

## Rohde & Schwarz FSEB 30 high-end spectrum analyzer

This report is dedicated to all the brave postmen of Innerstetals,  
but especially my favorite postman Burkhard.

Without knowing it, probably went about half of my entire  
Measuring station through his busy hands!

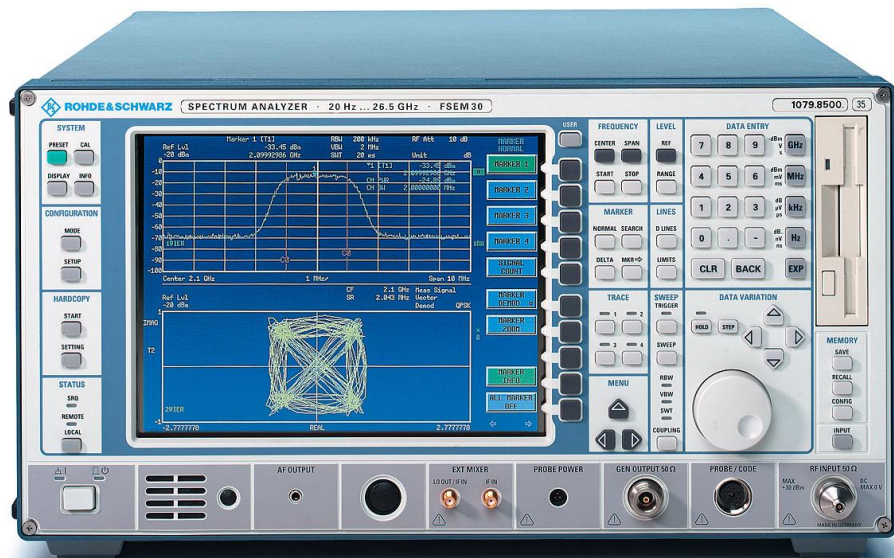


Figure 1: Rohde & Schwarz FSEM30 (Source: [www.rohde-schwarz.com](http://www.rohde-schwarz.com))

## 1 introduction

A spectrum analyzer is designed for RF hobbyists something like the F.Dick kitchen knives for the professional chef. Properly applied, it replaces the radio friend modulation knife HF Pegelmesser, frequency counters, measurement demodulator, BER tester and noise tester. Sure, you can also measure the everything with separate equipment, but actually a good analyzer alone would be sufficient to evaluate all these things. Just like the kitchen knife with which you can cut vegetables not just, but necessary also the cuisine bulls ;-)

The true cooking professional uses his favorite knife that is the same way: the fine chopping onions is done with him with the right knife "hand by hand" faster than the kitchen Amateur electrical Bosch onion chopper brought even out of the closet.

which is something like just with a spēki. He is virtually the "utility knife" of HFBastlers and that is why we should give him in this repair report some attention. was the trigger that I was asked to make measurement reports for a German amateur radio magazine in the future, and since there also such beautiful things as were "Interzeptpunktmessung 3rd order" on the wish list, I realized that this here is a new acquisition in the area would "spēki" initiate. (For the cook that would be probably the sushi tuna knife must always be especially sharp and high performance.)



Figure 2: The equivalent of the cooks to the spectrum analyzer (Source: kochkoffer.com)

Of course I wanted to have particularly sharp knife, because otherwise "I" just do not "I"! ;-). For incorporation into the subject I present to a data sheet comparing different spectrum analyzer. Even different manufacturers! The result was hardly surprising: of course, the Rohde & Schwarz instruments already liked by their specifications forth very well. R & S then, dared with his FSA my knowledge for the first time to the analyzer sector. And they do the same as a great success so successful that sometimes still today these devices are in some Para Matern as a reference. This is also my data sheet comparison, we present example, the data sheet value for the DANL (= DisplayAverageNoiseLevel, so the noise floor) the ancient FSA at  $f = 1\text{GHz}$  there a value of  $-150\text{dBm}$  ( $1\text{Hz RBW} = \text{on converted}$ ) other than newer devices over, we are surprised! Exactly the same thing creates namely "only" the current high-end flagship model: the FSW26! In between are determined more than 25 years and who has ever worked with a FSW26, will agree that lie between the measured performance of FSA and FSW worlds. But not in the noise floor: through an excellent circuit design it is even then penetrated into areas that can be improved even little more today. And even the FSU8 could "only"  $-155\text{dBm}$  drücken- a value which incidentally was also reached in the data sheet of the much older FSIG3 / FSIG3 \* the DANL on. Exactly the same thing creates namely "only" the current high-end flagship model: the FSW26! In between are determined more than 25 years and who has ever worked with a FSW26, will agree that lie between the measured performance of FSA and FSW worlds. But not in the noise floor: through an excellent circuit design it is even then penetrated into areas that can be improved even little more today. And even the FSU8 could "only"  $-155\text{dBm}$  drücken- a value which incidentally was also reached in the data sheet of the much older FSIG3 / FSIG3 \* the DANL on. that are wor

\* Note: For DANL are by  $P = k_0 \cdot T \cdot B$  at room temperature, a physical limit of about  $174\text{dBm}$  (where  $B = \text{bandwidth} = 1\text{Hz}$ ). This means that including it is not eh!

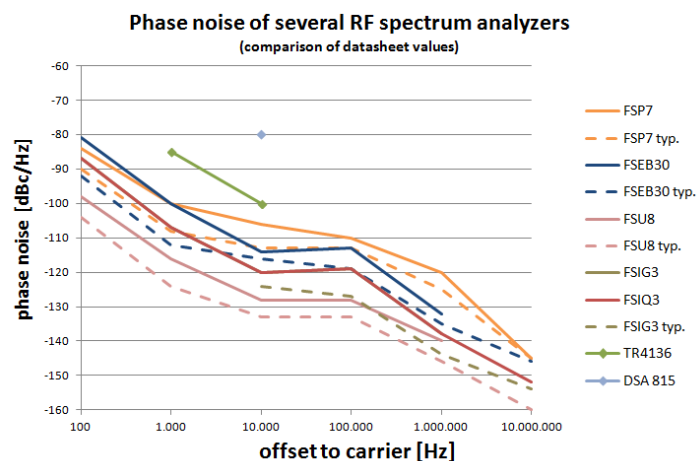


Figure 3: data sheet comparison of some spectrum analyzer (here: Phase Noise)

Okay, so isolated may be perhaps so do not let stand, but at least at this we see parameters that further development has taken place mainly in other areas in the analyzers. So you can with a FSW26 with the real-time option of transient radio transmitter power amplifiers already see and measure before the candidate ever suspect that the tester is equal to press the transmit button. Simply fantastic and I can advise everyone of you who is looking for a spēki and more budget than I, the new real-time enabled to view Analyzer from different manufactures them live at a fair somewhere!

But let us come back to my project wallpaper (= Excel data sheet comparison). After some consideration I have come to the conclusion that the models FSA for me (FSB), FSEA (FSEB) FSP3 (FSP7) would come into question. All these devices have for themselves advantages and disadvantages that must be weighed it. The decision was difficult: first, I ruled out the FSA / FSB models. The performance of these devices is indeed indisputable, but the weight of about 70kg too - for a possible maintenance or even repair an absolute nightmare that still reminds me of SMPU times with a broken disc. I need me today no longer exist, so FSE and FSP remain. Notably the 7GHzVersionen because that would nicely fit my 6 GHz signal generators. So FSEB and FSP7. When FSEB I would find the low phase noise option perfect for me,



Figure 4: Rohde & Schwarz FSA (Source: [www.helmut-singer.de](http://www.helmut-singer.de))

FSP7 is the more modern of the two Analyzer - but has re intermodulation noise and the slightly poorer data sheet values! For this, however, you get an option that you could use my existing signal generators as an external tracking generator for the device. That would have been a certain charm!

The FSEB was once used to be the R & S flagship (or 40 GHz version of FSEB called "FSEK") and makes with regard to the technical data still an excellent figure. But he's just a bit dated - but this can also be advantageous: computer platforms that are based on DOS, are according to my experience always somewhat easier to repair / check / maintain than Windows-based systems because of their lower complexity.. Alone because you can often work very effectively and easily with simple DOS tools.

Ultimately, I leave it to fate, which of the two types Analyzer I will give preference to - after all, it will be difficult enough to find one of the two, then for me is still affordable!

## 2 It is actually ...

Eventually, it is but as far and destiny has its say. It offers me a FSEB30 - without power supply and in otherwise unknown condition. Even if all the components are otherwise necessary are fully equipped, is open. A complete gamblers risk buying also. but significantly less expensive than a certified device from the second-hand market dealers.

I am considering the teeth bite together - and finally propose to. Something else I would anyway can not afford, as a quick check of the used market prices shows; let's go!

And so the story begins.



Figure 5: Rohde & Schwarz FSP7 (Source: rohde-schwarz.com)

## 3 first reporting

The unit arrives and I open excited the box. It seems to be mechanically intact, and the display appears to be scratch- and crack-free. I take off the lid and count the number of modules. Well, all I can no longer do without power supply. Because of course the missing. Although I had indeed known - somewhat frustrating it is at the moment but when you realize it right the first time, what you have there just done: I've significantly spent money on a device that does not even produce an error message. I have no other choice than to screw up again and put on the shelf for "better times". Man! This FSEB30 grant me really that absolutely nothing of joy!

Anyway, at the moment.

## 4 power adapter

A few days later I realize that I have to be active with respect to a power supply when it FSEB30 not remain a "Dismantled-investment", but also to do a bit of fun at least. So I try to figure out the Internet, which part number the power supply ever has. Wrong! Also other search terms "FSEB power supply" run absolutely fruitless! What a "motivating" start for this project!

I contact with the R & S service. Question, the "power supply FSEB30" as spare part. Answer: no longer available. Pity!



Figure 6: Power supply for the FSE series (Source: ebay.com)

but different from what he suspects - and yet my service has helped. The colleagues were namely so nice and have specified the R & S Part Number for this in its reply. And so I manage to find a few photos of the type of adapter on eBay in the USA! A first step!

In these photos, I discover the next "breadcrumbs": the power supply devices Stickers! is there to see that R & S has not even built the power supply, but was developed at the company "Ascom Frako" and produced. Also, an internal model designation can I see from the photo. Google fed with these data, throws me out even a phone number from the Baden-Württemberg Teiningen. I fackele not long, calling on there!

I tell my story, reports of my good fortune to get a FSEB30 without power supply and that I now seeking for one that must have been originally built at Ascom Frako. I will further connected a few times and then actually find a response: to produce even be years, no power supply, now is hot "Delta Energy Systems" and build primarily solar inverters for photovoltaic systems. But I should still even write an email, maybe you can find somewhere still something.

Actually, I had been wondering whether the trouble for this email at all worth it or if I interpret this as "politically polite refusal" and thus easy it should be to be good. But then I remembered on my persistence, they wrote email, hung the few eBay USA images off (more I had not) and hit "Send".

And then happened what, what I would have NEVER expected.

## 5 The power supply

It had been a day or two perhaps because I received a response. A nice employee "at that time" has really busy with my request. Even better, when the AC adapter is no longer produced for many years, he still finds a most-most-last resort, he can leave that to me.

I need to sit down. There's a saying that the initiative is not worthwhile.

## 6 fitting

A little later, the part is there and I'm very excited when I install it in the FSEB. Here, incidentally, another coincidence helps me, Rolf, whom I got to know an eBay gauges sale, is at its measuring Park faced a similar problem and sends me a great, installation guide, which he has specially made for me! This is now a tremendous help out, because soooo simply installing the FSEB-mode power supply is not. The connecting cables must be routed through many corners and there are some hidden screw points to which you would not think the same when you know only the "lowbrow" installation of PC power supplies.



Figure 7: FSEB power supply

Another proof that you like each other helps in the Measuring Instruments Screwdriver community and supported. •

## 7 first mistake

And then I already reached mistake number one. I had not even installed the power supply. In order to create some space, I moved before the assembly "A190 Detector Board" from the tool carriers - and noticed a faint rattling in his mind. "That sounds but not" I still thought and grimaced slightly pained face. I immediately interrupted the power supply installation and opened the rattling assembly. When dumping a piece SMD Elkogehäuse flew me the same counter that matched the sprawling remains of a coal pile will on the board. Au ha - that starts so good. A formal "exploded" Elko on a module with several, sensitive (presumably) FPGAs and processors it certainly does not bode well for my FSEB30 project !!!!!



Figure 8: Assembly A190 "Detector Unit"

Unfortunately, I had no suitable spare parts in stock, so I initially little sad just screwing on the assembly only again. The Elko-coal pile was at least a high resistance and the part looked in the operating voltage as a block Elko. With any luck, the assembly could thus still operate without this component - R & S is mainly backed with so much safety reserves that the leftover block electrolytic capacitors can get over the spent comrades might. At least temporarily, and for the first test.

fully broken •

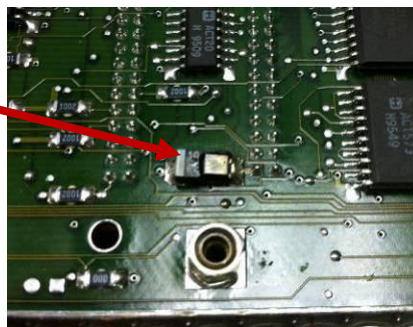


Figure 9: unexploded Elko!

Something disturbing I find the whole thing anyway. An unexploded Elko could reflect a surge experience in the past. This would also fit well on why the original power supply is no longer present. Imagine, the power supply would have due to a defect on the 5V digital supply a high voltage / current surge in the FSEB .... no, we do not introduce ourselves better. It would be too frustrating. Such an event would - for me - irreparable consequences in almost every module of the analyzer leave !!!

## 8th turn on

You can certainly imagine how queasy felt to me when I turned on the FSEB30 for the first time with the new power supply after THIS film has run into my "mental cinema". Now it would choose - lucky strike or Mega bust!

Click!

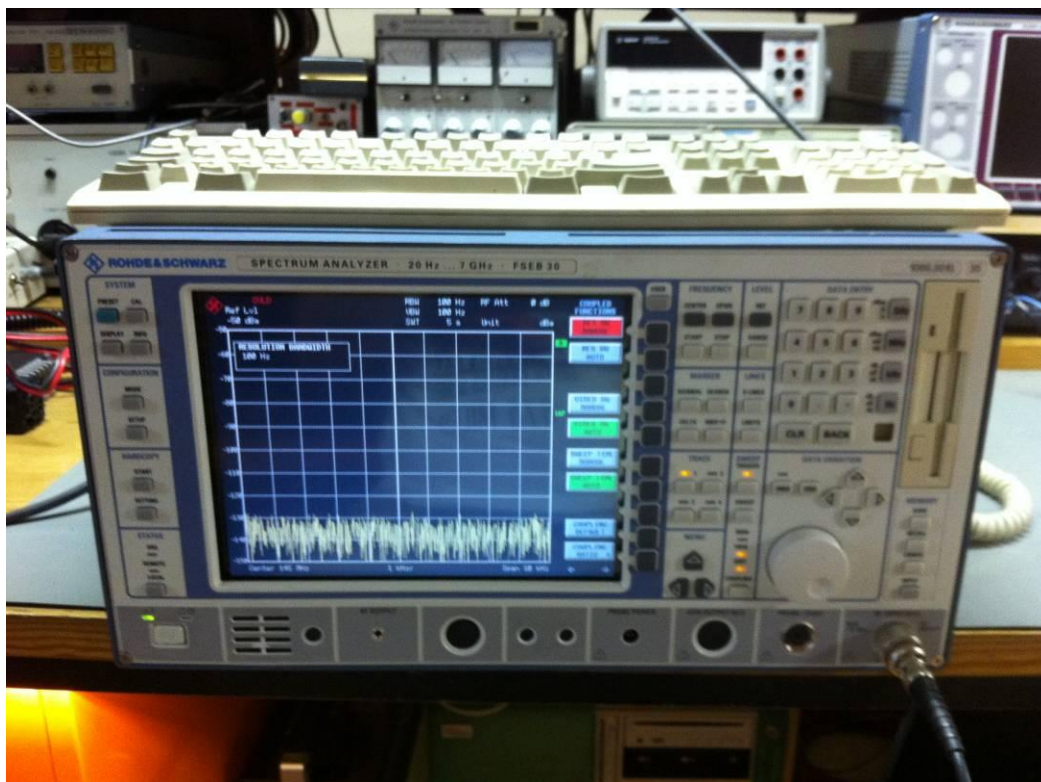


Figure 10: the first sign of life of my FSEBs!

It hums, it beeps, and - I see a first writing in the display: "Rohde & Schwarz, Munich" I read there. What a relief! At least the display module and some parts of digital technology seem to EMP pulse - to have survived ;- ) - if there was ever a

It is even better: the Analyzer boots, successful software downloads books in the digital modules and finally ends with the display of an RF noise spectrum on the screen! If it was not the top left the ugly red "UNCAL OVLD" message on the screen, I would almost say in this thing is probably more intact than broken!

## 9 Other errors

This is very encouraging everything, but I was only just getting started my journey. First I had to get my bearings and even learn how to use this device! Fortunately, I come up with R & S devices but basically actually just fine, so I knew within minutes that (ie the basic model) My FSEB30 holds actually for a FSEA20 that the device can not read any calibration data in the RF module, some mysterious "reference mapi\_cal.c" is missing and the part falls full on the nose during self-test course.

