

Innovation and Trends

Your global partner for end-to-end RF solutions



**Business Development &
Product Support EMEA
Dr Gurgen Harutyunyan**

WIRELESS / MICROWAVE / INDOOR / BROADCAST

RFS is a worldwide leading provider of innovative wireless and broadcast infrastructure products and solutions

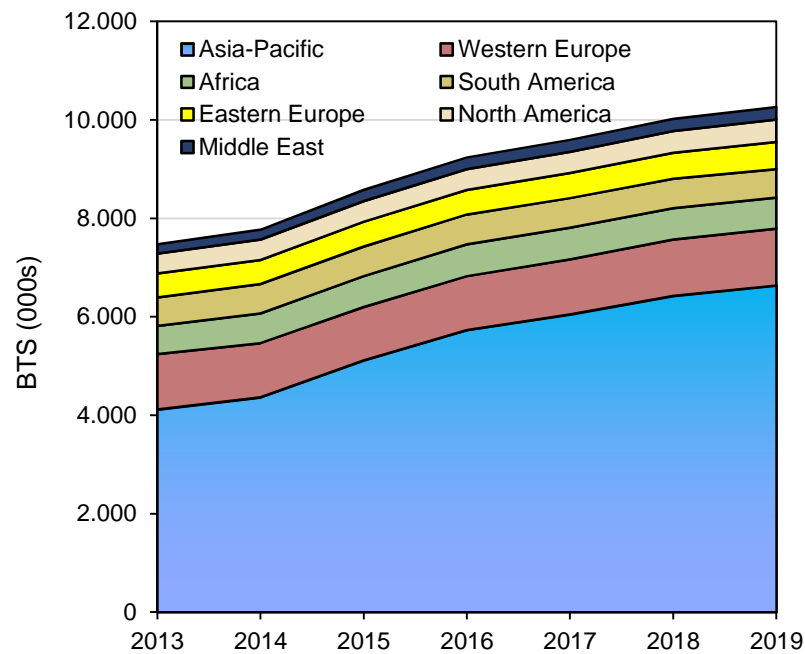


Agenda

- Antenna trend and our progress in multiband
- RFS Antenna key features and platforms
- New in 2015
- Antenna qualification program
- Roadmap 2015/16
- RFS BSA Highlights 2014
- Diplexer portfolio

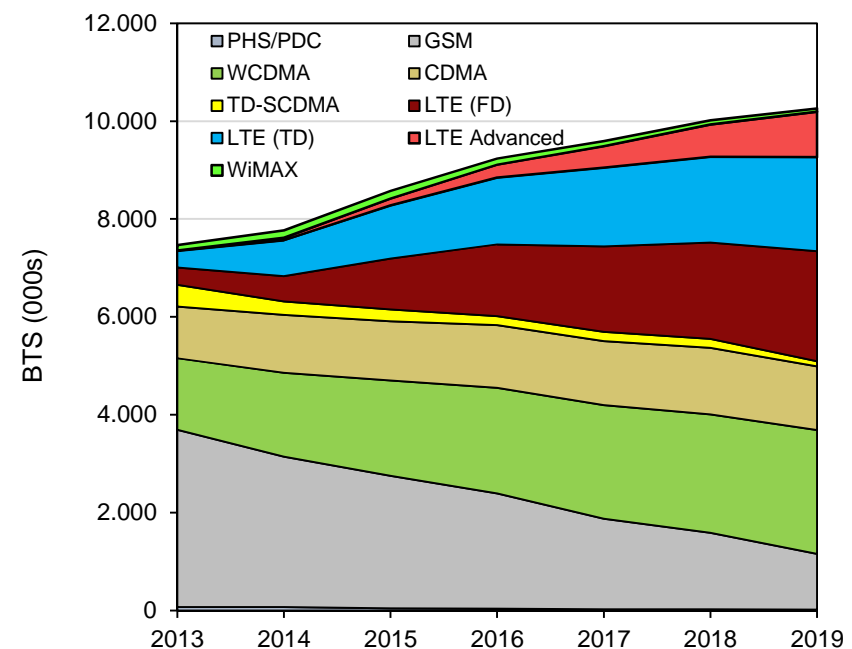
Market View

Installed Base Station Total on an Annual Basis by Region



Strong market growth in APAC

Installed Base Station Total on an Annual Basis by technology

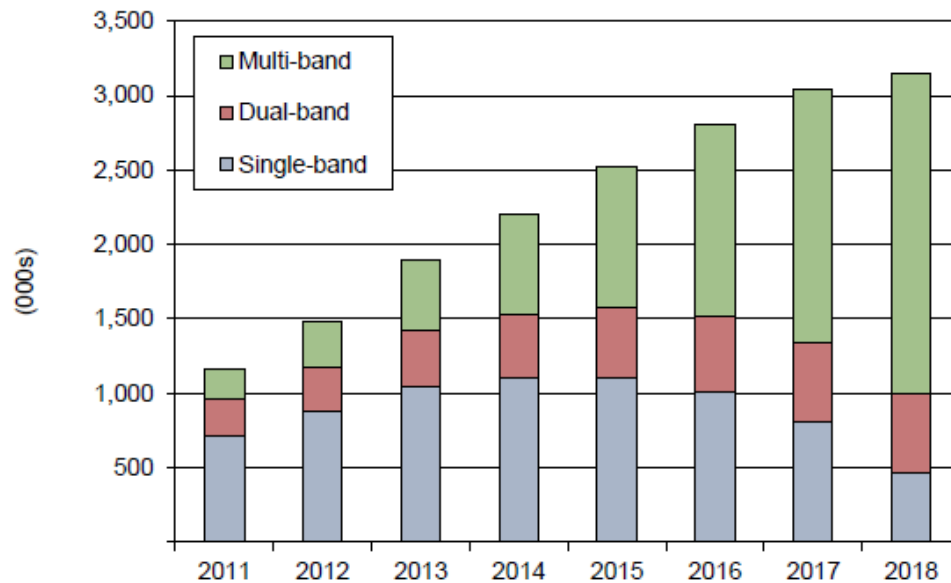


Growth of TD LTE is driven by APAC market

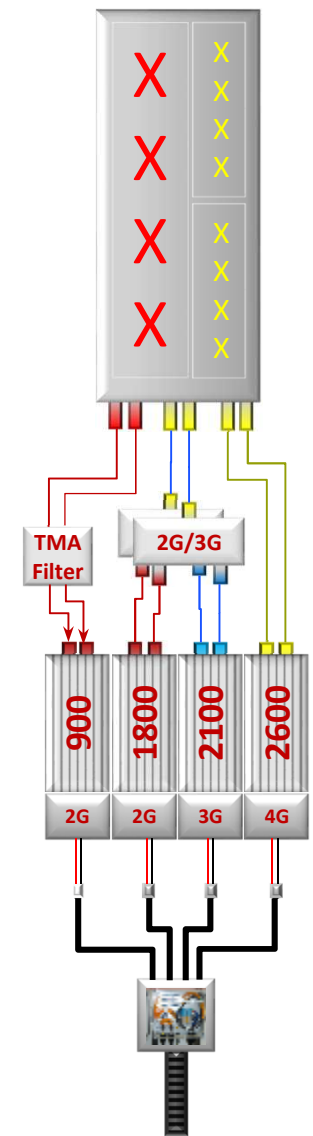
Source: ABI Research (MD-MBSE-160)

