

EQUITY RESEARCH

February 2, 2022

Blog

BLOG: Tracking The 5G Wireless Wave That Will Gain Momentum In 2022

Read Time: ~7 Minutes

While COVID-19 slowed the wireless wave's deployment, 2021 was marked by advancements in the development and innovation of 5G. In this blog, we update readers on the state of the 5G deployment in the U.S. as we enter 2022 and discuss the implications for the Canadian technology 5G landscape.

This year should see U.S. carriers gain momentum and intensify competition after the slow but steady groundwork they laid in 2020 and 2021. In 2022 and 2023, Verizon and AT&T plan to prioritize deploying their C-band spectrum that is a cornerstone of each of their highest performance 5G networks. Readers will recall that both carriers spent a combined ~\$70B at last February's auction for C-band spectrum licenses. In contrast, T-Mobile should be pre-occupied with the rollout of its own mid-band spectrum which it gained after its 2020 acquisition of Sprint. All carriers have ambitious plans to reach between 200 million and 300 million people by the end of 2023 with their high-performance 5G networks; a large contrast to the mere two million U.S. subscribers that had access in 2020 (Lightreading).

As carriers' 5G deployment plans progress this year, the list of 5G-compatible phones for consumers should also continue to expand. Already, handset manufacturers have added additional 5G-enabled devices to their lists since our last blog, including Apple's iPhone 13, Samsung Galaxy's Z Flip 3, and Z Fold3 5G, among many others.

While we view 5G as an exciting and investable technology theme, the direct opportunities in Canada are currently limited to the carriers and a handful of smaller technology companies. This slow but steady progress provides investors extra time to assess the industry for opportunities.

Todd Coupland, CFA
+1 416-956-6025
Todd.Coupland@cibc.com

Valery Heckel
+1 416-594-7232
Valery.Heckel@cibc.com

Sectors:

Information Technology, Telecommunication Services



2022 5G Commercial Deployments Continue Their Progress

As the 5G wireless wave gains momentum, our goal is to track its progress and implications. Our “Tracking The 5G Tidal Wave” blog provides updates for both global and Canadian developments, providing context and insights to investors.

The 5G commercial deployment plans in the U.S. experienced delays due to the COVID-19 pandemic; a slow rollout that extended into 2021. However, the pace is starting to pick up steam as we look to 2022. To explain why and how, we begin by discussing the current state of 5G deployment in the U.S., covering the plans of its three largest carriers before we continue with the known carrier network deployment plans for 2022. Throughout this blog we refer to “high-performance 5G networks” as the 5G carrier networks which are comprised of mid- or high-band spectrum, or a combination of both.

We conclude by discussing what these 5G trends mean for investors who continue to have time to assess the opportunities in 5G. These are substantial and range from consumer applications to enterprise IoT applications. Terry Matthews, the prolific founder and Chairman of Wesley Clover, reiterated to us that the 5G investment cycle is one of the most important technology trends of the next decade. Canada is in a terrific position to benefit, given its leadership and development of this important technology as well as its 5G innovation hub in the Ottawa/Kanata region.

While investors have been given extra time to assess the opportunities in the space, it is important that certain commercial deployment companies (like Nokia) have begun to outperform the early lab/field trial plays. That trend should continue and broaden out as further 5G investments take place, and both consumers and enterprises begin to adopt its many use cases.

Mid-band Deployments To Dominate U.S. 5G Plans In 2022

The three major U.S. carriers – Verizon, AT&T, and T-Mobile – continue to deploy their highest performance 5G networks that combine both mid- and high-band (or millimeter Wave, mmWave) spectrum. Readers will recall that 5G has already been available in low-band, mid-band and high-band to varying degrees.

Low-band 5G Is Virtually Everywhere

Low-band nationwide 5G coverage is available and characterized as any spectrum that is lower than 1GHz. While it can cover a large geographic footprint, it does not offer a higher speed advantage, and in fact is often slower than 4G LTE (Nokia). In terms of low-band 5G deployment, T-Mobile's low-band 5G is in the lead in terms of coverage, and reaches more than 310MM people. Second is AT&T with coverage of 255MM people, followed by Verizon which covers 230MM people (CNET).

