StreamStar 4

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Advanced Broadband Wireless Access System

- **Advanced** 4G Technology: Hybrid Air Interface – 8x Smart Antenna - Interference Resistance - SDMA
- **High Efficiency**: Long Range - Deep NLoS Coverage - High Capacity - Low Power Consumption
- **Multi-Service**: Voice Telephony - Broadband Internet - Messaging (SMS) - Trunk Services (PTT) - Video
- **Fixed & Mobile**: Voice and Data Portability and Mobility, Seamless Handoff
- **Complete** Ecosystem: Base Stations - Terminals (CPE) - Management - Voice Subsystems

Worldwide Adoption & Deployments

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- **Technology**: ITU-R Standard
- **Certified**: US FCC (FCC 700 MHz band)
- **Certified**: Anatel (Brazil) Homologation
- **Certified**: CE & TUV (EU), CCSA (PRC)
- **Commercially Deployed** in over 20 countries: *USA – Brazil – China – Panama – Russia – Cameroon – Nigeria – Iraq – Zimbabwe – Malawi – Sri Lanka – Myanmar – Chad – etc*.

Primary Features & Advantages

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- **Saves Money:**
  Long Range allows carriers to deploy coverage faster and with less cell sites - saving Time, CapEx, and OpEx

- **Makes Money:**
  Advanced RF and DSP technologies deliver high efficiency, and thus more subscribers and revenue

- **Serves All Customer Needs:**
  Fixed, Portable, Mobile Broadband, Telephony, SMS Messaging – all in one system

- **Easy to Deploy and Maintain:**
  All-IP standard architecture provides full compatibility with existing infrastructure and easy maintenance

- **Flexible:**
  Open to customization: frequencies, subscriber terminal models, ODM modules, etc.

Integrated Telecom Services

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- **Broadband Data:**

Broadband Internet access - corporate & residential, Intranet, VPN services

- **Digital Voice Telephony:**

Built-in native high capacity fixed & mobile voice services

- **Push to Talk:**

Portable, Mobile PTT trunking, dispatch, group communications

- **Customer Self-Install:**

Superior RF performance allows indoor portable customer terminals, eliminating installation

Advanced Technology: Hybrid CDMA + OFDMA Air Interface

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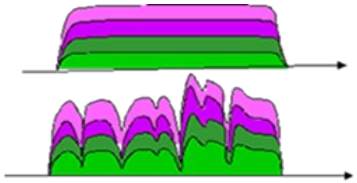
StreamStar^4 uses an optimal combination of two most popular wireless technologies - CDMA and OFDMA.

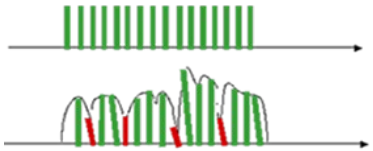
The Hybrid Air Interface negates the disadvantages of CDMA and OFDMA while combining their advantages, and ensures optimal multipath (Non-Line of Sight) and fading performance and inter-cell interference protection - thanks to hybrid orthogonality and spreading gain.

CDMA:



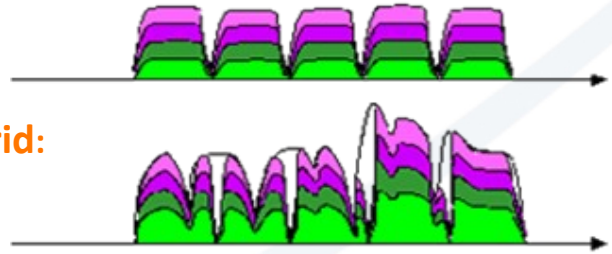
Strong on inter-cell interference
Strong on frequency-selective signal fading
Weak on multipath signal fading

OFDMA:



Strong on multipath signal fading
Weak on frequency-selective signal fading
Weak on inter-cell interference

Hybrid:



Strong on NLoS and multipath signal fading
Strong on frequency-selective signal fading
Strong on inter-cell interference rejection

Advanced Technology: Smart Antennas (Beamforming)

StreamStar^4 is equipped with an 8-element Smart Antenna System that uses true Digital Beamforming.

Beamforming is an intelligent digital signal processing algorithm that focuses the radio beam to each terminal (CPE), increasing the signal strength by up to 64 times – vastly increasing range and capacity. By adjusting the beam path every 10 milliseconds, the Smart Antenna can accurately track all the terminals even if they move at very high speed.

Traditional Single Antenna:

Like a light bulb: radiates energy in all directions. This results in wasted RF energy and extra noise.

Smart Antenna (Beamforming):

Like a torchlight: focuses the radio beam in the needed direction. This results in stronger signal, less wasted RF energy, and less inter-cell interference.

