ULTRA

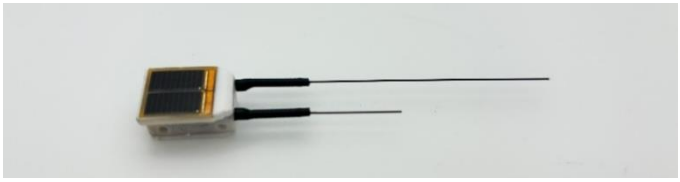
Debut ULTRA series is lightest tracker with standard GNSS function (more accurate than snapshot GPS technology), solar charging, accelerometer, and other environment sensors.

ULTRA series uses either long-range Bluetooth or 5G cellular network (LTE-M & NB-IoT) as the data transmission method.

Thanks to its compact size and versatile functionality, it holds potential for a wide array of applications.

CONTENTS

BASIC SPECIFICATIONS

MODEL	ULTRA
Appearance	 (ULTRA P1 with strengthened antenna root protection)
Battery Type	15mAh lithium polymer rechargeable battery
Battery Life	Over 150 positions under optimal GNSS satellite view at 5-minute interval
Solar Type	GaAs solar unit (30% efficiency) with good performance under weak light
Housing	X-Glue
Color	White, or customized color
Antenna	External, 0.2mm titanium alloy with protective coating (by default) Length: 45mm, 30mm for ULTRA (INTELINK), 96mm, 48mm for ULTRA (5G)
GNSS Module	Precision: CEP (50%) 5m Maximum update rate: 10 Hz
Working Temperature	-20°C~60°C (enough for very cold winter if close to warm-blood animal body)
Waterproof	> IP 68 (2 ATM for injection molding)
Data Types	- GNSS: longitude, latitude, altitude, altitude (ellipsoid), course, satellite quantity - ENV: voltage, light intensity, temperature - ODBA (overall dynamic body acceleration) - ACC: x/y/z acceleration data (upon request) - Beacon: with Debut series gateway devices
Data Storage	Collected data will be stored in memory before transmission. - Flash memory: 32 MB - Regular data storage: 460 days at default setting (1h GNSS+1h ENV+10 min ODBA) - BOOST data storage: 280,000 pieces - ACC data storage: 28,700 pieces
Working Schedule	Programmable from 1 min
Firmware Upgrade	Instantly via INTELINK (Bluetooth)

ULTRA

ULTRA utilizes long-range Bluetooth for data transmission. When paired with a professional gateway device like the HUB from Druid, ULTRA enables data downloading from distances of up to 1200 meters in an ideal field environment, meaning that both the ULTRA device and the HUB are 2 meters away from the ground, no obstacles in between, no electromagnetic interference, and the air is not too moist.

The good part of ULTRA is that everyone who has a mobile phone with Bluetooth function can scan for it using Ecotopia App, which generates beacon locating data like Air Tag from Apple. The project manager can also easily authorize others to download data from or operate the devices using their mobile phone.

TRANSMISSION BANDS

Specifications	INTELINK
Frequency Bands	2.4 GHz
Maximum Output Power	8 dBm (default)
Maximum Data Rate	1 Mbps/1 Mbps
Transmission Distance (ideal condition in field)	1200 m

TRANSMISSION STRATEGY

ULTRA is configured to broadcast its INTELINK (Bluetooth) signals all the time. Professional gateway devices, such as a HUB and TAG G, are usually configured to scan for INTELINK devices following a duty cycle pattern, say, 30s in every minutes. ULTRA can connect to them only when HUB or TAG G is at “ON” duty. This duty cycle is configurable.

Gateway device like a mobile phone, with Bluetooth activated, will be able to pick up a ULTRA immediately. For certain ULTRA sub-models that requires battery saving and thus configured also to broadcast in duty-cycle mode, you may have to wait longer before it can be picked up by a gateway device.

SUB-MODELS

ULTRA features high flexibility in customization due to its compact size. Below are the existing models. If you have any customization ideas, please feel free to contact us.

