



Talaria TWO™ (INP2045)

Ultra-Low Power Multi-Protocol Wireless Platform SoC

IEEE 802.11 b/g/n, BLE 5.0

User Guide for Talaria TWO MPD Demo Tool – MPD Modes

Release: 10-04-2023

Revision History

Version	Date	Comments
1.0	07-07-2022	First release.
1.1	08-04-2022	Updated Multicast Reception OFF GRAT ARP ON mode procedure.
2.0	09-29-2022	Updated for SDK 2.6 release.
2.1	01-20-2023	Updated to include the latest version of the MPD Tool GUI.
2.2	02-07-2023	Updated MQTT broker.
2.3	10-04-2023	Updated with the latest logs for the tool.

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Terms & Definitions

AP	Access Point
ARP	Address Resolution Protocol
COM	Composite Device Driver
ELF	Extensible Linking Format

EVK	Evaluation Kit
FTDI	Future Technology Devices International
GARP	Gratuitous Address Resolution Protocol
GUI	Graphical User Interface
HTTP	Hyper Text Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure
iPerf	Internet Performance Working Group
MPD	Multipurpose Demo
MQTT	Message Queuing Telemetry Transport
SSID	Service Set Identifier
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
URL	Uniform Resource Locator
USB	Universal Serial Bus

Introduction

This document describes the different modes in which the MPD application can be used with the Demo tool GUI.

MPD

Select the MPD tab on the Demo tool GUI to automatically load the signed firmware image for MPD application.

Note: For all the modes, the `Keep Alive Wake time` is fixed as 2 in the application. This time is the time window in milliseconds during which Talaria TWO will wait in receive mode before going to sleep.

Select the appropriate mode and enter the values specific to the mode selected. Failure to pass any value will result in an error. Click on either `PROG RAM/Flash` as per requirement.

Base Mode

Expected Result: Spike should be observed as per the `Beacon listen interval` configured. If beacon listen interval is configured as 10, then radio wakes up to listen beacon for every 1 second.

Oti log: Shows an average current consumption of 56.7 μ A for 30s.

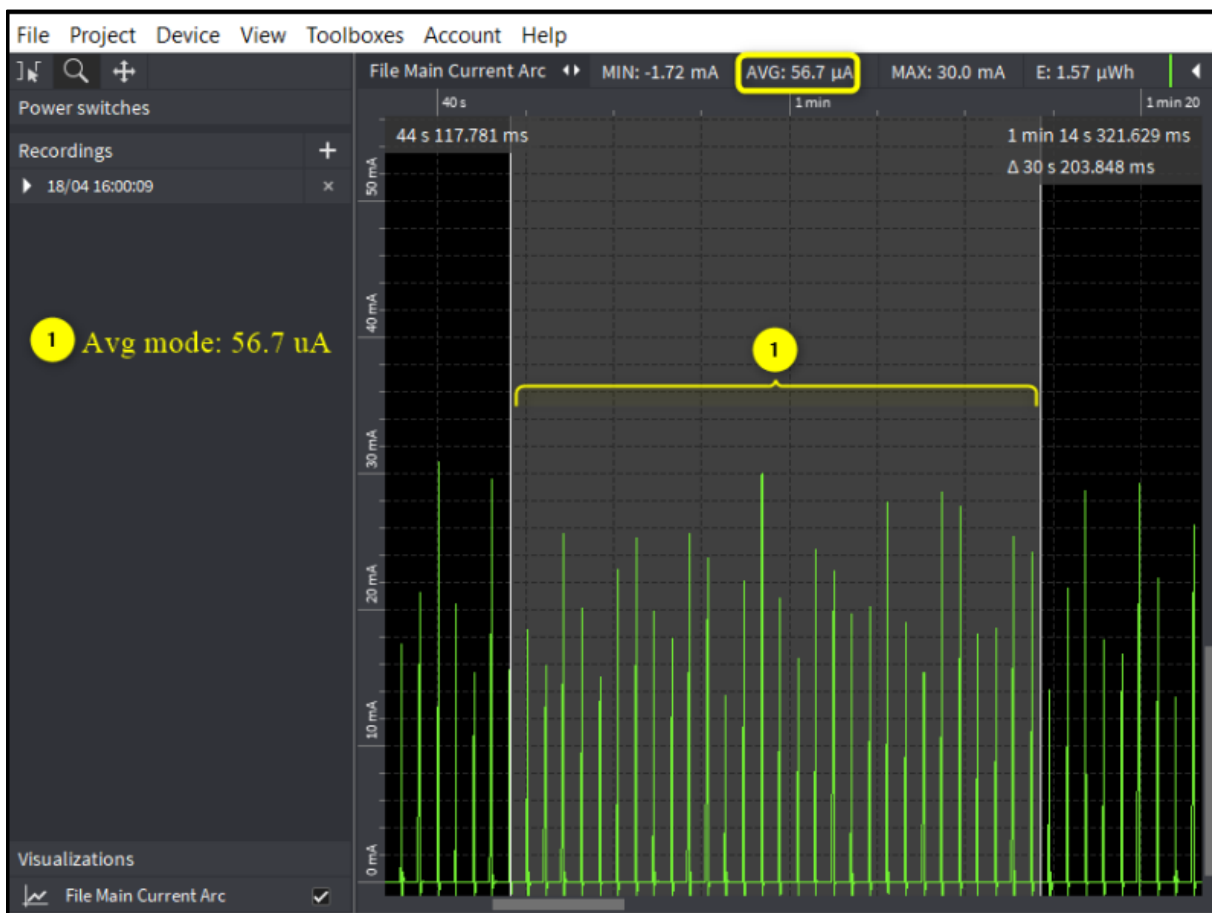


Figure 1: Base mode: Oti log

Console output:

```
UART:SNWWWWWAEBuild $Id: git-ba65998b7 $
mpd.mcast_rx=1 wifi.listen_interval=10 krn.gpio>--K wifi.keep_alive_wake_time=2
wifi.arp_grat_period=1800 wifi.max_idle_period=0 mpd.regdomain=FCC mpd.suspend=1
np_conf_path=/data/nprofile.json mpd.ssid=InnoPhase mpd.passphrase=43083191
$App:git-73e7f910
SDK Ver: SDK_2.6
T2 Multipurpose Demp App Version 0.12
network profile parse success.
Suspend Enabled.
Multicast reception Enabled.
Regdomain=FCC
addr e0:69:3a:00:13:90
Applying reg domain: 1-11@20
Connecting to network
.[2.018,216] CONNECT:00:5f:67:cd:c5:a6 Channel:11 rssi:-44 dBm
WCM_NOTIFY_MSG_LINK_UP
.WCM_NOTIFY_MSG_ADDRESS
[2.837,656] MYIP 192.168.0.104
[2.837,819] IPv6 [fe80::e269:3aff:fe00:1390]-link
WCM_NOTIFY_MSG_CONNECTED
Listen interval=10
Traffic Timeout=12
pm_flags=0x0
[3.498,504] WARNING! wcm_pm_config may overwrite the supplied power management boot
arguments!
WiFi Connection success. proceeding to app..
Timeout not specified.!
Application Exited..
Going for indefinite sleep...
```

Keep Alive Mode

Note:

To reduce power consumption, the Keep Alive messages are aligned to the next beacon reception period. The actual `Keepalive Interval` can therefore be longer than specified, especially if the `wifi.listen_interval` is set to a high value.

Wireshark log:

Expected Result:

Based on the configured keepalive interval (10s), QoS Null function packet is observed.

No.	Time	Source	Destination	Protocol	Length	Info
132	5.849847020	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
158	8.294887500	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
164	*REF*	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
269	10.227154802	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
371	20.467075050	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
476	30.707153513	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
580	40.947227934	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
682	51.187310296	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
784	61.427262403	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
889	71.667262094	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
992	82.009648934	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1096	92.249764839	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1198	102.489796987	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1300	112.729776595	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1402	122.969853494	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1507	133.209849781	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1609	143.449843566	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1718	153.689800505	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1820	163.929857636	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
1922	174.170054013	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function
2025	184.512380270	Innophas_00:2c:6c	Netgear_93:83:31	802.11	66	QoS Null function


```

> Frame 164: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface phy1.mon, id
> Radiotap Header v0, Length 36
> 802.11 radio information
▼ IEEE 802.11 QoS Null function (No data), Flags: ...P...TC
  Type/Subtype: QoS Null function (No data) (0x002c)
  ▼ Frame Control Field: 0xc811
    .... ..00 = Version: 0
    .... 10.. = Type: Data frame (2)
    1100 .... = Subtype: 12
    ▼ Flags: 0x11
      .... ..01 = DS status: Frame from STA to DS via an AP (To DS: 1 From DS: 0) (0x1)
      .... .0.. = More Fragments: This is the last fragment
      .... 0... = Retry: Frame is not being retransmitted
      ...1 .... = PWR MGT: STA will go to sleep
      ..0. .... = More Data: No data buffered
      .0.. .... = Protected flag: Data is not protected
  
```

Figure 2: Keep alive: Wireshark log

Otii log: Shows an average current consumption of 64.4 μ A for 30s. In idle cases, the average current consumption is 55.3 μ A.

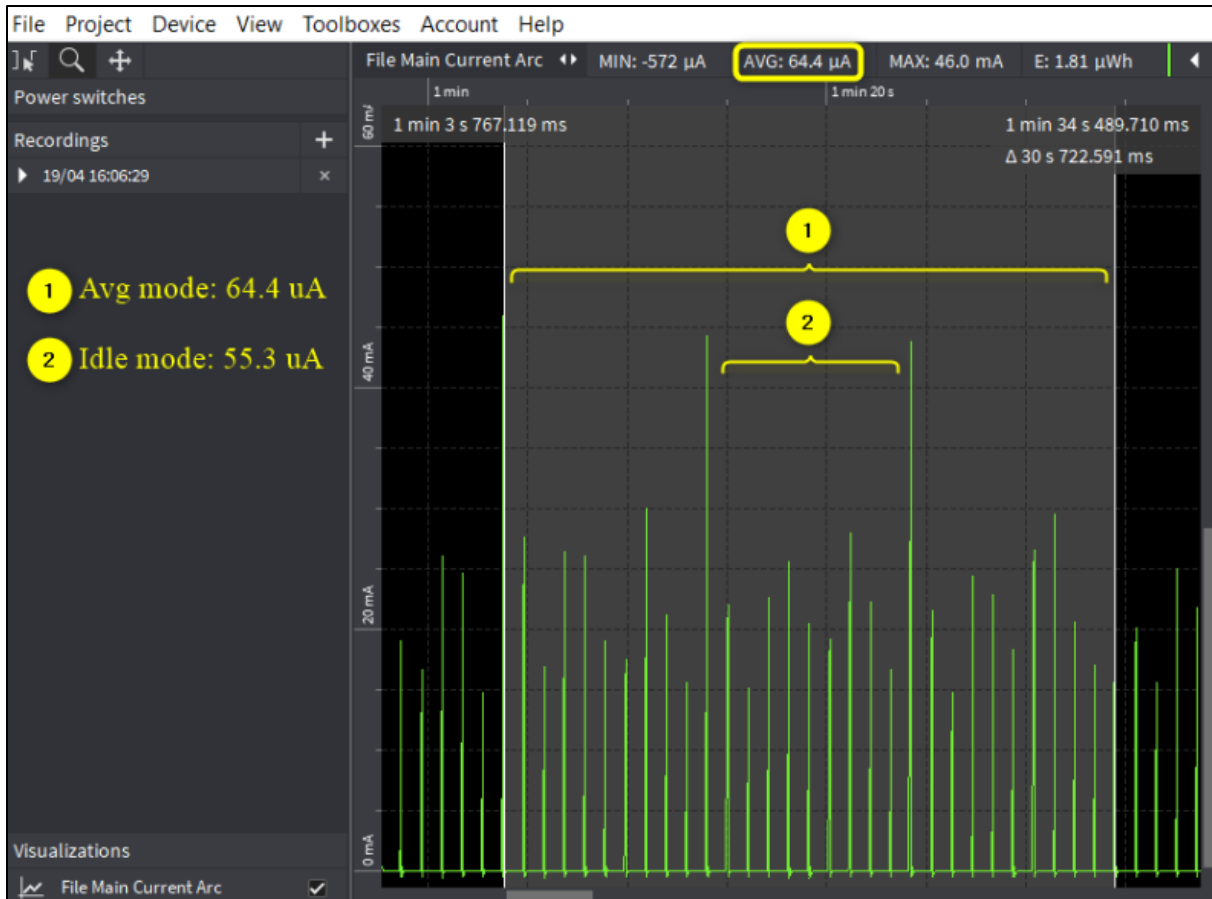


Figure 3: Keep alive - Otii logs

Console output:

```

Y-BOOT 208ef13 2019-07-22 12:26:54 -0500 790da1-b-7
ROM yoda-h0-rom-16-0-gd5a8e586
FLASH:PNWWWWWAEBuild $Id: git-ba65998b7 $
mpd.mcast_rx=1 mpd.proto=none wifi.max_idle_period=10 wifi.listen_interval=10 krn.gpio=-
-K wifi.keep_alive_wake_time=2 wifi.arp_grat_period=0 mpd.regdomain=FCC mpd.suspend=1
np_conf_path=/data/nprofile.json mpd.ssid=InnoPhase mpd.passphrase=43083191
$App:git-73e7f910
SDK Ver: SDK_2.6

```

```
T2 Multipurpose Demp App Version 0.12
network profile parse success.
Suspend Enabled.
Multicast reception Enabled.
Regdomain=FCC
addr e0:69:3a:00:13:90
Applying reg domain: 1-11@20

Connecting to network
.[0.893,908] CONNECT:00:5f:67:cd:c5:a6 Channel:11 rssi:-49 dBm
WCM_NOTIFY_MSG_LINK_UP
.WCM_NOTIFY_MSG_ADDRESS
[1.865,748] MYIP 192.168.0.104
[1.865,795] IPv6 [fe80::e269:3aff:fe00:1390]-link
WCM_NOTIFY_MSG_CONNECTED
Listen interval=10
Traffic Timeout=12
pm_flags=0x0
[2.200,625] WARNING! wcm_pm_config may overwrite the supplied power management boot
arguments!
WiFi Connection success. proceeding to app..
Timeout not specified.!
Application Exited..
Going for indefinite sleep...
```

TCP

Note: Both the Host and Talaria TWO are connected to the same network.