Smart Antenna Advantages: Increased Coverage

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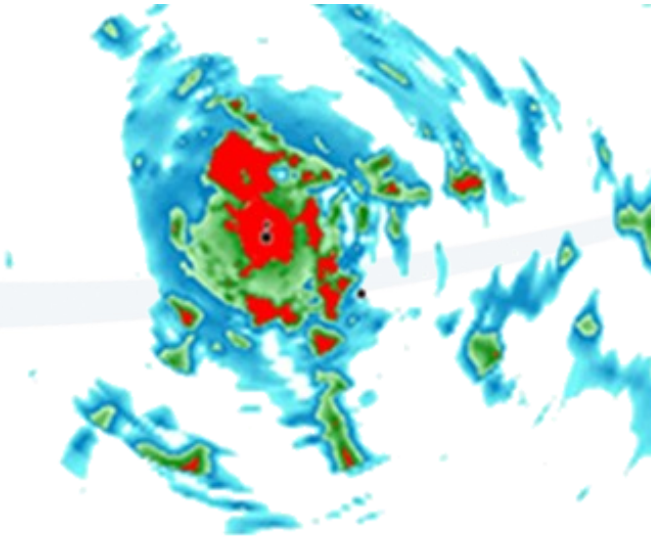
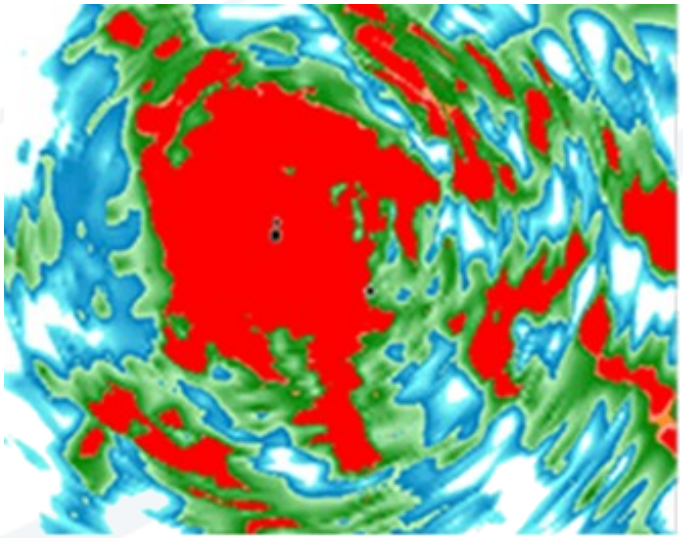
With Beamforming, coverage is improved by at least 3 times – reducing the number of cell sites required to cover required areas by a factor of 3. This results in major Capital and Operational expense savings.

Beamforming achieves massive effective signal power without using power-hungry RF amplifiers. This reduces power consumption, increases reliability, and provides environmentally-friendly, “green” networks.



Traditional Single Antenna Coverage Pattern



Smart 8-Element Antenna Coverage Pattern

Smart Antenna Advantages: Increased Capacity

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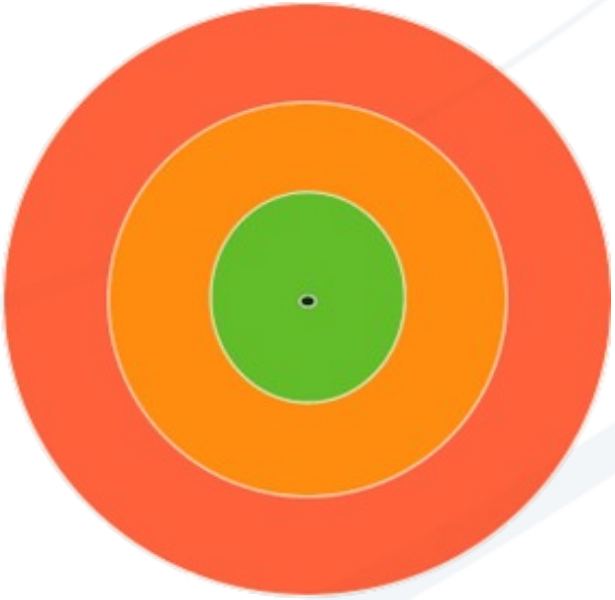
With Beamforming, the effective signal strength is much higher than systems with traditional single or MIMO antennas.

With a stronger signal, the system can run high-order modulations – resulting in higher capacity and efficiency.

