

DEPLOYMENT OF MULTIPLE WIRELESS HEADSETS IN LIMITED SPACE

THE CHALLENGES

Wireless headsets offer users freedom of movement and improved comfort. In addition to providing hands-free communication, wireless headsets enable users to roam around in the workplace, limited only by the headset radio signal range. Since wireless headsets utilize radio channels there may be situations where many headsets in a confined area can generate radio interference that results in audible distortions. The number of headsets that can be used in a given area depends on the area size, the furnishing of the office such as furniture, carpets, curtains, walls dividers, etc. Also, the average distance headset-to-base, the presence of metal objects or large glass surfaces, and headset settings matters. Several 'Simple rules of thumb' described on page four can guide you when planning your deployment, and Jabra Customer Support is pleased to provide advice and guidance as well.

THE CHALLENGES

If a larger number of wireless headsets are used within a limited area such as an open space office, users may experience less-than-optimal audio quality. This can be caused by so-called density or capacity issues. It is thus important to plan ahead if you consider deploying a larger number of wireless headsets in a limited area. Jabra offers a choice of large-scale installations that use either DECT or *Bluetooth*[®], both of which can be scaled successfully to provide the necessary capacity and audio quality in limited spaces. Even with the best planning process there are physical factors - notably office furnishing ("the office clutter factor") - that significantly impact either positively or negatively the number of headsets that can operate in one area.

SHORT-RANGE RADIO AND CAPACITY

Capacity issues apply generally for all wireless technologies because the number of available radio channels is limited. This is especially true if several short-range radio transmitters are operating at the same time and at the same frequency, and if the number of headset units exceeds the number of available channels, i.e. radio frequencies and time slots.

Both DECT and *Bluetooth* technologies seek to maximize the number of available channels by employing sophisticated methods to reduce the likelihood of simultaneous transmission on the same channel.

For DECT technology a channel reuse will automatically occur, in which a channel that is "farthest away" is used. To ensure the distance is sufficient for good audio quality, the planning process must impose minimum limits on area per headset. Ideally this distance will be a given and known figure, but in reality offices differ. Reflections due to metal panels could decrease the number of headsets, while cubicles with heavy fabric will absorb the radio signals and allow more headsets.

Bluetooth uses randomly assigned and rapidly changing radio channels. As with DECT, the office furnishing and distances play a key role. Channel collisions will inevitably occur from time to time but their effect is negligible and inaudible provided there is adequate distance between headsets.

ENHANCED PERFORMANCE WITH JABRA

Jabra offers a choice of large-scale wireless headset installations using DECT, *Bluetooth*, or 2G4 Digital Wireless telephony technologies. The headsets provide special features to improve performance in environments requiring high capacity. These include Dynamic Radio Transmit Power Management (i.e. the automatic signal strength adjustment) and range configuration setting.



HOW TO PLAN

The purpose of the planning process is to define a headset deployment layout that ensures a signal-to-noise ratio above the threshold for good audio quality, to avoid interference in a limited space.

The result is a layout that defines the average distance between headsets and the average area per headset. These figures are a function of the size of the area, the average distance from headsets to base and the technology employed.

Note that the low or very low range setting improves the density performance. At the same time, however, the actual useful range of the headset is reduced, which limits freedom of movement for the user. Managing user expectations in such situations could be difficult. Another viable approach in high density installation is to use different technologies, including traditional wired headsets, wireless DECT and *Bluetooth* headsets in the same area. In this case, please be aware that there are also range differences between various products within the same wireless technology.

