



Committee of the Whole – Regular Meeting
March 5, 2014 – 9:00 a.m.
The Frontenac Room, 2069 Battersea Road, Glenburnie, ON

AGENDA

- 1. CALL TO ORDER**
- 2. ADOPTION OF AGENDA**
- 3. DISCLOSURES OF PECUNIARY INTEREST AND GENERAL NATURE THEREOF**
- 4. DEPUTATIONS AND/OR PRESENTATIONS**
- 5. CLOSED MEETING**
- 6. REPORTS**
 - a) 2014-029
Corporate Services
Performance Concepts County of Frontenac Strategic Plan Draft Report

(This report was referred to the Committee of the Whole at the February 19, 2014 County Council Meeting)
BE IT RESOLVED THAT the Council of the County of Frontenac receive the Corporate Services – Performance Concepts Consulting Inc. – County of Frontenac Strategic Plan Draft Report for information;

AND FURTHER THAT Council approve the draft County of Frontenac Strategic Plan report provided by Performance Concepts Consulting Inc, attached to this report as Appendix A, as amended.
 - b) Discussion on the Radio Communications Report
[Addenda]
- 7. RISE AND REPORT**
- 8. COMMUNICATIONS**
- 9. NOTICE OF MOTION**
- 10. OTHER BUSINESS**
- 11. PUBLIC QUESTION PERIOD**

12. ADJOURNMENT



Report 2014-029

RECOMMEND REPORT TO COUNCIL

To: Warden and Council of the County of Frontenac

From: Marian VanBruinessen
Acting CAO/Director of Corporate Services/Treasurer

Date prepared: February 11, 2014

Date of meeting: February 19, 2014

**Re: Corporate Services – Performance Concepts Consulting Inc. –
County of Frontenac Strategic Plan Draft Report**

Recommendation

BE IT RESOLVED THAT the Council of the County of Frontenac receive the *Corporate Services – Performance Concepts Consulting Inc. – County of Frontenac Strategic Plan Draft Report* for information;

AND FURTHER THAT Council approve the draft County of Frontenac Strategic Plan report provided by Performance Concepts Consulting Inc, attached to this report as Appendix A, as amended.

Background

In December 2013, the County of Frontenac issued a Request for Proposals for the services of a consultant to undertake a County Strategic Plan. The contract was successfully awarded to Performance Concepts Consulting Inc.

Comment

As part of the requirements of the Request for Proposal, the Project involved leading Council members through a day-long strategic planning session supported by senior staff, anticipating outcomes to include: confirmation of the mission and vision statements, values, goals, objectives, and reporting/monitoring considerations. The Project also involved consultation with the Townships' Councils, one meeting in each Township and to have one or more public meetings held across the County to gain input from the community prior to the completion of the draft report.

Recommend Report to Council
Performance Concepts Consulting Inc. –County of Frontenac Strategic Plan Draft Report
February 19, 2014

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A day-long strategic planning session was held on Wednesday, January 28, 2014, resulting in the draft report by Performance Concepts Consulting Inc. This report is in line with the minutes taken at the meeting.

Approval by Council of the draft County Strategic Plan is required prior to Townships' Council and public consultation.

Sustainability Implications

As noted in *Directions for our Future*, Government decision-making processes are clear, transparent, forward thinking and focused on the longer term.

Financial Implications

There are no financial implications associated with this report.

Organizations, Departments and Individuals Consulted and/or Affected

Performance Concepts Consulting Inc.

Attachments

Appendix A Performance Concepts Consulting Inc. – County of Frontenac Strategic Plan Draft Report

“Wildly Important Goals” for the County of Frontenac

Council Strategic Priority Setting

February 2014



A. Introduction

The Council of the County of Frontenac is attempting to identify a set of strategic priorities that will drive the County for the balance of the current term, and also provide a jumping-off point for the upcoming 2015-18 term of office. In order to do so, County Council recently participated in a full-day strategic priorities brainstorming session facilitated by Performance Concepts Consulting.

County Council is committed to producing a focused set of “Wildly Important Goals” – true strategic priorities that mesh with the local Townships, and also reflect the public’s expectations and future service needs. To ensure consensus and coordination, dialogue sessions around the County’s draft set of Wildly Important Goals will be conducted with the four Township Councils within Frontenac, and a public input session will also be held. Again, collaboration and consensus are key objectives.

The County’s recently submitted KPMG Service Delivery and Organizational Review, and Council’s ongoing budget-making decisions will influence, and in turn be influenced by, the Wildly Important Goals identified in the January 28th 2014 strategic priority setting exercise.

Relentless Focus Amidst Change...

“The Main Thing is to Keep the Main Thing the Main Thing”

*Management Guru
Stephen Covey*

“If you’re currently trying to execute five, ten, or even twenty important goals, the truth is that your team can’t focus. This lack of focus magnifies the intensity of the whirlwind, dilutes your efforts, and makes success almost impossible.”

4 Disciplines of Execution

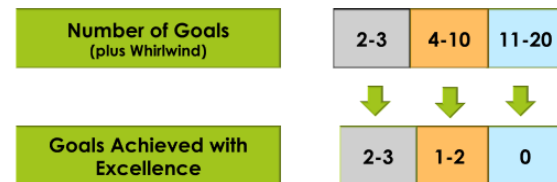


B. Moving Beyond Traditional Strategic Planning to “Wildly Important Goals”

Change is not easy. County Council has attempted to generate strategic priorities in the past. Traditional strategic planning models are often unsuccessful in generating meaningful strategic priorities, because the entire exercise is bureaucratic - not strategic in nature. Performance Concepts Consulting advocated a different approach in the January 28th brainstorming session.

A clear-eyed discussion of the real challenges/problems facing the County was undertaken by Council. Rather than producing a large swath of disconnected strategic plan goals, a decision was made to relentlessly focus the County’s finite capacity for change on a much smaller number of “Wildly Important Goals”. By saying “No” to some potential priorities, the probability of success in generating real strategic change is greatly improved. The Law of Diminishing Returns (set out below) is avoided and real progress is possible.

Setting Goals: The Law of Diminishing Returns



Human beings are genetically hardwired to do one thing at a time with excellence.

Performance Concepts Consulting and Frontenac Council are making use of the **4 Disciplines of Execution (4DX)** – an innovative tool for implementing strategic change developed by highly regarded management gurus at the Covey Group. The key to **4DX** is to focus on no more than 2-3 Wildly Important Goals – and implement them in the face of the “whirlwind” of organization busyness faced every day by County Council and staff.

Priority Setting Must Recognize the Realities of the Whirlwind



C. Council Identification of Challenges/Problems

Successful priority setting begins with the “kernel” found at the core of any good strategy. This kernel has three distinct components:

1. A **DIAGNOSIS** that explains the nature of the challenge. It cuts through complexity and gets to the critical

aspects of the situation. It explains exactly what is actually going on here.

2. A **GUIDING POLICY** for dealing with the challenge. An overall approach to cope with or overcome the obstacles identified in the diagnosis.
3. A set of **COHERENT ACTIONS** that are designed to execute the guiding policy. These are steps that are coordinated with one another to work together in executing the guiding policy.

At the January 28th retreat Performance Concepts presented a number of “big picture” problems/challenges for Council to consider in its Diagnosis of the situation Frontenac finds itself facing.

1. The lack of local government economies of scale & duplicated overheads in Frontenac. Five local governments, each with its own overheads - chasing just 26,000 permanent residents.

2. A County government in search of services because it does not deliver roads & social services like almost all other counties in Ontario.
3. The core County services (EMS & LTC) are both healthcare services that are going to be pounded by the unavoidable demographic Aging Tsunami that is gathering steam as the baby boomers start to become senior citizens... service demand growth is going to outstrip property assessment growth and the existing tax base.
4. Seniors housing & transportation demands are going to escalate under the pressure of the demographic Aging Tsunami that is gathering steam... the issues exceed the capacity of the local municipalities, yet the County has no developed capacity to respond at this time.
5. Waste management solutions (e.g. energy from waste) are going to require economies of scale that extend beyond the borders of the County, yet the County has not consolidated its thinking, resources, service delivery data, or expertise at the upper tier.
6. Countywide official planning is isolated from transportation operations that are controlled at the local level.
7. County \$ reserves are not assigned to specific capital or operating priorities at either level of government. How can we re-balance the \$ pressures among local

governments with the available \$ revenues until we know what the core challenges are at both levels of government? Don't we need the strategy worked out first?

The facilitated discussion at the January 28th brainstorming session considered these seven challenges facing the Frontenac community and its five local governments.

During their diagnosis of the current situation, Council members also made reference to the following range of issues:

- Limitations on the tax base due to an aging population
- Financial viability and the challenge of ensuring the long term viability of both the County and Townships by ensuring the right level of government is providing the service
- Customer satisfaction to ensure that citizens remain in the County
- Transportation connectivity and moving goods, services and people to where they need to go
- Disposal of solid waste

- Treatment of waste water
- Economic development
- Seniors and social housing
- Recognition and inclusion of the other agencies and boards involved in the County, including the City of Kingston, the Library Board, Public Health and the CRCA.

The suitability of a County government response to the challenges proposed by Performance Concepts, and County Councillors, was carefully considered. In keeping with the 4 Disciplines of Execution model, County Council wisely rejected making all of these challenges a simultaneous political priority. Some challenges, such as the duplication of overheads among 5 local governments, were appropriately delegated to County and Township staff to resolve on an ongoing basis. Efficiencies and shared service arrangements will be brought forward to Council on a case-by-case basis. Other challenges and problems will simply have to wait. Any attempt to solve all the challenges at once would likely result in none being resolved.

County Council honed in on three fundamental challenges/problems as the focus of its strategic priority setting. Those fundamental problems are set out in the following figure:

Council Considered 7 Challenges & Selected 3 Fundamental Challenges to Address Via Strategic Priority Setting

Fundamental Challenges Requiring Strategic Solutions
1. Inadequate Local/County government expenditure control & revenue stream generation could create long term economic viability deficit in community
2. Absence of proactive leadership/policy coordination/advocacy on solid waste management system design/funding in a post-landfill setting
3. Aging tsunami creating pressure for Seniors housing, Seniors transportation solutions, plus EMS & LTC – no coordination/leadership in place to protect/advocate County-wide community interests

Council has selected problems with a common theme - an existing “capacity gap” within the County of Frontenac community to generate an appropriate solution. Political capital and focus will be required beyond the interests of individual Townships, and perhaps beyond the entire County in the case of solid waste management. Interestingly the three fundamental problems touch on fiscal, environmental and

social health gaps across the community. **Long-term economic viability** requires tourism driven and other revenue streams and careful management of government spending. **Solid waste management in the post-landfill era** will require large-scale \$ investments, intergovernmental advocacy, and a new policy framework. **Aging tsunami pressures** could negatively impact EMS and seniors services.

The following figure sets out the evolving strategy necessary for the County to deal with these three fundamental challenges:

The Evolving Strategy

- County Council to **adopt the role of a strategy “quarterback” coordinating/funding a response to critical gaps in core public services**... working in collaboration with local townships and other Eastern Ontario counties as required... this role does not require an expanded County role in direct service delivery
- County Council to **emphasize role as the “comptroller” ensuring taxpayer value for money** re. the existing LTC & EMS and other County services – as well as any flow-through funding to the local municipalities for arterial road capital projects

County Council will not necessarily assume the mantle of direct service delivery. Council will coordinate, advocate and leverage \$ resources as required. This quarterback role avoids friction/duplication with the “team” of local government partners, and builds on collaboration and common interests that extend beyond any single Township or Frontenac stakeholder group.

D. Council’s Wildly Important Goals

By selecting 3 fundamental challenges to address, Council is ensuring its finite resources will pack punch and provide focus. Council will avoid the traditional strategic planning shortfall of being an inch deep and a mile wide. A strategy of gap-filling and “quarterback” coordination will be applied to 3 Wildly Important Goals. These “WIGS” are contained in the following three figures:

Wildly Important Goal #1

- **Meet Aging Tsunami challenge for Frontenac Seniors by:**
 - ✓ Addressing the existing gap in Seniors Transportation by ensuring 100% of Seniors receive a timely, affordable ride to scheduled medical appointments (when requests received in a timely fashion) – to be accomplished by the end of the 2015-18 term of County Council
 - ✓ Addressing the existing gap in Seniors Affordable Housing stock by leveraging and/or funding the construction of a 5-unit project in each of the four Frontenac townships – to be accomplished by the end of the 2015-18 term of County Council.

Wildly Important Goal #2

- **Meet the emerging “post landfill” Solid Waste Management challenge for Frontenac residents:**
 - ✓ Coordinate the establishment of a “Made in Frontenac” position and financial plan to be executed by the end of the current Council term, to inform the Eastern Ontario Wardens caucus on solid waste management solutions, including energy-from-waste.
 - ✓ Frontenac’s position will be supported by technical data and financial planning in collaboration with local municipalities.

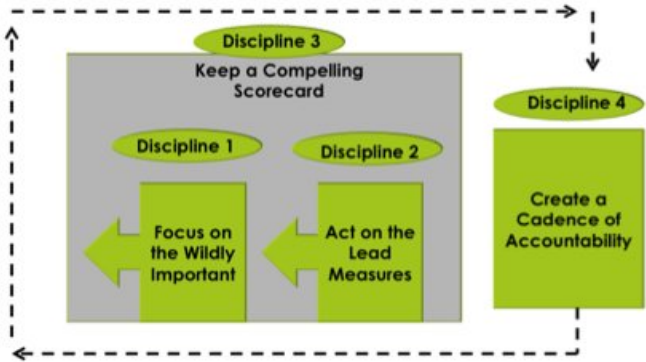
Wildly Important Goal #3

- **Good government & comptrollership focus of Council to drive the following**
 - ✓ Refocus/downsize the existing portfolio of County sustainability plan projects to support economic development objectives of employment/revenue generation. Do so by accelerating the ICSP Economic Pillar projects over the remainder of the current Council term and the upcoming 2015-18 term.

Council’s 3 WIGs represent the strategic priorities of Council until the end of the current term, and well beyond. Council will continue to make decisions within the “whirlwind” of existing County services and “urgent” issues. However, the WIGs will define the truly “important” in the eyes of Council - who will relentlessly push back against the urgency of the “whirlwind” in an effort to generate positive, meaningful progress and change.

In terms of next steps, the WIGs should be stress tested with the various Frontenac Township Councils and the taxpaying public.

County and Township staff will be critical resources in supporting WIG achievement. The 4 Disciplines of Execution sets out a “Cadence of Accountability” set of relentless WIG implementation tools that will ensure the WIG can be achieved. Once the WIGs have been achieved, Council can revisit its problems list and identify new WIGs in a process of never-ending strategic focus and superior performance. Training in the 4 Disciplines of Execution is recommended for staff.



Appendix A.

Economic Pillar of Sustainability

As one of the pillars of sustainability, the continued economic vitality of the Frontenacs is a key determinant in maintaining a high quality of life for residents and visitors alike. Studies have shown that greater stages of economic development often allow for further efforts to support environmentally and socially responsible actions. Going forward in Frontenac County, this will manifest itself through continued support of local businesses, trail development, and ongoing support for local food initiatives.

2.01 Sustainable Tourism Strategy

Throughout the stakeholder consultation process, support for a comprehensive sustainable tourism strategy is shared. Notable tourism developments have been undertaken with the Township of Frontenac Islands' trail development on Howe Island, as well as the Township of North Frontenac's continuing Dark Skies project.

2.02 Employability Service Training Plan

The potential for improved economic performance through improved customer service is acknowledged, and an employability service training plan has been suggested. Multiple agencies are actively involved in this type of effort, including The 1000 Islands Region Workforce Development Board, Algonquin College and St. Lawrence College. Recent training initiatives with St. Lawrence College in Sharbot Lake have been successful in preparing individuals for trades work and this sort of program could be modeled for application in other sectors, such as tourism.

2.03 Trails Network

The vast area encompassed within Frontenac County is endowed with substantial natural

beauty. As a community, we benefit from the connections and access to nature that is provided by a trails network. The County's Trails Advisory Committee has been very active over the past year and looks forward to expanding on recent successes. The Frontenac K&P Trail will be open from Kingston to Verona by the end of 2013. The focus continues northward to Sharbot

Lake. Interest is growing from the community for the development of trailhead buildings that could serve multiple purposes within the communities. Presentations have been made of concept plans for buildings at Harrowsmith and Sharbot Lake and conversations are starting around Robertsville, north of Highway 7. As more and more of the trail is completed, regional branding and marketing will aid in developing the economic benefits of this asset.

2.04 Local Food

Frontenac County has a rich agricultural heritage and numerous opportunities within its vibrant local food industry. There are an increasing number of independently-led initiatives in the County. The Farmers' Markets in Verona and Sharbot Lake have had a successful year again. A successful Friday afternoon market pilot ran on Friday afternoons through October along Road 38 at Harrowsmith to determine potential interest. The National Farmers Union Local 316 continues to support farmers and provides education through its Food Down the Road programs. The Food Charter has now received the support of the County and the City of Kingston and a Food Council is moving forward. All of these initiatives, and more, can be further supported with regional branding and marketing. In a large stakeholder survey, conducted as part of the County Local Foods Business Retention and Expansion program, stakeholders identified the need for more local abattoirs and noted that the regulation surrounding meat production and sale remains a challenge. A call has been made to allow zoning for backyard, small-scale agriculture. Increasing fuel prices may have an increasing effect on the price of food and local small-scale production will help to ease some of these costs for many families.

2.05 Cellular Service

In an increasingly electronic world, the deficiencies in cellular service coverage have been identified by stakeholders as a challenge to economic growth. Although direct development of such services remains with the private sector, the Eastern Ontario Wardens' Caucus recently passed a resolution recognizing cellular service as an area needing attention, on the heels of its successful roll out of the broadband infrastructure project across the region. All parties appear to agree that public-private initiatives in this sector may provide some relief.

2.06 Green Energy

How we power our homes and workplaces is a key component of sustainability. Newer, green energy alternatives are being developed every day to assist in the transition away from more traditional fossil fuel sources. While many of the developments of the past year have been driven by the Provincial *Green Energy Act*, funding and political changes at this level currently pose a challenge for many in this sector. Potential synergies exist for exciting partnerships between multiple organizations such as the County of Frontenac, Queen's University, SWITCH and St. Lawrence College, to name a few. St. Lawrence College is a post-secondary leader in green energy and has the potential to assist with both technical experiences through its own solar retrofits, as well as through teaching and co-operative learning. Frontenac community stakeholders have identified a need for, and opportunity to, further educate homeowners on energy saving retrofits. Education on energy conservation by everyone will also contribute to a more sustainable use of existing resources. Municipally, successful installations of solar panels on the Sharbot Lake fire station, on two ambulance stations in Sydenham and Kingston and a third planned in Robertsville, and an installation planned as part of the Fairmount Auditorium redevelopment, mean the public sector is participating and generating a return.

2.07 Transportation Management Plan

The sheer size and rural nature of Frontenac County imposes certain transportation demands on its residents. Daily tasks such as going to work, buying groceries and attending doctor's

appointments can pose a serious challenge for those who do not have a personal vehicle and impose associated costs on those who do. County residents identify a need for a Transportation Management Plan and the County of Frontenac has offered assistance to the Townships-led effort.

2.08 Smaller Scale Community-Led Sustainability Initiatives

This County-supported application-based program has supported a number of successful smaller scale community-led sustainability initiatives this year. The Frontenac Stewardship Foundation received support to discover the fundamental steps needed to develop a county-wide Stewardship Plan. In Sharbot Lake, the Farmers' Market was assisted to host a series of workshops which fostered awareness to interested residents of Frontenac for the producing and preparation of local food for one's own consumption. South Frontenac's Battersea-Loughbough Lake Association was one of various lake management groups that received assistance in taking steps to develop its lake management plan.

2.09 Feasibility Study for a Frontenac Agricultural Centre

As our local food industry grows and benefits recent activities, further developments could include a feasibility study for a Frontenac Agricultural Centre. This might form one of the multiple activities that could occur in a multi-use public facility.

2.10 Feasibility of Establishing Food Processing Facilities

Another avenue for investigation in the food sector would be to continue to assess the establishment of food processing facilities. The difficulties associated with distance to processing and the regulations associated with farm-gate sales have continually been raised as a cause for concern.

2.11 e-Commerce

The broadband infrastructure roll out by the Eastern Ontario Regional Network (EORN) will have increasingly positive impacts on current and future business development. With improved internet communications, more opportunities for e-commerce are becoming apparent.

2.12 Sustainability-minded Business Attraction

The modernization of existing electronic infrastructure, including increased access to smart metering and debit/credit machines are attracting sustainability-minded businesses to the region, which is, and will remain, a priority for economic development in the County.

2.13 Green/Business Park

The possibility of developing a business park, preferably green, would be very beneficial in overcoming any infrastructure concerns held by businesses considering relocation and it would also offer tremendous synergy benefits by grouping businesses in a central hub. Such a development could also incorporate shared green energy, thereby lowering the cost of business and increasing the appeal of this region.

2.14 Services: Hydro Transmission Capacity; Natural Gas Service Expansion

Additional infrastructure developments have been suggested that will benefit economic development in the area. Many industries would require increases in Hydro transmission capacity and expansion of natural gas service before they could open in Frontenac County. However, these amenities are controlled by Hydro One and other companies such as Union Gas and opportunities for partnerships between these businesses and various levels of government would need to be explored. Additional stakeholder assessment and discussion may also need to occur regarding the type of industries that will align with our vision of sustainability.

2.15 Regional Signage

For the tourism industry in particular, uniformity of regional signage infrastructure will provide a more consistent branded message for tourists and will help them navigate more successfully.

2.16 Renewable Energy Training

As provincial funding for green energy changes, it may become necessary to seek training partnerships to develop professional training on renewable energy for inspection and planning staff. Outreach and connections with educational partners such as St. Lawrence College should continue to be developed and existing connections enhanced.

2.17 County-wide Rural Community Energy Plan

The need to move away from fossil fuel energy sources was touched upon earlier and continues to frame energy development in the County for the foreseeable future. Although County Council disbanded its Green Energy Task Force Advisory Committee which was on track to lead the development of a County-wide Rural Community Energy Plan looking at renewable energy and conservation, community support remains for the project.

Radio Communications Study Report

Joint Project for Frontenac Townships



Prepared by;



Date: February 16, 2014

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A) Radio Communication Report Objectives

This Report was produced for Frontenac County, (on behalf of the Townships of South Frontenac, North Frontenac, Central Frontenac and Frontenac Islands), in response to RFP (2013-R01) for the completion of a Radio Communications Study, resulting in a signed contract on September 13, 2013.

The objectives of this study were as follows;

1. Completion of an extensive evaluation of the existing Radio Communications Network being utilized by Frontenac Fire and Public Works departments. This included a detailed site evaluation of the Network Infrastructure and Repeater sites, the Base/Mobile/Portable user equipment, current Network Operations and Maintenance. The study was also to determine Network Performance related to current RF coverage and existing Infrastructure, and,
2. Provide technical recommendations for a complete Network refresh in order to overcome existing network shortcomings and achieve key objectives as specified Frontenac County.

The following report summarizes these evaluations and provides Frontenac with a clear assessment of the current status of their Radio Communications Network. Also, the report provides recommendations for Frontenac to consider if they decide to develop an RFP in support of a Radio Communications Network refresh program.

B) Report Overview

The following report consists of 9 major sections plus a number of Appendices providing background support.

The initial section is an Executive Summary which will summarize the key findings and high level recommendations in the report. The intent is to provide the reader with a good understanding of the evaluation and recommendations as detailed in the subsequent sections.

The next three sections are a summary of the key findings from the technical evaluation of Frontenac's existing Network. This includes Repeater Site technical evaluation, Radio Coverage Summary and Radio Licensing and Frequencies. Details of these evaluations are provided in the attached Appendix 1: Current Radio System Evaluation and Coverage Report.

The next section deals with Frontenac's existing User Gear which includes Base, Mobile and Portable equipment that is currently in use. A User Gear inventory list has also been provided as an attachment.

The next three sections deal with the current Radio Network as a whole including Network Operations, Health and Safety Risks and ongoing Network Maintainability.

Based on the results of these evaluations, the final section of the report provides some high level recommendations for Frontenac highlighting some key requirements in support of a Network Refresh.

C) Executive Summary

As indicated, this report was developed in response to an evaluation of the existing Communications Network including Repeater Sites, current Radio Coverage, Licensing and User Gear. In addition, Network Operations, Health and Safety and Maintainability was taken into consideration and reported here.

In general, it can be concluded that the existing system is operational though extremely restrictive from a Network Operations perspective. There are no County wide communications capabilities available. Each Township is operating independently on separate frequencies from each of the 5 Repeater sites in the County. Communications Coverage is inadequate with multiple dead spots where communications is poor or non-existent. Most Repeater equipment and some User Gear is quite old, supplied from different manufactures and, in some cases, no longer supportable. Reliability is threatened due to lack of redundancy at the Repeater sites and at the

Network level due to lack of interoperability between Townships. Lack of interoperability with Mutual Aid partners will become apparent as ULCG and Kingston Fire moves to a upgraded Digital Communications system utilizing technology that will not be compatible with that of Frontenac County.

Repeater Site Evaluation

The technical evaluation performed included the physical inspection of all hardware, antenna systems and ancillary equipment. Detailed technical testing was performed on all Repeater equipment as captured in Section D of this report An extensive Evaluation and onsite Test program was completed on all 5 of Frontenac's current repeater stations including;

- Mountain Grove (Central Frontenac)
- Hartington (South Frontenac)
- Burrige Fire Hall (South Frontenac)
- Ompah (North Frontenac)
- Gore road water tower (Frontenac Islands)

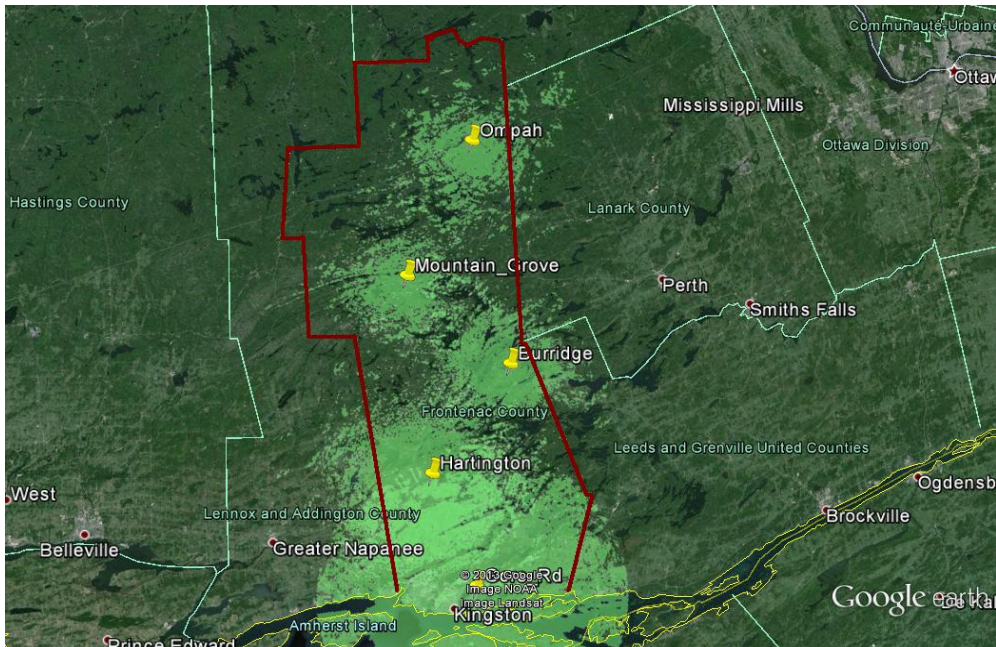
In summary, it was found that the equipment at each of the 5 sites was operational and met most technical performance requirements, however some key concerns were highlighted including;

- Non-redundancy of equipment at each site
- Non-standard equipment from multiple vendors
- Some equipment is no longer supported and parts are unavailable
- Inadequate power conditioning and backup
- No Security monitoring and in some cases poor physical security of sites and transmitter towers

Radio Coverage Evaluation

Section E of this report provides a complete evaluation of the existing radio coverage of the current network. The coverage plot below, shows the estimated 95/95 serviceability for the Frontenac region when combining all of the results from the 5 sites. 95/95 is the most useful means to determine radio coverage and dead spots. The 95/95 Service availability area plot indicates signal levels in 95% of the area in which a portable should work 95% of the time. This is considered as a standard for a Public Safety communication networks. The areas in green indicates adherence with the 95/95 Public Safety standard.

As shown below, dead spots are apparent in large sections of Central and North Frontenac and some sections in South Frontenac. The conclusion from this analysis indicates that the current RF Coverage is not adequate to provide reliable Radio Communications across the entire Frontenac region.



Licensing and Frequencies

As outlined in Section F, a large number of Industry Canada licenses are in place, distributed between the 4 Townships and are allocated to specific radio applications including Repeater, Fixed Mobile and Mobile operations. These licenses have been issued over a number of years and as such, some are outdated and no longer apply to the current disposition of Radios across the Region. There will be a need for reconciliation of Radio licenses as part of any Network Refresh.

Current User Gear

As outlined in section G, the current User Gear is a mix of new and aging equipment. Some of the User equipment is quite old and consists of various models from various vendors which equates to a lack of consistency and higher maintenance costs. Some of the User Gear is no longer supported and parts are no longer available. In addition, current User Gear will no longer be interoperable with the Cities or Counties that have moved to digital technology restricting Mutual Aid Partnerships.

Current Network Operations

As mentioned, the current system provides incomplete Radio coverage for the entire Frontenac County across the 4 Townships. In addition to the Radio coverage deficiencies, Section H points to a serious deficiency pertaining to the overall Network Topology. Currently, each Township is operating independently from each other which does not facilitate County Wide communications or true interoperability across the region. The Network is a Multicast system which means that each Township is operating independently on separate frequencies from each Repeater site. In essence, there is not one integrated County Wide Network, but more like 7 separate networks (5 Fire Networks and 2 Public Works Networks), operating from the 5 Tower Site locations.

At present, there is no interoperability within Frontenac County and no interoperability between Fire and Public Works departments. If an emergency event requires communications across Township regions, for coordinating

emergency crews for example, the current system cannot support it. This likely influences response times from crews outside of the immediate area due to lack of a contiguous communications system. Also, considering UCLG's recent migration to a Digital Radio System and the City of Kingston's imminent migration to a similar Digital Radio Solution, Frontenac will be faced with being incompatible with its Mutual Aid Partners

Health and Safety Risks

Section I discusses how the current Communications Network poses an elevated Health and Safety Risk to Frontenac's employees and the general public. Some of the risks highlighted include;

- Poor Radio Coverage across the County with dead spots for Fire and Public Works crews
- The Repeater sites are non-redundant, thereby reducing network reliability
- Lack of interoperability at the Network level, due to the current Multicast topology
- Lack of power backup systems thereby reducing site availability
- No Security monitoring systems and poor site security
- No facility to record radio communications, thereby increasing Liability for County
- Lack of interoperability for Mutual Aid Partnerships
- Network not designed to support a large, life threatening incident

Network Maintainability

Section J of this report discusses Maintainability issues and escalating costs related to legacy system including the following concerns;

- Some Repeater equipment is quite old and no longer supported by the manufacturers
- Some parts are no longer replaceable or repairable
- No monitor and control system is in place limiting remote diagnostics and poor site security
- Incorrect grounding at most Repeater sites
- Poor power conditioning and backup at sites
- Some User equipment is old and consists of various models from various vendors

All these factors decrease the maintainability of the network and increase ongoing maintenance costs. Having unique equipment at each site increases sparing requirements and non-supported equipment increase vulnerability to major service outages. From a Maintenance perspective, as this network ages, reliability will decrease and maintenance costs will escalate. A network refresh with consistent Repeater site equipment, configured with redundancy, proper power conditioning, remote monitoring and control will drive down maintenance costs.

