	11	22	DSSS	No
802.11g	2.4	54	20	OFDM/DSSS	No
802.11n	2.4/5	65/135	20/40	OFDM	4
802.11ac	5	86/180/390/780	20/40/80/160	OFDM	8

Spectrum Differences

Understanding the different spectrums and channel allocations can help identify trouble areas.

2.4 GHz Spectrum

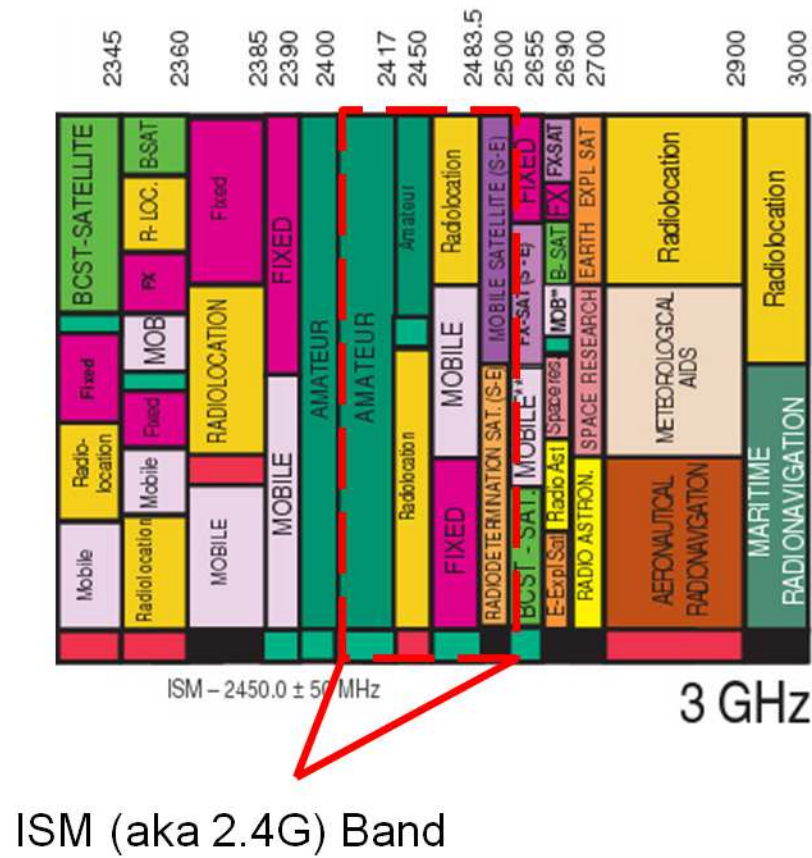
In North America, there are 11 channels, each 22 MHz wide. These channels overlap, except for 1, 6 and 11. Thus, these channels are always preferred.

The rest of the world includes two additional channels (12 and 13).

Figure 16 provides a map of the channel allocation for the 2.4 Ghz spectrum. Industrial, Science and Mechanical (ISM)” is the band that can be used by anything that

gets a FCC Part 15 approval (Bluetooth devices, cordless telephones, baby monitors and microwave ovens).

Figure 16 2.4G channel allocation

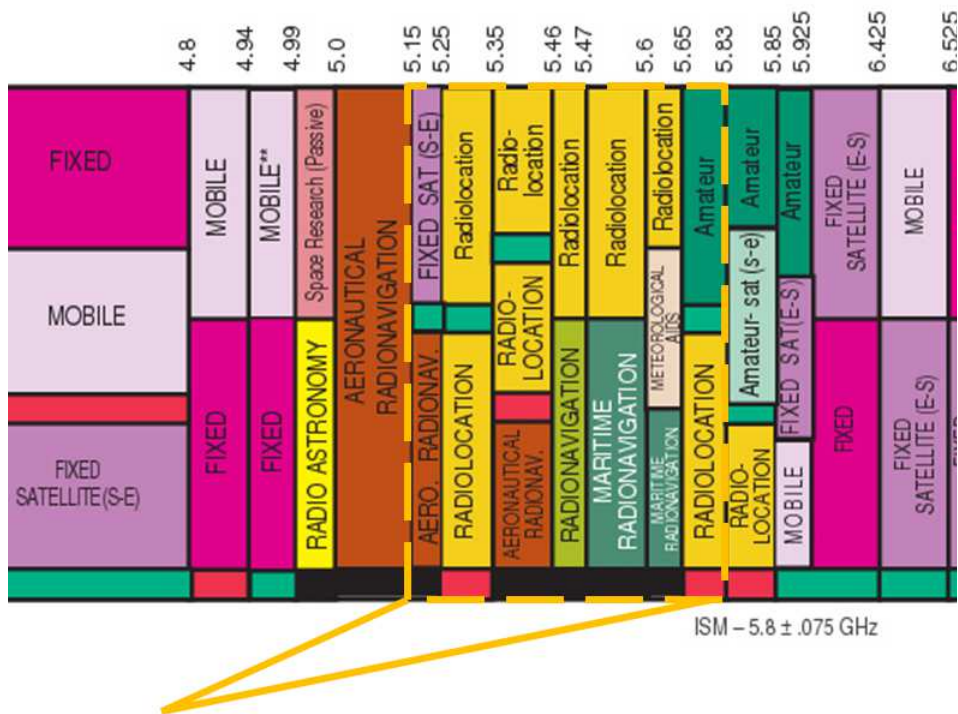


“5G” Band
(Worldwide except Japan)

