DTVM 2000(T)

Digital Terrestrial Television Transmitter Monitor

The DTVM 2000(T) Digital Terrestrial Television Transmitter Monitor range has been designed for DVB signal quality measurement applications. Mainly designed for measuring the performance of transmitters it works in accordance with ETS 300 744, and provides both 2K and 8K carrier mode options, supports all DVB modulation options, guard intervals and FEC rates.

Different versions allow solutions for VHF, UHF, and for 6/7/8MHz bandwiths

The receiver accepts a standard RF or baseband input, and demodulates the COFDM signal to give both SPI and ASI MPEG transport streams. BNC's on the rear of the unit allow the constellation and channel state diagrams to be displayed on a standard oscilloscope. A range of status and alarm outputs are also available. A built in Digital Signal Processor allows the baseband modulating signals (I,Q) to be monitored and measured in real-time in accordance with ETR 290, and this includes the key measurement of MER.

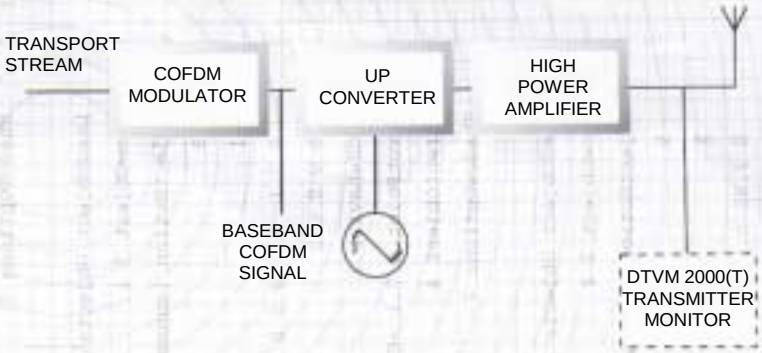
The DTVM 2000(T) can be fully controlled from the front panel, or via the RS232 port, whereby all the results can be fully monitored.

BROADCAST TECHNOLOGY

INSTALLATION & APPLICATION

As more countries are planning Digital Terrestrial Television broadcasting, the need for a reliable and accurate method of signal measurement is required. Unlike an analogue system, the loss of transmission path quality will result in the loss of the coverage area.

Broadcast Technology are proud to present the DTVM 2000(T) Professional DTT Transmitter monitor. The DTVM 2000(T) is a valuable tool for monitoring the performance of a DTT transmitter. In a transmitter set-up, the baseband COFDM signal from the modulator passes through the up-converter, high power amplifier and to the output-combiner. All types of signal disturbances will impart on the COFDM signal and can be measured by the DTVM 2000(T) using ETR 290 signal analysis.

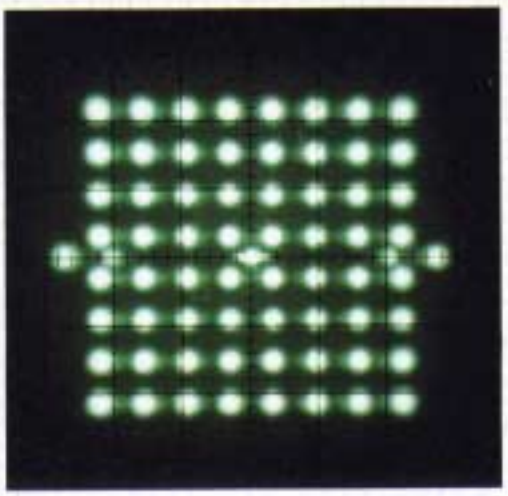


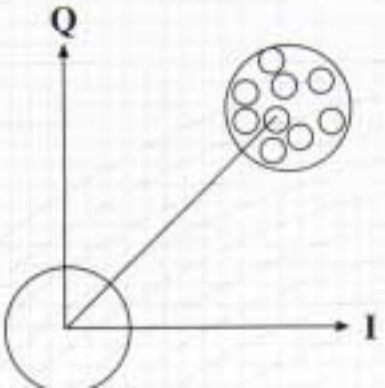
A typical digital transmitter set-up.

Connected directly to the transmitter output in this way, the unit performs a variety of measurements and calculations, to ensure that it is performing at its maximum. As the results are performed in real-time, any errors or potential problems are quickly indicated.

ETR 290 SIGNAL ANALYSIS

ETR 290 signal analysis is defined by the DVB and implemented in the DTVM 2000(T). The analysis can be made on a single carrier or multiple carriers. An analysis of each constellation point or cloud is made, and their offsets from the ideal.





A 64QAM Constellation diagram and constellation point

MEASUREMENTS THE DTVM 2000 (T) PERFORMS

MER (Modulation Error Ratio).

A single figure of merit that considers all possible impairments to the signal, such as the effects of noise, carrier leakage, and I,Q level and quadrature imbalance.
The benefits are MER are:

- In service measurements
- High sensitivity
- Expressed as a single numeric value
- Include all types of signal disturbances
- Simple in concept
- Familiar units of measurement

S/N (Signal to Noise)

The S/N ratio includes errors caused by White noise, Gaussian noise and Additive noise. Therefore, this measures 'noise' only, as opposed to the added errors included in MER. Noise can be seen from a constellation diagram as each constellation point becomes a cloud around the central point

STE (System Target Error)

In the constellation diagram, this represents a displacement of the cloud from the centre of its correct position. This may be caused by a number of issues such as Amplitude Imbalance, Quadrature errors, or Carrier suppression.

