Standard for multi-jurisdictional radio interoperability equipment

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Standards Background Information

Operational standards are critical for any organization because they ensure a common approach to all procedures and operational practices. Standards address service delivery, administration communication methodologies and other numerous other elements that contribute to providing a common operating picture regardless of location or mission. Standards are the foundation that builds highly efficient working groups.

The MIECM utilize the British Columbia Emergency Management System (BCEMS) as the comprehensive framework that helps to ensure a common coordinated and organized approach to the management of emergencies and disasters. The radio communications sub-committee (MIERCT) directly supports the MIECM driven (BCEMS) processes -- therefore a corresponding equipment standard should be in place for all local authority radio communications.

This document sets out a listing of ‘best in class’ communication equipment to support the MIECM mission covering both hardware and software radio applications.

MIECM members should not view equipment standards as an immediate requirement to replace existing radio communications equipment. EPCs should however, review the listed equipment with their radio coordinators in advance of any new purchases to ensure compliance with other MIECM member local governments. Purchasing equipment listed in this (standards) document ensures common equipment and operating procedures for all mutual aid personnel, which in turn, reduces start-up time normally attributed to familiarization of non-standard radio equipment. This will provide each local government access to trained volunteers in a timely manner when needed.

Selected Standard Equipment Rationale

The following communication equipment (hardware and software) is part of MIECM standard because it is both best in class (functionally) as well as being highly regarded by many other emergency communication groups. In some cases, the equipment is also the EMBC operational standard.

Note: this document has been prepared at the request of the MIECM

Hardware

This category consists of the following components:

- HF radios
- VHF / UHF portable and mobile radios
- Headphones for high-noise environment usage
- terminal node controllers or TNC
- HF, VHF, UHF and 220 MHz antennas
- Coax cable connectors and the corresponding termination process
- Lightening protection modules
- 12 volt wiring termination
- Antenna analyzer
- Automatic antenna tuner
- Commercial repeater
- Uninterruptable Power Supply (UPS)

HF radio

Kenwood TS480SAT (100w) or the TS480HX (200w)

- Full featured HF radio covering 160m through 6m
- Available in either a 100 or 200 watt version with only price difference
- TS480SAT has an internal antenna tuner, the HX-model does not have an internal antenna tuner
- In use throughout most EMBC PREOC locations
- Ease of use, menu configurable with good documentation
- Purchase from retailer in Burnaby, Calgary or Toronto

Portable and Mobile radios

Mobile radio

VERTEX VX-4600 (VHF and UHF) mobile radio for MRIP complete with TNC

- The VX4600 (VHF and UHF) radio are identical in terms of size and functionality
- Computer programed with provided software
- 512 channels that can be programmed in 32 unique groups
- Features 15-pin D-sub port on the rear of the radio allowing a TNC to be interfaced
- VHF radio is 50w TX power and UHF radio is a 45w TX power
- Radios are part of the MIECM (MRIP) package complete with KPC3+ TNC's

Portable Radio

Amateur portable radio

- Kenwood D72 **dual** band (VHF and UHF) radio with extended RX coverage
- Capable of APRS & Packet radio
- Computer programmable

Commercial portable radio

- Motorola XPR5550e VHF or UHF radio
- Computer programmable
- Tremendous feature set
- IP rated 68 (water and dust proof)

Headphones for high-noise environments

Headphones for use with Kenwood TS480SAT or TS480HX

- Numerous models available from Heil Sound depending on end-user requirements
- Headset needs an adapter for each radio
- Use of headset and foot switch (to key the radio like a PTT switch) increases operator efficiency
- Headphone boom mic and headset muffs can be sanitized
- Headset has two connectors; one for audio and the other for PTT function

Kenwood MJ-88 Mic adapter

Heil Sound 8-pin adapter for MJ-88

Foot Switch for HF radio allows operator to have both hands free

Headphones for high-noise environments

Headphones (RX-only) for use with VERTEX / Motorola commercial radios

Headphones for commercial radio use are unique and require specific attention to radio model and operational functionality. The David Clark headset Model H-3061 (shown on the right) is for a RX-only application where the radio hand microphone is used. For fixed applications, the headset complete with boom microphone (Model H10) similar to Heil unit shown above can be utilized but it is not a plug-n-play application and requires local modification to the radio.

David Clark Model H-3061

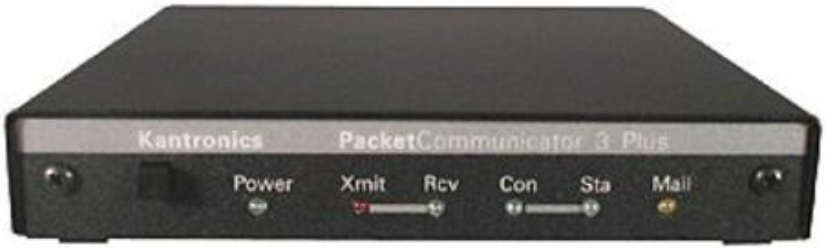
David Clark Model H10

Note: this product is only sold through authorized dealers such as RadioWorks Communications in Victoria

Terminal Node Controllers (TNC)

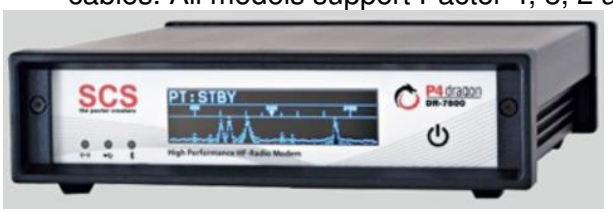
Kantronics KPC3+ Terminal Node Controller (TNC)

- Best in class device
- Current model is firmware v9.1
- Older model KPC3+ units such as v8.3 can be easily upgraded
- This product can be ordered from retailers in Burnaby, Calgary and Toronto



Modems for HF Pactor

- SCS P4Dragon DR-7400, DR-7800 and DR-7X00 modems are intended for all HF Pactor digital messaging applications and these units interface to Kenwood TS480 radios with appropriate cables. All models support Pactor 4, 3, 2 and 1 operating modes.

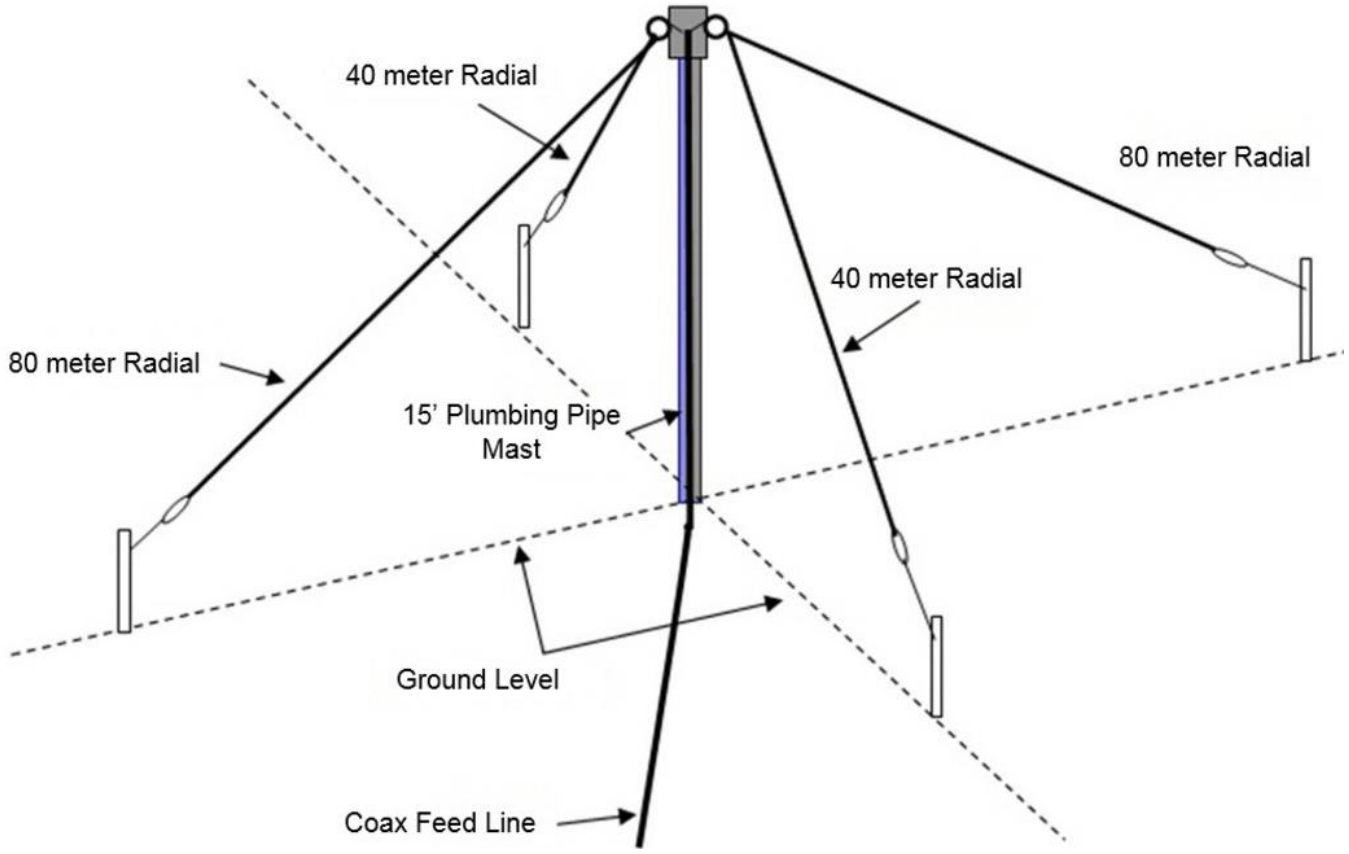


HF, VHF, UHF and 220 MHz antennas

HF antennas

- An endless list of possible configurations exist for HF antennas that support an EOC
- Selection of antenna will be driven by install location, height of support structure and desired coverage area
- The Near Vertical Incidence Skywave or NVIS antenna has its origins with the Inverted Vee design and is a very popular choice for EOC use
- Most common configurations include the Inverted Vee for 80 and 40m or dipole for each band
- Can be constructed to be tri-band design to incorporate another band such as 60 or 20m
- Best results come when HF antennas are installed in free and clear space away from power lines or other RF-noise sources

