

QK-A023 AIS Wireless Receiver (Auto-hopping V2.0)

Features

- Receiving on dual channels (161.975 MHz and 162.025 MHz) alternately
- Auto-hopping channel algorithm improves captured message rate by 4%
- Sensitivity up to -105 dBm @ 30% PER
- Up to 45 nautical miles receiving range
- USB 2.0 powered (<32mA @ 5.0V)
- Serial output: 38400 bps baud rate over USB
- Integrated TCP/IP protocol stack supports up to 4 simultaneous TCP clients
- Message output in NMEA-0183 format
- Supports interworking with GPS receiver
- Adhoc mode
- BNC connector for 50 Ohm VHF antenna
- Compatible with Windows 7, 8, 10, Mac OS X, Linux systems, Android and iOS
- Plug & Play connectivity with chart plotters and PCs
- Compatible with Windows, Mac, Linux, Android and iOS (optional Configuration must be completed using Windows software.)
- This device does not come pre-loaded with map data. We advise using openCPN for map data. Some iOS apps may charge for map use.



Designed in UK

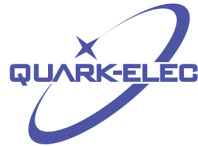




Figure 1 Typical application(Ad-hoc mode)



Figure 2 Typical application(station mode)



Limited warranty

Quark-elec warrants this product to be free from defects in materials and manufacture for one year from the date of purchase. Quark-elec will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and labour. The customer is, however, responsible for any transportation costs incurred in returning the unit to Quark-elec. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs. A returns number must be given before any unit is sent back for repair.

The above does not affect the statutory rights of the consumer.

Disclaimer

This product is designed to aid navigation and should be used to augment normal navigational procedures and practices. It is the user's responsibility to use this product prudently. Neither Quark-elec, nor their distributors or dealers accept responsibility or liability either to the product user or their estate for any accident, loss, injury or damage whatsoever arising out of the use or of liability to use this product.

Accuracy of this manual

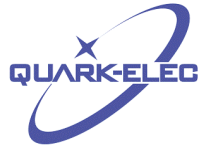
Quark-elec AIS receiver may be upgraded from time to time and future versions may therefore not correspond exactly with this manual. The manufacturer of this product disclaims any liability for consequences arising from omissions or inaccuracies in this manual and any other documentation provided with this product.

Document history

Issue	Date	Changes / Comments
1.0	31-10-	Initial release
2.0	26-01-	Upgrade to Operator Specified Auto-Hopping(V2.0)

Order Information

Part No	Description
QK-A023	Dual channel AIS wireless receiver (Auto-hopping v2.0)



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1 HARDWARE

The QK-A023 is a single channel AIS receive-only unit, designed to be installed in a protected indoor environment for the small-commercial, leisure, fishing boat and vessel monitoring markets in order to listen to other vessel's AIS information. Patented Auto-hop Channel Algorithm(ACA) improves the captured message rate by 4%. Connected to an on board PC running compatible software, or a chart plotter, AIS data transmitted from ships within range can be displayed on the screen enabling the skipper or navigator to visualize the traffic within VHF range. Using QK-A023 can enhance safety at sea by providing proximity, size and directional information from other vessels, improve safety and efficiency in navigation and help protect the marine environment. Although QK-A023 comes with an extruded aluminum enclosure to shield it from external RF interference, it should not be fitted close to generators or compressors (e.g. refrigerators) as they can generate substantial RF noise. Generally a suitable placement of QK-A023 is with other types of navigation equipment and the PC or chart plotter that will be used to display the AIS data.

The following figure shows an overview of the QK-A023. Two LEDs indicate the power status and signal traffic. Power for QK-A023 is provided via USB cable which also outputs NMEA messages in the absence of a connected WiFi device. If no USB data output is required this USB port can be connected to any 5V 0.3Amp power supply.



