

February 27, 2015

VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *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* (ET Docket No. 14-165); *Promoting Spectrum Access for Wireless Microphone Operations* (GN Docket No. 14-166); *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions* (GN Docket No. 12-268).

Dear Ms. Dortch,

On February 25, 2015, Scott Bergmann and Krista Witanowski of CTIA – The Wireless Association®, together with CTIA outside counsel and consultants, CTIA members (“collectively the Wireless Industry Representatives”) met with representatives of the Commission’s Incentive Auction Task Force, Office of Engineering and Technology, and Wireless Telecommunications Bureau, to discuss issues in the above-captioned proceedings. A full list of meeting attendees is attached. Wireless Industry Representatives discussed testing conducted by V-COMM, Inc. that examined potential interference from white space devices and wireless microphones to 600 MHz licensed mobile broadband services.

CTIA supports rules that maximize the repurposing of spectrum for licensed exclusive use in the 600 MHz band and provide for unlicensed use of the 600 MHz guard band and duplex gap, consistent with the Spectrum Act’s requirements. Specifically, the Spectrum Act emphasizes that the “Commission may not permit any use of a guard band that the Commission determines would cause harmful interference to licensed services.”¹ Therefore, in accordance with the Spectrum Act unlicensed operations in the 600 MHz guard band and duplex gap must be introduced through a regulatory framework that ensures that such operations do not raise harmful interference concerns.

To develop a framework for unlicensed white space devices and wireless microphones that would ensure protection of licensed services from interference, CTIA and its members commissioned V-COMM to test interference from these sources to mobile broadband devices. In the meeting, CTIA members/representatives and V-COMM discussed the results of V-COMM’s testing, a summary of which is attached. Meeting participants discussed the following issues:

¹ Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6407(e) (codified at 47 USC §1452), 126 Stat. 156 (2012) (“Spectrum Act”).

- CTIA explained that to protect licensed services from harmful interference the Commission will need to establish more stringent out of band emissions (“OOBE”) limits and frequency buffers between licensed and unlicensed services.
- CTIA and Commission staffers discussed V-COMM’s parameters and the technical assumptions used in conducting the interference testing. V-COMM explained that unlike the other parties that provided technical data in this proceeding, its testing relied upon actual measured values rather than 3GPP standard defined values for receiver sensitivity and blocking.
- V-COMM and CTIA also explained how wireless microphone and white space device interfering signals were simulated in the testing process.
- The wireless industry representatives at the meeting stressed that the Commission should: (1) adopt an OOBE limit of -89 dBm/100 kHz into the licensed downlink spectrum band, (2) modify its duplex gap proposal to provide a five megahertz buffer between licensed downlinks and white space devices to operate at 40 milliwatts, (3) modify its duplex gap proposal to provide a five megahertz buffer between licensed downlinks and wireless microphones to operate at 20 milliwatts, (4) modify its guard band proposal to provide a nine megahertz frequency buffer between licensed downlinks and wireless microphones, and (5) limit transmit power to 5 milliwatts for white space devices in the guard band operating five megahertz away from licensed downlinks.

The Wireless Industry Representatives at the meeting stressed that the Commission can facilitate a successful Incentive Auction through careful consideration of V-COMM’s testing and adoption of rules consistent with CTIA’s and V-COMM’s proposals.

Pursuant to Section 1.1206 of the Commission’s rules, 47 C.F.R. § 1.1206, this letter is being electronically filed via ECFS with your office. Please direct any questions to the undersigned.

