Vivaldi and SKALA IXR comparison

AA-low Technical Progress meeting

22/10/2012, Medicina

Benedetta Fiorelli

$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} J_{1x} & J_{1y} \\ J_{2x} & J_{2y} \end{bmatrix} \begin{bmatrix} E_x \\ E_y \end{bmatrix}$$

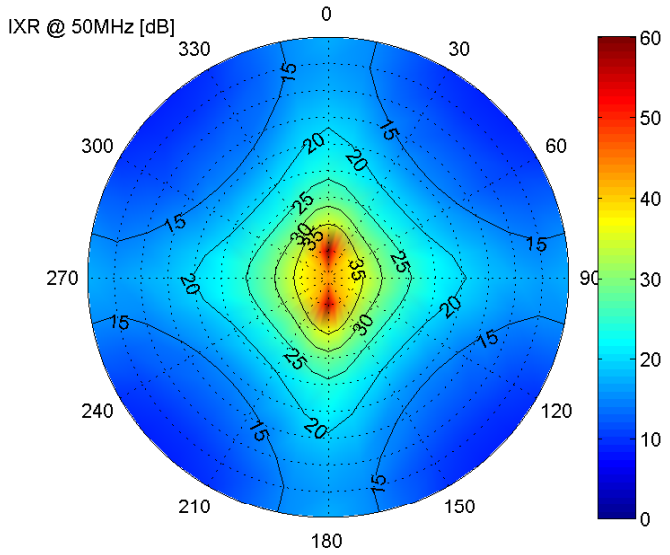
$$\boldsymbol{E}^{inc} = E_x \hat{\boldsymbol{x}} + E_y \hat{\boldsymbol{y}}$$

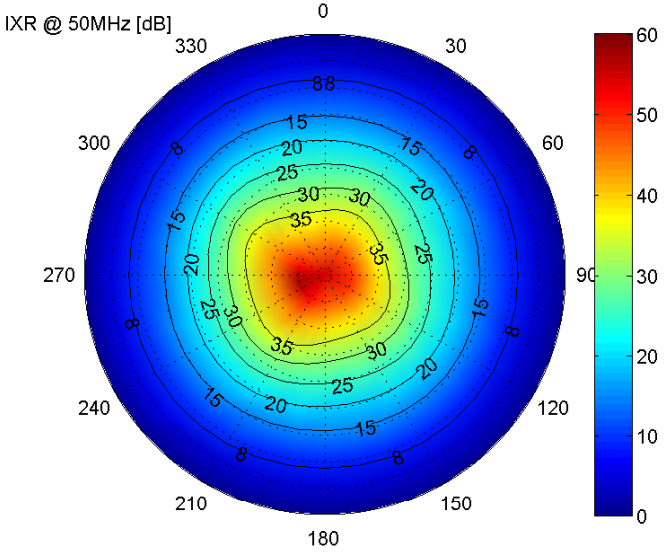
$$\mathrm{IXR} = \left(\frac{\kappa(\mathbf{J})+1}{\kappa(\mathbf{J})-1} \right)^2$$

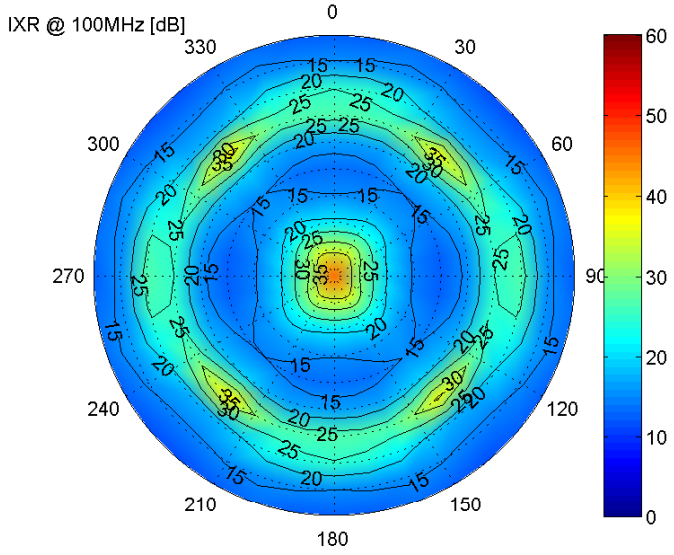
k(J) is the spectral condition number of the Jones matrix

