

WHITEPAPER

From DECT to Bluetooth: Rethinking Enterprise Wireless Audio

Why Now Is the Right Time to Invest in
Logitech Zone Bluetooth Headsets for Your Organization



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When DECT technology was developed in the 1980s, it represented a significant advance for wireless communication — providing secure connections, extended wireless range, reliable performance in demanding office settings, and low latency. Bluetooth® would not appear for another 10 years, and when it arrived it had limitations that made it less suitable for enterprise environments with dense wireless traffic.

Today that is no longer the case. By the early 2020s, the advantages of DECT technology had largely disappeared as Bluetooth audio technology continued to evolve. In this whitepaper, we present results from rigorous tests comparing Logitech Zone Wireless 2 Bluetooth headsets to DECT headsets in high-density environments, demonstrating the robustness of this technology.

The evidence suggests that improvements to Bluetooth technology and the superior design of the Logitech Zone family of wireless headsets make them an excellent headset for the modern office or contact center. The Zone family of Bluetooth headsets offer performance on par with or above that of DECT headphones, and other design features make these headsets very appealing to today's workforce.

But Logitech Bluetooth headsets deliver more than just great performance. They can also make IT management easier and more cost-effective, as we discuss below. Plus, familiarity with Bluetooth makes adoption easier and potentially reduces support requests.



Background

As anyone who has worked in an office knows, our modern work environment is full of wireless devices. Wi-Fi networks, personal mobile devices, and a growing number of IoT peripherals create a constant flow of digital information in a complex and crowded wireless landscape. In this environment, clear and reliable audio communication is imperative. Business depends on it.

So when [DECT wireless technology](#) (now known as “Digital Enhanced Cordless Telecommunications”) first arrived in the late 1980s and early 1990s, it opened the door to new possibilities for headsets and wireless communication. Before DECT, most wireless headsets depended on the crowded 900 MHz frequency, a band shared with other devices like medical equipment, which created interference and issues with reliability. But DECT represented a significant advancement, providing secure connectivity on a dedicated frequency, extended range for wireless devices, low latency, and reliable performance in demanding office settings and call centers.

In 1998, some 10 years after DECT arrived, [Bluetooth](#) was introduced. It was created as a short-range wireless technology standard used for exchanging data between fixed and mobile devices over short distances. It was designed for personal networks and not suitable for busy offices due to its limited range (just 10 meters for Class 2 devices), latency, security concerns, and poor performance in dense environments. It was also not designed to connect portable phones to an analog telephone network, as DECT was.

Since its release, however, Bluetooth technology has evolved significantly. (As of the publication of this whitepaper, Bluetooth has released [Core Specification 6.2](#).) Modern Bluetooth elevates the audio experience, delivering speed, extended range, lower latency, reduced power consumption, enhanced audio quality, and strong encryption to satisfy enterprise requirements. Class 1 Bluetooth headsets offer a range well over 100 feet, and modern versions perform much better in wireless density.



Value for IT Management: TCO and Simplicity

Beyond end-user performance, modern Bluetooth offers compelling advantages for IT administration, contributing to a lower total cost of ownership (TCO) and simplified management.

- **Standardization and interoperability:** Bluetooth is a universal standard today. This eliminates the need for proprietary hardware and ensures seamless interoperability between company-issued laptops, mobile phones, and certified headsets, simplifying the device ecosystem.
- **Reduced hardware footprint:** Unlike DECT, which typically requires a dedicated base station and a dedicated USB port for each user, native Bluetooth solutions connect directly to Bluetooth-enabled devices like PCs and laptops — no base station or USB port required. This simpler setup reduces desktop clutter, lowers hardware costs, and streamlines asset management.
- **Higher user adoption:** Employees are already familiar with Bluetooth from personal devices like phones and speakers. This familiarity shortens the learning curve, increases adoption rates, and ultimately reduces the volume of IT support tickets related to headset operation.

Security for the Enterprise

For any large business — and especially for those in certain sectors like financial services and government — security is non-negotiable. But while Bluetooth security was a reason for hesitation in the past, it should no longer be a concern for organizations considering Bluetooth technology today. Bluetooth security has seen major enhancements, particularly with Bluetooth 5.0 (and later), which made LE Secure Connections mandatory with ECDH key exchange for strong authentication. Bluetooth now uses 128-bit AES encryption for data confidentiality and employs frequency hopping to reduce interference and the risk of interception. (For a comparison between DECT security and Bluetooth security, see the [Appendix 1](#).)

The Logitech Zone family of Bluetooth headsets is engineered with security at its core, whether connecting through native Bluetooth or through the dedicated USB receiver. Both support Bluetooth 5.0 and above, with the connection secured through the enforcement of Secure Connections. The USB receiver provides a pre-paired, out-of-the-box, and guaranteed secure connection, especially helpful for older host devices. For modern computers, native Bluetooth enables the same secure connection without a receiver.

Testing Bluetooth and DECT

While some organizations may still prefer DECT technology for headsets, it's becoming clear to us that the advantages of DECT have largely disappeared. To evaluate the capabilities of Bluetooth for audio communication, we conducted three independent and rigorous tests using the Logitech Zone Wireless 2 headset as our test device (see [Appendix 3: Test Environments](#)) and comparing it to a DECT headset from another well-known vendor. How would the Zone headset perform in a demanding office environment? What did we learn?

Testing and Validation Environments

To ascertain the capabilities of Bluetooth technology in a headset like Zone Wireless 2, we put it through the paces in 3 different scenarios:

- **Extreme stress testing:** We created a “worst-case scenario” in a controlled lab environment, with 50 active headsets in a 100m² (10m x 10m) space operating simultaneously amidst heavy, purpose-built Wi-Fi interference on the 2.4 GHz band. This provided a data-driven baseline of performance under immense pressure.
- **Real-world corporate deployment:** We conducted a full-day field test with 110 employees in a live, high-traffic corporate office in the financial services industry. This provided insight into real-world usability, user satisfaction, and performance with the unpredictable variables of a typical workday.
- **Native Bluetooth scalability analysis:** Lastly, we worked with Intel to run a controlled performance test focused specifically on the scalability of native Bluetooth audio as density increased. Using specialized acoustic analysis equipment, we measured KPIs as the number of active users scaled from one to 24. The test was performed on both 5 GHz and 2.4 GHz bands to assess performance with increased interference, and it compared performance of native Bluetooth vs. dongles.



