DSS5600T/H DriveTest System with Diversity DVB-T/H Decoders

The DSS5600T/H is a DVB-T/H (COFDM) portable Terrestrial Broadcast Measurement System. The unit is a self contained system incorporating a laptop PC running proprietary Z Technology DriveTest Application Software.

The System features RF field strength and Digital Television (DVB-T & DVB-H) decoded parameter measurements while adding unique plotting and mapping capabilities. Using this Windows™ based system, a Broadcaster can easily generate signal coverage data including a full set of figure-of-merit parameters for DVB-T/H signals and plot these over a service area. Problems may be analyzed quickly to determine appropriate corrective action for improved signal coverage.

The DSS5600T/H provides all the capability of an RF Signal Level Measurement System with the added advantage of DVB-T/H Digital Television Signal Decoding. Extensive RF, DVB-T, and DVB-H decoded parameter measurement capability is contained within this one compact, easy to use package. The System is made up of precision RF measuring hardware, a diversity DVB-T/H decoder, WAAS-enabled GPS receiver, a Windows™ based laptop PC, and Z Technology DriveTest Application Software. It is a compact suitcase sized system to allow use in the laboratory and also in portable or mobile environments.

Comprehensive Field Measurement and Documentation System for the DVB-T/H Digital Television Standard

Incorporates Programmable Field Strength Meter, Diversity DVB-T/H Decoder with dual ASI outputs, & GPS receiver all controlled via DriveTest™ application

Graphic Display of RF Spectrum, DVB Constellation, and Impulse Response. Plot vs. time of any recorded parameter.

Records Clear Text Values for Integrated Power, Peak Power, Bandpass Tilt, In-Band Notches, Std. Deviation, FMT, Alpha, HP & LP Code Rate, Carrier, TPS, Viterbi, FEC and MPEG Sync Locks, SNR, Post-Viterbi BER, MER, PER, QEF, SQI, DVBH time slice, MPE-FEC and GPS Parameters

Rugged Design Provides Maximum Portability and Capabilities for Acquiring Data from Difficult to reach Locations

Measures and Maps Digital and Analog Signal Coverage on Embedded Maps and Customer-Licensed Image Files.

Precision Measurements:
The DSS5600T/H is a unique turnkey system for automatic data measurement, collection, storage and presentation. Parameters are continuously measured and stored in data files. During data capture, as well as at a later time, parameters can be plotted in color over maps of coverage areas. Plots and collected data are both available for analysis, print out and export to other programs.

The system takes advantage of the precision and flexibility of Z Technology’s programmable field strength meter technology to provide accurate, high-speed signal strength measurements under PC control. When used with calibrated antennas, the
DSS5600T/H provides a comprehensive facility for NIST traceable RF power measurement and documentation of digital or analog signal coverage.

In addition to RF measurements, the system’s diversity DVB-T/H decoder provides DVB signal analysis of demodulated parameters necessary to fully characterize a DVB-T/H signal. Many decoder figure-of-merit parameters are captured, measured and recorded during a data collection session.

This Digital Signal Analysis System includes the factory installed DriveTest Automated Measurement Program. This Application is a Windows™ based program that uniquely integrates separate yet related features: Data Collection, Dot Plotting, Swept Display analysis, DVB Constellation DVB Impulse Response and Plot vs Time of any measured parameter.

**Data Collection:**
The Data Tab is the control center of the DriveTest Application. From this screen location, recording sessions (or Jobs) are initiated. Recorded data can be viewed during operation and the status of the subsystems within the DSS5600T/H is constantly visible allowing review of proper operation.

Data Collection automates the process of logging against GPS locations and records several precise RF characteristics including field strength measurements and RF figure-of-merit parameters. These include peak signal power, integrated power, band pass tilt, signal notches and standard deviation of in-band power. In addition to RF characteristics, the DSS5600T/H also records DVB-T/H specific decoded parameters into data collection files. Important and useful parameters recorded include Antenna, FFT, Guard, FMT, Alpha, HP & LP Code Rate, and for each of the two receiver channels, AGC Lock, Carr Lock, TPS Lock, Vit Lock, MPEG-Sync Lock, MPEG-Data Lock, Bad MPEG Pkt, QEF, SQI, Cell ID, MER, BER, PER, SNR, DVBH SIG, HP & LP TSL, HP & LP MPE-FEC. These figure-of-merit parameters are invaluable when determining DVB-T/H signal coverage.

A Job is first defined using the straightforward “Create Job” tool. The Data Collection application can then be started before the vehicle is placed in motion. The system will initialize and begin accumulating data without further attention.