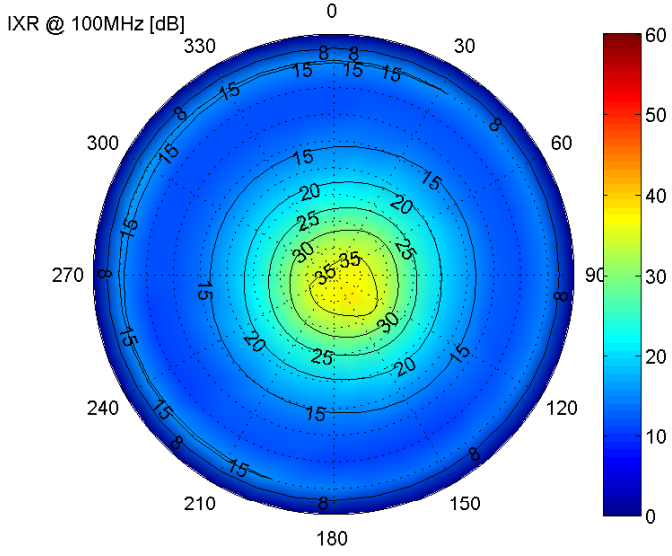
IXR is a measure of the precision achievable in inferring the input signal polarization state by inverting J

