

Radiofrequency Radiation Measurements for Public Wi-Fi Installations in Hong Kong

Office of the Communications Authority
8 December 2023

Introduction

The Office of the Communications Authority (formerly Office of the Telecommunications Authority, hereinafter collectively referred to as “OFCA”) has since 2007 regularly conducted territory-wide survey of the non-ionizing radiation (“NIR”) levels in the public areas due to public Wi-Fi access points (“APs”). The survey aims to gauge the abovementioned NIR levels and ensure that the NIR generated from public Wi-Fi APs does not cause exposure to the public in excess of the exposure limit recommended by the International Commission on Non-Ionizing Radiation Protection (“ICNIRP”) which is adopted by the Communications Authority (“CA”), in consultation with the Department of Health, for the protection of the public against the NIR hazards from radio transmitting equipment.

2. This report¹ presents the results of the survey conducted between June and August 2023. It is the seventh report in the series (previous ones were published in 2007, 2011, 2014, 2017, 2019 and 2021 respectively). As with the previous surveys, the latest survey results indicated that the NIR levels at the measurement locations with public Wi-Fi APs installed were well below the exposure limit recommended by the ICNIRP (the “ICNIRP limit”), ranging from less than 0.1% to 0.802% of the limit. The results tally with the finding of the World Health Organization (“WHO”) that exposure levels due to Wi-Fi are generally very low. According to the WHO, there is no convincing scientific evidence that the weak radiofrequency signals from wireless networks (including Wi-Fi) would cause adverse health effects.

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Wi-Fi and AP

Wi-Fi

3. In this report, Wi-Fi² refers to the IEEE 802.11 group of standards operating in the 2.4 GHz band, the 5 GHz band and the designated 6 GHz band. It is a wireless broadband access technology which uses radio frequencies for linking up user terminal equipment (e.g. notebook computers, smart phones, tablets, etc.) and the broadband network for Internet access. The network device providing the Wi-Fi air interface between the broadband network and the user terminal equipment is called AP, which is a radio transceiver. The user terminal equipment has installed/built-in Wi-Fi functionality for communication with the APs.

4. Wi-Fi devices share the same frequency spectrum with many other radio apparatus, such as Bluetooth wireless devices, cordless phones and video transmitters. Use of Wi-Fi devices for private purposes is covered by an exemption order³ and/or the Class Licence for 6 GHz Device⁴. Provision of public Wi-Fi services in premises and locations not situated at unleased Government lands or public streets is permissible under a class licence. For provision of public Wi-Fi services on or across unleased Government land or public streets, a unified carrier licence issued by the CA authorising the provision of public wireless local area network services is required.

5. According to the Exemption Order, the permissible peak equivalent isotropically radiated power⁵ (“e.i.r.p.”) in the 2.4 GHz and 5 GHz bands is 4 W. Under the Class Licence for 6 GHz Device, the maximum power is 0.25 W mean e.i.r.p. for indoor use and 0.025 W mean e.i.r.p. for outdoor use. However, the transmitting power of Wi-Fi devices, including those equipment used for provision of public Wi-Fi services in the market, is generally no higher than 0.1 W effective radiated power (“e.r.p.”). Such low transmitting power of Wi-Fi devices is commensurate with the intended usage of Wi-Fi for short range communications (within 50 meters).

² Wi-Fi devices can operate in the frequency spectrum 2.4 – 2.4825 GHz (“2.4 GHz band”), and the frequency spectrum 5.15 – 5.35 GHz, 5.47 – 5.725 GHz and 5.725 – 5.85 GHz (collectively referred to as “5 GHz band”) and 5.925 – 6.425 GHz (“the designated 6 GHz band”).

³ Applicable for 2.4 GHz and 5 GHz bands. The exemption order refers to the Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) (the “Exemption Order”) which exempts a number of frequency bands from the licensing requirement. Full text of the Order is available at <https://www.elegislation.gov.hk/hk/cap106Z>.

⁴ The Class Licence for 6 GHz Devices covers devices operating in the designated 6 GHz band - [https://www.coms-auth.hk/filemanager/common/licensing/Class_Licence_for_6_GHz_Device_\(ENG\).pdf](https://www.coms-auth.hk/filemanager/common/licensing/Class_Licence_for_6_GHz_Device_(ENG).pdf).

