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Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); Adding 2 GHz band LTE Frequency Division Duplex (FDD) (Band 23) for Ancillary Terrestrial Component (ATC) of Mobile Satellite Services (MSS) in North America (Release 10)

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Contents

Foreword

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1 Scope

The present document is a technical report for Adding 2 GHz LTE for ATC of MSS in North America work item, which was approved at 3GPP TSG RAN#47 [2]. The objective of this work item is to add the 2 GHz band LTE for ATC of MSS in North America to the appropriate 3GPP core specifications for LTE FDD networks. In addition to the schedule and status of the work items, the report includes a description of the motivation, requirements, study results and specification recommendations.

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] RP-100376 “Work Item proposal: Adding 2 GHz band LTE for ATC of MSS in North America”, RAN#47

[3] R4-112261 “Legacy UE RX Blocking with Band 23 LTE UE as interferer measurement results” , RAN#58AH

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 [x].

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

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

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] 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].

UE	User Equipment
BS	Base station
UL	Uplink (Reverse Link)
DL	Downlink (Forward Link)

4 Background

This work item, targeted for the Rel-10 timeframe, proposes adding the 2 GHz band LTE for ATC of MSS in North America to the 3GPP specifications for the above purposes. The effort involves developing the minimum RF characteristics and performance requirements for terrestrial FDD E-UTRA (LTE) networks.

In North America (US and Canada), the FCC and Industry Canada have studied and approved rules granting authority to operator(s) to integrate Ancillary Terrestrial Component (ATC) into their Mobile Satellite Services (MSS) network(s).

4.1 Task description

The purpose of this band class standardization is to enable the operators to offer enhanced mobile services through the terrestrial component with the spectrum resources allocated and authorized for MSS and ATC in this band.

The FCC has authorized two operators to deploy ATC networks in the S-band (Terrestar and DBSD North America, formerly ICO Global Communications) per the following authorizations:

- FCC DA 10-60 Terrestar : 2000 – 2010 MHz Uplink, 2190-2200 MHz Downlink
- FCC DA 09-38 DBSD: 2010 – 2020 MHz Uplink, 2180-2190 MHz Downlink

Based on the band allocation, there are two Tx-Rx frequency separation scenarios envisioned for this band: 170 and 190 MHz.

The ATC equipment will adhere to all 3GPP and FCC emission masks to protect adjacent band services. It is expected that during the work item progress the impacts will be studied.

4.2 Regulatory background

In 2003, the FCC and Industry Canada have approved rules permitting Mobile Satellite Services (MSS) and Ancillary Terrestrial Component (ATC) operations in assigned 2 GHz frequency bands. In the US, these rules have been legislated in Part 25 of the 47 Code of Federal Regulations, allowing ATC network operations to coexist with neighboring bands and services. The arrangement of the band is shown in Figure 4.2-1:

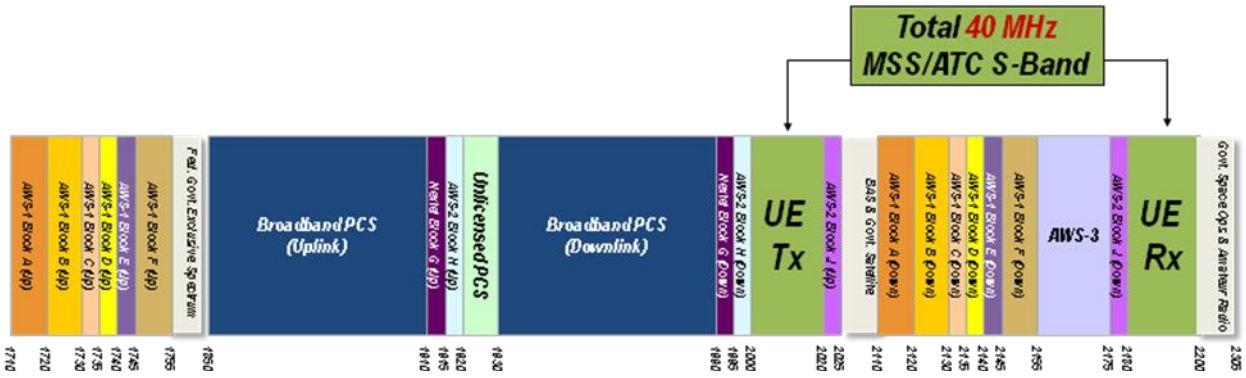


Figure 4.2-1: Band Arrangement

Two operators have been authorized in the band (Terrestar and DBSD North America), 10+10 MHz each:

- Terrestar : 2000 – 2010 MHz Uplink, 2190-2200 MHz Downlink (Authorization provided by FCC Docket DA 10-60)
- DBSD: 2010 – 2020 MHz Uplink, 2180-2190 MHz Downlink (Authorization provided by FCC Docket DA 09-38)

As illustrated the allocation for the two operators demands two different duplex spacing of 170 MHz and 190 MHz. It is proposed that this would be only defined as one band and not split into two bands in order to keep the total number of bands to a minimum and because there is such a high degree of commonality and synergy between the two. It is anticipated that in defining the performance requirements, the two duplex spacings will not yield separate specification values due to the large separation. But in the case that they do, the proposed methodology is to specify the worst case requirement between the two as a single requirement for the band. Such findings will be captured in the technical report.

The out of band emission (OOBE) requirements for this band are illustrated as follows.

Node B OOBE

ATC base stations authorized herein may transmit with power spectral density levels up to 32 dBW/MHz EIRP. ATC base stations authorized herein must attenuate out-of-band emissions by a factor of (43 + 10*log(P) dB) below the transmitter power (P) on frequencies outside the 2180-2200 MHz band.

There also exists an Operator-to-Operator Agreement between S-band operator and United States Federal Government Agencies Operating Earth Stations in the 2200-2290 MHz Band, and the EIRP spectral density of out-of-band emissions from any base station authorized herein that is situated within 133 kilometers of an existing Federal Government earth station operating in the 2200-2290 MHz band shall not exceed -100.6 dBW/4kHz in any portion of that band.

ATC base stations also need to prescribe limits on the radiated power and power spectral density of emissions in the 1559-1610 MHz band from 2 GHz ATC base stations and mobile terminals.

	Frequency	dBW/MHz EIRP	dBW EIRP of discrete emissions of less than 700 Hz bandwidth
Base Stations	1559-1610 MHz	-100	-110

For a wideband carrier, the EIRP level is to be measured using a root mean square (RMS) detector function with a resolution bandwidth of 1 MHz or equivalent and the video bandwidth is not less than the resolution bandwidth. For a narrowband carrier, the EIRP level is to be measured using an RMS detector function with a resolution bandwidth of 1 kHz or equivalent. The measurements are to be made over a 20 millisecond averaging period when the base station is transmitting.

The eNB OOBE requires -13 dBm/MHz at the edge of the band, hence it will be using the specifications defined in 3GPP TS 36.104. This OOBE is illustrated in the figure below. The additional requirement for eNB for protection of the Federal Government Earth stations will be met through an external filter and will not be specified as part of the 3GPP specifications.

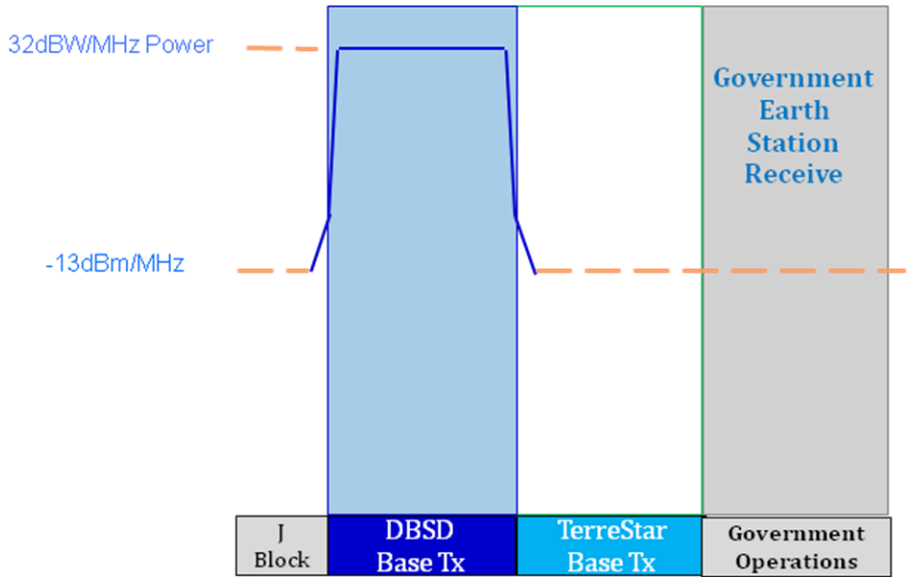


Figure 4.2-2:

The measurement instruments with a resolution bandwidth of one megahertz or more shall be used to verify compliance with the emission limits Compliance with this rule is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 megahertz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

UE OOBE

The EIRP spectral density of ATC terminal transmissions in transmission bandwidths less than 1.23 megahertz shall not exceed -60 dBW/Hz.

Emissions on frequencies lower than 1995 MHz shall be attenuated by at least 70 + 10 log P. Emissions in 1995-2000 MHz shall be attenuated by at least a value as determined by linear interpolation from 70 + 10 log P at 1995 MHz, to 43 + 10 log P dB at the nearest MSS band edge at 2000 MHz or 2020 MHz respectively.

ATC terminals also need to prescribe limits on the radiated power and power spectral density of emissions in the 1559-1610 MHz band from 2 GHz ATC base stations and mobile terminals.

	Frequency	**dBW/MHz EIRP**	**dBW EIRP of discrete emissions of less than 700 Hz bandwidth**
Mobile Terminals	1559-1610 MHz	-95	-105

The figure Figure 4.2-3 illustrates the UE OOBE.

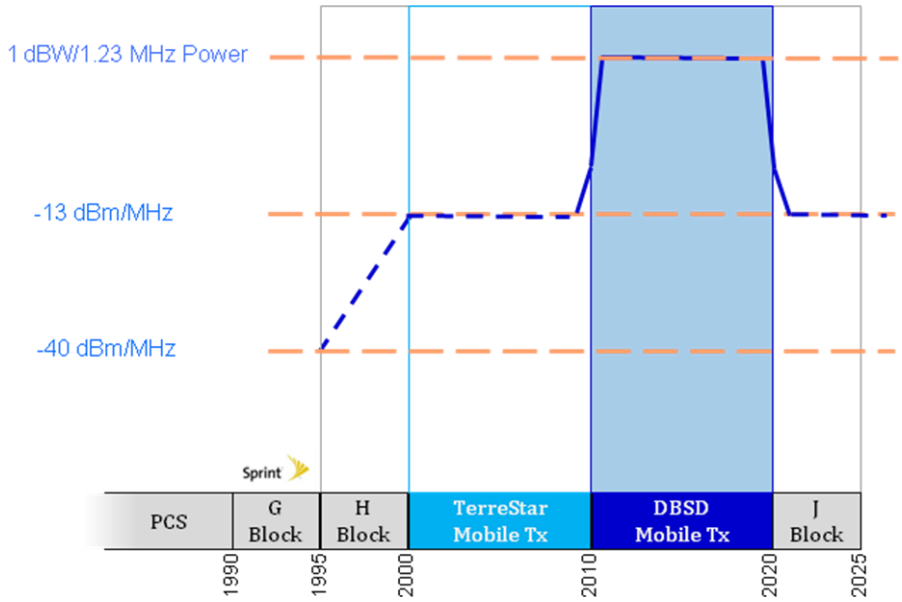


Figure 4.2-3: the UE OOBE

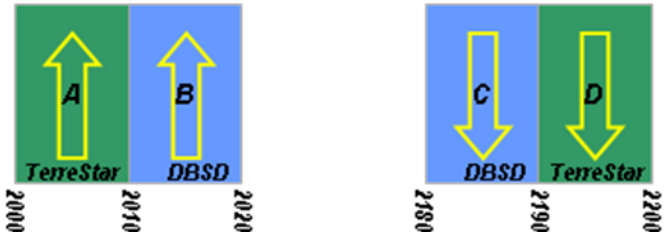
The UE OOBE requires -13 dBm/MHz at the edge of the band, hence it will be specified similarly to section 6.6.2 of TS 36.101 at the edge of the band to meet this requirement. There is an additional -40 dBm/MHz protection at 5 MHz away, only at the lower part of the band which needs to be met to protect PCS operations. Detailed requirements to comply with this mask will be included in the technical report.

S-Band UE will meet the 3GPP spurious emission requirements for UE-to-UE co-existence per 3GPP TS 36.101. Spurious emission requirements from the addition of this new band are expected to be the same as those required from the addition of other new US bands in 3GPP.

The measurement instruments with a resolution bandwidth of one megahertz or more shall be used to verify compliance with the emission limits Compliance with this rule is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 megahertz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

4.3 MSS/ATC Bandwidth Deployment Scenarios

Figure 4.3-1 illustrates the S-band Mobile Satellite Services with an Ancillary Terrestrial Component (MSS/ATC) spectrum:



4.3-1: S-band Mobile Satellite Services with an Ancillary Terrestrial Component (MSS/ATC) spectrum

Two operators have been authorized in the band (Terrestar and DBSD North America), 10+10 MHz each:

- Terrestar : 2000 – 2010 MHz Uplink, 2190-2200 MHz Downlink
- DBSD: 2010 – 2020 MHz Uplink, 2180-2190 MHz Downlink

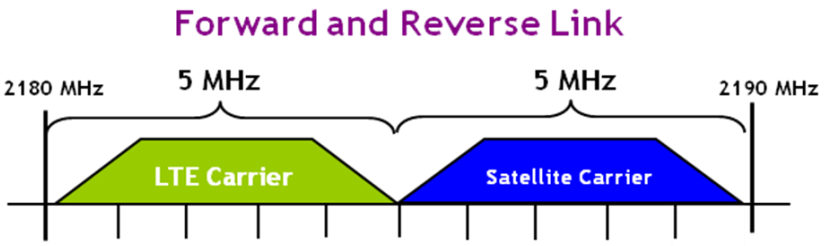
MSS and ATC services are meant to coexist in this band and could be deployed differently in each market. The services also need to be offered with respect to regulatory requirements and therefore carrier placements are going to be such to reduce potential interference. The following scenarios are envisioned for these services. Please note that even though the figures show a specific 10 MHz spectral range (2180 -2190 MHz), it is for illustration purposes and the same deployment could be in 2190-2200 MHz. Also the notations of forward and reverse links in these figures signify that the downlink and uplink will be deployed in a symmetrical manner of bandwidth allocation.

