PERSEUS22

4 CHANNELS DIRECT SAMPLING RECEIVER

USER MANUAL

- Revision EN 1.3 - June 2024 -

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Revision History

Revision	Date	Description
Rev 1.2	04/2024	• Added the revision history. • Updated section **3 - System requirements**.
Rev 1.3	06/2024	• Updated section **Technical Specifications**.

1 Receiver description

1.1 Overview

Perseus22 was born from **Elad and Microtelecom** fusion, this allows sharing of technologies, experiences and production capabilities. Microtelecom and Elad has been operating since 1990 and are involved in civil and strategic communication fields, Software Defined Radios, RF instrumentation, Data Acquisition Systems and Electromagnetic Compatibility Instrumentation and assessment tests.

Perseus22 is a **4 channels**, direct sampling receiver with a continuous frequency coverage **from 10 kHz to 225 MHz** (usable up to 240 MHz, for DAB) and a typical image rejection larger than 70 dB.

All channels are synchronously sampled by a **high SNR, 14 bits A/D converter** and processed by a software defined digital down converter, implemented on an FPGA, which outputs are routed to the host computer by an USB 3.0 controller, allowing wide bandwidth IF applications.

The frequency coverage is split-up into 2 groups of channels:

- the first group with 2 channels for VLF-HF frequency range (10 kHz to 70 MHz),
- the second group with 2 channels for VHF frequency range (70 MHz to 225 MHz).

Each group is capable of **diversity** which can reduce noise on the order of tens of dB. All channels include an analog RF frontend equipped with attenuators, preselection filters and amplifiers.

The receiver enclosure is machined from solid aluminum and finished with a fine, non-reflective, black surface treatment.

The new multichannel software which allows Perseus22 management was born from the new team formed by Elad and Microtelecom developers. It takes advantage on an agile GUI interface platform, integrating most of DSP past experiences and ready for adding new modules for demodulators and decoders.

The **available demodulations** are AM, SAM, QSAM, CW, CWr, RTTY, RTTYr, LSB, USB, IQ, FM, WFM and DAB+ with sampling frequencies of 250, 500, 1000 and 2000 kSps (maximum displayed span of 1600kHz).

WARNING!
Read carefully the section **4 - Operating the receiver safely**, prior to use your receiver. Failing to observe the indications herein listed could seriously damage the receiver and voids the warranty.

1.2 Front panel description

⏻ **& Fn:** power button and function led.
Press the **power button for at least one second** to turn the Perseus22 on/off, the Fn led will turn on/off.
Notes about the power management.

1. The Perseus22 **detects the connection to the computer**.
   When the computer is turned off or if the Perseus22 is not connected to a USB port, an internal circuit disables the Perseus22 and put it in **stand-by state**. When in stand-by state the Fn led blinks every 3 seconds.
2. The Perseus22 **detects the lack of power supply** or a too low a voltage value.
   When the USB port is connected and powered, if the power supply is not present or too low, the Perseus22 goes into stand-by and indicates this situation **by blinking the Fn led quickly 4 times** every 3 seconds.
3. The default behavior of the power button (on/off) can be bypassed to have the Perseus22 **automatically turn on** when powered up.
   To enable (and disable) this feature **called remote mode, keep pressed the power button** for about 8 seconds until the Fn led begins to blink quickly continually, then release the power button.

HF1/HF2 - En: channel status.
This led is turned on when the corresponding HF **channel is activated**.

HF1/HF2 - Wb: wideband mode.
This led indicates that the HF channel is operating in **wideband mode**, i.e. no RF preselection filters inserted in the signal path.
NB: each channel has its own preselection filters.

HF1/HF2 - Att: attenuator status.
This led indicates that one of the HF channel **attenuator is inserted**. The HF channels have four levels of attenuation: 0, 10, 20 and 30 dB.
NB: each channel has its own attenuators.

VHF1/VHF2 - 70 ⊥ 112: VHF band selection.
This led indicates that the VHF channel is operating in the **70 - 112 MHz frequency range**.

VHF1/VHF2 - 112 ⊥ 137: VHF band selection.
This led indicates that the VHF channel is operating in the **112 - 137 MHz frequency range**.

VHF1/VHF2 - 137 ⊥ 174: VHF band selection.
This led indicates that the VHF channel is operating in the **137 - 174 MHz frequency range**.

