



Very High Radiofrequency Radiation in the Passenger Cabin Measured in an Airplane with High-Speed Wi-Fi

Mona Nilsson^{1*} and Lennart Hardell²

Abstract

Exposure to radiofrequency (RF) radiation has become ubiquitous during recent years, especially since the introduction of the fifth, 5G, generation for communication. This has caused increasing environmental exposure in for example different types of transportation such as trains, buses, subways, and airplanes. It is of concern since exposure limits are in most countries based only on biological effects from RF radiation caused by heating, in spite of extensive evidence on health impacts that are not caused by heating (non-thermal). To our knowledge no results on RF radiation in the airplane cabin, especially since the recent introduction of high-speed Wi-Fi on board, exist. Measurements were made in June 2026 on board a plane with the new high-speed Wi-Fi and another flight with the previous standard Wi-Fi. The exposimeter Safe and Sound Pro II was used and each measurement was made during at least 2 minutes. With high-speed Wi-Fi the radiation level varied between 299,000 to 651,000 (n=6) $\mu\text{W}/\text{m}^2$, compared with 8,310 to 69,100 (n=10) $\mu\text{W}/\text{m}^2$ with standard Wi-Fi. These levels are within the limits proposed by ICNIRP and FCC, based only on heating effects. In contrast, the measured levels are much higher than guidelines from 2016 for Wi-Fi 2.4/5.6 GHz for exposure during daytime 10 $\mu\text{W}/\text{m}^2$, nighttime 1 $\mu\text{W}/\text{m}^2$, and for sensitive person 0.1 $\mu\text{W}/\text{m}^2$ proposed by the European Academy for Environmental Medicine (EUROPAEM) – EMF working group. The implement of high-speed Wi-Fi on board airplanes may be a health hazard both to the passengers and the staff. A risk evaluation should be made by scientists without conflicts of interest before further introduction of this technology.

Keywords: Radiofrequency radiation; Microwaves; Radiation; Wi-Fi; Airplane.

Introduction

Wireless communication technologies emit pulse modulated microwave or radiofrequency (RF) radiation. Microwaves are frequencies between 300 MHz and 300 GHz and it is within this frequency band that most mobile communication technologies operate. Wi-Fi operates at 2.4, 5, 6 or 7 GHz [1]. This kind of technology also entails exposure to low frequency signals. A Wi-Fi router's carrier frequency has been found to include pulses of around 10 Hz (5–20 Hz) [2]. Pulse modulated microwave RF radiation has been associated with various health and biological negative impacts, primarily on the nervous system, but also DNA-damage, oxidative stress and negative effects on reproductive system [3]. A group of symptoms such as sleeping problems, fatigue, headache, dizziness, vertigo, memory and concentration problems, heart arrhythmia, and chest pressure has been found to be increased among people living near mobile phone masts or base stations [4, 5]. Together these symptoms have been called the microwave syndrome, radiofrequency sickness or illness [6, 7].

In 2011 the International Agency for Research on Cancer (IARC) classified RF radiation as Group 2B, possibly carcinogenic to humans, based primarily on studies

Affiliation:

¹Swedish Radiation Protection Foundation, Adelsö, Sweden.

²The Environment and Cancer Research Foundation, Örebro, Sweden

*Corresponding author:

Mona Nilsson, BSc, Swedish Radiation Protection Foundation, Adelsö, Sweden

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showing increased risk for brain tumours from exposure to RF radiation from mobile phone use [8]. Several large animal studies have since then reported increased rates of cancer from long term exposure [9]. An increasing number of studies have shown mechanistic effects in terms of DNA-damage and oxidative stress [10, 11]. There is also a growing concern related to exposure to the unborn child during pregnancy. Several animal studies on fetal exposure have reported negative effects on behavior and the brain [12].

Studies on animals and on humans have shown that microwave RF radiation and low frequency fields may cause effects that have been associated with degenerative diseases [13, 14].

Since the start of this millennium the public's exposure to microwave RF-radiation has increased substantially through the increasing use of wireless technologies emitting microwave RF-radiation, among others mobile phones, wireless computers, Wi-Fi-routers, and the deployment of 3G, 4G and 5G mobile phone masts and base stations. Wi-Fi technology has also been deployed in different types of transportation such as trains, buses, subways, and airplanes. Our group has found increasing levels in various public places, as well as in people's homes, during the last decade. This is to a large extent driven by the roll-out of 5G beginning in 2020 [4, 15, 16]. Exposure to microwave RF radiation in various environments have been measured and reported in several studies during the last decade [17].

Reviews of previous measurement studies have reported that high exposure levels may occur in public transportation [18, 19].

Background

In March 2026 the airline company SAS announced the introduction of high speed Wi-Fi on board its aircrafts during 2026 [20]. It will offer speed up to 500+ MB/s and is first installed on its Airbus A320 aircrafts. To our knowledge, no study has so far measured RF radiation on board aircrafts with high speed Wi-Fi.

