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TECHNICAL BULLETIN # 27

August 1, 2015

To: All LabExpress and RFxpert units

Re: Getting started with Wi-Fi testing on the RFxpert

OVERVIEW

Testing Wi-Fi devices can be complicated as the Wi-Fi signal is bursty with lots of variations in the implementation. This document will give some general guidelines that should help with testing most types of Wi-Fi devices on the RFxpert. A more in-depth guide is available on demand at support@emscan.com

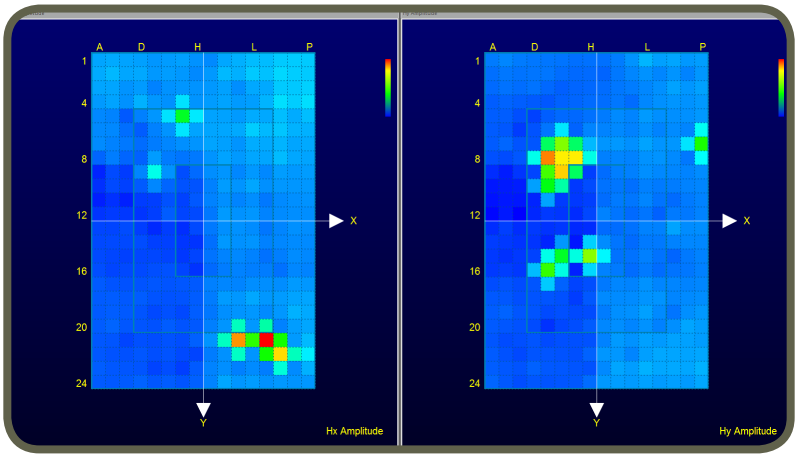
INTRODUCTION

Wi-Fi covers many different types of the 802.11 protocols and within each protocol there can be many different modes of operation. These protocols involve pulse signals with duty cycles that depend on data rate and such data rate is often adjusted dynamically depending on channel conditions and the data being transferred. RFxpert can handle the QAM of Wi-Fi signals but it also needs help to handle the pulse aspect. Some knowledge of the signal is required for the setup of parameters in the RFxpert software that ensure the RFxpert hardware does not get stuck looking for a signal when none is present.

The setting in the RFxpert software labelled Bursty/TDMA/etc. was built for GSM so it is targeted to bursty signals that have a pulse length of about 500 us with a pulse every 4 ms. To handle other pulse lengths and duty cycles, you have to use the Advanced mode. This Advanced mode can be difficult to set up even with knowledge of the signal details. Sometimes it is easier to modify the DUT to make it fit existing CW or Bursty mode settings in the RFxpert than the other way around. This document will give suggestions on how set up the RFxpert and the Wi-Fi DUT to give the best possible results.

SETUP DETAILS

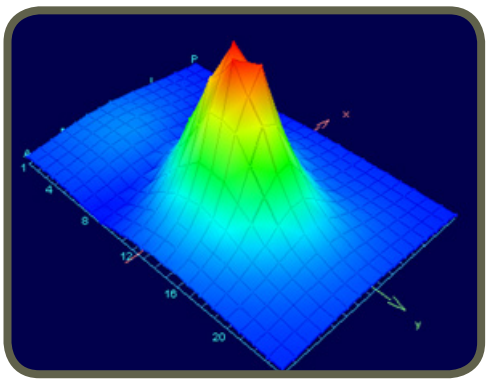
The problem with running the RFxpert in CW mode with a standard Wi-Fi signal is shown in the image below. The device is only transmitting intermittently so only a few cells out of 384 (in the RFX below, and out of 1600 in the RFX2) were measuring while the device was actually transmitting. The rest of the cells were measuring while the device was not transmitting between bursts.

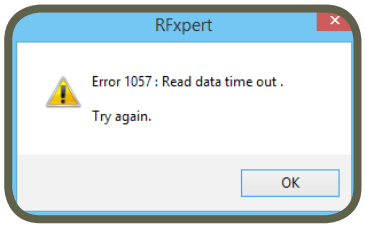


RFxpert™

Standard Bursty Mode

The first thing to try with a Wi-Fi devices is to test with the Bursty/TDMA/etc. setting in the RFxpert software. Some devices will be measurable in this mode. If the test is successful you should see a smooth continuous patter similar to the one below. If the test is not successful you will see an error message that says “Read data time out”.





