



MEDIATEK

5G-Adv. NTN Technology for Direct Satellite Access

- from Smart Phone to Automotive

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2025 R&S Mobile Test Summit
Satcom 2.0: Navigating the NTN Landscape

Satellite and Terrestrial Network Convergence

- Terrestrial network covers **>60% population**, but **<40% landmass**.
 - Still lack of broadband coverage in remote area
 - 4G/5G network deployment mostly based on human distribution
- Terrestrial + Satellite networks can offer **truly ubiquitous coverage** around the world
 - Cellular: urban + indoor
 - Satellite: rural + outdoor
- **Smart phone** as key to connect mobile and satellite ecosystems
 - Bring satellite services into consumer market
 - Enable “**smart phone direct access to satellite**” as key challenge



“Coverage” as Key KPI for 6G System Design

Technical Challenges – from Satellite System Perspective

- Propagation Loss

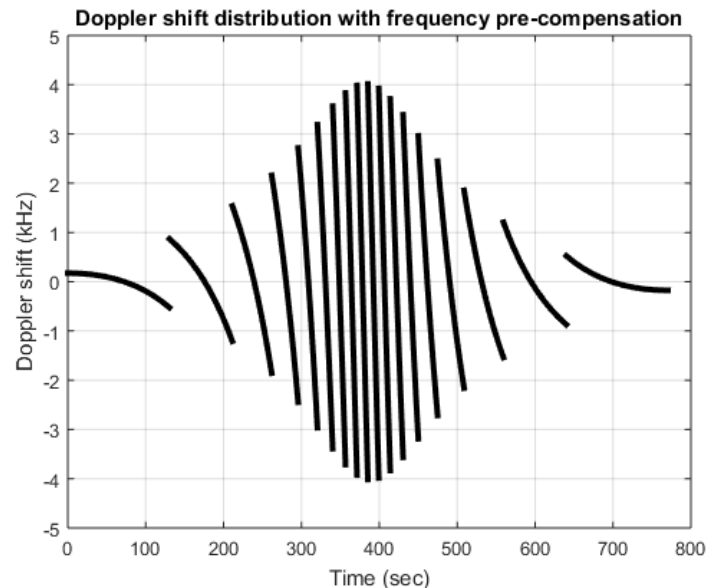
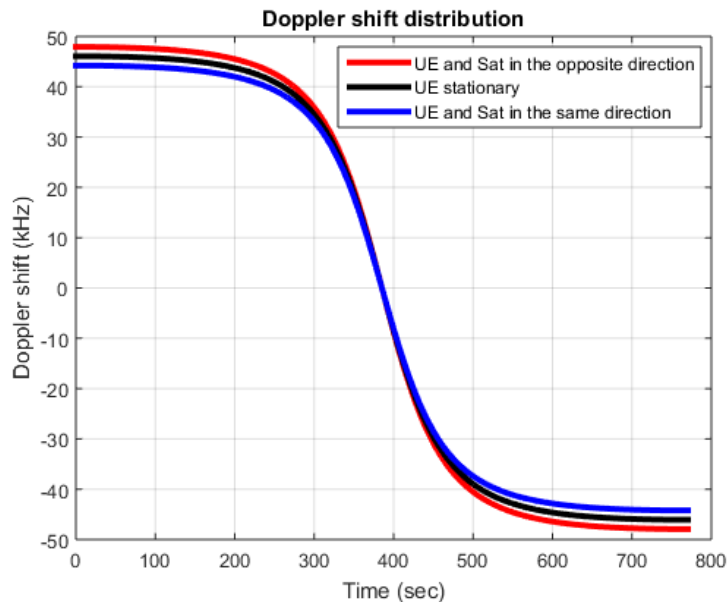
- Example link budget - 3GPP TR38.821 Set-1 satellite parameters [1]

S-band (i.e. 2GHz)	LEO		GEO	
Altitude	600 km		35786 km	
Elevation Angle θ	30 degrees		10 degrees	
$d(\theta)$	1075 km		40581	
Access Link Direction	DL	UL	DL	UL
DL EIRP Density [dBW/Hz]	34	-	59	-
Satellite Tx/Rx max. Gain [dBi]	51	51	30	30
G/T [dB/K]	-	1.1	-	19
3GPP IoT NTN				
Bandwidth [MHz]	0.18	0.18	0.18	0.083
CNR [dB]	6.5	2.7	2.5	5.4
3GPP NR NTN				
Bandwidth [MHz]	10	0.36	10	0.36
CNR	5.1	2.7	0.0	-10.9