But at least - for a purchased as "spare parts warehouse" device wit and explodiertem Elko in the Detector Unit works but actually still quite a bit! It could have been worse!

And another thing is very surprising: the attenuator has seen just 2,500 cycles according Diagnostics menu only - which is almost nothing! SME / SMIQ / SMT attenuators for example, are for a minimum of 5 million (!) Thus switching cycles spezifiziert- likely to still call this assembly as almost "brand new"! Anyway, the device looks not great "runtergeorgelt" nor "used" clearly. Therefore I do not suspect it in the production of a company, but was used in a developing area. That would not be bad, because most of these devices will have significantly fewer hours of operation under its belt. However, then also assumed that the part the cost of annual calibration and service wurde- not regularly maintained as is a company mostly just there,

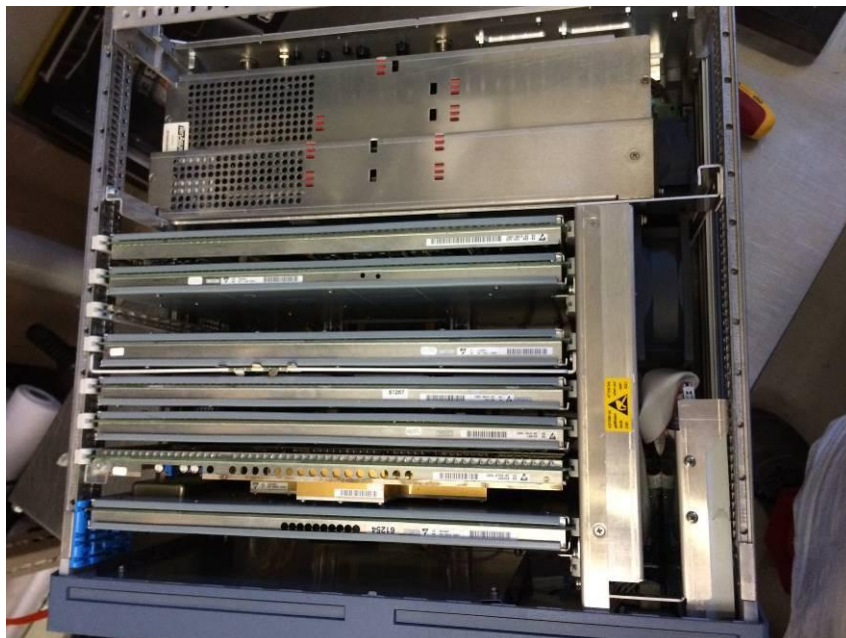


Figure 11: My FSEB30 from inside (without power supply)

As always, it is also - despite its spare parts inventory status this FSEB are amazingly new, after which already the light blue decorative border around reinterprets the screen: with most devices that can so see on the Internet, which is namely purple. Only in the younger unit series

you can see the light blue. Just the way the SMIQ - even as the recent series have a light blue decorative border around display rings.

Another indication is the way the device number. It ends with .35 and also indicates the latest generation of devices. \* However, what was it changed from the previous series \*, I can not say until today unfortunately. Maybe it knows one of you write me, that would interest me.

### **9.1 button away**

In view of the apparent relative youth of my FSEB surprises me all the more that it actually has anyone managed to pull a key from the keypad out! Instead of "EXP" button next to the numeric field a gaping hole in my device. Since you can not change the keys individually, but part of a common keypad rubber mat are (the so-called "Keypad"), I'll probably have to change the entire part. But first further see if I ever really get the box to work, because this kind spare parts are usually quite expensive and therefore I invest the only when the rest of this FSEBs really works here.

### **9.2 VAR wheel**

I still falls on what: the VAR-wheel grinds somewhere. Not bad, but just not appropriate for a second analyzer of Ten Thousand Euro class. So I write the point on my list.

### **9.3 stand feet**

Well, then, of course, missing a few of the side small plastic Gnubbel on which the device is when you park it sideways during transport. Trifle, but important detail to complement a perfect appearance.

### **9.4 SMB cable without a goal**

When viewing the module is I have noticed that there are on the bottom two SMB cable without a goal. At first I was worried that with my spare parts store - next to the power supply - may be missing other modules. But it seems to be emerging is that in the insertion shaft to the lead the two cables, actually can put only a tracking generator or preselector assembly. Both are options that you can install in FSEBs subsequently to extend its functionality. At the moment it looks almost as if this device had previously plugged one of these options, you had but then expanded than had then written off the Analyzer as "spare parts warehouse without power supply."

, Worries me with this idea, however, that by no means certain that the RF front-end is still intact. Even that could have been taken from my spare parts stock as organ donors - as a replacement for another device. A very ugly thought, for an RF front-end for an analyzer that performance is almost a total-

hurt the same. And the self-test error, the RF unit is not encouraging. But anyway, so easy I will not let it get me down.

## 10 overview

On my list now following points are:

- Change Lithium battery (date / time / Config)
- Setting the correct device variant
- Calibration data in the RF module can not be read
- renew lateral stand feet
- VAR-wheel grinds
- renew Tastaturmatte
- two SMB cable without a goal
- RF front end heal?

## 11 lithium battery

I begin my repair order to replace the equipment probably empty battery. From my experience I know that in computers and measuring the craziest things can happen if that is empty. And since the FSE is based on an industrial PC, has the certainly a battery. The PC part is mounted in a separate shielded enclosure below the power supply and can only be opened when the power supply is removed. So get out the power supply!

Thanks to Rolf's instructions but this is done relatively quickly and already a little later shows me my multimeter that this battery is completely "down". So, new battery cable ties, out with it pure, drum Adhesive labels with the change date on it, and - no, not assemble again!

Too big is the lure, the built-in hard drive that is openly accessible now to examine in more detail!



Figure 12: expanded processor board

## 12 Disk Image

Let's say it's an investment for a rainy day. But I have got used to read in any device that I have here on the bench as much as possible to firmware and to store a backup copy in a safe place. While it is very rare that I myself sometime uses these backups, but I was able to make several other people on this globe happy by I could send them the read firmware for a multimeter, a calibrator or a radio tester.

So I will try also first and foremost a hard copy of the FSEB30 to make before I fumble around them something. I'm doing that is doing something wrong, I could undo part in an emergency coming back to its initial state by simply playing back the disk backup. So, it is worth it to invest a little time.

It turned out that this backup would be one of the most complicated I've ever done! But just read on!

The procedure was as follows:

1. Developing FSEB hard drive.
2. Insert the hard drive in my old 200MHz Pentium MMX laptop. inside it has a connector that fits coincidentally.



Figure 13: old laptop with built-in hard drive FSEB

3. Because of the laptop with the FSEB hard drive, of course, does not boot, I need a (DOS) program that you can address the inserted FSEB hard drive and copy. From old DOS times I fish a Norton Ghost V6.51 floppy diskette my! A super cool program that was, unfortunately, nowadays replaced by newer (and in my opinion much more complicated).

4. Once the laptop with Norton Ghost has been booted, you can see partitions so that FSEB hard drive with its (partly. Hidden!). A first success!

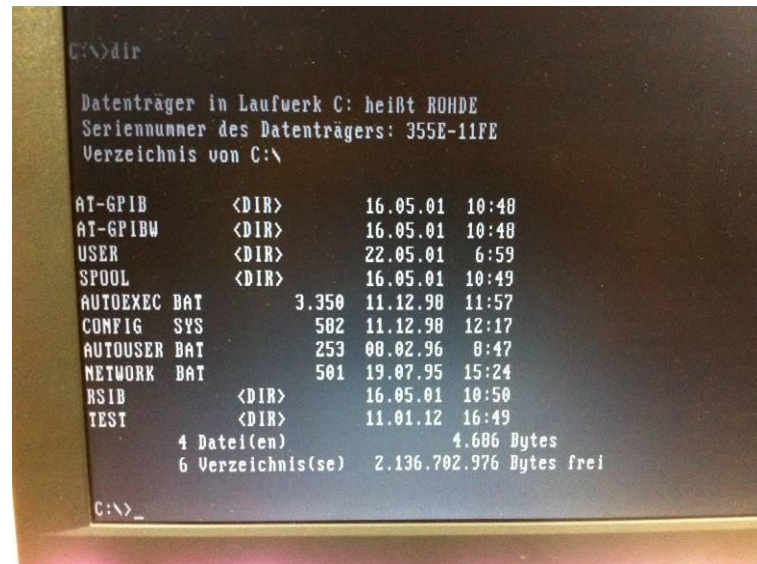


Figure 14: a first partition is visible!

5. Now it comes: while but I play the backup? There are, after all, something to 90MB. To a floppy disk that does not fit and a CD burner is not my old laptop.

6. So boot second PC with Norton Ghost and (by Laplink cable knows anyone still ;-)) transfer the image to this second PC?. The great: Norton Ghost supports this connection by Laplink cable! Really a great program !!!

7. Now I have "only" the problem that even my old measuring station PC has a formatted with the NTFS format HDD. Unfortunately Norton Ghost V6.51 does not recognize the program is it just simply too old. So:

8. Remove the hard drive from the measuring station PC and poke another from the junk box. The then format under MS-DOS FAT32, because that can read Norton Ghost.

9. Then again boot the measuring station PC with Norton Ghost, infected Laplink and connect with the laptop. Works. NOW is finally recognized the measuring station PC hard drive and a dubbing of FSEB data is on my tester PC nothing in the way.

10. It takes about half an hour until all the data is copied. But never mind, as have a fully automatic coffee at home, so it will not be boring ;-)

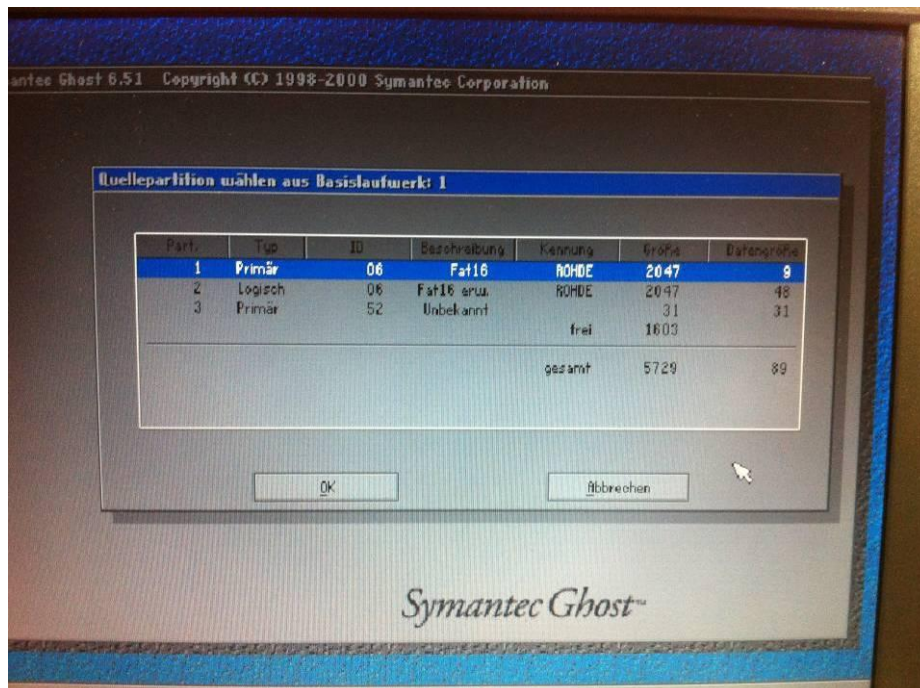


Figure 15: in reality there are but three partitions!

11. The image of FSEB plate is made and is now on the hard disk of the measuring station PCs. Because there but is no operating system on it (I had so fresh DOSformatiert), now the question is how I get it now shut the image back to the store!

12. idea: crack case of an external USB hard disk, the hard disk therein out and install the measuring station PC's hard drive instead of those. Then connect it to a standard Windows PC via a USB connection.

13. It works: the hard disk is recognized and I can built -in the USB hard drive enclosure - access it!



Figure 16: DOS disk in ext. USB enclosure

14. I successfully copy a 90MB large Norton Ghost file with the extension \* gho. In this gho file, the three partitions of FSEB hard drive - it would interest me burning to it take a look here!

15. So I research something and find the so-called "Ghost Explorer". A free software for Windows PCs, with the read one \* gho files and snooping on file level it can.

16. The Ghost Explorer extracted successfully the three partitions of FSEB hard drive and copied out all the files contained in it, so I can now read with the simple Windows Explorer.

17. Finish !!!!!

What made a hassle, but it is now. Should something go fully in the pants in further repairing my FSEB, I can thus restore the hard disk contents at any time. Also, I can now look at how the calibration files look like, the RF unit obviously still missing. but unfortunately I do not know exactly where the are and how they look, so I now brings to the ....

## 13 Service Documents

In my last report on the repair SMIQ06B I've learned that you have to invest what is sometimes, in order to successfully carry out repairs. A key issue is always the service documents, which naturally first tried every private hobbyists, downloading free somewhere on the Internet.

With all due respect for this approach but it will be increasingly get in trouble with the newer generations of measuring it. On the one for which there are very few service manuals in the world. The reason: while earlier in each portable radio nor the wiring diagram with it was, it has been found over the years that only very few of the customers need these documents at all. Many customers take the schematics of delivery of the meter anyway equal in the bin. The manufacturers have realized and supply the circuit documents only when explicitly ordering. Naturally, I would do the same. but has the disadvantage that, therefore, much less Manuals are printed at all.

The second hurdle is that - the new devices are - the repair is generally more difficult, because more and more SpezialKnowhow- and / or modern production techniques are needed for that. I do not mean that in the old equipment less brainpower than put in today and repair therefore becomes more difficult. No, it is about the availability of the necessary software tools or service adapters for repair sometimes necessary.

Nowadays, even the professional workshops of the manufacturer in front of real challenges when off a 128pin DSP from the IF assembly clean and again one-

need to solder. By amateur means almost hopeless - you can actually just replace the assembly in such a case against a functioning. The advises a way also the service manual of the manufacturer - because also know that a systematic fault finding to component level in such a complex digital part is almost hopeless!

So let's summarize:

- Schematic hardly needs an end customer
- Diagram in extremely complex digital modules almost useless (DSPs, processors, etc.);
- Approach similar to the repair of a PC: Tracing component level does not, only module exchange (eg, motherboard, graphics card)
- even if defective component is found: sometimes, therefore, then remove and reinstall overwhelmed the abilities of the workshop, here module exchange

Now you will understand why service manuals are so incredibly hard to get for the new devices. Anyone who knows my repair reports, knows who comes in now in this situation:

## 14 Rainer Förtig

The Copy Shop Zwingenberg under the direction of Mr. Filbert Fabian ([www.rainerfoertig.de](http://www.rainerfoertig.de)) is for me one more time the first address in town. It is actually managed to find an original, full service manual for FSE. On his website you can now order copies of this manual - which for some modules (RFUnit, IF Unit) contain diagrams!

I fackele not long, but order equal to the entire manual. It will happen very quickly, because I will know that I could never repair the FSEB without this book. But read on.

## 15 default

After the lithium battery has been changed and I had assembled everything, I would have expected that the analyzer would now adhere correctly for a FSEB30. But think!

The old sow still considers himself a FSEA20. Hmmm .... the FSEB30 should nevertheless have been a FSEA20 the end? No, based on nameplate, unit number and the label MUST have been a FSEB30. In addition, the module configuration (LowNoiseOption with OCXO, and FFT filter) indicates necessarily indicate a '30s version.

I flip to the service documentation that I have now received from the copy shop Zwingenberg. Lo and behold, there is a service function, with which you can set the device version! So go ahead, typed password, service function afterwards - Bingo! The device now committed to a FSEB30 and the view of the installed options (B4 and B5) is true at one time also. And also the frequency axis will be shown to 7GHz - rather than, as before, only to 3.5GHz!

Toll, a first success!

Then again off and on, actually; setting the correct device version was preserved thanks to the new battery.

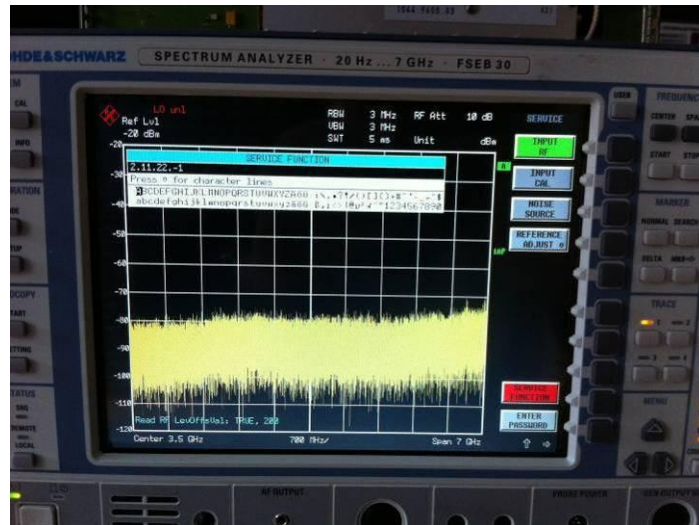


Figure 17: FSEB in starting a service function

## 16 RF Unit

Next construction site: the lack of calibration of the RF module. It seems as if the EEPROM that contains the calibration data is either empty or can not be read via I2C bus. I tap first to a hardware error and try to find a hardware error in the module by operating voltages. That does not succeed, everything seems to be fine! Strange.

