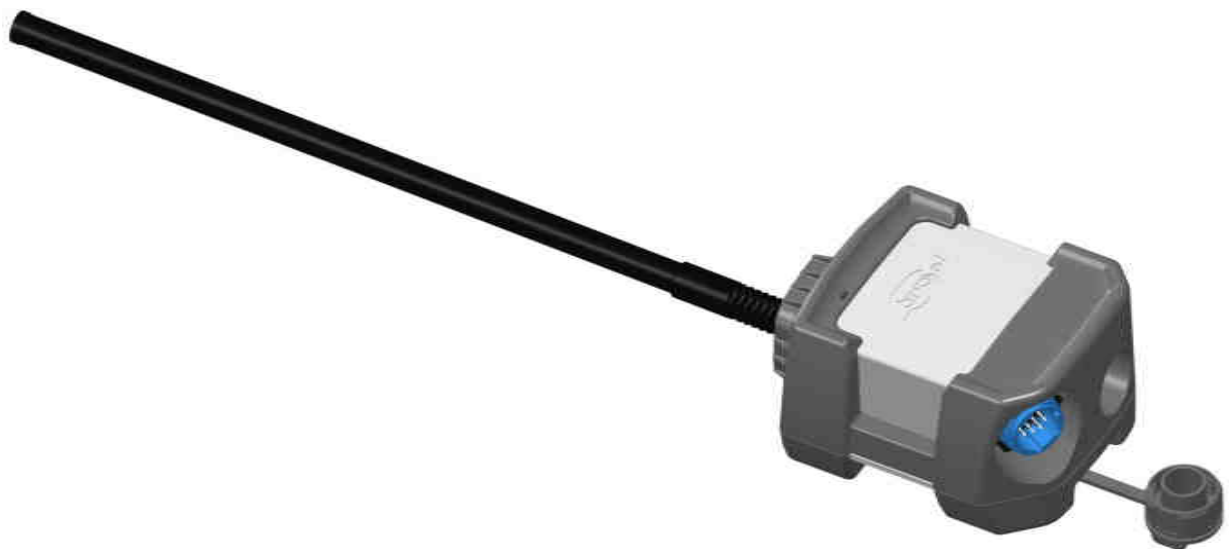


LRC-508

USER MANUAL



Ahead of the CurveSM

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Guidelines for Safe and Efficient Use:

Read this information before using your LRC-508.

Warnings, Cautions, and Important notices throughout this manual guide you to avoid injury, prevent equipment damage, and determine equipment use when varying components or configurations exist. Notes provide tips or additional information.

SERCEL is not responsible for damages or injuries that result from failure to observe the information provided.



When a Warning or Caution appears with an exclamation-point icon, as shown in this example, this is to indicate possible equipment damage or potential risk of misuse and incorrect operation.



Important notices appear in the manual to highlight information that does not affect the risk of bodily injury, death, or equipment damage, but is nevertheless important. These notices appear with a stop-sign icon, as shown in this example.

