

TPM530M EVK User Guide

Revision 1.1

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Document Revision History

Revision History		
Rev	Date	Description
V1.0	11/2024	Initial Release
V1.1	07/2025	The following content has been updated: 3.4. How to attach to network 3.5. How to active GNSS 6. How to Measure Power Consumption

PRODUCT NOTICE

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in User manual.

Unlicensed radiator / License-exempt radiator

(FCC) This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

1. this device may not cause harmful interference and
2. this device must accept any interference received, including interference that may cause undesired operation.

(FCC) You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

List of applicable FCC rules

This module has been tested and found to comply with the following requirements for Modular Approval.

- 47 CFR Part 24 Subpart E Broadband PCS
- 47 CFR Part 27 Miscellaneous Wireless Communications Services

RF exposure considerations

The host product operating conditions must be such that there is a minimum separation distance of 20 cm (or possibly greater than 20 cm) between the antenna radiating structures and nearby persons. The host manufacturer is obligated to confirm the use conditions of the host product to ensure that the distance specified in the instructions is met. In this case the host product is classified as either a mobile device or a fixed device for RF exposure purposes.

If the modular transmitter to be used in a specific type of host platform and installed such that it can be operated at closer than 20 cm to users or nearby persons, please follow below guidance.

- For the host product integrated with this modular transmitter as a stand-alone configuration, the maximum conducted power from the original grant shall be retained in order to meet SAR exemption requirements.
- For configuration with multiple transmitters in the same host, routine evaluation or SAR testing for the simultaneous transmission of the co-located transmitters according to KDB 447498 is required. The portable host product shall be evaluated for ensuring to continue compliance FCC rule part 2.1093 & part 1.1310 by C2PC. The additional guidance for the portable host products is provided in KDB Publication 996369 D02 and D04.
- For the host product is not installed according to this guide, the module certification will be invalid, and a new grant certification will be required for the host product.

ANTENNAS

This radio transmitter has been approved by Federal Communications Commission and Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible

gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna Type	Part No.	Antenna No.
Dipole	617202CPWY	Ant1
Note: Transmission frequencies in this test report are only available by the above antenna(s).		

LTE Band	Frequency Range (MHz)	Antenna Gain (dBi)
LTE Band 2	1850~1910	1.7
LTE Band 4	1710~1755	1.7
LTE Band 12	699~716	1.2
LTE Band 13	777~787	1.2

Label and compliance information

The host device integrating this module must be labeled with the following regulatory identifiers to ensure compliance with regulations, these labels must be clearly visible on the exterior of the host device's enclosure as required by applicable regulatory guidelines.

Contains FCC ID: **P27-TPM530**

Information on test modes and additional testing requirements

The module can be configured to continuously transmit on a specific frequency with a fixed modulation pattern. This allows evaluation of radiated emissions and spurious emissions in a controlled condition.

These test modes are intended for compliance testing only and must not be enabled during normal operation of the final product.

For more detailed information, please contact the grantee for assistance with test modes needed for module/host compliance test requirements.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Note EMI Considerations

Note that a host manufacture is recommended to use KDB996369 D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

For standalone mode, reference the guidance in KDB996369 D04 Module Integration Guide and for simultaneous mode; see KDB996369 D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.

How to make changes

Only Grantees are permitted to make permissive changes, if the module will be used differently than granted conditions, please contact us to ensure modifications will not affect compliance.

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1. Introduction

1.1. Document Purpose

The purpose of this document is to introduce TPM530M EVK and to provide a design reference. EVK also enables users to make a prototype on TPM530M platform which resembles the actual target during the design and build phases of a project. It makes the design efforts of a user simple, cost-effective and fast. Various interfaces which is included on the board make the development board ideal for a wide variety of applications. The EVK leverages the capability of the TPM530M LTE Cat. M1 cellular module and provides access to a variety of interfaces including UART, I2C, SPI, ADC, USIM.