VHF1/VHF2 - WBIF: VHF band selection.
This led indicates that the VHF channel is operating in the **174 - 225 MHz frequency range**.
NB: this band is optimized for wideband IF use.

VHF1/VHF2 - Att: attenuator status.
This led indicates that one of the VHF channel **attenuator is inserted**. The VHF channels have four levels of attenuation: 0, 6, 12 and 18 dB.
NB: each channel has its own attenuators.

1.3 Rear panel description

VHF1: antenna connector.
VHF 1, SMA type, 50 Ω input connector for 70 MHz to 225 MHz frequency range. For best performance connect the Perseus22 to a suitable 50 Ohm antenna system.

VHF2: antenna connector.
VHF 2, SMA type, 50 Ω input connector for 70 MHz to 225 MHz frequency range. For best performance connect the Perseus22 to a suitable 50 Ohm antenna system.

REF-IN: reference input.
SMA type reference-input connector. Accepts a 100 MHz, 0 dBm typical, reference signal (min. -3 dBm, max. +6dBm).

SYNC: synchronization connectors.
Synchronization input/output connectors for future use, LVDS compatible.

USB 3.0: USB connection.
Type-B USB 3.0 connector. Connect the Perseus22 to a computer USB 3.0 port with the cable provided.

POWER: power connection.
Connector for regulated power supply. Use the Perseus22 only with the wall adapter provided with it. Improper voltage power supplies may seriously damage the Perseus22.

HF1: antenna connector.
HF 1, SMA type, 50 Ω input connector for 10 kHz to 70 MHz frequency range. For best performance connect the Perseus22 to a suitable 50 Ohm antenna system.

HF2: antenna connector.
HF 2, SMA type, 50 Ω input connector for 10 kHz to 70 MHz frequency range. For best performance connect the Perseus22 to a suitable 50 Ohm antenna system.

2 USB driver installation

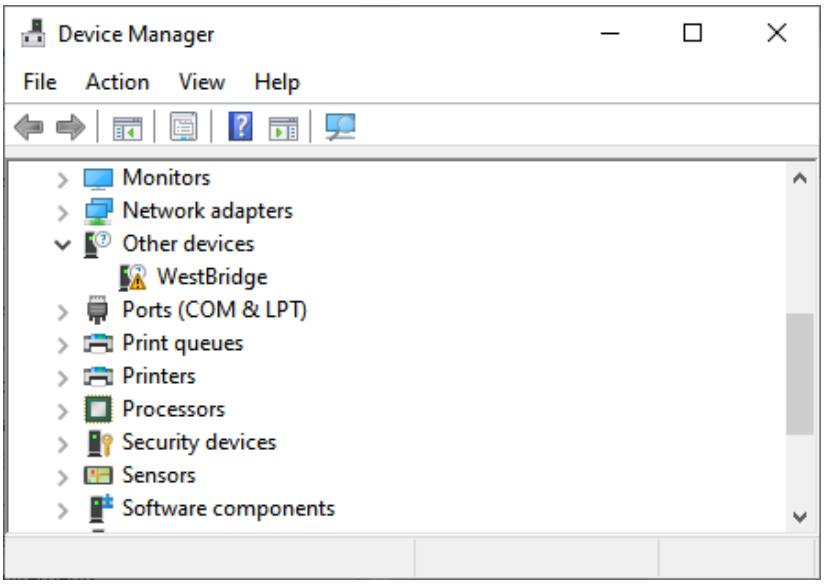
2.1 Preparation

Download the Perseus22 software from this address: https://www.microtelecom.it/en, it also includes the driver. Unzip the folder and place it in the location of your choice on your computer.