Recommendations

Section K of this report provides key recommendations. It is concluded that a major Network Refresh including Network Infrastructure and User Gear should be considered by Frontenac County in the near term.

D) Repeater Site Technical Evaluation Summary

An extensive Evaluation and onsite Test program was completed on all 5 of Frontenac's current repeater stations. This included physical inspection of all hardware, antenna systems and ancillary equipment. Based on information determined from these tests, Radio Coverage predications were determined and summarized in the following Section E. Details of these technical evaluations are provided as an attached Appendix 1: Current Radio System Evaluation and Coverage Report. (Note the Original Base station inspection reports).

The Five sites evaluated included:

- Mountain Grove (Central Frontenac)
- Hartington (South Frontenac)
- Burridge Fire Hall (South Frontenac)
- Ompah (North Frontenac)
- Gore road water tower (Frontenac Islands)

All repeater stations were visited and a series of tests performed to ascertain current performance. Antenna matching analysis was conducted on the existing VHF and UHF antennas and coaxial feed lines to determine the effectiveness of the transmission and antenna system. Discontinuity Measurement analysis was conducted on the existing VHF and UHF coaxial feed lines to identify possible signal path degradation. Spectrographic analysis was conducted on the current noise and interference levels as a snapshot of the spectrum at the time.

Also, other tests were performed and recorded in the attached Technical Report, including;

- Transmit power
- Transmit frequency error
- Receiver sensitivity
- Coupling system insertion loss
- Audio response

In addition, physical site inspections were conducted to evaluate the current state of the towers sites. These inspections included the condition of the shelter, grounding systems, power supply systems and backup, ventilation, security as well as equipment installation and mounting. Detailed checklists were completed for each site (as requested by Frontenac) and included in the attached Technical Report.

Summary of Results

Mountain Grove (Central Frontenac)

There are two base stations installed at Mountain Grove. The Fire service Motorola GR1225 base station was tested and found to be operating normally but was incorrectly programmed to receive on 159.150 Mhz while the Industry Canada license is for 159.120 Mhz. The Public works Motorola GR1225 base station was tested and also found to be operating normally. The Motorola GR1225 series base station equipment is no longer supported by the manufacturer. Also, the GR1225 is desktop type base station and is not suited for public safety applications. The duty cycle rating on the transmitter is only 50% (5 min on/ 5 min off), whereby standard practices for public safety systems require a 100% duty cycle rating. Both transmitters were found to be running at their licensed power. Return loss, distance to fault and Interference Analysis results were satisfactory.

A physical site inspection was carried out on the shelter and tower installation. While the tower and shelter are new, there are some deficiencies that do not meet the basic R56 guidelines and should be corrected. R56 refers to Motorola Standards and Guidelines for Communications Sites. The grounding is incomplete. As such, equipment housed within the shelter and mounted on the tower are vulnerable to damage from lightning or power line surges. The site is owned by Kingston Utilities so remedial actions should be taken by them. Equipment racks are not bolted to the floor which is a safety risk.

Other issues noted that do not affect the performances of the base station but are still of concern include;

- Security fence does not completely secure the tower. An adult can easily crawl under to gain access to the tower
- Shelter is not protected by a security fence.
- Anti-climb plates on the tower are not effective.
- No site Security monitoring system is in place
- The site does not have a generator for backup power. Instead there is a solar panel/battery/inverter system in place. As a result, the system does not have the longevity to hold the base stations on the air during a prolonged mains power outage.

Hartington (South Frontenac)

There are two base stations installed at Hartington including a Fire service GE Master 3 base station and the Public Works GE Master 3 base station. Both were tested and found to be operating normally. The Master 3 is still in production and is rated for a 100% duty cycle required for Public Safety applications. Both transmitters were found to be running at their licensed power. Return loss, distance to fault and Interference Analysis results were satisfactory. The insertion loss through the filters to the Public works receiver is twice the norm indicating a possible defective filter or a detuned filter array. One concern is that the Public Works base is not licensed for the Hartington site, but actually licensed to be in Sydenham.

The physical site inspection completed on the shelter and tower installation indicated some deficiencies that do not meet the basic R56 guidelines and need to be addressed. The grounding is incomplete. This leaves the equipment housed within the shelter and mounted on the tower vulnerable to damage from lightning or power line surges. The site is owned by SBA so remedial actions should be taken by them. Equipment racks are not bolted to the floor which is a safety risk.

The Fire base station has a battery backup system but Public works does not. There is a sufficiently large self-starting generator on site but the communications room AC circuits are not on the generator output so the generator has no practical value as wired. The communications room has only a 30A service supply rating which is considered too low of a rating. Also, the communications room breakers are not physically in the same room as the equipment and there is no easy access to the breaker panel. Both of these should be considered as Health and Safety risks. No security monitoring system is in place.

Burridge Fire Hall (South Frontenac)

There is one base station at this site. The Fire service GE Master 3 base station was tested and found to be operating normally. The Master 3 is still in production and is rated for a 100% duty cycle required for Public Safety applications. The base station was found to be running at the licensed power and all performance tests were satisfactory including return loss, distance to fault and Interference Analysis.

A physical site inspection was carried out on the building and tower installation. The grounding is incomplete and needs to be corrected. The base station has a battery backup system. There is a generator on site but it is a manual hook up and start. This provides no protection without a dispatch to the site by a technician during a power interruption. As indicated for the other sites, there is no Security monitoring for this site.

Ompah (North Frontenac)

There is one base station at this site The Fire service Kenwood NXR700 base station was tested and found to be running at the licensed power and all performance tests were satisfactory including return loss, distance to fault and Interference Analysis.

It was determined that the base station is not licensed for the Ompah location but is licensed for Clarendon station.

A physical site inspection was carried out on the building and tower installation and some deficiencies were noted compared to R56 guidelines. The grounding is incomplete and needs to be corrected. The base station has a battery backup system but there here is no generator power available on site making the site susceptible for power outages.

Other issues noted that do not affect the performance of the base station but are still of concern include;

- The shelter is new but the floor is uncovered OSB board which is prone to rot
- The frame supporting the floor has buckled and the door can no longer be shut and locked.
- There is no fence around either the shelter or the tower which is an obvious Health and Safety issue.
- No visible site monitoring system in place.

Gore road water tower (Frontenac Islands)

There is one base station at this site. The Fire service Tait TB8100 base station was tested and found to be running at the licensed power and performance tests were satisfactory including return loss, distance to fault and Interference The base station transmitter is on 153.86 Mhz but is not licensed by Industry Canada. Analysis testing indicated a potential problem with RF interference at 153.920 Mhz. Since this station is not licensed to be at this location on this frequency, there is no recourse with Industry Canada, other than to seek another frequency from the regulator. This issue should be resolved as part of a Network refresh.

A physical site inspection was carried out on the building and tower installation. The grounding is incomplete and should be corrected due to the Safety risk. The base station has a battery backup system but there is no power generator on site making the site vulnerable to power outages. As with all of the other sites, there is no Security monitoring for this site.

E) Radio Coverage Summary

An extensive Radio Coverage Evaluation was performed based on information obtained from the site evaluations. Details of these evaluations are provided in the attached Appendix 1: Current Radio System Evaluation and Coverage Report. (Note the Coverage Study reports).

All parameters gathered were used to generate coverage plots or heat maps using EDX Signal software application (Ver. 10). In order to provide a comprehensive model, studies were done for each tower site including;

- Portable downlink
- Portable Uplink
- 95/95 Service availability area.

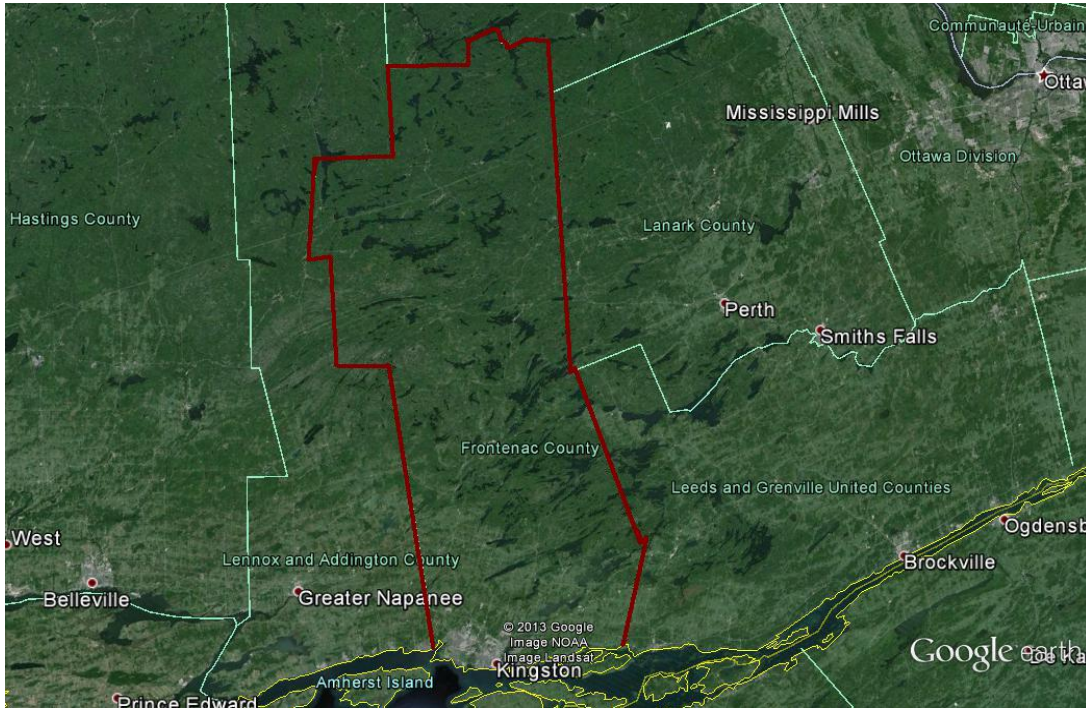
The Portable downlink plot indicates signal levels from the base station transmitter out to a portable in the field. The Portable uplink plot indicates signal levels from the portable in the field into the base station receiver. Typically the uplink coverage plot is smaller than the downlink plot since a portable typically transmits at a much lower power than a base station. The 95/95 Service availability area plot indicates signal levels in 95% of the area in which a portable should work 95% of the time. This is considered as a standard for Public Safety communication networks. In all cases, the portable is assumed to be stationary, outside in the open and held at head height for all plots. The results were output in KMZ file format which can be viewed using Google Earth. The attached Technical Report shows key screen shots of the plots. Native KMZ files have been supplied to Frontenac separately. Heat maps show signal strength with respect to color. The red / yellow colors indicate the stronger signals. For the 95/95 heat maps, only areas shown in green meet the criteria.

Summary of Results

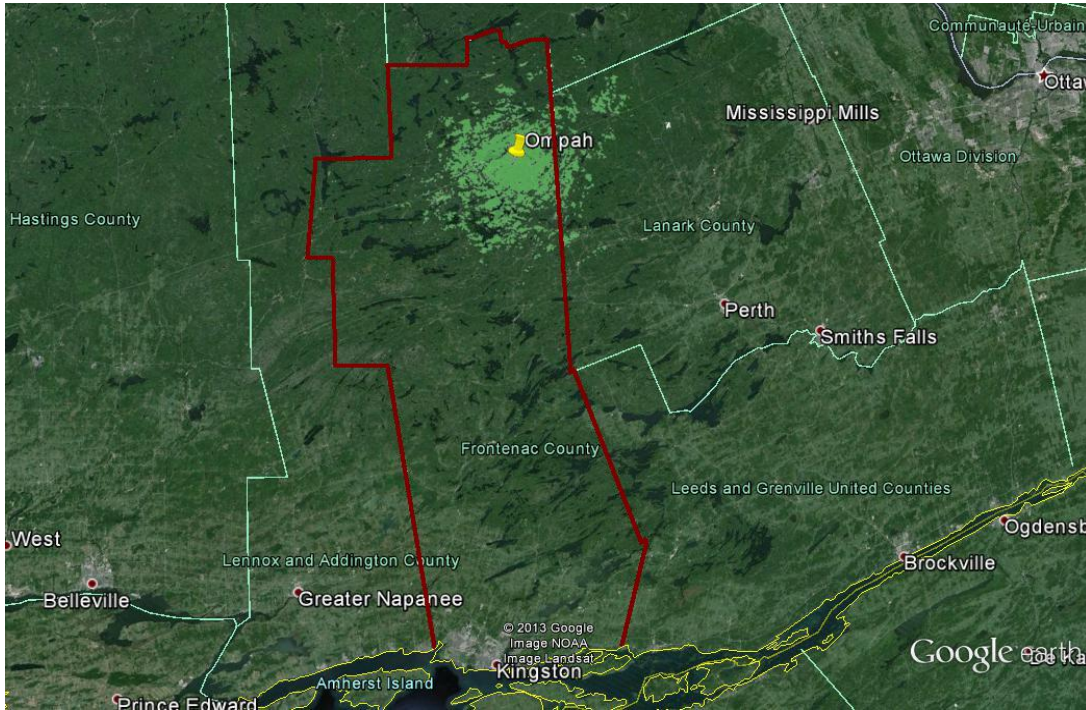
Although the attached Technical Report provides detailed Portable downlink, uplink and 95/95 Service availability plots, the 95/95 Service Availability results are the most useful when trying to determine useful radio coverage and dead spots. The following provides a summary of the 95/95 key findings. In all cases, the areas shown in green indicates adherence with the 95/95 Public Safety recommendations.

Frontenac County

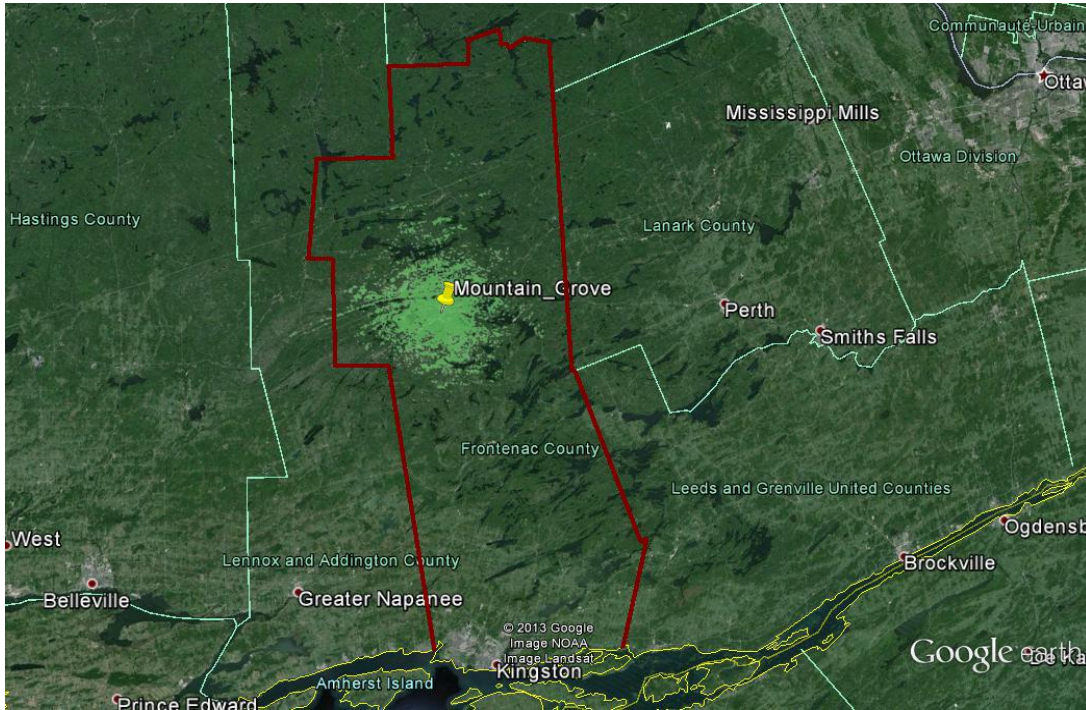
The following provides a representation of Frontenac County including Frontenac North, Central, South and Islands. Subsequent plots provide estimates of the current 95/95 Serviceability area from each of the transmitter sites and a final plot indicates 95/95 Serviceability for the entire Frontenac Region.



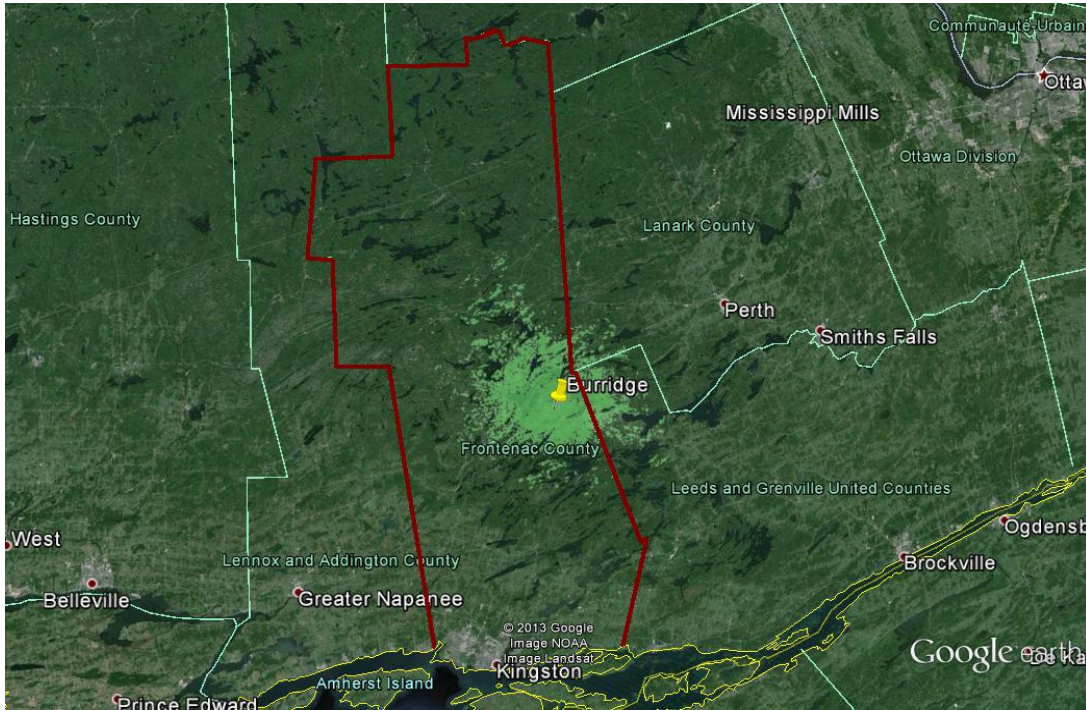
Ompah (North Frontenac) 95/95 Serviceability Area



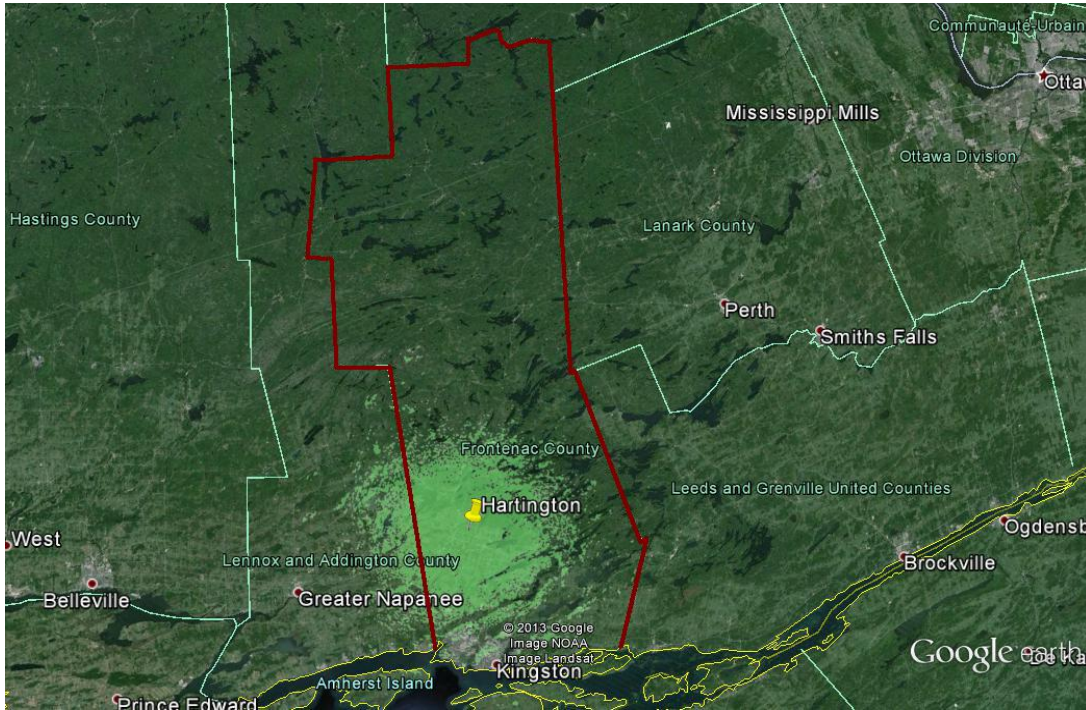
Mountain Grove (Central Frontenac) 95/95 Serviceability Area



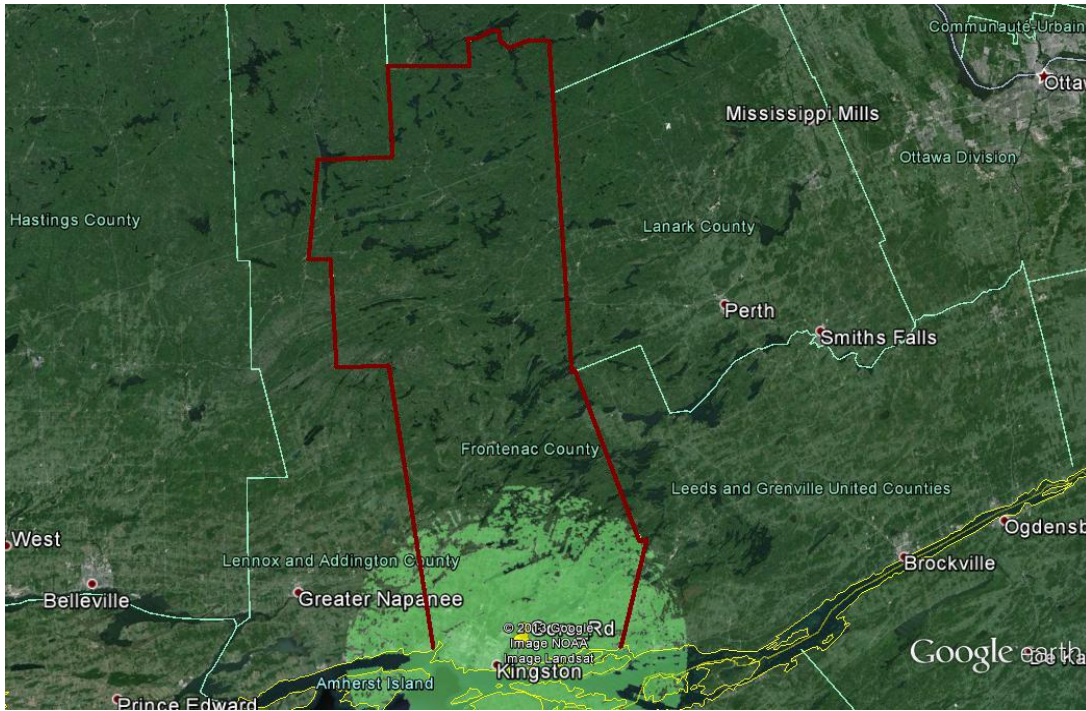
Burridge (South Frontenac) 95/95 Serviceability Area



Hartington (South Frontenac) 95/95 Serviceability Area

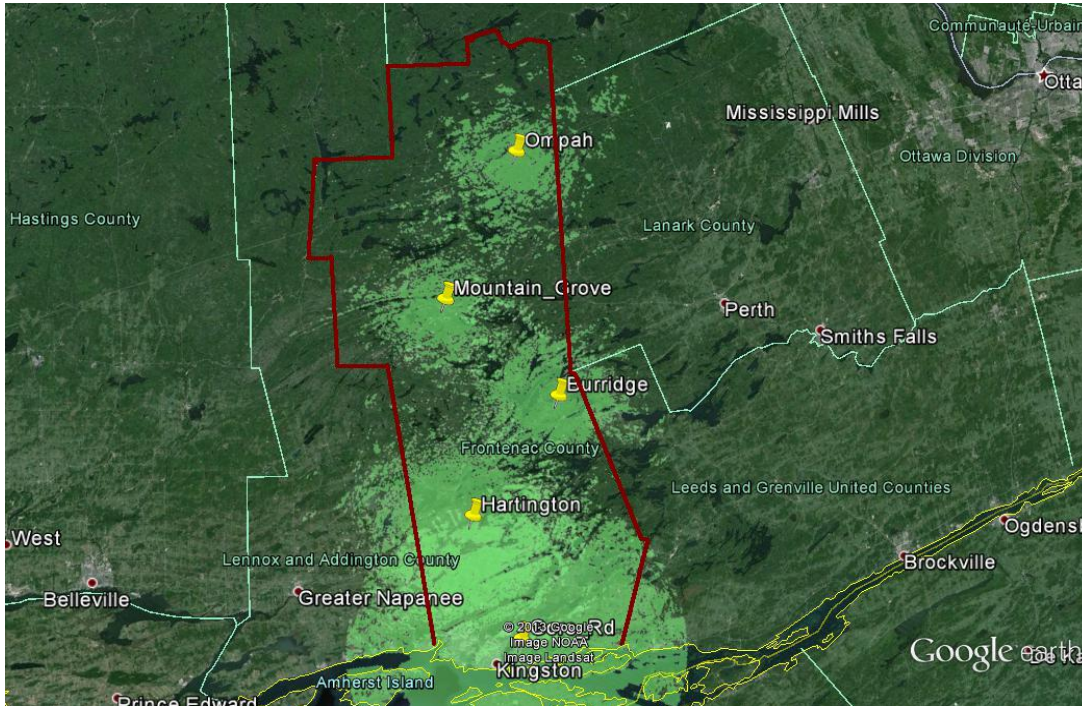


Gore Road (Frontenac Islands) 95/95 Serviceability Area



Combined Sites 95/95 Serviceability Area

This combined plot shows the estimated 95/95 serviceability for the Frontenac region when combining all of the results from the 5 sites. Dead spots are apparent in large sections of Central and North Frontenac and some sections in South Frontenac. The conclusion from this analysis would indicate that current RF Coverage is not adequate to provide reliable Radio Communications across the entire Frontenac region.



F) Licensing and Frequencies

An investigation was completed to determine the Radio Frequencies which have been licensed by Industry Canada in support of the current VHF Radio Network for Frontenac County. A large number of licenses are in place, distributed between the 4 Townships and are allocated to specific applications including Repeater, Fixed Mobile and Mobile operations. These licenses have been issued over a number of years and as such, some are outdated and no longer apply to the current disposition of Radios and location across the Region. An attached Spreadsheet provides a detailed compilation of Industry Canada licenses, sorted by Township, Department, and type of Radio application (Repeater, Fixed Mobile, Mobile).

[Frontenac county radio licenses Master Rev 1.xlsx](#)

The following is a summary by radio application:

Repeaters

There are currently 6 Industry Canada Licenses in place, allocated for Repeater use. From the results of the Repeater Site Technical evaluation it was determined that the Repeaters are adhering to the licenses with the following exceptions;

- Martin Grove Repeater Receive Frequency is licensed for 159.12Mhz, however is actually operating at 159.15Mhz
- Gore Road Repeater is not currently licensed. The Repeater is actually transmitting at 153.84 Mhz, however this frequency is not under license, which needs to be corrected.

Fixed Mobile

There are currently 27 licenses issued for this application including;

Central= 9

North=7

South=11

Mobile

There are currently 59 licenses issued for this application including;

Central=8

North=16

South=17

Islands=18

For both the Fixed Mobile and Mobile license count above, multiple frequencies may fall under the same Industry Canada license number designation. The numbers provided represent the maximum number of Fixed Mobile and Mobile radio transmissions that are supported under license. An evaluation of whether these designations have been correctly utilized was not completed as part of this report. It does however, point to a need for reconciliation of Radio licenses as part of any Network Refresh. Considering the large number of legacy radio licenses in place, Industry Canada should be open to issuing new licenses in support of a new digital network.

G) Current User Gear

The current User Gear is a mix of newer and aging equipment. Some of the User equipment is quite old and consists of various models from either Motorola or Kenwood. There is a wide variety of models in use and some of the models are no longer sold which equates to maintenance concerns. In some cases, the User Gear is no longer supported and parts are no longer available which means an equipment failure would likely require the unit to be disposed of. Also, for the older equipment, battery maintenance costs typically increase and reliability of existing battery packs are in question.

An inventory was completed as part of the technical evaluation. A complete list of all Mobiles, Portables and Pagers was ascertained for all 4 Townships. This information will be provided directly to Frontenac as a separate document.

As part of a Network Refresh, it is likely that none of the existing Mobile and Portable User Gear can be reused. An updated network would likely be Digital and since the existing radios are Analog, they would not be compatible. Trade in values for the equipment should be investigated as part of a replacement network, particularly for some of the newer equipment in the inventory. Also, the existing User Gear will be unusable with Mutual Aid Partners (UGLC and Kingston) since their respective equipment and networks are moving to Digital.

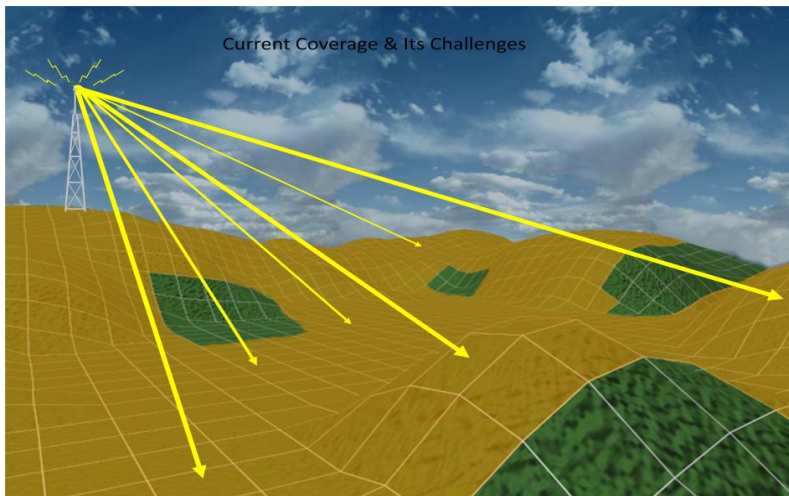
Procuring new user gear from a single manufacture is recommended from a Maintenance and support perspective. Also, as indicated in the Recommendations Section, later in this report, choosing Digital User equipment that adheres to various Tiers of operation should be considered. A higher Tier could be considered for very demanding and application critical applications like Fire, while a lower Tier could be considered for less demanding environments in order to save costs.

H) Current Network Operations

As described in Section E, (Radio Communications Coverage), the current system provides incomplete communications coverage for the entire Frontenac County across the 4 Townships. In addition to the Radio coverage problems however, one other serious deficiency pertains to the overall Network Topology. Currently, each Township is operating independently which does not facilitate County Wide communications or true interoperability across the region. The Network is a Multicast system which means that each Township is operating independently on separate frequencies from each Repeater site. In essence, there is not one integrated communication system but more like 7 separate networks (5 Fire Networks and 2 Public Works Networks), operating from the 5 Tower Site locations. Each repeater is operating independently with no interoperability between townships.

