

Intelligent Pipeline Technology

EMRx Onshore and EMRx Ex Operating Manual

Electromagnetic Receiver





and downloads

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1. GENERAL DESCRIPTION

The IK Trax EMRx Onshore receiver is a robust, state-of-the-art, multifrequency electromagnetic (EM) receiver for tracking pigs with EM transmitters. It confirms pig departures or arrivals, monitors pig movements, and locates stuck or stalled pigs. Its enhanced sensitivity allows detection even within heavy-walled receivers/launchers, pipeline bundles, or Pipe-in-Pipe. The EMRx Ex is an intrinsically safe certified version with the same capabilities.

The EMRx features three colour-coded LED bar graphs (red, blue and white), each with 20 LEDs. These graphs can be individually configured in the field using either the button interface or Bluetooth using the IK Trax EMRx Android or Windows application. The bar graphs display received signals at any fixed frequency between 10Hz and 30Hz

The red LEDs can be set to display magnetic flux from magnets on a pig passing through a pipe. If the flux exceeds a configurable threshold, the red LEDs flash to indicate pig passage.

The EMRx Onshore is powered from 6x standard AA Alkaline cells.



▲ See 9 CERTIFICATION APPENDIX for allowable battery types for EMRx Ex



1.1. IK TRAX SHORTCUT

IK Trax offers a comprehensive range of resources to support the operation and configuration of the EMRx device. To make accessing these materials easier, we've provided a QR code that allows you to instantly connect to our online resource hub using any mobile device. Simply scan the QR code to explore detailed guides, troubleshooting tips, and other essential materials to help you get the most out of your.



2. OPERATION

▲ WARNING: The instructions detailed within the product certificate and the Special Conditions for Safe Use as detailed in section 9 CERTIFICATION APPENDIX of this manual must be followed at all times. 1.

2.1. TURNING ON

Locate the red button on one of the endcaps of the EMRx device.



Press and hold the red button until you see the LEDs switch on, within the EMRx device.



Once the LEDs light up the EMRx is ready for operation.

2.2. TURNING OFF

To turn of the device, press and hold the red button for at least 5 seconds, the LED lights will switch off, at which point the device is off.

2.3. STORAGE

When placing an EMRx device into storage, it is advisable to remove all the batteries from the device.

2.4. APPROXIMATE TRANSMITTER LOCATION

The typical procedure for determining the approximate position of an electromagnetic transmitter is given below.

Ensure the gain is low (no more than 5) and place the receiver stationary on the ground at least 10m from the expected location of the transmitter. Ensure that the gain of the device is not higher than 5. At this range it is expected that the signal received from the transmitter will be negligible and any signal you do detect is background noise.

Increase the gain to the maximum setting possible without allowing the background noise level to illuminate more than 2x LEDs (10%) on the bar graph. The optimum background noise level for identifying an EM signal is typically 2x LEDs (10%) or less. It will be extremely difficult to detect a signal if the background noise level is more than 50%. If the background noise is more than 50% then the receiver gain must be reduced or the source for the excessive background noise must be identified and removed. Note that more gain is not always best, if there is significant background noise and the gain is too high then the transmitter signal may be hidden by the background noise.

Now gradually move the receiver towards the expected location of the transmitter keeping the receiver orientated parallel to the expected transmitter orientation as shown to maximise received signal and range. If the transmitter is at the expected location, then the received signal should rise significantly.



If the received signal is extremely weak then the receiver gain will need to be higher, the receiver must also be held as still as possible and as close as possible to the pipeline surface. Ideally it should be balanced on top of the pipeline surface or, if the pipeline is buried, placed on the ground as close as possible to the pipeline.

If the transmitter is in pulsing mode confirm that the expected pulse rate is being received.

Keeping the receiver parallel to the pipeline, step slowly and methodically along the pipeline (keeping a constant distance between the receiver and the pipeline surface) while watching the received signal to determine which direction results in an increasing signal. Keep moving in this direction until a peak in the signal is received which will occur at the approximate position of the transmitter. Gain should be reduced whenever the received signal exceeds approximately 18x LEDs (90%).

If the signal is strong and clear, then it should be possible to find this peak by following the pipeline while keeping the receiver as still as possible. If the signal is weak and difficult to detect without high gain, then it is usually best to periodically place the receiver stationary on top of the pipeline at 1m intervals to prevent false signals caused by movement of the receiver. A 1m interval is typical but may be increased or decreased depending on whether a strong or weak signal is expected.

Once a peak has been found confirm that if the receiver is moved away from the transmitter in any direction (along the pipeline or away from the pipeline) that the received signal drops.

2.5. ACCURATE TRANSMITTER POSITION

Establish the approximate transmitter location, before attempting to establish a more accurate location. The perpendicular receiver orientation used to establish the accurate transmitter location is not suitable for searching for the approximate transmitter location due to the relative insensitivity of this orientation.



Once the approximate location of the transmitter has been determined turn the receiver 90° so that it is perpendicular to the transmitter as shown.

Typically, the receiver should be held stationary approximately 1m from the pipeline surface however this distance may need to be reduced or increased depending on how weak or strong the received signal is respectively.

If received signal is above 90% at the peaks, then reduce gain and/or move away from the pipeline to reduce received signal.

Maintain the separation and orientation and slowly and methodically step the receiver along the pipeline in either direction from the approximate transmitter location. The received signal should drop significantly as you pass the 'null spot' of the transmitter which occurs when the perpendicular receiver is pointing at the centre of the transmitter. Moving just a few centimetres ahead or behind this point will cause a relatively large and sudden increase in signal.

This configuration can be used for centimetre accurate transmitter location. If the null spot cannot be found, try increasing the distance between the transmitter and receiver and/or reducing gain. Please note that the signal received from a transmitter in a pig inside a pipeline is going to be significantly less than the signal received from a transmitter in air.

If a particularly weak signal is being received, it may not be possible to determine the transmitter's exact location using this method. However, in such cases, the approximate location is typically indicated by a relatively narrow and well-defined peak, which still provides a fairly accurate estimate of the transmitter's position.