Figure 3 QK-A203 Connections diagram

QK-A023 has the following connections/indicators:

- **Antenna Fittings.** BNC female 50 Ohm connector.
- **AIS antenna.** Standard BNC female 50 Ohm connector. An active VHF antenna splitter is required if one VHF antenna is shared by QK-A023 and VHF voice radio.
- **USB connector.** A micro USB connector provides the power source for the product and also outputs NMEA messages.
- WiFi connectivity in Ad-hoc or station mode on 802.11 b/g/n.
- LED lights. QK-A023 features two LEDs which indicate power and AIS status respectively.

2 MOUNTING

QK-A023 is designed to be placed where it is well protected from humidity and water.

QK-A023 is **not** supplied with a VHF antenna as the type of antenna and cable requirements differ from vessel to vessel. A suitable VHF antenna should be connected before the receiver will operate fully.

3 POWER UP

QK-A023 is typically powered by PC, laptop, tablet, battery or other devices with 5.0V micro USB connectors.

QK-A023 is supplied with a USB cable. This cable provides power supply and NMEA 0813 data output. The QK-A023 can be linked directly to a USB port on a PC or other mobile device via the supplied cable. (OTG adapter may be required for tablets.)

4 USB CONNECTION

4.1 Connect antenna

Connect the module to a suitable VHF antenna. SMA or N type adaptors can be used to connect

QK-A023 with different types of external VHF antenna.



Figure 4 QK-A023 connection

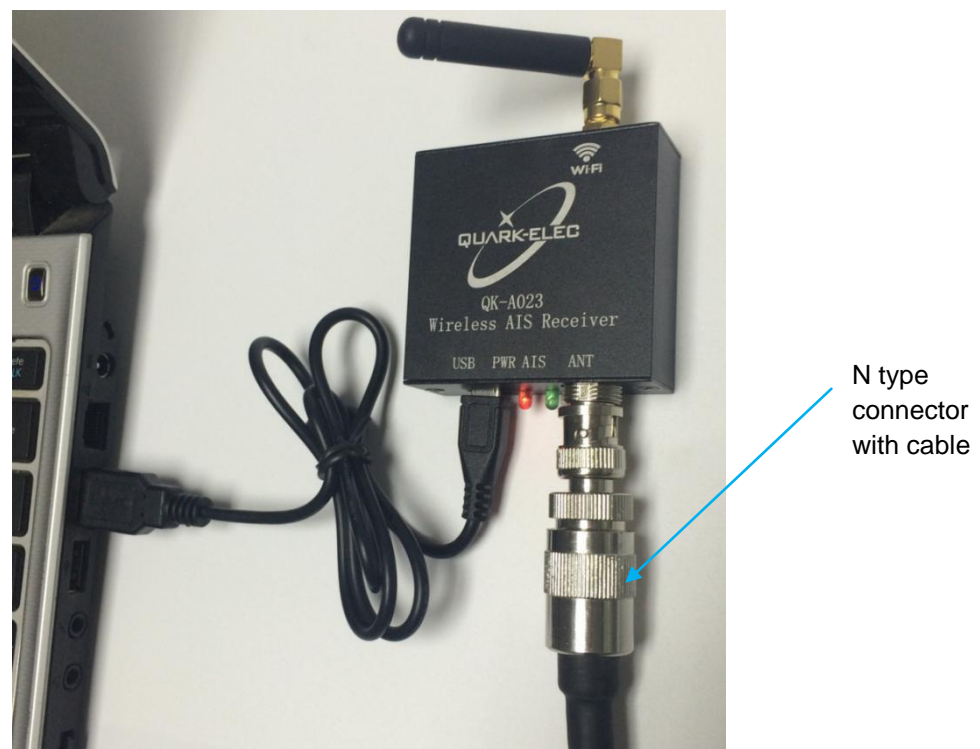
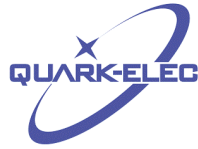


Figure 5 N type connection



4.2 Install driver

To enable the USB data connection of QK-A023 to other devices, related hardware drivers may be needed dependent on system requirements.

