

DriverI/DCM Module Setup Manual for FCC Certification

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DriverI/DCM LTE Connectivity Module ***(FCC ID: 2AM8R-DCM-NA1-100)***

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1. Introduction

This document is designed to provide information about DriverI/DCM module and setup instructions for FCC certification specifications like ESD, EMI/EMC etc.

DriverI/DCM Module is a LTE Dongle designed for US region will be used to provide high precision navigation and LTE Connectivity using Sprint Carrier.

This design is based on Sierra Wireless LTE Module WP7504 (SKU-1104278) and Ublox GPS/Glonass Module Neo-M8T for GPS navigation.

DriverI/DCM module will support Sprint Carrier LTE Band 2, 4, 5, 12, 25, 26.

DriverI/DCM Device contains FCC ID – 2AM8R-DCM-NA1-100

For external host interface "DriverI/DCM Module" supports USB interface with 12V DC supply input, on a 3 meter long custom USB Cable using RJ12 (6P6C) connector at the cable end.

DriverI/DCM Module dimensions are **66.5mm x 66.5mmx21.2mm** including LDS pattern antenna on the mechanical which connect to the LTE Module RF path using clips on the DriverI/DCM PCB board.

LTE LDS pattern antenna for both main and diversity path is customized from Pulse Electronics for DriverI/DCM module.

For LTE conducted power measurement on DriverI/DCM Module RF switch option is provided on the Main and diversity RF path.

2. FCC Compliance

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.

2.1 OPERATING REQUIREMENTS AND CONDITIONS

The design of Netradyne DriverI/DCM complies with U.S. Federal Communications Commission (FCC) guidelines respecting safety levels of radio frequency (RF) exposure for Mobile devices.

2.2 RF Radiation Exposure Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

2.3 FCC PART 15 STATEMENT

§ 15.105 (Class B digital device)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

2.4 REGULATORY INFORMATION

Model Name: **Driver1/DCM**

Contains FCC ID: **2AM8R-DCM-NA1-100**

2.5 FCC CAUTION STATEMENT FOR MODIFICATIONS

CAUTION: Any changes or modifications not expressly approved by Netradyne could void the user's authority to operate the equipment.

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3. DriverI/DCM Module Dimensions, Detailed Block Diagram and Description:

Below is the dimensions, detailed Block diagram of DriverI/DCM module and description of all the parts included in the DriverI/DCM Module.

