

## ST87MXX Wi-Fi scan application note

### Purpose and scope

This document provides details on the usage of AT commands for the embedded Wi-Fi scanning feature supported by the ST87MXX module.

Document status
Official

## 1 General information

---

### 1.1 Acronyms and terms

**Table 1** Definitions of terms

Term	Definition
AP	Access Point
BSSID	Basic Service Set Identifier
MAC	Medium Access Control
ME	Mobile Equipment
MSC	Message Sequence Chart
SSID	Service Set Identifier
UART	Universal Asynchronous Receiver Transmitter
URC	Unsolicited Result Code
Wi-Fi	Wireless Fidelity

## 1.2 Reference documents

The documents listed in [Table 2](#) provide further information.

**Table 2 Document references**

Reference	Document
[1]	ST87MXX UM AT commands description
[2]	ST87MXX_GNSS_Wi-Fi_Positioning_with_external_LNA_Application_Note

## 1.3 Revision history

**Table 3 Document revision history**

Date	Version	Changes
2025-03-25	V1.0	Official Release
2025-03-27	V1.1	URC #WSCHANNEL and #WSRESTART are issued only in <urc mode> = 1.
2025-06-30	V1.2	Update with Nb-Loop parameter
2025-07-28	V2.0	Update for release

## 1.4 Table of contents

Purpose and scope.....	1
1 General information .....	2
1.1 Acronyms and terms.....	2
1.2 Reference documents .....	3
1.3 Revision history .....	3
1.4 Table of contents.....	4
1.5 List of tables .....	4
2 Introduction.....	5
2.1 Wi-Fi Scanning overview .....	5
2.2 Channel configuration.....	6
3 Wi-Fi Scan usage.....	7
3.1 Preamble.....	7
3.2 Configuration commands.....	7
3.2.1 Overview.....	7
3.2.2 URC mode configuration.....	7
3.2.3 Hopping time configuration .....	7
3.2.4 Antenna input signal configuration .....	8
3.2.5 Loop mode configuration.....	8
3.3 Run time commands.....	9
3.3.1 Start command .....	9
3.3.2 Stop command.....	9
3.4 URC definitions .....	9
4 Scenario examples .....	10
4.1 Wi-Fi scanning in finite number of loops .....	10
4.1.1 Parameters .....	10
4.1.2 MSC.....	11
4.1.3 Terminal.....	12
4.1 Wi-Fi scanning in infinite number of loops .....	13
4.1.1 Parameters .....	13
4.1.2 MSC.....	14
4.1.3 Terminal.....	15

## 1.5 List of tables

Table 1 Definitions of terms .....	2
Table 2 Document references.....	3
Table 3 Document revision history.....	3