NVIS design for 80 and 40m



Centre Insulator for NVIS antenna

The Hy-Gain C-1 is a high-quality weatherproof, lightweight, high strength center insulator used for connecting coaxial feedline to a doublet-type or inverted vee antenna design. The "C-I" will designed for use with RG-213 coax cable and can be hung from a supporting mast.

VHF and UHF antennas

- Sinclair commercial grade antennas have a 20-year in-service lifespan
- Initial purchase price is high, but service life and durability ensures long-time EOC performance
- Sinclair antennas are large and depending on model, can be heavy – so should only be installed by qualified personnel
- Models can be cut for frequency specific applications or wide-band in performance

VHF

Sinclair SRL-210C4

Sinclair SRL-210C2

Sinclair SRL-210C1

UHF

Sinclair SRL-310C4

Sinclair SRL-310C1

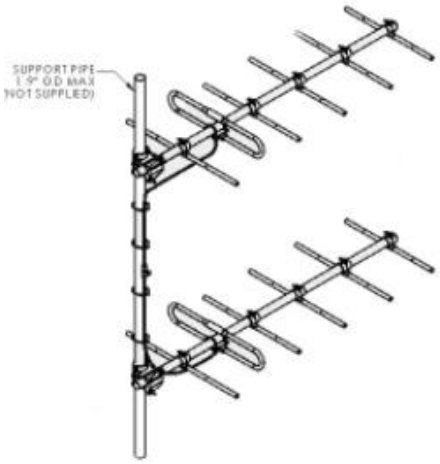
220 MHz antenna

- Limited offerings in this portion of the amateur radio spectrum
- For amateur radio gain applications, the M^2 5-element Yagi antenna is an inexpensive choice
- Sinclair has several commercial offering in a variety of operational configurations
- Initial purchase price of Sinclair antennas is high, but service life and durability ensures long-time EOC performance
- Sinclair antennas are large and depending on model, can be heavy – so should only be installed by qualified personnel
- Sinclair offers some vertical arrays, but given Omni-directional design, gain is lower than Yagi

Sinclair SY206 (217 to 225 MHz)

M^2 5-element Yagi

Sincalir SY20162 Dual array
12dB gain (217 – 225 MHz)



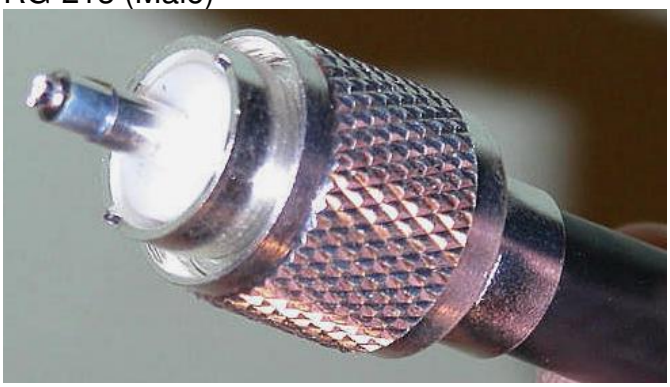
Coax cable connectors and termination process

Crimp-on Coax Connectors

Coax cable connectors are available to fit an extremely large wide variety of cable types. Regardless of cable type, good quality crimp-on connectors are required for all EOC and mobile command Centre applications. The advantages of crimp-on connectors are:

- Crimp connectors are a widely accepted industry standard
- Crimping is a repeatable process that produces a high-quality result for with each connector
- Production time is dramatically reduced in comparison to manual solder process that does not produce a consistent result
- Crimp connectors are very strong
- Crimp connectors are proven to clean up station RFI issues
- The process is a simple approach to consistency
- Initial purchase price of tools is high, but it is a one-time cost for guaranteed long-term results
- Crimp connectors are available for all cable types
- The RFI brand of crimp connectors can be sourced from Queale or Interior Electronics
- The EZ-400 series of LMR-400 connectors can be sourced from RadioWorks Communications

RG-213 (Male)



LMR-400 EZ-400 series for UHF Male

LMR-400 EZ-400 series for Type N Male

LMR-400 EZ-400 series for Type N Female

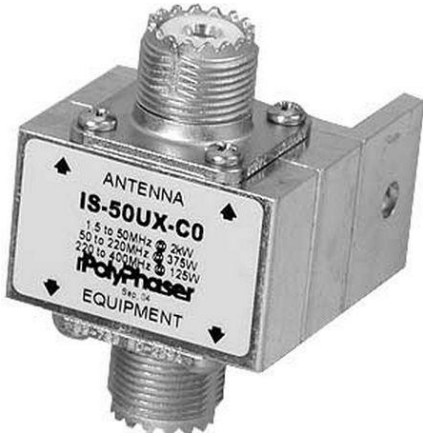
Crimp connector tools can be purchased from Queale Electronics

Stripping Tools to prepare cable for crimp connectors

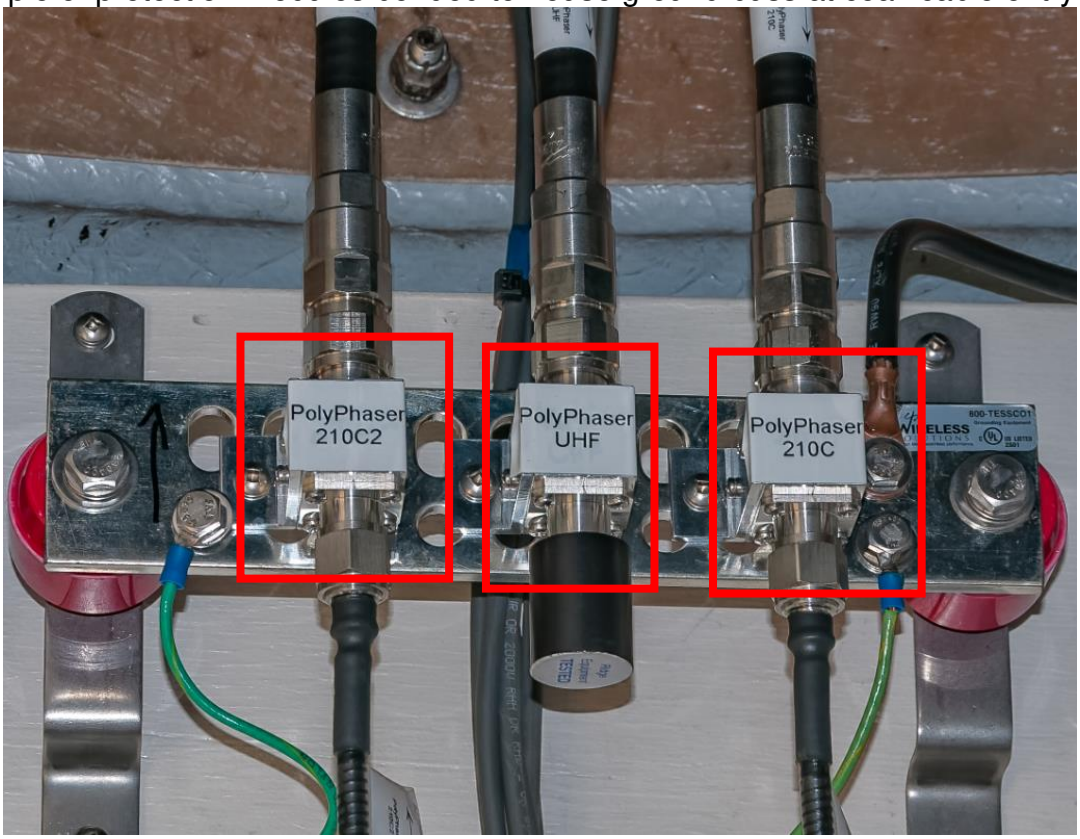
Lightning Protection Modules

Critical to every EOC antenna install is lightning protection on the coax cable feed line.

