



WAVE-by-AGC
Glass solutions to master
building Connectivity
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WAVE – by AGC Glass Europe



WAVETHRU

AGC: business overview



ARCHITECTURAL GLASS 24% of sales (¥ 476 bn)

- External glass
- Decorative glass
- Glass for high tech applications



AUTOMOTIVE 25% of sales (¥ 500 bn)

- Original Equipment Manufacturer (OEM)
- Automotive Replacement Glass (ARG)



ELECTRONICS 16% of sales (¥ 313 bn)

- Display
(LCD and OLED glass substrates)
- Electronic materials

Net Sales in FY 2023 ¥ 2,019 billion (bn)

CHEMICALS 28% of sales (¥ 660 bn)

- Fluorochemicals & specialty chemicals
- Chlor-alkali & urethane



LIFE SCIENCE 6% of sales (¥ 142 bn)

- Synthetic pharmaceuticals, agrochemicals and biopharmaceuticals



(*) Ceramic 4% / Other : -3%

AGC Group at a glance



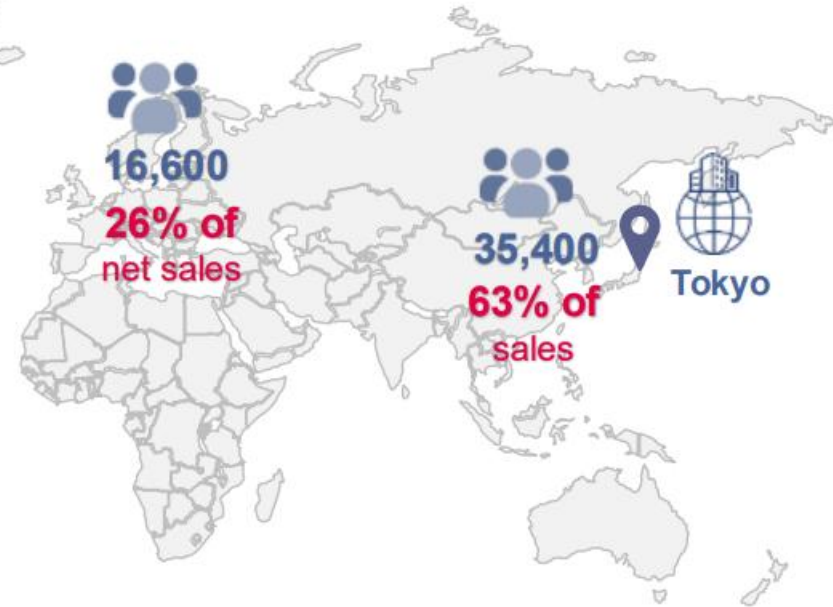
5 businesses

- ARCHITECTURAL GLASS
- AUTOMOTIVE
- ELECTRONICS
- CHEMICALS
- LIFE SCIENCE

AMERICAS



EUROPE



JAPAN - ASIA



201 companies in
30 countries



€ 13.3 billion
Net sales



€ 847 million
Operating profit

2 AGC start-ups to address connectivity challenges

Building / Architectural Glass



Automotive and transportation



Waves-by-AGC tackles 3 challenges

Challenge 1:

Facilitate indoor connectivity



Techno: 2G /3G / 4G / 5G /Tetra / GPS/ C-band/ FR3 band/ FWA / 5G mmwaves

Challenge 2:

Protect against radio waves/
ensure privacy/shielding



Techno: radio signal from 100MHz to 30GHz

Challenge 3 :

Ease densification of mobile network
inside and outside building



Techno: 5G Private, WIFI, 5G SA

Wave-by-AGC : what we sell ?

Created in 2018, Wave-by-AGC provides innovative glass solutions to control the connectivity aesthetically in and around buildings keeping energy insulation, comfort, safety or any other functions provided by glazed façade

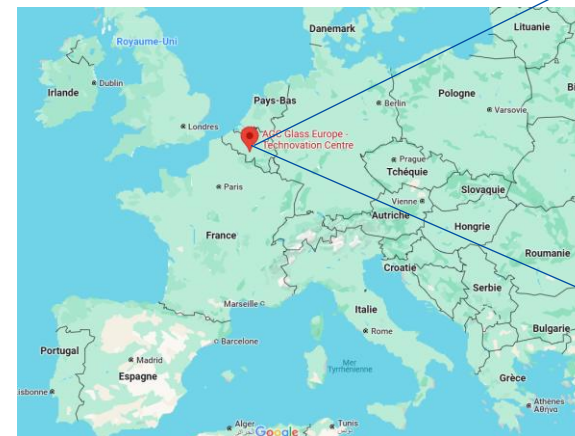
- Products

- WAVETRAP : **GLASS** to protect against unwanted radio waves
- GLASSANTENNA : Transparent **GLASS** antennas to densify mobile network outside and inside building

- Services

- WAVETHRU : On site **GLASS** treatment to make buildings transparent to radio waves
- WAVEMETER: Radio audit (light and advanced) to assess connectivity indoor /outdoor

Our brands :





WAVETHRU

On-site **GLASS** treatment to make buildings transparent to radio waves



Building facade materials have a strong impact on phone signal reception

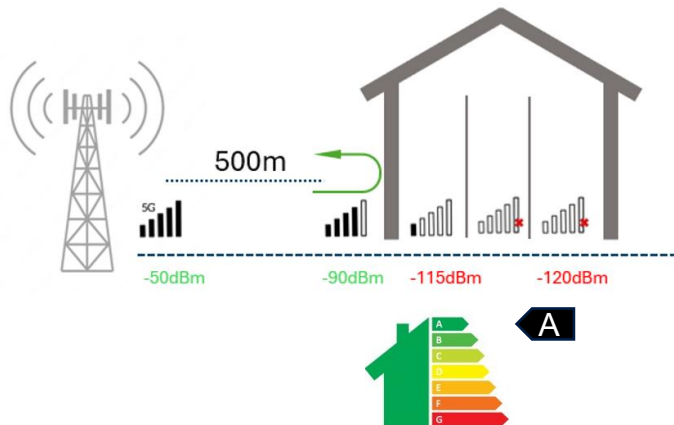
In new buildings, metallic materials are increasingly used in the walls and windows to ensure high energetical performance but these materials block the phone signals



- Modern building >2000**
- Class A (well insulated)
 - Energy efficient glazing
 - Insulated walls
 - Reinforced concrete



