

WWiSE IEEE 802.11n Proposal

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Authors:

Name	Company	Address	Phone	Email
Sean Coffey	Realtek Semiconductor	16269 Laguna Canyon Rd., Irvine, CA 92618	+1 415 572 6221	coffey@realtek-us.com

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Additional authors:

VK Jones	Airgo Networks	vkjones@airgonetworks.com
Richard van Nee	Airgo Networks	richardvannnee@airgonetworks.com
Ali Raissinia	Airgo Networks	aliraissinia@airgonetworks.com
Allert van Zelst	Airgo Networks	allertvanzelst@airgonetworks.com
Bruce Edwards	Broadcom	bedwards@broadcom.com
Matthew Fischer	Broadcom	mfischer@broadcom.com
Chris Hansen	Broadcom	chansen@broadcom.com
Tushar Moorti	Broadcom	tushar@broadcom.com
Chris Young	Broadcom	cyoung@broadcom.com
Takashi Ishidoshiro	Buffalo	doshir@melcoinc.co.jp
Masato Kato	Buffalo	mkato@melcoinc.co.jp
Dave Hedberg	Conexant	dave.hedberg@conexant.com
Cenk Kose	Conexant	cenk.kose@conexant.com
Jim Petranovich	Conexant	jim.petranovich@conexant.com

Additional authors:

Michael Seals	Conexant	michael.seals@conexant.com
Mark Webster	Conexant	mark.webster@conexant.com
Menzo Wentink	Conexant	menzo.wentink@conexant.com
Taehyun Jeon	ETRI	thjeon@etri.re.kr
Sok-kyu Lee	ETRI	sk-lee@etri.re.kr
Heejung Yu	ETRI	heejung@etri.re.kr
Tim Wakeley	HP	tim.wakeley@hp.com
Mustafa Eroz	Hughes Network Systems	feroz@hns.com
Lakshmi Iyer	Hughes Network Systems	liyer@hns.com
Lin-Nan Lee	Hughes Network Systems	llee@hns.com
Feng-Wen Sun	Hughes Network Systems	fsun@hns.com
Marc de Courville	Motorola	marc.de.courville@motorola.com
Markus Muck	Motorola	markus.muck@motorola.com
Alexandre Ribeiro-Dias	Motorola	alexandre.ribeirodias@motorola.com

Additional authors:

Stephanie Rouquette-Leveil	Motorola	stephanie.rouquette@motorola.com
Sebastien Simoens	Motorola	sebastien.simoens@motorola.com
Nico van Waes	Nokia	Nico.vanWaes@nokia.com
John Chang	Ralink	john_chang@ralinktech.com.tw
Sheng Lee	Ralink	shenghlee@ralinktech.com
Tom Pare	Ralink	tpare@ralinktech.com
David Tung	Ralink	dtung@ralinktech.com
Der-Zheng Liu	Realtek	dzliu@realtek.com.tw
Ravi Mahadevappa	Realtek	ravi@realtek-us.com
Stephan ten Brink	Realtek	stenbrink@realtek-us.com
Gabriella Convertino	STMicroelectronics	gabriella.convertino@st.com
Mike Moreton	STMicroelectronics	mike.moreton@st.com
Fabio Osnato	STMicroelectronics	fabio.osnato@st.com
Pratima Pai	STMicroelectronics	pratima.pai@st.com

Additional authors:

Vincenzo Scarpa	STMicroelectronics	vincenzo.scarpa@st.com
Massimiliano Siti	STMicroelectronics	massimiliano.siti@st.com
George Vlantis	STMicroelectronics	george.vlantis@st.com
Anuj Batra	Texas Instruments	batra@ti.com
Srikanth Gummadi	Texas Instruments	sgummadi@ti.com
Dale Hocevar	Texas Instruments	hocevar@ti.com
Richard Williams	Texas Instruments	richard@ti.com
Keith Chugg	TrellisWare	kchugg@trellisware.com
Paul Gray	TrellisWare	pgray@trellisware.com
Bob Ward	TrellisWare	bward@trellisware.com
Jeng-Hong Chen	Winbond Electronics	jhchen2@winbond.com
Pansop Kim	Winbond Electronics	pkim@winbond.com
Alfred Lin	Winbond Electronics	halin@winbond.com
Wei-Chung Peng	Winbond Electronics	wcpeng0@winbond.com

Abstract

The presentation summarizes the WWiSE proposal:

- What's new since the March meeting ...
 - Membership update
 - Proposal updates
- The WWiSE proposal
 - Summary and overview
 - Details and technical information
- Conclusions
 - Towards Draft 1.0 ...

