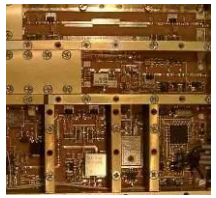
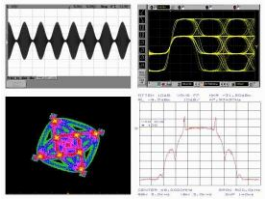


Analog-

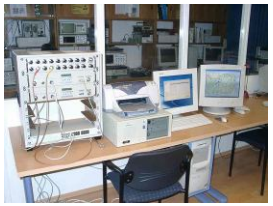
and digital hw



Signal processing-

and operating sw

Equipment



System

# Integrált felderítő és zavaró rendszer (INTERJAM)


## Dr. Eged Bertalan

Sagax Communications Ltd., 1096 Budapest  Haller u. 11-13. Hungary

# Tartalom

# Technikai felderítés és elektronikai harc doktrina elemek

- A felderítés minden ország saját feladata

*NATO Allied Joint Publications AJP 3.6*

- ISTAR képességekkel rendelkező felajánlott csapatok

*NATO 2006 Force Proposals for Hungary (2006-2016), EL0583*

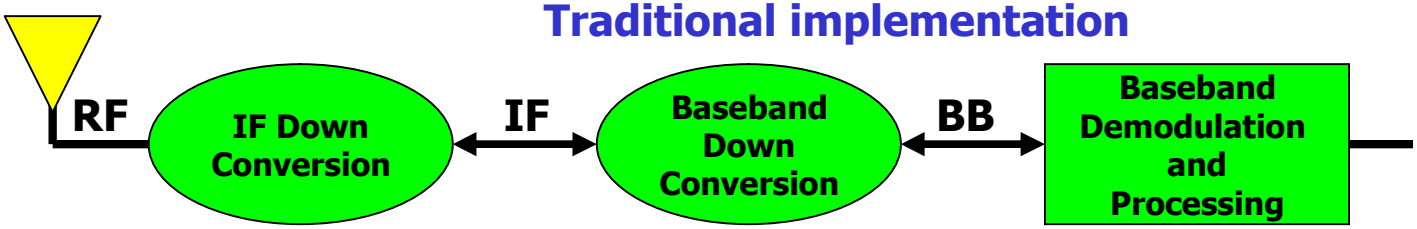
- Képességalapú haderőfejlesztést kell megvalósítani, amely lehetővé teszi a hatékony reagálást a biztonsági környezet változásaira. A hadfelszerelés fejlesztésének legfontosabb feladatai: ….
  - a technikai felderítőeszközök rendszerbe állítása.

