2 LGC*ell* Equipment

This section describes the LGC*ell* equipment and explains how the system operates and contains LGC*ell* system specifications.

For details about cables and connectors, refer to *Appendix A – Cables, Connectors, and Accessories*.

LGC*ell* has no user-serviceable parts. Faulty or failed units may be repaired or replaced through LGC Wireless. In the U.S., please contact us at 1-800-530-9960. International customers, please contact us at +1-408-487-2400.

Contents

Standard Equipment

The LGC*ell* standard equipment supports 800 MHz AMPS/TDMA/CDMA/iDEN, 900 MHz GSM, 1800 MHz DCS, 1800 MHz Korean PCS, 1900 MHz TDMA/CDMA/GSM, and Dual Band 900 GSM/1800 DCS installations.

LGC*ell* has three modular components:

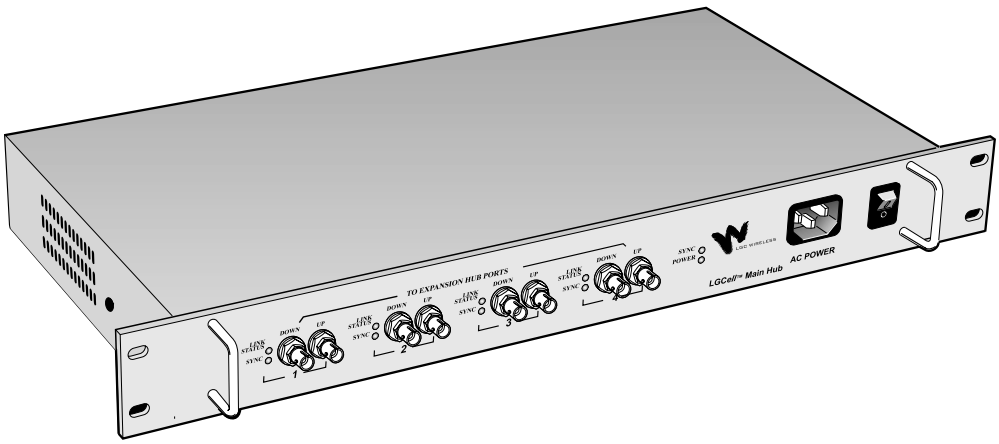
- Main Hub – 19” rack-mountable
- Expansion Hub – 19” rack-mountable
- Remote Antenna Units (RAUs) – Wall or ceiling mountable

LGC*ell* is shipped with the following items:

- Four rack-mount screws per hub
- Four screws for each RAU
- *LG*Cell *Installation and Reference Manual*

For cable and accessory information, see *Appendix A – Cables, Connectors, and Accessories.*

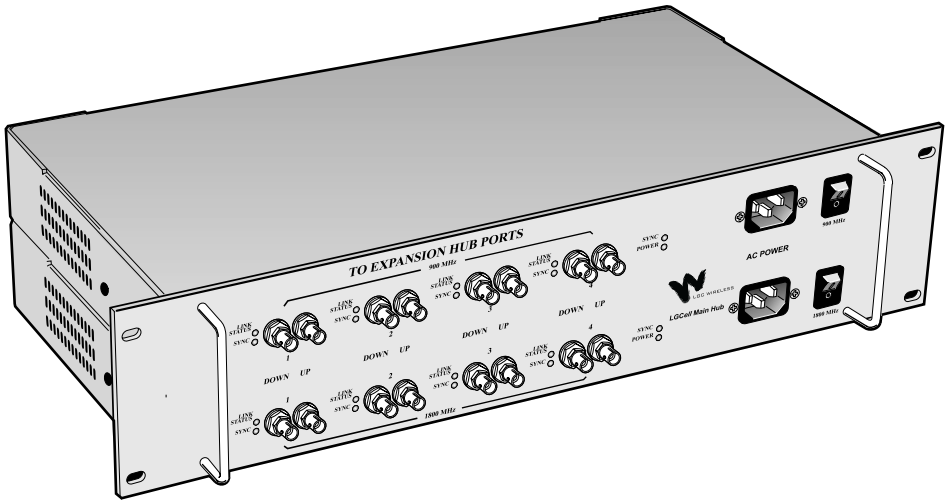
Main Hub



The Main Hub is the LGC*ell*’s central distribution point. It receives downlink cellular or PCS signals from an MBS or a roof-mounted antenna and redistributes them to multiple Expansion Hubs in low-frequency signal format (<200MHz), which can be passed over the MMF and CAT 5 cabling.

The Main Hub also receives signals from the Expansion Hubs and reconverts them back to the cellular or PCS band for transmission on the uplink channel (mobile) to the macrocellular base station (BTS) or microcellular base station (MBS).

The Dual Band 900/1800 Main Hub is shown below.

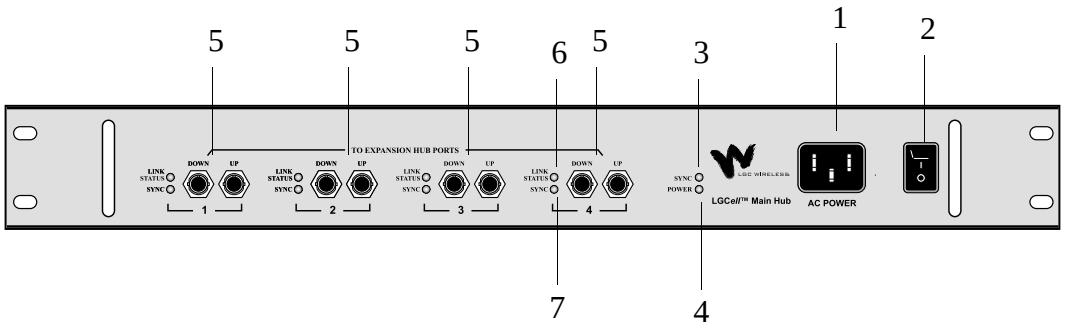


Main Hub Features

- Mounts in a standard 19” equipment rack, width 17.25” (438 mm)
- Height is 1.7” (44.5 mm). The Dual Band Main Hub is 3.5” (88.9 mm) high.
- Operates with worldwide AC power, 100-240 VAC at 1.6 A and 50/60 Hz
- Connects up to four Expansion Hubs and 16 RAUs per Main Hub. The Dual Band Main Hub connects up to four Expansion Hubs and 16 RAUs for the 900 system and an equal number for the 1800 system.
- Connect multiple Main Hubs to increase number of RAUs. See “Connecting Multiple LGCell Systems” on page 3 in *Section 5, Connectivity*.
- Connects to a roof-mounted antenna, repeater, or duplexed MBS via one coaxial cable using an N-type, female, duplexed, bi-directional RF connector
- Connects to MBS via two coaxial cables using two N-type female, simplex RF connectors
- Connects to Expansion Hubs via MMF fiber cable (up to 1 kilometer)
- Distributes cellular or PCS signals to the Expansion Hubs via standard MMF transmit and receive pairs
- Has easily accessible connectors

