**3GPP TSG-RAN WG4 Meeting # 99-e R4-2109016**

**Electronic Meeting, May. 19-27, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **1** | **Current version:** | 16.2.0 |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **x** | Core Network |  |

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| ***Title:***  | Draft CR for TS 38.174: IAB-MT EVM measurement |
|  |  |
| ***Source to WG:*** | CATT |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_IAB-Core |  | ***Date:*** | 2021-03-26 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | *Rel-16* |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | 1. The EVM measurement processes for FR1 and FR2 are not defined.
2. Some editorial mistakes in Annex B and C.
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| ***Summary of change:*** | 1. Add the EVM measurement processes for FR1 and FR2.
2. Correct the editorial mistakes.
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| ***Consequences if not approved:*** | EVM meausurement doesn’t have guidelines. |
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| ***Clauses affected:*** | Clause 1, Annex B, Annex C, Annex D, Annex E |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Add D.0 and E.0 according to the comments and corrected some mistakes. |

## < Start of the changes >

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.104: “NR; Base Station (BS) radio transmission and reception”

[3] 3GPP TS 38.101-1: “NR User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone”

[4] 3GPP TS 38.101-2: “NR User Equipment (UE) radio transmission and reception: Part 2: Range 2 Standalone”

[5] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios "

[6] 3GPP TS 38.133: “NR: Requirements for support of radio resource management”

[7] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[8] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[9] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[10] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[11] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[12] 3GPP TS 38.215: "NR; Physical layer measurements".

[13] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[14] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[15] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[16] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain".

[17] ERC Recommendation 74-01, "Unwanted emissions in the spurious domain".

[18] ITU-R Recommendation M.1545: “Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications – 2000”

[19] Recommendation ITU-R SM.328: "Spectra and bandwidth of emissions".

[20] "Title 47 of the Code of Federal Regulations (CFR)", Federal Communications Commission.

[21] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".

[22] 3GPP TS 38.141-1: "NR; Base Station (BS) conformance testing; Part 1: Conducted conformance testing".

[23] 3GPP TS 38.521-1: “NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone”.

[24] 3GPP TS 38.521-2: “NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone”.

## < Next change >

Annex B (normative):

IAB-DU Error Vector Magnitude (FR1)

The Annex B in TS 38.104 [2] applies to FR1 IAB-DU.

Annex C (normative):
IAB-DU Error Vector Magnitude (FR2)

The Annex C in TS 38.104 [2] applies to FR2 IAB-DU.

Annex D (normative):

IAB-MT Error Vector Magnitude (FR1)

# D.0 General

FR1 IAB-MT EVM can be determined by the process according to

1) Annex E in TS 38.521-1 [23]. Only CP-OFDM waveform of PUSCH is measured for IAB-MT.

Or

2) Annex D.1 to Annex D.7.

# D.1 Reference point for measurement

The Annex B.1 in TS 38.104 [2] applies to FR1 IAB-MT.

# D.2 Basic unit of measurement

The Annex B.2 in TS 38.104 [2] applies to FR1 IAB-MT.

# D.3 Modified signal under test

The Annex B.3 in TS 38.104 [2] applies to FR1 IAB-MT.

# D.4 Estimation of frequency offset

The Annex B.4 in TS 38.104 [2] applies to FR1 IAB-MT.

# D.5 Estimation of time offset

The Annex B.5 in TS 38.104 [2] applies to FR1 IAB-MT.

# D.6 Estimation of TX chain amplitude and frequency response parameters

The Annex B.6 in TS 38.104 [2] applies to FR1 IAB-MT.

# D.7 Averaged EVM

EVM is averaged over all allocated uplink resource blocks with the considered modulation scheme in the frequency domain, and a minimum of $N\_{ul}$ slots where $N\_{ul}$ is the number of slots in a 10 ms measurement interval.

For TDD, let $\_{}^{}$ be the number of slots with uplink symbols within a 10 ms measurement interval, the averaging in the time domain can be calculated from $\_{}^{}$ slots of different 10 ms measurement intervals and should have a minimum of $N\_{ul} $slots averaging length where $N\_{ul} $is the number of slots in a 10 ms measurement interval.

- $\overbar{EVM}\_{frame}$ is derived by: Square the EVM results in each 10 ms measurement interval. Sum the squares, divide the sum by the number of EVM relevant locations, square-root the quotient (RMS).

$$\overbar{}\_{}\sqrt{\frac{}{\sum\_{}^{\_{}^{}}\_{}}\sum\_{}^{\_{}^{}}\sum\_{}^{\_{}}\_{}^{}}$$

- Where $N\_{i}$ is the number of resource blocks with the considered modulation scheme in slot *i*.

