C101-D9S

Application board (rev. C)

User guide

Abstract

This document explains the use of C101-D9S application board. The C101-D9S board enables customers to evaluate L-band GNSS correction services with the NEO-D9S correction data receiver.

Document information

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This document applies to the following products:

Product name	Type number	Firmware version	PCN reference
C101-D9S	C101-D9S-0-00	PMP 1.04	N/A

Contents

1 Introduction

The C101-D9S board is a convenient tool that allows customers to become familiar with the u-blox NEO-D9S L-band correction data receiver. The board provides facilities for evaluating the product and demonstrating its key features.

NEO-D9S is a satellite data receiver for L-band correction broadcasts and can be configured for use with a variety of correction services. Using such correction services enables high precision navigation globally in multiple regions, as well as coverage across continents.

The C101-D9S application board offers:

- NEO-D9S module for use as L-band correction data receiver
- USB connection for communication and power supply
- L-band antenna connection for receiving the satellite data stream
- Arduino shield connection

1.1 Package contents

The delivered package contains:

- C101-D9S board
- L-band antenna
- Antenna ground plane (12 cm circular)
- USB interconnect cable
- Jumper connectors

Prior to using the board, it is useful to download the appropriate evaluation software and keep handy the documents listed in the Related documents section.

2 C101-D9S product overview

2.1 Components

C101-D9S houses the NEO-D9S L-band correction data receiver. The board is powered from the USB cable connection or via Arduino shield. The main components of the board are listed below and shown in Figure 1 and Figure 2:

- Native USB port
- FTDI USB bridge
- SMA RF connector and antenna supply capability (L-band)
- UART2 interface through Arduino shield
- NEO-D9S RESET button
- NEO-D9S SAFEBOOT button