Multicast System

A Multicast System is defined as a radio system where different radio frequencies are used at each Repeater site within the radio system. Each site is assigned a unique frequency or set of frequencies for service within the coverage area provided by the specific repeater(s) located at that site. This means that for each repeater, separate frequencies are assigned. No coverage overlap is possible, nor can Users "roam" between sites without changing frequencies. Communications across the County or even across multiple Townships is not supported. This results in a very restrictive communications environment, inefficient Spectrum utilization and a lack of interoperability across the regions. Also, within a specific coverage region, there are "dead spots" due to local terrain, since only one transmitter site is servicing the users in the designated areas. As depicted below, the yellow regions are supported, but due to terrain shadowing, the areas in green have poor or non-existent coverage. As a result, the current infrastructure has not been optimized to meet Public Safety coverage standards (i.e. 95% coverage ,95% of the time)



Current Infrastructure deficiencies

Over the years, each Township has been responsible for its own communications requirements. This has resulted in a patchwork of separate networks which has not been integrated into a unified system. Some of the equipment within the system is 25 years old and some equipment is no longer supported by the original manufacturers. Some parts are no longer available. As indicated in Section D (Repeater Site Technical Evaluation), the sites have little redundancy or emergency back-up power.

Interoperability

At present, there is no interoperability within Frontenac County and no interoperability between Fire and Public Works departments, even within a Township. If an emergency event requires communications across Township

regions, for coordinating emergency crews for example, the current system does not support it. This likely influences response times from crews outside of the immediate area due to lack of a contiguous communications system. Also, considering UCLG's recent migration to a Digital Radio System and the City of Kingston's imminent migration to a similar Digital Radio Solution, Frontenac will be faced with being incompatible with its Mutual Aid Partners.

I) Health and Safety Risks

The current Communications Network limitations contribute to an elevated Health and Safety Risk to Frontenac's employees and the general public. As indicated in the Radio Coverage evaluation above, the current system provides poor coverage across the region which equates to lower service levels. Fire crews that depend on reliable communications are using a system with known dead zones which hinders coordinated actions and influences response times. Typical Public Safety 95/95 Coverage requirements are not being achieved. Leveraging the right people, at the right place at the right time through a wide area communications system is being negatively affected.

The current Network is essentially non-redundant. The telecommunications links to each of the current Transmitter sites are non-redundant and, as such, are susceptible to interruptions due to equipment or transmission line failures. Each Repeater site is non-redundant, such that if one Repeater were to fail, there are no backup repeaters available on site to automatically ensure continued service. Due to the nature of the current Multicast system, there is also a lack of redundancy at a Network level. If one site fails, the other sites cannot be used to supplement communications since there is little coverage overlap and each network is self contained utilizing separate frequencies.

As determined in the Repeater Site Technical evaluation, there are no consistent power backup systems in place to ensure non-interrupted service during power outages. This is judged as inadequate to meet Public Sector reliability expectations. Each site requires an emergency battery backup system to carry the full equipment load for a specified duration, plus a generator with automatic start-up capability. Considering the size of the region and that the majority of the County is rural, power outages are common which must be mitigated with proper emergency power backup facilities at all sites.

Also, there are no Security monitoring systems in place at any of the sites leaving the Network vulnerable to tampering. Some of the sites have inadequate security fencing or tower barriers in place which poses a threat to individuals due to High Voltage and Radio Frequency exposure. By not adequately safeguarding against intruders, the County has a higher Liability risk from lawsuits.

The current network has no facility to record radio communications. This is major concern from a Liability perspective. Typically, Public Safety communication systems require that ALL conversations be digitally recorded and retained for some predetermined length of time. Currently, only the transmissions from the Dispatch Centre are recorded, though all other communications are not.

Lack of interoperability will be worsened considering UCLG's recent migration to a Digital Radio System and the City of Kingston's imminent migration to a similar system. Frontenac is about to be left with a system that is incompatible with its Mutual Aid Partners, which should be considered an elevated Health and Safety risk.

In summary, the existing Multicast system is poorly equipped to support a large, life threatening incident, where coordination of resources from different regions is required. Coverage is poor with many dead spots and the Network has no wide area capability. The Network is non-redundant as is all of the equipment at each of the sites and backup power systems are inadequate. Site Security and Monitoring is poor which is a concern from a Network Availability and Liability perspective.

J) Network Maintainability

As mentioned, the current Communications Network has evolved over time and is a compilation of separate networks supporting each of the four Townships. Some of the equipment is quite old and no longer supported by the manufacturers and some parts are no longer replaceable or repairable. The Repeater equipment at the sites is not consistent and manufactured by different vendors. There is no monitor and control system in place limiting remote diagnostics or failure mitigation. As indicated, site deficiencies, including incorrect grounding, poor power conditioning and backup and poor site security, result in a less reliable situation. All these factors negatively affect the maintainability of the network resulting in increased maintenance costs. Having unique equipment at each site increases sparing requirements and using non-supported equipment increase vulnerability to major service outages of long durations.

The current User Gear is also of concern. Some of the User equipment is quite old and consists of various models from various vendors. Reliability and maintainability of some of these older units is a concern and battery maintenance costs increases with older analog equipment. Much of the User Gear is overdue for replacement. Procuring new user gear from one manufacture with specific equipment classifications modelled to unique applications will increase reliability and drive down ongoing maintenance costs.

From a Maintenance perspective, as this network ages, reliability will decrease and maintenance costs will escalate. A network refresh with consistent Repeater site equipment, configured with redundancy, proper power conditioning, remote monitoring and control will drive down ongoing maintenance costs.

A single Service Provider under a network wide Service Level Agreement, using a comprehensive Maintenance Management system would provide the reliability expected from a Public Safety Network for both Infrastructure and User Gear.

K) Key Recommendations

Summary

Based on the evaluations provided as part of this report, it is recommended that Frontenac County consider a complete Radio Communication Network refresh. For many of the reasons outlined, the existing Network can no longer be updated or patched in order to meet current Public Safety Communications standards. Both the Repeater Sites and the User gear are old and outdated and in many cases no longer supportable. The network topology is outdated and does not support the wide area communication needs of the County. Radio coverage is poor with many dead spots which will necessitate the addition of more Repeater Site locations. Current Network Operations is hindered due to lack of interoperability between Townships. The Network will no longer support Mutual Aid partners since other jurisdictions are moving to updated Digital Technologies. The communication system as a whole, is comprised of a number of isolated systems at a Township level, which are not integrated as a wide area network.

The systems are non-redundant and, as such, do not provide a level of reliability expected for a Public Safety application. Power backup systems are inadequate to ensure reliable service during power interruptions. Telecommunication links to/from Repeater sites are non-redundant and vulnerable to transmission failures which can isolate a Repeater site from the network.

Radio frequencies must be reconciled with current Industry Canada licenses as part of a network refresh. Additional Repeater allocations will be required. Existing Mobile licenses will need to be transferred in support of newer Digital technology. The number of Health and Safety risks for employees and the general public as outlined earlier, can be mitigated with a Network refresh.

Updated Network Topology

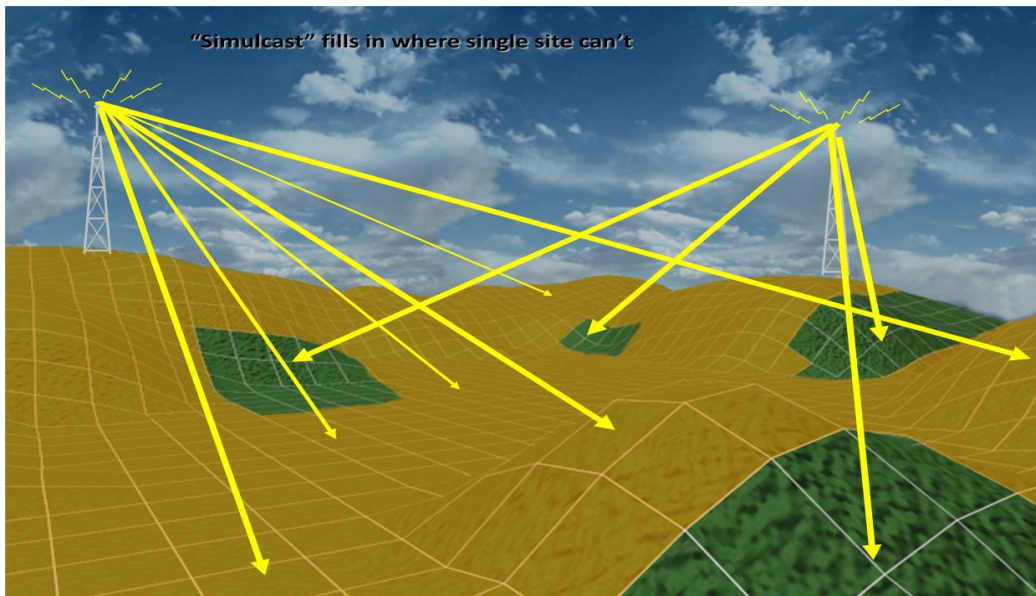
As described in Section E, to provide improved Radio coverage, an increased number of tower sites will be required in order to provide an expanded coverage footprint across the Region. Additional repeaters at each

location will be needed to ensure redundancy and multiple channels at each location for increased communication capabilities. The new system will need to incorporate the latest in Digital technology to support interoperability within Frontenac County, between all Fire and Public Works departments and with all mutual aid partners including ULCG and Kingston. A radio communications recording system must be implemented to ensure all communications are digitally recorded from a Liability perspective. In addition, the existing Voice Paging system will need to be integrated within the new network.

Simulcast System

From evaluating Frontenac's requirements, it is recommended that a Simulcast Transmission System be implemented as part of a Network refresh. A Simulcast System is defined as a radio system where the same radio frequencies are simultaneously broadcast from all tower sites within the Network. This allows same radio frequencies to be used throughout the entire coverage area and supports seamless communications throughout the radio system's coverage area. Not only will this optimize radio frequency utilization but it will also significantly improve coverage in areas with difficult terrain, like in Frontenac County. A Simulcast system will also improve in-building coverage since signals from multiple sites on the same frequency overlap to provide additive signal strengths.

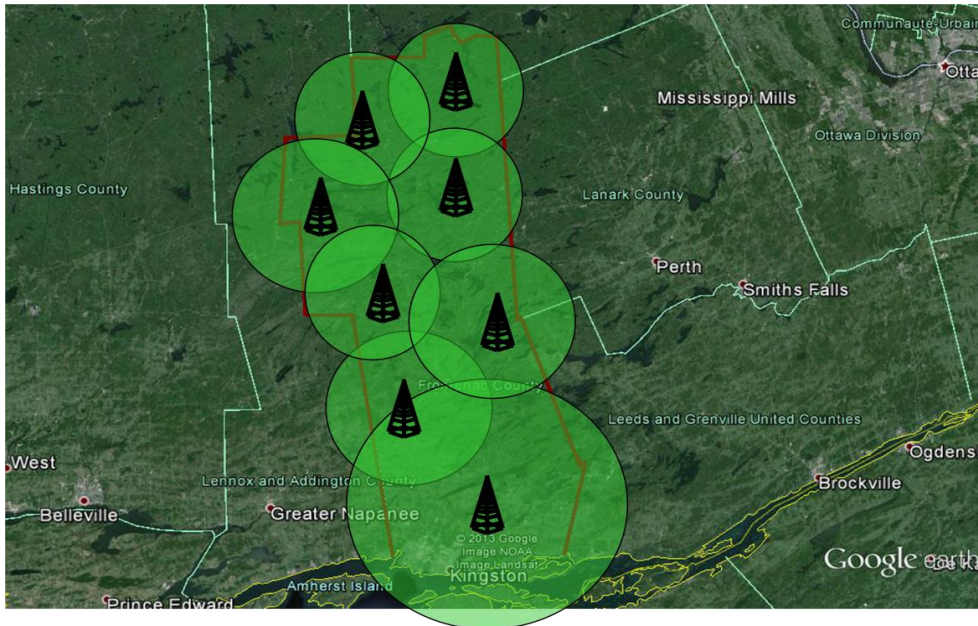
As illustrated in the diagram below, utilizing a Simulcast system, with multiple transmitter sites on the same frequency, will eliminate dead zones, ensuring improved communications coverage.



Coverage Performance

New Repeater Sites will be required to achieve 95/95 Serviceability coverage to ensure reliability for portables being carried on the hip in the presence of noise, interference, and other factors.

As shown below, additional Repeater sites will need to be constructed in order to fill in the dead zones and ensure complete communications coverage across the Region.



Network Requirements

The upgraded system must be able to provide support for a variety of applications. It must support Central Dispatch to remote communications as well as radio to radio (crew to crew) communications (bidirectional) without changing channels. The system must provide portable radio coverage throughout the Frontenac County with 95% coverage, 95% of the time. All radio units must be equipped with a PTT ID signalling feature and must be equipped with an emergency ID signalling feature.

It is recommended that the upgraded network be a Digital Simulcast System that is compatible with Mutual Aid providers and Kingston Dispatch. The system must be designed to ensure interoperability between Townships and between Fire and Public Works Departments across the Region. In addition, the existing Paging system must be maintained and integrated into the Radio Network solution.

Repeater Sites

Although new Repeater sites will be required, retention of existing sites may be considered, but upgrades will be required. Problems with lack of backup power, grounding issues, poor site security, no security monitoring, poor equipment mounting, AC Power breaker allocation and breaker box locations will need to be addressed.

In addition, Repeater equipment will need to be configured for redundancy. It is recommended that each Repeater Site be configured with an extra Repeater allocated for redundancy. In the event of a Repeater failure, a standby Repeater will be automatically made available to continue to support radio traffic.

In addition, the telecommunications links to/from the Repeater site will need to be configured with redundancy. A typical solution would involve a Ring telecommunications network, using Radio technology, thereby connecting all of the Repeater sites together. If there is an interruption anywhere on the telecommunications link, the Ring topology will support continuity to all sites through the rerouting of traffic around the other half of the Ring. This is a very typical approach for Public Safety Radio Networks. The design of the Ring must consider Capacity and Reliability. Capacity considers network transport resource availability and expansion capabilities. Reliability is important in order to meet stringent availability requirements consistent with public safety services.

Radios Required

As part of a Network Refresh, all of the existing Mobile and Portable User Gear will need to be replaced. The updated network will be Digital and the existing Analog radios will not be compatible. Trade in values for the equipment should be investigated as part of the refresh. It is important that selected User Gear be compatible with Mutual Aid Partners (UGLC and Kingston) equipment. Procuring new user gear from one manufacture is recommended from a Maintenance and support perspective. There is less compatibility between vendors of Digital technology compared to legacy Analog equipment. Choosing one vendor for User Gear would be advisable and volume discounts can be negotiated as part of a comprehensive Network procurement.

It is suggested that different models of Mobile and Portable User Gear be considered adhering to specific Tiers of operation. A higher Tier could be considered for very demanding and application critical applications like Fire, Lower Tiers could be considered for less demanding environments in order to save costs. Allocating radios to tiers based on performance and ruggedness, can result in significant cost savings

High-tier radios should be provided to each firefighter. This level of radio gives the highest level of performance and reliability that radio manufacturers can provide. Options to provide additional capabilities or functions (eg; Encryption, hazardous environment rating) are required for Fire services. Mid-tier radios may be appropriate for users who do not work in a firefighting environment. This type of radio would be a good choice for EMS functions or less harsh environments. Low-tier radios are an option for some support staff who do not work in harsh environments and have no need of all the functionality typical of higher tiered radios.

Dispatch Centre

As part of a Simulcast topology, communications links from Dispatch Centre to all Repeater sites will provide an uninterrupted, wide area type operation. Dispatch will be able to communicate with all Users throughout the Region and will be able to monitor all on scene communications. Monitoring and recording of all radio traffic plus the ability to monitor all emergency and Mayday traffic will now be available.

Frequencies and Licensing

As part of a Network Refresh, there will be a need to reconcile frequency requirements as part of the new topology to existing Industry Canada licenses. Additional Repeater frequencies may be required to support additional Repeater sites. Determining the number of wide-area channels for the entire coverage area will be based on appropriate traffic studies. The system will need to be designed to accommodate expansion as capacity requirements increase and additional functionality is required.

New Mobile license applications will be required, but considering the number of Mobile licenses already held by Frontenac, negotiating with Industry Canada for new Mobile frequencies should be much less challenging.

System Design and Implementation

It should be stressed that the design and implementation of a Radio Network of this size and complexity is a complicated process. Frontenac has a great opportunity however, since the Network can be redesigned and implemented from the ground up. As such, Network Operation and equipment functionality can be optimized with

the intent of ensuring a robust and expandable network in support of future growth. Also, considering that the new network is Digital, additional features and functionality that was not possible with the legacy system, are now available to Frontenac.

L) Report Summary

As indicated, this report was developed in response to an evaluation of the existing Communications Network including Repeater Sites, current Radio Coverage, Licensing and User Gear. Issues of Network Operations, Health and Safety and Maintainability were taken into consideration and reported here.

In general, it can be concluded that the existing system is extremely restrictive from a Network Operations perspective. There is no true County wide communications capability at present, with each Township operating independently on separate frequencies from each of the 5 Repeater sites with no interoperability across the region. Communications coverage is inadequate with multiple dead spots where communications is poor or nonexistent. Most Repeater equipment and some User Gear is quite old, from different manufactures and in some cases, no longer supportable. Reliability is threatened due to lack of redundancy at any of the sites. Lack of interoperability with Mutual Aid partners will become apparent as ULCG and Kingston Fire moves to a upgraded Digital Communications system.

We can conclude that a major Network Refresh including Network Infrastructure and User Gear be considered by Frontenac County in the near term.

Appendix 1

Current Radio System Evaluation and Coverage Report

Joint Project for Frontenac Townships



Prepared by;



Date: February 14, 2014

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1. Introduction

The following report document is a result of the test and evaluations of the current repeater station hardware and antenna systems plus physical inspection of current tower sites located at;

- Mountain Grove.
- Hartington.
- Burridge Fire Hall.
- Ompah.
- Gore road water tower.

In addition, in Section 9 of this report, coverage predication mapping has been derived from information derived from each site.

All repeater stations currently in use were tested to determine current performance.

Antenna matching analysis was conducted on the existing VHF and UHF antennas and coaxial feed lines to determine the effectiveness with which the antenna radiates the energy supplied to it.

Discontinuity Measurement analysis was conducted on the existing VHF and UHF coaxial feed lines to identify possible signal path degradation.

Spectrographic analysis was conducted on the current noise and interference levels. Since spectrum environments are inherently dynamic, this survey should be considered only a snapshot of spectrum at the time they were taken.

Physical site inspections were conducted to evaluate the current state of the towers sites.

- Condition of shelter.
- Condition of grounding system
- Power supply systems
- Ventilation
- Security

2. Method

To test the repeater stations, the primary instrument was the HP8920A communications test set with a Bird 43 power meter where in line power measurements were required.

Stations were tested for:

- Transmit power
- Transmit frequency error
- Receiver sensitivity

- Coupling system insertion loss
- Audio response.

The Anritsu S362A analyzer was used for the antenna, cable and spectrographic analysis.

A Fluke 1630 ground clamp meter was used to check grounding systems in accordance with the Motorola R56 guidelines for best practices with respect to communication system towers and shelters.

3. Central Frontenac Fire and Public works: Mountain Grove

The Fire service Motorola GR1225 base station was tested and found to be operating normally but is programmed to receive on 159.150 MHz while licensed for 159.120 MHz.

The Public works Motorola GR1225 base station was tested and found to be operating normally.

- The Motorola GR1225 series is no longer supported by the manufacturer.
- The GR1225 is desktop type base station and not really suited for public safety applications in that the duty cycle rating on the transmitter is only 50% (5 min on/ 5 min off). Best practices for public safety systems recommend a 100% duty cycle rating.
- Both are running at their licensed power.
- [#Appendix B: Original Base station inspection reports.](#)

A physical site inspection was carried out on the shelter and tower installation.

While the tower and shelter are new there are some deficiencies that do not meet the basic R56 guidelines and need to be addressed as soon as possible.

- The grounding is incomplete. This leaves the equipment housed within the shelter and mounted on the tower vulnerable to damage from lightning or power line surges. The site is owned by Kingston Utilities so any remedial actions will have to be undertaken with their blessing. A more comprehensive report on the grounding can be made available is requested.
- Equipment racks are not bolted to the floor.

Minor issues noted that do not affect the performances of the base station are:

- Security fence does not completely secure the tower and an adult can easily crawl under to gain access to the tower.
- Shelter is not protected by a security fence.
- Anti-climb plates on the tower are not effective.
- No visible site monitoring system in place.
- There is no generator for backup power. Instead there is a solar panel/battery/inverter system. The disadvantage to using such a system is that it does not have the longevity to hold the base stations on the air during a prolonged mains power outage.

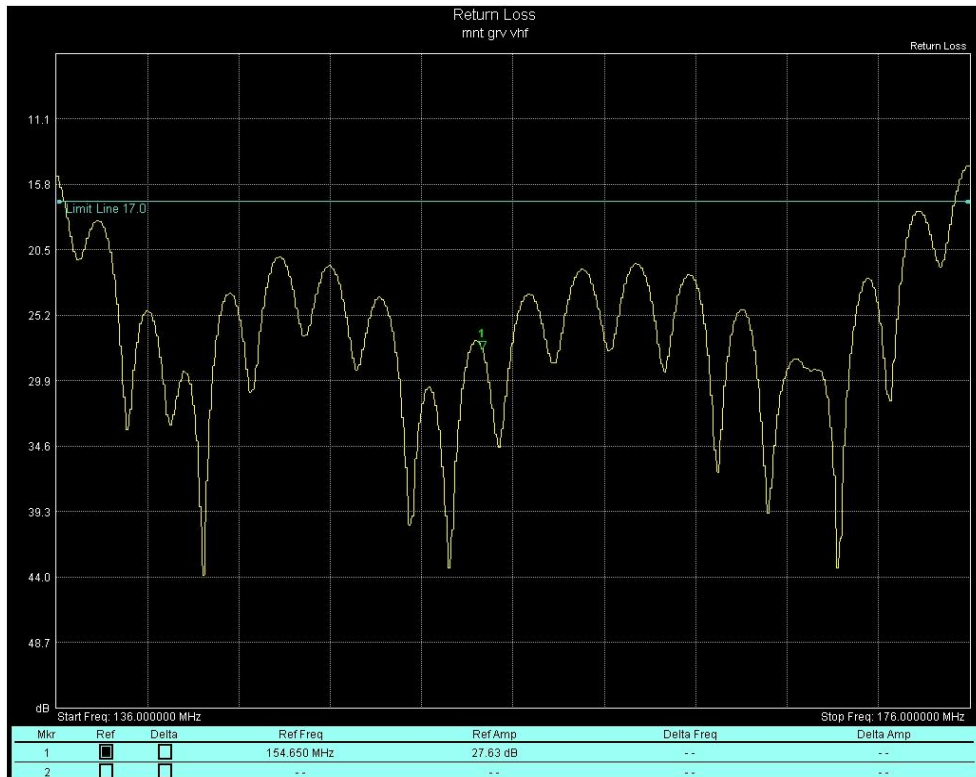
Other observations regarding the site.

- Mains power service is 100 Amp.

- Shelter has an AC unit installed.
- Shelter is modern precast concrete, secure and in good condition.
- Tower is modern and in good condition.
- [#Appendix A: Original site inspection reports.](#)

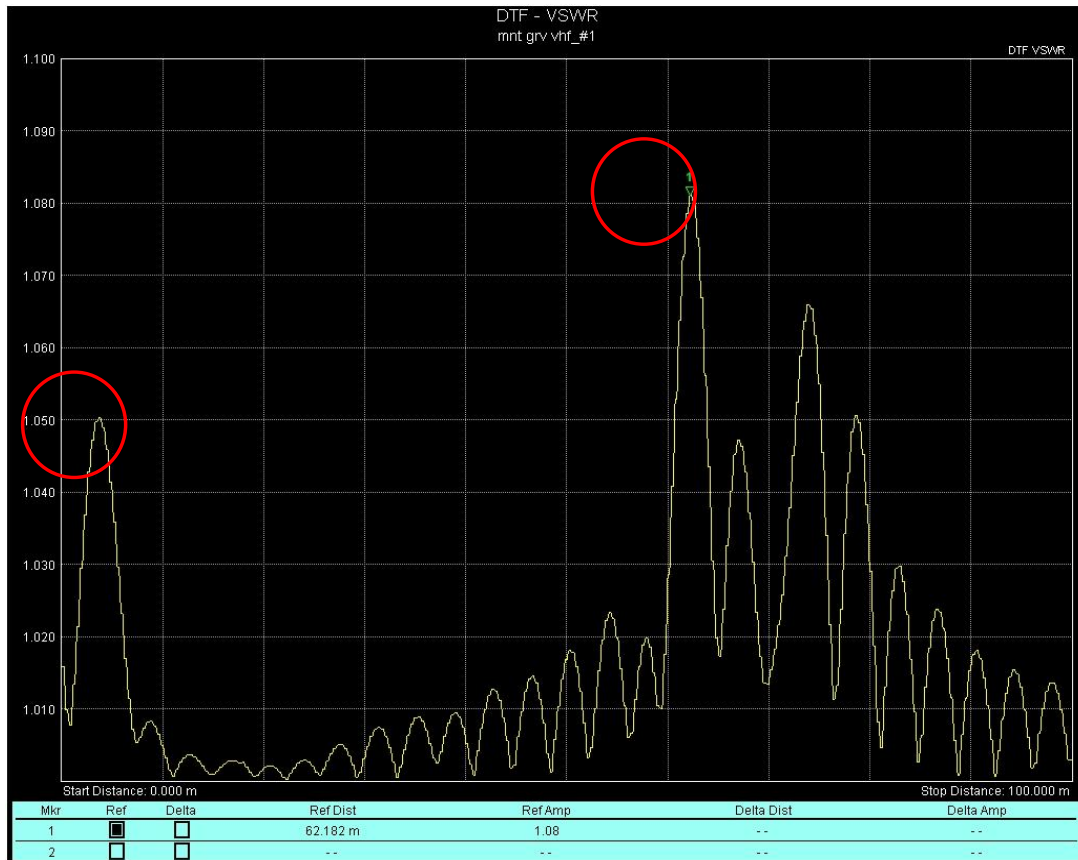
The VHF antenna and coaxial feed line were swept for return loss and distance to fault. Both returned normal results.

Figure 1: Mountain Grove VHF antenna and feed line Return loss



A good result would have most of the plot underneath the 17 dB limit line. This is the case with this antenna and feed line.

Figure 2: Mountain Grove VHF antenna and feed line Distance To Fault.

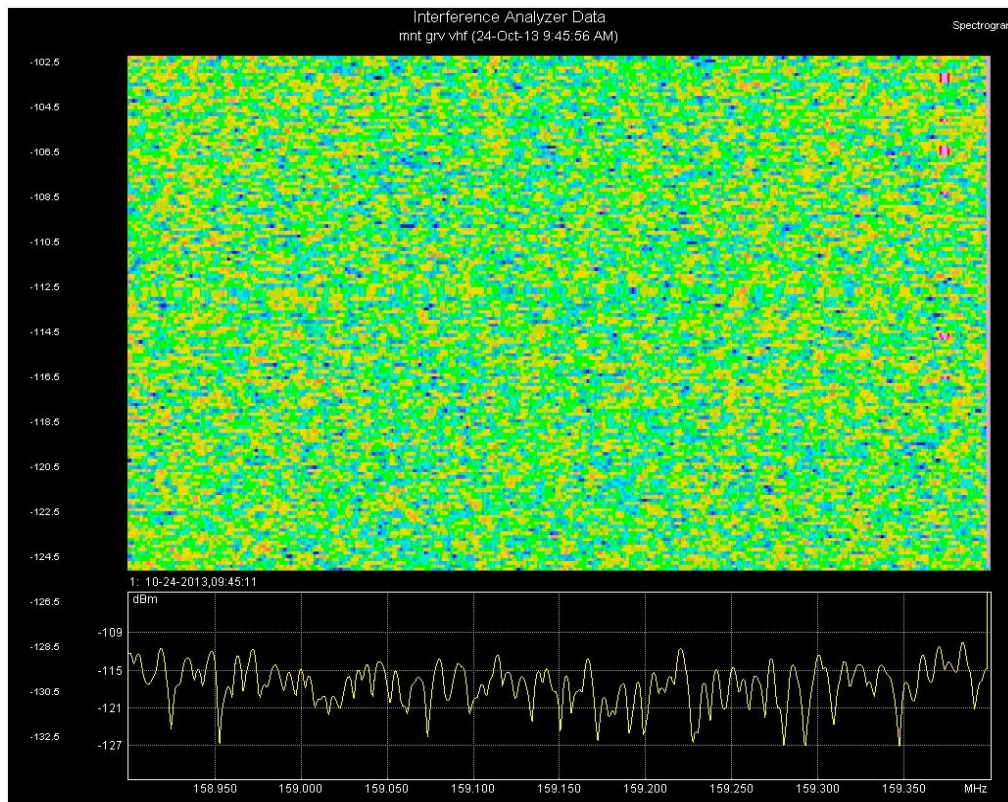


The distance to fault plot shows a normal return along the length of the cable.

- The peak on the left is the return from the coaxial surge arrester fitted to the end of the cable inside the shack.
- The peak on the right is the first radiating element of the antenna.
- The plot records a distance of 62 meters of cable up to the antenna.

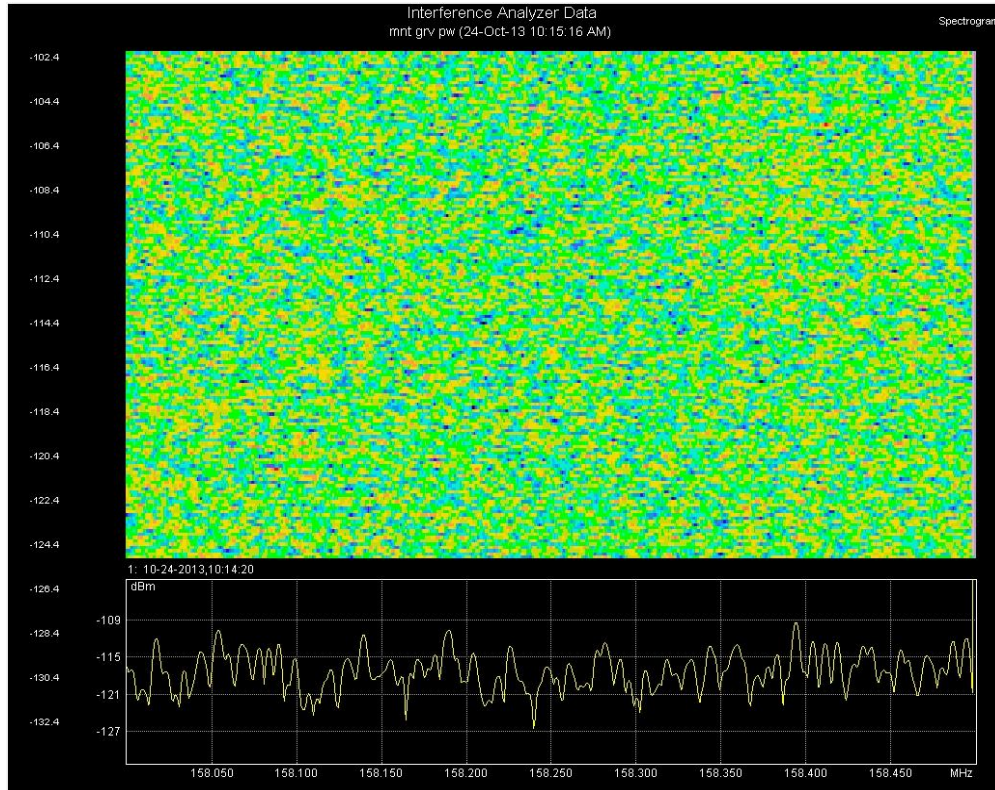
An interference analysis was conducted at the center frequencies of the Fire service and the Public works receivers (+- 250 KHz) to establish the noise floor at that point in time as well as identify any possible sources of interference.

