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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

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1 Scope

The present document contains the findings of the Study Item [28] of a more harmonised frequency variant approach within the frequency range of 806-849/851-894 MHz.

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] R4-122874: "Band 26/XXVI and global harmonisation of bands", Ericsson, ST-Ericsson, RAN4#63.

[3] R4-115687: "Alignment of UE requirements for Band 26 and Band XXVI", Ericsson, ST-Ericsson, RAN4#61.

[4] R4-122123: "Lower E850 band edge way forward", NII Holdings.

[4] R4-093902: "Liaison Statement in support of a UMTS/LTE band for 806-824/851-869Mhz (Source: International iDEN Operator's Forum, To: RAN 4, Cc:)", International iDEN Operator's Forum.

[5] AEI by Dempa Publications, September 2008.

[6] FCC rules Section 90.210(g): http://www.hallikainen.com/FccRules/2010/90/210/.

[7] FCC rules Section 90.691:http://www.hallikainen.com/FccRules/2010/90/691/.

[8] RSS-119 Issue 10, April 2010 "Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz", Industry Canada

[9] 3GPP TS 25.104: "Base Station (BS) radio transmission and reception (FDD)".

[10] 3GPP TS 25.113: "Base station (BS) and repeater electromagnetic compatibility (EMC)".

[11] 3GPP TS 34.124: "Electromagnetic compatibility (EMC) requirements for mobile terminals and ancillary equipment".

[12] 3GPP TS 25.133: "Requirements for support of radio resource management (FDD)".

[13] 3GPP TS 25.141: "Base Station (BS) conformance testing (FDD)".

[14] 3GPP TS 25.307: "Requirements on User Equipments (UEs) supporting a release-independent frequency band".

[15] 3GPP TS 25.331: "Radio Resource Control (RRC); Protocol specification".

[16] 3GPP TS 25.461: "UTRAN Iuant interface: Layer 1".

[17] 3GPP TS 25.466: "UTRAN Iuant interface: Application part".

[18] 3GPP TS 25.101: "User Equipment (UE) radio transmission and reception (FDD)".

[19] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[20] 3GPP TS 36.104: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception".

[21] 3GPP TS 36.113: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) and repeater ElectroMagnetic Compatibility (EMC)".

[22] 3GPP TS 36.124: "Evolved Universal Terrestrial Radio Access (E-UTRA); Electromagnetic compatibility (EMC) requirements for mobile terminals and ancillary equipment".

[23] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[24] 3GPP TS 36.141: "Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing".

[25] 3GPP TS 36.307: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements on User Equipments (UEs) supporting a release-independent frequency band".

[26] 3GPP TS 37.113: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) Electromagnetic Compatibility (EMC)".

[27] 3GPP TS 37.141: "E-UTRA, UTRA and GSM/EDGE; Multi-Standard Radio (MSR) Base Station (BS) conformance testing".

[28] RP-090666 "Proposed SI: Extended 850", Alcatel-Lucent, Ericsson, Motorola, NII Holdings, Nokia, Nokia Siemens Networks, ST-Ericsson.

3 Definitions, symbols and abbreviations

3.1 Definitions

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

3.2 Symbols

Void

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].

ETC Extreme testing conditions
ESMR Enhanced Specialized Mobile Radio
FBAR Bulk acoustic resonator
FCC Federal Communications Commission
IMT International Mobile Telecommunications
ITU International Telecommunication Union
RBW Resolution bandwidth
SAW Surface acoustic wave

4 Background

850 MHz bands like Band 5 with its local versions are of great importance for mobile communications: about 70% or the world's population has 850 MHz coverage and they have good propagation properties. Figure 4-1 shows a world map where the yellow and orange colours indicate 800/850 MHz usage. Hence it is natural to consider an extension of the 850 MHz band plan that has started Japan with the allocation and specification of Bands 18 and 19, and consider as a further step a world-wide harmonisation.

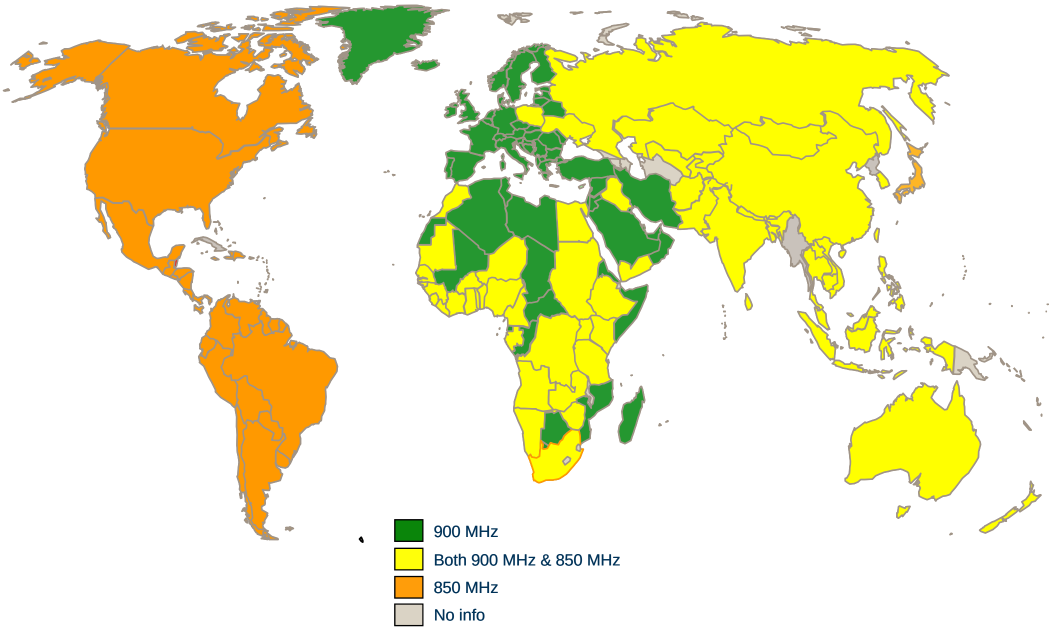

Figure 4-1: Allocation of bands below 1 GHz in the world

Furthermore, additional spectrum below Band 5 in the frequency range 806-824/851-869 MHz is already allocated by ITU for IMT around the world for possible 3GPP technologies. There are many operators around the world using this allocation for non-3GPP technologies that would like to have the option of adopting 3GPP technologies.

There are a number of 3GPP bands specified in the frequency range from 800 MHz to 900 MHz. Having many different bands that are different in different locations in the world, although overlapping each other, creating a problem for UE implementations since the number of bands available in one UE is limited and this will reduce the economy-of-scale. The same applies to the base station implementations in principle. Furthermore, large bandwidth allocations create better opportunities and flexibility in service offerings: different channel bandwidths can be used, it is easier to expand networks by adding frequencies when e.g. being capacity limited and LTE/HSPA migration is facilitated. Hence it is beneficial to study a more harmonised frequency variant approach within the frequency range of 806-849/851-894 MHz taking into account relevant coexistence scenarios and implementation aspects of duplex arrangements.

4.1 Task description

Study a more harmonised frequency variant approach within the frequency range of 806-849/851-894 MHz. The investigations will include RF performance requirements and backward compatibility issues.

Study means such as A-MPR (LTE) and power back-off (CM for WCDMA) to facilitate coexistence with services in adjacent bands. One example is the Public Safety band below the SMR band in the US.

5 Frequency band arrangements

5.1 Regulatory framework for bands in the range and their use

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5.1.1 The allocation in the Radio Regulations

The starting point is the Radio Regulations according to which the band 806-849/851-894 MHz is part of 790-960 MHz allocated to the MOBILE SERVICE on a primary basis subject to footnotes 5.316 in 790-862 and 5.317A (reproduced below) above 862 MHz.

5.317A *Administrations wishing to implement International Mobile Telecommunications (IMT-2000) may use parts of the band 806-960 MHz which are allocated to the mobile service on a primary basis or planned to be used for mobile systems (see Resolution* ***224 (WRC-2000)****). This indentification does not preclude the use of these bands by any application of the service to which they are allocated and does not establish priority in the Radio Regulations.*

5.1.2 Use of the additional spectrum in various regions

5.1.2.1 Region 1

5.1.2.2 Region 2

With the exception of the Southeastern United States and possibly border regions, the allocation in the United States after re-banding is shown in Figure 5.1.2.2-1. The lower frequencies in the 800 MHz range are mobile or control-station transmit frequencies, the upper frequencies for base-station transmit frequencies. For the 700 MHz band it is the converse (swapped band).

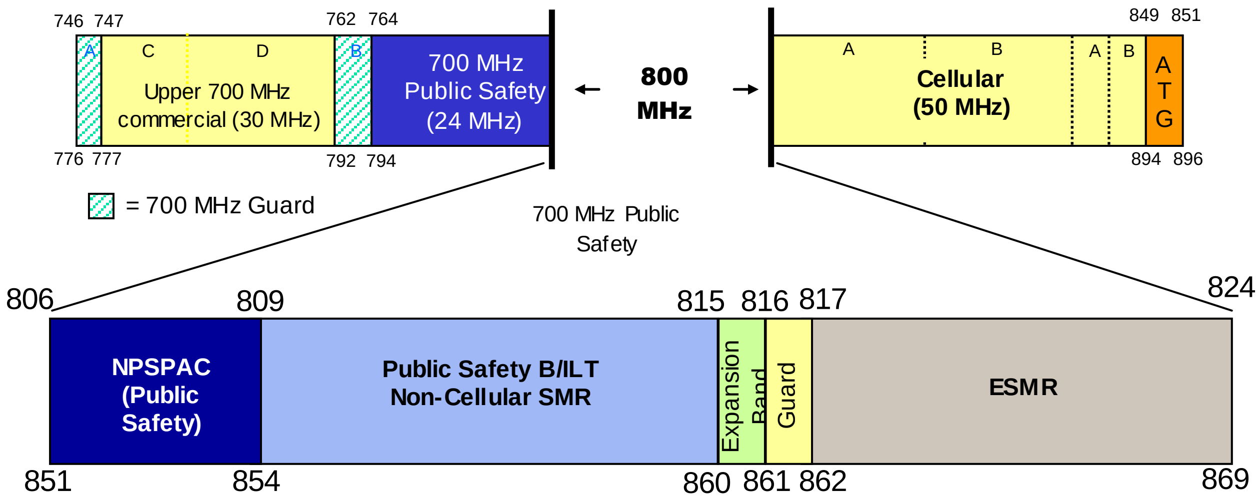

Figure 5.1.2.2-1: Band plan for many areas of the United States

In the Southeastern United States, the FCC's Re-banding Order expanded the ESMR band to accommodate both Sprint Nextel's and SouthernLINC Wireless' iDEN networks. The allocation in the Southeastern United States after re-banding is shown in Figure 5.1.2.2-2.

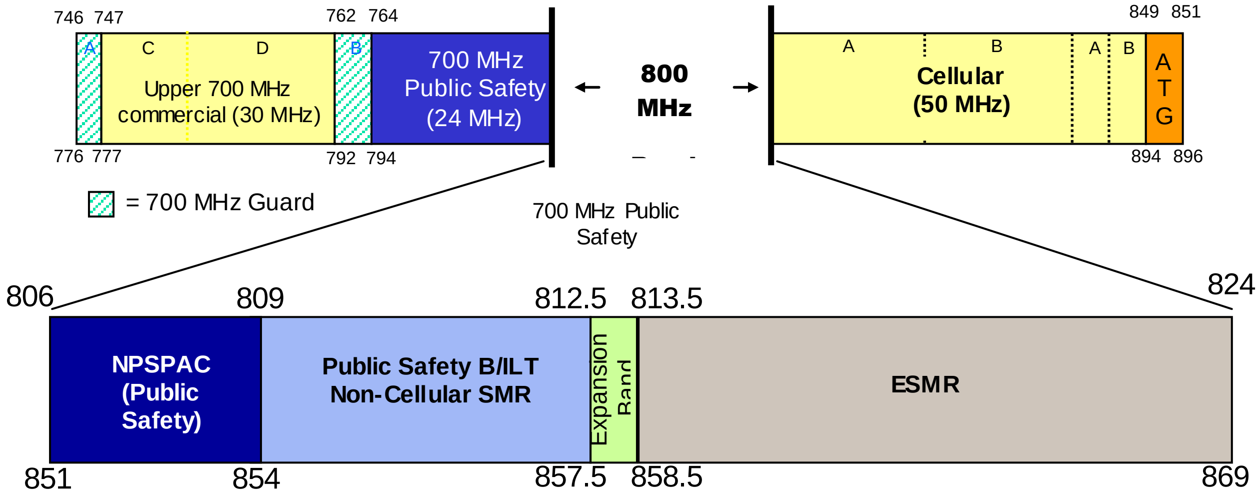

Figure 5.1.2.2-2: Band plan for the Southeastern United States

Numerous public safety radio systems (such as those used by police, firefighters and emergency medical technicians) operate at 806-824 MHz/851-869 MHz in the United States. A number of private mobile radio systems also operate in the 800 MHz band; many utility companies use the band for internal communications for example. The band is also home to Specialized Mobile Radio (SMR) systems that provide commercial mobile service to businesses and public, and can also be used for UTRA or E-UTRA. ESMR operators occupy the upper band segment, adjacent to the cellular band (Band 5). Public safety and other high-site systems occupy the lower band segment, adjacent to the 700 MHz public safety.

Figure 5.1.2.2-3 shows the general band plan for iDEN in South America. Other regions may have slightly different band plans. As we can see from the figure, there are different types of RF networks operating in adjacent spectrum blocks, which may result in additional RF requirements. In Argentina, the spectrum from 819.5- 824 MHz uplink and 864.5-869 MHz downlink is allocated in 25 kHz channels to various Public Safety agencies and the Armed Forces. Therefore, Public Safety will be in-band with both the Upper and Lower bands.

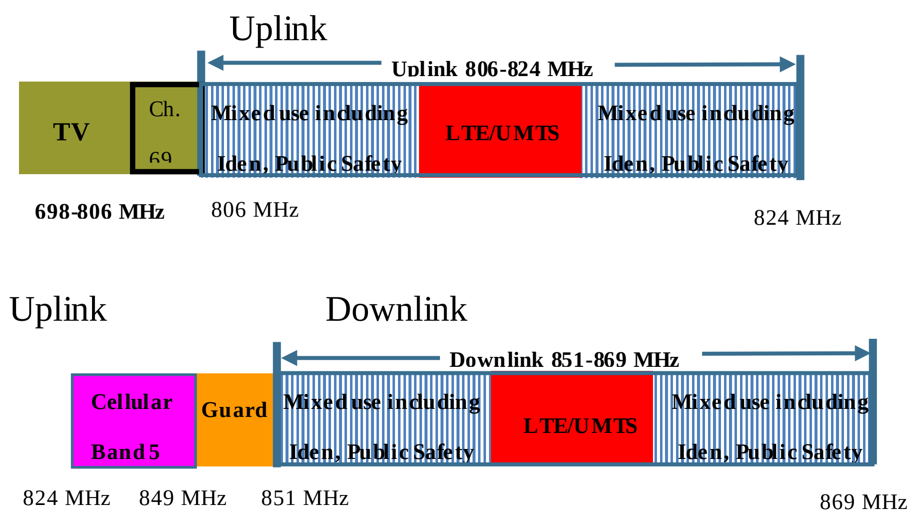

Figure 5.1.2.2-3: Generic iDEN band plan in South America

5.1.2.3 Region 3

The 850 MHz frequency allocation in China is illustrated in Figure 5.1.2.3-1.

825-835/870-880MHz for CDMA

885-915/930-960MHz for GSM

Figure 5.1.2.3-1: 850 MHz frequency allocation in China

Since the guard band between CDMA downlink and GSM uplink is only 5MHz in China, the CDMA base station transmitter will cause interference to GSM900 base station receiver in the same geographical area. The extending of 850MHz will further increase the coexistence inference. Furthermore, current extension band plan assumption of 806-849/851-894 MHz is overlapping with existing GSM900 frequency band in China. Therefore, the extension of 850MHz band is not applicable for China.

Figure 5.1.2.3-2 gives the 850MHz frequency allocation in Korea current and after 2011.

- 824-849/869-894MHz for IMT

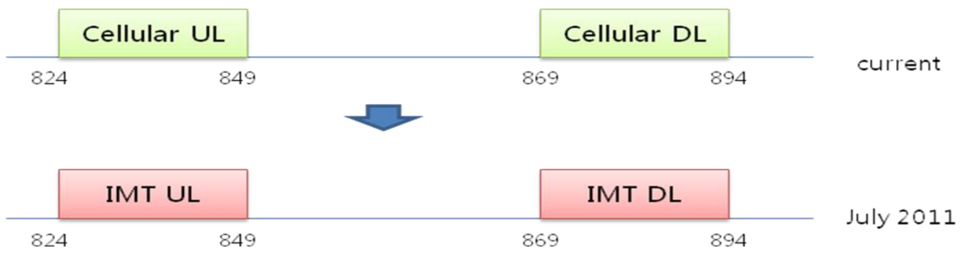

Figure 5.1.2.3-2: 850 MHz frequency allocation in Korea

The band that is currently being used in Korea is identical to band 5, which is a cellular band.

The usage contract of the band will expire in July, 2011.

In June, 2010, the Korean government has reclaimed and reallocated 10MHz of it to LG Uplus as an IMT band.

(IMT UL: 839~849 MHz, IMT DL: 884~894 MHz)

LG Uplus will launch a commercial LTE/LTE-Advanced service on this 10MHz band starting 2012. Since 2012, an LTE based IMT service is expected to be introduced on the band.

The band of 824-839 MHz, 869-884 MHz which is band for SKT will be paid for the extended use and expected IMT service.

5.2 Possible duplexer arrangements

5.2.1 Split duplexer arrangement

5.2.1.1 UE aspects

The entire band 806-849/851-894 MHz is not possible to cover using a single duplexer in the UE using any available technology: the duplex gap is only 2 MHz. The option is then to use a split-duplexer arrangement using two duplexers each covering a sub-part of the band. Figure 5.2.1.1-1 shows the general concept of splitting of the band with a possible overlap between the sub-bands.

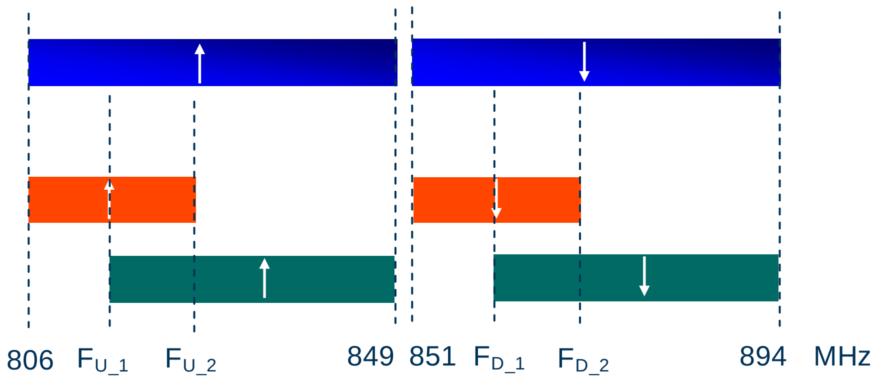

Figure 5.2.1.1-1: Split-band arrangement for 806-849/851-894 MHz (blue part the entire band under study)

An example of a UE implementation of the arrangement is shown in Figure 5.2.1.2 (note that this is only one possible implementation), two switches "S" are typically needed for sufficient overall duplexer performance. Each duplexer filter pair covers a sub-band in Figure 5.2.1.1-2

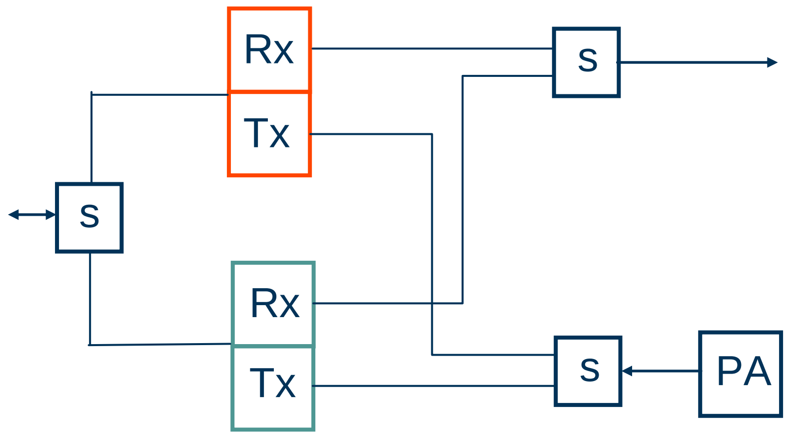

Figure 5.2.1.1.-2: A possible split-duplexer architecture in the UE

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5.2.1.2 BS aspects

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5.2.2 Sub-band arrangement

In the LS [4] The International iDEN Operator's Forum requests that one of the sub-bands be 806-824/851-869 MHz recognizing that the entire band cannot be covered by a single duplexer. This group of operators is interested in deploying UMTS or LTE in the aforementioned sub-band. Furthermore, Band 5 could be extended by 10 MHz with a view to cover Band 5, 6, 18 and 19 in a single duplexer to harmonize existing bands and to increase the amount of available spectrum in certain regions:

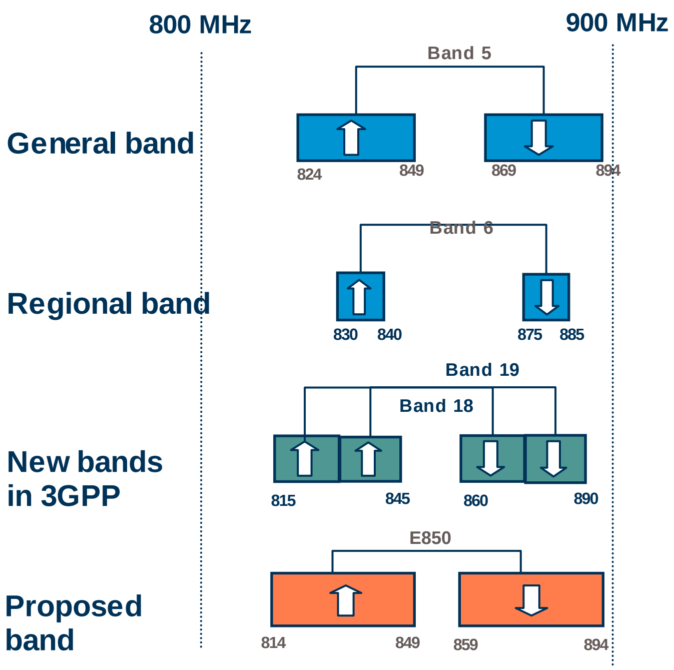

Figure 5.2.2-1: Extension of the general 850 MHz band (E850)

These two proposals would suggest choosing F_{U_1} = 814 MHz, F_{U_2} = 824 MHz, F_{D_1} = 859 MHz and F_{D_2} = 869 MHz in Figure 5.2.2-1, see Figure 5.2.2-2. F_{U_1}, F_{D_1} are the lowest UL and DL frequencies of the sub band 814-849/859-894 MHz and F_{U_2}, F_{D_2} are the highest UL and DL frequencies of the sub band 806-824/851-869 MHz

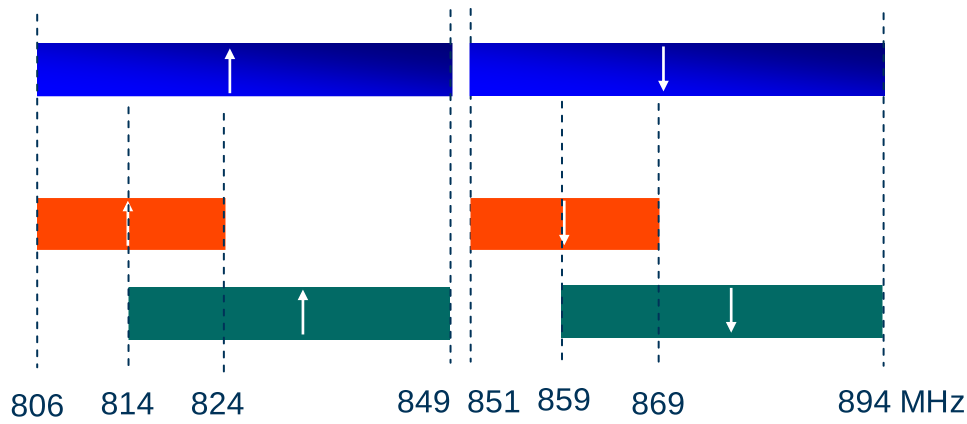

Figure 5.2.2-2: Option with extended Band 5

Some of the iDEN operators have spectrum which falls completely within the consolidated band (814-849/859-894) that has been proposed by Sprint and others. There are also many iDEN operators whose spectrum extends below 814/859 MHz that would benefit from a band that covers the full SMR spectrum. In support of the activity for the extended 850 band Study Item, NII polled the iDEN operators to see which operators were using spectrum above 814/859 MHz, and which operators were using spectrum below that. The purpose was to determine the level of support for a band or sub-band covering the full SMR spectrum of 806-824/851-869 MHz. The following is a list of iDEN operators and where their spectrum lies within the SMR band. This is not a comprehensive list of all iDEN operators.

814-849/859-894 MHz

Sprint Nextel (USA)

IConnect (Guam)

MIRS (Israel) after rebanding

806-824/851-869 MHz

Airtel Wireless (Canada)

Avantel (Colombia)

IConnect (Hong Kong)

GRID Communications (Singapore)

KTP (South Korea)

MIRS (Israel) before rebanding

Nextel Argentina

Nextel Brazil

Nextel Chile

Nextel Mexico

Nextel Peru

PTC (Saudi Arabia)

Red (El Salvador)

Red (Guatemala)

SouthernLINC (USA) 813.5+/858.5+

TELUS (Canada)

One thing to note is that although SouthernLINC's spectrum extends .5 MHz below 814/859 MHz, Depending on the required guard band, their spectrum that is usable for 3GPP technologies may be limited to above 814/859 MHz making them compatible with the consolidated band. This issue will require further study.

It is also worth noting that LTE may or may not be allowed in this band in all of these countries and inclusion in this list does not imply that existing regulations will allow deployment of LTE in the band.

As shown above, there are at least 16 iDEN operators in 15 different countries that could potentially benefit from a 3GPP LTE band that covers the full SMR spectrum of 806-824/851-869 MHz.

5.2.3 UE duplexer filter characteristics for proposed sub-bands

The duplexer characteristics of the band are important for assessment of specific UE requirements like spurious emission and reference sensitivity as well as co-existence with other technologies. Provisional duplexer performance is given for different filter technologies: SAW that is a common technology for high-volume products and has good performance below 2.5 GHz, and FBAR/BAW that is becoming available but is more expensive.

[Results below used for both UTRA and E-UTRA]

5.2.3.1 The range 806-824/851-869 MHz

This clause contains examples pf filter traces at ambient temperature.

5.2.3.1.1 Filter characteristics for SAW technology

This clause contains examples pf filter traces at ambient temperature using SAW technology. All of the results include 0.05 dB of loss from the test board.

Insertion loss for TX and RX

Simulation results for the attenuation from TX to antenna are shown in Figure 5.2.3.1.1-1. The red curve displays the expected performance for the new band.

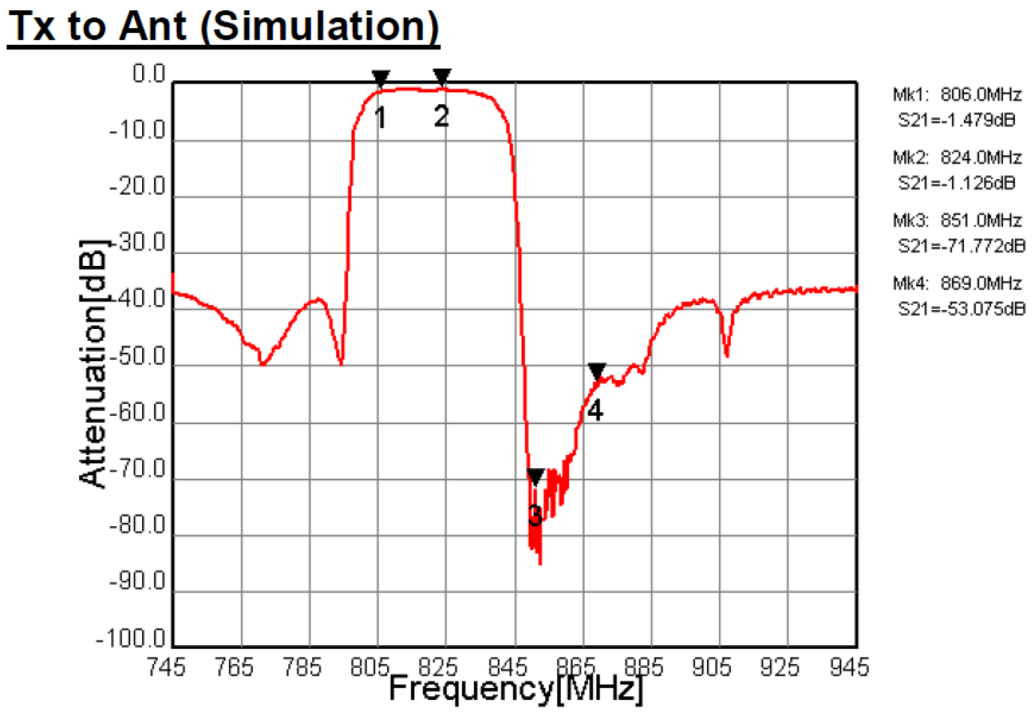

Figure 5.2.3.1.1-1: Attenuation from TX to antenna port

The corresponding results for the attenuation from RX to antenna are shown in Figure 5.2.3.2.1-2.

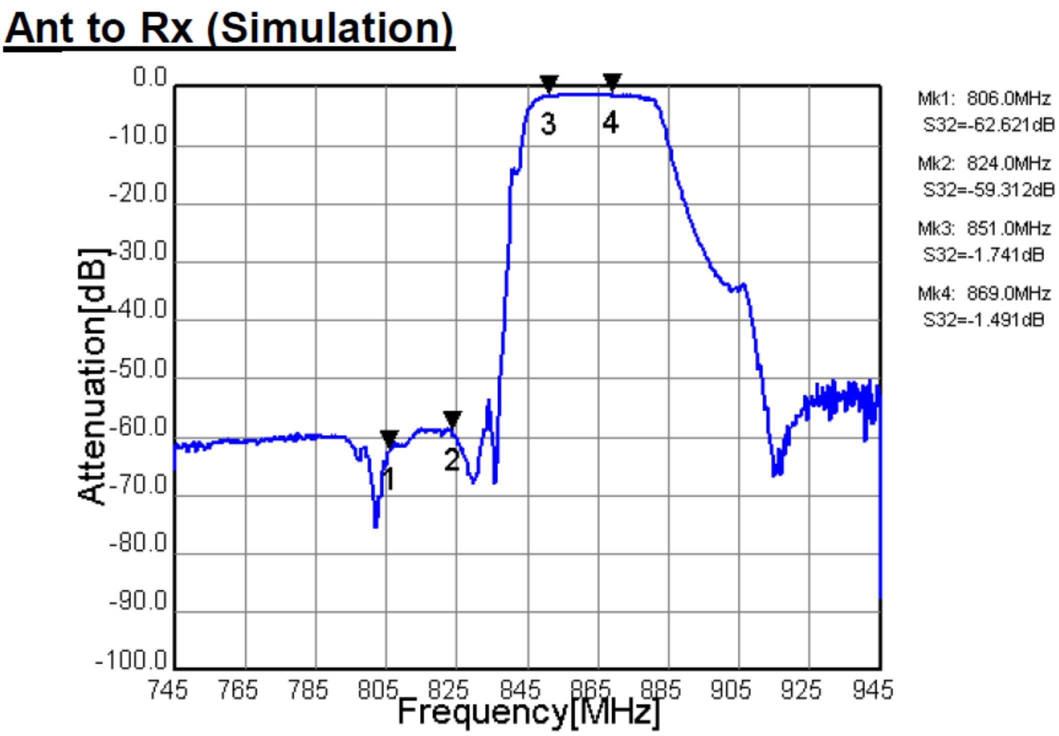

Figure 5.2.3.1.1-2: attenuation from antenna port to Rx

Simulation results for insertion loss for Tx and Rx at 1 dB/div are shown in Figure 5.2.3.1.1-3. The red line is for Tx to antenna, the blue line is for antenna to Rx.