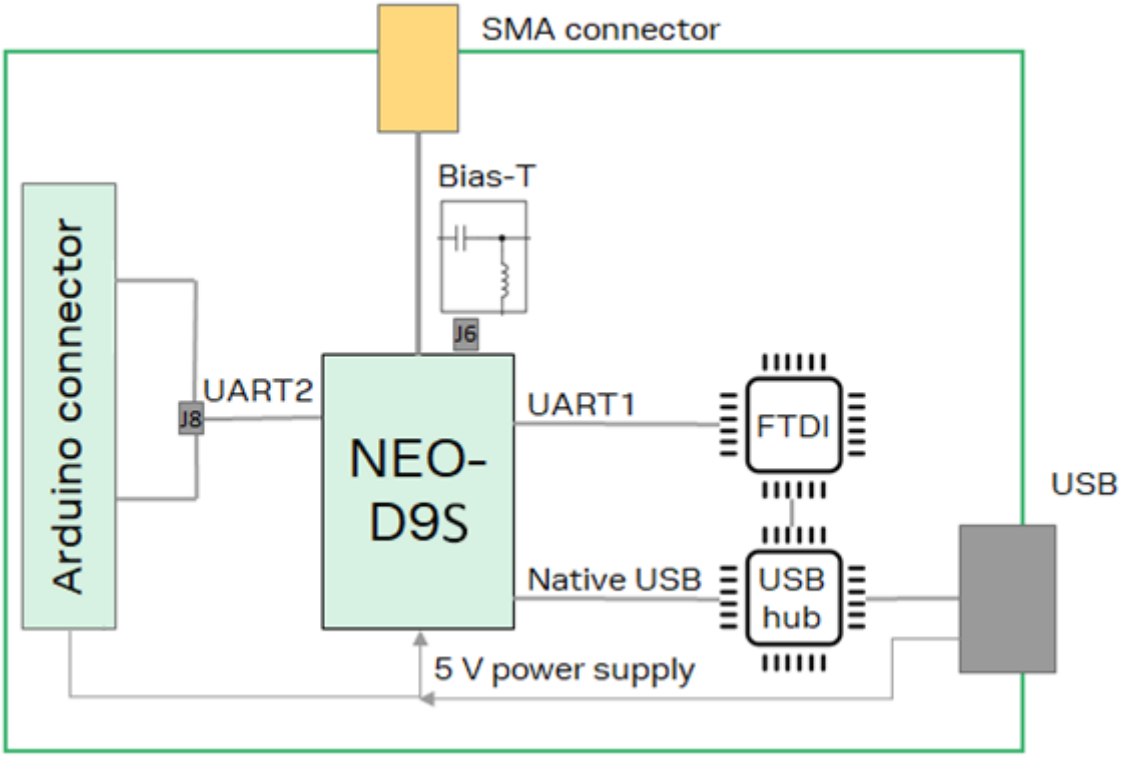


Figure 1: C101-D9S block diagram

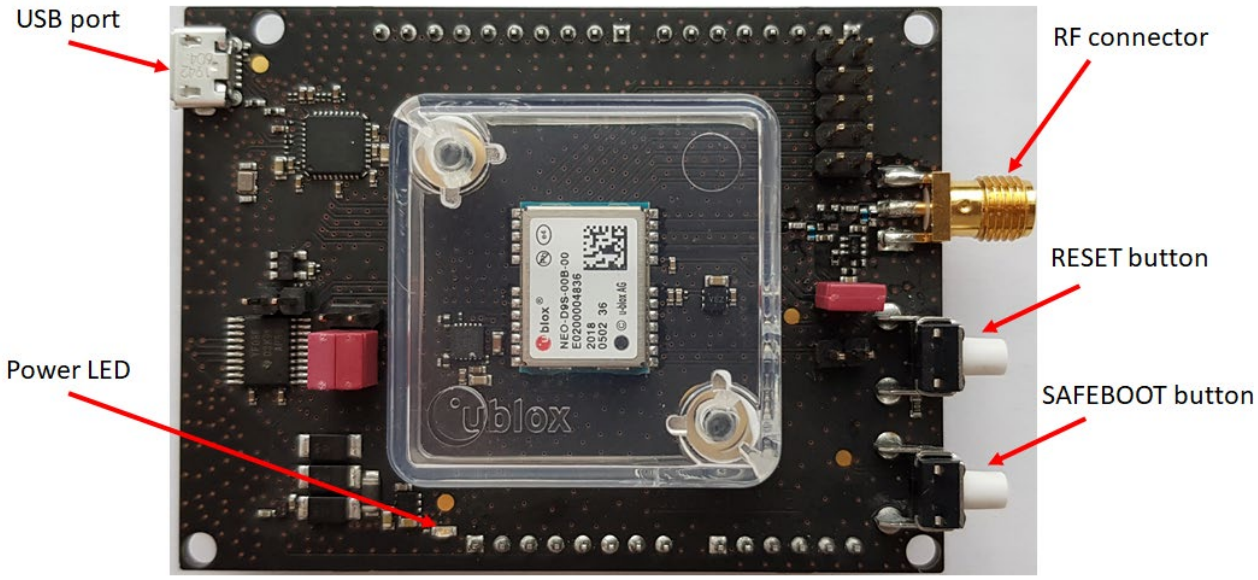


Figure 2: C101-D9S quick start basic overview

2.2 Jumpers

The board is delivered with the following default jumpers:

- **J6**: This jumper provides 3.3 V power supply to an external active antenna plugged to the SMA RF connector. The current limit circuit is also enabled up to 60 mA.
- **J8**: This jumper switches the communication from the UART2 of the NEO-D9S to the J2 or J3 connector of the Arduino shield (refer to Appendix D for further details).

Figure 3: C101-D9S jumpers overview

For further details, see the C101-D9S schematic in Appendix D.

3 C101-D9S standalone operation

This section provides some quicksteps to enable NEO-D9S standalone operation, and connecting via u-center (see u-center user guide [3]).

- Connect the supplied L-band antenna to the RF SMA connector. Ensure good visibility of the GEO communication satellites.
- Connect the USB to a Windows PC, this will power the board. The FTDI and USB drivers will be installed automatically from Windows Update when the user connects the board for the first time.
- The power LED will turn on in blue.
- Start the Device Manager utility from Windows. Two new ports will be visible under the Ports tab: the USB Serial Device is the Native USB port and the USB Serial Port is the FTDI USB bridge port, as shown in Figure 4.

