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Melbourne, Australia, 16-20 April, 2018

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Title: B41/n41 intra-band EN-DC A-MPR

Agenda Item: 7.1.2.1.1

Document for: Approval

B41/n41 Intra-band EN-DC A-MPR

5 APRIL 2018

Background and Plan of Action

R4-1801124 - WF on 41A_n41A A-MPR Evaluation

- For 2PA architecture, reverse component dominates IMD between channels
- Power sharing and allocation sizes are important factors

Plan of Action

- 3GPP definitions of MPR/AMPR for EN-DC in general, and for intra-band B41 in particular are not yet complete.
- RAN4 should work to complete the minimum set of A-MPR required by June
  - 2 PA A-MPR for DC_(n)41C BCS0
  - 2 PA A-MPR for DC_41A_n41A BCS0

AMPR is necessitated by distinct mechanisms

Spectral regrowth from individual channels may be impacted by NS_04 restrictions at bottom of band

- Impacts are a function of individual channel location and PRB allocation
- Taken into account by single-channel LTE and NR AMPR definitions, separately from EN-DC

IMD products between LTE and NR channels

- Locations of IMD products are a function of arrangement of the two channels, and placement of PRB allocations within channels.
- Impacts of IMD products are a function of IMD PSD, emission limits, and filter rejection

Summation of spectral regrowth in region between channels may exceed ACLR or Spectral Emissions Limits.

- For 2PA architecture, not likely to be significant issue for conducted measurements because of antenna isolation
- May be more significant factor for 1PA architectures.

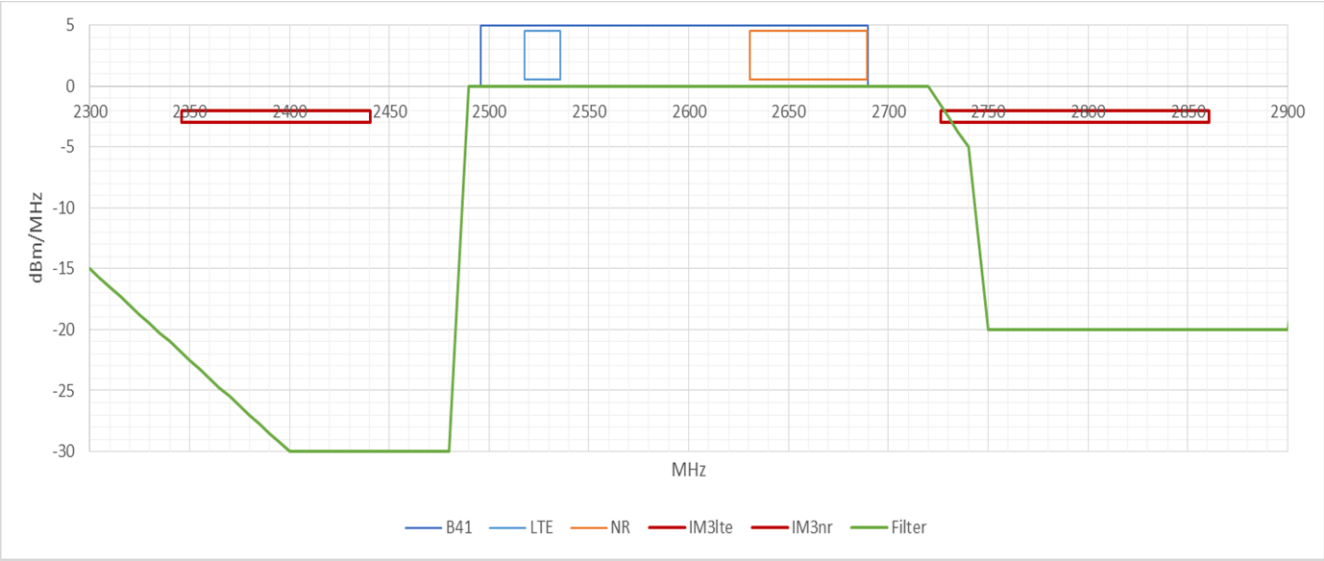
<u>AMPR definition for EN-DC should account for these mechanisms separately</u>

Filter Rejection must be taken into account

Wide channels and non-contiguous channel arrangements will often place IMD products well outside B41, where filter rejection attenuates them and reduces need for AMPR.

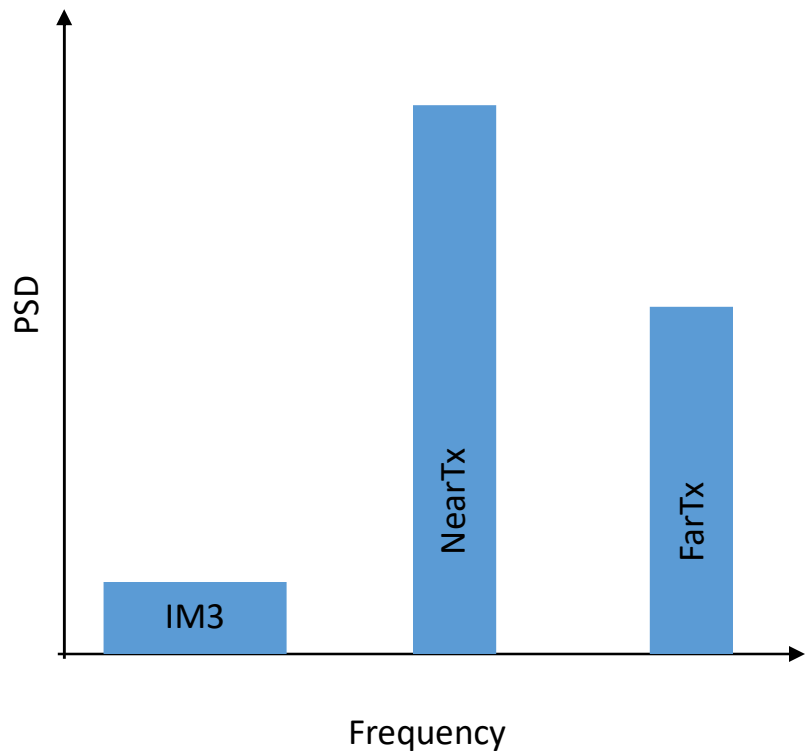
<u>Simplified model of filter should be incorporated into AMPR definition to avoid excessive, unnecessary power backoff.</u>

Typical Channel Arrangement and IM3 locations



IM3s are best managed by the near channel power

$$\log PSD_{IM3} \propto \left(2 \log PSD_{nearTx} + \log PSD_{farTx}\right)$$



The Power Spectral Density (PSD) of IM3 products are theoretically proportional to 2x the PSD of the near contributing transmission, and 1x the PSD of the far contributing transmission.

