Before the
Federal Communications Commission
Washington, D.C. 20054

In the Matter of	)	
	)	**RM-10805,**
The Amateur Radio Service:	)	**RM-10806,**
Proposed Changes to the Morse Code (CW)	)	**RM-10807,**
Proficiency Requirement for Operator	)	**RM-10808,**
Access to the Amateur Radio Bands	)	**RM-10809,**
Below 30 MHz	)	**RM-10810, and**
	)	**RM-10811**
	)	

To: The Commission

Reply Generally In Support of the Comments of Alan Dixon, N3HOE To The Petitions For Rulemaking Retaining Morse Code Testing

I, Leonard H. Anderson, respectfully wish to make some Comments to Mr. Dixon's Comments and, especially to the seven petitions requesting retention of the Morse Code test for an amateur radio license. I make these as a private citizen, as a professional electronics design engineer retired but only from regular hours, as a U. S. Army Signal Corps veteran who began in HF radio communication in 1953, and as a long-time radio and electronic hobbyist who has never had any amateur radio license or ever tested for same, nor has any affiliation with amateur radio organizations or businesses or publishers.

I generally agree with Mr. Dixon's Comments on removal of the Morse Code test element 1 but cannot reconcile the retention of tested Morse Code proficiency for an Amateur Extra class license. Several other petitions[1] and commenters[2] have shown that the amateur radio community is divided on the

[1] RM-10786 petition from No Code International, RM-10788 petition from the National Council of Volunteer Examiner Coordinators.

[2] Particularly Comments by LeRoy Klose III submitted on August 31, 2003, in regards to RM-10788.

Morse Code testing retention or elimination but a sizeable number strongly favor the elimination of the code test for all amateur radio classes. Those in favor of code test retention express a large number of phrases which can only be considered as “articles of faith” to this commenter. That “faith” has not been demonstrated by actual cases of fact in the observation of communications the last half century.

There exists a great schism among the already-licensed United States radio amateurs, a division of opinion over Morse Code use as well as federal testing. Morse Code testing has always been required for a U. S. amateur radio license ever since the first radio regulating agency came into being in 1912. This retention for 91 years was bound to have an effect on the opinions of many radio amateurs. When on-off keying coding was the **only way to communicate** via early, technologically-primitive radio, it was logical and reasonable to have testing for such singular proficiency. That need is long past. Radio now has a wide variety of modes and modulations available to all.

All parties interested in amateur radio regulations should keep in mind that, regardless of the self-glorifying phrases used about amateur radio, it remains essentially an avocational radio activity, a hobby, an interesting, sometimes fascinating technical activity, a recreational activity, all defined as done without pecuniary compensation. It is thus not a profession in the definition of the Commission. It is not a military service, not a public safety service, not an emergency service per se although radio amateurs may or have served in the military, be engaged in public safety, and could, but not required by law be used in emergencies. Amateur radio is not a guild or union or craft in the professional work sense. It is an avocation, a hobby.

There should be no shame or hesitation in describing or thinking about amateur radio as a hobby, an enjoyable recreation with a wide variety of technical interests, local to international social communication, some of which may have fall-out to the professional world of radio. By the nature of electromagnetic wave propagation and emission of radio frequency energy, amateur radio activities require regulation on emission by all the world’s administrations, no different than radio emission from the various professional radio services. Electrons, fields and waves do not respect human legislation of regulations. All radio services must respect physics of radio the same. Such physical laws are not subject to human legislation of any kind. Only the laws made by humans are negotiable in a democratic principle society.

In light of the above, I offer some commentary on typical, common statements made in RM-10805 through RM-10811, inclusive.

Implication That Amateur Radio Is Basically An Effective, Ready Radio Service For All Emergencies

Commenters have taken Part 97.1 (a) somewhat ambiguously. That first paragraph under§ 97.1 - Basis and Purpose reads: "*Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.*" Taken as a whole, the word *voluntary* comes first. Many misconstrue the conditional last part of the sentence as defining the amateur service as a definitive emergency communications entity. Actual emergency and disaster communications for radio amateur service regulations are in § 97.401 through § 97.407.

