White Paper
by C. Martin

Test & Measurement for DVB-H: The New Deal

Transition to digital broadcasting had already brought along a wind of change in Test & Measurement. Now, mobile TV, and especially DVB-H, brings its own lot of specificities.

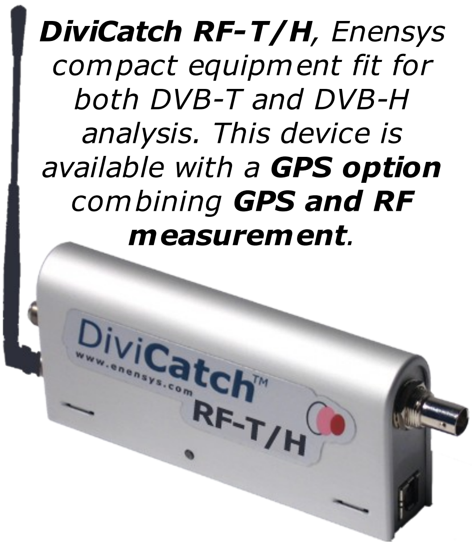
Whether you are willing to deploy and optimize a DVB-H network, validate the mobile devices fully compliant with your head-end or putting together a new generation receiver, Mobile TV implies specificities that your standard DVB Test & Measurement equipment will not be able to deal with.

Although DVB-H has not been yet widely deployed, it is essential to think about test and monitoring way ahead of a possible commercial roll-out. Test equipment is of course a requirement for trial phases, but devices for monitoring the future network must also be selected and evaluated ahead of the actual kick-off.

Differentiated equipment for different needs

First of all, two distinct needs for test and measurement must be clearly differentiated: laboratory or field testing and network monitoring. For the first type of use, lab & field, it is important that a DVB-H test device be both powerful and compact. Additionally, for field testing applications like network optimization, coverage tests or simple maintenance, it is highly important that the device is both portable and featuring GPS capabilities for measurement surveys. For optimized exploitation of survey results, the test equipment should either integrate cartographic capabilities or – for cost-efficiency considerations – be based on non-proprietary format for full interoperability with major cartographic applications on the market. The second type of use, network monitoring, also requires compact equipment, but primarily the devices must feature remote control capabilities. If a device has to be compact for head-end and primary sites because these spaces are most of the time already crowded, the device footprint becomes even more critical if you want to deploy an even more fault-resistant DVB-H network. Indeed, it may be highly useful depending on the network topology to also deploy network

***DiviCatch RF-T/H**, Enensys compact equipment fit for both DVB-T and DVB-H analysis. This device is available with a **GPS option** combining **GPS and RF measurement**.*

