Coverage Measurement System ARGUS-FMTV

Optimum use of frequency thanks to reliable forecasts in planning

New transmitter sites for FM and TV broadcasting are planned with the aid of special software that predicts the wanted field strength of a planned transmitter and the interfering field strength of transmitters already existing in the coverage area by model calculations. To date, however, the real coverage area of a planned transmitter could not be measured until after it was commissioned. So leeway for optimum frequency utilization was not always recognized. With the new Coverage Measurement System ARGUS-FMTV, reliable conclusions can be drawn on the expected coverage limits of a transmitter in the planning phase already.

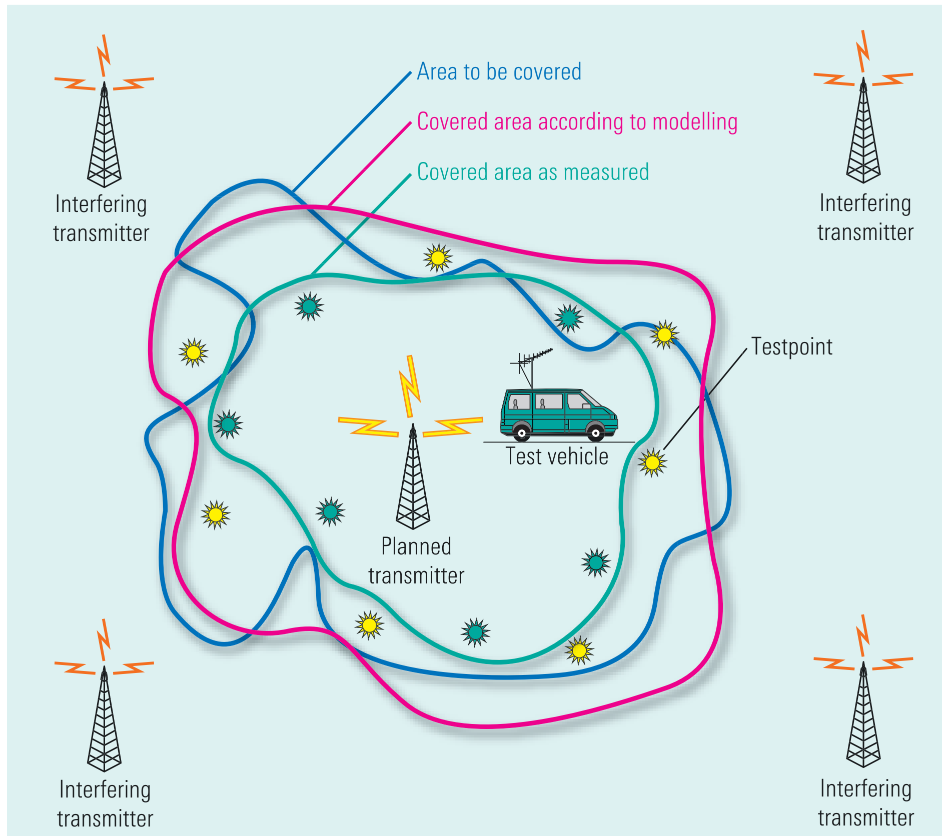

FIG 1 Areas covered according to planning, model calculation and measurement. ARGUS-FMTV calculates a reliable forecast in terms of range and compatibility of planned transmitters from the field-strength figures of existing transmitters and their characteristic features

Broadcast transmitter density impedes optimum frequency use

The intensive utilization of broadcasting frequencies is illustrated by the high density of transmitters in the FM and UHF TV bands. In Germany, for example, you find 8- to 12-fold occupancy per frequency in FM with approximately 1900 transmitters, and 160- to 250-fold occupancy per channel in UHF TV by some 9500 transmitters. The increasing need for frequencies or transmitters can hardly be satisfied in this limited frequency spectrum. What is more, only frequencies or levels of output power with short range are often authorized by national and international harmonizing procedures, because the protection of existing transmitters has priority.

