

CASE STUDY

5G IoT Connectivity by NR-Light



INTRODUCTION

This case study delves into the implementation, challenges, and advantages of 5G Internet of Things (IoT) connectivity using NR-Light technology. NR-Light, also referred to as New Radio Light, is an advanced technology that enables reliable and low-latency communication for IoT devices. We will explore a real-world scenario where NR-Light was deployed to enhance connectivity and facilitate advanced IoT applications.

The Demand for 5G IoT Connectivity

The demand for 5G IoT connectivity is essential in facilitating machine communications and supporting a wide array of IoT applications within connected industries. While the current focus of 5G IoT has primarily centred around low-complexity and high-performance devices, there is an evident need to cater to mid-tier devices, including wearables, health monitors, vehicle trackers, and industrial sensors.

Developing 5G-Native IoT Solutions

To effectively address this demand on a large scale and for a sustainable duration, it is imperative to develop a new category of 5G-native IoT solutions.



Challenges in Implementation

Despite the potential benefits, the implementation of 5G IoT connectivity using NR-Light poses certain challenges:

01 Infrastructure Deployment

Establishing a 5G NR-Light network infrastructure requires strategic positioning of mmWave base stations throughout the city, presenting logistical and cost challenges.

Solution: A meticulous planning process and collaboration with local authorities can help overcome logistical challenges. Strategic deployment plans considering optimal coverage and cost-effectiveness should be devised.

02 Device Integration

Integrating existing IoT devices with the NR-Light network involves upgrading devices to support 5G connectivity, which may pose compatibility and cost challenges.

Solution: Develop comprehensive upgrade strategies, including firmware updates and hardware enhancements. Collaboration with device manufacturers to ensure compatibility and cost-effective upgrades is essential.

03 Security Concerns

Protecting the IoT network from potential cyber threats demands robust security measures, raising concerns about data privacy and scalability.

Solution: Implement advanced encryption protocols, multi-factor authentication, and regular security audits. Establish scalable security frameworks to adapt to the growing network and evolving cyber threats.

Advantages of NR-Light for Mid-Tier Devices

Mid-tier IoT devices currently heavily rely on LTE Cat-1 and LTE Cat-4 devices, posing limitations in terms of data transfer rates, communication delays, and power consumption. The emergence of 5G NR-Light introduces an elevated level of capability, efficiency, and flexibility.

Key Advantages of NR-Light

NR-Light offers numerous advantages for such devices, encompassing superior data transfer rates, reduced communication delays, prolonged battery life, enhanced network security, and an optimised cost structure.

Transition from 4G to 5G

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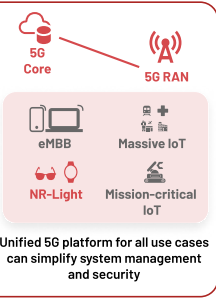
NR-Light Technology Overview

NR-Light, also known as RedCap (reduced capability), is the industry solution for mid-tier 5G IoT connectivity. It bridges the gap in capabilities and complexity between high and low-performance IoT devices available in the current 5G landscape.

NR-Light Introduction

NR-Light, introduced in 3GPP Release 17, aims to reduce the complexity and cost of 5G devices, minimize power consumption, and maintain data speeds comparable to LTE Cat-1. While it offers significant cost reductions, power savings of over 90%, and adequate data speeds.

	LTE Cat-1bis	LTE Cat-4	5G NR-Light (Rel-17)
Bandwidth	20 MHz	20 MHz	20 MHz (sub-7 GHz)
Peak data rate DL/UL	10/5 Mbps	150/50 Mbps	150/50 Mbps or higher
Duplexing	FD-FDD,TDD	FD-FDD,TDD	HD-FDD,FD-FDD,TDD
Tx/Rx chain	1Tx, 1Rx	1Tx, 2 Rx	1 or 2 Tx, 1 or 2 Rx
MIMO layers DL/UL	1/1	2/1	1 or 2/1
Maximum coupling loss	140 dB	144 dB	140 dB



Patent Publications

Some patent publications like US20230035261A1, US20220400511A1, etc. enlighten the NR-Light concept for IoT devices.



Smart City Infrastructure Implementation

The case study involves examining how a smart city infrastructure provider overcame the connectivity challenges by implementing 5G IoT connectivity with NR-Light technology.

Implementation Process

- 01 The infrastructure provider deployed a 5G NR-Light network infrastructure, including strategic positioning of mmWave base stations throughout the city to ensure optimal coverage and connectivity.
- 02 Integrating existing IoT devices with the NR-Light network involved upgrading devices to support 5G connectivity and configuring them to communicate efficiently with the network.
- 03 To protect the IoT network from potential cyber threats, the infrastructure provider implemented robust security measures, ensuring the scalability of the network to accommodate future growth and increasing device density.

Benefits of 5G IoT Connectivity with NR-Light

The implementation of 5G IoT connectivity with NR-Light technology yielded several significant benefits:

► High Bandwidth

NR-Light's utilisation of the mmWave spectrum provided considerably higher bandwidth compared to traditional IoT connectivity solutions, facilitating the seamless transmission of large amounts of data generated by IoT devices.

► Low Latency

NR-Light's ultra-low latency capability enabled real-time communication between IoT devices and the central management system, resulting in near-instantaneous responses and enhancing the efficiency of IoT applications.

► Reliability

NR-Light's reliability ensured consistent connectivity for IoT devices, minimizing downtime and optimizing the overall performance of the network.