AI (Amplitude Imbalance)

In the context of I,Q, an amplitude imbalance occurs when one or the other is compressed, the cause of which maybe errors in the modulation process.

QE (Quadrature Error)

These are phase errors between the cosine and the sine components of the carrier at 90^{o}, They must be orthogonal. If their phase is not exactly 90^{o}, then the constellation will appear trapezoidal.

CS (Carrier Suppression)

This the result of an unwanted coherent signal added to the centre carrier of the OFDM signal. It could be produced by dc offset voltages or crosstalk. The whole constellation can incur a lateral displacement.

PJ (Phase Jitter)

Phase Jitter of an oscillator is due to fluctuations of its phase or frequency. It is generated by converters in the transmission path or by the I,Q modulator, and acts simultaneously on the two paths. The carrier regeneration cannot therefore, follow the phase fluctuations. In order to perform this, the Common Phase Error Corrector (CPE) must be disabled. This monitors phase jitter performance of the transmission system which is useful to indicate failures of the transmitter up-converter Local Oscillator.

ENM (Estimated Noise Margin)

The ENM is the difference in dB between the estimated SNR of the received signal and the SNR which gives a BER of 10E-4 before RS decoding.

The above measurements are performed as part of the I,Q analysis in accordance with ETR 290. In addition to these, further analysis can be performed, which include:

BER (Bit Error Ratio)

An estimated value of the number of bit errors received. These can be shown for, Pre/Post Viterbi, and Post Reed-Solomon. Useful to indicate errors in the coding at the modulator.

Amplitude and Group Delay

The COFDM signal, although containing digital information is analogue and will suffer degredation through the signal path. Amplitude Response or Group Delay will manifest themselves as a loss of coverage.

Channel Impulse Response

Channel Impulse Response is useful to detect the presence of echoes at remote sites, which can reduce coverage.

FRONT PANEL

A STATUS DISPLAY

Backlit LCD provides clear viewing of status and unit configuration, enabling complete control of unit from the front panel.

REAR PANEL

1 MAINS INPUT

Universal input accepts 95 to 240V ac frequency 50/60 Hz.

2 MONITOR PORT

15-Way D-type providing connections to 8 user configurable Open Collector alarm outputs

3 SERIAL CONTROL

RS232 serial control via 9-Way D-type.

4 ALARM OUTPUT

9-Way D-type providing connections to 3 user configurable relay alarm outputs

5 CHANNEL MONITORING

6 BNC's allow connection in a standard oscilloscope to display the Channel State and Constellation diagrams.

B FUNCTION KEYS

The entire operation of the receiver can be carried out from the front panel using these keys. Up/Down selects the various menus, and Left/Right enables the different options in each menu to be selected. Enter is for effecting a change.

C STATUS LEDs

Two LEDs are situated on the front of the receiver:
Green POWER LED indicates that power is being supplied to the unit.
Red ALARM LED indicates an alarm level has been activated. This is dependant on a range of different fault conditions that can be selected. These being any of the relay alarm conditions, or Alarm 1 of the open collector alarms.

6 OPTICAL OUTPUT (OPTIONAL)

The ASI output is available via an SC connector.

7 ASI OUTPUTS

Two ASI outputs allow two transport streams to be processed. The ASI is selectable for 188 or 204 bytes.

8 SPI OUTPUT

One 25-way D-type allows the transport stream to be output in parallel format.

9 ECL OUTPUTS

Two 25-way D-types allow hierarchical transport streams to be output in ECL parallel format.

10 BASEBAND I/O

Under normal operation, the baseband output is fed to the input via a 'U' link. By removing the link, an external baseband input can be fed to the receiver.

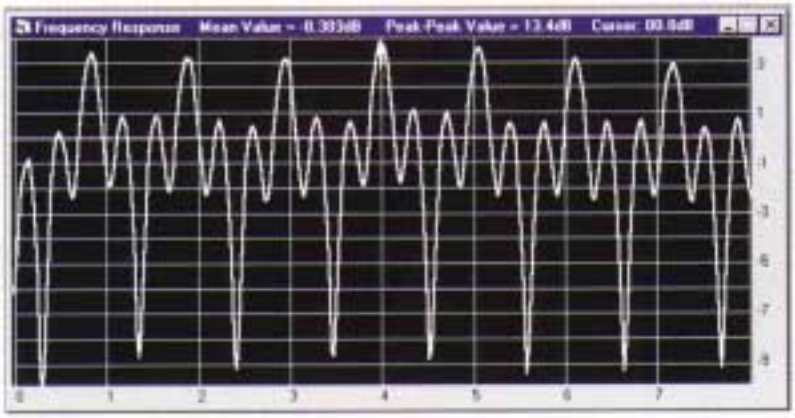
11 UHF INPUT

Standard RF input at 75 Ohms.