So AMPR taken on the near transmission is twice as efficient at reducing IM3 power as AMPR taken on the far transmission.

<u>AMPR definitions should be based on this assumption – power reduction should be taken on the near transmission, where it has largest effect on IM3 power.</u>

Current AMPR definitions are per-channel already, so incorporating AMPR for inter-channel IM3s into per-channel definitions minimizes change to existing specification structure.

AMPR Definition should be based on Type 1 UEs

<u>Baseline AMPR definition should be based on Type 1 UEs, with full communication between LTE and NR modems.</u>

- Allows AMPR definition to use actual allocations for both RATs in determining backoff allowance.

AMPR based on Type 2 UEs with independent modems would need to be based on worst case assumption for other channel.

- Real usage patterns, especially in loaded networks, will often result in allocations to only one RAT in a TTI
- Even for TTIs where both RATs are scheduled, many combinations will require little or no AMPR.
- Result would be excessive, unnecessary power backoff for many allocation combinations.

If RAN4 specifies AMPR for Type 2 UEs, it can be easily derived from definition created for Type 1.

- Reverse is not true. Subsequent creation of Type 1 AMPR definition would require at least re-analysis of underlying simulation/measurement data.

Key Point Summary and Proposals

Observation 1: AMPR is necessitated because of distinct mechanisms

Proposal 1: <u>AMPR definitions should account for each of the distinct mechanisms separately.</u>

Observation 2: Wide channel bandwidth and non-contiguous channel separations mean that bandpass filters provide significant protection against inter channel IMD products.

Proposal 2: <u>Simplified filter model should be incorporated into AMPR definition to avoid excessive, unnecessary power backoff.</u>

Observation 3: Power reduction of the near transmission has 2x the effect on IM3 power compared to power reduction of the far transmission.

Proposal 3: <u>Definition of AMPR for IM3s should assume power reduction on near transmission, where it is most efficient.</u>

Observation 4: AMPR defined for Type 1 UEs is easily convertible to AMPR allowance for Type 2 UEs, but the reverse is not true.

Proposal 4: <u>AMPR definition should be first developed for Type 1 UEs, with full knowledge of allocations on both RATs.</u>

Appendix1:
Proposed Structure for Intra-Band EN-DC AMPR

Intermodulation between Channels with EN-DC

Contiguous EN-DC

- Aggregated SEM covers all possible IM3 products in frequency domain
  - However, non-contiguous PRB allocations can concentrate power and exceed SEM limits developed using assumptions of contiguous transmissions.
  - PSD decreases as size of allocations increases, so allocation size should be major factor
- Some IM5 Products are not covered by SEM
  - For 2PA architectures, submission have shown that R-IM5 power is low enough to ignore.
  - For 1PA architectures, specific check for IM5s may be needed, similar to IM3 check defined here.

Non-Contiguous EN-DC

- Composite SEM does not cover all IM3 or IM5 products
- Need an IM3 check, similar to LTE IM5 check, to handle IM3s outside of SEM.

2PA architecture may break LTE assumption of equal PSD between signals

- May allow better optimization with asymmetrical semi-static power sharing.

Proposed Approach for EN-DC AMPR Definition

Assuming Type 1 UEs, with coordination between LTE and NR power control entities.

- IM3 calculation is based on actual allocations on both RATs
  - M_{IM3} = AMPR to accommodate IM3s, based on allocation size and locations
  - Key factor is whether IM3s fall outside SEM, or into NS_04 Spurious region
  - M_{IM3} should be reduced by simple model of filter attenuation if IM3 is outside B41
- M_{single} = AMPR required for single channel
  - For LTE, from current AMPR allowance.
  - For NR, based on ongoing NR-only AMPR work.
- AMPR = $MAX(M_{IM3,sem}, M_{IM3,spurious}, M_{single})$

This model could be used for both Contiguous and Non-Contiguous Channel EN-DC.

Same structure of AMPR definition could be used, with different values, for both 1PA and 2PA implementations.

- 1PA may require addition of explicit IM5 and intra-channel ACLR checks.

Proposed RIM3 AMPR – Tx blocks and Allocations

Non-contiguous allocations will consist of up to two Transmission Blocks, one on each of the two channels of EN-DC.

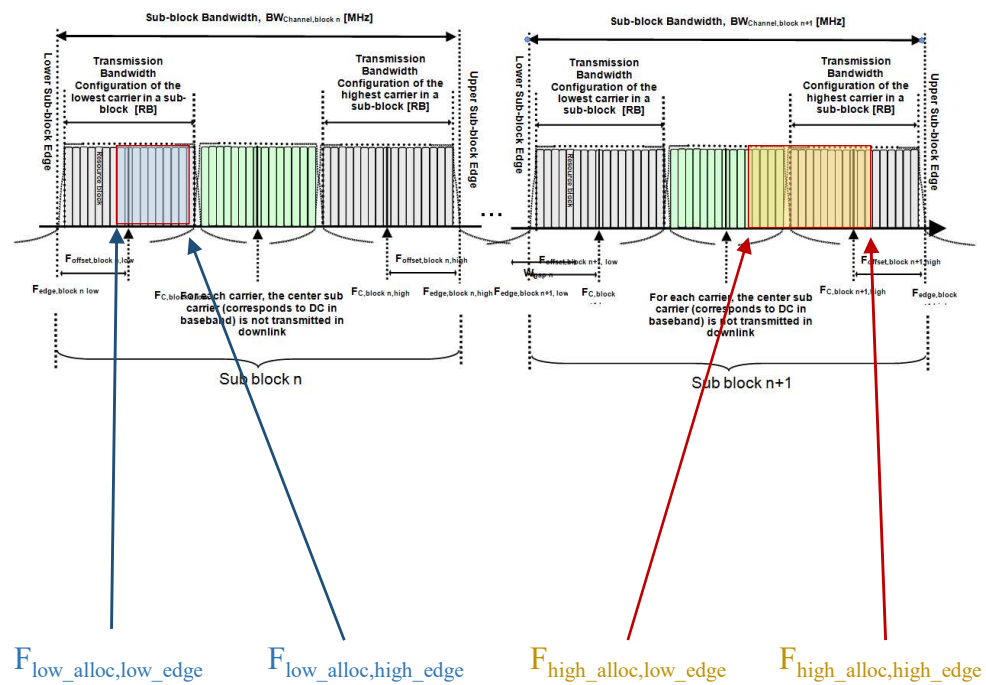
- For R-IMD, calculation is the same regardless of which is NR and which is LTE
- Calculation is the same regardless of contiguous or non-contiguous channels.