- Displays system status via front panel LEDs
- Provides contact closure of major alarms and error latches through a D-sub 9-pin connector

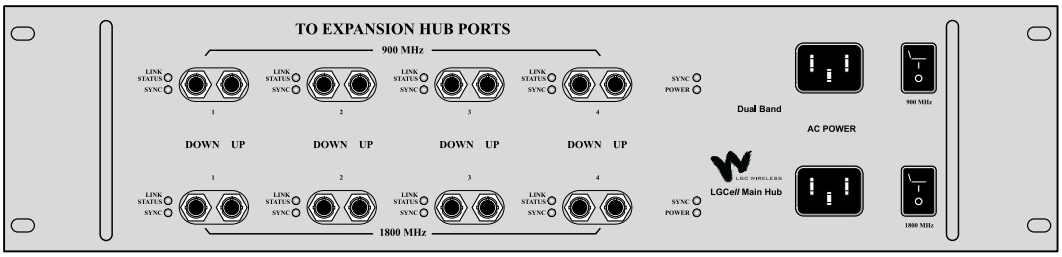
Main Hub Front Panel

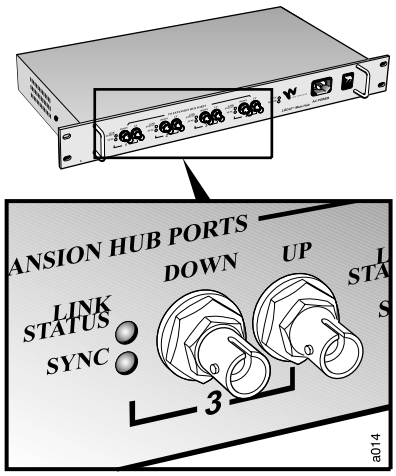


Front Panel Description

1 AC power cord connector
2 Power On/Off switch
3 One LED for sync status (labeled **SYNC**)
4 One LED for power (labeled **POWER**)
5 Four Ports (labeled **1**, **2**, **3**, **4**)
•One standard female ST-connector for MMF downlink (labeled **DOWN**)
•One standard female ST-connector for MMF uplink (labeled **UP**)
6 One LED for port RF link status (labeled **LINK STATUS**)
7 One LED for port sync status (labeled **SYNC**)

The Dual Band Main Hub Front Panel is shown below. The connectors are the same as those explained for the single band system.





Standard MMF Uplink and Downlink Ports

The Main Hub transmits and receives RF signals to and from the Expansion Hubs using up to 1 kilometer of industry-standard 62.5µm/125µm MMF cable (up to 1.5 dB optical loss, approximately 1 kilometer without jumpers).

- **Uplink/Input** (labeled **UP**)

  This signal is the combination of all uplink signals received by the Expansion Hubs connected to the system.

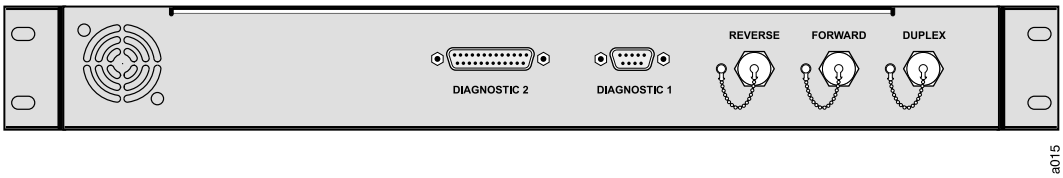
- **Downlink/Output** (labeled **DOWN**)

  The downlink is a composite signal coming from the duplexed N-type connector or from the downlink simplex connector on the Main Hub back panel. The downlink signal is re-radiated at all RAUs.

Main Hub LEDs

LED	Color	Indication
HUB LEDS		
POWER	Green	On/Off Fault
SYNC	Green	On/Off Fault
PORT LEDS		
SYNC	Green Red	Operational Fault
LINK STATUS	Green Red	Operational Fault

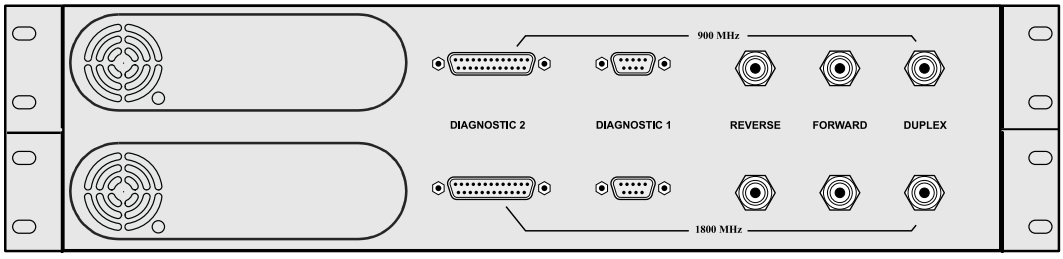
Main Hub Back Panel

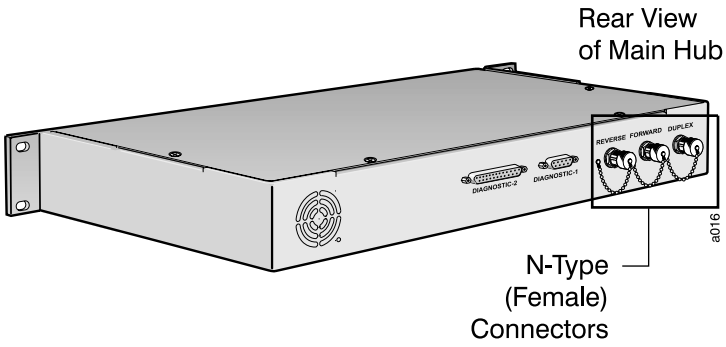


Back Panel Description

- Three N-type, Female Connectors with dust caps
  - One Duplexed (labeled **DUPLEX**)
  - One Uplink (labeled **REVERSE**)
  - One Downlink (labeled **FORWARD**)
- One D-Sub 9-pin Connector (labeled **DIAGNOSTIC 1**)
- One D-sub 25-pin Connector (labeled **DIAGNOSTIC 2**)

The Dual Band Main Hub Back Panel is shown below. The connectors are the same as shown for the single band LG*Cell* Main Hub.





