Corning MobileAccess

Combining MobileAccessHX Quad-Band Solution with Sprint's 800 MHz Band Application Note

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1 Introduction

There is market demand for a high-output multi-operator distributed antenna solution (DAS) that provides complete multiservice coverage and meets RSSI requirements for different cellular technologies. Corning MobileAccessHX Neutral Host addresses such needs by providing a complete suite of solutions to combine 850 CELL, 1900 PCS, 700 LTE and 2100 AWS services of the MobileAccessHX product with 800 MHz IDEN/SMR services.

MobileAccessHX is a multiservice platform that provides a cost-effective, high-output indoor coverage solution for multi-operators (e.g. Verizon, AT&T). It supports the CELL/PCS/700 LTE/2100 AWS bands and provides RF open space coverage for large-scale public venues, such as campuses, stadiums, airports and train stations. MobileAccessHX Neutral Host extends the multiband support of MobileAccessHX to iDEN 800 MHz band by providing solutions to combine the corresponding Corning MobileAccess2000 system, supporting the 800 MHz iDEN service (e.g. Sprint), to the MobileAccessHX platform. Because of relatively lower frequency, the iDEN 800 MHz band meets the RSSI requirements in an HX Neutral host deployment despite the lower output power from MA2000 unit compared to MobileAccessHX.

This Application Note provides guidelines for combining the HX and TSX systems for comprehensive HX indoor coverage solutions, supporting multi-operators (e.g. Verizon, AT&T and Sprint). This document provides the guidelines for five main scenarios that vary according to the following site requirements:

- SISO or MIMO coverage
- Dedicated or shared equipment (i.e. remote units)
- Two-or four-antenna coverage per remote

The example in Figure 1-1 shows the architecture for a dedicated SISO scenario where each operator (i.e. Verizon Wireless, AT&T and Sprint) has its own headend (RIU, BU) and remoteend unit (one HX SISO unit each for Verizon and AT&T; one TSX unit for Sprint). The services provided by each operator are combined using a 4x4 hybrid combiner which transmits the combined signals to four different antennas, providing a complete multi-operator coverage solution.

Note: The connections differ for other scenarios, depending on the site requirements, such as: SISO/MIMO; shared or dedicated; over two or four antennas. Additional secondary components may be required.

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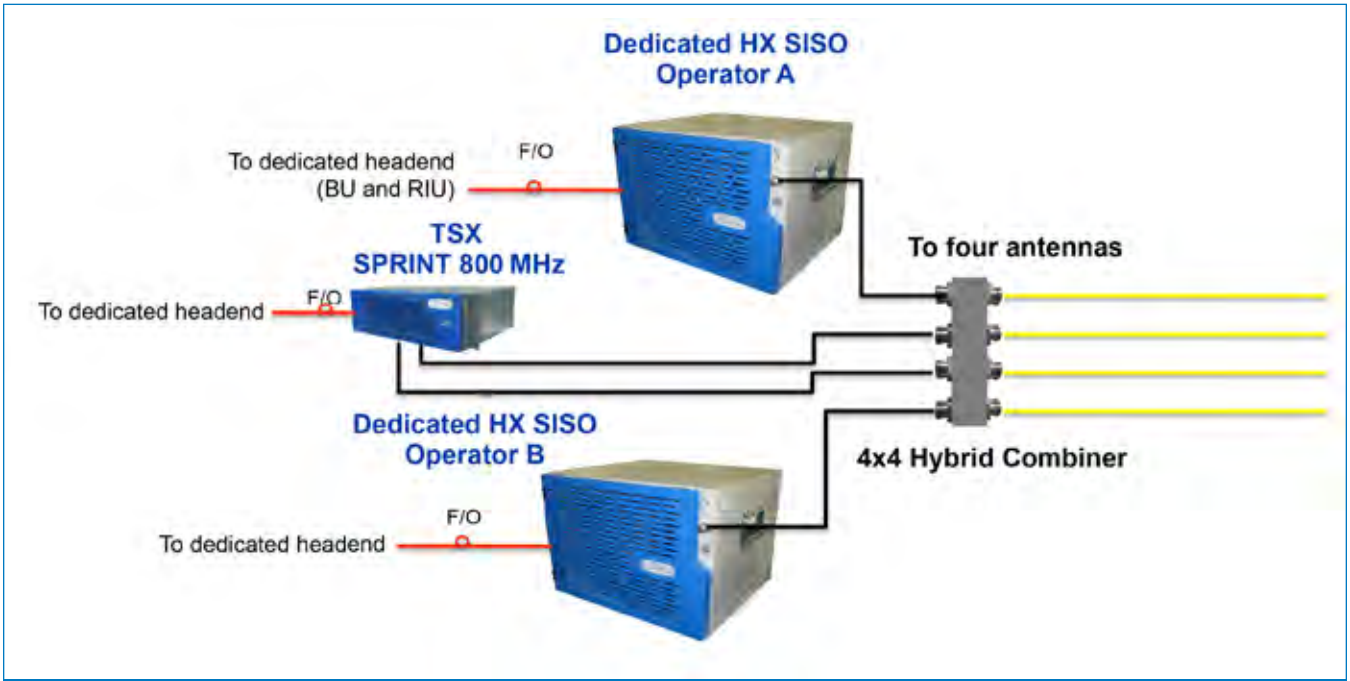

