

Measurements and analyses...

The Coverage Measurement System R&S ARGUS-FMTV is a powerful tool for regulatory authorities, national media and broadcasting corporations as well as transmitter operators planning for the future. It allows efficient utilization of the scarce frequency resources for FM and TV broadcasting on the basis of current transmitter data and real measurement results. This enhances the possibilities for model computations which do not always sufficiently recognize leeway for optimum frequency utilization if measurement results are not available.

Broadcast transmitter density impedes optimum frequency utilization

The intensive utilization of broadcasting frequencies is reflected 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 the FM range by approximately 1900 transmitters, and 160- to 250-fold occupancy per channel in the UHF TV range 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 output power levels with short range are often authorized by national and international harmonizing procedures, because the protection of existing transmitters has priority.

Areas covered by planning, model computation and measurement with R&S ARGUS-FMTV

Conventional planning methods are time-consuming and inaccurate

New FM and TV broadcast transmitters are usually planned with the aid of computing tools that define a model of the future coverage area and the compatibility with the existing transmitter network. The theoretical computations reflect trends relatively well but do not produce sufficiently accurate delimitation of the areas covered or affected by interference.

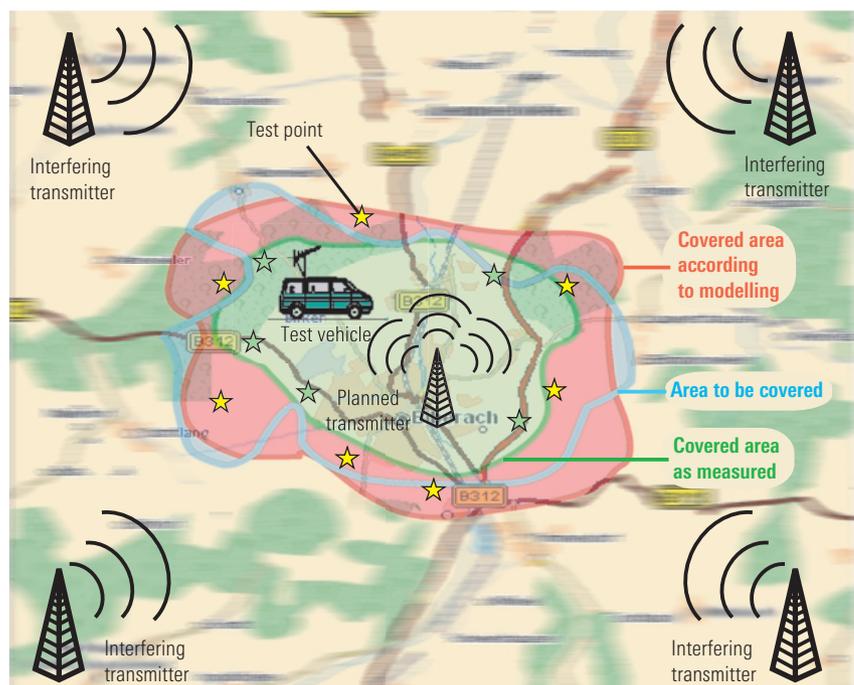
Such a procedure cannot exclude the possibility of misplanning. The actual result of transmitter planning cannot be measured until the transmitter goes into operation, i.e. some 12 months after planning starts. If the inevitable inaccuracy in planning is unacceptable, optimization measures must be taken to eliminate interference with other frequencies or to supply areas that are not covered.

Improvements, renewed planning and harmonization again take considerable 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 R&S 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.



... for optimal frequency utilization

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 the Coverage Measurement System R&S ARGUS-FMTV works. The propagation conditions usually vary little for the different frequencies at a transmitter site. So based on 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. A comparison of results from the frequencies already transmitted at a site with the predicted results of the planned broadcasting frequency yields a very good match if the different characteristics of transmitters, e.g. their effective radiated power and radiation pattern, are taken into account.

The Coverage Measurement System R&S 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. The validity of a forecast depends for the most part only on the completeness and correctness of the available transmitter data. There are also advantages when it comes to the assessment of interfering transmitters in the co-channel and adjacent channel, which are very difficult to detect, if at all, without shutting a transmitter down.