Scenario 1: Maximize Terrestrial Capacity: One 10 MHz LTE Carrier

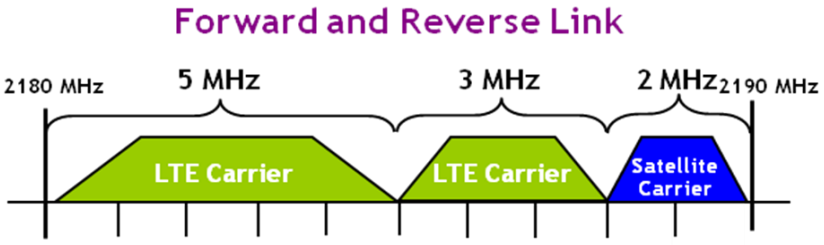
This case doesn't require illustration.

Scenario 2: Split Capacity

One 5 MHz LTE Carrier, 5 MHz Satellite Carrier Allocation

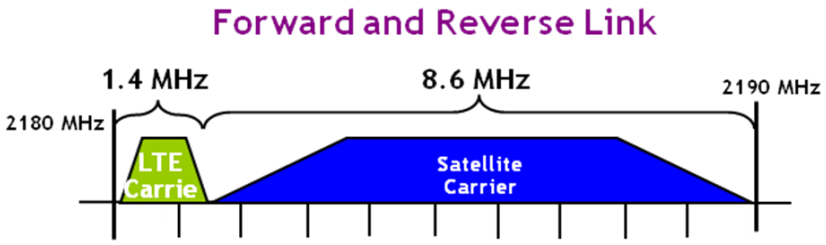


One 5 MHz LTE Carrier, One 3 MHz LTE Carrier, 2 MHZ Satellite Allocation



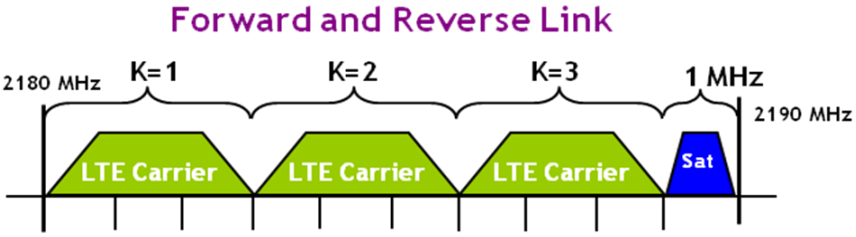
Scenario 3: Maximize Satellite Capacity

One 1.4 MHz LTE Carrier, 8.6 MHz Satellite Allocation



Scenario 4: Interference mitigation scenario

Reuse of three 3 MHz LTE Carriers, 1 MHz Satellite Allocation



5 Study of E-UTRA requirements

5.1 Operating bands and channel arrangement

Two operators, namely TerreStar and DBSD North America, have been authorized by the FCC to deploy networks in this band. Each of them is assigned a 10 MHz pair: 13

- Terrestar block : 2000 – 2010 MHz Uplink, 2190-2200 MHz Downlink (Authorization provided by FCC Docket DA 10-60) 13
- DBSD block: 2010 – 2020 MHz Uplink, 2180-2190 MHz Downlink (Authorization provided by FCC Docket DA 09-38) 13

The two company's spectrum blocks are adjacent to each other forming an "inner block" and an "outer block," but have different duplex spacings: 190 MHz for the Terrestar block and 170 MHz for the DBSD block. Thus, defining this as a single band necessitates that two duplex spacings be supported. 13

5.1.1 Frequency bands

The S-band is being specified as a single operating band supported by a single duplexer, a default duplex spacing of 180 MHz which allows a variability of ±10 MHz. This would cover the two operator allocations defined above and is defined in Table 5.1.1-1:

Table 5.1.1-1: E-UTRA frequency bands

E-UTRA Operating Band	Uplink (UL) operating band BS receive UE transmit	Downlink (DL) operating band BS transmit UE receive	Duplex Mode
	F_{UL_low} – F_{UL_high}	F_{DL_low} – F_{DL_high}	
[23]	2000 MHz – 2020 MHz	2180 MHz – 2200 MHz	V-FDD (Note 1)
Note 1: The duplex spacing is defined in Tables 5.1.4-1 and 5.1.4-2			

5.1.2 Channel bandwidths per operating band

The transmission bandwidth configuration in Table 5.1.2-1 shall be supported for each of the specified channel bandwidths.

Table 5.1.2-1: E-UTRA channel bandwidth

E-UTRA band / channel bandwidth						
E-UTRA Band	**1.4 MHz**	**3 MHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
[23]	Yes	Yes	Yes	Yes		

5.1.3 Carrier frequency and EARFCN

The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL_low} and $N_{Offs-DL}$ are given in Table 5.1.3-1 and N_{DL} is the downlink EARFCN.

$$F_{DL} = F_{DL\_low} + 0.1(N_{DL} – N_{Offs-DL})$$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where F_{UL_low} and $N_{Offs-UL}$ are given in Table 5.1.3-1 and N_{UL} is the uplink EARFCN.

$$F_{UL} = F_{UL\_low} + 0.1(N_{UL} – N_{Offs-UL})$$

Table 5.1.3-1 E-UTRA channel numbers

E-UTRA Operating Band	Downlink			Uplink		
	F_{DL_low}(MHz)	$N_{Offs-DL}$	Range of N_{DL}	F_{UL_low}(MHz)	$N_{Offs-UL}$	Range of N_{UL}
[23]	2180	7500	7500 – 7699	2000	25500	25500 – 25699

5.1.4 TX–RX frequency separation

The default E-UTRA TX channel (carrier centre frequency) to RX channel (carrier centre frequency) separation is specified in Table 5.1.4-1 for the TX and RX channel bandwidths defined in Table 5.1.2-1.

Table 5.1.4-1: Default UE TX-RX frequency separation

E-UTRA Operating Band	TX - RX carrier centre frequency separation
[23]	180 MHz

The range E-UTRA TX channel (carrier centre frequency) to RX channel (carrier centre frequency) separations for operating bands supporting variable duplex FDD is specified in Table 5.1.4-2

Table 5.1.4-2: TX-RX frequency separation for operating bands supporting variable duplex FDD

E-UTRA Operating Band	TX - RX carrier centre frequency separation	
	Allowed offset	**Separation**
[23]	-10 MHz	170 MHz
	+10 MHz	190 MHz

5.2 Specific UE RF requirements

5.2.1 Dual duplex spacing

Two operators, namely TerreStar and DBSD North America, have been authorized by the FCC to deploy networks in this band. Each of them is assigned a 10 MHz pair:

- Terrestar block : 2000 – 2010 MHz Uplink, 2190-2200 MHz Downlink (Authorization provided by FCC Docket DA 10-60)
- DBSD block: 2010 – 2020 MHz Uplink, 2180-2190 MHz Downlink (Authorization provided by FCC Docket DA 09-38)

The two company's spectrum blocks are adjacent to each other forming an "inner block" and an "outer block," but have different duplex spacings: 190 MHz for the Terrestar block and 170 MHz for the DBSD block. Thus, defining this as a single band necessitates that two duplex spacings be supported.

5.2.1.1 Signaling support of variable duplex spacing

The signaling support for variable duplex spacing is already available in the current Release 8 LTE specifications. In TS 36.331, as shown below, the *SystemInformationBlockType2* (SIB2) includes the *ul-CarrierFreq* field. For FDD systems, if this field is absent, the value determined from the default TX-RX frequency separation defined in TS 36.101 applies. To enable variable duplex spacing in a band, the UL carrier frequency can be explicitly defined.

SystemInformationBlockType2 information element

```
-- ASN1START

SystemInformationBlockType2 ::=      SEQUENCE {
    ac-BarringInfo                   SEQUENCE {
       ac-BarringForEmergency              BOOLEAN,
       ac-BarringForMO-Signalling          AC-BarringConfig            OPTIONAL,  -- Need OP
       ac-BarringForMO-Data             AC-BarringConfig            OPTIONAL   -- Need OP
    }                                                                  OPTIONAL,  -- Need OP
    radioResourceConfigCommon        RadioResourceConfigCommonSIB,
    ue-TimersAndConstants            UE-TimersAndConstants,
    freqInfo                         SEQUENCE {
       ul-CarrierFreq                   ARFCN-ValueEUTRA            OPTIONAL,  -- Need OP
       ul-Bandwidth                     ENUMERATED {n6, n15, n25, n50, n75, n100}
                                                                    OPTIONAL,  -- Need OP
       additionalSpectrumEmission          AdditionalSpectrumEmission
    },
    mbsfn-SubframeConfigList         MBSFN-SubframeConfigList         OPTIONAL, -- Need OR
    timeAlignmentTimerCommon         TimeAlignmentTimer,
    ...
}

AC-BarringConfig ::=             SEQUENCE {
    ac-BarringFactor                 ENUMERATED {
                                        p00, p05, p10, p15, p20, p25, p30, p40,
                                        p50, p60, p70, p75, p80, p85, p90, p95},
    ac-BarringTime                   ENUMERATED {s4, s8, s16, s32, s64, s128, s256, s512},
    ac-BarringForSpecialAC               BIT STRING (SIZE(5))
}

MBSFN-SubframeConfigList ::=     SEQUENCE (SIZE (1..maxMBSFN-Allocations)) OF MBSFN-SubframeConfig

MBSFN-SubframeConfig ::=         SEQUENCE {
    radioframeAllocationPeriod           ENUMERATED {n1, n2, n4, n8, n16, n32},
    radioframeAllocationOffset           INTEGER (0..7),
    subframeAllocation               CHOICE {
       oneFrame                         BIT STRING (SIZE(6)),
       fourFrames                       BIT STRING (SIZE(24))
    }
}
-- ASN1STOP
```

5.2.1.2 RF architecture

Although the proposed 2GHz band has two duplex spacings, a terminal implementation is not necessarily required to use two duplexers to support this band. As an example, a possible UE radio block implementation as shown in Figure 5.2.1.2-1 below where the same antenna, duplexer, transceiver, PA, and baseband sections are used regardless of the duplex or frequency of operation within the band. Here, it is assumed that the RF components are sufficiently wideband to support the aggregate bandwidth of the two blocks. For example, the duplexer is required to have a passband of at least 20MHz and a duplex spacing of 180 MHz. Operating with different duplex spacings can be managed in software to provide tuning control for the Rx and Tx LO's. Frequency tracking is always maintained on the uplink so that the UE is synchronized with the basestation no matter the duplex spacing. The limitation with this architecture is that only

a single duplex spacing can be supported at any given instant in time; however, a variable duplex band only operates with a single duplex spacing until it is reconfigured by SIB messaging.

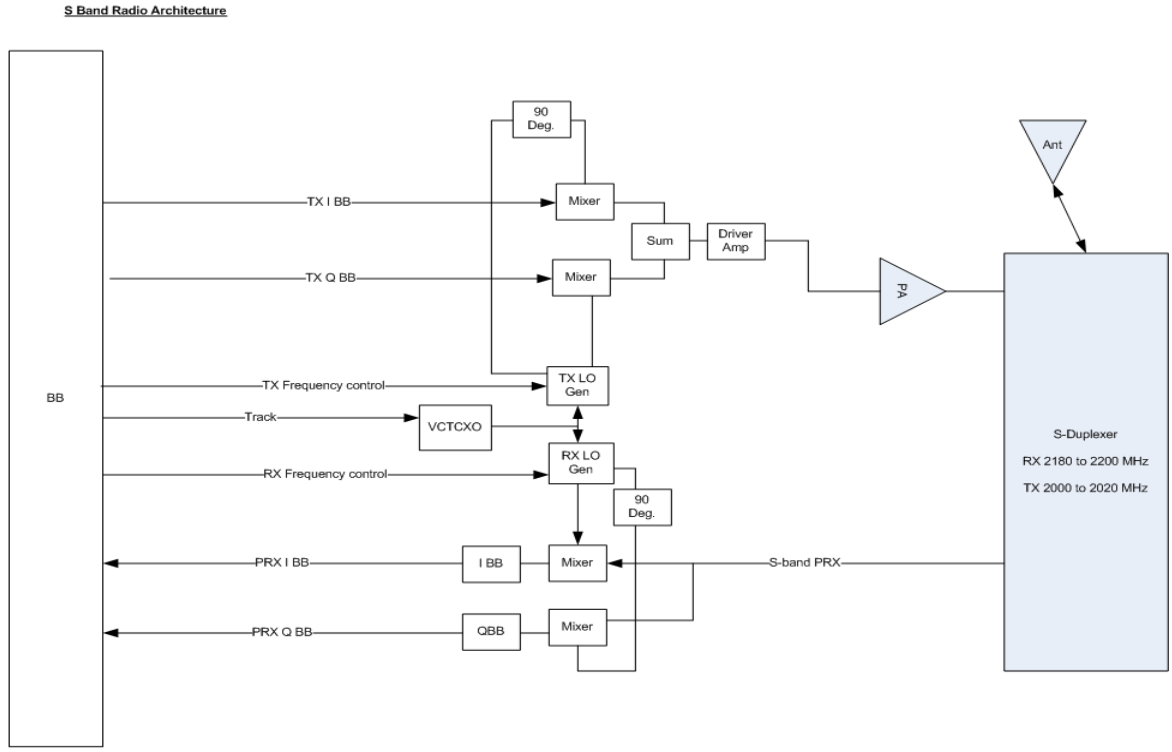
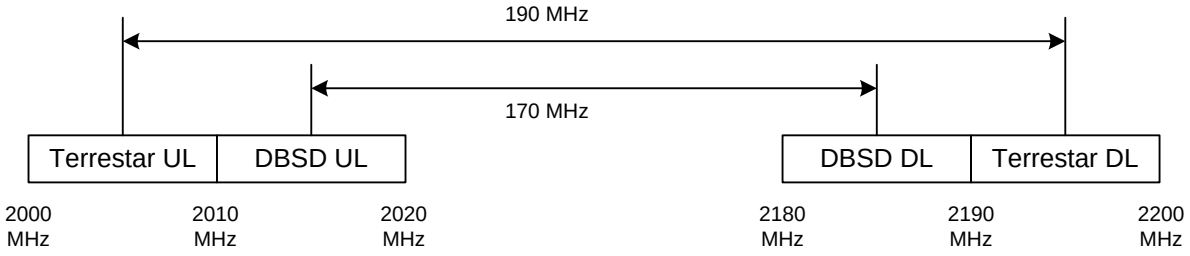


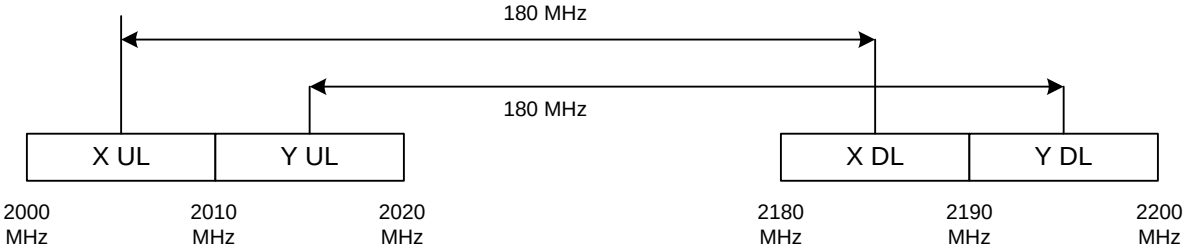
Figure 5.2.1.2-1: Example radio architecture supporting variable duplex spacing in US 2GHz band.

