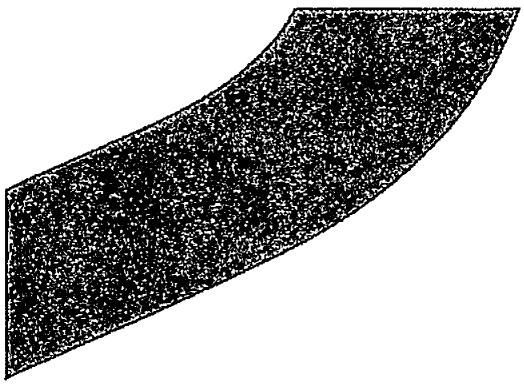


Bell 2018 5G trial plans

For discussion with ISED

Version 1.4

Confidential

Introduction

Continuing the success of our pre-standard trial, Bell is excited to evolve to 20(1)(b),20(1)(c) 20(1)(b),20(1)(c) 5G trial in multiple locations. This is paramount in order to:

- 20(1)(b),20(1)(c)
- Be Competitive Globally
  - Verizon plans to launch home broadband service using 5G "in 3-5 cities" in 2018
  - AT&T targets 12 cities for late 2018 with mobile 5G
- Be Innovative
  - Multiple research initiatives such as ENCQOR, CENGN, 20(1)(b),20(1)(c) 20(1)(b),20(1)(c)

In addition, expanding the trial allows for:

- Interaction with multiple sites
  - Expanding from 2-site/3-sector trial to clusters
  - 20(1)(b),20(1)(c)
  - Mobility and high speed (Highway)
- Vendor and technology comparison

20(1)(b),20(1)(c)

Bell

Overview

- 2017 Pre-standard 5G solutions is on-going and work will continue in 2018 in order to finalize our testing
- Bell's plan is to evolve the current 5G trial in 3 phases for 2018:
  - **Phase 1: Completed 2017 pre-standard trial** 20(1)(b),20(1)(c)
  - **Phase 2 (2H 2018): Rel 15 NR trial** 20(1)(b),20(1)(c) 20(1)(b),20(1)(c)
    - Lab testing
    - Add approximately 20(1)(b),20(1)(c) spread across multiple clusters to test 20(1)(b),20(1)(c) various environments (Urban, suburban and rural areas) 20(1)(b),20(1)(c)
    - Will need to request additional licenses
  - **Phase 3 (Q4 2018): Rel 15 NR trial with Nokia + Core integration**
    - Lab testing 20(1)(b),20(1)(c)
    - Will need to request additional licenses

Bell

2018 5G Trial High Level Timelines

- **Finalize Pre-standard trial** 20(1)(b),20(1)(c) **– Completed**

20(1)(b),20(1)(c)

- Goals of the trials

20(1)(b),20(1)(c)

20(1)(b),20(1)(c)

2018 2019

Bell

Phase 2

20(1)(b),20(1)(c)

Bell will select approximately 20(1)(b),20(1)(c) in the area to have a contiguous cluster 20(1)(b),20(1)(c) with 20(1)(b),20(1)(c) This allows us to test 5G in urban environment, 20(1)(b),20(1)(c) deployment, 20(1)(b),20(1)(c) small cell deployment 20(1)(b),20(1)(c) 20(1)(b),20(1)(c) and partner with companies for smart city applications. We will also be ready for

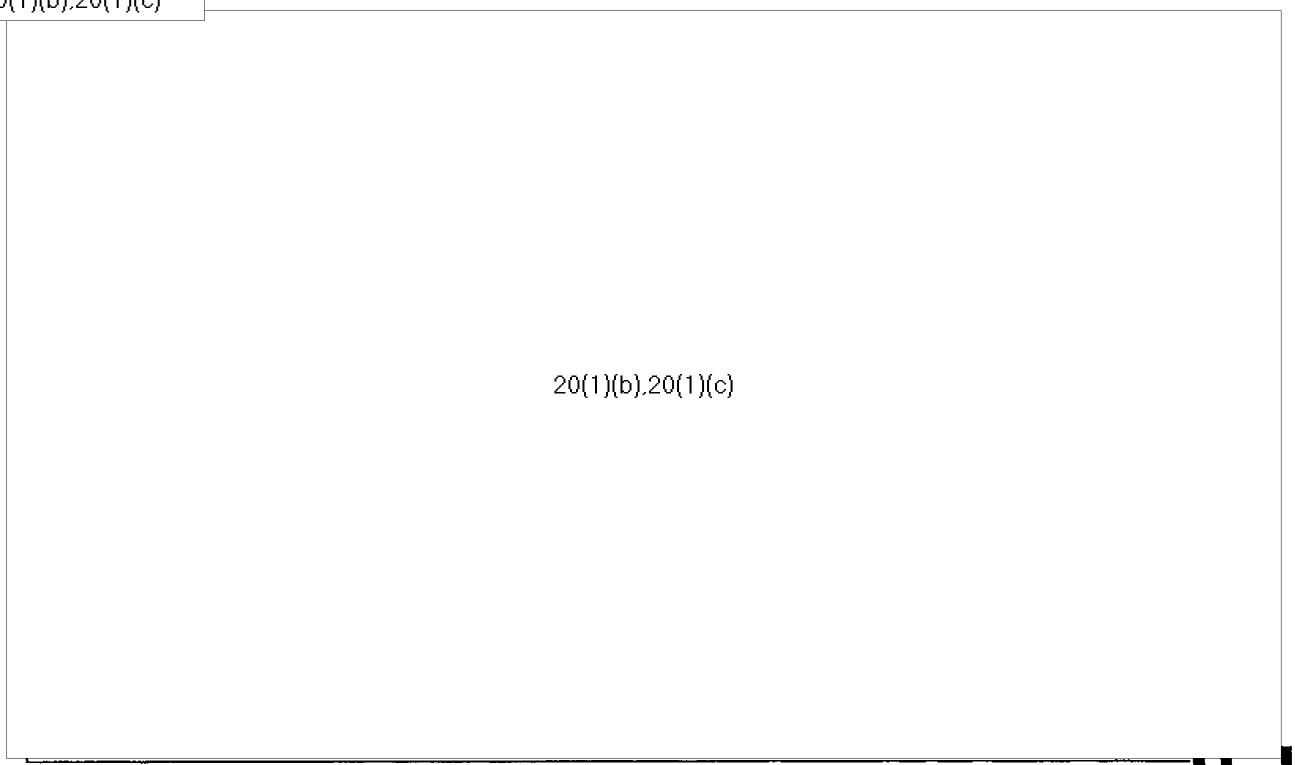
20(1)(b),20(1)(c)

Bell

Phase 2

20(1)(b),20(1)(c)

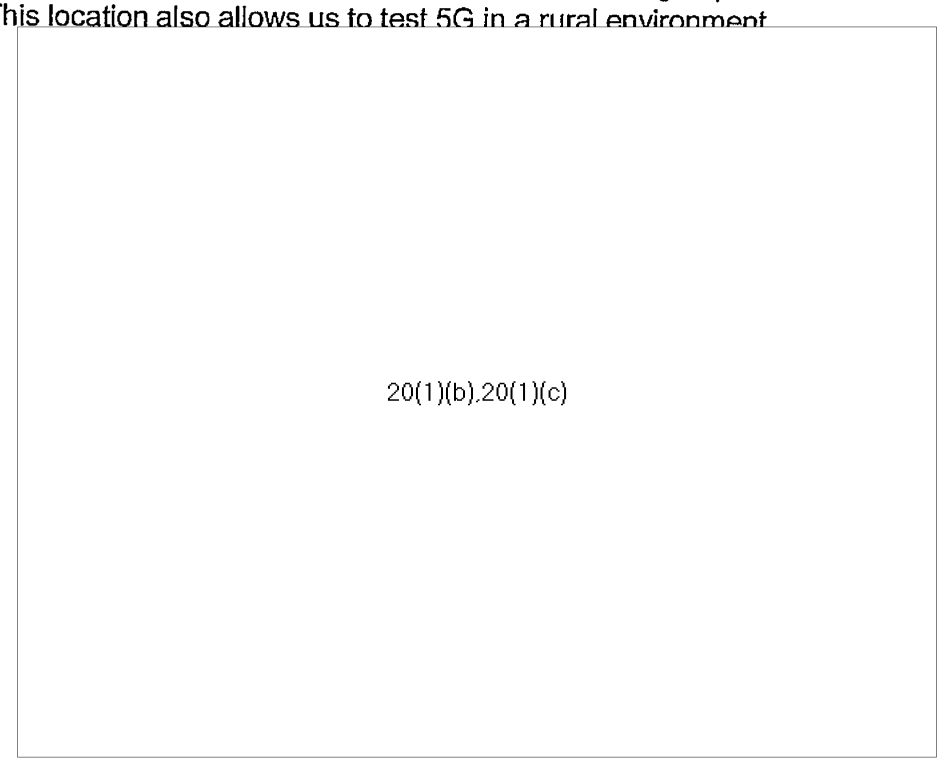
Bell will select approximately 20(1)(b),20(1)(c) the area to have a contiguous cluster 20(1)(b),20(1)(c)
In addition to testing in a suburban environment, 20(1)(b),20(1)(c)
20(1)(b),20(1)(c)



Bell

Phase 2 20(1)(b),20(1)(c)

Bell has selected 20(1)(b),20(1)(c) in the area to test 20(1)(b),20(1)(c) 20(1)(b),20(1)(c) Bell has successfully completed WTTH (Wireless to the Home) trials 20(1)(b),20(1)(c) 20(1)(b),20(1)(c) and plans to deploy to rural locations to increase high-speed home broadband outside urban centres. This location also allows us to test 5G in a rural environment.



Bell

Phase 2

20(1)(b),20(1)(c)

Bell is partnering with 20(1)(b),20(1)(c) applications, 20(1)(b),20(1)(c) other applications. This location allows us to test 5G mobility and high speed performance. Note location is not finalized.