On a practical matter, amateur radio equipment is generally designed and constructed in what the electronics industry could grade as somewhere between high-grade consumer quality to industrial-grade electronics quality. It is not generally intended or used in wide variations of temperature, vibration, shock, altitude, or submergence. Natural disasters and emergencies may force any one or more of those environments to take place. Design and construction to withstand extreme environments is costly, time-consuming in development, requiring great care and diligence to achieve. United States military radio and electronic equipment is designed and built for the maximum extremes in natural environments, has survived such in the field. Warfare may be considered the ultimate severe environment. U. S. military radios have survived warfare well in the last few decades.

In the case of homebuilt amateur radio equipment, there is generally little or no attention paid to severe environmental operational ability or survivability under non-operating conditions. Homebuilt as well as commercial manufacture amateur radio equipment is generally used within a narrow temperature range, generally within a relatively narrow comfort range indoors. Mobile, manpack, and hand-carry amateur radio equipment is generally of ready-built, commercial construction and can work over a wider temperature range, some moisture infall, but not complete submergence. Flooding conditions in disasters can cause submergence in various waters.

Hurricanes, tornados, and wind storms put severe wind loadings on antennas. The majority of wire antennas used at amateur radio residence stations are not designed nor constructed for severe wind conditions. Government and commercial antenna structures are designed and built to withstand severe winds.

Nearly all amateur radio stations at residences are dependent on primary electric power from power utilities. In disasters that primary power can fail as in Los Angeles in 1994.[3] Few amateur radio stations in residences have any source of emergency electric power generation. Mobile radios fare the best under such conditions, using vehicle electric power but that is dependent on the availability of engine fuel for an unknown period.

During sudden emergencies and disasters, the telephone switching centers are generally overloaded by too many subscribers trying to dial out. That is not “failure of telephones” but a temporary blockage. .

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[3] During the Northridge Earthquake of 17 January 1994, all electric power to about 10 million in the Greater Los Angeles area was cut off due to a falling MHV tower of the Pacific Intertie. Public safety agencies and hospitals were all equipped with emergency electric power generators as was the Disaster Communications Center in downtown Los Angeles and the electric power distribution control center in Sylmar, in the San Fernando Valley, east of the epicenter and north of downtown Los Angeles. Fire, police, paramedic, ambulance vehicles remained coordinated by radio. Utilities networked via radios in vehicles. Most broadcasting stations remained on the air via emergency power generators. There was no evidence that any amateur radio networks were operating immediately after the main shock occurring slightly after 4:30 AM until an electric power Black Start was completed in early afternoon.

Hardware and facilities are seldom destroyed. Telephone central offices have battery back-up and generator power available. Telephone companies lease fixed lines for many purposes that do not go through switching centers; those circuits are seldom disturbed during emergencies.

In the northeast USA power blackout of 14 August 2003, some 50 million in several states were without primary electric power for an entire day or more. As in the Los Angeles area of 1994, public safety agencies had emergency power back-up, nearly all hospitals continued to function on emergency power. Broadcasting companies were running on emergency power in studios, transmitters, and in field units transmitting video and audio to the rest of the United States. New York City did not have their subways or elevated trains "fail." Those simply remained stationary due to lack of electric power. There was some amateur radio activity in the blackout area some hours after its start but it is unclear on how much of that was related to actual emergency communications. The government and civilian infrastructure continued to function but under more primitive conditions.

In the 11 September 2001 terrorist attacks on the New York City World Trade Center and Washington, D.C.'s Pentagon, government and civilian communications continued to operate right after the attacks and later. The emergency communications center of New York's Manhattan was located in that disaster area and became useless. Emergency communications worked around that loss. Damage to the Pentagon was contained to the aircraft impact area by installed internal environment control system backups designed years before. Amateur radio networks aided both recovery efforts through health and welfare communications but it is not clear that any amateur radio communications contributed directly to rescue work immediately after the attacks. Several electronic companies manufacturing civilian and government radio equipment rushed shipments of replacements to agencies in New York City, the hardest-hit, within two days time.