5.2.1.3 Impacts to radio transmission and reception requirements

To help understand the impact to radio requirements of dual duplex spacing in this band, it may be convenient to compare this to the conventional case of single duplex spacing. Consider as shown in Figure 5.2.1.3-1a, the proposed spectrum allocation of the 2GHz S-band with dual duplex spacing. The outer block (assigned to Terrestar) has 190 MHz duplex spacing while the inner block (assigned to DBSD) has 170 MHz duplex spacing. For comparison, also consider as shown in Figure 5.2.1.3-1b, a fictitious allocation of the same band with single 180 MHz duplex spacing. In both of these two cases, the duplex spacing is at least 17 times the maximum channel bandwidth (10 MHz).



a) 2 GHz S-Band Spectrum Allocation
(Dual duplex spacing)



b) A Fictitious Allocation of the S-Band with
Fixed 180MHz Duplex Spacing

Figure 5.2.1.3-1: Comparison of the dual duplex spacing S-band with a fictictious single duplex spacing band.

5.2.1.3.1 Self interference and desense

On important distinction between treating the band with two duplex spacing vs. single duplex spacing is the self interference due to transmitter PA noise and intermodulation products extending into the receive band. In the case of this 2GHz band, however, the spacing from Tx to Rx is very large so that the self-interference is expected to be negligible. To evaluate the self interference at such large duplex spacing, a measurement of PA noise was made using a commercially available Band 1 PA. Band 1 is close in frequency to S-band and shares a similar large duplex spacing of 190 MHz; therefore, its performance should be similar to that expected of S-band. With 28dBm output power, the Band 1 PA noise density reaches its floor and is flat at the receiver band with a measured power level of -141 dBm/Hz. Factoring in the 45 dB attenuation from the duplexer, the expected self interference at the receiver input is -186 dBm/Hz, which is much lower than the receiver thermal noise floor. There fore, for the 2 GHz S-band in interest, the impact from self interference is negligible. Furthermore, because of the large separation between Tx and Rx, intermodulation terms from the transmitter are also expected to be negligible.

5.2.1.3.2 Receiver requirements

We now consider the reception requirements (i.e., reference sensitivity, adjacent channel selectivity, blocking, intermodulation, etc). Given the above conclusion that self-interference is negligible for this band, the reception requirements are mainly driven by the performance of receiver chain and interference from neighboring bands, which depends only on the location of the DL block. Comparing the diagrams of Figure 5.2.1.3-1, it can be seen that there is no difference between the receiver requirements for the block defined by the inner block (i.e., DBSD DL block) and a block X DL if the band were defined with single duplex. Similarly, the outer block (i.e., Terrestar DL block) is identical to the block Y DL block in terms of receiver requirements.

5.2.1.3.3 Transmitter requirements

The transmitter emissions (i.e., ACLR, out of band, spurious, etc) are mainly driven by requirements limiting interference to other bands and within its own band. We have already established that self-interference is not a consideration for this 2 GHz S-band. Interference to other bands is a function of the location of the UL block, the channel bandwidth, and the size of the uplink allocation. Comparing the diagrams of Figure 5.2.1.3-1, it can be seen

that there is no difference between the transmitter requirements for the block defined by the inner block (i.e., DBSD UL block) and a block Y UL if the band were defined with single duplex. Similarly, the outer block (i.e., Terrestar UL block) is identical to the block X UL block in terms of transmitter requirements.

5.2.1.3.4 Specification differences between one band and two bands approach

The analysis and reasoning in the previous section shows that, in general, there is no difference in the specification between defining the S-band as a single band with dual duplex spacing compared to defining it as a single band with fictitious single duplex spacing. . The large duplex separation makes self interference negligible for this band so that the actual separation, whether it be 170 MHz or 190 MHz does not affect the performance requirements. In the Table 5.2.1.3.4-1 all UE RF requirements in 36.101 that may potentially need changes for this 2 GHz S-band are listed. A brief discussion is also provided to compare the difference between one-band with dual duplex spacing solution versus two-band solution. In general, there should be no difference in requirements between defining the band as a single band vs. defining the band as two bands. Where there are possible differences, the worst case specification is proposed to be used when defining as a single band. Detailed analysis as appropriate will be provided in future contributions to support any requirement changes needed.

Table 5.2.1.3.4-1: UE RF requirements that may require changes for the 2GHz S-Band.

Clause	Description	Comments and Comparison to 2-band Solution
6.2.2	UE Maximum Output Power	No changes are needed for a one-band vs. two-band solution. Due to the large duplex gap, maximum output power relaxation is not required at the band edges.
6.2.4	UE Maximum Output Power with additional requirements (A-MPR)	FFS. Will determine from emission analysis whether A-MPR is needed. For a two-band solution, the analysis is done separately on the inner block and the outer block. For one-band with dual duplex spacing solution, the higher A-MPR number from the two blocks will be used.
6.6.2.2	Additional Spectrum Emission Mask	FFS. Will determine if any additional spectrum emission mask is needed. For a two-band solution, the analysis is done separately on the inner block and the outer block. For one-band with dual duplex spacing solution, the tighter emission limit from the two blocks will be used.
6.6.3.2	Spurious emission band UE co-existence	FFS. Will determine later if any changes needed. For the two-band solution, the analysis is done separately for the Terrestar band and DBSD band. For one-band with dual duplex spacing solution, the worst case number from the two bands will be used.
7.3.1	Reference sensitivity requirement	No differences are expected between a one-band vs. two-band solution. The self interference is negligible for this band due to the large duplex spacing. The location of the uplink RB's is to be allocated as close as possible to the downlink operating band within the channel bandwidth and in accordance with the duplex spacing as indicated in the SIB message.
7.5, 7.6, 7.7, and 7.8	ACS, blocking, spurious, and intermod	FFS. ACS, blocking, intermod, and other receiver requirements are defined as a function of the channel bandwidth and are not a function of the duplex separation. As with reference sensitivity, the uplink RB's are to be allocated as close as possible to the downlink operating band within the channel bandwidth and in accordance with the duplex spacing as indicated in the SIB message. No differences are expected between a one-band vs. two band solution.

5.2.2 UE Maximum Output Power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth. The period of measurement shall be at least one sub frame (1ms).

Table 5.2.2-1: UE Power Class

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
[23]					23	±2		

5.2.3 UE Maximum Output Power with additional requirements

A-MPR is needed to meet additional FCC emission requirements and possible UE coexistence requirements. Detailed number will be determined in the future study.

Table 5.2.3-1: Additional Maximum Power Reduction (A-MPR) / Spectrum Emission requirements

Network Signalling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks	A-MPR (dB)
NS_03	6.6.2.2.1	2, 4, 10, [23], 35, 36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤1
			20	>10	≤1
[NS_11]	TBD	[23][1]	1.4, 3, 5, 10	Table 5.2.3-2	Table 5.2.3-2
Note 1: Applies to the lower block of Band [23], i.e. a carrier placed in the 2000-2010 MHz region.					

Table 5.2.3-2: A-MPR for NS_11

Channel Bandwidth	Parameters			
3	Fc (MHz)	<2004	≥2004	
	L_CRB (RBs)	1-15	>5	
	A-MPR	≤5	≤ 1	
5	Fc (MHz)	<2004	2004 ≤ Fc <2007	≥2007
	L_CRB (RBs)	1-25	1-6 & 15-25 / 8-12	>6
	A-MPR	≤7	≤ 4 / 0	≤ 1
10	Fc (MHz)	2005		
	RB_start (RBs)	0-49		
	L_CRB (RBs)	1-50		
	A-MPR	≤ 12		

5.2.3.1 A-MPR Study for frequency range of 2000 – 2010 MHz

Based on the assumptions shown below this chapter presents results of a study which aims to define appropriate A-MPR for frequency range of 2000 – 2010 MHz belonging to Band 23. The final MPR values are subject to change based on RAN4 determining the coexistence values for both band [23] and band 2.

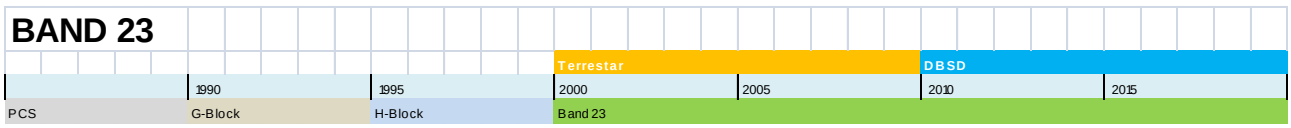


Figure 5.2.3.1-1 UL frequency arrangement of Band 23

Emissions requirements and simulation assumptions

Following emission requirements have been taken into account in this contribution.

1. NS_03 Mask
2. H-Block requirement as specified in [1]
3. G-Block – 40 dBm / 1 MHz (This emission value was not agreed during the time the study was made)
4. Band 2 (PCS) – 50 dBm / 1 MHz (This emission value was not agreed during the time the study was made)

Following simulation assumptions have been used in this contribution

1. PA Operating point $UTRA_{ACLR1}$ = 33 dBc
2. Carrier leakage = -25 dBc
3. IQ Image = - 25 dBc
4. Counter-IM3 = - 60 dBc

A-MPR needed for 1.4 MHz bandwidth

Simulations showed that when 1.4 MHz carrier is placed on worst case position Fc=2000.7 MHz the margin with full allocation to H-block requirement is 2 dB. Keeping in mind the fact that PA and modulator were driven with minimum requirements this margin could be satisfactory hence no A-MPR is required.

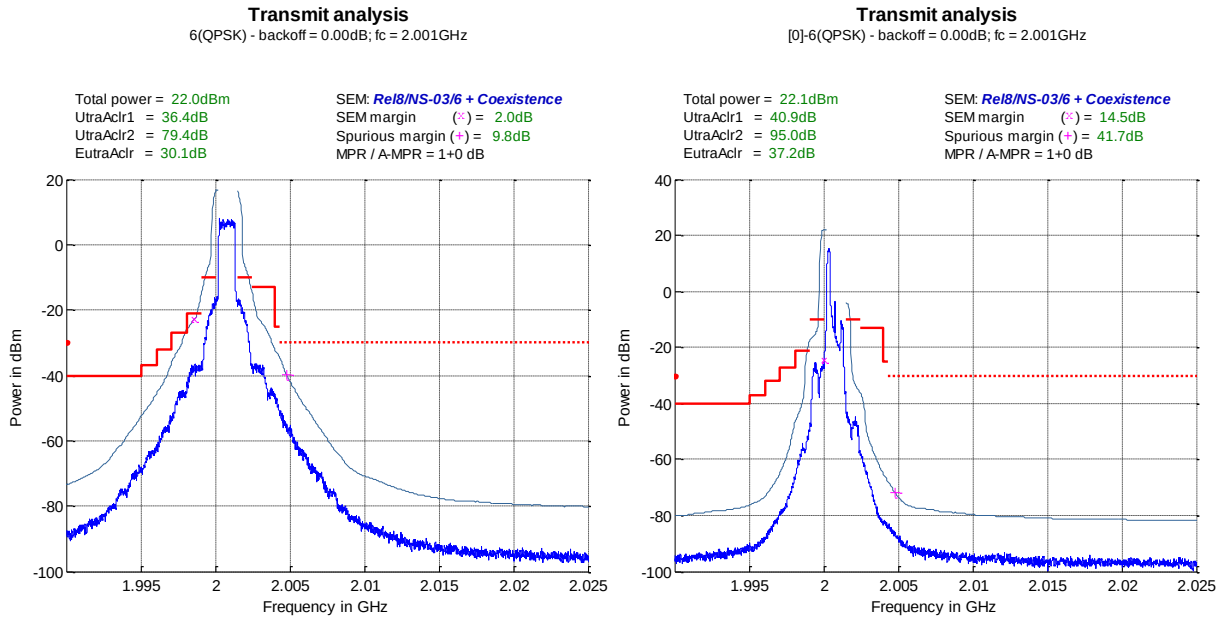


Figure 5.2.3.1-2 Spectrum plots from 1.4 MHz BW

A-MPR needed for 3 MHz bandwidth

Following table presents required A-MPR needed for 3 MHz carrier to meet the emission requirement listed previously in this chapter.

RB_Start for all cases is 0.

Table 5.2.3.1-1 Required A-MPR for 3 MHz carrier in lower 10 MHz frequency block of band 23

	#RB			
Fc	**15**	**10**	**5**	**1**
2001.5	4.71	2.77	1.37	3.56
2002	3.22	1	1	1.84
2002.5	2.53			1.86
2003	1.32			1
2003.5	1			

Following table captures the A-MPR requirement based on studies presented above in similar format that has been used in 36.101. Last column represents the NS_03 requirement.

Table 5.2.3.1-2 A-MPR table for 3 MHz signal

	F_C [MHz]	< 2004	≥ 2004
	L_CRB [RBs]	1-15	>5
3	A-MPR [dB]	≤ 5	≤ 1

A-MPR needed for 5 MHz bandwidth

Following table presents required A-MPR needed for 5 MHz carrier to meet the emission requirement listed previously in this chapter.