*Magyar Köztársaság Nemzeti Katonai Stratégia 2009*

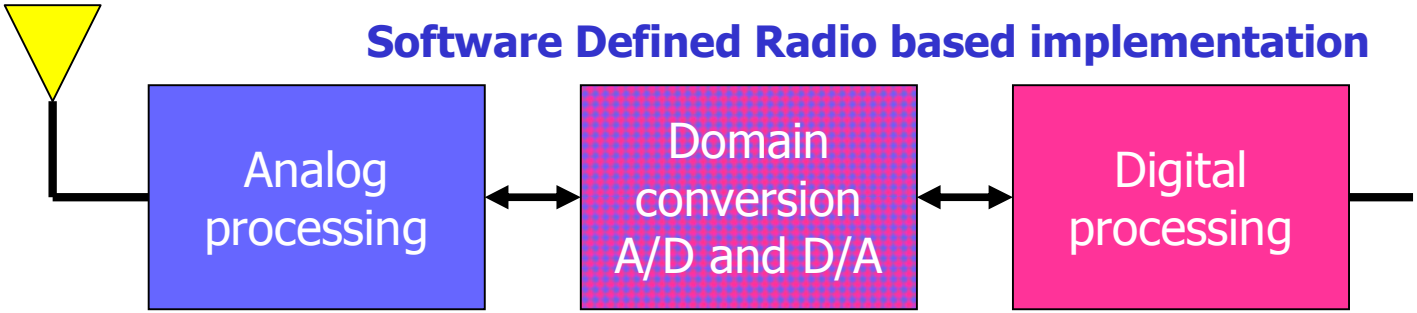
# SIGINT-COMINT-ESM-ECM-EW

# Rádióelektronikai eszköz modell

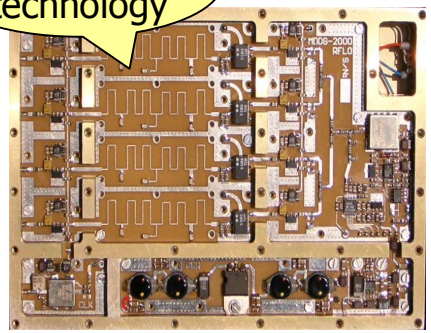
## Traditional implementation



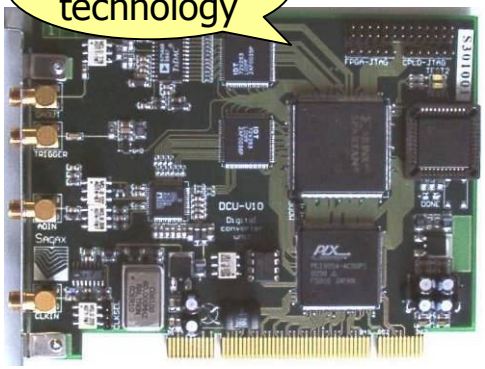

## Software Defined Radio based implementation



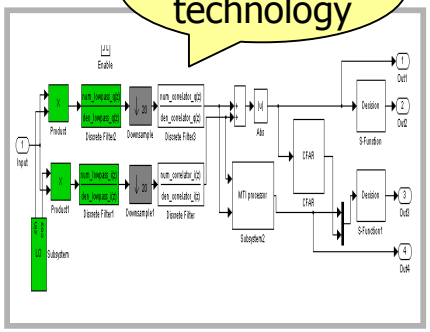

RF technology



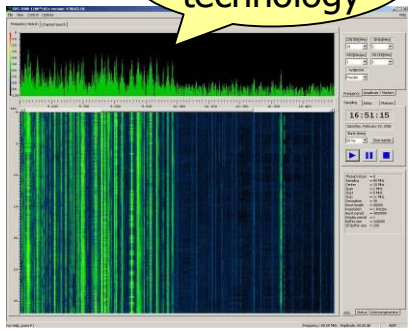
Conversion technology



DSP technology

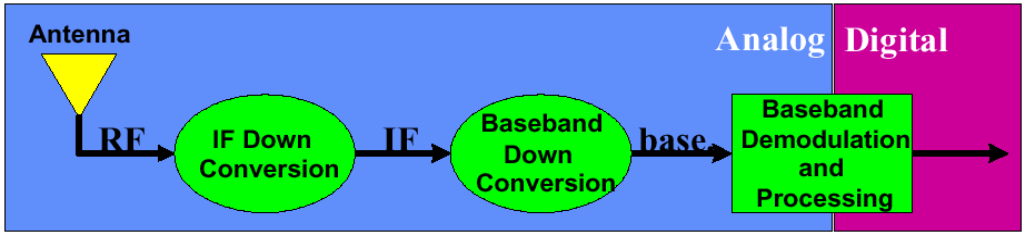


GUI technology

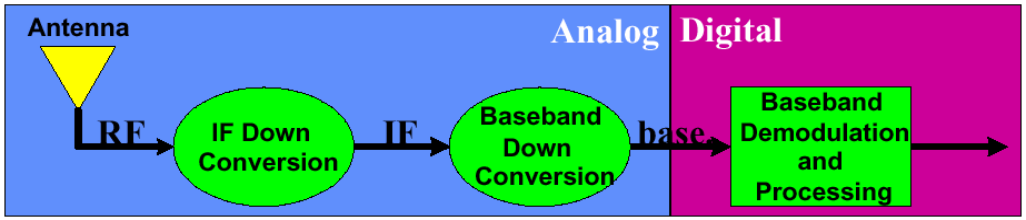


# SDR megvalósítási szintek

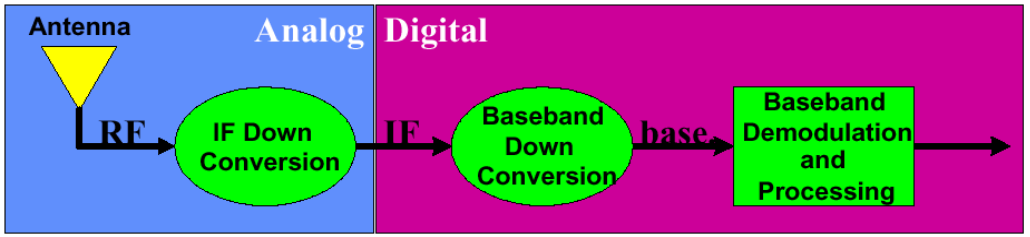
**Digital signals**




**Digital BB**




**Digital IF**

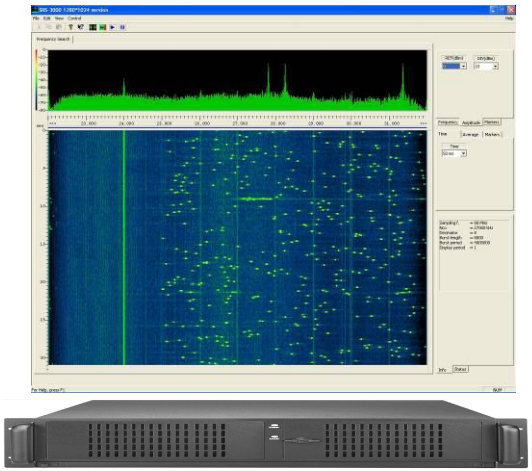


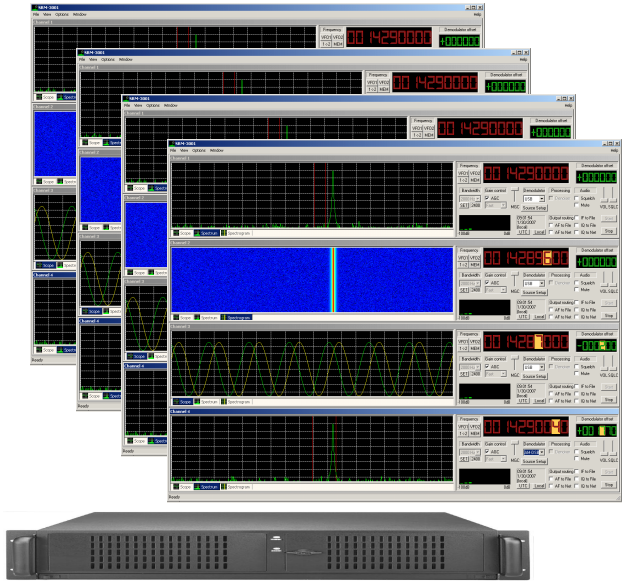

**Digital RF**

# Méret csökkenés – képesség növekedés

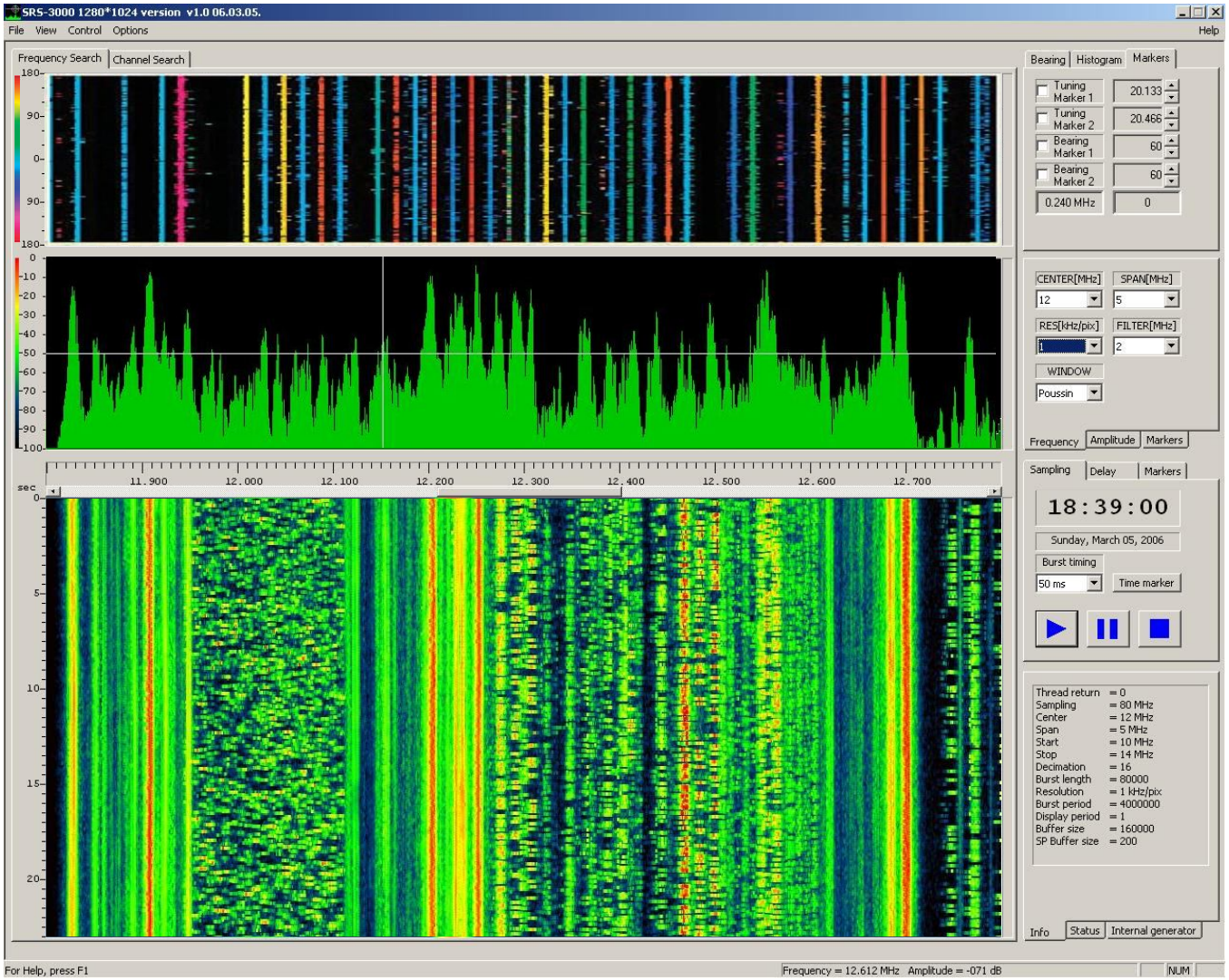
**DCU-314**
Max. 4 analog I/O channels
1 clock I/O channel
80Msps/14bit sampling
500MHz bandwidth
**80 bit front-end bus**
**Xilinx Virtex II FPGA**
**64bit/66MHz PCI interface**

**DRU-304**
Max. 4 analog I/O channels
1 clock I/O channel
80Msps/14bit sampling
500MHz bandwidth
**Xilinx Virtex II FPGA**
**Max. 16 digital tuner**
**64bit/66MHz PCI interface**

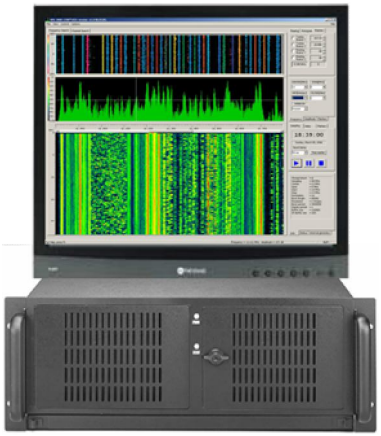




# Kereső vevőkészülék

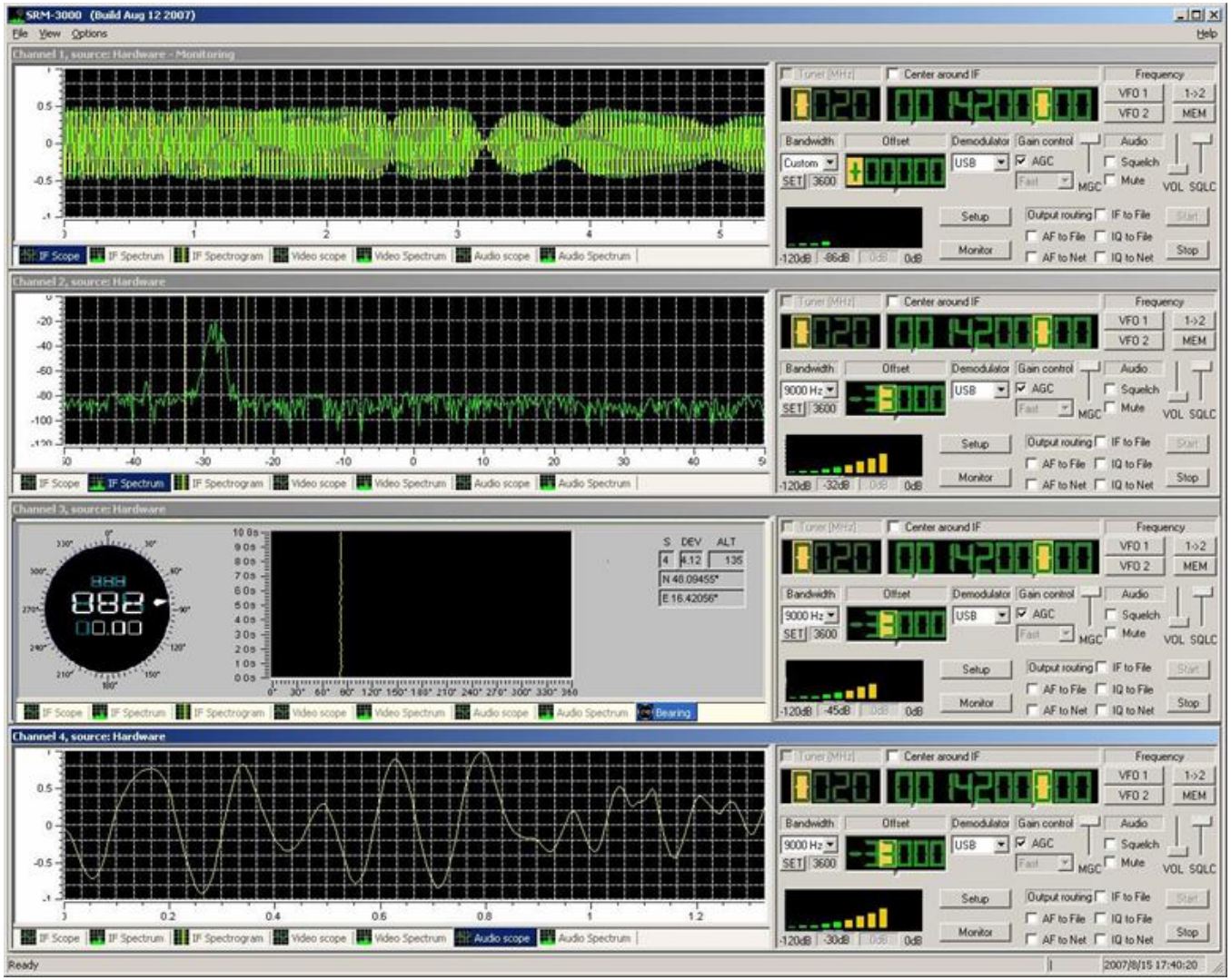



- 40MHz instantaneous bandwidth
- 1ms time resolution
- 1KHz frequency resolution
- 1200/3200 pixel display
- Full or partial bandwidth processing