IMPORTANT

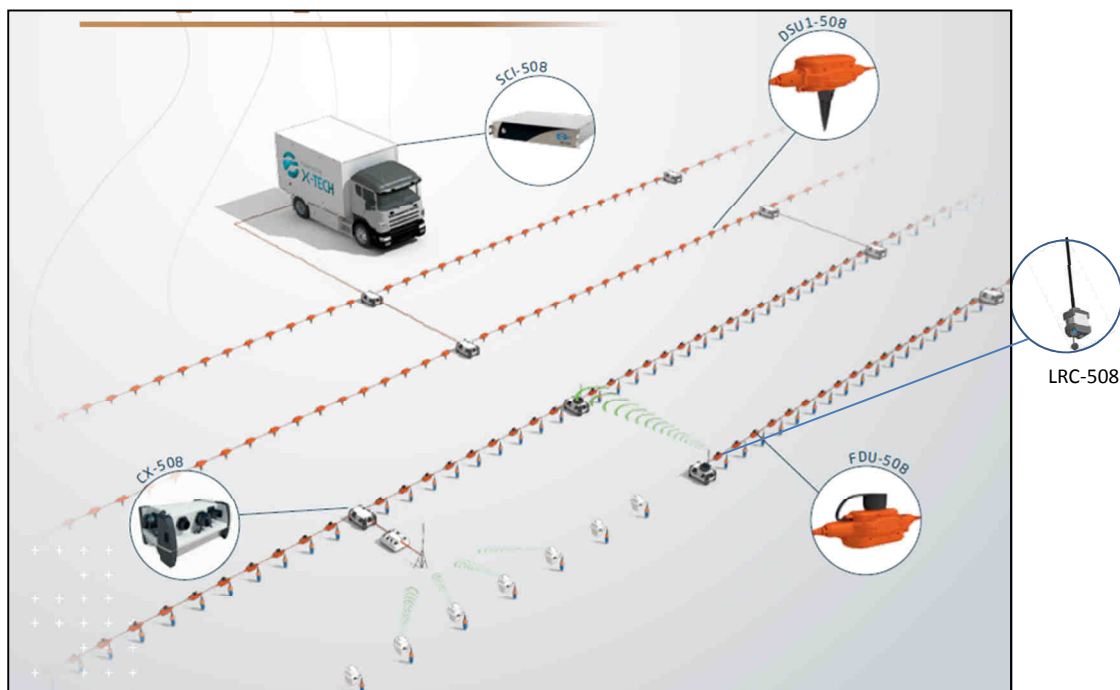


Warranty is void if the product shows evidence of being damaged as a result of disassembly/reassembly by anyone other than qualified, service-trained personnel authorized by SERCEL.

SUMMARY :

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Description:



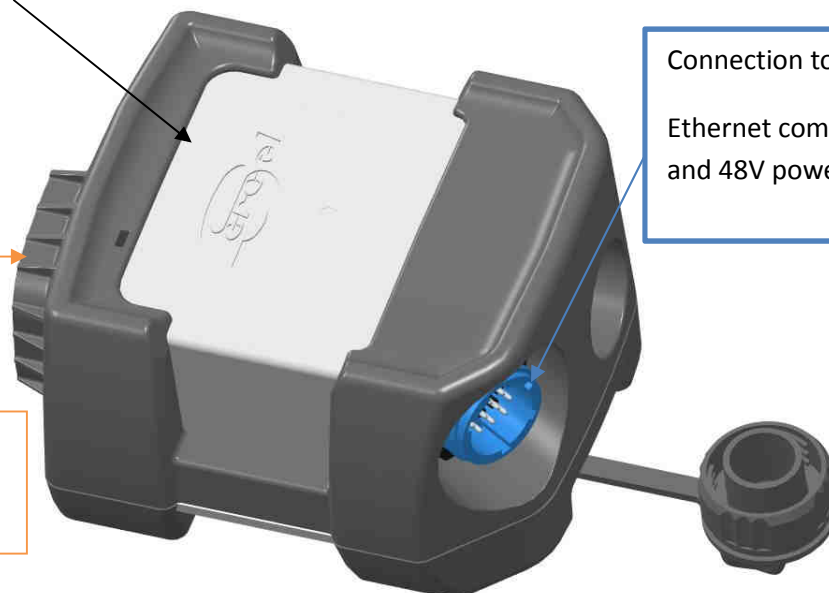
LRC-508 transmits data between CX-508 via 2.4 GHz radio communication link.

It includes:

GPS for radio synchronization

Connection to CX XDP port:
Ethernet communications link
and 48V power supply

Connection to
external 7.4 dBi
antenna



IMPORTANT



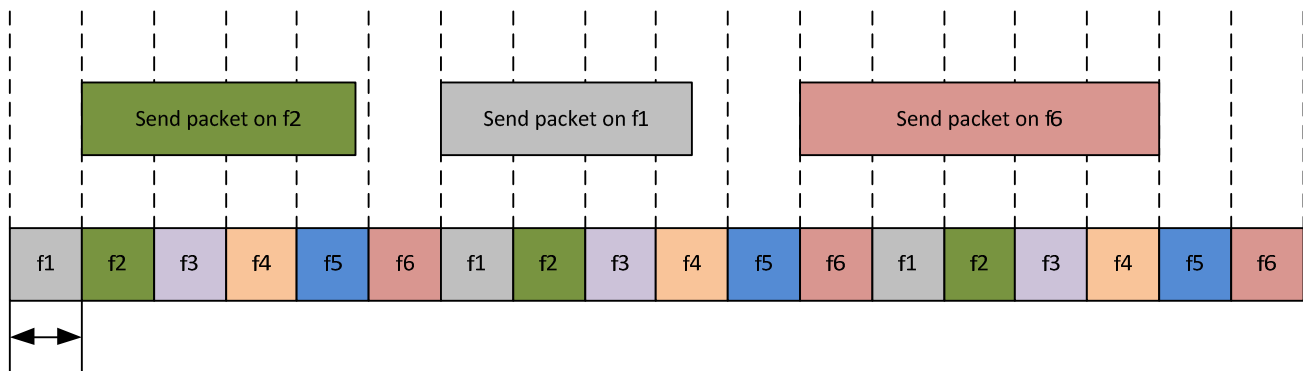
Whenever any connector is unused, put its connector protective cap in place.

Description of radio protocol:

The LRC-508 uses a half-duplex transmission protocol with a Frequency Hopping Spread Spectrum (FHSS) method. A mechanism of Listen Before Talk (LBT) is implemented to avoid radio collisions inside the LRC-508 network or with an external radio network. Moreover, two security keys are configured to secure the LRC-508 network.

Frequency Hopping Spread Spectrum (FHSS)

The FHSS operates on a set of frequencies. It uses one frequency for a fixed period of time and then switches to another channel. The next frequency is given by a pseudo-random sequence. In order to communicate, the transmitter and the receiver have to use the same set of frequencies, the same frequency sequence defined by the Frequency key. Moreover the LRC-508 has to be synchronized either by internal Gps or by IEEE1588 Ethernet protocol.



Example of FHSS based on a set of 6 frequencies

Listen Before Talk (LBT)

The LBT is based on a Channel Control Access mechanism: the LRC measures the Received Signal Strength Indication (RSSI) before beginning packet transmission. If the RSSI is too high, the media is said “busy” and the LRC-508 postpones the transmission for a random back off time.

Deployment:

The LRC-508 can be connected to a CX-508 or a SCI-508:

Connection to CX-508:



The +7.4 dBi 2.4GHz antenna delivered in the kit is connected to LRC-508.

LRC-508 is mounted on the LRC mounting kit.

The LRC-508 is connected to XDP port of CX-508 with the external 2-m cable. Then the CX-508 automatically powers LRC after its connection, to allow QC communication with the recording truck through a neighboring CX-508 located in a connected spread.

A 15-m cable option exists either to mount the LRC-508 over an antenna mast.



To provide a protection against lightning, LRC-508 cable to CX-508 is grounded. Grounding is performed by connecting metal part of the connector on CX-508 side to earth stake (provided with CX) by using the green/yellow cable provided with LRC.

Connection to SCI-508:



The +7.4 dBi 2.4GHz antenna delivered in the kit is connected to LRC-508.

LRC-508 is mounted on the LRC mounting kit or to an antenna mast.

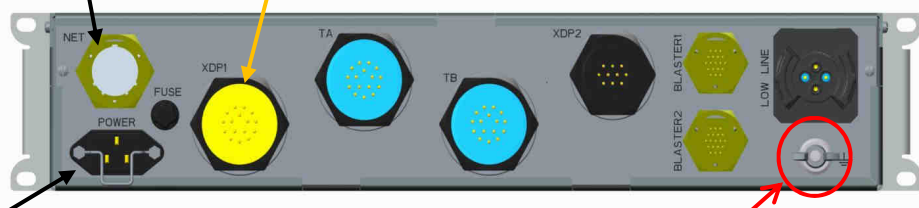
The LRC-508 is connected to XDP1 port of SCI-508 with the external 15-m cable. Then the SCI -508 automatically powers LRC after its connection, to allow QC communication with a neighboring CX-508.

NET Access:

- Communication between Central Unit and Spread.
- DHCP server to deliver to the concentrator IP

XDP1:

Port for connection to a radio tool

**AC Power Access:**

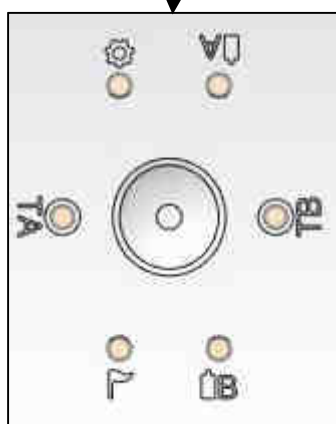
110-240Veff
1A – 0.5A

CAUTION

It is highly recommended to disconnect LRC cable from SCI in case of impending lightning, in order to protect personnel and equipment.

