

Patient-Staff Communications

# Integrating to Wireless Phone Systems



imagination at work

## Market Need

Wireless phone systems are becoming an integral part of patient-staff communications system installations, to enable intercom communication between mobile staff and patients in their beds. This multitasking can 1) eliminate the need for a dedicated staff member answering patient calls at the nurse station, 2) expedite staff audio and bedside response to patient needs, 3) eliminate unnecessary trips to patient bedsides, and 4) support primary care nursing. While not inexpensive, these wireless phone systems often justify themselves based on staff productivity increases when the phones are integrated with the patient-staff communications system. When a stand-alone wireless phone system is already present in a facility, additional integration investment is limited to extra handsets and integration components, and can significantly improve efficiency for a low dollar investment.

## Levels of Integration

At its simplest, phone integration allows a phone to act as a pager, with audible and visual notification when a call is placed. Based on the existence for many years of pocket paging capability, virtually all patient-staff communications suppliers offer some level of integration, either directly or through third party integrators. In these cases, the voice capability of the phone is limited to calls to other wireless phones or to inside or outside phones not associated with patient-staff communications. More advanced patient-staff communications to wireless phone integrations may support additional features as shown below. Many of the features depend on the capability of both the patient-staff communications system and the phone system.

### Simple

- Send a patient call “page” to a phone for audible and visual alert

### Advanced

- Roll over unacknowledged patient calls to a second, third, or fourth level of caregiver
- Roll over sequences specific to call priorities
- Indicate call priorities with unique ring tones
- Allow staff to use a short key sequence to establish voice communication with the patient
- Allow staff to use a short key sequence to set follow-up service requests from the phone
- Allow staff to use a short key sequence to forward a call to a backup
- Provide group call support for team nursing, with alerts ending upon first phone to answer

## Reliability

In loosely coupled systems with audio connections, phones can hang up while patient-staff communications is still connected to the PBX. With some PBX's, this may result in reorder tones disturbing the patient, and ties up a voice path. At minimum, patient-staff communications should implement a timeout so that any call will automatically clean up.

High reliability systems maintain timeouts and synchronization handshakes between the patient-staff communications system and both the phone system as a whole and each phone in an active session, so that when one side hangs up, the other disconnects as well, insuring patient satisfaction and maximum usability of the audio resources.

Top of the line systems maintain protocol and problem logs and can calculate error counts, mean time between failure (MTBF) and mean time between error (MTBE) statistics to facilitate system diagnostics, performance history, and problem resolution.

## Phone Technology

Wireless phone technology is now in its third generation. In the mid 1990's GE Security (at that time Dukane) partnered with Ericsson to introduce the first generation - an integration to wireless phones without displays. Patient calls would ring a phone which, when answered, voice-announced the room and call level. An auto-attendant performed this annunciation and the subsequent connection of the patient-staff communications patient room intercom to the staff phone. Communication be-

tween the systems consisted of standard telephony (loop drop disconnect) and DTMF (connect and disconnect ) signaling.

Second generation product included phones with displays, running either frequency hopping spread spectrum (FHSS) or direct sequencing spread spectrum (DSSS) in the unlicensed 900MHz range, or the licensed 1900 MHz range. Low level communication (generation 2A) between the systems included using the TAP1.8 paging standard protocol to initiate the display and ringing of a phone. Connection and disconnection were accomplished via DTMF signaling, either manually initiated or automatic. Neither of these provided the reliability needed to insure synchronized disconnect and prevent reorder tones. The first wireless display phone suppliers, Nortel and Spectralink, designed their own higher level interface protocols (generation 2B) to overcome the synchronization problem. Continuous data supervision between the patient-staff communications and wireless system insured that when a phone disconnected for any reason, the patient-staff communications was aware and would also clean up. In addition, elimination of the DTMF signaling allowed connection sequences that contained letters, so that hospital room naming conventions were not restricted to digits only. GE (still as Dukane) developed industry first integrations to those protocols to introduce wireless phone display capability into patient-staff communications.

Developing individual interfaces for each vendor proved expensive and time consuming. In an effort to lower the cost and increase the reliability of wireless phone integration, patient-staff communications suppliers worked together with wireless phone vendors under the Healthcare Signaling and

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Communications section of NEMA (the National Electrical Manufacturers Association) to develop an interface standard. Utilizing a combination of telephony and data signaling, phone vendors could interface to a variety of patient-staff communications systems with a single interface, and one patient-staff communications interface could be reused for many wireless vendors. NEC and GE (Dukane) introduced the first implementation of the NEMA standard early in 2001.