Then I flip the service manual and find a function that lets you write the data of the EEPROM on disk or can read back from there. I'm trying. First reading, without success. Then writing, then reload. And I'm floored: suddenly disappears the error message! Do not ask me what happened exactly whether the FSEB may have restored a backup of CAL data somewhere or whether a bit was flipped somewhere in the EEPROM (possibly still a EMPImpuls by a faulty power supply ;-), but I note : the assembly appears to be by inviting the CAL data now satisfied!

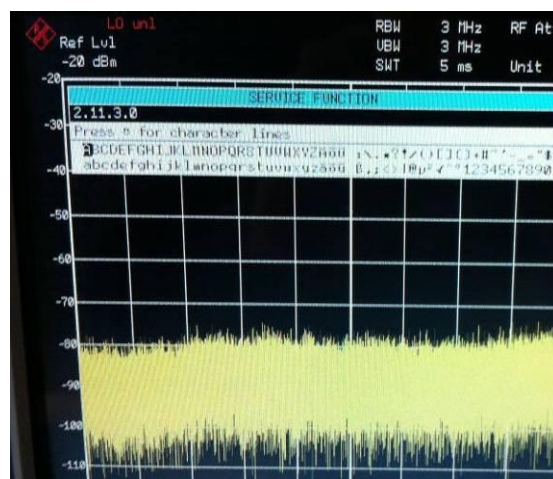


Figure 18: successful transfer of the EEPROM data

## 17 The breakthrough

Unfortunately, I still see the error message "LO UNCAL UNL" in the display. A fed-100MHz carrier looks somehow not really "right" from.



Figure 19: something is not right yet ....

It seems as if the RF unit does not get any one LO signal or at least the way "broken" goes. So I want to check the electrical interfaces first. For this, I toss and turn again the manual and get stuck in the wiring diagram. Actually, I just wanted to see what kind of signals as in and out going. Even one of my infamous rag drawings I make. But at some point I stop short.



Figure 20: nanu ...!

According to a summary table there are also different cabling for the various versions of the FSE's! Has here maybe someone ....

I can not believe it! The wiring in my FSEB definitely not right with the diagram of the manual match! To really make sure I paint the correct configuration for me (30s-model 7GHz, FFT filters, OCXO) in the picture and put the lines in my Analyzer according to to.

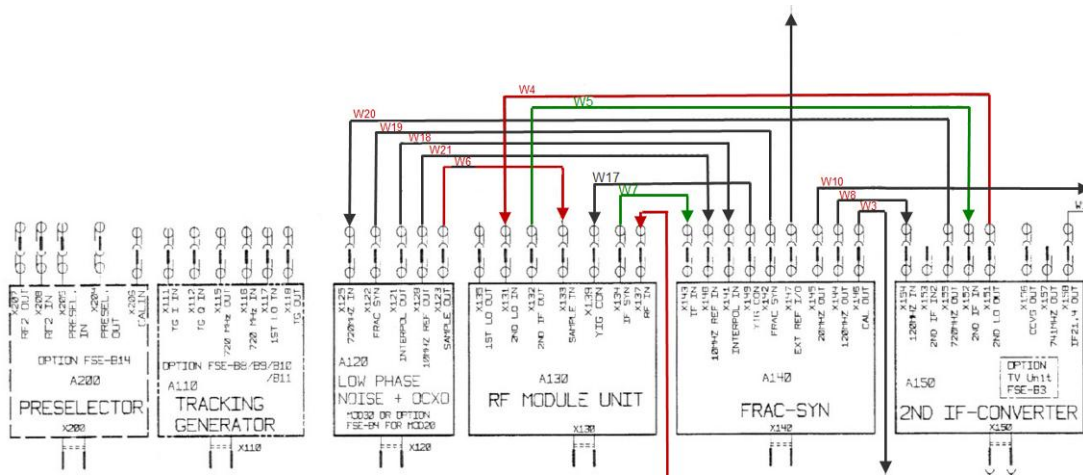


Figure 21: Excerpt from the module cabling plan

I turn on the device and my breath when I press the "CAL ALL" button. Naturally the FSEB30 rattles through all the self-test and self-calibration. I have left to do anything else to press than at the end still on "OK" and stunned to see how all error messages disappear from the LOG and off the screen.

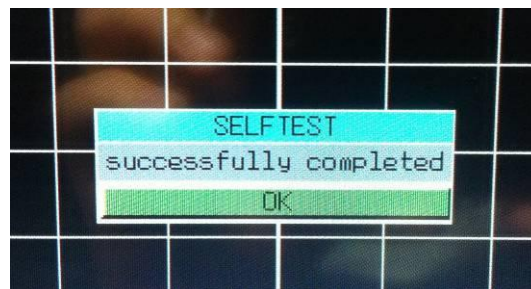


Figure 22: This looks ever VERY good!

With a little trembling hands I dine a 6GHz signal one ... the RF front end really should still intact .....

Indeed!!!! Heal !!!!!

## 18 intermediate sector

Man, what I have come back for a fluke. It seems to me it actually managed to have a spare parts carrier running again and shot me in the high-end analyzer class! Of course, there was a risk it would have on the thing after a power supply failure and everything can be broken. Even had the unit can not necessarily be complete. But all theoretically possible breakdown despite stands just a dream Analyzer with trim in a soft light blue, which reaches the FFT filters a noise floor of less than -160dBm (remember: physically induced minimum of 50 Ohm at room temperature is

-174dBm!) And it calculated noise figure of 14dB thus pushes forward even in areas of radio receivers.

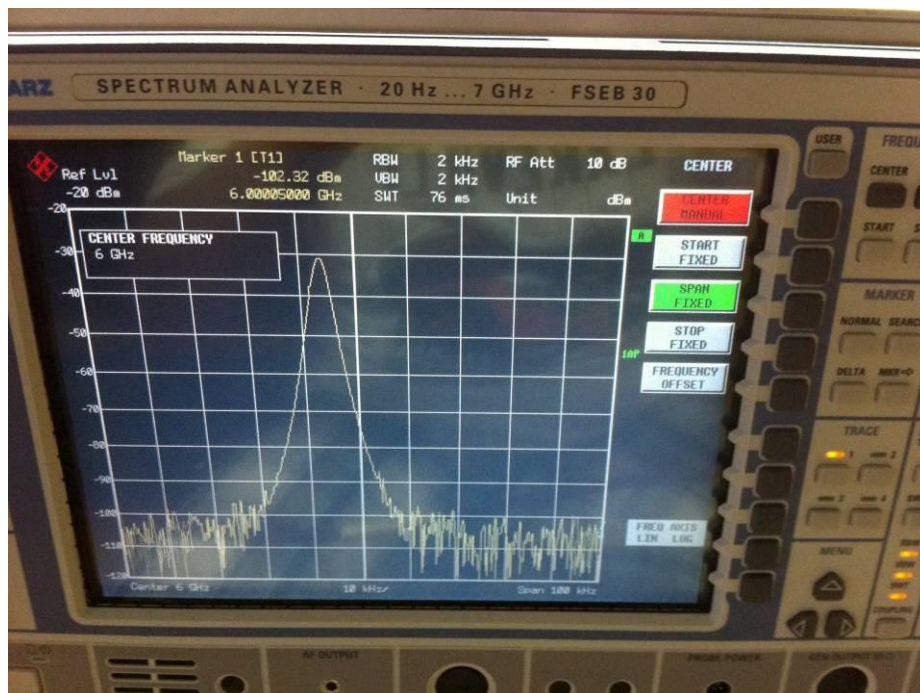


Figure 23: the first, reasonable signal shown!

I decide that I do now this device really nice pretty and monetary terms some wants to invest. Because much further forward it is hardly possible for a hobbyist!

The FSEB30 is a dream analyzer and an excellent platform for useful extensions such as tracking generator or vector demodulator. In heilem state some instruments dealers offer him just for high nearly five-figure sums! Okay, I think that's bad high side a bit, but still: a FSEB30 you get not thrown behind on every street corner as ebay bargain ebay bargain between and ambitious ;- ) instruments dealer is somewhere the truth. So it's worth in any case to give the unit the (financial) attention that it deserves.

## 19 Dress up

### 19.1 Tastaturmatte

Now that I know it will be worth it, I'll take care of all the little things that could only tarnish the FSEB experience somehow. The missing button on the rubber keypad mat part because certainly with it. As always, I try the Internet Form of Rohde & Schwarz website and formulate my spare part request. A short time later, I consider an offer for the spare parts in hand. Well, not exactly given the part, but at least I get there and it has indeed not asserted that Ferrari-driving is inexpensive spectrum analyzer luxury class. So unsheathed paid the wallet and the preliminary bill. (Unfortunately, it is still the case that you have to pay in advance before anything is sent out to a.)

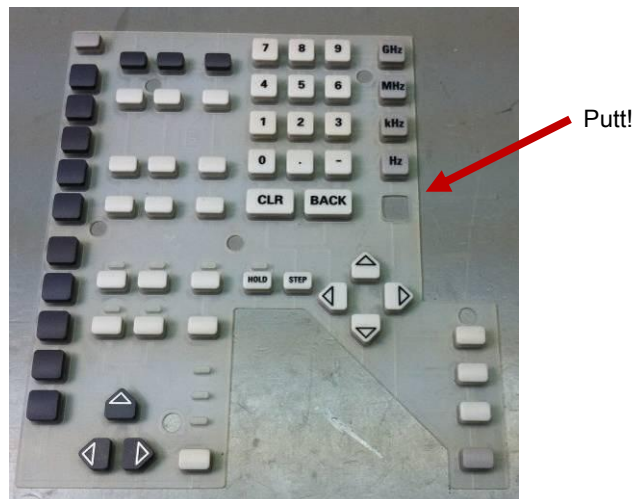


Figure 24: faulty keyboard mat

I ordered along a couple of broken plastic feet that should be naturally replaced with. Finally, the Analyzer will 1a look back when I'm done with it!

The installation of the keyboard pad is a little tricky because you have to remove the entire front unit to it (by the way, also a few hidden little screw top and bottom of the round metal frame has). Once you've done that, you split the front unit, the display is expanding and the VAR-wheel board. Why? Because you only approach is to all the little screws, with which the front panel is held forward! A good chance incidentally to clean the display glass and to take care of the grinding wheel VAR. But more on that later.

Once the front panel is off, you can see the keyboard mats (there are two) refer. Before I begin the new inlay and assembly, I take the opportunity and cleanse the removed front plate in the sink with detergent. With geputztem display, new keys and purified panel of FSEB looks again from ten years younger!