Console output:

```
UART:SNWWWWWAEBuild $Id: git-ba65998b7 $
mpd.mcast_rx=1 mpd.proto=tcp mpd.tcp.msginterval=10 mpd.tcp.msglen=100 mpd.port=80
wifi.listen_interval=10 krn.gpio/--K wifi.keep_alive_wake_time=2
wifi.arp_grat_period=1800 wifi.max_idle_period=0 mpd.regdomain=FCC mpd.suspend=1
np_conf_path=/data/nprofile.json mpd.ssid=InnoPhase mpd.passphrase=43083191
$App:git-73e7f910
SDK Ver: SDK_2.6
T2 Multipurpose Demp App Version 0.12
network profile parse success.
Suspend Enabled.
Multicast reception Enabled.
Regdomain=FCC
addr e0:69:3a:00:13:90
Applying reg domain: 1-11@20

Connecting to network
.[2.070,557] CONNECT:00:5f:67:cd:c5:a6 Channel:11 rssi:-56 dBm
WCM_NOTIFY_MSG_LINK_UP
.WCM_NOTIFY_MSG_ADDRESS
[2.805,664] MYIP 192.168.0.104
[2.805,711] IPv6 [fe80::e269:3aff:fe00:1390]-link
WCM_NOTIFY_MSG_CONNECTED
Listen interval=10
Traffic Timeout=12
```

```
pm_flags=0x0
[3.563,103] WARNING! wcm_pm_config may overwrite the supplied power management boot
arguments!
WiFi Connection success. proceeding to app..
Timeout not specified.!
listening socket success.. sd=0
Binding to port: 80
bind success..
listen success...

Config:
Proto :tcp
Port :80
Interval:10
msg len :100
Waiting for incoming connections..
Calling accept()
msg=Times=1:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLM
YZABCDEFGHIJKLM
send returned 100.
msg=Times=2:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLM
YZABCDEFGHIJKLM
send returned 100.
msg=Times=3:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLM
YZABCDEFGHIJKLM
send returned 100.
```

```
msg=Times=4:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
YZABCDEFGHIJKLM  
send returned 100.  
msg=Times=5:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
YZABCDEFGHIJKLM  
send returned 100.  
msg=Times=6:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
YZABCDEFGHIJKLM  
send returned 100.  
msg=Times=7:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
YZABCDEFGHIJKLM  
send returned 100.
```

TCP client windows console output:

```
C:\Program Files (x86)\Nmap>ncat.exe 192.168.0.104 80  
Times=1:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=2:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=3:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=4:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=5:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=6:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM
```

```
Times=7: ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN...
CDEFGHIJKLM
```

To start ncat in the host computer, follow the following steps:

1. Download and Install ncat using the following link: <https://nmap.org/ncat/>.
2. Open command prompt and pass command.
3. Ncat.exe IP-address (from console) and port_number (from console).

Expected Result: When client connects to the TCP server (server port configured with port boot argument), the TCP server sends a message to client after every <interval> seconds which is configured in Message_Send Interval.

Wireshark log:

1. The [SYN], [SYN,ACK] and [ACK] is observed for the TCP three-way handshake during the connection establishment.
2. [PSH,ACK] is observed for the TCP data sent from Talaria TWO.
3. [FIN,ACK] is observed for the TCP disconnection done from the application end point (TCP client).

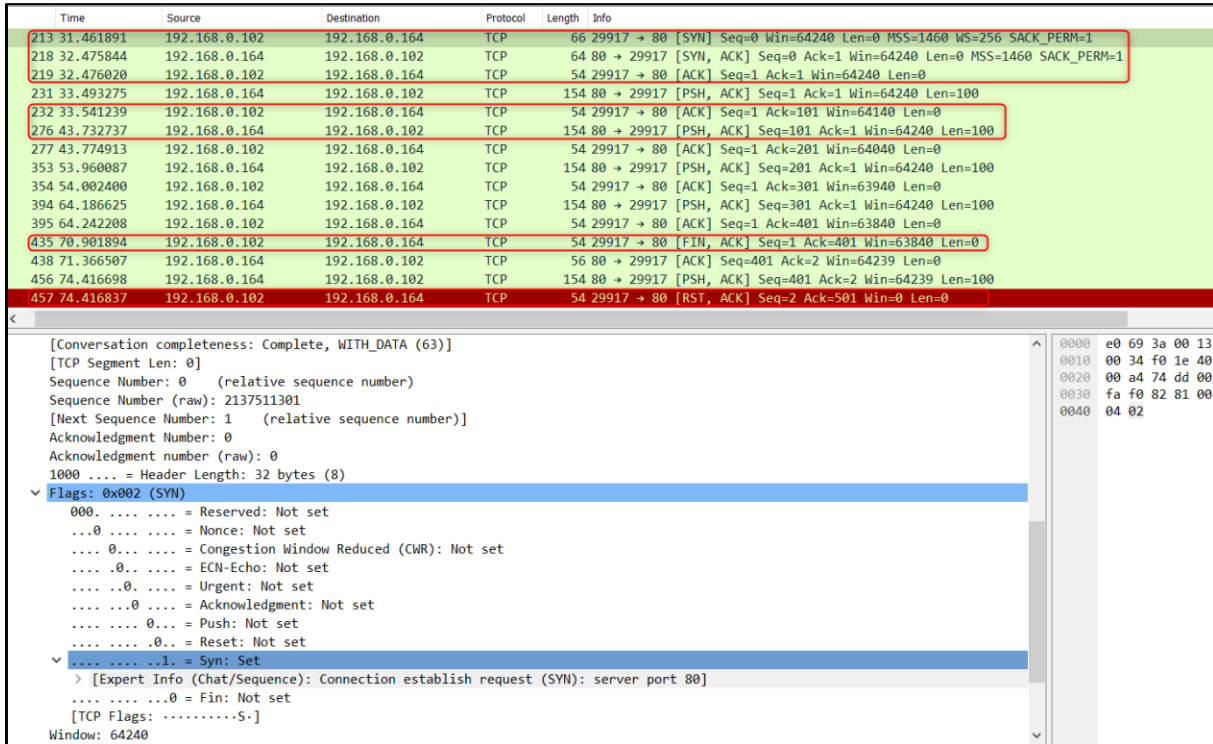


Figure 4: TCP - Wireshark log

Otii log: Shows an average current consumption of 109 μ A for 30s. In idle cases, the average current consumption is 58.1 μ A.

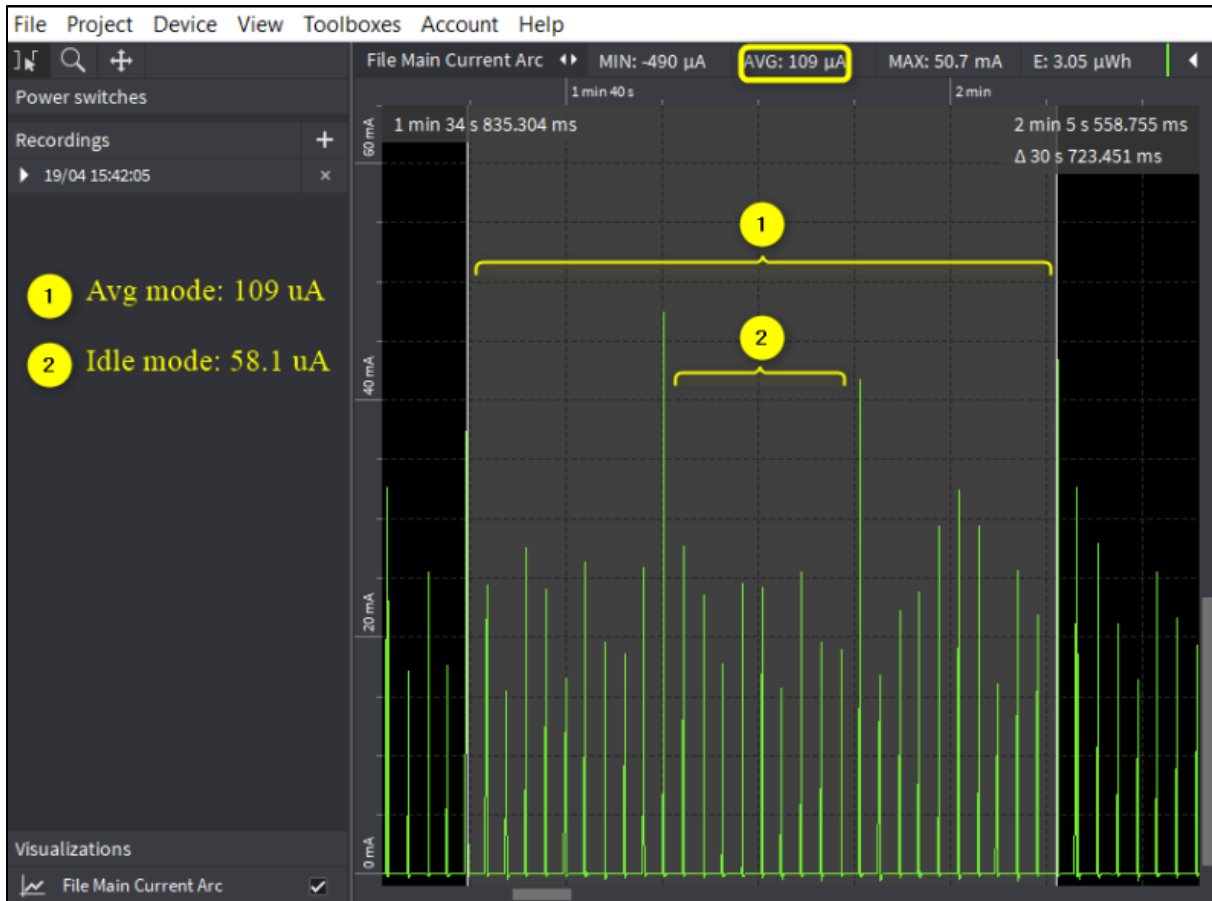


Figure 5: TCP - Otii log

UDP

Note: Both the Host and Talaria TWO are connected to the same network.

Console output:

```
UART:SNWWWWWAEBuild $Id: git-ba65998b7 $
mpd.mcast_rx=1 mpd.proto=udp mpd.udp.msginterval=10 mpd.udp.msglen=100 mpd.port=6009
wifi.listen_interval=10 krn.gpio/--K wifi.keep_alive_wake_time=2
wifi.arp_grat_period=1800 wifi.max_idle_period=0 mpd.regdomain=FCC mpd.suspend=1
np_conf_path=/data/nprofile.json mpd.ssid=InnoPhase mpd.passphrase=43083191
$App:git-73e7f910
SDK Ver: SDK_2.6
T2 Multipurpose Demp App Version 0.12
network profile parse success.
Suspend Enabled.
Multicast reception Enabled.
Regdomain=FCC
addr e0:69:3a:00:13:90
Applying reg domain: 1-11@20
Connecting to network
.[2.083,508] CONNECT:00:5f:67:cd:c5:a6 Channel:11 rssi:-44 dBm
WCM_NOTIFY_MSG_LINK_UP
.WCM_NOTIFY_MSG_ADDRESS
[3.027,081] MYIP 192.168.0.104
[3.027,130] IPv6 [fe80::e269:3aff:fe00:1390]-link
WCM_NOTIFY_MSG_CONNECTED
Listen interval=10
Traffic Timeout=12
pm_flags=0x0
```



```
[3.567,973] WARNING! wcm_pm_config may overwrite the supplied power management boot arguments!  
WiFi Connection success. proceeding to app..  
Timeout not specified.!  
UDP socket success  
Config:  
Proto   :udp  
Port    :6009  
Interval:10  
msg len :100  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.  
sendto returned 100.
```

UDP client windows console output:

```
C:\Program Files (x86)\Nmap>ncat.exe -u -l 6009  
Times=3:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=4:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM
```

```
Times=5:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=6:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=7:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=8:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=9:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
CDEFGHIJKLM  
Times=10:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
BCDEFGHIJKL  
Times=11:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
BCDEFGHIJKL  
Times=12:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
BCDEFGHIJKL  
Times=13:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
BCDEFGHIJKL  
Times=14:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
BCDEFGHIJKL  
Times=15:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
BCDEFGHIJKL  
Times=16:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
OPQRSTUVWXYZABCDEFGHIJKLMN  
BCDEFGHIJKL
```

To start ncat in the host computer, execute the following steps:

1. Download and install ncat using the following link: <https://nmap.org/ncat/>.
2. Open command prompt and pass the following command (from console):

```
ncat.exe -u -l port_number
```

Wireshark log:

Expected Result: Talaria TWO sends broadcast UDP message to the configured port number in MPD tool, every configured interval (10s).