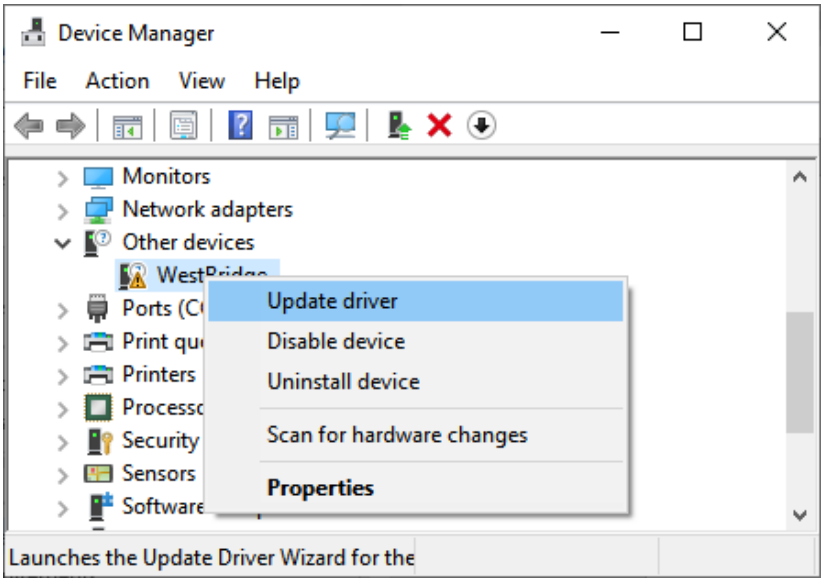
Now connect the Perseus22 to the wall adapter which must be powered, then connect the provided USB3.0 cable between the Perseus22 and your computer.

2.2 Installation

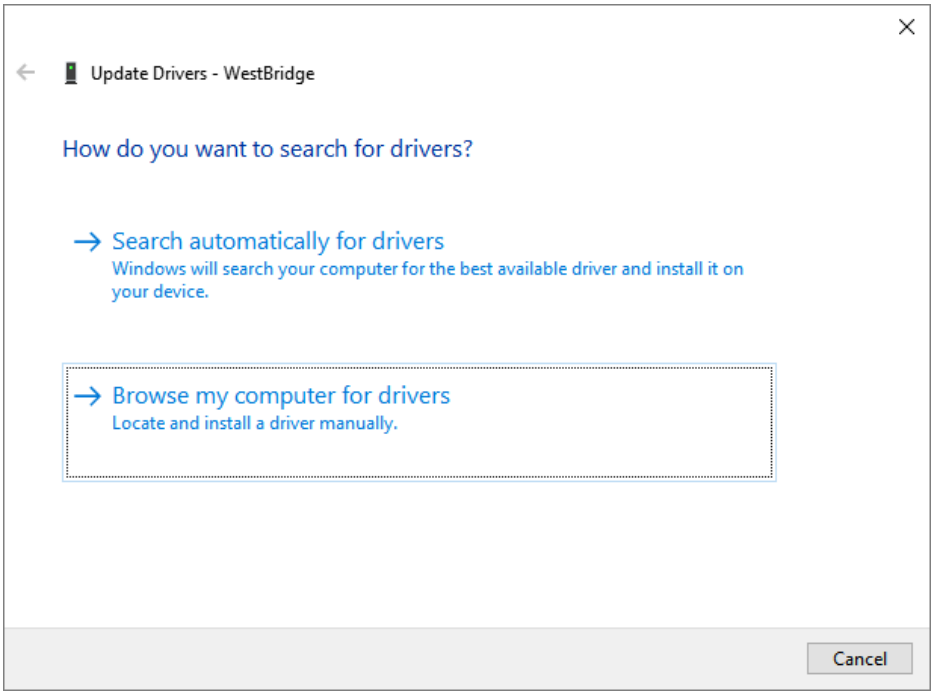
Once the first preparation step is done, open the Windows Device Manager and locate the **WestBridge** entry inside the **Other devices** section.