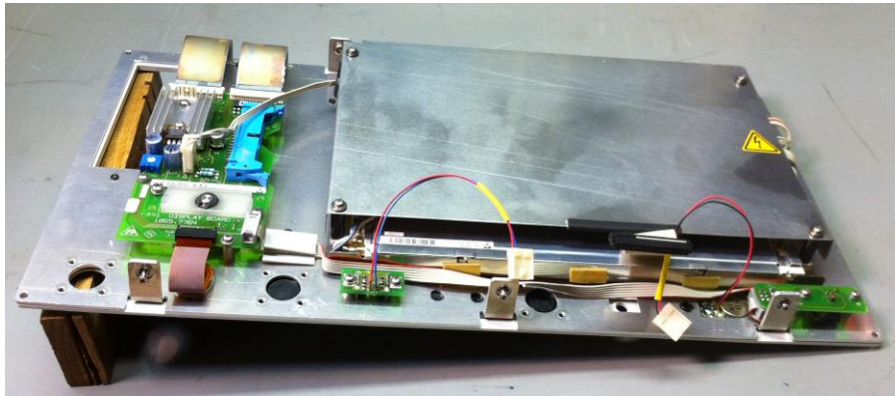


Figure 25: Front panel equipped with display and VAR-wheel



Figure 26: Removing the display cover

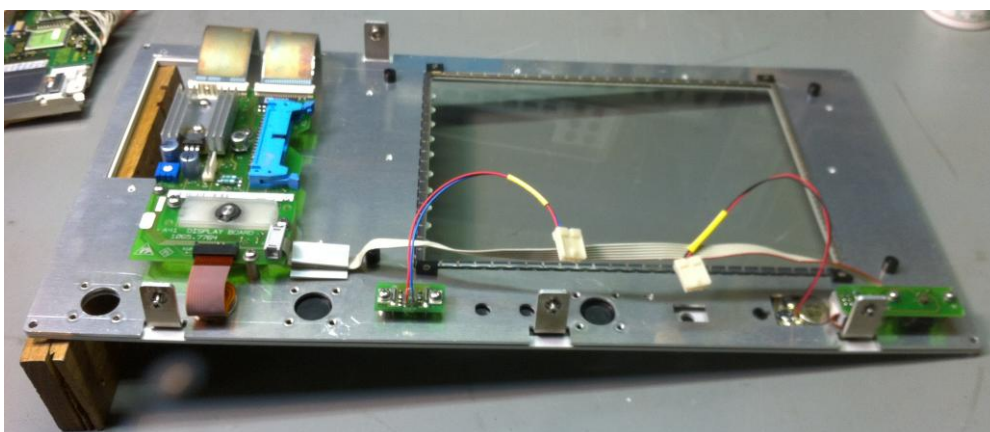


Figure 27: Display is out

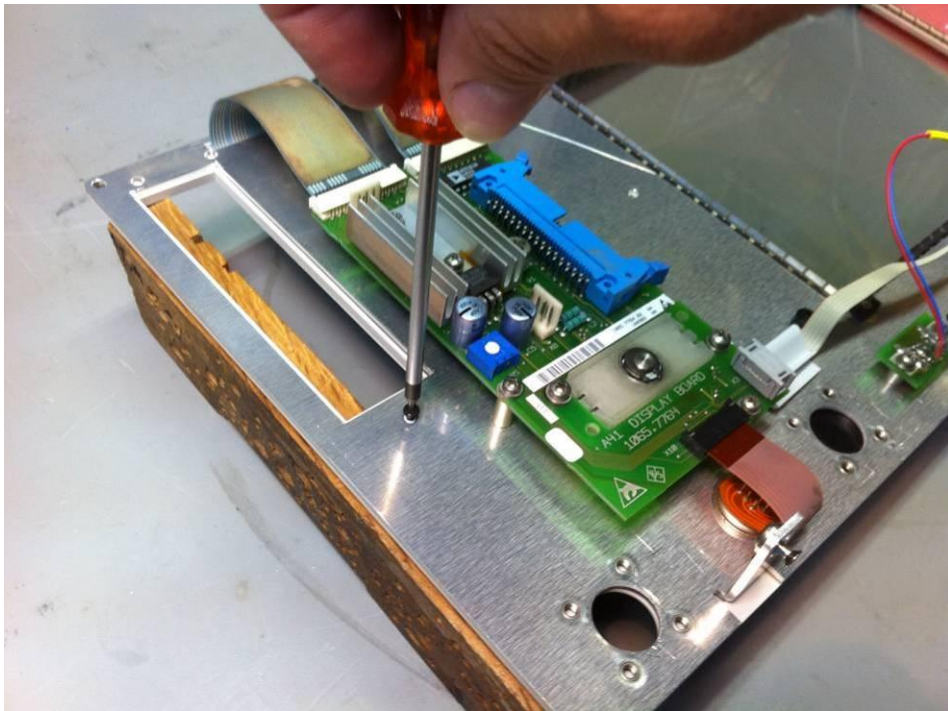


Figure 28: hidden cog

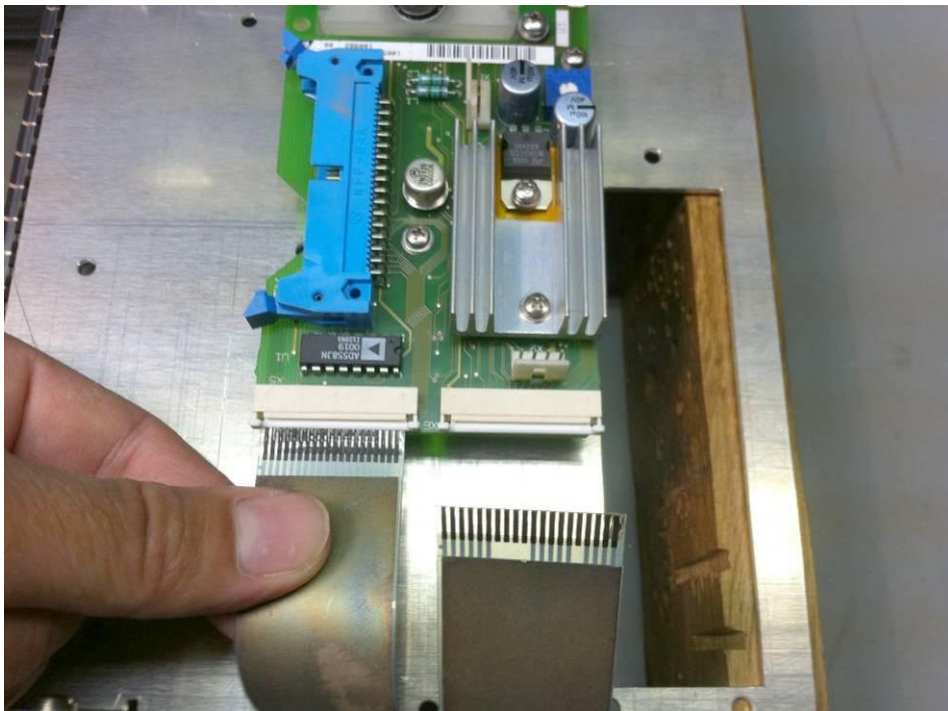


Figure 29: disconnect terminals of the keyboard sheet

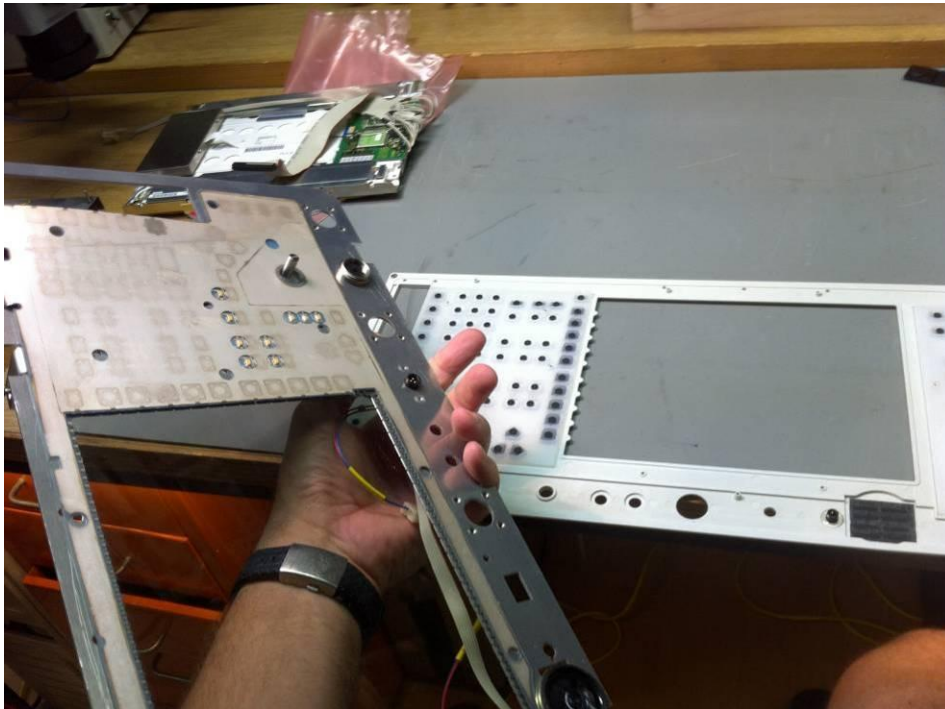


Figure 30: Front panel is now looking at the keyboard mats

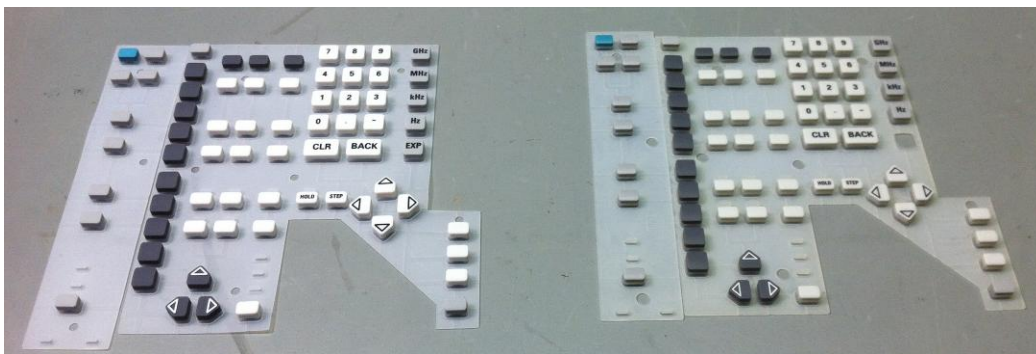


Figure 31: Keypad - old and new

## 19.2 VAR wheel

How convenient that it also works equally as close to the VAR-wheel assembly in the planned keyboard mat replacement. Since the expansion is not difficult.

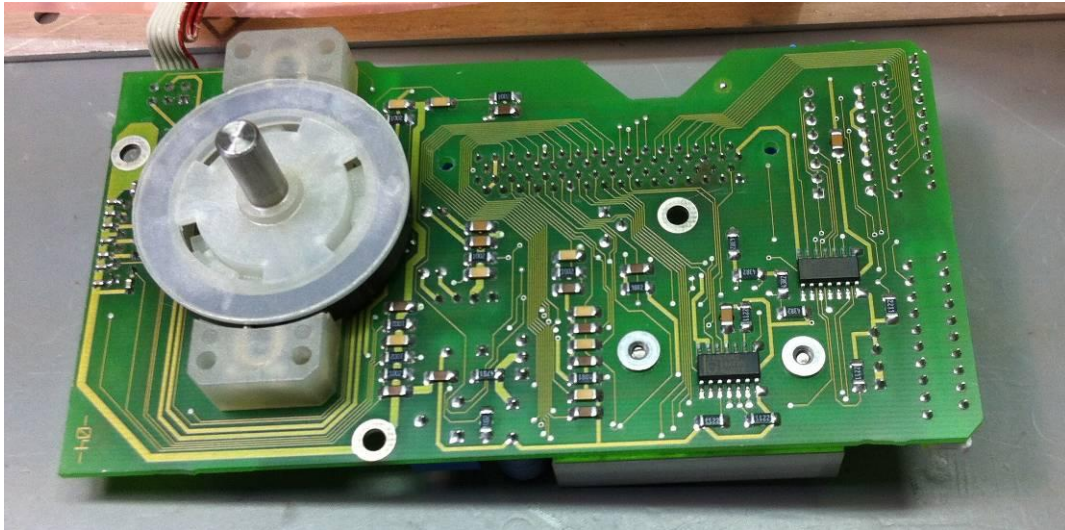


Figure 32: VAR-wheel assembly

I examine the grinding noise. They show up when I zwirbele the VAR-wheel axis very quickly between the fingers. So I build the part apart times.

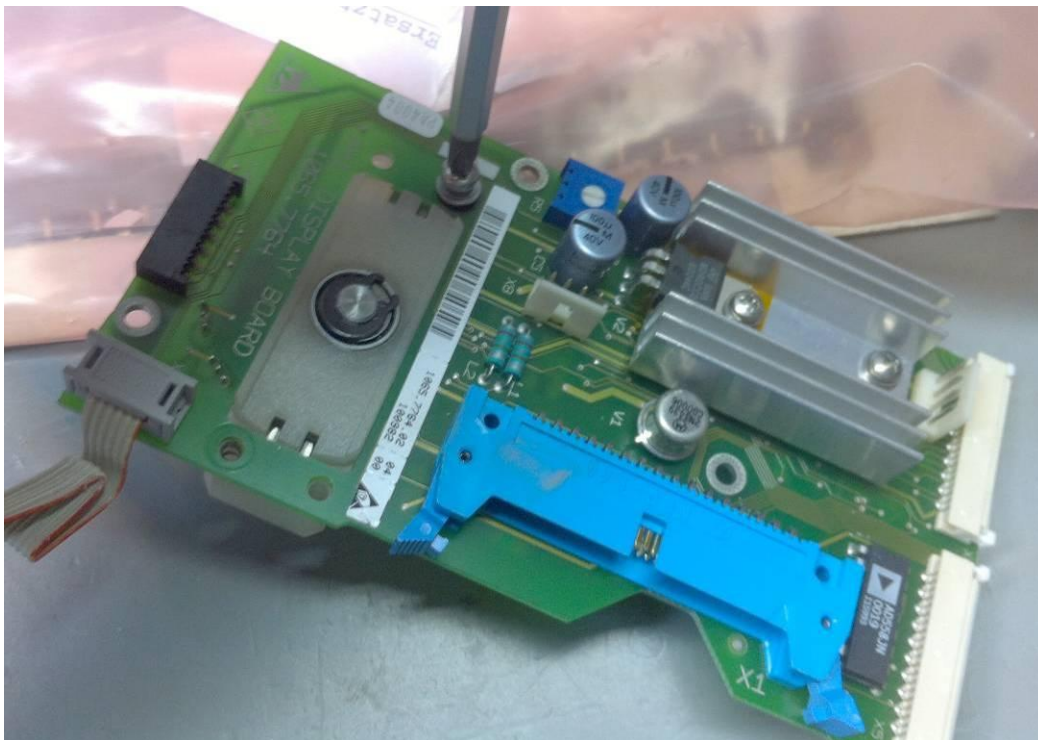


Figure 33: the rotary unit of the VAR-wheel assembly unscrew

Here, too, shows again that the manufacturer's equipment for intensive use oversized. The axis, ball bearing metal twice! The screening takes place magnetically - that is completely free of wear!

I'm always happy when I see such solutions, because just today I discover especially when disassembling of consumer devices but some Jökelkram "solutions" in which I simply only bad. Even without extensive testing because I can already tell by mere inspection within a few seconds, exactly where the part will break.

But not so with the FSEB. Which is designed for long use and otherwise I do not know it is actually from Rohde & Schwarz.



Figure 34: The VAR wheel with magnetic screening

Nevertheless, the part seems to grind somewhere. After a brief glance I decide to carefully shortening the magnetic stator bridges that generate magnetic screening.

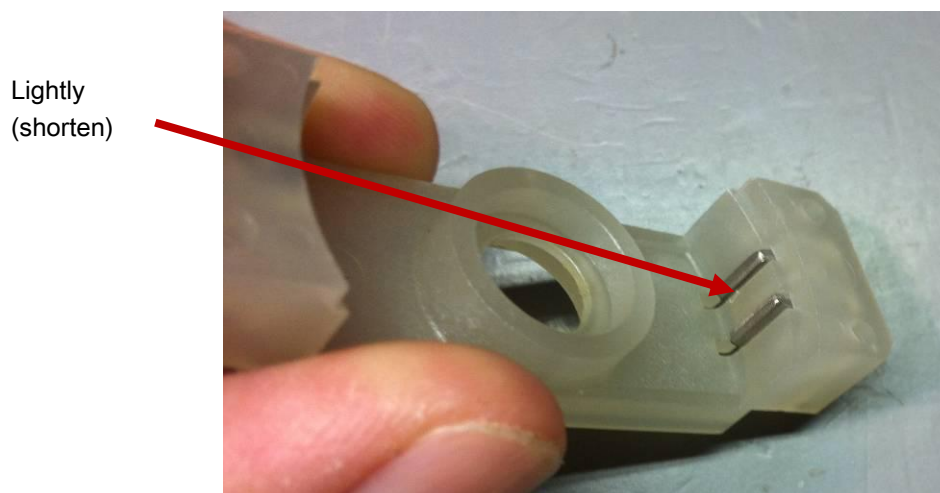


Figure 35: magnetic short-circuit bridges

Where am I ever going I fat also equal to the ball bearings, which can not hurt. After everything is assembled, the grinding sound of the past. Fine!

### 19.3 Plastic feet

Well, that's almost not worth mentioning. Old feet rausdrehen and new screw carefully. Even if it is just a detail - somehow the analyzer is thus more "youthful".

### 19.4 DA WAR BUT STILL ...

„right, which exploded in the Elko A190 detector unit. In the meantime, I have a new strip ordered me on ebay. Own value, same size, but now even produced with a voltage rating of 25V.



Figure 36: old and new SMD-Elko

Without making large studies, the faulty component is (at least ;-)) removed the remains and the new soldered. Because I am but basically cautious, I measure the new Elko previously by again. Nearly 9,6 $\mu$ F- that's fine,

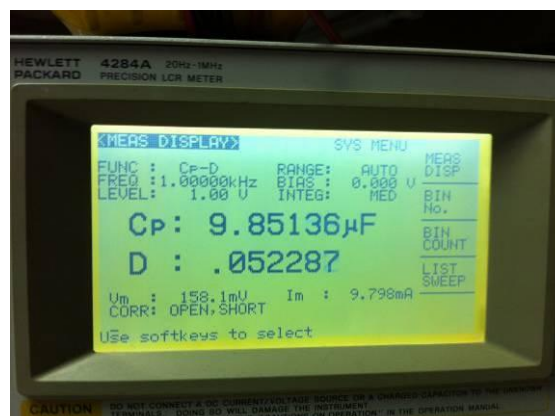


Figure 37: new SMD-Elko

Good cheer I build everything back together and turn on the FSEB30.

# BOOM!

Now please do not read on if you have the faint of heart!

After a few minutes it pops in FSEB, a foul-smelling cloud of smoke rises from the device and the power supply switches abruptly from. My FSEB has just participated in the fireworks competition.



Figure 38: International Fireworks Competition in Hannover

Crap.

Quick as a flash I tear the thermal imaging camera from the trunk, trying to find the still hot explosion site. but I sense already that I need for any camera, but only common sense.

When you open the straight repaired assembly A190 Elko parts already falling towards me again. The new has thus also gehimmelt already there. Now it's enough for me, we are not yet at Günter Jauch looking for the millionaire! I want to know this much, what it does and with this darn Elko on why the comrades that are soldered here constantly in the semiconductor sky soar like lemmings.

So the dehydrated comrade is unsoldered, the A190 plugged into an adapter, dug out the multimeter and turned on the FSEB. I measure the voltages on both sides and fall off almost from the faith.

Like now ... Elko wrong way around it ...! ??!?!?

I compare the photos I had was when I got the device. Result: no, I had the new Elko soldered exactly the same as before the old! So Elko really falschrum in there !!!!

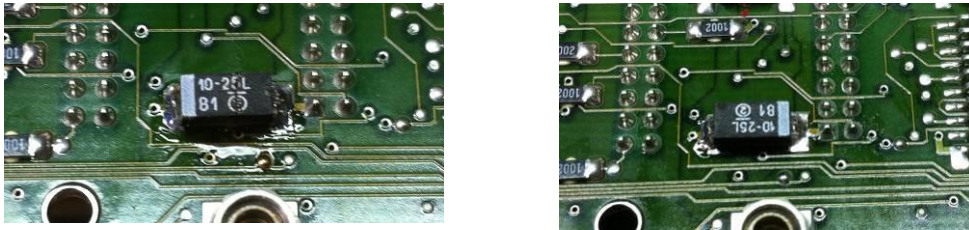


Figure 39: Left: Elko falschrum; right: Elko right way!

I begin to guess how these FSEB might have come to his Dismantled Status: Elko exploded in A190 because the wrong way around it. PSU is smart and switches off immediately. User thinks of smoke - not good! Power supply went out, so it is determined broken! He builds it out for further testing. but finds no error, may come not for lack of diagram, maybe the procurement of a replacement power supply is not granted because the device is already written off, no idea. Anyway, it is provided without power supply in the corner and degraded as a spare part support. The preselector who has obviously put on the first slot A110 (based on the RF cable configuration and the remaining blind cap for the tracking generator, I close to it) is pulled out and into another

At some point, nobody knows what happened to "this thing" going on, why the power supply is missing and why it is still in the parts shelf, so get with it! The FSEB is sold, do I get the thing, and raise it with a new power supply, some brains and perseverance back to life.

So the story needs might not be running, but it could!

Anyway, I can report that are more developed after cleaning the solder joint and right around-soldering of SMD 10uF electrolytic capacitors not smoke and I can consider officially as "perfect" and "ready to use" the device now!



Figure 40: A190 successfully repaired

## 20 performance

In the following weeks I work more intensively with the possibilities of FSEB. Alone to have the idea that an intermodulation-free range of more than 110dB available, turning many seasoned metrologists develop a Sabberauswurf such as Niagara Falls. I work myself up in these measurements and get to know the RF performance of the FSE series - and appreciate.

A bit unfair I will, as I repeat the intermodulation measurement with my little Rigol DSA815 - and come to "proud" 68,7dB. compare that with the 110,5dB the FSEB30, of course, is more than unfair. Nevertheless, I think it is important to explore its instruments and limits precisely. The better I know my instrument, the better I can classify the read measured values and trust them. Performing something "unfair" comparisons include as easy with this and must not be misunderstood as a compromise! The small Rigol has numerous other benefits (such as portability, USB port, display resolution, price!, Etc.) with which he can shine. I am convinced of the small device, otherwise I would not have bought it!

For high-performance laboratory measurements of intermodulation intervals but the FSEB can just his Advantages play. I would say the two little device are complementary rather than in competition with each other. A FSEB30 I would, for example, never drag on a garage roof for aligning a satellite TV antenna - a Rigol DSA815 however, at any time without problems!

