Intel NetStructure® SS7G21 and SS7G22 Signaling Gateways

Digital Signal Conversion Option

The Intel NetStructure® SS7G21 and SS7G22 Signaling Gateways are key building blocks in the next generation of networks and service platforms. They interface to both Signaling System 7 (SS7) and Internet Protocol (IP) networks, so SS7 information can be carried to and from IP-based applications such as softswitches.

With the addition of optional Digital Signal Conversion (DSC) software, the SS7G21 and SS7G22 can operate as a protocol converter, so developers can easily perform protocol conversions between SS7 circuit-related protocols and access-signaling protocols, including ISDN and SS7 over M2PA for long-haul configurations.

Features	Benefits
Provides protocol interworking between any pair of supported telephony protocols for both network protocols (such as SS7 or SS7 over SIGTRAN M2PA) and access protocols (such as DPNSS, ISDN, etc.)	• Lets network designers interconnect a variety of "off-the-shelf" network elements that may be running incompatible protocols • Network designers need not request time-consuming and expensive modifications to third-party network equipment
A higher level of SS7 building-block integration with ISDN and SIGTRAN	Developers can focus on application development and deployments that address the needs of premium SS7 market segments instead of SS7 integration
Housed in telco-grade NEBS-compliant chassis with built-in resiliency for SS7 links and networks that comes as a packaged SS7 building block	Proven and highly-resilient platform which has been engineered for central office deployments
Intelligent call routing capabilities	The signaling gateway can be used as a non-blocking switch and can perform parameter manipulation to support the intelligent call routing capabilities required for value-added services
Simple configuration and quick installation	Allows for an easier installation that does not require development when providing protocol conversion (e.g., between SS7 and ISDN)

Note: Only the SS7G21 can accommodate DPNSS, ISDN, or QSIG conversions.

The DSC functionality is provided as a software option license on the SS7G21 and SS7G22 signaling gateways. To enable this functionality, a DSC software license must be ordered and installed on the system. If the DSC software is not installed or is deactivated, the unit performs as a signaling interface unit (SIU) supporting the MTP3 protocol. For information about the SS7G21 and SS7G22 Signaling Gateways without the DSC software option, visit http://www.intel.com/network/csp/products/9369web.htm.

Expanded Capabilities

The signaling gateways with the DSC option represent a higher level of SS7 building-block integration, letting original equipment manufacturers (OEMs) concentrate on application design. A simple ISDN application can now address premium SS7 market segments. This strategy can drastically reduce deployment time without compromising quality and reliability. The SS7G21 and SS7G22 let users rely on proven network-grade platforms and concentrate on building high-value applications. Also, because the platforms have worldwide conformance certification, deployment is simpler and faster.

Protocol Conversion

The DSC option provides an internal signaling architecture that converts each protocol variant internally into a common signaling protocol that can then be converted back into any other protocol supported by the unit. As a result, any signaling protocol variant, once supported, can automatically work with any other protocol or variant supported. Protocol conversion is implemented with finite state machines, protocol procedures, and timers within the DSC option, rather than simple mapping with messages that could lead to poor interconnect functionality.

The SS7G21 with the DSC software option permits ISDN systems (or previously incompatible SS7 equipment) to interconnect with public network systems, enabling the creation of highly advanced value-added services. The platforms may also be used to significantly enhance application capabilities through intelligent call routing, digit analysis, and intrusive parameter manipulation, which are included with the DSC option.

For existing systems that use ISDN or a single SS7 variant, new market segments may be addressed using the SS7G21 and SS7G22 with the DSC option. A service node or switch may be interconnected to new network types, without the need for re-engineering or lengthy testing. The SS7G21 and SS7G22 with DSC provide compatibility with a wide range of networks and signaling types through a simple configuration, which also minimizes training needs. The DSC option is also ideal for interconnects, as the units can be placed for approval independently of the rest of the solution.