Traditional Antenna



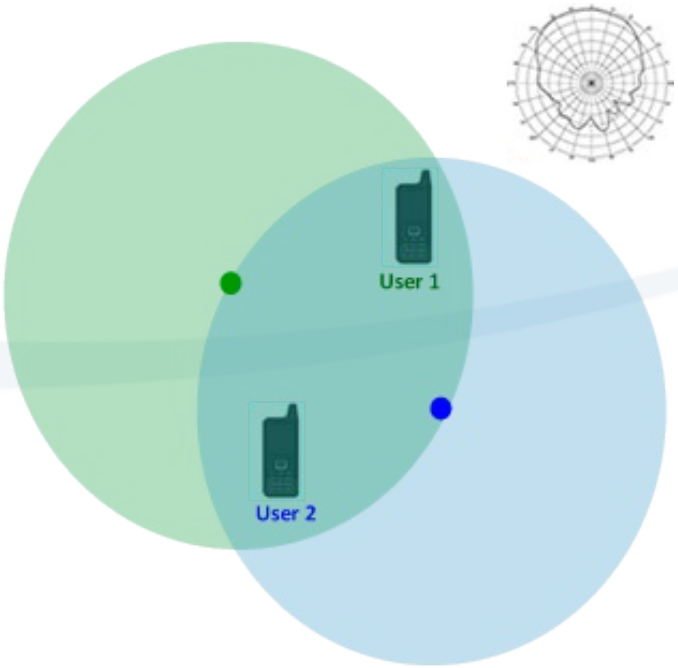
Smart 8-Element Antenna

64-QAM
16-QAM
QPSK

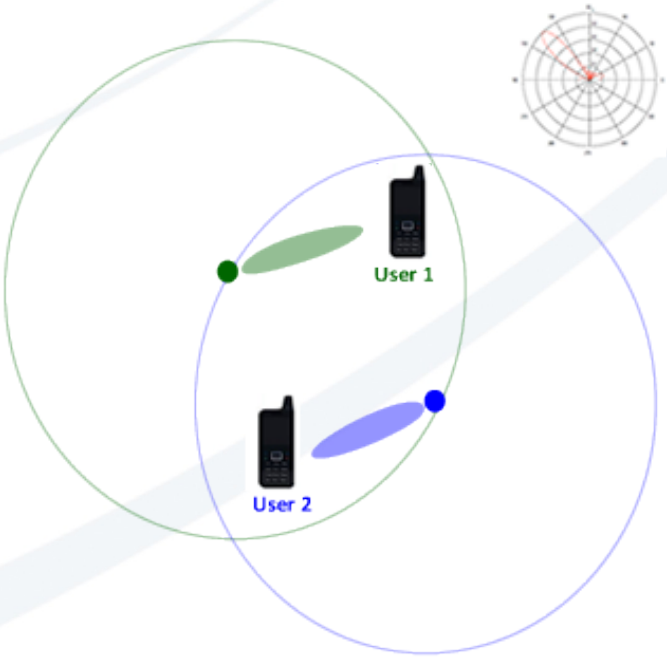
Smart Antenna Advantages: Increased Efficiency

With Smart Antenna Beamforming, probability of Inter-cell interference is significantly reduced.

Since the beam is narrowly shaped instead of being broadcast like with single antenna systems, efficiency and overall noise performance is increased dramatically.



Traditional Antenna: 100 % overlap, 40% collision



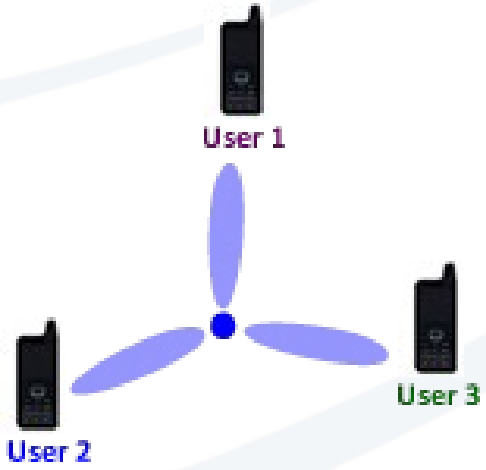
Smart Antenna Antenna: 100 % overlap, 0.1% collision

Smart Antenna Advantages: SDMA

SDMA – (Spatial Division Multiple Access) is an advanced technique used to increase the base station capacity and spectral efficiency, by introducing a 3rd domain into the resource allocation plane in addition to time and frequency – the space domain.

SDMA Spatial Multiplexing is only viable with a multi-element Smart Antenna and benefits from the fact that multiple users can be assigned the same frequency resources as long as they are sufficiently separated in space – and the 8x Smart Antenna is perfectly suited for that.

SDMA can as much as triple the base station throughput while using the same single frequency channel.

