**TSG RAN Meeting #17** **RP-020483**
**Biarritz, France, 3 - 6 September, 2002**

**Title** **CRs (Rel-4 and Rel-5 Category A) to TS 25.106 and TS 25.143 "Correction of the Out of Band Gain Limits"**
**Source** **TSG RAN WG4**
**Agenda Item** **7.4.4**

| RAN4 Tdoc | Spec | CR | R | Cat | Rel | Curr Ver | Title | Work Item |
|---|---|---|---|---|---|---|---|---|
| R4-021349 | 25.106 | 8 | 1 | F | Rel-4 | 4.2.0 | Out of band gain | RInImp-REP |
| R4-021350 | 25.106 | 9 | 1 | A | Rel-5 | 5.1.0 | Out of band gain | RInImp-REP |
| R4-021351 | 25.143 | 11 | 1 | F | Rel-4 | 4.4.0 | Out of band gain | RInImp-REP |
| R4-021369 | 25.143 | 12 | 1 | A | Rel-5 | 5.1.0 | Out of band gain | RInImp-REP |

**3GPP TSR RAN WG4 Meeting #24** **R4-021349**

**Helsinki, Finland 12 - 16 August 2002**

CR-Form-v7

# CHANGE REQUEST

⌘ **25.106** **CR** **8** ⌘ **rev** **1** ⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | Out of band gain |
| ***Source:*** | ⌘ | RAN WG4 |
| ***Work item code:*** | ⌘ | RInImp-REP |
| ***Date:*** | ⌘ | 21/08/2002 |
| ***Category:*** | ⌘ | **F** |
| ***Release:*** | ⌘ | Rel-4 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*

| | |
|---|---|
| *2* | *(GSM Phase 2)* |
| *R96* | *(Release 1996)* |
| *R97* | *(Release 1997)* |
| *R98* | *(Release 1998)* |
| *R99* | *(Release 1999)* |
| *Rel-4* | *(Release 4)* |
| *Rel-5* | *(Release 5)* |
| *Rel-6* | *(Release 6)* |

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To avoid that a repeater amplifies the emissions of the donor base station. |
| ***Summary of change:*** | ⌘ | A correlation between out of ban gain and the coupling loss between the repeater and the donor base station is introduced.. |
| ***Consequences if not approved:*** | ⌘ | A repeater could amplify the emission of a base station. |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | 3.1, 8, |

| Y | N | | | |
|---|---|---|---|---|
| | X | Other core specifications | ⌘ | |
| X | | Test specifications | | TS25.143 |
| | X | O&M Specifications | | |

***Other specs affected:*** ⌘

***Other comments:*** ⌘ Equivalent CRs in other Releases: CR9r1 cat. A to 25.106 v5.1.0

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Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**down-link:** signal path where base station transmits and mobile receives

**operating band:** the Repeater can have one or several operating bands. The operating band is the frequency range that the Repeater operates in with operational configuration. This frequency range can correspond to one or several consecutive nominal 5 MHz channels. If they are not consecutive each subset of channels shall be considered as an individual operating band.

**Repeater:** a device that receives, amplifies and transmits the radiated or conducted RF carrier both in the down-link direction (from the base station to the mobile area) and in the up-link direction (from the mobile to the base station).

**Donor coupling loss:** is the coupling loss between the repeater and the donor base station.

**up-link:** signal path where mobile transmits and base station receives.

========== next changed section ==========

# 8 Out of band gain

Out of band gain refers to the gain of the repeater outside the operating band.

## 8.1 Minimum requirement

The intended use of a repeater in a system is to amplify the in band signals and not to amplify the out of band emission of the donor base station.
In the intended application of the repeater, the out of band gain is less than the donor coupling loss.
The repeater minimum donor coupling loss shall be declared by the manufacturer. This is this the minimum required attenuation between the donor BS and the repeater for proper repeater operation.

