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

In the Matter of	)	
	)	
Review of the Commission's Part 95 Personal Radio Services	)	WT Docket No. 10-119
	)	
1998 Biennial Regulatory Review - 47 C.F.R. Part 90 - Private Land Mobile Radio Services	)	WT Docket No. 98-182
	)	RM-9222
	)	
Petition for Rulemaking of Garmin International, Inc.	)	RM-10762
	)	
Petition for Rulemaking of Omnitronics, L.L.C.	)	RM-10844
	)	

To: The Commission

COMMENTS IN REPLY TO COMMENTS OF JOE LEIKHIM AND COMMENTS OF THE NORTHERN CALIFORNIA GMRS USERS GROUP (NCGUG) CONCERNING PROPOSED NARROWBANDING OF THE GENERAL MOBILE RADIO SERVICE (GMRS)

Pursuant to Sections 1.415[1] and 1.419[2] of the Commission's Rules[3], the undersigned Commenter hereby submits the Reply Comments set forth below in the above-captioned matter.

Among the comments previously submitted by other commenters in the above-captioned matter, this Commenter submits that some of the most technically meritorious comments appear to have been submitted by Joe Leikhim of Leikhim and Associates[4] and by the Northern California GMRS Users Group (NCGUG)[5]. Joe Leikhim stated as follows:

> Furthermore, while narrowbanding of analog GMRS using analog technology will result in a 3 dB reduction of coverage (worse if NB and WB are mixed), using digital technology

[1] 47 C.F.R. § 1.415
[2] 47 C.F.R. § 1.419
[3] 47 C.F.R.
[4] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020510441
[5] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020910960

> instead would result in a 6 dB improvement. For this reason, I strongly feel that, in the interest of future digital capabilities, the best solution to provide a narrowband standard for GMRS is to adopt the APCO Project 25 CAI (Phase 1) as an optional mode of operation, with the understanding that scrambling or encryption continues to be prohibited.[6]

NCGUG stated as follows:

> However, we note that conversion to narrowband analog has a significant negative impact on both effective range (coverage), and on the ability of a receiver to reject co-channel interference.
>
> Range degradation in narrowband analog has been well documented in TSB-88[7] and by industry; with all else being equal, coverage is reduced by over 3 dB. Unlike commercial and public safety services, where high-density repeater systems are common, GMRS repeaters are sparse and operate more distant from their user base. Thus, GMRS users currently operate with weaker signals in many cases. A 3 dB or more reduction will have a significant impact on coverage and service.
>
> TSB-88 also shows that requisite carrier-to-interference (C/I) ratios required for a given audio quality are 6 dB higher for narrowband than for wideband analog FM. Thus, narrowband radios are much more affected by co-channel interference than wideband radios. This results in a further range reduction, particularly on shared channel where co-channel use in the same area is common.
>
> In contrast, the most common narrowband digital modulation schemes have equivalent range to wideband analog, and have a lower C/I requirement as well (can better reject co-channel interference). Digital also provides more consistent voice quality, and can provide enhanced signaling features, such as those cited by Garmin.
>
> Current digital technologies can also exceed the Commission's 2011/2013 Part 90 spectrum efficiency goals. Where narrowband analog provides a maximum of one voice channel per 12.5 kHz of spectrum, two digital technologies currently exist that can

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[6] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020510441 at page 8

[7] TIA Telecommunications Systems Bulletin, Wireless Communications Systems, Performance in Noise-Limited Situations, Part1: Recommended Methods for Technology Independent Performance Modeling, Table A-1

> provide one voice channel in 6.25 kHz (or equivalent) efficiency, with no significant impact on coverage or interference susceptibility.
>
> For these reasons, NCGUG suggests that the Commission permit digital voice and data emissions on GMRS, for all station classes. This would include F1E, FXE, FXD and F7W types. The Commission should consider a similar approach to that of Part 90, where both analog and digital technologies are permitted, as long as they meet certain spectrum efficiency requirements. Licensees should not be required to use digital equipment.
>
> Contrary to what manufacturers may admit under competitive conditions, analog and digital signals can co-exist o the same channels, and allow for pre-transmission monitoring as required in a shared channel service. Most all radios are equipped with a "busy lamp" which indicates when a channel is in use (in addition to a monitor switch that can disable coded squelch). To the extent that users actually monitor before transmitting today, analog or digital radio busy lamps will indicate the presence of a co-channel signal, regardless of the nature of the signal. It is not necessary to actually listen for a voice to know if the channel is in use. It is inevitable that most all communications will be digital in the foreseeable future; there is no better time to begin this transition.[8]