For Windows 8, 7, Vista and XP, the driver can be found on the CD in the packing box or can be downloaded from the Quark-elec website at:

<https://www.quark-elec.com/product/qk-a023-ais-wireless-receiver/>

No drivers are required on Windows 10, QK-A023 registers itself to the computer as a virtual serial port on Windows. A new COM port will automatically show up in the device manager after plug in.

For Mac OS X, QK-A023 will be recognized and shown as a USB modem. The ID can be checked with the following steps:

--- After plugging QK-A023 into a USB port, launch Terminal app.

--- Type `ls /dev/*usb*`

--- Mac systems will return a list of USB devices. QK-A023 will display as - `"/dev/tty.usbmodemXYZ"` where XYZ is a number. Nothing further needs to be done if it is listed.

No driver is required for Linux. When plugged into the computer, QK-A023 will show up as a USB CDC device on `/dev/ttyACM0`.

The USB connection status can always be checked with a terminal application like Putty or HyperTerminal. Ensure that the COM port is set at 38400bps, 8, N and 1, as shown below using HyperTerminal on Windows as an example to illustrate this process.

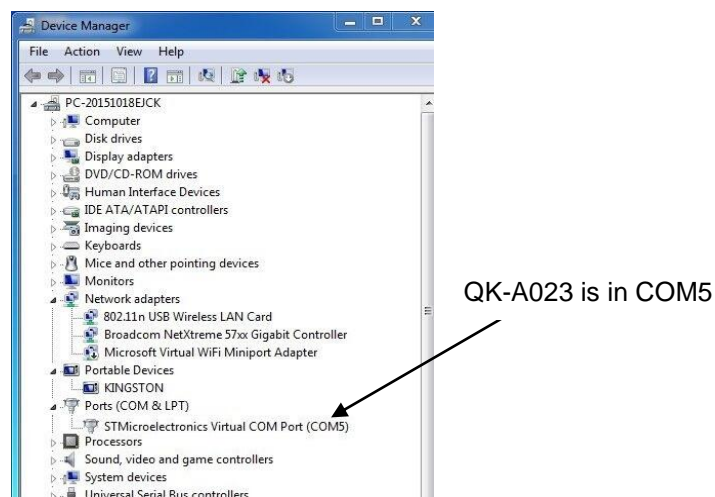


Figure 6 Virtual COM port

Run HyperTerminal to check the setting. Ensure that the COM port is set at 38400bps, 8, N and 1.



```

!AIVDM,1,1,A,B6:fnn00:1hUhSCCUP000N021Mk,0*2D
!AIVDM,1,1,A,H6:cdU61G3Cifh000000006@a880,0*10
!AIVDM,1,1,A,36:tnh5000870U0==TLWF'Tf0DHJ,0*49
!AIVDM,1,1,A,16:26d5000'7Wc0==qc7'bFP05ah,0*17
!AIVDM,1,1,A,369D6aU00087War=:quu=Dh>0000,0*7F
!AIVDM,1,1,A,168u:v0P00'74jP>BoMhwvB00S8,0*75
!AIVDM,1,1,A,403s131uv:ck:87B50==oAi00D9u,0*70
!AIVDM,1,1,A,16:V40PP1L86gnb>FmrIgvj0@IL,0*33
!AIVDM,1,1,A,168upK0P00'7BEH==hS<=wvr0<5e,0*3A
!AIVDM,1,1,A,168uRKPP01871<2==<mVrgw60HED,0*6E
!AIVDM,1,1,A,B6:fnn00:1hUhSCCUP000N021Mk,0*2D
!AIVDM,1,1,A,H6:cdU61G3Cifh000000006@a880,0*10
!AIVDM,1,1,A,36:tnh5000870U0==TLWF'Tf0DHJ,0*49
!AIVDM,1,1,A,16:26d5000'7Wc0==qc7'bFP05ah,0*17
!AIVDM,1,1,A,369D6aU00087War=:quu=Dh>0000,0*7F
!AIVDM,1,1,A,168u:v0P00'74jP>BoMhwvB00S8,0*75
!AIVDM,1,1,A,403s131uv:ck:87B50==oAi00D9u,0*70
!AIVDM,1,1,A,16:V40PP1L86gnb>FmrIgvj0@IL,0*33
!AIVDM,1,1,A,168upK0P00'7BEH==hS<=wvr0<5e,0*3A
!AIVDM,1,1,A,168uRKPP01871<2==<mVrgw60HED,0*6E
!AIVDM,1,1,A,B6:fnn00:1hUhSCCUP000N021Mk,0*2D
!AIVDM,1,1,A,H6:cdU61G3Cifh000000006@a880,0*10
!AIVDM,1,1,A,36:tnh5000870U0==TLWF'Tf0DHJ,0*49