~~The requirement shall be met by a repeater operating at maximum gain~~. The gain outside the operating band shall not exceed the maximum level specified in table 8.1, where:

- f_offset is the distance from the centre frequency of the first or last 5 MHz channel within the operating band.

**Table 8.1: Out of band gain limits 1**

| Frequency offset from the carrier frequency, f_offset | Maximum gain~~level~~ |
|---|---|
| 2,7 ≤ f_offset < 3,5 MHz | 60 dB |
| 3,5 ≤ f < 7,5 MHz | 45 dB |
| 7,5 ≤ f_offset < 12,5 MHz | 45 dB |
| 12,5 MHz ≤ f_offset | 35 dB |

For 12,5 MHz ≤ f_offset MHz the out of band gain shall not exceed the maximum gain of table 8.2 or the maximum gain stated in table 8.1 whichever is lower.

**Table 8.2: Out of band gain limits 2**

| Repeater maximum output power as in 9.1.1.1 | Maximum gain |
|---|---|
| P < 31 dBm | t.b.d. |
| 31 dBm < P <= 43 dBm | Out of band gain ≤ minimum donor coupling loss |
| P > 43 dBm | Out of band gain ≤ minimum donor coupling loss – (P-43dBm) |
| Note 1: The out of band gain is considered with 12,5 MHz ≤ f_offset | |

**3GPP TSR RAN WG4 Meeting #24** **R4-021350**

**Helsinki, Finland 12 - 16 August 2002**

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# CHANGE REQUEST

⌘ **25.106** **CR** **9** ⌘ **rev** **1** ⌘ Current version: **5.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | | | |
|---|---|---|---|---|
| ***Title:*** | ⌘ | Out of band gain | | |
| ***Source:*** | ⌘ | RAN WG4 | | |
| ***Work item code:*** | ⌘ | RInImp-REP | ***Date:*** ⌘ | 21/08/2002 |
| ***Category:*** | ⌘ | **A** | ***Release:*** ⌘ | Rel-5 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*

| | |
|---|---|
| *2* | *(GSM Phase 2)* |
| *R96* | *(Release 1996)* |
| *R97* | *(Release 1997)* |
| *R98* | *(Release 1998)* |
| *R99* | *(Release 1999)* |
| *Rel-4* | *(Release 4)* |
| *Rel-5* | *(Release 5)* |
| *Rel-6* | *(Release 6)* |

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To avoid that a repeater amplifies the emissions of the donor base station. |
| ***Summary of change:*** | ⌘ | A correlation between out of ban gain and the coupling loss between the repeater and the donor base station is introduced.. |
| ***Consequences if not approved:*** | ⌘ | A repeater could amplify the emission of a base station. |

| | | | | | |
|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 3.1, 8, | | | |
| ***Other specs affected:*** | ⌘ | Y / N | | ⌘ | |
| | | ☐ / ☒ | Other core specifications | | |
| | | ☒ / ☐ | Test specifications | | TS25.143 |
| | | ☐ / ☒ | O&M Specifications | | |
| ***Other comments:*** | ⌘ | Equivalent CRs in other Releases: CR8r1 cat. F to 25.106 v4.2.0 | | | |

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Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

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========== next changed section ==========

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~~The requirement shall be met by a repeater operating at maximum gain~~. The gain outside the operating band shall not exceed the maximum level specified in table 8.1, where:

- f_offset is the distance from the centre frequency of the first or last 5 MHz channel within the operating band.

**Table 8.1: Out of band gain limits 1**

| Frequency offset from the carrier frequency, f_offset | Maximum gain~~level~~ |
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| 7,5 ≤ f_offset < 12,5 MHz | 45 dB |
| 12,5 MHz ≤ f_offset | 35 dB |

For 12,5 MHz ≤ f_offset MHz the out of band gain shall not exceed the maximum gain of table 8.2 or the maximum gain stated in table 8.1 whichever is lower.