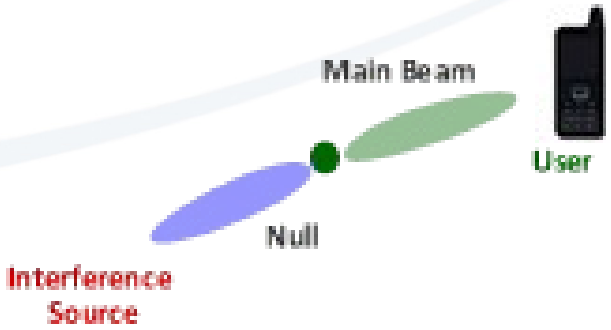


* SDMA is scheduled for release in Q3 2012 as a BTS software upgrade. SDMA will only be available for the 8-element Macro BTS models.

Smart Antenna Advantages: Interference Resilience

With Smart Antenna, external interference can also be defeated. Originating from a military communications system, the Smart Antenna employs Spatial Nulling technology which protects the system from intentional (jamming) and unintentional interference.

Spatial Nulling can detect the source and direction of interference and create a “null” towards the interferer, effectively attenuating it to harmless levels.



System Features: Security & QoS

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System security features are suitable for any deployment type – from public to military. Smart Antennas are originally a military antenna technology designed to be resistant to interception and intentional jamming.

- **Air Interface Security**

- Phased Array Antenna makes eavesdropping extremely difficult
- Code-Spreading makes decoding the signal even harder
- Terminal to BTS authentication prevents cloning and unauthorized terminals

- **Multi-Layer Security**

- VLAN tagging with QinQ - PPPoE
- ARP source address validation, ACL, Broadcast Filtering

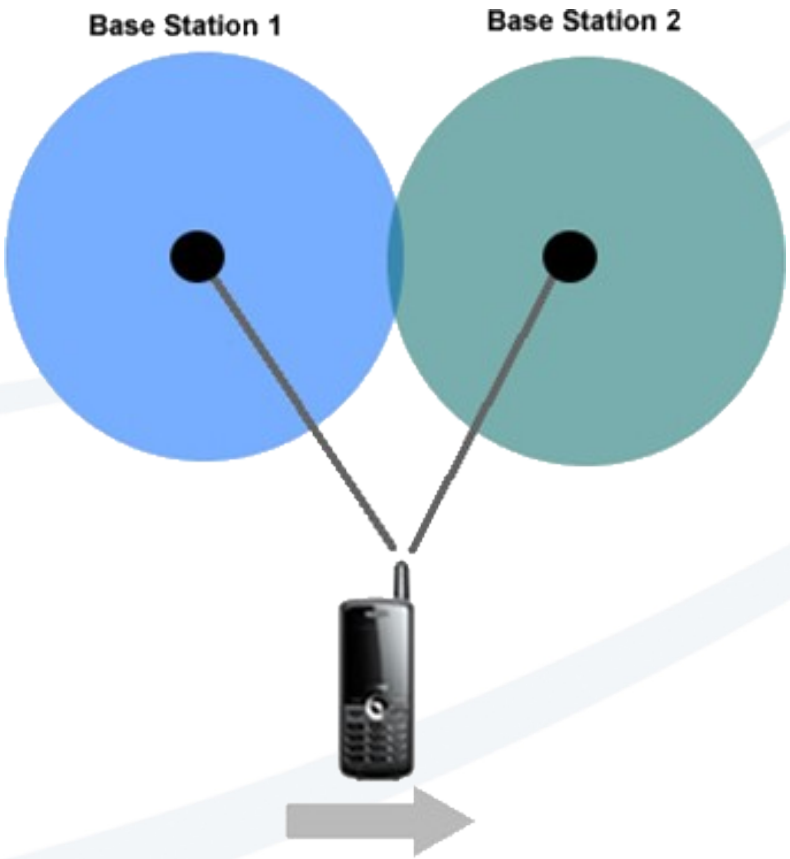
- **QoS and GoS**

- Per-terminal profile-based rate control (bandwidth management)
- Type Of Service (ToS) traffic classification at air interface level

System Features: Full Mobility

StreamStar^4 is a fully mobile system. Base stations coordinate handoff with no packet loss and no call disconnection.

All terminal types support mobility and no special software or hardware is required on both network and the client computers: handoff is completely transparent to the users.



System Features: Frequency Bands

StreamStar^4 supports a wide range of frequency bands for worldwide operation, and can operate even with limited spectrum allocations – as small as just 5 MHz.

- **336-344 MHz : UHF**
- **400-430 MHz : UHF**
- **698-746 MHz : 700 MHz US FCC**
- **1785-1805 MHz : 1.8 GHz GSM Guardband**
- **2150-2180 MHz : BWA/FWA band**
- **2525-2560 MHz : BWA/FWA, WiMAX**
- **3300-3400 MHz : BWA/FWA, WiMAX**
- **Custom frequency bands can be made**

System Network Elements: Macro Base Stations

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Macro Base Stations (BTS) are optimized for macro-cell coverage with a choice of Smart Antenna arrays.