1.2. Kit Contents

- USB to USB-C Cable
- J-LINK Cable
- TPM530M EVK board
- nRF52 Develop Kit
- White antenna is used for LTE
- Black antenna is used for GPS

1.3. TPM530M EVK Top and Bottom View

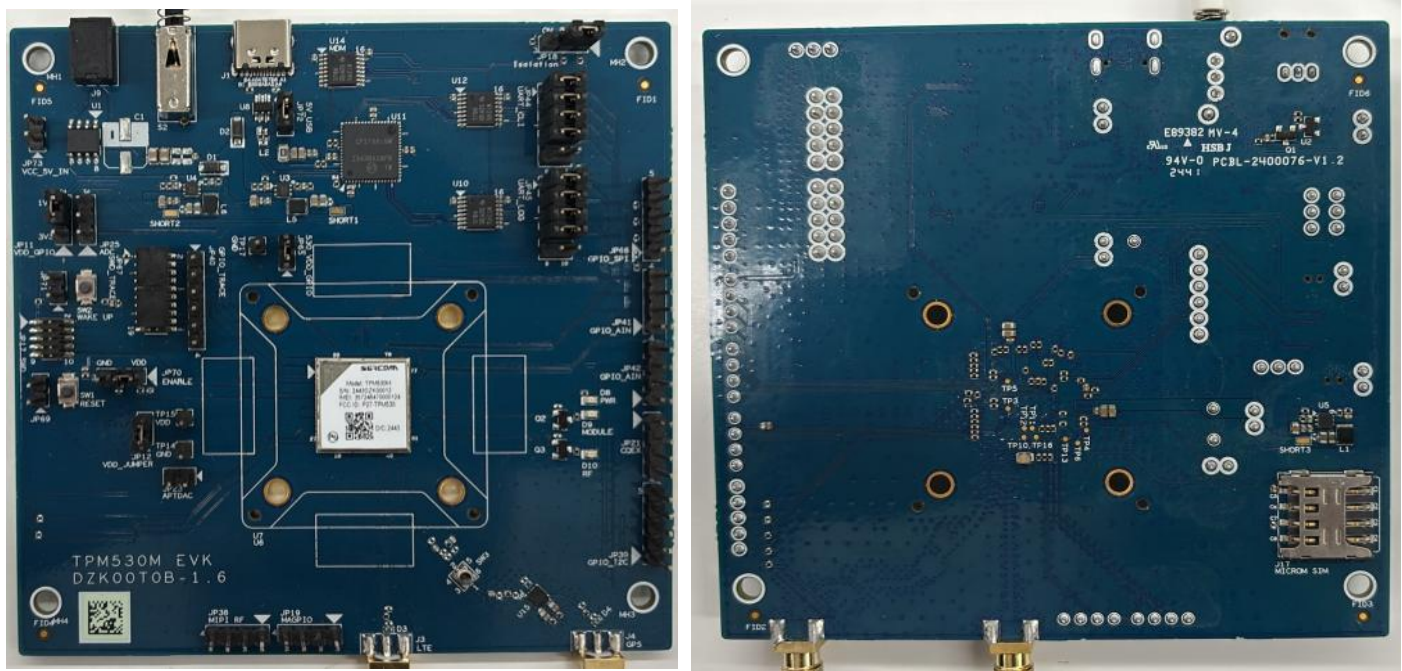


Figure 1.3 EVK Top and Bottom View

2. EVK Functions Introduce

2.1. EVK Interfaces list

Table 2.2 lists TPM530M available interfaces on EVK for reference .

Interface	Location	Description
UART_0	J1	Module MDM port for Debug
UART_1	J1	Module CLI port for AT command/Command line. The default baudrate is 115200 bps
UART_2	J1	Module Log port for output logs. The default baudrate is 115200 bps
GPIO_SPI	JP66	1x5 SPIM pins
GPIO_AIN	JP41	1x4 AIN pins
GPIO_AIN	JP42	1x4 AIN pins
COEX	JP21	1x4 COEX pins
GPIO_I2C	JP39	1x5 I2C pins
MAGPIO	JP19	1x4 MAGPIO pins
MIPI_RF	JP38	1x4 MIPI_RF pins
ADC	JP25	1x3 ADC pins
GPIO_TRACE	JP40	1x6 GPIO_TRACE pins
SWD_TRACE	JP67	2x10 SWD_TRACE pins for firmware upgrade and debug
SWD	JP17	2x5 SWD pins for firmware upgrade and debug
WAKEUP_SOURCE	JP71	1x2 Wakeup source pins for external wake up source.

