

TMR 2 Trunked Mobile Radio User Guide

Version 2, August 2014

Public Safety and Field Communications



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Overview

Trunked Mobile Radio System (TMRS)

This TMR system is shared by nearly all public safety organizations in Nova Scotia. The network has 86 tower sites and provides coverage across a large percentage of the provinces' landmass. All of these tower sites are connected to a central controller at Bell in Halifax.

The TMR 2 system has new and improved functionality which will result in enhanced clarity of voice transmissions, system redundancy, interoperability and additional radio features for some agencies.

This system is fully interoperable, with all agencies having one common zone of talkgroups. This allows for each user to easily navigate and communicate with any other user of the system at an incident via their TMR radio. This includes eight mutual aid talkgroups, three shared simplex channels and two common talkgroups.

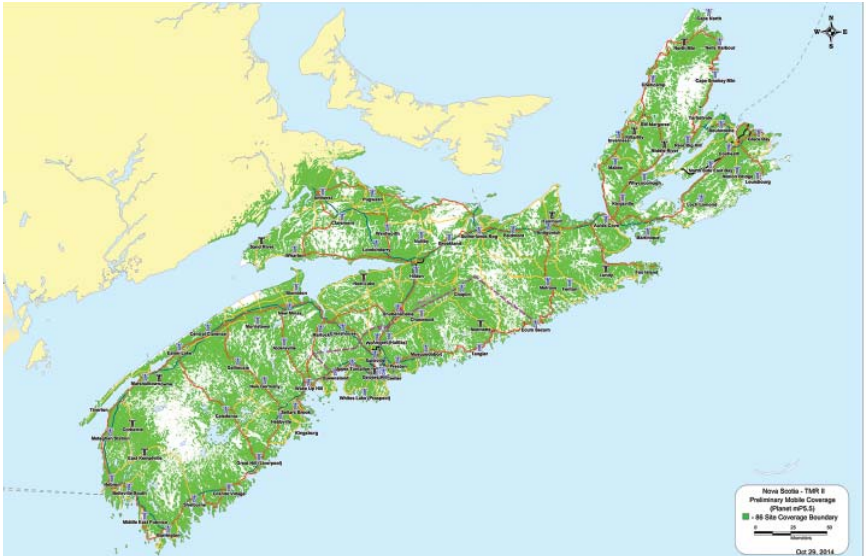
The TMR System (TMRS) uses a digital platform. Public Safety Organizations will notice much a sharper, crisper voice quality during radio transmissions in a digital environment. The digital conversion of a user's voice reduces external background noise and the digital technology platform is ideal for reducing environmental noise levels during transmission, such as emergency scenes or in windy conditions.

When you turn on your radio, it begins to search for the nearest TMRS site. When the radio connects to a site, the radio will send the identifier number of your radio to the central controller informing the system that your radio is now turned on and which talk group your radio is resting on. You can communicate with any other radio on that same talkgroup province-wide.

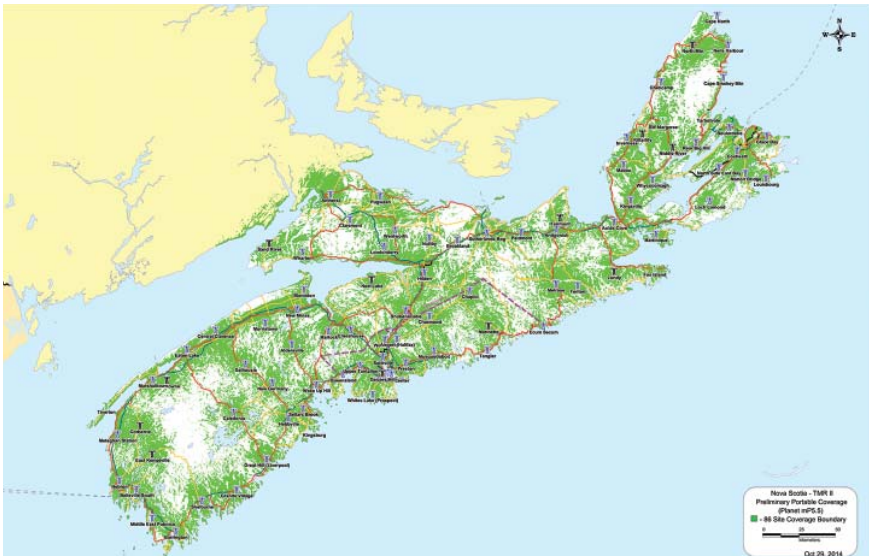
This guide will assist the TMR user by explaining specifics about the system operation, along with lists of agencies sharing the system, radio tones and alerts, best practices in radio etiquette, potential issues with the system along with various other helpful hints to make your TMR radio use both productive and successful.

