Calculating Abandoned Calls in the light of the Ofcom 2008 Statement

Summary

This document has been produced for operators of Predictive Dialling equipment to clarify the calculations required when determining the abandoned call rate as required by Ofcom's *Statement of Policy for Persistent Misuse*, published in September 2008. It is produced on behalf of the DMA's Contact Centres and Telemarketing Council. The DMA wishes to thank Rufus Grig, Dave Nicholls, Steve Smith and Roland Smith for their contribution to this document.

It is necessary because the presence of answering machines has an impact on the genuine abandoned call rate: some calls dropped by a predictive dialler will have actually been answered by an answering machine, and some calls classified as answering machines by equipment will actually have been live calls. The reports and statistical output of most predictive diallers do not factor this in, and it is therefore necessary to be able to demonstrate the true abandoned call rate from those figures that are available from the dialler.

This paper shows that the correct formula to apply when calculating the abandoned call rate when a contact centre is **not using Answer Machine Detection** is:

$$R = \frac{D}{D + A_L + A_M}$$

where R is the abandoned call rate defined by Ofcom, D is the number of calls dropped by the predictive dialler, A_M is the number of calls connected to agents that were classified as answering machines and A_L is the number of calls connected to agents that were classified as live.

When **Answer Machine Detection is being used**, the formula to use is:

$$R = \frac{D + (F_R \times (A_L + A_M))}{D + A_L + A_M}$$

Where R is the abandoned call rate, D is the number of calls dropped by the predictive dialler, A_M is the number of calls connected to agents that were subsequently classified as answering machines, A_L is the number of calls connected to agents that were classified as live, F_R is the measured false positive rate for the appropriate campaign.

NOTE that if AMD is not being used, the false positive rate (F_R) will be zero and it can be shown that when F_R=0, the second formula can be written the same as the first. However, rather than provide those contact centres who are not using AMD with a more complex formula to work with, both formulations have been shown.

Background

Predictive dialling equipment can work in a number of different ways to deliver increased productivity to an outbound contact centre:

Overdialling

The basic premise of the predictive dialler is that more calls are made than there are currently agents able to receive calls, since not all calls that are made are answered by live individuals. The predictive dialler's pacing algorithm (sometimes called a pacing engine) monitors the calling statistics in real time and combining the live calling information with parameters configured by the call centre campaign managers, manages the number of calls made at any given time.

While delivering a significant performance boost to contact centres, this has the side effect of generating calls to live individuals for which there is no agent available to take the call. When this happens, the dialler has to **abandon** or **drop** the call, playing the live call recipient an **information message** providing certain information, such as on whose behalf the call had been made, and what they can do in order to prevent any further calls being made to their number.

Answer Machine Detection

In addition to overdialling another technology is used by some predictive dialler manufacturers and operators known as Answer Machine Detection (AMD). This technology analyses the call to determine if it has been answered by a live individual or by an answering machine. If it believes that it has been answered by an answering machine, the predictive dialler will typically cut the call off. If it believes that it has been answered by a live individual, then provided there is an agent free to handle the call, it is connected to an agent. If not, the call is abandoned and an information message played.

AMD is not 100% accurate. In some circumstances it will falsely classify an answering machine as a live individual (a *false negative*) and in other circumstances it will classify a live individual as an answering machine (*a false positive*). *False positives* have a detrimental effect on the public because they have the effect of generating a *silent call*.

In the case of the *false negative*, the same issue applies as with overdialling – that some of the calls that are abandoned will actually have been answered by answering machines. However, in this case it is a statistically much less significant number.

Regulation

In March 2006, Ofcom introduced a set of procedures that outbound contact centres operating predictive dialling equipment should follow in order to avoid being found guilty of *Persistent Misuse of a Telecommunications Network* which included the requirement to play the information message in the event that a call is abandoned, and imposed a limit on the number of abandoned calls that can be made.

In September 2008, Ofcom introduced a revised version of the *Statement of Policy on Persistent Misuse* which covered a number of issues:

- It required contact centres using AMD to determine a *reasoned estimate* of false positives and to include them in their calculations of abandoned calls
- It provided a precise definition of an abandoned call
- It provided a formula to be used by contact centres to calculate their abandoned call rate.

Initially there was some confusion over the formula and its definitions, but Ofcom clarified their position during an open meeting organised by the Telephone Preference Service on March 31st 2009.

This document seeks to provide clear guidance for contact centre operators using AMD, and those not using AMD, on how to apply the procedures documented in the September 2008 statement and clarified during the March presentation.