20(1)(b),20(1)(c)

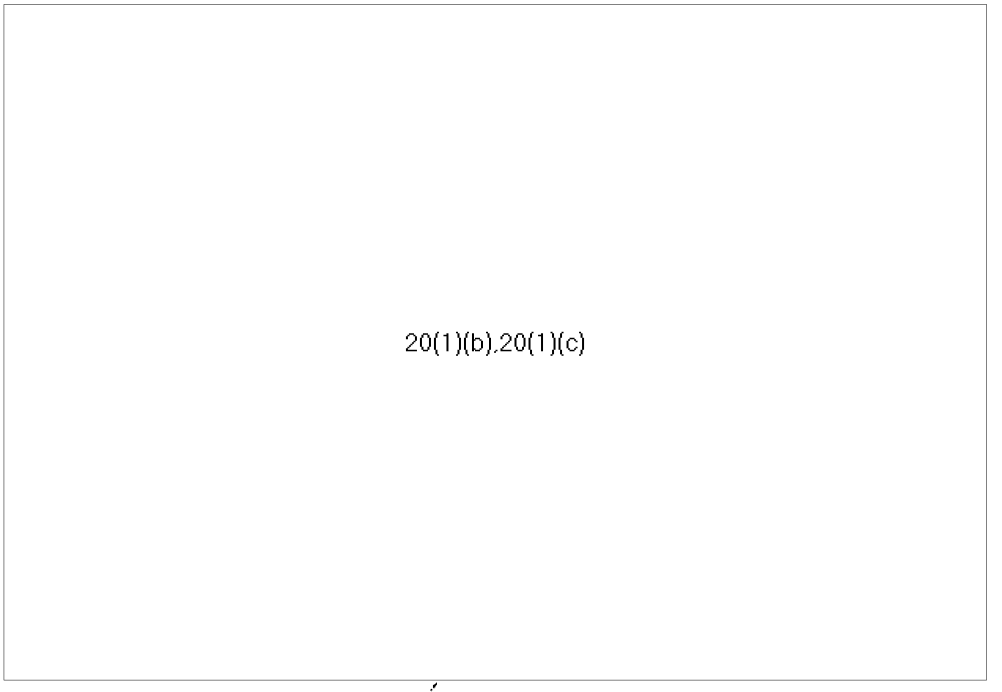
Bell

Phase 3

20(1)(b),20(1)(c)

Bell has selected 20(1)(b),20(1)(c) the area to test 5G solution from 20(1)(b),20(1)(c) for comparison with 20(1)(b),20(1)(c)
Different technology will be used including 20(1)(b),20(1)(c)

20(1)(b),20(1)(c)



Bell

20(1)(b),20(1)(c)

Bell has labs located in 20(1)(b),20(1)(c)

20(1)(b),20(1)(c)

- Macro site connected to lab core for testing

20(1)(b),20(1)(c)

Bell

Summary

20(1)(b),20(1)(c)

Bell

APPENDIX

Meeting with ISED 21(1)(a),21(1)(b) **M-MIMO**

November 29, 2018 12:30-2:30pm

Attendees:

ISED: Greguy Saint-Pierre, Marc Corbin, Josette Gallant, Paul Ma, Ron Flieler, Eric Parsons, Hughes Nappert, Matthew Messer, Joel Olenga, Jacob Morris, Abrar Fuad,

19(1),21(1)(b)

* Attended remotely

Summary of Meeting:

- Massive MIMO (M-MIMO) will be a very important new antenna technology in 5G deployment.
- 21(1)(a)
- Theoretical models used by 21(1)(a),21(1)(b) demonstrate that "actual maximum" power for M-MIMO is below 25% of maximum for 95% of the time. It was suggested 21(1)(a),21(1)(b)
- 21(1)(a),21(1)(b)
- 21(1)(a),21(1)(b)
- ISED noted that IEC Technical Report 62669 Ed.2 containing case studies has been drafted and will be sent for voting soon so it is not finalized yet. IEC 62232 Edition 3 international standard will not be finalized until December 2020.
- 21(1)(a),21(1)(b)
- Chair of the 21(1)(a),21(1)(b) and will see if carriers can meet to discuss the work being done within the IEC TC106 and also in 21(1)(a),21(1)(b)
- ISED encourages Canadian carrier representation at International EMF Standards meetings. 21(1)(a),21(1)(b) indicated initial interest.
- 21(1)(a),21(1)(b)

- 21(1)(a),21(1)(b)

Action Items:

- ISED to see if it can share investigative data from 21(1)(a),21(1)(b)
- 21(1)(a),21(1)(b)
- Carriers should determine if they will participate in domestic and international IEC standards meetings. 21(1)(a),21(1)(b)
- 21(1)(a),21(1)(b)

Nolan, Stephen (IC)

From: Nolan, Stephen (IC)
Sent: January 25, 2019 1:32 PM
To: Bawab, Alisar (IC); Chong, Lianne (IC); Corbin, Marc (IC); Ethier, Louis (IC); Flieler, Ron (IC); Hindle, Scott (IC); Kennedy, Caroline (IC); Kupferschmid, Lauren (IC); Lander, Elisabeth (IC); Liu, Herrick (IC); Ma, Paul (IC); Macdonald, Suzanne (IC); McNeill, Patrick (IC); Messer, Matthew (IC); Noel, Sylvain (IC); Nolan, Stephen (IC); O'Toole, Melissa (IC); Parsons2, Eric (IC); Scott2, Isabelle (IC); Simoneau, Eric (IC); Souliere, James (IC); Stewart2, Elizabeth (IC); Thiessen, Joanne (IC); Todhunter, Travis (IC); Wasilewski, Maura (IC); Weatherbee, Kevin (IC); Wu, Wendy (IC); Zwaan, Kelsey (IC); Tahirkheli, Mohsin (IC)
Subject: Summary - 5G Canada Council Event - January 23, 2019

Good afternoon everyone,

This past Wednesday, January 23, members of DOS attended the CWTA's Annual 5G Canada Council event here in Ottawa. In the context of the upcoming launch of 5th generation wireless networks some of the main themes from the event included updates on the current situation internationally as well as in Canada, the importance of spectrum, small cell deployment, security and privacy. For those who might be interested below I have provided a detailed summary of the presentations/panels from the event.

If you have any questions or would like to discuss in more detail, please feel free to send me an email or come by my office.

Have a great weekend!

Steve

"DGSO-DOS - Summary of 5G Canada Council (CWTA) - 2019-01-23 - EN.docx" can be accessed via the following link:
16(2)(c)

SUMMARY OF 5G CANADA COUNCIL – JANUARY 23, 2019

1. 5G Around the World

Tejas Rao, Managing Director and Global 5G Offering Lead for Accenture's Network Practice

- First commercial launches of 5G to take place in 2019, with large scale commercial deployments by 2020.
- Six key challenges: Spectrum availability, strategic use cases/business development, device innovation, network deployment, platform innovation, operational complexity.
- The U.S. and certain Asian countries currently leading in the race to deploy 5G.
    - U.S.:
        - Focus on network densification (150k to 800k small cell antennas nationally);
        - carriers making large scale investments & mergers (spectrum pooling, infrastructure sharing);
        - Strong regulatory approach (e.g. restrict municipal laws inhibiting a provider's ability to deploy, limit fees that municipalities can charge, limit state or local government fees for infrastructure access to cost recovery, etc.)
    - China:

        - One central organization overseeing tower deployment.
    - South Korea:
        - Three main carriers taking coordinated approach to accelerate deployment – single national network.
        - To deploy with devices in first half of 2019.
    - Japan
        - To deploy 5G in time for 2020 Olympic Games.
    - EU
        - Italy leading EU, spectrum auctions complete.
        - Other leaders are U.K., Nordic countries
        - May be delaying slightly because of significant 4G investments, ROI not complete, watching other countries and progress before making more new investments

2. 5G Canada Update

Bruce Rodin, VP Wireless Networks, Bell
Brian O'Shaughnessy, SVP & CTO, Freedom Mobile
Arnold Abramowitz, VP Access Network Engineering, Rogers

- Higher frequencies equal smaller wave lengths
    - Allows for multiple antennas, beam forming and massive MIMO
- Bell:
    - 5G requires continued evolution of network (speed & performance)
    - Using 3.5 GHz better broadband now & pave way for 5G
        - Only FWA for now
        - Will pivot to 5G and use network slice
        - Mid band ~ 2X speed gain
        - mmWave ~10X speed gain
    - 5G trails
        - Downtown Toronto, Stratford, Kitchener/Waterloo, Orangeville
    - Use cases
        - Advanced smart cities, self-driving cars, Industrial IoT
- Rogers:
    - Current partnership with University of BC to build real-world 5G network
    - Consumers will want the newer features/services, but for the same price
    - Must create and communicate value, consumer will pay more
- Freedom:
    - Much of 4G network was built with 5G in mind, current equipment capable of 5G
- Panels Questions/Other Topics:
    - Is Canada behind?
        - No, mid-2020 when quality, early flagship will be launched
        - Believe Canada in a better position than the U.S.
        - Beware of media headlines/hype:
            - Don't tell the entire story
        - First to 5G should not be the focus – learn from other jurisdictions and develop sound, reliable network. It isn't a race.
    - 4G/LTE to continue to expand for next 18-24 months while 5G is being deployed
        - Transition will be seamless – both are compatible.

- Service Provider Strategies for 5G:
  - Shaw – create seamless service for end-user
  - Bell – leverage existing service and continue to enhance

3. Getting Ready for 5G: A Network Technology Primer

Larry Murat, VP Networks Product Development Solutions, Ericsson

- Presented deck with simple approach to technical elements of 5G (will email CWTA to obtain a copy).
- Excellent diagrams/discussion on beam forming and MIMO
- 5G supports carrier aggregation and dual connectivity
  - Dual connectivity means LTE + 5G at the same time
- Network flexibility
  - Functionalities are virtual can be at the core or on the node
  - Many things that used to be hardware have been re-created in software

4. 5G and Importance of Spectrum

Dean R. Brenner, SVP Spectrum Strategy and Tech Policy, Qualcomm Inc.

- Access to shared/unlicensed spectrum key for success of 5G; higher bands well suited for sharing.
- 5G to build on spectrum sharing technology being deployed under LTE (LTE-U, LAA), continued enhancement of LTE.
- Over 30 5G-ready handsets set for release in 2019.
  - Some in < 6 GHz, some in mmWave
  - Building in many micro-antennas, phones can function on dozens of frequencies
- Spectrum:
  - FCC:
    - Low-band – 600MHz auction held in Spring 2017
    - Mid-band – 3.4-3.5 GHz, 3.7-4.2 GHz
    - High-band – 12.5 GHz of spectrum already allocated – more to come
  - Europe:
    - Looking to make up for performance on deployment of 4G/LTE; 5G Action Plan
    - Six countries where spectrum for 5G already allocated (3.4-3.8 GHz, 28GHz), 18 more in 2019.
    - Germany exploring Industrial IoT – localized spectrum auction (e.g. limited to stadium, factory, etc.)

5. Small Cell Deployment

Paul Cowling, SVP Legal & Regulatory Affairs, Shaw
Michael Piaskoski, Director of Municipal and Industry Relations, Rogers
Song Nhi Nguyen, Enterprise Architect Infrastructure & Security, City of Montreal
Bryan Tramont, Managing Partner, WBK Law

- Smaller coverage area means greater number of antennas required
- Small cells already being deployed under LTE
- Availability of licensed/unlicensed spectrum, increasing capacity to allow for small cells
  - Small cells require backhaul – currently limited by capacity of backhaul
- Reasonable access to passive infrastructure (hydro/telephone poles, roads, street lights, etc.) key to 5G deployment.