Dedicated HX NH SISO Scenario with Four Broadband Antennas | Figure 1-1

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1.1 MobileAccessHX Neutral Host Solution Components

The Corning MobileAccess HX Neutral Host solution is comprised of the following elements, where the combination of elements varies according to the physical configuration of the installation.

- **MobileAccessHX Indoor Unit** – High-power (2 W) indoor solution which provides RF open space coverage, supporting multiple wireless technologies and operator services over a single broadband infrastructure. The HX units are installed at the remoteend and can cover distances of up to 2 km from the BTS signal sources at the headend. There are two HX indoor unit models:
  - HX SISO – supports SISO coverage for the CELL/PCS/700 MHz LTE/2100 MHz AWS bands; includes one duplexed RF antenna port.
  - HX MIMO – supports SISO coverage for the CELL/PCS bands and MIMO coverage for the 700 MHz LTE/AWS bands; includes two duplexed RF antenna ports (MIMO stream 1 and MIMO stream 2).
- **MA2000 TSX** – The MA2000 TSX unit complements the HX supported services by providing coverage for the Sprint 800 MHz band (not supported by HX) over the same broadband antenna infrastructure.
- **Additional Passive Components** – The additional passive components required for the various combined HX and TSX scenarios include the following RF components:
  - 2x2 or 4x4 hybrid combiner
  - External filter to filter out IMD of IDEN and CELL bands
  - Duplexer
  - Splitter

  The use and number of components depends on the site requirements and configuration scenario (see section 1.3). The hybrid components enable splitting and combining the RF signal as needed with relatively low power loss.

1.2 Challenges and Solutions

Combining the HX system supporting the CELL/PCS/LTE/AWS bands with the MA2000 TSX system for additional iDEN support requires addressing a number of issues. The following table addresses the expected issues and solutions.

Issue	Solution
Ensuring sufficient isolation between the services supported by HX and TSX systems	ANHX cell cavity filter can mitigate interference in both HX and TSX systems; the filter is part of the accessory kit AK-HX-NTRL-HOST
Ensuring minimal effect on systems due to using combiners	Additional isolation provided prior to combiners; included in the HX Neutral Host solution architecture
Providing uniform coverage	Four antenna ports of the HX NH solution compared to one antenna port of HX to address uniform coverage
Providing dedicated or shared infrastructure as per the customer demand	HX NH offers solutions for both dedicated and shared remote scenarios

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1.3 Typical Configuration Scenarios

This document describes five typical customer scenarios that operators (usually Verizon Wireless, AT&T and Sprint) or integrators face in a neutral host deployment site. It provides guidelines for the corresponding Corning MobileAccess Neutral Host solutions that address each scenario.

The five typical configuration scenarios can be categorized according to dedicated and shared remote unit requirements.

Dedicated Scenarios – Operators do not share head-end or remote-end equipment. Each operator has its' own dedicated remote (HX), radio interface unit (RIU), base unit (BU) and SC-450. Typical dedicated scenario configurations follow:

- Dedicated SISO Scenario – with one HX SISO unit per quad-band operator, TSX for 800 MHz IDEN and four broadband antennas
- Dedicated MIMO Scenario #1 – with one HX MIMO unit per operator, TSX for 800 MHz IDEN and four MIMO broadband antennas or eight SISO broadband antennas
- Dedicated MIMO Scenario #2 – with two HX SISO units per operator, TSX for 800 MHz IDEN and four MIMO broadband antennas or eight SISO broadband antennas

Shared Scenarios – Operators share a common amplifier at the remoteend. They may share BUs and RIUs as well. Typical Shared scenario configurations follow:

- Shared MIMO Scenario – with One HX SISO Unit for multiple operators, TSX for 800 MHz IDEN and two MIMO broadband antennas or four SISO broadband antennas
- Shared Neutral Host MIMO Scenario – with HX MIMO Units for multiple operators, TSX for 800 MHz IDEN and two MIMO broadband antennas or four SISO broadband antennas

1.3.1 Dedicated Neutral Host SISO Scenario – with HX SISO Units

Combining the HX system supporting the CELL/PCS/LTE/AWS bands with the MA2000 TSX system for additional iDEN support presents challenges. The following table addresses these challenges and their solution.