Please note: *This guide will be updated periodically so be sure to review the most updated version of this User Guide from the Public Safety and Field Communications (PSFC) Team.*

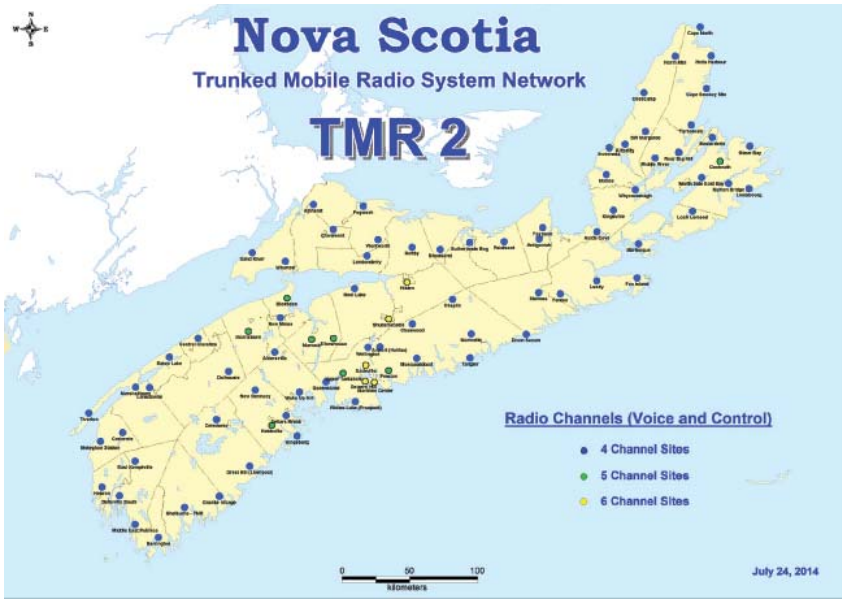
Mobile Coverage Prediction Map



Portable Prediction Coverage Map



Trunked Mobile Radio System Network



The colored dots illustrate the number of voice paths on each tower site plus a control channel that does not carry voice. In rural areas there are mostly blue dots meaning that those sites have three voice paths. On a three-voice path site no more than three simultaneous conversations can occur at once. In more urban areas there are more voice paths because there is a higher demand.

Site Numbers and Names

Site #	Site name	Site #	Site Name	Site #	Site Name
1	Sand River	31	Barrington	61	Marion Bridge
2	Wharton	32	Shelburne	62	East Bay
3	Claremont	33	Granite Village	63	Coxheath
4	Amherst	34	Great Hill	64	Glace Bay
5	Pugwash	35	Caledonia	65	Boularderie
6	Wentworth	36	Hebbsville	66	Tarbotvale
7	Londonderry	37	Kingsburg	67	Rear Big Hill
8	Hilden	38	Sellars Brook	68	Middle River
9	Noel Lake	39	New Germany	69	Cape Smokey
10	Shubenacadie	40	Wakeup Hill	70	Neils Harbour
11	Chaswood	41	Aldersville	71	Cape North
12	Airport	42	Queensland	72	North Mountain
13	Wellington	43	Tantallon	73	Cheticamp
14	Ellershouse	44	Whites Lake	74	SW Margaree
15	Martock	45	Geizers Hill	75	Kiltarlity
16	Blomidon	46	Maritime Center	76	Inverness
17	New Minas	47	Sackville	77	Mabou
18	Morristown	48	Preston	78	Whycocomagh
19	Central Clarence	49	Musquodoboit	79	Kingsville
20	Dalhousie	50	Tangier	80	Aulds Cove
21	Eaton Lake	51	Marinette	81	Fairmont
22	Lansdowne	52	Chaplin	82	Antigonish
23	Marshalltown	53	Ecum Secum	83	Piedmount
24	Tiverton	54	Melrose	84	Sutherlands Bog
25	Corberrie	55	Fenton	85	Brookland
26	Meteghan	56	Lundy	86	Nuttby
27	E Kemptville	57	Fox Island	87	Site on wheels
28	Hebron	58	Martinique		
29	Belleville S	59	Loch Lomond		
30	Pubnico	60	Louisbourg		

