COSPAS-SARSAT

406MHz emergency channel
and 121.5MHz homing signal
PCB module

Technical Description and User Guide Manual

Version 2.0

2020

Contents

1. GENERAL PURPOSE

1.1 **COSPAS-SARSAT 406MHz/121,5MHz PCB Module** is designed for using in all types of Cospas-Sarsat devices, such as PLB, EPIRB, ELT; man over board solutions, MSLS devices (MSLD) and other device combinations according to RTCM 11901.1.

Module can be used as emergency button on trucks or as lost containers tracking facility.

Module can be easily integrated in ready or new devices with minimum requirements and integration actions. (see Item 7.)

1.2 General view of the 406MHz and 121.5MHz PCB module is represented on the fig.1-1.

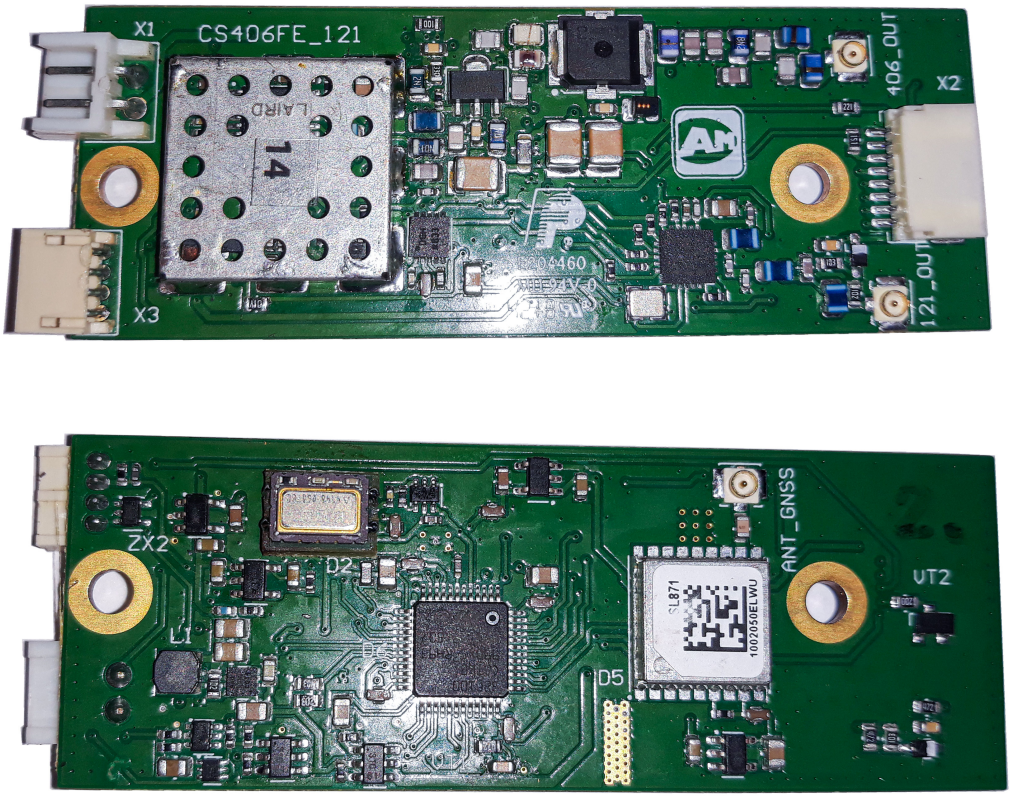


Figure 1.1 – General view, both sides

1.3 Module operates on 406MHz frequency that can be adjusted in 406.0-406.1MHz range with 3kHz step. It's designed in accordance with the CS-T-001-2018 specifications for 406MHz distress beacons.

1.4 Module also operates on 121.5MHz channel.

1.5 Module allows sending the emergency alert with unique emergency identifier to the COSPAS-SARSAT satellite system.

1.6 Module can be programmed by unique ID or MMSI by means of PC and given software – CS406_program_tools.

1.7 Module should be connected to any 406MHz and 121.5MHz antenna or diplexer by means of U.FL 50Ohms connector output (see Item 6.2.2).

