

Test: High-frequency measuring instruments

Myth and reality

By Siegfried Zwerenz

Not long ago, the mobile network operators still claimed that radiation wouldn't reach further than three to four metres from any antenna. Radiation stands for electromagnetic waves or electromagnetic fields.

A few years ago measuring instruments capable of really measuring high frequency were practically non-existent, with the exception of Spectrum-Analysers (at a price of approx. EURO 10.000,- or more including antenna). The network operators could easily argue with the above mentioned figures, as measurements were mainly done using instruments with very low sensitivity.

The TÜV (Technical Inspection Authority), for instance, provided expertises many years ago stating that the area within a radius of only a few metres around the antenna and the area below the antenna was free of high-frequency radiation. At that time the TÜV made use of a measuring instrument from Chauvin Arnoux which had such a low sensitivity that it wouldn't even show exposures of 1000 $\mu\text{W}/\text{m}^2$!

Decision makers argued that there could be no danger if there was no radiation, and so undertook close to nothing to support the population. Already at that time I made technical corrections for our members relevant to these "expertises", expertises which were willingly distributed among the decision makers in order to play down the danger.

Those corrections were also duplicated and distributed.

So why have we from Bürgerwelle decided to carry out tests?

We had several emergency calls from people who were allegedly exposed to large radiation. One example of November 20, 2005: message per e-mail: "I am a member of the action group ..., we don't know what's going on. We have repeatedly measured between 3.0 and 3.2 GHz at up to 3.14W/m² (= 3140000 $\mu\text{W}/\text{m}^2$ NB editorial of Bürgerwelle) in my room! What could the possible cause be? We have a television tower within a range of sight of 650 m, and a steel lattice mast within 100 m, but not in sight. Kind regards..."

I called the man from the action group by phone, and explained to him that it was unlikely to be the mobile radio because it has another frequency, and because according to the high rate of exposure he stated, the transmitter would have to be directly next to his window. He answered that he had measured these values himself. So I asked him which apparatus he'd used for his measurements. He said the apparatus was called Aaronia Spectran, and that the results had to be correct as a municipal worker had verified the measurements and had come to a similar result. Then I asked him which apparatus the municipal worker had used. The man from the action group answered: "An Aaronia Spectran!" (You will find the rest of the story at the end of this article).

Instruments from Aaronia were, for instance, advertised in the magazine Ökotest No. 01/January 2006. The following information in the advertisement arouse our interest: "Digital Electrosmog-Analyser up to 7 GHz: EXAMPLES OF USE: Measurement of radar, mobile phones, mobile radio, UMTS, DECT-phones, transmitter masts, WLAN, WiFi, blue-

tooth, microwaves, amateur radios, TETRA radios, radio transmitters, television transmitters, etc. [...]. Aaronia PLC is the only producer worldwide to offer the first REAL HF Spectrum Analysers for electrosmog within a price range of EURO 249,95 upwards!

At last you are in a position to measure electrosmog frequency-selective like a professional. This will allow analyses which so far have only been possible with the use of much more expensive professional measuring instruments. You can detect EXACTLY WHO or WHAT causes the pollution. You can amongst other things even detect the OPERATOR of the mobile radio transmitter masts!" Many technical hobbyists would be fascinated by this kind of information and convinced about its correctness, especially since it is printed and advertised in the renowned trade magazine "Ökotest". The text mentions that at last it is possible to undertake measurements like a professional, and that they are looking forward to become "measurement professionals" themselves.

However, those who know spectrum analysers and their sophistication meet them with scepticism, as we from the Bürgerwelle did. We wanted to have a closer look at the devices and ordered the Spectran HF-2025E Rev.2 and the Spectran HF-6060 Rev.2. After a bit of research, the association of the Bürgerwelle decided to do additional and parallel tests on HF-broadband measuring instruments, such as the instruments of Gigahertz Solutions named HF 58B, HF 58Br and HF 59B.

With respect to the market share in this price category of field strength measuring instruments for application in the building biology, Gigahertz Solutions is probably the largest producer next to Aaronia of high-frequency measuring instruments in Germany.

We purchased the measuring instruments directly from the producers, without informing them of our intentions of testing them.

In the following, Aaronia AG will only be called Aaronia, and Gigahertz Solutions only Gigahertz.

The consequences of wrong measurement results

In order to be able to judge the impact of high-frequency on mankind and nature, correct measurement results are absolutely essential. If, on the one hand, measuring instruments show high values which are not really given, this may of course unnecessarily worry people or even cause panic. On the other hand, people may be suffering from health problems or may just be interested in precautionary steps. If measurements with inaccurate instruments show much too little or even no radiation at all, these people are misled and rule out high-frequency as a possible cause for their health problems.

Therefore, it is essential for measuring instruments to show realistic results!

Reliable testing conditions are hard to define

In order for the technical hobbyist to also understand this subject, I will give my best to express myself as straightforward as possible. (High-frequency experts can have a look at our website in the internet under www.buergerwelle.de under the sub-topic Technology. Here you will find detailed physical descriptions).

An electromagnetic wave consists of an electric field (E) and a magnetic field (H). In the far field, these fields E & H face each other are orthogonal. The environmental energy (power flux density Pd) is in this case the product of E and H. So: $Pd=ExH$. The electromagnetic waves are sometimes reflected by objects, walls, buildings, etc. This way they either extinguish or increase, and the power density in a room often varies distinctly. If the test antenna is moved by only a few centimetres, the energy flow can fluctuate upwards or downwards by a hundredfold, which an efficient measuring instrument will show on its display.

Our experience has shown that from time to time assessors in favour of mobile radios take advantage of this fact by positioning the antenna in such a way that the measuring instrument will only read low energy flow!

Of course the above mentioned fact can be reduced by pivoting the antenna in the "peak-hold" mode (to keep peak values), as also described in the corresponding regulations for building biology measurements. In addition, the measurements could take place in an anechoic chamber and shielded against HF-radiation in order to avoid disturbances from outside (so-called "absorption halls"). However, the technically desirable so-called "free space conditions" can in practice not be generated according to their definition. The resulting data are definitely more accurate, yet not accurate enough to make reliable evaluations of the devices.

Bürgerwelle sets high standards

The measurement structure described above can be improved by parting the signal at the antenna output into two equal signals using a signal splitter, and then feeding them into the device to be tested on the one hand and the reference spectrum analyser on the other. However, even when implying this improved measuring method, we still have the problem that, for instance, due to their construction and design the Aaronia Spectran and the reference spectrum analyser will not always measure frequencies simultaneously, whereas the broad-band devices from Gigahertz always measure all frequencies at the same time.

With the aim of avoiding this additional source of error and achieving a reliable judgement of the total system, the antenna is exchanged by a high quality signal generator with a defined signal which is fed into the measuring instruments by means of a splitter in order to carry out the tests. This way the largest factor of measurement uncertainty described above is cleared, and the base units which manifest the real possibilities of the testing instruments with respect to pulsed energy etc. can be thoroughly examined.

This configuration is the base for our tests.

The following is valid for the antennae:

- A log-periodic antenna is a passive linear electronic component and complies with clear physical laws which can be calculated. Usually the difference between ideal and real antennas only amounts to a few dB (calibration protocols of the reference antennae are available to us).

- Log-periodic antennae have no influence inherent to the system on the modulation (e.g. the pulsing) and can therefore not compensate any respective weaknesses of the basic units.
- For this reason, the physical characteristics of the antennae have been taken account for in the test, but the low frequency-specific ripple has been factored out for the time being.

The test structure in detail

From the signal generator the signal is fed into a splitter which splits the signal into two equal signals. A pulse generator is connected to the signal generator allowing for the generation of pulsed frequencies. The pulse can be switched on or off at the frequency generator. Furthermore, a second signal can be generated with the frequency generator and switched on or off. For our tests, the second signal was chosen at a level of 10 MHz higher than the first. One of the outputs (A) of the splitter is connected to the reference unit, a calibrated spectrum analyser, allowing for a verification of the signal of the frequency generator. The second output (B) is connected to the device subject to inspection and is then compared to the reference spectrum analyser. Both outputs of the splitter are to be provided with an attenuator pad each of 20 dB each, as well as a DC-blocker each, in order for the measuring instrument subject to inspection not to have any influence on the reference spectrum analyser. The splitter has an attenuation of 6 dB per output. So the device subject to inspection and the reference spectrum analyser are decoupled with $2x20\text{ dB} = 40\text{ dB}$. We have noticed that the instruments from Aaronia release an interference voltage at the antenna input! The splitter, the attenuator pads, and the DC blockers are checked before, during and after the tests. For this purpose the outputs A and B are exchanged and checked with the reference spectrum analyser. The measurement results are recorded on photo and video, and then evaluated.

Where did we get the expensive instruments for the costly tests?

Bürgerwelle does in fact dispose of the know-how for the tests, but not of the corresponding laboratory measuring equipment. You can borrow the equipment from various lending companies, but this would have cost us EURO 4000,- for the complete testing period. A lot of money which, unfortunately, we do not have to spare. Therefore, we sent a letter to both Aaronia and Gigahertz, asking them whether they would provide us with the necessary laboratory measuring equipment free of charge. We asked for the following devices:

- a spectrum analyser of up to a minimum of 3.5 GHz
- a frequency generator with at least two carriers of 1 MHz to at least 3.5 GHz
- a pulse generator with a pulse width calibration of between 0.1% and 99.9% and a pulse frequency calibration of between 10 and 1800 Hz
- and a power divider.

