

DC-Air® and Handheld Dental X-Rays

Measured image detail, efficient beam use and the scale of the lifetime exposure difference.

The issue in one paragraph

A wired scintillator sensor can make an intraoral image with a shorter exposure than DC-Air on the same handheld X-ray source. DC-Air delivers something consequential in return: **high native spatial contrast measured across the complete sensor**, broad exposure latitude observed by independent evaluators, reliable cordless positioning, and clear clinical images. A time ratio alone omits the diagnostic value of the examination. The radiation question should be expressed in absolute dose, across an illustrative lifetime, alongside these documented benefits. [1-6]

Compare exposures on the same handheld source

With kV, mA, built-in cone and geometry held constant, X-ray output is approximately proportional to exposure time. Commonly discussed wired-sensor settings are 0.08-0.16 s, and DC-Air settings are 0.20-0.25 s. The 0.50 s setting is retained below to show the scale of a wider comparison, without presenting it as routine practice. [11]

Wired exposure	DC-Air exposure	Output ratio on the same source
0.16 s	0.20 s	1.25×
0.10 s	0.25 s	2.50×
0.10 s	0.50 s	5.00×

These are tube-output ratios for a fixed handheld setup. Patient effective dose depends on anatomy and projection; the lifetime table on page 3 states its dose assumptions explicitly.

Use the right dose quantity

Tube output or entrance air kerma describes radiation at a location in the beam. **Effective dose** (μSv) estimates the combined effect of doses to organs using standard tissue weights; it is the appropriate quantity for comparing an intraoral examination with natural-background effective dose. It is not a measured whole-body absorbed dose. The IAEA reports typical intraoral effective doses of **1-8 μSv per procedure** and says a usual single intraoral procedure is below one day of natural background. [7]

A larger percentage of a small exposure remains a small absolute exposure. The clinical question is what diagnostic image that exposure produces.

Full-sensor MTF: measured diagnostic detail

MTF measures how much object contrast survives in the recorded image as structures become finer. The **signed Athlos WIOSS WIOS-S2 performance report** measured the functioning complete sensor with a tungsten edge, using a 70 kVp RQA5 beam with 21 mm additional aluminium filtration. Its image data were offset and gain corrected, with faulty pixels masked; the resulting full MTF curve is reproduced below. [1]