Figure 3: Mountain Grove Fire service receiver IA.



The Spectrogram captured no interferers and established the noise floor at this frequency to be nominally -115 dBm which is acceptable for a rural location such as this.

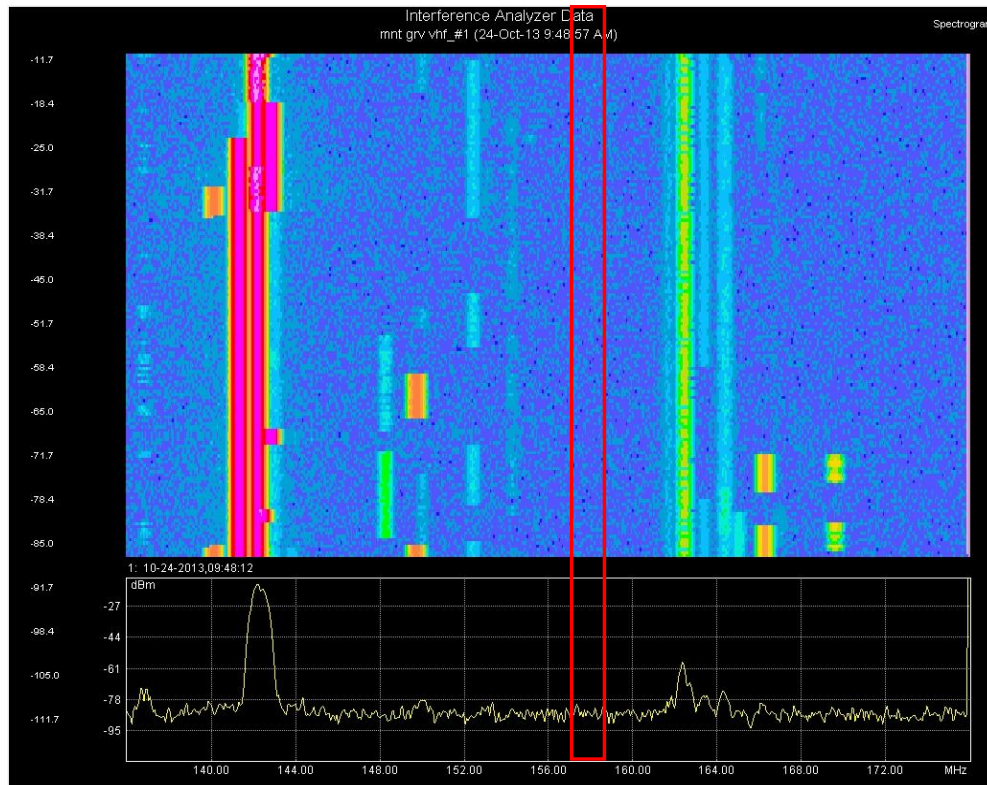
Figure 4: Mountain Grove Public works receiver IA



The Spectrogram captured no interferers and established the noise floor at this frequency to be nominally -115 dBm which is acceptable for a rural location such as this.

An interference analysis was conducted across the VHF spectrum (40 MHz span) to establish what other carriers are present in the area for future reference.

Figure 5: Mountain Grove VHF spectrum IA.



While there are some powerful carriers in the area, the spectrum is clear in the portions used by both Fire and Public works systems.

4. South Frontenac Fire and Public works: Hartington

The Fire service GE Master 3 base station was tested and found to be operating normally.

The Public works GE Master 3 base station was tested and found to be operating normally.

- The Master 3 is still in production.
- The Master 3 is rated for a 100% duty cycle.
- The both base stations are running at their licensed power.
- The Public work base is not licensed to be at the Hartington site, it is licensed to be in Sydenham.
- The Fire base station has a battery backup system but Public works does not.
- The insertion loss through the filters to the Public works receiver is twice the norm. This may be a defective filter or may just require retuning of the filter array.
- [#Appendix B: Original Base station inspection reports.](#)

A physical site inspection was carried out on the shelter and tower installation.

There are some deficiencies that do not meet the basic R56 guidelines and need to be addressed as soon as possible.

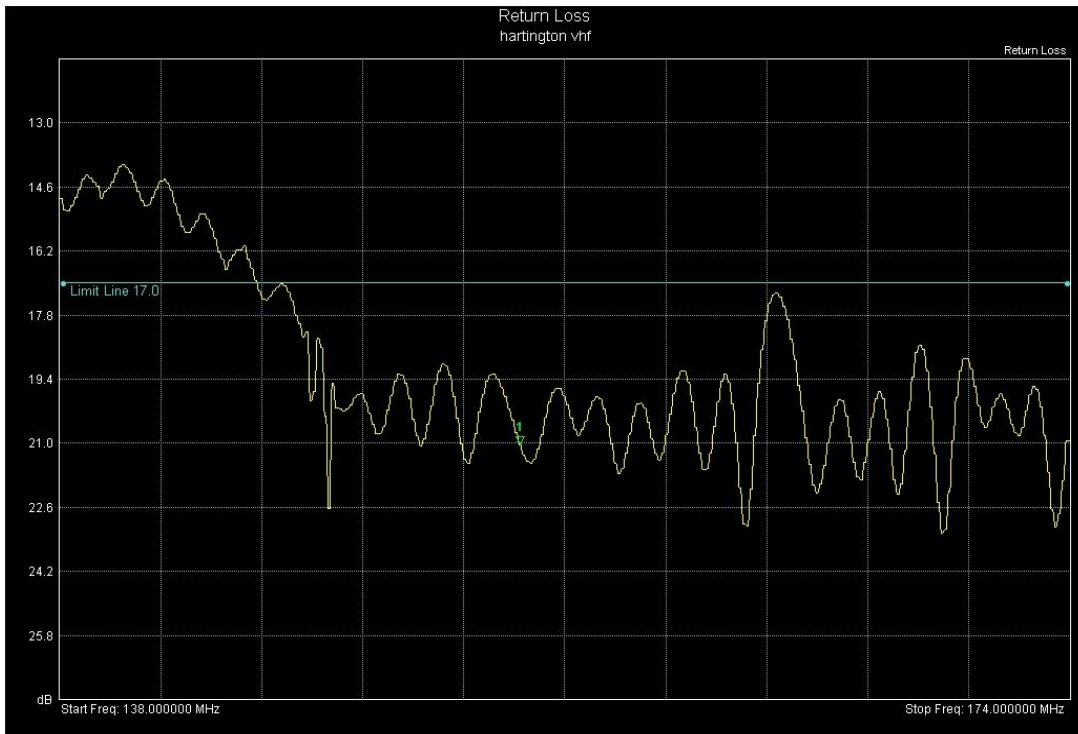
- The grounding is incomplete. This leaves the equipment housed within the shelter and mounted on the tower vulnerable to damage from lightning or power line surges. The site is owned by SBA so any remedial actions will have to be undertaken with their blessing. A more comprehensive report on the grounding can be made available is requested.
- Equipment racks are not bolted to the floor. This leaves them liable to tip over during an earth tremor.
- There is a sufficiently large self-starting generator on site but the communications room AC circuits are not on the generator output so the generator has no practical value at this time.
- The communications room has only a 30A service supply rating.
- The communications room breakers are not physically in the same room and there is no easy access to the breaker panel.

Minor issues noted that do not affect the performances of the base station are:

- No visible site monitoring system in place.
- [#Appendix A: Original site inspection reports.](#)

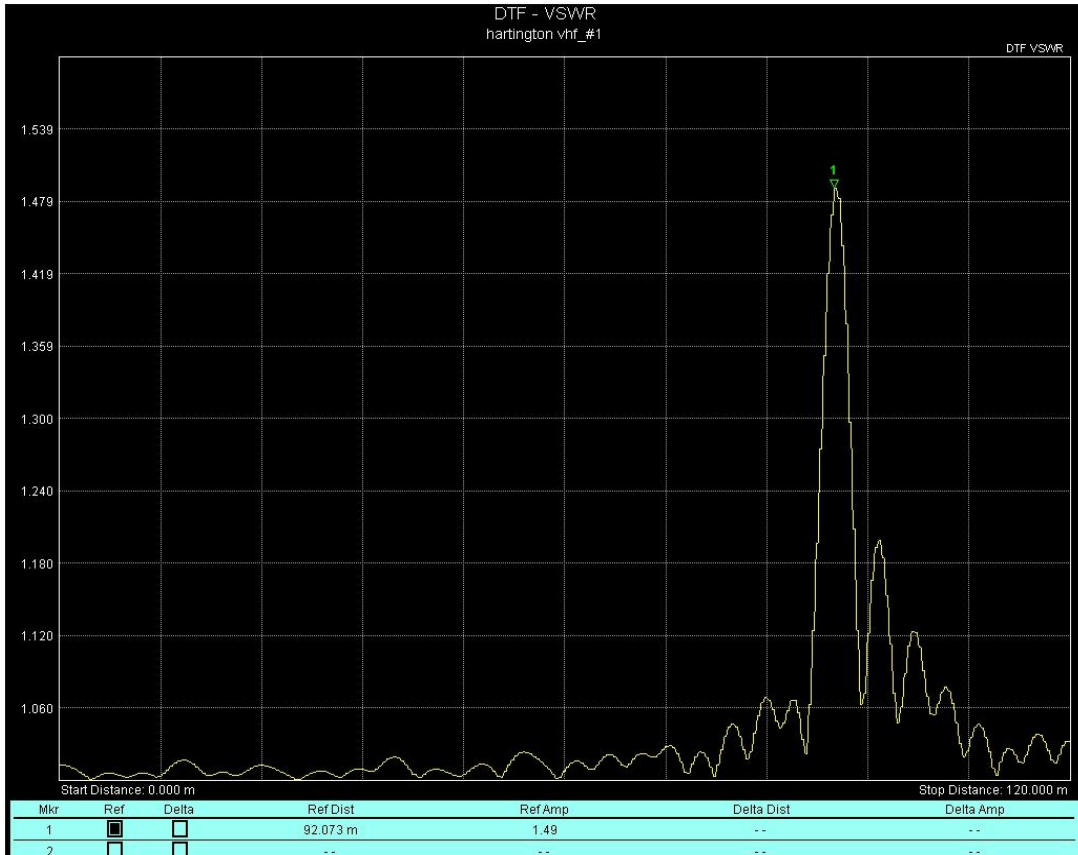
The VHF antenna and coaxial feed line were swept for return loss and distance to fault. Both returned normal results.

Figure 6: Hartington VHF antenna and feed line Return loss



This antenna and feed line plot shows a good result. There is an elevated return on the left hand side of the plot but this is below the 145 MHz mark and therefore does not affect the Fire and Public works stations as they transmit and receive above that portion.

Figure 7: Hartington VHF antenna and feed line Distance To Fault.

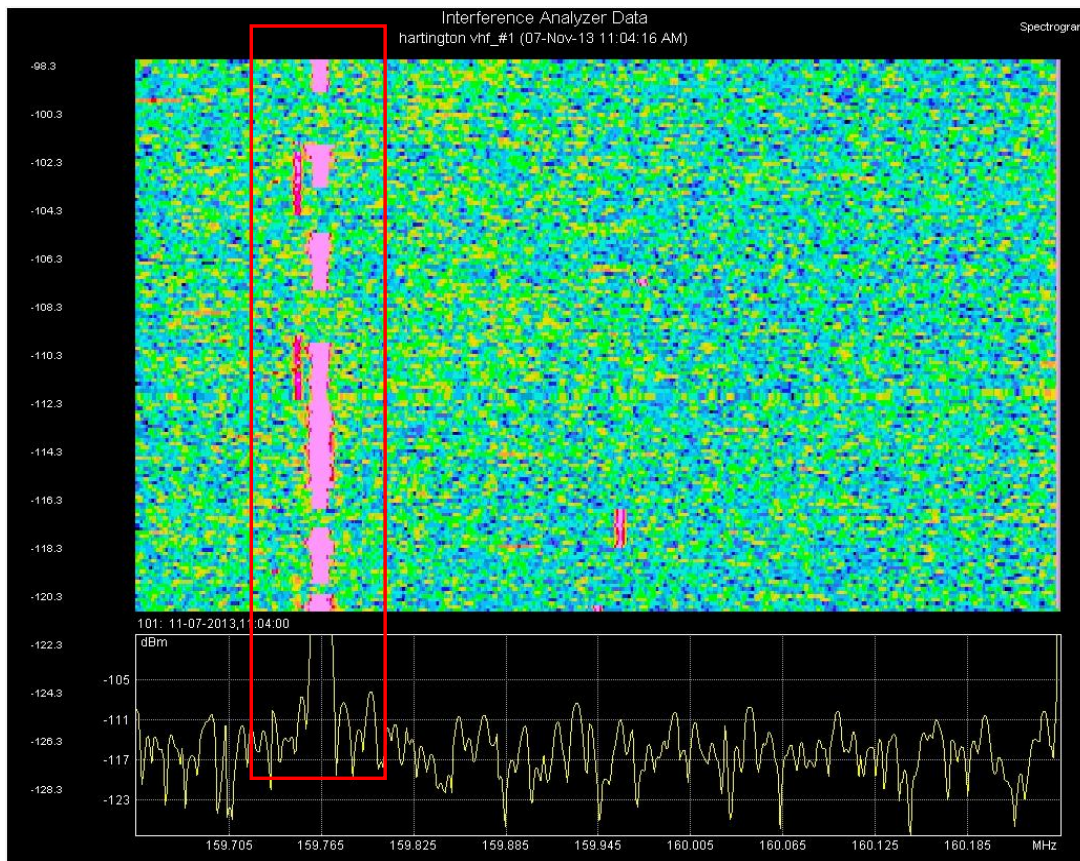


The distance to fault plot shows a normal return along the length of the cable.

- There is no coaxial surge arrester fitted to the end of the cable inside the shack so the cable return is flat out to the antenna.
- The peak on the right is the first radiating element of the antenna.
- The plot records a distance of 92 meters of cable up to the antenna.

An interference analysis was conducted at the center frequencies of the Fire service and the Public works receivers (+- 250 KHz) to establish the noise floor at that point in time as well as identify any possible sources of interference.

Figure 8: Hartington Fire service receiver IA.

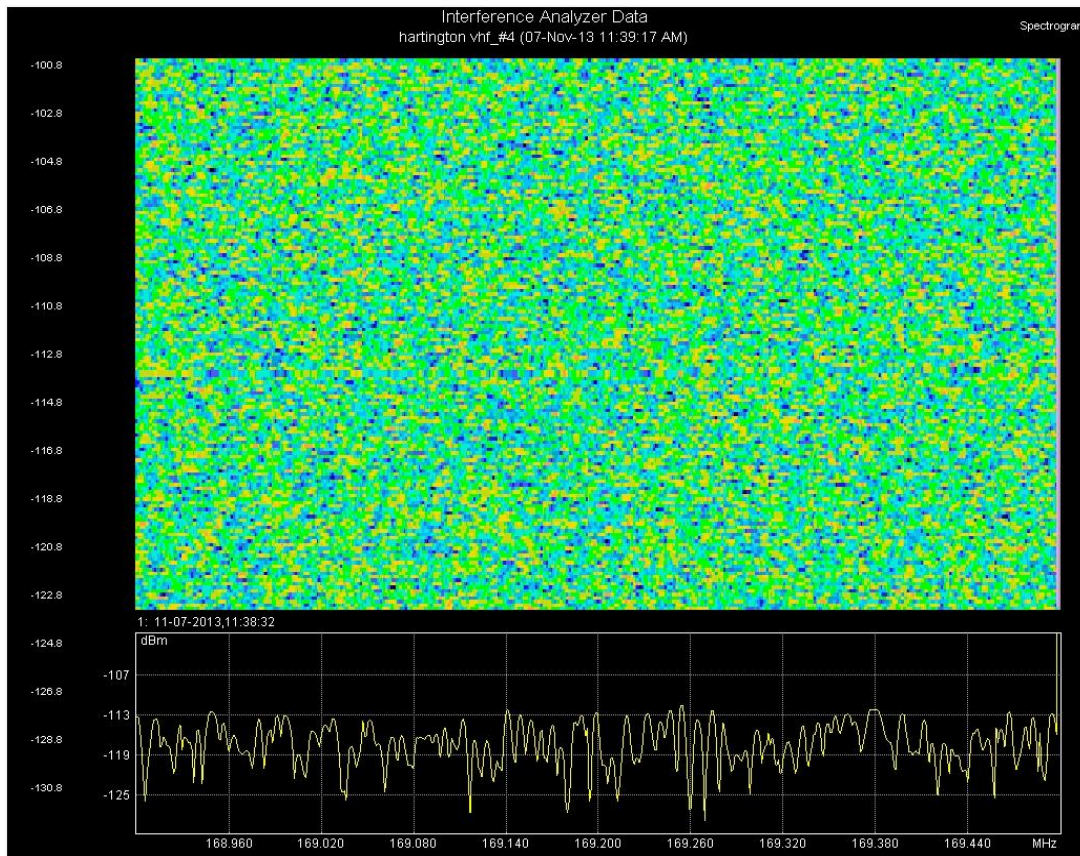


The Spectrogram captured no interferers at the receiver’s center frequency but there is an adjacent carrier that falls within the pass band of the filters and therefore will present itself to the receiver’s front end.

There is some measureable desensitizing of the receiver but no indication that this carrier is the source. Further on site testing will have to be done to determine it is a potential problem .

The noise floor was established the noise floor at this frequency to be nominally -112 dBm which is acceptable for a busy rural location such as this.

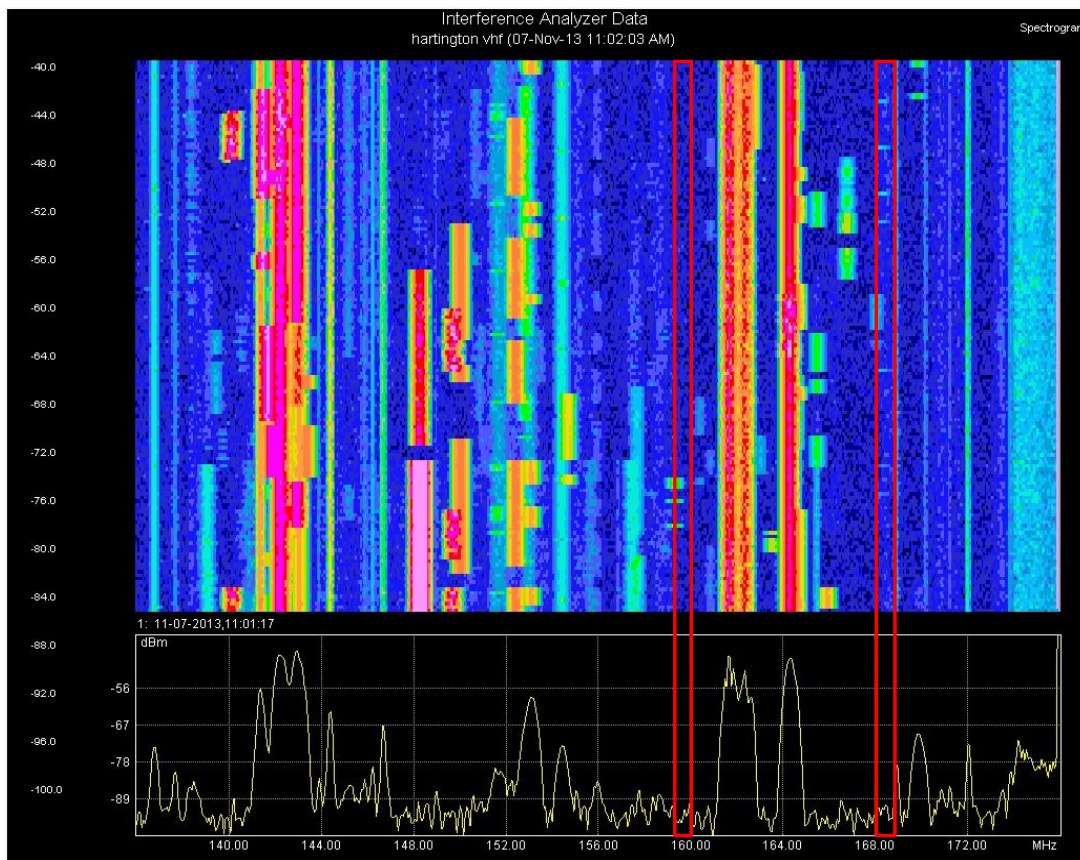
Figure 9: Hartington Public works receiver IA



The Spectrogram captured no interferers and established the noise floor at this frequency to be nominally -113 dBm which is acceptable for a busy rural location such as this.

An interference analysis was conducted across the VHF spectrum (40 MHz span) to establish what other carriers are present in the area for future reference.

Figure 10: Hartington VHF spectrum IA.



This is a busy site and the VHF spectrogram shows this clearly.

The portion of the spectrum marked out on the left and used by the Fire base station is clean with no significant carriers present.

The portion of the spectrum marked out on the right and used by the Public works base station is clean with no significant carriers present.

5. South Frontenac Fire: Burrige

The Fire service GE Master 3 base station was tested and found to be operating normally.

- The base station is running at the licensed power.
- The base station has a battery backup system.
- [#Appendix B: Original Base station inspection reports.](#)

A physical site inspection was carried out on the building and tower installation.

There are some deficiencies that do not meet the basic R56 guidelines and need to be addressed as soon as possible.

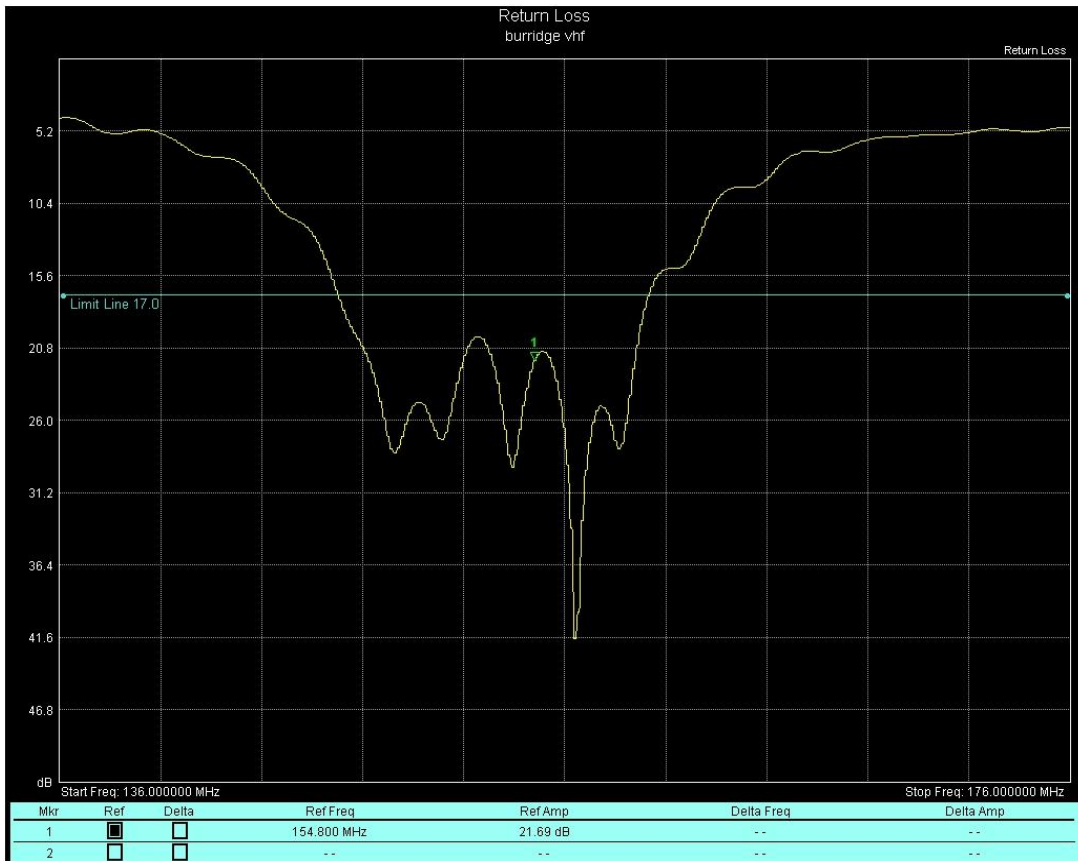
- The grounding is incomplete. This leaves the equipment housed within the building and mounted on the tower vulnerable to damage from lightning or power line surges. A more comprehensive report on the grounding can be made available is requested.
- There is generator power available on site but it is a manual hook up and start.

Minor issues noted that do not affect the performances of the base station are:

- No visible site monitoring system in place.
- [#Appendix A: Original site inspection reports.](#)

The VHF antenna and coaxial feed line were swept for return loss and distance to fault. Both returned normal results.

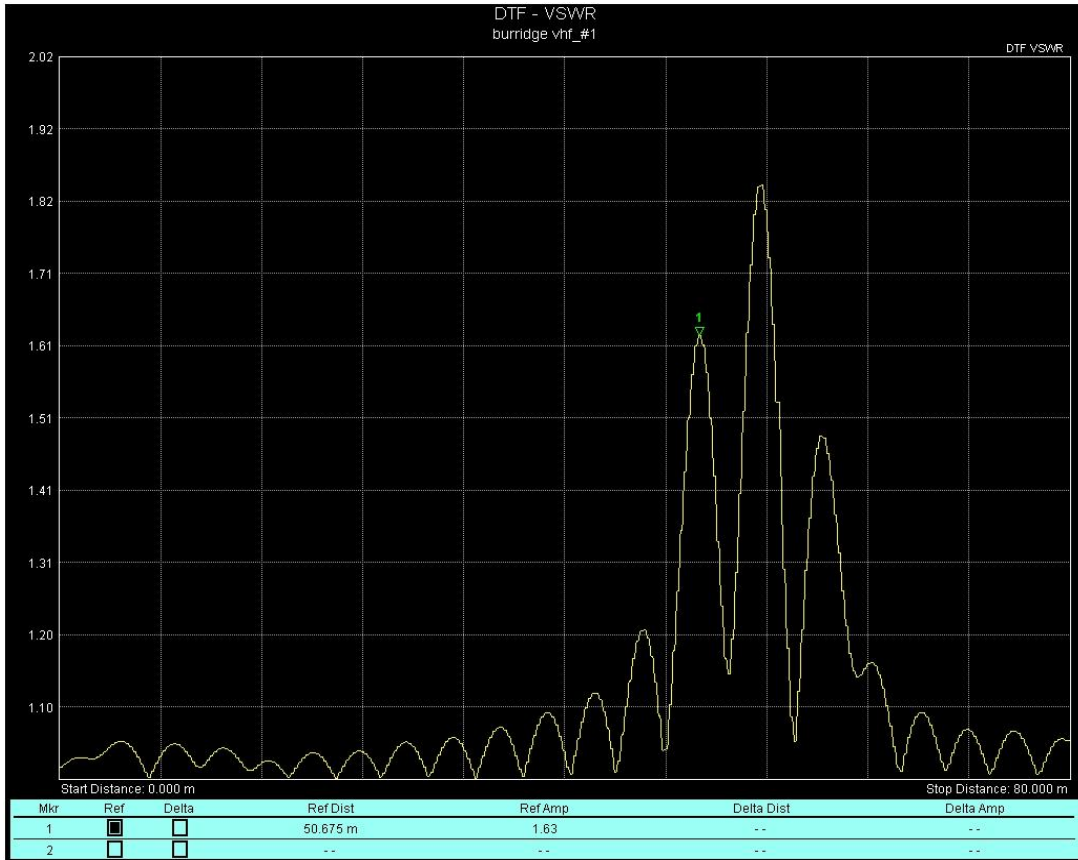
Figure 11: Burrige VHF antenna and feed line Return loss



A good result would have most of the plot underneath the 17 dB limit line. In this instance the antenna is not a wide band device and is therefore only properly resonant at and around the center frequency of the transmitter.

Since this base station is the sole user of this antenna this is not considered a problem.

Figure 12: Burrige VHF Distance to Fault

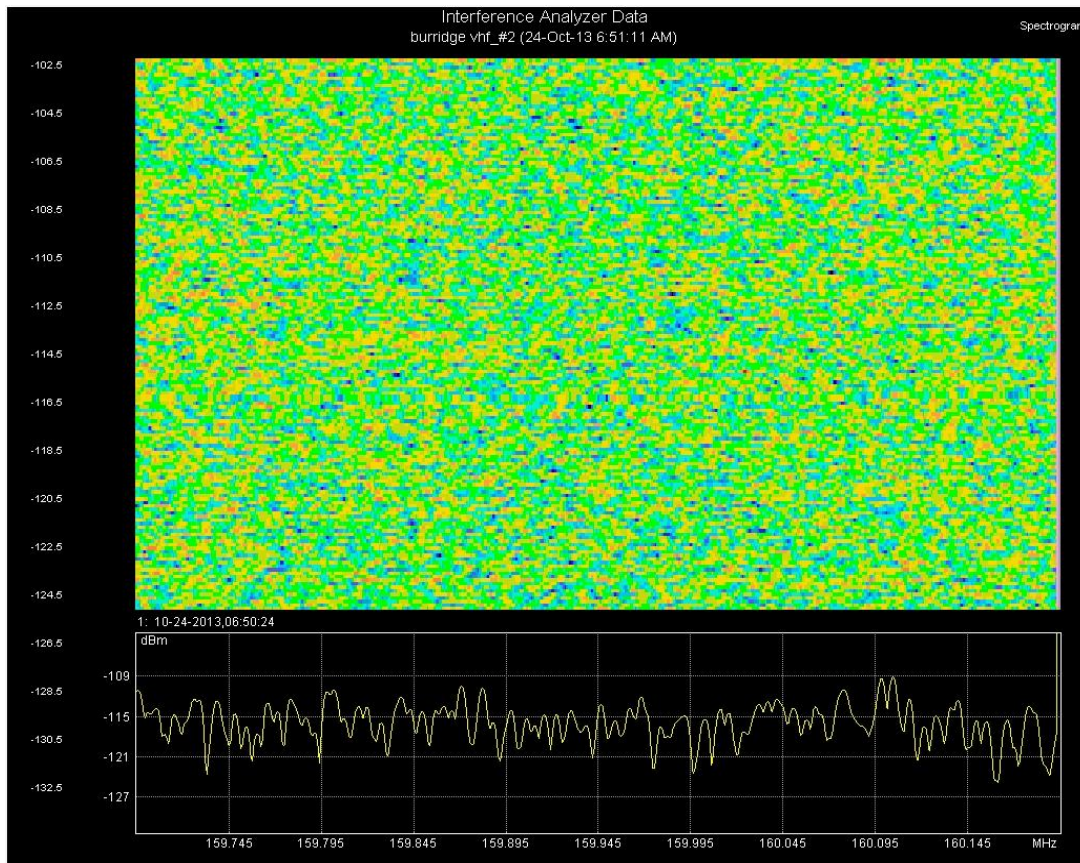


The distance to fault plot shows a normal return along the length of the cable.

- There is no coaxial surge arrester fitted to the end of the cable inside the shack so the cable return is flat out to the antenna.
- The peak on the right is the first radiating element of the antenna.
- The plot records a distance of 50 meters of cable up to the antenna.

