mLOCK Quick Start Manual

Scope: This document is a Quick Start Guide for a permanently sealed iControl mLOCK. iControl's mLOCK is a maintenance free GPS tracking system whose user interface is a wireless interface via a 802.15.4 radio integrated with the lock. The only physical user interface to the tag is a two conductor connector for a cradle charging system located on the bottom of the lock.

Overview: The iControl mLOCK (Figure 1) is a battery powered device which provides wireless communication and GPS tracking data for mobile assets. The mLOCK is an active RFID padlock that is a component of the Marine Asset Tag Tracking System sponsored by the United States Department of Homeland Security (DHS).

The mLOCK communicates bi-directionally using addressed and encrypted messages between the lock and a stationary (or mobile) reader. MATTS stationary readers are called iGATEs.

The mLOCK never transmits first. The mLOCK must detect a beacon from a MATTS reader (iGATE) or a MATTS handheld (Figure 2) and negotiate an authorized connection before transmission begins.

The stationary reader operates on a locally accepted 802.15.4 channel. The mLOCK scans all 802.15.4 channels and only communicates using the channel identified by the local reader. The user may configure the lock to operated (lock or unlock) automatically based on the local readers mode of operation.

When outside of the readers range, the mLOCK continues to log location and state of health data in non volatile memory (flash).

Figure 1 mLOCK

- GPS enabled active RF lock utilize secure 802.15.4 communications protocols
- Long range RFID read capability (up to 1 km)
- GPS position data is periodically logged during transit
- The mLOCK provides power scavenging options

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Powering the mLOCK. iControl ships all mLOCK's with the power disabled. To enable the power for the mLOCK, push and hold the front panel button for 30 seconds to enable power for the lock. A successful power up can be confirmed when the LCD display activates and displays the boot display "iControl mLOCK" for 10 seconds.

After power up, the LCD display menus can be reviewed by holding the front panel button to scan status displays.

Disabling the power in the lock can only be accomplished via a secure 802.15.4 radio link command that decommissions the lock until a new power cycle.

If the network connection is successfully negotiated, status and control data from the tag can be retrieved by either an iGATE user interface or via a MATTS handheld (figure 2)

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Figure 2 MATTS Handheld:

- Test and configure iTAG-WAN devices
- View waypoint and tracking data
- Modify iTAG-WAN schedules
- Monitor iTAG-WAN state of health

mLOCK Commissioning:

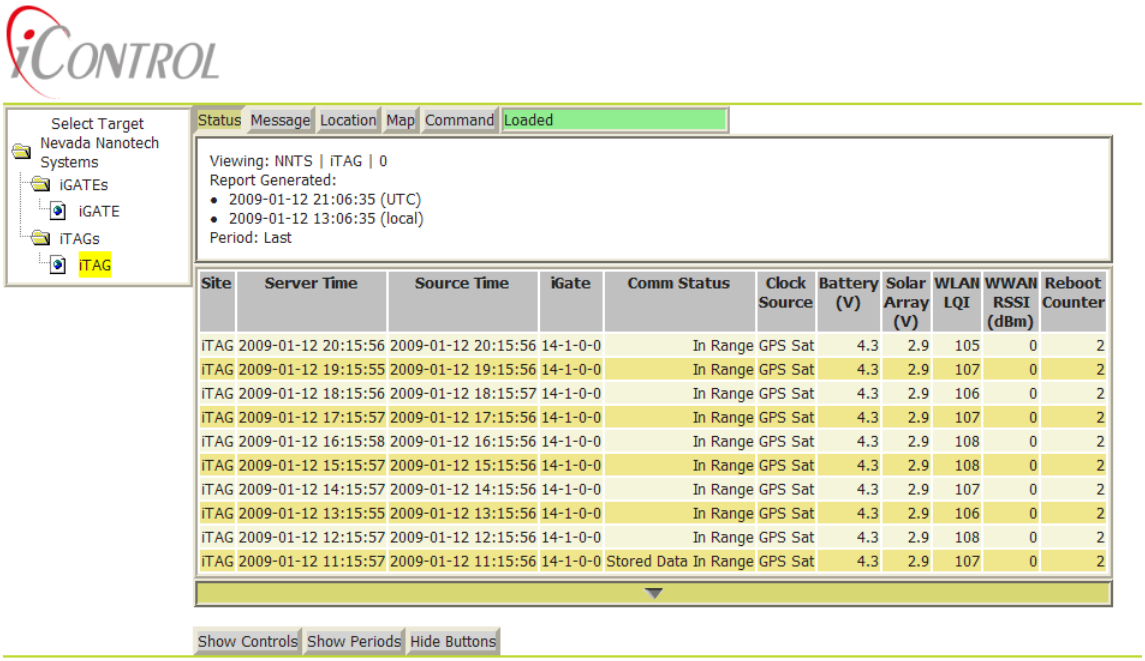
The mLOCK is commissioned for operation via the 802.15.4 radio link. The mLOCK network utilizes local base station gateways to forward schedules and control lock behavior for each commissioned trip.

