

MOTOROLA

Local Encoding for HITS[®] Affiliates

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Introduction

With digital encoding technology becoming more affordable, encoding at the local cable plant becomes a reality. Motorola's SE-1000 local encoder powerfully, yet inexpensively, encodes local content into the digital domain. Digitized content can be integrated with digital HITS multiplexes to create new customized channel line-ups. This service-grooming provides the flexibility to either shift programming from the analog to the digital tier or to add entirely new programming when there is not space for it in the analog channel line-up.

This paper is split into three sections. The first section reviews local encoding and Motorola's local encoder, the SE-1000, in more detail. The second section shows sample system configurations using the model SE-1000. The third section provides additional reference information, including a description of system components, a Frequently Asked Questions (FAQ) list, and an acronym list.

1.0 Local Encoding

Local encoding allows the integration of local content into a pre-existing digital service line-up, such as a HITS[®] (Headend in the Sky) multiplex. Knowledge of a local market can be taken advantage of through the integration of local-interest programming that is locally encoded. A customized programming schedule can help protect market share from digital broadcast satellites (DBS) and can create a loyal customer base. The cable viewer can receive a channel lineup that cannot be attained through DBS – programming tailored to the local market. Beyond the addition of new programming, the local encoder also allows the conversion of analog tier programming to the digital tier.

Encoding content locally at the cable plant creates a digital multiplex. The digital multiplex can consist solely of locally encoded content or it can consist of a combination of local content and HITS content. Motorola's SE-1000 Local Encoder accepts video and audio, then digitizes and compresses it into a Moving Pictures Expert Group-2 (MPEG-2) service. That digital service is fed into either

an Integrated Receiver Transcoder (IRT) or a Modular Processing System (MPS) for multiplexing with other services and modulating into a Quadrature Amplitude Modulation (QAM) format. To integrate the local service with HITS services, the digital service from the local encoder is input into a multiplexer before being modulated into QAM. The multiplexer “grooms” the services by accepting multiple digital input multiplexes and creating a new digital output consisting of an interspersed programming from the different inputs, such as the local encoder and the HITS feed.

HITS manages many aspects of the integration of the local channels with the HITS programming. HITS adds the locally encoded channel to the Electronic Program Guide (EPG) and to the Virtual Channel Table (VCT). The National Addressable System (NAS) continues to maintain the set-top authorization process and can also manage the encryption of the local channel, if desired.

1.1 Local Encoding Applications

Some typical kinds of local content include:

1. Community and government programming
2. Local and regional sports
3. Local commercials
4. Programming intended for a digital tier

The concentration of one type of content over another will probably shift over time, as programming is fine-tuned to a specific market. However, the decision on the type of content delivered is secondary to the choice to provide local content. Content type can be changed without changing the Motorola local encoding equipment. Also, the channel lineup can be expanded from a few select local services now, to a large number of services in the future. The Motorola equipment expands easily and cost effectively, providing a clear migration path to support future needs. Local encoding equipment already in place can be maintained and then expanded with additional channels as the business case dictates.

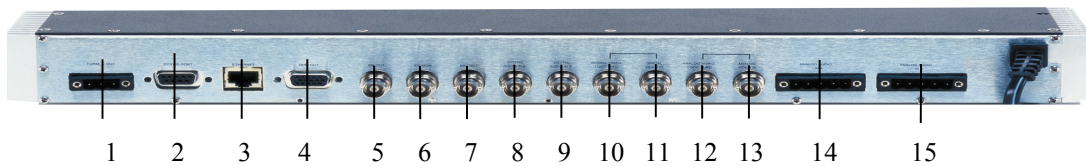
1.2 SE-1000

The SE-1000 is Motorola's local encoder. It incorporates powerful DigiCipher® II encoding technology into a small physical 1 RU design. The model SE-1000 accepts either analog composite or digital CCIR-601 video and performs MPEG-2 compression using highly refined Motorola compression techniques that provide high video quality at low bit rates. Video compression uses I-frame refresh to facilitate seamless MPEG-2 stream splicing. The video compression data rate is controlled by a simple front panel interface with pre-set configurations. Two stereo audio channels are compressed with either Dolby® brand AC-3® or DVB Musicam® encoding. The Motorola SE-1000 is Advanced Television Systems Committee (ATSC) and Digital Video Broadcasting (DVB) compliant, and it provides three types of outputs: DVB-ASI, Digital Headend Expansion Interface (DHEI), and DS-3, providing for easy interoperability with cable headends and broadcast equipment.

