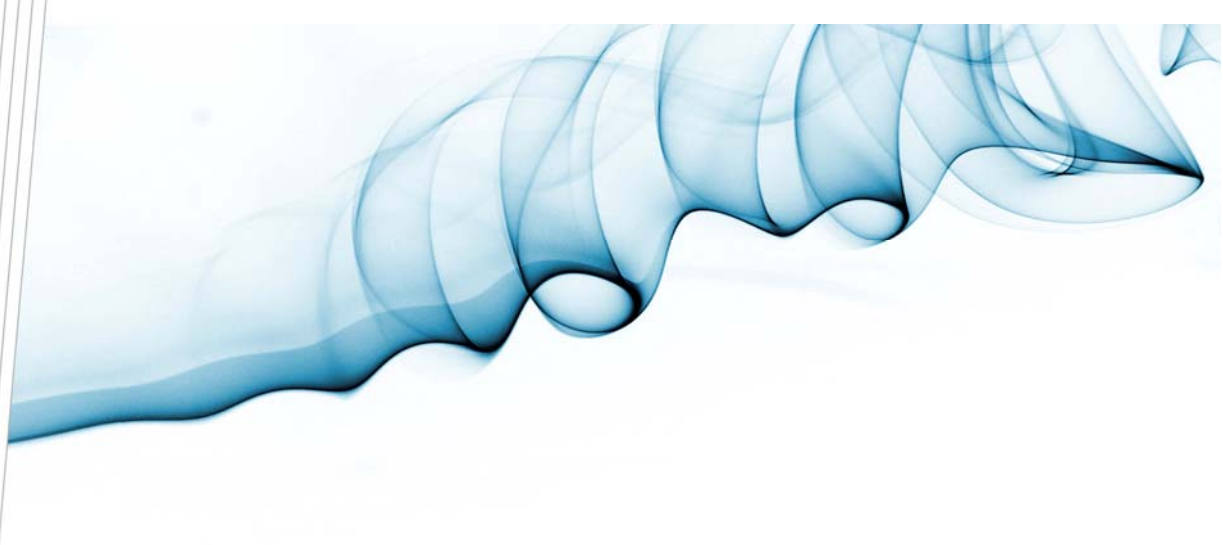
Smoke Sensitivity Testing of Residential Smoke Alarms

Commercial-in-Confidence



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1 INTRODUCTION

Fire and Rescue NSW submitted samples of four different models of residential smoke alarm for Directional Dependence and Initial Sensitivity testing in accordance with AS 3786-2014.

This report replaced CSRO report XF3033/R2 dated 13 May 2016.

2 TEST PROGRAM

The following activities were performed to evaluate the sensitivity of each model of residential smoke alarm:

- Directional Dependence (Clause 5.2) test (one test on one sample of each of the four models); and
- Initial sensitivity (alarm response threshold) test (Clause 5.3) on all samples of each model.

The results of these tests are detailed in Section 3 of this report.

2.1 Test Samples

A summary of the submitted samples are detailed in Table 1 of this report.

Table 1 Summary of the submitted samples of each of four models of residential smoke alarm.

CSIRO sample identification	Client identification	Smoke Alarm Type
XF3033/241 - XF3033/286	P061 – P0106	Photoelectric
XF3033/287 - XF3033/332	M061 – M106	Photoelectric
XF3033/333 - XF3033/356	P107 - P130	Photoelectric
XF3033/357 - XF3033/380	M107 - M130	Photoelectric
XF3033/381 - XF3033/452	D061 – D132[1]	Photoelectric & Ionisation
XF3033/453 - XF3033/524	I061 – I132	Ionisation

[1] Due to the enhanced photoelectric response to the presence of aspirated paraffin relative to ionisation chamber response, all results provided in this report related to samples D061 through D132 are expected to be due to the response of the photoelectric chamber, only. It is not possible to obtain the ionisation chamber response of this model without performing modifications to the alarm such that the photoelectric chamber is disabled prior to testing.

