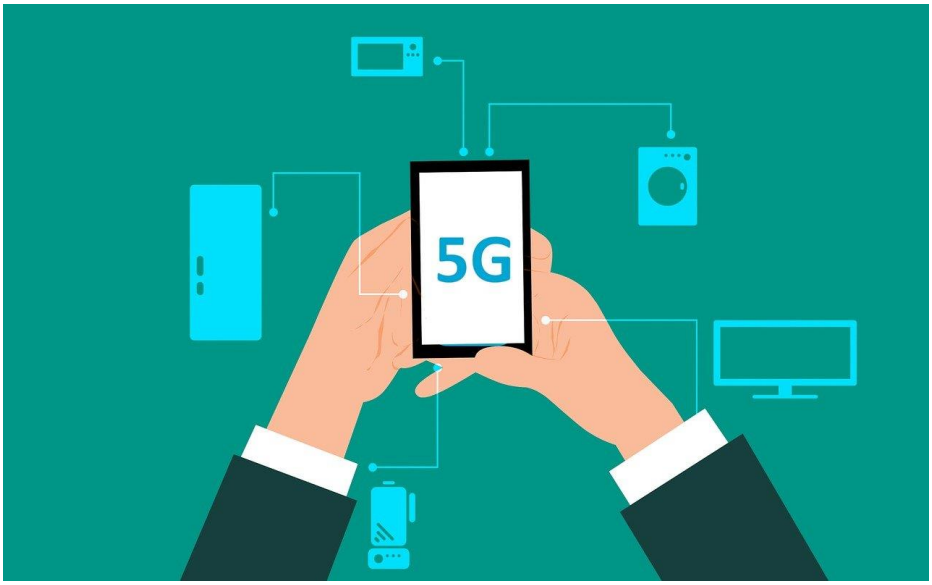
TECHNOLOGIE 5G

Bulletin de veille scientifique : Juin 2025



Objectifs : réaliser une veille scientifique sur la technologie 5G

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Généralités

Aucun article dans ce bulletin.

Performances et sécurité

Simulative Analysis of Stimulated Raman Scattering Effects on WDM-PON Based 5G Fronthaul Networks.

Xu Y, Wang S, Saleem A. *Sensors (Basel)*. 2025 May 21;25(10).

In future hybrid fiber and radio access networks, wavelength division multiplexing passive optical networks (WDM-PON) based fifth-generation (5G) fronthaul systems are anticipated to coexist with current protocols, potentially leading to non-linearity impairment due to stimulated Raman scattering (SRS). To meet the loss budget requirements of 5G fronthaul networks, this paper investigates the power changes induced by SRS in WDM-PON based 5G fronthaul systems. The study examines wavelength allocation schemes utilizing both the C-band and O-band, with modulation formats including non-return-to-zero (NRZ), optical double-binary (ODB), and four-level pulse amplitude modulation (PAM4). Simulation results indicate that SRS non-linearity impairment causes a power depletion of 1.3 dB in the 20 km C-band link scenario, regardless of whether the modulation formats are 25 Gb/s or 50 Gb/s NRZ, ODB, and PAM4, indicating that the SRS-induced power changes are largely independent of both modulation formats and modulation rates. This effect occurs when only the upstream and downstream wavelengths of the 5G fronthaul are broadcast. However, when the 5G fronthaul wavelengths coexist with previous protocols, the maximum power depletion increases significantly to 10.1 dB. In the O-band scenario, the SRS-induced maximum power depletion reaches 1.5 dB with NRZ, ODB, and PAM4 modulation formats at both 25 Gb/s and 50 Gb/s. Based on these analyses, the SRS non-linearity impairment shall be fully considered when planning the wavelengths for 5G fronthaul transmission.

Lien vers l'article

5G-based SharkNet protocol adaptation and wireless communication links.

Xie Y, Liu W, Yang Q. *Sci Rep*. 2025 May 31;15(1):19174.

