



PUBLIC NOTICE

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WIRELESS TELECOMMUNICATIONS BUREAU SEEKS COMMENT ON AN APPROPRIATE METHOD FOR DETERMINING THE PROTECTED CONTOURS FOR GRANDFATHERED 3650-3700 MHZ BAND LICENSEES

GN Docket No. 12-354

Comment Date: 30 days after Publication in the Federal Register
Reply Comment Date: 15 days after Comment Due Date

On April 17, 2015, the Commission adopted a *Report and Order and Second Further Notice of Proposed Rulemaking (3.5 GHz Order)* that established a new Citizens Broadband Radio Service in the 3550-3700 MHz band (3.5 GHz Band).¹ As noted in the *3.5 GHz Order*, there are currently other non-federal services licensed in this band, including wireless broadband services in the 3650-3700 MHz band.² In the *3.5 GHz Order*, the Commission adopted rules to protect existing licensees in the 3650-3700 MHz band from harmful interference from Citizens Broadband Radio Service users for a fixed transition period. During the transition period existing licensees will receive protection for operations that are within their “Grandfathered Wireless Protection Zone,” provided that: (1) the stations were registered in the Commission’s Universal Licensing System (ULS) on or before April 17, 2015; and (2) as of a year later (April 17, 2016) the stations are constructed, in service, and fully compliant with the relevant operating rules.

The *3.5 GHz Order* also instructed the Wireless Telecommunications Bureau (WTB) to release a public notice seeking comment on the appropriate methodology for determining the Grandfathered Wireless Protection Zone.³ In accordance with the Commission’s instructions, in this *Public Notice* we seek comment on a two-pronged approach to defining Grandfathered Wireless Protection Zones. We also seek comment on several other issues related to the establishment of the Grandfathered Wireless Protection Zone, including: (1) procedures for determining compliance with the Commission’s construction and operation requirements for the band; and (2) an implementation strategy to ensure that an accurate definition of the Grandfathered Wireless Protection Zone is available to the authorized Spectrum Access Systems (SASs).

¹ See Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, *Report and Order and Second Further Notice of Proposed Rulemaking*, 30 FCC Rcd 3959 (2015) (*3.5 GHz Order*).

² See *id.*

³ See *id.*, 30 FCC Rcd 3959 at 4077, ¶ 404; 47 C.F.R. § 96.3.

Methodology for Determining the Grandfathered Wireless Protection Zone: Consistent with the Commission’s instructions, we seek comment on a two-pronged approach to defining the Grandfathered Wireless Protection Zone around “grandfathered” base stations. Under this two-part approach, the Grandfathered Wireless Protection Zone around each base station would be defined by: (1) sectors with a 4.4 km radius from each registered base station, and the azimuth and beamwidth registered for that base station with associated unregistered customer premises equipment (CPE) to encompass the operational area of unregistered subscriber stations; and (2) sectors (centered on each base station with the registered azimuth and beamwidth) which would encompass all registered subscriber stations within that sector.

Existing networks in the 3650-3700 MHz band in the majority of cases are constructed to provide last mile wireless broadband access. Generally, a base station is constructed in the center of the area intended to be served and then as subscribers are enrolled, CPE is put in place at various points around the base station. CPE that operates below the mobile power limit of 1 watt/25 MHz EIRP⁴ does not have to be registered in ULS while all equipment that operates above that limit must be registered.

The first prong of the approach will provide protection for unregistered subscribers that operate below the mobile power limit, which are within the range of a registered base station. Since unregistered CPE operates at low power it is only able to effectively communicate with base stations within a limited range. Considering the relative low power of unregistered CPE compared to the power of a base station, the upstream or “talk-back” path determines the maximum range of a system. Using average values for unregistered CPE transmit power and base station receiver sensitivity specifications from existing type certified equipment, and assuming free space loss along a line of sight path, we calculate that a typical unregistered CPE will have a maximum range of approximately 4.4 km for “talk-back” to a base station.⁵ We recognize that the use of free space path loss is conservative, as propagation over the earth generally causes the signal to fall off as a function of distance more rapidly than predicted by the free space model, and that clutter near either antenna or in the path between them can further reduce the signal strength. However, in this case where the protection zones will exist for only a limited a time, and the unregistered CPE locations are not known, we find it acceptable to use this conservative approach. Therefore, we propose to define protected sectors around each grandfathered base station to protect unregistered CPE from harmful interference based on a 4.4 km radius and the base station antenna parameters (*e.g.* azimuth and beamwidth) registered in ULS.⁶ Considering the multitude of factors that could affect the actual service contour, we believe that these assumptions and methodology provide an appropriate balance between best and worst case scenarios and between simplicity and complexity in order to define a protection zone that is generally appropriate, but not overly protective in most situations. These protection zones will only be implemented for registered base stations with associated unregistered CPE. As such, licensees must affirm which base stations, if any, within their networks utilize unregistered CPE to avail themselves of this protection.

