

Importance on doing system sweep on a CATV-HFC system !

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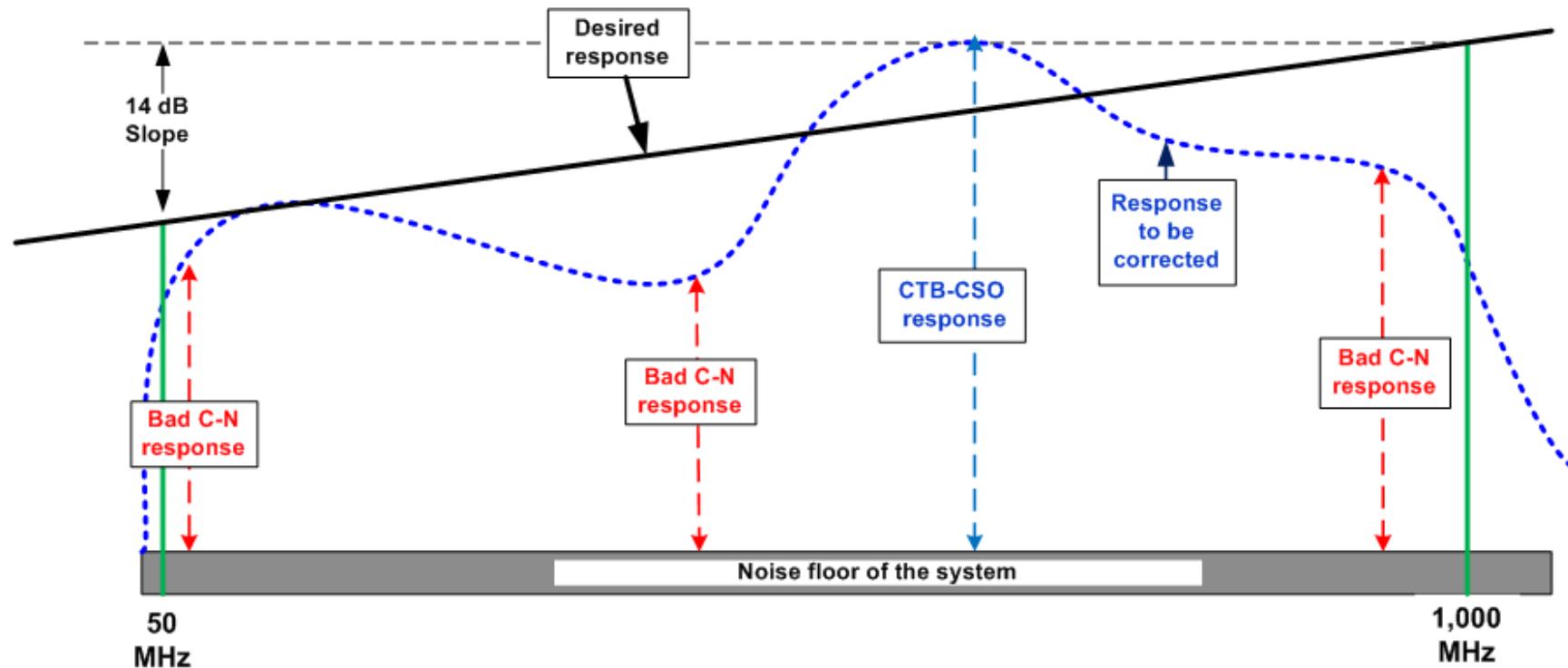
Importance of doing Sweep on a CATV-HFC system.

- Why is performing a frequencies sweep on a CATV-HFC system, so important?
- Doing frequencies sweep on a CATV-HFC system, assure that the CATV-HFC system is working with-in his boundary.
- It assure that the system is actually keeping his distortions (*CN to NOISE, CTB, CSO, INGRESS*) in good behavior.
- It guarantee that all of the customers are getting a good quality signals.
- The sweep function should be performed in both directions, forward (50 to 1,000 MHz) and reverse (5 to 40 MHz).

Type of sweep system.

- Many type of sweep systems have been sold over the years, but today's the tendency is to use a low level or a high level sweep system.
- A modern sweep system should not cause any interference on the any signals (Digital or Analog) while doing the sweep.
- A low level sweep system, send a sweep reference data below the signals on the CATV-HFC system and that low level sweep is upgraded at the receiving unit, as the actual frequency response of the system.
- A high level sweep, take the level reference of all the signals carried by the CATV-HFC or introduce by an equipment located at the head end and these references are used as response of the system by the receiving unit out in the field.
- For the return sweep (5-40 MHz) is a bit more complicated, but the sweep function does the same a the forward sweep, it give a frequency response of the return section.

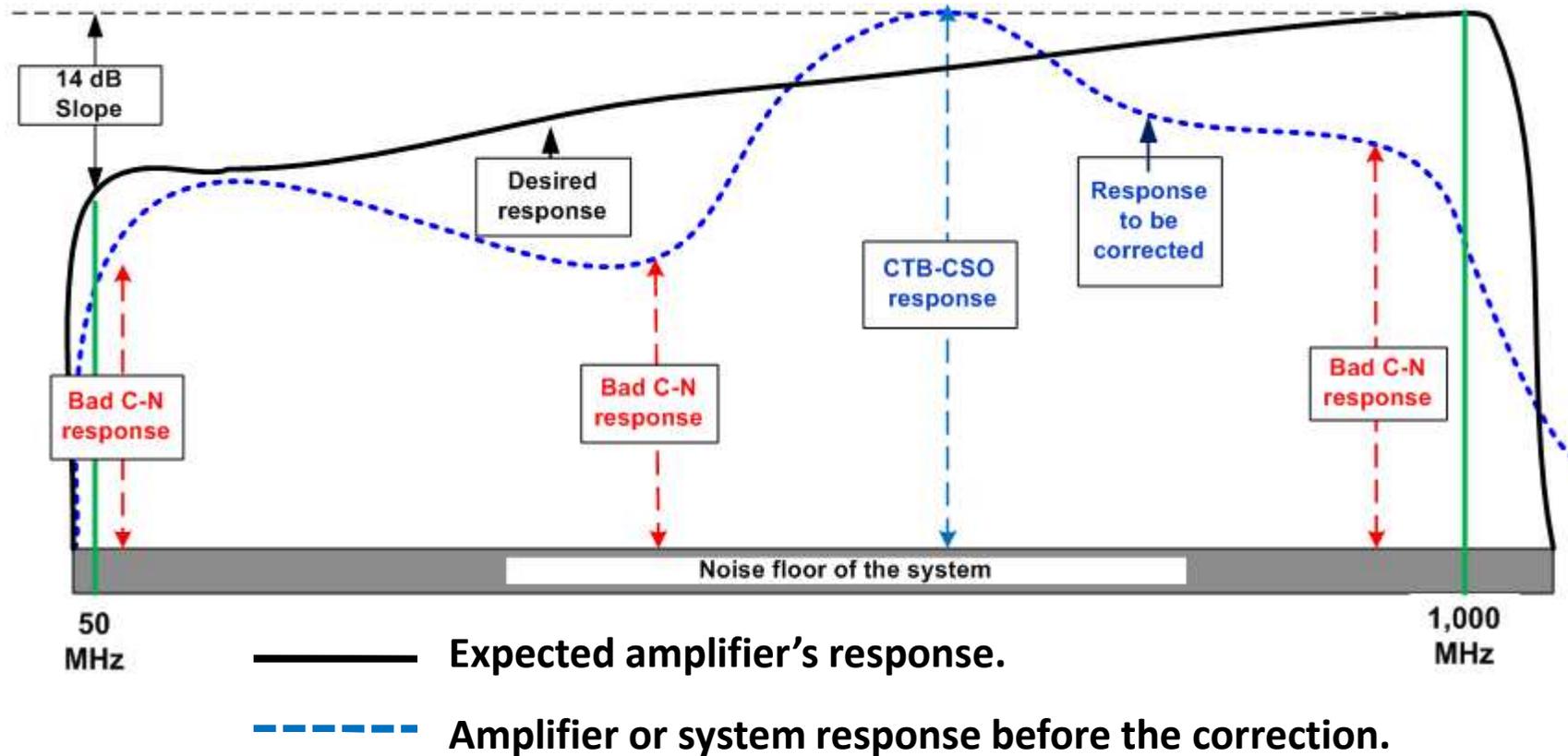
Example of a bad sweep response.



➤ Above is a bad response of an amplifier or a section of the CATV-HFC system. If the signal response is too low, the system will have a bad Carrier to Noise section and if the signal is too high you'll then have a CTB or CSO problem.

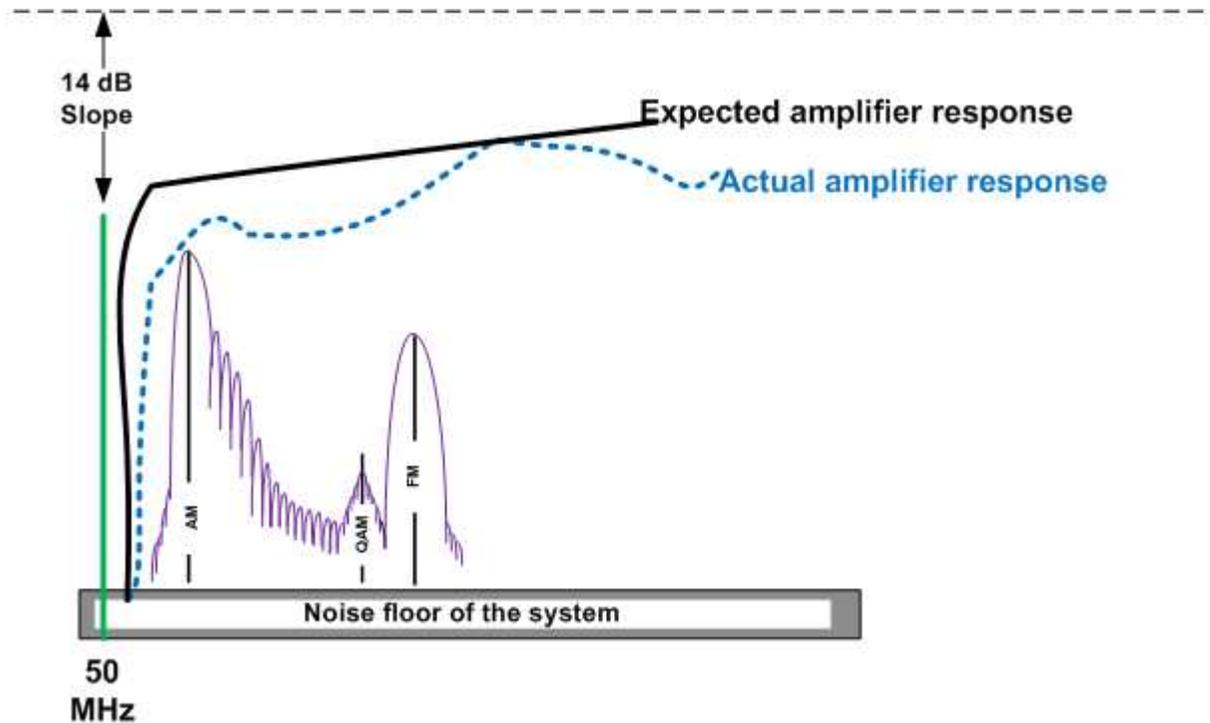
➤ Bad response is not always affected by an AMPLIFIER or a NODE, it can also be caused by the cable system itself.