An interference analysis was conducted at the center frequency of the Fire service receiver (+/- 250 KHz) to establish the noise floor at that point in time as well as identify any possible sources of interference.

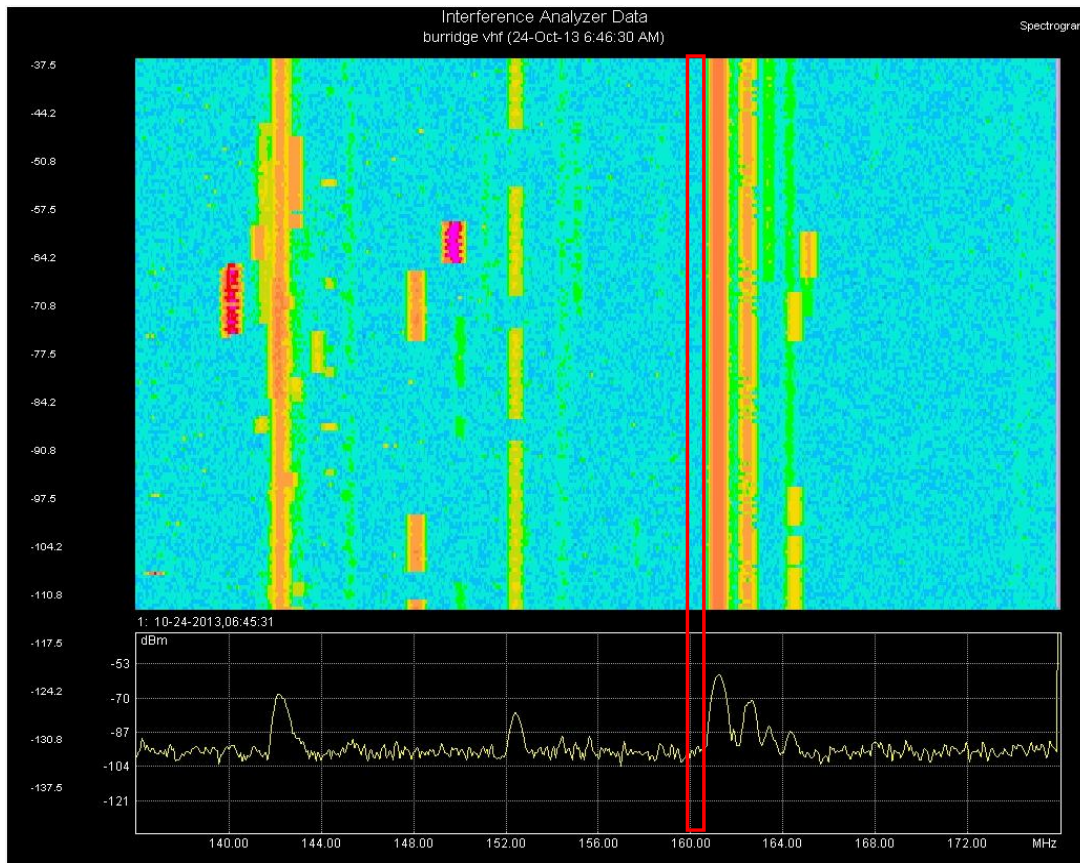
Figure 13: Burr ridge Fire service receiver IA.



The Spectrogram captured no interferers and established the noise floor at this frequency to be nominally -111 dBm which is acceptable for a rural location such as this.

An interference analysis was conducted across the VHF spectrum (40 MHz span) to establish what other carriers are present in the area for future reference.

Figure 14: Burrige VHF spectrum IA.



There is more activity along the spectrum at this location than was expected but the receiver portion is quiet.

6. North Frontenac Fire: Ompah

The Fire service Kenwood NXR700 base station was tested and found to be operating normally.

- The base station is not licensed to be at this location, the current license is for Clarendon station.
- The base station is running at the licensed power.
- The base station has a battery backup system.
- [#Appendix B: Original Base station inspection reports.](#)

A physical site inspection was carried out on the building and tower installation.

There are some deficiencies that do not meet the basic R56 guidelines and need to be addressed as soon as possible.

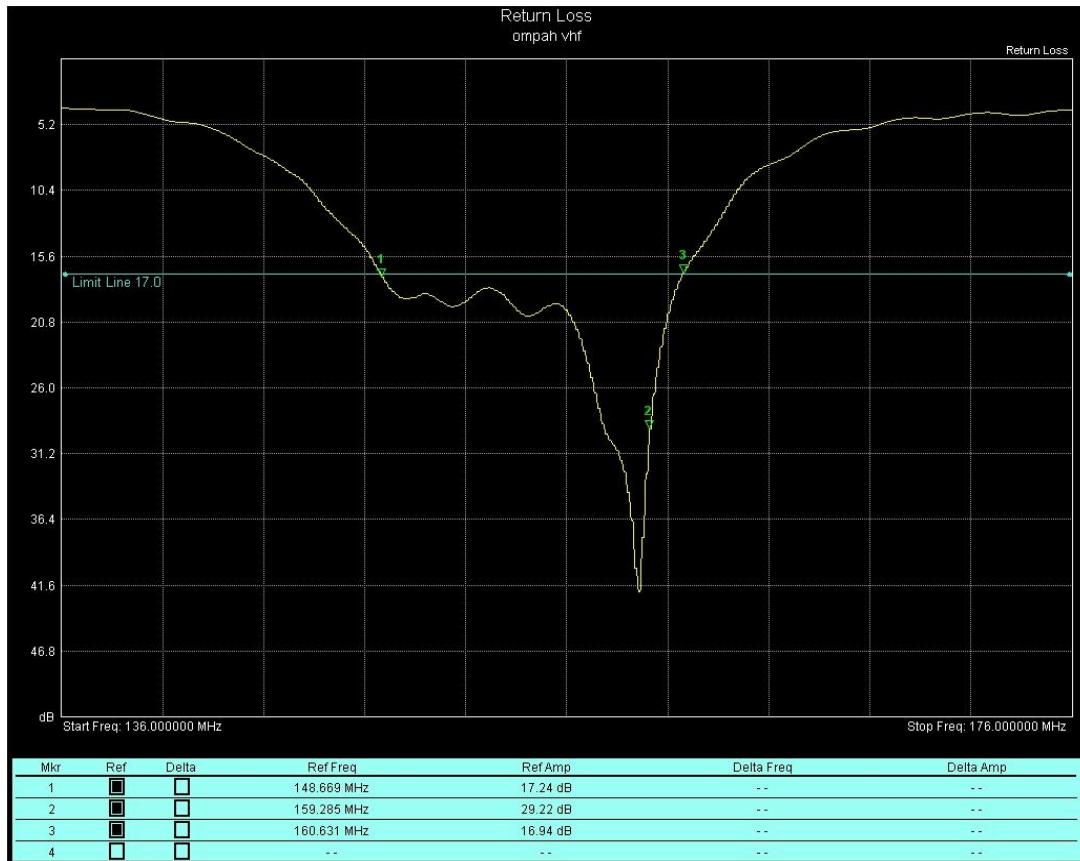
- The grounding is incomplete. This leaves the equipment housed within the building and mounted on the tower vulnerable to damage from lightning or power line surges. A more comprehensive report on the grounding can be made available is requested.
- There is no generator power available on site but there is a small battery backup system.

Minor issues noted that do not affect the performances of the base station are:

- No visible site monitoring system in place.
- The shelter is new but the floor is uncovered OSB board which is prone to rot quickly when exposed to water.
- The frame supporting the floor has buckled and the door can no longer be shut and locked.
- There is no fence around either the shelter or the tower.
- [#Appendix A: Original site inspection reports.](#)

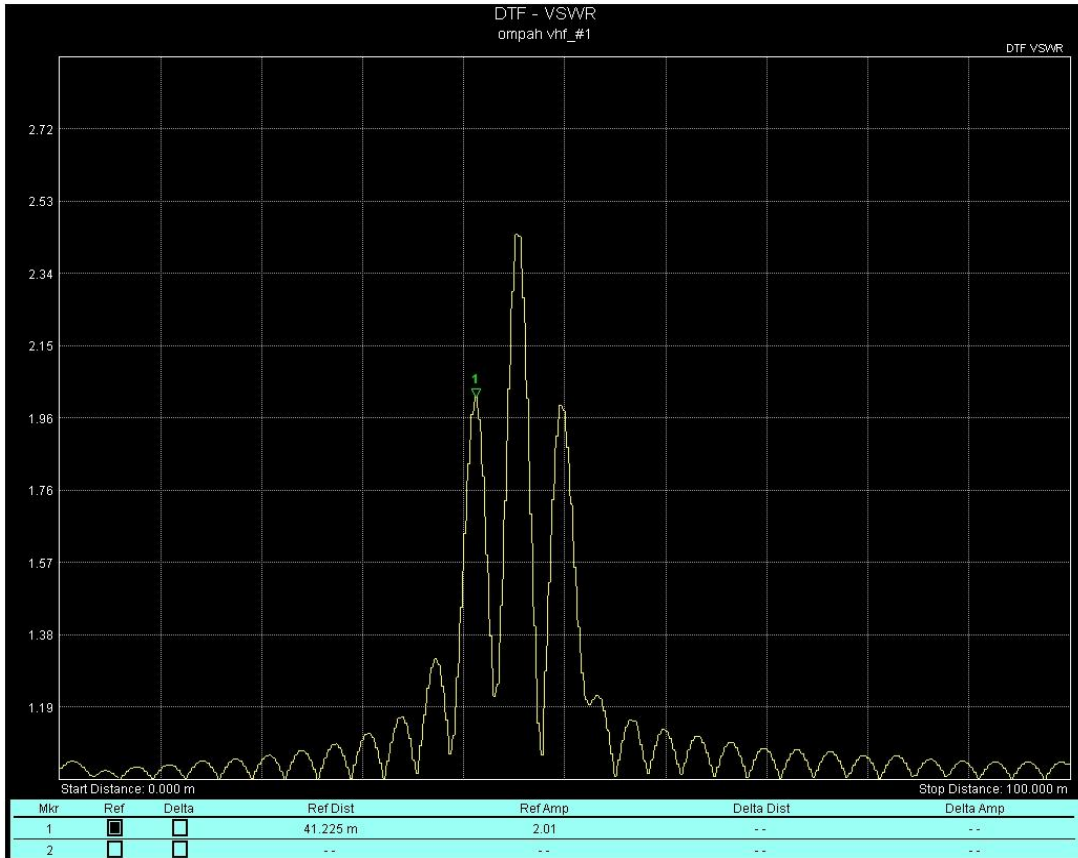
The VHF antenna and coaxial feed line were swept for return loss and distance to fault. Both returned normal results.

Figure 15: Ompah VHF antenna and feed line Return loss



A good result would have most of the plot underneath the 17 dB limit line. In this instance the antenna is not a wide band device and is therefore only properly resonant at near the center frequency of the transmitter. Since this base station is the sole user of this antenna this is not considered a problem.

Figure 16: Ompah VHF antenna Distance to fault

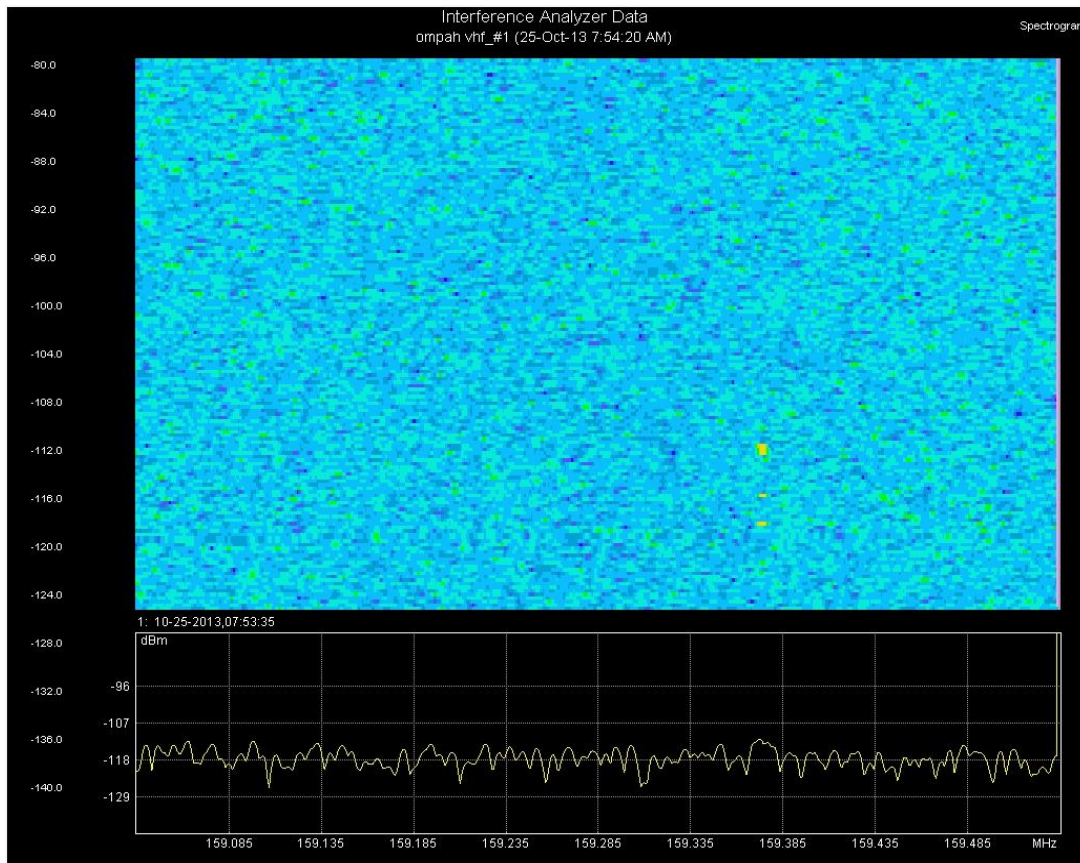


The distance to fault plot shows a normal return along the length of the cable.

- There is no coaxial surge arrester fitted to the end of the cable inside the shack so the cable return is flat out to the antenna.
- The peak on the right is the first radiating element of the antenna.
- The plot records a distance of 41 meters of cable up to the antenna.

An interference analysis was conducted at the center frequency of the Fire service receiver (+- 250 KHz) to establish the noise floor at that point in time as well as identify any possible sources of interference.

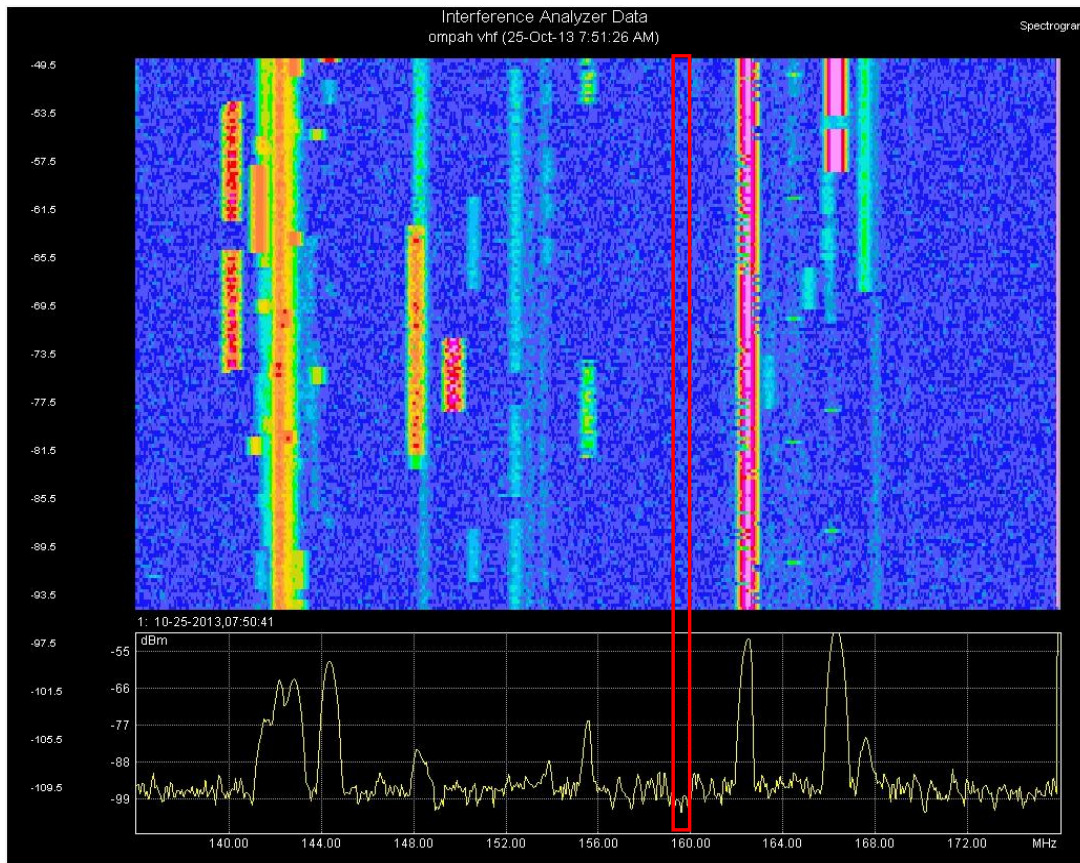
Figure 17: Ompah Fire service IA



The Spectrogram captured no interferers and established the noise floor at this frequency to be nominally -113 dBm which is acceptable for a rural location such as this.

An interference analysis was conducted across the VHF spectrum (40 MHz span) to establish what other carriers are present in the area for future reference.

Figure 18: Ompah VHF spectrum IA.



There are numerous carriers in the area but the receiver's portion of the spectrum is clear.

7. Frontenac Islands: Gore Road.

The Fire service Tait TB8100 base station was tested and found to be operating normally.

- The base station is not licensed to be on this frequency.
- The base station has a battery backup system.
- [#Appendix B: Original Base station inspection reports.](#)

A physical site inspection was carried out on the building and tower installation.

There are some deficiencies that do not meet the basic R56 guidelines and need to be addressed as soon as possible.

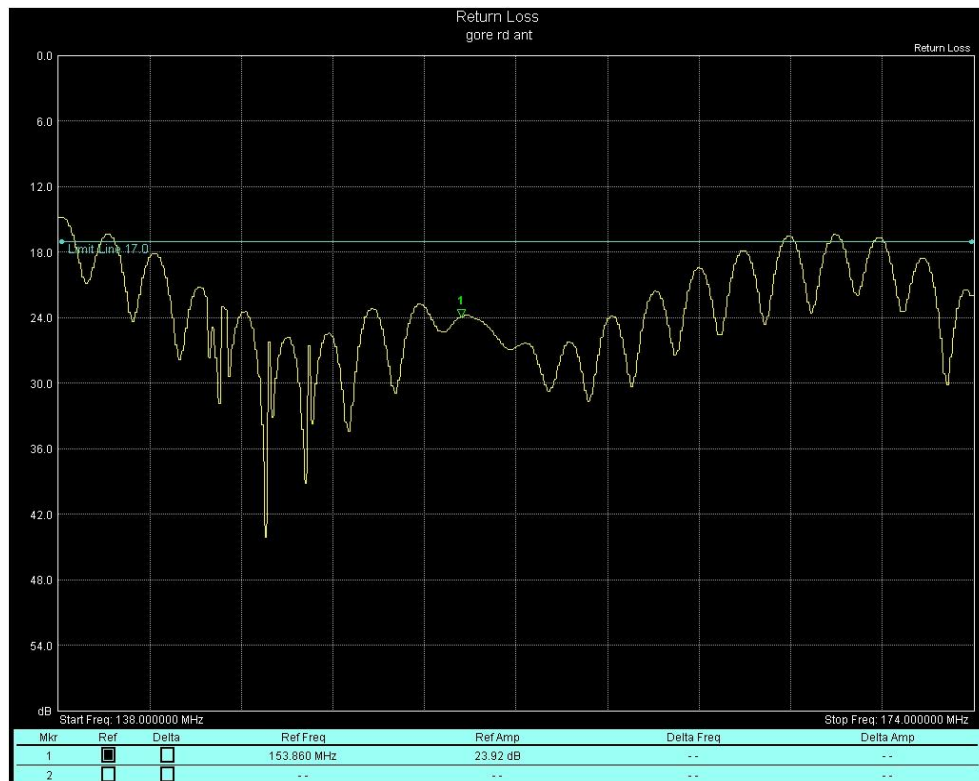
- The grounding is incomplete. This leaves the equipment housed within the building and mounted on the tower vulnerable to damage from lightning or power line surges. A more comprehensive report on the grounding can be made available is requested.
- There is no generator power available on site but there is a battery backup system.

Minor issues noted that do not affect the performances of the base station are:

- No visible site monitoring system in place.
- [#Appendix A: Original site inspection reports.](#)

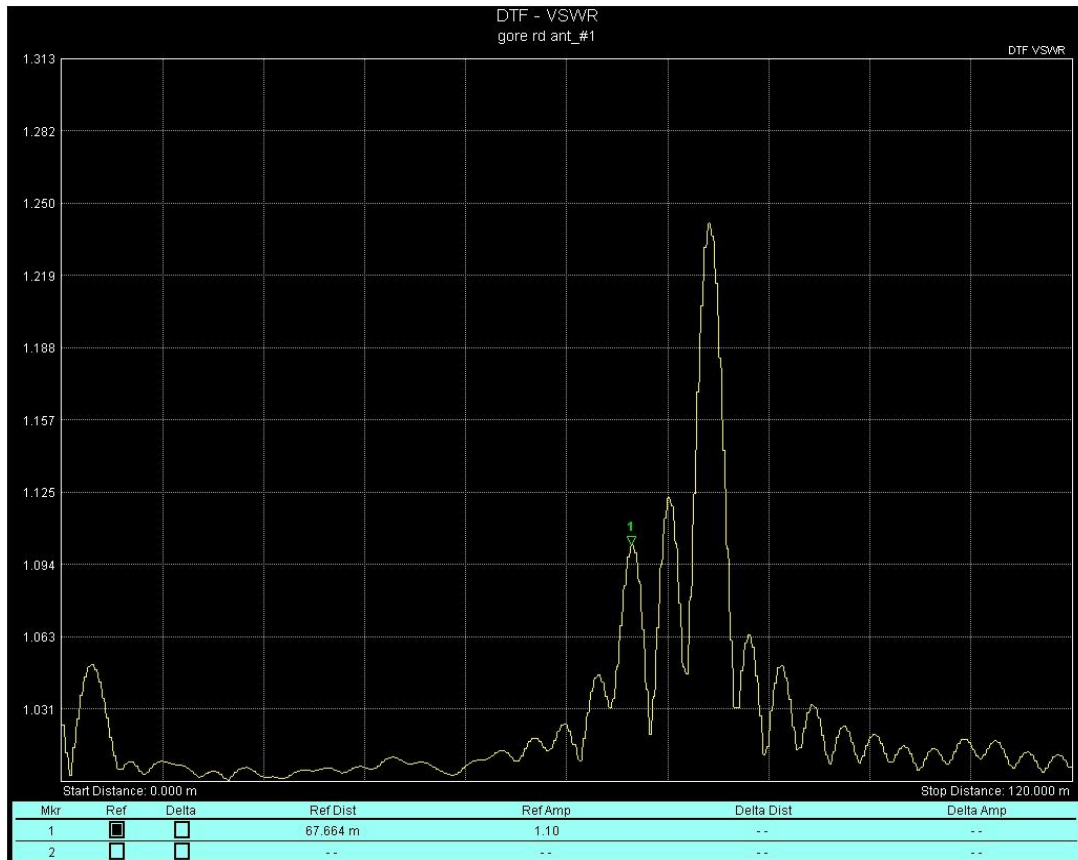
The VHF antenna and coaxial feed line were swept for return loss and distance to fault. Both returned normal results.

Figure 19: Gore rd. VHF antenna and feed line Return loss



This antenna and feed line plot returned a good result.

Figure 20: Gore rd. VHF antenna Distance to fault

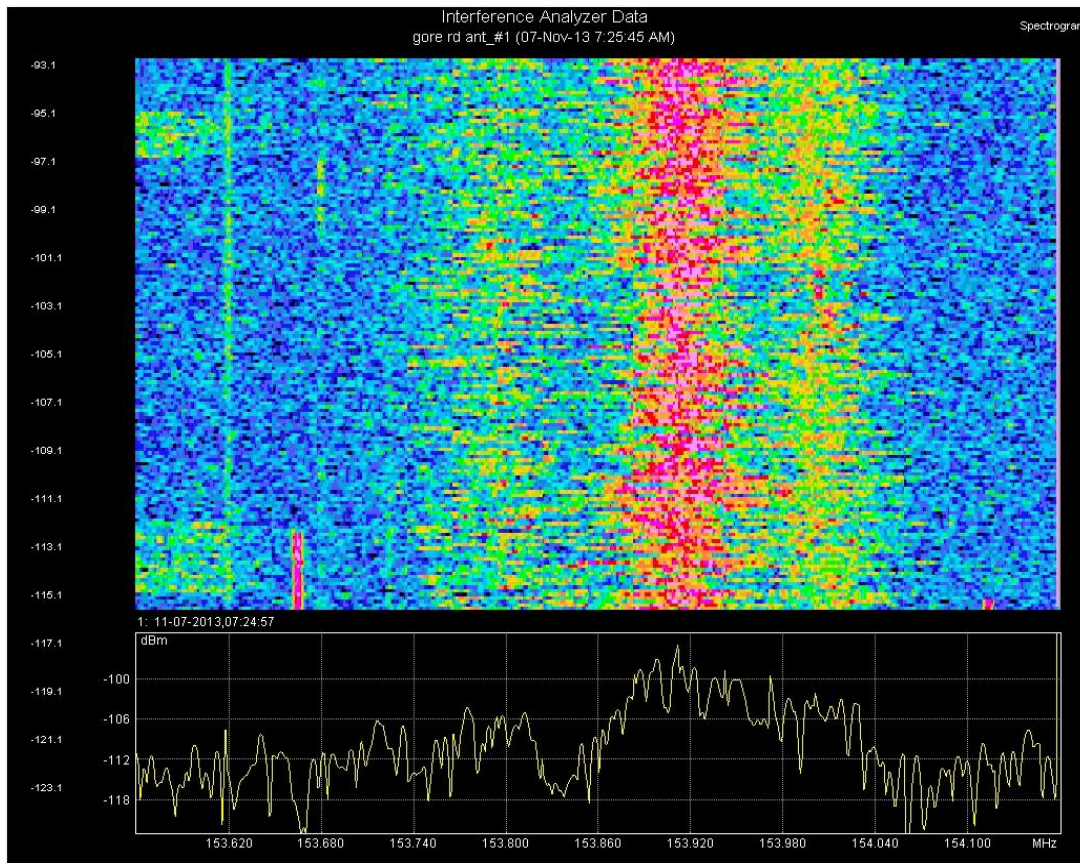


The distance to fault plot shows a normal return along the length of the cable.

- The peak on the left is the return from the coaxial surge arrester fitted to the end of the cable inside the shack.
- The peak on the right is the first radiating element of the antenna.
- The plot records a distance of 67 meters of cable up to the antenna.

An interference analysis was conducted at the center frequency of the Fire service receiver (+- 250 KHz) to establish the noise floor at that point in time as well as identify any possible sources of interference.

Figure 21: Gore Rd IA

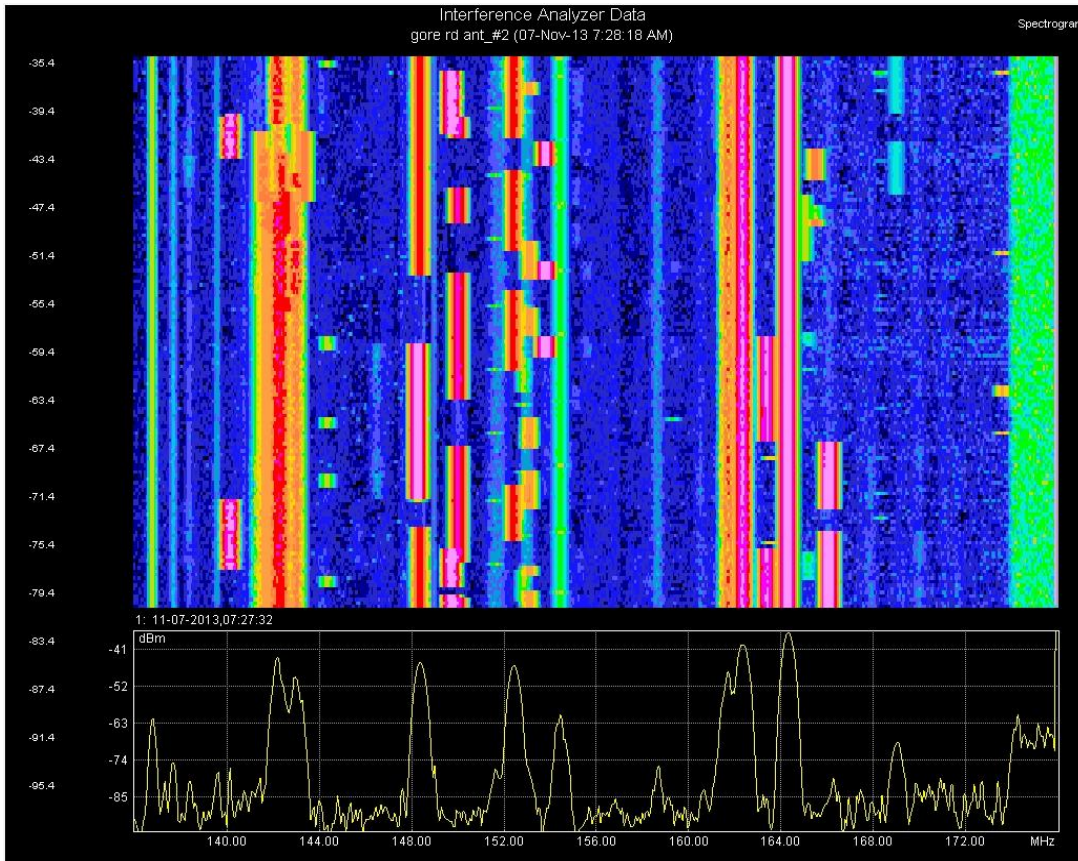


The Spectrogram captured a interferer at 153.920 MHz. It was not possible to estimate the noise floor level at this location due to the presence of the unwanted carrier.

Since this station is not licensed to be at this location on this frequency, there is no recourse other than to seek another frequency from the regulator.

An interference analysis was conducted across the VHF spectrum (40 MHz span) to establish what other carriers are present in the area for future reference.

Figure 22: Gore rd. VHF spectrum IA.



As expected from a site in an urban area the spectrum is fairly congested.

8. Summary.

- All base stations were found to be operating normally and no serious issues were uncovered.
- There are some discrepancies between the license particulars and the actual operating frequency and / or locations of some of the stations. Since failure to comply with the terms of the license can incur the displeasure of the regulator, steps to correct these should be taken as soon as possible.
- Backup power system where present meet only minimum requirements.
- Grounding with respect to the prevention of damage resulting from lightning or other surges was found to be substandard at all sites visited.
- This lack of proper grounding systems makes the value of the surge protection devices (where fitted) of questionable value.

9. Coverage study method.

All parameters gathered during the physical site survey were used to generate coverage plots or heat maps using EDX Signal software application Ver. 10.

4 studies were done for each tower site.

