LRU

User Manual

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General

The LRU (Line Remote Unit) relay is a long range point-to-point radio relay cell that can be inserted anywhere in a spread as an element of the 408UL network to relay the data transmission on a Line or a Transverse. It connects to any type of 408UL field electronics (LAUX, LAUL, FDU Link, etc.). Built in the LRU is a full performance LAUX.

In the LRU transmission protocol (Half-duplex), time is shared between transmission of Master-to-Slave messages and transmission of Slave-to-Master messages.

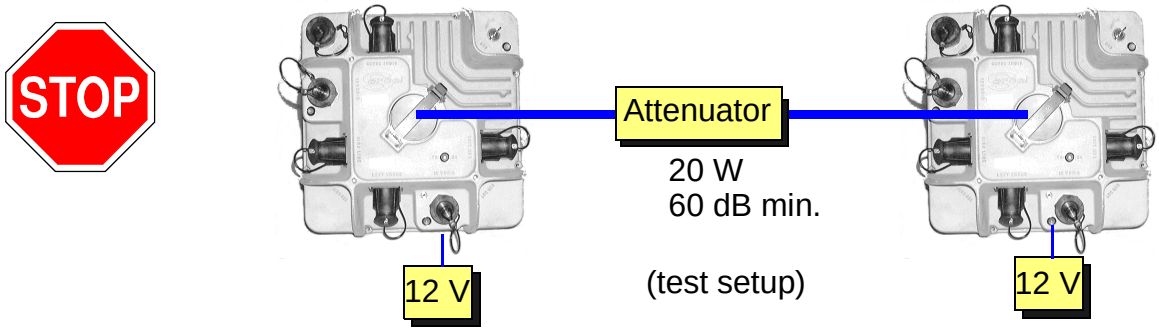
Master-to-Slave messages are called Network Control Sequences (NCS), used for synchronization, zero-time transmission and control.

Slave-to-Master messages are called Data Transfer Sequences (DTS), used for data retrieval, seismonitor and collecting test results.

Typical setups

CAUTION

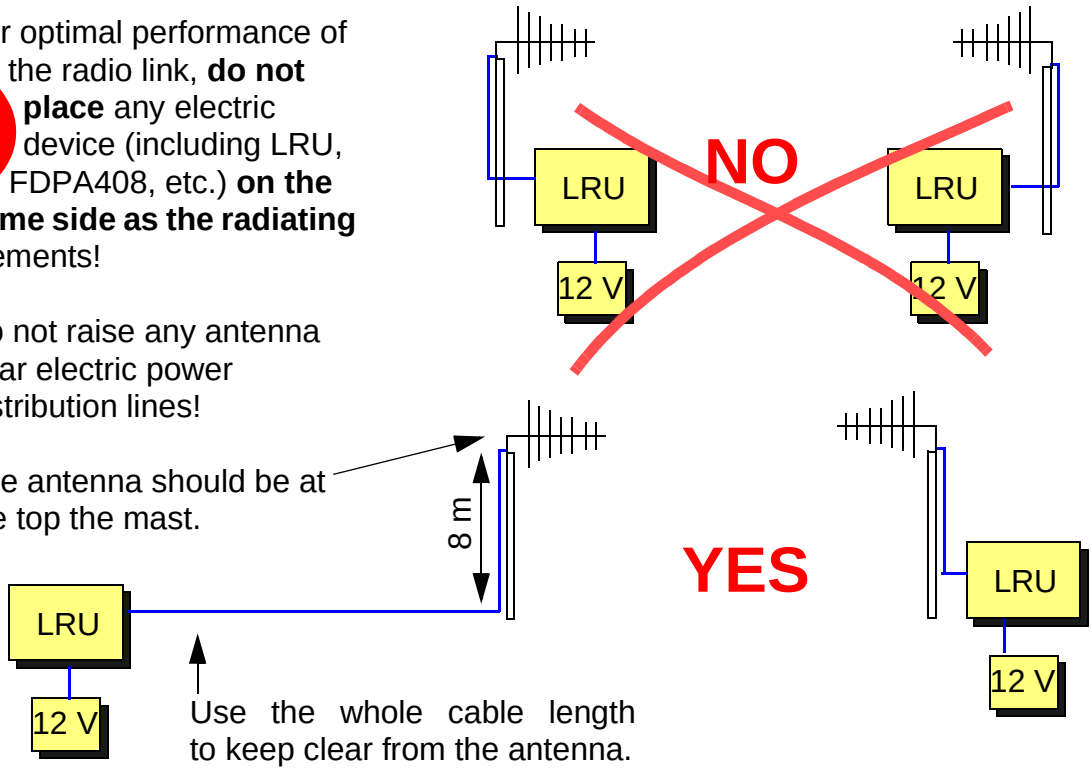
If you wish to test a radio relay cell through a wireline link between the coaxial connectors of two LRUs, use a 60 dB (minimum), 20 W attenuator.