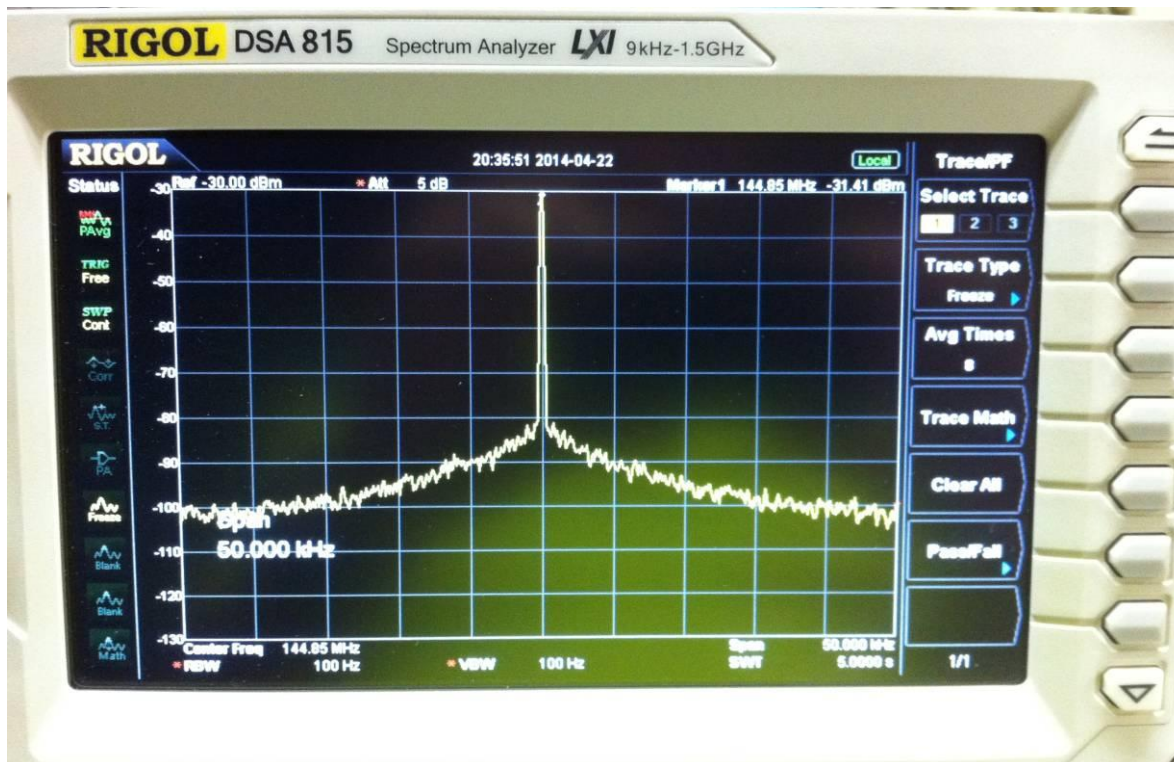


Figure 41: Phase noise measurement with Atten DSA-815

Now one from me, how many dB difference are there to see ;-)

But as I said - a very unfair comparison, but if you have such devices, you have to know their weaknesses and advantages, and not more or less I want to show these pictures.

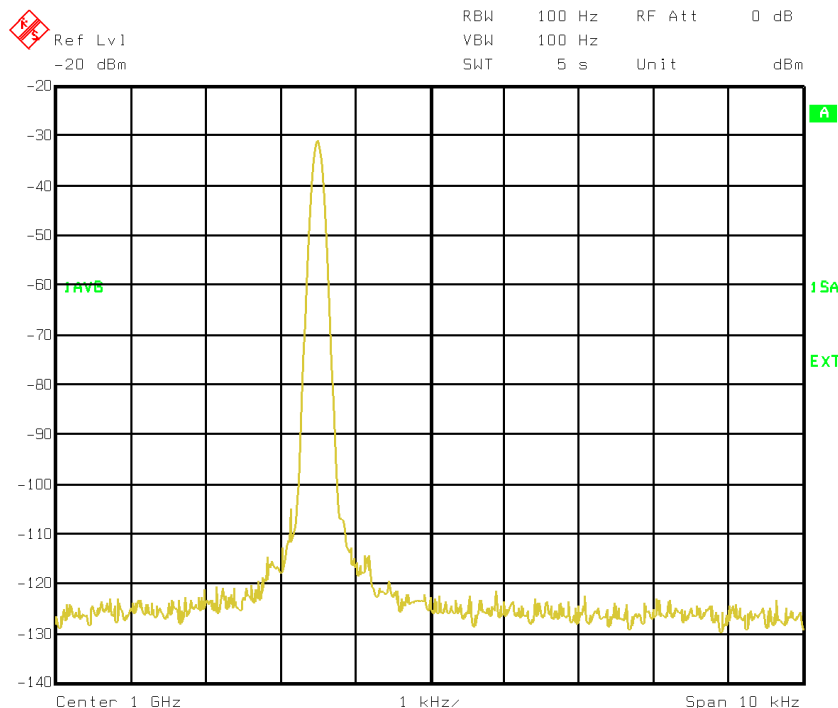


Figure 42: the same signal - but measured by the FSEB

## 21 Pimp me up

Over time, I start to get interested and digital modulations. That would be - after the IMA and third-order intercept point stuff - for me a new subject and certainly very interesting. As you can see the list of options of the FSE, you can retrofit the baby with a so-called "vector analysis" module FSE-B7. So you can use it as a measurement demodulator for AM, FM and I / Q modulation FSE also. By means of the built-in display displaying eye diagrams and evaluating the bit error rate are even possible. In a few days I will clear to me that I my geschontes when you purchase the Analyzer - wants to spend budget for two options:

- a) the FSE-B7 vector analysis
- b) an FSE-B8, B9, B10 or B11 tracking generator.

I had these two modules, I could upgrade the FSEB30 to a high-performance multi-analysis instrument to the certainly would even envy me some RF laboratory.

Now it is not so easy \* to buy such modules as upgrade options. If you have a lot of luck, you can see on ebay in the US by a module (at exorbitant prices), but around here I see the options only if they are already installed in a base unit and sold with them ,

\* I will learn that the installation is even \* more \* difficult than the procurement but read for yourself!

A case was made for Uwe Sander (company us\_tec)!

Motivated by my statement that I want wasted my entire gauges budget for my FSEB, he sits in the background again all the stops for me to move. I do not know how the man does it, but few days later, he can offer me an FSE-B7 vector analysis option and a 3.5 GHz tracking generator option. Incredible!

## 22 vector analysis

The FSE-B7 will be ordered from a standing start. As always with Mr. Sander, I get a proper invoice as well as a brief description of how the FSE-B7 is to be installed and which cables have to be plugged for it. us\_tec makes an output test principle before mailing anything. That's something I really appreciate about him, because then he stands out from the great mass of "unchecked" -Versender. He also, of course, is not inserted in detail in the circuits and in transit which can, for example go wrong, but in principle it can be assumed that one gets here neat, (at least) partially tested quality for your money and not some gamblers goods. Therefore, I make the money also loose - although I must admit that a larger,

### 22.1 installation

A few days later ringing Burkhard - who else - at my front door. If Burkhard packages brings with Rohde & Schwarz tape around, I'm always a particularly good mood. Without knowing how much I look forward to the assembly, he handed me the box and I can say before I "thank you," he is with his nimble legs go already with another package to my neighbors. Incidentally, since not stand Rohde & Schwarz on it, but "Amazon", but perhaps you also get since measuring instruments? ;-)

My own package but is now carefully opened. I have to say, better you can not be packaged with an electronic module! With ESD bubble wrap wrapped, packed with foam mats and additionally the side with specially rolled bubble rolls is Hr. Sander during shipping really safe. Great! After I've also saved me ESD standard (ESD wrist strap!), The module is removed from the package and inserted into the provided slot on FSEB A170. Previously, I have to unscrew a small air guide plate from the drive bay A170 so that the assembly can be pocketed.



Figure 43: Change in the wiring for FSE-B7

A snaps, I turn the FSEB on the back and adjust the RF cabling accordingly. Actually, it's all about, grind the assembly into the signal of two signals: the IF and the reference 120MHz. all it takes to operate at least according to block diagram of the service manual. Because the cables used to date are too short for repositioning, I will create a set of new with the good SMB connectors Radiall and the beautiful RG316 Teflon cable. The LF output and the ADC clock output of the module are not connected, according to a block diagram.

was thought that this is all too naive, I will learn the same.

## 22.2 The first hurdle

After a double check the correct wiring I turn the device around and press the start button expectantly. Then the disappointment: after starting the FSEB was supposed to appear, an additional button "Vector Analysis" in the menu. But it does not. Hmmm ..... why not?

In my present service and user manuals I find no evidence that you have the assembly "login" or somehow make known to the system. However, I find in the installation instructions for a tracking generator that performs a system cold start after the retrofit. Who was reached by pressing the period key during power up.

So it can not hurt to try it once. FSEB off, press Point button and hold switch on FSEB again. Then release button again. Unfortunately, the same result. Well almost - the calibration data were obviously reset successful, so I have to start a total calibration first before I can move on. Which runs at least through easily, but not change the fact: the FSE-B7 remains invisible to my FSEB.

## 22.3 Next try

But as soon I admit not occur. The next idea that I have, is aimed at service functions. By resetting the device variant means of service function 1.0.0.2.30 I could move to update its system configuration to FSEB may. A good idea; so I'm sure that my command is assumed correctly, I put the first mate on a FSEB20, controlling the successful reconfiguration, and then switch back to version 30th

Everything works, toggling I can successfully confirm. Unfortunately, nothing will change for FSE-B7. She continues to be invisible.

### 22.3.1 observation

I can not think about the whole of typing with the service capabilities to something: Once I release can change the service options and the device variant set (1.0.0.2.30), additional entries appear in the menu two (!): Namely, (for vector analysis toll ) and the (for a tracking generator why the ???).

Both modes can select and move in the underlying menu structure; However, the FSEB falls on response times in slow motion back and there are also experiencing not function correctly.

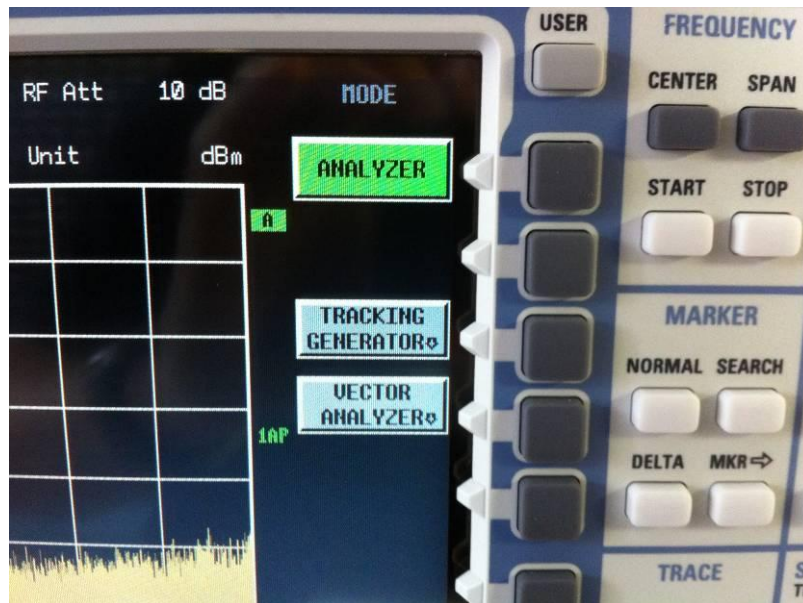


Figure 44: Two new operating modes!

I conclude that the two new menu items "Dummies" must be. For the latest I have a tracking generator, definitely Not in my device (unfortunately) and therefore the displayed "Tracking Generator" button is definitely a dummy.

## 22.4 second observation

However, we can report a small success: when I am in the service mode of FSEBs, the inserted module is actually listed in the version history of HW modules - even with the correct versions for MODIF and HW CODE! So somehow the assembly "a bit" seems to be recognized. Too bad that this entry after exiting the service mode (= off) is gone.

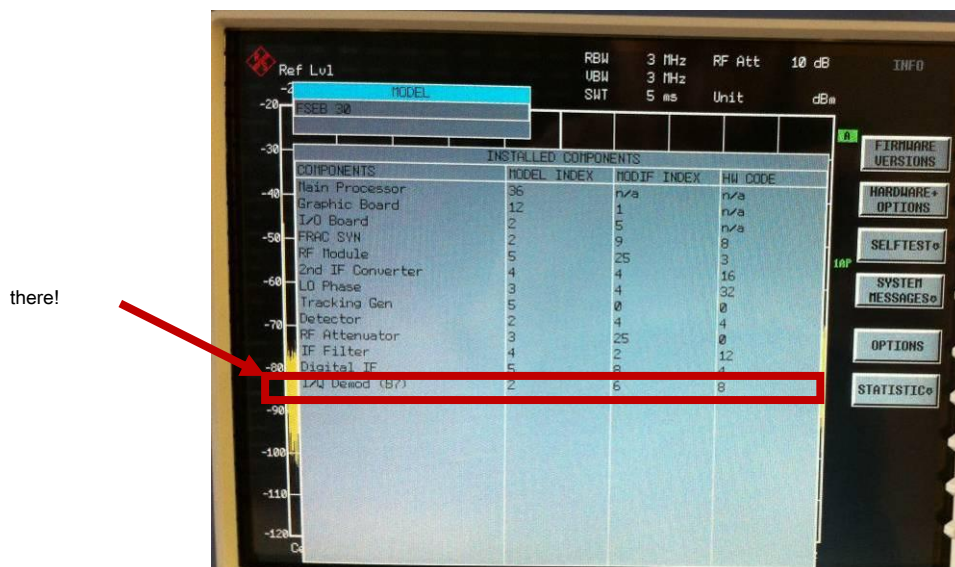


Figure 45: The module appears in the list but on!

## 23 Troubleshooting

Somewhat dejected I report Mr. Sander from this unfortunate turn of events. And I am happy again time to have bought any "gamer goods," but at an official company that still take care of their belongings after the sale. us-tech gives me a few tips on what I could try. Together, we quickly realize that even during the boot phase three important files

IQdem.bin  
IQfil\_x.DLF  
IQfil\_y.DLF

are obviously not loaded. without the can FSE-B7 not work! Well, but what's next? I look once more into the image that I had pulled from the FSEB hard drive in its infancy. Result: the files are present and a comparison with the FSEB30 of Mr. Sander shows that they are also identical to mine..

## 24 R & S Customer Support I

Slowly the ideas go from me now, unfortunately. How do I experience the situation, we seem it here primarily a problem of "HW" to have to do recognition. "- possibly with a variant incompatibility Especially in such complex devices in which computing platforms are at play, such can but problems are very ugly - and without the proper knowledge of software development and specific diagnostic tools no longer solvable maybe for me.

After I also was able to exclude the trivial idea (bent pins in the connector), I decide for placement of an e-mail to the Customer Service of Rohde & Schwarz. I say yes again and again that one with a purchased at R & S instrument-no matter how old it actual normally never is left standing alone in the rain, if there are any problems somewhere before. And with my current FSEB30 I give this department a further chance to prove their skills. And they will promptly do- just read on. :-)

## 25 Contacting (Intro)

Every now and then I get time requests from hobbyists who start something like "You and your good special contacts with R & S, could it out for me ..." or "Well, you get all the stuff but certainly cheaper, so I would have liked. .. "etc. etc. etc.

I will also say what times.

Of course, "knows" at some point a few of the names of those R & S employees who respond to my e-mails or send me the bills for my replacement parts. I can, however, tell you that I use the same **definitely contact forms on the Internet as you were and that I must pay the bills for spare parts as normal**

as you were. Nor do I get any special treatments in prices or even any valuable freebies.

So if you ever have a problem with one of your devices, I like to help you with my experience or tips (because if I have any). But otherwise you get the R & S Customer Support or R & S service hundred percent the same attention as I do, so do not ask me to, "to get cheaper" something for you. I can not - and even if I would not do it, because I'm a big fan of clean (and especially) is 100% legal dealings with one another. And the guys at R & S way, too, because what I experienced there, was always perfectly clean and correct - what else can also not afford.

So far so good for everyone?

## 26 contact

Nevertheless, it is not forbidden to be nice. So I start my emails usually with a friendly "Love R & S team ...". So I do it this time.

To me now quite well-known people from the Munich headquarters already answered a few hours later to me. (Such a response time I would also like to once again wish me from my garage.) He has already made the experts find for my question, but found that the had just gone on vacation. "Could I wait that long or whether it urgently was" I am asked.

Of course, my gauges projects are as good as never urgent. The next device test for the amateur radio magazine will probably be a pure analog device - so I could get over it loose when I up to then still can not measure digital vector modulation. so it's no problem for me to wait for the return of the expert, so I'll take that offer to you and do in Munich now not unnecessarily horses shy. So fair you have to be.

Mr. Sander promises me, however, to take back the assembly again and possibly. For compatible to worry about replacement if the problem should not be solved. It is reassuring to know that.

## 27 R & S Customer Support II

It is another great moment of Rohde & Schwarz customer support. As promised, the expert reports back shortly after his return and may bring the puzzle solution: need to commission a FSE-B7 IQ demodulator on a different module, two modules are added and the change condition to be checked!

Specifically, this means that plugged another DSP module on the A190 Detector Unit as well as the existing transputer must be replaced with a different model. It's all in the installation manual, which was also sent to me **immediately. Brilliant! I could have done without this info never can know!**

All the more grateful I am the nice ladies and gentlemen with their unique Bavarian-sounding surname ;-) for your great help for me north German "fish head". By the way, I was quite flabbergasted to hear that there were some of my repair reports already arrived. And you even regretted that they could not help out with even further documents to me at my last SMIQ project. Hey, no problem - I appreciate any help and am far from being able to do any expectations here!

