

User Manual

■ KT-RFCT 2400A



KT-RFCT 2400A

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1 Welcome

Welcome to the KT-RFCT 2400A User Manual. The purpose of this document is to provide information to users to verify device operation and to quickly get up and running with the device.



Figure 1 –KT-RFCT 2400A

The Konrad-Technologies Radio Frequencies Communication Tester (KT-RFCT 2400A) provides a low-cost test solution for test of wireless devices. Both RF parametric test and network throughput performance testing are possible within the same instrument covering key communication standards such as Bluetooth and Wi-Fi.

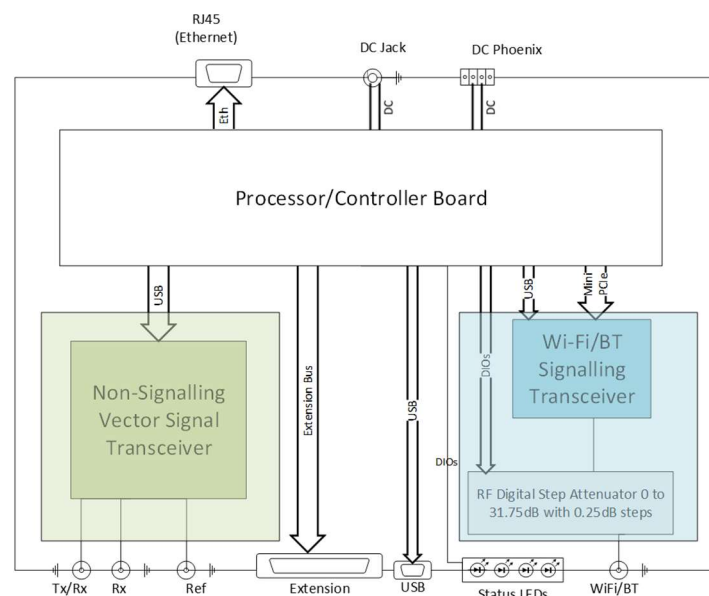


Figure 2 – Block Diagram of the KT-RFCT 2400A

The KT-RFCT 2400A Tester has connectors and status indicators on the front panel, but no actual user controls. The device is controlled remotely over the Ethernet Interface accessed on the rear of the device. You can use the supplied Konrad KT-RFCT 2400A Tools Software to configure and control via a Soft Front Panel application. Alternatively, you can control the test set remotely via software APIs provided by Konrad.

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The User Manual is divided into the following sections:

- Unpacking the KT-RFCT 2400A tester
- Documentation
- Front and Rear panels
- Hardware Setup
- Software Installation (for Windows users)
- Finding the KT-RFCT 2400A on the Ethernet using the Finder APP
- Operation using the KT-RFCT 2400A Soft Front Panel
- Changing the firmware using the KT-RFCT 2400A Updater
- Further Information
- Compliance and CE Marking
- Regulatory
- Konrad Support and Service Information

2 Unpacking the KT-RFCT 2400A

Initial Inspection

Please inspect the shipping container for damage. If the shipping container or packaging material is damaged it should be kept until the contents have been checked mechanically and electrically. If there is mechanical damage, notify Konrad Technologies (see page 28 for further information).

Keep the damaged shipping materials (if any) for inspection by the carrier and a Konrad representative.

What ships in the Box?

KT-RFCT-2400A when ordered using part number G170125 is supplied inclusive of AC/DC power converter, CAT6 1m data cable and a Quick Start Guide.

License keys for any purchased options can be obtained by emailing support@konrad-technologies.de

3 Documentation

KT-RFCT 2400A documentation includes:

- The *KT-RFCT 2400A User Manual* (this guide) – Leads you through unpacking, checking the tester, powering on the tester and communicating with the device using the supplied KT Software Application.
- The *KT-RFCT 2400A Product Datasheet* – This contains the detail on the Specifications and the interfaces available for you to use.
- The KT-RFCT 2400A Quick Start Guide – This is supplied in the box and provided a sub-set of this document.



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- The *KT-RFCT 2400A Application and Programming Guide* – a document providing detail on how to control and use the device under control from a user developed software application. (*Under Development*)

Abbreviations Used in this Guide

APP	Software Application
AC	Alternating Current
BT	Bluetooth
DC	Direct Current
DUT	Device under test, unit under test, test specimen
IP	Internet Protocol
KT	Konrad Technologies
PC	Personal Computer
RF	Radio Frequency
RFCT	KT-RFCT 2400A
SMA	Sub-Miniature type A – RF connector type
SN	Serial Number
USB	Universal Serial Bus
Wi-fi	Wireless Technology based on IEEE802.11 Standards



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4 Front and Rear Panels

4.1 Front Panel

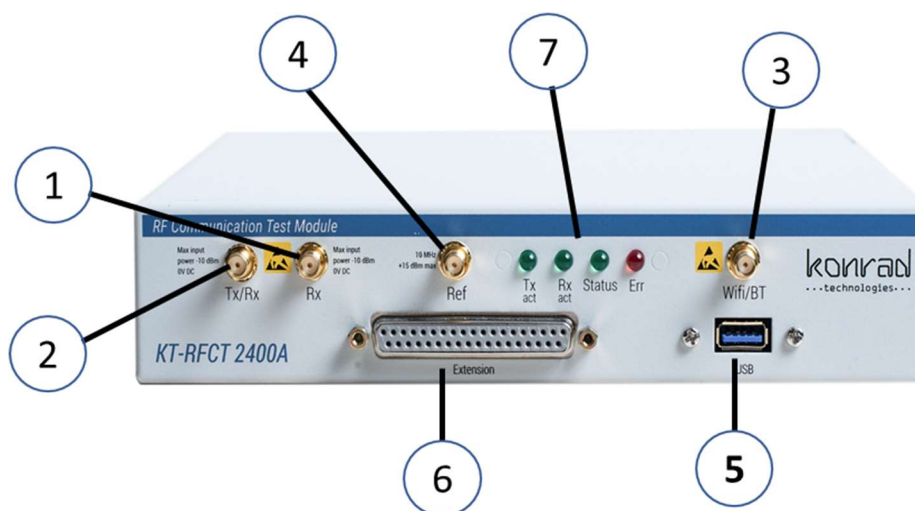


Figure 3 –KT-RFCT 2400A Front Panel Layout








	Description	Connector	Warning	
1	RF input to the non signaling transceiver	SMA (f) (50 ohms)	 	Do not exceed -10dBm Max RF power or 0V DC Ensure static precautions are taken to avoid damage through static discharge
2	RF input/output to the non signaling transceiver	SMA (f) (50 ohms)	 	Do not exceed -10dBm Max RF power or 0V DC Ensure static precautions are taken to avoid damage through static discharge
3	RF input/output to the Wi-fi / Bluetooth radio	SMA (f) (50 ohms)	 	Do not exceed -10dBm Max RF power or 0V DC Ensure static precautions are taken to avoid damage through static discharge
4	Input for an External 10MHz Reference	SMA (f) (50 ohms)		Do not exceed +15dBm
5	USB 3.0 (for future use but can be used to provide DC power)	Type A		
6	I/O Extension (see table)	D-Sub 37 way		
7	Status Indicators			