$F_{IM3,low_block,low} = (2 * F_{low_alloc,low_edge}) - F_{high_alloc,high_edge}$

$F_{IM3,low_block,high} = (2 * F_{low_alloc,high_edge}) - F_{high_alloc,low_edge}$

$F_{IM3,high_block,low} = (2 * F_{high_alloc,low_edge}) - F_{low_alloc,high_edge}$

$F_{IM3,high_block,high} = (2 * F_{high_alloc,high_edge}) - F_{low_alloc,low_edge}$



Allocation on low channel

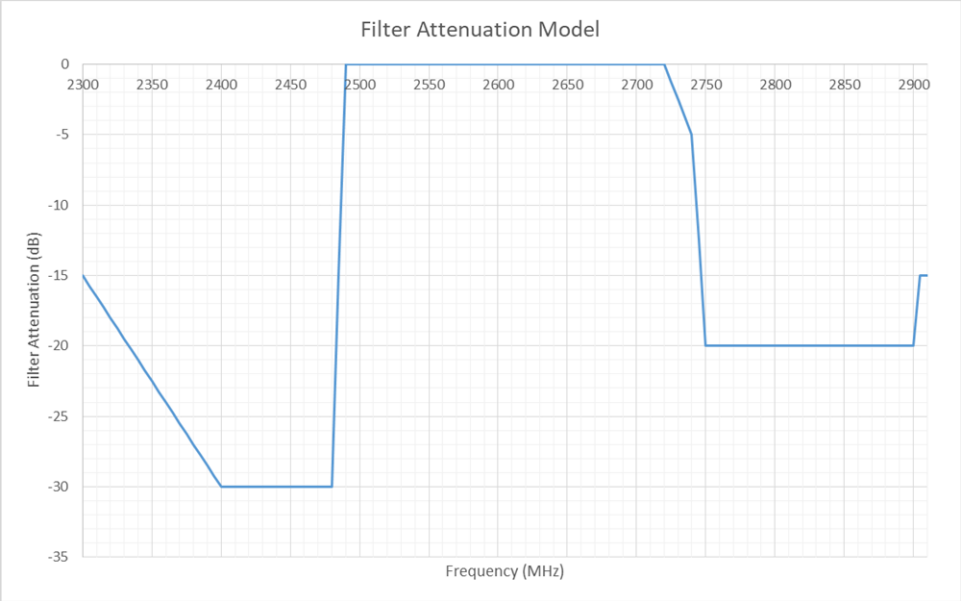
Allocation on high channel

Proposed R-IM3 AMPR – Filter Attenuation

- Filter Model for implementation could be specific to a device
- Filter Model for 3GPP standardization would be a consensus model, and likely conservative
- Model below is for illustration

Filter Attenuation = $A_{filter}(F)$, in dB
Where

$A_{filter}(F)$ =	-15	;F < 2300
	-15-0.15(F-2300)	;2300 ≤ F < 2400
	-30	;2400 ≤ F < 2480
	-30+3(F-2480)	;2480 ≤ F < 2490
	0	;2490 ≤ F < 2720
	-0.25(F-2720)	;2720 ≤ F < 2740
	-5-1.5(F-2740)	;2740 ≤ F < 2750
	-20	;2750 ≤ F > 2900
	-15	; F ≥ 2900



Where F is the frequency, in MHz

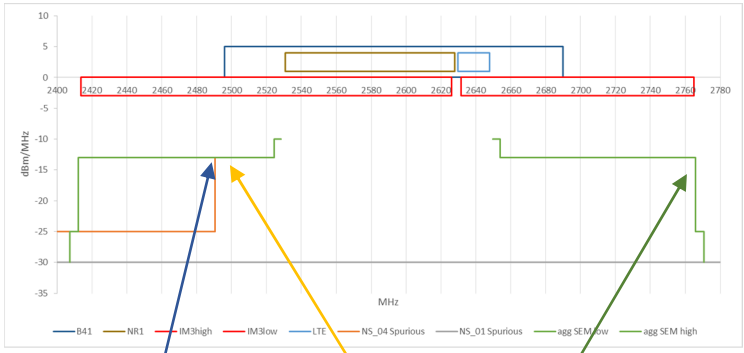
Proposed R-IM3 AMPR – Emission Mask Edges Definitions

$SEM_{-13,low}$ is defined as the frequency, below the lower signal in EN-DC, at which the permitted emissions power decreases from -13 dBm / 1MHz to -25 dBm / 1MHz. This is the higher of the threshold frequencies from the Spectrum Emissions Limits in Section 6.6.2 and the Additional Spurious Emissions limit in Section 6.6.3.3.