In this scenario:

- Operator A (e.g. AT&T) provides SISO coverage for CELL/PCS/LTE 700 MHz/AWS over dedicated active infrastructure
- Operator B (e.g. Verizon) provides SISO coverage for CELL/PCS/LTE 700 MHz/AWS over dedicated active infrastructure
- Operator C (e.g. Sprint) provides SISO coverage for 800 MHz over dedicated active infrastructure

All services are combined via the 4x4 Hybrid Combiner, and SISO coverage is provided for the combined services via four SISO broadband antennas.

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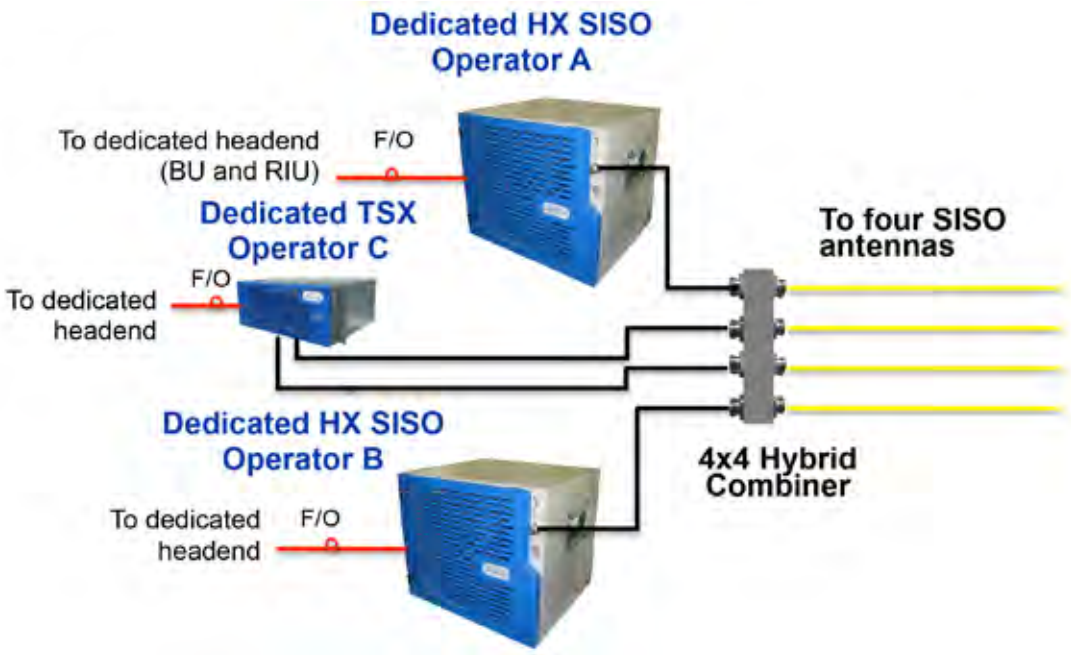

Dedicated HX NH SISO Scenario Configuration with HX SISO Units | Figure 1-2

Component	CMA Part Number	Number of Units
HX SISO	HX-C85P19L70A17-AC-A or similar	1 (per operator A/B)
HX Accessory Kit	AK-HX-NTRL-HOST	1 (per HX SISO unit)
TSX 800 MHz	2000-S80S90-A-TC or similar	1 (per operator C)
TSX IDEN Accessory Kit	AK-HX-IDEN-NTRL-HOST	1 (per TSX unit)
4x4 Hybrid Combiner	HX-SCU-4x4 or similar	1 (per HX NH SISO remote configuration)

Note: These CMA part numbers are provided as an example. Please check for the accurate CMA part numbers according to your individual requirements.