N-Type Female Connectors

The N-type, female connectors connect the coaxial cable from the roof-mounted antenna, repeater, or MBS to the Main Hub for RF connection. These cable connectors are operational in the cellular and PCS frequency bands.

See *Maximum Input RF Power per Carrier vs. Number of Carriers*, on page 17 in this section for the maximum uplink and downlink power.

There are three N-type female connectors:

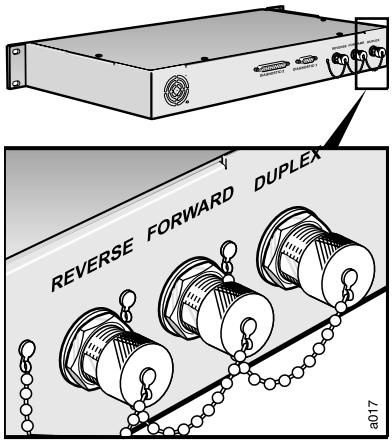
Duplexed: Output and Input **(**bi-directional)

Uplink: Simplex Output (unidirectional)

Downlink: Simplex Input (unidirectional)

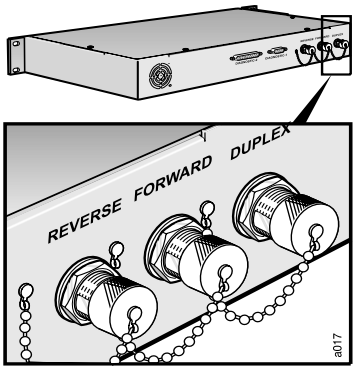
- **Duplexed (labeled DUPLEX)**

  The **DUPLEX** connector is for a duplexed connection. This connector provides both downlink and uplink signals to and from the roof-mounted antenna, repeater, or MBS to the Main Hub. This duplex port provides a 30 or 40 dB gain on the duplex part. See "LGCell System Gain" on page 17.



- **Uplink (labeled REVERSE) and Downlink (labeled FORWARD)**

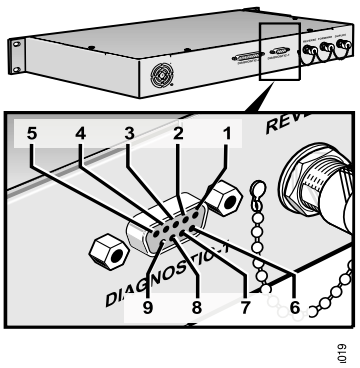
  The uplink and downlink connectors are for a simplex connection. The **FORWARD** connector receives RF signals and the **REVERSE** connector transmits RF signals to and from the roof-mounted antenna, repeater, or MBS.



DO NOT exceed the maximum input power into the Main Hub. See *Maximum Input RF Power per Carrier vs. Number of Carriers,* on page 17 in this section.

D-Sub 9-Pin Connector

The D-Sub 9-pin connector (labeled **DIAGNOSTIC 1**) provides contact closure for major and latch system alarm monitoring. The following table lists the function of each pin on the D-sub 9-pin connector.



Pin	Function
1	+10 V (fused)
2	Not connected
3	Not connected
4	Error Latch (positive connection)
5	Error Latch (negative connection)
6	DC Ground
7	Major Error (positive connection)
8	Error Reset
9	Major Error (negative connection)

Alarms

LGC*ell* provides full Operations Alarm Maintenance and Provisioning (OAM&P). The Main Hub senses then latches major alarms. An error latch provides historical information for troubleshooting.

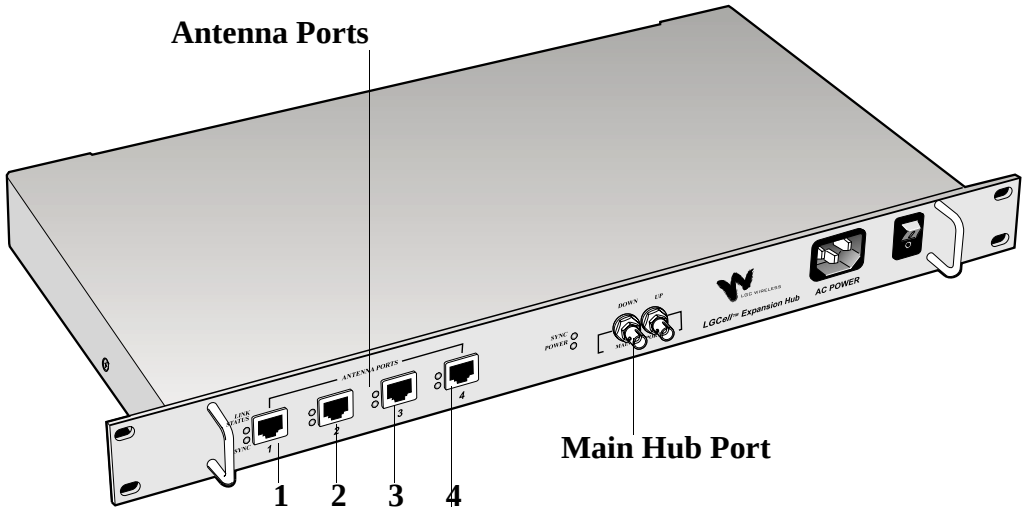
The major alarms and error latches are monitored with contact closures. Alarms can be sent to remote locations (see *Section 5, Connectivity* and *Section 6, Troubleshooting*). For details about alarm monitoring, see *Appendix E – Alarm Report Monitor (ARM2000).*

The two error connections, Major Error and Error Latch, are relay connections. They are either open or short circuit (see the following table).

Operation	Major Error	Error Latch
Proper Operation	Short Circuit	Short Circuit
Error	Open Circuit	Open Circuit
Proper Operation but had error and system latched; alarm was not reset	Short Circuit	Open Circuit

When you use these error pin connections, determine the error status by sending a current of no more than 40 mA through the positive connection and returning it through the negative connection. An error is indicated if current ceases to flow through the error connection.

