3.5GHz Petition for Reconsideration

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Nokia Networks

Outline

- For Reconsideration
  - Rule Part 96.15(b)(4) CBSD Suspension and Relocation
  - Rule Part 96.41(b) CBSD Conducted and Emitted Power Limits
  - Rule Part 96.41(e) End User Device (EUD) Emission Limits
  - Rule Part 96.39 Elevation And Accuracy Requirements
  - Summary
- For Clarification
  - Other issues
  - Rule Part 96.41(e)(1/2) 3.5 GHz Emissions and Interference Limits

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CBSD Suspension and Relocation

Rule Part 96.15(b)(4) CBSD Suspension and Relocation

Alex Hirsbrunner, Steve Magee

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Problem Statement

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Rule Part 96.15(b)(4) CBSD Suspension and Relocation : Problem Statement

Commercial network management practice and system impacts

Nokia Networks Analysis indicates a 60 second incumbent detection to CBSD suspension/relocation duration will not be achievable in most large commercial networks.
Refer to Nokia analysis assumptions and summary on slide 6.

Rule Part 96.15(b)(4) states that: "Within 60 seconds after the ESC communicates that it has detected a signal from a federal system in a given area, the SAS must either confirm suspension of the CBSD's operation or its relocation to another unoccupied frequency."

In contrast to existing commercial network management practices, SAS suspension and relocation requests resulting from incumbent detection will have a large geographic scope, with the potential to impact the majority of CBSDs under an operator's Network Management System

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Rule Part 96.15(b)(4) CBSD Suspension and Relocation: Problem Statement

Commercial network management practice and system impacts

- Existing high priority configuration plan change functionality is expected to facilitate the rapid suspension and relocation of CBSDs

- The time required to complete configuration plan change is generally proportional to the number of cells requiring reconfiguration
- Existing commercial Network Management Systems support in excess of 10,000 cells and are engineered to meet a *de facto* high priority plan change duration requirement of 300 seconds, 5 times the currently specified duration for CBSD suspension and relocation
- High priority plan change does not include configuration plan changes that require the reset of a network element (such as a change in operating frequency)

- High priority plan configuration change functionality is not intended to facilitate the network wide suspension of transmission licensed networks, as additional delays are required to gracefully effect the relocation of UEs to an alternate network

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Considerations

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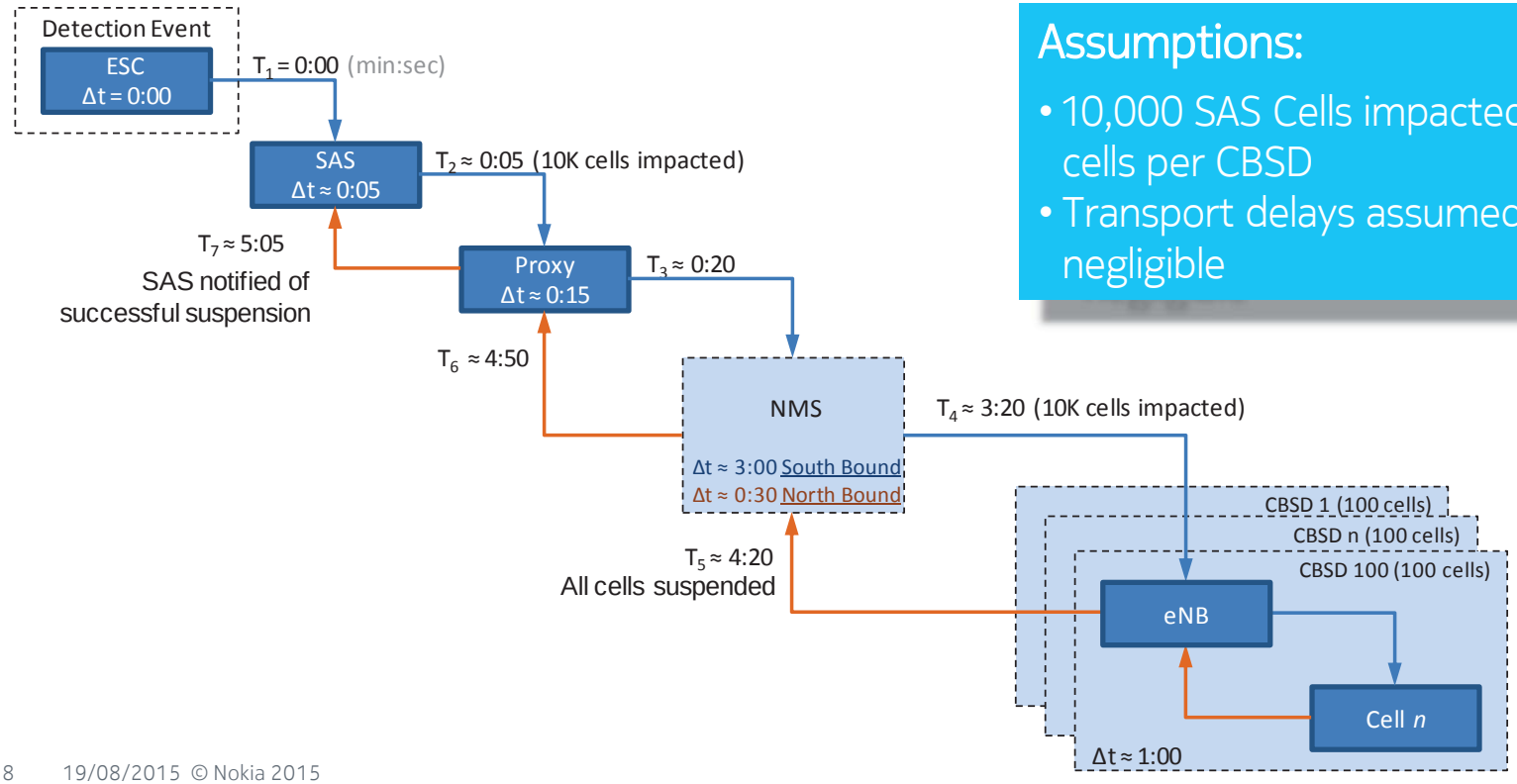
Rule Part 96.15(b)(4) CBSD Suspension and Relocation: Considerations

Suspension Processing Delay Analysis



All 100 CBSDs under NMS initiate cell suspension in parallel

Assumptions:

- 10,000 SAS Cells impacted, 100 cells per CBSD
- Transport delays assumed to be negligible

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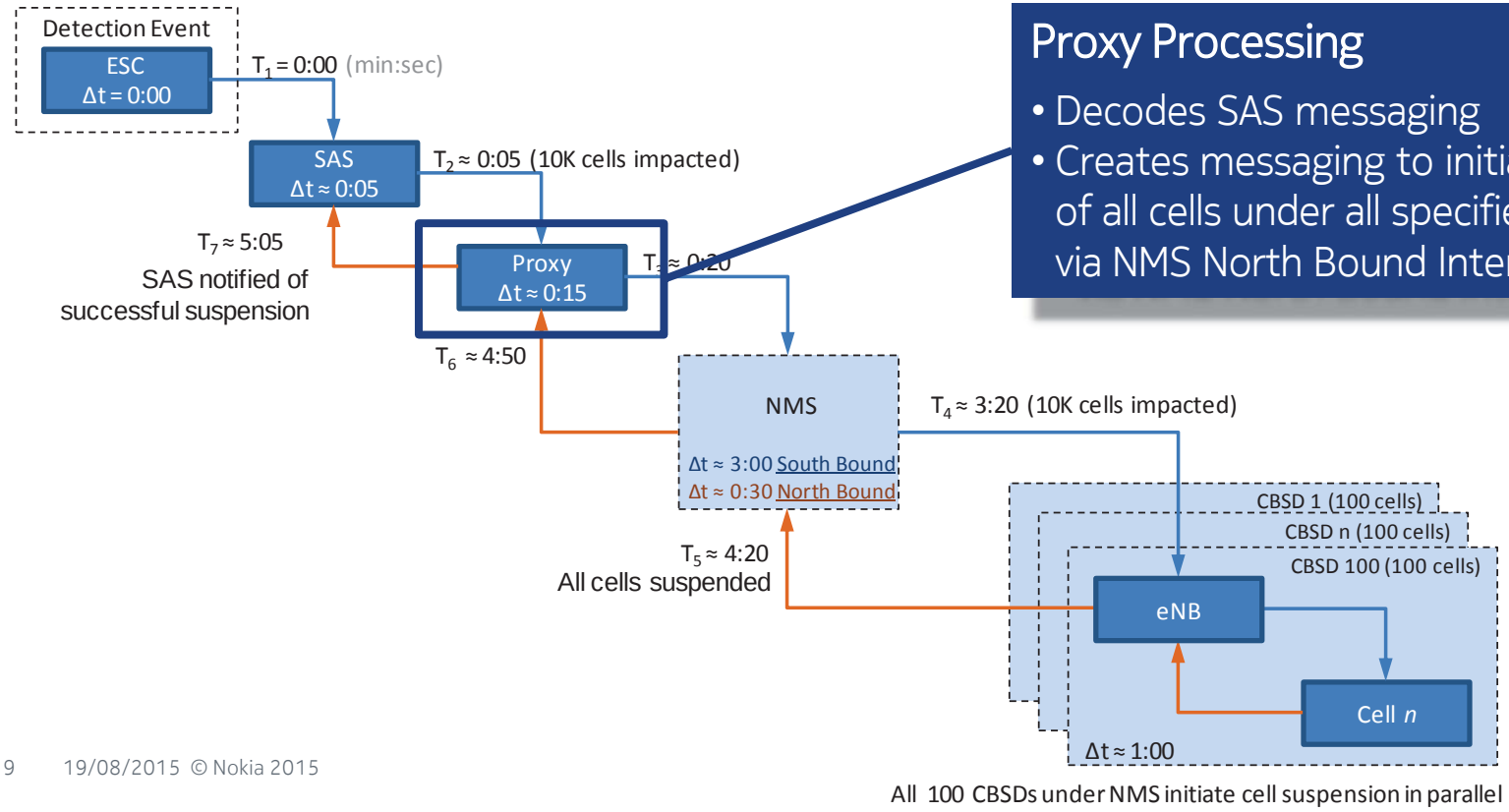
Rule Part 96.15(b)(4) CBSD Suspension and Relocation: Considerations