Good response and bad sweep response.



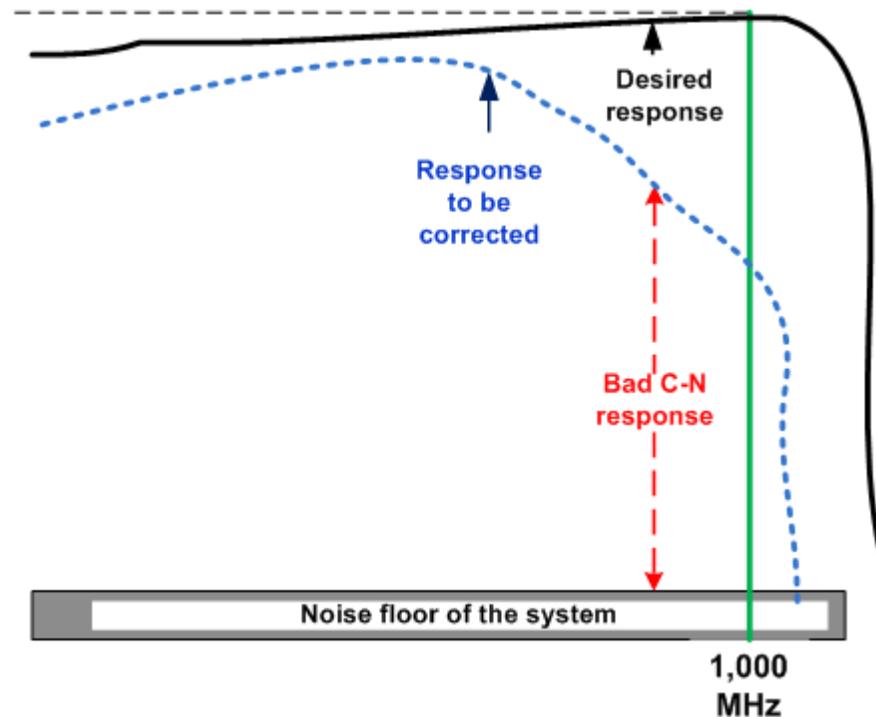
- The forward section operate on tilted output and this tilt depends on the forward frequency of the CATV-HFC system.
- A 850 MHz system requires a 12 dB tilt and a 1,000 MHz system requires a 14 dB tilt.

Forward sweep response. Lower section of the CATV-HFC system.



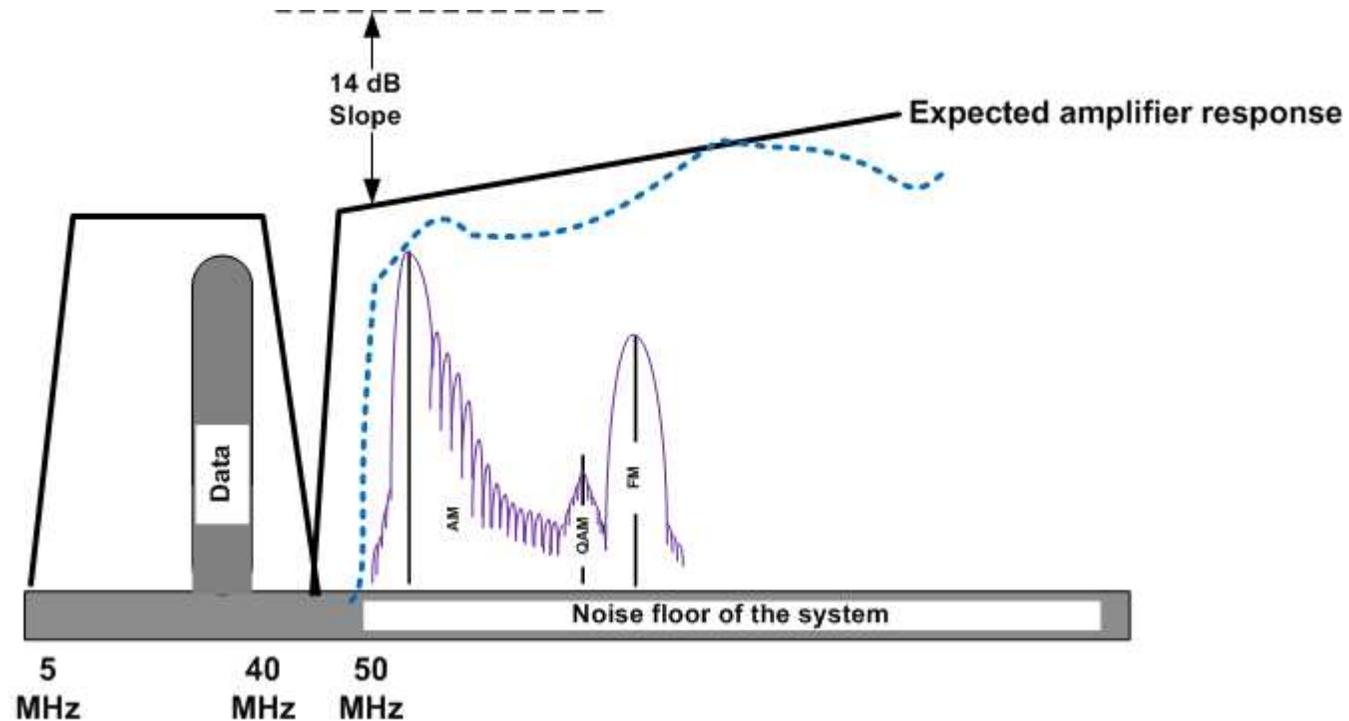
- One of the important section of the CATV-HFC system is the response from 50 to 100 MHz
- Often the system will have a bad response between 50 and 100 MHz, this can be caused by the bi-directional filter.
- The upper end of the system should also be verified at all time.

Forward sweep response Upper section of the CATV-HFC system.



- Often this is what you'll get as a response, where the highest part of the system will be affected.
- A bad response can also be caused by the passive or the coaxial cable of the CATV-HFC system , not always by an amplifier.

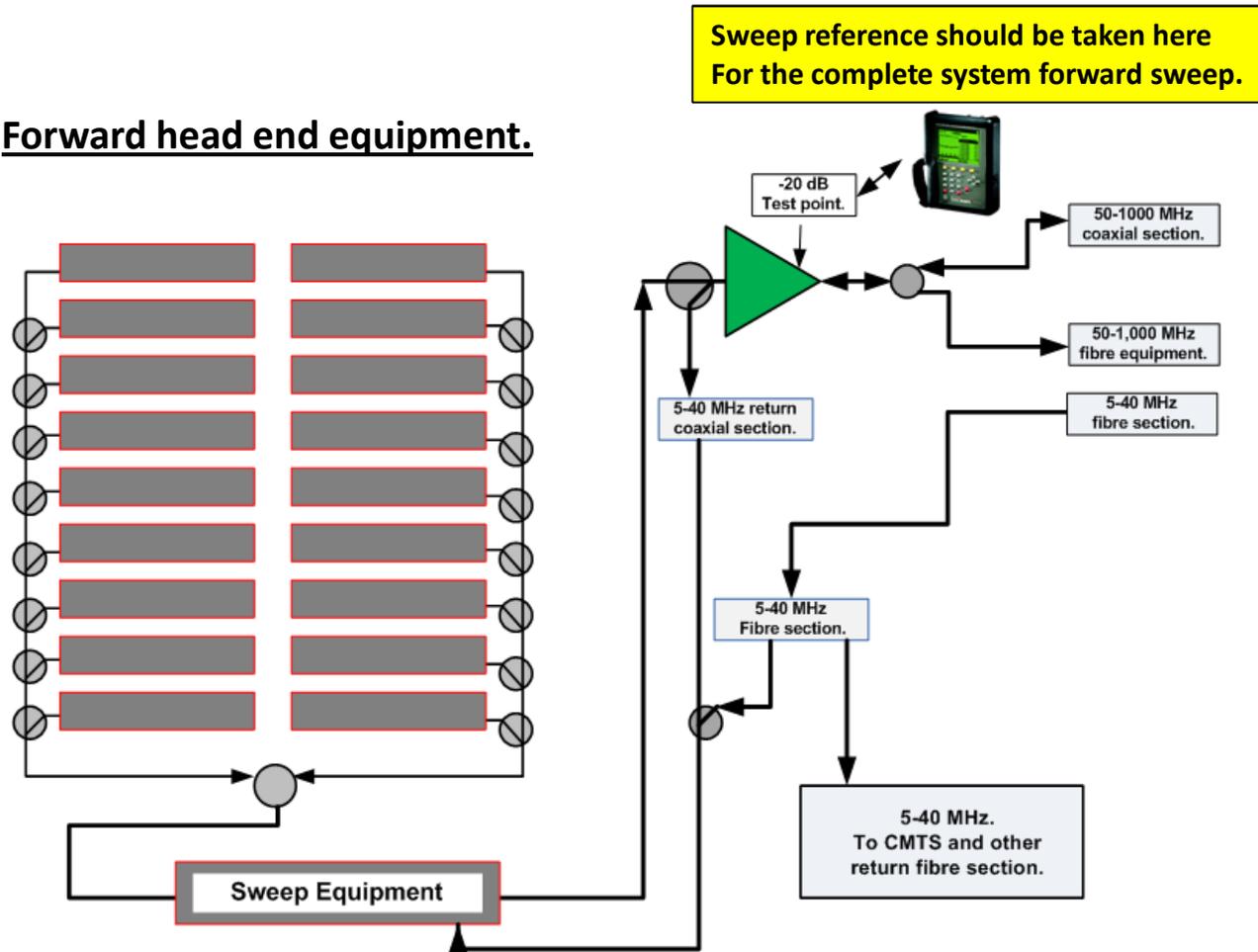
Return sweep section.



➤ Contrary to the forward section, which operates with a TILT output, the reverse section operates with a flat response and is subjects to INGRESS, NOISE or other none wanted signal (CB, AM, SHORT WAVE, CPD).