- PolyPhaser has established the industry benchmark for communication lightning protection solutions and is the most widely used product in the communications industry
- Protection model design is specific to cable connector type and frequency
- Polyphaser modules can be purchased from dealers such as RadioWorks Communications
- Must be installed inline on coax cable where cable enters structure
- Each unit is clearly labelled for connection to the antenna and equipment
- The module must be bonded to the house ground connection using #4 wire
- Each unit has a one-time use gas cartridge



Example of protection modules bonded to house ground buss at coax cable entry point

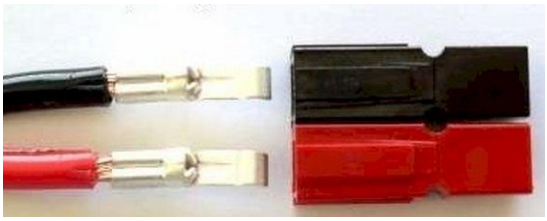


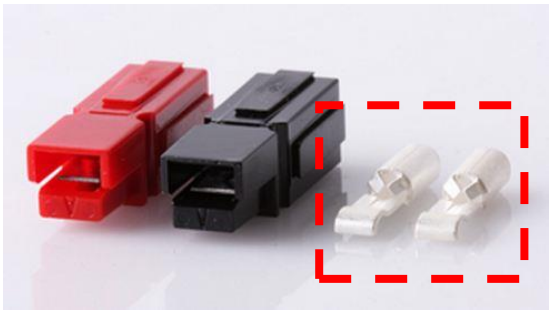
12 volt wiring termination

Anderson PowerPole (APP) DC crimp-on wiring connectors

The quality of DC (12 volt) wiring related applications for either mobile or EOC communications is an often overlooked area of concern and one that has the potential to result in equipment failure if not done properly. ECOMM organizations throughout North American and the American Radio Relay League (ARRL) have standardized on the use of the Anderson PowerPole DC wiring connectors. The connectors offer the following features and benefits:

- Genderless housings with simplified assembly that minimize the number of components
- Stackable modular housings available in four sizes to fit most applications
- Connection versatility
- Low resistance connection with silver or tin plated contacts inside housings that strongly force the contacts together
- Color coded housing help ensure that connectors are assembled and mated correctly
- Self securing design with stainless steel springs to create a robust force between the contacts that holds the connector in the mated condition, but allows it to be quickly disconnected
- For application wiring (12 through 16 gauge), **use only the 30amp APP crimp tooth** shown lower right corner of this page because it has the optimal fit to the APP housing.





Tools for making Anderson PowerPole (APP) connectors

In order to ensure the highest quality crimp product, only purchase crimping tools authorized by Anderson PowerPole (APP). Initial cost is higher than after-market or offshore made tools, but the quality of the crimp form exactly matches the interior of each APP connector. Offshore crimping tools do not consistently form the crimp inserts so they make the interior of the connector. APP tools can be purchased either from Queale Electronics or directly from APP.

12 volt termination for all Motorola radios

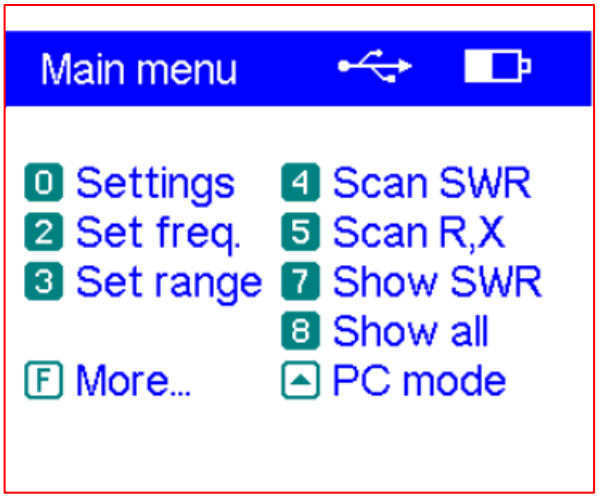
All Motorola mobile radios provide a chassis mounted 12v power connector.

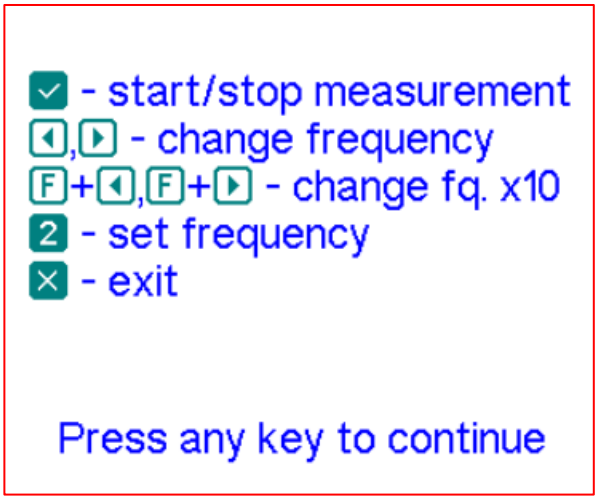
Motorola HKN4137A wiring harness for use with all Motorola radios

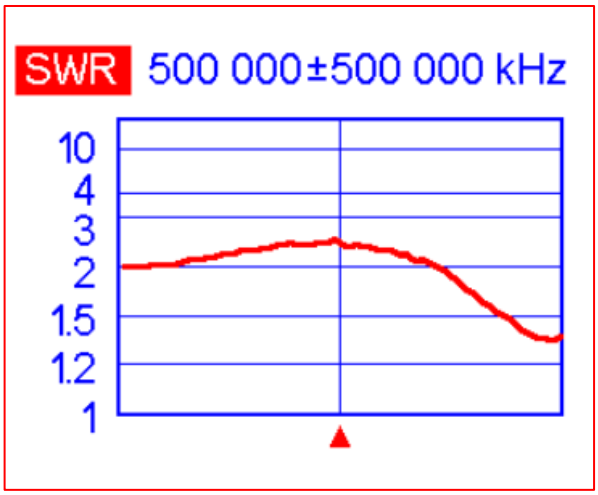
Standard Motorola wiring harness with protected 12+ terminal

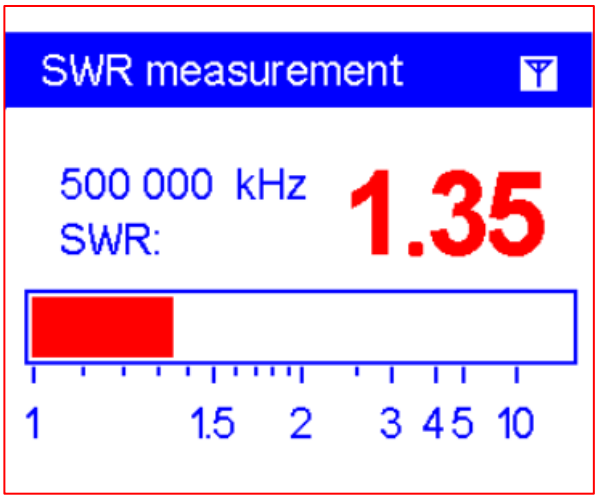
Antenna Analyzer for VHF, UHF and HF applications

- The RigExpert AA-600 is a powerful antenna analyzer designed for testing, checking, tuning or repairing antennas and antenna feedlines. It provides a graphical interface for measuring SWR (Standing Wave Ratio) and impedance, as well as a Smith / polar chart display to reduce the time required to adjust an antenna. Purchase from retailer in Burnaby, Calgary or Toronto









Automatic Antenna Tuner

If an antenna is designed for a resonant frequency, it will **not** require a tuner **unless** operation is required off the design frequency or VSWR is over 2.0:1. This is often the case when moving from the bottom to the top of the 80m band. Given the Kenwood TS-480HX (200 watts) is the MIECM HF standard; this radio will require an antenna tuner than can handle the output power level and provide a safe operating margin. Two automatic options from LDG Electronics address this operating criterion. Purchase from retailer in Burnaby, Calgary or Toronto

The **LDG AT-200ProII Autotuner** handles 250 watts

The **LDG AT-600Proll Autotuner** handles 600 watts (shown with the optional M-600 wattmeter). This package would be ideal for a station operating a smaller solid-state linear amplifier.