The grounding wing nut must be connected to the ground.

LEDs Function:



one yellow LED
dedicated for the
XDP port

lighted → LRC is connected to this port

Configuring the LRC-508:

The User has to download a Crew Setup and a Radio Setup in the LRC-508.

Crew Setup Parameters:

The parameters are:

The GPS configuration:

- list of allowed GNSS constellations (SBAS,QZSS,GALILEO,BEIDOU,GLONASS,GPS)
 - GPS Only is the default mode
 - GPS Only
 - GLONASS only
 - GPS+GLONASS+QZSS+SBAS
- Navigation model
 - Fixed (Default mode)
 - Pedestrian

Radio Setup Parameters:

The radio parameters of LRC-508 are:

Radio data rates:

The following data rates are supported:

- 1200 bps
The packet duration is up to 400 ms. Moreover, the maximum radiated output power is limited to +10 dBm in Europe countries, and +27dBm for USA and Canada.
- 100 kbps
The packet duration is up to 22 ms. Moreover, the maximum radiated output power is limited to +20 dBm in Europe countries, and +27dBm for USA and Canada.
- 500 kbps
The packet duration is up to 8.5 ms. Moreover, the maximum radiated output power is limited to +20 dBm in Europe countries, and +27dBm for USA and Canada.

Set Radio standards:



According to LRC versions, some units are CE (Europe) compliant only, and some are FCC (USA), IC (Canada) and CE (Europe) compliant. Please refer to housing marking to see if relevant LRC is compliant with your local authorities.

In case where only CE marking is present, LRC should only be used in Europe, or other countries that accept European standards. In that case following marking should be present:



In case where CE marking, FCCID as well as IC ID are present, LRC can be used in Europe, USA or Canada, or any other country that accepts these standards. In that case following marking should be present:



Use this menu to choose the appropriate maximum radiated output power for compliance with the local regulations of the country in which the radio unit is to be used:

- CE for Europe: +20 dBm max at 100 kbps and 500 kbps, +10 dBm max at 1200 bps
- FCC / IC for USA and Canada: +27dBm max at 1200bps, 100kbps, 500kbps

Set Radio frequencies:

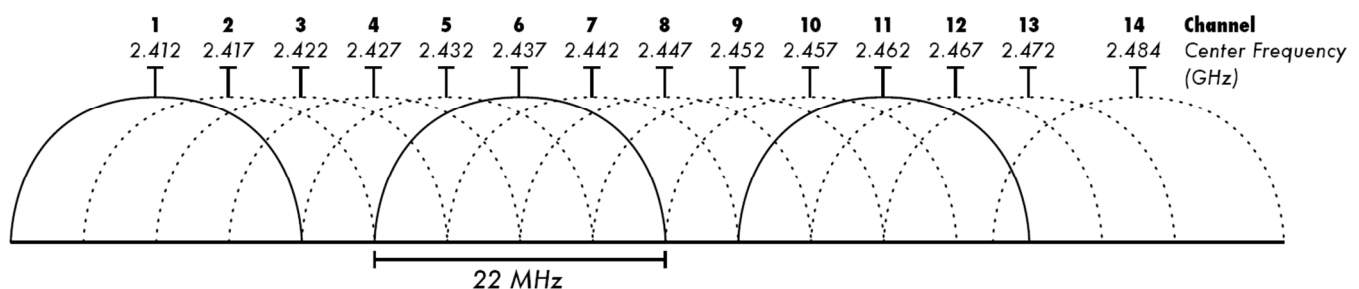
Use this menu to choose one of these sets of frequencies used in the Frequency Hopping Spread Spectrum (FHSS):