Suspension Processing Delay Analysis



Proxy Processing

- Decodes SAS messaging
- Creates messaging to initiate Lock of all cells under all specified CBSDs via NMS North Bound Interface

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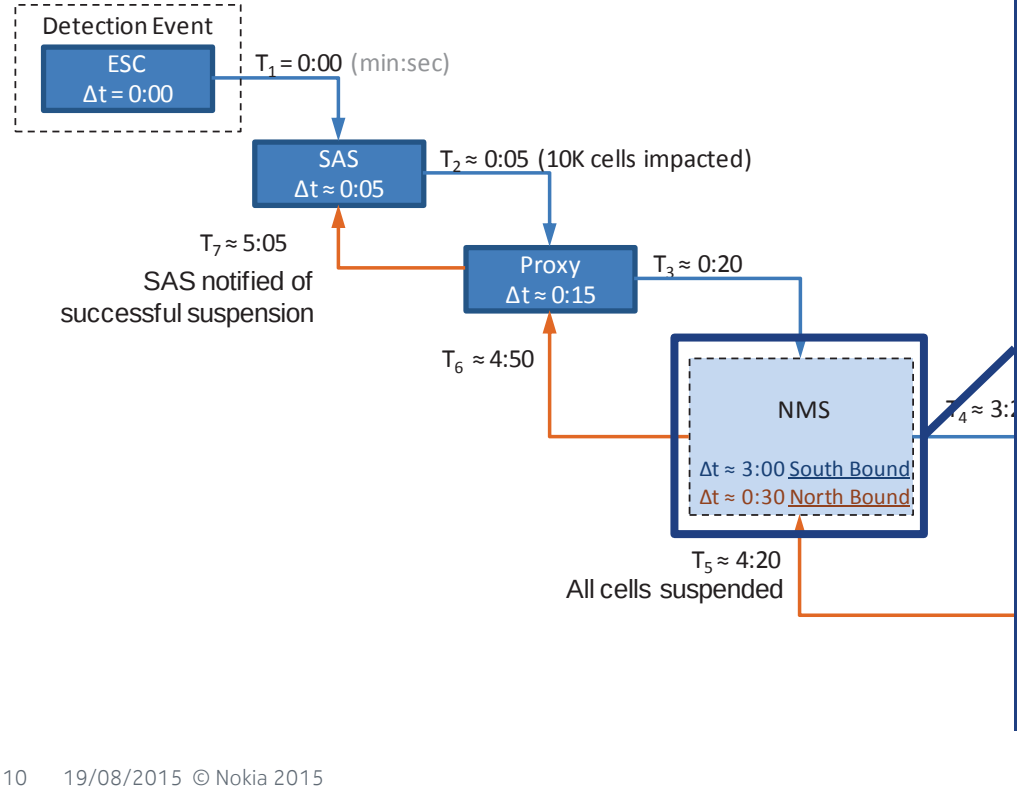
Rule Part 96.15(b)(4) CBSD Suspension and Relocation: Considerations

Suspension Processing Delay Analysis



Network Management System (NMS) Processing

- Creates delta CBSD plan files for impacted CBSDs
- Performs logical validation on all impacted configurations
- Downloads plan files to subtending mediators
- Mediators transform configuration received from NMS into individual CBSD plan files
- Downloads plan files and sends activation messages to subtending CBSDs

