June 8, 2012

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage through the Use of Signal Boosters, WT Docket No. 10-4

Dear Ms. Dortch:

In order to assist the Commission in its efforts to "facilitate the development and deployment of well-designed signal boosters that do not harm wireless networks," Nextivity, Inc., T-Mobile, USA, Inc., V-COMM, L.L.C., Verizon Wireless, and Wilson Electronics are submitting three documents for consideration by the Commission in the above-captioned proceeding. These documents are a set of proposed rules that would apply to all consumer boosters, and two separate consumer booster protection standards.

The two consumer booster protection standards are revisions of protection standards previously submitted by Verizon Wireless and Wilson Electronics,[1] and by Nextivity and T-Mobile.[2] The first consumer booster protection standard, labeled "Consumer Booster Safe Harbor Protection Standard 1," is a revised version of the Verizon Wireless/Wilson Electronics protection standard. The second protection standard, labeled "Consumer Booster Safe Harbor Protection Standard 2," is a revised version of the Nextivity/T-Mobile protection standard. Protection Standard 2 would apply to "frequency selective" consumer boosters designed to operate in fixed, in-building locations and only on the frequency bands of a carrier or carriers that have approved of their use on their frequencies and in their market areas. Protection Standard 1 would apply to all other fixed and mobile consumer boosters.

Over the last several weeks, the signatories to this letter have worked cooperatively to make changes to these protection standards so that each of the signatories is comfortable that consumer boosters that meet these standards, if operating properly and in accordance with all of the requirements of the protection standards, will not cause harmful interference to either the serving carrier or adjacent carrier networks.

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[1] *See* Letter from Verizon Wireless and Wilson Electronics to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 10-4, filed July 25, 2011.

[2] *See* Letter from Nextivity, Inc. and T-Mobile, USA, Inc. Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 10-4, filed February 17, 2012.

The signatories therefore urge the Commission to adopt these protection standards and require that consumer boosters manufactured, marketed, sold, leased or operated in the future meet one of these protection standards.

The signatories are also submitting proposed Part 20 rules that are similar to the set of rules previously submitted by Verizon and Wilson Electronics,[3] but have been modified both to remove the specific technical requirements from the rules and in other ways in order to reach consensus among the signatories. The rules are being submitted for consideration should the Commission decide to implement consumer booster protection standards by promulgating enforceable safe harbors that will operate outside of Part 20.

While the signatories have been able to agree on virtually every issue, there is one potential rule requirement issue where the signatories have been unable to reach consensus. In particular, the signatories have not been able to agree as to whether the draft Part 20 rules should also include a provision stating that carrier consent is also required prior to a customer being authorized to operate a consumer booster.[4] Accordingly, each signatory will make their views about carrier consent known to the Commission separately.

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[3] *See* Letter from Verizon Wireless and Wilson Electronics to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 10-4, filed March 14, 2012.

[4] The draft rules being submitted do not contain the carrier consent language. Since Protection Standard 2 requires carrier consent as part of the protection standard, carrier consent would only be an issue for consumers operating boosters designed to meet Protection Standard 1.

Nextivity, T-Mobile, V-COMM, Verizon Wireless, and Wilson look forward to continuing to work with the Commission towards adopting consumer booster rules and protection standards.

Sincerely,

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PROPOSED CONSUMER BOOSTER PART 20 RULES

PART 20—COMMERCIAL MOBILE RADIO SERVICES

1. The authority citation for Part 20 is amended to read as follows:

AUTHORITY: 47 U.S.C. 154, 160, 201, 251-254, 301-303, and 332 unless otherwise noted.

2. Section 20.3 is revised by adding definitions to read as follows:

§ 20.3 Definitions.

Signal booster. A device that automatically receives, amplifies, and retransmits on a bi-directional basis, the signals received from base, fixed, mobile, or portable stations, with no change in frequency or authorized bandwidth.

Consumer booster. A signal booster that meets the requirements of §20.16.

Fixed consumer booster. A consumer booster designed to operate in a fixed location in a building.

Mobile consumer booster. A consumer booster designed to operate in a moving vehicle.

3. Add new § 20.16 to read as follows:

§ 20.16 Operation of consumer boosters.

