FORMAL PUBLIC COMMENT

SUBMITTED TO THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES (HHS)

OFFICE OF THE ASSISTANT SECRETARY FOR HEALTH (OASH)

1. Submitter and Docket Information

- **Docket ID:** HHS-OASH-2026-0397
- **Federal Register Citation:** 91 FR 59792
- **Notice Title:** Request for Information (RFI) on Electromagnetic Fields (EMFs), Radiofrequency (RF) Radiation, and Wireless Radiation Exposure
- **Date of Submission:** October 2026
- **Submitter Name / Organization:** [Sett inn Navn / Organisasjon – eller "Individual Expert Submission"]
- **Submitter Category:** Senior Specialist in Regulatory Affairs, Bioelectromagnetics, and Administrative Law
- **Scope of Comment:** Scientific, Legal, and Technical Revisions to Federal RF-EMF Safety Standards

2. Executive Summary and Statement of Position

This submission presents bioelectromagnetic, dosimetric, and administrative law evidence demonstrating that the radiofrequency electromagnetic field (RF-EMF) exposure limits adopted by the Federal Communications Commission (FCC) in 1996—and historically acquiesced to by the Department of Health and Human Services (HHS) and the Food and Drug Administration (FDA)—are scientifically obsolete, biologically invalid, and legally deficient.

Judicial Mandate and Administrative Failure:

This filing is formally anchored in the binding decision of the U.S. Court of Appeals for the District of Columbia Circuit in *Environmental Health Trust et al. v. FCC*, 9 F.4th 893 (D.C. Cir. 2021). The D.C. Circuit ruled that the FCC's order maintaining its 1996 exposure thresholds was arbitrary and capricious under the Administrative Procedure Act (APA), 5 U.S.C. § 706(2)(A). Specifically, the court held that the federal government failed to provide a reasoned explanation for ignoring extensive record evidence regarding non-thermal biological effects, long-term chronic exposure hazards, children's unique anatomical vulnerability, complex signal modulation and pulsing, and environmental impacts on biota. Because the FCC relied primarily on an incomplete 2020 technical statement from the FDA to justify retaining its 1996 limits, HHS and the FDA bear direct administrative responsibility to remedy this continuing regulatory failure.

Statutory Responsibility:

Under the Public Health Service Act (42 U.S.C. § 241) and the Electronic Product Radiation Control provisions of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. §§ 360ii and 360kk), HHS and the FDA possess an explicit statutory mandate to conduct biological research, formally advise other federal agencies, and establish mandatory performance standards to protect public health from electronic product radiation. Deferring safety oversight to outdated 1996 thermodynamic metrics abdicates this federal duty.

Scientific Consensus and Federal Research Context (2018–2026):

Peer-reviewed experimental, epidemiological, and dosimetric literature published between 2021 and 2026 demonstrates that non-thermal RF-EMF exposure induces systemic physiological stress, mitochondrial decay, genomic instability, cellular oxidative damage, and reproductive impairment at exposure levels orders of magnitude below current federal limits. These findings build directly upon landmark federal research by the U.S. National Toxicology Program (NTP 2018; Technical Reports TR-595 and TR-596), which established clear evidence of carcinogenic activity (malignant cardiac schwannomas and cerebral gliomas) alongside DNA damage from chronic RF-EMF exposure. Crucially, in 2025, the World Health Organization (WHO)-commissioned systematic review of animal cancer studies (Mevissen et al., 2025) formally confirmed a **high certainty of evidence** that RF-EMF exposure increases the incidence of both malignant heart schwannomas and brain gliomas. HHS must immediately order the re-funding and reactivation of the NTP RF-EMF research program to evaluate modern 5G modulations and multi-frequency exposures.