The three preceding examples were all sudden and unpredictable.[4] Hurricanes along the eastern coasts yield days of warning time and preparation, due almost entirely to the National Oceanographic and Atmospheric Agency's satellite observation imagery and sensor-equipped aircraft flying into a growing hurricane's immediate vicinity. Tornados over land have only a few hours warning time to prepare from first sighting. Forest and other wildfire areas have anywhere from a few hours to several days warning for those in the path of the spreading fire, observation and path prediction supplied by the Forestry Service and several local agencies. Flooding may follow heavy rainfall but is tracked by many government agencies.

The many references to government and civilian agencies is deliberate. They are now well equipped to handle emergencies and disasters, are already networked, have various contingency plans, and do train together on a regular, cooperative basis. What must also be considered is the availability of the states' National Guard who can be activated to duty during emergencies and disasters, and have been often in the past. The same is true of the U. S. military forces nearby. All such military units are equipped with communications facilities which are survivable in extremes of environment, manned by already trained personnel. Regardless of the claims, amateur radio is not the only service which can back up normal civilian communications in a disaster.[5]

There exist claims of amateur equipment survivability over the commercial infrastructure that defy plausibility. That implausibility comes about when considering that commercial communications equipment is designed, built, and installed to operate reliably in severe environments while amateur radio equipment and installations are not so done. Civilian and government agencies cooperate in planning,

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[4] The Department of Energy is still investigating the cause of the 2003 northeast blackout at the time of this comment. There is some controversy among all parties as to whether or not it could have been expected.

[5] If it can. There is little evidence that U. S. amateur radio has contributed any significant direct emergency or disaster area communications to save lives, effect rescues, or actually aid any agency at the onset of an emergency in the last two decades. There are some cases of individual groups of radio amateurs saving some private boat people as reported by amateur radio membership organizations. Participation in actual emergencies or disasters are written in most general terms and communications generally described as "health and welfare" messages not defined as to content or extent of either "health" or "welfare."

equipping and training for many kinds of emergencies. Such organization has only begun significantly in amateur radio membership organizations after the 11 September 2001 terrorist attacks. .

On the Efficacy of Morse Code in On-Off Keying as the Claimed Most Robust of all Modes or Modulations

The Young (RM-10805), Napurano (RM-10806), Puerto Rico (RM-10809), FISTS (RM-10811) petitions all claim that On-Off Keying Morse Code is the most effective or most robust of all modes or modulations available to U. S. radio amateurs. Napurano claims also that it has "the most pure signal." There is the common phrase "'CW' gets through when nothing else will." Over the last half century this has become an article of faith among those favoring the mode.[6] Such has not been proven in actual testing in the laboratory or in-field operation.

Occupied bandwidth of a keyed continuous wave carrier depends on the on-off rate of minimum symbol time and the transition times of the keying. The faster the changes of either, the broader the RF bandwidth.[7] A "fast" rate of on-off keying Morse Code (equivalent to about 40 WPM text) will have a bandwidth of about 200 Hz. Signal to noise ratio at the receiving end depends principally on the bandwidth of the receiver and the signal-to-noise ratio is the determining factor in a signal getting completely through. According to the seminal Shannon's Law, the noise of the signal-to-noise ratio is proportional to the square-root of receiver bandwidth.[8] Typical amateur receiver narrow bandwidths are 400 to 500 Hz at -3

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6 Etymological evidence is beyond the scope of this comment. According to personal communications from others over the last half century, both professionals and amateurs in radio communications, it seems to have originated before 1941 in reference to AM voice versus on-off keying Morse Code communications.