- Portable downlink. This is the signal plot from the base station transmitter out to a portable in the field.
- Portable uplink. This is the signal plot from the portable in the field into the base station receiver.
- Typically the uplink coverage plot is smaller than the downlink plot due to the fact that a portable transmits at a much lower power than a base station.
- 95/95 Service availability area. This is the 95% of the area in which a portable should work 95% of the time.
- The portable is assumed to be stationary, outside in the open and held at head height for all plots.
- The results were output in KMZ file format which can be viewed using Google Earth. This report shows screen shots of the plots but the native KMZ files will be supplied as well.
- Heat maps show signal strength with respect to color. The hotter the color (red / yellow) the stronger the signal.
- For the 95/95 heat maps, only areas shown in green meet the criteria.

10. North Frontenac – Ompah tower site.

Figure 23: North Frontenac Portable downlink.

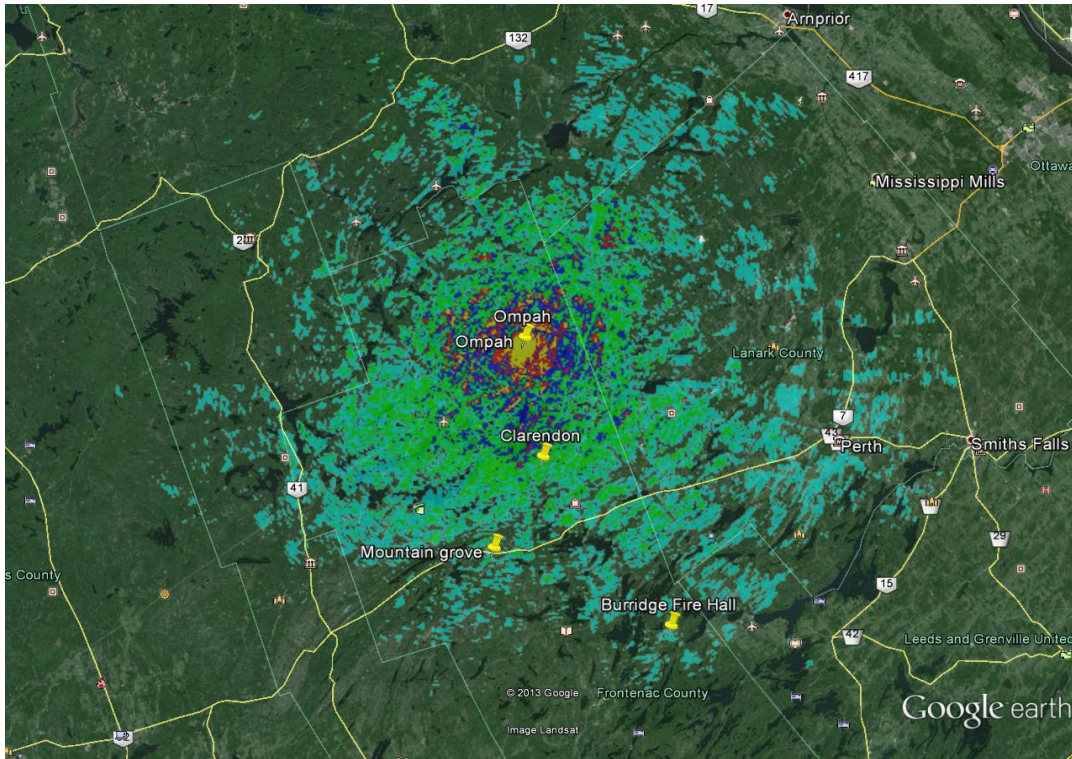


Figure 24: North Frontenac portable uplink

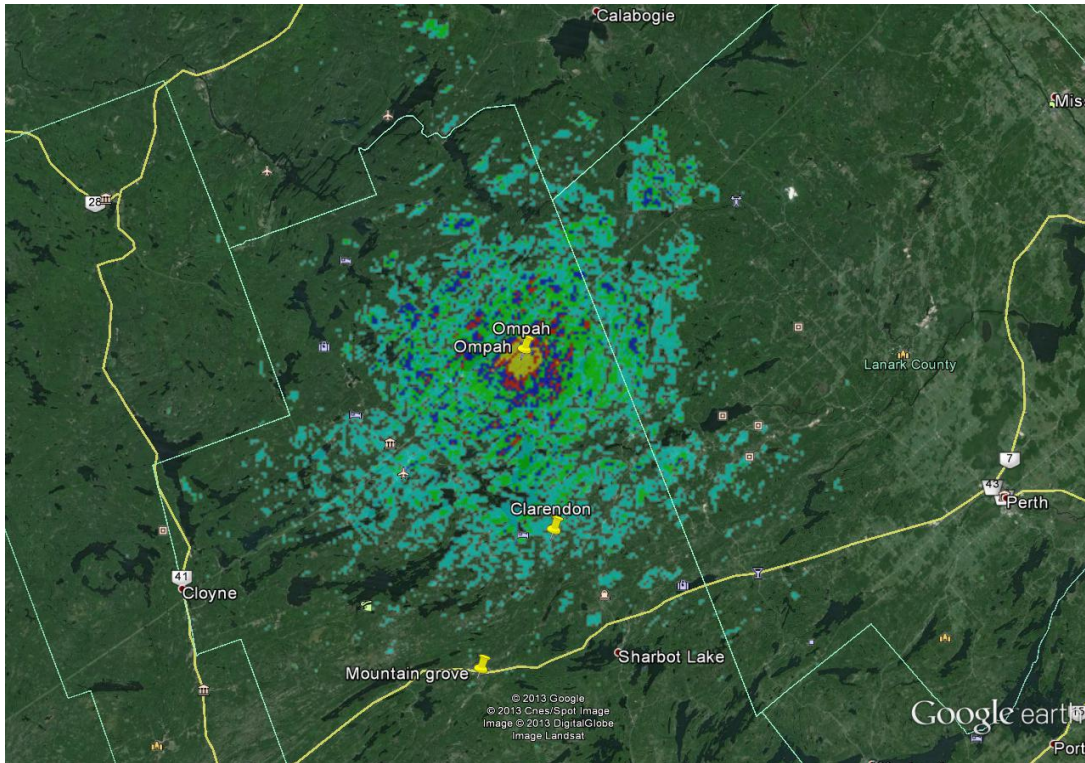
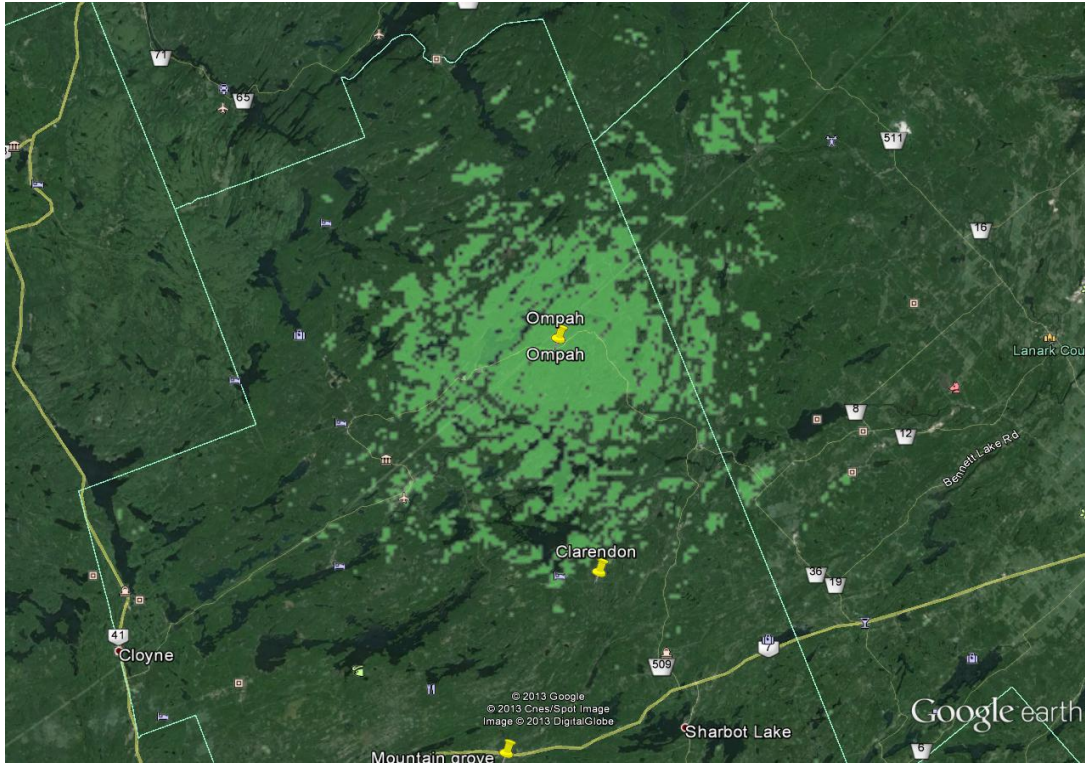


Figure 25: North Frontenac 95% service area



11. South Frontenac – Hartington tower site.

Figure 26: South Frontenac portable downlink Hartington

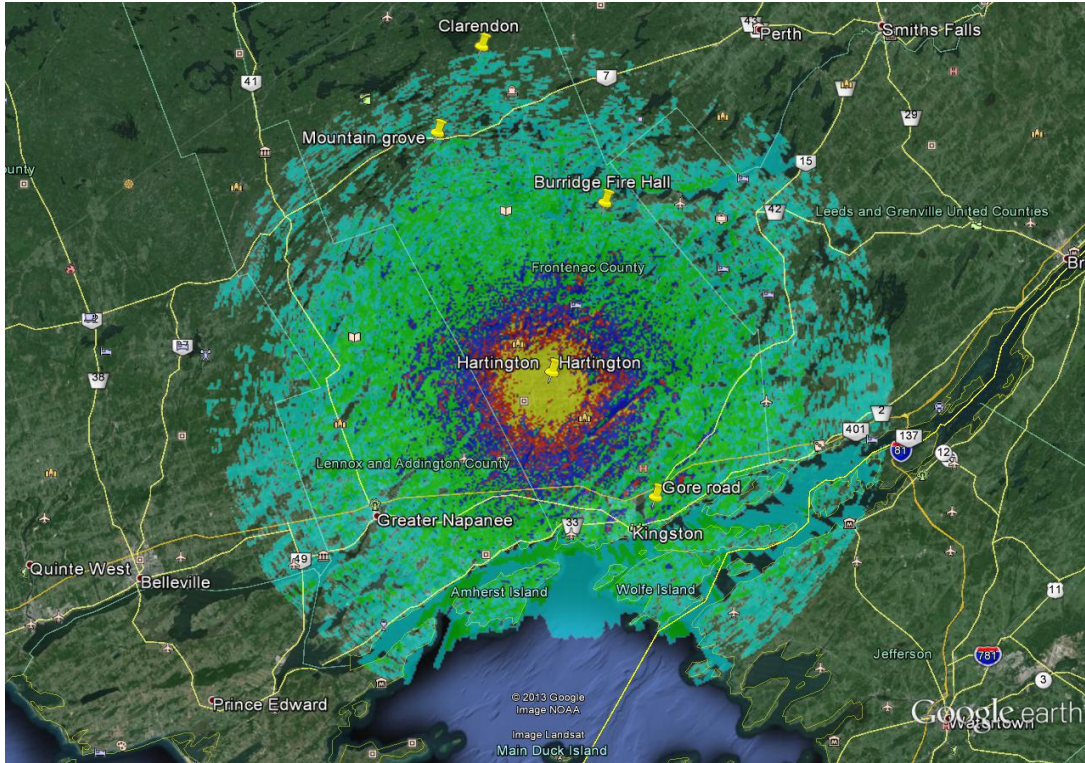


Figure 27: South Frontenac portable uplink Hartington

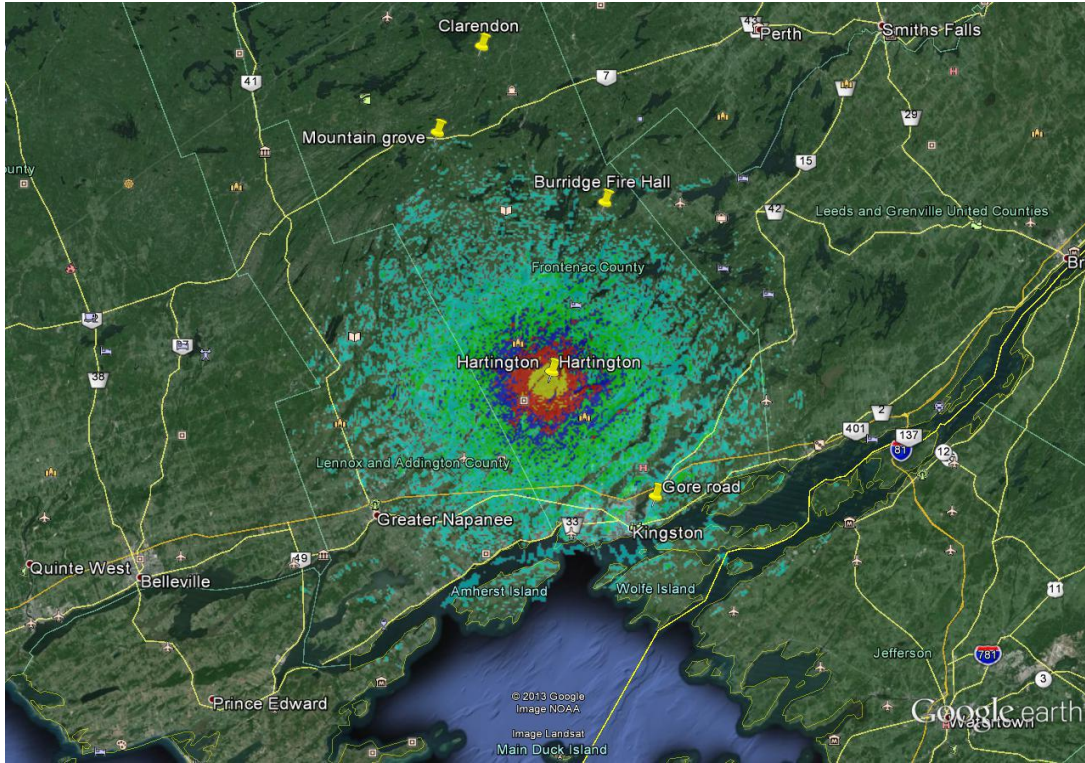
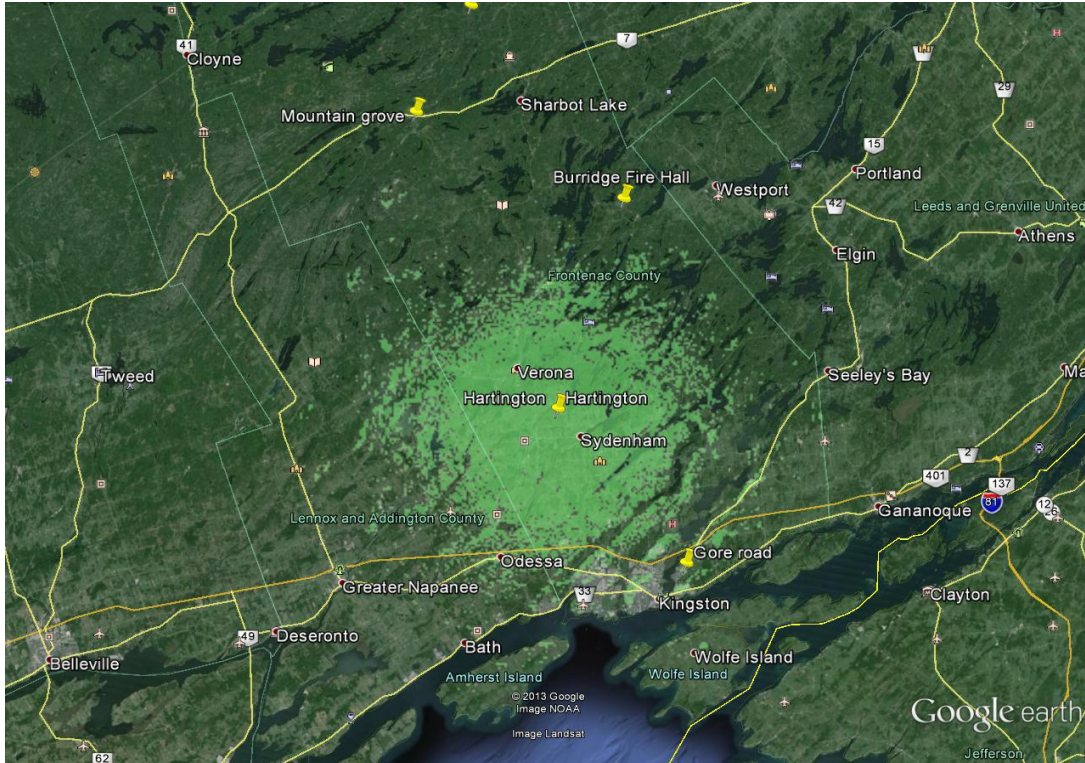


Figure 28: South Frontenac 95% service area Hartington



12. South Frontenac – Burridge fire hall site.

Figure 29: South Frontenac portable downlink Burridge

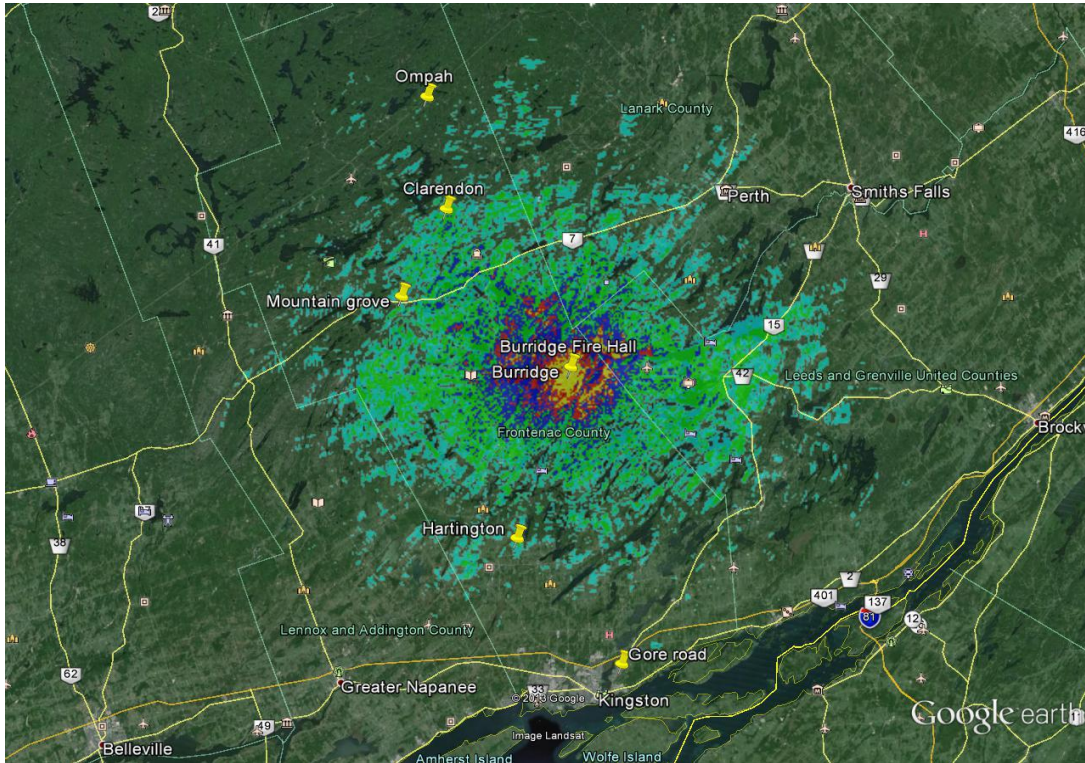


Figure 30: South Frontenac Portable uplink Burridge

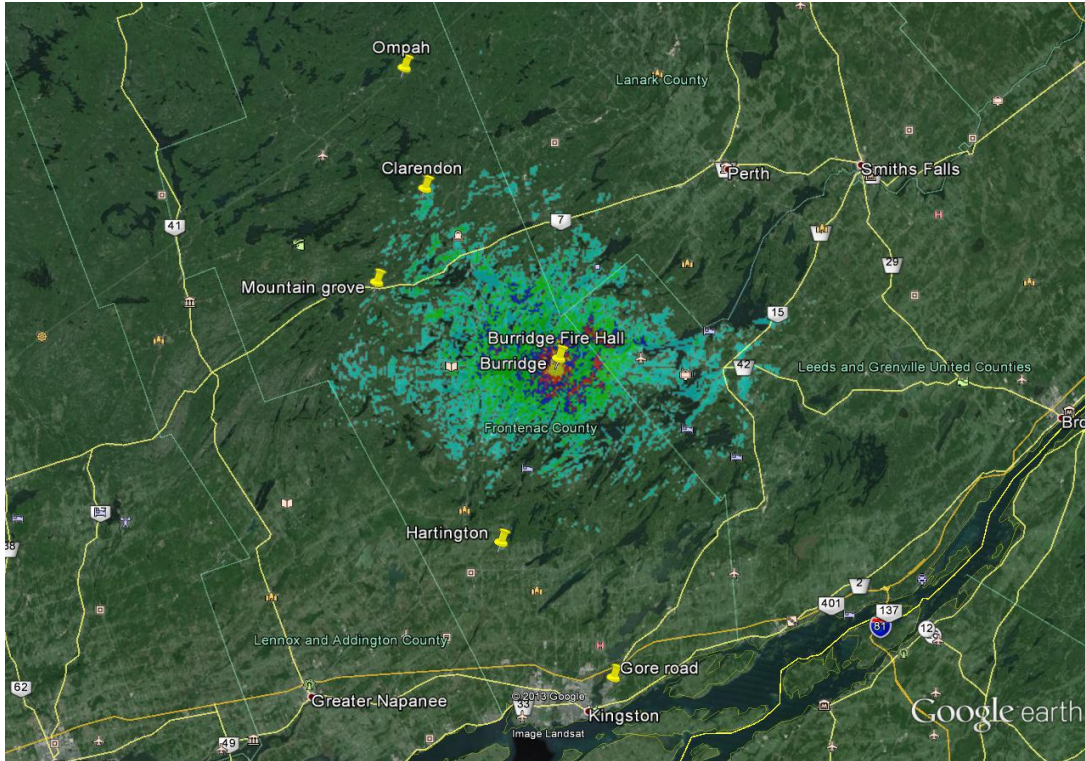
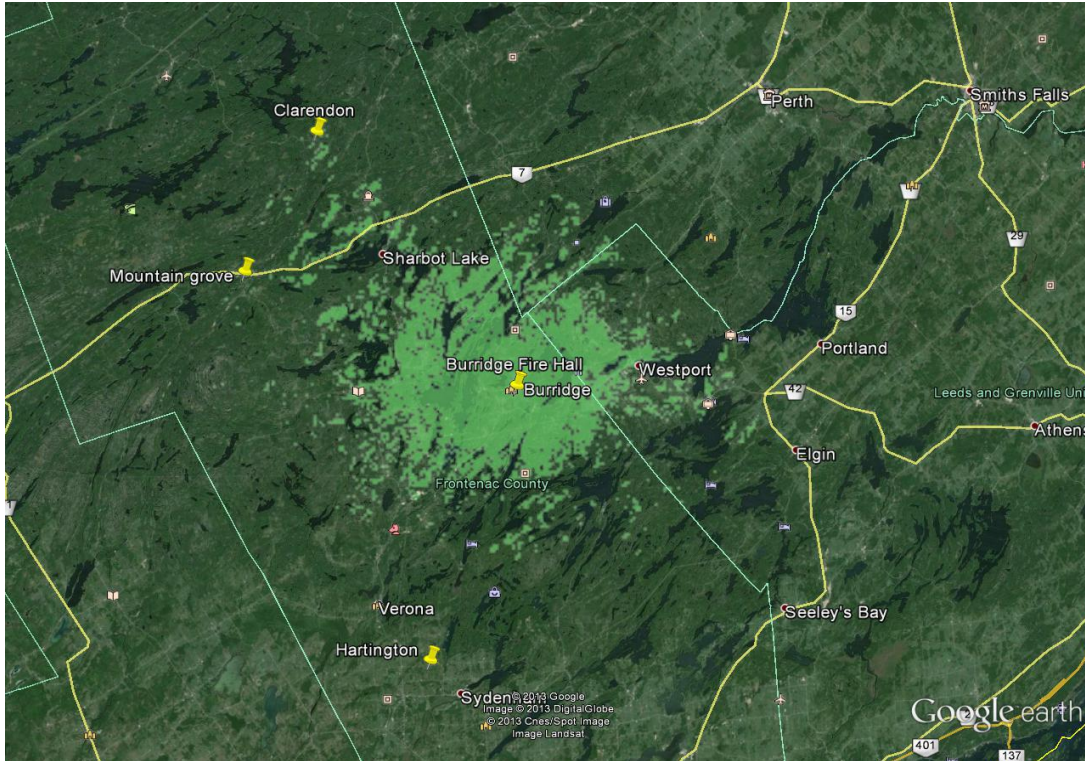


Figure 31: South Frontenac 95% service area Burrige



13. Central Frontenac – Mountain Grove tower site.

Figure 32: Central Frontenac portable downlink Mountain Grove

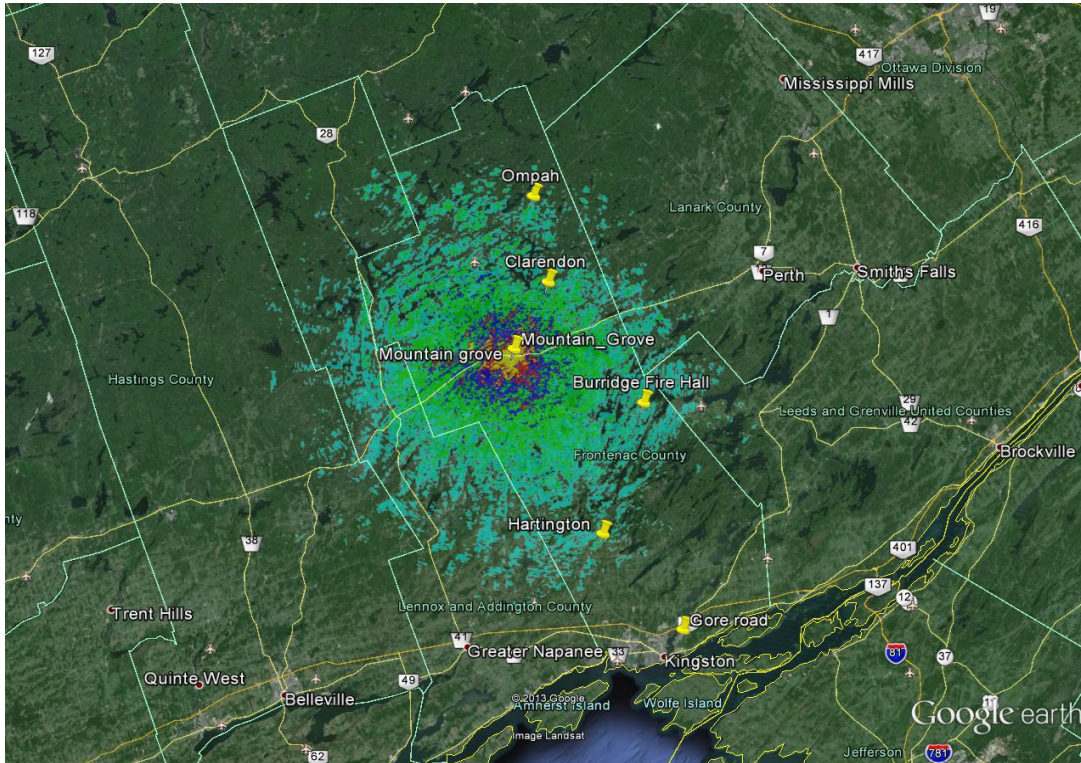


Figure 33: Central Frontenac Portable uplink Mountain Grove

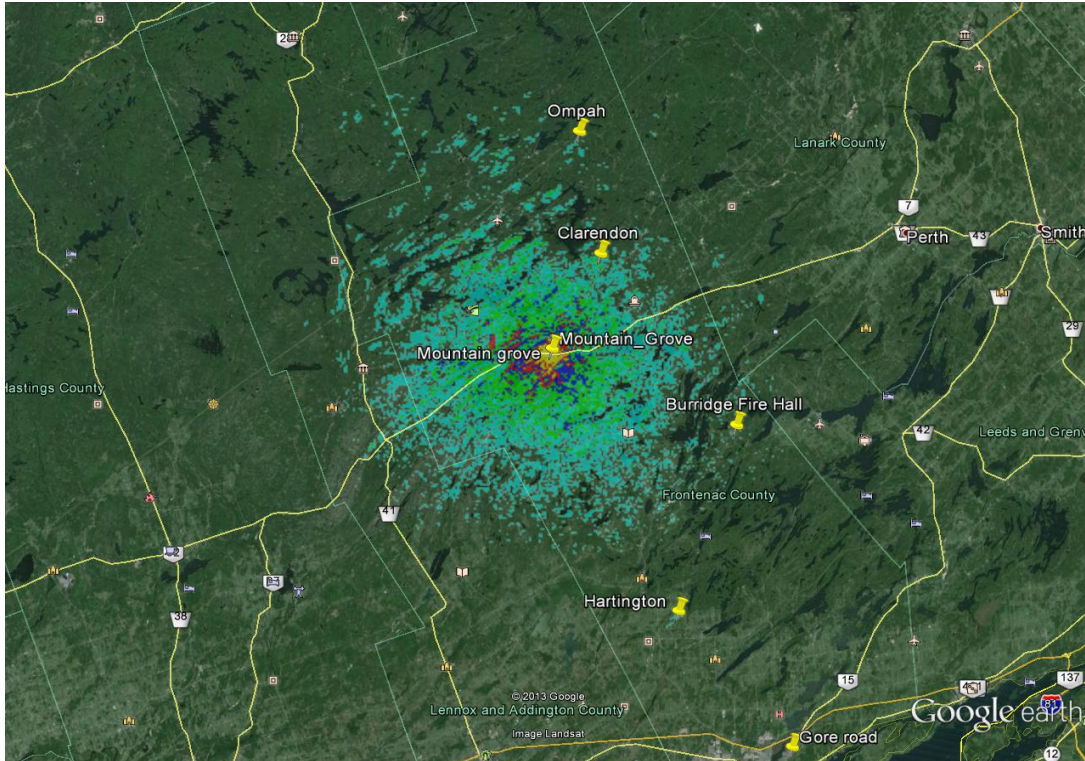
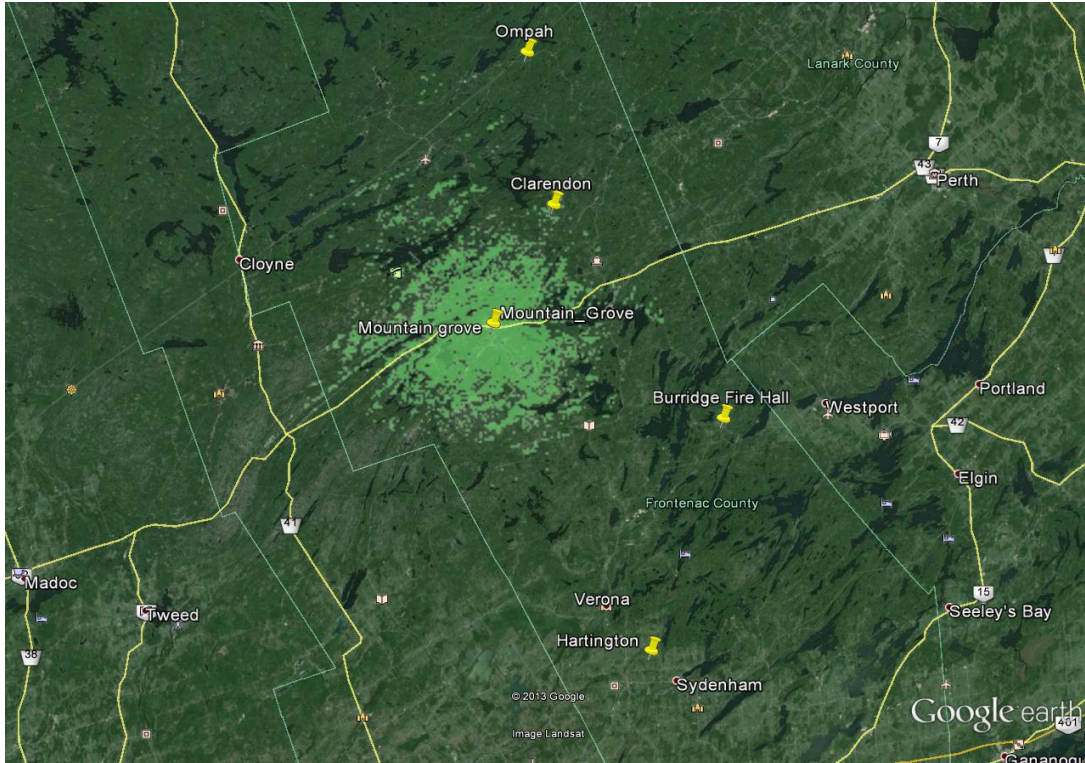


Figure 34: Central Frontenac 95% service area Mountain Grove



14. Frontenac Islands- Gore road tower site.

Figure 35: Frontenac Islands portable downlink Gore rd.

