

Trial Report
For
Provision of Mobile Service on Sheltered Bus Stop

Version 3

SmarTone

July 2021

Table of Contents

1. Introduction.....	3
2. Test Scope (Kwun Tong Road Bus Stop)	4
3. Test Location	4
4. Site Photo	4
5. Mobile Equipment Configuration (3G and 4G)	5
5.1 Results (3G and 4G).....	6
5.2.1. Temperature, Noise and Non-Ionizing Radiation Measurement (The site was OFF)	6
5.2.2 Temperature, Noise and Non-Ionizing Radiation Measurement (The site was turned ON).....	7
6. Mobile Equipment Configuration (4G and 5G)	7
6.1 Results (4G and 5G) Non-Ionizing Radiation Measurement (The site was turned ON)	8
7. Conclusion.....	9
8 5.8GHz Wireless Link Operational Performance	9
8.1 V Band Wireless Link Operational Performance	10
9. Field test Summary	13
10. The Weather Record	14

1. Introduction

The Government have proposed to release sheltered bus stop for provision of mobile service in 2018.

SmarTone is invited to conduct trial on two sheltered bus stops at

1. Kwun Tong Road near Tsun Yip Lane
2. Prince Edward Road West (outside house 249)

The purposes of having the trial in two bus stops are

1. To evaluate the set up whether it can meet KMB's requirements
2. To understand any nuisance (noise / temperature) will be generated that will affect public (at Kwun Tong Road)
3. To understand the NIR level (at Kwun Tong Road)
4. To study stability the transmission link by using microwave instead of optical fiber (at Prince Edward Road West)

2. Test Scope (Kwun Tong Road Bus Stop)

The scope of the test focused on the temperature, noise and non-ionizing radiation (NIR) with mobile equipment installed on the sheltered bus stop.

