

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

Unlicensed Operation in the TV Broadcast
Bands

ET Docket No. 04-186

Additional Spectrum for Unlicensed
Devices Below 900 MHz and in the 3 GHz
Band

ET Docket No. 02-380

REPLY COMMENTS OF MOTOROLA, INC.

Motorola, Inc. (“Motorola”) respectfully replies to comments submitted in response to the issues raised in the Commission’s Further Notice of Proposed Rule Making in the above captioned proceeding addressing the use of low-powered unlicensed devices to operate on vacant channels in the spectrum allocated for television broadcast service.¹

In the First R&O, the Commission adopted the general policy to allow the operation of fixed low power devices on most TV channels beginning on February 18, 2009, in areas where those frequencies are not being used for TV or other incumbent licensed services.² Exempted from this general decision were TV channel 37, which is used by radio astronomy and wireless medical telemetry devices, and the reallocated TV channels 52-69. The First R&O also

¹ See FCC 06-156, rel. October 18, 2006, (“Further Notice” or “First R&O”).

² First R&O at ¶ 2.

prohibited the use of unlicensed personal/portable devices on TV channels 14-20 due to the difficulties of coordinating unlicensed use with mobile services.³

The companion Further Notice sought additional technical analyses to determine the answers to the following fundamental questions: 1) can personal/portable devices operate in the TV broadcast band without causing harmful interference, 2) should fixed unlicensed devices be permitted to operate on TV Channels 14-20 in the 13 cities where these channels are used by public safety and other mobile services, and 3) should low power devices authorized to operate in the TV band be permitted only on a licensed, rather than an unlicensed, basis or should there be a hybrid licensing scheme. The Further Notice also requested further comment on the spectrum access methods that low power devices may use to determine whether a portion of the TV band is unused at a specific time and location.

In its comments to the Further Notice, Motorola affirmed its belief that TV white space spectrum will be valuable for a variety of both commercial and non-commercial uses and urged the Commission to allow both fixed and personal/portable devices to operate therein.⁴ Motorola noted, however, that the ability of unlicensed devices to use this spectrum while fully protecting services with higher regulatory priority will advance and improve over time. In Motorola's

³ *Id.* at ¶ 21.

⁴ Comments of Motorola, Inc. ET Docket No. 04-186, January 31, 2007 at 1, 5 ("Motorola Comments").

view, the nascent stage of product development requires that the Commission proceed with some caution so that future opportunities are not diminished by haphazard early deployments.

To that end, Motorola stated that while cognitive radios will inherently have sensing capabilities for determining which candidate channels provide the best communications opportunities, it is not clear at this time whether those capabilities can be used for independent identification and protection of licensed incumbents.⁵ Therefore, Motorola stated that geo-location and control channel techniques would also be needed for portable deployment.

Furthermore, Motorola stated that while it appreciated the Commission's decision to prohibit portable operations on TV channels 14-20, it may be possible to allow for some use of that spectrum while ensuring that critical public safety voice systems are protected. Motorola suggested that the Commission allow public safety and other critical users to deploy low powered devices – fixed and portable – on these channels on an “authorized by rule” basis.⁶ Also, in further recognition of public safety needs, Motorola recommended that public safety and other critical users be provided unconditional priority access to two VHF and two UHF channels in channels 7-13 and 21-25 respectively.⁷ In addition, during emergency situations, public safety

⁵ *Id.* at 17.

⁶ *Id.* at 10, 11.

⁷ *Id.* at 13.

and other critical users should have the ability to preempt users on other channels with this range if necessary to meet critical communications requirements.⁸

This proceeding has generated a great deal of interest from a broad range of commenters that demonstrate widely varying degrees of comfort with the protections to be afforded to incumbent operations. Motorola believes that the Commission is proceeding along the correct path where testing and validation are used to support the deployment of new technologies and services. Motorola therefore urges the Commission to adopt rules that allow for fixed and personal/portable devices in the TV white space consistent with the below discussion.

I. MOTOROLA SUPPORTS THE COMMISSION'S APPROACH FOR INTRODUCING TV BAND DEVICES.

Motorola supports the Commission's plans for introduction of TV band unlicensed devices especially as it allows full evaluation of both fixed devices and personal portable devices. For the most part, industry recognizes that further work is needed to support the introduction of personal portable devices but that the Commission should not now foreclose future options.⁹

Motorola supports the Commission evaluating the effectiveness of the various spectrum access techniques including spectrum sensing. While Motorola recognizes the benefits of being able to deploy devices that rely solely on spectrum sensing to identify acceptable channels for

⁸ *Id.* at 14.