This Commenter notes the National Telecommunications and Information Administration (NTIA) stated the following in NTIA Report 07-447: Assessment of Federal and Non-Federal Land Mobile Radio Frequency Assignment Methodologies[9]:

> Greater frequency re-use among federal land mobile systems could be achieved by transitioning from the use of the current Spectrum XXI interference analysis algorithm towards the methodology recommended in TSB-88-B. Increasing frequency re-use by identifying more interference-free frequencies that can be assigned enables a more efficient use of the land mobile radio frequency bands. In light of the increasing demands for land mobile radio communications spectrum, and to improve spectrum efficiency, federal spectrum managers must use frequency assignment methods that accurately represent

[8] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020910960 at pages 10 and 11

[9] NTIA Report 07-447: Assessment of Federal and Non-Federal Land Mobile Radio Frequency Assignment Methodologies, http://www.ntia.doc.gov/osmhome/reports/2007/FreqAssignMethods_07_447.pdf

> interference to and from systems in the environment. To achieve this goal, NTIA recommends that federal agencies use software based on the methodology described in TSB-88-B for assigning frequencies in the land mobile frequency bands. Implementation of the TSB-88-B methodology will help avert imminent future land mobile radio spectrum shortages faced by federal agencies, particularly in spectrally congested environments.[10]

This Commenter notes NTIA Report 07-447 also states as follows:

> 4.3 TSB-88-B Interference Criteria
>
> TSB-88-B uses CPC Service Area Reliability as the primary criteria for adequacy of channel performance. CPC is defined as the ratio of the median level of a Rayleigh fading carrier (C_f) signal required to provide the specified output quality to the combined sum of all noise and interfering-sources ($C_f/(\Sigma I+\Sigma N)$) necessary to produce a defined performance level.
>
> $CPC = C_f/(\Sigma I+\Sigma N)$ (4-3)
>
> Where:
>
> CPC = Channel Performance Criteria;
>
> C_f = Median level of a Rayleigh fading carrier which will provide the desired output quality;
>
> ΣI = Sum of all interfering carrier powers; and
>
> ΣN = Sum of all noise powers.
>
> The $C_f/(\Sigma I+\Sigma N)$ determines the faded sensitivity requirement. The faded sensitivity requires an absolute power reference. The faded sensitivity can be computed from the known reference sensitivity and the static desired carrier-to-noise (C_s/N) determined from bench testing, which provides the absolute power requirement for the (C_s/N) criterion. The faded sensitivity for a given CPC is:
>
> $C_f = C_s + (C_f/N - C_s/N)$ (4-4)
>
> Where:
>
> C_s = Static Reference Sensitivity.

[10] NTIA Report 07-447: Assessment of Federal and Non-Federal Land Mobile Radio Frequency Assignment Methodologies, http://www.ntia.doc.gov/osmhome/reports/2007/FreqAssignMethods_07_447.pdf at page vi

Typical output signal criteria are a 5% bit error rate (BER) or a 12 dB signal-plus-noise-plus-distortion to noise-plus-distortion (SINAD), or a Delivered Audio Quality (DAQ) of 3.0.32 Many public safety agencies use a DAQ of 3.4; however, the user can change these values. Suggested CPC values are included in TSB-88-B for various DAQ levels and different modulation types obtained from various manufacturers. An excerpt from TSB-88-B is included as Table 4-1. However, the user may apply data obtained from other sources (e.g., a specific manufacturer's model or type measurements). As an example from Table 4-1, the required CPC for narrow band, analog FM +/- 2.5 kHz modulation to provide a DAQ of 3.4 is 26 dB.