Table 1 – Front Panel Inputs and Output



KT-RFCT 2400A

4.1.1 Status Indication LEDs

LED	Description
Tx act	Off – RF output is in-active (Tx/Rx port) On – RF output is active (Tx/Rx port)
Rx act	Off – Signal acquisition is idle (Tx/Rx or Rx port as configured) On – Signal acquisition in progress (Tx/Rx or Rx port as configured)
Status	Off – No DC input power Flashing – Booting up in progress On – Ready
Err	Off – No error On –Error Present

Table 2 – Status Indication LED



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4.2 Rear Panel

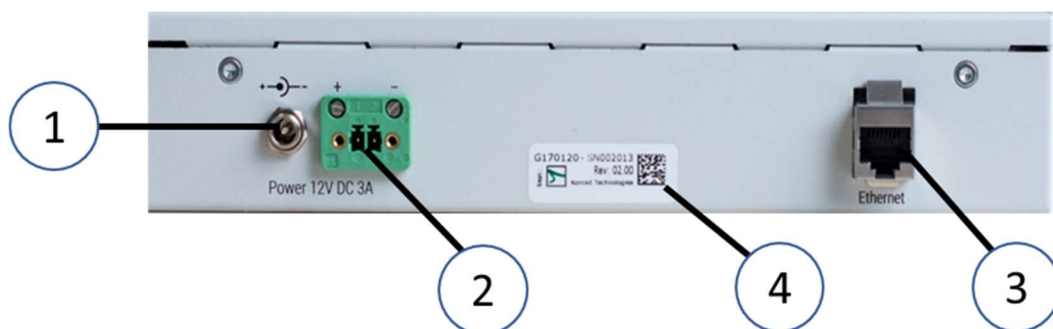


Figure 4 –KT-RFCT 2400A Rear panel inputs and outputs

	Description	Connector	Warning	
1	12 VDC input	Jack type RAPC722X 2.0 mm center pin diameter with positive (+) polarity		Do not exceed +12V DC Do not apply DC power to <u>both</u> DC power inputs simultaneously.
2	12 VDC input	Phoenix		Do not exceed +12V DC Do not apply DC power to <u>both</u> DC power inputs simultaneously.
3	Ethernet (1GB)	RJ45 Cat 6		
4	Serial Number			

Table 3 – Rear panel inputs and outputs

5 Hardware Set-Up

This section will step you through:

- Connection of a suitable power supply
- Confirmation of boot up

5.1 DC power connection

DC power can be applied to either the Jack input or the Pheonix input from a 12V/3A DC PSU.

The Pheonix input is best suited to permanent installation in a rack.

DC should not be applied to both simultaneously.



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5.2 Power On and Confirmation of Bootup

When the DC input is connected and tester will power on and all front panel LED's will illuminate briefly.

During bootup, the green Status LED will initially flash and then remain on once bootup is complete.

The KT-RFCT 2400A is then ready for use.



Figure 5 – Bootup Status LED



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6 Software Installation (for Windows)

This section will step you through:

- Installation of the KT-RFCT software to your Windows PC
- Finding the Tester on the Ethernet using the KT Finder Application
- Changing the Tester IP Address – (if required)

The KT RFCT companion software containing instrument drivers, firmware and tools can be downloaded from:

Link: <ftp://195.95.146.157/RFCT/Releases/>

Username: **read** Password: **Access2Files**

Run the KT-RFCT 2400A software installer and follow on screen prompts.

On completion you may launch the applications from within the start menu or from icons on the Windows desktop.

A Windows installer installs Windows C/C++ drivers, all optional plugins and a number of tools: The installer also copies LabVIEW drivers into the correct location for installation.

C/C++ drivers are distributed as 32 bit (x86) and 64 bit (x64) DLLs and have been compiled using Microsoft Visual Studio 2017.

The DLL import libraries can be found in the "Lib\x86" and "Lib\x64" subfolders.

If you do not have Microsoft Visual Studio 2017, its redistributable package needs to be installed. This can be downloaded from here:

<https://visualstudio.microsoft.com/downloads/>

The LabVIEW drivers are copied into the LabVIEW subfolder as VIP files. These files need to be installed before use using the "VI Package Manager" from JKI. This can be downloaded from here:

<https://jki.net/vipm>

KT-RFCT-2400A Tools include:

- KT-RFCT 2400A Soft Front Panel for manual instrument control
- KT-RFCT-2400A Updater for updating instrument firmware
- KT-RFCT 2400 Finder.

Their use has a dependency on National Instruments LabVIEW 2015 runtime. This can be downloaded from the NI Website <http://www.ni.com/download/labview-run-time-engine-2015/5507/en/>



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6.1 Additional Software Components

All firmware is pre-installed on the instrument when shipped however, firmware images are supplied separately for the basic instrument and each optional plugin.

C/C++ drivers are also supplied for Linux OS users. These should be copied/unzipped to your chosen location.

		Drivers				Firmware	Tools
		C/C++		LabVIEW	Python		
		Windows	Linux				
RFCT		Installer	.zip	Installer	.zip	.zip	Installer
Optional Plugins	LE Central		.zip		NA	.zip	NA
	DTM		.zip			.zip	
	iPerf		.zip			.zip	

Table 4 – Software Package



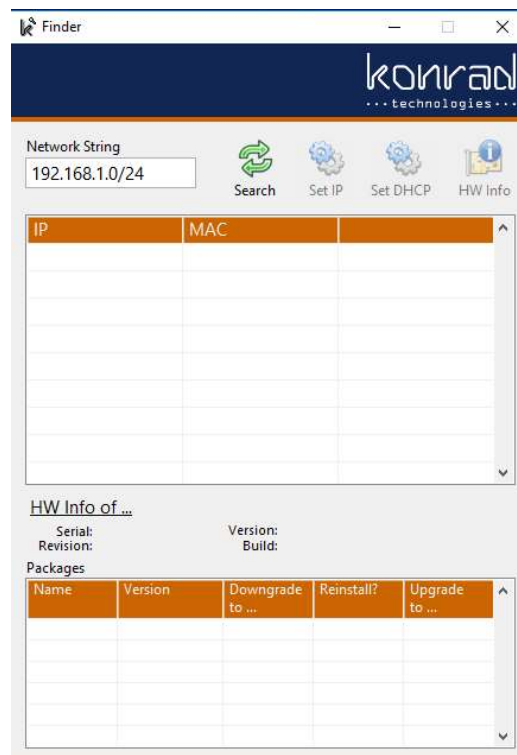
KT-RFCT 2400A

6.2 Using the Finder APP

Initially to find and set the IP Address of the KT-RFCT 2400A please follow these steps:

- On the Host PC disconnect from all other networks
- Connect the Ethernet cable from the KT-RFCT 2400A rear panel LAN port to the Host PC Ethernet port (for optimal performance use Gigabit LAN and a CAT6 cable)
- On the Host PC change the IP Address to static IP address 192.168.0.1
- If you wish to add the KT-RFCT 2400A to an existing network please contact your own IT/Network administrator for advice. The KT-RFCT 2400A can be configured to use a static IP address or a dynamically allocated IP address via DHCP.
- Power on the Tester, then wait until the Status LED stops flashing.
- Run the KT-RFCT 2400A Finder application

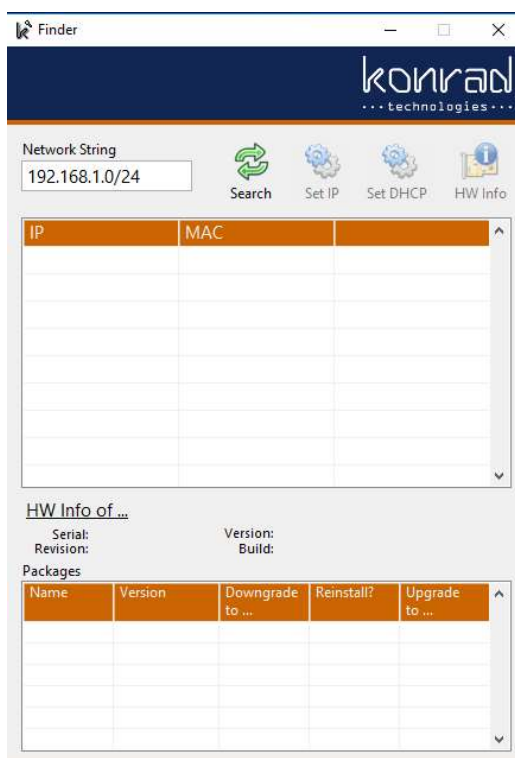
You press Search to cause the application to search the Subnet for the Tester, the default IP address is 192.168.0.023



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6.3 Changing the Tester IP Address – (if required)

Using the KT Finder application, you can change IP Address if you require it to be different from the default value or if you prefer the unit to use a DHCP server to allocate an IP address.



Power cycle the Tester.

Note: The that by default the tester has three IP addresses; a primary one that can be changed, and two backup addresses which cannot be changed.

Eth0 (main)	192.168.1.X (where X is related to the device serial number e.g. for SN2023, X would be 23)
Eth0:0(backup)	192.168.0.23 - Fixed
Eth0:1(backup)	10.102.4.203 - Fixed

Table 6 – Default IP Addresses

If the main IP address is changed to be in the 192.168.0.X or 10.102.4.X subnets, the fixed backup IP address on the same subnet will be disabled because the tester cannot have two IP address on the same subnet.

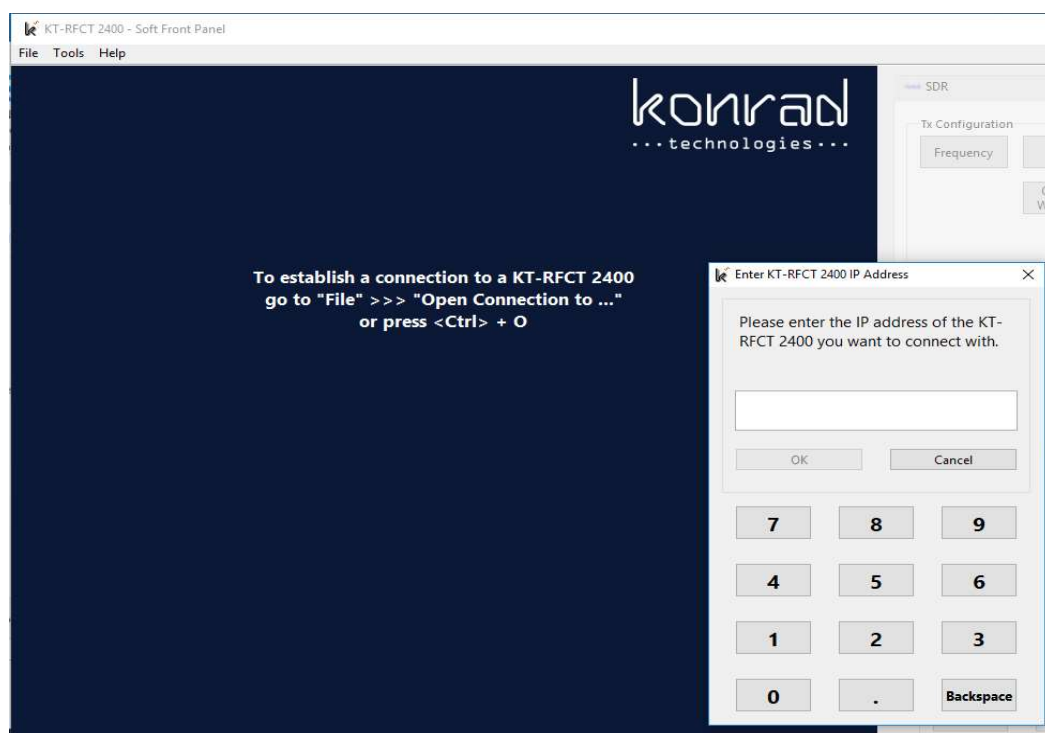


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7 Operation using the KT-RFCT 2400A Soft Front Panel

The Soft Panel Loads and you can prepare to run some basic Non-signaling, Wifi or Bluetooth tests.

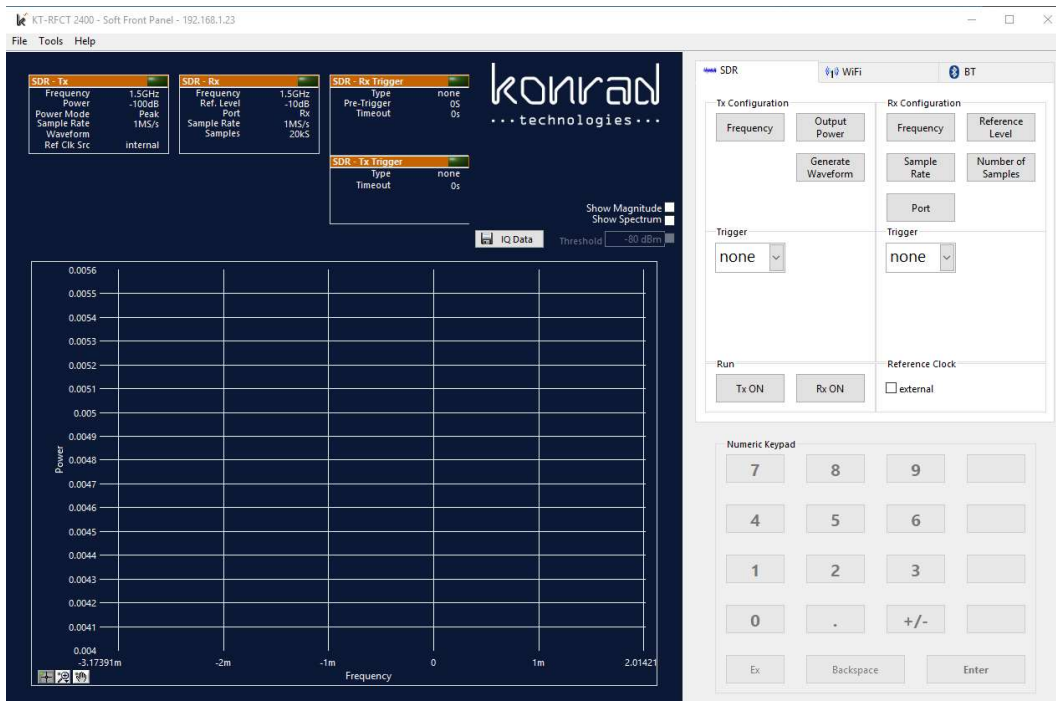
Connect to the KT-RFCT 2400A by entering it's IP Address