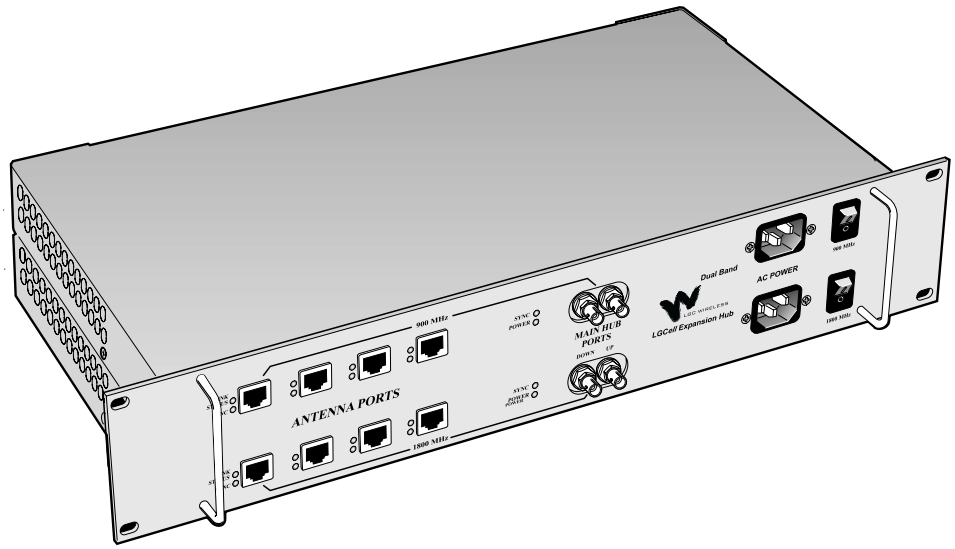
Expansion Hub



The Expansion Hub is LG*Cell*'s intermediate distribution point.

It transmits and receives low frequency signal (<200MHz) to and from the Main Hub, and to and from the RAUs. Utilizing LGC Wireless' proprietary technology, both the MMF and the UTP/STP cables can transmit signals in the cellular or PCS frequency bands.

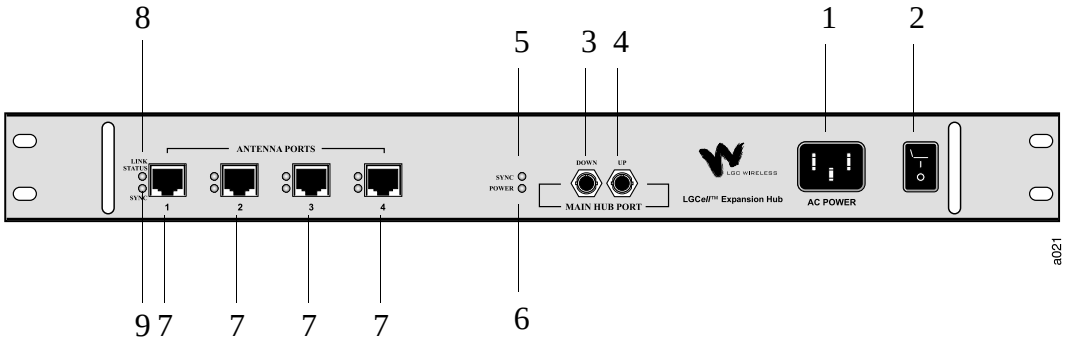
The Dual Band 900/1800 Expansion Hub is shown below:



Expansion Hub Features

- Mounts in a standard 19" equipment rack, with 17.25” (438 mm)
- Height is 1.7" (44.5 mm). The Dual Band Expansion Hub is 3.5” (88.9 mm) high.
- Operates with worldwide AC power, 100-240 VAC at 1.6 A and 50/60 Hz
- Connects up to four RAUs. The Dual Band Expansion Hub connects up to four RAUs for the 900 system and up to four RAUs for the 1800 system.
- Connects to the Main Hub with MMF transmit/receive cable (up to 1.5 dB optical loss, approximately 1 kilometer without jumpers)
- Connects up to four RAUs via four RJ-45 connectors that feed RAUs directly through a UTP/STP cable
- Provides DC power to RAUs through the UTP/STP cable
- Has easily accessible connectors
- Displays system operation via front panel LEDs
- Communicates with Main Hub for system alarm status

Expansion Hub Front Panel



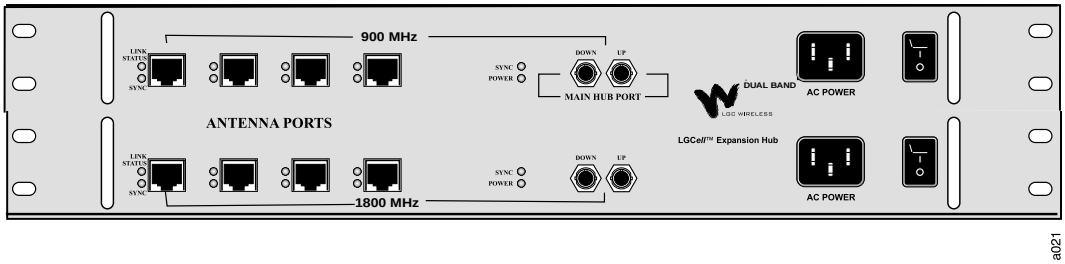
(Labeled **1**, **2**, **3**, and **4**)

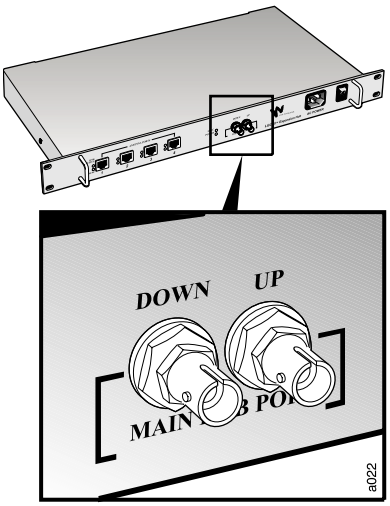
Expansion Hub Description

1 AC power cord connector
2 Power On/Off switch
3 In Fiber Port (labeled **MAIN HUB**), one standard ST connector for MMF downlink (labeled **DOWN**)
4 In Fiber Port (labeled **MAIN HUB**), one standard ST connector for MMF uplink (labeled **UP**)
5 One LED for port sync status (labeled **SYNC**)
6 One LED for power (labeled **POWER**)
7 Four standard UTP/STP CAT 5 Cable RJ-45 female connectors (labeled **ANTENNA PORTS 1**, **2**, **3**, and **4**)

8 One LED to monitor RF link status (labeled **LINK STATUS**)
9 One LED to monitor sync status (labeled **SYNC**)

The Dual Band Expansion Hub Front Panel is shown below. The connectors are the same as those explained for the single band system.





Standard MMF Uplink and Downlink Port

The Expansion Hub transmits and receives cellular or PCS signals to and from the Main Hub using up to 1 kilometer of industry-standard 62.5µm/125 µm MMF cable found in most buildings.