7 Fact is given in every radio-electronics textbook explaining modulation and bandwidth.

8 *Shannon's Law* is the familiar and respected name for the seminal paper by Claude Elwood Shannon published in Bell System Technical Journal, Volume 27, 1948, titled "A Mathematical Theory of Communications." See also "Communications in the Presence of Noise," Proceedings of the IRE, Volume 37, 1949, by Shannon. Shannon's mathematical analysis of communications throughput related all data rate to

db points. Digital Signal Processing (DSP) techniques can effect a very narrow "brick wall" like skirt shape of bandwidth response down to 150 to 200 Hz.   The narrower the bandwidth, the more sensitive the receiver for the same signal-to-noise ratio. On-off keyed CW signals can also be received with a wider bandwidth such as 2.4 to 2.8 KHz common with SSB voice reception. The wider bandwidth will yield a lesser receiver sensitivity for the same signal-to-noise ratio. The effective sensitivity of an on-off keyed CW carrier **is a function of the receiving apparatus, not the transmitter.**[9] In any radio circuit establishment, the bandwidth at the receiving end is not always known to the transmitting end operator. The approximate sensitivity increase of a pure on-off keyed CW carrier at 20 WPM equivalent Morse Code rate versus ordinary speech via SSB (approximately equivalent to 200 WPM) with respective receiver bandwidths of 400 and 2400 Hz is approximately 15 db in favor of the on-off keyed carrier signal. The rate of information transfer is approximately 10 times greater in favor of the SSB voice signal. Fast speech of approximately 400 WPM equivalent is possible with some speakers in the same SSB voice bandwidth; that is a function of the speaker's ability to talk clearly and quickly.

A related claim to efficacy of on-off keyed CW carriers is "*CW is more efficient on power consumed at the transmitting end than with voice modes.*" That claim dates back to when HF band amateur voice modes transmitters used "high-level" modulation of the final amplifier using an audio power amplifier of power output about one-half that of the RF power output of the final amplifier. That claim is only true when comparing an AM high-level modulated carrier (double sideband) with an on-off keyed CW power amplifier of the same RF output power. High-level double sideband modulation is rarely used on

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bandwidth and noise in the communications channel.

[9] On the presumption that the transmitter CW carrier contains a minimum of transition distortion. Instability of the carrier during on-off keying can exist, usually a result of poor transmitter power supply regulation. If such instability includes incidental FM or PM generated as a result of the keying, the transmitter bandwidth increases. A narrow bandwidth receiver will experience a reduced sensitivity for the same signal-to-noise ratio of such incidental keying modulation occurs.

HF amateur bands now. Single sideband suppressed carrier voice modulation now occurs at a much lower RF level within the transmitter and the power amplifier is linear; RF output is proportional to speech amplitude level, very low at quiet periods. The same linear power amplifier is used for on-off keyed (at a lower RF level) CW. Power consumption at the transmitting end is approximately the same for on-off keyed CW as it is for SSB voice.[10]

Morse Code can also be transmitted as frequency- or phase-shifting a steady RF carrier. While this has more primary power consumption at the transmitter, more elaborate frequency- or phase-locking detectors at the receiving end can have an improved signal-to-noise ratio over on-off keyed CW with the same code. Such is rare in common amateur radio practice.

Teleprinter data transmission using a 10-bit character code and a 170 Hz frequency-shift in steady CW carrier frequency-shift modulation can have a throughput of 100 WPM equivalent. The necessary receiver bandwidth is approximately 400 Hz for that Mark-to-Space frequency shift. For about the same bandwidth and thus the same signal-to-noise ratio at the receiver, the FSK teleprinter throughput will be 5 times faster than a 20 WPM equivalent text Morse Code mode. An advantage of the equal-character-time teleprinter coding is the ability to employ several available Forward Error Correction (FEC) techniques to improve the total circuit transmission reliability.

