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3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

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Foreword

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1 Scope

The present document is the technical report for the work item on Multi-standard radio Base Station RF requirements for non-contiguous spectrum deployments, which was approved at TSG RAN#48. The objective of the WI is to specify RF requirements for MSR specifications such that common RF components can be used for multi-RAT deployments where more than one spectrum block is in use, and where the blocks are non-contiguous in frequency within a band.

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 25.104: "Base Station (BS) radio transmission and reception (FDD)".

[3] 3GPP TS 25.105: "Base Station (BS) radio transmission and reception (TDD)".

[4] 3GPP TS 36.104: "Base Station (BS) radio transmission and reception".

[5] 3GPP TS 45.005: "Radio transmission and reception".

[6] 3GPP TS 37.104: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) radio transmission and reception"

[7] 3GPP TS 25.141: "Base Station (BS) conformance testing (FDD)".

[8] 3GPP TS 25.142: "Base Station (BS) conformance testing (TDD)".

[9] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing".

[10] 3GPP TS 51.021: "Base Station System (BSS) equipment specification; Radio aspects".

[11] 3GPP TS 37.141: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing".

[12] 3GPP TR 37.900: "Radio Frequency (RF) requirements for Multicarrier and Multiple Radio Access Technology (Multi-RAT) Base Station (BS)".

[13] ITU-R SM.329-10 Recommendation, "Unwanted emissions in the spurious domain".

[14] CEPT/ERC/Recommendation 74-01 (Siófok 98, Nice 99, Sesimbra 02, Hradec Kralove 05, Cardiff 11), "Unwanted Emissions in the Spurious Domain".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [x] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Band category: A group of operating bands for which the same MSR scenarios apply

Base Station RF bandwidth: The bandwidth in which a Base Station transmits and receives multiple carriers and/or RATs simultaneously

Base Station RF bandwidth edge: The frequency of one of the edges of the Base Station RF bandwidth

Carrier: The modulated waveform conveying the E-UTRA, UTRA or GSM physical channels

Carrier power: The power at the antenna connector in the channel bandwidth of the carrier averaged over at least one subframe for E-UTRA, at least one slot for UTRA and the useful part of the burst for GSM.

Contiguous spectrum: Spectrum consisting of a contiguous block of spectrum with no sub-block gaps.

Channel bandwidth: The bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

Downlink operating band: The part of the operating band designated for downlink.

Lower RF bandwidth edge: The frequency of the lower edge of the Base Station RF bandwidth, used as a frequency reference point for transmitter and receiver requirements

Lower sub-block edge: The frequency at the lower edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

Maximum Base Station RF bandwidth: The maximum RF bandwidth supported by a BS within an operating band.

NOTE: The Maximum Base Station RF bandwidth for BS configured for contiguous and non-contiguous operation is declared separately.

Maximum carrier power: Carrier power available at the antenna connector for a specified reference condition.

Maximum RAT power: RAT power available at the antenna connector for a specified reference condition.

Maximum throughput: The maximum achievable throughput for a reference measurement channel.

Maximum total output power: Total output power available at the antenna connector for a specified reference condition.

Measurement bandwidth: The bandwidth in which an emission level is specified.

MSR Base Station: Base Station characterized by the ability of its receiver and transmitter to process two or more carriers in common active RF components simultaneously in a declared RF bandwidth, where at least one carrier is of a different RAT than the other carrier(s).

Multi-carrier transmission configuration: A set of one or more contiguous carriers that a BS is able to transmit simultaneously according to the manufacturer's specification.

Necessary bandwidth: The width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions (as defined in [6]).

Non-contiguous spectrum: Spectrum consisting of two or more sub-blocks separated by sub-block gap(s).

Occupied bandwidth: The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean power of a given emission.

Operating band: A frequency range in which E-UTRA, UTRA or GSM operates (paired or unpaired), that is defined with a specific set of technical requirements.

NOTE: The operating band(s) for a BS is declared by the manufacturer.

RAT power: The sum of all carrier powers for all carriers of the same type.

RRC filtered mean power: The mean power of a UTRA carrier as measured through a root raised cosine filter with roll-off factor α and a bandwidth equal to the chip rate of the radio access mode.

NOTE: The RRC filtered mean power of a perfectly modulated UTRA signal is 0.246 dB lower than the mean power of the same signal.

Sub-block: One contiguous allocated block of spectrum for use by the same Base Station. There may be multiple instances of sub-blocks within the RF bandwidth.

Sub-block bandwidth: The bandwidth of one sub-block.

Sub-block gap: A frequency gap between two consecutive sub-blocks within an RF bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

Throughput: The number of payload bits successfully received per second for a reference measurement channel in a specified reference condition.

Total output power: The sum of all carrier powers for all carriers transmitted by the BS.

Transmission bandwidth: Bandwidth of an instantaneous E-UTRA transmission from a UE or BS, measured in Resource Block units.

Transmission bandwidth configuration: The highest E-UTRA transmission bandwidth allowed for uplink or downlink in a given channel bandwidth, measured in Resource Block units.

Uplink operating band: The part of the operating band designated for uplink.

Upper RF bandwidth edge: The frequency of the upper edge of the Base Station RF bandwidth, used as a frequency reference point for transmitter and receiver requirements

Upper sub-block edge: The frequency at the upper edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

α	Roll-off factor
β	Percentage of the mean transmitted power emitted outside the occupied bandwidth on the assigned channel
$BW_{Channel}$	Channel bandwidth (for E-UTRA)
BW_{Config}	Transmission bandwidth configuration (for E-UTRA), expressed in MHz, where $BW_{Config} = N_{RB}$ x 180 kHz in the uplink and BW_{Config} = 15 kHz + N_{RB} x 180 kHz in the downlink.
BW_{RF}	Base Station RF bandwidth, where $BW_{RF} = F_{BW\ RF,high} - F_{BW\ RF,low}$
$BW_{RF,max}$	Maximum Base Station RF bandwidth
f	Frequency
Δf	Separation between the Base Station RF bandwidth edge frequency and the nominal -3dB point of the measuring filter closest to the carrier frequency
Δf_{max}	The largest value of Δf used for defining the requirement
F_C	Carrier centre frequency
f_offset	Separation between the Base Station RF bandwidth edge frequency and the centre of the measuring filter
f_offset_{max}	The maximum value of f_offset used for defining the requirement
$F_{block,high}$	Upper sub-block edge, where $F_{block,high} = F_{C,block,high} + F_{offset,\ RAT}$
$F_{nlock,low}$	Lower sub-block edge, where $F_{block,low} = F_{C,block,low} - F_{offset,\ RAT}$
$F_{BW\ RF,high}$	Upper RF bandwidth edge, where $F_{BW\ RF,high} = F_{C,high} + F_{offset,\ RAT}$
$F_{BW\ RF,low}$	Lower RF bandwidth edge, where $F_{BW\ RF,low} = F_{C,low} - F_{offset,\ RAT}$

$\mathbf{F_{C,block,high}}$	Center frequency of the highest transmitted/received carrier in a sub-block.
$\mathbf{F_{C,block,low}}$	Center frequency of the lowest transmitted/received carrier in a sub-block.
$\mathbf{F_{C,high}}$	Center frequency of the highest transmitted/received carrier in the RF bandwidth.
$\mathbf{F_{C,low}}$	Center frequency of the lowest transmitted/received carrier in the RF bandwidth.
$\mathbf{F_{offset,RAT}}$	Frequency offset from the centre frequency of the *highest* transmitted/received carrier to the *upper* RF bandwidth edge or sub-block edge, or from the centre frequency of the *lowest* transmitted/received to the *lower* RF bandwidth edge or sub-block edge for a specific RAT.
F_{DL_low}	The lowest frequency of the downlink operating band
F_{DL_high}	The highest frequency of the downlink operating band
F_{UL_low}	The lowest frequency of the uplink operating band
F_{UL_high}	The highest frequency of the uplink operating band
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks (for E-UTRA)
$P_{REFSENS}$	Reference Sensitivity power level
W_{gap}	Sub-block gap size

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [x] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