Market View – Antennas for LTE

LTE-capable Antenna Shipments by Band Configuration



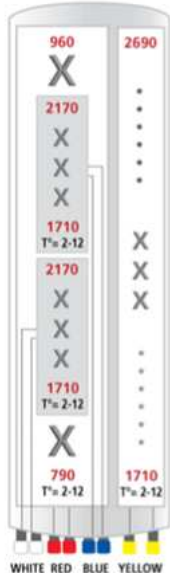
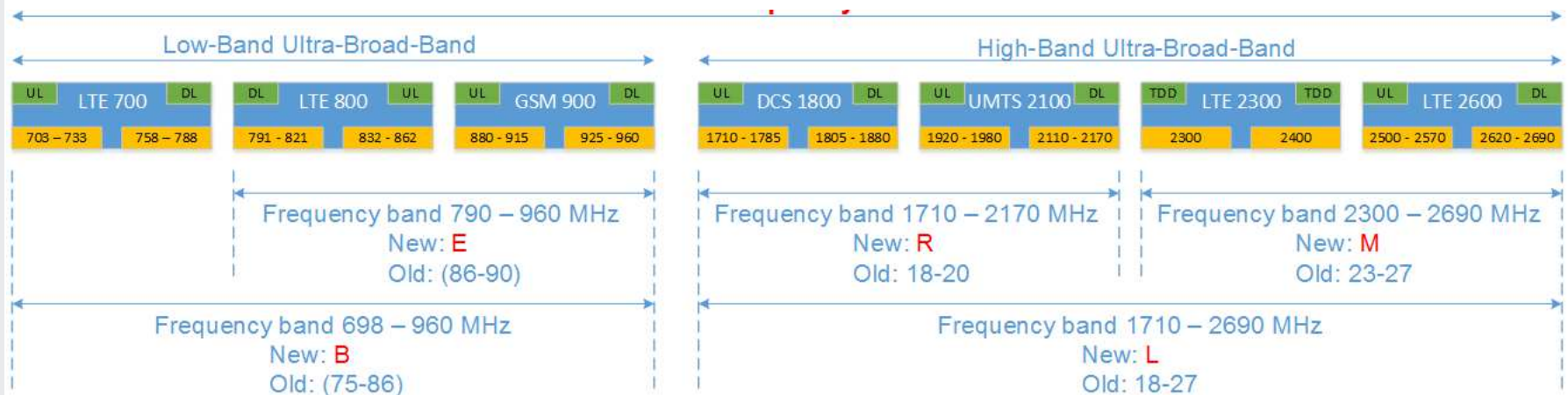
3x



LTE is driving to complex site infrastructure for multiband solutions

Source: ABI Research

EMEA Frequency bands & RFS models numbers



Ex. RFS Quad band antenna with RET called: **APXVERRL26-C-A20**

- A** Antennas for Base-Station
 - P** Panel directional 65 deg
 - X** Cross polarized antenna
 - V** Variable Electrical Tilt (VET) 2-12 deg
 - E** Low band port 790-960 MHz
 - R** High band port 1710-2170 MHz
 - R** High band port 1710-2170 MHz
 - L** Ultra broad band 1710-2690 MHz
 - 26** 2.6 meter type
 - C** Including bracket for pipe, wall and mechanical down tilt
 - A20** Including 4 RET motors with AISG 2.0
- } Including 8 port & 4 services

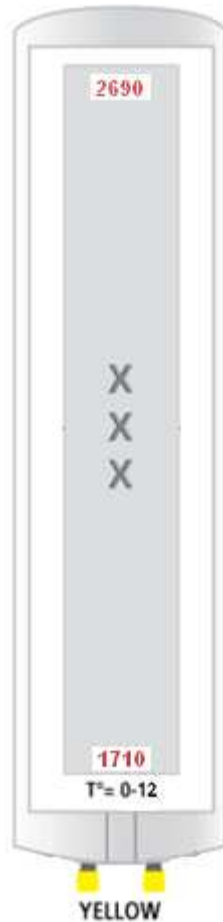
Multiband Antenna Array Architecture - LTE

Single Band
LB



APXVE
APXV86-90

Single Band
HB UBB



APXV18-27

Dual Band
SbS LB



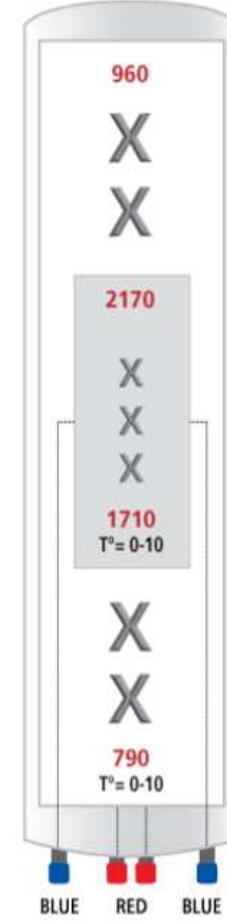
APXVEE

Dual Band
SbS HB UBB



APXVLL

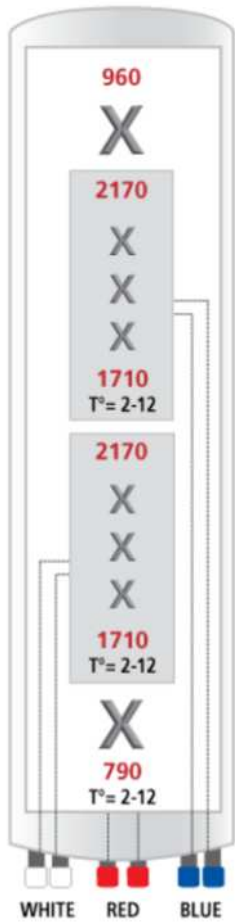
Dual Band
In-Line



APXVER

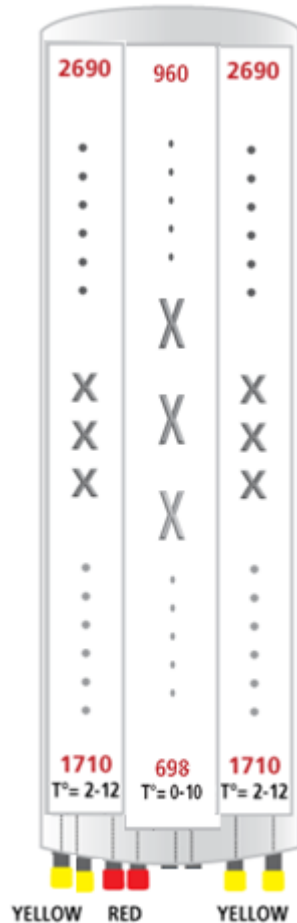
Multiband Antenna Array Architecture - LTE

