

3GPP TSG RAN Meeting #64
Sophia Antipolis, France
June 10-13, 2014

RP-140842

Agenda Item: 14.1.1

Motivation for Study on Elevation Beamforming/FD-MIMO for LTE

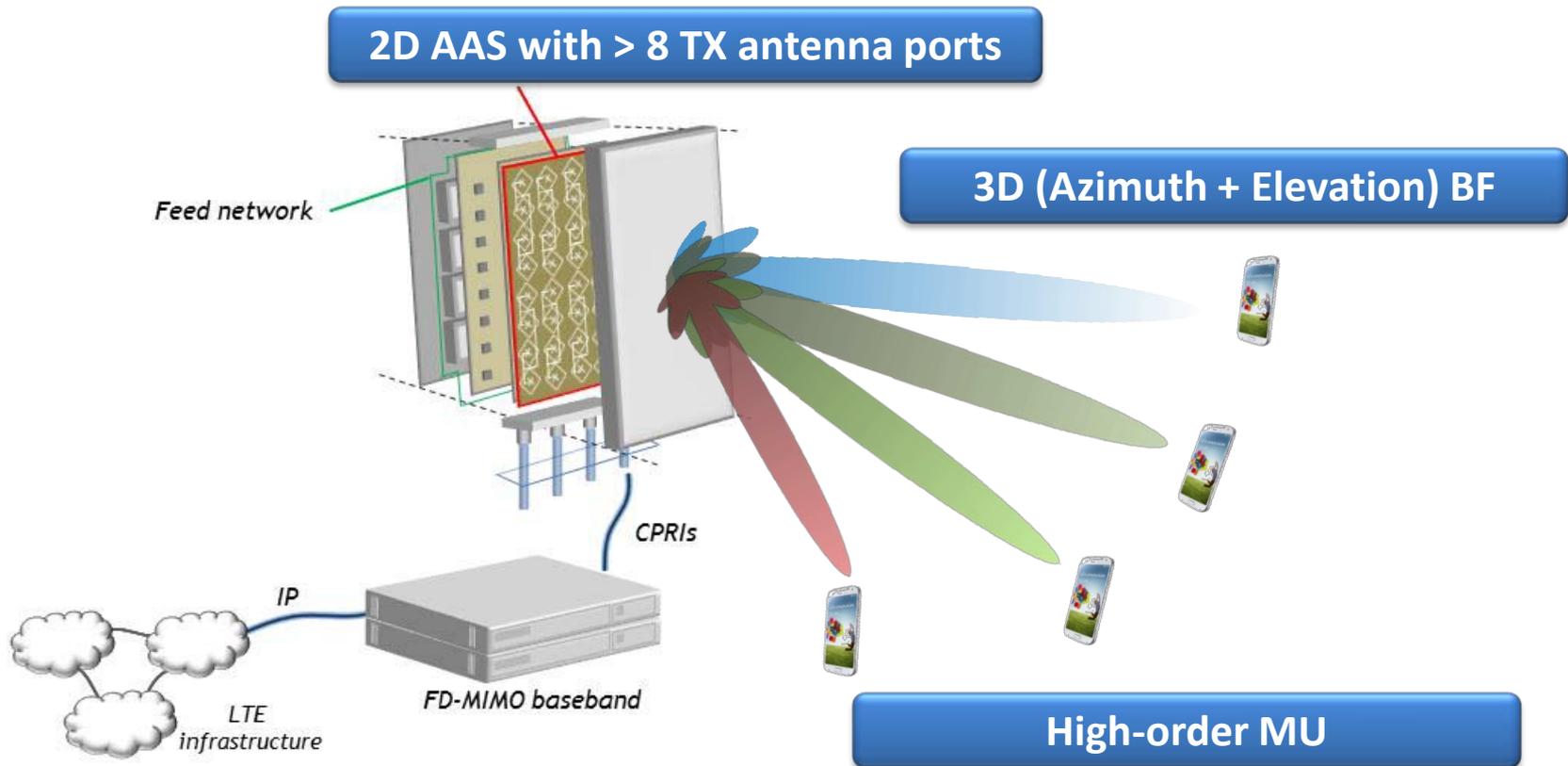
Samsung

Introduction

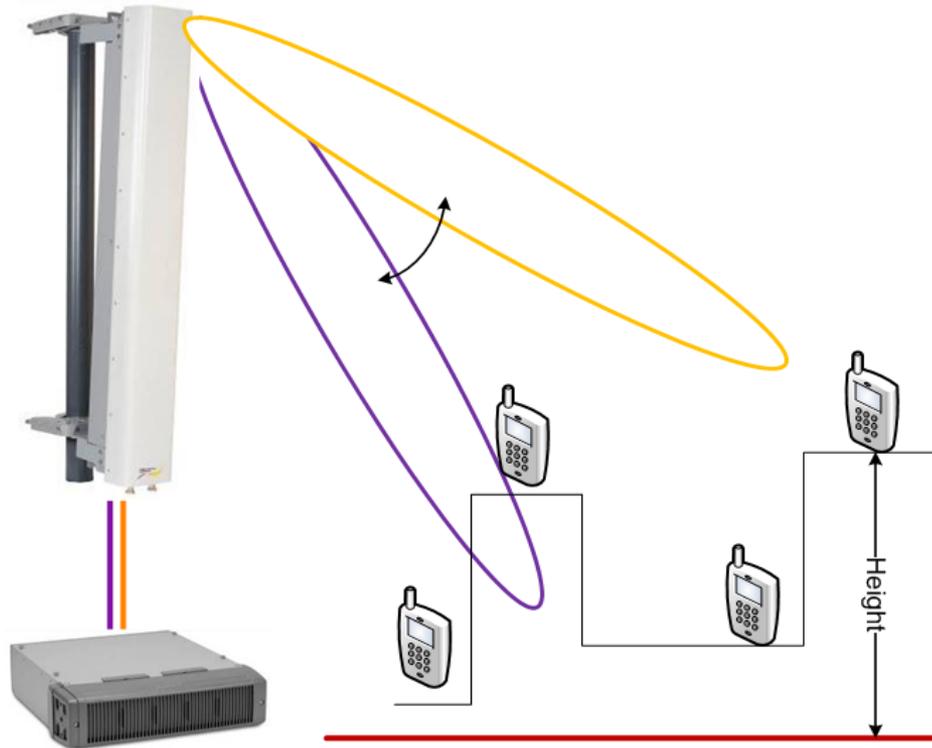
- ❑ Many contributions were submitted to RAN workshop on Rel-12 and onwards discussing AAS, elevation beamforming and full-dimension MIMO (FD-MIMO)
 - RWS-120002, Release 12 for C4 (Cost, Coverage, Coordination with small cells and Capacity), NSN
 - RWS-120003, Views on Rel-12, Ericsson & ST-Ericsson
 - RWS-120005, Views on Release 12, Orange
 - RWS-120006, Views on Rel-12 and onwards for LTE and UMTS, Huawei Technologies, HiSilicon
 - RWS-120011, Where to improve Rel-12 and beyond: Promising technologies, NEC