Expanded membership

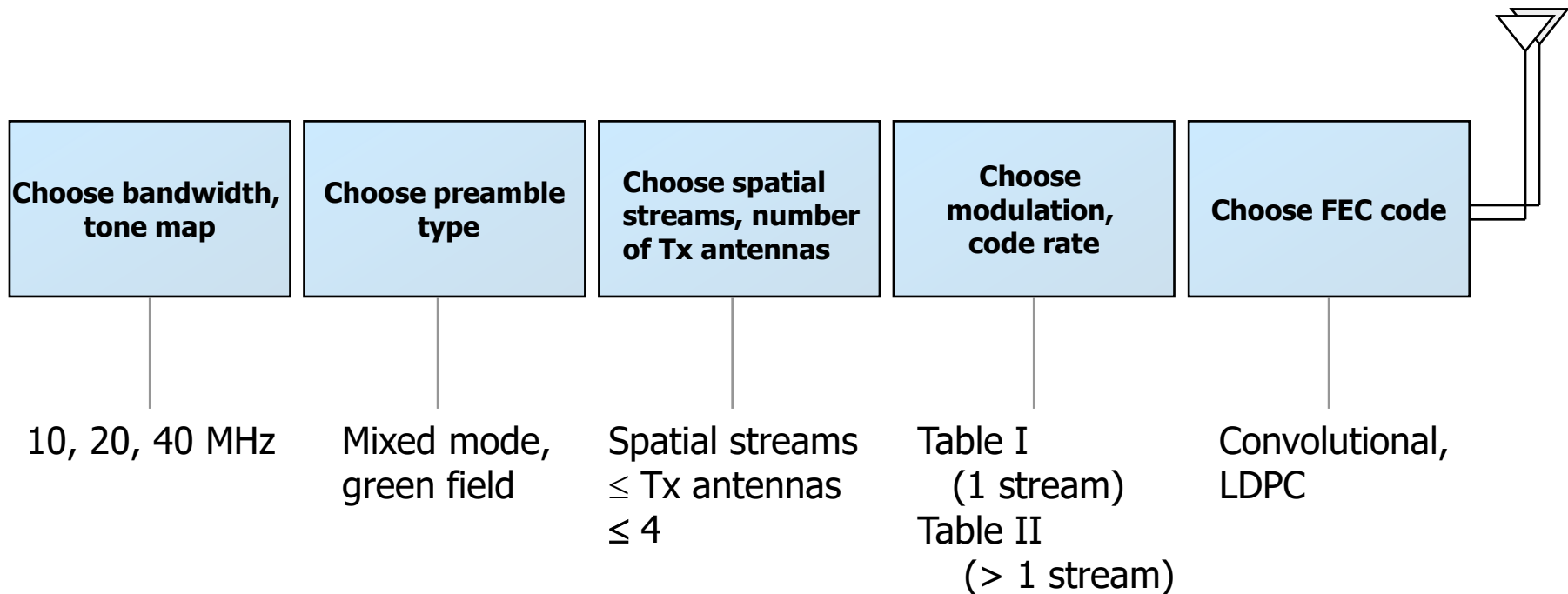
- Airgo Networks
- Broadcom
- Buffalo
- Conexant
- ETRI
- France Telecom
- *Hewlett Packard*
- Hughes Network Systems
- ITRI
- Motorola
- Nokia
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- Ralink
- Realtek Semiconductor
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- STMicroelectronics
- Texas Instruments
- TrellisWare
- Winbond