5G communication technology has become well established in daily life, but its use in industrial control remains in its early stages of development. Due to its low latency and high reliability, 5G URLLC holds substantial potential for development in industrial control. Meanwhile, although SharkNet offers high transmission speed and reliability, its dependence on wired connections limits its coverage and flexibility.To address these limitations, this paper proposes a novel wireless communication link adaptation scheme that integrates 5G URLLC and SharkNet. We first conduct an in-depth analysis of the data packet formats and communication timing characteristics of both SharkNet and 5G protocols. Based on this analysis, we design a protocol conversion scheme and prototype a wireless link system. To validate the adaptability and performance of this scheme, we conducted a number of experiments to evaluate its reliability and latency. The experimental results indicate that compared with a transparent transmission approach, the proposed adaptation scheme significantly reduces communication latency and enhances reliability.

Lien vers l'article

Antennes

High isolation quad ports MIMO antenna loaded with FSS for 5G communication.

Gaber SM, Kareem RA, Ibrahim AA. *Sci Rep*. 2025 Jun 20;15(1):20167.

This paper introduces a high isolation quad ports MIMO (Multiple-Input Multiple-Output) antenna with a frequency selective surface (FSS) structure for higher frequency bands in 5G communication systems. The recommended antenna is designed for 28 GHz application. The single unit of the antenna consists of a microstrip feed line on one side and a rectangular slot in the ground plane on the other side. The four MIMO antennas are arranged orthogonally on a Rogers RO4003C substrate with a permittivity of 3.38, a loss tangent (tan δ) of 0.002, and a height of 0.203 mm. The substrate features a cross-shaped cut to enhance the isolation between ports. An FSS is placed beneath the MIMO system to improve the overall gain across the desired frequency band. The antenna size is 25.7×25.7 mm². The design and simulation of the proposed structure were carried out using CST MW Studio. The antenna with and without the FSS structure was constructed and tested to verify the simulation results. The results indicate that the suggested structure is worked from 25.5 GHz up to 30 GHz with insertion loss ≤ -22 dB and peak gain of around 8dBi. As well, the envelope correlation coefficient (ECC), diversity gain (DG), and channel capacity loss (CCL) are measured and achieved ≤ 0.002, ≥ 9.99 dB, ≤ 0.2 bit/s/Hz, respectively. Also, extra MIMO parameters such as mean effective gain (MEG), channel capacity, and total active reflection coefficient (TARC) are extracted and achieve good outcomes confirming the ability of the antenna to be applicable for 5G networks.

Lien vers l'article

Architecture réseau

Aucun article dans ce bulletin.

Efficacité énergétique

Aucun article dans ce bulletin.

Autres équipements

Design and Realization of a High-Q Grounded Tunable Active Inductor for 5G NR (FR1) Transceiver Front-End Applications.

Saad S, Ben Hammadi A, Haddad F. *Sensors (Basel)*. 2025 May 13;25(10).

This paper presents a wide-tuning-range, low-power tunable active inductor (AI) designed and fabricated using 130 nm CMOS technology with six metal layers. To achieve high performance with a relatively small silicon area and low power consumption, the AI structure is carefully designed and optimized using a cascode stage, a feedback resistor, and multi-gate finger transistors. In the proposed

circuit topology, inductance tuning is realized by adjusting both the bias current and the feedback resistor. The performance of the circuit is evaluated in terms of tuning range, quality factor, power consumption, and chip area. The functionality of the fabricated device is experimentally validated, and the fundamental characteristics of the active inductor are measured over a wide frequency range using a Cascade GSG probe, with results compared to simulations. Experimental measurements show that, under a 1 V supply, the AI achieves a self-resonant frequency (SRF) of 3.961 GHz and a quality factor (Q) exceeding 1586 at 2.383 GHz. The inductance is tunable between 6.7 nH and 84.4 nH, with a total power consumption of approximately 2 mW. The total active area, including pads, is 345 × 400 µm(2).

Lien vers l'article

Electromagnetic textile absorber applied to 4G and 5G bands.

Carvalho PHB, Santana EEC, Barros Filho AKD, Silva Júnior PF, Martins KCR, Azevedo TC, et al. *Sci Rep*. 2025 May 29;15(1):18768.

