## ➢ User Manual

TM19FNEUHD2 as telematics module device equipped in the vehicles.

In charge of wireless communications in GSM/WCDMA/LTE/5G NR network

Platform for Telematics Virtual Machine (VM) and other VMs based on Hypervisor

TM19FNEUHD2 supports GSM850/1900, WCDMA B2/4/5, LTE B2/4/5/7/38/41/42/66, 5G NR n5/7/41/77/78 network

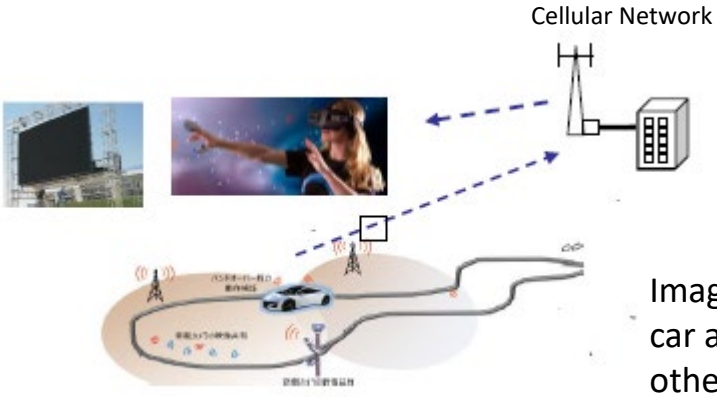
Them some use-case to demonstrate GSM/WCDMA/LTE/5G NR performances targeted

1. High throughput features
2. Low Latency features. below is just for example.

- **High throughput features**

Demonstrate high-throughput, high -quality image by hotspot.

- **Low Latency features**




Images and file uploaded from the car are displayed without delay to other devices

## ➢ Frequency Band

| Band | | Frequency | |
|---|---|---|---|
| | | Tx | Rx |
| GSM | 850 | 824.2~849.2 | 869.2~893.8 |
| | 1900 | 1850.2~1909.8 | 1930.2~1989.8 |
| WCDMA | B2 | 1850~1910 | 1930~1990 |
| | B4 | 1710~1755 | 2110~2155 |
| | B5 | 824~849 | 869~894 |
| LTE/5G | B2 | 1850~1910 | 1930~1990 |
| | B5(n5) | 824~849 | 869~894 |
| | B7(n7) | 2500~2570 | 2620~2690 |
| | B38 | 2570~2620 | |
| | B41(n41) | 2496~2690 | |
| | B42 | 3400~3600 | |
| | B66(B4) | 1710~1780 | 2110~2200 |
| | n77 | 3300~4200 | |
| | n78 | 3300~3800 | |

# 2. Notice

## ➢ Telematics NAD Module installation guide and information

NAD Module as TM19FNEUHD2 Module is mounted with solder ball on the main TSU board.

The strength of the RF field produced by the wireless module or modules embedded in th e TSU is well within all international RF exposure limits known at this time. Because the wir eless modules embedded in the TSU emit less than the maximum amount of energy permitted in radio frequency safety standards and recommendations, the manufacturer believes these modules are safe for use.

Regardless of the power levels, care should be taken to minimize human contact during normal operation. This module should be remain more than **20 cm (8 inches)** from the body when wireless devices are on and transmitting.

This transmitter must not be collocated or operated in conjunction with any other antenna or transmitter. Operation is subject to the following two conditions: (1) this module does not cause interference , (2) this module accepts any interference that may cause undesired operation.

Information for the integrator

The integrator must not provide information to the end user regarding how to install or remove this RF module in the user manual of the end product. The user manual that is provided by the integrator for end users must include the following information in a prominent location. To comply with FCC RF and IC RSS-102 exposure requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be collocated or operated in conjunction with any other antenna or transmitter. The label for the end product must include FCC ID: BEJTM19FNEUHD2 or A RF transmitter inside.

# 2. Notice

- Telematics NAD Module installation guide and information

This module complies with FCC rules.( FCC : Part 22, Part 24, Part 27)

Furthermore, this device complies with FCC radiation exposure limits set forth for uncontrolled environments.