Summary of proposal changes

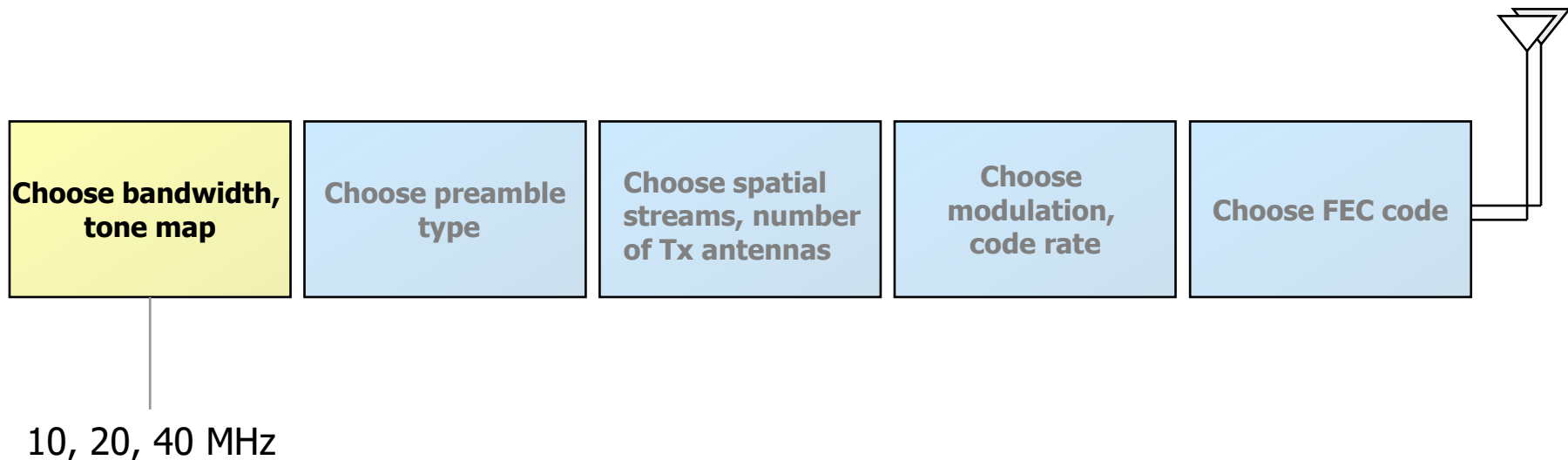
- Coexistence of Extended Range (ER) devices with Non-extended Range (NR) devices
- Secondary Channel Element
- Allowance and rules for zero-length PPDU
- New LDPC code design
- Further beacon refinement for longer range, low rate

WWiSE proposal summary

WWiSE proposal summary (PHY)

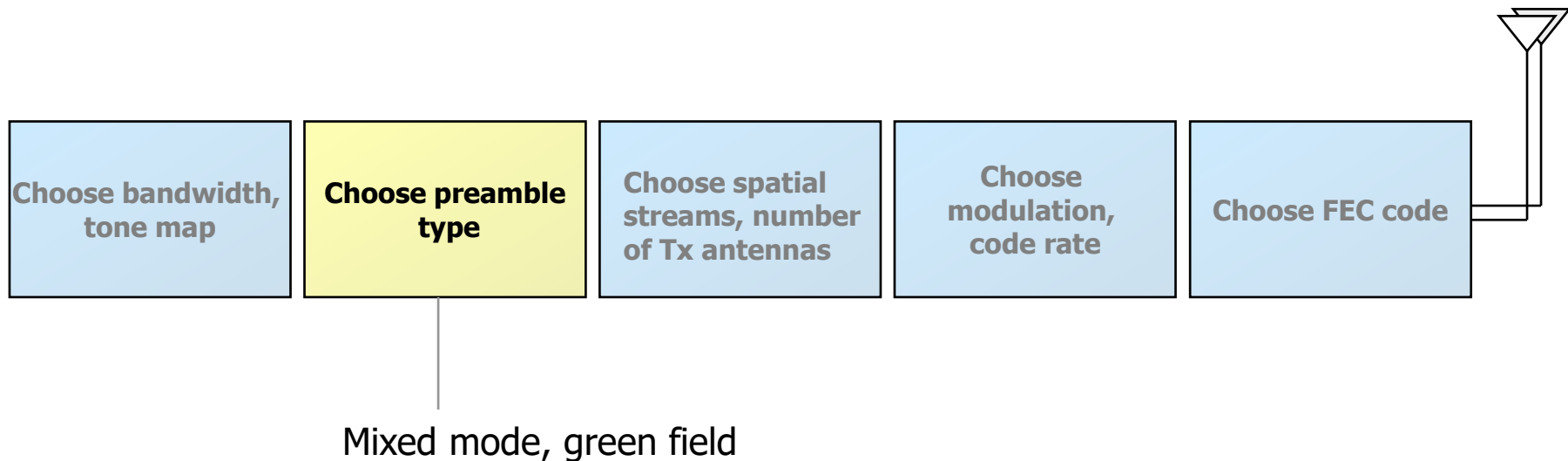


WWiSE proposal summary, contd.