[See Table 4-1 on next page]

Table 4-1. Sample CPC Values for Various Modulations and DAQs **Modulation Type (channel spacing)**	**Static** *refCN*$_s$/
Analog FM ± 5kHz (25 kHz)	12 dBS/4dB
Analog FM ± 4kHz (25 kHz)	12 dBS/5dB
Analog FM ± 2.5kHz (12.5 kHz)	12 dBS/7dB
C4FM (IMBE) (12.5 kHz)	5%/5.4 dB
C4FM (IMBE) (12.5 kHz)	5%/7.6 dB
CQPSK (IMBE) (12.5 kHz)	5%/5.4 dB
CQPSK (IMBE) (12.5 kHz)	5%/7.6 dB
CQPSK (IMBE) (6.25 kHz)	5%/7.6 dB
Table 4-1. Sample CPC Values for Various Modulations and DAQs **Modulation Type (channel spacing)**	**DAQ-3.0** ()*BERCIN*$_f$%/+
Analog FM ± 5kHz (25 kHz)	N/A/17 dB
Analog FM ± 4kHz (25 kHz)	N/A/19 dB
Analog FM ± 2.5kHz (12.5 kHz)	N/A/23 dB
C4FM (IMBE) (12.5 kHz)	2.6%/15.2 dB
C4FM (IMBE) (12.5 kHz)	2.6%/16.5 dB
CQPSK (IMBE) (12.5 kHz)	2.6%/15.2 dB
CQPSK (IMBE) (12.5 kHz)	2.6%/16.5 dB
CQPSK (IMBE) (6.25 kHz)	2.6%/16.5 dB
Table 4-1. Sample CPC Values for Various Modulations and DAQs **Modulation Type (channel spacing)**	**DAQ-3.4** ()*BERCIN*$_f$%/+
Analog FM ± 5kHz (25 kHz)	N/A/20 dB
Analog FM ± 4kHz (25 kHz)	N/A/22 dB
Analog FM ± 2.5kHz (12.5 kHz)	N/A/26 dB
C4FM (IMBE) (12.5 kHz)	2.0%/16.2 dB
C4FM (IMBE) (12.5 kHz)	2.0%/17.7 dB
CQPSK (IMBE) (12.5 kHz)	2.0%/16.2 dB
CQPSK (IMBE) (12.5 kHz)	2.0%/17.7 dB
CQPSK (IMBE) (6.25 kHz)	2.0%/17.7 dB
Table 4-1. Sample CPC Values for Various Modulations and DAQs **Modulation Type (channel spacing)**	**DAQ-4.0** ()*BERCIN*$_f$%/+
Analog FM ± 5kHz (25 kHz)	N/A/27 dB
Analog FM ± 4kHz (25 kHz)	N/A/29 dB
Analog FM ± 2.5kHz (12.5 kHz)	N/A/33 dB
C4FM (IMBE) (12.5 kHz)	1.0%/20.0 dB
C4FM (IMBE) (12.5 kHz)	1.0%/21.2 dB
CQPSK (IMBE) (12.5 kHz)	1.0%/20.0 dB
CQPSK (IMBE) (12.5 kHz)	1.0%/21.2 dB
CQPSK (IMBE) (6.25 kHz)	1.0%/21.2 dB

32. DAQ for digital systems and its SINAD equivalent for analog systems, are subjective evaluation methods using understandability, minimizing repetition and degradation due to noise to establish scores.

The calculated C/(ΣI+ΣN) is then compared to the CPC for each tile in the service area. CPC service area reliability is the

> probability that the required CPC will exist over the defined service area. As TSB-88-B considers the effects of Rayleigh fading in the determination of CPC, there is no additional time variability considered. Likewise, since it uses terrain data in the point-to-point calculations, the only location variability is within the tile and is generally not significant. For variability due to location, as well as general algorithm and database imperfections, TSB-88-B recommends including a 1 dB margin. The remaining principal variability is situational variability caused by clutter. It assumes that the clutter loss has a lognormal distribution whose mean is a function of frequency and land use and has a standard deviation of 5.6 dB, although other values can be used. A margin for clutter variability is included depending on the reliability required. Reliabilities of 90%, 95%, and 97% are used as examples with recommendations of 97% for public safety and 90% for other land mobile applications, but the user can define any percentage desired.