Δt ≈ 1:00

All 100 CBSDs under NMS initiate cell suspension in parallel

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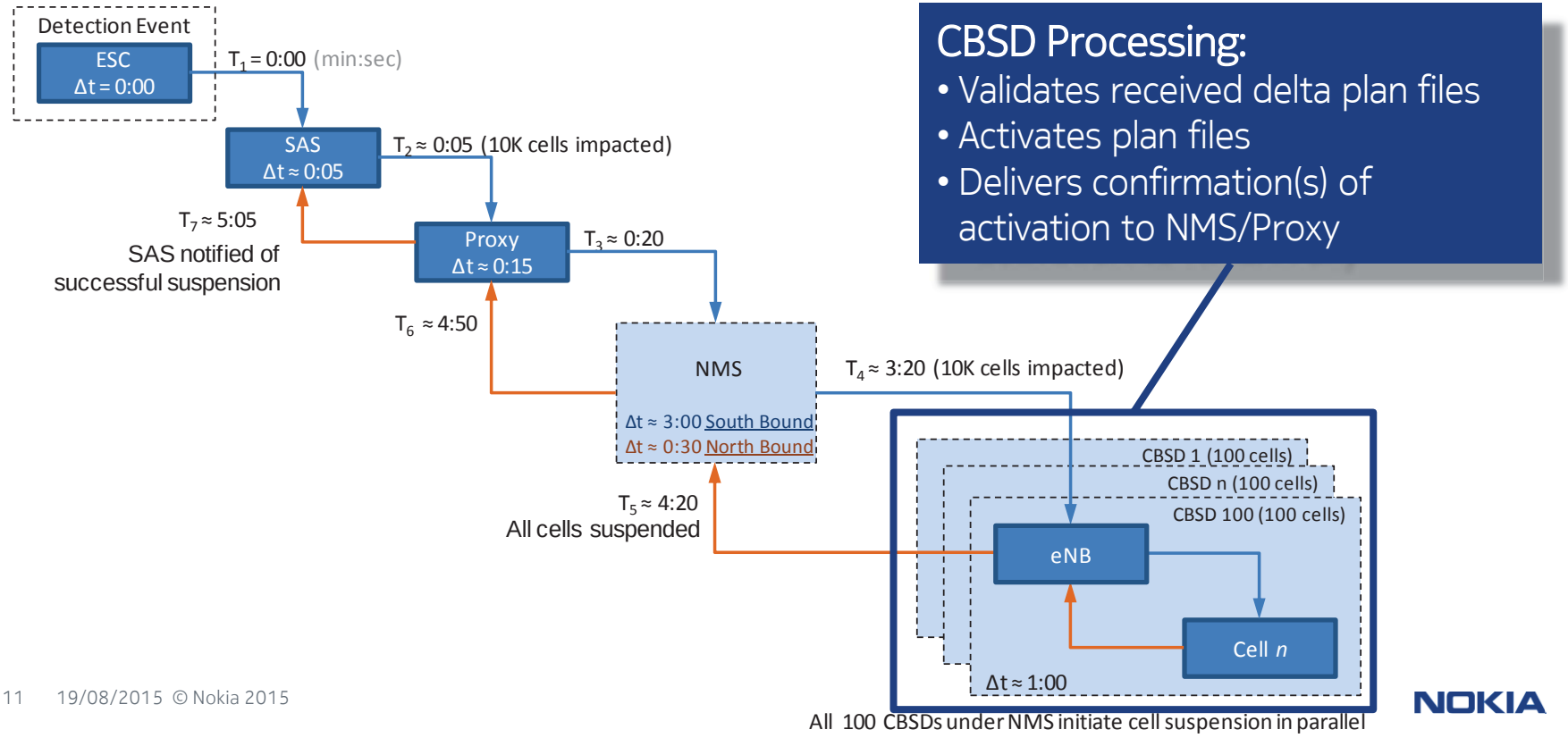
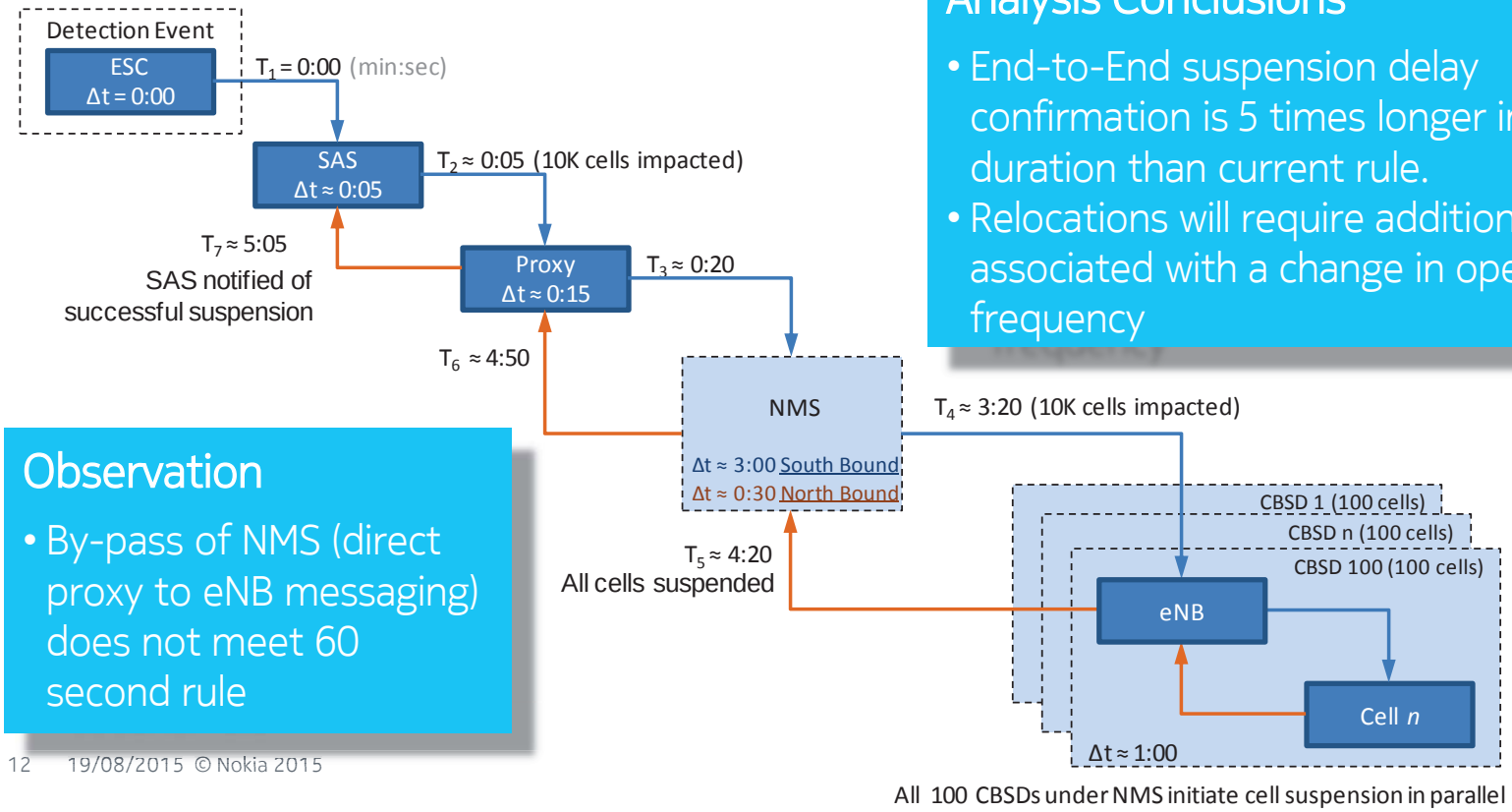
Rule Part 96.15(b)(4) CBSD Suspension and Relocation: Considerations

Suspension Processing Delay Analysis



Rule Part 96.15(b)(4) CBSD Suspension and Relocation: Considerations

Suspension Processing Delay Analysis



Analysis Conclusions

- End-to-End suspension delay confirmation is 5 times longer in duration than current rule.
- Relocations will require additional delay associated with a change in operating frequency

Observation

- By-pass of NMS (direct proxy to eNB messaging) does not meet 60 second rule

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Rule Part 96.15(b)(4) CBSD Suspension and Relocation : Proposal

Commercial network management practice and system impacts

Nokia Networks recommends that Rule Part 96.15(b)(4) be relaxed to 600 seconds to:

- Accommodate existing commercial network operability architectures and network deployment capabilities associated with suspension and relocation
- Accommodate existing network device software and hardware architectures that require a reset in order to make a change in operating frequency
- Allow the graceful relocation of subscriber devices to licensed networks

*Rule Part 96.15(b)(4) is recommended to be restated as follows: "Within **600** seconds after the ESC communicates that it has detected a signal from a federal system in a given area, the SAS must either confirm suspension of the CBSD's operation or its relocation to another unoccupied frequency."*

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CBSD Transmit Power

Rule Part 96.41(b) Conducted and Emitted Power Limits

Dennis Gilliland

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Rule Part 96.41(b) Conducted and Emitted Power Limits: Problem Statement

Current FCC Definition of CBSD Power

Device	Geographic Area	Maximum Conducted Output Power (dBm/10 megahertz)**	Maximum EIRP (dBm/10 megahertz)	Maximum Conducted PSD (dBm/MHz)
Category A CBSD	All	24	30	14
Category B CBSD*	Non-Rural	24	40	14
Category B CBSD*	Rural	30	47	20

* Category B CBSDs will only be authorized for use after an ESC is approved and commercially deployed consistent with sections 96.15 and 96.67.

- Current Rules assume relatively low conducted power with high antenna gain
- Will require unique deployment considerations compared to other small cell solutions
- Lack of alignment with other uses of unlicensed spectrum

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Considerations

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Rule Part 96.41(b) Conducted and Emitted Power Limits

Consideration of Existing Small Cell Approaches

- Typical small cell solutions provide higher conducted power and lower antenna gain
  - Outdoor Omni Coverage
    - 34 dBm / 10 MHz conducted per Tx
    - 36 dBm EIRP
    - PSD = 27 dBm / MHz
  - Outdoor Directional Coverage
    - 34 dBm / 10 MHz conducted per Tx
    - 40 dBm EIRP
    - PSD = 27 dBm / MHz
  - Indoor Omni Coverage
    - 21 dBm / 10 MHz conducted per Tx
    - 24 dBm EIRP
    - PSD = 24 dBm / MHz

- SAS has ultimate control over conducted power limitations to manage interference

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Rule Part 96.41(b) Conducted and Emitted Power Limits

Proposed Modification

Device	Geographic Area	Maximum EIRP (dBm/10 megahertz)
Category A CBSD	All	36
Category B CBSD	Non-Rural	49
Category B CBSD	Rural	56

Preferred Modifications

Device	Geographic Area	Maximum EIRP (dBm/10 megahertz)
Category A CBSD	All	30
Category B CBSD	Non-Rural	40
Category B CBSD	Rural	47

Minimal Requested Modifications

- Preferred Modifications
  - Increase Category A by 6 dB
    - Align with other uses of unlicensed spectrum
  - Increase Category B by 9 dB
    - Align with other uses of unlicensed spectrum and account for Tx Diversity approaches on outdoor deployments
  - Additional “Minimal” modifications below
- Minimal Requested Modifications
  - Specify Only EIRP Limits
    - EIRP Limits can remain unchanged from currently defined values
    - Allocation between Conducted Power and Antenna Gain left to product implementation
  - Necessary reduction of power under control of SAS

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End User Device (EUD) Emissions