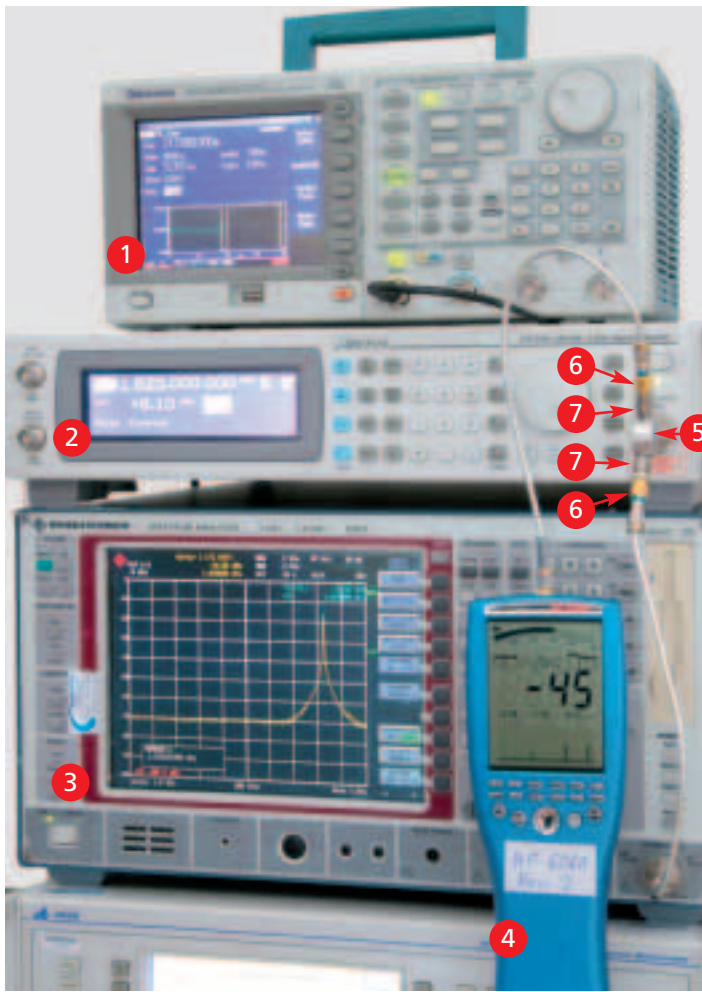


Fig. 1: test configuration

- 1 Pulse generator AFG 3102
- 2 Frequency generator IFR 3416
- 3 Spectrum analyser FSEA 20
- 4 Device subject to inspection
- 5 Splitter/power divider
- 6 DC-blocker
- 7 Attenuator pad 20 dB

Aaronia contacted us by phone after receiving our letter and tried to convince us that it was impossible to make tests using our method, and said that other companies which had done such tests had had to pay a fine of EURO 30,000!!! Bürgerwelle has great doubts about the validity of this fine of

30,000 EURO. However, we asked ourselves whether Aaronia was trying to say something to us. During a further phone call we asked which frequency generator Aaronia used for the reference measurements, and were told they used a Rohde & Schwarz CMD 80. As spectrum analyser we were told a Rohde & Schwarz ZVB 20. Aaronia offered us to test at their site, but said we would have to make an appointment at least a fortnight in advance. We were told that they could not put these instruments at our disposal for measurements at our site, also not if accompanied by a staff member of Aaronia, because they didn't want to transport these "expensive" devices.

At this point we have to mention that the ZVB 20 is suitable for the tests only to a limited extent. It is a network analyser and has a frequency range of only 0.5 MHz. UMTS would however require a range of 5 MHz, or even better 10 MHz. The specification of the CMD 80 as signal generator does not suffice for our tests. The CMD 80 is an elder device which can already be acquired on the second-hand market for about EURO 1500,-. This is why we cannot understand Aaronia's argument of not wanting to transport the "expensive" devices.

Another important point to mention is that we did not want to do the tests in the facilities of the producers subject to inspection, but totally independent of the producers, on the premises of Bürgerwelle.

For Gigahertz it was no problem whatsoever to place the measurement equipment at our disposal. They verified Mr. Zwerenz' competence in handling with professional high-class equipment, and then provided us with their equipment at a value as new of over 100,000,- EURO! This way Mr. Zwerenz was able to accomplish the tests personally and totally independently.

What did we test?

The tests were done with differing typical frequencies, first of all with an unpulsed carrier (i.e. the most simple signal form), and then with two unpulsed carriers (the second one with 10 MHz more than the first). Then the same frequencies as before were tested, but this time pulsed with varying pulse frequencies and varying pulse widths (see fig. 2).

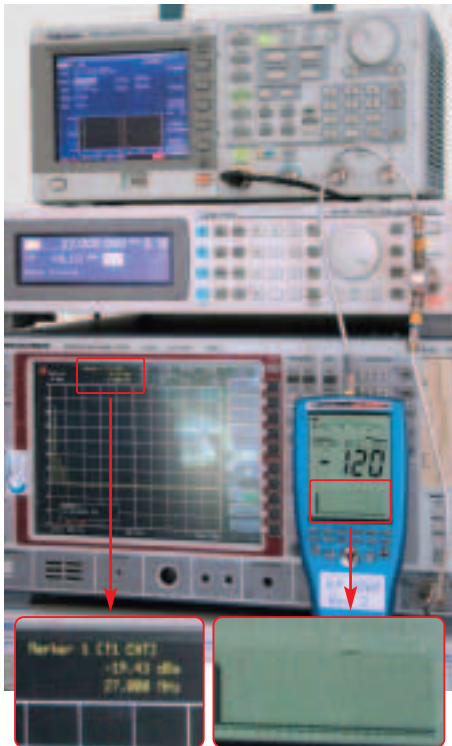
1. Constant carrier applied											
frequency range	frequency range	frequency range	frequency range	frequency range	frequency range	frequency range	frequency range	frequency range	frequency range	frequency range	frequency range
CB amateur			GSM 900	GSM 900		GSM 1800	GSM 1800				
radios	TV	TETRA	D-UP	D-DOWN	RADAR	E-UP	E-DOWN	DECT	UMTS-DOWN	WLAN	conspicuous
27MHz	50MHz	380MHz	900MHz	942MHz	1340MHz	1750MHz	1825MHz	1890MHz	2110MHz	2450MHz	3080MHz
2. Measurable value detections are in each case followed by an increase in 3 steps of 1 MHz each time. Fluctuations?											
+1MHz	+2MHz	+3MHz									
3. Two-carrier signal applied											
+10MHz											
4. Pulsed energy connected											
217Hz/12%	217Hz/12%	217Hz/12%	217Hz/12%	217Hz/12%	333Hz/0,1%	217Hz/12%	217Hz/12%	100Hz/4%	100Hz/1%	10Hz/1%	217Hz/12%
				217Hz/50%			217Hz/50%	100Hz/1%	333Hz/0,1%		
				217Hz/90%			217Hz/90%				
				1733Hz/99,9%			1733Hz/99,9%				

Fig.: 2: different settings with corresponding frequencies, carriers, pulse frequencies and pulse widths

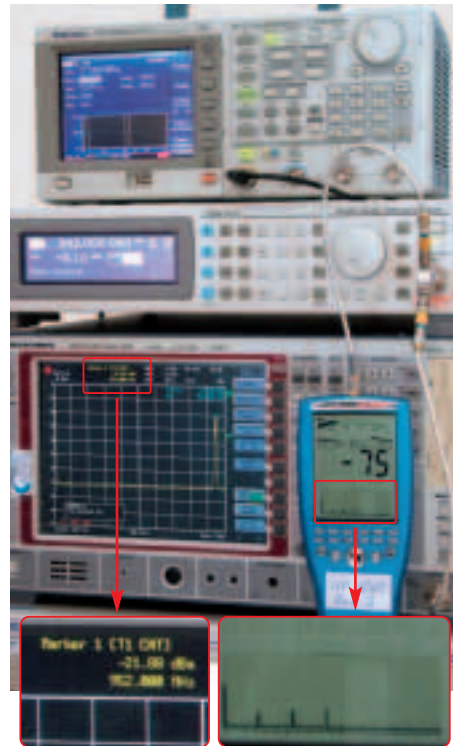
The lowest value the Aaronia Spectran devices can indicate is -120 dBm. So if the display shows -120 dBm, the actual value could in fact be even lower. -120 dBm is approxi-

mately ten billion times (!) lower than the signals fed into the Spectrans. We therefore define that when indicating a value of -120 dBm, the signal has not been recognised.

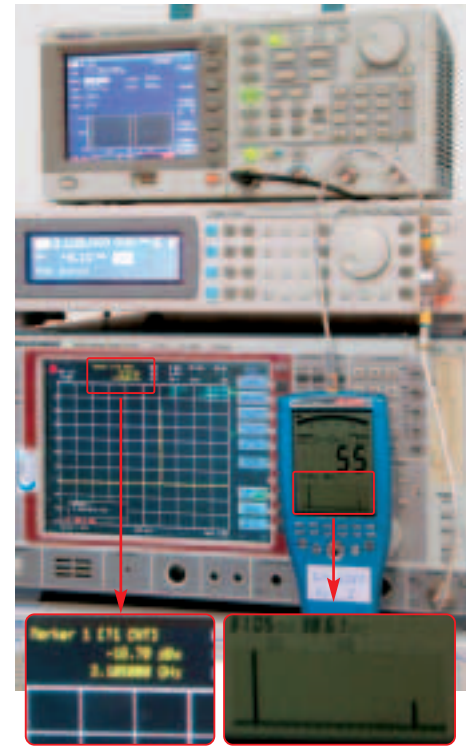
(Abbr.: No. o/c. = number of carriers)



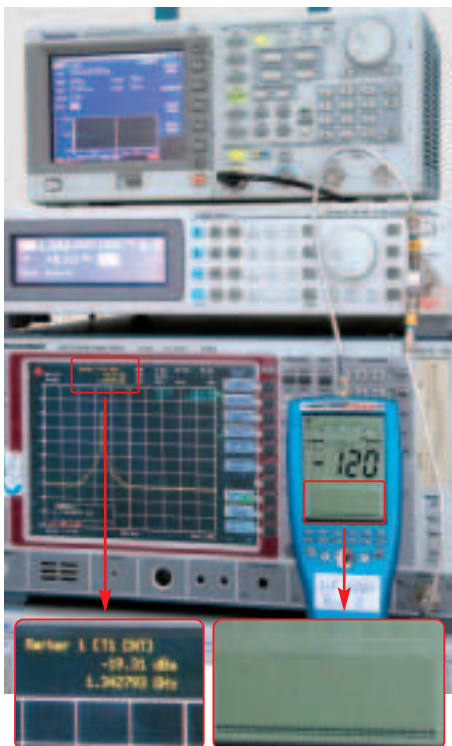
CB amateur radios frequency range Fig. 3
 Freq1: 27 MHz
 No. o/c. 1, pulse freq. 0, pulse width 100 %
 Setting at the Spectran: 0-1 GHz
 Display Spectran: -120 dBm,
 i.e. signal not found.



