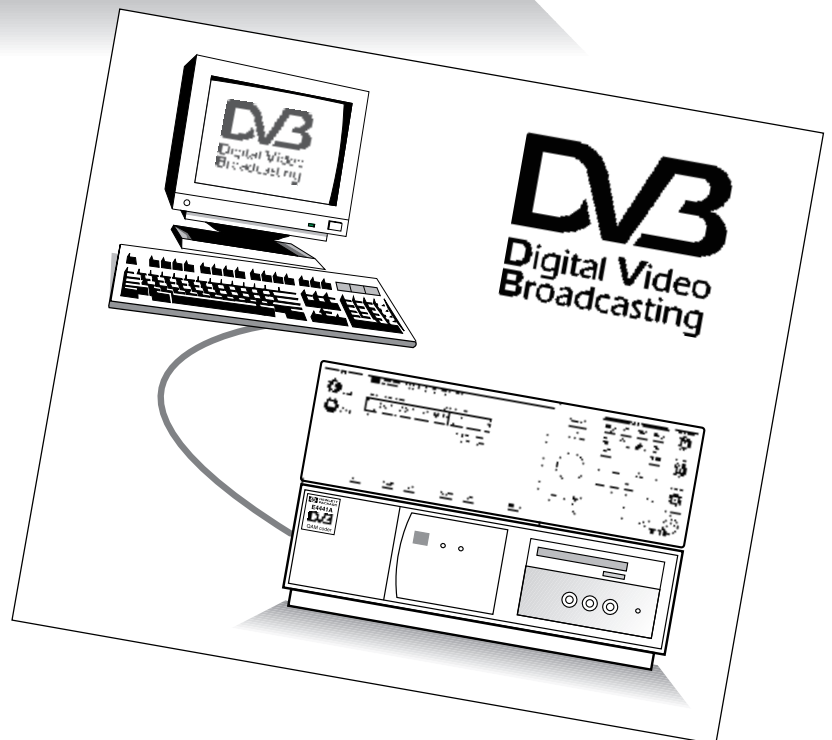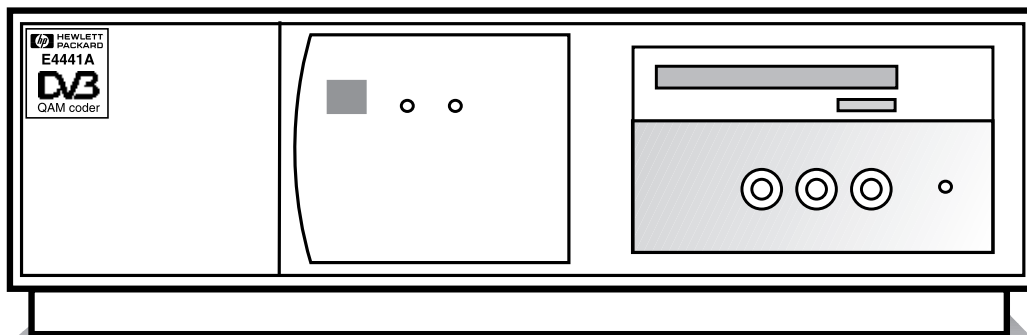# Testing the limits of DVB-C set top boxes, devices and networks

Product overview

**HP E4441A
DVB QAM coder**

The growing digital video business is now demanding compliance with the new DVB standards. Using the DVB QAM coder, hardware developers and system integrators can move quickly towards the new DVB-C standard for cable TV which has now been adopted by ETSI, ITU and DAVIC.

How can you be sure that your equipment works in a real-world DVB cable TV environment? Turn to the HP E4441A DVB QAM coder – the first fully compliant test source available allowing DVB set-top boxes, devices and networks to be tested with confidence.