Base Station Baseband Unit (BBU)

Base Station Outdoor Unit (RRU)

Antenna Arrays

- Base Station: Baseband Indoor Unit (BBU)
- Outdoor Unit: 8-channel RF Transceiver (RRU)
- Baseband to RF Unit connection: Single-mode Fiber
- Antennas: Smart 8-element Omni or Sector
- Backhaul Interface: Ethernet
- Synchronization: GPS

System Network Elements: Micro Base Stations

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Micro Base Stations (BTS) are optimized for micro-cells and quick addition of network capacity wherever it is needed.

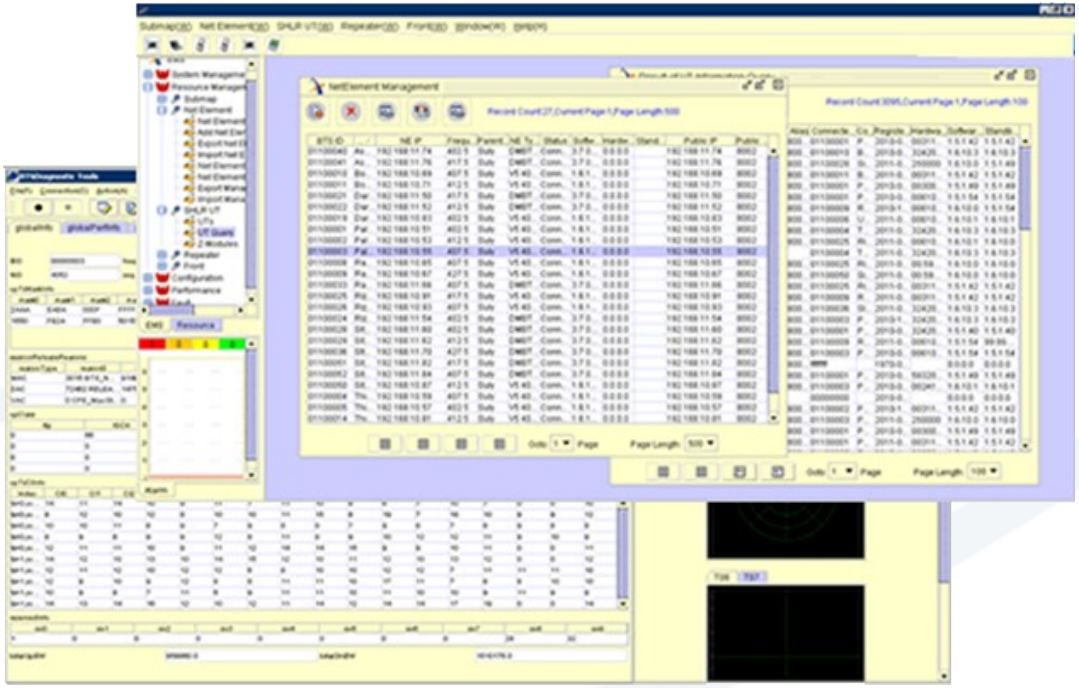
Micro BTS are fully outdoor and do not require any indoor infrastructure, reducing expense and deployment time.

Micro Base Station: All-Outdoor Unit

- Base Station: All-Outdoor Unit
- Antennas: Smart 2-element Omni or Sector
- Backhaul Interface: Ethernet
- Synchronization: GPS

System Network Elements: Management Software (EMS)

Element Management System software is a cross-platform client-server system that provides full configuration, management, performance monitoring, and diagnostics for all network elements.



System Network Elements: SAC Voice Switch

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Telephony services in a StreamStar[4] network are handled by a dedicated device – the SAC (Service Aggregation Controller). SAC supports standard Customized Local Area Signalling Service (CLASS) features, such as caller ID, call waiting, three-way calling, call holding, etc.