Absorber materials are developed to reduce electromagnetic radiation and ensure the compatibility of the operation of electronic equipment in environments subject to interference. This work presents the development of a low-cost textile electromagnetic absorber for 4G and 5G technologies, operating at frequencies of 2.5 GHz and 3.5 GHz. The proposed electromagnetic absorber utilizes a 1 mm-thick Denim substrate, with a graphite composite used in the agricultural and commercial polyvinyl acetate glue industry, with the relationship of 25 wt%. The measurements were carried out in a Vector Network Analyzer, model E5071C Agilent Technologies, with the characterization of the Denim substrate, the glue, and the identification of the best parameters for the construction of the absorber. In the project, three low-cost textile absorbers prototypes were fabricated, with G1 = 0.25 mm, G2 = 0.35 mm, and G3 = 0.5 mm of thickness layers of the composite deposited on a Denim fabric. The results indicate that the absorber prototypes G2 presents great results in the frequency range of 4G and 5G band, with a maximum absorption of 26.6 dB in 3.94 GHz, with a structure 98.83% thinner than the commercial absorber LF-75. The variation in absorption performance may be attributed to the different mechanisms by which the absorbers operate: the commercial absorber LF-75 primarily interacts with the magnetic field, whereas the textile prototype predominantly affects the electric field.

Lien vers l'article

Development of a 5G-Connected Ultra-Wideband Radar Platform for Traffic Monitoring in a Campus Environment.

Martín-Sacristán D, Ravelo C, Trelis P, Ortiz M, Fuentes M. *Sensors (Basel)*. 2025 May 20;25(10).

This paper presents the design, implementation, and testing of a traffic monitoring platform based on 5G-connected Ultra-Wideband (UWB) radars deployed on a university campus. The development of both connected radars and an IoT platform is detailed. The connected radars integrate commercial components, including a Raspberry Pi (RPi), a UWB radar, a standard enclosure, and a custom communication board featuring a 5G module. The IoT platform, which receives data from the radars via MQTT, is scalable, easily deployable, and supports radar management, data visualization, and external data access via an API. The solution was deployed and tested on campus, demonstrating real-time operation over a commercial 5G network with an estimated median latency between the radar and server of 75 ms. A preliminary evaluation conducted on a single radar during peak-hour traffic on a double-lane road, representing a challenging scenario, indicated a high detection rate of 94.81%, a

low false detection rate of 1.02%, a high classification accuracy of 97.29%, and a high direction accuracy of 99.66%. These results validate the system's capability to deliver accurate traffic monitoring.

Lien vers l'article

Applications médicales et industrielles de la 5G

Applications industrielles

Measurement Grid Optimization for OTA Testing of 5G Smart Watches.

An X, Liu F, Qu M, Sun S. *Sensors (Basel)*. 2025 May 19;25(10).

Over-the-air (OTA) testing is crucial for optimizing wireless performance of 5G smart watches and improving their user experience. However, the current required test time is so long that it is almost impossible to complete the entire OTA testing without recharging and repositioning, which is unacceptable for the industry. Therefore, test-time reduction is significant. The objective of this work is to optimize measurement grids for OTA testing of 5G smart watches, which balance accuracy with efficiency. In this research, passive patterns from a typical 5G commercial smart watch are measured at different bands as reference patterns, which represent general radiation properties of 5G commercial smart watches. The effect of various coarse grids on OTA testing precision is characterized quantitatively by analyzing their accuracy in reconstructing reference patterns. The related measurement uncertainty (MU) terms are then evaluated and determined quantitatively based on statistical analysis. According to the derived MU limits for grid configurations, reducing grid points from currently required 62 (30/30) to 26 (45/45), and from 266 (15/15) to 62 (30/30) could save roughly 60% and 75% of the test time, respectively, with an uncertainty increase of 0.1 dB for both Total Isotropic Sensitivity (TIS) and Total Radiated Power (TRP) testing, which is considered acceptable. Furthermore, the feasibility of the proposed MU analysis and recommended grids have been experimentally verified.

Lien vers l'article

Applications médicales

Surgery without distance: will 5G-based robot-assisted telesurgery redefine modern surgery?