Conventional planning methods are time-consuming and inaccurate

New FM and TV broadcast transmitters are usually planned by computing tools that define a model of the future coverage area and compatibility with the existing transmitter network. The theoretical calculations reflect trends relatively well but do not produce sufficiently accurate delimitation of the areas covered or affected by interference. Such a procedure cannot exclude the possibility of misplanning. The actual result of planning a transmitter cannot be measured until it goes into operation, i.e. some 12 months after planning starts. If the inevitable inaccuracy in planning is unacceptable, optimization measures will be necessary to eliminate interference with other frequencies or to supply areas that are not covered. Improvements, planning and renewed harmonization again take time, delaying startup of the modified transmitter.

Another way of planning a transmitter is to perform test emissions during measurements at the future site. But this method involves relatively high costs.

Reliable forecasts in planning with ARGUS-FMTV

To benefit from leeway for frequency utilization in the planning phase, it is essential to know the future actual coverage ranges and the effect of interference between transmitters, especially to avoid unacceptable impairment of existing coverage areas.

The large number of FM and TV programs means that the broadcasting frequencies concentrate on a relatively small number of transmitter sites, for technical and economical reasons. This fact is used in the new method by which Coverage Measurement System ARGUS-FMTV works. The propagation conditions usually vary little for the different frequencies at a transmitter site. So based on their field strength measured at different points, concrete conclusions can be drawn on the suitability of a planned frequency or transmitter as well as on the area to be covered and the area impaired by interference. Comparison of the results from the frequencies already transmitted at a site with the predicted results of the planned broadcasting frequency yields a remarkably good match if the different characteristics of transmitters, e.g. their effective radiated power and radiation pattern, are taken into account.

Coverage Measurement System ARGUS-FMTV allows all required measurements and the linking of results to transmitter data in an analysis. This produces more reliable forecasts regarding the range and compatibility of planned transmitters with those existing in a network (FIG 1). The validity of a forecast depends for the most part only on the quality of the available transmitter data. There are also advantages when it comes to the assessment of interfering transmitters on a co-channel and adjacent channel, which are very difficult to detect, if at all, without shutting a transmitter down.

Measurement and analysis

The system is operated in the FMTV measurement mode (FIG 2) of Measurement Software ArgusMon [1], also used by Rohde&Schwarz in the proven Spectrum Monitoring and Management System ARGUS-IT [2].

First the transmitter lists are composed of the planned transmitter, the interfering transmitters and (if existing at the planned site) the reference transmitters. In this connection, it is usual to access a transmitter database already used for model calculations. The first testpoint obtained from model calculations is then set and the measurements and analyses are performed. Analysis is possible in line with international ITU guidelines and German FTZ guidelines. Basically, the guard margins for the planned useful frequency are calculated to provide information on compliance with them. The results must be checked for plausibility. Single post-measurements