Consumer boosters operated by subscribers in good standing of a commercial mobile radio service system are considered to be operating under the authorization of that commercial mobile radio service system. Consumer boosters operated by subscribers in good standing of a commercial mobile radio service system, while receiving service from a different commercial mobile service system, are considered to be operating under the authorization of such different system. Subject to the requirements set forth below and in FCC-approved consumer booster protection safe harbors, consumer boosters that have received FCC certification pursuant to § 2.907 and in accordance with § 20.16(b) may be operated by a subscriber in good standing of a commercial radio service on the frequency bands listed in § 20.16(a). The requirements of this section apply to all consumer boosters.

(a) *Frequency bands.* Consumer boosters may be operated on frequencies used for the provision of subscriber-based services under Parts 22 (Cellular), 24 (Broadband PCS), and 27 (AWS-1, 700MHz Lower A-E Blocks, and 700MHz Upper C Block) of this chapter.

(b) *Certification requirements.* A consumer booster can only receive FCC certification and be operated if it complies with all applicable rules in this Section and all applicable technical rules for the frequency band(s) of operation including, but not limited to: §22.355, Public Mobile Services, frequency tolerance; §22.913, Cellular Radiotelephone Service effective radiated power limits; §22.917, Cellular Radiotelephone Service, emission limitations for cellular equipment; §24.232, Broadband Personal Communications Service, power and antenna height limits; §24.235 Broadband Personal Communications Service, frequency stability; §24.238,

Broadband Personal Communications Service, emission limitations for Broadband PCS equipment; § 27.50, Miscellaneous Wireless Communications Services, power limits and duty cycle; and §27.53, Miscellaneous Wireless Communications Services, emission limits; §27.54 Miscellaneous Wireless Communications Services, frequency stability.

(c) Operator responsibility. The operator of a consumer booster must comply with all applicable rules in this part and any other applicable part under this chapter. The operator is the person or persons with control over the functioning of the consumer booster, or the person or persons with the ability to deactivate it in the event of technical malfunctioning or harmful interference to a primary radio service. The operator of a consumer booster must only use approved antennas and cables as specified by the manufacturer of the consumer booster. Failure to comply with all applicable rules in this subpart and all applicable technical rules for the frequency band(s) of operation voids the authority to operate a consumer booster.

(d) *Operation on a secondary, non-interfering basis.* Operation of consumer boosters under this subpart is on a secondary, non-interference basis to primary services licensed for the frequency bands on which they transmit, and to primary services licensed for the adjacent frequency bands that might be affected by their transmissions. The operation of consumer boosters must not cause harmful interference to the communications of any primary licensed service. Consumer boosters that satisfy an FCC-approved consumer booster protection "safe harbor" are considered to meet the requirements of this subsection, subject to a finding of actual interference. If a service provider or Commission representative directs the operator to deactivate the consumer booster, the operator must deactivate the booster immediately.

(e) *Registration.* Prior to operating any consumer booster, subscribers are required to register consumer boosters either electronically if the booster enables electronic registration or by contacting their service provider(s), and providing the following information: booster make and model number, FCC ID #, frequency bands supported, contact name, address, location of intended use, email, and mobile phone number.

(f) *Interference safeguards.* Consumer boosters must include features to prevent harmful interference including, at a minimum, anti-oscillation, gain control and interference avoidance for wireless subsystems. These features may not be deactivated by the operator and must be enabled and operating at all times the signal booster is in use.

(g) *Labeling requirements.*

(i) Consumer booster manufacturers, distributors, and retailers must ensure that all consumer boosters marketed on or after [insert date six months after the effective date of this rule] include the following advisory (1) in any marketing materials, (2) in the owner's manual, and (3) on the outside packaging of the device:

WARNING. Operation of this device is on a secondary non-interference basis and must cease immediately if requested by the FCC or a licensed wireless service provider. No person may operate this device without approved antennas and cables as specified by the manufacturer. No person may operate this device without first registering the device with their wireless service provider.

(ii) Consumer booster manufacturers, distributors, and retailers must ensure that all consumer boosters marketed on or after [insert date six months after the effective date of this rule] include the following advisory (1) in any marketing materials, (2) in the owner's manual, and (3) on the outside packaging of the device:

WARNING. E911 location information may not be provided or may be inaccurate for calls served by using this consumer booster.