3. CONFIGURATION

3.1. MANUAL CONFIGURATION

The button interface allows the user to configure the device by only using various length button presses.

Note: The Android and Windows apps are provided free of charge and provide a more efficient method for configuring the EMRx device.

3.1.1. GAIN ADJUSTMENT



To increase the gain, use short (approximately 0.5 seconds long) presses of the control button to increment gain setting along the LED bar graphs from bottom to top.

To decrease the gain, use long (approximately 1.0 seconds long) presses of the control button to decrement gain setting along the LED bar graphs from top to bottom.

There are 20x possible settings displayed by a vertical line across all three 20x LED bar graphs. Minimum gain setting is on the extreme left of the LED bar graphs. Maximum gain setting is on the extreme right of the LED bar graphs.

If the gain setting is already at maximum (on the extreme right of the LED bar graphs) then the next short button press will return to the minimum gain setting (on the extreme left of the LED bar graphs) and vice versa.



3.1.2. FREQUENCY CONFIGURATION

If the EMRx device is on, switch it off by holding the red button for at least 5 seconds.



After turning off the device, press and hold the red button to turn it back on. Keep holding the button after the device powers on to display the current LED frequency configuration.



The first set of 9 LEDs displays the tens digit of the frequency, while the second set of 9 LEDs displays the unit's digit.



The example above displays the following configuration.

- RED LED: 17 Hz
- BLUE LED: 22 Hz
- WHITE LED: 27 Hz

Once the current configuration appears on the devices LEDs release the button and **<u>immediately</u>** press it again and hold it for 5 seconds. This will activate the configuration mode.



The first screen of the configuration mode is the magnetic/requency mode setting.



"F" stands for frequency.



"M" stands for magnetic.

Once the setting was chosen, wait for the configuration screen to time out before pressing the button again, approximately 5 seconds.

Next is the frequency configuration screen.

Note: The RED LED setting varies based on the current mode. In magnetic mode, it displays the Magnetic threshold. When set to frequency mode, the RED LEDs show the tracked frequency.

The first set of 9 LEDs displays the tens digit of the frequency, while the second set of 9 LEDs displays the unit's digit.

Each field begins timing out from the last button press. Each press increments the active field by one, cycling back to the first LED and resetting the value to 0 once the top is reached. To set the desired value for a field, wait for it to time out (approximately 5 seconds) before pressing the button again.

Once all the fields have timed out, the device will go into tracking mode.

3.2. SOFTWARE CONFIGURATION

3.2.1. ANDROID APP



IK Trax provides software that can assist with the configuration of the EMRx device and tracking. The software is available on Windows and Android platforms.

Launch the EMRx app

Press the "Start Tracking" button

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EMRx Demo File					Export	Delete
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Choose the target device.



If the EMRx was not previously paired with the android device the following dialogue will pop up.

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Click the "Pair" option to connect to the device. The connection attempt will fail if you click cancel.



Once connected, the app will automatically display the Signal chart, where each line represents a different frequency. You can track multiple frequencies by clicking the "Add" button to add new lines (up to 6). To change the frequency that a line represents, simply click on the button for that frequency. This will take you to a page where you can adjust the frequency settings for that line.

You can change the EMRx configuration through the settings page, which is accessible via the navigation menu.



On the settings page, you can modify the tracked frequency for each LED, adjust the gain levels, switch the red LED between magnetic and EM modes, and access device information, including the firmware version and serial number.



3.2.2. WINDOWS APP

The Windows software enables users to connect to the EMRx device using a PC. It provides functionality for signal monitoring, troubleshooting and EMRx configuration.

PAIRING

The EMRx device must be paired with the PC for it to be available for connection within the app.

Type "Bluetooth" in your windows search bar.

Select the "Add Device" option on the Bluetooth Settings page.



Find the EMRX in the list of devices to be paired, then proceed to pair it. Once done it will appear in the list of paired devices.

CONNECTING

The windows app can be downloaded on the IK Trax website, the instructions on how to do it can be found in the Appendix D.



After installation launch the EMRx app through the Windows search bar or by using the app launcher icon.



Once the app has launched, select the EMRx, previously paired, from the "Select Device" list and then press connect.

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Hardw	are Configure	COM24 EMRx Ex 0	002	>	Software Configure			
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	Gain	\sim			Intensity Chart			
LED	Frequency 1 (red)				Signal Chart			
LED	Frequency 2 (blue)		Write		Debug			
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	Low Noise				Firmware Configure			
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Once the connection is successful the app will automatically navigate to the Signal Strength Chart, where you can monitor the tracked signals.



On the settings page, you can modify the tracked frequency for each LED, adjust the gain levels, switch the red LED between magnetic and EM modes.



4. FUNCTION TEST

To ensure smooth deployment and optimal performance of the EMRx application, it is recommended to familiarise yourself with its operations at least 24 hours prior to deployment. Conducting a function test is essential to verify that all functions of the device are working correctly and that the power level is optimal. This preparation helps ensure the EMRx operates effectively and efficiently during deployment.

4.1.EM FUNCTION TEST

Ensure that the battery level is at least 75% (3 out of 4 Battery LEDs are lit)



Confirm that the Bluetooth light is flashing once every second indicating that it is ready for incoming connections.

Note: EMRX can only connect to one device at a time. If no connection is made within 5 min the Bluetooth will go into standby. Press the red button to reactivate Bluetooth.

Set the transmitter gain to 2 LEDs, indicating a gain of 10%. In the absence of any active signal, the LEDs should remain off while the EMRx is stationary. If the LEDs illuminate, this suggests the presence of noise. To ensure reliable measurements, repositioning the device is recommended. If relocating the device is not feasible, the presence of noise must be acknowledged and accounted for during pig location procedures.

If a transmitter not available, give the receiver a little shake which will cause it to move in the earth's magnetic field which will be detected by the receiver and cause the LEDs to move.

If a transmitter is available, it is recommended to practice both approximate and precise transmitter location techniques.

4.2. MAGNETIC FUNCTION TEST

In magnetic mode, set via the app or button interface, the RED LED indicates magnetic field changes. To test this feature, use a magnet or any device containing magnets.