RB_Start for all cases is 0.

Table 5.2.3.1-3 Required A-MPR for 5 MHz carrier in lower 10 MHz frequency block of band 23

	L_CRB										
Fc	25	20	16	15	12	10	8	6	5	2	1
2002.5	6.46	5.24	4.27	4.16	2.83	2.38	3.18	3.73	4.22	5.22	6.56
2003	5.71	4.17	3.14	2.56	1.72	1.42	2.38	3.01	3.29	5.02	5.82
2003.5	5.07	3.51	2.08	1.9	1.01		1.51	2.2	2.76	3.62	4.41
2004	4.31	3.1	1.32					1.06	1.48	3.53	4.01
2004.5	3.82	2.32								1.82	2.82
2005	3.36	1.44								1.71	2.16
2005.5	2.94									1	1
2006	2.34										
2006.5	1.4										

Table 1 is divided into four sections by colouring those with different colours. These sections map to A-MPR table presented below so that one section corresponds one A-MPR value. A-MPR value for Fc >=2007 is the NS_03 requirement and hence not derived from table 1.

Following table captures the A-MPR requirement based on studies presented above in similar format that has been used in 36.101. Last column represents the NS_03 requirement.

Table 5.2.3.1-4 A-MPR table for 5 MHz signal

	F_C [MHz]	< 2004		2004 ≤ Fc < 2007		≥ 2007
	L_CRB [RBs]	1-6 & 15-25	8-12	1-6 & 15-25	8-12	>6
5	A-MPR [dB]	≤ 7	≤ 3	≤ 4	0	≤ 1

A-MPR needed for 10 MHz bandwidth

Following table presents required A-MPR needed for 10 MHz carrier to meet the emission requirement listed previously in this chapter.

Fc for all cases is 2005 MHz.

Table 5.2.3.1-5 Required A-MPR for 5 MHz carrier in lower 10 MHz frequency block of band 23

	#RB							
RB_Start	50	40	30	25	20	10	5	1
0	10.61	9.47	7.43	6.45	5.54	6.81	9.18	10.75
10		6.73	4.5	4.07	2.36	0	2.65	4.12
12			4.36	3.64	1.75	0	0	2.41
15			4.2	3.22	0	0	0	0
20			3.86	1.96	0	0	0	0
30					0	0	0	0
35						0	0	0
40						5.7	4.24	
45							9.43	0
49								12

The simulated A-MPR values can presented as a table 5.2.3.1-6 shown below. Table 5.2.3.1-5 is divided into three sections by colouring those with different colours. These sections map to A-MPR table presented 5.2.3.1-6 so that one section corresponds one RB_Start region.

Table 5.2.3.1-6 A-MPR table for 10 MHz carrier

	F_C [MHz]	2005				
	RB_Start	0 - 14		15-35	35-49	
	L_CRB [RBs]	1 - 8 & 26-49	1 0- 25	>20	1 - 9	10
10	A-MPR [dB]	≤ 11	≤ 7	4	≤ 12	≤ 6

Summary

Next we combine results from previous chapters into a single A-MPR table see below.

Table5.2.3.1-7 NS_12 A-MPR table for band 23

Channel BW	Parameters					
	F_C [MHz]	[< 2004]	[≥ 2004]			
	L_CRB [RBs]	[1-15]	[>5]			
3	A-MPR [dB]	[≤ 5]	[≤ 1]			
	F_C [MHz]	[< 2004]		[2004 ≤ Fc < 2007]		[≥ 2007]
	L_CRB [RBs]	[1-6 & 15-25]	[8-12]	[1-6 & 15-25]	[8-12]	[>6]
5	A-MPR [dB]	[≤ 7]	[≤ 3]	[≤ 4]	[0]	[≤ 1]
	F_C [MHz]	[2005]				
	RB_Start	[0 - 14]		[15-35]	[35-49]	
	L_CRB [RBs]	[1 - 8 & 26-49]	[1 0- 25]	[>20]	[1 - 9]	[10]
10	A-MPR [dB]	[≤ 11]	[≤ 7]	[4]	[≤ 12]	[≤ 6]

In figure 5.2.3.1-3 below we have illustrated some possible carrier arrangements that could be done based on the proposed A-MPR table above.

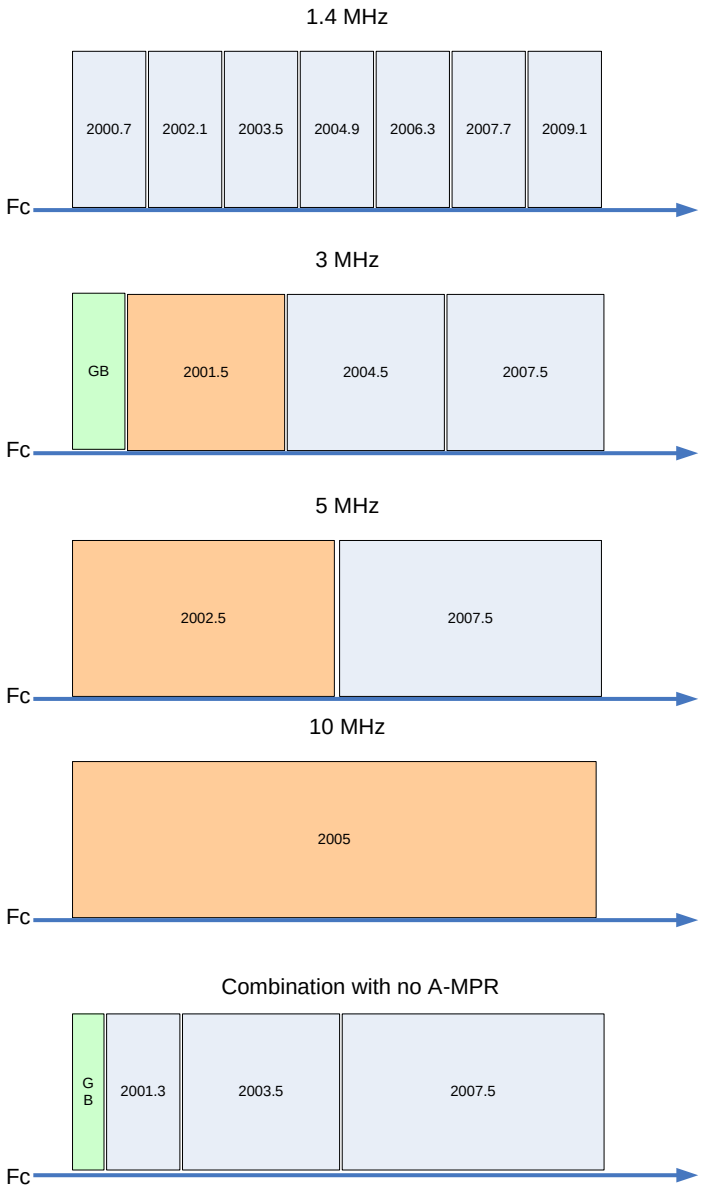


Figure 5.2.3.1-3 Possible channel arrangements for lower block of band 23

To summarize following observations can be made from A-MPR table 7 and figure 3.

1. For 1.4 MHz no A-MPR is needed hence can be used freely but because of large control signal overhead this is not attractive bandwidth but could be used in combination with other channel bandwidths

2. If frequency range is filled up with 3 MHz carriers then only the lowest one required A-MPR also there will be room for 1 MHz guard band against H-block. Higher block requires the A-MPR indicated by the NS_03 requirement.

3. If 5 MHz carriers are used then the lower carrier requires A-MPR but higher one does not require any additional A-MPR in addition to NS_03 requirement.

4. If 10 MHz carrier is used a over provisioned PUCCH must be used like with band 13. Then RB's locatred at RB_start =15 – 35 do not require A-MPR but the PUCCH carrier must be located into this region which reduced the amount of contiguous RB's for PUSCH. Maximum contiguous allocation for PUCCH is approximately 15.

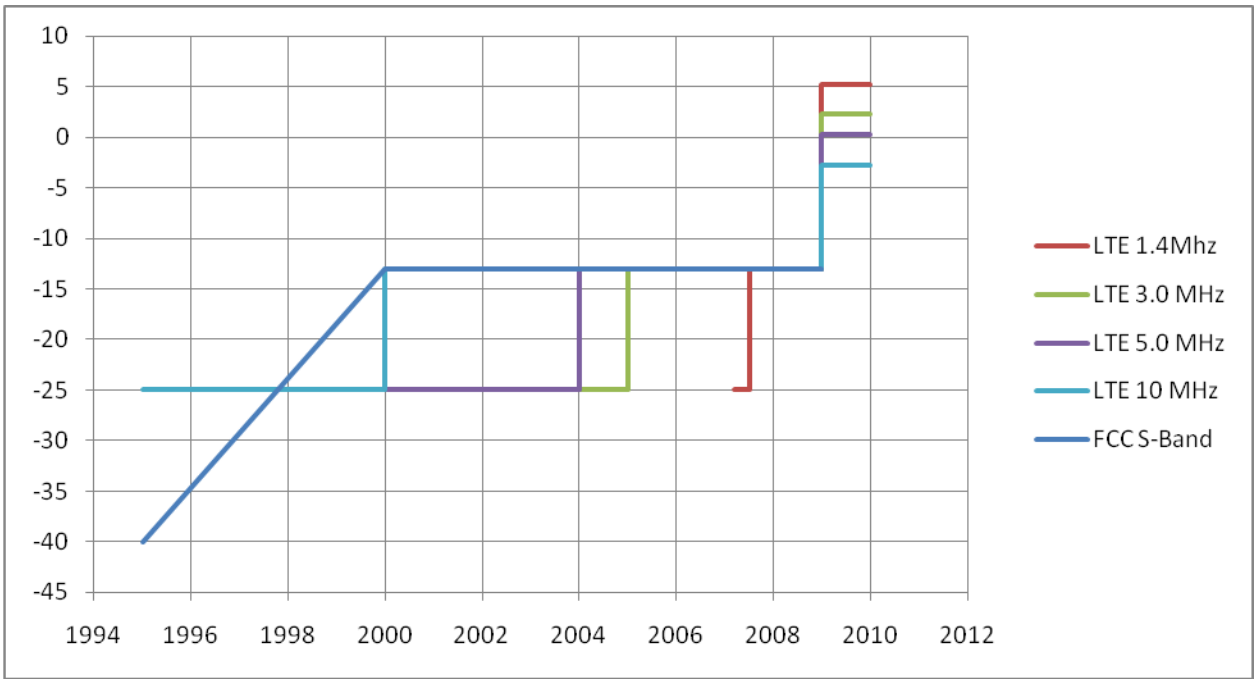
5. If a combination of 1.4, 3 and 5 MHz carriers is used those can be placed such way that no A-MPR is required to any of the carriers in addition to the NS_03 A-MPR. In addition there will be room for 600 kHz guard band against G-Block.

6. If satellite carriers are also placed into the band there will be several possibilities to have feasible LTE channel arrangements.

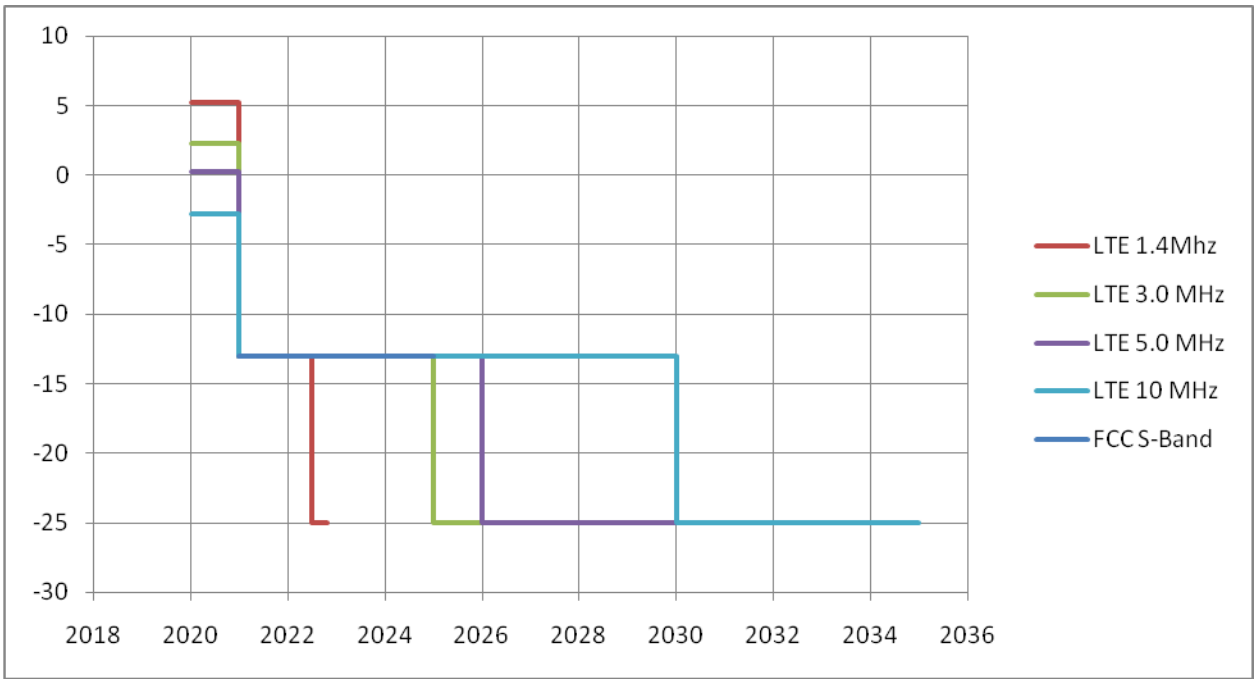
5.2.4 Output RF spectrum emissions

The following figures overlay the FCC-S-Band emission requirements with LTE OOBE additional emission mask for NS_03. It is always assumed in these figures that the LTE channel is located at the edge of the Lower Block or Upper Block. The unit of emission is dBm/MHz. It should be noted that the FCC requirement within the first 1 MHz outside of the channel edge is not drawn in the figures. According to the FCC ruling on S-band, within the the first 1 MHz immediately outside of channel edge, the maximum emission power level is -13 dBm and the measurement bandwidth used can be 1% of the emission bandwidth. This conforms with definition of general OOBE emission mask for the first 1 MHz.