A claim of Morse Code proponents is the use of common abbreviations and prosigns *"increases the Morse Code throughput rate, sometimes doubling it."* That isn't absolutely true. While abbreviations do reduce the textual content and prosigns do help reduce the time of transmission, that occurs only with the barest exchange of information such as station call sign, signal quality, local weather, salutations common to quick casual radio contacts. In emergency or disaster situations, the required transmission content will be varied and unknown, phrases of transmission content will be non-standard to amateur

[10] Typical of modern day commercial ready-built transceivers of 100 to 200 Watts Peak Envelope Power as well as kit-form transceivers having lesser PEP output.

practice. Abbreviations may need to be reduced and clear-text transmission used to insure accuracy of information received.[11] Throughput rate must bottom out to equivalent text rate.

One of the recent innovations in amateur radio communications means is PSK31.[12] Devised in the UK specifically for manual, on-air and on-line keyboard-send, electronic-display-read textual data, it will work in a very narrow (relative) RF spectrum space no wider than conventional on-off CW carrier radio-telegraphy. It has the advantage of optionally providing automatic textual storage and/or printout using a personal computer.

On the Contention That On-Off Keying CW Mode Hardware Is the Simplest and Most Effective Mode of Communications, Therefore Most Suited To Emergency Radio Work

This phrase is dated to pre-World War Two times and is applicable **solely to vacuum tube architecture radios**. Vacuum tubes have all suffered from one common unreliability factor, filament life. While vacuum tube design and manufacture improved this major flaw in the 1950s, solid-state active devices quickly achieved a reliability and longer life in the same period beginning just three years after the

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[11] An emergency or disaster situation could require medical supplies to be sent to the scene. Drugs, medications, medical equipment have long, unfamiliar names and phrases which must be sent accurately. The abbreviations used by medical personnel differ from the abbreviations used by radio amateurs in everyday contacts..

[12] Devised by Peter Martinez, G3PLX, in the United Kingdom, a narrowband mode of on-air data transmission with a maximum data rate of approximately 30 WPM equivalent text. Using a specific character coding which includes some error correction features, this phase-shift keying modulation of a CW carrier will work in the same radio frequency bandwidth as a high-rate manual radiotelegraphy Morse Code signal. It has the advantage of being able to employ relatively simple phase-locking techniques in receiver detectors to gain an effective increase in signal-to-noise ration over on-off keyed CW carrier radiotelegraphy. While normally used with a personal computer for ease of application, PSK31 support electronics could be implemented with a 20 square inch circuit board using no more than a handful of active devices (microcontroller, audio DSP, standard PC keyboard encoder, LCD driver module for liquid crystal display screen read-out, plus auxiliary buffers and interface transistors or I Cs). On-air tested in radio amateur communications among European amateurs for years before being tried in the United States, this new method is about six years old.

announcement of the invention of the transistor.[13] Continuing development of solid-state active device manufacture, design, production, quality control, plus the innovation of the integrated circuit having tens, then hundreds, and finally, hundreds of thousands of transistor junctions on a single semiconductor chip has, to pardon a pun, solidified the solid-state device as the absolute component for any electronic system, radio included. Vacuum tube technology remains viable only in specialized applications such as very high power radio frequency generation or amplification, cathode-ray display tubes, photo-multiplier sensors, and broadband microwave amplification such as traveling wave amplifier tubes. New active component developments and applications have already replaced some of those.[14]

The "simplest transmitter" is based n vacuum tube technology, embodied in an almost classic structure known to many (usually older) radio amateurs as a "MOPA" or Master-Oscillator, Power Amplifier for HF transmitter on-off keying CW carrier radiotelegraphy. This structure uses two vacuum tubes, operating frequency usually limited to a single quartz crystal controlling the master oscillator frequency. Of the various versions appearing in radio amateur publications over the last half century, the RF carrier maximum power output is about 25 Watts with top operating frequency rarely above the 20 meter amateur band at 14 MHz. The MOPA structure is extremely simple, requires only one specialized device (the quartz crystal), but is dependent on a usually-unspecified power supply for 100 to 300 Volts DC necessary for tube functioning.

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[13] AT&T press release in December, 1947, describing Bardeen, Brattain, and Shockley's transistor effect..