Vivaldi – Soil C



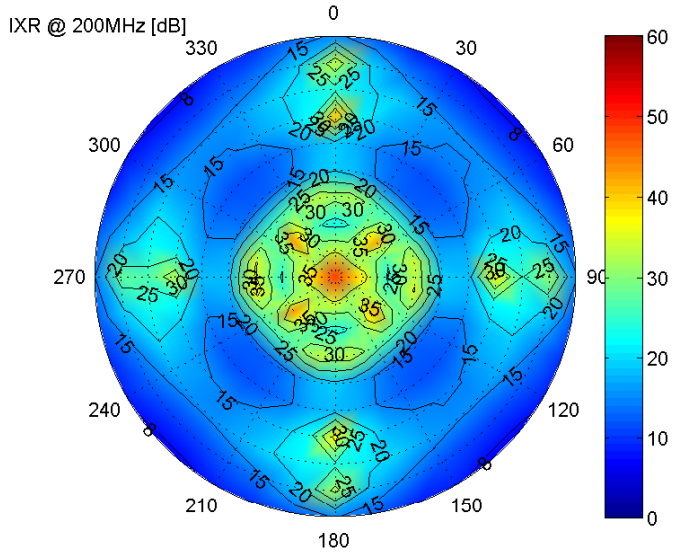


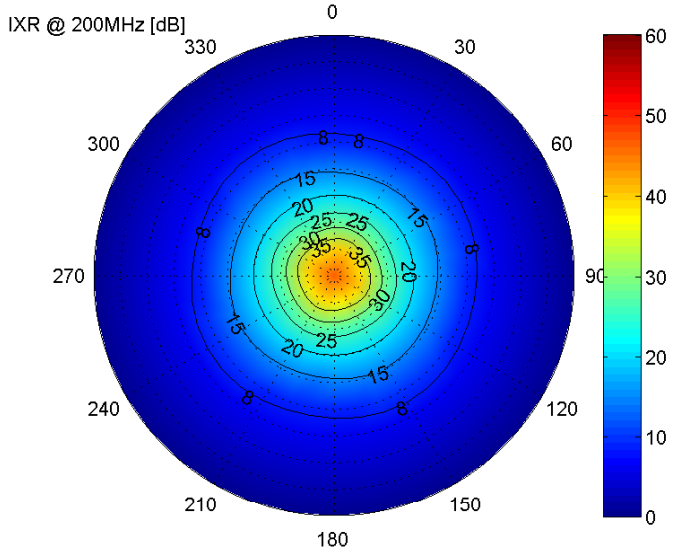


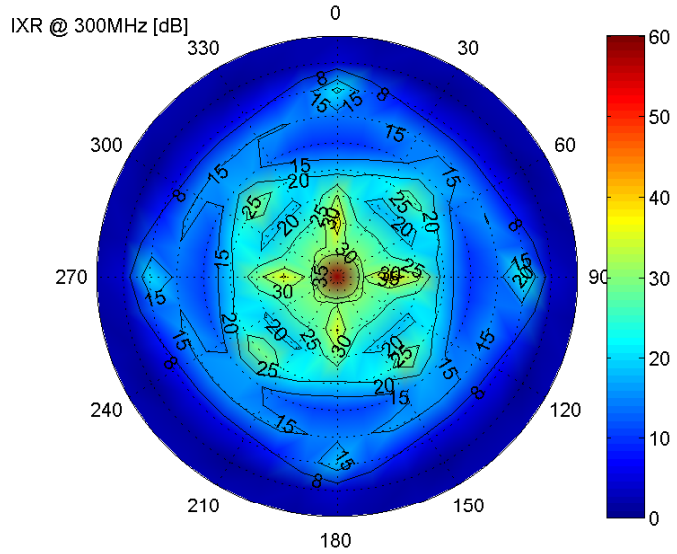


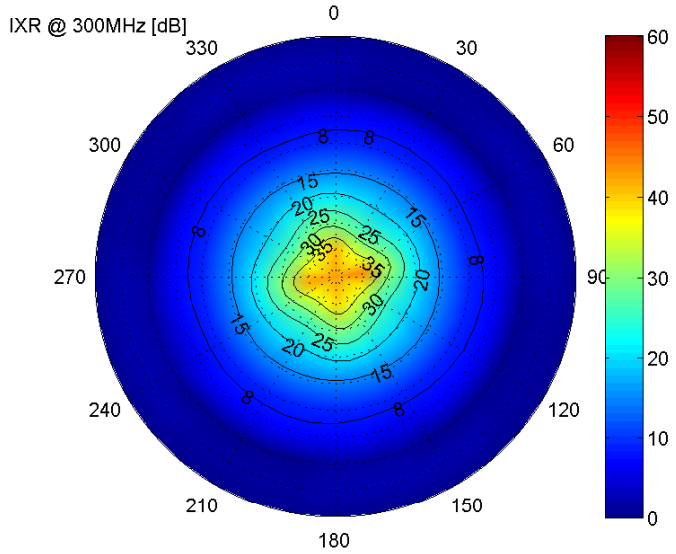
SKALA - GP

Vivaldi – Soil C





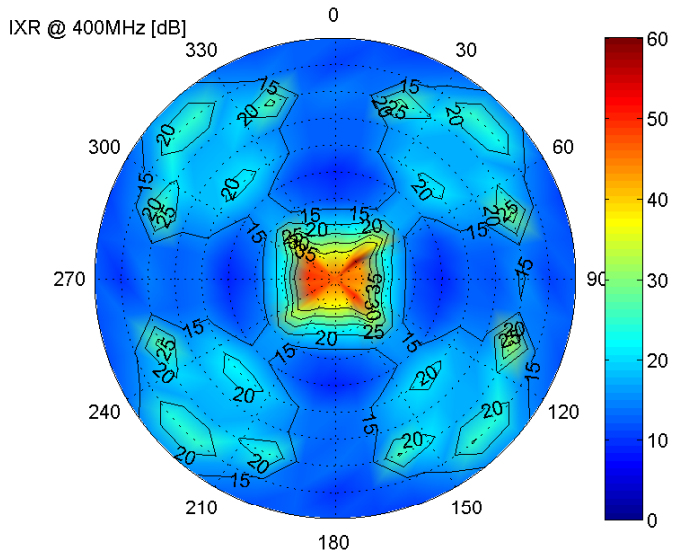


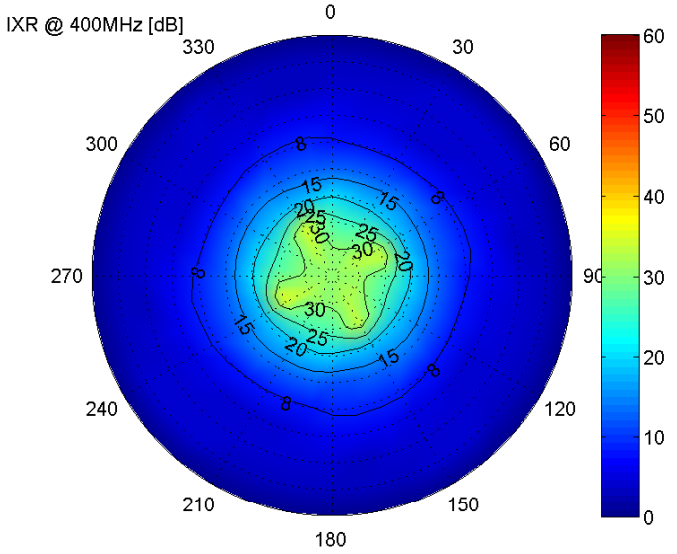


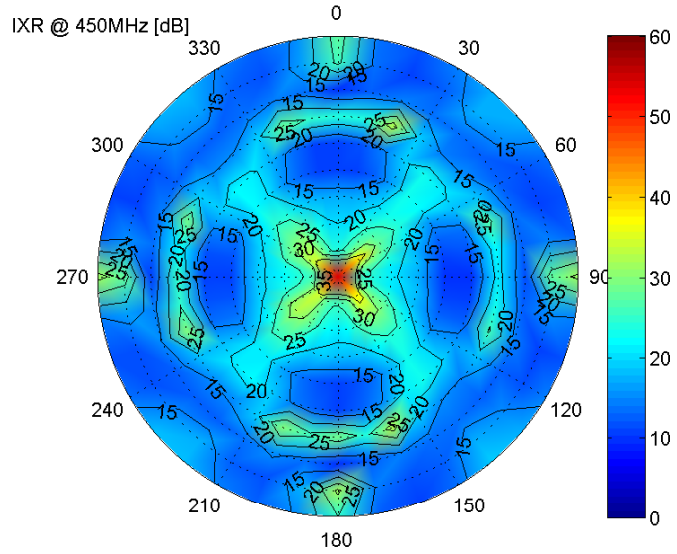
SKALA - GP

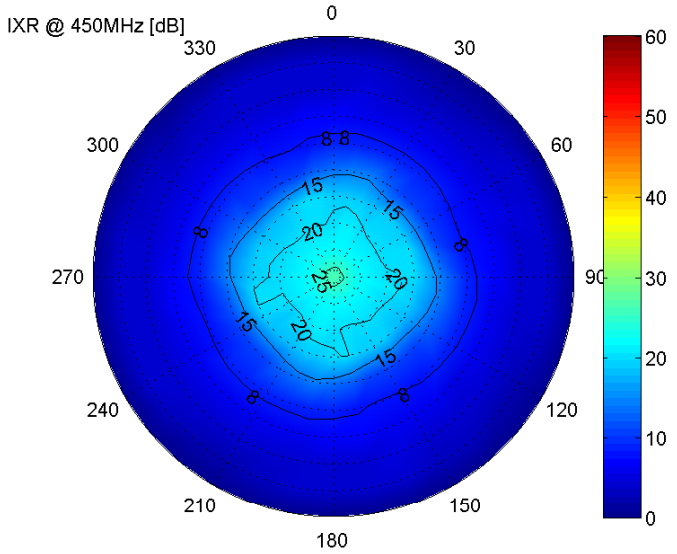
Vivaldi – Soil C

SKALA - GP







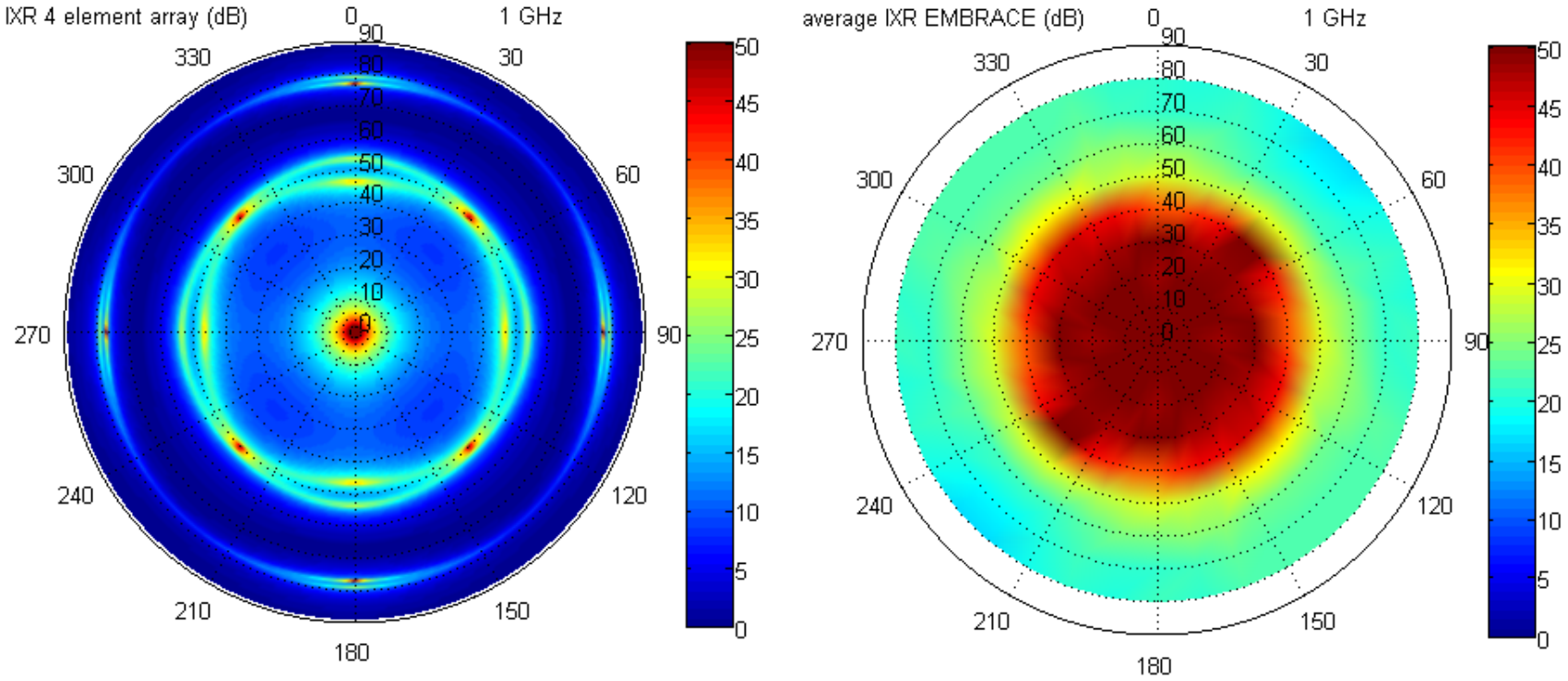


Electromagnetic:		
Frequency Range:	50 – 450 MHz	Frequency range of SKA_1 AA-low
Instantaneous Bandwidth:	400 MHz	To meet the SKA specifications
Polarisations:	2	Requires 2 orthogonal polarisations
Scan angle range min.:	±45°	Essential for the science requirements
Scan angle range goal:	±60°	More sky capability is an advantage
Polarisation separation (raw)	TBD	Needs to be sufficient to ensure after calibration the polarisation meets spec. All frequencies, all scan angles
Polarisation separation capability	>30dB	Estimation for imaging dynamic range. After calibration. Defines predictability of beam
Pitch capability min:	1.3m	To obtain desired required packing density
Pitch capability max.	No limit	There should be no obvious maximum.
Sensitivity smoothness with freq.	<2dB	Max deviation from a smooth sensitivity change, all scan angles
Sensitivity smoothness over scan.	<2dB	Max deviation from a smooth sensitivity change, all frequencies

From “Specification of AA-low element and array”

Which is the effect of the array configuration?

Example for dense array - EMBRACE



Conclusion:

- SKALA presents more homogeneous values of IXR at different theta.
- Vivaldi presents higher peak value.

Still to be defined:

- Required peak level
- Required homogeneity in FoV

Thank you.

Benedetta Fiorelli