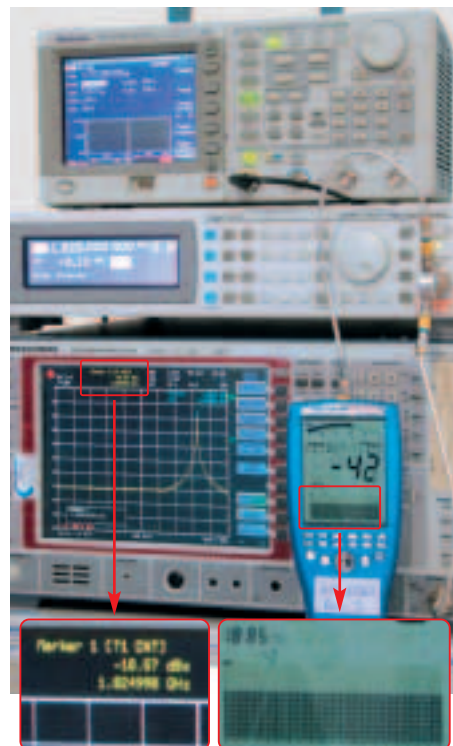
GSM 900 frequency range D-net downlink Fig. 4
 Freq1: 942 MHz, Freq 2: 952 MHz
 No. o/c. 2, pulse freq. 0 Hz, pulse width 100%
 Setting at the Spectran: 0-1 GHz
 Display Spectran: -75 dBm
 i.e. 205,116 times too little.
 Frequency not found.



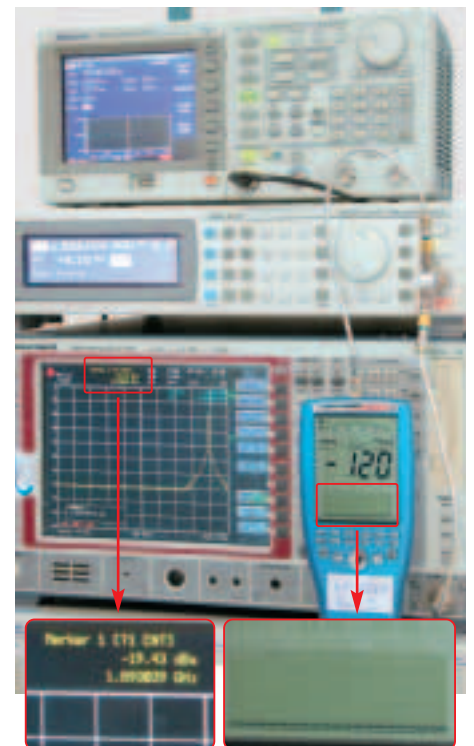
Over 3000 MHz Fig. 5
 Freq1: 3105 MHz
 No. o/c. 1, pulse freq. 0 Hz, pulse width 100%
 Setting at the Spectran: 3-4 GHz
 Display Spectran: 55 dBm
 i.e. 23,442,288 times too much. Two frequencies
 found: 3105 MHz and 3861 MHz.



Radar frequency range Fig. 6
 Freq1: 1342 MHz
 No. o/c. 1, pulse freq. 333 Hz,
 pulse width 0.1 %
 Setting at the Spectran: 1-2 GHz
 Display Spectran: -120 dBm,
 i.e. signal not recognised.



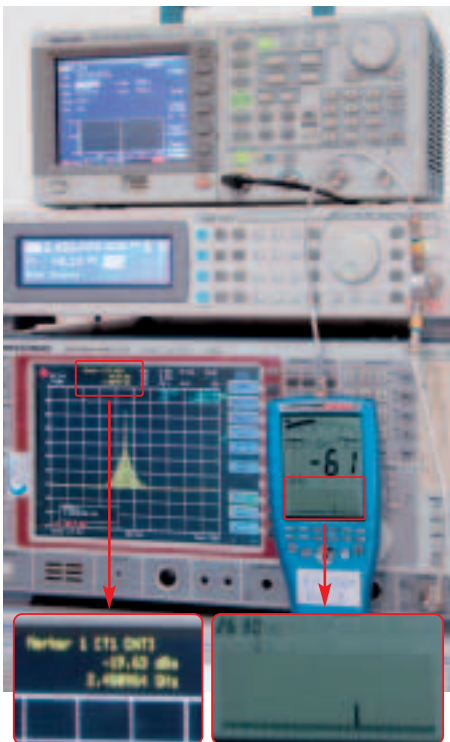
GSM 1800 frequency range E-net downlink Fig. 7
 Freq1: 1825 MHz
 No. o/c. 1, pulse freq. 1733 Hz, pulse width
 99.9%. With the setting on DECT analyser
 the Spectran will find a DECT-signal at 1885
 MHz (!) with -42 dBm instead of the energis-
 ed signal in the GSM frequency range



DECT-frequency range Fig. 8
 Freq1: 1892 MHz
 No. o/c. 1, pulse freq. 100 Hz, pulse width 1%.
 Setting at the Spectran: 1-2 GHz
 Display Spectran: -120 dBm,
 i.e. signal not recognised.

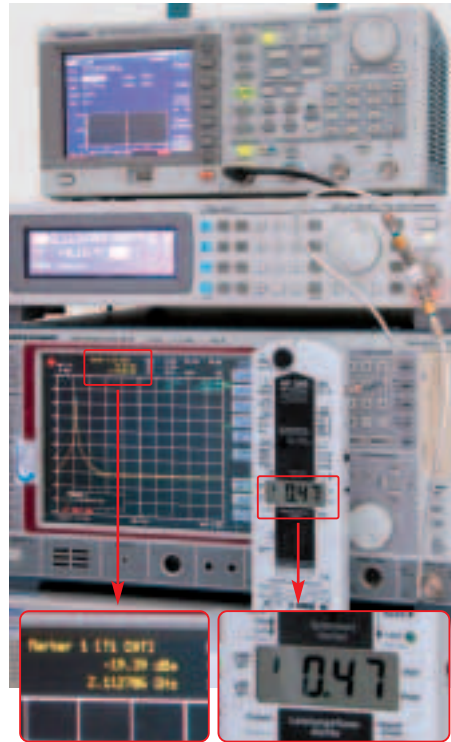
The test series comprised over 300 different settings. Some distinctive ones are shown, described and analysed here. The only two outliers with regard to the devices from Gigahertz were registered with extremely low pulse widths (0.1%, UMTS frequency range and Radar frequency range).

When changing to T_pmax/Radar/UMTS (HF 58B-r and HF 59B) these discrepancies can very well be corrected. Thus, these difficult measurement ranges can be determined very accurately using the HF 58B-r and the HF 59B.



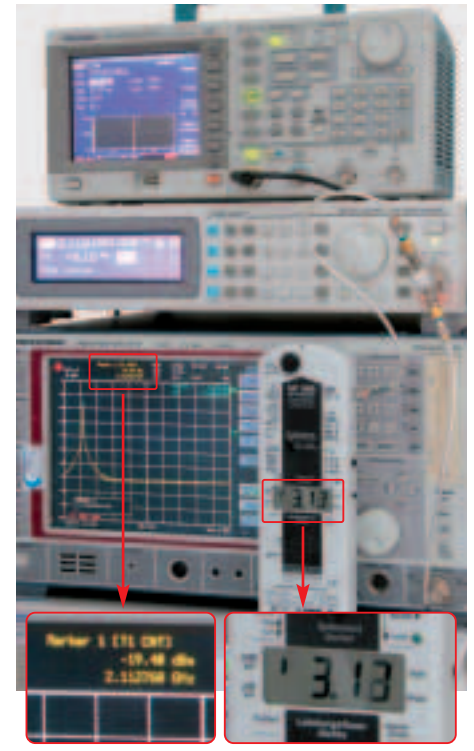
WLAN frequency range Fig. 9

Freq1: 2450 MHz
No. o/c. 1, pulse freq. 10 Hz, pulse width 1%
Setting at the Spectran: 2-3 GHz
It does not recognise the signal, yet it recognises another signal at 2650 MHz with -61 dBm which in reality is non-existent.



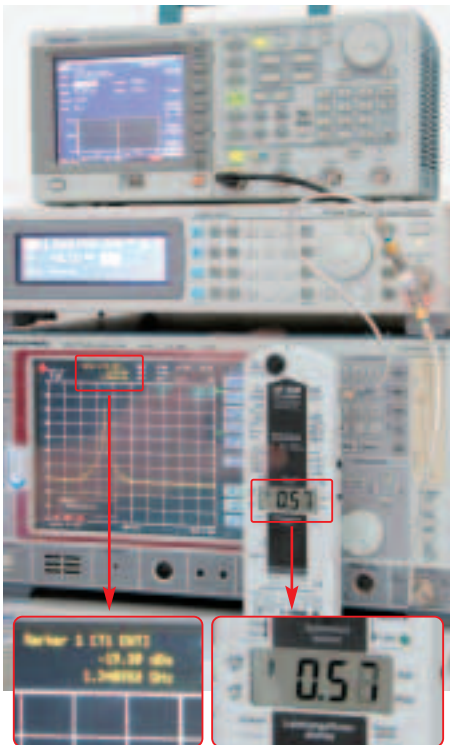
UMTS frequency range Fig. 10

Freq1: 2113 MHz
No. o/c. 1, pulse freq. 333 Hz, pulse width 0.1%
Setting at the HF 59: standard. The HF 59 rates the peaks in the UMTS frequency range (crest pulse) too little by a factor of 8.16.



