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

InnoPhase IoT, Inc. | 2870 Zanker Road, Suite 200, San Jose, CA 95134 | https://innophaseiot.com/ | sales@innophaseiot.com

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.

Contents

Figures

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.

Otii log: Shows an average current consumption of 56.7µA for 30s.

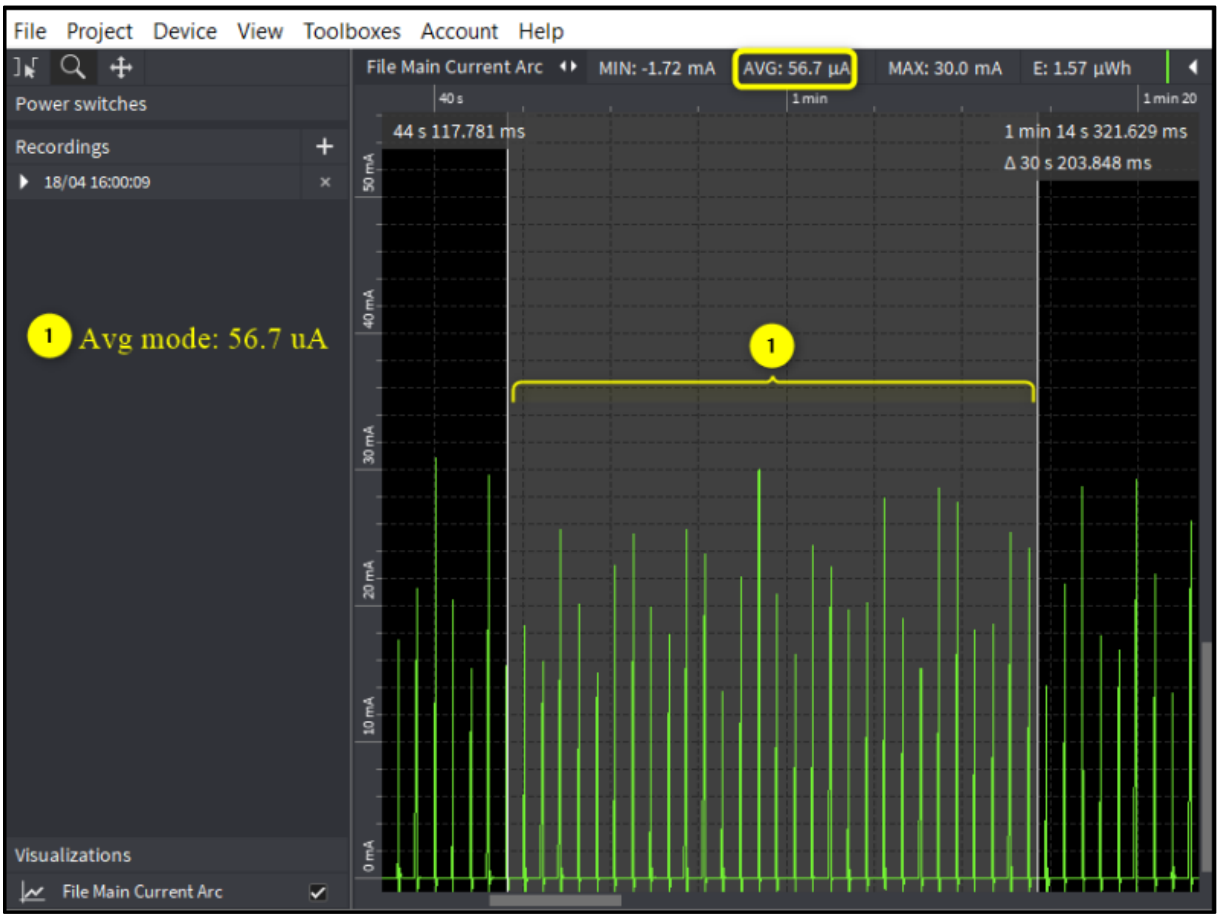


Figure 1: Base mode: Otii log

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

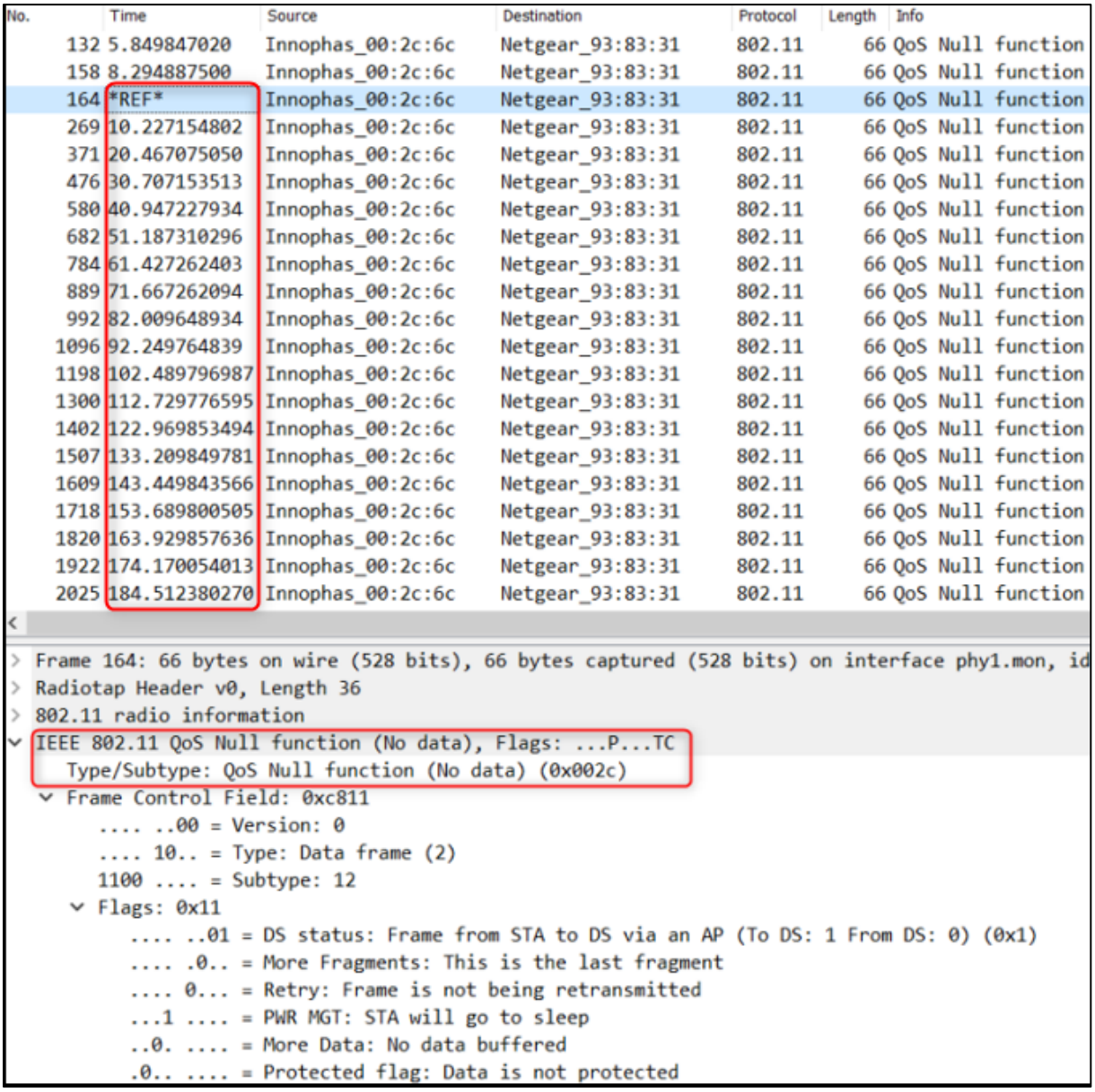
Note:

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
v IEEE 802.11 QoS Null function (No data), Flags: ...P...TC
    Type/Subtype: QoS Null function (No data) (0x002c)
  v Frame Control Field: 0xc811
      .... ..00 = Version: 0
      .... 10.. = Type: Data frame (2)
      1100 .... = Subtype: 12
    v 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 64.4µA for 30s. In idle cases, the average current consumption is 55.3µA.