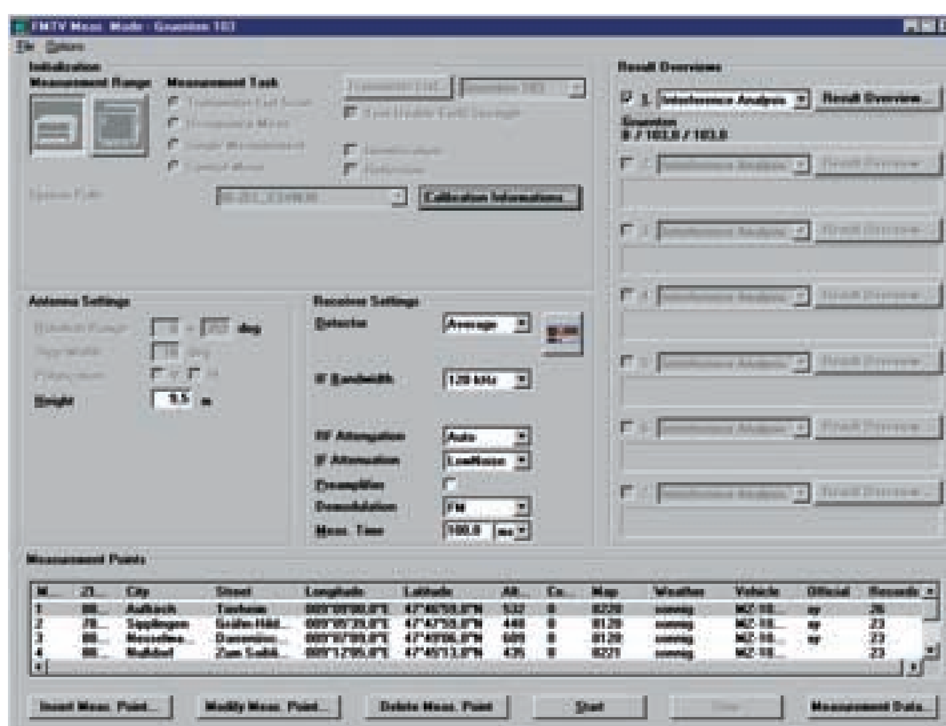

FIG 2 FMTV mode in Measurement Software ArgusMon

Basic structure of ARGUS-FMTV

The coverage measurement system is installed in a vehicle. The nucleus includes the following units (FIG 5):

- Antennas for the frequency range 47 MHz to 860 MHz, rotated by an azimuth and polarization rotator and mounted on a mast adjustable in height
- Test receiver for the measurement of field strength to determine coverage quality using the minimum wanted field strength and the guard interval, for the measurement of frequency offset and FM deviation to check measured data for plausibility as well as for orientating measurement of reflections in the FM range
- RDS decoder for decoding the program identification code and tone identification of FM transmitters
- Stereo measurement decoder for subjective assessment of the signal quality of FM transmitters with the same frequency or when no reference transmitters are available
- Data line decoder for decoding the program of TV transmitters
- Video measurement system for measuring reflections in the TV band
- Video monitor for subjective assessment of the signal quality of TV transmitters (co-channel and reflection interference)
- Compass and global positioning system for determining vehicle direction and location
- System controller for operating the system
- Printer to output lists and results

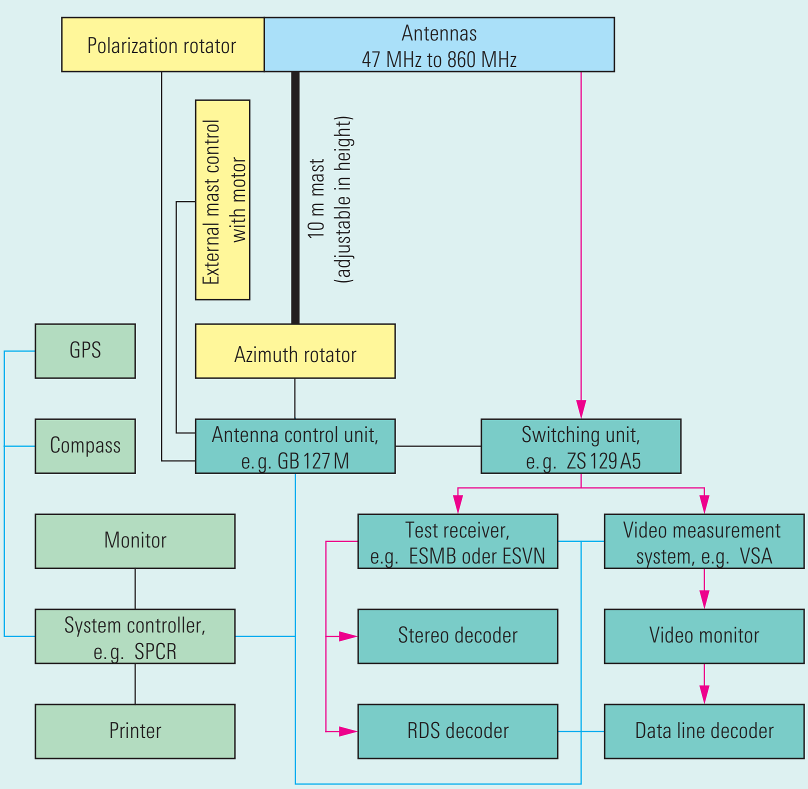

FIG 5 Structure of Coverage Measurement System ARGUS-FMTV

may be necessary to verify questionable results or identify interfering transmitters of very low field strength. All other testpoints selected from the results and model calculations are then set for measurement and analysis.

ArgusMon displays the vast amount of data on various transmitter characteristics and the results obtained at different testpoints in the form of easy to manage lists (FIG 3). The results can also be displayed on digital maps using the geographical information software MapView from Rohde & Schwarz (FIG 4). The result overview is the basis for further optimization measures.