For optimal performance of the radio link, **do not place** any electric device (including LRU, FDPA408, etc.) **on the same side as the radiating** elements!

Do not raise any antenna near electric power distribution lines!

The antenna should be at the top the mast.



CAUTION

Antenna height is limited to 6.1 metre near airports.

Below are typical examples of setups along with the associated specifications in terms of covered range and transmission capacity.

Basic radio relay cell

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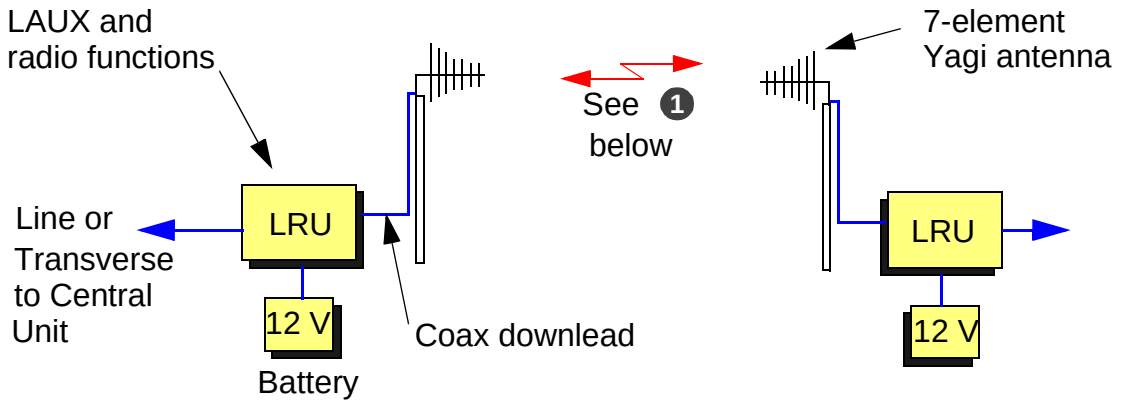


❶ Typical performance (Ground-Wave propagation above flat terrain):

- Range: 24 km, 60 Ch @ 2 ms, Real time.
- Range: 10 km, 240 Ch @ 2 ms, Real time.

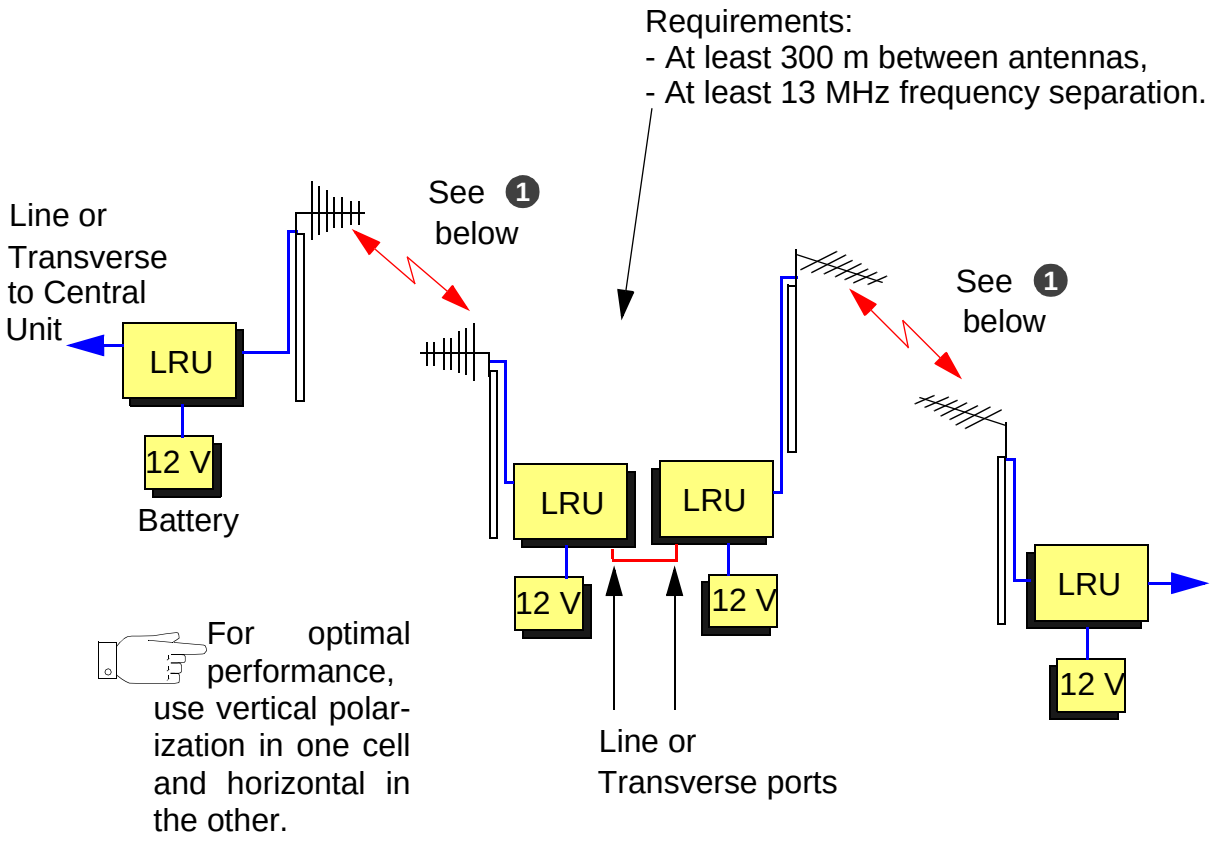
See **CAUTION** on *page 1-2*.