The second prong of the approach will provide protection to each base station’s registered CPE. Protected sectors around each base station will be defined based on the distance from the base station to the furthest CPE unit registered in ULS and the base station antenna parameters (*e.g.*, azimuth and beamwidth) registered in ULS.⁷ All stations that operate above the mobile power limit are required to be

⁴ See 47 C.F.R. §§ 90.1307(a); 90.1321(c).

⁵ Appendix B shows the methodology used in determining this radius. The 4.4 km distance is based on the minimum usable signal level of the “talk-back” from unregistered CPE to the base station.

⁶ Citizens Broadband Radio Service Devices (CBSDs) will have to comply with a maximum power flux density (PFD) level at the edge of the Grandfathered Wireless Protection Zone. CBSDs will gain close proximity to the Grandfathered Wireless Protection Zone by reducing their power and/or using a directional antenna to control the interference level.

⁷ Using typical values for base station and CPE transmit power and receiver sensitivity specifications from existing type certified equipment, and assuming free space loss along a line of sight path, we calculate that a typical

registered in ULS⁸ and, therefore sector-based protection zones will only be used in areas where licensees have registered CPE units. A diagram in Appendix C shows a graphic representation of this methodology. We seek comment on this two-pronged approach.

In addition, to protect incumbent operations, new stations in the Citizens Broadband Radio Service must limit the field strength of their operations at the boundary of the Grandfathered Wireless Protection Zone. We propose that the field strength limit of any Citizens Broadband Radio Service station should be 44 dBuV/m/MHz at the boundary of the Grandfathered Wireless Protection Zone.⁹ This level is derived to ensure that potentially interfering signals do not raise the noise floor at the incumbents' CPE locations and will provide a conservative margin below the receive sensitivity of the CPE to ensure protection from harmful interference. We believe this methodology will adequately protect existing registered, constructed, and operational incumbent operations.

We believe the protection model described above is consistent with the Commission's instructions in the *3.5 GHz Order*. We further believe that this approach will protect existing investment in the 3650-3700 MHz band while providing opportunities for new Citizens Broadband Radio Service users to invest in the 3.5 GHz Band. We seek comment on the two-pronged approach described above, as well as the values and methodology used to calculate the size of the protection zones and whether other methodologies might be more appropriate. We also seek comment on whether different network topologies and use cases (*e.g.*, WISP networks and utilities) could require different types of protection and whether these factors should be considered in calculating protection criteria. Commenters must support their responses – particularly alternate protection methodologies – with detailed technical and cost benefit analyses.

Implementation of the Process to Determine the Grandfathered Wireless Protection Zone: To implement this process there is a great deal of data that must be collected and managed. ULS has collected much of the relevant data on location, operating parameters, equipment used etc., in the registration process, but this database is missing a few key data points. Specifically, ULS does not collect information that would distinguish between base station and CPE use; ULS only records whether the station will operate in the upper 25 MHz or lower 25 MHz of the 3650-3700 MHz band, not the specific center frequency; and ULS does not have an indicator to determine whether a base station has associated unregistered CPE. These three elements, along with the distance from the base station to the furthest registered CPE in each sectors are necessary to define the Grandfathered Wireless Protection Zone. In addition, the *3.5 GHz Order* limited the Grandfathered Wireless Protection Zones to only those base and fixed stations that are registered by applications filed in ULS by existing licensees on or before April 17, 2015, and that are constructed, in service, and in full compliance with the rules by April 17, 2016.¹⁰ Therefore, we propose to implement a mechanism whereby licensees will certify which of their base stations are constructed, in service, and in full compliance with the rules by April 17, 2016. At the same time that licensees certify to the above they must identify the specific operating frequency for each sector, whether or not that base station has unregistered CPE, and the distance to the furthest registered CPE for that sector. Then the existing registration data in ULS, along with the supplementary information provided by licensees would determine the Grandfathered Wireless Protection Zone. The Grandfathered Wireless Protection Zones would be communicated to the SAS. We seek comment on this proposal for implementing the Grandfathered Wireless Protection Zone methodology. We also seek comment on

registered CPE would have a maximum range of approximately 18 km from a base station. We therefore caution licensees that any CPE distances in excess of this will be evaluated for legitimacy.