Interoperability

Mutual Aid Talkgroups

All public safety TMR units share eight Mutual Aid talkgroups. Mutual Aid allows direct communications with various agencies on one repeater. This decreases the chances of receiving a busy tone at an incident.

Permission is required to use a Mutual Aid talkgroup:

- 1) Contact your provincial dispatch point for assignment of a Mutual Aid talkgroup: Shubie Radio, Emergency Health Services (EHS), and Royal Canadian Mounted Police (RCMP).
- 2) Advise the dispatcher of who is to be notified of the talkgroup assignment (be sure you receive a radio check from each party you have requested to join).

Shared Simplex Channels

- All public safety agencies that use TMR have three shared simplex channels.
- Simplex is only reliable for roughly 1 to 2 km.
- Permission is not required when using the simplex channels but a person must first voice-call on the desired channel to verify if anyone in the area is using that channel.

Simplex All 1, Simplex All 2 and Simplex All 3

SX All 1 - International Calling Channel (ICALL)

SX All 2 - National Working Channel (ITAC-1)

SX All 3 - National Working Channel (ITAC-2)

The ICALL channel shall be used to contact other users in the Region for the purpose of requesting incident related information and assistance. If necessary, the calling party will be asked to move to one of the ITAC channels for continuing incident operations or other interoperability communication needs.

The ITAC channels are to be used primarily for coordination activity between different agencies in a mutual aid situation, or emergency activities of a single agency. Incidents requiring multi-agency participation will be coordinated over these channels by the agency controlling the incident.

Some communications may be best managed using simplex frequencies because they:

- Remove traffic from the TMRS repeaters, can be used in poor system coverage areas, and allows TMR for long range communications.
- Simplex frequencies have limited range and provide no contact with dispatch.
- There are no tones (such as the “go ahead” or “busy tone”) on the simplex channels.
- If you wish to use a simplex channel in a particular area, switch to that simplex channel and listen to see if anyone is actively on the channel.
 - If the channel is free, voice call **“Any station using this channel? Over”**
 - If no one answers, you are free to use the channel.
 - If you do receive a reply stating that the channel is in use, switch to another simplex channel.
- Simplex is direct radio-to-radio communication.
- These channels provide another interoperable tool for communications.

Radio/System Tones

The TMRS radios generate various tones to indicate different things to the user. These tones are important because you will need to react to each of them in different ways:




Go-Ahead: A fast, high pitched three-note tone (triple chirp) that tells you the radio is connected to the system and you can ‘go-ahead’ and talk. If you don’t hear this tone you are talking to yourself.

System Busy: This is like a fast telephone busy signal — a mid-range beep tone about every half-second. This signal means all the repeaters on the site you are connected with are currently busy with other radio traffic. Wait a few seconds and the radio will give you the ‘Go-Ahead’ tone.

System Bonk: A low pitched repeating bonk sound that means the radio has lost contact with the system. This is caused by poor coverage or loose or damaged antenna.