3. Test Location



Figure 1

4. Site Photo



Figure 2

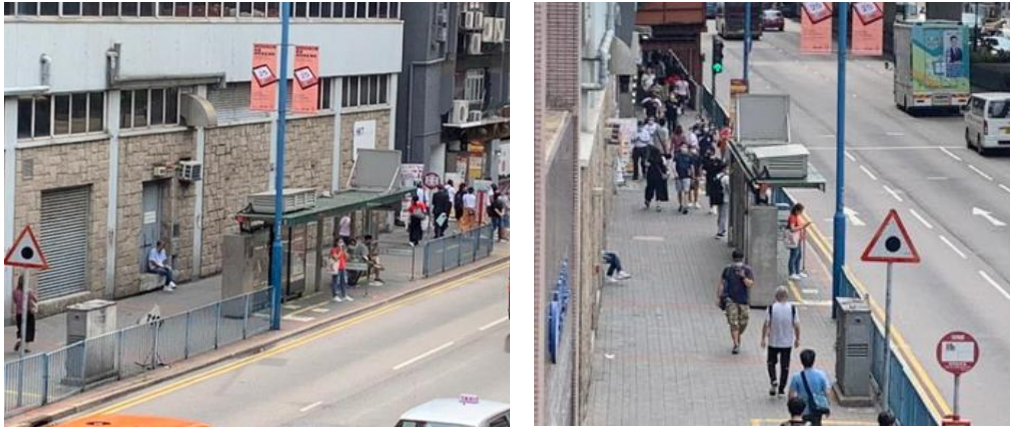


Figure 3

5. Mobile Equipment Configuration (3G and 4G)

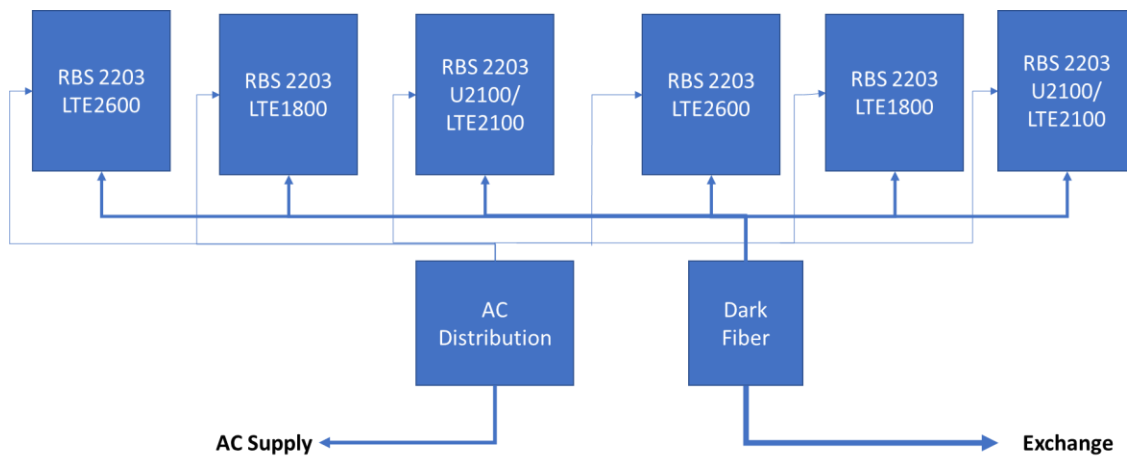


Figure 4

Radio network configuration

Band	Bandwidth	EIRP
1800MHz	DL 10MHz UL 10MHz	4W
2100MHz	DL 5MHz UL 5MHz	4W
2100MHz	DL 15MHz UL 15MHz	4W
2600MHz	DL 10MHz UL 10MHz	4W

5.1 Results (3G and 4G)

5.1.1 Temperature, Noise and Non-Ionizing Radiation Measurement (The site was OFF)

The measurement took when Bus Stop mobile site turn OFF. The measurement took each 2 meters along Kwun Tong Road pedestrians.

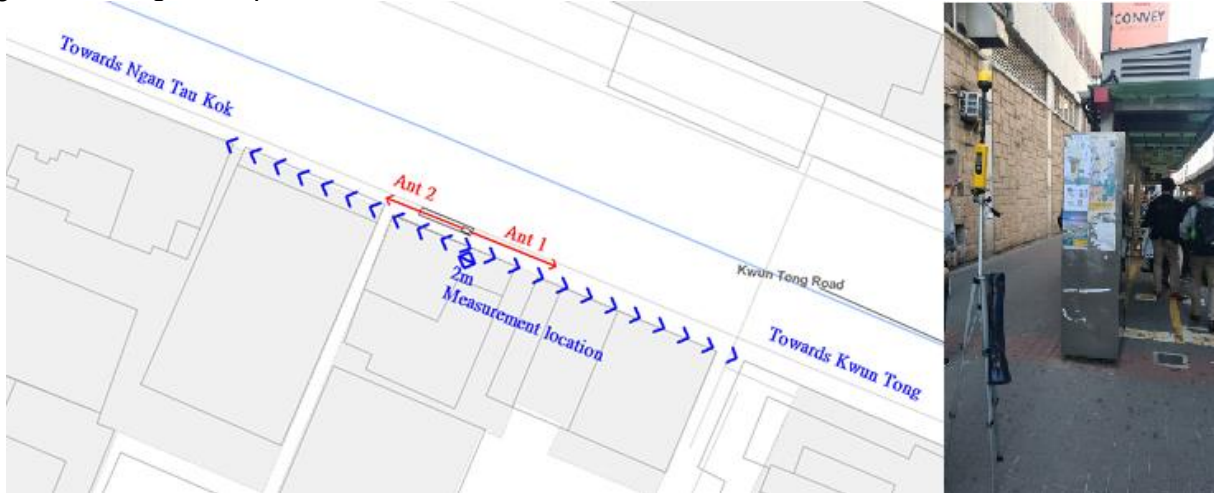


Figure 5. testing location and photo

Towards Ngau Tau Kok

Towards Kwun Tong

Distance (m)	12	10	8	6	4	2	0	2	4	6	8	10	12
NIR (V/m)	2.8	2.7	2.5	2.0	1.7	1.8	2.2	2.0	2.1	2.5	2.4	2.1	2.5
Noise (dB)	76.2	76.4	77.5	76.1	77.5	75.5	78.4	77.2	77.7	79.2	79.3	77.4	77.6
Temperature (C°)	26.0	25.8	25.6	25.7	26.0	25.7	25.6	25.5	25.4	25.5	25.6	26.0	26.2

Table 1. Measurement Results (The site was OFF)

5.1.2 Temperature, Noise and Non-Ionizing Radiation Measurement (The site was turned ON)

All RF power was set to 4W EIRP

Distance (m)	12	10	8	6	4	2	0	2	4	6	8	10	12
NIR (V/m)	2.6	2.5	2.9	2.4	2.9	6.0	3.3	5.8	6.6	4.8	4.0	3.6	2.9
Noise (dB)	76.3	79.8	80.0	77.6	78.8	78.2	76.9	77.4	76.7	77.8	78.5	80.6	79.3
Temperature (C°)	20.4	20.4	20.4	20.4	20.4	20.5	20.1	19.8	19.6	19.7	19.9	19.8	19.8

Table 2. Measurement Results (Bus Stop mobile site turn ON)

