

Winlink for ARES

AN OVERVIEW OF WINLINK, ITS FEATURES AND ITS USES

BY PATRICK N4LKZ

Traditional role of ARES Support

- ▶ Report health and welfare of affected public
- ▶ Voice communications among served agencies (EOCs, hospitals, shelters, IC)
- ▶ Site tactical support – Incident command, SAR, damage and storm reporting (SKYwarn)
- ▶ Formal, structured written emergency traffic handling (ICS-213 et al)

Problems with voice communications

- ▶ Our traditional methods of communications fail for complex message handling in today's agency environment.
- ▶ Since the advent of e-mail:
 - ▶ Need for delivering written procedures, lists, graphics, images and predefined, formatted documents to multiple recipients.
 - ▶ Multiple recipient e-mail with file attachments is the de facto standard to carry written information.
 - ▶ Hand-written message forms are seldom used.
- ▶ For complex messages, voice, CW, radiograms and traditional packet radio won't do...
 - ▶ Slow, inflexible, prone to error, no permanent record, not self-originating
 - ▶ Doesn't go end-to-end from user-to-user on their own computers in their own offices
 - ▶ No attachments and no automatic distribution

Fortunately, there is a solution...



What is Winlink?

- ▶ Winlink is a worldwide system to enable e-mail by HAM radio.
- ▶ Winlink system operates on HF, VHF and UHF frequencies and over the internet.
- ▶ It provides several services:
 - ▶ Email (with attachments) with or without internet
 - ▶ Position reporting (like APRS)
 - ▶ Weather bulletins
 - ▶ Emergency and relief communications
 - ▶ Message Relay

Why Winlink over traditional Email?

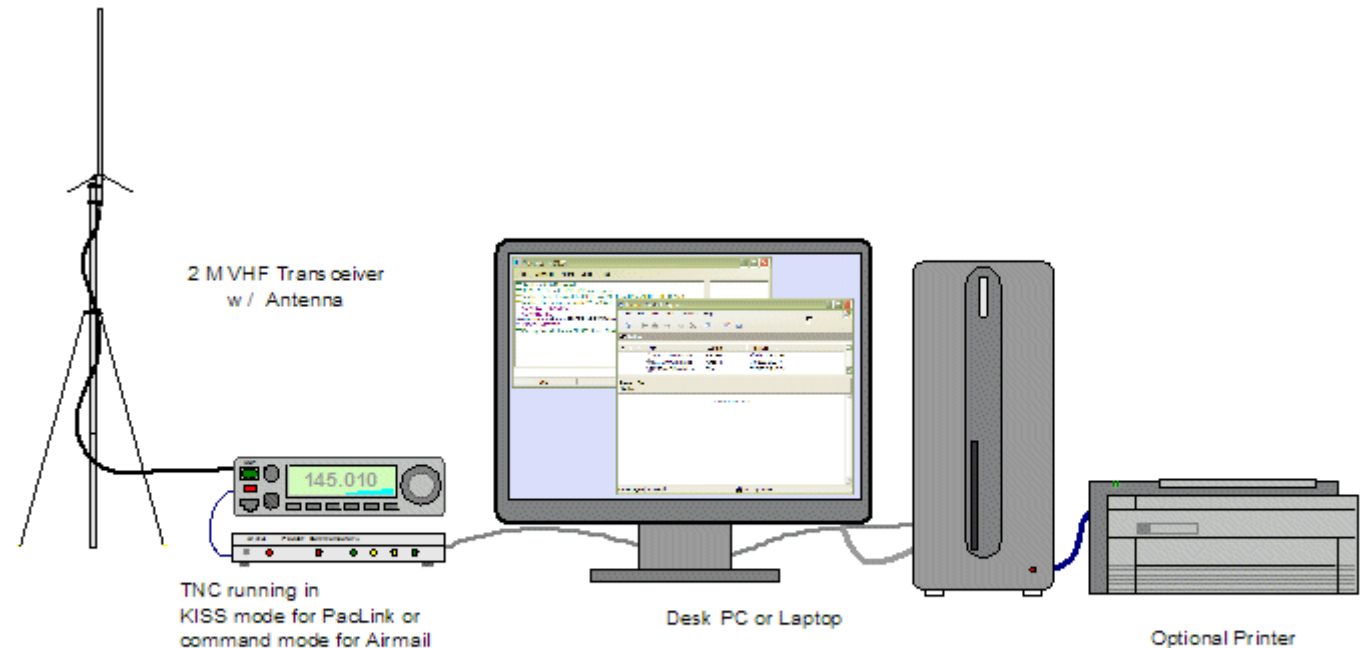
- ▶ Normal E-mail requires an internet connection.
 - ▶ Between agencies
 - ▶ Between an agency and the field
 - ▶ Between an agency and, well, *anywhere!*
- ▶ If a “last mile” internet link is broken, or the agency e-mail server is down, *e-mail cannot flow.*
 - ▶ The “last mile” is the path across an area where conventional communications have been disrupted or overloaded by an incident.
- ▶ Unfortunately, in today’s world, we cannot predict the frequency, size, nature or location of our disaster areas.

How does it work?

- ▶ Winlink consists of two cloud-based and four redundant Common Message Servers (or CMSs).
- ▶ The CMSs organize, synchronize and manage all WinLink e-mail traffic.
- ▶ All CMSs have the same (e.g. redundant) information.

How does it work?

- ▶ A typical HAM radio e-mail station is composed of simple components.
 - ▶ A VHF transceiver + antenna
 - ▶ A TNC or Soundcard interface (e.g. Signalink)
 - ▶ A computer running Windows with RMS Express



Winlink "Home" Station Equipment

How does it work?

- ▶ A radio “gateway” to the internet is called a Radio Message Server (RMS).
- ▶ To send or receive e-mail, a station makes a connection with an RMS which is always connected to the internet.
 - ▶ Packet networks or digipeaters can be used if the nearest RMS gateway has lost its internet connection.
- ▶ Up to 30 miles between stations, VHF Packet Radio is utilized.
- ▶ You can send and receive radio e-mail directly to internet e-mail users and even cell phone users via text message.

RMS Gateway Stations in the area

- ▶ W6BA* 145.050 MHz Yucca Valley / Landers
- ▶ N4LKZ-10** 145.030 MHz Yucca Valley
- ▶ KJ6BOI-1 431.070 MHz Twentynine Palms
- ▶ KJ6BOI-10 144.970 MHz Twentynine Palms
- ▶ KJ6BOI-4 145.050 MHz Twentynine Palms

* This is a digipeater. Contact KJ6BOI-10 via W6BA.

** This station is unavailable except in emergencies.

Winlink uses HF too!

- ▶ For long distances and difficult terrain, HF radios may be used.
- ▶ Instead of packet radio, HF Winlink uses Pactor 1-3 and WINMOR.
- ▶ If local VHF RMS gateways have lost their internet connection, HF Pactor or WinMOR may be the best option.

RMS HF Gateway Stations



Winlink Pactor Stations



Winlink WINMOR Stations

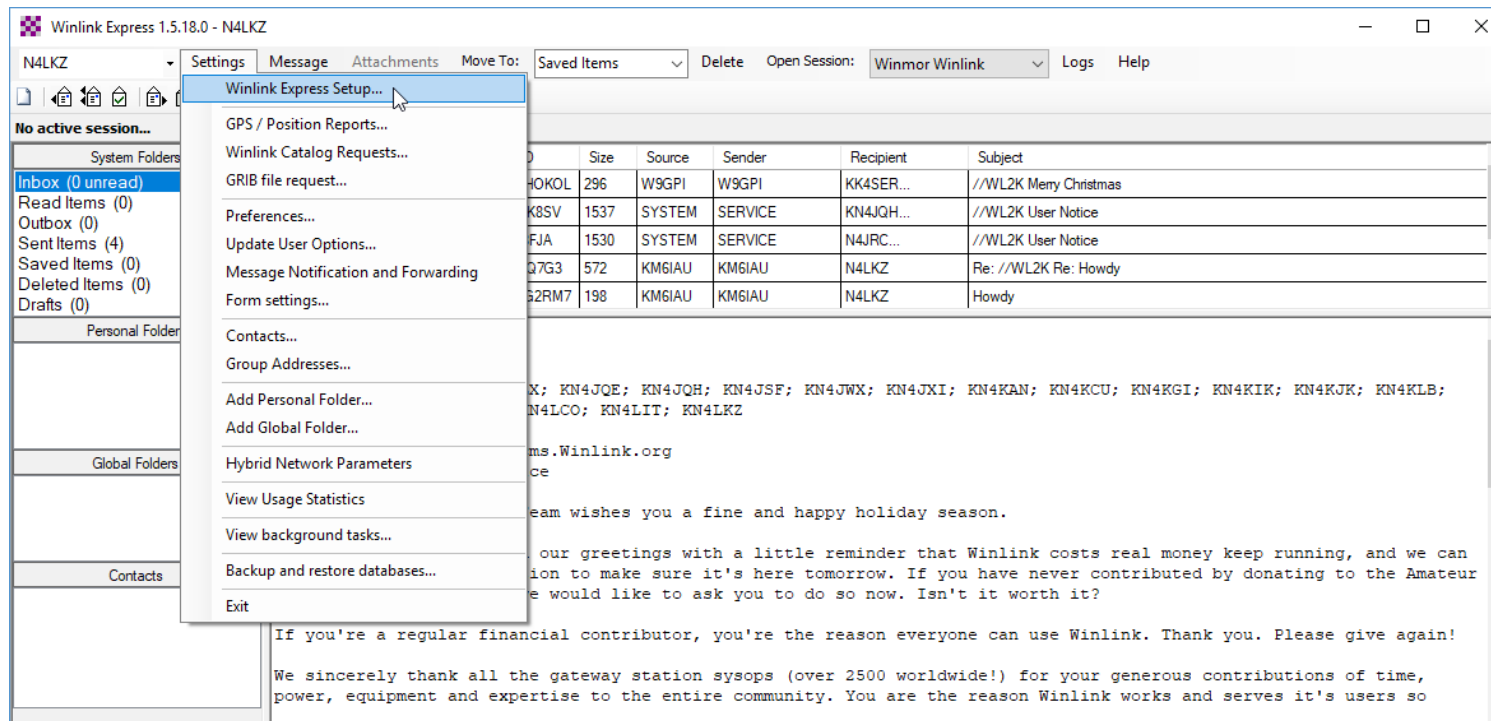
Find ideal HF stations at <https://winlink.org/RMSChannels>

