



**AIR
PARTS**



Signal Transmission & Analysis



Electrical Power & Analysis



Aviation Ordnance & Projects

**OUR COMPANY
YOUR SOLUTION**

Meten en analyseren van
Broadcast netwerken.

door: Thorwald de Boer

Overzicht

- **Overzicht Broadband netwerken**
- **DVB standaarden**
- **Signaal typen**
- **Wat willen we meten?**
- **Hoe meten we het?**
- **Antenne meetsysteem**

Huidige BB Netwerken

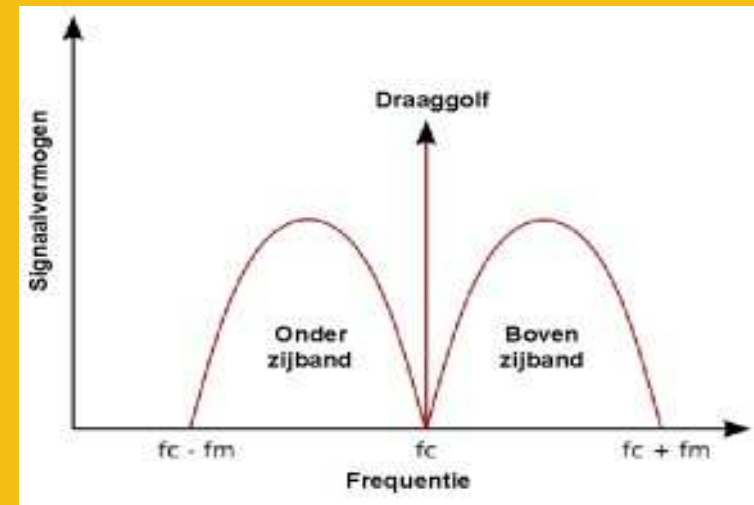
- **CATV**
 - **Analoog**
 - **Digitaal [HDTV]**

- **SATELLITE**
 - **Analoog**
 - **Digitaal [HDTV]**

- **TERRESTRIAL**
 - **Digitaal**
 - **Analoog**

Analoge radio signalen

- Analoge signalen
 - **AM**
Amplitude Modulatie
 - **FM**
Frequentie Modulatie
 - **FM (radio)**
Frequentieband radio omroep
87.5 - 108 MHz

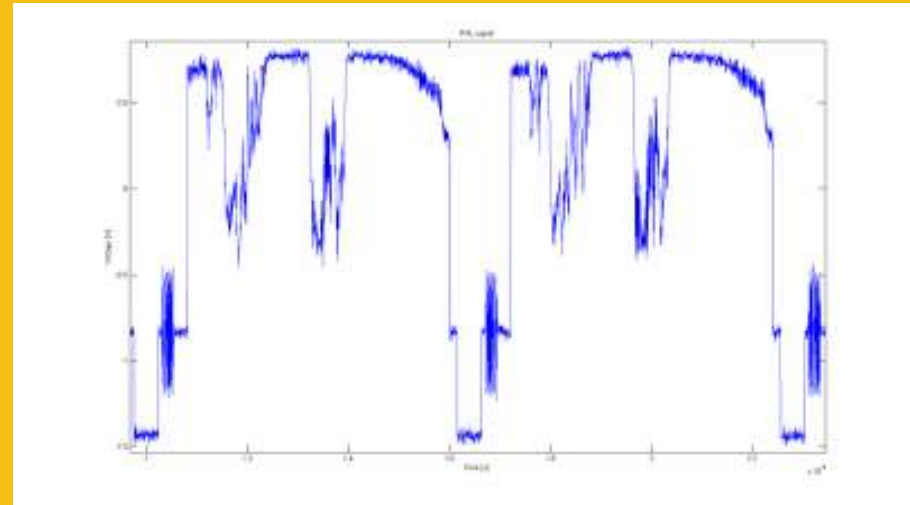


eerste proef uitzending Philips in 1950



Analoge TV signalen

- **PAL** (*Phase Alternate Line*)
televisiesysteem in de meeste landen Europa
625 lijnen 575 zichtbaar
- **NTSC** (*National Television Standards Committee*)
televisiesysteem Amerika en Japan
480 zichtbare beeldlijnen



