AVAYA

WHITE PAPER

1.9 GHz DECT™ 6.0

The New Standard in Wireless Technology

March 2007

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Section 1: Overview

Avaya has recently introduced three wireless headset systems for professional use — and all three are built on the DECT 6.0 technology. DECT 6.0 products, which operate in the 1.9GHz radio band, offer the best audio quality and best range/battery life balance on the market. The AWH65, an evolution of the landmark AWH55 wireless headset system, was the first headset in the US to take advantage of the newly available DECT 6.0 technology. The AWH65 was followed by two additional systems for office and contact center use: Supra Elite Wireless and AWH75.

In 2003, Avaya selected 900MHz to link professional headsets to desk base units, because it was the longest-range and best-quality technology available in the United States. In mid- 2005, Avaya added a 2.4 GHz *Bluetooth®* office system that allowed connection to ubiquitous *Bluetooth*-enabled cellular phones. Now, these Avaya headsets complement the existing family of office products, and take audio quality to the next level with DECT 6.0.

Section 2: Strong Advantage for Avaya Headset Users

In the US, the Federal Communications Commission (FCC) has reserved the 1.9GHz radio band exclusively for DECT 6.0 devices, which actively avoid interference with each other using a specific "listen before transmit" communication protocol. The result is superior transmission clarity even when traffic in that radio frequency increases. For that reason, Avaya has added the DECT 6.0 technology as a strategic development platform, complementing existing 900MHz, 1.8GHz DECT in Europe and 2.4GHz *Bluetooth* platforms worldwide.

This technology impacts Avaya headset users in North America in several ways:

1. **Interference Avoidance Within the Frequency Range:** The 1.9GHz radio band is reserved for DECT 6.0 communications equipment with "listen before sending" interference avoidance technology — yielding low interference and high quality audio. This sets it apart from other frequencies: 900MHz, 2.4 MHz, *Bluetooth*, and 5.8GHz.

2. **Coexisting With Other Radio Frequencies:** Avaya DECT 6.0 wireless headsets won't interfere with, or receive interference from, Wi-Fi networks, wireless security systems, cellular phones, or any other wireless equipment.

3. **Digital Privacy:** Commercial-grade digital encryption and interference-avoidance frequency hopping ensure privacy and security in accordance with both HIPAA and Sarbanes- Oxley requirements — so no one can eavesdrop on wireless conversations.

4. **Roaming Range and Installation Density:** Avaya DECT 6.0 headsets are engineered for range and density performance comparable the Avaya AWH55 — up to 300 feet of roaming, or unlimited density with limitations on range.

5. **Mixing 900MHz and 1.9GHz for Optimal Performance:** Because different radio frequencies can coexist without impacting performance, mixing the 900MHz AWH55 with new DECT 6.0 Supra Elite Wireless or AWH75 yields better density and range than either platform alone.

Section 3: Avaya DECT Headset Systems

For North American markets which have approved 1.9GHz for use — including the US, Canada and Mexico — Avaya has released three DECT 6.0 products. Europe and some regions in Asia and South America have access to an alternate non-US headset system, which operates in the similar, but slightly different, European DECT standard frequency range.

Headset System	Regional Availability	Frequency
AWH55	North America	900MHz
AWH65	Americas, Europe, Asia	1.9GHz & 1.8GHz models
AWH75	Americas, Europe, Asia	1.9GHz & 1.8GHz models
Supra Elite Wireless	Americas, Europe, Asia	1.9GHz & 1.8GHz models

Section 4: DECT 6.0: The New Standard in Voice Communication

The three Avaya headset systems operate in the 1920–1930MHz UPCS (Unlicensed Personal Communications Services) radio band in the United States. To say a device is based on DECT 6.0 technology means it is certified to operate in the UPCS radio band, and it uses a communication protocol (spectral etiquette) defined by the DECT Forum technology group (see **www.dect.org** for more information).

The DECT 6.0 communications protocol is based on the European DECT standard defined by ETSI (European Technology Standards Institute), slightly modified to comply with the regulatory requirements for the UPCS spectral etiquette, and for operating in the 1920 – 1930MHz band instead of the 1880–1900MHz band specified for Europe and countries sharing frequency bands with the European allocations. The equivalent designation in Canada is LE-PCS, for License-Exempt Personal Communications Service.

Because the FCC has reserved the 1.9GHz frequency band for only DECT communication devices, and because the DECT standard requires devices to actively avoid interference within the band to receive certification, the result is a clear frequency that is optimal for voice communication. To that end, all equipment approved for the 1.9GHz band must implement a “listen before transmit” spectrum-sharing etiquette. Interference manifests as pops, clicks or blanks noticeable to headset users, and occurs when two headsets share the same radio channel and timeslot. By changing channels when interference occurs, and by checking for interference before changing channels, DECT devices prevent interference.