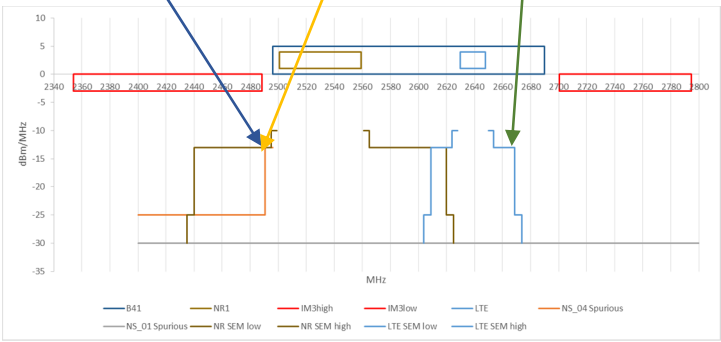
$SEM_{-13,high}$ is defined as the frequency, above the upper signal in EN-DC, at which the permitted emissions power decreases from -13 dBm / 1MHz to -25 dBm / 1MHz.

Reference:
TS 36.101 Section 6.6.2.2.2, Section 6.6.2.2A.1, and Section 6.6.3.1.9
TS 38.101 TBD

Contiguous Channels



$SEM_{-13,low}$ 2490.5 MHz $SEM_{-13,high}$



Non-Contiguous Channels

Table 6.6.2.2.2-1: Additional requirements

	Spectrum emission limit (dBm)/ Channel bandwidth				
Δf_{OOB} (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
± 0-1	-15	-18	-20	-21	30 kHz
± 1-2.5	-10	-10	-10	-10	1 MHz
± 2.5-2.8	-10	-10	-10	-10	1 MHz
± 2.8-5	-10	-10	-10	-10	1 MHz
± 5-6	-13	-13	-13	-13	1 MHz
± 6-9	-25	-13	-13	-13	1 MHz
± 9-10	-25	-25	-13	-13	1 MHz
± 10-13.5		-25	-13	-13	1 MHz
± 13.5-15		-25	-25	-13	1 MHz
± 15-18			-25	-13	1 MHz
± 18-20			-25	-25	1 MHz
± 20-25				-25	1 MHz

Table 6.6.3.3.19-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5, 10, 15, 20 MHz	
2490.5 ≤ f < 2495	-13	1 MHz
0 < f < 2490.5	-25	1 MHz

Proposed R-IM3 AMPR – Worst Case Filter Attenuation

For lower R-IM3:

If $F_{IM3,low_block,low} < SEM_{-13,low}$

$Spurious_risk_{low} = TRUE$

$A_{filter,worst_case,low} = A_{filter}(F_{IM3,worst_case,low})$

where $F_{IM3,worst_case,low}$ is defined as the maximum point, and $A_{filter}(F_{IM3,worst_case,low})$ is defined as the maximum value of $A_{filter}(F)$, over the range

$F_{IM3,low_block,low} < F < MIN[\ F_{IM3,low_block,high}, SEM_{-13,low}\ ]$

For upper R-IM3:

If $F_{IM3,high_block,high} > SEM_{-13,high}$

$Spurious_risk_{high} = TRUE$

$A_{filter,worst_case,high} = A_{filter}(F_{IM3,worst_case,high})$

where $F_{IM3,worst_case,high}$ is defined as the maximum point, and $A_{filter}(F_{IM3,worst_case,high})$ is defined as the maximum value of $A_{filter}(F)$, over the range

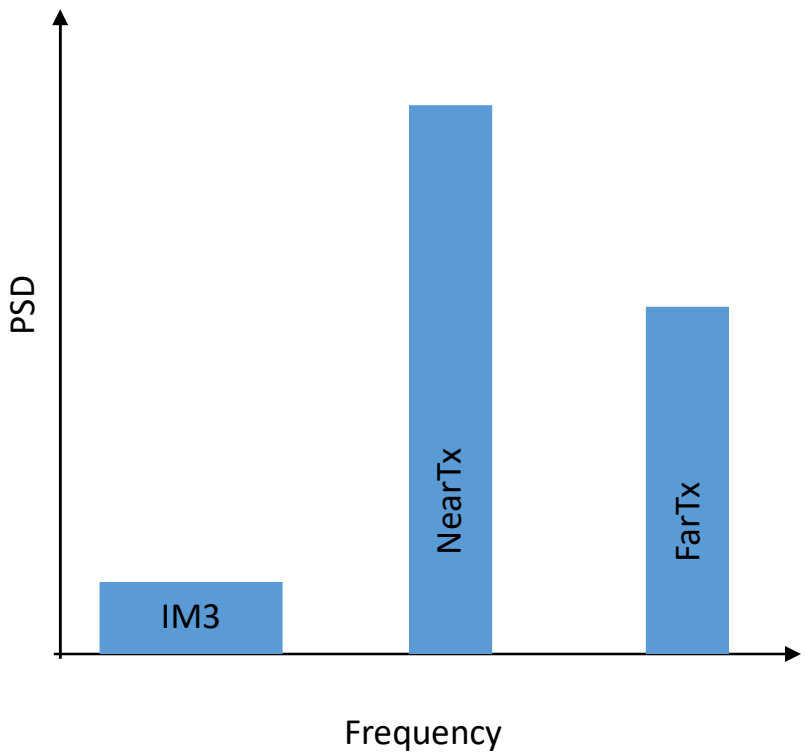
$MAX(\ F_{IM3,high_block,low}, SEM_{-13,high}) < F < F_{IM3,high_block,high}$

Assumptions baked into this:

- Each transmission (low or high) is responsible for the R-IM3 product nearest it. The R-IM3, generated at this Tx chain, on the far side has greatly reduced power (~20 dB lower).

Proposed AMPR IM3 Definition – Dynamic Power Sharing

$$\log PSD_{IM3} \propto \left(2 \log PSD_{nearTx} + \log PSD_{farTx}\right)$$



The Power Spectral Density (PSD) of IM3 products are theoretically proportional to 2x the PSD of the near contributing transmission, and 1x the PSD of the far contributing transmission.

The tables for $AMPR_{SEM}$ and $AMPR_{spurious,\ unfiltered}$ (defined in next slides) assume that the far transmission is at maximum power and a single RB. If the far transmission is actually at lower power or is spread over a wider bandwidth, PSD_{farTx} and PSD_{IM3} will be lower.