Xie X, Tian Y, Huang J, Luo Q, Chen T. *Transl Lung Cancer Res*. 2025 May 30;14(5):1821-9.

The rapid advancement of the 5G technology is catalyzing a paradigm shift in the realm of remote surgery, offering the potential to overcome geographical constraints and to realize optimized allocation of global healthcare resources. We review the evolution of telesurgery, from early pioneering efforts to recent advancements made possible by 5G networks, which offer low latency and high data transfer speeds crucial for real-time surgical operations. Thus, 5G facilitates seamless transmission of control signals, images, and audio, allowing surgeons to perform complex procedures remotely with unprecedented precision. Notable achievements in telemedicine demonstrate the feasibility and safety of this cutting-edge approach. Despite these milestones, challenges such as network reliability, cybersecurity concerns, and the need for standardized global protocols remain critical barriers that impede the broad implementation worldwide. Moreover, ethical considerations surrounding patient autonomy, informed consent, liability assignment, regulatory approval, and data privacy framework in cross-border telesurgery require careful attention. The development of regional robotic surgery centers powered by 5G, alongside advancements in artificial intelligence, holds promise for bridging healthcare disparities and enhancing the precision of remote surgical procedures.

As these technologies mature, they have great potential to redefine the landscape of surgery, ushering in an era of more accessible, collaborative, and efficient healthcare delivery worldwide.

Lien vers l'article

Correction: A Mixed Reality-Based Telesupervised Ultrasound Education Platform on 5G Network Compared to Direct Supervision: Prospective Randomized Pilot Trial.

Kim M, Hi Son M, Moon S, Cha WC, Jo IJ, Yoon H. *JMIR Serious Games*. 2025 Jun 12;13:e77586.

Lien vers l'article

Evaluation (Mesure des niveaux d'exposition)

Méthodes d'évaluation

Efficient design of electromagnetic field exposure maps with multi-method evolutionary ensembles.

Guillén-Pina J, Pérez-Aracil J, Chocano-Del-Cerro R, Sánchez-Montero R, López-Espí PL, Salcedo-Sanz S. *Environ Res*. 2025 Aug 1;278:121636.

Radio-frequency electromagnetic field (EMF) exposure is a growing concern among the population. This concern has led to a need for practical tools to contribute to an adequate risk perception. Representing spatial variations af-ter measurements from fixed sites and interpolating using different techniques is the most suitable method for obtaining EMF high-quality exposure maps. This paper uses evolutionary computation to obtain the optimal set of points to construct high-quality electromagnetic field exposure maps (minimizing an error measure with respect to a reference exposure map). A multi-method en-semble evolutionary approach, able to combine different search operators in a single population (PCRO-SL), is introduced for this particular problem, and it has been tested over actual measurements at Meco town, Madrid, Spain, obtaining good quality electromagnetic field exposure map reconstructions in terms of the differences with a reference EMF exposure map. The results obtained show that reducing the number of measurement points necessary to obtain significant exposure maps, while maintaining their representativeness, is possible.

Lien vers l'article

Evaluation population générale

Assessing radiofrequency electromagnetic field exposure in multiple microenvironments across ten European countries with a focus on 5G.

Veludo AF, Stroobandt B, Van Bladel H, Sandoval-Diez N, Deprez K, Aerts S, et al. *Environ Int*. 2025 Jun;200:109540.

To evaluate the implementation of 5G in Europe, we have systematically measured environmental, auto-induced downlink (DL) and uplink (UL) radiofrequency electromagnetic field (RF-EMF) exposure in more than 800 microenvironments in ten European countries. Outdoor, indoor, and public transport microenvironments were measured in two cities and three villages in each country. Exposure was measured during three mobile-phone user scenarios: flight mode (non-user), inducing maximum DL traffic (max DL) or maximum UL traffic (max UL). The mobile phone was carried in a backpack, placed 30 cm from an ExpoM-RF 4 that continuously measured 35 frequency bands (87.5 MHz-6 GHz). For each user scenario, mean exposure levels were calculated. In the non-user scenario, mean exposure levels ranged from 0.33 to 1.72 mW/m(2) per country and were lower in Switzerland, Belgium and Italy. RF-EMF levels were, on average, 80 % lower in villages compared to cities, with DL bands contributing the most in this scenario. During max DL, exposure increased mainly due to the 5G band at 3.5 GHz (mean exposure per country 2.61-11.12 mW/m(2)). However, the time-division nature of this band prevents distinguishing between DL and UL signals with the ExpoM-RF4. Exposure levels were the highest during max UL, particularly in the Netherlands, Italy and Belgium, with 50 % of the mean levels per country above 16 mW/m(2). Exposure was, on average, 35 % higher in villages compared to cities. Environmental exposure levels were below international guideline values. Countries with