- Rogers:
  - Finding conflicting views within municipalities – problematic
    - Want to be leaders but making it increasingly difficult for carriers to access infrastructure, e.g. rigid construction standards
    - High/increasing fees, e.g. rates for hydro pole access in Ontario have doubled over five years (highest fees in North America).
    - Red tape – requirement to deal with multiple departments within a single municipality
  - Approach to towers not going to work for small cells
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    - Preference for FCC model:
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      - States/municipalities may only charge on a cost recovery basis.
      - Shot clock – access granted if request not dealt with within established timeframe
- City of Montreal:
  - Striving to be a world leader, top smart city in the world.
  - Complex issues and considerations in allowing infrastructure access
    - E.g. development of service standards
      - Public safety issues – antennas drawing power from hydro poles – who is responsible for safety
    - Will require extensive sharing
      - Recent study determined upwards of 30k antennas required for a single provider.
      - Lamp posts may only allow for two small cell antennas, what about other carriers?
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- Try to automate threat checking and response
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Deborah Evans, CPO, Rogers
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Nolan, Stephen (IC)

From: Saint-Pierre, Greguy (IC)
Sent: January 25, 2019 2:02 PM
To: Gallant, Josette (IC); Losier, Yan (IC); Abou-Zeid, Alain (IC); Ménard2, François (IC); Morris2, Jacob (IC); Tran, Loan (IC); Popovici, Horia (IC)
Cc: Nappert, Hughes (IC); Nolan, Stephen (IC)
Subject: FW: Summary - 5G Canada Council Event - January 23, 2019

Good day folks,

Wednesday, among other ISED folks, Steven, Hughes and I have attended the CWTA Annual 5G Council.

Please find below an excellent summary that Steven prepared for DGSO.

Best,

Gréguy

P.S.: Thank you again for sharing Steven

From: Nolan, Stephen (IC)
Sent: January-25-19 1:36 PM
To: Saint-Pierre, Greguy (IC)
Subject: FW: Summary - 5G Canada Council Event - January 23, 2019

In case you think any of your DGEPS colleagues might find a summary of the event helpful/interesting please see below. Thanks again for providing your notes, they definitely helped to fill in some of the blanks.

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From: Nolan, Stephen (IC) <stephen.nolan@canada.ca>
Sent: January 25, 2019 1:32 PM
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    - Current partnership with University of BC to build real-world 5G network
    - Consumers will want the newer features/services, but for the same price
    - Must create and communicate value, consumer will pay more
- Freedom:
    - Much of 4G network was built with 5G in mind, current equipment capable of 5G
- Panels Questions/Other Topics:
    - Is Canada behind?
        - No, mid-2020 when quality, early flagship will be launched
        - Believe Canada in a better position than the U.S.
        - Beware of media headlines/hype:
            - Don't tell the entire story
        - First to 5G should not be the focus – learn from other jurisdictions and develop sound, reliable network. It isn't a race.
    - 4G/LTE to continue to expand for next 18-24 months while 5G is being deployed
        - Transition will be seamless – both are compatible.
    - Service Provider Strategies for 5G:
        - Shaw – create seamless service for end-user
        - Bell – leverage existing service and continue to enhance

3. Getting Ready for 5G: A Network Technology Primer

Larry Murat, VP Networks Product Development Solutions, Ericsson

- Presented deck with simple approach to technical elements of 5G (will email CWTA to obtain a copy).
- Excellent diagrams/discussion on beam forming and MIMO
- 5G supports carrier aggregation and dual connectivity
    - Dual connectivity means LTE + 5G at the same time
- Network flexibility
    - Functionalities are virtual can be at the core or on the node
    - Many things that used to be hardware have been re-created in software

4. 5G and Importance of Spectrum

Dean R. Brenner, SVP Spectrum Strategy and Tech Policy, Qualcomm Inc.

- Access to shared/unlicensed spectrum key for success of 5G; higher bands well suited for sharing.
- 5G to build on spectrum sharing technology being deployed under LTE (LTE-U, LAA), continued enhancement of LTE.
- Over 30 5G-ready handsets set for release in 2019.
    - Some in < 6 GHz, some in mmWave
    - Building in many micro-antennas, phones can function on dozens of frequencies

- Spectrum:
  - FCC:
    - Low-band – 600MHz auction held in Spring 2017
    - Mid-band – 3.4-3.5 GHz, 3.7-4.2 GHz
    - High-band – 12.5 GHz of spectrum already allocated – more to come
  - Europe:
    - Looking to make up for performance on deployment of 4G/LTE; 5G Action Plan
    - Six countries where spectrum for 5G already allocated (3.4-3.8 GHz, 28GHz), 18 more in 2019.
    - Germany exploring Industrial IoT – localized spectrum auction (e.g. limited to stadium, factory, etc.)

5. Small Cell Deployment

Paul Cowling, SVP Legal & Regulatory Affairs, Shaw
Michael Piaskoski, Director of Municipal and Industry Relations, Rogers
Song Nhi Nguyen, Enterprise Architect Infrastructure & Security, City of Montreal
Bryan Tramont, Managing Partner, WBK Law

- Smaller coverage area means greater number of antennas required
- Small cells already being deployed under LTE
- Availability of licensed/unlicensed spectrum, increasing capacity to allow for small cells
  - Small cells require backhaul – currently limited by capacity of backhaul
- Reasonable access to passive infrastructure (hydro/telephone poles, roads, street lights, etc.) key to 5G deployment.
- Rogers:
  - Finding conflicting views within municipalities – problematic
    - Want to be leaders but making it increasingly difficult for carriers to access infrastructure, e.g. rigid construction standards
    - High/increasing fees, e.g. rates for hydro pole access in Ontario have doubled over five years (highest fees in North America).
    - Red tape – requirement to deal with multiple departments within a single municipality
  - Approach to towers not going to work for small cells
    - Current regulatory model too stringent – looking for relaxation of rules
    - Preference for CRTC to have exclusive oversight related to towers/antenna siting, fees, etc.
    - Preference for FCC model:
      - Small cells exempt from certain reviews (e.g. environmental, tribal, etc.)
      - Municipalities may not simply deny a request for access
      - States/municipalities may only charge on a cost recovery basis.
      - Shot clock – access granted if request not dealt with within established timeframe
- City of Montreal:
  - Striving to be a world leader, top smart city in the world.
  - Complex issues and considerations in allowing infrastructure access
    - E.g. development of service standards
      - Public safety issues – antennas drawing power from hydro poles – who is responsible for safety
    - Will require extensive sharing
      - Recent study determined upwards of 30k antennas required for a single provider.
      - Lamp posts may only allow for two small cell antennas, what about other carriers?

        - Current infrastructure/street furniture not designed for support of telecom (power transmission, etc.)
- Telecom Act
    - Applies only to wireline services – does not include wireless
        - Guarantees access to infrastructure but not applicable to wireless

6. Security & 5G

Patrick Rhude, Head of Product Management Security, Nokia
Charles Eagan, CTO, BlackBerry

- Not a question of if there will be a breach, question of when and response
- As speeds increase, so will the speed of potential attacks/breaches
- Once firewall created, must check from the inside for anomalies
- Fast response time and isolation is key
- Speed of response can be difficult as there is so much data collected from networks
- With 5G there will be many more points of access for hackers
- Try to automate threat checking and response
- Overlap between network security and physical safety (e.g. self-driving cars)
- Blackberry focused on security rather than handsets, used in over 100 million vehicles

7. Privacy in a 5G & Big Data World

Deborah Evans, CPO, Rogers
Pratricia Kosseim, Counsel, Privacy and Data Management, Osler
Anick Fortin-Cousens, CPO and Data Responsibility Advocate, IBM Canada

- Much discussion of GDPR privacy regime in Europe
- Canada's regime is PIPEDA, has many of same rules as European model but people aren't aware
- Users also have some responsibility to protect data

Daala, Sanaa (IC)

From: Gilfillan, Fiona (IC)
Sent: December 13, 2018 10:22 AM
To: 20(1)(b),21(1)(b) Lodge, John (IC)
Cc: Jubinville, Colette (IC); Astell, Paul (IC); Levesque, Marc (IC); Gagnon, Stéphane (IC)
Subject: RE: Bell follow-up

20(1)(c),21(1)(b) is this a mix of research and coverage/operational benefit or purely research? Can you elaborate on the terms and costs/benefits for us and Bell? Thanks, Fiona

From: 20(1)(b),21(1)(b)
Sent: December-13-18 10:17 AM
To: Lodge, John (IC)
Cc: Jubinville, Colette (IC); Astell, Paul (IC); Gilfillan, Fiona (IC); Levesque, Marc (IC); Gagnon, Stéphane (IC)
Subject: Bell follow-up

Allo John

Please read from the bottom up, following up on Bell meeting.

- Would we do 2F?
- I know you are away but would we have the right people on Jan 3 20(1)(b)

Allo Fiona

This would be part of a collaboration agreement where Bell 20(1)(b)
20(1)(b)

Thanks
Regards
20(1)(b),21(1)(b)

From: 20(1)(b),21(1)(b)
Sent: December 13, 2018 10:09 AM
To: 'I 19(1) Quinn, Eileen (IC) <eileen.quinn@canada.ca>
Cc: CRC_VPBDOffice-CRC_BureauECIA (IC) <ic.crc_vpbdoffice-crc_bureauecia.ic@canada.ca>
Subject: RE: 19(1)

Allo 19(1)
Thanks for getting back to me so quickly. Here is the info I gathered yesterday on the people we interacted with on this issue
Bell

19(1)

19(1)

That's all I have on the individuals associated with the Bell testing of our cellular signal testing. The tests were conducted 22 and 29 June 2018.

From the looks of it though, looks like you already have tracked this down ☺ Thanks. Your picture is correct. We might want to add the little building 20(1)(b) however I need to validate as it is where we have our anechoic chambers and some free space testing.

I prefer FtF, anytime on Jan 3. I will need to confirm by end of week that I will have the right people not on vacation as I do not want to waste your time.

