

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

In the Matter of)
)
Applications for Public Safety Pool (Conventional) **File Nos. 0004270113**
Licenses in the 430-448 MHz Band for Mobile Use) ***et al.***
of ReconRobotics Video and Audio Surveillance)
Systems)

To: The Chief, Public Safety and Homeland Security Bureau
Via: The Office of the Secretary

**REPLY TO OPPOSITION TO
PETITION FOR RECONSIDERATION**

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.106(h) of the Commission’s rules [47 C.F.R. §1.106(h)], hereby respectfully submits its Reply to the pleading styled “*Opposition to Petitions for Reconsideration*” (the Opposition) filed on or about March 12, 2012 by Reconrobotics, Inc. (ReconRobotics). The Opposition addresses ARRL’s March 6, 2012 *Petition for Reconsideration*, by which ARRL requested that the Public Safety and Homeland Security Bureau reconsider and reverse¹ its *Order*, DA 12-123, released February 6, 2012, issued under delegated authority, granting all of the pending applications for authorization to use ReconRobotics’ “Recon Scout” device pursuant to a waiver² granted to ReconRobotics in 2010 authorizing the sale and marketing of the Recon Scout device. Notwithstanding the blatantly obfuscatory argument in ReconRobotics’ *Opposition*, ARRL reiterates and continues to assert that the fundamental error in *both* of the grants of

¹ This Reply is timely pursuant to Sections 1.106(h) and 1.4 of the Commission’s Rules.
² *ReconRobotics, Inc.*, Order, 25 FCC Rcd. 1782 (WTB/PSHSB 2010); *affirmed*, 26 FCC Rcd. 5895 (WTB/PSHSB/OET 2011).

equipment certification of the ReconRobotics device, and which is repeated in each and all of the applications granted by the Bureau (over ARRL's objection), is that the emission designator shows a 100 kHz necessary bandwidth. This completely nullifies the utility of the license grants to each of the licensees. The licenses must be set aside as having been improvidently granted, and each returned to pending status, dismissed or returned. The applications are not grantable unless and until (1) the certification grants are reissued to ReconRobotics with a correct emission designator, and (2) each of the applications is amended to reflect that correct emission designator. If this is not done, the licensees cannot use the Recon Scout device, which utilizes a far greater necessary bandwidth than that permitted by the license grants. For its reply, ARRL states as follows:

1. ReconRobotics' *Opposition* addresses two Petitions for Reconsideration; that of ARRL and another filed by Mr. James Whedbee. This Reply addresses only those of ReconRobotics' arguments relative to ARRL's Petition. The *Opposition*, at 4, asserts that ARRL based its Petition to Deny the subject applications on collateral issues that had earlier been resolved in the waiver proceeding. That is not true. The ARRL Petitions to Deny showed, among other things,³ that although the Recon Scout device transmits black & white, 30 frame-per-second video, using 6 megahertz bandwidth channels in the 430-448 MHz band, the emission designator in each of the applications incorrectly specified a

³ ARRL continues to assert that the waiver grant to ReconRobotics was ill-advised because of the choice of frequency band. ReconRobotics' choice of frequency band was both unnecessary and based *solely* on the convenience of the manufacturer. The Commission's conclusion that the lower frequency penetrates building materials better in all cases than would be possible at a higher frequency is incorrect, and ARRL has submitted information in the record in Docket 08-63 demonstrating the contrary. But that conclusion, and the waiver grant, however improper, is now not subject to further debate.

100 kHz *necessary* bandwidth.⁴ The normal bandwidth for a C3F emission without audio is greater than 3 MHz, and certainly not 100 kHz.

2. ReconRobotics' *Opposition* does not dispute that the Commission's Rules clearly require that the emission designator be based on *necessary* bandwidth, not on *occupied* or channel bandwidth.⁵ Instead, astonishingly, it claims first that there is no necessary or relevant distinction between occupied and necessary bandwidth, and that ARRL erred in attempting to "interpose" one. ReconRobotics also claims, at page 6 of its *Opposition* that "the actual (sic) bandwidth of the Recon Scout, as measured in accordance with the Commission's procedures, is very close to 100 kHz." These two arguments reflect a very serious misunderstanding on the part of ReconRobotics of the nature of its own device and the measurement procedures required.