Intelligent Call Routing and Digit Analysis

In its simplest configuration, a single Signaling Gateway with the DSC option can be used as a non-blocking switch to provide intelligent call routing based on digit analysis of the called-party number. Once sufficient digits have been received to determine the required outgoing route, the unit can use one of many different hunting algorithms to select a suitable outgoing circuit.

Prior to making the call, the DSC option allows prefix digits to be added or deleted from the called- and calling-party numbers, buffering the call if necessary, until a sufficient number of dialed digits have been received or until a user-configurable timer expires. This type of usage allows for conversion from overlap signaling to enbloc signaling.

Applications

- Interconnecting peripheral equipment such as a PBX- or ISDN-based application node to an SS7 network (using DPNSS, ISDN, or QSIG). Only available on the SS7G21 platform.
- Interconnecting different SS7 networks, including connections among mixed ITU-T, ANSI, UK, and Japan MTP protocols
- Protocol conversion between different SS7 telephony user parts (TUPs), including ITU-T, ETSI, ANSI, Chinese, UK, and French variants
- Conversion between M2PA and MTP2, enabling low-cost, long-haul SS7 signaling traffic between circuit and packet networks
- Connection between SS7- and IP-based telephony systems
- Creation of advanced value-added services, including number translation, 800 or pre-paid, least-cost routing, grooming, and circuit-hunting

If the subsequent switch rejects the initial outgoing call, the system can retry on a new circuit. If no circuits are available (due to congestion, for example), an alternative outgoing route can be selected (with the option of adding different prefix digits). Such a strategy is particularly useful in least-cost routing applications where, under congested conditions, calls need to be routed via alternative carriers.

Intrusive Parameter Manipulation

To overcome network compatibility issues and assist in the creation of advanced services, the DSC option can perform intrusive parameter manipulation. This strategy lets the user override certain protocol parameters with fixed user-selected values.

Parameter manipulation is based on the original location from which a call is made, its destination, and the digits dialed. Parameters that can be manipulated include

- Called- and calling-party numbers
- Type of address
- Numbering plan
- Echo-canceller indicators
- Clearing causes
- Calling-party categories
- ISDN service-level indicators

Scalability

The modular design of the SS7G21 and SS7G22 lets a single chassis scale from 2 to 12 T-1 or E-1 ports. The SS7G21 can handle up to 24 access side signaling links or 12 SS7 signaling links, while the SS7G22 can handle signaling for up to 128 SS7 signaling links. Two chassis can work as a pair to implement a single SS7 signaling point distributed over separate hardware platforms, providing even greater signaling capacity from a single point.

System Resilience

Each link set can support one or two signaling links, each of which can be terminated on separate signaling boards so that a single board failure will not result in a loss of signaling capability. Link sets can also be used in pairs as a combined link set, supporting load sharing across the combined link set. Alternatively, two link sets can be used as a preferred and a secondary link set to reach a destination.

Internally, the signaling extracted from any T-1 or E-1 interface port can be routed to any signaling processor board. This strategy allows the unit to be reconfigured in the event of a signaling board failure, so that a spare signaling resource can be brought into use without a site visit to gain entry to the unit.

In the dual configuration, two units can be configured to act as a single point code where a link set is spread across the two units. This allows one unit to be taken down for planned maintenance without losing any signaling routes. It is also possible to have a fully configured hot standby unit, which can be used in case the primary unit fails. This strategy is useful when a loss of signaling capacity is unacceptable if a failure occurs.

Modes of Operation

The Signaling Gateways with the DSC option support two fundamentally different modes of operation: signaling-and-voice mode and signaling-only mode.

In signaling-and-voice mode (see Figure 1), all traffic channels pass through the unit in addition to the signaling channels, providing the ability to support digit analysis, circuit selection, re-routing, and dynamic call switching.