Note: Ensure that the red LED is set to the magnetic tracking, it is apparent by the absence of the gain line on the red LED strip.

- 1. Place the EMRx in a stationery position.
- 2. Pass the magnet close to the EMRx device and observe the RED LED.
- 3. If it changes when the magnet is close, then the magnetic feature is operational

Note: if the magnetic threshold is exceeded the whole row of the red LEDs will flash.



5. BATTERY REPLACEMENT

The battery LEDs indicate the device's battery level, with each LED representing 25%. It is recommended to use the device only when at least 3 out of 4 LEDs are lit, indicating a battery level of 75%.

It is recommended to familiarize yourself with the safety procedures to ensure the safe operation and handling of the device.



If the EMRx device is on, switch it off by holding the red button for at least 5 seconds.

Locate the battery endcap of the EMRx transmitter which is opposite to the red button endcap.

Note: Do NOT remove the RED BUTTON endcap.

Make sure that the device is dry before removing the battery endcap to avoid the liquid draining into the device.

Remove the battery endcap by removing the two screws keeping it in place with a Philips screwdriver.





Remove the old batteries from the device.

As per diagram insert the new batteries into the device taking note of the correct orientation on the EMRX housing.



Switch the EMRx on to ensure the device is operational.

6. ROUTINE MAINTENANCE AND STORAGE

All IK Trax equipment is designed to require minimum maintenance. The housing should be cleaned using fresh water. Do not use chemicals, solvents or oils which could be damaging to the housing, endcaps or O-rings.

If the receiver is to be placed in storage for a long period of time remove the batteries from the receiver and store separately.

7. DISPOSAL OF UNIT

IK Trax former Online Electronics Ltd takes its responsibilities under the WEEE Regulations extremely seriously and has taken steps to be compliant in line with our corporate and social responsibilities. In the UK, IK Trax former Online Electronics Ltd has joined a registered compliance scheme WeeeCare (registration number WEE/MP3538PZ/SCH).

Electrical and electronic equipment should never be disposed of with general waste but must be separately collected for the proper treatment and recovery.

The crossed-out bin symbol, placed on the product, reminds you of the need to dispose of it correctly at the end of its life.

When buying a new product, you will have the possibility to return, free of charge, another end-of-life product of equivalent type that has fulfilled the same functions as the supplied equipment. These items may be deposited at:

IK Trax Online House Blackburn Business Park Woodburn Road Blackburn Aberdeen AB21 0PS UK

Alternatively, to arrange a collection of any waste electrical equipment, obligated to IK Trax former Online Electronics Ltd please telephone WeeeCare on 0844 800 2004.

8. WARRANTY

IK Trax products are guaranteed for one year from the date of purchase. Goods should be returned, transportation prepaid IK Trax.

There is no charge for parts or labour, should any product require repair due to a manufacturing deficiency during the guarantee period.

In the event of a manufacturing deficiency the inward transportation costs will be repaid to the client.

9. CERTIFICATION APPENDIX

EQUIPMENT:	EMRx Ex EM Rece	eiver
MANUFACTURER:	Online Electronics Online House Blackburn Busines Woodburn Road Blackburn Aberdeen AB21 0PS UK Tel: +44 (Web:www.online-e	s Ltd s Park 0) 1224 714 714 lectronics.com
UKEX CERTIFICATE:	EMA 22 UKEx 004	9 X
ATEX CERTIFICATE:	ERO 22 ATEX 000	8 X
IECEX CERTIFICATE:	IECEx EMT 22.000)3 X
MARKINGS:	⟨£x⟩ II 1 G	Ex ia IIC T4 Ga
APPLICABLE STANDARDS:	EN 60079-0:2018 EN 60079-11:2012 IEC60079-0:2017 IEC60079-11:2011	

SPECIAL CONDITIONS FOR SAFE USE:

1. WARNING – Do not open when an explosive atmosphere may be present.

2. WARNING – Use only one of the cell types from the table below. Do not install a mixture of cell types in the equipment.

3. WARNING – Allowable ambient temperature is dependent on the cell type used as per the table below.

4. WARNING – Observe correct battery polarity as indicated on the device.

	DURACELL	ENERGIZER	ENERGIZER
	MN1500	E91	L91
Allowable Ambient Temperature	-20°C to +54°C	-18°C to +55°C	-40°C to +60°C

APPENDIX A: SPECIFICATIONS

EMRx ONSHORE

Typical lifetime used continuously with Bluetooth	
Typical lifetime used continuously without Bluetooth	
Battery type	6 x 1.5V, Alkaline, AA cells
Frequency range	10Hz to 30Hz
Magnetic flux range	200 milli-Gauss
Operating temperature range	20°C to +50°C (-4°F to 122°F)
Weight	1.8 kg (4.0 lbs)
Housing material	Polycarbonate
Endcap material	Acetal
Endcap bumper material	EPDM rubber

EMRx Ex

Typical lifetime used continuously with Bluetooth	
Typical lifetime used continuously without Bluetooth	
Battery type	6x AA, 1.5V (Duracell MN1500 or Energizer L91)
Frequency range	10Hz to 30Hz
Operating temperature range	See 9 CERTIFICATION APPENDIX
Weight	1.9 kg (4.2 lbs)
Housing material	Polycarbonate
Endcap material	Acetal
Endcap bumper material	EPDM rubber
Ingress Protection	IP54
Certification markings	II 1 G Ex ia IIC T4 Ga
UKEx Certificate Number	EMA 22 UKEx 0049 X
EU Type Examination Certificate Number	ERO 22 ATEX 0008 X
IECEx Certificate Number	IECEx EMT 22.0003 X

APPENDIX B: DEPLOYMENT AND TRACKING BEST PRACTICES

EMRx ONSHORE

WARNING: The instructions detailed within the product certificate and the Special Conditions for Safe Use as detailed in section 9 CERTIFICATION APPENDIX of this manual must be followed at all times.