For the Left/Right and Low/High ports of the LRU, connect as usual (Left to Right; Low to High).

Radio relay in series connection

To extend the relay range, you can use two relay cells in series connection as shown below. You can choose between two types of series setups, one with fewer antenna masts to raise, the other optimizing the data rate.

- Two-mast series setup (high data rate)



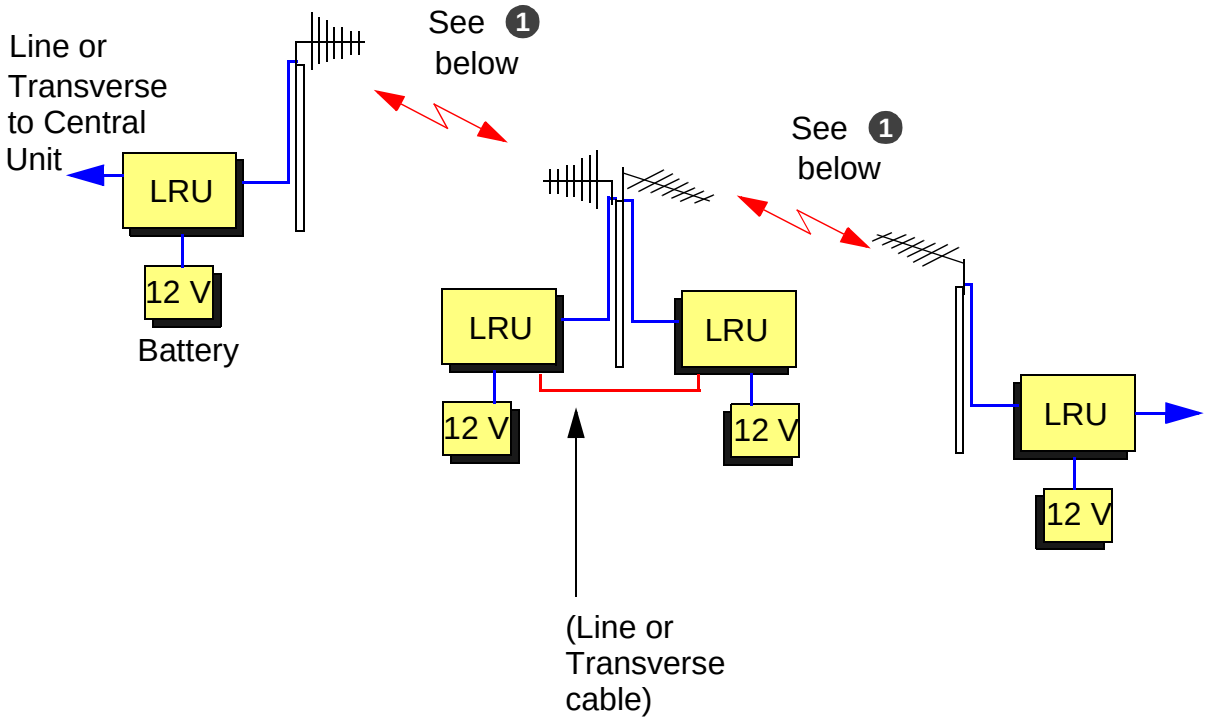
❶ Typical performance of each relay cell (Ground-Wave propagation above flat terrain):

- Range: 24 km, 60 Ch @ 2 ms, Real time.
- Range: 10 km, 240 Ch @ 2 ms, Real time.