3 TEST RESULTS

3.1 Directional Dependence Test Results

XF3033/333 (P107)

Sample	Orientation (˚)	Response Threshold Value, m (dB/m)	Ambient Air Temp (°C) & Relative Humidity (%RH)	Maximum / Minimum Sensitivity orientation
XF3033/01 (P001)	0	0.093	20/51	-
	45	0.091	20/51	-
	90	0.094	20/51	-
	135	0.096	20/51	Min
	180	0.092	20/51	-
	225	0.084	20/51	Max
	270	0.084	20/51	-
	315	0.092	20/51	-

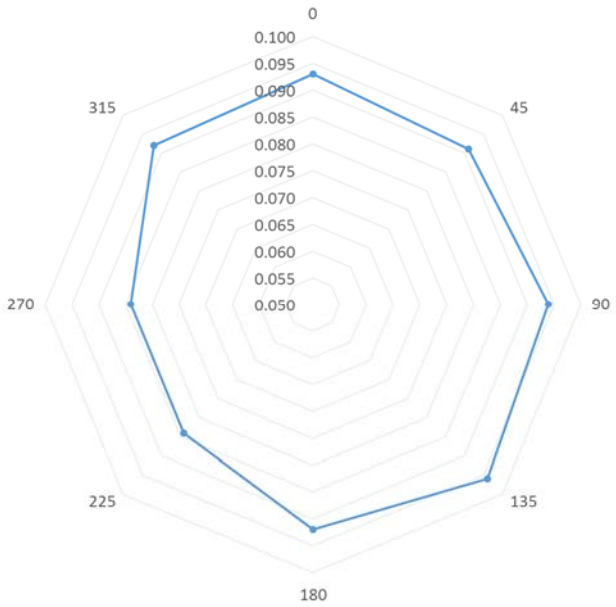

Figure 1. Polar chart of directional dependence test results of XF3033/333 (P107).

XF3033/357 (M107)

Sample	Orientation (˚)	Response Threshold Value, m (dB/m)	Ambient Air Temp (°C) & Relative Humidity (%RH)	Maximum / Minimum Sensitivity orientation
XF3033/61 (M107)	0	0.090	24/64	-
	45	0.083	24/63	-
	90	0.090	24/63	-
	135	0.092	24/62	-
	180	0.099	24/62	Max
	225	0.089	24/63	-
	270	0.087	24/63	-
	315	0.082	24/62	Min

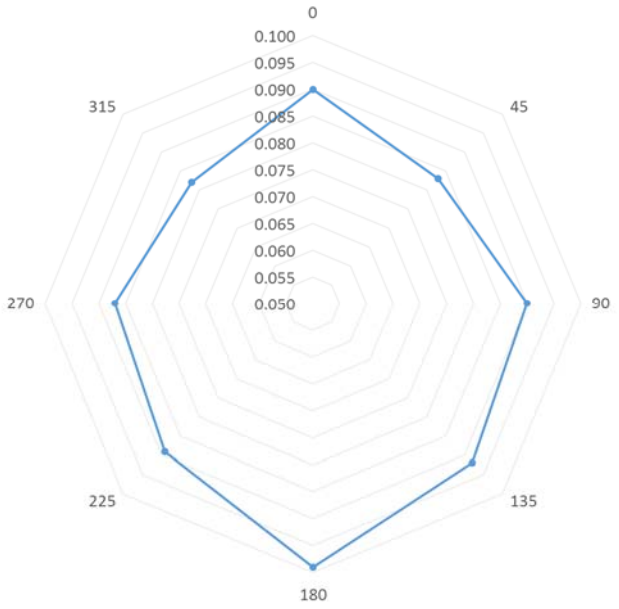

Figure 2. Polar chart of directional dependence test results of XF3033/357 (M107).

3.2 Initial Sensitivity Test Results

XF3033/241 (P061) through XF3033/286 (P106)

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/241 (P061)	0°	0.161	20/38	m ≥ 0.05 dB/m
XF3033/242 (P062)	0°	0.139	20/38	m ≥ 0.05 dB/m
XF3033/243 (P063)	0°	0.152	20/38	m ≥ 0.05 dB/m
XF3033/244 (P064)	0°	0.167	20/38	m ≥ 0.05 dB/m
XF3033/245 (P065)	0°	0.178	20/37	m ≥ 0.05 dB/m
XF3033/246 (P066)	0°	0.154	20/37	m ≥ 0.05 dB/m
XF3033/247 (P067)	0°	0.132	20/37	m ≥ 0.05 dB/m
XF3033/248 (P068)	0°	0.125	20/37	m ≥ 0.05 dB/m
XF3033/249 (P069)	0°	0.173	22/36	m ≥ 0.05 dB/m
XF3033/250 (P070)	0°	0.152	20/38	m ≥ 0.05 dB/m
XF3033/251 (P071)	0°	0.172	20/38	m ≥ 0.05 dB/m
XF3033/252 (P072)	0°	0.131	20/38	m ≥ 0.05 dB/m
XF3033/253 (P073)	0°	0.140	22/36	m ≥ 0.05 dB/m
XF3033/254 (P074)	0°	0.155	20/38	m ≥ 0.05 dB/m
XF3033/255 (P075)	0°	0.158	20/38	m ≥ 0.05 dB/m
XF3033/256 (P076)	0°	0.154	20/38	m ≥ 0.05 dB/m
XF3033/257 (P077)	0°	0.140	19/38	m ≥ 0.05 dB/m
XF3033/258 (P078)	0°	0.160	19/38	m ≥ 0.05 dB/m
XF3033/259 (P079)	0°	0.162	19/38	m ≥ 0.05 dB/m
XF3033/260 (P080)	0°	0.156	19/38	m ≥ 0.05 dB/m
XF3033/261 (P081)	0°	0.159	19/39	m ≥ 0.05 dB/m
XF3033/262 (P082)	0°	0.155	19/39	m ≥ 0.05 dB/m
XF3033/263 (P083)	0°	0.151	19/39	m ≥ 0.05 dB/m
XF3033/264 (P084)	0°	0.160	19/39	m ≥ 0.05 dB/m
XF3033/265 (P085)	0°	0.160	19/40	m ≥ 0.05 dB/m
XF3033/266 (P086)	0°	0.151	19/40	m ≥ 0.05 dB/m