1.8 Module uses GPS-GLONASS receiver SL871.

1.9 Module can be connected to any passive GPS-GLONASS antenna by means of U.FL connector.

1.10 Under the terms of operation module can be used after integration in the case at a temperature range of -20°C to + 55°C and relative humidity 95%.

1.11 The module should be powered by 5.8-9.0V external power source. For 24 hours of operation at -20°C module requires at least 1000mAh capacity with average consumption of 27mA and ability to support max. current up to 1.6A.

1.12 Module generates a strobe-impulse to control an external flashlight, placed on the casing.

1.13 Module can operate separately as ready device (casing is required) or as a part controlled by external main board (see debug board as example).

2. GENERAL DESCRIPTION AND SPECIFICATIONS

2.1 Channel 406MHz specifications:

- PCB Module emits signal on 406MHz frequency in range of 406.0MHz - 406.1Mhz that can be adjusted with 3kHz step
- 406MHz signal power is 37dBm ±2dB (5W)
- Signal modulation – phase modulation, 1.1 radian
- Modulation type – digital with phase discretization - 0.0044 radians
- Spurious emission attenuation: not less than 40dB
- Bit rate: 400Baud

2.2 Channel 121.5MHz specifications:

- Operation frequency – 121.5MHz
- Output power – 50mW
- Modulation – AM sweeptone 400-1500Hz
- Modulation type – digital
- Frequency stability – not more 2ppm

2.3 Module general specifications:

- Power supply: 5.8 – 9.0 V
- Average current consumption: 27mA
- Operation modes: emergency / test
- Self test includes: battery voltage test, output power, frequency capture, GPS source tests
- Operation temperature range: -20°C +55°C. (Required to be installed in the case)
- Module size: 25mm x 70mm x 7.5mm (height is indicated with add-on components)
- Module weight: not more than 15 grams

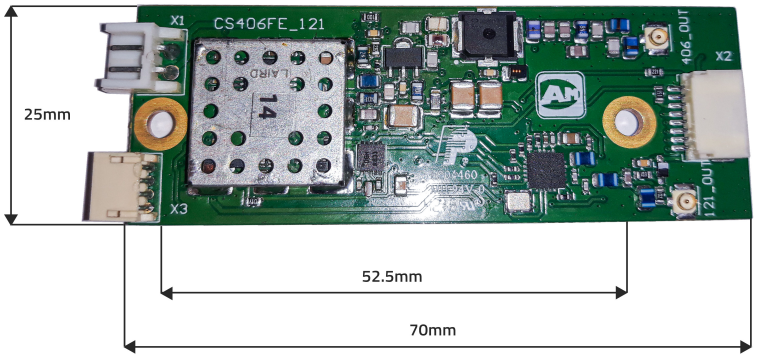


fig 2.1 – 406MHz and 121.5MHz PCB dimensions

3. TECHNICAL STANDARDS

3.1 **CS-T001-2019 –** 406MHz and 121.5MHz PCB module is designed under Cospas-Sarsat T.001 specifications for 406MHz distress beacons.

3.2 **CS-T007-2019** – Module complies with Cospas-Sarsat T.007 406 MHz Distress Beacons Type Approval Standards.

3.3 **IEC 61097-2** – Module complies with IEC 61097-2. Operational and performance requirements, methods of testing and required test results.

3.4 US **RTCM 11000** and **RTCM 11010** standards for 406MHz beacons

3.4 Canadian **RSS-287** - Radio Standard Specification

3.5 European Telecommunication Standard - **ETS 300 066**

*** The compliance is limited by integration requirements.**

4. MODULE OPERATION

4.1 406MHz and 121.5MHz PCB module has 3 operation modes:

- **Emergency** – mode of standard messages sending on CS-T-001-2019

- **Test** – mode of test message sending on CS-T-001-2019

- **Boot** – software loading mode

4.2 Module has following connectors:

- X1 – power source connector.
Type: 2 pin, 2,5mm step. **Reverse connector**: JST Sales America Inc. EHR-2

- X2 – interface controlling connector.
Type: 8 pin, 1,0mm step. **Reverse connector**: JST Sales America Inc. NSHR-08V-S

- X3 – interface programming connector.
Type: 4 pin, 1,5mm step. **Reverse connector**: JST Sales America Inc. ZHR-4

- XW1 – connector for passive antenna GPS-GLONASS or for connection cable to Carrier board.