**HP E4441A
DVB QAM coder**

**HP ESG-D1000A
digital signal generator**
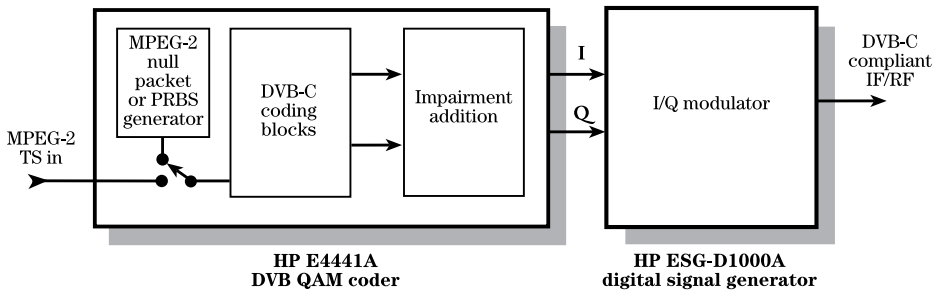
DVB-C compliance

The DVB QAM coder in conjunction with the digital signal generator produces fully DVB-C compliant test signals with programmable calibrated impairments. This allows true BER measurements to be made on receiver devices or set-top boxes (also known as integrated receiver decoders or IRDs).

Real-time encoding

The system can channel code and modulate either internally gener-ated MPEG-2 null packets (or a $2^{23} - 1$ PRBS) or an external MPEG-2 transport stream onto IF/RF to the DVB-C standard. This allows a variety of test or real world signals to be generated.

The internal MPEG-2 null packet (or $2^{23} - 1$ PRBS) source allows receivers to be fully characterized through bit error rate measurements (by using an HP 3764A digital transmission analyzer) or more simply through FEC results (from the device under test).

Via the external MPEG-2 input, real-life pictures or MPEG-2 stress patterns can be coded and modulated in real time. This facility is especially useful for subjective checks.

Calibrated impairments

The DVB QAM coder and digital signal generator combination provides a precision reference signal for laboratory or factory use. To simulate poor signal conditions the DVB QAM coder includes an accurate Gaussian noise source. Noise can be added to the reference in a controlled and calibrated manner.

The instrument combination can also produce a range of other signal impairments such as carrier leakage and I/Q imbalance to test the limits of receiver design or network performance.

Complete flexibility

The DVB QAM coder is user configurable making it ideal for R&D, early manufacture and system installation testing.

The unit has internal settings for 8, 6, 4 and 2 MHz channels and, by using an external clock source such as an HP 33120A function generator, the symbol rate (and hence the channel occupancy/bandwidth) can be varied continuously from 5.2 to 7 Mbaud.

By default the DVB QAM coder generates a 64 QAM signal which is coded, mapped and filtered according to the DVB-C standard. An intuitive Windows®-based graphical user interface allows coding, constellation size, symbol mapping and filter characteristics to be changed easily and quickly.

For R&D or manufacturing

The Windows-based graphical user interface controls both the DVB QAM coder and the digital signal generator for local operation. Both units are completely HP-IB compatible and easily racked, making them suitable for integration into manufacturing test systems.

Technical specifications

Modulation

Modulation types: 16, 32, 64, 128 and 256 QAM.
Symbol mapping: DVB compliant, user defined.
Error vector magnitude: < 1% typical[1].

Channel characteristics

Channel filter type: Root raised cosine, raised cosine, user defined.
Channel filter alpha: 0.15, 0.13.
Symbol rate (selectable):

Nominal channel bandwidth	Internal (Mbaud)	External (Mbaud)
8 MHz	6.890 6.872 [2] 6.875 [2] 6.900 [2]	5.2 to 7.0*
6 MHz	5.274 [2]	
4 MHz	3.445	2.6 to 3.5*
2 MHz	1.7225	1.3 to 1.75*

fully variable

Data source

Data source type:
- Internal $2^{23} - 1$ PRBS
- Internal packetized $2^{23} - 1$ PRBS
- Internal MPEG-2 null packets
- Internal arbitary fixed symbol
- External 188 byte MPEG-2 packet input
- External 204 byte MPEG-2 packet input.