```

Figure 8HyperTerminal output



5 WiFi CONNECTION

QK-A023 Version2.0 support both Ad-hoc mode and station mode. The module will work in Ad-hoc mode by default but it can be easily setup to station mode through GUI.



Figure 9WiFi Antenna

5.1 Ad-hoc mode

15 seconds after QK-A023 has been powered up, the operator should be able to scan and find a WiFi network (SSID) similar to 'QK-A023xxxx' using WiFi enabled devices such as computers, mobile phones or tablets.

Connect the device/s to 'QK-A023xxxx' with '88888888' as the default password. Set the protocol as 'TCP', IP address as '192.168.1.100' and the port number as '2000' in the chart software.

Item	Setting
SSID	Similar to 'QK-A023xxxx'
Protocol	TCP
IP address	192.168.1.100
Port	2000

With the above settings, wireless connection should be set and the operator will be able to receive the AIS messages through the chart software. the operator can always check the wireless connection with TCP/IP port monitoring software as shown below:

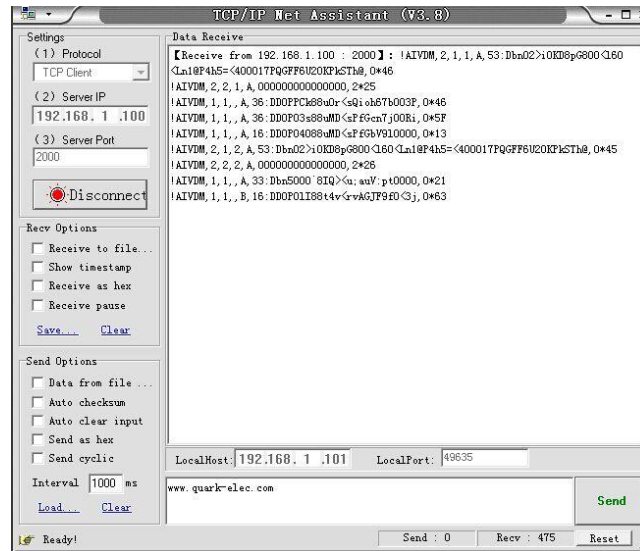
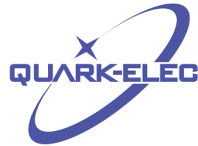
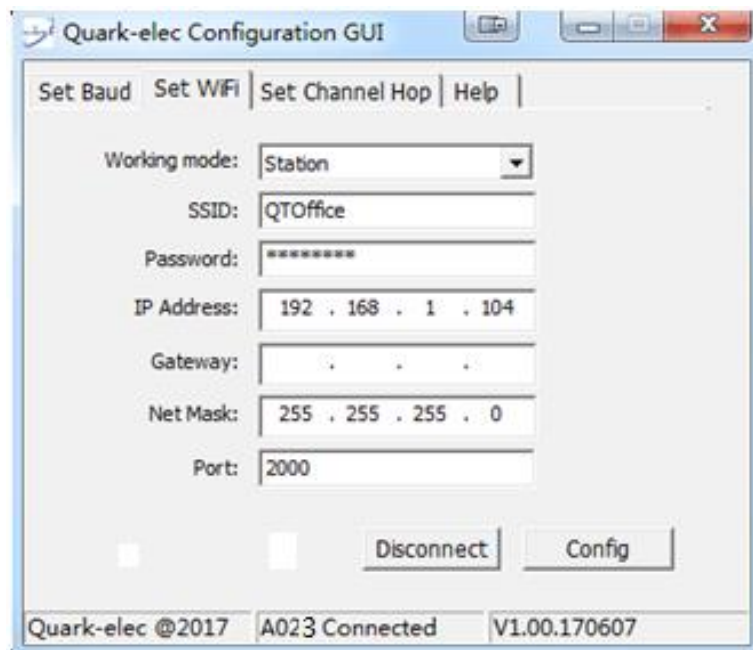