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/267 (P087)	0°	0.156	19/40	m ≥ 0.05 dB/m
XF3033/268 (P088)	0°	0.146	19/40	m ≥ 0.05 dB/m
XF3033/269 (P089)	0°	0.174	19/39	m ≥ 0.05 dB/m
XF3033/270 (P090)	0°	0.168	19/39	m ≥ 0.05 dB/m
XF3033/271 (P091)	0°	0.156	19/39	m ≥ 0.05 dB/m
XF3033/272 (P092)	0°	0.156	22/36	m ≥ 0.05 dB/m
XF3033/273 (P093)	0°	0.183	22/40	m ≥ 0.05 dB/m
XF3033/274 (P094)	0°	0.169	22/36	m ≥ 0.05 dB/m
XF3033/275 (P095)	0°	0.162	21/38	m ≥ 0.05 dB/m
XF3033/276 (P096)	0°	0.140	21/38	m ≥ 0.05 dB/m
XF3033/277 (P097)	0°	0.172	21/37	m ≥ 0.05 dB/m
XF3033/278 (P098)	0°	0.147	21/37	m ≥ 0.05 dB/m
XF3033/279 (P099)	0°	0.170	21/37	m ≥ 0.05 dB/m
XF3033/280 (P100)	0°	0.165	21/37	m ≥ 0.05 dB/m
XF3033/281 (P101)	0°	0.142	21/36	m ≥ 0.05 dB/m
XF3033/282 (P102)	0°	0.160	21/36	m ≥ 0.05 dB/m
XF3033/283 (P103)	0°	0.170	22/36	m ≥ 0.05 dB/m
XF3033/284 (P104)	0°	0.153	21/36	m ≥ 0.05 dB/m
XF3033/285 (P105)	0°	0.172	22/35	m ≥ 0.05 dB/m
XF3033/286 (P106)	0°	0.165	22/35	m ≥ 0.05 dB/m

XF3033/287 (M061) through XF3033/332 (M106)

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/287 (M061)	315°	0.167	23/39	m ≥ 0.05 dB/m
XF3033/288 (M062)	315°	0.161	23/39	m ≥ 0.05 dB/m
XF3033/289 (M063)	315°	0.167	23/39	m ≥ 0.05 dB/m
XF3033/290 (M064)	315°	0.175	23/39	m ≥ 0.05 dB/m
XF3033/291 (M065)	315°	0.158	23/39	m ≥ 0.05 dB/m
XF3033/292 (M066)	315°	0.168	23/39	m ≥ 0.05 dB/m
XF3033/293 (M067)	315°	0.171	23/39	m ≥ 0.05 dB/m
XF3033/294 (M068)	315°	0.178	23/39	m ≥ 0.05 dB/m
XF3033/295 (M069)	315°	0.158	24/38	m ≥ 0.05 dB/m
XF3033/296 (M070)	315°	0.178	24/38	m ≥ 0.05 dB/m
XF3033/297 (M071)	315°	0.172	24/38	m ≥ 0.05 dB/m
XF3033/298 (M072)	315°	0.170	24/38	m ≥ 0.05 dB/m
XF3033/299 (M073)	315°	0.170	23/38	m ≥ 0.05 dB/m
XF3033/300 (M074)	315°	0.162	23/38	m ≥ 0.05 dB/m
XF3033/301 (M075)	315°	0.177	23/38	m ≥ 0.05 dB/m
XF3033/302 (M076)	315°	0.162	23/38	m ≥ 0.05 dB/m
XF3033/303 (M077)	315°	0.164	23/38	m ≥ 0.05 dB/m
XF3033/304 (M078)	315°	0.156	23/38	m ≥ 0.05 dB/m
XF3033/305 (M079)	315°	0.166	23/38	m ≥ 0.05 dB/m
XF3033/306 (M080)	315°	0.169	23/38	m ≥ 0.05 dB/m
XF3033/307 (M081)	315°	0.180	23/38	m ≥ 0.05 dB/m
XF3033/308 (M082)	315°	0.163	23/38	m ≥ 0.05 dB/m
XF3033/309 (M083)	315°	0.191	23/38	m ≥ 0.05 dB/m
XF3033/310 (M084)	315°	0.172	23/38	m ≥ 0.05 dB/m
XF3033/311 (M085)	315°	0.170	24/38	m ≥ 0.05 dB/m
XF3033/312 (M086)	315°	0.158	24/38	m ≥ 0.05 dB/m