Measurement and analysis

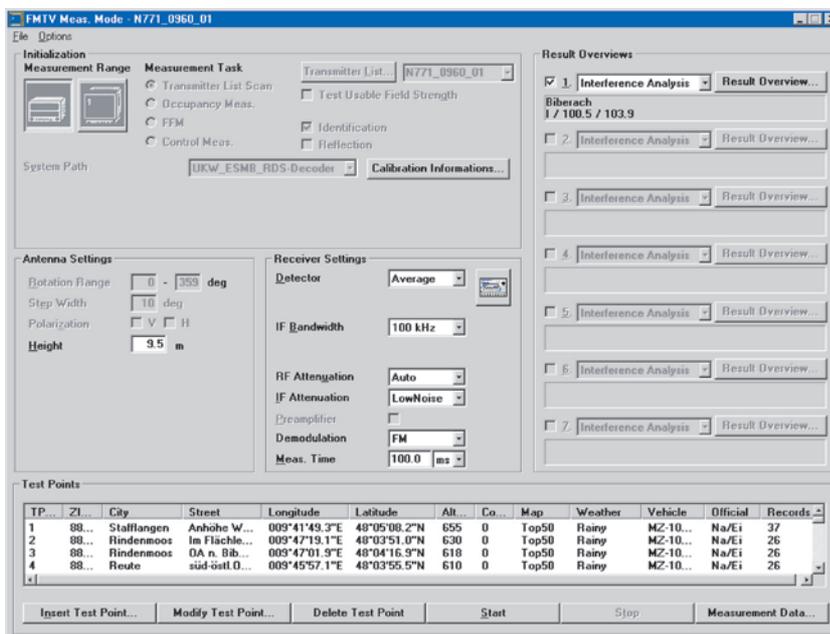
The system is operated in the FMTV measurement mode of Monitoring Software R&S ARGUS, also used by Rohde & Schwarz in the tried and tested Spectrum Monitoring and Management System R&S ARGUS-IT.

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 the model computations.

The first test point obtained from the model computations is then selected and the measurements and analyses are performed. Analysis is possible in line with international ITU Recommendations and German FTZ guidelines. Basically, the protection ratio for the planned useful frequency is calculated to obtain information on compliance with this ratio. The results must be checked for plausibility. Single post-measurements may be necessary to verify questionable results or identify interfering transmitters of very low field strength.

All other test points selected on the basis of the results and model computations are then used for measurement and analysis.

FMTV measurement mode in Monitoring Software R&S ARGUS



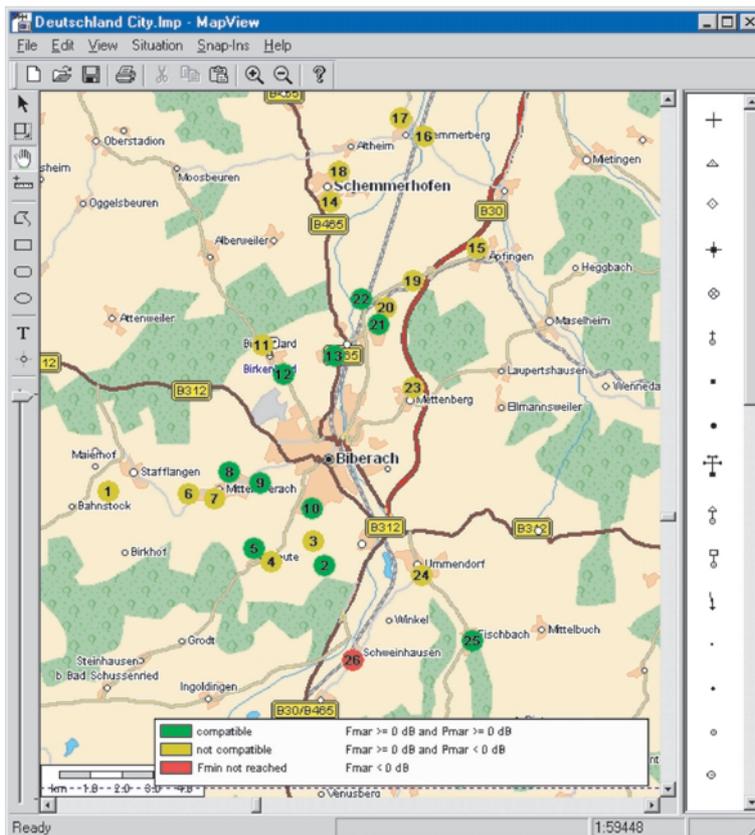
Evaluation of results...