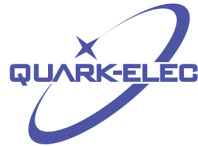
Figure 10 TCP/IP setting check

Note: In Ad-hoc mode, the IP address should not be changed and the password should be between 8 to 12 characters.

5.2 Station mode

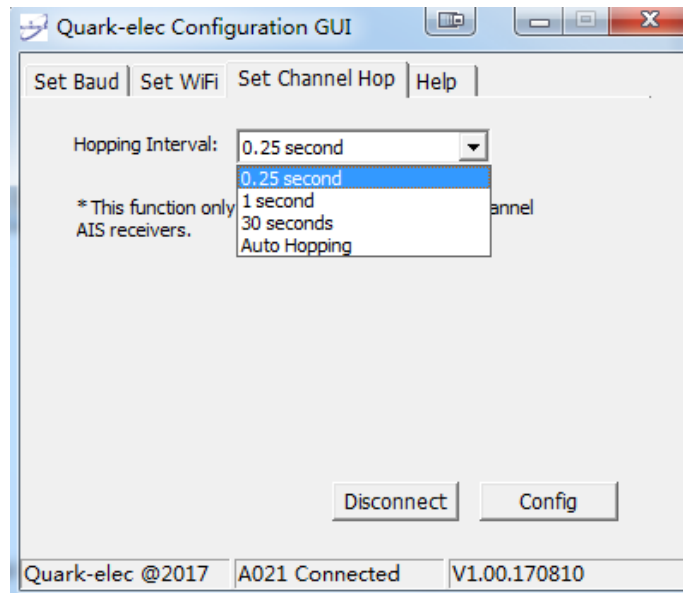
QK-A023 can also be connected in station mode by changing these parameters to those of your Wireless Access Point as illustrated below:





6 HOPPING INTERVAL

In the new V2.0 QK-A023, it is now possible to set the hopping interval manually via the GUI.



This enables the operator to specify hopping intervals of 1s, 30s and 0.25s according to preference and need.

Our patented algorithm is likely to pick up more messages, faster than the manual settings but there are certain environments and locations where manual setting may be desirable. An article is available explaining this is on our blog:

<https://www.quark-elec.com/blog/2017/12/20/latest-field-test-of-patented-autohopping-algorithm/>

The Configuration Software (GUI) can be used to adjust these settings, including baud rates and WiFi settings. You can download the software here:

https://quark-elec.com/doc/QE_MUX_configTool.zip

Detailed instructions on how to use the Configuration software are available here:

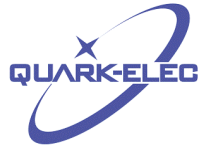
https://www.quark-elec.com/doc/QK-A0xx_GUI_application_note.pdf

Please check that no other APPs or programs are open when using the Configuration GUI.

7 WORKING WITH OPENCNP

OpenCNP is free software that can be used to view concise chart plotter and navigation information, It is available for use on both Windows and the MAC OSX system from:

<http://opencnp.org/ocpn/download>



Quark-Elec Manual

The following is a sample setting for the OpenCPN plotter. COM2 was set as the QK-A023 input and COM1 is used for a standard serial port GPS input.