Sincerely,

/s/ Krista L. Witanowski

Krista L. Witanowski
AVP, Regulatory Affairs
CTIA-The Wireless Association®

Attachments

Attachment
February 25, 2015 Meeting Participants

CTIA – The Wireless Association®, Counsel, and Consultants

Scott Bergmann, Vice President, Regulatory Affairs, CTIA
Krista Witanowski, Assistant Vice President, Regulatory Affairs, CTIA
Sean Haynberg, Director of RF Technologies, V-COMM, Inc.*
Thomas Dombrowsky, Senior Engineering Advisor, Wiley Rein LLP
Jessica Lyons, Wiley Rein LLP

CTIA Member Company Representatives

Brian Benison, AT&T
Neeti Tandon, AT&T
Richard Engelman, Sprint
Harry Perlow, Sprint*
Darryl Degruy, U.S. Cellular*
Leora Hochstein, Verizon
Max Solondz, Verizon*

Federal Communications Commission – Incentive Auction Task Force

Howard Symons, Vice Chair
AJ Glusman

Federal Communications Commission – Office of Engineering and Technology

Julius Knapp, Chief
Ira Keltz, Deputy Chief
Geraldine Matise, Associate Chief
Paul Murray, Associate Chief
Serey Thai
Hugh Van Tuyl

Federal Communications Commission – Wireless Telecommunications Bureau

John Leibovitz, Deputy Bureau Chief
Chad Breckinridge, Associate Bureau Chief
Chris Helzer, Chief Engineer
Blaise Scinto, Division Chief, Broadband Division
Stephen Buenzow, Deputy Chief, Broadband Division *
Chris Andes*
Stephanie Minnock

* - participated via teleconference.

Interference Testing in the 600 MHz Band ET Docket Nos. 14-165 and 14-166

February 25, 2015

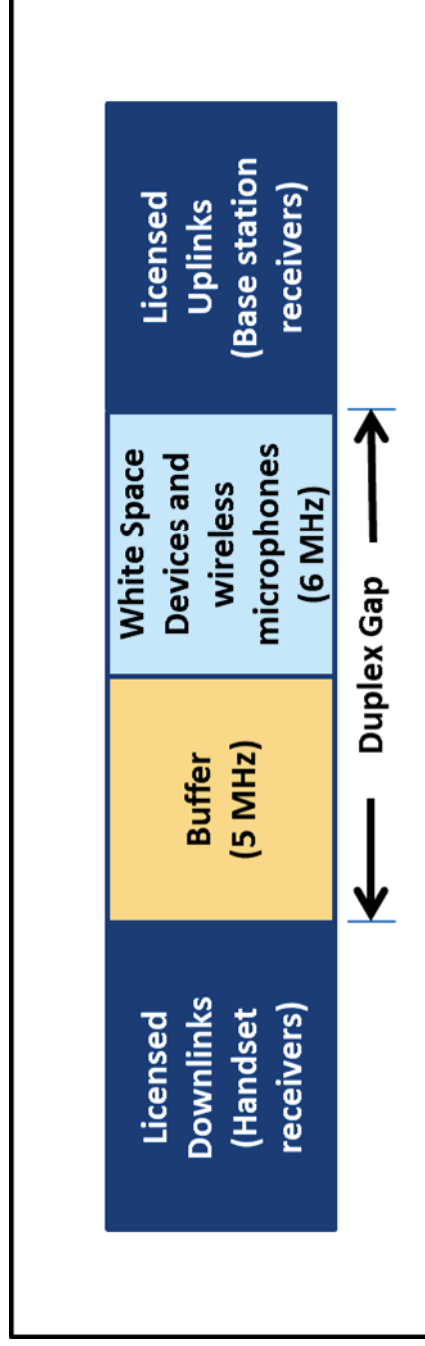
Overview

- Unlicensed white space device and wireless microphone use of the 600 MHz duplex gap and guard bands may only be permitted to the extent that they do not cause harmful interference to licensed operations.
 - Section 6407(e) of the Spectrum Act states, “The Commission may not permit any use of a guard band that the Commission determines would cause harmful interference to licensed services.”
- CTIA and its members commissioned V-COMM to test interference from these sources to mobile broadband devices.
- The objective of this testing was to develop a framework for unlicensed white space devices and wireless microphones that would ensure protection of licensed services from interference.
- Based on the results of this testing, CTIA urges the Commission to:
 - Modify its proposed rules for unlicensed and wireless microphone operations to ensure compliance with the Spectrum Act’s mandate that these operations adequately protect the substantial investments of 600 MHz licensees; and
 - Adopt out of band emission requirements and buffers in the duplex gap and guard bands consistent with the findings of CTIA’s test vendor V-COMM.