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/313 (M087)	315°	0.182	24/38	m ≥ 0.05 dB/m
XF3033/314 (M088)	315°	0.187	24/38	m ≥ 0.05 dB/m
XF3033/315 (M089)	315°	0.189	22/40	m ≥ 0.05 dB/m
XF3033/316 (M090)	315°	0.180	24/38	m ≥ 0.05 dB/m
XF3033/317 (M091)	315°	0.196	24/38	m ≥ 0.05 dB/m
XF3033/318 (M092)	315°	0.166	22/40	m ≥ 0.05 dB/m
XF3033/319 (M093)	315°	0.179	23/38	m ≥ 0.05 dB/m
XF3033/320 (M094)	315°	0.175	23/38	m ≥ 0.05 dB/m
XF3033/321 (M095)	315°	0.182	23/38	m ≥ 0.05 dB/m
XF3033/322 (M096)	315°	0.173	23/38	m ≥ 0.05 dB/m
XF3033/323 (M097)	315°	0.164	23/39	m ≥ 0.05 dB/m
XF3033/324 (M098)	315°	0.167	23/39	m ≥ 0.05 dB/m
XF3033/325 (M099)	315°	0.162	23/39	m ≥ 0.05 dB/m
XF3033/326 (M100)	315°	0.186	23/39	m ≥ 0.05 dB/m
XF3033/327 (M101)	315°	0.166	22/39	m ≥ 0.05 dB/m
XF3033/328 (M102)	315°	0.155	22/39	m ≥ 0.05 dB/m
XF3033/329 (M103)	315°	0.171	22/39	m ≥ 0.05 dB/m
XF3033/330 (M104)	315°	0.171	22/39	m ≥ 0.05 dB/m
XF3033/331 (M105)	315°	0.178	22/40	m ≥ 0.05 dB/m
XF3033/332 (M106)	315°	0.173	22/40	m ≥ 0.05 dB/m

XF3033/333 (P107) through XF3033/356 (P130)

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/333 (P107)	135°	0.092	19/50	m ≥ 0.05 dB/m
XF3033/334 (P108)	135°	0.083	19/50	m ≥ 0.05 dB/m
XF3033/335 (P109)	135°	0.091	18/49	m ≥ 0.05 dB/m
XF3033/336 (P110)	135°	0.071	18/49	m ≥ 0.05 dB/m
XF3033/337 (P111)	135°	Permanent Alarm State	Not tested	m ≥ 0.05 dB/m
XF3033/338 (P112)	135°	0.068	19/51	m ≥ 0.05 dB/m
XF3033/339 (P113)	135°	0.089	19/51	m ≥ 0.05 dB/m
XF3033/340 (P114)	135°	0.088	18/51	m ≥ 0.05 dB/m
XF3033/341 (P115)	135°	0.084	18/51	m ≥ 0.05 dB/m
XF3033/342 (P116)	135°	0.090	19/52	m ≥ 0.05 dB/m
XF3033/343 (P117)	135°	0.085	19/52	m ≥ 0.05 dB/m
XF3033/344 (P118)	135°	0.086	19/52	m ≥ 0.05 dB/m
XF3033/345 (P119)	135°	0.078	19/52	m ≥ 0.05 dB/m
XF3033/346 (P120)	135°	0.077	19/52	m ≥ 0.05 dB/m
XF3033/347 (P121)	135°	0.084	19/52	m ≥ 0.05 dB/m
XF3033/348 (P122)	135°	0.086	19/52	m ≥ 0.05 dB/m
XF3033/349 (P123)	135°	0.086	19/52	m ≥ 0.05 dB/m
XF3033/350 (P124)	135°	0.068	19/52	m ≥ 0.05 dB/m
XF3033/351 (P125)	135°	0.086	19/52	m ≥ 0.05 dB/m
XF3033/352 (P126)	135°	0.090	19/52	m ≥ 0.05 dB/m
XF3033/353 (P127)	135°	0.088	19/52	m ≥ 0.05 dB/m
XF3033/354 (P128)	135°	0.081	19/53	m ≥ 0.05 dB/m
XF3033/355 (P129)	135°	0.085	19/53	m ≥ 0.05 dB/m
XF3033/356 (P130)	135°	0.086	19/53	m ≥ 0.05 dB/m

