Cosmos 4.3 Setting up the system for ABDA measurements.

This paper is about setting up the ABDA process in a Cosmos 4.3 system; it is written in response to a perception that the existing published information needs to be augmented with a discussion on the problems associated specifically with setting ABDA – but from a different point of view.

CONTENTS

PREVIOUS READING

If you are new to, or interested in a briefing of, the concept of Simultaneous Broadcasting you may wish to read more on the subject. There are many sources of such information, some are listed in the bibliography at the end of this document.

1 INTRODUCTION

1.1 ABDA Test Tone.

The ABDA Test Tone is a sine wave train composed of 32 cycles of 1000Hz with a phase reversal after the first 16 cycles. The Station ABDA process detects this phase reversal and uses it to calculate the delay through the system. However because of the abrupt change in characteristics of the sine wave burst at the time of the phase reversal it would be difficult to detect this change if it passed through a significant number of filters such as those is associated with the group delay circuitry. Therefore the system is designed such that the ABDA Test Tone bypasses the Line Module group delay circuitry.

1.2 Group Adjustment Circuit – delay compensation.

All audio bar the ABDA Test Tone passes through the Line Module group delay circuitry which, by virtue of its function, adds delay into the system; this added delay is not taken in to account in the ABDA measurement process. Hence there is a requirement to add the delay due to the group circuit in to the total delay for the equalization algorithm to be accurate.

1.3 Wide Band Phase Shift Circuit – affect on ABDA Test Tone.

The Wide Band phase shift network is a part of the Group Delay, a consequence of this is that an adjustment of the wide band phase shift potentiometer will affect the amplitude of the normal audio signal but not the ABDA tone, so another potentiometer RV26 is incorporated in the Line Module circuitry to balance these two outputs. The ABDA burst is quite tolerant to amplitude so it is possible that field adjustment will not be required; if it is however follow the procedure set out later.

1.4 Audio Delay – composition.

The delay of the audio signal from the control centre to the transmitter output is made up of basically three parts, which are: -

- i The delay contributed by the audio filters in the system (including Group).
- ii The delay of the audio transmission medium e.g. telephone lines, microwave links.
- iii The delay set into the Line Module electronic bulk delay circuit.

1.5 Audio Delay – adjustment.

The only way the system can adjust the total delay of any link is by changing the value of the Electronic Bulk Delay circuit; the current setting for this is displayed in the |Card column| of the delay window. This number represents the delay in microseconds of the audio through the electronic delay circuitry in the Line Module and nothing else. The values in the |Group column| or the |Offset column| can be changed manually through the ET editing function; when the system is running on <automatic> these values are included in the algorithm calculating the next value to be inserted into the Electronic Delay circuit – and displayed in the |Card column|. If the system is being used in a <manual> mode then the only way to alter the setting of the Electronic Delay circuit is by changing the value in the |Card column| - in this case the values in |Group| and |Offset| are irrelevant.

The ET |Delay| screen shows columns of figures related to audio delay and compensating values.

Card	Group	Offset
	1000	10
	10	1000
	1010	0

In the **Automatic** Bulk Delay Adjustment mode (ABDA enabled) the figure in the |Card column| shows the value microseconds that the Electronic Bulk delay circuit has been set to. This process is automatic and the figure/value will change if the path/route delay varies.

There is almost always a requirement for the automatic process to be told of the values of fixed differences required to compensate for some delay that is either not in the measurement loop |Group delay| or is required to compensate for a measurement method error (flight time) or is a deliberate desynchronization of the transmitted audio |Offset|. The figures in the |Group| and |Offset| columns are inserted by a commissioning engineer to tell the automatic process of these values. The headings on the columns are only to assist the engineer – the automatic process uses the sum of the two columns in its algorithm; so the three examples shown will have the same effect. If it is required to enter values for the |Group|, |Flight Time| and |Offset| then two of them will have to be added together and inserted in one column.

2 SETTING UP ABDA – ON DIGITAL LINKS.

2.1 Group Delay with Digital Links – adjustment.

With digital lines it has been found that, in many cases, group compensation consists only in an adjustment of the wide band phase shift circuitry, so the Q controls on the group segments of the Line Modules can be set to the fully anticlockwise position.

If there are copper lines being used then it is more than likely that group compensation must be undertaken, which will require the initial settings of the Q pots to be in identical positions - perhaps one third of their max setting. See other documents in the Technical Publications series for group compensation adjustment methodology.