Triple Band In-Line



APXVERR

Triple Band SbS UBB



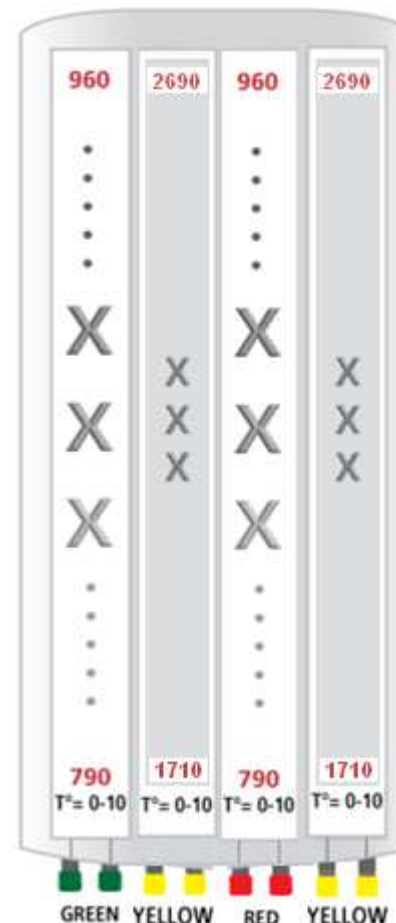
APXVBLL

Triple Band SbS HB UBB



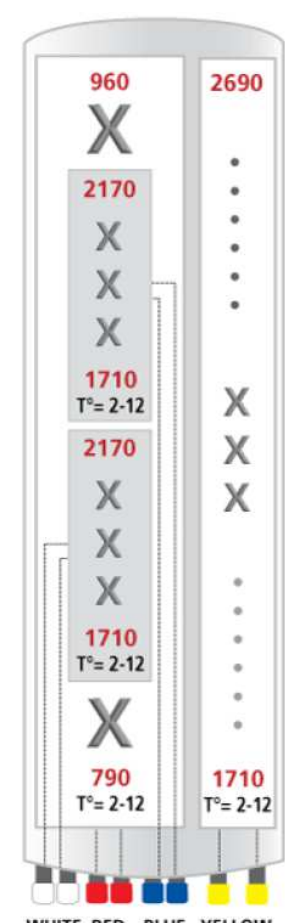
APXVRLl

Quad Band UBB SbS



APXV99LL

Quad Band UBB In-Line + SbS



APXVERRL

RFS Antenna key features

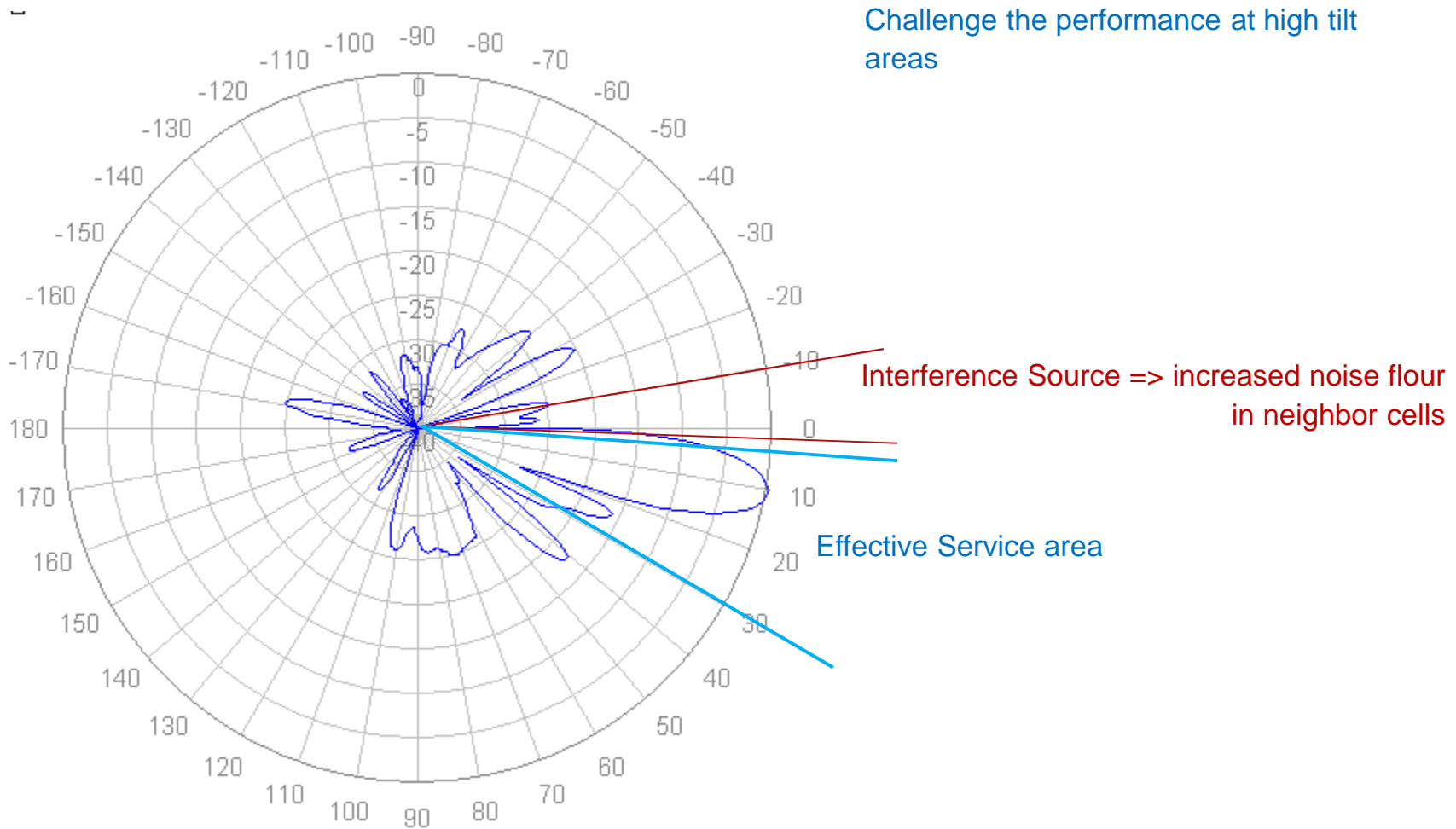
- ❑ **Ultra Broad Band High Gain antennas** with excellent performance over complete operating band: 790 – 960 MHz and 1710 – 2690 MHz
698 – 960 MHz and 1710 – 2690 MHz in 2014
- ❑ **High stability of electrical performance** over complete operating frequency band and tilt range due to separate phase shifter per dipole
- ❑ **Broad tilt range** for dense urban applications 0-12°
- ❑ **Advanced upper side lobe suppression** (USLS >17 dB in full UBB) resulting into maintained isolation with neighboring cells in high tilt range
- ❑ **Long term stable PIM performance** due to non metallic materials in VET system
- ❑ **Reduce tower load** due to optimized aerodynamic antenna shape
“*Wind Master*” trade Mark

