

Hurricane ... Intelligent AM Modulator with Digital Frequency Synthesizer

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Introduction

The **Hurricane** is our next generation intelligent AM Modulator, featuring a Digital Frequency Synthesizer controlled by a high-performance RISC-based Microcontroller with optional Bluetooth Audio and Bluetooth remote control.

With the **Hurricane** AM Modulator, it is easy to transmit high quality audio to any AM broadcast band radio receiver .

Features

- Easy setup, using the built in Menu and OLED display.
- Accepts audio from Mono or Stereo source.
- High quality modulation depth and linearity.
- Compliant with FCC Part 15 rules. (US Only)
- Crystal controlled Digital Frequency Synthesizer.
- RISC-based Microcontroller .
- Bluetooth Audio interface. (*model dependant*)
- Bluetooth Remote Control Interface (*model dependant*)
- Bluetooth Remote Control APP (Android, iOS and PC)

Configuration

All models EU and US

- Frequency range **520kHz to 1730kHz** (Medium Wave)
- Frequency default to **1600kHz / US** or **1440kHz / EU**
- Channel spacing default **10kHz / US** or **9kHz / EU**
- Frequency range 1800kHz to 2000kHz (160M)
- External 115/230 volt **regulated** 15 Volts DC supply.
- Correct country specific power plug, US, UK, EU and OZ.
- Standard 3 meter (9 foot) wire antenna.
- Audio Cable 3.5mm Male to Male Jack plug.

Optional Hardware

- Bluetooth BLE Audio Interface
- Bluetooth BLE Remote Control Interface

Optional Software

- Bluetooth BLE Remote Control APP (Android)
- Bluetooth BLE Terminal APP (Android)
- Bluetooth BLE Terminal APP (iOS)
- Bluetooth BLE Terminal APP (PC)

Think About

Frequency

First you should find a area of the medium wave (broadcast) band that is free of any stations and interference, this will vary from location to location – the best way is to tune an AM radio from one end of the broadcast band to the other looking for suitable gaps.

The upper half of the broadcast band will **give the best results** and more range, optimum range will be found from 1300 to 1700 Kc's.

More stations will be heard at night so you may need to do this again in the evening.

The lower half of the broadcast band is usually less congested.

Channel Spacing

Channel spacing is set to **9 KHz for the EU** and **10 KHz for the US.**

Installation

Before using your **Hurricane**, please read the Installation and Operating instructions.

The Hurricane will be supplied pre-configured with the correct power supply, channel spacing, for the country you are in and a default frequency chosen as a typical operating frequency in that country.

Under normal circumstances you do not need to open the Hurricane unless you decide to choose a significantly different operating frequency or use your own antenna.

Cables

Earth (Ground)

Connect the **Hurricane** to a suitable Earth or Ground using the socket marked **GND** on the back of the **Hurricane**.

This is the really important. A good, low impedance ground is required for optimum range and performance and to avoid hum (this applies to any AM transmitter).

When you connect the **Hurricane** to an AC powered audio source (such as a PC), there may be an Earth path through the audio cable outer shields and then through the mains wiring to GROUND.

These "built in" ground paths may provide good performance in some cases, but variations in house wiring and installation location may require you to ground the **Hurricane** directly to a separate GROUND.

Audio - Input Jack

Connect one end of the audio cable to the headphone output of your Audio source (i.e. PC sound card, MP3 player) and the other end to the socket marked **AUD** on the back of the **Hurricane**.

Audio - Bluetooth BLE (Option)

If your Hurricane has the Bluetooth Audio option, then you can simply pair the Hurricane with your Bluetooth Audio source and stream using Bluetooth.

If using Bluetooth it is recommended to unplug the Audio Input Jack.

Note: The Bluetooth option uses the latest BLE mode (that is Bluetooth Low Energy)

Antenna

The **Hurricane** has been designed to operate with the supplied 3 Meter (9 foot) antenna. The aerial wire should be run out straight.

Avoid proximity to nearby metal objects. If more range is needed, try relocating the unit to a different location.

Connect the supplied Antenna to the socket marked **ANT** on the back of the **Hurricane**.

