Test Report

For

Trial of 5G Base Station and User Equipment operating at 4.9GHz band

Version 1

SmarTone

September 2021

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1. Introduction

With refer to the Communications Authority ("CA") promulgated its work plan for making available additional spectrum for public mobile services to meet the increasing aspirations of mobile service users towards 2022 and beyond. The work plan has made available the spectrum in 4.9GHz band between 4.80 – 4.84 GHz and 4.92 – 4.96 GHz for the provision of fifth generation mobile ("5G") services.

Temporary permit was granted by CA to SmarTone Mobile Communications Limited ("SmarTone") in the 2nd half of 2021 for 5G NR network trial in the 4.9GHz band.

2. Test Scope

The scope of the test was concentrated on the radio propagation characteristics, penetration loss, indoor and outdoor coverage in typical Hong Kong environment. For the field trial, 4.9GHz cell was set up in Mong Kok.

2.1. Test Equipment

Equipment	Technical Specifications	
4.9GHz Active Antenna	Frequency Band	4.9 GHz
	Bandwidth	200 MHz
	MIMO Configuration	64Tx/64Rx
Test User Equipment	Frequency Band	4.9 GHz
	MIMO Configuration	2Tx/4Rx

(A) (B)

Figure 1. (A) 4.9 GHz Active Antenna, (B) 4.9 GHz Test User Equipment

2.2. Test location

Location	Area	Test Scenario	Band	Antenna Configuration
1	Mong Kok	Outdoor and Indoor Penetration	4.9 GHz	Bearing = 205° Down-tilt = 26°

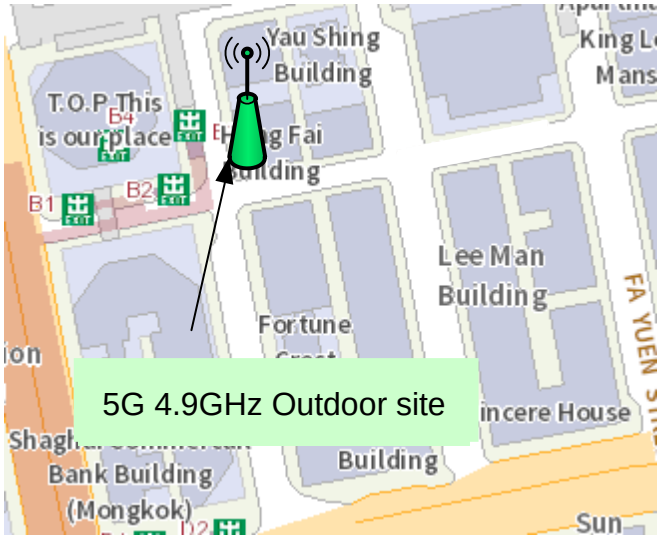

Figure 2. 5G 4.9GHz Test Location 1

Figure 3. 4.9GHz Active Antenna on site

2.3. Test configuration

5G network configuration was based on 3GPP Release 15 Option 3x. Co-located LTE cell was served as the anchor cell of 5G NR carrier.

Band	Operating Frequency	Bandwidth	EIRP
4.9GHz	4.92 – 4.96 GHz	1 x 40 MHz	50 dBm

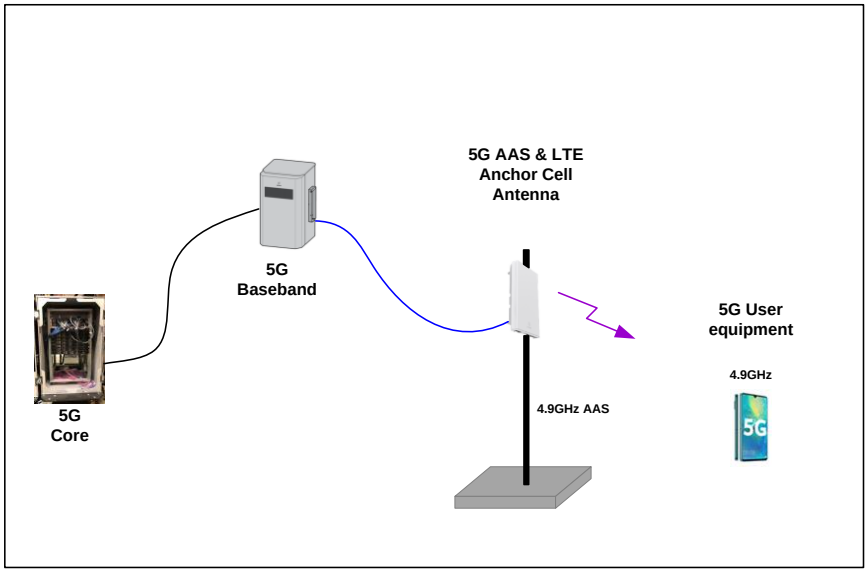

Figure 4. 5G test configuration

3. Test Results

3.1. Outdoor Test Result

3.1.1. Coverage Test

As the antenna is shadowed by the canopy of the building, the strongest signal strength was not at the area right below the site.

