White Paper NTS-005
Cycle 2 CAN and TCC Operation Guidelines
for the Central Area Staff of the American Radio Relay League

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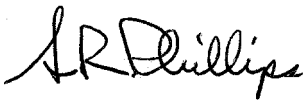

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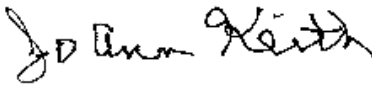

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1. Scope

1.1. General

This paper describes “best practices” guidelines for use with daytime (Cycle 2) Transcontinental Corps (TCC) operations and Cycle 2 Central Area Net (CAN) operations. These guidelines are based on years of experience with Cycle 4 CAN NCS and TCC Liaison operation and observations made while monitoring recent cycle 2 nets.

1.2. Introduction

Operation of Cycle 2 CAN has been problematic during the summer months, largely due to poor propagation during the day on 20 meters, where the net meets at 1400 Central Time.

As a result, Net Control Stations have had a very hard time communicating with the liaison stations to direct movement of traffic, requiring the help of external relay stations who may or may not be liaison stations themselves. Communication among the region net liaison stations has also been difficult.

Single TCC liaisons from the Pacific and Eastern area have tried to check in to CAN to pass traffic (bi-directional). These stations have generally had high power and good antenna systems so they can be heard, but have had a great deal of trouble hearing those CAN stations who are only running 100 watts with simple antennas.

As a result of complaints from the other area TCC directors, it has become apparent that an overhaul of the Central Area TCC liaison assignments is needed. Stations with higher power and/or better antennas are needed to perform the interface with the PAN and EAN liaisons. More about this will be described in section 4. It should also be noted that there is no longer an active cycle 1 or 2 Pacific Area Net, which means some Pacific Area stations may attempt to check into CAN to pass traffic for which they have no other routing. Options on how to handle this will be described in section 3, and what it means to the Central Area TCC liaisons will be dealt with in section 4.

It has also been observed that NCS stations must have high power and/or good antenna systems to be heard by the majority of net participants. More about this in section 3.

2. Applicable Documents

NTS-001	NTS Status white paper for the Central Area. Via the link on http://www.k6jt.com/
NTS-002	NTS Digital Operations (for WL2K description). Via the link on http://www.k6jt.com/
PSCM (ARRL)	Public Service Communications Manual: (Section II: NTS): http://www.arrl.org/public-service-communications-manual
MPG (ARRL)	NTS Methods and Practices Guide (Appendix B of the PSCM): http://www.arrl.org/appendix-b-nts-methods-and-practices-guidelines

3. Central Area Net

The purpose of the Central Area Net is to exchange traffic among the region nets, 5th, 9th, and 10th, and out of area traffic with the Pacific and Eastern areas. These interfaces are shown in Figure 1.