•Uplink/Output (labeled UP)

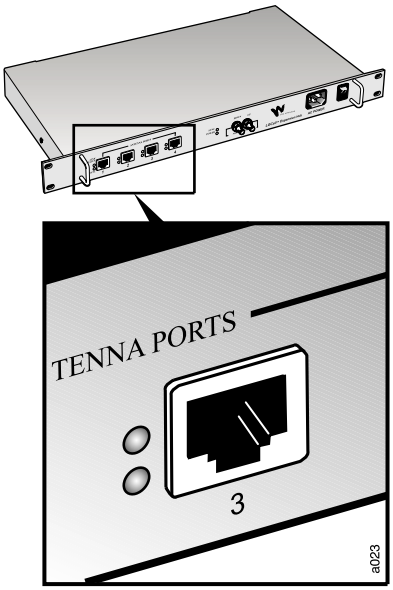
The uplink is the combination of all uplink signals received by the RAUs. The signals are fed into the Expansion Hub via the UTP/STP cables. The Expansion Hub then transmits the combination of all signals to the Main Hub via the MMF cable.

•Downlink/Input (labeled DOWN)

The Expansion Hub receives downlink signals from the Main Hub via the other MMF port. The downlink signals are subsequently re-radiated at all RAUs via the UTP/STP cable.

UTP/STP CAT 5 Cable Connectors

Delivers electrical power to the RAUs. Also transmits downlink signals and receives uplink signals to and from the RAUs.

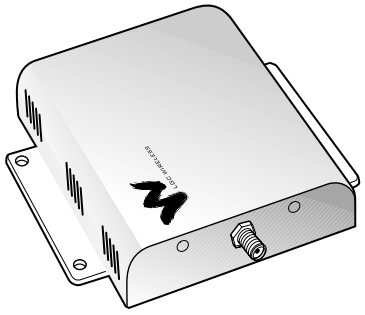


Expansion Hub LEDs

LED	Color	Indication
HUB LEDS		
POWER	Green	On/Off Fault
SYNC	Green	On/Off Fault
PORT LEDS		
SYNC	Green Red	Operational Fault
LINK STATUS	Green Red	Operational Fault

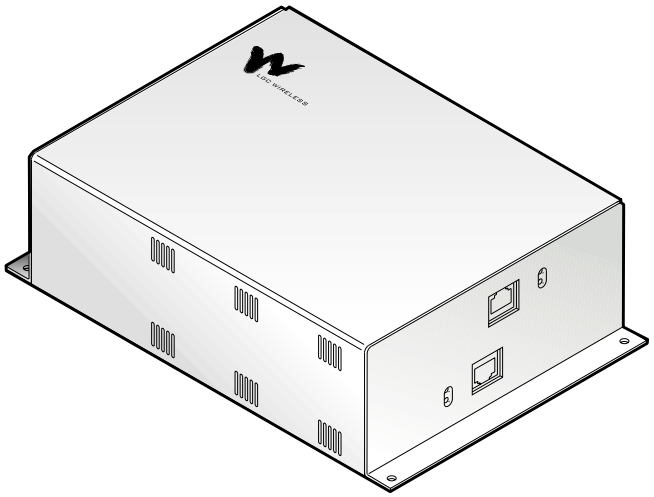
Remote Antenna Unit (RAU)

RAU Description



- One female SMA connector
- One Standard CAT 5 UTP/STP RJ-45 female receptacle
- Two LEDs
  - •One for antenna power
  - •One for antenna sync indication

The Dual Band 900/1800 RAU is shown here. The Dual Band RAU has the same connectors as the single band RAU. It has one set of connectors for the 900 RAU and one set for the 1800 RAU.



RAUs are active antennas that connect directly to an Expansion Hub over standard CAT 5 (or better) UTP/STP cable. The cable also delivers electrical power to the antenna.

RAUs receive uplink cellular or PCS signals and re-transmits them to an Expansion Hub in a low frequency signal format (<200MHz).

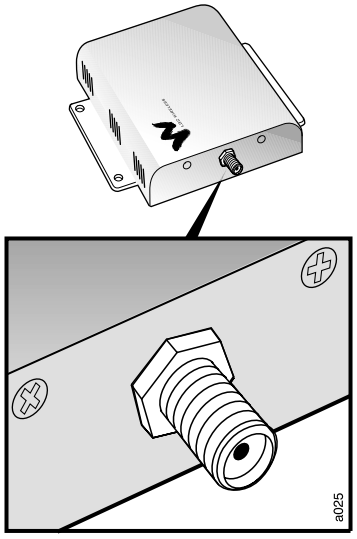
They also receive signals from the Expansion Hub, and re-convert the signals back to the cellular or PCS band for transmission on the downlink.

RAU Features

- Transmits to Expansion Hubs via an RJ-45 connector using UTP/STP cable
- Uses an SMA connector for standard in-building antennas
- Has easily accessible connectors
- Displays system operation via LEDs
- Dimensions: 5.7" x 5.5" x 1.2" (145 mm x 140 mm x 30 mm). The dimensions for the Dual Band RAU are 8” x 6.2” x 2.7” (1626 mm x 157 mm x 69 mm).
- Connects to Expansion Hub via one RJ-45 connector that feeds RAUs directly through a UTP/STP cable (up to 60 meters)

For system performance for cable lengths greater than 60 meters, see “LGCell System Gain vs. UTP/STP Cable Length (800 MHz, iDEN, 900 MHz)” on page 6 and “LGCell System Gain vs. UTP/STP Cable Length for 1800 MHz or 1900 MHz (Horizontal run, measured with 1 km of Multi-Mode Fiber)” on page 7 in *Appendix A – Cables, Connectors, and Accessories*.

RAU Connectors



SMA Connector

The SMA connector on the RAU is a duplexed RF input/output port that connects to standard in-building antennas.

•Uplink (Input)

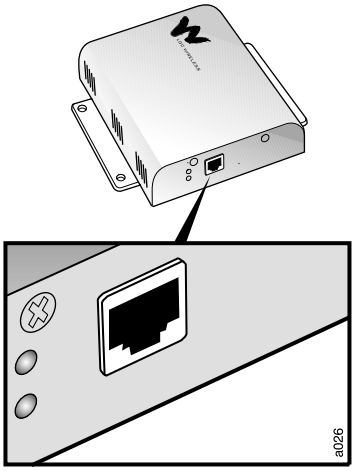
The uplink cellular or PCS channels are received from the mobile phone by the in-building antenna. For the maximum downlink composite radiated power at the RAU, see the table on page 17 in this chapter.

•Downlink (Output)

The downlink channels are transmitted (radiated) by the standard in-building antenna. For the maximum downlink composite radiated power at the RAU, see the table on page 17 in this chapter.

Standard CAT 5 UTP/STP RJ-45 Jack

Delivers electrical power to the antenna. Also transmits and receives uplink and downlink signals to the Expansion Hub.