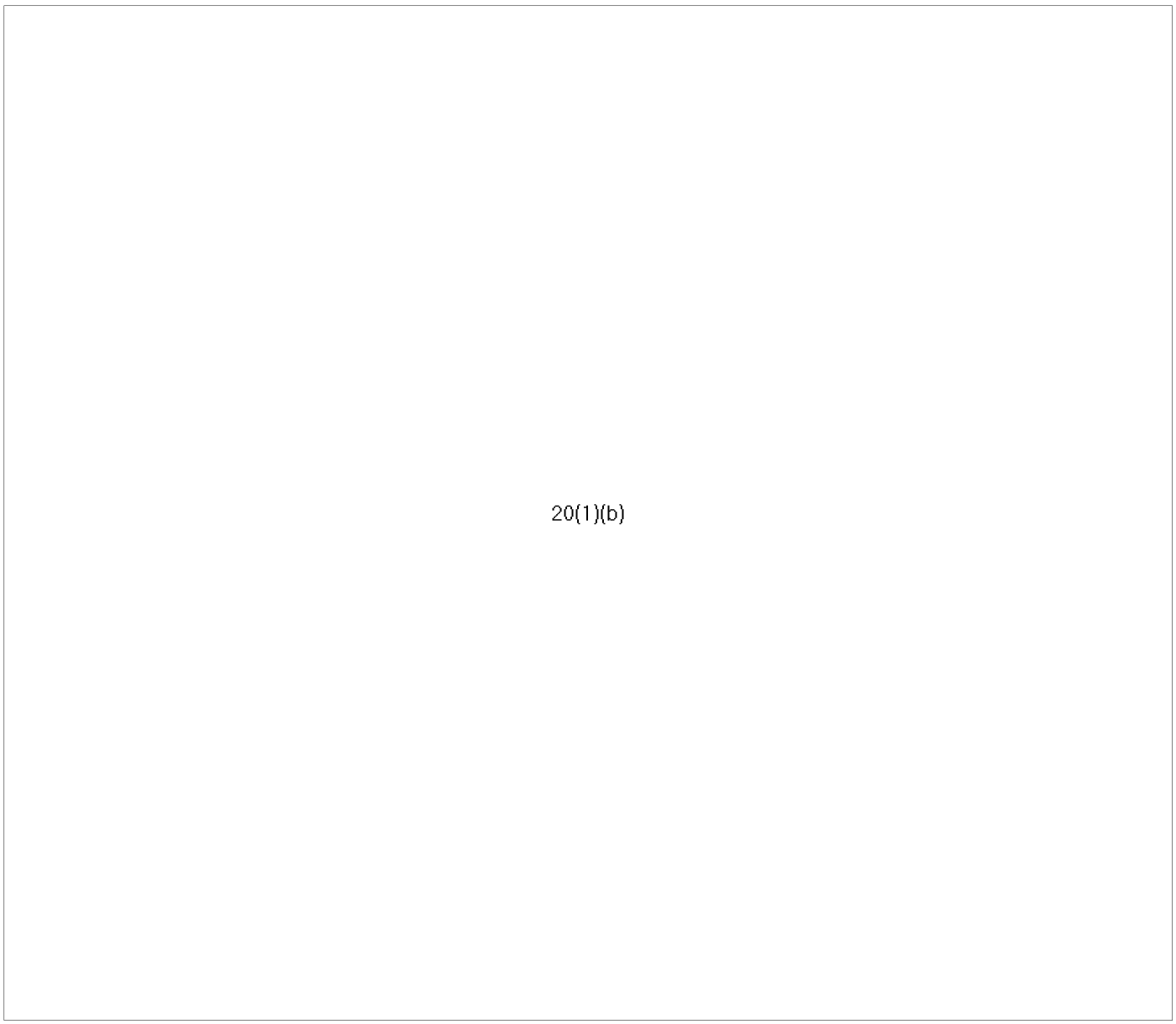
Eileen (to:) will coordinate time with your assistant.

Thanks again 19(1)
Looking forward to work with you
Regards
20(1)(b),21(1)(b)

From: 19(1)
Sent: December 13, 2018 8:57 AM
To: 20(1)(b),21(1)(b)
Subject: Re: 19(1)

Bonjour 20(1)(b),21(1)(b)
Good to see you again on Tuesday and appreciate your teams participation and feedback
Quick follow up on the in building LTE system – below picture represents the buildings that we already have measurements for at your 20(1)(b) does this represent the areas you have concerns with?
In terms of the 20(1)(b) with your foil / antenna technology, would be great to setup some time. I am happy to work out a slot anytime on 3rd or 4th January, conf call or f2f in Ottawa. If you can send your assistants details, we can connect our admins and workout a suitable time
Thanks

19(1)



From: "MacInnis, Michael" 19(1) @bell.ca>
Date: Thursday, December 13, 2018 at 6:11 AM
To: 20(1)(b).21(1)(b)
Cc: 19(1)
Subject: RE: 19(1)

Hi 20(1)(b).21(1)(b)

I'm glad you found the session useful – it was our pleasure. 19(1) email address is: 19(1)

Mike

From: 20(1)(b).21(1)(b)
Sent: December-12-18 7:06 PM
To: MacInnis, Michael 19(1) @bell.ca>
Subject: 19(1)

Allo Michael
Thanks for your session yesterday with ISED, very informative. I was talking with 19(1) and we agreed to follow-up but now I realize I do not have his email contact. Would you mind giving it to me?
Thanks
Regards

20(1)(b),21(1)(b)

20(1)(b),21(1)(b)

20(1)(b),21(1)(b)
Innovation, Science and Economic Development Canada / Government of Canada
20(1)(b),21(1)(b)

20(1)(b),21(1)(b)
Innovation, Sciences et Développement économique Canada / Gouvernement du Canada
20(1)(b),21(1)(b)

Hiebert, Andrea (IC)

From: Lodge, John (IC)
Sent: December 13, 2018 2:37 PM
To: 20(1)(b),21(1)(b)
Subject: RE: Bell follow-up
Attachments: 20(1)(b),21(1)(b)

Allo 20(1)(b),21(1)(b)

Please see attached.

Cheers,
John

From: 20(1)(b),21(1)(b)
Sent: Thursday, December 13, 2018 12:57 PM
To: Lodge, John (IC) <john.lodge@canada.ca>
Subject: RE: Bell follow-up

Understood, just checking with the CTO ☺

From: Lodge, John (IC) <john.lodge@canada.ca>
Sent: December 13, 2018 12:56 PM
To: 20(1)(b),21(1)(b)
Subject: FW: Bell follow-up

fyi

From: Petosa, Aldo (IC) <aldo.petosa@canada.ca>
Sent: Thursday, December 13, 2018 12:54 PM
To: Lodge, John (IC) <john.lodge@canada.ca>
Subject: RE: Bell follow-up

Hi John,

I agree with your view on 2F.

Thanks.

Aldo.

From: Lodge, John (IC) <john.lodge@canada.ca>
Sent: December 13, 2018 12:35 PM
To: Petosa, Aldo (IC) <aldo.petosa@canada.ca>
Subject: FW: Bell follow-up

Hi Aldo,

I cc'ed you in case you have a different opinion with respect to 2F.

John

From: Lodge, John (IC)
Sent: Thursday, December 13, 2018 12:34 PM
To: 20(1)(b),21(1)(b)
Cc: Petosa, Aldo (IC) <aldo.petosa@canada.ca>
Subject: RE: Bell follow-up

Allo 20(1)(b),21(1)(b)

With respect to 2F, I do not think we would do it. This is a test lab and adding another source of radio noise should only be done if necessary. There is already cell phone coverage in 2F (although not really strong coverage). I went down to 2F and made multiple cell phone calls from a variety of location. All attempts were successful.

With respect 20(1)(b),21(1)(b) I would like to brainstorm with you (tomorrow?) about what we could offer that makes sense.

Cheers,
John

From: 20(1)(b),21(1)(b)
Sent: Thursday, December 13, 2018 10:17 AM
To: Lodge, John (IC) <john.lodge@canada.ca>
Cc: Jubinville, Colette (IC) <colette.jubinville@canada.ca>; Astell, Paul (IC) <paul.astell@canada.ca>; Gilfillan, Fiona (IC) <fiona.gilfillan@canada.ca>; Levesque, Marc (IC) <marc.levesque@canada.ca>; Gagnon, Stéphane (IC) <stephane.gagnon@canada.ca>
Subject: Bell follow-up

Allo John

Please read from the bottom up, following up on Bell meeting.

- Would we do 2F?
- I know you are away but would we have the right people on Jan 3 20(1)(b),21(1)(b)

Allo Fiona

This would be part of a collaboration agreement 20(1)(b),21(1)(b)
20(1)(b),21(1)(b)

Thanks
Regards
20(1)(b),21(1)(b)

From: 20(1)(b),21(1)(b)
Sent: December 13, 2018 10:09 AM
To: 19(1) Quinn, Eileen (IC) <eileen.quinn@canada.ca>
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19(1)

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To: 20(1)(b),21(1)(b)
Cc: 19(1)
Subject: RE: 19(1)

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Mike

From: 20(1)(b),21(1)(b)
Sent: December-12-18 7:06 PM

To: MacInnis, Michael 19(1) @bell.ca>
Subject: 19(1)

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Thanks
Regards
20(1)(b),21(1)(b)

20(1)(b),21(1)(b)

20(1)(b),21(1)(b)
Innovation, Science and Economic Development Canada / Government of Canada
20(1)(b),21(1)(b)

20(1)(b),21(1)(b)
Innovation, Sciences et Développement économique Canada / Gouvernement du Canada
20(1)(b),21(1)(b)

Fancy, Thomas (IC)

Subject:	Meeting between Bell 20(1)(b),21(1)(b)
Location:	20(1)(b),21(1)(b)
Start:	Thu 03/01/2019 1:00 PM
End:	Thu 03/01/2019 3:00 PM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Not yet responded
Organizer:	20(1)(b),21(1)(b)
Required Attendees:	19(1) @bell.ca'; 19(1) @bell.ca'; 19(1) @bell.ca'; 19(1) @bell.ca'; Florea, Adrian (IC); Perras, Simon (IC); Periyalwar, Shalini (IC); Rochon2, Marc-Andre (IC); Levesque, Marc (IC); Ethier, Jonathan (IC)
Categories:	Purple Category, Red Category, Blue Category

You will need to stop at the Commissionaires office to check in upon arrival. Please ensure that you have government issued ID with you as it is a requirement for access to the campus.

Agenda will be:

1) 20(1)(b),21(1)(b)
2) LTE/5G in building systems 20(1)(b),21(1)(b)

Fancy, Thomas (IC)

From: Periyalwar, Shalini (IC)
Sent: January-08-19 9:46 AM
To: Rochon2, Marc-Andre (IC); Florea, Adrian (IC); Mayer, Richard (IC); Shaker, Jafar (IC); Perras, Simon (IC); Jubinville, Colette (IC)
Cc: Levesque, Marc (IC); Santarossa, Bruna (IC); Lodge, John (IC)
Subject: RE: Notes from the Bell Mobility meeting

Categories: Blue Category, Green Category

Hi Richard
Thanks for a very succinct summary capturing all the key points. I have added a couple of minor details.
Shalini

From: Rochon2, Marc-Andre (IC)
Sent: January-07-19 5:25 PM
To: Florea, Adrian (IC); Mayer, Richard (IC); Shaker, Jafar (IC); Perras, Simon (IC); Periyalwar, Shalini (IC); Jubinville, Colette (IC)
Cc: Levesque, Marc (IC); Santarossa, Bruna (IC); Lodge, John (IC)
Subject: RE: Notes from the Bell Mobility meeting

Hello,

I agree with the additions that Adrian made, not much to add.

They did talk about 20(1)(b) and wanting to reduce the number of 20(1)(b) and maximize the number 20(1)(b) Easier and cheaper to install and maintain.