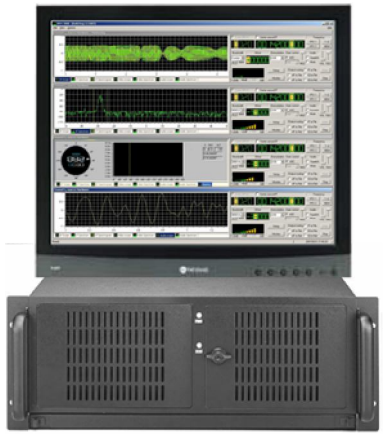


**SRS-3000 receiver**

# Monitoring vevőkészülék

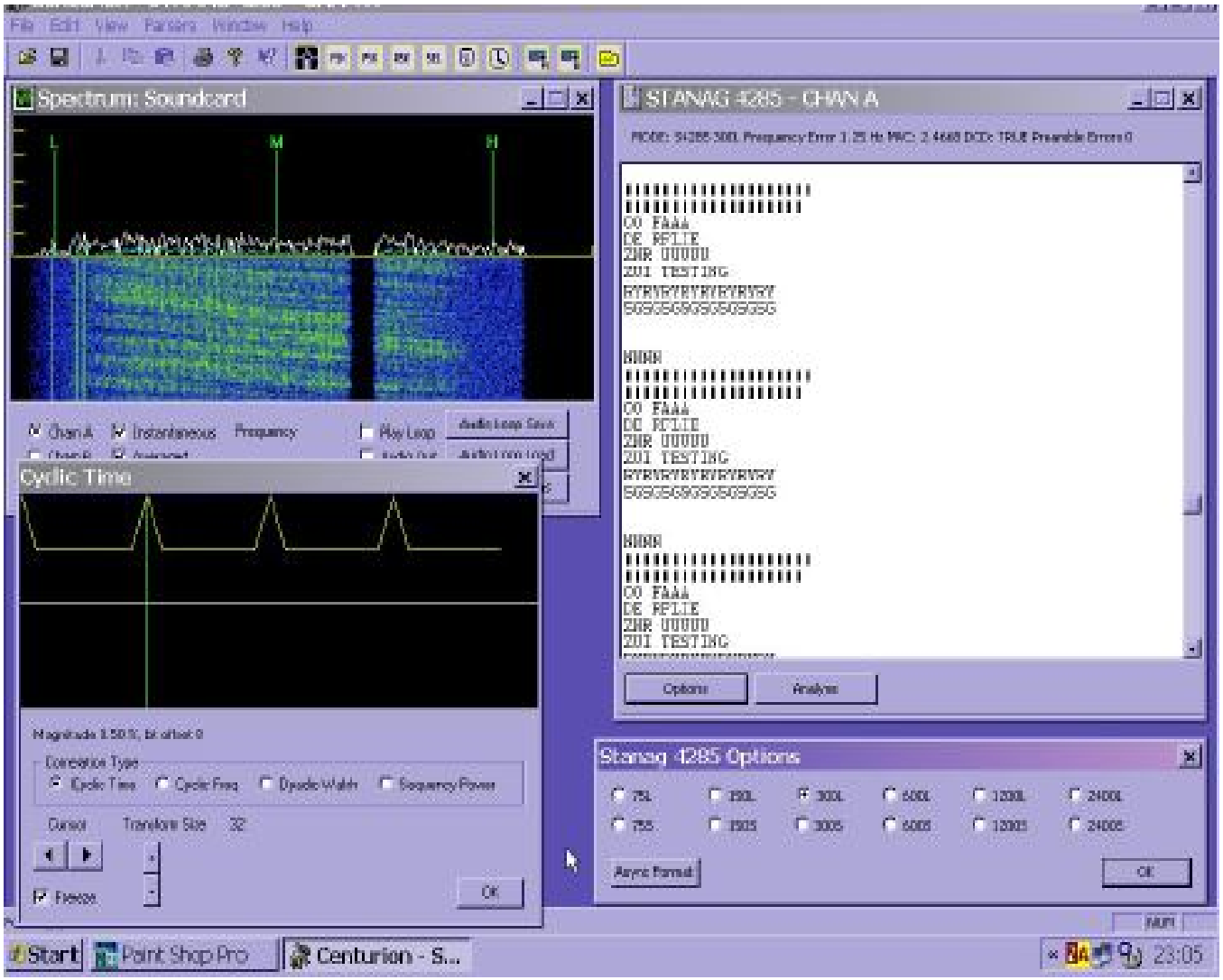



- Integrated front-end tuner
- 20-3000MHz VUHF
- 1.5-32MHz HF
- 400KHz IF bandwidth
- AM/FM/SSB/ISB demodulation
- Hard disk recording facility

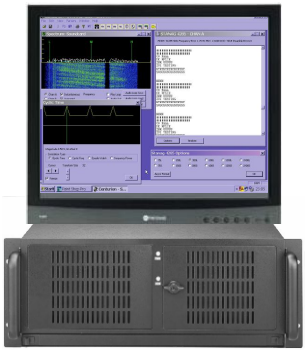


**SRM-3000 receiver**

# Demodulátor és dekóder

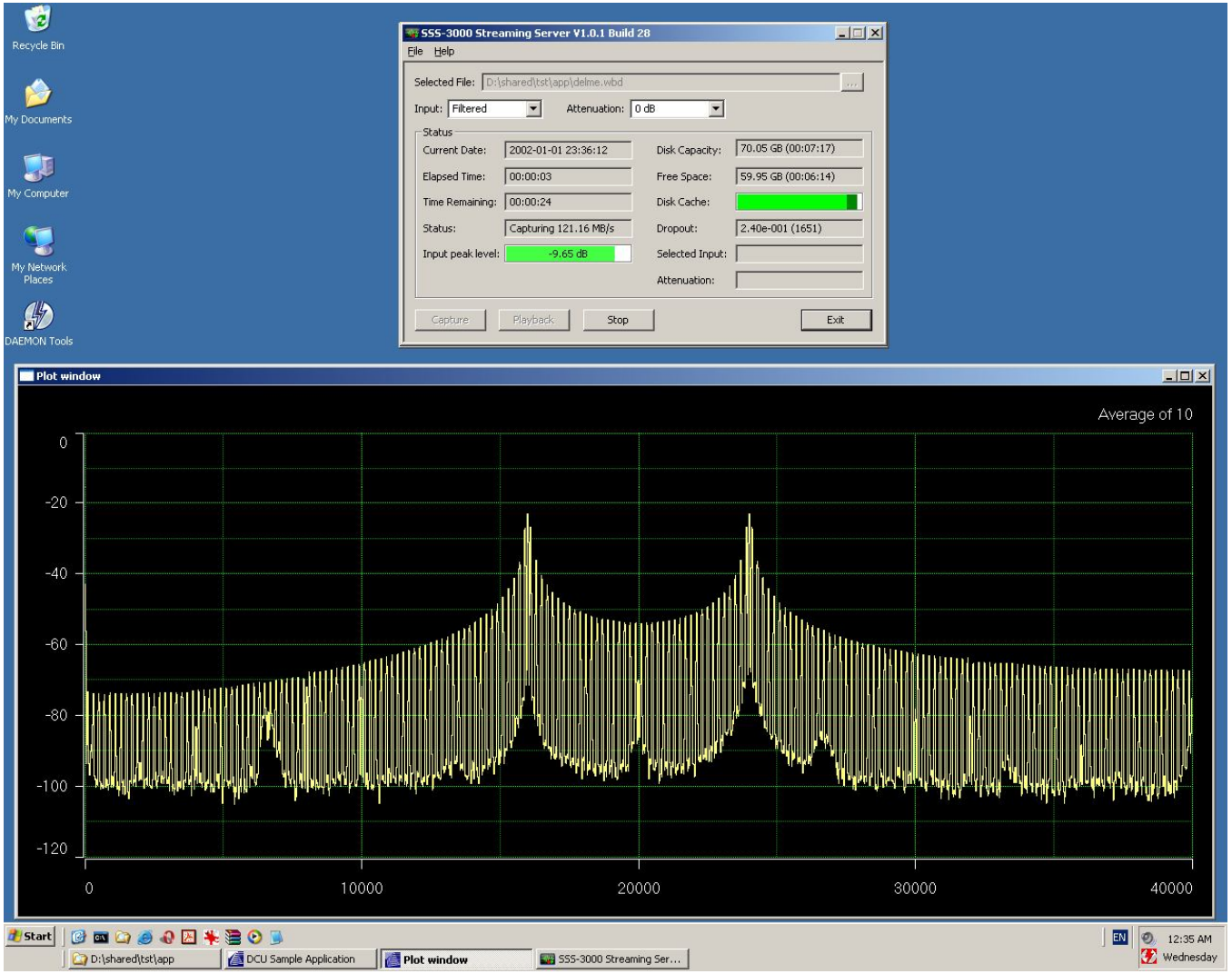



- Different signal input interfaces
- Digital demodulators
- Large number of signal decoding Advanced signal analysis functions
- Powerful signal intelligence tools
- Signal classification option

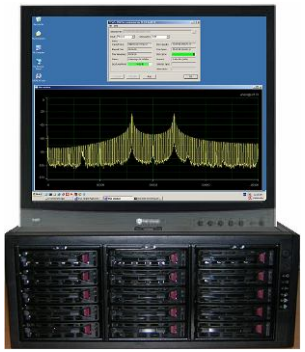


**SDW-3000 decoder**

# Tároló/késleltető szerver




- Compact design with graphical user interface
- Up to 40MHz wide instantaneous real-time bandwidth
- Analog or digital input and output
- Up to 8TB storage capacity in 4U
- Stand-alone or network access

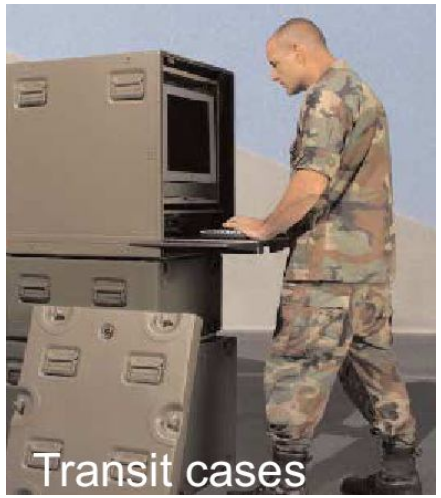


**SSS-3000 server**

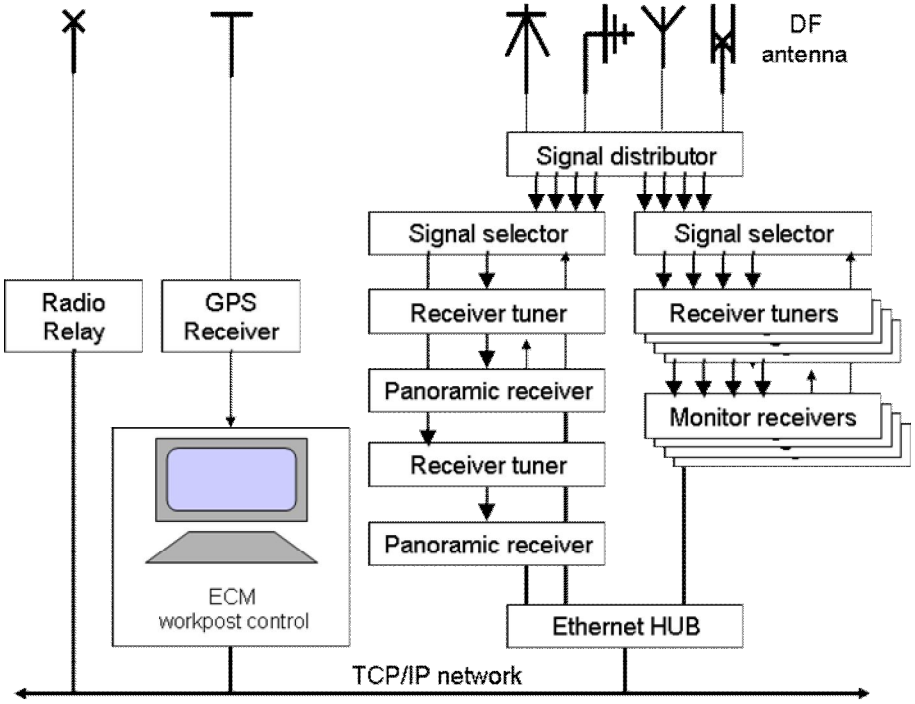
# Könnyű járműves nagy mobilitású telepítés

