Before the
FEDERAL COMMUNICATIONS COMMISSION

Washington, DC 20554

In the Matter of:

Response to Verizon Wireless, V-COMM and Wilson Electronics joint proposal for the design, operation and where necessary installation of signal boosters

WT Docket No. 10-4

COMMENTS OF NEXTIVITY, INC.

Nextivity, Inc.

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August 22, 2011

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INTRODUCTION

Nextivity Inc. supports the commission's efforts to adopt rules for the design and installation of signal boosters to optimize and improve cellular coverage for all subscribers. To this end, we have previously filed comments with the Commission that outlined our position in this regard. To recap, we believe that

- Any signal booster device shall be approved for use on a CMRS provider's network by the CMRS provider.
- Any signal booster device should include mechanisms to monitor the path loss between the base station and the booster and ensure that the signal booster gain is at least 25dB less than this path loss.
- Any signal booster device should amplify only the signals from the CMRS provider that approved the device for use on its network.
- Any signal booster device that is self installed by subscribers shall boost only the signals from one CMRS provider.
- All wideband (Multi-band, multi-carrier) signal boosters shall be installed by trained personnel only under controlled circumstances
- Any signal booster device shall include oscillation detection and mitigation algorithms.

DISCUSSION

On July 25th, 2011, Verizon Wireless, V-COMM and Wilson Electronics jointly filed a proposal for the design, operation and where necessary installation of signal boosters. Specifically focusing on the "Consumer Booster" section of the proposal, we applaud the steps taken by the companies involved to put a concrete proposal for standardization on the table. Specifically, we believe that the proposal intends to:

- create an environment where Consumer Boosters can be deployed by end users,
- where such user deployments will not cause any undue interference to adjacent RF channels and
    - where such user deployments will not cause any undue interference on the boosted frequencies.

As you can see, these goals are in line with the initial Nextivity position on the matter. However, we believe that the manner in which the joint proposal gives specifications is not appropriate for a standardization activity. Specifically, the joint proposal:

- Assumes a specific system architecture for a consumer booster (a bi-directional RF amplifier). It is our view that standardization should never specify system architecture, merely the required performance levels of the system.
- Calculates and proposes various limits based on a single assumption of a user installed external antenna. Such an assumption, again, imposes a specific system architecture that is neither optimum in all conditions nor does it represent the state of the art.
- Does not take into account intelligent repeater functions that are field proven when proposing emission limits. Various techniques exist today and have been proven in the field that allows for much safer system operation than those proposed in the joint proposal.

These flawed assumptions in turn lead to inappropriate calculations for limits throughout the proposal and hence the proposal cannot be used as the basis for any rule making activities. ***A more detailed treatment of the shortcoming of the proposal is presented in Appendix A.***

CONCLUSION

Because of these fundamental flaws in the joint proposal, Nextivity wishes to put forward two rulemaking guidelines that we believe will address our common goals in a systematic and open manner and lead to well designed, safe and low cost solutions to solving consumer indoor coverage problems.

Guideline #1: New specifications for repeater performance should be based on existing, well defined repeater specifications such as 3GPP TS25.106, EN 301 908-1 and EN 301 908-11. These specifications share the same intent as the proposal by Nextivity and the joint proposal namely

- Protection of Node-B
- Protection of other systems

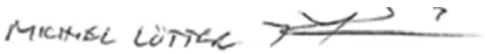
Furthermore, the specification contents, specification limits as well as the definition of additional important tests (such as out-of-band gain, input and output inter-modulations etc.) are done in a consistent and logical way. The specifications must still be adapted to accurately reflect the state of the art of self-installable indoor repeaters, but it provides a perfect basis from which to work. Please refer to Appendix B for more details.

Guideline #2: All Consumer Boosters must be type approved by the license holder on whose spectrum the booster is operating. Assuming that this premise is accepted by all parties, in-band behaviors such as the specific mechanisms and timing of functions such as oscillation detection should not be part of the FCC rules and should be left to the license holder to define what is acceptable behavior for the license holder's specific network. This is also consistent with the approach followed in 3GPP TS25.106.