Name	Weight	Dimensions (LWD, antennae excluded)	Energy Supply
ULTRA P1 [1]	1.7g	17 x 13 x 8 mm	15mAh rechargeable by solar
ULTRA XC [2]	1.4g	17 x 12.5 x 8mm	15mAh rechargeable by solar
ULTRA XC 40	2.0g	20 x 14 x 9 mm	40mAh rechargeable by solar
ULTRA XF [3]	1.6g	--	15mAh rechargeable battery
ULTRA XF 80	2.6g	--	80mAh rechargeable battery
ULTRA XF P500	4.9g	--	500mAh primary battery
ULTRA C4 P1050	10.8±0.2g	41 x 25 x 13 mm	1050mAh primary battery

Note:

[1] P1 refers the version using X-Glue technique. (For details, check later chapter of this file.) [2] XC refers to a special sealing technique called “X-Coating”. (For details, check later chapter of this file.) [3] XF refers to a special sealing technique called “X-Filming”. (For details, check later chapter of this file.) The weight slightly increases when users require that the battery be wrapped with silicone tubing for further protection.

[4] C4 P1050 refers to a version using 1050mAh primary battery and thick steel rope antenna, see the photo to the right. It is a customized model for nocturnal birds.

ULTRA 5G

ULTRA 5G supports both NB-IoT and LTE-M (or called eMTC) frequency bands. You can activate selected bands for usage in different regions. Note that, though ULTRA 5G also supports INTELINK for connecting and data downloading, the distance is not comparable to ULTRA the dedicated INTELINK type.

TRANSMISSION BANDS

NB-IoT:

Band	Duplex mode	f (MHz)	Uplink (MHz)	Downlink (MHz)	UL/DL Bandwidth (MHz)	Duplex spacing (MHz)	Channel bandwidths (kHz)
B1	HD-FDD	2100	1920-1980	2110-2170	60	190	180(/200)
B2	HD-FDD	1900	1850-1910	1930-1990	60	80	180(/200)
B3	HD-FDD	1800	1710-1785	1805-1880	75	95	180(/200)
B4	HD-FDD	1700	1710 -1755	2110 -2155	45	400	180(/200)
B5	HD-FDD	850	824-849	869-894	25	45	180(/200)
B8	HD-FDD	900	880-915	925-960	25	45	180(/200)
B11	HD-FDD	1500	1427.9-1447.9	1475.9-1495.9	20	48	180(/200)
B12	HD-FDD	700	699-716	729-746	17	30	180(/200)
B13	HD-FDD	700	777-787	746-756	10	31	180(/200)
B14	HD-FDD	700	788-798	758-768	10	30	180(/200)
B17	HD-FDD	700	704-716	734-746	12	30	180(/200)
B18	HD-FDD	800	815-830	860-875	15	45	180(/200)
B19	HD-FDD	800	830-845	875-890	15	45	180(/200)
B20	HD-FDD	800	832-862	791-821	30	41	180(/200)
B25	HD-FDD	1900	1850-1915	1930-1995	65	80	180(/200)
B26	HD-FDD	850	814-849	859-894	35	45	180(/200)
B28	HD-FDD	700	703-748	758-803	45	55	180(/200)
B31	HD-FDD	450	452.5-457.5	462.5-467.5	5	10	180(/200)
B66	HD-FDD	1700	1710-1780	2110-2200	70/90	400	180(/200)

LTE-M (eMTC):

Band	Duplex mode	f(MHz)	Uplink (MHz)	Downlink (MHz)	UL/DL Bandwidth (MHz)	Duplex spacing (MHz)	Channel bandwidths (MHz)
B1	HD-FDD	2100	1920-1980	2110-2170	60	190	1.08(/1.4)
B2	HD-FDD	1900	1850-1910	1930-1990	60	80	1.08(/1.4)
B3	HD-FDD	1800	1710-1785	1805-1880	75	95	1.08(/1.4)
B4	HD-FDD	1700	1710 -1755	2110 -2155	45	400	1.08(/1.4)
B5	HD-FDD	850	824-849	869-894	25	45	1.08(/1.4)
B8	HD-FDD	900	880-915	925-960	25	45	1.08(/1.4)
B11	HD-FDD	1500	1427.9-1447.9	1475.9-1495.9	20	48	1.08(/1.4)
B12	HD-FDD	700	699-716	729-746	17	30	1.08(/1.4)
B13	HD-FDD	700	777-787	746-756	10	31	1.08(/1.4)
B14	HD-FDD	700	788-798	758-768	10	30	1.08(/1.4)
B17	HD-FDD	700	704-716	734-746	12	30	1.08(/1.4)
B18	HD-FDD	800	815-830	860-875	15	45	1.08(/1.4)
B19	HD-FDD	800	830-845	875-890	15	45	1.08(/1.4)
B20	HD-FDD	800	832-862	791-821	30	41	1.08(/1.4)
B25	HD-FDD	1900	1850-1915	1930-1995	65	80	1.08(/1.4)
B26	HD-FDD	850	814-849	859-894	35	45	1.08(/1.4)
B28	HD-FDD	700	703-748	758-803	45	55	1.08(/1.4)
B31	HD-FDD	450	452.5-457.5	462.5-467.5	5	10	1.08(/1.4)
B66	HD-FDD	1700	1710-1780	2110-2200	70/90	400	1.08(/1.4)