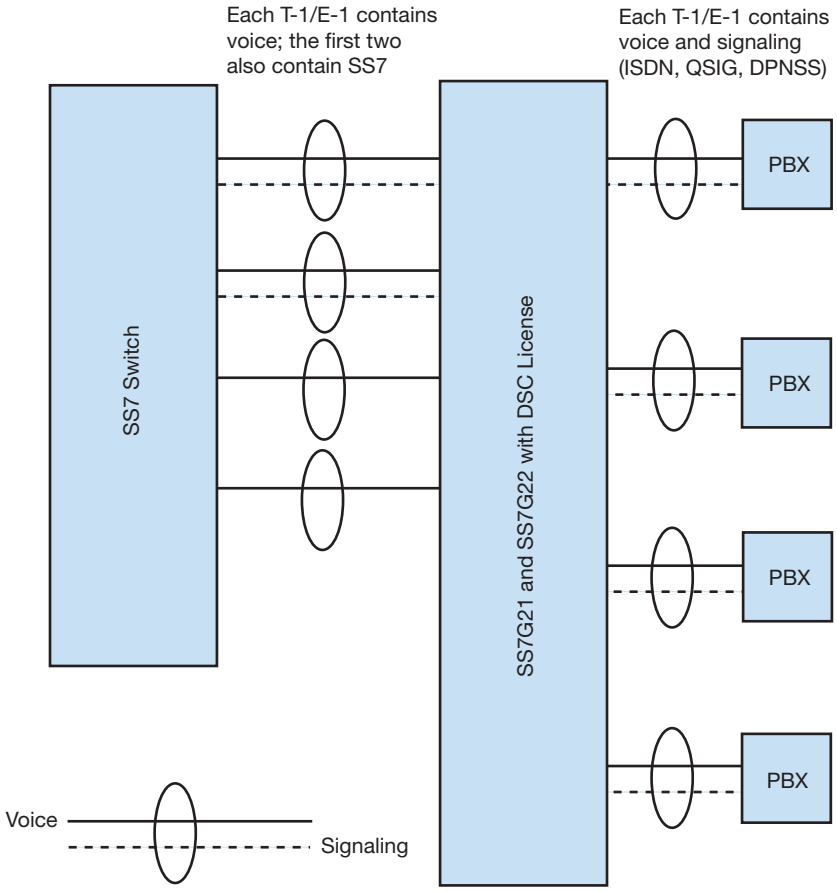

Figure 1. Signaling-and-Voice Mode

In signaling-only mode, signaling channels pass through the unit, letting a system with DSC support a very high signaling conversion density. Because speech paths pass externally and directly between the switches on either side of the system, fewer T-1/E-1 terminations are required (see Figure 2).