Type: Output U.FL. **Reverse cable connector**: Hirose U.FL-LP-066.

- XW2 – 406MHz antenna output. Intended for antenna or measuring equipment connection.

Type: Output U.FL. **Reverse cable connector**: Hirose U.FL-LP-066.

- XW3 – 121,5MHz antenna output. Intended for antenna or measuring equipment connection.

Type: Output U.FL. **Reverse cable connector**: Hirose U.FL-LP-066.

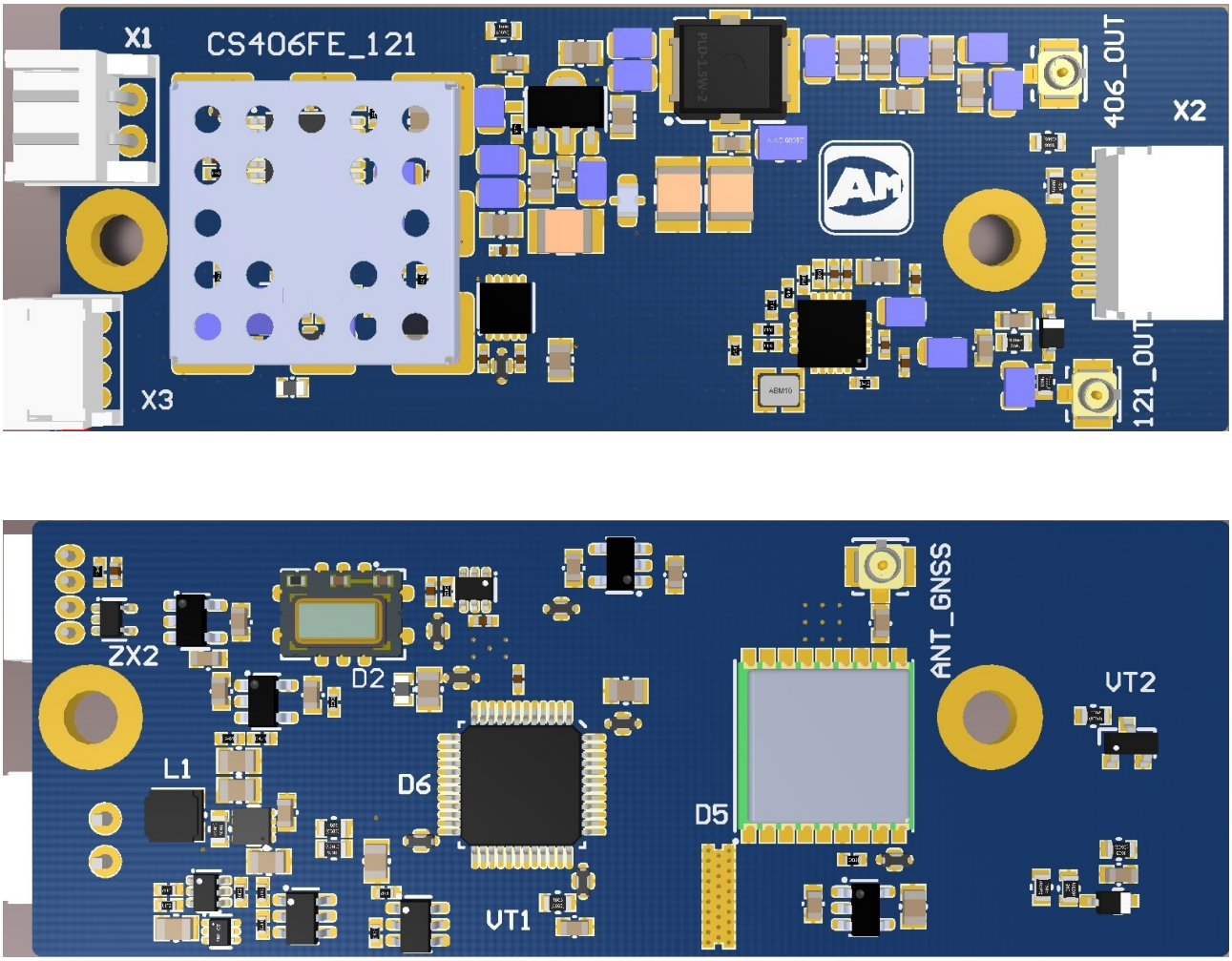


fig. 4.2 – 406MHz and 121.5MHz PCB module scheme, two sides

4.3 Control interface of the module – X2

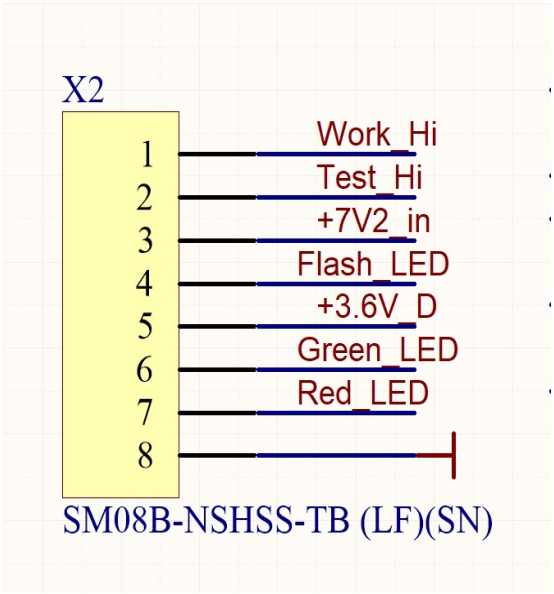
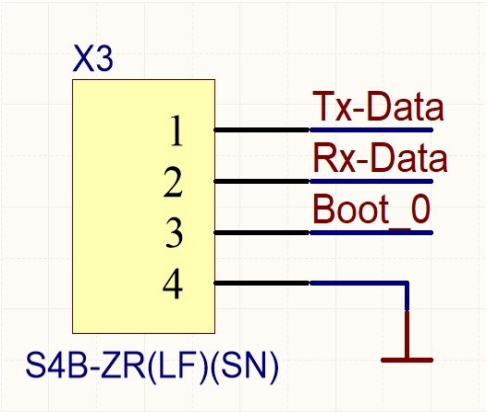


fig. 4.3 – Main control interface layout

The pins with numbers: 8 are GND-Negative power
The pins with numbers: 1, 2 – +7.2V output for switches between Work and Test modes
Pin 1 - Signal input to enable operating mode
Pin 2 - Signal input to enable test mode
Pin 3 - + 7V2_in - supply voltage of switches for working and test modes
Pin 4 – Out of strobe-impulse to power the LED. Active low level.
Pin 5 - + 3.6V_D - LED supply voltage.
Pin 6 – green light ON/OFF output. Active Hi level.
Pin 7 – red light ON/OFF output. Active Hi level.

Module can communicate with external controller via UART on X3 connector
with speed 115200Baud.



4.4 Module operation modes

4.4.1 Emergency mode

X2_Pin 1 “Work_Hi” – emergency mode
emergency mode ON: applying of constant +5.8…+9.0V level
emergency mode OFF: 0V

4.4.2 Test mode

X2_Pin 2 “Test_Hi” – test mode
test mode ON: short time applying of constant +5.8…+9.0V level
test mode OFF: 5 sec. applying of +5.8…+9.0V

4.4.3 Boot mode

X3_Pin 3 “Boot_0” – applying of high level (CMOS=3.6V) turns ON the mode of firmware downloading in MCU

4.4.4 Service mode

X3_Pin 1 “TxData”, X3_Pin 2 “RxData” – UART for external controller

4.4.5 Coding mode

To check operating and programming modes **MMSI** and **Beacon Identifier** please mount the module on Carrier board.

5. PCB MODULE CODING

5.1 There is software available for PCB coding with unique ID or MMSI. By default only user location EPIRB C/S message protocol is available. But any C/S message protocols are supported.

5.2 Coding procedure

MMSI and Country Code can be coded only in TEST mode.