Commercial grade repeater

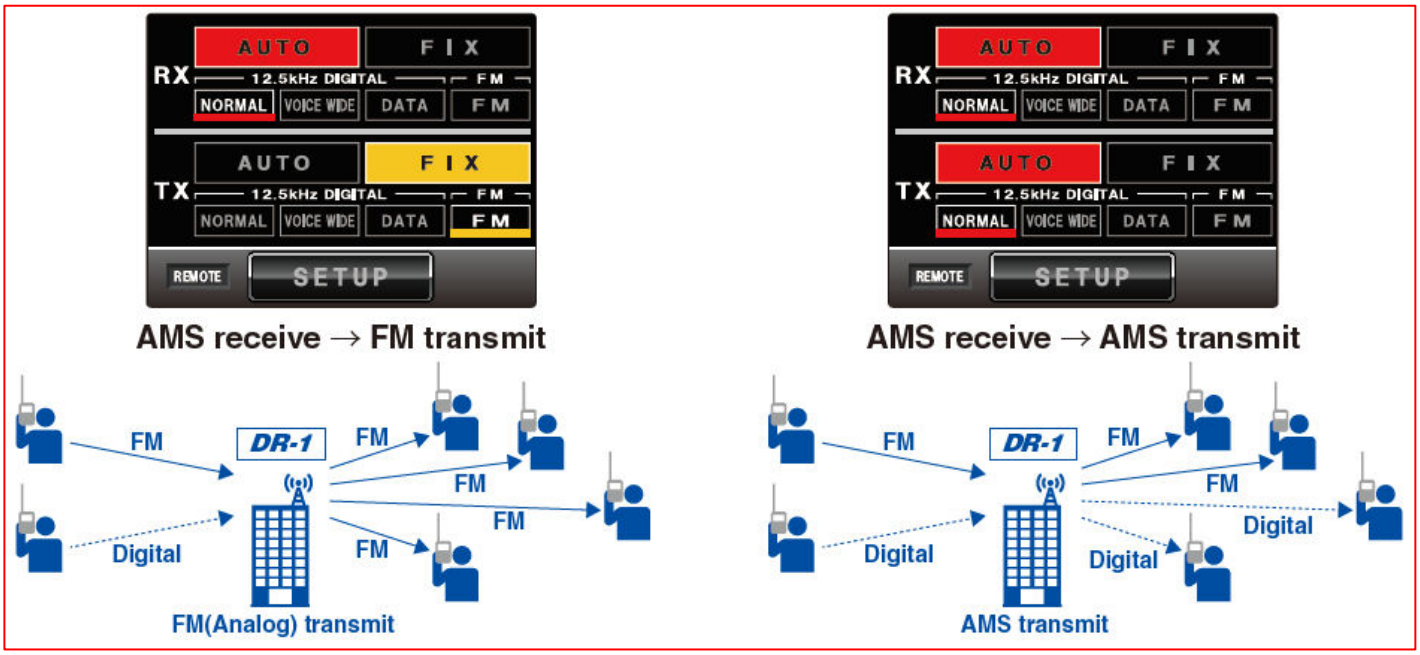
The Motorola SLR8000 repeater will provide reliable voice and data communications at a very attractive price. Covering the commercial spectrum (136 – 174 MHz and 400 – 470 MHz), this repeater could be used for both amateur and commercial applications – but not at the same time. Purchase from an authorized Motorola dealer in Victoria

Information: https://www.motorolasolutions.com/en_us/products/mototrbo-systems/infrastructure/slr-8000.html#tabproductinfo

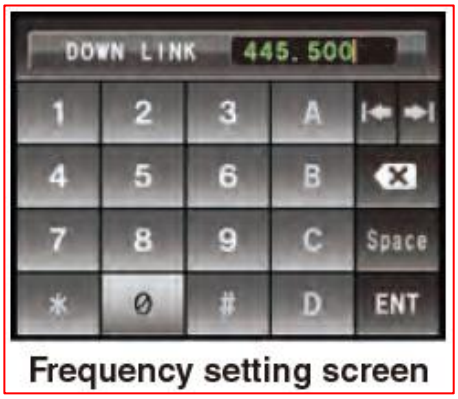
Amateur grade repeater

The YAESU DR-1 repeater is a digital / conventional FM dual mode repeater that covers the VHF and UHF amateur bands. Covering the amateur spectrum (144 – 148 MHz and 430 – 450 MHz), this repeater provides Automatic Mode Selection (AMS) allowing it to recognize a signal as C4FM digital or conventional FM.

Purchase from an authorized YAESU retailer in Burnaby, Toronto or online vendors in the USA.



Setup screen



Frequency setting screen

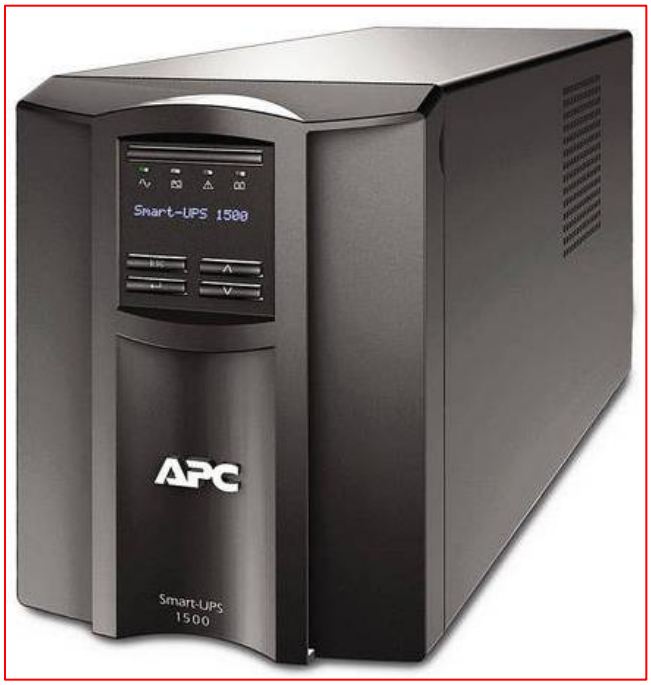
CTCSS setting screen

Uninterruptable Power Supply (UPS)

The APC Smart-UPS SMT1500 is a server grade UPS which provides an instant backup battery solution to ensure continuous power during the early stage of an outage.

This device features include:

- Active protection for electronic equipment from harmful power conditions
- Eight power / surge protected outlets, one switchable group for individual load management
- Pure sine wave output while on battery and green mode reduces power consumption
- Smart battery management for long battery life and LCD interface with intuitive navigation
- SmartSlot for using a network management card
- Available from online retailers that cater to government clients such as CDW Canada



APC Smart-UPS 1500VA LCD 120V (SMT1500) shown with
Legacy Communications SmartSlot Card

Legacy Communications SmartSlot Card for remote monitoring of power at
any location with an Internet connection

Coax Adapters

Each local jurisdiction should have the following collection of coax adapters in stock for various applications. Only purchase the best quality coax connectors and adapters such as the units shown below from the RF Industries catalog. Queale Electronics in Victoria can supply all products shown. http://www.rfcoaxconnectors.com/product-categories-adapters.html

Type N Adapters

RFN-1010-1

Double N Female to N Male
Adapter: RF
Adapter Style: T Adapter

RFN-1011-1

Triple N Female
Adapter: RF
Adapter Style: T Adapter

RFN-1012-1

N Female to N Male
Adapter: RF
Adapter Style: Right Angle Adapter

RFN-1013-1

N Female to N Female
Adapter: RF
Adapter Style: Straight Barrel Adapter

RFN-1014-1

N Male to N Male
Adapter: RF
Adapter Style: Straight Barrel Adapter

RFN-1054-AV

N Male to N Male
Adapter: RF
Adapter Style: Right Angle Adapter

RFN-1034-1

N Female to UHF Female
Adapter: RF
Adapter Style: Straight Adapter

RFN-1035-1

N Male to UHF Female
Adapter: RF
Adapter Style: Straight Adapter

RFN-1036-1

N Female to UHF Male
Adapter: RF
Adapter Style: Straight Adapter

RFN-1037-1

N Male to BNC Female
Adapter: RF
Adapter Style: Straight Adapter

RFN-1038-1

N Female to BNC Male
Adapter: RF
Adapter Style: Straight Adapter

RFN-1039-1

N Female to BNC Female
Adapter: RF
Adapter Style: Straight Adapter

UHF Adapters

RFU-532

UHF Male to UHF Female
Adapter: RF
Adapter Style: Right Angle Adapter

RFU-533

UHF Double Female to UHF Male
Adapter: RF
Adapter Style: T Adapter

RFU-534

UHF Triple Female
Adapter: RF
Adapter Style: T Adapter

RFU-536

UHF Female to UHF Female
Adapter: RF
Adapter Style: Barrel Adapter

RFU-537

UHF Female to UHF Female
Adapter: RF
Adapter Style: Bulkhead Adapter
Front Mount
With Hardware

RFU-538

UHF Male to UHF Male
Adapter: RF
Adapter Style: Barrel Adapter

RFU-545

UHF Female to BNC Female
Adapter: RF
Adapter Style: Straight Adapter

Mini UHF Adapters

RFU-620

Mini-UHF Male to N Female
Adapter: RF
Adapter Style: Straight Adapter

RFU-621

Mini-UHF Male to UHF Female
Adapter: RF
Adapter Style: Straight Adapter

RFU-622

Mini-UHF Male to BNC Female
Adapter: RF
Adapter Style: Straight Adapter

RFU-623

Mini-UHF Male to TNC Female
Adapter: RF
Adapter Style: Straight Adapter

RFU-624

Mini-UHF Male to Mini-UHF Male
Adapter: RF
Adapter Style: Straight Adapter

RFU-625-03

Mini-UHF Female to N Male
Adapter: RF
Adapter Style: Straight Adapter

RFU-626

Mini-UHF Female to UHF Male
Adapter: RF
Adapter Style: Straight Adapter

RFU-627

Mini-UHF Female to BNC Male
Adapter: RF
Adapter Style: Straight Adapter

RFU-628

Mini-UHF Female to TNC Male
Adapter: RF
Adapter Style: Straight Adapter

RFU-629

Mini-UHF Female to Mini-UHF Female
Adapter: RF
Adapter Style: Straight Adapter

RFU-630

Mini-UHF Male to Mini-UHF Female
Adapter: RF
Adapter Style: Right Angle Adapter

RFU-633

Mini-UHF Male to TNC Female
Adapter: RF
Adapter Style: Right Angle Adapter

RFU-642

Mini-UHF Female to SMA Female
Adapter: RF
Adapter Style: Straight Adapter
Motorola/Cellular

RFU-645

Mini-UHF Male to UHF Male
Adapter: RF
Adapter Style: Straight Adapter

Software

This category consists software within the following operational areas.