This module must be installed and operated with minimum distance of 20cm between the radiating element and the user. This module must not be co-located with any other transmitters or antennas. To comply with FCC regulations limiting both the maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed the values listed in the following table.

# 2. Notice

## ➢ Telematics NAD Module installation guide and information

*** Internal Antenna**

**4.2.1 I_TEL1 Antenna (LB+MB+HB+Sub-6) (Operating Band: GSM850/1900, WCDMA B2/4/5, LTE B2/4/5/7/38/41/66, n5/7/41)**

| Frequency [MHz] | 699 | 716 | 729 | 734 | 746 | 748 | 758 | 791 | 803 | 814 |
|---|---|---|---|---|---|---|---|---|---|---|
| Peak Gain(dBi) | -0.15 | -0.04 | 0.13 | 0.86 | 1.89 | 2.15 | 2.70 | 2.65 | 2.78 | 2.63 |
| Average Gain(dBi) | -5.78 | -5.41 | -5.64 | -5.12 | -4.40 | -4.37 | -3.49 | -2.92 | -2.68 | -3.64 |
| Frequency [MHz] | 824 | 832 | 849 | 859 | 869 | 880 | 894 | 915 | 925 | 960 |
| Peak Gain(dBi) | 2.14 | 1.77 | 1.63 | 1.49 | 1.37 | 1.25 | 0.79 | 0.13 | -0.20 | -0.38 |
| Average Gain(dBi) | -4.13 | -5.04 | -4.87 | -4.85 | -5.11 | -5.21 | -5.21 | -5.30 | -5.74 | -5.83 |
| Frequency [MHz] | 1710 | 1755 | 1785 | 1805 | 1850 | 1880 | 1910 | 1920 | 1930 | 1980 |
| Peak Gain(dBi) | 0.04 | 0.31 | 1.58 | 2.80 | 1.48 | 1.77 | 1.46 | 1.24 | 0.95 | 1.77 |
| Average Gain(dBi) | -4.34 | -4.10 | -3.09 | -2.04 | -2.81 | -3.52 | -3.65 | -3.52 | -3.84 | -2.98 |
| Frequency [MHz] | 1990 | 2110 | 2155 | 2170 | 2300 | 2400 | 2500 | 2570 | 2620 | 2690 |
| Peak Gain(dBi) | 1.89 | 1.63 | 1.02 | 1.47 | 1.06 | -0.29 | 1.20 | 0.42 | -0.15 | 0.36 |
| Average Gain(dBi) | -2.91 | -2.66 | -3.34 | -3.52 | -3.15 | -4.29 | -3.47 | -4.39 | -4.75 | -4.15 |
| Frequency [MHz] | 3300 | 3500 | 3700 | 3900 | 4100 | 4200 | | | | |
| Peak Gain(dBi) | 2.49 | 2.45 | 2.72 | 2.14 | 0.55 | 1.15 | | | | |
| Average Gain(dBi) | -3.62 | -3.68 | -4.62 | -3.76 | -4.26 | -5.08 | | | | |