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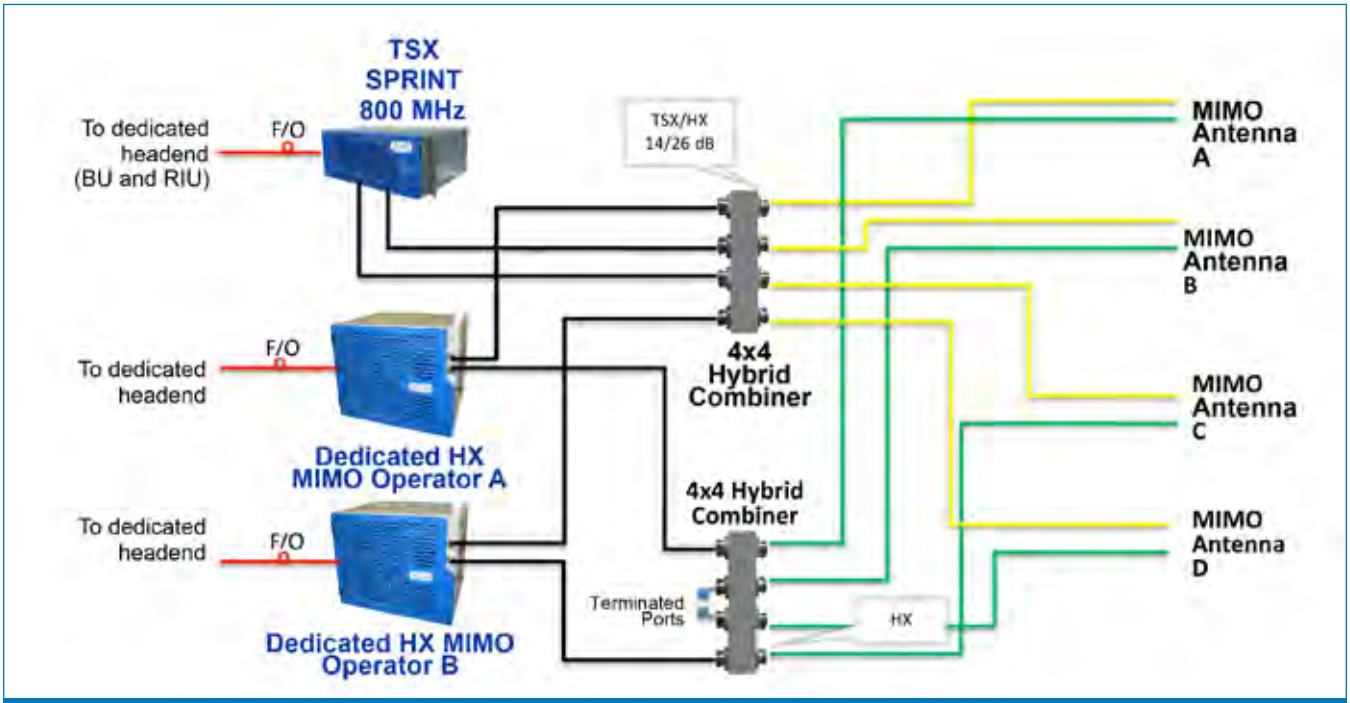
1.3.2 Dedicated Neutral Host MIMO Scenario #1 – with HX MIMO Units

Note: The supported MIMO services are only on the 700 MHz LTE and 2100 MHz AWS bands supported by the HX MIMO units.

- Operator A (e.g. AT&T) provides SISO coverage for the CELL/PCS bands and MIMO coverage for the LTE 700 MHz/AWS bands over dedicated active infrastructure
- Operator B (e.g. Verizon) provides SISO coverage for the CELL/PCS bands and MIMO coverage for the LTE 700 MHz/AWS bands over dedicated active infrastructure
- Operator C (e.g. Sprint) provides SISO coverage for 800 MHz over dedicated active infrastructure

All services are combined via two 4x4 hybrid combiners, and MIMO coverage is provided for the combined services via four MIMO broadband antennas.

Note: MIMO coverage can be provided either via four MIMO antennas or eight SISO antennas (one for each MIMO stream 1 and MIMO stream 2).



Dedicated HX NH MIMO Scenario Configuration with HX MIMO Units | Figure 1-3

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Component	CMA Part Number	Number of Units
HX MIMO	HX-C85P19L70MA17M-AC-A or similar	1 (per operator A/B)
HX Accessory Kit	AK-HX-NTRL-HOST	1 (per HX SISO unit)
TSX 800 MHz	2000-S80S90-A-TC or similar	1 (per operator C)
TSX IDEN Accessory Kit	AK-HX-IDEN-NTRL-HOST	1 (per TSX unit)
4x4 Hybrid Combiner	HX-SCU-4x4 or similar	1 (per HX NH SISO remote configuration)

Note: These CMA part numbers are provided as an example. Please check for the accurate CMA part numbers according to your individual requirements.

1.3.3 Dedicated Neutral Host MIMO Scenario #2 – with HX SISO Units

- Operator A (e.g. AT&T) provides MIMO coverage for its supported services with the use of two HX SISO remote units (one unit for each stream of MIMO), each connected to a dedicated headend (RIU and BU)
- Operator B (e.g. Verizon) provides MIMO coverage for its supported services with the use of two HX SISO remote units (one unit for each stream of MIMO), each connected to a dedicated headend (RIU and BU)
- Operator C (e.g. Sprint) provides SISO coverage for 800 MHz over dedicated active infrastructure

In this scenario, Operator A and/or Operator B can provide MIMO services on all four bands supported by the HX SISO units. All services are combined via two 4x4 hybrid combiners, and MIMO coverage is provided for the combined services via four MIMO broadband antennas.