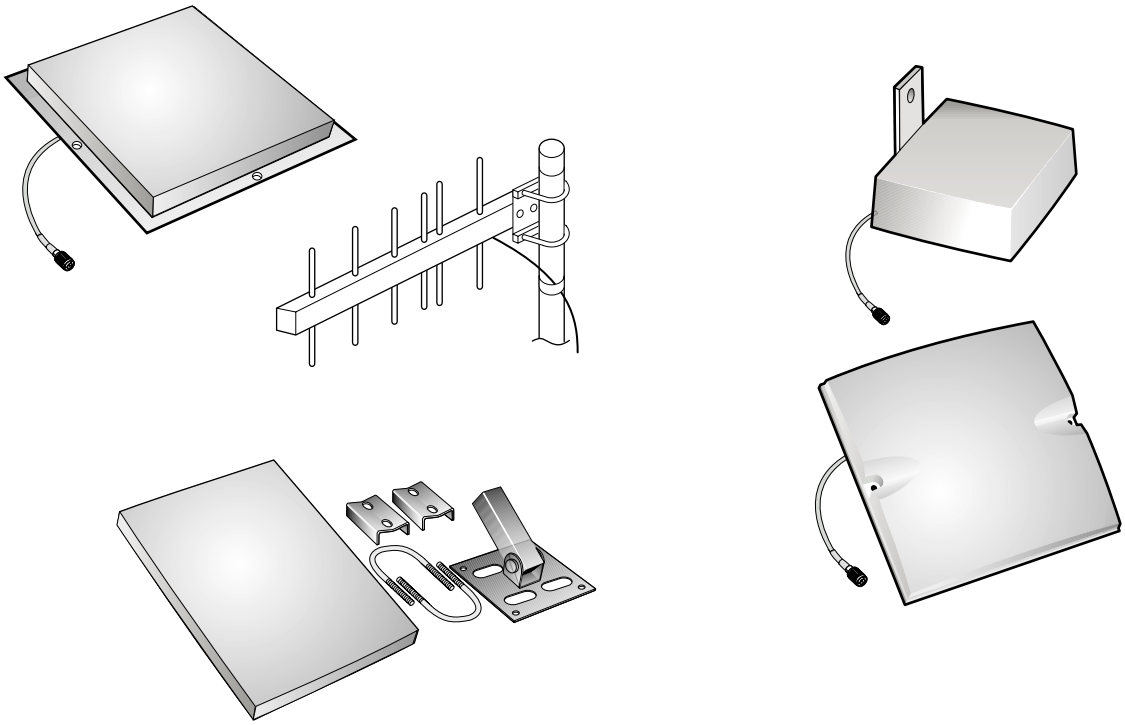
RAU LEDs

LED	Color	Indication
POWER	Green	On
SYNC	Red	Fault

If the antenna **SYNC** LED lights red, RF power in the antenna is automatically shut down. The antenna RF power is reset when the **SYNC** LED goes off.

RAU Optional Antennas

The following illustration shows optional antennas that can plug into the SMA connector. For recommended antennas, refer to the accessory section in the LG*Cell* Price List or contact your account manager.



LGC*ell* System Specifications

The following tables give system specifications for LGC*ell*.

- System gain, maximum input/output RF Power
- Maximum Input Power per Carrier vs. Number of Carriers

LGC*ell* System Gain

This table is a summary of the system gain for different frequencies and formats.

LGC*ell* Frequency/Format	System Gain	
	Duplex	Simplex
800 MHz AMPS, TDMA	30	0
800 MHz CDMA	30	0
800 MHz iDEN	0	0
900 MHz GSM	0	0
1800 MHz CDMA	0	0
DCS 1800 GSM	0	0
1900 MHz TDMA	40	0
1900 MHz CDMA	40	0
1900 MHz GSM	40	0

Maximum Input RF Power per Carrier vs. Number of Carriers

When you connect a Main Hub to an MBS that supports several RF carriers, the RF power per carrier must be cut back so as not to exceed the total composite radiated power into the Main Hub **DUPLEX** or **FORWARD** connector. The following table shows the maximum power per carrier and maximum composite power for different frequencies, formats, and numbers of carriers.

800 CDMA		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	10.0	10.0
2	7.0	10.0
3	5.2	10.0
4	3.0	9.0

1800 Korean CDMA		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	9.0	9.0
2	6.0	9.0
3	4.2	9.0
4	2.0	8.0

1900 TDMA		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	10.0	10.0
2	7.0	10.0
3	5.2	10.0
4	3.0	9.0

800 AMPS		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	20.0	20.0
2	15.5	18.5
3	12.8	17.6
4	11.0	17.0
5	9.5	16.5
6	8.3	16.1
7	7.3	15.8
8	6.5	15.5
9	5.7	15.2
10	5.0	15.0
11	4.4	14.8
12	3.8	14.6
13	3.3	14.4
14	2.8	14.3
15	2.4	14.1
16	1.9	14.0

800 TDMA		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	17.0	17.0
2	12.5	15.5
3	9.8	14.6
4	8.0	14.0
5	6.5	13.5
6	5.3	13.1
7	4.3	12.8
8	3.5	12.5
9	2.7	12.2
10	2.0	12.0
11	1.4	11.8
12	0.8	11.6
13	0.3	11.4
14	-0.2	11.3
15	-0.6	11.1
16	-1.1	11.0

800 GSM		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	20.0	20.0
2	8.0	11.0
3	6.0	10.8
4	4.7	10.7
5	3.8	10.8
6	3.0	10.8
7	2.3	10.8
8	2.0	11.0
9	1.5	11.0
10	1.2	11.2
11	0.8	11.2
12	0.5	11.3
13	0.3	11.4
14	0.0	11.5
15	-0.1	11.7
16	-0.3	11.7

1800 DCS/GSM		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	18.0	18.0
2	6.0	9.0
3	4.0	8.8
4	2.7	8.7
5	1.8	8.8
6	1.0	8.8
7	0.3	8.8
8	0.0	9.0
9	-0.4	9.1
10	-0.8	9.2
11	-1.1	9.3
12	-1.4	9.4
13	-1.7	9.4
14	-1.9	9.6
15	-2.1	9.7
16	-2.3	9.7

1900 AMPS		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	20.0	20.0
2	13.5	16.5
3	11.5	16.3
4	10.3	16.3
5	9.3	16.3
6	8.3	16.1
7	7.3	15.8
8	6.5	15.5
9	5.7	15.2
10	5.0	15.0
11	4.4	14.8
12	3.8	14.6
13	3.3	14.4
14	2.8	14.3
15	2.4	14.1
16	1.9	14.0