Getting started with Winlink

How do I get started?

Download and install RMS Express from
<http://www.winlink.org/ClientSoftware>

How do I get started?



How do I get started?

Winlink Express Properties

×

Call Signs

My Callsign: My Password: (Case sensitive) ☐ Show password

Call sign suffix (optional): (Used for country code)

Password recovery e-mail: (Non-Winlink e-mail address where lost password will be sent when requested)

Auxiliary Callsigns and Tactical Addresses

☒ KN4LKZ

My Grid Square:

Winlink Express registration key:

Service Codes

(Use PUBLIC for ham call signs. Separate multiple service codes by spaces.)

If you change service codes, you must update the list of channels.

Contact Information (Optional)

Name:

Street address 1:

Street address 2:

City:

State/Province:

Country:

Postal code:

Web Site URL (optional):

Phone number:

Non-Winlink e-mail:

Additional information (optional):

Recalculate HF path quality if SFI changes more than:

Keep logs for weeks. Keep deleted messages for days.

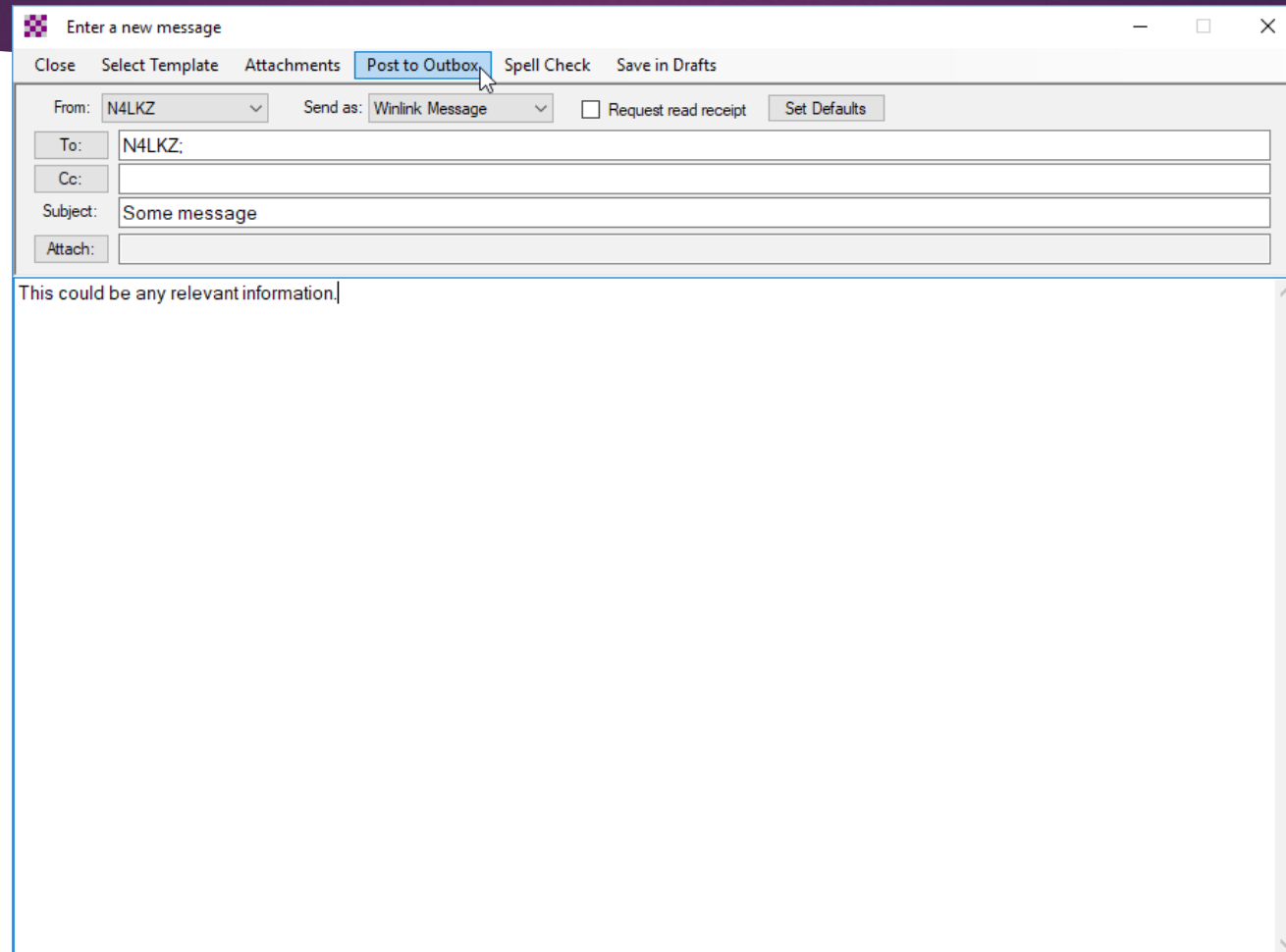
☐ Display list of pending incoming messages prior to download

☒ Warn about connections to stations holding messages

☒ Allow diagnostic information to be sent to the Winlink Development Team

☐ Automatically install field-test (beta) versions of Winlink Express

How do I get started?



The screenshot shows a window titled "Enter a new message" with standard Windows window controls (minimize, maximize, close). The window contains a toolbar with the following options: "Close", "Select Template", "Attachments", "Post to Outbox" (highlighted with a blue border and a mouse cursor), "Spell Check", and "Save in Drafts". Below the toolbar, the "From:" field is set to "N4LKZ" with a dropdown arrow. The "Send as:" field is set to "Winlink Message" with a dropdown arrow. To the right of these fields are a checkbox labeled "Request read receipt" (which is unchecked) and a "Set Defaults" button. Below the "From:" and "Send as:" fields are three input fields: "To:" containing "N4LKZ;", "Cc:" which is empty, and "Subject:" containing "Some message". Below these is an "Attach:" label followed by an empty input field. The main body of the window is a large text area containing the text "This could be any relevant information." with a vertical scrollbar on the right side.