**Table 8.2: Out of band gain limits 2**

| Repeater maximum output power as in 9.1.1.1 | Maximum gain |
|---|---|
| P < 31 dBm | t.b.d. |
| 31 dBm < P <= 43 dBm | Out of band gain ≤ minimum donor coupling loss |
| P > 43 dBm | Out of band gain ≤ minimum donor coupling loss – (P-43dBm) |
| Note 1: The out of band gain is considered with 12,5 MHz ≤ f_offset | |

**3GPP TSR RAN WG4 Meeting #24** **R4-021351**

**Helsinki, Finland 12 - 16 August 2002**

CR-Form-v7

# CHANGE REQUEST

⌘ **25.143** **CR** **11** ⌘ **rev** **1** ⌘ Current version: **4.4.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | Out of band gain |
| ***Source:*** | ⌘ | RAN WG4 |
| ***Work item code:*** | ⌘ | RInImp-REP |
| ***Date:*** | ⌘ | 21/08/2002 |
| ***Category:*** | ⌘ | **F** |
| ***Release:*** | ⌘ | Rel-4 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*

| | |
|---|---|
| *2* | *(GSM Phase 2)* |
| *R96* | *(Release 1996)* |
| *R97* | *(Release 1997)* |
| *R98* | *(Release 1998)* |
| *R99* | *(Release 1999)* |
| *Rel-4* | *(Release 4)* |
| *Rel-5* | *(Release 5)* |
| *Rel-6* | *(Release 6)* |

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To avoid that a repeater amplifies the emissions of the donor base station. |
| ***Summary of change:*** | ⌘ | A correlation between out of ban gain and the coupling loss between the repeater and the donor base station is introduced. |
| ***Consequences if not approved:*** | ⌘ | A repeater could amplify the emission of a base station. |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | 3.1, 8.1, 8.2, 8.4.2, 8.5 |

| | Y | N | | | |
|---|---|---|---|---|---|
| ***Other specs affected:*** | X | | Other core specifications | ⌘ | TS25.106 |
| | | X | Test specifications | | |
| | | X | O&M Specifications | | |

| | | |
|---|---|---|
| ***Other comments:*** | ⌘ | Equivalent CRs in other Releases: CR12r1 cat. A to 25.143 v5.1.0 |

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2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**down-link:** signal path where base station transmits and mobile receives

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**Repeater:** a device that receives, amplifies and transmits the radiated or conducted RF carrier both in the down-link direction (from the base station to the mobile area) and in the up-link direction (from the mobile to the base station).

**Donor coupling loss:** is the coupling loss between the repeater and the donor base station.

**up-link:** signal path where mobile transmits and base station receives.

========== next changed section ==========

# 8 Out of band gain

## 8.1 Definitions and applicability

Out of band gain refers to the gain of the Repeater immediately outside the operating band. The measurements shall apply to both paths Uplink and Downlink of the Repeater.

## 8.2 Minimum Requirements

The intended use of a repeater in a system is to amplify the in band signals and not to amplify the out of band emission of the donor base station.
In the intended application of the repeater, the out of band gain is less than the donor coupling loss.
The repeater minimum donor coupling loss shall be declared by the manufacturer. This is this the minimum required attenuation between the donor BS and the repeater for proper repeater operation.

~~The requirement shall be met by a Repeater operating at maximum gain~~. In normal conditions as specified in section 5.4.1 the gain outside the operating band shall not exceed the maximum level specified in Table 8.1, where:

- f_offset is the distance from the centre frequency of the first or last 5 MHz channel within the operating band.

**Table 8.1: Out of band gain limits 1**

| Frequency offset from the carrier frequency, f_offset | Maximum ~~level~~gain |
|---|---|
| 2,7 ≤ f_offset < 3,5 MHz | 60 dB |
| 3,5 ≤ f < 7,5 MHz | 45 dB |
| 7,5 ≤ f_offset < 12,5 MHz | 45 dB |
| 12,5 MHz ≤ f_offset | 35 dB |

For 12,5 MHz ≤ f_offset MHz the out of band gain shall not exceed the maximum gain of table 8.2 or the maximum gain stated in table 8.1 whichever is lower.

