



**China Mobile Hong Kong (“CMHK”)  
6/7 GHz Band (“U6G”) Mobile Base Station  
and User Equipment Trial  
(Temporary Permit No. T00841)**

**Revision History**

| <b>Version</b> | <b>Revision Date</b> | <b>Summary of Changes</b> |
|----------------|----------------------|---------------------------|
| 1.0            | 28 NOV 2024          | Initial draft             |
|                |                      |                           |

# 1 Introduction

In response to the Hong Kong Government proposal of establishing 5G-Advanced network in upper 6/7 GHz band (“U6G”), China Mobile Hong Kong (“CMHK”) has conducted a field trial aimed to explore the radio characteristics of this frequency band.

The field trial has been conducted near Tin Shui Wai Sport Centre, from 9<sup>th</sup> September to 20<sup>th</sup> September, 2024. The test is concentrated on the radio coverage and downlink throughput of 6/7 GHz band in both outdoor and indoor areas, encompassing various representative scenarios within Hong Kong.

## 1.1 Radio Propagation Characteristics

As the proximity of the 6/7 GHz band to the sub-6 GHz band, their radio propagation characteristics exhibit notable similarities. These characteristics include the Line of sight (LOS) propagation loss, Non-Line of sight (NLOS) propagation loss, reflection loss, diffraction loss and penetration loss. Therefore, the field test aims to verify the radio signal strength coverage and downlink throughput performance of the 6/7 GHz band.

## 1.2 Trial Site Location and Setup

For this trial, CMHK has setup a trial 6/7GHz band 5G New Radio (NR) base station at Tin Shui Wai Sport Centre, No. 1 Tin Pak Road, Tin Shui Wai. The base station is installed at height is approximately 23 metres above ground level, incorporating a single U6G sector.



Figure 1. U6G AAU Installation Set Up

The test utilizes a 6/7 GHz band AAU. The coverage area is a typical urban scenario, with high rise buildings and foliage blockage. The outdoor testing environment encompasses parks and streets, featuring both LOS and NLOS scenarios at varying distances. Additionally, the trial has also includes typical indoor scenerios, such as malls and hotels.