2 Beeldlijnen PAL signaal

DVB-standaarden

Systeem voor digitale televisie-omroep opvolger analoge TV
meerdere programma's in 1 analoog TV kanaal

- **DVB-C / DVB-C2 (toekomst)**

Systeem distributie digitale omroep over kabelnetwerk kanaal 6 / 8 MHz breed

- **DVB-T / DVB-T2 (toekomst)**

Systeem voor verspreiding omroep via aardse zenders

- **DVB-S / DVB-S2**

Distributie digitale televisie via de satellite

Compatible met DVB-C

Transmissie anders door Satellite

Satellite transponder bandbreedtes

DVB-S / S2 kanaal

Satellite EIRP (dBW)	51		53.7	
System	DVB-S	DVB-S2	DVB-S	DVB-S2
Modulation & Coding	QPSK 2/3	QPSK 3/4	QPSK 7/8	8PSK 2/3
Symbol Rate (Mbaud)	27.5 ($\alpha = 0.35$)	30.9 ($\alpha = 0.2$)	27.5 ($\alpha = 0.35$)	29.7 ($\alpha = 0.25$)
C/N (in 27.5MHz) (dB)	5.1	5.1	7.8	7.8
Useful Bitrate (Mbit/s)	33.8	46 (gain = 36%)	44.4	58.8 (gain = 32%)
Number of SDTV Programmes	7 MPEG-2 15 AVC	10 MPEG-2 21 AVC	10 MPEG-2 20 AVC	13 MPEG-2 26 AVC
Number of HDTV Programmes	1-2 MPEG-2 3-4 AVC	2 MPEG-2 5 AVC	2 MPEG-2 5 AVC	3 MPEG-2 6 AVC

Figure 1. Example comparison between DVB-S and DVB-S2 for TV broadcasting (Source: EBU Technical Review 10/04)

IP verkeer over de kabel

- **DOCSIS (Data Over Cable Service Interface Specification)**
- Specificaties versturen data kabel-TV netwerk
- Bandbreedte downstream 50 tot 750 of 850 MHz
- Bandbreedte upstream 5 – 42 MHz

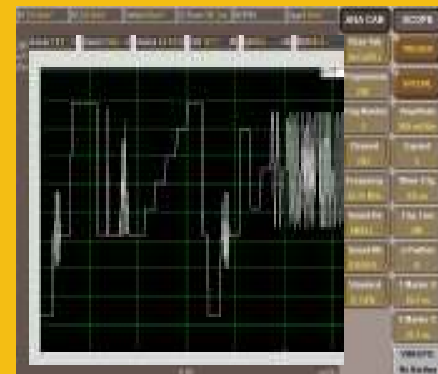
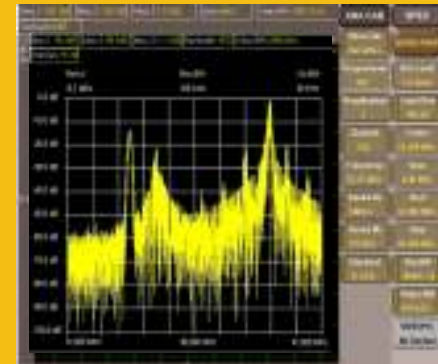
- **EuroDOCSIS (Europese versie) 8 MHz**
- Downstream spectrum 100 – 860 MHz
- Upstream spectrum 5 – 65 MHz

- **EuroDOCSIS 3.0**
- Snelheden vergelijkbaar met FO
- Parallele downstream en/of upstream kanalen
- Ondersteuning IPv6

Meten is weten

Overzicht Metingen

- 6 testen voor TV-signaal
 - **Spectrum analyser**
 - **Constellation analyser**
 - **Storage oscilloscope**
 - **Digital signal (MPEG)**
 - **LNB Multimeter**
 - **(DiSEqC Monitor)**