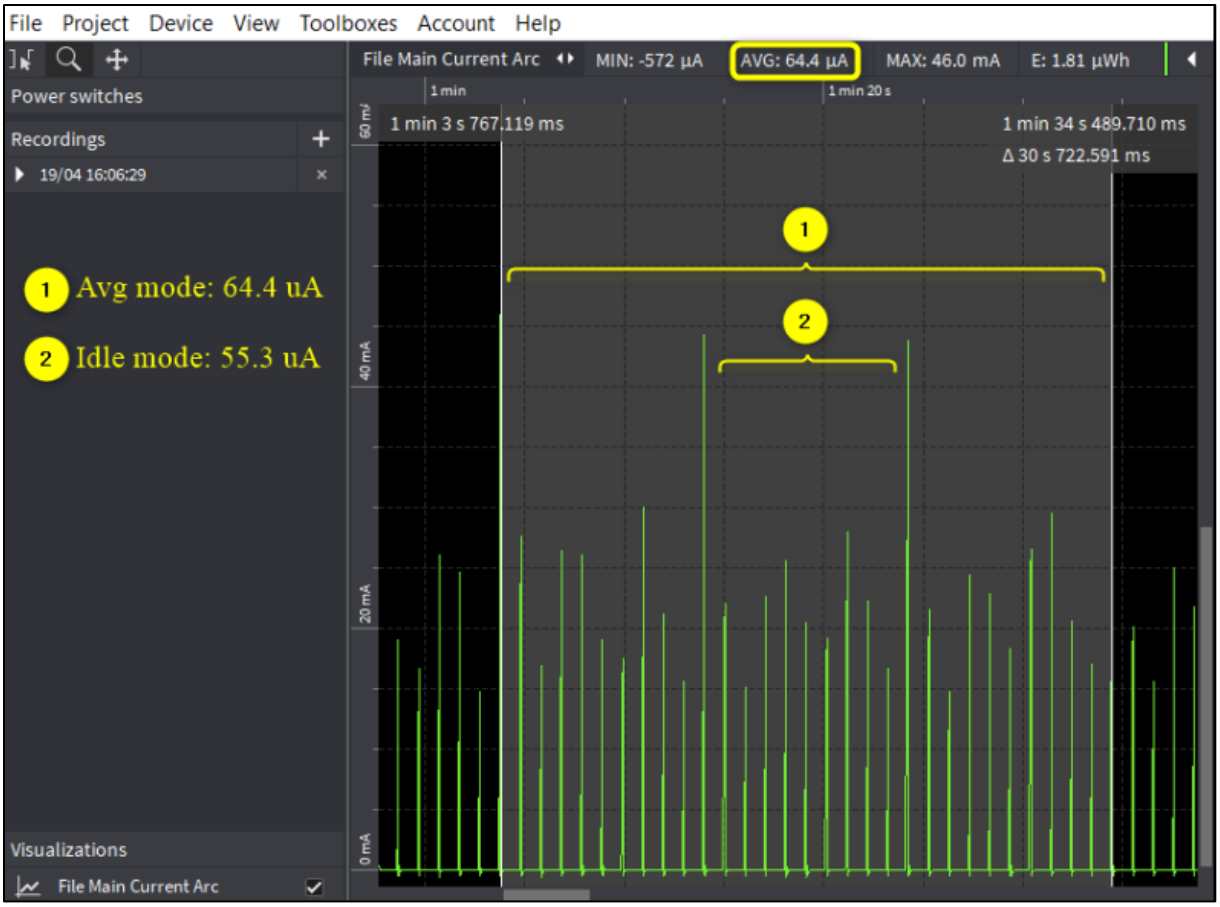


Figure 3: Keep alive - Otii logs

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:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWX
YZABCDEFGHIJKLM
send returned 100.
msg=Times=2:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWX
YZABCDEFGHIJKLM
send returned 100.
msg=Times=3:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWX
YZABCDEFGHIJKLM
send returned 100.
```

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

TCP client windows console output:

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

```
Times=7:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB

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).