Antenna Effectivity

Radiation Performance

+1 dB = +10% traffic

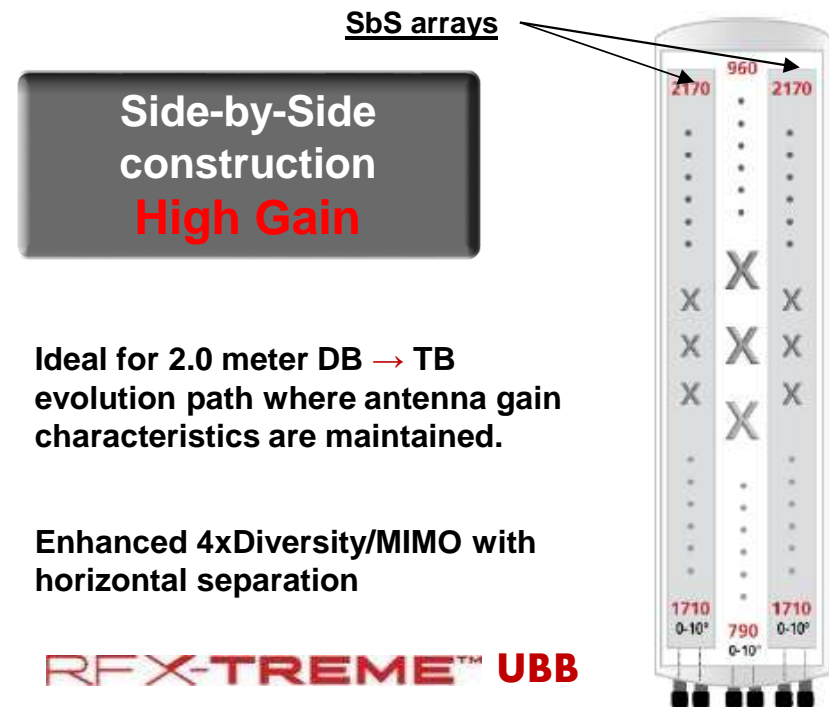
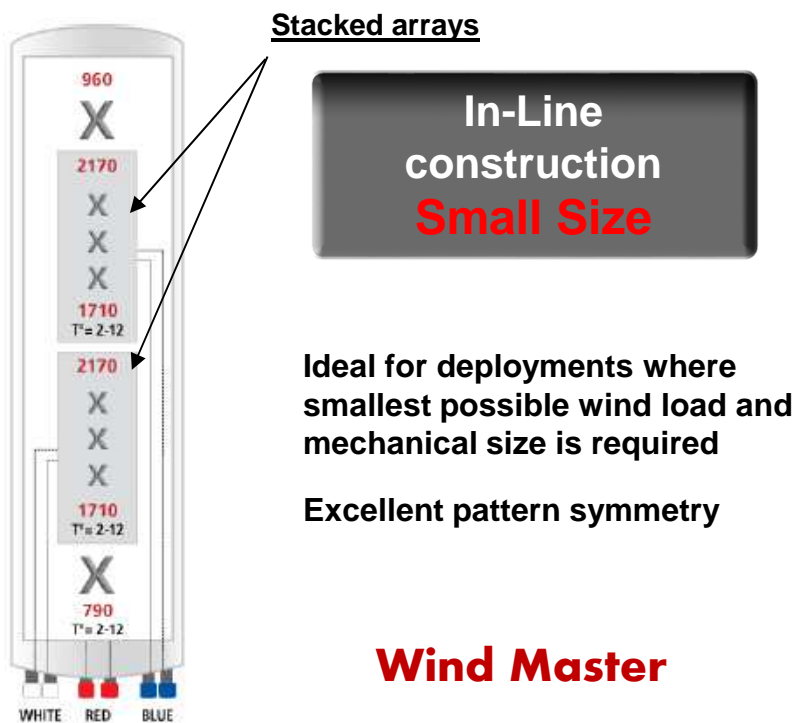
Challenge the performance at high tilt areas



BSA Platforms – Highest Gain or Lowest Wind load

Multi Band & High Gain

- ❑ Side-by-Side placement of full length antenna arrays gives the highest possible gain in all antenna lengths.
- ❑ In an in-line antenna HB arrays are only half the length of the antenna = Low Gain; 1.5dB difference in 2.0 meter class



Application: Dual-band SbS 2x 1710-2690 MHz

Ultra broad bands

- XX-Pol VET **1.3m** 65deg **18dBi** called APXVLL13N-C

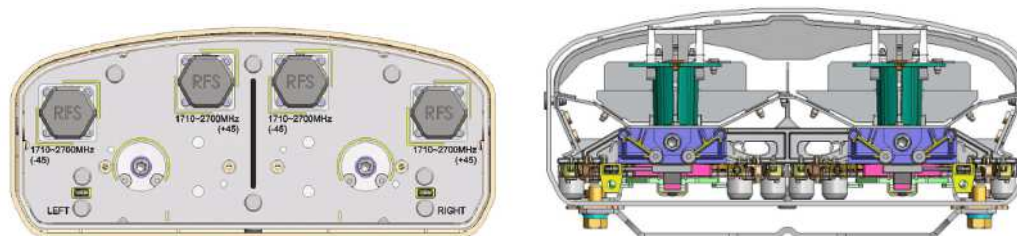
Key Benefits

- Ultra broad frequency range: 4 ports from 1710 to 2690 MHz
- Extended tilt range from **0 to 12°** : suitable **EVERYWHERE** (in rural, sub-urban, urban and dense-urban)
- Maximum gain in LTE 2.6 GHz band for more traffic
- Enabler for 4xn MIMO in LTE2600
- NEW WindMaster design: Small radome size, low wind load, only **288 mm** wide.



2x 11 dipoles with 1.17 lambda center spacing @ 2600

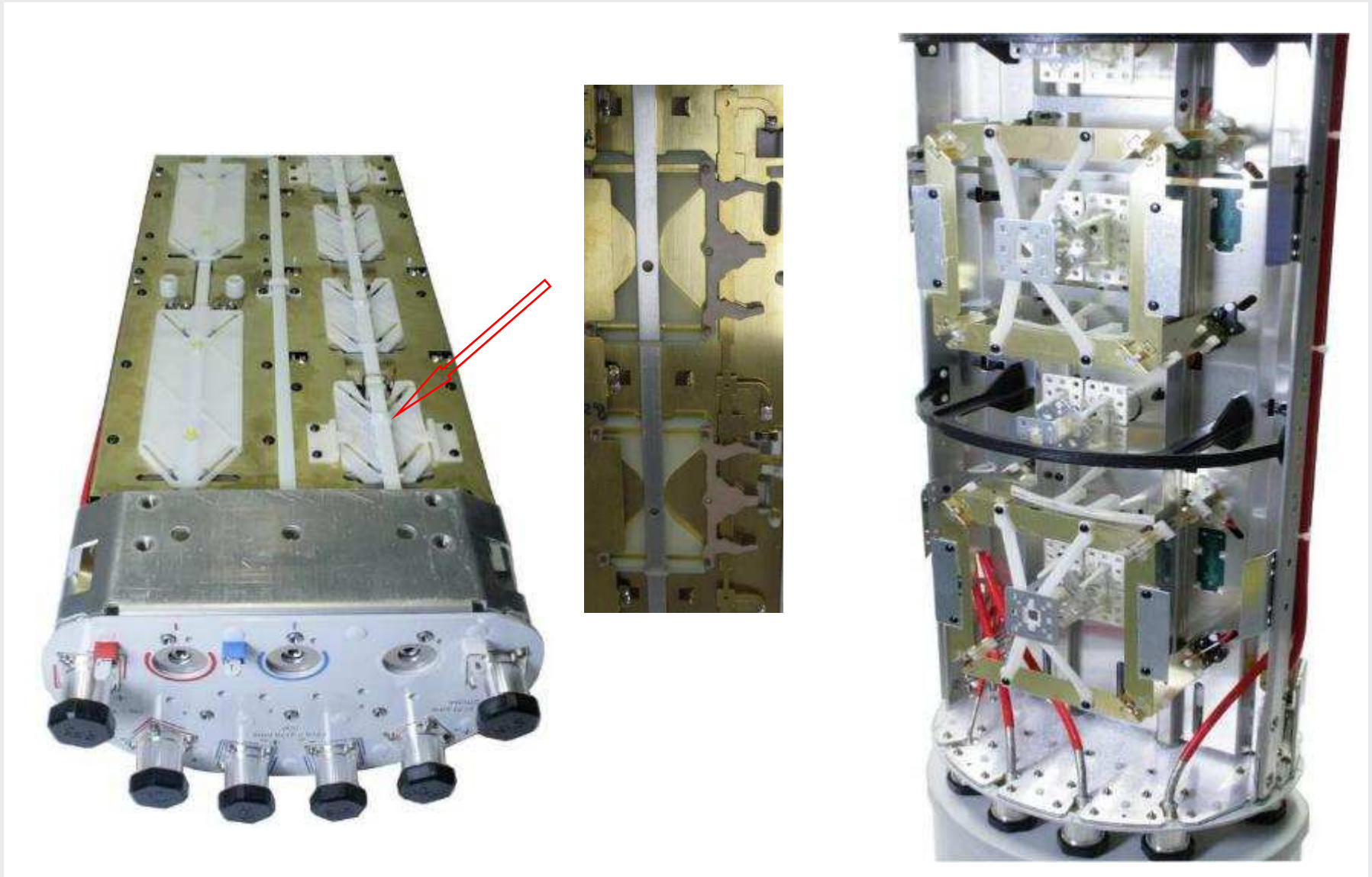
Very useful antenna to maintain one radome when adding 3G or LTE