SARTrack

- Developed in New Zealand, this free software is a complete asset management for all SAR groups and the communications units that support their operation
- http://www.sartrack.co.nz/

Radio Mobile coverage modelling and propagation tool

- Developed by Roger Coude, VE2DBE, this free software has a steep learning curve
- Best way to get started with software is to follow (to the letter) instructions at this link: http://www.g3tvu.co.uk/Radio_Mobile.htm . If you do not make any changes to the install process, the program will install properly every time.
- Once the user comprehends the three operational unit concepts, use of the program is relatively straightforward
- Program output allows the user to determine repeater or radio site coverage based on modelled results.
- Experience with the software has proven the model is often very accurate in terms of actual on-ground coverage
- To use the on-line version, go to: **http://www.cplus.org/rmw/rmonline.html**

Google Earth terrain plot modelling

- A feature within Google Earth allows the user to plot the terrain between any two points
- The feature is located towards the bottom of the <File> menu
- Feature is called <Show Elevation Profile>
- To use the feature, follow these steps:
    - Select a study point, place a (yellow) pin marker
    - Select second study point and place pin
    - Drill down to lowest resolution to get best location
    - Select Tools, Ruler and Path to create study link
    - Use mouse roller and arrow keys to navigate between study points
    - Click on start point and navigate to next point
    - With link established, name and save path
    - Click on path and select, Edit, Show Elevation Profile to produce plot

Winlink Express

- Complete details related to the MIECM digital message standard are contained in the final pages of this document. The document make specific reference to the three west coast communities, but operational concepts are universal and can therefore be applied to any location. The document was adopted by the MIECM as an operational standard for all locations at the June 2017 meeting in Tofino.

Digital Messaging Standard for MIECM

Project Overview

At the heart of most local jurisdiction emergency programs on Vancouver Island is a robust, resilient and well-tested communication strategy delivered by the in-house amateur radio based Emergency Communication Teams (ECT). The Industry Canada licenced radio operators who report to the local Emergency Program Coordinator (EPC) are task driven to supply both voice and secure digital messaging services (within the amateur radio spectrum) on an as-required basis. While voice communications are relatively straightforward in terms of the delivery mechanics, digital messaging is slightly more complex and consists of:

- A VHF or UHF radio based solution utilizing high-level sites for inter-jurisdictional connectivity;
- HF radio equipment; or
- A combination of these to move traffic well beyond the impacted area

Given the recent increase in amateur radio capability on the west coast of Vancouver Island within the emergency programs of Bamfield, Tofino and Ucluelet -- these three communities now serve as the opportunity to develop the MIECM standard for multi-jurisdictional radio interoperability in remote communities and therefore will be the focus throughout this report.

Currently, Bamfield, Tofino and Ucluelet can exchange **unsecured** information via VHF voice repeaters located at Mt. Ozzard (VE7RWC on 147.000 MHz) and at Telegraph Hill (VE7TOF on 146.880 MHz). If Internet connectivity is lost on the west coast however, these community EOC's are not capable of exchanging secure digital messaging via VHF radio because they lack the (local) infrastructure and a high-level radio site for complete interoperability between locations that are not within "line of site".

This report presents an inter-EOC strategy for digital messaging utilizing the west coast example of a single high-level radio site to link Bamfield, Tofino and Ucluelet.

Winlink Express Background

On a worldwide basis, Emergency Operations Centres (EOC) utilize Winlink Express as the preferred amateur radio-based digital messaging client because it supports multiple system features that include secure login to help prevent unauthorized access to the system. The network building blocks of the Winlink system consist of:

- Winlink Express client software used to link to local network nodes
- Local network nodes that are linked to local remote mail servers (RMS)
- Local remote mail servers (RMS) that provide access to five (5) redundant and mirrored common mail server (CMS) located in Halifax, Vienna, Brentwood, San Diego and Perth.

Written by the Winlink Development Team, Winlink Express features a simplistic feature set and uses the B2F Protocol radio transfer to support limited size attachments, multiple email addresses and tactical addresses. Winlink Express can be operated in a variety of configurable modes such as peer-to-peer (P2P) connecting directly via RF to other Winlink Express stations or via a Telnet (Internet) connection. It also contains the following capabilities:

- Manual and automated GPS position reporting abilities
- Support for the Winlink catalog of downloadable weather information bulletins such as Saildocs and GRIB files
- A propagation prediction feature to help determine which of the participating Winlink RMS gateway HF stations are best to connect to from anywhere on earth.

For emergency communications, the Winlink Express software offers emergency communications specific features that include HTML forms creation, compact formless content transport and a growing library of automatically updated forms that are available to all amateur radio stations.

For inter-EOC communication, in-house amateur radio operators can use Winlink Express to simultaneously send and receive secure digital messages because the software supports a wide selection of transceivers, TNCs and multimode controllers offering a host of connectivity options.

The client equipment to support Winlink software usually includes the following items:

- A commercial grade transceiver (such as the MRIP VX-4600 or a repurposed Motorola radio)
- A Kantronics KPC 3+ TNC (terminal node controller)
- Related cabling that includes RX audio, TX audio, push-to-talk (PTT), Ground and 12 volts positive
- ICT - 12 volt power supply rated for at least 12 amps (ICT part #: ICT12012 -12A)
- Antenna – base station (Sinclair SD210 – model: SF2P2SNM)
- Computer – either a desktop or laptop running the (free) Winlink Express software and a dedicated Internet connection.

Winlink Software Registration

Even though the Winlink Express software is free, the worldwide group of volunteers who constantly update code and maintain the program encourage users to register the software. The registration fee helps support software development and all Amateur Radio Safety Foundation projects on a global scale.

Registration provides a non-transferable license key that is call sign specific for use on multiple computers, or with multiple instances on the same computer.

The registration fee is US$24 per call sign for up to 17 call signs. A local authority may want to consider licencing the call sign for each of their ECT members as well as all call signs associated with their EOC operation. For registrations beyond 17 call signs, a bulk-pricing schedule is available from the Winlink development team. Additional information is available from the following sources:

- Contact: Steve Waterman k4cjx@winlink.org for license details and bulk pricing.
- Amateur Radio Safety Foundation, Inc.

Winlink Express Network Configurations

A local client (radio operator) can establish Winlink connectivity via the following scenarios:

1. P2P (Peer-to-Peer)
2. P2P through a Network Node
3. WL2K (Winlink email address), i.e. ve7uke@winlink.org, ve7eob@winlink.org or va7tof@winlink.org
4. WL2K connecting to a CMS Server (via the Internet)
5. WL2K using Network Nodes

The next section shows each connectivity scenario graphically.

Note: all Winlink users have a WL2K address associated with their call and the format is a call sign followed by @winlink.org such as ve7uke@winlink.org