Enter a new message

Close Select Template Attachments **Post to Outbox** Spell Check Save in Drafts

From: N4LKZ Send as: Winlink Message ☐ Request read receipt Set Defaults

To: N4LKZ;

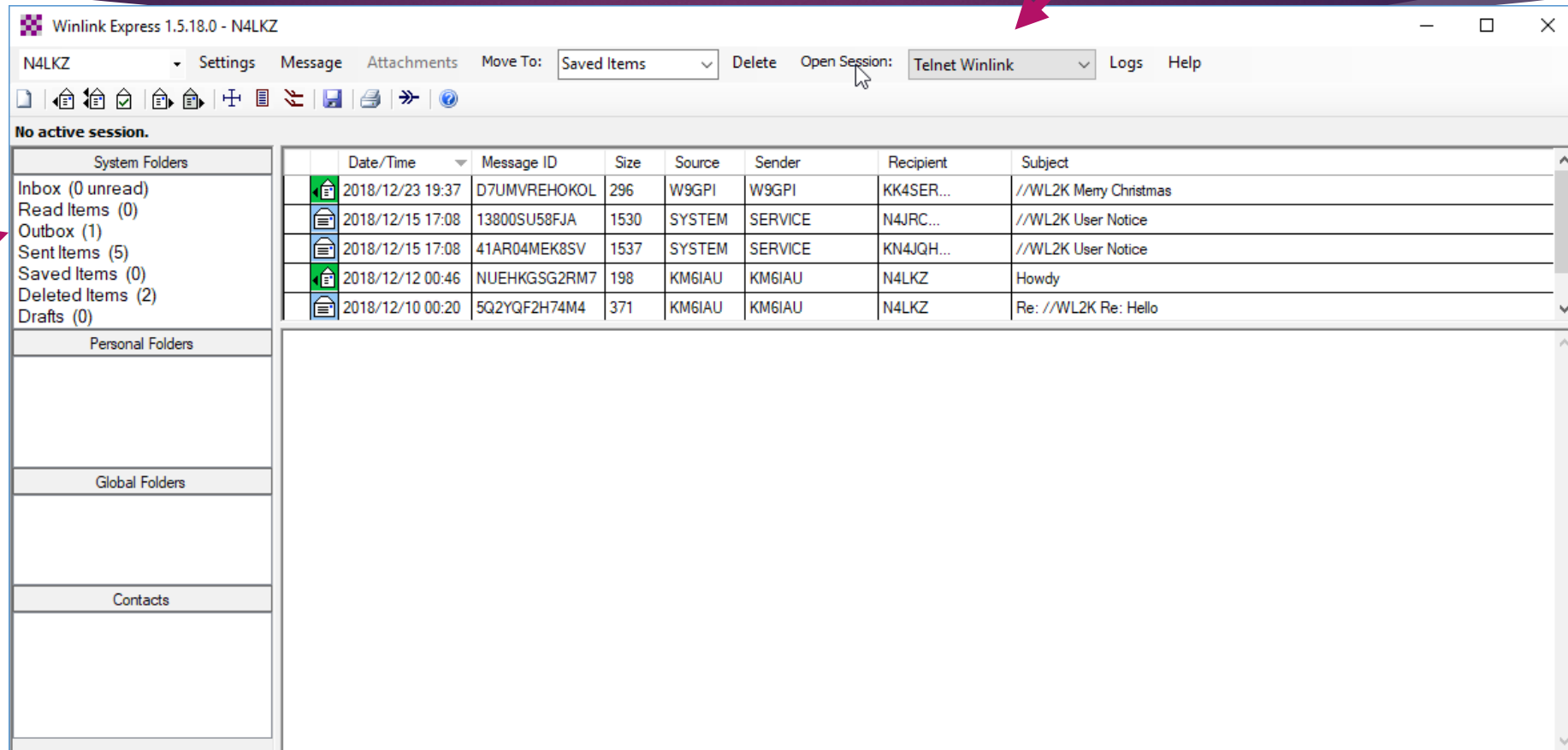
Cc:

Subject: Some message

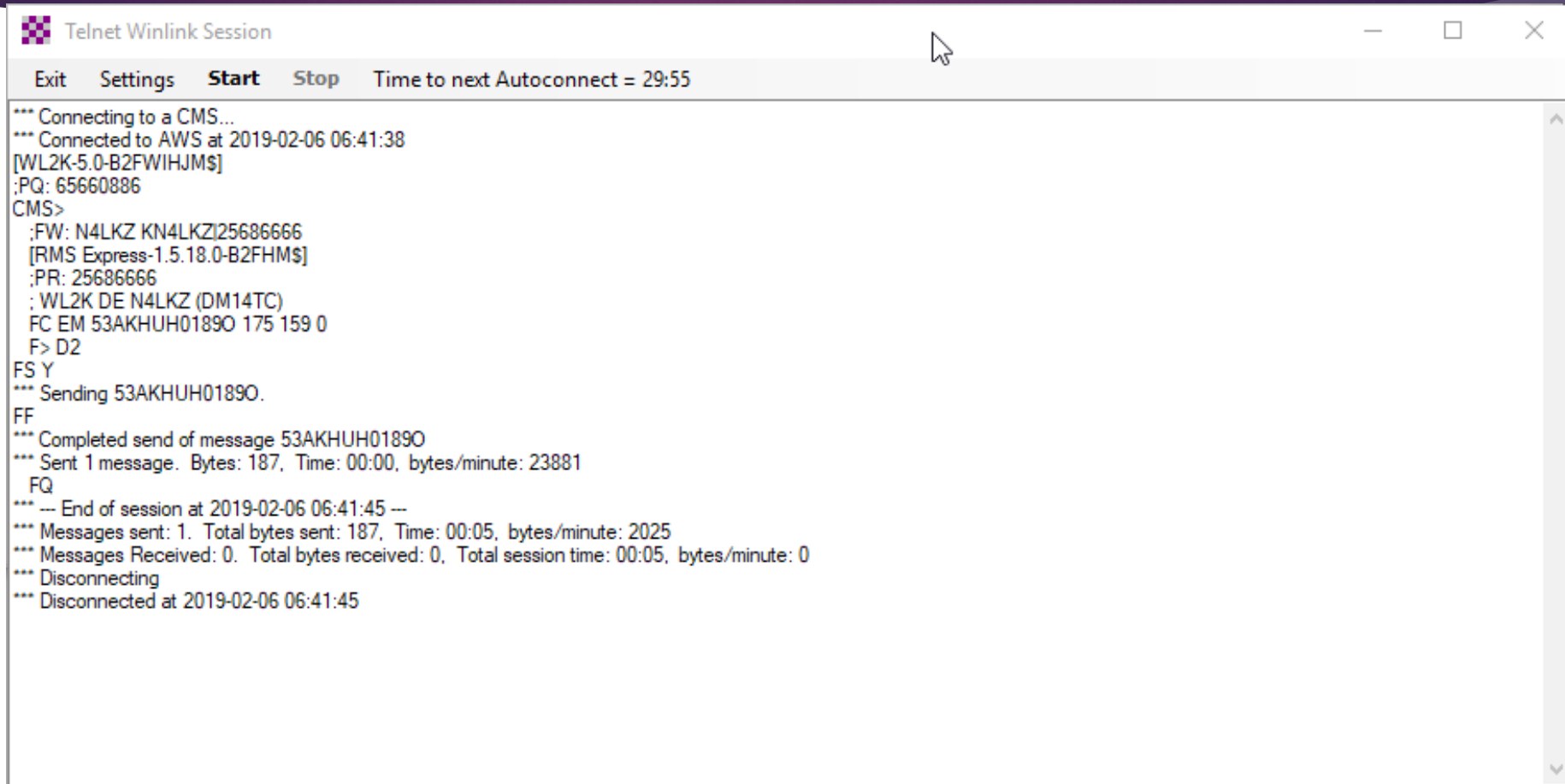
Attach:

This could be any relevant information.

How do I get started?



How do I get started?



```
Telnet Winlink Session
Exit  Settings  Start  Stop  Time to next Autoconnect = 29:55
*** Connecting to a CMS...
*** Connected to AWS at 2019-02-06 06:41:38
[WL2K-5.0-B2FWIHJM$]
;PQ: 65660886
CMS>
;FW: N4LKZ KN4LKZ125686666
[RMS Express-1.5.18.0-B2FHM$]
;PR: 25686666
; WL2K DE N4LKZ (DM14TC)
FC EM 53AKHUH01890 175 159 0
F> D2
FS Y
*** Sending 53AKHUH01890.
FF
*** Completed send of message 53AKHUH01890
*** Sent 1 message. Bytes: 187, Time: 00:00, bytes/minute: 23881
FQ
*** --- End of session at 2019-02-06 06:41:45 ---
*** Messages sent: 1. Total bytes sent: 187, Time: 00:05, bytes/minute: 2025
*** Messages Received: 0. Total bytes received: 0, Total session time: 00:05, bytes/minute: 0
*** Disconnecting
*** Disconnected at 2019-02-06 06:41:45
```

How do I get started?