The user interface for the mLOCK utilizes Internet based html interface (figure 3) that allows customers to configure the lock firmware using encrypted radio commands for the following,

1) Load GPS waypoints to enable geographic operation of the mLOCK
2) Program gateway destinations address to enable automatic lock operations on network Association
3) Set over due schedule alarms if a lock is overdue for arrival
4) Set data logging intervals for location and motion detection thresholds
5) Program remote (key chain) ID's to allow authorized mLOCK operation using iControl mLOCK miKEY keyfob's.

NOTE:

Please refer to the miKIT Users Manual for obtaining web access and iGATE configuration to control the mLOCK.



Site	Server Time	Source Time	iGate	Comm Status	Clock Source	Battery (V)	Solar Array (V)	WLAN LQI	WWAN RSSI (dBm)	Reboot Counter
iTAG	2009-01-12 20:15:56	2009-01-12 20:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	105	0	2
iTAG	2009-01-12 19:15:55	2009-01-12 19:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	107	0	2
iTAG	2009-01-12 18:15:56	2009-01-12 18:15:57	14-1-0-0	In Range	GPS Sat	4.3	2.9	106	0	2
iTAG	2009-01-12 17:15:57	2009-01-12 17:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	107	0	2
iTAG	2009-01-12 16:15:58	2009-01-12 16:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	108	0	2
iTAG	2009-01-12 15:15:57	2009-01-12 15:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	108	0	2
iTAG	2009-01-12 14:15:57	2009-01-12 14:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	107	0	2
iTAG	2009-01-12 13:15:55	2009-01-12 13:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	106	0	2
iTAG	2009-01-12 12:15:57	2009-01-12 12:15:56	14-1-0-0	In Range	GPS Sat	4.3	2.9	108	0	2
iTAG	2009-01-12 11:15:57	2009-01-12 11:15:56	14-1-0-0	Stored Data In Range	GPS Sat	4.3	2.9	107	0	2

Figure 3 mLOCK Web based control

Lock Operation:

To open the lock shackle, the lock mechanism must be enabled via the radio network or via a pre-programmed GPS waypoint (figure 4).

The lock mechanism internally enables the operation of the lock latch. Once the lock mechanism is unlocked, the user opens the lock hasp by pressing the actuator button on the side of the lock and pulling the hasp out of the lock body.

Even if the lock actuator is enabled, the hasp will not open with out operating the button actuator.

Note: For proper GPS tracking, the mLOCK must be installed vertically hanging from the padlock hasp.

Figure 4 Opening a mLOCK

mLOCK Radio Specification (Transmit):

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Overall					
RF Frequency Range	2400		2483.5	MHz	Programmable in 1 MHz steps, 5 MHz steps for compliance with [1]
Transmit Section					
Transmit bit rate	250		250	kbps	As defined by [1]
Transmit chip rate	2000		2000	kChips/s	As defined by [1]
Nominal output power	7	10		dBm	Delivered to a single ended 50 Ω load through a balun. [1] requires minimum –3 dBm
Programmable output power range		0		dB	Output power is not user programmable
Harmonics 2nd harmonic 3rd harmonic		 -37 -51		 dBm dBm	At max output power delivered to a single ended 50 Ω load through a balun. See page 53.
Spurious emission 30 - 1000 MHz 1– 12.75 GHz 1.8 – 1.9 GHz 5.15 – 5.3 GHz			 -36 -30 -47 -47	 dBm dBm dBm dBm	Maximum output power. Complies with EN 300 328, EN 300 440, CFR47 Part 15 and ARIB STD-T-66
Error Vector Magnitude (EVM)			20	%	Measured as defined by [1] [1] requires max. 35 %
Optimum load impedance **Receive Section**		115 + j160		Ω	Differential impedance as seen from the RF-port (RF_P and RF_N) towards the antenna. For matching details see the Input / Output Matching section on page 53.
Receiver Sensitivity	-90	-94		dBm	PER = 1%, as specified by [1] Measured in 50 Ω single endedly through a balun. [1] requires –85 dBm

mLOCK Radio Specification (Receive):