BROADCAST TECHNOLOGY

DTVM 2000 (T) Software

FREQUENCY RESPONSE

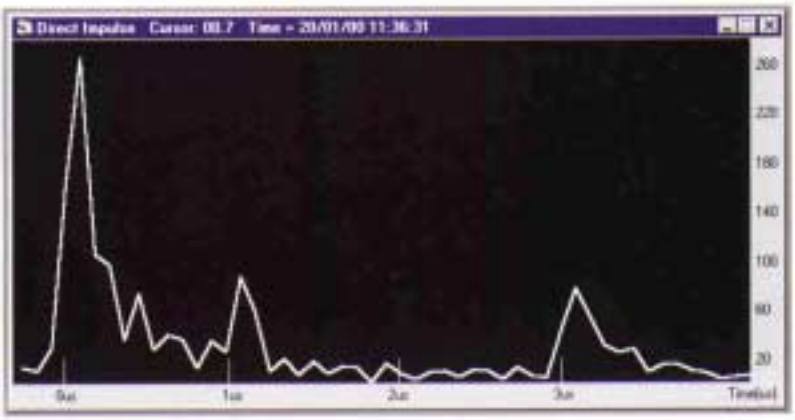


GRAPH 1.
Plotting of frequency response using pc package. Mean value and peak to peak direct from the receiver. This graph shows the presence of two echoes

CHANNEL IMPULSE RESPONSE

GRAPH 2
Plotting of Impulse Response showing signal and echoes, using pc package. Here, two echoes can clearly be seen in the time domain.

DIRECT IMPULSE RESPONSE



GRAPH 3
Plotting of Direct Impulse Response using pc package. This is a close up view of the Impulse Response.

MER

GRAPH 4
MER can be plotted against time. The time can range from 1 hour to 24 hours.

CONSTELLATION DIAGRAM

GRAPH 5
As well as the constellation diagram being available from the rear of the unit, it is also available from the pc package..

ALARMS

GRAPH 6
The receiver has an extensive range of alarms. In addition to three closing contact relay alarms, eight, user configurable open collector alarms are available that can indicate a number of conditions.

TECHNICAL SPECIFICATION

TUNER

Frequency Range	VHF/UHF 46 to 860 MHz
Frequency Accuracy	Triple Conversion
Channel Bandwidth	6/7/8 MHz (Options)
Typical Input Range	-10 to -77dBm (Optimum -35 to -45dBm)77dB
Typical Noise Figure	9dB
Input Impedance	75 Ohms
Typical Input Return Loss	10dB
Baseband Input Centre Frequency	3.429MHz (6MHz B/W), 4.0MHz (7MHz B/W), 4.571MHz (8MHz B/W),
Baseband Input	-6dBm (75 Ohms)

COFDM DEMODULATOR

Modulation Systems	QPSK, 16 QAM, 64 QAM
Carriers Supported	2K/8K DVB (T) selectable FFT automatically selected
Viterbi FEC	Supporting all DVB code rates: 1/2, 2/3, 3/4, 5/6 and 7/8
Guard Intervals	Supporting all DVB guard intervals: 1/32, 1/16, 1/8, 1/4
Hierarchical Modes	Both HP and LP streams available simultaneously
Error Correction	Reed Solomon (204, 188), and Viterbi
Synchronisation Monitoring	Status of TPS, FEC decoder, etc.
Maximum DVB-T input level	-35dBm
Maximum interfering PAL signal	-25dBm

CONNECTIONS

RF Input	46 to 860 MHz	75 Ohm BNC
Baseband Input	3.429MHz/ 4.0MHz/ 4.571MHz	75 Ohm BNC
Baseband Outputs	3.429MHz/ 4.0MHz/ 4.571MHz	75 Ohm BNC
Channel Monitoring Outputs	Trigger, W, X, Y, Z	75 Ohm BNC
MPEG Transport Stream Output	Primary & Secondary ECL	25- Way D-type
	SPI (LVDS)	25- Way D-type
	Two ASI Outputs	75 Ohm BNC
	ASI Optical - 1270-1380nm	Type SC
Serial Control	RS232	9-way D-type
Monitor Port	8 Open Collector Alarms	15-way D-type
Alarm Output	3 Closing Contact Relay Alarms	9-way D-type

CHANNEL MONITORING FUNCTIONS

BER	Bit Error ratio pre/post Viterbi and post RS
MER	Modulation Error Ratio in dB, Average MER in %, Peak MER in %
S/N	Signal to Noise ratio in dB
STE	System Target Error, Mean and Deviation
AI	Amplitude Imbalance in %
QE	Quadrature Error in °
CS	Carrier Suppression in dB
PJ	Phase Jitter in ° RMS
SF	Sync Failure
UCE	Uncorrectable Error Blocks (Overload of RS Decoder)
ETR 290	Full analysis including Amplitude, Group Delay, and Impulse Response

MECHANICAL

Height	44mm (1RU)
Width	19" Standard Rack Mounting
Weight	4.5Kg
Power	95-240 Vac 50/60Hz

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