Other software is available such as SeaClear, PolarNavy, PolarView. They all have similar settings.

<http://www.sping.com/seaclear/>

<http://www.polarnavy.com/>

<http://www.polarnavy.com/main/prod1>

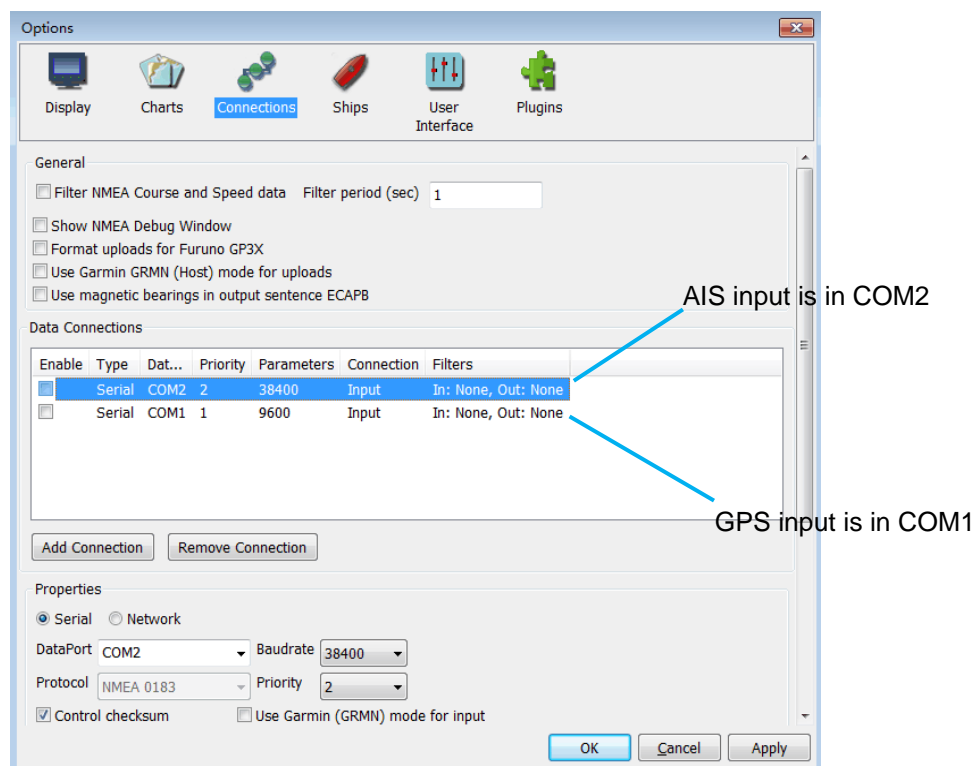


Figure 11Serial port setting on OpenCPN

For WiFi connection, 'Network' rather than 'Serial' needs to be selected in 'Connections->Properties' and the following settings need to be input.