| CONSIDERATIONS | PLANNING |
|--|---|
| Building layout and isolated areas | Identify the areas where headsets are to be deployed. An area is a separate, isolated office space and need to be considered one at a time. Determine the area size in square meters or square feet. |
| Number of headsets per area | Check whether the required number of headsets exceeds the limits per area stated on page 4. |
| Office furnishing | Office furnishing - the so-called "clutter factor" - has perhaps the biggest impact on the density. The worst situation - from a density perspective - is a sparsely furnished, line-of-sight office where every radio signal is heard by everyone. The best situation is a heavy furnished office with cubicles, carpets and acoustically dampened ceilings. The differences in density due to the office furnishing can be as large as a factor of four. |
| Average distance between headset and base, and user mobility | These are important factors that affect planning. The average distance between headset and base is typically less than 2 m / 7 ft. It makes however little difference if only few users are roaming. |
| Special DECT considerations | Wideband Audio The use of wideband audio reduces the maximum number of headsets in a given area by half. |
| | Range Configuration Jabra DECT products have a configuration option called Range Setting that reduces the range and radio signal strength. The 'Low' and 'Very Low' power settings will improve the density performance. Note that when this option is used, all products in the planned area must be set in the same way. |
| | Headset utilization For DECT we recommend planning with 100% headset utilization. DECT uses a part of a channel even when there is no call. A lack of an available channel - which could happen if there are more calls than the average utilization planned for - will result in loss of communication between a headset and a base. Therefore DECT planning process should always assume 100% headset utilization. |
| Special <i>Bluetooth</i> considerations | WiFi Coexistence <i>Bluetooth</i> must be used with care if WiFi (specifically 2.4 GHz IEEE 802.11b, g, or n networks) is being used. Using WiFi reduces the number of available channels. You are advised to use WiFi in 5 GHz to avoid interference with <i>Bluetooth</i> . |
| | Headset Utilization The amount of time in which headsets will be utilized - e.g. if users are on the call all the time vs. 50% of the time - makes a significant difference when using <i>Bluetooth</i> . If the actual utilization exceeds the planned average utilization, a <i>Bluetooth</i> headset will still be able to communicate with a base, although with some loss of audio quality. |
| | <i>Bluetooth</i> range setting affects site planning only to a minor extent. This is because long-range <i>Bluetooth</i> products (so-called "Class 1" products) employ Dynamic Radio Transmit Power Management, which adjusts the radio signal in the headset to relative to the distance between headset and base, thus reducing the impact on other wireless headset users. Manual reduction of the range on a Class 1 product to 'Low' or 'Very Low' will however limit the freedom of movement for the user and as a consequence also improve the density performance. |

SIMPLE RULES OF THUMB



Because of the many factors involved in the planning, we recommend that you contact Jabra Technical Support if the number of headsets exceeds the simple density limits indicated below. Jabra's engineers can calculate areas and provide recommendations based on product-specific planning data. Due to the many factors involved, the figures below should be treated as moderately conservative guidance. In many situations the density could be better, while in some situations it could be worse.

DECT

- There should be no deployment issues if the number of headsets in an area is below the following limits:

60 headsets for EU DECT (normal audio), or
30 headsets for EU DECT (wideband audio)

30 headsets for US DECT (normal audio), or
15 headsets for US DECT (wideband audio)

We recommend a distance of at least 2-4 m / 7-13 ft between bases even if the number of headsets is below the limit

- If the number of headsets exceeds these limits, you should configure them to operate in a low or very low range. You should start with the following conservative areas per headset:

25-49 m² for EU DECT
(i.e. 5-7 m / 16-23 ft) between bases)

49-100 m² / 527-1076 sq ft for US DECT
(i.e. 7-10 m / 23-33 ft between bases)

Large metal objects or large glass windows, especially those covered with a metallic layer cause radio reflections and necessitate more conservative planning.

The average areas are valid for average headset to base distance up to 3 m / 10 ft, otherwise more conservative planning is needed.

BLUETOOTH

- There should be no deployment issues if the number of headsets in an area is below 25. However, even if there are fewer than 25 headsets, we recommend you to make sure there is at least 1-1.5 m / 3.3-5 ft between bases.
- If there are 25 or more headsets, areas and base separation distances grow proportionally with the number of headsets up to a limit of 220:

26-80 headsets require an area of 4-9 m² / 43-97 sq ft per headsets

81-220 headsets require an area of 9 m² / 97 sq ft per headsets

More than 220 headsets require an area of 16 m² / 172 sq ft per headset

- Lower headset utilization, say less than 50%, means you can double the number of headsets within an area.