6. Mobile Equipment Configuration (4G and 5G)

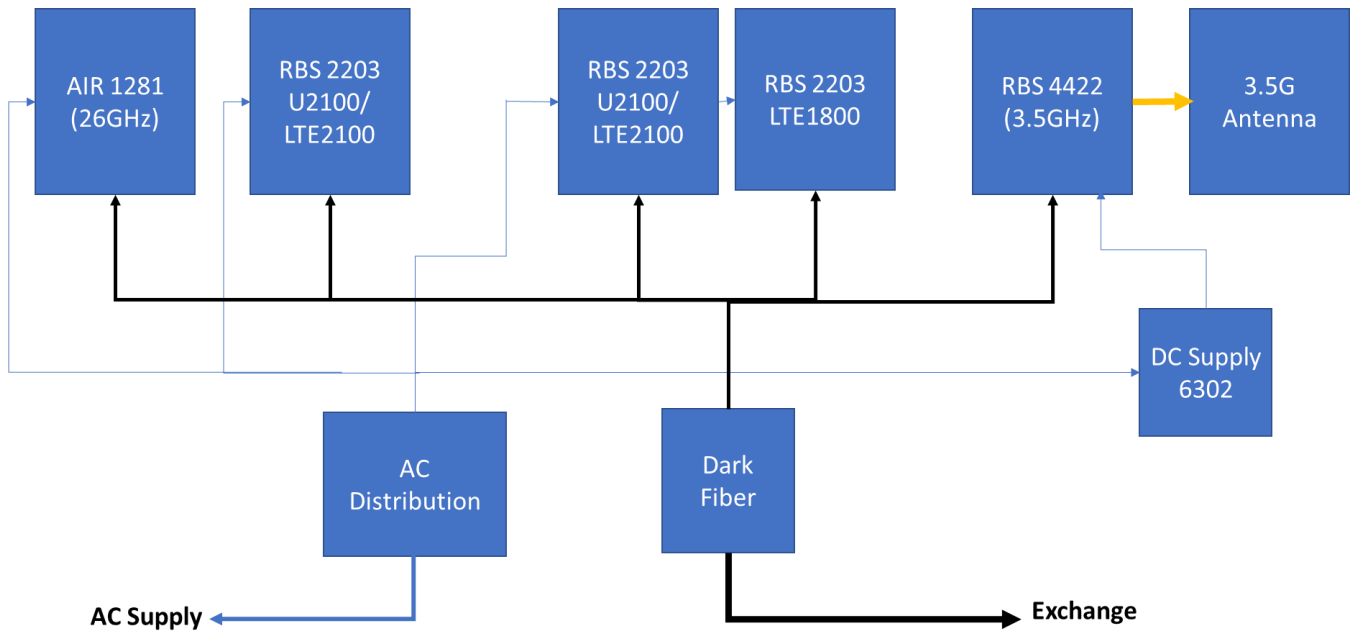


Figure 6

6.1 Results (4G and 5G) Non-Ionizing Radiation Measurement (The site was turned ON)



Figure 7 All RF power was set to 4W EIRP

Distance (m)	10	8	6	4	2	0	2	4	6	8	10
NIR (V/m)	2.9	3.0	3.1	3.1	3.6	3.5	6.2	5.8	3.7	3.4	3.1

Table 3. Measurement Results (Bus Stop mobile site 4G and N3500 turn ON)



Figure 8 All RF power was set to 4W EIRP

Distance (m)	10	8	6	4	2	0	2	4	6	8	10
NIR (V/m)	3.3	3.1	3.4	3.4	3.7	3.9	6.1	5.7	4.8	3.9	3.6

Table 4. Measurement Results (Bus Stop mobile site 4G, N3500 and N28G turn ON)

7. Conclusion

According to the result of this live trial of bus stop mobile site. The measured noise and temperature values are no major change and concluded that all non-ionizing radiation generated by the trial sites are in low value (peak value 6.6V/m). In view of the low value of NIR, the transmitted power can be increased to higher level.

8 5.8GHz Wireless Link Operational Performance

Prior to the V-band trial at the same location a 5.8GHz wireless link was deployed since Jan-2020. The link was stable and capable of delivering 300-357Mbps aggregated link capacity. It is approximately one third of V-band wireless link capacity where 1Gbps aggregated link capacity was confirmed. Figures 8 ~ 9 below show the performance of the 5.8GHz wireless link during the period Jan~Mar 2020 and the link statistics, respectively.