* TX/RX : under 3GHz
DRX : over 3GHz

**4.2.2 I_TEL2 MIMO Antenna (LB+MB+HB+Sub-6) (Operating Band: B42, n77/78)**

| Frequency [MHz] | 699 | 716 | 729 | 734 | 746 | 748 | 758 | 791 | 803 | 814 |
|---|---|---|---|---|---|---|---|---|---|---|
| Peak Gain(dBi) | -1.99 | -1.29 | -1.10 | -1.32 | -1.11 | -1.00 | -0.41 | 0.59 | 0.92 | 0.50 |
| Average Gain(dBi) | -5.67 | -5.24 | -4.82 | -5.25 | -4.51 | -4.12 | -3.62 | -3.12 | -3.12 | -2.82 |
| Frequency [MHz] | 824 | 832 | 849 | 859 | 869 | 880 | 894 | 915 | 925 | 960 |
| Peak Gain(dBi) | 0.40 | -0.17 | 0.24 | 0.60 | 0.29 | 0.02 | -0.59 | -0.77 | -0.77 | -0.85 |
| Average Gain(dBi) | -3.08 | -3.18 | -3.23 | -3.32 | -3.75 | -3.79 | -4.66 | -5.01 | -5.15 | -5.90 |
| Frequency [MHz] | 1710 | 1755 | 1785 | 1805 | 1850 | 1880 | 1910 | 1920 | 1930 | 1980 |
| Peak Gain(dBi) | -0.91 | -0.14 | 1.29 | 1.93 | 0.73 | -0.32 | -0.26 | 0.07 | -0.12 | 0.70 |
| Average Gain(dBi) | -4.63 | -4.23 | -3.97 | -3.09 | -3.51 | -4.15 | -4.79 | -4.46 | -4.79 | -3.70 |
| Frequency [MHz] | 1990 | 2110 | 2155 | 2170 | 2300 | 2400 | 2500 | 2570 | 2620 | 2690 |
| Peak Gain(dBi) | 0.75 | 2.17 | 2.12 | 1.76 | 2.21 | 0.99 | 2.01 | 0.53 | 0.29 | -0.11 |
| Average Gain(dBi) | -4.02 | -3.07 | -3.94 | -3.97 | -4.60 | -5.24 | -3.72 | -4.71 | -4.65 | -5.05 |
| Frequency [MHz] | 3300 | 3500 | 3700 | 3900 | 4100 | 4200 | | | | |
| Peak Gain(dBi) | 1.30 | 2.77 | 2.22 | 2.39 | 0.66 | 0.43 | | | | |
| Average Gain(dBi) | -3.74 | -3.19 | -3.12 | -3.41 | -4.77 | -4.37 | | | | |

* TX/RX : over 3GHz
DRX : under 3GHz

To satisfy the FCC's exterior labeling requirements, the following text must appear on the exterior of the end product. Contains transmitter module FCC ID: BEJTM19FNEUHD2 Contains transmitter module.

Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. Users may lose the authority to operate this equipment if an unauthorized change or codification is made.

Note: If this module is intended for use in a portable device, additional testing will be required to satisfy the RF exposure and SAR requirements of FCC Part 2.1093.

# 2. Notice

## ➢ Notice

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The OEM integrator is responsible for ensuring that the host product which is installed and operating with the module is in compliant with Part 15B unintentional Radiator requirements, please note that For a Class B digital device or peripheral, the instructions furnished the user manual of the end-user product shall include the following or similar statement, placed in a prominent location in the text of the host product manual:

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.

NOTE: 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.

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with minimum distance **20cm** between the radiating element of this device and the user.

## *Regulatory notice to host manufacturer according to KDB 996369 D03 OEM Manual*

**Modular Approval Statement**

Regulatory notice to host manufacturer according to KDB 996369 D03 OEM Manual.
This module has been granted modular approval as below listed FCC rule parts.
-FCC Rule parts 22, 24, 27

**Summarize the specific operational use conditions**

-The OEM integrator should use equivalent antennas which is the same type and equal or less gain then an antenna listed below this instruction manual.

**Limited module Procedures (N/A)**

This module is single modular approval.

**Trace antenna designs**

This module utilize the trace antenna. Therefore the host manufacturer must follow the installation guidance which is provided in documents from page 9 to 12.

**Antennas list**

The antenna certified with this module is listed following.

1) (Internal Antenna) ANT. Model: MY26 (LTE / Sub-6, GPS Antenna) / Type: Planar Inverted F Antenna
2) (Internal Antenna) ANT. Model: MY26 (LTE/Sub-6 MIMO, WIFI, WIFI MIMO Antenna) / Type: Planar Inverted F Antenna

A host manufacturer must not use the other types of antenna and an antenna with a gain that exceeds the values listed in this documents.

**RF exposure considerations**

-The module has been certified for integration into products only by OEM integrators under the following condition:
-The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.
-The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.
-Mobile use
As long as the three conditions above are met, further transmitter testing will not be required.
OEM integrators should provide the minimum separation distance to end users in their end-product manuals.

**End Product Labeling**

The module is labeled with its own FCC ID. If the FCC ID are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:
Contains FCC ID: BEJTM19FNEUHD2

**Information on test modes and additional testing requirements**

- OEM integrator should evaluate the final product with this module installed in a host to ensure FCC compliance. If the final product has any additional transmitters and those transmitter can be operating simultaneously, the simultaneous transmission mode should be evaluated to make sure there is no any additional emission generated during the operation of all transmitters.