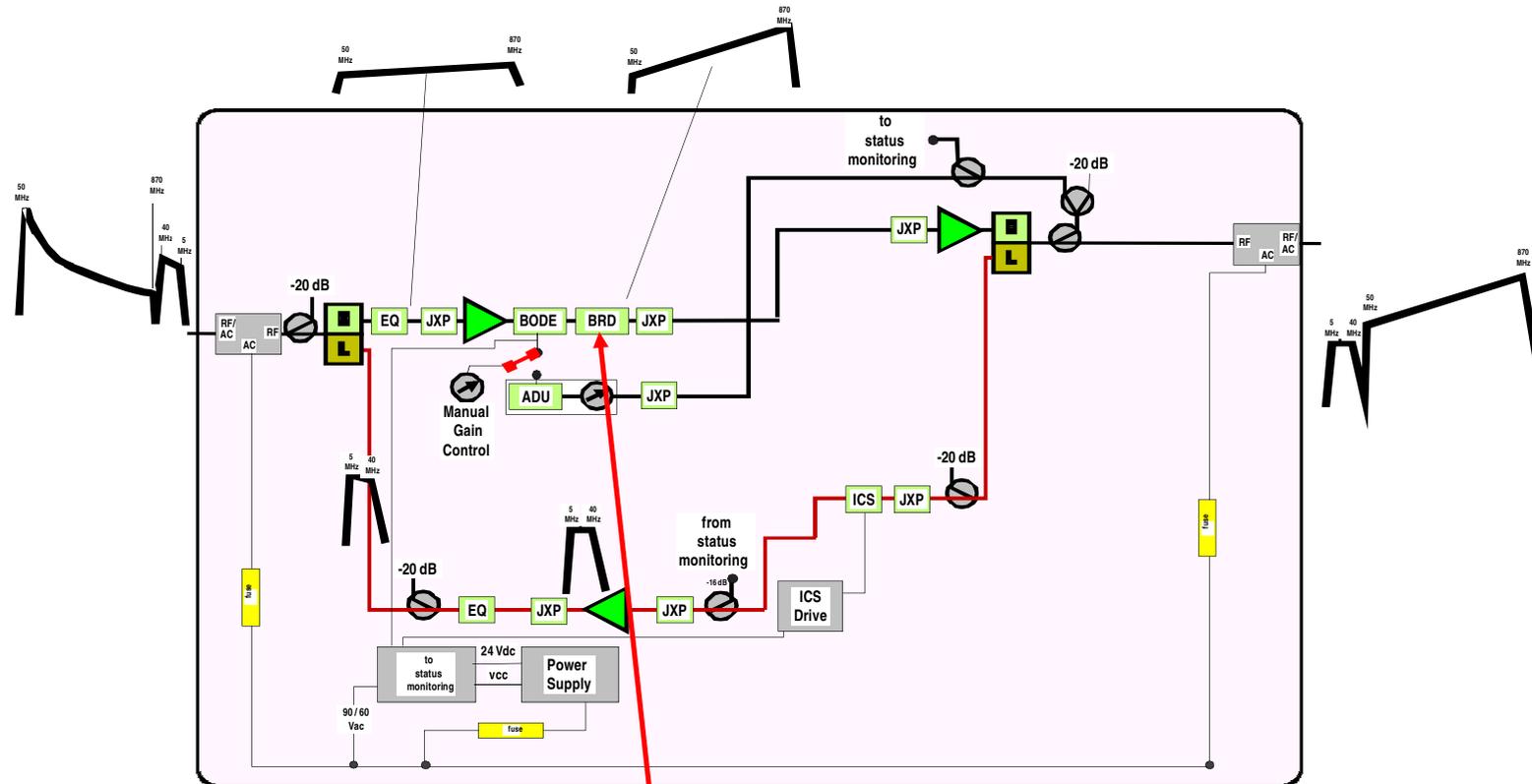
Head end setup for sweeping.

Forward head end equipment.



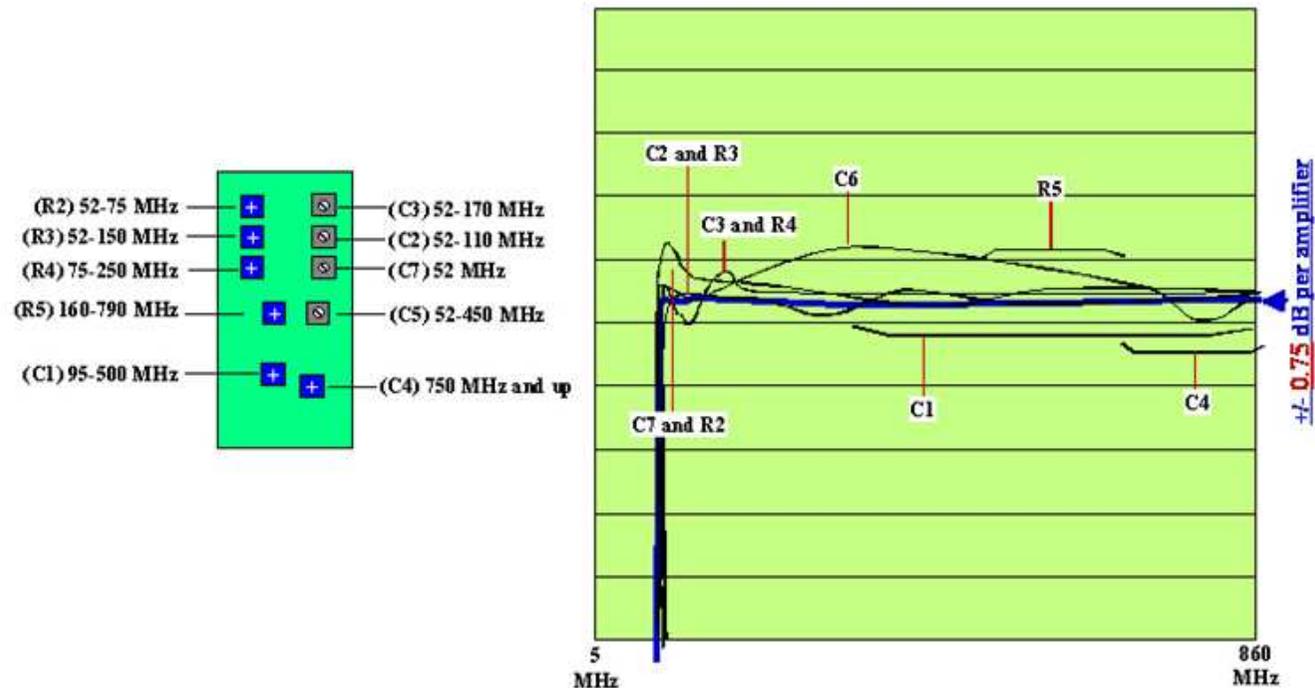
- The sweep response of the first amplifier of the head end should be saved and used as the reference for the complete sweep response of the CATV-HFC system.
- This also goes for the fiber section of the CATV-HFC system at each NODE.

RF section of a Line-Extender for a CATV-HFC system.



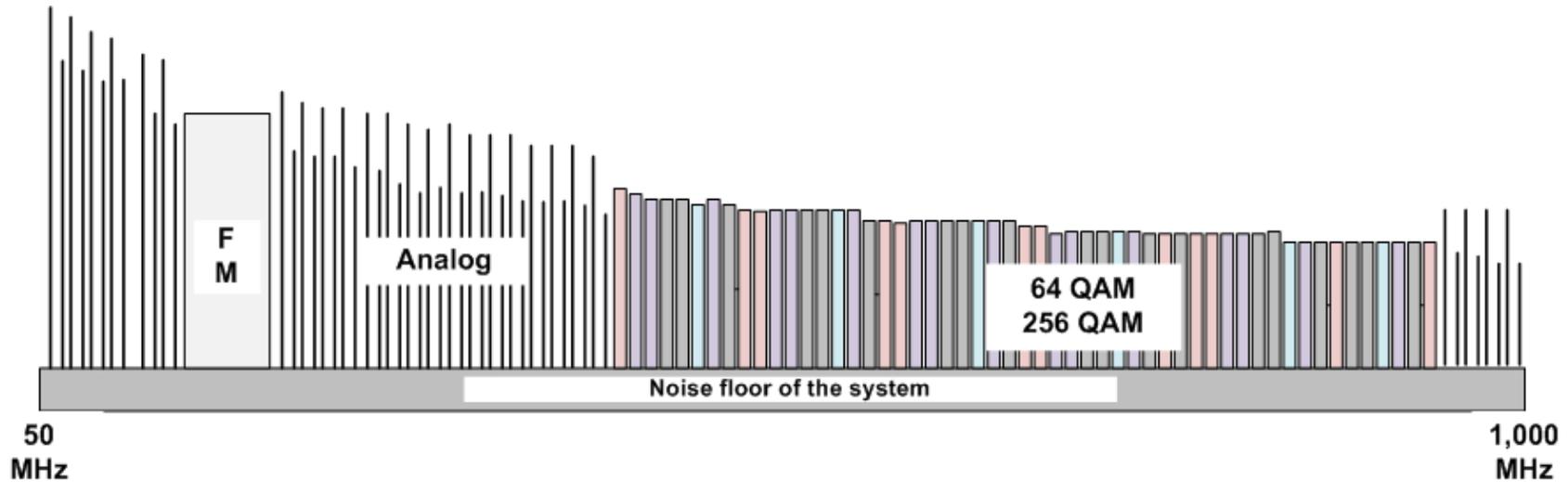
➤ Section of a Line-Extender amplifier, where the forward frequency correcting module is usually located. Between the first and second IC.

RF section on a CATV-HFC system



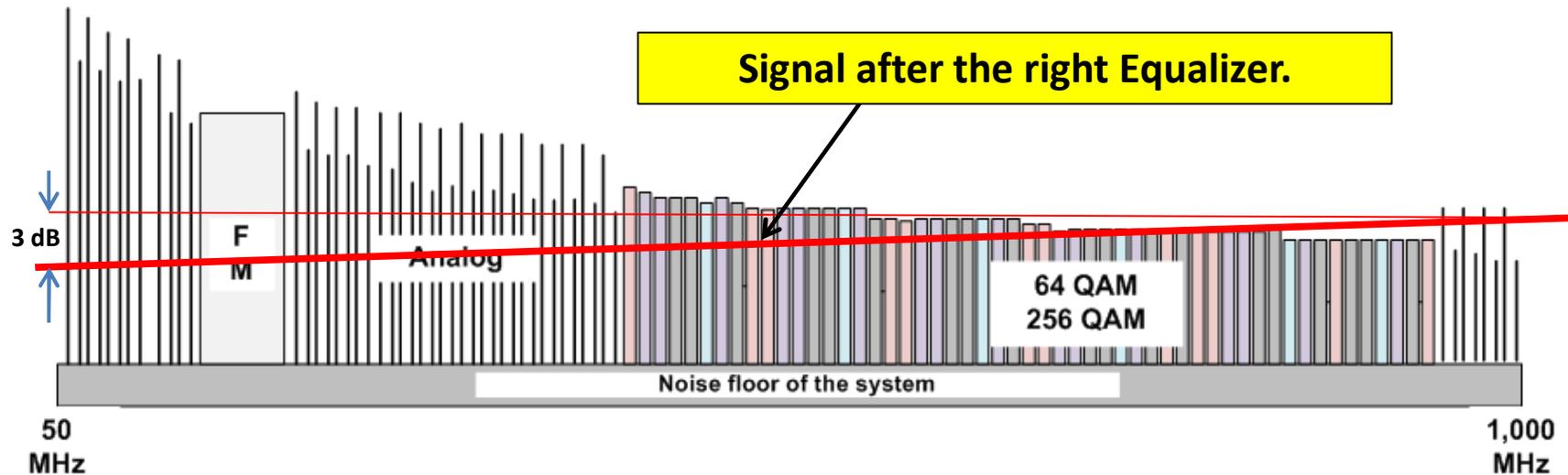
- This picture shows the possible corrections and at what frequencies these can be accomplished on an RF amplifier.
- These corrections should never be accomplished without the use of a sweep system.
- A special tool is also required to do these adjustments, a plastic screw driver can also be used.

Input signal of an RF amplifier.



