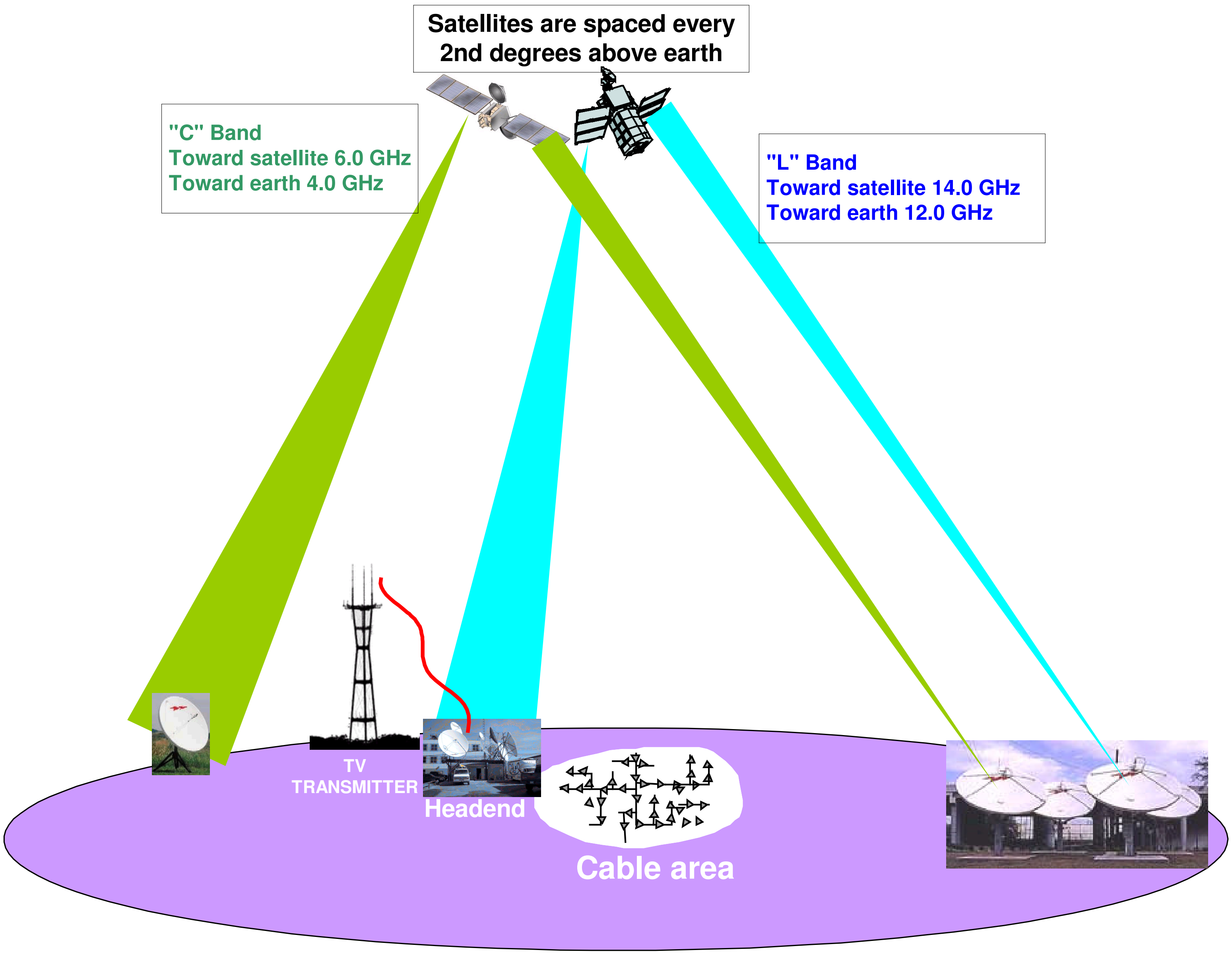
Broadband System - G



CatvExpert

RF Amplifiers.

RF amplifiers

RF Amplifiers

The quest for the ideal RF amplifier.

- The basic function of a power amplifier is always the same: to boost a low-power signal to a higher power level, to be delivered to the amplifier load. Because that role is so fundamental, it's tempting to view amplifiers as simple black-box devices, with an input, an output, and a constant amplification factor. In many instances, the black-box approach provides an adequate picture.

- It fails, however, when the demands placed on an amplifier are extreme.

- Hardest to satisfy is the requirement for maximum capability of two or more conflicting parameters, such as the demand;

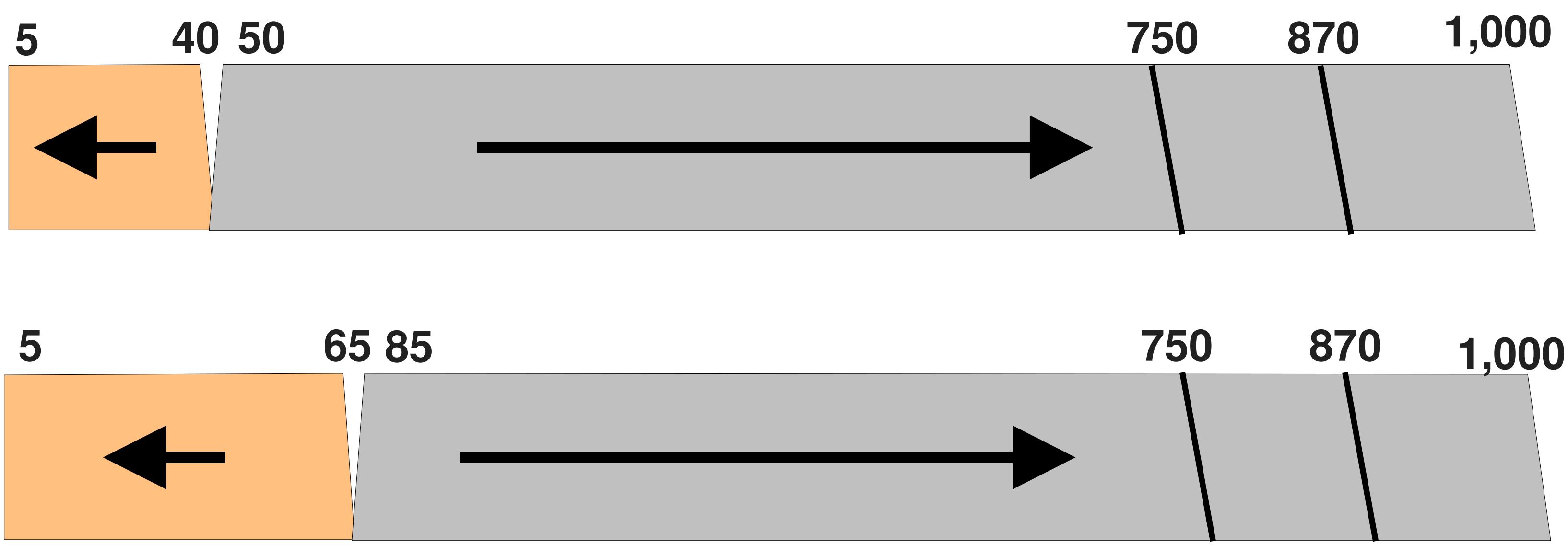
- For broad bandwidth, 870 to 1,000 MHz.

- High power in the same package, output at 46.0 to 48.0 dBmV.

RF Amplifiers

•Selecting the right amplifier, usually require a forward and a return path. The forward amplifier required for today's needs are either: 50 to 750, 50 to 870 and 50 to 1,000 MHz bandwidth.

•The return path can be from: 5 to 40 / 42 or 5 to 65 MHz.



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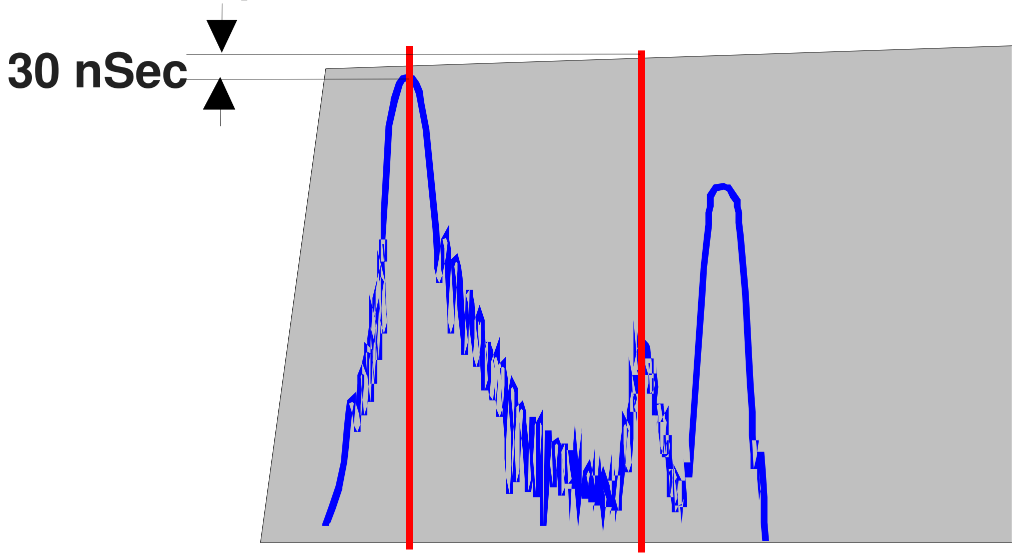
RF Amplifiers

Bi-directional filters on RF amplifier, can causes some problem on channel 2. This Problem is caused by the bi-directional filter, retarding the information between the Picture Carrier of channel 2, situated at 55.25 MHz and the Colour Information, situated at 3.59 MHz above the picture carrier or 58.84 MHz. This problem is called Group Delay. The group delay specification is given in nanosecond.

In most modern RF amplifier, the Group delay is around 30 nanosecond per amplifier at channel 2, the delay gets better as we increase in frequency. If this retard goes beyond 250 nSec due to cascading RF amplifiers, you'll see the colour not been display properly inside the picture.

A 10 amplifiers cascade with a 30 nanosecond would give a 300 nSec group delay, which could mean problem.



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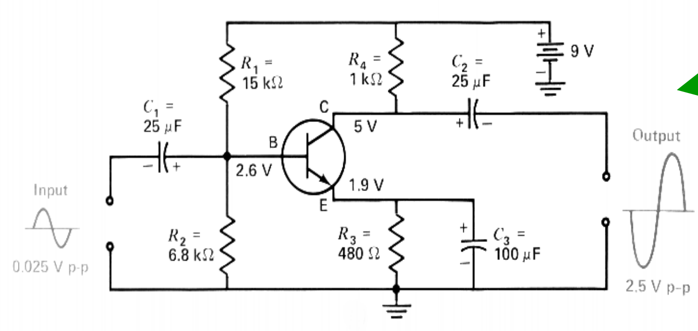
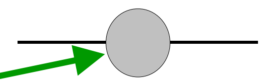
RF Amplifiers

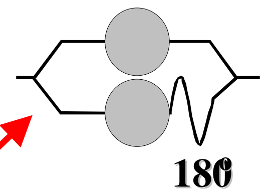
Type of amplifications Circuit used in modern RF amplifiers;

Single ended transistor



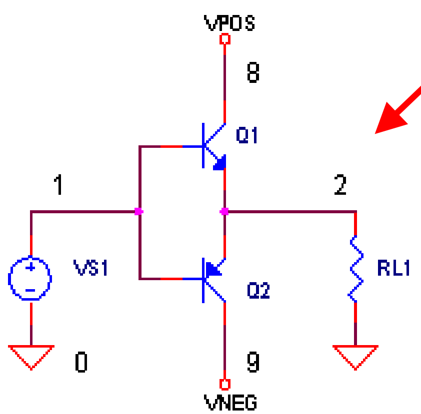


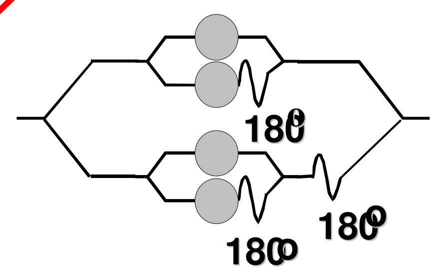
Single ended transistor



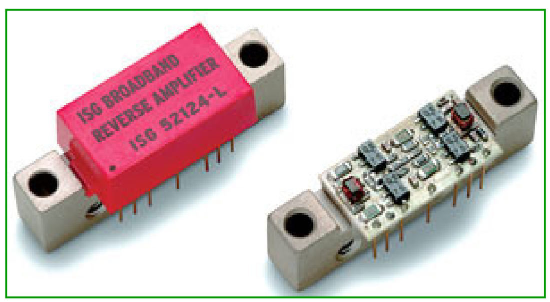
Push Pull transistor

Push Pull transistor





Power Doubling transistor



To day's Circuitry can be:

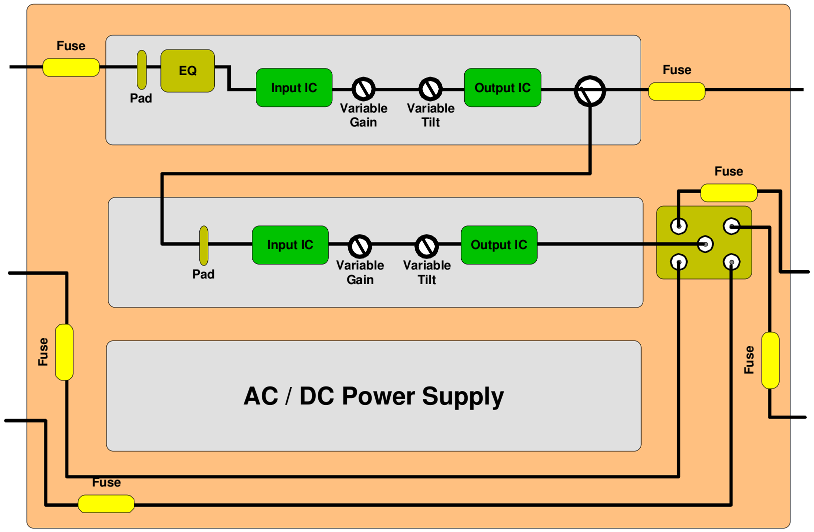
- Push pull
- Power Doubler
- GaAs

RF Amplifiers

- Today RF amplifiers requires a lot of gain. It is not rare today to see amplifiers operating between 30 to 45 dB of gain at 750, 870 or 1,000 MHz.
- They also requires a high output level, between 42 to 48 dBmV a their highest frequency.
- The need for high gain amplifier is mainly because, it is more economical to keep the old amplifier's location and just replaced old amplifier by new amplifiers with the required gain.
- Most of today amplifiers utilised either Power Doubling or GaAs amplification circuit at their output stage. GaAs circuit gives a 3 dB better output capability that a Power Doubling circuit.
- GaAs amplifiers also have a higher compression point than Power Doubling amplifiers.

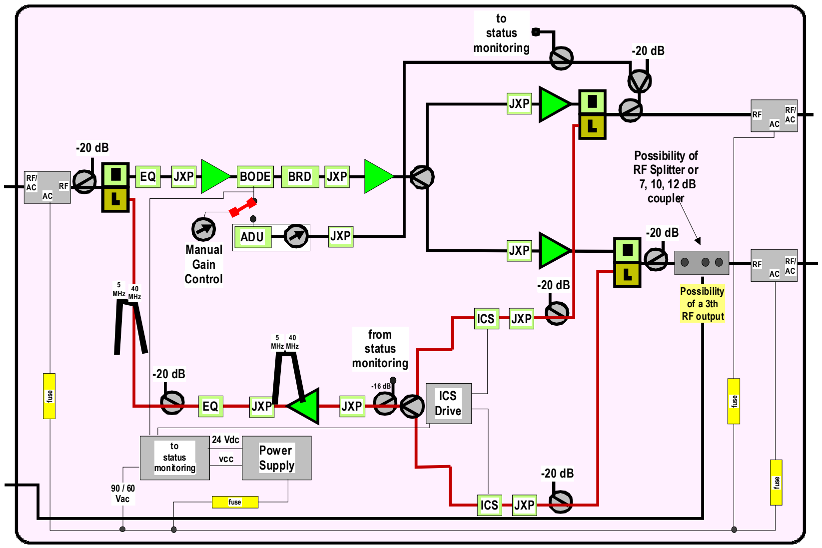
RF Amplifiers

Yesterday's amplifier



They were called TRUNK / BRIDGER amplifier. The BRIDGER and a distribution selector were added for local signal distribution. Often a AGC/ASC module was also needed to control its output level.