Table 2.2 List of TPM530M Interface

2.2. Button and Jumper

2.2.1. Reset button (SW1):

This button is connected to TPM530M's **NRESET** pin for initiating power cycle that resets the module.

2.2.2. Wakeup button (SW2):

This button is connected to TPM530M's GPIO (P0.12)pin and is used to wakeup modem while module is under sleep mode .

2.2.3. VDD_JUMPER (JP12):

Jumper JP12 is required when powering by USB or DC (J9). If you need to measure the current consumption of TPM530M, remove this jumper and connect a current meter to VDD (TP15) and GND(TP14) pin headers to monitor the current log.

2.2.4. Isolation control (JP18) :

JP18 is 3.3V to 1.8V level shift ICs control :

- OFF : Turn off level shift ICs
 - ON: Turn on level shift
- ICs Default is connected to ON.

2.2.5. VDD_GPIO (JP11) :

JP11 is GPIO level control pin for VDD_GPIO level select (1.8V or 3.3V) ,Default setting is 1.8V.

2.3. LED

2.3.1. PWR (D8) :

For VCC status indication and VCC is provided by 5V to 3.3V LDO.

- ON: VCC is present.
- OFF: VCC is absent.

2.3.2. MODULE (D9) :

TBD

2.3.3. RF (D10) :

This LED is connected to Module COEX2 pin used to indicate RF status. When active high, this indicates that the LTE modem transceiver is turned on.

3. Starting with TPM530M EVK

3.1. Hardware preparation and setup

- Attach the included white(LTE) antenna and black(GPS) antenna to the SMA connectors J3(LTE) and J4(GPS).
- Plug-in 3FF SIM card to J17(back side of EVK)
- Connect J1 (USB-C port) to PC using USB-C cable.
- If use DC adapter, switch on S2 (power switch) to turn on the module.
- There is no need to turn on S2 while using USB cable to power up EVK.

PWR LED will be lighted when power EVK successfully.

3.2. Power Modes Consideration Summary

- Prepare and install Silicon Lab CP210X UART to USB Driver.
- Prepare Serial Port Terminal Tool (Putty, SecureCRT, Teraterm..etc)
- Prepare Nordic Tool (Please access to Sercomm support website and download).

3.3. Starting to access EVK and TPM530M

- Turn on EVK
- Connect J1 to PC via USB cable.
- Setup Terminal tools, and select the COM port of Interface 1 (UART_CLI). Please refer figure 3.3 (COM port: com port will be enumerated on Windows device manager)

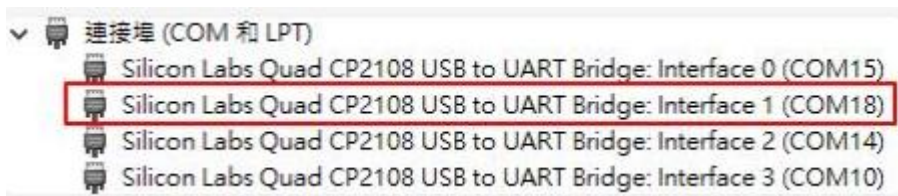


Figure 3.3-a COM Port List

- Turn on TPM530M EVK and opening terminal tools as below. It is a sample app then customer can send AT command/command line directly.

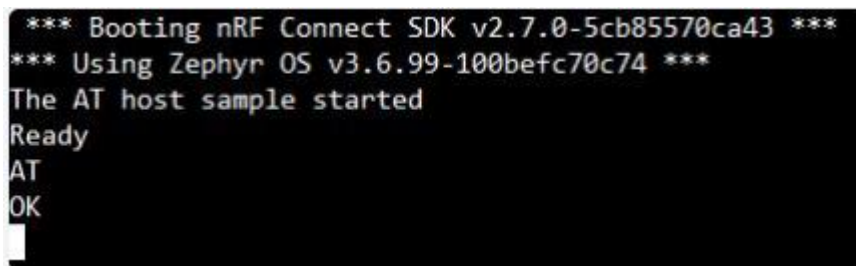


Figure 3.3-b Serial Port Terminal Tool

3.4. How to attach to network

Please refer the AT monitor example to attach the network.