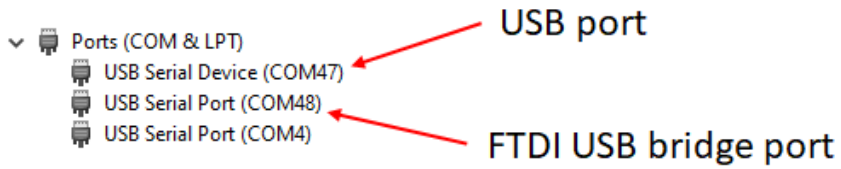


Figure 4: Windows Device Manager Ports identifications

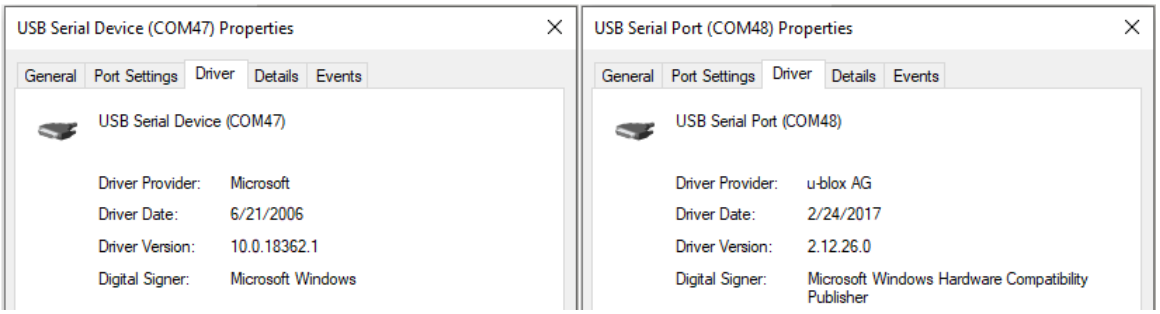


Figure 5: FTDI USB bridge and USB ports properties

- Start u-center and connect to one of the COM ports. If you are using the FTDI USB bridge, make sure the baud rate in u-center is set to 9600.
- Poll UBX-MON-VER message and check the content as shown in Figure 6.

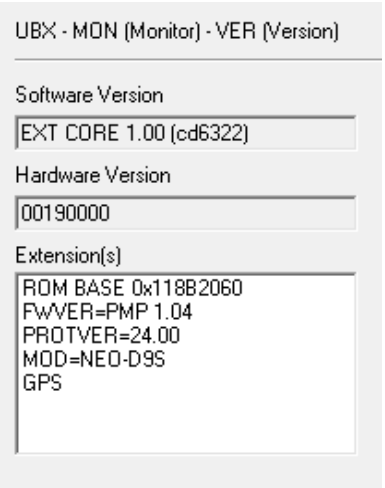


Figure 6: UBX-MON-VER message

NEO-D9S needs to be properly configured to receive the L-band signal correction data. See Appendix B for the default NEO-D9S L-band configuration, which can be adapted for other services.

The messages UBX-MON-PMP and UBX-RXM-PMP (see Figure 7 and Figure 8) can be polled or enabled to check respectively the reception of the signal and the decoded correction data.