Competition Intensifies Within Mid-band 5G And Sees Some Hiccups

Mid-band is available but not yet broadly. This type of frequency ranges between 1 – 6 GHz and offers faster speeds and greater capacity than low band. It also offers a much larger coverage area than high-band mmWave and can penetrate walls, but does not offer the download speed of over one gigabyte per second (Gbps) as mmWave does.

Verizon and AT&T's mid-band strategy, which runs on C-band frequencies (3.7 - 3.9 GHz), was slated to begin its rollout in late December. The plans hit a snag last month due to safety concerns raised by the Federal Aviation Administration (FAA) over the potential of the C-band frequency interfering with radio altimeters, which help planes determine altitude and distance from other objects. Issues with altimeters can jeopardize a plane's ability to operate safely. For now, a temporary agreement has been reached whereby Verizon and AT&T can continue their rollout, but are prohibited from activating C-band 5G within two-mile buffer zones around airports. This agreement still enables both carriers to expand with 90% of their planned 5G service expansion (NYT).

“5G is one of the most important technology trends in the next decade. Canada is in a terrific position to benefit, given its leadership and development of this important technology.”

- Terry Matthews, Founder and Chairman of Wesley Clover International

Each carrier has different mid-band coverage ambitions over the next two years. Verizon's mid-band already covers ~100MM people and 1,700 cities. The company expects to spend between five billion and six billion dollars in capex over the next year to increase coverage to 175MM people by late 2023. Mid-band is a crucial aspect of Verizon's highest performance 5G strategy, which in combination with the company's mmWave spectrum, is marketed and offered to consumers as **Ultra Wideband 5G**.

AT&T's C-band spectrum, meanwhile, is currently accessible in only a few markets, including Austin, Chicago, Dallas-Fort Worth, Detroit, Houston, Jacksonville, Miami and Orlando. The company has plans to reach 75MM people by 2022 and 200MM people by 2023. In combination with the company's high-band 5G spectrum, it is marketed as **5G+**.

In contrast, T-Mobile's mid-band strategy, which does not rely on C-band, has avoided the regulatory issues encountered by Verizon and AT&T. Its acquisition of Sprint in 2020 came with vast mid-band spectrum holdings in the 2.5 GHz band. Its mid-band footprint, marketed as **Ultra Capacity 5G**, covers 210MM people, with plans to cover over 300MM people by late 2023.

Readers will recall that carriers bid more than \$80B at last February's auction for the C-band portion of the wireless spectrum for 5G. Verizon spent \$46B, followed by AT&T (\$23B), and T-Mobile (\$9B) (NYT).

High-band 5G Coverage Remains Concentrated In High-volume Areas

High-band 5G typically ranges between 24 – 47 GHz and is not broadly available. Where deployed, it is often only accessible in certain areas with limited range due to its reliance on unobstructed proximity to cell towers. These spots are typically outdoors, available in a limited range, and often in places with high human-concentration levels; like sports stadiums and airports. Nonetheless, mmWave is an essential component to carriers' overall 5G strategy, in combination with their low- and mid-band spectrums.

Verizon continues to expand the coverage of its mmWave offerings, which now cover 82 cities, up from 57 at the time of our last report. The company launched its new Ultra Wideband 5G offering on January 19. It is purported to be 10x faster than typical 4G LTE speeds.

AT&T's high-band 5G offering (marketed as "**5G+**") is progressing slower than Verizon's. It is currently available in 44 cities, up from the 38 we reported a year ago. This coverage will also be augmented by AT&T's C-band spectrum.

T-Mobile too offers high-band 5G, but to a much more limited extent than Verizon and AT&T due to its prioritization of mid-band in its 5G strategy over mmWave. Nonetheless, the company currently offers high-band 5G in Atlanta, Cleveland, Dallas, Las Vegas, Los Angeles and New York, with plans to add additional cities to the list.

High-performance 5G supports both speed and low latency. Within two to three years, the benefits of smaller network delays or lower latency should be available with national high-performance 5G coverage. It is a crucial component of carriers' strategy to increasingly move consumers up into more comprehensive, albeit expensive, coverage plans.

Consumers will require a device capable of accessing these high-performance 5G networks, and in particular, the newly-available C-band spectrum. Since our last report, a number of new devices with this capability have been introduced into the market.