[14] Modular solid-state transmitter amplifier modules, some designed for "hot swapping" replacement (changing without having to disable transmitter) have been used for a decade in LF to VHF transmitters. Flat panel displays using LCD, plasma glow, or TFT (Thin Film Transistor) technology are now a consumer marketplace commodity for personal computer and television use. Photo-multiplier tubes remain a viable sensitive optical sensor, reliable largely for not having any filament; Charge-Coupled Device (CCD) semiconductor sensors are nearing the extreme sensitivity of photo-multiplier tubes. Silicon-germanium transistor junctions are now operating in the tens of GigaHertz range to challenge tube technology for broadband microwave amplification and generation. The ubiquitous microwave oven magnetron for food preparation seems to be the sole standout for vacuum tube application.

Solid-state versions have appeared in amateur publications during the last two decades using the same MOPA structure. Almost all of the solid-state versions have much lower RF power output, about 2 Watts maximum. Maximum operating frequency has reached the amateur 10 meter band at 28 MHz, more due to the availability of higher-frequency quartz crystal units for the master oscillator stage. They can operate directly from battery power, omitting any extra power supply.

While simplicity is stressed as a redeeming feature, reality is that all of these simple units are **mode limited and frequency limited.** Neither is a redeeming feature during emergency conditions. The onset of a sudden emergency or disaster usually upsets normal amateur radio operations. There is **no guarantee** that local or nearby communicators knowing Morse Code are available or able to "work" Morse. Any Morse Code radio circuit requires **operators at both ends who are proficient in Morse Code.** On the other hand, anyone still functioning in the emergency area can speak and write the local language and are able to "copy" spoken or written language. **In any true emergency anyone is permitted to use any mode, any frequency, licensed or not.**

Emergency or disaster situations do not always allow for operation on familiar frequency bands. High winds in storms may disable or prohibit continuing erection of HF wire antennas; VHF or UHF bands may be more suitable, especially with relatively short, low-wind-loading antennas. There has been no actual or demonstrated need for long-distance radio contacts during nearly all emergency and disaster situations. All of those are confined to relatively small geographical areas, usually with a maximum area distance less than the horizon for Line Of Sight radio communications.[15]

The mythology of on-off keying CW as a savior in communications might be traced back to the

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[15] The only possible exception to distance would be during **both** northeast United States' primary electrical blackouts. Neither case was a strict emergency or disaster situation since the civil infrastructure within the blackout areas were not disabled or destroyed. A true emergency or disaster situation would be the Loma Prieta or Northridge earthquakes in California where destruction was limited to line-of-radio-sight distances, various locations along the eastern Atlantic Ocean or Gulf of Mexico coastal areas hit by hurricanes, the "9-11" terrorist attacks on New York City or Washington, D. C., both of those having destruction over only small areas.

Titanic ship disaster of 1912. 91 years ago the **only possible mode for radio communications** was on-off keyed CW. Today, **public safety agencies do not use on-off keyed CW carrier communications.** None. Public safety agencies have radio communications with a wide variety of modes and modulations using solid-state radio equipment having demonstrated-by-long-use capability and reliability.

There can be a case made for unreliability using vacuum tube active devices. The mean time between failure of solid-state electronics, even of very complex architecture in systems, is many, many times greater than simple radio transmitters designed and built around vacuum tubes. **Simplicity in radio hardware is no guarantee of reliability, in or out of an emergency situation.**[16] The simple radio transmitters described in construction articles of amateur radio publications are seldom projects that have been maximized for reliability, even with a gentle operating environment of living quarters.

Radio transmitters are only part of any two-way radio circuit. Most radio receivers of today or even of three decades ago, are complex electronic structures yet exhibit long life and high reliability with low primary power drain. Most radio receivers in U. S. amateur radio stations are ready-built commercial models and have been so for the last half century. Most amateur radio receivers are multi-mode with optional selection of demodulation type, with sensitivities approaching near perfect limits. Simplistic, low-parts-count amateur radio transmitters are single-mode and of low RF power output, are seldom designed for reliable operation under wide variations in environment..