ACIR	Adjacent Channel Interference Ratio
ACLR	Adjacent Channel Leakage Ratio
ACK	Acknowledgement (in HARQ protocols)
ACS	Adjacent Channel Selectivity
ARFCN	Absolute Radio Frequency Channel Number
AWGN	Additive White Gaussian Noise
BC	Band Category
BER	Bit Error Ratio
BS	Base Station
BTS	Base Transceiver Station
CACLR	Cumulative Adjacent Channel Leakage Ratio
CP	Cyclic prefix
CRC	Cyclic Redundancy Check
CS	Capability Set
CW	Continuous Wave
DC	Direct Current
DB-DC-HSDPA	Dual Band Dual Cell HSDPA
DC-HSDPA	Dual Cell HSDPA
DTX	Discontinuous Transmission
DTT	Digital Terrestrial Television
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EVM	Error Vector Magnitude
FDD	Frequency Division Duplex
FRC	Fixed Reference Channel
GP	Guard Period (for E-UTRA TDD operation)
GSM	Global System for Mobile Communications
HSDPA	High Speed Downlink Packet Access
ICS	In-Channel Selectivity
ITU-R	Radiocommunication Sector of the ITU
LNA	Low Noise Amplifier
MC	Multi-Carrier (in single RAT)
MCL	Minimum Coupling Loss
MCS	Modulation and Coding Scheme
MIMO	Multiple Input Multiple Output
MR	Multi-RAT
MS	Mobile Station
MSR	Multi-standard Radio
OFDM	Orthogonal Frequency Division Multiplex
OOB	Out-of-band
PA	Power Amplifier
PHS	Personal Handyphone System

QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase-Shift Keying
RAT	Radio Access Technology
RB	Resource Block
RF	Radio Frequency
RMS	Root Mean Square (value)
RS	Reference Symbol
RX	Receiver
RRC	Root Raised Cosine
SC	Single Carrier
SNR	Signal-to-Noise Ratio
SR	single-RAT
TC	Test Configuration
TDD	Time Division Duplex
TD-SCDMA	Time Division Synchronous Code Division Multiple Access
TX	Transmitter
UARFCN	UTRA Absolute Radio Frequency Channel Number
UE	User Equipment

4 General

A work item to specify RF performance requirements for Multi-Standard Radio (MSR) Base Stations (BS) was completed in RAN#47. However, the specification work only considered multi-RAT deployments where the spectrum transmitted within a band using common RF components was considered to be a single contiguous spectrum block. Therefore the scenario where common RF components are transmitting multiple non-contiguous spectrum blocks within a band is not currently considered within the MSR specifications, and the assumption is that different RF components would need to be used for each block to ensure coexistence with other operators using the spectrum in between these blocks.

Given that the above non-contiguous block scenario exists in today's networks, it is essential that MSR BS requirements cover this case to allow operators to maximise the usage of MSR in the field, and for the cost saving benefits it brings.

Note that such requirements are already available for MC-BTS in GERAN.

4.1 Work item objective

The objective of the MSR-NC work item is to specify RF requirements for MSR specifications such that common RF components can be used for multi-RAT deployments where more than one spectrum block is in use, and where the blocks are non-contiguous in frequency within a band. It is originally proposed in the WID to primarily focus on the following scenario:

- Non-contiguous spectrum operation in 900MHz and 1800MHz where LTE, UTRA, and GSM deployment is considered, also considering the possibility that LTE is deployed in smaller spectrum blocks than 5MHz as well as equal and larger than 5MHz.

The objective of the WI will be to finalize MSR-NC requirements for all bands in BC1 and BC2. The reason is that most requirement are operating band agnostic and it is possible to write generic requirements that do not depend on specific scenarios for non-contiguous spectrum.

The work will focus on following steps:

1. Definition of the configuration scenarios to be reflected in specifications to ensure predictable MSR operation in practical deployed configurations.

2. Analyze if new requirements are needed in core specifications, only applicable in non-contiguous spectrum allocations.

3. Creation of the core requirements for dealing with the non-contiguous spectrum (for agreed cases)

4. Development of test configurations and specification of the test requirements corresponding to the core requirements applicable in non-contiguous spectrum allocations.

5. Requirements for MSR BS operating in contiguous spectrum shall remain unchanged.

The following specification work is required:

a. Core requirements RAN4 MSR specifications

b. Test requirements in RAN4 MSR specifications

4.2 Relation to other RAN and GERAN specifications

The core requirements for MSR are in most parts specified explicitly in TS 37.104 [6], while many requirements are also specified through normative references to the respective single-RAT specifications. These are in TR 37.900 [12] divided into three types:

1. **Generic MSR requirement:** A common generic requirement that applies for all RATs and for BS configured for both multi-RAT and single-RAT operation. In some cases, there are additional requirement(s) that apply only in some Band Category. There are no references to the single-RAT specifications.

2. **Generic MSR requirement, with additional single-RAT requirements:** A common generic requirement which applies as in point 1. In addition some single RAT requirement(s) apply, included by normative reference(s) to the single-RAT specification(s).

3. **Single-RAT only requirements:** In this case, no common generic requirement is defined. The existing single-RAT requirement applies for each RAT, included by normative reference(s) to the single-RAT specification(s).

The same requirements will apply for MSR in non-contiguous spectrum and the relation to other RAN and GERAN specifications will be the same, where single-RAT requirements are included by reference.

For single-RAT references to GERAN specifications [5][10], the GERAN requirement are in general applicable in non-contiguous spectrum, since that is within the scope of the GERAN specification. The requirements for GSM single RAT in MSR refer to the MCBTS specifications. The relationship to GERAN is the same as contiguous spectrum MSR. The details of how they apply are specified by TSG GERAN and do not require any specific treatment in TS 37.104 [6].

The scope of the UTRA specifications cover contiguous spectrum. For single-RAT references to the UTRA specifications [2][7], the single-RAT requirement will however apply also for non-contiguous spectrum, unless otherwise stated.

The scope of the E-UTRA specifications in Rel-10 presently covers contiguous spectrum. Non-contiguous spectrum aggregation is planned to be introduced in Rel-11. For this reason, definitions and terminology in non-contiguous spectrum should be aligned between MSR-NC in the MSR specifications [6][11] and LTE Carrier aggregation, which will be applied in both MSR and E-UTRA specifications [4][9]. For single-RAT references to the E-UTRA specifications [4][9], the single-RAT requirement will apply also for non-contiguous spectrum, unless otherwise stated.

The relation to the single-RAT specification can be kept unchanged for non-contiguous spectrum operation. No changes will be needed for TS 37.104 [6] in the general subclause 4.1 for "Relation to other RAN and GERAN specifications". If the applicability of any requirement is changed, that should be reflected in clause 5 of TS 37.104 [6].

The applicability of each requirement for MSR BS is described in TS 37.104 [6] clause 5.

4.3 Regional requirements

Since all the regional requirements listed in Table 4.4-1 of specification TS37.104 [6] are operation configuration independent, no changes are needed.

4.4 Manufacturer's declaration

The manufacturer shall declare which operational configurations the BS supports by declaring the following parameters:

a) General Parameters:

- Support of the BS in non-contiguous spectrum operation.
- The supported operating bands defined in subclause 4.4.
- The frequency range within the above frequency band(s) supported by the BS.
- Supported capability set
- The maximum RF bandwidth supported by a MSR BS within an operating band when the BS is configured with carriers of different RATs
  - for contiguous spectrum operation.
  - for non-contiguous spectrum operation
- The rated total output power as a sum over all RATs
  - for contiguous spectrum operation
  - for non-contiguous operation
- Maximum supported power difference between carriers
- Total number of supported carriers

If the rated total output power and total number of supported carriers are not simultaneously supported in Multi-RAT operations, the manufacturer shall declare the following additional parameters:

- The reduced number of supported carriers at the rated total output power in Multi-RAT operations(i.e. < total number of supported carriers)
- The reduced total output power at the total number of supported carriers in Multi-RAT operations (i.e. < rated total output power)

b) Parameters related to operation of GSM:

- The maximum number of supported GSM carriers
- The maximum RF bandwidth supported by the MSR BS when configured with GSM carriers only
  - for contiguous spectrum operation
  - for non-contiguous spectrum operation
- The rated output power per GSM carrier for each supported number of GSM carriers up to the maximum, for the case that all carriers are operated at the same nominal output power,
  - for contiguous spectrum operation
  - for non-contiguous operation

  The declaration shall be given for each supported modulation scheme.

c) Parameters related to operation of UTRA:

- The maximum number of supported UTRA carriers
- The maximum RF bandwidth supported by the MSR BS when configured with UTRA carriers only
  - for contiguous spectrum operation
  - for non-contiguous spectrum operation
- The rated output power for UTRA as a sum of all UTRA carriers
  - for contiguous spectrum operation

    - for non-contiguous spectrum operation
- The rated output power per UTRA carrier
    - for contiguous spectrum operation
    - for non-contiguous operation

d) Parameters related to operation of E-UTRA:

- Which of the E-UTRA channel bandwidths specified in TS 36.104 [5] clause 5.6 are supported
- The maximum number of supported E-UTRA carriers
- The maximum RF bandwidth supported by the MSR BS when configured with E-UTRA carriers only
    - for contiguous spectrum operation
    - for non-contiguous spectrum operation
- The rated output power for E-UTRA as a sum of all E-UTRA carriers
    - for contiguous spectrum operation
    - for non-contiguous spectrum operation
- The rated output power per E-UTRA carrier
    - for contiguous spectrum operation
    - for non-contiguous operation

If the parameters for contiguous and non-contiguous spectrum operation are declared identical, duplicated testing could be avoided. This needs to be considered on a case-by-case basis.