Rule Part 96.41(e) End User Device Emissions

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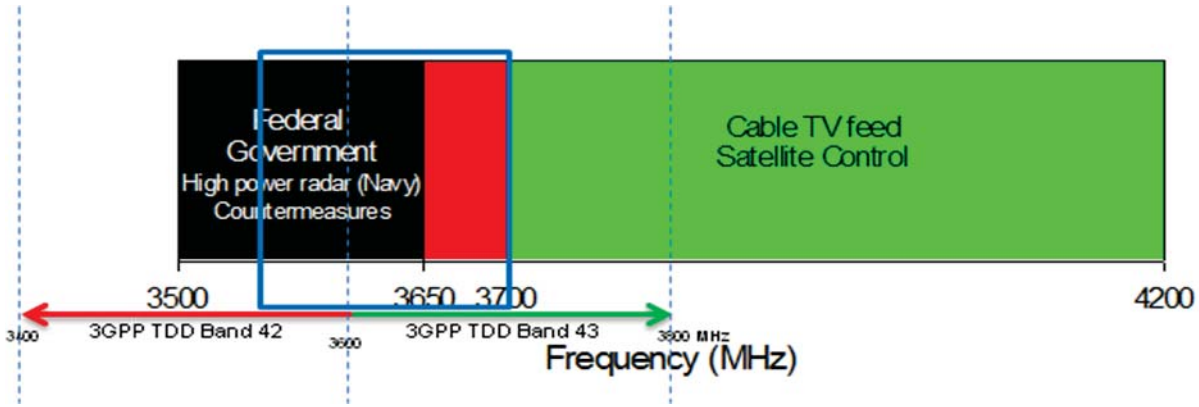
Studying use of 3GPP TD-LTE bands 42 & 43



Band 42: 3400-3600MHz
Band 43: 3600-3800MHz

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Emission Limits for EUDs (Rule Part 96.41(e))

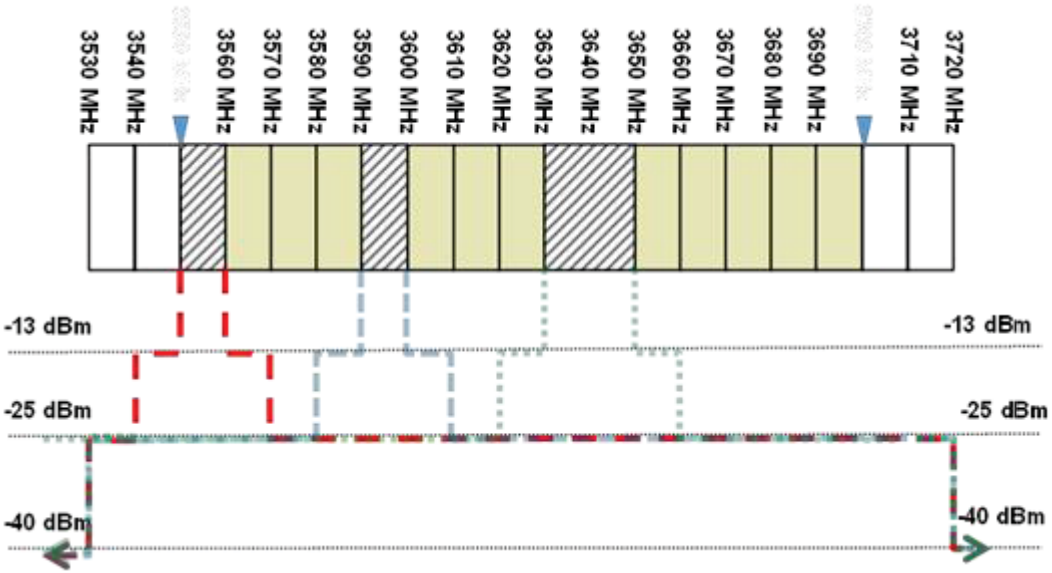
Part 96.41(e) *3.5 GHz Emissions and Interference Limits:*

(1) *General protection levels.* Except as otherwise specified below, for channel and frequency assignments made by the SAS to CBSDs, the power of any emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed:

•-13 dBm/MHz from 0 to 10 MHz from the assigned channel edge

•-25 dBm/MHz beyond 10 MHz from the assigned channel edge down to 3530 MHz and up to 3720 MHz

•-40 dBm/MHz below 3530 MHz and above 3720 MHz



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3GPP General LTE User Equipment (UE) spectrum emission mask

Spectrum emission limit (dBm)/ Channel bandwidth							
Δf_{OOB} (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz
± 1-2.5	-10	-10	-10	-10	-10	-10	1 MHz
± 2.5-2.8	-25	-10	-10	-10	-10	-10	1 MHz
± 2.8-5		-10	-10	-10	-10	-10	1 MHz
± 5-6		-25	-13	-13	-13	-13	1 MHz
± 6-10			-25	-13	-13	-13	1 MHz
± 10-15				-25	-13	-13	1 MHz
± 15-20					-25	-13	1 MHz
± 20-25						-25	1 MHz

-13dBm/(1% of channel bandwidth),
more relaxed than FCC's 3.5GHz limit of -13dBm/1MHz

Part 96.41(e)(3)(i): (3) *Measurement procedure*:
(i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's authorized frequency channel, a resolution bandwidth of no less than one percent of the fundamental emission bandwidth may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full reference bandwidth (*i.e.*, 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

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3GPP Additional spurious emissions for existing NS_22

When "NS 22" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in following table.

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	MBW
	5, 10, 15, 20 MHz	
3400 ≤ f ≤ 3800	-23 (NOTE 1, NOTE 3)	5 MHz
	-40 (NOTE 2)	1 MHz

NOTE 1: This requirement applies within an offset between 5 MHz and 25 MHz from the lower and from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.

NOTE 2: This requirement applies from 3400 MHz to 25 MHz below the lower E-UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge to 3800 MHz.

NOTE 3: This emission limit might imply risk of harmful interference to UE(s) operating in the protected operating band

•3GPP NS_22 requirement which is intended for band 42 and 43 coexistence cases and also can be used when networks are not synchronized inside the bands 42 and 43.

Additional-Maximum Power Reduction (A-MPR) for NS_22

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C	Region D
5	No A-MPR is needed for 5 MHz channel bandwidth				
10	RB_{start}	0-13	0-17	≤ 6	≥12
	L_{CRB} [RBs]	> 36	33-36	≤ 32	≤ 32
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥44
	A-MPR [dB]	≤ 4	≤ 3	≤ 3	≤ 3
15	RB_{start}	0-24	0-38	≤ 14	≥ 23
	L_{CRB} [RBs]	> 50	37-50	≤ 36	≤ 36
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥59
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3
20	RB_{start}	0-35	0-51	≤ 21	≥ 31
	L_{CRB} [RBs]	> 64	49-64	≤ 48	≤ 48
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥79
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3

NOTE 1; RB_{start} indicates the lowest RB index of transmitted resource blocks
NOTE 2; L_{CRB} is the length of a contiguous resource block allocation
NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.
NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