Setups with more than two relay cells in series connection have not been tested yet.

See **CAUTION** on *page 1-2*.

- Single-mast series setup



❶ Typical performance of each relay cell (in Ground-Wave propagation conditions above flat terrain):

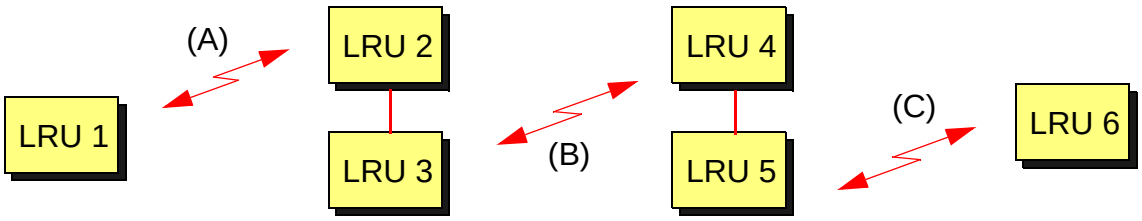
- Range: 24 km, 30 Ch @ 2 ms, Real time.
- Range: 10 km, 120 Ch @ 2 ms, Real time.

For the single-mast series setup, a special software configuration needs to be programmed in the LRUs, using an FDPA408 pocket terminal or the 408UL HCI workstation: in each intermediate pair, not to have one of the LRUs transmitting while the other is receiving, you must have them working on two distinct "**Subframes**". That's why the date rate is divided by two in the above example.

See LRU Operational Description.

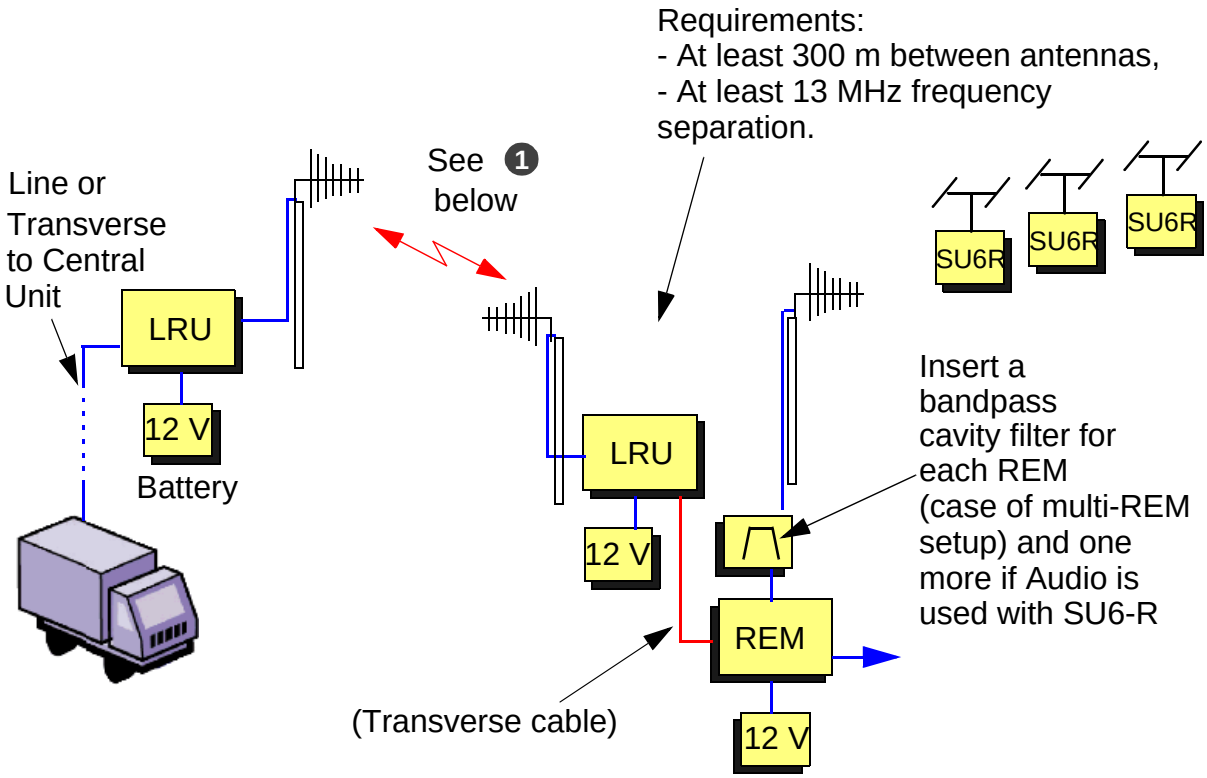
Where more than two relay cells are used in “single-mast series connection”, you can avoid reducing the data rate any further if you still work with only two Subframes, provided adjacent relay locations do not use the same Subframe.

