

# ARCC C-Notes

## ARCC Access Control Policy Applies to ALL Repeaters

Volume 2 Issue 9 – September 2017

I seem to be running a couple of weeks late, lately. I'll try to catch up. In the meantime I'd be pleased to hear from you all with suggestions for future topics.

This edition of C-Notes shall serve as notice of clarifications to ARCC Coordination Policies regarding Access Control for repeaters (including ATV and DATV repeaters) and links regardless of modes.

ARCC has had an access control policy since May 2002 that requires the use of PL/CTCSS, DPL/DCTS, tone burst or TT/DTMF to authenticate or validate access to a repeater. **Although when this policy was developed there were only analog FM voice-only repeaters in service it does, in fact, APPLY TO ALL REPEATERS REGARDLESS OF EMISSION TYPE; a repeater is a repeater.**

### Implementation Timing

At this point in time, we are aware of no conflicting co-channel operation between digital mode repeaters having an acceptable form of access control. Digital mode repeaters that have no or conflicting access control that are currently implemented and have had final coordination issued are NOT, at this time, required to make any changes.

**New and modified repeaters incorporating one or more digital mode will be required to have an approved access control method as a condition of coordination. Currently coordinated repeaters are subject to future review.**

This document addresses access control for those digital modes in current use and will be expanded to address new modes as they come into use. **Where a repeater uses multiple modes, each mode in use must comply with this policy.**

### D-STAR:

By design, D-STAR requires the entry of the destination repeater call sign. D-STAR repeater operators with multiple repeaters on the same pair with the same call sign will use variances of the repeater call sign to differentiate between repeaters.

- **D-STAR inherently meets ARCC access control requirements.**

### DMR/Trbo:

DMR uses Color Codes to permit access to a repeater. Color Codes range from 0 through 15.

- **Color Code 0 will be reserved and not issued or approved.**
- **Co-channel DMR repeaters will require each to use a unique color code or have 200 mile or greater spacing.**

### NXDEN/ NEXEDGE:

NXDN utilizes Radio Access Numbers (RAN) 0 through 63 for access control and network selection (steering).

- **RAN 0 will not be issued or approved for use.**
- **When a frequency is shared among NXDEN repeaters ARCC will assign a local access RAN to each.**  
**If additional RANs are required for networking purposes RANs should be selected starting at 63, decreasing.**

### Yaesu System Fusion (YSF):

Yaesu uses Digital Squelch code (YSF DSQ) to control access to the Yaesu Fusion digital mode. There are 126 codes with DSQ 1 being the default.

1. **DSQ 0 will not be assigned or approved for use.**
2. **Where multiple YSF repeaters exist on a frequency, ARCC will assign a non-conflicting DSQ.**
3. Pending the implementation of Per Memory DSQ settings in user equipment, the use of YSF DSQ 1 is permitted with the understanding that co-channel interference cases will not be considered.

## **P25 Network Access Code (NAC):**

P25 repeaters use a Network Access Code (NAC) to control access to a P25 system. A NAC is a 3 digit hexadecimal number. There are 4096 possible NACs.

- **ARCC will not issue or approve the use of NAC \$293, \$F7E and \$F7F.**
- **In the case of co-channel P25, ARCC will assign a non-conflicting NAC for use.**
- **P25 Phase 2 systems are also subject to co-channel spacing requirements as listed in DMR policy.**

## **ATV:**

To permit sharing of ATV frequencies, ATV repeaters shall use one of the following access control methods:

- **In-band (subcarrier) Audio – use PL/CTCSS on the audio subcarrier to activate the repeater.**
- **Out of band audio – use PL/CTCSS/DPL/DCS on the out of band FM channel to activate the repeater.** This will require a receiver at the repeater to detect the audio channel access code to activate the ATV repeater.

**DATV:** TBD

-----

Specific and detailed polices regarding access control will be updated and published on our Web site and in the ARCC Coordination Policies document.

**ALL coordination holders are REQUIRED, as a condition of coordination to maintain awareness and FULL compliance with ALL ARCC policies at ALL times.**

-----

## **NOTES:**

### **TDMA (DMR/Trbo/P25-II) Systems:**

**Color Code (CC)** and **NAC** are embedded in the signaling field and used to provide a simple means of distinguishing overlapping sites in order to prevent co-channel interference. Unfortunately using unique color codes or NAC may not be a universal answer to co-channel use.

### **TDMA Distance Calculations**

TDMA modes, including DMR and P25-II, are unique in that there is a distance limit brought about by the time-limited guard interval between time slots. The guard interval provides for propagation delay (roughly 5 microseconds per mile) between the repeater and subscriber unit. If the subscriber unit is too far from the repeater, the timing will be off between the subscriber and repeater, effectively preventing reliable communications.

The maximum coverage of TDMA systems is also influenced by 'near/far' issues.

Most all DMR vendors provide 0.5ppm frequency accuracy in the terminals so the theoretical limit will then be 150km; ~95 miles assuming that the subscriber unit can "lock on" to the repeater's time slot timing.

Also note that the "distance limit" only applies to two-way communications. There is effectively no distance limit for receive-only situations as the subscriber unit does not to be in lock-step with the repeater.

In the case of co-channel repeaters utilizing common color codes / NACs, there **MUST** be a minimum spacing equal to a minimum of (guard interval + safe zone + guard interval) or (95 Mi + 10 Mi + 95 Mi ) 200 Miles between co-channel repeaters to mitigate possible interference. However, this minimum spacing provides no benefits during band openings where the "near – far" issue will prevail. Consider a user on repeater A and one on repeater B. During a band opening the signal of the repeater A user may arrive at repeater B and be stronger than the repeater B user. Regardless of the time slots in use, the "mistimed" repeater user A signal may override the weaker local signal connected to repeater B, effectively blocking out the local unit and locking up repeater B with bad (late) timing, rendering both time slots useless. Investigations into co-channel interference due to near/far issues are being conducted by ARCC to allow policies to be refined.

### **Issues With DMR Policy**

We have received concerns that there is difficulty in the way that DMR subscriber units are programmed, implementing the policy will be arduous, requiring each channel and talk group to be individually “touched” to implement a color code – a possibly time consuming operation.

ARCC feels that the difficulty in programming, or reprogramming a particular radio is, unfortunately, a user interface issue caused by poor manufacturer design and not a coordination policy related issue; coordination policies apply only to repeaters and NOT to user radios.

As code plugs are widely shared, the issue only applies to the person generating the code plug and not those who receive and use unmodified copies for their radios.

### **Issues With Yaesu System Fusion**

Currently Yaesu provides DSQ as a means of access control.

However, there are two issues that complicate implementing access control:

1. Yaesu has chosen to make DSQ a radio wide setting on its YSF radios. That is, a user cannot set and save DSQ as a per-channel memory setting, requiring the user to potentially have to change the DSQ setting in their radio when changing channels. The decision by Yaesu to implement DSQ in this fashion is simply inexcusable in my opinion.
2. Recently, concurrent with the announcement of the DR-2X second generation YSF repeater, Yaesu announced a change to the air protocol: System Fusion II which apparently proposes to replace DSQ with DG-ID. As details of the updated protocol is not yet published and the functionality of DG-ID as a means of access control is untested, further policy regarding access control for Yaesu Fusion will be unavailable until such time as that information becomes available and testing completed.

It is also unknown if the current crop of YSF repeaters will be provided with a firmware update to implement System Fusion II.

Nonetheless, YSF operators are required, by policy and as a condition of their coordination to implement access control in YSF operations.