If desired, data for DVB-T, DVB-H and Analog television signals can be measured and stored in data files all during the same DriveTest. One or many DVB-T, DVB-H and/or Analog television signals may be measured during one session. This is invaluable in today’s mixed analog and digital signal environments.

**Map Plotting:**
The Plot Tab of the DriveTest Software is used to display plots and maps of test results during or after a DriveTest session has occurred.

Live plotting of GPS determined positions can be viewed while testing is in process and for many locations can be overlaid on maps. Upon completion of the first segment of a DriveTest, the software automatically assigns colors to the dot trail of a driven path where colors correspond to signal strength, or any one selected RF or Decoded figures-of-merit. The operator can customize colors and transition points to best highlight acceptable versus insufficient measurement results.

During a DriveTest, GPS plots can be viewed based on different operator criteria. The operator can zoom in or out as necessary to properly
evaluate signal parameters being displayed in color all during an active measurement test sequence.

**Mapping Options**

Z Technology provides Drive-Test System operators with several “real-time” as well as “post-measurement” mapping choices. Real-time maps are visible during an active measurement sequence, with critical information appearing on the map as measurements are being made. Real-time maps become visible by selecting the Plot tab within the DriveTest. These maps remain active on the screen while collecting measured data. Colored dots indicating GPS locations appear on “real-time” maps as an operator moves from place to place and measures signal parameters.

Depending on location, users will find real-time maps provide varying levels of country and/or provincial borders and road level data. Europe and the USA have the most detailed information on real-time maps including expressways, highways and major arterial roads. Other areas may have less detail.

Note: Users can also add real-time map data to their DriveTest Systems. Most countries have local map data providers who offer this service at varying levels of detail and at various pricing options. Z Technology provides detailed information concerning directory structures within DriveTest used to store locally purchased map data. Data must be provided in specific vendor formats and file structures.

Data must be provided in compatible ESRI™ file and format standards. Several other requirements must be met in order for local data to be effectively displayed within DriveTest. Contact a Z Technology Authorized Distributor or the Factory for implementation details.

Z Technology offers several post-measurement mapping options.

A significant new feature of the DSS5600T/H DriveTest System is graphic mapping of selected parameters over high-resolution customer provided bitmap images such as may be licensed from Google Earth PRO™. This feature is operational during live data gathering drives as well as for previously gathered data.

Some users may find extra mapping details are desired. When local street & city names or other terrain characteristics are important, commercially available post-measurement maps may be available. Post-measurement mapping involves two steps. First export the measurement data from the DriveTest native format to a format compatible with vendors such as Microsoft MapPoint™. Second, import these files into the chosen map application. When the appropriate option is purchased, Z Technology will configure DriveTest to enable the user to seamlessly...
move into the chosen post-measurement mapping applications.

By taking advantage of real-time and post-measurement mapping options, a Drive-Test operator is provided with a complete set of mapping capabilities all in one integral system.

**Spectrum Display Analysis:**
The Spectrum Display feature of the DSS5600T/H system provides active signal analysis, RF and Decoded Parameter review, and continuous monitoring of data being captured for storage to data files. It is a very useful and active presentation of both the received RF Spectrum and the DVB Decoded measurements.

The DSS5600T/H can measure and display total 5MHz, 6MHz, 7 MHz or 8MHz integrated power, peak in-band power, band pass tilt and signal notches.

Just below the RF monitoring area of the screen all on-going demodulated figure-of-merit parameters are displayed. The diversity decoder portion displays either a Plot vs Time of any decoded figure-of-merit, a Constellation display of the two inputs, or an Impulse Response of the two inputs.

**Summary:**
The DSS5600T/H provides truely mobile automated data collection, in-depth real time and post measurement signal analysis. Measurements may be made while stationary, walking with a cart, or while driving in a vehicle. GPS tagging provides mapping capability.

Screen captures of any display within the DriveTest Application can easily be recorded and stored for review or for use as printouts and in presentations. Creating a screen image is as simple as clicking the “Capture Screen” button.

The DSS5600T/H combines the functions of accurate RF signal strength measurement, diversity DVB-T/H decoded signal characterization, GPS location, and automatic data collection in a convenient lightweight system.
**DSS5600T/H DriveTest™ System Specifications:**

The DSS5600T/H DVB-T/H (COFDM) Terrestrial TV Broadcast Measurement System is a Windows™ based portable system. The DSS5600T/H offers extensive RF and COFDM decoded parameter measurement capability.

The DSS5600T/H is designed for automatic data measurement, collection and storage. Parameters are stored in open format comma delimited data files. Data can be plotted in color over maps of coverage areas. Collected data is available for analysis, print out and easy export to several other programs.