MARNING: Replace all batteries at the same time. NEVER install used batteries. NEVER install a mix of new and used batteries. USE only NEW batteries. DO NOT mix different brands or types of batteries. ALWAYS observe correct battery polarity. New batteries should be installed before each deployment.

▲ CAUTION: Opening of the equipment should only take place in a clean and dry environment.

 \triangle CAUTION: To prevent the formation of condensation within the equipment avoid opening the equipment when the equipment is colder than the surrounding environment. If possible, allow the equipment temperature to stabilise within the surrounding environment for a minimum of 6 hours prior to opening.

▲ CAUTION: It is possible for liquids to become trapped in threads and/or gaps around openings. ALWAYS point the end to be opened downwards to allow any trapped liquid to drain out of and not into the equipment.

▲ CAUTION: If the equipment is to be placed in storage, always ensure that it is turned OFF and the batteries are removed and stored separately.

EMRx Ex

MARNING: The instructions detailed within the product certificate and the Special Conditions for Safe Use as detailed in section 9 EMRx Ex CERTIFICATION APPENDIX of this manual must be followed at all times.

DEPLOYMENT CONSIDERATIONS AND TRACKING TIPS

Confirm that the 3x LED bar graph frequencies are configured to the required frequencies and that a note has been taken of these frequencies.

Confirm that all personnel who are to be involved in the deployment are aware of what frequency is represented by each LED bar graph colour.

For optimum results keep sources of electrical noise such as laptops, computers, radios, mobile telephones, electrical motors, electrical valves etc as far away from the receiver as possible to minimise unwanted noise.

For optimum results keep any magnetic items in the vicinity of the receiver such as steel toecaps, steel tools, magnets, vehicles etc as still as possible relative to the receiver to minimise unwanted noise. If possible, remove them from the vicinity of the receiver.

For optimum results do not knock or move the receiver excessively while attempting to receive signals. This causes false signals due to the receiver moving in the earth's magnetic field. Keep any movements slow and smooth. The receiver should be placed stationary on the pipe surface or on the ground whenever possible and particularly when attempting to receive very weak signals.

In an ideal, electrically quiet environment and with the receiver stationary on the ground it should be possible to set gain to maximum and have no signal registered on any LED bar graph. Unfortunately, most industrial environments are electrically noisy.

If received noise is not illuminating any LEDs, then the gain may be too low. Increase gain to keep received noise around 2x LEDs (10%).

If the received signal is regularly exceeding 18x LEDs (90%) then the gain is too high. Adjust gain to keep the received signal between 50% and 90% deflection.

Look out for potential problems due to excessively large signals. If unsure about a signal's legitimacy, move the receiver away from the transmitter. A sharp signal drop indicates a legitimate transmitter; a stable signal suggests noise. Signal strength decreases by a factor of eight when the distance is doubled due to the cubic relationship between distance and signal.

APPENDIX C : ANDROID APP DETAILS

EMRx ANDROID APPLICATION

The EMRx app enables users to connect to the EMRx device via Bluetooth, allowing them to monitor signals received by the device, including magnetic flux if the receiver is equipped with magnetic capabilities. Additionally, the app allows users to send new configurations to the device.



ANDROID INSTALLATION

The EMRX android application can be downloaded from the Google app store.

1. Open the google app store and search for the EMRX app.

2. From the search results locate the EMRX app. It can be identified by its logo.

3. Ensure that the app you are downloading matches the one described in this section to avoid downloading a similar-looking app.

4. On the app's page, tap the 'Install' button to begin the installation. Once installed, the app can be accessed by tapping the 'Open' button on the app page, or by locating and launching it on your device.

5. The app page also contains the app description and screenshots.

6. Please leave a review. Monitoring user experiences helps improve the application.

Note: Signed APKs are available on request, in case you are unable to download or install the app.



In addition, this QR code provides quick access to the IK Trax resource hub. It includes shortcuts to manuals, application downloads, and other essential materials.



ANDROID MAIN MENU



ANDROID SIGNAL STRENGTH CHART





The signal strength chart provides a traditional chart of received signal against time (hh:mm:ss). It is excellent for determining the relative signal strength of up to six colour coded (signals) transmitters.

You can use pinch, drag, and fling gestures on the touchscreen to zoom and pan as needed. Note that panning is only available when the chart is paused.



Ηz

This button opens the main menu.

This button hides or shows the colour coded frequency boxes. Up to six colour coded frequencies can be added by tapping the +Add button. Frequencies can be altered by tapping the relevant colour coded frequency box.



Place marker button allows placement of a marker.



Previous marker button jumps to previous marker.



Next marker button jumps to next marker.



Alternates between a play and pause button which plays or pauses the chart.



This button resets the screen to latest peak recorded.



This button allows addition of up to 6x colour coded frequencies to the chart. This button can be toggled on or off by tapping the Hz button.



Frequencies can be modified by tapping the relevant colour coded frequency box. These boxes can be toggled on or off by tapping the Hz button.



This button will toggle on or off the Magnetic detection line.



This Button will toggle on or off all the EM frequencies.

ANDROID INTENSITY CHART





The intensity chart intuitively represents signal strength across frequencies from 10Hz to 30Hz over time. It is excellent for determining the frequency and pulse rate of one or more signals simultaneously.

The horizontal axis shows time (hh:mm:ss), and the right-hand vertical axis shows frequency (Hz). The chart scrolls from right to left as new data is received. Signal strength at each point is represented by a colour gradient, ranging from black (low) through blue, green, and red, to white (high).

An intensity key on the left-hand side indicates signal levels: white represents a signal strength of approximately 97, red approximately 70, and green approximately 49. The scale can be adjusted using vertical drag and fling gestures.



This button hides or shows the intensity key.



ANDROID SPECTRUM CHART

F Spectrum Chart The spectrum analyser chart provides a live view of signal strength against frequency. While not typically required for normal EM transmitter reception, it is useful for debugging, especially in identifying significant noise sources outside the 10Hz to 30Hz range of interest.

