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HELP TO SELECT YOUR SIGNAL LEVEL METER

Reputed Indian and foreign Manufactures of Signal Level Meters or Field Strength Meters, are entering the Indian C.A.T.V market. Every product claims to be better than the other. This article will help Cable Operators select an F.S.M best suited to their requirements. It also throws some light on the calibration as well as the accuracy of Signal Level Measurement.

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To begin with there are three varieties of meters: -

1) The Installer's Meter : This is for the maintenance of the CATV Network. These variety of meters mostly display the level of any one selected channel. It has either a manual or automatic attenuator and is mainly used by the line technician to check the continuity of the signal to the subscriber end. Ideally, these products should have a measurement range of 48 to 860 MHz.

2) CATV System Analyser : The second variety of meter is used for setting up the gain and slope control of the trunk line amplifiers both in forward and reverse path. It has capability to display the part or the full spectrum of the signals present on the trunk line; the display is normally analogue in nature to facilitate ease of setting up of signal levels. Many of them even have on screen display to indicate measured values of the signal.

3) Proof of Performance : The third variety is used to certify the quality of the signal, quantitatively (i.e. in figures) at the subscriber end, like C/N / CTB.CSO. etc., as required by regulatory Govt. Organizations like F.C.C in U.S.A or B.I.S in India.

Now let us identify the need for the signal level measurement and that of the accuracy of the measurement. Basically the measurement is required to be carried out so that subscriber receives a enjoyable reception on his T.V set and hence happily pays the monthly subscription fees. To meet this objective, the signal level meter used for the purpose must be accurate. Signal levels need to be adjusted, so as to make the optimum use of the Trunk Line or the Line Extender Amplifiers. If the amplifiers are not adjusted with an accurate meter, you are likely to over load or under load the amplifiers.

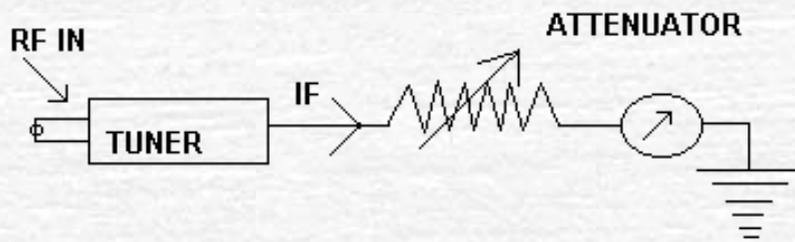
If you over load the amplifiers you increase / introduce nonlinear distortions like C.T.B & C.S.O, Inter Modulation and Cross Modulation. This in turn limits the usable length of the amplifier cascade. There by, the distance covered will be less. If you under load the amplifier; it will result into noisy pictures and distorted sound at the subscriber end.

AMPLIFIER OVERLOAD

Now let us see what is meant by the term over loading of an Amplifier. Most of the Hybrid Amplifier available locally are capable of handling signal levels of up to 104 dBm (dB microvolts) in the frequency band 48 to 550 MHz with a gain OF 30 to 40 db. So in other words, when ever you apply an input to an amplifier such that the out put of an amplifier goes beyond the specified value, (say 104 dBm) the amplifier operates in the saturation there by generating non linear distortions. Therefore, when you are adjusting an amplifier, measure the O/p rather than at the I/p. This is , because the input required to get 104 db microvolts at the O/p may be different from brand to brand. The effective output will depend on gain, as well as the type of the attenuator and equaliser circuits between the I/p of the amplifier and that of the Hybrid Module used in the amplifier.