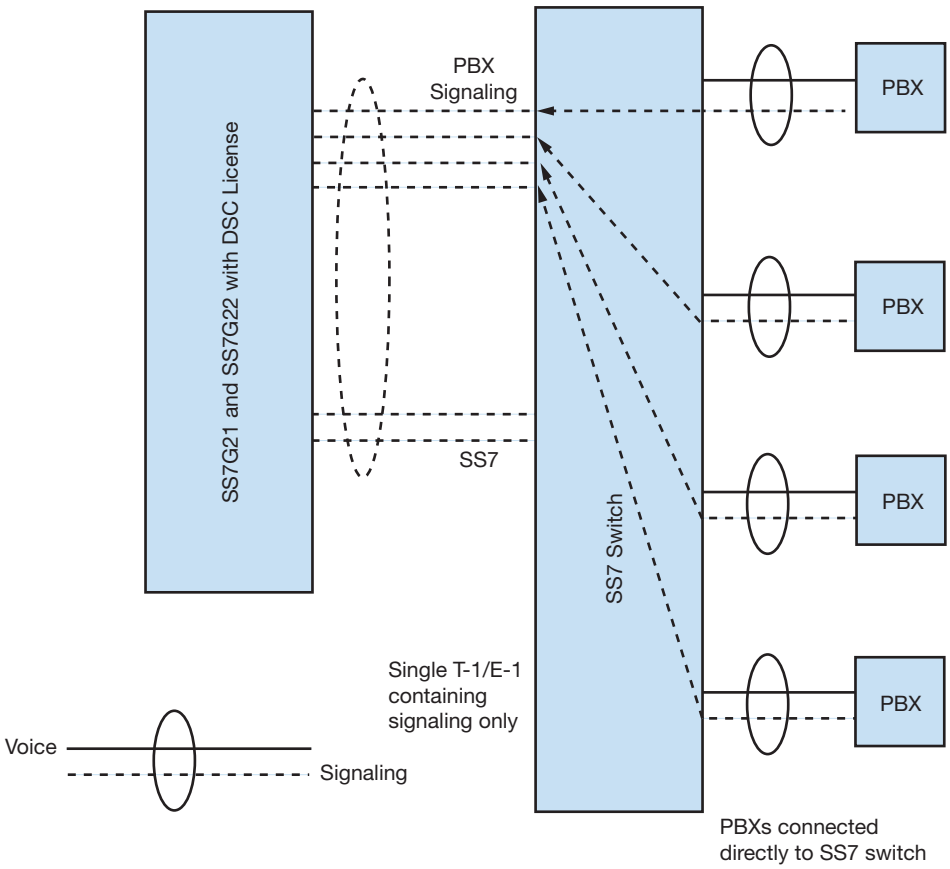

Figure 2. Signaling-Only Mode

In the case of SS7-to-ISDN protocol conversion, the systems can convert signaling from multiple ISDN signaling links into SS7 signaling on a pair of signaling links. For SS7-to-SS7 protocol conversion, where only a pair of signaling links is required on each side of the converter, the unit can support up to a maximum of 16,384 circuits with just two signaling boards.

Configuration and Maintenance

Configuration of the SS7G21 and SS7G22 units with DSC can be performed locally (using a local terminal port) or remotely (over a LAN/WAN using TCP/IP [Telnet]). Configuration parameters can be modified dynamically without impacting ongoing normal operation in other parts of the unit, and once entered, new parameters take effect immediately. A unit does not have to be restarted in order for new parameters to take effect. All configuration data is stored internally in non-volatile, solid-state memory. Following a power outage, the unit automatically restarts and resumes full operation using the current configuration parameters when power is restored.

For security, access to system configuration may be restricted by password. For greater security, Telnet and FTP access to the system may optionally be configured to operate only over secure shell (SSH).

Alarms

A rich set of status commands lets users interrogate the current operating state of all internal modules on the SS7G21 and SS7G22 with the DSC option. An internal alarm log, which can be viewed from any management interface, maintains a history of occurrences and the clearing of all recent alarm conditions. All alarm events have a fault title and are assigned to one of four classes: critical, major, minor, and disabled.

The user can freely configure the class of each alarm event to cause it to activate one of three alarm relays (designated critical, major, and minor). Each relay is activated by the appropriate type of alarm (for example, critical alarms cause the critical relay to be activated and so on). Disabled alarms are not logged in the alarm log. The Signaling Gateway also offers SNMP support reporting a summary of the alarms to a SNMP manager.

All alarm events can optionally be reported over TCP/IP to a remote management center as they occur by enabling the Remote Data Center (RDC) option.

Remote Data Center

The RDC lets several types of management data transfer automatically to one or more computers at remote locations. Call data records, call failure records, and alarm events are all transferred as they happen, while traffic measurements are generated periodically at user-configurable intervals. Traffic measurements provide statistics, allowing close and accurate monitoring of circuit utilization, route utilization, traffic volume, and quality of service (QoS). All data transferred to the RDC is in CSV format text files, so the data can be imported easily into spreadsheet or database applications for post processing.

This capability also permits uploading of information onto the unit from a remote site. Software updates can be performed remotely without the need for site visits. The Signaling Gateway also lets users backup configurations or current software to a remote site prior to change. Users can subsequently revert to this software or configuration by uploading from the RDC at a later date.

The Signaling Gateway itself can be configured to act as an RDC to permit the local storage of RDC data (measurements, alarms, etc.) in the event of loss of IP communication with a primary RDC.