Monitoring Software R&S ARGUS displays the vast amount of data from various transmitter characteristics and the measurement results obtained at different test points in the form of easy-to-manage lists. The measurement results can also be displayed on digital maps using the Geographical Information Software R&S MapView. The result overview is the basis for further optimization measures.

| TP No | TP Cod | City | Street | Coordinates | | Wanted Transmitter | | | Potentially Interfering Tr... | | | | | Pmar min |
|-------|--------|----------------|--------------------------------|---------------|--------------|--------------------|------|------|-------------------------------|----|----|----|----|----------|
| | | | | Longitude | Latitude | Fccr | Fmar | Rmar | Protection Margins in dB | | | | | |
| | | | | | | Biberach | | | Mitthoh | | | | | |
| | | | | | | / 100.5 / 103.9 | | | B / 100.6 / 100.6 | | | | | |
| | | | | | | | | | B / 100.6 / 102.5 | | | | | |
| | | | | | | | | | Muehlacker | | | | | |
| | | | | | | | | | B / 100.7 / 95.7 | | | | | |
| | | | | | | | | | B / 100.7 / 100.7 | | | | | |
| | | | | | | | | | dB | | | | | |
| 1 | 88400 | Stafflangen | Anhöhe Waldberg | 009°41'49.3"E | 48°05'08.2"N | 84.5 | 31 | --- | -7 | -7 | 40 | 45 | 8 | |
| 2 | 88400 | Rindenmoos | Im Fläche OA | 009°47'19.1"E | 48°03'51.0"N | 86.5 | 33 | --- | 4 | 6 | 55 | 57 | 4 | |
| 3 | 88400 | Rindenmoos | DA n. Biberach | 009°47'01.3"E | 48°04'16.3"N | 73.4 | 19 | --- | -2 | -1 | 48 | 50 | -2 | |
| 4 | 88400 | Reute | süd-östl Ortsrand | 009°45'57.1"E | 48°03'55.3"N | 74.9 | 21 | --- | -6 | -6 | 53 | 54 | -8 | |
| 5 | 88400 | Reute | DA n. Mittelbiberach | 009°45'32.1"E | 48°04'09.3"N | 78.2 | 24 | --- | 1 | 6 | 58 | 51 | 3 | |
| 6 | 88400 | Mittelbiberach | Ul. Nisch-Str. Holzschopf. | 009°43'50.7"E | 48°05'06.3"N | 77.6 | 24 | --- | -2 | -0 | 49 | 51 | -4 | |
| 7 | 88400 | Mittelbiberach | Wielandstrasse 5 | 009°44'31.0"E | 48°05'01.2"N | 78.0 | 24 | --- | -6 | -5 | 50 | 59 | -6 | |
| 8 | 88400 | Mittelbiberach | Friedenslinde/Kientzheimerstr. | 009°44'53.5"E | 48°05'29.1"N | 86.8 | 33 | --- | 4 | 5 | 54 | 58 | 4 | |
| 9 | 88400 | Mittelbiberach | Hilfmann-Ed. | 009°45'40.1"E | 48°05'17.6"N | 82.7 | 30 | --- | 0 | 2 | 60 | 60 | 0 | |

Tabular result overview in R&S ARGUS

Result overview on a digital map in R&S MapView



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 result overviews are available in one measurement procedure.

...in easy-to-manage lists and maps

Other measurement and evaluation capabilities of R&S ARGUS-FMTV

- ◆ The 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 computation.
- ◆ 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.
- ◆ Determining the frequency occupancy serves to detect the actual scenario. The occupancy of the broadcast frequency range is continually changing.

New transmitters are put into operation, existing transmitters change their technical parameters or are switched off, programs are exchanged. Particularly at national borders it may be of interest to check the frequency occupancy at regular intervals, to identify emissions and to compare them to data stored.

- ◆ The forecast results of the model computations normally yield several frequencies for a planned transmitter. The optimal frequency can then be determined by measurements.