precautionary limits had lower environmental exposure levels but higher auto-induced uplink exposure during data upload.

Lien vers l'article

Risques professionnels

Aucun article dans ce bulletin.

Effets biologiques et sur la santé

In silico

Aucun article dans ce bulletin.

In vitro

Aucun article dans ce bulletin.

Sur l'animal

Aucun article dans ce bulletin.

Sur l'homme

A comprehensive mechanism of biological and health effects of anthropogenic extremely low frequency and wireless communication electromagnetic fields.

Panagopoulos DJ, Yakymenko I, De Iuliis GN, Chrousos GP. *Front Public Health*. 2025;13:1585441.

Exposure to anthropogenic electromagnetic fields (EMFs), especially those of wireless communications (WC) has increased tremendously. This is an unprecedented phenomenon throughout biological evolution because, all anthropogenic EMFs, being fully polarized, coherent, and, especially WC EMFs, highly variable, differ substantially from the natural EMFs. WC EMFs consist of Microwave (MW) carrier waves, modulated, by Extremely Low Frequency (ELF) signals, and included in on/off pulses repeated at various ELF rates. Moreover, they exhibit intense random variability, mainly in the Ultra Low Frequency (ULF) band. Thus, WC EMFs are a combination of MW and ELF/ULF EMFs. The combination of polarization/coherence and intense low-frequency (ELF/ULF) variability seems to be the key to EMF-bioactivity. Epidemiological and laboratory studies highlight a connection between ELF or WC EMF exposure and cancer, infertility, electro-hypersensitivity, and various other pathologies. Studies also find DNA damage and Oxidative Stress (OS) which explain these pathologies. While man-made EMFs cannot directly ionize molecules, they are capable of doing this indirectly in biological tissue, by triggering the biosynthesis of Reactive Oxygen Species (ROS) which can damage biomolecules, including DNA. The (over)production of ROS and the consequent OS are triggered by irregular gating of Voltage-Gated Ion Channels (VGICs) in the cell membranes as described by the Ion Forced Oscillation (IFO)-VGIC mechanism: Mobile ions within VGICs forced to oscillate by the applied ELF/ULF EMFs exert forces on the voltage sensors of the VGICs, similar to or greater than the forces that physiologically gate those channels, resulting in their irregular gating (dysfunction). Dysfunction of ion channels disrupts intracellular ionic concentrations. This triggers ROS overproduction and OS by the ROS-generating systems/enzymes in the cells, such as the electron transport chain (ETC) in the

mitochondria, or the NADPH/NADH oxidases (NOXs), the Nitric Oxide synthases (NOS), etc. The IFO-VGIC mechanism and the consequent OS constitute a comprehensive mechanism that explains all known adverse biological and health effects reported to be induced by anthropogenic EMFs.

Lien vers l'article

Electromagnetic fields from mobile phones: A risk for maintaining energy homeostasis?

Seewooruttun C, Mai TC, Corona A, Delanaud S, Seze R, Bach V, et al. *Ann Endocrinol (Paris)*. 2025 Jun;86(3):101782.