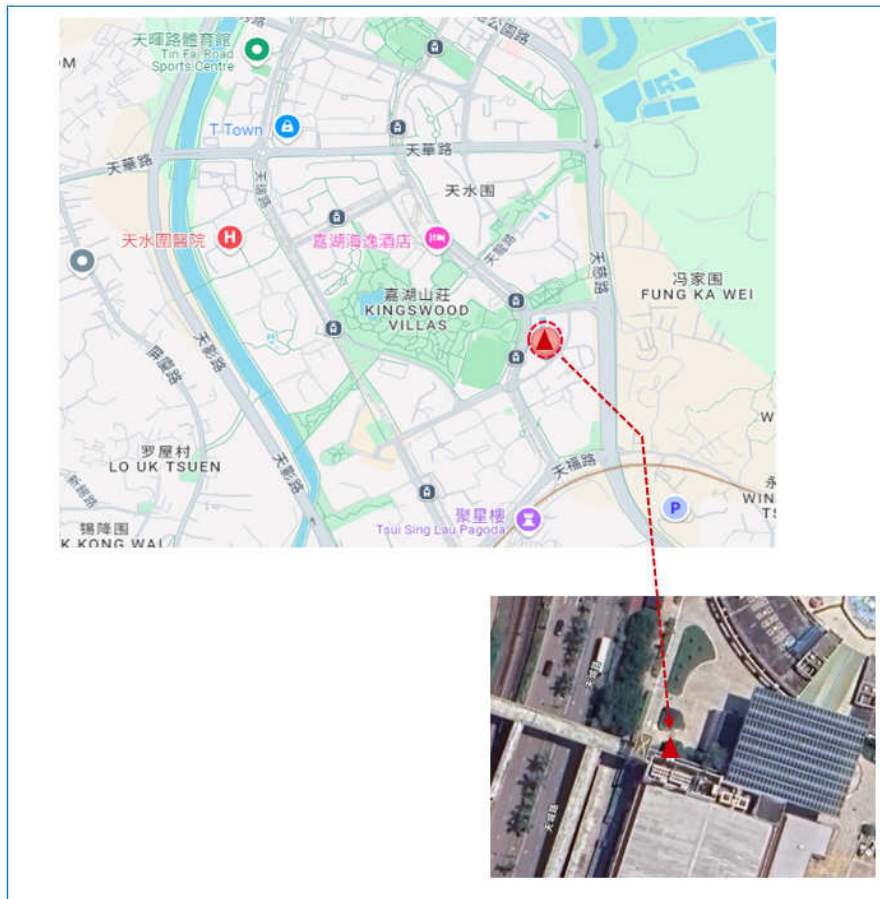


Figure 2. 6/7 GHz Band Field Trial Location



Figure 3. 6/7 GHz Band Field Trial: Top View of the Test Scenario



Figure 4. 6/7 GHz Band Field Trial: AAU View of the Test Scenario

### 1.3 Test Equipment Specification and Radio Parameter Setting

#### 1.3.1 BS Side: Huawei AAU5510 (transmitting equipment for the trial measurement)



Figure 5. Huawei AAU5510 Appearance

| Item                     | Value                        |
|--------------------------|------------------------------|
| Frequency(MHz)           | 6425~6825                    |
| Bandwidth(MHz)           | 400                          |
| Tx/Rx                    | 128                          |
| Max Power (dBm)          | 50                           |
| Antenna Gain (dBi)       | 29                           |
| Maximum EIRP(dBm)        | 79                           |
| Dimension H x W x D (mm) | 1020 x 525 x 205             |
| Power consumption (W)    | Max : 3800<br>Typical : 3000 |
| Weight (kg)              | 67                           |
| Heat Dissipation Mode    | Air-cooled                   |
| Voltage Range (V)        | -36V DC ~ -72V DC            |

### 1.3.2 UE Side: TUE (receiving equipment for the trial measurement)



Figure 6. Huawei TUE6513p Appearance

| Item            | Value      |
|-----------------|------------|
| Frequency(MHz)  | 6425~6825  |
| Bandwidth(MHz)  | 400        |
| Tx/Rx           | 4T8R       |
| Max Power (dBm) | 23         |
| Modulation      | Max 256QAM |

### 1.3.3 Radio Parameter Setting for the trial test:

| RF Parameters   |                       |    |
|-----------------|-----------------------|----|
| Frequency (MHz) | 6570~6670             |    |
| Bandwidth (MHz) | 100                   |    |
| Duplex mode     | TDD                   |    |
| DL:UL ratio     | 4:1                   |    |
| BS Side         | PA output power (dBm) | 31 |
|                 | EIRP (dBm)            | 60 |
| UE Side         | Max Power (dBm)       | 23 |

## 2 Measurement Results

### 2.1 Outdoor Radio Coverage and Downlink Throughput Test

To verify the outdoor coverage capability of 6/7GHz Band, a detailed point test is performed.

1. Cell Radius : 500 m
2. Test Route Length : >2000m
3. Test Point distance interval : about 10m
4. Detailed Analysis of Special Test Points: LOS location,NLOS location with high buildings and foliage blockage.