Radio – LED Lights

Both the portable and mobile radios have a series of red, yellow and green LED lights that indicate various items on the radio which are as follows:

LED LIGHTS	 RED	 YELLOW	 GREEN
Mobile			
Solid	Radio is transmitting	Indicates traffic on a simplex channel	Self-test being performed
Flashing	Radio is trying to access system	N/A	N/A
Portable			
Solid	Radio is transmitting	N/A	Self-test being performed
Flashing	Low Battery (lights while transmitting)	N/A	N/A
Flashing	Intermittent flashing - trying to connect to a TMR site or re-affiliating to a site	N/A	N/A

How to Transmit and Receive on a TMR

- Select the desired talk group on the radio.
- Listen for ongoing conversations; if the channel becomes clear, proceed with your call.
- Lift the mic, press and hold the PTT button to transmit and wait for the “Talk Permit” tone.
- If you hear three quick tones (go ahead tones), proceed with your message. Remember keep the microphone 1-2” from your mouth.
- If you hear a busy tone all trunked channels are in use.
- Release the PTT button and wait for the three quick tones. Within three seconds of hearing these tones, press and hold the PTT button to transmit your message.
- Release the PTT button to receive (listen).
- If another user is transmitting on the talkgroup and you attempt to transmit, you will be alerted by a “bonk.” Simply wait until the user has completed their message and proceed with yours.

TMR Agencies

In Nova Scotia, virtually all frontline emergency service providers utilize the TMR system for communications. In addition, several of our Federal and Municipal partners are either using the system or in various stages of development and implementation of TMR in their operations.

Potential Problems with Systems & Equipment

- Coverage limitations in some remote areas.
- Non-Province of Nova Scotia (PNS) aircraft and private vessels do not have TMRS radios.
- ‘Site Trunking’ can sever a site from the wider network, but it will continue to function within a local footprint.
- Every site is connected to and controlled by the central system controller in Halifax.
- One or more sites go into ‘Site Trunking’ when connection to the wider network fails (due to fiber-optic cable cut).
- When in “Site Trunking” each site functions for all users within its own footprint but allows no access to dispatch or to units outside the affected footprint(s).

The TMR 2 system is a very stable communications platform. There are only a few failure scenarios that can occur within the TMRS:

- One or more sites can independently go ‘Site Trunking’ due to backhaul failure. (Backhaul is the wire or fibre optic link from the tower to the central controller) .
- The Master Switch in Halifax can fail causing all sites to go ‘Site Trunking’.
- A massive, extended power outage could cause entire system shutdown.
- Blocked roads could prevent access to recharge site batteries meaning sites will fail. All sites have a battery backup to allow for uninterrupted service during power interruptions of up to eight hours. Some sites have generator backup.
- Certain components that make up the system can fail from time to time either locally at a tower site or at the central site in Halifax.

Failsoft

If the trunking system loses its control channel (channel that transmits data for system, and not voice) or has certain other failures, it is no longer able to operate in the trunking mode (normal operations). So instead of going into a condition that stops all communication, the system enters Failsoft.

In this state all transmitters (channels) turn on and operate in a 'conventional' repeater mode. The subscriber radios are able to recognize this state and switch to a predetermined frequency (one of the trunk system frequencies, but not the control channel frequency) depending on their selected talkgroup.

For example, if a site is in Failsoft, all users associated with the tower (i.e. Fire, Police, EHS etc) would end up on a single channel, rather than different agencies being assigned different channels. Everyone within range of the tower in failsoft will share this single channel. The radio will attempt to avoid failsoft mode by first seeking other sites that are working properly.

In most systems several talkgroups will share a frequency. If a particular failsoft frequency has also failed, the talkgroups assigned to that frequency will also be off the air during failsoft.

Etiquette

Radio Communication Techniques

The efficient use of radio depends greatly on the method of speaking and articulation of the operator. It is important to speak all words plainly and clearly in order to prevent the running-together of consecutive words. Avoid any tendency to shout, accent syllables, or speak too rapidly. The following techniques should be kept in mind when using a radio:

Speed: Keep the rate of speech constant, neither too fast nor too slow. Remember that the operator receiving your message may have to write it down.

Rhythm: Preserve the rhythm of ordinary conversation. Avoid the introduction of unnecessary sounds such as 'er' an 'um' between words.

To have words repeated for message confirmation or clarity use the command "words twice" or, upon request, ask the speaker to repeat the message using the phonetic alphabet.