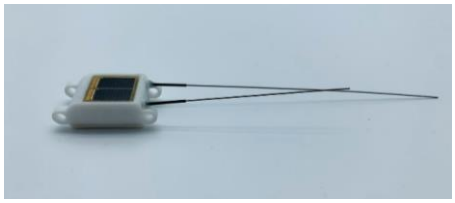
Maximum output power: 23 dBm

SUB-MODELS

Name	Weight	Dimensions (LWD, antennae excluded)	Energy Supply
ULTRA 5G P1 [1]	2.5~2.6g	17.7 x 12.8 x 8.6 (mm)	15mAh rechargeable by solar
ULTRA 5G XC [2]	2.3~2.4g	17.7 x 12.8 x 8.6 (mm)	15mAh rechargeable by solar
ULTRA 5G XC 100	4.1~4.2g	28 x 12.5 x 8 (mm)	95mAh rechargeable battery
ULTRA 5G XF [3]	2.5~2.6g	--	15mAh rechargeable battery
ULTRA 5G XF 210	5.6~5.7g	--	210mAh rechargeable battery
ULTRA 5G C3 [4]	3.8±0.1g	31 x 15 x 9 (mm)	30mAh rechargeable by solar

Note: [1] P1 refers the version using X-Glue technique. (For details, check later chapter of this file.) [2] XC refers to a special sealing technique called “X-Coating”. (For details, check later chapter of this file.)

[3] XF refers to a special sealing technique called “X-Filming”. For details, check later chapter of this file.) The weight slightly increased when users require that the battery be wrapped with silicone tubing for further protection. [4] Photo to the right shows ULTRA 5G C3.



ANTENNA OPTIONS

ANTENNA MATERIAL OPTIONS

Type	Description	Weight Change
A	0.2mm titanium alloy wire with waterproof coating	Default [1]
B	0.4mm titanium alloy wire with waterproof coating	+ 0.1g for 5G

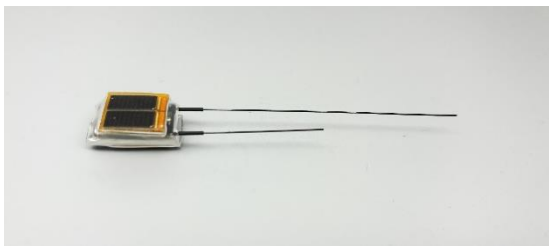
ANTENNA ROOT PROTECTION OPTIONS

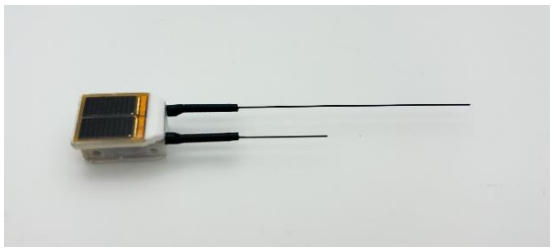
Type	Description	Weight Change
Default	Short plastic tube	Default [2]
Extra strengthened	Small spring with longer plastic tube	+ 0.3g

Note: [1] By default, 0.2 mm titanium alloy wire with waterproof coating will be used, to achieve the balance between weight and toughness. The weight change is calculated based on it. Generally, the thicker the antenna, the more resilient it is.
[2] By default, only plastic tube is used to achieve the balance between weight and toughness. The weight change is calculated based on it.