3. There are, and this case demonstrates, important distinctions between necessary bandwidth and occupied bandwidth. Those distinctions are the reason that both are defined separately – and differently – in the international Radio Regulations and in the Commission's regulations.⁶ ReconRobotics is correct that the rules permit measurements of necessary bandwidth. However, its oversimplified measurement of occupied

⁴ i.e. a 100KC3F emission designator for the video signal.

⁵ 47 C.F.R. § 2.201(a) and 47 C.F.R. § 90.209(a).

⁶ The Commission's Rules, at 47 C.F.R. § 2.202 pertaining to bandwidth, state as follows:

(a) Occupied bandwidth. The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. In some cases, for example multichannel frequency-division systems, the percentage of 0.5 percent may lead to certain difficulties in the practical application of the definitions of occupied and necessary bandwidth; in such cases a different percentage may prove useful.

(b) Necessary bandwidth. For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions. Emissions useful for the good functioning of the receiving equipment as, for example, the emission corresponding to the carrier of reduced carrier systems, shall be included in the necessary bandwidth.

bandwidth is *not* a measurement of necessary bandwidth at all. This is clear from the test results from ReconRobotics' own technical filings in this proceeding. In a report entitled "Extended Bandwidth Test Results of the Recon Scout" submitted by ReconRobotics with its November 10, 2010 equipment authorization application UYXRSK2010-01,⁷ ReconRobotics shows measurements of bandwidth using a wide range of video test patterns. More significantly, this report also shows the measured bandwidth using a 10 kHz measurement bandwidth and a 1 MHz measurement bandwidth. This is significant because the measured "occupied bandwidth" – which is also purportedly the necessary bandwidth -- shows a dramatically different result for each measurement bandwidth. This reveals that what ReconRobotics measured is closely related to the "necessary bandwidth" of its test instrumentation. By varying the bandwidth of its test instrumentation, one could present any measurement bandwidth it chooses. The test performed by ReconRobotics is *not even a valid measurement of occupied bandwidth of its device*, much less a finding that could be extended to a claim that such a test is an accurate measurement of necessary bandwidth.

4. ReconRobotics states at page 7 of its *Opposition* that its measurements were in accordance with the Commission's Section 2.202(a) definition of *occupied bandwidth*, and that using the "99 percent power criterion" in that definition it found the occupied bandwidth to be 100 kHz. It claims that the necessary and occupied bandwidths are "numerically equal" and that the distinction drawn by ARRL is of no consequence. However, measuring the -20 dB points under the circumstances of ReconRobotics' test is *not* the same as measuring the bandwidth in which 99% of the energy is contained. The amplitude level measured for the carrier will be independent of the bandwidth of the

⁷ This test was cited by ReconRobotics in the *Opposition* at 6.

measurement instrument while the amplitude level measured of the modulation sidebands will vary by approximately $10 \log(\text{bandwidth})$ for most video amplitude modulations. ECC Recommendation (06)01 is one of a number of documents that describes the *correct* way to make a measurement of occupied bandwidth. Rather than simply stipulating that one should measure the points at which the spectrum analyzer screen shows -20 db, as was done by ReconRobotics, this standard correctly requires that one determine the total power in the channel, then compare that to the bandwidth that contains 99% of that power, using digital-signal-processing and FFT techniques. ECC Recommendation (06)01 includes the following:

