

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

**In the Matter of** )  
 )  
**Amendment of Part 97 of the** ) **RM-11708**  
**Commission’s Amateur Radio Service** )  
**Rules to Facilitate High-Frequency** )  
**Data Communications** )

**To: The Chief, Wireless Telecommunications Bureau  
Via: Office of the Secretary**

Comments to the Federal Communications Commission regarding WT Docket No.16-239; RM-11708 by Radio Relay International.

Submitted May 4, 2019

**Executive Summary of this Filing**

Radio Relay International (hereinafter “RRI”) supports F.C.C. RM-11708 and endorses the ex-parte comments submitted by the Amateur Radio Safety Foundation on March 30, 2019. With this filing we contribute our summarized experience operating and maintaining networked Pactor relay stations, including recent exercises and drills that were quantitatively analyzed and assessed. RRI recommends amendment of part 97 of the rules to allow for use of Pactor 4 in the US Amateur Radio Service.

**About Radio Relay International**

RRI is an IRS recognized 501(c)(3) public benefit corporation, chartered in 2016 in the State of California, to manage and promote formal message traffic relay in the amateur radio service. RRI is supervised by an executive board of directors elected by our constituent member nets. Such nets conduct radiotelegraphy, radiotelephony, and digital waveform amateur message traffic operations in the Western, Central, and

Eastern areas of the United States and Canada. These areas are further organized into ten operating regions that represent states, provinces and territories. Operations extend beyond continental North America into the Caribbean, Alaska, Hawaii, Oceania, and Europe. More than two-hundred and fifty amateur radio operators are registered with RRI, comprising the most active of the several thousand operators that regularly join our affiliated nets. Attachment "A" appended hereto illustrates the present Digital Traffic Network topology of RRI.

RRI sponsors the publication QNI: the Independent Newsletter for Amateur Radio Traffic Handlers and hosts the "TFC-OPS" and "RadioRelay" on-line discussion groups for the amateur radio traffic handling community. RRI publishes field and technical manuals, training programs, operating aids, and other material at our main website, [www.radio-relay.org](http://www.radio-relay.org). This site demonstrates our expertise in the field.

### **Digital Traffic Network**

RRI maintains the Pactor-based Digital Traffic Network hereinafter ("DTN"), direct descendant of the amateur radio based, experimental AX.25 networks of the 1970s and 1980s and formerly affiliated with the American Radio Relay League as the NTSD. The network backbone operates in the high-frequency ACDS sub-bands using the Pactor 3 waveform under automatic control conditions. Many system operators offer local vhf access using standard packet radio equipment and techniques.

In a typical month, DTN relays between fifteen and twenty thousand radiograms to scores of state and local level stations. We estimate DTN and its predecessors relayed several million radiograms over more than thirty years of operation.

### **Pactor in Operation**

Many published comments in the present proceedings and related proceedings discuss Pactor's technical features, especially as implemented in hardware by its inventors, Germany's SCS GmbH & Co. Our comments pertain to its use on the air,

particularly during band-congesting amateur radio sport (contest) weekends and under real and simulated emergency conditions, and how Pactor contributes to satisfying the Part 97 public service mandate to provide emergency communications and to the advancement of skills in both the communication and technical phases of the art. Certainly RRI itself is dedicated to increasing the reservoir of skilled radio operators, technicians, and electronics experts. We believe new digital modes enhance this goal.

Concerning the mode Pactor, our digital operators have expertise with industrial, commercial, military and government communications and enjoy operating a variety of hardware and soundcard implemented data modes. Such modes include those offered by a leading expert in the field who is well published and celebrated, Professor Joseph H. Taylor Jr., (amateur call sign K1JT). A number of our DTN hub stations also use the digital mode Winmor to maintain interoperability with the Winlink message service, the subject of much of the present filings in this matter. Also, before standardizing on Pactor, DTN hub stations operated AMTOR, Clover and Pactor allowing for detailed observation and study of their relative performance. On the merits, Pactor 2 was selected as our backbone standard. Most hubs upgraded to Pactor level 3 within a few years, an endorsement of the waveform's increased capability.

Our accumulated experience gives RRI a broad institutional perspective of the relative merits of common waveforms, how amateur implementations stack up to industry standards, and the practical effectiveness of communicating messages under many propagation and operating conditions over a variety of technologies. We have arrived at our present position based on our experience.

Several RRI operators already use Pactor 4 in U.S. government service or foreign amateur radio services and remark on its superior performance. Improved performance has been observed even in Pactor modes 1, 2, and 3 attributable to improvements in the modem's design implementation. Simply put, RRI argues Pactor works and works well for written message operations. Accordingly, full consideration by

the Commission to Pactor 4's use as a legally authorized amateur radio mode of operation is urged.