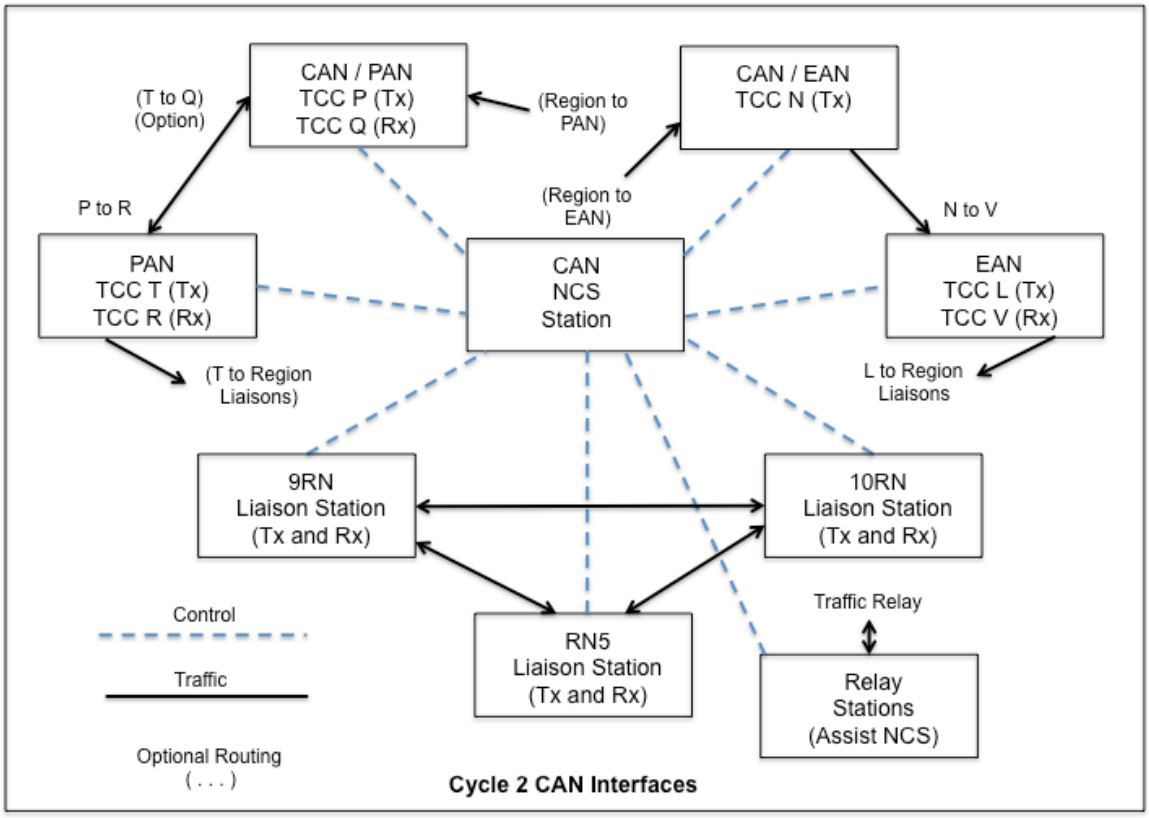

Figure 1. Central Area Net Interfaces

This diagram needs more explanation, especially regarding those paths shown as "(Optional)". The rationale for these will be summarized in this section, even though most of it applies to the TCC section.

The CAN NCS is tasked with checking in all the CAN region liaison stations and the Central, Pacific, and Eastern TCC stations, noting what traffic they have and matching up transmit and receive stations. The assistance of relay stations who can be heard by the NCS is generally necessary to complete this task. All stations checking in should identify their function (e.g., RN5 Tx and Rx or TCC November). These functions should be identified in the NCS report to the Net Manager as well.

Although the higher level nets such as Area and Region are normally limited to assigned liaisons, due to the propagation problems on 20 meters, stations who are available to help relay but otherwise do not have a specific function may assist with any of the NCS instructions or traffic relay, and are most welcome to participate. They must, of course, follow NCS direction and avoid transmitting until invited to do so.

3.1. Net Operating and Side Frequencies

Carolyn, KC5OZT, the CAN manager has defined the net operating frequency to be 14.345 MHz. If this frequency is in use, then the NCS should proceed down the band at 5 KHz intervals through 14.340, 14.335, 14.330, 14.325, etc. until a relatively clear frequency is found on which to call the net. Net participants must also be cognizant of this and search downward looking for the NCS when the band is particularly busy. The official alternate frequency is 14.340, and 14.325 is defined as the primary side frequency to which stations are sent to pass traffic. These are, of course, only suggestions and may require modification depending on activity and conditions. 7.243 MHz has also been defined as an alternate for those stations close enough to hear each other on 40 but cannot hear each other on 20 due to the longer skip zones.

Ideally, stations should be sent off frequency to pass their traffic, using a relay station if needed. When a relay is needed, all 3 stations should be sent off to the same frequency at the same time, after confirming the receive can hear the relay or direct transmitting station. When sent off, the station to RECEIVE is the one who calls the station who is to transmit. In the case of a 3rd party relay station, it is the RELAY station who calls first the receive station and then the transmit station and proceeds to receive the traffic. Once it is all sent and acknowledged, the transmit station should immediately return to the Net Frequency and check in with the NCS. The relay station then sends the traffic to the final receive station and both return when done, listening for any other stations who may be sent to also pass traffic.