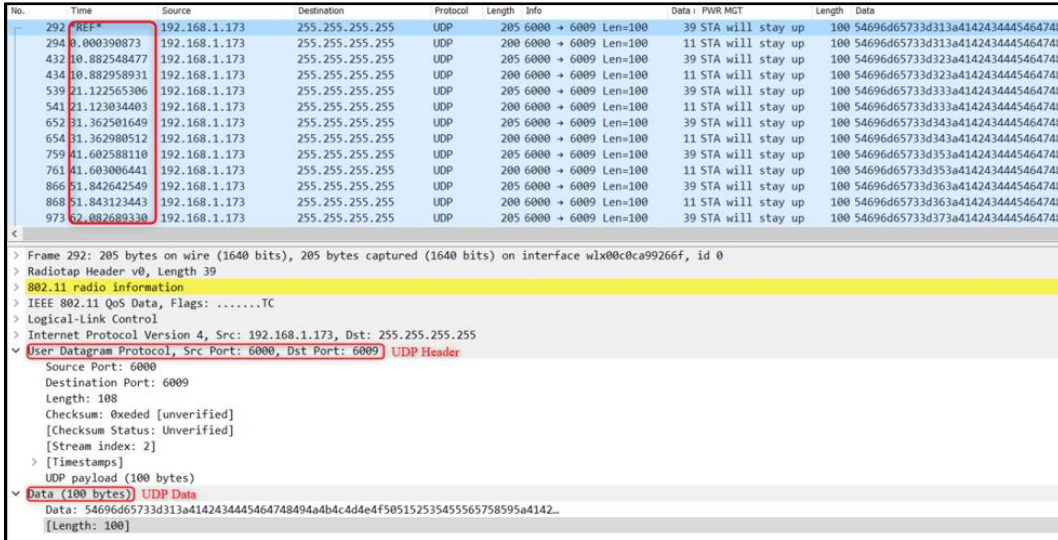


Figure 6: UDP - Wireshark log

Otii log: Shows an average current consumption of 107µA for 30s. In idle cases, the average current consumption is 59.1µA.

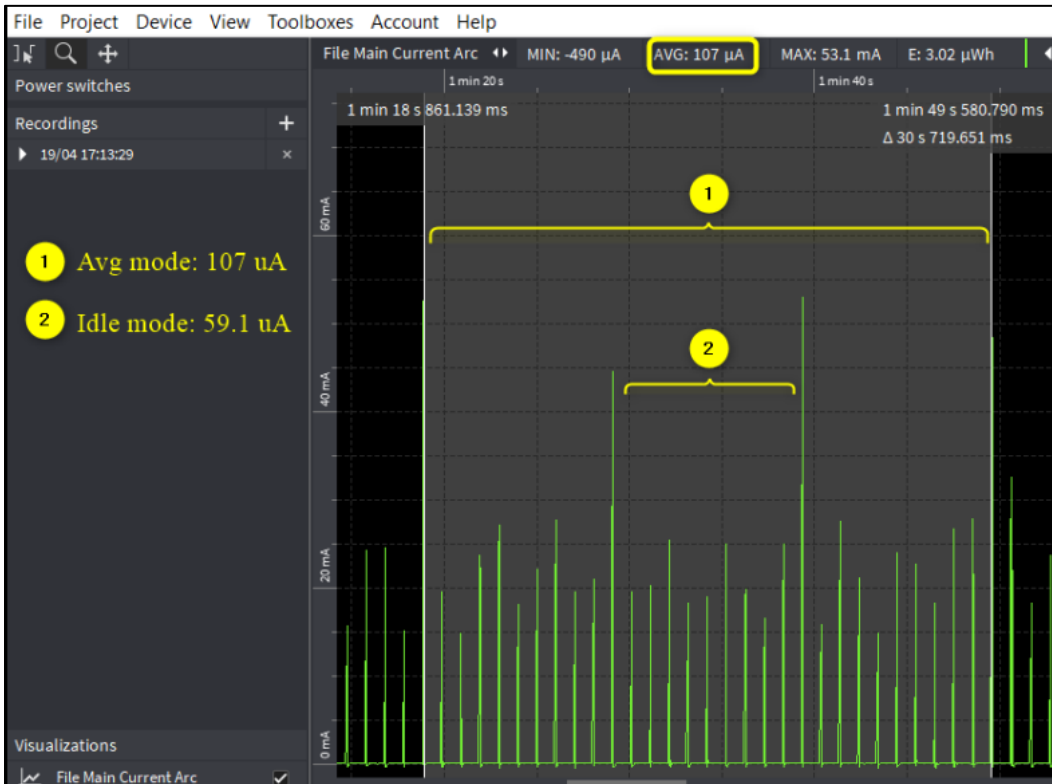


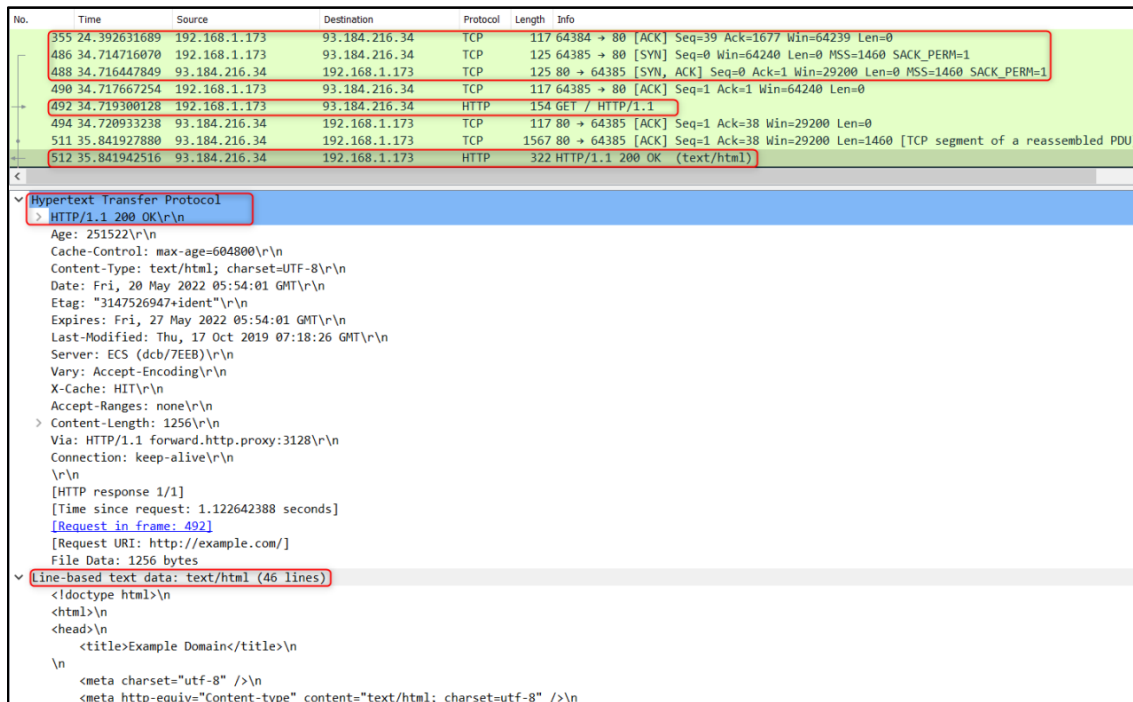
Figure 7: UDP - Otii log

HTTP

Wireshark log:

Expected Result: At configured interval (10s), application connects to URL, performs HTTP Get and hexdumps the page.

1. The first three packets (SYN, SYN/ACK, ACK) are the TCP three-way handshake.
2. HTTP GET message is observed for the GET operation.
3. HTTP/1.1 200 OK is the response from the server for the successful HTTP connection.



The image shows a Wireshark network traffic capture. The top pane displays a list of packets. The bottom pane shows the details of the selected packet (No. 492), which is an HTTP GET request. The packet list pane shows the following packets:

No.	Time	Source	Destination	Protocol	Length	Info
355	24.392631689	192.168.1.173	93.184.216.34	TCP	117	64384 → 80 [ACK] Seq=39 Ack=1677 Win=64239 Len=0
486	34.714716070	192.168.1.173	93.184.216.34	TCP	125	64385 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1
488	34.716447849	93.184.216.34	192.168.1.173	TCP	125	80 → 64385 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1
490	34.717667254	192.168.1.173	93.184.216.34	TCP	117	64385 → 80 [ACK] Seq=1 Ack=1 Win=64240 Len=0
492	34.719300128	192.168.1.173	93.184.216.34	HTTP	154	GET / HTTP/1.1
494	34.720933238	93.184.216.34	192.168.1.173	TCP	117	80 → 64385 [ACK] Seq=1 Ack=38 Win=29200 Len=0
511	35.841927880	93.184.216.34	192.168.1.173	TCP	1567	80 → 64385 [ACK] Seq=1 Ack=38 Win=29200 Len=1460 [TCP segment of a reassembled PDU]
512	35.841942516	93.184.216.34	192.168.1.173	HTTP	322	HTTP/1.1 200 OK (text/html)

The details pane for the selected packet (No. 492) shows the following information:

```
Hypertext Transfer Protocol
  HTTP/1.1 200 OK\r\n
  Age: 251522\r\n
  Cache-Control: max-age=604800\r\n
  Content-Type: text/html; charset=UTF-8\r\n
  Date: Fri, 20 May 2022 05:54:01 GMT\r\n
  Etag: "3147526947+ident"\r\n
  Expires: Fri, 27 May 2022 05:54:01 GMT\r\n
  Last-Modified: Thu, 17 Oct 2019 07:18:26 GMT\r\n
  Server: ECS (dcb/7EEB)\r\n
  Vary: Accept-Encoding\r\n
  X-Cache: HIT\r\n
  Accept-Ranges: none\r\n
  Content-Length: 1256\r\n
  Via: HTTP/1.1 forward.http.proxy:3128\r\n
  Connection: keep-alive\r\n
  \r\n
  [HTTP response 1/1]
  [Time since request: 1.122642388 seconds]
  [Request in frame: 492]
  [Request URI: http://example.com/]
  File Data: 1256 bytes
  Line-based text data: text/html (46 lines)
  <!doctype html>\n
  <html>\n
  <head>\n
  <title>Example Domain</title>\n
  \n
  <meta charset="utf-8" />\n
  <meta http-equiv="Content-type" content="text/html; charset=utf-8" />\n
```

Figure 8: HTTP - Wireshark log

Otii log: Shows an average current consumption of 171 μ A for 30s. In idle cases, the average current consumption is 58.4 μ A.

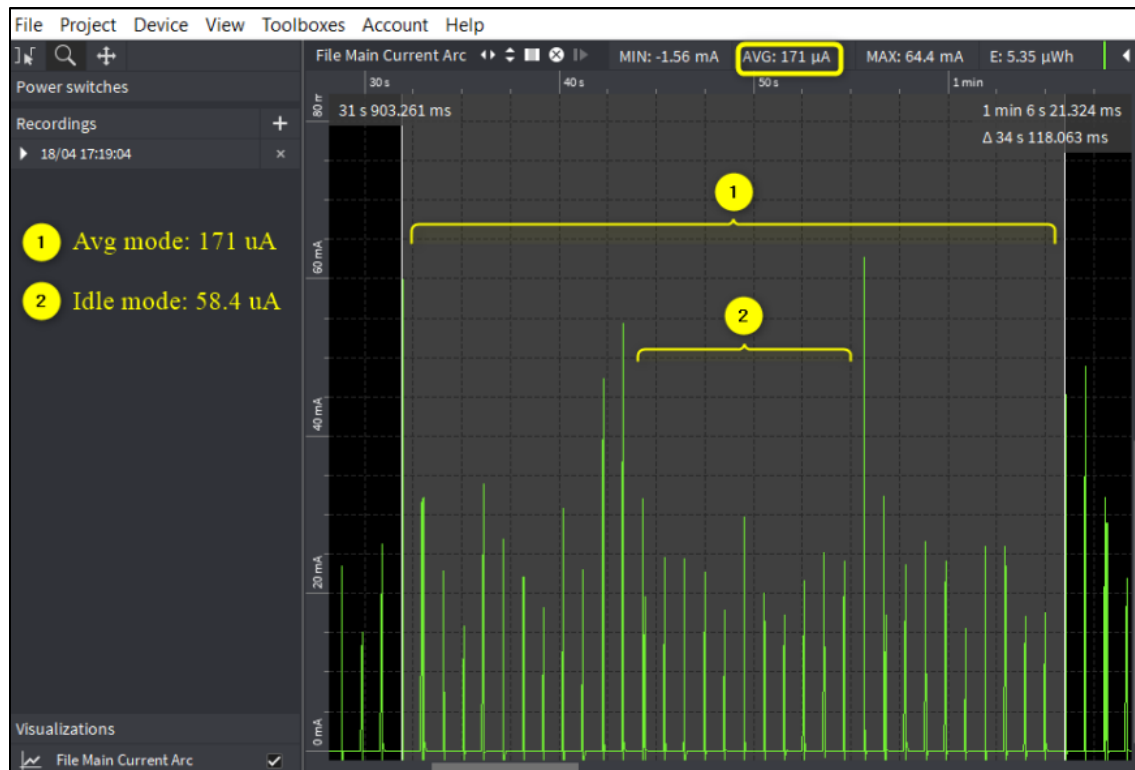


Figure 9: HTTP - Otii log

Console output:

```

UART:SNWWWWWAEBuild $Id: git-ba65998b7 $
mpd.mcast_rx=1 mpd.proto=http mpd.http.httpgetinterval=10 mpd.url=http://example.com
wifi.listen_interval=10 krn.gpio=--K wifi.keep_alive_wake_time=2
wifi.arp_grat_period=1800 wifi.max_idle_period=0 mpd.regdomain=FCC mpd.suspend=1
np_conf_path=/data/nprofile.json mpd.ssid=InnoPhase mpd.passphrase=43083191
$App:git-73e7f910
SDK Ver: SDK_2.6
T2 Multipurpose Demp App Version 0.12
network profile parse success.
Suspend Enabled.
Multicast reception Enabled.