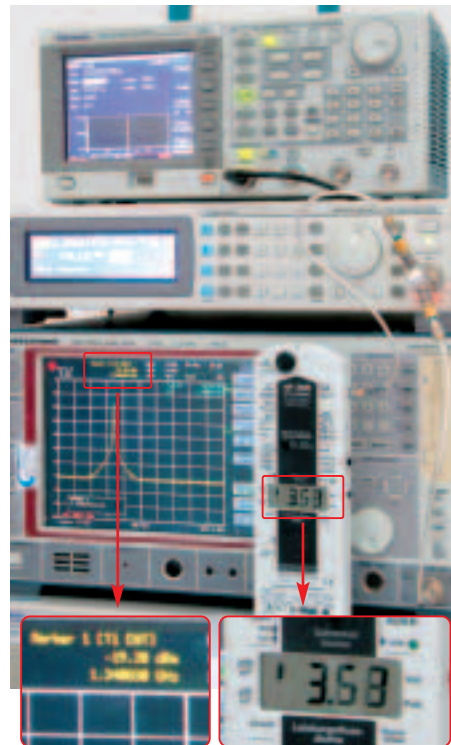
UMTS frequency range Fig.11

Freq1: 2113 MHz
No. o/c. 1, pulse freq. 333 Hz, pulse width 0.1%
Setting at the HF 59: TPmax/Radar/UMTS. The HF 59 indicates too little by a factor of only 1.22.



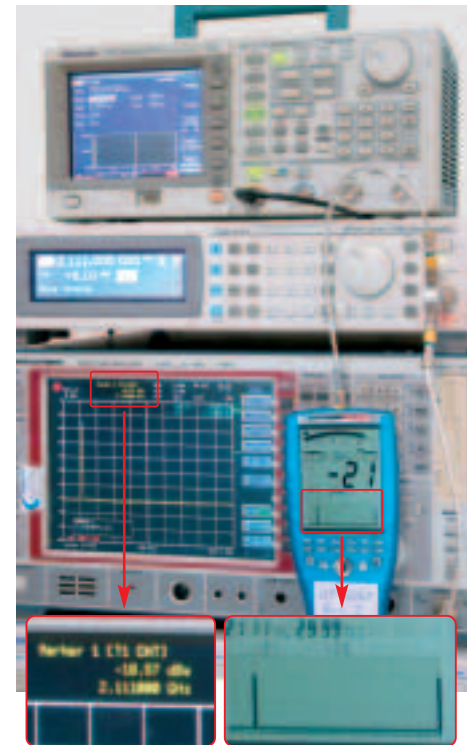
Radar frequency range Fig. 12

Freq1: 1342 MHz
No. o/c. 1, pulse freq. 333 Hz, pulse width 0.1%
Setting at the HF 59B: standard
The HF 59B indicates a level too little by a factor of 6.73.



Radar frequency range Fig. 13

Freq1: 1342 MHz
No. o/c. 1, pulse freq. 333 Hz, pulse width 0.1%
Setting at the HF 59B: TPmax/Radar/UMTS
The HF 59B shows too little by a factor of only 1.09.



UMTS Frequency range Fig. 14

Freq1: 2111 MHz
No. o/c. 1, pulse freq. 0 Hz, pulse width 100%
Setting at the Spectran: 2-3 GHz.
Permanent signal recognised, but at 2999 MHz yet another, in reality non-existent signal of similar power is recognised.

Signal Generator IFR3416				Spectrum Analyzer R&S FSEA				Aronia Spectran HF-6060 Rev.2								Gigahertz Solutions HF59B																				
Freq. 1 [MHz]	Freq. 2 [MHz]	number carriers	pulse frequency [Hz]	Pulse width [%]	Level1 [dBm]	Freq. 1 [MHz]	Level2 [dBm]	Freq. 2 [MHz]	Spectrum analyzer standard 9UW -> 3mW/m²	Hot Key (setting)	Level1 [dBm]	Freq. 1 [MHz]	Freq exist	diff. stand. Fktor	diff. Stand. [dB]	Level2 [dBm]	Freq 2 [MHz]	Freq exist	Level3 [dBm]	Freq 3 [MHz]	Freq exist	setting	display [mW/m²]	diff. Fktor	diff. Stand. [dB]											
27	27	1	0	100	-19,43	27,00	-52,00	54,00	3,80	0-1GHz	-120	???		>10000	>-40dB							TP30kHz	2,67	-1,25	-1,0											
frequency range CB amateur radios:												max. diff.:	keine Anzeige																							
942	952	2	0	100	-21,88	952,00	-21,88	942,00	4,32	0-1GHz	-75	???		>-205116	-53,1																					
944	944	1	1733	99,9	-18,55	944,00	-70,00		4,65	0-1GHz	-28	945	yes	-9,81	-9,5																					
944	954	2	0	100	-21,87	954,00	-21,87	944,00	4,33	GSM900	-27	944	yes	-3,26	-5,1	-27	954	yes																		
944	944	1	217	12	-19,08	944,98	-70,00		4,12	GSM900	-120			>10000	>-40dB																					
944	954	2	0	100	-22,16	944,00	-22,16	954,00	4,05																											
944	944	1	217	12	-19,14	944,48	-70,00		4,06																											
frequency range GSM 900 D-net downlink												max. diff.:	"0-1GHz":		-1,75	-2,44																				
												min. diff.:	"0-1GHz":		>10000	>-40dB																				
												max. diff.:	"GSM900":		>10000	>-40dB																				
												min. diff.:	"GSM900":		>10000	>-40dB																				
1342	1352	2	0	100	-22,24	1342,00	-22,24	1352,00	3,98	1-2GHz	-61	1555																								
1342	1	333	0,1	-19,31	1342,79	-70,00			3,91	1-2GHz	-120																									
1340	1	333	0,1	-19,39	1340,75	-70,00			3,84																											
1340	1	333	0,1	-19,38	1340,83	-70,00			3,84																											
frequency range Radar:												max. diff.:	"1-2GHz":		-3,49	-5,43																				
												min. diff.:	"1-2GHz":		>10000	>-40dB																				
1825	1	217	50	-18,96	1825,00	-70,00			4,24	1-2GHz	-120																									
1825	1	217	50	-18,83	1825,00	-70,00			4,36	1-2GHz	-45	1705	no	-414,00	-26,2	-47	19,45	no	-69	1336	no															
1825	1	217	50	-18,96	1824,87	-70,00			4,24	GSM1800	-120																									
1827	2	1733	99,9	-22,30	1827,00	-22,30	1837,00		3,93	GSM1800	-30	1838	yes	-5,89	-7,7	-31	1826	yes																		
1826	2	0	100	-22,53	1826,00	-22,53	1836,00		3,72																											
1826	1	217	12	-19,40	1826,97	-70,00			3,83																											
1825	1	1733	99,9	-18,76	1825,00	-70,00			4,43																											
frequency range GSM 1800 E-net downlink:												max. diff.:	"1-2GHz":		-1,10	-0,43																				
												min. diff.:	"1-2GHz":		>10000	>-40dB																				
												max. diff.:	"GSM18K":		-1,03	-0,12																				
												min. diff.:	"GSM18K":		>10000	>-40dB																				
1892	1	100	1	-19,43	1893,04	-70,00			3,80	1-2GHz	-120																									
1825	1	1733	99,9	-18,57	1825,00	-70,00			4,63	DECT	-42	1885	no																							
1892	1	100	1	-20,27	1893,07	-70,00			3,13																											
1891	1	100	1	-19,45	1891,03	-70,00			3,78																											
frequency range DECT:												max. diff.:	"1-2GHz":		-2,20	-0,12																				
												min. diff.:	"1-2GHz":		>10000	>-40dB																				
												max. diff.:	"DECT":		1,17	0,70																				
												min. diff.:	"DECT":		overcoupling																					
2111	1	0	100	-18,57	2111,00	-70,00			4,63	2-3GHz	-21	2111	yes	-1,75	-2,4	-23	2999	no																		
2111	1	333	0,1	-19,32	2110,75	-70,00			3,90	UMTS	-120																									
2113	1	333	0,1	-19,39	2112,71	-70,00			3,84																											
2113	1	333	0,1	-19,40	2112,77	-70,00			3,83																											
frequency range UMTS (W-CDMA):												max. diff.:	"2-3GHz":		-1,75	-2,43																				
												min. diff.:	"2-3GHz":		>10000	>-40dB																				
												max. diff.:	"UMTS":		-1,10	-0,42																				
												min. diff.:	"UMTS":		>10000	>-40dB																				
2450	1	10	1	-19,63	2450,96	-70,00			3,63	2-3GHz	-61	2650	no	-13708,82	-41,4																					
2452	1	10	1	-21,74	2452,91	-70,00			2,23																											
frequency range W-LAN:												max. diff.:	"2-3GHz":		1,22	0,88																				
												min. diff.:	"2-3GHz":		>10000	>-40dB																				
3105	1	0	100	-18,70	3105,00	-70,00			4,50	3-4GHz	55	3105	yes	23442288	73,7																					
3070	1	0	100	-19,09	3070,00	-70,00			4,11	3-4GHz	26	3069	yes	32285	45,1	-39	3633	no																		
3107	3117	2	0	100	-22,11	3117,00	-22,11	3107,00	4,10																											
3070	1	0	100	-19,02	3070,00	-70,00			4,18																											
over 3000 MHz:												max. diff.:	"2-3GHz":		51641637	77,13																				
												min. diff.:	"2-3GHz":		>10000	>-40dB																				

Fig. 15: table with extracts from the measurement series



Fig. 16:

Aronia Spectran HF-6060 Rev.2 with antenna
 Optically elegant casing with metallic coloured varnishing. The Aronia Spectran HF-units are available according to producer's price list from EURO 199,95 to EURO 999,95
 Prices of the Aronia units tested by us:
 Spectran HF-2025E Rev.2 EURO 249,95
 Spectran HF-6060 Rev.2 EURO 799,95



Fig. 17:

Gigahertz HF 59B with antenna
 clear, functional design
 Gigahertz HF units are available according to producer's price list from EURO 174,- to EURO 1113,60. The HF 59B with additional isotropic ultra broadband antenna UBB27, 27 MHz to much over 2.5 GHz and high-pass filter available for EURO 1490,60.
 Prices of the Gigahertz units with antenna tested by us:
 HF 58B EURO 783,-; HF 58B-r EURO 922,20;
 HF 59B EURO 1113,60

Evaluation of the test results of Aaronia Spectran HF-2025E Rev.2 and Spectran HF-6060 Rev.2

The Aaronia units are not easy to operate. Some specific measurements are only possible when considering special settings in the menu, rendering the use difficult for amateurs.