In this module protocol User Location EPIRB with MMSI is implemented

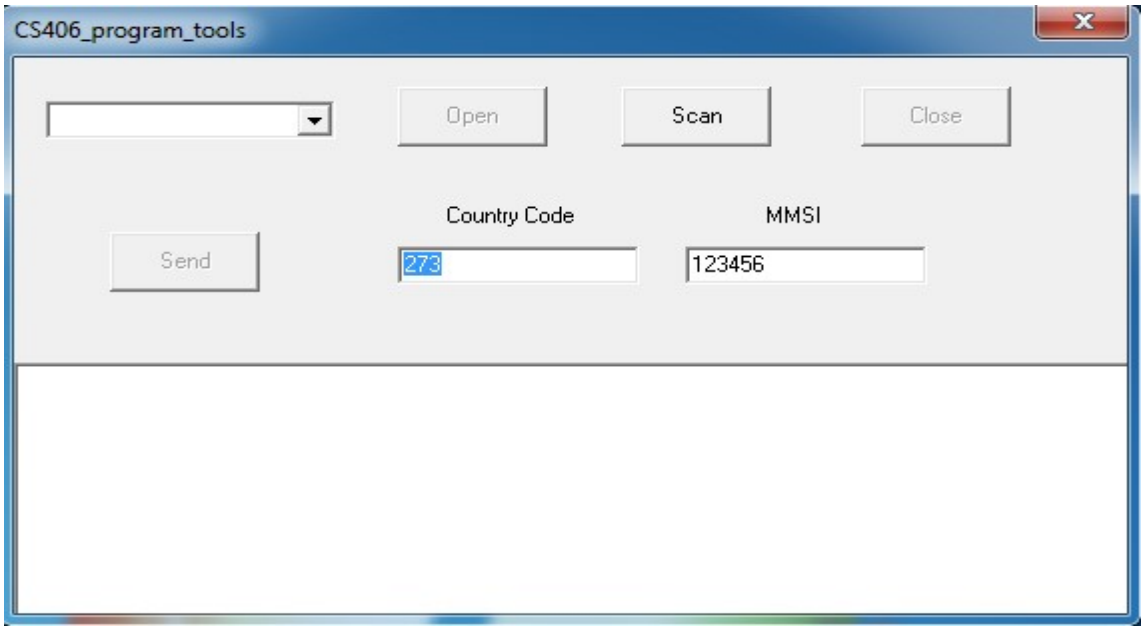


fig. 5.1 – Interface layout of program

Button “Scan” finds available COM-ports and shows in drop down list:

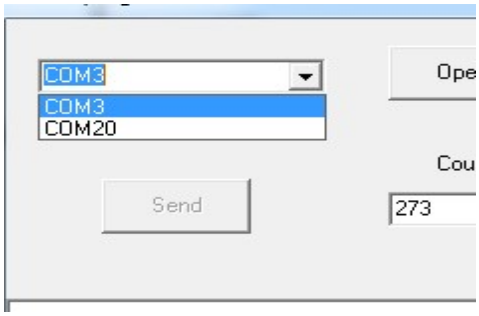


fig. 5.2 – COM-ports drop down list

After necessary COM-port is chosen, button Open becomes available and opens the chosen COM-port.