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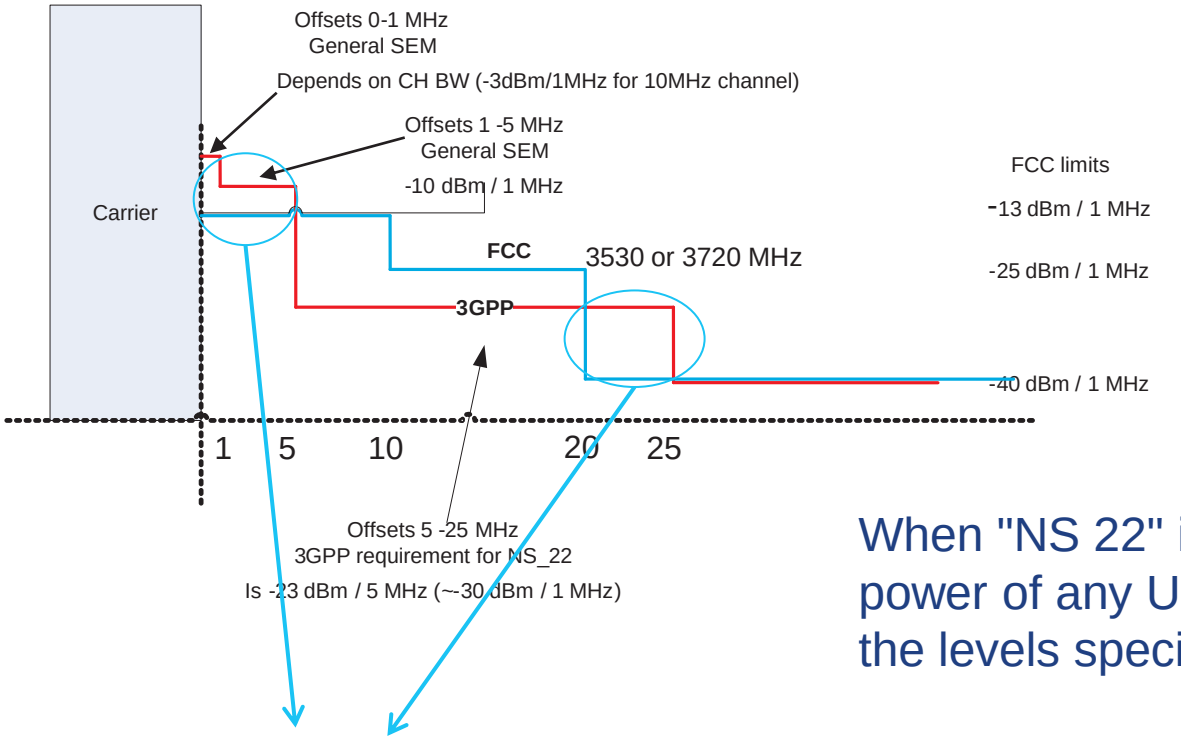
Comparison of FCC Emission requirement to 3GPP requirement



When "NS 22" is indicated in the cell, the power of any UE emission shall not exceed the levels specified by the red curve

FCC mask is tighter than 3GPP mask for: 0 - 5 MHz offset and below 3530/above 3720MHz.

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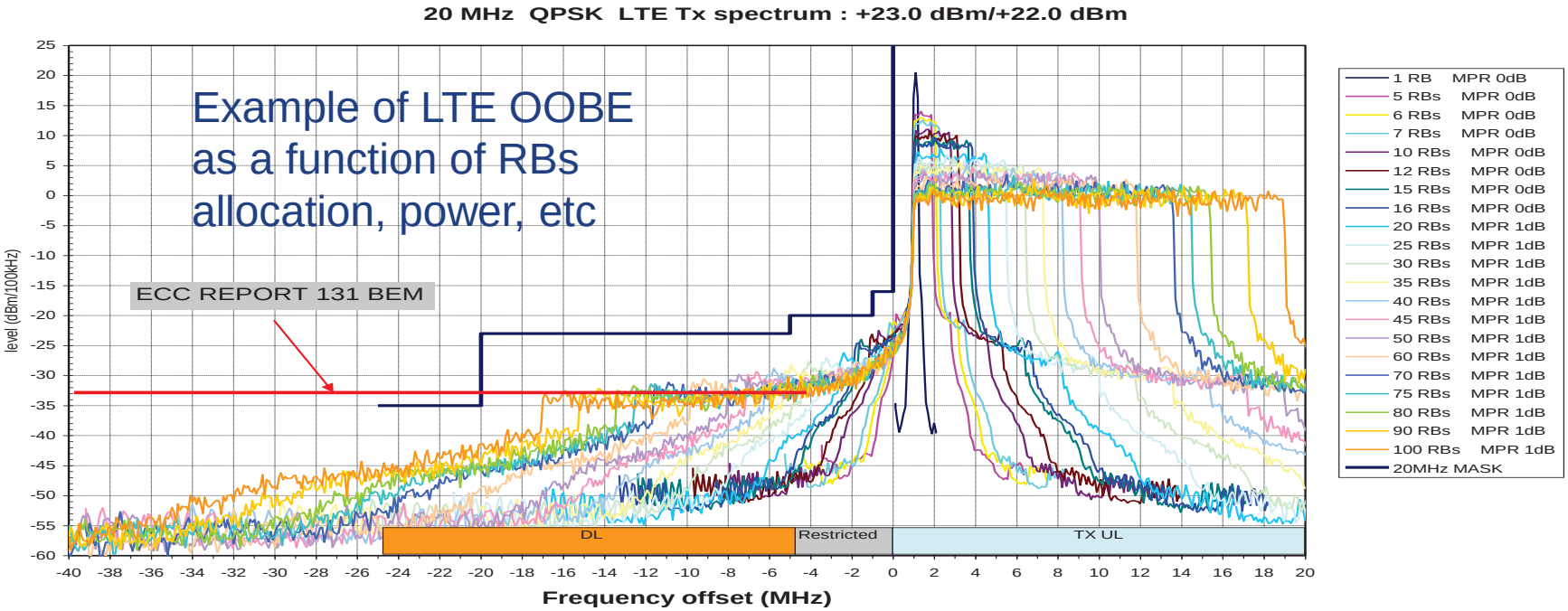
Solution: Leverage flexibility of LTE!!!



- Out-Of-Band-Emission (OOBE) dependent on the number, location and power of the Resource Blocks (RBs) transmitted
- Restrict RB configuration (RB allocation, location and Tx power) to further reduce OOBE
  - Impact on system throughput
  - Add more intelligence to scheduler
- Minimize impact of PUCCH at edge of channel

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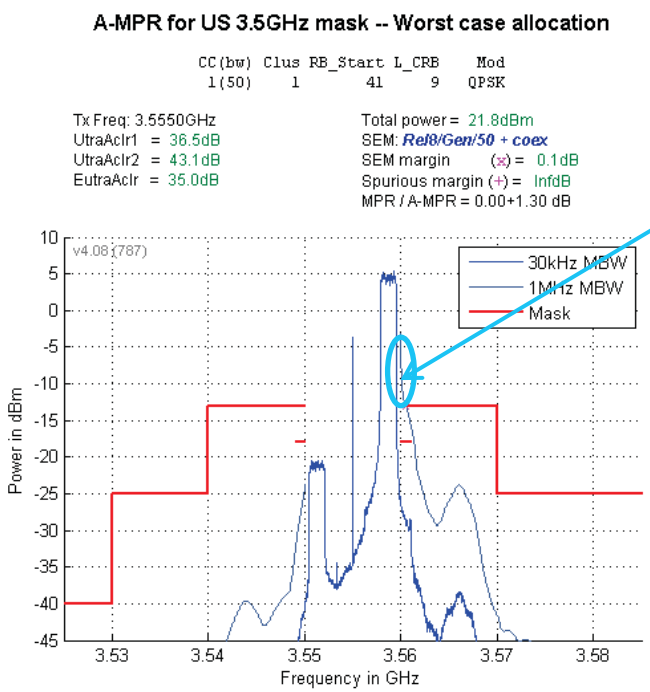
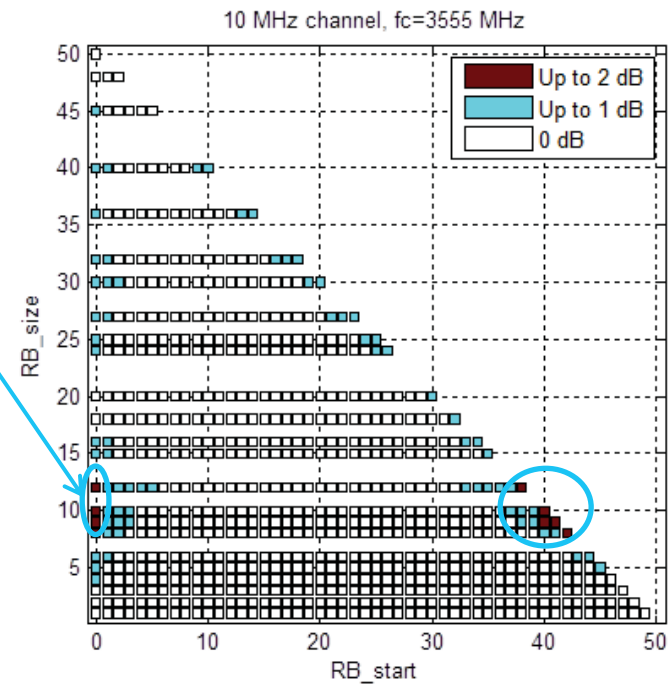
Additional-Maximum Power Reduction (A-MPR)

A-MPR simulations for 10 MHz channel for the lowest position i.e. Fcenter = 3555 MHz

When allocation size is 8-12 RB's and is located at the edge of the transmitted channel, the -13 dBm/1MHz requirement which starts immediately outside the transmitted channel requires A-MPR.