Today's high gain amplifier



These amplifiers comes completely equipped with either 2 or 4 outputs. The only module that can be added is a AGC or a TLC module.

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RF Amplifiers

Required gain for RF amplifiers, where we want to keep the same amplifier location, while upgrading an HFC system to a higher operating frequency.

For an upgrade from 550 MHz to 870 MHz, the new amplifier will require a <u>34.2</u> dB gain, when the old amplifier was operating at a <u>32.0</u> dB gain.

<u>These calculations are only for TRUNK amplifiers without multitap</u>

<u>Required gain for the RF section of a HFC system</u>

<u>This spread sheet will calculate the required gain, of the RF amp. when you want to keep</u>

the amplifiers at the same location, while doing a <u>frequency upgrade</u> on a HFC sysem.

<u>These calculations are only for replacement of TRUNK amplifiers without multitaps.</u>

ENTER Amp. GAIN.

<u>Actual</u> Gain : Amp. **32.0** dB @: <u>450</u> <u>550</u> <u>750</u> <u>870</u> <u>1000</u> MHz

<u>Enter gain of the amplifier.</u>

Loss dB 100' mt.	System Spacing MHz	Dist. Mt. Between Amp.	450	550	750	870	1000
4.43	450	722.5	32.0 dB	35.6 dB	42.2 dB	46.2 dB	49.1 dB
4.92	550	650.2		32.0 dB	38.0 dB	41.6 dB	44.2 dB
5.84	750	547.9			32.0 dB	35.1 dB	37.2 dB
6.40	870	500.2				32.0 dB	34.0 dB
6.79	1000	471.2					32.0 dB

<u>Above distances and losses are with 625 P-III Cable</u>

<u>The gain should be the same for any type of P-III cable.</u>

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RF Amplifiers

Required gain for RF amplifiers, where we want to keep the same amplifier location, while upgrading an HFC system to a higher operating frequency.

For an upgrade from 550 MHz to 870 MHz, the new amplifiers will require a <u>28.6</u> dB gain, when the old amplifiesr were operating at a <u>22.81</u> dB gain.

<u>These calculations are only for distribution amplifiers with multitap</u>

This program will calculate the loss between L.E. with multitaps

Present amplifier gain @ 450 MHz

1.63	*dB loss 100'*	Enter : 1.63	*for 500-P-III*	1.35 *for 625-P-III*

dBmV		1.63		1.63		1.63		1.63		1.63		1.63		1.63		distance
	0.9	100	0.8	100	1	100	1.4	100	1.4	100	1.9	100	4	100	Input	700
43.00	29		26		23		20		17		14		10		*20.19*	ft
	14		14.47		15.04		15.41		15.38		15.35		19.08	*< output at multitap*		
															gain	
														Present amp. Gain.	*22.81*	*dB*

Required amplifier gain @ 750 - 870 MHz

2.34	*dB loss 100'*	Enter : 2.16	*for 500-P-III @ 750 MHz*	2.35 *for 500-P-III @ 870 MHz*

dBmV		2.34		2.16		2.16		2.16		2.16		2.16		2.16		distance
	1.3	100	1.3	100	1.2	100	1.6	100	1.7	100	1.9	100	4.3	100	Input	700
46.00	29		26		23		20		17		14		10		*17.40*	
	15.7		16.36		15.9		15.54		14.78		13.92		18.18	*< output at multitap*		
With 64 QAM @ 870 MHz															gain	
28.60	*Amplifier dB gain required to upgrade the system from 450 to 750 MHz.*													*With 64 QAM @ 870 MHz*	*28.60*	*dB*

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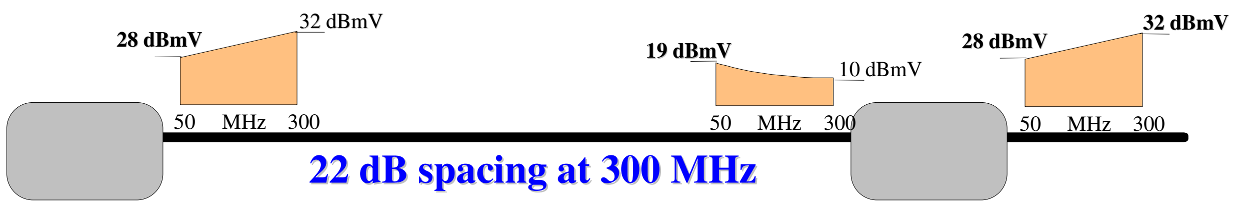
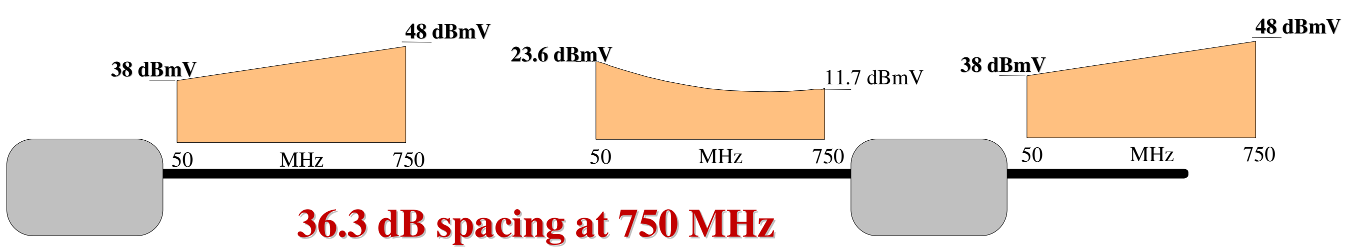
RF Amplifiers

•Example of RF amplifiers on a system operating at 300 MHz with <u>32 dB</u> gain, where the RF amplifier are keep at the same location for a new system operation at 750 MHz.

•These new amplifiers will require a <u>36.3 dB</u> gain at 750 MHz to expand the passing band to 750 MHz from 300 MHz.





RF Amplifiers

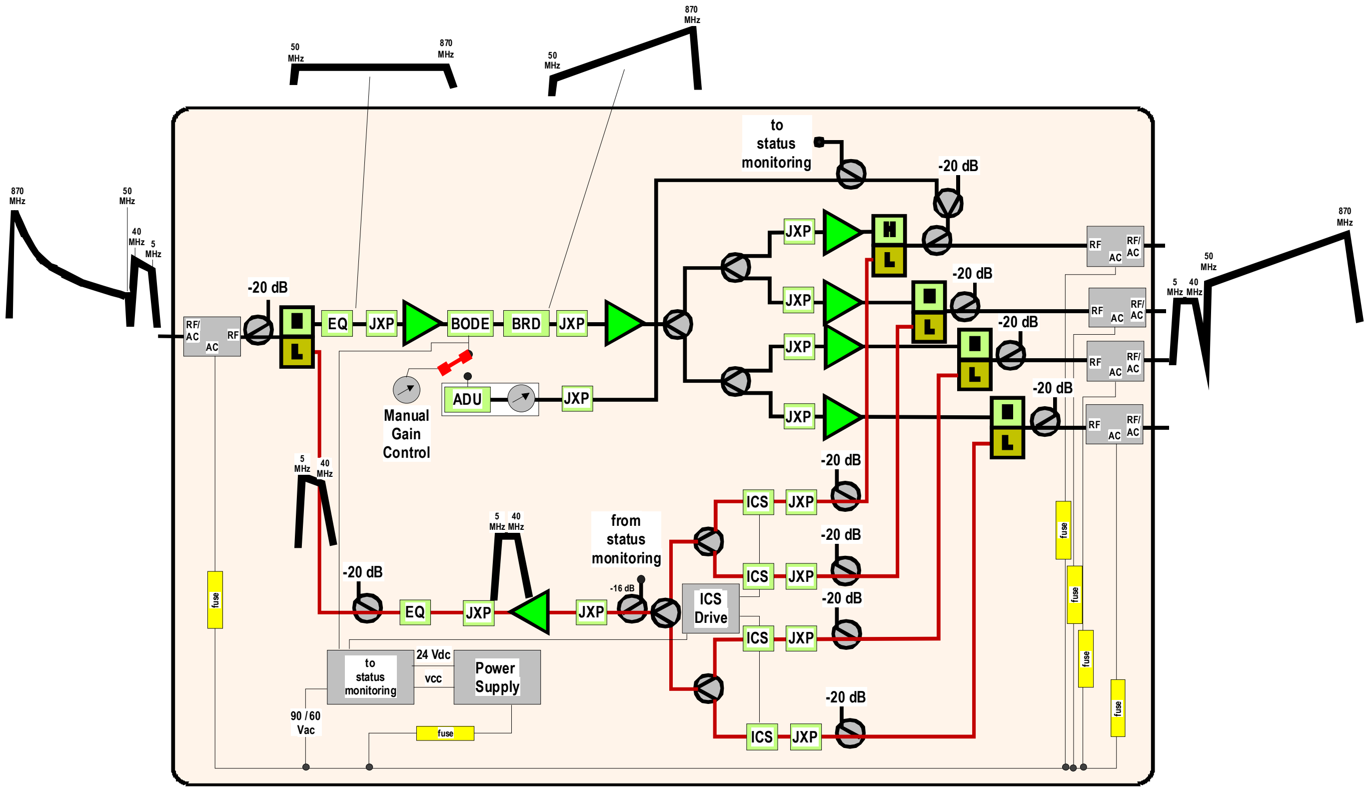
So for and upgrade in frequency for CATV-HFC system, you'll need to calculate two different amplifier gain:

- **One gain for the TRUNK amplifier section.**
- **One gain for the LINE EXTENDER section.**
- **With the LINE EXTENDER section, it could also mean to replace multitap with different value. We will see this in a later section.**

Let have a look at the different amplifiers possibility.

RF Amplifiers

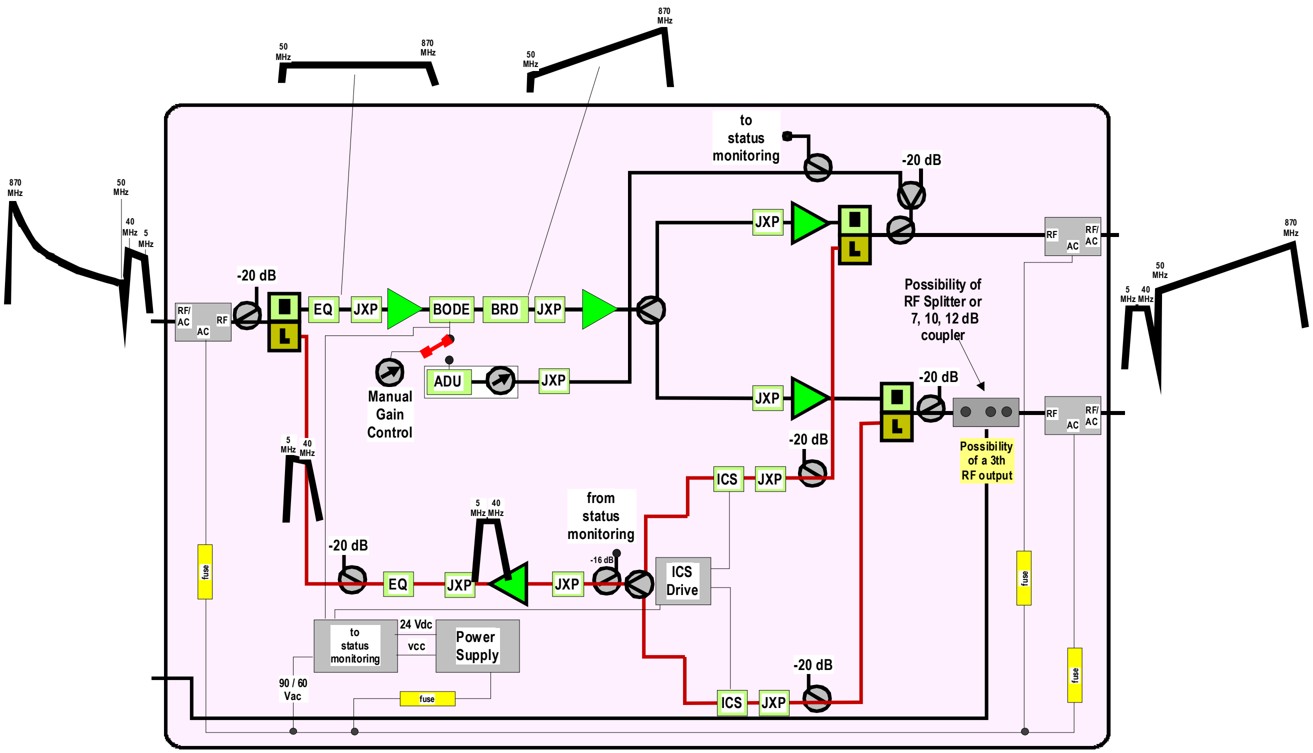
A Four Outputs, High Gain Amplifier.



47 dB gain, minimum full @ 1,000 MHz.

RF Amplifiers

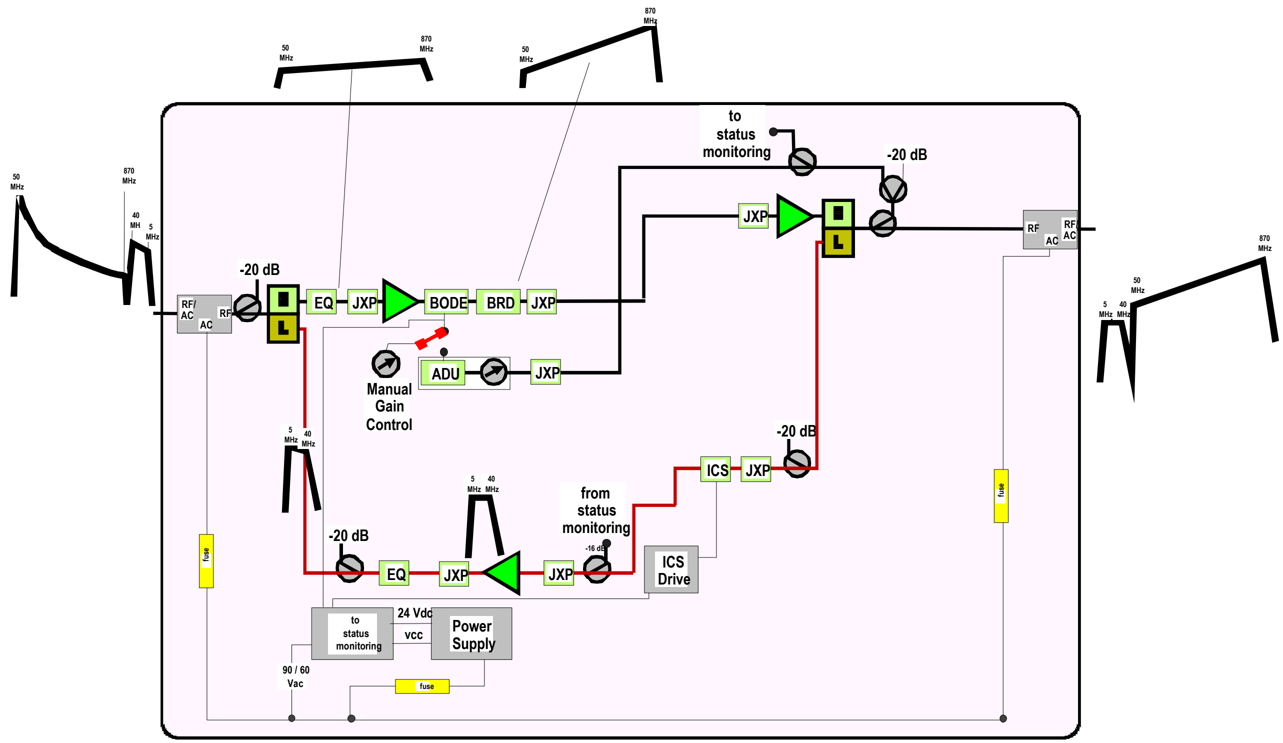
A Dual or Three Outputs, High Gain Amplifier.