- The $EVM\_{frame}$ is calculated, using the maximum of $\overbar{EVM}\_{frame}$ at the window *W* extremities. Thus $\overbar{EVM}\_{frame,l}$ is calculated using $\tilde{t}=∆\tilde{t}\_{l}$ and $\overbar{EVM}\_{frame,h}$ is calculated using $\tilde{t}=∆\tilde{t}\_{h}$ (*l* and *h*, low and high; where low is the timing $\left(∆c-W/2\right)$ and and high is the timing $\left(∆c+W/2\right)$).

$$\_{}\left(\overbar{}\_{}\overbar{}\_{}\right)$$

- In order to unite at least $N\_{ul}$ slots, consider the minimum integer number of 10 ms measurement intervals, where $N\_{frame}$ is determined by.

$$\_{}\left⌈\frac{\_{}}{\_{}^{}}\right⌉$$

and $N\_{slot}=1$ for 15 kHz SCS, $N\_{slot}=2$ for 30 kHz SCS and $N\_{slot}=4$ for 60 kHz SCS normal CP.

- Unite by RMS.

$$\overbar{}\sqrt{\frac{}{\_{}}\sum\_{}^{\_{}}\_{}^{}}$$

Annex E (normative):
IAB-MT Error Vector Magnitude (FR2)

# E.0 General

FR2 IAB-MT EVM can be determined by the process according to

1) Annex E in TS 38.521-2 [24]. Only CP-OFDM waveform of PUSCH is measured for IAB-MT.

Or

2) Annex E.1 to Annex E.7.

# E.1 Reference point for measurement

The Annex C.1 in TS 38.104 [2] applies to FR2 IAB-MT.

# E.2 Basic unit of measurement

The Annex C.2 in TS 38.104 [2] applies to FR2 IAB-MT.

# E.3 Modified signal under test

The Annex C.3 in TS 38.104 [2] applies to FR2 IAB-MT.

# E.4 Estimation of frequency offset

The Annex C.4 in TS 38.104 [2] applies to FR2 IAB-MT.

# E.5 Estimation of time offset

The Annex C.5 in TS 38.104 [2] applies to FR2 IAB-MT.

# E.6 Estimation of TX chain amplitude and frequency response parameters

The Annex C.6 in TS 38.104 [2] applies to FR2 IAB-MT.

# E.7 Averaged EVM

EVM is averaged over all allocated uplink resource blocks with the considered modulation scheme in the frequency domain, and a minimum of $N\_{ul}$$ $slots where $N\_{ul}$ is the number of slots in a 10 ms measurement interval.

For TDD, let $N\_{ul}^{TDD}$ be the number of slots with uplink symbols within a 10 ms measurement interval, the averaging in the time domain can be calculated from $N\_{ul}^{TDD}$ slots of different 10 ms measurement intervals and should have a minimum of $N\_{ul} $slots averaging length where $N\_{ul} $is the number of slots in a 10 ms measurement interval.

- $\overbar{EVM}\_{frame}$ is derived by: Square the EVM results in each 10 ms measurement interval. Sum the squares, divide the sum by the number of EVM relevant locations, square-root the quotient (RMS).

$$\overbar{}\_{}\sqrt{\frac{}{\sum\_{}^{\_{}^{}}\_{}}\sum\_{}^{\_{}^{}}\sum\_{}^{\_{}}\_{}^{}}$$

- Where $N\_{i}$ is the number of resource blocks with the considered modulation scheme in slot *i*.

- The $EVM\_{frame}$ is calculated, using the maximum of $\overbar{EVM}\_{frame}$ at the window *W* extremities. Thus $\overbar{EVM}\_{frame,l}$ is calculated using $\tilde{t}=∆\tilde{t}\_{l}$ and $\overbar{EVM}\_{frame,h}$ is calculated using $\tilde{t}=∆\tilde{t}\_{h}$ (*l* and *h*, low and high; where low is the timing $\left(∆c-W/2\right)$ and and high is the timing $\left(∆c+W/2\right)$).

$$\_{}\left(\overbar{}\_{}\overbar{}\_{}\right)$$

- In order to unite at least $N\_{ul}$ slots, consider the minimum integer number of 10 ms measurement intervals, where $N\_{frame}$ is determined by.

$$\_{}\left⌈\frac{\_{}}{\_{}^{}}\right⌉$$

and $N\_{slot}=4$ for 60 kHz SCS and $N\_{slot}=8$ for 120 kHz SCS.

- Unite by RMS.

$$\overbar{}\sqrt{\frac{}{\_{}}\sum\_{}^{\_{}}\_{}^{}}$$

## < End of the changes >