Nextivity stands ready to work with the Commission and other interested parties within the guidelines proposed above to move the rule making process relating to consumer boosters forward in an expeditious manner.

Respectfully submitted

Nextivity, Inc.



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Aug 22, 2011

APPENDIX A:

TECHNICAL SHORTCOMINGS OF JOINT PROPOSAL BY VERIZON, WILSON AND V-COMM.

1. SYSTEM CONCEPT:

1.1 The entire proposal assumes a bi-directional amplifier based design. Although there is some equivalence, a three-hop repeater (such as the Nextivity Cel-Fi) has considerations beyond a simple bi-directional amplifier.

1.2 All the noise limits and BTS overload limits are written in the context of an external roof-mounted antenna (for the fixed install case). Consequently,

- 1.2.1 the MSCL etc. and therefore maximum gains are derived only in this context;
- 1.2.2 As such the proposal does not address fixed, in-building repeater systems where even the antenna pointing to the NodeB is completely internal to the system and is, therefore, mounted indoors;
- 1.2.3 the MSCL assumptions and numbers are, at minimum, incomplete.

1.3 The limits are all derived in the context of systems which do not have run-time intelligence beyond RSSI measurements.

- 1.3.1 For systems which can measure run time parameters such as RSCP and also read SIB-MIB messages and compute coupling loss, the proposed approach is not very accurate.
- 1.3.2 Instead of making assumptions on the transmit side and imposing maximum gain limits on transmitter, the approach should be (as the final intent here is) that the limits should control the maximum received noise power at the NodeB receiver.

2. INAPPRPOPRAITE SPECIFICATIONS:

The Design Requirements Section provides guidelines on AGC overload, Amplifier Design (with an underlying assumption of the booster as a bidirectional amplifier), Oscillation protection and power cables etc. Many of these are inappropriate as written, while appropriate in spirit. Specifically:

2.1 The intent of the AGC Overload control and Amplifier Design specification is to make sure that the repeater does not go into compression at any input receive level (in an environment that tends to have a high receive dynamic range) and with any kind of signal (especially signals with high PAPR). In the event of compression spectral components beyond the intended ones might be radiated. Hence the intent is understood. However, all such linearity related requirements must still be wrapped back into the overall emissions requirements. The emissions part of the specification must provide test setups such that even at maximum TX power and(or) maximum system gain, the emissions stay within the limits. Variations of this test can be specified at different input levels to check performance against input dynamic range.

2.2 Since the spirit of this set of tests is to check for linearity – the suite may be appropriately extended to include other (common) sources of non-linearity. For these as well, the final tests can be written only as limits on emissions. In this sense the proposal is not complete.

2.3 Stability specifications etc. are best left for product qualifications between a vendor and a carrier.

2.3.1 Especially specific numbers such as "5 instabilities" being allowed point to the spec being written tightly coupled to one specific vendors implementation. Since there is no sanctity to one set of such numbers – they are best left to be decided between the network provider and the repeater manufacturer

2.3.2 Connector types and supply voltage specifications are also best left out of this specification. In so far as they have impacts on some EMC/ EMI issues, the specification must call out the specific EMC/ EMI issue (ESD, conducted and radiated emissions, input power variation) and set limits in that way

3. LIMIT CALCULATIONS:

3.1 All the limit calculations use RSSI as an input. Indeed RSSI is a load dependent quantity and, is varying. CPICH RSCP (or equivalent load independent quantity) must be used for deriving limits. If RSSI is used:

3.1.1 The limits keep changing at run-time without there being any justification.

3.1.2 Here RSSI is used to judge "nearness" to the Node-B. But without any change to distance and even in idealized path loss conditions - the downlink RSSI can change as NodeB loading changes. This should not mandate reduction to gains as the uplink noise power to the NodeB will not change at all as the NodeB loading on the downlink changes.