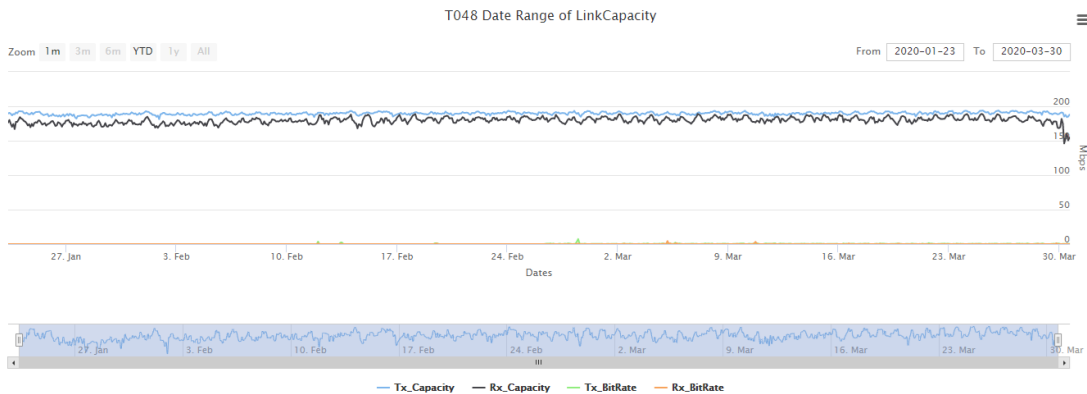


Figure 8. 5.8GHz Wireless Link Performance in Jan~Mar-2020

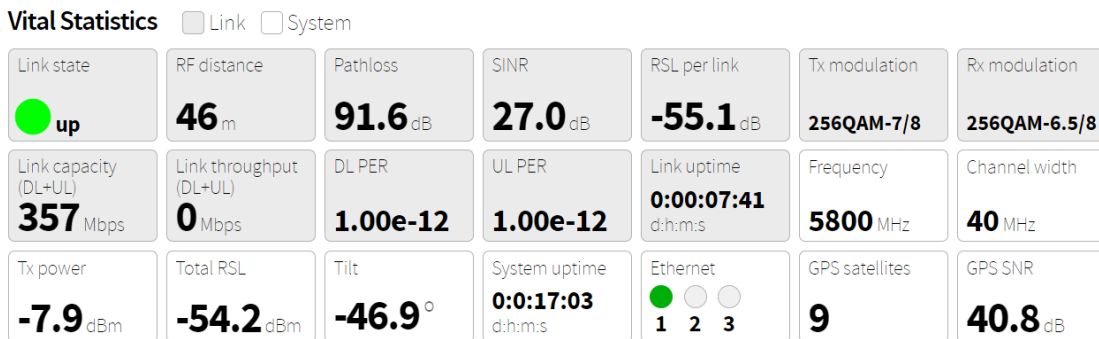


Figure 9. 5.8GHz Wireless Link Statistics

8.1 V Band Wireless Link Operational Performance

The V-band antennas were installed at the rooftop of Caritas Social Centre and on KMB Bus Stop Shelter on Prince Edward Road West referring to figures 10~12. 1Gbps aggregated throughput can be achieved. Figure 13 shows the snapshots of the link status after setup. The V-band link is then connected to 4G LTE radio units for live mobile communication site trial at KMB Bus Stop Shelter.

Testing Period: Aug-2020 ~ Jan-2021
 Operating Frequencies: 60.375 GHz
 Channel size: 500MHz
 Throughput: Aggregated throughput up to 1Gbps



Figure 10 Test locations



Figure 11 Caritas Social Centre toward KMB Bus Stop Shelter.



Figure 12 KMB Bus Stop Shelter toward Caritas Social Centre.



Figure 13 Link status.

9. Field test Summary

1Gbps aggregated throughput can be achieved most of the time for this V-band wireless link trial with link distance 43m. There were several link down records during heavy rainfall period. For instance, as shown in Figure 14 below, Rx minimum level dropped to -128 dBm due to heavy rainfall by Tropical Cyclone Higos in August 2020 causing link down. Overall, the trial site is stable with high throughput capacity using the V-band wireless link.