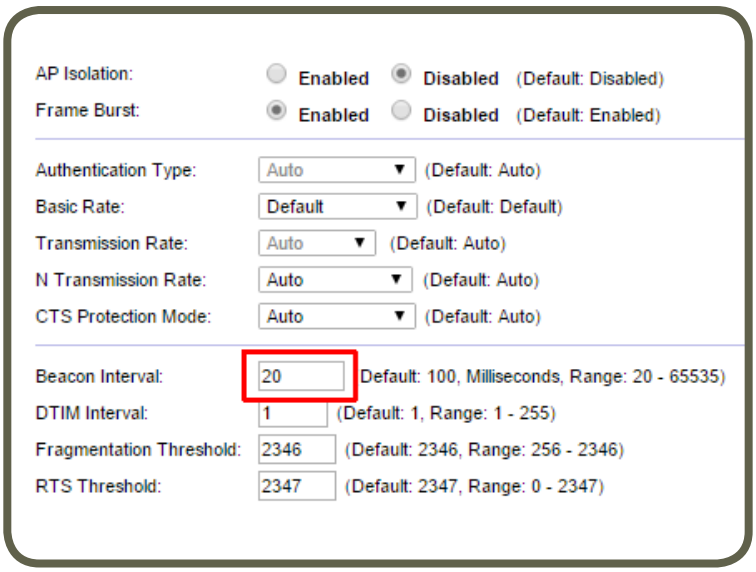
PS: Error 1057 can sometimes cause the RFxpert to lock. Close or End the RFxpert application and try different settings.

Increased Device Burst Method

If the device cannot be detected with the Bursty/TDMA/etc. mode then it may be possible to alter the device transmit parameters slightly so its signal can be detected. In this case, an attempt should be made to increase the rate of bursts from the Wi-Fi signal since slow burst rate is most likely causing the RFxpert to timeout.

The exact method of increasing the burst rate for a given Wi-Fi device will be different for every device but some examples are given here.

To increase the burst rate of a Wi-Fi access point it is sometime sufficient to decrease the beacon interval to the minimum time. Settings of a generic Wi-Fi access point are shown below. In other cases it may be required to establish a high throughput connection through the access point with another device.

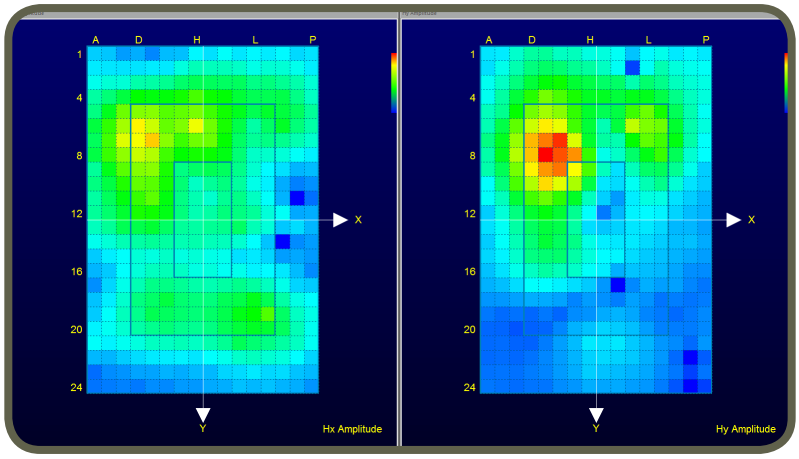


Uplink Speed Test Method

When testing Wi-Fi on a device like a mobile phone it is sometimes sufficient to establish an uplink connection and then test using the Bursty/TDMA/etc. setting. The results below were obtained using a mobile phone and a simple data rate connection app such “OOKLA Speedtest”. While the app was testing the uplink speed a full measurement could be completed.

