

Radio Broadcast Monitoring

Some Thoughts and Comments on Off-Air Monitoring

Monitoring to assess Audio Quality is necessary in the three following areas

- 1; Live Events and Concerts
- 2; Recording, Mixing and Mastering
- 3; Radio and TV Broadcasting

We will discuss Off-Air Monitoring for Radio Broadcasting only in the following text, with future discussions planned on monitoring for Live Events and Concerts, as well as Recording, Mixing and Mastering

Radio Broadcasting

Critical Monitoring of Broadcast Audio Quality as well as Continuous Monitoring for Transmission Faults is vitally important to Radio Stations

In Radio Broadcast Stations, when broadcasting "Live", the Announcer or Presenter is normally the person responsible for monitoring the station Off-Air, by listening to the transmitted program through high quality Loudspeakers and Headphones in the Studio

At Night and at other times when the station operates on Automation, or Networked from Satellite, it is also important for someone to be delegated to "Keep an Ear" on the station, maybe from home

The transmitted program should be picked up Off-Air by a Monitor Receiver, ideally installed in the Station Control Room, and fed from a suitable Outdoor Antenna System to ensure a Constant Signal Level and reception free from Interference and Multipath problems

A Transistor Radio, fed from it's own Telescopic Antenna, or a piece of wire hung at the back of it is simply not good enough to ensure satisfactory reception for critical monitoring or to give constant RF levels

Likewise in the On-Air Studio itself, cheap loudspeakers of unknown performance such as small cheap Surround Speakers or Computer Multimedia Speakers, often fed from a Power Amplifier of Questionable Quality are completely unsatisfactory, and will not allow critical monitoring of the Station Transmission Quality

Good quality Second Hand, or Cast-Off Stereo Hi-Fi Speakers and Amplifiers costing little or maybe nothing, may be perfectly suitable for Off-Air Monitoring in a Radio Station having only one On-Air Studio

This may not be practical for stations having two or more On-Air Studios, as the monitoring system in each studio should ideally, for consistency, have identical Monitor Amplifiers and Speakers

Many Hi-Fi Speakers have similar characteristics to Monitor Speakers, and are quite suitable for Off-Air Monitoring, while other so-called Hi-Fi Speakers are designed to sound pleasant and impressive (In the short term) but not necessarily accurate enough for serious monitoring

In General, ordinary domestic Hi-Fi Speakers are designed to have peaks in both the Bass and Mid Treble, and a somewhat subdued Mid Range making them sound fairly pleasant, but does tend to hide minor audio quality problems

The better Hi-Fi and Genuine Monitor Grade Speakers has a much flatter frequency response, and are designed to reveal audio quality problems rather than hiding them

On-Air Studio Monitoring

As mentioned earlier, the Announcer or Presenter is the person responsible for monitoring the broadcast programme Off-Air through the station Monitor Receiver, a good quality Studio Monitor Amplifier and suitable Monitor Loudspeakers, and Headphones when the Microphone is switched on

The Audio Quality of the Off-Air signal must be very good and pleasant to listen to, otherwise as is fairly common, the presenter will switch to the Mixer Output for monitoring leaving the transmitted program unmonitored

We know of several cases involving Community Radio Stations where the Transmitter had failed, or was transmitting Emergency Program, and one extreme case where the Antenna Mast had Fallen Down

They Transmitted for several hours, or thought they did, and the presenter did not know, because he was monitoring the output of the Mixer, and not Off-Air

This is understandable if the Off-Air Monitoring is of low quality, but it is not excusable

What to Monitor for

Is the Station On-Air?

This is the first responsibility of the presenter or the person monitoring the station

Program Material Quality

As most of the Program Material, apart from Live Microphone and Phone Calls is Pre-Recorded, in the form of CD's, LP's, Music Items or "Spots" etc from a PC Based, Announcer Assist System, there is not a lot the presenter can do apart from keeping audio levels correct

If a CD or other recording Sounds Bad, "**Grin and Bear It**", play it to the end, and then "**Don't Play it Again**"

If a PC Based Music Item or Spot sounds bad, report it to the Station Program Director and demand it be removed from the Play List, or Re-Done