Once connected, the Measurement Tabs are enabled



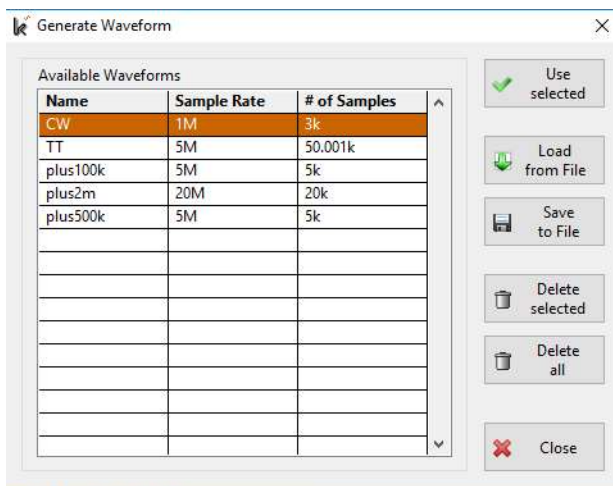
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7.1.1 Run a loopback test using the supplied Soft Front Panel Application.

Run loopback test on the non-signalling radio (SDR)

Press Generate Waveform Button



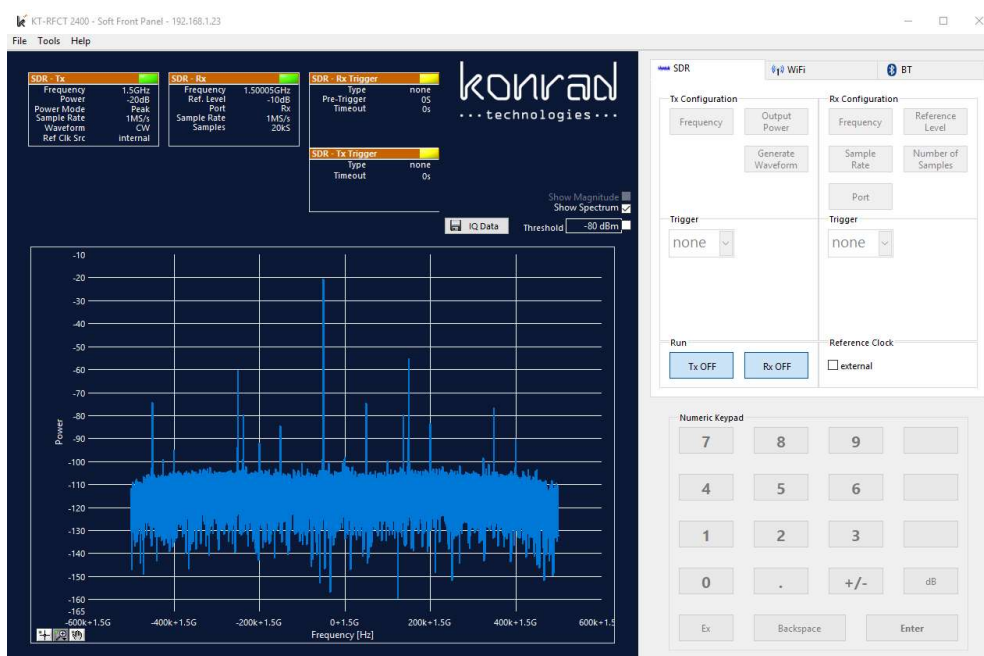
Select CW signal. Click Use Selected, then close the popup.



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Now Configure Tx and RX Settings

Tx Configuration	Rx Configuration
Frequency = 1.5 GHz	Frequency = 1.50005 GHz (note offset value)
Output Power = -20 dBm	Reference Level = -10 dBm
Trigger = None	Other settings leave as default
	Press in the Run window Tx ON and Rx ON