1900 TDMA		
Number of Carriers	Maximum Power per Carrier	Maximum Composite Power
1	17.0	17.0
2	12.5	15.5
3	9.8	14.6
4	8.0	14.0
5	6.5	13.5
6	5.3	13.1
7	4.3	12.8
8	3.5	12.5
9	2.7	12.2
10	2.0	12.0
11	1.4	11.8
12	0.8	11.6
13	0.3	11.4
14	-0.2	11.3
15	-0.6	11.1
16	-1.1	11.0

1900 GSM		
Number of Carriers	**Maximum Power per Carrier**	**Maximum Composite Power**
1	20.0	20.0
2	8.0	11.0
3	6.0	10.8
4	4.7	10.7
5	3.8	10.8
6	3.0	10.8
7	2.3	10.8
8	2.0	11.0
9	1.5	11.0
10	1.2	11.2
11	0.8	11.2
12	0.5	11.3
13	0.3	11.4
14	0.0	11.5
15	-0.1	11.7
16	-0.3	11.7

Band Selective Option

LGC*ell* 800 MHz, 900 MHz, 1800 MHz, and 1900 MHz

The LGC*ell* 800/900 MHz system has fixed bands of operation. The LGC*ell* 1800/1900 MHZ system has a fixed bandwidth filter in each system that is centered over the desired band of operation. The desired band of operation is an ordered item either by band (A, B, D, E, F) or by the center uplink and downlink frequency.

The following table shows the bandwidths for each type of system.

System	Fixed Filter Bandwidth	Uplink Center Frequency	Downlink Center Frequency
DAS 800 MHz - AMPS, TDMA, CDMA	25 MHz	836.5 MHz	881.5 MHz
DAS 800 MHz - iDEN	18 MHz	815 MHz	860 MHz
DAS 900 GSM	25 MHz	947.5 MHz	902.5 MHz
DAS 1800 KOREAN CDMA	30 Mhz	1765 MHz	1855 MHz
DAS 1800 DCS (GSM)	30 MHz	1725 MHz[1] to 1770 MHz	1820 MHz[1] to 1865 MHz
DAS 1900 MHz - CDMA, TDMA, GSM	15 MHz	1857.5 MHz[2] to 1892.5 MHz	1937.5 MHz[2] to 1972.5 MHz

For example, the **A** band for 1900 MHz PCS has the fixed 15 MHz filter centered at 1937.5 MHz for the downlink and 1857.5 for the uplink.

[1] 30 MHz pass filter can be positioned along the 75 MHz DCS 1800 band. Order product with uplink and downlink frequency at 1.25 MHz spacing. For example an uplink center frequency of 1737.5 MHz will provide a 30 MHz band between 1722.5 MHz and 1752.5 MHz and a downlink center frequency of 1832.5 MHz will provide a 30 MHz band between 1817.5 MHz and 1847.5 MHz.

[2] Similar to above, the 1900 PCS 15 MHz filter can be positioned along the 60 MHz band.

The LG*Cell* covers a 30 MHz band in frequency range of 1710 MHz to 1785 MHz on the uplink and 1805 MHz to 1880 MHz on the downlink. The operator can choose where to place the 30 MHz band of operation by choosing the corresponding center frequencies as shown in the following table.

Band Center Frequency of the DCS 1800 MHz LG*Cell*

The filter band is 30 MHz wide (or 15 MHz on each side of the center).

Uplink Freq	Downlink Freq
1725.00	1820.00
1726.25	1821.25
1727.50	1822.50
1728.75	1823.75
1730.00	1825.00
1731.25	1826.25
1732.50	1827.50
1733.75	1828.75
1735.00	1830.00
1736.25	1831.25
1737.50	1832.50
1738.75	1833.75
1740.00	1835.00
1741.25	1836.25
1742.50	1837.50
1743.75	1838.75
1745.00	1840.00
1746.25	1841.25
1747.50	1842.50

Uplink Freq	Downlink Freq
1748.75	1843.75
1750.00	1845.00
1751.25	1846.25
1752.50	1847.50
1753.75	1848.75
1755.00	1850.00
1756.25	1851.25
1757.50	1852.50
1758.75	1853.75
1760.00	1855.00
1761.25	1856.25
1762.50	1857.50
1763.75	1858.75
1765.00	1860.00
1766.25	1861.25
1767.50	1862.50
1768.75	1863.75
1770.00	1865.00

The following table shows settings for the 1900 MHz system.

Settings for Selecting Band Center Frequency of the 1900 MHz LG*Cell* System

Band	Uplink Frequency	Downlink Frequency
A	1857.50	1937.50 MHz
D	1867.50	1947.50 MHz
B	1877.50	1957.50 MHz
E	1887.50	1967.50 MHz
F	1892.50	1972.50 MHz

3 LGC*ell* Site Planning and Design

This section provides information to assist in planning and designing an LG*Cell* system and preparing a site for the LGC*ell* installation. Proper project management is instrumental in providing a timely and accurate deployment.

The first step in planning an LG*Cell* system is to estimate the amount of radio frequency (RF) coverage you need for your building or coverage area. Initial estimates can be developed using floor plans and the models that follow. Eventually you need to go on-site to evaluate the facility's readiness for installation and possibly perform RF measurements in order to guarantee performance. The LGC Wireless Site Survey Questionnaire is included for your reference.

Contents

Project Management

Installing the LGC*ell* system is easy after all of the pre-installation requirements are met. It is beneficial to have one person manage and coordinate all aspects of the planning, design, and installation. Managing the process should avoid unnecessary surprises.

The project manager is the person responsible for assigning tasks and ensuring scheduled work is performed on time. This includes collecting all information necessary for a complete site assessment, getting cost estimates and purchase order (PO) approval, scheduling any cabling work, scheduling the LGC*ell* installation and commissioning, and providing final as-built documentation.

The project manager also acts as the coordinator between the following people:

Cellular or PCS carrier
RF engineer
Site acquisition person
MBS vendor
MBS installer
Cabling contractor(s)
End user

If you do not have a designated project manager, please contact LGC Wireless. We can provide you with an estimate of what it would cost to have LGC Wireless manage your project. Please call us at 1-800-530-9960 (in the U.S.). International customers, please call us at +1-408-487-2400.