⁹ Comments of IEEE 802.18 at 3. Comments of the Wi-Fi Alliance at 2. Unless otherwise noted, all referenced comments were filed in ET Docket No. 04-186 on January 31, 2007.

operation and supports continued testing and develop of this technique, it would be inappropriate to rely solely on spectrum sensing in the TV White space at this point. There are still technical issues with relying only on spectrum sensing, particularly in outside applications, that only real world environments will identify. Indeed, nothing in the comments allayed Motorola's concerns that relying on sensing as a stand alone technique would not provide adequate protection to users and devices that warrant protection. This includes not only the ability of devices to accurately sense in the TV environment where the location of receivers relative to the desired transmitter is unknown, but also the need to ensure adaptability to not only detect current, but future waveforms. Inflexible implementations may detect today's waveforms but once devices are deployed, there will be no way to modify sensing requirements. Accordingly, the Commission would have to require some software defined capability to provide future adaptability.

Notwithstanding these concerns, Motorola believes that personal portable devices should be allowed with the same due diligence afforded to proposed designs for fixed deployment. Motorola is convinced that the same general mechanisms that allow for fixed deployment can ultimately work for personal portable equipment.

For example, Motorola supports the development of an "anchor" personal/portable/fixed device that would use geo-location and database techniques to determine its location and transmit a beacon signal to identify the channels available for use in the nearby region. Any associated personal portable device would be connected at limited distance due to limited radiated power levels and would also either operate under authority of the device that has

knowledge of the clear channels or its own knowledge of channels that would not interfere with broadcast TV operations. Geo-location and access to a database offers the best chance to be flexible in the future. With geo-location the exclusion radius around restricted channels can be increased or lessened with no impact on deployed devices.

With cognitive radios that access FCC databases based on geo-location, flexible rules can be extended or contracted simply by modifying the database. For instance, if all co-channel operation was considered technically ill advised, the database could mark as used all co-channels at a given location. If later technology or testing demonstrated co-channel was technically feasible, then the database could mark these channels as available and the devices would not have to change. The Commission should consider rules that allow some flexibility in the operating parameters that allow for higher power operations; for example higher power operations would have to respect larger exclusion zones around TV operations in order to avoid interference.

Motorola supports limiting the power levels for personal portable devices to 400 milliwatts EIRP. This will provide for enhanced penetration through foliage and buildings and serve to increase coverage of portable devices in rural areas. Comments filed by Dell, Google, HP, Intel, Microsoft, and Phillips would limit such power to 100 milliwatts for protection of wireless microphones.¹⁰ In contrast, Shure would limit power to 10 milliwatts.¹¹ In Motorola's

¹⁰ Comments of Dell Inc., Google, Inc., The Hewlett-Packard Company, Intel Corp., Microsoft Corp., and Philips Electronics North America Corp at 13.

view, neither of these proposals provides enough power to support any meaningful deployment of broadband devices. Motorola believes that a better method to protect wireless microphones and other transient devices that have higher regulatory status is the disabling beacon developed by IEEE 802.22.1.¹² Deployed by the users of wireless microphones or other authorized users, the beacon would alert personal portable unlicensed devices to the existence of protected, low powered devices.

II. IN GENERAL, UNLICENSED USE OF THE TV WHITE SPACE SPECTRUM IS APPROPRIATE.

Motorola has consistently argued that the Commission must not adopt a one-size-fits-all approach to making spectrum available. All regulatory approaches – licensed, unlicensed, authorized by rule, auctions, non-exclusive licenses – are valid depending on the type of service being promoted and the spectrum environment to be exploited.

In Motorola's view, the TV white space is uniquely situated for unlicensed use given that the primary spectrum user – broadcast television service – operates under a licensing scheme that severely limits the number of high-powered facilities that can be deployed in a given area thus creating significantly sized geographic "holes" where no spectrum is used or planned to be used. While not an excessively dynamic spectrum environment, primary incumbent use is not static and, as argued by Dell and other technology companies, unlicensed devices are better able to

(Continued)

¹¹ Comments of Shure Incorporated at 19.

¹² Motorola Comments at 19.

adapt to shifting spectrum environment that is envisioned for not only the traditional TV broadcast operations but also for wireless microphone uses and allows for continued evolution of licensed broadcasting uses of the spectrum.¹³

Some broadcast interests argue that the Commission must license any additional use of the TV white space in order to expedite the resolution of interference should it occur.¹⁴ Under these proposals, licenses would not be exclusive and could be made available only after broadcasters complete the possible expansion of their footprints via distributed transmission systems as proposed in Docket 05-312. One commenter, Advanced Broadband, argues that licenses should be issued on white space on channels 7-13 through auction for mobile video solutions.