Figure 1: SE-1000 Front Panel



Figure 2: SE-1000 Rear Panel



1. Form C Relay
2. Log Port
3. Ethernet
4. DHEI Output
5. ASI Output
6. ASI Monitor Output
7. DS-3 Output
8. Digital Audio A Input
9. Digital Audio B Input
10. Digital Video Loop-through Input
11. Digital Video Input
12. Analog Video Loop-through Input
13. Analog Video Input
14. Analog Audio A Input
15. Analog Audio B Input

2.0 System Configurations

There are many system configurations that might be used to encode local content, depending on the local encoding needs. To select the optimal local encoder configuration, several questions about the business model should be answered:

1. How many local channels are being added?
2. Will the programs be added to existing multiplexes or will they create an entire multiplex? What programs will the new or altered multiplexes contain?
3. Should the equipment provide the ability to groom the services in the multiplex?
4. Are the cable customers going to be charged for the local channels, i.e. do the local channels need to be encrypted?

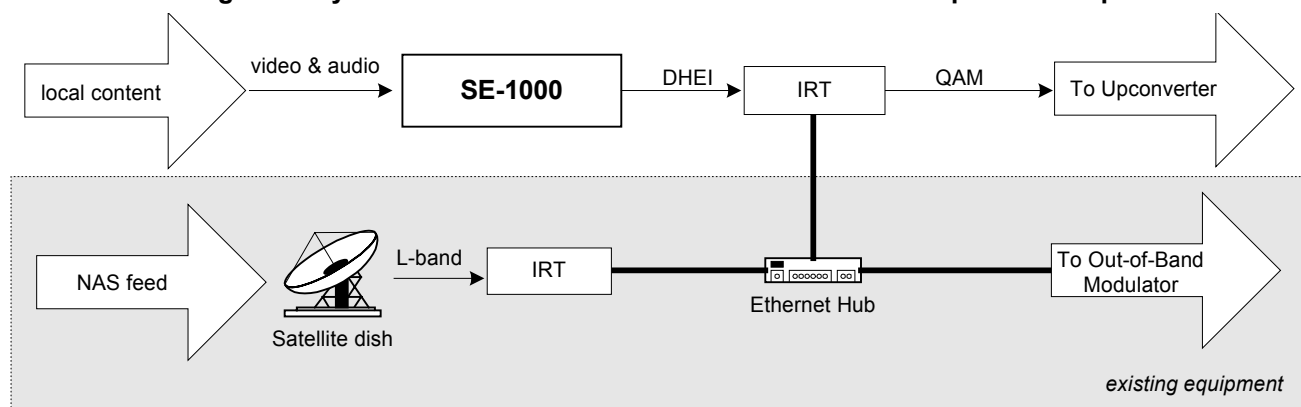
The following pages show several possible system configurations. Based on the answers to the above questions, a configuration that best meets the specific needs can be chosen. The configurations allow for future expansion as the local offerings are progressively expanded.

2.1 One Local Channel in a Separate Multiplex

Figure 3 shows the configuration for one channel of local content. Local audio and video content is encoded by a Motorola SE-1000 encoder and is output as a DHEI digital multiplex. The DHEI stream is then re-modulated by an Integrated Receiver Transcoder (IRT) and connected to an upconverter.

Note: The gray portion of the diagram depicts existing equipment. If the local program needs to be encrypted, NAS information will need to feed to the local channel IRT through an Ethernet hub.

Figure 3: System with One Channel of Local Content in a Separate Multiplex



2.2 Two or Three Local Channels in a Separate Multiplex

In Figure 4, the configuration provides two or three channels of local content in a digital multiplex. Each model SE-1000 encodes the video and audio for one local channel and outputs a DHEI stream. These DHEI streams are input into a Modular Processing System (MPS), which combines the three multiplexes into one and modulates the signal to a QAM format.

Note: The gray portion of the diagram depicts existing equipment. If the local program needs to be encrypted, NAS information will need to feed to the system controller card on the MPS through an Ethernet hub.

