5G Smart Apartment EME Testing
AMTA EME Symposium
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Debbie Wills, Steve Iskra, Mike Wood, Mick Strahan, Phill Knipe
Introduction

Phase 1 - 2019
➢ Following a survey of 76 Telstra staff we determined that people had an average of 19 connected devices in their homes with one home having 75 devices.
➢ Typical devices included phones, laptops, security cameras, wireless speakers and Bluetooth devices
➢ We undertook EME measurements in 5 homes and we found the levels to be well below RPS3 General Public limits

Phase 2 - 2020
➢ Simulate a smart apartment with many connected devices
➢ Include 5G into the EME measurements
Phase 2 - 2020

Scope
Show what EME levels are like for families in apartments and homes with multiple devices operating under high usage conditions

How
➢ Connect 50+ smart devices over 5G, 4G and 5G Wi-Fi in an apartment
➢ Challenge the family and kids to ‘max out’ the Wi-Fi and 5G usage
➢ Measure the EME levels under various levels of activity over a weekend
➢ Measure the EME levels from individual devices
Telstra 5G smart apartment
Inside the smart apartment
Smart apartment devices

<table>
<thead>
<tr>
<th>Device</th>
<th>Quantity</th>
<th>Connectivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile phone</td>
<td>4</td>
<td>5G</td>
</tr>
<tr>
<td>5G Wi-Fi router</td>
<td>3</td>
<td>5G</td>
</tr>
<tr>
<td>Mobile phone</td>
<td>9</td>
<td>4G</td>
</tr>
<tr>
<td>Smart watches</td>
<td>4</td>
<td>4G</td>
</tr>
<tr>
<td>Laptop</td>
<td>6</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Wireless keyboard and mouse</td>
<td>3</td>
<td>Bluetooth</td>
</tr>
<tr>
<td>TV</td>
<td>4</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Google home</td>
<td>1</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Google Nest Hub</td>
<td>1</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Google mini</td>
<td>3</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Doorbell</td>
<td>1</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Camera</td>
<td>1</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Gaming console</td>
<td>1</td>
<td>5G Wi-Fi</td>
</tr>
<tr>
<td>Gaming controller</td>
<td>1</td>
<td>Bluetooth</td>
</tr>
<tr>
<td>Wireless headset</td>
<td>3</td>
<td>Bluetooth</td>
</tr>
</tbody>
</table>

Wi-Fi devices (5G Wi-Fi) were connected to the HTC 5G routers
Results

Environmental EME Levels

Living Room
- Higher EME levels
- Main Wi-Fi routers & 5G hubs
- Highest concentration of users

Media room
- No Wi-Fi routers
- EME from gaming devices & smart TV
- Lower EME levels - middle of apartment, no windows

Device EME Levels
- Devices measured @ 20cm
- Results feed into AMTA / ACEBR devices project
EME Levels – Living Room (Friday/Saturday)

10,000 times below public EME safety limit

Note: 6 min average EME levels
EME Levels – Living Room (Saturday/Sunday)
10,000 times below public EME safety limit

Note: 6 min average EME levels
EME Levels – Living Room (Sunday/Monday)

10,000 times below public EME safety limit

Note: 6 min average EME levels
5G Network – did the dinner party max it out?

5G network loaded with iPerf (high load)
EME = 0.00143%

5G maxed out at dinner party
EME = 0.00149%
Test Results – Living Room

5G Smart Apartment - Highest Measured EME Levels
High Data Usage

Public safety limit

10,000 times below public safety limit

% Exposure Public Limit

0.000001 0.00001 0.0001 0.001 0.01 0.1 1 10 100

Wireless Technology

Wi-Fi (2.4GHz) background Wi-Fi (2.4GHz) 5G (3.6GHz) 4G 3G UHF TV

Wi-Fi Background 0.00626 0.00149 0.000323 0.000187 0.000093

Note: 6 min average EME levels
Test Results – Living Room

5G Smart Apartment - Highest Measured EME Levels
High Data Usage

% Exposure Public Limit

Wireless Technology

All  Wi-Fi (2.4GHz) background  Wi-Fi (2.4GHz)  5G (3.6GHz)  4G  3G  UHF TV  Background TV & FM (Balcony)  Background Mobiles (Balcony)

All EME = Wi-Fi 2.4GHz + 5G + 4G + 3G + UHF TV in living room

Note: 6 min average EME levels
Observations & Conclusions

Smart Apartment
58 devices - (5G, 4G, 5G Wi-Fi, Wi-Fi)

EME Testing
• Continuous EME Monitoring – living & media room
• Normal activity & High Utilization - (maxing out the network)
• Device Testing – individual device measurements

Highest EME Levels – living room
5G level = 0.00149% under high usage
Wi-Fi = 0.00626% under high usage
All = 0.00835% under high usage

Device EME Levels @ 20cm
Baby Monitor = 0.813% (highest)
Smart Power Board = 0.00008% (lowest)

The EME levels from 5G, 4G and Wi-Fi under high utilization in a smart apartment were all very low
Thank you

More Information:
EME.Enquiries@team.telstra.com

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The Wills Family