Procedural Words (Prowords) or Phrases and Their Meanings

Word or Phrase	Meaning
ACKNOWLEDGE	Let me know that you have received and understood this message.
AFFIRMATIVE	Yes, or permission granted.
BREAK	Indicates the separation between portions of a message. (Used when there is no clear distinction between portions of a message.) May be repeated to request urgent access to a channel/talkgroup.
CHANNEL	Change to channel ... before proceeding.
CLEARED	Authorized to proceed under conditions specified.
CONFIRM	I have received the following ... or did you receive the message?
CORRECTION	An error has been made in this transmission (message indicated). The correct version is...
DISREGARD	Consider this transmission as not sent.
GO AHEAD	Proceed with your message.
HOW DO YOU READ?	What is the readability of my transmission?
I SAY AGAIN	Self-explanatory (use instead of "I REPEAT").
MAYDAY	The spoken word for distress communications.
MAYDAY RELAY	The spoken word for the distress relay signal.
MONITOR	Listen on (frequency/talkgroup).
NEGATIVE	No, or that is not correct, or I do not agree.
OUT	Conversation is ended and no response is expected.
OVER	My transmission is ended and I expect a response from you.
PAN PAN PAN	The spoken word for urgency communications.
READ BACK	Repeat all, or a specified part of a message back exactly as received (do not use the word 'REPEAT').
ROGER	I have received all of your last transmission.

Word or Phrase	Meaning
SAY AGAIN	Self-explanatory. (Do not use the word "REPEAT".)
STAND BY	I must pause for a few seconds or minutes, please wait and I will call you.
SEELONCE	An international expression to indicate that silence has been imposed on the frequency/talkgroup due to a distress situation.
SEELONCE FEENEE (Silence)	An international expression to indicate that the distress situation has ended.
SEELONCE MAYDAY (Silence Fini)	An international expression to advise that a distress situation is in progress. The command comes from the station in control of the distress traffic.
THAT IS CORRECT	Self-explanatory.
VERIFY	Check coding, check text with originator and send correct version.
WILCO	Your instructions received, understood and will be complied with.
WORDS TWICE	(a) As a request: Communication is difficult, please send each word, or group of words, twice. (b) As information: Since communication is difficult, I will send each word or group of words, twice.

Radio Communications Procedures

Passing a message

Note: examples of words intended to be spoken will be bold and enclosed in quotes. Prowords will be all upper case.

Messages will be passed in the following order:

1. The call-sign of the station being called: **'Shubie Radio'**
2. The proword **'THIS IS'**
3. The call-sign of the sending station (your call-sign) **'RCMP Incident Commander'**
4. The proword **'OVER'**

After receiving acknowledgement from the called party that s/he is ready to listen, the message is spoken completely in a clear voice.

The receiving party will get any required repetitions, then acknowledge the information with **'ROGER, OVER'** or **'ROGER, OUT'**.

Phonetic Alphabet

Letter	Word	Pronunciation	Letter	Word	Pronunciation
A	ALPHA	al-fah	N	NOVEMBER	no-ven-ber
B	BRAVO	brah-vo	O	OSCAR	oss-car
C	CHARLIE	char-lee	P	PAPA	pah-pah
D	DELTA	dell-tah	Q	QUEBEC	kay-beck
E	ECHO	eck-oh	R	ROMEO	row-me-oh
F	FOXTROT	foks-trot	S	SIERRA	see-air-ra
G	GOLF	Golf	T	TANGO	tang-go
H	HOTEL	ho-tell	U	UNIFORM	you-nee-form
I	INDIA	in-dee-ah	V	VICTOR	vik-tar
J	JULIET	jew-lee-ett	W	WHISKEY	wiss-key
K	KILO	key-loh	X	X-RAY	ecks-ray
L	LIMA	lee-mah	Y	YANKEE	yang-key
M	MIKE	mike	Z	ZULU	zoo-loo

Note: the first syllable is generally accented to indicate the letter represented.

Difficult Words

Difficult words within the text of a message may be spelled using the phonetic alphabet and preceded by the proword, **'I SPELL'**. If the operator can pronounce the word to be spelled, s/he will do so before and after the spelling to identify the word.