Antenna End Plate

**10% more traffic in
LTE with RFS**

RFS Multiband Solutions



Application: Triple Band 790-960 / 2x 1710-2170

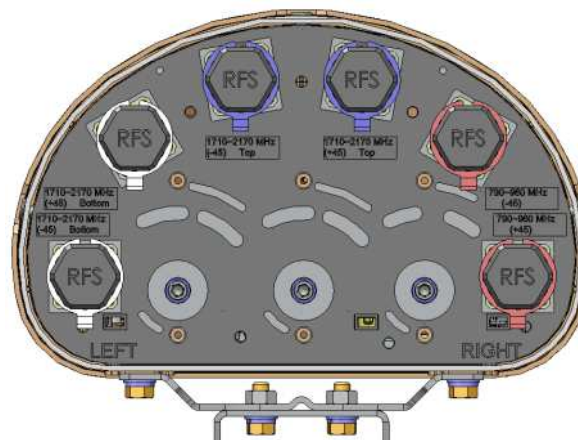
Triple Band XXX-pol VET

- XXX-pol VET 2.6m 65deg 17.5 dBi called APXVERR26-C

Key Benefits

- Extended band to LTE 800
- High Gain: A direct replacement for site upgrade
- Omni shape Radome – **Extreme low wind load** < 600N
- Broad tilt range: 2 to 12 deg
- Low width 28 cm

- Optimized radome shape
- Easy access to connectors
- color code on connectors
- Space for RET and indicator



Application: Triple Band 790-960 / 2x 1710-2170

Triple Band XXX-pol VET

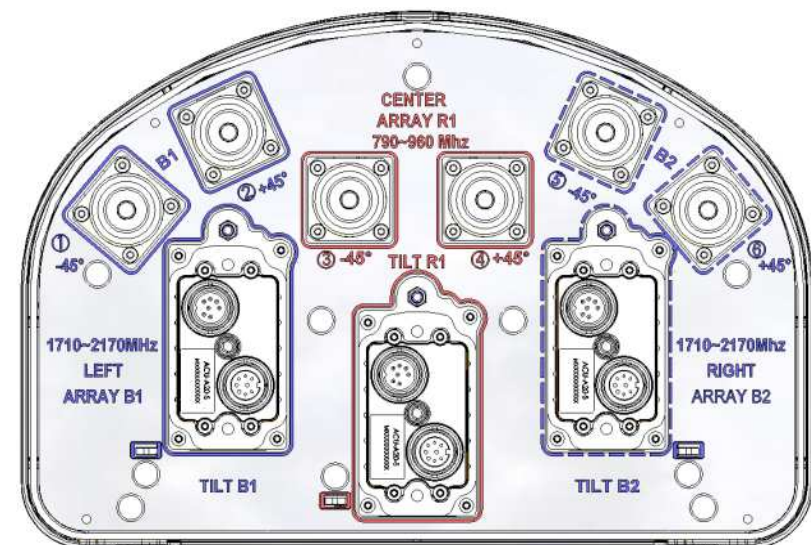
- XXX-pol VET 2m 65deg called APXVERR20X-C

Key Benefits

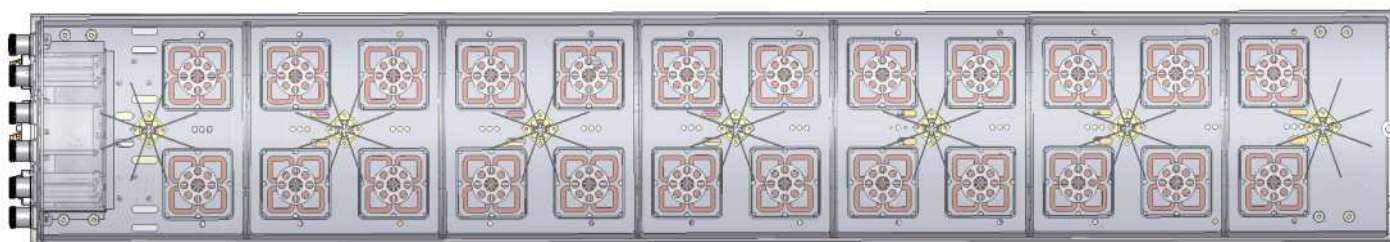
- Upper Sidelobe suppression: 18dB
- Very High Gain: 16dBi / 17.6dBi / 18.3dBi
- High XPD typically > 20dB in main axis
- Options for build in RET
- Broad tilt range: 0 to 10 deg
- Low width < 30 cm

RFX-TREME™

RET options



SBS design to optimized gain at 2 meter



Application: Quad band 900 / 1800 / 2100 / 2600

Quad Band X4-Pol VET

Application: 2G, 3G, 4G

XXXX-Pol VET 2.6m 65deg 17.4 / 17.4 / 17.7 /18.3 dBi
called APXVERRL26-C

Key Benefits

- XXXX-Pol with **8 ports** Quad Band, 2xLB/2xUBB, SbS
- Frequency range – 790 to 960 / 2x 1710 to 2170 / 1710 to 2690
- High gain - direct replacement
- Variable Tilt ranges 2° to 12° in all bands
- High USLS performance >17 dB
- 2.6 meter long and 36Kg and 33 cm
- Optional external RET on all ports

**Useful antennas for high traffic sites
when adding LTE**

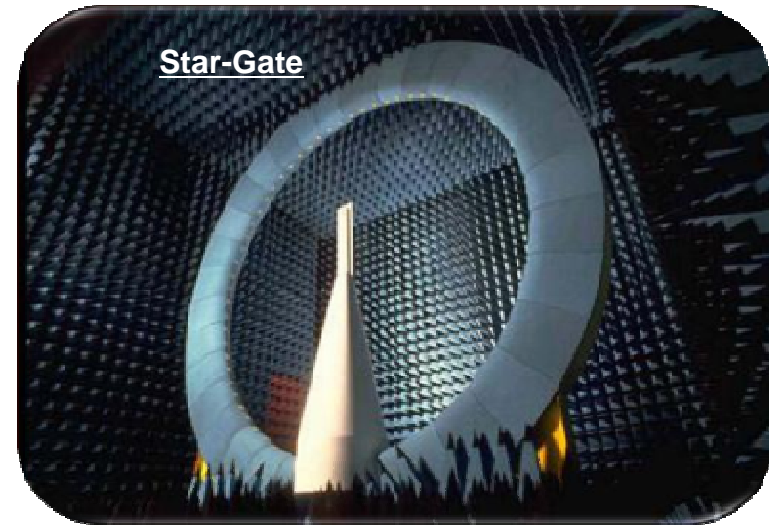
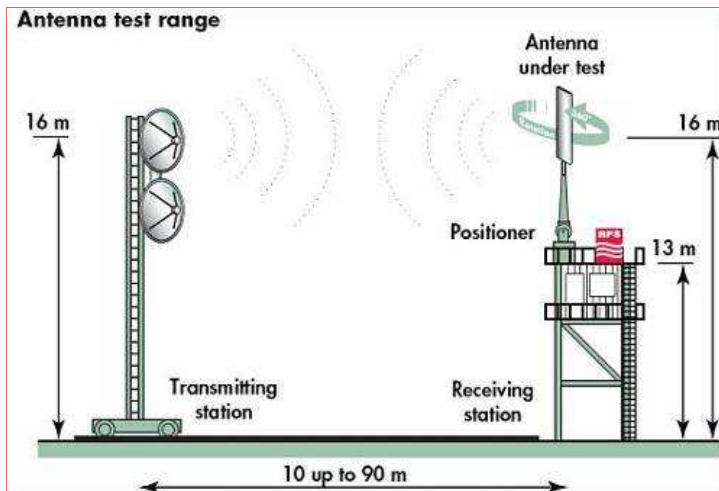