Technical Challenges – from Satellite System Perspective

- Doppler Effect

- Example LEO w 600km altitude and moving UE w 1,000km/hr [2]



[Example pre-compensation for Earth-Moving Beam Satellite]

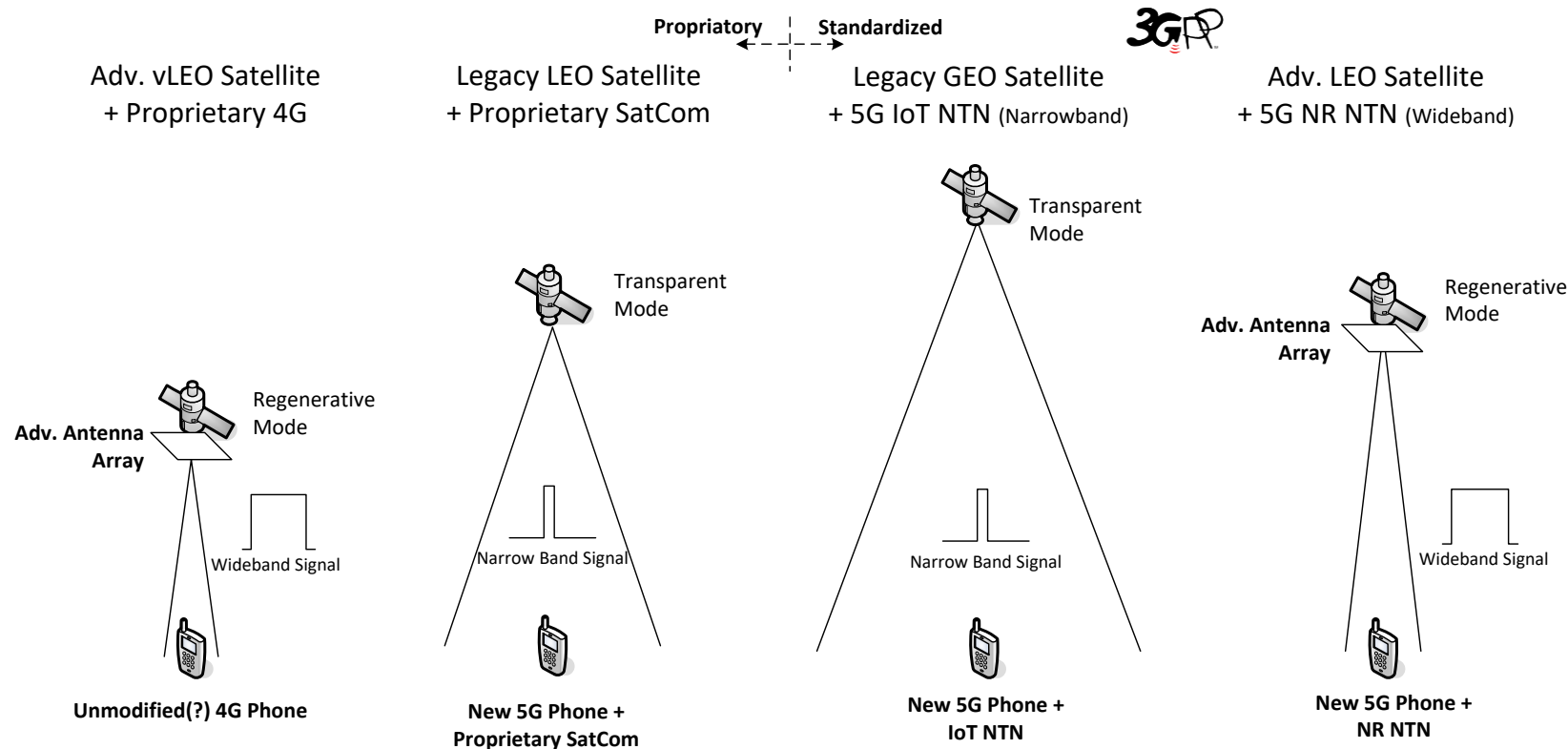
Technical Challenges – from Satellite System Perspective

