

**W.W.A.R.A. – General Meeting Minutes
Feb 22, 2020**

Kenny Richards – KU7M	Rob Chatham – AF7PR	Steve Van Wambeck, N9VW
Doyle Wenzel, N7UJK	Frank Wolf – NM7R	Rich Salter – KF7BJI
Alan Ferguson – N7OMS	Howard Wilhelm – K7UID	Mike Ping – N3KPU

Absences:

Rob Salsgiver – NR30, Scott Honaker – N7SS

In accordance with Article IX, Section 3a of the bylaws, a quorum was present. The meeting was called to order at 10:04am at the Tukwila Fire Station #51. Introductions were made and by a motion the minutes of the December 07, 2019 general meeting was approved, as posted on the website.

Officer's Reports

Treasurer Report:

- Full details are available upon request.
- Current assets total \$15,436.79

Secretary Report:

- All TDS received prior to Feb 20 have been processed.
- All Certificates of Coordination's approved in the last three months were e-mailed on Feb 21.
- Due to the number of systems being coordinated in the next 15-20 days, a special second run of certificates will occur around Christmas.
- A reminder e-mail has been sent to all expired and about to expire (within 3 months) coordination's. Additionally, all of the non-published link coordination's are being reminded, since they have not had a expired notification for several years.
- There are six coordination's which expired more than 12 months ago, have been notified at least twice and have not renewed. They received a final notice and will be canceled on March 7th, 2020 if not renewed. The six coordination's are:
 - 53.15 / K7CR
 - 53.09 / WB7OXI
 - 53.87 / W7SIX
 - 146.86 / W7RDR
 - 441.2625 / KF7UUY
 - 442.525 / WR7V

Committee Reports

IACC/BCARCC/ORRC

- ORCC – Steve-N9VW created a visual map of the southern WWARA border, which is confusing for people to understand from the description in the coordination policies. Kenny-KU7M will share the map with the ORCC, so they can provide input and hopefully agree it describes their northern border.

6/10 Meters – Frank Wolfe, NM7R

- No activity

2 Meters – Peter Dahl, WA7FUS

- Three pending applications
- One in public comment period (147.995), two are unknown status (147.4125, 147.4375)
- See attached band report

220 – Peter Dahl, WA7FUS

- Five active applications
- Three in testing, one out for comment period and one still proposed (see attached band report)

440/430 Repeaters & Links – Steve Vanwambeck, N9VW

- 17 application being tracked
- Four out for public comment, four in testing, two in holding (resolving technical issues at site), seven new proposed systems.

900 / 1.2Ghz – Scott Honaker, N7SS

- One pending (927.850 Buckley, W7AAO)

Old Business

- Update on Narrowband Proposal for 2m/70cm, KU7M, N7SS, N9VW, K7SLB
 - Attached document is the current version, which now includes 1Mhz of the 440 band mapping.
 - ~10% of 70cm are already narrowband
 - KU7M has received requests to speak about the narrowband plan and WWARA coordination process. He has already spoke to one group in February and is scheduled to speak to two more groups in the next couple months. In addition to being part of a series of talks at Comm Academy 2020.

New Business

- Confirming the meeting locations for the WWARA 2020 meetings. Per the decision made during the December meeting, this year the WWARA meeting will move around the state to hopefully attract more involvement.
 - Feb 22 – Tukwila (current meeting, hosted by KU7M)
 - May 23 – Paine Field (hosted by N7SS)
 - Sept 26 – Tacoma (exact location still being determined, hosted by AF7PR)
 - Dec 5 – Back to Tukwila unless someone volunteers a different locationPP

Adjourn Meeting: 12:04 PM

Next Meeting: May 23, 2020 / Paine Field, DEM / Time: 10am – 12pm

2 meters and 220 Band Chair report
February 2020

TR#	Frequency	Trustee	Location	Status
3226	147.4125	AF7PR	ARIEL	Status unknown
3227	147.4375	NA7Q	CHINOOK	Status unknown
3231	147.995	KU7M	COUGAR	In comment period
4093	223.9	W7PFB	CARNATION	Testing
4094	223.96	WA7TBP	CARNATION	Testing
4092	224.2	W7TJL	GIG HARBOR	In comment period
4095	224.22	K7RGK	BLAINE	Proposed
4089	224.82	AF5TR	ANACORTES	Testing