Configuration Examples

The SS7G21 and SS7G22 with DSC can be used in a wide variety of applications and configurations. The most common are illustrated and discussed here. They include

- Point of interconnect to an SS7 network
- Protocol conversion between different SS7 variants
- Connecting ISDN peripherals to an SS7 network
- Provision of sub-equipped ISDN PRI circuits
- Connecting PBX systems to an SS7 network
- Expanding the number of networks to which an SS7 switch can connect

When used as a point of interconnect to an SS7 network (see Figure 3), the DSC-enabled platform provides SS7 connectivity, satisfying the compatibility demands of the PSTN and 24×7 reliability requirements, while eliminating the need to buy an expensive switch.

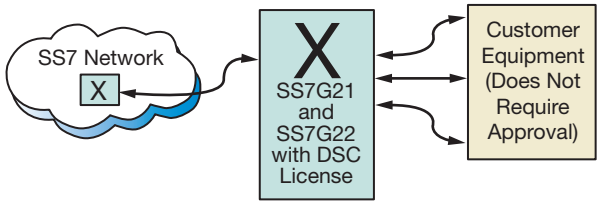

Figure 3. Point of Interconnect to an SS7 Network

With the DSC functionality, the SS7G21 and SS7G22 let networks interconnect using different SS7 variants simultaneously, including ITU-T, ETSI, ANSI, as well as specific national variants for Japan and the UK (see Figure 4). Voice circuits can be connected either through the unit or directly from one network to the other, making for a very cost-effective solution.

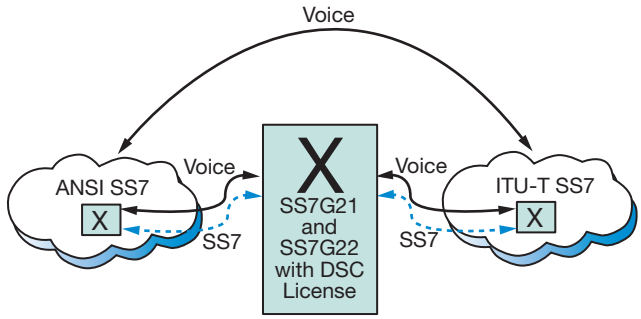

Figure 4. Protocol Conversion between Different SS7 Variants

Another supported configuration (see Figure 5) is the ability to enable SS7 connectivity to ISDN peripherals such as Internet gateways and IP telephony platforms for applications such as unified messaging is another supported configuration.