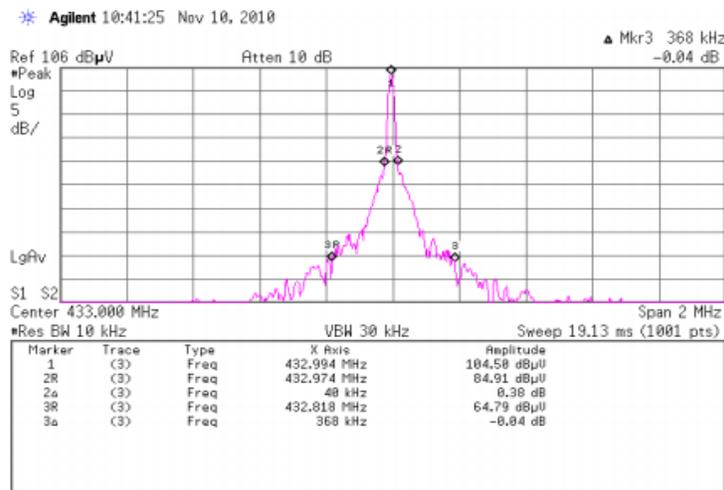
*The 99% bandwidth is calculated from each time record as follows:
The spectral power (or level) of each frequency line inside the stored sample is added throughout the whole recorded frequency range to give the 100% reference power. In a second calculation, starting from the lowest frequency recorded, the spectral power of each frequency line is again added up until the sum reaches 0.5% of the predetermined total power. At this point, a marker is set. The same calculation is then performed starting from the highest frequency recorded (the right end of the display) until again 0.5% of the total power is reached and a second marker is set. The 99% bandwidth is the frequency difference between the two markers.*

5. The 99% bandwidth of video modulation is essentially composed of lower frequency components, so in the case of high-speed video, a measurement of occupied bandwidth, even if correctly done, is not the same as necessary bandwidth. This point is clearly made in the rest of the spectral graphs that ReconRobotics showed in its supplementary report. The report shows that the spectral components vary significantly with the video pattern. Those additional spectral components, at levels lower than -20 dB below the video carrier, are very much necessary to convey the information that is in the pattern used for test equipment. Without those components, the pattern used to modulate

the video signal would be an unusable blur. If those components are not present, neither is the information in the pattern. It is inexplicable that ReconRobotics could provide test data showing a wide variation in spectral contents for various video patterns, and then claim that such spectral content did not meet the definition of what must be considered to determine necessary bandwidth. Those spectral components, extending out to 3 MHz from the video carrier for a monochrome analog amplitude modulated video signal, are very much for the “transmission of information at the rate and with the quality of the system employed.” Lower-amplitude spectral components of the transmitted signal are also needed to provide for the correct operation of the receiver – the sharp rise and fall of the horizontal sweep rate sync tips, for example. Thus, ReconRobotics is seriously in error in its claim that the occupied and necessary bandwidths are in this case numerically equal. They are not. The necessary bandwidth is far greater than 100 kHz.