440 Band Chair Report		Status	Submitted by N9VW	Followup
5381	443.250_KE7GFZ_Duval_5381_20191221.pdf	Testing 12/20/19	01/05/20 KGR - Relocated 440 system, requiring re-coordination. On air, recommend testing period 3m.	3/20/20
5563	440.925_W7BU_Megler_5563_20190927.pdf	Member Comment Period 02/15/20	10/14/19: KGR - Relocated 440 system, changed antenna type, height and power ERP, need to retest. recommend 3m test period 01/31/20: SvW - Sent follow up request for end of testing period. Replied all good, started poll 02/15/20: SvW - Polling complete, Member comment period	2/29/20
5707	443.525_K7SLB_Cougar_5707_20180122.pdf	Holding 12/10/19	01/29/18:KGR - Proposed P25/Analog repeater on Cougar. ETA 6/1/18 12/02/19: SvW - Inquiry for status sent 12/10/19: SvW - Spencer replied that the machine had gone up on the air, was experiencing an IM issue and has had a failure that is in process of being fixed. 01/31/20: SvW - Sent a request for status.	2/7/20
5714	442.000_NE7MC_Kenmore_5714_20180719.pdf	Holding 12/04/19	7/19/18: KGR - Relocated from LkForestPark, with brand new rpt. Treating as new coordination. on air 7/19/18 7/25/18: KGR Got note from Jon. Repeater hardware failed, sent back to Bridgecomm to fix. Will provide new eta for back on air. 10/15/18: KGR - Still waiting for hardware and site access. recommend leaving pending until six months up and cancel if not ready for testing. Can re-submit when issues resolved. 12/02/19: SvW - Inquiry for status sent 12/04/19: SvW - From Carl: The 442.000 repeater is currently located at 7220 NE 181st Kenmore (Northshore Fire Station 51). We are currently awaiting the completion of a construction project at 8204 NE 150th ST. The project has taken longer than we expected but is scheduled for completion at by December 31st. 12/31/19: SvW - Checked with Carl for status. No response so far. 02/12/20: KGR - says operational, but not final antenna. ETA 3/15/20 - Provided another TDS	3/15/20
5725	443.825_AA7MI_PortTownsend_5725_20181114.pdf	Work in progress, not on the air	11/22/18: KGR: Added TDS, ETA on air April 2019 12/04/19: SvW - Inquiry for status sent, response from Richard:We have a 20mw DMR hot spot on the air at the tower as a DMR placeholder. We are planning a full DMR repeater very soon. We were waiting for the internet link to the site which is now available. Please keep this active.	3/4/20
5727	440.750_K6MBY_Sequim_5726_20181230.pdf	Member Comment Period 02/15/20	12/30/18: KGR: Added TDS, on air now. 6/26/19: KGR was approved by BoD and went to public comment period. Issue was raised that running DR1x in wideband mode and shouldn't be in digital narrowband only channel. 10/2/19 KGR: Got an update from K6MBY. He has been unable to make DMR mode work in narrowband mode and also discovered repeater doesn't work in C4FM mode or narrowband FM analog. Sending back for repairs. 10/18/19: SvW - Notified that the system is now running on a pair of narrowband Motorola radio's, this is the final configuration. 01/31/20: SvW - Pinged for testing status, reply was testing OK, no complaints. Started poll 02/15/20: SvW - Polling complete, Memeber comment period	2/29/20