Third generation wireless phone systems implement the IEEE 802.11b "WiFi" standard for wireless networks, offering facilities the advantage of a single wireless network for mobile phones and data devices. This backbone already exists in a growing number of facilities, and adding phones can be a relatively inexpensive enhancement. Symbol Technologies and Dukane installed the first patient-staff communications interface with 802.11b phones mid-year in 2002 (using the NEMA interface standard). Most current wireless phone vendors offer 802.11b systems today, including Spectralink, ascom, and Cisco. Vocera has introduced an alternative 802.11b solution without a dial pad but with voice announce and voice recognition dialing.

## Availability

Wireless systems, patient-staff communications systems, and integrator offerings are changing frequently, so always get confirmation from all parties as to their latest integration capabilities. Today, wireless systems from Nortel, Spectralink, NEC, Avaya, Ascom, Cisco, Vocera, and others are in hospitals throughout the country. Integrators including Globestar, Emergin, and Logical have written interfaces that accept standard paging output long available from patient-staff communications systems (TAP 1.8) and convert it to phone interface standards, thereby allowing most patient-staff communications systems to send a page to a wireless phone. In some cases, these integrators have added callback capability similar to the advanced direct patient-staff communications interfaces, and added integrations from the phone systems to hospital systems other than patient-staff communications. When using a third party integrator, care should be taken to fully understand the integrator's capabilities, as it may not include the synchronized disconnect, the letter dialing, or the speed of connection that direct patient-staff communications / phone integration advertises.

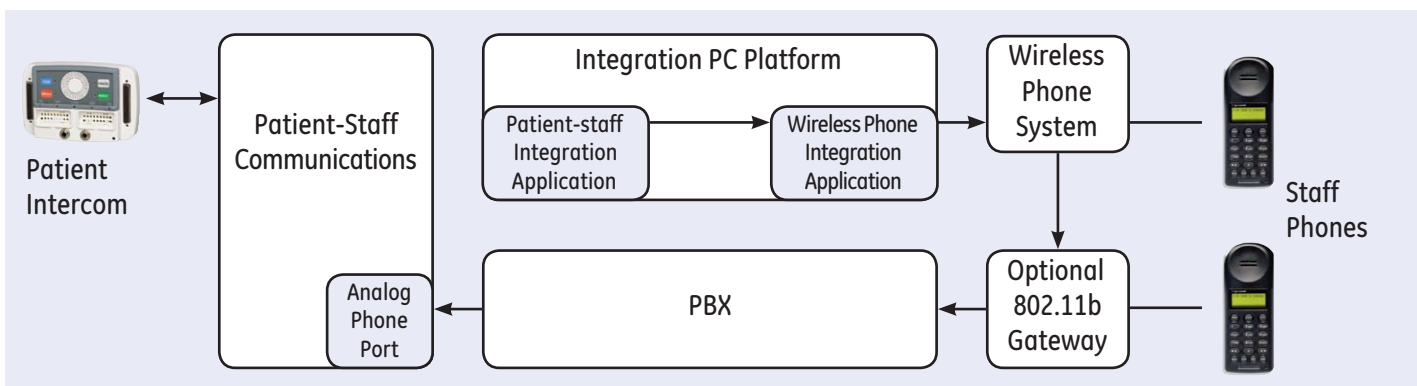


Figure 1 Integration Diagram

## What's Next?

Several facilities are investigating the use of dual-band phones that act like normal cellular phones when outside the building, but recognize the presence of an in-building system and drop to low power protocols required for operation within a hospital. This has been successfully implemented in at least one facility. While this promises the convenience of one phone / one number for staff traveling between campuses, several hurdles remain before this becomes widely adopted.

- Failure of the in-building system may cause the phones to revert to higher power (RFI) cellular mode
- Facilities may prefer that staff phones stay within the building and be restricted from outside access

## Safety Concerns

All hospitals have safety concerns involving Radio Frequency Interference (RFI), as interference with life safety and patient monitoring equipment can have severe consequences. Many facilities have policies regarding the use of cell phones within their buildings. The difference between cell phones and in-building systems is in the power output of the devices. Cell phones must transmit several miles to reach cell towers. In-building systems include base stations every hundred feet, so wireless handset transmissions are generally less than 1/100 the power output of cell phones. Consult your wireless vendor for power output specifics, and any safety testing results.

Issues can still arise when visitors see staff carrying wireless phones, and think that using their cell phone must be acceptable. Some facilities have adopted a policy of uniquely colored covers for their wireless phones, which serve to both protect the phones and identify them as non-cellular phones. Signage has been helpful in educating visitors about the acceptability of these phones versus the cellular phones that a visitor would carry.

## Regulatory Issues

Regulatory issues for wireless phone system integration exist if the wireless phone operation will disrupt any of the five fundamental patient-staff communications operations defined in the UL 1069 Hospital Signaling and Patient-staff communications Equipment product safety standard.