**SYSTEM RF SPECIFICATIONS**

*Frequency Range:* DVB-T/H Decoder covers high VHF & all UHF Systems B, D, G, & I Television Channels

*Extended coverage:* 5 - 1000 MHz contiguous RF coverage including all analog VHF and UHF Television Channels with minimum step size of 1kHz

*Measurement Range:* -10 dBuV to + 90 dBuV (-117 dBm to -17 dBm) using 4 internal Attenuation Ranges & 1 Preamp Range

*Measurement Accuracy:* +/-2 dB @ 25 degrees +/-10 degrees C. in Field Strength Meter Mode. Typical in Sweep Modes & for temperature range of 0 to 50 degrees C.

Some modulation types influence measurement accuracy. For analog video modulation, the signal level of the vertical sync peak is measured. This adds 0.5dB additional uncertainty, widening the above specification to +/- 2.5dB.

*Power Readout Capability:* dBm, dBuV or dBuV/M (dBuV/M reading requires optional calibrated antenna)

*RF Signal Parameters Measurements and Storage Parameters Measured & Recorded to data files (Band-pass settable from 1 – 9 MHz):*

1. Total Integrated Power
2. Peak Power
3. In-Band Tilt
4. In-Band Notches (Hi-Lo Diff)
5. In-Band Std Deviation of Power

*Image Rejection:* 60 dB typical, High Sensitivity mode

*Detuning Characteristics:* 40 dB typical; for undesired signal 2x IF BW away from center frequency

*Third Order Intercept:* Preamp ON typ. 0 dBm Preamp OFF typ. +20 dBm

*Noise Figure:* Preamplifier NF = 7 dB typical when RF AMP is selected.

*Audio Detection:* AM or FM to internal speaker selected from front panel

**Sensitivity:**

- **FM detection:** 1 mV for 12 dB SINAD typical
- **AM detection:** 1 mV for 12 dB S/N typical

**System Measurement Resolution:** 0.1dB

**Output Linearity Range:**

Continuous measurement range of 80 dB in auto-ranging mode

**IF Bandwidth:**

- Narrowband = 15 KHz
- Wideband = 150 KHz

**Input Impedance:** 50 Ohms

**DECODER SYSTEM SPECIFICATIONS**

*Class of Decoder:* DVB-T/H Diversity Type

*Decoder Description:* A fully compliant diversity decoder designed to operate in DVB-T/H environments. Fully compliant in all aspects of the ETS 300 744 specifications including it's DVB-H extension.

*Decoder features:* Capable of implementing 2K, 4K and 8K FFT. Includes an In-depth deinterleaver. Supports 1/4, 1/8, 1/16, and 1/32 guard intervals as well as QPSK, 16-QAM and 64 QAM constellations. 5MHz, 6 MHz, 7 MHz and 8 MHz wide IF bandwidths are selectable. DVB-H signalization (Time slicing and MPE-FEC) in TPS field. Generates Constellation and Impulse response data of Channel 1 & 2.

*Automatic transmission mode detection:* Automatically detects transmission mode including number of carriers and guard interval used.

*FEC Decoder:* FEC decoder is comprised of Viterbi Decoder followed by Reed Solomon (RS) decoder.

*Demodulator:* Uses DIBCOM chip set, optimized for difficult channels and mobile applications. All DVB-T/H demodulation modes are supported including hierarchical ones. Antenna diversity mode of operation is supported (Maximum Ratio Combining -MRC.)

*Decoder Signal Parameters, Measurements and Storage:* Diversity Decoder signal parameters measured and recorded into data files:

- FFT
- Alpha
- AGC Lock1&2
- TPS Lock1&2
- MPEG-Sync Lock1&2
- MPEG-Data Lock1&2
- Bad MPEG Pkt1&2
- QEF1&2
- SQI1&2
- Cell ID1&2
- MER1&2
- BER1&2
- SNR1&2
- Output Format
- HP TSL1&2
- HP MPE-FEC1&2
- LP TSL1&2
- LP MPE-FEC1&2

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**APPLICATION SOFTWARE, DATA STORAGE & DATA FORMATS**

*Application Software:* Windows™ XP/Visa based Automated Drive Test Measurement Software includes the following:

1) **Data Collection:** Provides for orderly collection and storage of RF and Decoded Figures-of-Merit Parameters outlined in the above sections.

2) **Dot Plotting/Mapping:** Allows GPS locations to be plotted and viewed during and after testing. Colors are assigned to the dot trail of the driven path and indicate range of parameter. Colors correspond to any one (1) selected RF or Decoded Figures-of-Merit Parameter.