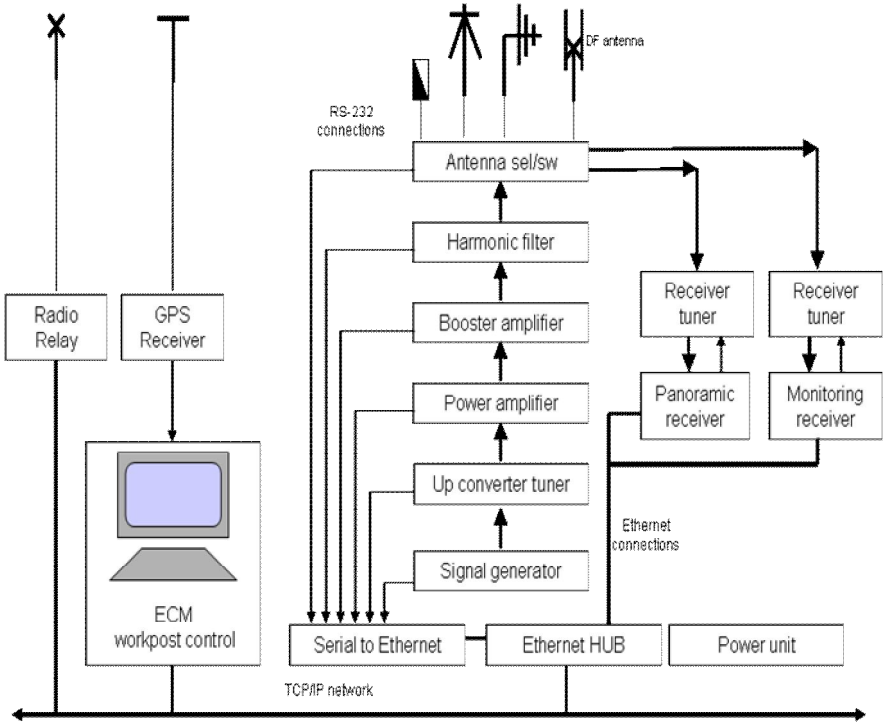
Elektronika a raktérben

Kezelőfelület a kabinban

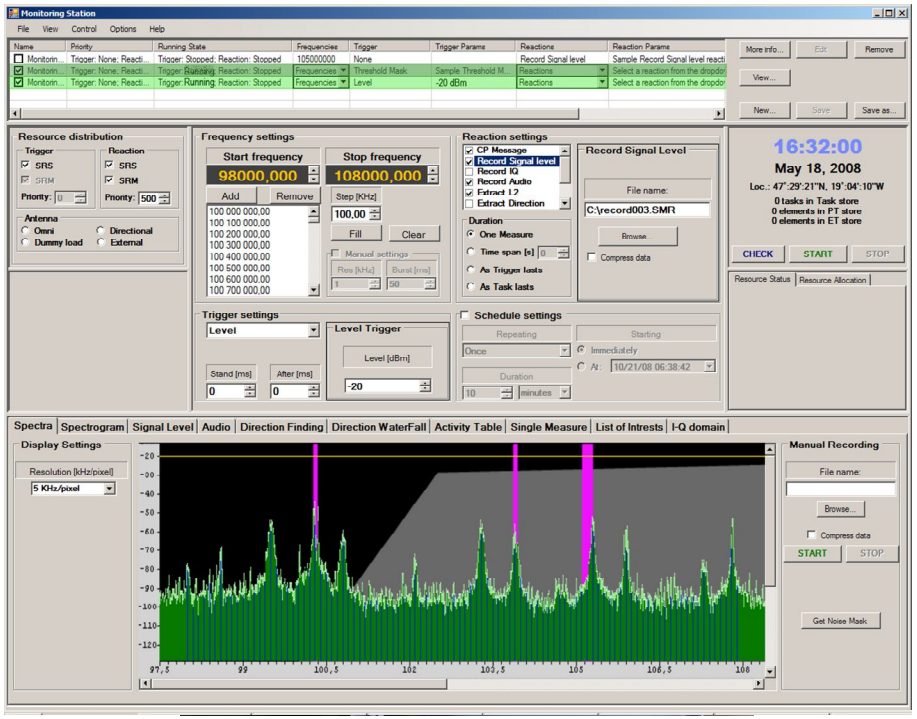


# Felderítő és zavaró állomás



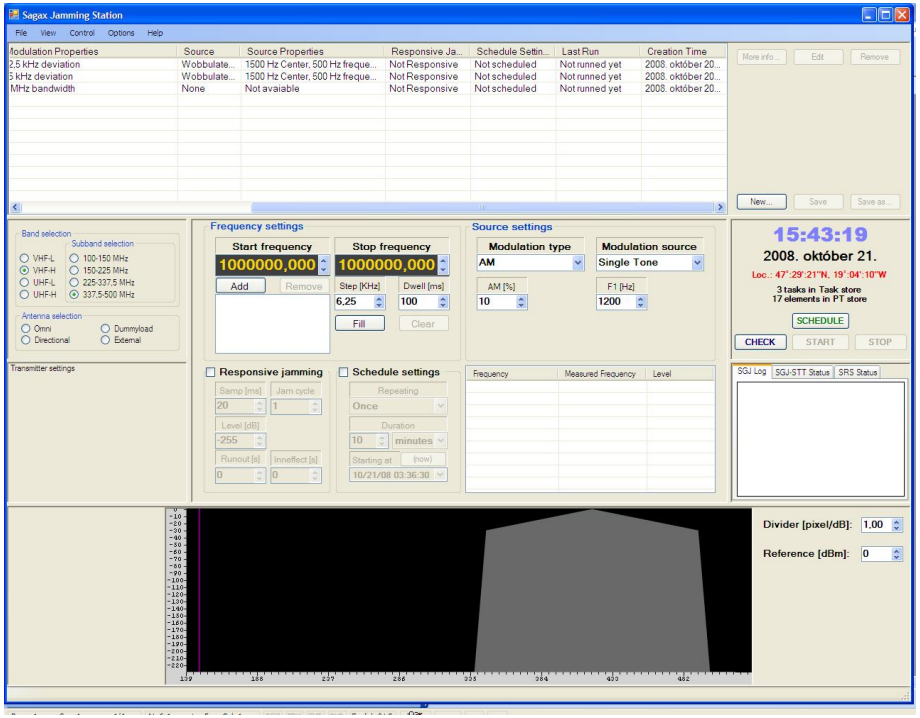



# Állomás prototípusok (12U 19” méretben)




## Felderítő (ESM) állomás

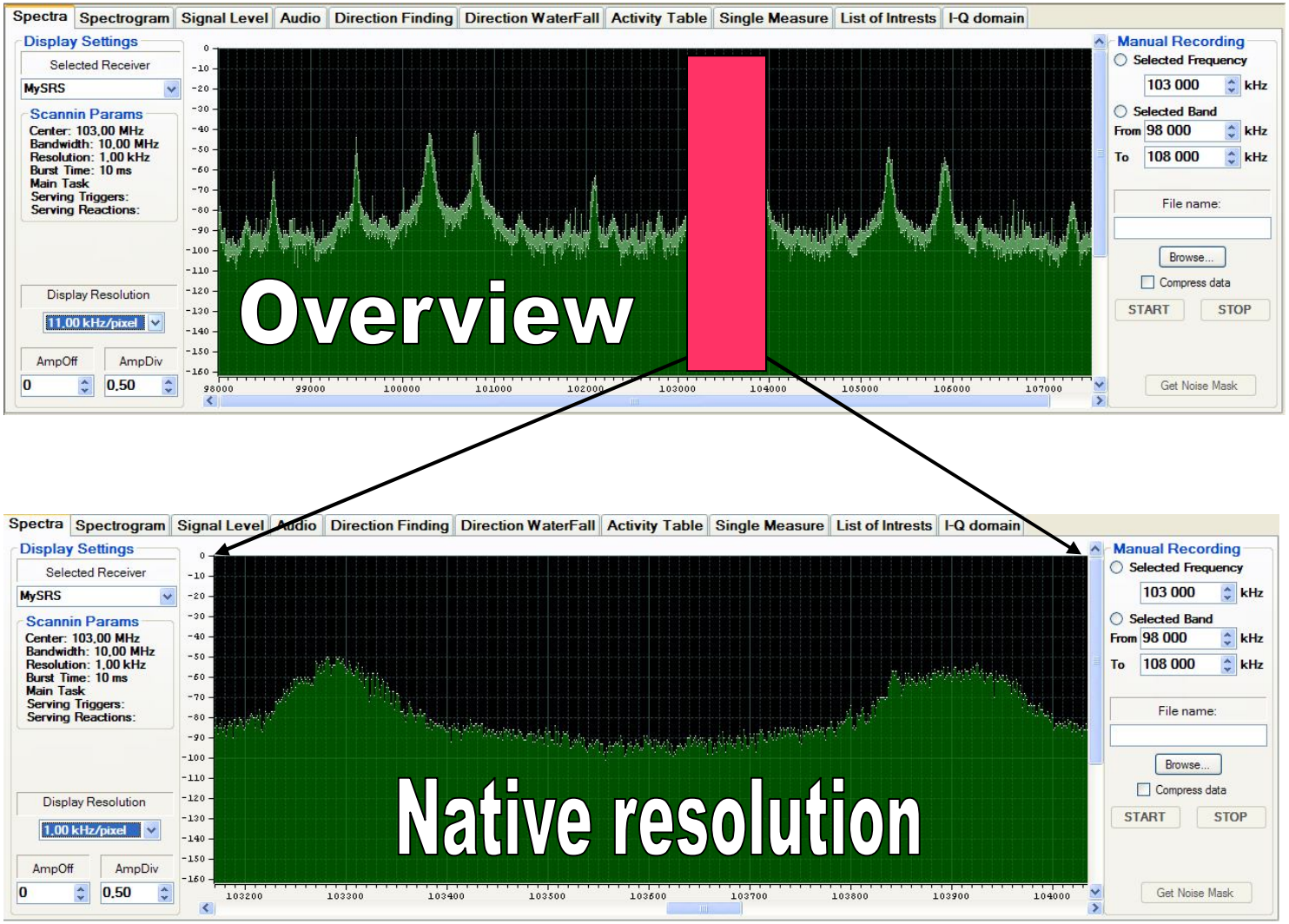
**0.09-3000MHz frekvencia tartomány**
**2/4 független kereső vevőkészülék**
**4/16/64 monitoring csatorna**
**Helyi vagy távoli rögzítési lehetőség**
**Iránymérési képességekkel bővíthető**
**Helyi vagy távoli vezérlés lehetősége**