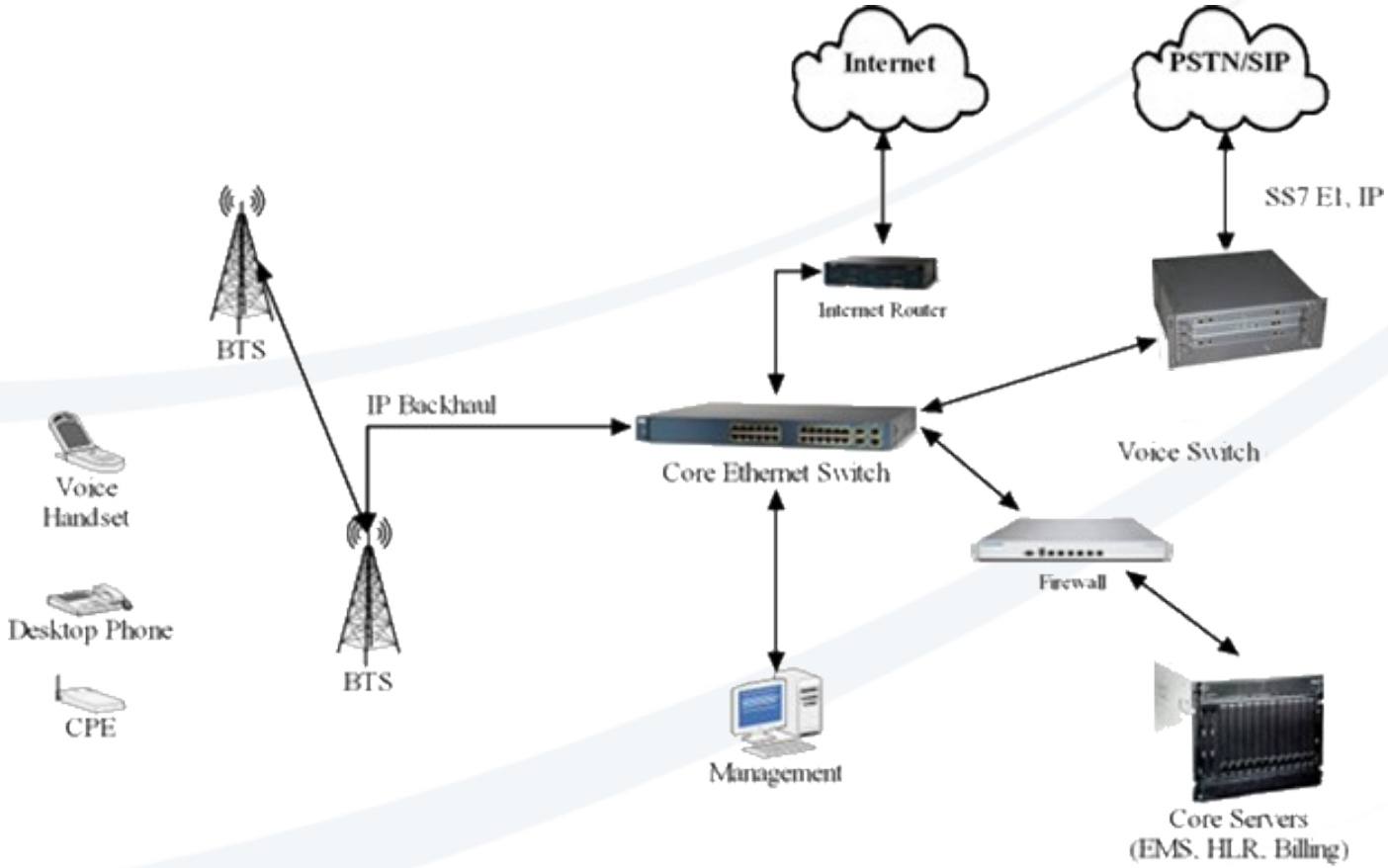
The SAC device functions as the gateway between StreamStar[4] and PSTN or NGN networks by providing TDM (SS7/R2 E1, STM-1) and SIP interfaces.

Each SAC device supports up to 1000 simultaneous voice calls; SAC devices can be stacked for additional capacity and redundancy.

System Network Elements: Core Network Diagram

StreamStar^4 uses an all-IP distributed core architecture. Core services are all software-based and run on standard x86 servers. Voice telephony services are processed by the dedicated SAC voice switch (not required for data-only deployments).

The all-IP architecture is compatible with all standard routers and switches.