[Cellular: AT monitor](#)

3.5. How to active GNSS

Please refer the GNSS example for related operation.

[Cellular: GNSS](#)

4. Firmware Upgrade

4.1. Prerequisites

4.1.1. Install nRF Command Line Tools for your workstation

Burning tool:

nRF Command Line Tools -- nrfjprog tool.

<https://www.nordicsemi.com/Products/Development-tools/nrf-command-line-tools/download>

Programming SDK and other nRF desktop tools:

[nRF Connect for Desktop - Downloads - nordicsemi.com](https://www.nordicsemi.com/Products/Development-tools/nrf-connect-for-desktop/downloads)

4.1.2. Prepare Modem firmware package and APP package

Please contact Sercomm FAE to get modem FW package.

	at_uart0_merged.hex	app	6/7/2024 1:18 PM	HEX 文件	240 KB
	mfw-pti_nrf91x1_2.3.5.zip	modem FW	6/7/2024 2:36 AM	ZIP 文件	1,993 KB

4.2. Firmware and APP upgrade

4.2.1. Device Connection

- Powered TPM530MEVK
- Connect TPM530M EVK to nRF51DK via SWD serial cable.

4.2.2. Execute Firmware upgrade commands

nrfjprog --recover

nrfjprog -f NRF91 --program <FW_Path> --verify

```
PS D:\_TPM530M\FW\pti> nrfjprog --recover
Recovering device. This operation might take 30s.
Restored application UICR.HFXOSRC and UICR.HFXOCNT.
Erasing user code and UICR flash areas.
Writing image to disable ap protect.
PS D:\_TPM530M\FW\pti> nrfjprog -f NRF91 --program .\mfw-pti_nrf91x1_2.3.6.zip --verify
[ ##### ] 0.000s | Finding image components - Finished
[ ##### ] 0.050s | Upload segments - segment 2 of 2
[ ##### ] 9.408s | Uploading modem image - segment 2 of 2
[ ##### ] 0.000s | Finding image components - Finished
[ ##### ] 0.003s | Verify modem image - Modem ready for verification
[ ##### ] 0.094s | Verify segment 0x00038000-0x000CDFFF - Successfully verified
[ ##### ] 0.140s | Verifying modem - Verifying memory range 3 of 3
[ ##### ] 0.142s | Verify segment 0x0027C000-0x0027FFFF - Successfully verified
```

Figure 4.2.2 Execute Firmware upgrade commands

4.2.3. Execute APP upgrade commands

nrfjprog --recover

nrfjprog -r -f NRF91 --program <App_Path> --sectorerase --verify

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```

PS D:\_TPM530M\FW\pti> nrfjprog --recover
Recovering device. This operation might take 30s.
Restored application UICR.HFXOSRC and UICR.HFXOCNT.
Erasing user code and UICR flash areas.
Writing image to disable ap protect.