**Additional testing, Part 15 Subpart B disclaimer**

-The final host product also requires Part 15 subpart B compliance testing with the modular transmitter installed to be properly authorized for operation as a Part 15 digital device.

**Manual Information To the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

**Note EMI Considerations**

Note that a host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional noncompliant limits due to module placement to host components or properties For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode; see D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.

**How to make changes**

Since only Grantees are permitted to make permissive changes, when the module will be used differently than granted, please contact the module manufacture on below contact information.

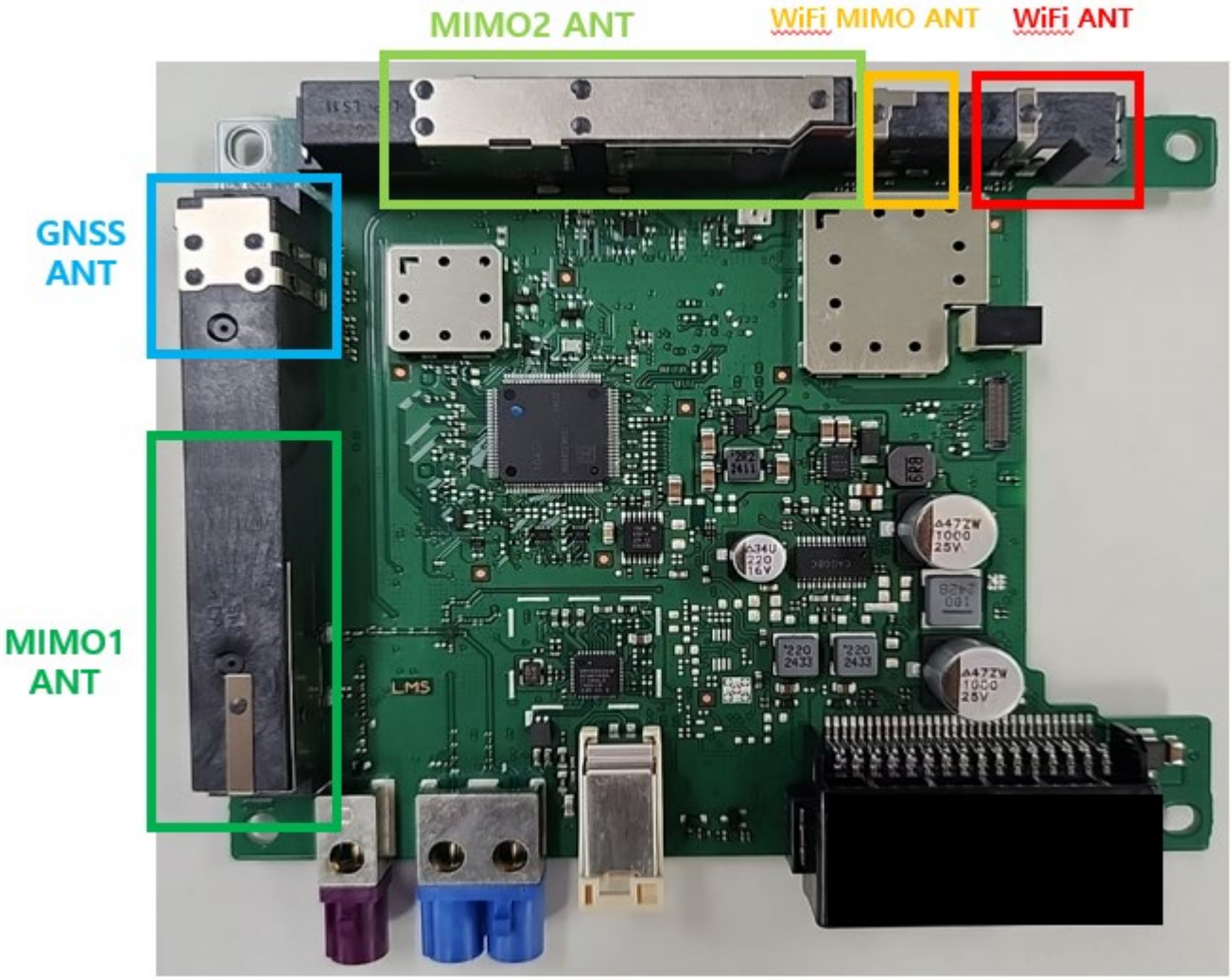
-. Contact information: Hannae Park / hannae.park@lge.com