Channel coding

Channel coding: As per ETS 300 429.
Channel coding control:
- Randomization on/off
- Sync inversion on/off
- Reed-Solomon encoding on/off
- Byte interleaving on/off
- Differential encoding on/off.

Impairments

Gaussian noise: On/off.
Eb/No range: +3 to +30 dB for 64 QAM.[3]
Eb/No accuracy: ±0.12 dB.[3]
Crest factor: > 15 dB.

Spurious tone:
On/off.
Frequency range: ±(1 kHz to 5.75 MHz).
Frequency accuracy: ±0.1%.
S/I range: −6 to +45 dB.
S/I accuracy: ±0.3 dB to ± 3.5 MHz.

Carrier leakage: On/off.
Magnitude range: −80 to −10 dB wrt rms output.
Magnitude accuracy: ±0.2 dB.
Angle range: −180° to +180°.
Angle accuracy: ±1° to −40 dB wrt signal.

I/Q magnitude imbalance: On/off.
Range: ±2 dB.
Accuracy: ±0.1 dB.

I/Q quadrature imbalance[4]**:** On/off.
Range: 80° to 100° typical.

Inverted spectrum: On/off.

I & Q outputs

Level: 0.28 V rms (nom.) into 50 ohms.[5]
Residual dc offset: < 300 µV.
Connectors: BNC.

Symbol clock output

Type: TTL compatible.
Connector: BNC.

MPEG-2 input[6]

Type: DVB-PI as per DVB document A010. Oct 1995.
Connector: 25-pin sub-miniature D-connector.

Control

Local control: Windows-based graphical user interface controls HP ESG-D1000A digital signal generator or HP 8780A/HP 8782B vector signal generators and HP E4441A DVB QAM coder.
Remote control: HP-IB interface. SCPI control.

General specifications

Dimensions (mm): 125 H, 420 W, 390 D.
Weight: 11 kg.
Operating temperature: 5 to 40°C.
Storage temperature: −40 to +70°C.
Humidity: 80% relative humidity to 40°C.
Power: 125 VA.
EMC: CISPR11 Level A. EN55011, 1991. EN55082-1, 1992.
Safety: IE950:1991.

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[1] *Valid when using internal clock with all impairments off and root raised cosine filter as supplied. Receive filter assumed to be a perfect match.*

[2] *Optional – see ordering information.*

[3] *Excluding residual EVM.*

[4] *Function of HP 8780A or HP 8782B vector signal generator. Not available with HP ESG-D1000A digital signal generator.*

[5] *With $2^{23} - 1$ PRBS data source selected.*

[6] *Includes external clock input which can be used to clock either internal or external data.*

Ordering information

HP E4441A DVB QAM coder

Includes coder hardware, embedded PC, keyboard, mouse, external clock cable, interconnects to HP ESG-D1000A digital signal generator, Microsoft DOS 6.22®, Microsoft Windows for Work Groups 3.11® and application software.

The DVB QAM coder is for use with HP ESG-D series digital signal generators or HP 8782B or HP 8780A vector signal generators. For more information on the HP ESG-D series digital signal generators see publications 5965-3095E and 5965-3096E.

The DVB QAM coder provides an internal fixed symbol rate of 6.89 Mbaud and an external symbol clock input. For an additional internal fixed symbol rate order one of options 001 thru 004.

Options

001: Internal fixed symbol rate of 6.872 Mbaud.
002: Internal fixed symbol rate of 6.875 Mbaud.
003: Internal fixed symbol rate of 6.900 Mbaud.
004: Internal fixed symbol rate of 5.274 Mbaud.
1CP: Rack mount kit.

Recommended accessories

HP D2818A ultra VGA 17-inch display.

For more information on Hewlett-Packard Test & Measurement products, applications or services please call your local Hewlett-Packard sales offices. A current listing is available via Web through AccessHP at http://www.hp.com. If you do not have access to the internet please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

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L4W 5G1
(905) 206 4725

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European Marketing Centre
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