New Network Signaled value "NS_24“ Needed

When "NS_24" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in following Tables.

	Spectrum emission limit (dBm)/ Channel bandwidth				
Δf_{OOB} (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
± 0 - 10	-13	-13	-13	-13	1 MHz

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)				Measurement bandwidth
	5 MHz	10 MHz	15 MHz	20 MHz	
3550 ≤ f ≤ 3700	-25	-25	-25	-25	1 MHz
f ≤ 3550 or 3700 ≤ f	-40	-40	-40	-40	1 MHz

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New A-MPR Table for NS_24

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C	Region D
5	RB_{start}				
	L_{CRB} [RBs]				
	RBstart + LCRB [RBs]				
	A-MPR [dB]				
10	RB_{start}	0			
	L_{CRB} [RBs]	4 - 45			
	RBstart + LCRB [RBs]				
	A-MPR [dB]	≤ 2			
15	RB_{start}				
	L_{CRB} [RBs]				
	RBstart + LCRB [RBs]				
	A-MPR [dB]				
20	RB_{start}				
	L_{CRB} [RBs]				
	RBstart + LCRB [RBs]				
	A-MPR [dB]				

NOTE 1; RB_{start} indicates the lowest RB index of transmitted resource blocks
NOTE 2; L_{CRB} is the length of a contiguous resource block allocation
NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.
NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

To be completed for 5, 10, 15, 20MHz channels

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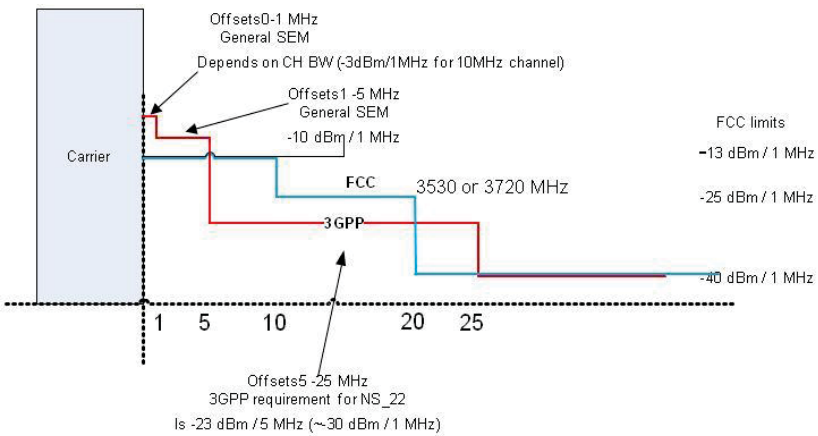
Summary

- FCC mask is tighter than 3GPP UE mask for 0 - 5 MHz offset from channel and below 3520/above 3720.
- Recommend FCC to align with 3GPP bands 42 & 43 specs:
  - for 0-5MHz offset, especially for first 1MHz offset (which should be -13dBm/(1% channel bandwidth) instead of -13dBm/1MHz)
  - also apply -40dBm/1MHz at 25MHz from band edge (instead of 20MHz), i.e., below 3525 MHz (instead of 3530MHz) and above 3725 MHz (instead of 3720MHz).
- Otherwise, still feasible for 3GPP bands 42 & 43 to meet current FCC EUD emission with a new Network Signaled value "NS_24" and Additional-Maximum Power Reduction (A-MPR).



Spectrum emission limit (dBm)/ Channel bandwidth							
Δf_{OOB} (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz
± 1-2.5	-10	-10	-10	-10	-10	-10	1 MHz
± 2.5-2.8	-25	-10	-10	-10	-10	-10	1 MHz
± 2.8-5		-10	-10	-10	-10	-10	1 MHz
± 5-6		-25	-13	-13	-13	-13	1 MHz
± 6-10			-25	-13	-13	-13	1 MHz
± 10-15				-25	-13	-13	1 MHz
± 15-20					-25	-13	1 MHz
± 20-25						-25	1 MHz

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Elevation And Accuracy Requirements

Rule Part 96.39 Elevation And Accuracy Requirements

Larry Svec

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Location Accuracy Requirements Statements

Rule Part 96.39:

"All CBSDs must be able to determine their geographic coordinates (referenced to the North American Datum of 1983 (NAD83)) to an accuracy of ±50 meters horizontal and ±3 meters of elevation."

SAS SERVER REQUIREMENTS:

- SAS server requires location information of an installed AP so it can determine if the AP can use spectrum in the 3.5GHz band at that particular location.

ACCESS POINT REQUIREMENTS:

- Due to the anticipated high quantity of APs that will be deployed, it is desirable to have the AP installation as "Plug and Play" as possible. It is desirable to be able to have "IT skill level" staff install the APs.

- At install time, the AP should report to the SAS server where it is located.
  - Outdoors the AP can usually determine its location with a high degree of accuracy by using GPS.
  - Indoors however, GPS typically does not work well, or at all.

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Location Accuracy Problem Statements

- RULE PART 96.39 STATES:
  "*All CBSDs must be able to determine their geographic coordinates (referenced to the North American Datum of 1983 (NAD83)) to an accuracy of ±50 meters horizontal and ±3 meters of elevation.*"

- Two problems arise:

  - OUTDOOR Installations:
    The elevation requirement of 3 meters is roughly 10X stricter than what is readily attainable using GPS

  - INDOOR Installations:
    GPS typically does not work well, or at all.
    Therefore there is no "logistically straightforward" way to determine location to ±*3 meters of elevation.*

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Supporting Discussion: OUTDOOR INSTALLATIONS

- Current text in RULE PART 96.39 STATES: *"±3 meters of elevation"*
- GPS Accuracy as stated by: US Government Position Accuracy standard is <= 15m 95% Vertical Error for Average conditions with an allowance of <= 37m 95% Vertical Error for worst site conditions as stated in the Global Positioning System Standard Positioning Service Performance Standard.

3.8.3 SPS Position/Time Service Accuracy Standards

The commitments for maintaining PDOP (Table 3.8-1) and SPS SIS URE accuracy (Table 3.4-1) result in support for position service availability standards as presented in Table 3.8-3.

Table 3.8-3. SPS Position/Time Accuracy Standards

Position/Time Accuracy Standard	Conditions and Constraints
Global Average Position Domain Accuracy • ≤ 9 m 95% Horizontal Error • ≤ 15 m 95% Vertical Error	• Defined for a position/time solution meeting the representative user conditions • Standard based on a measurement interval of 24 hours averaged over all points in the service volume.
Worst Site Position Domain Accuracy • ≤ 17 m 95% Horizontal Error • ≤ 37 m 95% Vertical Error	• Defined for a position/time solution meeting the representative user conditions • Standard based on a measurement interval of 24 hours for any point in the service volume.
Time Transfer Domain Accuracy • ≤ 40 nsec time transfer error 95% of time (SIS only)	• Defined for a time transfer solution meeting the representative user conditions • Standard based on a measurement interval of 24 hours averaged over all points in the service volume.

Source: Table 3.8-3
http://www.gps.gov/technical/ps/2008-SPS-performance-standard.pdf

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Supporting Discussion: INDOOR INSTALLATIONS

- Current text in RULE PART 96.39 STATES: *"±3 meters of elevation"*
- GPS does not work well or not at all indoors
- Because of above issue,

  Although GPS is a preferred SYNC solution for OUTDOOR deployments,

  INDOOR AP deployments s use methods other than GPS for obtaining frequency, time, and phase sync.

  - None of these methods can provide location (like GPS does). The following are these 3 techniques:
  - IEEE1588: Timing over Packet – provides time/phase to sub 1 microsecond accuracy, frequency 50PPB
  - Synchronous Ethernet: Frequency only for 50PPB
  - Network Listen Mode (Radio Interface Based Sync): time/phase to 1 microsecond, frequency 50PPB

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NOKIA RECOMMENDATION:

THE COMMISSION SHOULD REVISE ITS ELEVATION ACCURACY REQUIREMENT (Rule Part 96.39)

Establish two location accuracy requirements:

1. **OUTDOOR** INSTALLATION REQUIREMENTS:
   a. Outdoor installations use GPS for installation location.
   b. Location requirements should be aligned to the US Government Position Accuracy standard.

2. **INDOOR** INSTALLATION REQUIREMENTS:
   a. Indoor installations, the GPS location of the building for horizontal location.
   b. Remove the elevation reporting requirement.