“Extreme Stress” Testing Environment

For this test, we set up an environment (shown below) that we likened to a “worst-case scenario,” although in truth the density was significantly higher than in a typical contact center and likely far denser than any real-

world office environment. We also created aggressive interference by placing three 2.4 GHz Wi-Fi access points closer than in a normal use case to create an even more challenging environment.



Room setup for “Extreme Stress” testing environment

We used 50 Logitech Zone Wireless 2 headsets and repeated the test with 50 comparable DECT headsets from another company. We selected 6 units in each test and measured their performance. For the tests we streamed a 1 KHz sine tone and speech from the speaker

output in call mode. The following table provides data for the 6 units on the following measurements: number of dropouts, longest dropout in milliseconds, total dropout time, and percentage of bad signals.

Wi-Fi Environment	Test Sets	DUT Model Name	Note	System #1 Long range	System #21 Mid-range	System #25 Headset Nearby	System #36 Mid-range	System #49 Long range	System #50 Headset Moving
Iperf on (3APs at CH1, CH6, CH11 with traffic transmitted, TCP+UDP)	50	DECT	Number of Dropouts	34	16	0	21	28	19
			Longest Dropout (ms)	1311.33	302.46	0	636.52	1586.23	1451.98
			Total Dropout Time	2.34	0.62	0	1.9	2.63	2.56
			Percent Bad Signal (%)	1.8	0.48	0	1.46	2.03	2.02
	50	Zone Wireless 2 (BT headset)	Number of Dropouts	1342	447	7	655	349	477
			Longest Dropout (ms)	39.52	35	3.94	63.33	18.38	21.21
			Total Dropout Time (s)	4.69	1.61	0.02	2.86	1.27	1.66
			Percent Bad Signal (%)	3.6	1.24	0.02	2.2	0.98	1.3
Iperf off (3APs at CH1, CH6, CH11 without traffic transmitted)	50	DECT	Number of Dropouts	0	5	6	0	0	39
			Longest Dropout (ms)	0	1637.71	66.25	0	0	1232.98
			Total Dropout Time (s)	0	1.66	0.08	0	0	5.52
			Percent Bad Signal (%)	0	1.27	0.06	0	0	4.34
	50	Zone Wireless 2 (BT headset)	Number of Dropouts	533	301	5	192	137	202
			Longest Dropout (ms)	26.88	20	2.79	11.25	31.23	23.06
			Total Dropout Time (s)	1.77	1.07	0.01	0.69	0.51	0.77
			Percent Bad Signal (%)	1.36	0.82	0.01	0.53	0.39	0.61

Table showing results from "Extreme Stress" test, comparing Logitech Zone Wireless 2 to a comparable DECT headset

The “Extreme Stress” testing environment allowed us to do the following:

- Evaluate the audio quality and dropout rates of 50 active DECT and Bluetooth headsets in a simulated office environment.
- Incorporate a mobile unit to simulate a user who moves about the room.
- Implement a realistic and dynamic 2.4 GHz Wi-Fi interference simulation to represent a busy, open-office environment.

- Compare the performance of DECT and Bluetooth technologies under these updated conditions.

The table below provides Mean Opinion Scores (MOS) for both headset types, Logitech Zone Wireless 2 and DECT. As the table indicates, there were no significant differences in MOS results between the Logitech and DECT headsets.

Wi-Fi Environment	Test Sets	DUT Model Name	Note	System #1 Long range	System #21 Mid-range	System #25 Headset nearby	System #36 Mid-range	System #49 Long range	System #50 Headset moving
lperf on (3APs at CH1, CH6, CH11 with traffic transmitted, TCP+UDP)	50	DECT	DNSMOS_ovri_mos	3.151	3.264	3.301	3.273	3.239	2.996
			DNSMOS_sig_mos	3.484	3.547	3.584	3.556	3.54	3.599
			DNSMOS_bak_mos	3.986	4.082	4.096	4.093	4.058	3.512
	50	Zone Wireless 2 (BT headset)	DNSMOS_ovri_mos	3.289	3.34	3.315	3.203	3.381	2.935
			DNSMOS_sig_mos	3.588	3.62	3.611	3.546	3.662	3.668
			DNSMOS_bak_mos	4.043	4.096	4.077	3.958	4.101	3.308
lperf off (3APs at CH1, CH6, CH11 without traffic transmitted)	50	DECT	DNSMOS_ovri_mos	3.263	3.299	3.276	3.231	3.316	2.918
			DNSMOS_sig_mos	3.56	3.58	3.58	3.59	3.63	3.62
			DNSMOS_bak_mos	4.065	4.083	4.055	3.946	4.046	3.327
	50	Zone Wireless 2 (BT headset)	DNSMOS_ovri_mos	3.268	3.264	3.286	3.295	3.292	3.003
			DNSMOS_sig_mos	3.57	3.56	3.58	3.58	3.58	3.6
			DNSMOS_bak_mos	4.067	4.065	4.087	4.092	4.089	3.521

Table showing Mean Opinion Scores for Zone Wireless 2 and DECT headsets

Note: The MOS results presented here were generated by our own software tool based on SpeechMOS Python library, for internal evaluation purposes. These scores are not directly comparable to the standardized MOS results from POLQA or the predictive MOS metrics used within Microsoft Teams.

Results & Key Insights

To establish a definitive, machine-evaluated baseline, the extreme stress test utilized Speech MOS (MOS = Mean Opinion Score), an objective audio quality assessment tool (see [Appendix 2](#)) based on the ITU-T P.835 standard. This analysis provides key metrics for Signal MOS and Background MOS. We also measured dropout rates to evaluate connection reliability. Below is a summary of the results from this test environment.