# Antenna Trace

## 1. Antenna Matching Circuit and Trace

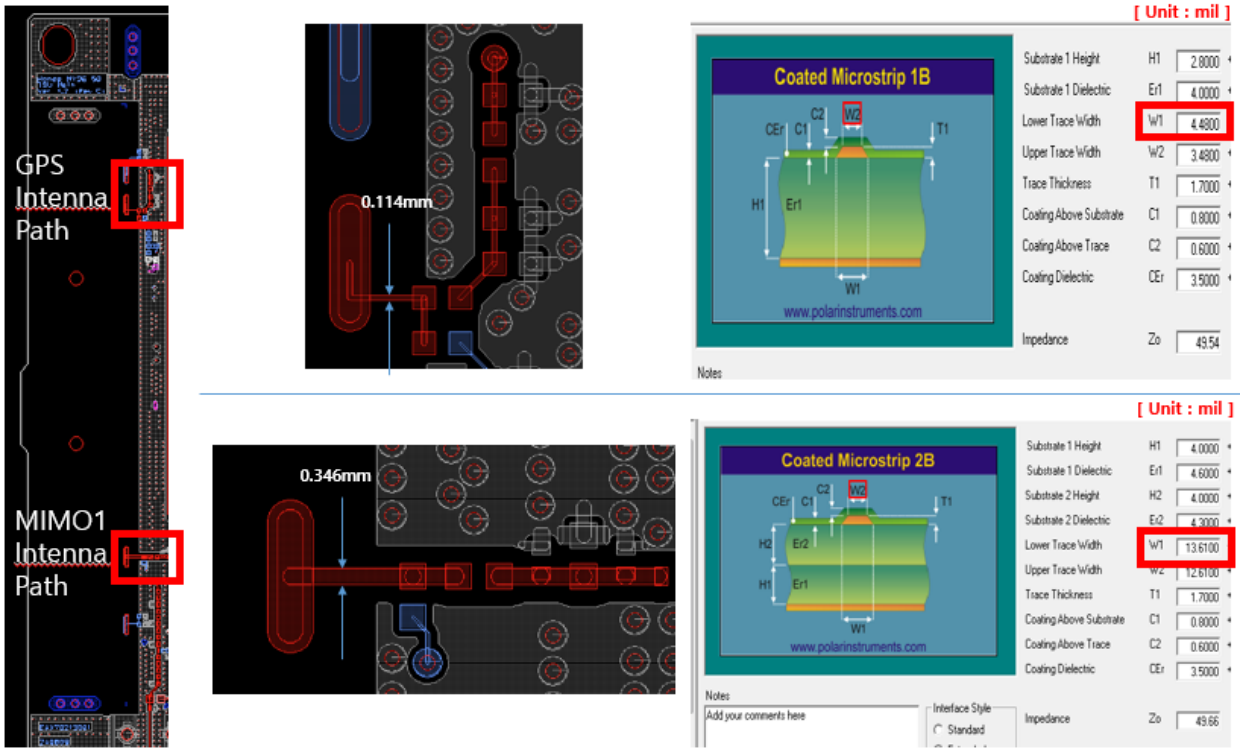
A 50 ohm line matching circuit between the module, the Host board and the RF antenna is required.