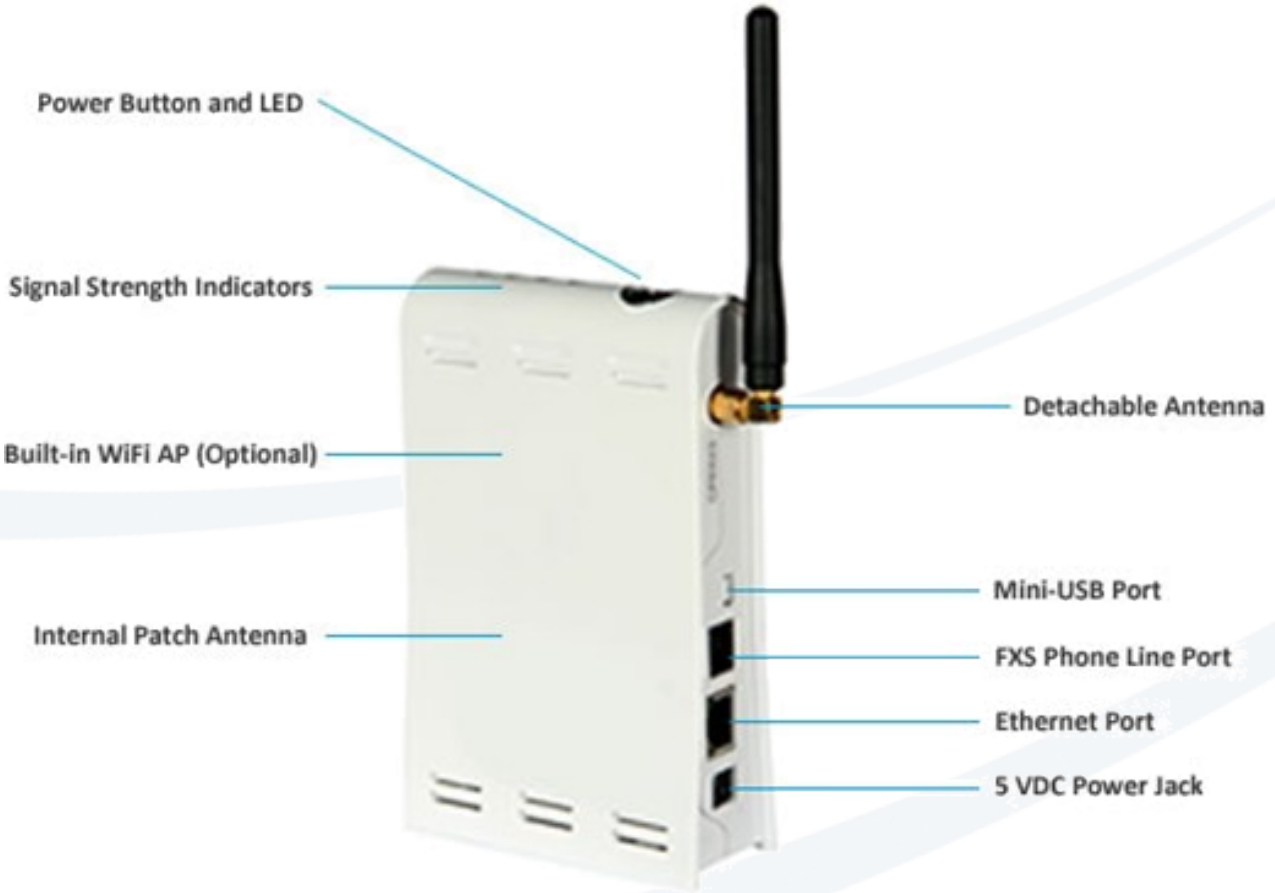


Subscriber Terminals (CPE)

A wide variety of CPE is available supporting integrated telephony, broadband Internet and messaging. All terminals can be used in fixed, portable and mobile scenarios.

Subscriber Terminals (CPE): Desktop Broadband Modem

Desktop Broadband Modem: Portable and Mobile Wireless Telephony + Broadband Data



Desktop CPE

- DC/USB Power
- USB / Ethernet Interfaces
- Optional Built-in 802.11bg WiFi
- FXS POTS Telephone Port
- 2 Internal Patch Antennas
- Detachable Antenna

Subscriber Terminals (CPE): Desktop Broadband Telephone

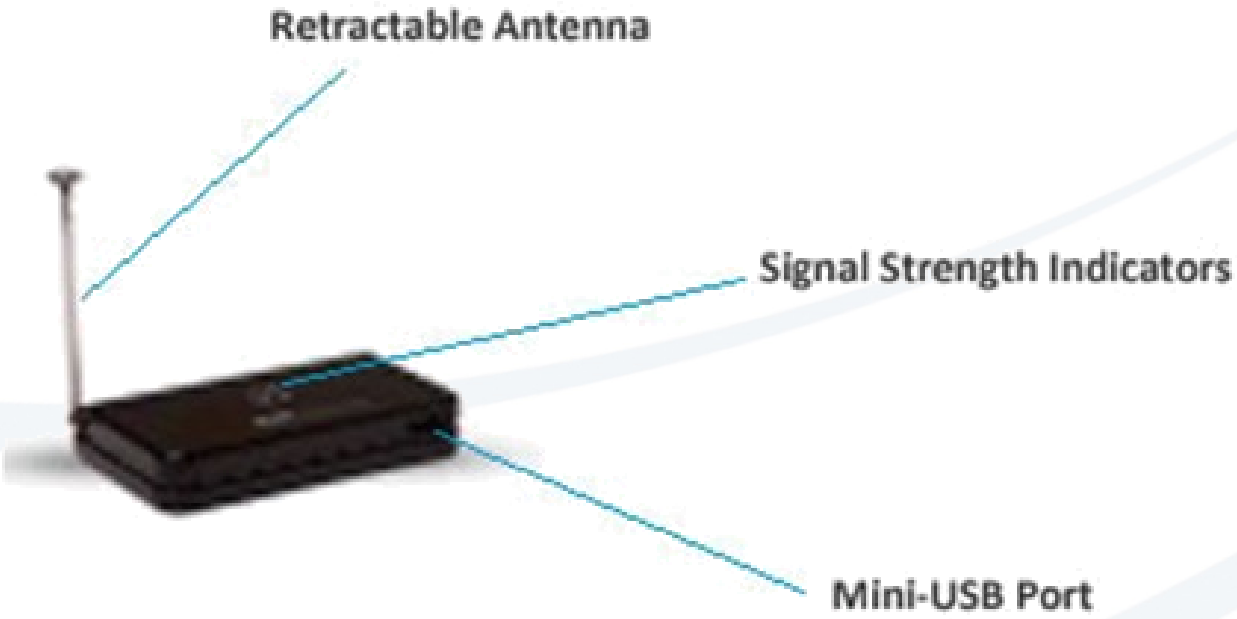
Desktop Broadband Telephone: Portable and Mobile Wireless Voice + Broadband + SMS