The horizontal axis represents frequency (Hz), and the vertical axis represents relative signal strength. The example shows a strong signal component at 22Hz and a significant noise component at 50Hz. The 50Hz and 60Hz frequencies are common noise sources due to mains-powered equipment and can compromise signal reception in the 10Hz to 30Hz range or cause input signal clipping.

ANDROID SETTINGS

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≡	Settings				Sa	ve	
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	Magnetic Disabled	EMRx10_3003_B00	EMRx10_3000_0	C00	1	Ŧ	ע
	Red LED (Hz)	Blue LED (Hz	:)	White	LED (Hz)		
	17	22		32			
		App Version EM	Pv10 3101 C00				
		App version Em	KX10_3101_C00				

දිාි Settings	Settings allows configuration of the connected EMRx unit. Once settings have been modified the Save button must be used to save settings to the EMRx unit. Once settings are saved to the EMRx unit they will be remembered even after it has been turned off. A set of hint messages is included in the input fields to advise on the acceptable values.
Save	Saves settings to EMRx unit.
Serial Number	Serial number of connected EMRx unit.
Supply Voltage	Supply Voltage of connected EMRx unit. A reading of 9.0V or more indicates new batteries are installed. A reading of 6.0V or below indicates critically low batteries are installed which should be replaced immediately.
Gain	Gain setting of connected EMRx unit.
Magnetic Threshold	Threshold setting for the magnetic field detection.
Note: If the Magnetic EMRx (Ex) unit does	Threshold box is greyed out with text " <i>Magnetic Disabled</i> ", it indicates that the not have the Magnetic Detection feature.
Firmware Version	Current firmware version of the connected EMRx unit. Note that the firmware can only be updated using the Windows application.
Bootloader Version	Current bootloader version of the connected EMRx unit.
LED Brightness	LED brightness setting of connected EMRx unit. Available settings are from 1 (lowest LED brightness) to 6 (highest LED brightness). Increasing LED brightness will reduce battery lifetime, so it is recommended that this setting is left at the default setting of 1 (minimum) whenever possible.
Red LED (Hz)	Frequency 1 setting (Hz) of Red LED bar graph.
Blue LED (Hz)	Frequency 2 setting (Hz) of Blue LED bar graph.

App Version Application version. This information can also be found by tapping and holding the application icon and then tapping App info.

ANDROID MARKERS



Markers and marker controls are available in the signal chart as shown above. Markers can be placed at points of interest. Once one or more markers have been placed the user can navigate between markers add notes to markers.

PLACING A MARKER

Tap this button once to highlight the M and then tap anywhere on the chart to place a marker. Marker appears as a bold vertical line as shown in the image above.

NAVIGATING BETWEEN MARKERS



М

Previous marker button jumps to the previous marker, while paused.



Next marker button jumps to the next marker, while paused.

MOVING A MARKER

Select the marker by tapping on it once. A circle will appear at the top and bottom of the marker vertical line indicating that it has been selected. The marker can now be dragged to a new location.

ADDING NOTES TO A MARKER

Select the marker by tapping on it once. A circle will appear at the top and bottom of the marker vertical line indicating that it has been selected. An Edit button will appear on the chart at the top right-hand corner.

Tapping the Edit button will open a new screen where Pig ID or Notes can be added to the marker as shown below.

2:32 🖪 😂 🛠 🔸	ال 🛠 🥱 ال 🛔
< Marker: 04-Jun-2020 13:45:10	Save
Pig #2	
Notes	
22Hz Pulsing Signal (2s rate)	
	29 / 150
🗊 Delete M	arker

DELETING A MARKER

Select the marker tap the Edit button on the next screen the marker can be deleted entirely by tapping Delete marker.

EXPORTING DATA LOG FILE

Use the export button to save logging information as a *.bcn text file on the host device. The app will prompt the user to select the location where the file should be saved. This file can then be located and forwarded by the user using e.g. email.

This *.bcn file can be opened in e.g. Microsoft Excel or Notepad and is simply a list data points from the log that can be used to plot the signal on the Windows App.

12:32 🖻 🎒 📽 🔹	اا، 🕏 🋠 🖻	
(k) TRAX		<
Start Tracking	Import File	
Tracking History From: 14-Feb-2024 09:20:26 To: 18-Mar-2024 13:16:55	LAPOIT Delete	Ο
EMRx Ex 0001 240214 090737 From: 14-Feb-2024 09:07:37 To: 18-Mar-2024 13:16:55	Export Delete	
EMRx Demo File	Export Delete	111
EMRx Ex 0001 240129 113606 From: 29-Jan-2024 11:36:06 To: 18-Mar-2024 13:16:55	Export Delete	

Whenever an EMRx unit is connected, a new background log file is created which logs all data received by the application until Stop Tracking is pressed. These files can then be opened and examined at a later date. Typically, these files are stored on the host device at the following location:

Internal shared storage\Android\data\com.ik trax.emrx\files

Each log file has the same format. The image displays the typical log file name which is composed of: Serial number (EMRx Ex 0001), the date (14 February 2014), time of the creation (09:07:30).



To open a log file simply tap on the filename on the screen shown above. It may take several seconds to load large files containing more than 30 minutes of data.

Once the file is loaded the user is presented with a signal chart. Up to 6x frequencies may be plotted as normal and all marker functionality is available.

Export Exports logging information.

Delete Deletes log file.

Import File

You can Import files from other Android devices or a logged data file from the Windows app to view on the Android device.

ANDROID EXCESSIVELY LARGE INPUT WARNING

If the gain setting is too high or an excessively large signal or noise is present, or the receiver is being moved excessively then the warning message below may be displayed and the EMRx unit will flash all LEDs to warn of "clipping" of the input signal.



This excessively large signal may not be at a frequency that the user is aware of or expects and is distorting the input signal which results in loss of valid frequency information and generation of spurious frequency information.

Note: The EMRx receiver must never be used if this is happening.

Gain must be reduced, or the receiver must be moved away from the source of the excessively large signal to reduce the signal to a level which does not cause the warning to appear.

ANDROID SCREENSHOT

At any point while using the application it is possible to capture a screenshot by using one of the standard Android screenshot methods below.