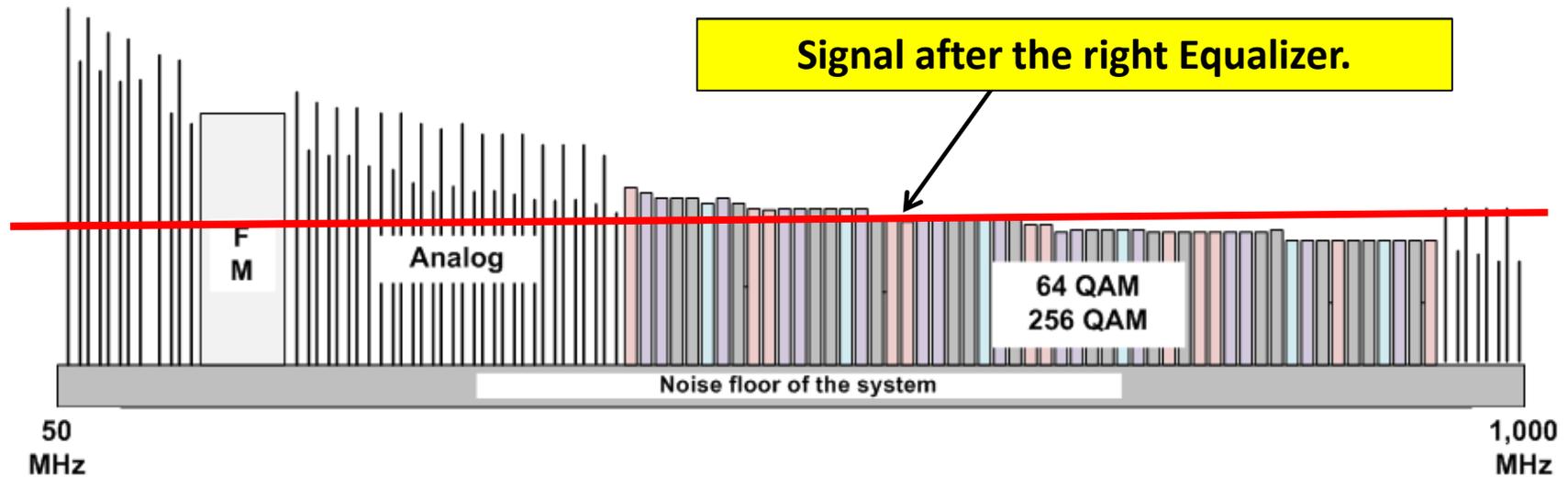
- The input signal of an RF amplifier on the Coaxial section of a CATV-HFC system, is always sloped, highest level are in the low end (50 MHz) and lowest level are in the upper section (870 or 1,000 MHz) of the CATV-HFC.
- That slope depend on the length of coaxial cable between amplifiers.
- The required input level of any amplifier should always be taken at the upper end of the CATV-HFC system (870 or 1,000 MHz).

Input signal of an Line Extender amplifier.



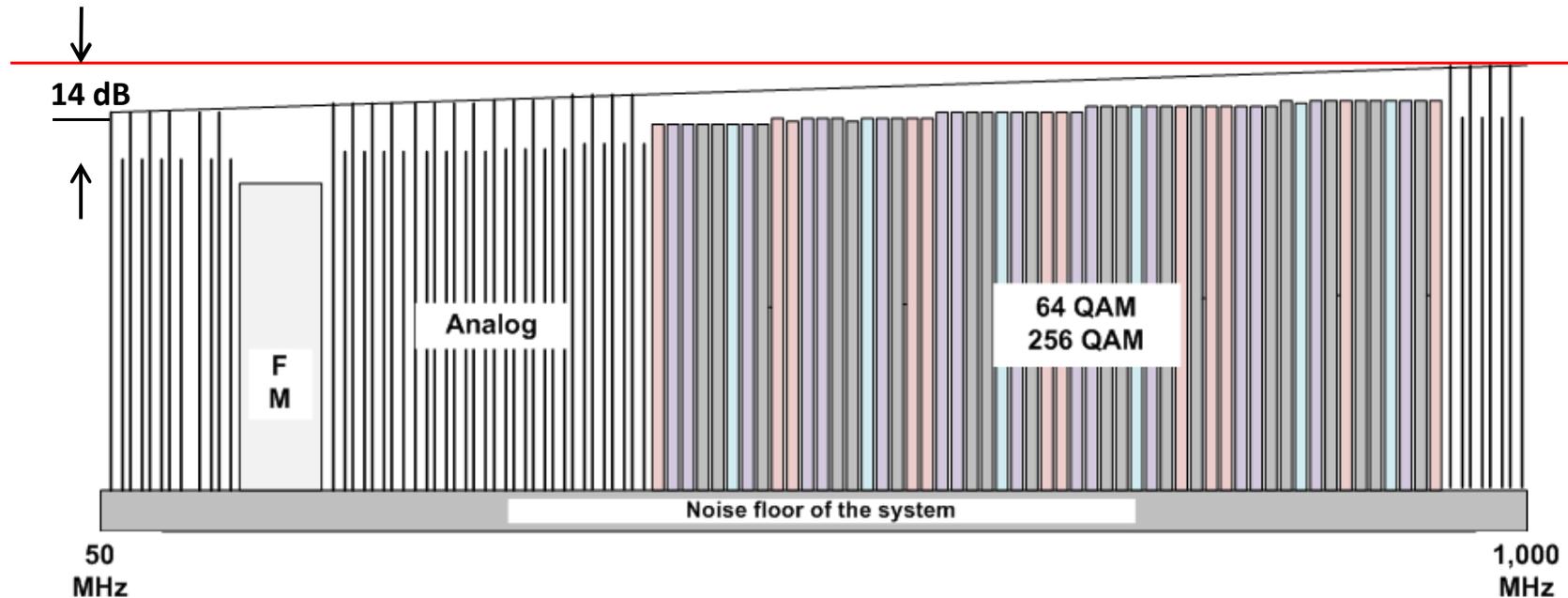
- A word of caution, on a modern Line Extender, there should always be a **3 dB TILT** in the input signal at the input of the amplifier, after the selection of the right cable input equalizer from (870 or 1,000 MHz). This will help the Line Extender to have better distortions (CTB-CSO and C-N).

Input signal of an Mini-Bridger amplifier.



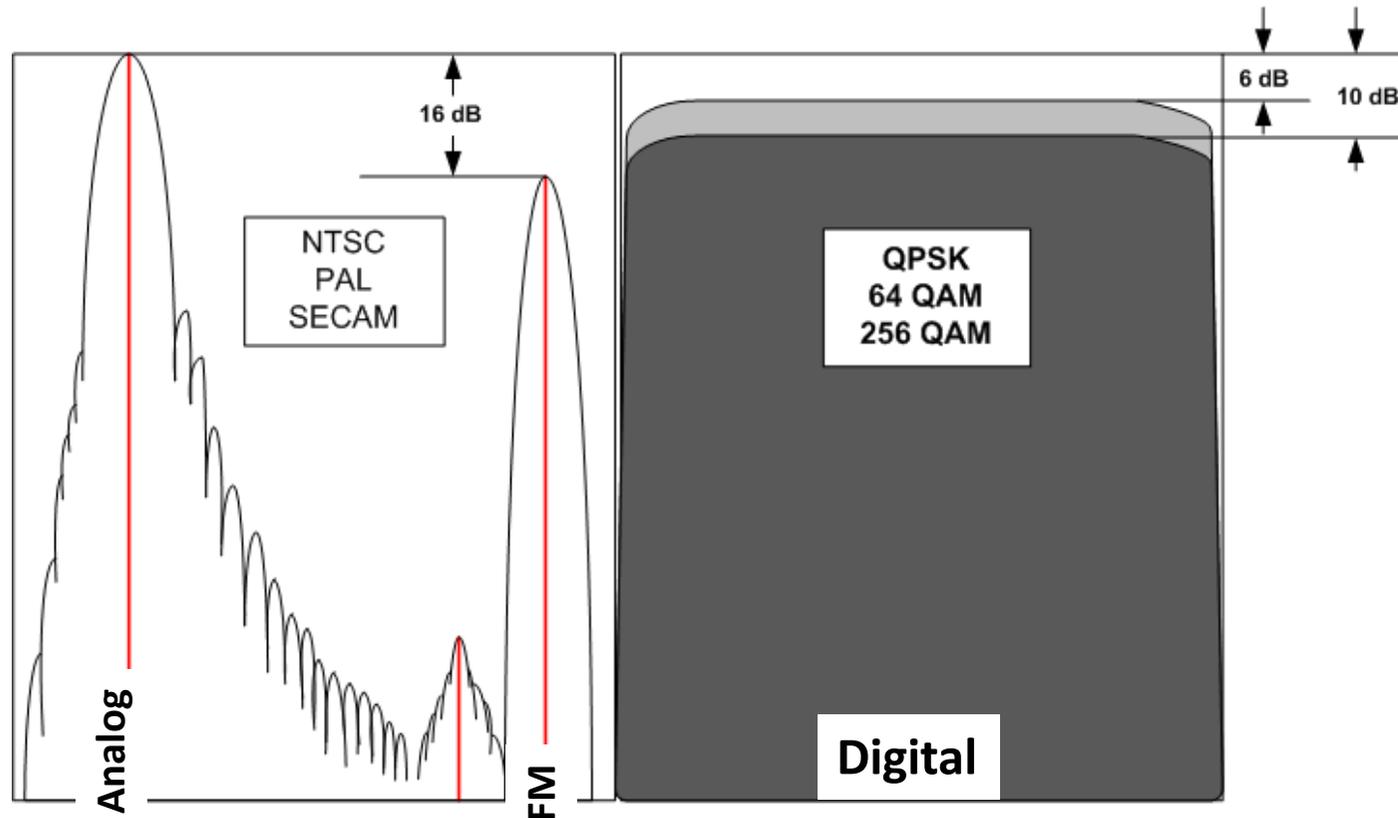
- A word of caution, on a modern Mini Bridger, there should be a flat input signal after the selection of the right cable input equalizer from (50 to 870 or 1,000 MHz).

Output signal of an RF amplifier.