### **Discussion**

**RELIABILITY:** The SCS modem itself is constructed to commercial standards and performs reliably and robustly, requiring no maintenance beyond its initial installation. Interfacing with modern transceivers with dedicated data ports and high-quality cables means Pactor stations are physically stable and innately immune to RFI, voltage variation, and mis-wiring errors.

**AUTOMATED OPERATION READY:** SCS modems include automated adaption algorithms for Busy Channel Detection, Transmit Power, Frequency Correction and Protocol Fallback that make automated operation practical. As a practical matter, P3 initializations often fall back to P2 and on rare occasions to P1. Power levels are similarly reduced for good circuits. Anecdotally, we have many reports of successful P2/3 connections inaudible to human ears.

**NARROW BANDWIDTH REQUIREMENTS:** Communication emergencies and simulated drills quickly fill the data sub bands, especially the segments reserved for automatically controlled digital stations. Pactor's narrow bandwidth, automatic adaption, combined with easily scripted polling policy allows us to establish useful circuit throughput under seemingly impossible conditions. Only continuous wave ("CW") Morse code amateur operations rival Pactor in this ability even as we note our most capable CW radio operators are falling silent as time progresses and such skilled operators are not replaced.

**NOTE:** Part 97.221 strictly limits waveform bandwidth to 500Hz outside the ACDS sub bands. We strongly urge the FCC to restore automatic control sub band allocations as they existed prior to 2006 and RM-11759. For example, the current 40m

ACDS allocation supports only two concurrent Pactor 3 connections.

**AVAILABILITY AND SUPPORT:** As a commercial product, Pactor's developers hold a vested interest in its stability and continued support, leading to its widespread distribution and large installed base of SCS modems at consumer level pricing. Its nearest rival in the amateur radio market is HAL Communication's CLOVER waveform and devices, no longer marketed to hams and generally unavailable to consumers at any price. While Kantronics still supports its G-Tor waveform, it is not widely used despite its origin in the automatic link establishment ("ALE") protocol.

**TRAINING AND MAINTENANCE:** Because it is implemented in hardware, Pactor requires little training or maintenance for basic message traffic relay. This is an obvious advantage of its use for emergency communication. Field-deployed Pactor stations in a communications disaster can be operational in a matter of minutes with a high expectation of reliability. Further, it is long-standing DTN policy to review and modify operating plans each year. DTN managers are in regular communication to discuss network management. They produce frequency files for the Airmail software client, distributed widely among hub stations and local DTN liaison stations. Thanks to internal communication and coordination, DTN stations are kept in good operating order. Poor performance is identified and remediated as it is noticed and the result is a well operating system that minimizes interference while maintaining a full-time, year-round operational capacity.

**OBSERVED AND QUANTIFIED PACTOR PERFORMANCE UNDER EXERCISE CONDITIONS:** While operating under the aegis of the ARRL's National Traffic System, before the formation of RRI, many of the current RRI operators participated in the 2016 FEMA exercise "Cascadia Rising" at the invitation of the director of the Disaster Emergency Communications Division in Washington, D.C. Then-NTSD had never before been tested in simulated emergency conditions and we were keen to see how it performed under pressure. Despite an unexpected glitch revealed by poor radio

propagation during the exercise, requiring direct intervention by the sysop, we were extremely impressed with Pactor's overall performance and accuracy under adverse, real-world conditions.

Performance of the radiotelegraph and digital relay networks is discussed in a document entitled "CRE Evaluation Report Final 2016-7-11", available at <http://radio-relay.org/about/publications/>. The NTSD (today's DTN) achieved 99.997% accuracy with only 16 non-fatal errors in more than 7,000 data points. The glitches prevented relay of a large fraction of messages within the exercise period. While correctable problems were addressed with revised procedures, we speculated Pactor 4 may have alleviated the bottleneck by virtue of its improved sensitivity and higher throughput even when connecting to legacy Pactor equipment.

Overall, the network's results compared favorably to our concurrent radiotelegraphy operations which achieved a remarkable 99.998% accuracy over 10,000 measured data points.

**NO ILLICIT OPERATION HAS BEEN OBSERVED:** At the RRI April 2019 board of directors teleconference, which includes the three DTN area managers and many hub sysops, no one could recall an identified instance of illicit Pactor operation. Several instances of incorrectly configured Hub and MBO stations were recalled, each of which led to immediate remediation of the problem. We should note that our Pactor hubs process all messages in plain text despite our ability to accommodate binary files as desired. We maintain binary capability while we reserve it for emergency use.

### **Conclusion**

RRI recommends Pactor 4 as an amateur radio mode of operation and urges the Commission's proposal to make it available to the U.S. amateur radio service by appropriate amendments of part 97 of the Amateur Radio Rules.

## **Radio Relay International**

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