PS D:\_TPM530M\530m_sample\DT_test\cut2_app> nrfjprog -r -f NRF91 --program .\TPM530M_MT_01_001_07_2325_A.hex
--sectorerase --verify
[ ##### ] 3.359s | Erase file - Done erasing
[ ##### ] 0.752s | Program file - Done programming
[ ##### ] 0.650s | Verify file - Done verifying
Applying system reset.
Run.

```

Figure 4.2.3 Execute APP upgrade commands

5. Get the modem trace log over UART_LOG

5.1. Prerequisites

Please check the Silicon Labs CP210x USB to UART driver version after 11.4.0.

If your driver is old, please download the newer version on below.

[CP210x USB to UART Bridge VCP Drivers - Silicon Labs](#)

5.2. Use Nordic Tool to Get modem trace logs

Cellular Monitor is supported by Nordic for capturing and analyzing modem traces to evaluate communication and view network parameters.

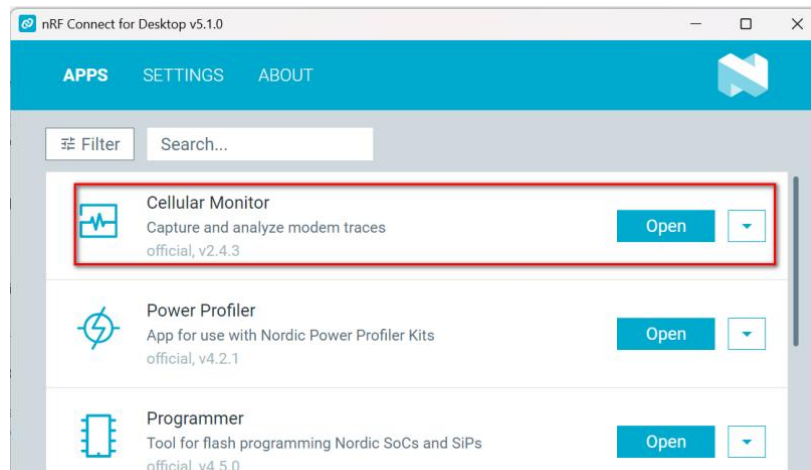


Figure 5.2 nRF Connect tool

5.2.1. Setup Cellular Monitor tool

- Connect the TPM530M EVK to PC and select the right device
- Select the corresponding signaling FW version
- Select UART_2 port
- Select UART_1 port

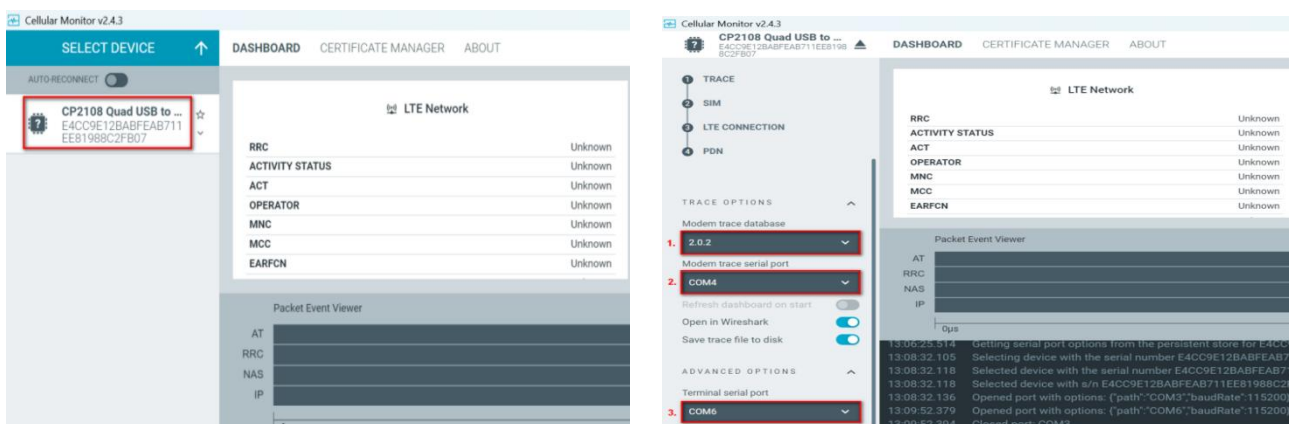


Figure 5.2.1-1 Setup Cellular Monitor tool

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- Click Start button to capture the logs
- Click Open Serial Terminal button to open Serial Terminal tool
- This tool can send AT command (For example: at_client App)

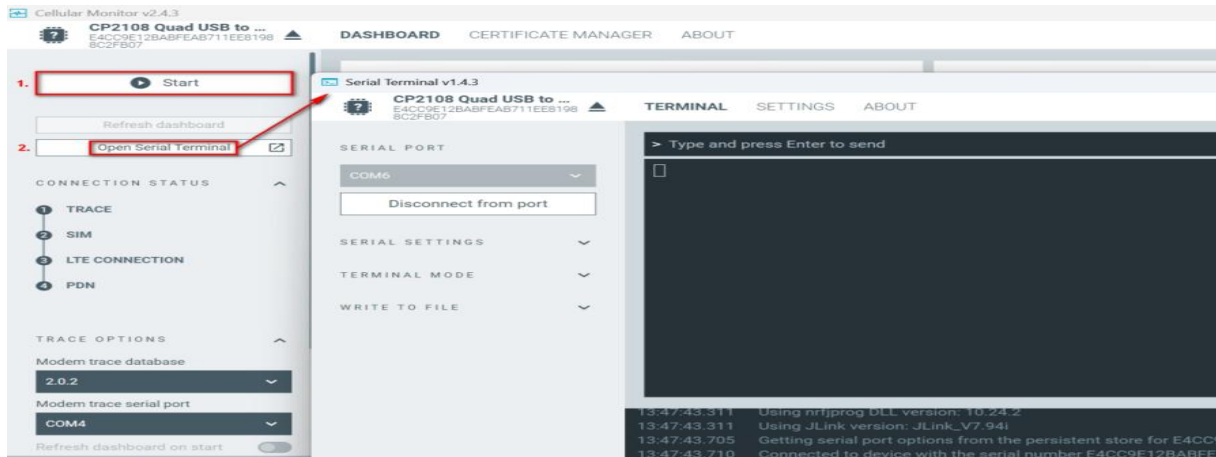


Figure 5.2.1-2 Start Capture Logs