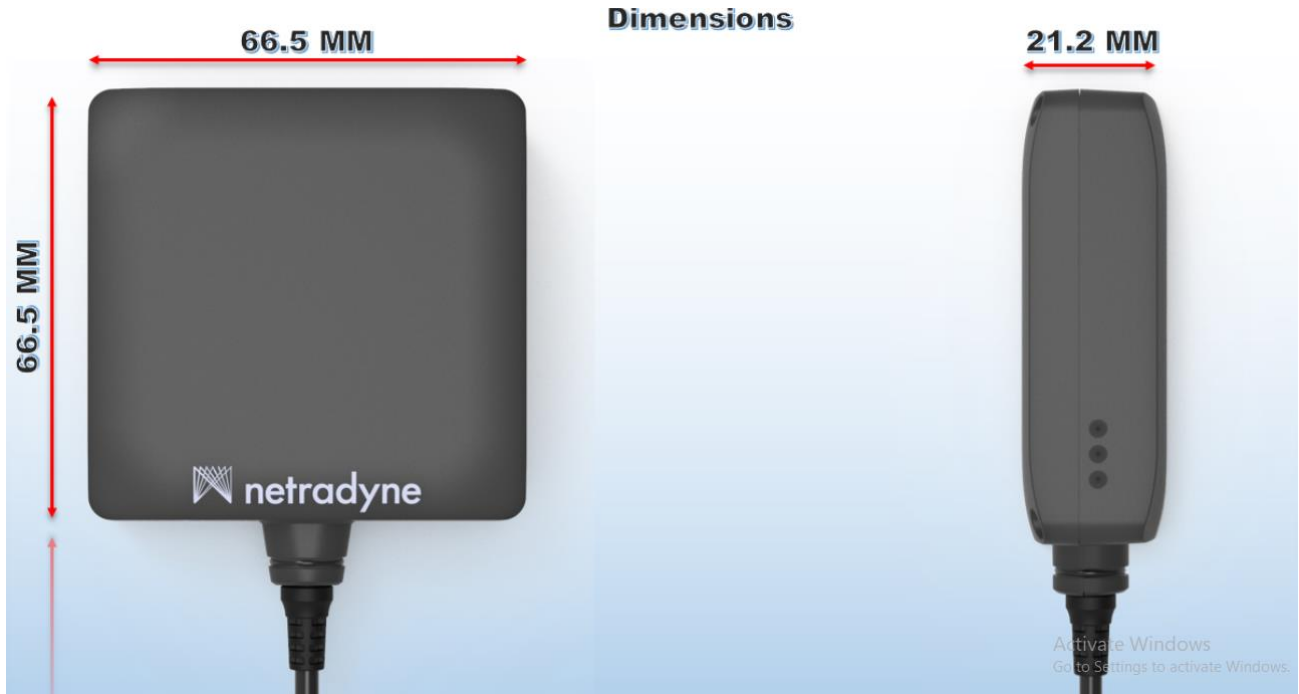


Figure 1: DriverI/DCM Module Dimensions

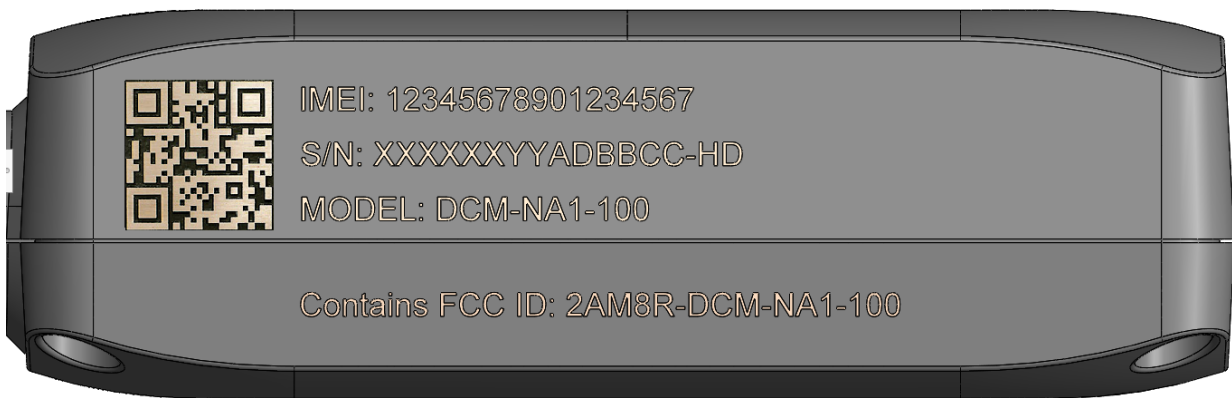


Figure 2: DriverI/DCM FCC Label



Figure 3: DriverI/DCM Actual Device FCC Label

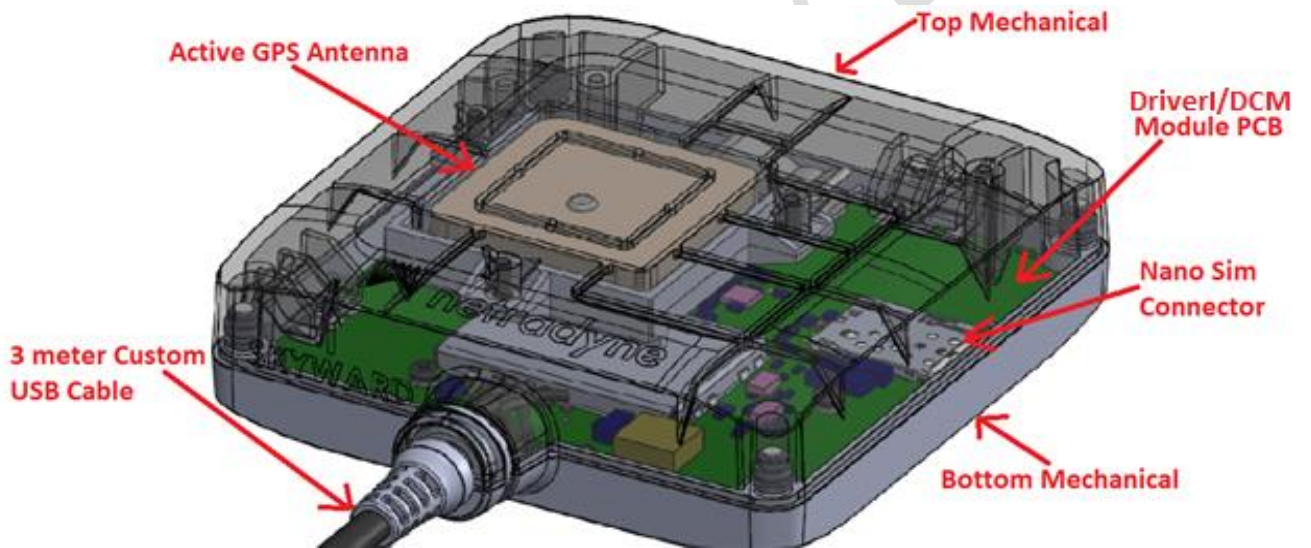


Figure 4: DriverI/DCM Module Transparent View

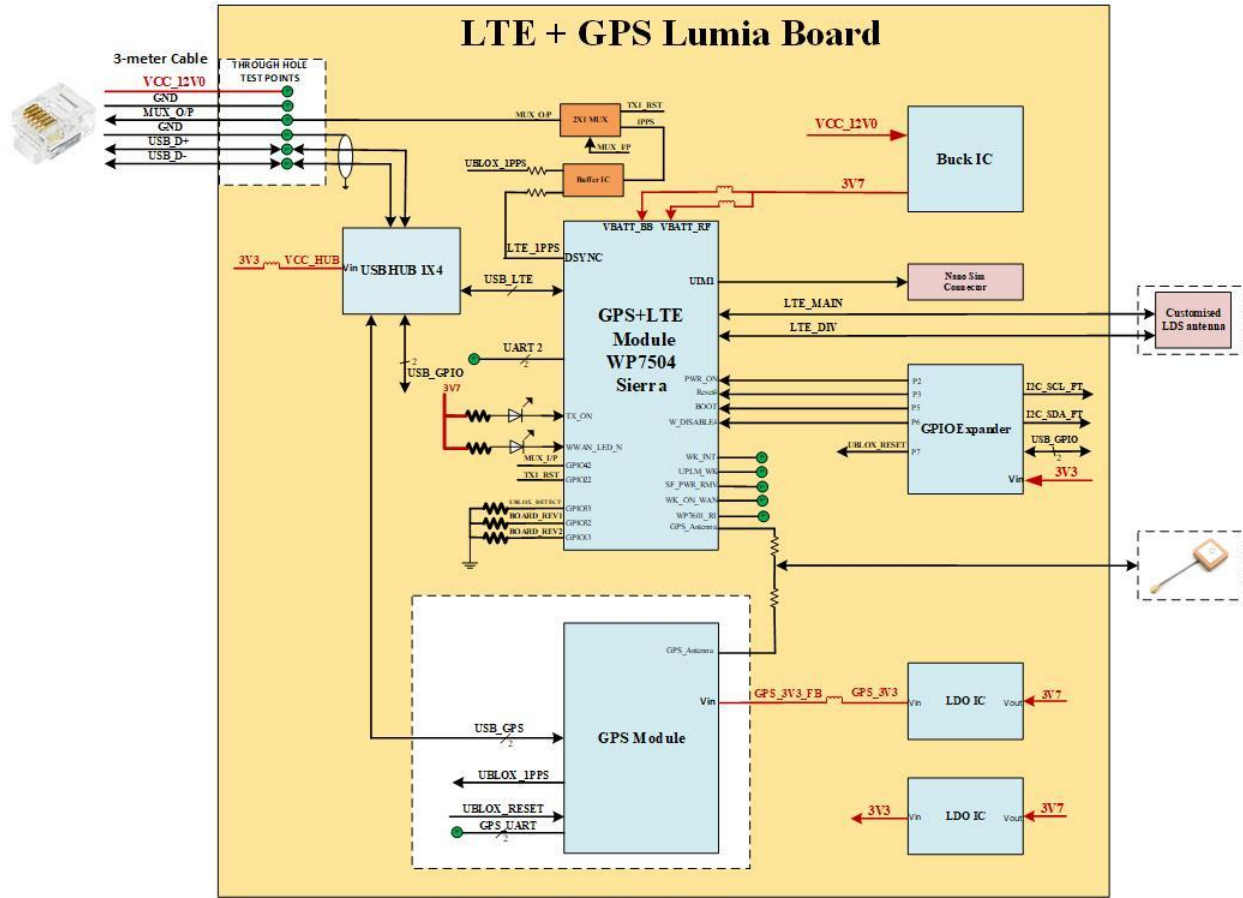


Figure 5 : Driver/DCM Module Detailed Block Diagram

3.1 LTE Module (WP7504 – Sierra Wireless):

WP7504 is a LTE embedded wireless module. This LTE Cat-3 embedded module delivers up to 100 Mbps download speed and is ideal for IoT applications requiring broadband connectivity such as industrial gateways, transportation, and mission-critical networking applications. Offering an application processor running the open source Legato® platform, optional GNSS receiver, and cellular modem with an ultra-low power domain, WP modules reduce system complexity and get you to market faster.