Marc-André

From: Florea, Adrian (IC) <adrian.florea@canada.ca>
Sent: January 7, 2019 4:55 PM
To: Mayer, Richard (IC) <richard.mayer@canada.ca>; Shaker, Jafar (IC) <jafar.shaker@canada.ca>; Perras, Simon (IC) <simon.perras@canada.ca>; Periyalwar, Shalini (IC) <shalini.periyalwar@canada.ca>; Rochon2, Marc-Andre (IC) <marc-andre.rochon2@canada.ca>; Jubinville, Colette (IC) <colette.jubinville@canada.ca>
Cc: Levesque, Marc (IC) <marc.levesque@canada.ca>; Santarossa, Bruna (IC) <bruna.santarossa@canada.ca>; Lodge, John (IC) <john.lodge@canada.ca>
Subject: RE: Notes from the Bell Mobility meeting

I made some suggested edits in blue below.

We have additional internal action item(s), do we list those as well, or just what was discussed with Bell.

Myself I missed the part about 20(1)(b) I only heard the taller the better.

Thanks
Adrian

From: Mayer, Richard (IC) <richard.mayer@canada.ca>
Sent: January 7, 2019 3:57 PM
To: Shaker, Jafar (IC) <jafar.shaker@canada.ca>; Florea, Adrian (IC) <adrian.florea@canada.ca>; Perras, Simon (IC) <simon.perras@canada.ca>; Periyalwar, Shalini (IC) <shalini.periyalwar@canada.ca>; Rochon2, Marc-Andre (IC) <marc-andre.rochon2@canada.ca>; Jubinville, Colette (IC) <colette.jubinville@canada.ca>
Cc: Levesque, Marc (IC) <marc.levesque@canada.ca>; Santarossa, Bruna (IC) <bruna.santarossa@canada.ca>
Subject: Notes from the Bell Mobility meeting

Notes from the Bell Mobility meeting on January 3, 2019. Please let me know if you have any comments/additions plus if anyone knows the answers to the highlighted sections.

Thanks,...Richard

Attendees

19(1)

20(1)(b),21(1)(b) Colette Jubinville, Adrian Florea, Simon Perras, Marc-Andre Rochon, Shalini Periyalwar, Jafar Shaker, Richard Mayer

The Bell team introduced themselves as an engineering team that fixes problems.

During the presentation on the 20(1)(b),21(1)(b) and its research Bell made the following remarks:

- operate large P25 LMR networks for the provinces of Ontario and Manitoba and are very interested in the concept and our research timeframe timeframe for dynamic spectrum management for LMR
- familiar with the concept of vertical challenges for wireless service deployments in tall buildings
- 15 years ago, 20(1)(b),21(1)(b) but now the network is becoming too dynamic, with too many changes (SON – self-organizing networks). The challenge for passive ES is that they can not "evolve" with the network, limiting their potential. This is making the capabilities offered by active engineered surfaces potentially useful and interesting in urban environments

Bell presented their Wireless-to-the-Premises (WTTP) system:

- focused on rural deployments
- approximately 20(1)(b),21(1)(b) where it is infeasible to get fibre close enough – 800 thousand communities in multiple provinces. Massive MIMO technology is now making it economically viable.
- 20(1)(b),21(1)(b)
- uses advanced 4G technology including Massive MIMO
- offering 25Mbps downlinks and 1Mbps uplinks (will be better in the future)

The Bell team has excellent clarity on mobile deployment but WTTP is offering new and unanticipated challenges.

However, they have three problems/challenges that they thought might be potential areas of collaboration 20(1)(b),21(1)(b)

1. RF propagation models passed on low resolution (one second) geographic database (terrain and clutter) are not accurate enough for different communities and geographies – lowering their prediction accuracy 20(1)(b),21(1)(b) 20(1)(b),21(1)(b)
   - 20(1)(b),21(1)(b)
   - they are trying to map more than 20(1)(b),21(1)(b) in rural areas – 20(1)(b),21(1)(b) 20(1)(b),21(1)(b)
   - Bell's current modeling uses 20(1)(b),21(1)(b)
   - their goal for link accuracy 20(1)(b),21(1)(b)

- how much overlap is there with 20(1)(b),21(1)(b) modeling/measuring propagation research 20(1)(b),21(1)(b) (not sure about this one)

2. CPE elevation and installation options – 20(1)(b),21(1)(b) how to minimize the 20(1)(b),21(1)(b) 20(1)(b),21(1)(b) because they are the costliest
   - sometimes there are adjacent buildings (barns) which will support a higher installation – but then this can add up to 100m trenching
   - can engineered surfaces help?

3. Household geolocation accuracy can 20(1)(b),21(1)(b)
   - Was there any overlap here with 20(1)(b),21(1)(b) work?

There are multiple areas where similar work is being done by both teams and the meeting was a productive discovery session for potential collaboration. 20(1)(b),21(1)(b) offered to host Bell staff/equipment for tests – both in remote areas of the 20(1)(b),21(1)(b) to simulate rural environment, as well as in building 5G test bed deployment for joint testing.

There were two actions from the meeting:

1. 20(1)(b),21(1)(b) will investigate what map data is available from NRCan
2. 20(1)(b),21(1)(b) will investigate if ES ruggedized prototypes for 20(1)(b),21(1)(b)
3. Follow up discussions in late January to clarify intersection points and next steps

Daala, Sanaa (IC)

From: Mayer, Richard (IC)
Sent: January 10, 2019 2:24 PM
To: Jubinville, Colette (IC)
Cc: 20(1)(b).21(1)(b) VPBDOffice 20(1)(b).21(1)(b) BureauECIA (IC); Santarossa, Bruna (IC)
Subject: RE: Notes from Bell meeting on January 3
Attachments: Notes 20(1)(b).21(1)(b) Bell Mobility Jan 2018.docx

Follow Up Flag: Follow up
Flag Status: Completed

Hi Colette – here is a simpler/shorter version which may be more appropriate to brief ADMO.

Thanks,...Richard

From: Mayer, Richard (IC)
Sent: January 9, 2019 4:16 PM
To: Jubinville, Colette (IC) <colette.jubinville@canada.ca>
Cc: 20(1)(b).21(1)(b) VPBDOffice 20(1)(b).21(1)(b) BureauECIA (IC) 20(1)(b).21(1)(b) Santarossa, Bruna (IC) <bruna.santarossa@canada.ca>
Subject: Notes from Bell meeting on January 3

Colette – for your consideration – please find attached some notes from the 20(1)(b).21(1)(b) meeting with Bell on January 3. I have incorporated feedback from other participants and then shortened to fit on one page.

Thanks,...Richard

Ps – this is what I wanted to speak with you about earlier and Bruna suggested this approach.

Notes from the Bell Mobility meeting 20(1)(b),21(1)(b) **– January 3, 2019**

Attendees:
Bell: 19(1),21(1)(b)
20(1)(b),21(1)(b) Jean Luc Bérubé, Colette Jubinville, Adrian Florea, Simon Perras, Marc-Andre Rochon, Shalini Periyalwar, Jafar Shaker, Richard Mayer

Notes: The Bell team introduced themselves as an engineering team that fixes problems.

During the presentation on 20(1)(b),21(1)(b) and its research, Bell made the following comments:

- they operate large LMR networks in Ontario and Manitoba and are very interested in the concept and our research timeframe for dynamic spectrum management for LMR
- are familiar with the concept of vertical challenges for wireless deployments in tall buildings
- repeaters are becoming less useful for dynamic networks with many changes – this may make engineered surfaces (passive or active) interesting in urban environments

Bell presented their Wireless-to-the-Premises (WTTP) system:

- using advanced 20(1)(b),21(1)(b) 20(1)(b),21(1)(b)

WTTP planning and deployment has challenges that might be potential areas of collaboration 20(1)(b),21(1)(b)

1. RF propagation models challenges in different communities and geographies – lowering prediction accuracy 20(1)(b),21(1)(b)
2. 20(1)(b),21(1)(b)
3. Household geolocation 20(1)(b),21(1)(b)

There are multiple areas where similar work is being done by both teams and the meeting was a productive discovery session for potential collaboration. 20(1)(b),21(1)(b) offered to host Bell staff/equipment for tests – both in remote areas of the 20(1)(b),21(1)(b) to simulate rural environment, as well as in building 5G test bed deployment for joint testing.

There were three actions from the meeting:

1. will investigate if useful map data is available from NRCan
2. 20(1)(b),21(1)(b) will explore ruggedized engineered surfaces prototypes for WTTP measurements/trials
3. Follow up discussions in late January to clarify intersection points and next steps

Daala, Sanaa (IC)

From: Santarossa, Bruna (IC)
Sent: January 10, 2019 5:07 PM
To: Jubinville, Colette (IC)
Cc: Mayer, Richard (IC); 20(1)(b),21(1)(b)/PBDOffice-20(1)(b),21(1)(b)BureauECIA (IC)
Subject: Notes from Bell meeting on January 3
Attachments: Notes-20(1)(b),21(1)(b)Bell Mobility Jan 2018.docx

Hi Colette,

For your consideration, attached are the notes Richard prepared on the-20(1)(b),21(1)(b)Bell meeting that took place on January 3rd, as per ADM's request. Others attending the meeting were consulted.
They can also be found in GCDOcs at: 16(2)(c)

Bruna

Bruna Santarossa
613-990-4109
Bruna.Santarossa@canada.ca

Daala, Sanaa (IC)

From: Copp, Kyla (IC)
Sent: January 11, 2019 4:13 PM
To: Jubinville, Colette (IC); Mayer, Richard (IC); Santarossa, Bruna (IC)
Subject: FW: Notes from Bell meeting on January 3

From: STS ADM Office / Bureau SMA SST (IC)
Sent: Friday, January 11, 2019 4:11:49 PM (UTC-05:00) Eastern Time (US & Canada)
To: 20(1)(b).21(1)(b)VPBDOffice-20(1)(b).21(1)(b)BureauECIA (IC); STS ADM Office / Bureau SMA SST (IC)
Subject: RE: Notes from Bell meeting on January 3

Hi there
Fiona has reviewed and said "Great. Thanks for the summary"

☺

Laura Pichette
Senior Advisor, Office of the Assistant Deputy Minister, Spectrum and Telecommunications Sector
Innovation, Science and Economic Development Canada / Government of Canada
Tel: 343-291-1276/ TTY: 1-866-694-8389

Conseillère principale, Bureau du Sous-ministre adjoint, Secteur du Spectre et télécommunications
Innovation, Sciences et Développement économique Canada / Gouvernement du Canada
Tél: 343-291-1276 / ATS: 1-866-694-8389

From: 20(1)(b).21(1)(b)VPBDOffice-20(1)(b).21(1)(b)BureauECIA (IC)
Sent: January-11-19 9:18 AM
To: STS ADM Office / Bureau SMA SST (IC)
Subject: Notes from Bell meeting on January 3

As requested by Fiona, the link below is a summary of the meeting with Bell.