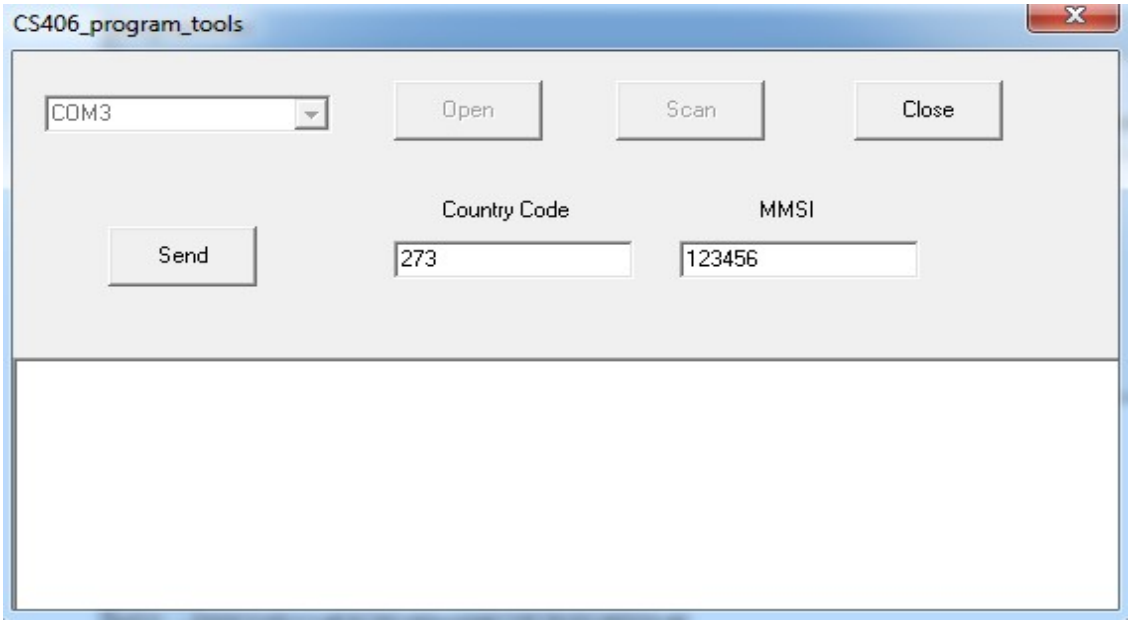


fig. 5.3 – Country Code and MMSI sending

If COM-port is available and program opens it, button “Send” can send the data Country Code and MMSI to module.

To code the MMSI and Country Code, run the program and choose COM-port, open COM-port and press TEST button on module. After greeting message press “Send” and send the necessary MMSI and Country Code.

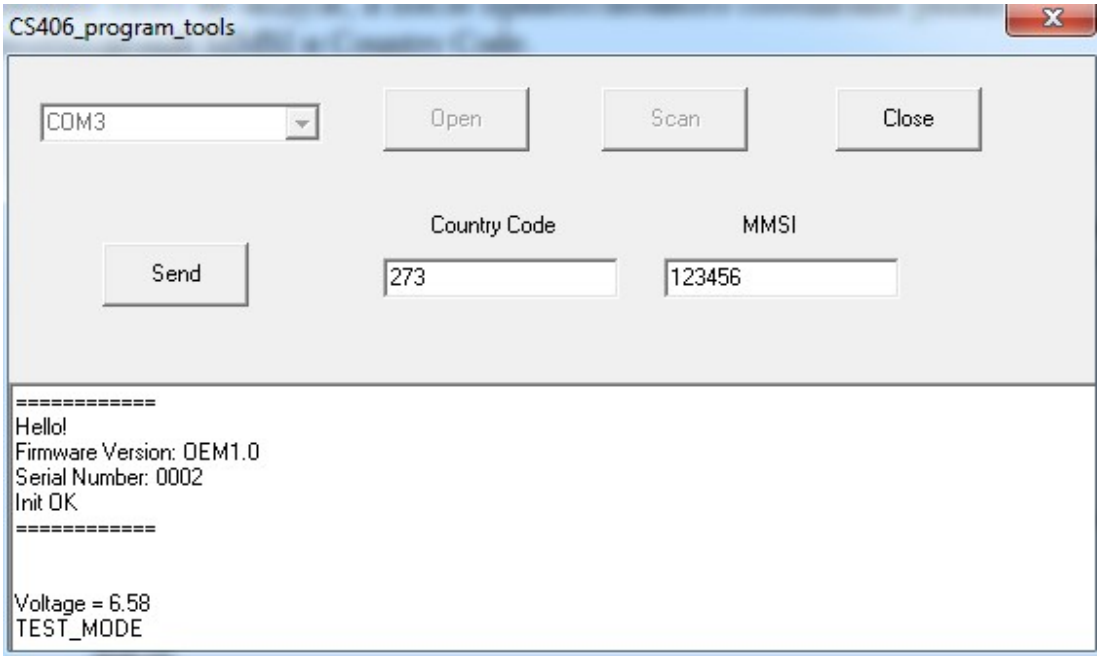


fig. 5.4 – MMSI and Country Code coding

If everything is correct, you will see message “BCH OK!” and HEX-code of message.