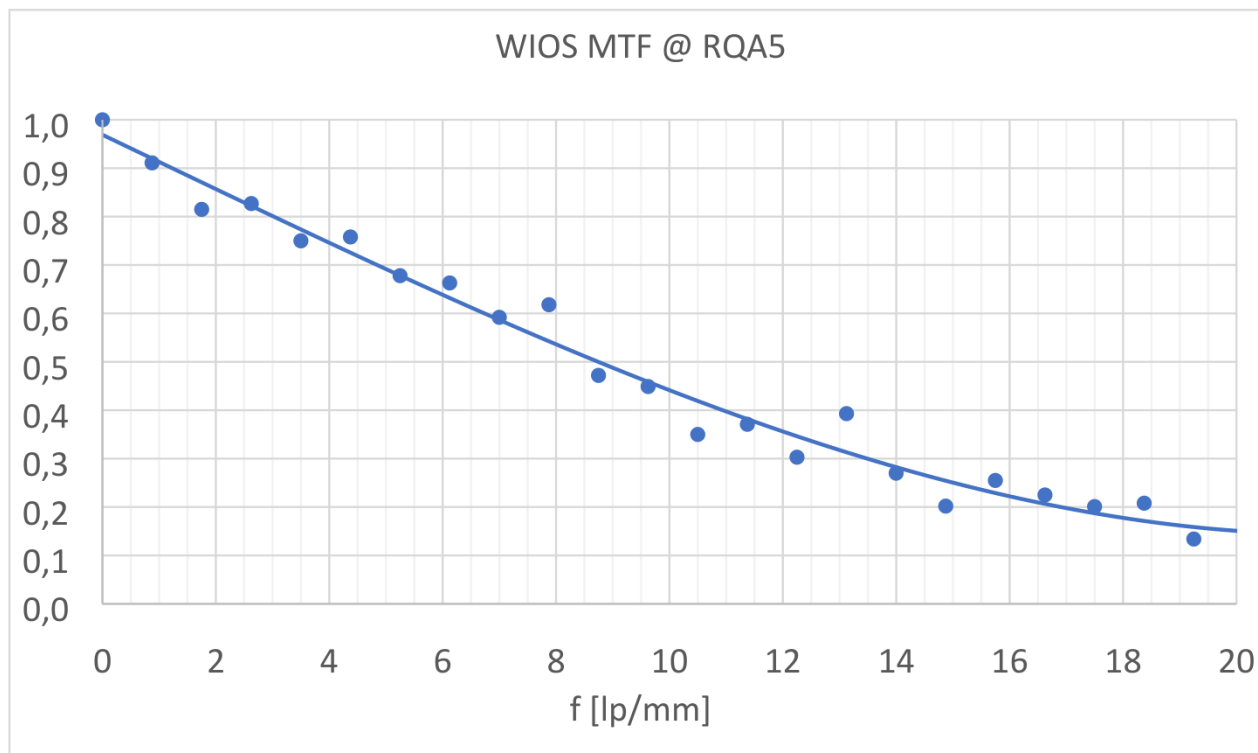


Figure 1. Complete WIOS-S2 sensor MTF (Athlos report, Figure 3.2.3). The reported MTF is **80% at 2 lp/mm, 40% at 10 lp/mm and 15% at 19.2 lp/mm**. This curve measures the detector assembly rather than an isolated conversion layer. [1]

Named-sensor comparison in the FDA record

The public DC-Air 510(k) summary compares the full DC-Air system with the wired, scintillator-based QuickRay HD. Its MTF values show the size of the contrast-transfer advantage at image-detail frequencies. [2]

Spatial frequency	DC-Air	QuickRay HD
2 lp/mm	85%	60%
5 lp/mm	>70%	30-45%
10 lp/mm	>40%	8-25%

Values are those reported in Athlos's FDA 510(k) summary, Table 6-1; its 2 lp/mm and 10 lp/mm figures are stated separately from the WIOS-S2 report curve above. [2]

This is a diagnostic advantage: higher MTF retains more of the original contrast in small structures. CR Foundation's clinical and science evaluation independently found sharp, detailed DC-Air radiographs, density sensitivity and spatial resolution among the highest it tested, and broad exposure latitude. Its published report illustrates DC-Air images alongside DEXIS Platinum and Schick 33 images. [3]

The 200-image illustrative lifetime

Consider **200 indicated intraoral images across a person's lifetime**, all made with the same handheld source and built-in round cone. To put the time difference into absolute terms, let a 0.50 s image deliver **d** μSv of effective dose. We use $d = 1, 4$ and $8 \mu\text{Sv}$ as illustrative points across the IAEA's published range for intraoral examinations. The shorter exposures scale from that reference in proportion to time. This is transparent scenario arithmetic, not patient-specific dosimetry. [7,11]

Natural-background reference: **2.4 mSv per year, or 6.58 μSv per day**, the IAEA's widely used global average. It is a practical reference for a low-altitude, sea-level illustration; actual local background varies with radon, geology and location. [8]

200-image comparison	Extra effective dose at $d = 4 \mu\text{Sv}$	Equivalent days of background at $d = 1 / 4 / 8 \mu\text{Sv}$
0.16 s wired → 0.20 s DC-Air	0.064 mSv	2.4 / 9.7 / 19.5 days
0.10 s wired → 0.25 s DC-Air	0.240 mSv	9.1 / 36.5 / 73.0 days
0.10 s wired → 0.50 s DC-Air	0.640 mSv	24.3 / 97.3 / 194.7 days

Formula: extra dose (μSv) = $200 \times d \times (\text{DC-Air time} - \text{wired time}) / 0.50 \text{ s}$; background days = extra dose $\div$ (2,400 $\mu\text{Sv} / 365$). Each row assumes the same beam and projection for both exposures. These are additional lifetime totals, not annual doses.

How to read the comparison

At the central $4 \mu\text{Sv}$ reference, 200 images at 0.25 s instead of 0.10 s add **0.24 mSv over the entire illustrative lifetime**, equivalent to **36.5 days** of ordinary natural background. Even the 0.50 s comparison gives 97.3 days across all 200 images. The comparison makes the scale tangible without assigning a disease probability or a lifespan change to a person.