The Aaronia Spectran HF-6060 Rev.2 is listed by the producer for frequencies from 1 MHz onwards. Yet it wasn't even possible to measure the most simple unpulsed signals in the 27 MHz-CB radio frequency range at a calibration as specified by the producer of 0-1 GHz. It can recognise higher unpulsed frequencies (CW), but mostly with a clearly underestimated level, also when implementing the calibration recommended by Aaronia in the manual ("hot-keys" etc.) (x-fold too little). Yet, in particular cases (e.g. with 3105 MHz) it indicates values more than 50 million-fold too high! If you add another carrier (frequency), in our case 10 MHz higher than the first, it can suddenly recognise no signal at all any more. However, in reality several different frequencies are standard. What meaning does this have for mobile radio measurements in practice? With the appropriate calibration, the units are able to recognise the GSM 900 MHz frequency range (D-net) and the GSM 1800 MHz frequency range (E-net) downlink, but mostly only the first channel, which is always busy. Other channels are not registered if only little used. Even if only one control channel is busy and another transmitter with a frequency difference of 10 MHz is available, it will not find any transmitter at all. So the Spectran units in the GSM 900 MHz frequency range (D-net) and GSM 1800 MHz frequency range (E-net) downlink can only fluke.

Similar surprises await the user when implementing the "hot-key" DECT. The tested Spectran clearly indicated an energised signal in the GSM 1800-downlink-frequency range („frequency range mobile radio transmitting antenna E-net“) without any other signals, especially without a signal, in the DECT frequency range as a DECT-signal with extremely high level at 1885 MHz. This result will definitely put any future measuring professional on the wrong track.

Say, for example, you are measuring in an apartment with the "hot-key"-DECT, searching for a DECT phone system in the neighbourhood, and even make a find although there is no such system, because the Spectran recognises the E-net of a mobile radio transmitter nearby, and indicates it as a DECT! As a consequence you try to persuade your neighbour to remove his DECT phone system, which will leave him smiling at your incompetence, as he's only in the possession of a corded phone.

And what about the "hot-key" UMTS? Another negative report. The average peak is relatively satisfactory, but the fine peaks especially critical with respect to our health (keyword "crest factor", see page 15) of the signal in the UMTS frequency range plainly perish – of course once again without the user being notified.

This all does not have much to do with reliable and professional measuring technology: According to the definition, the user would expect from a measuring instrument that, within the specified constraint, it principally indicated accurate measurement values, reproducible within the technically specified tolerances.

Based on above definition, the two tested devices from Aaronia Spectran HF-2025E Rev.2 and Spectran HF-6060

Rev.2 fail to "measure" pulsed signals in the frequency range such as those from DECT-base stations, Tetra, GSM 900 D-net and GSM 1800 E-net mobile phones and WLAN! In spite of the fact that these signals are existent in reality, you may in practice obtain no result whatsoever (no, you haven't misread – it won't indicate "less", it just won't indicate anything)!

Based on our tests of the Aaronia devices Spectran HF-2025E Rev.2 and Spectran HF-6060 Rev.2 we come to the conclusion that these devices are inadequate for high-frequency measurements with pulsed signals, as the measurement results are not reliable.

Evaluation of the test results of Gigahertz HF 58B, HF 58B-r and HF 59B

We also tested the Gigahertz devices under the same conditions as the Aaronia devices.

The Gigahertz devices are characterised by an impressive measuring accuracy for unpulsed as well as pulsed signals (see page 15). The slight discrepancies with regard to the reference spectrum analyser from Rohde & Schwarz can be utterly neglected. Similar discrepancies are standard in the expert high-frequency measurements, too. Even spectrum analysers within the price range of EURO 10000,- and more show discrepancies. Even amateurs will in short easily operate the Gigahertz devices. The setting knobs and push-buttons are clear and conveniently mounted, giving the devices a pretty unspectacular, clinical look. However it's not the look that counts but the accuracy of measurement!

The HF 58B-r and the HF 59B even allow accurate measurements in the radar frequency range and the UMTS frequency range. For UMTS, it is additionally possible to determine the crest factor, usually only possible with extremely expensive spectrum analysers with a True-RMS calibration (see page 15 crest factor and pulsed energy with UMTS).

A further, very useful analysis facility, not found with any other producer so far: These devices have a push-button which will allow separate measurements of the pulsed rate of the HF-exposure, especially relevant with respect to your health.

Comment

When evaluating the influence of high frequency on man's health, strongly pulsed signals are to be considered especially effective. Therefore, these signals are especially important.

Exactly these crucial signals were not reliably obtained when testing the Aaronia Spectran devices.

So Aaronia's advertisements are a glaring contradiction to reality. This was the reason we chose the subtitle "Myth and reality" for our test.

The user of Aaronia devices is feigned a non-existent efficiency, which leads to false evaluations of radiation exposure. People criticising mobile radios or affected by mobile radios cannot be taken seriously when referring to measurements carried out with these instruments.

Yes, they can even be ridiculed by the mobile radio operating companies, although these operators will probably often enough appreciate low or no measurements of radiation exposure from their transmitters. We explicitly recommend to repeat measurements carried out with these units with reliable instruments, in order to find out the proper radiation exposure.

After our tests we also understood why Gigahertz did not hesitate to put their top-quality laboratory measurement equipment at our disposal for several days free of charge. The reason is probably that the Gigahertz devices are excellent instruments, a fact which is best known to the producer himself, so he has no problems facing even the most critical tests.

The Gigahertz devices are not only recommendable for building biologists or measurement engineers, but also for technically interested non-professionals. If, for instance, a city, a community, an action group or private individuals decide to acquire such a device, they will be in a position to reliably determine the corresponding total radiation exposure without depending on others, and with the opportunity of repeating the tests whenever and wherever wanted. Based on this, it is possible to commission measurements with a professional spectrum analyser (unfortunately still too expensive), if, for instance, disputes with individual mobile radio operators require exact frequencies.

In the style of the well established school grades, we can summarize the test results as follows: Aaronia Spectran HF-2025E Rev.2 and Spectran HF-6060 Rev.2 will be graded "inadequate" – Gigahertz HF Analyser HF 58B, HF 58B-r and HF 59B will be graded "very good".

Luckily, in the meantime there are affordable and efficient measuring instruments, so that those interested are no longer dependent on information given by public authorities or by operators, and can undertake measurements themselves.

Test series over 3500 MHz

We were unable to find terminal equipment (DECT etc.) over 3500 MHz accredited for Germany, so the test relating to this frequency was limited. Future tests will include frequencies of more than 3500 MHz.

What was the actual problem of the member of the action group with the alleged 3.14 W/m^2 between 3.0 GHz and 3.2 GHz?

On March 1, 2006 I was at the site and tested the electro-magnetic field exposure with the spectrum analyser. The result showed high exposures caused by televisions, mobile radios and other radio services. However, the values were lower than the above mentioned 3.14 W/m^2 .

A very weak and practically negligent signal was determined between 3.0 GHz and 3.2 GHz.

Our tests proved that the devices from Aaronia show values which are a millionfold too high.

It was interesting to observe that the Aaronia Spectran HF-6060 Rev.2 brought along and the Aaronia Spectran implied by the action group showed repeatedly changing values of up to 79.2 Watt/m^2 (!) between 3.0 GHz and 3.2 GHz. An exposure to such an extent would give cause for immediate escape.

The exposure caused by television, mobile radio and other radio services are very alarming for the member of the action group with respect to health risks, but, on the other hand, the members of the action group could now be set at ease with regard to the allegedly extremely high exposure between 3.0 GHz and 3.2 GHz, as this was not the case.

Antenna gauge:

If a log-per (logarithmic-periodic) antenna absorbs energy (electro-magnetic fields) from the room, it will convert it and pass it on to the cable.

However, technically seen the higher the frequency gets the less power is passed on to the cable by the antennae,



Fig. 18: Schwarzbeck-antenna

the energy, however, remaining in the room.

The reason for this is that the higher the frequency, the shorter the antenna rods, so less energy can be absorbed from the room.

The antenna gain of a log-per antenna, relative to an isotrope, usually amounts to 6 dB. With a log-per antenna it is also easy to locate well hidden transmitters, for instance in a steeple or underneath a roof. 0 dBm (it ought to be 0 dbmW) is defined as 1 mW (milliwatt) power. So if the spectrum analyser shows a certain level, it is imperative to consider the corresponding frequency. The calibration certificate of the antenna shows the corrective factor of the respective frequency-power relation. The antenna factor varies with the frequency.

Now we are faced with a small problem, though. If, for instance, two or more different frequencies are being measured (e.g. 900 MHz and 1800 MHz and 2450 MHz), it is necessary to take into account the antenna factor for each one of the frequencies. A spectrum analyser will allow a metering of the frequency at all levels and consequently a calculation of the power density.

But what about broadband measuring instruments?

Here the frequency cannot be metered. In order to make an accurate measurement of the power density or field strength in the room, the antenna signal needs to be equalised. When doing so, the power density or field strength can be seen directly as a figure on the display. Otherwise, when not equalising, it is technically impossible to take accurate measurements. If the frequency is known, the antenna factor could be used to adjust the result of the measuring instrument. But how is anyone to know the frequency the transmitters use and to what extent they are using the individual frequencies? So equalising the antenna signal appears to be the technically correct solution, and measuring instruments which take this into consideration are not only easy to operate, but also very accurate with respect to the measuring results, provided that they're intelligently constructed with respect to their complete electronic system.