Statement of Position:

Regulatory compliance based exclusively on time-averaged Specific Absorption Rate (SAR ≥ 4.0 W/kg whole-body) and acute thermal heating thresholds ($\Delta T \geq 1.0$ °C) is scientifically untenable. HHS/OASH must exercise its statutory authority under 21 U.S.C. §§ 360ii and 360kk to formally rescind the FDA's 2020 RF assessment, advise the FCC to initiate immediate rulemaking for non-thermal and peak-sensitive exposure limits, and establish mandatory electronic product radiation performance standards.

3. Biological and Cellular Evidence Beyond Thermal Thresholds

3.1 Neuroendocrine Stress and Autonomic Dysregulation vs. Passive Dielectric Heating

A fundamental flaw in current regulatory paradigms is the assumption that core temperature shifts occur exclusively through passive dielectric tissue heating. In an investigation of chronic exposure to 5G New Radio (NR) signals (2.4 GHz, 15 MHz bandwidth), Makhmanazarov et al. (2024) documented a core body temperature

elevation of 1.0 °C in exposed rats at a whole-body average SAR of only 0.0431 W/kg—nearly two orders of magnitude below the 4.0 W/kg threshold assumed by FCC and ICNIRP guidelines.

Thermodynamically, an absorbed power of 0.0431 W/kg cannot passively heat mammalian tissue by 1.0 °C. Rather, physiological analysis confirms that this temperature elevation was not an acute microwave heating artifact, but a systemic biological response driven by chronic neuroendocrine stress, hypothalamic thermoregulatory disruption, and autonomic dysregulation (peripheral vasoconstriction) resulting from prolonged non-thermal RF-EMF exposure. Treating biological thermoregulatory stress as simple dielectric heating invalidates the foundational premise of the 4.0 W/kg regulatory threshold.

3.2 Rapid Temperature Rise Rate (dT/dt) and Peak-to-Average Power Ratio (PAPR) Failures

Current SAR compliance standards rely on Root-Mean-Square (RMS) temporal averaging over 6- to 30-minute intervals, assuming that biological harm depends solely on time-averaged thermal energy deposition. Recent bioelectromagnetic and exposimetric evaluations refute this assumption for complex digital modulations:

- **Transient Micro-Thermal Gradients and Neuronal Inhibition:** Canovi et al. (2023) evaluated primary cortical neuronal networks exposed to 3.5 GHz signals (continuous wave and 5G-modulated) using multi-electrode arrays. While 6-minute averaged exposures at 1.0 and 3.0 W/kg did not yield conclusive suppression, high-intensity exposure (28 W/kg) induced an immediate, statistically significant inhibition of spontaneous neuronal firing and bursting activity. Crucially, the authors demonstrated that this suppression was driven by the **rapid rate of local temperature rise (dT/dt)** during high-energy delivery rather than slow, steady-state thermal accumulation.
- **Failure of Time-Averaging Metrics Under High PAPR:** Miclaus et al. (2023) established that real-world 5G-FR1 mobile phone emissions exhibit high Crest Factors and elevated Peak-to-Average Power Ratios (PAPR), with instantaneous peak tail power emissions spiking up to 9.5 dB (nearly 9-fold in power) above mean levels during routine data streaming, while generating average electric fields 60% higher than 4G.

Synthesizing Canovi et al. (2023) and Miclaus et al. (2023) reveals a critical regulatory blind spot: high-PAPR 5G pulses generate intense instantaneous electric field spikes (E_peak) and localized micro-thermal transients (rapid dT/dt) in conductive tissue. Conventional 6- to 30-minute RMS averaging mathematically smooths out these microsecond spikes, masking transient exposures capable of disrupting neuronal signaling.