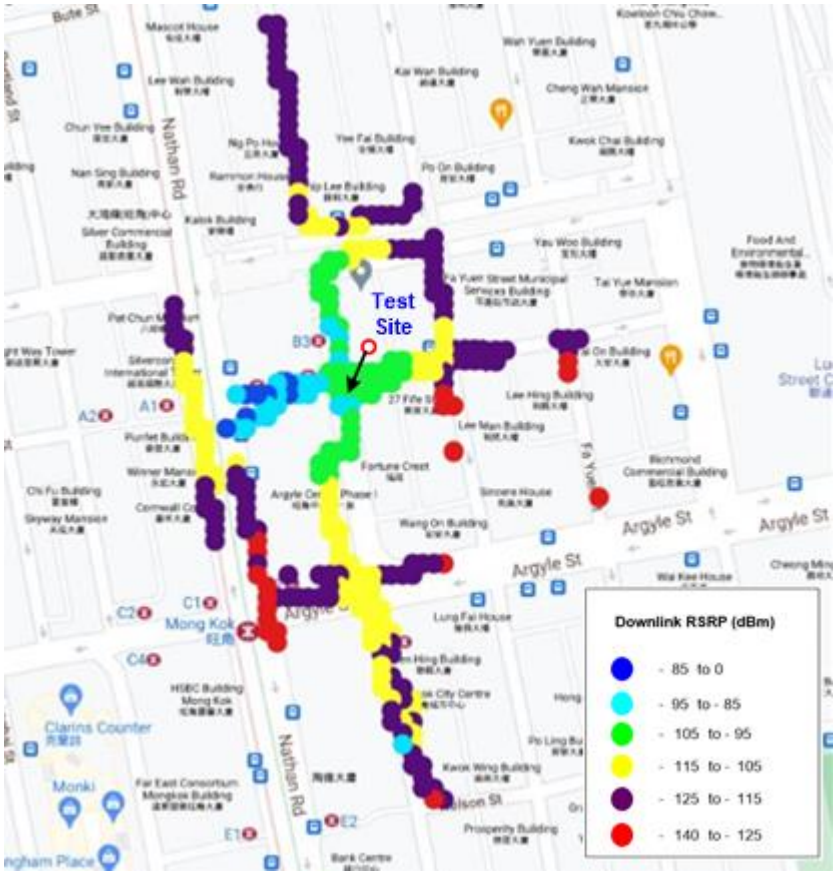

Figure 5. Coverage test result (RSRP)

3.1.2. Downlink throughput test

The downlink throughput over 300Mbps was achieved at the area with the strongest coverage.

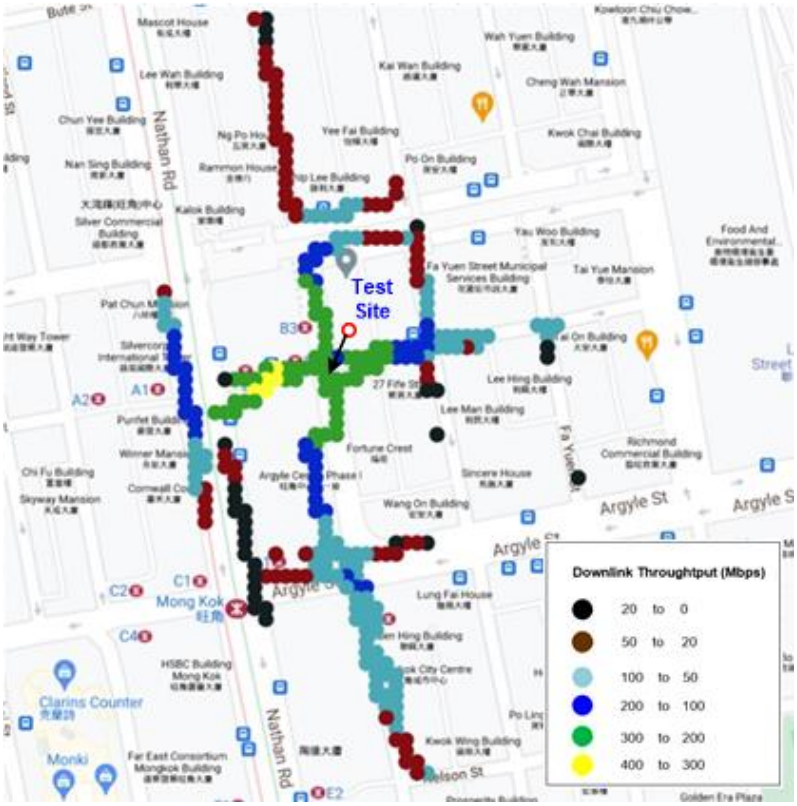

Figure 6. Downlink throughput test result

3.1.3. Uplink throughput test

The uplink throughput between 40-50Mbps was achieved at the serving area.