## 2 Introduction

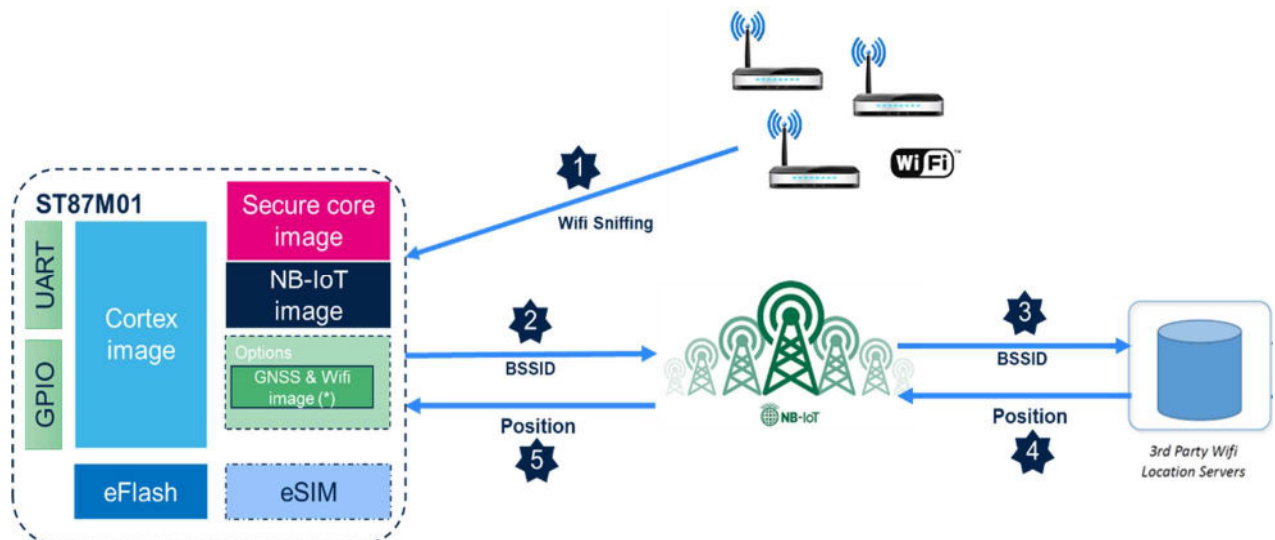
### 2.1 Wi-Fi Scanning overview

The Wi-Fi scan feature is typically used to determine a coarse position when GNSS is not usable, such as in indoor environments.

The primary purpose of the Wi-Fi scan feature is to detect and list all available Wi-Fi networks in the vicinity.

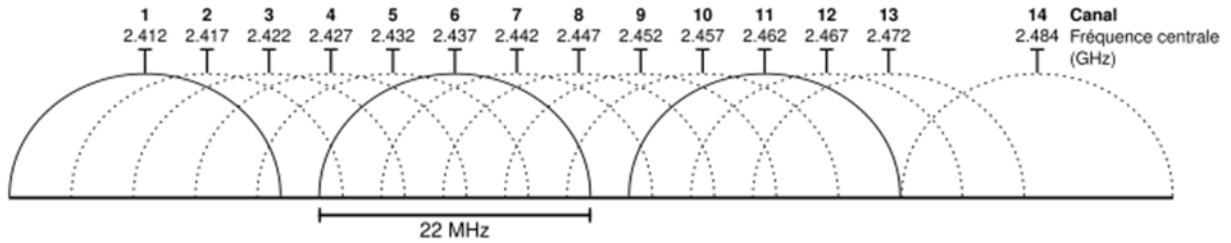
When a Wi-Fi scan is initiated, the ST87MXX discovers nearby Wi-Fi networks. It listens to beacons from Wi-Fi access points (APs) that provide network information. The resulting list of detected Wi-Fi networks is sent back to the Host through the UART connection.

To obtain a coarse position, the host stops the Wi-Fi scan and uses this data to initiate an NB-IoT connection to a global Wi-Fi positioning system on the Internet to retrieve the real position of the device.



## 2.2 Channel configuration

The ST87MXX can scan the Wi-Fi signals only covered by the bands of 2.4 GHz  
The available channels are 1 to 14. See details in the figure below:



Each channel has a bandwidth of 22 MHz

Most of time the used channels the Wi-Fi Beacons in Europe are channels 1,6 and 11.  
An optimization to save scanning time is to select channels 1, 6, and 11, which cover almost the full bandwidth of 2.4 GHz.

## 3 Wi-Fi Scan usage

### 3.1 Preamble

As the GNSS, the Wi-Fi scanning runs on the DSP core as a secondary user. The Nb-IOT firmware is the primary user. This means that the Wi-Fi feature will be executed during Nb-IOT sleep periods. So, the Wi-Fi scan process will be started not when the Start is sent by the host but when the module acknowledges the command by sending back "OK"  
Then the Wi-Fi session will run until the Stop command is sent or the number of programmed loops is reached.

The set of command for the Wi-Fi scanning can be divided into two parts:

- Configuration of parameters that generally must be set once for a given module,
- Activation / Deactivation of the feature.

The Wi-Fi scanning process returns URC messages to display the AP scanned and the status of the scanning process.

This document presents the whole Wi-Fi scanning feature usage and some common scenarios. **For the complete description of the AT commands and parameters, please refer to the AT command user manual [1].**

### 3.2 Configuration commands

#### 3.2.1 Overview

The Wi-Fi configuration commands allow setting parameters that will take effect at the next Wi-Fi scan start.