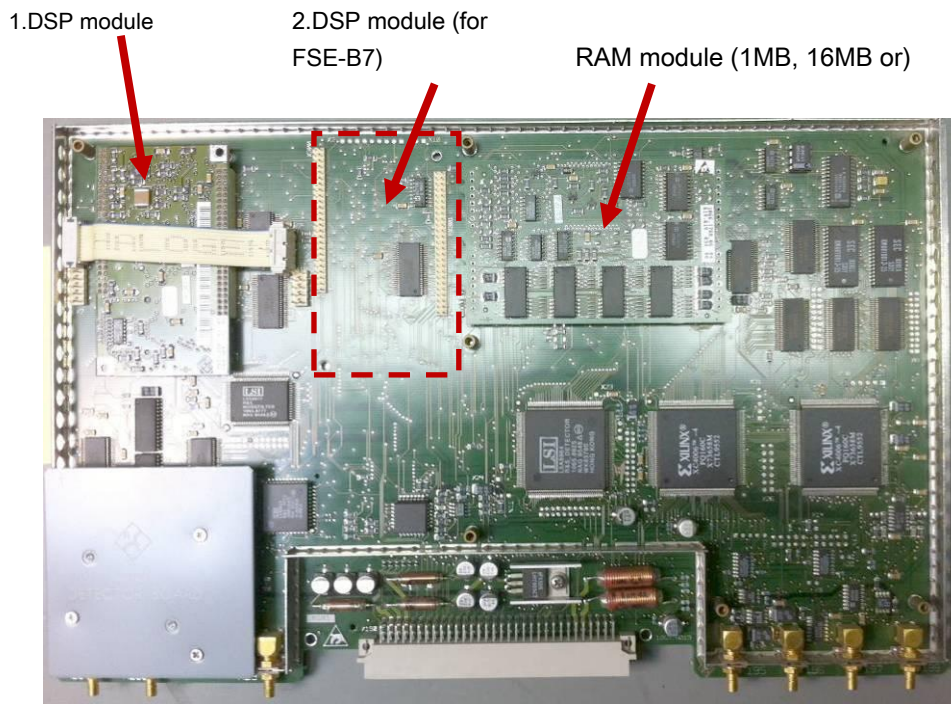


Figure 46: My A190 Detector Unit

Anyway, I've been through the FSE-B7 installation instructions first again a new thread - and a view! - get where I'm going to shimmy me along.

Noch'n Note:

The documentation that I sometimes get to my problems are not always normal part of the service documents. To say, they certainly are not secret, because otherwise they would not give me, but certainly not determined on the other side to unrestrained publication on the Internet.

So:

If you should also face the same problem and a special guidance needs (eg the FSE-B7 installation instructions), then please ask Not me but asks very sweet and nice with the R & S Customer Support, ok? You bring me otherwise namely in a very awkward position, because on the one hand of course I want to help you, but on the other hand, do not abuse the trust and of the producer, if he gives me such documents at all. I'm sure you also get the help you need if you ask only nice afterwards •.

## 28 The Olsen Gang

Yes, you read that right. The three lovable fellows who are not quite so pursue with their extremely witty and intelligent plans "knotless" goals are now the inspiration for my latest additions:



Figure 47: The Olsen Gang (Source: [www.moviepilot.de](http://www.moviepilot.de)); Benny, Egon and Kjeld (left to right)

### **Egon:**

FSEA30 spare parts warehouse without power supply, without front panel. Fitted with 5 modules.

### **Kjeld:**

FSEA30 spare parts warehouse without power supply, without front panel. Equipped with 8 modules.

### **Benny:**

FSEA30 spare parts warehouse without power supply, without front panel. 7 equipped with modules.

The honor of all women in the world's sake, I baptize my FSEB30 (to where I just want to install the FSE-B7), the name of the prettiest of the Register of the Olsen Gang:

**"Yvonne"!**

In a sale remains, I managed to buy these three crooks. to get without ever views of complete (! power supply, front panel), they were still interesting for me: if only half of in there plug end assemblies should still work, it would be for me a great help in possibly later pending repairs to Yvonne (eg alone the input attenuator). As already mentioned, I pass at around soldering in DSP computer modules or industrial PCs with Pentium processor my limits. Just in case there's only one complete module change. And thanks to the Olsen Gang will not be a problem for me in the future, because then is not soldered - but simply exchanged blunt. (Can do) as it now also only makes any TV repair service.

With so many assemblies "in stock" I should now be very well prepared for the most Analyzer accidents. Only the 7GHz frontend I could not get hold of, but one can not have everything now.

## 29 DSP module

As luck would have it, the Olsen Gang put a second DSP module in one of the detector modules! So out with it and tentatively built into Yvonne! But as it turned out, a short time later, this upgrading, alone Not from: 1MB and the "transputer module" (actually an assembly for a quick RAM) must - be obviously replaced with a 16MB version - as described in the installation instructions. As it stands right now, the FSE SW seems to recognize at boot that in Yvonne's inside even the small 1MB version and therefore denied the commissioning of IQDemodulator-SW.

## 30 DSP / transputer

I report us\_tec from new knowledge and experience for the first time in my life a slightly "stunned" Mr. Sander. That the option FSE-B7 also include two additional modules, was not even known to him, he says. I believe him immediately, because how could he know this - the installation manual was not publicly available paper, because actually the retrofitting of FSE-B7 was only the R & S workshops reserved. Therefore there was no reason to distribute them to anyone.

Then I got some time. ;-)

Fortunately Hr. Sander so that he can expand the missing modules and send me the device from which the assembly came, not resold. Once again I am very happy that I made this purchase "neatly on account" at a "real dealers" and not somewhere in the first man on the Internet. Would have sent with certainty only the module and the remaining problem I would stand alone now.

But in between I discover something else:

## 31 Firmware Update

When viewing the Olsenbande I realized that even the first of the trio on an obviously newer firmware features as Yvonne! I am amazed - because Yvonne was so far but actually as a very young lady. If my older software version (V3.0) might have something to do with the non-recognition of the FSE-B7?

I want to make here. So I ask friendly to the R & S Customer Support and an hour later I get the latest firmware V3.40 SP2 for Yvonne. Quite simple and straightforward via email. I can say it only ever again: the support of R & S is for me one of the best, I know.

A little later, when I found another 7 old floppy disks in the basement and my USBFloppylaufwerk I at Pollin in residues sale cheap have me once it sent, it starts: the firmware is unpacked and enrolled using the included DOSProgramm gradually to the 7 discs. Fortunately, you can win with my

dows XP still typing DOS commands. As the would look like with Windows 8 - no idea! "New" is in my view not necessarily always "better"!

To Yvonne update, you push the first of the seven discs in the FSE floppy drive and turn on the device while pressing the "USER" button. Moving Yvonne to boot from the floppy drive and install the new firmware. That takes a long hour away, but succeeds right away!

## **32 turn on**

A brief hope I had that the new SW perhaps recognize the new FSE-B7 module - but sadly wrong. It behaves exactly like its predecessor V3.0 also insists and obviously on the 16MB transputer module to activate the IQ demodulator.

Wrong it was not safe to bring Yvonne and software technology to date. But the solution of my problems it was not unfortunately.

## **33 The Olsen Gang dismantled**

Sounds a bit nasty, but actually it's something Leichenfledderei what do I do now with the three spare parts warehouses. I gather gradually all modules, look me production number, modification index and HW code and inventarisiere the modules in Excel to get a better idea of exactly what did I actually shot in scrap sales. The ultimate goal in this campaign was to learn about the components and possible optional modules that could help me in pregnant Yvonne. Since I will not find it, but I ever learn so much: from each module at least one is there, so it should be assembled from all its own FSEA nevertheless. or? ;-)

I can not resist the temptation.

## 34 Dr. Frankenstein's experiment

I grab Egon. Egon is the only band member on a processor card. Will say his heart (= industrial PC) seems completely. And with a defined 5VStromstoß to the right place it was supposed to be to get back to beating ... right?

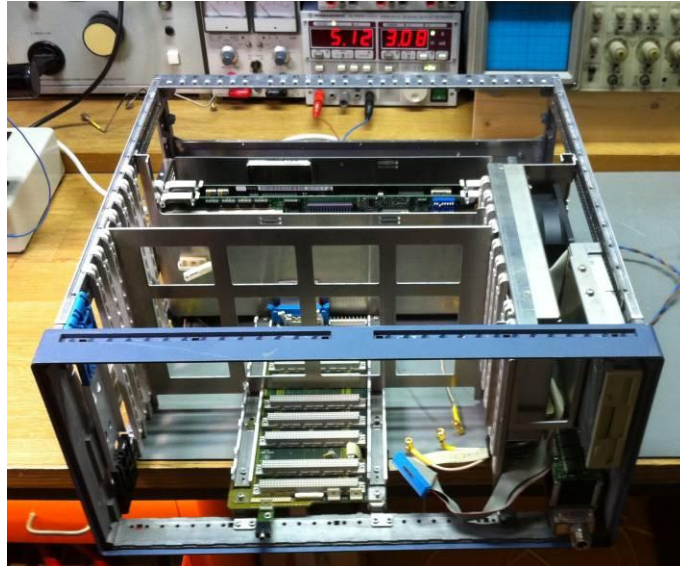


Figure 48: Egon with external power supply

So I look on the bottom of Egon to label points on the power supply. And I will find it. "+ 5V\_D" stands there - ie 5V for digital part. A second look at the service base confirms this. So go ahead, torches not last long. A stripper with banana plugs drangelötet, infected VGA screen to the socket and switch current. The hard drive starts, the power supply is approximately 3A, and I get on the connected external Bildschirmen picture! Wow!

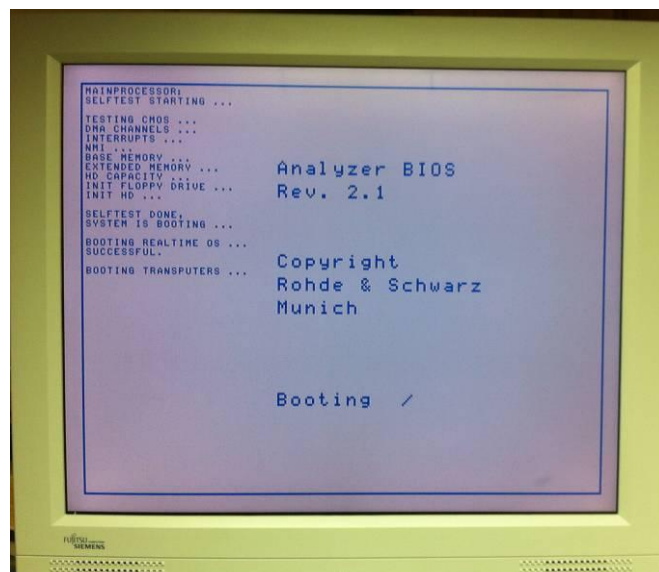


Figure 49: Egon boots!

Shortly thereafter, I stand in amazement in front of my monitor that shows with a virtual spectrum of an equally virtual 26GHz analyzer. Egon has actually booted! Of course, he finds no RF modules (which I had previously for safety all removed), but the computer platform (BIOS V2.1) seems clearly to be working! hot!

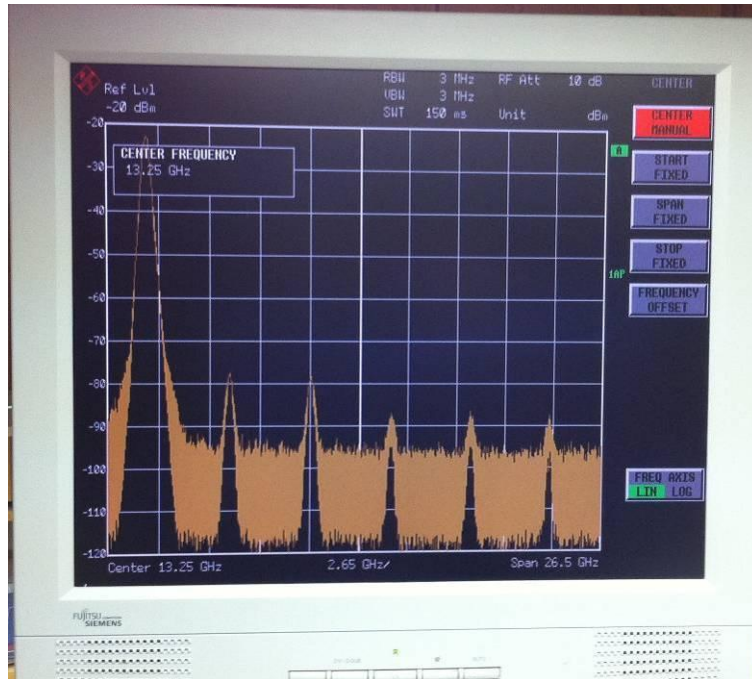


Figure 50: Egon lives !!!

I drive it to the top, build an old VGA card with 16 bit ISA connector from an old DOS PC and insert it into the slot A340 in Egon. This is actually meant "B15 Computer Function" for the option.



Figure 51: second VGA graphics card in Egon

I put the VGA screen now there - and indeed, here I see a picture! Namely, the Boot Loader, which outputs its status messages on this port. Scents! •

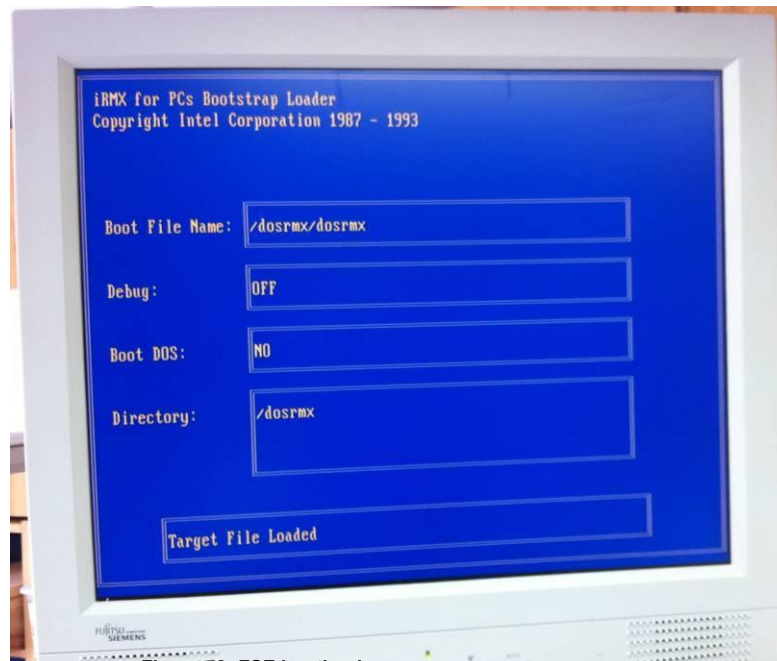


Figure 52: FSE bootloader

## 35 The next step

In the service manual I see what exactly is needed to further tensions in Egon to bring his remaining units to life. These include even more 5,5Volt, +/- 15V, 28V and 12V DC about the controlled fan for cooling Egon. With the help of a whole battery of external power supplies I manage to feed all these tensions with soldered banana lines externally Egon.



Figure 53: Egon artificial "respiration"

I measure according to the contact strip, if there tensions all applied correctly: they do. So I turn off all power supplies and insert a complete set of RF modules in Egon. Then power back on.

Egon boots high, but my hope is scrapped: at the point where the "LCA Downloads" will be displayed at boot time, there is a "failed" error message. The modules are obviously not recognized. still darn one that would have been too good.

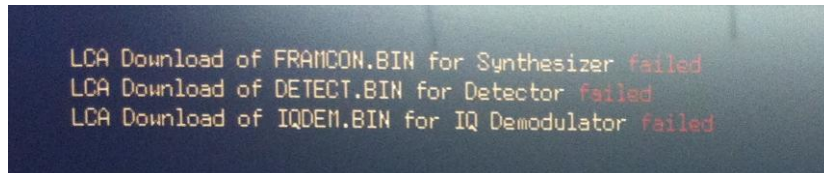


Figure 54: so simple then not again ...

## 36 consideration

This can now be due to different things.

Perhaps for the functioning of the lower RF lines between the modules must be wired. Because the Olsen Gang was delivered without any cables and unfortunately I have no second set, I had "just so" plugged in and hoped that sufficient alone that the modules would at least be detected and displayed by the processor - of course, without proper function. Presumably that was but I was wrong.

but it could just as well be the missing front panel module & display. For the computer to re-examines the components, you have to press the "option" key during the boot. However, without front panel buttons and I can not press (external keyboard is not already tried). Consequently, Egon does not search for new assemblies and can -möglicherweise  
- not recognize my inserted.

But perhaps simply what broken and blocked the bus.

Since that seems obviously not to be with the spare parts warehouse commissioning "low hangig fruit" (as they say in the industry so), I decide to first leave it at that and prefer to return to take care of Yvonne instead. Because the Sanders still waiting for the upgrade by Mr. modules and should I take before, before I on what others around fumble here -. So much as it attracts me.