```

```
url=http://example.com

Regdomain=FCC

addr e0:69:3a:00:13:90

Applying reg domain: 1-11@20

Connecting to network

.[2.049,462] CONNECT:00:5f:67:cd:c5:a6 Channel:11 rssi:-49 dBm

WCM_NOTIFY_MSG_LINK_UP

.WCM_NOTIFY_MSG_ADDRESS

[2.733,731] MYIP 192.168.0.104

[2.733,779] IPv6 [fe80::e269:3aff:fe00:1390]-link

WCM_NOTIFY_MSG_CONNECTED

Listen interval=10

Traffic Timeout=12

pm_flags=0x0

[3.541,272] WARNING! wcm_pm_config may overwrite the supplied power management boot
arguments!

WiFi Connection success. proceeding to app..

Timeout not specified.!

after parsing. port=80

Config:

Proto   :http

Port    :0

Interval:10

msg len :0

http_send_keepalive: times=1
```

```
[APP]Calling http_client_open(). cfg.port=80
[APP]HTTP Get. path=/callback entry

[APP]Response:
1120 -----

200
Age: 471654
Cache-Control: max-age=604800
Content-Type: text/html; charset=UTF-8
Date: Thu, 07 Jul 2022 10:23:01 GMT
Etag: "3147526947+gzip+ident"
Expires: Thu, 14 Jul 2022 10:23:01 GMT
Last-Modified: Thu, 17 Oct 2019 07:18:26 GMT
Server: ECS (dcb/7EA2)
Vary: Accept-Encoding
X-Cache: HIT
Accept-Ranges: none
Content-Length: 1256

[APP]Body:
Hexdump of http data, len=1120
3C 21 64 6F 63 74 79 70 65 20 68 74 6D 6C 3E 0A | <!doctype html>.
3C 68 74 6D 6C 3E 0A 3C 68 65 61 64 3E 0A 20 20 | <html>.<head>.
20 20 3C 74 69 74 6C 65 3E 45 78 61 6D 70 6C 65 | <title>Example
20 44 6F 6D 61 69 6E 3C 2F 74 69 74 6C 65 3E 0A | Domain</title>.
0A 20 20 20 20 3C 6D 65 74 61 20 63 68 61 72 73 | . <meta chars
```

```

65 74 3D 22 75 74 66 2D 38 22 20 2F 3E 0A 20 20 | et="utf-8" />.
20 20 3C 6D 65 74 61 20 68 74 74 70 2D 65 71 75 | <meta http-equ
69 76 3D 22 43 6F 6E 74 65 6E 74 2D 74 79 70 65 | iv="Content-type
22 20 63 6F 6E 74 65 6E 74 3D 22 74 65 78 74 2F | " content="text/
68 74 6D 6C 3B 20 63 68 61 72 73 65 74 3D 75 74 | html; charset=ut
66 2D 38 22 20 2F 3E 0A 20 20 20 20 3C 6D 65 74 | f-8" />. <met
61 20 6E 61 6D 65 3D 22 76 69 65 77 70 6F 72 74 | a name="viewport
22 20 63 6F 6E 74 65 6E 74 3D 22 77 69 64 74 68 | " content="width
3D 64 65 76 69 63 65 2D 77 69 64 74 68 2C 20 69 | =device-width, i
6E 69 74 69 61 6C 2D 73 63 61 6C 65 3D 31 22 20 | nitial-scale=1"
2F 3E 0A 20 20 20 20 3C 73 74 79 6C 65 20 74 79 | />. <style ty
70 65 3D 22 74 65 78 74 2F 63 73 73 22 3E 0A 20 | pe="text/css">.
20 20 20 62 6F 64 79 20 7B 0A 20 20 20 20 20 20 | body {.
20 20 62 61 63 6B 67 72 6F 75 6E 64 2D 63 6F 6C | background-col
6F 72 3A 20 23 66 30 66 30 66 32 3B 0A 20 20 20 | or: #f0f0f2;
20 20 20 20 20 6D 61 72 67 69 6E 3A 20 30 3B 0A | margin: 0;.
20 20 20 20 20 20 20 20 70 61 64 64 69 6E 67 3A | padding:
20 30 3B 0A 20 20 20 20 20 20 20 20 66 6F 6E 74 | 0;. font
2D 66 61 6D 69 6C 79 3A 20 2D 61 70 70 6C 65 2D | -family: -apple-
73 79 73 74 65 6D 2C 20 73 79 73 74 65 6D 2D 75 | system, system-u
69 2C 20 42 6C 69 6E 6B 4D 61 63 53 79 73 74 65 | i, BlinkMacSyste
6D 46 6F 6E 74 2C 20 22 53 65 67 6F 65 20 55 49 | mFont, "Segoe UI
22 2C 20 22 4F 70 65 6E 20 53 61 6E 73 22 2C 20 | ", "Open Sans",
22 48 65 6C 76 65 74 69 63 61 20 4E 65 75 65 22 | "Helvetica Neue"
2C 20 48 65 6C 76 65 74 69 63 61 2C 20 41 72 69 | , Helvetica, Ari
61 6C 2C 20 73 61 6E 73 2D 73 65 72 69 66 3B 0A | al, sans-serif;.
20 20 20 20 20 20 20 20 0A 20 20 20 20 7D 0A 20 | . }.
```



```

20 20 20 64 69 76 20 7B 0A 20 20 20 20 20 20 20 |   div {.
20 77 69 64 74 68 3A 20 36 30 30 70 78 3B 0A 20 |   width: 600px;.
20 20 20 20 20 20 20 6D 61 72 67 69 6E 3A 20 35 |       margin: 5
65 6D 20 61 75 74 6F 3B 0A 20 20 20 20 20 20 20 |   em auto;.
20 70 61 64 64 69 6E 67 3A 20 32 65 6D 3B 0A 20 |   padding: 2em;.
20 20 20 20 20 20 20 62 61 63 6B 67 72 6F 75 6E |       backgroun
64 2D 63 6F 6C 6F 72 3A 20 23 66 64 66 64 66 66 |   d-color: #fdffff
3B 0A 20 20 20 20 20 20 20 20 62 6F 72 64 65 72 |   ;.       border
2D 72 61 64 69 75 73 3A 20 30 2E 35 65 6D 3B 0A |   -radius: 0.5em;.
20 20 20 20 20 20 20 20 62 6F 78 2D 73 68 61 64 |       box-shad
6F 77 3A 20 32 70 78 20 33 70 78 20 37 70 78 20 |   ow: 2px 3px 7px
32 70 78 20 72 67 62 61 28 30 2C 30 2C 30 2C 30 |   2px rgba(0,0,0,0
2E 30 32 29 3B 0A 20 20 20 20head>..
6F 64 79 3E 0A 3C 64 69 76 3E 0A 20 20 20 20 3C |   ody>.<div>.    <
68 31 3E 45 78 61 6D 70 6C 65 20 44 6F 6D 61 69 |   h1>Example Domai
6E 3C 2F 68 31 3E 0A 20 20 20 20 3C 70 3E 54 68 |   n</h1>.    <p>Th
69 73 20 64 6F 6D 61 69 6E 20 69 73 20 66 6F 72 |   is domain is for
20 75 73 65 20 69 6E 20 69 6C 6C 75 73 74 72 61 |   use in illustra
74 69 76 65 20 65 78 61 6D 70 6C 65 73 20 69 6E |   tive examples in
20 64 6F 63 75 6D 65 6E 74 73 2E 20 59 6F 75 20 |   documents. You
6D 61 79 20 75 73 65 20 74 68 69 73 0A 20 20 20 |   may use this.
20 64 6F 6D 61 69 6E 20 69 6E 20 6C 69 74 65 72 |   domain in liter
61 74 75 72 65 20 77 69 74 68 6F 75 74 20 70 72 |   ature without pr
69 6F 72 20 63 6F 6F 72 64 69 6E 61 74 69 6F 6E |   ior coordination
callback exit
callback entry
Hexdump of http data, len=136

```

```
20 6F 72 20 61 73 6B 69 6E 67 20 66 6F 72 20 70 | or asking for p
65 72 6D 69 73 73 69 6F 6E 2E 3C 2F 70 3E 0A 20 | ermission.</p>.
20 20 20 3C 70 3E 3C 61 20 68 72 65 66 3D 22 68 | <p><a href="h
74 74 70 73 3A 2F 2F 77 77 77 2E 69 61 6E 61 2E | ttps://www.iana.
6F 72 67 2F 64 6F 6D 61 69 6E 73 2F 65 78 61 6D | org/domains/exam
70 6C 65 22 3E 4D 6F 72 65 20 69 6E 66 6F 72 6D | ple">More inform
61 74 69 6F 6E 2E 2E 2E 3C 2F 61 3E 3C 2F 70 3E | ation...</a></p>
0A 3C 2F 64 69 76 3E 0A 3C 2F 62 6F 64 79 3E 0A | .</div></body>.
3C 2F 68 74 6D 6C 3E 0A | </html>.
callback exit
```

HTTPS

Wireshark log:

Expected Result: At the configured interval, Message_Send Interval, application connects to URL, performs HTTPs Get and hexdumps the page.

1. The first three packets (SYN, SYN/ACK, ACK) are the TCP three-way handshake.
2. [Client hello], [Server hello], [Certificate, Server Key Exchange, Server Hello Done], [Client Key Exchange, Change Cipher Spec, Encrypted Handshake Message], [New Session ticket] are the SSL/TLS handshake, which indicates successful TLS connection.
3. All the data packets over TLS connection are observed as Application data which is encrypted.

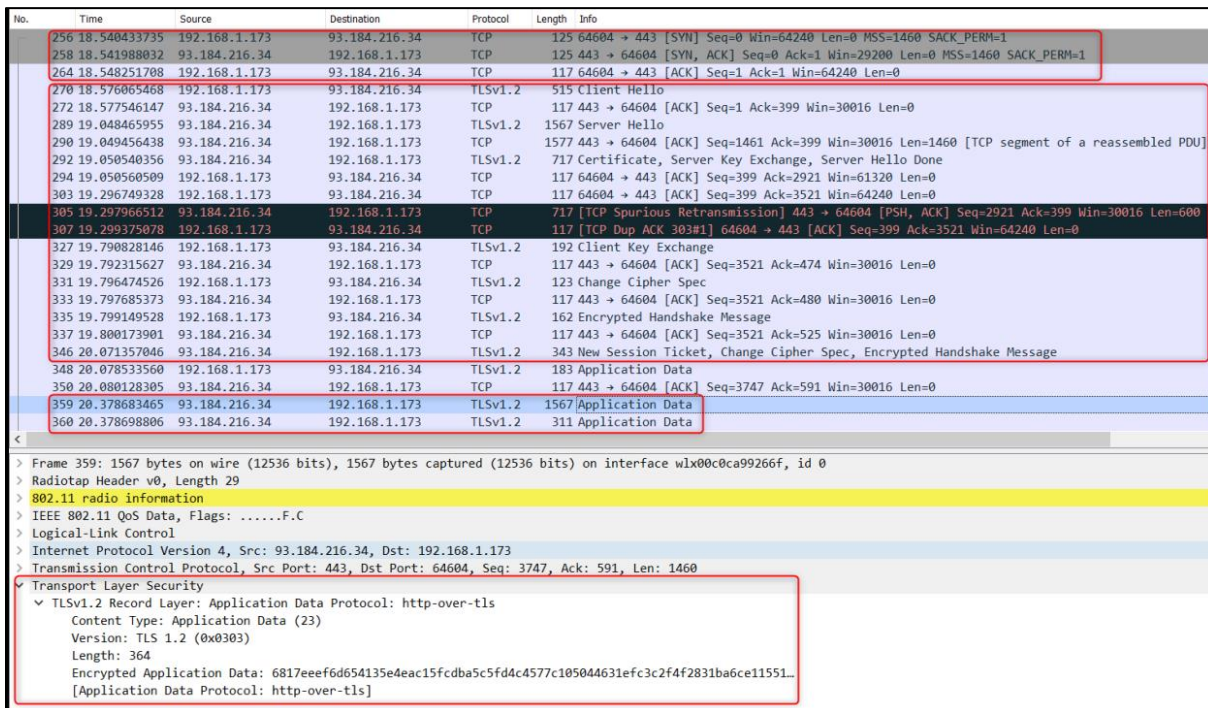


Figure 10: HTTPS - Wireshark log

Otii log: Shows an average current consumption of $640\mu\text{A}$ for 30s. In idle cases, the average current consumption is $58.1\mu\text{A}$.