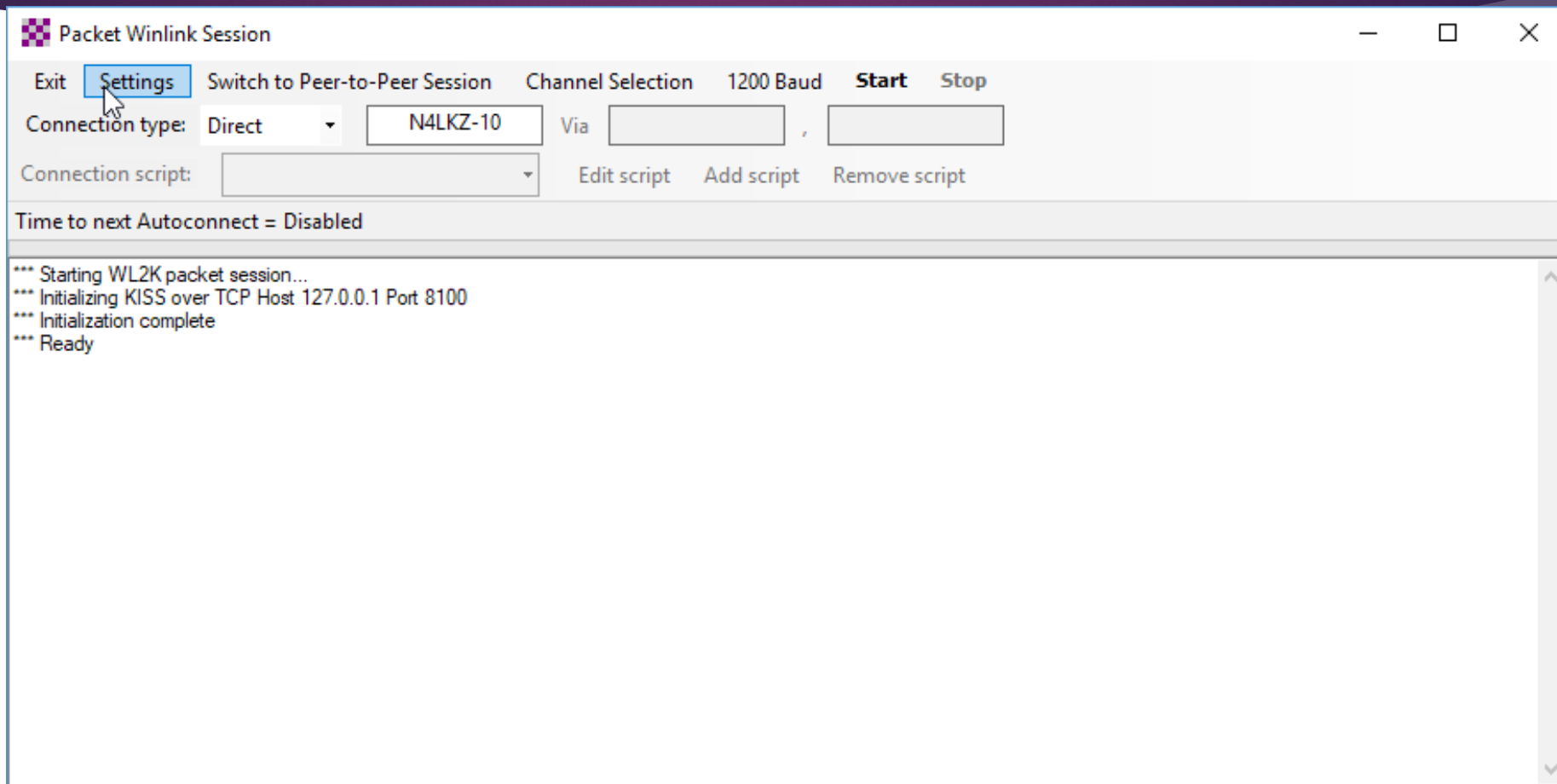
Winlink Express 1.5.18.0 - N4LKZ

N4LKZ Settings Message Attachments Move To: Saved Items Delete Open Session: Packet Winlink Logs Help

No active session.

	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
System Folders							
Inbox (0 unread)							
Read Items (0)							
Outbox (0)							
Sent Items (5)							
Saved Items (0)							
Deleted Items (2)							
Drafts (0)							
Personal Folders							
Global Folders							
Contacts							
	2018/12/23 19:37	D7UMVREHOKOL	296	W9GPI	W9GPI	KK4SER...	//WL2K Merry Christmas
	2018/12/15 17:08	13800SU58FJA	1530	SYSTEM	SERVICE	N4JRC...	//WL2K User Notice
	2018/12/15 17:08	41AR04MEK8SV	1537	SYSTEM	SERVICE	KN4JQH...	//WL2K User Notice
	2018/12/12 00:46	NUEHKGSG2RM7	198	KM6IAU	KM6IAU	N4LKZ	Howdy
	2018/12/10 00:20	5Q2YQF2H74M4	371	KM6IAU	KM6IAU	N4LKZ	Re: //WL2K Re: Hello

How do I get started?



How do I get started?

Packet Winlink/P2P Setup

TNC Connection

Packet TNC Type:

Packet TNC Model:

Serial Port:

AutoConnect Time:

TCP Host/Port:

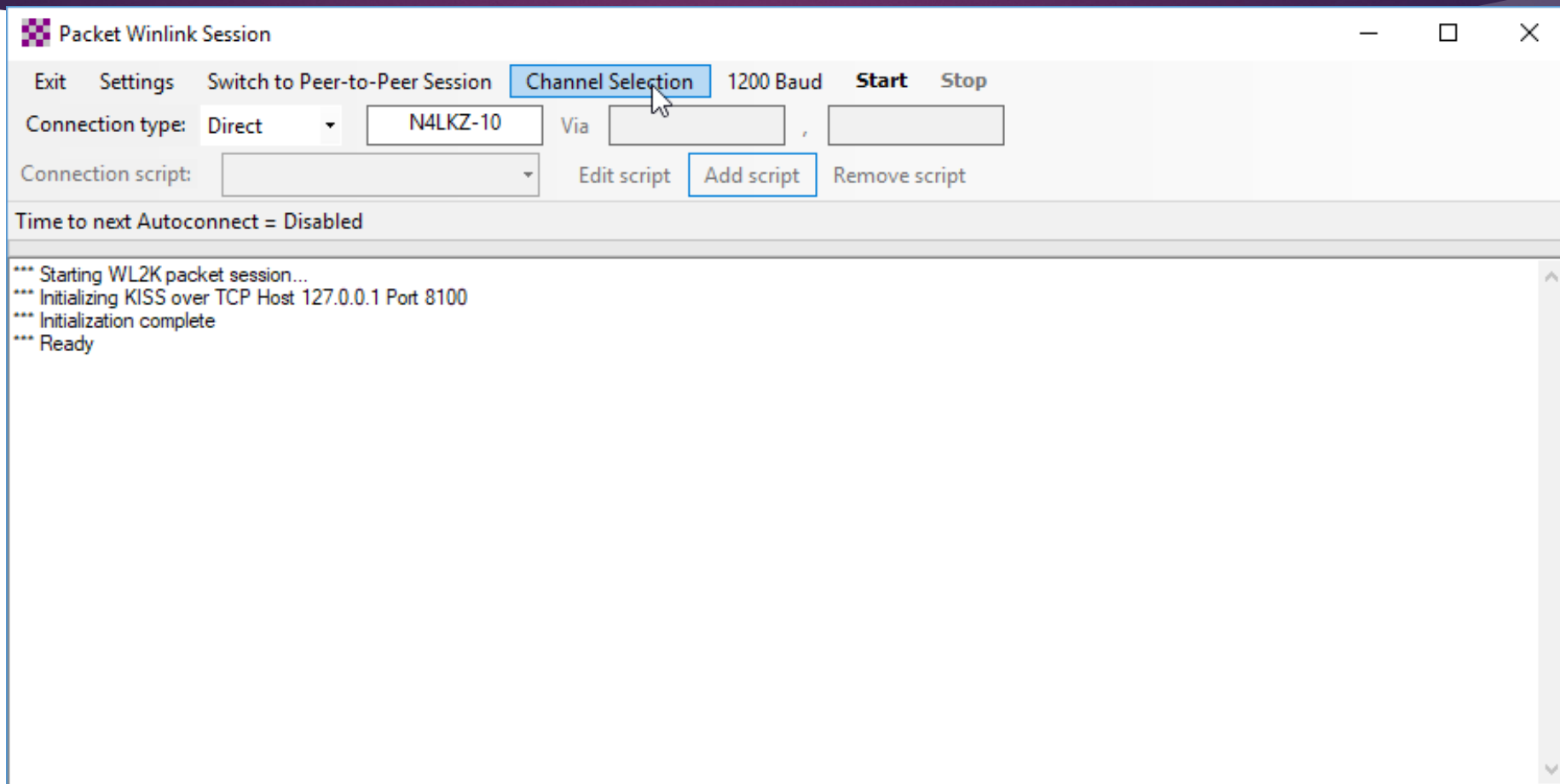
☐ If Auto Connect is enabled, open session when Winlink Express is started

TNC Parameters

☒ 1200 Baud ☐ 9600 Baud

TX Delay (Milliseconds):	<input type="text" value="400"/>	<input type="text" value="300"/>
Maximum Packet Length:	<input type="text" value="128"/>	<input type="text" value="255"/>
Maximum Frames:	<input type="text" value="4"/>	<input type="text" value="7"/>
Frack:	<input type="text" value="2"/>	<input type="text" value="2"/>
Persistence:	<input type="text" value="160"/>	<input type="text" value="224"/>
Slot time:	<input type="text" value="30"/>	<input type="text" value="20"/>
Maximum Retries:	<input type="text" value="5"/>	<input type="text" value="5"/>
Disable Xmt Level Adjust <input type="checkbox"/>	Transmit Level: <input type="text" value="100"/>	<input type="text" value="100"/>
Enable IPoll <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