Because 20 meters can become crowded, it is suggested that the Extra class segments be used when the stations passing traffic have the necessary license. The capability of each station to use the Extra segments has been added to the station roster that is published in the CAN Newsletter (note that no currently active stations have an Advanced license, so those segments are not considered here). The roster should be referenced by the NCS when assigning stations to exchange traffic and sending them to those segments to meet. If any station has only the General license, or the station is not in the roster, then of course a frequency in the General segment (14.225 and above) must be used by all. Carolyn has defined the “border” frequency of 14.175 as a starting point, moving down from there in 5 KHz increments for those with Extra class licenses (14.151 should probably be the lowest point so that the suppressed carrier and all Upper Sideband frequencies remain in the voice band).

3.1.1. Future Dual-Band Possibility

Currently it is an NCS option to send a station to 40 meters (7.243) to call for checkins and traffic listings for those stations who cannot hear the NCS. When enough participants are recruited, this will become an official position as Assistant NCS, or ANCS, and added to the net duty roster.

Normally, it is necessary for the NCS and ANCS to hear each other on 20 so the ANCS can report the checkins and traffic listings. We are thinking of possible alternatives, such as using Winlink 2K as an “orderwire” that the ANCS can use to communicate information to the NCS. The Airmail program can be set up, using TELNET, to automatically check for messages at a specific interval, say 5 minutes. If the NCS has this running on their computer, then the ANCS could send the checkin and traffic listings by that means, even if they cannot hear each other on 20 meters. This assumes the ANCS also has Winlink 2K capability, which is very easy to set up for TELNET access (see the NTS Digital Operations white paper as listed in section 2).

Should this dual-band operation become feasible with sufficient stations to handle it, this will be announced in a future CAN Newsletter.

3.2. Region Liaison Stations

It is the responsibility of the Region net managers to recruit and assign liaison stations to check into CAN, with or without traffic from the region net, which should meet at a time prior to CAN (cycle 1) and also after CAN (cycle 2) if possible. The assigned stations should be published,

ideally in the CAN Newsletter, so that the CAN NCS stations know who to call or who to solicit as a check-in using a relay station. At one time, separate transmit and receive stations were assigned for each region. However, since traffic is fairly light these days, and it is difficult to recruit enough volunteers, a single station can usually handle both Tx and Rx.

When distances are not long, it is suggested that Region liaison stations with traffic for another region be sent to 40 meters to try to pass the traffic. The CAN Manager has defined 7.240 or 7.243 MHz for the starting frequency. Changes and additions will be published in the Newsletter.

Because it is often difficult to recruit regular liaison stations, some method of handling traffic for a region with no liaison is required. It is suggested that one of the TCC stations, the one with the least amount of other traffic, be requested to take the missing region traffic from another region or TCC liaison station. This traffic may then be routed for passage on, for example, cycle 4 CW nets using a liaison station, as described in the next paragraph. Alternatively, NTS Digital may be used. NTS is a ***system***, as the name says, and all 3 parts can and should work together.

Any incoming traffic from the Pacific or Eastern area ***must*** always be handled. A TCC liaison station should ***never*** be left holding any traffic. If it is not feasible for the regular CAN TCC station to receive the traffic, then ***any*** CAN station, as assigned by the NCS, who also has Winlink 2K digital access and is capable of communicating with the Area TCC liaison, should take the traffic and pass it either to the assigned CAN TCC liaison via WL2K or to either K6JT or KA5KLU for handling on cycle 4 nets. Note that all TCC liaison stations in CAN will be ***required*** to have at least Winlink 2K digital capability, even if only via TELNET.

3.3. Pacific and Eastern Area TCC Traffic Routing

The diagram in Figure 1 shows some “optional” routing for traffic to and from the Pacific and Eastern TCC stations. This is because alternate routing may be needed depending on propagation conditions.