 - RWS-120014, Towards LTE RAN Evolution, ALU
 - RWS-120029, Views on LTE Rel-12 & Beyond, CMCC
 - RWS-120034, Views on 3GPP Rel-12 and Beyond, ZTE
 - RWS-120046, Technologies for Rel-12 and onwards, Samsung
- ❑ FS_LTE_3D_channel SI (RP-122034, RP-130811) has been progressed in RAN1 from JAN 2013, to prepare for the elevation beamforming and FD-MIMO
 - ❑ The first priority scenarios (3D-UMi, 3D-UMa) were concluded in RAN1#76, except for phase-2 calibration
- ❑ Right time to initiate a SI on elevation beamforming/FD-MIMO

Full-Dimension MIMO

Solution for enhanced capacity demand for both macro and small Cells



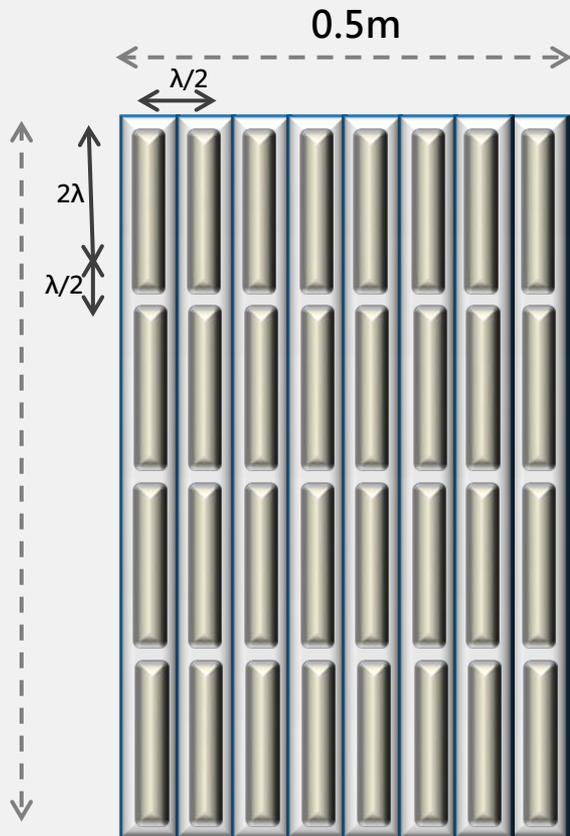
Elevation beamforming



Showing the size of an AAS column
@2 GHz band with 8 total ports (4
ports in elevation at $\pm 45^\circ$ each)