$A_{farTx,low}$ and $A_{farTx,high}$ are calculated separately for the two transmissions

$$A_{farTx} = (P_{powerClass} - P_{farTx}) - 10\log[\ MAX(\ N_{RB,farTx} * SCS * 12\ ,1.0\ )\ ]$$

Where A_{farTx} is the reduction in near IM3 PSD resulting from reduced PSD of the far channel transmission, in dB.

Proposed AMPR IM3 Definition – $AMPR_{IM3,SEM}$

AMPR for IM3 Products within Spectral Emission Mask ($AMPR_{SEM}$)			
γ_{CG}[3]	$BW_{RB_alloc} > 2$	$1 < BW_{RB_alloc} \leq 2$	$BW_{RB_alloc} \leq 1$
≥ 50%	? dB	? dB	? dB
< 50%, ≥ 25%	? dB	? dB	? dB
< 25%	? dB	? dB	? dB
NOTE 1: AMPR backoff allowances are relative to PC2 nominal power of 26 dBm NOTE 2: BW_{RB_alloc} is defined as the transmission bandwidth, (N_{RB} * SCS * 12) in MHz NOTE 3: From Power Sharing configuration (TS 36.213 and TS 38.213)			

Precise threshold values in rows and column are TBD.

Assumptions baked into this table:

- Other RAT transmission is a single PRB at full Tx power (26 dBm)
- No filter attenuation to IM3 products.

These factors are accounted for with correction factors A_{farTx} and $A_{filter,worst_case}$.

AMPR is applied separately for each transmission (low or high, LTE or NR).

If $F_{IM3,low_block,high} > SEM_{-13,low}$

$$AMPR_{IM3,SEM,low} = AMPR_{SEM} - 0.5\ A_{farTx}$$

Else

$$AMPR_{IM3,SEM,low} = 0$$

If $F_{IM3,high_block,low} < SEM_{-13,high}$

$$AMPR_{IM3,SEM,high} = AMPR_{SEM} - 0.5\ A_{farTx}$$

Else

$$AMPR_{IM3,SEM,high} = 0$$

Proposed AMPR IM3 Definition – $AMPR_{IM3,spurious}$

Unfiltered AMPR for IM3 Products outside SEM ($AMPR_{spurious,\ unfiltered}$)			
γ_{CG}^3	$BW_{RB_alloc} > 2$	$1 < BW_{RB_alloc} \leq 2$	$BW_{RB_alloc} \leq 1$
$\geq 50\%$	? dB	? dB	? dB
$< 50\%, \geq 25\%$	? dB	? dB	? dB
$< 25\%$	? dB	? dB	? dB
NOTE 1: AMPR allowances are relative to PC2 nominal power of 26 dBm NOTE 2: BW_{RB_alloc} is defined as the transmission bandwidth, (N_{RB} * SCS * 12) in MHz NOTE 3: From Power Sharing configuration (TS 36.213 and TS 38.213)			

Assumptions baked into this table:

- Other RAT transmission is a single PRB at full Tx power (26 dBm)
- No filter attenuation to IM3 products.

These factors are accounted for with correction factors A_{farTx} and $A_{filter,worst_case}$.

Precise threshold values in rows and column are TBD.

AMPR is applied separately for each transmission (low or high, LTE or NR).

If $Spurious_risk_{low}$ = TRUE

$AMPR_{IM3,spurious,low} = AMPR_{spurious,\ unfiltered,low} - 0.5\ (A_{filter,worst_case,low} + A_{farTx,low})$

Else

$AMPR_{IM3,spurious,low} = 0$

If $Spurious_risk_{high}$ = TRUE

$AMPR_{IM3,spurious,high} = AMPR_{spurious,\ unfiltered,high} - 0.5\ (A_{filter,worst_case,high} + A_{farTx,high})$

Else

$AMPR_{IM3,spurious,high} = 0$

Proposed AMPR Allowance

Each channel takes AMPR separately, based on AMPR definition for it's own single-RAT transmission, and the inter-transmission IM3 product nearest its transmission.

$AMPR_{low} = MAX(AMPR_{IM3,SEM,low}, AMPR_{IM3,spurious,low}, AMPR_{single,low})$

$AMPR_{high} = MAX(AMPR_{IM3,SEM,high}, AMPR_{IM3,spurious,high}, AMPR_{single,high})$

Where

$AMPR_{single}$ is defined as the AMPR for a single carrier transmission, per Section 6.2.4 of TS 36.101 or TS 38.101-1

Appendix 2:
AMPR Structure for Type 2 UEs

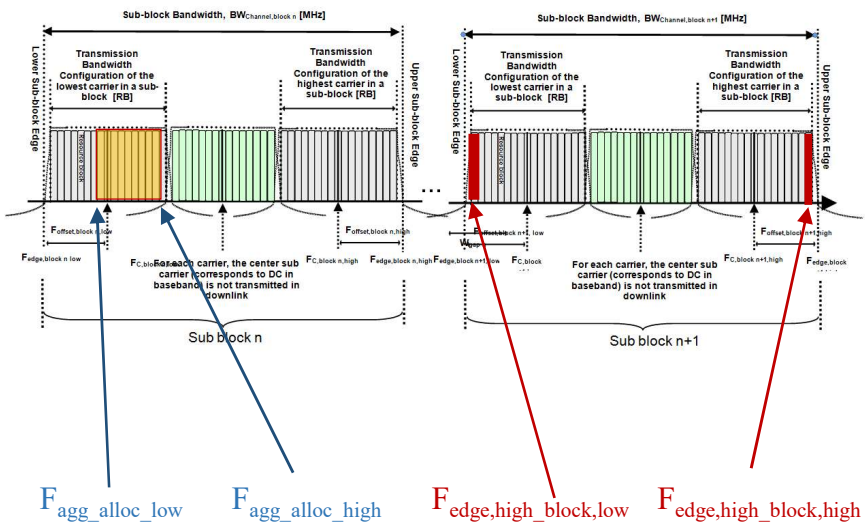
Proposed RIM3 AMPR – Tx blocks and Allocations