Definitions

The September 2008 Statement defines an abandoned call in section 4.8 as follows:

> *An abandoned call is where a connection is established but terminated by its originator in circumstances where the call is answered by a live individual. A call may also be regarded as abandoned even if an information message is played (although in those circumstances, it will not be a silent call - see below). A call may also be terminated after a predetermined period, say 15 seconds, because it has not been answered, perhaps because no one is there to take it. Within industry terminology and for the purposes of this statement such calls are not classified as 'abandoned calls'. Abandoned calls are likely to cause unnecessary annoyance, inconvenience or anxiety to consumers.*

Thus it is clear that an abandoned call is one which is answered by a **live individual**, irrespective of how it came about from the dialler. Thus for the purposes of complying with the Ofcom statement, a call is considered to be abandoned whether it was actively disconnected by the dialler because there were no agents free to handle the call, or if it was inadvertently disconnected by the AMD technology as a result of a *false positive*.

As to the formula that should be applied to calculate the abandoned call rate, Ofcom provided the following in section 4.16.1:

> *the 'abandoned call' rate shall be no more than three per cent of 'live calls', calculated per campaign[14] (i.e. across call centres) or per call centre (i.e. across campaigns) over any 24 hour period[15], and shall include a reasoned estimate[16] of Answer Machine Detection (AMD) false positives;*

and footnote 15 states the formula mathematically as:

> *The 'abandoned call' rate shall be calculated according to the following formula: abandoned calls (x)/(abandoned calls (x) + calls passed to live operator (y)) x 100/1*

There was some confusion in the contact centre community in that the formula given in the footnote and the text given in the paragraph appear to contradict each other. At the March 2009 meeting, Ofcom clarified that the phrase "*calls passed to live operator(y)*" referred to in the formula should only include *calls answered by a live individual*.

The implications for outbound contact centre operators

This presents two statistical problems for operators of predictive dialling equipment, depending on how they are operating:

- Operators using AMD cannot be strictly accurate about the number of false positives generated – they have to base this on the reasoned estimate that they derive from their own internal testing
- Operators not using AMD cannot be strictly accurate about the number of abandoned calls to **live** individuals – they have to calculate this based on statistical probabilities.

The Ofcom statement specifically states that operators using AMD should factor in a reasoned estimate of false positives. However, for contact centre operators **not** using AMD, the arrival of an estimate of the number of abandoned calls as defined in section 4.8 is not discussed. This document attempts to provide an explanation of the issues and a formula that can be used by contact centres to determine their live abandoned call rate as required in section 4.16.1 of the statement.

Abandoned calls when AMD is not in use

When AMD is not in use, there is no danger of abandoned calls being generated by false positives. Although they can be generated accidentally if an agent manually disconnects a phone, or there is some equipment failure, this is rare and can be handled by good

management and working practices. Thus, the only significant cause of abandoned calls is calls disconnected by the predictive dialler due to there not being an agent available to handle the call.

A predictive dialler that is not using AMD has to make its *decision* as to whether to abandon a call or connect it to an agent for all calls that are connected (i.e. those that are answered by an individual and for those that are answered by an answering machine). In other words, the calls that the dialler's pacing engine **decides to abandon** will be made up of calls to live individuals (where a nuisance will be caused) **and** calls answered by machines (where no nuisance is caused).

In order to arrive at an estimate of those calls disconnected by the dialler that count as an abandoned call for the purposes of complying with the Ofcom statement, it is necessary to estimate the proportion of calls the dialler disconnected that were actually live. It can be safely assumed that this proportion will be the same as the proportion of live calls that are connected to agents.

We now need to show the formula required to calculate the live abandoned call rate required by Ofcom, from the figures that we can simply obtain from the predictive dialler statistics.

In order to state a formula, we must first make some definitions:

Symbol	Definition	Obtainable directly from dialler
D_L	Calls dropped by the predictive dialler that were answered by live individuals	No
D_M	Calls dropped by the predictive dialler that were answered by answering machines	No
D	Calls dropped by the predictive dialler – note that $D = D_L + D_M$	Yes
A_L	Call answered by a live individual and passed to an agent	Yes
A_M	Call answered by an answering machine and passed to an agent	Yes
A	All calls connected to an agent – note that $A = A_L + A_M$	Yes
L	All calls that were answered by live individuals – note that $L = D_L + A_L$	No
R	The abandoned call rate – the proportion of calls answered by live individuals which are disconnected by the dialler	No

It is important to note that the key factor for us to calculate is R - the abandoned call rate. This is the figure which must not exceed 0.03, or 3% in order to comply with the Ofcom *Statement*.