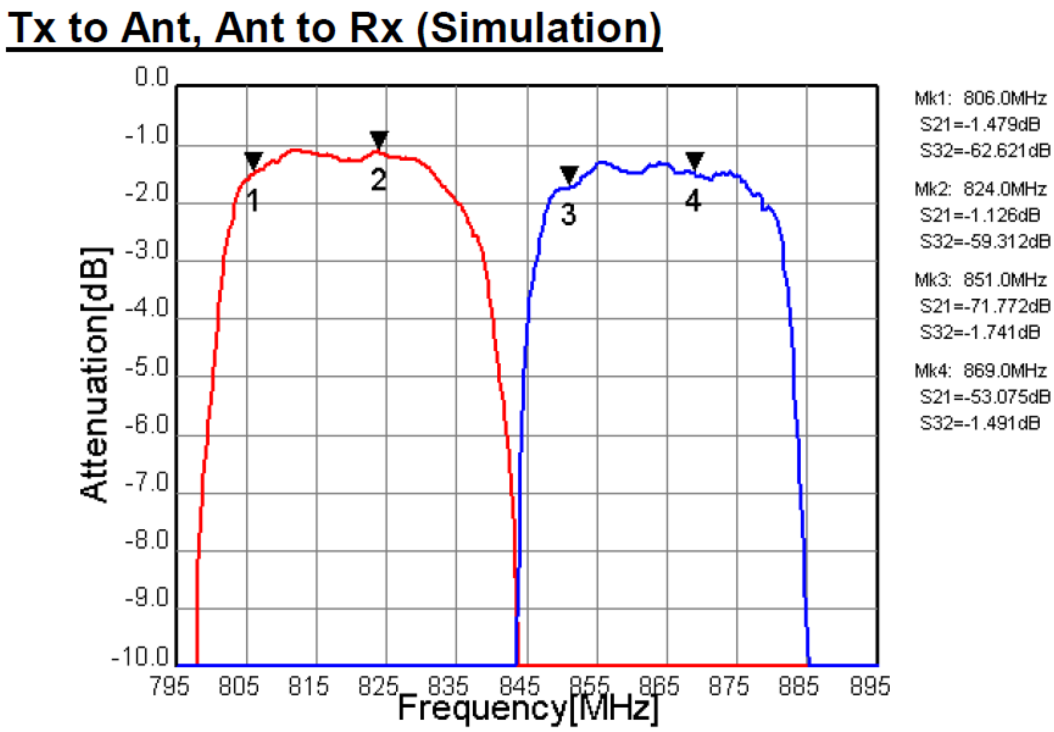

Figure 5.2.3.1.1-3: Insertion loss results

Tx-Rx isolation

Simulation results for the isolation from Tx to Rx are shown in Figure 5.2.3.1.1-4.

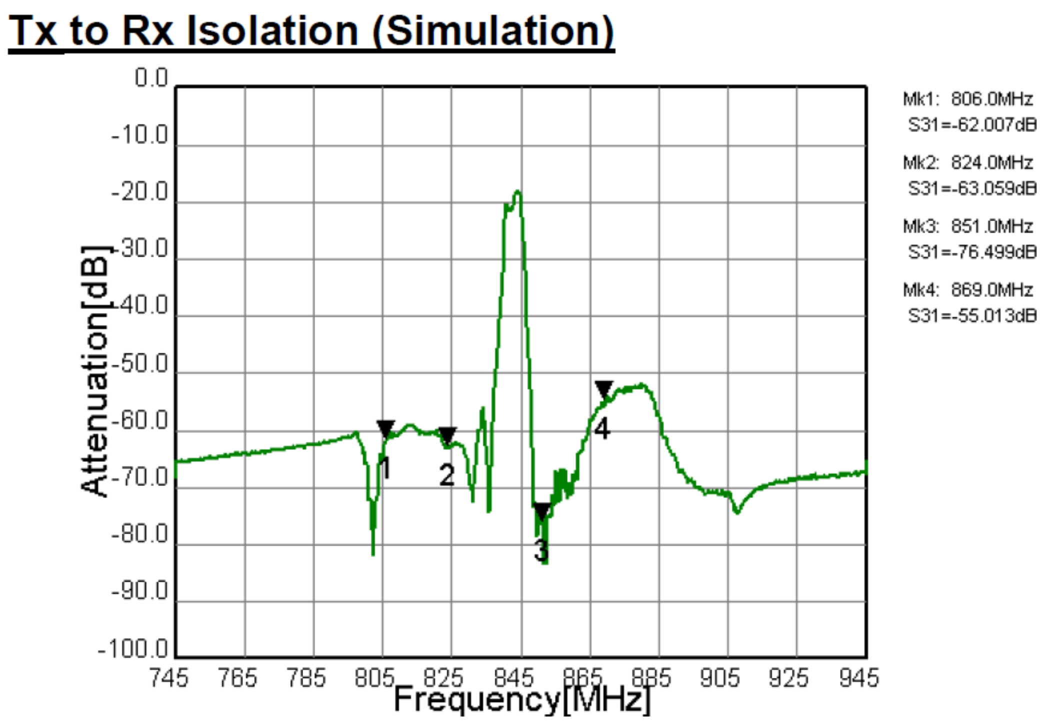

Figure 5.2.3.1.1-4: TX to Rx Isolation results

Table 5.2.3.1.1-1: Estimated IL and isolation for 806-824/851-869 and Band V/5

Frequency range	UL(Tx) IL [dB]	DL (Rx) IL [dB]	UL (Tx) Iso [dB]	DL (Rx) Iso [dB]
	Vendor 1 (SAW)			
806-824/851-869 MHz	1.8	2.3	60	55
Band V/5	1.9	2.2	60	55

5.2.3.2 The range 814-849/859-894MHz

This clause contains examples pf filter traces at ambient temperature using SAW and FBAR technology, respectively.

5.2.3.2.1 Filter characteristics for SAW technology and comparison to Band 5

Insertion loss for TX and RX

Provisional results for the attenuation from TX to antenna are shown in Figure 5.2.3.2.1-1. The red curve displays the expected performance for the new band. The blue curve is the response of a frequency-shifted Band 8 filter. The green lines denote the expected specified performance accounting for temperature variations -20 C to +85 C, i.e. larger than the temperature range at ETC.

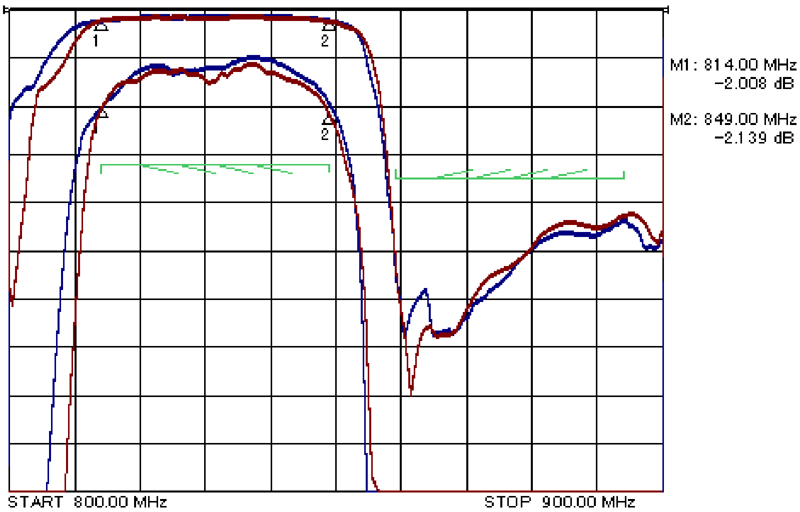

Figure 5.2.3.2.1-1: Attenuation from TX to antenna port, results with 1 dB/div and 10 dB/div

The corresponding provisional results for the attenuation from RX to antenna are shown in Figure 5.2.3.2.1-2.

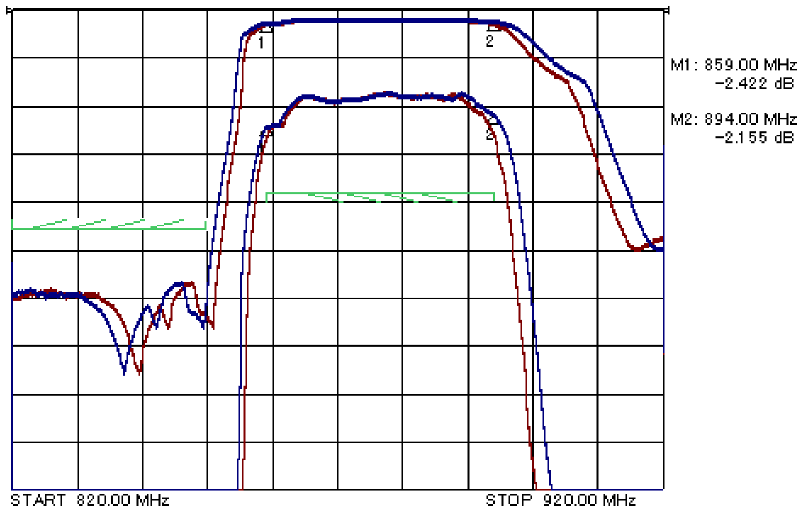

Figure 5.2.3.2.1-2: Attenuation from RX to antenna port, results with 1 dB/div and 10 dB/div

Comparison to Band 5

Results for a commercially available Band 5 duplexer are given in Figure 5.2.3.2.1-3 for comparison [5].

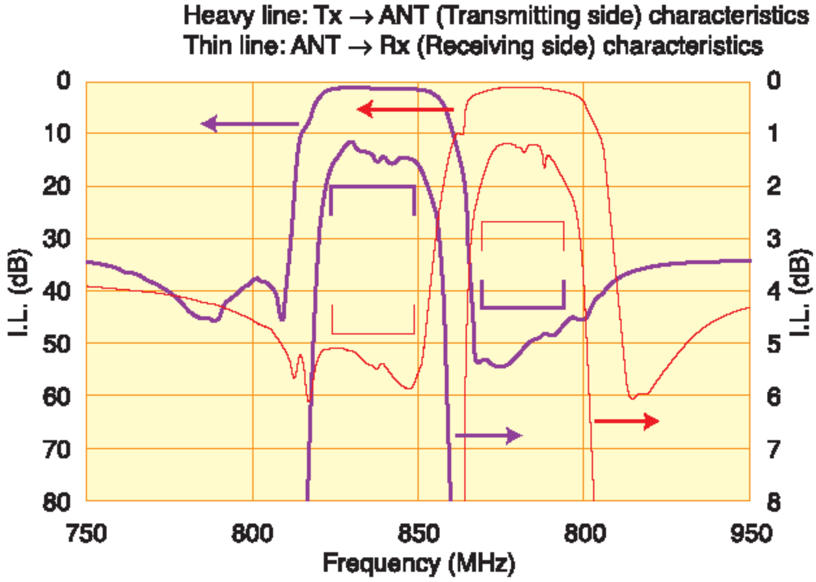

Figure 5.2.3.2.1-3: Insertion loss and stop band rejection for a Band 5 SAW duplexer

We observe that:

- there is no significant difference in typical insertion loss according to 5.2.3.2.1-1 and 5.2.3.2.1-3 for operation in the Band 5 frequency range at ambient temperature;
- there is no significant difference for Band 19 implemented with a Band 5 duplexer;
- the influence of temperature variation (across -20 C to +85 C) is smaller for the Band 5 duplexer, the pass-band of which is narrower;
- the specified performance accounting for temperature and batch variation is better for Band 5 duplexer.

Tx-Rx isolation

Provisional results for the isolation from TX to RX are shown in Figure 5.2.3.2.1-4. The green lines denote the expected specified performance accounting for temperature variations -20 C to +85 C, i.e. larger than the temperature range at ETC.

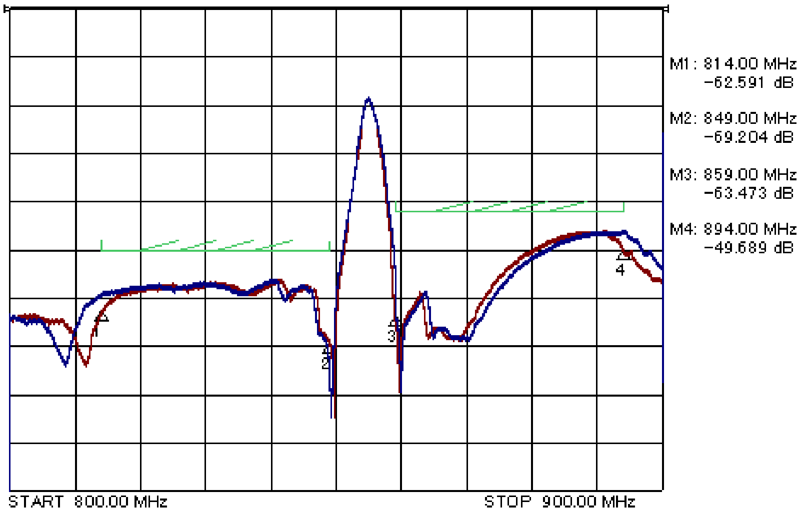

Figure 5.2.3.2.1-4: TX to RX isolation, results 10 dB/div

The isolation characteristics for a commercially available Band 5 duplexer are given in Figure 5.2.3.2.1-5 for comparison [5].

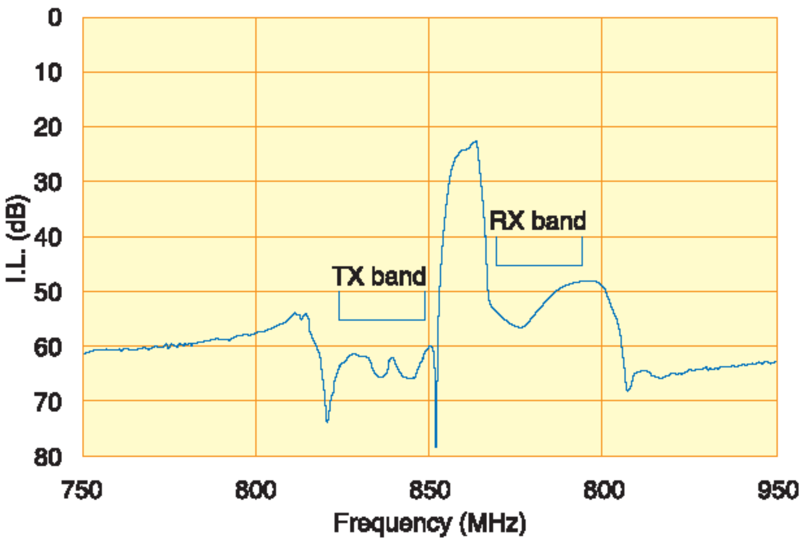

Figure 5.2.3.2.1-5: isolation for a Band 5 SAW duplexer.

We observe:

- a similar if not slightly better isolation at RX for 5.2.3.2.1-5 (Band 5) compared to the provisional results in 5.2.3.2.1-4 at ambient temperature.

The specified performance for isolation at RX for the range 814-849/859-894 MHz should be comparable to Band 8 performance for the SAW technology.

5.2.3.2.2 Filter characteristics for FBAR technology

Insertion loss for TX and RX

Figure 5.2.3.2.2-1 shows provisional results for the attenuation from TX to the antenna. It is noted that the results are indicative: they are based simulations and not representing a final product. All traces are "typical" at 25 C. About 2.5 MHz allowance at either end of the pass band needs to be made for performance over temperature and process variation. Figure 5.2.3.2.2-2 shows provisional results for the attenuation from the antenna to the RX.

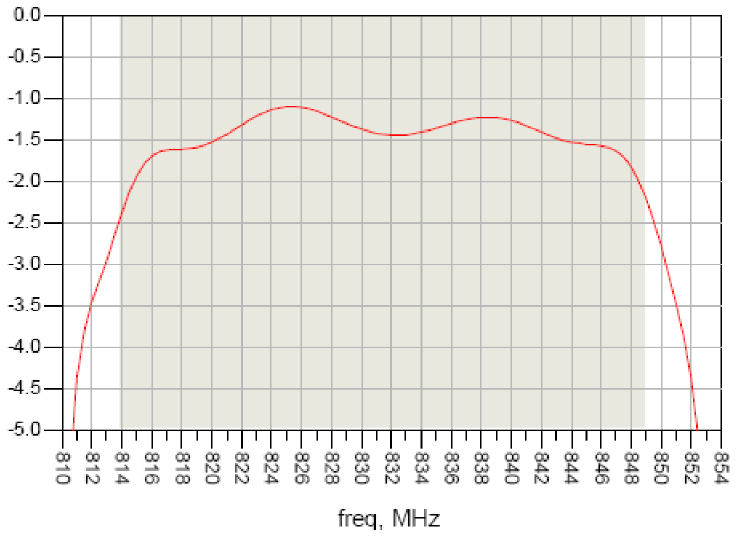

Figure 5.2.3.2.2-1: Attenuation from TX to antenna for an E850 upper sub-band

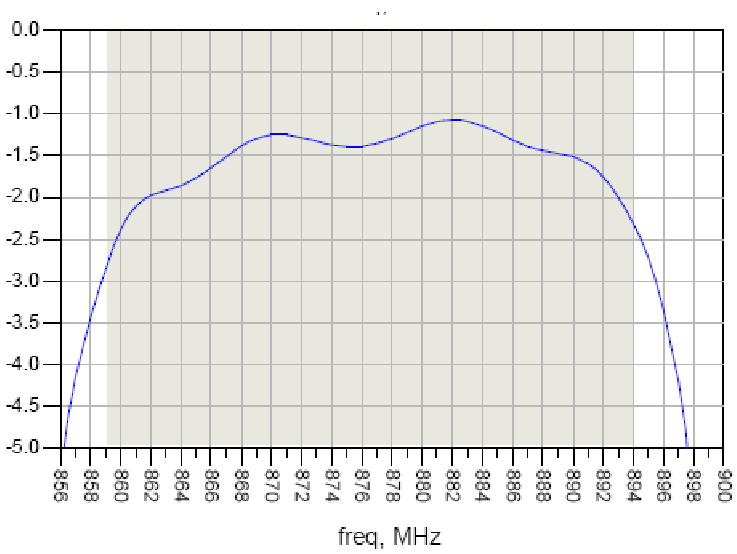

Figure 5.2.3.2.2-2: Attenuation from antenna RX for E850 upper sub-band

Comparison to Band 5

Figure 5.2.3.2.2-3 shows results for the attenuation from TX to the antenna for a Band 5 FBAR duplexer. The corresponding results from antenna to RX are shown in Figure 5.2.3.2.2-4.

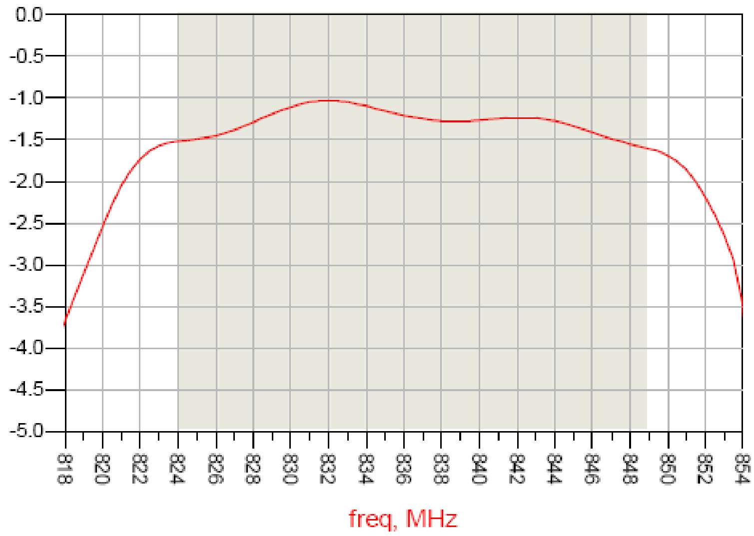

Figure 5.2.3.2.2-3: Attenuation from TX to antenna for a Band 5 FBAR filter

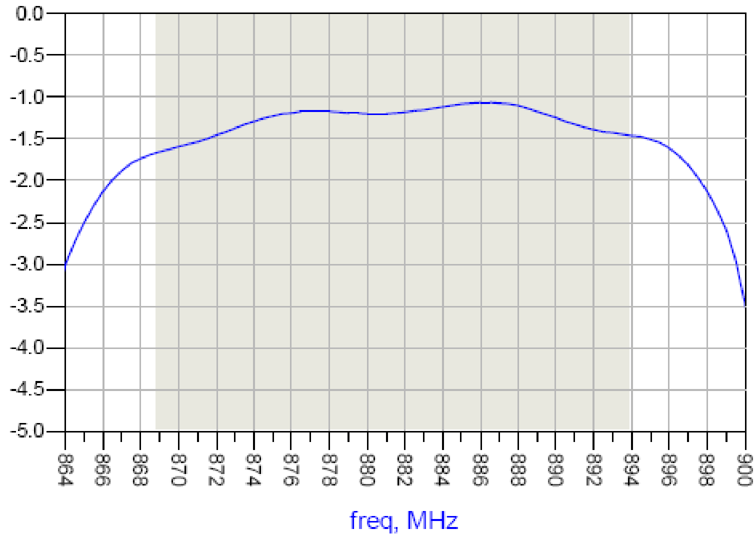

Figure 5.2.3.2.2-4: Attenuation from antenna to RX for a Band 5 FBAR filter

Comparing the extended filter with the Band 5 response we observe that:

- there is up to 1 dB difference in typical receiver insertion loss according to 5.2.3.2.2-2 and 5.2.3.2.2-4 for operation in the Band 5 frequency range at ambient temperature, lesser difference for mid-band operation
- there is no significant difference for Band 19 implemented with a Band 5 duplexer:
  - operation in Band 18 would be more affected by the steeper edge (less for the wider bandwidths > 5 MHz);
  - the influence of temperature variation (across -20 C to +85 C) is smaller for the Band 5 duplexer, the pass-band of which is narrower;
  - the specified performance accounting for temperature and batch variation significantly better for Band 5 duplexer.

The SAW filter responses displayed in chapter 5.2.3.1.1 show slightly lesser difference at the band edges. It is noted again that the E850 FBAR data is provisional.

Tx-Rx isolation

Simulated results of the TX-RX isolation for an FBAR filter is shown in Figure 5.2.3.2.2-5.

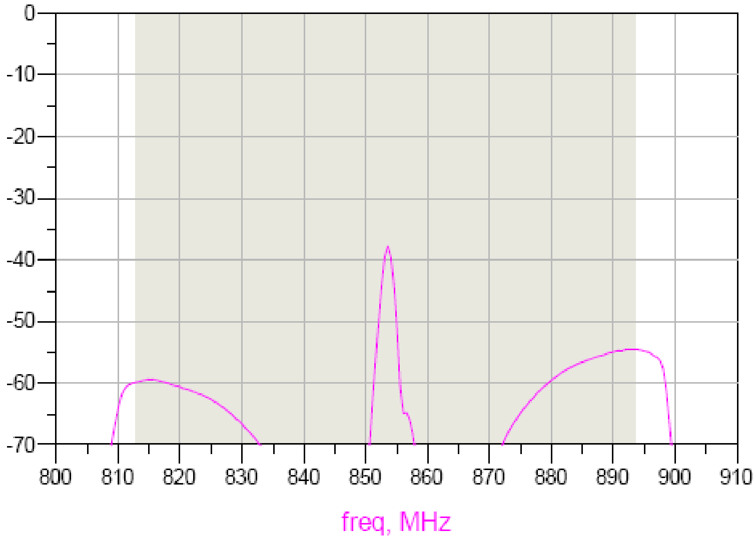

Figure 5.2.3.2.2-5: Isolation for an E850 upper sub-band duplexer

Wideband response

The wideband response is also interesting for coexistence with other bands: Figure 5.2.3.2.2-6 shows the results for the E850 upper sub-band FBAR filter, where the red and blue curves represent the TX and RX, respectively. The rejection is better than 30 dB for the ISM band for example (both TX and RX).

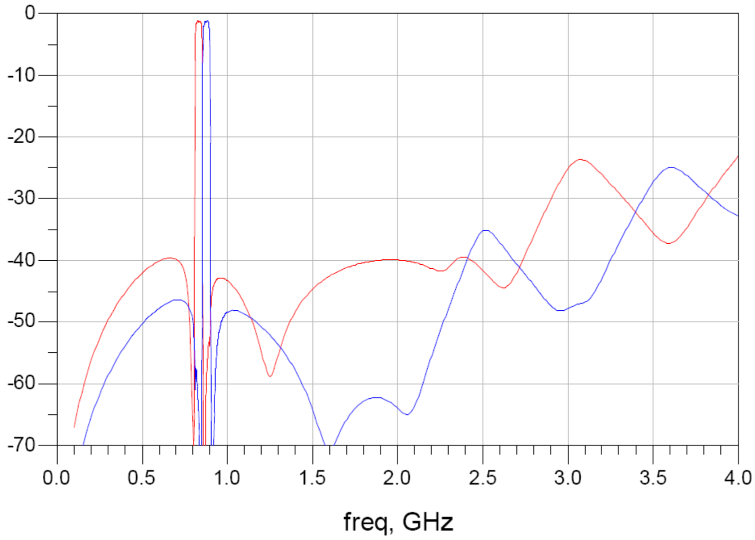

Figure 5.2.3.2.2-6: Wideband response for an E850 upper sub-band FBAR duplexer

5.2.3.2.3 Possible specification and comparison with other bands in the range

Provisional specifications for insertion loss and isolation over a temperature range -20 C to +85 C are given in Table 5.2.3.2.3-1, a larger range than that for ETC for the purpose of devising a requisite minimum requirement of the reference sensitivity. It is emphasized that the parameters in the table only constitutes part of a duplexer specification, and that other parameters like e.g. wideband response, stop-band rejection requirements and impedance matching also influence the filter characteristics near the desired transmit and receive bands.

Table 5.2.3.2.3-1: Estimated insertion loss and isolation (specified)

Frequency range	UL(Tx) IL [dB]	DL (Rx) IL [dB]	UL (Tx) Iso [dB]	DL (Rx) Iso [dB]
	Vendor 1 (SAW)			
814-849/859-894 MHz	3.0	3.5	50	42
Band V/5	1.8	1.8	54	45
Band VIII/8	3.0	3.0	50	42
	Vendor 2 (SAW)			
814-849/859-894 MHz	4.5	5.0	50	45
Band V/5	1.9	2.2	57	49
Band VIII/8	2.7*	3.5	55	48
	Vendor 3 (SAW)			
814-849/859-894 MHz	3.5	4.0	50	42
Band V/5	2.5	2.2	52	48
Band VIII/8	3.7	3.5	53	46
	Vendor 4 (SAW)			
814-849/859-894 MHz	2.9 (CW)	3.5 (CW)	50	46
Band V/5	2.0 (CW)	2.2 (CW)	52	48
Band VIII/8	3.0 (CW)	3.5 (CW)	50	42
	Vendor 5 (FBAR)			
814-849/859-894 MHz	[4.0]	[4.5]	>55	>50
Band V/5	[2.0]	[2.0]	>55	>50
	Vendor 6 (Improved BAW/FBAR)			
814-849/859-894 MHz	2.5	2.5	50	50
Band VIII/8	2.7	3.0	44	45

Note that some of the duplexer specifications provided by the vendors (as indicated by the asterisk) are valid for a slightly reduced frequency range. [The specification points for the FBAR filter are based on the traces in the Figures 2.3.2.1-1, 5.2.3.2.2-2, 5.2.3.2.2-5 and adding 2.5 MHz on either side of the nominal pass bands.]

5.2.4 BS duplexer filter characteristics for proposed sub-bands

The duplexer is an important component of the BS in terms of requirements for spurious emissions, reference sensitivity and co-existence with other systems. The results are applicable for both E-UTRA and UTRA.

5.2.4.1 The range 806-824/851-869 MHz

5.2.4.1.1 RX Filter characteristics

Taking into account of the TV TX interference, 8 orders filter can meet the 1dB desense rejection requirement at the TV band. However, guard band between the lower band E850 and TV band may be considered to meet the RX blocking requirement. All the filter characteristics shown are examples only and do not preclude other implementations. Figures 5.2.4.1.1-1 and 5.2.4.1.1-2 show the simulation results of an 8 orders filter with 2 zeros (blue curve) and 3 zeros (pink curve).

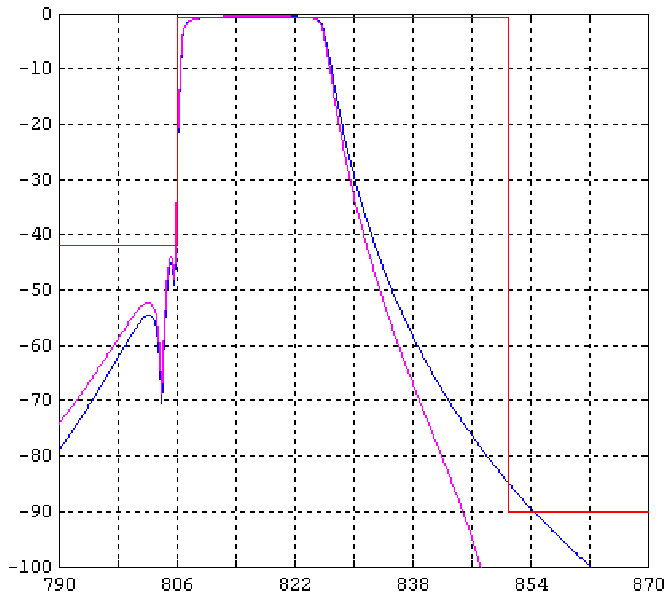

Figure 5.2.4.1.1-1: Simulation result of 8 orders RX filter

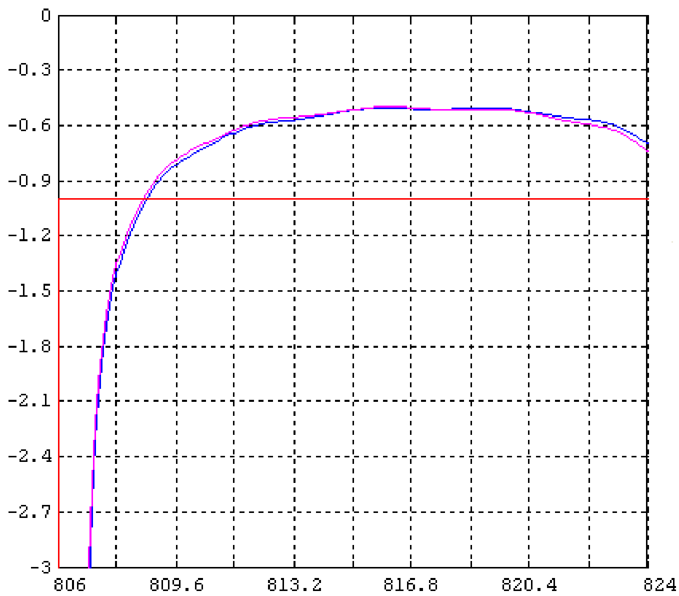

Figure 5.2.4.1.1-2: In-band insertion loss of 8 orders RX filter

5.2.4.1.2 TX Filter characteristics

Spurious emission limit for co-existence with Band 5 receiver is -49dBm/MHz. However, the present document does not cover the 10 MHz frequency range immediately outside the downlink operating band. -49 dBm/MHz spurious emission requirement is still used here as a reference. The near end emission of the BS is restricted by the operating unwanted emission (UEM) requirements. -13 dBm/MHz is assumed as the spurious emission level in the adjacent band in the analysis, which is stricter than the requirements defined in current specification. The spurious emission level used in the analysis is just a reference value for simulation. Based on these assumptions, the attenuation requirement of the TX filter to protect Band 5 BS receiver in co-existence scenario is 36 dB.

Figures 5.2.4.1.2-1 and Figure 5.2.4.1.2-2 show simulation results of a 7 orders filter with 3 zeros to meet the co-existence requirements. Considering the guard band in RX band due to TV interference, the TX lower band edge will not start from 851MHz. This is helpful to meet the co-existence requirement at Band 5 RX band. Based on the simulation result, the insertion loss at 852 MHz will be less than 1.5 dB.