⁸ See 47 C.F.R. § 90.1321(c).

⁹ See Appendix C.

¹⁰ See *3.5 GHz Order*, 30 FCC Rcd 3959 at 4077, ¶403.

alternative approaches. Parties proposing alternative approaches should describe their proposals in detail.

Interested parties may file comments on or before **30 days after publication in the Federal Register** and may file reply comments on or before **15 days after the comment due date**. When filing comments, please reference **GN Docket No. 12-354**.

Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies.¹¹ Comments filed through the ECFS can be sent as an electronic file via the Internet to <http://www.fcc.gov/cgb/ecfs/>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of the proceeding, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, U.S. Postal Service mailing address, and the applicable docket or rulemaking numbers. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form." A sample form and directions will be sent in reply. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number.

Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail (although we continue to experience delays in receiving U.S. Postal Service mail). Parties are strongly encouraged to file comments electronically using the Commission's ECFS. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission, 445 12th Street, S.W., Washington, DC 20554.

All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12th St., S.W., Room TW-A325, Washington, DC 20554. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes must be disposed of before entering the building. The filing hours at this location are 8:00 a.m. to 7:00 p.m. Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743. U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

Parties shall also serve one copy with the Commission's copy contractor, Best Copy and Printing, Inc. (BCPI), Portals II, 445 12th Street, S.W., Room CY-B402, Washington, DC 20554, (202) 488-5300, or via e-mail to fcc@bcpiweb.com.

Documents in WT Docket No. 12-354 will be available for public inspection and copying during business hours at the FCC Reference Information Center, Portals II, 445 12th St. S.W., Room CYA257, Washington, DC 20554. The documents may also be purchased from BCPI, (202) 488-5300, (202) 488-5563 (fax), (202) 488-5562 (tty), e-mail fcc@bcpiweb.com.

To request materials in accessible formats for people with disabilities (Braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at (202) 418-0530 (voice), (202) 418-0432 (tty).

This matter shall be treated as a "permit-but-disclose" proceeding in accordance with the *ex parte* rules.¹² Persons making *ex parte* presentations must file a copy of any written presentation or a

¹¹ See Electronic Filing of Documents in Rulemaking Proceedings, GC Docket No. 97-113, *Report and Order*, 13 FCC Rcd 11322 (1998).

¹² 47 C.F.R. § 1.1200 *et seq.*

memorandum summarizing any oral presentation within two business days after the presentation (unless different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

For further information, contact Paul Powell, Mobility Division, Wireless Telecommunications Bureau at (202) 418-1613, or by e-mail at Paul.Powell@fcc.gov or Stephen Buenzow, Broadband Division, Wireless Telecommunications Bureau at (717) 338-2647, or by e-mail at Stephen.Buenzow@fcc.gov.

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Appendix A

Calculation of maximum range of unregistered CPE.

The calculation of the maximum range of an unregistered CPE is based on the link budget between an unregistered CPE and the base station using the receiver (RX) sensitivity threshold of the lowest order modulation scheme, and assuming free space loss.

The following assumptions are used:

For RX sensitivity we used the average sensitivity for the lowest order modulation scheme of the available unregistered CPE equipment = -95 dBm¹

For transmit power we used the average EIRP of available unregistered CPE equipment = 21.5 dBm²

Base station antenna gain (RX) = 17.2 dBi³

Maximum Allowable Path Loss = System Gain + Antenna Gain (Rx only) – Fade Margin – Line Losses (tx only)

Where System Gain = EIRP – Rx Sensitivity = 21.5 dBm – (- 95dBm) = 116.5 dBm

Maximum Allowable Path Loss = 116.5 + 17.2 – 15 – 2 = 116.7 dBm⁴

From this we can derive distance as 4.4 km based on free space loss, where $d = 10^{\frac{((MAPL-92.45)/20) - \log(f)}{2}}$ where d is in km and f is in GHz.

¹ This is the average value for minimum receiver threshold based on equipment specifications of the top five most widely deployed base station devices. See Appendix D.

² Average EIRP value for unregistered equipment from type certifications.

³ Average gain based on 28,000 ULS registration records for base stations.