- **Propagation Delay**

- **Dependent to satellite altitude [3]**

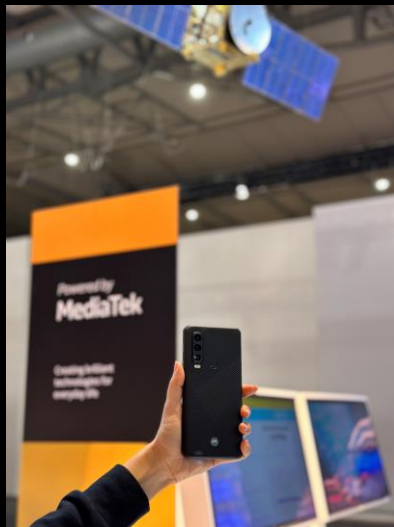
		LEO 600km		GEO 35786km	
Elevation angle	Path	Distance (km)	Delay (ms)	Distance (km)	Delay (ms)
UE: 10°	SAT-UE	1932.24	6,440	40586	135.286
UE: 90°	SAT-UE	600	2	35786	119.286
GW: 5°	SAT-GW	2329.01	7.763	41126.6	137.088
<i>Bent pipe satellite (transparent)</i>					
One-way delay	GW-UE	4261.2	14.204	81712.6	272.375
Round-trip delay	Twice	8522.5	28.408	163425.3	544.751
<i>Regenerative satellite (UE: 10°)</i>					
One-way delay	SAT-UE	1932.24	6.44	40586	135.286
Round-trip delay	SAT-UE-SAT	3864.48	12.88	81172	270.572

Smart Phone Direct Access to Satellite – Tech. Options



World's 1st 5G NTN Smart Phone

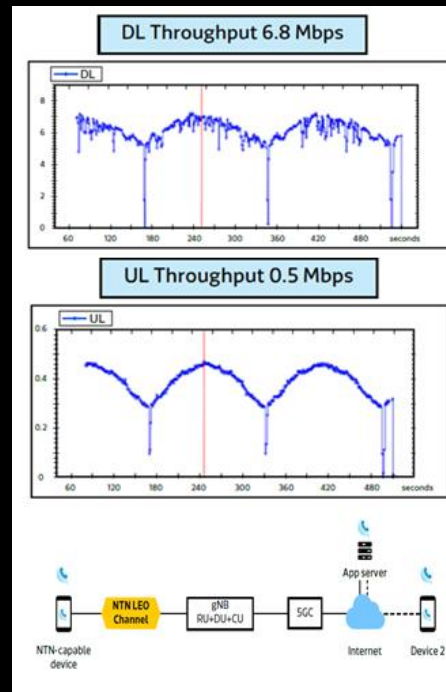
3GPP Rel-17 IoT NTN (Narrowband)



GSMA 2023 Global Mobile Awards in MWC

R17 IOT NTN	
WAVEFORM	NB IoT
BANDWIDTH	200KHz
FREQUENCY BAND	L-Band (255)/S-Band (256)
DATA RATE	~Kbps

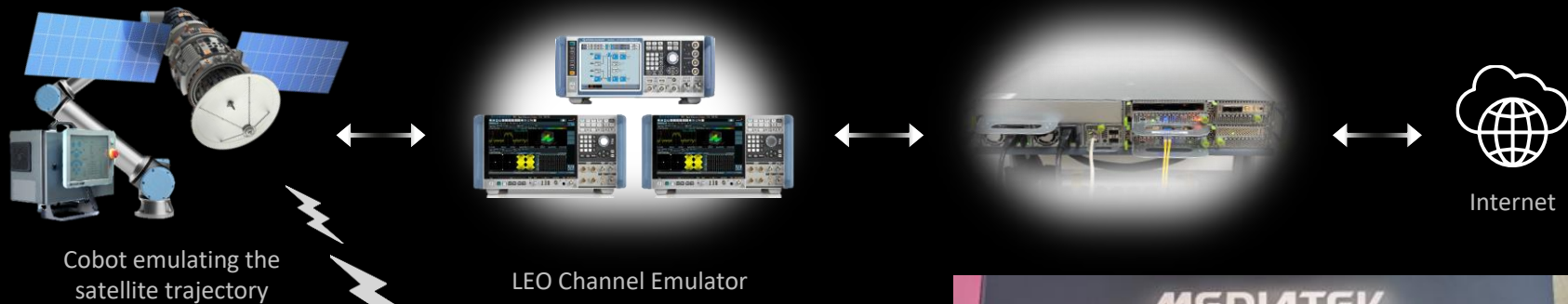
3GPP Rel-17 NR NTN (Wideband)