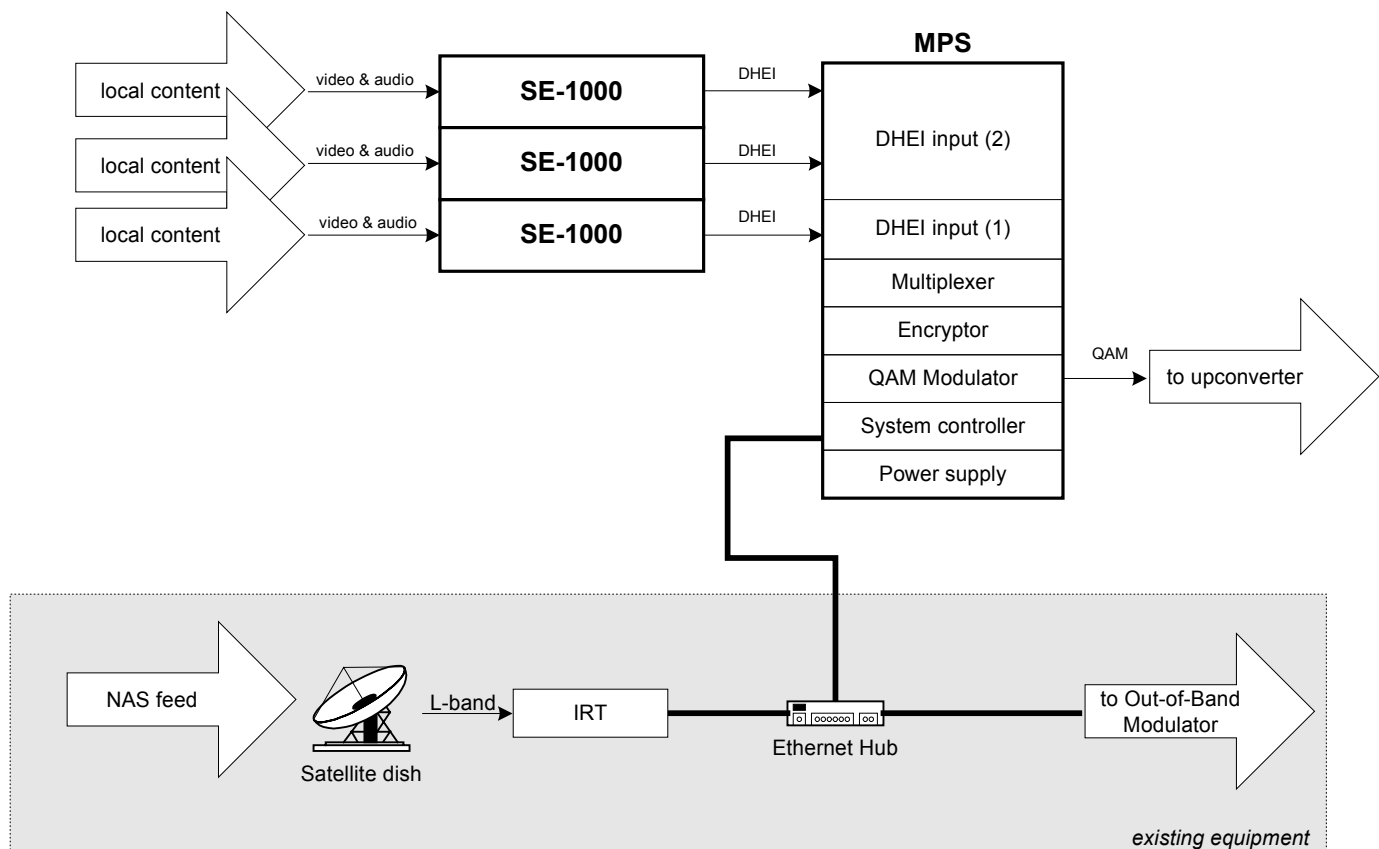