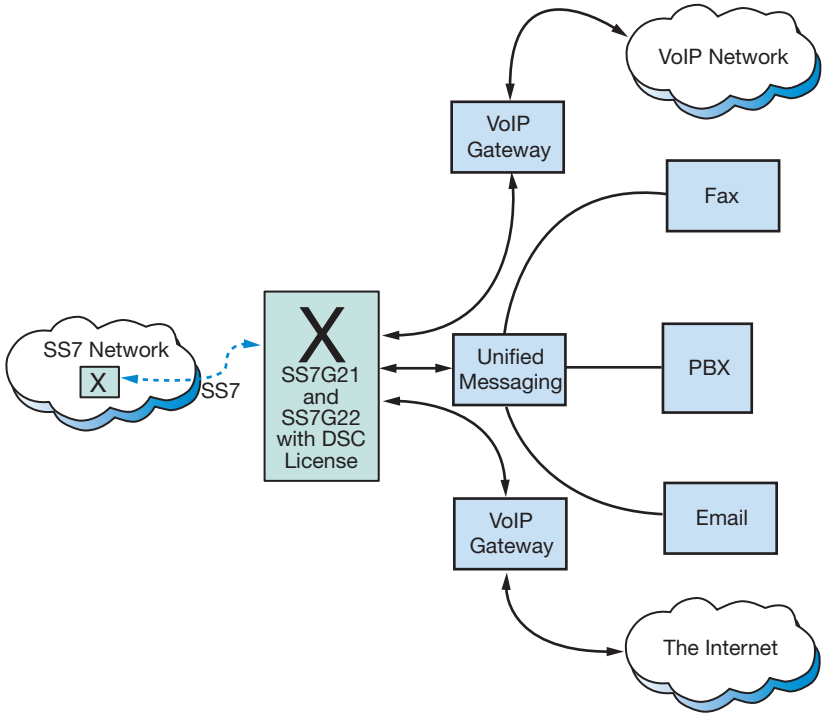

Figure 5. Connection of ISDN Peripherals to an SS7 Network

The DSC option can pass or reject calls based on calling line identity, letting the user implement services where screening is required. This strategy requires provisioning sub-equipped ISDN PRI circuits for routing (see Figure 6). Such a grooming facility allows maximum resource usage on the SS7 side, which can result in reduced costs.

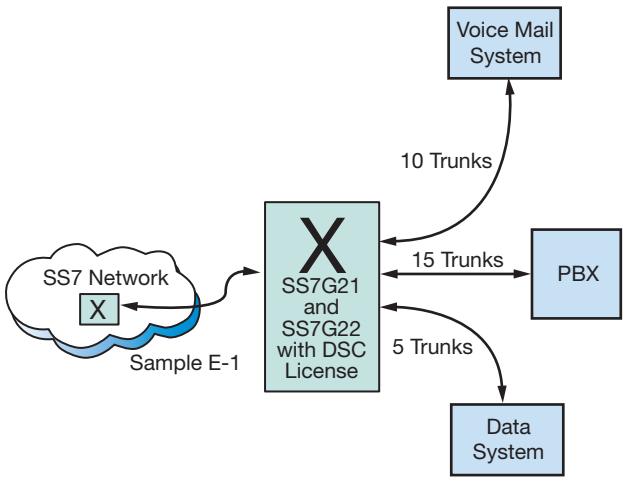

Figure 6. Provision of Sub-Equipped ISDN PRI Circuits

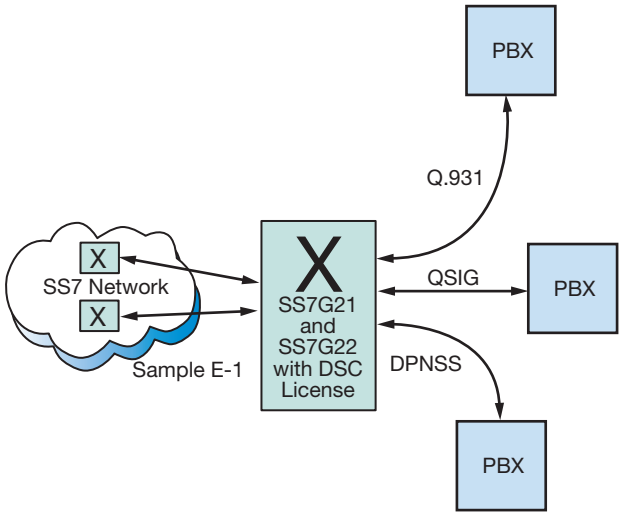

Figure 7. Connecting PBX Systems to an SS7 Network

It also allows SS7 network connectivity to a variety of PBXs using appropriate access protocols such as DPNSS, QSIG or Q.931 (see Figure 7).

The DSC option can greatly expand the number of adjacent switches and SS7 variants to which an existing switch can connect (see Figure 8). This allows for wider and more cost-effective deployment of existing equipment.