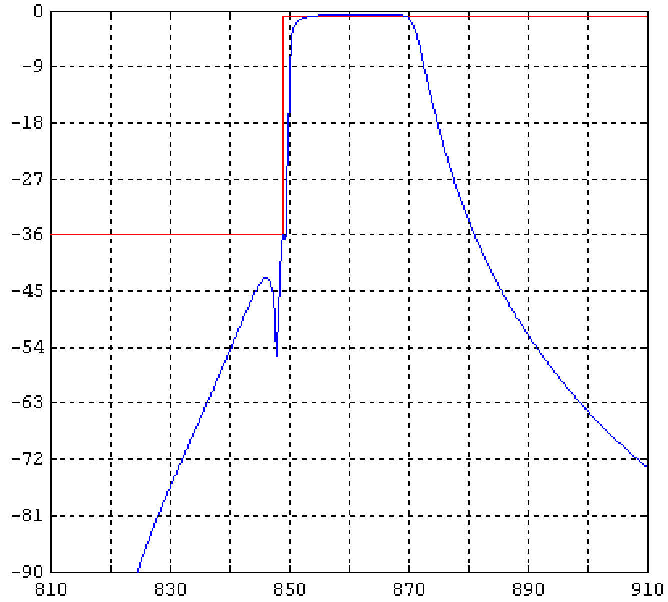

Figure 5.2.4.1.2-1: Simulation result of 7 orders TX filter

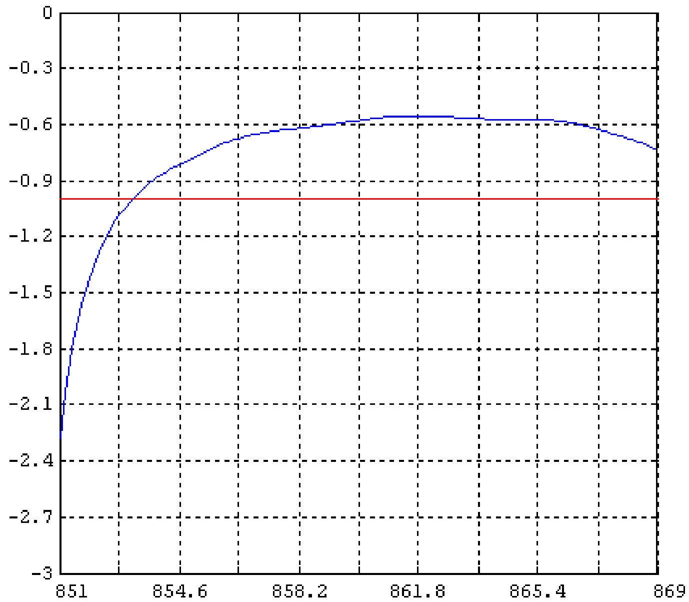

Figure 5.2.4.2-2: In-band insertion loss of 7 orders TX filter

In conclusion, for the RX filter, the most stringent requirement for the Rx filter comes from the TV blocking. In order to protect the E850 lower sub-band receiver, guard band is needed. The size of the guard band depends on the real network scenario and implementation of the filter. For the Tx filter, co-existence requirement with Band 5 shall be considered. Since the frequency distance is just 2 MHz between E850 lower sub-band DL and Band 5 UL, the rejection requirement of the Tx filter will deteriorate the in-band insertion loss at the band edge. However, considering the possible guard band in RX band due to TV interference and the paired frequency allocation, the in-band insertion loss of the Tx filter could be implemented by an acceptable value.

5.2.4.2 The range 814-849/859-894 MHz

The BS duplexer performance for the Extended Band 5 upper sub-band is considered in what follows. The filter characteristics shown are examples only and do not preclude other implementations.

5.2.4.2.1 Filter characteristics for a cavity filter and comparison to Band 5

Simulations of a cavity filter for Band 5 as well as a cavity filter for 814-849/859-894 MHz have been performed and compared.

TX to antenna

In Figures 5.2.4.2.1-1 and 5.2.4.2.1-2 the green curve represents simulations for a Band 5 duplexer TX path and the black curve simulations for an Extended Band 5 upper sub-band duplexer TX path.

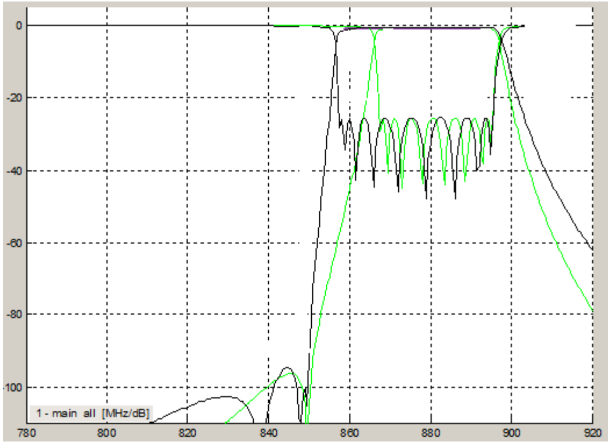

Figure 5.2.4.2.1-1: Attenuation of the duplexer for the TX path

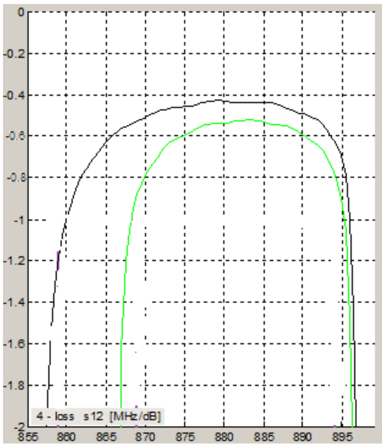

Figure 5.2.4.2.1-2: Insertion loss in the the duplexer TX path passband

RX to antenna

Simulations have also been performed for Band 5 (green curve) and Extended Band 5 upper sub-band (black curve) duplexer RX path, see Figures 5.2.4.2.1-3 and 5.2.4.2.1-4.

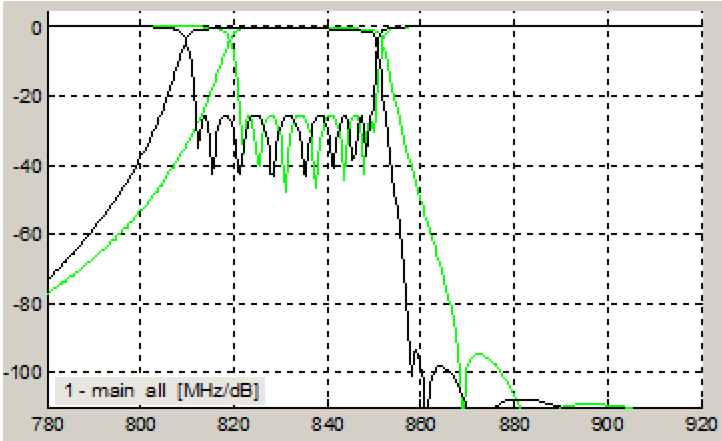

Figure 5.2.4.2.1-3: Attenuation of the duplexer for the RX path

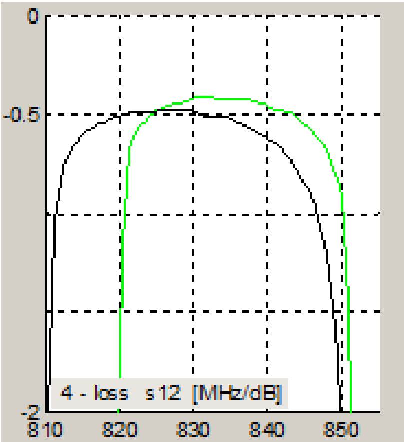

Figure 5.2.4.2.1-4: Insertion loss in the duplexer RX path passband

We observe that:

- There is no significant difference in average insertion loss in the duplexer according to Figure 5.2.4.2.1.1 and Figure 5.2.3.2.1.3 between Band 5 and Extended Band 5 upper sub-band.
- The insertion loss at the band edges for the TX path is almost the same for Band 5 and Extended Band 5 upper sub-band, as shown in Figure 5.2.4.2.1.2.
- Figure 5.2.4.2.1.4 shows that the insertion loss at the lower band edge for the RX path is almost the same for Band 5 and Extended Band 5 upper sub-band, while at the higher band edge; it is higher for Extended Band 5 upper sub-band since due to the reduced duplex gap.

In conclusion, the duplexer performance for the Extended Band 5 upper sub-band is comparable to that of Band 5. Therefore, the minimum requirements determined by the duplexer (i.e. reference sensitivity, spurious emissions and co-existence) can be kept as in Band 5.

5.3 Specific deployments aspects

<will also address coexistence with other services, e.g. public safety in the US, and technical means to coexist>

5.3.1 Region 1

5.3.2 Region 2

5.3.2.1 Emission requirements

While there might be different emission rules for different countries, we recommend the FCC Rules and Industry Canada rules for the iDEN band as an initial baseline for coexistence studies. The emissions mask requirements are found in the FCC rules under sections 90.210(g) [6] and 90.691 [7] and for Industry Canada under RSS-119 [8] which is close to 90.210(g). These rules apply to both devices and BTSs.

90.210(g) is typically used for single carrier system and 90.691 for multi-carrier. 90.691 emission limits are as follows:

(a) Out-of-band emission requirement shall apply only to the "outer" channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees.

1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log[10](f/6.1) decibels or 50 + 10 Log[10](P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log[10](P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

The measurement bandwidth is not defined in the FCC rules but RSS-119 does define the measurement bandwidth as 300 Hz at frequency offset less than 37.5 kHz from channel edge and 100 kHz for frequency offsets greater than 37.5 kHz.

Historically, 300 Hz for frequency offsets less than 37.5kHz and 100 kHz for frequency offsets greater than 37.5kHz have been used for narrow band product certification in that band. With the 1MHz guard band assumption, the emission requirement would be 100 kHz. Therefore, the emission limits that would apply would be -13dBm/100 kHz at a 1MHz offset from the edge of the channel bandwidth.

FCC Title 47 Part 22.917 defines the emission limits for cellular equipment for the frequency range. The emission limits defined are as in 90.691. In addition, the 22.917 includes a condition on interferences into other systems as follows:

- *Interference caused by out of band emissions.* If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this clause.

In order to avoid harmful interference, limits additional to the regulatory are therefore specified for the band (see clauses 6.3.1 and 7.2.2.1).

5.3.2.2 Deployment scenario

Figure 5.3.2.2-1 shows the current and proposed 3GPP spectrum and TV repeater spectrum allocation around 850 MHz.

The following can be noted on the current situation related to the spectrum around 850 MHz:

- The E850 upper sub-band covering in the 814-849 and 859-894 MHz band overlaps partly with the lower sub-band. The purpose of the upper sub-band is to consolidate and augment bands 5, 18 and 19 into a new single global band that supports UTRA and E-UTRA deployments, while the lower sub-band aims for the non-U.S. Region 2. Since Bands 18 and 19 are allocated for Region 3, the co-existence with Band 5 is the main issue to be solved for the E850 lower sub-band.

- There is a large number of installed Band 5 BSs for different technologies: GSM, UTRA, E-UTRA and CDMA2000.

- Broadcast TV repeaters use the frequency range 698-806 MHz in South America.

- There are also other non-3GPP technologies such as iDEN system operating in 806-824/851-869 MHz in the Americas which shall be considered.

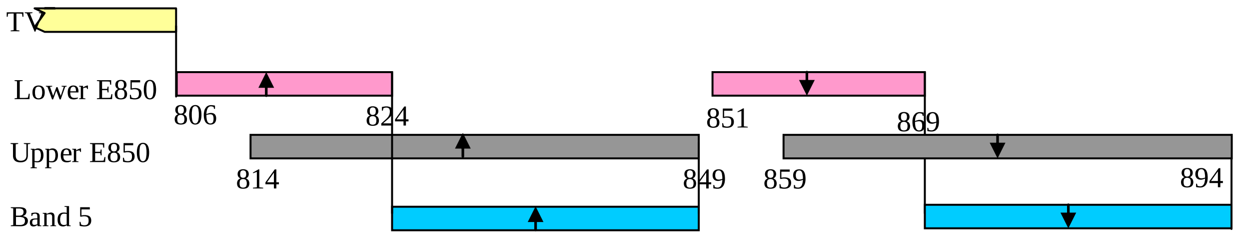

Figure 5.3.2.2-1: 3GPP Sspectrum allocation around 850 MHz

The main aspects for the lower sub-band are:

- BS-BS coexistence in the same geographical area with 2 MHz frequency gap to Band 5 and the upper sub-band. . It needs to be considered that Band 5 is a legacy band and there is a large number of installed Band 5 BSs for different technologies: GSM, UTRA, E-UTRA and CDMA2000.
- UE-UE coexistence with a 2 MHz gap with Band 5 and the upper sub-band considering that Band 5 is a legacy band.
- Co-existence with broadcast TV repeaters in the range 698-806 MHz in South America
- Co-existence with other iDEN systems in 806-824/851-869 MHz in the Americas

The main aspects for the upper E850 sub-band are:

- BS-BS coexistence in the same geographical area with 2 MHz frequency gap to Public Safety, iDEN and other Land Mobile Radio users. It needs to be considered that Public Safety, iDEN and Land Mobile Radio are legacy networks and there is a large number of installed BSs for these technologies. Signal levels of 52.1 dBm per 5 MHz from iDEN in the SMR band (851-869 MHz) are typical.

The main aspects for the both the upper E850 and lower E850 sub-bands are:

- BS-BS coexistence in the same geographical area with 2 MHz frequency gap between the upper E850 sub-band and the lower E850 sub-band.
- UE-UE coexistence with a 2 MHz gap between the upper E850 sub-band and lower E850 sub-band.

5.3.3 Region 3

For Band 19 the additional spurious emission requirements shown in Table 5.3.3-1 apply for the protection of the range 860 ≤ f ≤ 895 MHz, irrespective of the boundary between the OOB and spurious emission limit for the 15 MHz bandwidth.

Table 5.3.3-1: Additional requirement

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)			Measurement bandwidth
	5MHz	10MHz	15MHz	
860 ≤ f ≤ 895	-40	-40	-40	1 MHz

The network signalling value "NS 08" is specified to accommodate an A-MPR profile for meeting this requirement. Band 19 is covered by the upper sub-band of the E850 band, for which the same requirements consequently would apply in Japan. However, the A-MPR needed to meet the requirement in Table 5.3.3-1 is likely to be reduced for the upper E850 sub-band since its TX duplex filter must provide significant attenuation across 860 ≤ f ≤ 895 MHz to provide sufficient TX-RX isolation in the receive band 859-894 MHz.

5.3.4 Requirements for UE(s) roaming into legacy bands in the 814-849/859-894 MHz range

Band 5 will be extended by 10 MHz with a view to cover Band 5, 18 and 19 in a single duplexer to harmonize existing bands and to increase the amount of available spectrum in certain regions. A UE supporting the upper range of E850 band should be able to roam into these legacy bands and meet the Band 5, 18 and 19 minimum requirements. Handling of band support signaled in the UE capability with regard to regulatory requirements and potential modifications to some RF requirements for legacy bands supported by the wider E850 band have to be considered. These are not new problems: many UE(s) supporting the obsolete Band 6 are implemented by (wider) Band 5 duplexers.

5.3.4.1 Handling of band support in UE radio capability signaling

In this sub-clause we discuss the BS system information and the UE capability signaling needed to allow a Band 5, Band 18 or Band 19 UE into an 814-849/859-894 MHz (Band 26) network and the converse.

In its system information, a BS can only signal the support of one operating band per cell. In specifying extended bands that cover legacy operating bands such as the E850 upper sub-band (Band 26), there are two general problems associated with this:

1) a Band 26 UE roaming into a Band 5/18/19 network:

    a) requiring a Band 26 UE to be certified also for Band 5, 18 and 19 operation to circulate globally.

2) the support of Band 5/18/19 UEs on a Band 26 network:

    a) allowing roaming of UEs supporting subtending bands 5/18/19.

    b) keeping track of band capabilities so that a Band 5/18/19 UE is not assigned channels in the extended part.

The items above are relevant for any extended band, and can be resolved from Rel-10 onwards by appending extension fields to the SIB1 message and the SIB2 information element in RRC signaling. The extension fields in SIB1 and SIB2 carry the information about the harmonized band e.g. Band 26, while the existing field carries information about the legacy band e.g. band 5.

The extension field in SIB1 provides allowed band numbers in addition to that signaled in the existing field `FreqBandIndicator`. The corresponding optional information about uplink frequencies for additional bands would be contained in an extended field in SIB2. The information contained in `additionalSpectrumEmission` of the `FreqInfo` field in SIB2 on additional spurious emission requirements must be read by all UE(s) allowed on the network regardless of bands supported.

Considering the items above in turn, we note that:

1a. for a Band 26 UE implemented in *earlier release* roaming into existing Band 5/18/19 Rel-9 network, then the Band 26 UE needs to signal support of Band 5, Band 18 and Band 19 in its band capability. The UL EARFCN derived are then based on the Band 5/18/19 since the Band 26 can read the BCCH and is capable of supporting the legacy bands (certification needs to be carried of for these).

1b. for a Band 26 Rel-10 UE roaming into a Rel-10 Band 5/18/19/26 network, the extended fields can be understood and Band 26 UE that does not have to support all the legacy bands assuming that the Band 26 requirements include all necessary regulatory or otherwise required specifications of Band 5/18/19, which means a reduction of the certification effort

2a. for a Band 5/18/19 UE implemented in *earlier release* (can't read the extended fields) camping on a Band 26 Rel-10 network, then the *legacy band number is signaled* in the `FreqBandIndicator` for cells deployed in the legacy portion of Band 26. For legacy Band 5 UE(s) in a Band 26 network (will be Rel-10), for example, Band 5 is signaled in the frequency band indicator in the Band 5 portion, and Band 26 is indicated in the appended extended band indicator field. The Band 5 Rel-9 terminal would not understand Band 26 if signaled in the frequency band indicator, whereas the Band 26 UE can read the equivalent frequency band indicator in SIB1. A Band 26 UE implemented in an earlier release needs to indicate that it supports Band 5 when camping in the Band 5 portion of Band 26. For a carrier allocated in the extension part not overlapping with Band 5, Band 26 can be indicated in the existing frequency band indicator, which would not allow legacy Band 5 UE(s) into the extension part.

2b. by the provisions in 2a, a Rel-9 UE supporting Band 5 would be allowed in the Band 26 network. Band 18 and 19 UE(s) implemented in Rel-9 needs to support roaming in Band 5.

2c. for a Band 5/18/19 Rel-10 camping on Band 26 Rel-10 network, the appended fields are understood and no need to support the legacy bands and no need for certification of these assuming that the Band 26 requirements include all necessary regulatory or otherwise required specifications of Band 5/18/19.

The above is also applicable to other extended or overlapping bands.

5.3.4.2 UE receiver requirements: out-of-band blocking

Next we consider required changes of the out-of-band blocking (OOB) performance for UE(s) operating in legacy bands and equipped with the wider duplexer for 814-849/859-894 MHz (E850).

The OOBB performance requirements apply for an unwanted *CW* interfering signal falling more than 15 MHz below or above the UE receive band at a blocker level of -44 dBm up to 60 MHz away from it(range 1). For the first 15 MHz below or above the UE receive band the in-band blocking applies: the in-band blocker level is the same -44 dBm for larger frequency offsets to the assigned channel but the interferer is a *modulated* interferer of up to 5 MHz bandwidth. The two interferer types will generate e.g. different cross-modulation spectra that can fall into the receive band. Normally the duplexer provides at least some rejection of the OOB CW blocker, except perhaps for the close-in interferer frequencies.

First we consider the case of a E850 UE roaming into a Band 19 network. The OOB blocking requirements then apply below 860 MHz, see Figure 5.3.4.2-1 that shows the blocker interferer frequencies for range 1. Hence the CW blocker appears just inside the E850 receiver duplex filter (grey in the figure). However, the spectrum of the cross-modulation with the uplink signal would be mostly confined below the Band 19 passband, but it can be folded into it. The 5 MHz modulated in-band blocker just above 860 MHz would generate a cross-modulation spectrum of a different PSD that would fall into the Band 19 passband. It thus appears that:

- the Band 19 OOB blocking requirements would be met by a UE supporting E850,

but this needs to be confirmed quantitatively.

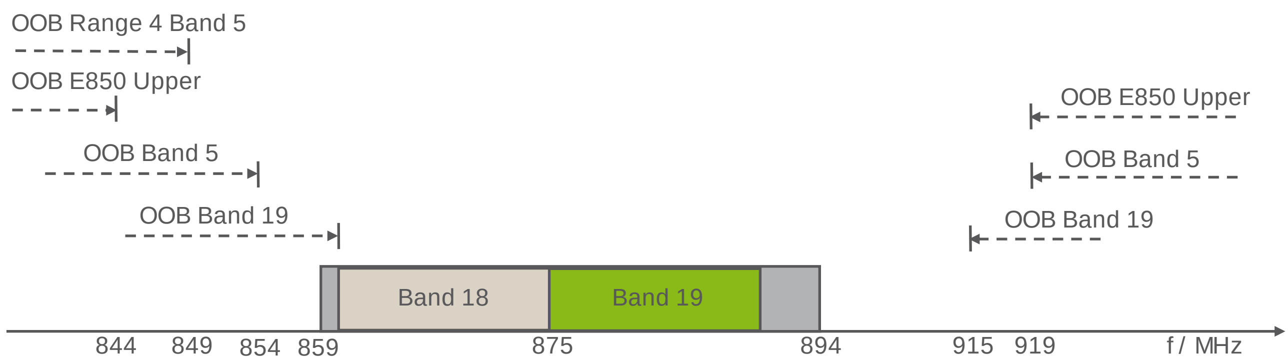

Figure 5.3.4.2-1: Out-of-band blocking range 1 for bands in the E850 range in relation to Band 19

In a live network scenario, any OOB interferer below 860 MHz would most likely be of modulated type down at least to 815 MHz, the lower edge of the Band 18 uplink, except possibly for narrowband interferers in the Band 18/19 duplex gap. A Band 19 duplexer would not supply significant advantages over an E850 duplexer in terms of rejection: the latter must also provide sufficient attenuation of an own TX blocker in the Band 18/19 range, the only possible advantage of a Band 19 duplexer would be rejection of in-band interferers much stronger than -44 dBm in the lowest part of Band 18

The same assertions can be made for an E850 UE roaming into a Band 5 network. For Band 5 there is an additional OOB requirement for a -15 dBm unwanted CW blocker falling into the Band 5 transmit band (range 4, up to 824 MHz). However, the E850 transmit duplexer filter must provide a stop band rejection that matches a Band 5 filter for range 4. A similar blocking requirement could apply for the extended range 814-849 MHz.

For an E850 UE operating in Band 5 in the United States, OOB interferers 15 MHz below the receive band originated from NPSPAC (Public Safety) systems allocated down to 851 MHz (see Figure 5.1.2.2-1). Suppression of high-power transmissions from these systems mounted in high control-station towers is provided by Band 5 duplexer. From Figure

5.2.3.2.1.2 we observe that the RX duplex filter of E850 would also provide significant rejection below 854 MHz, even if not the same as the Band 5 filter.

For OOB range 2 that applies for an unwanted -30 dBm *CW* interfering signal falling more than 60 MHz below or above the UE receive band, the Band 5 and E850 receive duplexer filters provide similar performance.

(It appears that the out-of-band blocking requirements of Bands 5, 18 and 19 can be met with an E850 duplexer.)

6 Study of UTRA requirements

<text will be added>

6.1 Band and channel arrangement

In chapter 5.2.1, a split-band arrangement for extending 850 MHz (806-849/851-894 MHz) was presented and agreed. Two different blocks upper Extending 850 MHz and lower Extending 850 MHz were defined. The lower Extending e850 is not considered for UTRA.

- Upper Extending 850 MHz:
    - UL: 814-849 MHz
    - DL: 859-894 MHz

The upper Extending 850 MHz band allocation is for UTRA referred as Band [XXVI]

UARFCN can be defined as in Table 6.1-1, by reserving a part of the unused numbers that follow the Band [XXV] Add allocation.

Table 6.1-1: UARFCN allocated for UTRA Band [XXVI]

			Uplink UARFCN				Downlink UARFCN			
UTRA FDD Band	Band range [MHz]	Range res. [MHz]	Formula offset F_{UL_Offset} [MHz]	Assigned/ Reserved	N_U	F_{UL} [MHz]	Formula offset F_{DL_Offset} [MHz]	Assigned/ Reserved	N_D	F_{DL} [MHz]
[XXVI]	2x35	2x35	-291	Start res.	5525	814.0	-291	Start res.	5750	859.0
				Min.	**5537**	**814.4**		**Min.**	**5762**	**861.4**
				Max.	**5688**	**846.6**		**Max.**	**5913**	**891.6**
				End res.	5699	848.8		End res.	5924	893.8
[XXVI] (Add.)	2x35	2x35	-325.9	Start res.	5700	814.1	-325.9	**Start res.**	5925	859.1
				Min.	**5712**	**814.5**		**Min.**	**5937**	**861.5**
				Max.	**5862**	**846.5**		**Max.**	**6087**	**891.5**
				End res.	5874	848.9		**End res.**	6099	893.9

6.2 Coexistence with other technologies

<text will be added>

6.3 Specific UE requirements

6.3.1 Transmitter characteristics

6.3.1.1 UE MOP

Duplexer assumptions used to derive for Band XXVI UE MOP are presented in Table 6.3.1.1-1.

Table 6.3.1.1-1: Duplexer assumptions

Parameter	Band XXVI	Band V
Duplexer Tx insertion loss [1]	3.0 dB	2.0 dB
Duplexer Rx insertion loss [1]	2.9 dB	2.2 dB
Tx isolation	52 dB	55 dB
Rx isolation	47 dB	50 dB
Tx to Ant Attenuation on Rx band	37 dB	
Switchplexer insertion loss [2]	0.6 dB	
Trace losses and VSWR mismatch [2]	0.4 dB	
Note 1: Integrated insertion loss over any 3.84 MHz channel within the band Note 2: It is not a part of a duplexer		

Table 6.3.1.1-2 shows the UE MOP requirements derived from Table 6.3.1.1-1. The tolerance for Band XXVI is relaxed by 1dB compared to Band V due to the fact thet TX IL in Band XXVI duplexer is 1dB higher than in Band V However, Band V MOP applies for those devices supporting both Band V and Band XXVI.

Table 6.3.1.1-2: UE Power ClassesThe UE MOP agreed for UTRA is different to the UE MOP defined for E-UTRA

Operating Band	Power Class 1		Power Class 2		Power Class 3		Power Class 3bis		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
V	-	-	-	-	+24	+1/-3	+23	+2/-2	+21	+2/-2
VIII	-	-	-	-	+24	+1/-3	+23	+2/-2	+21	+2/-2
XXVI					+24	+1/-4	+23	+2/-3	+21	+2/-3
NOTE: For the UE which supports both Band V and Band XXVI operating frequencies, the UE maximum output power of Band V shall apply for Band XXVI when the carrier frequency of the assigned UTRA channel is within 824-845 MHz.										

The minimum requirements for UE MOP for UTRA and 5 MHz E-UTRA are thus different. However, harmonization of Band 26/XXVI is currently under discussion. Co-banding between E-UTRA and UTRA is essential for harmonization of the band [2].

6.3.1.2 Spurious emissions

UE spurious emissions for protection of PS , the e850 lower sub-band and the APT700 band are specified in clauses 7.3.1.2.2.1, 7.3.1.2.2.2 and 7.3.1.2.2.3, respectively. For UTRA, a guard band is required to fulfil the UE emission requirements towards PS and e850 lower sub-band as specified in Table 6.3.1.x-1.

Table 6.3.1.2-1. Additional spurious emissions requirements with a guard band

Operating Band	Frequency Bandwidth	Measurement Bandwidth	Minimum requirement	Guard Band (F_{guard} MHz)
XXVI	806 MHz ≤ f ≤ 813.5 MHz	6.25 kHz	-42 dBm	TBD
	806 MHz ≤ f ≤ 816 MHz	6.25 kHz	-42 dBm	TBD
	851 MHz ≤ f ≤ 859 MHz	1 MHz	-32 dBm	TBD
	851 MHz ≤ f ≤ 859 MHz	6.25 kHz	-53 dBm	TBD

6.3.2 Receiver characteristics

6.3.2.1 Diversity characteristics

<text will be added>

6.3.2.2 Reference sensitivity

6.3.2.2.1 Void

6.3.2.2.2 The sub-band 814-849/859-894 MHz

Duplexer assumptions used to derive for Band XXVI UE REFSENS are presented in Table 6.3.2.2.2-1.

Table 6.3.2.2.2-1: Duplexer assumptions

Parameter	Band XXVI	Band V
Duplexer Tx insertion loss [1]	3.0 dB	2.0 dB
Duplexer Rx insertion loss [1]	2.9 dB	2.2 dB
Tx isolation	52 dB	55 dB
Rx isolation	47 dB	50 dB
Tx to Ant Attenuation on Rx band	37 dB	
Switchplexer insertion loss [2]	0.6 dB	
Trace losses and VSWR mismatch [2]	0.4 dB	
NOTE 1: Integrated insertion loss over any 3.84 MHz channel within the band. NOTE 2: It is not a part of a duplexer.		

Table 6.3.2.2.2-2 shows the UE REFSENS requirements derived from Table 6.3.2.2.2-1. Band XXVI UE REFSENS is relaxed by 1.5dB compared to Band V. This is because of 0.7 higher RX IL in Band XXVI duplexer compared to Band V and 3dB lower isolation which translates into 0.8 dB sensitivity degradation (0.7+0.8=1.5 dB).

Table 6.3.2.2.2-2: Test parameters for reference sensitivity

Operating Band	Unit	DPCH_Ec <REFSENS>	<$REF\hat{I}_{or}$>
V	dBm/3.84 MHz	-115	-104.7
VIII	dBm/3.84 MHz	-114	-103.7
814-849/859-894 MHz	dBm/3.84 MHz	-113.5	-103.2
NOTE: For the UE which supports both Band V and Band XXVI operating frequencies, the reference sensitivity level of -115 dBm DPCH_Ec <REFSENS> shall apply for Band XXVI when the carrier frequency of the assigned UTRA channel is within 869-894 MHz. The corresponding <$REF\hat{I}_{or}$> is -104.7 dBm.			

The conditions for UE REFSENS for UTRA and 5 MHz E-UTRA are currently different. However, harmonization of Band 26/XXVI is currently under discussion. Co-banding between E-UTRA and UTRA is essential for harmonization of the band A proposal for aligning the requirements for UTRA Band XXVI and Band 26 can be found in [3]

6.3.2.3 Maximum input level

<text will be added>

6.3.2.4 Adjacent Channel Selectivity (ACS)

<text will be added>

6.3.2.5 Blocking Characteristics

6.3.2.5.1 In-band blocking

Currently the in-band blocking requirement is the same for all band classes except for the special requirement for Band 17, which is due to the consideration of potential blocking scenarios from the adjacent MediaFLO and MediaFLO like mobile TV broadcasting signals from the Lower 700 MHz D and E blocks. Since there are no similar interference issue near the E850 band under study; and the prior assessment that with the split duplexer approach the extended Band 5 UE duplexer can achieve similar performance as a Band 5 UE duplexer, **the E850 in-band blocking requirement can be the same as the generic requirement for all bands except Band 17**.

6.3.2.5.2 Out-of-band blocking

Currently the out-of-band blocking requirement is the same for all band classes except for the additional modulated interference signal requirement for the UE transmit frequency range for bands 2, 5, 12, and 17 which seems to be a requirement for Region 2 to address potential self-interference or UE-to-UE interference. For E850 the same requirement would also apply. This would also address the potential interference from other UEs in the sub-bands of E850, namely bands 5, 6, 18, and 19. The split-duplexer implementation will either help to meet this requirement or have no bearing. **The E850 out-of-band blocking requirement can be the same as the generic requirement for all bands. In addition the requirement for range 4 shall also apply.**

6.3.2.5.3 Narrow band blocking

Currently the narrow band blocking requirement is the same for all band classes with an offset of ~200 kHz from the edge of channel. Since the requirement is not related to RF band or filters, **the E850 narrow band blocking requirement should be the same as the generic requirement for all bands.**

6.4 BS specific requirements

6.4.1 Transmitter characteristics

6.4.1.1 Lower sub-band

The lower sub-band or Band 27 is not defined for UTRA. However, spurious emissions from other operating bands needs to consider such band.

6.4.1.1.1 Spurious emissions

Co-existence and co-location with Band 27 also needs to be added into the specifications by adding a row to the spurious emissions for co-existence or co-location tables.