47 dB gain, minimum full @ 1,000 MHz.

RF Amplifiers

A One Output, High Gain Amplifier.



38 dB gain, minimum full @ 1,000 MHz.

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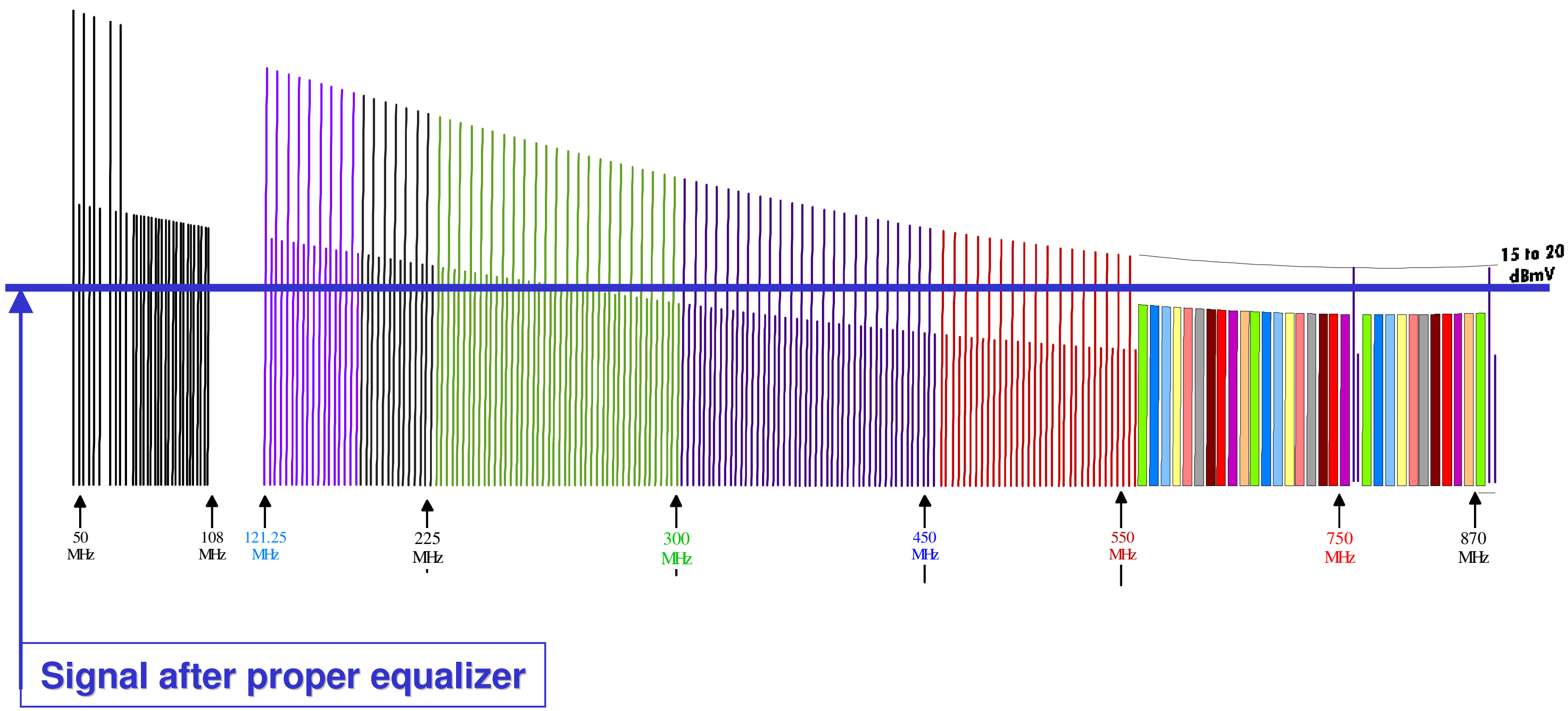
RF Amplifiers

RF Input of a Modern Amplifier.



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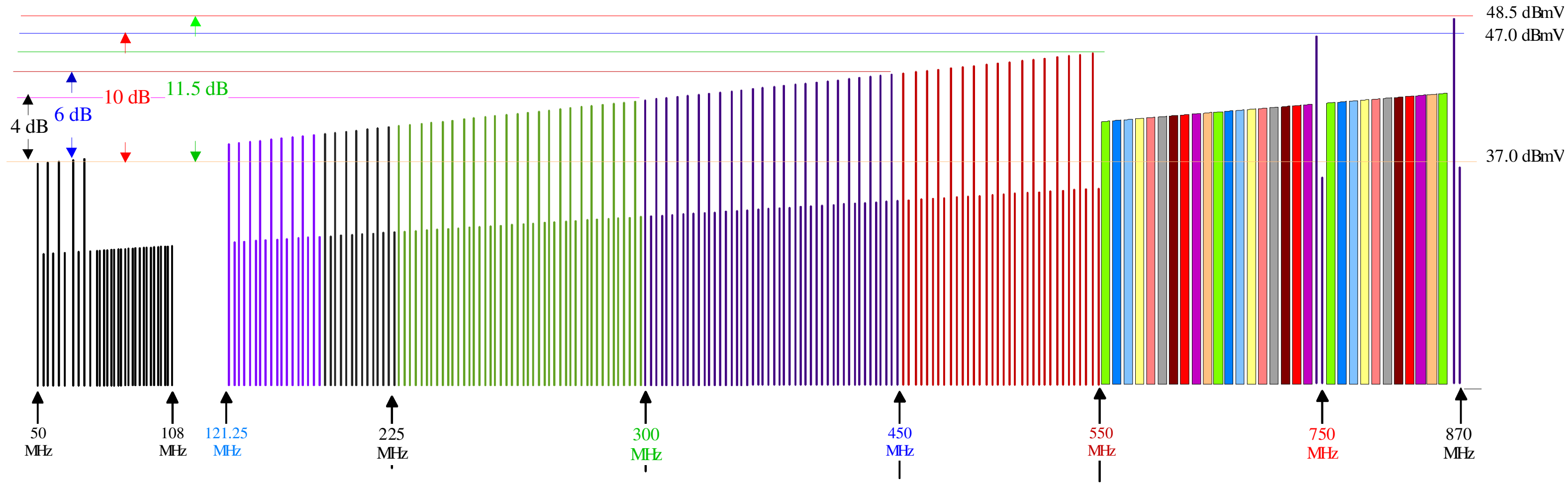
RF Amplifiers

RF Output of a Modern Amplifier.



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RF Amplifiers

•Because coaxial cable is frequency dependent, the loss at high frequency (750, 870 or 1,000 MHz) is much higher than at lower frequency, 50 MHz, something like 4.2 to 1 for 750 MHz system, 4.6 to 1 for 870 MHz system and 4.9 to 1 for 1,000 MHz system.

•This difference will cause a big difference in level at the input of the next amplifier. With this big difference in level between the LOW and HIGH frequencies, the next amplifier will require a cable equalizer at his input, the equalizer will bring all the signal at a flat level before hitting the first amplification circuit.

•When temperature change are high, it is a good practice to equipped RF amplifier with a AGC circuit. (Automatic Gain Control)

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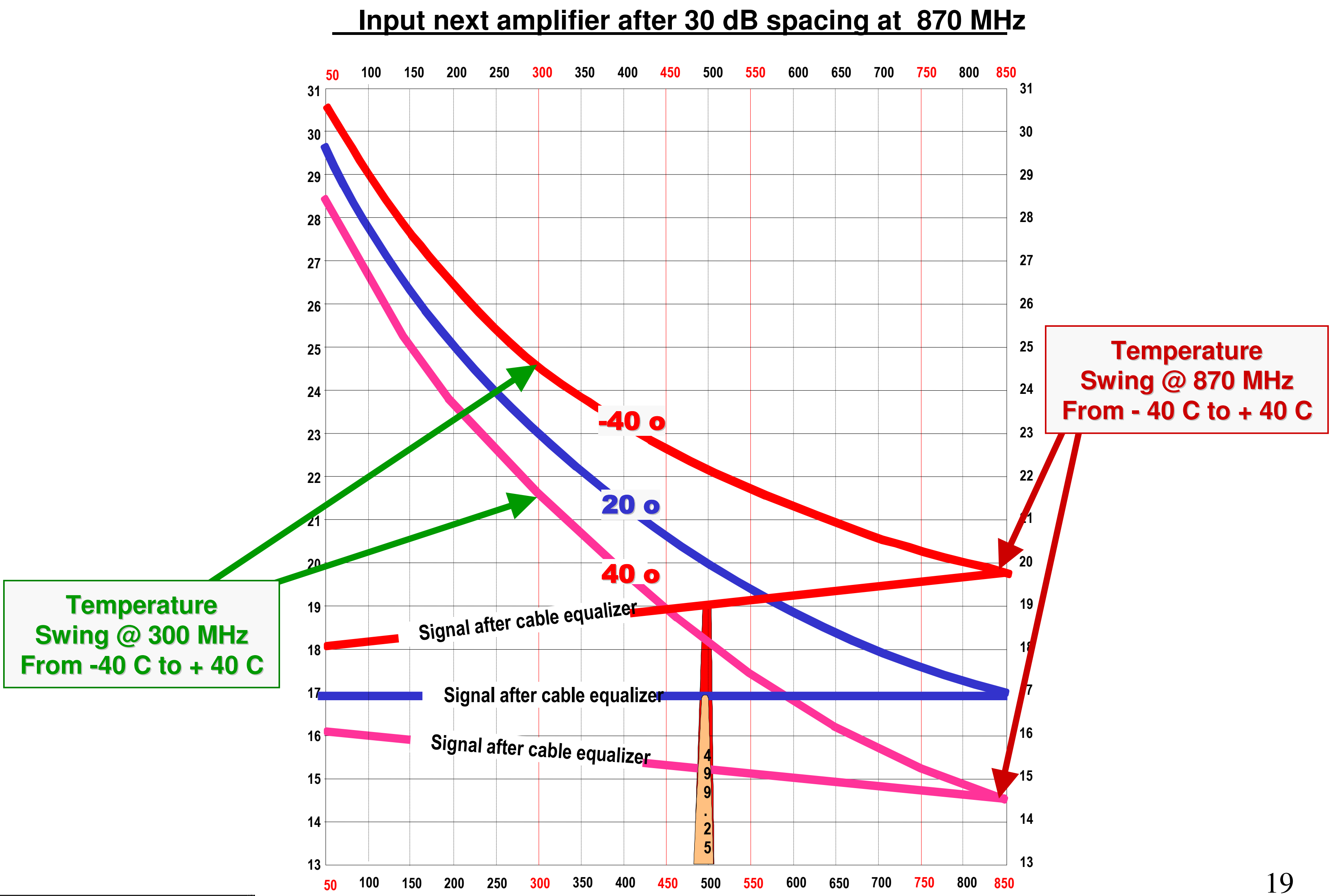
RF Amplifiers with an AGC control.



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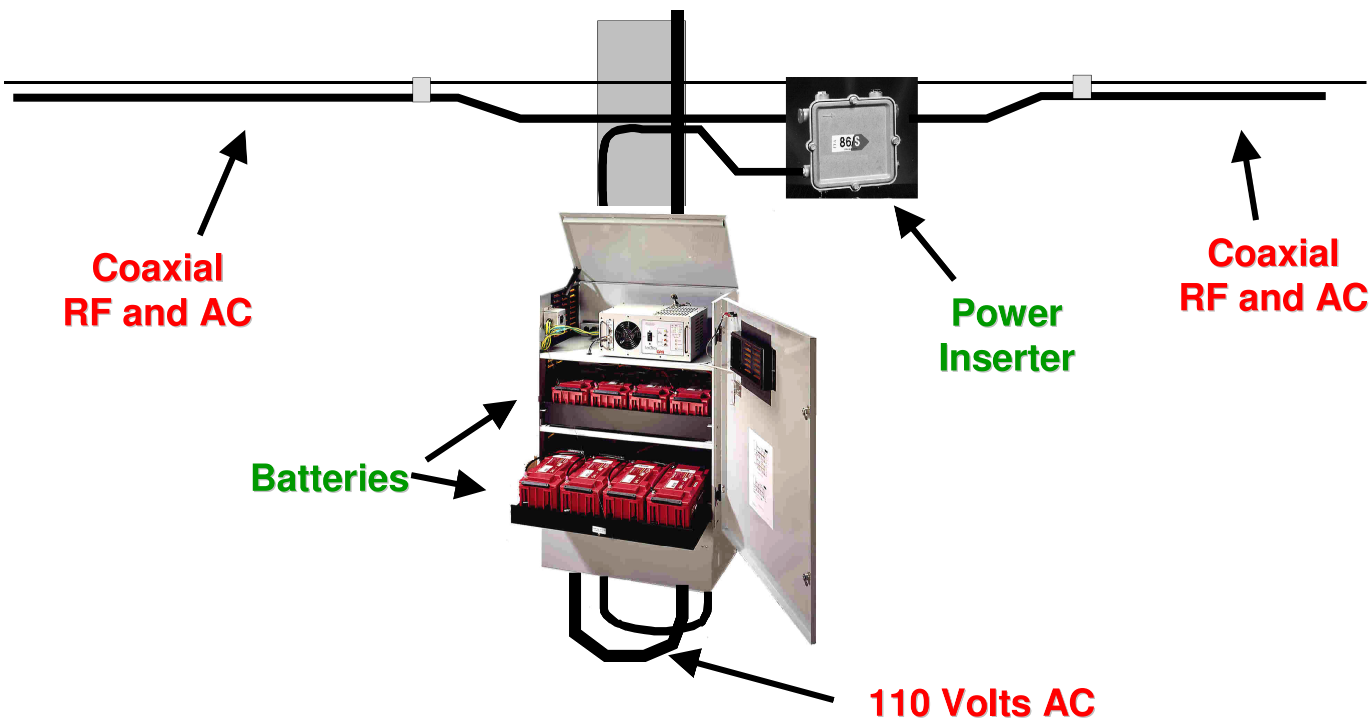
Powering RF Amplifiers

Today RF amplifiers requires between <u>40 to 90 volts AC</u> to operates properly. This voltage is generally supplied by a UPS power working off the power line at 110 volts AC or from a non-standby power supply also working at 110 VAC.



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Powering RF Amplifiers

•<u>Powering an HFC system.</u>

•The first thing to know about powering a HFC system, is to only utilized 80% of the capacity of the AC Power Supply. If a Power Supply is capable of delivering 15 amperes, 80% of 15 amperes will be 12 amp. This will permit a reserve for the warm day of summer, where the coaxial cable losses get higher, then drawing more amperage.

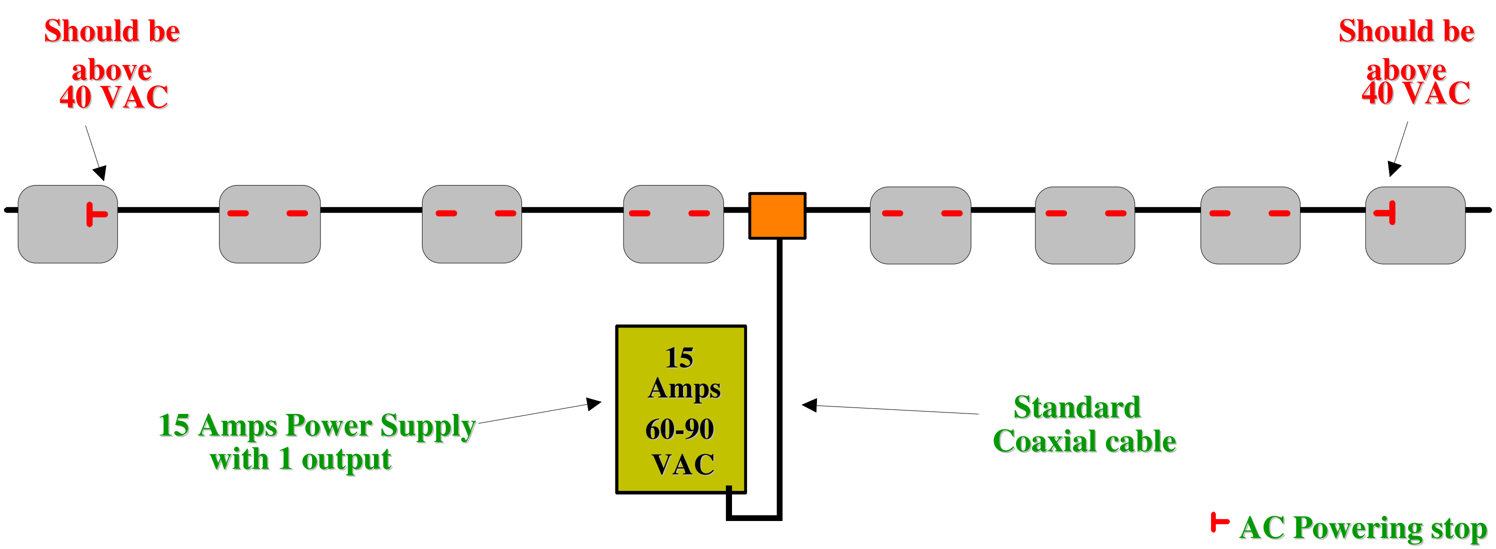
•In the future, a broadband system, will also require more utilisation of AC power, mainly because we will be installing active equipment on the side of each home. This active equipment will require AC voltage that will be feed by the drop wire to supply VoIP telephony, Cable modem services, Pay television, Security services, and other types of services.