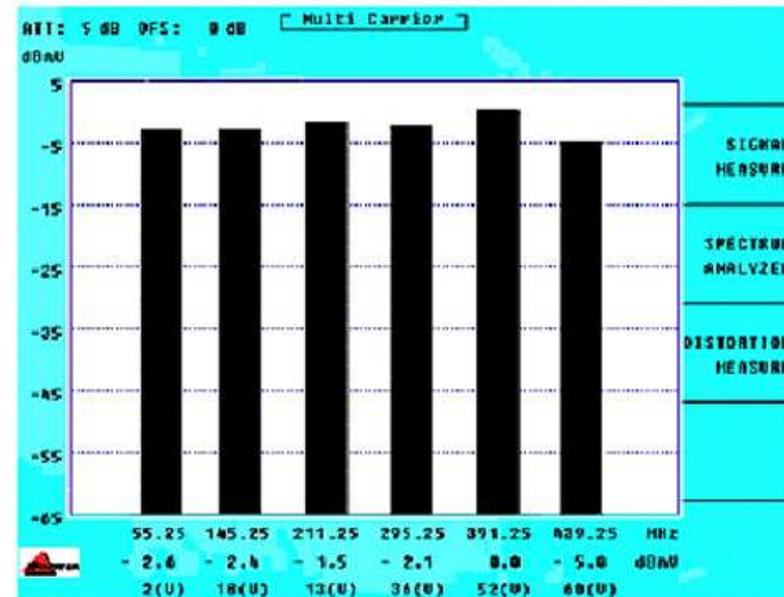
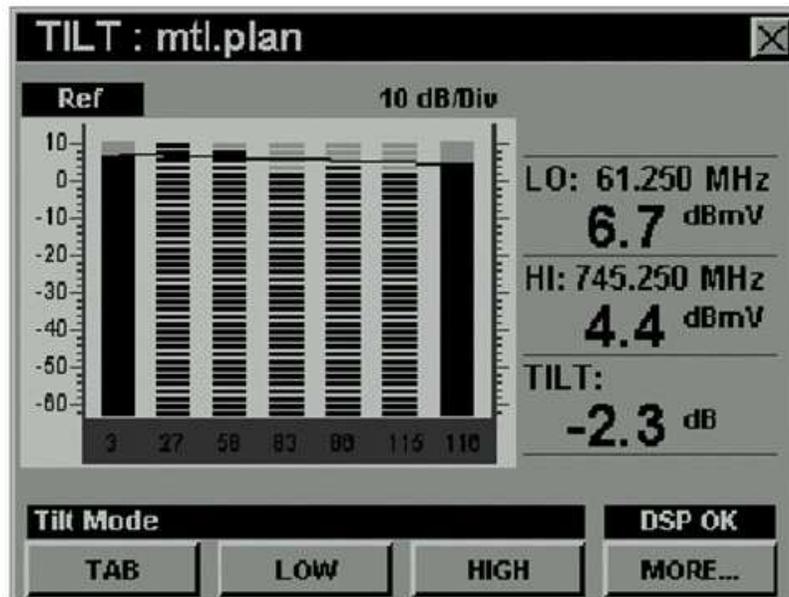
- First thing, the RF output of any RF active equipment should always be tilted, 12 dB for a 870 MHz and 14 dB for a 1,000 MHz system.
- A well engineers modern CATV-HFC system, should have the same output level for all RF active module on the system.
- The technician should make sure he inserts the right input pad (if required) and the proper value cable equalizer.
- Once the output of the active module has been adjusted, the technician should then verify the sweep response of the module.

Types of signal been transported by a CATV-HFC system.



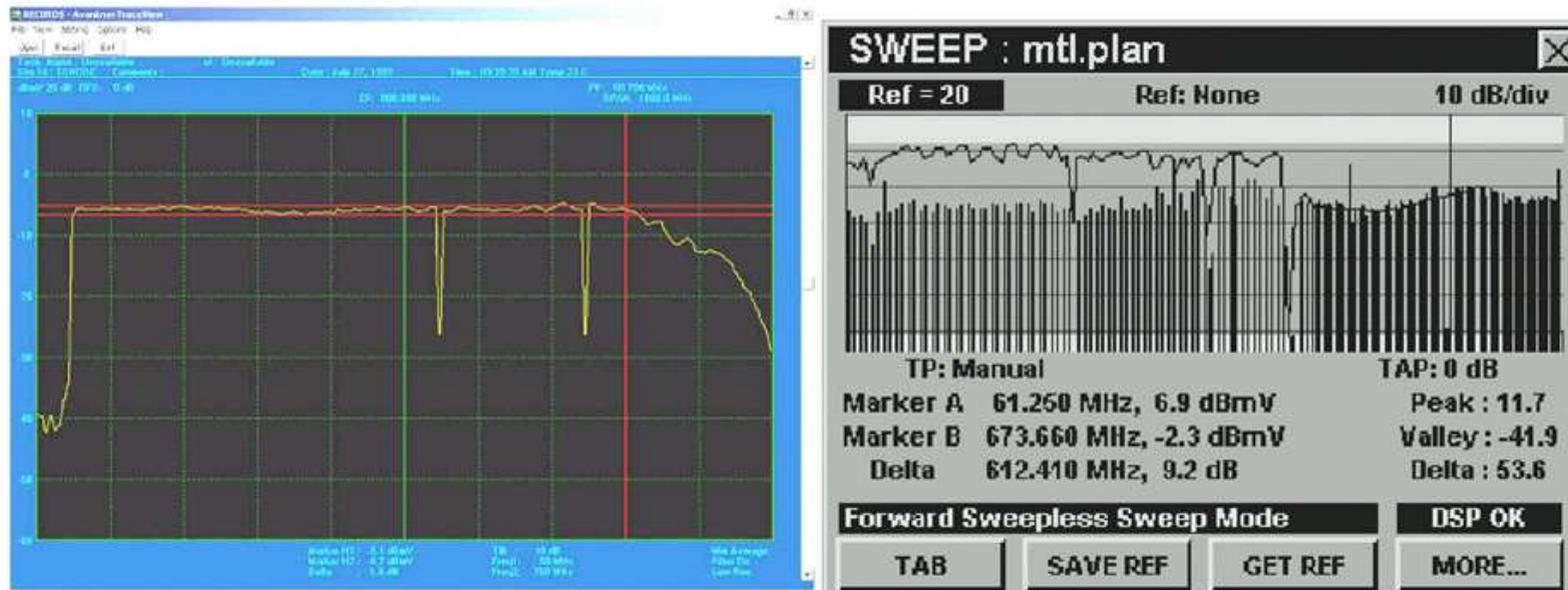
- Types of signal usually transported by a CATV-HFC system are:
- In the analog section are: NTSC, SECAM, PAL
- In the digital form are: QPSK and QAM.
- 64 QAM should be 10 dB lower than any analog channel
- 264 QAM should be 6 dB lower than any analog channel.

Another way of checking the response of a CATV-HFC system.



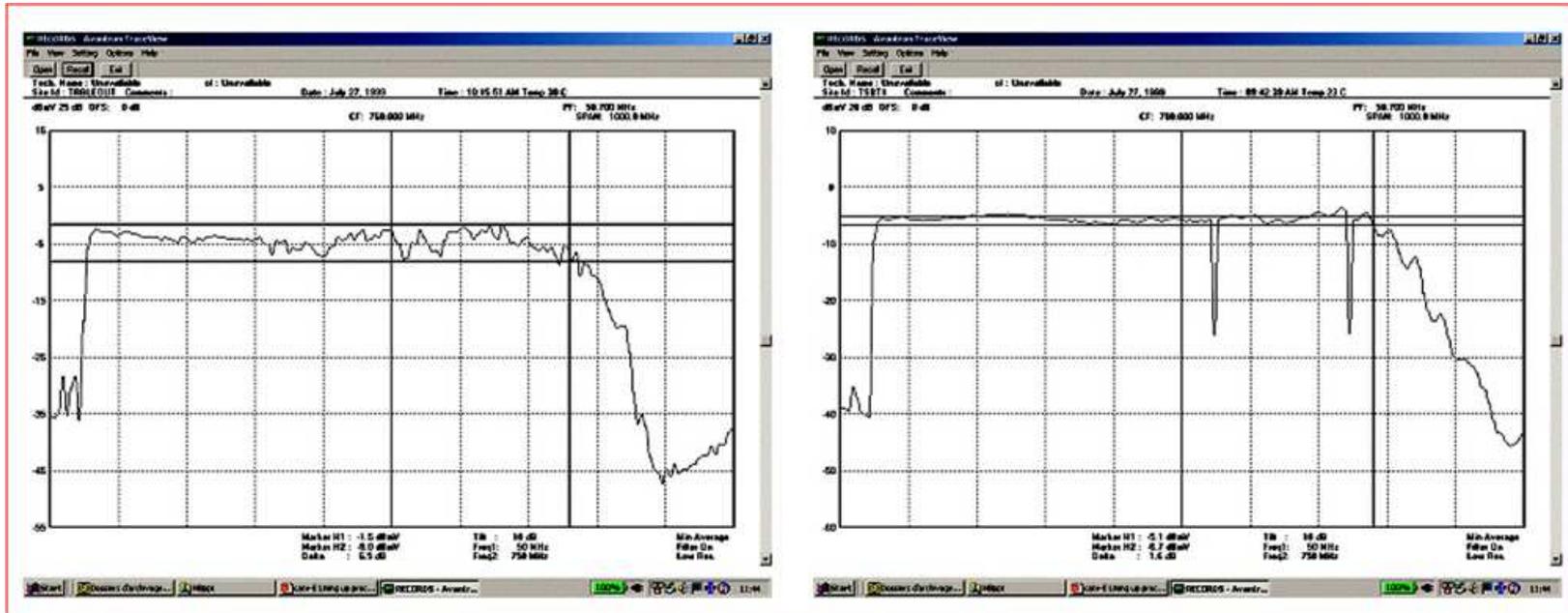
- Some sweep system gives you the option of doing a fast verification of the system sweep response.
- Most system call this option TILT option.
- Most system give you the chance of verifying the level output by the selection of 8 to 10 channels at one time. You must program the unit to have access at the right channels for this option.

Examples of a forward sweep system.



- Above are examples of two different forward sweeps response of a system.
- The one on the left is a low level sweep.
- The one on the right is a high level sweep.

Example of a forward sweep system.

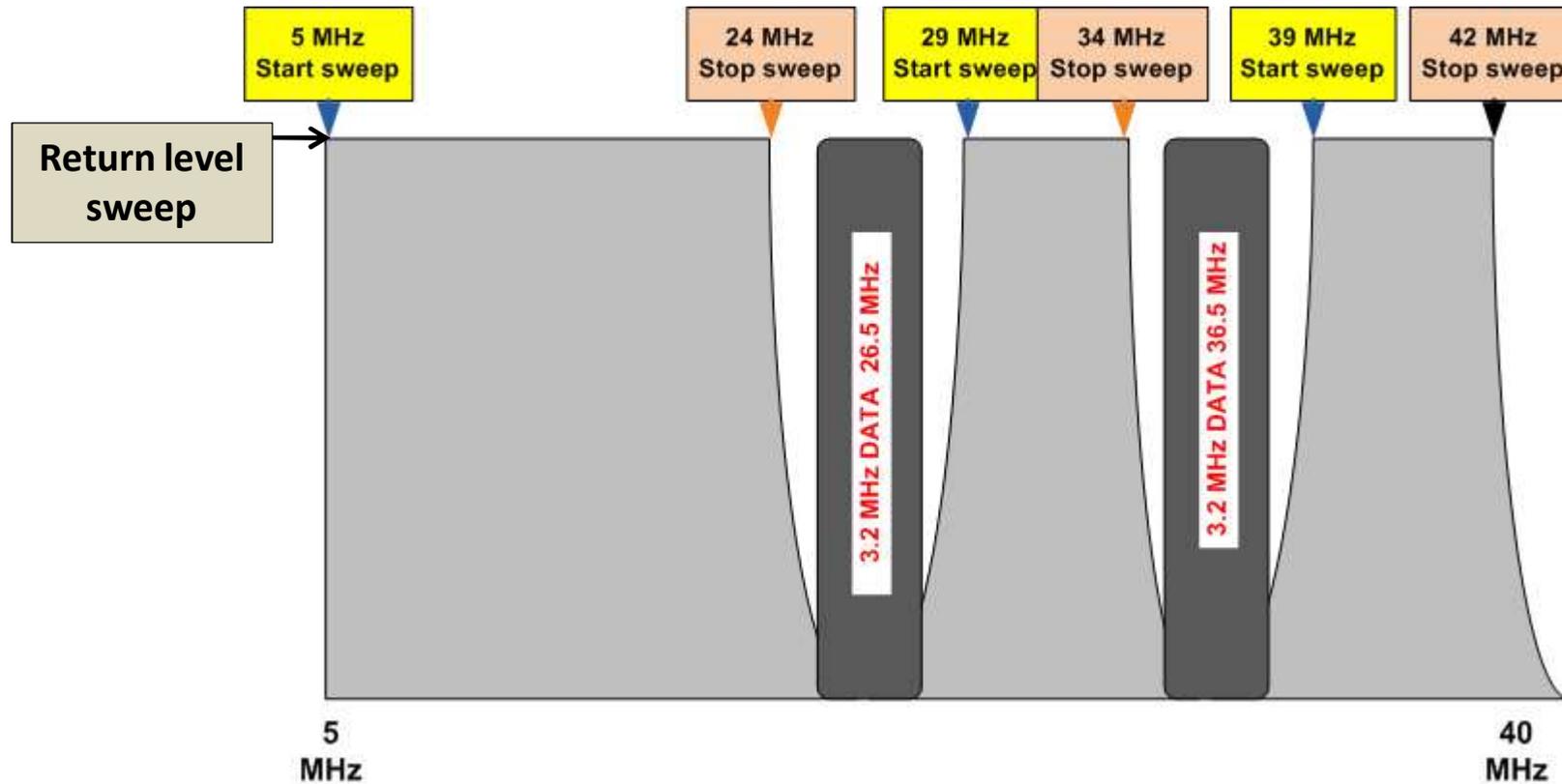


- Example of a forward sweep response of a CATV-HFC system, after a frequency sweep response correction.
- The one on the left is the original response and the one on the right is after a frequency response correction.