Table 6.4.1.1.1-1: BS Spurious emissions limits for UTRA FDD BS in geographic coverage area of systems operating in other frequency bands

E-UTRA Band 27	852 – 869 MHz	-52 dBm	1 MHz	This requirement does not apply to UTRA BS operating in Band V or XXVI.
	807 – 824 MHz	-49 dBm	1 MHz	For UTRA BS operating in Band XXVI, it applies for 807 MHz to 814 MHz, while the rest is covered in sub-clause 6.6.3.2.

Table 6.4.1.1.1-2: BS Spurious emissions limits for Wide Area BS co-located with another BS

WA E-UTRA Band 27	807 - 824 MHz	-96 dBm	100 kHz	

Table 6.4.1.1.1-3: BS Spurious emissions limits for Local Area BS co-located with another BS

LA E-UTRA Band 27	807 - 824 MHz	-82 dBm	100 kHz	

Table 6.4.1.1.1-4: Home BS Spurious emissions limits for co-existence with Home BS operating in other bands

E-UTRA FDD Band 27	807 – 824 MHz	-71 dBm	100 kHz	

6.4.1.2 Upper sub-band

Operating band unwanted emissions and spurious emissions defined in TS 25.104 and TS 25.141 need to be updated to include Band [XXVI]

6.4.1.2.1 Operating band unwanted emissions

Applicable requirements to Band V also need to be required to be fulfilled by Band [XXVI]

6.4.1.2.2 Spurious emissions

Band [XXVI] protection has to be included by adding a row for the band to the spurious emission tables for protection of own receiver band. Co-existence and co-location with Band 26 or Band [XXVI] also needs to be added into the specifications by adding a row to the spurious emissions for co-existence or co-location tables. In addition, modifications in the current co-existence emission tables to the rows for co-existence with Band 5 or Band V and GSM850 or CDMA850 are required due to overlap with Band [XXVI]

Table 6.4.1.2.2-1: Wide Area BS Spurious emissions limits for protection of the BS receiver

[XXVI]	814-849 MHz	-96 dBm	100 kHz	

Table 6.4.1.2.2-2: Medium Range BS Spurious emissions limits for protection of the BS receiver

[XXVI]	814-849 MHz	-86 dBm	100 kHz	

Table 6.4.1.2.2-3: Local Area BS Spurious emissions limits for protection of the BS receiver

[XXVI]	814-849 MHz	-82 dBm	100 kHz	

Table 6.4.1.2.2-4: Home BS Spurious emissions limits for protection of the BS receiver

[XXVI]	814-849 MHz	-82 dBm	100 kHz	

Table 6.4.1.2.2-5: BS Spurious emissions limits for UTRA FDD BS in geographic coverage area of systems operating in other frequency bands

GSM850 or CDMA850	869 - 894 MHz	-57 dBm	100 kHz	This requirement does not apply to UTRA FDD BS operating in frequency band V or [XXVI]
	824 - 849 MHz	-61 dBm	100 kHz	This requirement does not apply to UTRA FDD BS operating in frequency band V or [XXVI], since it is already covered by the requirement in sub-clause 6.6.3.2.
UTRA FDD Band V or E-UTRA Band 5	869 - 894 MHz	-52 dBm	1 MHz	This requirement does not apply to UTRA FDD BS operating in band V or [XXVI]
	824 - 849 MHz	-49 dBm	1 MHz	This requirement does not apply to UTRA FDD BS operating in band V or [XXVI], since it is already covered by the requirement in sub-clause 6.6.3.2.
UTRA FDD Band [XXVI] or E-UTRA Band [26]	859-894 MHz	-52 dBm	1 MHz	This requirement does not apply to UTRA FDD BS operating in band V or band [XXVI]
	814-849 MHz	-49 MHz	1 MHz	This requirement does not apply to UTRA FDD BS operating in band [XXVI], since it is already covered by the requirements in sub-clause 6.6.3.2 For UTRA FDD BS operating in band V, it applies for 814MHz to 824MHz, while the rest is covered in sub-clause 6.6.3.2

Table 6.4.1.2.2-6: BS Spurious emissions limits for Wide Area BS co-located with another BS

WA UTRA FDD Band [XXVI] or E-UTRA Band [26]	814-849 MHz	-96 dBm	100 kHz	

Table 6.4.1.2.2-7: BS Spurious emissions limits for Medium Range BS co-located with another BS

MR UTRA FDD Band [XXVI]	814.849 MHz	-86 dBm	100 kHz	

Table 6.4.1.2.2-8: BS Spurious emissions limits for Local Area BS co-located with another BS

LA UTRA FDD Band [XXVI] or E-UTRA Band [26]	814-849 MHz	-82 dBm	100 kHz	

Table 6.4.1.2.2-9: Home BS Spurious emissions limits for co-existence with Home BS operating in other bands

UTRA FDD Band [XXVI] or E-UTRA Band [26]	814-849 MHz	-71 dBm	100 kHz	

Protection of Public Safety operations in 800 MHz is also required from Band [XXVI]. This requirement is applicable in the spurious emissions domain but also at specified frequencies falling between 12.5 MHz below the first carrier frequency used and 12.5 MHz above the last carrier frequency used.

Table 6.4.1.2.2-10: BS Spurious emissions limits for protection of 800 MHz public safety operations

Operating Band	Frequency range	Maximum Level	Measurement Bandwidth	Note
[XXVI]	851 - 869 MHz	-13 dBm	100 kHz	Applicable for offsets > 37.5 kHz from the channel edge

6.4.2 Receiver characteristics

6.4.2.1 Lower sub-band

Noting that Band 27 is a E-UTRA band, other UTRA bands need to consider this blocking for protection.

6.4.2.1.1 Blocking

A new row is needed to include Band 27 to blocking when co-located BS.

Table 6.4.2.1.1-1: Blocking performance requirement for Wide Area BS when co-located with BS in other bands

WA E-UTRA Band 27	852 - 869 MHz	+16 dBm	-115 dBm	CW carrier

Table 6.4.2.1.1-2: Blocking performance requirement for Local Area BS when co-located with BS in other bands

LA E-UTRA Band 27	852 - 869 MHz	-6 dBm	-101 dBm	CW carrier

6.4.2.2 Upper sub-band

Blocking as well as intermodulation requirements need to be adapted to support Band [XXVI] in TS 25.104 and 25.141.

6.4.2.2.1 Blocking

A new row for Band [XXVI] needs to be included in the blocking tables. A new row is also needed to include Band [26] or Band [XXVI] to blocking when co-located BS.

Table 6.4.2.2.1-1: Blocking performance requirement for Wide Area BS

[XXVI]	814-849 MHz	-40 dBm	-115 dBm	±10 MHz	WCDMA signal *
	794-814 MHz 849-859 MHz	-40 dBm	-115 dBm	±10 MHz	WCDMA signal *
	1 MHz - 794 MHz 859 MHz - 12750 MHz	-15 dBm	-115 dBm	—	CW carrier

Table 6.4.2.2.1-2: Blocking performance requirement for Medium range BS

[XXVI]	814-849 MHz	-35 dBm	-105 dBm	±10 MHz	WCDMA signal *
	794-814 MHz 849-859 MHz	-35 dBm	-105 dBm	±10 MHz	WCDMA signal *
	1 MHz - 794 MHz 859 MHz - 12750 MHz	-15 dBm	-105 dBm	—	CW carrier

Table 6.4.2.2.1-3: Blocking performance requirement for Local Area / Home BS

[XXVI]	814-849 MHz	-30 dBm	-101 dBm	±10 MHz	WCDMA signal *
	794-814 MHz 849-859 MHz	-30 dBm	-101 dBm	±10 MHz	WCDMA signal *
	1 MHz - 794 MHz 859 MHz - 12750 MHz	-15 dBm	-101 dBm	—	CW carrier

Table 6.4.2.2.1-4: Blocking performance requirement for Wide Area BS when co-located with BS in other bands

WA UTRA-FDD Band [XXVI] or E-UTRA Band [26]	859 - 894 MHz	+16 dBm	-115 dBm	CW carrier

Table 6.4.2.2.1-5: Blocking performance requirement for Med ium Range BS when co-located with BS in other bands

MR UTRA-FDD Band [XXVI]	859 - 894 MHz	+8 dBm	-105 dBm	CW carrier

Table 6.4.2.2.1-6: Blocking performance requirement for Local Area BS when co-located with BS in other bands

LA UTRA-FDD Band [XXVI]or E-UTRA Band [26]	859 - 894 MHz	-6 dBm	-101 dBm	CW carrier

Band [XXVI] also require narrowband blocking since it overlaps with GSM850 as follows.

Table 6.4.2.2.1-7: Blocking performance requirement (narrowband) for Wide Area BS

[XXVI]	814-849 MHz	-47 dBm	-115 dBm	±2.7 MHz	GMSK modulated*

Table 6.4.2.2.1-8: Blocking performance requirement (narrowband) for Local Area / Home BS

[XXVI]	814-849 MHz	- 37 dBm	-101 dBm	±2.7 MHz	GMSK modulated*

6.4.2.2.2 Intermodulation

The same requirements which are applicable to Band V are also valid for Band [XXVI]

7 Study of E-UTRA requirements

This clause documents the E-UTRA requirements for the e850 bands.

7.1 Band and channel arrangement

This clause documents the band and channel arrangements for the e850 bands.

7.1.1 E-UTRA operating band and channel arrangement

In clause 5.2.1, a split-band arrangement for extending 850 MHz (806-849/851-894 MHz) was presented and agreed. Subsequently, it was agreed to move the lower edge of the lower band to 807/852 MHz. Two different blocks upper Extending 850 MHz and lower Extending 850 MHz were defined as follows:

- Upper Extending 850 MHz:
  - o UL: 814-849 MHz
  - o DL: 859-894 MHz
- Lower Extending 850 MHz:
  - o UL: 807-824 MHz
  - o DL: 852-869 MHz

The upper Extending 850 MHz band allocation is for E-UTRA referred to as Band [26] and the lower Extending 850 MHz band allocation is for E-UTRA referred to as Band [27]

E-UARFCN can be defined as in Table 7.1.1-1, by reserving a part of the unused numbers that follow the band 25 allocation.

Table 7.1.1-1 EARFCN allocated for E-UTRA Band [26] and Band [27]

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}
[26]	859	8690	8690-9039	814	26690	26690-27039
[27]	852	9040	9040-[9209]	806	27040	27040-27209

7.1.2 MSR BS operating band and categories

MSR has to define which band category is supported for the lower and upper E850 as follows.

Table 7.1.2-1 MSR operating band and categories for upper and lower E850

MSR and E-UTRA Band number	UTRA Band number	GSM/EDGE Band designation	Uplink (UL) BS receive UE transmit	Downlink (DL) BS transmit UE receive	Band category
[26]	[XXVI]	-	814 MHz – 849 MHz	859 MHz – 894 MHz	1
[27]	[XXVII]	-	807 MHz – 824 MHz	852 MHz – 869 MHz	1

7.2 Coexistence with other technologies

7.2.1 Coexistence scenarios for the range 806-824/851-869 MHz and 814-849/859-894 MHz

This clause addressed some of the potential coexistence issues that could occur depending on the markets.. This analysis was performed for the lower edge of the band at 806/851 MHz.

7.2.1.1 LTE vs. Public Safety

Public Safety typically uses lower number and higher towers than an LTE system. In addition, Public Safety operators typically design their networks to operate down to the noise floor. With LTE and Public Safety deployments being quite different, interference issues could arise.

LTE BS Tx OOBE → NB P:

- The Tx noise from an LTE BS is at most 6dB below NB PS Portable Rx noise floor (1dB desense criteria).
- NB PS Portable NF = 9dB
- NB PS Portable antenna gain = -6dB

The Tx noise must be less than -127.0dBm/6.25kHz

Assuming FCC rule 90.691 [6] and Industry Canada RSS-119 [7] are used for the BS Unwanted Emission limits, the LTE BS Tx emission levels are -3dBm/MHz or -25 dBm/6.25 kHz.

Assuming an LTE BS antenna gain of 16dB, antenna feeder loss of 3 dB and 70 dB path loss between the LTE BS and NB PS portable, an additional 45 dB of attenuation is required.

If using 70 dB port to port isolation, which is less stringent than 70 dB MCL assumption, TX filter requirement = 38 dB.

At least 1 MHz guard band with RF filter is potentially needed to obtain the additional isolation.

LTE BS Tx Power → NB PS portable (Blocking)

LTE UE Tx OOBE → NB PS BTS receiver

LTE UE Tx Power → NB PS BTS receiver (blocking)

7.2.1.2 LTE vs. iDEN and other users of the band

While co-location of LTE with iDEN should help the interference, co-location might not always be possible. If LTE and iDEN deployments are not co-located, interference could be an issue, especially if the deployments are very different (e.g., cell size, antenna height, etc.).

The interference between LTE and iDEN is studied here.

LTE BS TX OOBE → iDEN portable

Assuming FCC rule 90.691 [6] and Industry Canada RSS-119 [7] are for the BS Unwanted Emission limits, the LTE BS Tx emission levels are -3dBm/MHz as noted in the previous clause or -19 dBm/25 kHz. The maximum tolerable interference level is

-127 dBm/25 kHz assuming a 1 dB desense criteria, and the interference from LTE BS Tx noise is -89 dBm/25 Hz assuming 70 dB port to port isolation. Therefore 38 dB of additional attenuation is required.

Guard band potentially needed is at least 1 MHz.

LTE BS TX Power → iDEN portable (Blocking)

Assuming iDEN portable adjacent channel selectivity of 80 dB and a receiver noise floor of -121 dBm/25 kHz, the maximum tolerable interference level at the iDEN receiver is -41 dBm/25 kHz. With the LTE BS Tx power of 43 dBm/5 MHz and 70 dB port to port isolation, no additional attenuation is required.

LTE UE Tx OOBE → iDEN BTS receiver

LTE UE Tx Power → iDEN BTS receiver (blocking)

7.2.1.3 LTE UE to LTE UE and LTE BS to LTEBS coexistence issues at 849-851 MHz

LTE BS Tx Power → LTE BS Receiver (Blocking)

LTE TX Pout = 43 dBm/5 MHz

Assuming minimal coupling loss between LTE BS and LTE BS is 67 dB, then the interferer level at LTE BTS is -24 dBm/5 MHz

From 3GPP TS 36.104 Table 7.5.1-3 Adjacent channel selectivity for Wide Area BS and Table 7.6.1.1-1 Blocking performance requirement for Wide Area BS, the minimum LTE receiver protection assuming 6dB desense is -52 dBm for adjacent channels and -43 dBm for other in-band channels, i.e. in band blocking. Adjusting for a more realistic 1dB desense allowance, the corresponding adjacent and alternate channel protection becomes -63 dBm and -54 dBm respectively.

Therefore an additional 39 dB of protection is required for an interferer in the adjacent channel spectrum, while interferers elsewhere in band will only require an additional 30 dB of protection.

By contrast, when 5 MHz of iDEN is above 851 MHz, a Band 5 or Band 26 BS requires an additional 64.2 dB of protection for an interferer in the adjacent channel spectrum, while interferers elsewhere in the SMR band will require an additional 55.2 dB of blocking protection. The calculation for iDEN power in 5 MHz is as follows:

An iDEN basestation power amplifier typically outputs 6 watts per 25 KHz channel. In 5 MHz of spectrum, there are 200 25 KHz channels. iDEN frequency reuse can be as high as n=5. With a more typical n=9 frequency reuse, there are 22 iDEN carriers per sector in 5 MHz, or 51.2 dBm per sector. This is 8.2 dB greater than the 43 dBm transmit power of an LTE basestation.

So, deploying LTE in the Lower e850 band will result in significantly lower levels of blocking than iDEN does today. However, TS36.104 does not include any blocking requirement against iDEN protection. Instead, blocking from iDEN systems have been solved in a case-by-case deployment basis.

Band 5/V is a legacy band. There is currently a large number of installed Band V base stations as well as Band 5/V development. The current applicable requirements at 851 MHz is ACS and in-band blocking, thus a DL signal at such frequency may cause blocking in a Band 5 BS RX, degrading its performance. For new Band 5/V as well and 26/XXVI BSs the large required attenuation at 2MHz from the UL operating band will introduce more insertion loss compared to other bands with larger frequency separation to blocking signals and thus cause performance degradation. Alternatively, site specific solutions, can be considered which will increase cost and complexity.

LTE BS Tx OOBE → LTE BTS Receiver

Assuming a 1 dB desense criteria, the Tx noise from LTE BS (5 MHz channel) must be more than 6 dB below the LTE BS Rx noise floor. With an LTE BS NF of 5 dB, the Tx noise must be less than -115dBm/MHz. Assuming FCC rule 90.691 [6] and Industry Canada RSS-119 [7]emission limits, the LTE Tx power in the LTE Rx bandwidth is -13 dBm/100 kHz or -3 dBm/MHz. Assuming a coupling loss between LTE Base Stations of , 67 dB, an additional 45 dB of suppression is required.

The 2MHz guard band (849-851 MHz) with RF filter on the BSs could be enough for certain typical deployments while it may impose certain penalty on the BSs, for example high IL.

LTE UE Tx at 849MHz Edge--->LTE UE Rx at 851 MHz (ACS)

For LTE UE ACS Case 1, the allowed maximum interference power on the adjacent channel of the victim UE Rx channel is Refsens + 45.5 dB, and the wanted signal is a REFSEN+14 dB. For ACS case 1, the required additional isolation is 25.5 dB for 1 m separation between UE and UE.

For LTE UE ACS Case 2, the allowed maximum interference power on the adjacent channel of the victim UE Rx channel is -25 Bm, and the wanted signal is -56.5 dBm. For ACS case 2, no additional isolation is required for 1m separation between UE and UE.

LTE UE Tx at 849MHz Edge--->LTE UE Rx at 851 MHz (In Band Blocking)

For In-band blocking case 1, the allowed maximum interference power is -56 dBm assuming 6 dB desense. In this case, the required addition is 29 dB for 1 m separation between victim and aggressor UEs.

For In-band blocking case 2, the allowed maximum interference power is -44 dBm assuming 6 dB desense. In this case, the required addition is 17 dB for 1 m separation between victim and aggressor UEs.

LTE UE Tx at 849 MHz Edge--->LTE UE Rx at 851MHz (Desense due to OOB)

Based on FCC band plan, here we consider two aggressors at 849 MHz band edge:

- LTE/1.4MHz/23 dBm, with higher channel edge at 849 MHz.
- LTE/5MHz/23 dBm, with higher channel edger at 845 MHz.

Assuming a 3dB desense criteria, the out of band emission from Band5 UE should not be higher than E850 lower band UE Rx noise floor. With an the victime UE NF is assumed to be 9dB , the maximum allowed OOBE is -174 dBm + 10log(1E6) + 9 = -105 dBm/MHz. From TS 36.101 Table 6.6.2.1.1-1, the UE spectrum emission levels are defined for different frequency offset (Δf_{OOB}). The required isolation can be calculated as:

$$\text{Required isolation} \geq \text{Spectrum emission limit} - \text{maximum allowed OOBE}$$

Based on the UE spectrum emission limit for 5MHz channel bandwidth from frequency (Δf_{OOB}) starting from the channel edge of ±0 to ±10 MHz, the required isolation is calculated to meet 3 dB desense criteria. If assuming MCL between UEs of 50 dB (distance separation: 1 meter, body loss at each side: 10 dB), an additional isolation required are calculated in the tables below:

7.2.1.3-1: Isolation requirement for 5MHz LTE channel bandwidth

Δf_{OOB} (MHz)	Spectrum emission limit (5 MHz)	Required Isolation	Additional Isolation
± 0-1	-15 dBm/30 KHz		
± 1-2.5	-10 dBm/1 MHz	95 dB	45 dB
± 2.5-2.8	-10 dBm/1 MHz	95 dB	45 dB
± 2.8-5	-10 dBm/1 MHz	95 dB	45 dB
± 5-6	-13 dBm/1 MHz	92 dB	42 dB
± 6-10	-25 dBm/1 MHz	80 dB	30 dB

7.2.1.3-2: Table Isolation requirement for 1.4MHz LTE channel bandwidth

Δf_{OOB} (MHz)	Spectrum emission limit (5MHz)	Required Isolation	Additional Isolation
± 0-1	-10 dBm/30 KHz		
± 1-2.5	-13 dBm/1 MHz	92 dB	42 dB
± 2.5-2.8	-25 dBm/1 MHz	80 dB	30 dB

7.2.1.4 Void

7.2.1.5 Conclusions

For e850 coexistence, specially considering the legacy Band 5 equipment, certain guard band may be required based on OOBE and Blocking studies. For coexistence with DTV, a guard band will be required if the TV repeater occupies the spectrum adjacent to the low end of the proposed band. Co-existence between lower E850 and Band 5 needs to be considered considering that the impact on the legacy Band 5 is minimized/negligible. Co-existence with upper e850 also needs to be studied. The UE to UE coexistence at 849-851 MHz is for further study.

7.2.2 The range 814-849/859-894 MHz

7.2.2.1 Region 2 specific

In this clause we start by discussing co-existence problems with regard to the FCC limits in the United States. We consider the range 817-824/862-869 MHz and unwanted emissions below the block edge at 817 MHz in particular, but the results are also applicable near any block edge (or to spectrum adjacent to interior channels used by incumbent licensees) within the entire range 806-849/851-894 MHz. Figure 7.2.2.1-1 shows the spectrum situation around 850 MHz in Region 2.

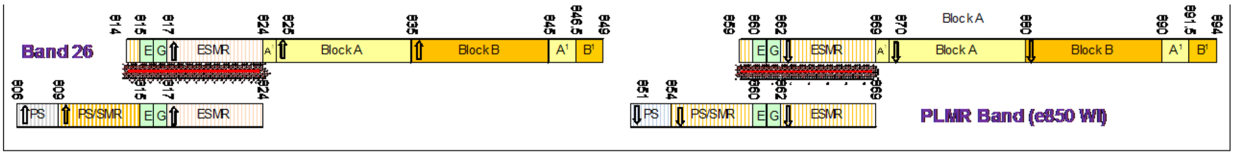

Figure 7.2.1-1: Spectrum arrangement around 850 MHz in Region 2

7.2.2.1.1 UE interference into Public Safety in the United States

7.2.2.1.1.1 UE interference into Public Safety below Band 26

First we look at interference from an aggressor UE in the ESMR band 817-824/862-869 MHz (the available extension of Band 5 in the United States) a victim Public Safety device or control station below 816 MHz (use of the Expansion Band) with regard to the applicable FCC emission limits on 90.691, described in Clause 5.3.2.1. The resolution bandwidth is not defined in the FCC rules but we follow the RSS-119 (and the historical) which defines the measurement bandwidth as 300 Hz at frequency offset less than 37.5 kHz from channel edge and 100 kHz for frequency offsets greater than 37.5 kHz. Results for 1 MHz resolution bandwidth is also given for the latter case. The emission limits that would apply are -20 dBm/0.3kHz at an offset between 12.5 kHz and 37.5 kHz from the ESMR block, and -13 dBm/100kHz beyond 37.5 kHz.

For the UE unwanted emission results we assume a transmitter that just meets the LO leakage and IQ image minimum requirements for Rel-8, and with a counter-IM3 at -60 dBc (full power). The graphs show the emission at the antenna port assuming no additional attenuation provided by the duplexer the lower band edge of which is 814 MHz.

Figure 7.2.2.1.1-1 shows the results for a 1.4 MHz channel with its lower edge at 817 MHz, hence a 0.16 MHz guard between the ESMR lower edge and the lowest PRB of the transmission configuration. We observe that a limit of -20 dBm/0.3 kHz would be met at an offset between 12.5 kHz and 37.5 kHz from the channel edge for both a 1 and 6 PRB allocations: there is a margin of up to 10 dB under the above assumptions.

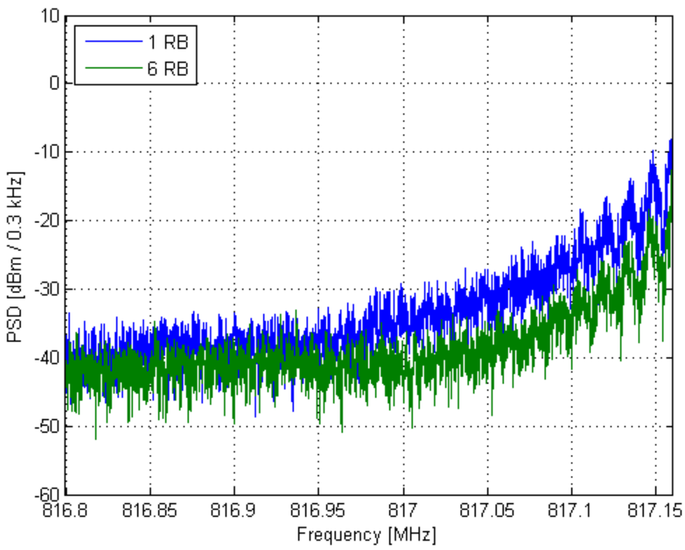

Figure 7.2.2.1.1-1: Emission for the 1.4 MHz bandwidth for 300 Hz RBW for small offsets from 817 MHz

The results for a resolution bandwidth of 100 kHz are shown in Figure 7.2.2.1.1-2. For offsets greater than 37.5 kHz we assume that the first measurement position is at an 87.5 kHz offset from the allocated block with the 100 kHz bandwidth. We observe that the limit -13 dBm/100 kHz is not met for the 1 PRB allocation at offset smaller than 100 kHz from the block edge: power back-off or a guard created above 817 MHz is needed based on the assumed transmitter performance and PA model. For most devices the performance should exceed the minimum, but there are also other tolerances not considered herein. Results for a wider frequency range are shown in Figure 7.2.2.1.1-3, the -13 dBm/100 kHz limit is met at an offset of 100 kHz away from the block edge at 817 MHz for the PRB allocations considered.

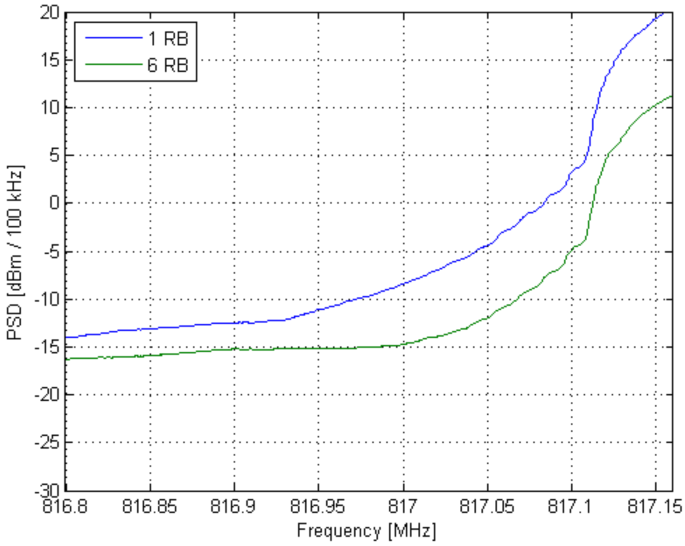

Figure 7.2.2.1.1-2: Emission for the 1.4 MHz bandwidth with 100 kHz RBW for small offsets from 817 MHz

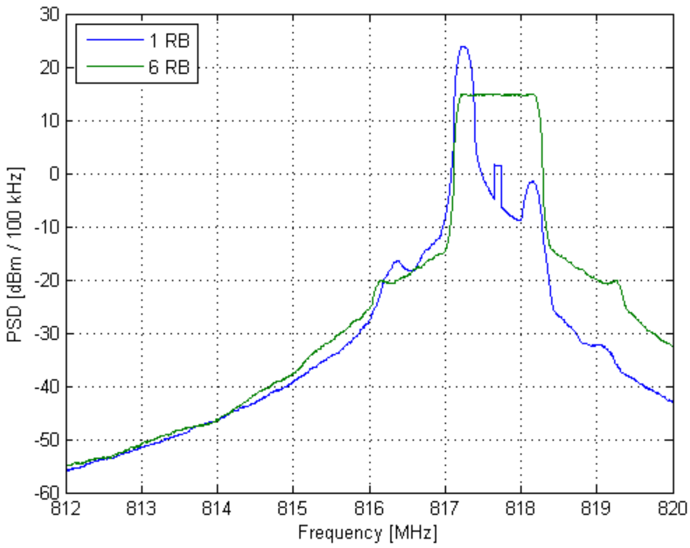

Figure 7.2.2.1.1-3: Emission for the 1.4 MHz bandwidth with 100 kHz RBW

The corresponding results for the 5 MHz channel centred at 819.5 MHz are shown in Figure 7.2.2.1.1-4 for the range around the lower ESMR block edge. We observe that a limit of -20 dBm/0.3 kHz would be met at an offset between 12.5 kHz and 37.5 kHz from the channel edge for all PRB allocations studied. The results for 100 kHz resolution bandwidth are shown in Figure 7.2.2.1.1-5, the limit -13 dBm/100 kHz is not met for offsets smaller than 300 kHz from the block edge for the 5 PRB allocation: the same results over a wider frequency range are shown in Figure 7.2.2.1.1-6. The intermodulation products (wider than 100 kHz) stay below the limit.

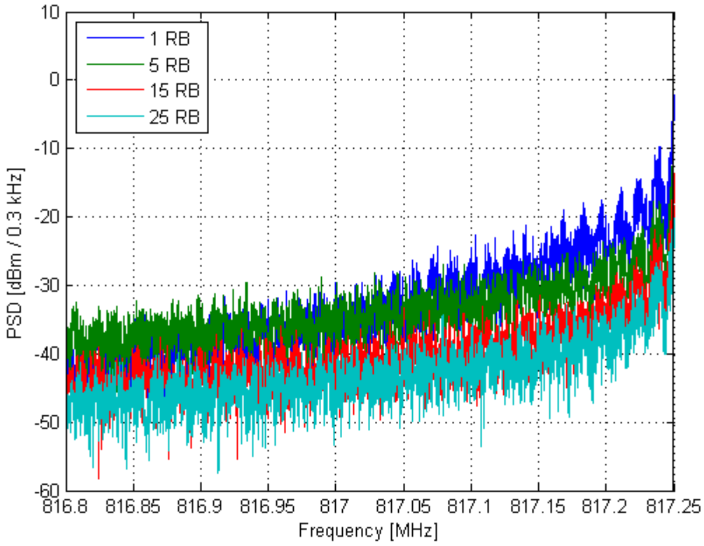

Figure 7.2.2.1.1-4: Emission for the 5 MHz bandwidth with 300 Hz RBW for small offsets from 817 MHz

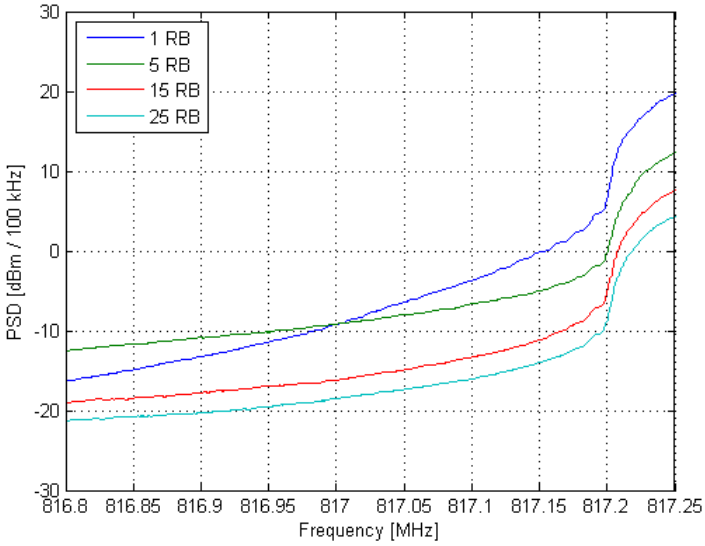

Figure 7.2.2.1.1-5: Emission for the 5 MHz bandwidth with 100 kHz RBW for small offsets from 817 MHz

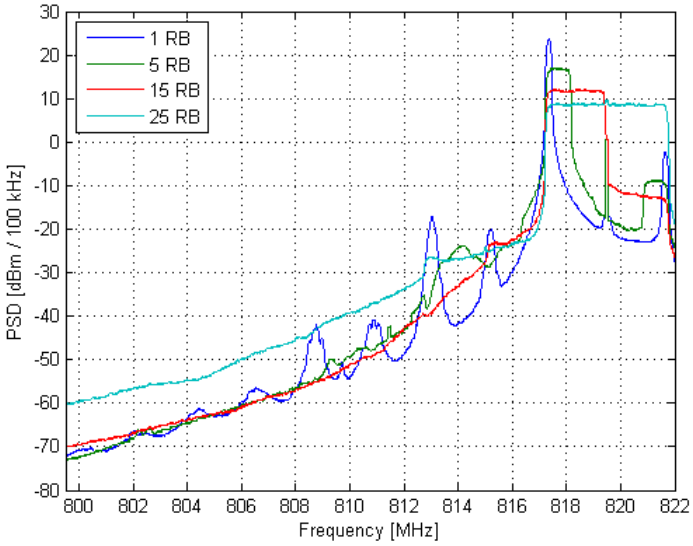

Figure 7.2.2.1.1-6: Emission for the 5 MHz bandwidth with 100 kHz RBW

Figure 7.2.2.1.1-7 shows the corresponding results for the 1 MHz resolution bandwidth. Assuming that the first measurement frequency is 537.5 kHz, the limit -13 dBm/MHz is not met close in to the carrier, and a third order intermodulation product also exceeds this limit

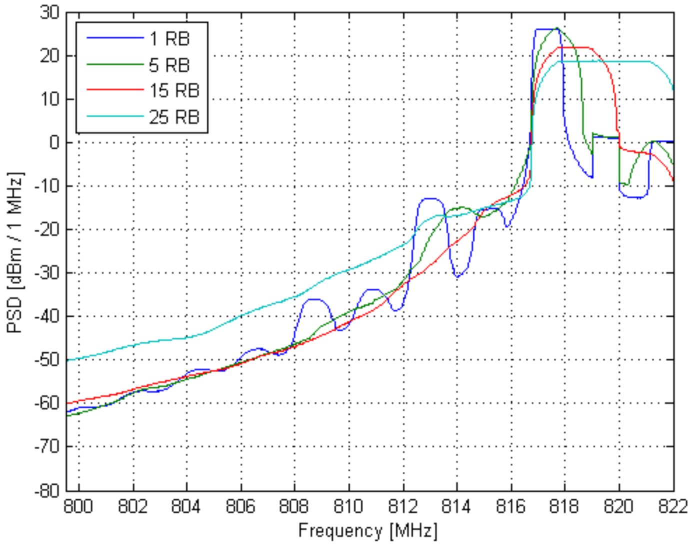

Figure 7.2.2.1.1-7: Emission for the 5 MHz bandwidth with 1 MHz RBW

To sum up, to meet the FCC requirements (Clause 5.3.2.1) for the ESMR block:

- a limit of -20 dBm/0.3 kHz would be met at an offset between 12.5 kHz and 37.5 kHz for all PRB allocations studied for the 1.4 and 5 MHz bandwidths,
- for the 100 kHz resolution bandwidth, the limit -13 dBm/100 kHz would require a guard of up about 100 kHz and 300 kHz (taken inside the ESMR band) for the 1.4 and 5 MHz bandwidths, respectively
- for the 1 MHz resolution, a moderate power back-off is needed to meet the -13 dBm/MHz bandwidth.