⁵ Equivalent isotropically radiated power (“e.i.r.p.”) refers to the power radiated from an isotropic antenna while effective radiated power (“e.r.p.”) refers to the power radiated from a half-wave dipole which has a gain of 1.64 over the isotropic antenna.

APs for Public Wireless Internet Access

6. APs are radiocommunications transceivers for the provision of wireless access to Internet service and they are scattered throughout the entire territory of Hong Kong, mainly in the densely populated and built-up areas.

7. In Hong Kong, there are many APs installed in publicly accessible areas, such as shopping malls, coffee shops, restaurants, MTR stations, airport, universities, convenience stores, supermarkets, public libraries, public hospitals, markets and public payphone kiosks. According to OFCA's record, as of 9 August 2023, there were already over 82,531 public Wi-Fi APs installed. The information on the locations of these APs is available at: https://app2.ofca.gov.hk/apps/wifi_search/onlineEnquiry.

NIR Limits

8. As a safety precaution to protect public health, the CA issued the "*Code of Practice for the Protection of Workers and Members of Public Against Non-Ionizing Radiation Hazards from Radio Transmitting Equipment*" ("CoP")⁶. Radiocommunications service providers are required to follow the CoP and ensure that the NIR generated from their radio transmitting equipment does not cause exposure to occupational personnel and the public in excess of the ICNIRP limits laid down in the "*Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz)*" (the "ICNIRP guidelines"). The relevant NIR limits are extracted in **Annex 1** for ease of reference.

The Survey

9. The survey was conducted between June and August 2023 at 55 selected locations with public Wi-Fi APs installed including the following types of places:

- (a) cafe, fast food shop, restaurant, convenience store, supermarket, public library, public hospital, market, public park, leisure place, promenade, sightseeing spot, betting branch, bank, theatre, etc.;
- (b) public place with a large number of co-located Wi-Fi installations such as immigration control point, MTR station, ferry pier, airport, etc.;
- (c) public payphone kiosk with APs where the APs are close to users

⁶ The CoP is available at https://www.ofca.gov.hk/filemanager/ofca/en/content_175/cop-radiation-hazards.pdf.

- due to physical constraint of the kiosk;
- (d) public housing estate and government premises provided with public Wi-Fi services;
 - (e) busy district where signals of public Wi-Fi services and those of domestic and commercial Wi-Fi installations co-exist;
 - (f) educational institution; and
 - (g) franchised bus, airport express train and ferry between Hong Kong and Macao.

Measurement Equipment and Method

Measurement Equipment

10. The levels of NIR from public Wi-Fi APs were measured with a professional radiation meter which is designed for measurement of aggregated NIR levels contributed from different radio transmitters in the vicinity and provides direct readout of the average NIR levels⁷ as required by the ICNIRP guidelines.

Measurement Method

11. The methodology of measurements on public Wi-Fi APs generally followed the widely adopted approach for NIR measurements. The measurements were carried out in areas accessible by the general public with measurement probe positioned at a height of approximately 1.7 m above ground corresponding to the head position of an average adult. The measurement results were obtained on the basis of continuous sampling of the radio frequency signals. Details of the measurement procedures and methodology are set out in **Annex 2**.

The Survey Results

12. The survey results are given in **Annex 3** which showed that the NIR levels measured at the selected locations with public Wi-Fi APs installed were substantially below the ICNIRP limit, ranging from less than 0.1% to 0.802% of the ICNIRP limit of 10 W/m².

⁷ The meter reads out E-field in V/m where the unit is converted into power density in W/m² for ease of reference.

Conclusion

13. Based on the survey results, it is concluded that the **NIR levels in various public areas of Hong Kong, including government premises with public Wi-Fi APs installed, are well below the international exposure limit adopted by the CoP. The survey results tally with the WHO's finding that exposure levels due to Wi-Fi are generally very low.** According to the WHO, there is no convincing scientific evidence that the weak RF signals from wireless networks (including Wi-Fi) would cause adverse health effects.

14. OFCA will continue to conduct regular territory-wide survey of public Wi-Fi APs to ensure that the general public exposure to NIR due to those Wi-Fi APs does not exceed the ICNIRP limit for the protection of public safety.