Winlink Express Network Configuration for Bamfield, Tofino and Ucluelet

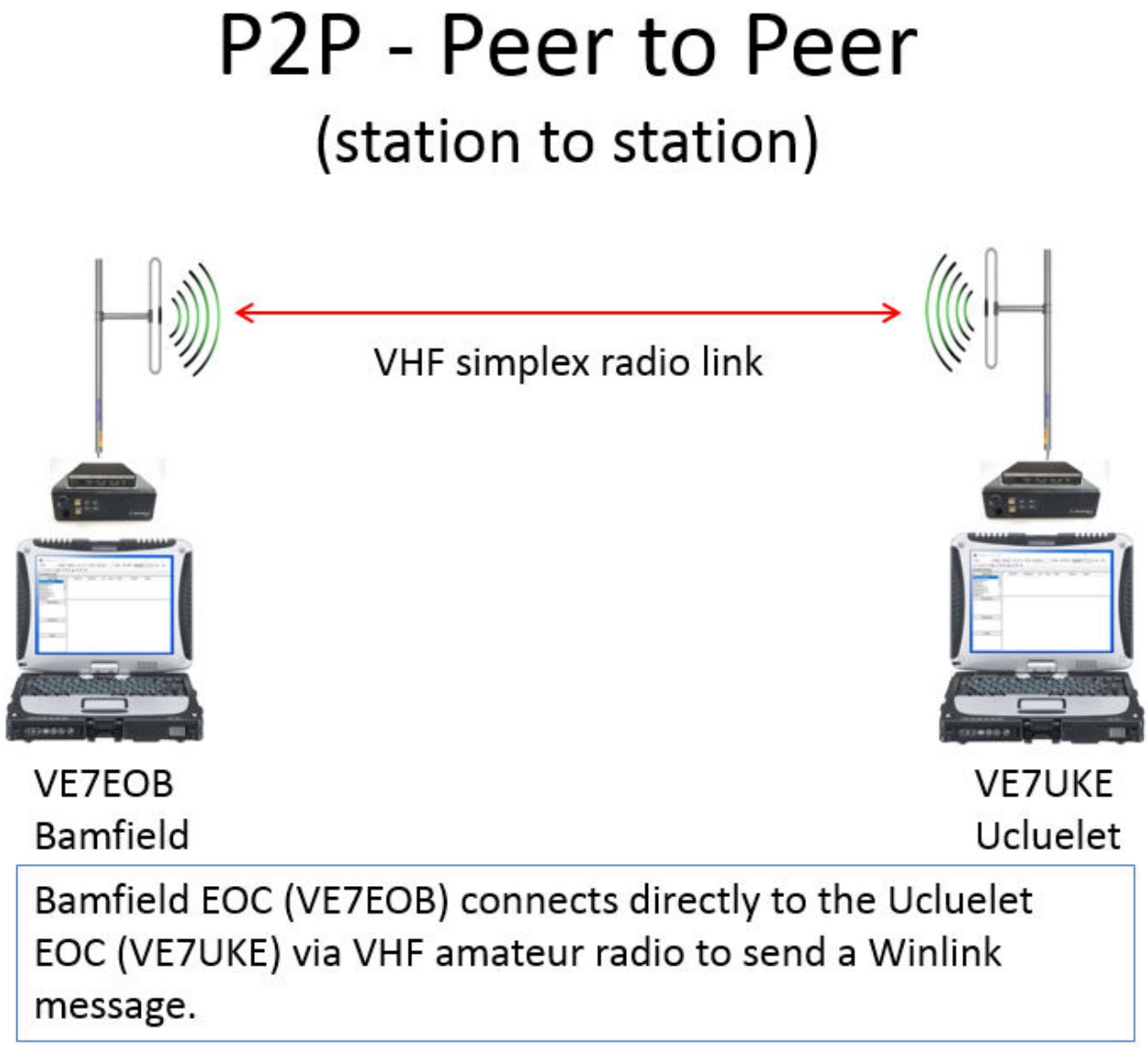
Within these three west coast communities, the EOC's operate using the following Industry Canada assigned amateur radio call signs:

- Bamfield: VE7EOB
- Tofino: VA7TOF
- Ucluelet: VE7UKE

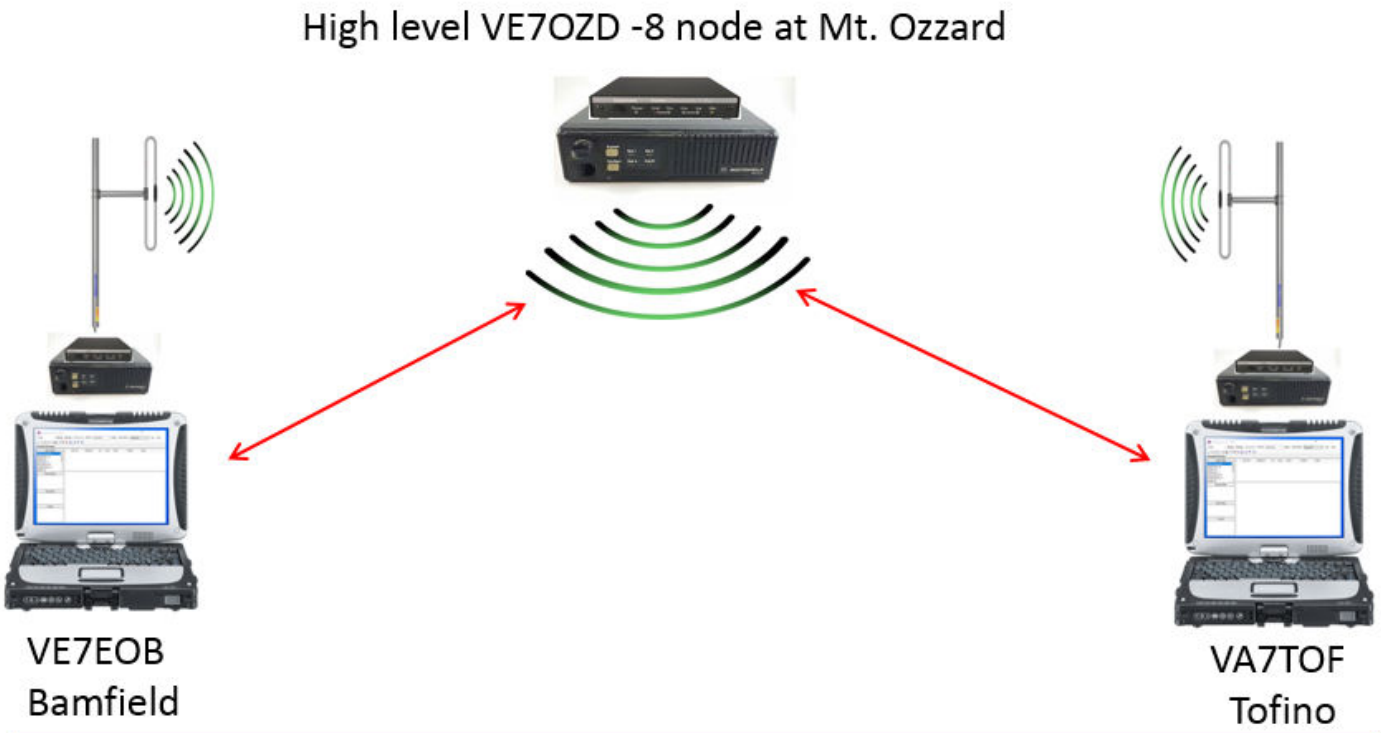
In addition, VE7OZD will be the call sign for a potentially new high-level (-8) network node that will hopefully be established within the Mt. Ozzard radio site complex at some point in the near future.

Using above noted call signs, the following network examples illustrate the various Winlink network configurations for connectivity between the three west coast communities.

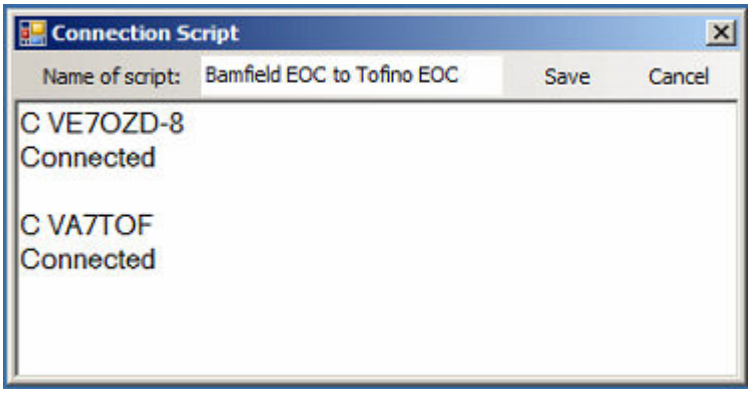
Network Configuration / Connectivity Examples



P2P through a Network Node

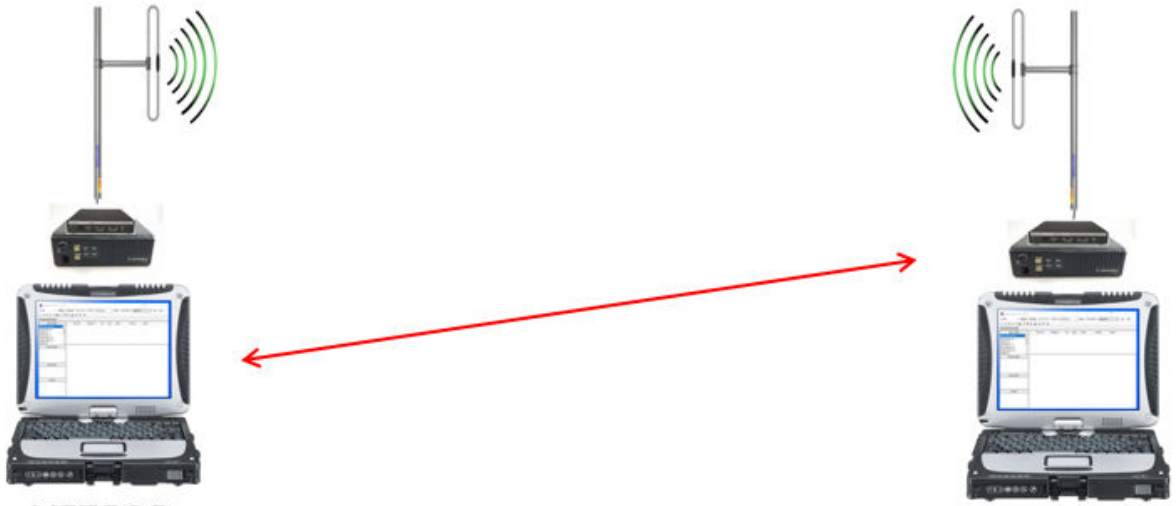


Given the Bamfield EOC (VE7EOB) is not likely to have a reliable simplex (direct) radio path to the Tofino EOC (VA7TOF) via VHF amateur radio, the Mt. Ozzard (VE7OZD-8) high-level intermediate radio site is required in order to send the Winlink message.