From the figures below, it was found that the FCC has more stringent emission requirement than that of LTE OOBE in the frequency range from 1995 to 2000 MHz. We prefer to address this emission requirement difference in UE Co-Existence requirements instead of adding a new OOBE mask for S-band due to the following reasons. First, the strict FCC emission requirement of -40dBm/MHz at 1995 MHz frequency range is intended to protect G-block so this is an UE coexistence issue. Second, LTE OOBE is defined with respect to the LTE channel instead of operation band, while the FCC emission requirements for the 1995-2000 MHz range is the requirement for the S-band. If this FCC requirement is reflected in a new OOBE mask, it has to assume the worst case that the LTE channel edge is located at 2000 MHz, ie.lower boundary of the S-band, as shown in the Figure 5.2.4-2 a). The OOBE has to drop to the level of -40 dBm/MHz just 5 MHz away from the channel edge. This requirement is unnecessarily stringent for a LTE channel allocated not on the lower edge of S-band. For example, for a LTE channel located in the upper half of the S-band, as shown in the Figure 5.2.4-1 a), as far as the OOBE drops to -40dBm/MHz after 15 MHz, the FCC requirement is still satisfied. This requirement difference for different LTE channel locations can not be reflected in the OOBE mask.

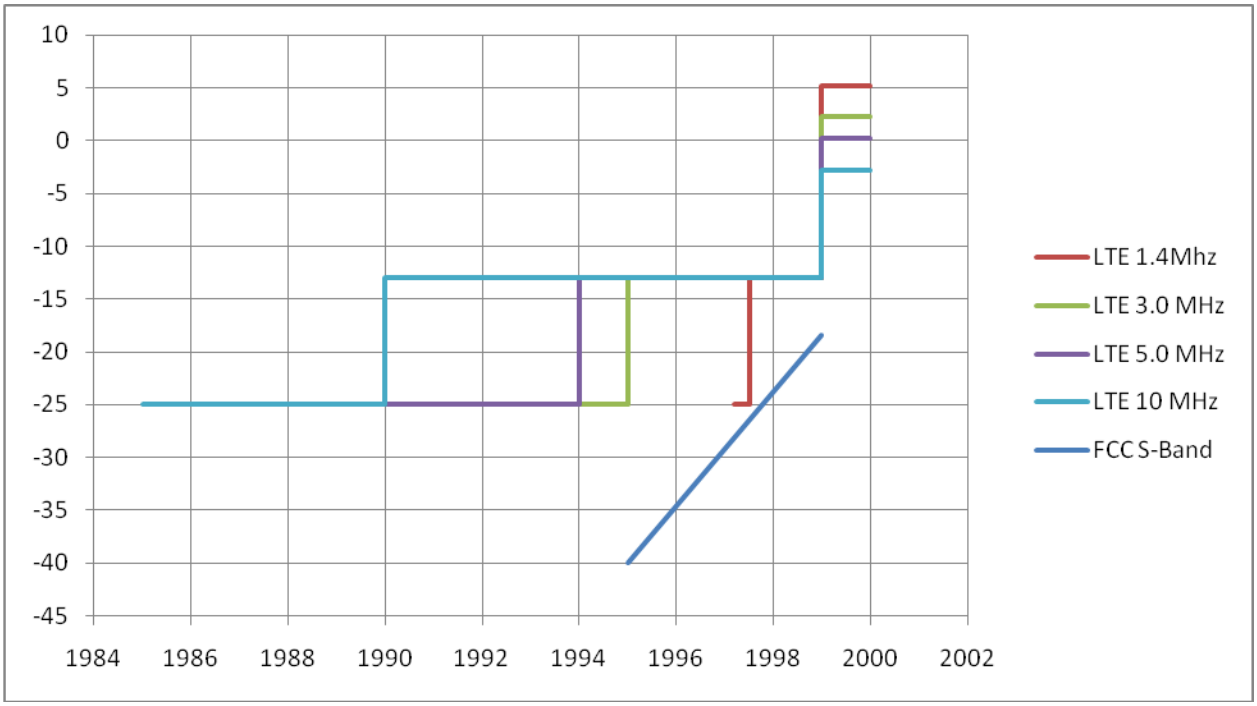


(a) OOBE Requirements for an S-band channel with its Lower Edge at 2010 MHz

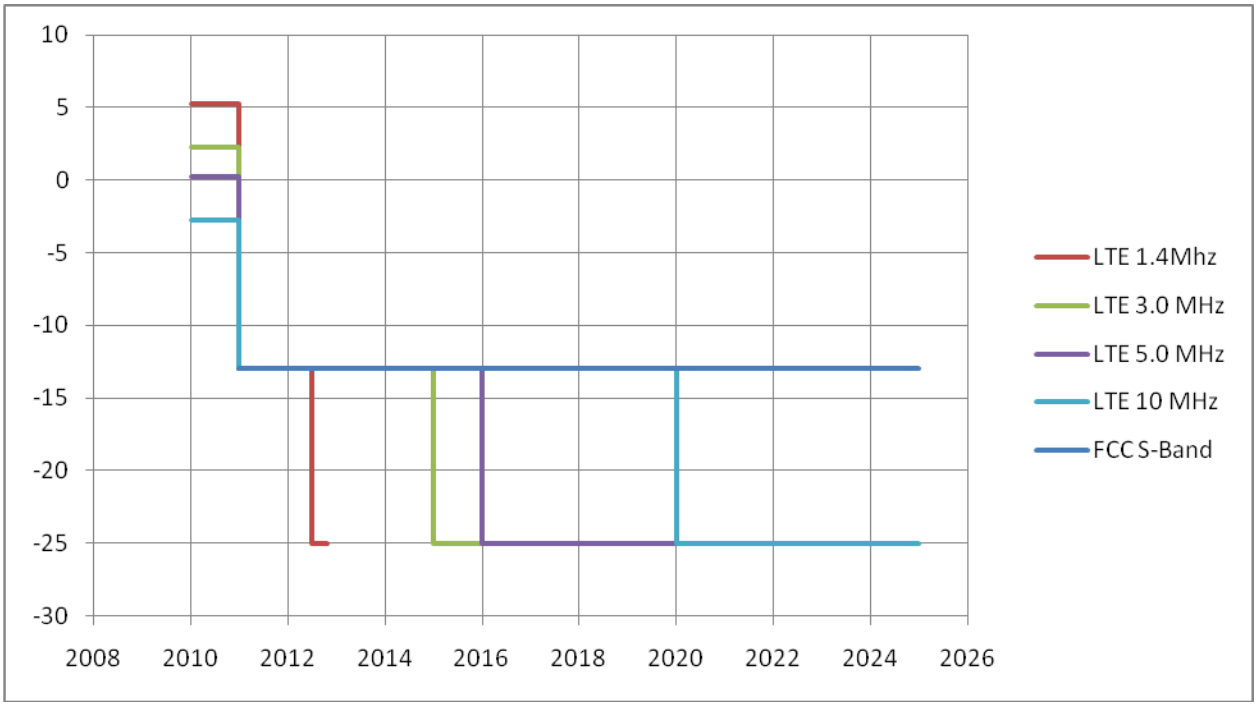


(b) OOBE Requirements for an S-band Channel with its Upper Edge at 2020 MHz

Figure 5.2.4-1. Comparison of S-Band Upper block FCC requirements and LTE OOBE Mask (NS_03).



(a) OOBE Requirements for an S-Band Channel with its Lower Edge at 2000 MHz



(b) OOBE Requirements for an S-band Channel with its Upper Edge at 2010 MHz

Figure 5.2.4-2. Comparison of S-Band Lower block FCC requirements and LTE OOBE Mask (NS_03)

5.2.4.1 Additional Spectrum Emission Mask

This requirement is specified in terms of an "additional spectrum emission" requirement.

5.2.4.1.1 Minimum requirement (network signalled value "NS_03" and "NS_11")

S-band uses the additional spectrum emission mask of NS_03 and NS_11.

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS_03" or "NS_11" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 5.2.4.1.1-1.

Table 5.2.4.1.1-1: Additional requirements

	Spectrum emission limit (dBm)/ Channel bandwidth						
Δf_{OOB} (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz
± 1-2.5	-13	-13	-13	-13	-13	-13	1 MHz
± 2.5-5	-25	-13	-13	-13	-13	-13	1 MHz
± 5-6		-25	-13	-13	-13	-13	1 MHz
± 6-10			-25	-13	-13	-13	1 MHz
± 10-15				-25	-13	-13	1 MHz
± 15-20					-25	-13	1 MHz
± 20-25						-25	1 MHz

5.2.4.2 Spurious Emissions

5.2.4.2.1 Spurious emission band UE co-existence

This clause specifies the requirements for the specified E-UTRA band, for coexistence with protected bands

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 5.2.4.2.1-1: Requirements

E-UTRA Band	Spurious emission						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	Measurement Bandwidth (MHz)	Comment
2	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
4	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
5	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
10	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
12	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
13	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
	Frequency range	763	-	775	-35	0.00625	
14	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
	Frequency range	763	-	775	-35	0.00625	
17	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
[23]	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, [23]	FDL_low	-	FDL_high	-50	1	
	Frequency range	1998	-	1999	-21	1	Note 1
	Frequency range	1997	-	1998	-27	1	
	Frequency range	1996	-	1997	-32	1	
	Frequency range	1995	-	1996	-37	1	
Note 1: To meet this requirement NS_11 value shall be signalled when operating in 2000-2010 MHz							

5.2.5 Receiver characteristics

The frequency range of S-band (UL 2000 to 2020 MHz, DL 2180 to 2200 MHz) is very similar to the Band 1 (UL 1920 to 1980 MHz, DL 2110 to 2170 MHz). Both bands have very large duplex spacing so the self interference is insignificant. It is also expected that UE coexistence emissions requirements will be addressed by A-MPR rather than by imposing additional requirements on the Tx filtering. Therefore, it is expected the receiver characteristics of S-band should be the same as those of Band 1.

5.2.5.1 Reference sensitivity power level

5.2.5.1.1 Minimum requirements (QPSK)

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 5.2.5.1.1-1 and table 5.2.5.1.1-2

Table 5.2.5.1.1-1: Reference sensitivity QPSK $P_{REFSENS}$

Channel bandwidth							
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
[23]	-104.7	-101.7	-100	-97			FDD

Table 5.2.5.1.1-2specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement must be met.

Table 5.2.5.1.1-2: Minimum uplink configuration for reference sensitivity

E-UTRA Band / Channel bandwidth / NRB / Duplex mode							
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
[23]	6	15	25	50			FDD

5.2.5.2 Requirement for large transmission configurations

For some combinations of bandwidths and operating bands, a certain relaxation of the UE performance is allowed when the transmission configuration is larger than that in Table 5.2.5.2-1. Table 5.2.5.2-1 specifies the allowed maximum sensitivity degradation (MSD) when the UL resource block allocation is the maximum supported transmission bandwidth configuration N_{RB} (Table 5.6.1-1 of TS 36.101). Unless given by Table 7.3.1-3 of TS 36.101, the MSD shall be verified with the network signalling value NS_01 (Table 6.2.4-1 of TS 36.101) configured.

Table 5.2.5.2-1: Maximum Sensitivity Degradation

Channel bandwidth							
E-UTRA Band	1.4 MHz (dB)	3 MHz (dB)	5 MHz (dB)	10 MHz (dB)	15 MHz (dB)	20 MHz (dB)	Duplex Mode
[23]	n/a	n/a	n/a	n/a			FDD

5.2.6 Blocking characteristics

5.2.6.1 In-band blocking

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels.

5.2.6.1.1 Minimum requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 5.2.6.1.1-1 and 5.2.6.1.1-2.

Table 5.2.6.1.1-1: In band blocking parameters

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Wanted signal mean power	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
$BW_{Interferer}$	MHz	1.4	3	5	5	5	5
$F_{loffset, case\ 1}$	MHz	2.1+0.0125	4.5+0.0075	7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125
$F_{loffset, case\ 2}$	MHz	3.5+0.0075	7.5+0.0075	12.5+0.0075	12.5+0.0125	12.5+0.0025	12.5+0.0075
Note 1: The transmitter shall be set to 4dB below P_{UMAX} at the minimum uplink configuration specified in TS 36.101 Table 7.3.1-2.							
Note 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1							

Table 5.2.6.1.1-2: In-band blocking

E-UTRA band	Parameter	Units	Case 1	Case 2	Case 3
	$P_{Interferer}$	dBm	-56	-44	-30
	$F_{Interferer}$ (Offset)	MHz	=-BW/2 - $F_{loffset, case\ 1}$ & =+BW/2 + $F_{loffset, case\ 1}$	≤ -BW/2- $F_{loffset, case\ 2}$ & ≥ +BW/2 + $F_{loffset, case\ 2}$	-BW/2 – 9 MHz & -BW/2 – 15 MHz
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12, 13, 18, 19, 20, 21, [23] 33,34,35,36,37,38,39,40	$F_{Interferer}$	MHz	(Note 2)	F_{DL_low} -15 to F_{DL_high} +15	
17	$F_{Interferer}$	MHz	(Note 2)	F_{DL_low} -9.0 to F_{DL_high} +15	F_{DL_low} -15 and F_{DL_low} -9.0 (Note 3)
Note 1 For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band. 2 For each carrier frequency the requirement is valid for two frequencies: a. the carrier frequency -BW/2 -Floffset, case 1 and b. the carrier frequency + BW/2 + Floffset, case 1. 3 $F_{interferer}$ range values for unwanted modulated interfering signal are interferer center frequencies. 4 Case 3 only applies to assigned UE channel bandwidth of 5 MHz.					

5.2.6.2 Out-of-band blocking

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the UE receive band. For the first 15 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in TS 36.101 sub-clause 7.5.1 and sub-clause 7.6.1 shall be applied.

5.2.6.2.1 Minimum requirements

. The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 5.2.6.2.1-1 and 5.2.6.2.1-2.

For Table 5.2.6.2.1-2 in frequency range 1, 2 and 3, up to $\max(24,\ 6\cdot\lceil N_{RB}/6\rceil)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.4.2-1). For these exceptions the requirements of clause 7.7 Spurious response are applicable.

For Table 5.2.6.2.1-2 in frequency range 4, up to $\max\left(8, \lceil (N_{RB} + 2 \cdot L_{CRBs})/8 \rceil\right)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configurations (see Figure 5.4.2-1 of TS 36.101) and L_{CRBs} is the number of resource blocks allocated in the uplink. For these exceptions the requirements of clause 7.7 spurious response are applicable.