Example: 'Trivia - I SPELL, Tango Romeo India Victor India Alpha Trivia'

Numerals

In order to distinguish numerals from similarly pronounced words, the proword **'FIGURES'** may be used preceding numbers. When transmitted by radio, the following rules for their pronunciation will be observed if the communication is not clear:

Numeral	Spoken As
0	ZE-RO
1	WUN
2	TWO
3	THREE
4	FOW-ER
5	FIFE
6	SIX
7	SEV-EN
8	AIT
9	NIN-ER

Example: 'I SAY FIGURES Fife Sev-en Wun FIGURES'

Note: When conditions are good there is no objection to pronouncing numerals in the regular way (IE. **'THREE, FIVE, NINE'**).

Numbers

All numbers except whole thousands should be transmitted by pronouncing each digit separately, except exact multiples of thousands may be spoken as such.

Numeral	Spoken As
44	FOW-ER FOW-ER
90	NIN-ER ZE-RO
7000	SEV-EN THOUSAND
5318	FIFE THREE WUN AIT

The decimal point is to be spoken as **‘DE-SEE-MAL’**.

Example: 987.6 is to be spoken as **‘Nin-er Ait Sev-en De-see-mal Six’**

Dates will be spoken digit by digit, with the months in full.

Example: 20 August is spoken as **‘Two Ze-ro August’**

Roman numerals shall be spoken as the corresponding Arabic letters preceded by the prowords ROMAN NUMERAL.

Example: XX in Roman numerals would be spoken as **‘ROMAN NUMERALS X-ray X-ray’**.

Monetary denominations, when transmitted with groups of digits, should be sent in the sequence in which they are written.

Example: \$17.25 is spoken as **‘dollars one sev-en de-see-mal two fife’**.
.75 becomes **‘sev-en fife cents’**

Call Signs

Use of regular radio Call Signs is mandatory at the beginning and end of a radio conversation. With the clear voice quality typical of radio systems today, intermediate transmissions need not have the Call Signs used as this simply adds unnecessary radio traffic to the system.

For ease of communication in emergency situations, tactical call signs may be assigned on multi-agency radio networks. The tactical call signs will describe the radio operator's location or function.

Example: The Incident Commander at a Dartmouth General Hospital incident might use the call sign '**Dartmouth General Incident Commander**'.

Calling

Before transmitting, the operator of every station shall listen for a period long enough to ensure that there will be no harmful interference to transmissions already in progress. If such interference seems likely, one must wait for the first break in transmission where he may intercede. A station having distress, urgency, or safety communication to transmit is entitled to interrupt at any time when a transmission of lower priority is in progress.

Station Call

When a station wishes to establish communication with another station it must transmit the following items in order:

Name of the station being called
The words '**THIS IS**'
Name of Station calling
Invitation to reply: '**OVER**'

Replying

When a station is ready to receive the communication, it should reply in the following form:

Name of calling station
The words '**THIS IS**'
Replying Station
The words '**GO AHEAD**'















Batteries

The battery must be charged before use. Memory effect is a phenomenon that causes a loss in battery capacity or voltage due to repetitive shallow discharging or long-term overcharging. This memory effect has been greatly reduced in your batteries through the use of new cell technology. It is still recommended, however, that you discharge your battery as much as possible before recharging it. Recharging after each shift is good standard practice. When charging a battery that is attached to your radio, turn the radio off to ensure a full charge.

Common Types of Radio Batteries

IMPRES

IMPRES batteries when used with an IMPRES charger provide automatic, adaptive reconditioning, end-of-life display, and other advanced features. IMPRES chargers have technology that avoids overcharging. IMPRES batteries may be left in IMPRES chargers for extended periods. IMPRES chargers are compatible with non-IMPRES batteries; however the IMPRES features are only realized when using IMPRES batteries and chargers together. It is NOT recommended that an IMPRES battery be charged in a non-IMPRES charger.

UNCHARGEABLE		+		FLASHING RED
WAITING TO CHARGE		+		FLASHING ORANGE
RAPID CHARGING		+		STEADY RED
CHARGED (90% CAPACITY)		+		FLASHING GREEN
FULLY CHARGED		+		STEADY GREEN
SERVICE LIFE		+		FLASHING RED/GREEN
RECONDITIONING		+		STEADY ORANGE

Please note when battery is showing steady orange, this indicates that the battery is reconditioning and may not be available for use for several hours.