Using the Winlink script editor, the Bamfield EOC radio operator creates a simple script to facilitate the automated connection via Mt. Ozzard (VE7OZD-8) between Bamfield and Tofino

WL2K - Winlink Network



VE7EOB
Bamfield

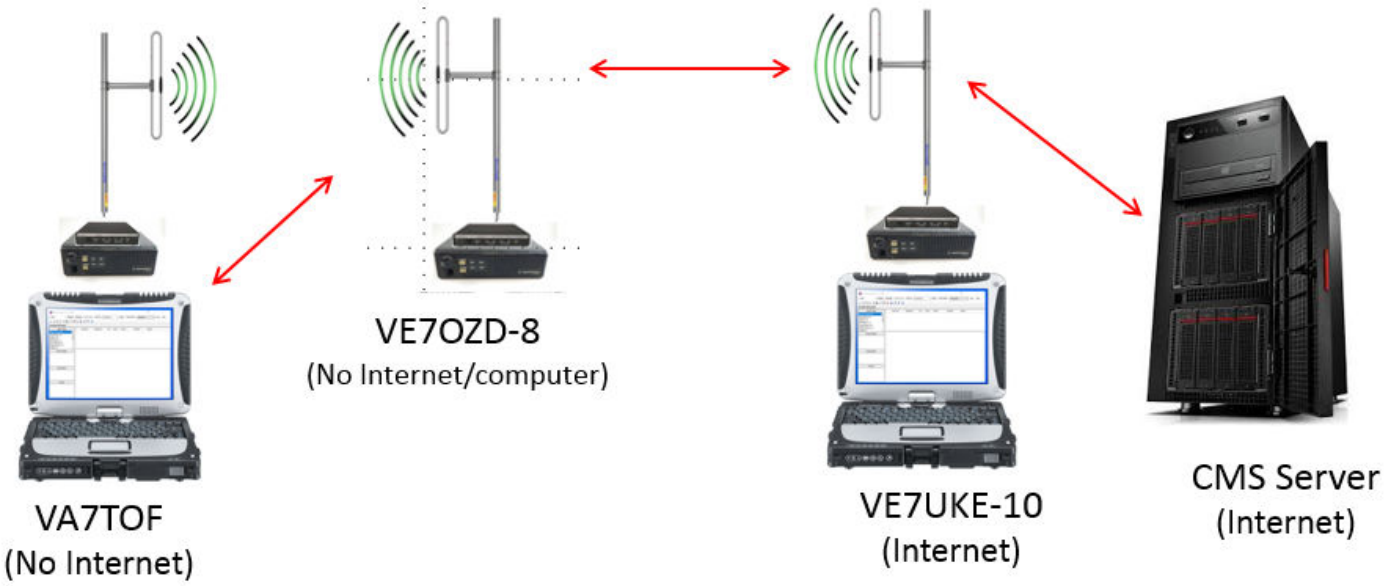
VE7UKE-10
Internet to CMS

The Bamfield EOC (VE7EOB) does not have a VHF radio path towards Port Alberni to send message traffic, so they utilize the Ucluelet EOC VE7UKE-10 RMS Packet Gateway which is connected to the Internet. The message leaves the local -10 Gateway and is routed to one of the five worldwide mirrored common mail servers (CMS). From the CMS, the message is routed to its destination which could be EMBC or any other location.
Note: in this example, Bamfield could utilize local Internet connectivity and route their traffic via a Telnet Winlink connection, but using a VHF radio path to Ucluelet simply demonstrates the diversity available within the Winlink network.

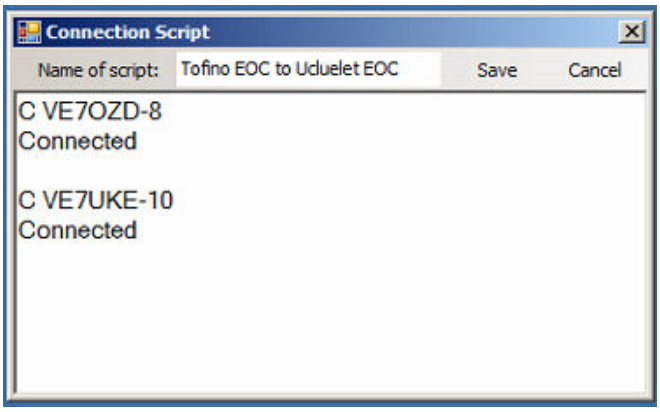
WL2K - Winlink Network

If Bamfield EOC (VE7EOB) wants to send a message to EMBC, but has no Internet connectivity, they utilize the VHF radio path to Ucluelet EOC and the VE7UKE-10 RMS Packet Gateway which is connected to the Internet. The message leaves the local -10 Gateway and is routed to one of the five worldwide mirrored common mail servers (CMS).

WL2K using Network Nodes



If the Tofino EOC (VA7TOF) has no Internet connectivity, but wants to send a message to EMBC, they utilize the VHF radio path to Mt. Ozzard (VE7OZD-8) and then link to the Ucluelet EOC (VE7UKE-10) RMS Packet Gateway which is in turn connected to the Internet. The message leaves the local -10 Gateway and is routed to one of the five worldwide mirrored common mail servers (CMS).



Using the Winlink script editor, the EOC radio operator creates a simple script to facilitate the automated connection between Tofino and Ucluelet

Winlink node at Mt. Ozzard (VE7OZD-8)

Central to inter-EOC connectivity for secure digital messaging between the three west coast communities, is the establishment of a single high-level Winlink node (VE7OZD-8) at the Mt. Ozzard radio site. This high-level site is a critical local network element that is required to support inter-EOC secure digital messaging for the emergency programs in Bamfield, Tofino and Ucluelet. Without the Mt. Ozzard site -– and in the absence of Internet connectivity, there is no other mechanism to facilitate inter-EOC secure digital messaging for the local emergency programs. Admittedly, the use of HF Pactor is an alternative, but given the relatively close proximity of one community to another and vagaries of HF radio propagation – not to mention the complexity of the equipment, it simply is not a reliable enough alternative for all three communities. Creation of the VE7OZD-8 Winlink node guarantees inter-EOC secure digital messaging for all three communities in an emergency.

While a site intermodulation study would likely be required at Mt. Ozzard, the VE7OZD-8 node could operate on any of the following frequencies: 144.350, 144.930, 144.950, 144.970, 144.990, 145.010, 145.050, 145.070, 145.090, 145.630 or 145.690. All frequencies are available for use in this project as they are within the Amateur Radio portion of the Industry Canada spectrum – so no additional radio licencing is required to implement the Node.

The VE7OZD-8 node project is an initiative of the Mid Island Emergency Program Coordinators and Managers (MIECM) group, which consists of EPC's from each local emergency program jurisdiction on Vancouver Island, Powell River and the Sunshine Coast. Greater Victoria EPC's are part of a separate Local Government Emergency Program Advisory Committee (LGEPAC), which is similar to the MIECM.

Establishing an RMS Packet Gateway in Ucluelet

Given there is little in the way of Winlink Express infrastructure on the west coast, the VE7OZD-8 node at Mt. Ozzard and a corresponding RMS Packet Gateway in Ucluelet need to be created to build operational capacity that will support local emergency programs in all three communities.

Centrally located between Bamfield and Tofino, the Ucluelet emergency program radio room is the ideal location to establish an RMS Packet Gateway using call sign VE7UKE-10.

The Gateway and its corresponding RMS Relay software will be operational 24 x 7 x 365 and other than periodic computer housekeeping which includes updating the software, there is no requirement for local intervention as the Gateway simply runs unattended. If required, a member of the Mid Island Emergency Radio Coordinators Team (MIERCT) could connect remotely to the Gateway using TeamViewer software and perform software updates or operational maintenance. From an IT perspective, the Gateway is a very benign application.

The RMS Packet Gateway will operate on the same frequency as the Mt. Ozzard VE7OZD-8 node.