5G Handset Options And Adoption Grows

The high-performance 5G networks of all three carriers are compatible with numerous new devices introduced to the market over the last year. This includes Apple's iPhone 13 and 12, in addition to its iPad 5G series. Samsung's Galaxy S21 series, Flip 3 and Fold 3 are on this list as well. Devices within the Google Pixel 6 series, however, are currently only compatible with AT&T and T-Mobile's high-performance 5G networks. Verizon has stated that the Pixel 6 series and other 5G-enabled phones that do not currently support its C-band spectrum will receive software updates to make them compatible in early 2022. The company plans to have over 20 C-band compatible devices by the end of the year. AT&T already offers 17 devices that support its C-band network.

5G-enabled Smartphone Adoption Increases

Counterpoint Research estimated that between 2020 and mid-2021, 5G smartphones significantly increased their U.S. market share, increasing from 3% of total U.S. mobile phone sales in January 2020 to 57% by March 2021. This aligns with data from IDC's Telecom Services Tracker which confirmed that in mid-2021, 5G-enabled phones represented 60% of the smartphones in the U.S. By the end of 2021, 5G smartphone sales are expected to have represented 80% of U.S. mobile sales.

Growth in the U.S. 5G smartphone market in 2021 was largely driven by Apple's iPhone 13, which in the December quarter accounted for over half of the company's total revenue. The device holds the top market share in the country according to Apple CEO Tim Cook. Fierce Wireless reports that 85% of the company's smartphone revenue is from 5G devices, vs Android where that figure is just over half.

This year is expected to be characterized by intense competition between carriers, who are likely to continue strong trade-in promotions on flagship devices, a trend that was kicked off by AT&T in 2021. These will be crucial for carriers to increase their average revenue per user (ARPU) and attract new customers to their networks, ultimately helping offset the costs of their 5G deployments (Counterpoint Research).

5G Average Sales Prices Increased In 2021 But Trend Should Reverse

In 2021, supply chain shortages impacted 4G components more than 5G components, and this has had a more of a detrimental impact on smartphone manufacturers with a higher portfolio mix of 4G devices (e.g., Android) than those with a higher proportion of 5G devices (e.g., Apple).

This has resulted in a bump in the 5G average selling prices (ASP) as the production of higher-value devices is not as materially impacted by shortages. IDC expects 5G-powered smartphones to have an ASP of \$643 in 2021, which is 1.7% higher than in 2020 due to the immense success of the iPhone 12 and 13 (the iPhone 13 ranges in price from \$699 to \$1,099). By the end of 2023, IDC expects ASPs to drop to \$416 as competition in the 5G Android space increases and applies downward pressure on 5G ASPs.

Beyond Smartphones: Other Devices That Will Benefit From 5G

As 5G smartphone adoption rises, additional innovative products that benefit from 5G will also be introduced into the market. For example, we have heard that Apple may be launching its own 5G modem as part of its 2023 iPhone line up (Mac Rumors). Once released, it would help harness other related IoT applications.

5G smartphones have increased their U.S. market share from 3% of total U.S. mobile phone sales in early 2020 to 57% in March the following year. Adoption should continue to rise as more 5G-enabled smartphone options enter the market and average selling prices eventually start to fall.

Conclusion: 5G Is An Investable Theme Beyond 2022

“5G has the potential to deliver \$8 trillion of economic value over time.”
- Nokia Labs Consulting

According to Nokia Labs Consulting, 5G has the potential to deliver \$8 trillion of economic value over time. Prior to that happening, the network must be upgraded. In the U.S. alone it is estimated that US\$275 billion must be invested in networks over the 5G cycle, according to the industry trade group CTIA. 5G wireless spectrum, infrastructure for base stations, the core of the network, and all the next generation applications should benefit from this very large investment cycle that is likely to play out over the next 10 years. The 5G opportunity is large and there will be multiple ways for investors to participate. The graphic in Exhibit 1 shows the 5G cycle by phase and year indicating when specific companies are expected to benefit.

In 2021, the share prices of lab and field trial companies (e.g., Keysight Technologies, Viavi) performed well, while U.S. carriers have lagged during the second half of 2021. The only exception is T-Mobile, which had a run-up in its share price in the first half of 2021. Infrastructure companies like Ciena, Nokia, and Ericsson also performed well in 2021 and continue to do so in 2022. This is positive as it points to investors anticipating the scale-up phase of the 5G investment cycle.