•One more thing that will be required from the AC power supply, is able to deliver at less 6 hours of standby time, giving the technician, time to comes and hook up a gasoline generator, to make sure the system is keep in operation at all time.

•By doing the above, we will be able to meet the 99.99999% working time, demanded by some insurance and protection company.

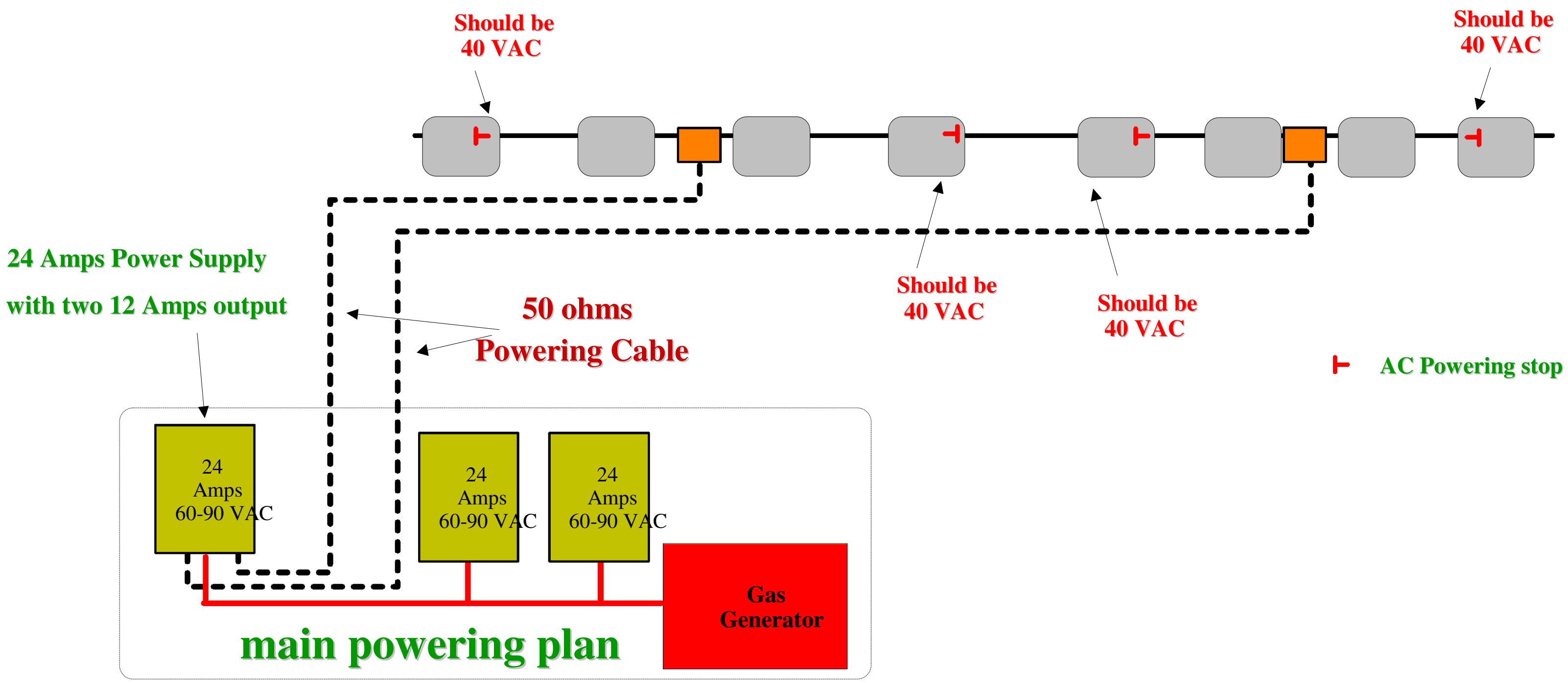
Powering RF Amplifiers

There is two ways to supply the require AC to a cascade of amplifiers. The oldest and most utilized way is called Standard Powering P.S, where the P.S. converted 110 VAC to either 60 or 90 VAC. To day, the industry uses standby-by P.S. where batteries supply DC voltage that is then converted in AC voltage.



Powering RF Amplifiers

A new way to supply AC to a cascade of amplifier is called <u>Centralized Powering</u>, where the UPS are installed in a centre location, where the AC is feed thru a special cable called « <u>Power cable</u> ».



Powering RF Amplifiers

Mechanical Description (nominal)	Power 50	Power 30	Power 20
Inner Conductor (Inches)	0.218 Solid Copper Inner Conductor	0.320 Copper-Clad Aluminium	0.345 Copper-Clad Aluminium
Dielectric Diameter	0.563	0.563	0.515
Outer Conductor	**0.625 Seamless Aluminium**	0.625 Seamless Aluminium	0.625 Seamless Aluminium
Jacket Diameter	0.685 Black PE	0.685 Black PE	0.685 Black PE Four Yellow Stripes
Minimum Bend Radius	4.5	8.5	7.0
Weight lb/kft	268	233	307
Electrical Description (nominal)	**Power 50**	**Power 30**	**Power 20**
Impedance, ohms	50	30	20
Capacitance, pF/ft	23.1	38.2	66.9
Velocity of Propagation, %	87%	88.6%	79.5%
DC Resistance, ohms/kft @ 68F			
Centre Conductor	0.22	0.16	0.13
Outer Conductor	0.23	0.23	0.14
Loop	0.45	0.39	0.27

POWER CABLE.

Power cable is a different type of coaxial cable than the one used for CATV system. This cable is a 50 ohms coaxial cable utilized only to transport 60 or 90 Volts AC from a centralized powering centre to a cascade of amplifiers. The most common type is a 625 cable, where the centre conductor is different than standard coaxial cable.

Specifications of P-III-625 vs Power Cable

Standard Coaxial Cable 75 ohms:

Type	Central Conductor	DC Loop
T-10-625	0.137”	1.10 ohms/1000’

Power Feeder Cable 50 ohms:

Type	Central Conductor	DC Loop
Power - 50	0.45”	0.218 ohms/1000’
Power – 30	0.30”	0.320 ohms/1000’
Power – 20	0.27”	0.345 ohms/1000’

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Powering RF Amplifiers

To find the voltage at location **6B** = 60 or 90 VAC - (VD1 + VD2 + VD3 + VD4 + VD5)

VD1 = The current drawn by amplifiers: 4 – 5 – 6 - 5A -6B -6C must pass by T-10-750 (D1) in this case.

I (total) = (.94 + .99 + .95) + (5 (.45)) = 5.12 amperes

I (total) X (0.00076 ohm X 2000') or 5.12 amp. X 1.58 ohm = 7.78 Volts AC

VD2 = The current drawn by amplifiers: 5 – 6 – 5A - 6A - 6B - 6C must pass by VD2

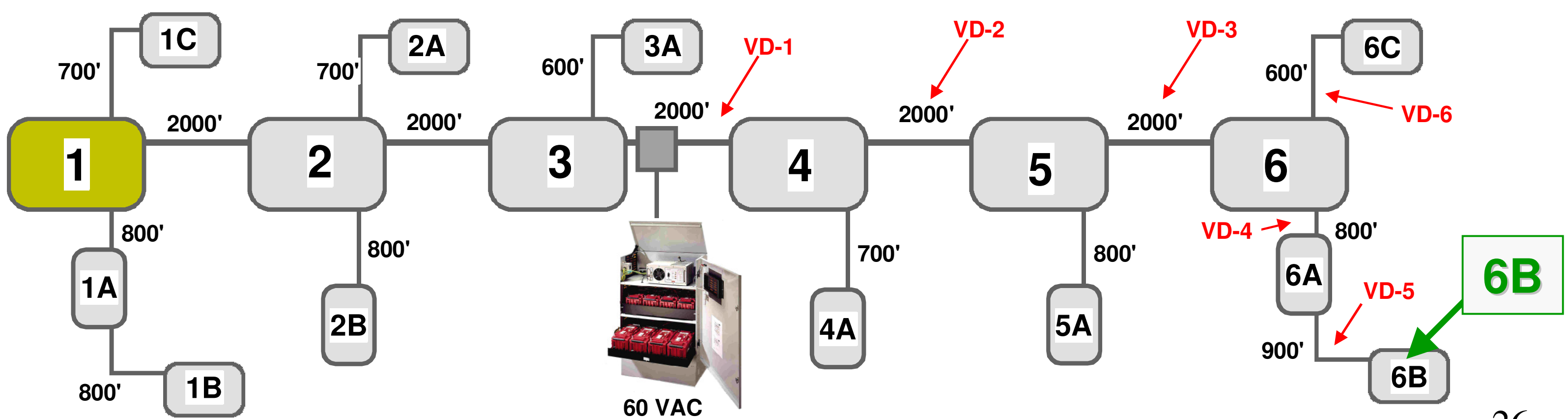
(0.99 + 0.94) + (4 X (0.45)) = 3.78 amp X 1.58 ohm = 5.67 Volts AC

VD3 = The current drawn by amp. 6 - 5A - 6A - 6B - 6C must pass by VD3 = 0.94 + (4 X (0.45)) = 2.29 amp X 1.58 ohm = 3.48 Volts AC

VD4 = The current drawn by amp. 6A - 6B = 0.9 amp. = 0.9 amp. X (0.00018 ohm X 800') = 1.334 = 1.21 Volt AC

VD5 =The current drawn by amp. 6B = 0.45 X (0.00018 ohm X 900') = 1.512 ohm = 0.68 Volt AC

VD6 = 60 – (7.78 + 5.67 + 3.48 + 1.21 + 0.68) = 41.2 Volts AC



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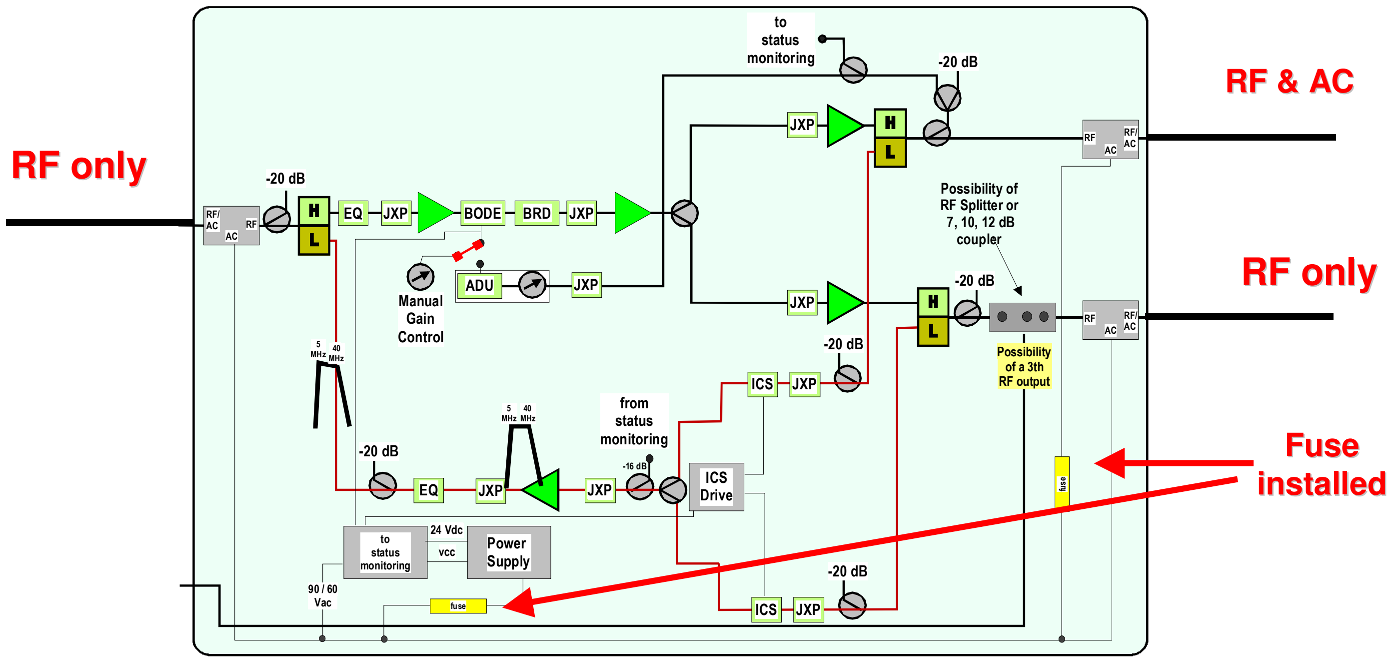
Cable T-10-750 (0.00076 ohm / ft)

Cable T-10-500 (0.00163 ohm / ft)

Powering RF Amplifiers

In most amplifiers, the AC power can be feed by any of the input or the output port. Adding or removing a <u>20 or 30 amperes fuse</u>, will get this amplifier to work properly. Proper fuses location will also give the possibility to send the required AC power to the next amplifier.



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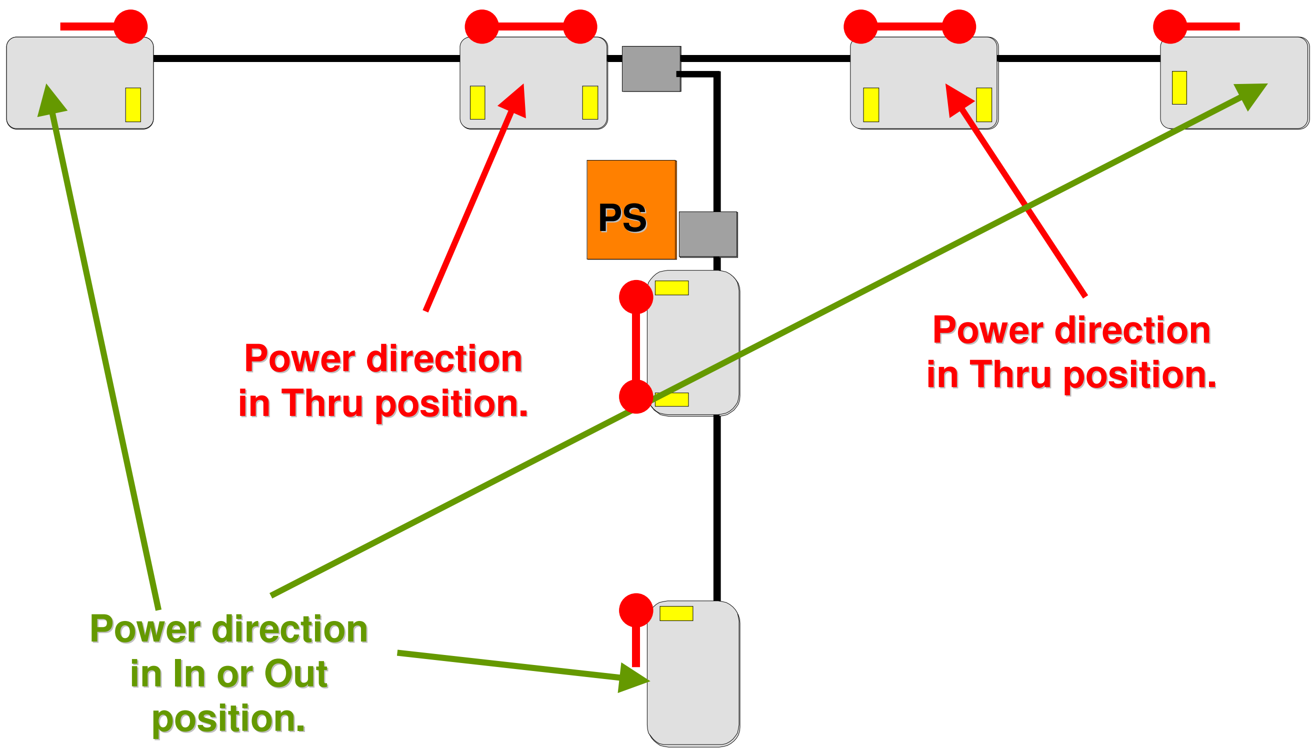
Powering RF Amplifiers

Adding and removing fuses at input and output of RF amplifiers, will direct how the amplifiers will get their required AC voltage.