The WP7504 module is based on the MDM9615 QUALCOMM baseband processors.

WP7504 LTE module used in DriverI/DCM Module of SKU – 1104278.

The following bands/connectivity are supported by the WP7504 LTE Module:

- LTE Bands : Band 2, 4, 5, 12, 17, 25, 26

3.1.1 LTE LDS Antenna:

LTE LDS antenna is printed on the DriverI/DCM module mechanical and is customized from Pulse Electronics for DriverI/DCM Module.

Both LTE LDS main and diversity antenna will be connected to LTE module WP7504 RF pin using RF clips on the DriverI/DCM PCB board.

Note: There might be slight changes in the DriverI/DCM Mechanical but the LDS pattern LTE Antenna will remain same.

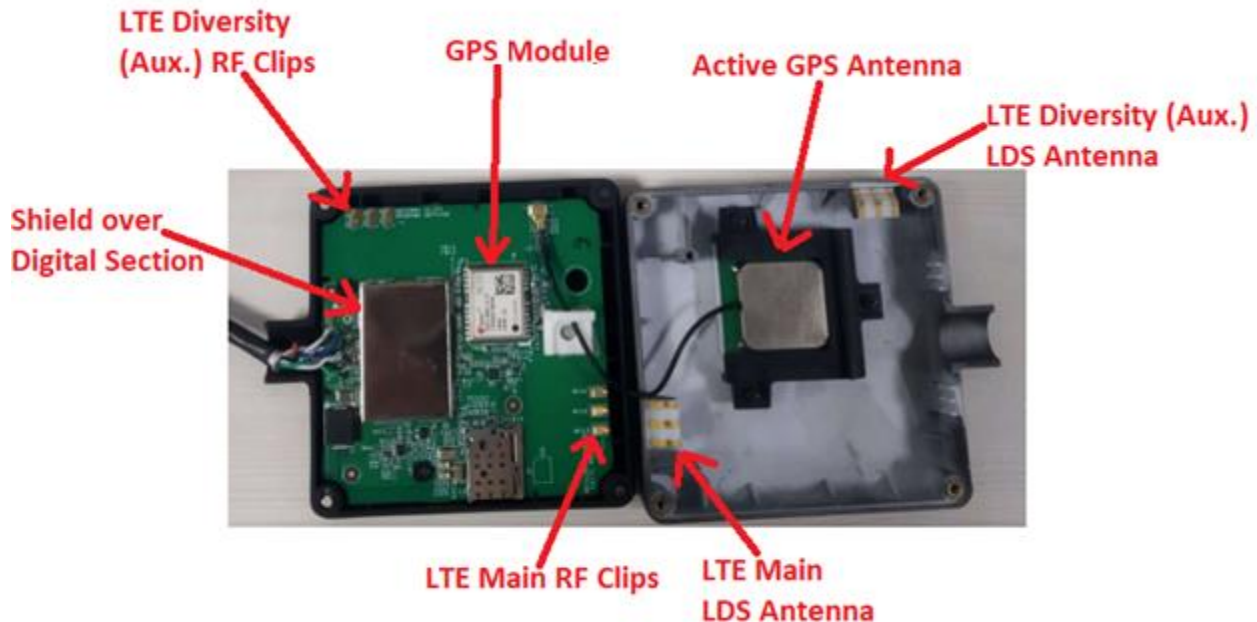


Figure 6: DriverI/DCM Module Top Side

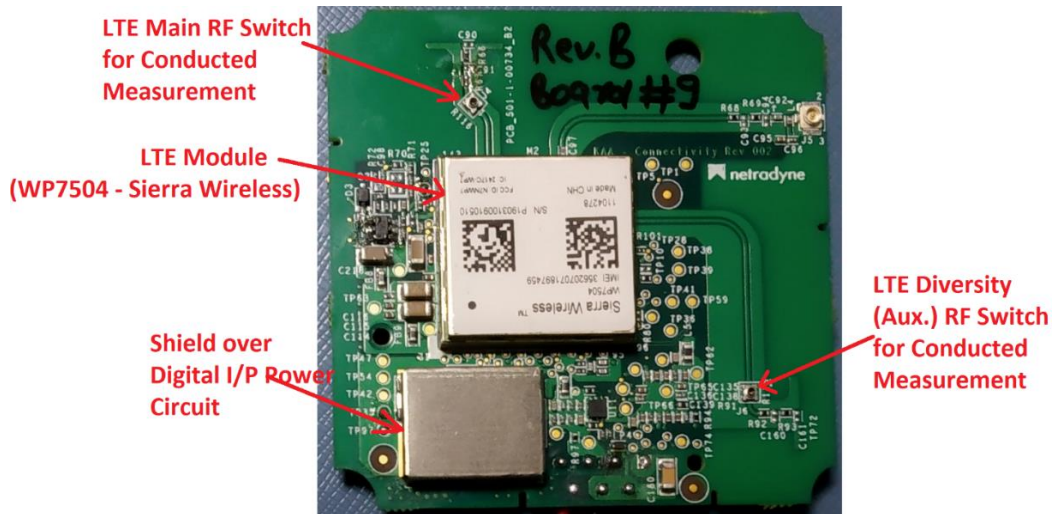


Figure 7: Driver/DCM Module Bottom Side

3.2 GPS Module:

Driver/DCM device includes GPS module that deliver high integrity, precision timing in demanding applications world-wide. Support for BeiDou, GLONASS and Galileo constellations enables compliance with national requirements. Enhanced sensitivity and concurrent constellation reception extend coverage and integrity to challenging signal environments. Survey-in and fixed-position navigation reduce timing jitter, even at low signal levels, and enable synchronization to be maintained with as few as one single satellite in view.