Motorola disagrees with these comments and believes that, outside of TV channels 14-20, unlicensed use is the preferred access method for TV white space. We believe that the Commission, through its rules, has both the mandate and tools to ensure that devices operating in the TV bands do comply with the Commission's rules and that the fears of interference brought up by the broadcast community are not warranted. Use of channels 7-13 for a licensed broadcast mobile technology, while a somewhat attractive proposal, seems unrealizable as it would require

¹³ Comments of Dell, *et al* at 21.

¹⁴ *See, e.g.*, Joint Comments of the Association for Maximum Service Television, Inc. and the National Association of Broadcasters at 26.

clearing of the band from TV operations in the major markets to make this a viable service nationwide. Such a proposal is therefore well beyond the scope of this proceeding.

Motorola opposes other proposals to issue exclusive use licenses via auctions for commercial services.¹⁵ Exclusive licensing would dramatically change the ability of TV broadcasters, wireless microphone users (recording events/television events/broadcast/news events) and health care facilities to meet their current communications requirements. This would also stop all future deployment of TV translators and LPTV stations that currently meet important needs to small communities. Exclusive licensing of the TV white space would also affect the future deployment of TV broadcast translator stations and low power television stations as these licensees would probably be unable to outbid wide area service providers.

Some opposing comments to unlicensed operation have made the point that there is no demonstrated need.¹⁶ The overarching fact is that there is almost no unlicensed spectrum suitable for data applications below 2.4 GHz. In fact, other than 26 MHz of spectrum in the 900 MHz band there is no unlicensed spectrum below 2.4 GHz suitable for broadband use. The spectrum available in the TV White Space has desirable propagation characteristics compared to 2.4 GHz and offers new opportunities for users and services, particularly in providing connectivity in rural applications where coverage over greater distances are required and in penetrating obstructions such as foliage or in-building applications. The TV White Space offers

¹⁵ See e.g., Comments of Charles L. Jackson and Dorothy Robyn.

¹⁶ *Id.*

the only chance for unlicensed data applications to take advantage of the inherent differences in spectrum. At 600 MHz a 100mW device will penetrate 3 or more typical walls. A 4W transmitter will provide coverage up to 10 miles. While the “Swiss cheese” effect created by incumbent broadcast facilities places considerable constraints on use of the spectrum, this is the only band where unlicensed data applications needing these types of performance can be supported.

III. PROTECTION OF LAND MOBILE OPERATIONS IS WARRANTED.

There was broad support for the Commission’s decision to protect land mobile operations on TV channels 14-20.¹⁷ More importantly, there were no comments suggesting that unfettered unlicensed use of the band was warranted. There were some comments supporting fixed use of the band in areas where land mobile use is now permitted, recognizing that that exclusion zones around the protected markets would be needed.¹⁸ These proposals were in contrast to those submitted by the Land Mobile Communications Council, which urged the Commission to initiate further proceedings to consider new licensed uses of this spectrum by all Part 90 eligibles for emerging technology.¹⁹

Motorola supports the LMCC’s recommendation for further proceedings to potentially expand the use of the 470-512 MHz band on a licensed basis for land mobile uses. In this

¹⁷ Comments of the Land Mobile Communications Council at 2. Comments of the County of Los Angeles, California In Response to Further Notice of Proposed Rulemaking at 1.

¹⁸ Comments of IEEE 802.18 at 22. Comments of the Consumer Electronics Association at 6.

¹⁹ Comments of the Land Mobile Communications Council at 9, 10.

regard, Motorola believes that its proposal to make available this spectrum for low-power uses by public safety and other critical users on an “authorized by rule” basis will provide experience for that user community on both fixed and mobile use cases while addressing concerns with potential for interference. Motorola thus believes that its proposal is complementary to the LMCC request and urges for its speedy adoption.

IV. CONCLUSION.

Use of the TV white space spectrum for low powered devices will provide the opportunity to serve a variety of commercial and public safety related communications requirements. However, the Commission should proceed in a cautious manner at this point in time given the nascent state of spectrum sensing techniques and other spectrum access methods that must be refined to ensure interference protection to incumbent and protected facilities. As products are improved and new cognitive techniques are developed, the Commission can possibly expand its policies to make even more effective use of spectrum allocated to the TV broadcast services.

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