Press and hold the Power and Volume down buttons at the same time for a few seconds.

ANDROID FAQs PAGE

Signal Chart • What is a Signal Chart? The signal strength chart provides a traditional chart of received signal against time (hh:mm:ss). It is excellent for determining the relative signal strength of up to six colour coded (signals) How can I add a frequency? Press on the + Add button In the top left corner. How can I delete a tracked frequency? Tap on the frequency that needs to be deleted, its represented by a button of the same colour as the tracked line, on the next screen press delete and confirm. Intensity Chart • Spectrum Chart • Troubleshooting •

The FAQ page in the EMRx app provides a structured and accessible reference for commonly asked questions about the app's features and functionality. It is designed to support users by offering clear explanations and guidance across various areas of the application.

То	na	viga	te to tl	ne FAQs	page	tap on the FA	Qs bu	utton tha	t can be found c	on the Landing page	FAOr
or	in	the	Main	Menu		during scanni	ng.				FAUS
								?	FAQS		

Each topic can be expanded into its content or collapsed.

Signal Chart	-
What is a Signal Chart?	
The signal strength chart provides a traditional ch of up to six colour coded (signals)	art of received signal against time (hh:mm:ss). It is excellent for determining the relative signal strength
How can I add a frequency?	
Press on the + Add button In the top left corner.	
How can I delete a tracked freq	uency?
Tap on the frequency that needs to be deleted, its confirm.	represented by a button of the same colour as the tracked line, on the next screen press delete and
Intensity Chart	Tap the title to expand or collapse the topic.

TROUBLESHOOT CHECKBOX



The Troubleshooting checkbox enables the Spectrum Chart, which displays the general signal spectrum of the surrounding environment. This feature is useful for identifying potential sources of interference, allowing the user to either eliminate them or relocate to a clearer area.

APPENDIX D: WINDOWS SOFTWARE DETAILS

EMRx WINDOWS APPLICATION



WINDOWS INSTALLATION

The installation folder for the EMRx Windows application has typical name EMRx10_3100_XXX which represents the full application name and version.

The typical size of the installation folder is 2MB.

Simply unzip the folder if applicable, save the folder into any location on the target device, run the setup.exe file, found within the folder, and then follow the instructions when prompted.

Most Windows computers will already have all other necessary software and drivers installed. If not, then download and install the latest available versions of the following software and drivers:

- 1. Latest compatible .NET framework runtime <u>https://dotnet.microsoft.com/download</u>.
- 2. Latest compatible DirectX Runtime from <u>https://www.microsoft.com/en-gb/download</u>.

WINDOWS RIBBON CONTROLS





Shows the signal strength chart.



Shows the spectrum chart.



Shows the raw signal chart.



Shows the settings page.

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Captures a screenshot.

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Enables or disables audio output. When enabled audio tone(s) with amplitude and frequency proportional to received signal are generated for each frequency enabled on the signal strength chart.

WINDOWS INTENSITY CHART





The intensity chart, always shown in the upper half of the main window, represents signal strength across frequencies from 10Hz to 30Hz over time. It is useful for determining the frequency and pulse rate of transmitters.

The horizontal axis shows time (1 second per division), and the right-hand vertical axis shows frequency (Hz). Signal strength is represented by colours from black (low) to red (high). The chart scrolls from right to left as new data is received.

An example shows a 22Hz transmitter pulsing every 2 seconds and a 17Hz transmitter pulsing every 5 seconds. The intensity key on the left indicates signal levels: red (1900), yellow (1500), and green (1100).

The vertical scale can be adjusted by clicking and dragging the mouse up or down anywhere on the chart. If the chart has been clicked previously then you can also use the keyboard up and down arrows. Double clicking on the chart will autozoom to the visible data.

The horizontal scale can be adjusted between 5 seconds and 60 seconds by clicking and dragging the mouse left or right anywhere on the chart.

The main window can be resized like a normal windows application. The individual chart heights can be adjusted by dragging the grey bar immediately below the intensity chart up or down.

WINDOWS SIGNAL STRENGTH CHART



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The signal chart displays the received signal against time, helping to determine the relative signal strength of up to six signals. The intensity chart typically confirms the frequencies present, while the signal strength chart provides the accurate signal strength of each frequency.

In the example above, a 22Hz transmitter pulses every 2 seconds, and a 17Hz transmitter pulses every 5 seconds. The left vertical axis represents signal strength, and the right vertical axis represents magnetic strength.

Freque	ency	Legend
12	Hz	143
17	Hz	828
22	Hz	108
27	Hz	97
	Hz	0
	Hz	0

The magnet strength chart example shows EM detection deselected, illustrating one cycle of magnet detection as it approaches and passes the receiver. The signal peaks when the magnetic detection is closest to the receiver.

Frequency	Legend
Hz	0
Mag	175

You can plot up to six frequencies by entering them into the color-coded Frequency Legend. Instantaneous signal strengths are displayed in grey next to each frequency. Blank frequencies are not plotted.

Click and drag to adjust the vertical scale up or down. Double-click on the chart to autozoom both the signal and mag graphs. The EM axis shows signal strength numerically, while the Mag axis shows signal value in milli-Gauss. To adjust the time, click and drag the horizontal scale (5 to 60 seconds) left or right.

WINDOWS SPECTRUM CHART



The spectrum chart can be displayed in the lower half of the main window by pressing the relevant icon on the ribbon.

The spectrum analyser chart provides a live chart of signal against frequency. It is not usually required for normal EM transmitter reception but can be useful for debug purposes – particularly identifying significant noise sources outside the normal 10Hz to 30Hz range of interest.

The horizontal axis of the spectrum analyser is frequency (Hz), and the vertical axis is relative signal strength.



The example shown above shows a strong signal component at 22Hz and a huge noise component at 50Hz. 50Hz and 60Hz are common noise frequencies due to their use for mains powered equipment and if large enough can compromise reception of signals in the normal 10Hz to 30Hz range and/or cause "clipping" of the input signal.



WINDOWS RAW CHART

R

The raw signal chart can be displayed in the lower half of the main window by pressing the relevant icon on the ribbon.