MediaTek Conduct World's First Public Test of 5G Satellite IoT Data Connection with Inmarsat, Aug 19, 2020
<https://corp.mediatek.com/news-events/press-releases/mediatek-conduct-worlds-first-public-test-of-5g-satellite-iot-data-connection-with-inmarsat>

World's 1st 5G NTN Broadband for Automotive

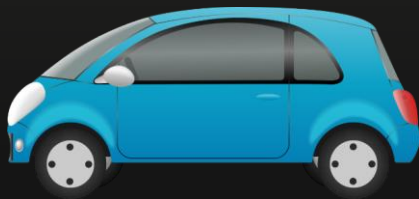
Pre 3GPP Rel-19 Ku-band NR NTN



DL Streaming
over Satellite
Broadband

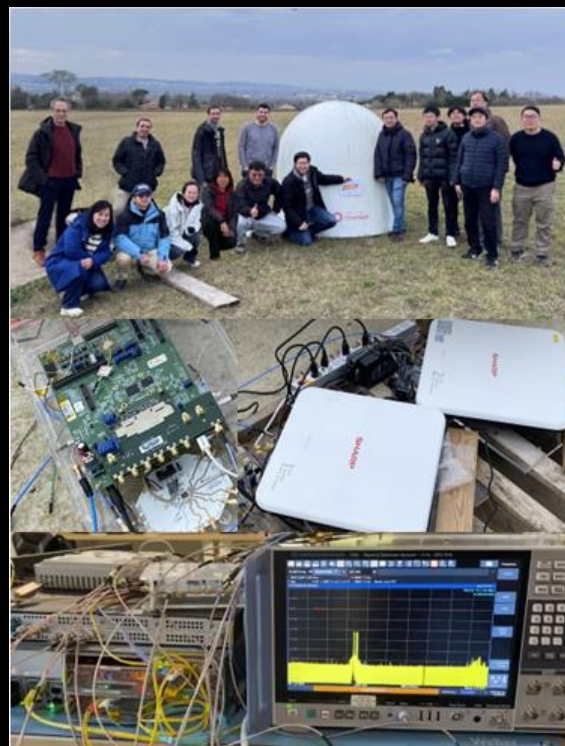
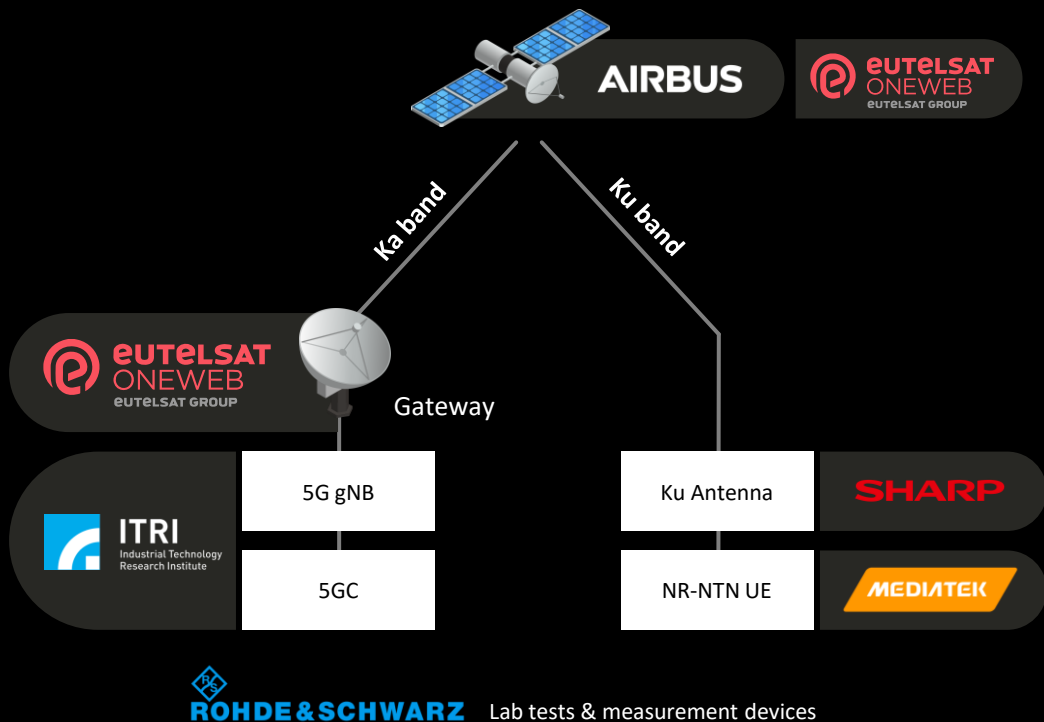