We reiterate that Canada is a global hub for 5G wireless development with much of it centered in the Kanata/Ottawa, Ontario region. The area is home to the most important R&D centers for the large and established infrastructure companies like Ciena, Nokia and Ericsson, and to emerging private companies that include Solace and Think RF.

In Canada public companies, including Baylin, have seen their share prices well off their peaks from 2015. In 2021, it remained relatively unaffected by 5G opportunities. Baylin has suffered from execution issues and supply chain constraints due to COVID-19. That resulted in the change of its CEO. Leighton Carroll agreed to join the company as President and Chief Executive Officer in June 2021, and brings 25 years of experience in wireless networks. Prior to Baylin, he held progressively senior positions within AT&T, including as a leader of significant business units within AT&T and as a merger & integration executive.

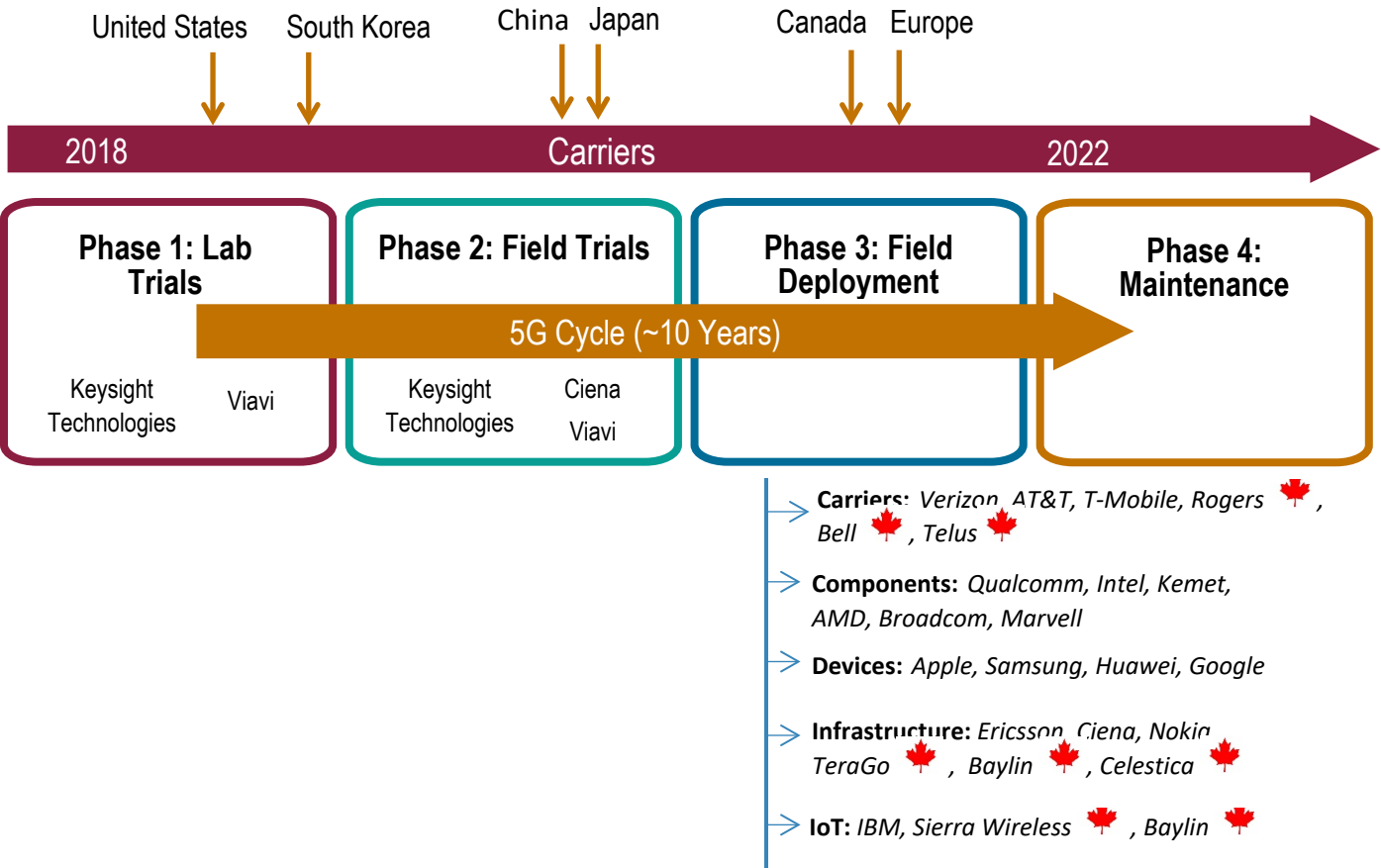
Beyond its leadership challenges, Baylin suffered from lower-than-expected small cell densification by its major carrier customers (the largest being AT&T). A recovery in standalone 5G and alternate Internet of Things use-cases could help Baylin. Timing on this beginning remains unclear.