3.3 Reproductive Toxicity, Experimental Nuances, and WHO Data Gaps

In the WHO-commissioned systematic review of mammalian reproductive studies, Cordelli et al. (2023) conducted meta-analyses demonstrating that prenatal RF-EMF exposure significantly increases resorbed and dead fetuses (OR = 1.84 at whole-body average SAR of 20.26 W/kg), reduces fetal weight and length, and increases litters with malformed fetuses (OR = 3.22 at 16.63 W/kg). While these pooled meta-analyses reflect high-SAR hyperthermic regimes, Cordelli et al. (2023) explicitly highlighted a critical lack of standardized, low-dose mammalian studies near human environmental exposure levels—confirming that current regulatory assurances rest on an absence of federal testing rather than proof of safety.

Recent experimental and epidemiological studies directly address these low-dose non-thermal pathways and exposure dynamics:

- **Non-Thermal Spermatogenic Damage Under Baseline CW Signals:** Gautam et al. (2023) demonstrated that male Wistar rats exposed to 2350 MHz RF-EMF at a strictly non-thermal whole-body SAR of 0.0625 W/kg for 56 days suffered significant reductions in sperm viability, depleted serum testosterone, impaired sperm mitochondrial activity, elevated testicular lipid peroxidation (malondialdehyde [MDA]), and structural histopathology. Notably, while 2350 MHz corresponds to a 4G carrier band, the laboratory signal generator employed (Keysight N9310A) delivered an unmodulated continuous wave (CW) signal. This proves that non-thermal testicular toxicity occurs even under a baseline unmodulated carrier wave at 0.0625 W/kg, before accounting for the added bioactive potency of real-world pulsed modulations.
- **Oxidative Stress in Prepubertal Testis:** Karadayı et al. (2023) established that prepubertal male rats exposed to 2.45 GHz RF-EMF across low electric field intensities (0.6 V/m to 15 V/m) experienced significant testicular MDA accumulation and glutathione (GSH) depletion accompanied by seminiferous tubule disruption.
- **Human Semen Depletion, Cumulative Use, and Anatomical Proximity:** In a nationwide cohort of 2,886 young men, Rahban et al. (2023) found that frequent mobile phone use (>20 times/day) was associated with a statistically significant reduction in total sperm count (adjusted $\beta = -0.271$; 95% CI: -0.515 to -0.027) and a downward trend in sperm concentration (adjusted $\beta = -0.152$; 95% CI: -0.316 to 0.011). In adjusted logistic regression models, high usage conferred a statistically significant 30% and 21% increased risk of sperm concentration and total sperm count falling below WHO fertility reference thresholds ($P_{trend} < 0.05$). While Rahban et al. noted that self-reported passive carrying of phones in pants pockets was not independently associated with semen parameters—reflecting that active transmission frequency rather than passive standby dominates

cumulative dose—prospective epidemiological and clinical evidence underscores the hazard of cumulative exposure and direct body contact. In the UK Biobank cohort of 431,861 participants followed for a median of 10.7 years, Zhang et al. (2023) established a statistically significant positive dose-response relationship between cumulative years of mobile phone use (>8 years) and incident prostate cancer in men (HR = 1.19; P_trend < 0.001) as well as non-melanoma skin cancer (NMSC) in both sexes (P_trend < 0.001). Furthermore, clinical case documentation by Minoretti et al. (2023) identified localized soft-tissue pathology within the *tensor fasciae latae* muscle directly underlying habitual smartphone storage in a front pants pocket.

3.4 Ecotoxicology, Conserved Cellular Mechanisms, and Federal Environmental Law

Under the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 et seq., and the judicial remand in *Environmental Health Trust v. FCC*, 9 F.4th 893 (D.C. Cir. 2021), federal agencies are legally obligated to evaluate environmental radiation impacts on wildlife and ecosystems.