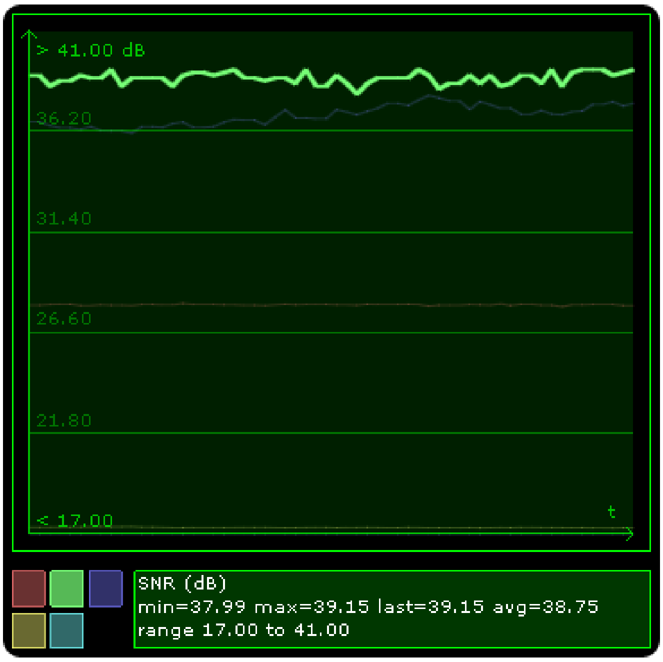


probes in other strategic points like potentially crowded or shadow areas but also places where many different RF networks are in operation. And in these places, there may be nothing else available than simple outdoor cabinets, where environmental capabilities also become key selection characteristics. All probes must be capable of sending back information logs to a centralized Network or Performance Monitoring System, and therefore feature both at least one Ethernet port and non-proprietary log formatting. Finally, cost-efficiency can be achieved by using frequency polling – the probe device would then need to feature one single RF input thus reducing costs – or by lowering the level of measurements to be sent back, especially from secondary sites where it may be sufficient to monitor only critical RF parameters and a couple of top-priority alarms on MPEG2-TS errors.

Now that we have identified possible usage schemes of the equipment, let's take a look at the features. First we'll identify RF parameters, and finally TS-level features along with DVB-H specificities.

RF level measurements

First of all, DVB-H is not highly specific in terms of RF transmission, therefore usual RF parameters will be found in this section. However, it is still important to make sure that the DVB-H test equipment selected for your operations is 100% DVB-H compliant, that means compliant with 4K FFT mode, 5MHz channel bandwidth and in-depth interleaving. Even though these modulation modes are not widely used in DVB-H trials for the moment, test equipment still needs to be future-proof and compliant to whatever scheme may be actually implemented later.Whether you are in need of performing a test in the R&D lab, field coverage measurements, or continuously monitoring your network through probes, the following RF parameters are essential for a complete diagnosis: Signal level, C/N, BER and MER.



Graph showing the evolution of major RF parameters on the signal monitored

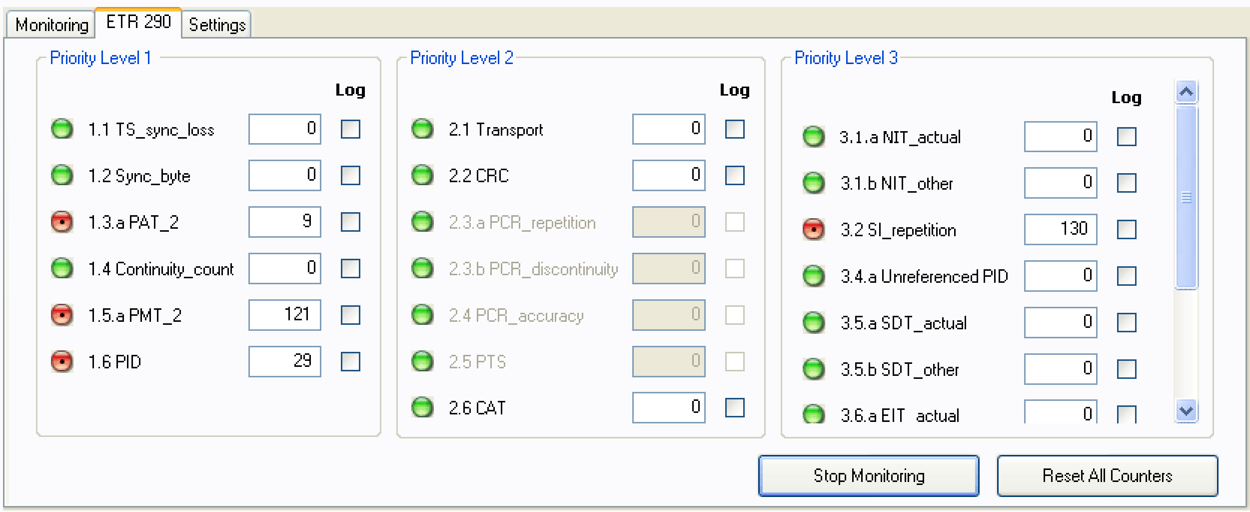
Signal level, expressed in dBµV or dBm, indicates the level of the signal received. It is a helpful value to identify significant power variations that could be caused by a faulty transmitter or "blank" areas where signal level may be too low for proper reception or decoding.