16(2)(c)

Please let me know if you have any issues opening the link.
Thanks,
Eileen

Eileen Quinn
613-998-2369

Fancy, Thomas (IC)

From: Florea, Adrian (IC)
Sent: January-16-19 6:50 PM
To: 20(1)(b),21(1)(b) Levesque, Marc (IC); Gagnon, Stéphane (IC); Lodge, John (IC); Rochon2, Marc-Andre (IC); Perras, Simon (IC); Periyalwar, Shalini (IC); Petosa, Aldo (IC); Ghasemi, Amir (IC); Bouffard, Jean-Michel (IC); Dumoulin, Sarah (IC)
Subject: RE: Update: Bell investigative work
Attachments: Bell response - Jan 15 2019_v 0.7.pptx

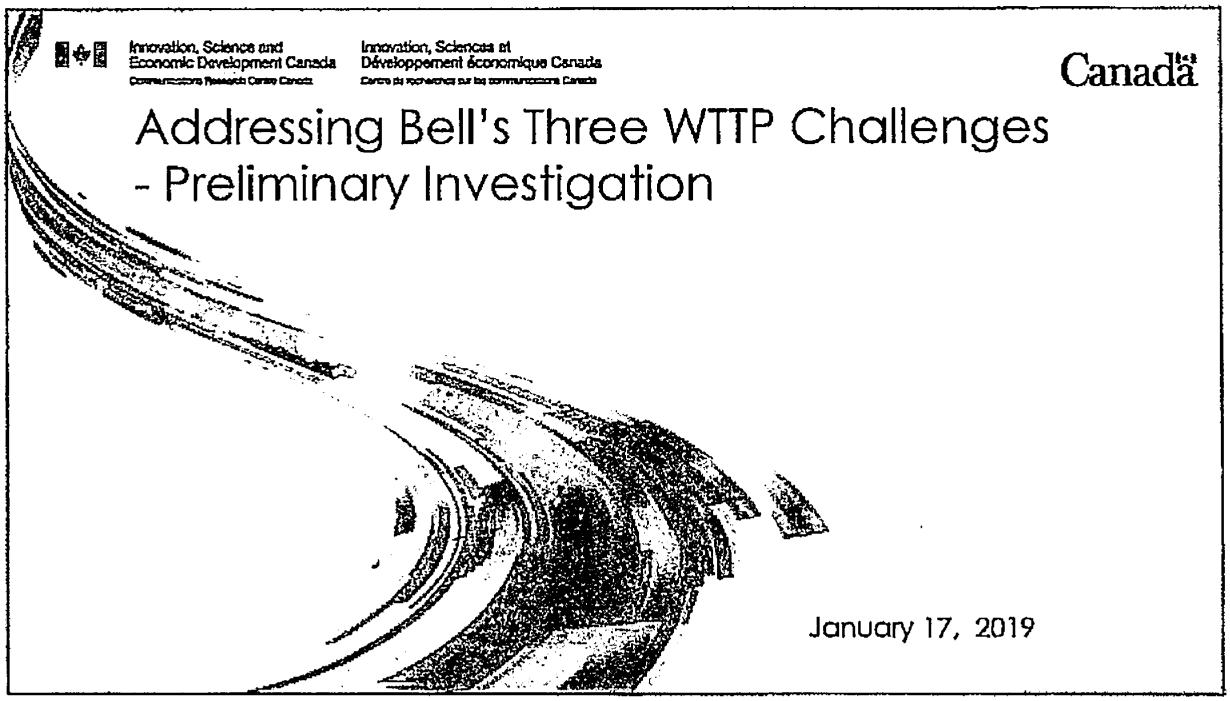
Bonsoir 20(1)(b),21(1)(b)

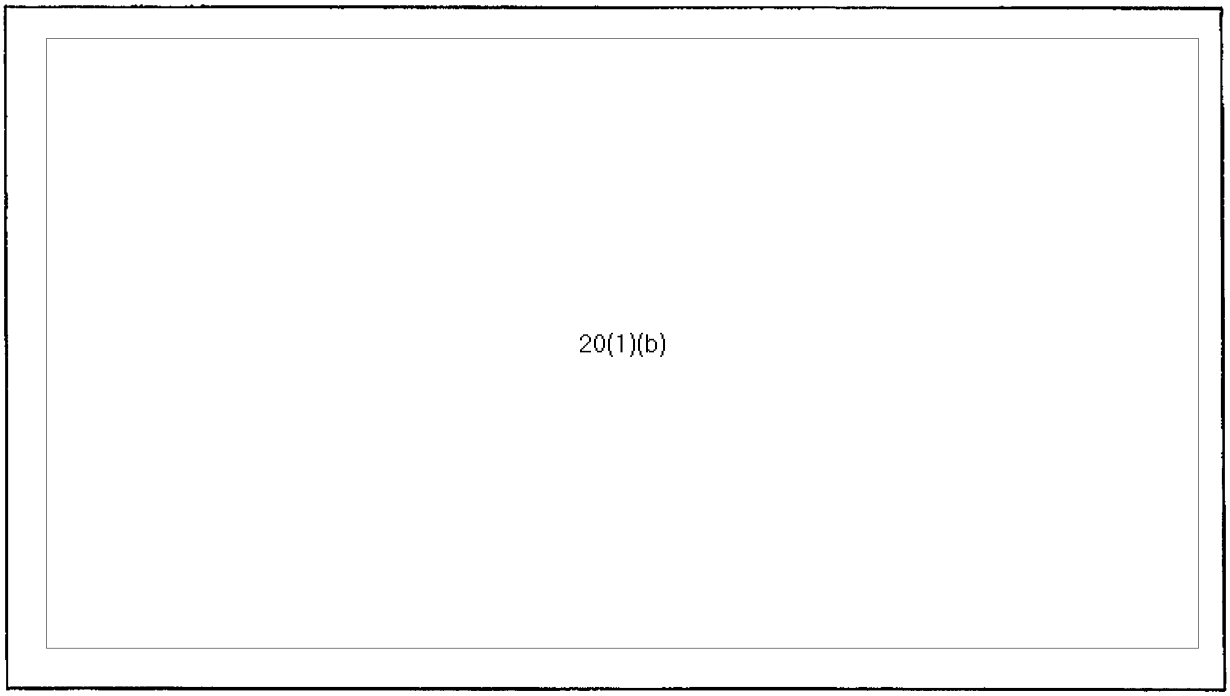
Vous trouverez ci-joint quelques diapositives résumant nos progrès à ce jour sur les trois sujets liés à la possible collaboration avec Bell sur leurs défis WTTP 3,5 GHz.

Nous continuons à travailler sur ce sujet, on pourrait avoir des petites mises à jour pour notre discussion demain.

Adrian et Co.

-----Original Appointment-----
From: 20(1)(b),21(1)(b)
Sent: January 14, 2019 11:16 AM
To: 20(1)(b),21(1)(b) Levesque, Marc (IC); Gagnon, Stéphane (IC); Lodge, John (IC); Florea, Adrian (IC); Rochon2, Marc-Andre (IC); Perras, Simon (IC); Periyalwar, Shalini (IC); Petosa, Aldo (IC); Ghasemi, Amir (IC)
Subject: Update: Bell investigative work
When: January 17, 2019 1:00 PM-1:30 PM (UTC-05:00) Eastern Time (US & Canada).
Where: 2E Boardroom


Innovation, Science and Economic Development Canada
Communications Research Centre Canada
Innovation, Sciences et Développement économique Canada
Centre de recherches sur les communications Canada
Canada
Addressing Bell's Three WTTP Challenges - Preliminary Investigation
January 17, 2019


20(1)(b)

Recommendations (1)

20(1)(b)

Recommendations (2a)

20(1)(b)

- Limitations:
  - NRCan may have licensing restrictions on HR satellite imagery
  - HRDEM data is currently available only in a very small area of rural Canada

20(1)(b)

- *leverage NRCan's ML driven image recognition tools
- ** 1m resolution

Recommendations (2b & 2c)

- 20(1)(b)
  - Data driven enhancements leveraging higher resolution terrain data along with training data to improve propagation prediction*
- Requirements:
  - **adequate** supply of training data from trial deployments
  - 20(1)(b)

*Crowdsourced data – not very useful in this case, number of data points in rural areas is too small

Additional slides

1. Engineered Electromagnetic Surfaces 3.5 GHz Design and Deployment

Can engineered electromagnetic surfaces (EES) be designed and deployed at 3.5 GHz to connect to rural homes in NLOS of towers?

- Theoretically, it is feasible, by installing a panel on the side of a barn up to a few hundred meters away that has LOS with both the base station and home
- Not clear that this will be a practical or cost effective solution:
  - Based on medium-volume EES production costs of ~$5/sq. ft., a 2 x 2 m panel would cost ~$220 (not including installation costs)
  - Installation may not be simple (diffusers can be used to simplify placement, but will incur up to ~10 dB more loss than a tailored grating design)
  - Might be more practical to install a tower next to the house to achieve LOS (20' tower costs ~$500)
- Currently CRC does not have any 3.5 GHz EES designs and some extra effort would be required to develop a weather-proofed prototype (~2-3 months)

2. More Accurate Propagation

20(1)(b)

- Three possible approaches
  a) 20(1)(b)
  b) Data driven enhancements to propagation prediction
  c) 20(1)(b)
- Initial exploration into a) and b) are addressed in the slides that follow.