(i) *RF Exposure.* Consumer boosters are subject to the radio frequency radiation exposure requirements specified in sections 1.1307(b) and 2.1091 of this chapter. Consumer boosters operating in fixed and mobile exposure conditions are subject to routine environmental evaluation pursuant to the above sections. Applications for equipment authorization of consumer boosters with respect to 1.1307(b) and 2.1091 must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions; and technical information showing the basis for this statement must be submitted to the Commission upon request.

(j) *Marketing of Non-Conforming Boosters.* Except as provided in Section 2.803 of the Commission's Rules, no person, manufacturer, distributor, or retailer may market, distribute or offer for sale or lease any consumer booster that does not comply with the requirements of this Section to any person in the United States or to any person intending to operate the signal booster within the United States at any time after [insert date six months after the effective date of this rule].

CONSUMER BOOSTER SAFE HARBOR PROTECTION STANDARD 1

CONSUMER BOOSTER SAFE HARBOR PROTECTION STANDARD 1

1. Definitions.

Signal booster. A device that automatically receives, amplifies, and retransmits on a bi-directional basis, the signals received from base, fixed, mobile, or portable stations, with no change in frequency or authorized bandwidth.

Consumer booster. A signal booster that meets the requirements of §20.16.

Fixed consumer booster. A consumer booster designed to operate in a fixed location in a building.

Mobile consumer booster. A consumer booster designed to operate in a moving vehicle.

2. Frequency Bands. Consumer boosters may be operated on frequencies used for the provision of subscriber-based services under Parts 22 (Cellular), 24 (Broadband PCS), and 27 (AWS-1, 700MHz Lower A-E Blocks, and 700MHz Upper C Block) of FCC rules.

3. Technical Requirements. A consumer booster can receive FCC certification and be operated if it complies with all of the technical requirements of Section 20.16 of FCC rules and this safe harbor protection standard.

(i) *Noise Limits.*

(A) The transmitted noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed -103 dBm/MHz – RSSI.

Where RSSI is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation. RSSI is expressed in negative dB units relative to 1 mW.

(B) The transmitted maximum noise power in dBm/MHz of consumer boosters at their uplink and downlink ports shall not exceed the following limits:

Fixed booster maximum noise power shall not exceed -102.5 dBm/MHz + 20 Log (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

Mobile booster maximum noise power shall not exceed -59 dBm/MHz.

Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

(ii) *Bidirectional Capability.* Consumer Boosters must be able to provide equivalent uplink

and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (i.e. uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering may be used provided the uplink filter attenuation is not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

(iii) *Booster Gain Limits.*

(A) The uplink gain in dB of a consumer booster referenced to its input and output ports shall not exceed -34 dB – RSSI + MSCL.

Where RSSI is the downlink composite received signal power in dBm at the booster donor port for all base stations in the band of operation. RSSI is expressed in negative dB units relative to 1 mW.

Where MSCL (Mobile Station Coupling Loss) is the minimum coupling loss in dB between the wireless device and input port of the consumer booster. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

(B) The uplink and downlink maximum gain of a Consumer Booster referenced to its input and output ports shall not exceed the following limits:

Fixed Booster maximum gain shall not exceed 6.5 dB + 20 Log (Frequency)

Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

Mobile Booster maximum gain shall not exceed 50 dB when using an inside antenna, 23 dB when using direct contact coupling, or 15 dB when directly connected.

(iv) *Power Limits.* A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Composite downlink power shall not exceed 0.05 watt (17 dBm) conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

(v) *Out of Band Emission Limits.* Booster out of band emissions (OOBE) shall be at least 6 dB below the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

(vi) *Intermodulation Limits.* The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave

(CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

(vii) *Booster Antenna Kitting.* All consumer boosters must be sold with user manuals specifying antennas and cables that meet the requirements of this section. Mobile consumer boosters *must* be sold together with antennas, cables, and/or coupling devices that meet the requirements of this section. The grantee is required to submit a technical document with the application for FCC equipment authorization that shows compliance of antennas, cables and/or coupling devices with the requirements of this section.

(viii) *Transmit Power Off Mode.* When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power OFF Mode". In this mode of operation the uplink and downlink noise power shall not exceed -70 dBm/MHz and uplink gain shall not exceed the lesser of 23 dB or MSCL.

(ix) *Uplink Inactivity.* When a consumer booster is not serving an active device connection after 5 minutes the uplink noise power shall not exceed -70 dBm/MHz.

4. Interference Safeguards. Consumer boosters must include features to prevent harmful interference including, at a minimum, those enumerated in this subsection. These features may not be deactivated by the operator and must be enabled and operating at all times the signal booster is in use.