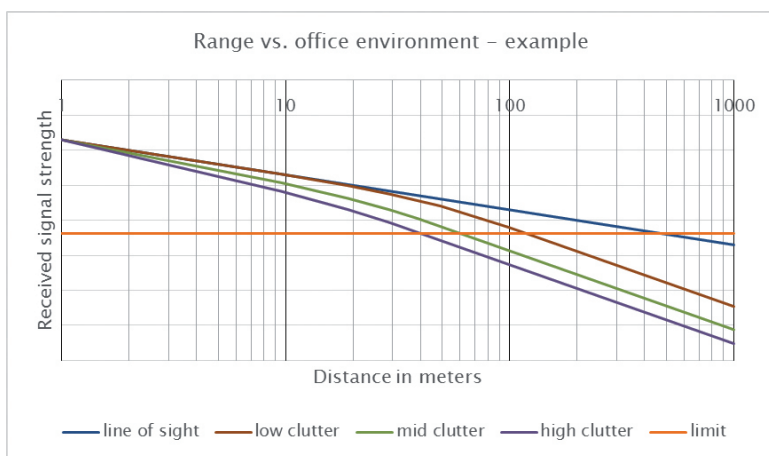
IMPACT OF THE OFFICE ENVIRONMENT

As has been highlighted, the physical environment of the office plays a big role in the perceived product performance. The figures below illustrate these effects.

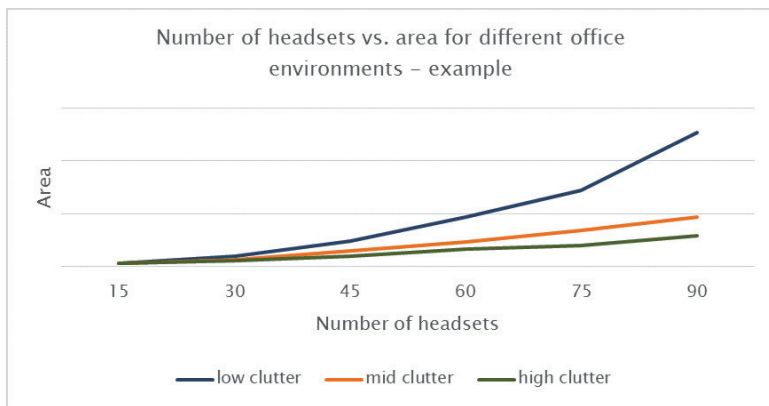
between several hundred meters in free space to approximately 30 m / 100 ft in a very high clutter environment.

The first graph shows how signal strength varies with the distance in line-of-sight, low clutter, medium clutter and a high clutter office, respectively. The orange horizontal line defines the maximum achievable range which varies

The next graph indicates how the required areas vary depending on the office clutter. If the office is sparsely furnished you might need up to four times larger area per headset than if the office is densely furnished.



Assumptions: Jabra PRO™ 920, US DECT, normal transmit power/long range
 *To convert meters to feet multiply by a factor of 3.3



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FIND OUT MORE

Different working environments, office layouts and interiors present an almost infinite variety of challenges when planning the effective deployment of multiple wireless headsets in a limited space. As a world leading supplier of wireless headset solutions, Jabra has many years of experience helping customers deploy effective wireless solutions on their premises.

Find out more about your options in your particular location and workplace environment by contacting Jabra customer service, where experts are available to discuss your particular needs and how best to address them.

www.jabra.com

ABOUT JABRA

Jabra is the brand of GN Netcom, a subsidiary of GN Store Nord A/S (GN) - listed on NASDAQ OMX. Jabra employs approximately 925 people worldwide and in 2013 produced an annual revenue which amounted to DKK 2,612 million. Jabra is a world leader in the development, manufacturing, and marketing of a broad range of communications and audio solutions. With a reputation for innovation, reliability, and ease of use that goes back more than two decades, Jabra's consumer and business divisions produce corded and wireless headsets, plus mobile and in-office speakerphones that empower individuals and businesses through increased freedom of movement, comfort, and functionality.