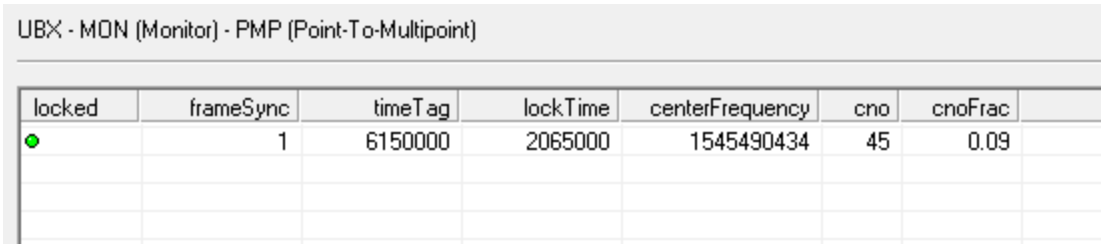


Figure 7: UBX-MON-PMP message

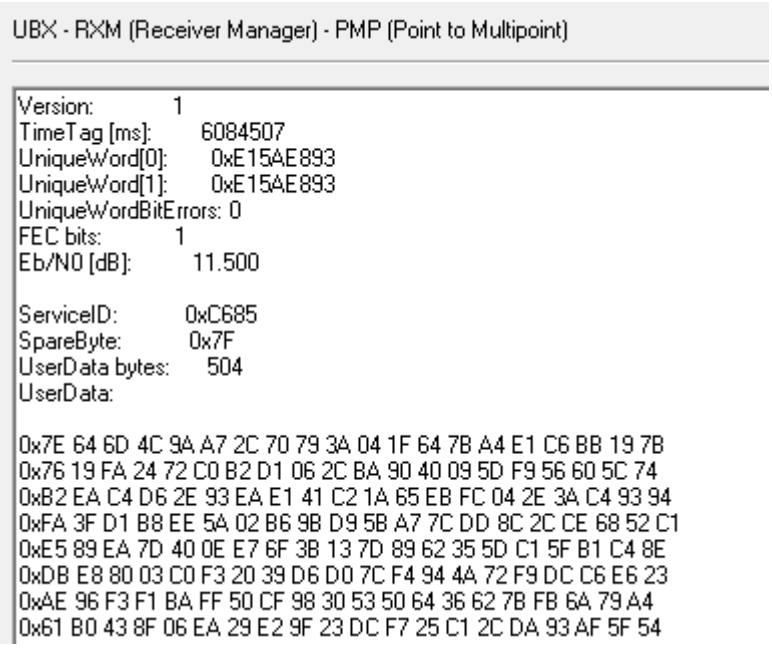


Figure 8: UBX-RXM-PMP message

4 C101-D9S operation with C099-F9P

It is possible to use the C101-D9S board together with C099-F9P. Figure 9 shows how to interface the C101-D9S board with the C099-F9P board.

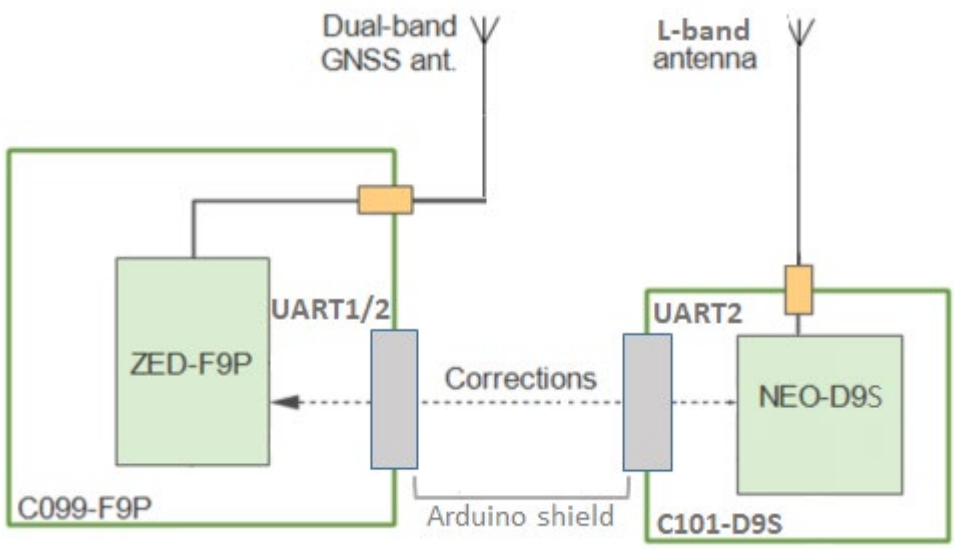


Figure 9: C101-D9S - C099-F9P interfacing scheme

Figure 10 shows the placement of the Arduino connectors on the C101-D9S board and Figure 11 shows how to physically connect the C099-F9P board to the C101-D9S board via the Arduino shield. Jumper J18 on the C099 board is needed for the ZED-F9P to receive the correction data on the UART1 port. See the C099 application board User guide [4] for further details.