(i) *Anti-Oscillation.* Consumer boosters must be able to detect and mitigate (i.e. by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

(ii) *Gain Control.* Consumer boosters must have automatic limiting control to protect against excessive input signals that would cause output power and emissions in excess of that authorized by the Commission.

(iii) *Interference Avoidance for Wireless Subsystems.* Consumer boosters using unlicensed (Part 15) or other frequency bands for wireless transmissions between donor and server subsystems for its internal operations must employ interference avoidance methods to prevent interference transmitted into authorized CMRS spectrum bands.

CONSUMER BOOSTER SAFE HARBOR PROTECTION STANDARD 2

CONSUMER BOOSTER SAFE HARBOR PROTECTION STANDARD 2

1. Definitions.

Signal booster. A device that automatically receives, amplifies, and retransmits on a bi-directional basis, the signals received from base, fixed, mobile, or portable stations, with no change in frequency or authorized bandwidth.

Consumer booster. A signal booster that meets the requirements of §20.16.

Fixed consumer booster. A consumer booster designed to operate in a fixed location in a building.

Frequency selective consumer booster. A fixed consumer booster designed to operate on some or all of the frequencies of a licensee's network, and meets the requirements below.

(i) In order to receive FCC certification as a frequency selective consumer booster, the device must meet the technical criteria listed herein and have received express licensee consent to operate on its network.

(ii) A frequency selective consumer booster shall only operate on the frequencies owned by the licensee who has approved its use and only within that licensee's market areas.

(iii) Frequency selective consumer boosters shall only operate on the licensee's spectrum blocks using the specific technologies supported by the booster. Frequency selective consumer boosters must verify the licensee's transmitted system identification codes prior to operations on uplink and downlink spectrum blocks.

(iv) A frequency selective consumer booster shall not operate on the frequencies of those licensees who have not approved its use.

(v) Frequency selective consumer boosters shall be designed so consumers cannot readily modify the operating parameters of the device.

2. Frequency Bands. Consumer boosters may be operated on frequencies used for the provision of subscriber-based services under Parts 22 (Cellular), 24 (Broadband PCS), and 27 (AWS-1, 700MHz Lower A-E Blocks, and 700MHz Upper C Block) of FCC rules.

3. Technical Requirements. A consumer booster can receive FCC certification and be operated if it complies with all of the technical requirements of Section 20.16 of FCC rules and this safe harbor protection standard.

(i) *Noise Limits.* The transmitted noise power in dBm/MHz of frequency selective consumer boosters outside the licensee's spectrum blocks at their uplink and downlink ports shall not exceed the following limits:

(A) -103 dBm/MHz – RSSI

Where RSSI is the downlink composite signal power received in dBm for frequencies in the band of operation outside the licensee's spectrum block as measured after spectrum block filtering is applied and is referenced to the booster's donor port for each band of operation. RSSI is expressed in negative dB units relative to 1 mW.

Boosters with MSCL less than 40 dB, shall reduce the Noise output in (A) by 40 dB – MSCL, where MSCL is the minimum coupling loss in dB between the wireless device and booster's server port. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

(B) Maximum downlink noise power shall not exceed -102.5 dBm/MHz + 20 Log (Frequency), where Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

Compliance with Noise limits will use instrumentation calibrated in terms of RMS equivalent voltage, and with booster input ports terminated or without input signals applied within the band of measurement.

(ii) *Bidirectional Capability.* Consumer Boosters must be able to provide equivalent uplink and downlink gain and conducted uplink power output that is at least 0.05 watts. One-way consumer boosters (i.e. uplink only, downlink only, uplink impaired, downlink impaired) are prohibited. Spectrum block filtering used must provide uplink filter attenuation not less than the downlink filter attenuation, and where RSSI is measured after spectrum block filtering is applied referenced to the booster's input port for each band of operation.

(iii) *Booster Gain Limits.* The gain of the frequency selective consumer booster shall be set at a level that ensures no material increase in the noise floor at the base station, and meet the limits below.

(A) The uplink and downlink gain in dB of a frequency selective consumer booster referenced to its input and output ports shall not exceed BSCL – 28dB – (40dB – MSCL).