A lot of these frequencies are used for satellite communications (low power). That means to them, WiFi is the interferer. U-NII stands for Unlicensed National Information Infrastructure and was set aside primarily for WiFi use. Most of the world uses the spectrum from 5.18 – 5.835 GHz. Note that another ISM band exists here (cordless telephones, point-to-point radios, baby monitors).

Figure 17 provides a map of the channel allocation for the 5 Ghz spectrum.

Figure 17 5G channel allocation



This band can vary in a greater number of regions, as shown in [Figure 18](#), and certain channels are designated as indoor use only or outdoor use.

Figure 18 International channel map

Channel	Frequency	United States	Europe	Turkey	Australia	Brazil
34	5170	No	No	Indoors	No	Indoors
36	5180	Indoors	Yes	Indoors	Yes	Indoors
38	5190	No	No	Indoors	No	Indoors
40	5200	Indoors	Yes	Indoors	Yes	Indoors
42	5210	No	No	Indoors	No	Indoors
44	5220	Indoors	Yes	Indoors	Yes	Indoors
46	5230	No	No	Indoors	No	Indoors
48	5240	Indoors	Yes	Indoors	Yes	Indoors
52	5260	DFS	DFS	Indoors	DFS	Indoors
56	5280	DFS	DFS	Indoors	DFS	Indoors
60	5300	DFS	DFS	Indoors	DFS	Indoors
64	5320	DFS	DFS	Indoors	DFS	Indoors
100	5500	DFS	DFS	DFS	DFS	DFS
104	5520	DFS	DFS	DFS	DFS	DFS
108	5540	DFS	DFS	DFS	DFS	DFS
112	5560	DFS	DFS	DFS	DFS	DFS
116	5580	DFS	DFS	DFS	DFS	DFS
120	5600	No	DFS	DFS	No	DFS
124	5620	No	DFS	DFS	No	DFS
128	5640	No	DFS	DFS	No	DFS
132	5660	DFS	DFS	DFS	DFS	DFS
136	5680	DFS	DFS	DFS	DFS	DFS
140	5700	DFS	DFS	DFS	DFS	DFS
149	5745	Yes	No	No	Yes	Yes
153	5765	Yes	No	No	Yes	Yes
157	5785	Yes	No	No	Yes	Yes
161	5805	Yes	No	No	Yes	Yes
165	5825	Yes	No	No	Yes	Yes

The terms “Indoor” or “Outdoor” relate to output power restrictions on the radios.



Customer Services and Support

This appendix provides information about standard support services, add-on services, and training available through JDSU. Topics discussed in this appendix include:

- [“About our services” on page 56](#)
- [“Standard support services” on page 56](#)
- [“Add-on services” on page 57](#)
- [“Training options” on page 59](#)

About our services

JDSU offers an unmatched and comprehensive portfolio of standard support services, add-on services, and training options to help customers successfully use purchased JDSU products. Services that come standard with every product sale include business hour technical assistance, in-warranty repair, calibration services, upgrade services, and immediate return authorizations. Add-on services designed to optimize product capabilities and maximize efficiencies include field engineering and deployment, technical training, 24x7 product support, consulting, and custom software development. Refer to the sections that follow for additional details.

Standard support services

Standard support services that accompany the sale of every JDSU product include:

- Instrument repair and calibration services
- Business hour technical assistance
- Access to general warranty information on the JDSU Web site
- Extensive product documentation and related technical information, accessible on the JDSU Web site

For more information, refer to the following subsections.

Instrument repair and calibration services

Our service centers provide repair and calibration services for JDSU equipment. JDSU understands the impact of equipment down time on operations and is staffed to ensure a quick turnaround. Available services include the following:

Product Repair — All equipment returned for service is tested to the same rigorous standards as newly manufactured equipment. This ensures products meet all published specifications, including any applicable product updates.

Calibration — JDSU's calibration methods are ISO approved and based on national standards.

For more information, including instructions for returning equipment for repair and/or calibration, go to: www.jdsu.com/en-us/Test-and-Measurement/support/repair-and-calibration/Pages/default.aspx.