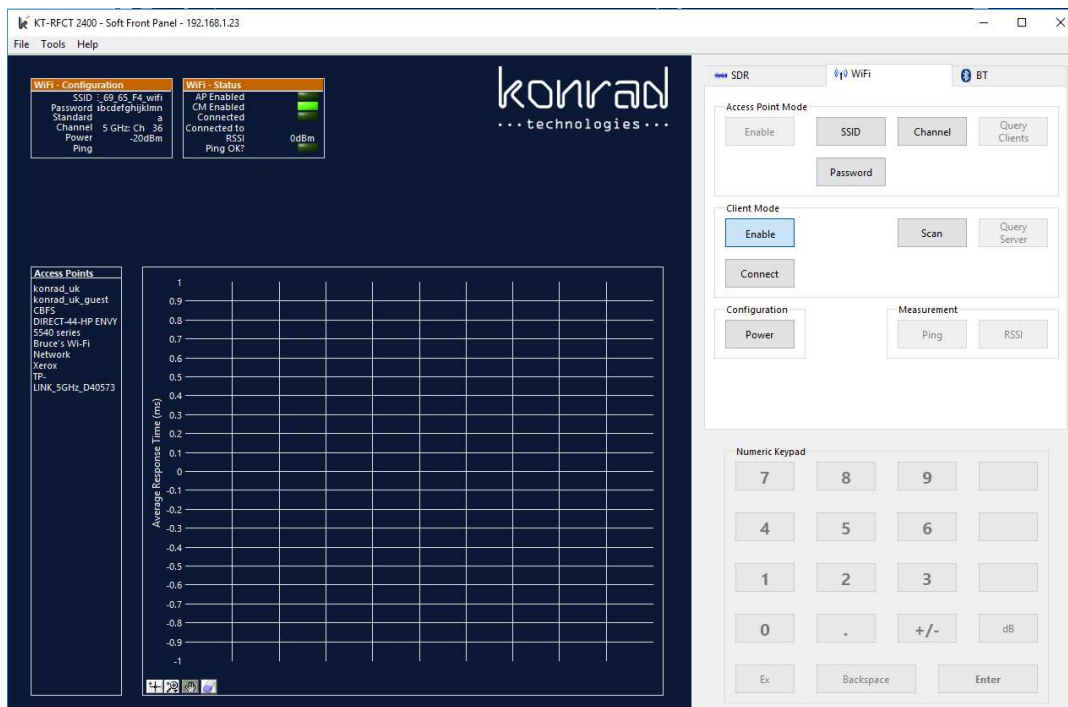
7.1.2 Run a WiFi Scan on the WiFi Tab

Select the WiFi Tab on the Soft Front Panel

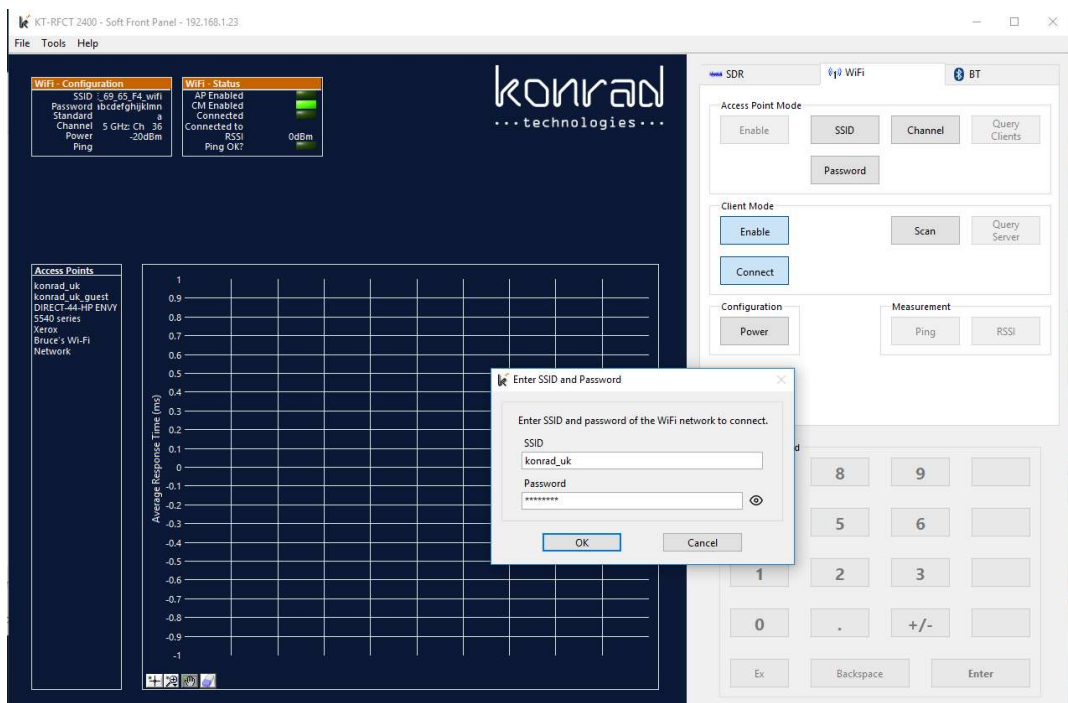
In the Client Mode Block select press Enable, then press Scan.



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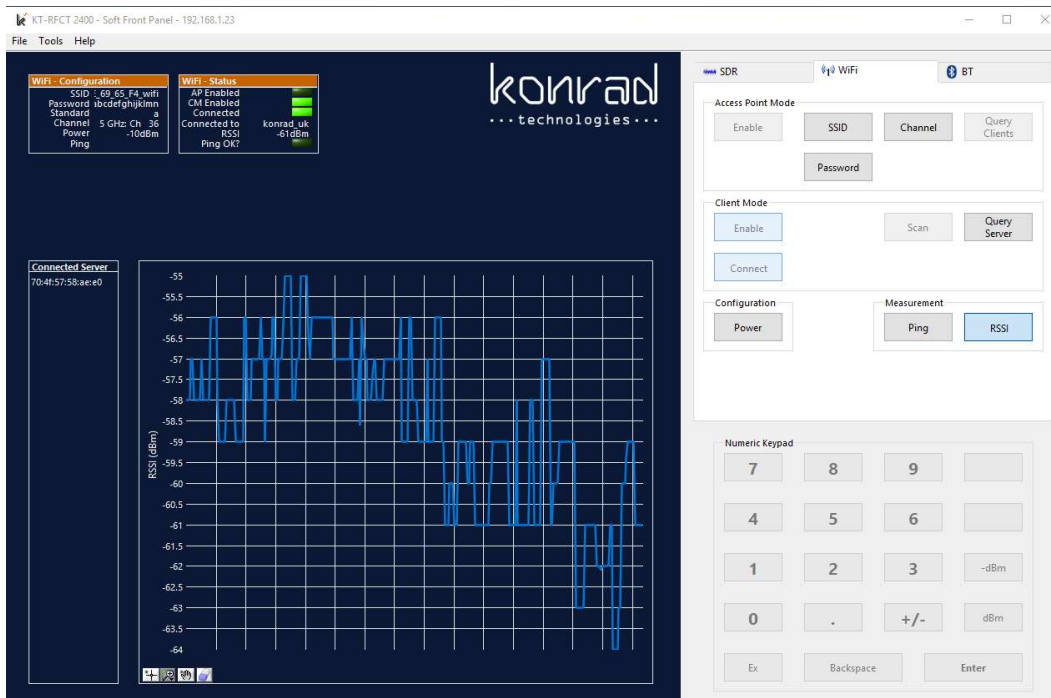


Note the list of Access Points, select one to connect to, then press Connect.