The raw signal chart provides a live chart of the raw signal being received by the EMRx prior to the digital signal processing. It is not usually required for normal EM transmitter reception but can be useful for debug purposes and particularly for identifying "clipping" of the input.

WINDOWS SETTINGS

Connection Cor	figure		
Data Select Device File	COM24 EMRx Ex 0002	Uisconnect Bluet	tooth RS485 Demonstration
Hardware Configure		Software Configure	
Supply Voltage	7.6 (56%)	1	128 ~
Gain	2 ~	Intensity Cha	rt 🗹
LED Frequency 1 (red)	22.0	Signal Cha	rt 🗹
	05.0 W	Vrite	er 🗹
LED Frequency 2 (blue)	25.0	Debu	g 🗌
LED Frequency 3 (white)	29.0	Frespons	e 🗹
LED brightness	3 ~	Screenshot Folde	er C:\Users\Nari Phromthep\Des Select
Filter		Data Folder	C:\Users\Nari Phromthep\Des Select
Low Noise		Firmware Configure	
Calibration	128	Firmware Versio	m EMRx10_3003_B00 Select Image
		Bootloader Versio	m EMRx10_3000_C00
		No bootloader reques	t detected
			Cancel



The settings page can be displayed in the lower half of the main window by pressing the relevant icon on the ribbon.

CONNECTION CONFIGURE GROUP

The Connection Configure group is used to establish connection to an EMRx unit.

Select Device	Drop down list to allow selection of the required EMRx unit. EMRx units will appear in the list of available devices with name "EMRx Onshore ####" where "###" is the serial number of the EMRx unit. Note that all previously paired EMRx units will also appear in this list even if they are not powered or within range.
Connect Disconnect	Connect/Disconnect to/from the device selected within the Select Device drop down list.
Bluetooth	Sets the "Select Device" dropdown list to display only the paired Bluetooth devices.
Bluetooth	Sets the "Select Device" dropdown list to display all available COM ports.
O Demonstration	Simulates the signals from a 22Hz transmitter with a 2-second pulse rate and a 17Hz transmitter with a 5-second pulse rate being received simultaneously. This feature allows for demonstration and training with the various controls and charts within the application without the need for an actual EMRx unit or EM transmitter.
Screenshot Folder Data Folder	The screenshot and Data folder are where you can predetermine a folder in which to store the screenshots and where the logged files are automatically saved.
Load Data File	Load Data File is where you can import a previously saved files or files exported from an Android device.

HARDWARE CONFIGURE GROUP

The Hardware Configure group is used to view and modify settings on the EMRx unit. To refresh settings, press the settings control within the *press* ribbon controls.

When configuring the LED frequencies always ensure that a note is taken of the latest settings so that there is a record of what frequency each LED colour is assigned to, otherwise the unit must be interrogated using the application, or manual operations, to determine the current LED frequency settings.

The EMRx is only designed to work with frequencies between 10Hz and 30Hz .

- Supply Voltage Supply voltage (V) and percentage (%) of connected EMRx unit. A reading of 9.0V or more indicates new batteries are installed. A reading of 6.0V or below indicates critically low batteries are installed which should be replaced immediately.
 - Gain Drop down list for gain setting of connected EMRx unit.

LED Frequency 1 (red)	30.0	
LED Frequency 2 (blue)	17.0	Write
LED Frequency 3 (white)	27.0	

LED brightness

Frequency settings for 3x available colour coded LED bar graphs of connected EMRx unit. Simply type in any frequency between 10Hz and 30Hz and then press the Write button.

Drop down list for LED brightness setting of connected EMRx unit. Available settings are from 1 (lowest LED brightness) to 6 (highest LED brightness). Increasing LED brightness will reduce battery lifetime, so it is recommended that this setting is left at the default setting of 1 (minimum) whenever possible.

Filter V I I I I Setting Should be left licked by delau	Filter 🔽	This setting should be left ticked by default.
---	----------	--

- Low Noise
 This setting should be left ticked by default.
- Light Switch
- Calibration 200 This setting is for information only.

SOFTWARE CONFIGURE GROUP

The Software Configure group is used to view and modify settings within the EMRx application.

N 128 ~	This setting should be left at default 128.
Intensity Chart 🗹	This setting enables or disables the Intensity Chart. Disabling the Intensity Chart may allow the application to run on lower performance devices.
Signal Chart 🔽	This setting enables or disabled the Signal Chart. Disabling the Signal Chart may allow the application to run on lower performance devices.
Filter 🗹	This setting should be left ticked by default.
Debug	This setting should be left unticked by default.
Fresponse 🗹	This setting should be left ticked by default.
Screenshot Folder	This specifies the target folder for screenshots. The default location is the host device Desktop. Press the Select button to specify an alternative location.

EMRx MAGNETIC

If the EMRx device has magnetic sensor, then the application will detect it and show additional interface elements.

)ata File	Select Device	COM21 EM	Rx Onshore DEV \sim	Disconnect Bluetoot	th CRS485 Demons	tration
Hardwar	re Configure			Software Configure		
	Supply Voltage	8.9	(96%)	N	128 🗸	
	Gain	1 \	1	Intensity Chart		
LED F	requency 1 (red)	22.0		Signal Chart		
ED En	aquency 2 (blue)	19.0	Write	Filter		
		10.0		Debug		
ED Frei	quency 3 (white)	19.0		Fresponse		
	LED brightness	1 \	1	Screenshot Folder	C:\Users\Ivan	Select
	Filter			Data Folder	C:\Users\Nari	Select
	Low Noise			Firmware Configure		
	Calibration	128		Firmware Version	EMRx10_3003_D00	Select Image
Mad	anetic Threshold	65	7	Bootloader Version	EMRx10_3000_C00	
110		MAG	EM	No bootloader request de	etected	Program
		10.00	L. 191			Cancel

The additional elements allow the configuration of settings related to magnetic field measurements.



Sets the red LED to display magnetic field measurements. NOTE: If the red LED is flashing when switched to magnetic mode then it is likely that either the magnetic threshold is too low, or there is a strong magnetic field in the vicinity.