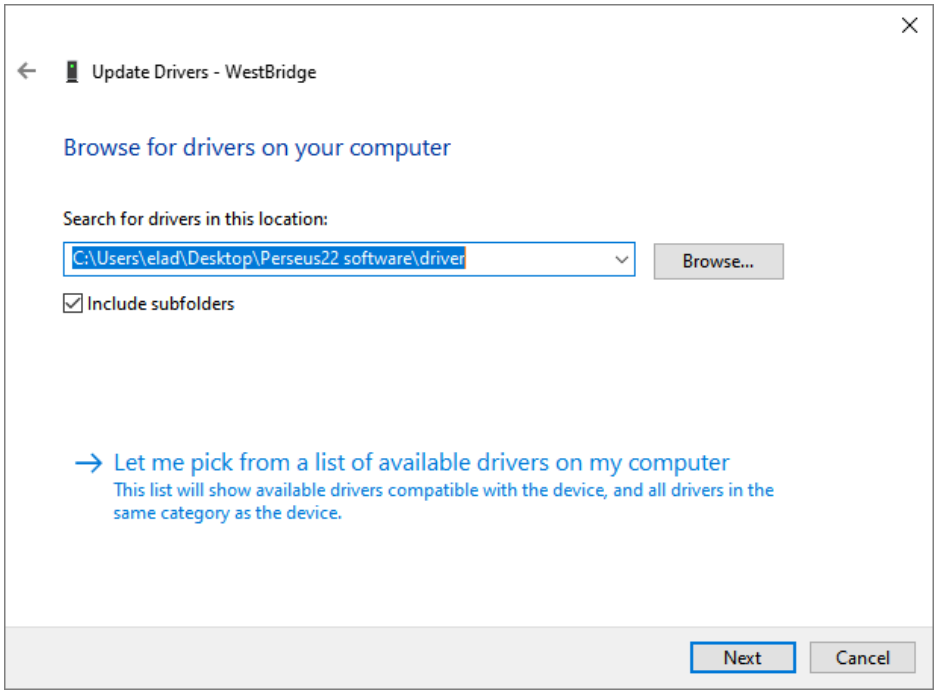
Select the **WestBridge** entry, right click on it and choose **Update driver**.



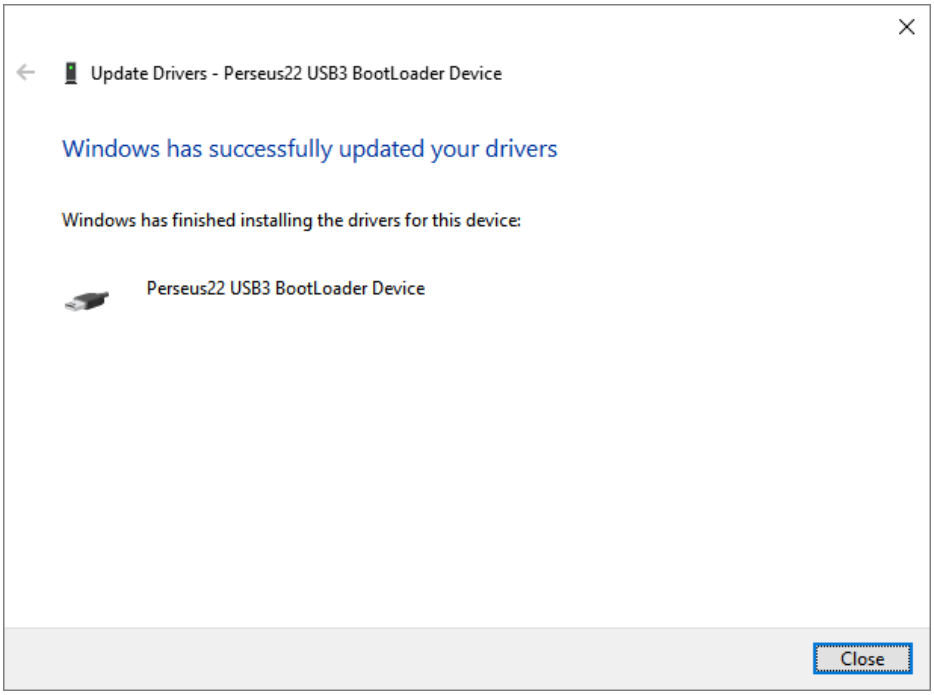
Choose to **browse** for your computer.