Project Management Estimated Timeline

Description	Details	Time Interval
Detailed site walk-through/RF survey	Prepare installation information, including RF plan, floor plan, equipment order form, and final design.	2 weeks
Order LGC*ell* equipment	Get all standard parts and accessories required.	8 weeks
Select cabling contractor	Complete installation statement of work and provide floor plan with equipment locations, list of cabling runs, and other materials and connections. Get cabling quotation after walk-through.	2 weeks
Order all other equipment	Get equipment from all vendors, including cables, connectors, MBS, surge protectors, and so on. Monitor order progress and shipment.	4 weeks
Install cable	Monitor installation.	1-5 days
Install LGC*ell*	Review installation checklist and prepare all materials.	1-3 days
Test installation and RF coverage	Be sure there are no blank areas.	1 hour per RAU
Generate as-built document	Prepare site plan diagram and coverage performance.	1-5 days

RF Coverage Estimate for a Site

To provide adequate RF coverage within a facility, you need a median signal level strong enough for good voice communications.

As a guideline, you can refer to the following tables for general coverage areas, based on a design goal of 0 dBm output power per carrier, -85 dBm received signal strength (independent of communications protocol), 5 dB fade margin and 3 dBi antenna gain.

Antenna Coverage for 800/900 MHz Frequency Applications (0 dBm per carrier, 5 dB fade margin, -85 dBm design goal and 3 dBi antenna gain)

Facility	PLS	Coverage per Antenna (Square Feet)
Manufacturing	27.3	30,000
Hospital	28.8	15,000
Airport	27.3	30,000
Retail	27.7	25,000
Warehouse	27.3	30,000
Parking Garage	26.8	40,000

Antenna Coverage for 1800/1900 MHz Frequency Applications

Facility	PLS	Coverage per Antenna (Square Feet)
Manufacturing	24.9	25,000
Hospital	26.5	10,000
Airport	24.9	25,000
Retail	25.2	20,000
Warehouse	24.9	25,000
Parking Garage	24.3	35,000

Office Antenna Coverage for 800/900 MHz Frequency Applications

Facility	PLS	Coverage per Antenna (Square Feet)
Open - 80% cubicles/20% offices	27.7	25,000
80% - 50% cubicles/50% offices	28.2	20,000
10% - 20% cubicles/80% offices	28.8	15,000

Office Antenna Coverage for 1800/1900 MHz Frequency Applications

Facility	PLS	Coverage per Antenna (Square Feet)
Open - 80% cubicles/20% offices	25.2	20,000
80% - 50% cubicles/50% offices	25.7	15,000
10% - 20% cubicles/80% offices	26.5	10,000

The preceding tables show estimated clutter-defined path loss slope (PLS) for different frequencies at various kinds of sites. If you change the design goal or other parameters, these numbers will change based on the PLS.

If the design parameters (output power per carrier, design goal, antenna gain, and fade margin) differ from those stated above, you can use the PLS value shown in the preceding tables in the following formula to estimate the area of coverage per antenna:

Path Loss Formulas

Path Loss (dB) = PLS * log $4\pi fD / c$

Note: Path Loss Slope = PLS dB/decade for free space loss

D is the distance in meters
f is the frequency in MHz
c is the speed of light

Path Loss=Power per Carrier + Antenna Gain - Fade Margin - Design Goal (dBm)

$D = [10^{(\text{Path Loss} / \text{PLS})}] \times [c / (4\pi f)]$

To convert feet to meters:

$\text{Area} = (D \times 3.281)^2 \times \pi$

The PLS is a general path loss number which takes into account free space loss and normal barriers to the RF signal. Severe obstructions such as metal, cement walls, or elevator shafts are best accounted for by a physical site survey.

As a reference the following table gives estimates of the signal loss for some RF barriers.

Average Signal Loss of Common Building Materials

Partition Type	Loss @ 815 MHz
Metal wall	26 dB
Aluminum siding	20 dB
Concrete block wall	13 dB
Foil insulation	4 dB
Concrete floor	15 dB
Sheetrock	1.4 dB

RF Measurements and Site Survey

Before designing an LG*Cell* system, one should go to the site and measure the loss characteristics of the building. To determine the amount of coverage per antenna, the best method is a test of RF propagation, which you can do on-site with a test transmitter and field strength meter.

While at the site, one can use the following Site Survey Questionnaire to document site specifics.

Site Survey Questionnaire

You can use the LGC Wireless Site Survey Questionnaire to help design your LG*Cell* system. A sample questionnaire follows. The following information is needed when you walk a site:

Site Survey Questionaire

585 EAST BROKAW ROAD | SAN JOSE, CA 95112 | TEL 408.487.2400 | FAX 408.487.2410

Project Name:		**Company Name:**	
Purchaser:		**Contact:**	
Address:		**Phone:**	
		E-Mail:	
End-User:		**End-User Contact:**	
Address:		**Phone:**	
		E-Mail:	

Type of System Enhancement: ◯ Coverage (BDA) ◯ Capacity (BTS) ◯ Wireless Office

If BTS, what Manufacturer & Model #: _____ # of Carriers: _____

If BTS, what is the # of Subscribers: _____ BHCR: _____ Erlangs/Sub: _____

What is the desired downlink power at mobile (-dBm): ☐ -75 ☐ -80 ☐ -85

Frequency(ies): ☐ 800 ☐ 900 ☐ 1800 ☐ 1900

Protocol(s): ☐ AMPS ☐ iDEN ☐ GSM ☐ TDMA ☐ CDMA ☐ DCS

Are Floor Plans Available (Including Map Scale): ☐ YES ☐ NO

Is Coverage Required Out Doors: ☐ YES ☐ NO

If Floor Plans are not available, how many Buildings are to be Covered: _____

How Many Floors per Building: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

(Use the Add'l comments if needed) ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Total Square Footage to Cover per Building: 1 = 2 = 3 = 4 = 5 =

(Use the Add'l comments if needed) 6 = 7 = 8 = 9 = 10 =

	Yes	No	Don't Know
Are Exposed Antennas Tolerated Inside:	☐	☐	☐
Are Exposed Antennas Tolerated Outside:	☐	☐	☐
Locations for Main & Expansion Hubs Available (closets):	☐	☐	☐
Are 19" Equipment Racks Available:	☐	☐	☐
Is AC Power available at the Main and Expansion Hubs:	☐	☐	☐
Are Multimode Fiber Optic Cables Already Available:	☐	☐	☐
Are CAT 5 UTP/STP Runs Already Available:	☐	☐	☐
Are LGC Wireless Services Required:	☐	☐	☐
If so, which Services:			
- Project Management:	☐	☐	☐
- Site Survey:	☐	☐	☐
- LGCell Equipment Install & Commissioning:	☐	☐	☐
- CAT5, MMF, Coax & Antenna Installation:	☐	☐	☐

Estimated Installation Start Date (Must Provide If Services are Needed):

Add'l Comments: (Special install requirements, covered areas, contacts, etc)