In the example below, relay cell (**A**) can use the same Subframe as relay cell (**C**) if they are distant enough and if they use two separate frequency channels.



Relay Cell	LRU No.	Transmit on Subframe 1	Transmit on Subframe 2
(A)	1	✔	
	2	✔	
(B)	3		✔
	4		✔
(C)	5	✔	
	6	✔	

Radio relay with REM



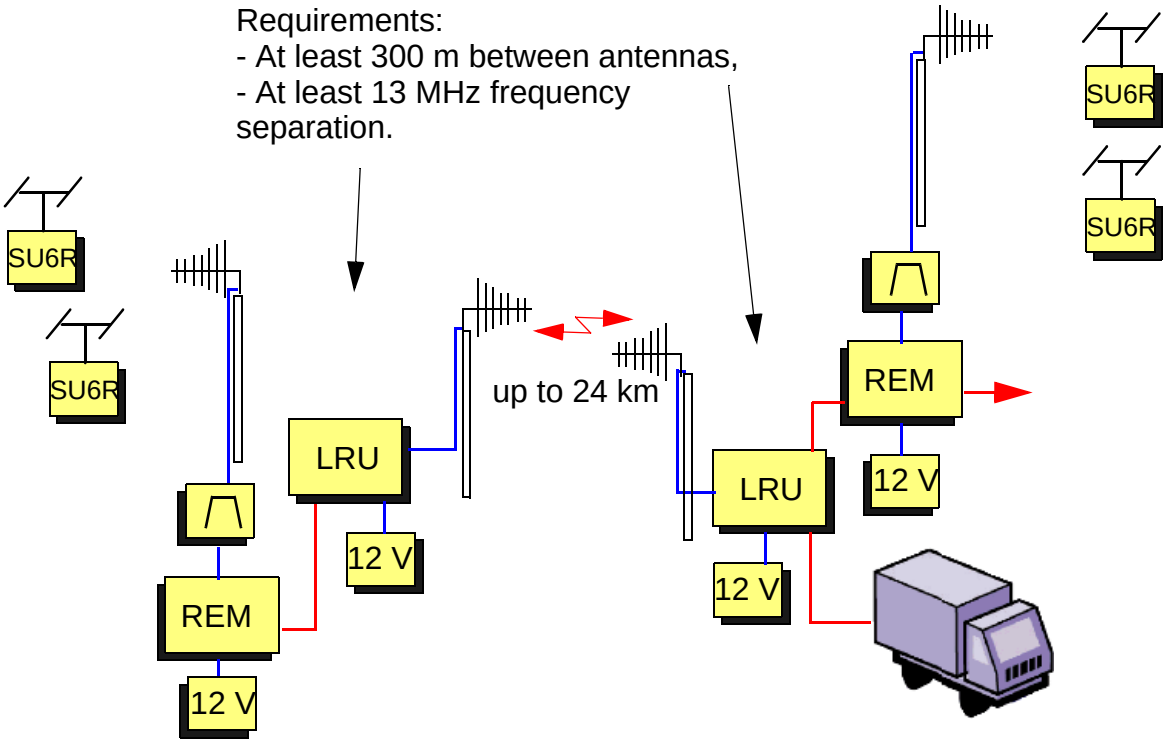
❶ Typical performance of each relay cell (in Ground-Wave above flat terrain):

- Range: 24 km, 60 Ch @ 2 ms, Real time.
- Range: 10 km, 240 Ch @ 2 ms, Real time.