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Saturation (maximum input level)	0	10		dBm	PER = 1%, as specified by [1] Measured in 50 Ω single endedly through a balun. [1] requires –20 dBm
Adjacent channel rejection + 5 MHz channel spacing		46		dB	Wanted signal @ -82 dBm, adjacent modulated channel at +5 MHz, PER = 1 %, as specified by [1]. [1] requires 0 dB
Adjacent channel rejection - 5 MHz channel spacing		39		dB	Wanted signal @ -82 dBm, adjacent modulated channel at -5 MHz, PER = 1 %, as specified by [1]. [1] requires 0 dB
Alternate channel rejection + 10 MHz channel spacing		58		dB	Wanted signal @ -82 dBm, adjacent modulated channel at +10 MHz, PER = 1 %, as specified by [1] [1] requires 30 dB
Alternate channel rejection - 10 MHz channel spacing		55		dB	Wanted signal @ -82 dBm, adjacent modulated channel at -10 MHz, PER = 1 %, as specified by [1] [1] requires 30 dB
Channel rejection ≥ + 15 MHz ≤ - 15 MHz	39			dB	Wanted signal @ -82 dBm. Undesired signal is a 802.15.4 modulated channel, stepped through all channels from 2405 to 2480 MHz. Signal level for PER = 1%.
Blocking / Desensitisation +/- 5 MHz from channel centre +/- 10 MHz from channel centre +/- 20 MHz from channel centre +/- 50 MHz from channel centre		 -24 -24 -24 -23	 -50 -45 -40 -30	 dBm dBm dBm dBm	Wanted signal 3 dB above the sensitivity level, CW jammer, PER = 1%. Maximum values according to EN 300 440 class 2.
Spurious emission 30 – 1000 MHz 1 – 12.75 GHz			 −57 −47	 dBm dBm	Complies with EN 300 328, EN 300 440 class 2, CFR47, Part 15 and ARIB STD-T-66
Frequency error tolerance	-300		300	kHz	Difference between centre frequency of the received RF signal and local oscillator frequency [1] requires 200 kHz
Symbol rate error tolerance			120	ppm	Difference between incoming symbol rate and the internally generated symbol rate [1] requires 80 ppm

Enclosure Specification: The mLOCK utilizes a sealed impact resistant die-cast zinc enclosure that is weather and shock proof. The mLOCK is attached for security applications via the lock hasp.

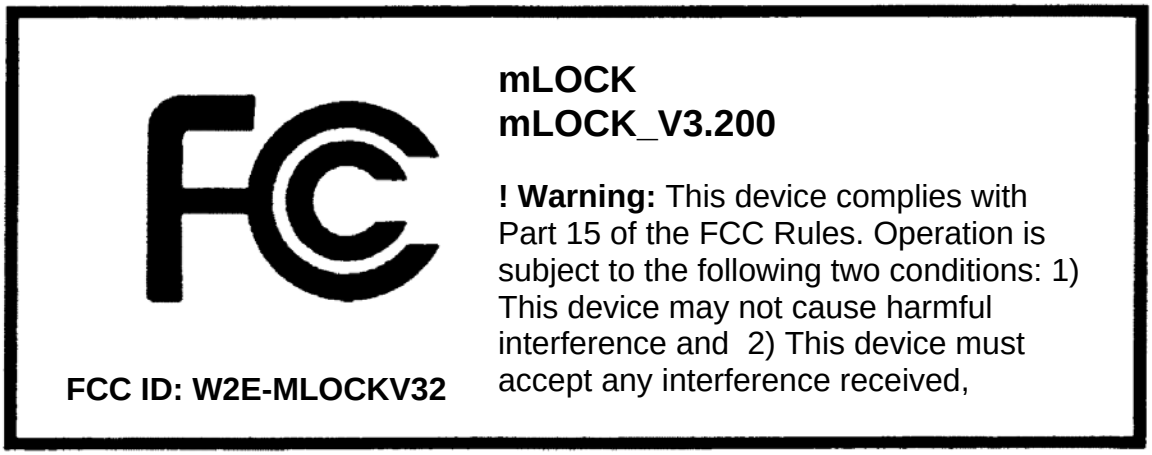
Operating Condition:

Parameter	Min	Max	Unit
Operating Temperature	**-40**	**85**	**C**

Maintenance:

1) There are no user serviceable parts inside the mLOCK.
2) Battery cycle life for the lock rechargeable Li battery is approximately 200 charge/discharge cycles.

FCC NOTICE:



FCC COMPLIANCE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and receiver.
3. Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician.
This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:
1. This device may not cause harmful interference
2. This device must accept any interference received, including interference that may cause undesired operation.

FCC WARNING:
Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC Rules.

This equipment has been evaluated in accordance with the FCC bulletin 56 "Hazards of radio frequency and electromagnetic fields" and bulletin 65 " Human exposure to radio frequency and electromagnetic fields. Safe operation in an uncontrolled environment will result if the following distances from the device are maintained as a minimum.

A distance greater than or equal to 20 cm from the device should be maintained.