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RF Amplifiers Distortions.

RF amplifiers are not a perfect device, they not only give GAIN, but they also causes some problems to the quality of the signal deliver to the HFC broadband system.

Here are some of the problems amplifiers are causing:

•Second Order distortion (2nd).

•Third Order distortion (3th).

•Cross Modulation distortion (XM).

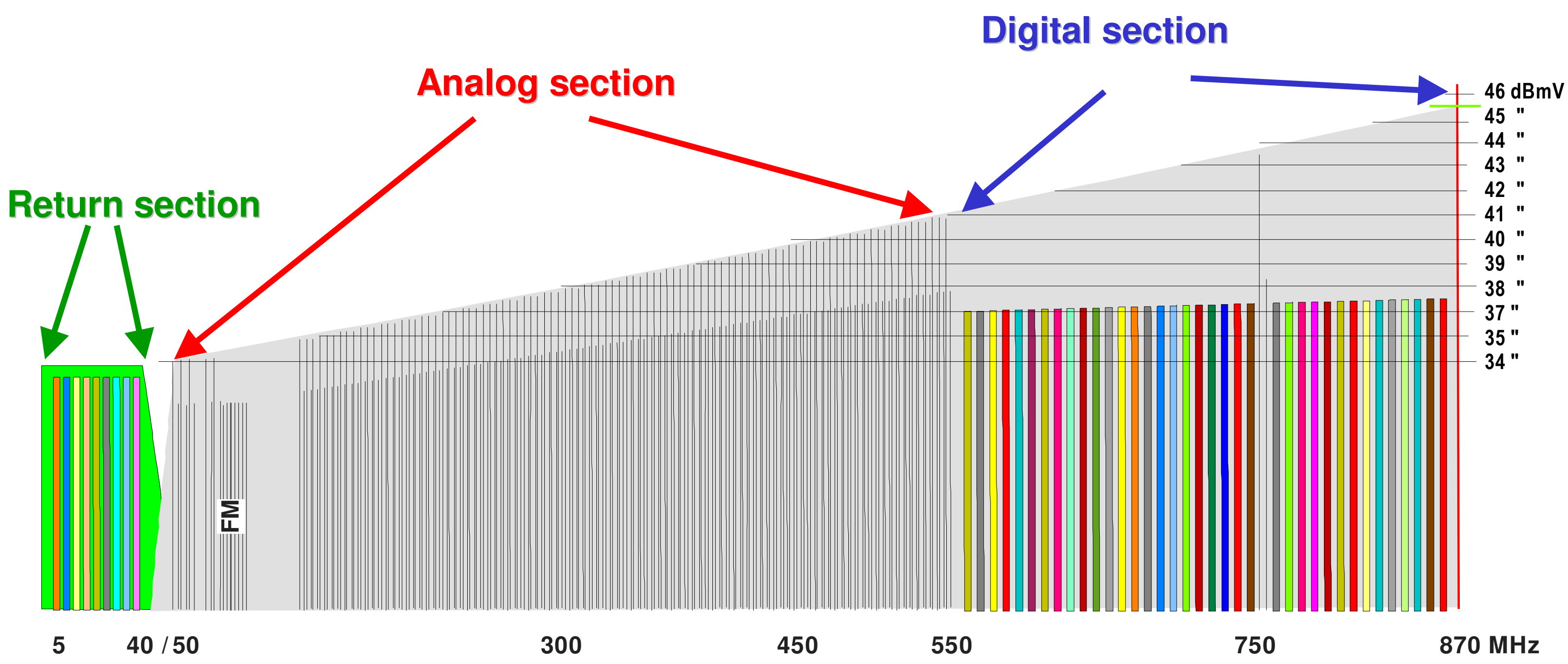
•Composite Third Order distortion (CTB).

•Composite Second Order distortion (CSO).

•Noise distortion (C/N).

•Hum distortion (HUM).

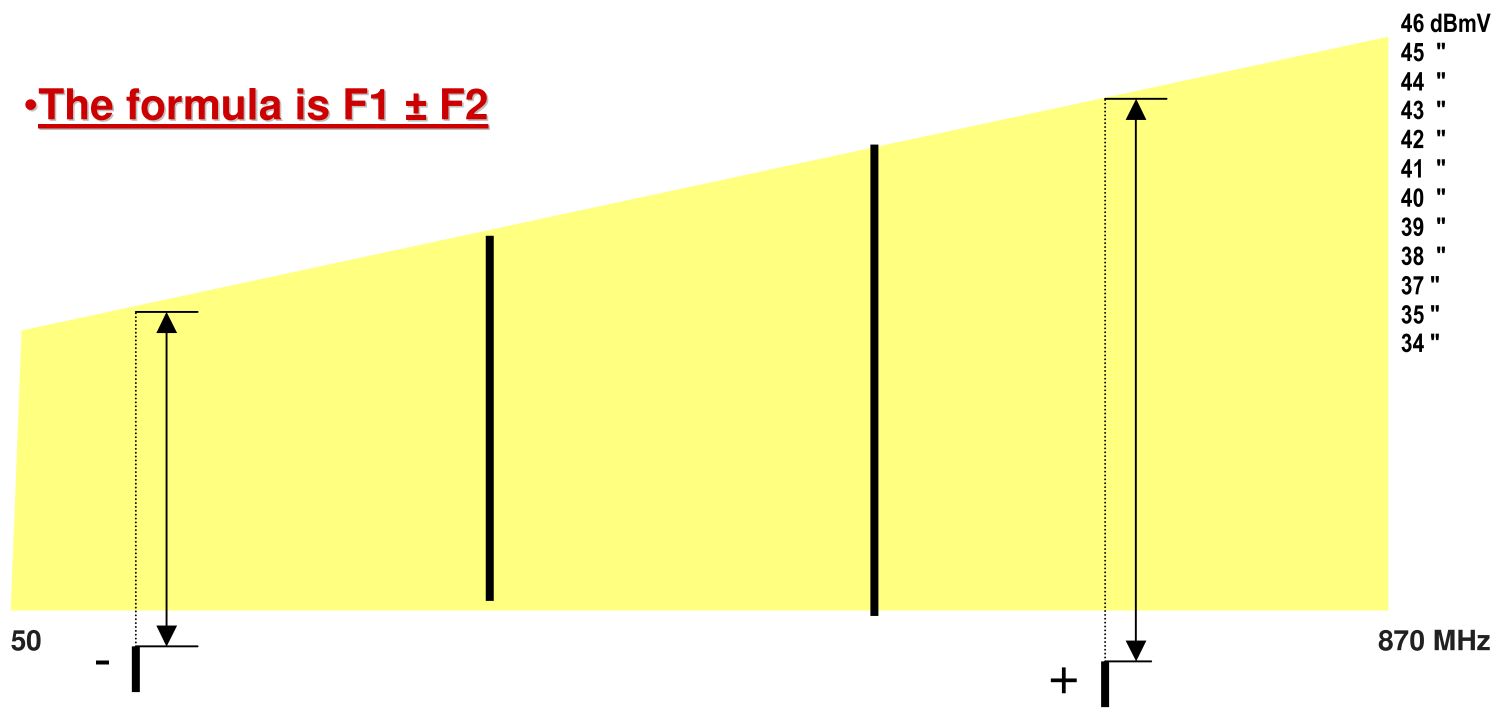
Response of an RF Amplifiers.



RF Amplifiers Distortions.

A Second Order distortion is the addition or the subtraction of two (2) CW signals or two (2) television channels causing a none wanted signal in the operating bandwidth of the RF amplifier.

- The formula is F1 ± F2



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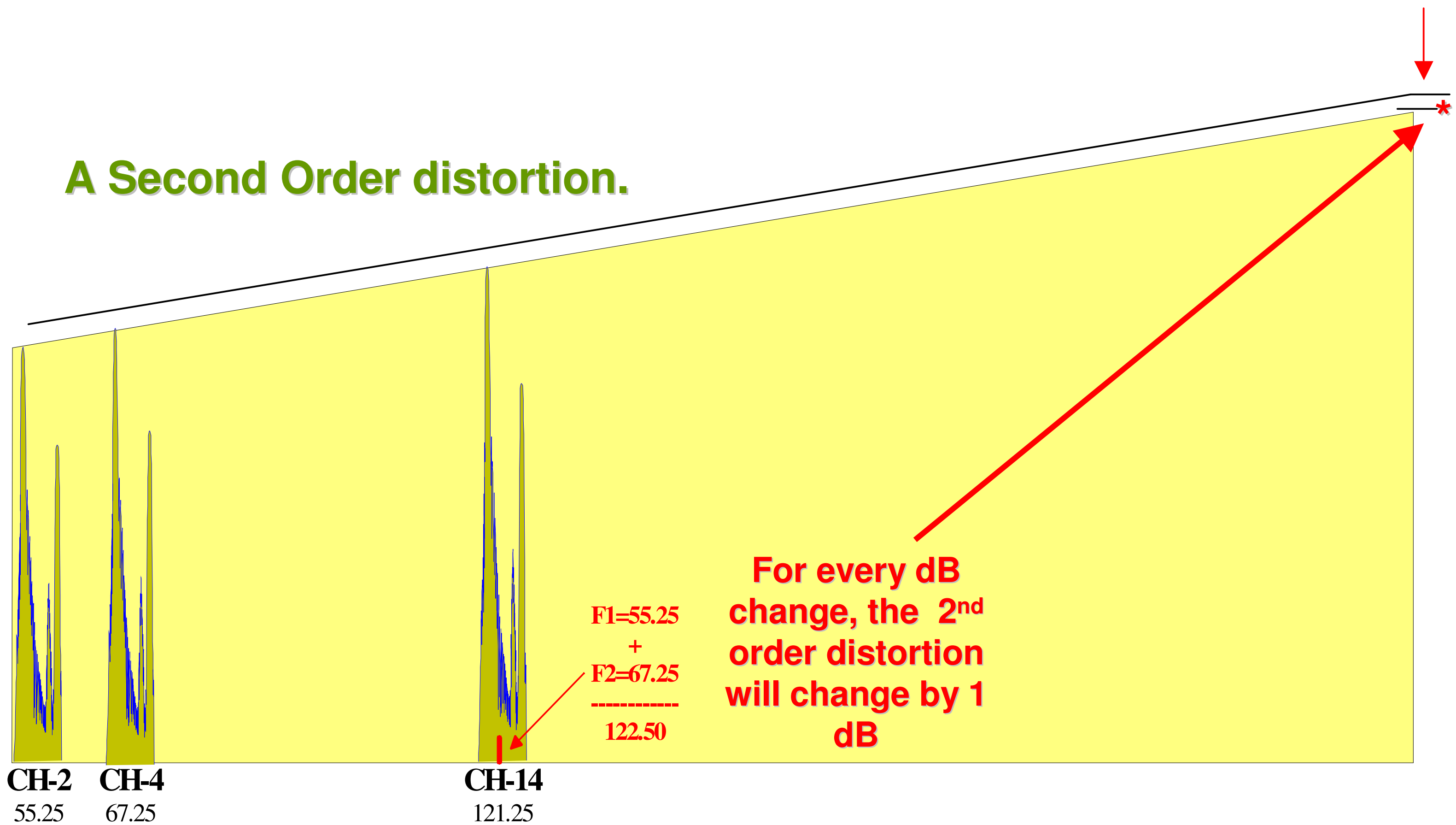
RF Amplifiers Distortions.



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RF Amplifiers Distortions.

A Third Order distortion is the addition or the subtraction of the frequency of three (3) CW signals or three (3) television channels causing a none wanted signal in the bandwidth of the RF amplifier.

- The formula is F1 ± F2 ± F3

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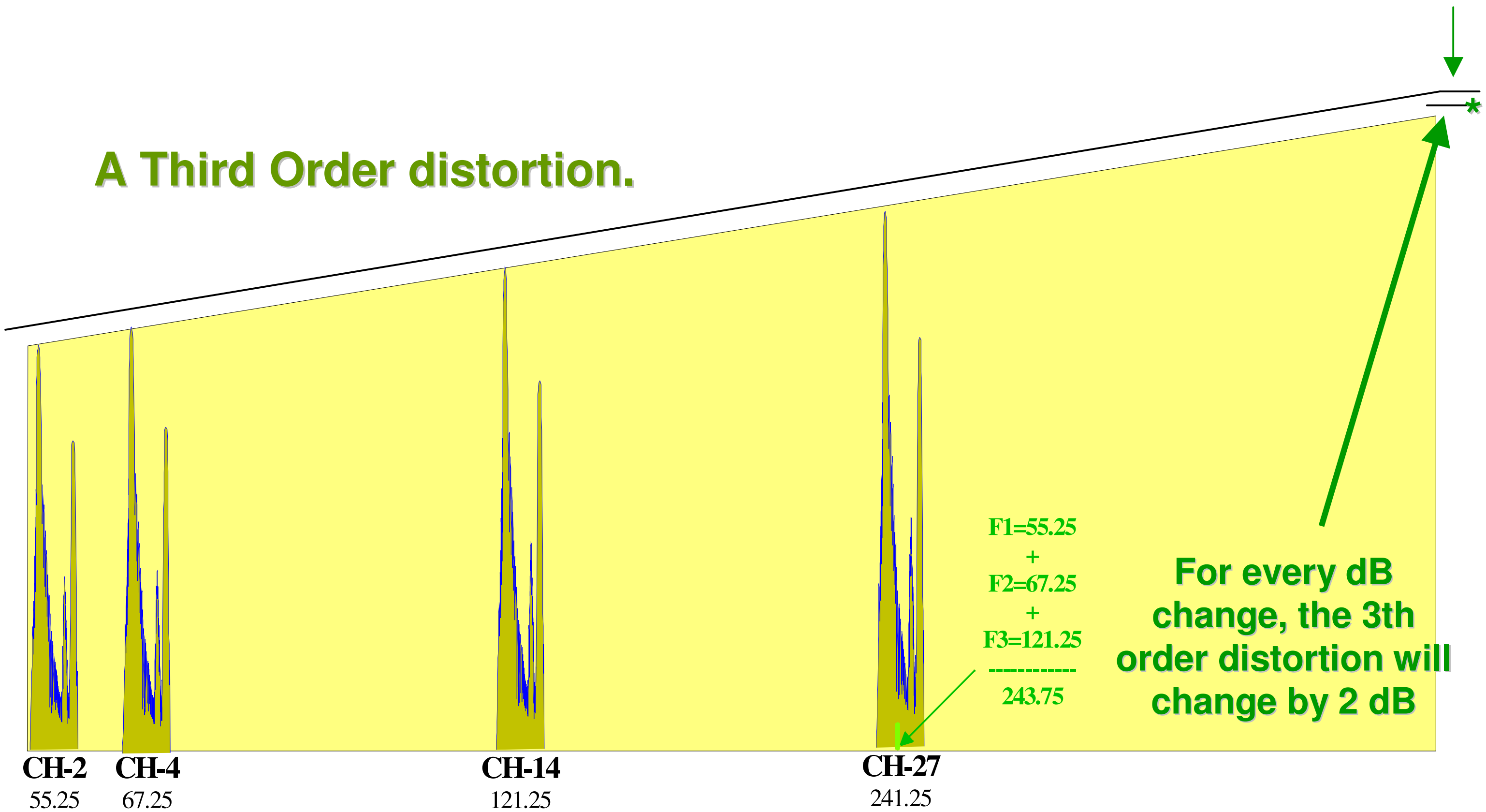
RF Amplifiers Distortions.