- **Ecotoxicological Evidence at Ambient Field Levels:** Thill, Cammaerts, and Balmori (2023) synthesized 55 peer-reviewed studies on insects, finding that 86% of studies evaluating electric field strengths below 6.0 V/m (~100 mW/m^2) observed statistically significant biological toxicity starting at 2.0 V/m (10 mW/m^2)—exposure levels 100 to 1,000 times below ICNIRP public limits (41–61 V/m). Documented effects include disrupted orientation, reduced reproductive capacity, altered gene expression, and mortality. Froidevaux et al. (2023) further established that human-centric thermal guidelines fail to protect wildlife habitats and foraging zones.
- **Evolutionarily Conserved Biophysical Pathways:** While insects also experience size-dependent electromagnetic resonance in the GHz spectrum (Jeladze et al., 2023), the non-thermal cellular toxicity observed at low field strengths operates through biophysical mechanisms conserved across eukaryotic taxa. As reviewed by Thill et al. (2023), López-Martín et al. (2023), and Panagopoulos (2023), polarized and pulsed EMFs induce forced oscillation of free ions near plasma membranes, destabilizing voltage-gated calcium channels (VGCCs). The resulting influx of intracellular calcium (Ca^{2+}) triggers mitochondrial reactive oxygen species (ROS) cascades and oxidative DNA damage across both ecological sentinels and mammalian tissues.

3.5 Mitochondrial Dysfunction, Genotoxicity, and Neurological Biomarkers

Peer-reviewed studies across human cohorts, primary cell models, and rodent studies confirm widespread non-thermal intracellular and neurological disruption:

- **Human Central Nervous System Reactivity (Double-Blind EEG):** van der Meer et al. (2023) conducted a rigorously controlled, double-blind, counterbalanced crossover study using a 63-electrode EEG array and Bayesian modeling, proving that mobile phone RF-EMF exposure significantly increases resting alpha-band brain wave power in healthy adults.
- **Mitochondrial ROS Amplification:** Patrignoni et al. (2023) demonstrated that 24-hour exposure to 5G-modulated 3.5 GHz signals at low SAR levels (0.25 and 1.0 W/kg) altered mitochondrial ROS homeostasis in human dermal fibroblasts and significantly amplified UV-B-induced mitochondrial ROS generation in human keratinocytes.
- **Mitochondrial Membrane Depolarization:** Bertuccio et al. (2023) demonstrated that 2.45 GHz exposure induced pronounced vulnerability in human neuron-like SH-SY5Y cells compared to peripheral blood mononuclear cells (PBMCs), causing significant depolarization of mitochondrial transmembrane potential ($\Delta\Psi m$), altered NAD^+/NADH ratios, downregulation of mitochondrial transcription factor A (mtTFA), and dysregulated BAX/BCL2 apoptotic signaling.
- **In Vivo Human Genotoxicity & Synergistic DNA Repair Inhibition:** Sangle et al. (2023) documented a statistically significant increase in micronuclei (MN) frequency in exfoliated oral mucosal cells among high mobile phone users (>10 hours/week), specifically localized to the side of the head where the phone was held. In vitro, Panagopoulos (2023) exposed human peripheral blood lymphocytes to mobile phone EMFs at power densities ~136 times below the ICNIRP limit prior to gamma irradiation, demonstrating a synergistic, super-additive surge in chromosomal aberrations driven by impaired DNA repair capacity.
- **Loss of Tumor Suppressor p53:** Obajuluwa et al. (2023) showed that exposing male Wistar rats to 5 GHz MIMO router signals (SAR 0.54 W/kg) caused complete loss of tumor suppressor *p53* gene bands (exons 5–7) in cerebral cortex genomic DNA alongside elevated micronucleated polychromatic erythrocytes.
- **Neurological Injury Biomarkers:** Wang et al. (2022) demonstrated that dual-frequency microwave exposure (1.5 GHz and 4.3 GHz) caused spatial learning and memory deficits in rats, damaged hippocampal ultrastructure, and altered serum exosomal proteins—identifying VAMP8, Syn7, and VMAT as circulating biomarkers of RF-induced central nervous system injury.