- ◆ The coverage of a transmitter can be measured. The results inform on the area covered by a transmitter, the influence of another transmitter (potential interferer) on the existing coverage area and whether reception at a specific point is undisturbed. Conclusions may also be drawn on how to improve the coverage, by changing the characteristic features of the existing transmitter or by making plans for a new one.
- ◆ Measurements to check test equipment and propagation conditions.



Interior of test vehicle



Test vehicle with Coverage Measurement System R&S ARGUS-FMTV

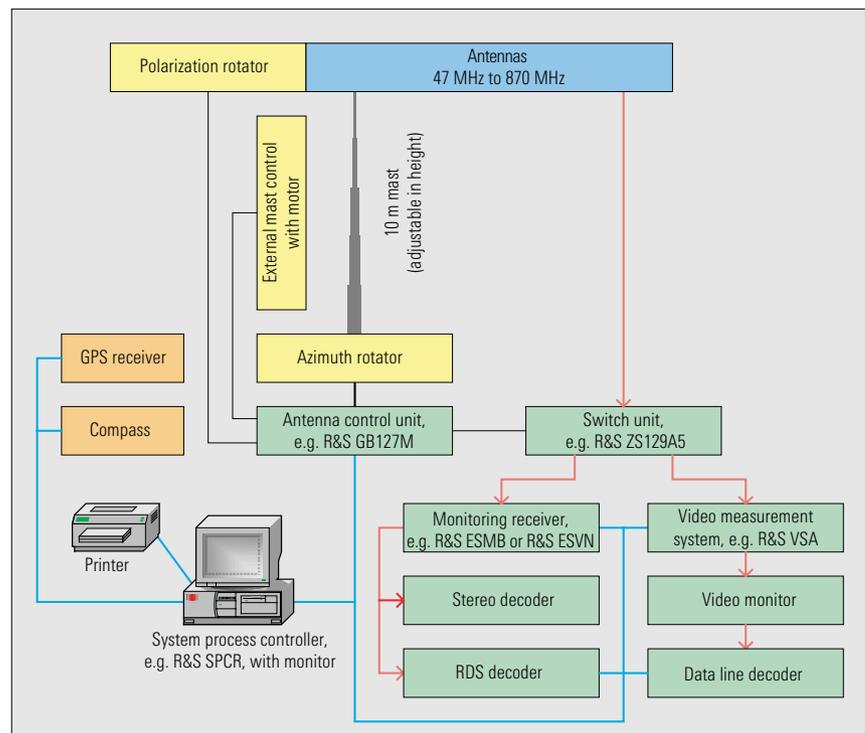
Complex systems ...

Structure of R&S ARGUS-FMTV

The coverage measurement system is installed in a vehicle. It comprises:

- ◆ 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
 - field strength measurements to determine the coverage quality using the minimum wanted field strength and the protection ratio
 - frequency offset and FM deviation measurements to check measured data for plausibility as well as for orientating reflection measurements in the FM range
- ◆ RDS decoder for decoding the PI (program identification) code and the sound ID of FM transmitters
- ◆ Stereo measurement decoder for subjective assessment of the signal quality of FM transmitters using 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 GPS (global positioning system) receiver for determining vehicle direction and location
- ◆ System process controller with Monitoring Software R&S ARGUS and Geographical Information Software R&S MapView for system operation
- ◆ Printer to output lists and results

Structure of Coverage Measurement System R&S ARGUS-FMTV



... from a single source

All services from one source

If requested by the customer, Rohde & Schwarz supplies complete turnkey systems. For this reason, Rohde & Schwarz ensures support during the whole lifetime of the Coverage Measurement System R&S ARGUS-FMTV.

Detailed advice permits optimum adaptation of the system design to special customer requirements. In addition to R&S equipment and software, Rohde & Schwarz supplies all other components, e.g. vehicle, racks, mast, air-conditioning system and power supply, and integrates them in the test vehicle.

Comprehensive function and integration tests, proper commissioning and specific operator training ensure the quick availability of the system.

In addition to these services, Rohde & Schwarz offers continuous support as part of a customer-specific maintenance concept for hardware and software.

Further information

Further information on instruments and software is available on the Internet at **www.argus.rohde-schwarz.com**, or from your local Rohde & Schwarz representative.

Information can also be obtained by e-mail to **argus@rohde-schwarz.com**.

Ordering information

Contact your nearest Rohde & Schwarz sales office for system offers.





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