3) **Sweep Analysis:** Displays spans of 5MHz, 10MHz or 20MHz. RF Parameters calibrated in 10MHz & 20MHz (150KHz BW). Acquisition Sweep Rates in these two modes: 550msec per sweep. Sweep refresh rate depends on Decoder settings.

4) **Export:** Formats comma delimited data for popular mapping and analysis applications such as Excel™, MapPoint™, Access™, EDX™, Radiosoft™, etc.

All measured RF & Decoded Figures-of-Merit Parameters are displayed for users review and analysis.

*Data Storage:* Data Stored on PC Hard Drive under open folder and file hierarchy.

*Data Format:* Format is comma delimited non proprietary files accessible for importing into other standard utilities.

Values recorded into the data file for each DVB signal measurement include:

- **Date, Time, Name, Frequency, Latitude, Longitude, Integrated Power, Peak Power, Tilt, High-Low diff, Standard Deviation, Antenna, FFT, Guard, FMT, Alpha, HP Code Rate, LP Code Rate, OUTFMT[Bytes], AGC Lock1, Carr Lock1, TPS Lock1, VIL Lock1, MPEG-Sync Lock1, MPEG-Data Lock1, Bad MPEG Pkt1, QEF1, Cell ID1, MER1[db], BER1, PER1/sec, SNR1[db], SQI1, DVBH SIG1, HP TSL1, HP MF1, LP TSL1, LP MF1, AGC Lock2, Carr Lock2, TPS Lock2, VIL Lock2, MPEG-Sync Lock2, MPEG-Data Lock2, Bad MPEG Pkt2, QEF2, Cell ID2, MER2[db], BER2, PER2/sec, SNR2[db], SQI2, DVBH SIG2, HP TSL2, HP MF2, LP TSL2, LP MF2.

The data file also includes information on vehicle heading and speed, instrument attenuator and RF pre-amplifier settings, and parameter units.

**GPS RECEIVER & ANTENNA SPECIFICATIONS**

*General Description:* L1 frequency, C/A code (1.023MHz chip rate), 12-channel continuous tracking receiver. Sensitivity to -170dBW.

*Accuracy:* Horizontal position-15 meters rms, WAAS accuracy to -5 meters rms. (WAAS must be enabled manually by user.)

*Datum:* WGS-84

*Acquisition rate:* Hot start - 8 sec. (ephemeris and almanac valid)

*Warm start* - 38 sec. (almanac valid; ephemeris not)

*Cold start* - 45 sec. (neither almanac or ephemeris)

*Reacquisition* - 0.1 second average

*I/O Protocol options:* NMEA 0183 v2.2 @ 4800baud, 8-None-1

*NMEA messages:* Standard: GGA, GSA, GSV, RMC Optional: VTG, GLL

*Connector:* USB for power and all communications

*Power:* 90 ma typical

*Physical characteristics:* receiver integrated with antenna. Entire package magnetically mounted and must be within clear view of sky.

**COMPUTER**

*Laptop Computer:* Windows™ OS, Speed of 1500 MHz or better and at least 1.0 Gb Memory

**SYSTEM PHYSICAL SPECIFICATIONS**

*System Power Requirements:* 12VDC at 3.5AMP or 120/220VAC (specify on order).

*Power Inverter:* 12V DC input - 120V or 220V AC output, 250 watts.

*Certiﬁcations:* CE

*System Dimensions:* 216 mm (8.5 in) High x 375 mm(14.75 in) Deep x 470 mm (18.5 in) Wide

*System Weight:* 13.9 Kg (29 lbs.)

*System Operating Temp:* +10 to +40 Deg. C

**Options:**

- **MD 01** Real-Time North American Map Data
- **MD 02** Real-Time European Map Data
- **MA 04** Post-Measurement Microsoft MapPoint™ USA
- **MA 05** Post-Measurement Microsoft MapPoint™ Europe
- **MA 06** Post-Measurement Custom Mapping

**Accessories:**

- **AA1-B1:** Calibrated tuned dipole antenna 30 - 70 MHz
- **AA1-B2:** Calibrated tuned dipole antenna 65 - 180 MHz
- **AA1-B3:** Calibrated tuned dipole antenna 170 - 340MHz
- **AA1-B4:** Calibrated tuned dipole antenna 325 - 1000 MHz
- **AA-TV SET:** Calibrated tuned dipole antenna Set 57 - 806 MHz
- **AA-3 Biconical antenna system** 20 MHz - 330 MHz
- **AA-4 Log Periodic antenna system** 290 MHz - 1000 MHz
- **AA-6 Log Periodic antenna system** 150 MHz - 1000 MHz
- **AA-7 Bi-Log Periodic antenna system** 25 MHz - 1000 MHz

*Option M:* Magnet Mount System for tuned dipole antenna

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