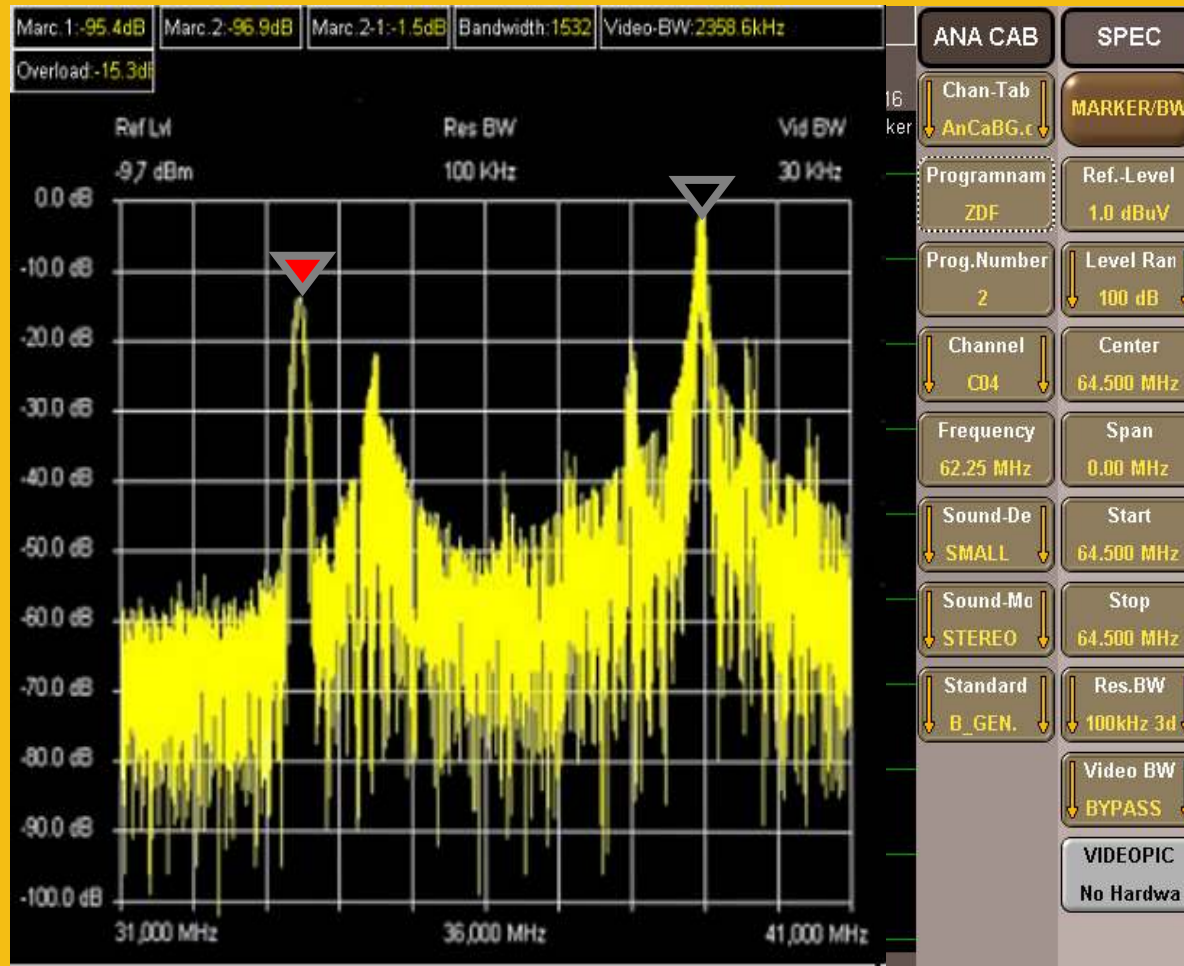


De Spectrum Analyser

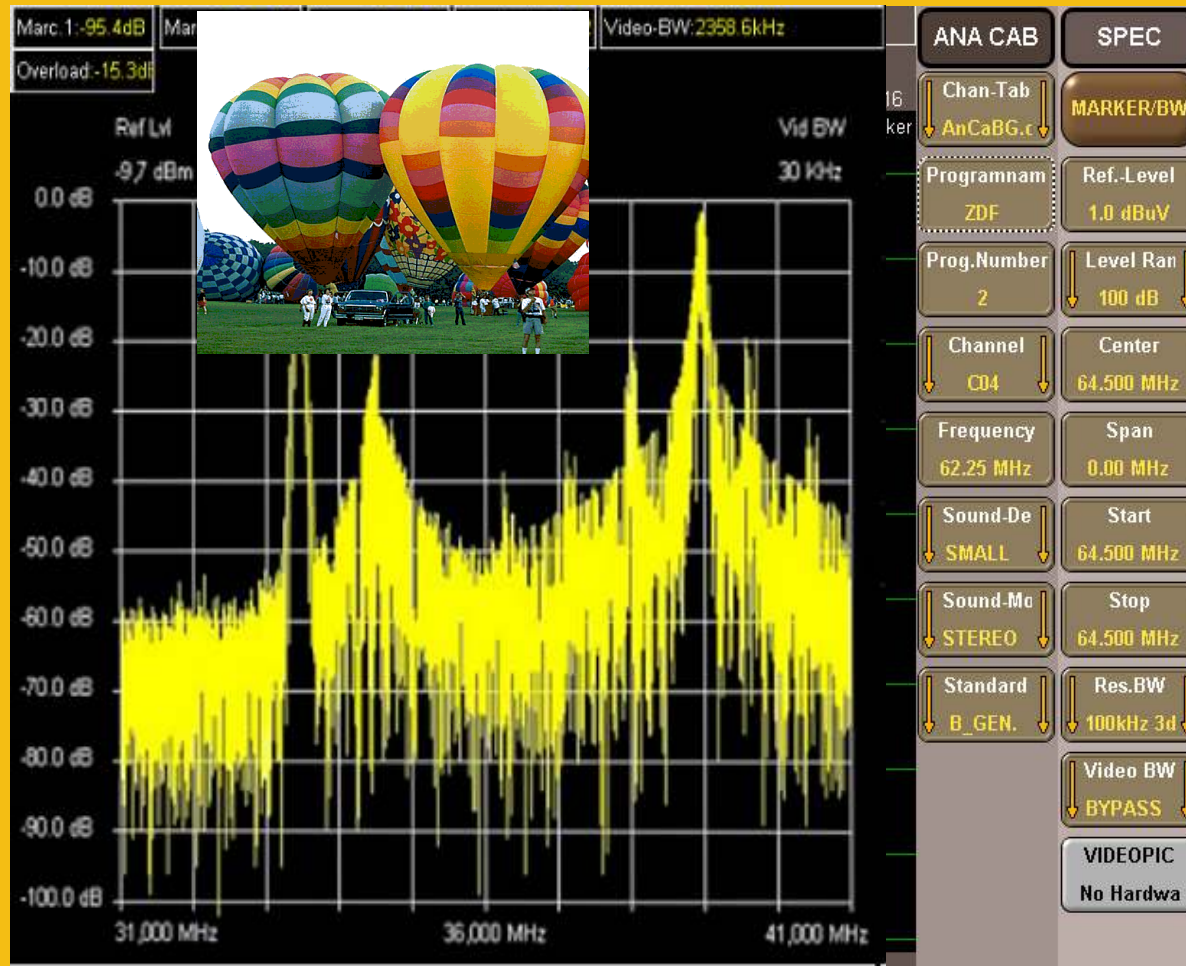
Spectrum Analyser

- Spectrum van analoog en digitaal signaal
- Signaal Level
 - Meting met twee markers
- S/N signal-to-noise ratio
Verschil tussen signaal sterkte en signaal ruis
- C/N carrier-to-noise ratio
Verhouding in dB tussen gemiddeld ontvangen signaal en gemiddeld ontvangen ruis.

