Multi Dipole CSAMT

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Abstract: In the recent years CSAMT was frequently used in exploration. Especially geothermal fields and CSS (carbon storage and sequestration) require high resolution EM soundings. Where on the receiver side lots of developments were done in the last years, the transmitter technology hasn't much changed since 20 years. A new GPS controlled transmitter with freely editable wave forms (PRBS), recording of the transmission currents for near field recordings and free orientation of the transmission dipoles is introduced here

For CSAMT at least two transmitting dipoles are required to achieve the full tensor information. In the classical style N-S dipole and a E-W dipole are transmitted separately one after each other. The disadvantage is that the data can only be interpreted *offline*: the transmission data is stored on the disk and evaluated after the second dipole has finished.

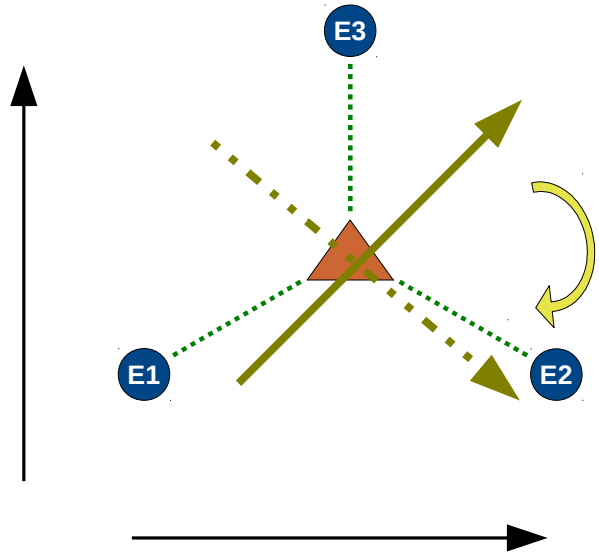


Fig. 1: Freely rotating dipoles

The Metronix TXM-22 (22 kW) can rotate the dipole during transmission. Assuming three pre-defined dipole positions, 60 s transmission time for each direction, the geophysicist can calculate the first impedance tensor after two minutes. The transmission continues until the impedance and phase are smooth.

With three dipoles three tensors are possible, with 6 dipoles 15 tensors are possible.

This overcomes the problem that one transmission direction may deliver poor data because of the geological setting. Changing the dipole direction can eliminate shielding problems.

Additionally the positioning of the receivers is not limited relatively to the transmitter and the dipole field of the transmitter: the dipole field can be rotated that way that the optimum field strength can be recorded at the receiver site.