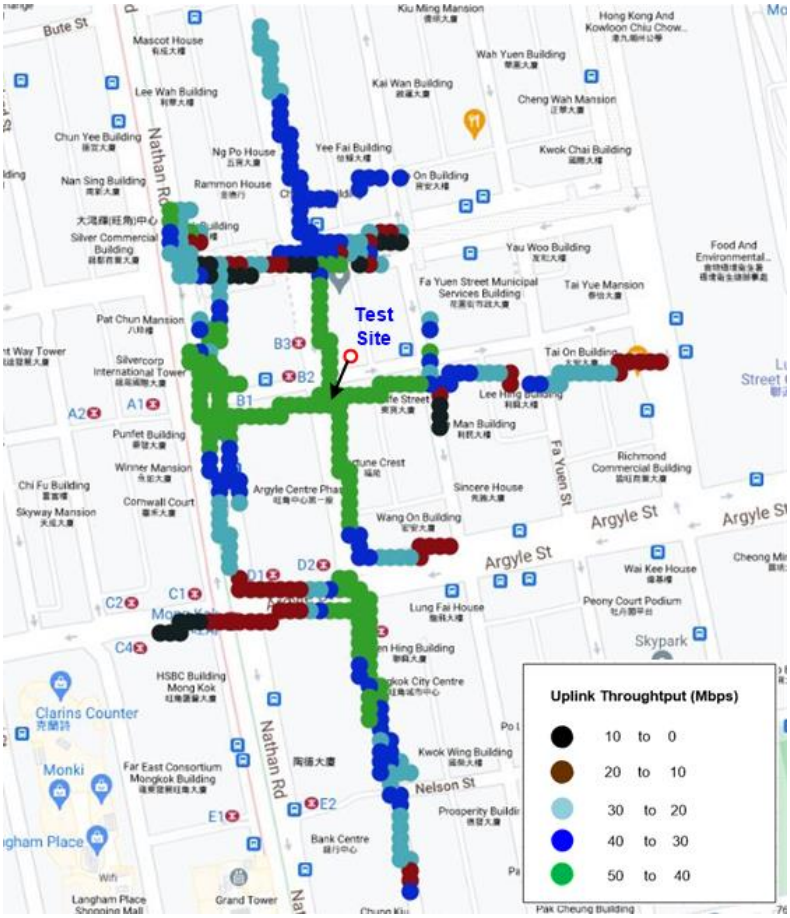

Figure 7. Uplink throughput test result

3.2. Indoor Test Result

An indoor coverage test was done in the shopping mall nearby.

Figure 8. 4.9GHz indoor penetration test

3.2.1. Coverage Test

Downlink RSRP was measured on G/F and 2/F of the shopping mall.