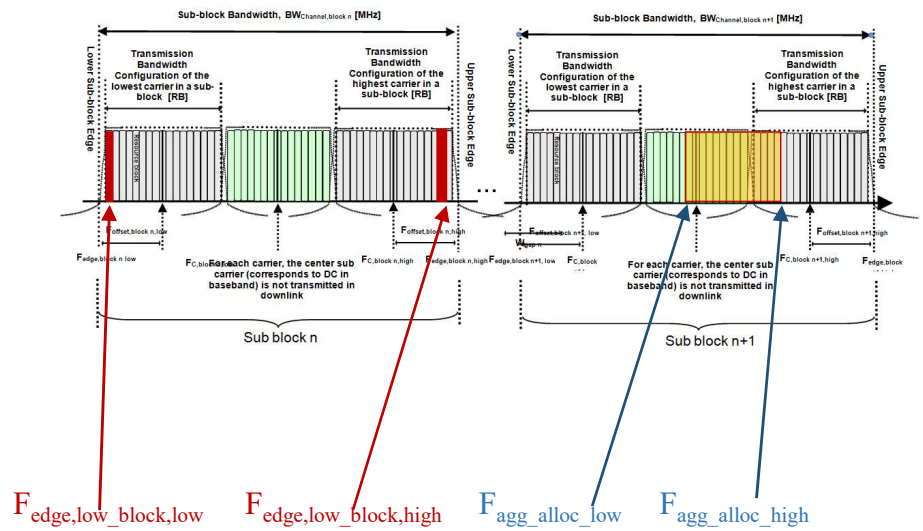
If modem is controlling lower channel block:

$$F_{IM3,low_block,low} = (2 * F_{alloc_low}) - F_{edge,high_block,high}$$
$$F_{IM3,low_block,high} = (2 * F_{alloc_high}) - F_{edge,high_block,low}$$
$$F_{IM3,high_block,low} = (2 * F_{edge,high_block,low}) - F_{alloc_high}$$
$$F_{IM3,high_block,high} = (2 * F_{edge,high_block,high}) - F_{alloc_low}$$

If modem is controlling upper channel block:

$$F_{IM3,low_block,low} = (2 * F_{edge,low_block,low}) - F_{alloc_high}$$
$$F_{IM3,low_block,high} = (2 * F_{edge,low_block,high}) - F_{alloc_low}$$
$$F_{IM3,high_block,low} = (2 * F_{alloc_low}) - F_{edge,low_block,high}$$
$$F_{IM3,high_block,high} = (2 * F_{alloc_high}) - F_{edge,low_block,low}$$





Worst Case Assumptions on other modem

Actual allocation on controlling modem

UE AMPR

For Type 2 modems, each modem must maintain independent Power Control function

- Semi-static configuration of other connection is known
- Allocation information and other Power Control parameters are not known
- For AMPR determination, each modem must assume worst case allocation on other connection
    - AMPR allowances will be specified per RAT (separately for LTE and NR)
    - If UEs require less AMPR than 3GPP allows, it will be critical that OEMs tune UEs to take only what is required.

Proposed AMPR IM3 Definition – $AMPR_{IM3,SEM}$

AMPR for IM3 Products within Spectral Emission Mask ($AMPR_{SEM}$)			
γ_{CG}[3]	$BW_{RB_alloc} > 2$	$1 > BW_{RB_alloc} \geq 2$	$BW_{RB_alloc} \leq 1$
≥ 50%	? dB	? dB	? dB
< 50%, ≥ 25%	? dB	? dB	? dB
< 25%	? dB	? dB	? dB

NOTE 1: AMPR allowances are relative to PC2 nominal power of 26 dBm
NOTE 2: BW_{RB_alloc} is defined as the transmission bandwidth, (N_{RB} * SCS * 12) in MHz
NOTE 3: From Power Sharing configuration for UEs not supporting dynamic power sharing (TS 36.213 and TS 38.213)

Precise threshold values in rows and column are TBD.

If modem is controlling lower channel block

If $F_{IM3,low_block,high} > SEM_{-13,low}$

$AMPR_{IM3,SEM,low} = AMPR_{SEM}$

Else

$AMPR_{IM3,SEM,low} = 0$

If modem is controlling upper channel block

If $F_{IM3,high_block,low} < SEM_{-13,high}$

$AMPR_{IM3,SEM,high} = AMPR_{SEM}$

Else

$AMPR_{IM3,SEM,high} = 0$

Proposed AMPR IM3 Definition – $AMPR_{IM3,spurious}$

Unfiltered AMPR for IM3 Products outside SEM ($AMPR_{spurious,\ unfiltered}$)			
γ_{CG}^3	$BW_{RB_alloc} > 2$	$1 > BW_{RB_alloc} \geq 2$	$BW_{RB_alloc} \leq 1$
$\geq 50\%$	? dB	? dB	? dB
$< 50\%, \geq 25\%$	? dB	? dB	? dB
$< 25\%$	? dB	? dB	? dB
NOTE 1: AMPR allowances are relative to PC2 nominal power of 26 dBm NOTE 2: BW_{RB_alloc} is defined as the transmission bandwidth, (N_{RB} * SCS * 12) in MHz NOTE 3: From Power Sharing configuration for UEs not supporting dynamic power sharing (TS 36.213 and TS 38.213)			

Precise threshold values in rows and column are TBD.

If Spurious_risk = TRUE

$$AMPR_{IM3,spurious} = AMPR_{spurious,\ unfiltered} - 0.5\ A_{filter,worst_case}$$

Else

$$AMPR_{IM3,spurious} = 0$$

Proposed AMPR Allowance

Each modem calculates AMPR separately, based on AMPR definition for it's own single-RAT transmission, and the worst case IM3 products with the other RAT.