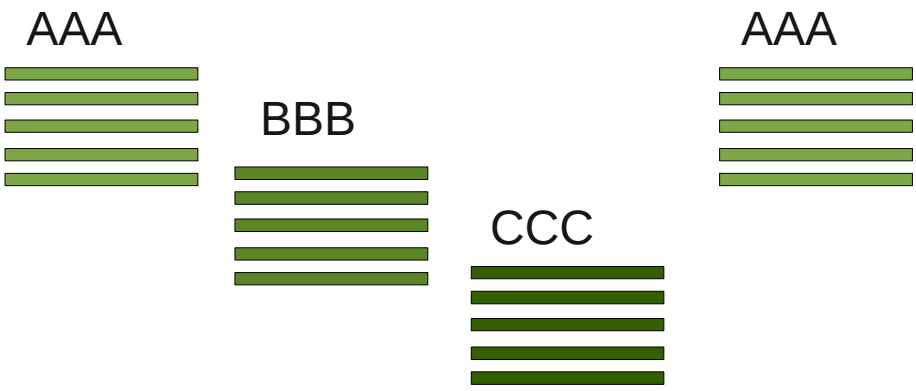


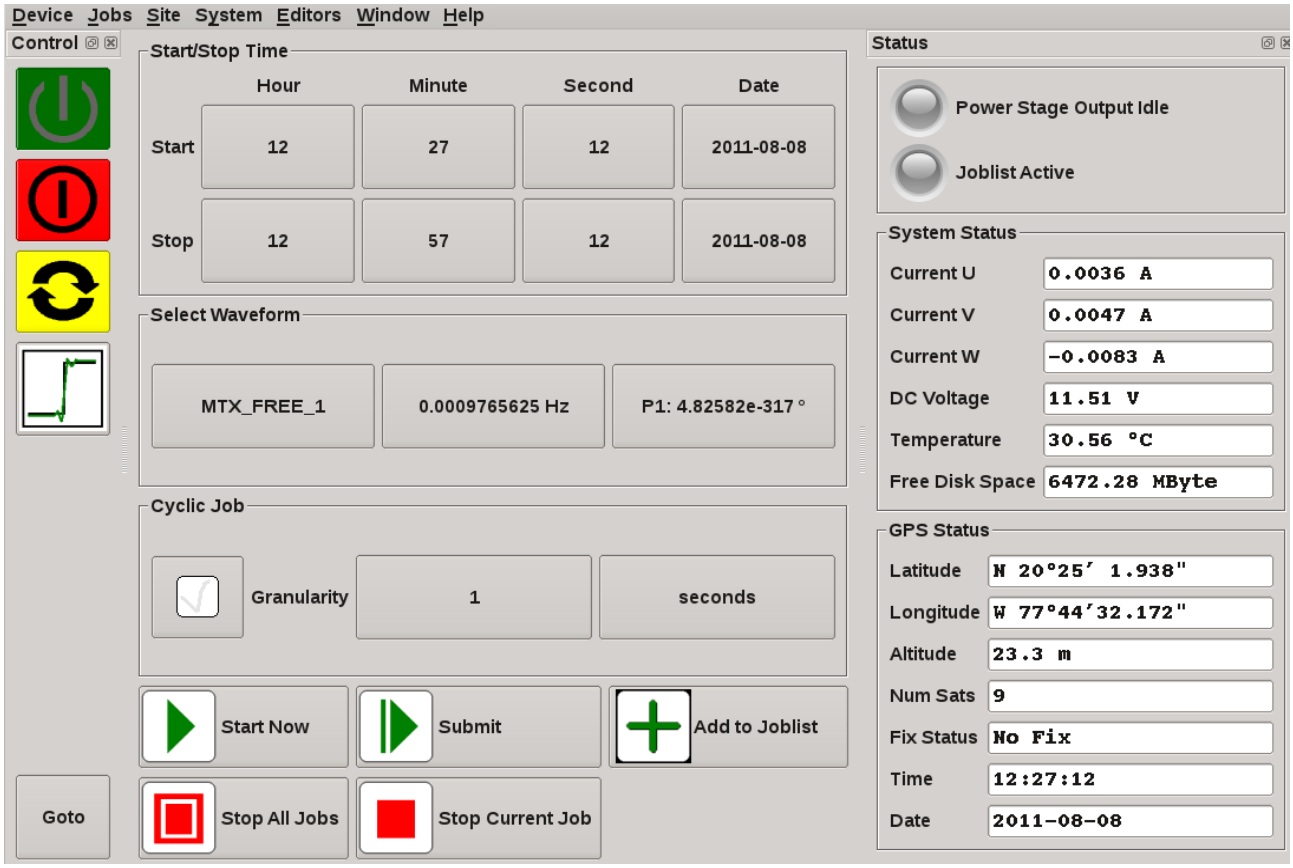
Fig. 2: Transmission Scheme for three dipoles and online interpretation

The transmitter is free programmable. A waveform can be described by 2048 nodes. This allows classical rectangular signals with multiple harmonics as well as any other from. Especially PRBS (pseudo random binary sequence) signals are possible.