In the world, there is a near ubiquitous presence of a low-intensity radiofrequency electromagnetic field (RF-EMF) radiation, due to telecommunications as mobile phones. However, their rapid expansion raises concerns about possible interaction with biological mechanisms. The RF-EMF safety guidelines recommended limits to protect against the thermal heating, the most recognized effect at high intensity levels with a known biophysical mechanism. Among all the effects studied, the impact of RF-EMF exposure on thermoregulation is one of the most important aspects of this research. This review aims to present the complex relationship between RF-EMF exposure and thermoregulation, at intensity levels below the threshold to produce thermal effects. In fact, most studies showed that RF-EMF exposure at 900MHz seems to elicit physiological and biological effects similar to responses inducing by cold environment in two different rodent models. In this brief review, we will describe the effects and underlying mechanisms induced by RF-EMF exposure at low levels and discuss the potential implications for environmental health and safety.

Lien vers l'article

Epidemiological criteria for causation applied to human health harms from RF-EMF exposure: Bradford Hill revisited.

Frank JW. *Front Public Health*. 2025;13:1559868.

PURPOSE: This paper reviews the applicability of standard epidemiological criteria for causation, to the multidisciplinary studies of RF-EMF exposure and various adverse biological and health effects, with the aim of demonstrating that these criteria, although 60 years old, are still helpful in this context-albeit in some cases not entirely straightforward to apply. METHODS: This is a commentary, based on Bradford Hill's criteria for assessing evidence of causation, applied to recent primary studies and systematic reviews of the RF-EMF/health-effects literature. Every effort has been made to use non-epidemiological language to reach a wide readership of biologists, physicists, and engineers now active in this field. RESULTS: A rapidly growing number of human observational epidemiological studies have assessed the association of diverse adverse health effects with RF-EMF exposures. However, existing systematic reviews and meta-analyses of these primary studies have substantially diverged in their conclusions. The application of Bradford Hill's epidemiological criteria for assessing evidence of causation, originally designed for use in occupational and environmental health, casts light on some of reasons for this divergence, mostly reflecting the key weaknesses in the primary literature, which are discussed in detail. As a result of these threats to their validity-particularly the facts that (1) exposure measurement is typically subject to substantial error, and (2) insufficient time has elapsed, since modern cell phone use began in earnest, to allow tumors of longer latency to develop-most primary studies to date, and therefore many published systematic reviews of them, probably underestimate the true potential for causation, if in fact this association is causal. CONCLUSION AND RECOMMENDATIONS: In view of these findings, international experts representing professional and

scientific organizations in this field should convene an independent Guidelines development process to inform future epidemiological studies of associations between RF-EMF exposures and human health outcomes. Wide dissemination of such Guidelines could help researchers, journals and their reviewers in this field to execute, review and publish higher-quality studies to better inform evidence-based policy.

Lien vers l'article

5G Radio-Frequency-Electromagnetic-Field Effects on the Human Sleep Electroencephalogram: A Randomized Controlled Study in CACNA1C Genotyped Volunteers.

Sousouri G, Eicher C, MariaAngelo R, Billecocq M, Fussinger T, Studler M, et al. *Neuroimage*. 2025 Jun 18:121340.

BACKGROUND: The introduction of 5G technology as the latest standard in mobile telecommunications has raised concerns about its potential health effects. Prior studies of earlier generations of radiofrequency electromagnetic fields (RF-EMF) demonstrated narrowband spectral increases in the electroencephalographic (EEG) spindle frequency range (11-16 Hz) in non-rapid-eye-movement (NREM) sleep. However, the impact of 5G RF-EMF on sleep remains unexplored. Additionally, RF-EMF can activate L-type voltage-gated calcium channels (LTCC), which have been linked to sleep quality and EEG oscillatory activity. OBJECTIVE: This study investigates whether the allelic variant rs7304986 in the CACNA1C gene, encoding the α1C subunit of LTCC, modulates 5G RF-EMF effects on EEG spindle activity during NREM sleep. METHODS: Thirty-four participants, genotyped for rs7304986 (15 T/C and 19 matched T/T carriers), underwent a double-blind, sham-controlled study with standardized left-hemisphere exposure to two 5G RF-EMF signals (3.6 GHz and 700 MHz) for 30 min before sleep. Sleep spindle activity was analyzed using high-density EEG and the Fitting Oscillations & One Over f (FOOOF) algorithm. RESULTS: T/C carriers reported longer sleep latency compared to T/T carriers. A significant interaction between RF-EMF exposure and rs7304986 genotype was observed, with 3.6 GHz exposure in T/C carriers inducing a faster spindle center frequency in the central, parietal, and occipital cortex compared to sham. CONCLUSION: These findings suggest 3.6 GHz 5G RF-EMF modulates spindle center frequency during NREM sleep in a CACNA1C genotype-dependent manner, implicating LTCC in the physiological response to RF-EMF and underscoring the need for further research into 5G effects on brain health.