While still in the early stages of a 10-year 5G cycle, investors are getting extra time to assess commercial and/or field deployments to identify the next round of opportunities.

While we are still in the early stages of a 10-year 5G cycle, investors continue to get extra time to assess the commercial or field deployments for the next round of opportunities. The carrier plans for 2022 and 2023 are to deploy their mid-band spectrum across the U.S. and encourage consumers to upgrade to 5G devices on their networks. With these two-year-long deployment plans known, we will continue to track their progress. As they advance, it should begin to reveal investment opportunities.

Longer term, as high-performance 5G becomes more prevalent, it will allow many of these companies to benefit. The graphic in Exhibit 1 shows our timeline and the impact to the related companies and carriers.

Exhibit 1: The 5G Deployment Cycle – Companies That Should Benefit By Phase And Year, 2018 – 2022 And Beyond



Source: Company reports and CIBC World Markets Inc.

Important Disclosures

Analyst Certification: Each CIBC World Markets Inc. research analyst named on the front page of this research report, or at the beginning of any subsection hereof, hereby certifies that (i) the recommendations and opinions expressed herein accurately reflect such research analyst's personal views about the company and securities that are the subject of this report and all other companies and securities mentioned in this report that are covered by such research analyst and (ii) no part of the research analyst's compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by such research analyst in this report.

Potential Conflicts of Interest: Equity research analysts employed by CIBC World Markets Inc. are compensated from revenues generated by various CIBC World Markets Inc. businesses, including the CIBC World Markets Investment Banking Department. Research analysts do not receive compensation based upon revenues from specific investment banking transactions. CIBC World Markets Inc. generally prohibits any research analyst and any member of his or her household from executing trades in the securities of a company that such research analyst covers. Additionally, CIBC World Markets Inc. generally prohibits any research analyst from serving as an officer, director or advisory board member of a company that such analyst covers.

In addition to 1% ownership positions in covered companies that are required to be specifically disclosed in this report, CIBC World Markets Inc. may have a long position of less than 1% or a short position or deal as principal in the securities discussed herein, related securities or in options, futures or other derivative instruments based thereon.

Recipients of this report are advised that any or all of the foregoing arrangements, as well as more specific disclosures set forth below, may at times give rise to potential conflicts of interest.

CIBC World Markets Inc. does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that CIBC World Markets Inc. may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

Analysts employed outside the U.S. are not registered as research analysts with FINRA. These analysts may not be associated persons of CIBC World Markets Corp. and therefore may not be subject to FINRA Rule 2241 restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

CIBC World Markets Inc. Stock Rating System

Stock Ratings	Abbreviation	Description
Outperformer	OP	Stock is expected to outperform similar stocks in the coverage universe during the next 12-18 months.
Neutral	NT	Stock is expected to perform in line with similar stocks in the coverage universe during the next 12-18 months.
Underperformer	UN	Stock is expected to underperform similar stocks in the coverage universe during the next 12-18 months.
Tender	TR	Shareholders are advised to tender shares to a specific offer as we do not believe a superior offer will materialize.
Not Rated	NR	CIBC World Markets does not maintain an investment recommendation on the stock.
Restricted	R	CIBC World Markets is restricted (due to potential conflict of interest) from rating the stock.