Equipment in Field

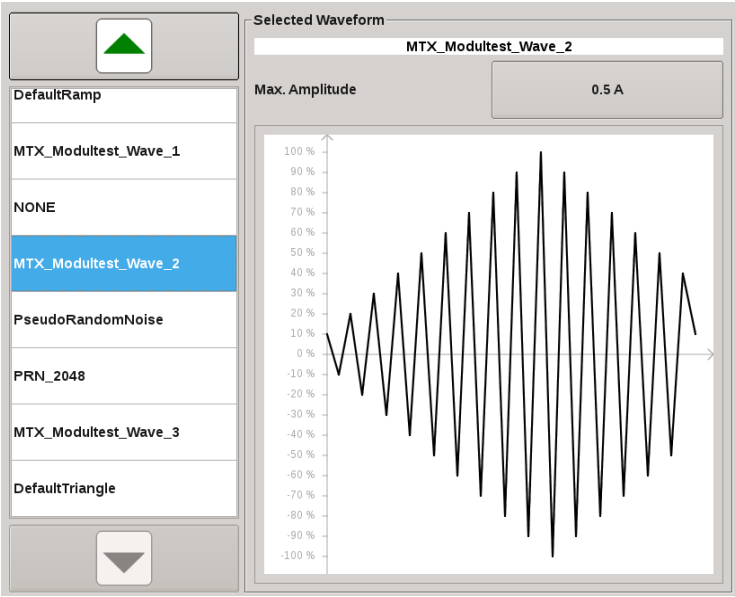
The TXM-22 can be connected to any 400 V 50/60 Hz (3 phases) generator. Any alternation of load is compensated by electronic circuits in order to get stable output signal of the transmitter.

Transmitter Interface



The interface shows the actual running job list and the transmitted currents. Multiple jobs can be submitted for a complete day or survey.

A wave form editor allows the design of any signal forms.



Near field measurements

The transmitter controller box TXB uses the same GPS and same electronics as the receiver ADU-07e.

Both signals RX and TX can be used in the time domain.

With time domain data, other methods than MT can be used for resistivity - depth sounding. The signal can be convoluted against the predicted wave form a geophysical model.

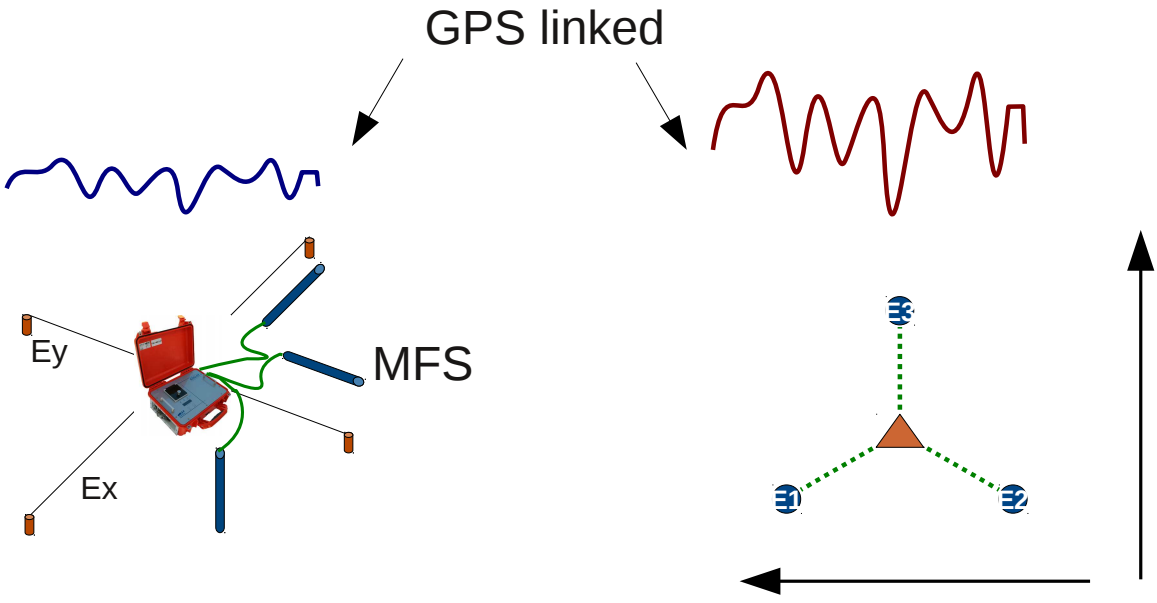


Fig. 5: Signals are recorded at the receiver side (RX) as well as at the transmitter site (TX).

For complex geological structures or small 3D targets multiple transmitter receiver combinations can be used.
Receiver and transmitter can be operated fully automatized by job lists. The user defines a set of transmission frequencies and a set of transmission times; the transmission times are equal to the receiving times. In case the job list on the receiver can be re-started by mobile phone. This guarantees maximum productivity.