**All bands included
790-2690 MHz**

Premium quality – Designed to last

Antenna Qualification Program

- Temperature – IEC 600-68-2-14 Test Nb
- Dry Heat – IEC 600-68-2-2 Test Bb
- Cold – IEC 600-68-2-1 Test Ab
- Humidity – IEC 600-68-2-78 Test Cab
- Rain Test – IEC 600-68-2-18 Test Rb
- Salt Mist – ISO 9227:2006
- Sinusoidal Vibration – IEC 600-68-2-6
- Shock & Bump – IEC 600-68-2-29
- Free Fall – IEC 600-68-2-31
- UV test – ISO 4892-2A
- Wind Load – done in a wind tunnel
- HALT tests



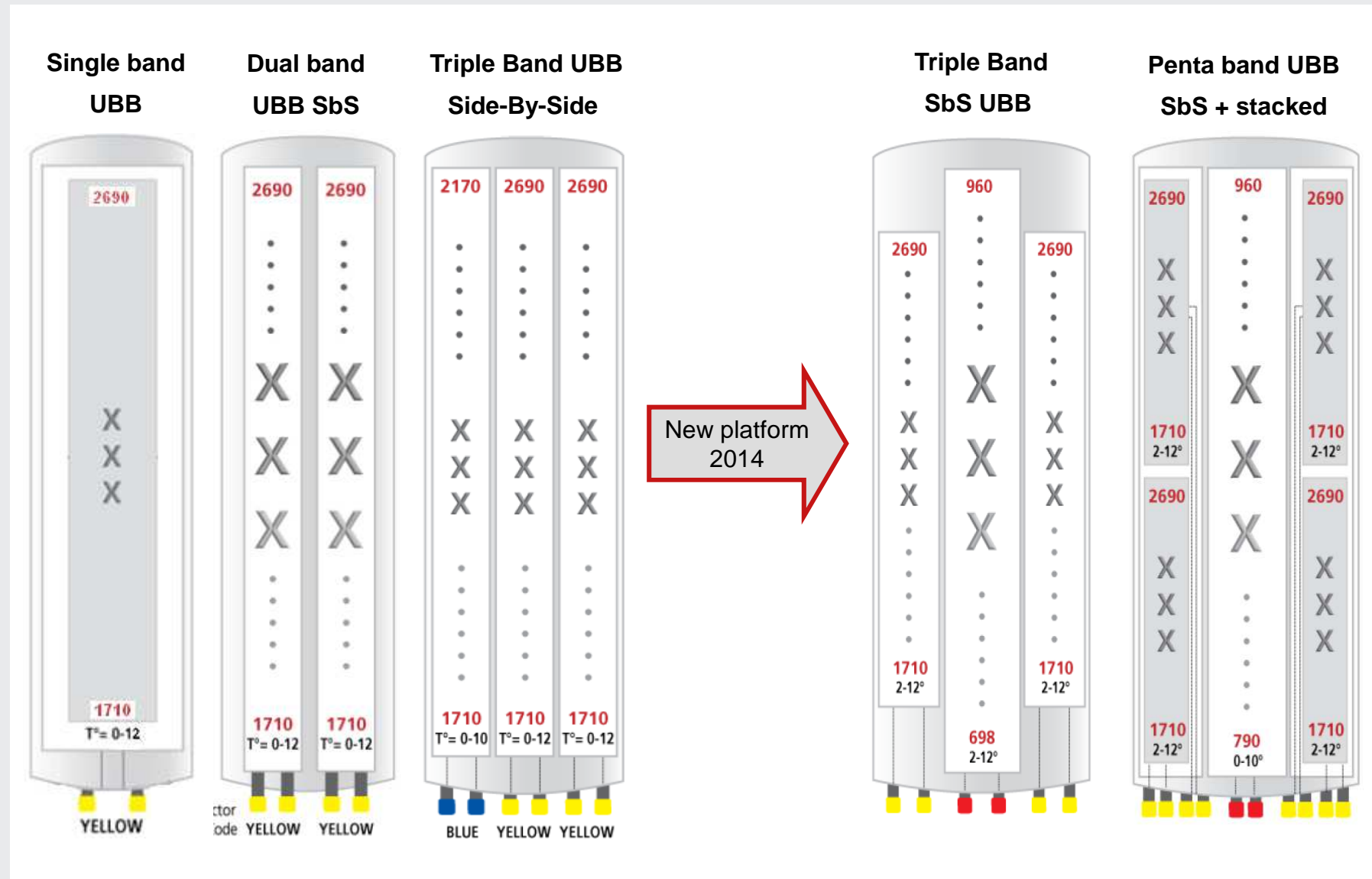
Production test on: (100%)

- VSWR / return loss
- Cross polar isolation
- Dynamic Intermodulation

Comprehensive product qualification is the key to success in verifying reliability