Table 5.2.6.2.1-1: Out-of-band blocking parameters

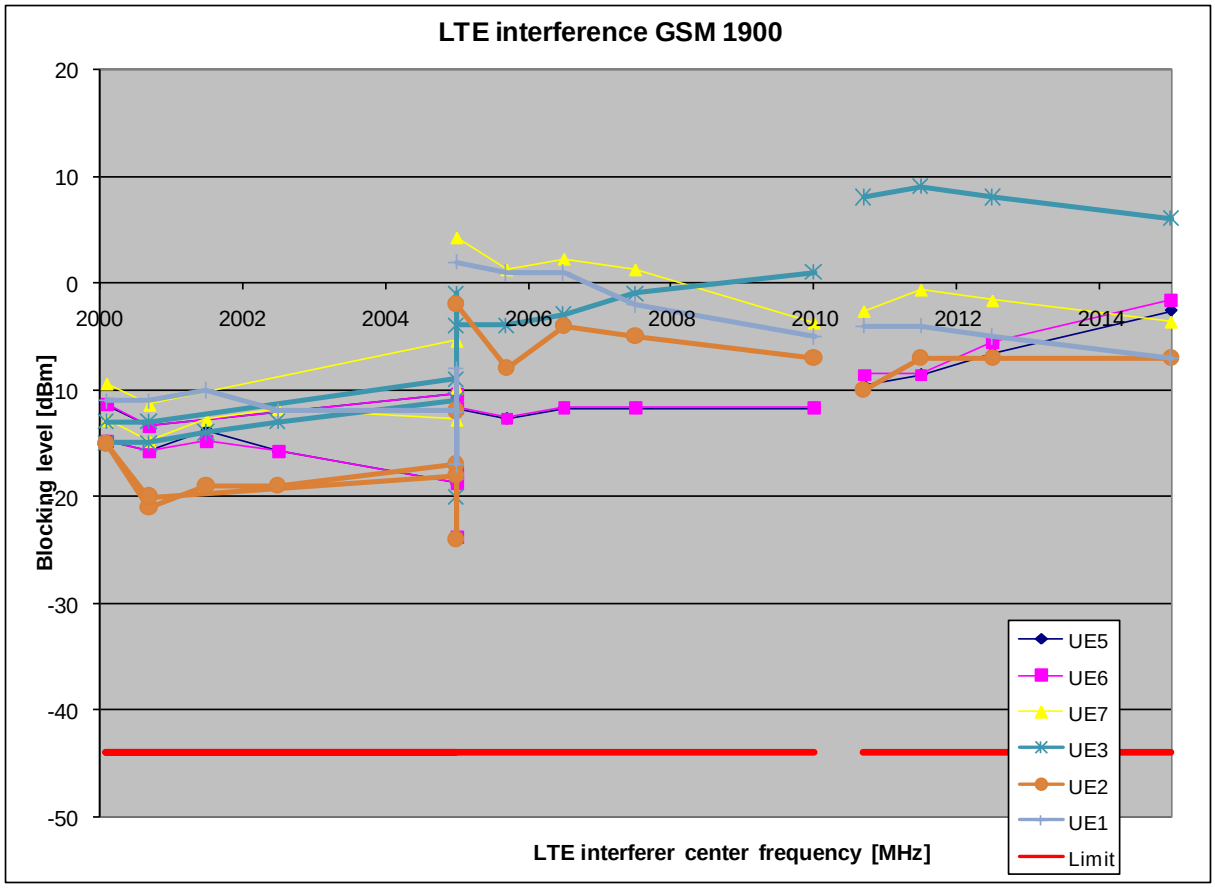
Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Wanted signal mean power	dBm	REFSENS + channel bandwidth specific value below					
		6	6	6	6	7	9
Note 1: The transmitter shall be set to 4dB below P_{UMAX} at the minimum uplink configuration specified in Table 7.3.1-2.							
Note 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.							

Table 5.2.6.2.1-2: Out of band blocking

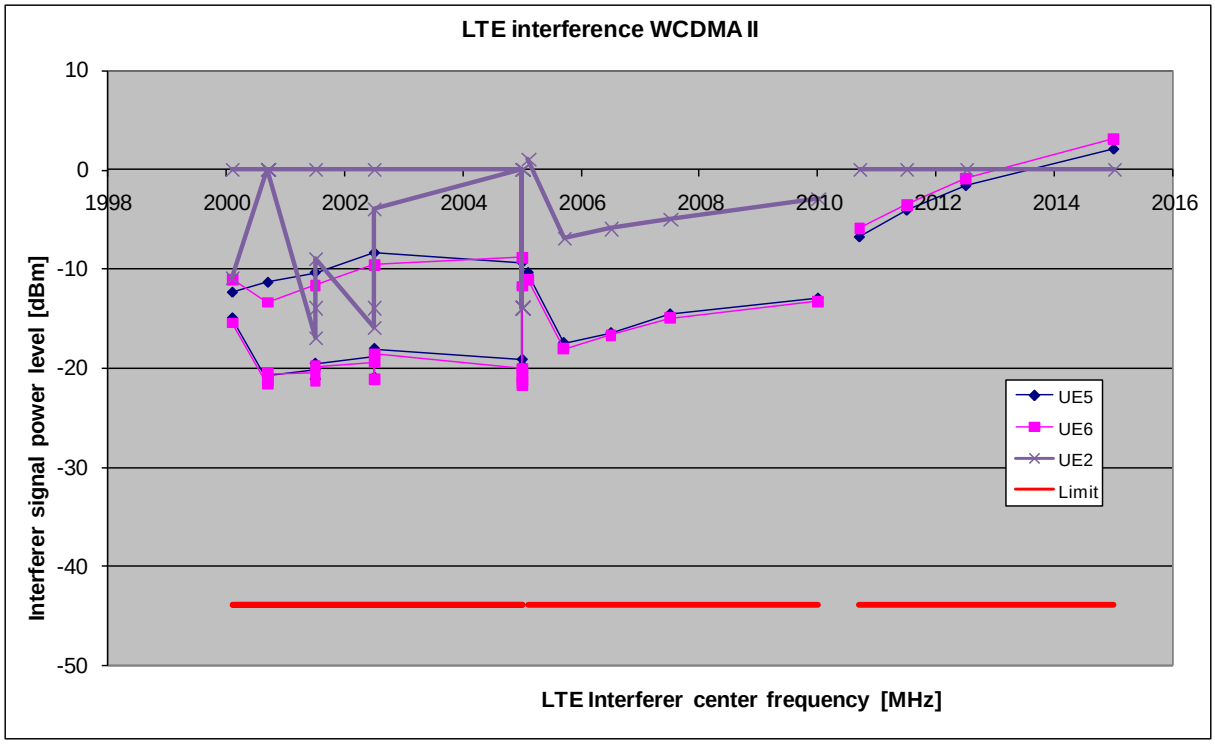
E-UTRA band	Parameter	Units	Frequency			
			range 1	range 2	range 3	range 4
	$P_{Interferer}$	dBm	-44	-30	-15	-15
1, 2, 3, 4, 5 6, 7, 8, 9, 10,11,12, 13, 17, 18, 19, 20, 21, [23], 33,34, 35, 36, 37, 38, 39, 40	$F_{Interferer}$ (CW)	MHz	F_{DL_low} -15 to F_{DL_low} -60	F_{DL_low} -60 to F_{DL_low} -85	F_{DL_low} -85 to 1 MHz	-
			F_{DL_high} +15 to F_{DL_high} + 60	F_{DL_high} +60 to F_{DL_high} +85	F_{DL_high} +85 to +12750 MHz	-
2, 5, 12, 17	$F_{Interferer}$	MHz	-	-	-	F_{UL_low}- F_{UL_high}
Note 1: For the UE which supports both Band 11 and Band 21 the out of blocking is FFS.						

5.2.7 UE Co-existence Consideration

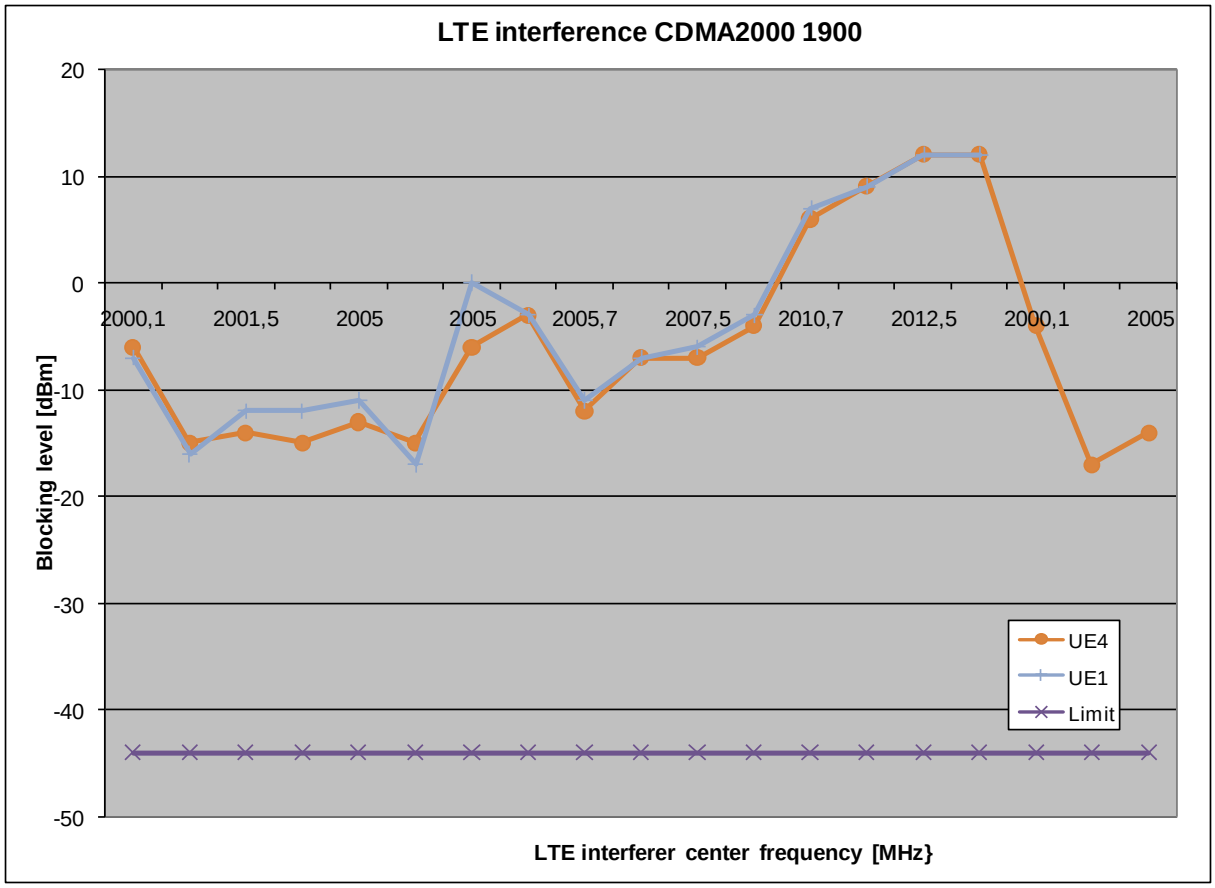
Below are presented measurement results from [3].



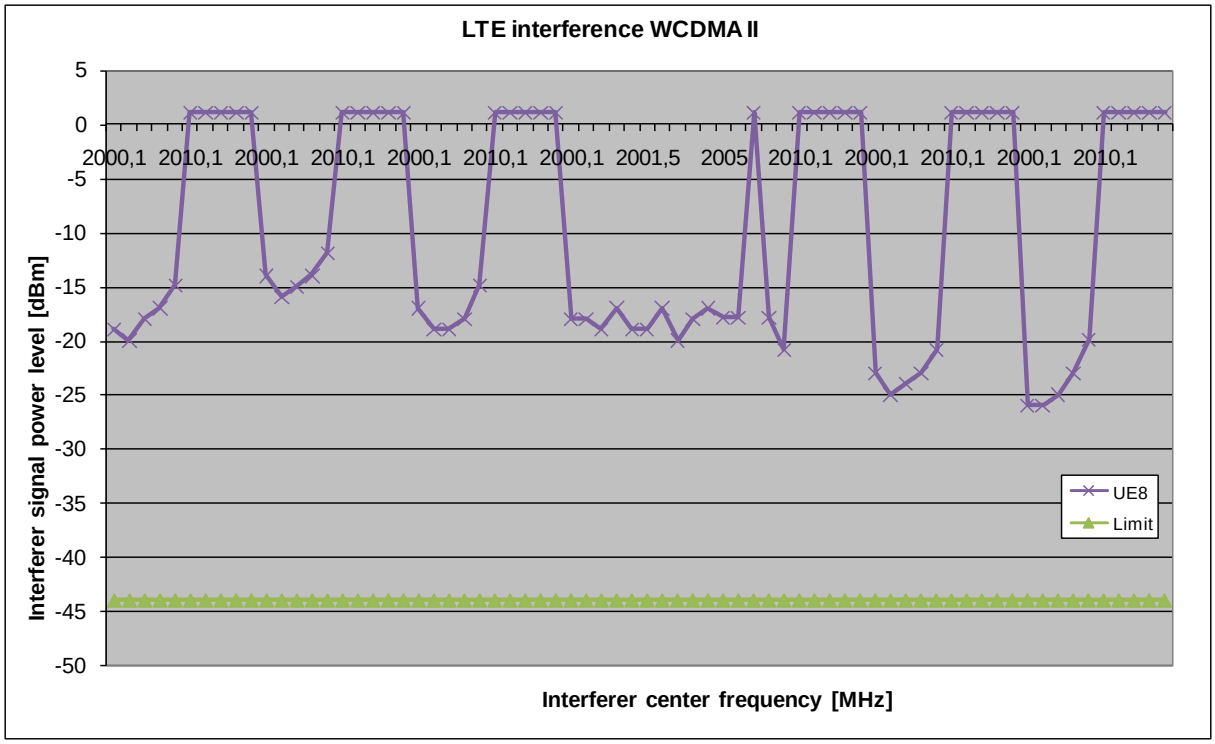
5.2.7-1: GSM1900 results.