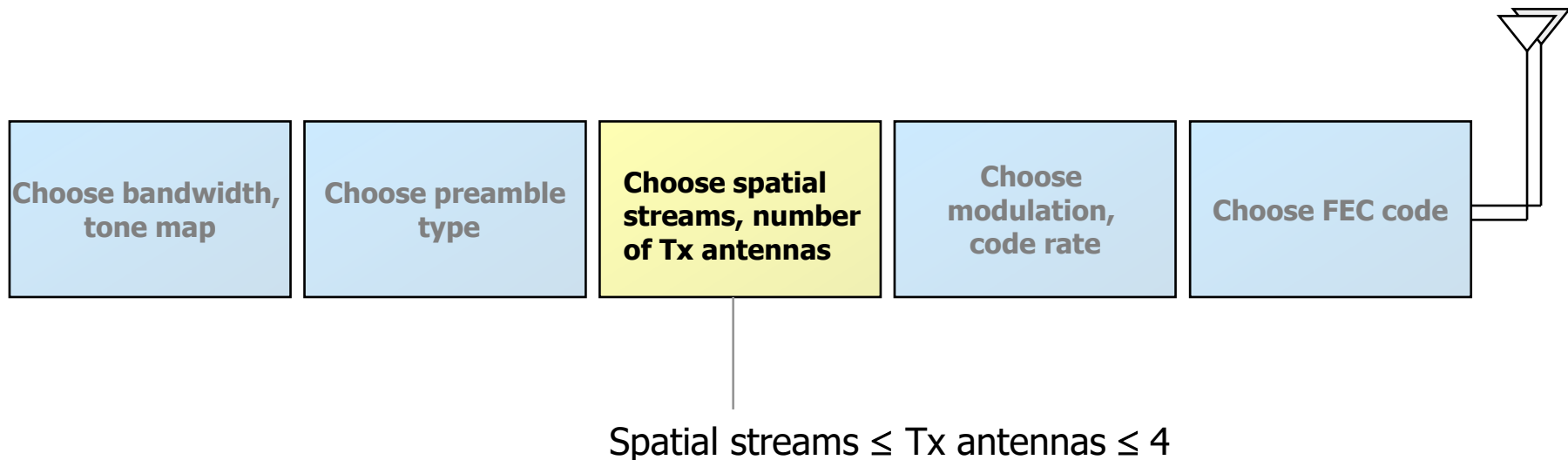
- Bandwidth determines tone map
- Increased efficiency for 10 & 20 MHz tone maps

WWiSE proposal summary, contd.



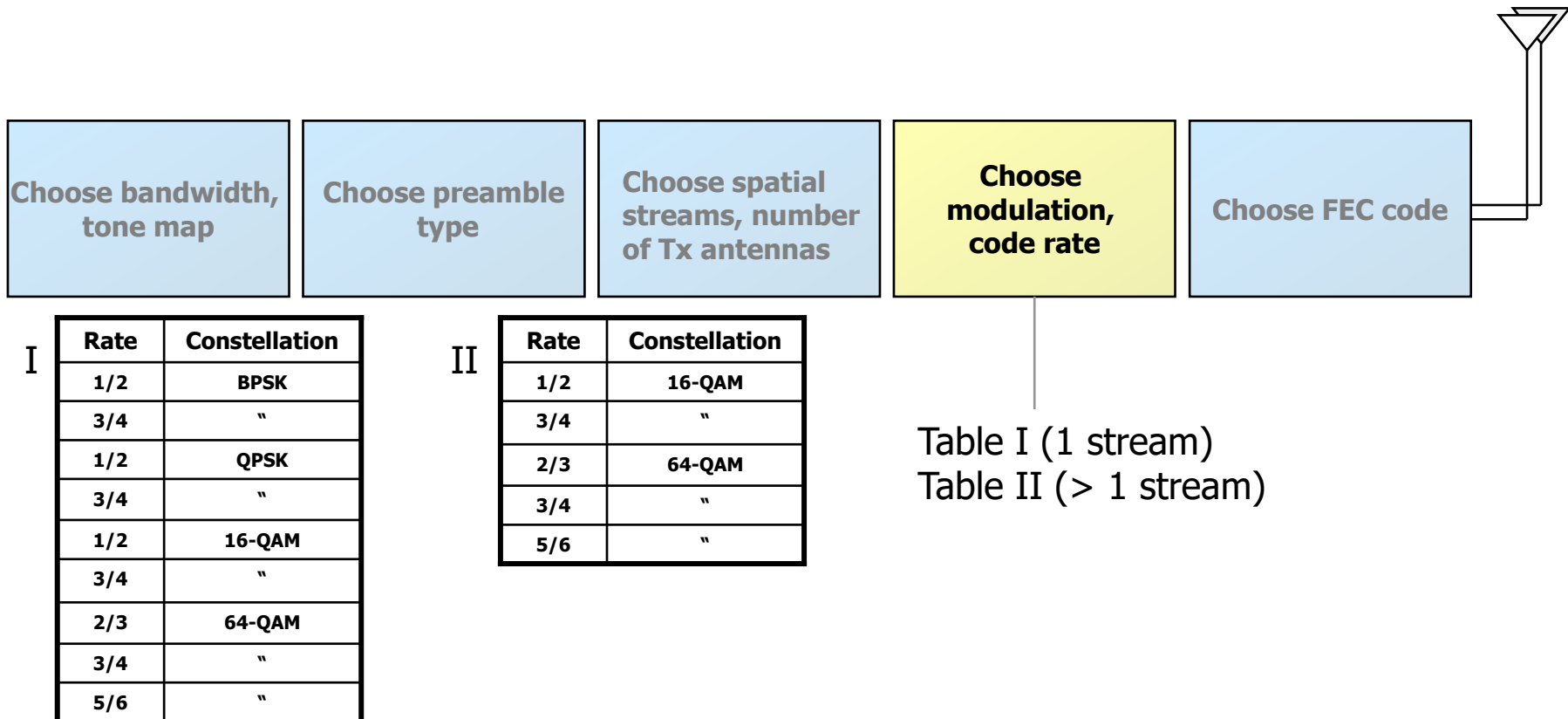
- Mixed mode preamble = green field preamble, with GF short replaced by full legacy preamble