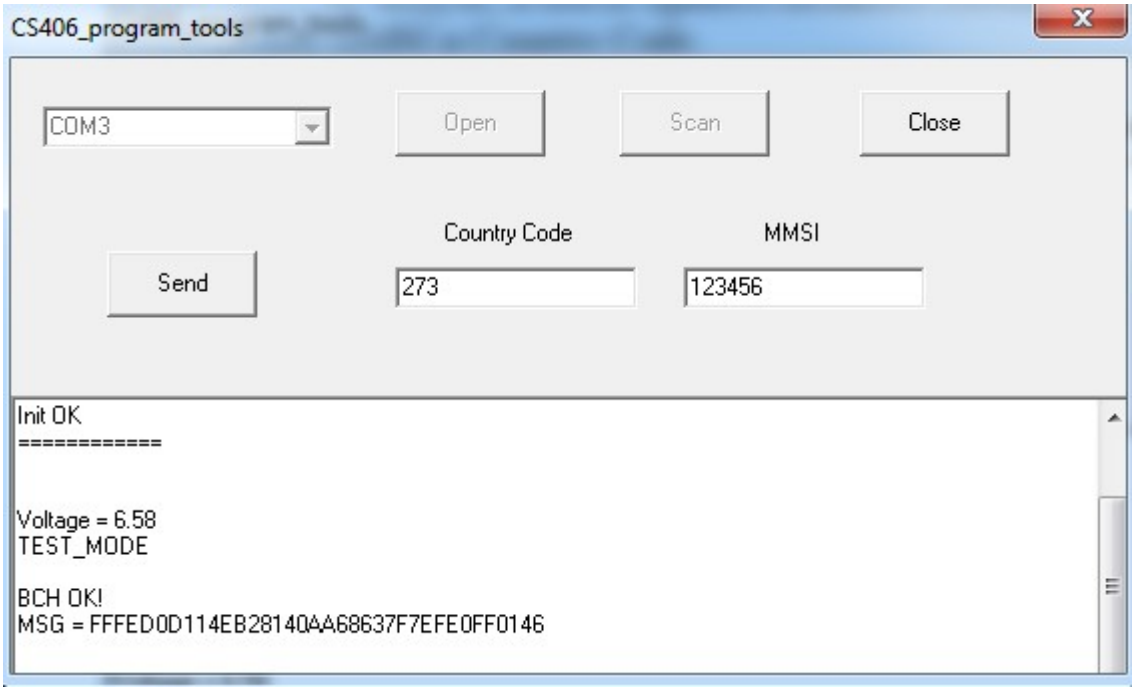


fig. 5.5 – Successful MMSI and Country Code coding

Command to load message into module
:MSG=[18 bites message]\r\n

6. MODULE INTEGRATION

6.1 406MHz and 121.5MHz PCB module can be integrated in ready or new device.

It can operate separately as ready device or as a part controlled by external main board.

6.2 Minimum integration requirements

6.2.1 External case

The case should comply with minimum C/S requirements: have separate emergency and test mode buttons and comply with device type – PLB, EPIRB or else. It should have enough space for PCB itself and power supply units.

6.2.2 406MHz antenna

406MHz antenna should comply with CS-T-001-2019 item 2.3.3 and IEC61097-2 item.4.7.

Antenna socket: U.FL
Reverse cable connector: Hirose U.FL-LP-066.

6.2.3 GPS-GLONASS antenna

Any passive GPS-GLONASS antenna
Antenna socket – U.FL
Reverse cable connector - Hirose U.FL-LP-066

6.2.4 Power supply source

The module should be powered by 5.8-9.0V external power source.

For 24 hours of operation at -20C module requires at least 1000 mAh capacity with average consumption of 27mA and ability to support max. current up to 1.6A.

6.2.5 Direct connection to control buttons on the case

The PCB can be directly installed in the case and connected to buttons on the case to power on in one of the two operation modes: emergency or test.