4. Specific Responses to RFI Questions 5, 6, 12, 13, 16 & 17

Response to Question 5 (Non-Thermal Biological Mechanisms)

Non-thermal RF-EMF biological damage operates through four primary sequential cellular pathways independent of tissue heating:

1. **Ion Forced-Oscillation, VGCC Activation & Ca^{2+} Overload:** Polarized RF carrier waves paired with Extremely Low Frequency (ELF) pulse-modulation frames exert coulombic forces on membrane-bound ions, destabilizing voltage-sensing domains of plasma membrane calcium channels (VGCCs) and provoking an influx of cytosolic Ca^{2+} (Panagopoulos, 2023; López-Martín et al., 2023; supported by ELF-MF neurodegeneration mechanisms in Çakıt et al., 2023).
2. **Mitochondrial Depolarization & ROS Accumulation:** Intracellular Ca^{2+} overload disrupts the electron transport chain, causing loss of mitochondrial membrane potential ($\Delta\Psi m$) and acute generation of superoxide and reactive oxygen species (ROS) (Bertuccio et al., 2023; Patrignoni et al., 2023).
3. **Lipid Peroxidation & Antioxidant Depletion:** Unchecked ROS accumulation oxidizes polyunsaturated fatty acids in cellular and organellar membranes, evidenced by elevated malondialdehyde (MDA), nitric oxide (NO), and protein carbonyls alongside depletion of superoxide dismutase (SOD), catalase (CAT), and glutathione (GSH) across testicular, cardiac, and hepatic tissues (Karadayı et al., 2023; Goudarzi et al., 2023; Gautam et al., 2023).
4. **Genotoxicity & Structural DNA Breakage:** Free radical cascades and peroxynitrite formation induce single- and double-strand DNA breaks, micronuclei formation, inhibition of DNA repair enzymes, and loss of tumor suppressor *p53* exons, establishing a direct mechanistic pathway to mutagenesis and carcinogenesis (Obajuluwa et al., 2023; Panagopoulos, 2023; Sangle et al., 2023; Mevissen et al., 2025).

Response to Question 6 (Vulnerable Populations – Children, Pregnancy & Neonates)

Pediatric populations, developing embryos, and neonates exhibit heightened anatomical and physiological susceptibility to RF-EMF:

1. **Anatomical Dosimetric Vulnerability in Children:** Six-layer anatomical head modeling by Sonawane & Bormane (2023) at 1800 MHz (4G) confirms that a 5-year-old child's head absorbs significantly higher localized SAR and electric field energy than a 40-year-old adult head. This disparity stems from thinner pediatric cranial bones, smaller pinna dimensions, and higher dielectric permittivity and conductivity in developing juvenile tissues.
2. **Spontaneous Abortion & Developmental Toxicity:** A systematic review and meta-analysis by Irani et al. (2023) encompassing 3,187 pregnant women established that maternal exposure to elevated EMF levels is associated with a statistically significant 1.70-fold increased risk of spontaneous abortion (RR =

1.699; 95% CI: 1.121–2.363; $P < 0.001$), with peak vulnerability during early gestation (<10 weeks).

3. **Neonatal Sleep Architecture Disruption:** Continuous polysomnographic monitoring of hospitalized preterm neonates by Besset et al. (2023) revealed that chronic ambient RF-EMF exposure inside neonatal units significantly increases indeterminate sleep and causes sleep fragmentation during critical windows of brain maturation.

Response to Question 12 (Peak Exposures & Complex Modulations)

Compliance protocols relying solely on 6- to 30-minute RMS time-averaged SAR fail to capture the biological potency of modern wireless signals:

1. **5G-FR1 Peak Dynamics and Crest Factors:** Miclaus et al. (2023) demonstrated that real-world 5G-FR1 smartphone emissions generate average electric fields 60% higher than 4G (and up to 300% higher during video streaming), while exhibiting extreme Peak-to-Average Power Ratios (PAPR) with peak tail emissions spiking up to 9.5 dB above mean power.