The EAN station brings traffic for the 3 regions in CAN as TCC Lima. This traffic should normally be sent directly to the appropriate region liaison station(s). There is no corresponding CAN TCC station to receive it. However, relays may be needed and substitute stations with the capability to receive the EAN TCC station should always pick up all traffic, as mentioned previously.

For traffic from CAN to EAN, there are 2 possibilities. Normally the CAN region liaisons will be directed to send their traffic to the TCC November station, who then collects them and passes them to the EAN station at the end of the net, or as assigned by the NCS. But if the region liaison has a good path direct to the EAN station but not to the CAN TCC station, then the traffic may be sent directly to the EAN station without going through TCC November. This would also be the case when no TCC November station shows up. Note that the traffic is still counted in a TCC report by the November station, even if it is sent directly to the EAN station.

For Pacific area traffic, the routing is modified from what would normally occur, as described in the Public Service Communications Manual. The PSCM stipulates that the CAN TCC Quebec should either check into PAN to receive the traffic or meet the PAN TCC Tango station after PAN (which would normally meet ***after*** CAN for the day) and bring the traffic to CAN or the region nets the next day.

Because there is currently no PAN net in cycle 2, the PAN TCC station is bringing the traffic directly to CAN to distribute to the region liaison stations. Alternatively, a schedule may be set up with a TCC Quebec station in CAN prior to CAN meeting. It does not make any sense for the PAN Tango station to send the traffic to a Quebec liaison on CAN itself unless the region liaisons are not reachable. More about this in section 4.

For traffic going from CAN to PAN, the normal process is for TCC Papa to collect the messages from the region liaisons, similar to TCC November for EAN, and then pass that traffic to the PAN TCC Romeo station. However, as with EAN, if the region liaison can communicate directly with the PAN TCC station, it is more efficient, and permitted, to send that traffic directly to PAN TCC.

Again, this traffic is still counted in the TCC Papa report to the TCC director, even if sent directly by a region liaison.

3.4. Net Discipline for Stations Checking In

It is quite disconcerting for an assigned liaison station, either region or TCC, to be on frequency at the proper time but unable to hear the NCS station. With propagation as it has been on 20 meters, this is unfortunately going to happen, perhaps frequently. Under no circumstance should a station transmit "blind". It is the responsibility of the net control station to request relay stations that are far away from the NCS location to make "net calls", i.e., ask for check-ins to CAN. Only when the liaison station hears one of these invitations to check in should transmission be made.

As for the NCS, after calling for checkins, either as a directed group (i.e., calling for each region and TCC function in sequence, followed by a general check-in invitation) or as a general call for CAN stations to check in (NCS option), as soon as the sequence is completed, if listed traffic can be passed, assignments to another frequency for the stations with the traffic should be made. Once traffic passage is started between stations who can hear each other, the next item of business should be to request that other stations who have checked in do a net call to solicit additional checkins from stations that either cannot copy the NCS or who the NCS cannot hear directly. Choosing a station farthest from the NCS location is generally the best approach, but intermediate stations who have strong signals are also to be used. It is advisable for more than one station, including perhaps the PAN and EAN TCC stations, to do a net call for additional checkins. This procedure is currently used and seems to work the best.

The NCS is the "boss", and when assignments for passage of traffic have been made, even if they are perceived to be in error by another liaison station, those assignments should be carried out. It is not permissible to take another station off frequency to pass traffic without knowledge of the NCS. Of course, it is permissible to ask the NCS for alternate routing if there is any problem, but permission must be first obtained, even if that requires going through a relay station.

An example may help understand this last item. Let's say that the EAN TCC station has traffic for a region for which there is no region liaison station or that liaison station cannot be heard by the EAN station. The NCS may direct that another CAN station with a good path to the EAN station take the traffic instead of a CAN TCC. That is essentially an intermediate relay, and the NCS can then direct that the relay station taking the traffic send it to the regular TCC liaison, perhaps using 40 meters if they are close.