Return sweep system

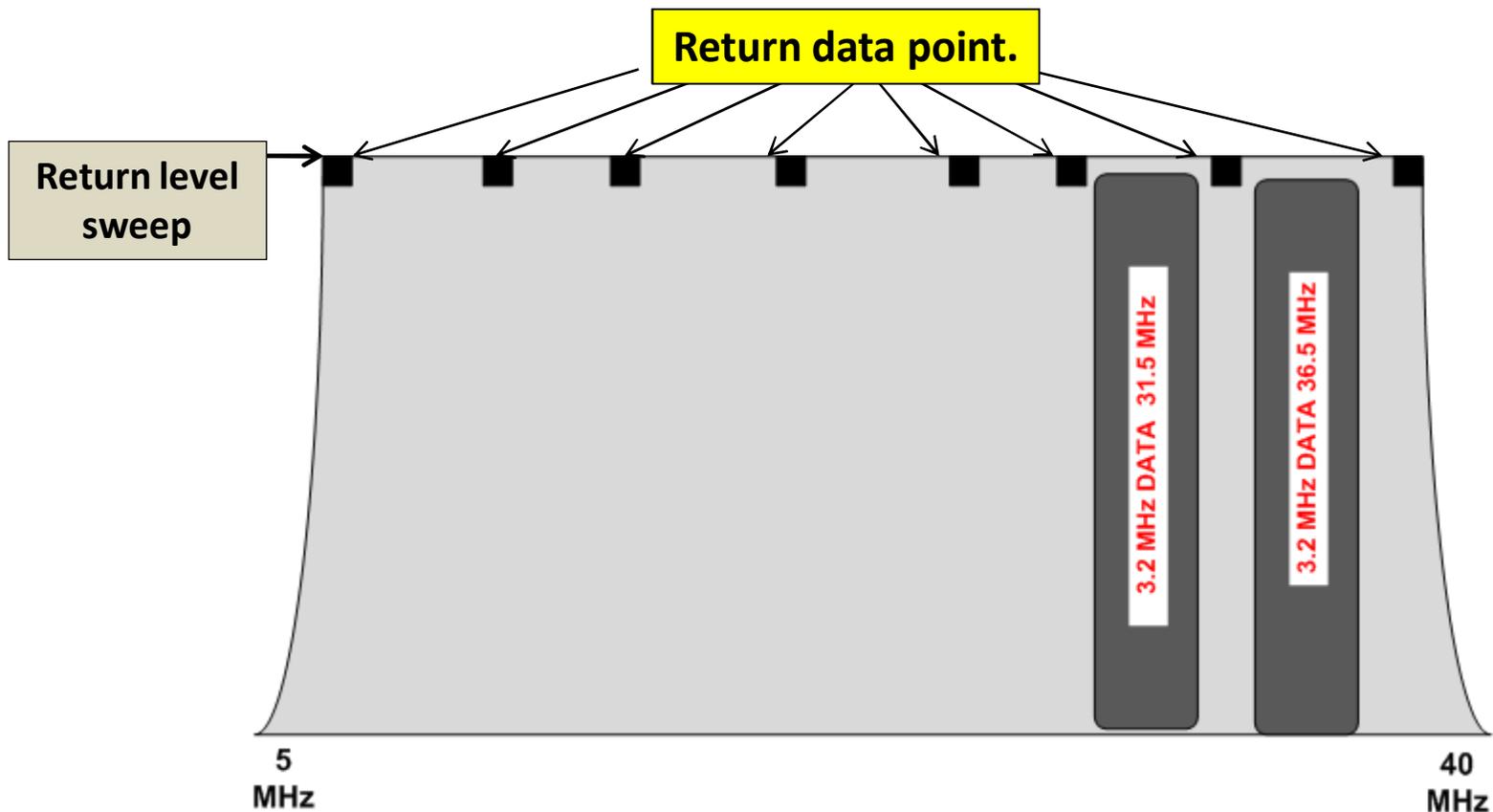
- To work properly, a field return sweep unit must communicate with a piece of equipment installed in the head end while doing return sweep.
- Once the head end equipment receives the return data, it reads the signal and sends the results to the field unit, this signal is usually in a digital form, which is then read by the field unit.
- For the two units (*field and head end*) to communicate with each other, you must select a communication frequency in the *50 to 53.75 MHz* range or the *70-75.75 MHz* range or from *80.5 to 92 MHz*
- Other frequencies are also available, depending on the equipment supplier.
- Again, some equipments are low level sweep, data sweep and high level sweep.
- High level sweep must have a stop and start frequency for each return frequency, not to affect the portion of the return signal used.
- Data return sweep must be selected and these should be placed in the area not to affect the return signal.

High level return sweep system.



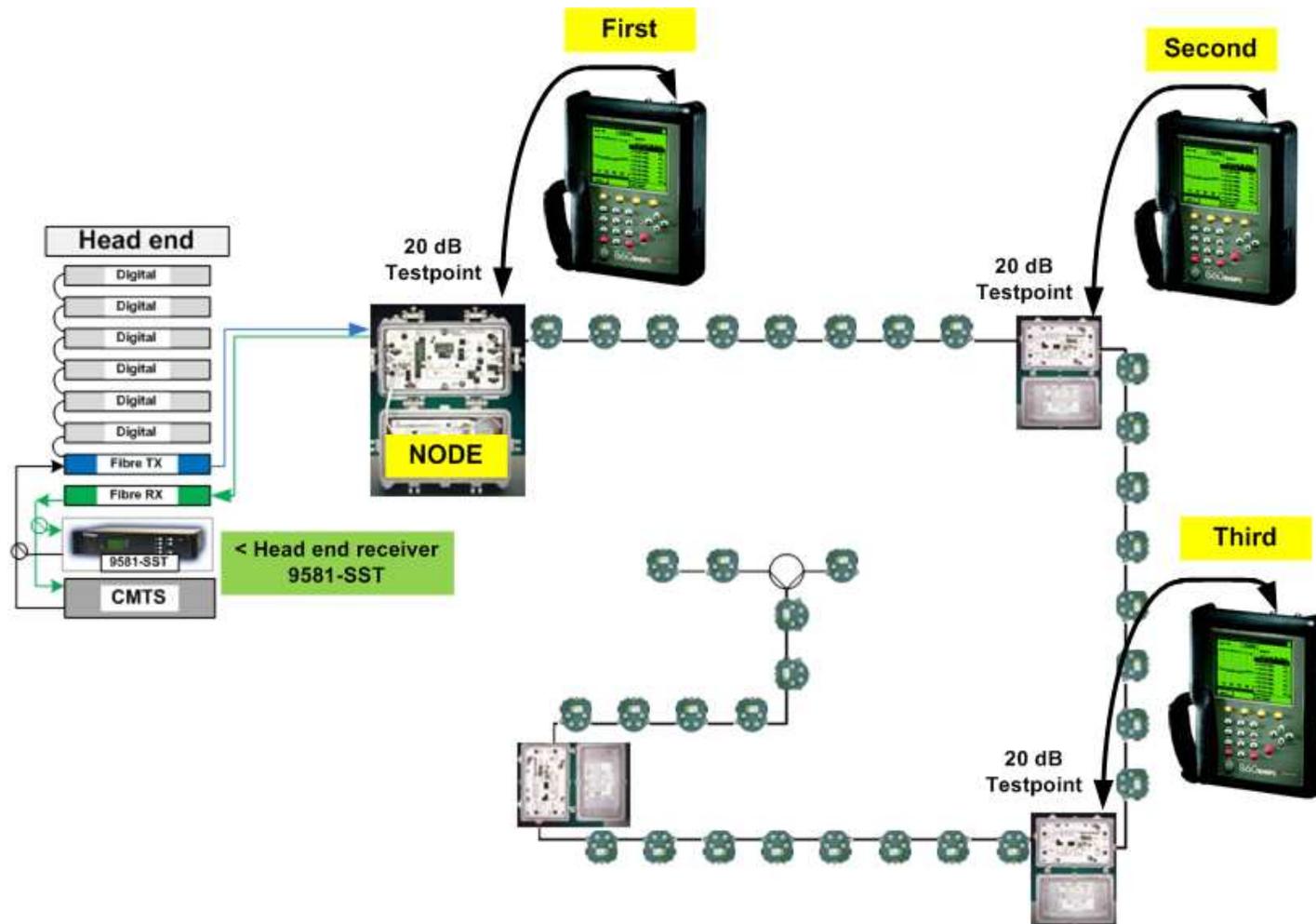
- Example of a high return level sweep.
- This sweep system must be stopped before each data signal and must be started again after each data that is carried on the return path.

Data level return sweep system.