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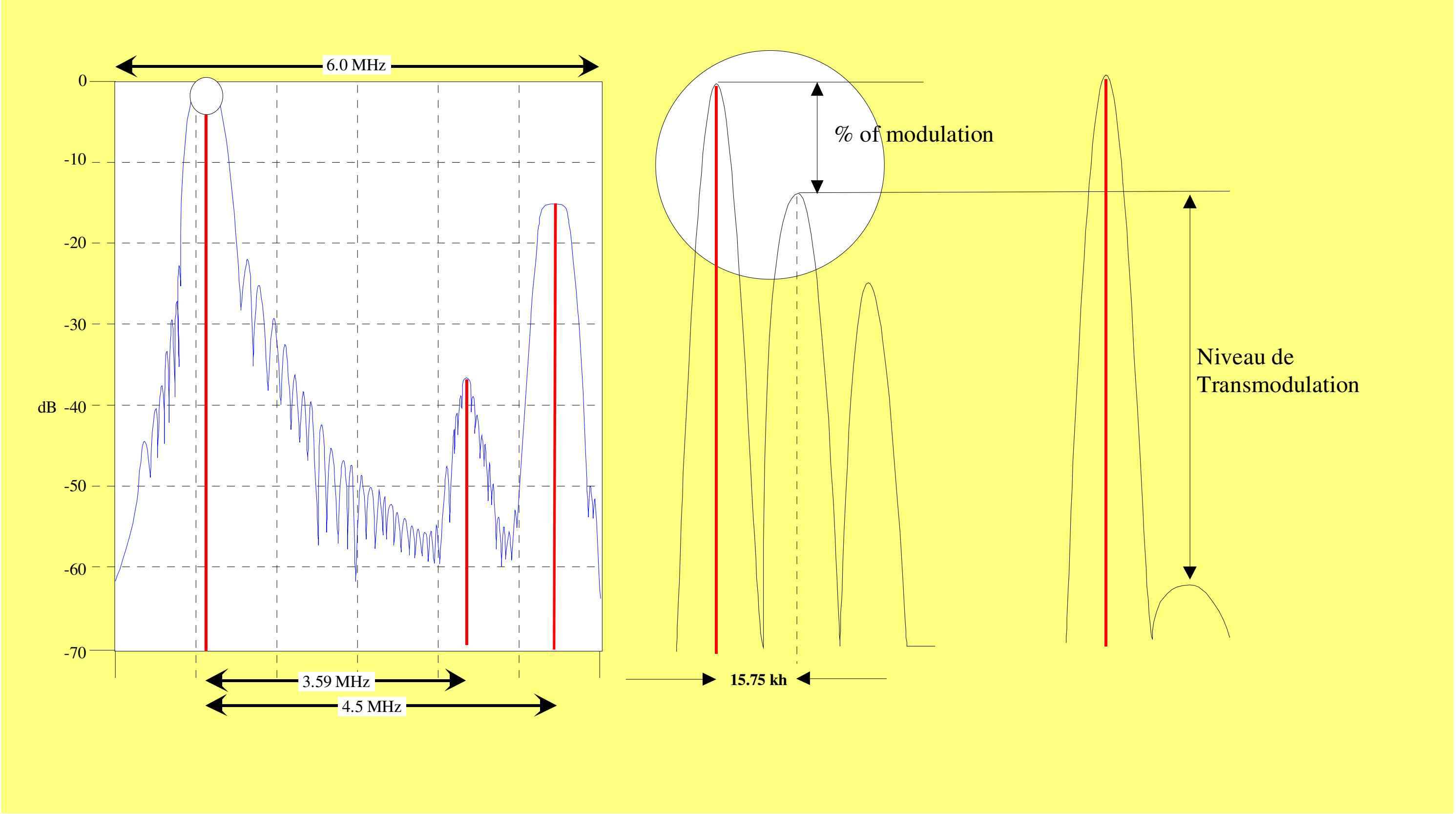
RF Amplifiers Distortions.

<u>Cross Modulation (XM)</u> distortion is a mixing of the first side band of a TV signal located at; <u>15.75 KHz,</u> with any of the other TV signal in the spectrum. Cross modulation is always measured to a CW reference.

•<u>Cross modulation is no longer a major problem with modern amplifier</u>



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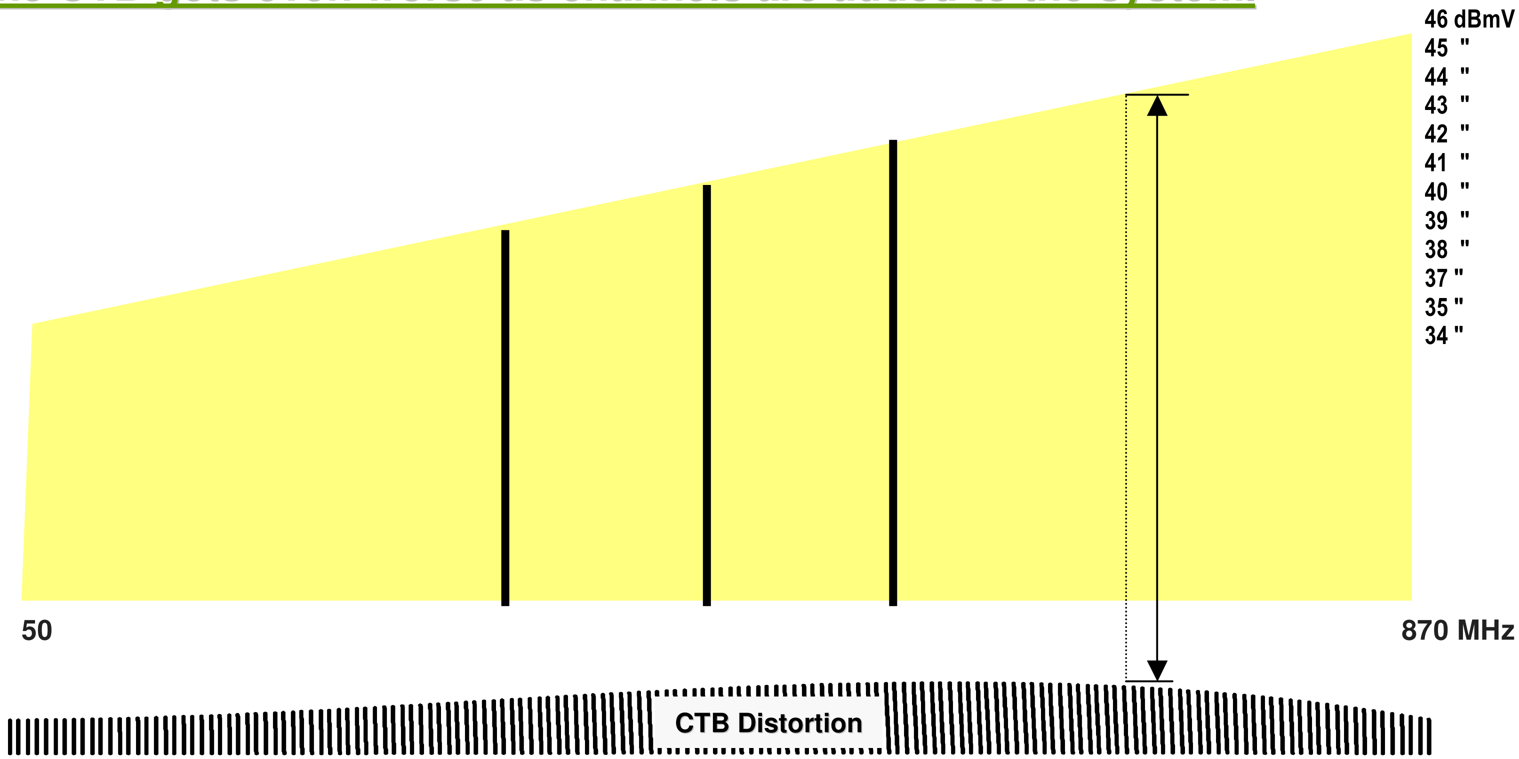
RF Amplifiers Distortions.

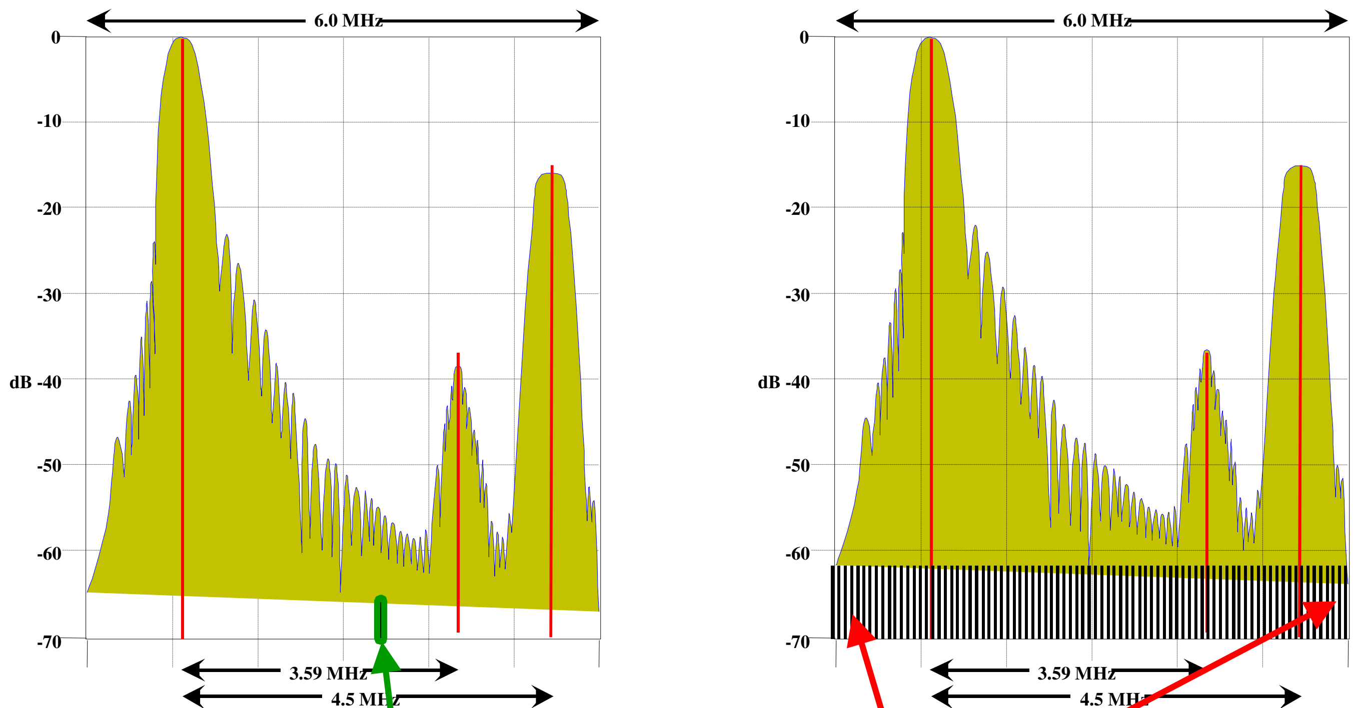
Composite Third Order (CTB) distortion is the addition of many third order beats in a 6 MHz spacing, where it become impossible to be measured as a single beat. This problem becomes more important when a RF amplifier are carrying more than 30 channels.

The CTB gets even worse as channels are added to the system.



RF Amplifiers Distortions.

3th Order beat versus Composite Third Order Beat (CTB).



3th Order beat.

Composite 3th Order

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RF Amplifiers Distortions.

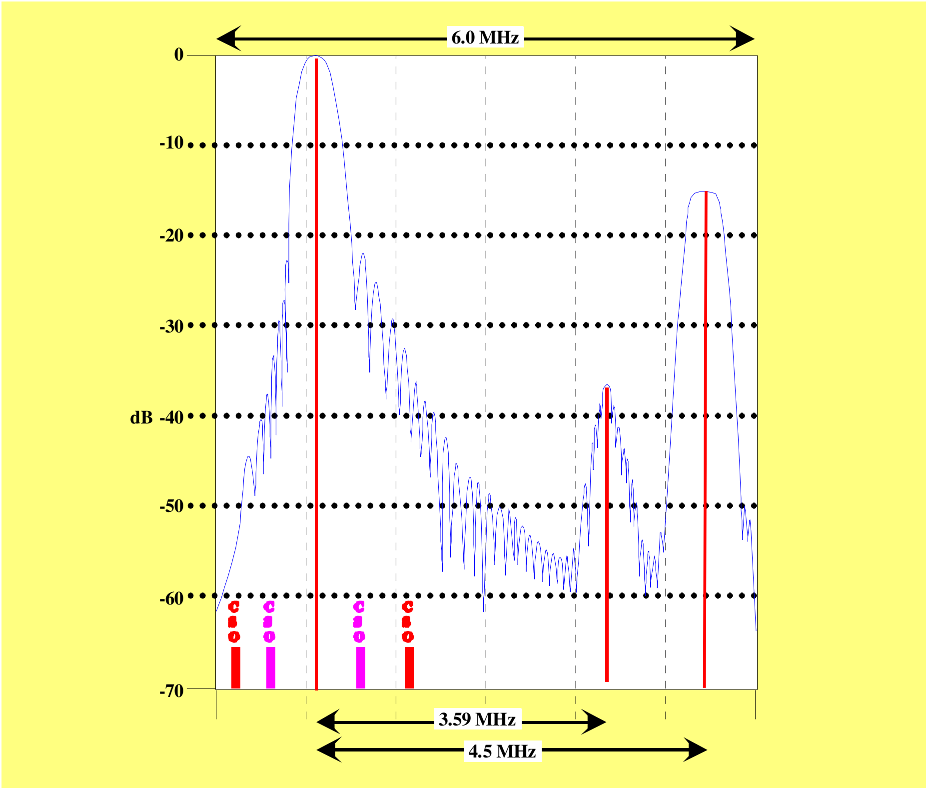
Since the problem of Composite Third Order (CTB) gets worst by the number of channels carried by the RF system, the worst channel been affected by CTB will change depending on the number of channels the HFC system is carrying.

MHz	CH.	Nub. Beat (4 MHz)	@ CH.
54-300	36	334	11
54-450	60	1156	32
54-552	77	1983	41
54-750	110	4206	57

RF Amplifiers Distortions.

Composite Second Order (CSO) distortion occurred at <u>+0.75 and 1.25 MHz</u> above and below of all the TV carrier. The CSO problem is because all the frequency of all TV channel are at : ****.25 MHz.

If ch-2 freq.: (55.25) + ch-3 freq.: (67.25) give a beat at 122.50 MHz, which is 1.25 MHz above ch-14 (121.25 MHz). Channel 34 (283.25) minus ch-12 (205.25) will give a beat at 78.00 MHz then 0.75 MHz above ch-4 (77.25).



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RF Amplifiers Distortions.

Since the problem of Second Order Composite (CSO) gets worst by the number of channels carried by the RF system, the television channel most offended, will also be at different place in the passing band of the system.