XF3033/357 (M107) through XF3033/380 (M130)

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/357 (M107)	180°	0.080	24/54	m ≥ 0.05 dB/m
XF3033/358 (M108)	180°	0.103	24/54	m ≥ 0.05 dB/m
XF3033/359 (M109)	180°	0.113	24/54	m ≥ 0.05 dB/m
XF3033/360 (M110)	180°	0.107	24/54	m ≥ 0.05 dB/m
XF3033/361 (M111)	180°	0.090	24/53	m ≥ 0.05 dB/m
XF3033/362 (M112)	180°	0.074	24/53	m ≥ 0.05 dB/m
XF3033/363 (M113)	180°	0.100	24/53	m ≥ 0.05 dB/m
XF3033/364 (M114)	180°	0.088	24/53	m ≥ 0.05 dB/m
XF3033/365 (M115)	180°	0.091	24/51	m ≥ 0.05 dB/m
XF3033/366 (M116)	180°	0.092	24/51	m ≥ 0.05 dB/m
XF3033/367 (M117)	180°	0.093	24/51	m ≥ 0.05 dB/m
XF3033/368 (M118)	180°	0.096	24/51	m ≥ 0.05 dB/m
XF3033/369 (M119)	180°	0.096	24/51	m ≥ 0.05 dB/m
XF3033/370 (M120)	180°	0.078	24/51	m ≥ 0.05 dB/m
XF3033/371 (M121)	180°	0.089	24/51	m ≥ 0.05 dB/m
XF3033/372 (M122)	180°	0.099	24/51	m ≥ 0.05 dB/m
XF3033/373 (M123)	180°	0.130	24/50	m ≥ 0.05 dB/m
XF3033/374 (M124)	180°	0.083	24/50	m ≥ 0.05 dB/m
XF3033/375 (M125)	180°	0.131	24/50	m ≥ 0.05 dB/m
XF3033/376 (M126)	180°	0.092	24/50	m ≥ 0.05 dB/m
XF3033/377 (M127)	180°	0.084	24/49	m ≥ 0.05 dB/m
XF3033/378 (M128)	180°	0.074	24/49	m ≥ 0.05 dB/m
XF3033/379 (M129)	180°	0.092	24/49	m ≥ 0.05 dB/m
XF3033/380 (M130)	180°	0.088	24/49	m ≥ 0.05 dB/m

XF3033/381 (D061) through XF3033/452 (D132)