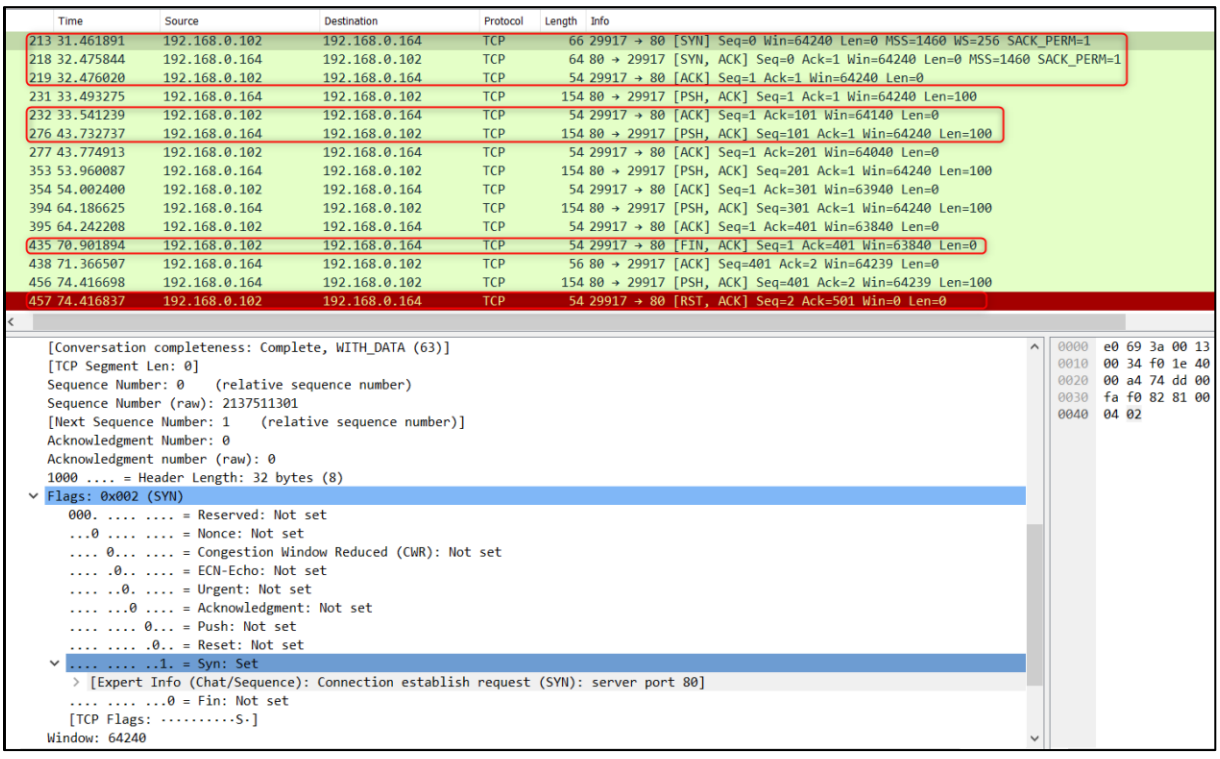


Figure 4: TCP - Wireshark log

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

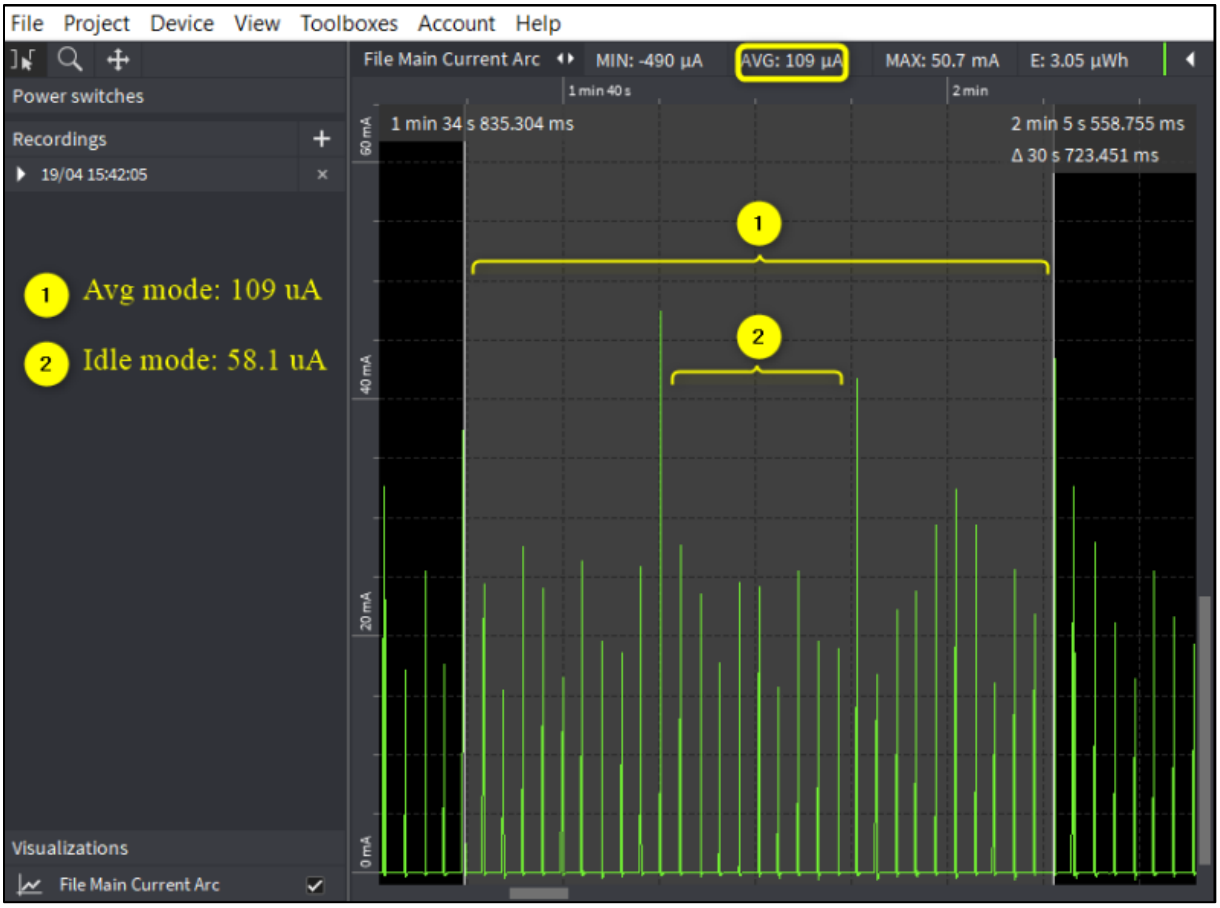


Figure 5: TCP - Otii log

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.
```

UDP client windows console output:

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

```
Times=5:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Times=6:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Times=7:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Times=8:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Times=9:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Times=10:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Times=11:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Times=12:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Times=13:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Times=14:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Times=15:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Times=16:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
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).

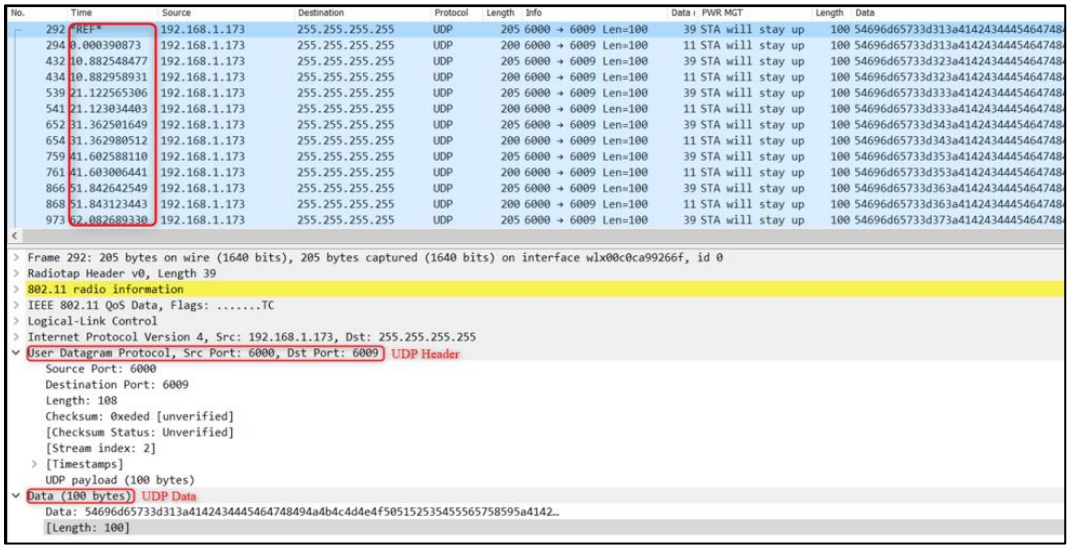


Figure 6: UDP - Wireshark log

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

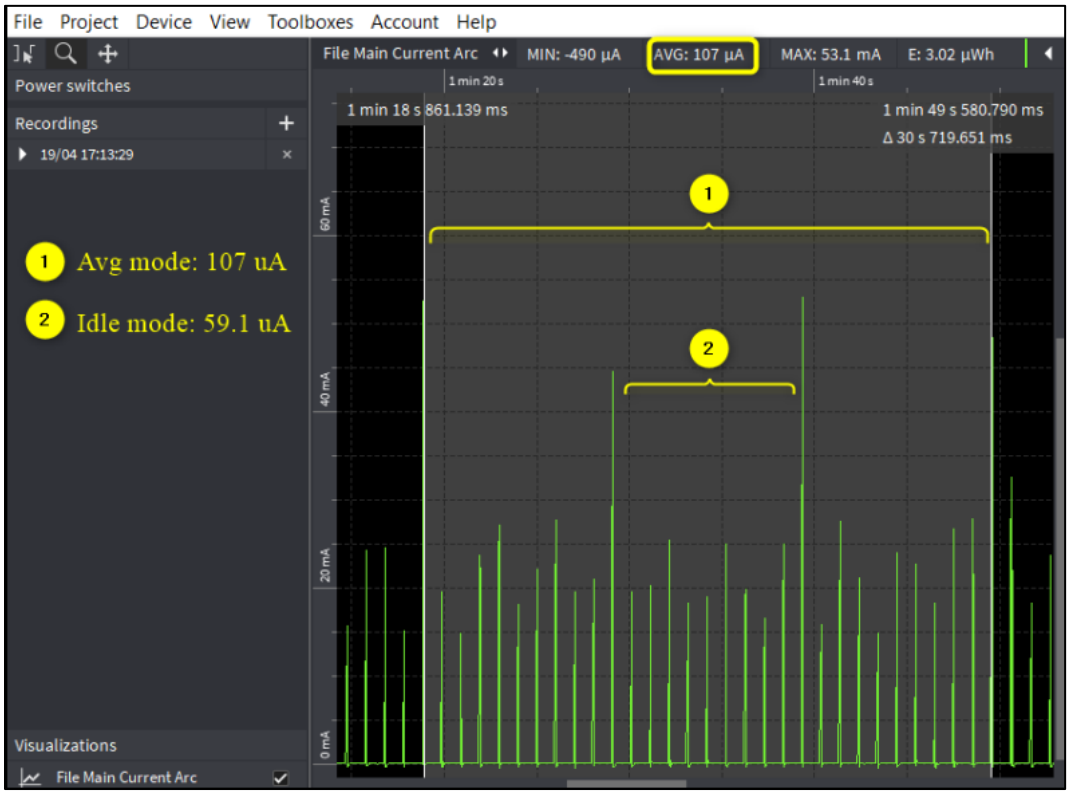


Figure 7: UDP - Otii log

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.