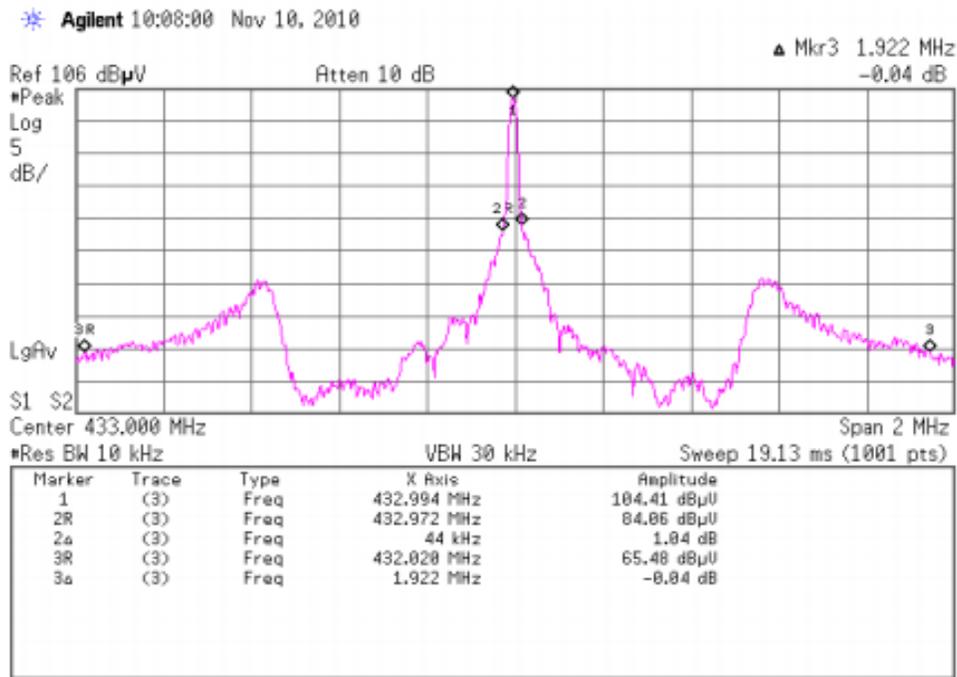
A 433 MHz Channel Data

Figures 7 through 19 depict the testing of a Recon Scout at 433 MHz with respect to all thirteen test views (9 static patterns, 3 videos, and 1 no pattern.) A summary of the data is available in Table 5.



(a) 10 kHz RBW

Figure 2 -- This excerpt from the ReconRobotics supplemental report shows the measurement of “necessary bandwidth” of the Scout viewing a white raster screen.



(a) 10 kHz RBW

Figure 3 -- This graph from ReconRobotics' supplemental report shows a ReconRobotics Scout viewing a checkered pattern. The frequency components out to 1 MHz are very much necessary to communicate the checkered pattern of the video. Similar frequency components exist for all types of video images.

6. ReconRobotics claims that ARRL is to be faulted for references to "NTSC" video signals, and that ARRL made an "assumption" that the video signal met the NTSC standard. It suggests that when the "misleading NTSC references are out of the way, the bandwidth discrepancies noted by ARRL disappear." Then it concludes that "the 100 kHz emission designators in the equipment certifications and the license applications are correct." The reference to NTSC video by ARRL⁸ was not an "assumption" by ARRL, nor is the reference necessary to ARRL's point. Furthermore, ReconRobotics' claim that the device does not "conform to NTSC standards" is misleading. ARRL's use of the reference was for the purpose of illustrating that the ReconRobotics system uses the same

⁸ The same reference was used earlier by ReconRobotics on its web site. That has now been removed. The reference is still used by ReconRobotics distributors, e.g. Zistos Corporation of Holbrook, NY.

modulation characteristics, frame rate (30 frames per second), sweep rate and essentially the same number of lines (600) as does the monochrome portion of an NTSC video signal. In reviewing the purported measurements of “necessary bandwidth”, labeled by ReconRobotics as “occupied bandwidth” in its reports, it is apparent that the vestigial sideband that is used under the NTSC scheme is not used in the Recon Scout. Rather, the signal is a full double-sideband video signal. For a monochrome “NTSC-similar” video signal, ReconRobotics claim of need for three 6-MHz wide channels instead of three 100-kHz wide channels,⁹ is apparent, as the modulation frequencies of a monochrome video signal extend to 3 MHz from the video carrier. The necessary bandwidth of the Scout is 6 MHz total. The spectral components extending to +/- 3 MHz from the video carrier of a Scout signal are a necessary part of the information being transmitted. Without these, the video signal is unusable. The quality of a 100 kHz video signal using the Scout’s operating parameters would not, as ReconRobotics asserts, be somewhere between a blur and motion-picture quality. It would instead just be a blur.¹⁰

7. In summary, some modulation schemes have necessary components that are weaker than 1% of the total transmitted power, which is what "occupied bandwidth" evaluates. The necessary bandwidth of the Scout signal is not 100 kHz, as measured incorrectly by ReconRobotics, but rather the +/- 3 MHz that would be required to convey the monochrome information in a high-speed video signal. Obfuscating that fact with unjustified claims that the Scout signal is somehow different and so the emission

⁹ ReconRobotics has never explained why, if its device has a 100 kHz occupied and necessary bandwidth, it was necessary in the waiver request to have three, 6 MHz channels for these devices, one operating on each channel in a given area. The absurdity of its argument is inherently obvious in this unexplained dichotomy.