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/381 (D061)	0°	0.080	22/52	m ≥ 0.05 dB/m
XF3033/382 (D062)	0°	0.072	22/52	m ≥ 0.05 dB/m
XF3033/383 (D063)	0°	0.071	22/52	m ≥ 0.05 dB/m
XF3033/384 (D064)	0°	0.064	22/52	m ≥ 0.05 dB/m
XF3033/385 (D065)	0°	0.083	22/53	m ≥ 0.05 dB/m
XF3033/386 (D066)	0°	0.069	22/53	m ≥ 0.05 dB/m
XF3033/387 (D067)	0°	0.058	22/53	m ≥ 0.05 dB/m
XF3033/388 (D068)	0°	0.059	22/53	m ≥ 0.05 dB/m
XF3033/389 (D069)	0°	0.096	22/53	m ≥ 0.05 dB/m
XF3033/390 (D070)	0°	0.073	22/53	m ≥ 0.05 dB/m
XF3033/391 (D071)	0°	0.071	22/53	m ≥ 0.05 dB/m
XF3033/392 (D072)	0°	0.069	22/53	m ≥ 0.05 dB/m
XF3033/393 (D073)	0°	0.078	22/53	m ≥ 0.05 dB/m
XF3033/394 (D074)	0°	0.074	22/53	m ≥ 0.05 dB/m
XF3033/395 (D075)	0°	0.074	22/53	m ≥ 0.05 dB/m
XF3033/396 (D076)	0°	0.088	22/53	m ≥ 0.05 dB/m
XF3033/397 (D077)	0°	0.096	22/53	m ≥ 0.05 dB/m
XF3033/398 (D078)	0°	0.057	22/53	m ≥ 0.05 dB/m
XF3033/399 (D079)	0°	0.068	22/53	m ≥ 0.05 dB/m
XF3033/400 (D080)	0°	0.070	22/53	m ≥ 0.05 dB/m
XF3033/401 (D081)	0°	0.128	23/52	m ≥ 0.05 dB/m
XF3033/402 (D082)	0°	0.076	23/52	m ≥ 0.05 dB/m
XF3033/403 (D083)	0°	0.089	23/52	m ≥ 0.05 dB/m
XF3033/404 (D084)	0°	0.098	23/52	m ≥ 0.05 dB/m
XF3033/405 (D085)	0°	0.070	23/50	m ≥ 0.05 dB/m
XF3033/406 (D086)	0°	0.059	23/50	m ≥ 0.05 dB/m
XF3033/407 (D087)	0°	0.079	23/50	m ≥ 0.05 dB/m

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/408 (D088)	0°	0.096	23/50	m ≥ 0.05 dB/m
XF3033/409 (D089)	0°	0.071	23/49	m ≥ 0.05 dB/m
XF3033/410 (D090)	0°	0.078	23/49	m ≥ 0.05 dB/m
XF3033/411 (D091)	0°	0.095	23/49	m ≥ 0.05 dB/m
XF3033/412 (D092)	0°	0.070	23/49	m ≥ 0.05 dB/m
XF3033/413 (D093)	0°	0.089	23/49	m ≥ 0.05 dB/m
XF3033/414 (D094)	0°	0.068	23/49	m ≥ 0.05 dB/m
XF3033/415 (D095)	0°	0.072	23/49	m ≥ 0.05 dB/m
XF3033/416 (D096)	0°	0.089	23/49	m ≥ 0.05 dB/m
XF3033/417 (D097)	0°	0.084	23/48	m ≥ 0.05 dB/m
XF3033/418 (D098)	0°	0.066	23/48	m ≥ 0.05 dB/m
XF3033/419 (D099)	0°	0.061	23/48	m ≥ 0.05 dB/m
XF3033/420 (D100)	0°	0.078	23/48	m ≥ 0.05 dB/m
XF3033/421 (D101)	0°	0.084	23/44	m ≥ 0.05 dB/m
XF3033/422 (D102)	0°	0.080	23/44	m ≥ 0.05 dB/m
XF3033/423 (D103)	0°	0.075	23/44	m ≥ 0.05 dB/m
XF3033/424 (D104)	0°	0.078	23/44	m ≥ 0.05 dB/m
XF3033/425 (D105)	0°	0.088	22/45	m ≥ 0.05 dB/m
XF3033/426 (D106)	0°	0.061	22/45	m ≥ 0.05 dB/m
XF3033/427 (D107)	0°	0.096	22/45	m ≥ 0.05 dB/m
XF3033/428 (D108)	0°	0.092	22/45	m ≥ 0.05 dB/m
XF3033/429 (D109)	0°	0.081	22/44	m ≥ 0.05 dB/m
XF3033/430 (D110)	0°	0.069	22/44	m ≥ 0.05 dB/m
XF3033/431 (D111)	0°	0.062	22/44	m ≥ 0.05 dB/m
XF3033/432 (D112)	0°	0.064	22/44	m ≥ 0.05 dB/m
XF3033/433 (D113)	0°	0.058	22/45	m ≥ 0.05 dB/m
XF3033/434 (D114)	0°	0.064	22/45	m ≥ 0.05 dB/m
XF3033/435 (D115)	0°	0.071	22/45	m ≥ 0.05 dB/m