- Speech quality was virtually identical. The S-MOS scores, which directly measure voice clarity, were nearly indistinguishable between Zone Wireless 2 and its DECT counterpart.
- Both DECT and Bluetooth headsets can be susceptible to performance degradation in a busy Wi-Fi environment under extreme conditions. See [Appendix 3](#).
- Both types of headsets performed well. DECT headsets had a low number of dropouts, but when dropouts occurred they were more noticeable to users due to their longer duration (up to 1,637 milliseconds). In comparison, Bluetooth headsets had far more frequent but shorter dropouts (all less than 64 milliseconds). For an explanation of the dropout rates and duration, see [Appendix 4](#).
- Despite the higher number of dropouts for Bluetooth, the brief nature of each event often resulted in a total dropout time similar to or better than DECT. See [Appendix 3](#).
- When density issues arise, the pattern of short dropouts with Bluetooth may be more acceptable or less noticeable to users compared to the longer-duration dropouts with DECT, which can be long enough to result in whole words or phrases being lost. See [Appendix 3](#).

Takeaway: The results from this test show that the voice quality of the Zone Wireless 2 headset is on par with the DECT headset in an extreme high-density environment. It confirms that Bluetooth headsets can indeed deliver voice quality and connection reliability that is equal to or better than DECT headsets. This should alleviate a primary concern that many corporate buyers have about Bluetooth headsets.

Objectively, the Zone Wireless 2 headset performed well in a structured test environment. But how would it do in an actual office environment, with the unpredictable variables of a typical workday?

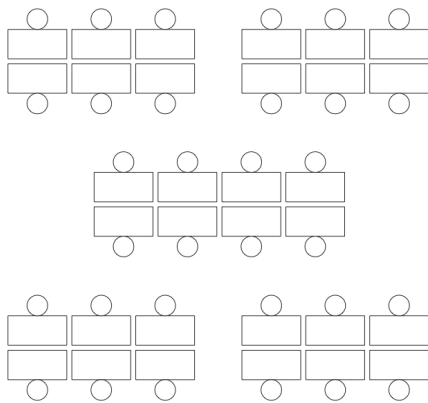


Real-World Corporate Environment

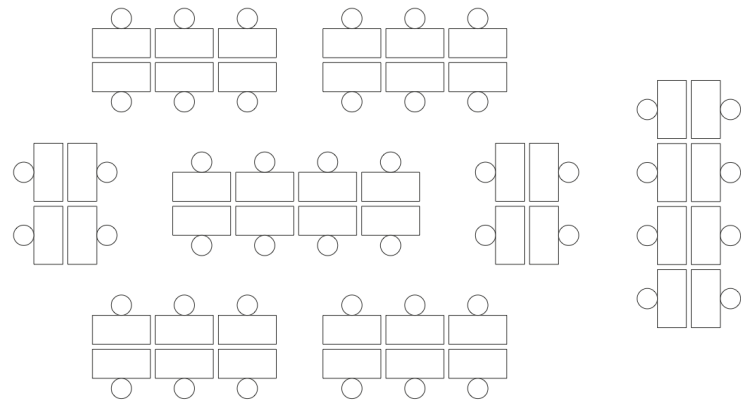
For the real-world scenario, we worked with a large US financial services company to test 110 Zone Wireless 2 headsets on one floor of their corporate building. The majority of headset users were concentrated in five nearby areas in seating arrangements similar to the following.

All employees were provided with the headset and a dongle. The majority connected to their computer; however, some employees also connected the headset to their mobile phone using multipoint Bluetooth connection. Over 100 employees used the headsets all day (8 am to 5 pm) and 87 provided feedback.

Typical 32-seat configuration:



Typical 48-seat configuration:



These two schematics represent typical seating configurations in the corporate offices where we tested headsets

Results & Key Insights

Objective highlights and feedback from the test include:

- Zone Wireless 2 headset had an overall highly positive rating of 4.7 out of 5
- Overall mic and audio quality rated 4.7 out of 5
- Pairing and setup rated 4.6 out of 5
- No density issues reported by users roaming away from their desk despite observed high radio frequency (RF) traffic, including an average of 65%+ of users actively on calls, meetings, or listening to audio.
 - In most cases, there were no performance issues within the user's normal roaming distance (an average of 20 feet)
- Some users reported reliable Bluetooth performance up to 115 feet from their desk, which was up to 2x better than the DECT headset they were currently using
- Performance was measured across multiple users over different times of the day
- All headsets had 90% charge when deployed. The battery lasted throughout the full workday without needing charging and users were very satisfied with the battery performance.
- Some employees connected their Zone Wireless 2 headset to a secondary work device, like a mobile phone or Bluetooth-enabled desk phone; this capability was not possible with their DECT headset.

More subjective results are based on user feedback and ratings at the end of the day. Feedback was consistently positive and included statements such as the following:

“Able to go at least 3 times the distance compared to the existing headset.”

“Easy to use and has good audio quality. Better than previous headset.”

“I prefer this device to what we currently have. Better overall & great noise cancellation.”

“Really good headset for home and office use. Noise cancelling is excellent and call quality was good.”

“Everything was great!! Clear sound, easy to use, great ANC!!”

Takeaway: This test was very different from the previous one. The “Extreme Stress” environment used an objective audio quality assessment tool (see [Appendix 2](#)) to measure results and compared a DECT headset with the Zone Wireless 2 Bluetooth headset. The “real world” environment test relied on subjective human experience with the Logitech headset, with an implicit comparison to the DECT headset that the users were familiar with.

Less scientific and more subjective, this test nonetheless gives us real-world feedback about how people actually experience the headset. That experience was clearly positive and supports the objective data from the first test. It confirms that Zone Wireless 2 headsets perform well in real corporate environments.