Power

Connect the supplied, 15 volt regulated power supply to the socket marked **PWR** on the back of the **Hurricane**.

Operation

Self Test

When the **Hurricane** is powered up it will perform a self-test, which can be viewed on the front panel display. It will then re-call the last used operation frequency and audio gain settings and commence transmission.

Front Panel

Virtually every function of the **Hurricane** can be selected from the menu and the results viewed on the front panel display.

To select each menu option, press the front panel **Menu** button to advance to the next menu option (in sequence as follows).

Frequency Menu

This is the default menu displayed after the Hurricane has completed the Self Test.

To change the Frequency use the **Inc** and **Dec** buttons.

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VU Meter Menu

Displays the VU Meter bar graph showing the average audio level.

Audio Gain Menu

Displays the Audio Gain bar graph showing the audio gain level.

To change the Audio Gain use the **Inc** and **Dec** buttons.

Modulation Menu

Displays the Modulation % and bar graph showing the Modulation level.

Antenna Voltage Menu

Displays the Antenna voltage and bar graph showing the average level.

Tone Menu

Injects a 800 Hertz tone (useful for locating signal)

The Tone will be turned OFF as soon as any other menu option is selected

Wavelength (Display Mode)

Selects between Frequency displayed in **kHz** or in **Meters**.

To change the Frequency Display mode use the **Inc** and **Dec** buttons.

Remote Terminal (Option)

If your Hurricane has the Bluetooth BLE Remote option, then you can simply pair the Hurricane with any Bluetooth BLE Terminal APP or the Hurricane APP.

Virtually every function of the **Hurricane** can be selected using any Bluetooth BLE Terminal APP available for (Android or iOS) or the Hurricane APP (Android only).

Note: The Bluetooth option uses the latest BLE mode (that is Bluetooth Low Energy)

The commands are

Command	Function	Response
Frequency		
F+	Frequency Increment	Fxxxx
F-	Frequency Decrement	Fxxxx
F?	Frequency	Fxxxx
F=xxxx	Frequency Set	Fxxxx
	<i>if out of range</i>	ERROR
VU Meter		
V?	VU Monitor	Vxxxx
Audio Gain		
G+	Audio Gain Increment	Gxxxx
G-	Audio Gain Decrement	Gxxxx
G?	Audio Gain	Gxxxx
Modulation		
M?	Modulation Monitor	Mxxxx
Antenna Voltage		
A?	Antenna Voltage	Axx.xx
Tone		
T+	Tone ON (800Hz)	T+
T-	Tone OFF	T-
Display Mode		
	Frequency Display	
W+	Frequency in kHz	W+
W-	Frequency in Meters	W-

ATU Switch

The **Hurricane** will be supplied pre-configured with a default frequency chosen as a typical operating frequency in that country.

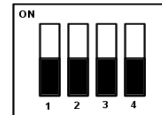
Under normal circumstances you do not need to change the ATU settings unless you decide to choose a significantly different operating frequency or use your own antenna.

Open the Case

Turn the **Hurricane** upside down and undo the two screws to release the top cover. Remove the top cover, you can now see the PCB and access the ATU switch.

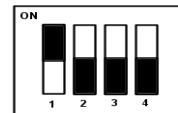
External ATU (your own Antenna)

The first picture shows the arrangement when using an External ATU (the internal ATU is out of circuit).



External ATU
all switches in ON position

The next pictures show an example switch settings when using the Internal ATU. Refer to the ATU chart to select the best settings.



Internal ATU
see table for settings

This is a guide only and actual settings will vary depending on how the Antenna is positioned.

The frequency band column gives approximate minimum and maximum frequencies. If the desired frequency falls across more than one band, chose the lower band that includes the desired frequency. If you can't get a resonant, try the next higher or lower range setting.

The goal is to find the best ATU switch setting that gives resonance. Some experimentation will find the best combination.