Sample	Orientation	Response Threshold Value (dB/m)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/436 (D116)	0°	0.073	22/45	m ≥ 0.05 dB/m
XF3033/437 (D117)	0°	0.066	22/44	m ≥ 0.05 dB/m
XF3033/438 (D118)	0°	0.096	22/44	m ≥ 0.05 dB/m
XF3033/439 (D119)	0°	0.076	22/44	m ≥ 0.05 dB/m
XF3033/440 (D120)	0°	0.057	22/44	m ≥ 0.05 dB/m
XF3033/441 (D121)	0°	0.102	22/44	m ≥ 0.05 dB/m
XF3033/442 (D122)	0°	0.074	22/44	m ≥ 0.05 dB/m
XF3033/443 (D123)	0°	0.080	22/44	m ≥ 0.05 dB/m
XF3033/444 (D124)	0°	0.087	22/44	m ≥ 0.05 dB/m
XF3033/445 (D125)	0°	0.071	22/43	m ≥ 0.05 dB/m
XF3033/446 (D126)	0°	0.062	22/43	m ≥ 0.05 dB/m
XF3033/447 (D127)	0°	0.074	22/43	m ≥ 0.05 dB/m
XF3033/448 (D128)	0°	0.073	22/43	m ≥ 0.05 dB/m
XF3033/449 (D129)	0°	0.070	22/42	m ≥ 0.05 dB/m
XF3033/450 (D130)	0°	0.068	22/42	m ≥ 0.05 dB/m
XF3033/451 (D131)	0°	0.086	22/42	m ≥ 0.05 dB/m
XF3033/452 (D132)	0°	0.083	22/42	m ≥ 0.05 dB/m

XF3033/453 (I061) through XF3033/524 (I132)

Sample	Orientation	Response Threshold Value (MIC y)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/453 (I061)	0°	0.85	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/454 (I062)	0°	0.70	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/455 (I063)	0°	0.79	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/456 (I064)	0°	0.74	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/457 (I065)	0°	0.80	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/458 (I066)	0°	0.71	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/459 (I067)	0°	0.85	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/460 (I068)	0°	0.71	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/461 (I069)	0°	0.84	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/462 (I070)	0°	0.70	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/463 (I071)	0°	0.78	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/464 (I072)	0°	0.82	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/465 (I073)	0°	0.76	21/39	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/466 (I074)	0°	0.78	21/39	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/467 (I075)	0°	0.90	21/39	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/468 (I076)	0°	0.75	21/39	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/469 (I077)	0°	0.86	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/470 (I078)	0°	0.68	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/471 (I079)	0°	0.72	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/472 (I080)	0°	0.78	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/473 (I081)	0°	0.72	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/474 (I082)	0°	0.72	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/475 (I083)	0°	0.73	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/476 (I084)	0°	0.75	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/477 (I085)	0°	0.74	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/478 (I086)	0°	0.74	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/479 (I087)	0°	0.71	23/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$

Sample	Orientation	Response Threshold Value (MIC y)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/480 (I088)	0°	0.74	23/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/481 (I089)	0°	0.75	23/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/482 (I090)	0°	0.78	23/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/483 (I091)	0°	0.95	23/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/484 (I092)	0°	0.83	23/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/485 (I093)	0°	0.75	23/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/486 (I094)	0°	0.80	23/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/487 (I095)	0°	0.69	23/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/488 (I096)	0°	0.68	23/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/489 (I097)	0°	0.69	22/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/490 (I098)	0°	0.71	22/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/491 (I099)	0°	0.78	22/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/492 (I100)	0°	0.72	22/39	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/493 (I101)	0°	0.72	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/494 (I102)	0°	0.68	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/495 (I103)	0°	0.85	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/496 (I104)	0°	0.65	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/497 (I105)	0°	0.85	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/498 (I106)	0°	0.72	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/499 (I107)	0°	0.71	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/500 (I108)	0°	0.79	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/501 (I109)	0°	0.71	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/502 (I110)	0°	0.71	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/503 (I111)	0°	0.78	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/504 (I112)	0°	0.87	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/505 (I113)	0°	0.75	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/506 (I114)	0°	0.78	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*
XF3033/507 (I115)	0°	0.74	22/40	*0.05* ≤ Δy/Δt ≤ *0.3*

Sample	Orientation	Response Threshold Value (MIC y)	Ambient Air Temperature (°C) & Relative Humidity (%RH)	Requirement
XF3033/508 (I116)	0°	0.74	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/509 (I117)	0°	0.85	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/510 (I118)	0°	0.77	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/511 (I119)	0°	0.85	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/512 (I120)	0°	0.77	22/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/513 (I121)	0°	0.84	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/514 (I122)	0°	0.75	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/515 (I123)	0°	0.71	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/516 (I124)	0°	0.71	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/517 (I125)	0°	0.68	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/518 (I126)	0°	0.78	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/519 (I127)	0°	0.69	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/520 (I128)	0°	0.81	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/521 (I129)	0°	0.76	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/522 (I130)	0°	0.76	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/523 (I131)	0°	0.87	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$
XF3033/524 (I132)	0°	0.67	21/40	$0.05 \leq \Delta y/\Delta t \leq 0.3$

4 REFERENCE INFORMATION

The following information is provided to assist in the interpreting of the results detailed in this report.