5 Non-contiguous deployment scenarios

5.1 Definitions and terminology

5.1.1 General MSR definitions

The definitions of operating bands, band numbering, channel arrangements, channel spacing, channel raster and channel numbering remains from what is defined for MSR in subclause 5.1.1 of TR 37.900 [12].

5.1.2 MSR-NC specific definitions

The MSR definitions of the RF bandwidth and related parameters for contiguous spectrum allocations remain in principle from what is set out in subclause 5.1.2 of TR 37.900 [12].

A non-contiguous spectrum allocation is split into two or more sub-blocks, each with an individual sub-block bandwidth. An un-coordinated operator may be using the spectrum inside the sub-block gaps, implying a similar co-existence scenario as when an un-coordinated operator is using spectrum outside the RF bandwidth. When the BS is configured for non-contiguous operation, it therefore must have transmitter and receiver RF characteristics inside the sub-block gaps that are similar to the characteristics defined outside the RF bandwidth.

The following terminology and symbols applies for MSR non-contiguous RF bandwidth related aspects. This terminology is illustrated in Figure 5.1.2-1 and Figure 5.1.2-2.

Base Station RF bandwidth: Existing definition for MSR [12], applicable for multiple carriers that are either contiguous or non-contiguous.

Maximum Base Station RF bandwidth: The maximum RF bandwidth supported by a BS within an operating band . The Maximum Base Station RF bandwidth for BS configured for contiguous and non-contiguous operation is declared separately.

Sub-block: One contiguous allocated block of spectrum for use by the same Base Station. There may be multiple instances of sub-blocks within the RF bandwidth.

Sub-block bandwidth: The bandwidth of one sub-block.

Sub-block gap: The frequency gap between the two consecutive sub-blocks within an RF bandwidth.

Upper sub-block edge: The frequency at the upper edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

Lower sub-block edge: The frequency at the lower edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

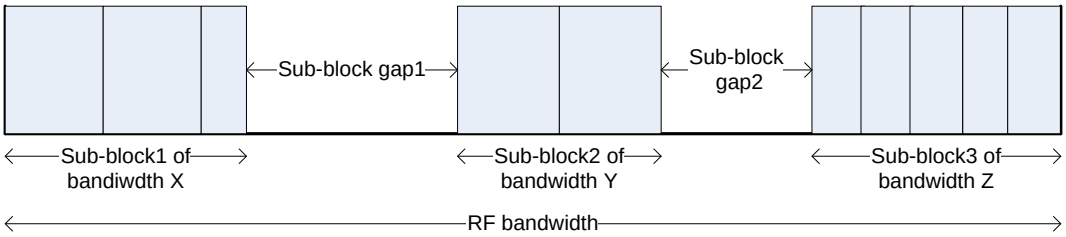


Figure 5.1.2-1: Graphical description of suggested terminology

The concept used for MSR-NC is to reuse as much as possible the existing MSR definitions, as they will impact the definition of the subsequent requirements. In this way, it is possible to re-use the structure of existing requirements. The main parameter is the RF bandwidth, which is not a declared parameter but merely a construct to apply the RF requirements, and will for MSR-NC be applied also for non-contiguous allocations. The Maximum RF bandwidth, $BW_{RF,max}$, on the other hand is a BS HW capability and is declared by the manufacturer. The HW capability may be different between contiguous and non-contiguous MSR and will need separate declarations. The parameters defining the RF bandwidth can be maintained from MSR [12], namely $F_{C,high}$, $F_{C,low}$, $F_{offset,RAT}$, $F_{BW\ RF,high}$ and $F_{BW\ RF,low}$.

Since there will be multiple sub-blocks within the RF bandwidth for the non-contiguous case and requirements can be applied in an equivalent fashion to the sub blocks, there are equivalent definitions defining the sub-block bandwidth: $F_{C,block,high}$, $F_{C,block,low}$, $F_{block,high}$ and $F_{block,low}$, as illustrated in Figure 5.1.2-2. It is assumed that the same $F_{offset,RAT}$ values applies as for contiguous MSR. This also means that the Sub-block Bandwidth is also not a declared parameter, but a mere construct to apply the RF requirements. The sub-block gap merely defines the gap between two consecutive sub-blocks.

From regulatory point of view, the sub-block edges would normally also correspond to the license block edges for an operator, with an un-coordinated operator in the sub-block gap. The RF scenarios at the sub-block edges are therefore potentially the same as for the RF bandwidth edges for contiguous MSR.

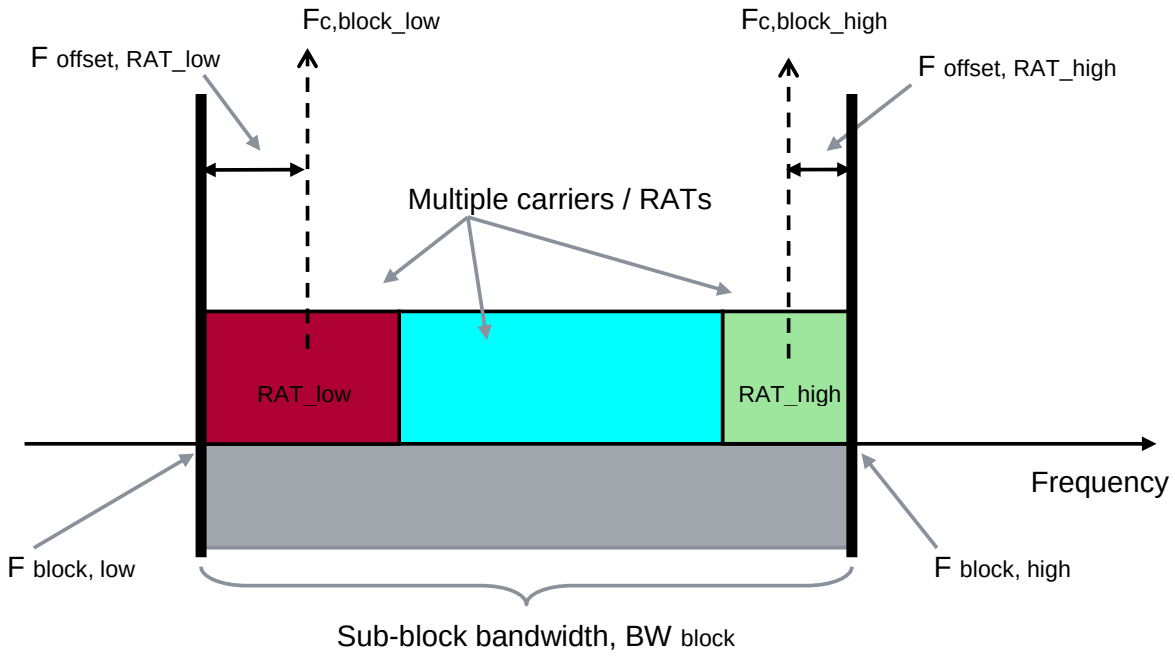
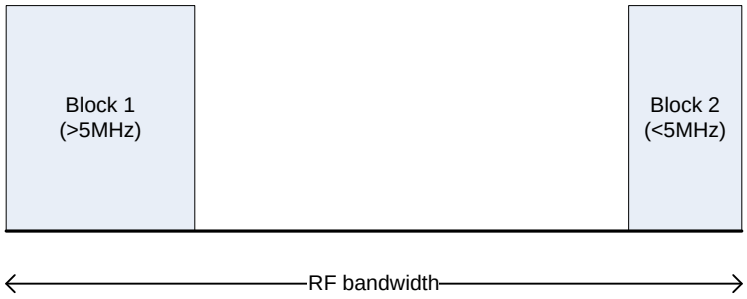


Figure 5.1.2-2: Illustration of sub-block bandwidth and related parameters.