MHz	CH.	Nub. Beat	@ CH.
54-300	36	10	41
54-450	60	20	61
54-552	77	29	78
54-750	110	45	116

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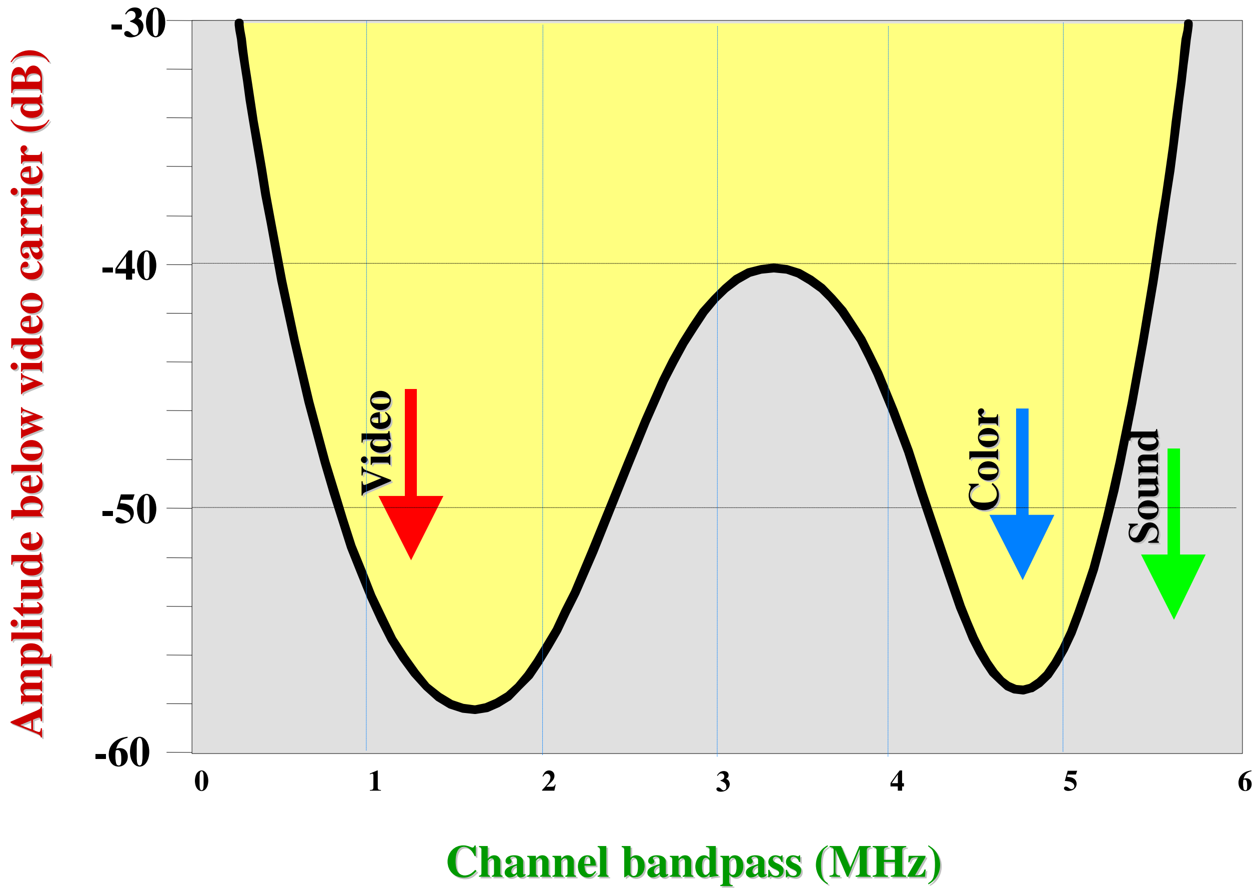
Signal-to-Interference Limits for Non-Coherent Carriers.



For good quality signal, there should not be any signal other that QAM or Video information in the <u>YELLOW section</u>.

RF Amplifiers Distortions.

RF amplifiers distortions specifications are usually given by the amplifier manufacturer. It is very important that the following should be mentioned, when RF amplifier distortions are published.

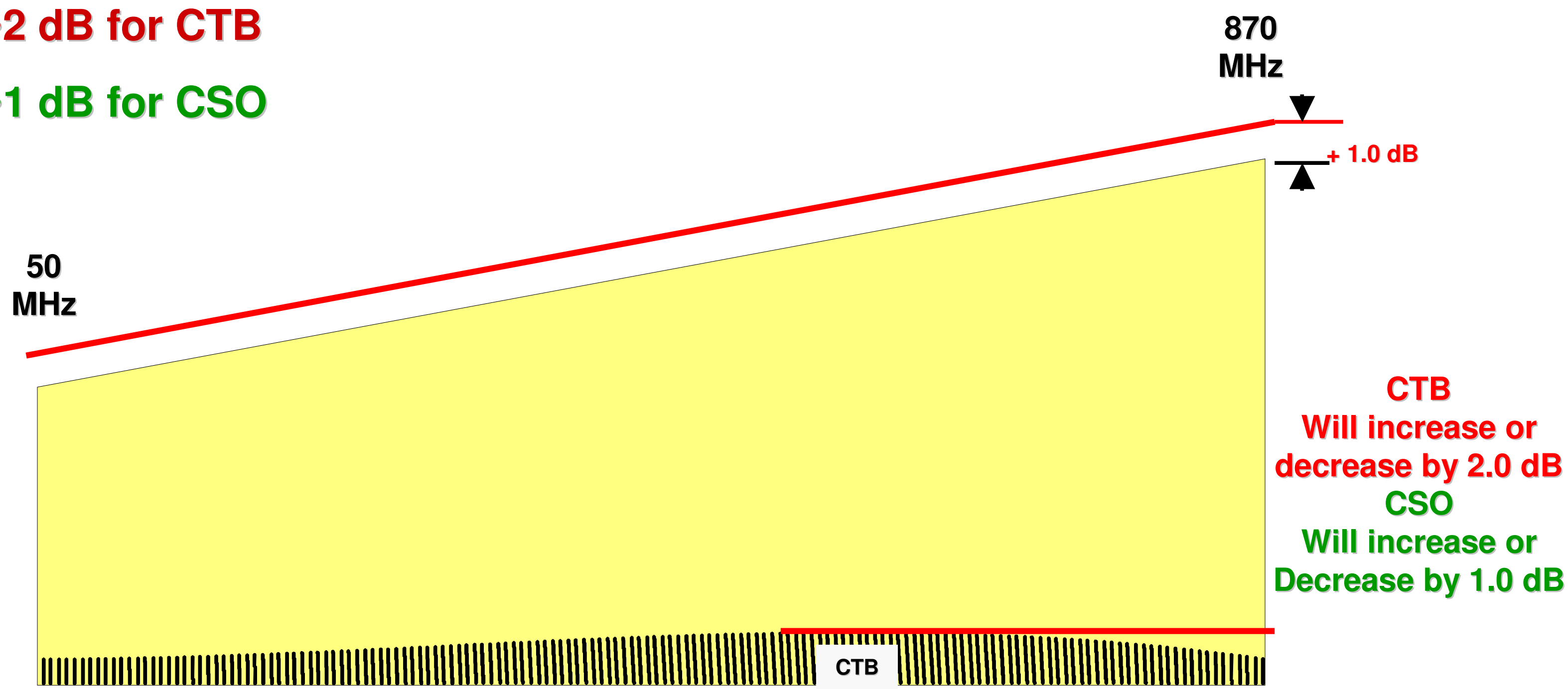
- The number of channels measured for the amplifier's specification.
- The operating level at which the distortion were measured.
- For CTB and CW, the distortion should always be mentioned with CW channels.
- For CTB and CSO, the number of channels should always be mentioned.

- Third Order Distortion level get worst by 2 dB, when the operating level is augmented by 1 dB. The same thing goes for X Mod, 3th Order.
- Second Order has a ration of 1 for 1. The same thing goes for 2^{nd} Order

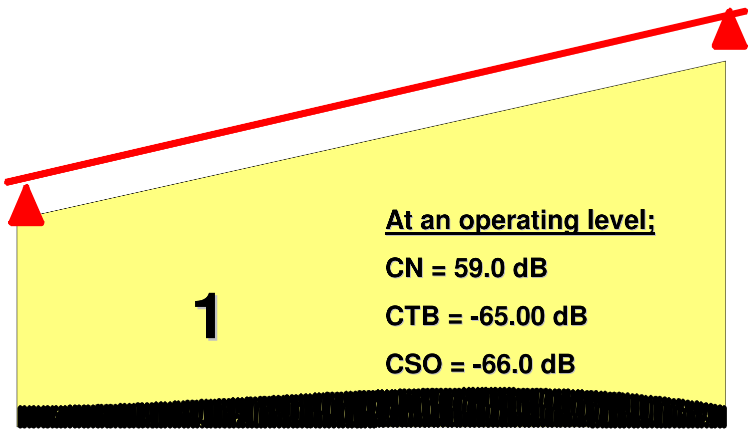
RF Amplifiers Distortions.

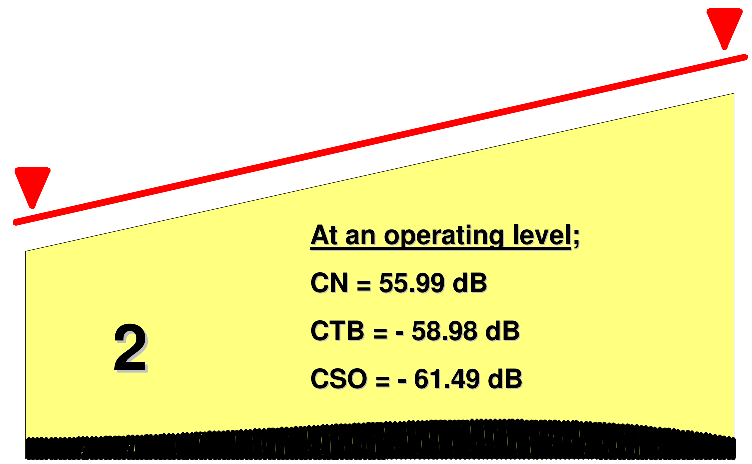
Since distortions level of CTB, CSO are affected by the operating level of the amplifiers, every time we increase or decrease the operating level by 1.0 dB, these distortions will be affected by:

- 2 dB for CTB
- 1 dB for CSO



RF Amplifiers Distortions.





If the operating level of both amplifier is;

Augmented by 2 dB, Distortions will be;

CN = 57.99 dB

CTB = - 54.98 dB

CSO = - 59.49 dB

If the operating level of both amplifier is;

Lower by 2 dB, Distortions will be;

CN = 53.99 dB

CTB = - 62.98 dB

CSO = - 63.49 dB

RF Amplifiers Specifications.

STARLINE® — 2 Port, Parallel E-GaAs Hybrid

Enhanced Gallium Arsenide
1 GHz MiniBridger Amplifier

MB100S Specifications

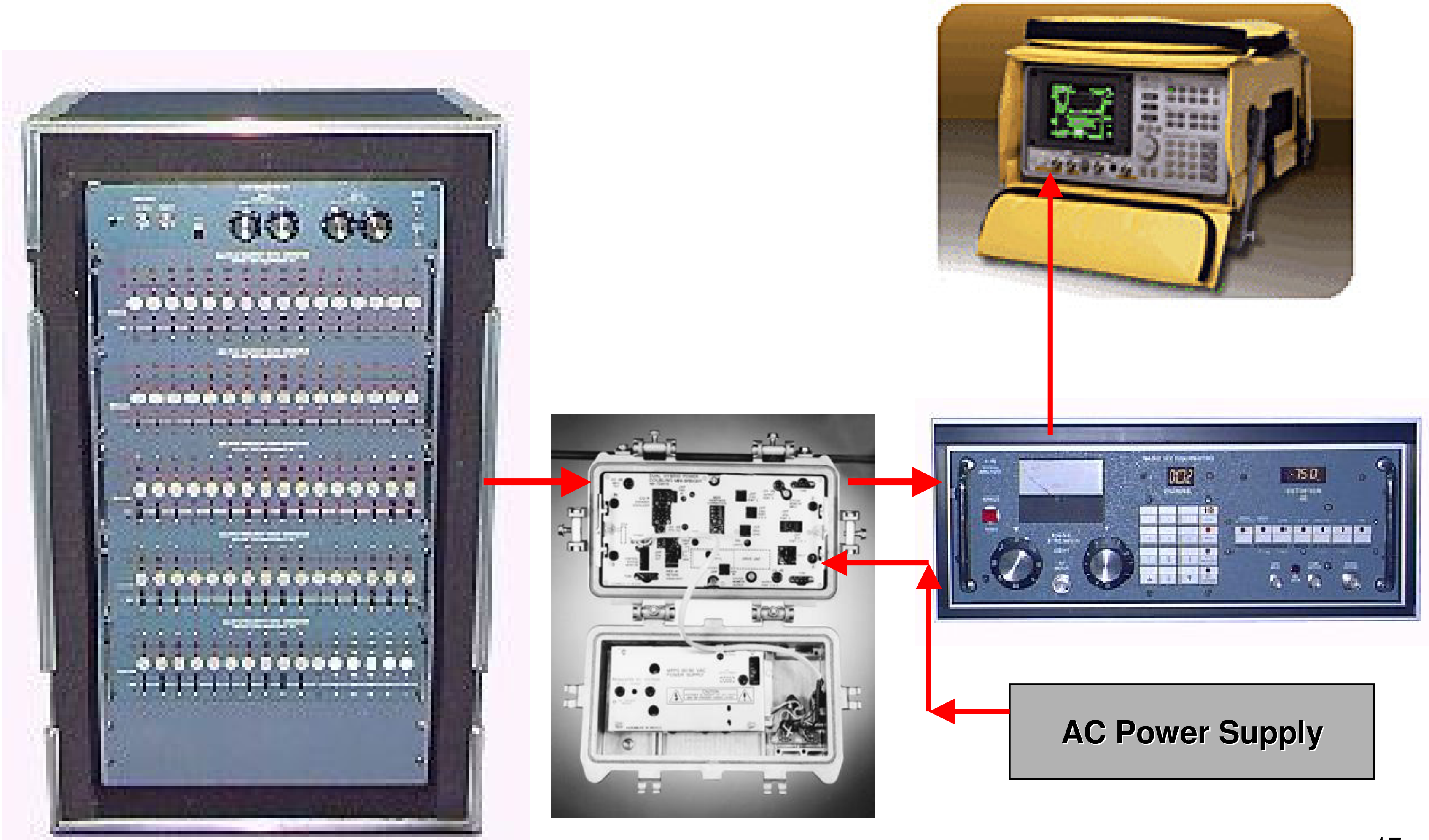
PARAMETER		UNITS	NOTE	FORWARD	RETURN RA-KIT-40H
Passband		MHz	1	52-1003	5-40
Flatness		dB	2	± 0.70	± 0.50
Minimum Full Gain		dB	3	47	NA
Operational Gain		dB	4	42	20
Manual Bode Slope Control Range		dB	5	± 5	NA
Interstage Equalizer Slope		dB	6	14 ±1	NA
Noise Figure 40/52/1003MHz		dB	7	NA / 10 / 10	9 / NA / NA
Reference Frequency		MHz	8	1003 / 550 / 52	
Output Level		dBmV		45 / 44 / 37	35 flat
Channel Loading		NTSC		79	6
Compressed data loading		MHz		320	NA
Distortion (max)	CTB	dBc	9,21,23	76.5	86
	XM	dB	10,21	68.5	77
	CSO	dBc	9,11,21	71	82
	CCN	dBc	12	56.5	NA
Test Point (all)		dB	13	20 ±1.0	
Return Loss		dB	14	16	
Hum Modulation		dBc	15,20	65	
DC Voltage		VDC	16	+ 24.0 ± 0.25	
Current DC		mA	17	1475	1610
DC Ripple		mV		15 P-P	
Power Consumption		W		44.0	48
AC Input Voltage Range		VAC		38 - 90	

RF Amplifiers Specifications.

AC Current Draw	@90 VAC	A	18	0.51	0.56
	@75 VAC	A		0.62	0.68
	@60 VAC	A		0.74	0.81
	@53 VAC	A		0.85	0.92
	@45 VAC	A		0.95	1.08
	@38 VAC	A		1.2	1.31
AC Bypass Current	All Ports	A	18	15 (or 10 amp option)	
Group Delay (max)			19		
	55.25 to 58.83 MHz	nSec		30	NA
	5.0 to 6.5 MHz	nSec		NA	45
	10.0 to 11.5 MHz	nSec		NA	10
	33.5 to 35.0 MHz	nSec		NA	12
	38.5 to 40.0 MHz	nSec		NA	35
Housing Dimensions				15.4"L x 5.5"W x 9.6"D	39.1cm x 13.97cm x 24.3 cm
Weight				15 Pounds	6.8 kg
Ambient Operating Temperature				-40° to +140° F	-40° to +60° C

RF Amplifiers Distortions.