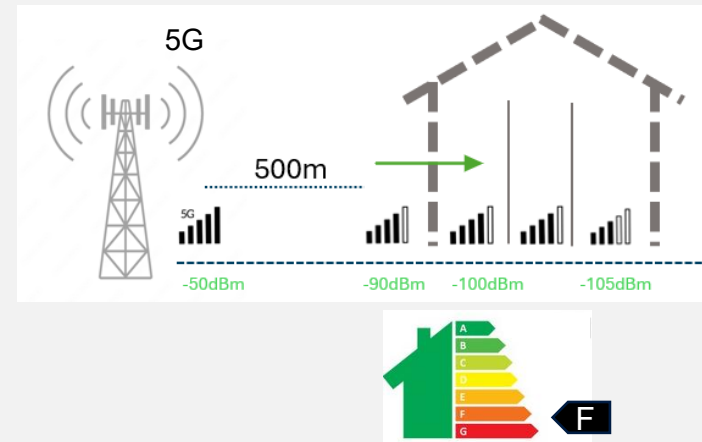
Strong signal reduction
Poor indoor coverage



- Old building <2000**
- Class F (energy leakage)
 - Glazing not insulated
 - Poorly insulated walls

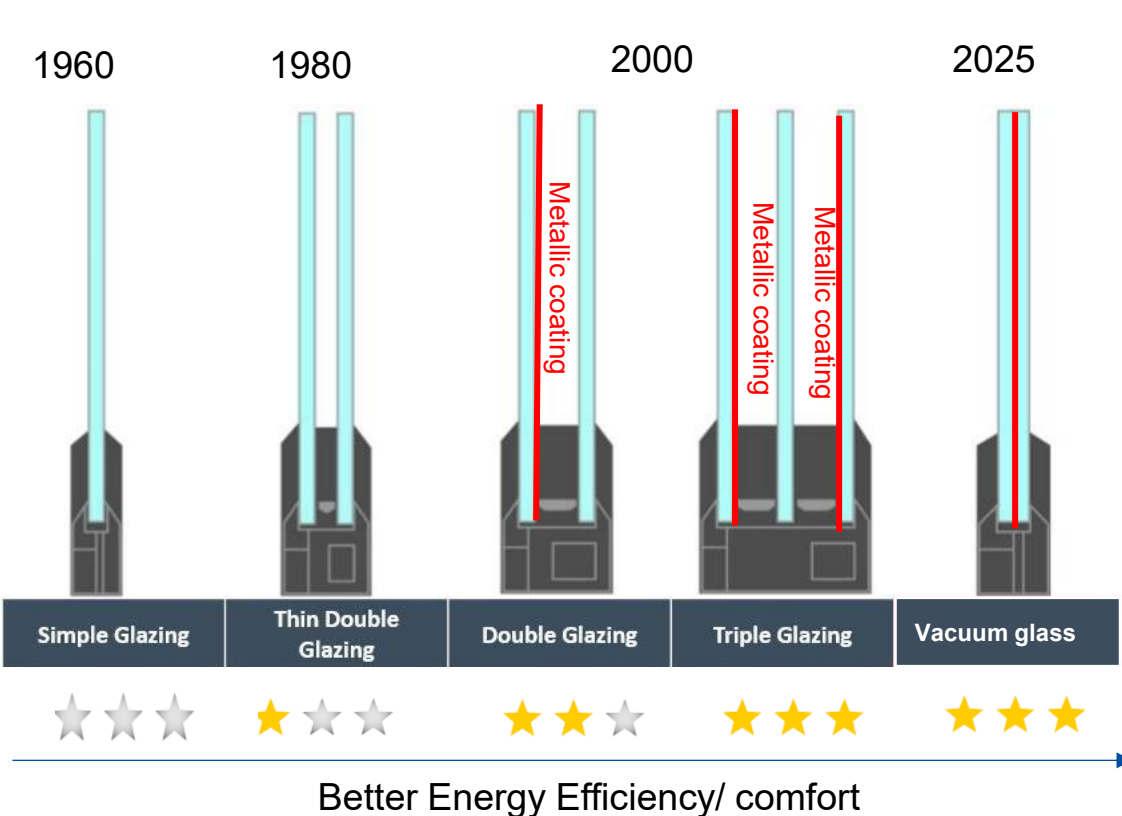


Low signal reduction
Good phone signal inside
but low thermal comfort

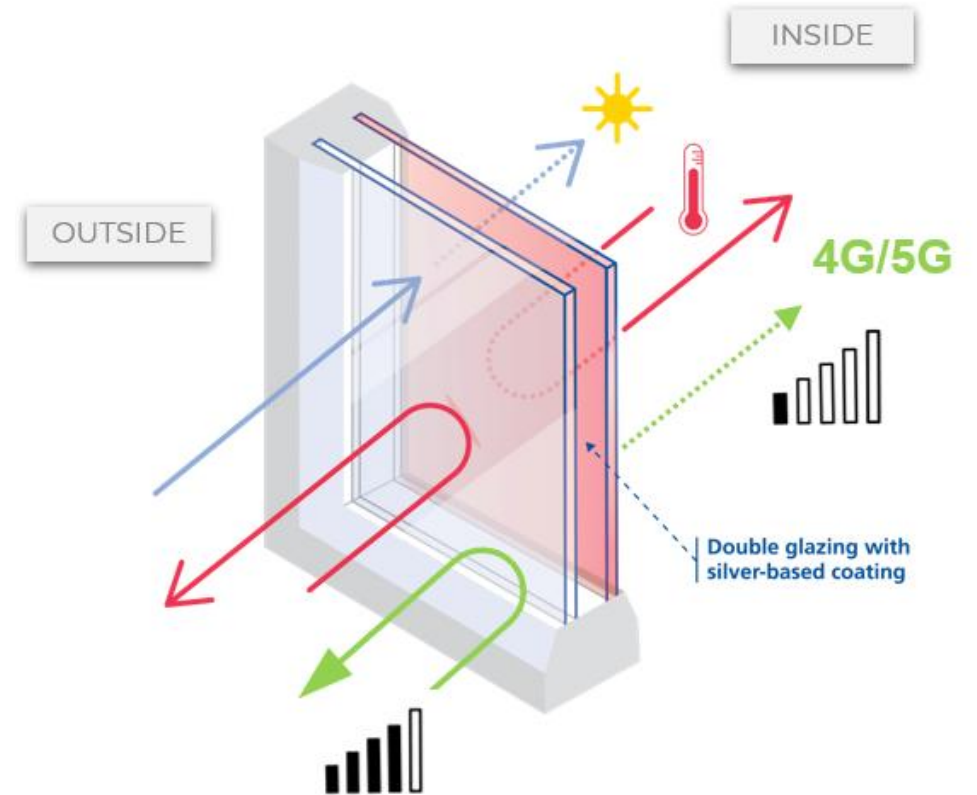


High-performance glazing blocks the mobile phone signal

Since the 2000s, most glazing on the market contains one or more invisible silver coatings to achieve high thermal performance.