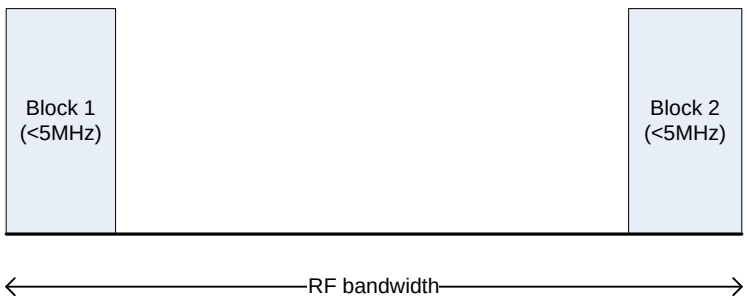
5.2 Operator scenarios

There is an infinite set of possible deployment scenarios where the spectrum is non-contiguous. Some example scenarios are presented below:

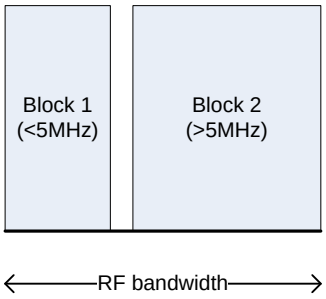
Scenario 1a: Two sub-blocks with large sub-block gap



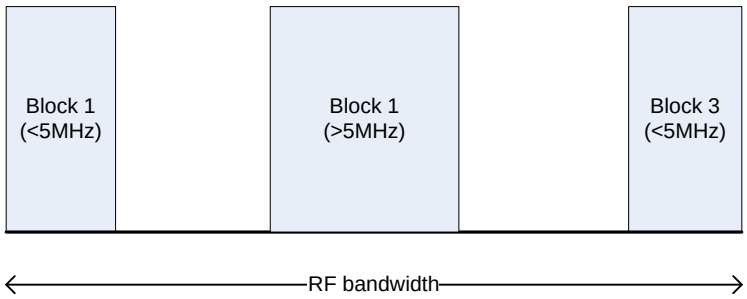
Scenario 1b: Two sub-blocks with large sub-block gap



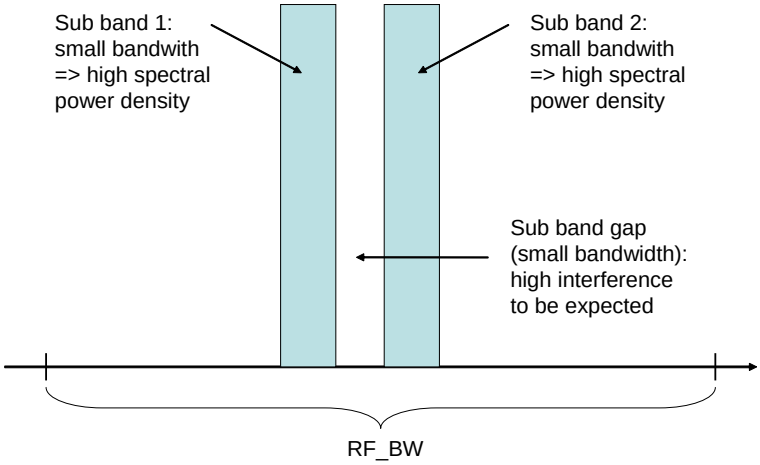
Scenario 2: Two sub-blocks with small sub-block gap



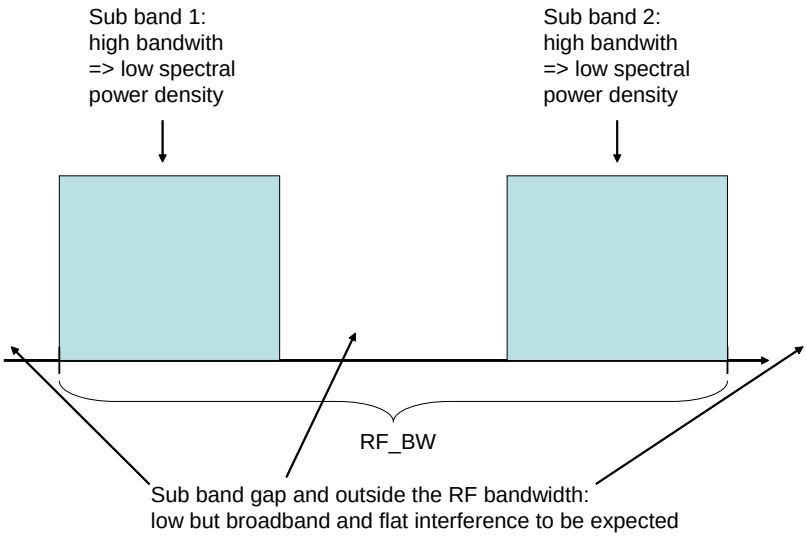
Scenario 3: Three sub-blocks with medium sub-block size



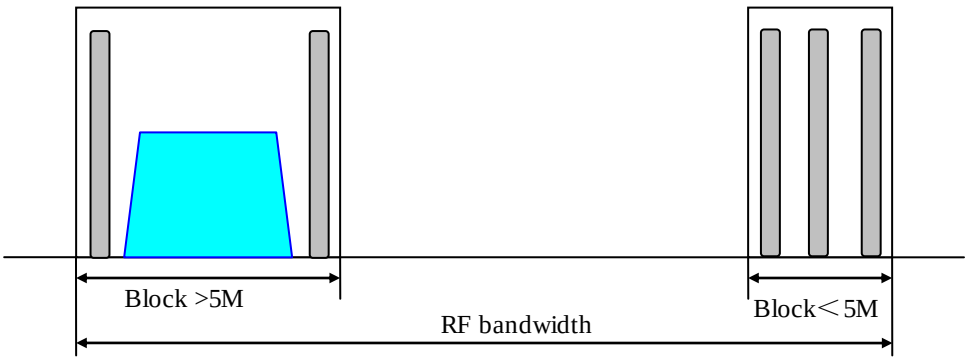
Scenario 4: Two sub-blocks with small sub-block size and sub-block gap



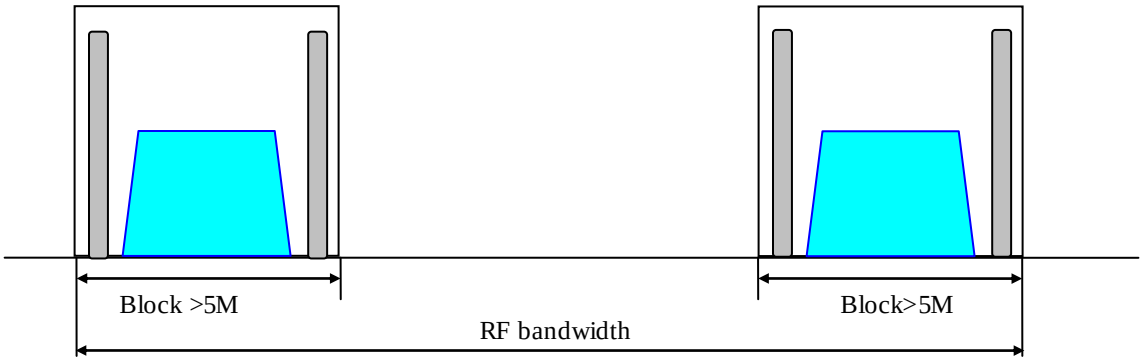
Scenario 5: Two sub-blocks with large sub-block size and sub-block gap



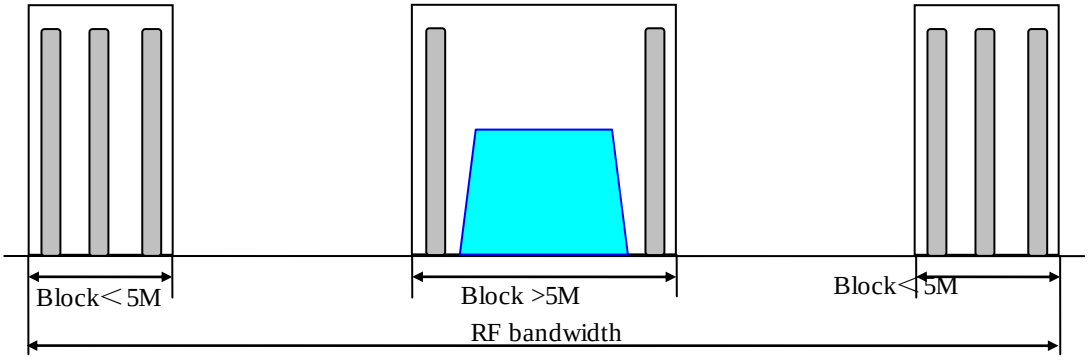
Scenario 6: Two sub-blocks with one sub-block bandwidth bigger than 5MHz and the other small than 5MHz;



Scenario 7: Two sub-blocks with both sub-blocks bandwidth bigger than 5MHz;



Scenario 8: Three sub-blocks with outer most sub-blocks bandwidth small than 5MHz and middle sub-blocks bigger than 5MHz;



5.3 Scenario implications

A scenario based standard would in principle be restricted to the scenarios it is based on and due to the almost infinite set of possible scenarios and carrier/RAT deployment for non contiguous spectrum as shown in 5.2, such a standard would potentially also become complex. Every additional arising scenario or carrier deployment within the particular scenario would also require additional standardization. It is also questionable whether MSR-NC capable equipment could be deployed in cases where there is deviation from the scenarios that the requirements are based on.