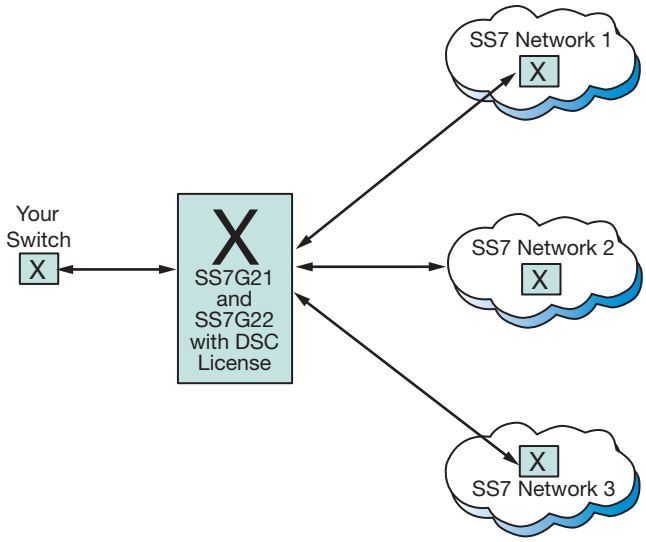

Figure 8. Expanding the Number of Networks to Which an SS7 Switch Can Connect

Technical Specifications

SS7 Signaling Capabilities of the SS7G21 and SS7G22 with DSC Option

- Connects directly to a maximum of 64 adjacent switches
- Connects indirectly (via signaling transfer points [STPs]) to a maximum of 512 switches
- Supports combined link sets
- Allows simultaneous use of ANSI, ITU-T, and Japan message transfer parts (MTP)
- Enables fully flexible mixing between 14-, 16-, and 24-bit point code sizes
- Allows multiple local point codes (up to 4)
- Supports configurable data rate (48 kb/s, 56 kb/s, or 64 kb/s) and error correction mode (basic or PCR)
- Supports ISUP variants simultaneously (ITU, ANSI, Japan, etc.)

System Specification

Maximum capacity is dependent on the number of signaling boards installed. The figures listed here are for a single unit. Use of the SS7G21 and SS7G22 with the DSC option in dual pairs or in clusters will proportionally increase the capacity of the overall system while still acting as a single SS7 point code or deliver a highly resilient platform which supports multiple networks or point codes.

Capacity	**SS7G21**	**SS7G22**
Signaling boards per chassis	Up to 3	Up to 3
Physical ports per unit		
T-1/E-1	Up to 12	Up to 12
V.11 (V.35 compatible)	Up to 6	0
SS7 links per unit (including M2PA)	Up to 12	Up to 128
SS7 linksets per unit	Up to 48	Up to 64
Number of SS7 routes	512	512
Number of networks	4	4
10/100/1000 Mbit/sec Ethernet interfaces	4	4
ISDN signaling links	Up to 24	0 (n/a)
DPNSS signaling links	Up to 24	0 (n/a)
Maximum number of bearer channels	16,384	16,384
Reliability/Warranty		
MTBF prediction for Bellcore* Method @ 40° C (1 signaling board and single psu configuration)	55,700 hours	49,000 hours
Warranty	Intel® Telecom Products Warranty Information at http://www.intel.com/network/csp/products/3144web.htm	
Declaration of Conformity	See http://developer.intel.com/design/litcentr/ce_docs/index.htm	
Country-specific Approvals	See the Global Product Approvals list at http://resource.intel.com/globalapproval/globalapproval.asp	

Technical Specifications (cont.)

Interfaces (SS7G21 and SS7G22)

LAN interface	4 × 10/100/1000 MB/s Ethernet
Line interface: PCM	Up to 12 interfaces, each software configurable as either T-1 or E-1
Pulse mask	T-1: TIA-968-A, CS-03, and AT&T* TR62411 E-1: ITU-T G.703
Data rate	T-1: 1544 kbits/s ± 50 ppm E-1: 2048 kbits/s ± 50 ppm
Frame format	T-1: D4, ESF, and ESF-CRC6 E-1: E1 and E1-CRC4
Line codes	HDB3 AMI (ZCS) AMI B8ZS
Connector type	RJ-45
Line interface: Serial	Up to six interfaces (SS7G21 only)
Electrical	V.11 (V.35 compatible)
Connector type	D-type (26-pin high density)

Power

DC-powered products	
Supply voltage (range nominal)	–48 VDC to –60 VDC
Input power (fully equipped)	200 W
Range limits	–38 VDC to –75 VDC
AC-powered products	
Supply voltage (auto ranging)	100 VAC to 127 VAC / 200 VAC to 240 VAC
Input power (fully equipped)	230 W
Frequency	50 Hz to 60 Hz