WWiSE proposal summary, contd.

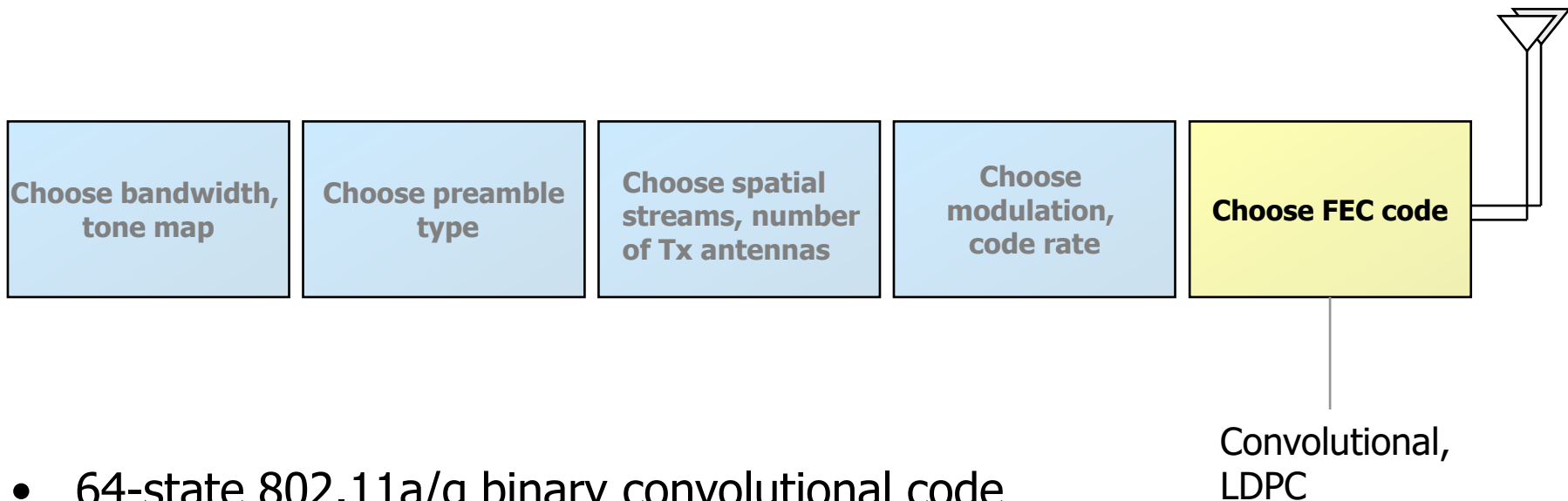


- Simple two-symbol space-time block codes
- Cycle through transmit antennas for 3, 4 transmit antennas and single receive antenna

WWiSE proposal summary, contd.



WWiSE proposal summary, contd.



- 64-state 802.11a/g binary convolutional code
- Parallelized for > 2 spatial streams in 40 MHz, to enable efficient decoding
- LDPC code

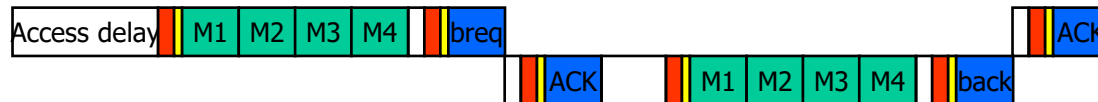
WWiSE proposal summary (MAC)

- WWiSE brings three simple efficiency enhancements over 802.11e:

802.11e TXOP



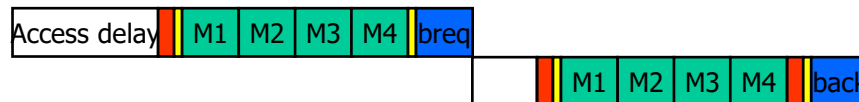
Aggregation



HTP Burst



No-ACK Block Ack



WWiSE proposal summary, contd.