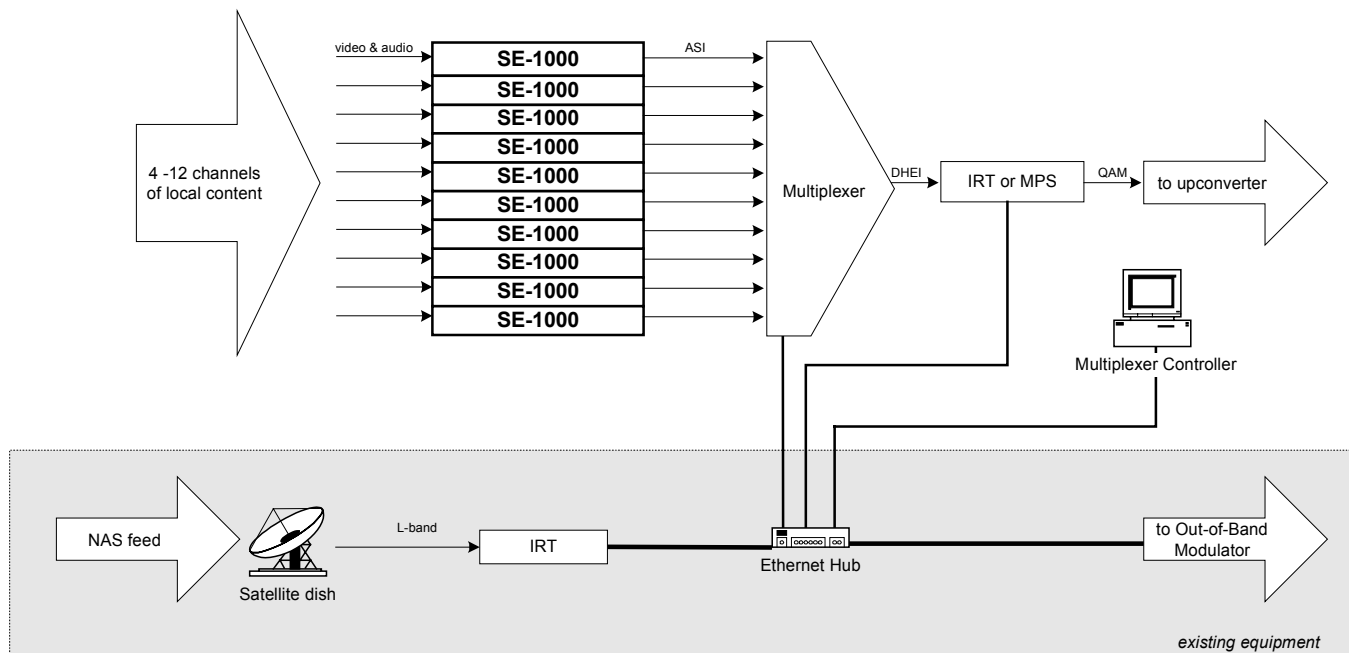