Since it is very difficult to measure High frequency signals to close tolerences, some manufacturers of F.S.M display the amplitude of a synchronising signal by the side of a picture, on the display of the meter, there by indicating an over load of an amplifier if the amplitude of the synchronising pulse is reduced. To understand the accuracy of the measurement, we will have to study the basic block diagram of the meter:

BASIC BLOCK DIAGRAM OF A SIGNAL LEVEL METER



As you can see from figure 1,

a signal level meter is made up of three main components namely: -

- (1) T.V Tuner at the input followed by ,
- (2) RF attenuator and
- (3) Level indicating meter,

It is therefore clear that an accuracy of reading is affected by :

- (I) the flatness of the response of the tuner used inside ,
- (II) flatness of the response of an attenuator used inside and the accuracy of the display device used. Besides these the accuracy of reading also depends on :

- (A) level of the signal being measured,
- (B) Impedence match between the meter and the device under test or the coaxial cable on which the measurement is being done,
- (C) IF band width will decide the accuracy of C/N as well as the selectivity of the meter,
- (D) Detection System:- A meter with peak detection system will show a higher reading than the one with average detection.

Recently the manuf-acturers like " ROVER SAT " incorporate a system known as an Electronic Correction, in which the above mentioned inaccuracies are first mapped and then corrected by storing the data in the memory against the reference, there by offering better accuracy.

Now having discussed basic issues governing the accuracy, let us find out how to know whether the accuracy of a meter is as good as specified by the manufacturer. To verify accuracy, the meter reading is compared with a meter with a Calibration Certificate and having greater accuracy than the meter under test. For example if you want to check a meter that has a level accuracy of ± 1.5 dB then. You require a meter that has a certified accuracy of ± 1 db or less. This is a correct method of comparison. Some people compare the another meter with the meter that they are already using, which is not correct way of comparing the accuracy.

CALIBRATION

Q1. What is Calibration?

A1. Calibration is a process and a Correction chart is a measure of inaccuracies of measuring Equipment as compared to the known standard.

Most manufacturers specify the accuracy of their level meter in terms of \pm dB. In simple terms, it means the amount of signal that is required to be added or subtracted, to arrive at the correct reading.

Q2. What is the difference between a Signal Level Meter and a Field Strength Meter?

A2. A Field Strength Meter (FSM) is a signal level meter that is calibrated with a unit dipole antenna to indicate the strength of a signal at a particular distance from a transmitter. It may have a 50 ohms or 75 ohms input Impedence or any other to match the antenna. In comparision, a Signal Level Meter has an input Impedence of 75 ohms to make the measurements of signal level on the coaxial cable, in a C.A.T.V / M.A.T.V Network.

MEASUREMENT LEVELS

The points to consider in measurements are: -

1) The signal level at which the measurement is done. Inside the signal level meter there are two measurement ranges (1) 0 to 80 dBm and (2) 80 to 130 dBm For relatively low level signals, i.e. upto 80 dBm, the signal to be measured is fed directly to the T.V Tuner without any attenuator in series.

For higher signal levels (above 80 dBm) the signals are first fed through a series attenuator. In the 0 to 80 dBm range the inaccuracy of the measured value will depend on the inaccuracies in the frequency response of the tuner itself. Where as in the higher range i.e., from 80 to 130 dBm range, even the inaccuracies of the series attenuator add to the inaccuracy of the T.V Tuner thereby reducing over all accuracy of the meter.

2) The other point to consider is the type of detection system used in the meter. There are two types in use

- (i) Peak Detection detects the peak Signal levels and
- (ii) Average Detection, detects the average signal level.

In short, two different meters with different type of detection system will also differ in readings.

3) The IF band width: It will decide on how accurately the C/N is measured, or how close you can measure the amplitude of a particular frequency in a crowded spectrum. For an accurate measurement of the C/N you require the measurement to be made over the full video bandwidth 0 to 5 MHz. For a closer look at a particular frequency you require a very narrow band of typically less than 300 KHz in case of a signal level meter and much less in case of a Spectrum Analyser.

4) Accuracy of measurement will also depend on the amount of match or miss match of the meter with that of the point of measurement or the coaxial cable or a device under test.

For example, 'A' brand or a model of a meter, which has a better match with 75 ohms Impedance, will read a higher (and more accurate) level, than another Brand " B " ,that has poor match with 75 ohms impedance. !

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