5732	441.125_WA7OS_GraysHarbor_5732_20190614.pdf	Member Comment Period 02/15/20	06/14/19: KGR Added TDS, not on air, ETA 09/01/2019 11/16/19: KGR/SvW - On air 10/19/19, started testing phase 01/31/20: SvW - Pinged for testing status, indicated testing complete, no complaints. Started poll 02/15/20: SvW - Polling complete, Memeber comment period	02/29/20
5735	444.2375_Snohomish_K7LKA_5735_20190619.pdf	Work in progress, on the air, not ready for testing period	07/06/19: KGR Added TDS, not on air, ETA 12/01/2019 12/04/19: SvW - Inquiry for status sent, Steven responded that the machine is still in construction phase 01/31/20: SvW - Inquiry sent for status. Operating at low level elevation and power. Waiting on weather to raise up to final height	3/2/20
5737	442.300_W7ACS_Seattle_5737_20190728.pdf	Testing 02/02/2020	08/11/19: KGR Added TDS, not on air, ETA 09/01/2019 08/11/19: E-mail thread between N7LYE and NC7Q about 442.300. NC7Q is going to move DMR repeater currently on 442.300 to 440.7625, co-channeling with SeattleACS dstar repeater. This will open up 442.3 for SACS group. 11/27/19: SvW - Mark, N7LYE, advised on-air 11/20/19 11/28/19: KGR - confused, 443.200 has been on the air since 11/20/19 see 5742, 442.300 is scheduled for 1/1/20 01/31/20: SvW - Pinged Mark for on air status 02/02/20: SvW - Machine is on the air, testing phase started.	04/26/20
5738	441.850_KE7GFZ_Duval_5738_20190815.pdf	Work in progress, not on the air	08/15/19: KGR Added TDS not on air, ETA 2/29/2020	03/01/20
5739	440.975_W7AW_Seattle_5739_20190817.pdf	Member Comment Period 02/15/20	08/23/19: KGR Added TDS, system on the air and ready for testing period 12/09/19: SvW - Randy indicates testing period is complete but the radio is currently off the air. Waiting for the system to be restarted before sending to poll 12/31/19: SvW - Randy indicates no site access, another two weeks for resolution. 01/23/20: SvW - Pinged Randy for status 01/31/20: SvW - 2nd ping to Randy, he responded that he was gaining site access on Tuesday (02/04/20) to fix the machine. 02/16/20: SvW - Randy noted that repeater is fixed, testing period is now complete 02/21/20: SvW - Polling complete, member comment period	3/6/20
5740	441.9500_KF7CFR_LymanHill_5740_20190904.pdf	Work in progress, on the air to level Mt Vernon Holding for site access, awaiting TDS	9/04/19:KGR Added TDS, system expected to be on the air by 2/1/2020 01/31/20: SvW - Pinged to see if on the air. Operating at low level in Mt. Vernon. Cannot access mountain until the snow melts.	5/31/20
5741	442.7500_WA7SV_Bellingham_5741_20191101.pdf	Testing 12/04/19	11/11/19: KGR added TDS, not on air, ETA 12/30/2019 12/04/19: SvW - Notified by Thomas that the machine was on the air and ready for testing	03/04/20
5742	443.200_W7ACS_Seattle_4742_20191125.pdf	Testing 11/20/19	11/28/19: KGR added TDS, on air as of 11/20/2019	2/20/2019
5743	440.575_WA7FI_FoxIsland_5743_20191209.pdf	Work in progress, not on the air	12/12/19: KGR added TDS, ETA on air 06/01/2020	6/2/20
5745	442.625_KJ7HML_Darrington_5745_20200121.pdf	Work in progress, not on the air	01/21/20: KGR added TDS, not on air, ETA 02/01/2020. Missing DSQ code for Fusion side	02/02/20
5746	444.900_W6MPD_PortAngeles_5746_20200128.pdf	Operational, but no ETA for	01/28/20: KGR added TDS, says operational, but with no ready date.	02/20/20