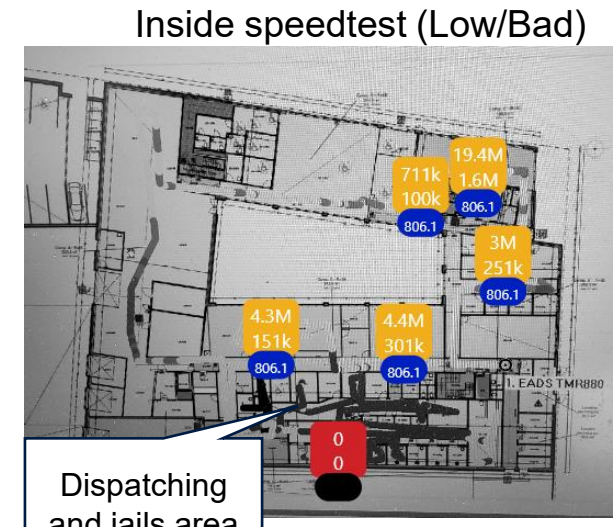
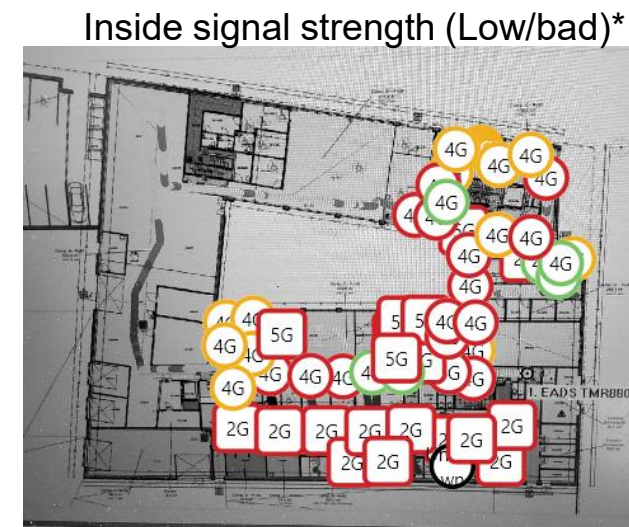
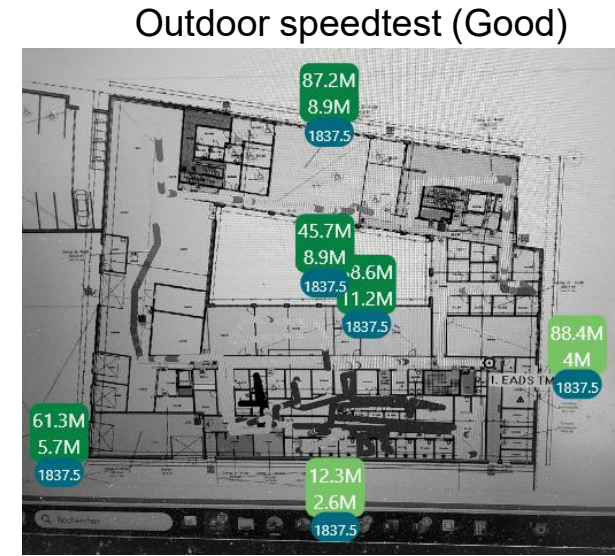
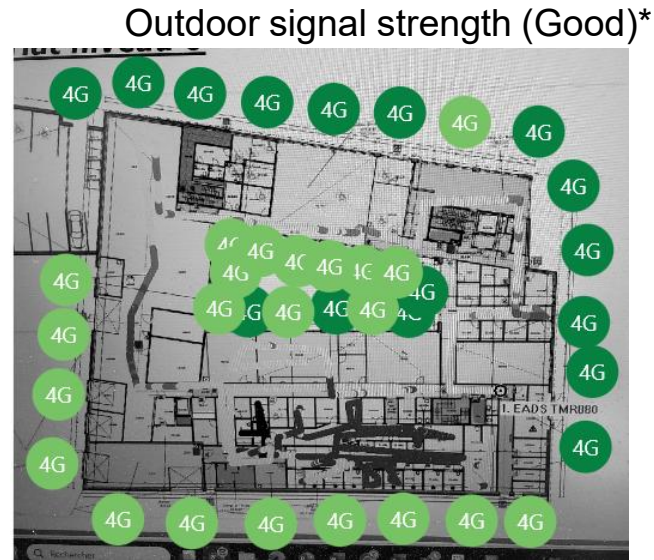


When a coating is present, less than 1% of the radio signal is transmitted.



Example : New police station at Mouscron with poor indoor

Perfect ●
 Good ●
 Acceptable ●
 Bad ●



Building

- Double glazing with 1 silver coating
- Well insulated
- High Façade attenuation around 24dB to 35B

Radio outdoor

- Good outdoor signal delivered at 800Mhz and 1800Mhz
- Successful speedtest

Radio inside

- Weak signal for all MNO especially in the dispatching and jails corridor
- Speedtests give poor results, or not possible

Problem for police officers to be reachable, safety issue

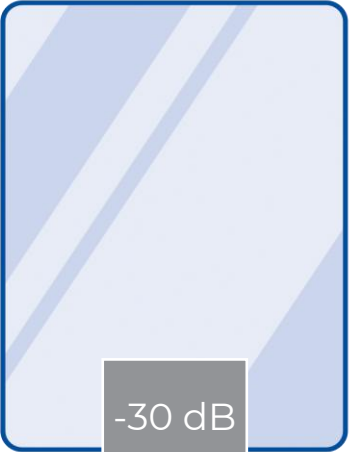


*Coverage for Floor 0 -Proximus

WAVETHRU onsite treatment improves the transmission of mobile phone signal through the glazing without loss of performance.



Energy efficient double glazing

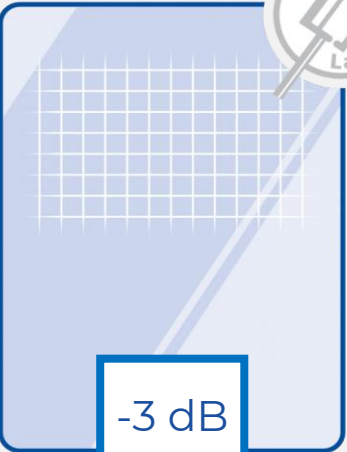


Signal
X300



Up to +25 dB
Better radio transmission

WAVETHRU
WAVETHRU surface treatment



Mobile Radio Loss

-30 dB

-3 dB

Light transmission

72

72

Solar factor

38

38

U-value (Insulation)