Physical Dimensions

Height	3.45 in. (8.763 cm)
Width	17.11 in. (43.46 cm)
Depth	20 in. (50.8 cm)
Weight - fully equipped	40.5 lbs (18.5 kg)

Environmental

Operating temperature	+5° C to +40° C
Storage temperature	–40° C to +70° C

Approvals

Safety	
International	CB Certificate to IEC 60950-1, EN60950-1
United States	UL 60950-1
Canada	CAN/CSA-C22.2 No 60950-1
EMC	
International	EN 300 386, EN55022, EN 55024, CISPR 22
United States	FCC Part 15 Class A
Canada	ICES-003
Telecommunications	
International	TBR12, TBR13
United States	TIA-968-A
Canada	CS-03

Ordering Information

The SS7G21 is fitted with Intel NetStructure SPCI4 or SPCI2S SS7 Boards with a system maximum of 12 SS7 links and provides a form, fit, and function replacement for the Intel NetStructure SG430 SS7 Signaling Gateway on a higher performance platform. An SS7G21 may be purchased with either

- 1, 2, or 3 SPCI2S boards (4 SS7 links, 2 T-1/E-1 interfaces, two V.11 serial ports per board)
- 1, 2, or 3 SPCI4 boards (4 SS7 links, 4 T-1/E-1 interfaces per board)

The SS7G22 is fitted with Intel NetStructure SS7HDP boards and offers significantly greater performance and link density than the SS7G21. An SS7G22 may be purchased with 1, 2, or 3 SS7HDP boards (64 SS7 links, 4 T-1/E-1 interfaces per board) with a system maximum of 128 SS7 links.

Both the SS7G21 and SS7G22 use the same 2U carrier-grade chassis and operate with the same software. For each one, many variants are available offering different numbers of signaling boards and power supply types (AC or DC). Differences include

- The type of SS7 signaling boards installed in the unit
- The number of T-1/E-1 ports provided
- The number of signaling links that can be processed (from 4 to 128)
- The processing performance

Optional redundant power supply units may be ordered separately.

When ordering the SS7G21 or SS7G22, there is no need to order individual signaling boards, as the product is delivered with the boards already installed. According to the requirement, the correct Product ID (item market name) can be ordered to identify a unit with 1, 2, or 3 boards of any variant, and power supply type.

Product Line Overview Table

Product (Item Market Name)	Description
SS7SBG20DSC	DSC software license
SS7G22AH1 or SS7G22AH2 or SS7G22AH3	SS7G22 AC system with 1, 2, or 3 SS7HDP boards
SS7G22DH1 or SS7G22DH2 or SS7G22DH3	SS7G22 DC system with 1, 2, or 3 SS7HDP boards
SS7G21AQ1 or SS7G21AQ2 or SS7G21AQ3	SS7G21 AC system with 1, 2, or 3 SPCI4 boards
SS7G21DQ1 or SS7G21DQ2 or SS7G21DQ3	SS7G21 DC system with 1, 2, or 3 SPCI4 boards
SS7G21AD1 or SS7G21AD2 or SS7G21AD3	SS7G21 AC system with 1, 2, or 3 SPCI2S boards
SS7G21DD1 or SS7G21DD2 or SS7G21DD3	SS7G21 DC system with 1, 2, or 3 SPCI2S boards
Optional	
SS7SBG20M2PA	M2PA software license
TLPACPSU002	Redundant AC power supply module for SS7G21A or SS7G22A
TLPDCPSU002	Redundant DC power supply module for SS7G21D or SS7G22D
TMLPMOUNT51	2/4-post 19” (48.26 cm) rack mount
TMLPMOUNT52	2/4-post 23” (58.42 cm) rack mount

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1515 Route Ten
Parsippany, NJ 07054
Phone: 1-973-993-3000

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