Sector Ratings	Abbreviation	Description
Overweight	O	Sector is expected to outperform the broader market averages.
Marketweight	M	Sector is expected to equal the performance of the broader market averages.
Underweight	U	Sector is expected to underperform the broader market averages.
None	NA	Sector rating is not applicable.

Note: Broader market averages refer to S&P 500 in the U.S. and S&P/TSX Composite in Canada.

CIBC World Markets Inc. Price Chart

For price and performance charts, please visit CIBC on the web at <https://researchcentral.cibccm.com/#/disclaimer-central-new> or write to CIBC World Markets Inc., 161 Bay Street, 4th Floor, Toronto, ON M5H 2S8, Attn: Research Disclosure Chart Request.

Important Disclosure Footnotes

For important disclosure footnotes for companies mentioned in this report that are covered by CIBC World Markets Inc., click here: [CIBC Disclaimers & Disclosures](#)

Companies mentioned in the report but not listed are not covered by fundamental research at CIBC.

Ratings Distribution*: CIBC World Markets Inc. Coverage Universe

(as of 02 Feb 2022)	Count	Percent	Inv. Banking Relationships	Count	Percent
Outperformer	176	58.5%	Outperformer	176	100.0%
Neutral	116	38.5%	Neutral	115	99.1%
Underperformer	9	3.0%	Underperformer	9	100.0%
Tender	0	0.0%	Tender	0	0.0%
Restricted	7	2.3%	Restricted	7	100.0%

Important disclosures for each issuer can be found by visiting the Research Central website at <https://researchcentral.cibccm.com/#/disclaimer-central-new> and then entering the issuer name. Access to our research dissemination policy can be found on the same website at <https://researchcentral.cibccm.com/#/dissemination-policy>. These important disclosures can also be obtained by writing to CIBC World Markets Inc., 161 Bay Street, 4th Floor, Toronto, ON M5H 2S8, Attention: Research Disclosures Request.

Access to CIBC Equity Research

Clients may access CIBC Equity Research online at Research Central at <https://researchcentral.cibccm.com/>, or at the following research aggregators: Bloomberg, Refinitiv, Capital IQ, and FactSet.

Legal Disclaimer

This report is issued and approved for distribution by (a) in Canada, CIBC World Markets Inc., a member of the Investment Industry Regulatory Organization of Canada ("IIROC"), the Toronto Stock Exchange, the TSX Venture Exchange and a Member of the Canadian Investor Protection Fund, (b) in the United Kingdom, CIBC World Markets plc, is Authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority, (c) in Australia to wholesale clients only, CIBC Australia Ltd, a company regulated by the ASIC with AFSL license number 240603 and ACN 000 067 256, and (d) in Japan, CIBC World Markets (Japan) Inc., a registered Type 1 Financial product provider with the registration number Director General of Kanto Finance Bureau #218 (collectively, "CIBC World Markets") and (e) in the United States either by (i) CIBC World Markets Inc. for distribution only to U.S. Major Institutional Investors ("MII") (as such term is defined in SEC Rule 15a-6) or (ii) CIBC World Markets Corp., a member of the Financial Industry Regulatory Authority ("FINRA"). U.S. MIIs receiving this report from CIBC World Markets Inc. (the Canadian broker-dealer) are required to effect transactions (other than negotiating their terms) in securities discussed in the report through CIBC World Markets Corp. (the U.S. broker-dealer). CIBC World Markets Corp. accepts responsibility for the content of this research report.

This report is provided, for informational purposes only, to institutional investor and retail clients of CIBC World Markets in Canada, and does not constitute an offer or solicitation to buy or sell any securities discussed herein in any jurisdiction where such offer or solicitation would be prohibited. This document and any of the products and information contained herein are not intended for the use of Retail investors in the United Kingdom. Such investors will not be able to enter into agreements or purchase products mentioned herein from CIBC World Markets plc. The comments and views expressed in this document are meant for the general interests of wholesale clients of CIBC Australia Ltd.