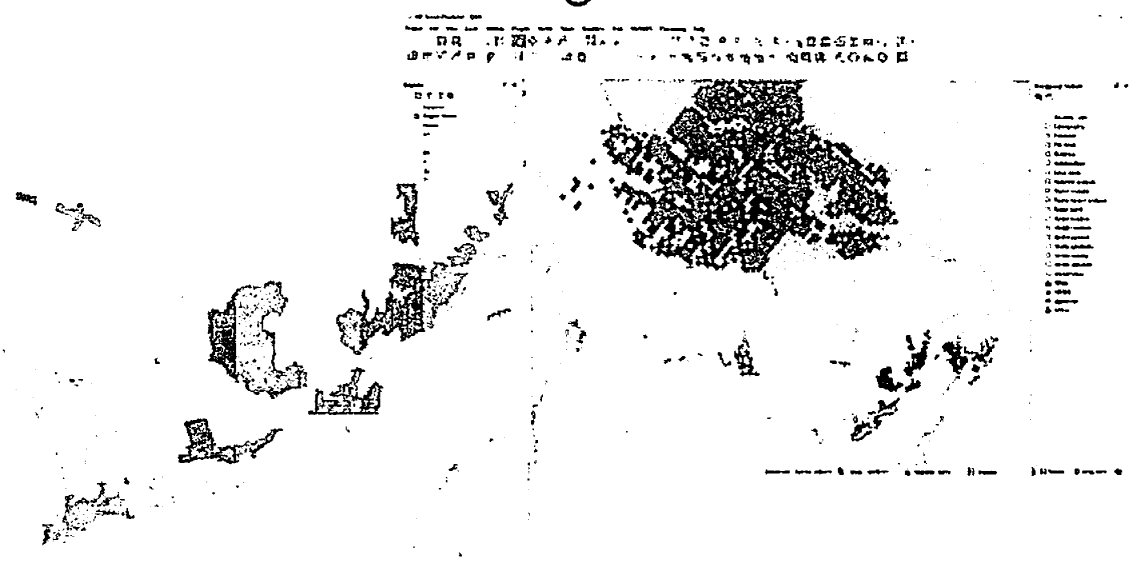
8

2. a,b) Data driven location prediction with NRCan datasets

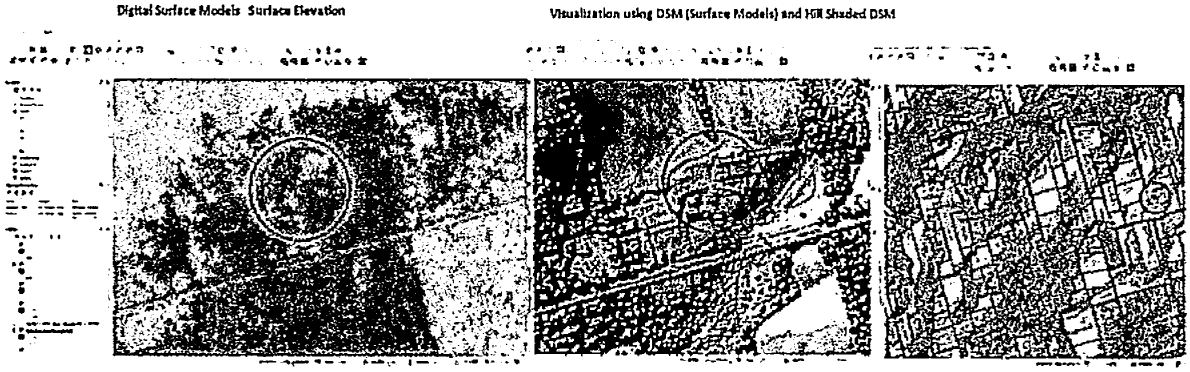
- Footprint of HRDEM data (1-2 m resolution) is small for Ontario
-

20(1)(b)

NRCan HRDEM Regions



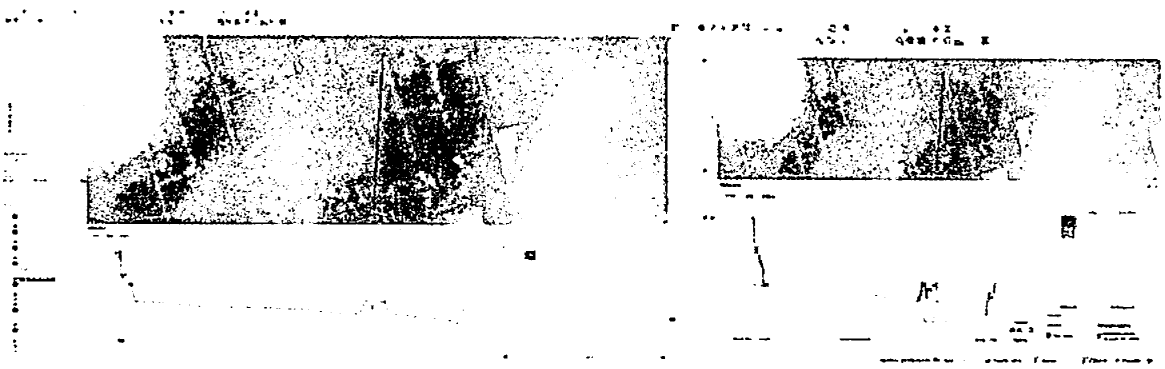
Different HRDEM Views of a Rural Home



20(1)(b)

Terrain and Line of Sight Analysis

- The HRDEM includes enough details to see if features block the line of sight between 2 points on a map. In the example below, a line of trees are located between the departure point (location of a transmitter) and the roof of a house where potential wireless service is required.



Path Profile to Home from 4 Nearby Towers

For the house of interest – located in a valley, there is no LOS path from nearby Bell towers.

20(1)(b)

Bell's 20(1)(b)

20(1)(b)

Canada

Dojack, DeNeige (IC)

From: Gilfillan, Fiona (IC)
Sent: February-08-19 9:53 AM
To: Dojack, DeNeige (IC); Calvery2, Ryan (IC)
Subject: RE: Bell 5G comments

Nothing says love like an investors' call ;)

From: Dojack, DeNeige (IC) <deneige.dojack@canada.ca>
Sent: February 8, 2019 9:52 AM
To: Gilfillan, Fiona (IC) <fiona.gilfillan@canada.ca>; Calvery2, Ryan (IC) <ryan.calvery2@canada.ca>
Subject: RE: Bell 5G comments

Valentines day – Thursday Feb 14th

From: Gilfillan, Fiona (IC) <fiona.gilfillan@canada.ca>
Sent: February 8, 2019 9:48 AM
To: Dojack, DeNeige (IC) <deneige.dojack@canada.ca>; Calvery2, Ryan (IC) <ryan.calvery2@canada.ca>
Subject: RE: Bell 5G comments

Many thanks. Much appreciated. When is the TELUS call next week?

From: Dojack, DeNeige (IC) <deneige.dojack@canada.ca>
Sent: February 7, 2019 9:17 AM
To: Gilfillan, Fiona (IC) <fiona.gilfillan@canada.ca>; Setlakwe, Lisa (IC) <lisa.setlakwe@canada.ca>
Cc: Noir, Charles (IC) <charles.noir@canada.ca>; Kwan, Wen (IC) <wen.kwan@canada.ca>; Miller, Pamela (IC) <pamela.miller@canada.ca>
Subject: RE: Bell 5G comments

Fiona, Lisa

Below is a summary of Bell's comments regarding 20(1)(b),21(1)(b) call this morning.

Thanks to Ryan for listening

From: Calvery2, Ryan (IC)
Sent: February-07-19 8:12 AM
To: Dojack, DeNeige (IC)
Subject: Bell 5G comments

Bell statement regarding 5G vendors

- Bell uses Huawei has been the supplier for the radio access layer for 3G and 4G networks, but do not use it in the network core.
- We recognize the issues at play and will abide by any decision outcome.
- We have made no selection yet for a 5G supplier.
- Whatever the outcome is, will not impact the capex forecast or timeline of 5G rollout.

From:	Media Monitoring / Surveillance des médias (IC)
Sent:	February-07-19 10:42 AM
To:	IC.O MM MinisterISED / SM MinistreISDE O.IC; IC.O MM SITT / SM STIT O.IC; IC.O MM Digital / SM Numérique O.IC; IC.O MM Internet / SM Internet O.IC; IC.O MM CETA / SM AECG O.IC
Subject:	NB - Bell says it will be ready to deploy 5G in time even if Canada bans Huawei (Mobile Syrup)

Published | Publié: 2019-02-07 10:38 (EST)
Received | Reçu: 2019-02-07 10:40 (EST)

Mobile Syrup

Bell says it will be ready to deploy 5G in time even if Canada bans Huawei

Shruti Shekar

The federal government is currently conducting two reviews, one on Huawei, the other on 5G in Canada

Feb 7, 2019 8:28 AM EST

BCE CEO George Cope says a ban of Huawei would not impact Bell's timeline to bring 5G technology to the Canadian market.

"If there was a ban or we chose a different supplier than Huawei, we are quite comfortable and all those developments would be addressed within our traditional capital intensity envelope and therefore no impact from a capital expenditure program." Cope said during the company's Q4 2018 results conference call.

Canada's relationship with China has soured since the beginning of December when Canadian authorities arrested Huawei's global CFO Meng Wanzhou in Vancouver. Meng, who is also the daughter of Huawei president and founder Ren Zhengfei, was arrested on fraud-related charges.

The U.S. laid 13 charges of bank and wire fraud against Meng, Huawei and its subsidiary Skycom. She currently faces extradition to the U.S.

Bell, along with its competitor Telus, have invested millions of dollars to prepare for their future 5G technology rollout. If a ban is implemented by the federal government, they could stand to lose as much as $1 billion.

"Huawei has been a supplier...for our 3G and 4G mobile networks for a number of years with, of course, the Canadian government's support," Cope said. "We do not use Huawei network in our core and everyone knows the government is conducting a cyber security review whether to permit the continued use of Huawei equipment for 5G."

During a sit-down interview in Ottawa on Parliament Hill on January 31st, **Innovation, Science and Economic Minister Navdeep Bains** said that whatever the results of the review are, the government would support the carriers in its deployment of 5G networks.

Currently, there are two ongoing reviews of Huawei by Public Safety Minister Ralph Goodale's department. Bains told *MobileSyrup* that the government has been having ongoing conversations with Canada's allies to understand what they are doing and what their experiences have been.

But there is growing pressure from Canada's allies.

Out a stated fear of cybersecurity attacks, the U.S. banned the Chinese telecommunications giant from providing 5G equipment in August 2018.

Following the U.S., Australia and New Zealand banned the company, as well. The three countries are members of the Five Eyes intelligence-sharing alliance, as is Canada and the U.K.

Shortly after all the news broke and continues to unfold, Bell, as well as Telus issued separate internal memos to their respective employees concerning the topic of Huawei.

"We clearly recognize the issues at play and we will manage those appropriately going forward and of course all the law," Cope said.

Dojack, DeNeige (IC)

From:	Dojack, DeNeige (IC)
Sent:	August-03-18 1:34 PM
To:	Calvery2, Ryan (IC)
Cc:	Arbour, Andre (IC)
Subject:	FW: Bell note
Attachments:	SITT-STIT-#898194-v4-Cope_input_-_STS.DOCX

From: Aghajanian, Nicholas (IC)
Sent: August-03-18 1:30 PM
To: Dojack, DeNeige (IC)
Cc: Chevrier, Aline (IC); Scott, Adam (IC); Fod, Habone (IC); Anderson, Daniel (IC)
Subject: RE: Bell note

Hi DeNeige,

Attached is our revised input. Adam has approved, but we're not sure if Fiona will have time to look at it.

Would you be able to share the full revised note with Adam too, please?

Thanks!

Nick

From: Chevrier, Aline (IC)
Sent: August-03-18 10:04 AM
To: Scott, Adam (IC); Anderson, Daniel (IC)
Cc: Dojack, DeNeige (IC); Aghajanian, Nicholas (IC); Fod, Habone (IC)
Subject: RE: Bell note

Hi Daniel, could you expand on the input provided for the Cope note as per email below.

Thank you

From: Dojack, DeNeige (IC)
Sent: August-03-18 9:31 AM
To: Scott, Adam (IC)
Cc: Chevrier, Aline (IC)
Subject: Bell note

Adam, Aline

We got comments back on the Cope note from DMO. They want more substantive speaking notes.

