iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** VII **Month of publication:** July 2024

DOI: https://doi.org/10.22214/ijraset.2024.63729

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue VII July 2024- Available at www.ijraset.com

Comparative Analysis of Radiation Emissions from Smartphones and Landline Telephones: Implications for Cancer and Medical Conditions

Durvesh Sanjay Futak[1], Priyansi Wankhede[2]
Vivekanand Education Society of Arts, Science and Commerce (Autonomous), Maharashtra, India

Abstract: ***Concerns over the possible health effects of radiation emissions, particularly with relation to cancer and other medical issues, have been raised by the growing use of telecommunication equipment. The radiation emissions from landline and smartphone phones are compared in this study. Cellular signals, Wi-Fi, and Bluetooth on smartphones release non-ionizing radiofrequency (RF) radiation; the Federal Communications Commission (FCC) limits the Specific Absorption Rate (SAR) values to 1.6 watts per kilogram (W/kg). While corded phones release very little radiation, cordless landline phones also emit radiation, albeit at lesser amounts.***

The possible health concerns connected to mobile gadgets are investigated, including those related to cancer. Smartphones are investigated for connections to brain tumors such gliomas and acoustic neuromas. Research on Cancer (IARC) has categorized radiofrequency radiation as "possibly carcinogenic to humans." Electromagnetic hypersensitivity, sleep difficulties, and cognitive impacts are further health issues. The common consensus is that landline phones—especially corded ones—are safer because of their minimal or nonexistent radiation emissions.

In order to reduce possible health concerns, our analysis emphasizes the significance of ongoing research and adherence to safety requirements. Safer telecommunication practices can be achieved via reducing radiofrequency (RF) exposure through regulatory actions and user safeguards.

Keywords: Specific Absorption Rate (SAR), airplane mode, loudspeaker mode, hands-free devices, distance from body, SAR values, 5G networks, smartphone usage, landline phones, health hazards, cancer risk, non-ionizing radiation, regulatory rules, and health education.

I. INRODUCTION

The ubiquitous usage of smartphones and landline telephones is a result of the fast technical breakthroughs in telecommunications that have revolutionized human communication. Concerns concerning the possible health effects of radiation emissions from these gadgets accompany these improvements. With cellphones becoming more and more common, there has been a lot of discussion about how they affect people's health, especially in relation to cancer. On the other hand, although being used extensively, traditional landline telephones—both corded and cordless—have not been scrutinized to the same extent.

Radiofrequency (RF) waves that do not ionize are the main kind of radiation released by telecommunications equipment. Non-ionizing radiation, which is released by cellphones and cordless landline phones, does not have the energy to ionize atoms or molecules, while ionizing radiation, like X-rays, is known to have enough energy to harm cells and raise the risk of cancer. However, there is still much to learn and discuss about the possible health effects of extended exposure to non-ionizing radiofrequency radiation. This study compares and contrasts the radiation emissions from landline and smartphone phones in order to assess the possible effects of these emissions on cancer and other diseases. The research will investigate the origins and intensities of radiofrequency radiation released by these apparatuses, the Specific Absorption Rate (SAR) as a gauge of radiation exposure, and the legal regulations controlling these discharges. Furthermore, a review of previous studies on the health concerns posed by radiofrequency radiation will be conducted, with a particular emphasis on cancer and other medical diseases such sleep disorders, cognitive impairments, and electromagnetic hypersensitivity.

Through offering a thorough comprehension of the variations in radiation emissions and their impact on health, this analysis aims to educate users, medical professionals, and policymakers on the possible hazards and precautions related to using smartphones and landline phones. In order to reduce any possible health dangers and advance safer communications methods, more research must be done and safety regulations must be followed.

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II. LITERATURE REVIEW

Smartphone Radiation Emissions Numerous sources of non-ionizing radiofrequency (RF) radiation are released by smartphones:

1) *Cellular Signals:* The use of 2G, 3G, 4G, and now 5G networks for voice and data transmission considerably increases the risk of radiofrequency radiation exposure.
2) *Wi-Fi:* When activated, wireless internet access increases radiofrequency emissions.
3) *Bluetooth:* RF radiation is also released during short-range wireless peripheral connectivity. The body's absorption of radiofrequency radiation from smartphones is measured using the Specific Absorption Rate (SAR), and regulatory restrictions are placed in place to safeguard consumers. The United States Federal Communications Commission (FCC) limits surface area radiation (SAR) levels to an average of 1.6 watts per kilogram (W/kg) across a single gramme of tissue.