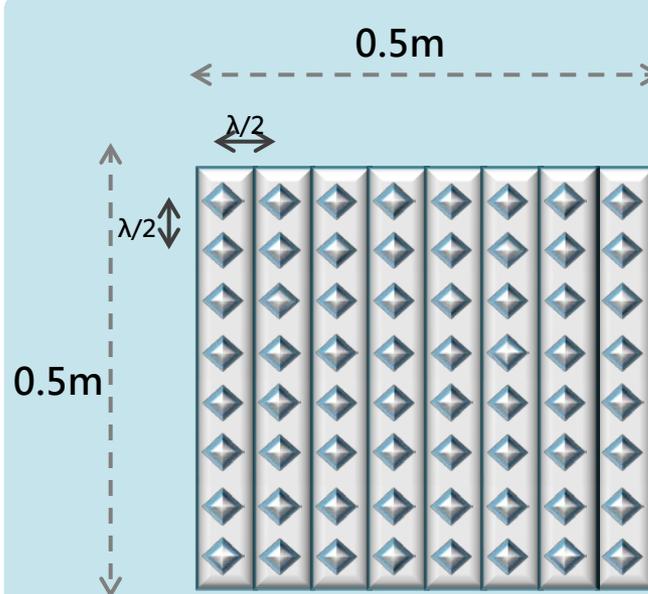
- Supports Vertical sectorization and UE Specific elevation beamforming
- Up to 8 Tx Antenna Ports
- Elevation dimension is used to dynamically focus energy to UEs at different floors
- MU-MIMO in elevation dimension is attractive due to narrow angle spread

Examples of 2D AAS Form Factor



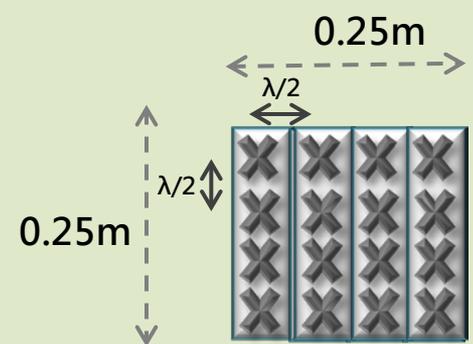
Eg. 1: 8x4 with subarrays each comprising 4 elements with analog beamforming

Macro Cells



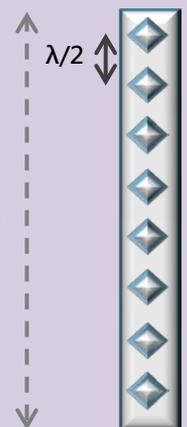
Eg.2: 8x8 array with full digital beamforming across 64 elements