To create the VE7UKE-10 RMS Packet Gateway, the following components are required:

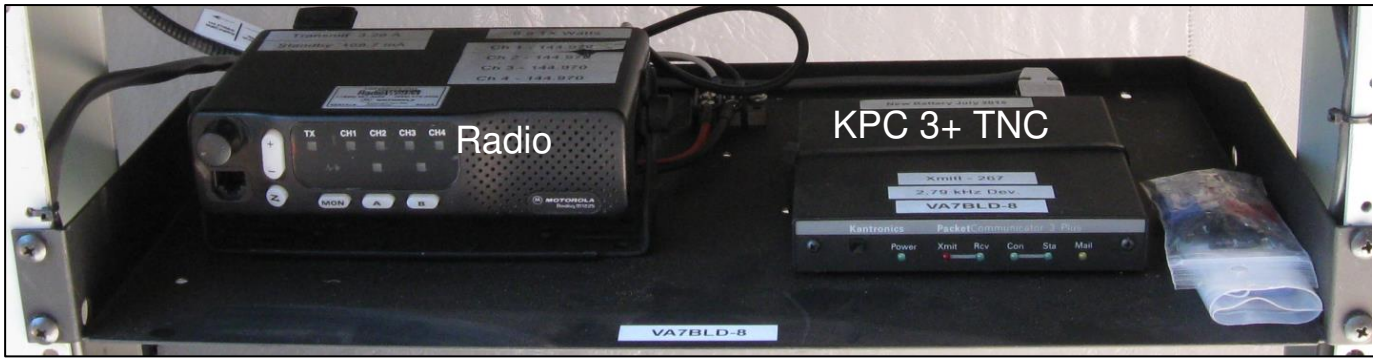
- RMS Packet software complete with RMS Relay software – both are free programs
- Commercial grade VHF radio and a Kantronics KPC 3+ TNC
- Commercial grade external VHF antenna that is high and in the clear (free from other objects)
- Desktop computer and UPS that can be dedicated to the application 24 x 7 x 365 (no other use)
- Full-time Internet access
- TeamViewer v12 software for remote maintenance of the installation

Note: the Cowichan Valley Regional District – Public Safety Division operates RMS Packet Gateways in Duncan (VE7SKR-10), Ladysmith (VE7LSO-10) and Lake Cowichan (VA7LKC-10). In addition, they operate Winlink Nodes at Mt. Wood (VE7WOD-8) and Bald Mtn (VA7BLD-8). While these facilities directly support the CVRD Emergency Program, they also provide secure messaging capacity to our mutual aid partners to the north and the south – including EMBC who utilize the site at Mt. Wood.

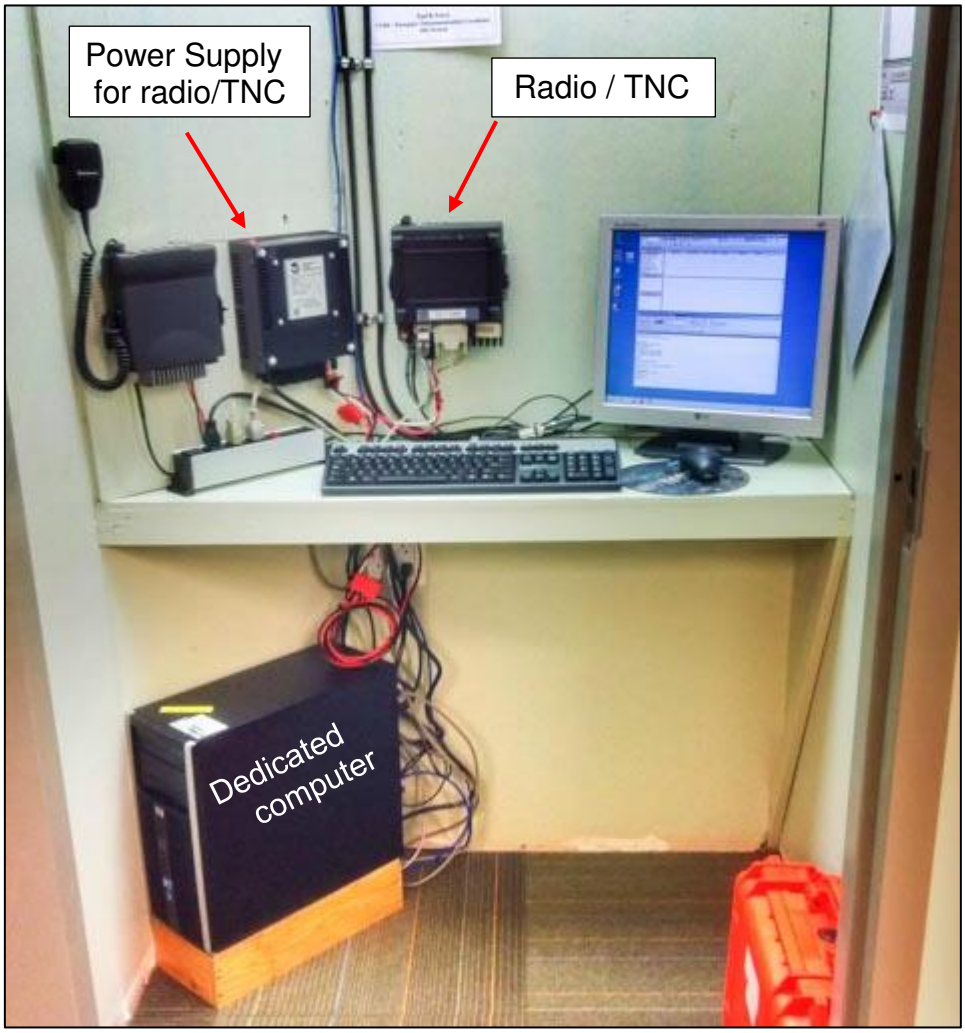
If the Ucluelet Emergency Program were to install an RMS Packet Gateway/Node, it would provide similar support to both Bamfield and Tofino – and it would be available to travelling amateur radio operators as well as local mariners who wish to send / receive Winlink messages.

Assuming a repurposed computer, commercial VHF radio and Sinclair antenna were available to the Ucluelet RMS Packet Gateway project; the additional costs would be less than $600. This would include a new Kantronics KPC 3+ TNC (CAD$300) and LMR-400 coax cabling plus connectors and Polyphaser lightning protection module. A low cost - high rate of return project from any perspective.

Equipment associated with both a -8 and -10 configuration



VA7BLD-8 Node at the CVRD Bald Mtn radio site



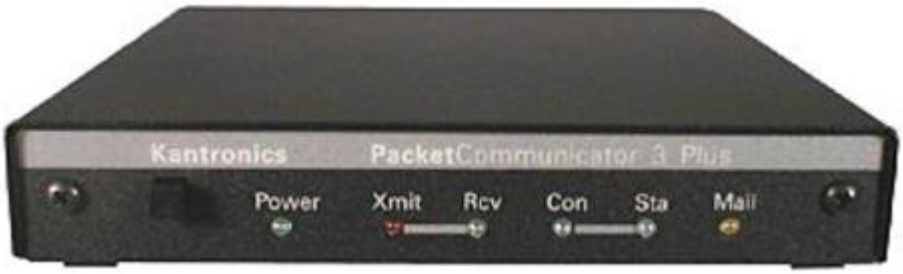
VA7LKC-10 RMS Packet Gateway located in the radio closet at the CVRD Lake Cowichan Sports Arena.

Sinclair SD210 (SD210-SF2P2SNM)
1 dipole, bi-directional pattern, 138-174 MHz
• Covers 138-174 MHz Band
• 2.0 dBd gain with bi-directional pattern
• Can be top or side mount (Universal mount)

This commercial grade antenna is the minimum requirement for either a -8 or a -10 application

Kantronics

KPC-3+ Packet Communicator



Next Steps

In order to move this project through its development cycle, the MIECM and especially the three west coast communities should consider:

1. Review the project at the June 23, 2017 MIECM meeting in Tofino to gain approval in principle from all members. MIECM approved and adopted this document as the Winlink Express standard.
2. Review total project cost and determine related funding sources
3. Discuss with local (in-house) IT departments to ensure they are onboard with the implementation of the Winlink software within their networks
4. Review the project with Canadian Coast Guard (CCG) -- focusing on the tremendous value to all three community emergency programs in establishing the Mt. Ozzard VE7OZD-8 node
5. Source parts for the Ucluelet VE7UKE-10 RMS Packet Gateway and implement the facility
6. Establish additional RMS Packet Gateways at both the Tofino and Bamfield EOC's
7. Exercise the new local network

Summary Comments

These three west coast communities have an operational vulnerability that needs to be addressed by the MIECM.

Building infrastructure to support secure digital messaging is a critical component that should be added to all three local jurisdiction emergency program EOC's in the immediate future. While each community is making incremental local improvements to their in-house radio communication program, all three need to work collectivly to implement this inititive which has the potential to provide significant value in an emergency.

Admittedly amateur radio voice communication can now be used by all three EOC's, but the volume of message traffic in an emergency will quickly outstrip the ability of a small number of local radio operators to succesfully pass all traffic in a timely manner. With the implementaiton of digital messaging, all three EOC's can move a tremendous volume of message traffic in a fraction of the time required to send the equivalent traffic via voice with a logged audit trail. The focus of this report is primarily inter-EOC communications for the west coast communities and the timely delivery of secure digital message traffic to the Alberni-Clayoquot Regional District EOC, EMBC and beyond.

The wider scope of this project however is to develop and refine the process for securing digital radio/TNC interoperability that can be replicated in small remote communities wherever they may be located.

The operational effieciency gained by an EOC that utilizes the Winlink software is a game-changer allowing fast, secure and logged message tranmission/receipt that enhances any local authority emergency program!

Please direct all questions related to any aspect of this project to:

Paul B. Peters
CVRD – Emergency Telecommunications Coordinator
Phone: 250-715-6618
Email: radio@cvrd.bc.ca

Ed Gorse, VE7ED created the base drawing content used within the "Network Configuration and Connectivity Examples" section and offered it to the MIECM for use within this project document.