Equalisation of antennae

Gigahertz states that the measuring instruments HF 58B and HF 58B-r are equalised within the device itself. So, given a constant level at the frequency generator but a continuously rising frequency, they should, therefore, indicate a continuously rising value. This was the case during the test.

The HF 59B is not equalised, the equalisation takes place at the antenna. Therefore, given a constant level but a continuously rising frequency, the device should indicate a constant value, which, apart from slight discrepancies (+0.9 dB = factor +1.22 and -0.5 dB = factor -1.11) was also the case during the test.

The discrepancies of the HF 58B were +1.4 dB = factor 1.39 and -0.5 dB = factor -1.11. The discrepancies of the HF 59B-r were +1.6 dB = factor 1.46 and -1.1 dB = factor -1.28, thus in both cases very low. The Gigahertz devices only have one fully distinctive vane of the standardised log-per antenna. For this reason a gain of 3 dBi was estimated.

Modulation types for further tests

If you are of the opinion we should in future also imply special modulations, we will be glad to do so. With the help of the program IQ-Creator, to be found in the internet for free-of-charge download under www.aeroflex.com/products/signalsources/IQCreator.cfm, technically experienced users can set up their own modulation schemes. Please be so kind and forward them to us on a CD.

Producer addresses:

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Kauthenbergstr. 14 · D-54597 Strickscheid
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Tel. +49 (0)6556-93033 · Fax +49 (0)6556-93034
Email: info@aaronia.de
Internet: www.aaronia.de

Gigahertz Solutions

Mühlsteig 16 · D-90579 Langenzenn
Germany
Tel. +49 (0)9101-9093-0 · Fax +49 (0)9101-9093-23
Email: info@gigahertz-solutions.de
Internet: www.gigahertz-solutions.de

Laboratory measuring technology implied:

Spectrum analyser Rohde & Schwarz 9 kHz to 3.5 GHz, FSEA 20, serial no.: 839973/007. calibrated on 16.11.2005, calibrated until 16.11.2006

Pulse generator Tectronix AFG 3102, serial no.: C010063, date of calibration: 28.07.2005

Signal generator Aeroflex IFR 3416, 250 kHz to 6 GHz Vector signal generator with option 5, arbitrary waveform generator; option 6, pulse modulation; option 21, 3G CDMA software license. Serial no.: 341003/026. calibrated until 19.09.2007

Multi-source signal generator IFR 2026, 10 kHz to 2.4 GHz Serial no.: 202601/196. calibrated until 14.09.2006

Antenna Schwarzbeck USLP 8143-325, calibrated on 15.04.2005 Power divider Huber + Suhner 4901.19.A, DC to 12.4 GHz Cable Tensolite 601, 26.5 GHz, 2 ex. Radial attenuators 20 dB, 18 GHz, R 411 820 21, 2 ex. Huber + Suhner DC-Block 1100.19.A, 18 GHz

Crest factor and pulsed energy for UMTS

The crest factor of pulsating signals is the ratio between power peak value and average value.

UMTS has especially high requirements due to its high crest factors and at the same time large signal band width. Normally, the UMTS crest factor is at approx. 10 to 13 dB, i.e. the pulse peaks are an average of approx. 10 to 20 times higher than the average value. Even higher crest factors are also possible though. So, due to the crest factor, UMTS has irregular, sharp, spicular pulses, which can be approx. 10 to 20 times stronger than the average value, giving reason for the statement that UMTS is pulsed. Furthermore, the control channel of UMTS is pulsed too.

Definitions

Uplink: from the portable unit to the base unit

Downlink: from the base unit to the portable unit

Pulse frequency in Hz: amount of pulses per second

Pulse width in %: e.g. pulse width 100% means no pulse, pulse width 50% means the signal is on for 50% of the action time and off for 50% of the action time. Pulse width 1% means the signal is on for 1% of the action time and off for 99% of the action time.

dB = logarithmic ratio.

The following applies for power ratio: e.g. 10 dB = factor 10, 20 dB = factor 100, 30 dB = factor 1000. Our tests were exclusively carried out with power.

The following applies to field strength, voltage and current: e.g. 20 Bürgerwelle dB = factor 10, 40 dB = factor 100, 60 dB = factor 1000.

Frequency index

An outline of some of the important radio services, (PW) = pulsed F/MHz radio service

885-887	cordless telephone CT1+ uplink
876-880	GSM-R rail uplink (PW)
890-915	GSM 900 - D-net uplink (PW) with 217 Hz
921-925	GSM-R rail downlink (PW)
930-932	cordless telephone CT1+ downlink
935-960	GSM 900 - D-net downlink (PW), 217 - 1736 Hz
1240-1400	air traffic control radar (PW)
1710-1785	GSM 1800 - E-net, uplink (PW) with 217Hz
1805-1880	GSM 1800 - E-net, downlink (PW), 217 - 1736 Hz
1880-1900	cordless telephone DECT (PW) with 100Hz
1900-1920	UMTS-TDD CDMA down- and uplink (PW) with 100 Hz
1920-1980	UMTS-FDD CDMA uplink (PW)
2010-2025	UMTS-TDD down- and uplink (PW) with 100 Hz
2110-2170	UMTS-FDD downlink (PW)
2450	domestic microwave oven (PW)

Bürgerwelle's area of activity

Since 1997, Bürgerwelle supports citizens and action groups trying to fend mobile radio transmitters. Bürgerwelle informs about the health risks caused by high frequency exposure. So far we have had to rectify many untrue statements given by the mobile radio operators or by the authorities, thus countering the belittlement of these risky technologies. Now, however, we are faced with yet another important task: verifying the operability of measuring instruments in order to avoid people being misled by wrong measurement results. In spite of the fact that tests like these are accompanied by an immense expenditure of time and partly also money, their importance gives reason to carry them out also in the future. This test was a starter.

At the last minute!

Reflections regarding the most recent publications by Aaronia

By Siegfried Zwerenz

Our test obviously triggered off a lot of fuss in its run-up! For the skilled eye the hastily published "test results" on the Aaronia homepage were slightly astonishing. As we only noticed the publications shortly after printing this edition of our newsletter, we've decided to summarise the verification of the results for you in this inlay (separately numbered I-IV).

On March 15, 2006 we discovered a newly set internet page on the Aaronia website (source: www.aaronia.de) under spectrum analyser, on which Aaronia refers to a test and states:

"The level of the GSM-signal of -10 dBm is perfectly reproduced on the SPECTRAN (-10 dBm). The frequency is perfectly hit (950 MHz)".

This statement insinuates perfectly accurate measurement results which appear strongly contradictory to our test results. On the first page we found the introduction, which we have reprinted here in full, immediately followed by our comments to individual statements.

Aaronia (source: www.aaronia.de):

"The one or other HOBBYIST tries to "simulate" complex signals such as Bluetooth, Wlan, GSM, DECT, etc. with a "normal" frequency generator using the pulse function. Unfortunately, this only shows the user's serious lack of knowledge, as signals like these CANNOT be generated with a common generator. Regretfully, even the one or other alleged "expert" cannot (or does not want to) understand this and therefore obtains respectively incorrect measurement results. These absurd results are then even bluntly published. This misleads users and even editorials who do not make any effort to verify the results."

Bürgerwelle: After our phone calls with Aaronia at the end of February concerning the solicited laboratory measurement instrumentation, we did, of course, check the statements prior to our test, and came to the result that it does not make any difference whether the for instance GSM pulse modulated signals are fed in using either a normal pulse generator or a vector signal generator with arbitrary waveform generator.

The advantage of considering the pulsed energy individually is that it allows a better analysis of signals consisting of constant and pulsed parts.

Aaronia (source: www.aaronia.de):

"Quite a lot more is of need for a proper generation of GSM, DECT, UMTS, etc. In fact, it requires a special and very costly generator, a so-called "Vector Signal Generator" or "Arbitrary Waveform Generator".

These generators will allow a REPRODUCIBLE verification, for instance, of the accurate functioning of the SPECTRAN with regard to the correct level indication or power measurement of GSM, DECT, Wlan, etc.

Bürgerwelle: "Now we ask ourselves why Aaronia suggested outdated devices to us (see page 9) and suddenly carries out measurements with a borrowed modern vector generator?"

Aaronia (source: www.aaronia.de):

"Unfortunately, generators like these are very rare, as they are extremely expensive. Non-professionals as well as many professionals will hardly possess or be able to use such an apparatus. ALL measurements made here have therefore been carried out with these types of generators from different suppliers. The measurement results are made available here.

Bürgerwelle: The Keithley device used by Aaronia comes up to approx. EURO 19,000,- exclusive of VAT. For a manufacturer this price should not cause a problem. The Aeroflex IFR 3416 with all its additional functions we used costs about EURO 32,000,-.

Gigahertz immediately provided us with a vector signal generator, exactly the type required by Aaronia now. A generator even capable of covering the complete frequency range requested by us, and furthermore of generating all complex signal types up to 6000 MHz as to be expected in the superior future Wlan-zone at 5800 MHz. The Keithley model 2910 used by Aaronia can only cover a frequency range of 400 MHz to 2500 MHz. With this device it would have been impossible, for instance, for parts of the television zone to be tested. Apart from that we would not have been able to detect neither the overvaluation of the level given by the Spectran HF-6060 Rev.2 within the range of 3100 MHz, nor the inability to locate the CB radio signals at 27 MHz (see page 10, fig. 3 and 5).

On the basis of the arguments quoted by us, the statements made by Aaronia are not supportable for us.

We do, however, wonder what purpose Aaronia was pursuing with this introduction. Maybe they were aiming at deterring people who intended to carry out tests? Or maybe they wanted to devalue publications of tests in spite of their diligence and accuracy? Or was it their intention to discredit the systematic tests by a series of illustrations showing complex signal types of which a total of many thousand presets are possible?