The RFX very-near-field results as shown below should always be checked when using this method to ensure that there are no dropped cells which will impact measurement accuracy.

Another way to verify this is to run several scans and look for repeatable results.

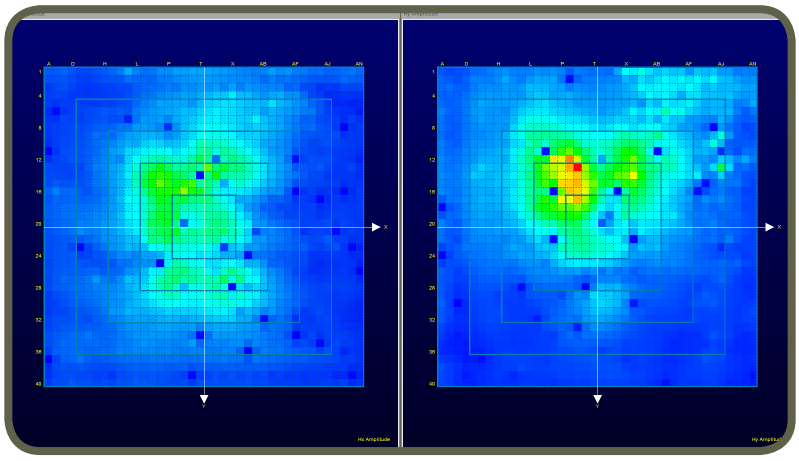


File Transfer Method

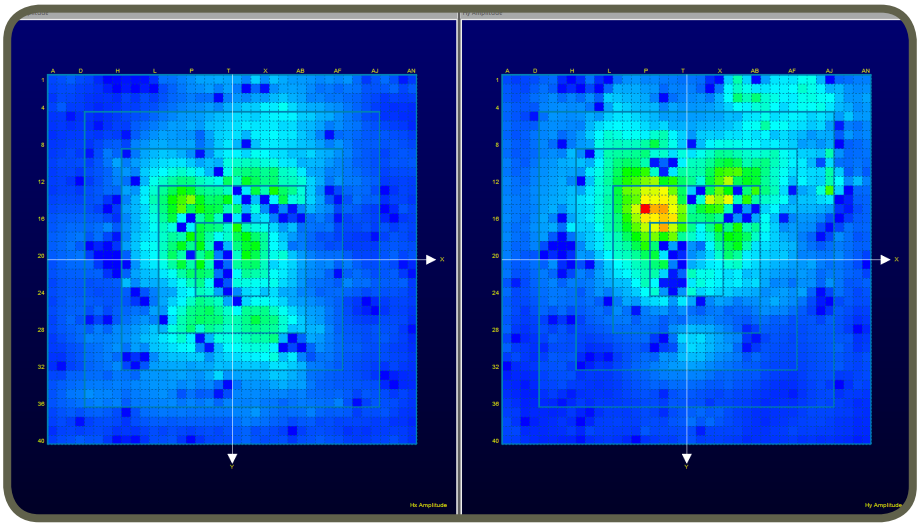
If the Uplink Speed Test method does not work, it is possible to make a longer lasting uplink using a direct file upload of a large file. The results below were from testing a tablet on the RFX2 with this method since it did not work out with the Uplink Speed Test method.

In this case, an application called ‘Fast File Transfer’ was used and an arbitrary large file was chosen to be uploaded from the device. The near continuous transmission allows the RFX or RFX2 to be run in CW mode. It is important to note the CW mode does not synchronize to the pulses so the accuracy is dependent on the user judging signal stability and the relative amount of very-near-field dropouts.