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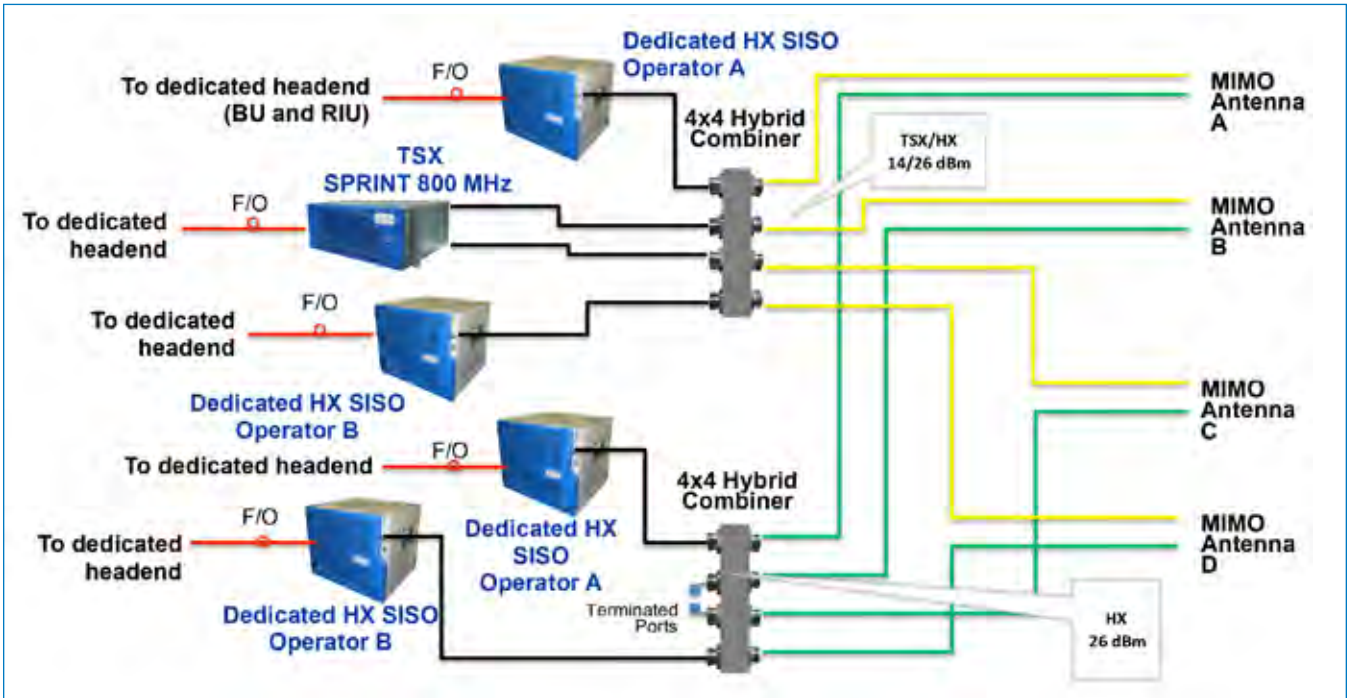

Dedicated HX NH MIMO Scenario with HX SISO Units | Figure 1-4

The following table provides a summary of the required components for this scenario type.

Component	CMA Part Number	# of Units
HX SISO	HX-C85P19L70A17-AC-A or similar	2 (per operator A/B), one for each MIMO stream
HX Accessory Kit	AK-HX-NTRL-HOST	1 (per HX SISO unit)
TSX 800 MHz	2000-S80S90-A-TC or similar	1 (per operator C)
TSX IDEN Accessory Kit	AK-HX-IDEN-NTRL-HOST	1 (per TSX unit)
4x4 Hybrid Combiner	HX-SCU-4x4 or similar	2 (one each for MIMO stream 1 and the MIMO stream 2)

Note: These CMA part numbers are provided as an example. Please check for the accurate CMA part numbers according to your individual requirements.