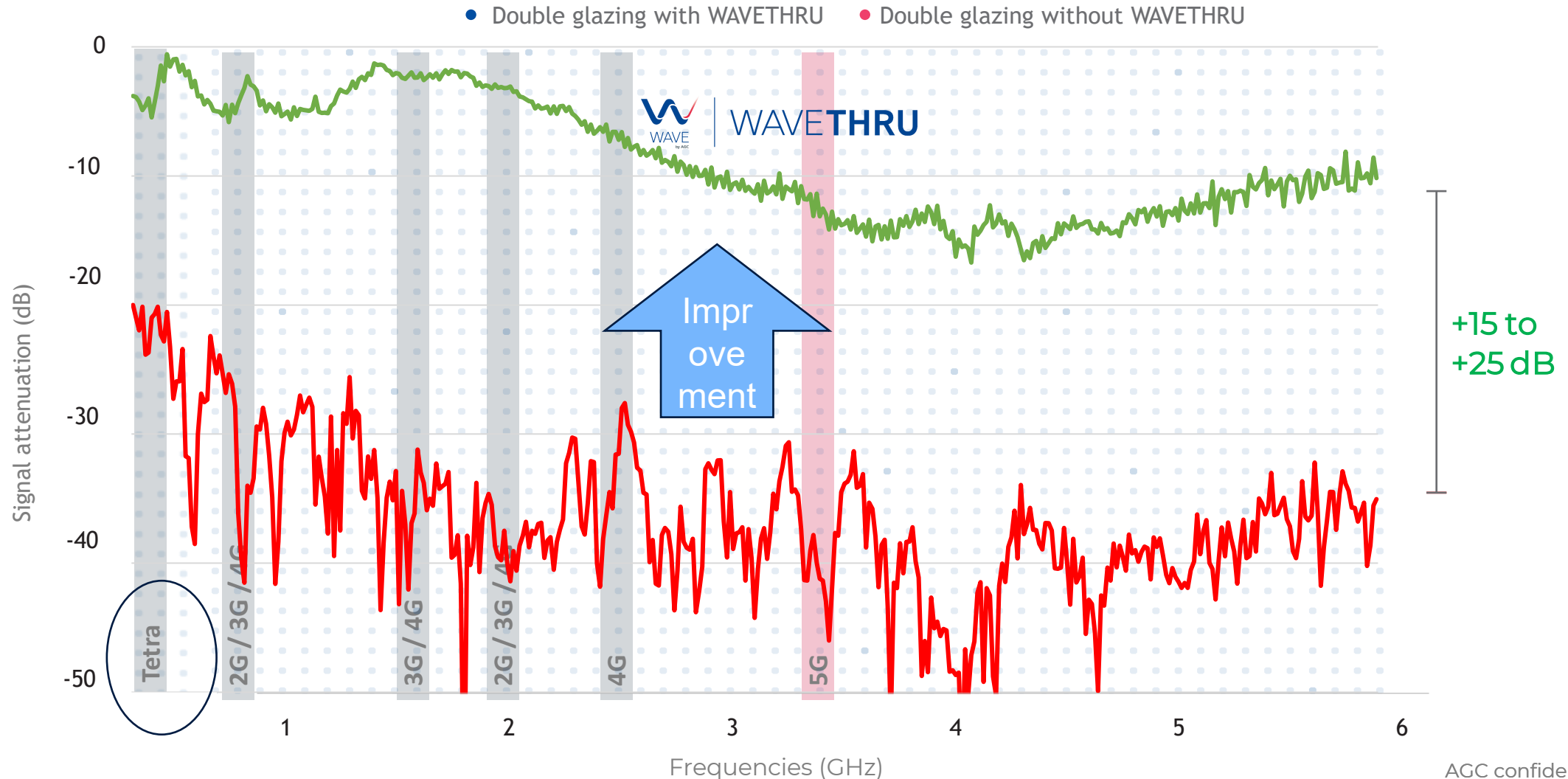
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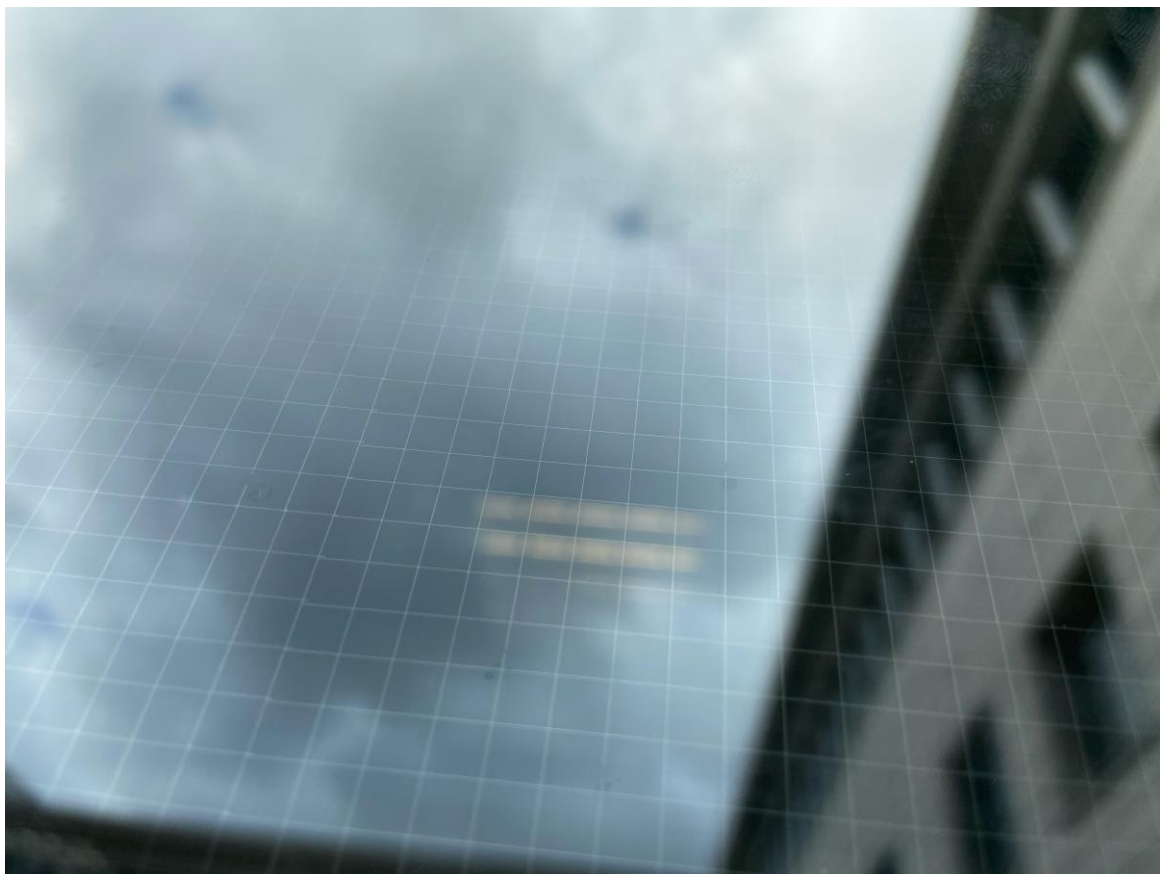


Multi-operator | multi-frequencies | 5G-ready

WAVETHRU treatment enables to recover **same radio behavior as double clear glass**