One day of background is not the same physical exposure pattern as one dental image. The unit is effective dose in both cases, so background days are a transparent way to express magnitude. Dental images remain clinically indicated and exposures are selected to produce the information needed for care. [7,9]

Put more of the existing beam onto the receptor

The built-in round cone creates a diverging beam. At a fixed output, increasing the distance from the cone end to the sensor spreads that beam over a larger area and reduces the fraction reaching the active receptor. **Zero Profile® holders hold DC-Air in alignment and position the aiming ring and tube end close to the cheek.** The Athlos holder patent describes ring positions 2.5 cm and 5 cm from the sensor's active area. [10,12]

The following geometric illustration uses a 6 cm round field at a cone tip 20 cm from the focal spot and approximately 8.3 cm² of active receptor area. For an aligned tube tip at the ring face, the useful share at a gap g is $8.3 \div \{\pi \times [3(20+g)/20]^2\}$. [3,10,11]

Tube end → active receptor	Beam diameter at receptor	Beam intercepted by active receptor	Relative useful photons
2.5 cm	6.75 cm	23.2%	100%
5.0 cm	7.50 cm	18.8%	81%
7.5 cm	8.25 cm	15.5%	67%
10.0 cm	9.00 cm	13.0%	56%
12.5 cm	9.75 cm	11.1%	48%

Centered-beam, uniform-fluence geometry. The 2.5 cm row corresponds to the closer patent-described ring position; 5 cm is another described position. These percentages are beam use at the receptor plane, not percentages of patient effective dose. [10]

The FDA-hosted ADA/FDA dental guidance recommends holders that precisely align the receptor with the beam, minimum necessary beam coverage, and limiting radiation to tissues outside the intended image. The Zero Profile design puts those principles into the positioning workflow with the handheld's existing cone. [9,10]

Clinical evidence and recognition

Independent source	Documented result
CR Foundation	Sharper detail, high exposure latitude, easier wireless positioning; 2026 Buying Guide distinction for "best image quality." [3,6]
Dental Advisor	91% rating over 274 uses by six evaluators; all six would recommend it; Top Product Awards in 2024 and 2025. [4]
Dental Product Shopper	4.6/5 evaluation; clinicians reported image clarity, comfort, faster workflow and easier positioning. [5]

Our conclusion. DC-Air's longer exposure is measurable. So is its strong full-sensor MTF; independent evaluators have observed the resulting clinical image detail and wireless positioning benefits. Across the 200-image illustration, the additional effective dose is expressed in days of natural background. That is the appropriate scale for discussing this tradeoff alongside the diagnostic value of the images. [1-10]

References

The four-page body contains fewer than 3,000 words. References are excluded. Sources accessed 30 September 2026.

- [1]** Athlos Oy. WIOSS Performance Report, document 0000696 Rev. 1, approved 10 December 2020, pp. 6–11. Signed internal technical report supplied by Athlos Oy; Figure 3.2.3 reproduced on page 2.
- [2]** Athlos Oy. DC-Air 510(k) summary, K211688, pp. 8–9, Table 6-1. US Food and Drug Administration, 2021. www.accessdata.fda.gov
- [3]** CR Foundation. “DC-Air: Wireless Intraoral Sensor with Improved Image Quality.” Clinicians Report 15(3), March 2022, official reprint. 9299038.fs1.hubspotusercontent-na1.net
- [4]** Dental Advisor. DC-Air Wireless Sensor: Clinical Evaluation (six evaluators, 274 uses, 91% rating); product page and 2024/2025 award listings. dentaladvisor.com
- [5]** Dental Product Shopper. DC-Air Product Evaluation, 15 February 2024. www.dentalproductshopper.com
- [6]** CR Foundation. “The Best Products for 2026,” CR Buying Guide, December 2025, official reprint. ftgimaging.com
- [7]** IAEA. “Radiation doses in dental radiology: FAQs for health professionals.” www.iaea.org
- [8]** IAEA Radiation Safety Standards Committee. Technical meeting briefing, 2024, p. 2 (global natural-background average approximately 2.4 mSv/year). nucleus.iaea.org
- [9]** ADA and FDA. Dental Radiographic Examinations: Recommendations for Patient Selection and Limiting Radiation Exposure, 2012, pp. 14–17. FDA-hosted professional guidance. www.fda.gov
- [10]** Athlos Oy. US patent application US20210290188A1, “Wireless intra oral sensor holder,” descriptions of ring positions and Figure 19. patents.google.com
- [11]** DEXIS. NOMAD Pro 2 Operator Manual, section 8.1, built-in round-cone geometry and time/output relationship. Used solely as an example of handheld beam geometry. aseptico.com
- [12]** Dental TI / FTG Imaging. “DC-Air Zero Profile Holders: Correct Assembly and Use,” holder positioning instructions and demonstrations. www.dentalti.com