Where BSCL is the coupling loss between the booster's donor port and the base station's input port, and MSCL is the minimum coupling loss in dB between the wireless device and the booster's server port. MSCL must be calculated or measured for each band of operation and provided in compliance test reports.

In order of preference, BSCL is determined as follows: (1) determine path loss between the base station and the booster; such measurement shall be based on measuring the received forward pilot/control channel power at the booster and reading the pilot/control channel transmit power from the base station as defined in the system information messages sent by the base station, (2) estimate BSCL by assuming that the base station is transmitting at a level of +25dBm per channel (assume a small, lightly loaded cell) and measuring the total received signal power level within the channel in dBm (RPCH) received at the booster input port. BSCL is then calculated as 25 – RPCH, or (3) assume

that the BSCL is 70dB without performing any measurement.

(B) The uplink and downlink maximum gain of a frequency selective consumer booster referenced to its input and output ports shall not exceed 19.5 dB + 20 Log (Frequency), or 100 dB for systems having automatic gain adjustment based on isolation measurements between booster donor and server antennas.

Where, Frequency is the uplink mid-band frequency of the supported spectrum bands in MHz.

(iv) *Power Limits.* A booster's uplink power must not exceed 1 watt composite conducted power and equivalent isotropic radiated power (EIRP) for each band of operation. Downlink power shall not exceed 0.05 watt (17 dBm) composite and 10 dBm per channel conducted and EIRP for each band of operation. Compliance with power limits will use instrumentation calibrated in terms of RMS equivalent voltage.

(v) *Out of Band Gain Limits.* A frequency selective booster shall have the following minimum attenuation referenced to the gain in the center of the pass band of the booster:

a. -20dB at the band edge, where band edge is the end of the licensee's allocated spectrum
b. -30dB at 1MHz offset from band edge
c. -40dB at 5MHz offset from band edge

A frequency selective booster having maximum gain greater than 80 dB (referenced to the center of the pass band) shall limit the out of band gain to 60 dB at 0.2 MHz offset from the band edge, and 45 dB at 1 MHz offset from the band edge, where band edge is the end of the licensee's allocated spectrum.

(vi) *Out of Band Emission Limits.* Booster out of band emissions (OOBE) shall meet the FCC's mobile emission limits for the supported bands of operation. Compliance to OOBE limits will utilize high peak-to-average CMRS signal types.

(vii) *Intermodulation Limits.* The transmitted intermodulation products of a consumer booster at its uplink and downlink ports shall not exceed the power level of -19 dBm for the supported bands of operation. Compliance with intermodulation limits will use boosters operating at maximum gain and maximum rated output power, with two continuous wave (CW) input signals spaced 600 kHz apart and centered in the pass band of the booster, and with a 3 kHz measurement bandwidth.

(viii) *Booster Antenna Kitting.* All consumer boosters must be sold with user manuals specifying antennas and cables that meet the requirements of this section. Mobile consumer boosters *must* be sold together with antennas, cables, and/or coupling devices that meet the requirements of this section. The grantee is required to submit a technical document with the application for FCC equipment authorization that shows compliance of antennas, cables and/or coupling devices with the requirements of this section.

(ix) *Transmit Power Off Mode.* When the consumer booster cannot otherwise meet the noise and gain limits defined herein it must operate in "Transmit Power OFF Mode". In this mode of operation the uplink and downlink noise power shall not exceed -70 dBm/MHz and uplink gain shall not exceed the lesser of 23 dB or MSCL.

(x) *Uplink Inactivity.* When a consumer booster is not serving an active device connection after 5 seconds the uplink noise power shall not exceed -70 dBm/MHz.

4. Interference Safeguards. Consumer boosters must include features to prevent harmful interference including, at a minimum, those enumerated in this subsection. These features may not be deactivated by the operator and must be enabled and operating at all times the signal booster is in use.

(i) *Anti-Oscillation.* Consumer boosters must be able to detect and mitigate (i.e. by automatic gain reduction or shut down), any oscillations in uplink and downlink bands. Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.

(ii) *Gain Control.* Consumer boosters must have automatic limiting control to protect against excessive input signals that would cause output power and emissions in excess of that authorized by the Commission.

(iii) *Interference Avoidance for Wireless Subsystems.* Consumer boosters using unlicensed (Part 15) or other frequency bands for wireless transmissions between donor and server subsystems for its internal operations must employ interference avoidance methods to prevent interference transmitted into authorized CMRS spectrum bands.