Spectrum Analyser



Spectrum Analyser



Constellation Analyser

Constellation Analyser

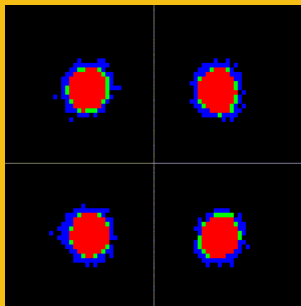
Constellation diagram voor alle type digitale modulatie

- **Kabel-TV**
 - DVB-C (J83A/C) QAM 16, 32, 64, 128 en 256
 - USA (J83B) 64 QAM
 - DOCSIS/Euro D. 64 QAM, 256 QAM
- **Terrestrial TV**
 - DVB-T QPSK, 16 QAM, 64 QAM
 - ATSC 8VSB
- **Satellite TV**
 - DVB-S QPSK
 - DVB-S2 8PSK

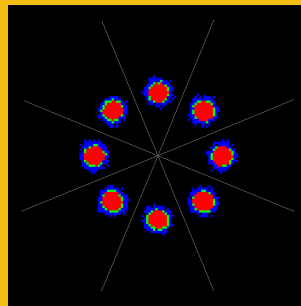
Constellation Analyser

Voorbeelden van ideale constellatie diagrammen:

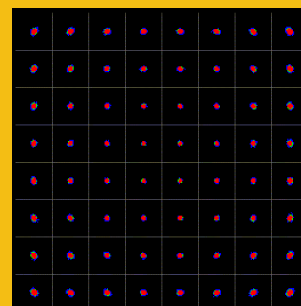
QPSK:



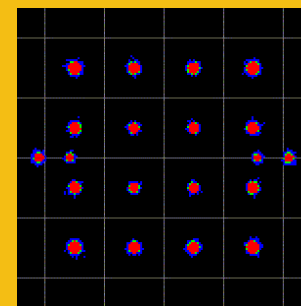
8PSK:



QAM 64:



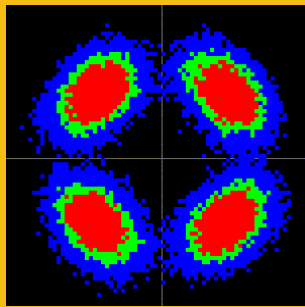
COFDM QAM 16:



Constellation Analyser

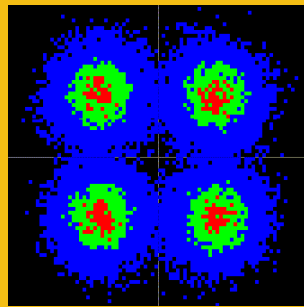
Examples of various errors:

**QPSK
phase noise:**



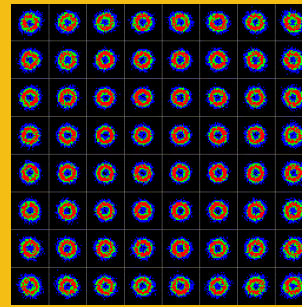
Possible cause:
LNB-
phase noise

**QPSK
broadband noise:**



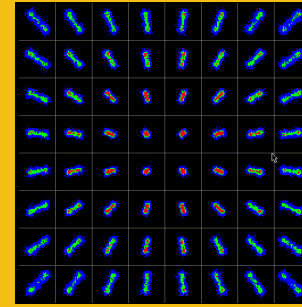
Possible cause:
High cable attenuation

**QAM 64
intermodulation:**



Possible cause:
Interference signal in the channel

**QAM 64
amplitude hum:**

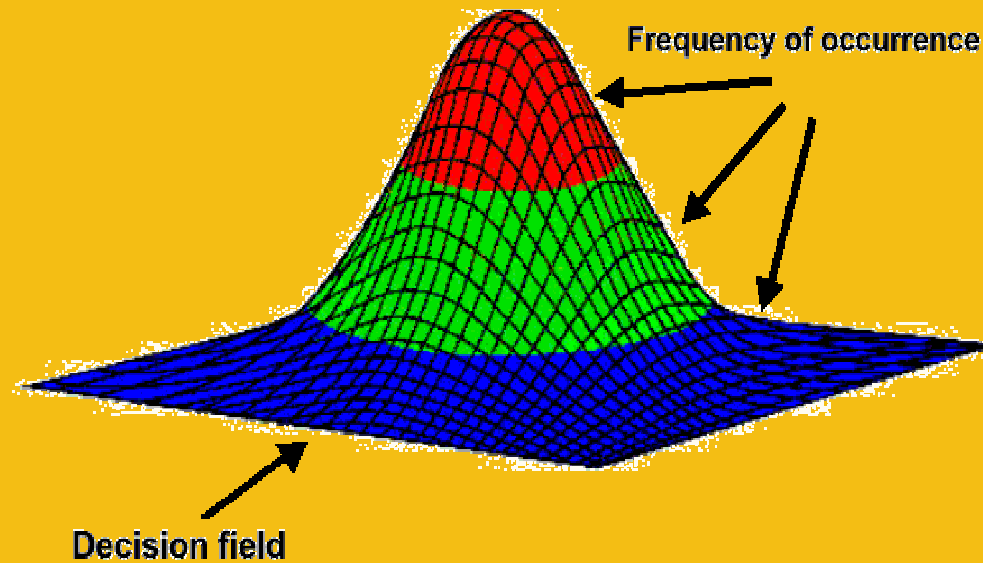


Possible cause:
Amplifier hum,
defective power supply unit



Constellation Analyser

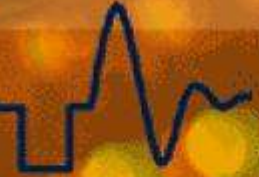
Colour display of the constellation:



RED - very many hits, GREEN - many hits, BLUE - few hits

Constellation Analyser

- **MER metingen (Modulation error rate)**
 - Voor alle vormen van modulatie
 - prestatie digitale radio transmitter of receiver.
- **BER metingen (Bit error rate)**
 - Voor en na FEC
 - Percentage bits dat fout aankomt tov totaal verstuurde bits
- **Offset**
- **Modulation scheme**



Oscilloscope

Storage Oscilloscope



Multimeter

- LNB spanning
- LNB stroom
- Remote feed voltage voor externe versterker
- Remote feed current
- 14 / 18 volt 22 kHz

Meten is weten...

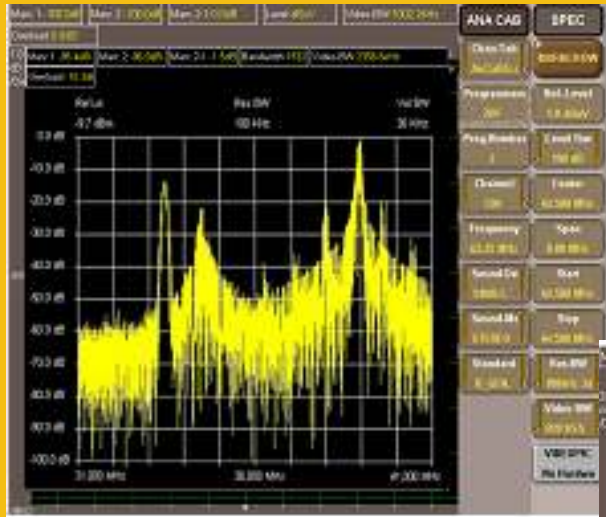
Maar hoe meten
we?

Analoge / Digitale Antenne Meet Systeem



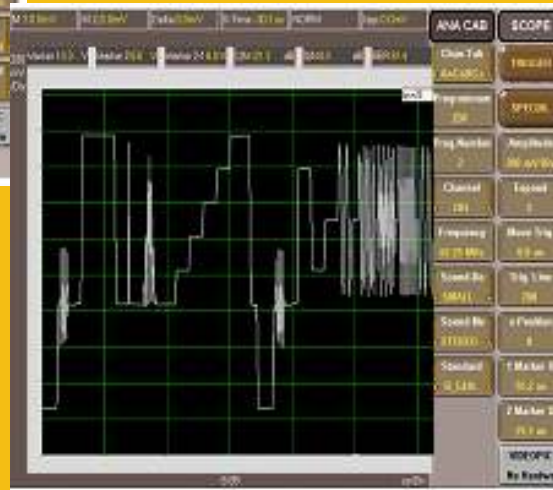
MSK 200

- **Handig, draagbaar meetinstrument**
- **High-Definiton TFT colour display 10.4"**
- **Background verlichting**
- **Eenvoudige bediening, 12 soft keys, Touch-screen, Muis aansluiting**
- **Op scherm oproepbaar alpha-nummeriek toetsenbord om tekst te maken.**
- **Alles in een apparaat:**
 - **Spectrum analyser**
 - **Storage oscilloscope**
 - **Constellation analyser**
 - **Multimeter**
 - **en meer.**