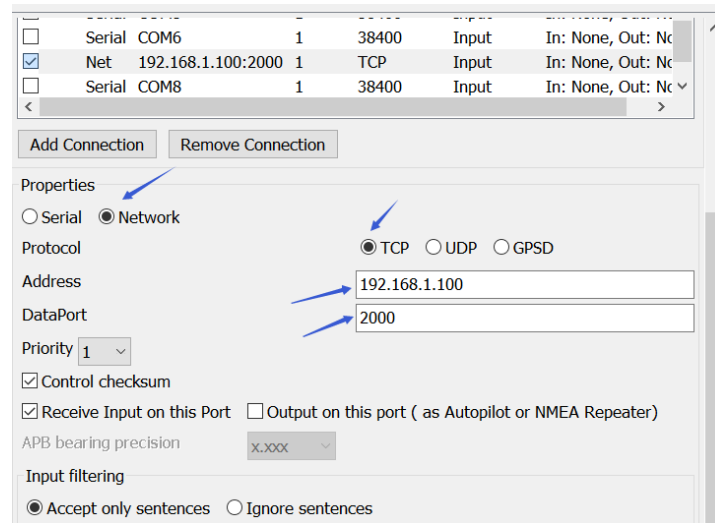


Figure 12WiFi setting on OpenCPN

8 ANTENNA

AIS communication systems use frequencies in the maritime VHF band, which is considered to be 'line of sight' radio. This means that if the QK-A023 antenna cannot 'see' the antennas of other vessels, the AIS signals from vessels will not reach QK-A023. In practice, this is not a strict requirement, a few buildings and trees between them will be fine. Large obstacles such as hills and mountains, on the other hand, will significantly degrade the AIS signal

To have the best possible receiving range, the AIS antenna should be placed as high as possible with a relatively clear view of the horizon. Large obstructions might shade the AIS radio communication from certain directions, giving uneven coverage.

AIS communication system frequencies are close to the duplex channels used for marine communication, so the antenna should be separated as much as possible (Ideally at least 3.0 meters) from the voice communication VHF antenna to avoid unnecessary adjacent channel interference. Best separation is achieved by installing the antennas over each other or on separate sides of the mast. If an existing VHF transmitting antenna is used to receive AIS signals, proper separation equipment (e.g., an active VHF antenna splitter) should be applied.



9 SPECIFICATION

Item	Specification
Frequency bands	161.975MHz & 162.025MHz
Operating temperature	-25°C to +80°C
Storage temperature	-25°C to +85°C
DC supply	5.0V(+/-0.2V)
Average supply current	32mA@5.0V
AIS receive sensitivity	-105dBm@30%PER
WiFi mode	Ad Hoc on 802.11 b/g/n
Security	WPA/WPA2
Network Protocols	TCP



Choosing the right Quark Marine product...

Features	A021	A022	A023	A024	A026	A027	A031
AIS channel hopping ^[1]	✓		✓				
AIS dual channel		✓		✓	✓	✓	
AIS sensitivity @30% PER	-105dBm	-106dBm ^[1]	-105dBm	-106dBm ^[1]	-106dBm ^[1]	-105dBm	
AIS range ^[2]	45nm	45nm	45nm	45nm	45nm	45nm	
AIS antenna type	SMA	SMA	BNC	BNC	BNC	BNC	
USB powered	✓	✓	✓	✓	✓		
Configuration through USB port	✓		✓	✓	✓	✓	✓
USB NMEA 0183 output	✓	✓	✓	✓	✓	✓	✓
Windows /Mac/Linux	✓	✓	✓	✓	✓	✓	✓
Works with chart plotters	✓	✓	✓	✓	✓	✓	✓
Interworks with GPS	✓	✓	✓	✓	Built in GPS	Built in GPS	✓
Android		✓	✓	✓	✓	✓	✓
iOS		✓	✓	✓	✓	✓	✓
WiFi			✓	✓	✓	✓	✓
Ad-Hoc connection			✓	✓	✓	✓	✓
Station mode connection				✓	✓	✓	✓
NMEA 0183 input				✓	✓		✓
NMEA 0183 output				✓	✓	✓	✓
Multiplexing				✓	✓	✓	✓
GPS (powered for active antennas)					✓	✓	
SeaTalk™ converting						✓	✓
Connects to Garmin if used with AS03				✓	✓	✓	✓

[1] Next upgrade should increase this to -110dBm.

[2] Tested with a pushpit antenna mounted at masthead, 60 feet above sea level.

[3] Next upgrade will include manually adjustable hopping interval rates (0.25 second, 1 second, 30 second and auto-hopping. (due 3/18)

For more technical information and other enquiries, please go to the Quark-elec forum at:

<https://www.quark-elec.com/forum/>

For sales and purchasing information, please email us: info@quark-elec.com

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