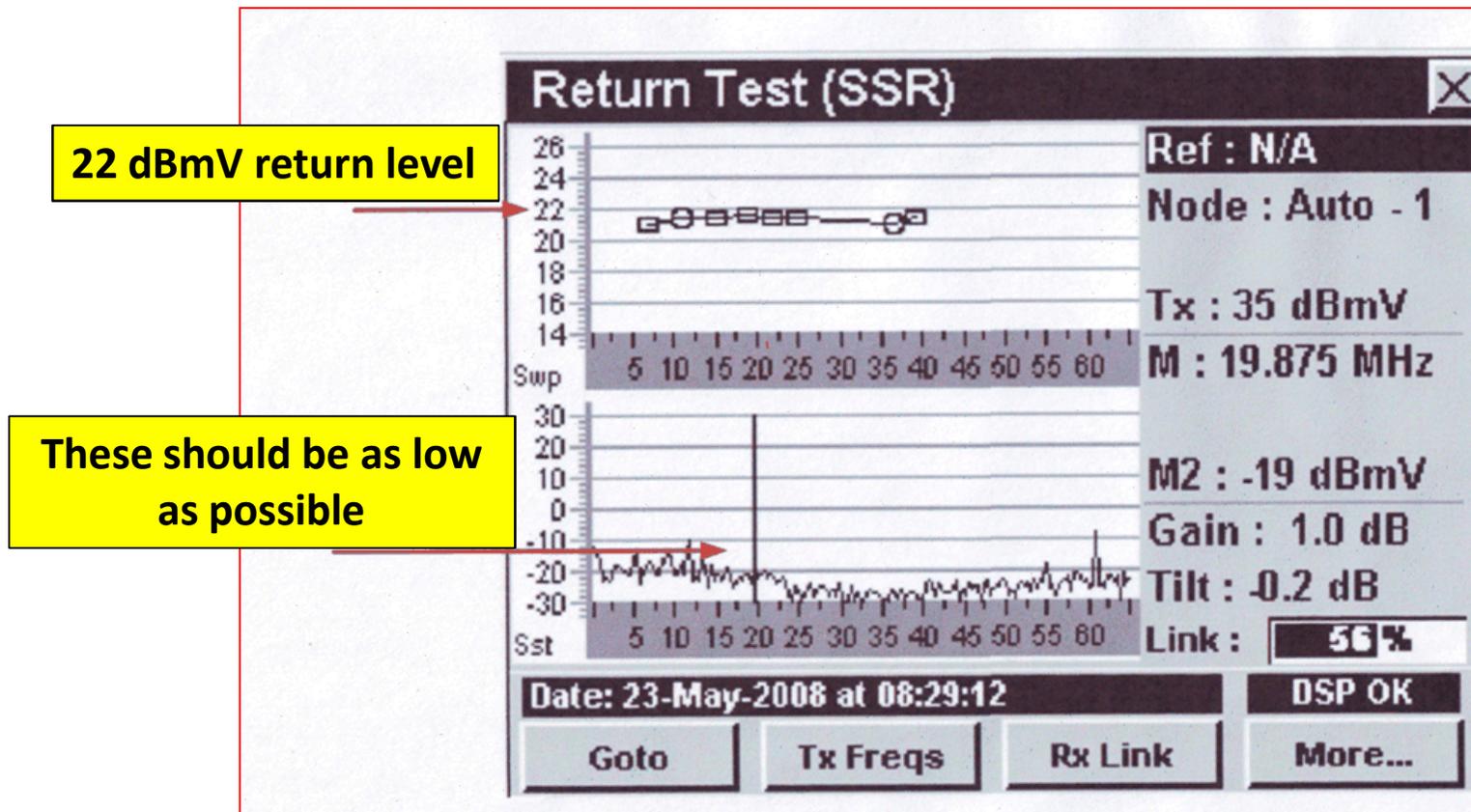
- Example of a data level sweep.
- Eight (8) data points can be selected between 5 and 65 MHz
- You must be sure that none of the data selected fall in the return channels.

Data level return sweep system, how does-it work?



- The forward section should be sweep and aligned at the NODE first.
- Then you sweep the return section (5 - 40 MHz) from the NODE.
- Then you go from the FIRST, SECOND, THIRD amplifier and so on.

Data level return sweep system.



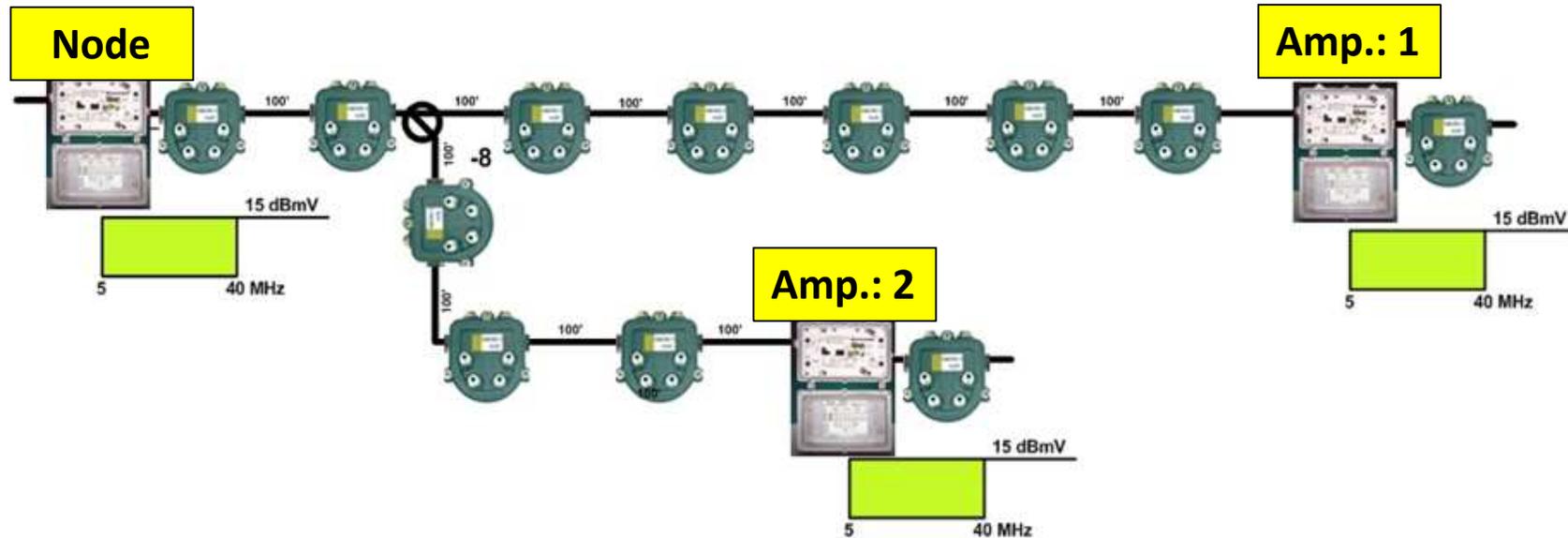
➤ Since some of these equipments equipped with data level reference are also equipped with a return digitizer (5 to 65 MHz), this equipment also let you see the return signal and the not wanted signal like INGRESS and NOISE.

High level return sweep system.



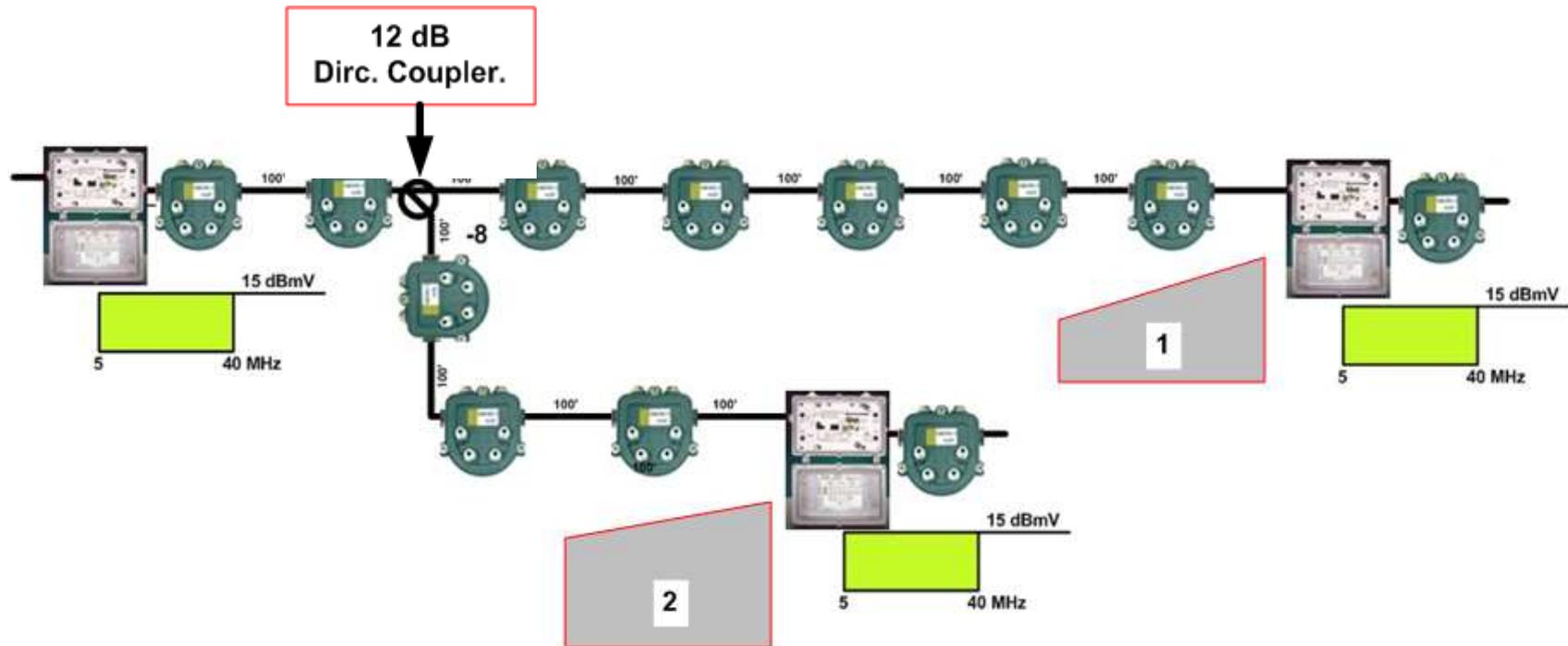
➤ Example of a high level return sweep.

Unity gain on the return section.