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NIR Limits

The health protection standards specified in the CoP are those laid down in the ICNIRP guidelines. According to the ICNIRP guidelines, the limits of NIR levels applicable to Wi-Fi devices are as follows:

**Reference levels for general public exposure to electromagnetic fields
in the frequency range of 2 – 300 GHz to
(unperturbed rms values)**

Class of personnel	Power density (W/m²)
General public	10

Measurements of NIR from Public Wi-Fi APs

Measurement Procedures

- Measurement of NIR levels is done in accordance with the following procedures:
 - (a) At each Wi-Fi hotspot location, the NIR meter is moved around in the local area to locate the maximum receivable signal strength. The first measurement will be taken at that position.
 - (b) At the measurement position, the NIR meter is positioned at a height of approximately 1.7 m (corresponds to the head position of an average adult).
 - (c) The NIR level averaged as read out from the meter is recorded.
 - (d) After conducting the measurement at the position identified in Step (a) which is usually close to the AP, further readings are taken sparsely within the local area where people normally stay. Steps (b) and (c) are repeated at other four sampling positions as far as the situation allows.
 - (e) The minimum and the maximum recorded NIR levels obtained in Step (c) at the measurement positions are presented in the summary table in **Annex 3**.

Results of NIR Measurements for Public Wi-Fi APs

Remarks

The NIR levels shown in the table below have nothing to do with the coverage performance of the respective APs as measurements were conducted in close proximity to the APs only. Some photos of the measurement locations are shown in the table.

Locations of APs	NIR Level		
	Measured Minimum / Maximum Power Density (W/m ²)	Measured Minimum / Maximum Power Density in term of Percentage of Exposure Limit (i.e. 10 W/m ²)	
Hong Kong Island (20 locations)			
Aberdeen Sports Ground	108 Wong Chuk Hang Road, Hong Kong	0.0033 / 0.007	0.033% / 0.07%
			

★ : the location where AP installed

Nam Long Shan Road
Cooked Food Market

1 Nam Long Shan Road, Wong
Chuk Hang, Hong Kong

<0.003

<0.03%



HK- Macau Ferry
Terminal (Outer Pier
Passenger Departure
Waiting Hall)

Shun Tak Centre, 200 Connaught
Road, Sheung Wan, Hong Kong

<0.003

<0.03%



<p>Central Pier 3</p>	<p>G/F, Central Pier 3, 11 Man Kwong Street, Central, Hong Kong</p> 	<p><0.003 / 0.0087</p>	<p><0.03% / 0.087%</p>
<p>Central (Exchange Square) Bus Terminus</p>	<p>G/F, Exchange Square, 8 Connaught Place, Central, Hong Kong</p> 	<p>0.0085 / 0.0273</p>	<p>0.085% / 0.273%</p>

<p>Starbucks Coffee</p>	<p>Shop No. 80, 1/F, Admiralty Centre, Admiralty, Hong Kong</p> 	<p><0.003 / 0.0057</p>	<p><0.03% / 0.057%</p>
<p>Aldrich Bay Promenade</p>	<p>Oi Lai Street, Aldrich Bay, Shau Kei Wan, Hong Kong</p> 	<p><0.003 / 0.0056</p>	<p><0.03% / 0.056%</p>

Hong Kong Film Archive

50 Lei King Road, Sai Wan Ho, Hong Kong

<0.003

<0.03%



Victoria Park

1 Hing Fat Street, Causeway Bay, Hong Kong

0.0048 / 0.0788

0.048% / 0.788%



<p>Bowrington Road Market</p>	<p>21 Bowrington Road, Wan Chai, Hong Kong</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Times Square</p>	<p>G/F, Times Square, 1 Matheson Street, Causeway Bay, Hong Kong</p> 	<p><0.003 / 0.0119</p>	<p><0.03% / 0.119%</p>

<p>The Hong Kong Jockey Club - Betting Branch</p>	<p>1/F, Lai Yuen Apartments, 78-82 Percival Street, Causeway Bay, Hong Kong</p> 	<p>0.0052 / 0.0174</p>	<p>0.052% / 0.174%</p>
<p>Bank of China (Hong Kong)</p>	<p>213 Queen's Road East, Wan Chai, Hong Kong</p> 	<p><0.003 / 0.0053</p>	<p><0.03% / 0.053%</p>