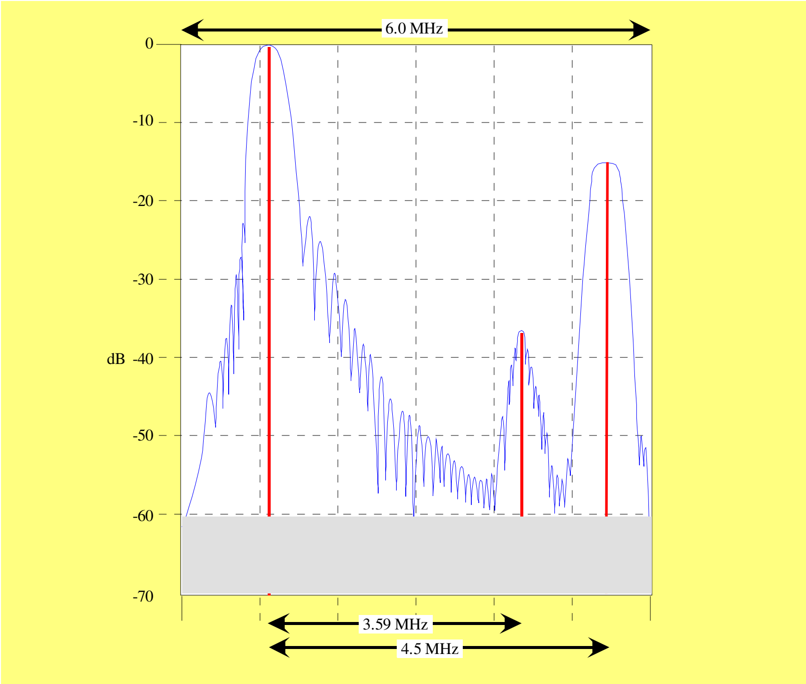
How RF amplifiers are tested for distortion measurements.



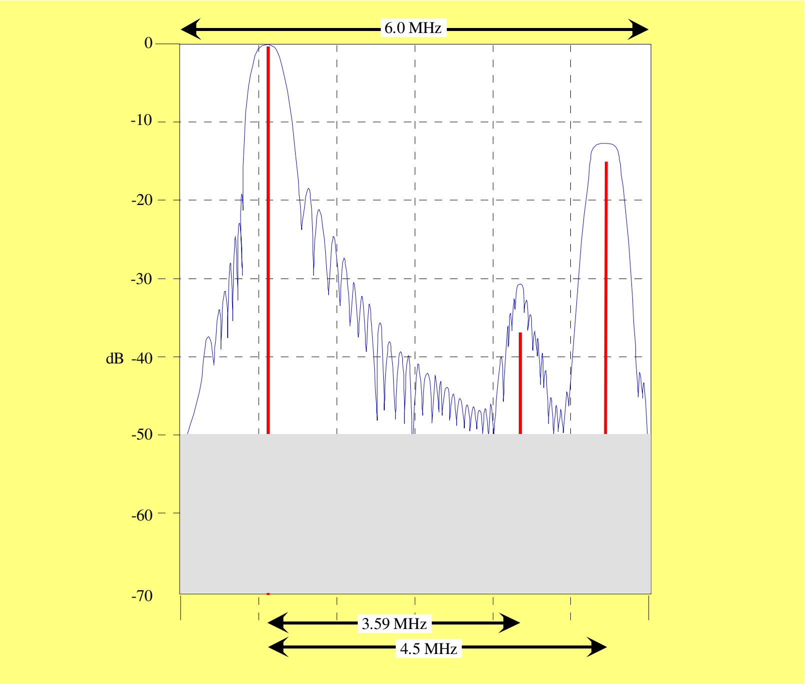
RF Amplifiers Distortions.

As RF amplifier are not perfect devise, they also have another problem called noise, often called thermal noise. Noise is caused by the transistor giving amplification. Some amplifiers circuitry are causing more noise than other.

Noise in a CATV Broadband system is always measure for a 4.2 MHz bandwidth and it is measured as a CARRIER to NOISE ratio. Thermal noise ratio of a perfect RF amplifier is 59.2 dB, before his noise figure is added. The noise of an RF amplifier is usually given as a dB NOISE FIGURE.



Noise figure of an RF amplifier with 0 dB Noise Figure



Noise figure of an RF amplifier with 10.0 dB Noise Figure

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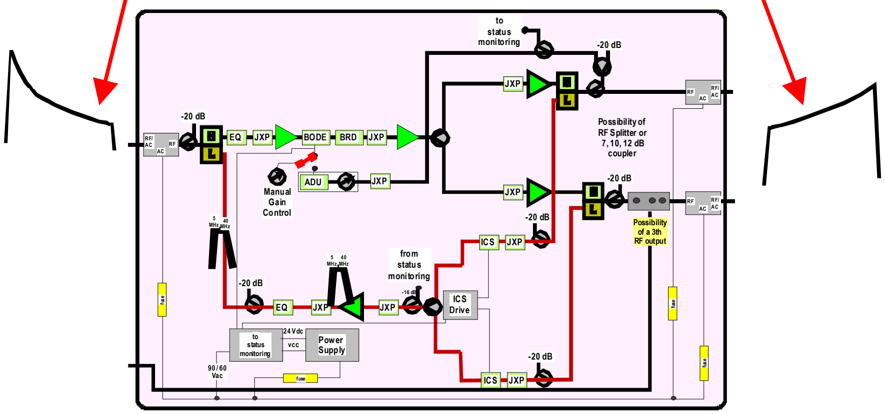
RF Amplifiers Distortions.

Below is an example on how Carrier to Noise affect an RF amplifier.

10 dBmV

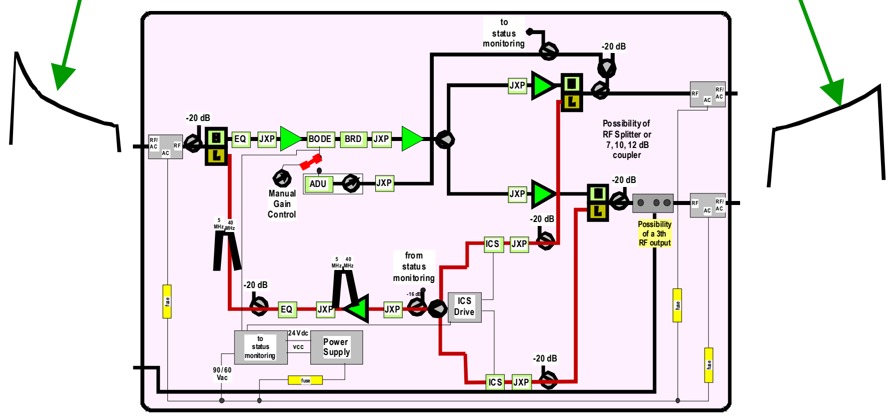
57.2 dB C/N



Carrier to Noise
Noise Figure 11.0 dB
59.2-12.0 +10 = 57.2 dB C/N

15 dBmV

62.2 dB C/N



Carrier to Noise
Noise Figure 11.0 dB
59.2-12.0 +15 = 62.2 dB C/N

1 dB is added to the fig. To Noise for the EQ.

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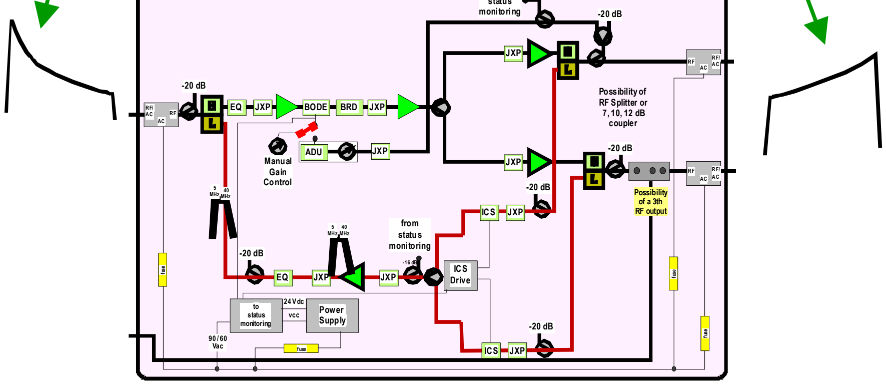
RF Amplifiers Distortions.

Below is an example on how Carrier to Noise affect a cascade of RF amplifier.

15 dBmV

62.2 dB C/N

FIRST Amp.

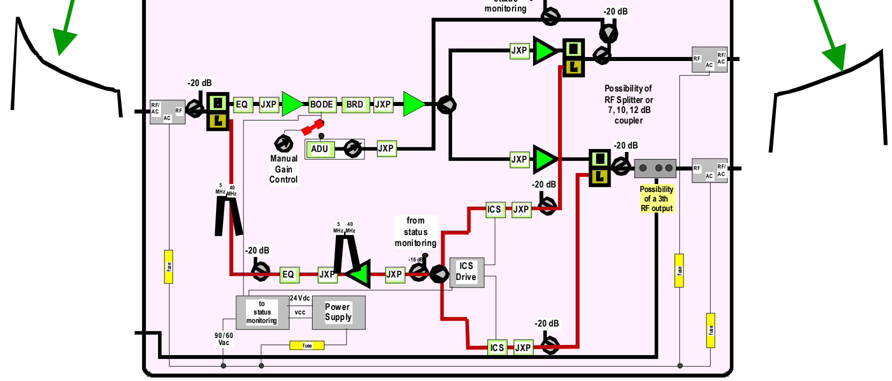


Carrier to Noise
Noise Figure 11.0 dB
59.2-12.0 +15 = 62.2 dB C/N

15 dBmV

59.19 dB C/N

SECOND Amp.



Carrier to Noise
Noise Figure 11.0 dB
59.2-12.0 +15 = 62.2 dB C/N

Formula for a cascade of amplifier for: Carrier to Noise.

C/N of FIRST Amp. – 10Log $_{10}$ of 2 = 3.01 dB

RF Amplifiers Distortions.

Hum is a amplitude modulation, where the 50 or 60 Hz frequency of the power company is harmonized with the 59.94 Hz of the television horizontal sweep.

Hum can be generated by faulty AC-DC power supply or by defective passive equipment in the system.

•One or two bars appears usually going up the TV screen, at the same time as the picture is showed on the television set.

•The easiest way to measure hum is using a CW carrier and a spectrum analyzer.

•In Canada we expect broadband system to have a HUM ratio better than 2.0% or 34 dB to CW carrier.

RF Amplifiers Distortions.

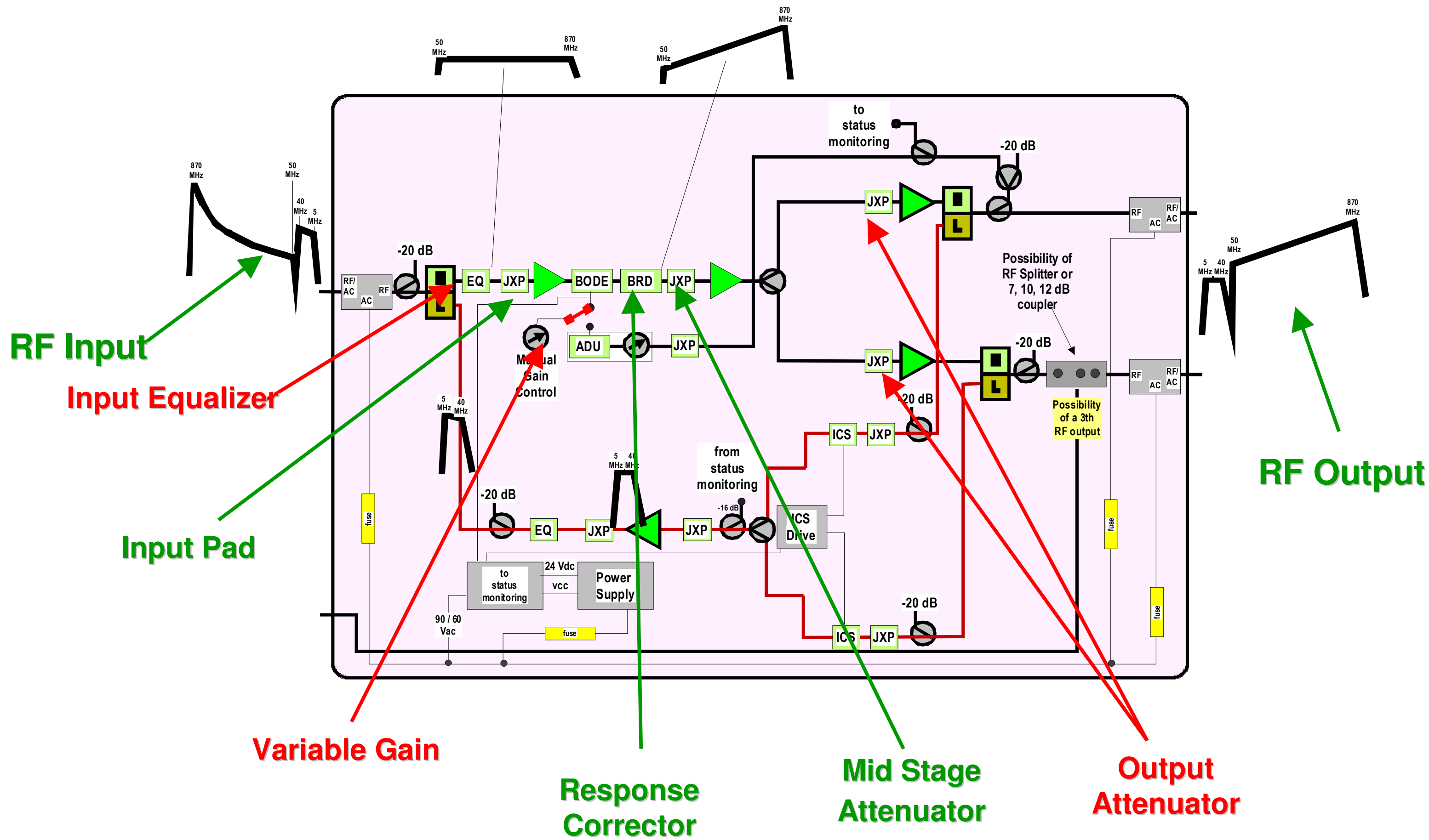
Below are the maximum distortion expected at all customers for a good quality picture in a modern Broadband System.

•Second Order.	-51.0 dB
•Third Order.	-51.0 dB
•Cross Modulation.	-48.0 dB
•Third Order Composite.	-51.0 dB
•Second Order Composite.	-51.0 dB
•Carrier to Noise.	+48.0 dB
•Hum Modulation.	34.0 dB or 2%

How to Adjust an RF Amplifier.

1. Make sure the amplifier is installed properly.
2. Make sure that the AC power route is properly mapped and is in the proper range.
3. Check the RF level at the input of the amplifier, it should meet what is put on the plan.
4. Install the proper equalizer at the input of the amplifier.
5. If required, install an RF pad at the input of the amplifier.
6. Get the amplifier to work at his maximum output by adjusting the amplifier’s gain control at his minimum, this output should give about 4.0 dB above the operation level requires.
7. If the above function give you more that 4.0 dB, you should install a proper pad, to bring this level at 4.0 dB above operating level.
8. Adjust the amplifier at his proper operating level by adjusting the variable gain.
9. Once operating his proper operating level, check if the slope is in his right range. This range should be 10.0 dB for 750 MHz system, and 11.5 dB for 870 MHz system.
10. If above operation is not in his normal range, verify or change the input equalizer.
11. If the amplifier overall response is not acceptable, adjust his response by adjusting the overall mop-up control.
12. Function 11 should only be done with proper sweep equipment.

How to Adjust an RF Amplifier.



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Test!

- Does CTB and CSO add at the same speed in a HFC system?

____

- What linear distortions works at 20 $\log_{10}$, in a HFC system?

____

- What is the operating level difference between Push pull and Power Doubling?

____

- Name a new type amplification circuitry used in modern RF amplifier?

____

- What is the minimum requirement at a customer for Carrier to Noise Level?

____

- What is the level of CTB and CSO required at a customer?

____

- What does HUM do to a television signal?

____

- What is the proper RF level at a multitap?

____

The end of this session.