- Send AT command at+cfun=1 to connect the network

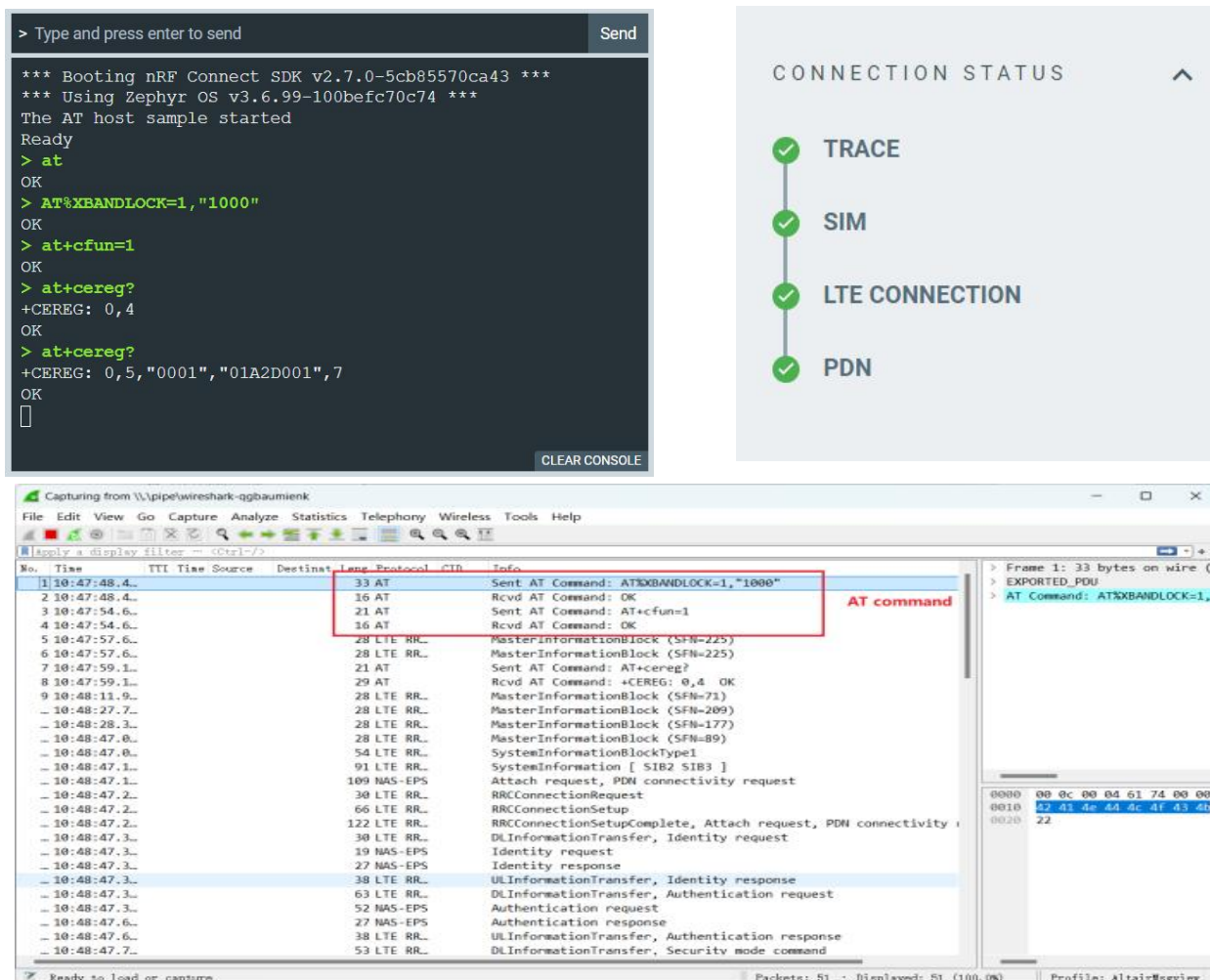


Figure 5.2.1-3 Wireshark logs

5.3. Add build parameter to enable trace log on your APP

west build -p -b tpm530mekv/tpm530m/ns -- -Dserial_lte_modem_SNIPPET=nrf91-modem-trace-uart

6. How to Measure Power Consumption

This chapter provides how to use EVK board to measure the power consumption of TPM530 in Active state/Idle(DRX)/Idle(eDRX)/PSM state.

6.1. Measuring Conditions and Note

EPC needs to allow TPM530 to configure both PSM or eDRX parameters.

SIM card needs to support eDRX function, or it will increase power consumption.

6.2. Measurement Procedure

The procedure will be separated to the software preparation and the measurement operation.

6.2.1. Software Preparation

For the measurements of Active state, Idle(DRX), Idle(eDRX), PSM state, the sample application “at_edrx_psm” is suggested to be used, and it can be downloaded from Sercomm portal at [Sercomm - Download](#).

As the code capture of “at_edrx_psm” below, to configure corresponding commands for different power saving mode tests. For the command details, please refer to the AT command manual at [nRF91x1 Cellular AT Commands](#).

%XSYSTEMMODE - Set the access technology

%XBANDLOCK - Set the locked bands

+CEDRXS - Configure the setting of eDRX parameters

%XPTW - Set the Paging Time Window (PTW)

+CPSMS - Configure PSM settings