Technical Problems and Faults

If you cannot hear your station through the "Off-Air" Monitor System, you are probably "Off the Air", so instigate immediate Emergency Action as directed in the Station Technical Manual

Also listen Off-Air for Hum, Hiss, Clicks, Pops, Distortion, Inverted Phase In One Channel, Channel Balance, Missing Channel etc, and if possible, investigate and isolate the cause and report the problem to the Station Program Director

Tips to investigate and isolate transmission faults and problems

Station Off-Air

Switch to monitoring of Mixer Output

A; If you then hear Normal Program
Delegation Switcher, Audio Processor, Studio to Transmitter Link or Path, Transmitter, or your Off-Air Monitor System has failed

B; If you get silence
The problem is in the Mixer or Source Equipment, try operating from the other studio

In either case, report immediately to the station technical person

Hum, Hiss, Clicks or Pops

Stop sending programme from the mixer for a few seconds

Your Off-Air Monitor should be almost completely silent, no Hum, Hiss, Clicks or Pops

A; If you hear Hum, Hiss, Clicks or Pops, you have a problem

Temporarily Switch to Monitoring of the Mixer Output

B; If you still hear Hum, Hiss, Clicks or Pops

The problem is in the Mixer or Source Equipment

If Monitor is now silent, the problem is in the Delegation Switcher, Audio Processor, Studio to Transmitter Link or the Transmitter itself

Report to the station technical person

Distortion

If you hear Distorted Sound Off-Air, you have a problem

Temporarily Switch to Monitoring of the Mixer Output

A; If still Distorted, the problem is in the Mixer, Source Equipment or Source Material

B; If Distortion Disappear, the problem is in the Delegation Switcher, Audio Processor, Studio to Transmitter Link or the Transmitter

Report to the station technical person

Inverted Phase

If program sounds "Strange or Peculiar" you probably have a Phase Inversion where One Channel is reversed in respect to the other channel

Press MONO CHECK Switch, (Standard feature on all Elan Audio Mixers)

If the audio level drops, or Bass disappear, you have a Phase Inversion making the transmission useless on Mono Receivers such as small Battery Portables

Centre Channel Audio such as Voice or Speech will completely disappear when listening on a Mono Radio Receiver

Generally nothing the presenter can do about it easily, except report to the Program Director, and not play that piece again

In extreme cases where you may have a lengthy recorded piece such as a Lecture, Play or Music Compilation in Mono, it might be better to abort the transmission altogether

If your station is regularly presented with program material having Inverted Phase, your station technical person can easily construct a Phase Reversal Switch, or Phase Reversal Plug to correct the problem

WARNING: If Phase is corrected for a particular piece of program material, **DO-NOT forget** to restore the Phase Switch or Plug to normal, otherwise correct material will broadcast out of phase

Inverted Phase in one channel, is a technical mistake made by a human person during production or duplication of recorded material and is not a Technical Equipment Fault

It is not uncommon on program material prepared without taking the appropriate care in monitoring during preparation, usually on Reel to Reel Tape, but also known to exist on Amateur Produced CD's

Channel Balance

If you notice one channel is low relative to the other channel, you have a problem

Temporarily Switch to Monitoring of the Mixer Output

A; If still low, the problem is in the Mixer, Source Equipment or Source Material

B; If now correct, the problem is in the Delegation Switcher, Audio Processor, Studio to Transmitter Link or the Transmitter

Report to the station technical person

Missing Channel

If you notice one channel is missing, you have a problem

Temporarily Switch to Monitoring of the Mixer Output

A; If still missing, the problem is in the Mixer, Source Equipment or Source Material

B; If now correct, the problem is in the Delegation Switcher, Audio Processor, Studio to Transmitter Link or the Transmitter

Report to the station technical person

About your Off-Air Monitoring System

The above discussion should clearly illustrate the importance of a quality Off-Air Monitoring System

What your station needs for Monitoring

- 1; An Outdoor Receiving Antenna
- 2; A High Quality Off-Air Receiver
- 3; Distribution Amplifier sending Off-Air Audio to all Studios and other areas
- 4; Program Fail Detection System (Optional) but nice to have
- 5; Monitoring System and Speakers in Control room
- 6; Quality Monitor Amplifier in each Studio
- 7; Monitor Quality Speakers in each Studio
- 8; Good Quality Headphones in each Studio for listening when Microphone is on