Native Bluetooth Scalability Analysis

The test environments above assess the performance of Logitech Zone Wireless 2 headsets using Bluetooth and connecting to laptops with a USB receiver. For the third test, we wanted to evaluate the performance of these same headsets connecting to a laptop via “native Bluetooth” — that is, directly and without a USB receiver.

We believe that native Bluetooth is the future of wireless headsets. Because connecting directly to the laptop eliminates the need for a receiver, it also removes a source of problems for users and IT. Small USB receivers, or dongles, are easily lost, left at home or in the office, or broken. And when in use, they occupy a valuable USB port that might be needed for another peripheral, like a mouse or USB key.

One more important point: now that Microsoft has begun certifying headsets for use with Teams over native Bluetooth, organizations that standardize on Microsoft Teams can consider deploying headsets that don’t require dongles.

On the other hand, we know that a USB receiver provides a highly stable connection between headset and laptop. So if the receiver is removed, does “going native” result in less stable wireless connections?

There’s good news there, too. Our test indicates that not only are native Bluetooth connections robust and stable, but they remained so even as we increased the density of wireless traffic to a level well above that expected in a real-world office environment.



Room setup for native Bluetooth testing

Results & Key Insights

For this test, we used specialized acoustic analysis equipment and measured KPIs (MOS score, packet error rate, NAK count, no sync events, CRC errors) as we increased from 1 active “user” in the room (low density) to 10 (medium density) then to 24 (high density). We conducted two phases for the native Bluetooth test: Phase 1 using Wi-Fi 5 GHz with minimal or no congestion, and Phase 2 with Wi-Fi coexistence and congestion on 2.4 GHz.

The table below provides data for one representative station (station #9) in the low-, medium-, and high-density environments. (The complete data set is available upon request.)

Metric	5 GHz Wi-Fi / 2.4 GHz Wi-Fi Low Density	5 GHz Wi-Fi / 2.4 GHz Wi-Fi Medium Density	5 GHz Wi-Fi / 2.4 GHz Wi-Fi High Density
MOS Score (RX)	4.25 / 4.15	4.20 / 4.05	3.91 / 3.85
MOS Score (TX)	4.10 / 4.05	4.05 / 4.00	3.75 / 3.75
Packet Error Rate (PER)	1.98 / 1.91	2.08 / 2.20	2.88 / 2.94
NAK Count	0.72 / 0.65	0.70 / 0.77	1.11 / 1.03
No Sync Events	1.60 / 1.14	1.20 / 1.21	0.95 / 1.62
CRC Errors	0.15 / 0.11	0.18 / 0.22	0.82 / 0.29

Table showing native Bluetooth test results at one station (STA #9) as the number of active “users” and density increased

The following table shows native Bluetooth (NBT) test results for a representative sample of stations during the highest-density test (with all 24 stations active). This table shows NBT results with and without Wi-Fi congestion, and MOS scores for headsets using NBT vs. those using a Bluetooth receiver.

Metric	NBT+ Wi-Fi 5 GHz (Baseline)					NBT+ Wi-Fi 2.4 GHz + Traffic					BT Dongle + Wi-Fi 2.4 GHz + traffic				
	STA #1	STA #6	STA #9	STA #19	STA #24	STA #1	STA #6	STA #9	STA #19	STA #24	STA #1	STA #6	STA #9	STA #19	STA #24
MOS Score (RX)	3.99	3.87	3.91	3.95	3.90	3.99	3.82	3.85	3.82	3.87	3.67	3.75	3.70	3.75	3.67
MOS Score (TX)	3.85	3.75	3.75	3.90	3.85	3.8	3.71	3.75	3.78	3.81	3.82	3.84	3.65	3.68	3.61
Packet Error Rate (PER)	2.55	2.94	2.88	2.74	2.55	2.95	2.99	2.94	2.96	1.91	-	-	-	-	-
NAK Count	0.92	1.50	1.11	1.20	0.92	1.03	1.05	1.03	1.04	0.65	-	-	-	-	-
No Sync Events	1.14	0.73	0.95	0.82	1.14	1.62	1.64	1.62	1.63	1.14	-	-	-	-	-
CRC Errors	0.49	0.71	0.82	0.72	0.49	0.3	0.3	0.29	0.3	0.11	-	-	-	-	-

Table showing test results for a representative sample of stations during the highest-density test

This test demonstrated the following:

- Scaling from low to medium to high density (from 1 to 10 to 24 stations) in the same room showed no significant degradation in key Bluetooth metrics
- MOS stability: Scores remained stable as long as packet error rate (PER) was less than ~5%, confirming audio quality resilience
- Both audio quality (phase 1 test) and mic quality (phase 1 and phase 2 tests) were consistently rated "good"
- Overall native Bluetooth connection quality was robust and stable

Takeaway: Even in an environment with a high density of active users (24 in the space of a small classroom), the native Bluetooth connections of the Logitech Zone Wireless 2 headset remained robust and stable. If organizations are considering deploying native Bluetooth headsets in busy offices, this should give them the confidence to go forward with at least a proof of concept.

The superior performance with a native Bluetooth connection comes from the Intel chipset’s advanced implementation of LE Power Control (LEPC).

Unlike standard dongles that often transmit at fixed or maximum power, the Intel solution dynamically optimizes its transmission power and receiver gain based on real-time signal quality (RSSI). This prevents signal saturation and reduces the overall noise floor in high-density environments, ensuring a stable connection even when the airwaves are crowded.

Synthesized Findings: The Case for Bluetooth Audio in an Enterprise Setting

Analysis across all three testing environments provided a number of compelling findings that support the use case for Zone Wireless 2 Bluetooth headsets.

Finding 1: Bluetooth audio quality remains robust and resilient under density

The ultimate measure of a headset is the clarity of its audio. Across several objective and subjective tests, Zone Wireless 2 demonstrated high-level performance mic and audio quality even under the most strenuous conditions. In addition, during the extreme and real-world tests, Zone Wireless 2 call quality was on par with DECT.