Assuming that the resolution bandwidth is 100 kHz, an A-MPR could be configured to avoid the necessary guards just above 817 MHz. The duplex filter with the lower edge at 814 MHz would not provide sufficient attenuation of the intermodulation product for the 1 MHz resolution bandwidth. However, for the 100 kHz resolution bandwidth:

- the limit -13 dBm/100kHz is met in the public safety band 806-815 MHz (uplink), including the expansion band up to 816 MHz (Figure 5.1.2.2-1).

<results for15 MHz bandwidth for the upper block edge at 849 MHz>

While -13 dBm/100 kHz follows the FCC rules on emission limits, it is also necessary to ensure that other radio services will not be interfered from a regulatory point of view, as indicated in clause 5.3.2.1 (FCC Title 47 Part 22.917). Table 7.2.2.1.1.1-1 includes simulations for the PSNB average system outage with or without LTE UL interference. The simulation parameters can be found in Annex B.

Table 7.2.2.1.1.1-1: NB PS (8km cell radius) average system outage with or without LTE UL interference

	LTE cell radius 1.0 km		LTE cell radius 2.0 km		LTE cell radius 4.0 km	
	Average	Edge	Average	Edge	Average	Edge
No LTE interference	2.0%	4.6%	2.0%	4.6%	2.0%	4.6%
OOBE -43dBm/6.25 kHz	3.5%	7.7%	2.4%	5.1%	2.1%	4.8%
OOBE -35dBm/6.25 kHz (USA 700 MHz OOBE based on FCC CFR Title 47 Part 27.53)	9.8%	19.4%	3.9%	7.9%	2.4%	5.1%
OOBE -13dBm/100KHz (-25dBm/6.25 kHz) (USA 800 MHz OOBE based on FCC §90.691 and Industry Canada RSS-119)	32%	50%	13.2%	26.8%	5.0%	10.2%
NOTE: Typical NB PS design is tile by tile based, for each tile, 95% or more reliable (less than 5% outage) is required. Although the table showed average and cell edge outage, it does not capture all the NB PS outage aspects due to interference.						

The systems outage criteria is defined as:

$$system\ outage = \frac{number\ of\ unavailable\ users + number\ of\ interfered\ users}{total\ number\ of\ users}$$

The system outage is calculated for each trial then averaged over a number of trials to obtain the final figure. A maximum amount of outage for the NB PS system of 2.5% is typical.

The system outage is very high when a Band 26 UE emits -13 dBm/100 kHz while it becomes reasonable when the UE emissions from Band 26 is -35 dBm/6.25 kz and almost unappreciable for -43 dBm/6.25 kHz.

7.2.2.1.1.1 UE interference into Public Safety above Band 26

As indicated in clause 5.3.2.1 (FCC Title 47 Part 22.917), the regulatory limits are conditioned on that harmful interference to other radio services does not occur. Given an allowed 1dB desense in PS NB portable devices as interference condition, Table 7.2.2.1.1.2-1 includes the overall and cell edge probability of interference with an LTE UL interference at 1, 2 or 3m separation distance and different LTE OOBE levels. The simulation parameters can be found in Annex B.

Table 7.2.2.1.1.2-1: Probability of interference from LTE UE to PSNB portable at close proximity

Separation distance	1 meter separation			2 meters separation			3 meters separation		
LTE UE Pmax(dBm)	23	23	23	23	23	23	23	23	23
OOBE (dBm/6.25kHz)	-50	-53	-57	-50	-53	-57	-50	-53	-57
ACP(dBc)	73	76	80	73	76	80	73	76	80
Overall probability of interference with 1dB desense	5.8%	3.4%	1.5%	1.9%	0.9%	0.5%	0.7%	0.3%	0.1%
Probability of interference at cell edge with 1dB desense	58.0%	43.0%	25.0%	30.0%	18.0%	8.7%	14.8%	7.8%	2.8%

7.2.2.1.2 BS interference into Public Safety

Here we consider the interference from an aggressor BS in the ESMR band 817-824/862-869 MHz to a victim Public Safety service below 861 MHz (use of the Expansion Band) with regard to the applicable FCC emission limits describe in clause 5.3.2.1.

In TS 36.104 clause 6.6.3.3, additional operating band unwanted emission limits for E-UTRA band < 1GHz comes from FCC rule Title 47 part 22. The comparison of the additional requirements in TS 36.104 with the requirements from FCC 90.691 and RSS-119 is shown in Figure 7.2.2.1.2-1. In this example, the higher channel edge of the carrier is at 865 MHz.

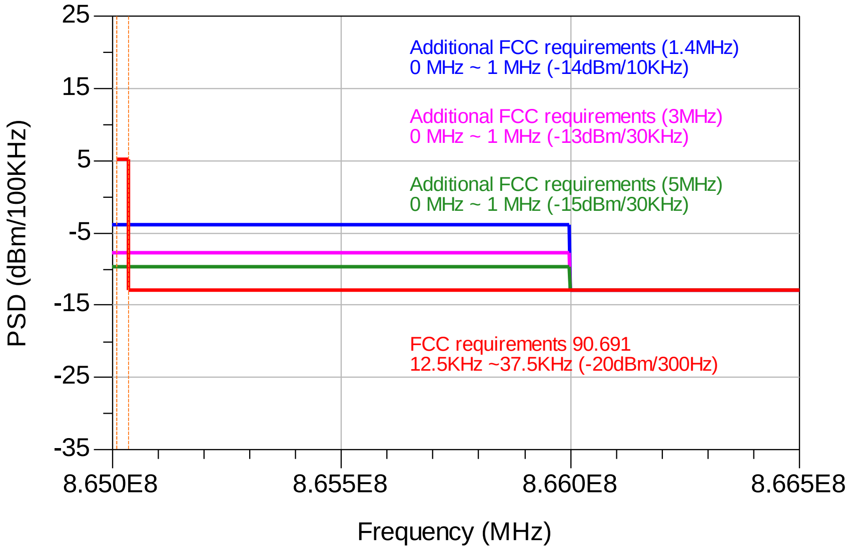

Figure 7.2.2.1.2-1: Comparison of additional requirements in TS 36.104 with FCC 90.691

As can be seen from the figure above, the requirements from FCC 90.691 and RSS-119 are much stricter than the additional requirements defined in TS 36.104.

Simulations for 1.4 MHz, 3 MHz and 5 MHz with 300 Hz and 100 kHz RBW are carried out to evaluate the emission requirements from FCC 90.691 and RSS-119. Simulation assumptions are listed below:

- RB allocation for different channel bandwidth: Maximum RB's
- Output power: Max 43dBm
- Spectrum shaping filter: 0.1dB Ripple and 50dB rejection
- ACLR=45dB

Figure 7.2.2.1.2-2 shows the results for a 5 MHz channel with its lower edge at 862 MHz, hence a 0.2425 MHz guard between the ESMR lower edge and the lowest PRB of the transmission configuration. The ACLR of the PA model is 45 dBc and the RBW of the spectrum is 300 Hz. The limit of -20 dBm/0.3 kHz could be met easily at an offset between 12.5 kHz and 37.5 kHz from the block edge for full RB allocation.

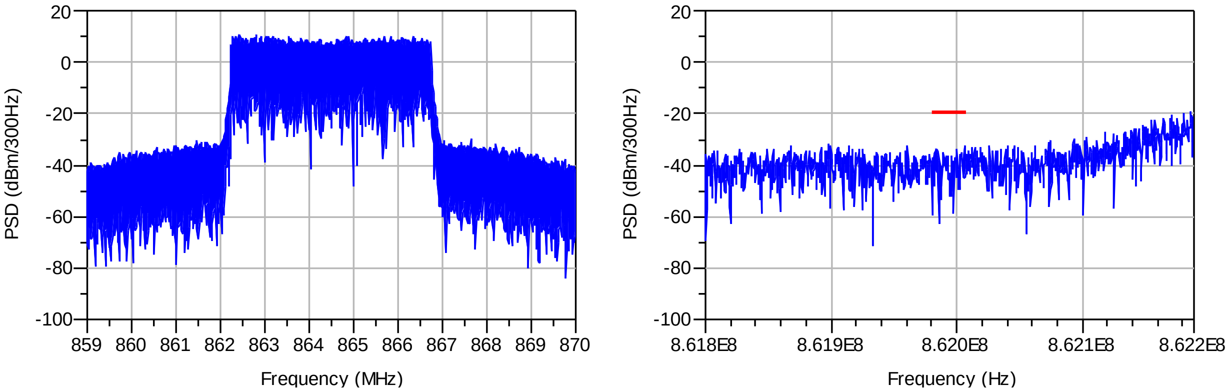

Figure 7.2.2.1.2-2: Emission for the 5 MHz channel bandwidth with 300Hz RBW

The results for a resolution bandwidth of 100 kHz is shown in Figure 7.2.2.1.2-3. For offsets greater than 37.5 kHz, the limit -13 dBm/100 kHz is not met at near end close to the channel edge based on the assumed PA model.

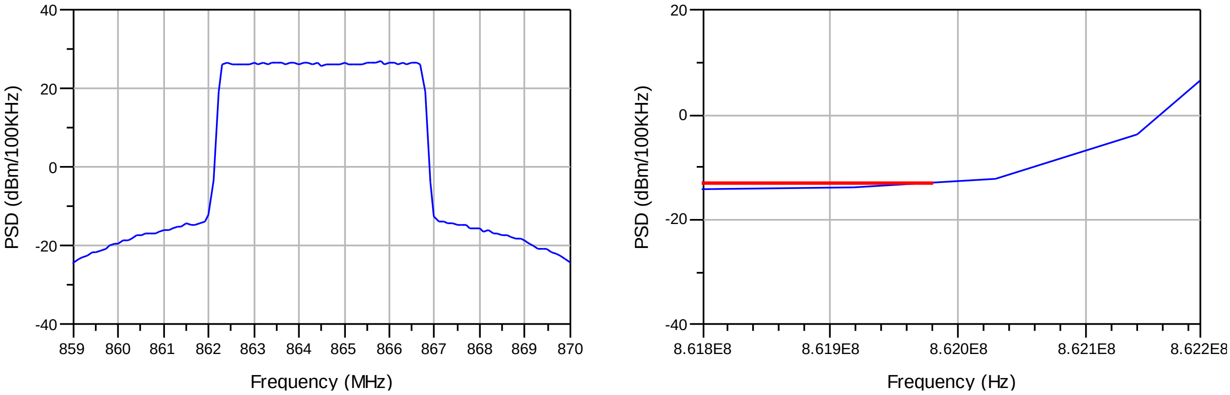

Figure 7.2.2.1.2-3: Emission for the 5 MHz channel bandwidth with 100kHz RBW

The ACLR of a real PA for BS should be better than 45dBc. Figure 7.2.2.1.2-4 shows a typical measurement ACLR for 5MHz channel bandwidth carrier at 46dBm output power. Therefore, the FCC requirements (Clause 5.3.2.1) for the ESMR block could be met for BS with 5MHz channel bandwidth.

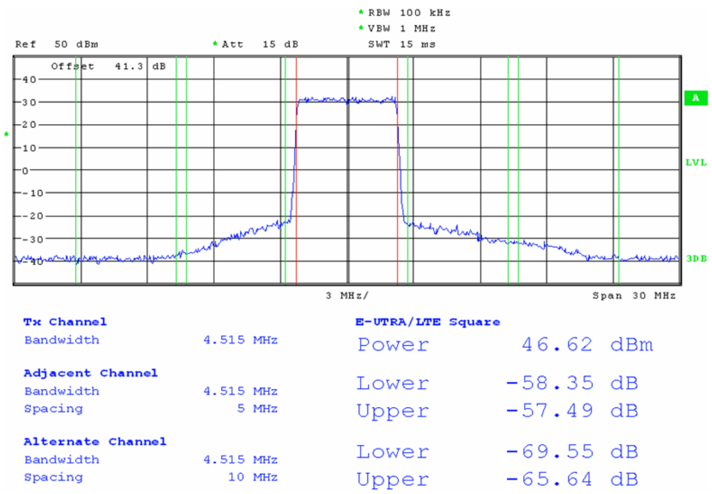

Figure 7.2.2.1.2-4: Measurement ACLR for 5MHz channel bandwidth (<1GHz band)

With regards to Figure 7.2.2.1.2-4, the simulation assumption is revised a little bit as:

- RB allocation for different channel bandwidth: Maximum RB's

- Output power: Max 43dBm
- Spectrum shaping filter: 0.1dB Ripple and 50dB rejection
- ACLR=55dB

The corresponding results with 55dBc ACLR PA model, i.e. 10dB better than the specification, for the 1.4 MHz channel centred at 862.7 MHz are shown in Figure 7.2.2.1.2-5 for 300 Hz resolution bandwidth and Figure 7.2.2.1.2-6 for 100 kHz resolution bandwidth. The limit of -20 dBm/0.3 kHz could be met at an offset between 12.5 kHz and 37.5 kHz from the channel edge, but the limit -13 dBm/100 kHz could not be met for offsets 37.5 to about 100 kHz from the block edge at 862MHz.

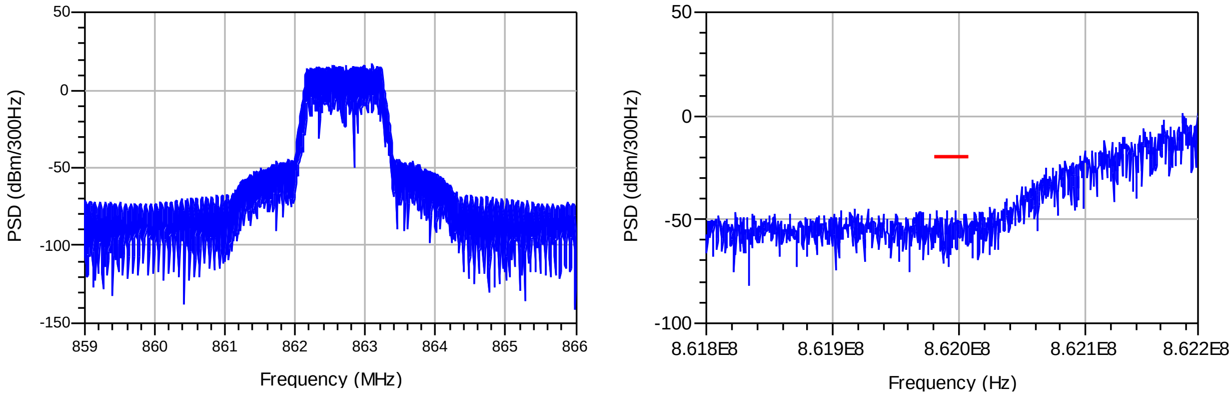

Figure 7.2.2.1.2-5: Emission for the 1.4 MHz channel bandwidth with 300Hz RBW

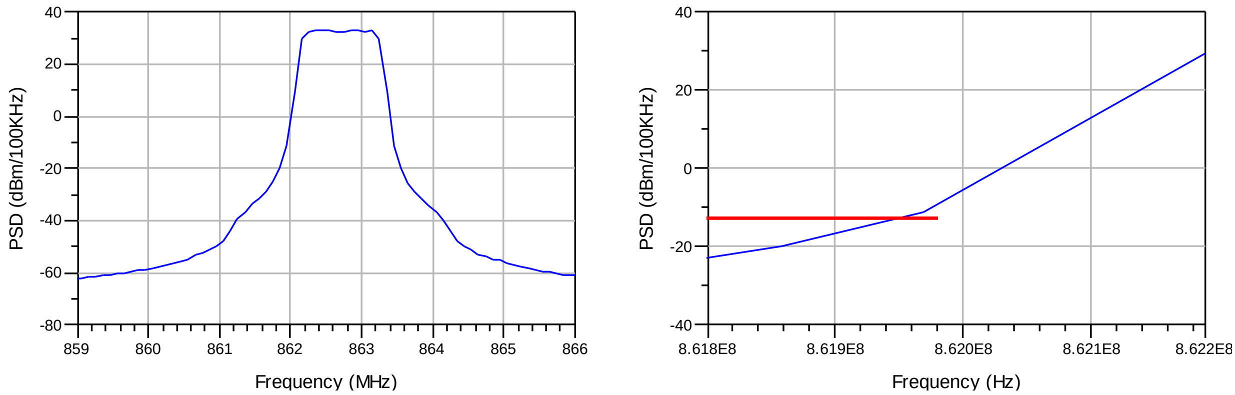

Figure 7.2.2.1.2-6: Emission for the 1.4 MHz channel bandwidth with 100kHz RBW

The corresponding results with 55dBc ACLR PA model, i.e. 10dB better than the specification, for the 3 MHz channel centred at 863.5 MHz are shown in Figure 7.2.2.1.2-7 for 300Hz resolution bandwidth and Figure 7.2.2.1.2-8 for 100 kHz resolution bandwidth. The limit of -20 dBm/0.3 kHz could be met at an offset between 12.5 kHz and 37.5 kHz, and the limit -13 dBm/100 kHz could also be met for offsets larger than 37.5 kHz from the block edge at 862MHz.

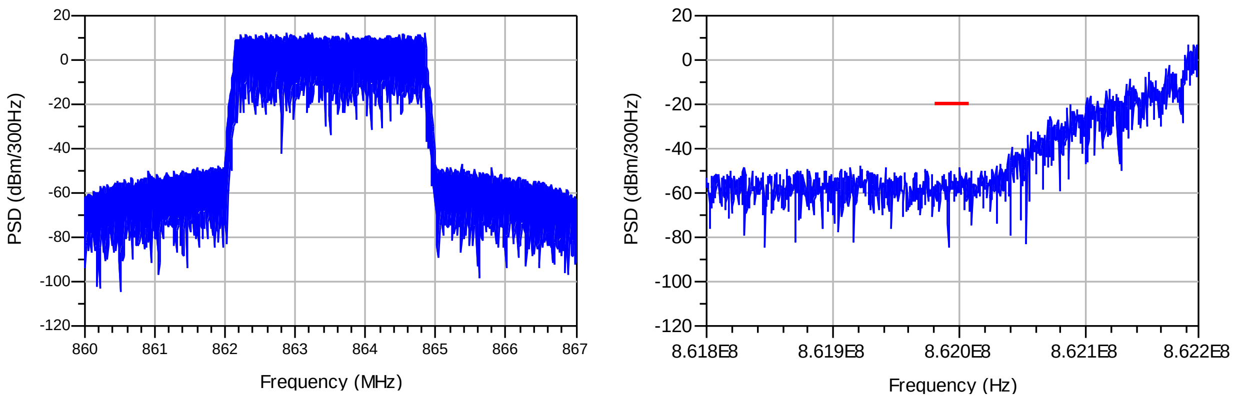

Figure 7.2.2.1.2-7: Emission for the 3 MHz channel bandwidth with 300Hz RBW

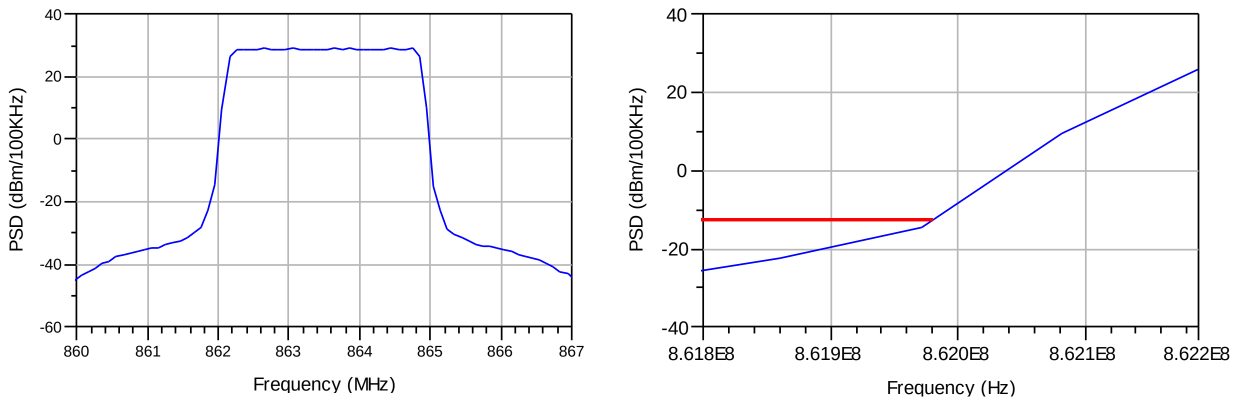

Figure 7.2.2.1.2-8: Emission for the 3 MHz channel bandwidth with 100kHz RBW

On the basis of the simulation results, we can summarize the conclusion as below:

- In the frequency region 12.5 KHz <△f <37.5 kHz, it is easy to meet the -20 dBm/300 Hz emission limit for BS with 1.4MHz, 3MHz and 5 MHz channel bandwidth.
- In the frequency region △f >37.5 kHz, the emission requirement of -13 dBm/100 kHz from FCC rules could be met for BS with 3 MHz and 5MHz channel bandwidth. The limit -13 dBm/100 kHz is not met for offsets smaller than 100 kHz from the channel edge for the 1.4 MHz channel bandwidth. Therefore, additional 100 kHz guard band is needed for 1.4 MHz carrier configured at the band edge close to the public safety service. Please note that this is achieved with 55 dBc ACLR at 43 dBm as average performance, which is 10 dB higher than minimum requirements.

7.2.2.1.3 UE interference into another iDEN operator within the upper band

void

7.2.2.1.4 BS interference into another iDEN operator within the upper band

void

7.2.3 The range 806-824/851-869 MHz

This clause addressed some of the potential coexistence issues that could occur, depending on the market and deployment.

7.2.3.1 LTE vs. Broadcast TV below the band

Interference from TV stations below the proposed UL band to LTE BS can be mitigated with filters on LTE BS, guard bands, site planning and physical separation. While these techniques will help with the receiver blocking issue, the out--of--band emissions from the TV transmitters can only be mitigated with additional filtering at the TV site or with frequency separation. Interference from LTE UEs to TV receivers is a similar issue to that found in Band 12 and will also need further investigation.

Two interference mechanisms are considered: OOBE and blocking.

DTV Tx OOBE → LTE BS Receiver

With the following assumptions:

- Assume requirement = TX noise < 6 dB below LTE BS RX noise floor (1 dB desense criteria)
- LTE BS NF = 5 dB
- LTE BS antenna gain = 16 dB
- Antenna feed loss = 3 dB

TX noise < -174 dBm – 6 dB + 10log(1.4e6) + 5 dB – 16 dB + 3 dB < -126.5 dBm/1.4 MHz

Figure 7.2.3.1-1 below shows the FCC emission requirements and typical emission performance for DTV based on a sampling of FCC filings.

- DTV antenna gain = 15 dB
- DTV feeder loss = 3 dB

- DTV Tx Pout is 80 dBm

- 0 MHz guard band is assumed,

The FCC rule gives the OOBE of 26.7 dBm / 1.4 MHz (Figure 7.2.3.1-1). Then, the required antenna-to-antenna path loss = 26.7 + 15 - 3 + 126.5 = 165 dB.

For the typical OOBE performance of -1.3 dBm / 1.4 MHz (Figure 7.2.3.1-1), antenna-to-antenna path loss is 137 dB.

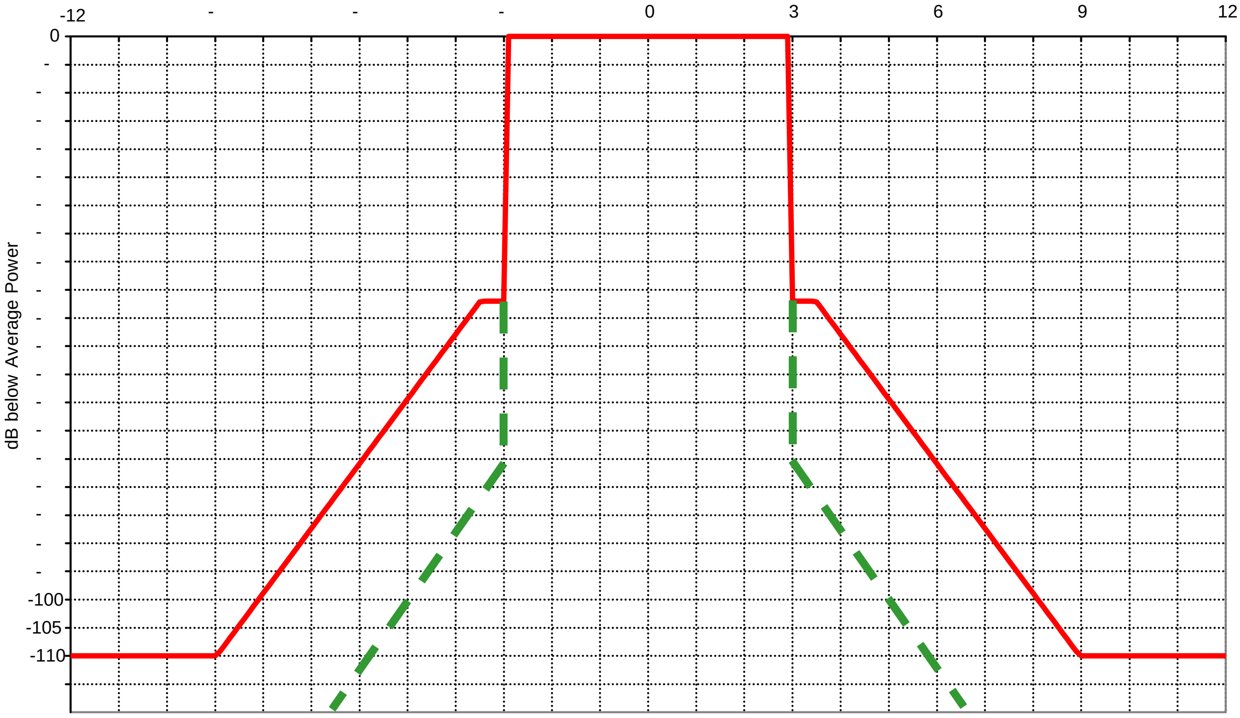

Figure 7.2.3.1-1: FCC Part 73.622 (h) (red curve) and typical performance (green curve)

If 3 MHz guard band is assumed, the FCC rule gives the OOBE of -1.3 dBm / 1.4 MHz. Then, the required antenna- to-antenna path loss is 137 dB.

For the typical OOBE performance of -39 dBm / 1.4 MHz, the required antenna- to- antenna path loss is 99.4 dB.

If 6 MHz guard band is assumed, the FCC rule gives OOBE of -36.3 dBm / 1.4 MHz. Then the required antenna to antenna path loss is 102 dB.

For the typical OOBE performance of -66.3dBm / 1.4MHz, the required antenna to antenna path loss is 72dB.

Table 7.2.3.1-1 shows the required separation distance needed between DTV and LTE BS based on ITU-R P. 1546 path loss model.

Table 7.2.3.1-1: Separation distance between DTV and LTE BS based on OOBE

Guard Band	Required antenna to antenna path loss between TV and LTE BS		Separation distance using ITU-R P.1546	
	Based on FCC Part 73.622 (h)	Based on sampled FCC filings	Based on FCC Part 73.622 (h)	Based on sampled FCC filings
0MHz	165	137	44km	12.5km
3MHz	137	99	12.5km	1km
6MHz	102	72	1km	0.126km

From the above analysis, a guard band may be required in regions where DTV transmitters are located in the spectrum immediately adjacent to the band.

DTV Tx Power → LTE BS Receiver (Blocking)

Port to port isolation between DTV and LTE BS is assumed to be 71.2 dB based on typical antenna heights, antenna patterns and propagation model. This implies 96.2 dB DTV antenna to LTE BS antenna path loss. With DTV Tx output power at 80 dBm/6 MHz based on 92 dBm EIRP limit), the interferer level at LTE BS is 8.8 dBm / 6 MHz or 8 dBm / 5 MHz.

Per the analysis in Section 7.2.1.3, the adjacent and alternate channel protection is -63 dBm and -54 dBm respectively for 1 dB desense. Therefore an additional 71 dB of protection is required for an interferer in the adjacent channel spectrum, while interferers elsewhere in band will only require an additional 62 dB of protection.

A guard band is recommended to achieve the desired additional protection.

Lower sub-band BS Rx blocking due to TV Tx

The TV band is located at the lower end of the sub-band 806~824MHz.

The path loss between the DTV antenna and the LTE BS antenna is assumed to be 96.2dB, as indicated above Assuming the LTE BS antenna gain is 16dB, and the antenna feeder loss is 3dB. The TV antenna gain is 15dB and TV feeder loss is 3dB. Then MCL between DTV and LTE BS is assumed to be 71.2dB based on typical antenna heights, antenna patterns and propagation model. With TV Tx output power at 80dBm/6MHz, the interferer level at LTE BS is 8 dBm / 5 MHz.

An additional 71 dB of protection is required for an interferer in the adjacent channel spectrum, while interferers elsewhere in band will require an additional 62 dB of protection for 1 dB desense. However, such isolation requirements are too stringent for the BS duplexer. Considering 6 dB desense, the protection requirements are 60 dB for an interferer in the adjacent channel spectrum and 51 dB for interferers elsewhere in band.

Table 7.2.3.1-2 gives the summary of the additional protection requirements for the lower Rx sub-band.