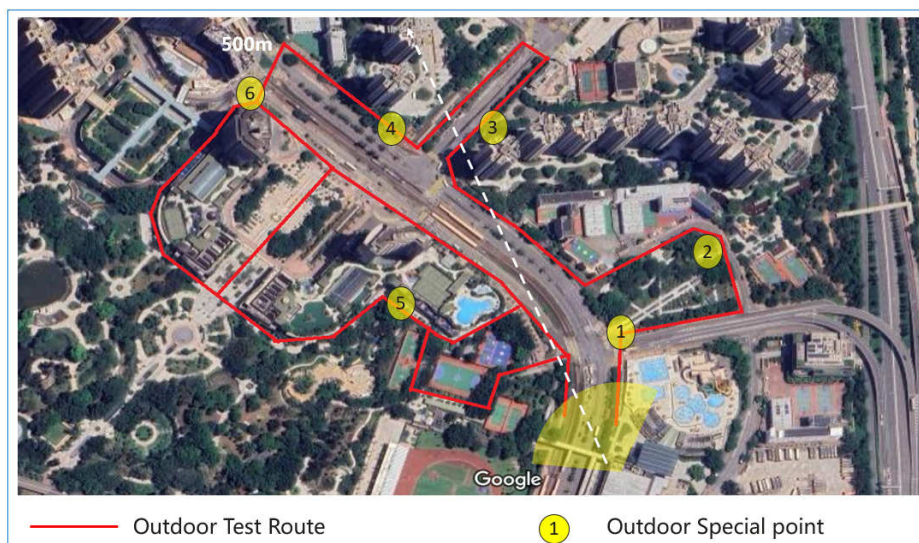


Figure 7. Outdoor Coverage Test Route and Special Test Point

## 2.1.1 Outdoor Radio Signal Strength Coverage Test

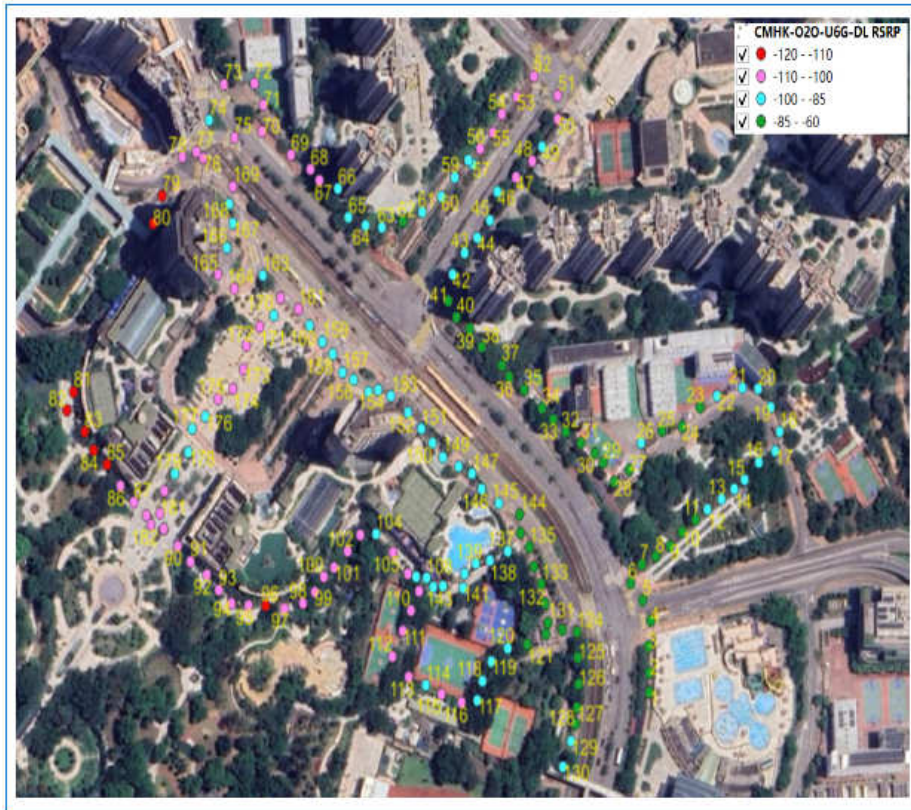


Figure 8. Outdoor's Field Test Downlink RSRP Coverage Map

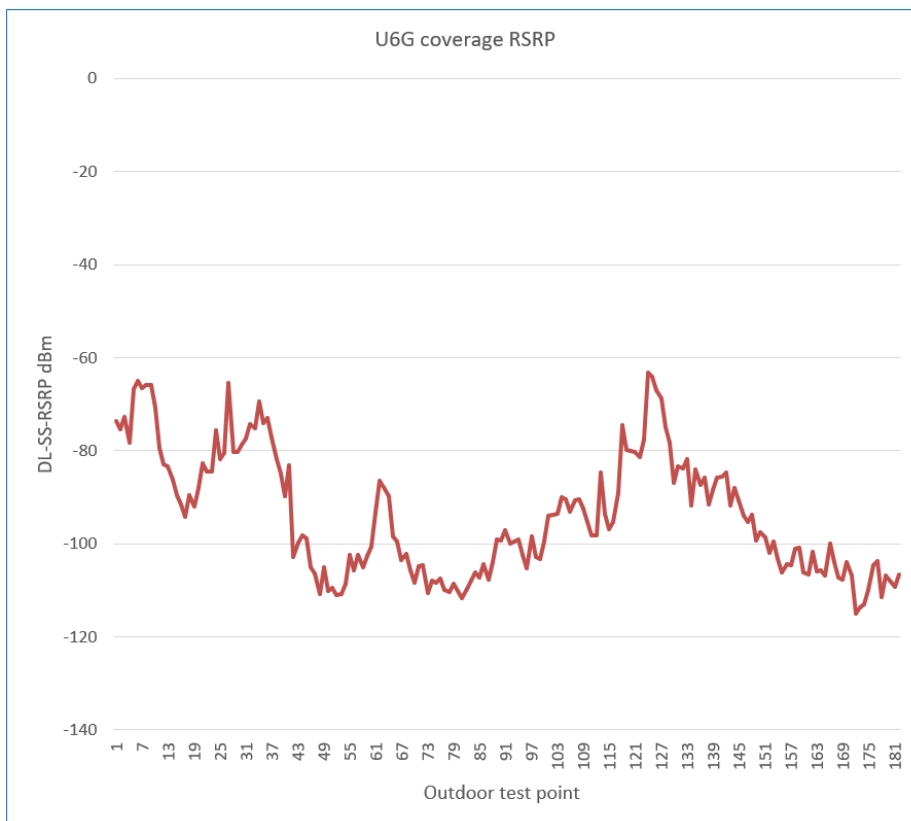


Chart 1. Outdoor Field Test Route vs Downlink RSRP Curve



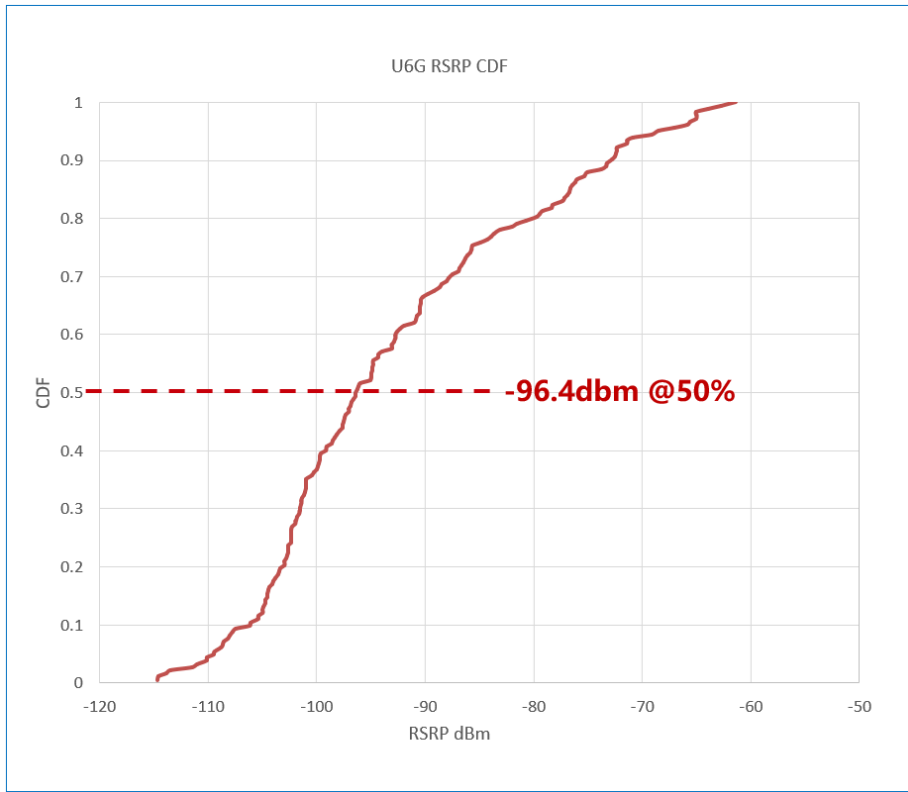


Chart 2. Outdoor Coverage Signal Strength (RSRP) CDF Curve

**2.1.2 Outdoor Downlink Throughput**

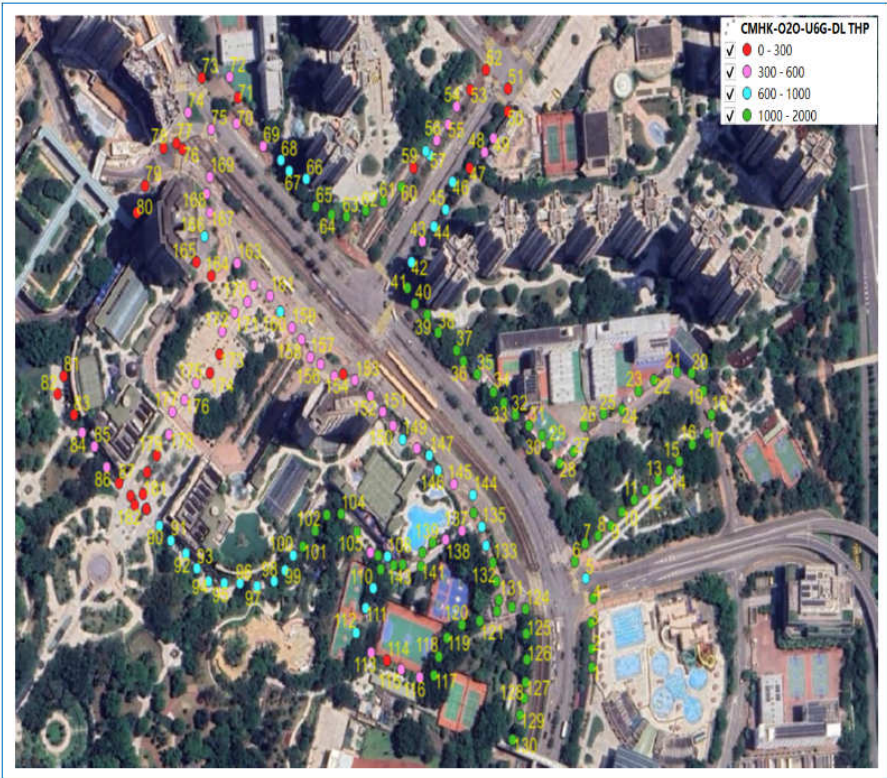


Figure 9. Outdoor Field Test Downlink Throughput Coverage Map

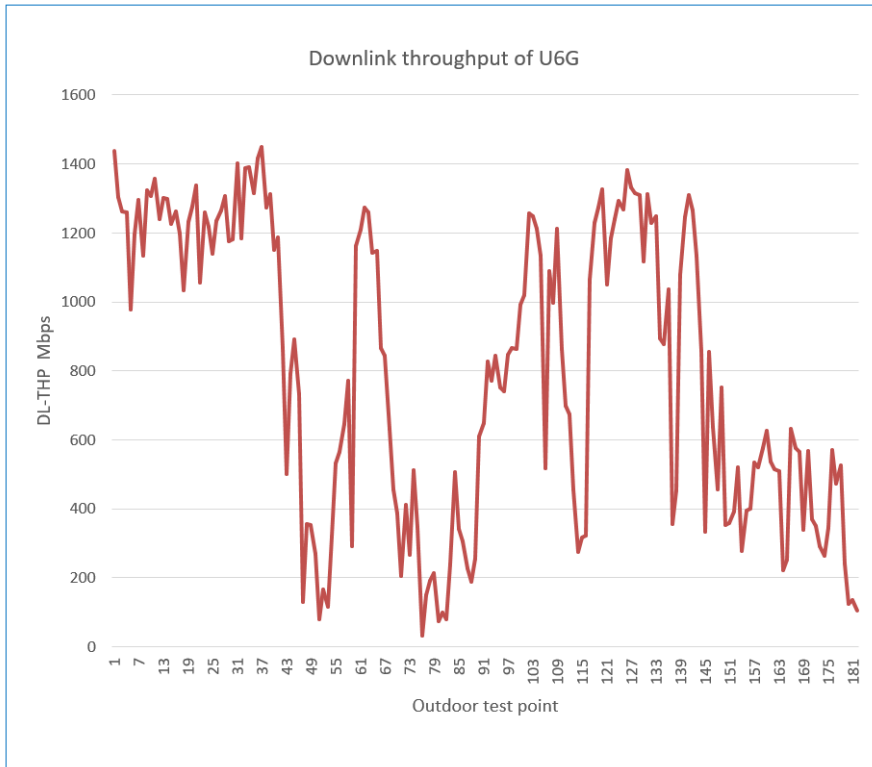


Chart 3. Outdoor's Field Test Route vs Downlink Throughput Curve