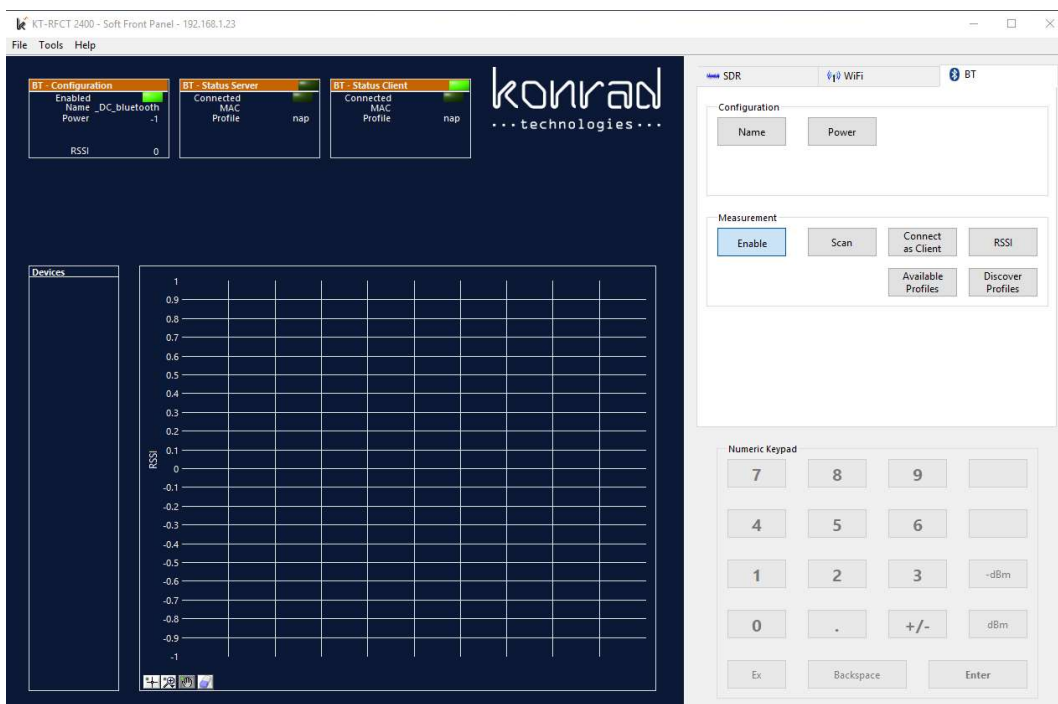
Press the RSSI to obtain measurements.

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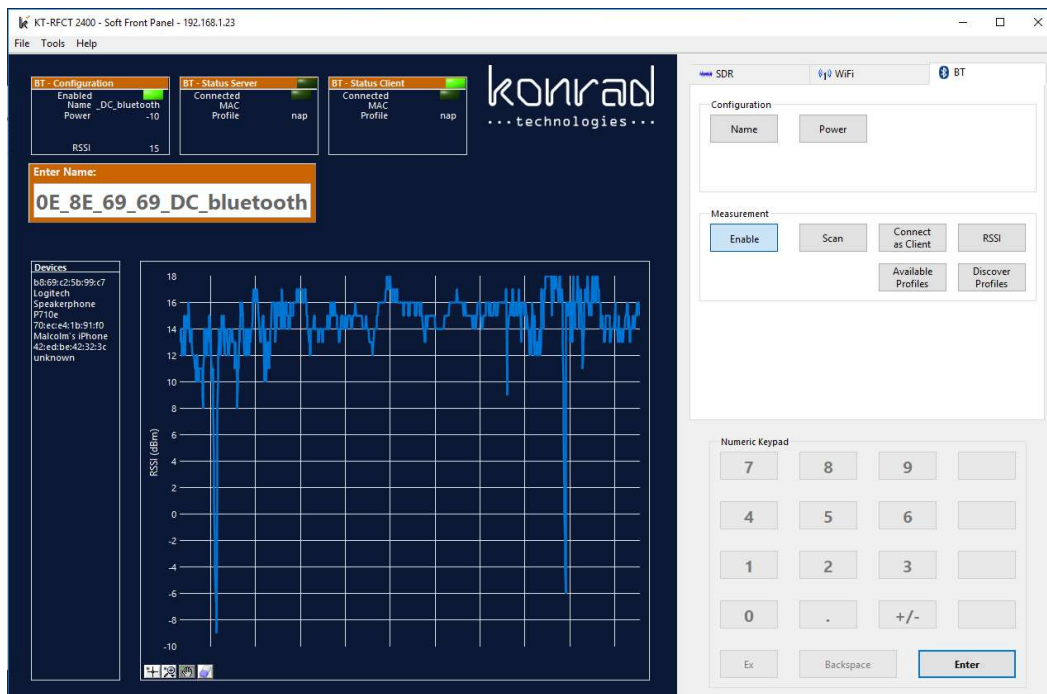
7.1.3 Run a BT Scan on the BT Tab.

Select the BT Tab, Press the Enable button on the Measurement block



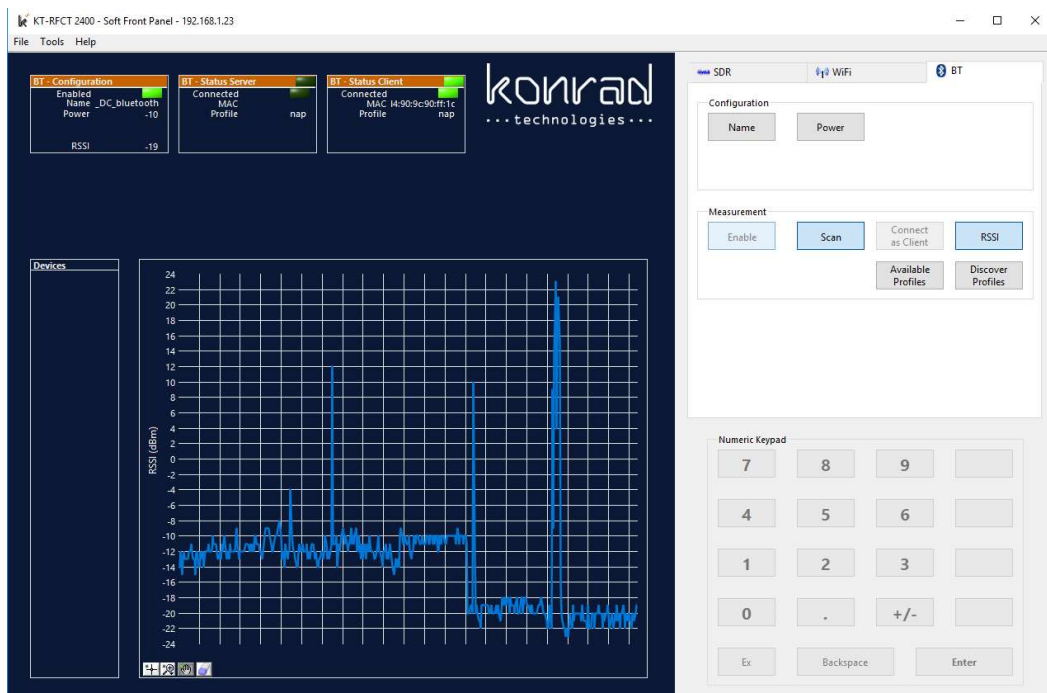
Press Scan button, a list of available BT devices will be listed. On a suitable BT device attempt to pair with the 00_0E_8E_69_69_DC_bluetooth device.

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Once a device is connected as a Client you will see the status change.

Press the RSSI button to obtain measurements when the BT Device is paired with the KT-RFCT 2400A BT.



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8 Changing the KT-RFCT 2400 firmware using the Updater APP

This section is only relevant where a user wishes to upgrade or downgrade the firmware installed on the instrument.

The KT RFCT companion software can be downloaded from:

Link: <ftp://195.95.146.157/RFCT/Releases/>

Username: read Password: Access2Files

The software contains instrument drivers, firmware and tools.