Table 7.2.3.1-2: Summary of the additional protection requirements for lower Rx sub-band

Rejection (dB)	Freq (MHz)	Requirement
60	806	ACS requirement considering 6 dB desense
51	806	in band blocking requirement considering 6 dB desense
71	806	ACS requirement considering 1 dB desense
62	806	in band blocking requirement considering 1 dB desense
70	851	Rx rejection to the Tx band

Considering a 8 and 9 order cavity filter with 4000 un-loaded Q value, Figure 7.3.2.1-2 gives the evaluation of the BS duplexer with larger than 60 dB attenuation at the TV band. Additional 70 dB rejection to the Tx band is suggested for the Rx band. All the filter characteristics shown are examples only and do not preclude other implementations.

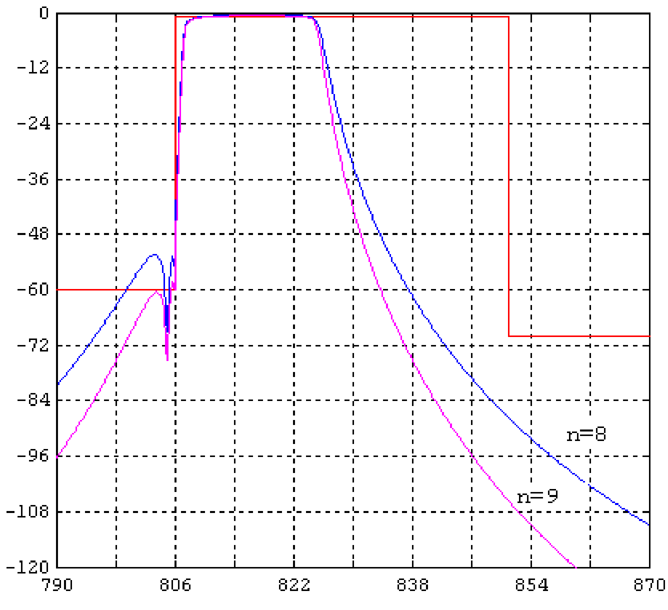

Figure 7.3.2.1-2: Lower sub-band BS Rx filter evaluation

From the simulation results, a 9 order filter can meet the rejection requirement at the TV band. Taking into account the temperature and manufacturing margin, the insertion loss at 808 MHz is about 2.2 dB, which can be seen from the enlarged in-band insertion loss curve shown below in Figure 7.3.2.1-3.

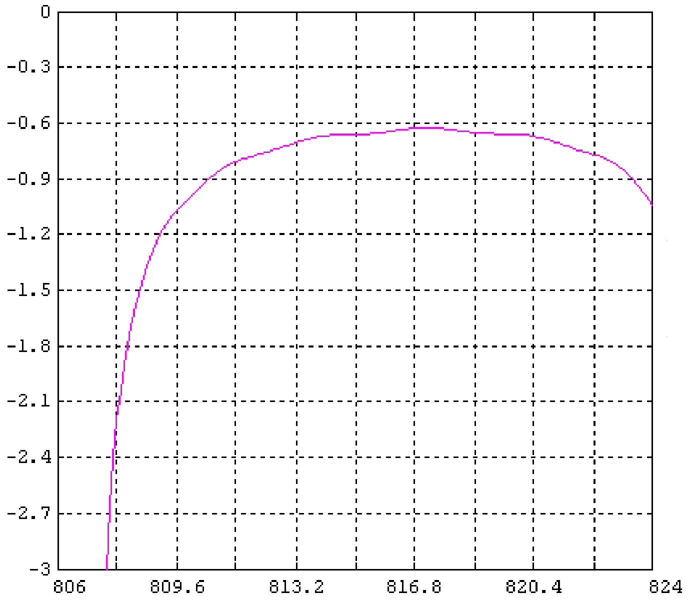

Figure 7.2.3.1-3: In-band insertion loss

Though the insertion loss at 808 MHz is larger than the normal value, it is still an acceptable value. However, 2 MHz guard band is needed to realize such an insertion loss result.

Based on the simulation results, in order to meet the ACS and in-band blocking requirements with 6 dB desense defined in TS 36.104 clause 7.5 and 7.6, for the lower sub-band BS Rx blocking due to TV Tx, additional 2 MHz guard band is suggested.

Lower sub-band BS Rx blocking due to 47 dBm TV repeater

The TV band is located at the lower end of the sub-band (806~824MHz). TV repeaters are deployed at the channel adjacent to 806 MHz in South America. The output power of the TV repeater is similar as a macro BTS. Therefore, the same parameter assumption as the macro BS is chosen in this analysis. The path loss between the TV antenna and the LTE BS antenna is assumed to be 93 dB. Assuming the LTE BS and TV antenna gain is 16 dB, and the antenna feed loss is 3 dB. Then MCL between TV repeater and LTE BS is assumed to be 67 dB based on typical antenna heights, antenna patterns and propagation model. With TV Tx output power at 47dBm/6MHz, the interferer level at LTE BS is --21 dBm / 5 MHz.

Considering 1 dB and 6 dB desense criteria, Table 7.2.3.1-3 gives the summary of the additional protection requirements for the lower Rx sub-band.

Table 7.2.3.1-3: Summary of the additional protection requirements for lower Rx sub-band

Rejection (dB)	Freq (MHz)	Requirement
42	806	ACS requirement considering 1 dB desense
33	806	in band blocking requirement considering 1 dB desense
31	806	ACS requirement considering 6 dB desense
22	806	in band blocking requirement considering 6 dB desense
70	851	Rx rejection to the Tx band

For the 80 dBm TV broadcast, the corresponding rejection to meet ACS and in band blocking requirement considering 1 dB desense at 806 MHz are 71 dB and 62 dB respectively. Due to the smaller output power, the rejection requirements for the duplexer of the TV repeater are relaxed.

Considering a 7 and 8 orders cavity filter with 4000 un-loaded Q value, Figure 7.2.3.1-4 gives the evaluation of the BS duplexer with larger than 42 dB attenuation at the TV band. For the Rx to Tx rejection, considering the output power is 46 dBm, and the blocking requirement for LTE is -43 dBm, then the rejection requirement for the Rx filter is at least 89 dB. Currently, most BS receivers are implemented by a superheterodyne structure. A mixer is used to down convert the RF frequency to IF frequency. In such structure, image rejection filter before mixer is absolutely necessary. Image rejection filter is also a RF filter, which could provide additional rejection at Tx band. For example, typical RF saw filter using as an image rejection filter at Band 5 could provide at least 30 dB rejection at the Tx band. The distance between Tx and Rx band for E850 lower sub-band is larger than Band 5. Thus, from an implementation point of view, the image rejection filter could provide better rejection at Tx Band for E850 lower sub-band comparing with Band 5. Therefore, the rejection requirement for the duplexer Rx filter could be relaxed. Here, both 70 dB and 90 dB rejection to the Tx band are considered in the simulation for the Rx band. All the filter characteristics shown are examples only and do not preclude other implementations.

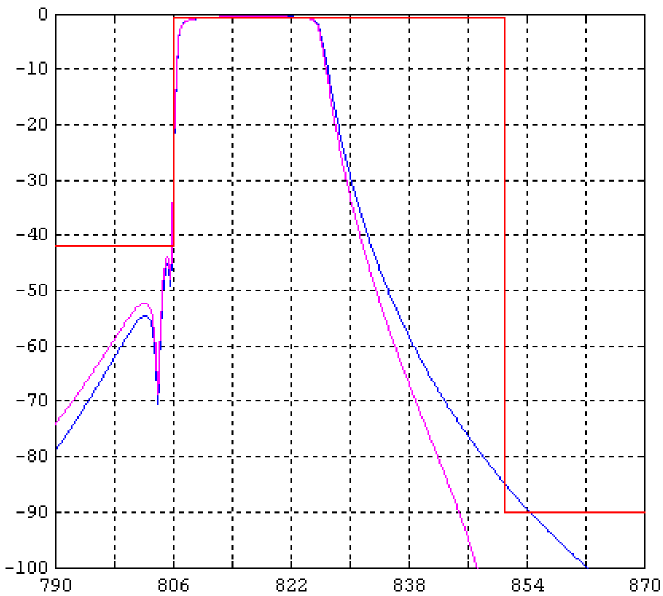

Figure 7.2.3.1-4: Lower sub-band BS Rx filter evaluation with 70 dB and 90 dB rejection at Tx band

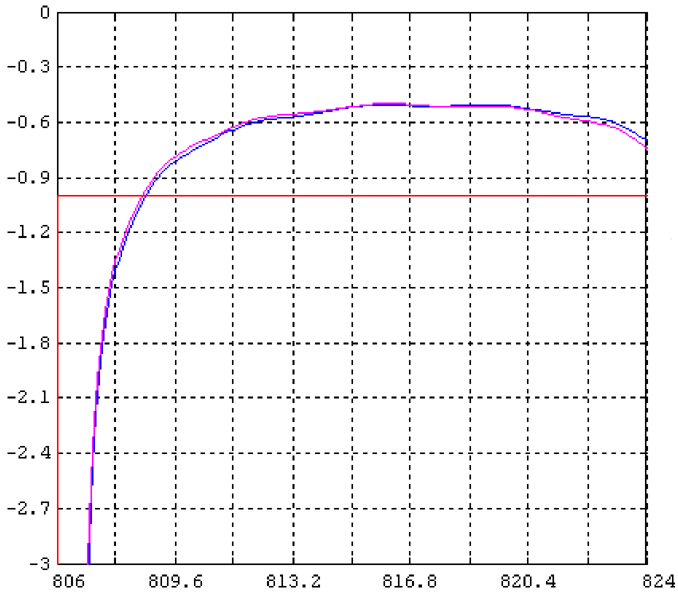

Figure 7.2.3.1-5: In-band insertion loss of Rx filter with 70 dB and 90 dB rejection at Tx Band

From the simulation results, 8 orders filter can meet the 1 dB desense rejection requirement at the TV band. 2 zeros are needed to meet the 70 dB Rx to Tx rejection requirement and 3 zeros are needed for the 90 dB requirement. Taking into account of the temperature and manufacturing margin, the insertion loss at 807.5 MHz is less than 2 dB in both filter implementation cases.

Based on the simulation results, additional guard band is needed. The insertion loss at the lower edge of the RX band will decide the guard bandwidth. For the common used metal cavity duplexer, the insertion loss below 807.5 MHz could be larger than 3 dB. Other technology such as Non-TEM mode dielectric filter may improve the insertion loss with narrow guard band, but the volume or cost of the duplexer will increase greatly. The bandwidth of the guard band depends on the operator's requirement and the BS vendor's capability. It should be studied further and case by case in the real network scenario.

7.2.4 BS coexistence between e850 bands and APT700

7.2.4.1 BS Coexistence between e850 bands

As highlighted in section 7.2.1.5, co-existence between lower E850 and Band 5 needs to be considered since Band 5 UL is located 2 MHz from lower e850 DL. Specifically it has to be noted that Band 5 is a legacy and largely deployed band.

Legacy Band 5/V BS RXs (824-849 MHz) do not have the mandate for the protection of high interference at 851 MHz, just ACS and in-band blocking are required, as indicated in section 7.2.1.3. One possible way to alleviate this problem would be to separate these bands in frequency, Since Band V is already under deployment and Band 5/V is also be under development , moving the lower edge of lower e850 is the option to considered while taking into account current allocations in lower e850.

At the same time, new Band 5 as well as Band 26 BS RXs require high duplexer attenuation to reject a blocker at 851 MHz, assuming ACS and in-band blocking as the applicable requirements at such frequency, translating into possible performance degradation or alternatively increasing the cost, complexity, size of the filter.

7.2.4.2 BS Coexistence lower e850 and APT700

APT700 is defined as 703-748/758-803 MHz and lower e850 is proposed as 806-824/851-869MHz. APT700 DL is then located 3 MHz from lower e850 UL. APT700 BS TX filter requires high attenuation to be able to fulfil the standard 3GPP emission requirement towards lower e850 UL. Considering a global solution, the DL performance is degraded while this can be improved if implementing specific solutions, such as split duplexers.

7.2.4.3 lower e850 band re-arrangement

To solve co-existence issues between lower e850 and Band 5/26 as well as APT700 due to the UL to DL proximity between separate bands, a change of the original lower e850 frequency arrangement was considered. Figure 7.2.4.3-1 shows the 3GPP spectrum around lower e850.

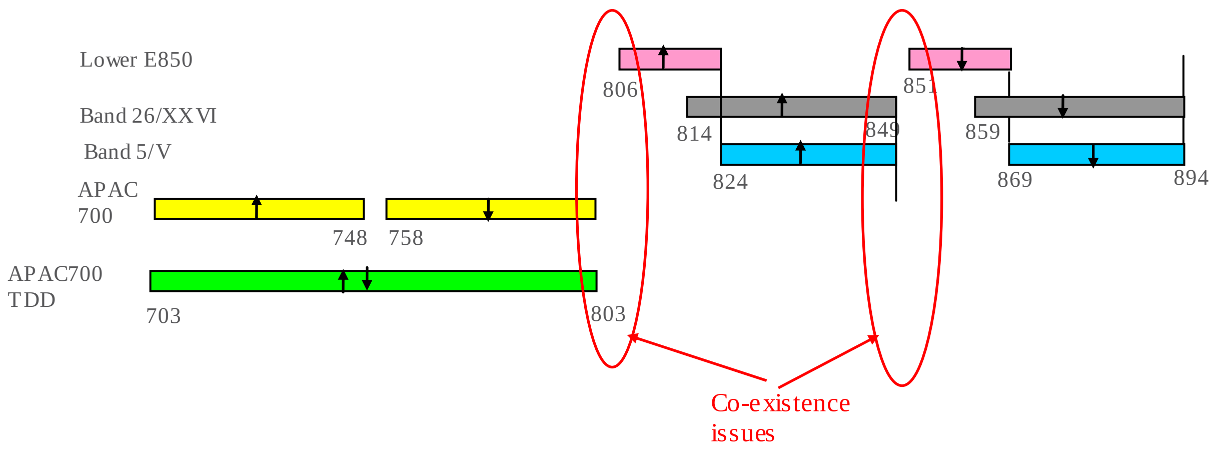

Figure 7.2.4.3-1: 3GPP spectrum around 850 MHz

Two proposals were discussed: 1 MHz and 2 MHz shift, 807-824/852-869 MHz and 808-824/853-869 MHz, respectively:

- 2 MHz shift would improve co-existence between lower e850 and legacy Band 5 and also alleviate (but not solve) co-existence between lower e850 and with APT700. Moreover, global solutions are considered in this proposal.
- 1 MHz shift would slightly increase the frequency separation towards the co-existing bands while allowing operators at the lowest frequencies of lower e850 to possibly deploy larger channel bandwidths, Specific solutions and/or performance degradation are accepted on Band 5, lower e850, upper e850 and APT700

A 1 MHz shift was agreed [4], i.e. 807-824/852-869 MHz.

7.3 UE specific requirements

7.3.1 Transmitter characteristics

7.3.1.1 Transmit power

7.3.1.1.1 The sub-band 807-824/852-869 MHz

7.3.1.1.1.1 UE maximum output power

The minimum requirements for maximum output power apply for any transmission bandwidth, down to a single PRB allocation. For some operating bands with a small duplex gap or large relative bandwidth, the lower tolerance limit is relaxed by 1.5 dB for allocations completely contained with a 4 MHz region at the operating band edge to accommodate duplex filter ripple at the edge. Given the duplex gap of this band is not particularly small or the relative bandwidth large, and considering the filter trace for SAW filter in Figure 5.2.3.1.1-1, relaxation of the lower tolerance limit by 1.5 dB is not needed for this band.

The minimum requirement for the lower sub-band is aligned with those of Band 5, which has a similar duplex arrangement at slightly higher carrier frequency. The requirements for bands in the range are summarised in Table 7.3.1.1.1.1-1.

Table 7.3.1.1.1.1-1: 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)
5					23	±2		
18					23	±2		
19					23	±2		
…								
807-824/ 852-869 MHz					23	±2		
…								
NOTE 1: The above tolerances are applicable for UE(s) that support up to 4 E-UTRA operating bands. For UE(s) that support 5 or more E-UTRA bands the maximum output power is expected to decrease with each additional band and is FFS.								
NOTE 2: For transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB.								
NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.								
NOTE 4: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance.								

7.3.1.1.2 The sub-band 814-849/859-894 MHz

7.3.1.1.2.1 UE maximum output power

The minimum requirements for maximum output power apply for any transmission bandwidth, that is, down to a single PRB allocation. For some operating bands with small duplex gap or large relative bandwidth, the lower tolerance limit is relaxed by 1.5 dB for allocations completely contained with a 4 MHz region at the operating band edge to accommodate duplex filter ripple at the edge. Considering the filter trace for SAW filter in Figure 5.2.3.2.1-1 with the indicated minimum performance, and the corresponding FBAR trace in Figure 5.2.3.2.2-1 with a 2.5 MHz allowance at either end of the pass band to account for temperature and process variation, a relaxation of the lower tolerance limit by 1.5 dB is needed for small PRB allocations in the neighbourhood of the band edge.

The minimum requirement for the upper sub-band is aligned with those of Band 8, which has the same duplex arrangement at slightly higher carrier frequency. The requirements for bands in the range are summarised in Table 7.3.1.1.2.1-1.

Table 7.3.1.1.2.1-1: 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)
5					23	±2		
8					23	±2[2]		
18					23	±2		
19					23	±2		
…								
814-849/ 859-894 MHz					23	±2[2]		
…								

NOTE 1: The above tolerances are applicable for UE(s) that support up to 4 E-UTRA operating bands. For UE(s) that support 5 or more E-UTRA bands the maximum output power is expected to decrease with each additional band and is FFS.
NOTE 2: For transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} – 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB.
NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.
NOTE 4: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance.

Note that the UE MOP for 5 MHz E-UTRA and UTRA are different.

7.3.1.2 Spurious emissions

7.3.1.2.1 The sub-band 807-824/852-869 MHz

7.3.1.2.1.1 UE spurious emissions towards Band 28 (APT700 FDD)

It was agreed with lower E850 operators to harmonize the Band 26 UE emissions towards the frequency range 851-869 MHz with the E850 emissions towards Band 28 at a level of -32 dBm/MHz. At the same time, Band 28 self-protection has been defined as -32 dBm/MHz. An alternative level of -35 dBm/MHz was also considered to improve victim protection while it would have imposed larger A-MPR in the agressor.

Initial filter simulations showed that 25 dB attenuation is expected from a lower E850 duplexer at 790 MHz. -50 dBm/MHz is then achievable below 790 MHz without AMPR

Lower E850 UE emissions towards Band 28 are:

- -32 dBm/MHz @790-803 MHz
- -50 dBm/MHs @748-790 MHz

Three different NS values have been defined to fulfil -32 dBm/MHz @790-803 MHz, depending where the carrier is placed. A-MPR associated with such NS signalling are defined as follow:

Table 7.3.1.2.1.1-1: A-MPR with channel lower edge at ≥807 MHz

CBW	Parameter					
3 MHz	RBstart	0	1-2			
	LCRB [RBs]	12	12			
	A-MPR [dB]	≤2	≤1			
5 MHz	RBstart	0-1	2	2-9	2-5	
	LCRB [RBs]	1 - 25	12	15-18	20	
	A-MPR [dB]	≤5	≤1	≤2	≤3	
10 MHz	RBstart	0 - 8	0-14		15-20	15-24
	LCRB [RBs]	1 - 12	15-20	≥24	≥30	24-27
	A-MPR [dB]	≤5	≤3	≤7	≤3	≤1

Table 7.3.1.2.1.1-2: A-MPR with channel lower edge at ≥808.5 MHz

CBW	Parameter					
5 MHz	RBstart	0	0-1	10-5		
	LCRB [RBs]	16-20	≥24	16-20		
	A-MPR [dB]	≤2	≤3	≤1		
10 MHz	RBstart	0 - 8	0-14		15-20	15-24
	LCRB [RBs]	1 - 12	15-20	≥24	≥30	24-27
	A-MPR [dB]	≤5	≤3	≤7	≤3	≤1

NOTE: The current A-MPR for 10 MHz CBW starting at 808.5 MHz is the same as the 10 MHz CBW starting at 807 MHz because simulations for 10 MHz were not available from all the UE vendors at the time.

Table 7.3.1.2.1.1-3: A-MPR with channel lower edge at ≥812 MHz

CBW	Parameter					
10 MHz	RBstart	0 - 9	0	1-14	0-5	
	LCRB [RBs]	27-32	36-40	36-40	≥45	
	A-MPR [dB]	≤1	≤2	≤1	≤3	

7.3.1.2.2 The sub-band 814-849/859-894 MHz

7.3.1.2.2.1. UE spurious emissions for PS protection

Based on results from section 7.2.2.1 and 7.2.2.2, the UE spurious emissions for PS protection are specified as:

- 806-816 MHz : -42dBm/6.25kHz
- 851-859 MHz : -53dBm/6.25kHz

A-MPR is required to fulfil such levels.

7.3.1.2.2.1.1 UE spurious emissions at 806-816 MHz

Different emission limits have been considered for PS BS protection: -13dBm/100kHz, -35 dBm/6.25kHz and -42/-43dBm/6.25kHz. While -13dBm/100kHz is the limit defined by FCC, simulations presented in section 7.2.1.1 shows that PS outage is high for such level. Therefore, UE spurious emissions between -35 and -42/-43 dBm/6.25kHz is preferred.

OOBE from iDEN devices currently in the market are shown in Table 7.3.1.2.2.1.1-1. We can observe that all of them fulfil OOB of -35dBm/30kHz, which is approximately -42dBm/6.25kHz. These devices are today co-existing with PS.

Table 7.3.1.2.2.1.1-1: iDEN Handset FCC Certification Testing Summary 2005-2010 [https://apps.fcc.gov/oetcf/eas/reports/GenericSearch.cfm]

	Mfg/Vendor	Model	FCC ID	Max Power Certified mW	Max Power Certified (dBm/25 kHz)	Max Power Certified (dBm/30 kHz)	37.5 kHz offset OOBE (dBc)	37.5 kHz offset OOBE (dBm/30kHz)
1	Motorola	i836	AZ489FT5828	615	27.89	28.68	62	-33.32
2	Motorola	i605	AZ489FT5838	571	27.57	28.36	64	-35.64
3	Motorola	i930	AZ489FT5843	598	27.77	28.56	65	-36.44
4	Motorola	i580	AZ489FT5848	596	27.75	28.54	66	-37.46
5	Motorola	i880	AZ489FT5853	597	27.76	28.55	66	-37.45
6	Motorola	r765is	AZ489FT5856	1100	30.41	31.21	67	-35.79
7	Motorola	i365 & i365IS	IHDP56HJ1	639	28.06	28.85	64	-35.15
8	Motorola	i576 & i776	IHDP56HS1	597	27.76	28.55	68	-39.45
9	Motorola	i410	IHDP56KR2	640	28.06	28.85	66	-37.15
10	Motorola	i296-iden800	IHDP56KY1	640	28.06	28.85	66	-37.15
11	Motorola	i290	IHDT56HG1	642	28.08	28.87	69	-40.13
12	Motorola	i335	IHDT56HG2	642	28.08	28.87	67	-38.13
13	Motorola	i9	IHDT56JQ1	599	27.77	28.57	67	-38.43
14	Motorola	i465 Clutch	IHDT56KB1	640	28.06	28.85	68	-39.15
15	Motorola	i856w Debut	IHDT56KC1	640	28.06	28.85	66	-37.15
16	Motorola	i680 Brute	IHDT56KD1	640	28.06	28.85	69	-40.15
17	Motorola	i890	IHDT56KQ1	640	28.06	28.85	66	-37.15
18	RIM	Blackberry 7100i	L6ARAW20IN	663.74	28.22	29.01	63	-33.99
19	RIM	BlackBerry 8350i Curve	L6ARCD20IN	591.56	27.72	28.51	64	-35.49

UE spurious emissions at 806-816 MHz has been defined as -42 dBm/6.25 kHz since it creates unappreciable degradation in PS and devices on the field can fulfil such limit.

Three different A-MPR profiles (and NS values) have been identified for PS BS protection (806-816 MHz) based on different deployment scenarios, i.e. different offsets. A-MPR agreements are summarized in section 7.3.1.2.2.2.

The UE spurious emissions limit, -42dBm/6.25kHz, as well as the different offsets considered to define A-MPR are currently under consideration. A relaxation of such requirement would reduce A-MPR as well as make possible flexible offsets (guard bands) that would facilitate global deployment of the upper 850 [2]

- up to -35 dBm/6.25kHz appears sufficient for public safety/narrow-band protection and removes need for operator-specific coexistence solutions (guard bands);
- -38 dBm/6.25kHz – -35 dBm/6.25kHz allows UTRA deployment almost down to the lower band edge (1 MHz guard, 0.5 MHz from nominal 5 MHz), increased use of Band XXVI.

However, any change of the proven -42 dBm/6.25kHz emission limit must be preceded by careful investigation of compatibility with other services below the band.

7.3.1.2.2.1.1.1 AMPR for -42dBm/6.25kHz below Band 26

Counter IM3 (60 dBc assumed) is not a limiting factor in any of the cases because of the relaxed emission mask:

1) -42 dBm/6.25 kHz for 806–813.5 MHz protection with 0.7 MHz offset for 1.4, 3 and 5 MHz channel BW

Table 7.3.1.2.2.1.1.1-1: NS_12 table for Foffset ≥ 0.7 MHz

Channel Bandwidth	F_{offset} ≥ 0.7 MHz for -42 dBm/6.25 kHz emission requirement			
1.4 MHz	RB_start [RBs]	0		1-2
	L_CRB [RBs]	≤3	≥4	≥4
	A-MPR [dB]	≤3	≤6	≤3
3 MHz	RB_start [RBs]	0-3		4-5
	L_CRB [RBs]	4-9	1-3 and 10-15	≥9
	A-MPR [dB]	≤4	≤3	≤3
5 MHz	RB_start [RBs]	0-6		7-9
	L_CRB [RBs]	≤8	≥9	≥15
	A-MPR [dB]	≤5	≥3	≤3
NOTE: When NS_13 is signalled, 10 and 15 MHz bandwidths are not applicaple				

2) -42 dBm/6.25 kHz for 806–816 MHz protection with 3 MHz offset for 3 and 5 MHz channel BW

Table 7.3.1.2.2.1.1.1-2: NS_13 table for Foffset ≥ 3 MHz

Channel Bandwidth	F_{offset} ≥ 3 MHz for -42 dBm/6.25 kHz emission requirement		
5 MHz	RB_start [RBs]	0-2	
	L_CRB [RBs]	≤5	≥18
	A-MPR [dB]	≤3	≤2
NOTE: When NS_14 is signalled, 10 and 15 MHz bandwidths are not applicaple			

3) -42 dBm/6.25 kHz for 806–816 MHz protection with 8 MHz offset for 5, 10 and 15 MHz channel BW

Table 7.3.1.2.2.1.1.1-3: NS_14 table for Foffset ≥ 8 MHz

Channel Bandwidth	F_{offset} ≥ 8 MHz for -42 dBm/6.25 kHz emission requirement		
10 MHz	RB_start [RBs]	0	
	L_CRB [RBs]	≤5	≥50
	A-MPR [dB]	≤3	≤1
15 MHz	RB_start [RBs]	≤8	
	L_CRB [RBs]	≤16	≥50
	A-MPR [dB]	≤3	≤1

7.3.1.2.2.1.2. UE spurious emissions at 851-859 MHz

Spurious emissions below -50dBm/6.25kHz were shown in section 7.2.2.1.2 to reduce the interference towards PSNB at 851-859 MHz. -57 dBm/6.25 kHz will reduce the probability of interference, however it will impose high A-MPR from the aggressor. A -53 dBm/6.25kHz limit would not significantly degrade the protection, but significantly reduce the A-MPR required.

-53dBm/6.25kHz is chosen as the UE emission requirement towards 851-859MHz.

7.3.1.2.2.1.2.1 AMPR for -53dBm/6.25kHz above Band 26

Due to the counter IM3 non-linearity, for the wider carriers, some A-MPR is required in "Region A", the region farthest away from the protected frequency. The NS_07 table allows 3 dB A-MPR for the CIM3 region, which is a tight requirement; hence 4 dB is proposed in this document. The carrier bandwidth has little effect in the CIM3 component, so the same number is used in all cases.

1) -53dBm/6.25kHz for 851-859 MHz protection for 1.4, 3, 5, 10 and 15 MHz channel BW

Table 7.3.1.2.2.1.2.1-1: NS_15 table for Foffset ≥ 2 MHz

Channel BW	Parameters	Region A		Region B	Region C	
1.4	RB_{end}	4-5				
	L_{CRB} [RBs]	≤3	≥4			
	A-MPR [dB]	≤2	≤3			
3	RB_{end}	0-1	8-12	13-14		
	L_{CRB} [RBs]	≤1	≥8	>0		
	A-MPR	≤2	≤4	≤8		
5	RB_{end}	0-4	12-15	16-19	20-24	
	L_{CRB} [RBs]	≤1	≥12	≥8	>0	
	A-MPR	≤2	≤3	≤5	≤8	
10	RB_{end}	0-12	23-30	31-36	37-49	
	L_{CRB} [RBs]	=1	≥20	≥15	≥4	≤3
	A-MPR [dB]	≤2	≤4	≤6	≤5	≤9
15	RB_{end}	0-20	26-44	45-53	54-74	
	L_{CRB} [RBs]	≤1	≥27	≥20	>0	
	A-MPR [dB]	≤2	≤3	≤5	≤9	

Table 7.3.1.2.2.1.2.1-1: NS_15 table for Foffset ≥ 6 MHz

Channel BW	Parameters	Region A	Region B	Region C	Region D
5	RB_{start}1	19-24			
	L_{CRB} [RBs]	≥18			
	A-MPR [dB]	≤2			
10	RB_{start}1	0-4	29-37	38-44	45-49
	L_{CRB} [RBs]	≤1	≥27	≥24	>0
	A-MPR [dB]	≤2	≤1	≤4	≤8
15	RB_{start}1	0-12	44-56	57-61	62-74
	L_{CRB}	≤1	≥32	≥20	>0
	A-MPR [dB]	≤2	≤3	≤5	≤8

7.3.1.2.2.2 UE spurious emissions towards Band 28 (APT700 FDD)

Filter vendors have indicated that 25-30 dB rejection from the duplexer can be achieved at 803MHz. Table 7.3.1.2.2.2-1 shows the achievable spurious emissions @803MHz from a Band 26 terminal without A-MPR.

Table 7.3.1.2.2.2-1: Attainable spurious emission level of a Band 26 terminal

dBm/MHz		Duplexer TX–Antenna attenuation @803MHz					
		25dB	26dB	27dB	28dB	29dB	30dB
Modulator LO and image suppression (dBc)	25	−37.8 1RB −48.8 75RB	−38.7 1RB −49.8 75RB	−39.7 1RB ≤−50 75RB	−40.8 1RB ≤−50 75RB	−41.7 1RB ≤−50 75RB	−42.7 1RB ≤−50 75RB
	28	−40.7 1RB −48.8 75RB	−41.6 1RB −49.8 75RB	−42.7 1RB ≤−50 75RB	−43.7 1RB ≤−50 75RB	−44.7 1RB ≤−50 75RB	−45.7 1RB ≤−50 75RB
	29	−41.6 1RB −48.8 75RB	−42.6 1RB −49.8 75RB	−43.6 1RB ≤−50 75RB	−44.6 1RB ≤−50 75RB	−45.6 1RB ≤−50 75RB	−46.6 1RB ≤−50 75RB
	30	−42.6 1RB −48.8 75RB	−43.6 1RB −49.8 75RB	−44.6 1RB ≤−50 75RB	−45.6 1RB ≤−50 75RB	−46.6 1RB ≤−50 75RB	−47.6 1RB ≤−50 75RB
	31	−43.6 1RB −48.8 75RB	−44.6 1RB −49.8 75RB	− 45.6 1RB ≤−50 75RB	−46.6 1RB ≤−50 75RB	−47.6 1RB ≤−50 75RB	−48.6 1RB ≤−50 75RB
	32	−44.6 1RB −48.8 75RB	−45.6 1RB −49.8 75RB	−46.6 1RB ≤−50 75RB	−47.6 1RB ≤−50 75RB	−48.6 1RB ≤−50 75RB	−49.6 1RB ≤−50 75RB

The UE spurious emissions for APT protection are defined as:

- -50 dBm/MHz for 703-799 MHz
- -40 dBm/MHz for 799-803 MHz

7.3.1.2.2.3 UE spurious emissions towards Band [27] (E850 lower sub-band)

There is no special UE spurious emissions limit for Band 27 protection. The protection towards this band is defined by the A-MPR necessary to fulfil -53 dBm/6.25 kHz protection at 851 MHz and is equivalent to -32 dBm/MHz. Figure 7.3.1.2.2.3-1 shows the peak emission levels for a 15 MHz E-UTRA carrier when applying the required A-MPR at 2MHz offset to fulfil -53 dBm/6.25 kHz.

