

ODIN-W2 series

Bluetooth and Wi-Fi Coexistence

Application Note



Abstract

This document describes how Bluetooth and Wi-Fi in ODIN-W2 should be configured to work simultaneously (in coexistence), or separately (either Bluetooth or Wi-Fi).

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1 Bluetooth Wi-Fi Coexistence

The ODIN-W2 radio supports simultaneous Wi-Fi and Bluetooth operation. However, the default configuration might not be an optimal configuration in some use case scenarios. This application note provides some special configuration options to optimize performance when using Wi-Fi and Bluetooth at the same time.

1.1 Simultaneous Wi-Fi and Bluetooth

There are some specific Wi-Fi and Bluetooth configuration options to consider when running Wi-Fi and Bluetooth at the same time.

1.1.1 Wi-Fi Configuration

1.1.1.1 Scan listen interval

By default, the Wi-Fi radio scans actively to quickly find an appropriate access point (AP) in order to connect to it. This feature is ideal if you would like to use Wi-Fi only or if there are no active Bluetooth links. However, if the Wi-Fi link is setup when there is an active Bluetooth link, there is a risk of losing the Bluetooth link or severely affecting the performance of the link. It might then be a good idea to configure the Wi-Fi scan to be less active and to leave more time for the Bluetooth link to access the radio. Generally, it is a good idea to add a delay of 150 ms between every channel scan.

```
AT+UWCFG=14,<ms>
```

This also means that the Wi-Fi connection may take longer to establish, since the time for scanning is roughly doubled.

Furthermore, if roaming is not disabled, it might be a good idea to increase the Fast scan sleep timeout. The default value might be a bit aggressive in use cases where both Wi-Fi and Bluetooth links are active during a roaming background scan.

```
AT+UWCFG=8,<ms>
```

A value of 250 ms or higher might be a better choice in some use cases. However, this will make the background scanning slower, which might affect the roaming behavior.

1.1.1.2 Remain on channel

When a Wi-Fi connection is set up, the default behavior during authentication is that the radio is locked to a specific channel. Normally this is not a problem since this is a very fast procedure. However, if the link is poor or if authentication fails for some other reason, it may keep the radio on the same channel for more than 5 seconds. This will effectively shut out all active Bluetooth links with a risk of losing the connections or severely affecting the performance. Therefore, it might be a good idea to configure the radio not to remain on a specific channel during Wi-Fi authentication.

```
AT+UWCFG=15,0 (disable remain on channel)
```

The disadvantage of not remaining on the channel during authentication is that it can be more difficult for the Wi-Fi radio to perform the authentication with a higher risk of failure.

1.1.1.3 Net up watchdog

When a Wi-Fi station performs the DHCP (Dynamic Host Configuration Protocol) negotiation, there is an interval where the radio will lock the channel in use. This is not configurable. Normally, this is not a problem since it is a very short duration and will not severely affect active Bluetooth links. However, if the Wi-Fi link is poor, or if there is no DHCP server on the network, the radio can remain on a channel for more than 5 seconds.

Typically, this will severely affect the performance of a Bluetooth link with a high risk of losing the connection. It might then be a good idea to enable a net up watchdog for the Wi-Fi connection. The net up watchdog aborts the DHCP negotiation if it takes too long, disconnects the link, and after some back-off time, retries again (with hopefully a faster successful result). Thus, this procedure gives time for the active Bluetooth links to transmit or receive data and not to lose the connection.

An appropriate net up watchdog time depends on several aspects. One is the link supervision timeout of the Bluetooth links. This depends on configuration of the master device in the Bluetooth connection. For two ODIN-W2 modules, the default value is 2 seconds and it can be configured for a longer time. For phones or laptops, it might not be configurable but typically it is above 5 seconds. With a Bluetooth link supervision timeout of >4 seconds, a good net up timeout could be 3 seconds.

```
AT+UDWS=6,<seconds>
```

By activating the net up watchdog, the risk of aborting DHCP negotiation is that it might take longer to get the final Wi-Fi connection.

 The net up watchdog does not prevent the radio from remaining on the same channel during DHCP negotiation. Bluetooth data will not be received or transmitted during this time. It may reduce the maximum time, which might help keeping the Bluetooth connection from going down.

1.1.2 Bluetooth configuration

1.1.2.1 Always master

For a module with both Wi-Fi and Bluetooth connections, it might be a good idea to make sure that the module is master of the Bluetooth link. This makes it easier for the radio to schedule air slots for both the Wi-Fi link(s) and Bluetooth link(s).

For a module that accepts incoming Bluetooth connections, this is done by setting the master/slave switch policy to “always master”.

```
AT+UBTMSP=0
```

For a module initiating a Bluetooth connection, by default, it will become the master of the Bluetooth link. This is not guaranteed since the remote side can request a master/slave switch, which will be accepted by the module. Many smartphones do not accept being a slave on a Bluetooth connection and in those cases, the slave role must be accepted by the module.

1.1.2.2 Link supervision timeout

By default, the link supervision timeout for the module is 2s. This is guaranteed only between two u-blox modules since a third party device might enforce a longer connection timeout. For many smartphones, the link supervision timeout could be around 8 seconds or more.

There are certain occasions where the Wi-Fi radio might lock out Bluetooth, and if it is important not to lose the link, a longer timeout should be considered. If the Wi-Fi net up watchdog is enabled to ensure a maximum time for DHCP negotiation, it could be a good idea to increase the Bluetooth link supervision timeout to at least a second longer. For example, for a Wi-Fi net up watchdog timeout of 3 seconds, it is recommended to have a link supervision timeout of at least 4 seconds.

```
AT+UBTCFG=7,<ms>
```

 This does not mean that transmission or reception of data will be successful during this time. It just means that the Bluetooth radio will not trigger a link loss unless 4 seconds pass without any communication with the remote device. Hence, transmission might be stopped for 3 seconds but the link is still considered to be active with the link supervision timeout of 4 seconds.

1.2 Wi-Fi Only

For a module configured to use Wi-Fi only, the default settings are not optimal. Bluetooth low energy is disabled by default, but Bluetooth BR/EDR is not. Even if no Bluetooth classic connections are setup, the radio will still listen to incoming page scans (connection attempts) and inquiry scans (discoveries). To ensure that the radio does not use the radio for Bluetooth, consider the following settings to disable connectable and discoverable and turn off Bluetooth low energy (which is off by default).

AT+UBTCM=1 (not connectable)

AT+UBTDM=1 (not discoverable)

AT+UBTLE=0 (Bluetooth low energy off, which is default)

The module will now not be discoverable or connectable and as long as no connections are setup from the module itself, the radio will not schedule any air time to Bluetooth.

1.3 Bluetooth Only

For a module configured to use Bluetooth only, make sure that the Wi-Fi radio is disabled.

AT+UWCFG=0, 0

Related documents

[1] u-blox Short Range Modules AT Commands Manual, document Number UBX-14044127

[2] ODIN-W2 Getting Started, document number UBX-15017452

[3] Using u-blox connectivity software, document number UBX -16024251

 For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Comments
R01	2-Jul-2018	cmag	Initial release.
R02	14-Nov-2018	kgom	Included support for ODIN-W2 software version 6.0.1.

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