3.5. PAN Stations Checking into CAN Directly

As mentioned in the introduction, because there are no current cycle 1 or 2 PAN nets, there may be stations checking into CAN from the Pacific Area with traffic for the Central Area or even the Eastern Area. Because NTS is a system, the CAN NCS should make every effort to assist these stations in passing their traffic.

There are several ways of handling these stations, depending on propagation and available liaisons and where their traffic is destined. If they bring traffic for PAN sections, that traffic should be sent to the PAN TCC liaison station, possibly via a relay in CAN. Similarly, if they bring EAN traffic, that should be routed to the EAN TCC station, assuming both stations can copy each other. Alternatively, EAN traffic may be routed to the CAN TCC November station for relay to the EAN TCC station. If all else is not possible due to poor signals, any CAN station (with WL2K) that has a path to the PAN station can take the traffic and forward it via WL2K to K6JT or KA5KLU for handling on cycle 4.

For CAN region net traffic, it should be routed directly to the region net liaison stations, again using relay stations if needed. If there is no region liaison, then the traffic may be passed to any

CAN station, with preference given to one of the CAN TCC stations, who will then take it to the region net themselves or handle via NTS Digital.

As often happens, stations checking in with traffic may not understand the breakout of CAN regions. The NCS will determine the proper region routing based on the state of the destination using the following table (states / provinces listed across in alphabetical order).

Table 1, Central Area States/Provinces and Regions

State	Region	State	Region	State	Region	State	Region	State	Region
AL	5	AR	5	IA	10	IL	9	IN	9
KS	10	KY	9	LA	5	MAN	10	MN	10
MO	10	MS	5	ND	10	NE	10	OK	5
SASK	10	SD	10	TN	5	TX	5	WI	9

States to the east of those listed are all in EAN, while states to the west are all in PAN.

3.6. NCS Guidelines

The CAN Manager has defined the net callup format, which appears in the CAN Newsletter. This section summarizes the primary NCS functions and defines a standard report format that may be used. Net reports should be sent to the CAN manager as soon as feasible after the net. Ideally, they should be sent via radiogram using NTS, but any other method may be used if that is not feasible.

The following major points should be kept in mind by NCS stations. It is a learning process, and it may take quite some time for a station to master the skills needed to cope with the poor propagation conditions currently plaguing 20 meter operation during the day.

3.6.1. NCS Procedure

1. The NCS should have a good antenna and higher power (than 100 watts) or be located in an area with good propagation to south, east and west (e.g., northern states).
2. Call up the net using the prescribed format.
3. Check in all TCC liaison stations first, starting with those most likely to have traffic (i.e., the Pacific and Eastern TCC stations) and then the CAN TCC stations (see Figure 1).
4. Check in all region liaison stations.
5. The NCS should have a good grasp of geography and know where each station checking in is located in relation to the other stations so the optimal band can be used for traffic transfer.
6. Start traffic moving for those stations who can hear each other, using side frequencies. Note that routing should be used based on the reported liaison functions.
7. Call for relay stations to check in.
8. Send a station to 40 meters (7.243), if one is available, to solicit checkins.
9. Ask relay stations in different parts of the country to do a “net call” to check in other stations. This should be repeated at least every 5 minutes for the first 15 minutes of the net.

10. Arrange relays for traffic between liaison stations who cannot hear each other. Use side frequencies and 40 meters where the stations are too close to hear each other on 20.
11. It is OK to send a relay station off frequency first with the transmitting station to pick up the traffic and then when the station has returned, send them off again with the receiving station, possibly to 40 meters.
12. Make maximum use of the Extra Class portions of the band when both stations are able to go there.
13. If traffic is listed for regions where no liaison station has checked in, one of the CAN TCC stations should be asked to take the traffic if they can copy the transmitting station. If they cannot copy the transmitting station, or the transmitting station cannot hear them, assign a relay station to take the traffic and move it to either cycle 4 or the TCC station as previously described.
14. Traffic should be passed using voice whenever possible. Digital (Winlink 2K) should be used only as a backup when all other means have failed.
15. The net should not be closed until all traffic is routed. It may be closed after sending stations off frequency to handle the last traffic, making sure they are able to connect, or allow them to use the net frequency after close.
16. If the Pacific and Eastern TCC stations have traffic for each other, direct them to move to a side frequency to handle it after all CAN traffic has been cleared to and from each of them (or give them the net frequency upon closing the net if no more traffic remains).
17. All traffic is counted, only once even if a relay is used. It is also counted if directed by the NCS to send the traffic via Winlink 2K.