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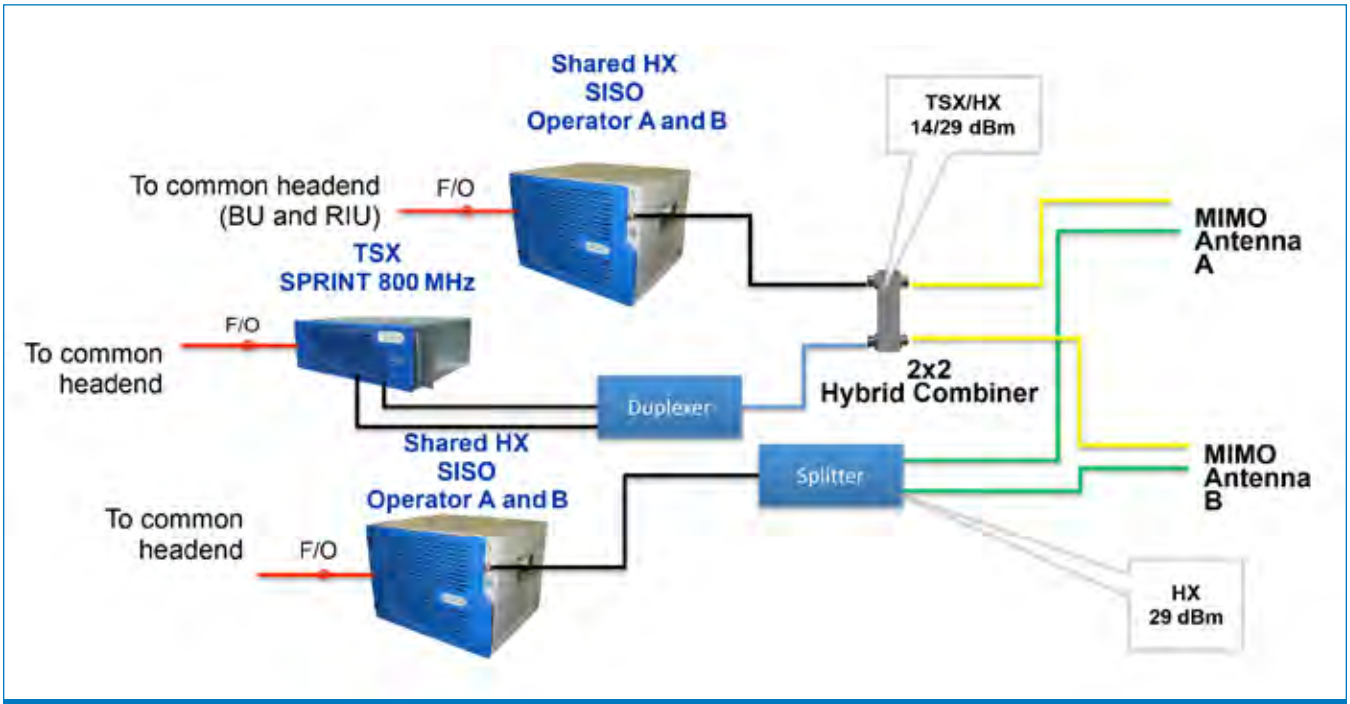
1.3.4 Shared MIMO Scenario – with HX SISO Units

- Operator A and B (e.g. AT&T and Verizon) share two HX SISO units, each of which provides each operator with a single MIMO path for its supported bands
- Operator C (e.g. Sprint) provides SISO coverage for 800 MHz

All services are combined via a 2x2 hybrid combiner, and MIMO coverage is provided for the combined services via two MIMO antennas. One MIMO path is transmitted via a 2x2 combiner which combines the services from one HX SISO unit and TSX unit, while the second MIMO path is transmitted from the other HX SISO unit to both MIMO antennas via a splitter.

Note: MIMO coverage can be provided either via four MIMO antennas or eight SISO antennas (one for each MIMO stream 1 and MIMO stream 2).



Shared HX NH MIMO Scenario – with HX SISO Units | Figure 1-5

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The following table provides a summary of the required components for this scenario type.

Component	CMA Part Number	Number of Units
HX SISO	HX-C85P19L70A17-AC-A or similar	2 (both shared by operators A and B); 1 for each MIMO stream CELL/ PCS/LTE 700/AWS on bands
HX Accessory Kit	AK-HX-NTRL-HOST	1 (per HX SISO unit)
TSX 800 MHz	2000-S80S90-A-TC or similar	1 (per operator C)
TSX IDEN Accessory Kit	AK-HX-IDEN-NTRL-HOST	1 (per TSX unit)
2x2 Hybrid Combiner	HX-SCU-2x2 or similar	1 (per HX NH remote configuration)
IDEN Duplexer	Third-Party item	1 (per TSX unit)
N-N Jumper	Third-Party item	1 (per IDEN duplexer)
Splitter	Third-Party item	1 (per HX NH remote configuration)

Note: These CMA part numbers are provided as an example. Please check for the accurate CMA part numbers according to your individual requirements.

1.3.5 Shared Neutral Host MIMO Scenario – with HX MIMO units

Note: The supported MIMO services are only on the 700 MHz LTE and 2100 MHz AWS bands supported by the HX MIMO units.

- Operator A and B (e.g. AT&T and Verizon) share an HX MIMO unit which supports SISO coverage for the CELL/PCS bands and MIMO coverage for the LTE 700 MHz/AWS bands.
- Sprint – provides SISO coverage for 800 MHz over dedicated active infrastructure.

All services are combined via a 2x2 hybrid combiner, and MIMO coverage is provided for the combined services via two MIMO antennas. The HX MIMO 1 path is transmitted to two MIMO antennas via a splitter, whereas the HX MIMO 2 path is transmitted via a 2x2 hybrid combiner, which also combines the HX services with the TSX Sprint 800 MHz.