The antenna of the REM and the antenna of the LRU attached to that REM can be mounted on the same mast, but in that case a minimum vertical separation of 30 metres (100 feet) should be provided. The rule is to have at least 80 dB attenuation between the two antennas to allow each system to work at its full sensitivity. The cavity filters for the REMs are still required.

A REM upgrade may be required.

See **CAUTION** on *page 1-2*.


Requirements:
- At least 300 m between antennas,
- At least 13 MHz frequency separation.
SU6R
SU6R
SU6R
SU6R
LRU
12 V
REM
12 V
up to 24 km
LRU
12 V
REM
12 V

Antennas

The LRU is used as a point-to-point radio relay. For a stationary relay, directional antennas are used, allowing maximum performance and protection from interference. Where one of the two LRUs involved in a radio relay is subject to roving (Marine, Shalow-water operation, etc.) omni-directional antennas are more suitable.

Directional antenna

Below are the specifications of a wide-band, 7-element Yagi antenna available from SERCEL.

This directional antenna can be used either horizontally or vertically.

A 50-ohm impedance coax cable should be used to connect the antenna to the LRU. To increase the system performance, a low-attenuation, double-shield coax cable is recommended.

Prior to using the antenna, especially after assembly, a VSWR check should be done, including the coax cable. The maximum VSWR within the bandwidth of interest should be less than 1.5:1 to work in good conditions.

- Specifications
  - Type: Wideband 7-Element Yagi (Sercel P/N: 07-820070-001).
  - Frequency: 215 to 240 MHz.
  - Power Gain: 10.5 dBi, Center frequency.
  - VSWR: 1.6:1 Max.
    1.3:1 Center frequency.
  - Front-to-back Ratio: 20.45 dB, Center frequency
  - 3-dB beamwidth: E = 48 degrees.
    H = 57 degrees

- Feed Impedance: 50 ohm.
- Connector type Type UHF.
- Antenna Boom length: 1.9 m (75").
- Longest Element: 68 cm (26.772").
- Shortest Element: 48 cm (18.898").
- Weight: 900 g (2 lb).
- Maximum mast OD: 5 cm (2").

LRU Specifications

GENERAL

Radio Functions	Communication with another LRU for data transmission with error recovery and temporary storage
Cable Functions	full LAUX capabilities
Tests capabilities	Power supply Radio data transmission Cable data transmission Field tests Instrument tests
Antenna spectrum monitoring capability	
Radio setup	Pocket terminal connection capability
Memory	4Mb local buffer for non-real time transmission mode
Interval between LRU's or LRU and LAUX on transverse	Up to 300 m with ST cable Up to 250 m with WPSR Up to 400 m with WPSRLR

RADIO PERFORMANCES

Radio link between LRU's
(Typical propagation condition, bit error rate better than 10^{-6}, 8 m (26 feet) antenna mast, Yagi type antenna)

- 16 km (10 miles) up to 240 Channels (*) @2ms sample rate real time retrieval.
- 24 km (15 miles) up to 60 Channels (*) @2ms sample rate real time retrieval.

RF Characteristics :

RF Frequencies	USA use : limited to 216 MHz to 218 MHz and 219 MHz to 220 MHz Canadian use : limited to 217 MHz to 218 MHz and 219 MHz to 220 MHz Other countries : in respect with local regulation Overall capability : 215 MHz to 250 MHz
RF Output Power	RF power management ; 6W nominal
RF Output Impedance	50 Ω
FCC Emission Designators	250KD1D and 800KD1D

CABLE PERFORMANCES

(Typical @ 2 ms sample rate and 25°C)

Maximum number of FDU's per LRU :

- 120 with up to 30 m interval
- 96 with up to 55 m interval
- 80 with up to 75 m interval

Maximum number of FDU's between LRU's or between LRU and LAU :

- 60 with up to 30 m interval
- 48 with up to 55 m interval
- 40 with up to 75 m interval

PHYSICAL

Material	Aluminium
Dimension and Weights	
Size	380x380x225 mm (14.9x14.9x8.8 in)
Weigths	12.6 kg (27.8 lbs)
Power	
Operating Power Voltage	10.5 to 15 VDC, 2 battery connectors, to allow uninterrupted operation during battery replacement
Power consumption	Master : 23 W Slave : 80 W when retrieving Sleep : 1,2 W
Operating Temperatures	-40°C to 70°C
Storage Temperatures	-40°C to 70°C
Water Depth	1.5 m

(*) the number of channels increases proportionally with the ratio : (shot cycle time) / (acquisition time).