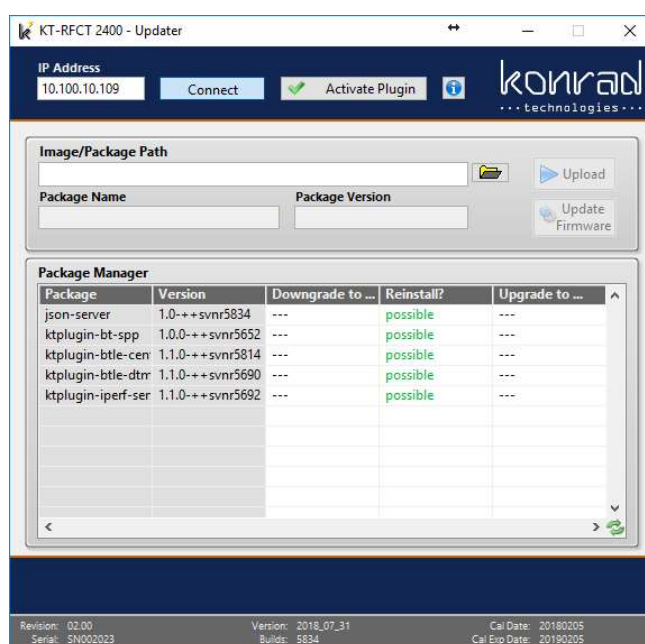
The Updater application enables the user to easily update the firmware on the KT-RFCT 2400 and to install or upgrade optional plugins at a later date to provide additional functionality.

8.1.1 Changing Firmware

To access the latest firmware contact Konrad Support

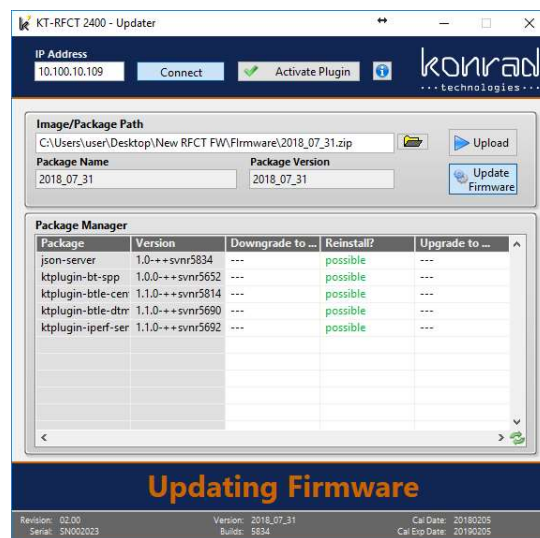
To change the firmware, please perform the following steps:

- Run the KT-RFCT 2400A Updater application.
- Enter the IP address of the KT-RFCT 2400 (either the primary IP address or the fixed address 192.168.0.23). Unless previously changed, the primary address is 192.168.1.xxx where xxx is the last 3 digits of the serial number.
- When using the Primary IP address the Host PC static IP Address must be changed to be in the same subnet.
- Click the Connect button. The Updater application will connect to the KT-RFCT 2400 and query the current firmware version and installed plugins as shown below:

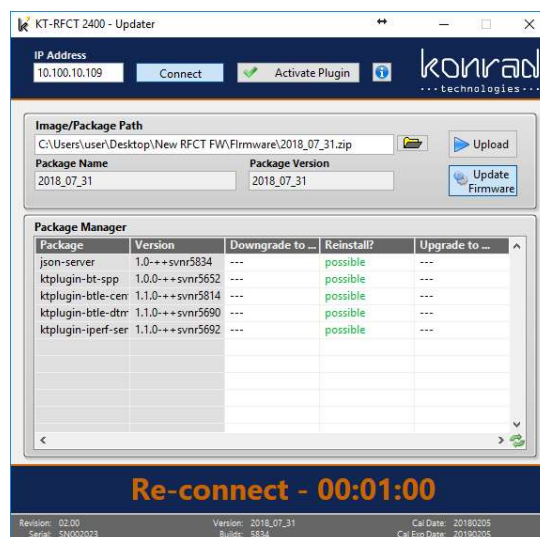


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- Click on the folder icon next to the Image/Package Path text box and navigate to the location of the firmware image file which will be a dated zip file e.g. 2018_07_31.zip
- Click the Upload button. A licence information screen will pop up, click Agree.
- Click the Update Firmware button – A pop up warning dialog will be displayed which will explain what will happen during the firmware update process, click OK to proceed.
- Wait until the firmware update is complete which is indicated when the Updater status shows 'Finished!'. The firmware update will take at least 5 minutes, do NOT disconnect DC power or attempt to use the KT-RFCT 2400 during the firmware update process.



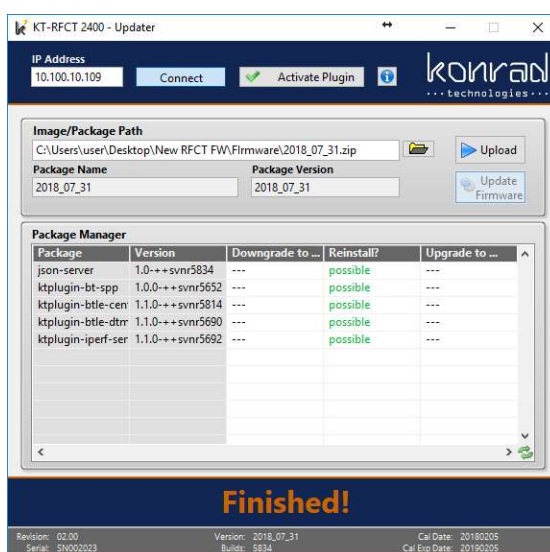
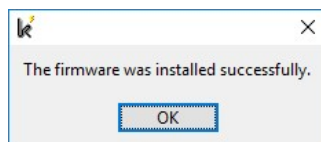
Stage 1



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Stage 2

The KT-RFCT 2400 will reboot at least once during this stage of the firmware upgrade. When complete the following pop up will be displayed – click OK.