<p>Tang Shiu Kin Hospital</p>	<p>G/F, Main Building, 282 Queen's Road East, Wan Chai, Hong Kong</p> 	<p>0.0053 / 0.0079</p>	<p>0.053% / 0.079%</p>
<p>Golden Bauhinia Square</p>	<p>Expo Drive, Wan Chai, Hong Kong</p> 	<p>0.0047 / 0.0157</p>	<p>0.047% / 0.157%</p>

<p>7-Eleven Convenience Store</p>	<p>Shop No. GD18, G/F, Lei King Wan, 25 Tai On Street, Shau Kei Wan, Hong Kong</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Eastern Magistrates' Courts</p>	<p>Lobby, 7/F, Eastern Law Courts Building, 29 Tai On Street, Sai Wan Ho, Hong Kong</p>	<p><0.003 / 0.0034</p>	<p><0.03% / 0.034%</p>

<p>Circle K Convenience Store</p>	<p>Unit No. 5, G/F, City Garden Shopping Mall, 233 Electric Road, North Point, Hong Kong</p> 	<p><0.003</p>	<p><0.03%</p>
<p>KFC restaurant</p>	<p>1/F, Ming Yuen Centre, 402-404 King's Road, North Point, Hong Kong</p> 	<p><0.003 / 0.0048</p>	<p><0.03% / 0.048%</p>

Java Road Market
Cooked Food Centre

1/F, Java Road Municipal Services
Building, 99 Java Road, North
Point, Hong Kong

<0.003

<0.03%



Kowloon (19 locations)			
Queen Elizabeth Hospital	6/F, Ambulatory Care Centre, Queen Elizabeth Hospital, 30 Gascoigne Road, Kowloon	<0.003 / 0.0038	<0.03% / 0.038%
			
Tung Wah College (King's Park Campus)	31 Wylie Road, Ho Man Tin, Kowloon	<0.003	<0.03%
			

<p>Langham Place</p>	<p>Food Court, Level 4, Langham Place, 8 Argyle Street, Mongkok, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Un Chau Estate</p>	<p>Sitting-out Area, Un Chau Estate, Sham Shui Po, Kowloon</p> 	<p><0.003 / 0.0033</p>	<p><0.03% / 0.033%</p>

<p>PCCW payphone kiosk</p>	<p>Kiosk ID no. PP07411 outside Un On Building, 130 Camp Street, Sham Shui Po, Kowloon</p> 	<p>0.0106 / 0.0225</p>	<p>0.106% / 0.225%</p>
<p>The Hong Kong Jockey Club - Betting Branch</p>	<p>G/F, 137-139 Kweilin Street, Sham Shui Po, Kowloon</p> 	<p>0.013 / 0.0472</p>	<p>0.13% / 0.472%</p>

<p>Hong Kong Metropolitan University</p>	<p>30 Good Shepherd Street, Ho Man Tin, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Ho Man Tin Estate</p>	<p>Near Homantin Plaza, G/F, Yat Man House, Ho Man Tin Estate, Kowloon</p> 	<p>0.0033 / 0.0036</p>	<p>0.033% / 0.036%</p>

<p>Ko Shan Theatre</p>	<p>3/F, Ko Shan Theatre New Wing, 77 Ko Shan Road, Hung Hom, Kowloon</p> 	<p>0.0073 / 0.0082</p>	<p>0.073% / 0.082%</p>
<p>Kwun Tong Promenade</p>	<p>80 Hoi Bun Road, Kwun Tong, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>

<p>HSBC Kwun Tong Branch and Premier Centre</p>	<p>71 Hoi Yuen Road, Kwun Tong, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>
<p>PARKnSHOP Supermarket</p>	<p>Shop No. S229, Chuk Yuen Shopping Centre, 15 Chuk Yuen Road, Wong Tai Sin, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>

<p>Pacific Coffee</p>	<p>Shop No. N111 and N112, Level 1, Temple Mall North, 136 Lung Cheung Road, Wong Tai Sin, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Tao Heung Teas House</p>	<p>Shop No. S150-153, 2/F, Phase 1 Amoy Plaza, 77 Ngau Tau Kok Road, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>