- *Other features:*
 - Rate recommendation from receiver
 - Channel state information from receiver
 - 20/40 coexistence mechanisms
 - n-beacon, Long SIG

Details and technical information on WWiSE proposal

LDPC highlights

- The WWiSE LDPC code has been changed so that the four code rates have the corresponding uniform base matrix dimensions:
 - $R=1/2$ with base matrix size 12×24
 - $R=2/3$ with base matrix size 8×24
 - $R=3/4$ with base matrix size 6×24
 - $R=5/6$ with base matrix size 4×24
- The WWiSE proposal's three codeword sizes now having the following corresponding submatrix sizes:
 - $N = 1944$ using $z = 81$ (submatrix size)
 - $N = 1296$ using $z = 54$
 - $N = 648$ using $z = 27$

LDPC highlights, contd.

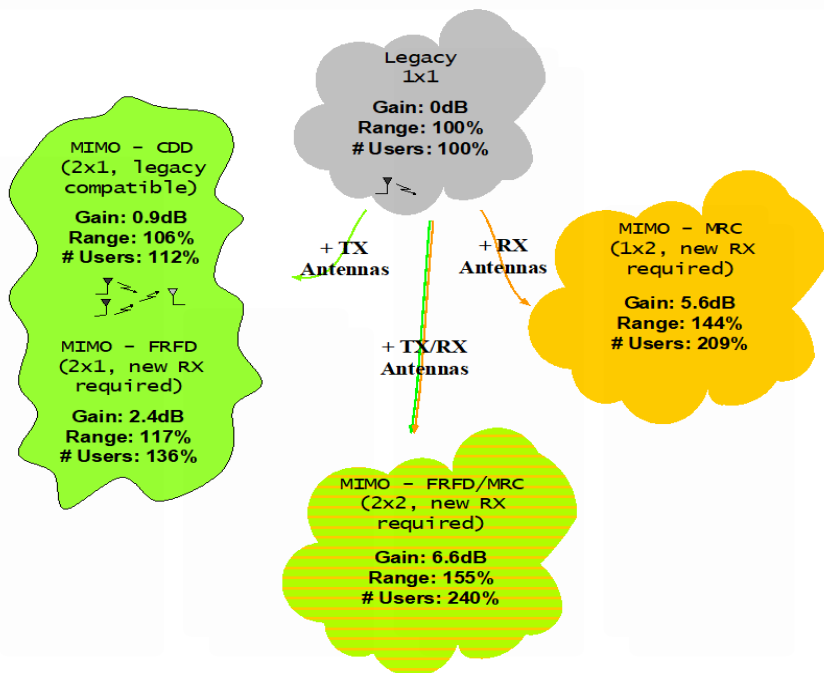
- Each code is designed with the following unified encoding structure:
 - Cyclically shifted identity matrices for the parity section
 - Modified block staircase for the information section
 - Modification allows for numerous high speed decoder architectures, including both high throughput Layered Belief Propagation and Turbo-like architectures
- The WWiSE proposal has improved error rate performance with no flooring exhibited across AWGN and fading channels.

Extended Range features

- New & modified ER features:
 - The (optional) doubled length SIG field now has in addition a frequency domain permutation
 - This exploits frequency diversity and has performance consistent with robust STBC modes
 - MAC protection mechanisms have been finalized to allow peaceful Normal Range (NR), Extended Range (ER) coexistence
 - Both multiple/single TxOP protection schemes

Range extension: from the PHY up to the MAC

- 4 main features need to be ensured to grant range extension
 - Appropriate PHY modes:*
 - Enables enough coverage for handset applications: VoIP, video streaming
 - Allow a number of spatial streams lower than the number TX antennas!
 - Beacon:* Enable association at extended range (ER): legacy beacon doesn't allow extended range stations to associate



- Coexistence:* if PHY modes are not mandatory then MAC protection mechanisms are required to allow coexistence of extended/normal range (ER/NR) stations
- Enable robust signaling:* define an 11n specific signal field that enables stations at a larger range to be able to understand the parameters of the incoming packets

MAC features summary

There were three significant MAC modifications between March and July, relating to:

- Coexistence of Extended Range (ER) devices with Non-extended Range (NR) devices
- Secondary Channel Element
- Allowance and rules for zero-length PPDU.