6.2.6 External control board

The PCB can be connected by means of main connector X2 to any main board. See EVO board as example.

6.2.7 Flashlight

Module generates a strobe-impulse to control an external flashlight, placed on the casing.

APPLICATION

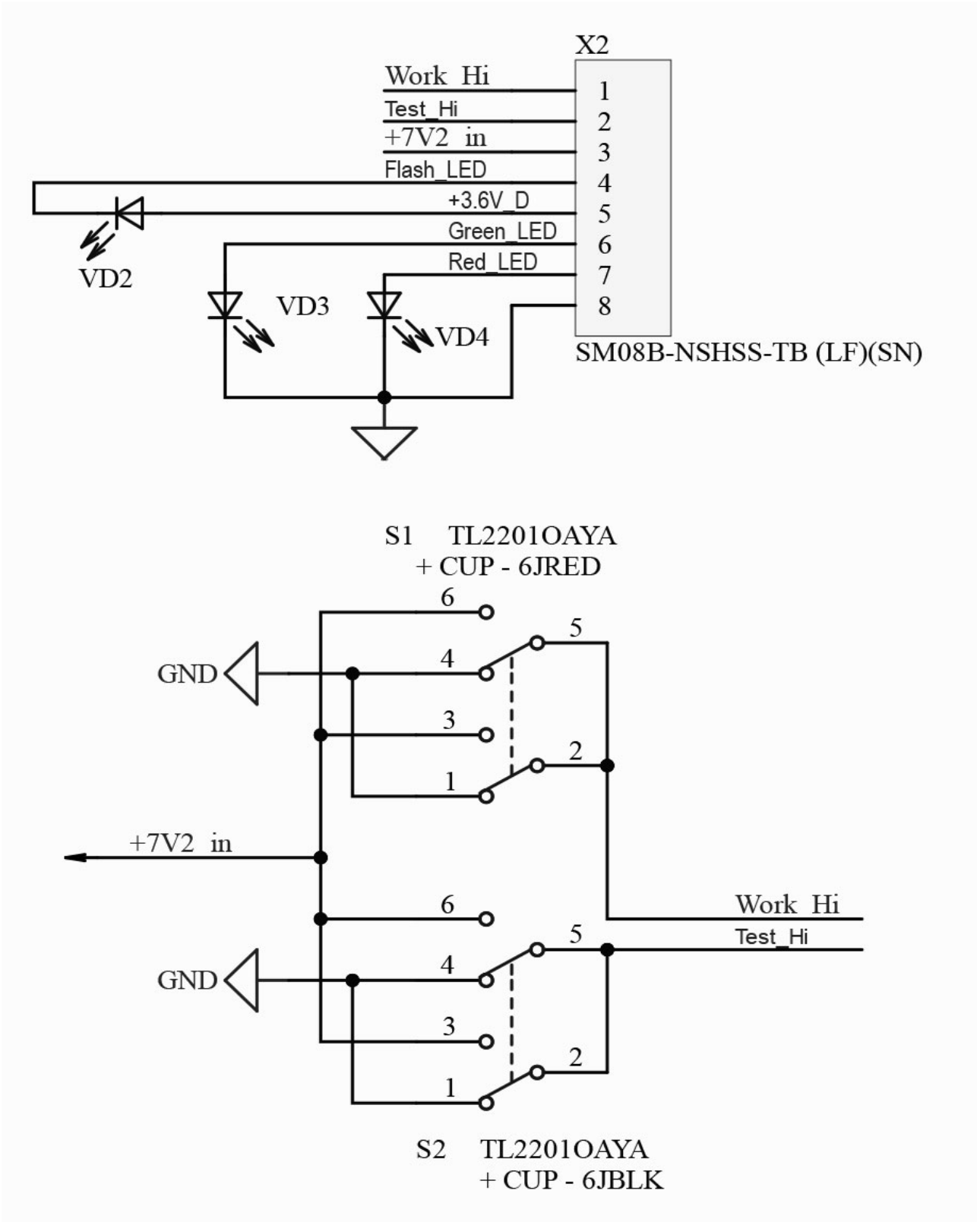


fig. 6.1 – Carrier board schematic diagram