Finding 2: Bluetooth connection stability is proven and reliable

Data shows that modern Bluetooth connections are highly stable — with or without a dongle. In the scalability test, the packet error rate (PER) averaged just 2.79% at a density of 24 users, well below the acceptable 5% threshold, which ensures a positive user experience, rated “Good to Excellent.” This data-backed stability was confirmed in the real-world deployment, where users reported no dropped calls within a typical roaming distance.

Finding 3: Dropout behavior with Bluetooth is fundamentally less disruptive

While any wireless technology can be stressed, its failure mode is critical. The “Extreme Stress” test demonstrated a key difference. This one difference is due to the way DECT and Bluetooth establish connection and reestablish connection during a disruption. Dropped connections with DECT were less frequent but potentially more disruptive; the longest dropout time in our testing was 1.6 seconds. In contrast, Bluetooth interruptions were more frequent but extremely brief and far less disruptive; even the longer glitches lasted less than .06 seconds. In a live conversation, a momentary stutter is far less jarring and disruptive than a silence of 1.5 seconds.

Finding 4: Logitech Zone Wireless 2 exceeds enterprise expectations

The corporate field test at a large financial services company proved the Zone Wireless 2 headset’s readiness for the modern workplace, where its thoughtful design translated into tangible benefits:

- **Superior range:** Many users were able to roam a typical distance from their desks without issue. As noted above, some users reported reliable Bluetooth performance up to 115 feet from their desk, 2x better than the DECT headset they were currently using.
- **High user satisfaction:** Beyond audio, the overall user satisfaction rating was 4.7 out of 5.0 for the Zone Wireless 2 headset, with high marks for mic and audio quality (4.7) and ease of pairing (4.6).
- **Modern features:** Users highlighted modern features like multi-device connection and flip-to-mute microphones as significant enhancements to their workflow, showcasing the user-centric design philosophy of Zone Wireless 2.

Best Practices for Deploying Bluetooth Headsets

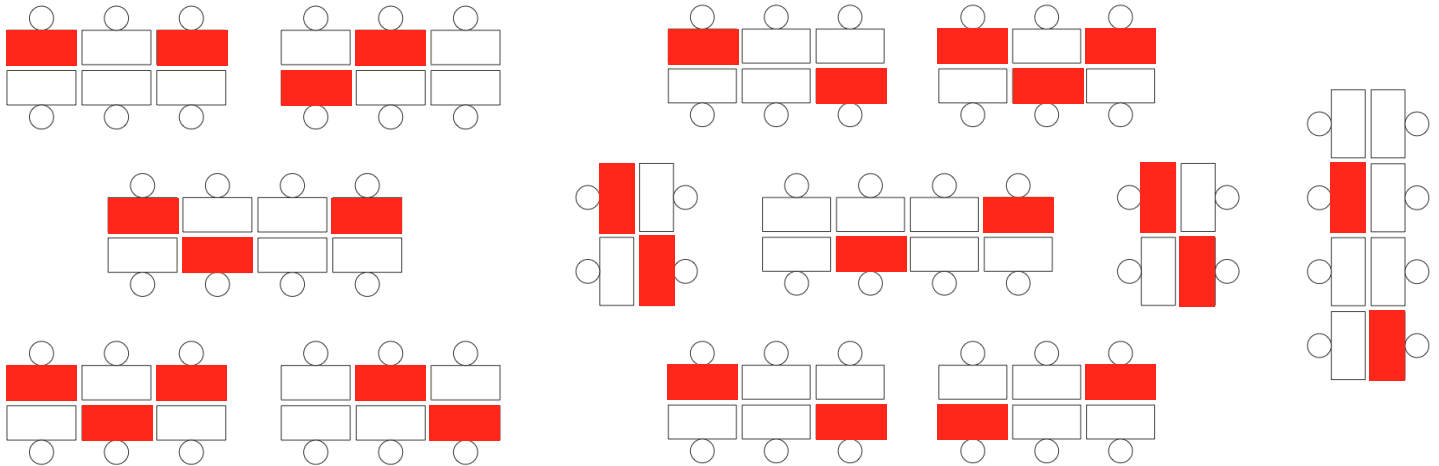
Bluetooth headsets offer efficiency and mobility, but getting the most out of them requires thoughtful setup. Here are some practical tips to help ensure a successful deployment.

1. Make sure other devices are on a 5 GHz Wi-Fi

Because Bluetooth operates on the busy 2.4 GHz band, headsets can compete for bandwidth with other devices on a 2.4 GHz Wi-Fi. Connecting office computers and other infrastructure to 5 GHz Wi-Fi networks frees up the 2.4 GHz band for Bluetooth devices, improving call clarity and reducing interference. IT teams that have adopted this approach consistently report smoother headset performance.

2. Allow a minimum of 5 square meters (54 square feet) per headset

Bluetooth headsets work well in busy offices, but cramped environments can lead to signal congestion. A good rule of thumb is to aim for at least 5 square meters of space per headset user. This helps minimize interference and ensures reliable connections.



In this schematic of a typical corporate office (see page 10), the red rectangles represent locations of desks with USB receivers

3. Spread out USB receivers

Clustering USB Bluetooth receivers can create interference, even with Bluetooth's adaptive, frequency-hopping technology. Here's how to avoid interference if you are using USB receivers:

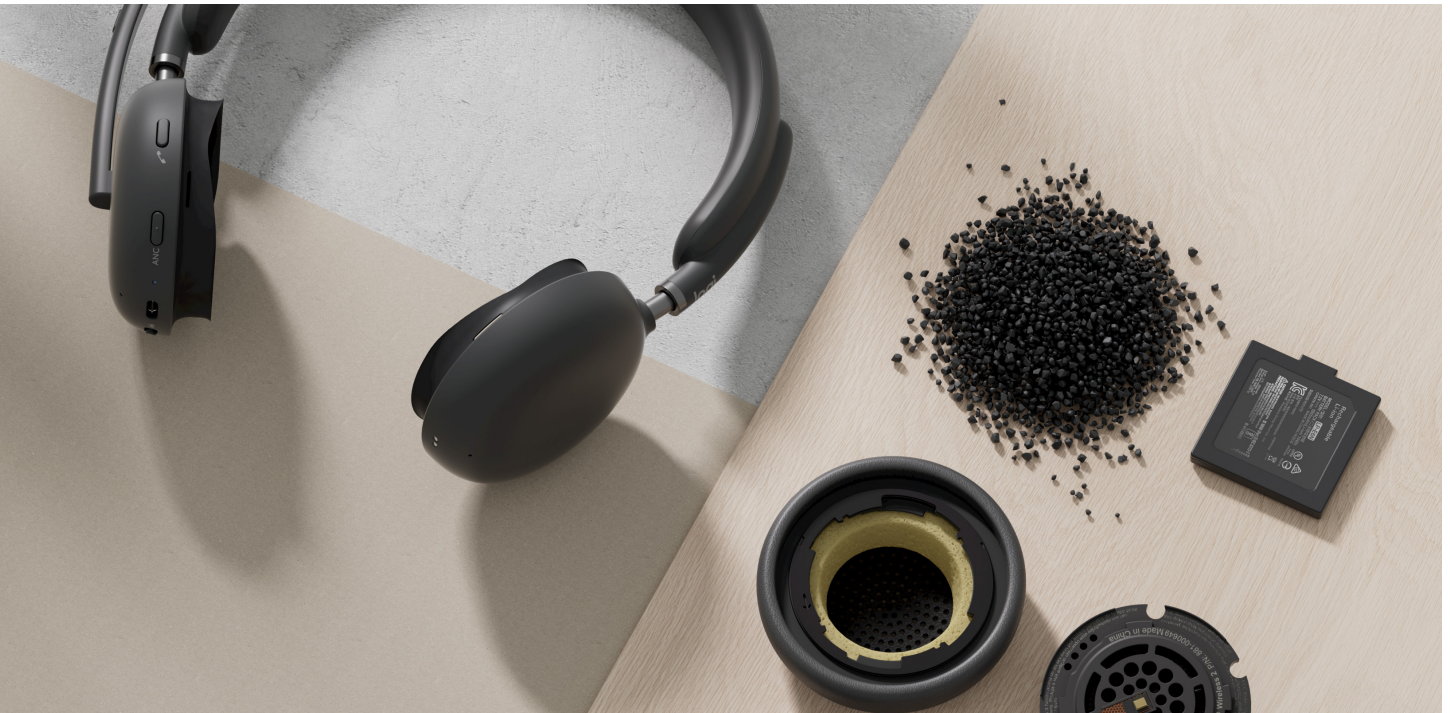
- Avoid clustering multiple USB receivers in a single, dense location.
- Plug receivers into opposite sides of laptops or docking stations to maximize physical separation.
- Avoid shared USB hubs when possible, especially under desks.

4. Account for office layout and materials

Here are some things to keep in mind planning your deployment:

- Concrete and steel will block signals more than glass or drywall. Wireless performance could be affected in offices with dense building materials.
- Open layouts provide better signal flow than offices with high cubicle walls or numerous enclosed rooms.
- A Bluetooth connection is always strongest when there is a clear line of sight between the headset and its USB receiver (or computer, in the case of native Bluetooth). Avoid placing computers under metal desks or inside cabinets.

With planning, Bluetooth headsets can deliver crystal-clear calls and the flexibility employees need.



Future Outlook: A Forward-Looking Investment

Choosing Bluetooth is not just a decision for today — it is a forward-looking investment. The Bluetooth standard is continuously evolving, with next-generation technologies poised to further enhance the enterprise audio experience. Upcoming standards like LE Audio will introduce benefits such as higher audio quality at lower power consumption (enabling longer battery life). By standardizing on Bluetooth, enterprises position themselves to seamlessly adopt these future innovations.

From worst-case laboratory simulations to large-scale corporate deployments and controlled scalability analyses, the evidence is clear. Modern Bluetooth technology has proven that it's the right technology to invest in for offices today and into the future, and the Logitech Zone family of Bluetooth headsets, with meticulous RF design, optimized firmware, and advanced audio processing, is an expression of this technological leap.

Zone wireless headsets deliver:

- Support Bluetooth version 5.0 or above
- Audio quality on par with DECT
- A stable and reliable connection, enabled by an advanced Bluetooth antenna design and robust firmware
- A fundamentally less disruptive dropout behavior due to Bluetooth technology
- Real-world range that meets and exceeds daily needs
- A superior feature set that drives user satisfaction

For organizations investing in a wireless audio solution, Logitech Zone Bluetooth headsets offer uncompromising performance and an exceptional user experience. They're the new standard in wireless communications.

Appendix 1: Security Comparison

The following table compares the security features and primary vulnerabilities of commercial DECT headsets and commercial Bluetooth headsets.

Feature	Commercial DECT Headset (Modern)	Commercial Bluetooth Headset (v5.x)	Comments
Protocol Standard	DECT 6.0 / CAT-iq (Security Step C)	Bluetooth 5.0 / 5.2 / 5.3 / 5.4	
Encryption Algorithm	AES-128 (via DSC2 algorithm)	AES-128 (via AES-CCM algorithm)	Both use 128-bit AES for commercial grades. Neither is susceptible to brute-force attacks with current technology.
Key Exchange / Pairing	DSAA2 (AES-128 based authentication)	ECDH (P-256 Elliptic Curve) Requires "Secure Connections"	Bluetooth ECDH is mathematically robust, but you must ensure the device doesn't degrade to legacy modes.
Max Security Potential	Very High (AES-256) Specific Military/ Financial models (e.g., Savi 7300) support 256-bit.	Standard (AES-128). Current core specs are capped at 128-bit; no higher tier available.	If you have "Top Secret" requirements, DECT is the only path to AES-256.
Primary Vulnerabilities	Legacy devices (non-Step C) are weak. Must verify "Step C" compliance.	MITM (Man-in-the-Middle), Spoofing, Malware on the host device (Phone/PC).	Bluetooth risks often originate from the host device, not the wireless transmission itself.