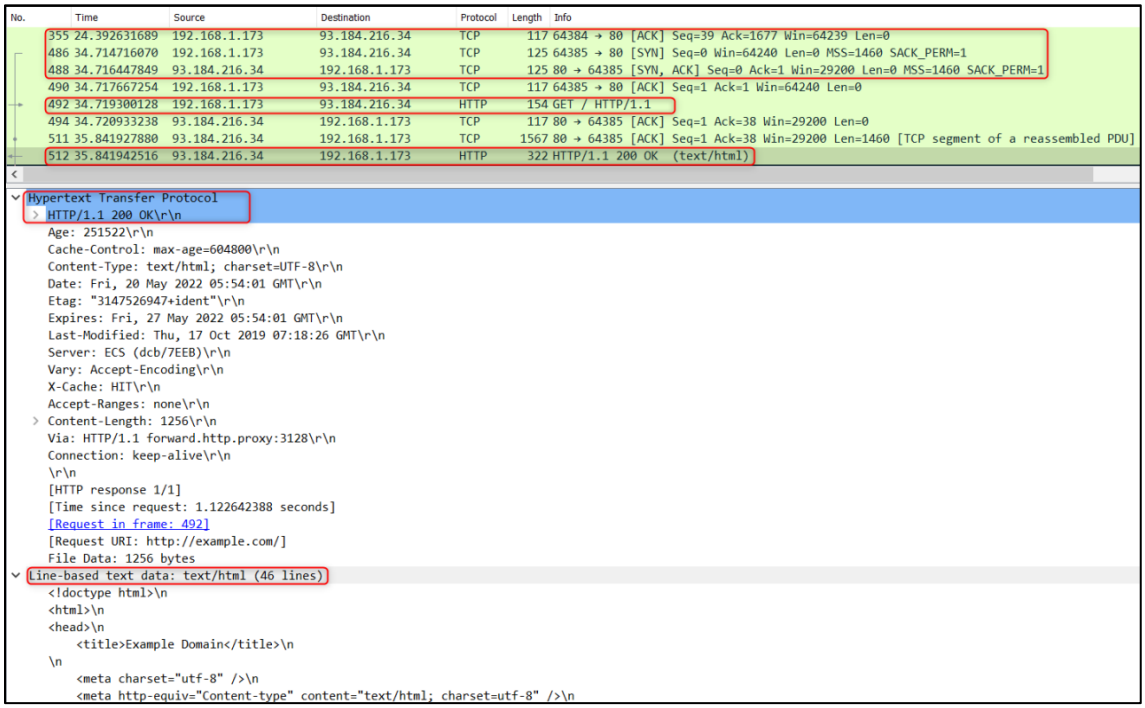


Figure 8: HTTP - Wireshark log

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

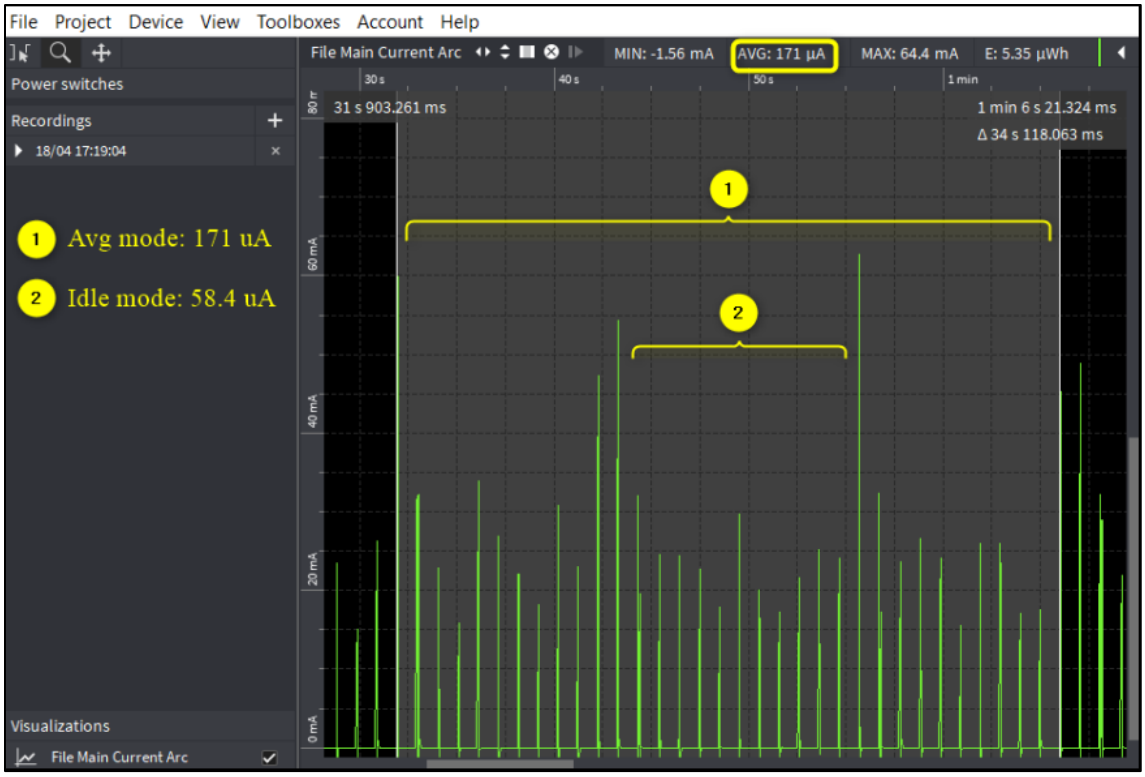


Figure 9: HTTP - Otii log

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: #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 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>..<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
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.

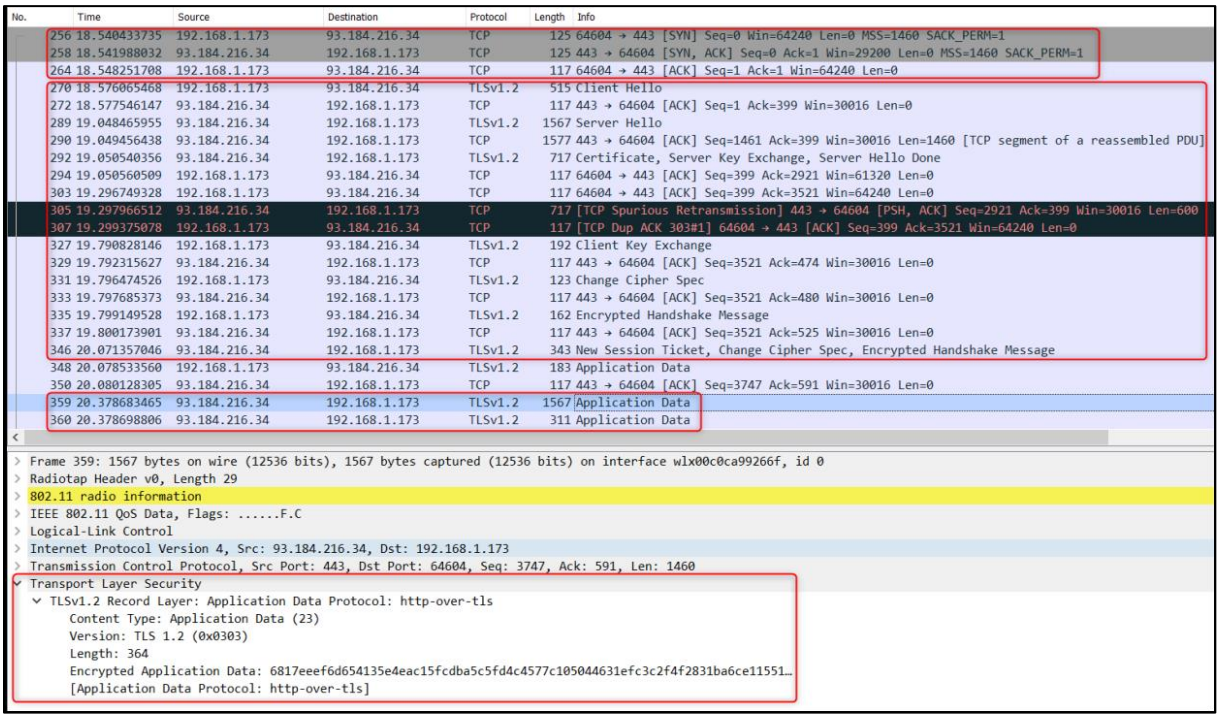


Figure 10: HTTPS - Wireshark log

Otii log: Shows an average current consumption of 640µA for 30s. In idle cases, the average current consumption is 58.1µA.