By default, the parameter settings are not retained after a reset. To make them permanent, the command **AT#RESET=1** must be sent so that the new setting will be saved in the NWM and kept after a reset.

#### 3.2.2 URC mode configuration

The Wi-Fi scanning URC mode configuration command allows setting the level of verbosity that the process will return.

The command to set the URC mode is as follows:

**AT#WSCAN=2,<urc\_mode>**

The parameter can take the following values:

- 0: The Wi-Fi AP URC is issued once, the first time the AP is scanned (Default mode),
- 1: The Wi-Fi AP URC is issued every time the AP is scanned.

Note that the URC #WSCHANNEL and #WSRESTART are issued only in URC mode parameter set to 1. Refer to chapter 3.4 for more details on the URC.

#### 3.2.3 Hopping time configuration

The Wi-Fi scanning hopping time configuration command allows setting the scanning time spent on each channel.

The command to set the hopping time is as follows:  
**AT#WSCAN=3,<hopping\_time>**

The parameter of the command is the hopping time value in milliseconds.

### 3.2.4 Antenna input signal configuration

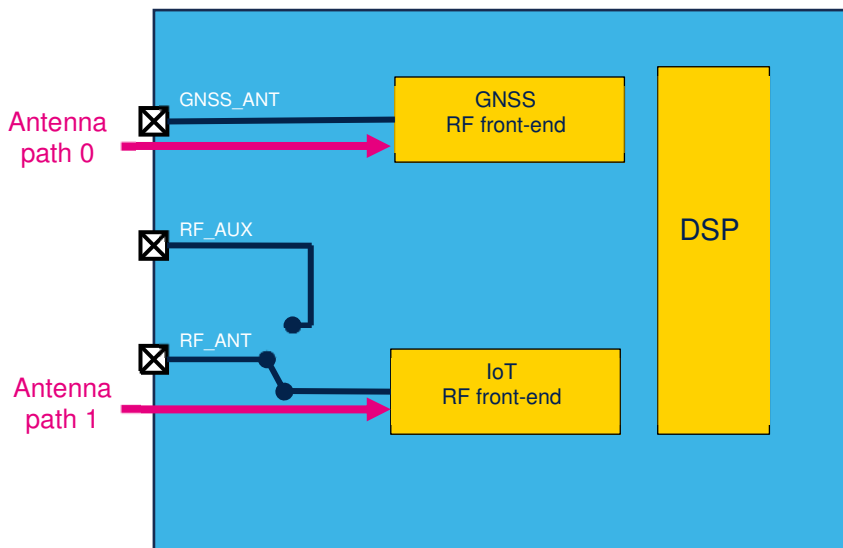
The antenna input configuration command allows setting the path for the Wi-Fi RF signal antenna.

The command to set the antenna input is as follows:  
**AT#WSCAN=4,<antenna\_path>**

The parameter can take the following values:

- 0: GNSS antenna path is used for the Wi-Fi signal
- 1: NB-IoT antenna path is used for the Wi-Fi signal

See the following schematics for details:



### 3.2.5 Loop mode configuration

The Wi-Fi scanning loop mode configuration command allows setting the number of times the process loops through the channel list.

The command to set the loop mode time is as follows:  
**AT#WSCAN=5,<nb\_loop>**

The command parameter specifies the number of loops in the range [0,256]. The value 0 means the system will run in an Infinite loop.

When the number of loops is reached, the URC **#WSSTOP** is issued, and the scanning process stops.

### 3.3 Run time commands

#### 3.3.1 Start command

The AT command for Wi-Fi start/stop feature is as follows:  
**AT#WSCAN=<command>[,<param1>[,<param2>,...]]**

To start the Wi-Fi scanning use the command:  
**AT#WSCAN=1,<Channel 1>,<Channel 2>,....,<Channel x>**

The number of channels in the command is variable from 1 to 14.

As stated earlier, an optimized scan selects channels 1, 6, and 11, as shown in the example below:  
**AT#WSCAN=1,1,6,11**

Note that the Wi-Fi scanning starts only after receiving the “OK” acknowledgment.