Taking the Next Step – A proposal for the WWARA to move to narrowband

Part 97, subpart B-Station Operation Standards reads:

*(b) Each station licensee and each control operator must cooperate in selecting transmitting channels **and in making the most effective use of the amateur service frequencies.** No frequency will be assigned for the exclusive use of any station.*

One could argue that the WWARA moving to narrowband channels for repeater operations is a requirement or at least strongly suggested by the FCC for Amateurs.

Background

The repeater landscape has undergone a significant change, which really began in 2005 when Icom released the first digital mode radios designed specifically for Amateur radio. While other digital modes that originated from the commercial land mobile market had been experimented with, DSTAR was the first to gain wide spread Amateur acceptance. While other modes have existed, only DMR has approached the initial success as DSTAR here in western Washington.

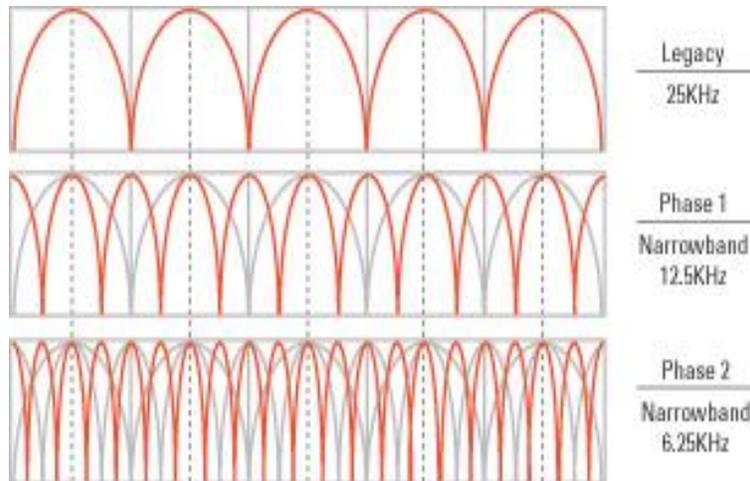
While the WWARA Narrowband Committee have been unable to find data to support the claim, we believe that overall repeater usage has declined over the last 10 years. Using just the random sample of scanning all the available 2m and 70cm repeaters while driving to work from various locations around the Puget Sound, we believe there has been a 50% or more drop off since the mid-2000's. There are exceptions of course, some repeaters in the area are very active, with multiple daily nets and regular QSO's happening all day long.

Another interesting fact is that while the usage of repeaters is declining, the number of repeaters, at least in western Washington is increasing. The WWARA list of coordinated systems has increased 28% since 2013. The number of digital repeaters (defined as DSTAR, DMR, Fusion, NXDN and P25) has increased over the same period by 77%. Based purely on newly coordinated systems, the desire to install a digital repeater is far out pacing analog.

It is a simple fact that most of the coordinated 2m repeaters in western Washington are still wide analog FM systems (as defined by 5 kHz deviation or 16 kHz occupied bandwidth or 16K0F3E FCC emission mask), the same basic technology that was deployed in the 1970's. There are many advantages to it, including the widely available equipment and fairly simple operation/setup. But this paper is about considering what comes next for Amateur repeaters in western Washington.

The FCC forced the land mobile market (of which most of the repeater equipment Amateurs uses comes from) to go to some form of narrowband in January 2013, which was announced in 2007. All commercial uses (with certain exceptions) were required to move from 25 kHz channels to 12.5 kHz channels.

Although not requiring it, the FCC also announced a future move to the 6.25 kHz wide Ultra-narrowband at some point in the future. For many, this meant making the move from wide band FM to a ultra-narrowband option up front would avoid a second transition later. This allowed systems like NXDN (6.25 kHz wide) and P25/DMR (12.5 kHz two time slot TDMA) to become a popular commercial options. Only AM/SSB and ACSSB would meet 6.25 kHz criteria via analog, making the digital options increasingly important



One of the drawbacks, which were outlined in an FCC document published around the time of the announcement for shifting to narrowband, was the impact when narrowing analog signals from 5 kHz to 2.5 kHz deviation. With the reduction in deviation when going to narrowband, it is estimated to also decrease the signal to noise by 3 dB, this was estimated to mean a loss of 30% repeater coverage, without an increase in ERP to compensate for it.

From the FAQ in the FCC document:

It has been estimated that Narrowband compliance can result in a 3 dB loss in signal strength. However, this rule of thumb is based upon a “plain vanilla” Narrowbanding scenario where 25 kHz analog system converts to a 12.5 kHz analog system. Consult with a manufacturer and/or consulting engineer for a better estimate of how Narrowbanding will affect your particular system.

It should be noted that the repeater coverage issue described in the FCC document will not be universal for repeaters located in the Puget Sound area. Many of the WWARA coordinated repeater systems, specifically the low level systems, are already limited in coverage due to terrain issues. This issue will have the most impact to those high-level systems, which have coverage over large geographical areas.

What are the options? The obvious one is simply increasing the power of radios. That might be doable at the repeater side, but what about the other end of the system? It would mean all the HT's in use will also need to double their power, which means a reduction of usage time due to battery capacity or even larger antennas. The other option, which isn't called out directly in the FCC documents, is moving to a digital signal. All of the current digital solutions leverage high quality codec's and benefit from forward error correction (FEC). This technology allows similar coverage of wide band analog systems, but using narrowband channels and similar ERP.