Recommendations Based Upon V-COMM Test Findings

- More Stringent OOB E Requirements Are Needed To Protect Licensed Services
 - OOB E was found to be the predominant interference effect once appropriate buffers between wireless microphone/white space device operations and licensed LTE services were utilized
 - The Commission’s proposed -56.8 dBm/100 kHz OOB E attenuation requirement must be increased to -89 dBm/100 kHz at band edge to fully protect licensed downlink services in the 600 MHz band
 - Should the FCC adopt its -56.8 dBm/100 kHz OOB E limit, LTE devices will suffer harmful interference as much as 20 meters away
- Duplex Gap Requirements Must Be Modified To Protect Licensed Services
 - The OOB E limit must be -89 dBm/100 kHz at the downlink band edge
 - White Space Devices must have a five megahertz buffer from licensed downlink spectrum to operate at 40 milliwatts (16 dBm)
 - Wireless microphones must have a five megahertz buffer from licensed downlink spectrum to operate at 20 milliwatts (13 dBm)

Duplex Gap Proposal

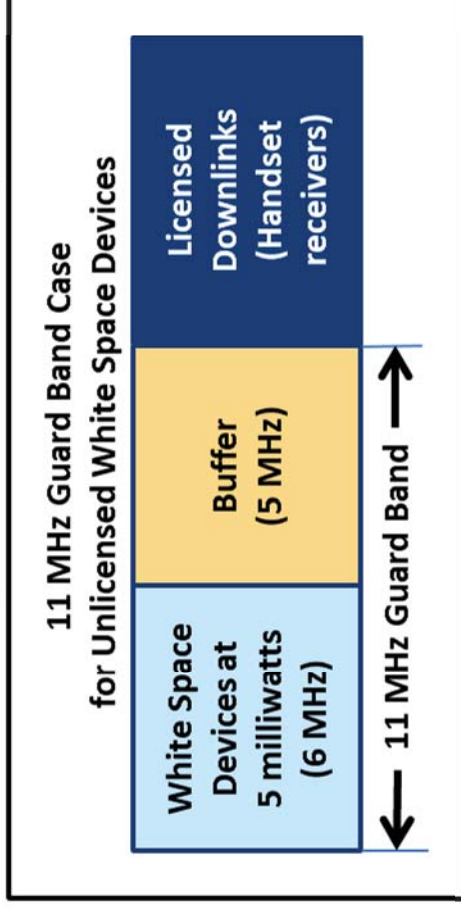


Note: Assumes White Space Devices and wireless microphones are subject to OOB limit of -89 dBm/100 kHz.