► Enhanced IoT Applications

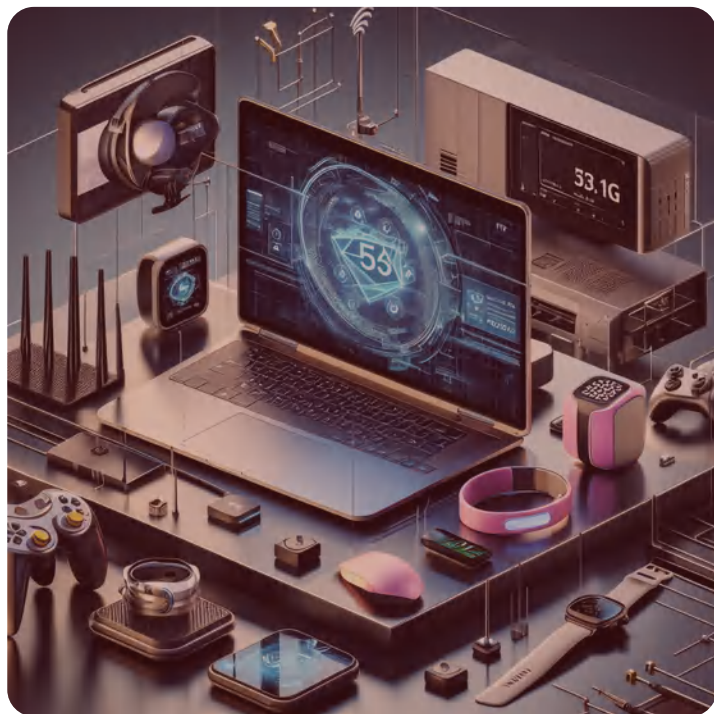
5G IoT connectivity using NR-Light allowed the infrastructure provider to leverage advanced IoT applications such as real-time monitoring and control of smart city infrastructure, predictive maintenance, and improved data.

Qualcomm's Contribution

In addition to the above, one of the major players "Qualcomm" is currently in the process of enhancing its Snapdragon chipsets to cater to the next generation of 5G devices.

Snapdragon X35 - World's First 5G NR-Light Modem

One significant addition is the "Snapdragon X35", the world's first 5G NR-Light modem, which offers a cost-effective design with optimized power efficiency, thermal performance, and a reduced footprint. It is specifically designed for a new wave of 5G devices like smartwatches, XR glasses, health monitors, surveillance cameras, and fixed wireless customer premises equipment (CPEs).



Advanced Technologies in Snapdragon X35

The Snapdragon X35 5G Modem-RF System incorporates advanced modem-RF technologies that significantly reduce power consumption, enhance 5G coverage, lower latency, improve battery life, and increase uplink speeds.

Cost-Effective Solution

By offering a cost-effective solution and bridging the gap between extreme 5G capabilities, the Snapdragon X35 provides a device platform suitable for mid-tier use cases. It provides a long-term migration path for replacing LTE CAT4+ devices, ultimately promoting the adoption of 5G and facilitating a faster transition to a unified 5G network.



Future Outlook

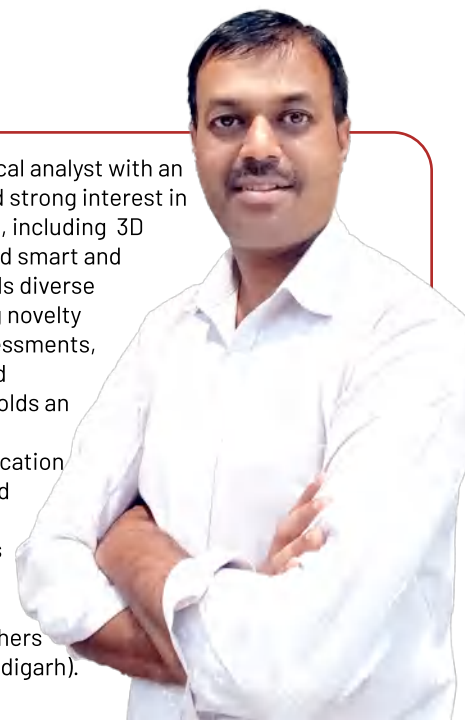
Moving forward, we will remain vigilant in monitoring the advancements in technology and patent documents in this emerging field. As the applications of this technology gain more traction in the consumer market, we will closely observe its progress. This captivating technology domain is poised for further evolution in the future.

Fact

Ericsson highlighted that the 3GPP Release 17 work on the support for reduced capability NR devices is an important step to further expand the addressable market of 5G NR. "Some of the wearable and video surveillance use cases are currently addressed by LTE-based solutions. NR RedCap offers a path for migrating from LTE to NR for these use cases. Such a migration path is important as it can accelerate the spectrum re-farming from LTE to NR a number of years down the path.

Expert

Pardeep is a skilled technical analyst with an experience of 7 + years and strong interest in cutting-edge technologies, including 3D Printing, IoT, 3G/4G/5G, and smart and power electronics. He leads diverse IP projects, encompassing novelty searches, invalidation assessments, infringement analyses, and technology scouting. He holds an engineering degree in Electronics and Communication from the Swami Parmanand College of Engineering and Technology (Punjab), and is also pursuing Master of Engineering from National Institute of Technical Teachers Training & Research, (Chandigarh).



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