The third column in the table gives an indication as to whether this is a figure that can be counted directly from the predictive dialler's statistics (**counted** rather than statistically **calculated**). Clearly, the key information that we need in able to determine the abandoned call rate is **not** available directly from any predictive dialler generated counts – it is going to have to be calculated.

We need to be able to measure R, the abandoned call rate.

This, from paragraph 4.16.1, is calculated as:

$$R = \frac{D_L}{L} \tag{1}$$

We have seen that neither D_L nor L can be measured by the dialler directly, but they can be estimated accurately.

Firstly, we need to determine D_L, the number of dropped calls that were answered by live individuals – what Ofcom calls *abandoned calls*.

We have to assume that the proportion of dropped calls that are live will be the same as the proportion of calls transferred to agents that are live. This proportion, P_L, can be calculated as:

$$P_L = \frac{A_L}{A_L + A_M} \tag{2}$$

So D_L, the live abandoned calls, can be calculated as:

$$D_L = P_L \times D \tag{3}$$

Substituting P_L in the above equation from line (2), we can write that as:

$$D_L = \frac{A_L}{A_L + A_M} \times D \tag{4}$$

We also know, from our definition of L in the table, that the live calls total is made up of live calls connected to agents and live calls abandoned by the dialler – or $L = D_L + A_L$.

So, substituting this statement of L and our statement of D_L from equation (4), we can re-write our function (1) as:

$$R = \frac{D_L}{A_L + D_L} = \frac{\frac{A_L}{A_L + A_M} \times D}{A_L + \frac{A_L}{A_L + A_M} \times D} \quad (5)$$

Although technically correct, this formula is complex and difficult to work with. Fortunately, it can be algebraically simplified into something much more workable.

We will simplify equation (5) by dividing the top and the bottom of the fraction by $\frac{A_L}{A_L + A_M}$. We then get:

$$R = \frac{D}{\left(\frac{A_L}{\left(\frac{A_L}{A_L + A_M}\right)}\right) + D} \quad (6)$$

Which simplifies to:

$$R = \frac{D}{A_L + A_M + D} \quad (7)$$

All the required numbers for this formula are directly available from the dialler's statistics.

Factoring in False Positives from AMD

The False Positive Rate

In order to factor in the number abandoned calls due to false positives from AMD, it is first necessary to arrive at a measure of the *false positive rate* – a measure of the accuracy of the live speaker detection functionality of the AMD technology. This paper does not set out to explain how to measure this rate, but it is important to define how it is to be stated.

The *false positive rate* is the proportion of *live calls* that will be mis-classified by the AMD technology as being answered by an answering machine, when in fact they are answered by a live individual. If F_R is the *false positive rate*, then the number of false positives generated for every *L* live calls will be $F_R \times L$.

Measurement of the *false positive rate* needs to be relevant for the particular campaign circumstances, and dialler operators should note with their records what *false positive rate* is being used and why it is deemed appropriate.

False Negatives

As with the case where AMD is not in use, there will be some calls dropped by the dialler that will not have been answered by live individuals but by answering machines. This occurs when a *false negative* call is abandoned by the dialler's algorithm. This has been factored in to the equation derived below, but will not have such a significant effect as in the case where AMD is not in use, as the proportion of *false negatives* in the overall calling list will be significantly lower.

Determining the Correct Formula

Firstly, some definitions:

Symbol	Definition	Obtainable directly from dialler
F_R	The false positive rate for your campaign, determined by your testing / measuring activity	No
F_C	The false positive count – i.e. how many calls were abandoned as a result of false positives. Note that this is equal to $F_R \times L$.	No
D_L	Calls answered by live individuals and dropped (abandoned) by the dialler	No
D_M	Calls dropped by the predictive dialler that were answered by answering machines	No
D	The total number of calls dropped by the predictive dialler = $D_L + D_M$	Yes
A_L	Calls answered by a live individual and passed to an agent	Yes
A_M	Call answered by an answering machine and passed to an agent	Yes
O	The Ofcom "abandoned call" figure, which is made up of live calls abandoned by the dialler and false positives = $D_L + F_C$	No
R	The abandoned call rate – the proportion of calls answered by live individuals which are disconnected by the dialler, either as false positives or predictive abandoned calls	No
L	Calls that were answered by live individuals – note that $L = D_L + A_L + F_C$	No

From paragraph 4.16.1 in the Ofcom *Statement*, the abandoned call rate R is:

$$R = \frac{O}{L} \quad (1)$$

(Note that Ofcom actually state it as a percentage by multiplying R by $\frac{100}{1}$. To keep the formulae simpler, this exercise will derive how R can be measured. To convert to a percentage, call centre operators simply need multiply by 100 themselves).