ER Coexistence – issues

- WWISE proposal includes STBC rates for Extended Range
 - These rates are OPTIONAL
 - ER device
 - A device which optionally supports the STBC rates in addition to the mandatory rates
 - NR device
 - A device which optionally does NOT support the STBC rates, but supports the mandatory rates
 - Existence of two classes of devices (ER/NR) creates an opportunity for hidden nodes
 - ER devices can be attached to the BSS at a greater distance from the AP
 - At such range, the ER devices can no longer communicate with the AP at the non-ER rates (NR rates)
 - ER devices will miss NR “protective frames” e.g. RTS/CTS (any frame with a non-zero DUR field value)
 - This creates a hidden node situation

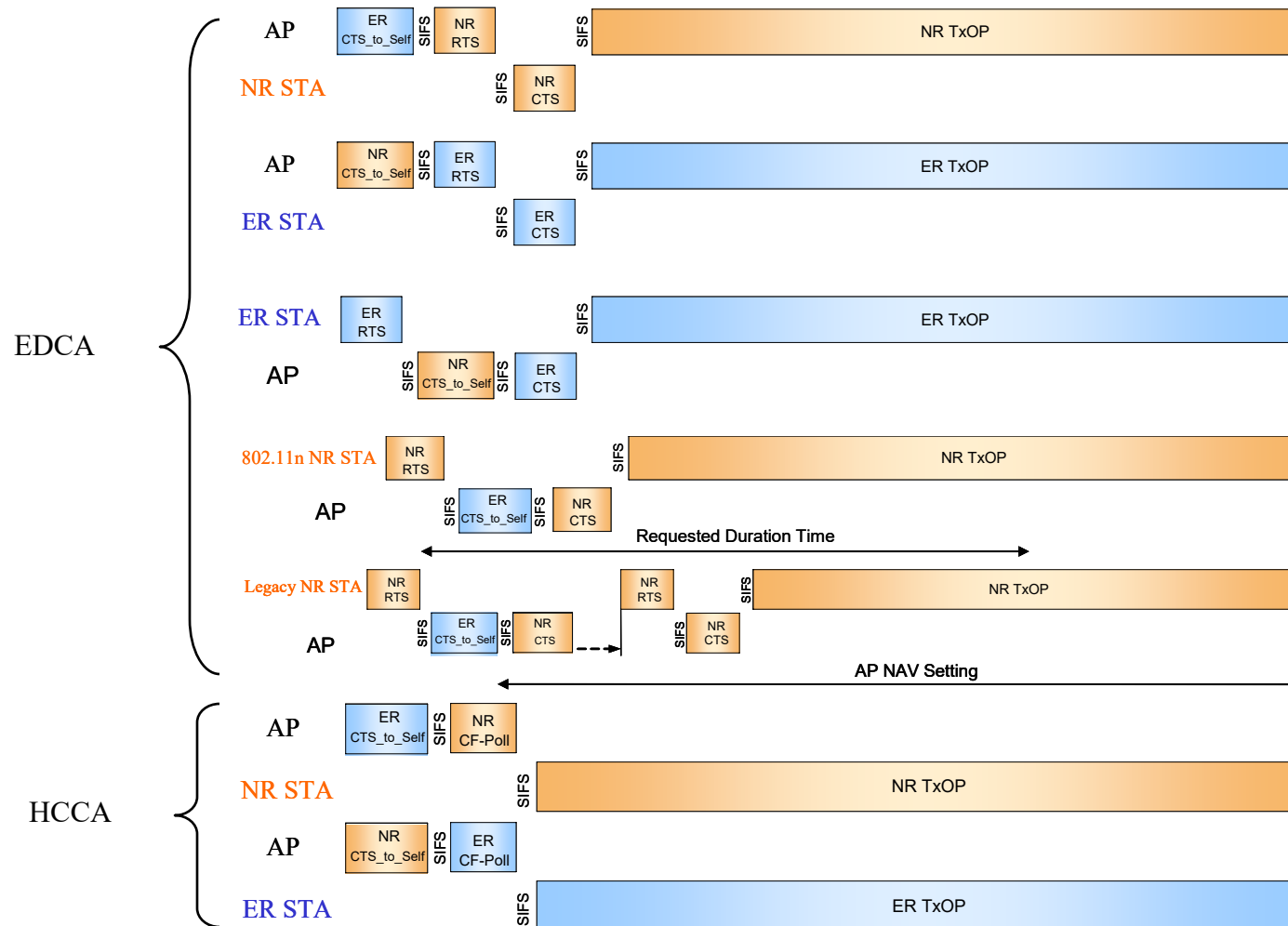
ER coexistence

- ER Beacon, NR Beacon
 - Separate beacons with same periodicity, but ER TBTT offset from NR TBTT
 - ER MCAST follows ER Beacon
 - NR MCAST follows NR Beacon
 - TSF value is common, offset describes shift
 - Offset contained in beacons (new field in ERP Information Element)
- Use_ER_Protection signal (a new bit added to existing ERP Information element)
 - This Element is included in Beacons, Probe Responses
- ER Protection mechanisms
 - Self-managed
 - AP-managed