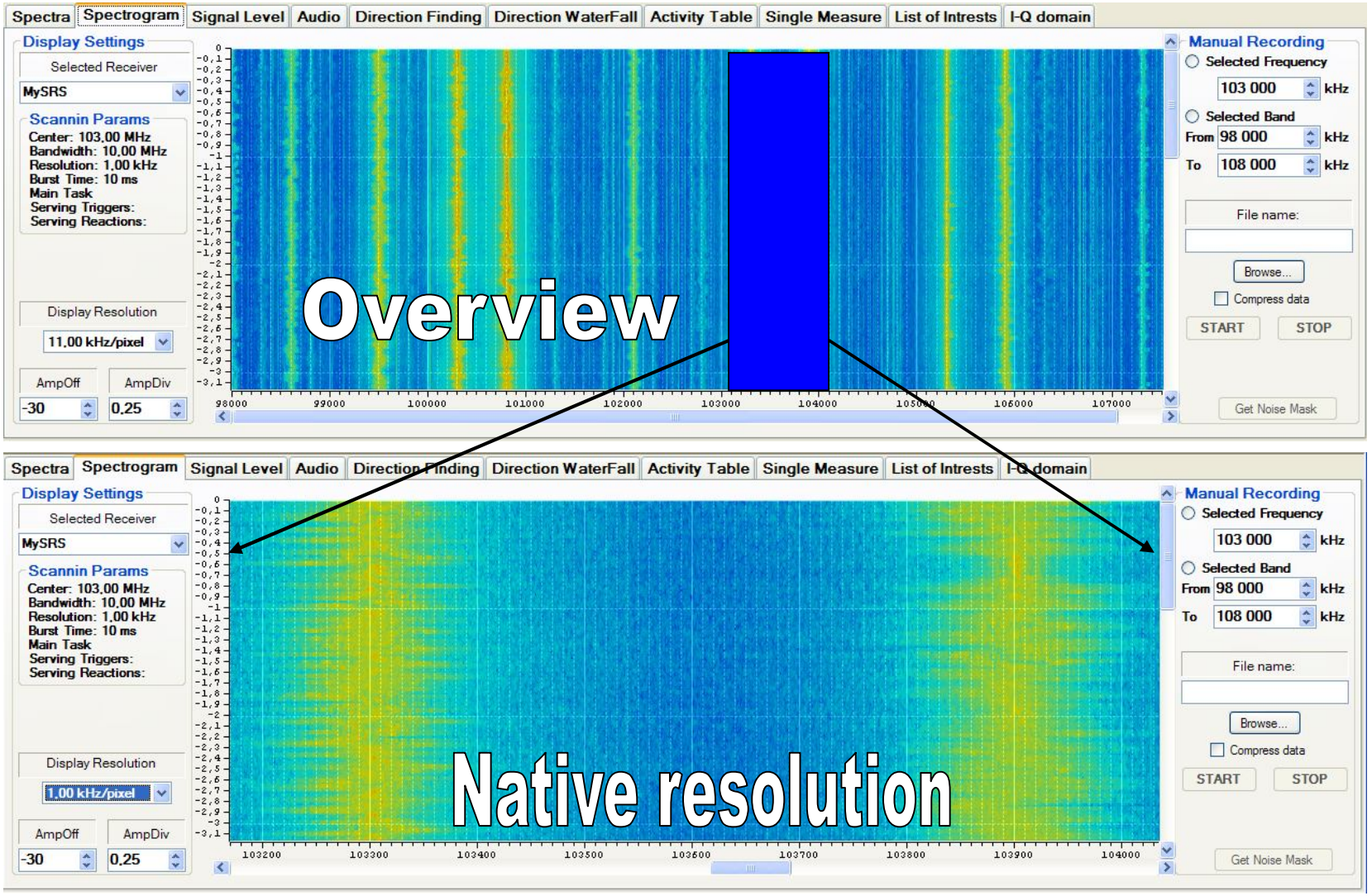

## Zavaró (ECM) állomás

**Adó 100-500MHz frekvencia tartomány**
**Folyamatos és felelő (responsive) üzemmód**
**100ms válaszidejű akcióképesség (1ms opció)**
**Széles adaptálható moduláló jelkínálat**
**1000W adó kimenő teljesítmény**
**Akkumulátoros üzem csökkentett képességekkel**