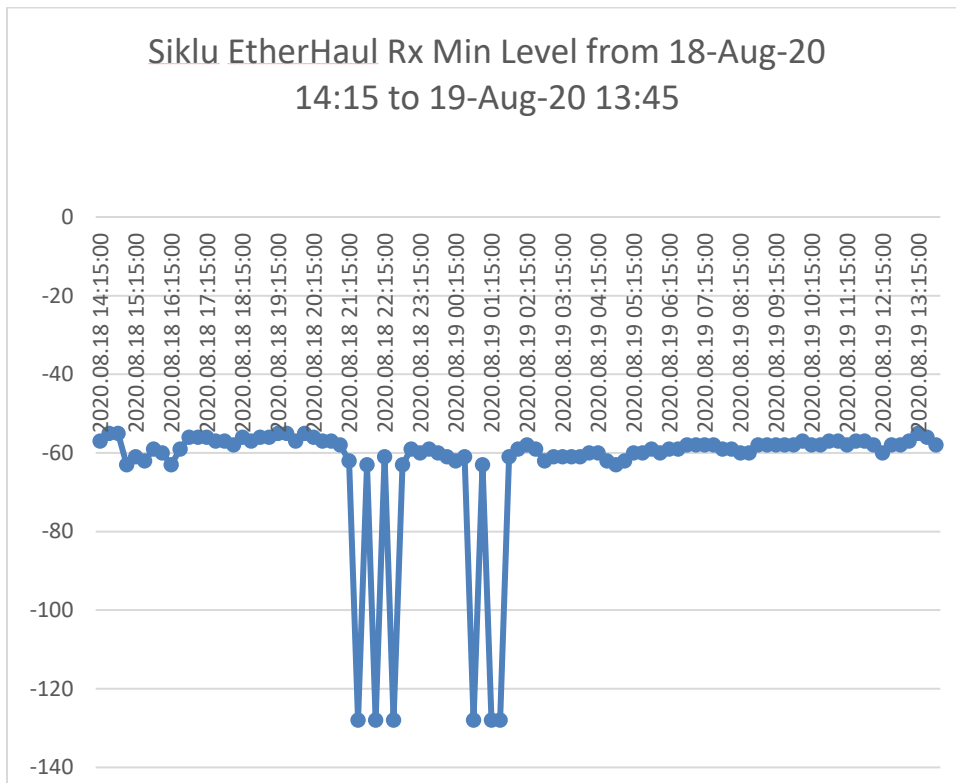


Figure 14: Rx Min Level during heavy rainfall due to Tropical Cyclone Higos on 18-Aug-2020 and 19-Aug-2020.

10. The Weather Record

Figures 15 ~ 22 below show the weather of Hong Kong and Warning and Signal Issued from August 2020 to December 2020¹. There were several Tropical Cyclone warning signals and Rainstorm warning signals during the period.