## 37 A190 the Second

Mr. Sander keeps his word and just send me the complete A190 assembly as a replacement part. This is certainly the easiest and safest course of action: with the same two modules of physically the same device I can so be 100% ig sure that the least fit together have to ! Even if I notice that the new A190 seems to have also not have the 16MB module (as far as I can through a small window in the sheet metal lid see), I do not hesitate now on, but build a same everything. So slowly I have since exercise it.

Then again down the period key and waited.



Figure 55: Point-key at boot => cold start

Crap.

No loading the driver, not a function of FSE-B7 in my Yvonne. You just will not get pregnant with the IQ demodulator.

It is time again for a nice picture. Finally, this is indeed a consumer report and no dissertation. Although would sometimes not hurt them a little humor ;-)



It shows me at the 41st Berlin Marathon on passing through of about km 35. At the end I will exactly 2 hours and 23 minutes later than Dennis Kimetto to finish (new world record runner: 2h 02min 57sec). It's a strange feeling einzulaufen at the end of 42.195km in the same destination where just athletics history was written. Especially when the time measuring vehicle is stationary with the new, eingefrorenen world record time still left of the target. As everything tingles, I can tell you! The muscles tingle from 40 kilometers anyway ;-)

But now further in the text. Here, too, so I have to go through some kind of "Marathon". Just different.

## 38 R & S Customer Support III

So slowly run out of ideas to me. Even if the new Detector Board A190 "only" seems to have the 1MB memory version, so there must also to function

- Finally, it comes from a work machine in which these FSE-B7 had worked assembly also neat!

The installation instructions I have worked through clean and viewed all hardware changes or review the various hardware items. As far as I see it, I've done everything right. The only thing that strikes me is that the LED of the floppy drive is not lit 8s after starting when you press the "option" key, as is described in the statement. If the FSEB30 so the cold start not done correctly and therefore not made the module initialization?

I just came from the dentist and get in the car because my phone rings. Munich number, dial "12345" at the end. Clearly, R & S Customer Support. Now everything is determined good. With the customer service I ultimately still just about be able to crack any nut, even if I ausbeiße me almost the teeth on some issues. But where I ever had just come from the dentist, I would as well be well prepared. And should afterwards but 'nen tooth missing ... no, always think positive!

It does not take long because I know that it must have been obvious in the Detector Unit A190 once two variants. A slower with a transputer, but more RAM. And another time just the opposite - less RAM, but faster. (I hope Spend again really, because the cell phone in the parking lot of my dentist, I might not understood everything correctly). We therefore agree that once I put together a list of all my assembly part numbers, so the nice colleague at R & S can search based on my information for possible incompatibilities. Maybe this is also the reason why the Yvonne "B7er" does not accept.

In any case, my guess is shattered, that the cold start could not be initiated correctly: the lighting of the floppy disk LED is not decisive. Much more important is that the FSE logs after a cold start with a neat "UNCAL" on the display - and he does, unfortunately. This means: that the cold start has actually been carried out. So again all also made right here. The hope really lies on the nice gentleman in the R & S Customer Support, which will now make every effort to detect possible incompatibilities in my system configuration.

A bit of bad conscience I have already that I always deal with my colleagues "comical" projects. However, I really do it's only when I really do not get ahead alone. And much I get so actually go alone. Only sometimes you do not continue without the help of the manufacturer and its experts specialized knowledge. And all in all this way for me is the only way to enjoy such high-end instruments: buy for spare parts for reasonably affordable price and put in his own power to get the part back up and running. Anders It's not just when you want as a private man play at the top :-)

## 39 Deep Dive

What comes now, make sure to only very, very few companies with. Since we are talking about a least a 15-year-old device, is my FSE for the guys in Munich, of course, already an "old hat" and not all experts on this device are still tangible. Nevertheless, the Lord from the Customer Service does not give up and find him in the house even someone who has a stand FSEA in the laboratory and persuaded him to take the part for me apart! He is to make a series of tests which settings have the impact on the IQ demodulator and how through which incorrect settings consciously create my fault pattern.

I can hardly believe it. Now that someone screwed me even at the factory equipment apart, just to help me with my Nachrüstung FSE-B7. Better support you can not want and I do not know who else would make such an effort. Here is definitely lifeblood and passion for its products with the game, otherwise I can not explain it!

## 40 Noch'n RAM complacent

What comes out in this test does not bring the node while to burst, but I now know in advance where a node might be.

The colleague from Munich finds that upgraded to install my FSE-B7 on the graphics card is another module and a jumper couple has to be plugged!

Wow. How was I supposed to come out alone!

The part number of the module to be attached to the graphics card is 1066.1724.07. Apparently, these are again a RAM module. By Leichenfledderei in Olsenbande I find a RAM module 1066.1724.06! Not quite the target module, but a try?



Figure 56: Yvonne's graphics card - with slot

So screwdriver out and Yvonne's on leather. The power supply has to go back so I can get to the PC board. Lid on - indeed! On the graphics card slot is still free; two pin headers testify that there's what can attach.

Although the part number is not quite correct, I put it to the module. A little risk must sometimes go if you want to get ahead. The power supply back in, the FSE-B7 and the new A190, press Point button and then turn on. Pulse rate increases, voltage too!



Figure 57: RAM module Kjeld in Yvonne

Oh wonder! Yvonne realizes that she should be fertilized, but is not pregnant ;-). For the first time I see after all that is attempted "LCA downloading" IQDEM.BIN during boot! Great!

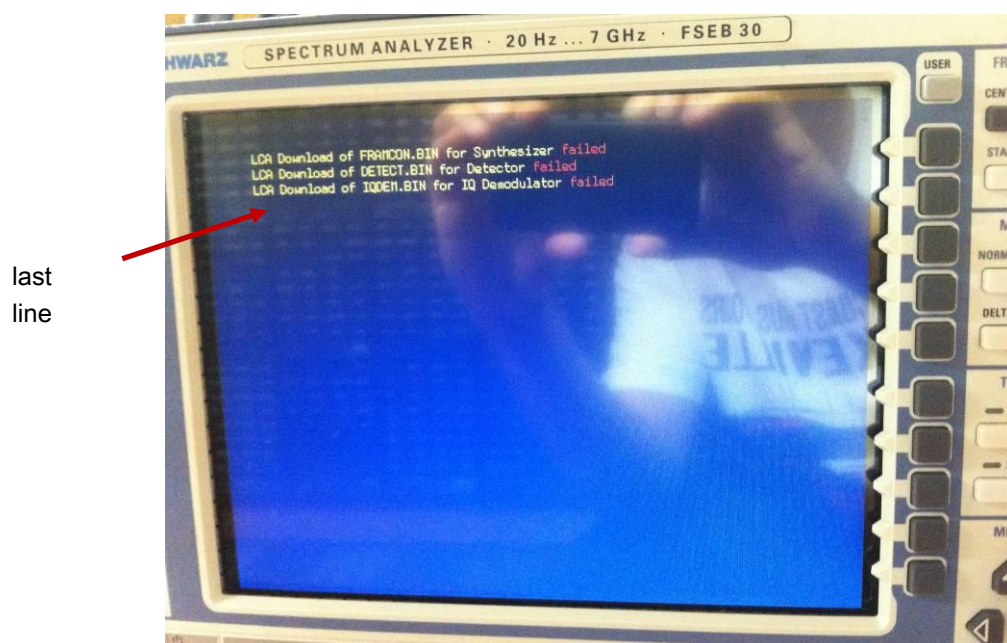


Figure 58: Yvonne asks for the first time after the IQ demodulator!

Not so great: the "failed" message. Similarly, "failen" all other drivers. Yvonne starts in me by now well-known "dummy mode", considers himself a 26GHz Analyzer type FSEIB and so of course makes no meaningful measurements.

So I note:

The installation of the RAM chip on the graphics card with the repositioning of the two jumpers in accordance with R & S manual has a real difference! But unfortunately we are still not at the end. It will stay with me no other choice than poor Mr. Sander also ask for the expansion of this RAM module for. I'm going strongly believe that has stuck namely the right on his FSEB graphics card!

Frankly, I dare soon no longer slow, us\_tec to ask for ever more assemblies. But it remains for me nothing more unfortunately left. If the B7 are up and running, these modules are obviously having "supplied" to it. But that did neither I nor Mr. Sander. And you can also make anyone reproach.

Nevertheless, I am sorry that I have to follow up so often.

## 41 Rolf and his friends

Hape Kerkeling wrote in his book about the Way of St. James, that he had learned on the way, some things just to wish the universe. If you think only almost enough to it and wish it hard enough the wishes would actually come to pass, according to the author.

I have tried that now. I desperate enough for this approach was yes.

I wished that I finally get the FSE-B7 option in my spectrum analyzer up and running. Only nothing happened. Just as in the book by Hape.

But then reports shortly thereafter "Rolf and his friends" with me. The hammer!

Rolf is someone I once sold one of my instruments. Rolf had then personally picked up the equipment here from my home. It quickly became apparent that we have many common interests (for example, not only instruments and electronics, but also the long-distance running) and then developed fairly quickly something like a loose email friendship.

Rolf has not only incredible RF special expertise, but also many "friends" - namely a bunch of instruments :-). One of his best friends is actually a FSEB30 in full equipment (including with IQ demodulator and tracking generator!) Wants and exactly the he bring to a short spontaneous visit next week when he is on his way to Berlin. We are planning a wild Module replacement until we Yvonne finally get pregnant with the FSE-B7.

So, dear Hape, I must say that seems the universe really work!

## 42 The visit

Time is Rolf at the door and drags in its FSEB30. I get eye thick, as I see populates the 7GHz tracking generator option in his Analyzer. A dream device with almost all options in there that you can get for a FSE. Even GSM measurement software contained therein, as well as "B15 Computer Function", or a network connection.

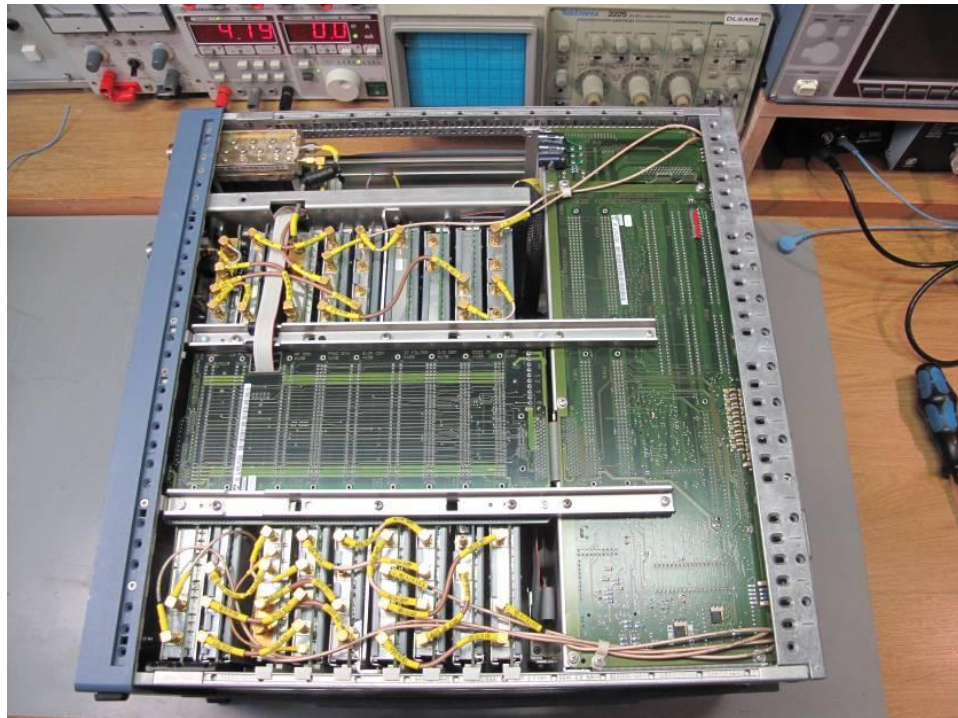


Figure 59: "Once please fully equipped!" - Rolfs FSEB30!

And yet Rolf's just absolutely miserable with his device. The reason: he had the Analyzer kindly loaned to someone and got him back with a broken RF front end. To cap it all Rolf was still sitting in person at the damage and of course that is really bitter. I find it even more regrettable that there are still obviously people who exploit the good nature as ice cold and not even say what if they do something broken.

The more I was glad now that I could help some Rolf: I do not that is able to convey to him about one of my contacts a used, but salvation 7GHz spare frontend. Actually, I wanted to put my own for Yvonne on the shelf, but when I heard that bad luck has happened to Rolf, I have decided to give him a right of first refusal. Because with a broken front end in FSEB he needs it definitely more than I do!

As Rolf's FSEB30 with the new RF front-end times passed the self-test for many weeks for the first, he is to me almost in the arms before rejoicing. Understandable. This story would have unwanted have been very different - the RF front-end is probably one of the most expensive components in the entire Analyzer - if it as a new part at all is it still in stock. So this story took so still a good turn and I am glad that I myself could even help - and I'm not always rely only on the help of others.

## 43 The reward

But now comes the second goal for the day: Yvonne pregnant with FSE-B7 :-)

According to R & S only the (correct!) RAM module missing so now on my graphics card, so Yvonne recognizes the IQ demodulator. We now want to try systematically, so I finally can write the redemptive email Mr. Sander that it \* really \* only this is a part now and there is finally prospect of a successful end.

but first I put the FSE-B7 assembly from Mr. Sander in Rolf's Analyzer and let the self-test. Result: go! This is ever good, so that assembly work ever. What else could I but also not expected us\_tec, although sometimes it takes something'm one gets what, but if you get it, it was always fine with me.

As well as the A190 Detector unit that we wanted to share. The also runs properly with the FSE-B7 in Rolf's Analyzer.

Now that we know without any doubt that the two supplied us\_tec assemblies definitely work, I put them in Yvonne and insert - with me still missing - graphics card RAM from Rolf's Analyzer it. if the R & S Customer Service is right, should now finally the IQ demodulator function with this configuration - now the big moment. So I press the period key and unlock Yvonne one.

## 44 A dream!

I had almost given up hope, but suddenly finds Yvonne the module loads at boot already a pile driver and boot up! I press the "Mode" button and see - for the first time - the entry "VECTOR ANALYZER" !!! Juchuuu!

now lying I almost in Rolf's arms ;-)

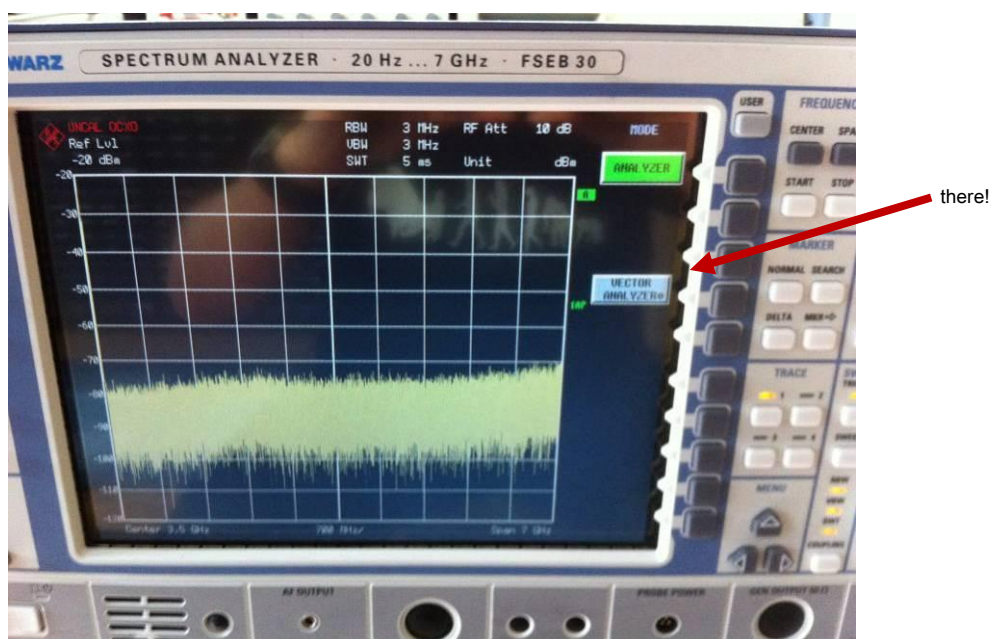


Figure 60: the "Vector Analyzer" button is visible!

Just to make sure I follow Yvonne nor by the large CAL routine as well as the self-test. Both runs through without complaint and thus the ultimate goal is finally within reach. If I so us\_tec still sends the lack of graphics card RAM, the Odyssey is now really over. Uff!