**Table 8.2: Out of band gain limits 2**

| Repeater maximum output power as in 9.1.1.1 | Maximum gain |
|---|---|
| P < 31 dBm | t.b.d. |
| 31 dBm < P <= 43 dBm | Out of band gain ≤ minimum donor coupling loss |
| P > 43 dBm | Out of band gain ≤ minimum donor coupling loss – (P-43dBm) |
| Note 1: The out of band gain is considered with 12,5 MHz ≤ f_offset | |

# 8.3 Test purpose

The purpose of this test is to verify that the Repeater meets the out of band gain requirements as specified in TS 25.106.

# 8.4 Method of test

## 8.4.1 Initial conditions

Set-up the equipment as shown in annex A.

The test shall be performed with an offset between CW-signal and the first or last 5 MHz channel within the operating band of 2,7 MHz, 3 MHz, 3,5 MHz, 5 MHz, 7,5 MHz, 10 MHz, 12,5 MHz, 15 MHz and 20 MHz, excluding other operating bands. In addition the test shall also be performed for all harmonic frequencies of the repeaters operating band up to 12,75 GHz.

## 8.4.2 Procedure

1) Set the Repeater to maximum gain.

2) Set the signal generator to generate a CW-signal, applied to the input port of the Repeater. The power level of the RF input signal shall be at least 5 dB below the power level which, when applied within the operating band, would produce the maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

3) The average output power in each case shall be measured using a spectrum analyser connected to the output port of the Repeater and the net gain shall be recorded compared to table 8.3 or table 8.4 whichever is lower.

4) With the same input power as in step 1) set the repeater gain to the minimum specified by the manufacturer.

5) The average output power in each case shall be measured using a spectrum analyser connected to the output port of the Repeater and the net gain shall be recorded and compared to table 8.3 or table 8.4 whichever is lower.

# 8.5 Test requirements

**Table 8.32: Out of band gain limits**

| Frequency offset from the carrier frequency, f_offset | Maximum ~~level~~gain |
|---|---|
| 2,7 ≤ f_offset < 3,5 MHz | 60,5 dB |
| 3,5 ≤ f < 7,5 MHz | 45,5 dB |
| 7,5 ≤ f_offset < 12,5 MHz | 45,5 dB |
| 12,5 MHz ≤ f_offset | 35,5 dB |

**Table 8.4: Out of band gain limits 2**

| Repeater maximum output power as in 9.1.1.1 | Maximum gain |
|---|---|
| P < 31 dBm | t.b.d. |
| 31 dBm < P <= 43 dBm | Out of band gain ≤ minimum donor coupling loss + 0,5 dB |
| P > 43 dBm | Out of band gain ≤ minimum donor coupling loss – (P-43dBm) + 0,5 dB |
| Note 1: The donor coupling loss is considered with 12,5 MHz ≤ f_offset | |

**3GPP TSR RAN WG4 Meeting #24** **R4-021369**

**Helsinki, Finland 12 - 16 August 2002**

CR-Form-v7

# CHANGE REQUEST

⌘ **25.143** **CR** **12** ⌘ **rev** **1** ⌘ Current version: **5.1.0** ⌘

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***Proposed change affects:*** UICC apps⌘ ☐ ME ☐ Radio Access Network ☒ Core Network ☐

| | | | | |
|---|---|---|---|---|
| ***Title:*** | ⌘ | Out of band gain | | |
| ***Source:*** | ⌘ | RAN WG4 | | |
| ***Work item code:*** | ⌘ | RInImp-REP | ***Date:*** ⌘ | 21/08/2002 |
| ***Category:*** | ⌘ | **A** | ***Release:*** ⌘ | Rel-5 |