3.6.2. NCS Record Sheet

Every operator generally develops their own style for keeping track of checkins and listed traffic. The following outline is provided for those who are new to controlling a high level net like CAN.

Table 2, Sample NCS Record Sheet

Call	Liaison	Traffic
	EAN TX (___RX)	
	PAN TX (___RX)	
	TCC Papa (to PAN)	
	TCC Quebec	(May be same station as Papa to receive PAN traffic)
	TCC Novem (to EAN)	
	RN5 TX (___RX)	
	9RN TX (___ RX)	
	10RN TX (___RX)	
	Relay or _____	
	Relay or _____	
	Relay or _____	
	Relay or _____	
	Relay or _____	

	Relay or _____	

Side Frequencies

Frequency	Stations	Frequency	Stations

Total QTC _____ Time in Session _____

Note that if there are separate TX and RX stations for the Region or TCC functions, enter the call again on a Relay line and fill in the liaison type (omit the word Relay if desired). Put a checkmark before the RX if it is the same station in those boxes that show TX. List the traffic in the space provided with room to put a check mark when each piece is assigned for transfer.

There does not need to be a TCC November if the EAN station can copy region liaisons directly to receive their traffic. Use a TCC November station only when a) the EAN station can copy them, and b) they can copy the region liaison station who has the EAN traffic. Then have TCC November call the EAN station once all traffic has been collected.

It is a good idea to keep track of side frequencies and the stations there so other stations can be sent to follow one another for additional traffic. Cross each station off when they return.

3.6.3. Net Reports

A net report should contain a list of all stations and their function as well as the traffic count and time in session. If a station is not a regular liaison, but only a relay, it is not necessary to declare their relay function, just list their call.

The following is an example of a net report that could be sent using NTS to the net manager. The TCC functions are called out and the region liaisons are called out according to their transmit, receive, or both function. Note that the report is shown in a format suitable for sending via digital or CW as well as voice.

101 R K5BMR 24 LUBBOCK TX SEP 24
CAROLYN WOMACK KC5OZT
642 EAST FOX AVE
LEWISVILLE TX 75057
BT
CAN SEP 24 K5BMR/NCS W5KAV/TANGO/ROMEO
N1OTC/LIMA/VICTOR KF5IOU/PAPA/QUEBEC KA5AZK/RN5/RX/9RN/RX KJ2V/RN5/TX
AB9WR/9RN/TX
N9ACQ KB5SDU NE5V KE5LTA AG5CQ
X NO 10RN QTC 9
QTR 18 MIN 73
BT
GEORGE K5BMR
AR

4. Transcontinental Corps

The purpose of the Transcontinental Corps (TCC) is to relay traffic from one NTS area to another, conducting liaison with NTS nets to do so. Each NTS cycle has specific functionaries under the supervision of a TCC director.

The function of the TCC director is to assign functions, centralize, coordinate and supervise these activities and file status reports each month with ARRL Headquarters.

TCC stations must have the following qualifications:

- Adequate signal power and appropriate mode to perform the job to be done.
- The highest caliber of operating ability and NTS net savvy.
- Capability (both operator and equipment) to keep the required schedules.

The text above was taken directly from the PSCM, chapter 7, which should be reviewed by all TCC candidates and is available at:

http://www.arrl.org/chapter-seven-operation-of-the-transcontinental-corps

4.1. Central Area TCC Stations

The current practice for both the Pacific and Eastern Areas is to have a single TCC liaison station handling both transmit and receive. That is generally sufficient with the low traffic load we now have. However, it is also possible that in stressed situations there could be separate TX and RX stations. Thus it is important for Central TCC to have backup stations available to handle separate TX and RX functions. Note that there is no Central TCC to receive EAN traffic. This is to be sent by the EAN station (Lima) directly to region liaison stations, possibly using a relay. This means that a maximum of 3 Central TCC stations are required.