Appendix 2: Testing Methodology for Audio Quality

For the "Extreme Stress" test environment, we utilized the following setup to measure audio quality.

- **Headset placement:** The headset being tested was mounted on a high-fidelity HATS system equipped with precision microphones and speakers that simulate human hearing and speech characteristics. (See image on the right.)
- **Audio capture:** Audio was recorded through a calibrated setup using a high-precision measurement system and control software suite.
- **POLQA algorithm:** Conducts a comprehensive comparison between the captured and reference recordings, assessing distortion, noise, and other acoustic impairments.
- **Audio quality score (MOS):** Produces a Mean Opinion Score (MOS) ranging from 1 (Bad) to 5 (Excellent), reflecting the predicted perceived audio quality.

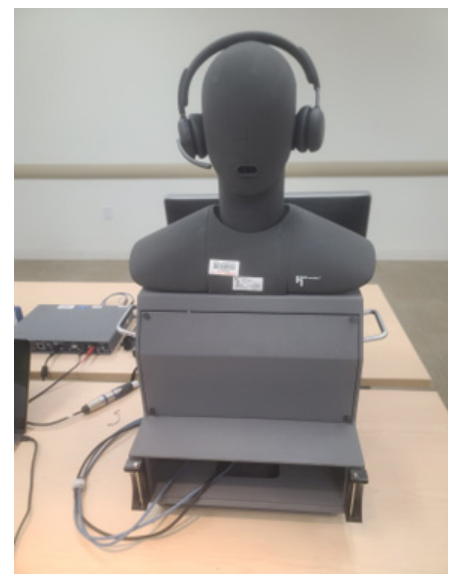


Photo of one device used to test headsets

Appendix 3: Details on Test Environments

“Extreme Stress” Test Environment

The following table provides details for this test environment.

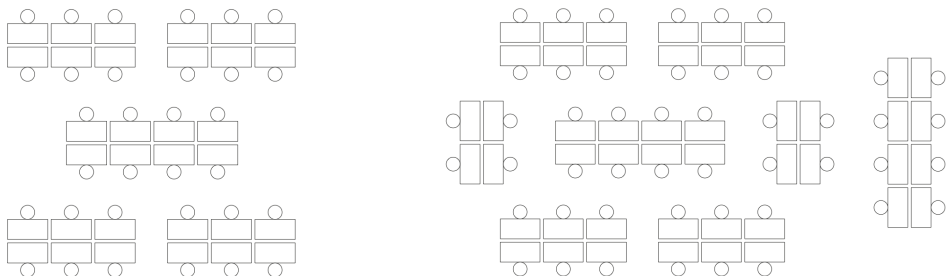
Environment (space)	A 100 square meter room (10m x 10m) simulating a small office or midsize meeting room
Equipment	<p>50 x Logitech Zone Wireless 2, Bluetooth version 5.2 and firmware versions v1.3.60 (headset) + v2.45.1 (receiver)</p> <p>50 x comparable DECT headsets</p> <p>50 x laptops running Windows 11 24H2, BT Module: Qualcomm FastConnect, 7800 Dual Bluetooth Adapter, BT driver: 3.1.0.1323</p> <p>3 x Netgear access points</p>
Other environment details	<ul style="list-style-type: none"> ● Wi-Fi interference simulation: To create a realistic, busy office environment, three Wi-Fi access points (APs) with 2.4 GHz were deployed. ● Three APs were located around the space and configured to transmit on Wi-Fi Channels 1, 6, and 11. ● A combination of Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) traffic was used to simulate a dynamic, mixed traffic environment.
Test plan	<p>Each station was paired with a headset in two separate tests:</p> <ul style="list-style-type: none"> ● Test 1 = Logitech Zone Wireless 2 ● Test 2 = Comparable DECT headsets <p>Data was captured from the following 6 headsets:</p> <ul style="list-style-type: none"> ● Headset #50: Placed on a mobile unit in continuous motion during the test to simulate a person walking through the office while on a call ● Headsets #1 and #49: Units simulating a long range across seats from the DECT/BT sources ● Headsets #36 and #21: Units simulating a mid-range across seats from the DECT/BT sources ● Headset #25: A static unit simulating normal use in a fixed position near its source <p>Data captured:</p> <ul style="list-style-type: none"> ● Number of dropouts, longest dropout in milliseconds, total dropout time, and percentage of bad signals ● SpeechMOS scores <p>These units were recorded while streaming a 1 KHz sine tone and speech from the speaker output in call mode.</p>



Schematic diagram of the setup for the "Extreme Stress" testing environment. See the photos on page 6.

Real-World Corporate Environment

The following table provides details for this test environment.

<p>Environment (space)</p>	<p>40,000+ square feet of usable space in a live office environment.</p> <p>Approximately 600 active employees, with 110 employees participating in the test.</p> <p>The test layout space averaged about 2,000 square feet (estimated) and the density level was approximately 4.2 square meters (45 square feet) of space per employee. Below are two typical seating arrangements:</p> 
<p>Equipment</p>	<p>110 x Logitech Zone Wireless 2, Bluetooth version 5.2 and firmware versions v1.3.76 (headset) + v2.68.1 (receiver)</p> <p>110 x mix of HP T740 and T755 thin clients running Windows 10 locally, HP Elitebook 830 G8, 630 G10 running Windows 11 23H3, and Dell Precision 5450 running Windows 11 23H2</p> <p>Wi-Fi access points throughout the office, at least one in each work area</p>
<p>Other environment details</p>	<p>The environment also included:</p> <ul style="list-style-type: none"> ● 5 GHz access points ● Cell Tower Booster (located outside, 50-75 feet from the office building) ● Wireless printers, microwave appliances, electrical rooms, and network room throughout the office ● Elevators in the center of the building ● Interior and conference room walls made of glass and drywall ● Non-testers using other Bluetooth devices such as cellphones, wireless earbuds, Bluetooth-enabled desk phones and similar devices. ● Approximately 75% desk occupancy
<p>Test plan</p>	<ul style="list-style-type: none"> ● 8 am to 5 pm: Full day test + radio frequency (RF) scanning ● Employees report or record any unexpected behaviors or issues such as latency, disconnection, and audio glitchy/static, along with call quality, mic performance, frequency, and time of the day. ● We used an Ellisys Bluetooth Protocol Analyzer to determine the spectrum occupancy at 2.4 GHz over a 10-minute period at different times throughout the day. We wanted to understand how the spectrum occupancy changed as occupancy changed.