Not visible at 1 meter from window



Easy glass treatment on site



OUTDOOR SIGNAL DIAGNOSTIC

Available network outside



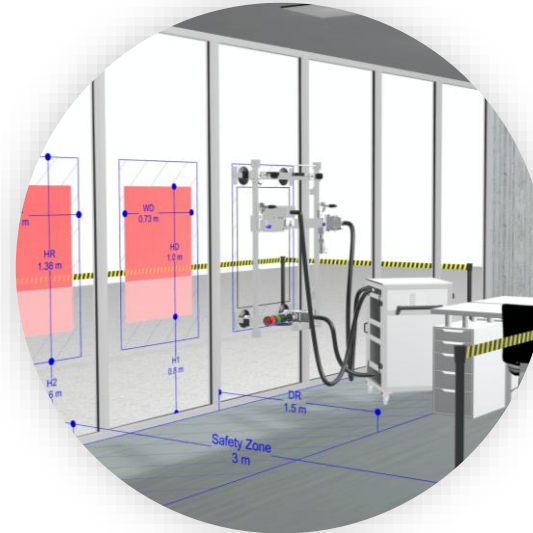
FULL INDOOR DIAGNOSTIC

Floor plans analysis
Radio signal measurement



WORK AREA PREPARATION

Space to walk around
Access to windows from indoor



ON-SITE TREATMENT

Access to offices
during work hours



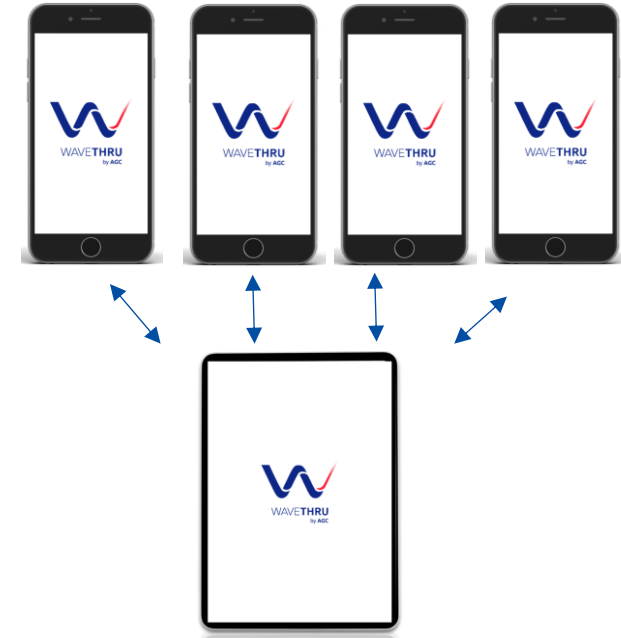
⊘ No material installed

⊘ No dust

⊘ No cabling

⊘ No maintenance

WAVETHRU tools: Glass treatment + radio measurement



A/ Measure radio KPIs

- 1 phone per MNO
- 2G/3G/4G/5G
- Strength/Quality/PCI/ Frequency
- Call and speedtest
- Direct result visualization

B/ Follows WAVETHRU operation

WAVETHRU benefits in a nutshell



BETTER INDOOR coverage

- Improved quality of service indoor
- Multi-frequencies
- 5G future proof
- Multi-operators
- Less congestion



PASSIVE SOLUTION

- No need for heavy installations (DAS systems)
- No maintenance
- Cheaper than active system



EASY and FAST INSTALL

- Application on all windows (AGC and competitors)
- Treatment performed on any glass (double/triple)
- Network audit included



PRESERVED AESTHETICS

- Invisible to building occupants
- Does not affect the glass insulation or thermal performances
- Sustainable Solution



PRESERVED EFFICIENCY

- Does not affect the glass insulation/ thermal performances/ solar factor
- Certified by independent company



BETTER FOR END-USERS

- Better radio signal means lower power emitting handset and longer battery life
- Higher building value

NOT SUITABLE FOR ALL SITUATIONS :

- Deep indoor coverage (>15meters) / Underground / High capacity needs
- Prerequisites: good outdoor coverage (signal >-95dBm) + enough window area on the facade

Who are the WAVETHRU customers ?

>>Customer that have a **compelling event** to solve connectivity issues



Public place/emergency center:

Ensure the presence of mandatory emergency networks for buildings welcoming the public, improve TETRA network

Elderly care/hospital:

Ensure the proper functioning of the alarm system for the occupants (E-Health), reduce DAS cost, ensure mobile payment

Coworking:

Offer multi-operator connectivity to occupants, retain customers



Offices:

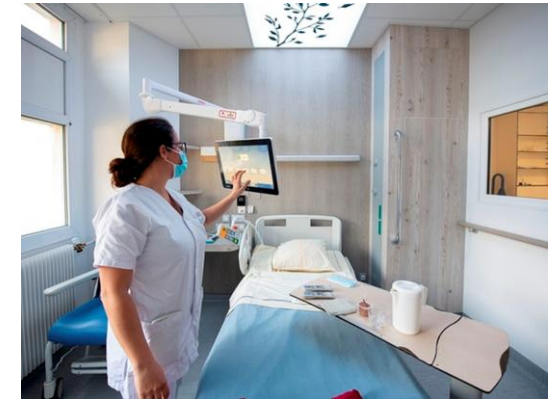
Improve the quality of calls for employees, freelancers, lawyers (multi-operators), multioperation coverage, Mobile authentication

Bank agencies:

Offer good connectivity to customers during their appointment, allow the use of mobile applications imposed by the corporate

Retail:

Allow mobile payment at the checkout via mobile



Case 1 : CSC Building (Private Banking) - 2025

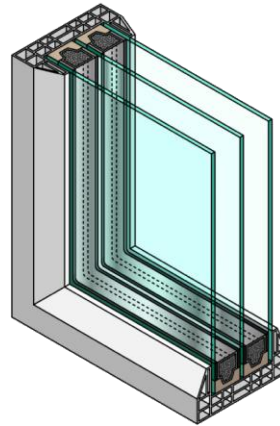
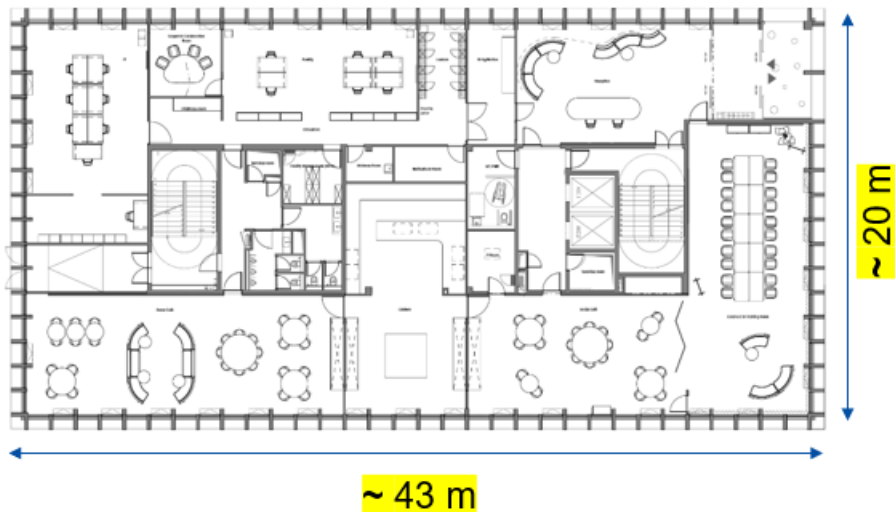