#### 3.3.2 Stop command

To stop the Wi-Fi scanning use the command:  
**AT#WSCAN=0**

If the system is programmed to loop a specific number of times, the Wi-Fi scanning stops automatically, so this command should not be sent in this case. See chapter 3.2.5 for more details.

### 3.4 URC definitions

This chapter gives details on the URC returned by the Wi-Fi scanning process to display the AP scanned and the status of the scanning process.

The main URC received by the host, is the result of the scanning when an AP is found. It is composed as follows:

**#WSCAN: <Channel Number>,<RX Level>,<MAC Address (BSSID)>, <SSID name>**

Some URC are also sent back to the host depending on the URC mode parameter (See 3.2.2) to give the status of the scanning process:

**#WSCHANNEL: XX** is displayed at the start scanning of a given channel

**#WSRESTART** is displayed when the list of channels to scan rolls over

**#WSSTOP** is displayed when the system is stopped, either after the stop scan command or when the programmed number of loops is reached.

## 4 Scenario examples

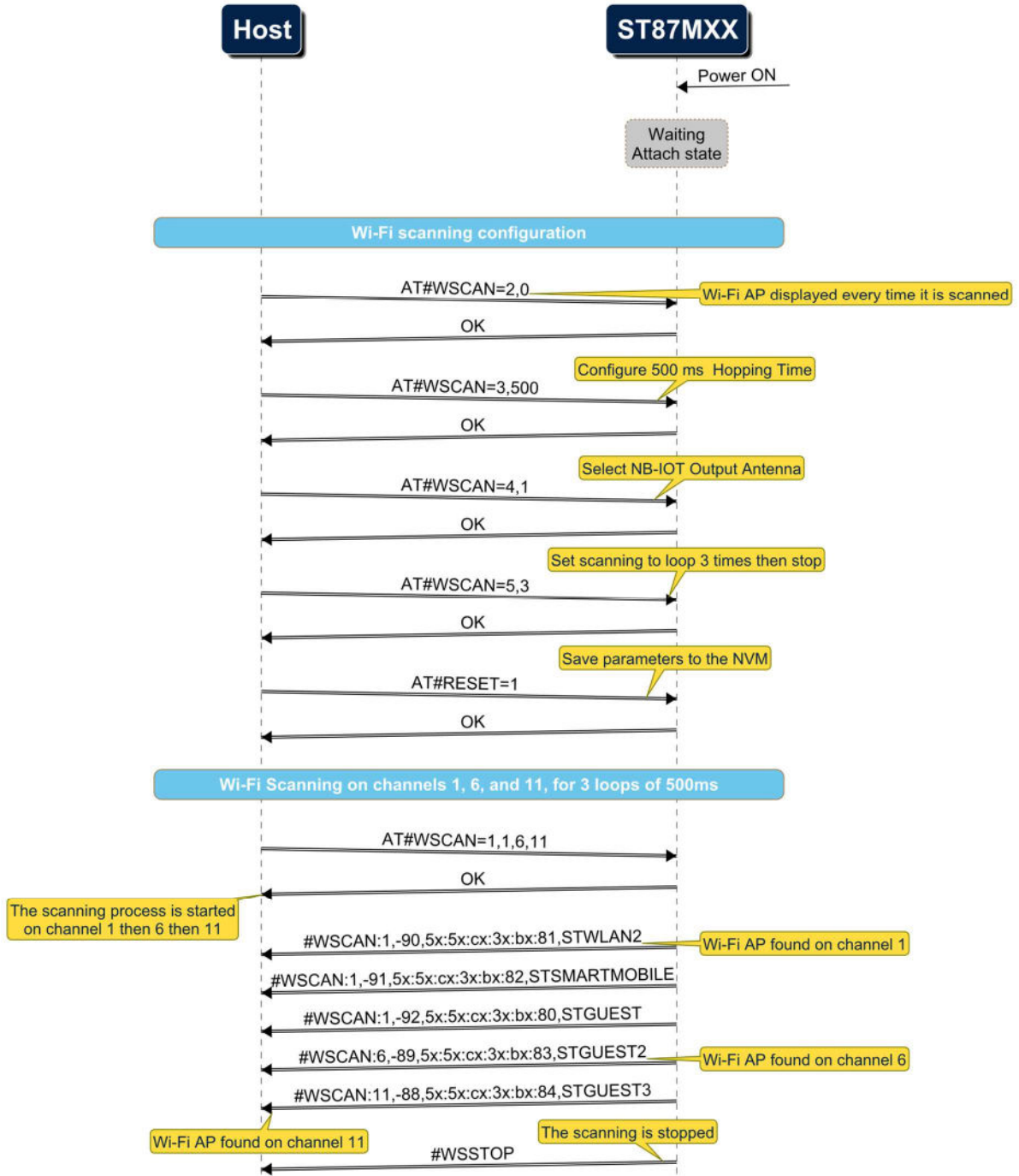