Sets the red LED to display electromagnetic field measurements.

Magnetic Threshold 65

Sets the magnetic threshold.

WINDOWS EXCESSIVELY LARGE INPUT WARNING

If the gain setting is too high, an excessively large signal or noise is present, or the receiver is being moved excessively, the warning message below may be displayed. Additionally, the EMRx unit will flash all LEDs to indicate "clipping" of the Raw Signal.



The image below shows an excessively large signal "clipping" the Raw Signal - notice the "clipped" peaks of the sine wave where they approach a reading of approximately 33,000. This excessively large signal may not be at a frequency that the user is aware of or expects. This clipping is distorting the signal which results in loss

of valid frequency information and generation of spurious frequency information. <u>THE EMRx RECEIVER</u> <u>MUST NEVER BE USED IF THIS IS HAPPENING.</u>



Gain must be reduced, or the receiver must be moved away from the source of the excessively large signal to reduce the signal to something which looks like the signal below - notice that the peaks of the sine wave are no longer "clipped" because they do not get anywhere near a reading of 33,000.



WINDOWS SCREENSHOT

At any point while using the application it is possible to capture a timestamped screenshot by pressing the screenshot icon on the ribbon as per 5.5 WINDOWS RIBBON CONTROLS.

Screenshot Folder	C:\Users\ss\Desktop	Select	
Data Folder	C:\Users\ss\Documents\EMR	Select	

Screenshots are saved in the specified screenshot folder which can be modified at any time.

The title bar of the EMRx application includes COM port number, device serial number, date and time which will all appear on the screenshot itself.

For the screenshot feature to work reliably the desktop scale should be set to 100% on the host device (on a typical Windows 10 device this setting can be found under Start> Settings> System> Display> Scale and layout) and the application should be on the primary display.

DATA LOGGING

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EMRx Ex 0002 231220 141045.bcn is too large. Only the last 600 seconds will be displayed.

Would you like to do the following?

Back up the original file to a subfolder called 'Original Files'

Split the original file into 4 files
 Display the first file on the charts

Yes No

Data from the EMRx is automatically logged in the specified folder in 600 second segments. You can review previously logged data here and load data that has been exported from an Android device.

Data Folder C:\Users\ss\Documents\EMR Select

If the exported file is too large, when you click Load Data File on the Windows App it will pop up with a window as shown below. Which states that the file is too large and has to be segmented. The number of files it breaks into depends on the size of the original file.

APPENDIX E: TROUBLESHOOTING

BLUETOOTH CONSIDERATIONS

Bluetooth technology is a short-range wireless communication system designed for the transfer of lightweight data. Due to the low power of its signal, Bluetooth can be affected by interference from other 2.4 GHz devices, such as Wi-Fi networks, microwaves, and cordless phones. Additionally, multiple active Bluetooth devices in proximity can cause signal congestion, leading to connectivity issues. Obstacles like metal surfaces can also degrade signal strength. Because of these limitations, troubleshooting may be necessary to optimise Bluetooth functionality and ensure a reliable connection.

BLUETOOTH TROUBLESHOOTING: ANDROID

BLUETOOTH TROUBLESHOOTING

When experiencing Bluetooth-related issues on an Android device, the first step is to restart the Bluetooth service. This can be done by turning Bluetooth off, waiting a few seconds, and then turning it back on. This simple step often resolves minor connectivity issues by refreshing the connection.

This may be done by accessing the quick settings menu by pulling down the top of your screen.



Disable Bluetooth, for 5 seconds, then enable it again.

It is also advisable to restart the app experiencing Bluetooth-related issues. In many cases, restarting the app can resolve connectivity problems by refreshing its Bluetooth connection and clearing temporary glitches.

EMRX PAIRING METHOD

Since the EMRx uses Bluetooth Classic, it requires pairing before a connection can be established. The app is designed to automatically pair the EMRx with a new Android device. However, in some cases, the Android device may fail to detect the unpaired EMRx through the app's functionality. In such situations, the issue can often be resolved by manually pairing the EMRx with the Android device through the device's Bluetooth settings.



Tap on scan to start/refresh the available devices section, find the device that follows the format of <u>EMRx</u> <u>1234</u>, tap on it then confirm the pairing by tapping the pair button on the popup message

BLUETOOTH TROUBLESHOOTING: WINDOWS

If you experience performance issues with the EMRx application, follow these steps to ensure optimal performance and data integrity:

- 1. Enable "Flight Mode" and/or Disable Wi-Fi: Ensure that Bluetooth remains enabled.
- 2. Close All Other Applications: Make sure no other applications are running in the background.
- 3. Minimize Other Activities: Keep calls, messages, and other activities to a minimum.

Additional Recommendations:

- **Test Performance**: Before deployment, test the EMRx application on the intended host device to confirm it can handle the application.
- Use a Dedicated Device: For critical tracking jobs, it is recommended to use a dedicated host device.

By following these steps, you can help ensure the EMRx application runs smoothly and efficiently on your device.

WINDOWS 11 PAIRING ERRORS

By default, Bluetooth devices on Windows 11 are set to limited devices discovery, which prevents the target PC from detecting the EMRx device. This default setting is the primary obstacle to completing the EMRx pairing process. To circumvent this issue, the devices discovery setting must be changed to **Advanced**.

To change the Bluetooth devices discovery setting to advanced:



Navigate to the Bluetooth settings page by typing "Bluetooth in the Windows search bar

On the Bluetooth settings page locate the "Bluetooth devices discovery" setting and set it to "Advanced" setting.

USB Root Hub (USB 3.0) •	
ice settings	
how notifications to connect using Swift Pair onnect to supported Bluetooth devices quickly when they're close by and in pairing mode	On 🦲
workload over metered connections evice software (drivers, info, and apps) for new devices will download when you're on metered internet connections—data charges may a	off Off
luetooth devices discovery Then adding a Bluetooth device. Default lets you connect common accessories—choose Advanced to see all types of devices.	Default Advanced
ted settings	
10) Sound	>
Display	þ
	G