ER-protection – Self-managed

- Self-managed protection
 - AP with ER STA associated
 - Sends NR CTS-to-self before ER exchange (either EDCA or HCCA)
 - Sends ER CTS-to-self before NR exchange (either EDCA or HCCA)
 - Non-AP ER STA send ER RTS, receive NR CTS followed by ER CTS
 - Non-AP NR STA send NR RTS, receive ER CTS followed by NR CTS
 - Legacy STA send NR RTS, receive ER CTS followed by NR CTS
 - They either accept the “late CTS” and continue, or they declare a timeout and backoff and try again
 - Other devices in deferral due to the ER CTS and/or NR CTS during backoff

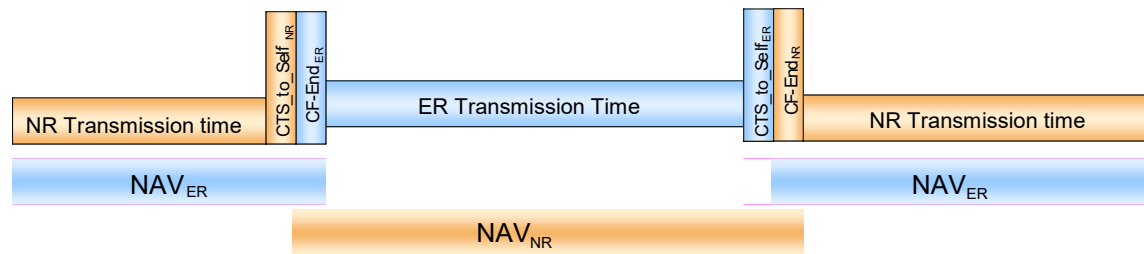
Self-managed ER Protection



ER-protection – AP-managed

- AP-managed protection
 - The AP creates separate time windows for ER operation and NR operation
 - Sends CTS-to-self/CF-end combination at the start of each period
 - E.g. NR CTS-to-self with ER CF-end to create ER-friendly period
 - Dynamic creation
 - Informatively described

AP-managed ER Protection



Zero-length PPDU

- Allow Zero-length PPDU
 - WWISE proposal includes A-PPDU aggregation
 - Aggregation of multiple PSDUs within a single PPDU
 - Each PSDU has its own signal field
 - New language allows use of signal fields with an indicated ZERO length
 - Allows for speculative A-PPDU aggregation
 - LP=0 for all frames
 - If TX FIFO underflow, then set LP=1 with ZERO length
 - LP shall be set to 1 when LEN=0
 - 20.3.4 (signal fields) – one sentence added:
 - When the LEN field is set to 0, no PSDU bits are present and the Last PSDU indicator (LPI) shall be set to 1 to end the current PPDU.

New Secondary Channel Element

- Addition of a new element to provide information regarding the secondary channel
 - For cases when:
 - BSS moves from one 40-MHz pair to a different 40-MHz pair
 - BSS moves from a 20-MHz pair to a 40-MHz pair
 - Description of appropriate behavior for transition from a 40-MHz pair to a 20-MHz channel is also given
 - This new element is added to some management frames as part of the existing channel switch mechanisms:
 - Beacons
 - Probe responses
 - Channel Switch Announcement frames

WWiSE proposal features, summary

- High-performance PHY and MAC
- Modularity and simplicity in PHY design
 - Eases interoperability and verification, enables faster time to market and provides true scalability
- Efficient, streamlined MAC extensions
 - High performance, no unnecessary complexity
- Well defined, stable technical specification
 - Suitable for immediate use as Draft 1.0

References and further information

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3. IEEE 802.11/04-0935-r3-000n and -r4-000n, IEEE 802.11/05-1591r3, "WWiSE complete proposal presentation," S. Coffey et al.
4. IEEE 802.11/05-0016-02-000n, "WWiSE MAC proposal for TGn," M. Fischer et al.

See also www.wwise.org

Or send email to info@wwise.org