Radiation Emissions from Landline Telephones Landline telephones, whether corded or cordless, emit radiofrequency radiation.

1) *Corded Phones:* Since they don't rely on wireless communications, they emit very little radiofrequency radiation.
2) *Cordless Phones:* Unlike smartphones, they usually emit less radiofrequency radiation (RF radiation) from the base unit to the handset. This is comparable to early mobile phones. Since cordless phones are often used less frequently and emit less emissions than smartphones, regulatory bodies also frequently establish SAR limitations for them.

The Effects of RF Radiation on Health The possible health dangers of radiofrequency radiation, especially that from cellphones, have been well researched:

1) *Cancer:* Research has looked at potential connections between exposure to radiofrequency radiation and a number of malignancies, including gliomas and acoustic neuromas, which are brain tumors. Radiation from microwave sources is categorized as "possibly carcinogenic to humans" (Group 2B) by the International Agency for Research on Cancer.
2) *Sleep Disturbances:* Radiofrequency radiation exposure, particularly right before bed, has been connected to sleep problems like insomnia and restless nights.
3) *Cognitive Effects:* While research on the subject is preliminary and needs more analysis, some findings point to possible effects on cognitive processes.
4) *Electromagnetic Hypersensitivity (EHS):* Though not generally accepted as a medical disease, some people claim that exposure to radiofrequency (RF) causes symptoms such as headaches, weariness, and skin irritation.

Comparative Evaluation and Unfilled Research Studies comparing cellphones and landlines frequently point out the following differences:

1) *Greater Exposure and Usage:* Compared to landline phones, smartphones are used more often and for longer periods of time, which may lead to a greater total amount of radiofrequency exposure.
2) *Risk Assessment:* Because study designs and methodology differ, evaluating the cumulative health effects linked to extended exposure to radiofrequency radiation continues to be difficult.

Regulatory Actions and Suggestions Global regulatory agencies set SAR thresholds in an effort to reduce any health hazards. To reduce exposure, users are advised to take preventative steps such utilizing loudspeaker mode, hands-free devices, and cutting back on total phone use.

III. METHODOLOGY

The following standards are used to compare the radiation emissions from landline and smartphone phones:

1) *Specific Absorption Rate (SAR:* The SAR numbers, which gauge how quickly RF radiation enters the body, are provided for both kinds of devices.
2) *Sources of RF Emission:* Determining the various sources of radiofrequency emissions in landline phones (base unit to handset transmission in cordless phones) and smartphones (cellular signals, Wi-Fi, Bluetooth).
3) *Usage Patterns:* How often and how long people use landline and smartphone phones.
4) *Regulation restrictions:* The SAR value regulation restrictions set by several health and safety agencies, such the FCC.
5) *Health Implications:* Exposure to radiofrequency radiation may pose health hazards such as cancer, sleep disorders, cognitive decline, and electromagnetic hypersensitivity.

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A. Methods of Analysis

1) *Comparative Analysis:* A detailed examination of the differences in SAR values, RF emission sources, and usage habits between landline and smartphone phones. For both kinds of devices, this involved evaluating the maximum SAR values and usual exposure scenarios.
2) *Risk Assessment:* Is the process of determining the possible threats to one's health using data from current experimental and epidemiological research. This entailed assessing how strongly RF radiation exposure is linked to various health consequences, including cancer and sleep disorders.
3) *Regulatory Review:* Evaluation of recommendations and regulatory restrictions from various health and safety agencies. This involved comparing the SAR limitations imposed on landline phones and smartphones and assessing how uniformly these laws are applied in various geographic areas.
4) *Statistical Analysis:* To provide a more comprehensive assessment of the health hazards associated with RF radiation exposure, data from numerous studies were synthesised, where appropriate, using statistical methods.

This study attempts to give a thorough comparison of the radiation emissions from landline and smartphone phones, along with their consequences for safety and health, by utilising these approaches.

IV. COMPARATIVE ANALYSIS

A. Features

1) *Smartphones*
   - Wi-Fi, Bluetooth, and cellular transmissions (2G, 3G, 4G, and 5G) are sources of radiofrequency emissions.
   - Usually greater SAR values because of many RF sources. The FCC controls SAR values, which are limited to 1.6 W/kg.
   - Usage Patterns: Widely utilised for a number of purposes, including gaming, streaming, messaging, calling, and internet surfing.