Outdoor Receiving Antenna

For AM, we recommend the Model 1000 AM/FM Omnidirectional antenna available from Electrocraft

For FM, the Model 1000 AM/FM Antenna is suitable, but a Band II 3 or 4 Element Yagi available from Hills Industries and others, correctly installed will produce a better signal

High Quality Off-Air Receiver

A Portable Stereo Receiver, Integrated Tuner/Amplifier or Ghetto Blaster as used by a number of Community Radio Stations will work, but is to be honest, not really suitable

A good quality Hi-Fi AM/FM Radio Tuner such as the Denon TU-255 is much better

Sometimes, quality AM/FM Tuners can be found second hand in Op-Shops, Pawn Shops or free as donations from station members or interested parties

Unfortunately, mechanically tuned units tend to drift off station, so units with digitally Pre-Set Tuning are more suitable

The best solution is a Professional Broadcast Off-Air Receiver

Although first cost is high, a Professional Broadcast Off-Air Receiver such as the Elan Audio RMR-01 is actually very good value by incorporating all the necessary Audio Distribution Amplifiers and Program Fail Detection facilities

The Elan Audio RMR-01

Is a Professional Monitor Receiver is designed specifically as a complete Monitor Receiver System providing all necessary facilities and functions required for monitoring Off-Air such as 10 Balanced Left, 10 Balanced Right Outputs, 5 Balanced Mono Outputs, Unbalanced Left and Right Outputs to feed your Logger, Carrier and Audio Level Indicators, and Alarm Outputs

See our web site www.elan.com.au for details

The Elan Audio RRR-01

Another Professional Monitor or Re-Broadcast Receiver

See our web site www.elan.com.au for details

The Elan Audio RRA-01

This is not a Receiver, but designed as an Add-On unit to a Hi-Fi AM/FM Tuner making the combination a complete Broadcast Monitor Receiver System

See our web site www.elan.com.au for details

The Elan Audio RDA-02

Audio Distribution Amplifier, suitable for use in conjunction with a Hi-Fi AM/FM Tuner

See our web site www.elan.com.au for details

Distribution Amplifier sending Off-Air Audio to all Studios and other areas

Facility incorporated in the Elan Audio RMR-01

Alternatives are the Elan Audio RRA-01 and RDA-02

Program Fail Detection System (Optional) but nice to have

Facility incorporated in the Elan Audio RMR-01

Alternatives are the Elan Audio RRA-01 and RPF-02

Find details on the RPF-02 on www.elan.com.au

Monitoring System and Speakers in Control room

Vital for Technical Monitoring in order to Troubleshoot and Identify Problems

The Elan Audio RDS-02 Delegation Switcher incorporates a complete monitoring Facility requiring external speakers, the Elan Audio RTM-02 is a complete Technical Monitor Unit that incorporates 100mm Built-In speakers, but will accept external speakers

Quality Monitor Amplifier in each Studio

You need a High Quality 25 to 30 Watt Per Channel Monitoring Amplifier for serious monitoring of Audio Quality in your On-Air Studio, preferably a Professional Stereo Monitor Amplifier with Balanced Inputs as Professional Mixers generally have Balanced Line Level Monitor Outputs

Monitor Amplifiers such as the Elan Audio RMA-01 are ideal for On-Air Studio use

The RMA-01 features external Muting Control Inputs, making it practical for use with Non-Broadcast Mixers

Find details on the RMA-01 on www.elan.com.au

A High Quality Stereo Hi-Fi Amplifier with Unbalanced Inputs may be perfectly satisfactory if the Mixer can be modified for Unbalanced Monitor Outputs, or by using the Elan Audio SBU-01 passive Balanced to Unbalanced adapter

Find details on the SBU-01 on www.elan.com.au

For large Studios such as Recording Studio Control Rooms, and to drive very large or inefficient speakers, a larger Monitoring Amplifier will be needed such as the Elan Audio RMA-02 "Challenger"

The RMA-01 "Challenger" is also a very nice amplifier for serious Audiophiles for home Hi-Fi Listening

Find details on the RMA-02 on www.elan.com.au

Monitor Quality Speakers in each Studio

High Quality Speakers having similar characteristics to Professional Monitor Speakers rather than Hi-Fi Speakers are required for serious monitoring of Audio Quality