$AMPR = MAX(AMPR_{IM3,SEM}, AMPR_{IM3,spurious}, AMPR_{single})$

Where

$AMPR_{single}$ is defined as the AMPR for a single carrier transmission, per Section 6.2.4 of TS 36.101 or in TS 38.101-1

Appendix 3

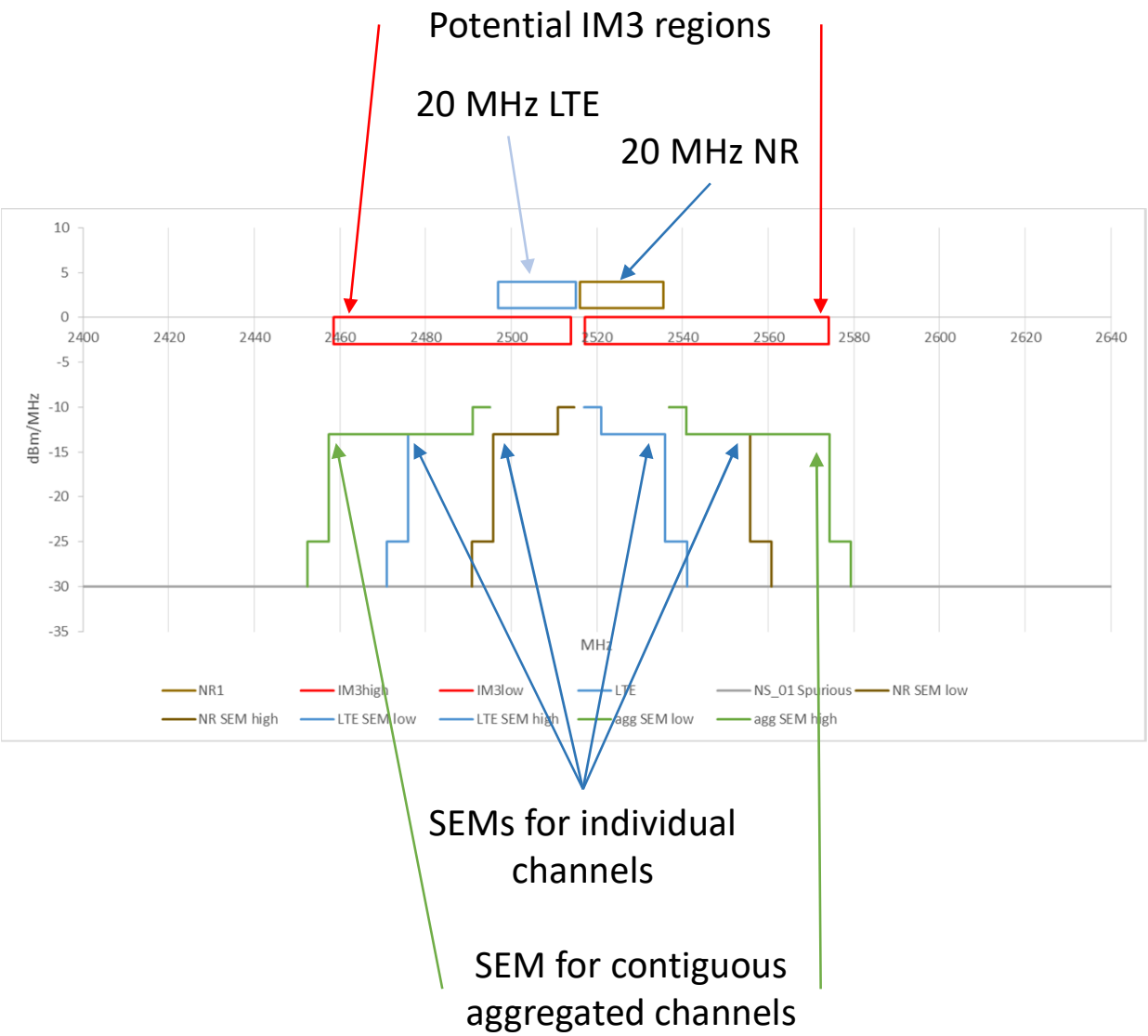
Configuration For Sprint Initial Deployment

Priority Assumptions:
30 kHz SCS
40, 60, 80, 100 MHz NR
20 MHz LTE
4 Variants of Channel Arrangements
Power Class 2
DFT-S-OFDM
2PA – Reverse IMD through antenna coupling

BCS0 for B41/n41 intra-band EN-DC

		E-UTRA – NR configuration / Bandwidth combination set				
		Component carriers in order of increasing carrier frequency				
Downlink EN-DC configuration	**Uplink EN-DC configurations**	**Channel bandwidths for LTE carrier [MHz]**	**Channel bandwidths NR for carrier [MHz]**	**Channel bandwidths for LTE carrier [MHz]**	**Maximum aggregated bandwidth [MHz]**	**Bandwidth combination set**
DC_(n)41C	DC_(n)41C	20	40, 60, 80,100		120	0
			40, 60, 80,100	20		
DC_(n)41D	DC_(n)41C, DC_41A_n41A	20+20	40, 60, 80,100		140	0
			40, 60, 80,100	20+20		
DC_(n)41E	DC_(n)41C, DC_41A_n41A	20+20+20	40, 60, 80,100		160	0
			40, 60, 80,100	20+20+20		
DC_41A_n41A	DC_41A_n41A	20	40, 60, 80,100		120	0
			40, 60, 80,100	20		
DC_41C_n41A	DC_41A_n41A	20+20	40, 60, 80,100		140	0
			40, 60, 80,100	20+20		
DC_41D_n41A	DC_41A_n41A	20+20+20	40, 60, 80,100		160	0
			40, 60, 80,100	20+20+20		

General Spectral Emission Mask



Currently, with LTE, 3GPP general spectral emission mask emission limit is -13 dBm/MHz out to offset equal to channel bandwidth.

- This region includes all potential IM3 products from internal allocations
- For <u>contiguous</u> UL CA, mask scales to aggregated bandwidth (i.e. 40 MHz for 2CA), thus <u>including all IM3 products between the carriers</u> as well.

FCC mask is defined by 26dB transmission bandwidth, which is implementation dependent and may be narrower than nominal channel bandwidth.

- In LTE, ~90% of nominal is used, so 18 MHz for a nominal 20 MHz channel
- Theoretically, this is more restrictive than 3GPP mask, but it has never been a practical problem.