2. **Micro-Thermal Transients and Neuronal Suppression:** High-PAPR signals deliver intense microsecond electric field bursts (E_{peak}). As shown by Canovi et al. (2023), the rapid rate of temperature rise (dT/dt) during high-amplitude bursts triggers immediate inhibition of cortical neuronal firing. Regulatory compliance must incorporate mandatory caps on instantaneous peak electric fields (E_{peak}) and PAPR weighting alongside RMS metrics.

Response to Question 13 (Wildlife and Ecosystem Impacts)

Human-centric thermal thresholds provide no protection for flora, fauna, and ecological systems:

1. **Pollinator Toxicity and Dielectric Resonance:** Thill et al. (2023) documented non-thermal biological toxicity in 86% of insect studies below 6.0 V/m, commencing at 2.0 V/m (10 mW/m^2). Furthermore, FDTD dosimetric simulations of honeybees (*Apis mellifera*) by Jeladze et al. (2023) prove that RF power absorption increases dramatically between 2.5 GHz and 100 GHz (5G FR1/FR2 bands) as wavelengths approach the physical dimensions of the insect body.

2. **Avian Magnetoreception and Cetacean Interference:** Muheim & Phillips (2023) and Balmori (2023) demonstrated that low-level anthropogenic RF fields disrupt the avian radical-pair magnetic compass and impair animal orientation. In marine ecosystems, Balmori-de la Puente & Balmori (2024) linked high-power pulsed RF/radar emissions to interference with cetacean sensory systems and mass stranding events.

Response to Question 16 (Gaps in Current Testing Protocols & Hardware Caveats)

Current regulatory testing methodologies and experimental evaluations suffer from three major structural defects:

1. **Obsolete SAM Phantom Homogeneity:** The Specific Anthropomorphic Mannequin (SAM) relies on a homogeneous fluid inside a large adult male head shell. As shown by Sonawane & Bormane (2023), SAM fails to represent the heterogeneous 6-layer tissue architecture (skin, fat, bone, dura, CSF, brain) of human skulls and systematically underestimates localized SAR in children.
2. **Unrealistic Testing Separation Distances (5–15 mm vs. 0 mm):** FCC compliance protocols allow manufacturers to test devices at artificial separation distances of 5 to 15 mm from the phantom. In actual usage, smartphones are pressed against the ear (0 mm) or carried in tight clothing pockets, where localized SAR exceeds federal limits (Sonawane & Bormane, 2023) and is associated with localized tissue pathology (Minoretti et al., 2023) and site-specific malignancies (Zhang et al., 2023).
3. **Asymmetric Interpretation of Signal Generator Hardware in Literature:** A critical methodological flaw in regulatory risk assessment is the reliance on "null-effect" studies that utilize simplified laboratory signal generators incapable of replicating real-world 5G New Radio (NR) traffic (e.g., Jamal et al., 2023, who utilized a Rohde & Schwarz SMB100A generator lacking true commercial 5G NR dynamic framing and high-PAPR transients). From a toxicological standpoint, null findings obtained with simplified signals cannot be used to assert the safety of real-world pulsed 5G emissions. Conversely, when experimental studies utilizing unmodulated continuous waves (e.g., Gautam et al., 2023 at 0.0625 W/kg) demonstrate significant oxidative and histopathological damage, they establish a conservative baseline hazard that is further amplified by the high crest factors and pulse modulations of commercial wireless networks (Miclaus et al., 2023; Panagopoulos, 2023).

Response to Question 17 (Inter-Agency Coordination & Policy Action)

To remedy the legal and scientific defects identified in *Environmental Health Trust v. FCC*, 9 F.4th 893 (D.C. Cir. 2021):

1. **Exercise of Statutory Authority Under 21 U.S.C. §§ 360ii and 360kk:** HHS must formally rescind the FDA's flawed 2020 RF technical review, transmit updated non-thermal biological hazard determinations to the FCC under 21 U.S.C. § 360ii, and initiate formal rulemaking under 21 U.S.C. § 360kk to establish mandatory radiation safety performance standards for consumer wireless devices.