---

### 4.1 Wi-Fi scanning in finite number of loops

#### 4.1.1 Parameters

Here is an example of AT command sequence to start Wi-Fi scanning on channels 1, 6, and 11. The access points (APs) are displayed only once, and the scanning runs for three loops of 500 ms each.

4.1.2 MSC



<http://msc-generator.sourceforge.net v7.2>

### 4.1.3 Terminal

Below is the sequence obtained in the UART terminal when executing the scenario (in **Bold** the commands sent to the module):

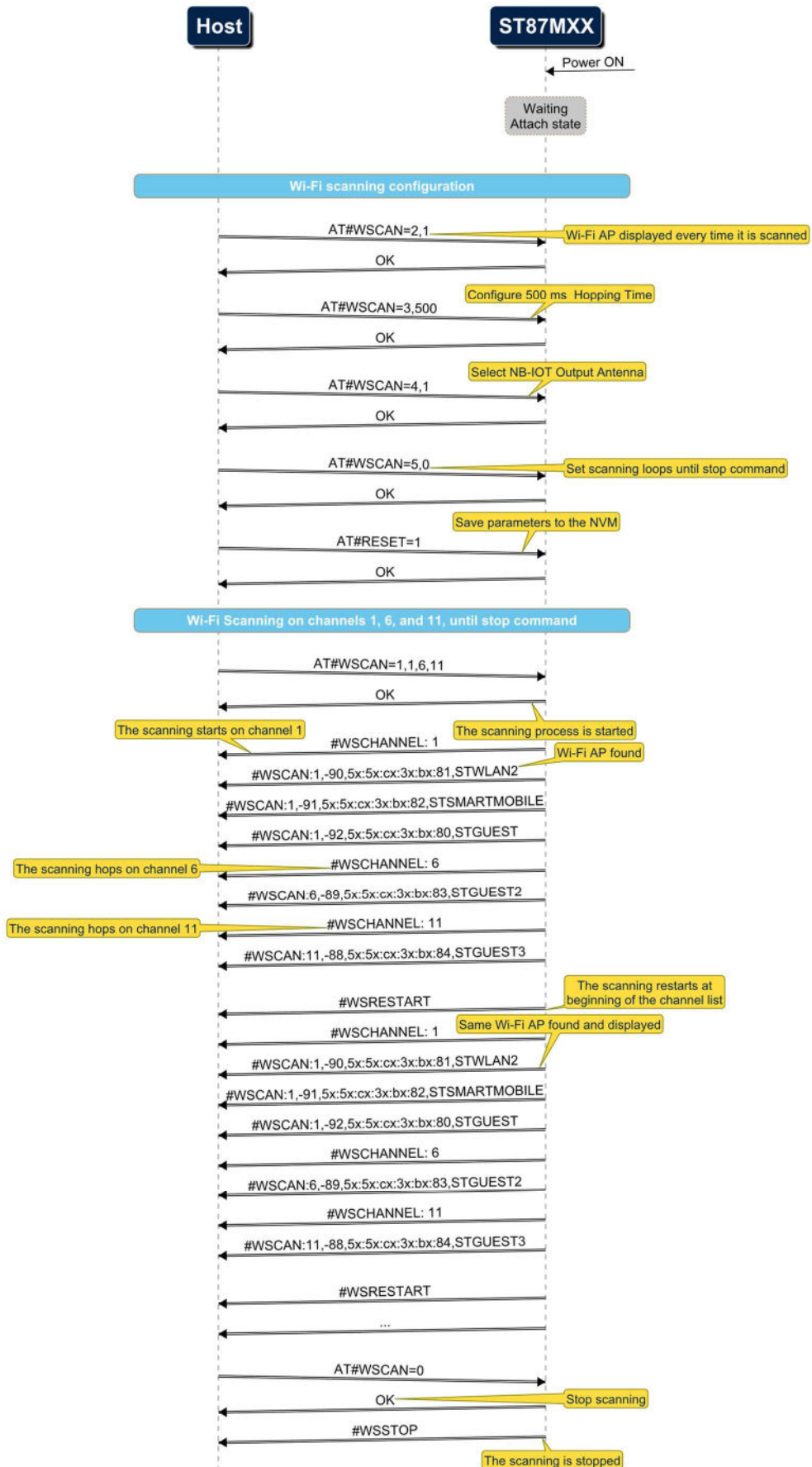
```
AT#WSCAN=2, 0  
OK  
AT#WSCAN=3, 500  
OK  
AT#WSCAN=4, 1  
OK  
AT#WSCAN=5, 3  
OK  
AT#RESET=1  
OK  
  
AT#WSCAN=1, 1, 6, 11  
OK  
#WSCAN:1, -90, 5x:5x:cx:3x:bx:81, STWLAN2  
#WSCAN:1, -91, 5x:5x:cx:3x:bx:82, STSMARTMOBILE  
#WSCAN:1, -92, 5x:5x:cx:3x:bx:80, STGUEST  
#WSCAN:6, -89, 5x:5x:cx:3x:bx:83, STGUEST2  
#WSCAN:11, -88, 5x:5x:cx:3x:bx:84, STGUEST3  
  
#WSSTOP
```