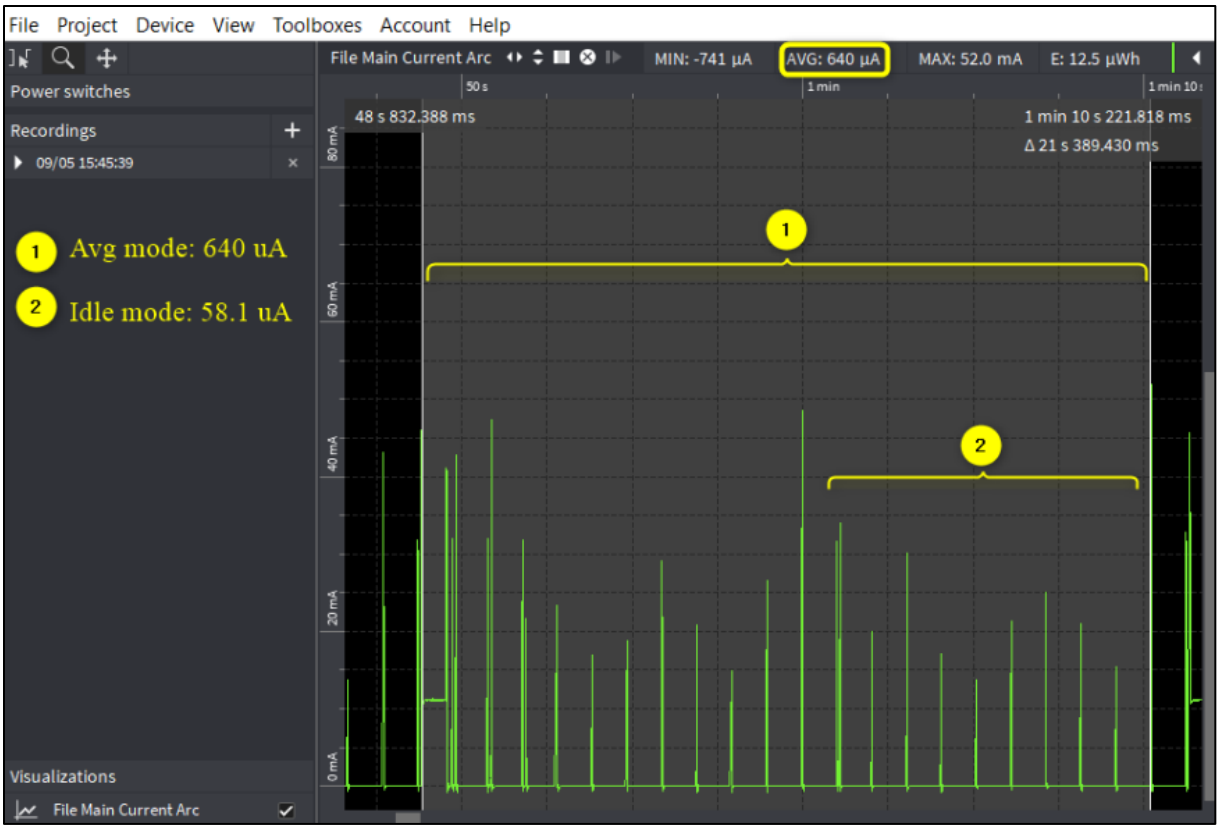


Figure 11: HTTPS - Otii log

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 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: #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-7XNzxTypruvc9Bkybj sending CONNECT

Client mosq-7XNzxTypruvc9Bkybj received CONNACK (0)

Client mosq-7XNzxTypruvc9Bkybj sending PUBLISH (d0, q0, r0, m1, 'SUBMSG1', ... (4

bytes))

Client mosq-7XNzxTypruvc9Bkybj 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:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
PUBMSG
Times=8:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
PUBMSG
Times=9:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
PUBMSG
Times=10:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
PUBMSG
Times=11:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZA
BCDEFGHIJKL
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
```

```
PUBMSG
Times=0:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
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:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
CDEFGHIJKLM
Client mosq-3SHpQMGOLvcW97fbtH received PUBLISH (d0, q0, r0, m0, 'PUBMSG', ... (99
bytes))
PUBMSG
Times=2:ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZAB
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.

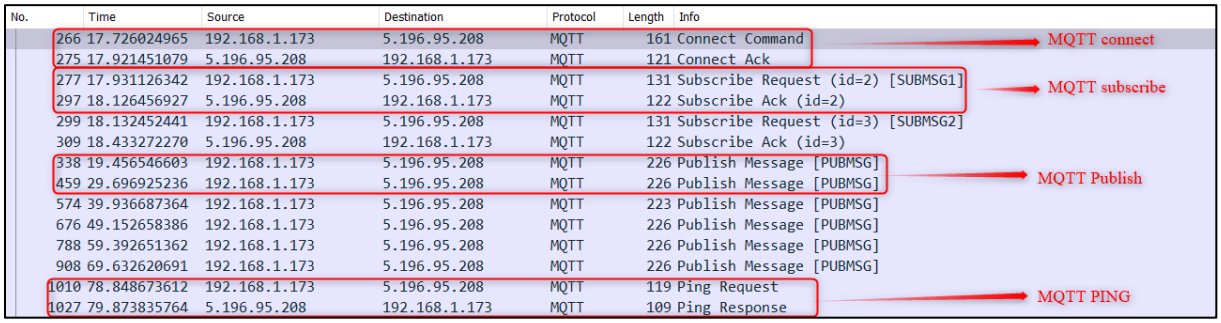


Figure 12: MQTT connection flow - Wireshark log

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.