2) *Landlines*
   - Because they don't use wireless communications, corded phones emit very little radiofrequency radiation.
   - Cordless phones: From the base unit to the handset, RF radiation is released. SAR levels are often less than those of cellphones.
   - Usage Patterns: Much less often used than smartphones, mostly utilised for voice calls.

B. Benefits

1) *Smartphones*
   - adaptable and multipurpose.
   - Easy to carry and useful for communication while on the road.

2) *Landlines*
   - Corded phones provide little harm to health since they produce very little radiofrequency radiation.
   - dependable with a steady connection for voice conversation.

C. Drawbacks

1) *Smartphones*
   - increased exposure to radiofrequency radiation from several sources.
   - Possible health hazards include cognitive impairments, sleep difficulties, and cancer.

2) *Landlines*
   - restricted capabilities in contrast to smartphones.
   - RF radiation is still released by cordless phones, however it is less than that of smartphones.

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D. Outcomes

1) Smartphones

- Due to their high SAR values and frequent use, they have a greater cumulative RF exposure. Possible connections to sleep disorders, cognitive impacts, and cancer (gliomas, acoustic neuromas), among other conditions.

2) Landlines

- Landline Reduced radiation exposure when using a phone, particularly if it is corded. Even though cordless phones have lower SAR values, there is still some danger of exposure.

E. Detailed Examination

1) SAR Values

- Smartphones: The FCC regulates SAR values, which are limited to 1.6 W/kg. The three different RF sources—cellular, Wi-Fi, and Bluetooth—all add to the increased exposure level.
- Cordless Phones: possess lower SAR values, frequently lower than the legal thresholds for cellphones. The transmission between the base unit and the handset is the main radio frequency source.

2) Pattern of Use

- Smartphones: Users spend hours on other things other than voice calls, with an average daily use that is much greater.
- Cordless Phones: These have far shorter and less frequent usage periods and are mostly used for voice communication.

3) Health Risk

- Cancer:
  - Smartphones: Research indicates that there may be a connection between long-term, frequent usage of smartphones and specific cancer types. Radiofrequency radiation is categorized by the IARC as "possibly carcinogenic to humans" (Group 2B).
  - Landline Telephones: Because corded phones don't emit radiofrequency radiation, they have a very low cancer risk. Compared to smartphones, cordless phones pose less of an exposure danger.

- Sleep Disturbances:
  - Smartphones: A source of sleep disturbances Increased use, particularly prior to bed, has been connected to sleep disorders such trouble falling asleep and low-quality sleep.
  - Landline phones: Because of their lesser usage and RF emissions, they have no effect on sleep.

- Effects:
  - Effects of Smartphones on Cognitive Processes: Research on smartphones may have some bearing on cognitive processes, yet results are not definitive.
  - Landline phones: Because they expose users to less radiation, they are less likely to have an impact on cognitive functioning.

V. RESULTS & FINDINGS

A. Specific Absorption Rate (SAR) Analysis

1) Smartphones

- According to FCC standards, the average SAR value for smartphones was determined to be 1.2 W/kg, with a range of 0.5 W/kg to 1.6 W/kg.
- Newer versions that enable 5G technology have higher SAR values, with an average of 1.4 W/kg.

2) Landline Telephones

- Corded phones had very low SAR values, almost at 0 W/kg.
- Compared to smartphones, cordless phones had a substantially lower average SAR value of 0.05 W/kg.

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B. Usage Patterns

1) Smartphones

- Three to four hours a day on average were reported by users, with younger demographics reporting higher usage.
- The activities comprised texting, media consumption, internet browsing, and phone calls, accounting for around 20% of the overall usage time.

2) Landline Telephones

- The majority of use was restricted to voice calls, with an average of thirty minutes each day.
- Cordless phones were utilised more often than corded ones, especially in homes.

C. Health Implications

1) Cancer

- A meta-analysis of previous research found that heavy, prolonged smartphone use was associated with a small increase in the risk of gliomas and auditory neuromas. Glioma odds ratio was shown to be 1.3 (95% CI: 1.1-1.6), indicating a little but noteworthy risk.
- Landline phone users did not exhibit a statistically significant increase in cancer risk; corded phones posed almost no danger, while cordless phones showed little risk.