Lien vers l'article

Reproduction

Effects of 5G Mobile Phone Network Electromagnetic Field Exposure on Testicular Endoplasmic Reticulum Stress and the Protective Role of Coenzyme Q10.

Yilmaz H, Tümkaya L, Mercantepe T, Yılmaz A, Gül F, Suzan ZT. *Arch Med Res*. 2025 Jun;56(4):103157.

AIM: Nowadays, the electromagnetic field (EMF) has become an issue of electromagnetic pollution. This study aimed to determine the effect of 5G Fr1 frequency band EMF waves on endoplasmic reticulum (ER) stress in testicular tissue and to demonstrate the efficacy of coenzyme Q10 (CoQ10) in suppressing the potential situation. MATERIALS AND METHODS: Three groups of eight male Sprague-Dawley rats were established. In group I (control) received only saline solution by oral gavage. In group II (EMF), saline solution was administered by oral gavage and the rats were exposed to 5.9 GHz EMF for 2 h/d (09:00-11:00). In group III (EMF+ CoQ10), the EMF exposure was created in the same way as in group II and CoQ10 was given daily at 10 mg/kg (CoQ10), 2 mg/kg dissolved in corn oil and administered by oral gavage for the experimental period (30 d). RESULTS: Histopathological damage, including edematous regions, vascular congestion, and neutrophil inflammation accompanied by loss of spermatogenic cells, particularly spermatozoa, and spermatids, increased thiobarbituric acid (TBARS) and decreased total thiol (TT) levels were observed in the seminiferous tubules in the EMF group. Furthermore, germinal epithelial cells showing intense GRP-78 immunopositivity and spermatogenic cells indicating C/EBP homologous protein (CHOP) immunopositivity were increased in the seminiferous tubules. On the other hand, in the EMF+CoQ10 group, both histopathological and biochemical findings were observed in the opposite direction. CONCLUSION: Due to its antioxidant properties and its ability to suppress oxidative stress and apoptosis, CoQ10 may be a promising candidate against 5G EMF-induced testicular ER damage.

Lien vers l'article

A novel experimental design approach to generating orbital angular momentum waves using wearable textile antenna for sub-6 GHz 5G.

Noor SK, Ismail AM, Elamin NIM, Mohd Yasin MN, Osman MN, Soh PJ, et al. *PLoS One*. 2025;20(5):e0310113.

This paper presents a novel wearable textile array antenna designed to generate Orbital Angular Momentum (OAM) waves with mode + 1 at 3.5 GHz (3.4 to 3.6 GHz) of the sub-6 GHz 5G New Radio (NR) band. The proposed antenna is based on a uniform circular array (UCA) of four microstrip patch antennas on a felt textile substrate. Compared to previous works involving the use of hard substrates for OAM waves generation, this work explored the use of flexible textile substrates to generate OAM waves for the first time to the best of our knowledge. The overall dimension of the array antenna is 170 × 156 mm2 while the dimension of each element is 35 × 35.7 mm2. In order to control the phase and generate OAM waves, the proposed antenna was designed using a felt textile substrate and meandering lines of various lengths connecting the radiating patches. 1.48λ was the separation between radiating patches in order to prevent mutual coupling between them. The antenna was fabricated and measured prior to comparison to simulations to validate this feature. It achieved a measured gain of 3.18 dBi with a bandwidth of 430 MHz (3.24 to 3.67 GHz). Additionally, mode purity analysis was carried out to verify the generation of OAM mode + 1, and the purity obtained was 52.12%. This paper also covered the effect of bending on OAM waves characteristics and the use of airgap technique to enhance the antenna gain. The antenna gain increased from 3.762 dBi to 5.327 dBi by using 1 mm airgap without affecting the mode purity. Furthermore, as per the Specific Absorption

Rate (SAR) obtained, it is found that the proposed antenna is safe for on-body use. The novel approach in generating OAM using patch array antenna with flexible substrate by replacing conventional hard substrate has opened up new scope of research in wearable textile antenna domain. The proposed antenna has simple structure, easy to design, fabricate and deploy on human body and has important significance in scaling up this design to generate multiple OAM modes for carrying multiple signals simultaneously.