Carrier to Noise ratio (C/N) is an indicator of the signal quality. It is a

comparison between the total noise strength on the signal monitored and the carriers' signal power. Of course, the less noise, the better the signal quality.
Modulation Error Ratio (MER) is also an indicator of the signal quality. Expressed in dB, it is a representation of the distance between measured and theoretical constellation points. It is an indicator of noise, interferences or distortions on the signal.
A real-time view of the constellation may also be useful for instant visual diagnosis. For example, a constellation showing dots in concentric lines indicates phase noise whereas a diamond-shaped constellation indicates quadrature errors.

MPEG2-TS analysis

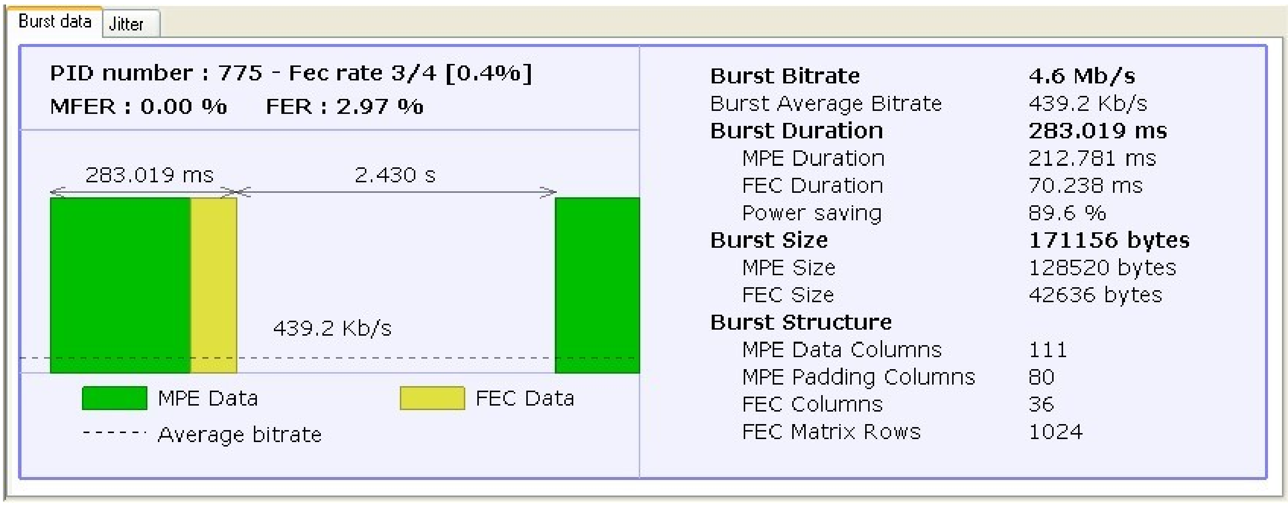
And now, let's move to transport stream level. First, like standard DVB measurement equipment, a DVB-H test device should be able to parse most essential PSI/SI tables for a quick view of the contents of the transport stream. The DVB-H specific table, IP-MAC Notification Table (INT) should be available for identifying the IP target addresses of each elementary stream inside the multiplex.
DVB-H test devices should also feature ETSI TR 101 290 (or ETR290) to help automatically identify critical failures like continuity errors and synchronization losses and validate the conformity of the TS. When writing ETR290 guidelines, the DVB consortium has identified three priorities of errors at the transport stream level. The first level of priority identifies faults that can be critical for program decoding. Second level lists additional parameters which are recommended for continuous monitoring, and third level lists further optional parameters covering varied interests.



ETR290 alarms should be easy to read (colored LEDs indicating status) and feature a counter for the number of errors detected on each alarm.
For DVB-H, PCR and PTS-related alarms are not relevant since this information does not exist on DVB-H time-sliced streams.