*Use one of the following categories:*
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***A*** *(corresponds to a correction in an earlier release)*
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*Use one of the following releases:*

| | |
|---|---|
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| *Rel-5* | *(Release 5)* |
| *Rel-6* | *(Release 6)* |

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To avoid that a repeater amplifies the emissions of the donor base station. |
| ***Summary of change:*** | ⌘ | A correlation between out of ban gain and the coupling loss between the repeater and the donor base station is introduced. |
| ***Consequences if not approved:*** | ⌘ | A repeater could amplify the emission of a base station. |

| | | | | | |
|---|---|---|---|---|---|
| ***Clauses affected:*** | ⌘ | 3.1, 8.1, 8.2, 8.4.2, 8.5 | | | |
| ***Other specs affected:*** | ⌘ | **Y** / **N** | Other core specifications | ⌘ | TS25.106 |
| | | **X** / | Other core specifications | | |
| | | / **X** | Test specifications | | |
| | | / **X** | O&M Specifications | | |
| ***Other comments:*** | ⌘ | Equivalent CRs in other Releases: CR11r1 cat. F to 25.143 v4.4.0 | | | |

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========== next changed section ==========

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**Table 8.2: Out of band gain limits 2**

| Repeater maximum output power as in 9.1.1.1 | Maximum gain |
|---|---|
| P < 31 dBm | t.b.d. |
| 31 dBm < P <= 43 dBm | Out of band gain ≤ minimum donor coupling loss |
| P > 43 dBm | Out of band gain ≤ minimum donor coupling loss – (P-43dBm) |
| Note 1: The out of band gain is considered with 12,5 MHz ≤ f_offset | |

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The purpose of this test is to verify that the Repeater meets the out of band gain requirements as specified in TS 25.106.

## 8.4 Method of test

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The test shall be performed with an offset between CW-signal and the first or last 5 MHz channel within the operating band of 2,7 MHz, 3 MHz, 3,5 MHz, 5 MHz, 7,5 MHz, 10 MHz, 12,5 MHz, 15 MHz and 20 MHz, excluding other operating bands. In addition the test shall also be performed for all harmonic frequencies of the repeaters operating band up to 12,75 GHz.

### 8.4.2 Procedure

1) Set the Repeater to maximum gain.

2) Set the signal generator to generate a CW-signal, applied to the input port of the Repeater. The power level of the RF input signal shall be at least 5 dB below the power level which, when applied within the operating band, would produce the maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

3) The average output power in each case shall be measured using a spectrum analyser connected to the output port of the Repeater and the net gain shall be recorded compared to table 8.3 or table 8.4 whichever is lower.

4) With the same input power as in step 1) set the repeater gain to the minimum specified by the manufacturer.

5) The average output power in each case shall be measured using a spectrum analyser connected to the output port of the Repeater and the net gain shall be recorded and compared to table 8.3 or table 8.4 whichever is lower.

## 8.5 Test requirements

**Table 8.32: Out of band gain limits**

| Frequency offset from the carrier frequency, f_offset | Maximum ~~level~~gain |
|---|---|
| 2,7 ≤ f_offset < 3,5 MHz | 60,5 dB |
| 3,5 ≤ f < 7,5 MHz | 45,5 dB |
| 7,5 ≤ f_offset < 12,5 MHz | 45,5 dB |
| 12,5 MHz ≤ f_offset | 35,5 dB |

**Table 8.4: Out of band gain limits 2**

| Repeater maximum output power as in 9.1.1.1 | Maximum gain |
|---|---|
| P < 31 dBm | t.b.d. |
| 31 dBm < P <= 43 dBm | Out of band gain ≤ minimum donor coupling loss + 0,5 dB |
| P > 43 dBm | Out of band gain ≤ minimum donor coupling loss – (P-43dBm) + 0,5 dB |
| Note 1: The donor coupling loss is considered with 12,5 MHz ≤ f_offset | |