Stage 3 - Finished

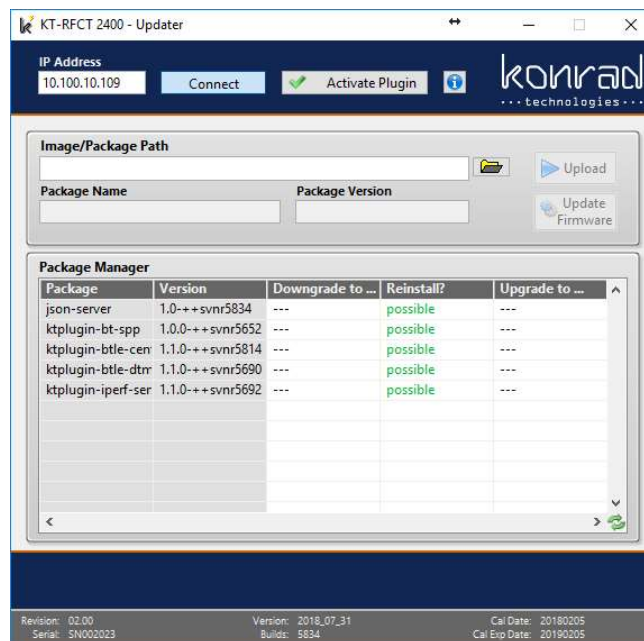


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8.1.2 Installing Firmware Plugins

To install a firmware plugin, please perform the following steps:

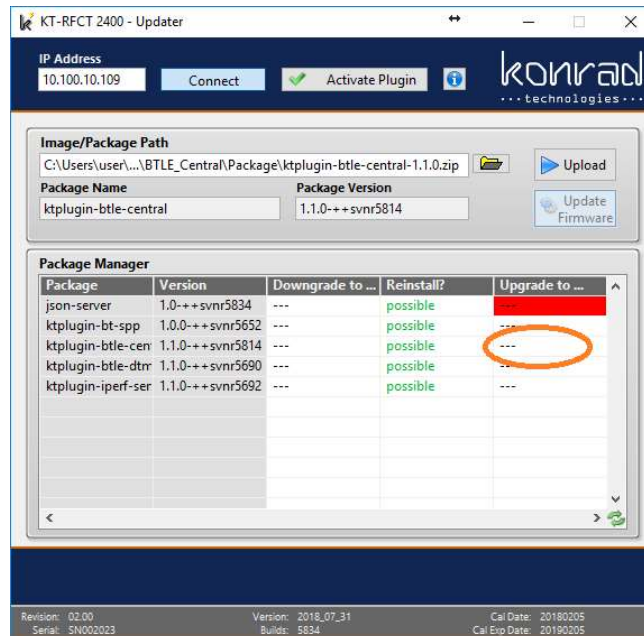
- Power on the KT-RFCT 2400, wait until the front panel LED's have stopped flashing and only the status LED is illuminated.
- Connect the KT-RFCT 2400 to the same ethernet network as the PC, and ensure that networking settings are correctly configured.
- Run the KT-RFCT 2400A Updater application.
- Enter the IP address of the KT-RFCT 2400 and click the Connect button. The Updater application will connect to the KT-RFCT 2400 and query the current firmware version and installed plugins as shown below:



- Click on the folder icon next to the Image/Package Path text box and navigate to the location of the plugin package file which will be zip file named ktplugin-<plugin name>-<version>.zip e.g. ktplugin-btle-central-1.1.0.zip.zip
- Click the Upload button. A licence information screen will pop up, click Agree.
- The selected plugin will be uploaded to the KT-RFCT 2400



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- The version number of the uploaded plugin will appear in the Upgrade to... column of the Package Manager. Note that it is not shown in the above picture because the version number of the uploaded plugin is the same as that currently installed, therefore there is nothing to upgrade to.
- To install or upgrade a plugin, double click on the version number in the Upgrade to... column of the Package Manager (i.e. the area highlighted in orange).

Repeat the above procedure for any additional plugins that need to be installed or upgraded.

8.1.3 Activating Plugins

When installing plugins for the first time, each plugin must be activated using a purchased activation key.

To activate a plugin, click the Activate Plugin button and copy/paste the activation key in to the Activation Key field of the dialog box, then click Activate.

Activation only needs to be done once – upgrading firmware or plugins will not delete the activation key.



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9 Additional Information

9.1 Extension Port

Interface	Number of pins used
UART - TTL	2
GPIO	5
ADC (12bit)	4
3.3V	1
5V	1
3V PWM	4

Table 7 – Extension Connector Interface Types

DSUB	Function	DSUB	Function
1	I2C_SDA	20	AN1 ADC0
2	I2C_SCL	21	AN1 ADC1
3	DGND	22	AGND
4	SPI1_CS	23	AN1 ADC2
5	SPI1_CLK	24	AN1 ADC3
6	SPI1_MISO	25	AGND
7	SPI1_MOSI	26	GPIO0
8	DGND	27	GPIO1
9	UART3_RXD	28	future use
10	UART3_TXD	29	future use
11	DGND	30	GPIO2
12	UART4_RXD	31	GPIO3
13	UART4_TXD	32	GPIO4
14	DGND	33	Fan Stat
15	CAN1_H	34	DGND
16	CAN1_L	35	DGND
17	CAN1_GND	36	DGND
18	CAN2_H	37	DGND
19	CAN2_L		

Table 8 – DSUB pinout

Items in italics are placeholders for future use



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9.2 Rack mount Installation (optional)

If required, the unit can be mounted in a 1U space within a 19" rack using the rack mounting kit Part number G170123, (supplied separately).

Mounting position screw holes are located on side of the device.



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10 Regulatory

The KT-RFCT 2400A conforms to CE and a copy of the declaration document is provided here:



Declaration of Conformity According to EN ISO/IEC 17050-1:2010



Manufacturer Name: Konrad GmbH
Address: Fritz-Reichle-Ring 12
D-78315 Radolfzell am Bodensee, Germany
Web: www.konrad-technologies.de

We hereby declare under our sole responsibility that the following apparatus:

Product Description: KT-RFCT-2400_GEN_II
Model Number: G170120
Product Category: Electrical equipment for measurement, control and laboratory use

Complies with the essential requirements of the following applicable European Directives:

Electromagnetic Compatibility (EMC) Directive 2014/30/EU,
Low-Voltage Directive 2014/35/EU,
RoHS Directive 2011/65/EU.

Conformity is assessed in accordance to the following standards:

EMC: Emissions
DIN EN 55011: 2011 Class B
DIN EN 61000-3-2: 2015
DIN EN 61000-3-3: 2014

Immunity
DIN EN 61000-4-2: 2009 Class 3
DIN EN 61000-4-3: 2011
DIN EN 61000-4-4: 2013 Class A
DIN EN 61000-4-5: 2015
DIN EN 61000-4-6: 2014
DIN EN 61000-4-11: 2005

Safety: DIN EN 61010-1: 2011

Environmental Affairs: Articles manufactured on or after the Date of Issue of this Declaration of Conformity do not contain any of the restricted substances in concentrations/applications not permitted by the RoHS Directive.

April 28, 2017, Radolfzell

Date and Place of Issue

P. Wachtendorf

Peter Wachtendorf, EMV Representative Konrad GmbH



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11 Support

11.1 Calibration

The recommended calibration interval is 12 months.
Contact Konrad Customer support to arrange a calibration of your KT-RFCT 2400A

11.2 Warranty

KT-RFCT 2400A is supplied with a 12 month warranty against defective parts or workmanship.
This warranty may be void in the event the integrity seal is broken on the equipment.

For all questions regarding support please contact:

Konrad GmbH
Fritz-Reichle-Ring 12
D-78315 Radolfzell

Tel: 07732-9815-0
Fax: 07732-9815-104
Email: info@konrad-technologies.com
Homepage: www.konrad-technologies.com