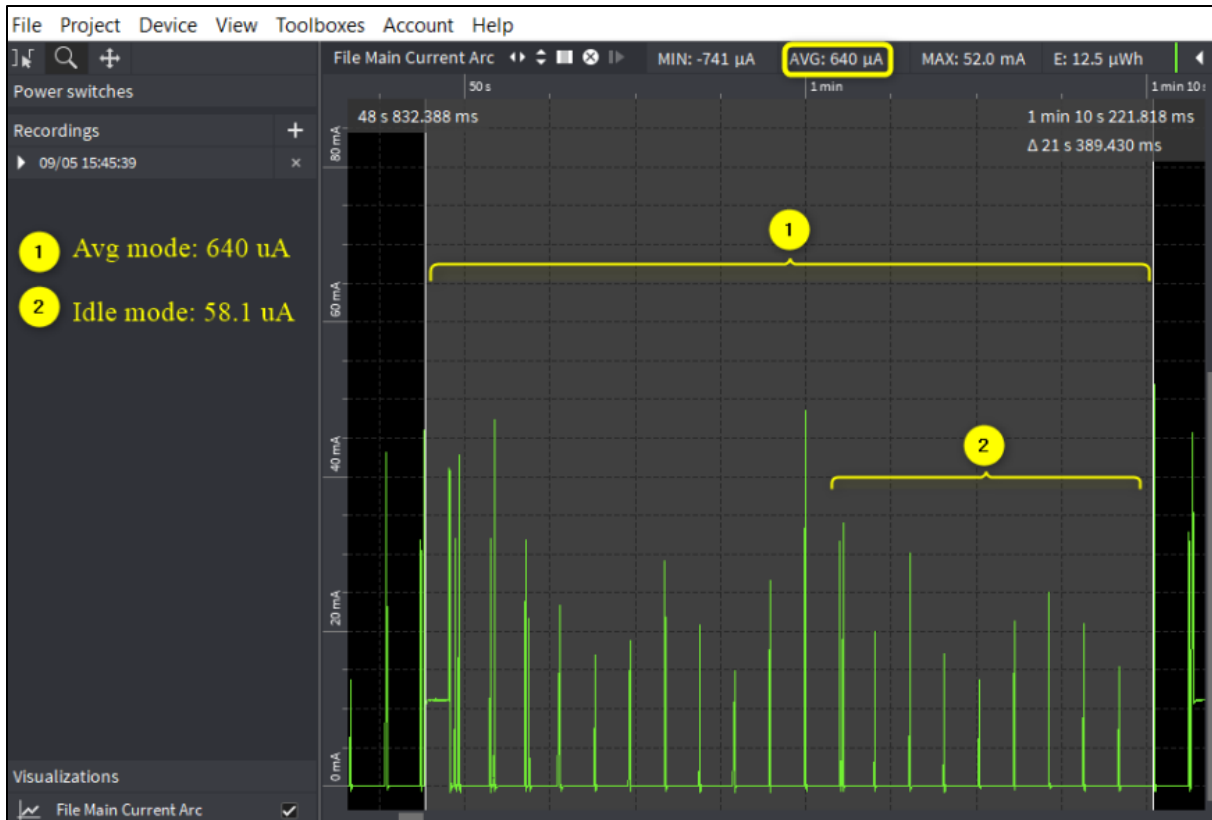


Figure 11: HTTPS - Otii log

Console output:

```

UART:SNWWWWWAEBuild $Id: git-ba65998b7 $
mpd.mcast_rx=1 mpd.proto=https mpd.https.httpsgetinterval=10 mpd.url=https://example.com
wifi.listen_interval=10 krn.gpio>--K wifi.keep_alive_wake_time=2
wifi.arp_grat_period=1800 wifi.max_idle_period=0 mpd.regdomain=FCC mpd.suspend=1
np_conf_path=/data/nprofile.json mpd.ssid=InnoPhase mpd.passphrase=43083191
$App:git-73e7f910
SDK Ver: SDK_2.6
T2 Multipurpose Demp App Version 0.12

```

```
network profile parse success.

Suspend Enabled.

Multicast reception Enabled.

url=https://example.com

Regdomain=FCC

addr e0:69:3a:00:13:90

Applying reg domain: 1-11@20

Connecting to network

.[2.171,820] CONNECT:00:5f:67:cd:c5:a6 Channel:11 rssi:-57 dBm

WCM_NOTIFY_MSG_LINK_UP

.WCM_NOTIFY_MSG_ADDRESS

[2.917,496] MYIP 192.168.0.104

[2.917,543] IPv6 [fe80::e269:3aff:fe00:1390]-link

WCM_NOTIFY_MSG_CONNECTED

Listen interval=10

Traffic Timeout=12

pm_flags=0x0

[3.543,978] WARNING! wcm_pm_config may overwrite the supplied power management boot
arguments!

WiFi Connection success. proceeding to app..

Timeout not specified.!

after parsing. port=443

Config:

Proto   :https

Port    :0
```

```
Interval:10
msg len :0

http_send_keepalive: times=1

[APP]Calling http_client_open(). http_cmn_ctx.cfg.port=443
. [SSL_WRAP]Checking input configurations...
. [SSL_WRAP]Seeding the random number generator...
. [SSL_WRAP]Connecting to tcp example.com:443...
. [SSL_WRAP]Setting up the SSL/TLS structure...
. [SSL_WRAP]setting configurations..
    >auth mode = 0 (0- skip, 1- optional, 2- required
    >max fragment len = 0
    >Handshake timeout = 30 Sec
. [SSL_WRAP]Performing the SSL/TLS handshake...
. [SSL_WRAP] Handshake done. ok
. [SSL_WRAP]Verifying peer X.509 certificate.

[APP]HTTP Get. path=/

[APP]Response:
0 -----

200
Age: 378199
Cache-Control: max-age=604800
Content-Type: text/html; charset=UTF-8
```

Date: Thu, 07 Jul 2022 11:04:16 GMT

Etag: "3147526947+ident"

Expires: Thu, 14 Jul 2022 11:04:16 GMT

Last-Modified: Thu, 17 Oct 2019 07:18:26 GMT

Server: ECS (dcb/7F80)

Vary: Accept-Encoding

X-Cache: HIT

Content-Length: 1256

[APP]Body:

Hexdump of http data, len=0

Hexdump of http data, len=1256

```

3C 21 64 6F 63 74 79 70 65 20 68 74 6D 6C 3E 0A | <!doctype html>.
3C 68 74 6D 6C 3E 0A 3C 68 65 61 64 3E 0A 20 20 | <html>.<head>.
20 20 3C 74 69 74 6C 65 3E 45 78 61 6D 70 6C 65 | <title>Example
20 44 6F 6D 61 69 6E 3C 2F 74 69 74 6C 65 3E 0A | Domain</title>.
0A 20 20 20 20 3C 6D 65 74 61 20 63 68 61 72 73 | . <meta chars
65 74 3D 22 75 74 66 2D 38 22 20 2F 3E 0A 20 20 | et="utf-8" />.
20 20 3C 6D 65 74 61 20 68 74 74 70 2D 65 71 75 | <meta http-equ
69 76 3D 22 43 6F 6E 74 65 6E 74 2D 74 79 70 65 | iv="Content-type
22 20 63 6F 6E 74 65 6E 74 3D 22 74 65 78 74 2F | " content="text/
68 74 6D 6C 3B 20 63 68 61 72 73 65 74 3D 75 74 | html; charset=ut
66 2D 38 22 20 2F 3E 0A 20 20 20 20 3C 6D 65 74 | f-8" />. <met
61 20 6E 61 6D 65 3D 22 76 69 65 77 70 6F 72 74 | a name="viewport
22 20 63 6F 6E 74 65 6E 74 3D 22 77 69 64 74 68 | " content="width
3D 64 65 76 69 63 65 2D 77 69 64 74 68 2C 20 69 | =device-width, i
6E 69 74 69 61 6C 2D 73 63 61 6C 65 3D 31 22 20 | nitial-scale=1"
2F 3E 0A 20 20 20 20 3C 73 74 79 6C 65 20 74 79 | />. <style ty

```

```

70 65 3D 22 74 65 78 74 2F 63 73 73 22 3E 0A 20 | pe="text/css">.
20 20 20 20 62 6F 64 79 20 7B 0A 20 20 20 20 20 | body {.
20 20 62 61 63 6B 67 72 6F 75 6E 64 2D 63 6F 6C | background-col
6F 72 3A 20 23 66 30 66 30 66 32 3B 0A 20 20 20 | or: #f0f0f2;
20 20 20 20 20 6D 61 72 67 69 6E 3A 20 30 3B 0A | margin: 0;.
20 20 20 20 20 20 20 20 70 61 64 64 69 6E 67 3A | padding:
20 30 3B 0A 20 20 20 20 20 20 20 20 66 6F 6E 74 | 0;. font
2D 66 61 6D 69 6C 79 3A 20 2D 61 70 70 6C 65 2D | -family: -apple-
73 79 73 74 65 6D 2C 20 73 79 73 74 65 6D 2D 75 | system, system-u
69 2C 20 42 6C 69 6E 6B 4D 61 63 53 79 73 74 65 | i, BlinkMacSyste
6D 46 6F 6E 74 2C 20 22 53 65 67 6F 65 20 55 49 | mFont, "Segoe UI
22 2C 20 22 4F 70 65 6E 20 53 61 6E 73 22 2C 20 | ", "Open Sans",
22 48 65 6C 76 65 74 69 63 61 20 4E 65 75 65 22 | "Helvetica Neue"
2C 20 48 65 6C 76 65 74 69 63 61 2C 20 41 72 69 | , Helvetica, Ari
61 6C 2C 20 73 61 6E 73 2D 73 65 72 69 66 3B 0A | al, sans-serif;.
20 20 20 20 20 20 20 20 0A 20 20 20 20 7D 0A 20 | . }.
20 20 20 64 69 76 20 7B 0A 20 20 20 20 20 20 20 | div {.
20 77 69 64 74 68 3A 20 36 30 30 70 78 3B 0A 20 | width: 600px;.
20 20 20 20 20 20 20 6D 61 72 67 69 6E 3A 20 35 | margin: 5
65 6D 20 61 75 74 6F 3B 0A 20 20 20 20 20 20 20 | em auto;.
20 70 61 64 64 69 6E 67 3A 20 32 65 6D 3B 0A 20 | padding: 2em;.
20 20 20 20 20 20 20 62 61 63 6B 67 72 6F 75 6E | background
64 2D 63 6F 6C 6F 72 3A 20 23 66 64 66 64 66 66 | d-color: #fdfdff
3B 0A 20 20 20 20 20 20 20 20 62 6F 72 64 65 72 | ;. border
2D 72 61 64 69 75 73 3A 20 30 2E 35 65 6D 3B 0A | -radius: 0.5em;.
20 20 20 20 20 20 20 20 62 6F 78 2D 73 68 61 64 | box-shad
6F 77 3A 20 32 70 78 20 33 70 78 }.
    
```



```

20 20 7D 0A 20 20 20 20 3C 2F 73 74 79 6C 65 3E | } . </style>
20 20 20 20 0A 3C 2F 68 65 61 64 3E 0A 0A 3C 62 | .</head>..<b
6F 64 79 3E 0A 3C 64 69 76 3E 0A 20 20 20 20 3C | ody>.<div>. <
68 31 3E 45 78 61 6D 70 6C 65 20 44 6F 6D 61 69 | h1>Example Domai
6E 3C 2F 68 31 3E 0A 20 20 20 20 3C 70 3E 54 68 | n</h1>. <p>Th
69 73 20 64 6F 6D 61 69 6E 20 69 73 20 66 6F 72 | is domain is for
20 75 73 65 20 69 6E 20 69 6C 6C 75 73 74 72 61 | use in illustra
74 69 76 65 20 65 78 61 6D 70 6C 65 73 20 69 6E | tive examples in
20 64 6F 63 75 6D 65 6E 74 73 2E 20 59 6F 75 20 | documents. You
6D 61 79 20 75 73 65 20 74 68 69 73 0A 20 20 20 | may use this.
20 64 6F 6D 61 69 6E 20 69 6E 20 6C 69 74 65 72 | domain in liter
61 74 75 72 65 20 77 69 74 68 6F 75 74 20 70 72 | ature without pr
69 6F 72 20 63 6F 6F 72 64 69 6E 61 74 69 6F 6E | ior coordination
20 6F 72 20 61 73 6B 69 6E 67 20 66 6F 72 20 70 | or asking for p
65 72 6D 69 73 73 69 6F 6E 2E 3C 2F 70 3E 0A 20 | ermission.</p>.
20 20 20 3C 70 3E 3C 61 20 68 72 65 66 3D 22 68 | <p><a href="h
74 74 70 73 3A 2F 2F 77 77 77 2E 69 61 6E 61 2E | ttps://www.iana.
6F 72 67 2F 64 6F 6D 61 69 6E 73 2F 65 78 61 6D | org/domains/exam
70 6C 65 22 3E 4D 6F 72 65 20 69 6E 66 6F 72 6D | ple">More inform
61 74 69 6F 6E 2E 2E 2E 3C 2F 61 3E 3C 2F 70 3E | ation...</a></p>
0A 3C 2F 64 69 76 3E 0A 3C 2F 62 6F 64 79 3E 0A | .</div>.</body>.
3C 2F 68 74 6D 6C 3E 0A | </html>.