DVB-H specific analysis

However useful ETR290 validation may be, it is not fully adequate for DVB-H broadcasting. First of all, IP DataCasting used in DVB-H implies a new table, IP/MAC Notification Table signalling availability and location of IP streams within the TS. As for standard ETR290, this INT table transmission frequency must also be watched. Additionally, DVB-H has strong specificities: Time-slicing, additional error correction scheme at burst level (MPE-FEC), IP datagrams encapsulated into MPGE2-TS packets. DVB-H therefore requires further validation parameters. DVB-H test & measurement devices should be able to provide real-time information on burst structure, inter-burst off-time and delta-t. Burst structure can provide useful information on MPE size (ie, actual useful data) or FEC size (ie, redundancy for error correction). Inter-burst off-time can identify a failure in the IP encapsulator if too long or too short. Delta-T information is critical for battery saving optimization on handsets: If the discrepancy between theoretical and actual burst transmission time is too high, it may result in either low battery saving or loss of information.



All these monitoring parameters are especially valuable in a DVB-H test equipment if customizable alarms can be raised on any of them.

Time-slicing characteristics have also led to the definition of two new DVB-H specific ratios for evaluating the quality of restitution to the receiver: MFER and FER. Frame Error Rate (FER) is the ratio of transmitted bursts containing errors during a specified period. A burst is marked erroneous if any TS-packet within the burst is erroneous.

MPE-FEC Frame Error Rate (MFER) is the ratio of uncorrectable MPE-FEC frames received during a specified period. An uncorrectable MPE-FEC frame is a frame in which there are more errors in the MPE section than the number of errors that FEC is actually capable of correcting.

Both ratios have become referential indicators of the quality of restitution for each transmitted service and the « degradation point » has been unanimously set to 5% for both ratios. Note that an MFER of 5% means that each 5 minutes there is 15 seconds without any video (based on a time slicing of 3 seconds).

In the end the key word for DVB-H monitoring should be simplicity. Not many technicians or engineers are already fully familiar with the new standard for Mobile TV and it is important that the test device they are using helps them through the validation process. For example, should all network technicians know that inconsistencies between NIT and declarations contained in each PID can stop a handset from decoding a program? Predefined alarms quickly checking such critical failures should rather be available in the DVB-H test device.

As we have been detailing through this article, Monitoring levels may be different throughout the network but there are however many parameters to monitor on DVB-H – much more than with any other DVB standards – and all DVB-H test equipment should allow for a complete control of potential failures may they be due to standard errors or DVB-H specificities.

Glossary

BER	Bit Error Rate
C/N	Carrier to Noise
DVB-H	Digital Video Broadcasting - Handheld
ETR290	ETSI TR 101 290
FEC	Forward Error Correction
FER	Frame Error Rate
FFT	Fast Fourier Transform
INT	IP/MAC Notification Table
MER	Modulation Error Rate
MFER	MPE-FEC Frame Error Rate
MPE	Multi Protocols Encapsulation
NIT	Network Information Table
PCR	Program Clock Reference
PTS	Presentation Time Stamp
SNR	Signal to Noise Ratio

About the author

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Graduated from the European Business Engineering Master at ENST Bretagne, she joined Enensys in 2006 to help develop Test & Measurement products. Previously, she had worked for 6 years in the IT industry.

About ENENSYS Technologies SA

ENENSYS has years of experience in designing and manufacturing high quality transmission equipments for Digital TV Broadcast, and is the ideal partner for:

- Mobile TV broadcast
  based on DVB-H, MediaFLO, T-DMB, DVB-SH, CMMB technologies
- Digital Terrestrial TV broadcast
  using DVB-T, ATSC, DTMB technologies
- Video over IP transport
  DVB-IPI with Pro MPEG Forum Forward Error Correction
- Test & Measurement
  Full range of pocket sized USB2.0 players / recorders / analyzers for Cable, Terrestrial, Mobile TV applications or any compressed digital video signal processing

ENENSYS has over 200 customers located in 36 countries including Broadcast Operators, Network Operators, Telcos, TV Channels Chipset Vendors, Set Top Boxes Manufacturers, Professional Equipment Manufacturers and System Integrators. ENENSYS already has set up partnerships with international representatives and technology partners which demonstrate the seamless integration of its products to complex plateform.
Headquartered in Rennes, France, in the heart of the European Digital Broadcast Cluster, is publicly listed on Euronext Paris Stock Exchange (FR0010286252 – MLENS).
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