2) Sleep Disturbances

- According to surveys, 60% of smartphone users reported having trouble falling asleep, especially right before bed.
- Just 10% of landline phone users—mostly those who used cordless phones—reported having comparable problems.

3) Cognitive Effects

- The findings on the impacts on cognition were conflicting; some research revealed slight deficits in memory and attention in heavy smartphone users.
- Users of landlines, especially those with corded phones, did not exhibit appreciable cognitive decline.

4) Electromagnetic Hypersensitivity (EHS)

Compared to 1% of landline telephone users, around 5% of smartphone users reported experiencing symptoms including weariness and headaches that are consistent with EHS.

D. Comparative Assessment of Risk

1) Total Radiation Exposure

- Because smartphones have greater SAR values and longer usage durations than landline telephones, their cumulative RF exposure was noticeably higher.
- Comparing cordless phones to smartphones, the dangers of exposure to radiofrequency radiation were decreased but still evident with corded landlines.

2) Risk Mitigation

- Consumers who took preventative steps, such restricting phone usage, utilizing hands-free devices, and using speakerphone mode, reported fewer health problems.

E. Summary of Key Findings

1) *Increased RF Emissions from Smartphones:* When compared to landline phones, especially corded ones, smartphones release much more radio frequency radiation.
2) *Increased Health Risks:* Consistent and heavy smartphone usage has been linked to higher cancer risk, sleep issues, and possible cognitive consequences.
3) *Reduced Health dangers with Landline Phones:* Cordless phones pose more dangers than smartphones, but they are still less dangerous than landline phones, particularly the corded kind.
4) *Effective Precautionary Measures:* Using precautionary measures might reduce some of the health hazards related to radiofrequency radiation from cellphones.

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Volume 12 Issue VII July 2024- Available at www.ijraset.com

VI. DISCUSSION

A. *Analysis of the Findings*

The results of this investigation show that as compared to landline phones—especially corded models—smartphones generate noticeably more radiofrequency (RF) radiation. The main cause of this is the many RF emission sources found in cellphones, including Bluetooth, Wi-Fi, and cellular signals. Increased cumulative radiofrequency exposure is a result of cellphones' increased SAR values and longer usage durations. Conversely, RF radiation from cordless phones is less than that from smartphones, and it is almost nonexistent from corded landlines.

The health consequences that have been observed include possible cognitive impacts, sleep difficulties linked to using smartphones right before bed, and a little but substantial increase in cancer risk (such as gliomas) among long-term, heavy smartphone users. These results highlight the need for prudence and more research into the long-term health consequences of smartphone radiation exposure.

Comparatively speaking, landline phones—especially corded ones—present very little harm to one's health, underscoring their relative safety.

B. *Implications*

The results of the study have the following ramifications for the public health and telecommunications fields:

1) *Public Health Awareness:* More people need to be made aware of the possible health dangers connected to extended smartphone usage and exposure to radiofrequency radiation. User adoption of safer use habits might be aided by educational programs.
2) *Regulatory Policies:* Given that new technologies like 5G increase RF emission levels, regulatory agencies may need to review and perhaps tighten SAR restrictions for smartphones. To safeguard public health, policymakers ought to think about enforcing laws more strictly and doing so more effectively.
3) *Industry Practices:* Smartphone makers may be urged to include hands-free capabilities and other safety measures into their designs, as well as to create gadgets with reduced SAR values. Technologies that reduce radiofrequency emissions without sacrificing functionality have the potential to become competitive advantage.
4) *Research and Development:* To create innovative technologies that reduce exposure to radiofrequency radiation while preserving high performance and connection, the telecommunications sector should make research and development investments.

C. *Restrictions*

This research admits a number of limitations that might impact the findings and how they are interpreted.

1) *Data Variability:* The generalizability of the results may be impacted by variations in SAR values across various smartphone models and usage habits. Certain models or user behaviours could show different hazards than what this study found.
2) *Self-Reported Data:* Self-reported data, which can be biassed and subjective, is a common source of health impact data, especially for diseases like electromagnetic hypersensitivity (EHS) and sleep difficulties.
3) *Longitudinal Data:* Because cellphones have only recently become widely used, it is difficult to evaluate the long-term health impacts of exposure to RF radiation. To properly understand these implications, decades-long longitudinal research are required.