We are verifying our antenna patterns under real far field conditions

Future Multiband UBB Platforms

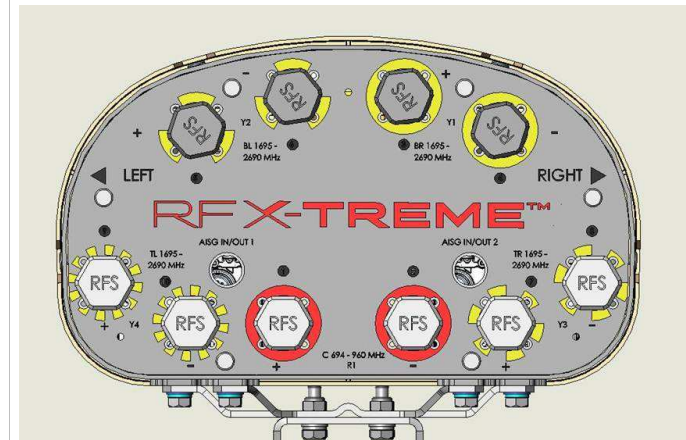


Introduction to RFS Pentaband 2.6m

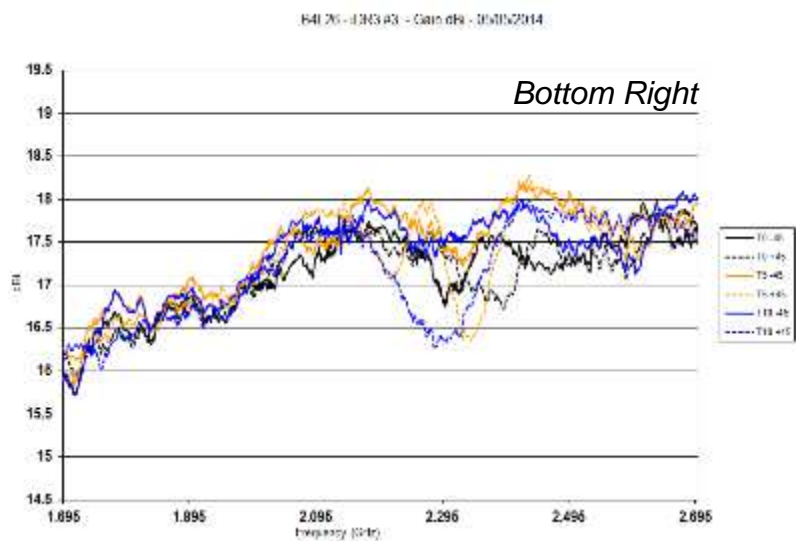
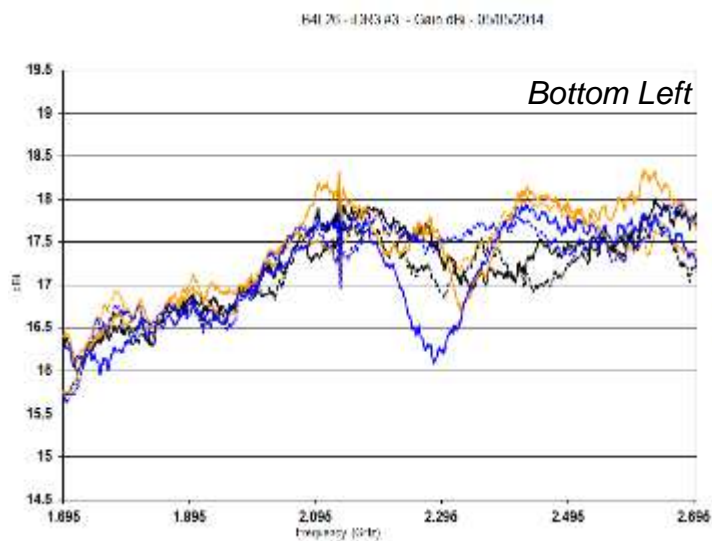
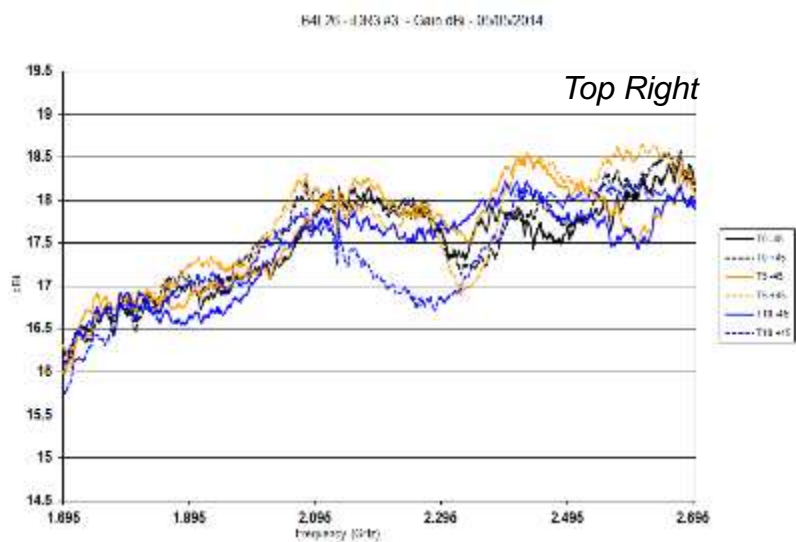
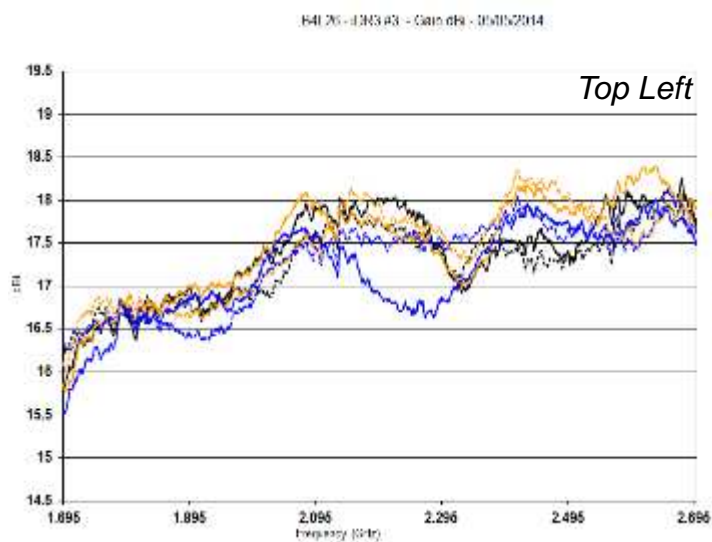
➤ APXVB4L26X-C-I20B

- ✓ **1x 698-960 / 4x 1710-2690 MHz, integrated RET and BiasT**
 - Natural choice when migrating from legacy tripleband
 - MIMO 4x4 intended for 1800 and 2600 MHz
 - Suitable for LTE 2.3 GHz application also

- ✓ **Key features**
 - Integrated RET and BiasT : no external devices for RET control,
 - AISG connectors for alternative feeding via AISG cables or from a TMA
 - Side by side configuration for MIMO schemes
 - Ultra broadband in low band and high band for multiple applications and ready for LTE 700
 - Shaped radome for low wind load



High-band gain, all arrays, T0-T5-T10

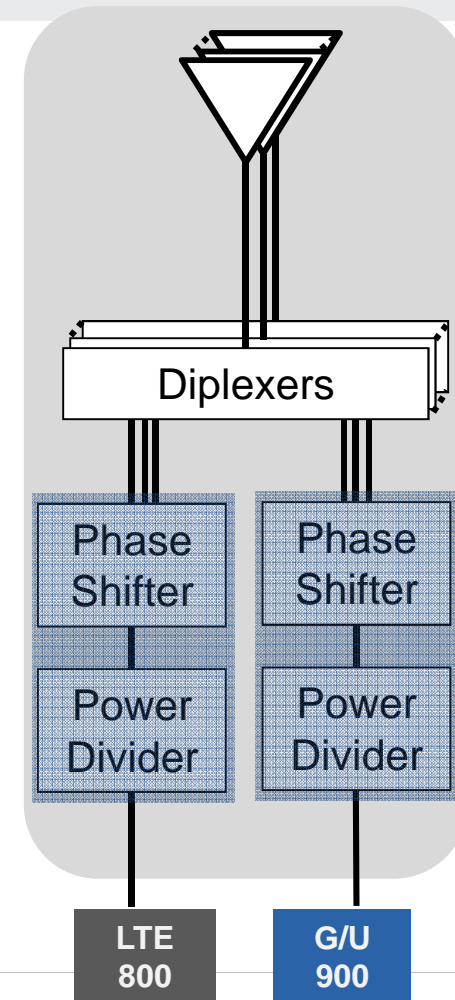
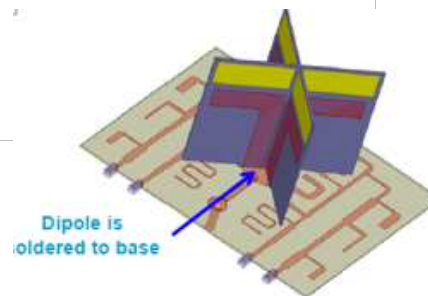