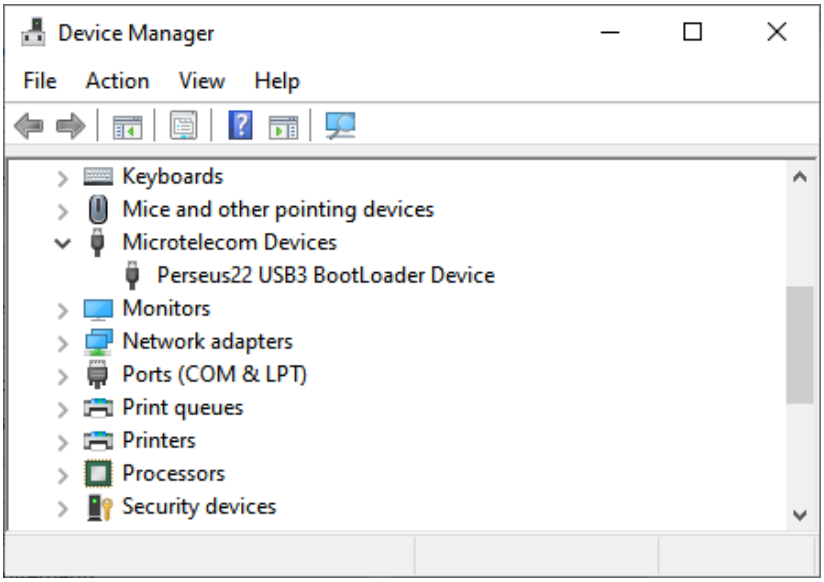
Click on the **Browse button** and choose the path of the **driver folder** which is inside the Perseus22 software folder you downloaded before. Then click **Next**.



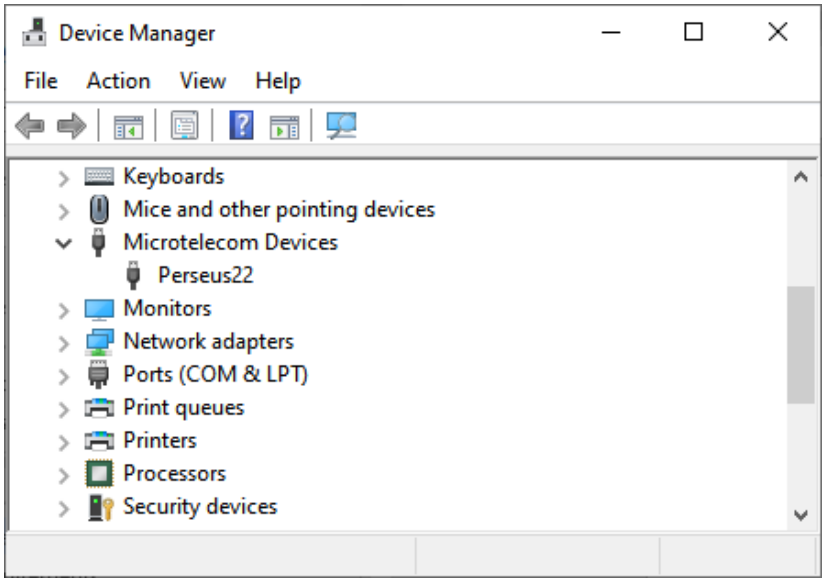
The **outcome window** must be the one below.



Now the Device Manager will have the **Perseus22 USB3 BootLoader Device** entry under the **Microtelecom Devices** section.



Once the Perseus22 software is launched, the **Perseus22 USB3 BootLoader Device** entry becomes **Perseus22.**



3 System requirements

Perseus22 software is a **64-bit** program that uses **OpenGL** libraries.

Supported operating systems are: **Windows 10**, **Windows 11**.

A computer with a **USB 3** port (Type-A or Type-C connector) is required to operate the Perseus22. Note that the Perseus22 is shipped with a USB 3 cable with a Type-A connector, but a USB 3 C-A adapter can be used to connect the Perseus22 to a USB 3 port with a Type-C connector.

Recommended configuration: 9th generation Intel Core i5 processor or higher (or equivalent, for example: AMD Ryzen 5), 16GB of RAM. **Minimum configuration**: 7th generation Intel Core i3 processor (or equivalent, for example: AMD Ryzen 3), 8GB of RAM.

The choice of the **graphics card** used should not be underestimated (whether it is integrated or dedicated), in fact the Perseus22 software uses graphics libraries that exploit the graphics card (GPU), relieving the processor (CPU) of part of the work.

A **configuration lower than the minimum one** can be used but considering (1) the use of other programs in conjunction with the Perseus22 software and (2) the ever-increasing demand for resources by operating systems, the choice is not recommended.

Finally, the **processor** used must support **AVX2 Instruction Set Extensions**.