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Summary

Summary of Nokia's Recommendations

- In Part 96.15(b)(4), the suspension and relocation durations should be relaxed from 60 seconds to 10 minutes.
- In Part 96.41(b), the total transmit power of the Citizens Broadband Radio Service Devices (CBSDs) should be stated simply as maximum Equivalent Isotropically Radiated Power (EIRP) and increased by 6dB for Category A and 9dB for Category B CBSDs respectively.
- In Part 96.41(e), the Commission should specify emission limits for End User Devices that are compliant with 3GPP specifications to enable the use of existing 3.5GHz Bands 42 & 43, as is, in the United States.
- In Part 96.39, the Commission should set two Vertical Axis location accuracy requirements:
  - One requirement for outdoor installations aligned to the US Government Position Accuracy standard which is <= 15m 95% Vertical Error for Average conditions with an allowance of <= 37m 95% Vertical Error for worst site conditions as stated in the Global Positioning System Standard Positioning Service Performance Standard.
  - One requirement for indoor installations which would be the GPS location of the building for the horizontal location and removing the elevation reporting requirement, allowing for instance, the SAS system to estimate CBSD elevation.

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For Clarification

Other issues

- Timeline for reconsideration?
- PAL auction?
- GAA timeline?
- Will GAA users be required to meet all FCC rules that apply to providing a telecom service, for example?
  - 911 location accuracy,
  - Outage reporting,
  - etc
- If a GAA network is composed of a large provider, with many “tenants” holding 3.5GHz radios in their geographical area, who is beholden to these FCC rules?
  - The big provider is fully responsible?
  - The tenants who emit RF? (the radio holders)?
  - If GAA interfere with other GAA players, who do you go to for action or no recourse?
  - Who has the responsibility for detection and correction, if any?
  - etc

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CBSD Emissions

Rule Part 96.41(e)(1/2) 3.5 GHz Emissions and Interference Limits

Dennis Gilliland

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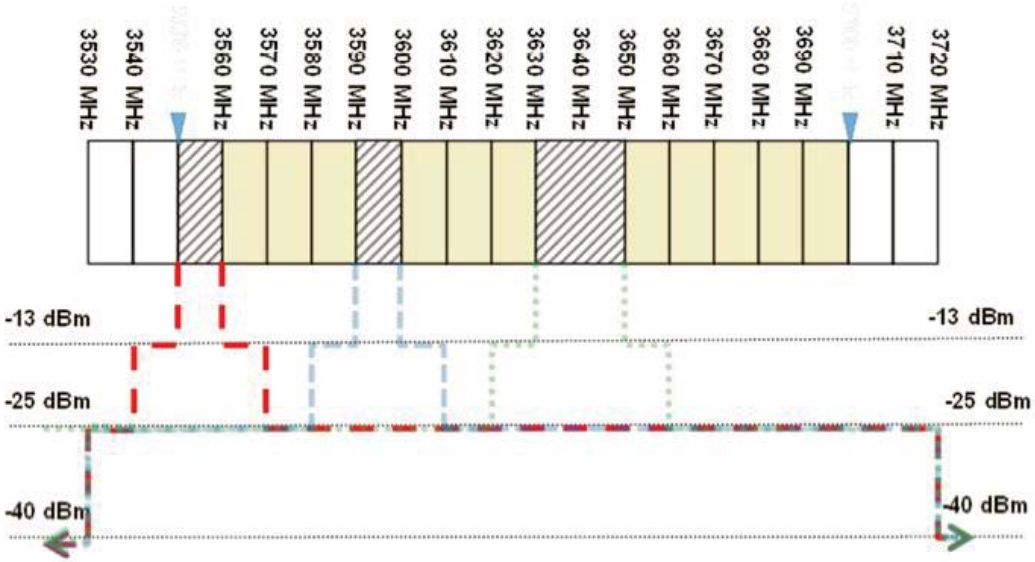
FCC Defined Emissions vs. 3GPP Specifications

Rule Part 96.41(e)(1/2) 3.5 GHz Emissions and Interference Limits: Problem Statement

- *Assess FCC Requirement alignment to existing 3GPP specifications*



- *-13 dBm/MHz from 0 to 10 megahertz from the SAS assigned channel edge*
- *-25 dBm/MHz beyond 10 megahertz from the SAS assigned channel edge down to 3530 MHz and up to 3720 MHz*
- *-40 dBm/MHz below 3530 MHz and above 3720 MHz*

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Considerations

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FCC Defined Emissions vs. 3GPP Specifications

Considerations

- *-13 dBm/MHz from 0 to 10 megahertz from the SAS assigned channel edge*
  - 3GPP ACLR specification (36.104 Section 6.6.2.1) is currently more stringent:
    - Existing ACLR requirements satisfy this limit. Taking into account the worst case scenario (30dBm BS), the limit will be -15dBm/10MHz -> -25dBm/MHz. For LA BS, this limit is also satisfied with UEM mask (see Table 6.6.3.2A-3 in 36.104).
  - **No change to 3GPP necessary for FCC Compliance**

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FCC Defined Emissions vs. 3GPP Specifications
Considerations

- *-25 dBm/MHz beyond 10 megahertz from the SAS assigned channel edge down to 3530 MHz and up to 3720 MHz*
  - 3GPP Operating Band Unwanted Emissions spec (36.104 Table 6.6.3.2A-3) Local area (aligns with CBSD Category A / B – non rural) requirement is more stringent.
  - 3GPP Operating Band Unwanted Emissions spec (36.104 Table 6.6.3.2C-6) Medium area (CBSD Category B – rural) requirement is less stringent.
    - While existing ACLR requirements apply up to the second adjacent channel only, it can be assumed this limit is satisfied as emissions will be lower with larger frequency separation to the channel edge. Taking into account the worst case scenario (30dBm BS), the limit in the second adjacent channel can be estimated as -15dBm/10MHz (-25dBm/1MHz). For LA BS, this limit is satisfied with UEM mask (see Table 6.6.3.2A-3 in 36.104).
  - **No change to 3GPP necessary for FCC Compliance**

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FCC Defined Emissions vs. 3GPP Specifications

Considerations

- *-40 dBm/MHz below 3530 MHz and above 3720 MHz*
  - Existing 3GPP requirements do not satisfy this requirement. However, above limit can be added as an additional regional requirement in Clause 6.6.4.3, 36.104.
  - **Update required for CBRS band to be FCC compliant**

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Proposal

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FCC Defined Emissions vs. 3GPP Specifications

Summary

- In this document it was shown two out of three FCC limits are satisfied with existing 3GPP requirements. If RAN4 concludes Bands 42&43 can be used in US, -40dBm / MHz requirement can be added as an additional regional requirement in Clause 6.6.4.3, 36.104.

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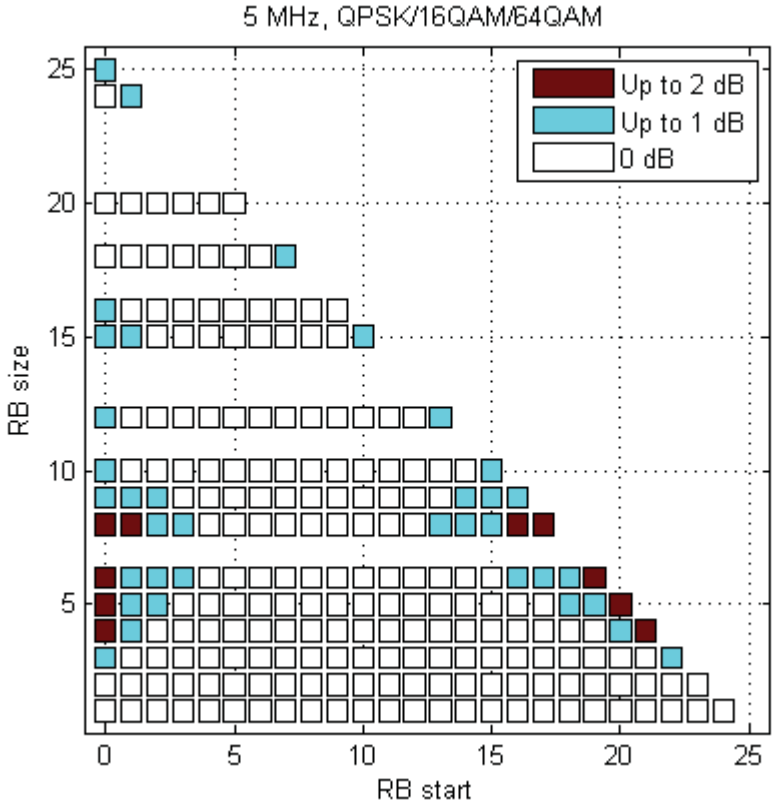
Thank You