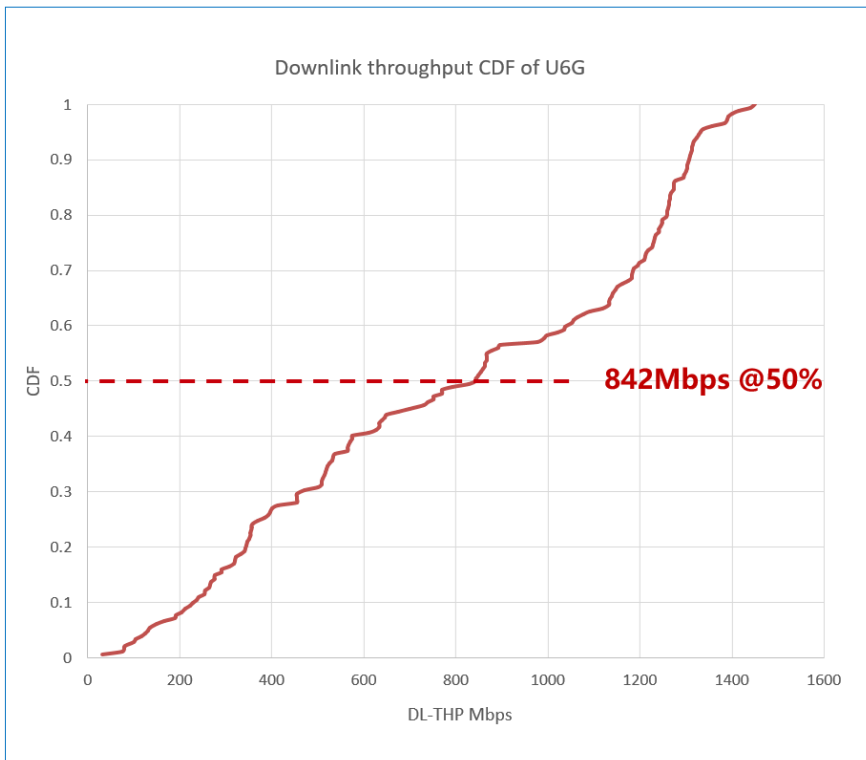


Chart 4. Outdoor Downlink Throughput CDF Curve

### 2.1.3 Specific Locations of Outdoor Test

|  |                        |           |          |                 |      |                 |                 |             |           |                      |      |                |   |                      |      |
|--|------------------------|-----------|----------|-----------------|------|-----------------|-----------------|-------------|-----------|----------------------|------|----------------|---|----------------------|------|
|   | <b>Test Point: 7</b>   | <b>NO</b> | <b>1</b> | <b>Distance</b> | 140m | <b>Scenario</b> | LOS 近点          | <b>Freq</b> | 6570~6670 | <b>DL THP (Mbps)</b> | 1295 | <b>DL Rank</b> | 4 | <b>SS-RSRP (dBm)</b> | -65  |