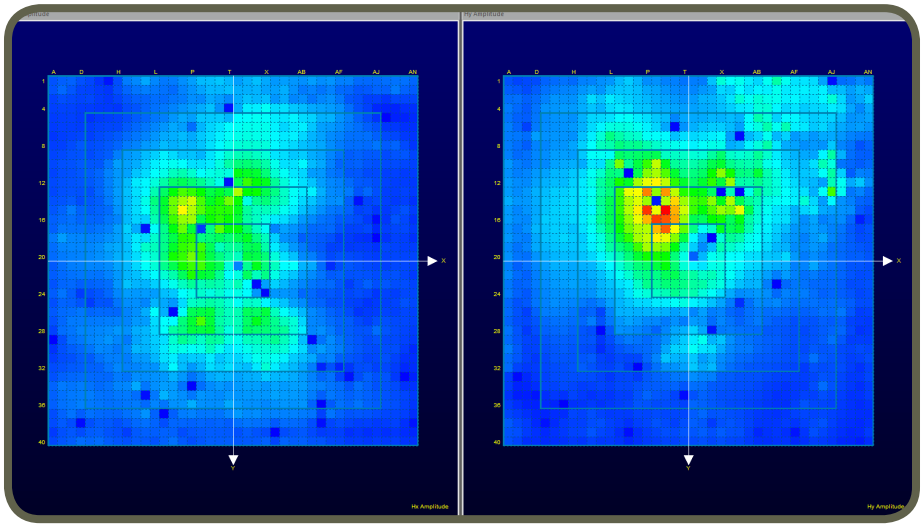
The image below shows a good result from the measurement of the tablet under test. There are about 20 noticeable dropouts and none of them appear in the hotspot of the antenna which is indicated by red and orange.



The image below was taken with the exact same setup but it shows too many random dropout locations. This measurement gave a reading 2dB lower than the one above and should be rejected if high accuracy is desired.

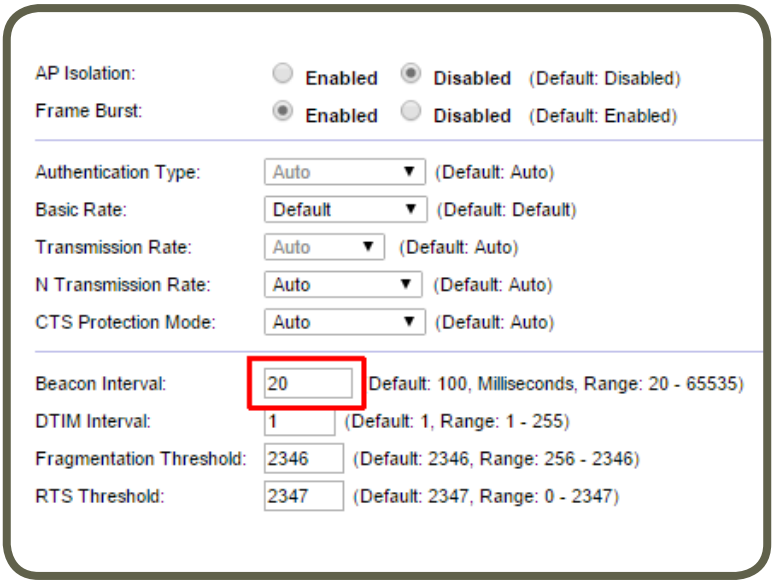


The image below shows only a few dropouts but one of the dropped location in right in the middle of the antenna hotspot. This measurement is not ideal and gave a reading 0.4dB lower than the first measurement.



Advanced Mode

If the previous methods did not deliver repeatable results then it is time to try the Advance mode setting. This method is difficult to set up and does require trial and error to work. The first step is to run a scan with default settings. If this shows the “Read data time out” error message the threshold level should be raised by 1 dB at a time until a signal is captured. For example, from -55.94 dBm to -53.94 dBm at first. A measurement should be tried at each new threshold level. If no signal is captured when the limit of -30 dBm is reached then the threshold should be set back to the default of -55.94 dBm and the threshold should be lowered by 1 dB at a time until the limit of -70dBm is reached.



If setting the threshold to the limit does not capture a signal then the timeout can be increased and the process repeated. With knowledge of the actual time between bursts the timeout can be modified directly at first.

Sometimes the device will modify the output power based on data rate and channel conditions. This means that running a live connection can have variable results based on condition well outside the measurement space. It is normal to have larger variability when testing devices using these methods than when testing stable signals like a CW signal.