In the below photos:

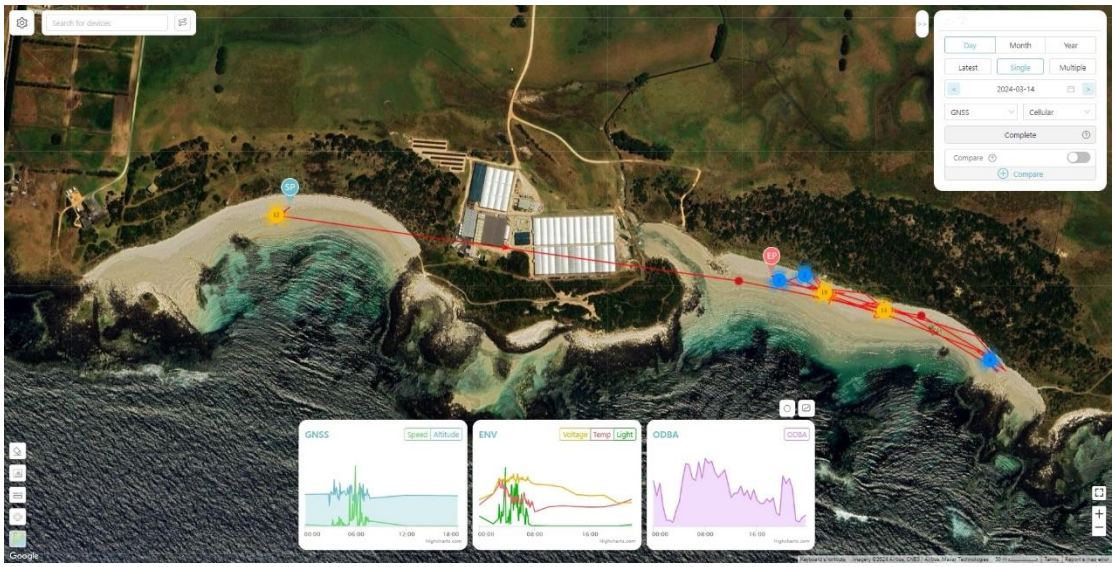
- the left one shows default antenna (A)+ default antenna root protection;
- the right one shows antenna material (B) + extra strengthened antenna root protection.





DATA SAMPLES

Equipped with a high-efficiency solar unit, ULTRA has the capability to gather dozens of GNSS data daily. The screenshot below displays one-day track of a small shorebird wearing ULTRA P1, in March, at south latitude 37°. The device generated over 60 GNSS data in one day.



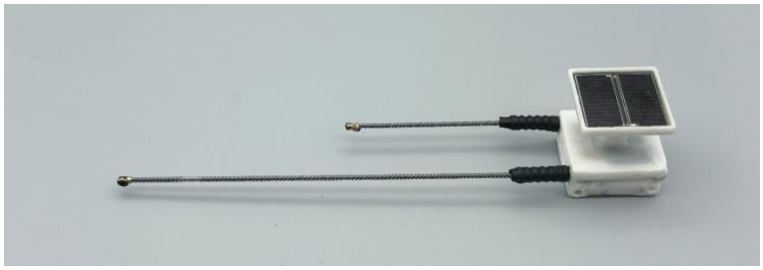
Additionally, the accompanying small charts illustrate the variations in flying speed, altitude, light intensity, temperature, and activity index throughout this timeframe.

ULTRA also witnessed many species completed their migration cycle. We will share the data sample when we received permission from the users.

X SERIES CRAFTS

X-GLUE

X-Glue is a sealing technique is used for manufacturing P versions of devices, e.g., NANO P1, ULTRA P1.



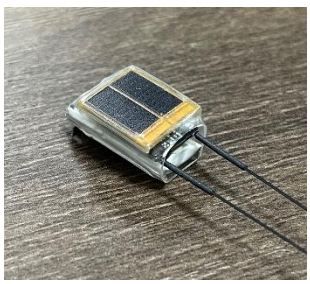
The photos to the left shows a MINI 2G P1 with elevated solar panel.

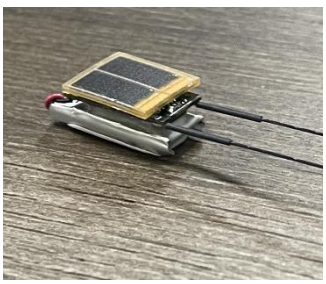
This technical is used primarily for reducing weight, especially when compared with traditional epoxy-resin sealing method, 3D-printed housing, or the toughest ASA/PC injection-molding housing.
Devices treated with X-Glue housing provides two through holes (2mm diameter) for harnessing.