```

```
[APP]Success: http_client_get(), rval = 2
```

```
http_send_keepalive: times=2
```

```
[APP]Calling http_client_open(). http_cmn_ctx.cfg.port=443
```

```
. [SSL_WRAP]Checking input configurations...
```

```
. [SSL_WRAP]Seeding the random number generator...
. [SSL_WRAP]Connecting to tcp example.com:443...
. [SSL_WRAP]Setting up the SSL/TLS structure...
. [SSL_WRAP]setting configurations..
    >auth mode = 0 (0- skip, 1- optional, 2- required
    >max fragment len = 0
    >Handshake timeout = 30 Sec
. [SSL_WRAP]Performing the SSL/TLS handshake...
. [SSL_WRAP] Handshake done. ok
. [SSL_WRAP]Verifying peer X.509 certificate.

[APP]HTTP Get. path=/
```

MQTT

To observe Publish messages and to Subscribe any message run the following commands:

1. To Publish:
mosquitto_sub -d -v -h mqtt-dashboard.com -t PUBMSG
2. To Subscribe:
mosquitto_pub -d -h mqtt-dashboard.com -t SUBMSG1 -m "msg1"

Note: Mosquitto.exe can be downloaded from the following link: <http://mosquitto.org/download/>.

MQTT - Command Prompt Output (Subscribe message):

```
synergic@synergic-vostro-3470:~/Downloads$ mosquitto_pub -d -h mqtt-dashboard.com -t
SUBMSG1 -m "msg1"

Client mosq-7XNzxTypruv9Bkybj sending CONNECT
Client mosq-7XNzxTypruv9Bkybj received CONNACK (0)
Client mosq-7XNzxTypruv9Bkybj sending PUBLISH (d0, q0, r0, m1, 'SUBMSG1', ... (4
bytes))
Client mosq-7XNzxTypruv9Bkybj sending DISCONNECT
```

MQTT - Command Prompt Output (Publish message):

```
synergic@synergic-vostro-3470:~/Downloads$ mosquitto_sub -d -v -h mqtt-dashboard.com -t
PUBMSG

Client mosq-3SHpQMGOLvcW97fbtH sending CONNECT
Client mosq-3SHpQMGOLvcW97fbtH received CONNACK (0)
Client mosq-3SHpQMGOLvcW97fbtH sending SUBSCRIBE (Mid: 1, Topic: PUBMSG, QoS: 0,
Options: 0x00)
Client mosq-3SHpQMGOLvcW97fbtH received SUBACK
Subscribed (mid: 1): 0
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
```

```
PUBMSG  
Times=7:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB  
CDEFGHIJKLM  
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99  
bytes))  
PUBMSG  
Times=8:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB  
CDEFGHIJKLM  
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99  
bytes))  
PUBMSG  
Times=9:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB  
CDEFGHIJKLM  
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99  
bytes))  
PUBMSG  
Times=10:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA  
BCDEFGHIJKL  
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99  
bytes))  
PUBMSG  
Times=11:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA  
BCDEFGHIJKL  
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99  
bytes))
```

```
PUBMSG
Times=0:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
CDEFGHIJKLM
Client mosq-3SHpQMGOLvcW97fbtH sending PINGREQ
Client mosq-3SHpQMGOLvcW97fbtH received PINGRESP
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
PUBMSG
Times=1:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
CDEFGHIJKLM
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
PUBMSG
Times=2:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
OPQRSTUVWXYZABCDEFGHIJKLMN
CDEFGHIJKLM
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
```

Console output:

```
Y-BOOT 208ef13 2019-07-22 12:26:54 -0500 790da1-b-7
ROM yoda-h0-rom-16-0-gd5a8e586
FLASH:PNWWWWWAEBuild $Id: git-d198c0771 $
mpd.mcast_rx=1 mpd.proto=mqtt mpd.port=8883 mpd.mqtt.publishinterval=10 mpd.url=mqtt-
dashboard.com mpd.mqtt.clientid=T2_TALARIA mpd.mqtt.username=t2_user
mpd.mqtt.password=t2_pass mpd.mqtt.pub_msg=PUBMSG mpd.mqtt.sub_msg1=SUBMSG1
mpd.mqtt.sub_msg2=SUBMSG2 mpd.mqtt.ping_interval=60 wifi.listen_interval=10 krn.gpio=--
K wifi.keep_alive_wake_time=2 wifi.arp_grat_period=1800 wifi.max_idle_period=0
```

```
mpd.regdomain=FCC mpd.suspend=1 np_conf_path=/data/nprofile.json mpd.ssid=low_rssi
mpd.passphrase=12345678
$App:git-fdceeca3
SDK Ver: SDK_2.6.2
T2 Multipurpose Demp App Version 0.12
network profile parse success.
Suspend Enabled.
Multicast reception Enabled.
url=mqtt-dashboard.com
Regdomain=FCC
addr e0:69:3a:00:01:24
Applying reg domain: 1-11@20

Connecting to network
.[0.900,792] CONNECT:74:da:88:a6:9c:ea Channel:11 rssi:-4 dBm
WCM_NOTIFY_MSG_LINK_UP
.WCM_NOTIFY_MSG_ADDRESS
[1.612,858] MYIP 192.168.1.100
[1.613,022] IPv6 [fe80::e269:3aff:fe00:124]-link
WCM_NOTIFY_MSG_CONNECTED
Listen interval=10
Traffic Timeout=12
pm_flags=0x0
[2.214,225] WARNING! wcm_pm_config may overwrite the supplied power management boot
arguments!
WiFi Connection success. proceeding to app..
Timeout not specified.!
```

```
url=mqtt-dashboard.com hostname=mqtt-dashboard.com, port=8883, page=/  
starting mqtt.. Ping interval=60 Secs
```

```
. Seeding the random number generator... ok  
. Loading the CA root certificate ... ok (0 skipped)
```

```
Connect success. Returning :0
```

```
ok
```

```
. Setting up the SSL/TLS structure... ok  
. Performing the SSL/TLS handshake... ok
```

```
init_ssl_and_connect success... proceeding..on retry (1)
```

```
_mqtt_cycle : packet_type = 2
```

```
_mqtt_cycle : packet_type = 9Subscribed to "SUBMSG1"
```

```
_mqtt_cycle : packet_type = 9Subscribed to "SUBMSG2"
```

```
MQTT init: returning 0
```

```
Config:
```

```
Proto :mqtt
```

```
Port :8883
```

```
Interval:10
```

```
msg len :100
```

```
mqtt_loop entry
```

```
publish_data, value=1, interval=10Secs
```

```
publish_data, value=2, interval=10Secs
```

```
publish_data, value=3, interval=10Secs
```

```
publish_data, value=4, interval=10Secs
```

```
publish_data, value=5, interval=10Secs
publish_data, value=6, interval=10Secs
publish_data, value=7, interval=10Secs

_mqtt_cycle : packet_type = 13publish_data, value=8, interval=10Secs
publish_data, value=9, interval=10Secs
publish_data, value=10, interval=10Secs
publish_data, value=11, interval=10Secs
publish_data, value=0, interval=10Secs
publish_data, value=1, interval=10Secs

_mqtt_cycle : packet_type = 13publish_data, value=2, interval=10Secs

_mqtt_cycle : packet_type = 3messageArrived: SUBMSG1 msg1
publish_data, value=3, interval=10Secs
publish_data, value=4, interval=10Secs
publish_data, value=5, interval=10Secs
publish_data, value=6, interval=10Secs
publish_data, value=7, interval=10Secs
publish_data, value=8, interval=10Secs

_mqtt_cycle : packet_type = 13publish_data, value=9, interval=10Secs
publish_data, value=10, interval=10Secs
publish_data, value=11, interval=10Secs
publish_data, value=0, interval=10Secs
publish_data, value=1, interval=10Secs
publish_data, value=2, interval=10Secs
```



```
publish_data, value=3, interval=10Secs

_mqtt_cycle : packet_type = 13publish_data, value=4, interval=10Secs
publish_data, value=5, interval=10Secs
publish_data, value=6, interval=10Secs
publish_data, value=7, interval=10Secs
publish_data, value=8, interval=10Secs
publish_data, value=9, interval=10Secs

_mqtt_cycle : packet_type = 13publish_data, value=10, interval=10Secs
publish_data, value=11, interval=10Secs
publish_data, value=0, interval=10Secs
publish_data, value=1, interval=10Secs
publish_data, value=2, interval=10Secs
publish_data, value=3, interval=10Secs

_mqtt_cycle : packet_type = 13publish_data, value=4, interval=10Secs
publish_data, value=5, interval=10Secs
publish_data, value=6, interval=10Secs
publish_data, value=7, interval=10Secs
publish_data, value=8, interval=10Secs
publish_data, value=9, interval=10Secs

_mqtt_cycle : packet_type = 13publish_data, value=10, interval=10Secs
publish_data, value=11, interval=10Secs
publish_data, value=0, interval=10Secs
publish_data, value=1, interval=10Secs
```

```
publish_data, value=2, interval=10Secs  
publish_data, value=3, interval=10Secs  
  
_mqtt_cycle : packet_type = 13publish_data, value=4, interval=10Secs  
publish_data, value=5, interval=10Secs  
publish_data, value=6, interval=10Secs  
publish_data, value=7, interval=10Secs  
publish_data, value=8, interval=10Secs  
publish_data, value=9, interval=10Secs  
publish_data, value=10, interval=10Secs  
publish_data, value=11, interval=10Secs  
  
_mqtt_cycle : packet_type = 13publish_data, value=0, interval=10Secs  
publish_data, value=1, interval=10Secs  
publish_data, value=2, interval=10Secs  
publish_data, value=3, interval=10Secs  
publish_data, value=4, interval=10Secs  
publish_data, value=5, interval=10Secs  
  
_mqtt_cycle : packet_type = 13publish_data, value=6, interval=10Secs  
publish_data, value=7, interval=10Secs  
publish_data, value=8, interval=10Secs  
publish_data, value=9, interval=10Secs  
publish_data, value=10, interval=10Secs  
publish_data, value=11, interval=10Secs  
  
_mqtt_cycle : packet_type = 13publish_data, value=0, interval=10Secs
```

```
publish_data, value=1, interval=10Secs
publish_data, value=2, interval=10Secs
publish_data, value=3, interval=10Secs
publish_data, value=4, interval=10Secs
publish_data, value=5, interval=10Secs
```

Wireshark log:

1. The connection sequence of the MQTT is as shown in Figure 12.

No.	Time	Source	Destination	Protocol	Length	Info
266	17.726024965	192.168.1.173	5.196.95.208	MQTT	161	Connect Command → MQTT connect
275	17.921451079	5.196.95.208	192.168.1.173	MQTT	121	Connect Ack
277	17.931126342	192.168.1.173	5.196.95.208	MQTT	131	Subscribe Request (id=2) [SUBMSG1] → MQTT subscribe
297	18.126456927	5.196.95.208	192.168.1.173	MQTT	122	Subscribe Ack (id=2)
299	18.132452441	192.168.1.173	5.196.95.208	MQTT	131	Subscribe Request (id=3) [SUBMSG2]
309	18.433272270	5.196.95.208	192.168.1.173	MQTT	122	Subscribe Ack (id=3)
338	19.456546603	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG] → MQTT Publish
459	29.696925236	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
574	39.936687364	192.168.1.173	5.196.95.208	MQTT	223	Publish Message [PUBMSG]
676	49.152658386	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
788	59.392651362	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
908	69.632620691	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1010	78.848673612	192.168.1.173	5.196.95.208	MQTT	119	Ping Request → MQTT PING
1027	79.873835764	5.196.95.208	192.168.1.173	MQTT	109	Ping Response

Figure 12: MQTT connection flow - Wireshark log

2. The Connect command is sent from Talaria TWO to MQTT broker, connection is established when the connect acknowledgement is received by Talaria TWO from broker.

No.	Time	Source	Destination	Protocol	Length	Info
266	17.726024965	192.168.1.173	5.196.95.208	MQTT	161	Connect Command
275	17.921451079	5.196.95.208	192.168.1.173	MQTT	121	Connect Ack


```
> Frame 266: 161 bytes on wire (1288 bits), 161 bytes captured (1288 bits) on interface wlx00c0ca99266f, id 0
> Radiotap Header v0, Length 39
> 802.11 radio information
> IEEE 802.11 QoS Data, Flags: .....TC
> Logical-Link Control
> Internet Protocol Version 4, Src: 192.168.1.173, Dst: 5.196.95.208
> Transmission Control Protocol, Src Port: 53921, Dst Port: 1883, Seq: 1, Ack: 1, Len: 44
MQ Telemetry Transport Protocol, Connect Command
  > Header Flags: 0x10, Message Type: Connect Command
  Msg Len: 42
  Protocol Name Length: 6
  Protocol Name: MQIsdp
  Version: MQTT v3.1 (3)
  > Connect Flags: 0xc2, User Name Flag, Password Flag, QoS Level: At most once delivery (Fire and Forget), Clean Session Flag
  Keep Alive: 60
  Client ID Length: 10
  Client ID: T2_TALARIA
  User Name Length: 7
  User Name: t2_user
  Password Length: 7
  Password: t2_pass
```

→ Configured parameters in the MPD tool

Figure 13: MQTT connection packet - Wireshark log

3. SUBMSG1 and SUBMSG2 are the two configured topic to subscribe, Talaria TWO gets registered to the topics from the subscription request.