Guard Band Recommendations Based Upon V-COMM Test Findings

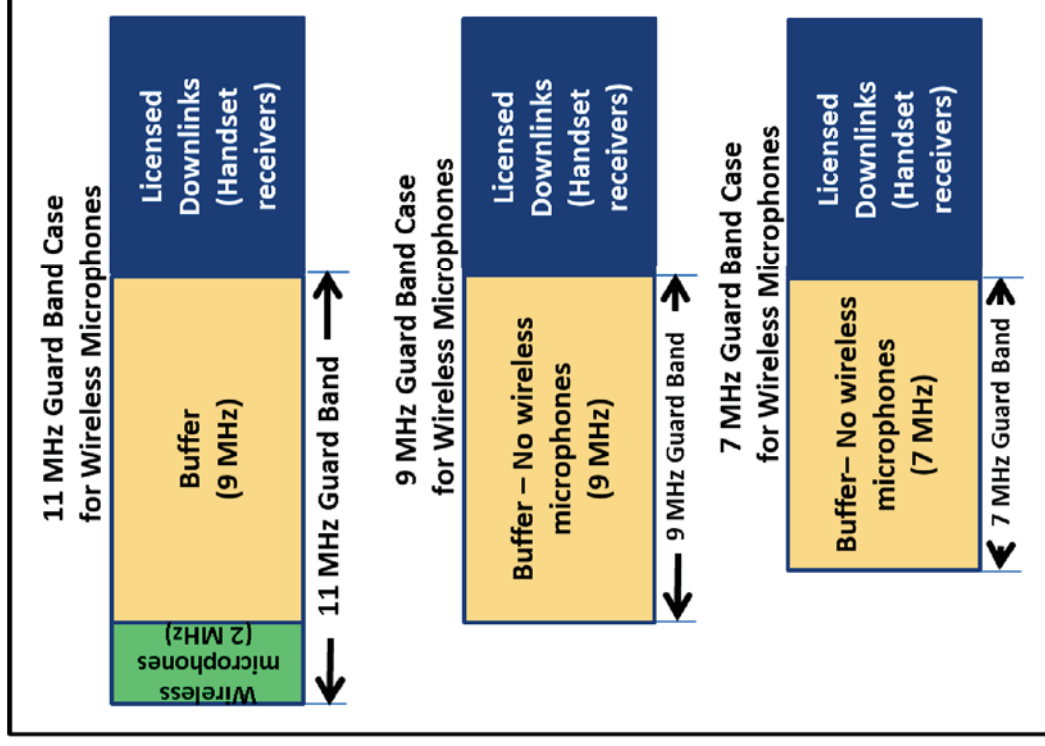
- Guard Band Requirements Must Be Modified To Protect Licensed Services
 - The OOB limit must be -89 dBm/100 kHz at the downlink band edge
 - White Space Devices must have a five megahertz buffer from licensed downlink spectrum and be limited in transmit power to 5 milliwatts (6.6 dBm)
 - Wireless microphones must have a nine megahertz buffer from licensed downlink spectrum to operate at 20 milliwatts (13 dBm)

Guard Band Proposal – White Space Devices



Note: Assumes White Space Devices are subject to OOB limit of -89 dBm/100 kHz.

Guard Band Proposal – Wireless Microphones



Note: Assumes wireless microphones are subject to OOB limit of -89 dBm/100 kHz.

V-COMM Testing

- The Commission requested in these proceedings to have real world testing data provided in the record.
- CTIA and its members commissioned V-COMM to test LTE mobile device receivers and simulated interference from unlicensed white space devices and wireless microphones.
- 10 LTE devices were tested (8 smartphones and 2 tablets)
 - These LTE devices operate in the 3GPP LTE Band 12 (699-716 MHz and 729-746 MHz)
 - Band 12 was chosen because it is the closest in operating frequency, has a similar duplex gap (13 MHz as compared to 11 MHz), and has many devices commercially available for testing

V-COMM Testing (cont.)

- Testing could not use actual white space devices or wireless microphones as none exist that comply with the FCC's proposed technical parameters
 - Wireless microphone interference was simulated by a two-tone FM modulated signal, using a frequency of 1 kHz at the rated deviation of 40 kHz, with a pilot frequency of 32.768 kHz at a 5 kHz deviation
 - TV white space device interference was simulated by using an 802.11 ac signal, using the sample rate parameter setting to achieve an occupied bandwidth of 4.875 MHz
 - OOB/E interference was simulated by additive white Gaussian noise (AWGN) signals transmitted co-channel to the LTE device under test
- Unlike other parties that provided technical data, the V-COMM testing relied upon actual measured values rather than 3GPP standard defined values for receiver sensitivity and blocking

Testing Scenarios

- All devices were tested to ensure their compliance with 3GPP receive sensitivity specifications (all devices were compliant) and to determine a benchmark to be used to measure protections to LTE devices
- Receiver blocking tests were performed with the LTE Band 12 devices to determine the rejection of the LTE devices to the interference sources (white space devices and wireless microphones)
- Intermodulation rejection of the LTE devices from white space devices and wireless microphones was measured
- OOB receiver tests were used to determine the rejection of the LTE devices to emissions from adjacent band devices