Figure 4: System with Two or Three Channels of Local Content in a Separate Multiplex

2.3 Four to Twelve Local Channels in a Separate Multiplex:

For configurations containing four to twelve channels of local content, the model SE-1000 DHEI streams are input into a Multiplexer, which combines the separate multiplexes into one. The single multiplex is then output to an IRT or MPS, which can encrypt the services, if desired, and modulates the signal to a QAM format, as shown in Figure 5.

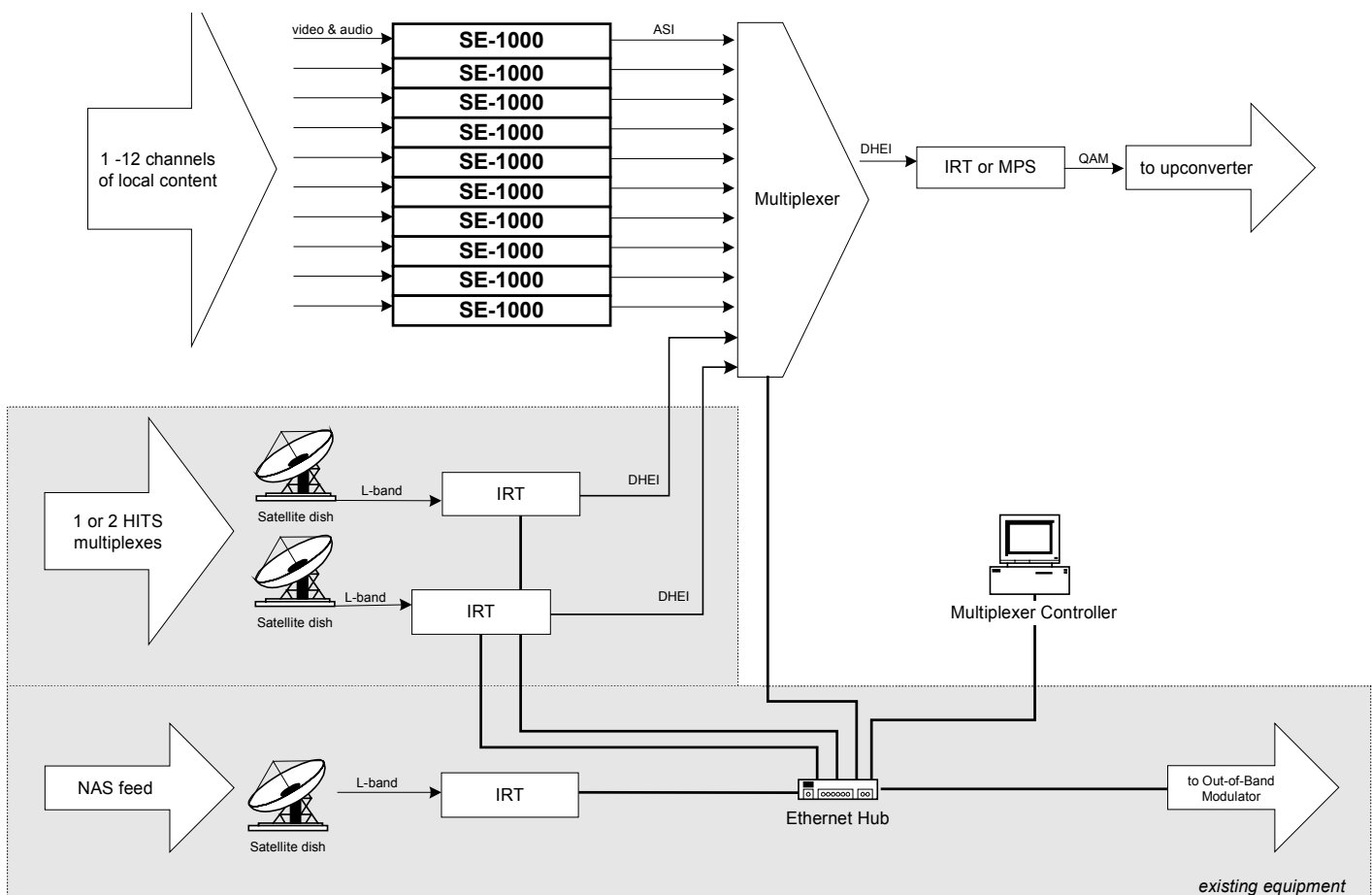
**Figure 5: System with Four to Twelve Channels of Local Content
Creating a Separate Multiplex**



2.4 Local Channels Combined with a HITS Multiplex

The configuration in Figure 6 shows one or more channels of local content combined with channels from HITS multiplexes. The DHEI streams from the Motorola SE-1000s and L-band HITS streams are input into a Multiplexer. The multiplexer then grooms the services and combines the channels into one multiplex. This single multiplex is then output to an IRT or MPS, which encrypts the services, if desired, and modulates the signal to a QAM format. For encryption, the NAS information is fed to IRT or MPS.

Figure 6: Channels of Local Content Combined with HITS Multiplex



3.0 References

3.1 System Components

The previous system configurations show several pieces of Motorola equipment. A description of each is listed below.

SE-1000

For a description of the model SE-1000, see page 5.

IRT (Integrated Receiver Transcoder)

The IRT receives a modulated QPSK carrier and transmodulates it into a more bandwidth efficient 64 QAM format. The unit accepts L-band input from a satellite downconverter and produces a signal appropriate for transmission in a 6 MHz television RF channel. The IRT decrypts and performs Forward Error Correction (FEC) on the incoming satellite data stream. It then clears information streams not intended for local cable transmission and inserts new information streams for this purpose. It prepares the signal for transmission across the terrestrial cable system by re-encrypting programs under either local headend control or NAS control. IRTs are linked via an Ethernet connection in a local headend LAN. The IRT provides local generation and insertion of program specific data, including tier level, purchaseability, price, and rating codes. IRTs may be optionally daisy-chained together via the multidrop port and controlled remotely over the satellite link where no Ethernet connectivity exists. The IRT also provides a DHEI expansion interface port so external devices can be cascaded to allow for processing beyond the capacity of a single IRT.