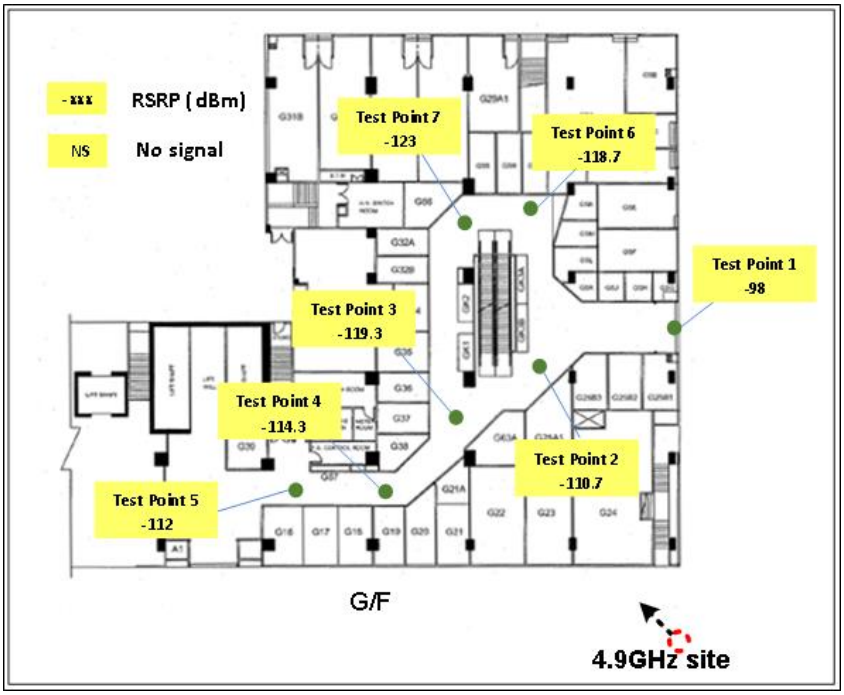

Figure 9. Indoor penetration test result – G/F

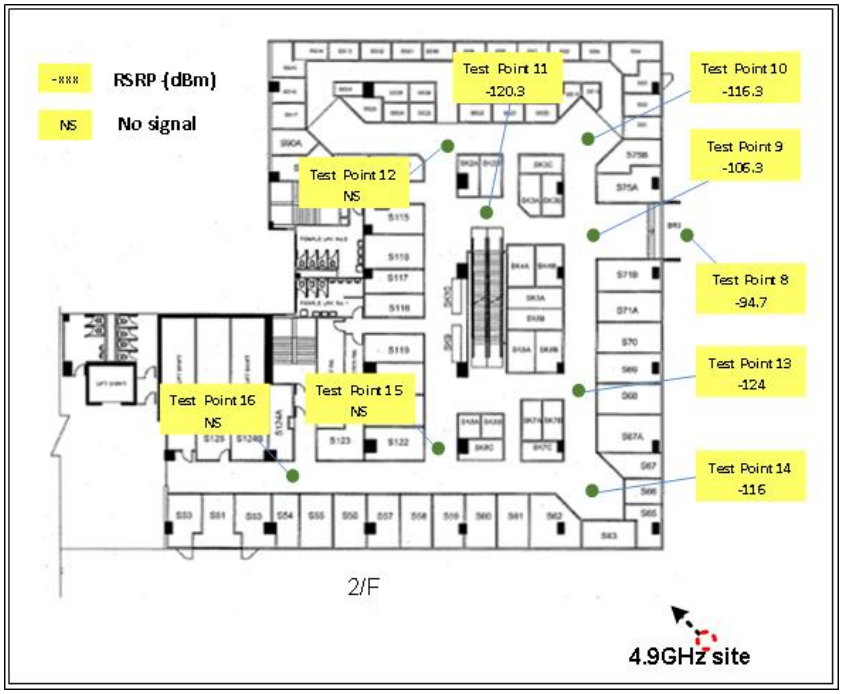

Figure 10. Indoor penetration test result – 2/F

Refer to the reference of -98dBm measured at the G/F entrance, 20dB or more path and penetration loss was observed which was contributed by different building materials of the exterior wall and interior layout such as the infrared reflective (IRR) glass, concrete, wood, etc.

The extent of signal strength drop on 2/F was more than that on G/F as the indoor area on 2/F was more enclosed.

3.2.2. Throughput Test

On G/F, the downlink throughput 229Mbps and uplink throughput 43 Mbps were measured at the entrance of the shopping mall (test point 1). The downlink and uplink throughputs were dropped to 38Mbps and 29Mbps respectively at the weakest coverage area (test point 7).

On 2/F, the downlink throughput 275Mbps and uplink throughput 43 Mbps were measured at the open area (test point 8). The downlink and uplink throughputs were dropped more significantly when the user equipment was moved inside the enclosed area.

Figure 11. Indoor test points – G/F

Figure 12. Indoor test points – 2/F

Location	Test Point	Throughput - Application layer	
		Downlink (Mbps)	Uplink (Mbps)
G/F	1	229.0	42.5
	2	121.7	40.9
	3	57.6	31.8
	4	61.4	38.1
	5	66.8	37.0
	6	67.4	30.9
	7	37.7	29.0
2/F	8	275.3	42.6
	9	131.7	42.6
	10	85.8	42.3
	11	22.7	24.8
	12	-	-
	13	43.2	24.9
	14	91.3	38.8
	15	-	-
	16	-	-

Figure 13. Indoor throughput test result

4. Conclusions

The 5G NR trial tests were conducted to evaluate the 5G performance operating at 4.9GHz frequency band.

For 4.9GHz band performance, the download >300Mbps and uplink throughput ~40Mbps were achieved with 40MHz carrier bandwidth under good signal strength LOS outdoor environment. Around 20Mbps downlink throughput was achieved (test point 11) under weak signal strength NLOS indoor environment.

Based on the trial test results, 4.9GHz band performance is comparable to 3.5GHz in providing 5G continuous coverage and in-building coverage. 4.9GHz band can enhance 5G services in 3.5GHz restricted zones. With the increase in the number of 4.9GHz capable handsets, customers can have better 5G experience in both outdoor and indoor areas with additional capacity provided by 4.9GHz band. Moreover, the peak throughput can further increase through carrier aggregation between 4.9GHz and 3.5GHz bands.