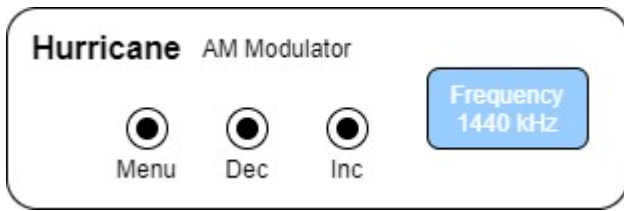
ATU (Antenna) Trim

Can be used to peak the Antenna signal using the Antenna Voltage display.

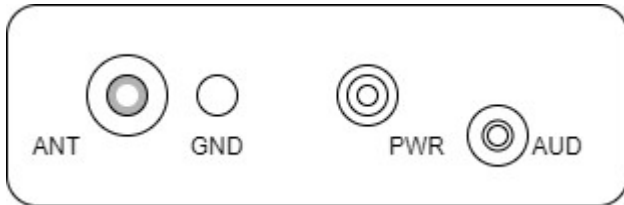
Mode	Frequency	1	2	3	4
External	All	ON	ON	ON	ON
Internal	1480 – 2000 kHz	ON	OFF	ON	ON
Internal	1140 – 1610 kHz	OFF	OFF	ON	ON
Default factory frequency setting					
Internal	1000 – 1400 kHz	ON	ON	OFF	ON
Internal	880 – 1230 kHz	OFF	ON	OFF	ON
Internal	830 – 1160 kHz	ON	OFF	OFF	ON
Internal	750 - 1060 kHz	OFF	OFF	OFF	ON
Internal	620 – 870 kHz	ON	ON	ON	OFF
Internal	590 – 820 kHz	OFF	ON	ON	OFF
Internal	570 – 800 kHz	ON	OFF	ON	OFF
Internal	550 – 770 kHz	OFF	OFF	ON	OFF
Internal	530 -740 kHz	ON	ON	OFF	OFF
Internal	510- 710 kHz	OFF	ON	OFF	OFF
Internal	490 -700 kHz	ON	OFF	OFF	OFF
Internal	480 – 670 kHz	OFF	OFF	OFF	OFF

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Front View



Rear View



Bluetooth BLE Pairing

Both the Audio and Remote Bluetooth option uses the latest BLE mode (that is Bluetooth Low Energy)

Pairing name for Audio look for device ending with **M18**

Pairing name for Remote look for device ending with **BT05**

Other Antenna

For many applications, the standard 3 meter (9 foot) wire Antenna, supplied with the **Hurricane** will produce good results around your home and grounds..

Note: To Comply with US FCC rules - be sure, that the total length of the Aerial, feed line, and grounding wire is less than 10 feet as required by the FCC Part 15 rules.

A simple but effective hint is to connect the Hurricane to a longer aerial.

A properly matched antenna will radiate more efficiently and, in some cases, will produce a better-sounding AM signal.

Instead of a complete and complex antenna tuner, many LPAM stations use a variable inductance (coil) located at the feed point of the antenna. This approach is popular with Part 15 experimenters using shortened "loaded" vertical antennas. Varying the inductances while the Modulator is on, and see which setting provides the best range.

Use a field strength meter to find the best taps for both the antenna and the Modulator.

However, the improved radiation efficiency of a properly matched antenna more than makes up for it! Delivering one milliwatt of power to a properly matched antenna will produce a much stronger signal than delivering 10 milliwatts to a severely mismatched antenna.

Convert Meters to Frequency

The dials of the majority of European radios will be marked in wavelengths (metres) rather than frequencies.

To convert from one to the other, divide 300,000 by the known figure. The result should be rounded up or down to the closest whole number.

Thus 300,000 divided by 1000 KHz gives 300 Metres. Conversely, 300,000 divided by 300 Metres gives 1000 KHz.

