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July 11, 2000

Federal Communications Commission
Washington, DC 20554

Reference: FCC Docket 00-47

Our firm is aware that the window of comments has pasted. It is our oversight.

We are submitting to the commission comments from one of our professional engineers for whatever value it may be.

This is a public interest firm submitting comments without consolation, support, or representation from any of the firm's client base.

Respectfully,

Frederick G. Griffin, P.C.

Frederick G. Griffin, P.C.
President

cc: AFCCE Engineering Rules
& Standards Committee

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Thoughts on Software Defined Radios

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by Cleve Watkins, P.E.

Background

The FCC currently has Docket 00-47 out soliciting comments on the subject of Software Defined Radios. The following are my thoughts on the subject. I would be interested in feedback from others.

Multiple Band Operations

The physics of antennas makes multiple band antennas a compromise which may limit practical use of multiple band transceiver operation. Multiple single-band antennas may be combined through filter boxes to accommodate two or more radio bands but the result adds complexity, cost and some compromise to performance.

Transmitters lend themselves to broadband design with software-controlled modulation and filtering quite well. A software-controlled transmitter even to multiple frequency bands is very realizable.

High performance radio receivers require linear performance over a great dynamic range and historically require L/C filters to achieve this good performance. I believe it will be difficult to achieve excellent RF perfomance with a multi-band, all software-controlled receiver.

How to Allocate Spectrum for a SDR:

I would suggest licensing spectrum in blocks according to the amount of traffic justified. A small user might get a 12.5 kHz bandwidth, like today. By contrast, a large city multi-function system with many users might get several hundred kHz of bandwidth. The system operators could make their own decision on what modulation system is best for them. The rules would simply define a power density mask to limit radiation outside the licensed frequency block.

I support the continuing of dedicated blocks of spectrum for Public Safety and for Industrial/Business. This seems like the best way to avoid I/B users from interrupting with the Public Safety priority need.

why is there need for a specific BAnd for SDR? should be an "overlay" band on existing bands and systems

Modulation choice:

For a single system operator with a lot of radio traffic the most efficient method of using the RF spectrum today is probably by CDMA modulation. This is particularly true if the desire is to reduce hardware while using more software. With CDMA hardware is minimized (1 frequency, 1 system infrastructure) and software has the burden of enabling much radio traffic on this single, shared RF channel. The key limitation is that CDMA requires precise power control of mobile transmitters to make all this work well. An impressive data network is required between all base stations and a central switch. With multiple system operators trying to share a block of spectrum such a frequency sharing, without coordination appears impossible.

I recommend leaving the choice of modulation to the user. A recommended restriction is that any software manufacturer must be required to license use of his modulation definition and software to create it to other parties at a fair market value. This would ensure that multiple suppliers of hardware / software combinations would be likely. This should help user choices and keep costs reasonable. This step does not prevent a supplier of a computer-controlled trunking system from locking a customer into his format for life. This would keep such a supplier from blocking others from emulating compatibility at the modulation level (not the system level). I recommend leaving the system level compatibility up to free marketing license agreements. This will not solve however, the inability to talk directly between units or systems from different suppliers if they choose not to license their proprietary system features.

Interoperability:

With all modulation techniques available through cross licensing to all manufacturers of radio hardware and software, it should be possible for all suppliers to achieve excellent capability for new SDRs to talk with anyone else (except as limited by encryption, trunking or other proprietary system features). It should be easy to mix narrowband FM channel capability with a CDMA like complex system talk group capability in the same radio. Individual licensing of all users in mutual aid situations should be continued, as is the case today.

Registrating, Labeling and changes:

I believe the hardware / software combination is what must be registered and guaranteed to perform. I see the requirements no longer tied to specific modulation schemes such as AM or FM. Instead the licensed bandwidth would have a modulation mask and power density defined. A software supplier would be the entity seeking the license. A separate FCC type number would be required for every combination of hardware and software to produce a given modulation. The burden of verifying that the combination meets the requirements would be on the software supplier. A verification of compliance with test documentation would be sufficient for the FCC to issue type acceptance. Obviously, a penalty system would be required to keep the software manufacturers honest.

A display system such as suggested in Docket 00-47 is a good idea. Based on a "maintenance level" command to the radio it would be required to display the appropriate FCC type number for the combination in effect. If multiple modulation schemes were present in a radio for mutual aid, etc., then multiple FCC type numbers would apply and each would be displayed.

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Software loading should be allowed by any means. The software load would include the new FCC type number which would then be available for display after the new load is in place.

Revisions to Hardware and Software:

I anticipate two levels of "Permissive Changes" be allowed for both hardware and software similar to the current system. No new FCC type number would be required under situations where conditions of these changes apply. More significant changes to the hardware / software combination would require a new FCC type number as is the case today.