Inbuilt GPS module include Flash memory for field upgrade. UART, SPI and DDC (I2C compatible) interfaces provide connectivity and enable synergies with most u-blox cellular modules.

Driver/DCM device GPS module use GNSS chips qualified according to AEC-Q100, are manufactured in ISO/TS 16949 certified sites, and are fully tested on a system level. Qualification tests are performed as stipulated in the ISO16750 standard: “Road vehicles – Environmental conditions and testing for electrical and electronic equipment”.

3.2.1 GPS Active Antenna:

GPS Active ceramic patch antenna from Pulse Electronics is connected with GPS module in the Driver/DCM module using u.FL connector. Below are the antenna specifications:

- Frequency Range: 1575 – 1615 MHz
- Gain: 27+/- 3 dB (at 3.0 +/- 0.1V)
- Noise Figure: 2.0dB typ.
- Output VSWR: 2.5 max.
- Operation Voltage: DC=3.0 +/- 0.6V
- Current: DC=9 +/- 3mA (at 3.0 +/- 0.1V)

3.3 3 Meter Custom USB Cable:

3 meter custom USB cable is used to power up and provide USB connectivity to DriverI/DCM Module. USB custom cable is soldered to DriverI/DCM Device at one end and having RJ12 (6P6C) connector at the other end.

Below are specification for the custom 3 meter USB Cable used for DriverI/DCM Module:

- 6 wire cable (3 pairs twisted)
- 28 AWG Wire
- Impedance (Approx. 90 ohms)
- Cable Outer Dia.(around 3.6mm)
- Aluminum Foil Shielded with Drain Wire

DriverI/DCM Board Custom Cable Drawing

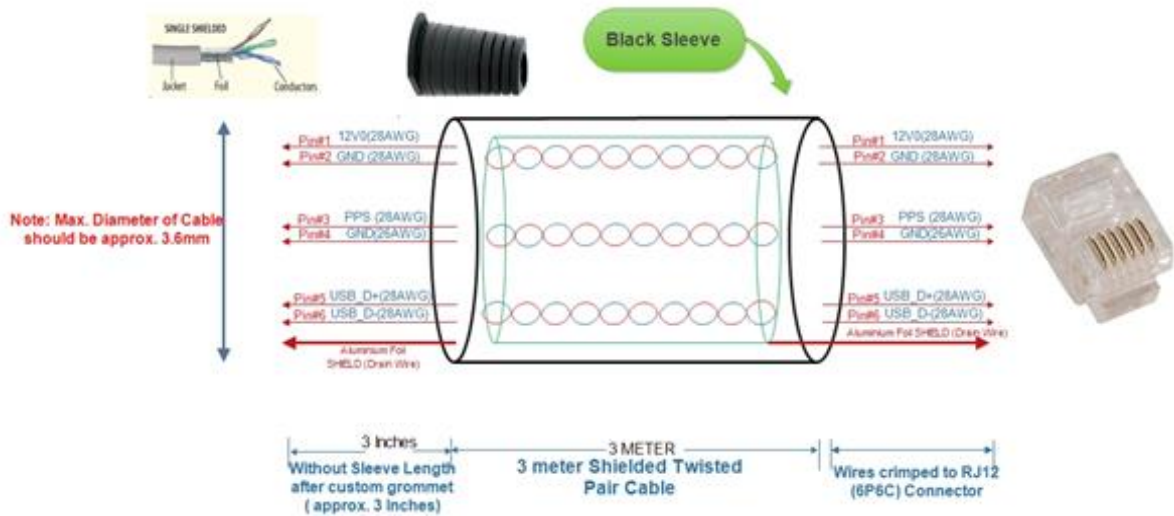


Figure 8: DriverI/DCM Module Custom 3 meter USB Cable Drawing

4. Additional Power Board for DriverI/DCM Module:

Additional 12 volt Power Board will be used with DriverI/DCM device during certification to power up the device. RJ12 connector from DriverI/DCM Module cable end will be connected to power board. Power Board will rest on acrylic setup.

Below is the Block diagram of additional power board required to power up the DriverI/DCM Module:

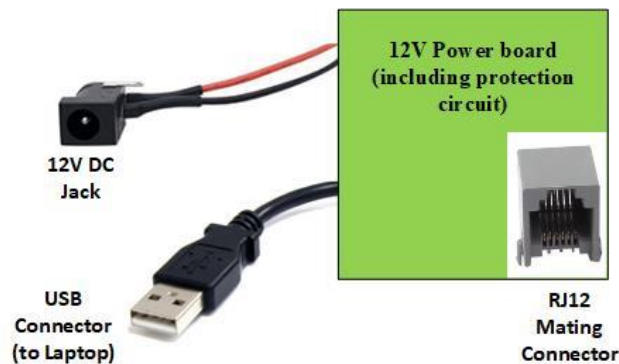


Figure 9: Power Board with DriverI/DCM Setup

Note: This power board will be used only for certification testing of the DriverI/DCM Module and will not be shipped along with DriverI/DCM Module.

5. DriverI/DCM Module Setup with Power Board:

12V DC adaptor (FCC and UL Certified) will be connected to DC Jack provided on the power board and USB connector from the Power board will be connected to Laptop and then DriverI/DCM LTE module will be accessible using AT commands.

Below are 12V DC adaptor specifications:

- Input : 100-240VAC 50/60Hz
- Output: 12V / 2A

Below is the complete block diagram of DriverI/DCM module setup with Power board and 12V DC Adaptor:



Figure 10: DriverI/DCM module complete setup with Power Board

6. Inserting Nano Sim Card in DriverI/DCM Module for Signalling Mode

Step 1: Open the DriverI/DCM Module mechanical as shown in below image:

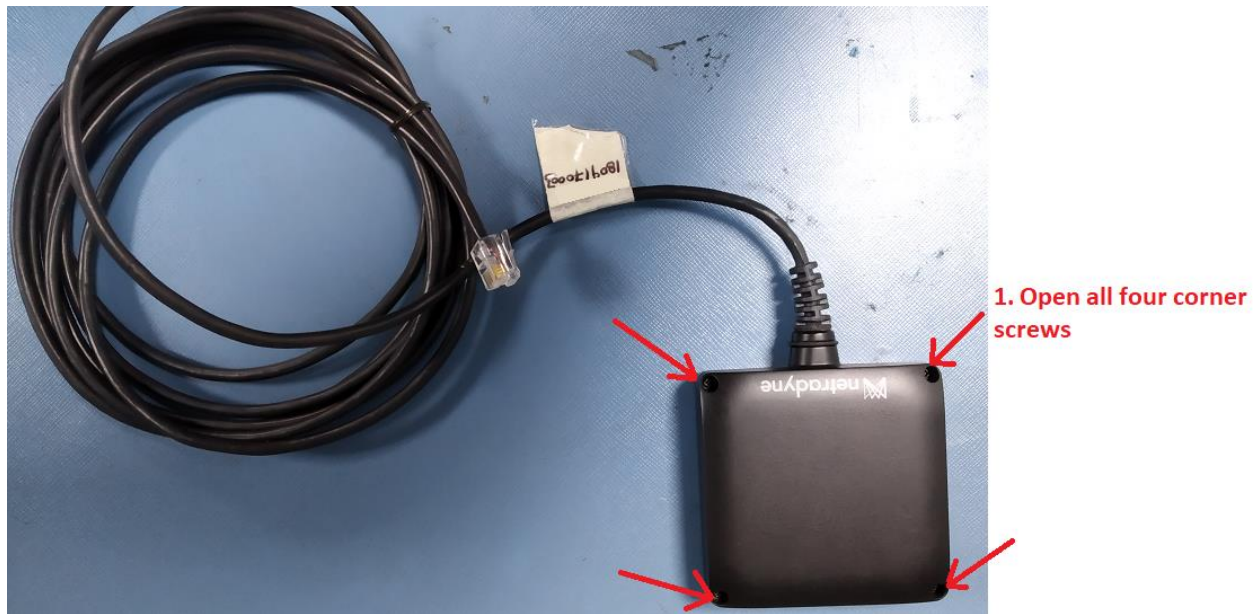


Figure 11: Insert Nano Sim Card Step 1

Step 2: After opening the four screws, open the further two screws inside the mechanical as shown in below image and take out the PCB Board from mechanical. After taking the PCB Board out from mechanical, Insert a Nano Sim card in the Nano Sim connector as shown in below image:

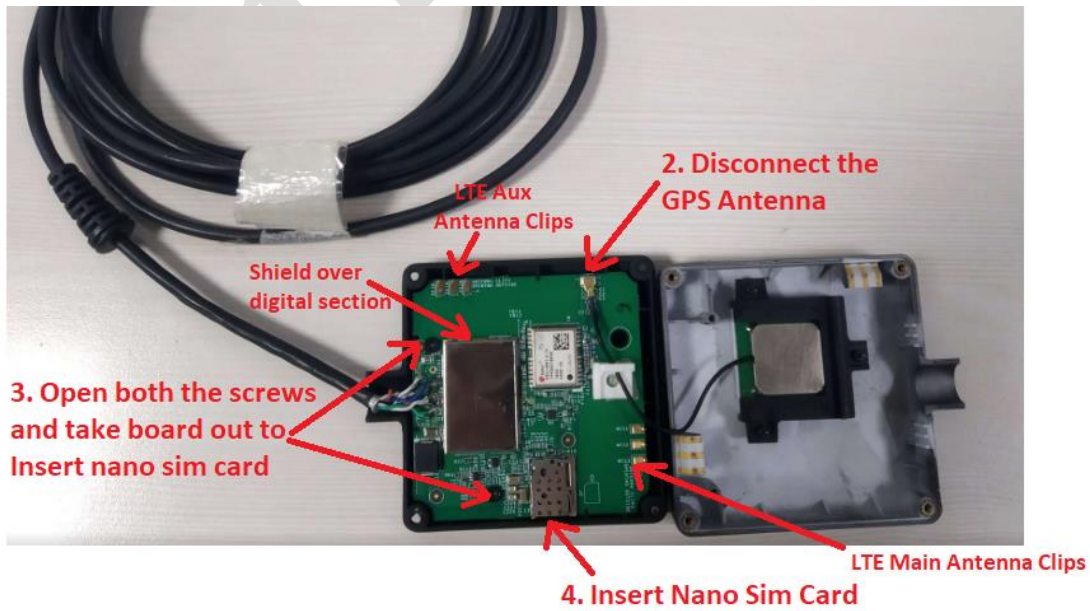


Figure 12: Insert Sim Card Step 2

Step 3: After inserting Nano Sim card put the PCB Board inside the mechanical and as shown in **step 2** tight the two screws and connect GPS Antenna cable on J1 connector.

Step 4: After that close the mechanical as in **step 1** and tight all four corner screws of mechanical.

Now DriverI/DCM Module is ready to connect with Windows PC. Follow below step for test in signaling mode.

Below is the image of complete setup after inserting the sim card and closing the mechanical.