For the foregoing reasons, this Commenter supports a methodology based on Telecommunications Industry Association (TIA)/Electronics Industries Alliance (EIA) Telecommunications Systems Bulletin 88 (TSB-88)[11] for minimizing interference and increasing frequency re-use in the GMRS. This Commenter notes the 6-dB advantage in carrier-to-interference (C/I) ratio for a given delivered audio quality (DAQ) that 25-kHz analog FM signals provide over the proposed 12.5-kHz narrowband analog FM signals. This Commenter also notes the approximately 8-to-10-dB advantage in C/I ratio for a given DAQ that digital modulation schemes, such as 8.10-kHz constant-envelope four-level frequency modulation (C4FM) using improved multi-band excitation (IMBE) vocoding (e.g., Association of Public Safety Communications Officials (APCO) Project-25 common air interface (CAI) – Phase 1), provide over the proposed 12.5-kHz narrowband analog FM signals.

[11] TIA Telecommunications Systems Bulletin, Wireless Communications Systems, Performance in Noise-Limited Situations, Part1: Recommended Methods for Technology Independent Performance Modeling

To maximize the potential benefits of such an approach, this Commenter supports NCGUG's proposal[12] that the Commission permit digital voice and data emissions, including digital emissions having F1E, FXE, FXD, and F7W emission designators, on GMRS, for all station classes. This Commenter supports Joe Leikhim's comments that digital emissions be "an optional mode of operation" [emphasis in original][13] and NCGUG's comments that a sufficient transition period be provided to transition to more spectrum-efficient technologies.[14] As NCGUG noted, "With regard to a narrowband transition period, it is noted that the Commission gave Part 90 commercial and public safety licenses many years to complete the transition to narrowband (from approximately 1997 to 2013)."[15] Thus, this Commenter supports a transition period for the GMRS of no less than ten years (e.g., until at least January 1, 2021).

Also, as the technological hurdles to providing such high-performance digital radio technology have already been cleared in the Private Land Mobile Radio Services and interoperable digital radio equipment has been certified for use under Part 90[16] of the Commission's Rules[17] and is currently commercially available from numerous manufacturers, this Commenter supports the comments of Joe Leikhim[18] and NCGUG[19] in opposition to restrictions of combination radios certified under multiple Parts of the Commission's Rules[20] (e.g., both Part 90[21] and Part 95[22]). As NCGUG notes, "Part 90

[12] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020910960 at page 10
[13] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020510441 at page 8
[14] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020910960 at page 11
[15] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020910960 at page 11
[16] 47 C.F.R. Part 90
[17] 47 C.F.R.
[18] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020510441 at page 9
[19] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020910960 at pages 12 and 13
[20] 47 C.F.R.

equipment...meets or exceeds the emission mask and frequency tolerance of Part 95 certification requirements."[23] Thus, this Commenter respectfully requests continued certification of equipment under multiple Parts of the Commission's Rules[24].

CONCLUSION

WHEREFORE, for the foregoing reasons, this Commenter respectfully requests the Commission to act in accordance with this Commenter's recommendations above.

Respectfully submitted,

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Dated: September 21, 2010

[21] 47 C.F.R. Part 90
[22] 47 C.F.R. Part 95
[23] http://fjallfoss.fcc.gov/ecfs/document/view?id=7020910960 at page 13
[24] 47 C.F.R.

CERTIFICATE OF SERVICE

I, Ross Snyder, certify that a copy of the foregoing COMMENTS IN REPLY TO COMMENTS OF JOE LEIKHIM AND COMMENTS OF THE NORTHERN CALIFORNIA GMRS USERS GROUP (NCGUG) CONCERNING PROPOSED NARROWBANDING OF THE GENERAL MOBILE RADIO SERVICE (GMRS) in WT Docket No. 10-119, FCC 10-106, was served on this 21st day of September 2010 by first-class, United States mail, postage prepaid, or via electronic mail, to the following persons:

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