<p>Kai Tak Cruise Terminal</p>	<p>Waiting Hall B, 2/F, Kai Tak Cruise Terminal Building, 33 Shing Fung Road, Kai Tak, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Kai Tak Cruise Terminal (Cont'd)</p>	<p>Baggage Hall, G/F, Kai Tak Cruise Terminal Building, 33 Shing Fung Road, Kai Tak, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>

<p>Mikiki Shopping Mall</p>	<p>LG1, 638 Prince Edward Road East, San Po Kong, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Tsim Sha Tsui Star Ferry Pier</p>	<p>Star Ferry Pier (inside paid area), Tsim Sha Tsui, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>

<p>Avenue of Stars</p>	<p>Tsim Sha Tsui, Kowloon</p> 	<p>0.0481 / 0.0802</p>	<p>0.481% / 0.802%</p>
<p>West Kowloon Art Park</p>	<p>West Kowloon Cultural District, Kowloon</p> 	<p><0.003</p>	<p><0.03%</p>

New Territories (10 locations)			
Tsuen Wan Public Library	Children's Library, 4/F, Tsuen Wan Public Library, 38 Sai Lau Kok Road, Tsuen Wan, New Territories	<0.003	<0.03%
			
Tsuen Wan Job Centre	2/F, Tsuen Wan Government Offices, 38 Sai Lau Kok Road, Tsuen Wan, New Territories .	<0.003	<0.03%
			

<p>Café de Coral</p>	<p>1/F, Cheong Yiu Mansion, 163-174 Castle Peak Road, Tsuen Wan, New Territories</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Kwai Tsing Theatre</p>	<p>12 Hing Ning Road, Kwai Chung, New Territories</p> 	<p><0.003 / 0.0039</p>	<p><0.03% / 0.039%</p>

<p>Sha Tin Public Library</p>	<p>Children's Library, 1 Yuen Wo Road, Sha Tin, New Territories</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Sha Tin Central Bus Terminus</p>	<p>G/F, New Town Plaza (Phase 1), 18 Sha Tin Centre Street, Sha Tin, New Territories</p> 	<p>0.0093 / 0.0332</p>	<p>0.093% / 0.332%</p>

<p>Sha Tin Home Affairs Enquiry Centre</p>	<p>G/F, Sha Tin Government Offices, 1 Sheung Wo Che Road, Sha Tin, New Territories</p> 	<p><0.003</p>	<p><0.03%</p>
<p>AsiaWorld-Expo</p>	<p>Opposite to First Aid Room, G/F, AsiaWorld-Expo, Hong Kong International Airport, Lantau Island</p> 	<p><0.003</p>	<p><0.03%</p>

<p>Hong Kong International Airport's Terminal 1</p>	<p>Level 5, Terminal 1, Hong Kong International Airport</p> 	<p>0.0049 / 0.0063</p>	<p>0.049% / 0.063%</p>
<p>Hong Kong International Airport's Terminal 1 (Cont'd)</p>	<p>Level 7, Terminal 1, Hong Kong International Airport</p> 	<p><0.003</p>	<p><0.03%</p>

PARKnSHOP
Supermarket

Shop No. 313, 3/F, Maritime
Square, 33 Tsing King Road,
Tsing Yi, New Territories

<0.003 / 0.0046

<0.03% / 0.046%



Public Transportation (6 locations)			
Hong Kong to Macau Ferry TurboJET	on the lower deck of TurboJet's PENHA	<0.003	<0.03%
			
Citybus	on the bus	<0.003	<0.03%
			

<p>MTR Station – Austin</p>	<p>Concourse of Austin MTR Station</p> 	<p><0.003 / 0.0053</p>	<p><0.03% / 0.053%</p>
<p>Hong Kong West Kowloon Station</p>	<p>Concourse of Hong Kong West Kowloon Station</p> 	<p>0.0031 / 0.0062</p>	<p>0.031% / 0.062%</p>

<p>MTR Station - Tsing Yi</p>	<p>Concourse of Tsing Yi MTR Station</p> 	<p><0.003</p>	<p><0.03%</p>
<p>Airport Express</p>	<p>on the Airport Express train</p> 	<p><0.003 / 0.0057</p>	<p><0.03% / 0.057%</p>