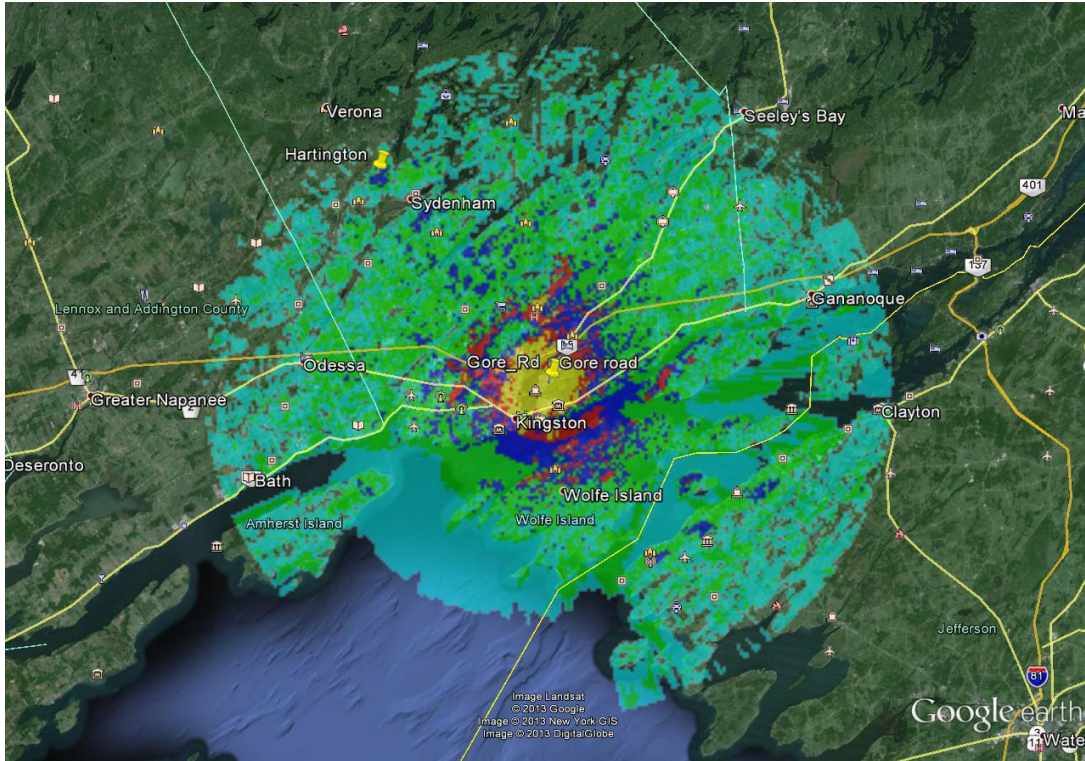


Figure 36: Frontenac Islands portable uplink Gore rd.

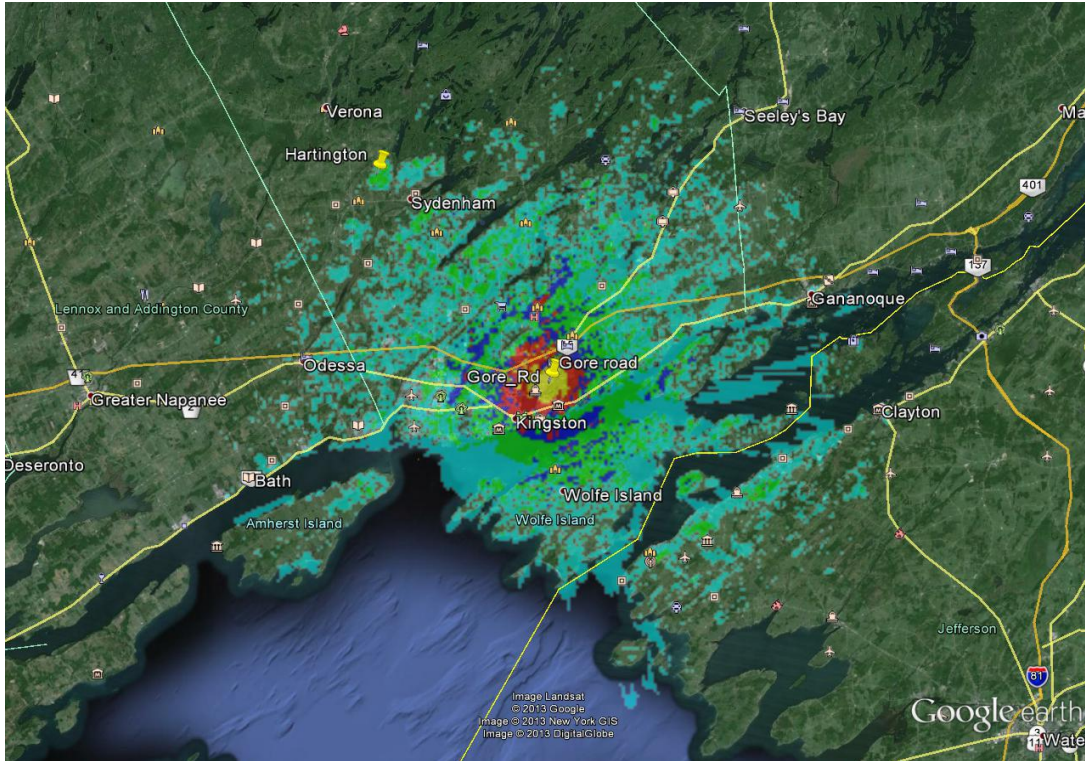
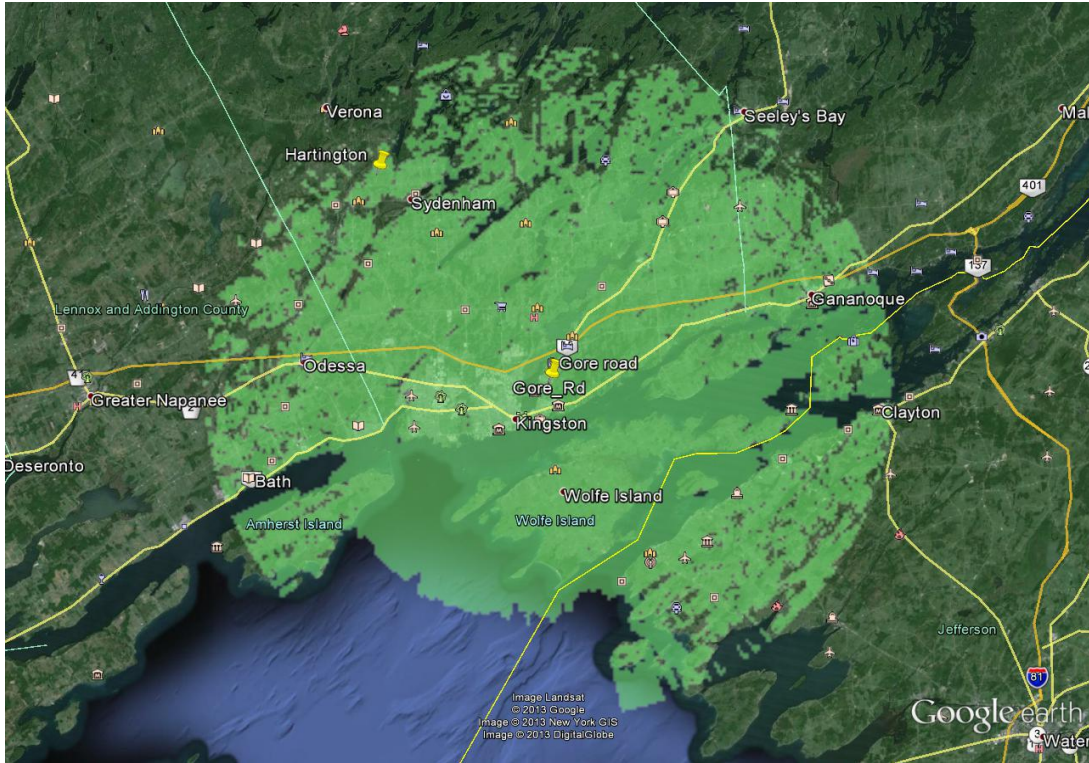


Figure 37: Frontenac Islands 95% service area Gore rd.



1. Appendix A: Original site inspection reports.

Figure 38: Mountain Grove physical site inspection report

Physical site inspection: Checklist

Customer: Central Frontenac		Location: Mountain Grove	
#	Item to be checked	Pictures	Y/N
1	Complete site diagram	Y	Y
2	Complete tower diagram	Y	Y
3	Physical condition of shelter exterior in good condition.	Y	Y
4	Physical condition of shelter interior in good condition.	Y	Y
5	Common ground system installed.	Y	N
6	Physical condition of bonded joints.	Y	N/A
7	Tower ground bar (TGB) available	Y	N
8	TGB bonded to common grounding system	Y	N/A
9	External ground bar (EGB) / bus available	Y	N/A
10	EGB bonded to common grounding system	Y	N/A
11	Internal ground bar(s) (IGB) available	Y	N
12	IGB bonded to common grounding system	Y	N
13	Internal perimeter ground bus available	Y	N
14	IPGB bonded to common grounding system	Y	N
15	Incoming cables bonded to EGB.	Y	N
16	Racks bonded to IGB	Y	N
17	Cabinets bonded to IGB	Y	N
18	Equipment bonded to IGB	Y	N
19	Surge protection devices installed on main power circuit.	Y	Y
20	Surge protection devices installed on RF cables	Y	Y
21	Surge protection devices installed on Telco circuits	Y	N/A
22	Surge protection devices installed on data circuits	Y	Y
23	Sufficient mains power available (Service rating)	Y	Y
24	Neutral - ground bonding done in AC load center	Y	Y
25	AC load center bonded to common ground	Y	Y
26	Additional outlets available	Y	Y
27	Auto start generator power available	Y	N
28	UPS power available	Y	Y
29	Ventilation system installed and working	Y	Y
30	Tower lighting system installed and working	Y	N
31	Antenna combining system in place	Y	Y
32	Antenna combining system tested and recorded if present	Y	Y
33	Antenna system swept and IA done.	Y	Y
34	Equipment tested and results recorded	Y	Y

Technologist: Glen McMahon **Date:** 24-Oct-13

Details / Comments
No grounding on incoming power circuits.
No external or internal ground bars.
Using small electrical ground wire for shelter ground.
100A service
1.3 Ohm measured on Neutral to ground.
Upright AC unit installed.
Equipment racks are not bolted down
Adult can crawl under the fence to gain access to tower.
Anti climb plates on tower are ineffectual.
Tower grounded on 3 legs but cable is just wound round bolts.
Fence not grounded or bonded to ground.
No tower lights installed but is adjacent to a higher tower that does.

Figure 39: Hartington physical site inspection report

Physical site inspection: Checklist

Customer: <u>South Frontenac</u>		Location: <u>Hartington</u>	
#	Item to be checked	Pictures	Y/N
1	Complete site diagram	Y	Y
2	Complete tower diagram	Y	Y
3	Physical condition of shelter exterior in good condition.	Y	Y
4	Physical condition of shelter interior in good condition.	Y	Y
5	Common ground system installed.	Y	N
6	Physical condition of bonded joints.	Y	N
7	Tower ground bar (TGB) available	Y	N
8	TGB bonded to common grounding system	Y	N
9	External ground bar (EGB) / bus available	Y	N
10	EGB bonded to common grounding system	Y	N
11	Internal ground bar(s) (IGB) available	Y	N
12	IGB bonded to common grounding system	Y	N
13	Internal perimeter ground bus available	Y	N
14	IPGB bonded to common grounding system	Y	N
15	Incoming cables bonded to EGB.	Y	N
16	Racks bonded to IGB	Y	N
17	Cabinets bonded to IGB	Y	N
18	Equipment bonded to IGB	Y	N
19	Surge protection devices installed on main power circuit.	Y	N
20	Surge protection devices installed on RF cables	Y	N
21	Surge protection devices installed on Telco circuits		N/A
22	Surge protection devices installed on data circuits		N/A
23	Sufficient mains power available (Service rating)	Y	N
24	Neutral - ground bonding done in AC load center	Y	Y
25	AC load center bonded to common ground	Y	N
26	Additional outlets available	Y	Y
27	Auto start generator power available	Y	Y
28	UPS power available	Y	Y
29	Ventilation system installed and working	Y	Y
30	Tower lighting system installed and working	Y	Y
31	Antenna combining system in place	Y	Y
32	Antenna combining system tested and recorded if present	Y	Y
33	Antenna system swept and IA done.	Y	Y
34	Equipment tested and results recorded	Y	Y

Technologist: Glen McMahon / Clint Dare Date: 07-Nov-13

Physical site inspection

#	Details / Comments
	Breaker panel in generator room not communications room. Not accessible,
	30A service panel.
	Generator present but communications room is not on the generator circuit.

Figure 40: Burrige physical site inspection report

Physical site inspection: Checklist

Customer: <u>South Frontenac</u>		Location: <u>Burrige</u>	
#	Item to be checked	Pictures	Y/N
1	Complete site diagram	Y	Y
2	Complete tower diagram	Y	Y
3	Physical condition of shelter exterior in good condition.	Y	Y
4	Physical condition of shelter interior in good condition.		N/A
5	Common ground system installed.	Y	N
6	Physical condition of bonded joints.	Y	N/A
7	Tower ground bar (TGB) available	Y	N
8	TGB bonded to common grounding system	Y	N
9	External ground bar (EGB) / bus available	Y	N
10	EGB bonded to common grounding system	Y	N
11	Internal ground bar(s) (IGB) available	Y	N
12	IGB bonded to common grounding system	Y	N
13	Internal perimeter ground bus available	Y	N
14	IPGB bonded to common grounding system	Y	N
15	Incoming cables bonded to EGB.	Y	N
16	Racks bonded to IGB	Y	N/A
17	Cabinets bonded to IGB	Y	N/A
18	Equipment bonded to IGB	Y	N/A
19	Surge protection devices installed on main power circuit.	Y	N
20	Surge protection devices installed on RF cables	Y	N
21	Surge protection devices installed on Telco circuits	Y	N/A
22	Surge protection devices installed on data circuits	Y	N/A
23	Sufficient mains power available (Service rating)		Y
24	Neutral - ground bonding done in AC load center		Y
25	AC load center bonded to common ground		N
26	Additional outlets available		N
27	Auto start generator power available		N
28	UPS power available		Y
29	Ventilation system installed and working		Y
30	Tower lighting system installed and working		N/A
31	Antenna combining system in place		N
32	Antenna combining system tested and recorded if present		N/A
33	Antenna system swept and IA done.		Y
34	Equipment tested and results recorded		Y

Technologist: Glen McMahon Date: 24-Oct-13

Details / Comments
Tower covered in vines
Snow fence used as anti climb barier
Propane tank on site
Manual start generator and transfer switch
No grounding system.

Figure 41: Ompah Physical site inspection report

Physical site inspection: Checklist

Customer: North Frontenac Location: Ompah

#	Item to be checked	Pictures	Y/N
1	Complete site diagram	Y	Y
2	Complete tower diagram	Y	Y
3	Physical condition of shelter exterior in good condition.	Y	Y
4	Physical condition of shelter interior in good condition.	Y	Y
5	Common ground system installed.	Y	Y
6	Physical condition of bonded joints.	Y	Y
7	Tower ground bar (TGB) available	Y	N
8	TGB bonded to common grounding system	Y	N
9	External ground bar (EGB) / bus available	Y	N
10	EGB bonded to common grounding system	Y	N
11	Internal ground bar(s) (IGB) available	Y	N
12	IGB bonded to common grounding system	Y	N
13	Internal perimeter ground bus available	Y	N
14	IPGB bonded to common grounding system	Y	N
15	Incoming cables bonded to EGB.	Y	N
16	Racks bonded to IGB	Y	N
17	Cabinets bonded to IGB	Y	N
18	Equipment bonded to IGB	Y	N
19	Surge protection devices installed on main power circuit.	Y	N
20	Surge protection devices installed on RF cables	Y	N
21	Surge protection devices installed on Telco circuits	Y	Y
22	Surge protection devices installed on data circuits	Y	N/A
23	Sufficient mains power available (Service rating)	Y	Y
24	Neutral - ground bonding done in AC load center	Y	Y
25	AC load center bonded to common ground	Y	Y
26	Additional outlets available	Y	Y
27	Auto start generator power available	Y	N
28	UPS power available	Y	Y
29	Ventilation system installed and working	Y	Y
30	Tower lighting system installed and working	Y	N
31	Antenna combining system in place	Y	Y
32	Antenna combining system tested and recorded if present	Y	Y
33	Antenna system swept and IA done.	Y	Y
34	Equipment tested and results recorded	Y	Y

Technologist: Glen McMahon Date: 25-Oct-13

Details / Comments
Physical condition of bonded joints is poor
6.2 Ohm on ground. 1 Ohm is the norm.
Battery backup present 12 V 26 A/H (12260D)
Floor is not covered, bare OSB sheets only.
Building has buckled the door frame as it has settled. Door can no longer be locked

Figure 42: Gore rd. Physical site inspection report

Physical site inspection: Checklist

Customer: Frontenac Islands **Location:** Gore Road Kingston

#	Item to be checked	Pictures	Y/N
1	Complete site diagram	Y	Y
2	Complete tower diagram	Y	Y
3	Physical condition of shelter exterior in good condition.	Y	Y
4	Physical condition of shelter interior in good condition.	Y	Y
5	Common ground system installed.	Y	50/50
6	Physical condition of bonded joints.	Y	Y
7	Tower ground bar (TGB) available	Y	N
8	TGB bonded to common grounding system	Y	N
9	External ground bar (EGB) / bus available	Y	N
10	EGB bonded to common grounding system	Y	N
11	Internal ground bar(s) (IGB) available	Y	N
12	IGB bonded to common grounding system	Y	N
13	Internal perimeter ground bus available	Y	N
14	IPGB bonded to common grounding system	N/A	N
15	Incoming cables bonded to EGB.	N/A	N
16	Racks bonded to IGB	N/A	N
17	Cabinets bonded to IGB	N/A	N
18	Equipment bonded to IGB	N/A	N
19	Surge protection devices installed on main power circuit.	Y	N
20	Surge protection devices installed on RF cables	Y	Y
21	Surge protection devices installed on Telco circuits	Y	Y
22	Surge protection devices installed on data circuits	Y	Y
23	Sufficient mains power available (Service rating)	Y	Y
24	Neutral - ground bonding done in AC load center	N/A	N
25	AC load center bonded to common ground	N/A	N
26	Additional outlets available	Y	Y
27	Auto start generator power available	N/A	N
28	UPS power available	Y	Y
29	Ventilation system installed and working	Y	Y
30	Tower lighting system installed and working	Y	Y
31	Antenna combining system in place	Y	Y
32	Antenna combining system tested and recorded if present	Y	Y
33	Antenna system swept and IA done.	N/A	Y
34	Equipment tested and results recorded	N/A	Y

Technologist: Glen McMahon / Clint Dare **Date:** 11-Nov-13

Details / Comments
Physical condition of bonded joints is poor
100 A service available

2. Appendix B: Original Base station inspection reports.

Figure 43: Central Frontenac Fire base station test report Mountain Grove.

Base station test report

Customer:	Central Frontenac	Location:	Mountain Grove
Station:	Fire	Technologist:	James Parsons
Comm. Set:	HP8920A	Analyzer:	Anritsu S362E
Comm set Serial #	3430A01167	Analyzer Serial #	1125179
Cal date :	22-Oct-12	Cal date :	6 Aug 1013
TIM set:	N/A	In line power meter	Bird 43
TIM set Serial #		ILPM Serial #	294744
Cal date :		Cal date :	None
Make	Motorola	ESN	780THU0707
Model	GR1225	Chassis	780THU0708
Accessories		Accessories	
Read database:	Yes		
Rx frequency	159.1500	MHz	
CTCSS / DCS frequency	146.2	Hz	
Rx Open	-118.6	dBm. Direct to Rx port	
Rx Close	-119.6	dBm. Direct to Rx port	
12 dB SINAD	-117.8	dBm. Direct to Rx port	
12 dB SINAD	-114.9	dBm. Direct to Ant port	
Insertion loss	2.9	dB	
12 dB SINAD	-73.1	dBm. 40 dB pad, 50 Ω load	
12 dB SINAD	-72.3	dBm. 40 dB pad, antenna	
Effective Rx sensitivity	-113.6	dBm.	
12 dB SINAD with own Tx active.	-72.1	dBm. 40 dB pad, antenna	
Desense due to own transmitter	0.3	dB	
12 dB SINAD with all Tx active.	-72.1	dBm. 40 dB pad, antenna	
Desense due to all transmitters	0.3	dB	
Tx frequency	154.6500	MHz	
Frequency error	262	Hz	
CTCSS / DCS frequency	146.1	Hz	
Forward power: PA port Comms.	45.5	Watt	46.6 dBm
Forward power: PA port ILPM	45.0	Watt	46.5 dBm
In line Power meter variance	-1	%	
Reverse power: PA port	0.8	Watt	29.0 dBm
VSWR 1:	1.15		

Base station test report: Page 2 of 3

Forward power: Ant port	21.0	Watt	43.2	dBm
Reverse power: Ant port	0.1	Watt	20.0	dBm
VSWR	1.07			
Insertion loss	3.4			

Transmitter deviation response to receiver input at stated level

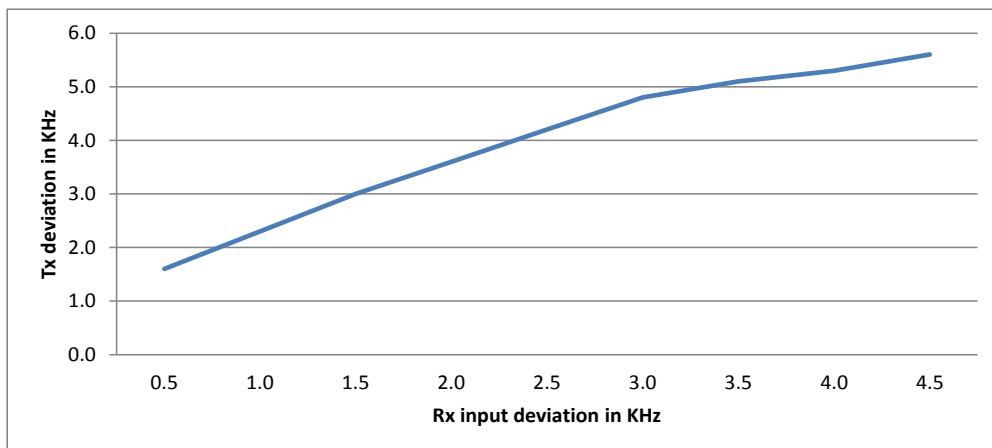
60% Tx deviation	4.20	KHz @ 60% Rx input
Max Tx deviation	5.50	KHz @ 5 KHz Rx input
Tx CTCSS / DCS deviation	500	Hz

Rx input Dev

0.5	KHz
1.0	KHz
1.5	KHz
2.0	KHz
2.5	KHz
3.0	KHz
3.5	KHz
4.0	KHz
4.5	KHz
5.0	KHz

Tx output Dev

0.9	KHz
1.6	KHz
2.3	KHz
3.0	KHz
3.6	KHz
4.2	KHz
4.8	KHz
5.1	KHz
5.3	KHz
5.6	KHz



Base station test report: Page 3 of 3

Transmitter frequency response to receiver input at stated level

Rx input Freq.		Tx output Dev	
300	Hz	2.4	KHz
400	Hz	3.3	KHz
500	Hz	3.9	KHz
600	Hz	4.1	KHz
700	Hz	4.2	KHz
800	Hz	4.1	KHz
900	Hz	4.1	KHz
1000	Hz	4.1	KHz
1250	Hz	4.1	KHz
1500	Hz	3.9	KHz
1750	Hz	3.8	KHz
2000	Hz	3.6	KHz
2250	Hz	3.6	KHz
2500	Hz	3.6	KHz
2750	Hz	3.2	KHz
3000	Hz	2.8	KHz

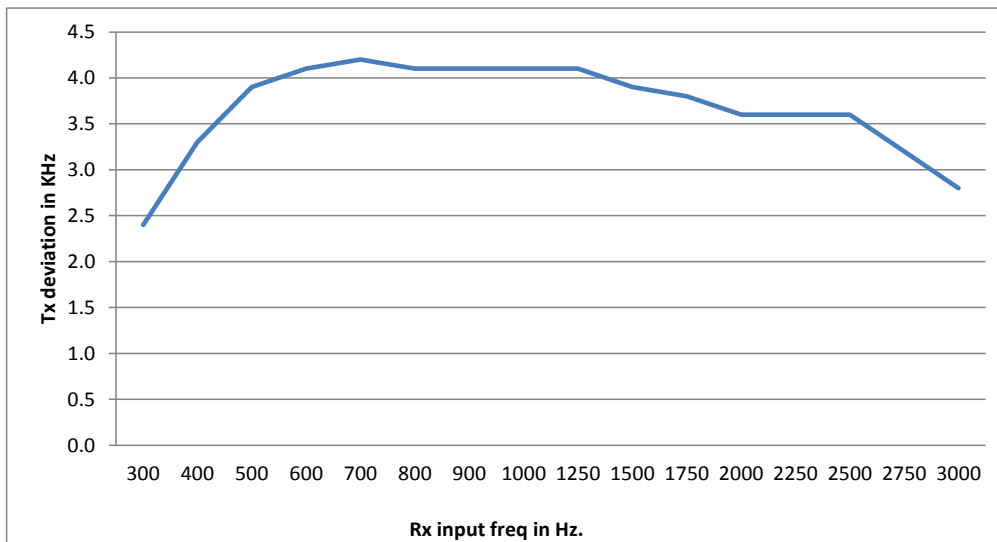


Figure 44: Central Frontenac Public Works base station test report Mountain Grove.