4 Operating the receiver safely

WARNING!
Failure to observe the following instructions could seriously damage the receiver:

- USE ONLY THE POWER SUPPLY PROVIDED WITH THE RECEIVER,
- DO NOT CONNECT THE ANTENNA CONNECTOR OF THE RECEIVER TO THE ANTENNA CONNECTOR OF A TRANSCEIVER/TRANSMITTER,
- DO NOT CONNECT THE RECEIVER TO AN ANTENNA WHICH IS NEAR AN ANTENNA SYSTEM CONNECTED TO A HIGH POWER HF TRANSCEIVER/TRANSMITTER, I.E. A HIGH RF FIELD.

5 Latest software release

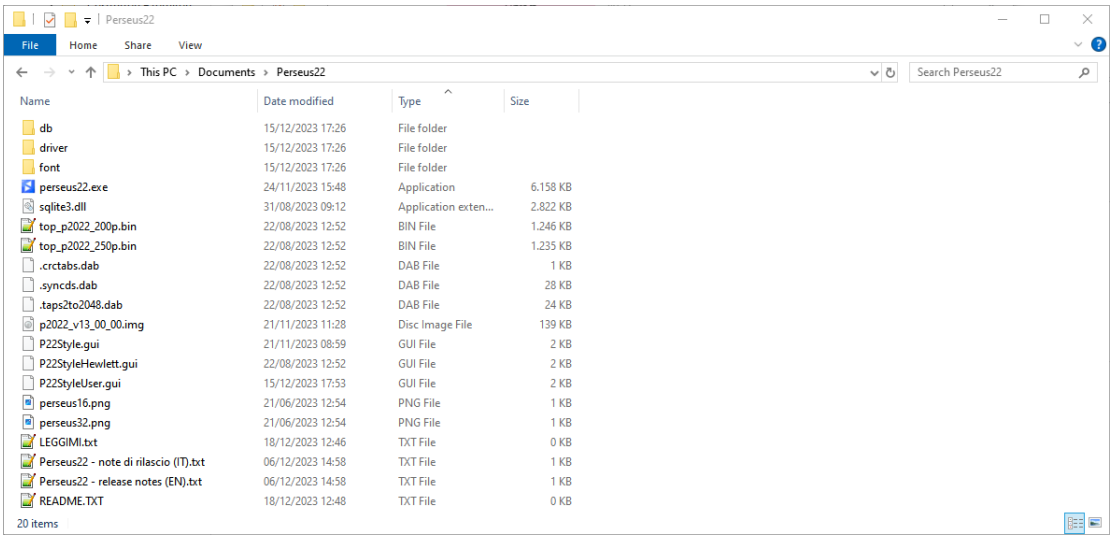
The latest software release is available for download on the internet at the address:

https://www.microtelecom.it/en

Release notes are provided at the same address or in the distributed software.

6 Operating the Perseus22 software

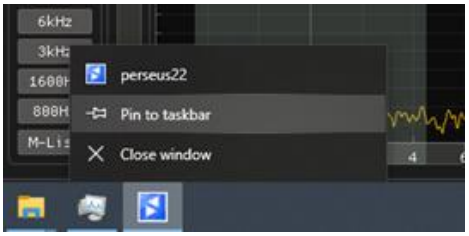
To use the software, simply copy the "*Perseus22*" folder present in the archive (.zip file) of the latest downloaded version onto your computer's disk. Any location is acceptable, such as in the "*Documents*" folder or on a disk/partition other than the main one.



The Perseus22 software is able to work independently and does not install any files on the computer, except for the drivers which must be installed manually. To activate the Perseus22 receiver, run the "*perseus22.exe*" file (double click on the file, or right-click and "*Open*").

To **create a shortcut** to the software on the Desktop, simply right-click (assuming mouse left button is the primary one) on the "*perseus22.exe*" file, select the "*Send to*" item and then click on "*Desktop (create shortcut)*". The Perseus22 software icon will be added to the desktop.

Once the software has started you can also **add it to the taskbar**. To do this, right-click on the software icon in the taskbar and choose "*Pin to taskbar*".



In case of **updating the software** to a more recent version, simply copy the files of the most recent software version into the “Perseus22” folder already present on your computer. User settings files are never overwritten during copying.

If it is necessary to carry out manual actions on the **settings files**, here is a brief description of their function:

- imgui.ini file: graphics settings saving file,
- .gui files: theme (skin) saving files,
- .gst files: files for saving software application settings,
- dbperseus22.db file: file of stored frequencies/stations.