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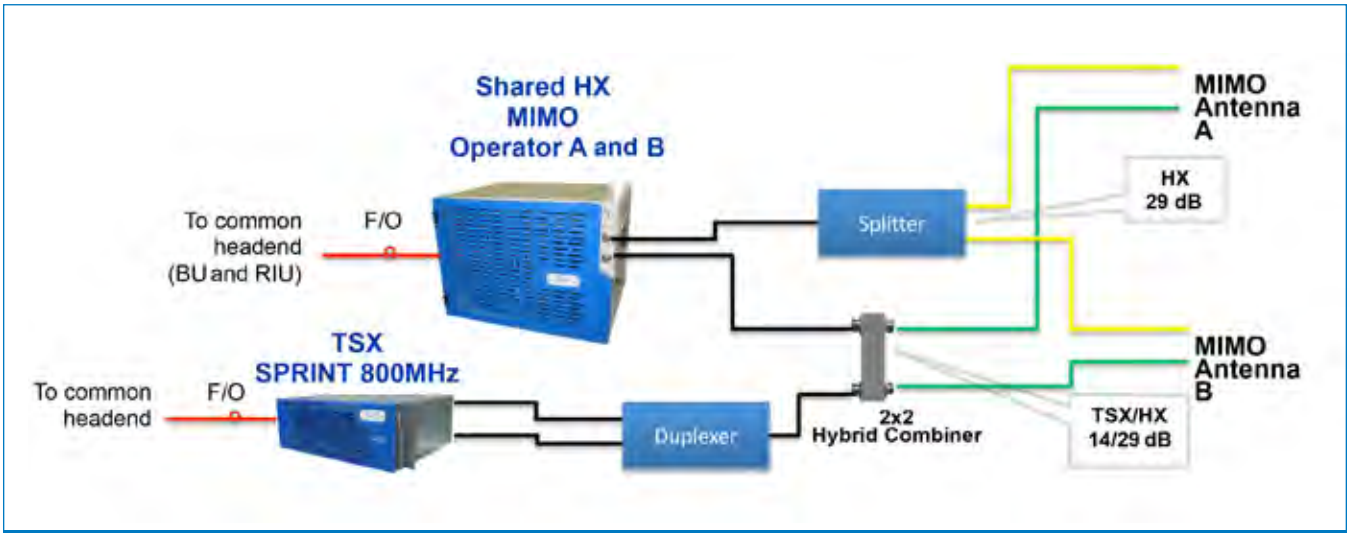

Shared HX NH MIMO Scenario – with HX SISO Units | Figure 1-5

The following table provides a summary of the required components for this scenario type.

Component	CMA Part Number	# of Units
HX MIMO	HX-C85P19L70A17-AC-A or similar	1 (both shared by operators A and B); 1 for each MIMO stream CELL/ PCS/LTE 700/AWS on bands
HX Accessory Kit	AK-HX-NTRL-HOST	1 (per HX SISO unit)
TSX 800 MHz	2000-S80S90-A-TC or similar	1 (per operator C)
TSX IDEN Accessory Kit	AK-HX-IDEN-NTRL-HOST	1 (per TSX unit)
2x2 Hybrid Combiner	HX-SCU-2x2 or similar	1 (per HX NH remote configuration)
IDEN Duplexer	Third-Party item	1 (per TSX unit)
N-N Jumper	Third-Party item	1 (per IDEN duplexer)
Splitter	Third-Party item	1 (per HX NH remote configuration)

Note: The CMA part numbers are provided as an example. Please check for the accurate CMA part numbers according to your individual requirements.

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2 Interconnections

This section demonstrates the interconnections between the HX and TSX units and other accessory components of the HX NH solution.

2.1 MobileAccessHX RF Connections

The MobileAccessHX RF connections are performed from the N-type antenna ports located on side panel on the front to the relevant passive components (i.e. combiner, splitter).

HX Indoor SISO | Figure 2-1

HX Indoor MIMO | Figure 2-2

However, in the presence of IDEN service on the same antenna infrastructure, a band pass filter needs to be added to the UL CELL band on the HX. Please refer to the quick installation sheet packaged with AK-HX-NTRL-HOST for detailed assembly instructions.

2.2 MA2000 TSX Sprint 800 MHz Connections

Route the internal iDEN DL and iDEN UL cables through the TSX unit upper slot to connect to the relevant passive component (i.e. combiner, splitter, duplexer).

Note: The 900 MHz SMR band is not relevant.