The individual results can be evaluated under various aspects. This is useful for modifying the planned transmission parameters or planning another transmitter, for example. For this purpose, seven different result overviews are available in one measurement.

Further possibilities with ARGUS-FMTV

- This measurement procedure can also be used when no reference transmitter is available at the planned site. The field-strength figures from the model computation tool can be used instead of measured references. This detracts somewhat from the performance of the method, but it is still much more accurate than pure calculation.
- If no transmitter lists are available, omnidirectional measurements are a help. The direction with the maximum field strength is the direction to the transmitter. This method is much more elaborate since you have to measure at all points round 360° for every possible frequency and identify as many transmitters as possible.
- Occupancy measurements on operative transmitters to check that coverage areas are maintained and other

broadcasting frequencies are not interfered. These measurements can also be used to correct model computing tools.

- Monitoring of FM and TV transmitter networks, e.g. to check that important transmission parameters such as FM deviation, frequency offset and bandwidth are in tolerance.
- Control measurements to check the measurement facility and propagation conditions.

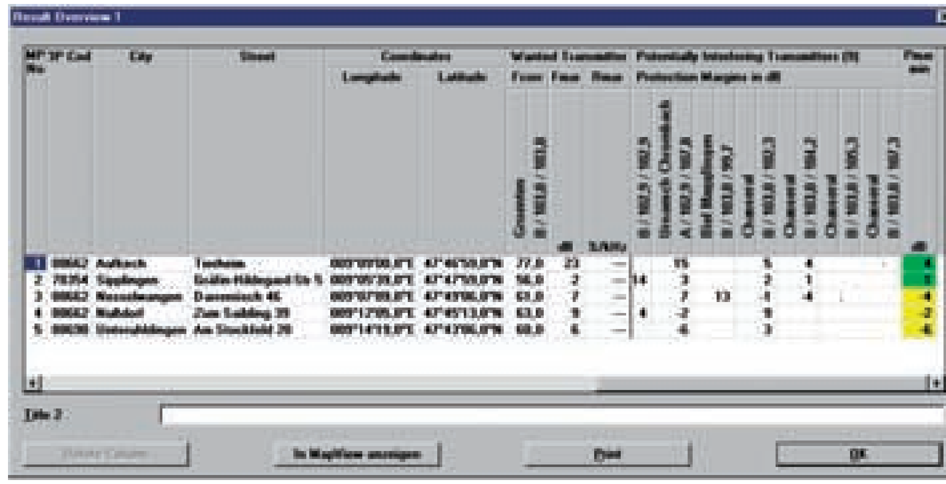

FIG 3 Tabular result overview in ArgusMon

Summary

Coverage Measurement System ARGUS-FMTV is a powerful tool for regulatory authorities, national media and broadcasting corporations as well as providers planning their transmitter operations. As early as planning FM and TV transmitters, they obtain more reliable information about expected coverage and the impact on the existing transmitter network, and can better utilize margins with existing transmitters.

ARGUS-FMTV allows more efficient utilization of scarce frequency resources on the basis of current transmitter data and actual measured values.

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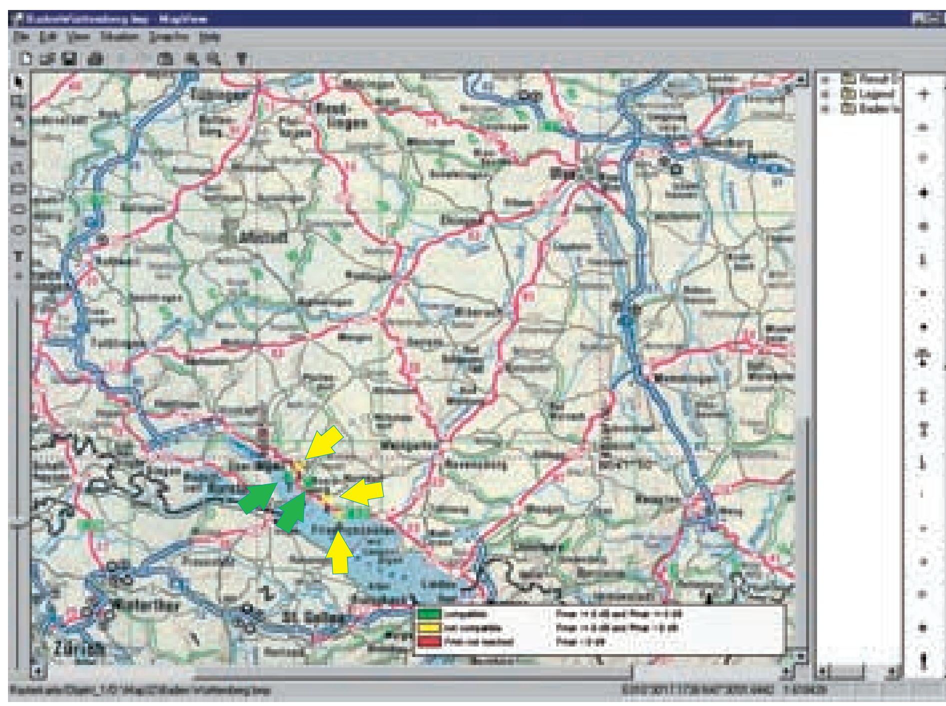