5.4 Generic approach

The alternative to scenario based requirements is a “generic approach”, where the requirements are assumed to apply for all possible scenarios within a certain limitation. There are a few areas that need to be considered for MSR in non-contiguous spectrum for developing such an approach:

- Broadband transmitter characteristics
- Broadband receiver characteristics
- Gap requirements
- Declared parameters and their relation to testing.

For the broadband transmitter characteristics, extensive work was conducted in RAN4 during the MSR Work item [12] with the conclusion that the strictest scenario is with a high PSD carrier at the edges of the RFBW. This lead to a design of the MSR transmit test configuration which stresses the peak reduction schemes as well as the linearization properties of the transmitter.

For the non-contiguous MSR case, the gaps can belong to another un-coordinated operator. For this reason, requirements inside the gaps should be similar to the ones at the RFBW edges. Assuming that the edge requirements and gap requirements are similar, there is not much difference between contiguous and non-contiguous scenarios given a declared maximum RF bandwidth. From linearization point of view, the linearization bandwidth is several times larger than the declared maximum RFBW to handle the edge requirements such as UEM and thus linearization will apply both for edges and in the gaps. The most fundamental issue and challenge with MSR-NC is the declared maximum RF bandwidth and not the specific non-contiguous scenarios that such equipment would be deployed for. It is thus crucial that the requirements apply when different RATs and carriers are deployed all over the declared RFBW, not allowing for testing on a per sub-block basis.

For the broadband receiver needed for MSR, the non-contiguous case implies that there are similar requirements for the gaps as for the block edges, since the gaps belong to uncoordinated operators.

Since both receiver and transmitter requirements needed for the gaps can be similar to the requirements for the block edges, MSR-NC can in fact be treated in the same way as contiguous MSR as long as proper MSR-NC specific test configurations are applied that cover the most stressful scenarios, completely based on declared parameters.

The generic approach considering the broadband receiver and transmitter characteristics is based on the equivalence between contiguous and non-contiguous MSR and implies the following:

- MSR in non-contiguous spectrum is treated as contiguous MSR, with thr proper new test configurations to stress the receiver and transmitter characteristics.
- The current requirements for the RF BW edges are maintained and equivalent requirements are introduced in the gaps.

5.5 Principles for implementing requirements for non-contiguous spectrum

Based on the generic approach discussed in subclause 5.4, the requirements for MSR in non-contiguous spectrum are expressed in a generic format. The main implication is that requirement are in general applicable for operation in both contiguous and non-contiguous spectrum and that the requirements in the sub-block gaps should be equivalent the ones at the RF bandwidth edges.

In the core specification, this is implemented in the following way:

- A new subclause "4.7 Requirements for contiguous and non-contiguous spectrum" is introduced, explaining that requirements in general apply for both contiguous and non-contiguous spectrum, unless otherwise stated.
- For requirements that apply for both contiguous and non-contiguous spectrum, there is no special statement needed for the requirements in clause 6 and 7, since there is a global statement in subclause 4.7 about the general applicability.
- For requirements that apply both at the RF bandwidth edges and in the sub block gaps, there should be separate statements for how the requirement applies in each case.
- In cases where the requirement limits at the RF bandwidth edge and in the sub-block gap are equivalent (in line with the generic approach), the limits as expressed in tables or similar are not to be unnecessarily repeated.
- In cases where a requirement can only be partially applied inside the sub-block gaps (depending on e.g. the gap size), such limitations are explained within the requirement.
- All requirements for MSR operation in non-contiguous spectrum are implemented in such a way that requirements for MSR BS operating in contiguous spectrum remain unchanged.

MSR-NC is a work item acronym that refers to MSR BS for non-contiguous spectrum deployments. Since "non-contiguous spectrum" is an attribute of the spectrum and not of the MSR Base Stations, the acronym "MSR-NC" is not used in the MSR specifications. Reference is instead made to "MSR BS operating in non-contiguous spectrum", where appropriate.

6 Transmitter characteristics

6.1 General

Transmitter requirements for BS in non-contiguous spectrum will apply in the same way as in contiguous spectrum, thus no change is needed for subclause 6.1 of TS 37.104 [6]. A general statement on how requirements apply in contiguous and non-contiguous spectrum respectively is made in the new subclause 4.7 in TS 37.104. This is further discussed in subclause 5.5.

6.2 Base station output power

In existing Rel-9 specification for contiguous MSR, maximum total output power, maximum RAT output power and maximum carrier output power are defined for BS output power requirement. The requirement consists of a limit on the maximum carrier output power relative to the configured carrier power declared by the manufacturer. This requirement can be kept unchanged for BS supporting non-contiguous spectrum operation.

The declaration of BS output power and other parameters is further discussed in subclause 4.4.

6.3 Output power dynamics

In existing Rel-9 specification for contiguous MSR, output power dynamics is specified per single RAT only and no common generic requirement is defined. The requirement can be kept unchanged for BS supporting non-contiguous spectrum operation.

6.4 Transmit ON/OFF power

This requirement applies for UTRA and E-UTRA TDD operation in BC3, and is thus not applicable to non-contiguous spectrum in BC1 or BC2.

6.5 Transmitted signal quality

6.5.1 Modulation quality

The modulation quality in existing specification for contiguous MSR is specified per single RAT. This requirement can be kept unchanged for BS supporting non-contiguous spectrum operation.

6.5.2 Frequency error

Frequency error is a measure of the difference between the actual BS transmit frequency and the assigned frequency. This requirement can be kept unchanged for BS supporting non-contiguous spectrum operation.

6.5.3 Time alignment between transmitter branches

Time alignment requirement in existing specification for contiguous MSR is specified per single RAT. This requirement can be kept unchanged for BS supporting non-contiguous spectrum operation.

6.6 Unwanted emissions

6.6.1 Transmitter spurious emissions

The transmitter spurious emission limits apply from 9 kHz to 12.75 GHz, excluding the frequency range from 10 MHz below the lowest frequency of the downlink operating band up to 10 MHz above the highest frequency of the downlink operating band. It is a generic requirement that applies regardless of operation mode, as stated in TS 37.104, subclause 6.6.1. The same limits should apply for MSR BS operating in non-contiguous spectrum deployments as in contiguous spectrum and no changes for BS operation in non-contiguous spectrum operation are needed.

Spurious emission limits as defined in international regulations apply in the spurious domain. MSR spurious emission limits and operating band unwanted emission limits are both to a large part in the frequency range of the spurious domain. The frequency boundary of the spurious domain depends on the *necessary bandwidth* as defined in international regulations. This is further discussed in TR 37.900 [12] and in subclause 6.6.5.

6.6.2 Operating band unwanted emissions

Operating band unwanted emission limits are defined from 10 MHz below the lowest frequency of the downlink operating band to the lower RF bandwidth edge and from the upper RF bandwidth edge up to 10 MHz above the highest frequency of the downlink operating band. There are general minimum requirements for BC1+BC3 and for BC2, GSM single-RAT requirements and additional requirements based on regional regulation.

The generic approach described in subclause 5.4 is based on the equivalence between contiguous and non-contiguous MSR and that MSR in non-contiguous spectrum is in general treated as contiguous MSR. This means that the current

Operating band unwanted emissions requirements for the RF BW edges are maintained and that there will be equivalent requirements introduced in the gaps.

The operating band unwanted emission limits for MSR are based on the definitions of out-of-band domain and spurious domain emissions in international regulation, see also discussion in subclause 6.6.5 and TR 37.900 [12]. The conclusion from the discussion in 6.6.5 is that the present definitions can be applied also to non-contiguous spectrum allocations in essentially all realistic scenarios.