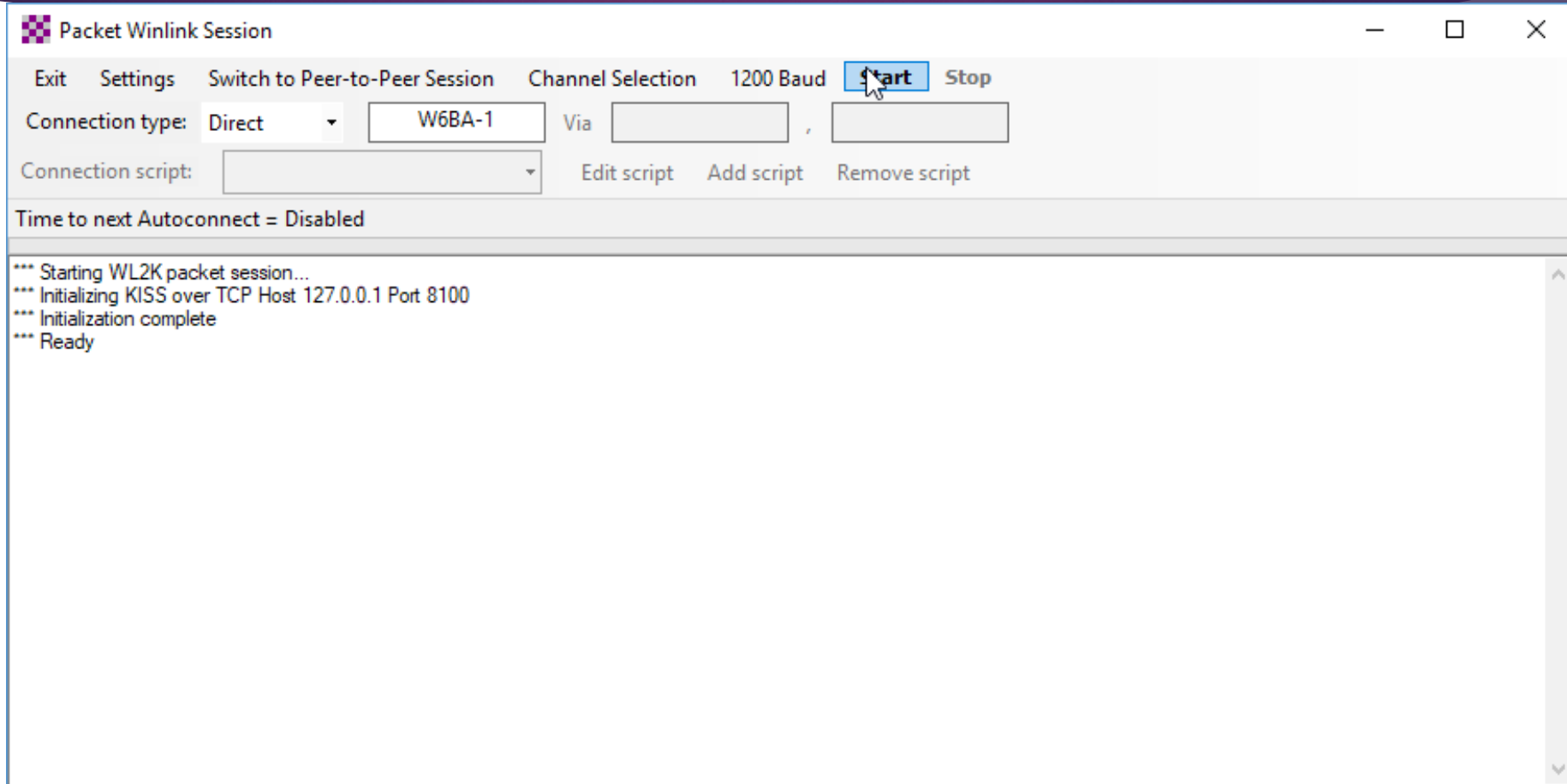
How do I get started?



How do I get started?

Packet Channel Selector						
Exit Select Channel Update Table Via Internet Update Table Via Radio						
Stations found within 160 kilometers of your grid square.						
Callsign	Frequency (MHz)	Baud	Grid Square	Group	Distance (km)	Bearing (Degrees)
KJ6BOI-1	431.070	9600	DM14WC	PUBLIC	023	090
KJ6BOI-10	144.970	1200	DM14WD	PUBLIC	024	076
KJ6BOI-4	145.050	1200	DM14WE	PUBLIC	025	066
WM6T-10	145.090	1200	DM14JG	PUBLIC	079	284
NH6WR-10	145.050	1200	DM13LM	PUBLIC	089	224
KG6HSQ-10	145.050	1200	DM13JJ	PUBLIC	109	225
WB6TT-10	144.970	1200	DM13FU	PUBLIC	110	256
AG6MO-10	145.090	1200	DM14EC	PUBLIC	115	270
KD6ILO-10	145.050	1200	DM13IF	PUBLIC	128	221
W6ACS-10	431.475	9600	DM13DS	PUBLIC	128	254
W6ACS-11	431.125	9600	DM13CW	PUBLIC	131	263
W6ACS-12	431.075	9600	DM13EK	PUBLIC	137	238
KJ6YAL-10	145.090	1200	DM12KX	PUBLIC	142	209
K6NBR-10	431.475	9600	DM13BO	PUBLIC	149	249
K6NBR-10	145.050	1200	DM13BO	PUBLIC	149	249
W6RDX-10	145.050	1200	DM12KT	PUBLIC	159	206

How do I get started?



How do I get started?

The image shows two windows from a software application. The left window, titled "Packet Winlink Session", displays connection settings and a log of the session. The right window, titled "SoundModem by UZ7HO - Ver 1.00b - [AFSK AX.25 1200bd]", shows a list of received and sent packets and a waveform at the bottom.

Packet Winlink Session Window:

- Exit Settings Switch to Peer-to-Peer Session Channel Selection 1200 Baud Start Stop
- Connection type: Direct Via W6BA-1
- Connection script: Edit script Add script Remove script
- Received: 56 Sent: 270 Time to next Autoconnect = Disabled
- Log:
 - *** Starting to call W6BA-1
 - *** Opening KISS over TCP Host 127.0.0.1 Port 8100
 - *** Connecting to W6BA-1
 - *** Connected to W6BA-1 at 2019-02-06 19:51:14
 - [BPQ-6.0.17.12-B2FWIHJM\$]
 - Please enter your Name
 - >
 - :FW: N4LKZ KN4LKZ
 - [RMS Express-1.5.18.0-B2FHM\$]
 - : W6BA-1 DE N4LKZ (DM14TC)
 - FC EM ZOAC6FQCNYEV 143 140 0
 - F> 5C
 - FS Y
 - *** Sending ZOAC6FQCNYEV.

SoundModem by UZ7HO - Ver 1.00b - [AFSK AX.25 1200bd] Window:

- Settings View Clear monitor Calibration About
- A: AFSK AX.25 1200bd 1700 DCD threshold Hold pointers
- Log:
 - 1:Fm N4LKZ To W6BA-1 <RR R F R1> [11:51:15T]
 - 1:Fm N4LKZ To W6BA-1 <I C R1 S0 Pid=F0 Len=18> [11:51:16T]
 - :FW: N4LKZ KN4LKZ
 - 1:Fm N4LKZ To W6BA-1 <I C R1 S1 Pid=F0 Len=30> [11:51:16T]
 - [RMS Express-1.5.18.0-B2FHM\$]
 - 1:Fm N4LKZ To W6BA-1 <I C R1 S2 Pid=F0 Len=27> [11:51:16T]
 - :W6BA-1 DE N4LKZ (DM14TC)
 - 1:Fm N4LKZ To W6BA-1 <I C R1 S3 Pid=F0 Len=29> [11:51:16T]
 - FC EM ZOAC6FQCNYEV 143 140 0
 - 1:Fm W6BA-1 To N4LKZ <RR R R4> [11:51:20R] [+++]
 - 1:Fm N4LKZ To W6BA-1 <I C R1 S4 Pid=F0 Len=6> [11:51:21T]
 - F> 5C
 - 1:Fm W6BA-1 To N4LKZ <I C P R5 S1 Pid=F0 Len=5> [11:51:23R] [+++]
 - FS Y
 - 1:Fm N4LKZ To W6BA-1 <RR R F R2> [11:51:23T]
 - 1:Fm N4LKZ To W6BA-1 <I C R2 S5 Pid=F0 Len=128> [11:51:23T]
 - /AwL2K Test0CE"C idzmg>ic&*jU0P<—&âlà*ý ,ôô{AYx0VQ%@[GfV00Áu0ŸT,T,y0æ Kžc 706zll Ô-âD™â—>ž Ý(Ů 734iUXAY<eH
 - 1:Fm N4LKZ To W6BA-1 <I C R2 S6 Pid=F0 Len=32> [11:51:23T]
 - 9V0 R,j0K9"i0ß dF000"hsz0

MyCall	DestCall	Status	Sent pkts	Sent bytes	Rcvd pkts	Rcvd bytes	Rcvd FC	CPS TX	CPS RX	Direction

Waveform display at the bottom of the SoundModem window shows signal activity over time, with a scale from 0 to 4000.