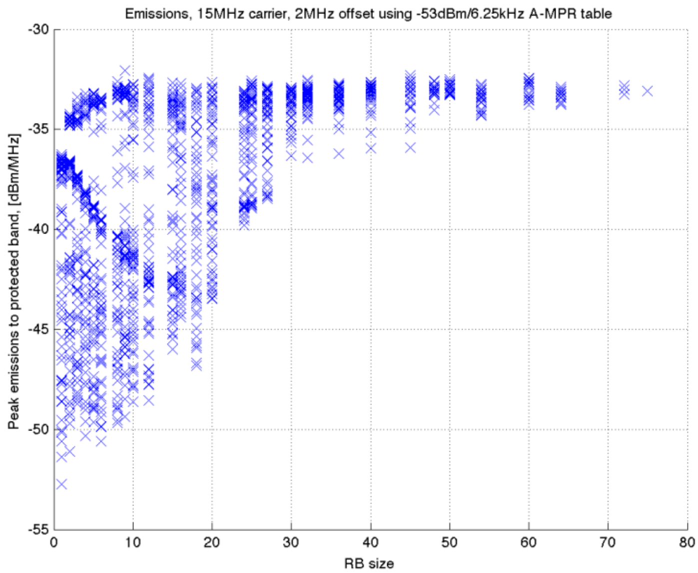

Figure 7.3.1.2.2.3-1: Peak emissions for a 15 MHz E-UTRA carrier using -53 dBm/6.25 kHz A-MPR table

7.3.2 Receiver characteristics

7.3.2.1 Diversity characteristics

<text will be added>

7.3.2.2 Reference sensitivity

The reference sensitivity can be estimated as shown in Annex A for two different transceiver architectures that should cover the possible implementations, the minimum requirements apply for any architecture.

We begin by listing the $ACLR_{RX}$ values for various allocations (Table 7.3.2.2-1), a measure of the transmitter noise falling into the receive band, assuming a transmitter that just meets the minimum requirements for image and LO leakage (-25 dBc).

Table 7.3.2.2-1: $ACLR_{RX}$ (dBc) for various UL allocations

E-UTRA Band	5 MHz	10 MHz	15 MHz
5,18,19	88.4 (25 RB)	80 (25 RB)	[75] (20 RB) [74] (25 RB)

The difference between the 20 and 25 RB allocations are small for the 15 MHz bandwidth due to intermodulation products falling into the receive bands [further verification needed]. The results in Table 7.3.2.1-1 are applicable for both sub-bands.

7.3.2.2.1 The sub-band 807-824/852-869 MHz

Table 7.3.2.2.1-1 shows the reference sensitivity as obtained by assuming Band 5 baseline performance. The reference sensitivity requirement for 807-824/852-869 MHz could have been more aggressive given the wider band gap and narrower passband than Band 5, but Band 5 performance was chosen to encourage vendors to implement the band.

Table 7.3.2.2.1-1: Reference sensitivity QPSK $P_{REFSENS}$ with baseline performance

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
5	-103.2	-100.2	-98	-95			FDD
	Band 5 performance (Note 1, Note 2)						
807-824/852-869 MHz	-103.2	-100.2	-98	-95			FDD
NOTE: Fmax = 11 dB.							

Table 7.3.2.2.1-2 specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement must be met.

Table [7.3.2.2.1-2]: 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
5	6	15	25	25[1]			FDD
807-824/852-869 MHz	6	15	25	25[1]			FDD
NOTE: The number of UL resource blocks allocated is less than the total resources blocks supported by the channel bandwidth. The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).							

7.3.2.2.2 The sub-band 814-849/859-894 MHz

Table 7.3.2.2.2-1 shows the reference sensitivity as obtained by assuming a baseline performance, between Band 5 and Band 8, but modified by -0.5 dB (hence Band 5 performance) for channel bandwidths ≥ 5 MHz when assigned between 865-894 MHzwhich is used as a working assumption for the reference sensitivity of the upper sub-band.. A method of calculation is described in Annex A.

Table 7.3.2.2.2-1: Reference sensitivity QPSK $P_{REFSENS}$ with different baseline performance

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
5	-103.2	-100.2	-98	-95			FDD
8	-102.2	-99.2	-97	-94			FDD
	Band 8 performance (see note)						
814-849/859-894 MHz	-102.7	-99.7	-97.5[1]	-94.5[1]	-92.7[1]		FDD
NOTE: [1] indicates that the requirement is modified by -0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.							

The key difference between Band 5 and Band 8 performance is the insertion loss. The difference in insertion loss is largest at the band edges, mid-band there are only differences of a few tenths of dBs, see the example filter traces in Section 5.2.3. The specified insertion loss accounts for process variations and temperature variations causing frequency drift, and is determined by the attenuation across a range slightly wider than the passband. Data from various filter vendors are given in Table 5.2.3.2.3-1: it is assumed that the RX insertion loss for the upper sub-band allows an F_{max} = 11.5 dB for the estimation of the reference sensitivity in Annex A.

For 814-849/859-894 MHz, it is assumed that Band 5 performance can be attained for bandwidths ≥ 5 MHz mid-band and at the upper edge. However, a relaxation is needed at he lower edge due to the required stop-band attenuation in the transmit band. A performance between Band 5 and Band 8 is therefore required at the lower edge for these bandwidths. This is also assumed for the 1.4 and 3 MHz bandwidths across the entire passband.

Table 7.3.2.2.2-2 specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement must be met.

Table 7.3.2.2.2-2: 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
5	6	15	25	25[1]			FDD
8	6	15	25	25[1]			FDD
18/19			25	25[1]	25[1]		FDD
814-849/859-894 MHz	6	15	25	25[1]	25		FDD
NOTE: The number of UL resource blocks allocated is less than the total resources blocks supported by the channel bandwidth. The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).							

Note that the UE REFSENS for 5 MHz E-UTRA and UTRA are different.

7.4 BS specific requirements

7.4.1 Transmitter characteristics

7.4.1.1 Lower sub-band

To be able to support the lower sub-band from the transmitter side, it is necessary to modify TS 36.104 and TS 36.141 operating band unwanted emissions and additional spurious emission requirements.

7.4.1.1.1 Operating band unwanted emissions

Operating band unwanted emissions need to include Band 27 on Category A and Category B (Option 1). Additional requirements which are applicable to Band 5 are also required for Band 27.

7.4.1.1.2 Spurious emissions

Protection for Band 27 need to be included in the specifications by adding a row for the band to the additional spurious emissions in TS 36.104 chapter 6.6.4.3 and TS 36.141 chapter 6.6.4.5.4. and also some protection for Band 5 or Band V, GSM850 or CDMA850 and Band 26 or XXVI from Band 27 need to be included in the current rows for these bands.

Table 7.4.1.1.2-1: BS Spurious emissions limits for E-UTRA BS for co-existence with systems operating in other frequency bands

E-UTRA Band 27	852 – 869 MHz	-52 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 5, 26 or 27.
	807 – 824 MHz	-49 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band [27], since it is already covered by the requirement in subclause 6.6.4.2. For E-UTRA BS operating in Band [26], it applies for 806 MHz to 814 MHz, while the rest is covered in sub-clause 6.6.4.2. This requirement also applies to E-UTRA BS operating in Band 28, starting 4 MHz above the Band 28 downlink operating band (NOTE).
GSM850 or CDMA850	869 - 894 MHz	-57 dBm	100 kHz	This requirement does not apply to E-UTRA BS operating in band 5 or 26. This requirement applies to E-UTRA BS operating in Band 27 for the frequency range 879-894 MHz.
	824 - 849 MHz	-61 dBm	100 kHz	This requirement does not apply to E-UTRA BS operating in band 5 or 26, since it is already covered by the requirement in sub-clause 6.6.4.2. For E-UTRA BS operating in Band 27, it applies 3 MHz below the Band 27 downlink operating band.
UTRA FDD Band V or E-UTRA Band 5	869 - 894 MHz	-52 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 5 or 26. This requirement applies to E-UTRA BS operating in Band 27 for the frequency range 879-894 MHz.
	824 - 849 MHz	-49 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 5 or 26, since it is already covered by the requirement in sub-clause 6.6.4.2. For E-UTRA BS operating in Band 27, it applies 3 MHz below the Band 27 downlink operating band.
UTRA FDD Band XXVI or E-UTRA Band 26	859 – 894 MHz	-52 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 5 or 26. This requirement applies to E-UTRA BS operating in Band 27 for the frequency range 879-894 MHz.
	814 – 849 MHz	-49 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 26, since it is already covered by the requirement in subclause 6.6.4.2. For E-UTRA BS operating in Band 5, it applies for 814 MHz to 824 MHz, while the rest is covered in sub-clause 6.6.4.2. For E-UTRA BS operating in Band 27, it applies 3 MHz below the Band 27 downlink operating band.

NOTE 1: For E-UTRA Band 28 BS, specific solutions may be required to fulfil the spurious emissions limits for E-UTRA BS for co-existence with E-UTRA Band 27 UL operating band.

Table 7.4.1.1.2-2: Home BS Spurious emissions limits for co-existence with Home BS operating in other frequency bands

E-UTRA Band 27	807 - 824 MHz	-71 dBm	100 kHz	This requirement does not apply to Home BS operating in band [27], since it is already covered by the requirement in sub-clause 6.6.4.2. For Home BS operating in Band [26], it applies for 807 MHz to 814 MHz, while the rest is covered in sub-clause 6.6.4.2. This requirement also applies to E-UTRA BS operating in Band 28, starting 4 MHz above the Band 28 downlink operating band (NOTE).
UTRA FDD Band V or E-UTRA Band 5	824 - 849 MHz	-71 dBm	100 kHz	This requirement does not apply to Home BS operating in band 5 or 26, since it is already covered by the requirement in sub-clause 6.6.4.2. For E-UTRA BS operating in Band 27, it applies 3 MHz below the Band 27 downlink operating band.
UTRA FDD Band XXVI or E-UTRA Band 26	814 - 849 MHz	-71 dBm	100 kHz	This requirement does not apply to Home BS operating in band 26, since it is already covered by the requirement in sub-clause 6.6.4.2. For Home BS operating in Band 5, it applies for 814 MHz to 824 MHz, while the rest is covered in sub-clause 6.6.4.2. For E-UTRA BS operating in Band 27, it applies 3 MHz below the Band 27 downlink operating band.

NOTE 2: For E-UTRA Band 28 BS, specific solutions may be required to fulfil the spurious emissions limits for E-UTRA BS for co-existence with E-UTRA Band 27 UL operating band.

Co-location with other BS requirements, chapter 6.6.4.4 in 36.104 and 6.6.4.5.5 in 36.141 also need to include Band 27 in the tables

Table 7.4.1.1.2-3: BS Spurious emissions limits for Wide Area BS co-located with another BS

E-UTRA Band 27	807 – 824 MHz	-96 dBm	100 kHz	

Table 7.4.1.1.2-4: BS Spurious emissions limits for Local Area BS co-located with another BS

E-UTRA Band 27	807 – 824 MHz	-88 dBm	100 kHz	

7.4.1.2 Upper sub-band

To be able to support the upper sub-band from the transmitter side, it is just necessary to modify TS 36.104 and TS 36.141 operating band unwanted emissions and additional spurious emission requirements.

7.4.1.2.1 Operating band unwanted emissions

Operating band unwanted emissions need to include Band [26] on Category A and Category B (Option 1). Additional requirements which are applicable to Band 5 are also required for Band [26]

7.4.1.2.2 Spurious emissions

Protection for Band [26] or Band [XXVI] need to be included in the specifications by adding a row for the band to the additional spurious emissions in TS 36.104 chapter 6.6.4.3 and TS 36.141 chapter 6.6.4.5.4 and also some alterations are needed in the current rows for Band 5 or Band V and GSM850 or CDMA850 due to overlap with band [26].

Table 7.4.1.2.2-1: BS Spurious emissions limits for E-UTRA BS for co-existence with systems operating in other frequency bands

GSM850 or CDMA850	869 - 894 MHz	-57 dBm	100 kHz	This requirement does not apply to E-UTRA BS operating in band 5 or 26
	824 - 849 MHz	-61 dBm	100 kHz	This requirement does not apply to E-UTRA BS operating in band 5 or 26, since it is already covered by the requirement in sub-clause 6.6.4.2.
UTRA FDD Band V or E-UTRA Band 5	869 - 894 MHz	-52 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 5 or [26]
	824 - 849 MHz	-49 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 5 or [26], since it is already covered by the requirement in sub-clause 6.6.4.2.
UTRA FDD Band [XXVI] or E-UTRA Band [26]	859 – 894 MHz	-52 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band 5 or [26].
	814 – 849 MHz	-49 dBm	1 MHz	This requirement does not apply to E-UTRA BS operating in band [26], since it is already covered by the requirement in subclause 6.6.4.2. For E-UTRA BS operating in Band 5, it applies for 814 MHz to 824 MHz, while the rest is covered in sub-clause 6.6.4.2.

Table 7.4.1.2.2-2: Home BS Spurious emissions limits for co-existence with Home BS operating in other frequency bands

UTRA FDD Band V or E-UTRA Band 5	824 - 849 MHz	-71 dBm	100 kHz	This requirement does not apply to Home BS operating in band 5 or 26, since it is already covered by the requirement in sub-clause 6.6.4.2.
UTRA FDD Band [XXVI] or E-UTRA Band [26]	814 - 849 MHz	-71 dBm	100 kHz	This requirement does not apply to Home BS operating in band [26], since it is already covered by the requirement in sub-clause 6.6.4.5.3. For Home BS operating in Band 5, it applies for 814 MHz to 824 MHz, while the rest is covered in sub-clause 6.6.4.2.

Co-location with other BS requirements, chapter 6.6.4.4 in 36.104 and 6.6.4.5.5 in 36.141 also need to include Band [26] or Band [XXVI] in the tables

Table 7.4.1.2.2-3: BS Spurious emissions limits for Wide Area BS co-located with another BS

WA UTRA FDD Band [XXVI] or E-UTRA Band [26]	814 – 849 MHz	-96 dBm	100 kHz	

Table 7.4.1.2.2-4: BS Spurious emissions limits for Local Area BS co-located with another BS

LA UTRA FDD Band [XXVI] or E-UTRA Band [26]	814 – 849 MHz	-88 dBm	100 kHz	

Protection of Public Safety operations in 800 MHz is also required from Band [26]. This requirement is applicable in the spurious emissions domain but also at the frequency range from 10 MHz below the lowest frequency of the BS downlink operating band up to 10 MHz above the highest frequency of the BS downlink operating band.

Table 7.4.1.2.2-5: BS Spurious emissions limits for protection of 800 MHz public safety operations

Operating Band	Frequency range	Maximum Level	Measurement Bandwidth	Note
[26]	851 - 869 MHz	-13 dBm	100 kHz	Applicable for offsets > 37.5kHz from the channel edge

7.4.2 Receiver characteristics

7.4.2.1 Reference sensitivity

The same reference sensitivity as for the rest of the bands is applicable for Band [26] since the in band performance of the duplexer is very similar to the in band performance of a duplexer for Band 5 as shown in chapter 5.2.4.2 and the current requirements in TS 36.104 and TS 36.141 already cover Band 5.

The same reference sensitivity as for the rest of the bands is applicable for Band 27.

7.4.2.2 Dynamic range

No change is needed in this requirement to support Band [26]

7.4.2.3 In-channel selectivity

No change is needed in this requirement to support Band [26]

7.4.2.4 Blocking

7.4.2.4.1 Lower sub-band BS Rx blocking

From the simulations shown in this chapter and in chapter 5.2.4.1, we can conclude that out of band blocking can be defined as the frequency range 1 to (F_{UL_low} -20) MHz and (F_{UL_high} +20) to 12750. TS 36.104 chapter 7.6.1 and TS 36.141 chapter 7.6.5.1 need to be modified in order to include Band 27 as follows.

Table 7.4.2.4.1-1: Blocking performance requirement for Wide Area BS

Operating Band	Centre Frequency of Interfering Signal [MHz]	Interfering Signal mean power [dBm]	Wanted Signal mean power [dBm]	Interfering signal centre frequency minimum frequency offset from the lower (upper) edge or sub-block edge inside a sub-block gap [MHz]	Type of Interfering Signal
27	(F_{UL_low}-20) to (F_{UL_high}+20)	-43	$P_{REFSENS}$ +6dB*	See table 7.6.1.1-2	See table 7.6.1.1-2
	1 to (F_{UL_low}-20) (F_{UL_high}+20) to 12750	-15	$P_{REFSENS}$ +6dB*	—	CW carrier

Table 7.4.2.4-2: Blocking performance requirement for Local Area BS

Operating Band	Centre Frequency of Interfering Signal [MHz]	Interfering Signal mean power [dBm]	Wanted Signal mean power [dBm]	Interfering signal centre frequency minimum frequency offset from the channel edge of the wanted signal [MHz]	Type of Interfering Signal
27	(F_{UL_low}-20) to (F_{UL_high}+20)	-35	$P_{REFSENS}$ +6dB*	See table 7.6.1.1-2	See table 7.6.1.1-2
	1 to (F_{UL_low}-20) (F_{UL_high}+20) to 12750	-15	$P_{REFSENS}$ +6dB*	—	CW carrier

Table 7.4.2.4-3: Blocking performance requirement for Home BS

Operating Band	Centre Frequency of Interfering Signal [MHz]	Interfering Signal mean power [dBm]	Wanted Signal mean power [dBm]	Interfering signal centre frequency minimum frequency offset from the channel edge of the wanted signal [MHz]	Type of Interfering Signal
27	(F_{UL_low}-20) to (F_{UL_high}+20)	-27	$P_{REFSENS}$ +14dB*	See table 7.6.1.1-2	See table 7.6.1.1-2
	1 to (F_{UL_low}-20) (F_{UL_high}+20) to 12750	-15	$P_{REFSENS}$ +14dB*	—	CW carrier

7.4.2.4.2 Upper sub-band BS Rx blocking

As shown in section 5.1.2.2, there is no DTV band located at the lower end of the sub-band 806~824MHz in United States. Thus, for the upper sub-band, here we consider the Rx blocking problem caused by cross modulation noise due to the narrow Tx and Rx band gap. Generally, in order to suppress the cross modulation noise to lower than the noise floor, 70 dB Rx to Tx rejection is needed to meet the sensitivity requirement considering the near end interference. At the lower end of the Rx band, larger than 50 dB rejection is considered in the simulation, which could provide enough rejection to the interferer from other adjacent system.

Considering a 9 orders cavity filter with 4000 un-loaded Q value, Figure 7.4.2.4.2-1 gives the evaluation of the BS duplexer with larger than 70 dB attenuation at Tx band. All the filter characteristics shown are examples only and do not preclude other implementations.

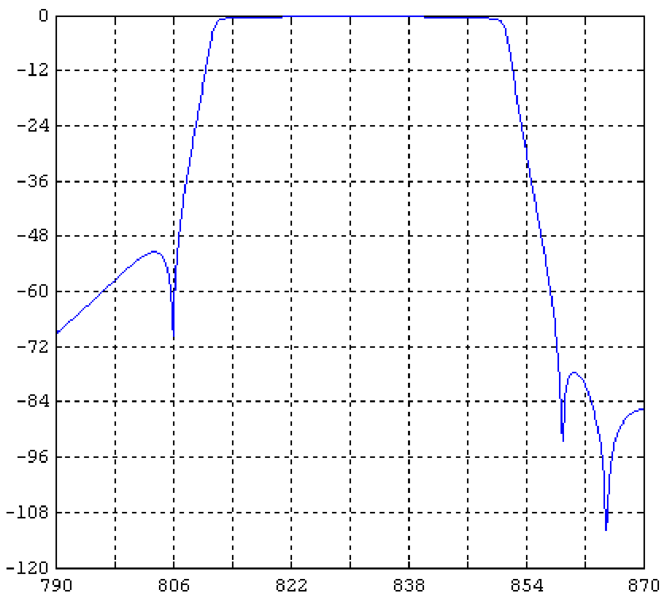

Figure 7.4.2.4.2-1: Upper sub-band BS Rx filter evaluation

From the simulation results, a 9 orders filter with three transmission zeros can meet the rejection requirement at Tx band and the lower end of the Rx band. Taking into account the temperature and manufacturing margin, the in-band insertion loss can be lower than 1dB, which can be seen from the enlarged insertion loss curve in Figure 7.4.2.4.2-2.

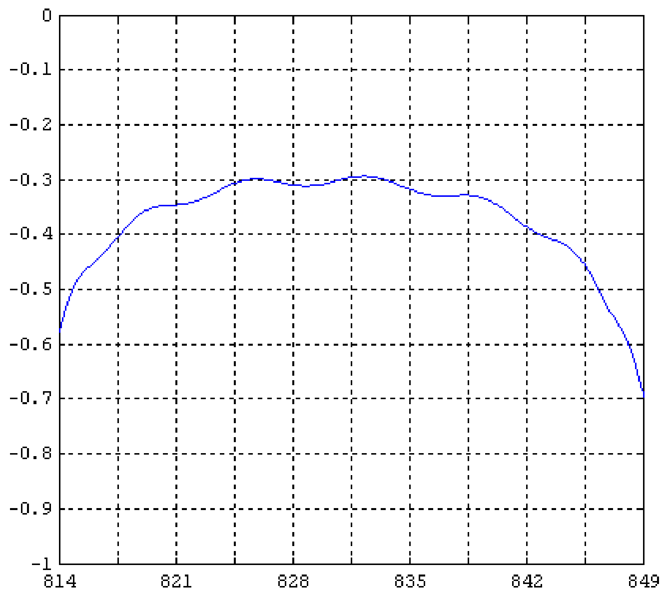

Figure 7.4.2.4.2-2: In-band insertion loss

Based on the simulation results, current cavity filter technology can guarantee enough isolation between the Rx and Tx band. There will be no blocking problem caused by cross modulation noise for the E850 upper sub-band.

From the simulations shown in this chapter and in chapter 5.2.4.2, we can conclude that out of band blocking can be defined as the frequency range 1 to (F_{UL_low} -20) MHz and (F_{UL_high} +10) to 12750. TS 36.104 chapter 7.6.1 and TS 36.141 chapter 7.6.5.1 need to be modified in order to include Band [26] as follows.

Table 7.4.2.4.2-1: Blocking performance requirement for Wide Area BS

Operating Band	Centre Frequency of Interfering Signal [MHz]	Interfering Signal mean power [dBm]	Wanted Signal mean power [dBm]	Interfering signal centre frequency minimum frequency offset from the lower (higher) edge [MHz]	Type of Interfering Signal
8, [26]	(F_{UL_low}-20) to (F_{UL_high} +10)	-43	$P_{REFSENS}$ +6dB*	See table 7.6.1.1-2	See table 7.6.1.1-2
	1 to (F_{UL_low}-20) (F_{UL_high}+10) to 12750	-15	$P_{REFSENS}$ +6dB*	—	CW carrier
NOTE*: $P_{REFSENS}$ depends on the channel bandwidth as specified in Table 7.2.1-1.					

Table 7.4.2.4.2-2: Blocking performance requirement for Local Area BS

Operating Band	Centre Frequency of Interfering Signal [MHz]	Interfering Signal mean power [dBm]	Wanted Signal mean power [dBm]	Interfering signal centre frequency minimum frequency offset from the lower (higher) edge [MHz]	Type of Interfering Signal
8, [26]	(F_{UL_low}-20) To (F_{UL_high} +10)	-35	$P_{REFSENS}$ +6dB*	See table 7.6.1.1-2	See table 7.6.1.1-2
	1 to (F_{UL_low}-20) (F_{UL_high}+10) to 12750	-15	$P_{REFSENS}$ +6dB*	—	CW carrier
NOTE*: $P_{REFSENS}$ depends on the channel bandwidth as specified in Table 7.2.1-1.					

Table 7.4.2.4.2-3: Blocking performance requirement for Home BS

Operating Band	Centre Frequency of Interfering Signal [MHz]	Interfering Signal mean power [dBm]	Wanted Signal mean power [dBm]	Interfering signal centre frequency minimum frequency offset from the lower (higher) edge [MHz]	Type of Interfering Signal
8, [26]	(F_{UL_low}-20) To (F_{UL_high} +10)	-27	$P_{REFSENS}$ +14dB*	See table 7.6.1.1-2	See table 7.6.1.1-2
	1 To (F_{UL_low}-20) (F_{UL_high}+10) to 12750	-15	$P_{REFSENS}$ +14dB*	—	CW carrier
NOTE*: $P_{REFSENS}$ depends on the channel bandwidth as specified in Table 7.2.1-1.					

The co-location requirements in TS 36.104 chapter 7.6.2 and TS 36.141 chapter 7.6.5.2 also need to be altered to support Band [26] or Band [XXVI], as indicated below.

Table 7.4.2.4.2-4: Blocking performance requirement for E-UTRA Wide Area BS when co-located with BS in other frequency bands

Co-located BS type	Centre Frequency of Interfering Signal (MHz)	Interfering Signal mean power (dBm)	Wanted Signal mean power (dBm)	Type of Interfering Signal
WA UTRA FDD Band [XXVI] or E-UTRA Band [26]	859 – 894	+16	$P_{REFSENS}$ + 6dB*	CW carrier

Table 7.4.2.4.2-5: Blocking performance requirement for Local Area BS when co-located with BS in other frequency bands

Co-located BS type	Centre Frequency of Interfering Signal (MHz)	Interfering Signal mean power (dBm)	Wanted Signal mean power (dBm)	Type of Interfering Signal
LA UTRA FDD Band [XXVI] or E-UTRA Band [26]	859 – 894	-6	PREFSENS + 6dB*	CW carrier

8 Summary of changes to UTRA specifications

8.1 Required changes to TS 25.101

In order to implement the E850 new band into the UTRA TS 25.101, the required changes are shown in Table 8.1-1.

Table 8.1-1: Required changes for TS 25.101

Section	Requirement	Description of changes in TS 25.101
5.2	Frequency bands	Add a row for the band to Table 5.0
5.3	TX–RX frequency separation	Add a row for the band's frequency separation to Table 5.0A
5.4.3	Channel number	Add a channel numbering for the band to Tables 5.1 (general) and 5.1A (additional channels)
5.4.4	UTRA Absolute Radio Frequency Channel Number (UARFCN)	Add channel numberings for the band to Table 5.2 (see Channel number above)
6.2.1	UE Maximum output power	Add a row for the band's UE power class to Table 6.1 (Power Classes 3, 3bis, 4).
6.6.2.1.1 & 6.6.2.1A.2	Out of band emission	Add the band covered by Tables 6.10B ("Additional spectrum emission limits…") and 6.10E ("Additional spectrum emission mask for DC-HSUPA…")
6.6.3.1 & 6.6.3.1A	Spurious emissions	Add the band to Tables 6.13 and 6.13A for mutual protection with applicable UTRA bands (consider V, VI, VIII, XVIII, XIX, and XX, and others)
7.3.1 & 7.3.2	Reference sensitivity level	Add a row the band to Tables 7.2 and 7.2A (check if Table 7.2B of Section 7.3.3 also needs update)
7.6	Blocking characteristics	Add the band to Tables 7.6, 7.6A, 7.6B and 7.6C for in-band blocking; to Tables 7.7, 7.7AA, and 7.7AB for out-of-band blocking; to Tables 7.7A, 7.7B, 7.7C, and 7.7D for narrow-band blocking
7.8	Intermodulation characteristics	Add the band to Tables 7.9AC, 7.9A, 7.9B, 7.9C, and 7.9D
7.9	Spurious emissions	Add the band to Table 7.11 for mutual protection with applicable UTRA bands (consider V, VI, VII, XVIII, XIX, and XX, and others) (see Spurious emissions above)
B.2.2	Multi-path fading propagation conditions	Add the band to Tables B.1, B.1B, B.1C, B.1D and B.1E
B.2.6.1 & B.2.6.2	MIMO propagation conditions	Add the band to Tables B.4 (single stream) and B.5 (dual stream)
E.2	UARFCN used for UTRA FDD bands	Add the uplink/downlink UARFCN for the band to Table E.1

8.2 Required changes to TS 25.104

In order to implement the E850 new band into the UTRA TS 25.104, the required changes are shown in Table 8.2-1.

Table 8.2-1: Required changes for TS 25.104

Section	Requirement	Description of changes in TS 25.104
5.2	Frequency bands	Add a row for the band to Table 5.0
5.3	TX–RX frequency separation	Add a row for the band's frequency separation to Table 5.0A
5.4.3	Channel number	Add a channel numbering for the band to Tables 5.1 (general) and 5.1A (additional channels)
6.6.2.1	Out of band emission	Add the band covered by Table 6.6B ("Additional spectrum emission limits…"), perhaps with Additional requirements and exception notes
6.6.3.1.2	Spurious emissions (Category B)	Add the band to either Table 6.9 or 6.9A as appropriate
6.6.3.2.1	Protection of the BS receiver of own or different BS	Add a row for the band to Tables 6.10, 6.10A, 6.10B and 6.10C
6.6.3.3.1	Co-existence with other systems in the same geographical area	Add a row for the band to Table 6.11, verify current requirements, check if exceptions needed
6.6.3.4.1	Co-existence with co-located and co-sited base stations	Add a row for the band to Tables 6.12, 6.13 and 6.14, verify current requirements, check if exceptions needed
6.6.3.9.1	Co-existence with Home BS operating in other bands	Add a row for the band to Table 6.20
7.5	Blocking characteristics	Add the band to Tables 7.4, 7.4A and 7.4B for general blocking; to Tables 7.5, 7.5A and 7.5B for narrowband blocking; to Tables 7.5C, 7.5D and 7.5E for co-located blocking
7.6	Intermodulation characteristics	Add the band to Tables 7.6A, 7.6C and 7.6E
7.7.1	Spurious emissions	Add the band to Table 7.7A, verify current requirements, check if exceptions needed
B.2	Multi-path fading propagation conditions	Add the band to Table B.1
B.5	Multipath fading propagation conditions for E-DPDCH and E-DPCCH	Add the band to Table B.3

8.3 Required changes to TS 25.113

In order to implement the E850 new band into the UTRA TS 25.113, the required changes are shown in Table 8.3-1.

Table 8.3-1: Required changes for TS 25.113

Section	Requirement	Description of changes in TS 25.113
4.5.2	Receiver exclusion band	Add a row for the FDD band

8.4 Required changes to TS 34.124

In order to implement the E850 new band into the UTRA TS 34.124, the required changes are shown in Table 8.4-1.

Table 8.4-1: Required changes for TS 34.124

Section	Requirement	Description of changes in TS 34.124
4.4	Receiver exclusion band	Add a row for the FDD band

8.5 Required changes to TS 25.133

In order to implement the E850 new band into the UTRA TS 25.133, the required changes are shown in Table 8.5-1.