¹⁰ ReconRobotics’ assertion that the Scout’s signal quality is “adequate to [its customers’] purposes”, if correct, is because the necessary bandwidth is not 100 kHz, but closer to 6 MHz and contains the necessary spectral components.

designator used for the necessary bandwidth of a 30-frame-per-second, 600-line signal somehow doesn't apply is unavailing. The measurement of occupied bandwidth was done in a way that was neither correct nor valid for a video signal. Occupied bandwidth is not a good indicator of the necessary bandwidth of a high-speed video signal and the necessary bandwidth of the signal is the same as the channel width that ReconRobotics was given: roughly 6 MHz.¹¹

8. ReconRobotics' *Opposition* (at page 8) asserts, relative to ARRL's Petition for Reconsideration that ARRL's objection to the license grants while ARRL's challenge to the equipment certification is pending is not valid because a mere challenge does not suspend a grant of equipment certification.¹² Of course it doesn't. That was not ARRL's point. The point was that the grant of the applications was premature because the emission designators shown in each of the applications was incorrect and the Bureau was well-aware of that issue. The license grant order, at paragraph 15, completely missed the mark: It was not a matter of the device simply using a narrower necessary bandwidth than the channel bandwidth authorized. The correct bandwidth is important for two reasons: (1) the licenses, as granted, do not authorize the licensees to use the Recon Scout because the licenses limit the devices authorized for use to those with a 100 kHz necessary bandwidth; and (2) the error leads a co-channel Amateur Radio operator to believe that

¹¹ Notably, nowhere in ReconRobotics' *Opposition* is there any reference to the fact that since September of 2010, ReconRobotics has held Experimental License WE2XCL, file number 0041-EX-ML-2010 allowing operation of its Scout device at 82 different sites at either 430.92-436.92 MHz or 2449-2455 MHz. Each site specified the emission designators 5M7C3F (for the video transmitter) and 250KF3E (for the telecommand signals to move the device around). This establishes that ReconRobotics understands that the "actual" bandwidth of the Scout device is closer to 5.7 MHz than 100 kHz.

¹² ReconRobotics argues that revocation of an equipment certification grant is rare and requires a hearing. However, revocations are permitted pursuant to Section 2.939 of the Commission's rules where upon subsequent inspection of the device, it does not conform to the technical requirements or the representations in the application. Also, the Commission can request that a TCB conduct post-grant surveillance of a specific product for technical compliance and post grant remedies for non-compliance. See 47 C.F.R. § 2.962(g).

operation closer than 50 kHz away from the center frequency being used by the public safety licensee will not cause interference. If an offending Amateur Radio signal is placed that close to a video carrier, it will cause interference in the video passband of the Scout. On this latter point, ReconRobotics' blithe response that the Recon Scout devices are not protected from interference is not comforting to public service and public safety-minded co-channel Amateur Radio licensees, and it should not be comforting to ReconRobotics' public safety customers or to the Commission. Because the license grants do not authorize the operation by the licensees of the Recon Scout, they should be vacated, dismissed or returned, and none should be granted without the proper emission designator, following ReconRobotics' application for and grant of certification for the device with a correct emission designator.

Therefore, for all of the above reasons, ARRL, the National Association for Amateur Radio, again respectfully requests that the Commission reconsider and rescind the *Order* in accordance with the foregoing, and vacate the licenses granted thereby.

Respectfully submitted,

**ARRL, THE NATIONAL ASSOCIATION FOR
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CERTIFICATE OF SERVICE

I, Christopher D. Imlay, do hereby certify that I caused to be mailed, via first class U.S. Mail, postage prepaid, a copy of the foregoing **REPLY TO OPPOSITION TO PETITION FOR RECONSIDERATION** to the following, this 20th day of March, 2012. As to the applicants affected by this Petition, they were served via ULS online filing this 20th day of March, 2012.

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