|   | <b>Test Point: 16</b>  | <b>NO</b> | <b>2</b> | <b>Distance</b> | 222m | <b>Scenario</b> | NLOS树木遮挡 (稀疏遮挡) | <b>Freq</b> | 6570~6670 | <b>DL THP (Mbps)</b> | 1262 | <b>DL Rank</b> | 4 | <b>SS-RSRP (dBm)</b> | -93  |
|  | <b>Test Point: 43</b>  | <b>NO</b> | <b>3</b> | <b>Distance</b> | 370m | <b>Scenario</b> | NLOS建筑物遮挡       | <b>Freq</b> | 6570~6670 | <b>DL THP (Mbps)</b> | 500  | <b>DL Rank</b> | 3 | <b>SS-RSRP (dBm)</b> | -90  |
|   | <b>Test Point: 63</b>  | <b>NO</b> | <b>4</b> | <b>Distance</b> | 420m | <b>Scenario</b> | LOS 远点          | <b>Freq</b> | 6570~6670 | <b>DL THP (Mbps)</b> | 1260 | <b>DL Rank</b> | 4 | <b>SS-RSRP (dBm)</b> | -86  |
|   | <b>Test Point: 111</b> | <b>NO</b> | <b>5</b> | <b>Distance</b> | 216m | <b>Scenario</b> | NLOS树木遮挡 (浓密遮挡) | <b>Freq</b> | 6570~6670 | <b>DL THP (Mbps)</b> | 699  | <b>DL Rank</b> | 4 | <b>SS-RSRP (dBm)</b> | -99  |
|  | <b>Test Point: 79</b>  | <b>NO</b> | <b>6</b> | <b>Distance</b> | 513m | <b>Scenario</b> | NLOS建筑物遮挡       | <b>Freq</b> | 6570~6670 | <b>DL THP (Mbps)</b> | 211  | <b>DL Rank</b> | 1 | <b>SS-RSRP (dBm)</b> | -111 |

Figure 10. Detailed Results of Specific Locations of Outdoor Test

## 2.2 Indoor Radio Coverage and Downlink Throughput Test

Compared with sub 6GHz, 6/7GHz Band has a larger penetration loss theoretically. Therefore, we have selected some specific indoor locations of shopping malls and hotels to do test and coverage comparison.

