**3GPP TSG-RAN WG4 Meeting #** **96-e Draft R4-2012637**

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**Title:** TP to TR 38.809 on IAB EMC emission requirements

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# Introduction

IAB (Integrated Access and Backhaul) is essentially about NR self-backhauling, i.e. using NR, the new 5G radio-access technology, not only for the access link, but also as a wireless backhaul technology (instead of fiber) to enable flexible and very dense deployment of cells without the need for pulling fiber to new sites. A key benefit of IAB is enabling flexible and very dense deployment of NR cells without densifying the transport network proportionately. A diverse range of deployment scenarios can be envisioned including support for outdoor small cell deployments, indoors, or even mobile relays (e.g. on buses or trains).

EMC (ElectroMagnetic Compatibility) testing exists to ensure that electronic or electrical device does not emit a large amount of electromagnetic interference (radiated and conducted emissions) and that devices continue to function as intended in the presence of several electromagnetic phenomena (immunity). In the following sections we provide an analysis of EMC requirements and its applicability in the context of IAB.

# Discussion

## **Emissions Testing**

EMC radiated emissions test involves measuring the electromagnetic field strength of the emissions that are **unintentionally** **generated** by a product. Emissions are inherent to the switching voltages and currents within any digital circuit. In this case, the radiated emission requirements as well as the test methods that apply are defined by IEC and CISPR subcommittee in the Standard CISPR 32 [1]. Testing and limits of **emissions intentionally generated** by the BS are covered by ITU-R recommendations SM.329 [3] and SM.1539 [4].

According to CISPR 32 [1] in section 6, the procedures to be used for measurement of emission levels depend upon several elements. These include but are not limited tothe type of EUT, the type of port, the types of cables used, the frequency range, and **the mode of operation.** Same standard defines mode of operation as the “*set of operational states of all functions of an EUT during a test or measurement*”. According to this definition IAB-DU and IAB-MT requirements can be grouped within the modes of operation of an IAB node.

CISPR 32 [1] Annex B specifies the methods for exercising the EUT during emission measurements. Regarding MME (which typically have several different functions and numerous modes of operation associated with each function), CISPR indicates that *“For each function, or group of functions selected to exercise the EUT, a number of representative modes of operation, including low power/standby mode, shall be considered for testing. The mode(s) that produce(s) the highest emissions shall be selected for the final measurements”.* In that sense, the emission requirements should reuse those defined for the BS.

**Observation 1: *EUT/BS typically have several different functions and numerous modes of operation associated with each function. The mode(s) that produce(s) the highest emissions could be selected for the final measurements.. In that sense, the emission requirements should reuse those defined for the BS.***

It has been agreed in TR 38.809 [5] that IAB will consider requirements sets for BS Type 1-H, 1-O and 2-O. It worth to mention that 3GPP has agreed that for BS type 1-O and BS type 2-O, the radiated emission is covered by radiated spurious emission requirement in TS 38.104 [6], conforming to the test requirement in TS 38.141-2 [7]. Other types of BS with antenna port make it possible to aisle the intentional emissions from the unintentional ones. With this consideration, the emission requirement for the IAB node should follow the same principle implemented in TS 38.113.

**Observation 2: *3GPP has agreed that for BS type 1-O and BS type 2-O, the radiated emission is covered by radiated spurious emission requirement in TS 38.104 [6], conforming to the test requirement in TS 38.141-2 [7]. Same principle should be used in the definition of IAB emission requirements.***

# Conclusion

In this contribution considerations on the EMC IAB testing have been presented. The following observations have been discussed:

**Observation 1:** *EUT/BS typically have several different functions and numerous modes of operation associated with each function. The mode(s) that produce(s) the highest emissions could be selected for the final measurements.. In that sense, the emission requirements should reuse those defined for the BS.*

**Observation 2:** *3GPP has agreed that for BS type 1-O and BS type 2-O, the radiated emission is covered by radiated spurious emission requirement in TS 38.104 [6], conforming to the test requirement in TS 38.141-2 [7]. Same principle*

Based on these elements we propose:

***Proposal 1: The radiated emission requirements defined for IAB should reuse the ones defined for NR BS.***

***Proposal 2: For OTA IAB nodes the same principle applied for the radiated emissions (the radiated emission is covered by radiated spurious emission requirement in TS 38.104 [6], conforming to the test requirement in TS 38.141-2 [7]) and reflected in TS 38.113 [11] shall be applied.***

***Proposal 3: Agreed on the proposed text for TR 38.809.***

# References

1. CISPR 32. Electromagnetic compatibility of multimedia equipment - Emission requirements.
2. CISPR 16. Specification for radio disturbance and immunity measuring apparatus and methods.
3. Recommendation ITU-R SM.329-12: "Unwanted emissions in the spurious domain
4. Recommendation ITU-R SM.1539-1: "Variation of the boundary between the out-of-band and spurious domains required for the application of Recommendations ITU-R SM.1541 and ITU-R SM.329"
5. 3GPP TR 38.809. “NR; Background for Integrated access and backhaul radio transmission and reception.”
6. 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".
7. 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing Part 2: Radiated conformance testing"
8. ETSI EN 301 489-1, ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU.
9. IEC 61000-4-3: "Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency electromagnetic field immunity test"
10. IEC GUIDE 107:2014. Electromagnetic compatibility - Guide to the drafting of electromagnetic compatibility publications
11. 3GPP TS 38.113. “NR Base Station (BS) Electromagnetic Compatibility (EMC)”

# Annex (Text Proposal)

**--------------Start of text proposal-------------**

12.1 IAB EMC Emission requirements

EMC emissions testing covers both conducted and radiated emissions. Test methods and levels for conducted emissions, harmonic and voltage fluctuations and flicker testing defined by IEC/CISPR are independent of the product (IAB) characteristics and features, including the operating frequency or the Radio Access Technology (RAT). It is agreed that the applicable requirements for EMC conducted emissions of IAB nodes are the ones defined for NR BS in TS 38.113.

EMC radiated emissions test involves measuring the electromagnetic field strength of the emissions that are unintentionally generated by a product (an IAB node in this case). Emissions are inherent to the switching voltages and currents within any digital circuit. In this case, the radiated emission requirements as well as the test methods that apply are defined by IEC and CISPR subcommittee in the Standard CISPR 32 [X]. Testing and limits of emissions intentionally generated by the BS are covered by ITU-R recommendations SM.329 [X] and SM.1539 [X].

3GPP has agreed that for IAB type 1-O and IAB type 2-O, the radiated emission is covered by radiated spurious emission requirement in TS 38.104 [X], conforming to the test requirement in TS 38.141-2 [X].

**--------------End of text proposal-------------**