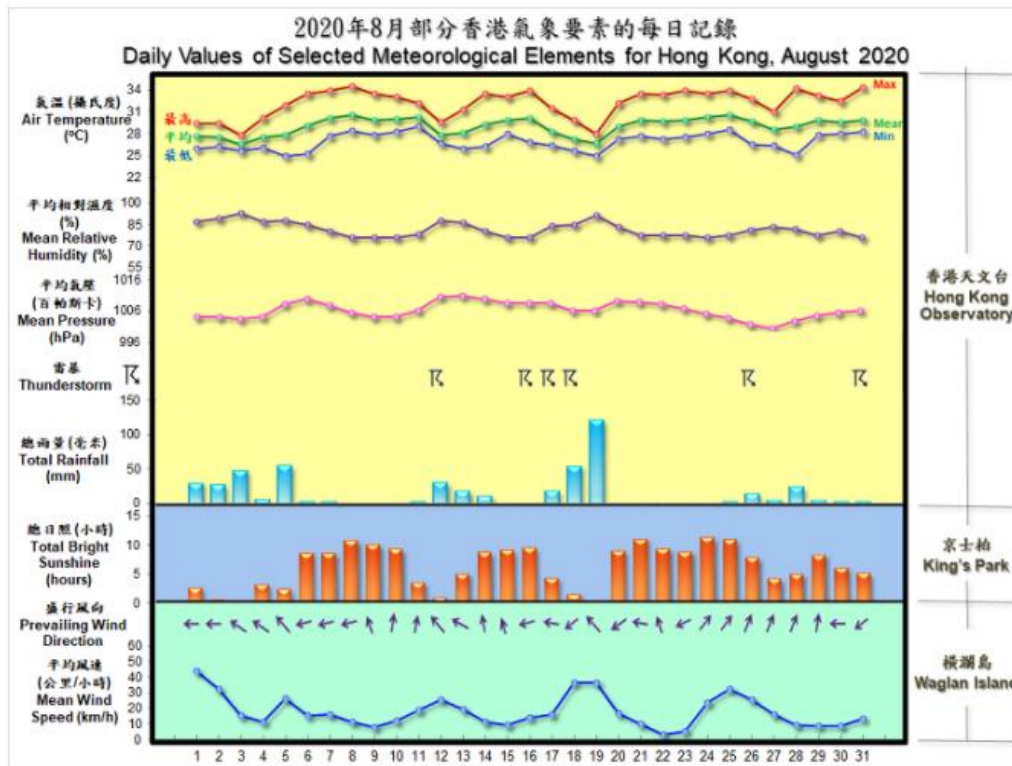


Figure 15 Weather of August 2020

¹ Hong Kong Observatory
<https://www.hko.gov.hk/en/wxinfo/pastwx/mws/mws.htm>

Warnings and Signals issued in August 2020

Table 1.1 Tropical Cyclone Warning Signals

Name of Tropical Cyclone	Signal Number	Beginning Time		Ending Time	
		Day/Month	HKT	Day/Month	HKT
SINLAKU	3	31 / 7	2040	1 / 8	2110
	1	1 / 8	2110	1 / 8	2315
HIGOS	1	18 / 8	0340	18 / 8	1420
	3	18 / 8	1420	18 / 8	2240
	8 NE	18 / 8	2240	19 / 8	0130
	9	19 / 8	0130	19 / 8	0740
	8 SE	19 / 8	0740	19 / 8	1110
	3	19 / 8	1110	19 / 8	1320

Table 1.2 Rainstorm Warning Signals

Colour	Beginning Time		Ending Time	
	Day/Month	HKT	Day/Month	HKT
Amber	5 / 8	1955	6 / 8	0040
Amber	18 / 8	2320	19 / 8	1050

Figure 16 Warnings and Signals issued in August 2020

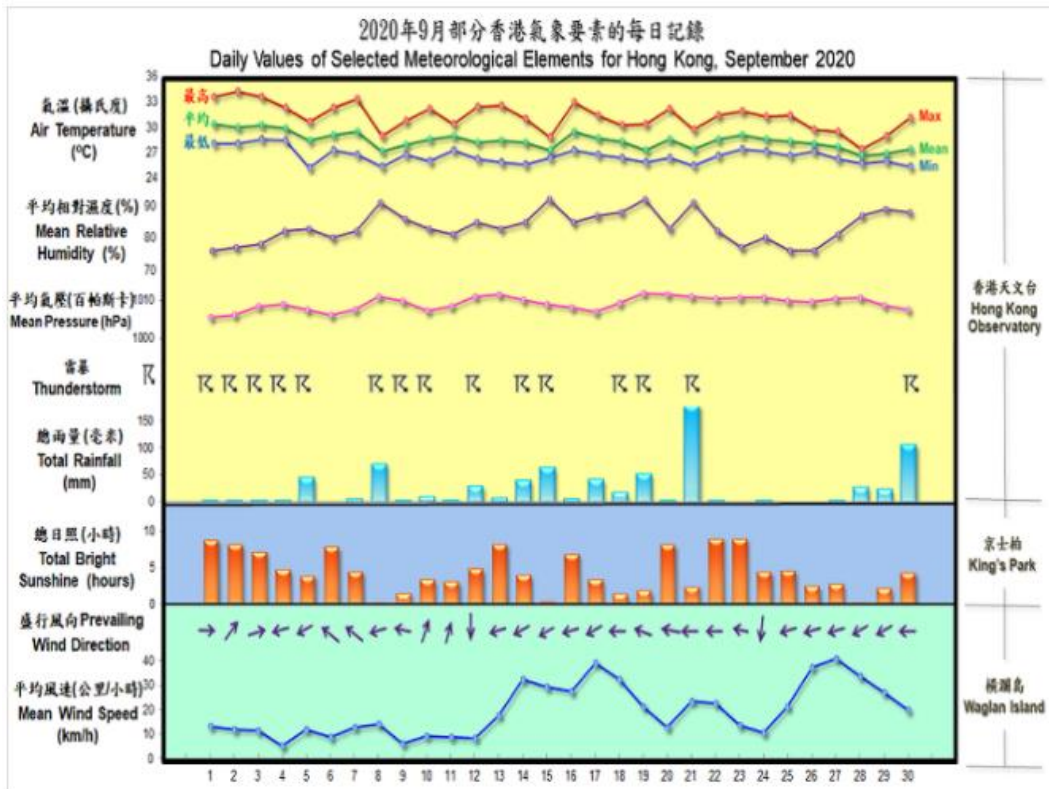


Figure 17 Weather of September 2020

Warnings and Signals issued in September 2020

Table 1.1 Strong Monsoon Signal

Beginning Time		Ending Time	
Day/Month	HKT	Day/Month	HKT
18 / 9	1440	19 / 9	0845

Table 1.2 Rainstorm Warning Signals

Colour	Beginning Time		Ending Time	
	Day/Month	HKT	Day/Month	HKT
Amber	5 / 9	0855	5 / 9	0955
Red	5 / 9	0955	5 / 9	1055
Amber	5 / 9	1055	5 / 9	1115
Amber	8 / 9	0425	8 / 9	1000
Amber	12 / 9	1410	12 / 9	1600
Amber	12 / 9	2130	12 / 9	2230
Amber	15 / 9	1210	15 / 9	1715
Amber	21 / 9	1430	21 / 9	1800
Red	21 / 9	1800	21 / 9	2010
Amber	21 / 9	2010	21 / 9	2140
Amber	28 / 9	1810	28 / 9	1940
Amber	30 / 9	1915	30 / 9	1950
Red	30 / 9	1950	30 / 9	2010
Black	30 / 9	2010	30 / 9	2125
Red	30 / 9	2125	30 / 9	2245
Amber	30 / 9	2245	30 / 9	2330