STS Input to Cope Note

Mr. Cope also plans to talk to you about the ongoing 3500 MHz consultation. 3500 MHz has been targeted as the first key band for 5G development internationally. In Canada,

21(1)(a),21(1)(b)

Inukshuk, a partnership between Bell and Rogers holds 21(1)(a),21(1)(b) **of the 3500 MHz spectrum in the 3500 MHz band, mainly in urban areas. In the 3500 MHz consultation launched in June, ISED proposed two options affecting how much spectrum current licensees would retain. Option 1 would see Inukshuk's holdings drop from** 21(1)(a),21(1)(b) 21(1)(a),21(1)(b) **Option 2 would see it drop to** 21(1)(a),21(1)(b) **Bell has submitted comments to the first round of consultations, arguing that current licensees should not return any spectrum.**

20(1)(b),21(1)(b)

Bell obtained the majority of its 3500 MHz licences in spectrum auctions in 2004-2005.

20(1)(b),21(1)(b)

20(1)(b),21(1)(b) Other companies, including Xplornet and small WISPs, have been using the band to offer wireless internet service for years. 20(1)(b),21(1)(b)

20(1)(b),21(1)(b)

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3500 MHz

- As you know, the 3500 MHz consultation is still underway, and I cannot comment on the outcome until our decision is issued. The challenge for us is to construct a decision that leads to 5G networks being built in Canada, but maintains the progress we've been seeing in terms of competition within the mobile sector, and still provides a path forward for the smaller service providers that are using this spectrum for rural broadband.

- We understand your positions on the consultation proposals and we are carefully considering all comments. As you know, you have the opportunity to reply to other stakeholder's comments by August 10.

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- We heard from stakeholders, including Bell, that we needed to move quickly in order to use about the importance of this band tofor unleashing the potential of 5G. That is why we are investing significant resources in havingholdingmoving ahead quickly with our consultation process this consultation.

- I understand you are seeking for ISED to treat Bell and Rogers separately, despite holding the spectrum in a partnership. As ISED is seeking to providemake this spectrum available to providers that will use it to meet our policy objectives,

21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

Responsive to Bell's proposal to split Inukshuk's holdings -

- I understand you are proposing that ISED treat Bell and Rogers separately, despite holding the spectrum in a partnership.

21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

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21(1)(a),21(1)(b)

- Fixed wireless is a method of providing broadband Internet access to homes using wireless technology rather than cable or fiber. It involves installing an antenna that is typically permanently mounted at the customer premises that communicates with a fixed wireless tower.
- Fixed wireless is currently delivered using 4G. It's anticipated that Telecommunications Service Providers (TSPs) will upgrade their networks to 5G in the coming years to provide faster speeds and enhanced quality.
  - 21(1)(a),21(1)(b)
- 21(1)(a),21(1)(b)

Impact on Mobile

- With respect to Mobile, LTE networks have been deployed to cover 99% of Canadians.

21(1)(a),21(1)(b)

Impact on Xplornet

- Xplornet is the largest national fixed-wireless service provider in Canada and has discussed using 5G for fixed-wireless. They recently launched mobile wireless in Manitoba replacing MTS as the regional mobile provider.
- 21(1)(a),21(1)(b)
-
-
  - Xplornet is currently seeking to be acquired creating uncertainty. 21(1)(a),21(1)(b)
    21(1)(a),21(1)(b)
  - Xplornet has received significant funding from the government through ISED broadband programs

21(1)(a),21(1)(b)

- SaskTel is Crown cooperation and the incumbent telecom provider in Saskatchewan offering mobile and fixed-wireless services. 21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

- Bell and TELUS focus the vast majority of investment on urban or suburban areas rather than rural areas. TELUS' investment plan is focused on fibre-to-the-home to compete with existing cable like Shaw.
- Bell has announced some fixed wireless expansion for some suburban and semi-rural areas 21(1)(a),21(1)(b)
  21(1)(a),21(1)(b) They are looking at potentially 700-800k at 25 Mbps via fixed wireless. 21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

- With respect to Mobile, LTE networks have been deployed to cover 99% of Canadians.

21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

- SaskTel is Crown cooperation and the incumbent telecom provider in Saskatchewan offering mobile and fixed-wireless services.
- 21(1)(a),21(1)(b)
- Saskatchewan has some of the lowest wireless prices in Canada but is typically slower to adopt new technologies. For example, in 2016 the national average LTE deployment was 98.6% while Saskatchewan was at 86.2%
- 21(1)(a),21(1)(b)
- SastkTel's annual CAPEX is in the $275M dollar range.

	2014	2015	2016
SaskTel CAPEX (without spectrum)	21(1)(a),21(1)(b)		

21(1)(a),21(1)(b)

- Xplornet is the largest national fixed-wireless service provider in Canada 21(1)(a),21(1)(b) 21(1)(a),21(1)(b) They recently launched mobile wireless in Manitoba replacing MTS as the regional mobile provider.
- 21(1)(a),21(1)(b)
- Xplornet invests around 21(1)(a),21(1)(b)

	2014	2015	2016
Xplornet CAPEX (without spectrum)	21(1)(a),21(1)(b)		

- Xplornet is currently seeking to be acquired creating uncertainty. 21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

  - Xplornet has received significant funding from the government through ISED broadband programs
    - Connecting Canadians Program 21(1)(a),21(1)(b) Total Authorized Assistance: $
    - 21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

21(1)(a),21(1)(b)

- Bell and TELUS focus the vast majority of investment on urban or suburban areas rather than rural areas. TELUS' investment plan is focused on fibre-to-the-home to compete with existing cable like Shaw.
- Bell has announced some fixed wireless expansion for some suburban and semi-rural areas (potentially as a strategic deployment to retain 3500 MHz spectrum). They are looking at potentially 700-800k at 25 Mbps via fixed wireless. 21(1)(a),21(1)(b)
- The national incumbents have large CAPEX portfolios, ranging from $2.5-$4B annually. If that between $700M and $1B is for wireless

Total telecom capex in Billions (excluding spectrum)

	2017	2016	2015	2014	2013	2012	2011
Bell	21(1)(a),21(1)(b)						
Rogers							
Telus							

Wireless capex in Millions (excluding spectrum)

	2017	2016	2015	2014	2013	2012	2011
Bell	21(1)(a),21(1)(b)						
Rogers							
Telus							

21(1)(a),21(1)(b)

- 5G, like previous advances in telecommunications technology, will follow a multi-year deployment schedule.
- For 4G LTE, Deployment in urban centers started in 2011 with deployment starting to reach rural communities in 2014 and eventually coving 99% of Canadians by 2016.

YEAR	LTE
2017	99%
2016	99%
2015	97%
2014	90%
2013	81%
2012	72%

*rounded

21(1)(a),21(1)(b)

Government Support Considerations

- The Fall Economic Statement announced accelerated capital cost allowances that lower the costs of capital investment, including for network equipment.
- 21(1)(a),21(1)(b)

Pichette, Laura (IC)

From: Pichette, Laura (IC)
Sent: January-10-19 1:48 PM
To: STS ADM Office / Bureau SMA SST (IC); Gilfillan, Fiona (IC)
Cc: Proulx, Martin (IC); Kwan, Wen (IC)
Subject: FW: Request for a call with Greta Bossenmaier

fyi

Laura Pichette
Senior Advisor, Office of the Assistant Deputy Minister, Spectrum and Telecommunications Sector
Innovation, Science and Economic Development Canada / Government of Canada
Tel: 343-291-1276/ TTY: 1-866-694-8389

Conseillère principale, Bureau du Sous-ministre adjoint, Secteur du Spectre et télécommunications
Innovation, Sciences et Développement économique Canada / Gouvernement du Canada
Tél: 343-291-1276 / ATS: 1-866-694-8389

From: Dei, Joel (IC)
Sent: January-10-19 1:43 PM
To: Fortier, Laurie-Ann (IC); Novak, Rione (IC)
Cc: Patriquin, Sarah (IC); Pichette, Laura (IC)
Subject: RE: Request for a call with Greta Bossenmaier

Hi LA,

21(1)(a),21(1)(b)

Joel

From: Fortier, Laurie-Ann (IC) <laurie-ann.fortier@canada.ca>
Sent: January 10, 2019 10:35 AM
To: Novak, Rione (IC) <rione.novak@canada.ca>
Cc: Patriquin, Sarah (IC) <sarah.patriquin@canada.ca>; Dei, Joel (IC) <joel.dei@canada.ca>
Subject: RE: Request for a call with Greta Bossenmaier

Thanks, I was going to request from them originally but this subject is always fuzzy as to who leads.

JOEL: can you as Pam for a rec?

Thanks,

From: Novak, Rione (IC)
Sent: January-10-19 10:33 AM
To: Fortier, Laurie-Ann (IC)
Cc: Patriquin, Sarah (IC); Dei, Joel (IC)
Subject: RE: Request for a call with Greta Bossenmaier

21(1)(b)

Rione.Novak@canada.ca
343-291-2123 (desk)
19(1)

From: Fortier, Laurie-Ann (IC)
Sent: January-10-19 10:32 AM
To: Novak, Rione (IC)
Cc: Patriquin, Sarah (IC)
Subject: FW: Request for a call with Greta Bossenmaier

Hi Rione,

Can you get a recommendation on this as to whether or not David should meet with Bell re: 21(1)(b)
21(1)(b) Bell has not reached out to us yet.

Laurie-Ann

From: De Santis, Heather (PS/SP)
Sent: January-10-19 8:29 AM
To: Aceti, Julia; Fortier, Laurie-Ann (IC)
Subject: RE: Request for a call with Greta Bossenmaier

Hi Julia,

Let me check with the DM. He met with Telus in Dec He may wish to discuss with the NSIA this aft. cheers

From: Aceti, Julia [mailto:Julia.Aceti@pco-bcp.gc.ca]
Sent: Wednesday, January 09, 2019 6:14 PM
To: De Santis, Heather (PS/SP); Fortier, Laurie-Ann (IC)
Subject: FW: Request for a call with Greta Bossenmaier

Colleagues,

A representative from Bell has requested a meeting with the NSIA on Huawei. 21(1)(b)

21(1)(b)

Grateful for your views.

Cheers,

Julia

Julia Aceti
Chief of Staff, Office of the National Security and Intelligence Advisor to the Prime Minister
Privy Council Office / Government of Canada

Julia.Aceti@pco-bcp.gc.ca / 613-957-5538

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From: 19(1) @bell.ca]
Sent: January 8, 2019 2:33 PM
To: Aceti, Julia
Cc: 19(1) Thibault, Dina
Subject: RE: Request for a call with Greta Bossenmaier

Hi Julia:

I am writing to request a phone call meeting regarding Bell 20(1)(b) with Greta Bossenmaier as soon as possible.

It would be with myself and the Head of Bell's Corporate Security cyber group, and our liaison with the Government's security agencies.

I am hoping a phone call is an easier/faster way to speak.

I do realize it is short notice, but we are very much hoping for this week.

Please advise.

19(1)
Bell
Government Affairs
19(1)