X-COATING

X-Coating is a specialized technique that applies an extremely thin, invisible layer to electronic components, rendering them waterproof. Devices treated with X-Coating appear unprotected, yet submersion under 30 cm of water for extended periods confirms their normal functionality during and after exposure.
However, a drawback of X-Coating is its susceptibility to scratching due to the thin layer. To mitigate this vulnerability, we typically encase the device in silicone tubing for added protection against scratches, and also to the structure. This layer adds some weight, but can be removed easily with a small knife. So, many researchers will decide whether to keep it or not, based on the situation in the field, e.g., body weight of individual, juvenile or adult.

The photos to the left shows an ULRTA XC device equipped with a 3D-printed harnessing structure which weighs approx. 0.1g, and wrapped by a hot-shrinking silicon tube which weigh approx. 0.15~0.2g.
This silicon tube layer can be removed using a small knife, just be careful to cut from the empty space to avoid damaging the X-coating layer.



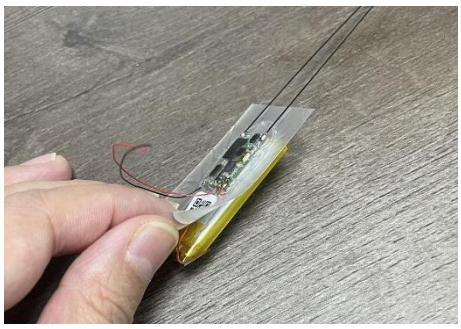


The photos to the left show how an ULTRA XC 40 device looks when the extra layer of hot-shrinking silicon tube is added or removed.
This device is not added with a 3D-printed harnessing structure, as the researcher intended to glue it on animals.

X-FILM

X-Filming is an advanced technique that envelops the PCBA (printed circuit board assembly) containing chips and sensors within a specialized film, rendering it waterproof. The film itself boasts exceptional anti-light-aging properties and remarkable durability.

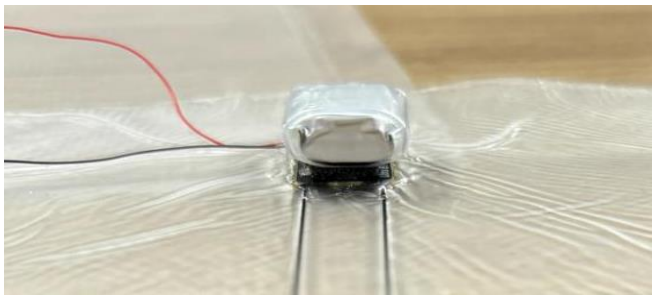
The solar unit and battery are typically not encapsulated within the film due to the high-temperature environment (over 100°C) and pressure required during the X-Filming process.



The photo to the left shows a ULTRA 5G XF 210 device without solar unit. The X-film is trimmed small for the purpose of evaluating the final weight, but there's still much room left for the researcher to tailor in the field.
This device is customized for tracking bats. The two wires tilting upward are for manual recharging. The user will need to properly protect the wires before deploying the device on bats, so that the device can be retrieved later to be recharged and used again.

When preparing devices with the X-Filming technique, we intentionally leave an excessively large film to allow users the flexibility to trim it to their desired shape.

Some researchers opt to trim all excess film, leaving 1-2mm margin from edge, and then affix the device directly to the animal using glue or attach two short plastic hollow tubes along the sides for a leg-loop harness. Others may utilize the excess film material to make harnesses or other attachment styles.



The photo to the left shows a ULTRA XF 80 device without solar unit. Note that the battery part (facing upward in the photo) is also wrapped by a silicon tube for protection, as required by the researcher.
The excessive X-film is not trimmed, as the research is trying to but a harness structure out of the film itself.

The provided weight of X-Filming devices in previous chapter is measured after the excess filming is removed. The ± range accounts for variations, primarily when users opt to protect the battery with an extra layer of silicone tubing to include the solar panel and battery.

X-Filming is commonly employed by researchers seeking to customize their own devices, utilizing Debut series PCBA while incorporating their own battery or adding to other devices.