Frequency	Nomenclature	Geography	Usage
902 – 928MHz	ISM (Industrial, Scientific & Medical)	North America; some South American countries	Shared with cordless telephones and some other wireless consumer electronics products
1880 – 1900MHz or 1.8GHz	DECT (Digitally Enhanced Cordless Telecommunications)	Europe; some Asian and South American countries	Dedicated to certified communications systems
1920 – 1930MHz or 1.9GHz	DECT 6.0 or UPCS (Unlicensed Personal Communications Service)	North America	Dedicated to certified communications systems
1850 – 1910MHz & 1930 – 1990MHz or 1900MHz	GSM (Global System for Mobile Communications)	North America; some South and Central American countries	Shared frequency used by mobile telecommunications systems (cellular phone networks)
2400 – 2480MHz or 2.4 GHz	ISM (Industrial, Scientific & Medical)	Worldwide	Shared with Wi-Fi, microwave ovens, alarm systems, cordless phones etc. Also the *Bluetooth* frequency

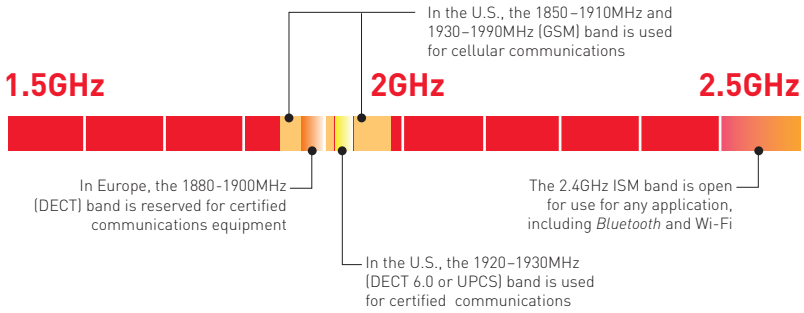
Section 5: Technical Detail

1. Interference Avoidance within the DECT Band. Avaya DECT headset systems prevent interference by selecting the best available channel at the start of a call, and subsequently changing channels automatically if the channel in use becomes susceptible to interference from another user. When the headset system's audio link is enabled, it employs aperiodic adaptive frequency hopping to accomplish this channel changing. Rather than changing channels at a fixed interval of time, the system hops channels in response to changing conditions — such as the presence of another user sharing the same channel and producing interference. In an environment with many users, this adds a layer of security because users change channels from time to time, rather than staying in a fixed channel that would allow enough time for attempts to eavesdrop.

During the idle-locked state — when the base and the remote are in range but audio is not enabled — Avaya DECT headsets employ fixed-rate adaptive frequency hopping. This ensures that the base and headset are adapting to changes in the radio signal spectrum caused by other users and the presence of interferers. The hop sequence is random, on the basis of the physical environment.

In a high-density deployment — one in which many DECT headsets are installed within direct line-of-sight to each other — privacy is of higher concern than interference. When no other better radio channel and timeslot are available, two co-located headsets sharing the same channel and timeslot will experience occasional mutes of the receive or transmit audio and occasional audio distortion, rather than intercepted audio — thus preserving privacy.

2. Coexisting With Other Radio Frequencies. By using a dedicated radio band, Avaya headsets both experience and produce minimal interference with systems that use adjacent frequency ranges. Avaya DECT headsets can be used without interference to or from *Bluetooth* systems and Wi-Fi networks (802.11a, 802.11b and 802.11g systems).



Low Power for Safe Use

Avaya DECT headsets contain low-power transmitters, which eliminates concerns about electromagnetic effect as a carcinogen. Measured maximum SAR level is 0.0056 W/kg. For comparison, that's about 1/250th of the maximum of a cellular phone.

Avaya DECT headset systems use a TDMA/TDD transmission system — 32kbit/s ADPCM vocoding, encryption of the vocoded data, then formatting into TDMA format and PSK modulation. The transmitter operates at a low duty cycle in non-constant-envelope mode. This transmission system turns the transmitter on periodically and at a low duty cycle to send voice data packets. This is similar to TDMA cellular telephone systems, though at much lower transmit power. The low transmit power level generally permits operation of DECT headsets in all environments; the exception being within a few feet of EKG, EEG, pulse oximetry, or similarly sensitive equipment typically found in certain areas of hospitals or medical offices. The general rule about electromagnetic compatibility for Avaya DECT headsets is that units can be used wherever cellular phones can be used, and will be less of an electromagnetic compatibility challenge than a cellular phone because of the very much lower transmit signal level.

The North American GSM frequency range is a common cellular technology adjacent to the 1.9GHz DECT 6.0 band. GSM 1900, as it is called, occupies 1850 –1910MHz upstream (phone transmit) and 1930 –1990MHz downstream (phone receive). Interference with DECT 6.0 headset systems does not occur except when the system base or headset is placed within a few inches of a cellular phone. Simply repositioning the cellular phone or the DECT 6.0 system headset to increase the separation eliminates interference.