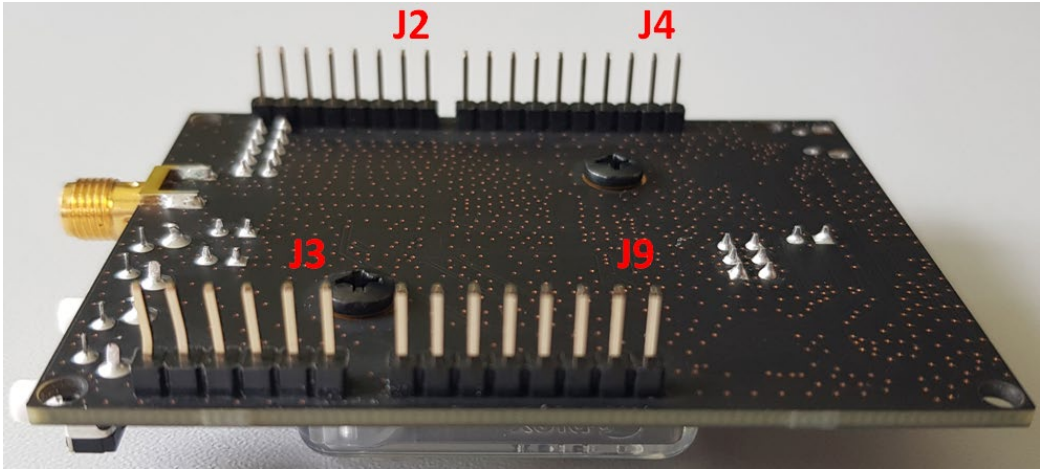


Figure 10: C101-D9S Arduino connectors

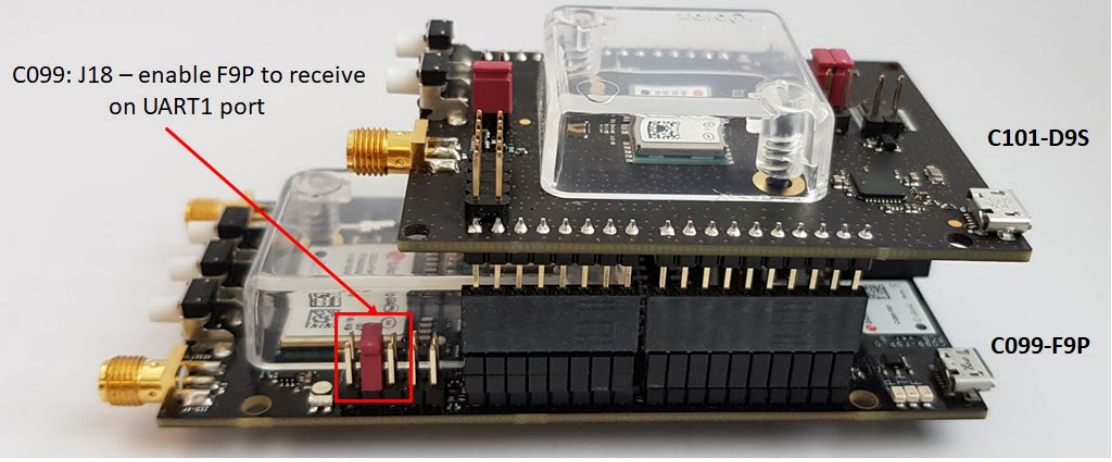


Figure 11: Connecting C101-D9S to C099-F9P

Depending on the position of jumper J8 on the C101-D9S board (as shown below) the ZED-F9P housed on the C099-F9P board will receive the correction data on the UART1 or the UART2 port:

The ZED-F9P receives the correction data on UART1 port.

The ZED-F9P receives the correction data on UART2 port.

For further details, see the C101-D9S schematic in Appendix D.

UBX protocol needs to be enabled in output on the UART2 interface of the NEO-D9S to allow the communication, using the following configuration item:

CFG-UART2OUTPROT-UBX=1

For further details regarding receiver configuration, see the related Interface description [5].

Appendix

A Glossary

Abbreviation	Definition
FTDI	Future Technology Device International
GEO	Geostationary Earth Orbit
LED	Light Emitting Diode
LNA	Low Noise Amplifier
RF	Radio Frequency
RHCP	Right Hand Circular Polarized
SMA	SubMiniature version A
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

Table 1: Explanation of the abbreviations and terms used

B NEO-D9S L-band configurations

Correction services from several providers are available via the L-band communication satellites. The service provider will have several correction service specific configurations that need to be configured before the receiver can provide the relevant service provider data such as:

- Service provider service ID
- Service provider frequency based on geographical location
- Service provider data rate

This means that the frequency allocation for a particular service provider could change. Service providers do provide information on any frequency changes when required.