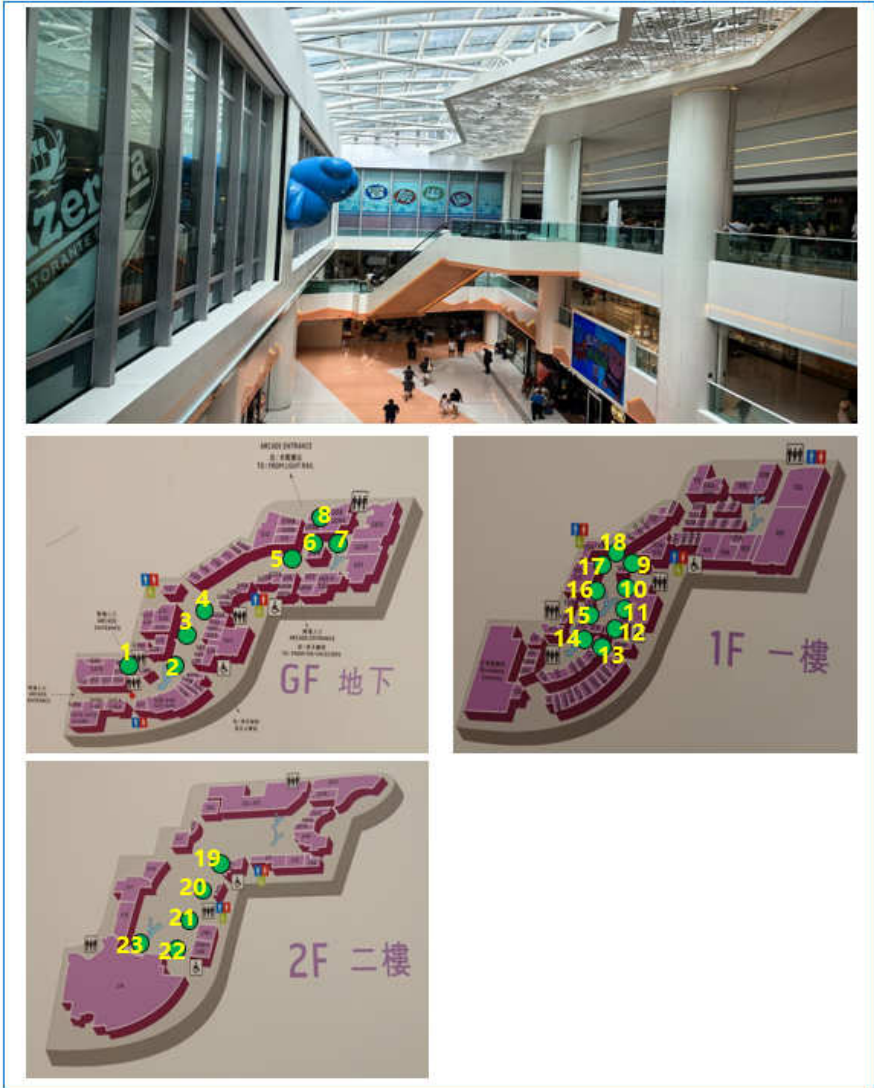


Figure 11. 6/7 GHz Band Field Trial: O2I Scenario, + WOO Shopping Mall

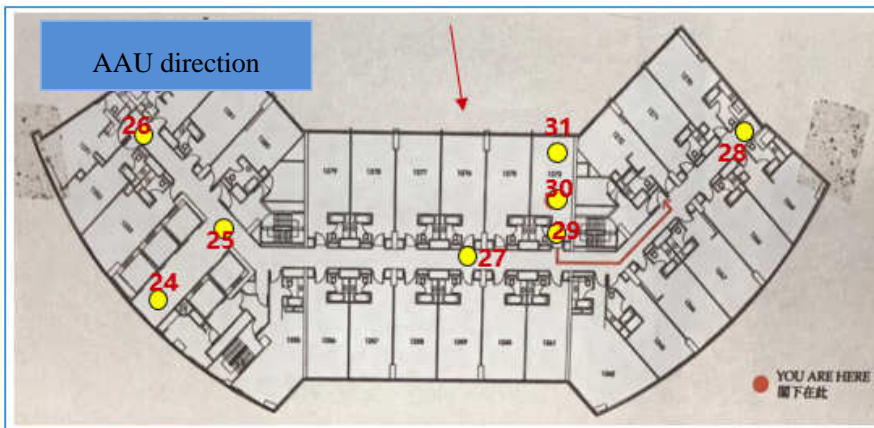


Figure 12. 6/7 GHz Band Field Trial : O2I Scenario, +WOO Hotel

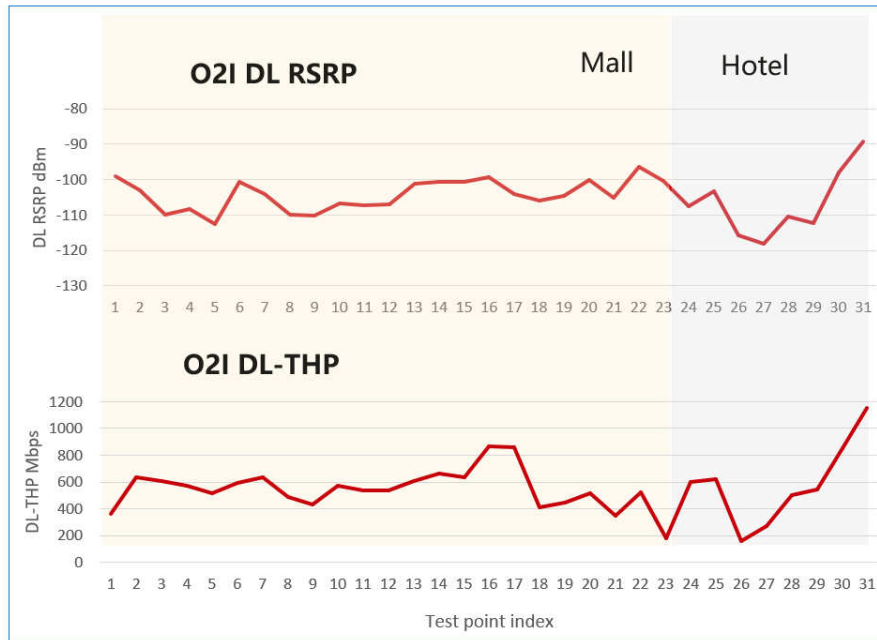


Figure 13. Indoor RSRP and Downlink Throughput vs the Test Location



Figure 14. Detailed Results of Special Locations of Indoor Test

### **3 Findings**

After completion of 6/7 GHz Band 5G NR field measurement, there are some key observations.

According to the test result in section 2.1, the 6/7 GHz band coverage capability in outdoor environment in term of cell radius is around 500 meters. The average throughput of 6/7GHz Band with 100MHz radio bandwidth has achieved downlink throughput of 842 Mbps and average RSRP of -96.4 dBm within the 500 meter cell range.

Theoretical calculations indicate that the 6/7 GHz band experiences greater penetration loss compared to the sub-6 GHz band. However, as evidenced by the indoor test results presented in Section 2.2, this disparity is mitigated through the implementation of Extremely Large Antenna Array (ELAA) technology which is used to compensate the radio path loss due to higher frequency range of 6/7 GHz band. Consequently, the indoor coverage capabilities of the 6/7 GHz band are still able to provide partial indoor coverage from the outdoor sector. Notably, an average downlink throughput of 556 Mbps was achieved within the indoor area of +WOO mall and +WOO hotel (300m from the macro base station).