How do I get started?

Packet Winlink Session

Exit Settings Switch to Peer-to-Peer Session Channel Selection 1200 Baud **Start** **Stop**

Connection type: Direct W6BA-1 Via .

Connection script: Edit script **Add script** Remove script



Received: 59 Sent: 273 Time to next Autoconnect = Disabled

[BPQ-6.0.17.12-B2FWIHJM\$]
Please enter your Name
>
;FW: N4LKZ KN4LKZ
[RMS Express-1.5.18.0-B2FHM\$]
; W6BA-1 DE N4LKZ (DM14TC)
FC EM ZOAC6FQCNYEV 143 140 0
F> 5C
FS Y
*** Sending ZOAC6FQCNYEV.
FF
*** Completed send of message ZOAC6FQCNYEV
*** Sent 1 message. Bytes: 160, Time: 00:03, bytes/minute: 2561
FQ
*** Disconnected at 2019-02-06 19:51:29

*** Disconnect reported.
*** --- End of session at 2019-02-06 19:51:31 ---
*** Messages sent: 1. Total bytes sent: 160, Time: 00:17, bytes/minute: 561
*** Messages Received: 0. Total bytes received: 0, Total session time: 00:17, bytes/minute: 0
*** Disconnecting

Other features of Winlink

Position Reports

- ▶ Position reports may be sent in RMS Express using the  on.
- ▶ Location may be entered manually or received from a serial GPS device.
- ▶ Reports are sent to Winlink's QTH system and APRS.
 - ▶ Position reports will appear on APRS maps with this symbol: 
- ▶ Position reports enhance situational awareness for all parties involved in an incident.

Position Reports

GPS / Position Report

GPS Serial Port

GPS Serial Port: COM10

GPS Baud Rate: 4800

GPS Status

\$GPRMC,173643.000,A,3406.2285,N,11623.3874,W,0.00,33.07,060219,...A*40

Last fix at 2019-02-06 17:36:42

GPS Latitude: 34-06.23N

GPS Longitude: 116-23.39W

GPS Speed: 0.00

Knots

GPS Course: 033

True



Automatically update grid square from GPS position:

DM14TC

Position Report

Your last position report was posted at 2019/02/06 17:30:40 UTC

Copy GPS Data

Use Current Time

Report Date/Time: 2019-02-06 17:36:38 UTC

Latitude: 34-06.23N

Longitude: 116-23.39W

Speed: 0.00

Knots

Course: 033

True


Comment - 148
Characters Maximum:

Add Marine Weather Report

Post Report

Close

Catalog Request

- ▶ Winlink provides a catalog of real time data for end users.
- ▶ The catalog query may be accessed using the `ico` 
- ▶ Available queries include:
 - ▶ Weather conditions
 - ▶ World news
 - ▶ Propagation
 - ▶ Winlink Status
 - ▶ And much, much more!

Catalog Request

- ▶ The catalog may be refreshed using the “Update Via Internet” option.

DO NOT USE THE “REQUEST UPDATE VIA RADIO” OPTION!

Winlink is a low baud rate system, and updating the catalog may take a significant amount of time to complete.

BE MINDFUL OF THE SIZE OF QUERIES!

Like above, larger queries may clog up the frequency for an unacceptable amount of time.

Catalog Request

Winlink Query Catalog

Categories	Inquiry ID	Description	Size
LIGHTNING	CMS_STATUS	Real time Operational Status of all WL2K CMSs	3968
METAR	CMS_TRAFFIC	Winlink Message Traffic History	1787
METAREA	WL2K_MOBILES	WL2K Mobile user posting reports in the last 30 days	46620
METAREA_I	WL2K_NEARBY	Closest 30 WL2K Mobiles to Your Last Reported Position	3968
METAREA_II			
METAREA_III			
METAREA_IV			
METAREA_IX			
METAREA_VII			
METAREA_X			
METAREA_XII			
METAREA_XIV			
METAREA_XVI			
NEWS			
NICARAGUA			
PROPAGATION			
S/PACIFIC_WX			
SAT_KEPS			
SAT_PIX			
UK_CADET			
WL2K_HELP			
WL2K_RMS			
WL2K_USERS			
WX_AK_COAST			
WX_ARCTIC			
WX_ATLANTIC			
WX_AUS			
WX_AUS_RAD			
WX_BALT_DE			
WX_BALT_DK			
WX_BALT_EST			
WX_BALT_FIN			
WX_BALT_SWE			

Selections

CMS_STATUS

Double click to add or delete query selections.

Post Request

Last Update
2019/02/06 17:44


Update catalog list

Update via Internet

Request update via radio

Cancel

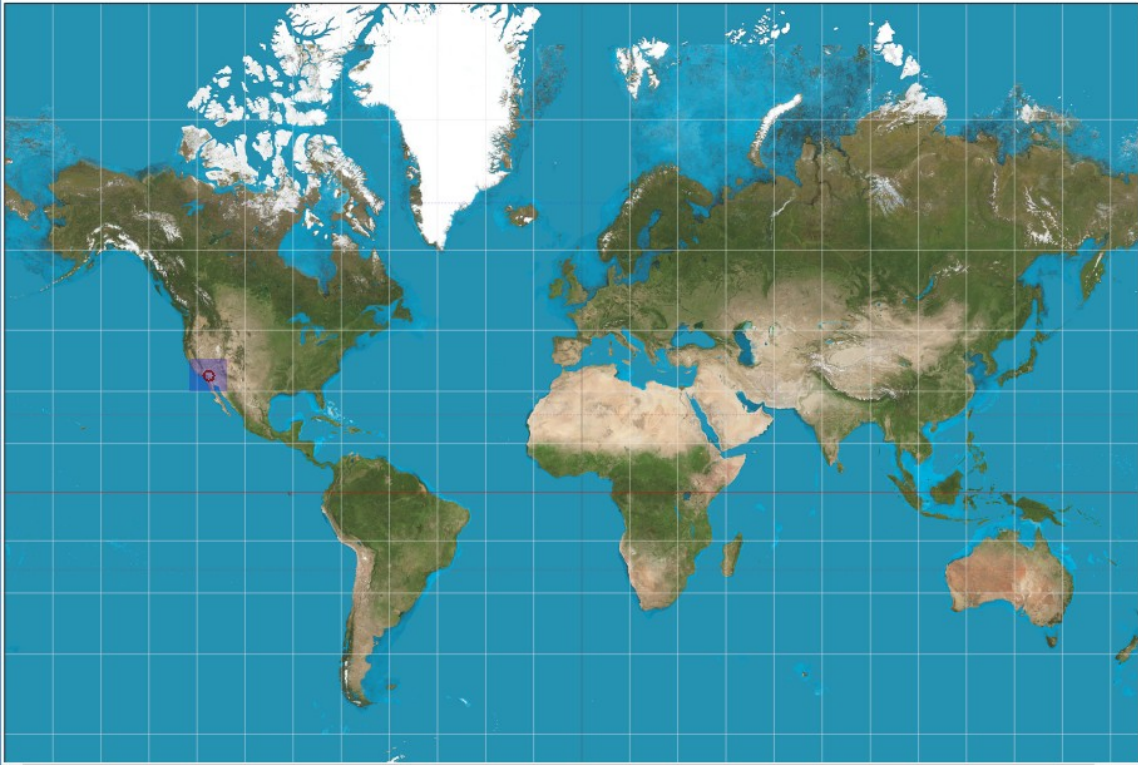
GRIB Request

- ▶ GRIB (GRIdded Binary) is a data format used in meteorology to store historical and forecast data.
- ▶ Available meteorological data consists of Wind, Rain, Pressure, Surface Temperatures, and other technical data.
- ▶ The GRIB request may be accessed using the n.
- ▶ A request may be made for an area or a spot on the map.
- ▶ Once the request is posted, you will receive a message with the GRIB file as an attachment.
- ▶ To view the resultant GRIB data, download an application such as XyGrib.