This report has been prepared by the CIBC group and is issued in Hong Kong by Canadian Imperial Bank of Commerce, Hong Kong Branch, a registered institution under the Securities and Futures Ordinance, Cap 571 (the "SFO"). This report is intended for "professional investors" only (within the meaning of the SFO) and has been prepared for general circulation and does not take into account the objectives, financial situation or needs of any recipient. Any recipient in Hong Kong who has any questions or requires further information on any matter arising from or relating to this report should contact Canadian Imperial Bank of Commerce, Hong Kong Branch at Suite 3602, Cheung Kong Centre, 2 Queen's Road Central, Hong Kong (telephone number: +852 2841 6111). Orders for Hong Kong listed securities will be executed by Canadian Imperial Bank of Commerce, Hong Kong Branch. Canadian Imperial Bank of Commerce, Hong Kong Branch has entered into an arrangement with its broker-dealer affiliates worldwide to execute orders for securities listed outside of Hong Kong for Hong Kong clients.

This report is intended for distribution in Singapore solely to "institutional investors" (within the meanings of the Financial Advisers Act (Chapter 110 of Singapore)).

The securities mentioned in this report may not be suitable for all types of investors. This report does not take into account the investment objectives, financial situation or specific needs of any particular client of CIBC World Markets. Recipients should consider this report as only a single factor in making an investment decision and should not rely solely on investment recommendations contained herein, if any, as a substitution for the exercise of independent judgment of the merits and risks of investments. The analyst writing the report is not a person or company with actual, implied or apparent authority to act on behalf of any issuer mentioned in the report. Before making an investment decision with respect to any security recommended in this report, the recipient should consider whether such recommendation is appropriate given the recipient's particular investment needs, objectives and financial circumstances. CIBC World Markets suggests that, prior to acting on any of the recommendations herein, Canadian retail clients of CIBC World Markets contact one of our client advisers in your jurisdiction to discuss your particular circumstances. Non-client recipients of this report who are not institutional investor clients of CIBC World Markets should consult with an independent financial advisor prior to making any investment decision based on this report or for any necessary explanation of its contents. CIBC World Markets will not treat non-client recipients as its clients solely by virtue of their receiving this report.

Legal Disclaimer (Continued)

Past performance is not a guarantee of future results, and no representation or warranty, express or implied, is made regarding future performance of any security mentioned in this report. The price of the securities mentioned in this report and the income they produce may fluctuate and / or be adversely affected by exchange rates, and investors may realize losses on investments in such securities, including the loss of investment principal. CIBC World Markets accepts no liability for any loss arising from the use of information contained in this report, except to the extent that liability may arise under specific statutes or regulations applicable to CIBC World Markets.

Information, opinions and statistical data contained in this report were obtained or derived from sources believed to be reliable, but CIBC World Markets does not represent that any such information, opinion or statistical data is accurate or complete (with the exception of information contained in the Important Disclosures section of this report provided by CIBC World Markets or individual research analysts), and they should not be relied upon as such. All estimates, opinions and recommendations expressed herein constitute judgments as of the date of this report and are subject to change without notice.

Nothing in this report constitutes legal, accounting or tax advice. Since the levels and bases of taxation can change, any reference in this report to the impact of taxation should not be construed as offering tax advice on the tax consequences of investments. As with any investment having potential tax implications, clients should consult with their own independent tax adviser.

This report may provide addresses of, or contain hyperlinks to, Internet web sites. CIBC World Markets has not reviewed the linked Internet web site of any third party and takes no responsibility for the contents thereof. Each such address or hyperlink is provided solely for the recipient's convenience and information, and the content of linked third party web sites is not in any way incorporated into this document. Recipients who choose to access such third-party web sites or follow such hyperlinks do so at their own risk.

Although each company issuing this report is a wholly owned subsidiary of Canadian Imperial Bank of Commerce ("CIBC"), each is solely responsible for its contractual obligations and commitments, and any securities products offered or recommended to or purchased or sold in any client accounts (i) will not be insured by the Federal Deposit Insurance Corporation ("FDIC"), the Canada Deposit Insurance Corporation or other similar deposit insurance, (ii) will not be deposits or other obligations of CIBC, (iii) will not be endorsed or guaranteed by CIBC, and (iv) will be subject to investment risks, including possible loss of the principal invested. The CIBC trademark is used under license.

© 2022 CIBC World Markets Inc. and CIBC World Markets Corp. All rights reserved. Unauthorized use, distribution, duplication or disclosure without the prior written permission of CIBC World Markets is prohibited by law and may result in prosecution.