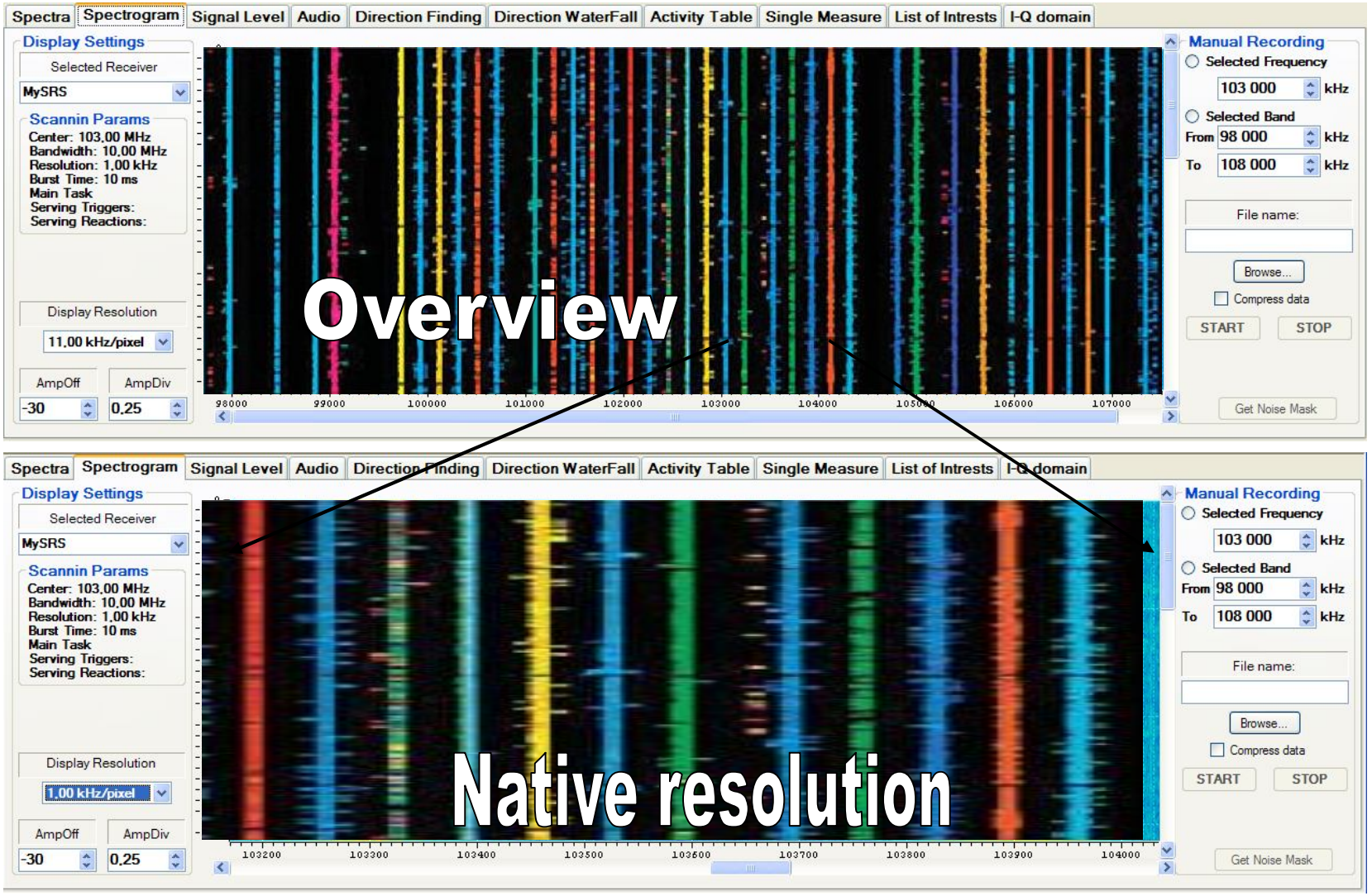
# Spectrum Display



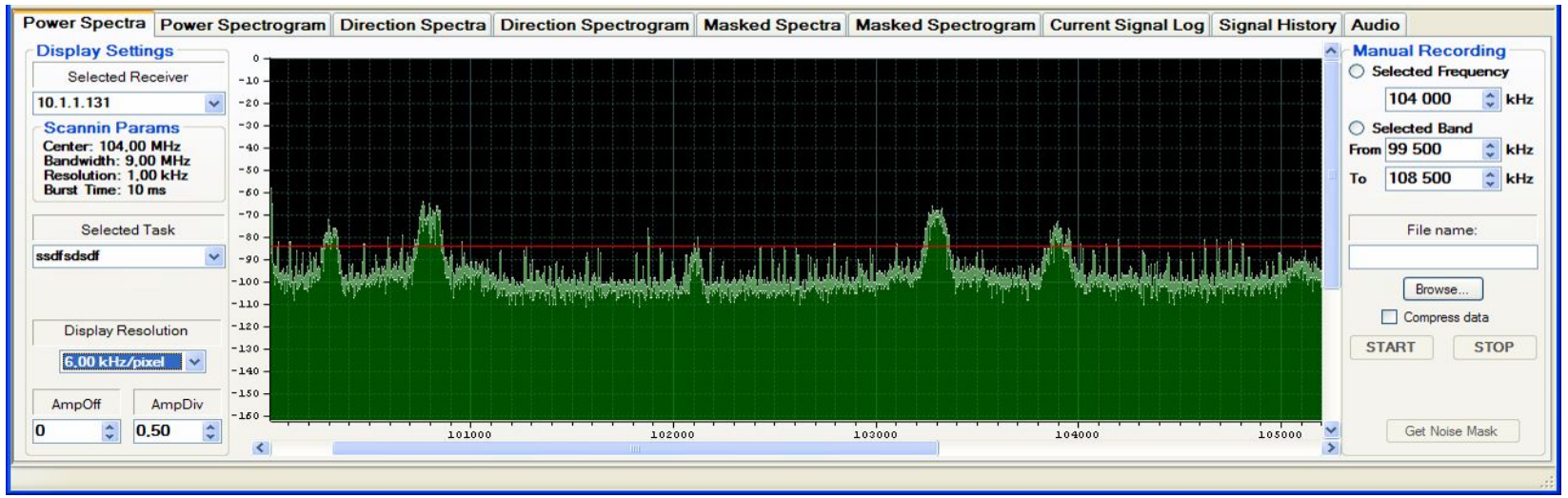
# Spectogram Display

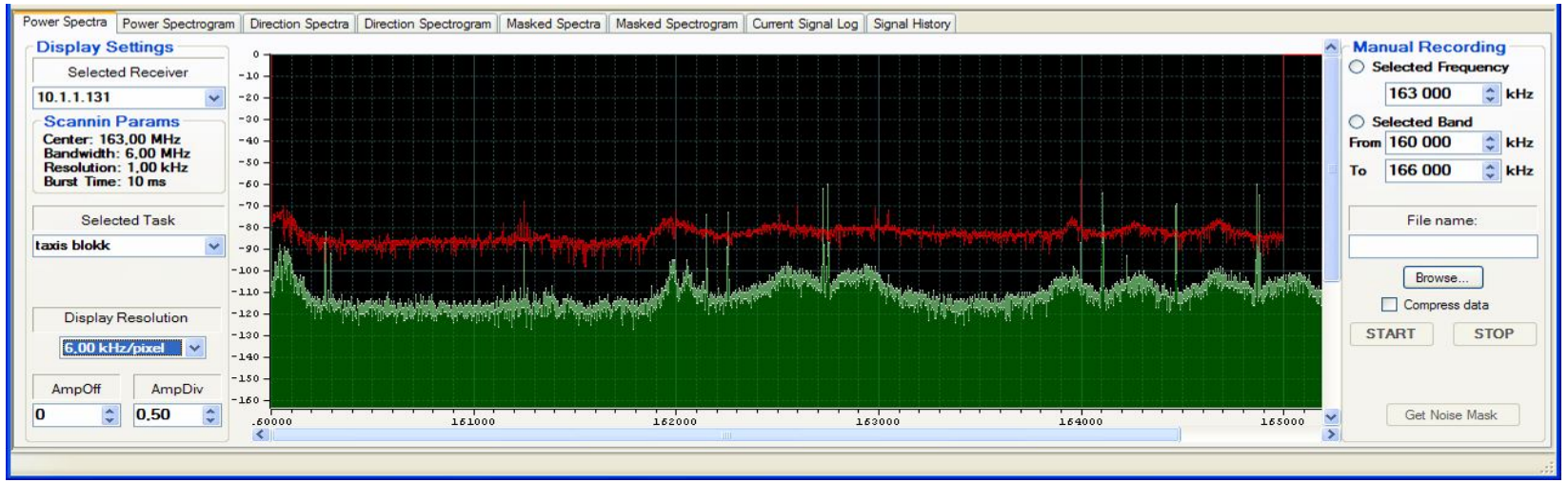


# Directogram Display

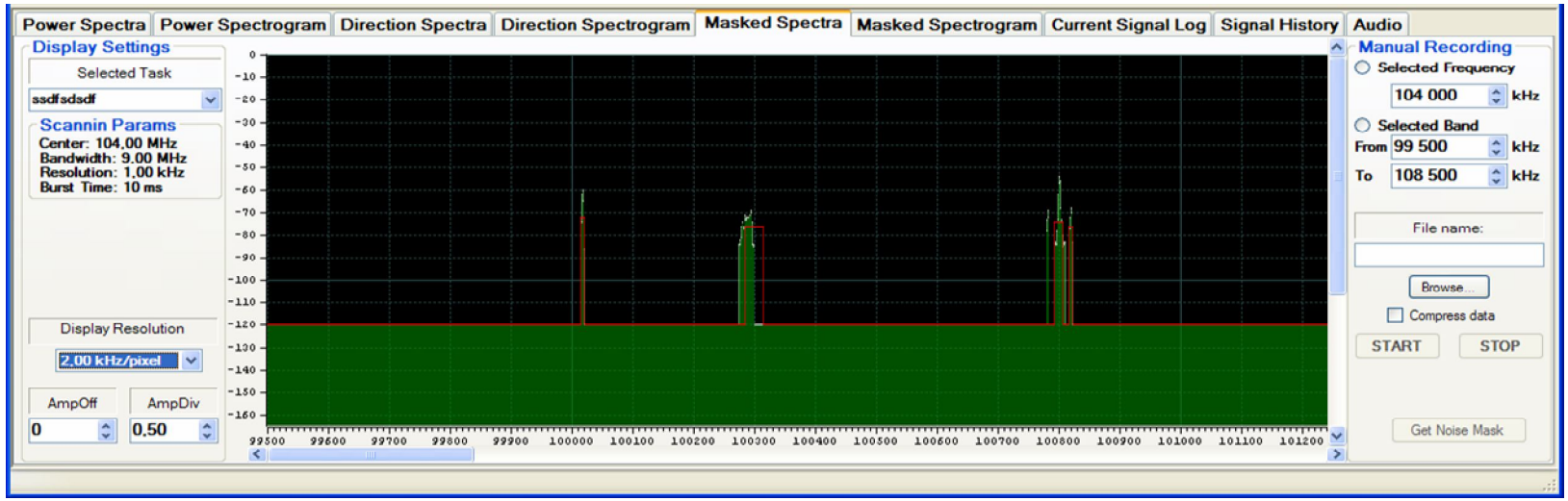


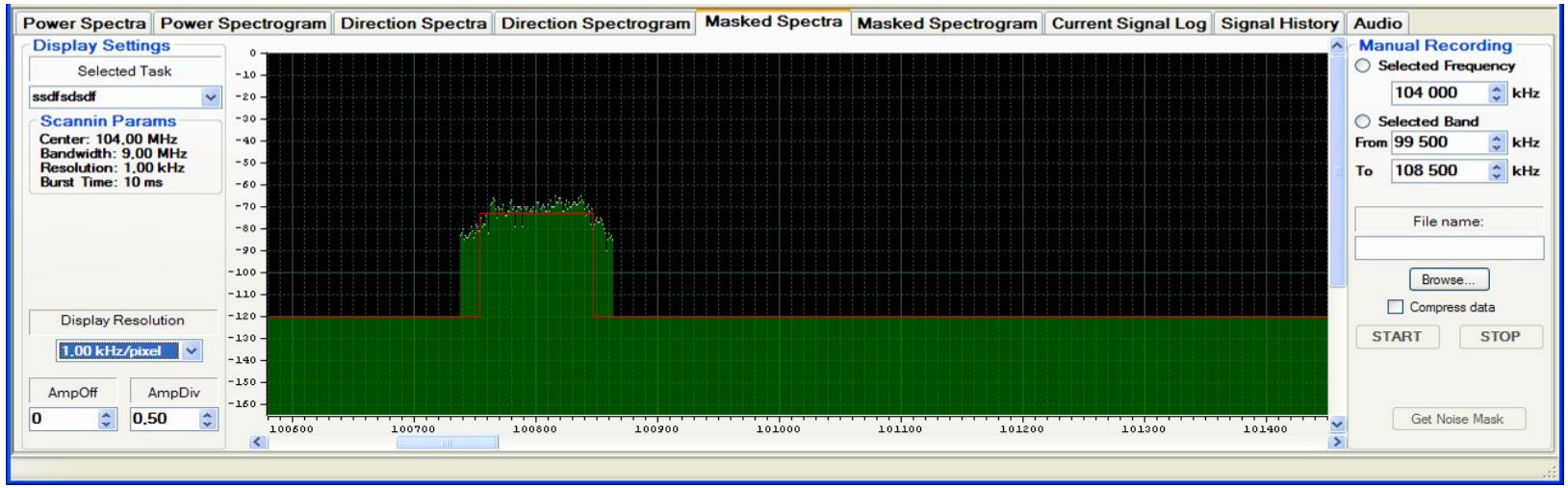
# Level threshold



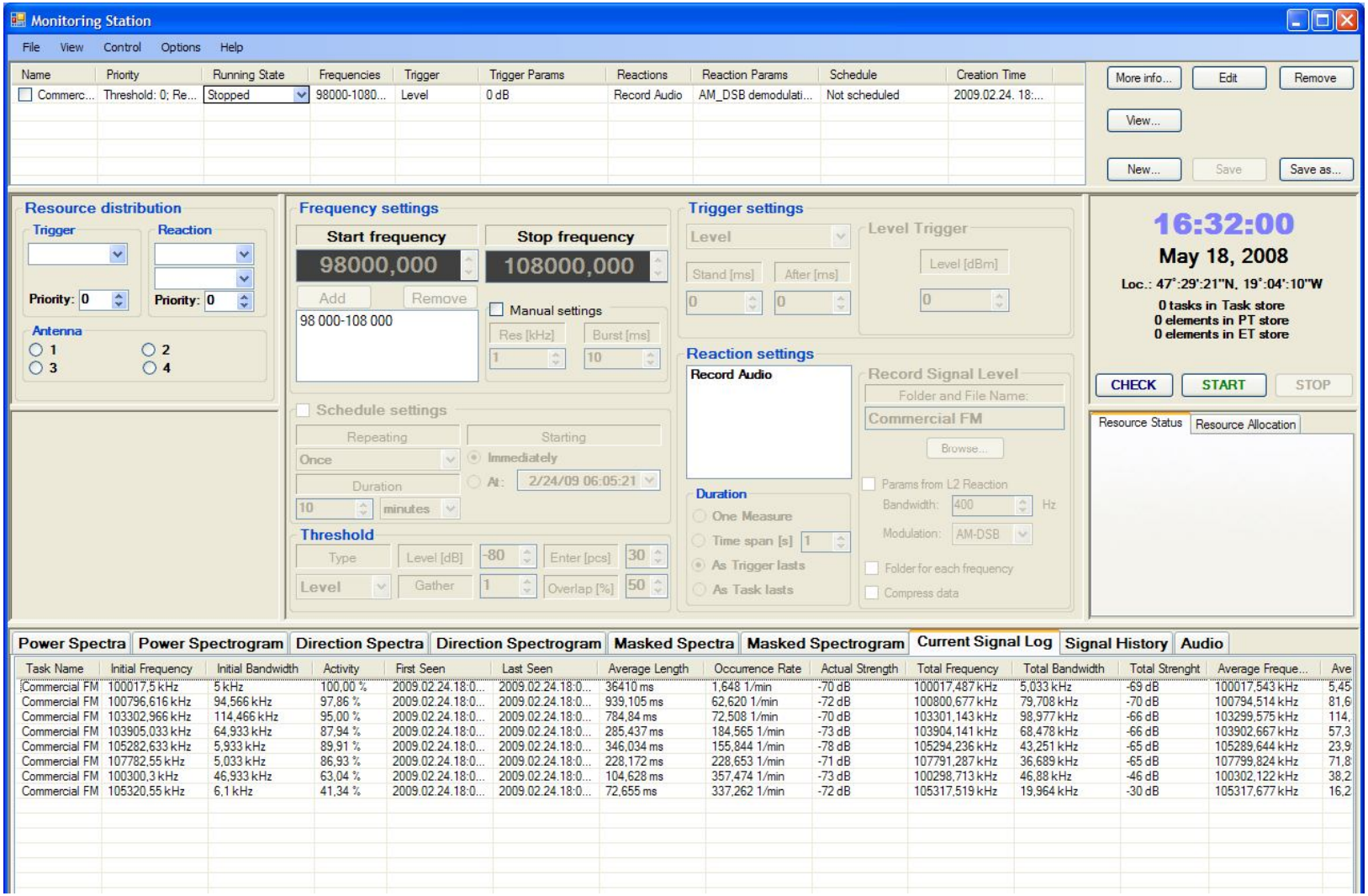



# Detected signals

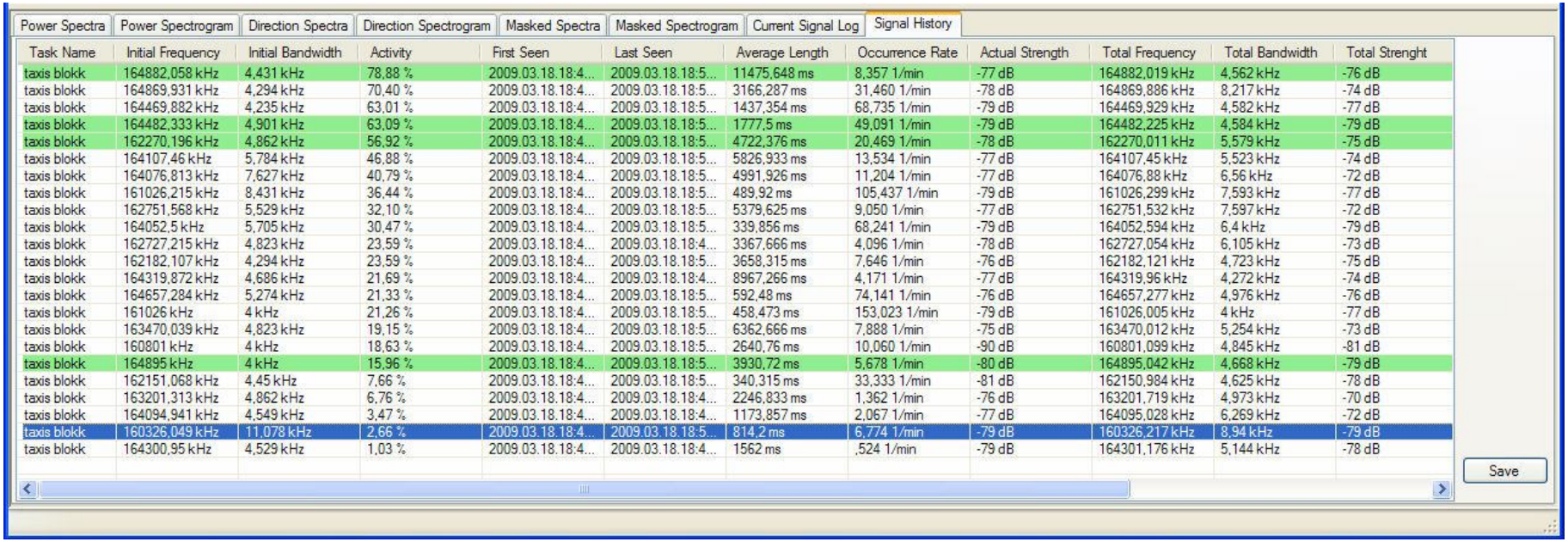


# Current signal log list

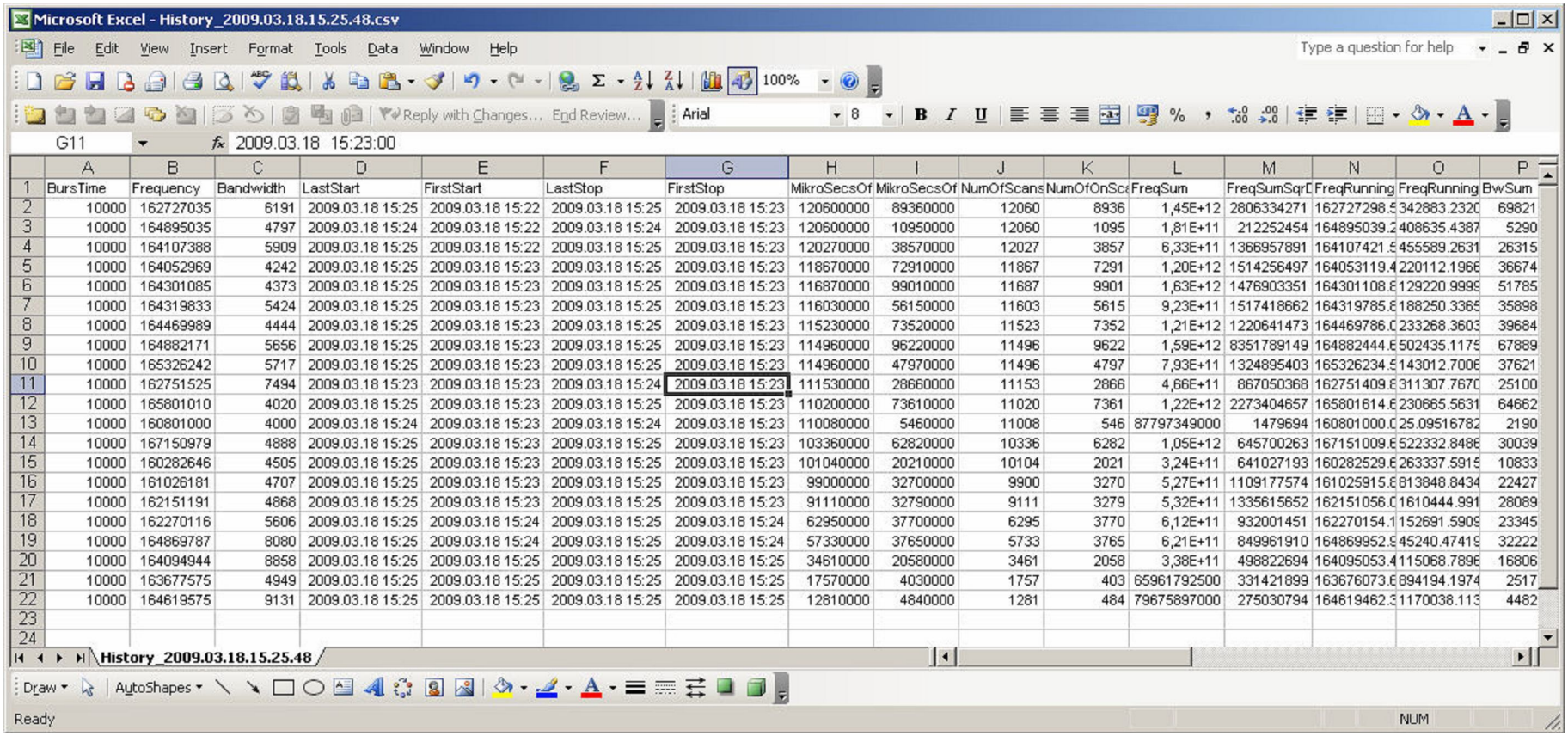


# Signal history list




| Task Name | Initial Frequency | Initial Bandwidth | Activity | First Seen | Last Seen | Average Length | Occurrence Rate | Actual Strength | Total Frequency | Total Bandwidth | Total Strenght |
|---|---|---|---|---|---|---|---|---|---|---|---|
| taxis blokk | 164882,058 kHz | 4,431 kHz | 78,88 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 11475,648 ms | 8,357 1/min | -77 dB | 164882,019 kHz | 4,562 kHz | -76 dB |
| taxis blokk | 164869,931 kHz | 4,294 kHz | 70,40 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 3166,287 ms | 31,460 1/min | -78 dB | 164869,886 kHz | 8,217 kHz | -74 dB |
| taxis blokk | 164469,882 kHz | 4,235 kHz | 63,01 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 1437,354 ms | 68,735 1/min | -79 dB | 164469,929 kHz | 4,582 kHz | -77 dB |
| taxis blokk | 164482,333 kHz | 4,901 kHz | 63,09 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 1777,5 ms | 49,091 1/min | -79 dB | 164482,225 kHz | 4,584 kHz | -79 dB |
| taxis blokk | 162270,196 kHz | 4,862 kHz | 56,92 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 4722,376 ms | 20,469 1/min | -78 dB | 162270,011 kHz | 5,579 kHz | -75 dB |
| taxis blokk | 164107,46 kHz | 5,784 kHz | 46,88 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 5826,933 ms | 13,534 1/min | -77 dB | 164107,45 kHz | 5,523 kHz | -74 dB |
| taxis blokk | 164076,813 kHz | 7,627 kHz | 40,79 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 4991,926 ms | 11,204 1/min | -77 dB | 164076,88 kHz | 6,56 kHz | -72 dB |
| taxis blokk | 161026,215 kHz | 8,431 kHz | 36,44 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 489,92 ms | 105,437 1/min | -79 dB | 161026,299 kHz | 7,593 kHz | -77 dB |
| taxis blokk | 162751,568 kHz | 5,529 kHz | 32,10 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 5379,625 ms | 9,050 1/min | -77 dB | 162751,532 kHz | 7,597 kHz | -72 dB |