Given the state of things today, what should the WWARA do, to help move the repeater systems of western Washington forward? The WWARA knows that our users want to construct more repeaters. The WWARA knows there is already a strong interest and adaption for digital solutions. The Narrowband Committee's recommendation is the WWARA begin down the path of restructuring the band plan to align with this vision. We know it won't happen quickly and there

will be many who will get very upset about the prospect. But we believe this aligns with the overall mission of the WWARA and is the right thing to-do.

How will the shift happen?

This is just a thought experiment based on various discussions that have been taking place among the WWARA board and other groups. It isn't meant to be a detailed plan and certainly needs more research and input from others. When developing a plan, it is best to start from the outcome desired and work backwards. To that end, the Narrowband Committee has been using ten years as the point where the WWARA has completely transitioned to a narrow band plan for 2m and 70cm. The logic being that one of the biggest factors in the transition is the wide spread adaptation of client radios that supports narrowband, whether that is analog or digital. It appears that most Amateur radios released in the last ten years supports at least a narrowband analog mode, while more than half support at least one type of digital mode. So, projecting out ten years, it seems safe to assume that most client radios in use will support some form of narrowband.

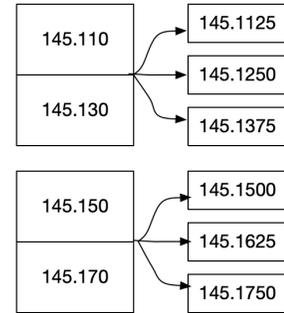
If most of the client radios support some form of narrowband already, the major 'cost' of the switch will be for the repeater owners. Other than a need to retune the filtering to adjust to the new band plan, the biggest cost is the TX/RX systems. The old reliable GE Mastr II systems will probably need to be replaced by something made in the last decade. We don't have an answer for this, other than that is what will need to happen. Based on historical patterns, the commercial land mobile market will also be turning over and replacing many of the first-generation (or second-generation) narrowband system at this point (which is actually already happening). This was the source for the GE Mastr II systems, so it is logical to assume a ready supply of 'cheap' repeater systems available on the market over the next ten years.

The next hurdle is how do we move from the current 20 kHz channel spacing to 12.5 kHz? It is best to imagine this as a giant game of Tetris. As wide analog systems are replaced, it allows the creation of pockets of narrowband channels. The common proposal is that when two adjacent 20 kHz channels have moved to using narrow band repeaters, the 40 kHz of spectrum be converted to three 12.5 kHz channels.

NOTE: *There was an earlier proposal to use two 12.5 kHz channels, with a 6.25 kHz in between them. This proposal had the advantage of overlaying the current 20 kHz channels exactly, but when it was mapped out, the frequency steps didn't work. Most existing radios wouldn't support the spacing. This lead the narrowband working group to come up with the current proposal.*

The complete mapping of the existing 20 kHz pairs to 12.5 kHz pairs for the 2m band is included in Appendix A for reference. The narrowband committee reviewed how the FCC approached this and taking that pattern, applied it to the 2m repeater sub-bands. Using the 145.100 Mhz repeater

sub-band as an example, three 12.5 kHz channels would be created in the space currently used



for the 145.110 and 145.130 Mhz wide band pairs. The diagram in Figure 1 provides a visual representation of the conversion of the first four wide band pairs to the six new narrowband pairs.

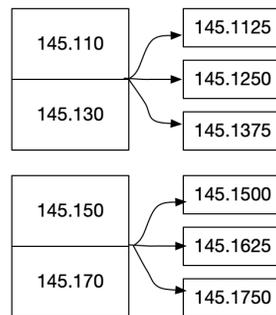


Figure 1: Wide to narrow band conversion

This solution will create 31 narrowband (12.5 kHz) pairs, where there are currently 20 wideband pairs in the 145 repeater sub-band (145.1 to 145.5 Mhz). Similarly, 62 narrowband (12.5 kHz) pairs will be created in the 146 repeater sub-band (146.2-147.4 Mhz). As mentioned above, this approach aligns with the spacing supported by all the modern radios reviewed, which supports at least one type of narrowband mode.