3.1.3 Since maximum gain settings are also given in terms of Minimum Coupling Loss (MSCL), the assumptions under which these MSCL are derived must be clearly given. For example, in significant amounts of literature in the 3GPP context for repeaters, with external roof mounted antennas, the MSCL assumptions (with justification) are shown to be in the 73dB range[1]. The numbers given in the proposal are in line with co-located NodeB and repeater situations. However, again, the final specifications must be in terms of limits emissions – and where limits on emissions (rather than maximum gains) need to be justified, the appropriate assumptions for deriving those MSCL and their numerical values should be properly given.

3.1.4 Power specifications are best specified in a normalized context. For example a booster that boosts only one 5MHz channel and another that boosts the whole band - each still can only reach 30dBm or 17dBm EIRP. These should be specified per channel or normalized.

[1] 3GPP TR 25.942, 3GPP TR 45.050, 3GPP TR 25.956

Appendix B: EXAMPLE REFERENCE SPECIFICATIONS FOR REPEATERS

A good example of a booster/repeater compliance specification are the EN 301 908-1 and EN 301 908-11 set. They share the same intent as the proposals from Nextivity as well as those from Verizon et al. namely

a. Protection of Node-B
b. Protection of other systems

However, what is in the specification and what is not in it, how the limits are set as well as other important tests are done in a consistent and logical way. Although, that specification also assumes an external roof-mounted antenna and has some dependence on MSCL based on this assumption, overall it is a well-organized specification.

Firstly, since the word "Band" is a confusing term, the specification clearly defines Operating Band (such as UMTS Band I etc.) and Pass Band (The frequencies that are actually repeated by the repeater) and clearly sets the limits in one or the other context.

1) Operating Band Unwanted Emissions: Sets limits on emissions of the repeater (referred to the output conducted port and where appropriate adjusted for maximum antenna gain) inside the operating band in which the repeater pass band is contained. In case the repeater pass band spans multiple operating bands, the limits apply to all the operating bands
2) Spurious emissions: Sets limits on emissions of the repeater outside the repeater operating band in a comprehensive way (from 30MHz to 12.5GHz).
    a. The specification also gives specific test procedures for testing 1 & 2
    b. Together they achieve the same objective as the bulk of the Wilson-VZW proposal – which is protection of NodeB in the operating bands and protection of other systems from the emissions of the repeater
    c. However, it also gives detailed justifications of these limits with the same context (consumer repeater) and test procedures
3) Maximum output power: defines power classes, sets limits on output power and also provides allowances for variations in extreme conditions (voltage and temperature)
4) Input Intermodulation: Although the proposal tries to address some linearity issues, the main linearity tests are not given. Specifically the external radio environment is full of other signal (both narrow and wideband) which can generate intermodulation products at the very first radio element of the repeater chain if these are not sufficiently linear. These in turn can cause spurious spectral components in-band. Hence, this class of tests is very common to specify system linearity. The specification gives specific tests and emissions limits in this context
5) Out-of-band gain: Although the repeater is only expected to boost what is in the passband, its gain rolls off for out-of-band components. These specifications set tight limits so that adjacent systems are not impacted by changes to their signal characteristics.
6) Adjacent Channel Rejection Ratio: It is a test similar to out-of-band gain. However, it sets limit in terms of gain provided to an in-band (inside passand) signal to an immediate out of band signal
7) Output intermodulation: These test the ability of the repeater not to generate spurious spectral components from strong signals reaching the output port of the repeater.

As can be seen this specification set addresses gives requirements and limits in the following comprehensive areas applicable to the same domain – i.e. consumer based repeaters. Since both test procedures and derivations and justifications for specific limits are directly provided or referenced, it is

possible to understand any system context assumptions (of which there are very few). Hence the set of specifications is a very good point of reference.

The goal here should be to generate something similar and also appropriately fix the numbers to fit all system scenarios (especially fixed, in-building repeaters with completely internal antenna systems).