Initial situation

- No possibility to make calls inside the building despite a very good outside network

Solution

- 9% of façade surface treated with Wavethru
- All floors treated
- Glazing performance are maintained



CSC building

- Triple glazing – double silver coating
- 7 floors
- 6000m² total floor surface

Case 1 : CSC Building – Signal strength improvement

BEFORE



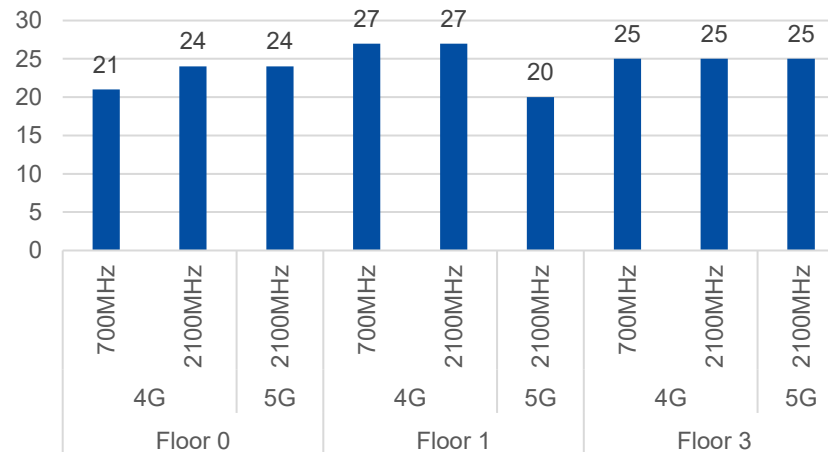
RSRP – 4G – POST

WAVE | WAVETHRU
AFTER



RSRP – 4G – POST

WT improvement in dB



IBflex®
In-Building and Outdoor Network Testing
Scanning Receiver | 10 MHz – 6 GHz



Measurement performed with scanner

AFTER treatment

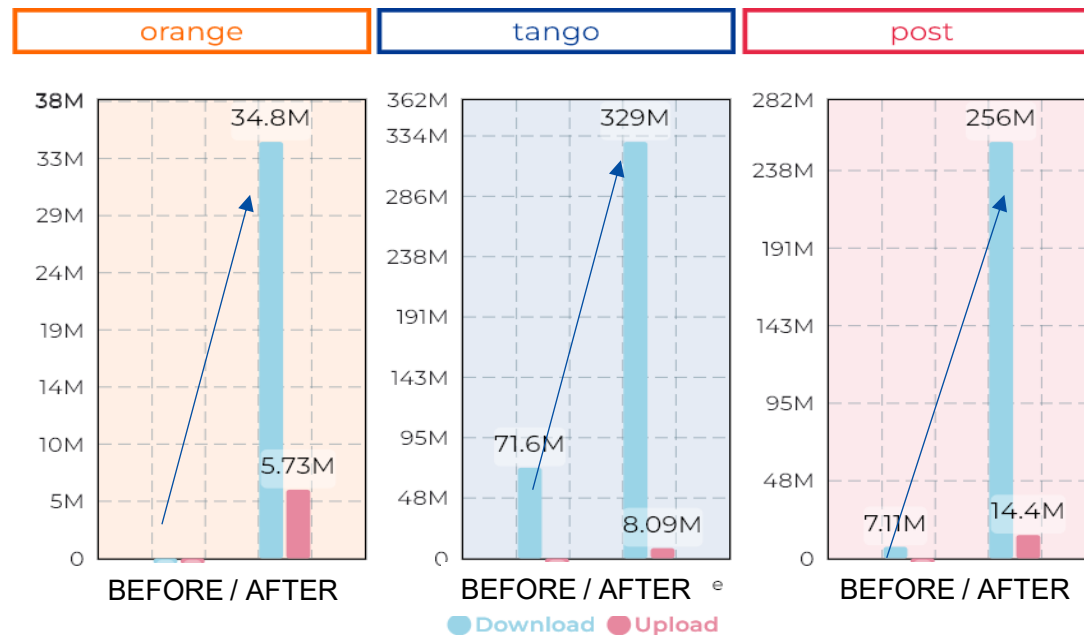
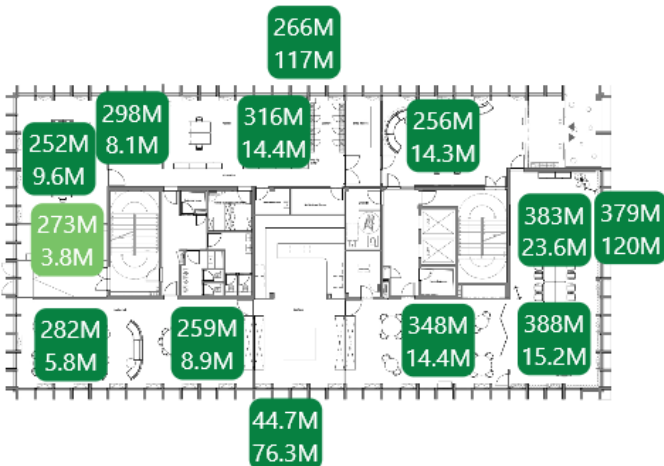
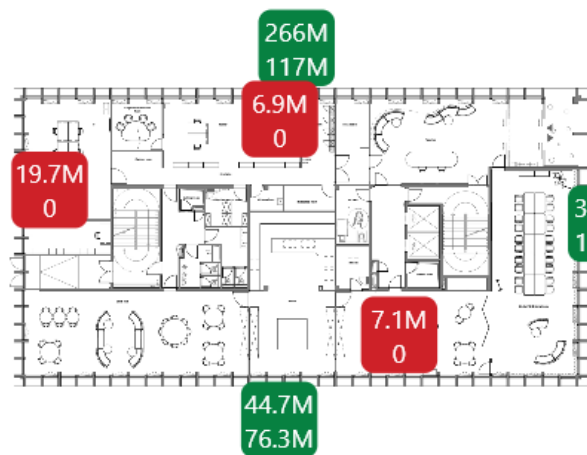
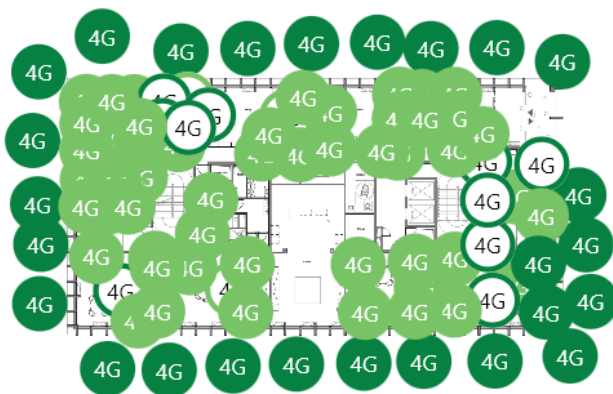
- Improvement for low band and high band
- 4G, 5G and Tetra
- Improvement between 21dB up to 27dB