5.2.7-2: WCDMA band 2 results



5.2.7-3: CDMA2000 (1900) results



5.2.7-4: LTE band2 results

In results analysis, Power level of -44dBm is used as a blocking requirement in all test cases presented in contribution [3].

On GSM1900 band there is at least 20 dB margin (worst case) and typically margin is > 25 dB.

On WCDMA band 2 there is at least 22 dB margin (worst case) and typically margin is > 20 dB.

On CDMA2000 (1900) there is at least 27 dB margin (worst case) and typically margin is > 30 dB.

On LTE band 2 there is at least 18 dB margin (worst case) and typically margin is > 25 dB.

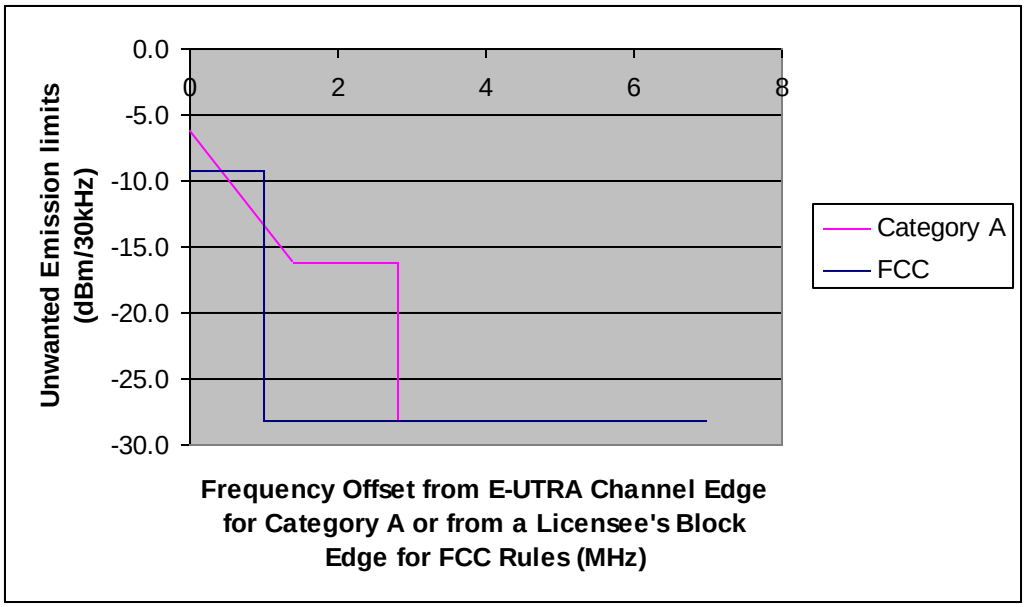
Based on measured devices [3], conclusion is that Band 23 UE (simulated by signal generator) is not causing blocking interference to measured UE's operating in 1900 MHz band. From the results it can be seen also that measured UE's are having significant margin to required blocking levels. This conclusion is based on a single round of measurements with eight (8) UEs and additional measurements, if performed, can be presented later on. If the results of future measurements are different, this conclusion can be revised.

5.3 Specific BS RF requirements

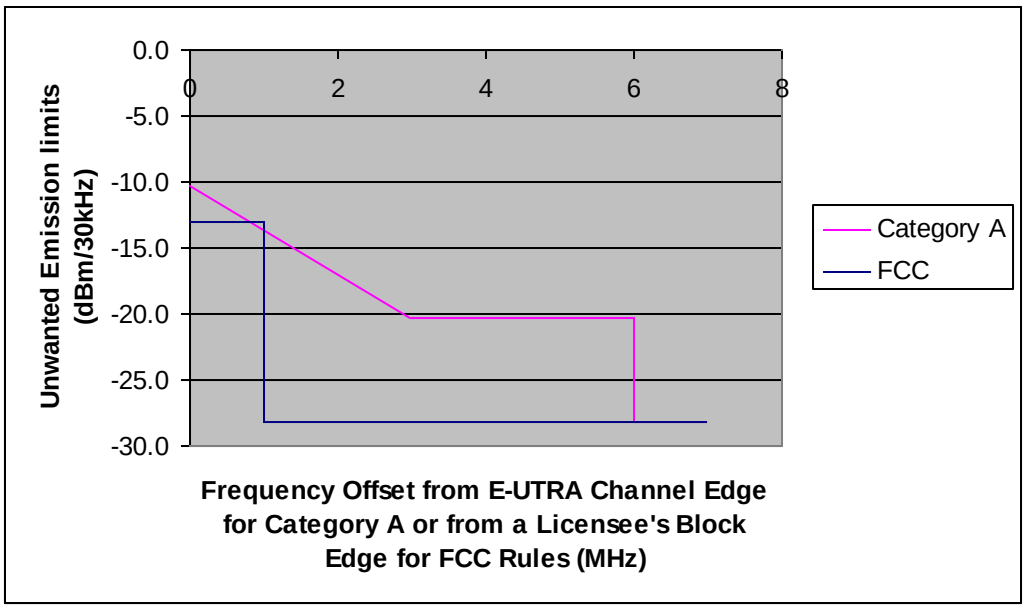
5.3.1 Operating band unwanted emissions

The operating band unwanted emission limits are defined 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. The requirements shall apply whatever the type of transmitter considered (single carrier or multi-carrier) and for all transmission modes foreseen by the manufacturer's specification.

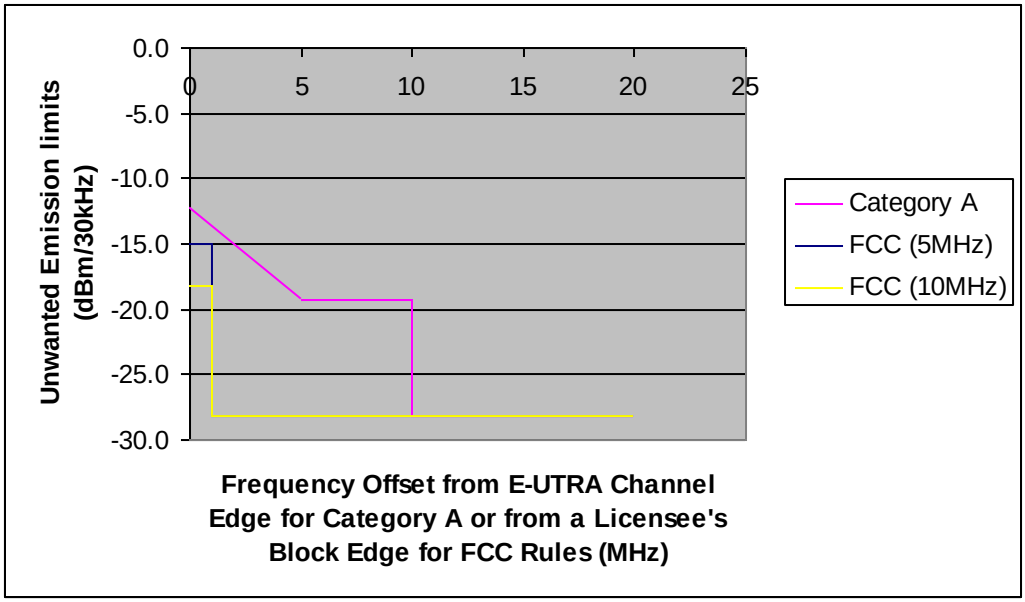
As discussed in Section 4, the BS out-of-band-emission limits mandated by the FCC for this band are the same as those of the PCS (E-UTRA Band 2) and AWS-1 (E-UTRA Band 4), i.e. attenuate out-of-band emissions by a factor of (43 + 10* log(P) dB) below the transmitter power (P) for a resolution bandwidth of 1 MHz or greater. Therefore, the general limits for Category A (as specified in Tables 6.6.3.1-4 to 6.6.3.1-6 of TS 36.104) and the additional limits for E-UTRA bands >1GHz as specified in Table 6.6.3.3-2 of TS 36.104 for E-UTRA Bands 2 and 4 shall also be applied for this band. When the E-UTRA channel edge is aligned with a licensee's band edge, the additional limits outside the E-UTRA channel in Table 6.6.3.3-2 are identical to the FCC emission limits outside the licensee's band. The general (Category A) limits for E-UTRA bands >1GHz and the additional (FCC) limits for this band are shown in Figure 5.3.1-1 below for the 1.4MHz, 3MHz, 5MHz and 10MHz channel bandwidth options. Note that the general limits for Category B are not applicable in North America, and thus need not be specified for this band.



(1a) 1.4MHz channel bandwidth



(1b) 3MHz channel bandwidth



(1c) 5MHz and 10 MHz channel bandwidth

Figure 5.3.1-1: The general (Category A) limits for E-UTRA bands >1GHz and the additional (FCC) limits

5.3.2 Additional spurious emissions requirements

These requirements may be applied for the protection of system operating in frequency ranges other than the E-UTRA BS downlink operating band. The limits may apply as an optional protection of such systems that are deployed in the same geographical area as the E-UTRA BS, or they may be set by local or regional regulation as a mandatory requirement for an E-UTRA operating band.

Through the RAN4 process there have been coexistence challenges identified between the proposed Bands [23] and [25], as well as potentially Band 2. After many months of analysis and negotiation, the coexistence values captured in this Technical Report represent the best compromise feasible at present, and may need to be revisited in the future.

The E-UTRA BS spurious emissions limits currently specified for co-existence with systems operating in other frequency bands are more stringent than the out-of-band emissions limits by the FCC. To ensure sufficient protection to the co-existing systems, the same limits as the other E-UTRA bands BS shall be specified for this band in Clause 6.6.4.3 of TS 36.104 and Clause 6.6.4.5.4 of TS 36.141. And to ensure sufficient protection from the co-existing systems, the same limits as the other E-UTRA bands BS shall be specified for coexistence with the BS in this band in Clause 6.6.4.3 of TS 36.104 and Clause 6.6.4.5.4 of TS 36.141. This is shown in Table 5.3.2-1.

For operation of a BS in Band [25], parts of the limits in Table 5.3.2-1 covering 2000-2005 MHz would according to the definition of spurious emissions not be applicable, since it is less than 10 MHz from the highest frequency of the downlink operating band. In order for the limit to apply, the Band [25] requirement will have to be identified as an exception in the introduction of clause 6.6.4 of TS 36.104, which will be normative. Also, for information, Note 1 below Table 6.6.4.3.1-1 of TS 36.104 will have to be modified to indicate that Band [25] is an exception to Note 1.

Table 5.3.2-1: BS Spurious emissions limits for E-UTRA BS for co-existence with systems operating in other frequency bands:

System type for E-UTRA to co-exist with	Frequency range for co-existence requirement	Maximum Level	Measurement Bandwidth	Note
E-UTRA Band [23]	2180 - 2200 MHz	-52 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in Band [23].
	2000 - 2020 MHz	-49 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in Band [23], since it is already covered by the requirement in subclause 6.6.4.2. This requirement does not apply for BS operating in Bands 2 or [25], where the limits are defined separately.
	2000 – 2010 MHz	-30 dBm	1 MHz	This requirement only applies to E-UTRA BS operating in Band 2 or [25]. This requirement applies starting 5 MHz above the Band [25] downlink operating band. (Note 3)
	2010 – 2020 MHz	-49 dBm	1 MHz	
NOTE 3: This requirement does not apply to a Band 2 E-UTRA BS of an earlier release. In addition, it does not apply to an E-UTRA Band 2 BS from an earlier release manufactured before 31 December, 2012, which is upgraded to support Rel-10 features, where the upgrade does not affect existing RF parts of the radio unit related to this requirement.				

Moreover, as discussed in Section 4, the BS in this band shall meet the following limits on emissions in the 1559-1610 MHz band as requested in FCC DA 09-38 and FCC DA 10-60 as shown in Table 5.3.2-2 below:

Table 5.3.2-2: FCC emission limits in the 1559-1610 MHz band:

	Frequency	dBW/MHz EIRP (Measurement bandwidth = 1 MHz)	dBW EIRP of discrete emissions of less than 700 Hz bandwidth (Measurement bandwidth = 1 kHz)
Base Stations	1559-1610 MHz	-100	-110

Therefore, these requirements shall be specified as additional spurious emissions requirements for this band in Clause 6.6.4.3 of TS 36.104 and Clause 6.6.4.5.4 of TS 36.141. Note that the limits by the FCC in the 1559-1610 MHz band (as shown in Table 5.3-2) are defined in terms of EIRP (effective isotropic radiated power), which is dependent on both the BS emissions at the antenna connector and the deployment (including antenna gain and feeder loss). The EIRP level is calculated using: $EIRP = P_{Tx} + G_{ant}$ where P_{Tx} denotes the BS transmitted power at the antenna connector, G_{ant} equals the BS antenna gain minus feeder loss.

5.3.3 Co-location with other base stations

These requirements may be applied for the protection of other BS receivers when GSM900, DCS1800, PCS1900, GSM850, UTRA FDD, UTRA TDD and/or E-UTRA BS are co-located with an E-UTRA BS. The requirements assume a 30 dB coupling loss between transmitter and receiver and are based on co-location with base stations of the same class.

The E-UTRA BS spurious emissions limits currently specified for co-location with another BS are more stringent than the out-of-band emissions limits by the FCC. To ensure sufficient protection to the co-located BS, the same limits as the other E-UTRA bands BS shall be specified for this band in Clause 6.6.4.4 of TS 36.104 and Clause 6.6.4.5.5 of TS

36.141. And to ensure sufficient protection from the co-located BS, the same limits as the other E-UTRA bands BS shall be specified for co-location with the BS in this band in Clause 6.6.4.4 of TS 36.104 and Clause 6.6.4.5.5 of TS 36.141.

5.3.4 General blocking requirement

The blocking characteristics is a measure of the receiver ability to receive a wanted signal at its assigned channel in the presence of an unwanted interferer, which are either a 1.4MHz, 3MHz or 5MHz E-UTRA signal for in-band blocking or a CW signal for out-of-band blocking.

The general blocking requirements currently specified for E-UTRA BS apply the in-band blocking signal within the +/- 20 MHz of the UL frequency range of a band, except when the DL frequency range of the same band falls within such range. Since the duplex distance of this band is larger than 20 MHz and thus no exception is needed, the same general blocking requirements as specified for E-UTRA Bands 2 and 5 BS shall be specified for this band in Clause 7.6.1 of TS 36.104 and Clause 7.6.5.1 of TS 36.141 to ensure sufficient BS receiver blocking ability.