Technical assistance (business hour)

Expert business hour technical support is provided with your product. For assistance related to the use of your product, call or e-mail JDSU's Technical Assistance Center (TAC) in your region. For a current listing of TAC phone numbers and e-mail addresses, go to: www.jdsu.com/en-us/Test-and-Measurement/support/technical-assistance/Pages/default.aspx.

For information about optional 24x7 technical assistance, see "[Extended product and systems support services](#)" on page 58.

Warranty information

Information about standard warranties, terms, and conditions specific to JDSU's Test & Measurement products and third party software that may be included within such products is posted on the JDSU Web site. For more information, go to: www.jdsu.com/terms.

Product documentation library

An extensive library that includes documentation for JDSU products and related technology-specific documents is available on the JDSU Web site. For more information, go to: www.jdsu.com/en-us/Test-and-Measurement/support/Technical-Library/Pages/TechLibrary.aspx.

Add-on services

JDSU offers a broad portfolio of add-on services to enable customers to aggressively build their competitive advantage within the markets they serve. Available services include:

- Extended product and systems support, including:
 - Optional extended product warranties
 - Optional extended repair services
 - Calibration management services
 - Around-the-clock technical assistance
 - A certified pre-owned equipment program
 - Tailored support services for your JDSU system
- Various professional and consulting services
- Specialized managed services

For more information, refer to the following subsections.

Extended product and systems support services

For information about optional extended product warranties, go to: www.jdsu.com/en-us/Test-and-Measurement/services/a-z-service-list/Pages/ext-warr.aspx.

For information about optional extended equipment repair services, go to: www.jdsu.com/en-us/Test-and-Measurement/services/a-z-service-list/Pages/factory-repair.aspx.

For information about equipment calibration management services, go to: www.jdsu.com/en-us/Test-and-Measurement/services/a-z-service-list/Pages/calibration.aspx.

For information about optional 24x7 technical assistance, go to: www.jdsu.com/en-us/Test-and-Measurement/services/a-z-service-list/Pages/tac.aspx.

For information about JDSU's Assets and Certified Equipment (ACE) Program (for the resale of certified pre-owned equipment), go to: www.jdsu.com/en-us/Test-and-Measurement/services/a-z-service-list/Pages/ace-prgm.aspx.

For information about tailored support services for your JDSU system, go to: www.jdsu.com/en-us/Test-and-Measurement/services/products-and-systems-support/systems-support/Pages/default.aspx.

Professional and consulting services

For information about optional professional and consulting services available from JDSU, go to: www.jdsu.com/en-us/Test-and-Measurement/services/professional-and-consulting-services/Pages/default.aspx.

Managed services

For information about specialized managed services available from JDSU, go to: www.jdsu.com/en-us/Test-and-Measurement/services/managed-services/Pages/default.aspx.

Training options

JDSU offers a wide array of training options designed to support customers at various stages of the network life cycle. Training options include:

- Public training
- On-site training
- Virtual classroom
- Self-paced training
- Certifications
- Workshops and blended learning
- Train-the-trainer/course licensing
- Free Webinars
- Contact training

For more information about available training options, go to: www.jdsu.com/en-us/Test-and-Measurement/Training/Pages/default.aspx.



Glossary

- A** **AP** — Access Point. The 802.11 device which allows wireless devices to connect to a wired network (in general)
- B** **BSSID** — Basic service set identifier. An identifier that represents a single 802.11 cell (similar to a MAC address)
- C** **Client** — Client – device with connects to an access point, does not function as an AP (but can operate as a wired to wireless “adapter”)
- CPE** — Customer Premise Equipment
- D** **DSSS** — Digital Sequence Spread Spectrum. A type of Modulation.
- M** **MIMO** — Multiple Input, Multiple Output antenna – simultaneous (and smart; each antenna can choose RF signals) transmit and receive (referenced as “mxn antennas” such as 2x2 or 3x3)
- Modulation** — RF (analog) delivery mechanism of digital data (FM is a type of modulation)

MTTO — Mean Time To Optimize

MTTR — Mean Time To Repair

O **OFDM** — Orthogonal Frequency Division Multiplexing

R **Retransmission retries** — For packets requiring retransmission, this is the number of retries required to successfully retransmit the packet

RF — Radio Frequency. RF energy can cause interference

RSSI — Received Signal Strength Indication

S **SNR** — Signal to Noise Ratio

Spectral — A spectrum analyzer is used to measure signal amplitude (strength) as it varies by signal frequency. The frequency appears on the horizontal axis, and the amplitude is displayed on the vertical axis.

A spectrum analyzer can be used to determine whether or not a wireless transmitter is working according to federally defined standards for purity of emissions. Output signals at frequencies other than the intended communications frequency appear as vertical lines (blips) on the display. A spectrum analyzer can also be used to determine, by direct observation, the bandwidth of a digital or analog signal.

SSID — Service Set Identifier. The network that we are connected to (or attempting to connect to).



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