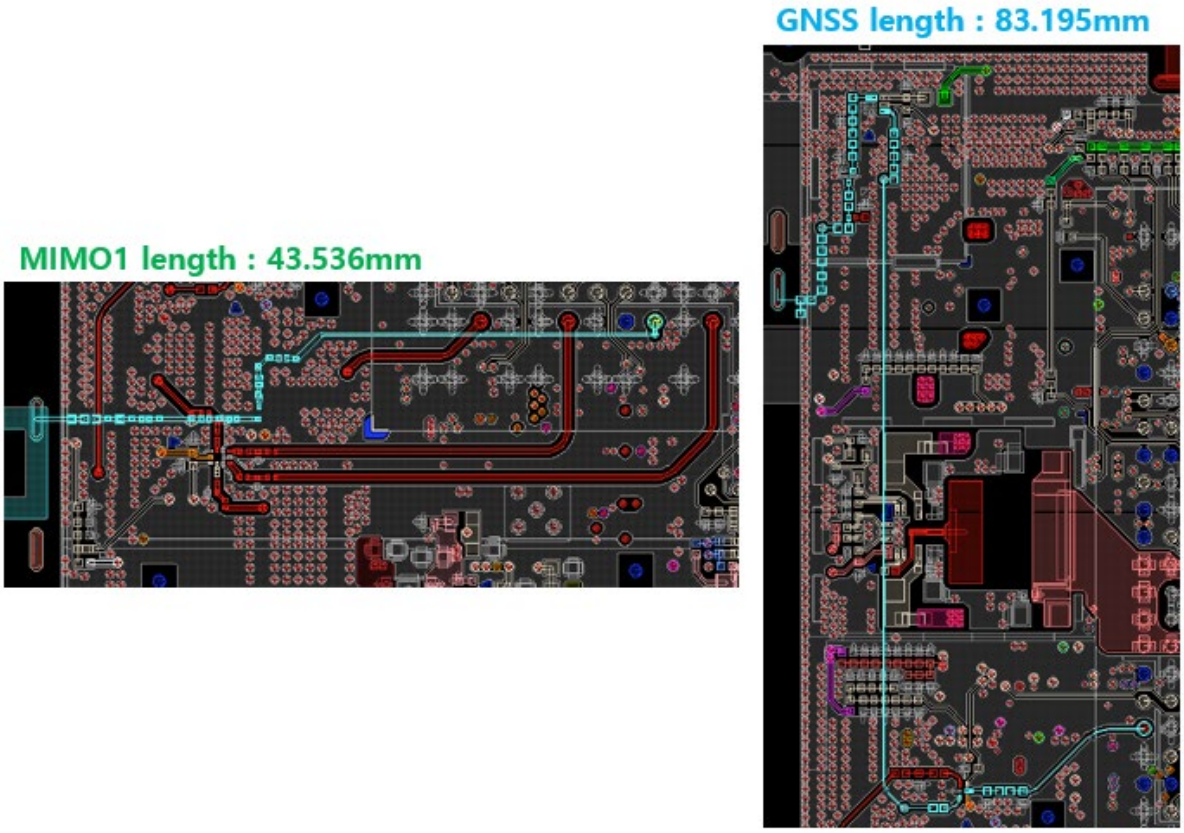
### 1.1 Internal Antenna Placement



## 1.2 MIMO1 & GNSS

### MIMO1 / GNSS Antenna Trace Layout

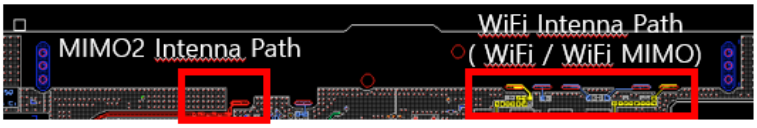


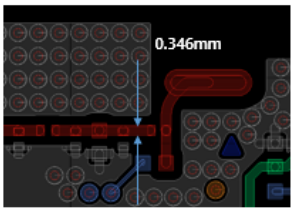



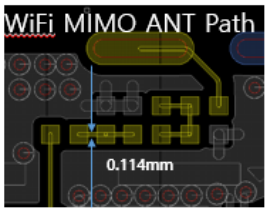

The trace is designed as a 50Ω coplanar stripline and its MIMO1 width is 0.346 mm and GNSS width is 0.114 mm, MIMO1 length is 43.536mm and GNSS length is 83.195mm.