Native Bluetooth Scalability Analysis

The following table provides details for this test environment.

Environment (space)	Space: 875 sq ft room simulating a small office or mid size meeting room
Equipment	24 headsets were tested in a space with 875 sq ft
Other environment details	<p>24 x Logitech Zone Wireless 2 headsets, Bluetooth version 5.2 and firmware versions v1.3.75 (headset) + v2.33.1 (receiver)</p> <p>24 Intel-based PC stations with Intel Core Ultra with BE201, Windows 11 26100.4061 each running the latest Bluetooth driver 23.160.0.1, audio driver 20.42.12248.1, and Wi-Fi driver: 23.160.0.1 to ensure platform currency</p> <p>3 x access points</p>
Test plan	<p>Testing Methodology</p> <ul style="list-style-type: none"> ● Conducted in a dedicated room on the Intel JF campus, configured as a modern training room in a real office environment ● Space arranged with rows of desks, and typical obstructions, creating realistic RF reflections and interference paths ● Each stations paired with a Logitech Zone Wireless 2 headset, positioned in a high-density configuration to stress the Bluetooth link layer ● Data capturing was done/targeted on up to 5 different stations. In each iteration, the selected stations where data was captured were in each corner of the room, with one in the center to ensure data diversity ● Key performance metrics monitored: <ul style="list-style-type: none"> - Packet error rate (PER) and retransmissions, measured using internal Intel debug tools - MOS scores (MOS TX [PC Transmit] and MOS RX [PC Receive]) to quantify user-perceived audio quality, measured using the Head Acoustics HATS system and POLQA analysis (see Appendix 2) <p>PHASE 1</p> <p>Testing Configuration Overview</p> <p>Test experiment was done in three separate iterations as follows:</p> <ul style="list-style-type: none"> ● Baseline: 1 Station/user active in a Microsoft Teams call for 5 minutes (all others idle/Bluetooth off) ● Medium density: 10 Stations/users simultaneously active in Teams calls for 5 minutes (remaining systems idle/BT off) ● Maximum density: All 24 Stations/users active in Teams calls for 5 minutes, creating peak Bluetooth load and noise <p>Wi-Fi Connectivity Status</p> <p>All stations were connected to the 5 GHz Wi-Fi network</p>

Test plan (continued)

PHASE 2

Testing Configuration Overview

- **Baseline:** 1 Station/user active in a Microsoft Teams call for 5 minutes (all others idle/BT off)
- **Medium density:** 10 Stations/users simultaneously active in Teams calls for 5 minutes (remaining systems idle/BT off)
- **Maximum density:** All 24 Stations/users active in Teams calls for 5 minutes, creating peak Bluetooth load and noise

Co-Running & Wi-Fi Connectivity Status

- **Baseline :** All systems connected to the 5 GHz network
- **Medium Density :** All systems connected to the 2.4 GHz network (Channel 11) for co-running scenario
- **Maximum Density :** All systems connected to the 2.4 GHz network (Channel 11) in the Dongle scenario

Appendix 4: Comparing Dropout Rates & Duration for Bluetooth and DECT

One of the notable — and *noticeable* — differences between Bluetooth and DECT has to do with dropout rates and duration.

A dropout occurs when the headset loses its connection with another device (laptop, phone, etc.). Dropouts are not uncommon, and Bluetooth and DECT are both engineered to automatically reestablish the lost connection. However, the time it takes to re-create the connection varies between the two technologies.

In our tests, DECT headsets had a low number of dropouts, but when dropouts occurred they were more noticeable due to their longer duration (up to 1.6 seconds). In comparison, Bluetooth headsets had more frequent but shorter dropouts (all less than 0.064 seconds). A 1.5-second dropout could result in whole words or phrases being lost during what would be a perceptible pause in the conversation. By contrast, a person likely wouldn't even be aware of a 64-millisecond dropout.

The primary reason for the longer dropouts for DECT headsets in a high-density environment is its channel selection and connection re-establishment process. DECT operates on its own dedicated frequency band (typically 1.9 GHz), which is great for avoiding interference from

Wi-Fi and Bluetooth. It uses a system called Dynamic Channel Selection. Before a DECT headset transmits, it first “listens” for a clear channel and time slot. When it finds a free one, it establishes a stable connection with its base station. This creates a very robust, high-quality link, which is why DECT is known for its reliability.

The problem arises when the environment is saturated with other DECT devices. If another DECT headset starts transmitting nearby on the same channel, it can disrupt the existing connection, causing the initial audio loss. When the connection is lost, the DECT headset and its base must immediately start hunting for a new, clear channel to re-establish the link. This “hunting” process is what causes the long dropout. In a crowded environment, the device has to scan through numerous busy channels before it can find a free one and successfully re-synchronize with its base. The entire process — losing the link, scanning for a new one, and locking on again — takes a noticeable amount of time, which users perceive as a long, continuous audio dropout.

Bluetooth is of course also subject to interference in high-density environments, which can also cause dropouts. In general, the Bluetooth connection is not as stable as DECT and thus dropouts may be more frequent. However, the time to reconnect is much faster, meaning that dropouts are much shorter and likely much less noticeable.

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