GRIB Request

Select Map Region and Options for GRIB File

Zoom-in Zoom-out Lat: 062° 44' S Lon: 012° 32' W Type of GRIB: Area



Selected GRIB Region

038° 16' N
122° 22' W 110° 39' W
029° 50' N

Information

☒ Wind ☐ HGT500
☐ Waves ☐ SFCTMP
☒ Rain ☐ TMP500
☐ PRMSL ☐ LFTX

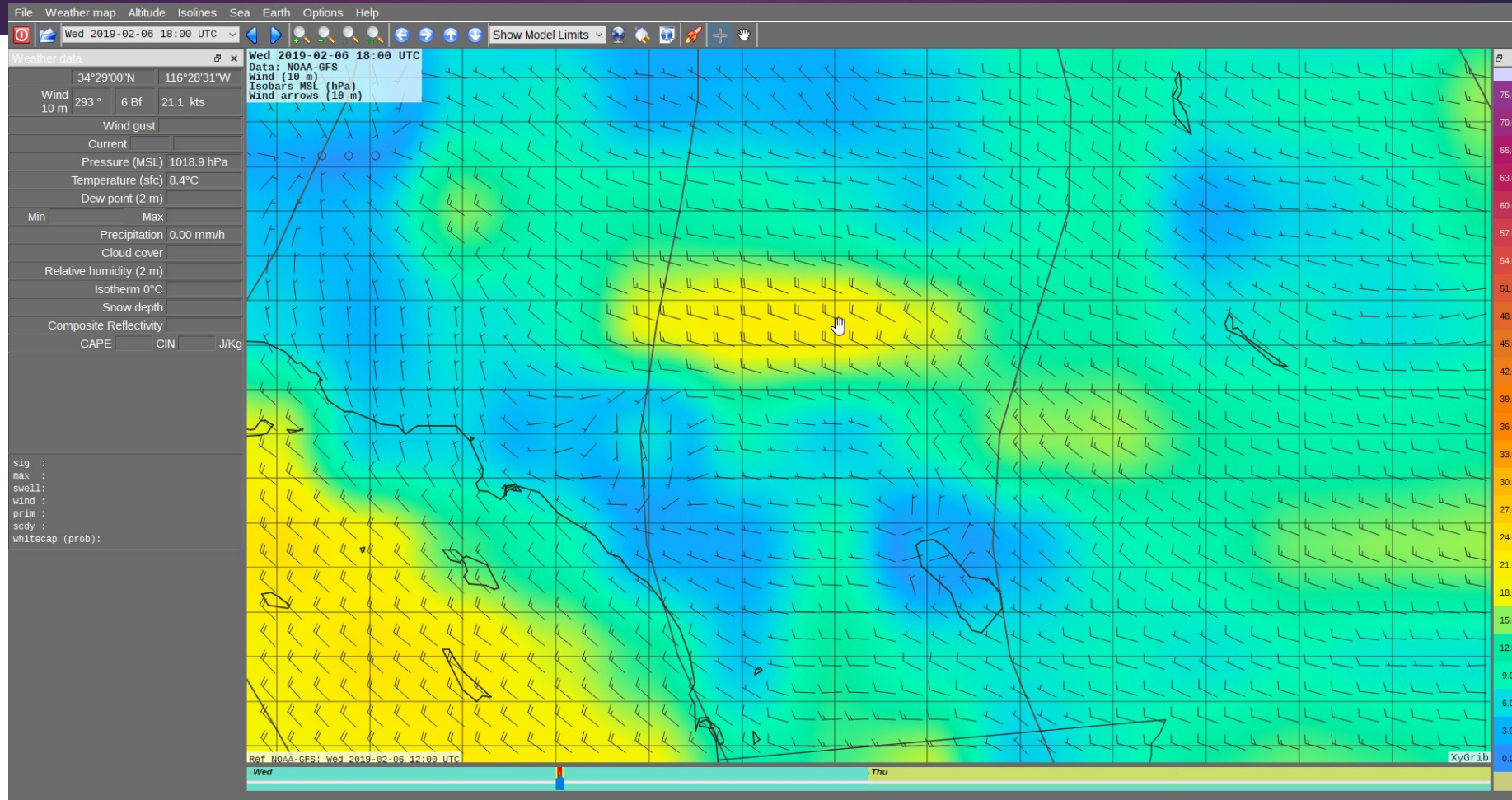
Forecast

Days: 2 Hours: 6
Time of day: 00:00 UTC
Resolution: 0.5 degrees

Action

Post Request
Cancel
File size (kb): 8

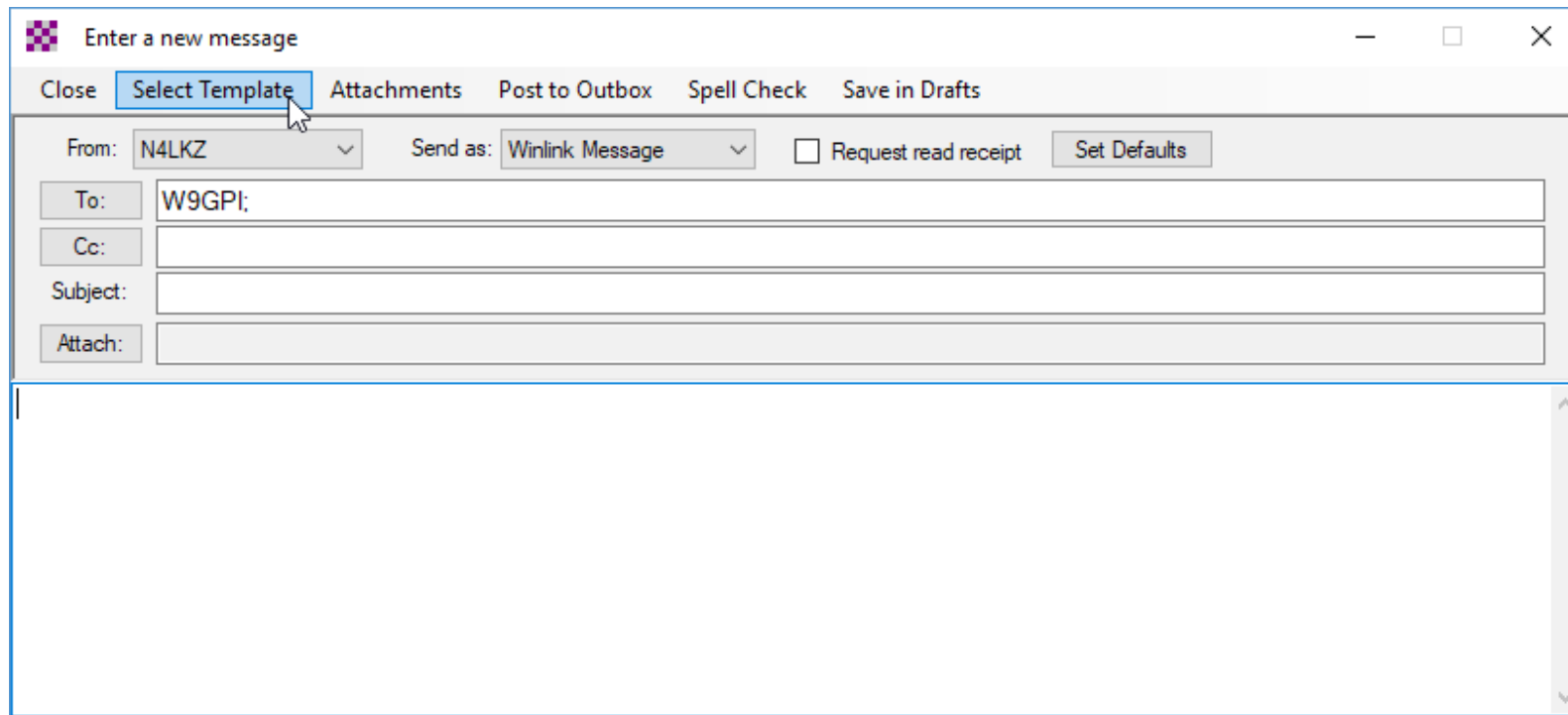
GRIB Request



Message Templates

- ▶ When operating under ICS, we will typically be requested to transmit information in standardized forms (such as ICS-213).
- ▶ Winlink provides a simple way to handle these requests.

Message Templates



Enter a new message

Close Select Template Attachments Post to Outbox Spell Check Save in Drafts

From: N4LKZ Send as: Winlink Message ☐ Request read receipt Set Defaults

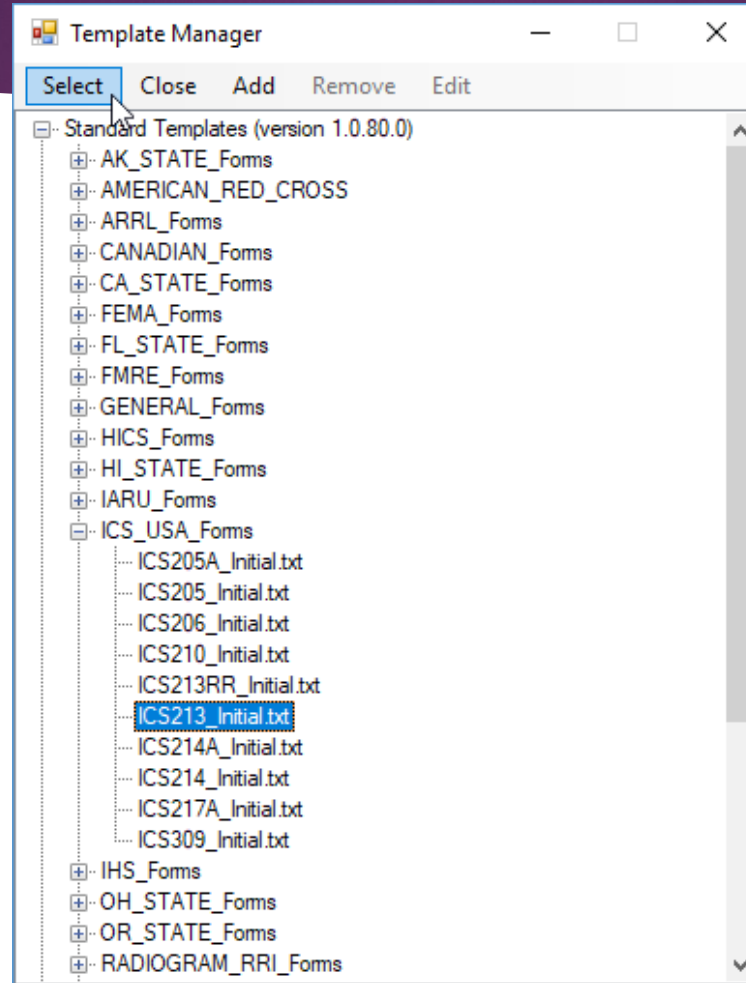
To: W9GPI;