2.2 Audio Compensation with Digital Links – adjustment methodology.

- i Set the <Wideband Phase> controls to mid travel.
- ii Configure the system to operate ABDA in |Adjust for Longest Line| mode – rather than |Adjust all for 15ms|.
- iii Select the <Delay window> on the <Engineering Terminal>.
- iv Set all rows of the |Group column| to 500 (us).

v Let ABDA run for a few iterations and check that the results from the stations show that ABDA is working and that the signal is not inverted.

vi If it is inverted change the polarity of that Link and let ABDA run again for a few more iterations then inhibit it.

vii Make a note of the figures in the |Card column|, these will be used later on in the setting up procedure.

viii A receiver, which can reach all the transmitters in the system, is used to set up the system. It is not necessary to have this at the link node it can be at any of the transmitter sites as its output can be connected to one of the return lines.

ix When analysing a path through a transmitter Inhibit all the other transmitters. Run the <Little Gem> analyser in |Amplitude mode|.

x If the system has been set up correctly all the other transmitters should have the same amplitude as the reference however slight adjustments of the low and high frequency tone control potentiometers RV1 & RV2 may be necessary.

xi Now using the edit function on the engineering terminal add 1000 microseconds to each number in the |Card column|. The reason for doing this is that the line with the longest delay in the system will only have 200 microseconds showing in the |Card column|, which is the smallest number to be allowed in that column by the automatic adjustment algorithm, and later on it may be necessary to change that column by more than 200 microseconds. The other cards have greater values in that column to bring their delays (card plus line) to equal the longest line.

xii Choose a transmitter to be the reference; perhaps it may be on the longest line but not necessarily so.

xiii Run the <Little Gem> analyser in |Phase mode| through this transmitter with the others inhibited and |Calibrate| it. The calibrated trace will be a straight line from 300Hz to approx 2600Hz. Take off |Calibration| and run it through each transmitter in turn making adjustments to the figures in the |Card column| and adjustments to the potentiometers in the group delay circuitry until the Little Gem trace on the engineering terminal lines up with the calibration trace.

xiv Refer also to the document SimulcastAudioSynchronization.pdf.

xv When all the transmitters have been compared with the reference transmitter again make a note of the numbers in the |Card column|. Remember <Little Gem> output goes through the group delay circuitry whereas the ABDA burst does not; therefore, the difference between the two |Card| figures represents the changes made in the |Group delay| settings. These values must be made available to the automatic algorithm so that it can compensate for the |Group delay| variable. *If ABDA was now set to run, the card column figures would revert to the original figures.* So, change the |Group column| value to reflect the change in the |Card column|; the original |Card column| figures are subtracted from the new |Card column| figures with, of course, the reference site unchanged. These figures can be positive or negative; if they are positive they are subtracted from the |Group column| figure if they are negative they are added to the |Group column| figure. *When ABDA is run again the algorithm uses the figures in the |Group column| to compute the figure in the |Card column| so a decrease in the |Group column| will cause an increase in the |Card column| and visa versa.*

xvi When a common monitor receiver is used to calibrate the system the delay in each circuit also includes the ‘flight time’ of the signal from the transmitter to that receiver; the further the receiver is from the transmitter the longer the ‘flight time’. The system will have been adjusted to show that all paths have the same delay to the monitor receiver, it follows that because of the variation in ‘flight time’ the instantaneous output from each transmitter will not be synchronized. To make the system truly operationally Quasi Synchronous all the transmitters must launch the signals simultaneously, so a delay must be added into each link to compensate for the distance of each transmitter from the common receiver. The distance can be measured and the flight time converted to microseconds. This figure can be subtracted from the group column before ABDA is allowed to run.

3 SYSTEMS TOLERANCES.

3.1 Transmitter Deviation.

FM quasi sync (simulcast) systems are not very tolerant of the transmitters having differing deviations for the same level of input, so it is important to set the transmitters up to have the same level of deviation with standard input level. Common practices seems to be that for systems with channel spacing of 12.5KHz with -10dB standard audio level into the transmitter the deviation should be set to 2KHz, which will be at the start of compression. This means that the level of audio output from the <Little Gem> analyser should be such that its level into the transmitters of no more than -18dB.

3.2 Audio Compensation.

Common practice gives the tolerances with respect to the Reference: -

Amplitude	+/-0.5dB
Phase	$<10^0$ (with easing to $<15^0$ under difficult conditions).

4 BIBLIOGRAPHY, ACKNOWLEDGEMENTS AND FURTHER READING

4.1 Acknowledgements

Thanks to David Hurst and David Wilcox for your input, help and constructive criticism.

4.2 Further Reading

"Simulcasting Without (Too Many) Tears" – Update of a paper presented by R. Atack at the 1989 APCO Conference in Sparks, Nevada
(Available on the web: - http://quasi-sync.atackscomputers.co.uk)

"Simulcast Briefing" by D Cahill.
File SimulcastBriefing.doc* Dalman Technical Services Ltd.

"Simulcast Audio Synchronization" by D Cahill.
File SimulcastAudioSynchronization.doc * Dalman Technical Services Ltd.

Adjustment of Audio Compensation, Cosmos4 – Technical Publications Book 1 Section 8.
File 10800_18.doc* Dalman Technical Services Ltd.

* The files marked with an asterisk are available as *.pdf on the web at http://www.dalmants.co.uk.

First published in July 2004.
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