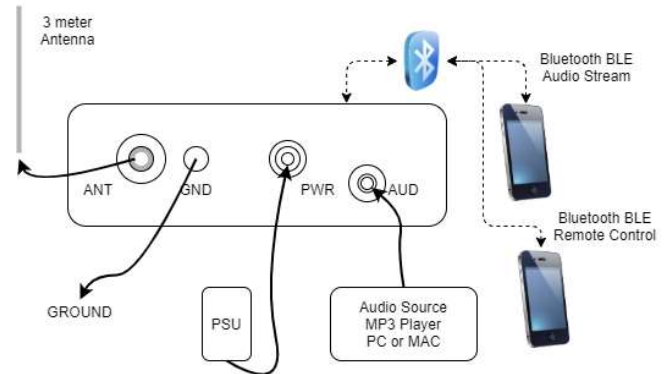
FAQ

If you experience noise on the transmitted signal then your EARTH / GROUND is inadequate, connect EARTH connection on the rear of the unit.

Possible Earth Loop (see Earth Loop section).

If you are still experiencing noise on the transmitted signal, check your audio source.

Example Installation



Trouble Shooting

Audio distorted:	Audio source volume to high.
Hum on audio:	Bad audio cables, check for broken shield wire. No or defective Earth connection. Possible Earth Loop (see Earth Loops).
No Audio:	Bad audio cables, Audio volume set to low.

Earth Loops

An Earth Loop occurs when there is more than one path to Earth (Ground) in the installation.

When you connect the **Hurricane** to an AC powered audio source (such as a PC with an Earth), there may be an Earth path through the audio cable outer shields and then through the mains wiring to GROUND.

If you suspect Earth Loop might be a problem the solution's are:

1. Fit a Earth Loop adapter to the Audio Jack lead
2. Remove the Earth wire from the Hurricane **GND** terminal and rely on the Earth provided by the Audio lead.
3. Use The Bluetooth Audio with the Audio Jack disconnected.

Note: These "built in" ground paths may provide good performance in some cases, but variations in house wiring and installation may require you to ground the Hurricane directly GROUND.

Specifications

Modulation mode:	High-level AM Power output 100mw
Power requirements:	15 VDC at <400mA (Regulated)
Power connector:	2.1mm coaxial (tip positive)
Audio input:	Standard Mono or Stereo signal
Audio connector:	Standard Stereo 3.5mm Jack
Aerial:	3 meter (9 foot) antenna
Aerial connector:	RCA Phono
Frequency Broadcast	520 to 1730 kHz (Medium Wave)
Frequency SW 160M	1800 to 2000 kHz (160M Top Band)
Crystal controlled PLL:	US - 10.240 MHz (10 KHz Channels) EU - 9.216 MHz (9KHz Channels)

Warranty

We guarantee the product to be free from defects in materials and workmanship for one year. We will repair or replace such product, if found to be defective in materials or workmanship.

The customer will be responsible for all costs of transportation and insurance, in both directions.

This warranty shall be void and of no force of effect in the event a covered product has been modified in design or function, or subjected to abuse, misuse, mishandling or unauthorized repair.

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Remote Control (Option)

Command Line

The Bluetooth BLE Remote Control option, allows you to control the Hurricane using an APP on an Android phone or Tablet, or an iOS device like a iPhone or iPad.

Note: Bluetooth BLE Remote Control is an option.

Any Bluetooth BLE Terminal APP for Android and iOS.

The Bluetooth BLE Terminal APP, are available now and downloadable from the Google and Apple Store for Android and iOS

Note: The terminal APP must support BLE mode.

Summary of commands

Command	Function	Response
Frequency		
F+	Frequency Increment	Fxxxx
F-	Frequency Decrement	Fxxxx
F?	Frequency	Fxxxx
F=xxxx	Frequency Set	Fxxxx
	<i>if out of range</i>	ERROR
VU Meter		
V?	VU Monitor	Vxxxx
Audio Gain		
G+	Audio Gain Increment	Gxxxx
G-	Audio Gain Decrement	Gxxxx
G?	Audio Gain	Gxxxx
Modulation		
M?	Modulation Monitor	Mxxxx
Antenna Voltage		
A?	Antenna Voltage	Axx.xx
Tone		
T+	Tone ON (800Hz)	T+
T-	Tone OFF	T-
Display Mode		
W+	Frequency Display	W+
W-	Frequency in kHz	W-
	Frequency in Meters	

Software Graphic UI - for Android phone or Tablet, the APP is downloadable from this website (release date May 2021)