Introduction to RFS Quadband 2xLB/2xHB 2.6m

➤ APXVNGLL26XD-C : a technology jump

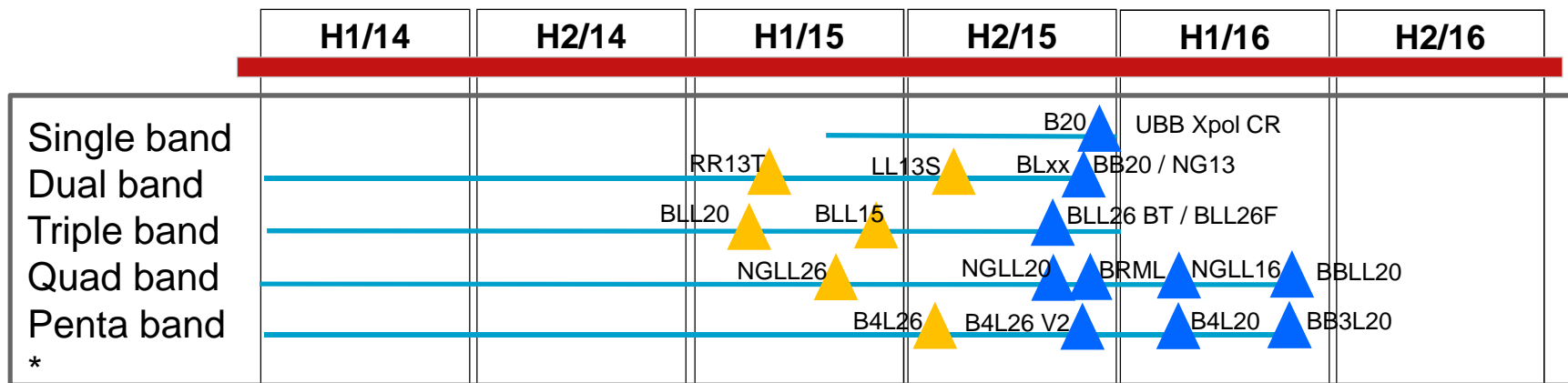
- ✓ **1x 800 / 1x 900 / 2x 1710-2690 MHz**
 - Typically for LTE 800 application, when migrating from legacy tripleband
 - Embeds array diplexing technology

- ✓ **Key features**
 - Integrated RET and BiasT : no external devices for RET control,
 - AISG connectors for alternative feeding via AISG cables or from a TMA
 - Side by side configuration for MIMO schemes
 - Ultra broadband in low band and high band for multiple applications:
 - Shaped radome for low wind load



Roadmap 2015/16

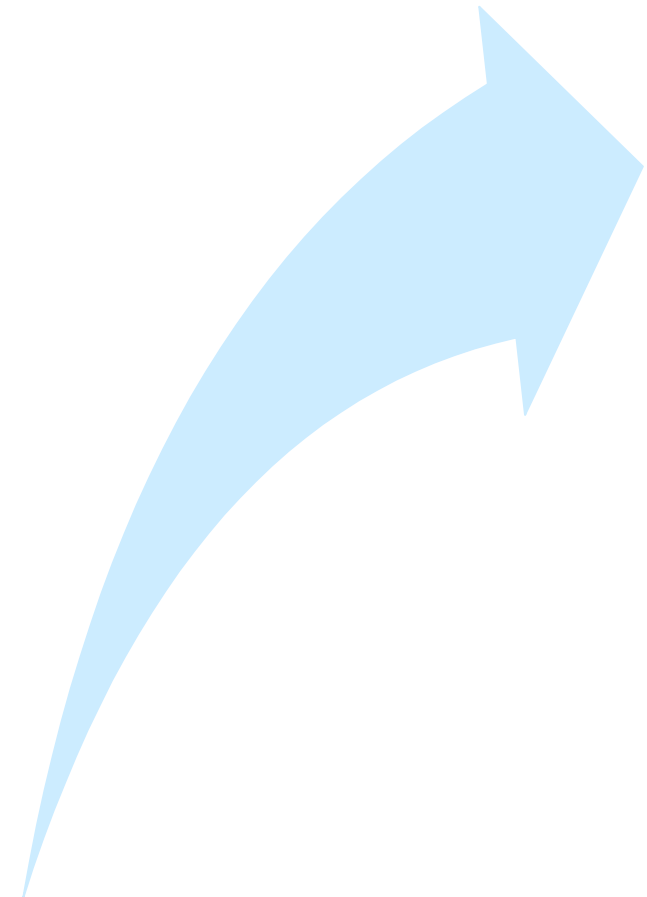
Region	Description	Bands	Model Number	2015
EMEA APAC LATAM	Triple Band UBB 2.0m	Xxx	APXVBLL20X	Q1
EMEA APAC LATAM	Triple Band UBB 1.5m	Xxx	APXVBLL15X	Q2
EMEA	UBB Quad 2.6 - Array Diplexed LB	XXxx	APXVNGLL26XD	Q2
EMEA	Triple Band UBB 2.6m	Xxx	APXVBLL26X	Q3
EMEA	Penta Band UBB	Xxxxx	APXVB4L26X	Q3



BSA EMEA - Highlights 2014

Top 5 major wins

- Big success with KPN Netherlands 2014/15: Wind Master antennas
- We are listed as one of the two major suppliers for BSA at Telenor
- Increase our BSA market share in Russia by 300%
- First success with NSN in Africa
- Positioning our quad band in Orange Romania



Tangible capacity increase on-going

Easy & fast handling in the field



One motor for all RFS antennas:

- new slim RET version
- AISG compatible (3GPP)
- Tested with more than 36,000 antenna movements
- More space for connector and suitable for slide-in/internal RET solution
- IOT test performed with leading equipment suppliers



ACU can be delivered together with already correct configured and uploaded software



One mount for all RFS antennas:

- Basic Direct mount kit for beam sliding mechanical down tilt 0 - 10°
 - Include in the antenna packaging
 - for pipe diameter : 60 - 120 mm (optional for 30 - 60 mm)
- Upgradable scissor for more tilt and azimuth adjustment +/-30°
 - for wall mount or more flexibility on mast

Well appreciated by installers

ShareLite Diplexers and Triplexers



Products available for almost any sharing application today :

- FD9R6004 series: 700-900 // 1700-2200 Diplexer
- FDRL3502 series: 1700-2200 // 2500-2700 Diplexer
- FDDG3015 series 694-862 // 876 – 960 Diplexer
- FDEG5002 series: 790-862 // 880-960 Diplexer
- FDDW6002 series: 1710-1880 // 1920-2170 Diplexer
- FT9DW series: 790-960 // 1710-1880 // 1920-2170 Triplexer

ShareLite Diplexers Portfolio

FDDW6002 series

Combining bands 1710 - 1880 / 1920 – 2170

LTE1800, GSM1800 & UMTS2100

Key benefits:

1. Very low insertion: typically 0,15dB
2. Low unit weight: 2.8 Kg
3. Good level of isolation: 55 dB



Parameter	Value
Insertion Loss	Typ 0.15 dB Max 0.30 dB
Rejection	> 55 dB
Return Loss	>18 dB
Power Handling	> 250 Watt

Product options:

- Single and Dual KIT available
- 4 variants with DC & AISG path
- Pole mounting (**included in box**) and Wall mounting

RFS Motivation