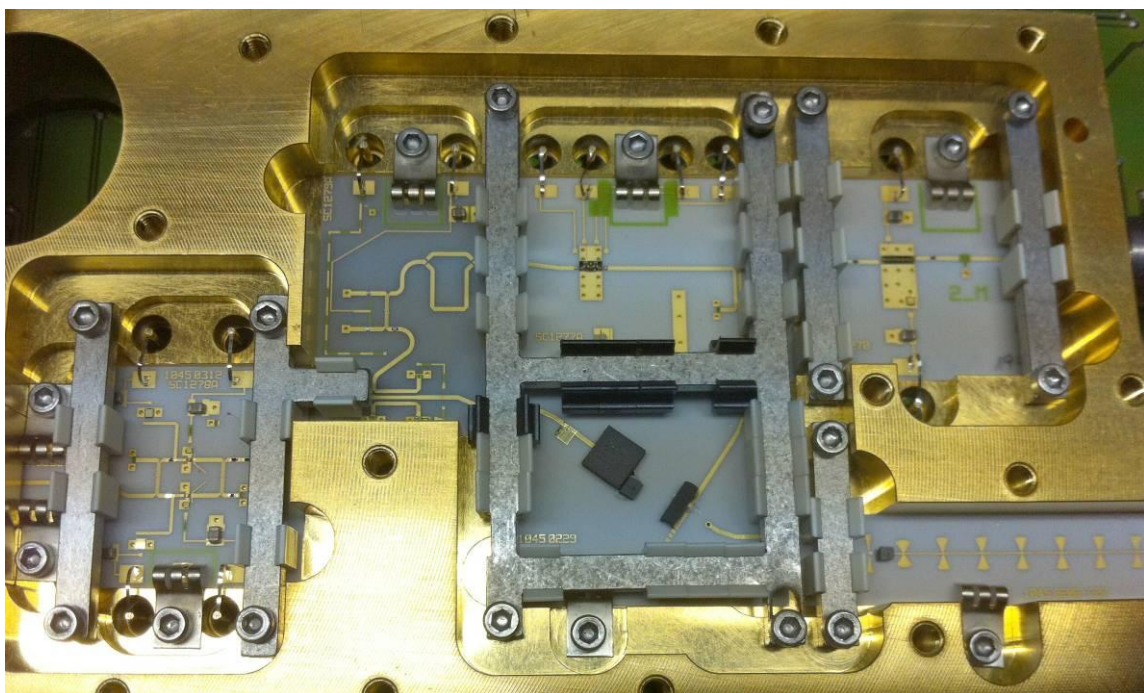
## 45 review

The FSE is definitely a device where you come as a hobbyist to its limits. Even with years of computer experience encountered with some things with his brain quickly to concrete; Just because there are things here that are as non-experts just do not know can ,

That, for example, an IQ demodulator a second DSP needs to calculate both "I" and "Q" appears in retrospect logical. However, he can tell nobody to me that you would come from mere plan watching on the device of their own accord to the idea of where the action is to complement of modules here yet, so that everything works in total.

Much you just have to try. So now I know for example, that the SMB via cable distributed from the bottom reference clock must be connected to the module so that the module software download can be performed at boot time. one forgets here a cable, the modules can not be initialized and the unit is not running. This caused at Rolf's Analyzer briefly for a moment of shock, but was quickly found.

So my advice: if you want to incorporate the encoder Hobby freshly should prefer to first choose what other than initial project. Without a functioning secondary device in which you can do by module replacement troubleshooting at the module level, a freshman at a FSE will just fail. My advice: Searches you as a gateway drug, perhaps an old, defective SMS or a nice SMY01 or SMX. As you come certainly faster to repair success.



## 46 finish

When Rolf moves back, we can at least announce two achievements: his FSE is working again with the new RF Baugruppe and Yvonne only separates a single RAM module from the same state. Not bad for a short morning visit.

## 47 Computer function FSE-B15

I used while Rolf's visit once the opportunity to try the option B15 "computer function". About one finds on the net actually relatively little - at least if you want to know how it works exactly and what it does.

I present the following states: B15 is first "only" an additional built-in graphics card with 16 bit ISA connector. This card, however, has not only known to us 15-pin VGA analog port but is also fed with a thick ribbon cable from the motherboard ago. And that's exactly the difference to normal VGA cards: this one is obviously switched between the meter display and the calculator display. This is done by the way by the keyboard command "Alt-Print", which one hammers away on the externally connected keyboard.

Rolf's FSEB30 based on DOS. Therefore, one can in this model at best Windows Install 3.11. But at least - that's enough to make some interesting SW as the phase noise measurement software R & S run. Just as important, I personally, however, two other options:

- a) access to the screenshots, data tables, device settings
- b) access to the second partition on the hard drive with the FSE runtime files!

Here one can in fact simply copy via DOS command files on floppy disk drive. If you have the B15 not the parts per FSE menu you have to move individually on disk and you have access to the system partition (eg for service purposes) not GAR.

So it would be for me still interesting to expand Yvonne somehow B15 standard. But first, one by one. A few weeks ago I still had are an expensive stock of spare parts on the shelf and now I will of course be back EVERYTHING. But even that does just fun: try out what you can still get the most unloved of a pile of electronics "scrap", when just a little stuck behind it.

## 48 Everything will be fine!

Now ye have waited long enough for the happy ending. I shuffle just - from the melee with the gasoline engine scythe against the long grass drawn next to our property - across the courtyard towards shower. As Burkhard comes with his yellow car hit and hands me one of those dinky us\_tec cartons in hand. Already shower and two-stroke smell are forgotten and hastily the package is opened. Again a sensational package in which the gift is really too unpacking joy. Then the view: in fact, it is a 1066.1724.07 it! Yay!



Figure 62: perfectly packaged - Burkhard bring me my RAM module!

Later, were washed away as gasoline and grass clippings and the little one makes his nap, I have enough rest to install the RAM module. This is quickly accomplished. With the most important thing is to properly ground and work on an ESD mat. Finally, we want to heal what make and not broken.

For installation, there is not much to say. The installation position is uniquely identified by a abgekniffenen pin on one of the two pin rows. The module simply push on and then reassemble it. Power cord off press point key and then turn on. And then:



Figure 63: it looks; the additional RAM module!

Finally !!!!

Yvonne showered me with messages about successfully installed software modules almost too! Both the IQDem.bin and many other modules are loaded at boot time. When Yvonne's done, I press confident the MODE button ... and ... behold for the first time the button to Vector Analyzer!



Figure 64: You boot !!!! :-)))

Done!

## 49 What now?

Following this phenomenal success I close this project only once - at least mentally - from. The Olsen Gang I will certainly take care of me later. But first I'll Yvonne "Edit" extensively, because the newspaper has just called and asked measurements for a new wireless device to review.

This comes just at the right, because with the FSE-B7 I am now really professionally measure capable of frequency and Leistungseinschwingen and to make screenshots of them. Very nice that you can save your device settings to Yvonne, so I asked one once a device setting can call quickly on subsequent measurement tasks at any time. Tip: Your measurement programs or device settings at the end again on a CD-ROM burning (via floppy drive ;-). If the hard drive in the Analyzer namely times make the opponent - the firmware for a FSE get you anywhere at any time to restore. Your laboriously compiled measurement programs but not!

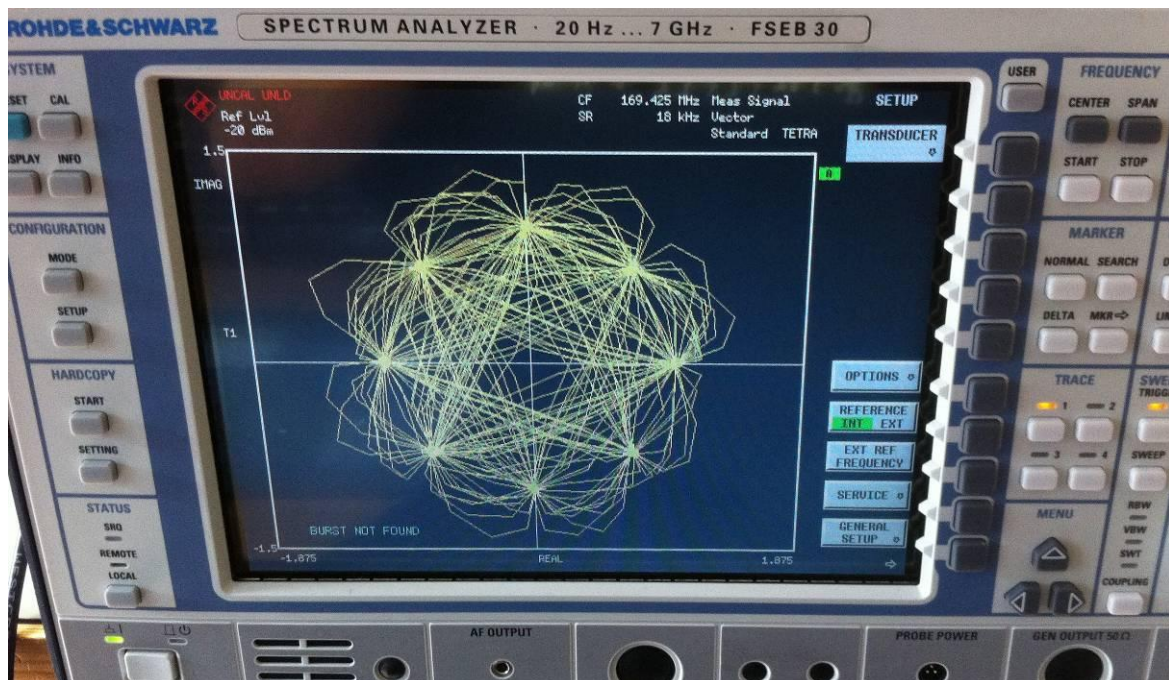


Figure 65: State diagram with IQ modulation

## 50 outlook

The FSE device family is so diverse that you could deal with it for years almost. would be very interesting to put the remaining members of the Olsen Gang back to a working unit together - if necessary also with external display, power supply and keyboard. Or try if you can rebuild a FSEA30 in a FSEM if you put only the modules in the (lower) housing part of a FSEM and reconfigured accordingly. This idea I was so horny that I immediately bought yet another FSEA30 me spontaneously. He will carry the name of the most recent addition of Olsen Band: Børge.

To my FSEM idea gave me the R & S Customer Service already tell that this must match the accommodated in the basic unit YIG filter assembly "Microwave Converter", because the latter is measured based on a very well individually (!) Frequency table in its resonant frequency parallel carried for analyzer receive frequency. Means: Beware YIG tuning and frequency analyzer not together, you constantly receives "nothing" because the YIG filter is set to a different (wrong) receiving frequency and therefore nothing passes at RF level.

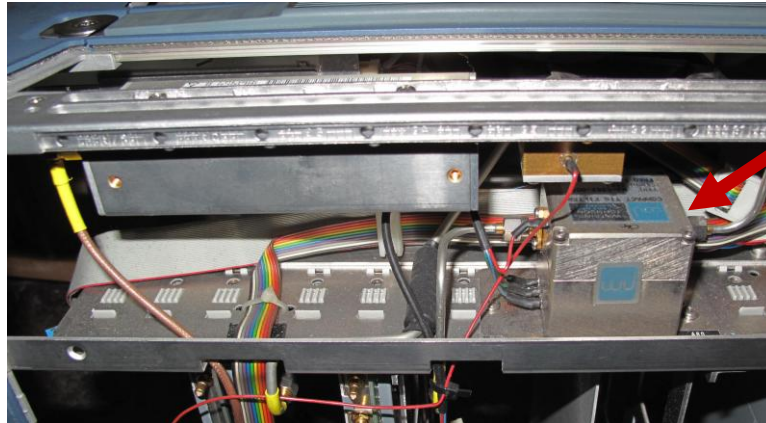


Figure 66: expensive toy: YIG filter in a 26GHz- FSEM

For a re-recording of calibration data is (obviously not public) R & S service program and a 26.5GHz signal generator and a 26,5GHzHF voltmeter needs a special. Three sites that place extreme demands on the hobbyist and personally probably solve for me only with an official assignment in the R & S service laboratory.

It is therefore initially remain likely to Yvonne and Børge. By sequentially-plugging the whole Olsenbanden modules I could by now to find out which are heal from them and what defective. Maybe I'm trying so again in the repair of these modules, as well as a largely similar structure IF assembly is - you might even some opportunities.

But this is another story. First I'm going to Yvonne and Børge enjoy and one thing is certain: I will learn a lot from them!

And that is what matters to us, right? •

## 51 Acknowledgments & Greetings

To stay with the analogy of the "pregnant Yvonne": this baby is here but still become quite thick at the end! Now with about 60 pages, it has almost reached point-scale - perhaps as little excuse for all those who have waited so long for the publication of this report. On my home page I had already announced this report and prompt many of you have approached me full of expectation on the INTER RADIO already on it. I am glad and I am amazed at how many fans of my reports there are already obvious. •

Speaking INTER RADIO. This year I was also again the nice Dutchmen visited at the measuring station, which has now given me for the second time a Ailtech noise source. Unfortunately, I manage not to this day to remember his name. Nevertheless, once again thank you, I'm flabbergasted every time how many nice people there still exists in the world. And this smart Dutchman with his guest gifts is for me 100% with it!

Rolf I want to especially thank, not only for its long drive to my home, but also for the SMA torque wrench, I can definitely good use! He also turned out to be extremely valuable review reader me with no less than 372 my preliminary version of this report (!) Spelling suggestions and comments sent back !!

Of course, I also like to thank the company us\_tec or Mr. Sander, who proved throughout the odyssey really stoic patience with me, and whose cooperation I have ever only owe it to have successfully brought this project to an end.

More greetings go to the copy shop Zwingenberg with Mr. Filbert, whose well-stocked base archive me time and again surprised.

Thank you I am surely also with the former employees of Ascom Frako for the driving up of the power supply module and - which now stand me for several years so bravely with the ladies and gentlemen at Rohde & Schwarz, and always assert again and again that I - course really would not do them in the spirit, but they would still appreciate my repair reports.

I do not know if they still mean really serious ;-) but I makes tinkering in devices of the Munich forged because of the great technology simple fun and it gives me courage when I hear that I now other hobbyists for refurbishing of your equipment can motivate.

And of course a big greeting to Burkhard and all his brave colleagues of the mounted bag mail! I know there are many people who grumble about the post, sometimes running safely something wrong with you, but who does not happen something like that! So you are enjoying my full respect, because your job is certainly not always easy - especially when I ordered again a heavy gauge somewhere that you have me in all weathers again take the hand truck to the basement ;-)

So a very big **THANK YOU** to you!

And then there's ....

A special greeting but I set finally to the office of Hape Kerkeling, I - must also present at Reinhold Messner I yes occasionally like to quote the report, of course, before the release of "authorization" as it was then.

His Way of St. James-book has brought me so when reading a flier in a time to laugh, that the timid Asian flight attendant came up with a worried face and a glass of apple juice oriental armed me rushing up to administer first aid!

But how could I have this flying beauty to explain in Chinese that I bekringele me just above the green with eject itself bekölpenden ram in the back of Hapes transport. So I took instead bravely caring gereichten apple juice in reception, tried my peals of laughter from a "normal Sino-friendly" exchange face while I gave her a slightly drunk sounding tears of joy "Funny book!" hurled as an explanation contrary - which they then but was satisfied also thank God.

If she had me at this moment instead of cider still a "delicious lunch" brought, I swear to you, then it would have been finally happened to me and the plane had to Singapore can fly only with whipped side in a circle laughing !!!!

Horny experience I will never forget. Thank Hape!

## 52 Final image & Vorgucker



Figure 67: Final screen (Papa & Son with the trip in the beautiful Heath in Undeloh)

Metaphorical final scene. It has actually been both cheeks full of biscuits, but already considered as one still comes to more biscuits. Although it has not even been bought and actually already do nothing more fits in. But no matter!

Just as it is with me unfortunately with measuring equipment. (Only that the less calories and not quite as good taste.)

And it's even worse:

Der Kleine grapscht auch schon nach der Tüte mit den Keksen! ;-)

Im nächsten Bericht restauriere ich ein fast 30 Jahre altes Bird43 HF-Wattmeter und messe dabei 20kV/m! Seid also gespannt! :-)



**Abbildung 68: ESD-Messung an einem 50Ohm-Gerät...warum?**

**Demnächst hier bei den Ober-Nerds! :-)**

---

**Hinweise:**

1. Wer auf dieser Grundlage bastelt, bastelt auf eigene Gefahr!
2. Das hier ist ein privat und hobbymäßig zusammengestellter Reparaturbericht. Ich übernehme keine Garantie für die Korrektheit der hier beschriebenen Inhalte.
3. Ich übernehme keine Folgekosten, die durch evtl. Anwendung der hier beschriebenen Informationen entstehen könnten.
4. Das Basteln in elektrischen Geräten kann für nicht Sachkundige ein hohes Risiko von Verletzungen aller Art bedeuten. Sollten Sie nicht sachkundig sein, lassen Sie bitte lieber die Finger davon.
5. Die kommerzielle Nutzung des hier beschriebenen Wissens ist nicht vorgesehen.
6. Alle Meinungsäußerungen (insbesondere über Firmen oder Hersteller) sind stets rein subjektiver Natur und spiegeln nur meine eigenen Erfahrungen oder persönlichen Vorlieben wieder. Sie sind weder als Werbung noch Verunglimpfung dieser Firmen oder Hersteller zu verstehen, sondern als persönliche Meinungsäußerung aufzufassen.
7. Vor dem Veröffentlichen meiner Berichte bemühe ich mich stets im Vorfeld um eine Zustimmung der in meinen Berichten vorkommenden Personen/ Firmen. Wenn Sie der Meinung sind, dass das in Ihrem Fall einmal (unabsichtlich!) vergessen wurde und über bestimmte **Darstellungen oder Beschreibungen verärgert sind, so setzen Sie sich zur Problemlösung bitte zuerst direkt mit mir in Kontakt (und nicht gleich mit Ihrem Anwalt ;-).**

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