



Tiantong Project

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Why in News?

Recently, **Chinese engineers** and scientists have created the **world's first [satellite](#)** enabling **smartphones** to make calls without mobile towers.

- It is **aimed at [emergencies](#)** where mobile connectivity may be disrupted, people can directly seek help by connecting to an overhead communication orbiter.

What is the Tiantong Project?

▪ About:

- The **Tiantong satellite initiative** represents a **strategic response** to the evolving landscape of telecommunications, characterised by the **increasing demand** for connectivity, especially in remote and disaster-prone regions.
- Each Tiantong satellite is designed to have a **lifespan of 12 years**, and its antenna undergoes daily temperature changes of up to 160 degrees Celsius while simultaneously transmitting and receiving **electromagnetic waves** in 800 different frequency bands.
- The **first satellite** of the **Tiantong-1 series** was launched in August 2016, with the second and third satellites following in 2020 and 2021.
 - The three satellites form a network in a **geosynchronous orbit** at an altitude of 36,000km, covering the **entire Asia-Pacific region** from the Middle East to the Pacific Ocean.
- In September 2023, Huawei Technologies launched the **world's first smartphone supporting satellite calls**, connecting directly to Tiantong satellites, followed by similar models from other companies.
- Chinese consumers have embraced these products, with Huawei alone selling tens of millions of units, surpassing **SpaceX's Starlink satellite** service with over 2 million global customers.

▪ Need:

- The satellite concept arose following the 2008 **Sichuan earthquake**, where over 80,000 lives were lost due to communication breakdowns hindering rescue efforts.
- The Chinese government initiated the **Tiantong Project**, a **satellite communication system**, in response to the disaster, symbolising a commitment to enhancing communication resilience.

▪ Issues:

- Satellite communication with mobile phones is expected to become mainstream. However, experts argue that **challenges** may occur in its **implementation**.
- **Since the 1970s**, most commercial communication satellite networks operated by the US, Europe, and international organisations have faced **significant disruptions** because their **signals overlap** with the receiving frequency band.
- **A similar challenge** can occur in the case of the Tiantong Project. **For example**, to reach a small smartphone, the satellite must emit a powerful signal, but when many high-power signals flood the satellite's antenna simultaneously, they can **interfere, creating new signals**.

- These randomly occurring signals can **deteriorate satellite call quality** and, in severe instances, **lead to system failure**.
- This issue, known as **passive intermodulation (PIM)** among telecommunications engineers, has become a bottleneck for further development of satellite communication technology.
- There is currently **no universally effective technology** to suppress the occurrence of PIM.

▪ **Solutions:**

- To deal **with the issue of passive intermodulation (PIM)**, China's Tiantong Project has gathered communication technology elites from across the country.
- The scientist observed that different metal components in huge satellite antennas come into contact with each other, leading to the main source of PIM.
- Physicists explored **microscopic physical mechanisms** like **quantum tunnelling** and **thermal emission** at the contact interface, unveiling new physical laws for **silver-plated** and gold-plated microwave components.
- They've created a **physical model** for predicting PIM effects with **exceptional precision** across different contact states, pressures, temperatures, vibrations, and external factors.
- Scientists developed the **world's first universal PIM simulation software**, enabling the numerical analysis and evaluation of PIM generation in **complex microwave components** under external factors like electricity, heat, and stress with minimal error rates.
- Engineers have used this powerful software to develop effective PIM suppression techniques, including **dielectric isolation capacitors** and optimised mesh antenna wire preparation and weaving methods.
- It has enhanced the world's most sensitive PIM detection technology, capable of instantly pinpointing the source of weak PIM emissions, enabling satellites to receive signals from smartphones thousands of kilometers away.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims:

Q. With reference to the Indian Regional Navigation Satellite System (IRNSS), consider the following statements: (2018)

1. IRNSS has three satellites in geostationary and four satellites in geosynchronous orbits.
2. IRNSS covers entire India and about 5500 sq. km beyond its borders.
3. India will have its own satellite navigation system with full global coverage by the middle of 2019.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 1 and 2 only
- (c) 2 and 3 only
- (d) None

Ans: (a)