A discussion on Loudspeakers is included later in this

Good Quality Headphones

The Presenter and Studio Guests require Headphones to allow them to listen to Station Program when Microphones are turned on and the Loudspeaker Monitoring is Muted

Generally, the Announcer or Presenter buys his own headphones of a type he likes and feels comfortable with

Cost of suitable Headphones vary from about \$ 50.00c to in excess of \$ 1000.00c with the actual choice left to the individual

Good Headphones for the Presenter are Mid-Priced types such as the AKG K 141M, K 141S, K 240M and K 240S

Normally, the station supply the Guest Headphones with the AKG K 44 being a suitable economic and "Hard to Destroy" choice at about \$ 50.00c

Very Cheap Headphones should be avoided, they generally do not sound very good, are uncomfortable and tend to fall apart rather quickly

A bit about Loudspeaker Systems

The number of different Makes and Types of Loudspeaker Systems available, is absolutely staggering making the correct choice very difficult and controversial

We will try our best to clarify a few issues in the following

Some Loudspeaker Systems are absolutely Superb, many are good, some only average, and a lot are awful "Boom and Spit" Boxes

Some are marketed as Hi-Fi Speakers, others marketed as Monitor Speakers, and virtually none, except very humble PA Speakers are marketed as just Loudspeakers

Unfortunately, the distinction between Hi-Fi and Monitor Speakers is not absolutely clear with some so called Hi-Fi Speakers definitely being very ordinary Lo-Fi while others are good enough to classify as Monitor Speakers

Furthermore, some marketed as Monitor Speakers are actually "Just Very Loud" Stage PA or "Disco" Speakers, and suitable neither as Hi-Fi nor Monitor Speakers

Some Speaker Systems are Passive, requiring an external Monitor Amplifier while others are Active, meaning that they have "Built In" Power Amplifiers

Power Ratings for both Passive and Active Speaker Systems is not at all clear, so we have more or less given up on understanding this

As examples, there are Computer Speakers touted as having frequency response from DC to Light and Output Power of 400 Watts+, and \$ 100.00c sets of 5+1 Surround Speaker Systems claimed to be absolutely fantastic with Power Ratings at 100 Watts+

All very confusing

We will try to put things into perspective

Small, Low Cost Surround Speaker Systems

Interesting "Toys" to play with, but have no place whatsoever in Broadcasting

Larger, Medium Cost Surround Speaker Systems

May be of use for listening to Non Critical Audio

Computer Speakers

Generally have Poor Sound Quality and High Distortion, no use for serious application in Broadcasting and an absolute No-No for Monitoring

Subjective tests with certain Music Tracks comparing original CD Wave File with MP3 160 KB/Sec 44.1 KHz, 80 KB/Sec 44.1 KHz and 64 KB/Sec 22 KHz indicates that the quality degradation is difficult to pick due to the inherent High Distortion and Peakiness of Speakers

In other words, they sound awful on clean undistorted audio, and not much worse on severely compressed or mutilated MP3 audio

Hi-Fi Speakers

Generally designed to give a pleasant rather than accurate sound, often with slightly exaggerated and peaked Bass response, suppressed Mid Range and boosted Treble

Huge variation between different makes and models, with some being "Boom and Spit" Boxes with "Poor Stereo Imaging"

Others are very accurate classifying them as Monitor Speakers

Hi-Fi Speakers are usually "Dressed Up to be Wife Friendly" with an attractive Front Grille and nicely polished

Good Speaker Systems are usually "Heavy and Expensive"

If a Speaker System is "Light and Cheap" it is in all likelihood not very good

Some of the Better Types of Mid-Sizes and Mid-Prized Hi-Fi Speaker Systems may be perfectly satisfactory as Monitor Speakers in the On-Air Studio

Some of the Superb, Large, Heavy and Expensive ones may be perfectly suitable as Recording Studio Monitors, and are in fact used as such by many Professional Recording Studios

Monitor Speakers

Unfortunately a very misused “Buzz” term

Very few Speaker Systems advertised as being Monitor Speakers are actually Monitor Speakers

Real Monitor Speakers are usually fairly Plain, Heavy, Expensive and not “Dressed Up” to please the wife