The AWH75 and Supra Elite Wireless are officially certified by the United States FCC, according to the requirements of regulations 47 CFR 15D for UPCS systems. These products (when marked with an IC registration number) are also certified according to the regulations of Canada according to the requirements of RSS-213 Issue 2.

3. Digital Privacy. The Avaya DECT 6.0 wireless headset systems provide commercial-grade security against eavesdropping. The casual eavesdropper listening to the radio channel will hear only a buzzing sound, rather than voices, because the transmission is digitally coded and encrypted. Protection against deliberate eavesdropping takes the form of user authentication and 64-bit true digital encryption of voice data according to the ETSI standard algorithm EN 300 175-7. A description of the public portion of this encryption algorithm is available through the website of the ETSI at **http://www.etsi.org**.

All three Avaya DECT 6.0 headset systems have sufficient protection of privacy to make them HIPAA compliant and Sarbanes-Oxley (2002) sec. 404 compliant. This statement is based on the compliance of the encryption measures incorporated in the product with the requirements of DHHS regulation 45 CFR 164.312(a)(2)(iv).

4. Roaming Range and Installation Density. Users of the Avaya AWH55 will find the AWH65 has approximately the same range, despite the different frequency. The DECT 6.0 headsets can roam as much as 300 feet from the base unit in an open area with only a few DECT systems in place. Range is reduced by obstructions such as interior walls, and the presence of a large number of other systems using the same frequency band in the immediate area (density). At the edge of a system's range, the weak signal introduces audible interference that

make communication difficult. To counterbalance interference and improve the user's perception of audio quality, Avaya DECT 6.0 headset systems reduce the listening volume level when operating near the edge of range.

Using certain guidelines, Avaya guarantees successful use of DECT 6.0 wireless headset systems in a high-density installation. The system automatically senses the presence of other users and will reduce coverage area if there are too many other users to permit good audio performance at long range. Therefore, in a high-density environment, the system becomes a short-range, in-office system. The level of density at which this effect begins to occur depends on:

- Amount of time all users in an area spend with their systems in talk mode
- Distance between users
- Amount of physical obstruction in the office environment
- Number of systems within line-of-sight of each other

As a general rule, the larger the number of systems, the smaller the range. And the further the roaming distance, the more audio disruption occurs. The most prominent disruption occurs when a headset user is distant from the base but close to other user systems.

In most environments, even high-density environments, users in a cubicle grid with walls high enough to prevent line-of-sight with other users while the system is in use will get clear audio within their own cubicle — where most of headset usage occurs. Users will both receive — and be a source of — interference when they leave their work area while a call is in progress. However, experience with such products has taught that often performance in a high-density application is satisfactory even for very large numbers of users — several hundred on a building floor — as long as there is sufficient physical separation of the radio signals from different users. This separation can be attained by cubicle walls, by hard walls, or in some cases by physical distance. An open-plan layout (no cubicle walls or hard walls) with more than about 30 users of Avaya DECT 6.0 systems within line of sight of each other will, however, probably not offer acceptable audio quality for most users even at short range from base to headset.

Note that in a high-density installation, DECT 6.0 headsets may take some time to reestablish connectivity with the base when the user returns to the coverage area after having been out of range. It normally takes a few seconds for the headset to find the base's signal as the user enters the coverage area, but this process can take a minute or so in a high-density application. To the user this effect appears as inability to enter talk mode until the user has been in the coverage area for a minute or so.

5. Mixing 900MHz and 1.9GHz for Optimal Density. The three DECT 6.0 Avaya headsets operate in a different radio band than does the older AWH55 (1.9GHz vs. 900MHz). Thus, adding new DECT 6.0 units to a AWH55 installed base does not produce interference or degrade performance. This allows a high-density AWH55 installation to coexist physically in the same area as a high-density DECT 6.0 system, offering a net greater density. To enable both long-range and high density service within an area, a cubicle environment would have a DECT 6.0 system on every desk offering in-cubicle coverage, while up to 30 users of AWH55 systems are present specifically for longer roaming applications. The AWH55s can each roam up to the full range of the system, limited only by the signal strength loss with distance, rather than by interference from other users.

Accurately predicting the effective range and region of susceptibility to interference for individual environments and building layouts is complex, and the performance of individual installations may vary.

Rule of Thumb

In an office layout with cubicle walls high enough to prevent line-of-sight when users are seated, if there are more than 30 users with full-time headset usage within 100 feet of each other, system is limited to in-cubicle. If there are fewer than 15 full-time users within 100 feet, or with less than full-time usage, then coverage area will be larger.

About Avaya

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04/07 • MIS3375

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