Aim of this study

The aim of this study was to measure RF radiation on board of two of SAS aircrafts, one with the new high speed Wi-Fi and one with previously existing standard Wi-Fi.

Methods

RF radiation was measured during two flights with SAS in June 2026. One flight had enacted the new high speed Wi-Fi and the other flight was equipped with the previous standard Wi-Fi. Both flights lasted 1 hour and 20 minutes. On the flights, the measurement equipment Safe and Sound

Pro II was placed on similar position within the aircraft (seats 3E and 4D, respectively). Both flights were full of passengers. Most of them used wireless devices during the flight. Each measurement was performed during at least 2 minutes. This was done six times on the high speed Wi-Fi flight and 10 times on the standard Wi-Fi flight. Max peak values were recorded. The person performing the measurements did not use or wear any wireless device during the two flights.

Results

Table 1 shows the measured max peak levels for the two flights. RF radiation levels were markedly higher on the high speed Wi-Fi flight compared to the standard Wi-Fi flight. Maximum peak levels varied between 299,000 and 651,000 $\mu\text{W}/\text{m}^2$ on the aircraft with high speed Wi-Fi and between 8,310 and 69,100 $\mu\text{W}/\text{m}^2$ on the flight with standard Wi-Fi.

Table 1: Max peak RF radiation levels in $\mu\text{W}/\text{m}^2$ each measured during at least two minutes, on SAS flights with high speed Wi-Fi compared with standard Wi-Fi.

Measure no	High speed Wi-Fi	Standard Wi-Fi
1	409,000	13,700
2	400,000	69,100
3	370,000	19,200
4	651,000	56,300
5	400,000	8,310
6	299,000	14,300
7	-	32,900
8	-	23,500
9	-	47,700
10	-	12,300

Discussion

Over the past two decades, public exposure to microwave RF radiation has increased, reflecting both higher exposure levels and a growing number of environments and devices that emit RF radiation. Today nearly every human environment is exposed including those that were not exposed two decades ago. One such example is on board aircrafts. In-flight Wi-Fi was first introduced on commercial passenger aircrafts in 2004 [21, 22]. This study shows that introduction of more powerful high speed Wi-Fi on flights may lead to substantially higher exposure than with the previously existing standard Wi-Fi. These, in this study, high max peak levels varying between 299,000 and 651,000 $\mu\text{W}/\text{m}^2$ are higher than levels that have been shown to cause harmful effects among people living close to base stations [4, 5, 23].

The levels measured on the flights, and in particular on the flight with high speed Wi-Fi, are lower than the limits from

the FCC in the USA and ICNIRP, adopted by most countries in the world. The ICNIRP limits for Wi-Fi frequencies are 10,000,000 $\mu\text{W}/\text{m}^2$ measured as average over 6 or 30 minutes [24, 25]. However these thermal based limits only protect against thermal (heating) effects from short term exposure and fail to protect against any non-thermal effect that may arise within both short time and long term exposure [26, 27]. EUROPAEM EMF Guidelines therefore propose upper limits for exposure to Wi-Fi during daytime of 10 $\mu\text{W}/\text{m}^2$, for nighttime 1 $\mu\text{W}/\text{m}^2$, and for sensitive person 0.1 $\mu\text{W}/\text{m}^2$ in order to protect against non-thermal effects [28]. These are ignored by the ICNIRP and the FCC.

The levels measured on the high speed Wi-Fi aircraft are of large concern for individuals who are particularly sensitive, for toddlers and children, pregnant women, for those who travel long distances, and frequent flyers. The high RF radiation levels in the cabin may also be a workplace hazard to the employees on board.

In the current study no measurement could be made in the pilot's cabin. Since intact cognitive functions are particularly important for pilots, it is of concern if pilots are exposed to the high RF radiation levels similar to or even higher than those measured among passengers on board. Impacts on cognitive functions such as memory, attention and concentration are among the non-thermal effects that have been repeatedly shown to be associated with exposure to pulsed microwave RF radiation from Wi-Fi [29, 30, 31].

Conclusion

To our knowledge, this is the first study to assess RF radiation exposure on board an aircraft after the introduction of high speed Wi-Fi. All measurements showed high levels that exceed those reported to have negative impacts on human health. However, the results were below limits from FCC and ICNIRP that are only based on thermal effects and excluding influence not based on heating (non-thermal). The levels are problematic particularly for sensitive parts of the population, frequent flyers and the staff on board the aircrafts. Before new technology based on RF radiation is introduced proper risk evaluation should be performed by scientists without conflicts of interest.

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Availability of data and materials

The information generated and analyzed during the current study is available from the corresponding author on reasonable request.

Authors' contributions

LH made the RF radiation measurements. Both authors participated in the writing of the manuscript, and have read and approved the final version.

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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