⁴ 15 dB Fade Margin from Ubiquiti outdoor link design guideline at <https://help.ubnt.com/hc/en-us/articles/204952224-airMAX-Plan-an-outdoor-wireless-link>

Appendix B

Starting with a link budget calculation

Maximum Allowable Path Loss = System Gain + Antenna Gain (tx) – Fade Margin – Line Losses (tx)

Where System Gain = EIRP – Rx Sensitivity = 35.6 dBm⁵ – (-93dBm)⁶ = 128.6 dBm

Maximum Allowable Path Loss = 128.6 + (17.2) – 15 dB – 2 dB = 128.8 dB

From this we can derive distance as 18 km assuming free space loss where $d = 10^{\left[\frac{((MAPL-92.45)/20) - \log(f)}{2}\right]}$ where d is in km and f is in GHz.

⁵ Average EIRP from equipment type certifications for the top five most widely deployed base station devices referenced to 3.5 MHz or 5 MHz bandwidth.

⁶ This is the average value for receiver threshold based on equipment specifications of the top five most widely deployed CPE devices that operate above the mobile power limit in Section 90.1321(c) referenced to 3.5 MHz or 5 MHz bandwidth. See Appendix D, Table 1.

Appendix C

Starting with a thermal noise power of -114 dBm/MHz and assuming a noise figure of 5 dB⁷ at the CPE receiver and also assuming co-channel interference at the edge of the protection contour to be 0 dB or a 3 dB rise in the noise floor,⁸ we arrive at a co-channel interference limit of -109 dBm/MHz.

Using average CPE antenna gain of 15.6 dBi, adjusted by -20 dB for antenna discrimination⁹ we get a co-channel interference limit at the edge of the protection zone of -104.6 dBm/MHz, or I in the equation below:

$$I = S \cdot \frac{\lambda^2}{4\pi} = \frac{E^2}{120\pi} \cdot \frac{\lambda^2}{4\pi}$$

Where I is the co-channel interference, S is the PFD and E is the electric field strength

From this equation we can find that the PFD able to produce -104.6 dBm/MHz co-channel interference at 3.675 GHz is -71.8 dBm/m²/MHz. This translates to an electric field strength of 44 dBuV/m/MHz.

⁷ <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=4266451>

⁸ See In the Matter of Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap, *Report and Order*, GN Docket No. 14-165, ET Docket No. 12-268, 2015 WL 476221 (Aug. 11, 2015) (in which we assume a 3 dB rise in the noise floor as the appropriate interference criterion).

⁹ Based on average antenna gain from Table 1 in Appendix D of 15.6 dBi reduced by 20 dB for antenna discrimination (ETSI EN 302 085 V1.1.2 Table 2) assuming CPE is pointed toward its respective base station and 180° away from the edge of the contour.

Appendix D

Most Widely Deployed Customer Premises Equipment

FCC ID#	Number Deployed	EIRP in Watts (3.5 or 5 MHz channels)	<u>Antenna gain in dBi</u>	Rx Sensitivity in dBm
E5MDS-MERCURY 3650	7822	1.38	18*	-95
ABZ89FT7633	7723	2.97	14.5	-91
SWX-M365N	3091	3.8	13.7	-94
MXFWIXS-177	1491	2.547	16	Not available
PIDASMAX37	1067	3.28	16	Not available

Table 1

*Gain listed in user's manual from manufacturer for an external directional panel antenna

Most Widely Deployed Base Station Equipment

<u>FCC ID#</u>	<u>Number Deployed</u>	<u>EIRP in Watts (3.5 or 5 MHz channels)</u>	<u>Rx Sensitivity in dBm</u>
<u>E5MDS-MERCURY 3650</u>	7822	1.38	-95
<u>ABZ89FT7632</u>	3499	3.041	-103
<u>SWXM365</u>	4910	4.977	-94
<u>O2J-365T</u>	1920	4.07	Not available
<u>Z8H89FT0010</u>	985	4.85	-90

Table 2

Unregistered Equipment EIRP in Watts

FCC ID #	EIRP in Watts
PIDASMAX36	0.197 @ 5 MHz
PIDGWU-200	0.1778 @ 5 MHz
QC8-SUIIRM	0.133 @ 3.5 MHz
Q3K-BSA3XS	0.17 @ 5 MHz
WQE-703702	0.159 @ 5 MHz
OJB-SSIDU-365	0.14 @ 3.5 MHz
X8Q-MMX-362322	0.013 @ 4.48 MHz
X8Q-MMX-362314	0.1414 @ 4.46 MHz
V8YFWA1FUS38000W	0.135 @ 5.5 MHz

Appendix E