There have been some informal claims elsewhere that *"simple radio equipment could be assembled easily in the event of an emergency or disaster."*[17] That beggars the mind for its unrealistic

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[16] This is a complex subject and has no simple, quantifiable general number values. Reliability engineering has been practiced in radio and electronics design for over a half century. The average home personal computer of today has millions of transistor junctions contained in dozens of integrated circuits and hundreds of passive components. Personal computers have hardware reliabilities of greater than a year. By contrast the first U.S. large scale electronic computer, ENIAC, containing over 5000 vacuum tubes, could experience at least one hardware failure within an operating day's time.

[17] That has surfaced many times in Internet newsgroups of amateur radio interest.

consideration of actual emergency or disaster situations. Electric power may be cut off, rendering electric tools and soldering irons unuseable. Proper electronic components may not be available since the "ham shack" may have been destroyed or disables. There is no guarantee that local electronic parts stores will be able to help in that regard since those might also be destroyed or disabled. Amateur radio literature might be damaged or destroyed so that there is no access to details of construction or diagrams.[18]

The only practicality is to **have on hand radio equipment of multi-mode and wide frequency range capability along with primary electrical power sources, all able to operate outside the gentle environment of the residence radio station.**

On the Tested Mode Certification of RM-10808

In Joseph Speroni's petition of RM-10808, he suggests separate formal testing for each operating mode used in amateur radio as an "alternate" to the elimination of the Morse Code test requirement. This seems totally impractical to both the Commission and to radio amateurs, increasing the workload of the Commission and being an impractical nuisance for all radio amateurs, newcomers or old-timers.

Radio regulations must be flexible enough to handle advances in the radio art that **might arise in the near future** or be **innovated for amateur radio through adoption of radio art of other radio services.** The adoption of single-user, single-sideband voice modulation of the 1950s required reconsideration of existing amateur radio rules even though multi-channel single-sideband radio equipment was known and practiced by government and commercial carriers since the early 1930s. Radio teleprinter

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[18] Few radio amateurs have the capability to design a radio transmitter, let alone handle all the construction and test under adverse conditions. Design alone can take many days for those not familiar with the process. Part of that design process is knowing how to substitute parts values; there is no guarantee that a full range of components for a possible transmitter would be available. Any construction will require at least some test equipment to insure it can operate at all; there is no guarantee that even a small amount of test equipment will remain working or workable during an emergency or disaster. Radio design is not a required area of knowledge for a United States amateur radio license. General or basic radio theory is required but that is insufficient to undertake an actual design task.

operation was aided by availability of military and commercial surplus teleprinter terminals in the two decades after the end of World War Two. "RTTY" was not much used by the radio amateur community before the start of World War Two. Amateur radio voice communication on VHF and higher frequencies was rare prior to 1950 yet became the most-used mode on VHF and higher afterwards. PSK31 is less than half a dozen years old yet it is seeing more and more use on HF amateur bands, was not a possible amateur mode of the 1980s and prior. No one, including the Commission, **has sufficient prescience to foresee all the possibilities in the far future of radio arts and technologies.** The radio technology of the future is sure to change. The Commission can anticipate only some of that based on prior art in all radio services and the considered opinions of those experienced in a variety of radio communication.

Worse yet, the "tested Mode Certification" robs the innovative, inventive, curious minds of licensed radio amateurs by **restriction only to known modes of communication after subjecting them to an unnecessary hardship of required formal testing.** That "suggestion" essentially negates the two definitions of purpose in §97.1 (b) and §97.1 (c). Individual experimentation is discouraged, not encouraged. Individual innovation would be much reduced due to personal hardships of formal testing and certification for every major **mode now fully optional to use by all amateurs today.**

RM-10808 has no sensible solutions, would only add to bureaucracy and inconvenience hundreds of thousands of already-licensed radio amateurs and further discourage uncounted more considering personal amateur radio licensing..

Respectfully submitted electronically this 11th day of October, 2003
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