Table 3, Central Area TCC Functions

Station	Function
Papa	Collect traffic for PAN and send it to PAN station Romeo. Note that CAN stations may also send traffic directly to PAN Romeo if that path is good so there is no need for Papa to collect traffic unless Romeo cannot copy the CAN stations (but can copy Papa).
Quebec	Receive PAN traffic from PAN station Tango – Note that this is intended to occur AFTER cycle 2 PAN meets, either by checking into PAN or an after-net schedule. However, there is no cycle 2 PAN net so the PAN station checks into CAN and sends traffic, either to CAN liaison stations directly or to a designated (by NCS) receive station, which MAY be Quebec if copy is good in both directions.
November	Collect EAN traffic from PAN stations and send to EAN station Victor. CAN stations may also send traffic directly to EAN if that path is good so there is no need for November to collect traffic unless Victor cannot copy the CAN stations (but can copy November).

4.2. TCC Station Requirements

In order to meet the adequate signal power and appropriate mode requirements specified in the PSCM (referenced earlier), CAN TCC stations *must* have a good antenna system (ideally a beam for 20 meters) and sufficient power for SSB signaling (generally 500 watts or more). This is

particularly important for the Station Papa and November positions since the Pacific and Eastern TCC liaisons must be able to copy them.

Station Quebec could get by with less power as long as they have a quiet (RF-wise) location with a low noise level and a relay station can forward their requests for message fills or acknowledgment. Both the Pacific and Eastern TCC stations have high power and beam antennas.

In addition, all TCC representatives *must* have Winlink 2000 capability, preferably via radio, but with TELNET access at a minimum. While traffic should always be handled by voice when signals permit, there can be very poor propagation days, so Winlink 2000 may then be used to transfer the traffic. For Pacific, W5KAV should be the target station, and for Eastern, KW1U should be the target, although the Eastern TCC station may also request the traffic be routed to them.

It is also desirable, but not required, that a TCC station have NTS Digital capability to use as yet another backup means of distributing received traffic.

Finally, the Pacific and Eastern TCC stations should ***NEVER*** be left holding Central Area traffic at the close of CAN. If all other means to move the traffic fail, traffic from PAN may be sent to TCC Papa or Quebec (generally KF5IOU) or to K6JT (to take to cycle 4) via Winlink 2K. Traffic from Eastern may be sent via WL2K to the TCC November station if one checks in. If none, the traffic may be sent to KC5OZT or N5TMC, the TCC director, who will distribute it to other liaison stations, or to K6JT to take to cycle 4 CAN and/or RN5.

4.3. Alternate Frequencies

Jeff, N5TMC, has asked that TCC stations who are having difficulty on 20 meters try 17 or 15 meters to determine if signals are any stronger there. Jeff believes that 15 meters has better signals with less power. The suggested frequencies are 18.115 on 17 meters or 21.305 on 15 meters. If both stations have an Extra class license, the suggested 15 meter frequency is also 21.225.

Communication on 20 meters should first be attempted and then arrange to move to one of the other bands / frequencies if it is determined it may be better. Naturally, conditions will vary and 15 / 17 may be even worse than 20. The skip zone on those bands will be longer than on 20, so this is only for stations widely separated geographically. If no contact is made on the alternate frequency within 3 or 4 minutes, return to the CAN NCS on 20.

5. Notes

5.1. Acronyms and Abbreviations

9RN	Region Net Nine
10RN	Region Net Ten
CAN	Central Area Net
EAN	Eastern Area Net
MPG	Methods and Practices Guide (Appendix B of the PSCM)
PAN	Pacific Area Net
PSCM	Public Service Communications Manual
RN5	Region Net Five
TCC	Transcontinental Corps
WL2K or Winlink 2K	Winlink 2000 communications system (winlink.org)