Figure 18 Warnings and Signals issued in September 2020

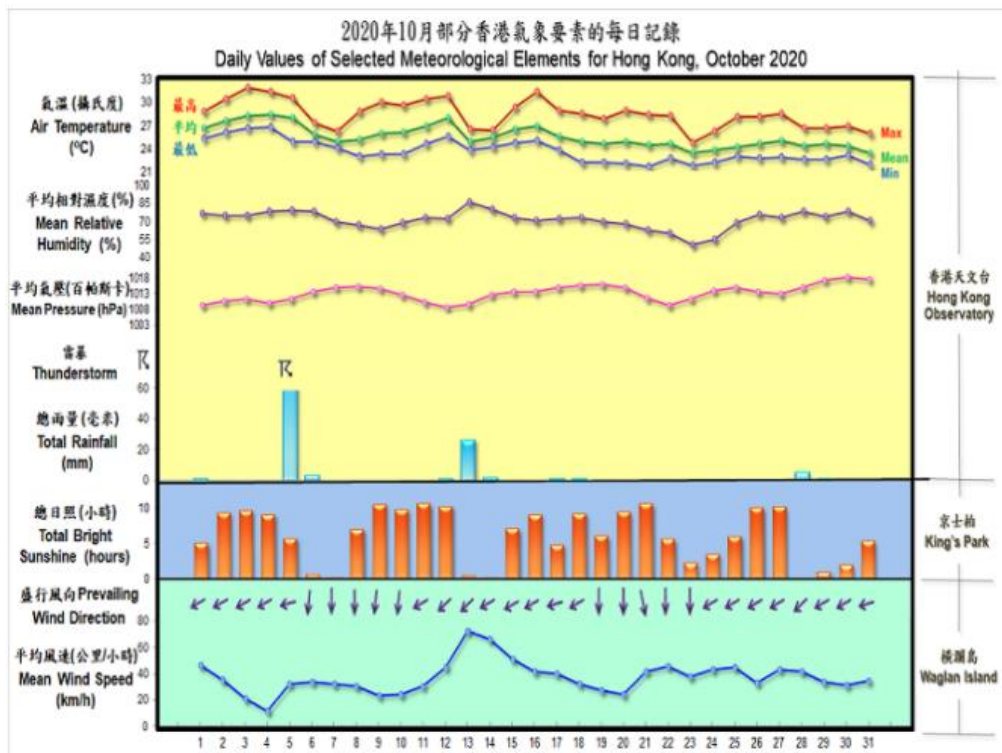


Figure 19 Weather of October 2020

Warnings and Signals issued in October 2020

Table 1.1 Tropical Cyclone Warning Signals

Name of Tropical Cyclone	Signal Number	Beginning Time		Ending Time	
		Day/Month	HKT	Day/Month	HKT
NANGKA	1	11 / 10	2040	12 / 10	1710
	3	12 / 10	1710	13 / 10	0540
	8 NE	13 / 10	0540	13 / 10	1940
	3	13 / 10	1940	14 / 10	0240
SAUDEL	1	22 / 10	1740	23 / 10	0020
	3	23 / 10	0020	24 / 10	0910

Table 1.2 Strong Monsoon Signal

Beginning Time		Ending Time	
Day/Month	HKT	Day/Month	HKT
1 / 10	0045	2 / 10	1340
5 / 10	2135	6 / 10	0740
14 / 10	0240	15 / 10	1015
15 / 10	2205	16 / 10	0510
24 / 10	0911	25 / 10	1300
27 / 10	2355	29 / 10	1330

Table 1.3 Rainstorm Warning Signals

Colour	Beginning Time		Ending Time	
	Day/Month	HKT	Day/Month	HKT
Amber	5 / 10	0725	5 / 10	0805
Red	5 / 10	0805	5 / 10	0905
Amber	5 / 10	0905	5 / 10	0930