The NEO-D9S default L-band configuration keys are listed below:

- CFG-PMP-CENTER_FREQUENCY = 1539812500 Hz
- CFG-PMP-SEARCH_WINDOW = 2200 Hz
- CFG-PMP-USE_SERVICE_ID = 1 (true)
- CFG-PMP-SERVICE_ID = 50821
- CFG-PMP-DATA_RATE = 2400 (B2400) bps
- CFG-PMP-USE_DESCRAMBLER = 1 (true)
- CFG-PMP-DESCRAMBLER_INIT = 23560
- CFG-PMP-USE_PRESCRAMBLING = 0 (false)
- CFG-PMP-UNIQUE_WORD = 16238547128276412563

The NEO-D9S correction data receiver is fully compliant with the u-blox configuration concept. The messages UBX-CFG-VALSET, UBX-CFG-VALGET and UBX-CFG-VALDEL are used to configure the above keys. See the NEO-D9S Integration manual [1] for further details.

C L-band antenna specification

The following is an overview of the provided Inpaq L-band antenna, LBAND01D-S6-00:

. Patch

Characteristics	Specification	
Frequency Range	1525~1559 MHz	
Peak Gain	1525 MHz	3.8 dBic
	1537.5 MHz	5.6 dBic
	1550 MHz	3.8 dBic
	1559 MHz	1.3 dBic
Polarization	RHCP	
Axial Ratio	3.0 dB typ.	
VSWR	2.0 typ.	
Impedance	50 ohm	

Filter / LNA

Characteristics	Specification		
Frequency Range	1525~1559 MHz		
Gain	1525 MHz	27.0±3.0 dB	
	1537.5 MHz	27.0±3.0 dB	
	1550 MHz	27.0±3.0 dB	
	1559 MHz	26.0±3.0 dB	
Noise Figure	2.0 dB typ.		
Filter Out Band Attenuation	F_1= 1525 MHz	F_1-50 MHz	> 65 dB
		F_1-100 MHz	> 70 dB
	F_2= 1559 MHz	F_2+50 MHz	> 65 dB
		F_2+100 MHz	> 75 dB
Output VSWR	2.0 typ.		
Operation Voltage	3.0~5.0 V		
Current	13.0±3.0 mA		

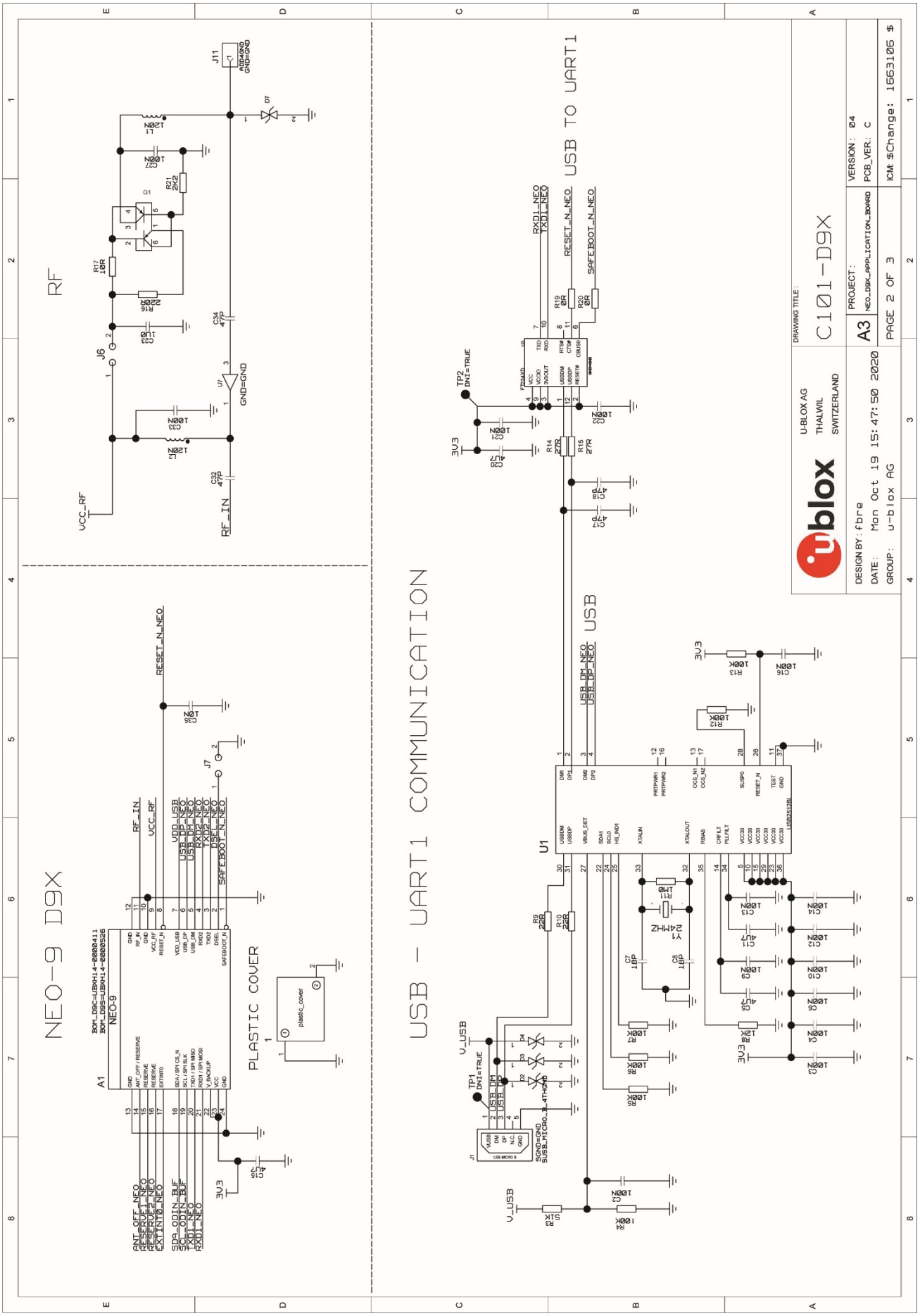
. Overall Specification (Through Antenna, LNA, Without Cable Loss)