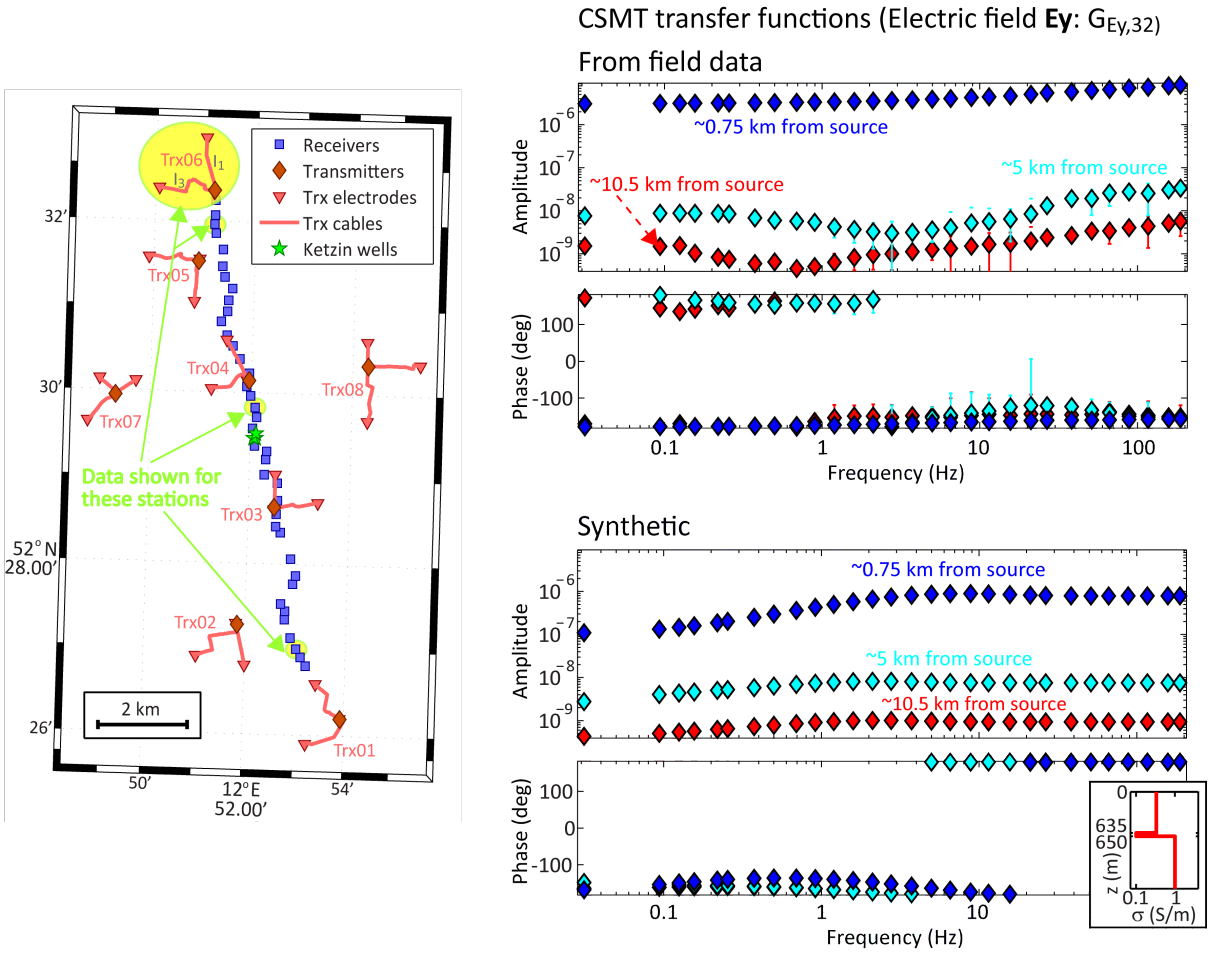


Fig. 6: Near and far field soundings by Rita Streich, GFZ, Germany

Summary

- The TXM-22 transmitter combines GPS and 24bit technology with wireless LAN access; wave forms and statistical signals can be programmed.
- The transmission dipole can be rotated to any direction in order to get the best field strength.
- The TXM-22 and ADU-07e systems can operate fully automatically.
- The receivers can be controlled by mobile phone (GPRS, 3G connection).
- The TXM-22 can record the dipole currents to enable near field interpretation of the receiver data.
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