Desktop Telephone

- Ethernet Data Interface
- Speakerphone, Call Memory
- LCD screen, SMS Support
- Detachable Antenna
- Internal Battery

Subscriber Terminals (CPE): Mini-USB Portable CPE

Mini-USB CPE: Portable and Mobile Broadband Wireless Internet Access



Mini-USB CPE

- USB Power and Interface
- Retractable Antenna
- Weighs 50 grams

Subscriber Terminals (CPE): Mobile Handsets

Mobile Wireless Handsets: Mobile Voice + Data + SMS + GSM dual-mode

Mobile Handsets

- Fully Mobile Data/Voice/SMS
- USB Data Interface
- USB Charging Capable
- Dual-mode with GSM SIM
- Internal Battery

Subscriber Terminals (CPE): Push-to-Talk Trunk Handset

Trunk Handset: Mobile Voice + Data + SMS + Push to Talk functions

PTT Handsets

- Data via USB
- Mobile Data/Voice/SMS/PTT
- Internal Battery

Technology Comparison: StreamStar[4] vs. WiMAX

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	WiMAX 802.16e	StreamStar[4]
Advanced Antenna Systems (AAS)	MIMO	**8x Beamforming w/SDMA**
Multi-Antenna Gain	Up to 5 dB MIMO A (DL Only)	**18 dB DL, 9 dB UL**
Typical Link Budget	150 dB	**165 dB**
Air Interface	OFDMA	**SCDMA + OFDMA Hybrid**
Native Voice Telephony	None (3rd party VoIP)	**Built-in Digital Telephony**
Single Frequency Capability (N=1)	None, impossible with OFDMA	**Yes, N=1 capable**
Net Spectral Efficiency	1 b/s/Hz	**2.8 b/s/Hz**
Custom Frequency Bands	Only standard bands	**Yes, custom bands available**

Technology Comparison: StreamStar[4] vs. CDMA / EVDO

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	CDMA / EVDO	StreamStar[4]
Smart Antennas	None	**8x Beamforming w/SDMA**
Beamforming Gain	None	**18 dB DL, 9 dB UL**
Air Interface	CDMA	**SCDMA + OFDMA Hybrid**
Maximum Modulation Mode	16 QAM	**64 QAM**
Dynamic Telephony / Data	No, needs separate carriers	**Yes, dynamic partitioning**
Duplexing	FDD - separate UL/DL carriers	**Flexible 7-Level TDD**
Cell Breathing Problem	Yes	**No**
Net Spectral Efficiency	0.8 b/s/Hz	**2.8 b/s/Hz**
Terminal Throughput	153 kbps	**3 Mbps**
Custom Frequency Bands	Only standard bands	**Yes, custom bands available**

Technology Comparison: StreamStar^4 vs. TETRA (PMR)

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	TETRA	StreamStar^4
Smart Antennas	None	**8x Beamforming w/SDMA**
Beamforming Gain	None	**+ 18 dB (64x power)**
Air Interface	TDMA	**SCDMA + OFDMA Hybrid**
Interception	Easy (All communication is broadcast)	**Hard (Communications are directional)**
Group Calling	YES	**YES**
BTS Data Throughput	152 kbps	**15 Mbps**
Terminal Data Throughput	7.2 kbps	**1.5 Mbps**
Custom Frequency Bands	Only standard bands	**Yes, custom bands available**

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Thank You!

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