Case 1: CSC Building – Positive impact on data speed transfer in UL and DL

BEFORE



AFTER WAVETRHU



AFTER treatment

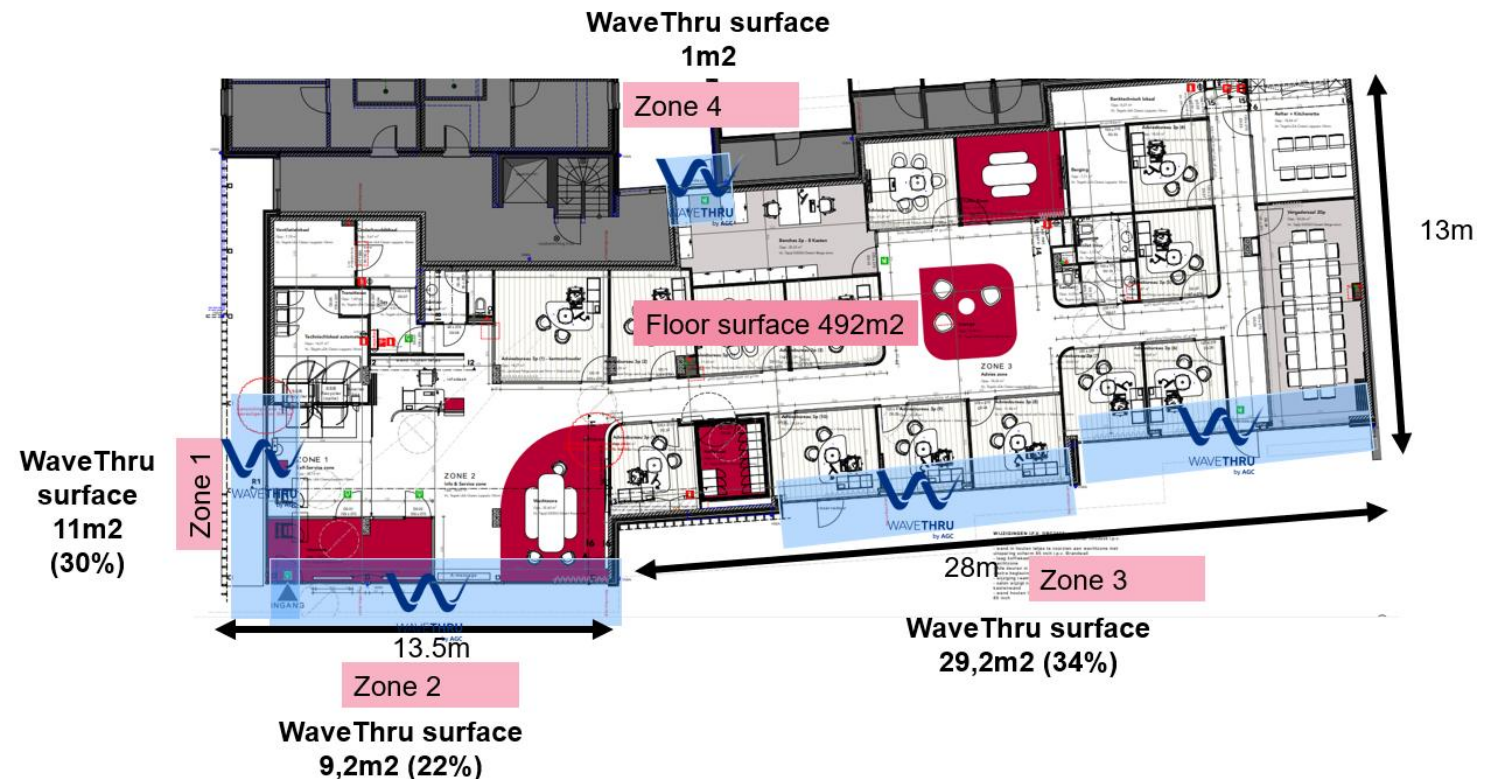
- Speedtest improved in upload and download thanks to the fact that many 4G/5G frequency bands enter inside

Case 2 : Bank office



New bank office built in 2022:

- High-efficiency double glazing, well-insulated walls
- No possibility to make phone calls inside
- Solution: application of WAVETHRU treatment on front glazing



Case 2 : Bank office (BEFORE/AFTER)