The indicated settings files can be deleted if you do not wish to retain previous graphics/application settings. However, we recommend that you never delete your dbperseus22.db memory file because otherwise the frequencies of all previously stored radio stations will be lost.

Technical Specifications

HF	**HF1 & HF2 antenna connectors**
Frequency coverage	10 kHz - 70 MHz
Preselection [1]	LPF filter: 10 kHz - 1700 kHz BPF filters (MHz): 1.6 - 2.1, 2.1 - 3.0, 3.0 - 4.2, 4.2 - 6.0, 6.0 - 8.4, 8.4 - 12.0, 12.0 - 17.0, 17.0 - 24.0, 24.0 - 32.0, 32.0 - 70.0 Wb (Wideband mode): 10 kHz - 70 MHz
Attenuators [2]	0 / 10 / 20 / 30 dB
Minimum Detectable Signal (MDS)	-131 dBm (14 MHz, 2 Msps, CW, BW 500 Hz)
Input clipping level	-7 dBm (14 MHz, 2 Msps)
Modes (Software defined)	AM, SAM/QSAM, CW/CWr, RTTY/RTTYr, LSB, USB, FM, WFM, IQ
VHF	**VHF1 & VHF2 antenna connectors**
Frequency coverage	70 - 225 MHz (usable up to 240 MHz)
Preselection [1]	70 - 112 MHz band 112 - 137 MHz band 137 - 174 MHz band 174 - 225 MHz band (usable as wideband IF)
Attenuators [2]	0 / 6 / 12 /18 dB
Preamplifier gain	0 or 15 dB
Switchable DC injection (bias)	5 V +/-5%, 80 mA (for each VHF channel)
Sensitivity	less than -13 dBuV (125 MHz, FM, 12 dB SINAD, 2 Msps, preamp ON) less than -12 dBuV (125 MHz, FM, 12 dB SINAD, 0.25 Msps, preamp ON) less than -6 dBuV (100 MHz, WFM, 12 dB SINAD, 2 Msps, preamp ON) less than -5 dBuV (100 MHz, WFM, 12 dB SINAD, 0.25 Msps, preamp ON)
Minimum Detectable Signal (MDS)	-132 dBm (125 MHz, 2 Msps, CW, BW 500Hz) -132 dBm (225 MHz, 2 Msps, CW, BW 500Hz)
Input clipping level	-6 dBm (225 MHz, 2 Msps)
Modes (Software defined)	AM, CW/CWr, RTTY/RTTYr, LSB, USB, FM, WFM, DAB+, IQ
General	
Image rejection	better than 70 dB
ADC sampling rates	200 or 250 Msps
DDC sampling rates	250 Ksps, 500 Ksps, 1 Msps, 2 Msps
PC interface	5 Gbit/s USB 3.0 port
Power supply	9 Vdc, 2A
Operating temperature range	0 - 40 °C
Aluminum cabinet (WxHxD)	215 x 44 x 220 mm (feet included)
Weight	1680 g (without power supply)

1: each channel has its own preselection filters
2: each channel has its own attenuators

Declaration of Conformity (EC)

The product marked as

PERSEUS22

manufactured by

Manufacturer:	Microtelecom S.r.l.
Address:	Via del Gelso, 15 I-33100 UDINE (UD)

is produced in conformity to the requirements contained in the following EC directives:

- Radio equipment Directive 2014/53/EU
- EMC Directive 2014/30/EU
- Low Voltage Directive 2014/35/EU
- RoHS Directive 2011/65/EU

The product conforms to the following product specifications:

Radio, Emissions & Immunity:
EN 301 489-1 V2.2.3 (2019-11)
EN 301 489-15 V2.2.1 (2019-04)
EN 301 783 V2.1.1 (2016-01)
EN 55032:2015/A11:2020
EN 55035:2017/A11:2020

Safety:
EN 62368-1:2014

and further amendments.

This declaration is under responsibility of the manufacturer

Microtelecom S.r.l.
Via del Gelso, 15
I-33100 UDINE (UD)

Issued by

Name: Franco Milan
Function: CEO of Microtelecom S.r.l.

CANEVA	December, 15th 2023	
Place	Date	Signature