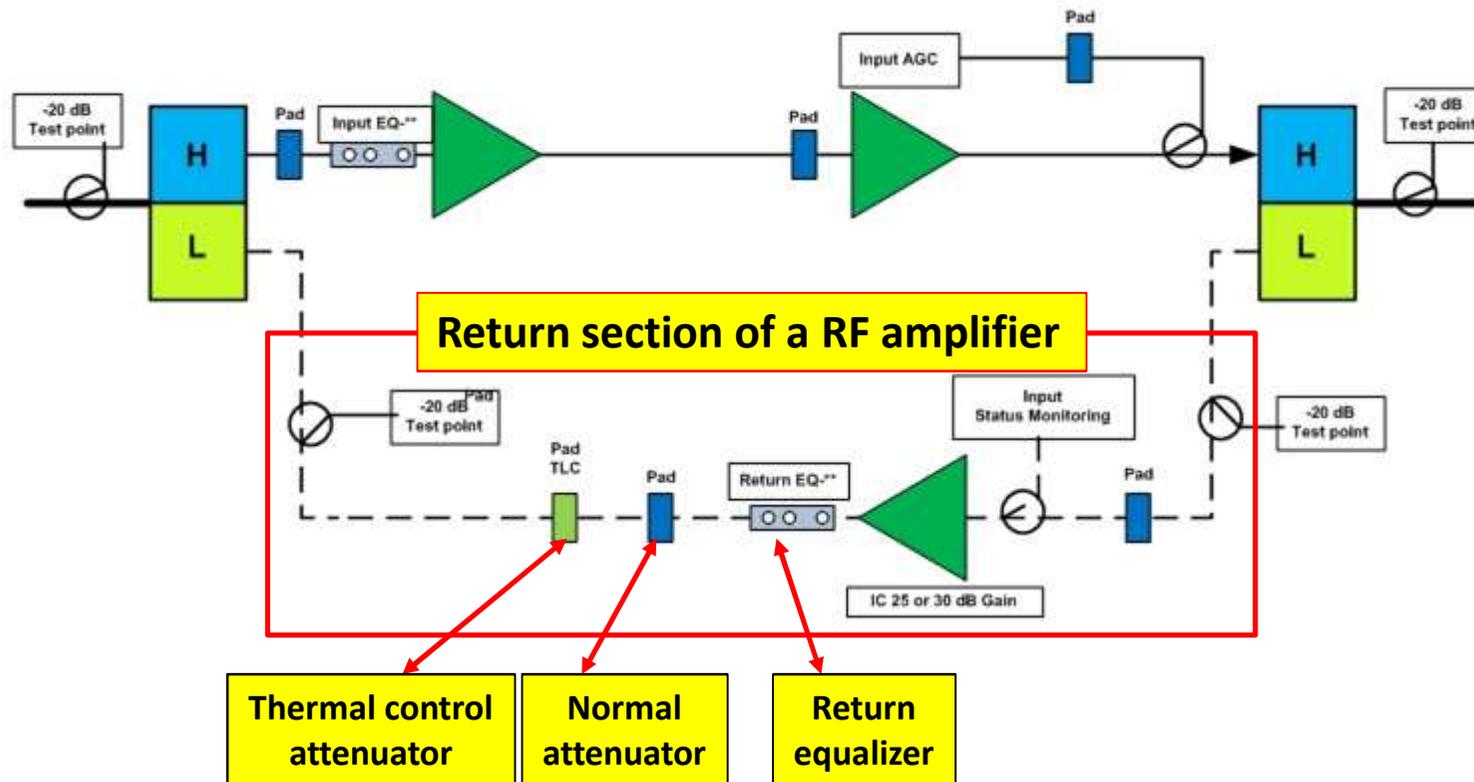
- Unity gain means that the Amplifier: 1 and Amplifier: 2 will require a different output level, a different slope and a different gain.
- Since a proper level for return sweep signal at each Node and Amplifiers is around +15 dBmV, the sweep level will have adjusted at 35 dBmV if your equipment are equipped with 20 dB test point.

Unity gain on the return section.



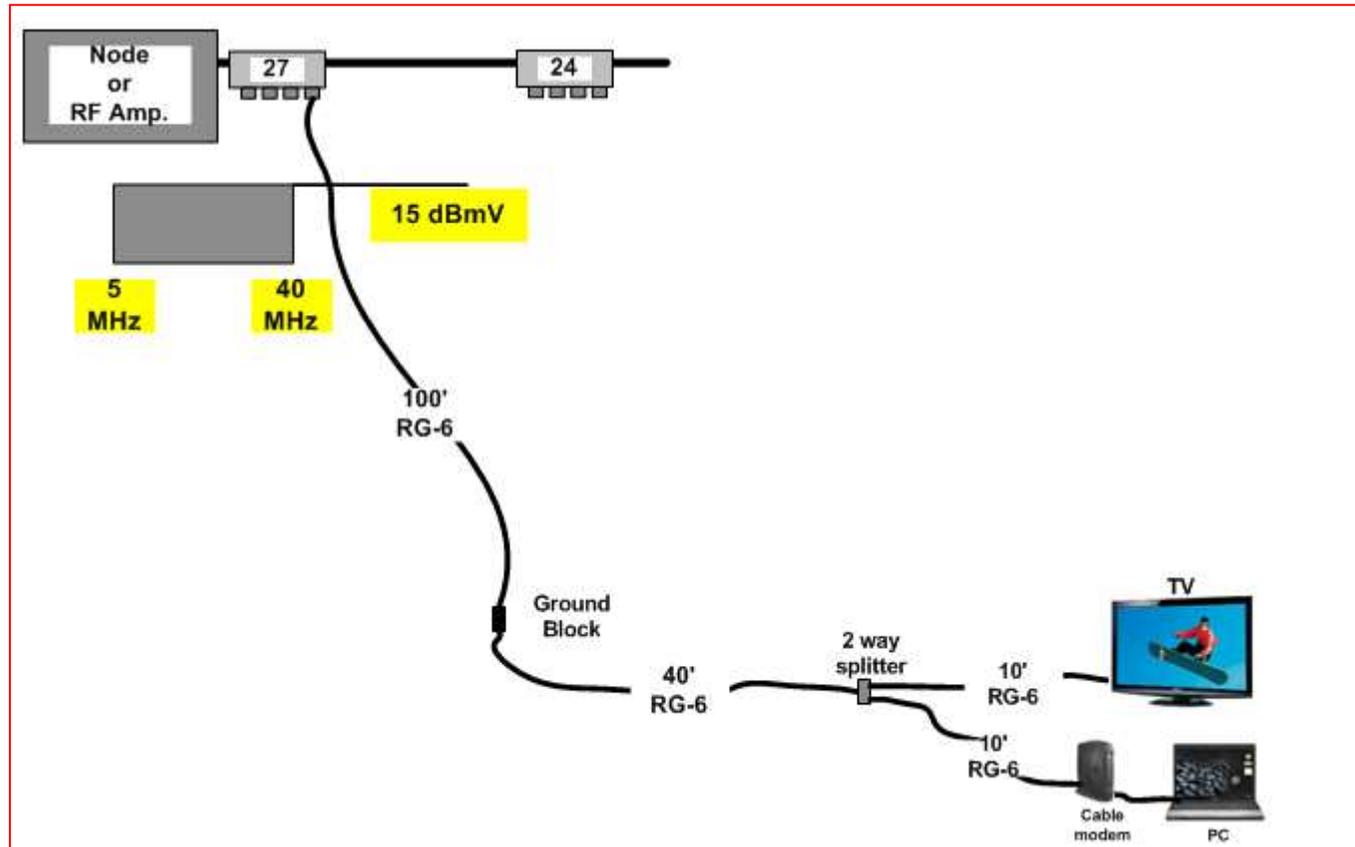
- Return Amplifier No:1 will required a higher EQ value, due to high cable loss and less gain than Amplifier No:2
- Return Amplifier No:2 will required a lower EQ value, due to low cable loss but will require a higher gain because of the 12 dB coupler loss.
- This is basically what Unity Gain means.

Adjusting the return level in an RF amplifier.



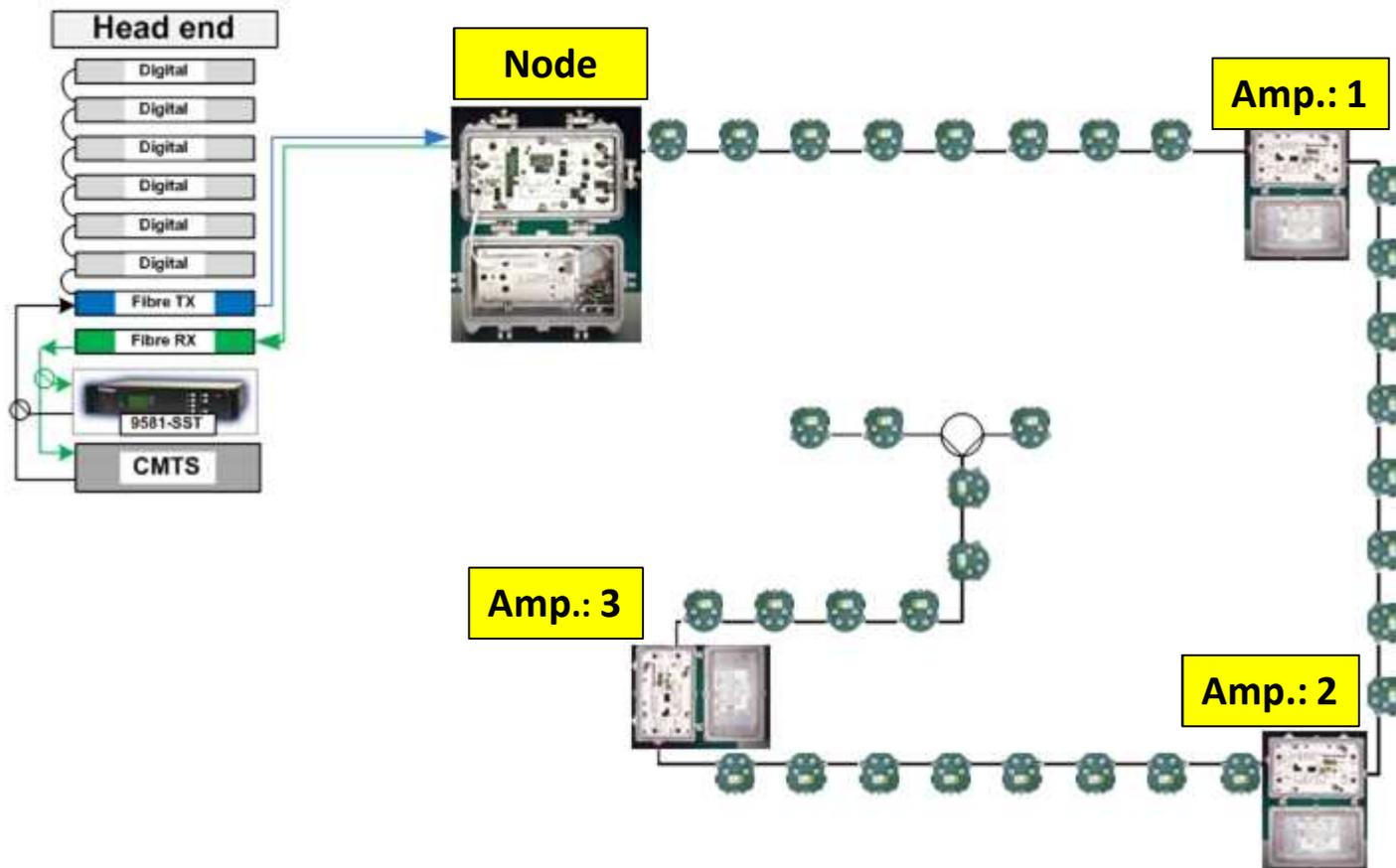
- First, you should rarely install a PAD before the return IC.
- Using the return sweep, you must install the proper return EQ.
- Remember that the return section always requires a flat input at the next amplifier, the next one toward the head end.
- You then need to install the proper pad to reach the next active on the system. Remember this level is around + 15 dBmV.

Why selecting + 15 dBmV for a return level.



- First, let calculate the RG-6 loss @ 40 MHz $(1.37 + 0.55 + 5.0 + 0.14) = 7.01$ dB loss.
- Let calculate the output at the 27 dB multitap $(7.01 + 27) = 34.01$ dB
- Now let add the required input + 15 dBmV $(34.01 + 15) = 49.01$ dB loss
- Since a cable modem is capable of an output of + 55.0 dBmV, this leave a windows of
- $(55.0 - 49.01) = 5.99$ dB spare for INGRESS and NOISE on the return section.

Sequence of adjusting the level in an RF amplifier.



- The right sequence in adjusting the return section is to adjust the NODE first, then the first amplifier, the second one and so on.
- It is always a good policy to do both the forward and the return section while adjusting a CATV-HFC system.

Conclusion.

- ❖ Thank you for viewing this presentation.
- ❖ If you like me to add more information on the subject or you want to discuss this presentation, you can do it by sending an e-mail at:

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