- 2405-2469 hopset : full 2.4GHz frequency band1
{2405.5 MHz; 2409.5 MHz;....; 2465.5; 2468.5 MHz } is the set of frequencies
- 2405-2469 hopset : full 2.4GHz frequency band2
{2406.5 MHz; 2410.5 MHz;....; 2466.5; 2467.5 MHz } is the set of frequencies
- 2405-2469 hopset : full 2.4GHz frequency band3
{2407.5 MHz; 2408.5 MHz; 2412.5 MHz; 2463.5; 2464.5 MHz } is the set of frequencies
- 2405-2438 hopset : half 2.4GHz frequency band1
{2405.5 MHz; 2407.5 MHz;....2437.5 MHz }
- 2422-2458 hopset : half 2.4GHz frequency band2
{2422.5 MHz; 2424.5 MHz;....2434.5 MHz; 2439.5 MHz; 2441.5 MHz;....2457.5 MHz }
- 2436-2469 hopset : half 2.4GHz frequency band3
{2436.5 MHz; 2438.5 MHz;....2468.5 MHz }
- 2405-2422 hopset : narrow 2.4GHz frequency band1
{2405.5 MHz; 2406.5 MHz;....2421.5 MHz }
- 2429-2446 hopset : narrow 2.4GHz frequency band2
{2429.5 MHz; 2430.5 MHz;....2445.5 MHz }
- 2452-2469 hopset : narrow 2.4GHz frequency band3
{2452.5 MHz; 2453.5 MHz;....2468.5 MHz }

The hopset has to be chosen to reduce interference with other radio equipments in 2.4 GHz frequency band.

For example, if a Wifi access point is configured at channel 6, the frequency band of the access point is 2426MHz-2448MHz. Thus, the “Narrow Band 1” (2405-2422MHz) and “Narrow band3” (2452-2469MHz) hopsets have no interference with this Wifi access point.

The following chart shows the Wifi channels in 2.4GHz frequency band:



Set Radio Security Keys :

Use the Frequency and the Synchro Word keys to secure its LRC-508 network.

Use the Frequency key to limit the interference with another LRC-508 network. The Frequency key defines a unique frequency sequence. Two different Frequency keys define two frequency sequences, using the same set of 17 frequencies but correlation between the two different sequences is about null.

Use the Synchro Word key to prevent connection to another LRC-508 network. The radio packets transmitted with a Synchro Word key cannot be received by a LRC-508 configured with another Synchro Word key.

Frequency key = 1 (default) ... 255

Synchro Word key = 1 (default) ... 255

Maintenance:

Calibration

The 1200-bps mode needs an oscillator of LRC-508 radio with a 1-ppm accuracy or better. To guarantee such accuracy along the lifetime of the product, a calibration of oscillator frequency is necessary one time every year.

To do that, deploy LRC-508 in an open-sky environment and at about +25°C +/- 5°C. Launch an oscillator calibration test, internal GPS Pulse-Per-Second is the reference during this test.

Other setups are allowed to do such calibration:

- Indoor calibration and use a GNSS repeater
- Connect LRC to a IEEE1588 network, with a Master Clock

IMPORTANT



Prior to connecting any plug, make sure there is no water inside connectors.

Electrostatic discharge:



Use the following guidelines to provide a static-free repair station that will preclude any ESD-related damage to electronic circuits:

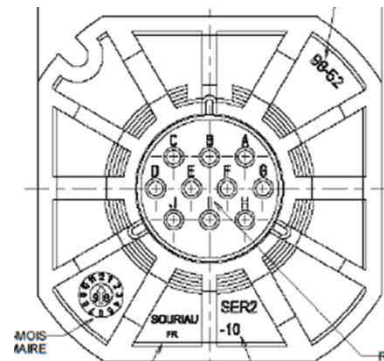
- All spare parts (circuit boards and ESD sensitive devices) should be stored and transported in static-shielding bags.
- Unless the repair station rests on a conductive floor, chairs or stools should rest on a grounded, rigid-type, static-dissipative floor mat.
- Use a static-dissipative table mat.
- Wear a static-control wrist strap or foot grounder.
- Provide common-point grounding for all conductive items (including personnel and soldering iron tip).
- To control the discharge rate and protect workers from electric shocks, both the table mat and wrist strap should be grounded through a 1-MΩ resistor. The mat should be connected to the same earth ground point as the wrist strap.
- Wear static-dissipative garments.