Lien vers l'article

WHO to build neglect of RF-EMF exposure hazards on flawed EHC reviews? Case study demonstrates how "no hazards" conclusion is drawn from data showing hazards.

Nordhagen EK, Flydal E. *Rev Environ Health*. 2025 Jun 26;40(2):277-88.

We examined one of the first published of the several systematic reviews being part of WHO's renewed initiative to assess the evidence of associations between man-made radiofrequency electromagnetic radiation (RF-EMF) and adverse health effects in humans. The examined review addresses experimental studies of pregnancy and birth outcomes in non-human mammals. The review claims that the analyzed data did not provide conclusions certain enough to inform decisions at a regulatory level. Our objective was to assess the quality of this systematic review and evaluate the relevance of its conclusions to pregnant women and their offspring. The quality and relevance were checked on the review's own premises: e.g., we did not question the selection of papers, nor the chosen statistical methods. While the WHO systematic review presents itself as thorough, scientific, and relevant to human health, we identified numerous issues rendering the WHO review irrelevant and severely flawed. All flaws found skew the results in support of the review's conclusion that there is no conclusive evidence for nonthermal effects. We show that the underlying data, when relevant studies are cited correctly, support the opposite conclusion: There are clear indications of detrimental nonthermal effects from RF-EMF exposure. The many identified flaws uncover a pattern of systematic skewedness aiming for uncertainty hidden behind complex scientific rigor. The skewed methodology and low quality of this review is highly concerning, as it threatens to undermine the trustworthiness and professionalism of the WHO in the area of human health hazards from man-made RF-EMF.

Lien vers l'article

Effects of 700 MHz radiofrequency radiation (5 G lower band) on the reproductive parameters of female Wistar rats.

Jha N, Sarsaiya P, Tomar AK, Pardhiya S, Nirala JP, Chaturvedi PK, et al. *Reprod Toxicol*. 2025 Aug;135:108910.

The advent of 5 G technology has raised concerns about its potential biological effects, particularly reproductive health being one key area of focus. This study investigated the impact of 700 MHz, a lower 5 G frequency band, on the reproductive health of female Wistar rats. The experiment analyzed the effects of short-term and long-term exposure to 700 MHz mobile radiation on female Wistar rats. Rats were divided into three groups (control, sham-exposed, and exposed), with sample sizes of n = 6 for short-term and n = 8 for long-term exposure. For short-term exposure, rats were subjected to 6 hrs of radiation daily for 10 days, while for long-term exposure, rats exposed 4 hrs daily for 60 days. Physiological parameters, including estrous cyclicity, were monitored, and histopathological and biochemical analyses were conducted on harvested ovaries. Comet assay was performed to assess DNA damage. The results indicated no changes in estrous cycles or comet assay parameters in either

exposure group. Serological hormone levels, including estradiol and progesterone, remained within normal ranges, but a slight yet significant increase in testosterone levels was observed in exposed groups. Oxidative stress markers revealed elevated malondialdehyde (MDA) levels and significant decreases in superoxide dismutase (SOD), total sulfhydryl content, and ferric reducing antioxidant power (FRAP) in exposed ovaries. Histopathological analysis showed no significant changes in ovarian morphology in short-term exposure but revealed alterations, including cystic follicles and abnormal vasculature, in long-term exposure. These findings suggest that 700 MHz radiation may induce oxidative stress and tissue changes in ovarian samples over prolonged exposure.

Lien vers l'article

Dispositifs médicaux implantables

Aucun article dans ce bulletin.