Table 8.5-1: Required changes for TS 25.133

Section	Requirement	Description of changes in TS 25.133
4.2.2.5a	Measurements of inter-RAT E-UTRA cells	Add the band to the RSRP/SCH_RP list as appropriate
8.1.2.6.1	Identification of a new cell	Add the band to the RSRP/SCH_RP list as appropriate
9.1.1	CPICH RSCP	Add the band to Tables 9.1 (Intra-frequency absolute accuracy), 9.2 (Intra-frequency relative accuracy) and 9.3 (Inter-frequency) and condition lists as appropriate for CPICH_RSCP and I_o
9.1.2	CPICH Ec/Io	Add the band to Tables 9.5 (Intra-frequency absolute accuracy), 9.6 (Intra-frequency relative accuracy), 9.7 (Inter-frequency absolute accuracy) and 9.8 (Inter-frequency relative accuracy) and condition lists as appropriate for CPICH_Ec/Io and I_o
9.1.3	UTRA Carrier RSSI	Add the band to Tables 9.10 (absolute accuracy) and 9.11 (relative accuracy) and condition lists as appropriate for UTRA Carrier RSSI and I_o
9.1.7	SFN-CFN observed time difference	Add the band to Tables 9.16 (Inter-frequency) and 9.17 (Intra-frequency) and condition lists as appropriate for SFN-CFN observed time difference and I_o
9.1.8	SFN-SFN observed time difference	Add the band to Tables 9.19 (Type 1), 9.21 (Type 2 without IPDL) and 9.22 (Type 2 with IPDL) and condition lists as appropriate for SFN-SFN observed time difference and I_o
9.1.9	UE Rx-Tx time difference	Add the band to Tables 9.25 (Type 1) and 9.27 (Type 2) and condition lists as appropriate for UE Rx-Tx time difference and I_o
A.9.1.1	CPICH RSCP	Add the band to Tables A.9.1 (Intra-frequency) and A.9.2 (Inter-frequency) as appropriate for CPICH_RSCP and I_o
A.9.1.2	CPICH Ec/Io	Add the band to Tables A.9.3 (Intra-frequency parameters), A.9.4 (Inter-frequency parameters), A.9.4A (Intra-frequency absolute accuracy) and A.9.4B (Inter-frequency relative accuracy) as appropriate for CPICH_Ec/Io and I_o
A.9.1.3	UTRA Carrier RSSI	Add the band to Tables A.9.5 (absolute accuracy parameters), A.9.5.1 (relative accuracy parameters), A.9.5A (absolute accuracy) and A.9.5A1 (relative accuracy) as appropriate for UTRA Carrier RSSI and I_o
A.9.1.4	SFN-CFN observed time difference	Add the band to Tables A.9.6 (Inter-frequency) and A.9.7 (Intra-frequency) as appropriate for SFN-CFN observed time difference and I_o
A.9.1.5	SFN-SFN observed time difference	Add the band to Tables A.9.8 (Type 1), A.9.9 (Type 2 without IPDL) and A.9.10 (Type 2 with IPDL) as appropriate for SFN-SFN observed time difference and I_o
A.9.1.6	UE Rx-Tx time difference	Add the band to Tables A.9.11 (Type 1) and A.9.12 (Type 2) as appropriate for UE Rx-Tx time difference and I_o
A.9.1.10	E-UTRAN FDD RSRP absolute accuracy	Add the band to N_{oc}, RSRP, and I_o lines of Table A.9.1.10.1-3
A.9.1.12	E-UTRAN FDD RSRQ absolute accuracy	Add the band to N_{oc}, RSRP, RSRQ, and I_o lines of Table A.9.1.12.1-3

8.6 Required changes to TS 25.141

In order to implement the E850 new band into the UTRA TS 25.141, the required changes are shown in Table 8.6-1.

Table 8.5-1: Required changes for TS 25.141

Section	Requirement	Description of changes in TS 25.141
3.4.1	Frequency bands	Add a row for the band to Table 3.0
3.4.2	TX–RX frequency separation	Add a row for the band's frequency separation to Table 3.0A
3.5.3	Channel number	Add a channel numbering for the band to Tables 3.1 (general) and 3.2 (additional channels)
6.5.2.1.5	Out of band emission	Add the band covered by Table 6.21B ("Additional spectrum emission limits…"), perhaps with Additional requirements and exception notes
6.5.3.7.2	Spurious emissions (Category B)	Add the band to either Table 6.36 or 6.36A as appropriate
6.5.3.7.3	Protection of the BS receiver of own or different BS	Add a row for the band to Tables 6.37, 6.37A, 6.37B and 6.37C
6.5.3.7.4	Co-existence with other systems in the same geographical area	Add a row for the band to Table 6.38, verify current requirements, check if exceptions needed
6.5.3.7.5	Co-existence with co-located and co-sited base stations	Add a row for the band to Tables 6.39, 6.40 and 6.41, verify current requirements, check if exceptions needed
6.5.3.7.10	Co-existence with Home BS operating in other bands	Add a row for the band to Table 6.47
7.5.5	Blocking characteristics	Add the band to Tables 7.4K, 7.4L and 7.4M for general blocking; to Tables 7.4N, 7.4P and 7.4Q for narrowband blocking; to Tables 7.4R, 7.4S and 7.4T for co-located blocking
7.6.5	Intermodulation characteristics	Add the band to Table 7.5A(b)
7.7.5	Spurious emissions	Add the band to Table 7.7A(b), verify current requirements, check if exceptions needed
D.2	Multi-path fading propagation conditions	Add the band to Table D.1
D.5	Multipath fading propagation conditions for E-DPDCH and E-DPCCH	Add the band to Table D.3

8.7 Required changes to TS 25.307

In order to implement the E850 new band into the UTRA TS 25.307, the required changes are shown in Table 8.7-1.

Table 8.7-1: Required changes for TS 25.307

Section	Requirement	Description of changes in TS 25.307
TBD	UTRA release-independent frequency band	Add a section for the band

8.8 Required changes to TS 25.331

In order to implement the E850 new band into the UTRA TS 25.331, the required changes are shown in Table 8.8-1.

Table 8.8-1: Required changes for TS 25.331

Section	Requirement	Description of changes in TS 25.331
10.3.3.21a	Measurement capability extension	Add the band to the IE "FDD Frequency band 2"
10.3.3.42a	UE radio access capability extension	Add the band to the IE "Frequency band 2"
10.3.6.35c	Frequency band indicator 2	Add the band to the IE "Frequency band indicator 2"

8.9 Required changes to TS 25.461

In order to implement the E850 new band into the UTRA TS 25.461, the required changes are shown in Table 8.9-1.

Table 8.9-1: Required changes for TS 25.461

Section	Requirement	Description of changes in TS 25.461
4.3.7	Operating bands	Add a row for the band to Table 4.3.7.1

8.10 Required changes to TS 25.466

In order to implement the E850 new band into the UTRA TS 25.466, the required changes are shown in Table 8.10-1.

Table 8.10-1: Required changes for TS 25.466

Section	Requirement	Description of changes in TS 25.466
Annex B	Coding for operating bands	Add an entry for the band to Table B.2-1

9 Summary of changes to E-UTRA specifications

9.1 Required changes to TS 36.101

In order to implement the E850 new band into the E-UTRA TS 36.101, the required changes are shown in Table 9.1-1.

Table 9.1-1: Required changes for TS 36.101

Section	Requirement	Description of changes in TS 36.101
5.5	Operating bands	Add a row for the band to Table 5.5-1
5.6.1	Channel bandwidths per operating band	Add all channel bandwidths (1.4, 3, 5, 10, 15, 20 MHz) for the band to Table 5.6.1-1
5.7.3	Carrier frequency and EARFCN	Add a channel numbering for the band to Table 5.7.3-1
5.7.4	TX–RX frequency separation	Add a row for the band's frequency separation to Table 5.7.4-1
6.2.2	UE Maximum output power	Add a row for the band's UE power class to Table 6.2.2-1 (Power Class 3).
6.2.4	UE Maximum output power with additional requirements	Add the band to Table 6.2.4-1 (or appropriate table in same section)
6.6.3.2	Spurious emission band UE co-existence	Add the band to Table 6.6.3.2-1 for mutual protection with applicable E-UTRA bands
6.6.3.3	Additional spurious emissions	Add band to existing NS_0x table or add new table as applicable
7.3	Reference sensitivity power level	Add a row for the band to Tables 7.3.1-1, 7.3.1-2, and 7.3.2-1. Add row for the band to Table 7.3.1-3 if applicable.
7.6.1.1	In-band blocking	Add the band to Table 7.6.1.1-2.
7.6.2.1	Out-of-band blocking	Add the band to Table 7.6.2.1-2.

9.2 Required changes to TS 36.104

In order to implement the E850 new band into the E-UTRA TS 36.104, the required changes are shown in Table 9.2-1.

Table 9.2-1: Required changes for TS 36.104

Section	Requirement	Description of changes in TS 36.104
5.5	Operating bands	Add a row for the band to Table 5.5-1
5.7.3	Carrier frequency and EARFCN	Add a channel number set for the band to Table 5.7.3-1
6.6.3.1	Operating band unwanted emissions (Category A)	Add the band to Category A
6.6.3.2	Operating band unwanted emissions (Category B)	Apply requirement for Option 1, perhaps with Additional requirements and exception notes
6.6.4.3	Additional spurious emissions requirements	Add a row for the band to Tables 6.6.4.3.1-1 and 6.6.4.3.1-1x; verify current requirements, check if exceptions needed
6.6.4.4	Co-existence requirements	Add a row for the band to Tables 6.6.4.4.1-1 and 6.6.4.4.1-2; verify current requirements, check if exceptions needed
7.5.1	Adjacent Channel Selectivity	Verify current ACS values, ensure no exceptions needed
7.6.1	General blocking requirement	Add the band to Tables 7.6.1.1-1, 7.6.1.1-1a, and 7.6.1.1-1b, verify current requirements, check if exceptions needed
7.6.2	Co-location with other base stations	Add a new row for the band to Tables 7.6.2.1-1 and 7.6.2.1-2; verify current requirements, check if exceptions needed

9.3 Required changes to TS 36.113

In order to implement the E850 new band into the E-UTRA TS 36.113, the required changes are shown in Table 9.3-1.

Table 9.3-1: Required changes for TS 36.113

Section	Requirement	Description of changes in TS 36.113
4.5.2	Receiver exclusion band	Add a row for the band

9.4 Required changes to TS 36.124

In order to implement the E850 new band into the E-UTRA TS 36.124, the required changes are shown in Table 9.4-1.

Table 9.4-1: Required changes for TS 36.124

Section	Requirement	Description of changes in TS 36.124
4.4	Receiver exclusion band	Add a row for the band

9.5 Required changes to TS 36.133

In order to implement the E850 new band into the E-UTRA TS 36.133, the required changes are shown in Table 9.5-1.

Table 9.5-1: Required changes for TS 36.133

Section	Requirement	Description of changes in TS 36.133
4.2.2.3	Measurements of intra-frequency E-UTRAN cells	Add the band to the RSRP/SCH_RP list as appropriate
4.2.2.4	Measurements of inter-frequency E-UTRAN cells	Add the band to the RSRP/SCH_RP list as appropriate
8.1.2.2.1	E-UTRAN intra-frequency measurements	Add the band to the SCH_RP lists as appropriate (review 8.1.2.2.1.1, 8.1.2.2.1.2)
8.1.2.3.1	E-UTRAN inter-frequency measurements	Add the band to the RSRP/SCH_RP lists as appropriate (review 8.1.2.3.1.1, 8.1.2.3.1.2)
8.1.2.5.1	E-UTRAN FDD Intra-Frequency OTDOA Measurements	Add the band to the PRP condition list
8.1.2.6.1	E-UTRAN FDD-FDD Inter-Frequency OTDOA Measurements	Add the band to the PRP condition list
9.1.2.1 & 9.1.2.2	RSRP Intra-frequency absolute/relative accuracy	Add the band to the RSRP condition tables and lists
9.1.3.1 & 9.1.3.2	RSRP Inter-frequency absolute/relative accuracy	Add the band to the RSRP condition tables and lists
9.1.5.1	RSRQ Intra-frequency absolute accuracy	Add the band to the RSRP/Q condition table and list
9.1.6.1 & 9.1.6.2	RSRQ Inter-frequency absolute/relative accuracy	Add the band to the RSRP/Q condition tables and lists
9.1.9.1	UE Rx – Tx time difference	Add the band to the RSRP condition table and list as appropriate
9.1.10.1 & 9.1.10.2	Reference Signal Time Difference (RSTD) accuracy	Add the band to the RSRP condition tables and lists as appropriate
9.2.1	UTRAN FDD CPICH_RSCP absolute accuracy	Add the band to the RSCP condition table as appropriate
A.9.1.1.2	RSRP FDD Intra-frequency test	Add the band to N_{oc}, RSRP, and I_o lines of Table A.9.1.1.2-1
A.9.1.3.2	RSRP FDD-FDD Inter-frequency test	Add the band to N_{oc}, RSRP, and I_o lines of Table A.9.1.3.2-1
A.9.2.1.2	RSRQ FDD Intra-frequency test	Add the band to N_{oc}, RSRP, RSRQ, and I_o lines of Table A.9.2.1.2-1
A.9.2.3.2	RSRQ FDD-FDD Inter-frequency test	Add the band to N_{oc}, RSRP, RSRQ, and I_o lines of Table A.9.2.3.2-1
A.9.3	UTRAN FDD CPICH RSCP	Add the band to the band list for Ioc, CPICH RSCP and Io in Tables A.9.3.1.2-3 and A.9.3.2.2-3
A.9.4	UTRAN FDD CPICH Ec/No	Add the band to the band list for Ioc, CPICH Ec/No and Io in Tables A.9.4.1.2-3 and A.9.4.2.2-3

9.6 Required changes to TS 36.141

In order to implement the E850 new band into the E-UTRA TS 36.141, the required changes are shown in Table 9.6-1.

Table 9.6-1: Required changes for TS 36.141

Section	Requirement	Description of changes in TS 36.141
5.5	Operating bands	Add a row for the band to Table 5.5-1
5.7.3	Carrier frequency and EARFCN	Add a channel number set for the band to Table 5.7.3-1
6.6.3.5.1	Operating band unwanted emissions (Category A)	Add the band to Category A
6.6.3.5.2	Operating band unwanted emissions (Category B)	Apply requirement for Option 1, perhaps with Additional requirements and exception notes
6.6.4.5.4	Additional spurious emissions requirements	Add a row for the band to Tables 6.6.4.5.4-1 and 6.6.4.5.4-1x; review current mandatory requirements for any changes
6.6.4.5.5	Co-existence requirements	Add a row for the band to Tables 6.6.4.5.5-1 and 6.6.4.5.5-2; verify current requirements, check if exceptions needed
7.5.5	Adjacent Channel Selectivity	Verify current ACS values, ensure no exceptions needed
7.6.5.1	General blocking requirement	Add the band to Tables 7.6-1, 7.6-1a, and 7.6-1x, verify current requirements, check if exceptions needed
7.6.5.2	Co-location with other base stations	Add a new row for the band to Tables 7.6-3 and 7.6-4; verify current requirements, check if exceptions needed

9.7 Required changes to TS 36.307

In order to implement the E850 new band into the E-UTRA TS 36.307, the required changes are shown in Table 9.7-1. For each affected 3GPP Release, the same change would applied for the corresponding version of TS 36.307. The affected Releases are indicated as Rel-8, Rel-9 and Rel-10.

Table 9.7-1: Required changes for TS 36.307 (Release 8, 9, 10)

Section	Requirement	Description of changes in TS 36.307 (per Release)
TBD	E-UTRA release-independent frequency band	Add a section for the band

9.8 Required changes to TS 37.104

In order to implement the E850 new band into the E-UTRA MSR TS 37.104, the required changes are shown in Table 9.8-1.

Table 9.8-1: Required changes in TS 37.104

Section	Description	Required Changes in TS 37.104
4.5	Operating bands and band categories	A new row is expected to be added in Table 4.5-2.
6.6.1.3.1	BS spurious emissions limits for co-existence with systems operating in other frequency bands	A new row is expected to be added in Table 6.6.1.3.1-1. It is proposed to evaluate the appropriate requirement of the new band for BS spurious emissions limits for co-existence with systems operating in other frequency bands.
6.6.1.4.1	BS spurious emissions limits for BS co-located with another BS	A new row is expected to be added in Table 6.6.1.4.1-1. It is proposed to evaluate the appropriate requirement of the new band for BS spurious emissions limits for co-located with another BS.
7.4.1	General blocking minimum requirement	It is proposed to evaluate the appropriate general blocking minimum requirement for the new band and make corresponding changes in Table 7.4.1-1.
7.4.5	Additional BC3 blocking minimum requirement	It is proposed to evaluate the appropriate additional BC3 blocking minimum requirement for the new band and make corresponding changes in Table 7.4.5-1.
7.5.1	General minimum requirement for out-of-band blocking	It is proposed to evaluate the appropriate out-of-band blocking requirement for when co-located with BS in other frequency bands for the new band and make corresponding changes in Table 7.5.1-1.
7.5.2	Co-location minimum requirement for out-of-band blocking	A new row is expected to be added in Table 7.5.2-1. It is proposed to evaluate the appropriate out-of-band blocking performance requirement for the new band.

9.9 Required changes to TS 37.113

In order to implement the E850 new band into the E-UTRA MSR TS 37.113, the required changes are shown in Table 9.9-1.

Table 9.9-1: Required changes in TS 37.113

Section	Description	Required Changes in TS 37.113
4.4.2	Receiver exclusion band	A new row is expected to be added in Table 4.4-3

9.10 Required changes to TS 37.141

In order to implement the E850 new band into the E-UTRA MSR TS 37.141, the required changes are shown in Table 9.10-1.

Table 6.13-1: Required changes in TS 37.141

Section	Description	Required Changes in TS 37.141
4.4	Operating bands and band categories	A new row is expected to be added in Table 4.4-2.
6.6.1.5.5	Additional spurious emissions requirement for co-existence with systems operating in other frequency bands	A new row is expected to be added in Table 6.6.1.5.5-1. It is proposed to evaluate the appropriate requirement of the new band for additional spurious emissions limits for co-existence with systems operating in other frequency bands.
6.6.1.5.6	Spurious emissions limits for BS co-located with another BS	A new row is expected to be added in Table 6.6.1.5.6-1. It is proposed to evaluate the appropriate requirement of the new band for BS spurious emissions limits for co-located with another BS.
7.4.5.1	General blocking test requirement	It is proposed to evaluate the appropriate general blocking test requirement for the new band and make corresponding changes in Table 7.4.5.1-1.
7.4.5.5	Additional BC3 blocking test requirement	It is proposed to evaluate the appropriate additional BC3 blocking test requirement for the new band and make corresponding changes in Table 7.4.5.5-1.
7.5.5.1	General minimum requirement for out-of-band blocking	It is proposed to evaluate the appropriate out-of-band blocking requirement for when co-located with BS in other frequency bands for the new band and make corresponding changes in Table 7.5.5.1-1.
7.5.5.2	Co-location test requirement	A new row is expected to be added in Table 7.5.5.2-1. It is proposed to evaluate the appropriate co-location test requirement for when co-located with BS in other frequency bands for the new band.

Annex A: Calculation of the reference sensitivity

Editor's note: references will be updated and more data added

For calculating the reference sensitivity, the starting point assumed is always a MRC receiver. For comparison we first consider the case in which the transmitter noise is not dominating, that is $\mathrm{V}n >> \mathrm{V}t$, noise contributions on the diversity branches are uncorrelated for which the combined SNR is

$$\text{(A.1)} \quad SNR = \frac{2|s|^2}{\alpha \mathrm{V}n}.$$

The sensitivity is the signal level s for which the SNR after combining is 1.0 dB (including a 2.0 dB implementation margin, see [add reference]). Included is also an additional margin for 'excessive' transmitter noise α = 0.5 dB applicable for most operating band and bandwidth combinations. (A.1) yields

$$P_{REFSENS} = SNR - 3 + 10\log_{10} \alpha \mathrm{V}n = SNR_j + 10\log_{10} \alpha \mathrm{V}n \text{ [dBm]}$$

with $SNR_j = SNR - 3$ = -2.0 dB the required SNR per antenna port. The parameter α, first introduced in [add reference], is admittedly somewhat awkward for the noise factor should include all transmitter noise. For the cases considered next the transmitter noise is significant and correlation is assumed whence other methods must be used.

We continue by discussing the assumed transmitter configuration that has an impact on the transmitter noise. If the architecture is properly accounted for, the current sensitivity requirements can be reused for configurations with two antenna ports in Rel-10.

A.1 The transmitter configuration and transmitter noise

The notation and the data are according to [add reference] and [add reference] if not otherwise stated. All noise contributions are referred to the antenna input.

The reference sensitivity requirements should be applicable to any transceiver architecture with two antenna ports. We consider two architectures: two TX/RX branches and a configuration with an RX-only diversity port. For many bands and bandwidth configurations, the difference in performance between these is not large for the PA output power must be twice as high for the latter to produce the requisite output power at the antenna.

A.1.1 Two TX/RX branches

First we consider a transceiver architecture where the same uplink signal applied at both TX/RX ports, which would correspond to a precoder

$$W = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\1\end{pmatrix}.$$

We thus assume full correlation between the transmitter signals, the SNR is

$$\text{(A.2)} \quad SNR \approx \frac{2|s|^2}{\mathrm{V}n + 2\mathrm{V}t},$$

which yields $P_{REFSENS} \cong SNR - 3 + 10\log_{10}(\mathrm{V}n + 2\mathrm{V}t)$. If generally applied, this case could also represent a scenario with two uplink signals used for uplink MIMO; when the transmitter noise is not dominating, (A.1) follows.

The assumption of full correlation is a worst case and it is perhaps more relevant to assume uplink signals of 'transmit diversity type'. These signals would be (almost) uncorrelated, whence the SNR is

(A.3) $SNR \approx \frac{2|s|^2}{\text{V}n + \text{V}t}$

to the first order, neglecting mutual coupling between branches. We get $P_{REFSENS} \cong SNR - 3 + 10\log_{10}(\text{V}n + \text{V}t)$.

A.1.2 One main TX/RX branch and one RX-only diversity port

The standard expression for MRC

(A.4) $SNR = \frac{|s|^2}{\text{V}n + \text{V}t} + \frac{|s|^2}{\text{V}n + |c|^2\text{V}t}$

can be used if the following is fulfilled

(A.5) $\left(1 + \frac{\text{V}t}{\text{V}n}\right) << \frac{1}{2|c|}$

However, we do not really need to be as restrictive as (A.5) for (A.4) to be sufficiently accurate.

If $|c|^2\text{V}t >> \text{V}n$ with c the complex amplitude of the coupling between the branches, then the transmitter noise is dominating at both branches and from [add reference]

(A.6) $SNR \approx \frac{|s|^2}{\text{V}n + |c|^2\text{V}t}$.

These results can also be applied to UE antenna selection.

A.2 What to use?

The sensitivity requirement should apply to any architecture. Comparing (A.3) for transmit diversity with (A.4), the latter will at least yield a better sensitivity if the condition for its applicability (A.5) is met. The criterion is strict, and (A.4) will be sufficiently accurate as long as the transmitter noise does not exceed the remaining noise contributions. This also accounts for the fact that the PA output power can be set 3 dB lower for the transmit diversity case.

When the transmitter noise is dominating both and the main and the diversity port, (A.6) is applicable but this expression is quite conservative in practice.

For the bands considered here we use (A.3) assuming that reference sensitivity will no be tested with identical uplink signals in the case of transmit diversity.

Annex B: LTE and PSNB simulation parameters

B.1. LTE and NB PS system parameters

Table B-1 and Table B-2 contain the LTE and NB PS parameters used for Band 26 and PSNB co-existence in section 7.2.2.1.1. ISD for LTE is used for the simulations in section 7.2.1.1.1 while cell radius is used in the simulations included in section 7.2.2.1.1.2

Table B.1-1. LTE parameters

	Base Station	UE
Carrier frequency Carrier frequency	850 MHz	
Channel bandwidth	5 MHz	
ISD (section 7.2.2.1.1.1)	1.7km	
Cell radius (section 7.2.2.1.1.2)	1.0 km / 2.0 km / 4.0 km	
Frequency reuse	1x3x1	
Lognormal fading	10 dB	
Antenna gain and antenna pattern	$A(\theta) = -\min\left[12\left(\frac{\theta}{\theta_{3dB}}\right)^2, A_m\right]$ 15 dBi, θ_{3dB} = 65 degrees, *Am* = 20 dB	Antenna gain + body loss= -10 dBi
Noise figure	5 dB	9 dB
Transmit power	43 dBm	23 dBm
Antenna height	30 m	1.5 m

Table B.1-2. NB PS system parameters

	Base Station	Portable
Carrier frequency	850 MHz	
Channel bandwidth	6.25 kHz	
Cell radius	12 km	
Antenna height	100 m from ground	1.5m
Lognormal fading	10 dB	
Antenna gain and antenna pattern	11 dBi omni-directional	Antenna gain + body loss =-6 dBi
Noise figure	5.7 dB	9.75 dB
Transmit power	45 dBm (after combiner loss)	36 dBm
SNR Threshold	16.5 dB	16.5 dB
Effective Noise Bandwidth (ENBW)	6.25 kHz	6.25 kHz
Noise Floor	-130.3dBm / 6.25 kHz	-126.3dBm / 6.25 kHz
Sensitivity	-113.8dBm / 6.25 kHz	-109.8dBm / 6.25 kHz

B.2. NBPS/LTE System Layout

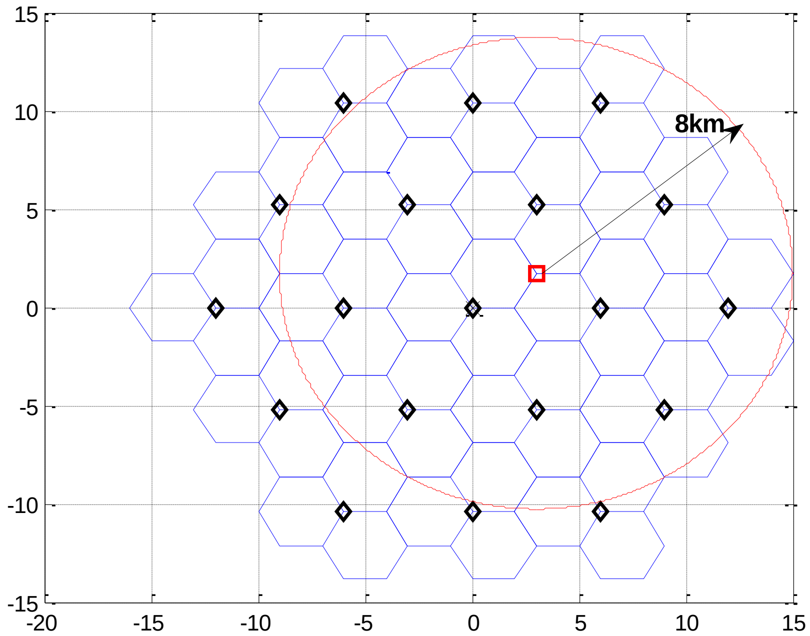

Figure B.2-1. NBPS/LTE System Layout

Annex C: Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2009-06	RAN4-51bis	R4-092380			Skeleton	N/A	0.0.1
2010-03	RAN4#55	R4-101587			Agreed text proposals at RAN4#54 **R4-100637**, "TP E850: band arrangement"	0.0.1	0.1.0
2010-06	RAN4 AH#3	R4-102379			Agreed text proposals at RAN4#55 **R4-101910**, "TP E850: reference sensitivity for the 814-849/859-894 MHz sub-band" **R4-102332**, "Text Proposal for E850 TR: coexistence between LTE and other systems in E850 band" **R4-102333**, "Text proposal for E850 TR: use of the additional spectrum"	0.1.0	0.2.0
2010-08	RAN4#56	R4-103195			Agreed text proposals at RAN4 AH#3 **R4-102576**, "TP for E850 TR: co-existence with public safety in Region 2 (United States)" **R4-102715**, "Text proposal on 850MHz frequency allocation in China" TR number added on cover page (37.806)	0.2.0	0.3.0
2010-10	RAN4 AH#4	R4-103693			Agreed text proposals at RAN#56 **R4-102832**, "iDEN Operators Spectrum" **R4-102956**, "Text proposal for E850 TR: Assessment of UE Blocking Requirements" **R4-103066**, "TP for E850 REFSENS" **R4-103197**, " TP for E850 TR: out-of-band blocking for legacy bands in the range" **R4-103407**, " TP for E850 TR V0.3.0: Band plans in Region 2 (United States)" **R4-103455**, "BS: TP Unwanted Emissions for E850."	0.3.0	0.4.0
2010-11	RAN4#57	R4-104462			Agreed text proposals at RAN4 AH#4 **R4-103961**, "TP for TR 37.806: Way Forward for REFSENS for 814-849/859-894 MHz"	0.4.0	0.5.0
2011-01	RAN4 #57AH	R4-110063			Agreed text proposals at RAN4#57 **R4-104463,** "TP for TR 37.806: scope and background" **R4-104464**, "TP for TR 37.806: duplexer data and REFSENS for 814-849/859-894 MHz" **R4-104465**, "TP for TR 37.806: regulatory requirements for Region 3" **R4-104619**, "UE Duplex-filter characteristics information for E850 band" **R4-104697**, "TP for TR 37.806v0.5.0: Co-existence Studies" **R4-104877**, "TP on E850 frequency band allocation in Korea" **R4-104878**, "TP for E850 TR 37.806, Summary of required changes to E-UTRA specifications" **R4-104879**, "TP for E850 TR 37.806, Summary of required changes to UTRA specifications" **R4-104893**, "TP for TR 37.806v0.5.0: Additional Co-existence Study" **R4-104995**, "TP for Extending 850 MHz BS duplexer characteristics for sub-bands (TR 37.806)" **R4-105004**, "BS blocking characteristics of upper sub-band for E850" **R4-105005**, "BS blocking characteristics of lower sub-band for E850" **R4-105020**, "TP for E850 TR 37.806, Summary of required changes to MSR specifications"	0.5.0	0.6.0
2011-01	RAN4#57 AH	R4-110518			Agreed editorial update at RAN4#57AH **RAN4-110518**, "Extending 850MHz Study Item TR 37.806 v0.6.1 editorial update"	0.6.0	0.6.1
2011-02	RAN#58	R4-111213			Agreed text proposals at RAN4#57AH **R4-110034**, "TP for E850MHz Study Item TR37.806, band and channel arrangement for UTRA and E-UTRA" **R4-110554**, "TP for Extended 850MHz, E-UTRA BS requirements on upper E850"	0.6.1	0.7.0
2011-04	RAN4#58 AH	R4-112175			Agreed text proposals at RAN4#58 **R4-111025, "**UE coexistence between lower E850 band and adjacent systems**"**	0.7.0	0.8.0

					R4-111093, "TP for E850 TR 37.806: REFSENS for 806-824/851-869 MHz" **R4-111205**, "TP for TR 37.806: maximum output power for E850 upper sub-band" Reference '[4]' corrected		
2011-04	RAN4#59	R4-112608			Agreed text proposals at RAN4#58AH **R4-111747**, "TP for E850 TR 37.806: E850 Lower Band UE Duplex Filter" **R4-111748**,"TP for E850 TR 37.806: E850 Lower Band refsens" **R4-111749**, "TP for E850 TR 37.806: E850 Lower Band UE Transmit Power" **R4-112019**, "TP to TR 37.806 BS spurious emission "	0.8.0	0.9.0
2011-06	RAN#52	RP-110752			Agreed text proposals at RAN4#59 **R4-112774**, "TP to TR 37.806 BS blocking characteristics" **R4-113192**, "TP for TR 37.806: Co-existence issues on lower E850" **R4-113237**, "TP to TR 37.806 BS duplexer filter characteristics" **R4-113284**, "TP for TR 37.806: operating band signaling and support of legacy bands"	0.9.0	1.0.0
2011-08	RAN4#60	R4-114382			Agreed text proposals at RAN4#59AH (following RAN#52) **R4-113852**, "TP for E850 TR 37.806: E850 Upper Band BS-BS Coexistence" **R4-113858**, "TP for E850 TR 37.806: E850 Lower Band BS-BS Coexistence"	1.0.0	1.1.0
2011-10	RAN4#60 bis	R4-115040			Agreed text proposals at RAN4#60 **R4-114641**, "Correction for TR 37.806 Coexistence text (7.2.1.3)" **R4-114707**, "TP for TR 37.806: E850 Coexistence Scenarios"	1.1.0	1.2.0
2012-03	RAN4#62 bis	R4-121727			Agreed text proposals at RAN4#60bis and RAN4#62 **R4-115466**, "TP for TR 36.806: Public Safety in Argentina for E850_UB and E850_LB" **R4-115470**, "TP for TR 37.806: Band 26 BS requirements" **R4-120773**, "TR 37.806 cleanup"	1.2.0	1.3.0
2012-08	RAN4#64	R4-124679			Agreed text proposals at RAN4#64 **R4-124670**, "TP to TR 37.806: Band 26/XXVI UE spurious emissions, A-MPR for E-UTRA and GB for UTRA" **R4-124673**, "Band 26 UE REFSENS" **R4-124675,** "TP to TR 37.806:: Band XXVI UE MOP and REFSENS" **R4-124676** , "TP to TR 37.806: Band 27 UE emissions towards APT700 and A-MPR" **R4-124965**, "TP for TR 37.806: Band 27 BS requirements update" **R4-124966**, "TP for TR 37.806" **R4-124967**, "TP to TR 37.806: Band 27 band edge"	1.3.0	1.4.0
2012-08	RAN#57	RP-121185			Presentation of the report to TSG RAN for approval	1.4.0	2.0.0
2012-09	RAN#57				Report Approved by RAN	2.0.0	11.0.0