MediaTek 5G-Adv NTN
platform integrated
onto a vehicle

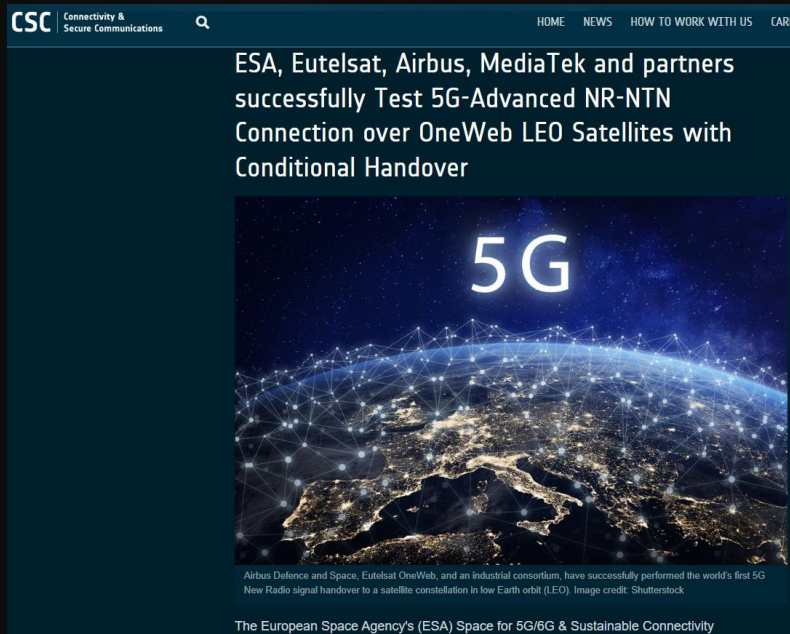


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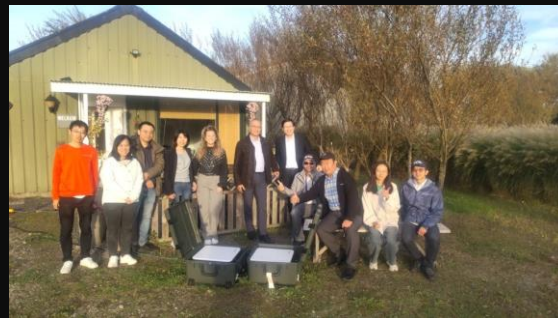
World's 1st 5G NR-NTN Live Connection Success over In-Orbit Commercial LEO Satellites



World's 1st Rel-19 5G-Adv. NR-NTN Live Connection Success over In-Orbit Commercial LEO Satellites



<https://connectivity.esa.int/news/esa-eutelsat-airbus-mediatek-and-partners-successfully-test-5gadvanced-nrntn-connection-over-oneweb-leo-satellites-conditional-handover>



Source: ESA

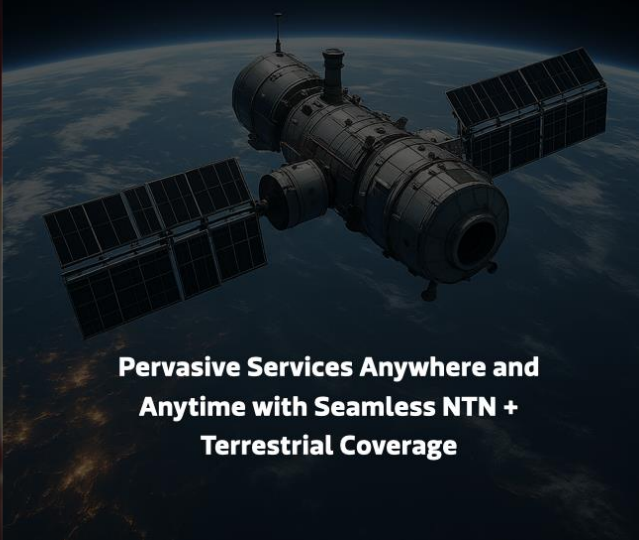


**Sustainable, Ultra-Low Energy Consumption
with Optimized End-to-End and TCO**



Advancing Towards 6G

**Intelligence-Driven User Experience
Powered by Edge Cloud, Hybrid Compute
& Distributed DoE**



**Pervasive Services Anywhere and
Anytime with Seamless NTN +
Terrestrial Coverage**

Paradigm shift of mobile industry