No.	Time	Source	Destination	Protocol	Length	Info
266	17.726024965	192.168.1.173	5.196.95.208	MQTT	161	Connect Command
275	17.921451079	5.196.95.208	192.168.1.173	MQTT	121	Connect Ack
277	17.931126342	192.168.1.173	5.196.95.208	MQTT	131	Subscribe Request (id=2) [SUBMSG1]
297	18.126456927	5.196.95.208	192.168.1.173	MQTT	122	Subscribe Ack (id=2)
299	18.132452441	192.168.1.173	5.196.95.208	MQTT	131	Subscribe Request (id=3) [SUBMSG2]
309	18.433272270	5.196.95.208	192.168.1.173	MQTT	122	Subscribe Ack (id=3)


```

> Frame 277: 131 bytes on wire (1048 bits), 131 bytes captured (1048 bits) on interface wlx00c0ca99266f, id 0
> Radiotap Header v0, Length 39
> 802.11 radio information
> IEEE 802.11 QoS Data, Flags: .....TC
> Logical-Link Control
> Internet Protocol Version 4, Src: 192.168.1.173, Dst: 5.196.95.208
> Transmission Control Protocol, Src Port: 53921, Dst Port: 1883, Seq: 45, Ack: 5, Len: 14
> MQ Telemetry Transport Protocol, Subscribe Request
  > Header Flags: 0x82, Message Type: Subscribe Request, QoS Level: At least once delivery (Acknowledged deliver)
    Msg Len: 12
    Message Identifier: 2
    Topic Length: 7
    Topic: SUBMSG1
    Requested QoS: At least once delivery (Acknowledged deliver) (1)
  
```

Figure 14: MQTT subscribe package - Wireshark log

4. Publish message is observed from Talaria TWO for the configured interval of seconds (10s) with the topic PUBMSG.

No.	Time	Source	Destination	Protocol	Length	Info
266	17.726024965	192.168.1.173	5.196.95.208	MQTT	161	Connect Command
275	17.921451079	5.196.95.208	192.168.1.173	MQTT	121	Connect Ack
277	17.931126342	192.168.1.173	5.196.95.208	MQTT	131	Subscribe Request (id=2) [SUBMSG1]
297	18.126456927	5.196.95.208	192.168.1.173	MQTT	122	Subscribe Ack (id=2)
299	18.132452441	192.168.1.173	5.196.95.208	MQTT	131	Subscribe Request (id=3) [SUBMSG2]
309	18.433272270	5.196.95.208	192.168.1.173	MQTT	122	Subscribe Ack (id=3)
338	19.456546603	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
459	29.696925236	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
574	39.936687364	192.168.1.173	5.196.95.208	MQTT	223	Publish Message [PUBMSG]
676	49.152658386	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
788	59.392651362	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]


```

> Frame 338: 226 bytes on wire (1808 bits), 226 bytes captured (1808 bits) on interface wlx00c0ca99266f, id 0
> Radiotap Header v0, Length 39
> 802.11 radio information
> IEEE 802.11 QoS Data, Flags: .....TC
> Logical-Link Control
> Internet Protocol Version 4, Src: 192.168.1.173, Dst: 5.196.95.208
> Transmission Control Protocol, Src Port: 53921, Dst Port: 1883, Seq: 73, Ack: 15, Len: 109
> MQ Telemetry Transport Protocol, Publish Message
  > Header Flags: 0x30, Message Type: Publish Message, QoS Level: At most once delivery (Fire and Forget)
    Msg Len: 107
    Topic Length: 6
    Topic: PUBMSG
    Message: 54696d65733d313a4142434445464748494a4b4c4d4e4f505152535455565758595a4142...
  
```

Figure 15: MQTT publish packet - Wireshark log

5. At configured interval of seconds (60s) a ping request and response is observed from Talaria TWO.

No.	Time	Source	Destination	Protocol	Length	Info
459	29.696925236	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
574	39.936687364	192.168.1.173	5.196.95.208	MQTT	223	Publish Message [PUBMSG]
676	49.152658386	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
788	59.392651362	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
908	69.632620691	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1010	78.848673612	192.168.1.173	5.196.95.208	MQTT	119	Ping Request
1027	79.873835764	5.196.95.208	192.168.1.173	MQTT	109	Ping Response


```

> Frame 1010: 119 bytes on wire (952 bits), 119 bytes captured (952 bits) on interface wlx00c0ca99266f, id 0
> Radiotap Header v0, Length 39
> 802.11 radio information
> IEEE 802.11 QoS Data, Flags: .....TC
> Logical-Link Control
> Internet Protocol Version 4, Src: 192.168.1.173, Dst: 5.196.95.208
> Transmission Control Protocol, Src Port: 53921, Dst Port: 1883, Seq: 727, Ack: 15, Len: 2
> MQ Telemetry Transport Protocol, Ping Request
  > Header Flags: 0xc0, Message Type: Ping Request
    1100 .... = Message Type: Ping Request (12)
    .... 0000 = Reserved: 0
    Msg Len: 0
    
```

Figure 16: MQTT ping - Wireshark log

6. Data is sent from MQTT broker to Talaria TWO with the subscribed topic SUBMSG1.

No.	Time	Source	Destination	Protocol	Length	Info
1134	89.088889856	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1246	99.328809754	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1366	109.568657439	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1478	119.808889817	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1580	129.024833718	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1695	139.264886684	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1714	140.392456031	192.168.1.173	5.196.95.208	MQTT	119	Ping Request
1730	141.313454822	5.196.95.208	192.168.1.173	MQTT	109	Ping Response
1828	149.505172344	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
1943	159.744911122	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]
2045	168.961341281	5.196.95.208	192.168.1.173	MQTT	132	Publish Message [SUBMSG1]
2063	169.985115154	192.168.1.173	5.196.95.208	MQTT	226	Publish Message [PUBMSG]


```

> Frame 2045: 132 bytes on wire (1056 bits), 132 bytes captured (1056 bits) on interface wlx00c0ca99266f, id 0
> Radiotap Header v0, Length 39
> 802.11 radio information
> IEEE 802.11 QoS Data, Flags: .....F.C
> Logical-Link Control
> Internet Protocol Version 4, Src: 5.196.95.208, Dst: 192.168.1.173
> Transmission Control Protocol, Src Port: 1883, Dst Port: 53921, Seq: 19, Ack: 1712, Len: 15
> MQ Telemetry Transport Protocol, Publish Message
  > Header Flags: 0x30, Message Type: Publish Message, QoS Level: At most once delivery (Fire and Forget)
    0011 .... = Message Type: Publish Message (3)
    .... 0... = DUP Flag: Not set
    .... .00. = QoS Level: At most once delivery (Fire and Forget) (0)
    .... ...0 = Retain: Not set
    Msg Len: 13
    Topic Length: 7
    Topic: SUBMSG1
    Message: 6d736731
    
```

Figure 17: MQTT subscribe packet - Wireshark log

Otii log:

Case 1: Shows an average current consumption of 200 μ A for 30s for MQTT subscribe. In idle cases, the average current consumption is 57.6 μ A.

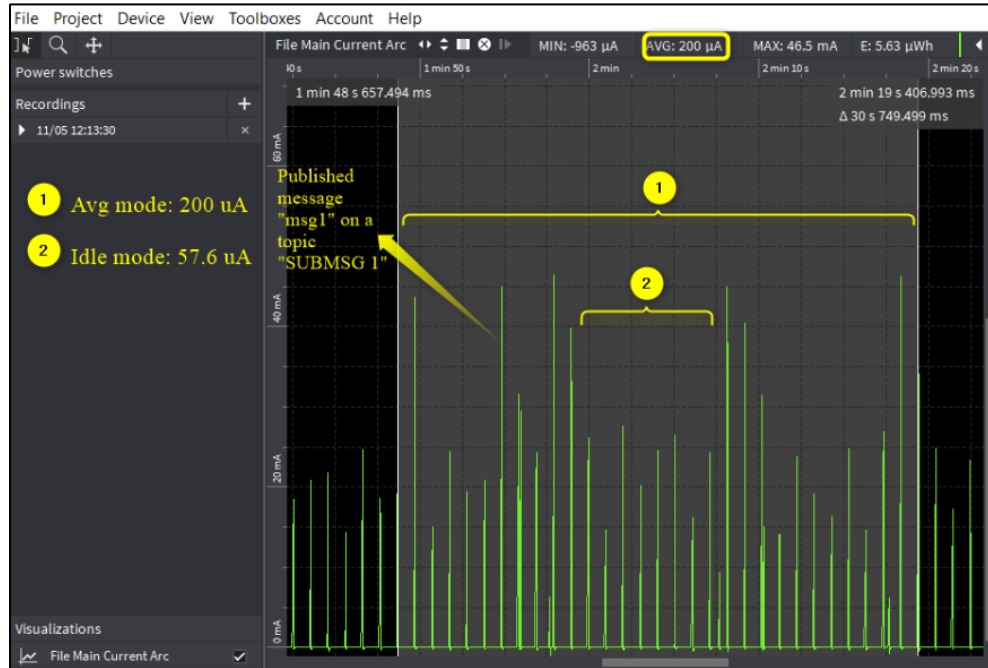


Figure 18: MQTT subscribe - Otii log

Case 2: Shows an average current consumption of 173 μ A for 30s for MQTT publish. In idle cases, the average current consumption is 59.3 μ A.

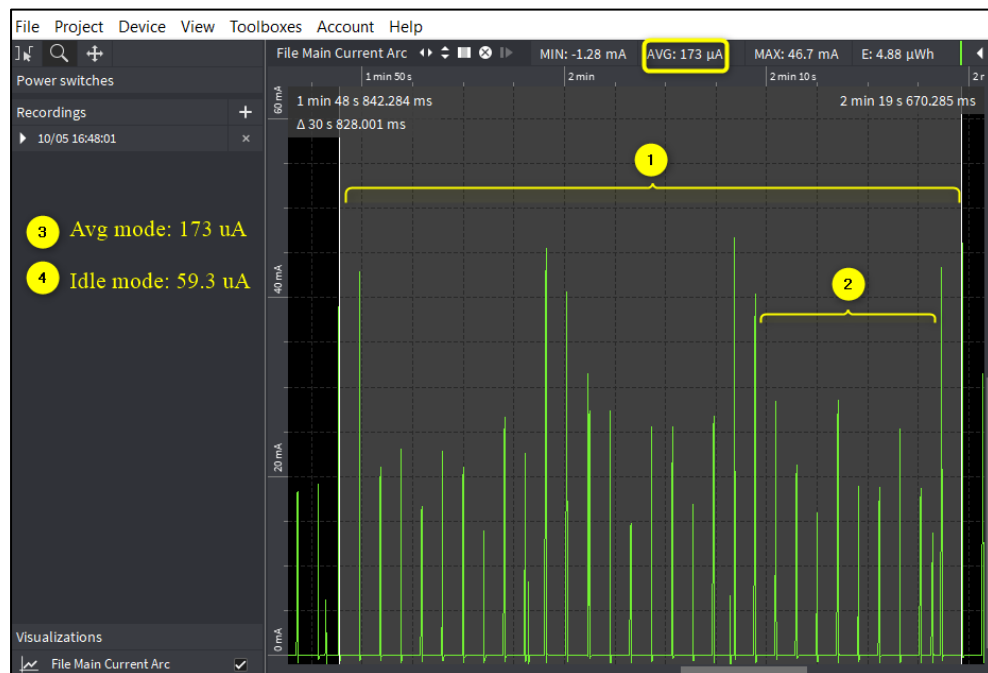


Figure 19: MQTT publish - Otii log

Multicast Reception OFF GRAT ARP ON

Console output:

```
UART:SNWWWWWAEBuild $Id: git-ba65998b7 $

mpd.proto=none --flash=vm --reset=evk42 mpd.mcast_rx=0 wifi.arp_grat_period=10
wifi.max_idle_period=0 wifi.listen_interval=10 krn.gpio=--K wifi.keep_alive_wake_time=2
mpd.regdomain=FCC mpd.suspend=1 np_conf_path=/data/nprofile.json mpd.ssid=InnoPhase
mpd.passphrase=43083191

$App:git-73e7f910

SDK Ver: SDK_2.6

T2 Multipurpose Demp App Version 0.12

network profile parse success.

Suspend Enabled.

Multicast reception Disabled.

Regdomain=FCC

addr e0:69:3a:00:13:90

Applying reg domain: 1-11@20

Connecting to network

.[2.062,636] CONNECT:00:5f:67:cd:c5:a6 Channel:11 rssi:-53 dBm

WCM_NOTIFY_MSG_LINK_UP

.WCM_NOTIFY_MSG_ADDRESS

[2.770,812] MYIP 192.168.0.104

[2.770,975] IPv6 [fe80::e269:3aff:fe00:1390]-link

WCM_NOTIFY_MSG_CONNECTED

Listen interval=10

Traffic Timeout=12

pm_flags=0x0
```

```
[3.543,107] WARNING! wcm_pm_config may overwrite the supplied power management boot
arguments!

WiFi Connection success. proceeding to app..

Timeout not specified.!

Application Exited..

Going for indefinite sleep...
```

Expected output:

1. To verify if the GRAT ARP and multicast reception is disabled, connect the PC to the same AP to which the Talaria TWO is connected and flash the application using tool.
2. Further, the ARP table needs be cleared from the PC. This ensures that the ARP table does not contain entries of Talaria TWO IP address.
3. When the PC tries to ping, ARP does not pass as the mcast rx at Talaria TWO is turned off. However, Talaria TWO keeps sending the GRAT ARPs at configured intervals. The PC receives the GRAT ARP and the ARP table at the laptop gets updated, and the ping is executed.