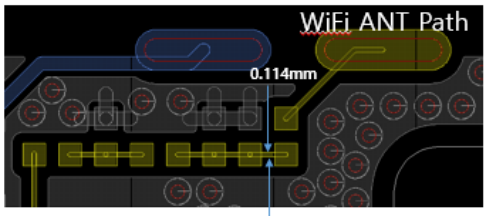
## 1.3 MIMO2 & WiFi

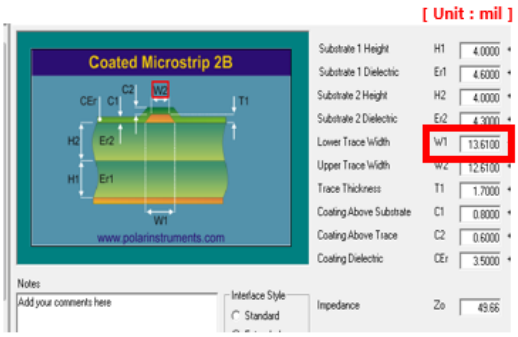
### MIMO2 / WiFi Antenna Trace Layout

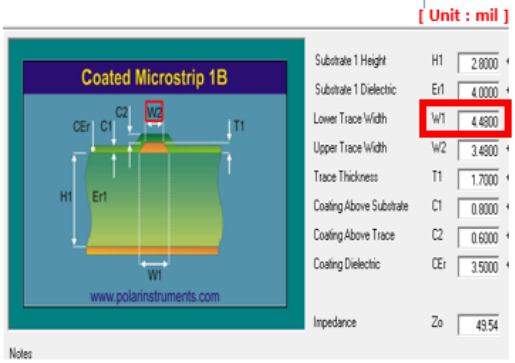


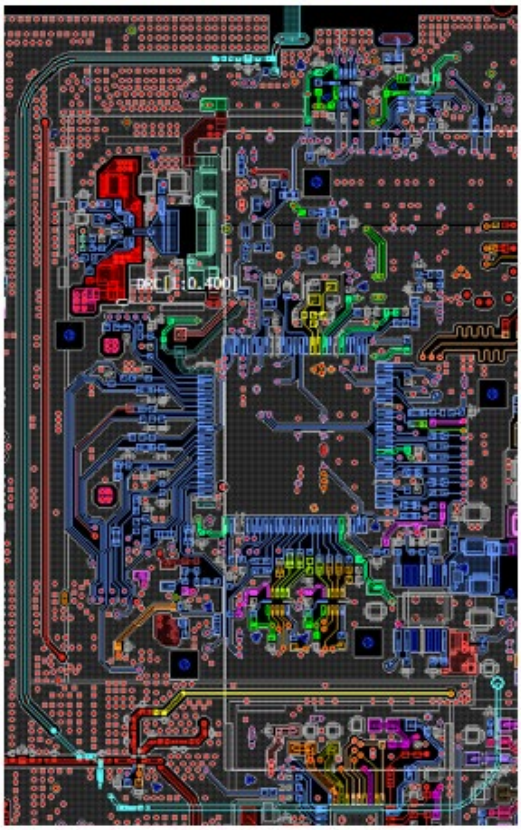



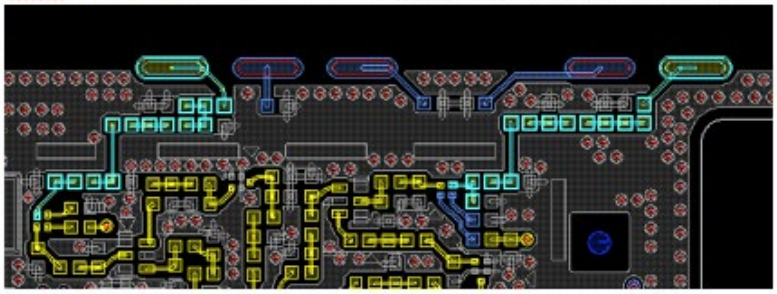




MIMO2 length : 125.48mm



WiFi MIMO length : 11.091mm WiFi MIMO length : 12.844mm



The trace is designed as a 50Ω coplanar stripline and its MIMO2 width is 0.346 mm and WiFi width is 0.114 mm, MIMO2 length is 125.48mm, WiFi ANT length is 11.091mm and WiFi MIMO ANT length is 12.844mm.