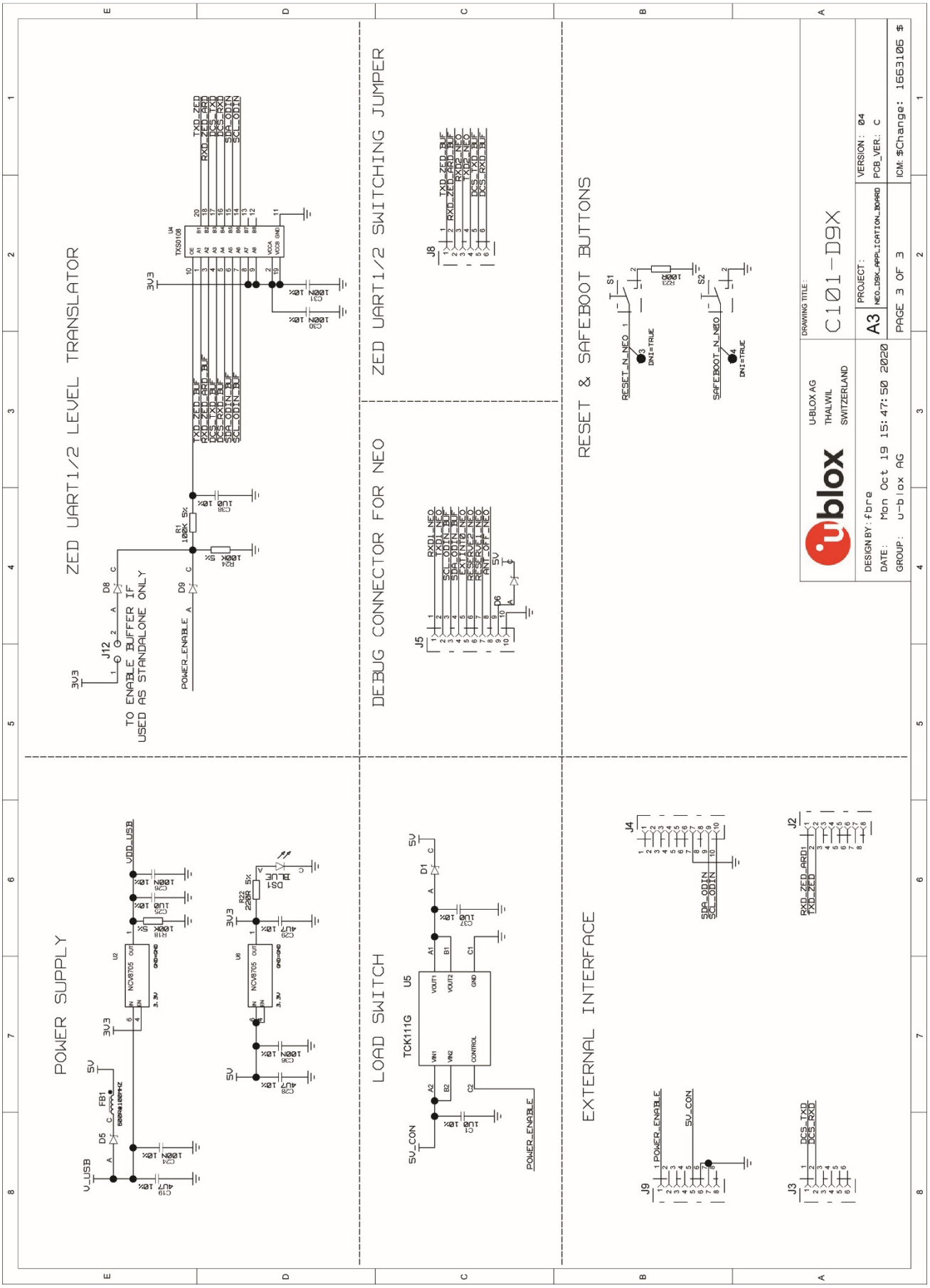
Characteristics	Specification	
Frequency Range	1525~1550 MHz	
Gain	1525 MHz	30.8±3.0 dB
	1537.5 MHz	32.6±3.0 dB
	1550 MHz	30.8±3.0 dB
	1559 MHz	27.3±3.0 dB
'Output VSWR	2.0 typ.	
Operation Voltage	3.0~5.0 V	
Current	13.0±3.0 mA	