In order to maintain equivalence also with scenarios where the individual sub-blocks in a non-contiguous spectrum allocation are generated using separate BS transmitters, a cumulative approach is used. This means that emissions limits in the gap are calculated as the sum of the limits relative to the to the adjacent sub blocks on each side of the gap.

Application of operating band unwanted emission limits are introduced in the core specification TS 37.104 [6], subclause 6.6.2 through the following additions to the BC1+BC3 and the BC2 general requirements:

- It is stated that the general requirement outside the RF bandwidth edges always applies. The existing application of the Δf and f_offset parameters is used for this case.

- A new requirement inside the sub block gap(s) is introduced based on a cumulative approach. A new application of the Δf and f_offset parameters relative to the sub block edges is introduced in this case. In this way, the existing requirement tables can be re-used unchanged.

The GSM single-RAT requirements in subclause 6.6.2.3 and the additional (regulatory) requirements in subclause 6.6.2.4 in TS 37.104 remain unchanged and thus apply for MSR BS in both contiguous and non-contiguous spectrum.

In the discussion of necessary bandwidth in subclause 6.6.5, it is concluded that individual sub-blocks can be smaller than 5 MHz, assuming that the sum of the sub-block bandwidths is at least 5 MHz. It is also noted that for sub-block bandwidth less than 5 MHz, the scenario is similar to the case with GSM /EDGE carriers or E-UTRA 1.4 or 3 MHz carrier at the RF bandwidth edge for MSR BS in contiguous spectrum operation. The existing UEM can therefore be re-used also for sub-block bandwidth less than 5 MHz in non-contiguous spectrum operation.

The cumulative emission level is related to gap sizes. As shown in Figure 6.6.2-1, for example, there is about 2.8 dB difference for the cumulative level of position A between gap size = 400KHz and gap size =5 MHz. In order to reduce the complication of application in conformance test, detailed tables shall be defined in test specification.

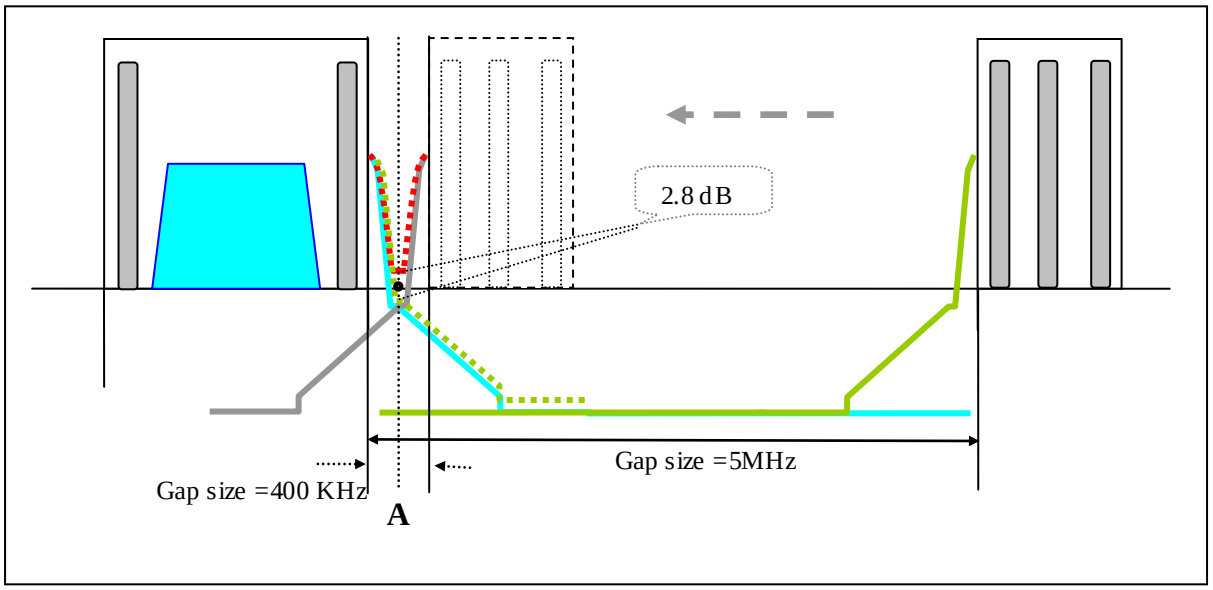


Figure 6.6.2-1 Comparison between gap size =5 M and gap size =400 KHz

6.6.3 Occupied bandwidth

In Rel-9 MSR specification, the occupied bandwidth is specified per carrier. The requirements can be reused for BS supporting non-contiguous spectrum operation.

6.6.4 Adjacent Channel Leakage power Ratio (ACLR)

The generic approach described in clause 5.4 implies that MSR in non-contiguous spectrum should be treated as contiguous MSR. This means that the current requirements for the RF Bandwidth edges remain and equivalent requirements are introduced in the sub-block gaps.

One of the concerns on specifying the ACLR for the frequency range of a sub-block gap is the complexity to apply accumulation of the impacts (emission) from the sub-blocks, when the output power of the two carriers adjacent to a sub-block can be different. The ACLR requirement in the sub-block gaps should be kept simple in order not to complicate the calculation and create unnecessary new requirements. Considering the impacts (emission) from a sub-block 10 MHz away from the measured carrier would be flattened, accumulation for this sub-block 10 MHz away is not needed, and thus accumulation for ACLR is only applied for frequency offsets smaller than 10 MHz from the measured carrier within the sub-block gaps.

The implications for ACLR are as follows:

- Existing ACLR requirements remain outside the RF bandwidth edges: Here the same references to single-RAT requirements for UTRA and E-UTRA can be re-used without any changes.
- ACLR is specified inside the sub-block gap for UTRA and E-UTRA carriers: To limit the complexity of the requirement, it should be defined only for adjacent 5 MHz UTRA carriers (3.84 Mcps RRC filter).
- The Sub-block gap size (Wgap) will influence what limits that apply in a sub-block gap: ACLR can be defined for channels that fit within the gap, implying that ACLR in the 1st adjacent channel applies for Wgap $\geq$ 5 MHz and for the 2nd adjacent channel for Wgap > 10 MHz.
- In order to maintain equivalence also with scenarios where the individual sub-blocks in a non-contiguous spectrum allocation are generated using separate BS transmitters, a cumulative approach is applied in the sub-block gap for sub block gaps for the 1st adjacent channel for sub block gaps with 5 $\leq$ Wgap < 15 MHz and for the 2nd adjacent channel for sub block gaps with 10 < Wgap < 20 MHz.

The cumulative approach for ACLR is achieved by defining a Cumulative ACLR (CACLR), which is applicable in a sub-block gap between two E-UTRA/UTRA carriers adjacent to the sub-block gap. This is achieved by relating the total power transmitted on the two assigned channel frequencies to the power in the adjacent channel.

The CACLR limit is set to 45 dB for 1st and 2nd adjacent channels, which is the same limits as for E-UTRA [4].

The absolute ACLR limits from E-UTRA and UTRA are also introduced in the sub block gap.

Note that UTRA TDD (1.28 Mcps) does not have an ACLR requirement for adjacent 5 MHz UTRA.

6.6.5 Application of necessary bandwidth for non-contiguous spectrum

The frequency range of the spurious domain emissions is normally defined by the *necessary bandwidth* of the transmission as explained below. The boundary between unwanted emissions in the spurious domain and the out-of-band domain is normally defined based on the *necessary bandwidth* of the emission, where the spurious domain generally consists of frequencies separated from the centre frequency of the emission by 250% or more of the necessary bandwidth of the emission. Both the transmitter spurious emissions and the operating band unwanted emission limits occur in the spurious domain, making the necessary bandwidth an important parameter.

This is discussed in detail for MSR in TR 37.900 [12], with reference to the international recommendations on spurious emissions, ITU-R SM.329-10 [13] and ERC Rec 74-01 [14]. The latter recommendation has recently been updated to accommodate for multi-carrier and multi-RAT transmitters such as MSR BS. The conclusion in TR 37.900 12] is that the necessary bandwidth is equal to the RF bandwidth of the MSR BS. This implies that operating band unwanted emission limits defined in such a way that they comply with the spurious emission limits in international recommendations ([13] and [14]) for frequencies separated more then 10 MHz from the RF bandwidth edges, will be in line with those recommendations, assuming an RF bandwidth of at least 5 MHz.