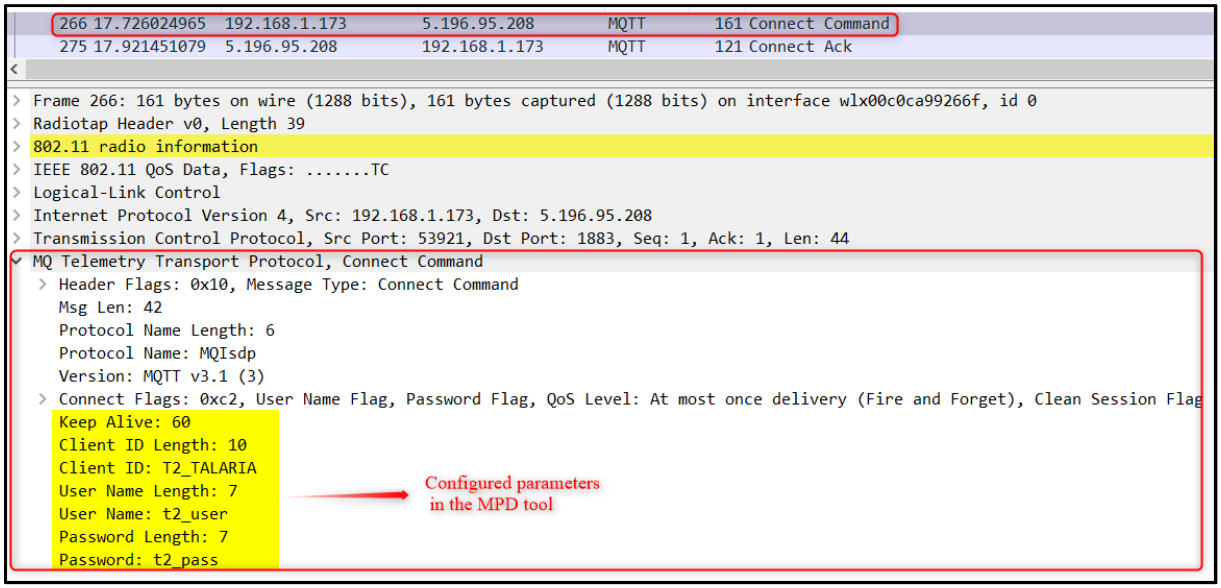


Figure 13: MQTT connection packet - Wireshark log

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

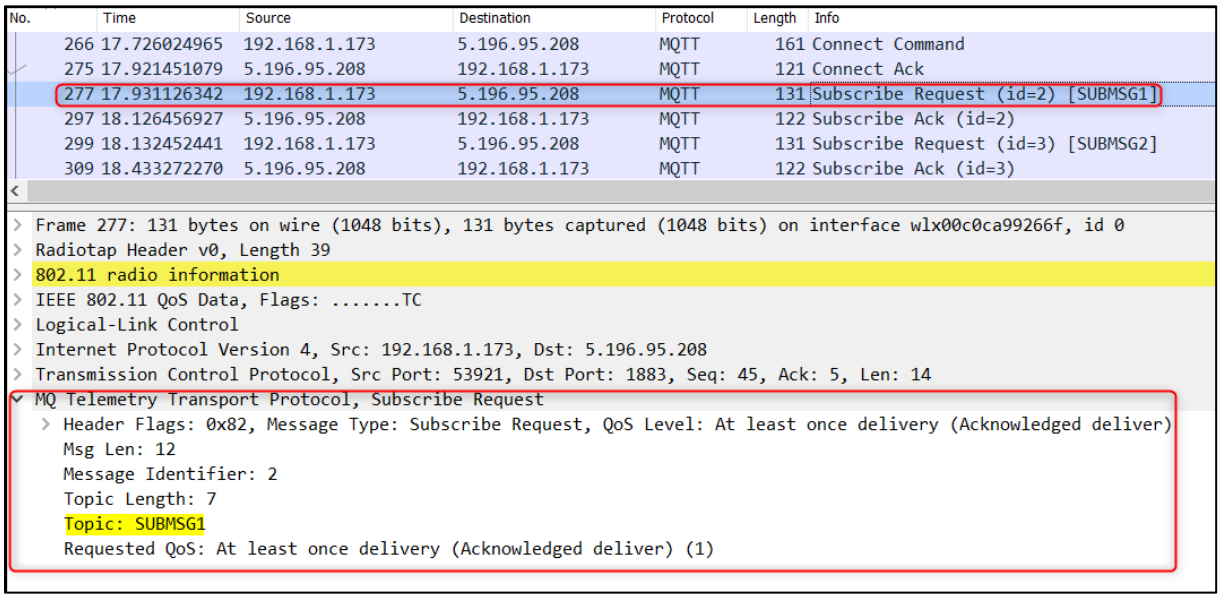


Figure 14: MQTT subscribe package - Wireshark log

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

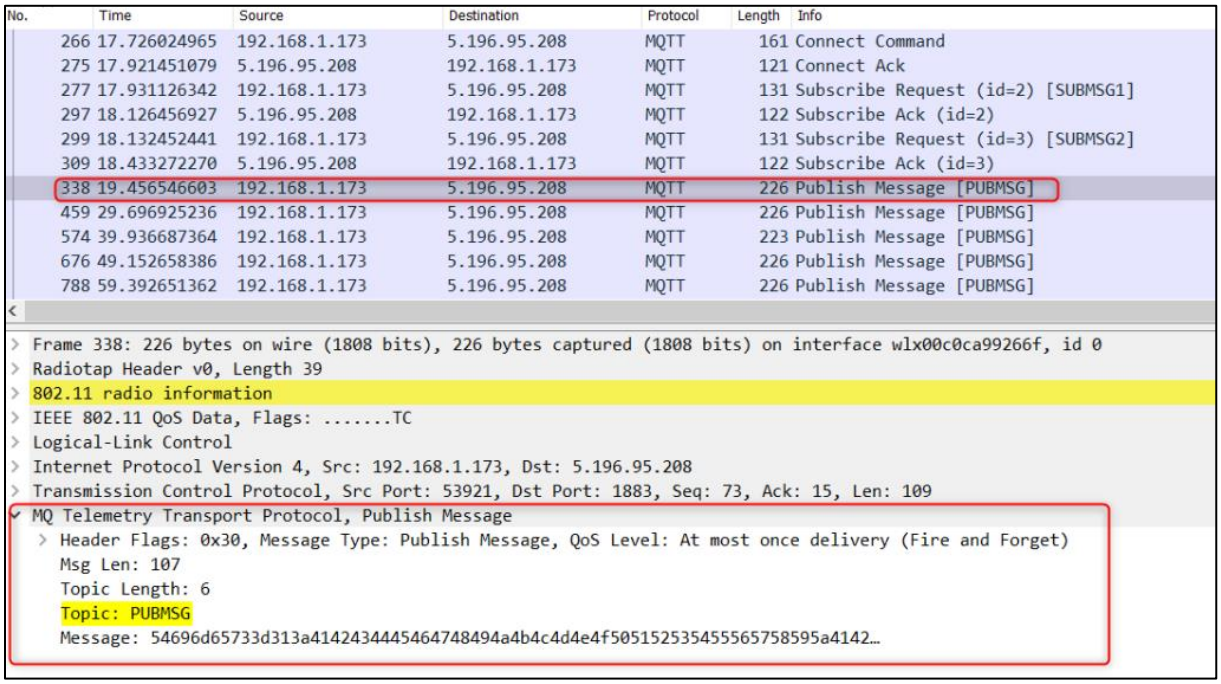


Figure 15: MQTT publish packet - Wireshark log

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

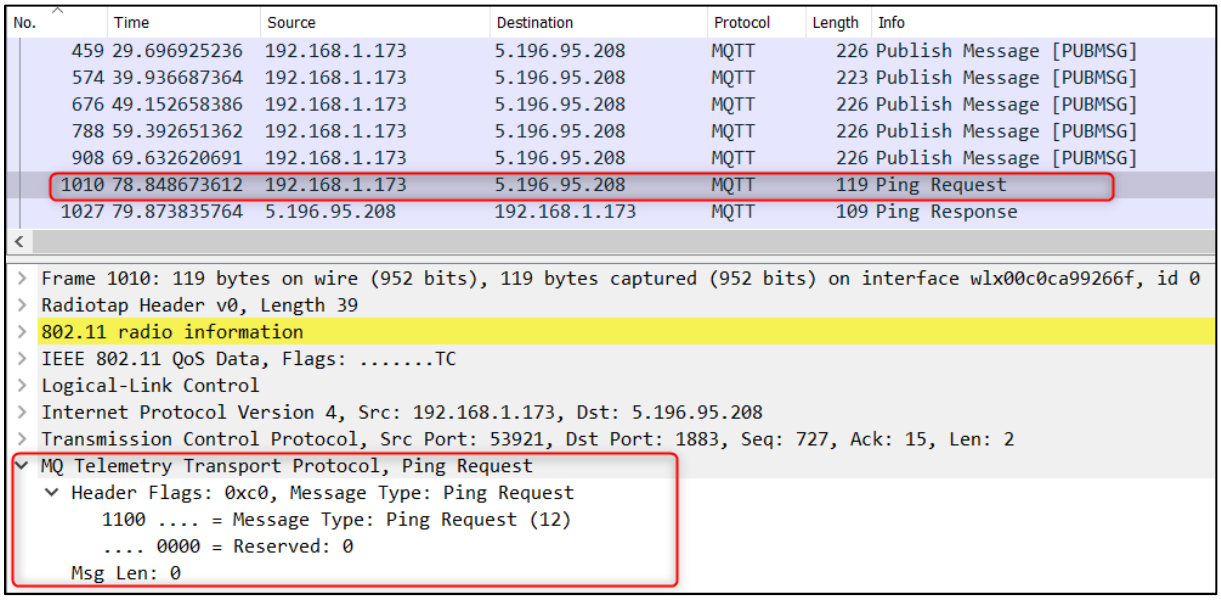


Figure 16: MQTT ping - Wireshark log

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

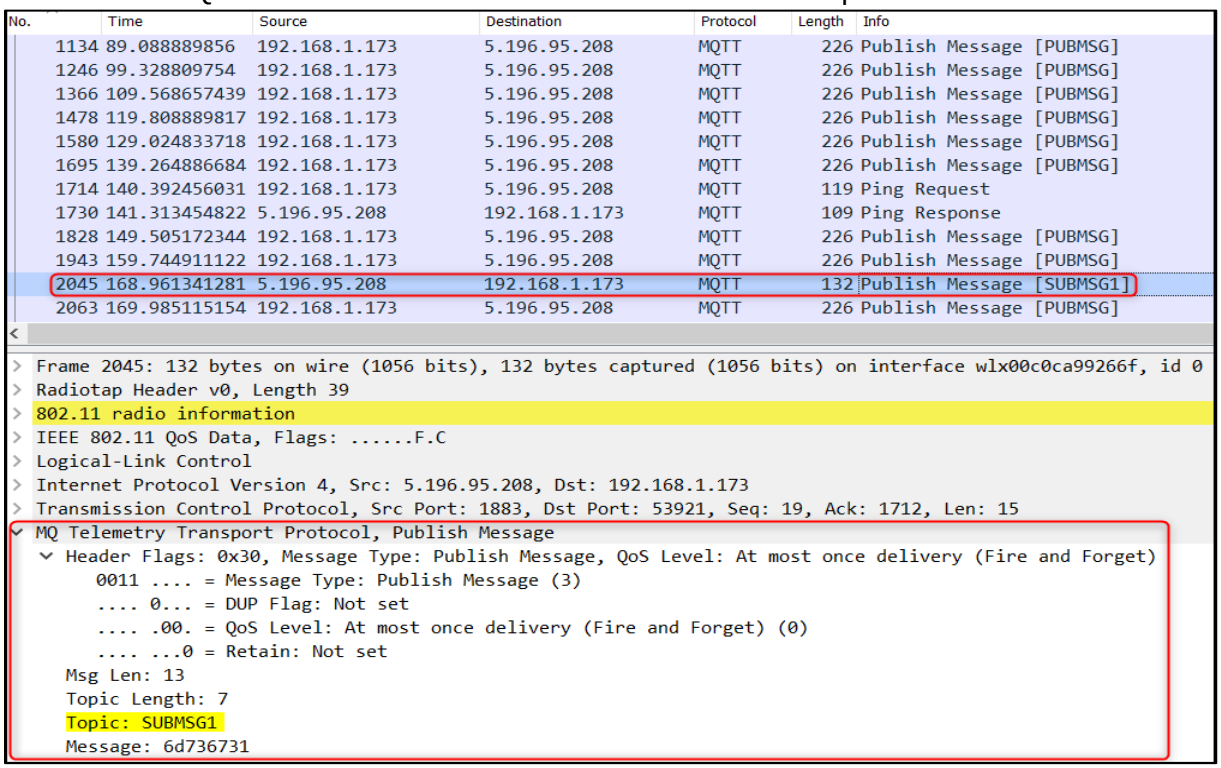


Figure 17: MQTT subscribe packet - Wireshark log

Otii log:

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

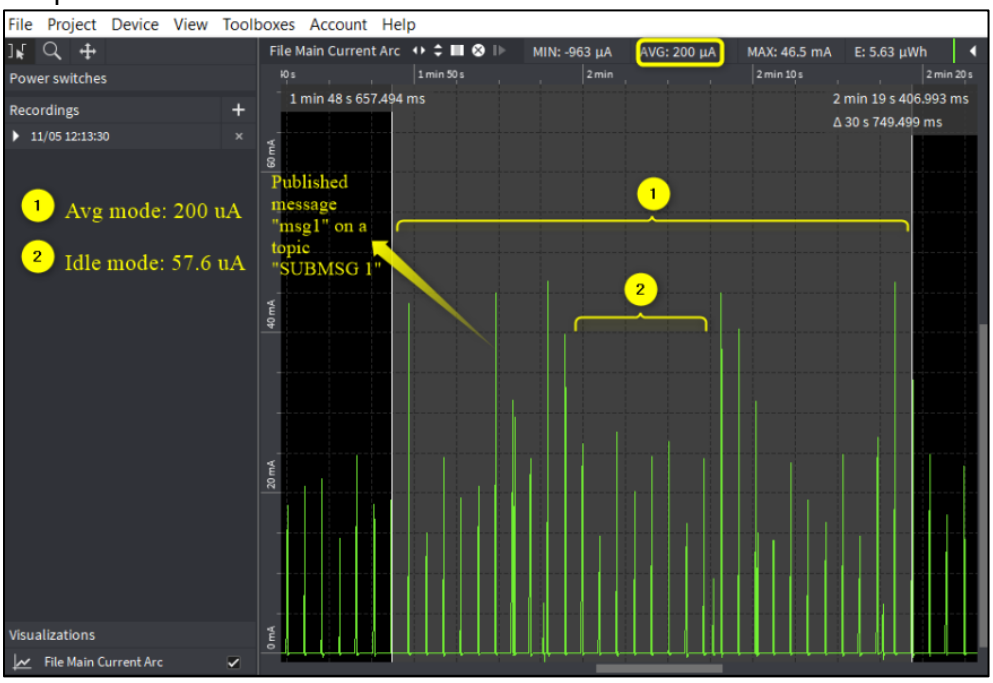


Figure 18: MQTT subscribe - Otii log

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

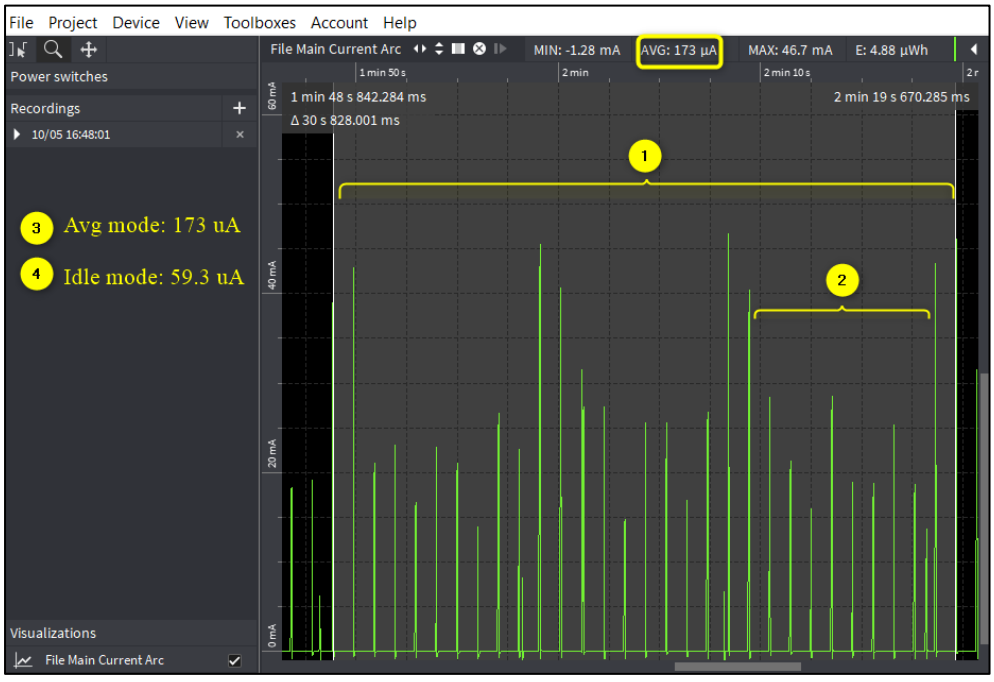


Figure 19: MQTT publish - Otii log

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:

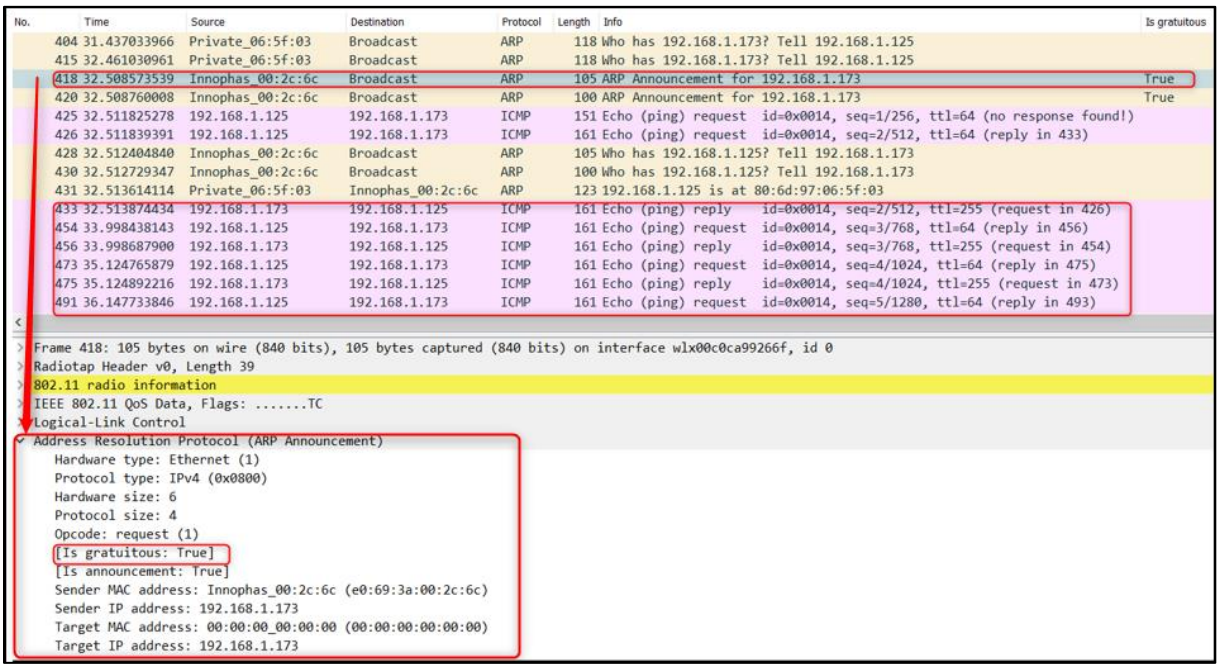


Figure 20: Multicast Reception OFF GRAT ARP ON - Wireshark log

Multicast OFF:

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

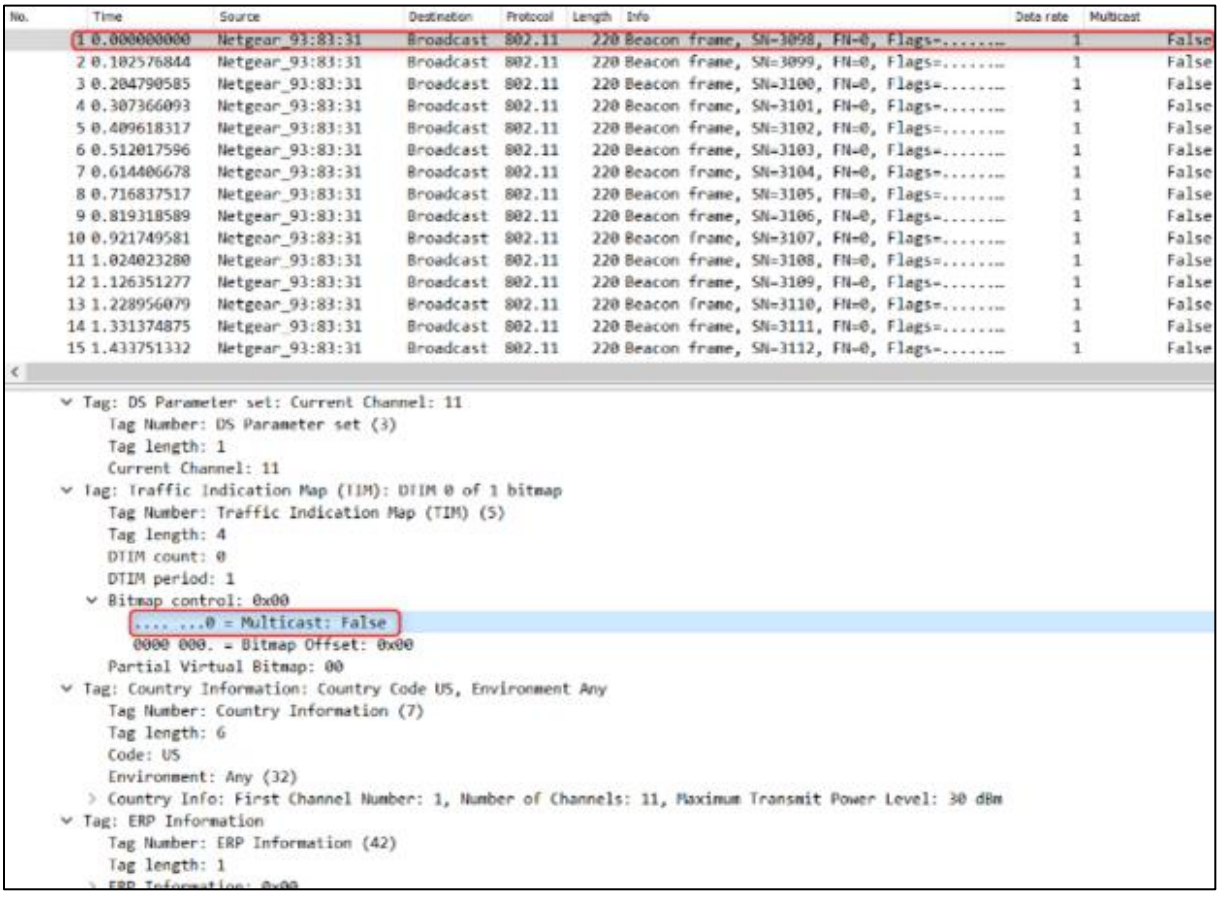


Figure 21: Multicast Reception OFF GRAT ARP ON - Multicast disabled Wireshark log

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

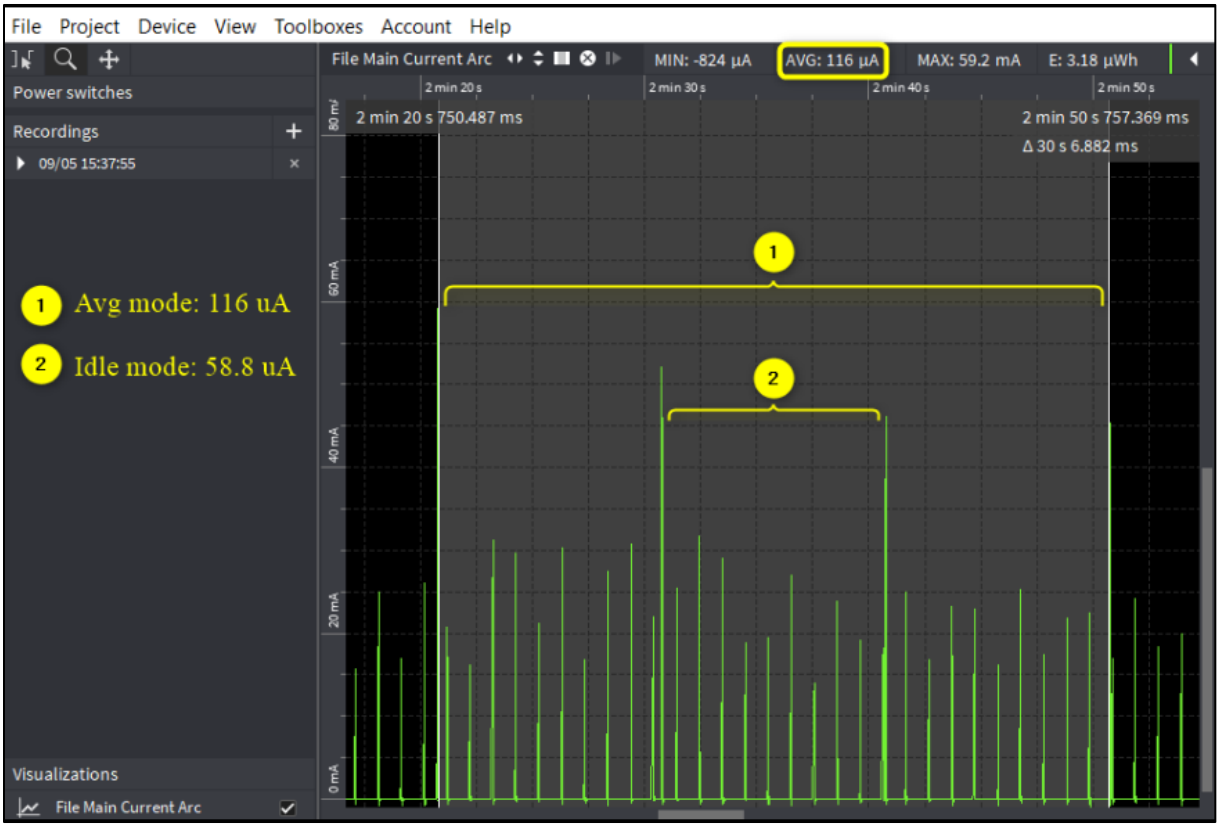


Figure 22: Multicast Reception OFF GRAT ARP ON - Otii log

Support

1. Sales Support: Contact an InnoPhase sales representative via email – sales@innophaseiot.com
2. Technical Support:
    a. Visit: https://innophaseiot.com/contact/
    b. Also Visit: https://innophaseiot.com/talaria-two-modules/
    c. Contact: support@innophaseiot.com

InnoPhase is working diligently to provide customers outstanding support to all customers.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, InnoPhase IoT Incorporated does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and assumes no liability associated with the use of such information. InnoPhase IoT Incorporated takes no responsibility for the content in this document if provided by an information source outside of InnoPhase IoT Incorporated.

InnoPhase IoT Incorporated disclaims liability for any indirect, incidental, punitive, special or consequential damages associated with the use of this document, applications and any products associated with information in this document, whether or not such damages are based on tort (including negligence), warranty, including warranty of merchantability, warranty of fitness for a particular purpose, breach of contract or any other legal theory. Further, InnoPhase IoT Incorporated accepts no liability and makes no warranty, express or implied, for any assistance given with respect to any applications described herein or customer product design, or the application or use by any customer's third-party customer(s).

Notwithstanding any damages that a customer might incur for any reason whatsoever, InnoPhase IoT Incorporated' aggregate and cumulative liability for the products described herein shall be limited in accordance with the Terms and Conditions of identified in the commercial sale documentation for such InnoPhase IoT Incorporated products.

Right to make changes — InnoPhase IoT Incorporated reserves the right to make changes to information published in this document, including, without limitation, changes to any specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — InnoPhase IoT Incorporated products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an InnoPhase IoT Incorporated product can reasonably be expected to result in personal injury, death or severe property or environmental damage. InnoPhase IoT Incorporated and its suppliers accept no liability for inclusion and/or use of InnoPhase IoT Incorporated products in such equipment or applications and such inclusion and/or use is at the customer's own risk.

All trademarks, trade names and registered trademarks mentioned in this document are property of their respective owners and are hereby acknowledged.