LRC-508 connectors:

RF connectors: straight bulkhead Jack panel seal

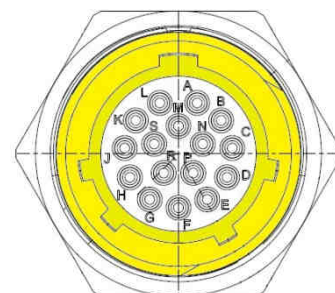
10-C connector:

Low Line plug	Signal Name	I/O type	Other signal
A	+5V	In	
B	GND	In	
C	Not connected		
D	Not connected		
E	ETH_RX_N	In	+24Vdc
F	ETH_RX_P	In	+24Vdc
G	ETH_TX_N	Out	-24Vdc
H	ETH_TX_P	Out	-24Vdc
I	RS232_TX	Out	
J	RS232_RX	In	



LRC cable is connected to CX XDP connector with the following pinout:

XDP plug	Signal Name	I/O type	Other signal
B	XDP-MX1+	In-Out	XDP_P24 → +24Vdc
A	XDP-MX1-	In-Out	XDP_P24 → +24Vdc
C	XDP-MX2+	In-Out	XDP_M24 → -24Vdc
N	XDP-MX2-	In-Out	XDP_M24 → -24Vdc
M	Resistance between S and M = 330 Ohm		
L	Not connected		
S	Resistance between S and M = 330 Ohm		
K	Not connected		
J	GROUND		
H	Not connected		
D	Not connected		
E	Not connected		
P	Not connected		
R	Not connected		
G	Not connected		
F	Not connected		



Specifications:

Operating Voltage	48 Vdc
Current consumption	10mA (Typical current consumption)
Power consumption	0.5W (Typical power consumption) 0.7W (Max power consumption in CE configuration) 0.9W (Max power consumption in FCC configuration)
Radio data rates	1.2 – 100 – 500 kbps
Radio Frequency Characteristics:	
Frequency band	2405 – 2469 MHz
Spreading method	FHSS
Number of channels	17
Antenna gain	+7.4 dBi typ.
Radiated output power	
CE Mode at 1.2 kbps	+7 dBm typ, +10 dBm max
CE Mode at 100 and 500 kbps	+17 dBm typ, +20 dBm max
FCC Mode at 1.2kbps, 100kbps, and 500kbps	+24 dBm typ, +27dBm max
Supported GNSS Constellations	GPS L1 C/A, GLONASS
Altitude functioning	Up to 5000m
Weight (LRC with antenna)	1.20kg (2.64lbs)
Operating Temperatures	-40°C to +70°C (-40°F to +158°F)
Operating Environment	IP68

Regulatory Information:

USA

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, and*
- (2) This device must accept any interference received, including interference that may cause undesired operation.*

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WARNING



This device must be professionally installed.

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:

- Reorient or relocate the receiving antenna.*
- Increase the separation between the equipment and receiver.*
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- Consult the dealer or an experienced radio/TV technician for help*

This equipment complies with FCC's radiation exposure limits set forth for an uncontrolled environment under the following conditions:

- 1. This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.*
- 2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.*

Canada

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference, and*
- (2) This device must accept any interference, including interference that may cause undesired operation.*

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et*
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, that antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter (1317A-0104A) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with the device.

Manufacturer	Reference	Gain	Impedance
L-COM	HG2408UR-NM	+7.4dBi	50 Ohms
NCG	SFR-245SPR-R	+7.4dBi	50 Ohms

Europe:

Conforms to the essential requirements of the following EEC directives:

R&TTE 1999/5/CE

EMC 2004/108/CE

LV 2006/95/CE

WARNING



The LRC-508 meets the reference level set by the 1999/519/CE recommendation:

Electric field strength in the far field of a radio frequency point source is calculated as follows:

$$E = \frac{\sqrt{30 * P * G}}{d}$$

With: E = Electric field in V/m

P = Maximum average transmit power capability of the radio, in W

G = total Tx gain as a factor, converted from dB

D = distance from the point source, in m

band	P	G	E ⁽¹⁾	d	Recommended distance
2.4GHz	0.1W (+20dBm)	5.5 (7.4dBi)	61V/m	0.07m	0.2m

⁽¹⁾ reference level of the table 2 of the 1999/519/CE