One of the downsides of this channel transition is the ‘overlap’ between current wideband and narrowband groups. In previous proposals, once two wideband pairs were available for conversion, it immediately created three narrowband channels. That is sometimes the case with the new approach, but there are cases where three wideband channels will need to be converted before all three of the narrowband channels will become available. As an example, the narrowband channel of 145.4125 is a part of the set of three channels that maps to the 145.43 and 145.45 wideband pairs, but any repeater using it would likely cause interference to the existing 145.41 Mhz wideband pair. When the conversion of these pairs happens, special consideration will need to be given and possibly the narrowband channel will be unavailable until the third wideband pair is transitioned.

Narrowband Digital Channels

The last narrowband channel in the new narrowband proposal (147.3875 Mhz) overlaps with the second ultra-narrowband digital only pair (147.3950 Mhz) created several years ago. As part of the transition, it is recommend the existing ultra-narrowband digital only pair would be replaced with the 147.3950 Mhz narrowband pair, when the 147.38 wideband pair is no longer needed.

Similarly it was discovered the other ultra-narrowband digital only pair (146.005 Mhz) is not practical due to the proximity to the FM cross-band linking frequency at 146.600 Mhz. A coordinated DSTAR repeater on the pair was asked to terminate operation due to the interference with the cross-band linking frequency. It is recommended this ultra-narrowband digital only pair be removed from the WWARA band plan.

Other than proposed changes to the two ultra-narrowband digital only pairs (146.005 and 147.3950 Mhz), no other changes are suggested or needed for the narrowband transition.

Shared Non-Protected Channels

The two Shared Non-Protected (SNP) pairs (145.13 and 145.29 Mhz) will remain wide-band pairs, until their 'partner' convert to narrowband. (145.11/145.13 and 145.27/145.29) At that time the SNP will also convert to narrowband automatically. It is recommended that two of the newly created narrowband channels are designated as shared non-protected pairs..

70cm Band Transition

Up until this point, the focus has been on the 2m band. This was done because the 2m band is the most compressed of any of the amateur repeater sub-bands in the WWARA. In late 2016 for the first time in WWARA history, there were no 'free' repeater pairs available in the 70cm band. Over the years as repeaters were retired, a few free pairs have become available again, but co-channeling is now a common occurrence. Similar the seven 70cm narrowband digital only pairs created in June 2016 are now 'full', with several having multiple repeaters co-channeling.

In some ways the 70cm band is 'ahead' of the 2m band with regard to moving to narrowband, because most of the new digital mode systems went to 70cm first, because there were no available pairs in the 2m band. This means a higher percentage of existing 70cm repeaters could immediately switch to a narrow band plan, with only slight changes in frequencies. Another major difference is the 70cm band is still on the older 25 Khz channel spacing, whereas the 2m band moved to 20 Khz pairs decades ago.

It is the belief of the Narrowband Committee that the re-channeling of the 70cm band should following the approach used for the 2m band, but the ultimate path it takes to reach that point may differ. A partial narrowband layout for the 70cm band is included in Appendix B, in future drafts the entire repeater sub-band will be included.

Possible options for the transition

This section will probably be the most controversial, but we hope over time some of these approaches can be implemented, even if not immediately.

Using the ten-year date from the above thought experiment, starting five years in the future, the WWARA could stop accepting new 2m applications for any system which isn't 12.5 kHz or smaller (whether digital or analog). So existing repeater owners would be able to continue to renew the in-place systems, but any new application would need to be narrowband. Additionally, if a 2m system must re-coordinate (due to a site move or any other existing reason which today requires re-coordination), the new system would also have to be narrowband. As wide band 2m channels were vacated, the narrowband pairs would become available, using the scheme described earlier.

This process would ensure existing 2m wide band repeaters and users wouldn't be 'forced' to go narrowband, but at the same time it would allow the natural transition to the narrowband channels.

There are other more aggressive options for the transition, which center around the general theme of setting a specific date and requiring all systems to transition. This has several problems with it, including the WWARA having no authority to force a system trustee to change. The hope is that by allowing owners and their users to pick when the transition happens, the change will be less impactful, even though it will take longer. It is important to remember that the technology Amateur's enjoy using and experimenting with is going to continue to move forward. Ten years is a long time, which will probably bring many advances we are only dreaming about right now. It is even possible a mixture of spread-spectrum technology, with the continually advancing SDR solutions, will remove the needs for coordination's of repeaters all together.