Interference Assumptions for Path Loss

- V-COMM used reasonable technical assumptions and parameters that are consistent with those used by wireless industry standard practices
- V-COMM used the following assumptions for link/path losses:
 - Device and user equipment antenna gain = 0 dBi
 - Transmitter device antenna loss = 3 dB (held in hand)
 - Receiver user equipment antenna loss = 3 dB (held in hand)
 - Antenna polarization mismatch and other losses = 3 dB
 - Path loss at 665 MHz = 29 dB (assumes 1 meter separation)
- In sum, V-COMM applied a 38 dB (3 dB + 3 dB + 3 dB + 29 dB) coupling loss to model the interference environment where a licensed LTE device would be 1 meter away from a white space device or wireless microphone

OBE Protection Requirement

- V-COMM evaluated the ten LTE devices and determined that, on average, the additive white Gaussian noise (AWGN) interference level was measured at -127 dBm/100 kHz
 - V-COMM evaluated the interference susceptibility of LTE devices reference to the tested devices' actual desensitization levels instead of at the standards set levels to better model and quantify real world effects from adjacent white space devices and wireless microphones to actual LTE devices
- Based on the 38 dB of coupling losses determined, an OBE limit of -89 dBm/100 kHz into 600 MHz downlink spectrum is required to protect licensed services
 - This is calculated by adding the 38 dB of losses to the measured -127 dBm/100 kHz interference level (-127 dBm/100 kHz + 38 dB = -89 dBm/100 kHz)
- This attenuation requirement greatly exceeds the FCC proposed -56.8 dBm/100 kHz limit – the V-COMM testing of measured performance of LTE devices indicates that the OBE requirement should be modified to protect licensed downlinks

Duplex Gap – Receiver Blocking Tests

- V-COMM conducted receiver blocking interference tests in the duplex gap based on the FCC's duplex gap proposal
- None of the ten tested devices were able to meet the threshold for interference from a wireless microphone using only a one or three megahertz frequency buffer
 - Threshold is calculated by subtracting the 38 dB of path losses from the 13 dBm proposed power level for wireless microphones (-25 dBm)
- With a five megahertz buffer, V-COMM found that the majority of LTE devices met the interference threshold
 - Assumes that the OOB limit is -89 dBm/100 kHz at the downlink band edge
 - Was determined to be true for both white space device and wireless microphones operating five megahertz away from the licensed downlink spectrum

Guard Bands – Receiver Blocking Tests

- V-COMM conducted receiver blocking interference tests in the guard bands based on the FCC's guard band proposals
- None of the ten tested devices were able to meet the threshold for interference from a wireless microphone or for white space devices using only a one, three or five megahertz frequency buffer at the FCC proposed power levels
 - Only a couple of the tested devices were able to meet the threshold with a seven megahertz buffer for wireless microphones
 - White space devices were not tested further than five megahertz away as it is believed that these devices would require six megahertz for operations (five megahertz frequency buffer plus six megahertz for WSD = 11 MHz, the largest guard band size)
 - White space devices operating five megahertz from licensed downlink spectrum would require a power limit of 5 milliwatts
- With a nine megahertz buffer for wireless microphones, V-COMM found that the majority of LTE devices met the interference threshold
 - Assumes that the OOB limit is -89 dBm/100 kHz at the downlink band edge

Conclusion

- Testing of real world LTE devices demonstrates that the technical protections proposed by the FCC are insufficient to protect licensed services
- The Spectrum Act requires the Commission to fully protect licensed services
- To comply with the requirements of the Spectrum Act, the FCC should:
 - Adopt an OOB limit of -89 dBm/100 kHz into the licensed downlink spectrum band;
 - Modify its duplex gap proposal to provide a five megahertz buffer between licensed downlink spectrum and white space devices/wireless microphones; and
 - Modify its guard band proposals to:
 - Provide a nine megahertz frequency buffer between licensed downlink spectrum and wireless microphones; and
 - Limit transmit power for white space devices operating five megahertz away from licensed downlink spectrum to 5 milliwatts