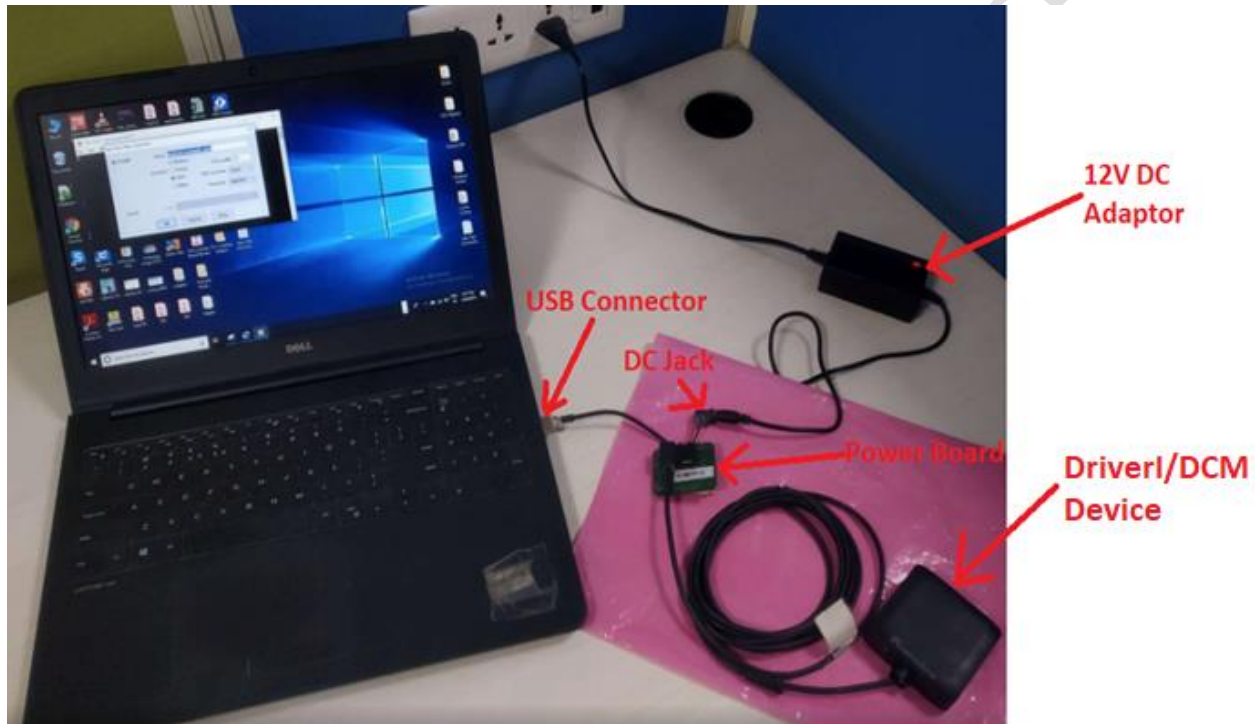


Figure 13: DriverI/DCM Module Actual Setup with Power Board

7. Driver/DCM Board Operating Steps in Signalling Mode:

7.1 Software Requirement

Step 1: Install Tera Term Software on Windows PC. Below is the download link:

https://filehippo.com/download_tera_term/

Step 2: Install LTE Module (Sierra Wireless) Drivers for Windows from the below link:

For Windows:

https://source.sierrawireless.com/resources/legato/drivers-for-wp75xx_wp76xx_wp8548-series-modules---latest-release/

7.2 Device Operating Steps:

Step 1: Connect 12V Battery to DC Jack provided on Power board.

Step 2: Connect the USB connector of power board to Windows PC.

Step 3: After connecting USB Connector, Wait for some time as Windows PC will search for Drivers as shown in below image:

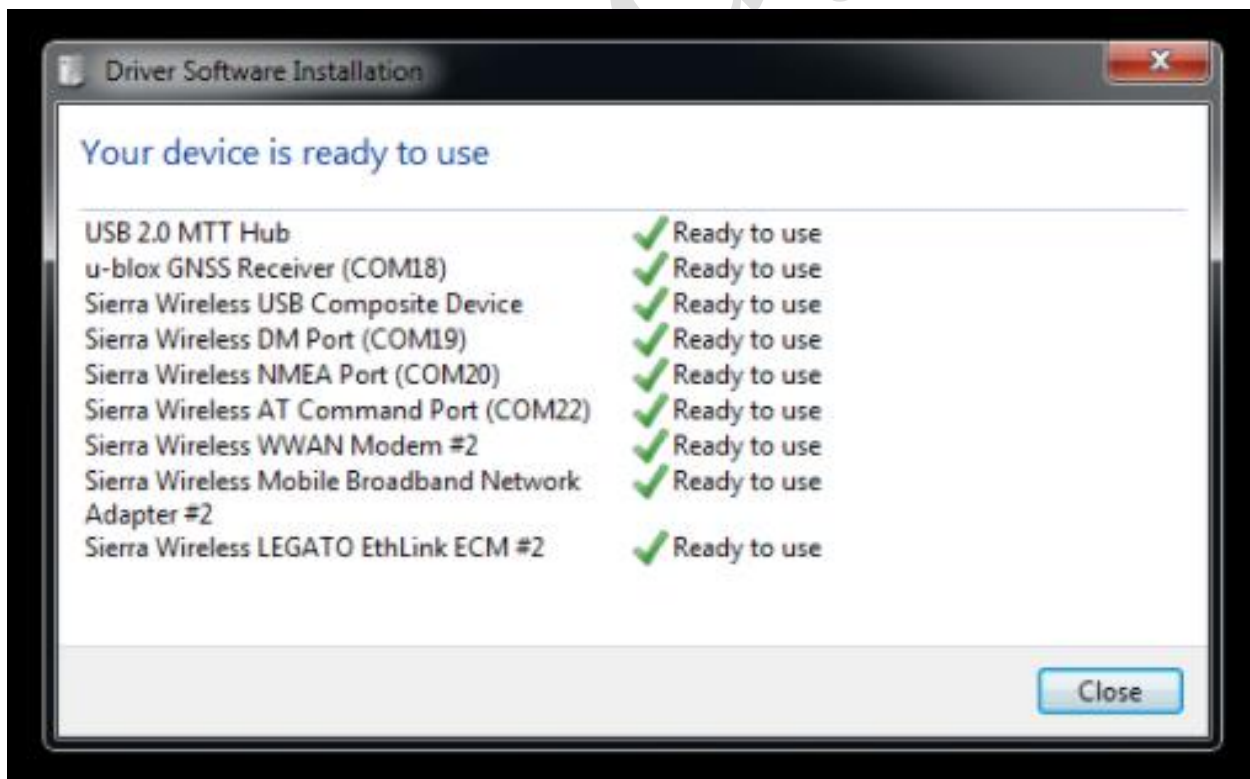


Figure 14: Check Driver Installation

Step 4: Open the device manager in Windows PC and check AT port of LTE Module (WP7504) as shown in below image:

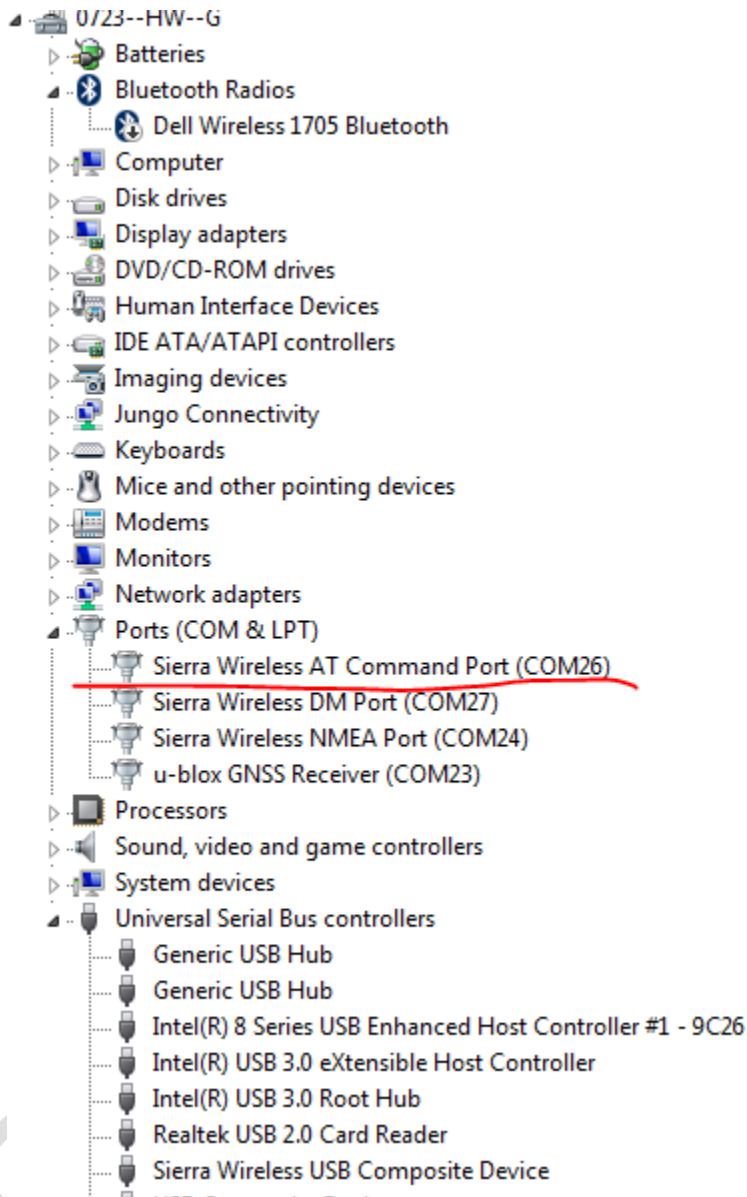


Figure 15: LTE Module COM Port Detection

Step 5: Open Tera Term software and connect with Sierra Wireless AT Command port as shown below:

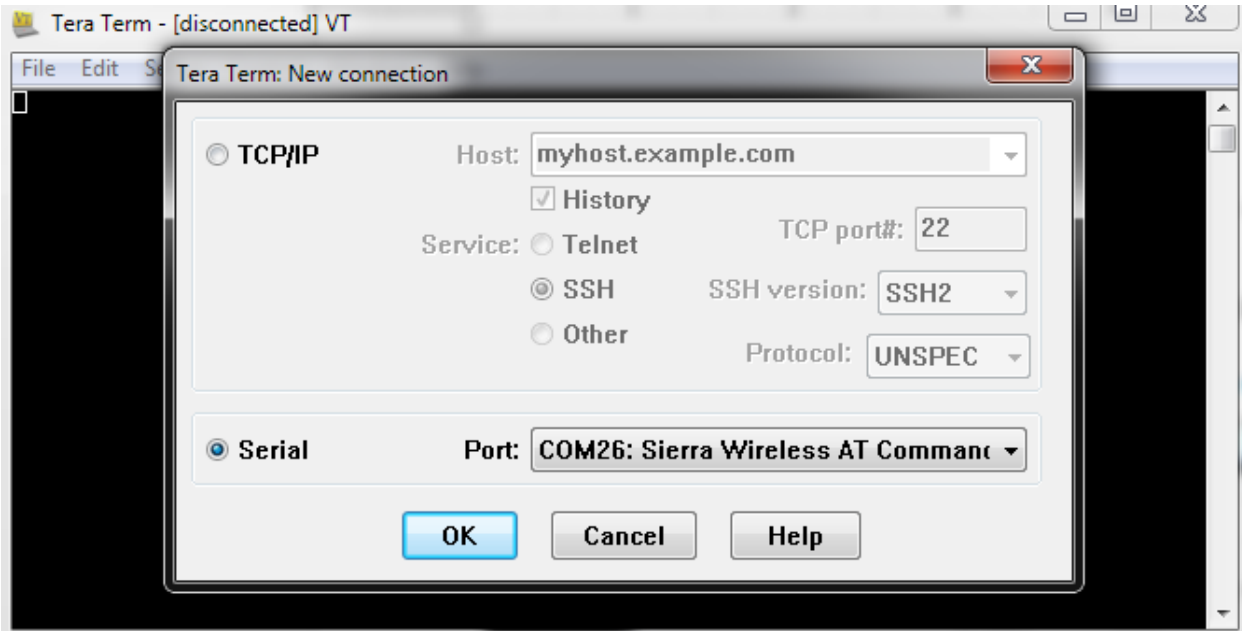


Figure 16: Connection with LTE Module COM Port

Step 6: Send the following at commands to check the sim card detection:

1. First Command: `at!uims=0`

Response: **OK**

2. Second Command: `at!iccid?`

Response:

!ICCID: XXXXXXXXXXXXXXXXXXXX (Sim Card IMSI Number)

OK

Step 7: After sim detection is OK, the device is ready to be tested in signaling mode with Call Box.