| taxis blokk | 164052,5 kHz | 5,705 kHz | 30,47 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 339,856 ms | 68,241 1/min | -79 dB | 164052,594 kHz | 6,4 kHz | -79 dB |
| taxis blokk | 162727,215 kHz | 4,823 kHz | 23,59 % | 2009.03.18.18:4... | 2009.03.18.18:4... | 3367,666 ms | 4,096 1/min | -78 dB | 162727,054 kHz | 6,105 kHz | -73 dB |
| taxis blokk | 162182,107 kHz | 4,294 kHz | 23,59 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 3658,315 ms | 7,646 1/min | -76 dB | 162182,121 kHz | 4,723 kHz | -75 dB |
| taxis blokk | 164319,872 kHz | 4,686 kHz | 21,69 % | 2009.03.18.18:4... | 2009.03.18.18:4... | 8967,266 ms | 4,171 1/min | -77 dB | 164319,96 kHz | 4,272 kHz | -74 dB |
| taxis blokk | 164657,284 kHz | 5,274 kHz | 21,33 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 592,48 ms | 74,141 1/min | -76 dB | 164657,277 kHz | 4,976 kHz | -76 dB |
| taxis blokk | 161026 kHz | 4 kHz | 21,26 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 458,473 ms | 153,023 1/min | -79 dB | 161026,005 kHz | 4 kHz | -77 dB |
| taxis blokk | 163470,039 kHz | 4,823 kHz | 19,15 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 6362,666 ms | 7,888 1/min | -75 dB | 163470,012 kHz | 5,254 kHz | -73 dB |
| taxis blokk | 160801 kHz | 4 kHz | 18,63 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 2640,76 ms | 10,060 1/min | -90 dB | 160801,099 kHz | 4,845 kHz | -81 dB |
| taxis blokk | 164895 kHz | 4 kHz | 15,96 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 3930,72 ms | 5,678 1/min | -80 dB | 164895,042 kHz | 4,668 kHz | -79 dB |
| taxis blokk | 162151,068 kHz | 4,45 kHz | 7,66 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 340,315 ms | 33,333 1/min | -81 dB | 162150,984 kHz | 4,625 kHz | -78 dB |
| taxis blokk | 163201,313 kHz | 4,862 kHz | 6,76 % | 2009.03.18.18:4... | 2009.03.18.18:4... | 2246,833 ms | 1,362 1/min | -76 dB | 163201,719 kHz | 4,973 kHz | -70 dB |
| taxis blokk | 164094,941 kHz | 4,549 kHz | 3,47 % | 2009.03.18.18:4... | 2009.03.18.18:4... | 1173,857 ms | 2,067 1/min | -77 dB | 164095,028 kHz | 6,269 kHz | -72 dB |
| taxis blokk | 160326,049 kHz | 11,078 kHz | 2,66 % | 2009.03.18.18:4... | 2009.03.18.18:5... | 814,2 ms | 6,774 1/min | -79 dB | 160326,217 kHz | 8,94 kHz | -79 dB |
| taxis blokk | 164300,95 kHz | 4,529 kHz | 1,03 % | 2009.03.18.18:4... | 2009.03.18.18:4... | 1562 ms | ,524 1/min | -79 dB | 164301,176 kHz | 5,144 kHz | -78 dB |