FIG 4 Result overview in geographical information software MapView. The software marks the transmitters with a cross (highlighted here by arrows)

REFERENCES

[1] Spectrum Monitoring Software ARGUS 4.0: New software generation for spectrum monitoring systems. News from Rohde&Schwarz (2000) No. 167, pp 18–20

[2] Spectrum monitoring and management system for Sri Lanka: Electromagnetic waves do not stop at frontiers. News from Rohde&Schwarz (2000) No. 168, pp 40–42

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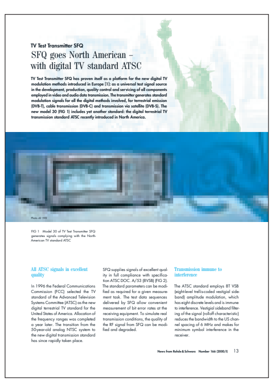
TV Test Transmitter SFQ

Now signals to digital cable standard ITU-T/J.83B

Rohde&Schwarz proves again the innovative and universal concept of TV Test Transmitter SFQ. Equipped to match the North-American terrestrial ATSC standard a year ago (FIGs 1 and 2), SFQ now comes with a coder for the North-American cable standard ITU-T/J.83B.

Excellent signal quality

SFQ provides a signal at maximum quality that conforms in all functions to standard ITU-T/J.83B [2]. This makes it an indispensable test modulator for all companies involved in American cable broadcast. All standard parameters can be modified as required for a given measurement task. Selectable coder-internal test data sequences, which substitute the transport stream input signal in the different function blocks of the FEC (forward error correction), enable comprehensive quality classification of receiving equipment. A BER option allows measurement of the system failure limit even when the program is running without extra equipment. The SFQ-Z17 adapter card is especially useful. It enables BER measurements by using any consumer set-top boxes even without transport stream output, provided they have a common interface.


TV Test Transmitter SFQ

SFQ goes North American – with digital TV standard ATSC

FIG 1
Number 166 of News from Rohde&Schwarz reported on SFQ for ATSC [1]

To simulate real transmission conditions, the quality of the RF signal from SFQ can be specifically modified and degraded (e.g. by fading or noise).

Quadrature amplitude modulation

The selection of the transmission method depends to a large extent on the transmission medium. Cable channels (including glass fiber) are assumed to be bandlimited and linear, with the system prone to white noise, interference and echoes. The quadrature amplitude modulation (QAM) selected in standard J.83B is ideal for these media.

Depending on the application, SFQ allows selection between two formats: 64QAM and 256QAM (FIGs 3 and 4). Root-raised cosine filtering (transmitter and receiver use the same filtering) carried out at symbol level with subsequent I/Q modulation limits the output spectrum to the US channel spacing of 6 MHz and minimizes symbol interference in the receiver.

Structure of coder

The ITU-T/J.83B coder consists of five processing blocks: checksum generator, Reed-Solomon encoder, convolutional interleaver, randomizer and trellis coder.

FIG 2
Keeping pace with developments: TV Test Transmitter SFQ now also supports the digital cable standard to ITU-T/J.83B

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New optional noise generator for SFQ see page 37