Spectrum analyser

Oscilloscope

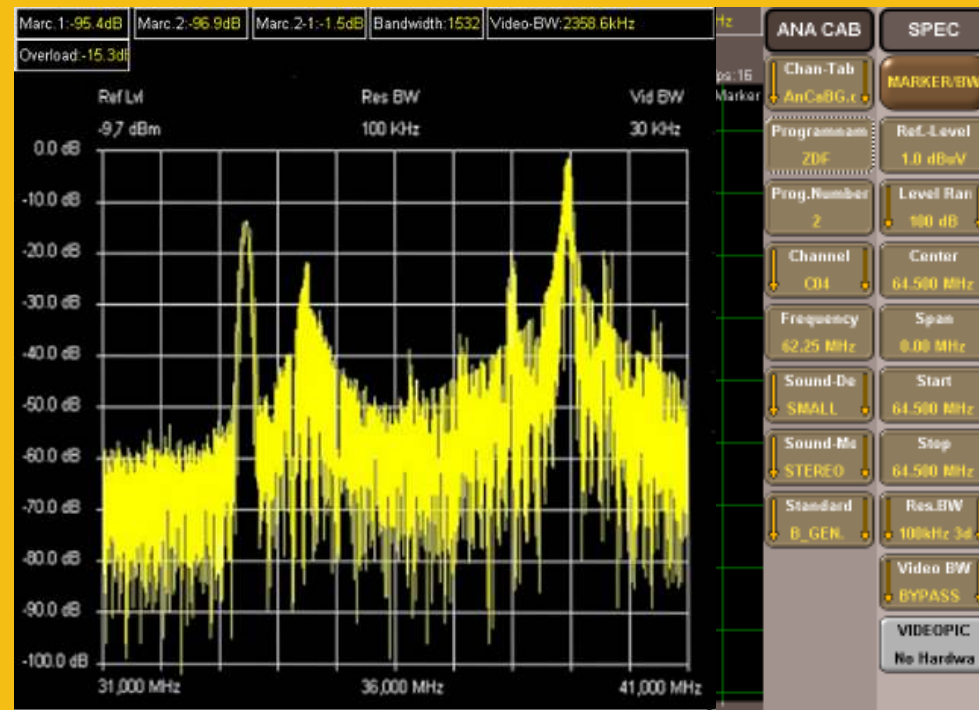


Constellation analyser



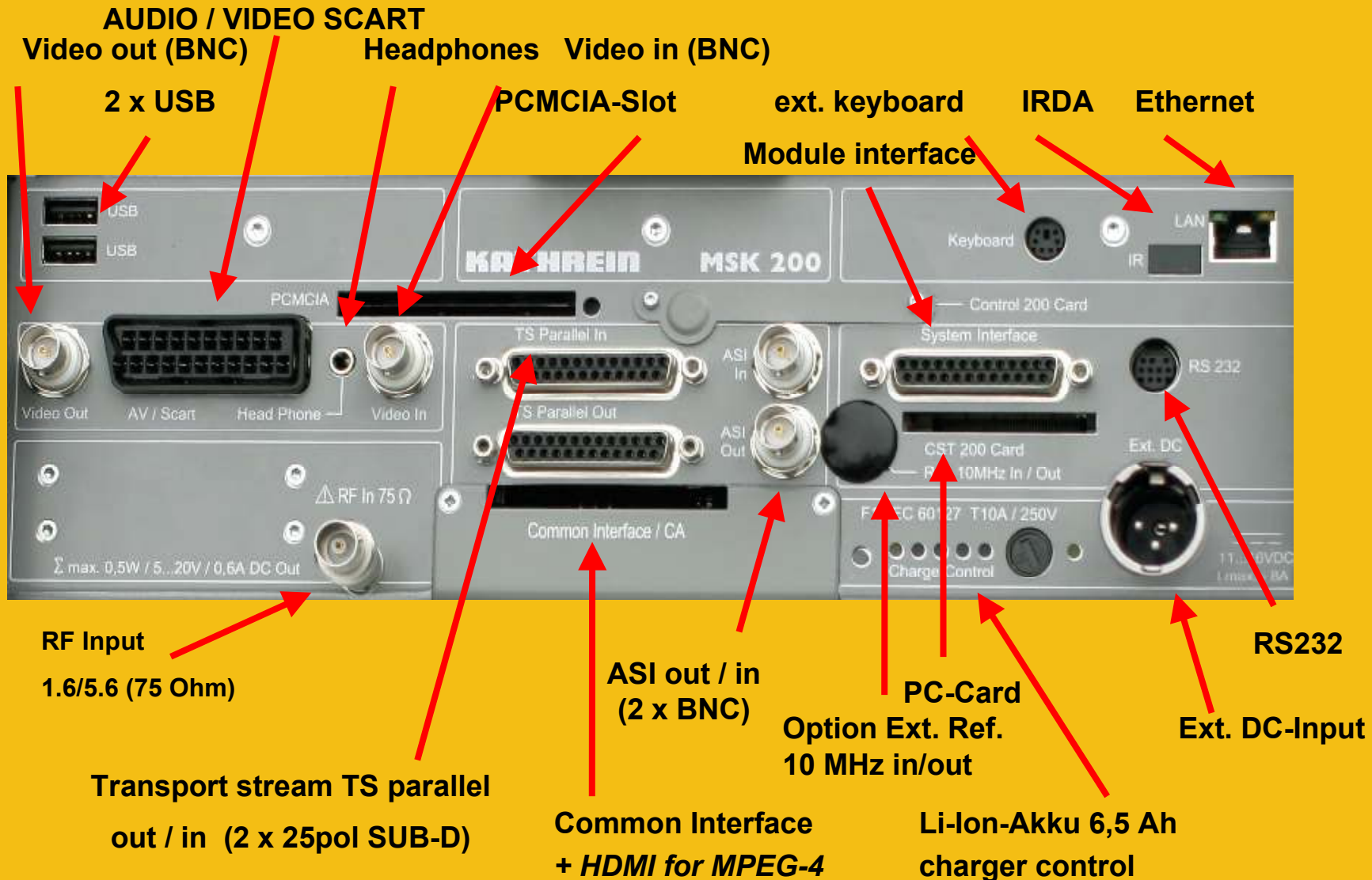
Gebruik

- Direct control
 - TFT display
 - IR touch-screen
 - Hard-keys
- Controle met bv vingers of met de muis (USB-aansluiting)



aansluitingen

Interfaces



Additional Functies

Meet protocols (samenvatting)

MEASUREMENT SUMMARY				
LIST OF MEASUREMENTS				
Measurement Type	Minimal Value	Maximal Value	Actual Value	Average Value
RF-Level (dBuV)				
S/N (dB)				
HUM (dB)				
BER				
MER				
Video Upp (mV)				

- Simultaneous display of several results
 - **min. / max. value**
 - **actual value**
 - **average**
- i.e. RF level, S/N, HUM, MER / BER, etc.

ANA CAB	SUMMARY
Chan-Tab AnCaBG.r	Programli
Programnam ZDF	Sort Prg by Name
Prog.Number 2	S/N Line 0
Channel C04	S/N Filter
Frequency 62.25 MHz	
Sound-De SMALL	Reset all
Sound-Mo STEREO	Show HUM Diag.
Standard B_GEN.	VIDEOPIC No Hardwa

Desktop Functie

- Gebruik van de MSK 200 als een Linux based PC
 - List-editor included
 - Organize stored measurement
 - Store data to USB storage device
 - Office software included (text editor, graphic software)
 - call up with ON/OFF button



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**Einde van
de presentatie.**

Dank voor uw aandacht