Macro Cells



Eg.3: 4x4 full-digital cross-pol array

Small Cells

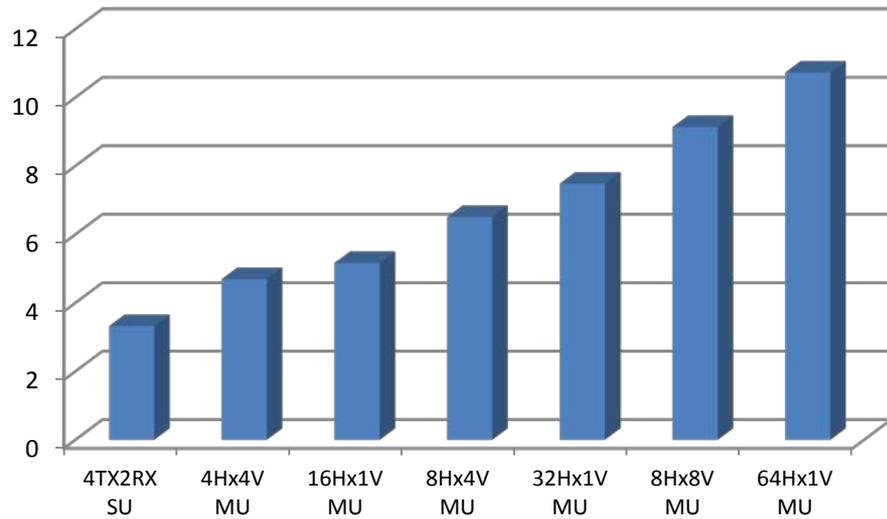


Eg.4: 1x8 array. Digital elevation beamforming

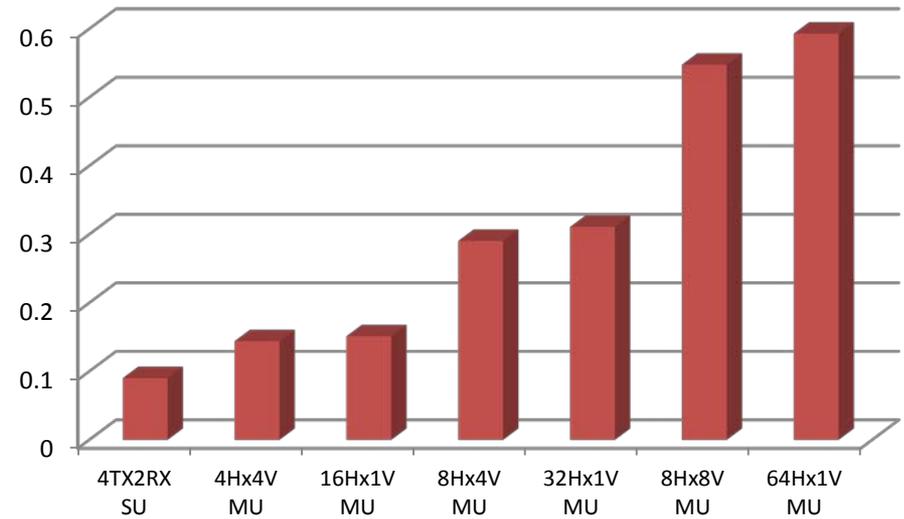
$\lambda = 12\text{cm}$
@ 2.5GHz

FD-MIMO antenna panel form factor is well within practical range

Preliminary Performance Analysis



Average cell throughput



Cell edge throughput

- 57 sectors, 10 full-buffer UEs/sector
- 3D-UMa with ideal CSI

BS Antenna configuration	4Tx 2RX SU	(4Hx4V) MU, $d_H=d_V=0.5\lambda$	(8Hx4V) MU, $d_H=d_V=0.5\lambda$	(8Hx8V) MU, $d_H=d_V=0.5\lambda$	(64Hx1V) MU, $d_H=0.5\lambda, d_V = 0.5\lambda$
Half power beamwidth (H, V)	(70, 10)	(65, 65)	(65, 65)	(65, 65)	(65, 65)
Cell average throughput (bps/Hz)	3.320	4.690	6.523	9.14	11.96
Cell edge throughput (bps/Hz)	0.090	0.143	0.290	0.570	0.630

Purpose of the New SI

- ❑ Understand benefits of elevation beamforming/FD-MIMO in further enhancing the capacity of macro and small cells and study a common framework to utilize both elevation domain and azimuth domain for different numbers of antenna ports
- ❑ Identify antenna configurations to be considered
 - Decide if other numbers of antenna ports will be considered for study, in addition to {8, 16, 32, 64}.
- ❑ Evaluate performance benefits of possible transmission schemes with up to two-dimensional antenna array, taking into account the discussion and findings of the 3D channel model SI.
- ❑ Identify potential specification impact required for implementing the MIMO transmission schemes that would provide the identified performance benefits

- **Expected outcome and time scale**

New specifications [If Study Item, one TR is anticipated]						
Spec No.	Title	1 st rsp. WG	2 nd rsp. WG(s)	Presented for information at plenary#	Approved at plenary #	Comments
TR36.xxx	Feasibility study on elevation beamforming/FD-MIMO for LTE	RAN1		RAN#67	RAN#68	

- RAN time budget proposal**

Q3/2014							
RAN	R1L	R1U	R2L	R2U	R2J	R3	R4
64	78	78	87	87	87	85	72
	2TU						

Q4/2014														
RAN	R1L	R1U	R2L	R2U	R2J	R3	R4	R1L	R1U	R2L	R2U	R2J	R3	R4
65	78b	78b	87b	87b	87b	85b	72b	79	79	88	88	88	86	73
	2TU							2TU						

Q1/2015							
RAN	R1L	R1U	R2L	R2U	R2J	R3	R4
66	80	80	89	89	89	87	74
	2TU						

Q2/2015														
RAN	R1L	R1U	R2L	R2U	R2J	R3	R4	R1L	R1U	R2L	R2U	R2J	R3	R4
67	80b	80b	89b	89b	89b	87b	74b	81	81	90	90	90	88	75
	2TU							2TU						