To prevent from conditioning, remove battery from charger and re-insert.

Nickel Cadmium (NiCd)

Among rechargeable batteries, the NiCd remains a popular choice for two way radio applications and is one of the most rugged rechargeable batteries available. The NiCd prefers a fast charge to a slow charge. This battery is a strong, silent worker and hard labor poses no problem BUT it should not be left in a charger for days or be used only occasionally for brief periods. A periodic FULL discharge is very important. If this does not occur, large crystals form on the cell plates, thus decreasing battery capacity and performance.

NiCd Advantages:

- Fast and simple charge – even after prolonged storage.
- High number of charge/discharge cycles – if properly maintained over 1000 cycles are possible.
- Allows recharging at low temperatures.
- Long shelf life in any state of charge.
- Good low temperature performance.
- Economically priced.

NiCd Limitations:

- Develops memory effect.
- Relatively high self-discharge rate during storage.

Nickel-Metal Hydride (NiMH)

The modern NiMH battery offers up to 40% higher energy density as compared to the NiCd. Both NiCd and NiMH batteries have high self-discharge rates. The NiCd loses about 10% of its capacity within the first 24 hours, after which the rate settles to about 10% per month. The self-discharge rate of the NiMH battery is about one and a half to two times greater compared to NiCd. This type of battery is widely accepted to be the interim step to lithium battery technology.

NiMH Advantages:

- 30-40 % higher capacity than a standard NiCd.
- Less prone to memory effect than the NiCd – periodic cycles are required less often.

NiMH Limitations:

- Limited service life — if repeatedly deep cycled, especially at high load currents, the performance starts to deteriorate after 200 to 300 cycles. Shallow rather than deep discharge cycles are preferred.
- NiMH batteries generate more heat during charge and require a longer charge time than the NiCd. The trickle charge is critical and must be controlled carefully.
- NiMH has about 50% higher self-discharge rate as compared to NiCd.
- Performance degrades if stored at elevated temperatures.

Lithium Ion (Li-ion)

The energy density of the Li-ion battery is typically twice that of the standard NiCd. There is no memory effect and no scheduled cycling is required to prolong the battery's life. In addition, the self-discharge rate is less than half compared to NiCd and NiMH.

Li-ion Advantages:

- High energy density.
- Relatively low self-discharge rate.
- Low maintenance – no periodic discharge necessary, no memory effect.

Li-ion Limitations:

- Subject to aging, even if not in use.
- More expensive than NiCd and NiMH.
- Discharge rapidly in cold conditions.

Installing and Removing the Battery

To install the battery:

1. Turn the radio off.
2. Align the three tabs at the bottom of the battery with the three slots at the bottom of the back of the radio.
3. Angle the battery forward toward the radio until the battery clicks into place.

To remove the battery:

1. Turn the radio off.
2. Holding the radio in one hand, push down on the battery release slides on both sides of the battery with the other hand.
3. Angle the battery away from the radio and remove.

Radio Repair Procedure

TMR system users should consult with their radio or user group coordinator for direction on radio repairs.

Mobile Communications Support

PSFC provides on scene communications support and equipment support for both emergency incidents and planned events that may impact public safety. The PSFC Office has several specially equipped vehicles with extra radios, antennas, battery chargers, repeaters, linking devices, and other equipment that can be provided to any emergency services personnel at exercises and emergency events. For example, staff has responded with equipment to events such as forest fires, ground search and rescue incidents, water rescues, major public gatherings, and outages of fixed communications networks. The support team has extensive technical and operational communications training, and brings expertise in communications planning (in advance or during an event) as well as significant equipment assets, which are all available at no cost.

This service is available on a 24/7/365 basis and can be activated by contacting Shubie Radio at 1-877-293-6977. Please note that this support depends on staff availability and concurrent provincial demand. Coordination with EMO NS may be required for deployment priorities.

For more information visit:

<http://novascotia.ca/is/branch/psfc/>

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