Figure 20 Warnings and Signals issued in October 2020

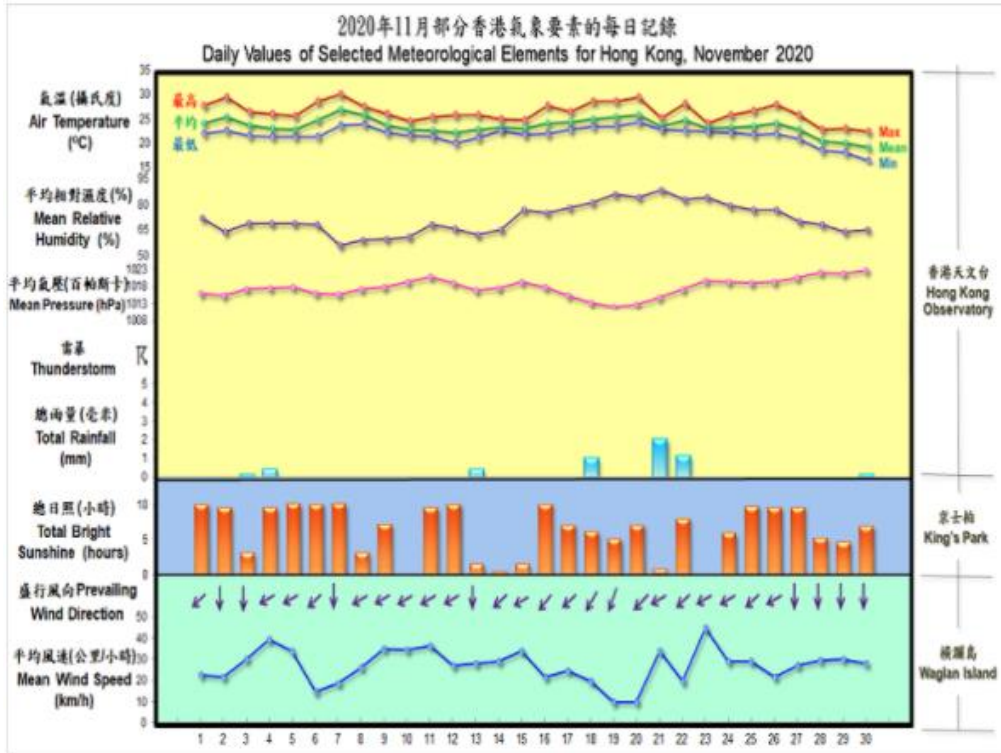


Figure 21 Weather of November 2020

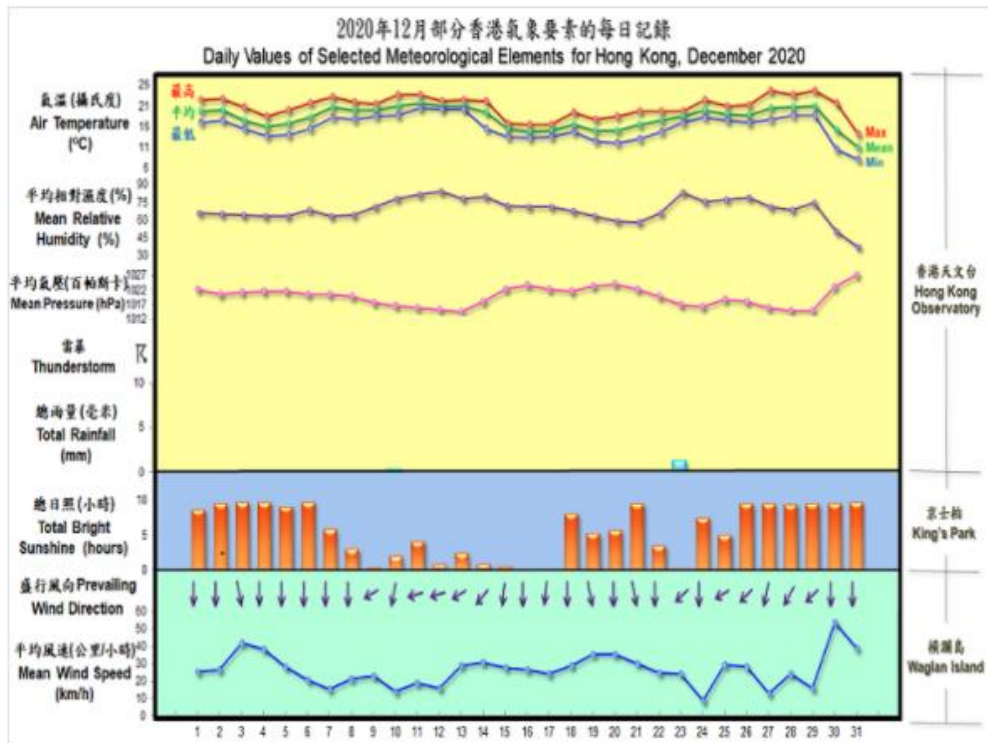


Figure 22 Weather of December 2020