Cc:

Subject:

Attach:

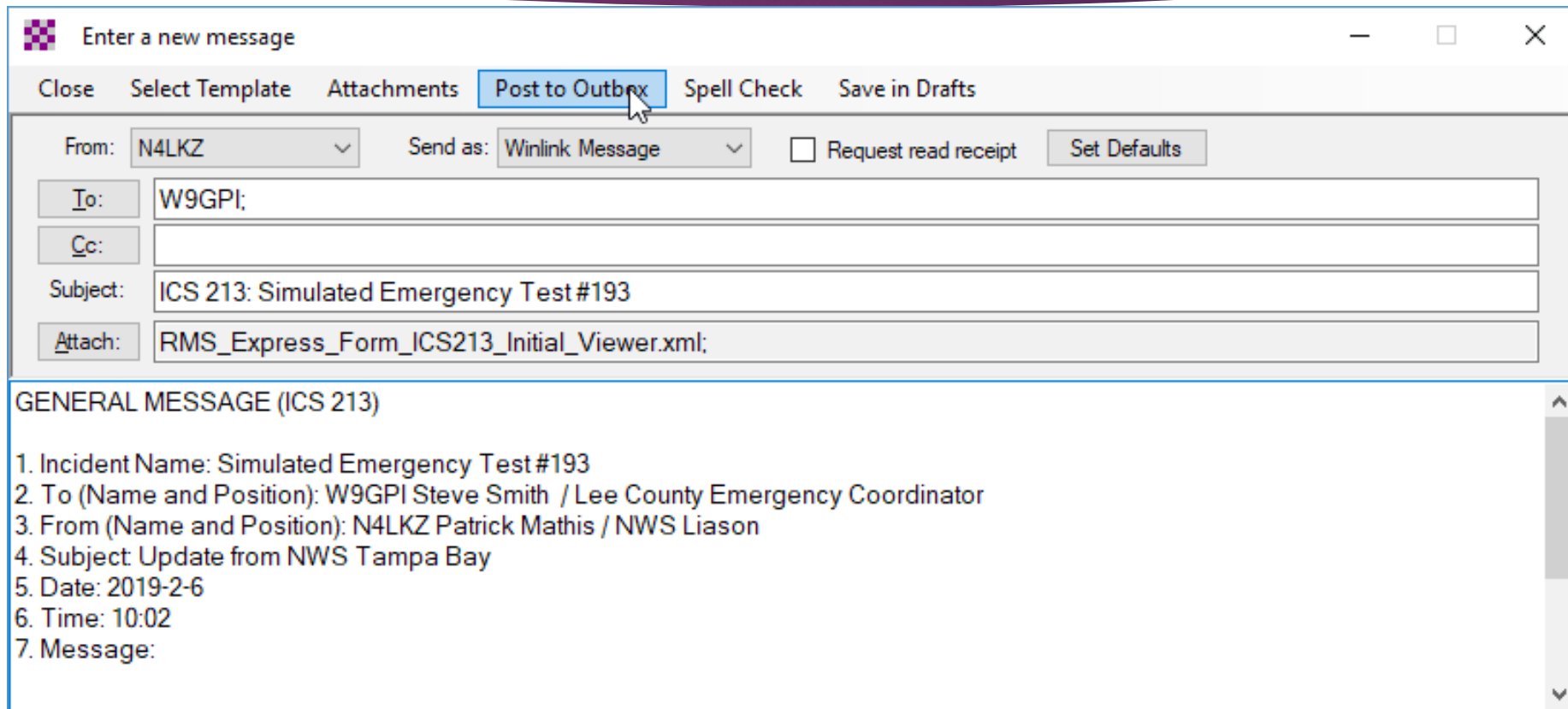
Message Templates




Message Templates

General Message (ICS 213)			
Load ICS213 INITIAL Data		Form Instructions	
1. Incident Name: <input type="text" value="Simulated Emergency Test #193"/>			
2. To (Name/Position): <input type="text" value="W9GPI Steve Smith / Lee County Emergency Coordinator"/>			
3. From (Name/Position): <input type="text" value="N4LKZ Patrick Mathis / NWS Liason"/>			
4. Subject: <input type="text" value="Update from NWS Tampa Bay"/>		5. Date: <input type="text" value="2019-2-6"/>	6. Time: <input type="text" value="10:02"/>
7. Message: <div><p>The chief meteorologist at <u>NWS</u> Tampa Bay has acknowledged our contact with <u>SKYwarn</u> Net Control at Ruskin.</p></div>			
8. Approved by: <input type="text" value="N4LKZ Patrick Mathis"/>		Position / Title: <input type="text" value="NWS Liason"/>	
Save ICS213 INITIAL Data	Submit	Reset Form	Senders Base Call: <input type="text" value="N4LKZ"/> Ver 36.2

Message Templates



 Enter a new message

Close Select Template Attachments **Post to Outbox** Spell Check Save in Drafts

From: N4LKZ Send as: Winlink Message ☐ Request read receipt Set Defaults

To: W9GPI;

Cc:

Subject: ICS 213: Simulated Emergency Test #193

Attach: RMS_Express_Form_ICS213_Initial_Viewer.xml;

GENERAL MESSAGE (ICS 213)

1. Incident Name: Simulated Emergency Test #193
2. To (Name and Position): W9GPI Steve Smith / Lee County Emergency Coordinator
3. From (Name and Position): N4LKZ Patrick Mathis / NWS Liason
4. Subject: Update from NWS Tampa Bay
5. Date: 2019-2-6
6. Time: 10:02
7. Message:

Message Templates

General Message (ICS 213)		
1. Incident Name: Simulated Emergency Test #193		
2. To (Name/Position): W9GPI Steve Smith / Lee County Emergency Coordinator		
3. From (Name/Position): N4LKZ Patrick Mathis / NWS Liason		
4. Subject: Update from NWS Tampa Bay	5. Date: 2019-2-6	6. Time: 10:02
7. Message The chief meteorologist at NWS Tampa Bay has acknowledged our contact with SKYwarn Net Control at Ruskin.		
8. Approved by: N4LKZ Patrick Mathis		Position / Title: NWS Liason
9. Reply: <div></div> <p><small>Print form to obtain a written response if needed. You cannot create a reply from here. Close this form. When ready to respond double click on the message. Click <i>Reply</i> at the top and enter the response into the new form. Click SUBMIT when ready to post.</small></p>		
10. Replied By (Name): <input type="text"/>		Position / Title: <input type="text"/>
Date / Time: <input type="text"/>	Senders Base Call: N4LKZ Ver 36.2	

Message Templates

- ▶ Other templates include:
 - ▶ ICS 205A Communications List
 - ▶ ICS 205 Incident Radio Communications Plan
 - ▶ ICS 206 Medical Plan
 - ▶ ICS 210 Resource Status Change
 - ▶ ICS 214A Individual Activity Log
 - ▶ ICS 214 Activity Log
 - ▶ ICS 217A Communications Resource Availability Worksheet
 - ▶ ICS 309 General Purpose Communications Log
 - ▶ Many, many, MANY more!

Final Notes

- ▶ Keep messages and attachments as small as possible when using Winlink over RF.
 - ▶ A 10kb message will take ~5-10 minutes on average to send after the gateway handshake. A 1MB picture will take **several hours** to send over VHF, and over **a day** to complete over HF.
 - ▶ For an example, an 30kb attachment took 50 minutes to download on VHF using the W6BA digipeater.
- ▶ Keep polling intervals short.
 - ▶ A RF RMS gateway handshake takes approximately 45 seconds.
- ▶ You can use software such as Paclink to link existing e-mail clients to the Winlink network.



Any questions?