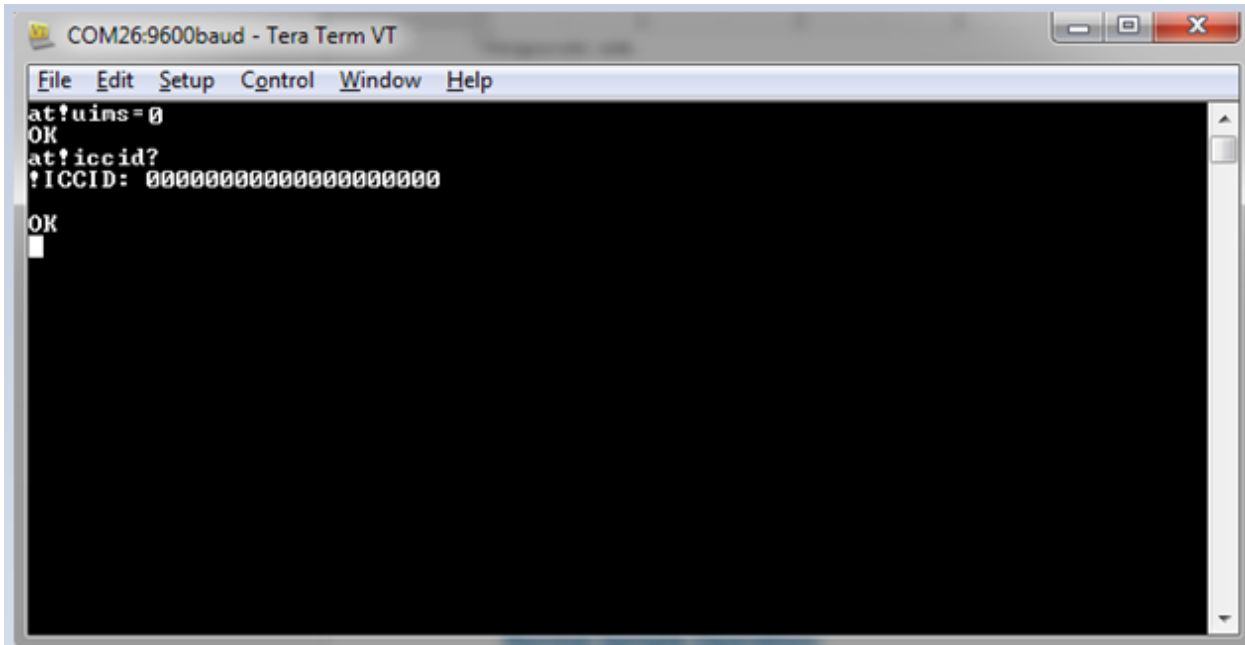


Figure 17: LTE Module Sim Detection

8. DriverI/DCM Board Operating Steps in FTM Mode (Non-Signalling Mode) to transmit maximum power:

Step 1: After connecting the device using Tera-Term, Send the following AT commands to set LTE in FTM mode and transmit maximum RF Output Power:

Command: `at!entercnd="A710"`

Response: **OK**

Command: `at!daftmact`

Response:

290300

OK

Command: `at!dasband=43`

Response:

43

OK

For Band 2: `at!dasband=43`

For Band 4: `at!dasband=42`

For Band 12: `at!dasband=50`

For Band 25: `at!dasband=61`

For Band 26: `at!dasband=62`

Command: `at!dalstxbw=3`

Response: **OK**

Command: **at!dalsrxbw=3**

Response: **OK**

Command: **at!daschan=18900**

Band 2 Channels: 18600, 18900, 19150

Response:

Band 4 Channels: 20000, 20175, 20350

18900

Band 12 Channels: 23060, 23095, 23130

OK

Band 25 Channels: 26090, 26365, 26640

Band 25 Channels: 26750, 26865, 26990

Command: **at!dalstxmod=0**

Response: **OK**

Command: **at!dalswaveform=1,12,0,19**

Response: **OK**

Command: **at!dalsnsval=1**

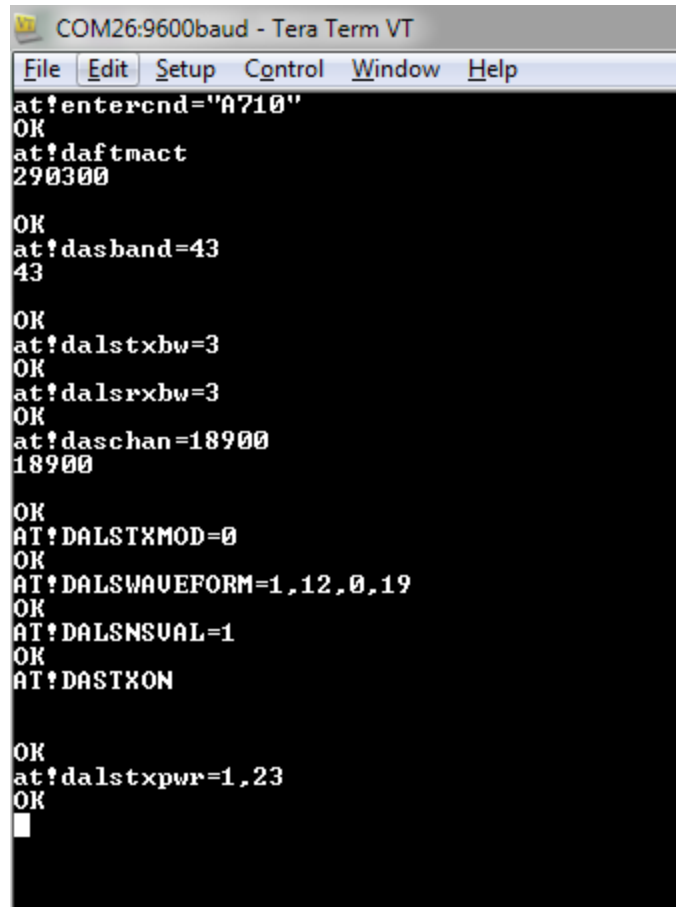
Response: **OK**

Command: **at!dastxon**

Response: **OK**

Command: **at!dalstxpwr=1,23**

Response: **OK**



```

COM26:9600baud - Tera Term VT
File Edit Setup Control Window Help
at!entercnd="A710"
OK
at!daftmact
290300
OK
at!dasband=43
43
OK
at!dalstxbw=3
OK
at!dalsrxbw=3
OK
at!daschan=18900
18900
OK
AT!DALSTXMOD=0
OK
AT!DALSWAVEFORM=1,12,0,19
OK
AT!DALSNSUAL=1
OK
AT!DASTXON
OK
at!dalstxprw=1,23
OK

```

Figure 18 : Set LTE FTM Mode Max. RF O/P Power

After the last command (**at!dalstxprw=1,23**) response is **OK** as shown in above image 15, LTE Module set to transmit maximum RF output power on band 2 and channel 18900.

i. To Change LTE Transmit Band:

To change LTE transmit band, change the command as follows:

For Band 2: **at!dasband=43**

For Band 4: **at!dasband=42**

For Band 12: **at!dasband=50**

For Band 25: **at!dasband=61**

For Band 26: **at!dasband=62**

For Example: to change LTE Band 12 from LTE Band 2, give the following command:

For Band 12: **at!dasband=50**

ii. To Change LTE Transmit Channel:

Similarly to change LTE Band Channels select the corresponding band channel for the LTE Band. Channels for LTE Band are:

Band 2 Channels: 18600, 18900, 19150

Band 4 Channels: 20000, 20175, 20350

Band 12 Channels: 23060, 23095, 23130

For Example: to change LTE Band 2 channel from 18900 to 18600, give the following command.

Command: `at!daschan=18600`

iii. To Change LTE Transmit Power:

Also, We can adjust the maximum output power value using the below command.

Command: `at!dalstxpw=1,23`

In the above command, 23 means output power is set to 23dBm, to change this output power to 20dBm give the below command:

Command: `at!dalstxpw=1,20`

Now, LTE module will transmit maximum output power 20dBm.

Note: To change any value (LTE Band, Channel and transmit power), Please run all the commands from start in sequence.