As described above the 70cm band is starting from a different place than 2m, so it follows that the transition options might also be different. Currently the Narrowband Committee is considering proposals that would more aggressively transition part of the 70cm repeater band, because more of the repeaters currently coordinated are already narrowband and can be easily shifted in frequency with a re-tuning of the duplexers. A recent review showed that nearly 20% of the current 70cm repeater coordination are for systems which are already narrowband, but using the older 25 kHz channel spacing. A proposed first step for the 70cm band is to identify a part of the 70cm repeater sub-band and immediately declare it narrowband, meaning now new wide band coordination's would be accepted. Then by working with existing repeater owners, the existing wide band repeaters in that section would be swapped with existing narrowband repeaters. This has the benefit of immediately opening up additional 70cm repeater (narrowband) pairs with only a minor inconvenience to existing repeater owners.

Appendix A: Existing and Proposed 2m Band Channel Raster

Existing	New	Existing	New	Existing	New
145.1100	145.1000	146.6200	146.6250	147.0000	147.0000
145.1300	145.1125	146.6400	146.6375	147.0200	147.0125
145.1500	145.1250	146.6600	146.6500	147.0400	147.0250
145.1700	145.1375	146.6800	146.6625	147.0600	147.0375
145.1900	145.1500	146.7000	146.6750	147.0800	147.0500
145.2100	145.1625	146.7200	146.6875	147.1000	147.0625
145.2300	145.1750	146.7400	146.7000	147.1200	147.0750
145.2500	145.1875	146.7600	146.7125	147.1400	147.0875
145.2700	145.2000	146.7800	146.7250	147.1600	147.1000
145.2900	145.2125	146.8000	146.7375	147.1800	147.1125
145.3100	145.2250	146.8200	146.7500	147.2000	147.1250
145.3300	145.2375	146.8400	146.7625	147.2200	147.1375
145.3500	145.2500	146.8600	146.7750	147.2400	147.1500
145.3700	145.2625	146.8800	146.7875	147.2600	147.1625
145.3900	145.2750	146.9000	146.8000	147.2800	147.1750
145.4100	145.2875	146.9200	146.8125	147.3000	147.1875
145.4300	145.3000	146.9400	146.8250	147.3200	147.2000
145.4500	145.3125	146.9600	146.8375	147.3400	147.2125
145.4700	145.3250	146.9800	146.8500	147.3600	147.2250
145.4900	145.3375	147.0000	146.8625	147.3800	147.2375
	145.3500		146.8750		147.2500
	145.3625		146.8875		147.2625
	145.3750		146.9000		147.2750
	145.3875		146.9125		147.2875
	145.4000		146.9250		147.3000
	145.4125		146.9375		147.3125
	145.4250		146.9500		147.3250
	145.4375		146.9625		147.3375
	145.4500		146.9750		147.3500
	145.4625		146.9875		147.3625
	145.4750				147.3750
	145.4875				147.3875

Appendix B: Existing and Proposed 70cm Band Channel Raster (partial)

The following shows the just one segment of the 70cm repeater sub-band and how the conversion would be applied to go from the current 25 kHz channel spacing to 12.5 kHz channels.

Current	Proposed
440.0250	440.0125
	440.0250
	440.0375
440.0500	440.0500
	440.0625
440.0750	440.0750
	440.0875
440.1000	440.1000
	440.1125
440.1250	440.1250
	440.1375
440.1500	440.1500
	440.1625
440.1750	440.1750
	440.1875
440.2000	440.2000
	440.2125
440.2250	440.2250
	440.2375
440.2500	440.2500
	440.2625
440.2750	440.2750
	440.2875
440.3000	440.3000
	440.3125
440.3250	440.3250
	440.3375
440.3500	440.3500
	440.3625
440.3750	440.3750
	440.3875
440.4000	440.4000
	440.4125
440.4250	440.4250

Current	Proposed
	440.4625
440.4750	440.4750
	440.4875
440.5000	440.5000
	440.5125
440.5250	440.5250
	440.5375
440.5500	440.5500
	440.5625
440.5750	440.5750
	440.5875
440.6000	440.6000
	440.6125
440.6250	440.6250
	440.6375
440.6500	440.6500
	440.6625
440.6750	440.6750
	440.6875
440.7000	440.7000
	440.7125
440.7250	440.7250
	440.7375
440.7500	440.7500
	440.7625
440.7750	440.7750
	440.7875
440.8000	440.8000