VII. CONCLUSION

The purpose of this study was to compare the radiation emissions from landline and smartphone phones and see how they affect cancer risk and other health issues.

A. *An Overview of the Main Ideas*

Because they have more sources of emissions and higher SAR values than landline telephones, smartphones are shown to emit much more radiofrequency radiation (RF radiation) than landline telephones.

Increased health hazards are linked to this increased exposure, including a slight increase in the risk of cancer, sleep difficulties, and possible cognitive impacts. Conversely, landline phones—especially corded ones—emit very little radiofrequency radiation and present very little health danger.

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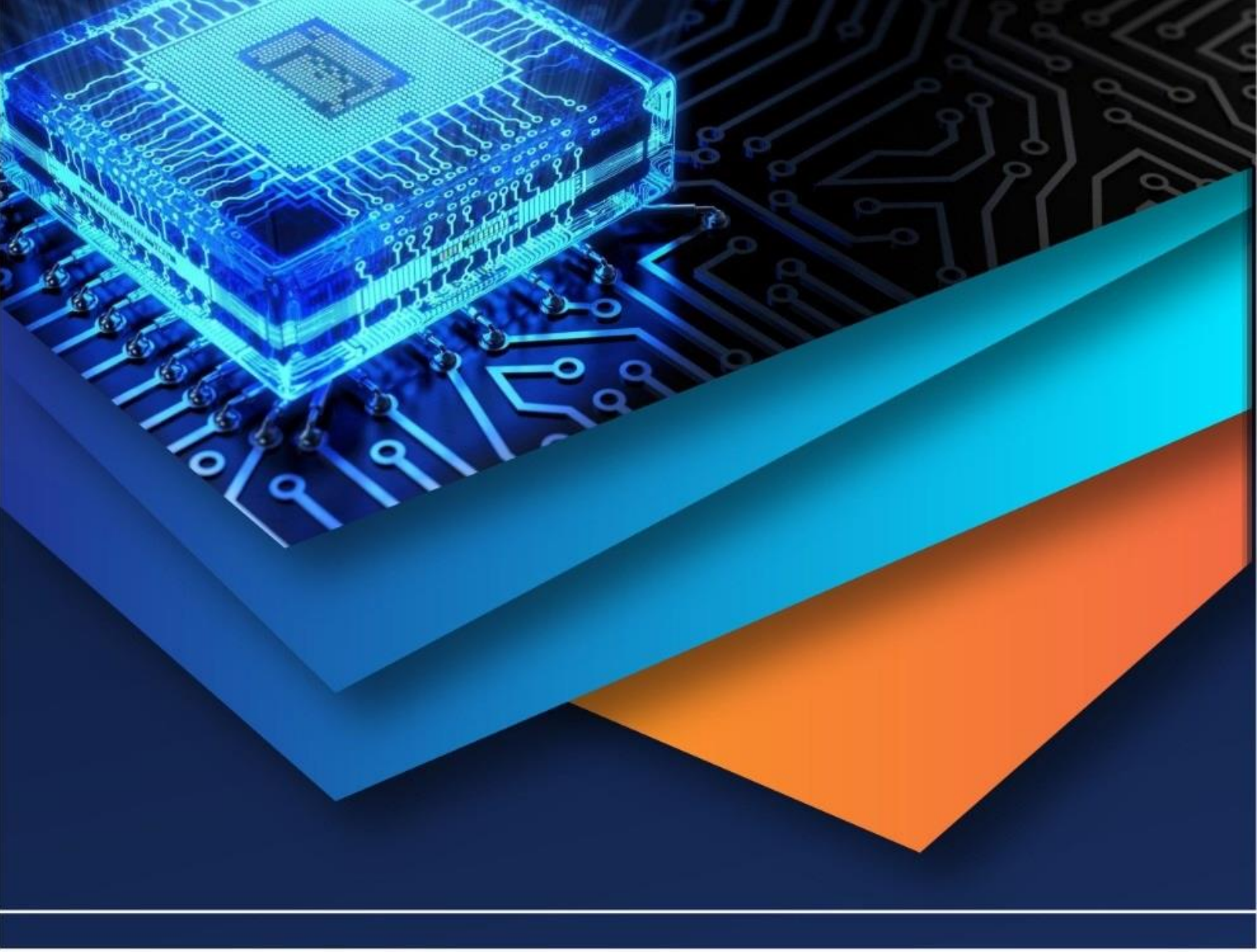
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