### **4 Recommendation**

The integration of Extremely Large Antenna Array (ELAA) technology into the 6/7 GHz band AAU design, coupled with UE capability enhancements and algorithm performance optimization in the future, enables the eNodeB to achieve coverage performance comparable to C-band (3.5G/4.9GHz) base stations, effectively functioning as a macro base station for 5G mobile network.

In addition, 6/7 GHz Band has a larger bandwidth and can provide higher uplink and downlink throughputs, which improves user experience and the cell capacity of 5G system.

## 5 Appendix

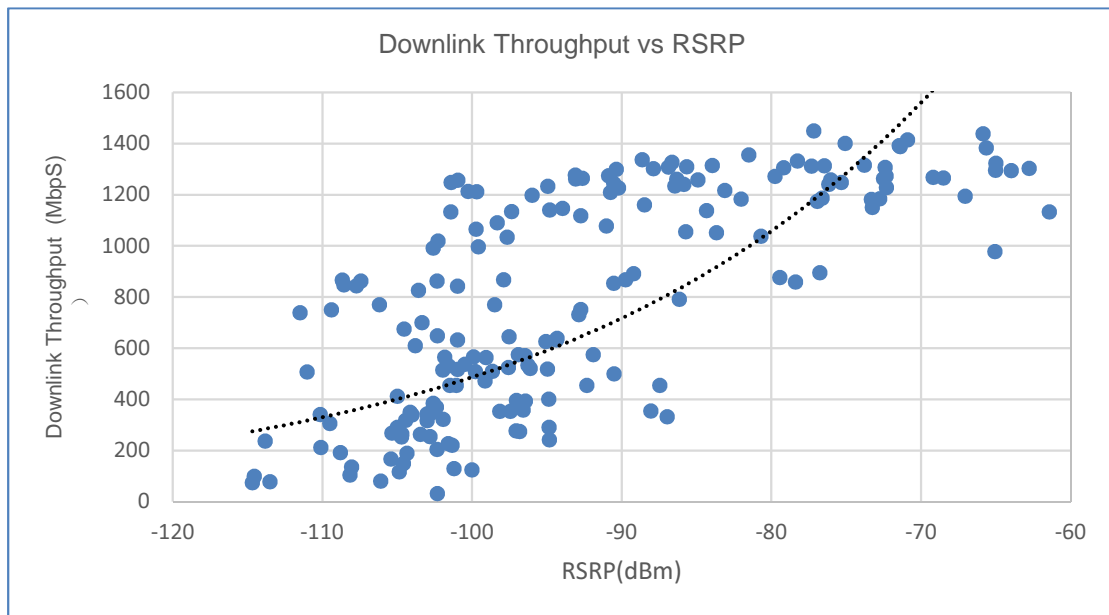


Chart 5. Downlink Throughput vs RSRP Plot

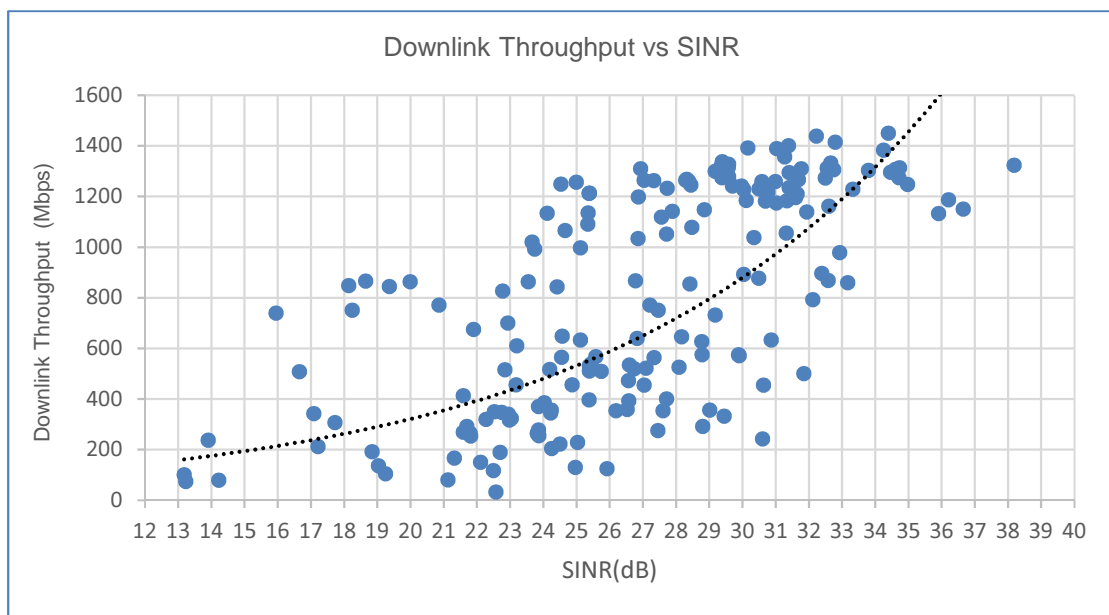


Chart 6. Downlink Throughput vs SINR Plot