MPS (Modular Processing System)

The MPS is a modular system for processing digital video, audio, and other data that is transmitted according to the MPEG standard. The internal architecture of the MPS provides eight available slots that can be equipped with various functional modules. Available modules are: a QPSK receiver module, a DHEI input module, an ASI input module, a multiplexer module, a DigiCipher encryptor module, and a QAM modulator module. The QPSK receiver module demodulates up to two QPSK signals, supporting both MCPC and SCPC signals, and outputting an ASI signal. The DHEI input module accepts up to two DHEI input streams. The ASI input module accepts up to four ASI streams. The

multiplexer module combines up to six digital streams into two output ASI streams.

The DigiCipher II encryptor module uses DigiCipher II encryption technology to encrypt up to 32 services, 16 per ASI stream. The QAM modulator module takes an ASI input and modulates the service into either a 64 or 256 QAM. The MPS also includes a power supply and a controller unit. The system controller controls MPEG signal distribution, communication between modules, and other control functions.

Multiplexer

The Multiplexer is a modular digital multiplexer and service groomer. It provides statistical re-multiplexing for highest channel efficiencies. It allows customization of local digital programming line-up. The Multiplexer supports ASI and DHEI inputs. It multiplexes up to twelve input streams and grooms the services among the inputs, as controlled by the Multiplex Controller. The Multiplexer contains an Ethernet interface for connection to the Multiplex Controller.

Multiplex Controller

The multiplex controller controls the multiplexer. It maintains the PSI/SI tables, controls the statistical multiplexing operations of the Multiplexer, and controls communications between the Multiplexer boards.

NAS (National Addressable System)

The NAS provides turnkey access control for the HITS system. It allows for the authorization and de-authorization of receivers and services. It handles the implementation of subscription services for Pay-Per-View (PPV) and Impulse Pay-Per-View (IPPV).

3.2 Frequently Asked Questions (FAQ):

Q: How can I get more information about the Motorola SE-1000 or other equipment described in this paper?

A: Contact your local HITS manager or your Motorola sales representative.

Q: How do I order a model SE-1000?

A: Contact your local HITS manager.

Q: Will the channel line-up reflect my local channels?

A: Yes. Work with your local HITS manager to ensure that the new multiplex is created, the VCT channels are added, and the EPG entries are updated for your local channels.

Q: Can I charge my customers for the local content?

A: Yes. The services can be encrypted so you can charge your customers for them.

Work with your local HITS manager to ensure proper channel encryption and customer billing.

Q: How do I get training on configuration of the new equipment?

A: The NAS will configure some of your equipment and your local HITS manager will arrange training for the other pieces of equipment that you will configure yourself.

3.3 Acronyms

ASI	Asynchronous Serial Interface
ATSC	Advanced Television Systems Committee
CCIR	Comite Consultatif Internationale par Radio
DAC	Digital Authorization Center
DBS	Direct Broadcast Satellite
DHEI	Digital Headend Expansion Interface
DS-3	Digital (Transmission) System 3
DVB	Digital Video Broadcasting
EPG	Electronic Program Guide
FAQ	Frequently Asked Questions
FEC	Forward Error Correction
HITS	Headend In The Sky
I/O	Input/Output
IPPV	Impulse Pay-Per-View
IRT	Integrated Receiver Transcoder
LAN	Local Area Network
MCPC	Multi Channel Per Carrier
MPEG	Moving Pictures Expert Group
MPS	Modular Processing System
NAS	National Addressable System
NVOD	Near Video On Demand
PPV	Pay-Per-View
PSI/SI	Program Specific Information/System Information
QAM	Quadrature Amplitude Modulation
OOB	Out-of-Band
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
SCPC	Single Channel Per Carrier
SE	Single Encoder
VCT	Virtual Channel Table