Back-Up

Additional-Maximum Power Reduction (A-MPR)

A-MPR simulations for 5 MHz channel



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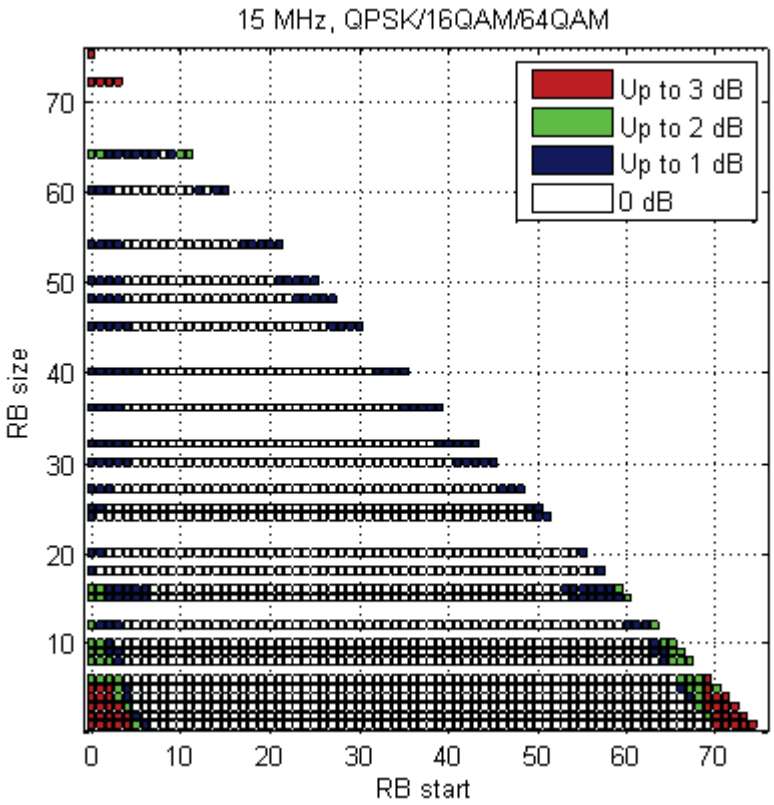
Additional-Maximum Power Reduction (A-MPR)

A-MPR simulations for 15 MHz channel



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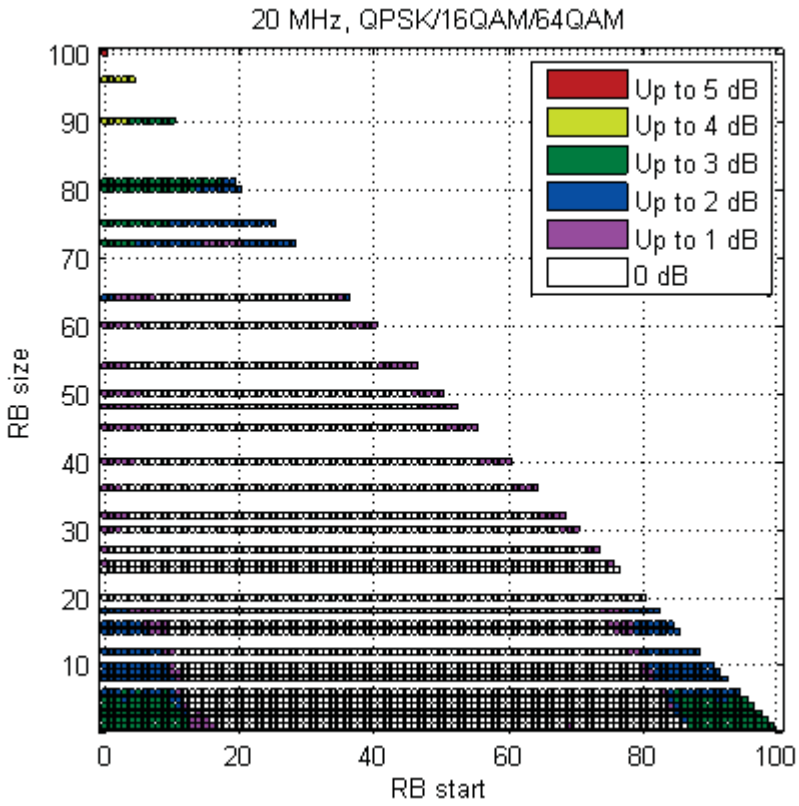
Additional-Maximum Power Reduction (A-MPR)

A-MPR simulations for 20 MHz channel



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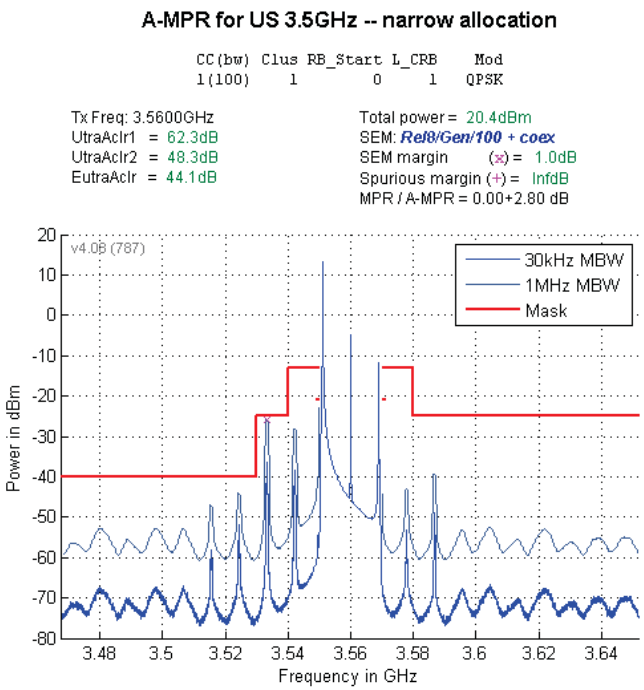
Additional-Maximum Power Reduction (A-MPR)

A-MPR simulations for 20 MHz channel for the lowest position i.e. Fcenter = 3560 MHz

1 RB transmission at the edge of the channel



For 20 MHz channel with 1 RB transmission at the edge of the channel, the -25 dBm/1MHz requirement is the limiting factor.

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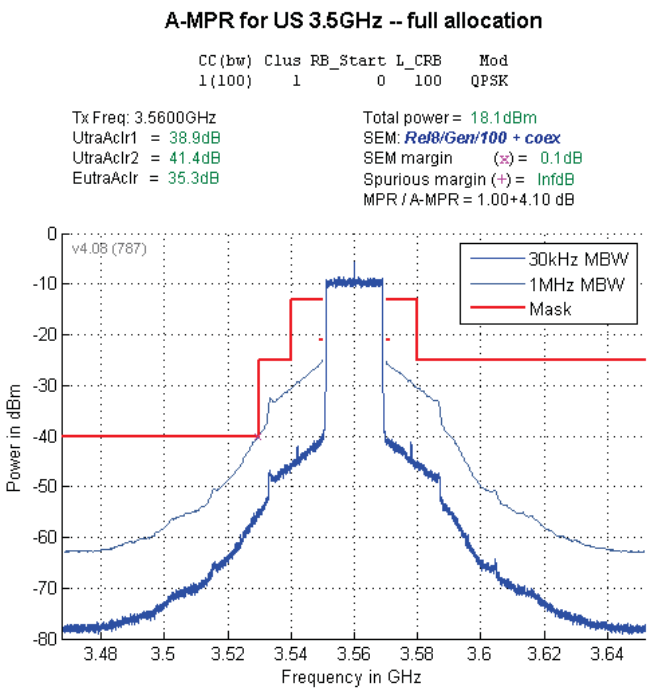
Additional-Maximum Power Reduction (A-MPR)

A-MPR simulations for 20 MHz channel for the lowest position i.e. Fcenter = 3560 MHz

When 20 MHz channel has large allocation at the lowest position of band



When 20 MHz channel has large allocation and channel is at the lowest position of band, then -40 dBm/1MHz is limiting.
If channel is placed further away from edge of the 3550 MHz or 3700 MHz then the need for A-MPR is lower.

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