After our asking for laboratory measurement instrumentation and our various phone calls, Aaronia ought to have expected us to plan and carry out a test.

Those who know Bürgerwelle also know that we do not let ourselves be intimidated by nothing or no-one, and that we make our way consequently and purposeful.

We chose simple signal types for our test, as one can expect that a measuring instrument which is not able to accurately indicate the simple signals will not work with the more complicated signals either. For our tests we deliberately chose the frequencies that we are surrounded with in everyday life. On these frequencies we made exemplary tests of the basic modulation types, so that our measurement results can be used to assess a complex sampled signal.

Hence, for Bürgerwelle, the statements given by Aaronia concerning the competence of the tests do not apply at all.

In the evening of March 17, 2006, we were once more made available the necessary laboratory measurement instrumentation by Gigahertz.

Due to a lack of time we were only able to closely investigate individual calibrations from Aaronia.

(NB from the translator: the above statements by Aaronia are translations of the German originals. They have not been published in English by Aaronia on their homepage.)

On March 17, 2006 we discovered another entry on Aaronia's homepage in the internet: "Measuring results with IMST". We would also like to comment this entry.

For its measurement configuration, Aaronia chose a similar method as we used for our tests, i.e. the signal from the generator was directly fed into the device subject to testing.

However, Aaronia did not implement a reference spectrum analyser to control the signal! Therefore it is not obvious what was really fed into the device subject to testing! Experience has shown that this leads to statistical measurement faults, as it is easy to oversee the one or other setting when configuring the devices, which in turn could possibly mean that instead of having a fully pulsed GSM downlink signal with only one time slot you might end up with a signal consisting of a continuous-wave (CW) part and a pulsed part.

Aaronia states that all settings are identical to the "Hotkey 7" GSM downlink 920-960 MHz. This is not quite correct. The photo shows that the button Pulse was additionally pushed, which indicates Peak on the display. We've

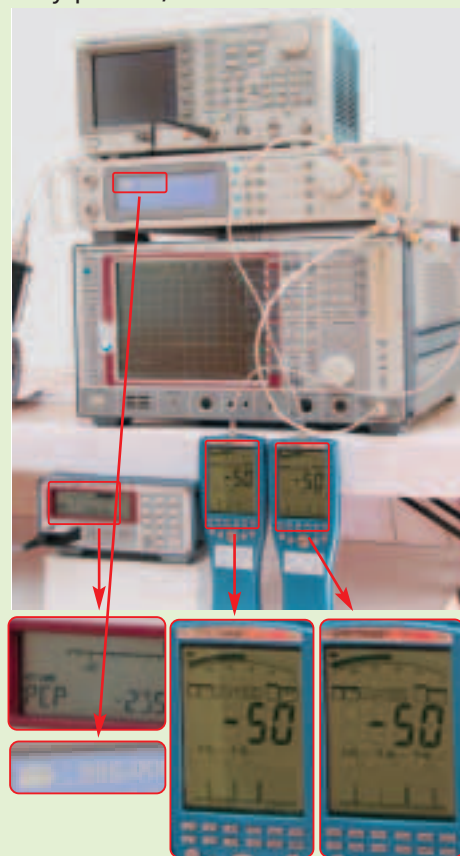


Fig. 19: Spectrans with Aaronia configuration: identify CT1+ telephones as GSM-downlink signal.

made the experience that this setting is rather inconvenient as it can lead to also reading CT1+ telephones with a frequency of, for instance, 886 MHz as a GSM downlink signal between 935 MHz-960 MHz (see fig. 19). Imagine you are measuring with a Spectran with the above configuration and a neighbour happens to be making a phone call on a CT1+ phone, you will receive considerable GSM downlink signals although you are in a GSM dead zone! Nobody will be able to take you seriously as a "measuring engineer".

Nevertheless, we have decided to check this unemployable special configuration chosen by Aaronia in order to trace down the unbelievable measuring results.

Our relentless analysis of data evaluation

The original photo (fig. 20) of Aaronia shows three frequencies. 931 MHz (this is the CT1+ downlink frequency, however only 950 MHz had been injected!), 938 MHz and 950 MHz.

On the display we added the scale graduation of the pixel field, to be seen on the Spectran when pushing the Menu button:

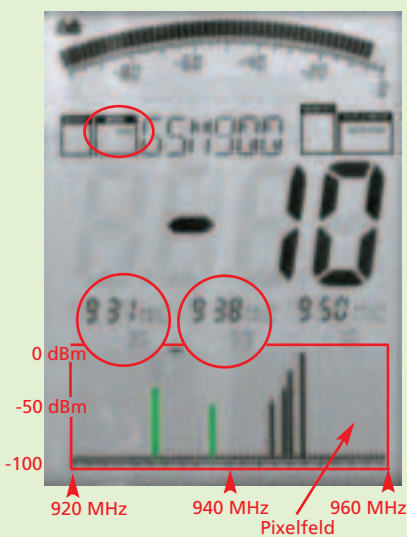


Fig. 20: Configuration and results by Aaronia; source: www.aaronia.de

Red = the symbols added by Bürgerwelle for an improved understanding;
Green = the pixels Bürgerwelle included to the frequencies 930 MHz and 938 MHz.

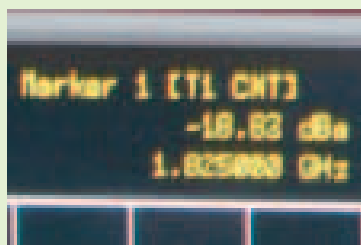


Fig. 21: cut-out of the photo of Fig. 1, page 9; injections: 1825 MHz, found by the Spectran 1336 MHz, 1705 MHz, and 1945 MHz

However, this would require the inadequate setting of Peak. (see fig. 19: CT1+ is identified as GSM 900 (D-net)). The Spectran now shows continuously varying measurement results. We have illustrated some of them here.

These photos have all been taken within one minute given a constant signal! This means it shows levels with discrepancies of approx. 26 dB, i.e. approx. a 400-fold! Now how would it be possible to allegorise an at least fairly correct level? (fig. 25 + 26).

Quite easy. It's just a matter of publishing the "matching" photo! The fact that a pulsed and a CW signal have been used simultaneously is just not obvious when failing to implement a reference spectrum analyser for a control of the signals, which would relentlessly show this.

Frequency from mid-left to right

920 MHz; 940 MHz; 960 MHz

Level from top centre to bottom

0 dBm, -50 dBm -100 dBm.

Where on the pixel field can you find the identified frequencies 931 MHz and 938 MHz?

The solution: The Spectran works in such a way, that first of all it deletes all the pixels, and a split second later also the frequency data.

So I'd just have to "take a photo" at the right moment, in order to make sure the pixels of the wrongly identified frequencies cannot be seen!

We have noticed in our test that the Spectran can, for instance, not identify pulsed GSM downlink frequencies with only one time slot. So why can they obviously be identified when Aaronia does the tests? It did take us quite a while to find out how this can be "possible". Just don't use a purely pulsed signal, but a simultaneously pulsed and unpulsed signal (This does not exactly correspond to the GSM-reality).

As already described by us, the Spectran can also often identify unpulsed signals (CW). When setting the generator on pulsed and simultaneously CW, the Spectran finds the CW-signal, and from time to time also a part of the pulsed signal.

With respect to the other photos of Aaronia, we can only say at this point of time that again the pixels of the pseudo frequencies are missing, and that the Spectran is well able to find the set average level of UMTS on the generator, fact we also showed in our test. **Fact though also is that it cannot find the up to a 20-fold stronger spicular pulse peaks (see crest-factor) which are immensely important for the biological evaluation.**

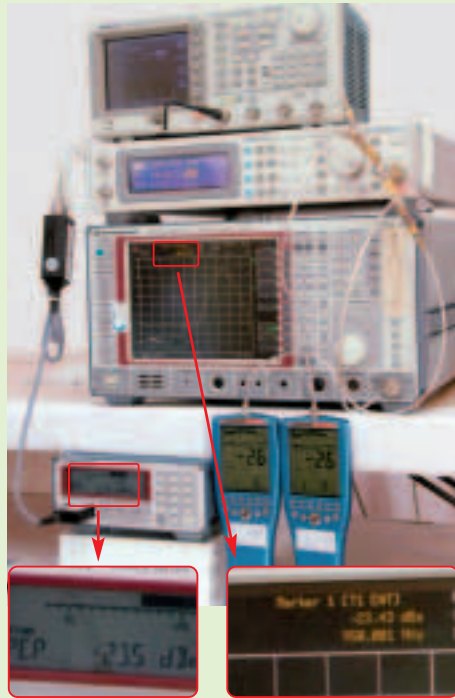


Fig. 22: Test setup similar to the first test, only now splitting the signal in four equally strong levels. This way we were able to additionally connect a PEP-meter (Peak Envelope Power) and so test two devices at a time. The signal used was a CW-signal 950 MHz. Settings on the Spectrans as suggested by Aaronia. Setting (Hotkey 7) and Shift-button (Peak) The same laboratory measurement technique was used for this test as for the prior test (see page 15), however with an additional

- Power-Meter Rhode & Schwarz, NRVS, serial no. 1020.1809.02 calibrated on 07.10.2005, calibrated until 07.10.2006
- Peak-Power Sensor, Rhode & Schwarz, TDMA-Model NRV-Z32 serial no. 1031680704, calibrated on 07.10.2005, calibrated until 07.10.2006
- as well as additionally equal splitters, DC-blockers, attenuators and cables

One possible photo-optical way to achieve the favoured measuring results:

1. "Real" GSM signal to "real" Hotkey 7 GSM 900

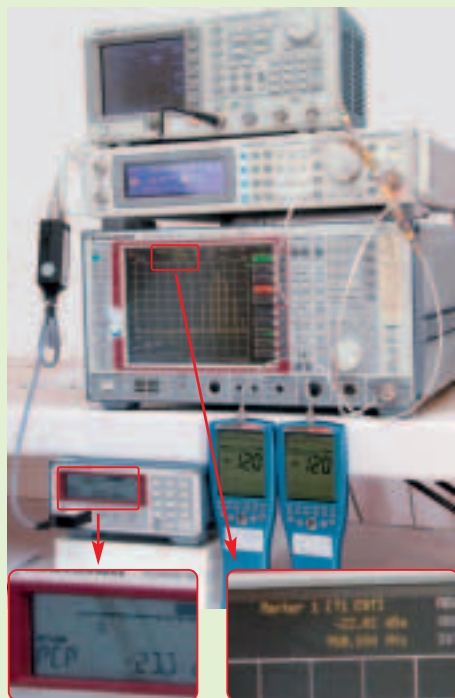


Fig. 23: Setting at the frequency generator rIFR 3416: GSM MSK-8PSK,(Down/Forward-Channel)1 Frame, Rise/Fall Gaussian, 15 µs Rise Time, 15 µs Fall Time, no disturbances. Burst Data: Tail 3 bits Zeros, Data 58 bits PRBS Type PN 9, TSC 26 bits TSCO, Data 58 bits PRBS Type PN9,Tail 3 bits Zeros,Guard Long 9 bits Ones, Burst Control RF bursting, i.e. full pulse; Spectrans on Hotkey 7.