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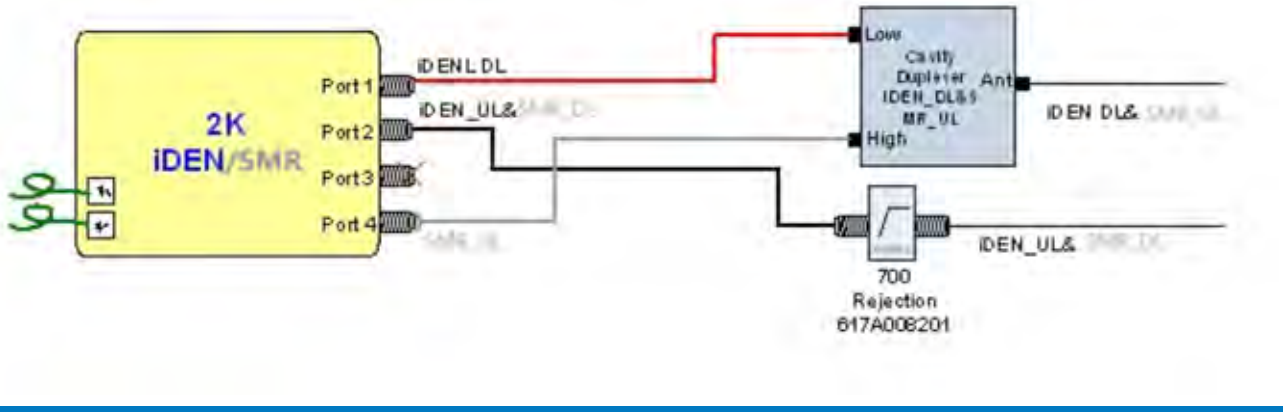

Internal Connections Inside an IDEN TSX | Figure 2-3

Internal Connections Inside an IDEN TSX | Figure 2-4

Use the QMA to N-type cable jumpers to connect the TSX to a duplexer or combiner. Please refer to the quick installation sheet packaged with AK-HX-IDEN-NTRL-HOST for detailed assembly instructions.

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3 Specifications

3.1 MobileAccess Components

3.1.1 MobileAccessHX Specifications

Supported Services	Quad-band services: CELL/PCS/LTE 700 MHz/AWS 2100 MHz MIMO model: includes additional module for LTE 700 MHz/AWS MIMO support
Output Composite Power (per service)	33 dBm
Power	
Local Power (AC) Feeding Option	90-264 V AC
Remote Power (DC) Feeding Option	36-75 V DC
Maximum Power Consumption: SISO	350 W
MIMO	500 W
RF Connectors	One N-type female 50 Ohm connector for antenna two connectors for MIMO models)
Physical Dimensions	
W x H x D cm (in)	43 x 38 x 35 (16.9 x 14.9 x 13.8)
Weight kg (lb)	42 (92)

3.1.2 MA2000 TSX Sprint

Supported Services	800 MHz Sprint band
Output Composite Power	14 dBm
Power	
Local Power (AC) Feeding Option	100-240 V AC
Remote Power (DC) Feeding Option	25-48 V DC
Maximum Power Consumption	85 W
RF Connectors	One QMA-type female 50 Ohm connectors
Physical Dimensions	
W x H x D cm (in)	17.7 x 43.4 x 36.9 (6.7 x 17.1 x 14.5)
Weight kg (lb)	19 (42)

3.2 Additional Passive Components

Each component must operate in the 698 MHz to 2.7 GHz frequency range and should be rated to handle 33 dBm power due to HX system implementation. Cable loss attenuation should be as low as possible, and the two types of hybrid combiners mentioned earlier should be specified with a low insertion loss so to minimize the combining configurations impact on the systems performance.

3.2.1 N-Type (Male to Male) Cables

N male to N male type cables Specifications	
Frequency Range	698 MHz ~ 2.7 GHz
Input Power	2 W (33 dBm)
Coupling/Insertion Loss/ Passive Loss	14 dB/100 ft maximum
Port Types	N Male
Impedance	50 Ohms

3.2.2 4x4 Hybrid Combiners

2x2 Hybrid Combiner Specifications	
Frequency Range	698 MHz ~ 2.7 GHz
Input Power	2 W (33 dBm)
Coupling/Insertion Loss/ Passive Loss	3 dB +/-0.5 dB
Port Types	N Female
VSWR	< 1.3
Impedance	50 Ohms
Isolation	30 dB
Dimension	Thickness within 1RU

3.2.3 2x2 Hybrid combiners

2x2 Hybrid Combiner Specifications	
Frequency Range	698 MHz ~ 2.7 GHz
Input Power	2 W (33 dBm)
Coupling/Insertion Loss/ Passive Loss	3 dB +/-0.5 dB
Port Types	N Female
VSWR	< 1.3
Impedance	50 Ohms
Isolation	30 dB
Dimension	Thickness within 1RU

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3.2.4 IDEN Duplexer

2 x 2 Hybrid Combiner Specifications		
	Rx	Tx
Frequency Range	806 MHz ~821 MHz	851 MHz ~866 MHz
Insertion Loss	≤ 1.6 dB	≤ 1.6 dB
Pass Band Ripple	≤ 1.0 dB	
Return Loss	18 dB	
Attenuations	120 dB @ 851 MHz~866 MHz	120 dB @ 806 MHz ~821 MHz
Port Types	N Female	
Input Power	3 W (34.8 dBm)	
Impedance	50 Ohms	
Isolation	30 dB	
Temperature Range	-30°C to +70°C	

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Notes |

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CMA-238-AEN / December 2012

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