Power Sharing Impact

Power Sharing distribution impacts the power of the IMD products

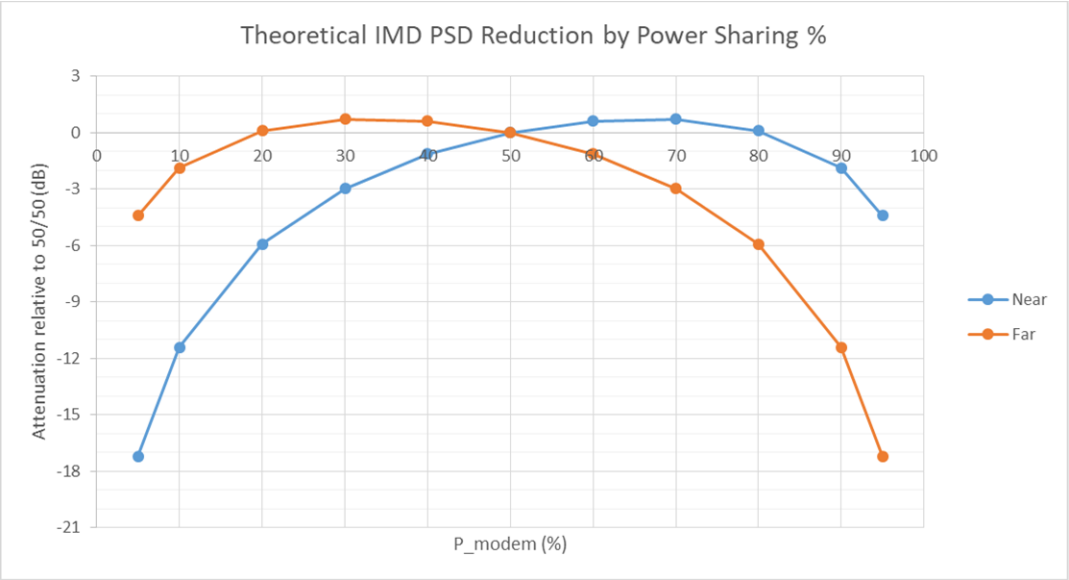
In theory,

- 1 dB change in the near signal PSD changes the PSD of the near IM3 product by 2 dB.
- 1dB change in the far signal PSD changes the PSD of the near IM3 by 1 dB.

Implication:

- With 70/30 split, IM3 on the lower power side is 3dB lower than 50/50
- With 80/20 split, IM3 on lower power side is 6 dB lower than 50/50

This could be incorporated into AMPR definition as a formula, or as a table. The table could use theoretical values, or separate sets of measurements.



LTE Contiguous CA with non-contiguous Allocations

$$MPR = CEIL\ \{ \min(M_A, M_{IM5}), 0.5\}$$

Where M_A is defined as follows for QPSK, 16 QAM and 64 QAM

$M_A =$	8.2	; $0 \le A < 0.025$
	9.2 - 40A	; $0.025 \le A < 0.05$
	8 – 16A	; $0.05 \le A < 0.25$
	4.0	; $0.25 \le A < 1$

Where M_A is defined FFS for 256 QAM

and M_{IM5} is defined as follows

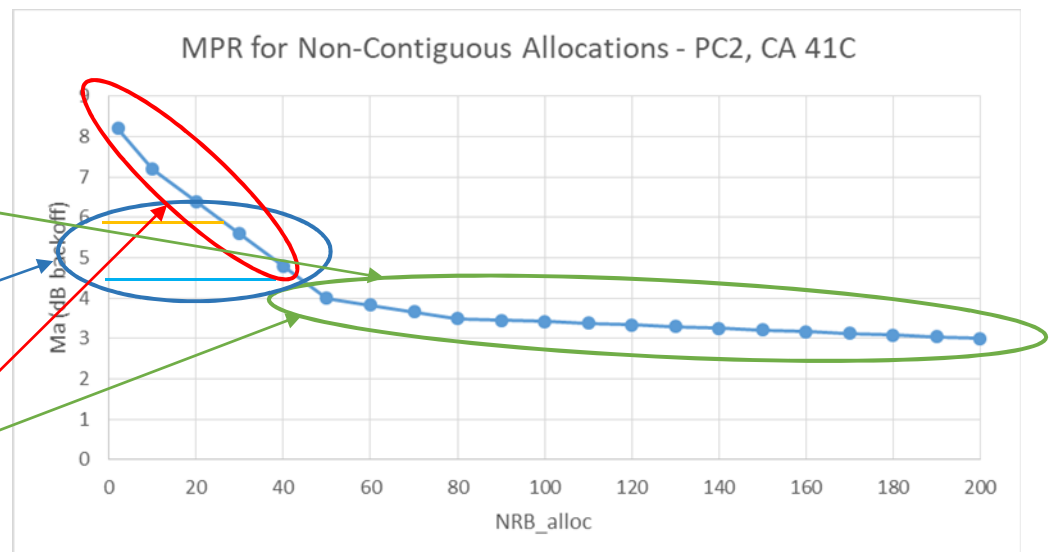
$M_{IM5} =$	5.0	; $\Delta_{IM5} < 1.5 * BW_{Channel_CA}$
	6.0	; $1.5 * BW_{Channel_CA} \le \Delta_{IM5} < BW_{Channel_CA}/2 + F_{OOB}$
	M_A	; $\Delta_{IM5} \ge BW_{Channel_CA}/2 + F_{OOB}$

Where

$$A = N_{RB_alloc} / N_{RB_agg.}$$

$$\Delta_{IM5} = \max(| F_{C_agg} - (3*F_{agg_alloc_low} - 2*F_{agg_alloc_high}) |, | F_{C_agg} - (3*F_{agg_alloc_high} - 2*F_{agg_alloc_low}) |)$$

$$F_{C_agg} = (F_{edge_high} + F_{edge_low})/2$$

Translation for 41C:

- If Allocations result in IM5s only in SEM region
  - If allocation is large (low PSD),
    - Use M_A shallow part of M_A curve (larger allocs give lower MPR)
  - Else (allocation is small (high PSD))
    - Use M_{IM5} formula, MPR = 4.5 dB (6.0dB for borderline)
- Else use full M_A curve
  - If allocation is large (low PSD),
    - Use M_A shallow part of MA curve (larger allocs give lower MPR)
  - Else (allocation is small (high PSD))
    - Use Steep part of M_A curve