Windows console output:

```
C:\WINDOWS\system32>ping 192.168.1.173

PING 192.168.1.173 (192.168.1.173) 56(84) bytes of data.

From 192.168.1.173 icmp_seq=1 Destination Host unreachable

From 192.168.1.173 icmp_seq=2 Destination Host unreachable

From 192.168.1.173 icmp_seq=3 Destination Host unreachable

64 bytes from 192.168.1.173: icmp_seq=6 ttl=255 time=676 ms

64 bytes from 192.168.1.173: icmp_seq=7 ttl=255 time=676 ms

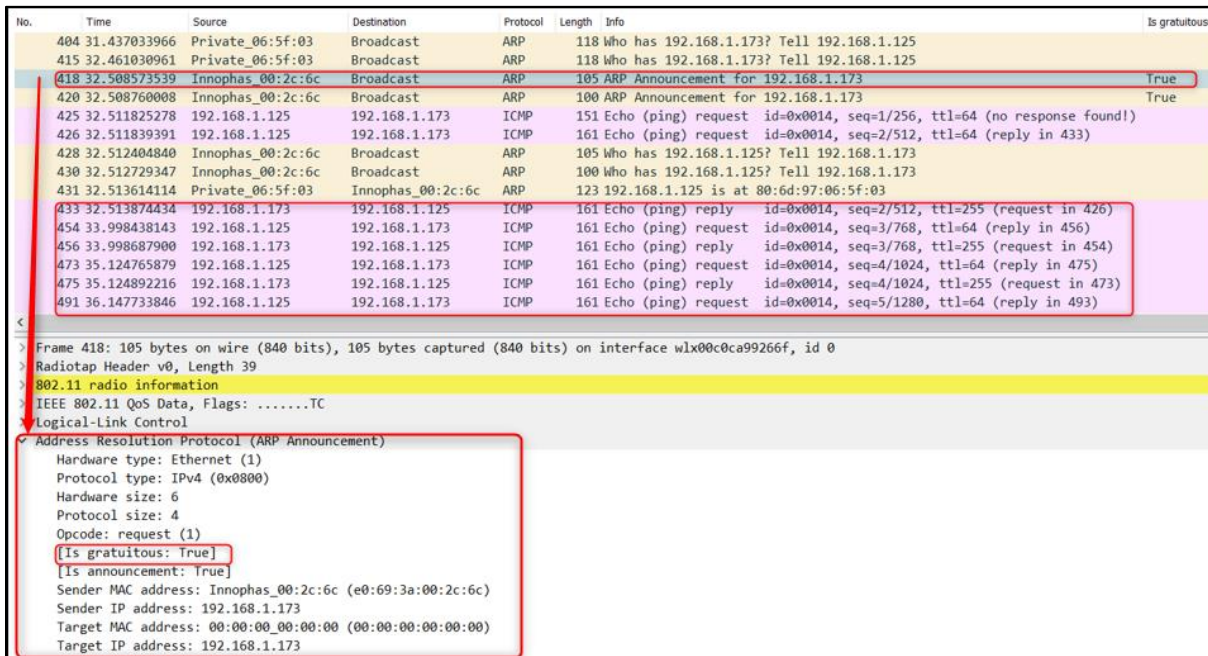
64 bytes from 192.168.1.173: icmp_seq=8 ttl=255 time=676 ms

64 bytes from 192.168.1.173: icmp_seq=9 ttl=255 time=676 ms

64 bytes from 192.168.1.173: icmp_seq=10 ttl=255 time=676 ms

64 bytes from 192.168.1.173: icmp_seq=11 ttl=255 time=676 ms
```

Wireshark log:



No.	Time	Source	Destination	Protocol	Length	Info	Is gratuitous
404	31.437033966	Private_06:5f:03	Broadcast	ARP	118	Who has 192.168.1.173? Tell 192.168.1.125	
415	32.461030961	Private_06:5f:03	Broadcast	ARP	118	Who has 192.168.1.173? Tell 192.168.1.125	
418	32.508573539	Innophas_00:2c:6c	Broadcast	ARP	105	ARP Announcement for 192.168.1.173	True
420	32.508760008	Innophas_00:2c:6c	Broadcast	ARP	100	ARP Announcement for 192.168.1.173	True
425	32.511825278	192.168.1.125	192.168.1.173	ICMP	151	Echo (ping) request id=0x0014, seq=1/256, ttl=64 (no response found!)	
426	32.511839391	192.168.1.125	192.168.1.173	ICMP	161	Echo (ping) request id=0x0014, seq=2/512, ttl=64 (reply in 433)	
428	32.512404840	Innophas_00:2c:6c	Broadcast	ARP	105	Who has 192.168.1.125? Tell 192.168.1.173	
430	32.512729347	Innophas_00:2c:6c	Broadcast	ARP	100	Who has 192.168.1.125? Tell 192.168.1.173	
431	32.513614114	Private_06:5f:03	Innophas_00:2c:6c	ARP	123	192.168.1.125 is at 80:6d:97:06:5f:03	
433	32.513874434	192.168.1.173	192.168.1.125	ICMP	161	Echo (ping) reply id=0x0014, seq=2/512, ttl=255 (request in 426)	
454	33.998438143	192.168.1.125	192.168.1.173	ICMP	161	Echo (ping) request id=0x0014, seq=3/768, ttl=64 (reply in 456)	
456	33.998687900	192.168.1.173	192.168.1.125	ICMP	161	Echo (ping) reply id=0x0014, seq=3/768, ttl=255 (request in 454)	
473	35.124765879	192.168.1.125	192.168.1.173	ICMP	161	Echo (ping) request id=0x0014, seq=4/1024, ttl=64 (reply in 475)	
475	35.124892216	192.168.1.173	192.168.1.125	ICMP	161	Echo (ping) reply id=0x0014, seq=4/1024, ttl=255 (request in 473)	
491	36.147733846	192.168.1.125	192.168.1.173	ICMP	161	Echo (ping) request id=0x0014, seq=5/1280, ttl=64 (reply in 493)	

Frame 418: 105 bytes on wire (840 bits), 105 bytes captured (840 bits) on interface wlx00c0ca99266f, id 0

- Radiotap Header v0, Length 39
- 802.11 radio information
- IEEE 802.11 QoS Data, Flags:TC
- Logical-Link Control
- Address Resolution Protocol (ARP Announcement)
 - Hardware type: Ethernet (1)
 - Protocol type: IPv4 (0x0800)
 - Hardware size: 6
 - Protocol size: 4
 - Opcode: request (1)
 - Is gratuitous: True
 - Is announcement: True
 - Sender MAC address: Innophas_00:2c:6c (e0:69:3a:00:2c:6c)
 - Sender IP address: 192.168.1.173
 - Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)
 - Target IP address: 192.168.1.173

Figure 20: Multicast Reception OFF GRAT ARP ON - Wireshark log

Multicast OFF:

Multicast reception disabled flag can be checked from the beacon frame if the Multicast flag is set to false.

No.	Time	Source	Destination	Protocol	Length	Info	Data rate	Multicast
1	0.000000000	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3098, FN=0, Flags=.....	1	False
2	0.182576844	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3099, FN=0, Flags=.....	1	False
3	0.284790585	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3100, FN=0, Flags=.....	1	False
4	0.307366093	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3101, FN=0, Flags=.....	1	False
5	0.409618317	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3102, FN=0, Flags=.....	1	False
6	0.512017596	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3103, FN=0, Flags=.....	1	False
7	0.614406678	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3104, FN=0, Flags=.....	1	False
8	0.716837517	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3105, FN=0, Flags=.....	1	False
9	0.819318589	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3106, FN=0, Flags=.....	1	False
10	0.921749581	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3107, FN=0, Flags=.....	1	False
11	1.024023280	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3108, FN=0, Flags=.....	1	False
12	1.126351277	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3109, FN=0, Flags=.....	1	False
13	1.228956079	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3110, FN=0, Flags=.....	1	False
14	1.331374875	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3111, FN=0, Flags=.....	1	False
15	1.433751332	Netgear_93:83:31	Broadcast	802.11	220	Beacon frame, SN=3112, FN=0, Flags=.....	1	False


```

    <
    v Tag: DS Parameter set: Current Channel: 11
      Tag Number: DS Parameter set (3)
      Tag length: 1
      Current Channel: 11
    v Tag: Traffic Indication Map (TIM): DTIM 0 of 1 bitmap
      Tag Number: Traffic Indication Map (TIM) (5)
      Tag length: 4
      DTIM count: 0
      DTIM period: 1
    v Bitmap control: 0x00
      ....0 = Multicast: False
      0000 000. = Bitmap Offset: 0x00
      Partial Virtual Bitmap: 00
    v Tag: Country Information: Country Code US, Environment Any
      Tag Number: Country Information (7)
      Tag length: 6
      Code: US
      Environment: Any (32)
    > Country Info: First Channel Number: 1, Number of Channels: 11, Maximum Transmit Power Level: 30 dBm
    v Tag: ERP Information
      Tag Number: ERP Information (42)
      Tag length: 1
    < ERP Information: 0x00
  
```

Figure 21: Multicast Reception OFF GRAT ARP ON - Multicast disabled Wireshark log

Otii log: Shows an average current consumption of 116 μ A for 30s. In idle cases, the average current consumption is 58.5 μ A.

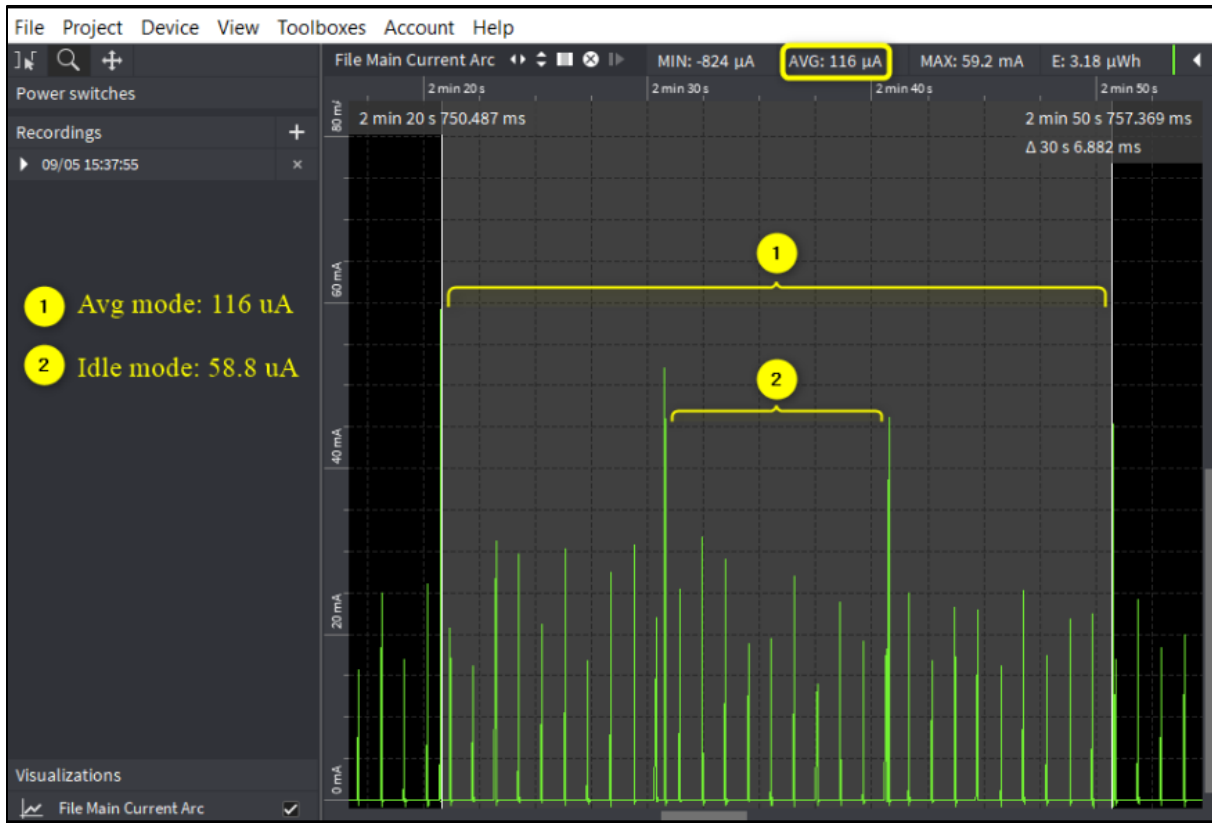


Figure 22: Multicast Reception OFF GRAT ARP ON - Otii log

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