See the NEO-D9S Integration manual [1] for further details.

D C101-D9S schematics

The following pages show the complete schematics for the C101-D9S evaluation board.


RF
NEO-9 D9X
USB - UART1 COMMUNICATION
USB TO UART1
PLASTIC COVER
C101-D9X
U-BLOX AG
THALWIL
SWITZERLAND
DESIGN BY: fbre
DATE: Mon Oct 19 15:47:50 2020
GROUP: u-blox AG
DRAWING TITLE:
A3
PROJECT: NEO_D9X_APPLICATION_BOARD
PAGE 2 OF 3
VERSION: 04
PCB_VER: C
ICM: $Change: 1663106 $
VCC_RF
RF_IN
GND=GND
3V3
V_USB
USB_DM_NEO
USB_DP_NEO
RESET_N_NEO
SAFEBOOT_N_NEO
RXD1_NEO
TXD1_NEO
ANT_OFF_NEO
RESERVE1_NEO
RESERVE2_NEO
EXTINT0_NEO
SDA_ODIN_BUF
SCL_ODIN_BUF
TXD1_NEO
RXD1_NEO
VDD_USB
RXD2_NEO
TXD2_NEO
SAFEBOOT_N
U1
J1
J6
J7
J11
TP1
TP2
X1
24MHZ


ZED UART1/2 LEVEL TRANSLATOR
TO ENABLE BUFFER IF
USED AS STANDALONE ONLY
ZED UART1/2 SWITCHING JUMPER
DEBUG CONNECTOR FOR NEO
RESET & SAFEBOOT BUTTONS
POWER SUPPLY
LOAD SWITCH
EXTERNAL INTERFACE
U-BLOX AG
THALWIL
SWITZERLAND
C101-D9X
A3
PROJECT:
NEO_D9X_APPLICATION_BOARD
VERSION: 04
PCB_VER: C
PAGE 3 OF 3
ICM: $Change: 1663106 $
DESIGN BY: fbre
DATE: Mon Oct 19 15:47:50 2020
GROUP: u-blox AG

Related documentation

[1] NEO-D9S Integration manual, UBX-19026111
[2] ZED-F9P Integration manual, UBX-18010802
[3] u-center User guide, UBX-13005250
[4] C099 application board User guide, UBX- 18063024
[5] U-blox D9 PMP 1.04 Interface description, UBX- 21040023

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Revision history

Revision	Date	Name	Comments
R01	30-Jul-2020	dama	Initial release
R02	24-Jun-2021	dama	Add chapter 4: C101-D9S operation with C099-F9P
R03	17-Jan-2022	dama	Chapter 4 update

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