Referring to the table, we know that $O = D_L + F_C$. From the table we can see that we cannot measure either D_L or F_C directly, so we need to arrive at a method of calculating them both.

Firstly, to arrive at a way of stating D_L.

The effect of false negatives is twofold – it will connect calls that were answered by answering machines to agents, but it also impacts the live dropped predictive call rate because some of the calls dropped by the predictive dialler will have been false negatives. The proportion of predictively dropped calls that are live will be the same as the proportion of calls transferred to agents that are live. So we can write that the proportion of genuinely live calls, P_L, is:

$$P_L = \frac{A_L}{A_L + A_M} \tag{2}$$

Thus D_L, the number of calls dropped as a result of predictive dialling that were actually answered by live individuals is:

$$D_L = P_L \times D \tag{3}$$

Substituting P_L from equation (2), we get:

$$D_L = \frac{A_L}{A_L + A_M} \times D \tag{4}$$

Next, we have to consider the *false positive* count, F_C. From our definition, we know that $F_C = F_R \times L$. We also know that $L = F_C + D_L + A_L$. Substituting our formula for F_C in our definition of L, we get:

$$L = (F_R \times L) + A_L + D_L \tag{5}$$

Subtracting $F_R \times L$ from both sides, we get:

$$L - (F_R \times L) = A_L + D_L \tag{6}$$

Which can be re-arranged as:

$$L \times (1 - F_R) = A_L + D_L \tag{7}$$

Which we can use to express L as:

$$L = \frac{A_L + D_L}{(1 - F_R)} \tag{8}$$

Substituting our equation for D_L from (4), we can show this as:

$$L = \frac{A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)}{(1 - F_R)} \tag{9}$$

The false positive count, F_C, can then be written as:

$$F_C = F_R \times L = F_R \times \frac{A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)}{(1 - F_R)} \tag{10}$$

all of which, with the exception of F_R which is measured by experiment, can be taken directly from the dialler's statistics.

We can now start applying some of this work back into our original equation (1) to determine the abandoned call rate. Firstly, we will express O, the number of calls abandoned according to Ofcom's definition, as a function of statistics that can be taken from the dialler. We know from our definitions in the table that O is made up of calls abandoned + false positives or $D_L + F_C$. From our definition of D_L in equation (4) and F_C in equation (10), we can write that:

$$O = \left(\frac{A_L}{A_L + A_M} \times D\right) + \left(F_R \times \frac{A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)}{(1 - F_R)}\right) \tag{11}$$

We also have a definition of L, factoring in *false positives*, from equation (8). So we can re-state equation (1) using our formula for O from (11) and our formula for L from (8) as:

$$R = \frac{\left(\frac{A_L}{A_L + A_M} \times D\right) + \left(F_R \times \frac{A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)}{(1 - F_R)}\right)}{\frac{A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)}{(1 - F_R)}} \tag{12}$$

This would be a truly awkward formula to work with. Fortunately, it simplifies quite well.

Firstly, multiply the top and bottom of equation (12) by $(1 - F_R)$ and we get:

$$R = \frac{\left(\left(\frac{A_L}{A_L + A_M} \times D\right) \times (1 - F_R)\right) + \left(F_R \times \left(A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)\right)\right)}{A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)} \quad (13)$$

Expanding the right hand side of the numerator in equation (13), we can re-state it as:

$$R = \frac{\left(\left(\frac{A_L}{A_L + A_M} \times D\right) \times (1 - F_R)\right) + F_R \times A_L + \left(F_R \times \frac{A_L}{A_L + A_M} \times D\right)}{A_L + \left(\frac{A_L}{A_L + A_M} \times D\right)} \quad (14)$$

Multiplying the top and bottom of equation (14) by $\frac{A_L + A_M}{A_L}$, we get:

$$R = \frac{\left(D \times (1 - F_R)\right) + F_R \times (A_L + A_M) + (F_R \times D)}{A_L + A_M + D} \quad (15)$$

For which the numerator can be further simplified and written as:

$$R = \frac{D + \left(F_R \times (A_L + A_M)\right)}{D + A_L + A_M} \quad (16)$$

Note that if AMD is not being used, the false positive rate will be zero. Thus the equation simplifies to:

$$R = \frac{D}{D + A_L + A_M} \quad (17)$$

which is the same as the formula derived when we went through the case without AMD.