It is stated in the updated ERC Rec 74-01 [14] that the multicarrier-related provisions are for transmitters "…intended to operate only within a single contiguous allocation to a service and application." This does not exclude non-contiguous operation within a GSM/UTRA/E-UTRA operating band, since such a band *is* an allocation specifically for mobile services.

For an MSR BS operating in non-contiguous spectrum, it is not realistic to define the necessary bandwidth as being equal to the RF bandwidth. The updated ERC Rec 74-01 [14] states that "…the transmitter bandwidth is used instead of the necessary bandwidth for determining the boundary between the out-of-band and spurious domains. In the context of multicarrier base and mobile stations in the mobile service, the transmitter bandwidth is defined as the width of the frequency band covering the envelope of the transmitted carriers, which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions for all transmitted carriers." A reasonable application of this definition to a non-contiguous spectrum deployment is that the envelope covers the sub-blocks, i.e. the necessary bandwidth equals the sum of the sub block bandwidths, see also figure 5.1.2-1.

One challenge with UEM is the cases with sub-block sizes below 5 MHz. With the application of necessary bandwidth described above, that will not pose any problem if the sum of the sub block bandwidths exceeds 5 MHz.

Another regulatory implication comes from gap sizes that exceed 20 MHz. In this case, part of the gap could potentially be in the spurious emission domain and would consequently not allow for a cumulative approach to emission requirements. Also here it can be seen that this will not pose any problem if each sub-block gap is at the most four times as wide as the necessary bandwidth (no part of the sub-block gap should have a separation from the sub-block edges that is more than twice the necessary bandwidth). With the above application of necessary bandwidth as being the sum of the sub-block bandwidths, this will not be very likely to occur.

Based on the discussion above, the following can be concluded for MSR and MSR-NC:

- The necessary bandwidth for Multicarrier transmitters as defined in international regulation also applies to MSR BS transmitters, both for contiguous and non-contiguous spectrum
- The necessary bandwidth in case of non-contiguous spectrum will be the width of the frequency band covering the envelope of the transmitted carriers, which is the same as the sum of the sub-block bandwidths for all sub-blocks within the RF bandwidth.
- The present definition of spurious emissions relies on the boundary between the out-of-band and spurious domain to be at least 10 MHz away from the RF bandwidth edges. This implies that the necessary bandwidth and thus the sum of the sub-block bandwidths should be at least 5 MHz. This conclusion is aligned with the conclusion for contiguous MSR BS in TR 37.900 [12].
- The resulting implications for the MSR requirement in non-contiguous spectrum deployments are that the present MSR definitions of spurious emissions can be applied also for MSR-NC, with the following observations:
  - Individual sub-blocks can be smaller than 5 MHz, assuming that the sum of the sub-block bandwidths is at least 5 MHz
  - No part of a sub-block gap will fall in the spurious domain, assuming that the width of each sub-block gap is not larger than four times the sum of all sub-block bandwidths. It is noted that wider sub-block gaps would not likely occur in any realistic scenario.

6.7 Transmitter intermodulation

The existing transmitter intermodulation requirements for MSR in contiguous spectrum apply for the edges of the RF bandwidth, which should also be the case in non-contiguous spectrum. For MSR in non-contiguous spectrum, the transmitter IM requirement should be made applicable per sub-block when all sub-blocks are transmitted. The interferer should be allocated outside the RF BW as well as within the gap(s).

Core specification TS 37.104 requires placing modulated interferers in 3 different offsets from edge of the RF bandwidth. Taking into account a generic approach agreed for non-contiguous MSR, existing MSR requirements could be re-used and apply them to each sub-block. Due to the interferer type and offset, the general transmitter intermodulation requirements can not be made applicable if the sub-block gap is too small. For this reason, the additional BC2 requirement should be made applicable in the sub-block gap for MSR-NC. The general requirement should also be applicable in the sub-block gap for interferer offsets where the interferer would fit in the gap. If the sub-block gap size is less than 5 MHz, only the additional BC2 requirement can apply for non-contiguous spectrum in BC1.

7 Receiver characteristics

7.1 General

Receiver requirements for BS in non-contiguous spectrum will apply in the same way as in contiguous spectrum, thus no change is needed for subclause 7.1 of TS 37.104 [6]. A general statement on how requirements apply in contiguous and non-contiguous spectrum respectively is made in the new subclause 4.7 in TS 37.104. This is further discussed in subclause 5.5.

7.2 Reference sensitivity level

The reference sensitivity requirements are expressed per Single-RAT only. No changes due to non-contiguous spectrum operation are needed.

7.3 Dynamic range

The receiver dynamic range requirements are expressed per Single-RAT only. No changes due to non-contiguous spectrum operation are needed.

7.4 In-band selectivity and blocking

For MSR in non-contiguous spectrum, the in-band selectivity and blocking requirements should be similar regardless if the interferer is allocated outside the RF bandwidth or within the gap and the same requirements as for MSR in contiguous spectrum should apply, in line with the generic approach described in subclause 5.4.

Depending on the gap size in MSR-NC cases, some in-band requirements can not be made applicable inside a sub-block gap, due to either too large interferer offset or too large interferer bandwidth to fit the gap. The existing MSR general blocking requirements will require a gap size of at least 15 MHz in order to be applicable. The general narrowband blocking requirement is based on significantly smaller offsets and also has narrowband interferer types, which makes it suitable as gap requirements for most cases.

Based on these observations the following will apply for MSR in non-contiguous spectrum:

- The general blocking requirement will apply in the sub-block gap(s) if the interferer type and offset fits the gap, for sub-block gaps at least 15 MHz wide (see Figure 7.4-1).
- The general narrowband blocking requirement will apply in the sub-block gap(s) , for sub-block gaps at least 3 MHz wide (Figure 7.4-2).

The existing MSR requirements shall apply at the RF bandwidth edges for all MSR BS.

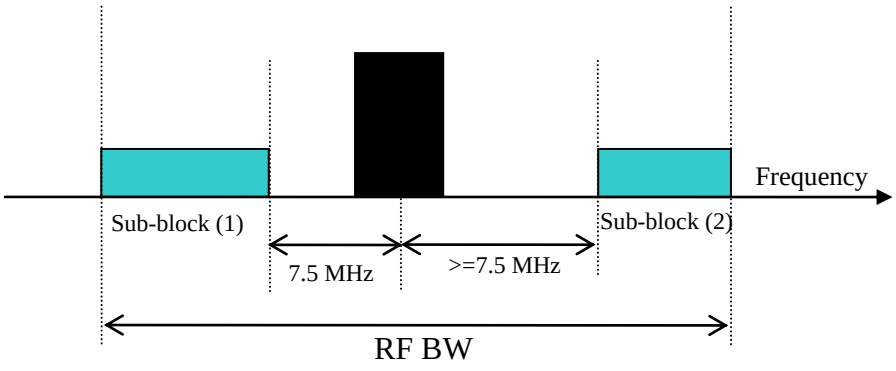


Figure 7.4-1: Applicability of the general blocking requirement inside a gap.

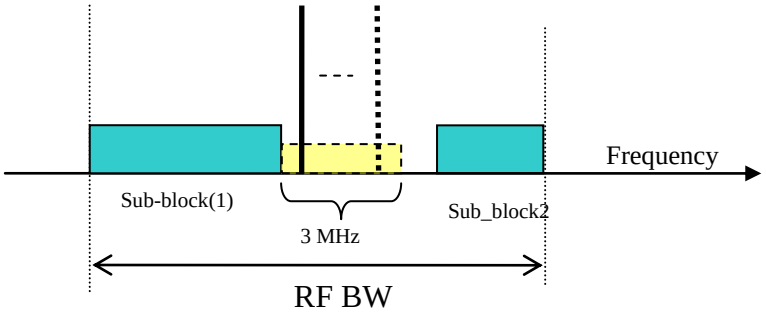


Figure 7.4-2: Applicability of the narrowband blocking requirement inside a gap.

7.5 Out-of-band blocking

The Out-of-band blocking characteristic is a measure of the receiver capability to receive a wanted signal at its assigned channel in the presence of an unwanted interferer outside the uplink operating band. No changes for BS supporting non-contiguous spectrum operation are needed.

7.6 Receiver spurious emissions

The limits specified for MSR receiver spurious emissions are based on the spurious emission requirements for "Receivers and idle/standby transmitters" defined in [14]. This requirement is kept unchanged for BS supporting non-contiguous spectrum operation.

The spurious domain is at least 10 MHz away from the downlink RF bandwidth edges also for non-contiguous spectrum operation, which means that the same excluded frequency range from $F_{BW\ RF,DL,low}$ -10 MHz to $F_{BW\ RF,,DLhigh}$ + 10 MHz will apply as for contiguous spectrum operation. This is aligned with the requirement for transmitter spurious emissions and is further discussed in subclause 6.6.5.