```
static const char *const at_commands[] = {
    "AT%XFACTORYRESET=0",      // resets all modem data to factory settings

    "AT%XSYSTEMMODE=1,0,0,0", // CATM
    // "AT%XSYSTEMMODE=0,1,0,0", // NBIoT

    "AT%XBANDLOCK=2,\"10000001000000001100\"", // B3, B4, B13, B20
    // "AT%XBANDLOCK=2,\"10000000000000000000000000000000\"", // B28

    "AT%REDMOB=1",             // Enable Nordic-proprietary reduced mobility feature
    "AT%UICCPOWERSAVE=3",      // UICC deactivation in RRC IDLE

    // "AT+CEDRXS=1,4,\"0101\"", // CATM 81.92
    // "AT+CEDRXS=1,4,\"1011\"", // CATM 655.36
    // "AT%XPTW=4,\"0001\"", // CATM 2.56

    // "AT+CEDRXS=1,5,\"0101\"", // NBIoT
    // "AT%XPTW=5,\"0000\"", // NBIoT 2.56

    "AT+CPSMS=1,,,\"00000010\", \"00100001\""
};
```

Figure 6.2.1 at_edrx_psm source code

6.2.2. Measurement Operation

- a. Remove the jumper on “VDD_JUMPER” (JP12), and connect “VDD” (TP15) and “GND” (TP14) on the TPM530 EVK to a power source/analyzer.
- b. Attached to a call box or a network.
- c. Observe whether the power consumption performance meets the setting in Active State/IDLE/PSM.