Monitor Speakers are designed to tell you “What you Got” and not hide imperfections

They should have a Flat Frequency Response, nicely damped Bass, accurate Mid Range, Silky Smooth Top and good Stereo Imaging as well as being pleasant to listen to

A fairly Tall Order

For a small On-Air Studio or Production Room, Mid Sized Monitor Speakers such as the Landmark LM-TB Near-Field Monitors or similar types of other makes are suitable

For a Mid Sized On-Air Studio or Production Room, we recommend the Landmark LM-1B Air Studio Monitors or similar types from other manufacturers such as the Energy C-3

For Serious Music Recording, Mixing and Mastering, you need large Monitor Speakers exhibiting a “Bottomless Pit of accurate Bass Response” such as the Landmark LSX Mastering Speakers or similar

You will most likely also need a pair of Near-Field Monitors to allow you to evaluate sound quality from smaller Loudspeaker Systems

Stage, PA and “Disco” Speaker Systems

Most of these are just unrefined “Very Loud Speakers”, generally reproducing “Boomy Mid Bass and Spitty Mid-Highs” and no real Low or High Frequency Response

They are OK for Stage, PA and Disco applications, but are completely useless for serious monitoring

Unfortunately, Loudspeaker Systems of this general type are often and misleadingly advertised and sold as Monitor Speakers

Buyer Beware

Passive V/s Active Loudspeaker Systems

A highly controversial subject for which there is no simple answer

For Serious Monitoring, particularly for recording, my personal preference is for Passive Loudspeaker Systems, coupled with a very good Monitor Amplifier of Adequate Power for two reasons

- 1; A well constructed Passive Crossover Network contains only a few components makes a Passive Loudspeaker System inherently stable and not likely to change it's characteristics over time making it the reliable “Fixed Reference” needed for recording
- 2; It also gives you the choice of selecting the best and most suitable Monitor Amplifier for your particular application, and if that Monitor Amplifier for some reason should break down, you can use virtually any Power Amplifier as a temporary replacement

From personal experience, the Built-In Amplifier in some, even well known Active Speakers is “Built to a Price”, and not particularly good or reliable

Other Active Monitor Speaker Systems are of excellent quality in every respect leaving the actual choice of Monitor Speakers System, Passive or Active entirely one of personal preference

For other applications

Active Loudspeaker Systems for Stage, PA and Disco is a good and practical solution

Active Computer Speakers are probably the only practical solution

Loudspeaker Power Rating

We must confess that we do not fully understand what advertised Manufacturers Loudspeaker Power Rating actually means

When Monitoring to Evaluate Audio Quality at Moderate Sound Levels, Loudspeaker Power Rating probably does not matter a great deal anyway

We rather think about Loudspeaker Power Rating as “How Loud and for How Long” can you operate a Loudspeaker before it Falls Apart or Burns Up

We know that some Loudspeaker Drivers “Fall Apart” easily while others are tough and durable

Maybe someone can enlighten us on Loudspeaker Power Rating

Loudspeaker Drivers

Being Danish, I claim that Danish Loudspeaker Drivers such as Dynaudio, Vifa and Peerless are the best sounding, and tough too, but must admit that the Brit’s and others also make good Loudspeaker Drivers

Brands of Loudspeaker Systems suitable for Monitoring

Makes known to myself that I like and have confidence in

Landmark	Australia	Passive	
Energy	Canada	Passive	Mid and Near Field
Dynaudio	Denmark	Passive and Active	
Bowers and Wilkins	UK	Passive	
Tannoy	UK	Passive and Active	
Genelec	Finland	Active	
Westlake	USA	Passive	
UREI	USA	Passive	Historical Only
KEF and Rogers	UK	Passive	LS3/5A Near Field
ATC	UK	Passive and Active	

There are other well known makes of Monitor Loudspeakers, some of which were excellent and highly respected at one stage, some have disappeared, some have changed ownership and declined in quality

Many newer Makes, not known to us may be OK while others are simply awful, but for Legal Reasons, we cannot name or discuss any of these here

In reality, serious Audio Monitoring is about accurately hearing “What you Got”, “Warts and all”, and that is possible only by using a genuine Monitor Loudspeaker System