## 4.1 Wi-Fi scanning in infinite number of loops

### 4.1.1 Parameters

Here is an example of AT command sequence to start Wi-Fi scanning on channels 1, 6, and 11. The access point (AP) is displayed every time it is scanned, running in loops of 500 ms each until the stop command is sent.

4.1.2 MSC



<http://msc-generator.sourceforge.net v7.2>

### 4.1.3 Terminal

Below is the sequence obtained in the UART terminal when executing the scenario (in **Bold** the commands sent to the module):

```

AT#WSCAN=2, 1
OK
AT#WSCAN=3, 500
OK
AT#WSCAN=4, 1
OK
AT#WSCAN=5, 0
OK
AT#RESET=1
OK

AT#WSCAN=1, 1, 6, 11
OK
#WSCHANNEL: 1
#WSCAN:1, -90, 5x:5x:cx:3x:bx:81, STWLAN2
#WSCAN:1, -91, 5x:5x:cx:3x:bx:82, STSMARTMOBILE
#WSCAN:1, -92, 5x:5x:cx:3x:bx:80, STGUEST
#WSCHANNEL: 6
#WSCAN:6, -89, 5x:5x:cx:3x:bx:83, STGUEST2
#WSCHANNEL: 11
#WSCAN:11, -88, 5x:5x:cx:3x:bx:84, STGUEST3
#WSRESTART

#WSCHANNEL: 1
#WSCAN:1, -90, 5x:5x:cx:3x:bx:81, STWLAN2
#WSCAN:1, -91, 5x:5x:cx:3x:bx:82, STSMARTMOBILE
#WSCAN:1, -92, 5x:5x:cx:3x:bx:80, STGUEST
#WSCHANNEL: 6
#WSCAN:6, -89, 5x:5x:cx:3x:bx:83, STGUEST2
#WSCHANNEL: 11
#WSCAN:11, -88, 5x:5x:cx:3x:bx:84, STGUEST3
#WSRESTART
...
AT#WSCAN=0
OK
#WSSTOP

```

#### IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2025 STMicroelectronics – All rights reserved