5.3.5 Blocking requirement for co-location with other base stations

This additional blocking requirement may be applied for the protection of E-UTRA BS receivers when GSM, UTRA or E-UTRA BS operating in a different frequency band are co-located with an E-UTRA BS. The requirements assume a 30 dB coupling loss between interfering transmitter and E-UTRA BS receiver and are based on co-location with base stations of the same class.

The blocking requirements currently specified for E-UTRA BS when co-located with BS in other frequency bands do not apply when the interfering signal falls within the +/-10 MHz of the UL frequency range of a band, except for Band 13 in order to allow co-location with Band 14 BS. The blocking requirements shall be specified for this band in Clause 7.6.2 of TS 36.104 and Clause 7.6.5.2 of TS 36.141 using the same interfering signal as the other E-UTRA bands BS, but do not apply when the interfering signal falls within -10 MHz and +10 MHz of the UL frequency range of this band (i.e. 1990 – 2030 MHz).

6 Summary of required changes to E-UTRA specifications

6.1 Required changes to TS 36.101

Required changes in TS36.101are shown in Table 6.1-1.

Table 6.1-1: Required Changes for TS 36.101

Clause	Description	Description of change
5.5	Operating bands	Add a new row for the band into Table 5.5-1.
5.6.1	Channel bandwidths per operating band	Add channel bandwidths 1.4 – 10 MHz for the band into Table 5.6.1-1.
5.7.3	Carrier frequency and EARFCN	Add a new channel numbering for the band into Table 5.7.3-1.
5.7.4	TX–RX frequency separation	Add a new row for the band into Table 5.7.4-1.
6.2.2	UE Maximum Output Power	Add a new row for the band into Table 6.2.2-1.
6.2.4	UE Maximum Output Power with additional requirements	(FFS) Add a new row for the band into Table 6.2.4-1.
6.6.2.2	Additional Spectrum Emission Mask	Add new requirements for the band.
6.6.3.2	Spurious emission band UE co-existence	Add the band into Table 6.6.3.2-1 for mutual protection with E-UTRA Band 2, 4, 5, 10, 12, 13, 14 and 17.
6.6.3.3	Additional spurious emissions	(FFS) Add new requirements for the band.
7.3	Reference sensitivity power level	Add a new row for the band into Tables 7.3.1-1, 7.3.1-2, 7.3.2-1 and, when deems necessary, 7.3.1-3.
7.6.1	In-band blocking	Add the band into Table 7.6.1.1-2.
7.6.2	Out-of-band blocking	Add the band into Table 7.6.2.1-2.

6.2 Required changes to TS 36.104

Required changes in TS36.104 are shown in Table 6.2-1.

Table 6.2-1: Required Changes for TS 36.104

Clause	Description	Description of change
5.5	Operating bands	Add a new row for the band into Table 5.5-1.
5.7.3	Carrier frequency and EARFCN	Add new channel numbers for the band into Table 5.7.3-1.
6.6.3	Operating band unwanted emissions	Add the band to Category A.
6.6.4.3	Additional spurious emissions requirements	Add a new row for the band into Tables 6.6.4.3.1-1 and 6.6.4.3-1x.
6.6.4.4	Co-location with other base stations	Add a new row for the band into Tables 6.6.4.4.1-1 and 6.6.4.4.1-2.
7.6.1	General blocking requirement	Add the band into Tables 7.6.1.1-1, 7.6.1.1-1a, and 7.6.1.1-1b.
7.6.2	Co-location with other base stations	Add a new row for the band into Tables 7.6.2.1-1 and 7.6.2.1-2.

6.3 Required changes to TS 36.113

Required changes in TS36.113 are shown in Table 6.3-1.

Table 6.3-1: Required changes for TS36.113

Clause	Description	Description of change
4.5.2	**Receiver exclusion band**	**Add a new row for the band.**

6.4 Required changes to TS 36.124

Required changes in TS36.124 are shown in Table 6.4-1.

Table 6.4-1: Required changes for TS36.124

Clause	Description	Description of change
4.4	Receiver exclusion band	Add a new row for the band.

6.5 Required changes to TS 36.133

Required changes in TS36.133 are shown in Table 6.5-1.

Table 6.5-1: Required changes for TS36.133

Clause	Description	Description of change
4.2.2.3	Measurements of intra-frequency E-UTRAN cells	Add the band to the band list for RSRP and SCH_RP.
4.2.2.4	Measurements of inter-frequency E-UTRAN cells	Add the band to the band list for RSRP and SCH_RP.
8.1.2.2	E-UTRAN intra frequency measurements	Add the band to the band list for SCH_RP.
8.1.2.3	E-UTRAN inter frequency measurements	Add the band to the band list for RSRP and SCH_RP.
8.1.2.5	E-UTRAN OTDOA Intra-Frequency RSTD Measurements	Add the band to the band list for PRP.
8.1.2.6	E-UTRAN Inter-Frequency OTDOA Measurements	Add the band to the band list for PRP.
9.1.2	Intra-frequency RSRP Accuracy Requirements	Add the band to the band list for RSRP.
9.1.3	Inter-frequency RSRP Accuracy Requirements	Add the band to the band list for RSRP.
9.1.5	Intra-frequency RSRQ Accuracy Requirements	Add the band to the band list for RSRP.
9.1.6	Inter-frequency RSRQ Accuracy Requirements	Add the band to the band list for RSRP.
9.1.9	UE Rx – Tx time difference	Add the band to the band list for RSRP.
9.1.10	Reference Signal Time Difference (RSTD)	Add the band to the band list for PRP.
A.9.1.1	(RSRP) FDD Intra frequency case	Add the band to the band list for Noc, RSRP, and Io.
A.9.1.3	(RSRP) FDD—FDD Inter frequency case	Add the band to the band list for Noc, RSRP, and Io.
A.9.2.1	(RSRQ) FDD Intra frequency case	Add the band to the band list for Noc, RSRP, RSRQ, and Io.
A.9.2.3	(RSRQ) FDD—FDD Inter frequency case	Add the band to the band list for Noc, RSRP, RSRQ, and Io.

6.6 Required changes to TS 36.141

Required changes in TS36.141 are shown in Table 6.6-1.

Table 6.6-1: Required Changes for TS36.141

Clause	Description	Description of change
5.5	Operating bands	Add a new row for the band into Table 5.5-1.
5.7.3	Carrier frequency and EARFCN	Add new channel numbers for the band into Table 5.7.3-1.
6.6.3	Operating band unwanted emissions	Add the band to Category A.
6.6.4.5.4	Co-existence with other systems in the same geographical area	Add a new row for the band into Tables 6.6.4.5.4.1-1 and 6.6.4.5.4-1x.
6.6.4.5.5	Co-location with other base stations	Add a new row for the band into Tables 6.6.4.5.5-1 and 6.6.4.5.5-2.
7.6.5.1	(Blocking) General requirement	Add the band into Tables 7.6-1, 7.6-1a and 7.6-1x.
7.6.5.2	Co-location with other base stations	Add a new row for the band into Table 7.6-3 and 7.6-4..

6.7 Required changes to TS 25.461

Required changes in TS25.461 are shown in Table 6.7-1.

Table 6.7-1: Required changes for TS25.461

Clause	Description	Description of change
4.3.7	Operating bands	Add a new row for the band in Table 4.3.7.1.

6.8 Required changes to TS 25.466

Required changes in TS25.466 are shown in Table 6.8-1.

Table 6.8-1: Required changes for TS25.466

Clause	Description	Description of change
Annex B	Assigned fields for additional data	Add an entry for the band in Table B.2-1.

6.9 Required changes to TS 36.307 Version 8.1.0

Required change in TS36.307 Version 8.1.0 are shown in Table 6.9-1.

Table 6.9-1: Required changes for TS36.307 Version 8.1.0

Clause	Description	Description of change
X	Added Band	Add new section X and its tables X.1.1-1 and X.1.2-1 for the band to define as release-independent.

6.10 Required changes to TS 36.307 Version 9.1.1

Required change in TS36.307 Version 9.1.1 are shown in Table 6.9-1.

Table 6.9-1: Required changes for TS36.307 Version 9.1.1

Clause	Description	Description of change
X	Added Band	Add new section X and its tables X.1.1-1 and X.1.2-1 for the band to define as release-independent.

6.11 Required changes to TS 25.101

Required changes in TS25.101are shown in Table 6.11-1.

Table 6.11-1: Required Changes for TS25.101

Clause	Description	Description of change
6.6.3	Spurious emissions	Add the band DL frequency range into Tables 6.13 and 6.13A for UTRA Band II, IV, V, X, XII, XIII and XIV.

6.12 Required changes to TS 25.104

Required changes in TS25.104 are shown in Table 6.12-1.

Table 6.12-1: Required Changes for TS25.104

Clause	Description	Description of change
6.6.3.3	Co-existence with other systems in the same geographical area	Add a new row for the band into Table 6.11.
6.6.3.4	Co-existence with co-located and co-sited base stations	Add a new row for the band into Tables 6.12 and 6.14.
6.6.3.9	Co-existence with Home BS operating in other bands	Add a new row for the band into Tables 6.20.
7.5.2	Minimum Requirement - Co-location with GSM900, DCS 1800, PCS1900, GSM850, UTRA FDD and/or E-UTRA FDD	Add a new row for the band into Tables 7.5C and 7.5E.

6.13 Required changes to TS 25.141

Required changes in TS25.141 are shown in Table 6.13-1.

Table 6.13-1: Required Changes for TS25.141

Clause	Description	Description of change
6.5.3.7.4	Co-existence with other systems in the same geographical area	Add a new row for the band into Table 6.38.
6.5.3.7.5	Co-existence with co-located and co-sited base stations	Add a new row for the band into Tables 6.39 and 6.41.
6.5.3.7.10	Co-existence with Home BS operating in other bands	Add a new row for the band into Tables 6.47.
7.5.5	Blocking characteristics - Test Requirements	Add a new row for the band into Tables 7.4N and 7.4Q.

6.14 Required changes to TS 37.104

Required changes in TS37.104 are shown in Table 6.14-1.

Table 6.14-1: Required Changes for TS37.104

Clause	Description	Description of change
6.6.1.3	Additional spurious emissions requirements	Add a new row for the band into Table 6.6.1.3.1-1.
6.6.1.4	Co-existence with co-located and co-sited base stations	Add a new row for the band into Table 6.6.1.4.1-1.
7.5.2	Co-location minimum requirement	Add a new row for the band into Table 7.5.2-1.

6.15 Required changes to TS 37.141

Required changes in TS37.141 are shown in Table 6.15-1.

Table 6.15-1: Required Changes for TS37.141

Clause	Description	Description of change
6.6.1.5.5	Additional spurious emission requirements	Add a new row for the band into Table 6.6.1.5.5-1.
6.6.1.5.6	Co-location with other Base Stations	Add a new row for the band into Table 6.6.1.5.6-1.
7.5.5.2	Co-location test requirements	Add a new row for the band into Table 7.5.5.2-1.

7 Project plan

The schedule and work task status for this work item are summarized in Table 7.1-1 below.

Table 7.1-1 Schedule and work task status

RAN4 Meeting and Date	Work Tasks	Status
RAN4#55 (April 2010)	TR Skeleton	Approved
	Task description and regulatory background	Approved
	Summary of required changes to E-UTRA specifications	Approved
	Band and channel arrangement	Discussed
RAN4 Ad-hoc#3 (June 2010)	Work plan	Agreed
	Continue discussion on regulatory background	Agreed
	Bandwidth deployment scenarios	Agreed
	Discussion on specific BS RF requirements	Discussed
	Discussion on specific UE RF requirements (maximum output power with additional requirements, spurious emissions, reference sensitivity power level, blocking characteristics)	Discussed
	Agreement on band and channel arrangement	Agreed
RAN4#56 (August 2010)	Continue discussion on specific BS RF requirements	Partially agreed
	Continue discussion on specific UE RF requirements	Partially agreed
RAN4 Ad-hoc#4 (October 2010)	Agreement on specific UE RF requirements	
	Agreement on specific BS RF requirements	
	Updated Work Plan	
	Draft CRs for review and comment	
RAN4#57 (November 2010)	Final TR	
	Final CRs	

8 Open issues

Annex A: Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2010-05	RAN4#55	R4-102131			TS skeleton created from 3GPP TS template.		0.0.1
2010-6	R4 AH 10-03	R4-102653			Update based on approved text from the Work item	0.0.1	0.1.0
2010-08	RAN4#56	R4-103299 R4-103427			Update based on approved R4 AH 10-03 input documents Update based on approved R4#56 input documents	0.1.0 0.2.0	0.2.0 0.3.0
2010-09	RAN#49	RP-100804			Update presented for information (60% complete)	0.3.0	1.0.0
2010-11	R4#57	R4-104120			Update numbering, content unchanged, presented for information	1.0.0	1.0.1
2011-01	RAN4#57	R4-110462			Update based on approved R4#57 documents	1.0.1	1.1.0

	AH				**R4-103565** "Work plan for Adding 2 GHz band LTE for ATC of MSS in North America **R4-104070** "Updated Reference Sensitivity Requirements for 1.4 bandwidth for Band 23" **R4-104247** "Updates for required changes for Adding 2GHz band LTE of MSs in North America" **R4-104320** "Add 2 GHz band LTE for ATC of MSS in North America to TS36.133" **R4-104321** "Add 2 GHz band LTE for ATC of MSS in North America to TS36.307" Rel-8 **R4-104322** "Add 2 GHz band LTE for ATC of MSS in North America to TS36.307" Rel-9 **R4-104323** "Add 2 GHz band LTE for ATC of MSS in North America to TS25.466" R4-104804 "Band 23 A-MPR"		
2011-02	RAN4#58	R4-111325			Update based on approved R4#57AH documents: **R4-110500** "Band 23 UE Requirements"	1.1.0	1.2.0
2011-04	RAN4#58 AH	R4-112143			Update based on approved R4#58AH document: R4-112229 "Band 23 BS Requirements"	1.2.0	1.3.0
2011-05	RAN4#59	R4-112529			Update based on approved R4#58AH documents: R4-112261 "Legacy UE RX Blocking with Band 23 LTE UE as interferer measurement results"	1.3.0	1.4.0
2011-06	RAN#52	RP-110622			Submitted for Approval to TSG-RAN	1.4.0	2.0.0
2011-06	RAN#52	RP-110622			V2.0.0 approved by TSG-RAN	2.0.0	10.0.0