7.7 Receiver intermodulation

For MSR in non-contiguous spectrum, the receiver intermodulation requirements should be similar regardless if the interferer is allocated outside the RF bandwidth or within the gap and the same requirements as for MSR in contiguous spectrum should apply, in line with the generic approach described in subclause 5.4.

Depending on the gap size in MSR-NC cases, some in-band requirements can not be made applicable inside a sub-block gap, due to either too large interferer offsets or too large interferer bandwidth to fit the gap. The existing MSR general receiver intermodulation requirement, which will require a gap size of more than 20 MHz in order to be applicable, is not suitable as sub-block gap requirement and should be excluded. The general narrowband intermodulation requirement is based on significantly smaller offsets and also has narrowband interferer types, which makes it suitable as sub-block gap requirements for most cases.

Based on these observations the following will apply for MSR in non-contiguous spectrum:

- The general blocking requirement will not apply in the sub-block gap(s).
- The general narrowband receiver intermodulation requirement will apply in the sub-block gap(s), for sub-block gaps at least as wide as the channel bandwidth of the E-UTRA interfering signal.

The existing MSR requirements shall apply at the RF bandwidth edges for all MSR BS.

7.8 In-channel selectivity

The in-channel selectivity requirement is only specified for E-UTRA, and this requirement is defined per carrier and is independent of contiguous or non-contiguous spectrum operation. No changes due to non-contiguous spectrum operation are needed.

8 Test specification

8.1 General

To ensure that receiver requirements are applicable for "any carrier" received and to capture the broadband receiver characteristics for MSR BS in non-contiguous spectrum, it is necessary to apply multiple activated carriers that are measured simultaneously for receiver testing, in case of in-band blocking and receiver intermodulation requirements. The number of activated carriers will be limited to four as illustrated in figure 8.1-1. If there are fewer than four carriers in the test configuration, all carriers are activated. Interfering signals for testing should be applied both outside the RF bandwidth edges and within the sub-block gap.

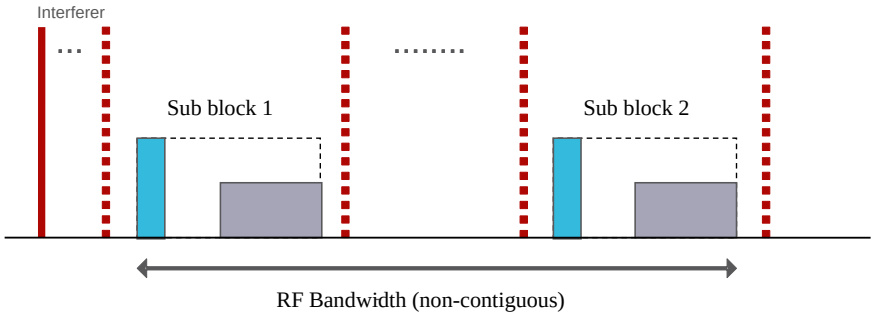


Figure 8.1-1: Example interfering signal positions in relation to two sub-blocks for MSR-NC, with example interfering signal positions illustrated in red.

8.2 Test configurations

The test configurations for non-contiguous testing should follow the main principles below:

1. The test configuration should contain two sub-blocks and one sub-block gap.
2. The available power should be split into the same power on each carrier.
3. The maximum RF bandwidth should be used
4. Carriers edges should align with sub-block edges
5. Sub-block granularity should be 5 MHz for BC1 test configurations

If there are reasons for deviating from these principles other test configurations may be specified.

Further studies on the allocation of spectrum to sub-blocks and gaps are needed. The allocation may take into account:

- What constitutes the most stringent case for each individual requirement.
- The trade off between gap size and sub-block size
- The relation between the number of carriers supported in the BS and the number of carriers possible to fit in the test configuration.
- The applicability of the test configurations.

Table 8.2-1 provides the examples of how the sub-block and sub-block gap size can be obtained. Note that this is an example and does not pose any restrictions on the final sizes of sub-blocks and gaps. The bandwidth of the sub-blocks should be N*5MHz, where N shall be selected such that sub-block gap size is not less than 5MHz. The bandwidth of the sub-block gap should be the maximum RF bandwidth minus the sum of the bandwidths of the two sub-blocks. For declared max RF BW is larger than 25 MHz, two test configurations are proposed.<Text will be added.>

Table 8.2-1: Examples of sub-block sizes and sub-block gap sizes for different declared maximum supported RF bandwidths

Declared max RF BW [MHz]	Sub-block size [MHz]	Sub-block gap size [MHz]
11-14.9	3*	5-8.9
15-25	5	5-15
25.1-35	5,10**	5.1-25
35.1-45	5,15**	5.1-35
45.1-55	5,20**	5.1-45
Note*: If the smallest supported carrier bandwidth is 5MHz, the sub-block size shall be 5MHz, sub-block gap size shall be adjusted accordingly Note**: Two sub-blocks with 5 MHz and two sub-blocks with the 2nd value		

Annex A:

Void

Annex B:
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2010-08	R4#56	R4-103159			Report skeleton		0.0.1
2010-11	R4#57	R4-104787			Agreed Text Proposal in RAN4 AH#3: **R4-104393**, "TP for MSR-NC Work Item objective (TR 37.802 clause 4.1)" **R4-104882**, "TP for MSR-NC Definitions and terminology (TR 37.802 clause 3, 5.1)"	0.0.1	0.1.0
2011-01	R4#57 AH	R4-110527			Agreed Text Proposal in RAN4 AH#3: **R4-110112**, "Update of TR 37.802" **R4-110150**, "TP on Output power dynamics" **R4-110155**, "TP on Occupied bandwidth" **R4-110157**, "TP on Reference sensitivity level" **R4-110158**, "TP on Dynamic range" **R4-110163**, "TP on In-channel selectivity' **R4-110498**, "TP for MSR-NC Generic approach (TR 37.802 clause 5.4)" **R4-110499**, "TP on Regional requirements" **R4-110507**, "TP on out-of-band transmitter spurious emissions" **R4-110510**, "TP on Out-of-band blocking" **R4-110528**, "TP for MSR-NC Necessary bandwidth (TR 37.802 clause 6.6)" **R4-110529**, "TP for MSR-NC Requirements principles (TR 37.802 clause 5.4)" **R4-110550**, "TP on Transmitted signal quality'	0.1.0	0.2.0
2011-02	R4#58	R4-111609			Agreed Text Proposal in RAN4 #58: **R4-111114**, "TP for MSR-NC Tx characteristics general part (TR 37.802 clause 6.1)" **R4-111116**, "TP for MSR-NC On/off power (TR 37.802 clause 6.4)" **R4-111120**, "TP for MSR-NC Rx characteristics general part (TR 37.802 clause 7.1)" **R4-111555**, "TP for MSR-NC unwanted emissions requirement for the gap (TR 37.802 clause 6.6.2)" **R4-111558**, "TP for MSR-NC In-band selectivity and blocking" **R4-111559**, "TP for MSR-NC receiver intermodulation" **R4-111560**, "TP on receiver spurious emissions" **R4-111649**, "TP for MSR-NC transmitter intermodulation requirement (TR 37.802 clause 6.7)"	0.2.0	0.3.0
2011-05	R4#59	R4-113249			Agreed Text Proposal in RAN4 #58 AH: **R4-112009**, "Update of applicability of requirements (clause 5)" **R4-112121**, "TP for MSR-NC Receiver requirement testing (TR 37.802 clause 9.X)" **R4-112245**, "TP for MSR-NC Relation to other RAN and GERAN specifications (TR 37.802 clause 4.2)" **R4-112247**, "TP for MSR-NC BS output power (TR 37.802 clause 6.2)" Agreed Text Proposal in RAN4 #59: **R4-113174**, "Further considerations for ACLR within sub-block gap in NC MSR" **R4-113184**, "TPs for MSR-NC manufacturer parameters declaration" **R4-113186**, "MSR transmitter test" **R4-113193**, "TP for MSR-NC Receiver requirement testing"	0.3.0	0.4.0
2011-06	RP#52	RP-110767			Submitted to TSG RAN for information.	0.4.0	1.0.0
2011-06	RP#52	RP-110767			V1.0.0 approved by TSG RAN.	1.0.0	10.0.0
2011-09	RP#53	RP-111256	003		Removal of Annex A in TR 37.802	10.0.0	10.1.0