# Signal history list



Microsoft Excel - History_2009.03.18.15.25.48.csv

File Edit View Insert Format Tools Data Window Help

G11 2009.03.18 15:23:00

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BursTime | Frequency | Bandwidth | LastStart | FirstStart | LastStop | FirstStop | MikroSecsOf | MikroSecsOf | NumOfScans | NumOfOnSc | FreqSum | FreqSumSqr | FreqRunning | FreqRunning | BwSum |
| 2 | 10000 | 162727035 | 6191 | 2009.03.18 15:25 | 2009.03.18 15:22 | 2009.03.18 15:25 | 2009.03.18 15:23 | 120600000 | 89360000 | 12060 | 8936 | 1,45E+12 | 2806334271 | 162727298.5 | 342883.2320 | 69821 |
| 3 | 10000 | 164895035 | 4797 | 2009.03.18 15:24 | 2009.03.18 15:22 | 2009.03.18 15:24 | 2009.03.18 15:23 | 120600000 | 10950000 | 12060 | 1095 | 1,81E+11 | 212252454 | 164895039.2 | 408635.4387 | 5290 |
| 4 | 10000 | 164107388 | 5909 | 2009.03.18 15:25 | 2009.03.18 15:22 | 2009.03.18 15:25 | 2009.03.18 15:23 | 120270000 | 38570000 | 12027 | 3857 | 6,33E+11 | 1366957891 | 164107421.5 | 455589.2631 | 26315 |
| 5 | 10000 | 164052969 | 4242 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 118670000 | 72910000 | 11867 | 7291 | 1,20E+12 | 1514256497 | 164053119.4 | 220112.1966 | 36674 |
| 6 | 10000 | 164301085 | 4373 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 116870000 | 99010000 | 11687 | 9901 | 1,63E+12 | 1476903351 | 164301108.8 | 129220.9999 | 51785 |
| 7 | 10000 | 164319833 | 5424 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 116030000 | 56150000 | 11603 | 5615 | 9,23E+11 | 1517418662 | 164319785.8 | 188250.3369 | 35898 |
| 8 | 10000 | 164469989 | 4444 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 115230000 | 73520000 | 11523 | 7352 | 1,21E+12 | 1220641473 | 164469786.0 | 233268.3603 | 39684 |
| 9 | 10000 | 164882171 | 5656 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 114960000 | 96220000 | 11496 | 9622 | 1,59E+12 | 8351789149 | 164882444.6 | 502435.1175 | 67889 |
| 10 | 10000 | 165326242 | 5717 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 114960000 | 47970000 | 11496 | 4797 | 7,93E+11 | 1324895403 | 165326234.5 | 143012.7006 | 37621 |
| 11 | 10000 | 162751525 | 7494 | 2009.03.18 15:23 | 2009.03.18 15:23 | 2009.03.18 15:24 | 2009.03.18 15:23 | 111530000 | 28660000 | 11153 | 2866 | 4,66E+11 | 867050368 | 162751409.8 | 311307.7670 | 25100 |
| 12 | 10000 | 165801010 | 4020 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 110200000 | 73610000 | 11020 | 7361 | 1,22E+12 | 2273404657 | 165801614.6 | 230665.5631 | 64662 |
| 13 | 10000 | 160801000 | 4000 | 2009.03.18 15:24 | 2009.03.18 15:23 | 2009.03.18 15:24 | 2009.03.18 15:23 | 110080000 | 5460000 | 11008 | 546 | 87797349000 | 1479694 | 160801000.0 | 25.09516782 | 2190 |
| 14 | 10000 | 167150979 | 4888 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 103360000 | 62820000 | 10336 | 6282 | 1,05E+12 | 645700263 | 167151009.6 | 522332.8486 | 30039 |
| 15 | 10000 | 160282646 | 4505 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 101040000 | 20210000 | 10104 | 2021 | 3,24E+11 | 641027193 | 160282529.6 | 263337.5915 | 10833 |
| 16 | 10000 | 161026181 | 4707 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 99000000 | 32700000 | 9900 | 3270 | 5,27E+11 | 1109177574 | 161025915.8 | 813848.8434 | 22427 |
| 17 | 10000 | 162151191 | 4868 | 2009.03.18 15:25 | 2009.03.18 15:23 | 2009.03.18 15:25 | 2009.03.18 15:23 | 91110000 | 32790000 | 9111 | 3279 | 5,32E+11 | 1335615652 | 162151056.0 | 1610444.991 | 28089 |
| 18 | 10000 | 162270116 | 5606 | 2009.03.18 15:25 | 2009.03.18 15:24 | 2009.03.18 15:25 | 2009.03.18 15:24 | 62950000 | 37700000 | 6295 | 3770 | 6,12E+11 | 932001451 | 162270154.1 | 152691.5909 | 23345 |
| 19 | 10000 | 164869787 | 8080 | 2009.03.18 15:25 | 2009.03.18 15:24 | 2009.03.18 15:25 | 2009.03.18 15:24 | 57330000 | 37650000 | 5733 | 3765 | 6,21E+11 | 849961910 | 164869952.9 | 45240.47419 | 32222 |
| 20 | 10000 | 164094944 | 8858 | 2009.03.18 15:25 | 2009.03.18 15:25 | 2009.03.18 15:25 | 2009.03.18 15:25 | 34610000 | 20580000 | 3461 | 2058 | 3,38E+11 | 498822694 | 164095053.4 | 115068.7896 | 16806 |
| 21 | 10000 | 163677575 | 4949 | 2009.03.18 15:25 | 2009.03.18 15:25 | 2009.03.18 15:25 | 2009.03.18 15:25 | 17570000 | 4030000 | 1757 | 403 | 65961792500 | 331421899 | 163676073.6 | 894194.1974 | 2517 |
| 22 | 10000 | 164619575 | 9131 | 2009.03.18 15:25 | 2009.03.18 15:25 | 2009.03.18 15:25 | 2009.03.18 15:25 | 12810000 | 4840000 | 1281 | 484 | 79675897000 | 275030794 | 164619462.3 | 1170038.113 | 4482 |
| 23 | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | |

History_2009.03.18.15.25.48

Draw AutoShapes

Ready NUM

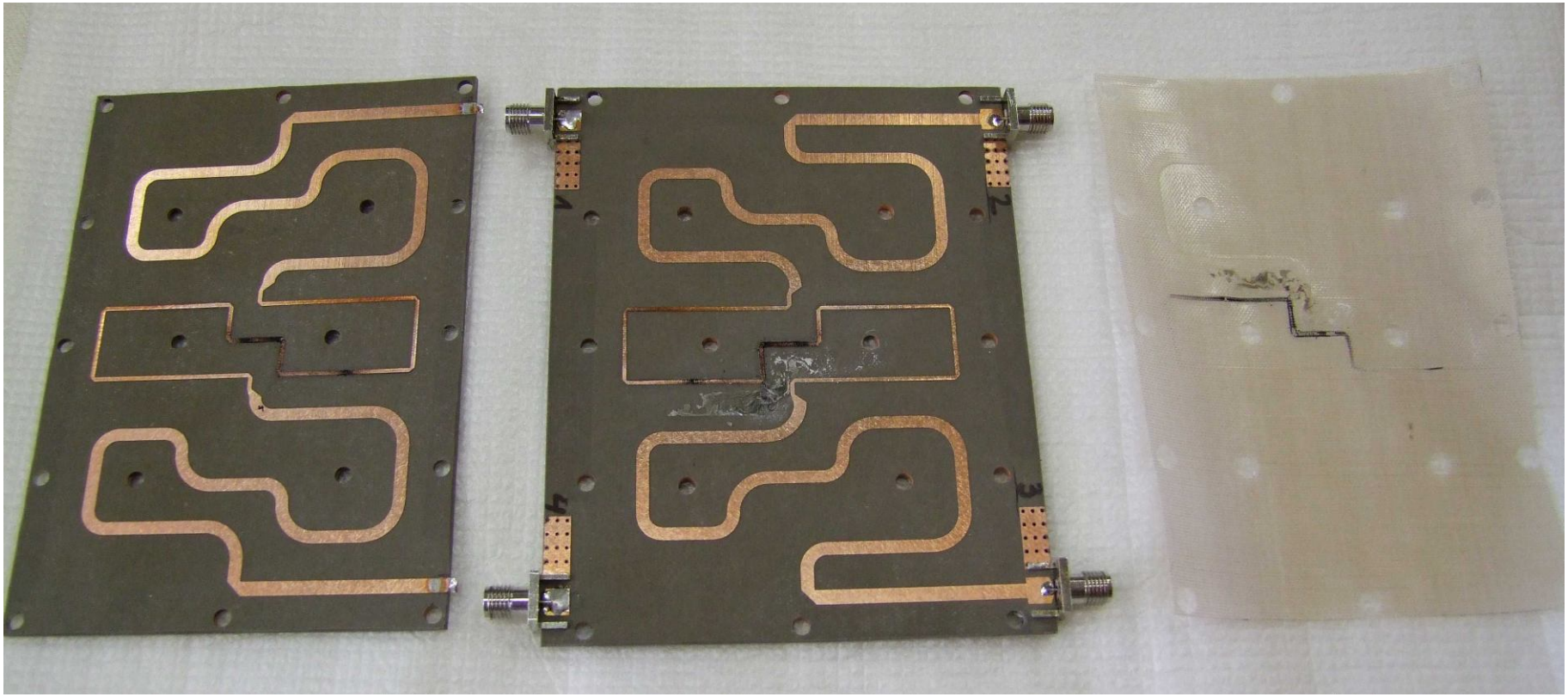
# Összefoglaló

- Felderítési feladatok
- Szoftver rádió technológia
- Rendszer komponensek
- Intergrált rendszer

„önálló államhoz nemzeti ipar kell”

1842 Ipari kiállítás
1844 Védegylet a hazai ipar védelmében

# Teljsítmény összegző



# Ezüstözés hatása