1. Call annunciation at a nurse station (audible and visible)
2. Call annunciation at the dome light
3. Call placed indicator on the patient station (visible)
4. Zone annunciation (audible and visible)
5. Call reset / cancellation

Typical patient-staff communications systems do not allow cancellation of emergency calls from anywhere other than the calling device itself. Wireless phone systems are often purchased with the intent of eliminating an unnecessary trip to a room by canceling a non-emergency bed call. This use requires wireless phone systems be subject

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to evaluation and listing by a Nationally Recognized Testing Lab (NRTL), including the submittal and evaluation of schematics, bills of materials, component ratings, operation, environmental conditions, and failure modes for all devices. This is a significant time and dollar commitment from equipment suppliers, which is unrealistic when the systems include ubiquitous off-the-shelf components (PC's, routers, switches ...), components that change frequently and are produced in high volume for markets beyond healthcare.

To provide a solution that meets the UL 1069 requirement but allows the option of canceling calls, patient-staff communications systems must offer two modes of operation. To maintain compliance with the UL 1069 standard, installation documentation must recommend a mode that will not cancel any patient calls. Systems can offer the option of installing in a manner that allows canceling of normal level bed calls from the phone, losing UL 1069 compliance but gaining a valuable capability. Dukane offers these two options on its ProCare 6000 and 2600 systems, letting the facility choose whether function or UL 1069 compliance is most critical to their needs.

## Frequently Asked Questions

### ***Are wireless phone systems safe for use in hospitals?***

Yes, typically. While cellular phones must transmit at high power levels to reach antenna systems miles away, in-building wireless phones transmit to base stations located every 100 feet. Power levels and the resultant radio frequency interference (RFI) levels for these transmissions are generally less than 1/100th that of cell phones. Please consult your wireless phone supplier for details.

### ***Are all integrations alike?***

No. Virtually every patient-staff communications supplier claims integration through third party integrators and the TAP 1.8 paging interface standard. This only provides one way paging through the phone. User-friendly answering of patient calls via the phone requires a higher level of integration, and has many facets, including answer sequences, connection delays, and group call capability. Performance varies with patient-staff communications suppliers, phone system suppliers, and integrators, and adding an integrator can positively or negatively affect the performance of a direct integration. Be sure to view a demonstration of the exact combination of equipment that will be installed to know what to expect when your system goes live.

### ***Do I need a third party integrator to interface my wireless phone to patient-staff communications?***

Perhaps. If your patient-staff communications system does not integrate to your wireless phone system, an integrator may bridge that gap. If you want systems other than patient-staff communi-

cations to integrate to the phones, an integrator may fulfill that need. Even with a third party integrator for other systems, direct patient-staff communications interface to phones may still offer the best feature solution if the phone system allows multiple inputs.

### ***What integration requirements must my IS department be aware of? My telephony department?***

Specific integration requirements vary by installation, but in general include:

- An IP drop for a Windows 2000 Server-based SQL Server communication server in the IS server room
- An IP drop for each workstation that will be making daily assignments of nurses to phones to patients
- An IP drop in the telephony room if the interface applications will reside on a PC in that room
- One or two analog phone line drops for each nursing unit, in the associated patient-staff communications equipment closet

### ***Is my wireless phone system UL 1069 Listed?***

No wireless phone system is listed as fundamental equipment under UL 1069 as patient-staff communications equipment. The frequent upgrades in technology, high volume use outside the patient-staff communications market, and reliance on the existing facility PBX to operate make it highly unlikely that any will be listed in the future.

### ***Must my wireless phone system be UL 1069 Listed?***

No. Wireless phone systems that annunciate calls and allow voice communication between mobile staff and patients, but do not cancel calls or replace nurse station call annunciation, can be added to a patient-staff communications system without affecting the UL 1069 compliance of the patient-staff communications system.

### ***Can wireless phones replace a patient-staff communications master station?***

No. UL 1069 compliant patient-staff communications systems must include call annunciation at a nursing station by a Listed device. While facility operations can include phones, the patient-staff communications annunciation must always be available as a backup in case the phone system is not working.

### ***Who services the patient-staff communications / wireless phone integration?***

Purchasing anything other than a turnkey solution requires close cooperation between the patient-staff communications supplier, integrator, and the wireless phone supplier to avoid delays in service. Make sure that there is a consensus on simple instructions to determine which supplier should be called first, that there is an initial point of contact for each supplier with appropriate service hours, that systems contain sufficient diagnostic capability so that each vendor can quickly determine whether the source of the problem lies within their system, and that each supplier agrees to pick up responsibility for the problem if another supplier's diagnostics so indicate.

GE  
Security  
Sound and Communications

U.S.  
T 888 GE SECURITY  
F 800 483 2495

Canada  
T 519 376 2430  
F 519 376 7258

[www.gesecurity.com](http://www.gesecurity.com)

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