2. **Conflict-Free Interagency Taskforce:** HHS, FDA, NIEHS/NTP, EPA, and the U.S. Fish and Wildlife Service (FWS) must establish a joint regulatory taskforce—strictly screened to exclude financial or advisory ties to the telecommunications industry—to formulate biologically based human and environmental exposure limits.

5. Feasible Regulatory and Technical Recommendations

To fulfill statutory mandates under 21 U.S.C. §§ 360ii, 360kk, and NEPA, HHS and the FDA must recommend and enforce five concrete regulatory reforms anchored in the ALARA (As Low As Reasonably Achievable) principle:

- **5.1 Mandate 0 mm SAR Compliance Testing Distance:**
    - *Specific Regulatory Action:* Eliminate the 5–15 mm manufacturer testing gap; require all handheld and body-worn wireless devices to pass SAR compliance certification at 0 mm separation (direct skin contact) and 2 mm (clothing contact).
    - *Scientific & Legal Rationale:* Reflects real-world usage against the head and in pockets, preventing unmeasured local SAR exceedances and tissue pathology (Sonawane & Bormane, 2023; Zhang et al., 2023; Minoretti et al., 2023).
- **5.2 Replace Homogeneous SAM Phantom with Multi-Layer Pediatric Models:**
    - *Specific Regulatory Action:* Mandate multi-layer (skin, fat, cranial bone, dura, CSF, brain) anatomical head and body models—including 5-year-old and 10-year-old pediatric phantoms and pregnant abdomen models—for all device certifications.
    - *Scientific & Legal Rationale:* Captures elevated dielectric energy absorption in thinner pediatric skulls and developing tissues, addressing the D.C. Circuit remand in *EHT v. FCC* (Sonawane & Bormane, 2023; Cordelli et al., 2023).
- **5.3 Establish Peak Electric Field (E_peak) and PAPR Limits:**
    - *Specific Regulatory Action:* Supplement 6-minute RMS time-averaged SAR with mandatory regulatory caps on instantaneous peak electric field strength (E_peak), Crest Factor, and Peak-to-Average Power Ratio (PAPR), while lowering chronic whole-body SAR thresholds below 0.04 W/kg.
    - *Scientific & Legal Rationale:* Prevents micro-thermal transient gradients (rapid dT/dt) that inhibit neuronal activity and induce non-thermal autonomic and oxidative stress (Canovi et al., 2023; Miclaus et al., 2023; Makhmanazarov et al., 2024).

- **5.4 Mandate Hardwired Infrastructure in Sensitive Public Environments:**
    - *Specific Regulatory Action:* Issue federal public health guidance requiring hardwired Ethernet/fiber connectivity as the primary network architecture in neonatal intensive care units (NICUs), hospitals, daycare centers, and K–12 schools, paired with automatic beacon-disable modes on wireless access points when idle.
    - *Scientific & Legal Rationale:* Protects preterm neonates, pregnant women, and children from chronic background RF-EMF exposure during critical neurodevelopmental windows (Besset et al., 2023; Irani et al., 2023).
- **5.5 Enforce Ecological Buffer Zones and NEPA Environmental Assessments:**
    - *Specific Regulatory Action:* Coordinate with the EPA and FWS to enforce base station setbacks and 5G active-antenna beam-steering restrictions near wildlife refuges, pollinator habitats, and migratory corridors, establishing ambient environmental targets below 2.0 V/m in sensitive ecological zones.
    - *Scientific & Legal Rationale:* Fulfills NEPA statutory duties and the *EHT v. FCC* mandate to prevent non-thermal toxicity and dielectric resonance heating in pollinators and wildlife (Thill et al., 2023; Jeladze et al., 2023; Froidevaux et al., 2023).

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