Base station test report: Page 1 of 3

Customer:	Central Frontenac	Location:	Mountain Grove
Station:	Public works	Technologist:	James Parsons
Comm. Set:	HP8920A	Analyzer:	Anritsu S362E
Comm set Serial #	3430A01167	Analyzer Serial #	1125179
Cal date :	22-Oct-12	Cal date :	6 Aug 1013
TIM set:	N/A	In line power meter	Bird 43
TIM set Serial #		ILPM Serial #	294744
Cal date :		Cal date :	None
Make	Motorola	ESN	780THU0624
Model	GR1225	Chassis	780THU0624
Accessories		Accessories	
Read database:	Yes		
Rx frequency	158.2500	MHz	
CTCSS / DCS frequency	114.8	Hz	
Rx Open	-117.8	dBm. Direct to Rx port	
Rx Close	-118.9	dBm. Direct to Rx port	
12 dB SINAD	-117.8	dBm. Direct to Rx port	
12 dB SINAD	-114.4	dBm. Direct to Ant port	
Insertion loss	3.4	dB	
12 dB SINAD	-73.5	dBm. 40 dB pad, 50 Ω load	
12 dB SINAD	-72.3	dBm. 40 dB pad, antenna	
Effective Rx sensitivity	-112.5	dBm.	
12 dB SINAD with own Tx active.	-72.3	dBm. 40 dB pad, antenna	
Desense due to own transmitter	0.0	dB	
12 dB SINAD with all Tx active.	-72.3	dBm. 40 dB pad, antenna	
Desense due to all transmitters	0.0	dB	
Tx frequency	153.0800	MHz	
Frequency error	72	Hz	
CTCSS / DCS frequency	114.8	Hz	
Forward power: PA port Comms.	43.0	Watt	46.3 dBm
Forward power: PA port ILPM	42.0	Watt	46.2 dBm
In line Power meter variance	-2	%	
Reverse power: PA port	1.0	Watt	30.0 dBm
VSWR 1:	1.18		

Reverse power: Ant port

0.2

 Watt

23.0

 dBm
 VSWR

1.12

 Insertion loss

3.8

Transmitter deviation response to receiver input at stated level

60% Tx deviation

3.00

 KHz @ 60% Rx input
 Max Tx deviation

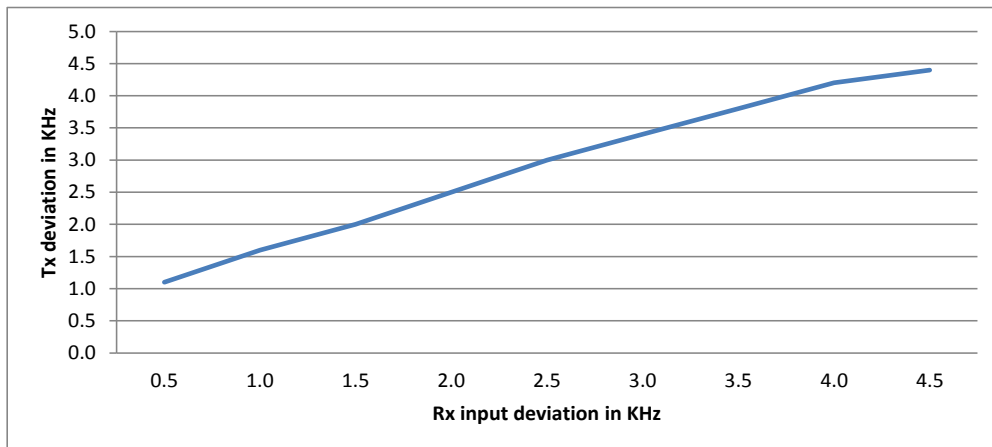
4.40

 KHz @ 5 KHz Rx input
 Tx CTCSS / DCS deviation

607

 Hz

Rx input Dev	Tx output Dev	
0.5 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">0.6</td></tr></table> KHz	0.6
0.6		
1.0 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">1.1</td></tr></table> KHz	1.1
1.1		
1.5 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">1.6</td></tr></table> KHz	1.6
1.6		
2.0 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">2.0</td></tr></table> KHz	2.0
2.0		
2.5 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">2.5</td></tr></table> KHz	2.5
2.5		
3.0 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">3.0</td></tr></table> KHz	3.0
3.0		
3.5 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">3.4</td></tr></table> KHz	3.4
3.4		
4.0 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">3.8</td></tr></table> KHz	3.8
3.8		
4.5 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">4.2</td></tr></table> KHz	4.2
4.2		
5.0 KHz	<table border="1" style="display: inline-table;"><tr><td style="width: 50px;">4.4</td></tr></table> KHz	4.4
4.4		



Base station test report: Page 2 of 3

Transmitter frequency response to receiver input at stated level

Rx input Freq.		Tx output Dev	
300	Hz	2.0	KHz
400	Hz	2.0	KHz
500	Hz	2.3	KHz
600	Hz	2.6	KHz
700	Hz	2.9	KHz
800	Hz	3.0	KHz
900	Hz	3.0	KHz
1000	Hz	2.9	KHz
1250	Hz	2.9	KHz
1500	Hz	2.8	KHz
1750	Hz	2.6	KHz
2000	Hz	2.5	KHz
2250	Hz	2.3	KHz
2500	Hz	2.1	KHz
2750	Hz	1.8	KHz
3000	Hz	1.5	KHz

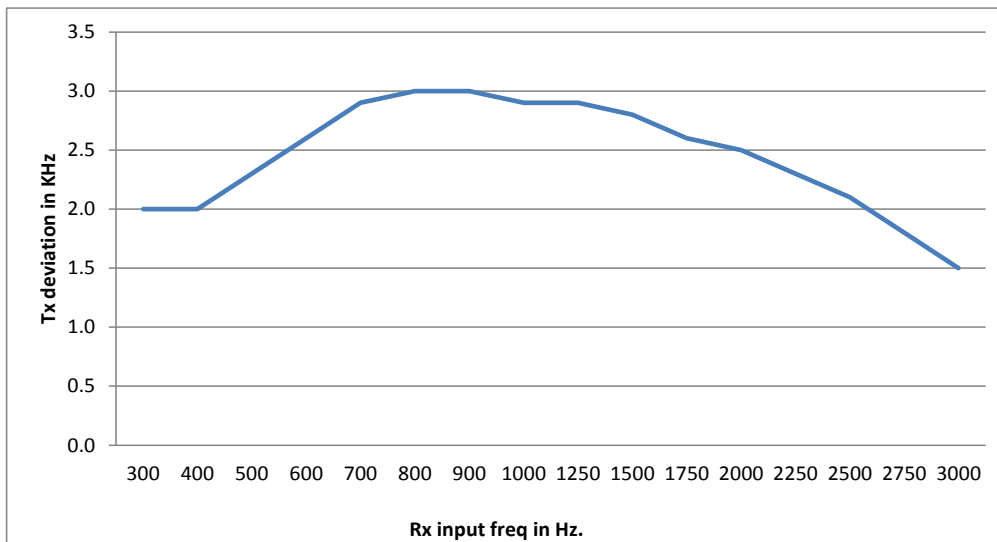


Figure 45: South Frontenac Fire services base station test report Hartington

Base station test report: Page 1 of 3

Customer:	South Frontenac	Location:	Hartington
Station:	Fire	Technologist:	James Parsons
Comm. Set:	HP8920A	Analyzer:	Anritsu S362E
Comm set Serial #	3430A01167	Analyzer Serial #	1125179
Cal date :	22-Oct-12	Cal date :	6 Aug 1013
TIM set:	N/A	In line power meter	Bird 43
TIM set Serial #		ILPM Serial #	294744
Cal date :		Cal date :	None
Make	GE	ESN	N/A
Model	Master 3	Chassis	
Accessories	Battery backup	Accessories	
Read database:	No		
Rx frequency	159.9450	MHz	
CTCSS / DCS frequency	141.3	Hz	
Rx Open	-118.6	dBm. Direct to Rx port	
Rx Close	-120.6	dBm. Direct to Rx port	
12 dB SINAD	-118.6	dBm. Direct to Rx port	
12 dB SINAD	-117.3	dBm. Direct to Ant port	
Insertion loss	1.3	dB	
12 dB SINAD	-75.1	dBm. 40 dB pad, 50 Ω load	
12 dB SINAD	-71.3	dBm. 40 dB pad, antenna	
Effective Rx sensitivity	-111.4	dBm.	
12 dB SINAD with own Tx active.	-71.3	dBm. 40 dB pad, antenna	
Desense due to own transmitter	0.0	dB	
12 dB SINAD with all Tx active.	-71.3	dBm. 40 dB pad, antenna	
Desense due to all transmitters	0.0	dB	
Tx frequency	154.8000	MHz	
Frequency error	27	Hz	
CTCSS / DCS frequency	141.0	Hz	
Forward power: PA port Comms.	104.0	Watt	50.2 dBm
Forward power: PA port ILPM	100.0	Watt	50.0 dBm
In line Power meter variance	-4	%	
Reverse power: PA port	0.8	Watt	29.0 dBm
VSWR 1:	1.10		

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Forward power: Ant port	70.0	Watt	48.5	dBm
Reverse power: Ant port	1.5	Watt	31.8	dBm
VSWR	1.17			
Insertion loss	1.7			

Transmitter deviation response to receiver input at stated level

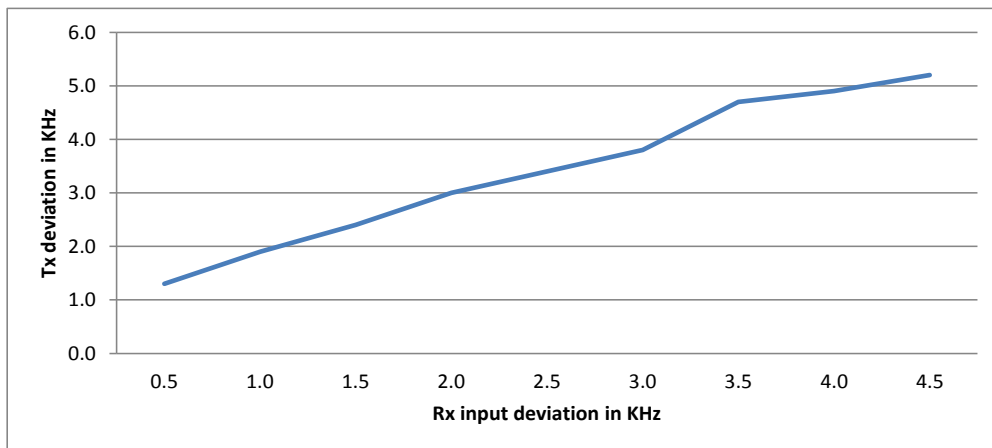
60% Tx deviation	3.40	KHz @ 60% Rx input
Max Tx deviation	5.30	KHz @ 5 KHz Rx input
Tx CTCSS / DCS deviation	700	Hz

Rx input Dev

0.5	KHz
1.0	KHz
1.5	KHz
2.0	KHz
2.5	KHz
3.0	KHz
3.5	KHz
4.0	KHz
4.5	KHz
5.0	KHz

Tx output Dev

0.8	KHz
1.3	KHz
1.9	KHz
2.4	KHz
3.0	KHz
3.4	KHz
3.8	KHz
4.7	KHz
4.9	KHz
5.2	KHz



Base station test report: Page 3 of 3

Transmitter frequency response to receiver input at stated level

Rx input Freq.		Tx output Dev	
300	Hz	2.8	KHz
400	Hz	2.9	KHz
500	Hz	3.1	KHz
600	Hz	3.4	KHz
700	Hz	3.6	KHz
800	Hz	3.5	KHz
900	Hz	3.3	KHz
1000	Hz	3.4	KHz
1250	Hz	3.5	KHz
1500	Hz	3.5	KHz
1750	Hz	3.5	KHz
2000	Hz	3.2	KHz
2250	Hz	3.0	KHz
2500	Hz	2.8	KHz
2750	Hz	2.6	KHz
3000	Hz	2.4	KHz

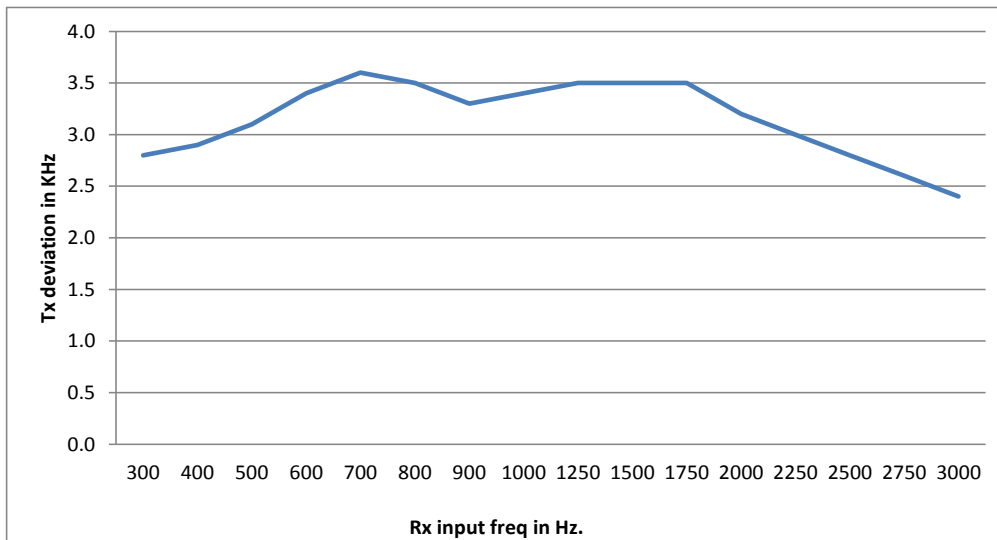


Figure 46: South Frontenac Public works base station test report Hartington

Base station test report: Page 1 of 3

Customer:	South Frontenac	Location:	Hartington
Station:	Public Works	Technologist:	James Parsons
Comm. Set:	HP8920A	Analyzer:	Anritsu S362E
Comm set Serial #	3430A01167	Analyzer Serial #	1125179
Cal date :	22-Oct-12	Cal date :	6 Aug 1013
TIM set:	N/A	In line power meter	Bird 43
TIM set Serial #		ILPM Serial #	294744
Cal date :		Cal date :	None
Make	GE	ESN	
Model	Master 3	Chassis	
Accessories		Accessories	

Read database: No

Rx frequency	169.2000	MHz
CTCSS / DCS frequency	118.8	Hz
Rx Open	-121.0	dBm. Direct to Rx port
Rx Close	-122.1	dBm. Direct to Rx port
12 dB SINAD	-117.2	dBm. Direct to Rx port
12 dB SINAD	-110.8	dBm. Direct to Ant port
Insertion loss	6.4	dB
12 dB SINAD	-66.4	dBm. 40 dB pad, 50 Ω load
12 dB SINAD	-64.5	dBm. 40 dB pad, antenna
Effective Rx sensitivity	-107.6	dBm.
12 dB SINAD with own Tx active.	-64.5	dBm. 40 dB pad, antenna
Desense due to own transmitter	0.0	dB
12 dB SINAD with all Tx active.	-64.5	dBm. 40 dB pad, antenna
Desense due to all transmitters	0.0	dB

Tx frequency	169.7400	MHz	
Frequency error	52	Hz	
CTCSS / DCS frequency	118.7	Hz	
Forward power: PA port Comms.	43.7	Watt	46.4 dBm
Forward power: PA port ILPM	44.0	Watt	46.4 dBm
In line Power meter variance	1	%	
Reverse power: PA port	2.0	Watt	33.0 dBm
VSWR 1:	1.27		

Base station test report: Page 2 of 3

Forward power: Ant port	24.7	Watt	43.9	dBm
Reverse power: Ant port	0.2	Watt	23.0	dBm
VSWR	1.10			
Insertion loss	2.5			

Transmitter deviation response to receiver input at stated level

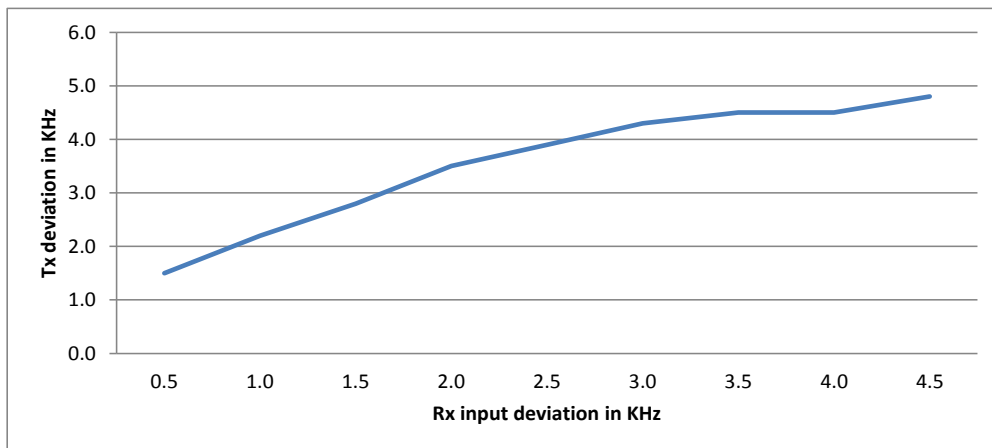
60% Tx deviation	4.00	KHz @ 60% Rx input
Max Tx deviation	4.80	KHz @ 5 KHz Rx input
Tx CTCSS / DCS deviation	645	Hz

Rx input Dev

0.5	KHz
1.0	KHz
1.5	KHz
2.0	KHz
2.5	KHz
3.0	KHz
3.5	KHz
4.0	KHz
4.5	KHz
5.0	KHz

Tx output Dev

0.9	KHz
1.5	KHz
2.2	KHz
2.8	KHz
3.5	KHz
3.9	KHz
4.3	KHz
4.5	KHz
4.5	KHz
4.8	KHz



Base station test report: Page 3 of 3

Transmitter frequency response to receiver input at stated level

Rx input Freq.		Tx output Dev	
300	Hz	4.0	KHz
400	Hz	4.3	KHz
500	Hz	3.7	KHz
600	Hz	3.9	KHz
700	Hz	4.1	KHz
800	Hz	3.9	KHz
900	Hz	3.9	KHz
1000	Hz	4.0	KHz
1250	Hz	3.9	KHz
1500	Hz	3.7	KHz
1750	Hz	3.5	KHz
2000	Hz	3.4	KHz
2250	Hz	3.2	KHz
2500	Hz	3.0	KHz
2750	Hz	2.8	KHz
3000	Hz	2.6	KHz

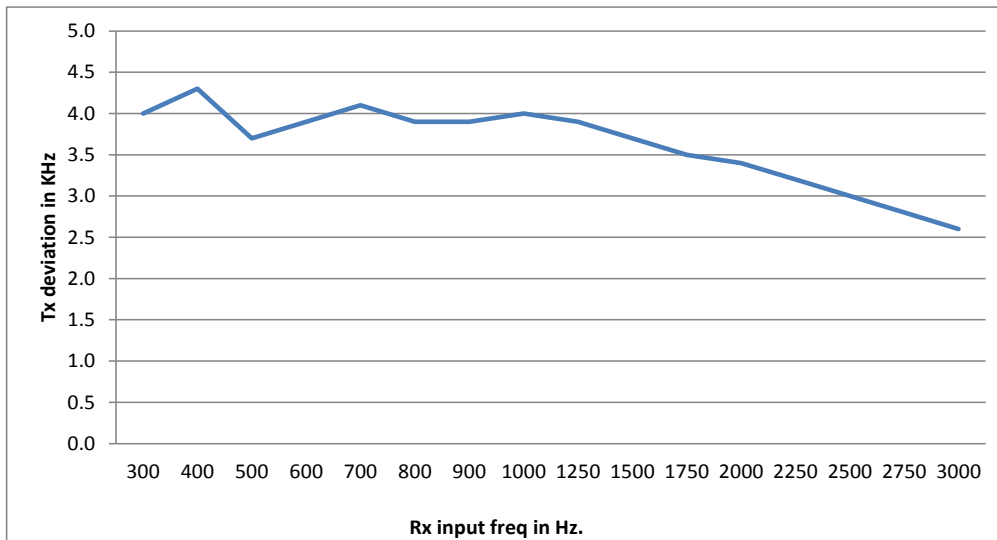


Figure 47: South Frontenac Fire services base station test report Burrige

Base station test report: Page 1 of 3

Customer:	South Frontenac	Location:	Burrige
Station:	Fire	Technologist:	James Parsons
Comm. Set:	HP8920A	Analyzer:	Anritsu S362E
Comm set Serial #	3430A01167	Analyzer Serial #	1125179
Cal date :	22-Oct-12	Cal date :	6 Aug 1013
TIM set:	N/A	In line power meter	Bird 43
TIM set Serial #		ILPM Serial #	294744
Cal date :		Cal date :	None
Make	GE	ESN	N/A
Model	Master 3	Chassis	
Accessories	Battery backup	Accessories	
Read database:	No		
Rx frequency	159.9450	MHz	
CTCSS / DCS frequency	141.3	Hz	
Rx Open	-110.7	dBm. Direct to Rx port	
Rx Close	-112.6	dBm. Direct to Rx port	
12 dB SINAD	-111.1	dBm. Direct to Rx port	
12 dB SINAD	-110.9	dBm. Direct to Ant port	
Insertion loss	0.2	dB	
12 dB SINAD	-74.4	dBm. 40 dB pad, 50 Ω load	
12 dB SINAD	-72.3	dBm. 40 dB pad, antenna	
Effective Rx sensitivity	-107.8	dBm.	
12 dB SINAD with own Tx active.	-72.3	dBm. 40 dB pad, antenna	
Desense due to own transmitter	0.0	dB	
12 dB SINAD with all Tx active.	N/A	dBm. 40 dB pad, antenna	
Desense due to all transmitters	N/A	dB	
Tx frequency	154.8000	MHz	
Frequency error	92	Hz	
CTCSS / DCS frequency	141.1	Hz	
Forward power: PA port Comms.	106.4	Watt	50.3 dBm
Forward power: PA port ILPM	100.0	Watt	50.0 dBm
In line Power meter variance	-6	%	
Reverse power: PA port	1.0	Watt	30.0 dBm
VSWR 1:	1.11		

Base station test report: Page 2 of 3

Forward power: Ant port	100.0	Watt	50.0	dBm
Reverse power: Ant port	1.0	Watt	30.0	dBm
VSWR	1.11			
Insertion loss	0.3			

Transmitter deviation response to receiver input at stated level

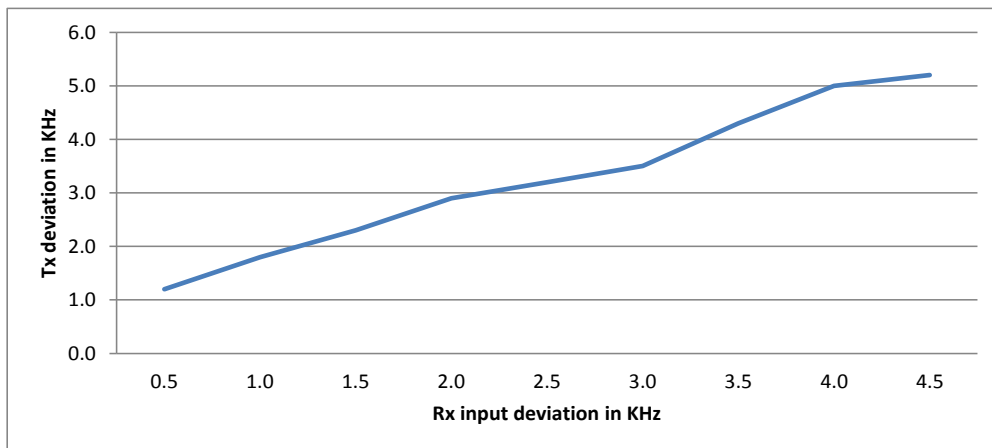
60% Tx deviation	3.40	KHz @ 60% Rx input
Max Tx deviation	5.20	KHz @ 5 KHz Rx input
Tx CTCSS / DCS deviation	500	Hz

Rx input Dev

0.5	KHz
1.0	KHz
1.5	KHz
2.0	KHz
2.5	KHz
3.0	KHz
3.5	KHz
4.0	KHz
4.5	KHz
5.0	KHz

Tx output Dev

0.7	KHz
1.2	KHz
1.8	KHz
2.3	KHz
2.9	KHz
3.2	KHz
3.5	KHz
4.3	KHz
5.0	KHz
5.2	KHz



Base station test report: Page 3 of 3

Transmitter frequency response to receiver input at stated level

Rx input Freq.	Tx output Dev
300 Hz	0.8 KHz
400 Hz	3.1 KHz
500 Hz	3.0 KHz
600 Hz	3.2 KHz
700 Hz	3.2 KHz
800 Hz	3.0 KHz
900 Hz	3.2 KHz
1000 Hz	3.2 KHz
1250 Hz	3.3 KHz
1500 Hz	3.2 KHz
1750 Hz	3.1 KHz
2000 Hz	3.0 KHz
2250 Hz	2.9 KHz
2500 Hz	2.7 KHz
2750 Hz	2.4 KHz
3000 Hz	2.2 KHz

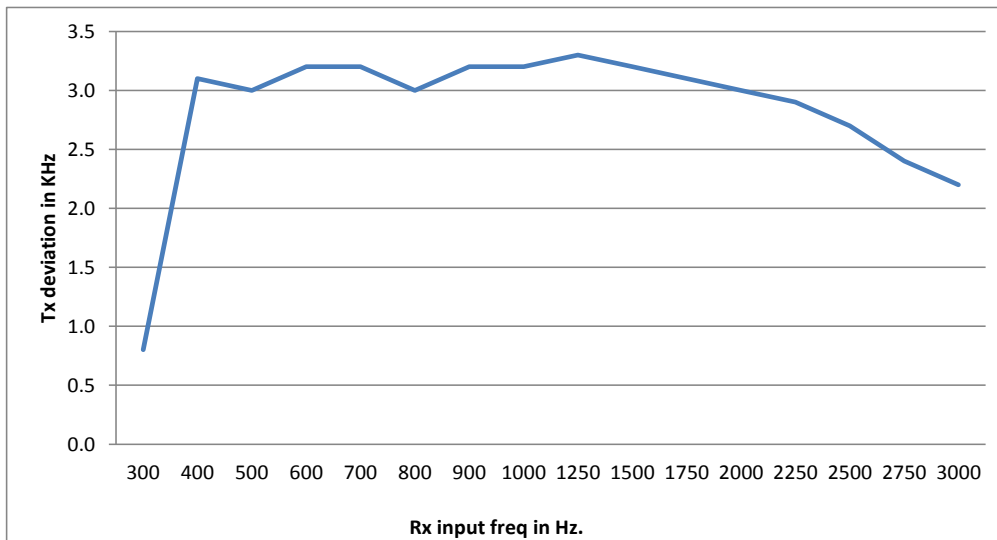


Figure 48: North Frontenac Fire services base station test report Ompah

Base station test report: Page 1 of 3

Customer:	North Frontenac	Location:	Ompah
Station:	Fire	Technologist:	James Parsons
Comm. Set:	HP8920A	Analyzer:	Anritsu S362E
Comm set Serial #	3430A01167	Analyzer Serial #	1125179
Cal date :	22-Oct-12	Cal date :	6 Aug 1013
TIM set:	N/A	In line power meter	Bird 43
TIM set Serial #		ILPM Serial #	294744
Cal date :		Cal date :	None
Make	Kenwood	ESN	B0C0055
Model	NXR-700	Chassis	B0C0055
Accessories	Zetron DAPT 32 Jnr	Accessories	
Read database:	No		
Rx frequency	159.2850	MHz	
CTCSS / DCS frequency	123.0	Hz	
Rx Open	-121.2	dBm. Direct to Rx port	
Rx Close	-122.8	dBm. Direct to Rx port	
12 dB SINAD	-118.4	dBm. Direct to Rx port	
12 dB SINAD	-115.5	dBm. Direct to Ant port	
Insertion loss	2.9	dB	
12 dB SINAD	-70.8	dBm. 40 dB pad, 50 Ω load	
12 dB SINAD	-70.7	dBm. 40 dB pad, antenna	
Effective Rx sensitivity	-115.3	dBm.	
12 dB SINAD with own Tx active.	-70.7	dBm. 40 dB pad, antenna	
Desense due to own transmitter	0.0	dB	
12 dB SINAD with all Tx active.	N/A	dBm. 40 dB pad, antenna	
Desense due to all transmitters	N/A	dB	
Tx frequency	154.2800	MHz	
Frequency error	57	Hz	
CTCSS / DCS frequency	122.8	Hz	
Forward power: PA port Comms.	108.2	Watt	50.3 dBm
Forward power: PA port ILPM	101.0	Watt	50.0 dBm
In line Power meter variance	-7	%	
Reverse power: PA port	3.0	Watt	34.8 dBm
VSWR 1:	1.20		

Base station test report: Page 2 of 3

Forward power: Ant port	62.0	Watt	47.9	dBm
Reverse power: Ant port	1.5	Watt	31.8	dBm
VSWR	1.18			
Insertion loss	2.4			

Transmitter deviation response to receiver input at stated level

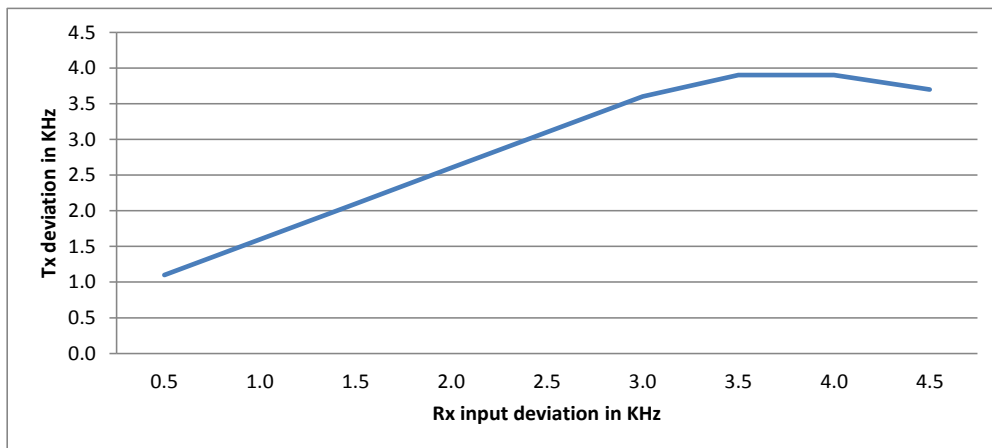
60% Tx deviation	3.10	KHz @ 60% Rx input
Max Tx deviation	3.80	KHz @ 5 KHz Rx input
Tx CTCSS / DCS deviation	630	Hz

Rx input Dev

0.5	KHz
1.0	KHz
1.5	KHz
2.0	KHz
2.5	KHz
3.0	KHz
3.5	KHz
4.0	KHz
4.5	KHz
5.0	KHz

Tx output Dev

0.6	KHz
1.1	KHz
1.6	KHz
2.1	KHz
2.6	KHz
3.1	KHz
3.6	KHz
3.9	KHz
3.9	KHz
3.7	KHz



Base station test report: Page 3 of 3

Transmitter frequency response to receiver input at stated level

Rx input Freq.		Tx output Dev	
300	Hz	2.0	KHz
400	Hz	2.7	KHz
500	Hz	2.9	KHz
600	Hz	2.9	KHz
700	Hz	3.0	KHz
800	Hz	3.1	KHz
900	Hz	3.1	KHz
1000	Hz	3.1	KHz
1250	Hz	3.1	KHz
1500	Hz	3.0	KHz
1750	Hz	3.0	KHz
2000	Hz	3.0	KHz
2250	Hz	3.0	KHz
2500	Hz	3.0	KHz
2750	Hz	3.0	KHz
3000	Hz	2.9	KHz

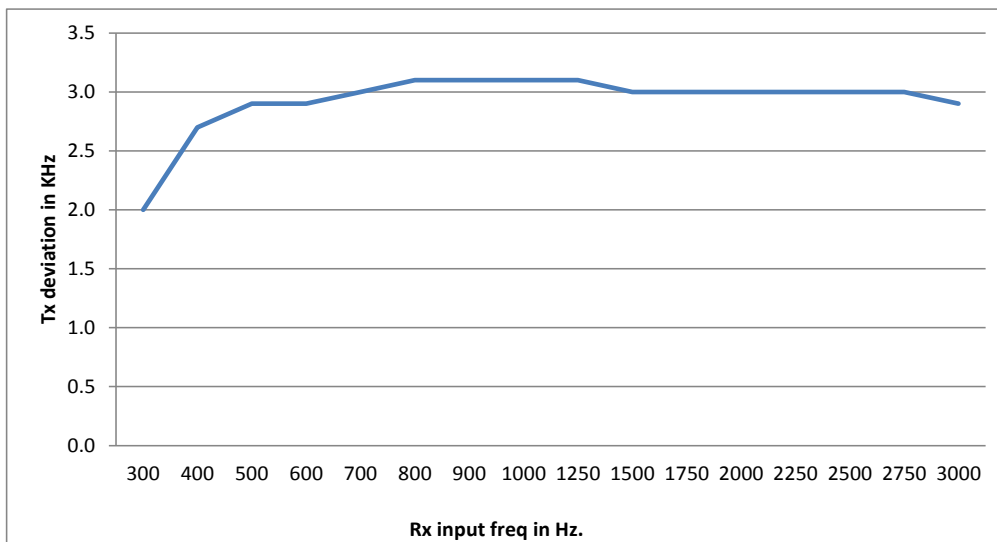


Figure 49: Frontenac Islands Base station test report Gore Rd.

Base station test report: Page 1 of 2

Customer:	Frontenac Islands	Location:	Gore Road Kingston
Station:	Fire	Technologist:	James Parsons
Comm. Set:	HP8920A	Analyzer:	Anritsu S362E
Comm set Serial #	3430A01167	Analyzer Serial #	1125179
Cal date :	22-Oct-12	Cal date :	6 Aug 1013
TIM set:	N/A	In line power meter	Bird 43
TIM set Serial #		ILPM Serial #	294744
Cal date :		Cal date :	None
Make	Tait	ESN	
Model	TB8100	Chassis	
Accessories	ICT Power supply	Accessories	

Read database: Yes

Rx frequency	153.8600	MHz
CTCSS / DCS frequency	N/A	Hz
Rx Open	-118.0	dBm. Direct to Rx port
Rx Close	-119.0	dBm. Direct to Rx port
12 dB SINAD	-120.0	dBm. Direct to Rx port
12 dB SINAD	-117.8	dBm. Direct to Ant port
Insertion loss	2.2	dB
12 dB SINAD	-72.3	dBm. 40 dB pad, 50 Ω load
12 dB SINAD	-66.0	dBm. 40 dB pad, antenna
Effective Rx sensitivity	-107.5	dBm.
12 dB SINAD with own Tx active.	-70.7	dBm. 40 dB pad, antenna
Desense due to own transmitter	-7.7	dB
12 dB SINAD with all Tx active.	N/A	dBm. 40 dB pad, antenna
Desense due to all transmitters	N/A	dB

Tx frequency	153.8600	MHz	
Frequency error	86	Hz	
CTCSS / DCS frequency	N/A	Hz	
Forward power: PA port Comms.	44.1	Watt	46.4 dBm
Forward power: PA port ILPM	44.0	Watt	46.4 dBm
In line Power meter variance	0	%	
Reverse power: PA port	0.1	Watt	20.0 dBm
VSWR 1:	1.05		

Base station test report: Page 2 of 2

Forward power: Ant port	29.6	Watt	44.7	dBm
Reverse power: Ant port	0.1	Watt	20.0	dBm
VSWR	1.06			
Insertion loss	1.7			

Transmitter deviation response to receiver input at stated level

60% Tx deviation	N/A	KHz @ 60% Rx input
Max Tx deviation	4.40	KHz @ 5 KHz Rx input
Tx CTCSS / DCS deviation	N/A	Hz