Results:
The Spectrans do not find a signal. This is identical to our prior test

For these tests again we used the same Spectrans HF-2025E Rev.2 and HF-6060 Rev.2 as already used in the test on page 7.

2. "Real" GSM-signal to "inadequate" Hotkey 7

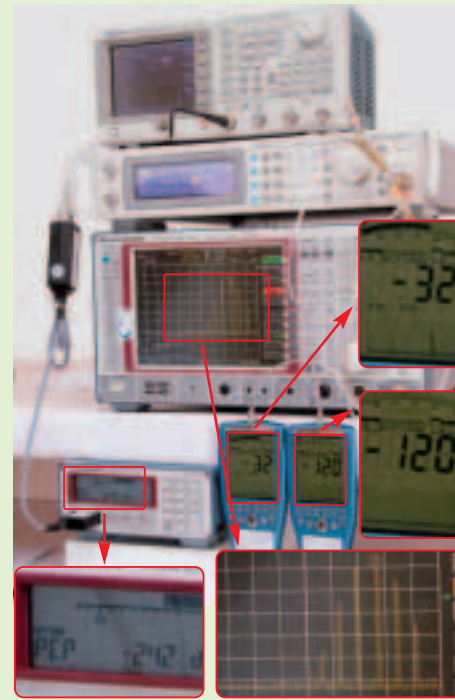


Fig. 24: Spectran on Hotkey 7 and additional Shift (Peak-Modus) burst control RF Bursting, i.e. full pulse.

Result:
The Spectrans HF-2025E Rev.2 and HF-6060 Rev.2 can only find a signal from time to time, the level of which, moreover, is displayed far too low.

3. "Bad" GSM-signal to "inadequate" Hotkey 7

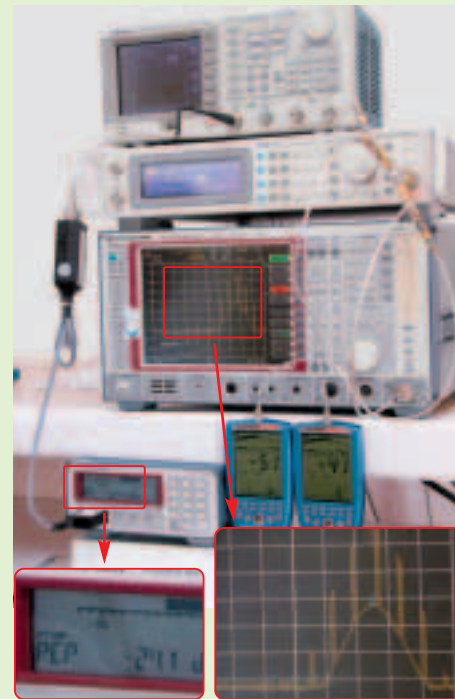


Fig.: 25 Spectran on Hotkey 7 and additional Shift. Burst Control IQ Profiling, i.e. approx. 25 dB pulse, rest CW. (does not correspond exactly to reality). CW = continuous wave

Conclusion: The measuring results presented by Aaronia do not in the least correspond to the results achieved in our precise test-series.



Fig. 26: Continuously finds varying levels.

Result: One could assume the following: The GSM 900 setting, for the majority of the customers (Hotkey 7), ignores strongly pulsed biologically active signals. Which customer knows prior to measurement which frequencies are available. Hence there are hardly ever complaints towards the producer of the "measuring instruments". If in need of an opportune result, the settings have to be changed for laboratory measurements. The consequence: measurements are made of anything (possibly even of what was intended to measure). Therefore, the customer is left ignorant about strongly pulsed exposures, and unpleasant questions can be avoided. After all, the sufferer is not the producer of "measuring instruments".

Malfunction due to overcoupling can in part be detected by the customer himself, as he will in reality also find CT1+ telephones, for instance, which will then be indicated as GSM 900 (D-net) mobile radio transmitting antenna.

Comment on the protocol of IMST GmbH, Kamp-Lintfort dated 14.03.2006

(Basis: Download of the Aaronia-homepage www.aaronia.de on 17.03.2006)

The first sentence already states that the setting of the reference unit and the calibrated Spectran ought to preferably be done simultaneously. In reality, however, the settings are pretty unequal, as shown in the following illustrations. Fig. 27 and 28 show the photos of the IMST protocol.

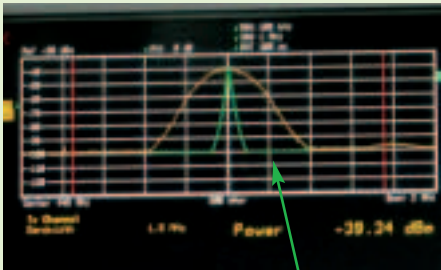


Fig. 27: Reference spectrum analyser FSQ 26; Source: www.aaronia.de

The green signal line was plotted by Bürgerwelle. This is what the signal would look like if the same frequency settings had been chosen as on the Spectran shown in fig. 28.



Fig. 28: Evaluation: Now the green signal in fig. 27 does not have much in common any more with the Spectran "frequency peak"

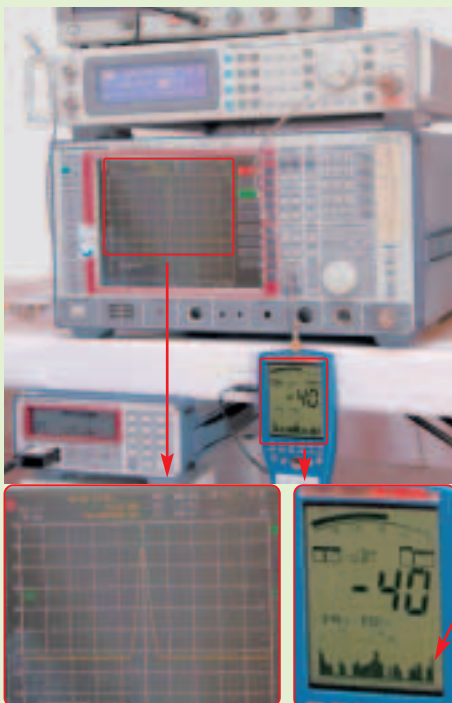


Fig. 29: The Spectran HF-2025E has the same settings as the FSQ 26. We purposely worked without a splitter here, in order to have the same conditions as at IMST.

Result: The Spectran shows a completely different display report and moreover finds an inexistent second frequency (see pixel field). It requires several minutes for the measurement of the GSM/Edge signal.

The following pictures of the IMST protocol will not be commented here – you can see for yourselves that the display reports of the FSQ26 and the Spectran are completely different. A better comparison of the displays would have been possible, by the way, if the devices had been supplied with exactly equal signals by means of a splitter – as done in our measurement configuration.

Ref. to 1.3 Measurement of a WLAN signal

The comparison of the WLAN measurements can only be commented when a level is detected, as the Spectran only records this type of signal in the form of a black bar on the display (comparison impossible). Given the settings suggested by IMST, the Spectrans will find WLAN signals even if there are no such signals in this frequency range. If, for instance, there is a signal at 895 MHz (GSM uplink frequency range), it will suddenly identify a WLAN. In practice this would mean that you might for instance be searching WLAN with the suggested setting, while next door somebody is using a mobile phone in the GSM 900 net (D-net): the device will identify WLAN. But how are you supposed to identify an alleged WLAN pseudo transmitter, if it doesn't exist?

The IMST protocol of measurements with the Rhode & Schwarz equipment neither includes serial numbers nor specifications considering the date of calibration or the end of calibration period. IMST failed to carry out necessary tests with differing settings on the Rhode & Schwarz Spectrum Analyser and the Spectran HF-2025E.

This is what made the results in favour of the Spectran possible in the first place. For this reason, the IMST protocol of the "measurements" cannot be considered supportable or representative.

Surprisingly enough, upon a renewed download on March 20 of the same test page on Aaronia's website under the sub-topic "The IMST results", the following alterations were to be found: "...detailed measurements..." at IMST had been changed to "...several hours of measurements...".

Our test took a total of over 7 days.

It is necessary to get well acquainted with the operation of the devices subject to testing in order to avoid operating errors and unfair evaluations. It is equally necessary to carry out a survey measurement, and to use practice oriented configurations corresponding to the field of application of the measurement devices. How are you supposed to comply with all these necessities within only several hours? However, this revelation shows the IMST protocol in a different light.

Further details on the Aaronia test results and the IMST protocol later in the text.

We have the feeling that there will be lots of news considering measuring devices in short, so we have created a special subject area on this matter on our website under www.buergerwelle.de. Feel free to visit our homepage and inform yourself on the latest news to this matter.

We from Bürgerwelle are curious to see how long the Aaronia "test results" will remain on Aaronia's homepage.

These tests were also carried out fully independently and by Mr. Zwerenz personally. Bürgerwelle would appreciate mailings considering your experience with measurement devices!