- Perfect ■
- Good ■
- Acceptable ■
- Bad ■

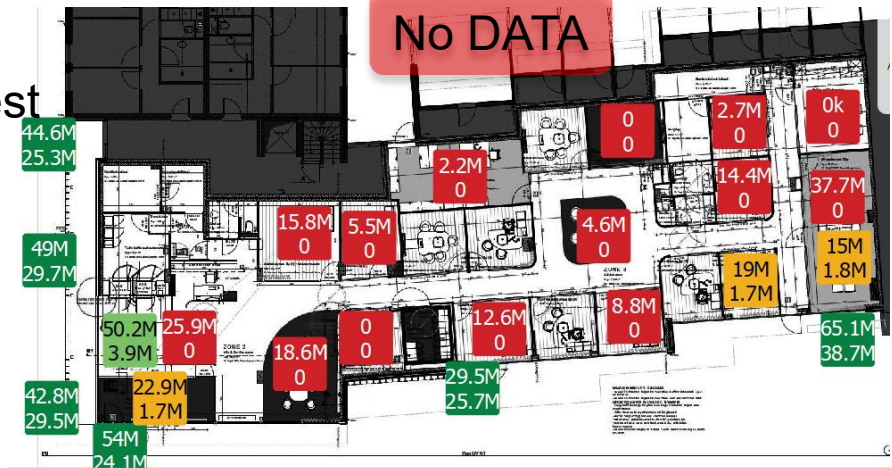
Calls



Unstable calls



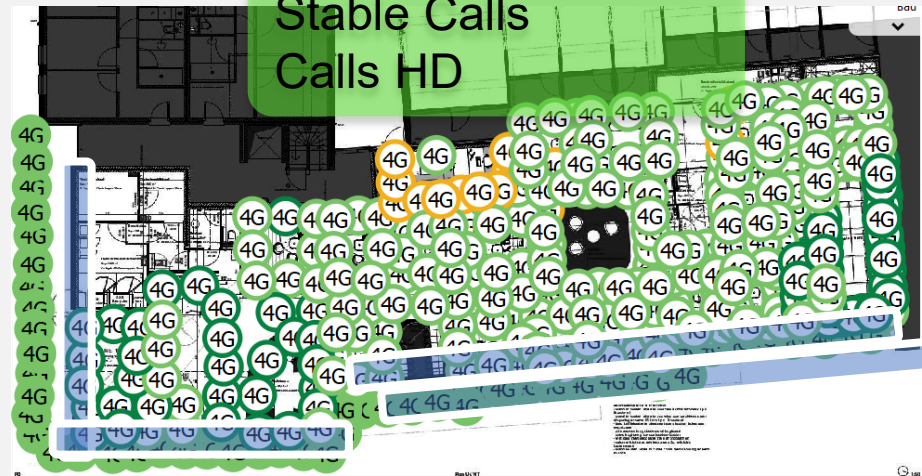
No DATA



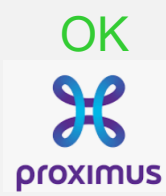
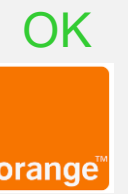
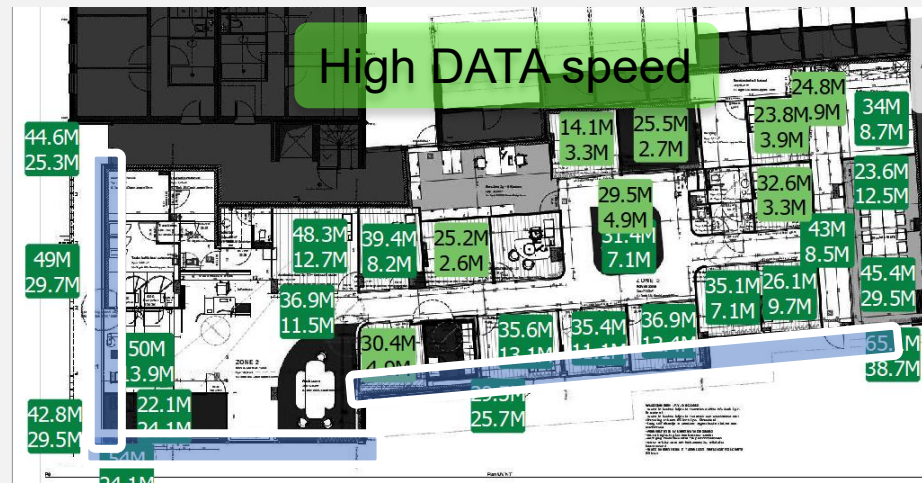
WAVE THRU

by AGC

Stable Calls
Calls HD



High DATA speed



Very good improvement for Mobile Operators

Case 3 : Immobel Offices in Brussels

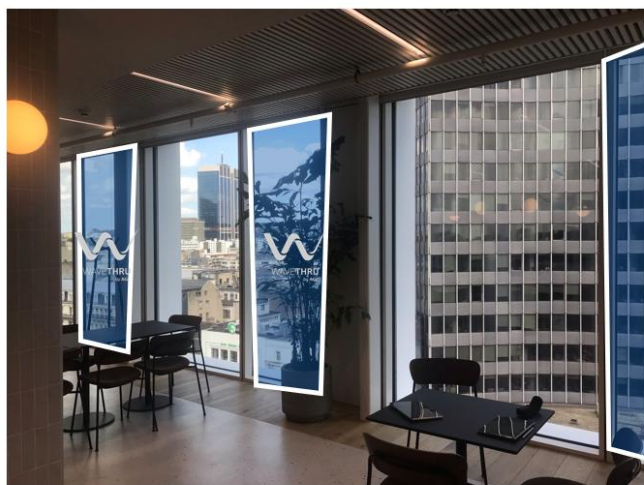


Initial situation

- Unstable and interrupted calls during peak hours, no GPS signal for employees and IT , especially in central part and phone corners

Solution

- WAVETHRU treatment of all small glazings at floor 10



Immobel building

- New offices built in 2022 in the center of Brussels
- Façade entirely made of high-performance double glazing

Case 3 : Immobil Office in Brussels (BEFORE/AFTER)

- Perfect ■
- Good ■
- Acceptable ■
- Bad ■

Appel



Call unstable
Congestion during rush hours



Stable calls, HD
No more Traffic jam

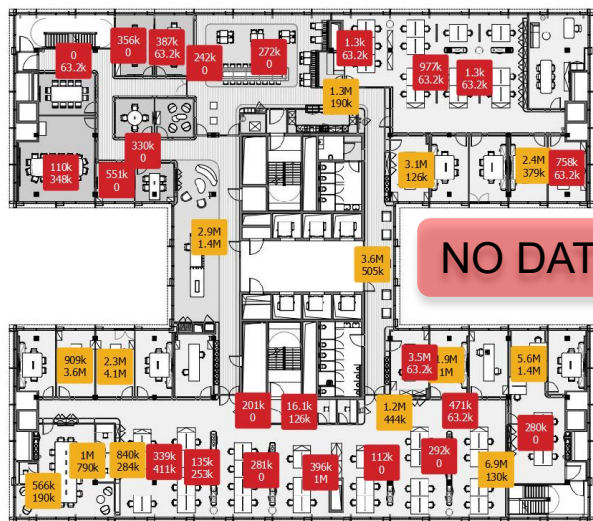
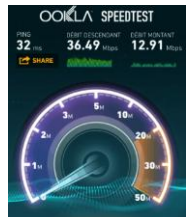


OK
orange™

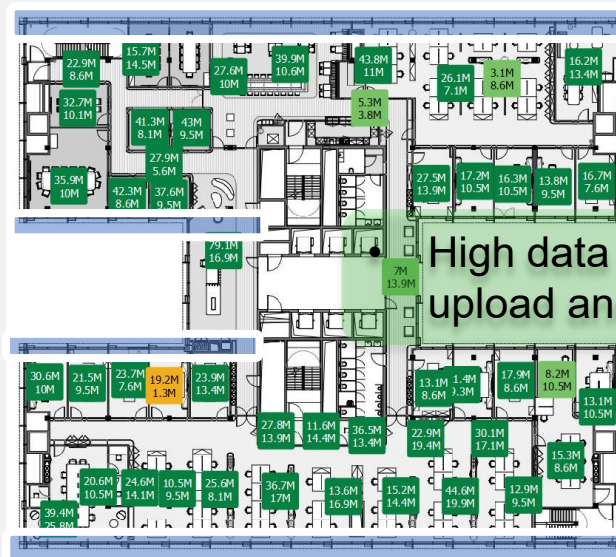
OK
proximus

OK
BASE

Speedtest



NO DATA in UL



High data speed in
upload and download

Very good improvement after treatment

References in BENELUX

More than 100 buildings treated in BENELUX since 2021



Sotheby's



Sambrinvest