4.1 Obscuration vs. Ionisation data

The data shown in Figure 3 demonstrates the relationship between smoke density measured by the reference IR obscurometer (measured in dB/m) and by the reference measuring ionisation chamber (MIC, measured in terms of “MIC y”). Refer to Section C2 of AS 3786:2014 for details of the MIC and its response values.

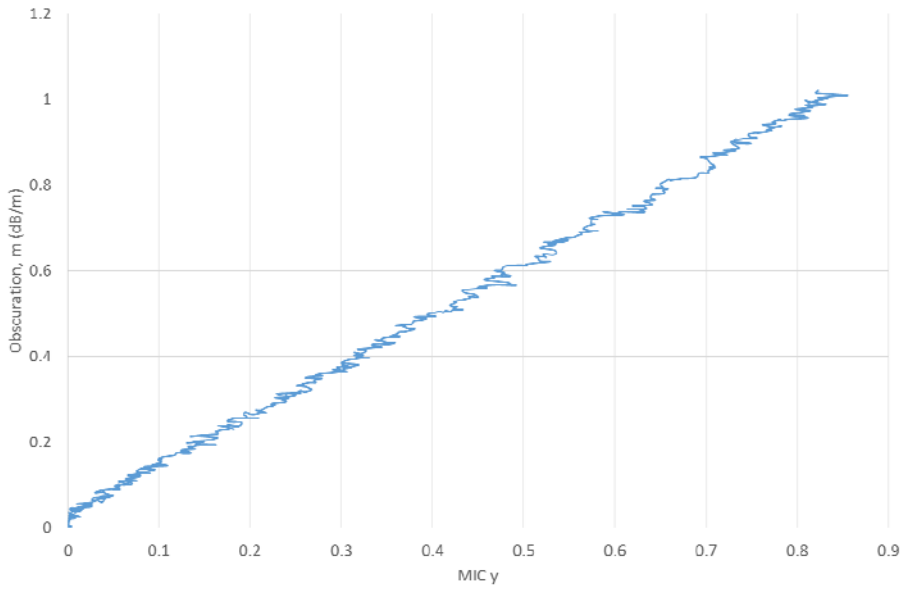

Figure 3. Typical response values of the reference obscurometer and MIC, as fitted to the CSIRO AS 3786 / AS 7240.7 test tunnel, to aspirated paraffin during tunnel sensitivity tests of smoke alarms and detectors.

4.2 Obscuration units

The data shown in Figure 4 and Figure 5 demonstrates the relationship between smoke density calculated in terms of the units of dB/m and %obscuration/m.

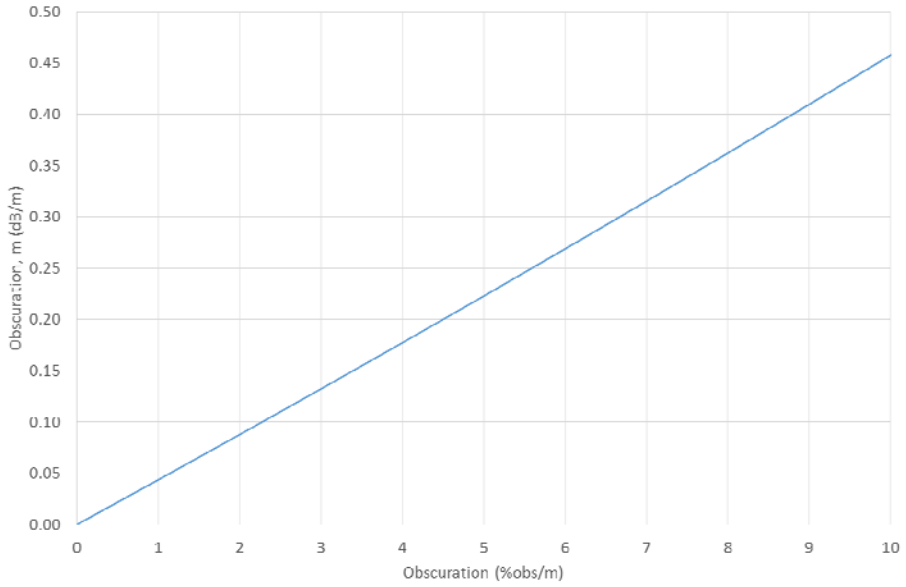

Figure 4. Relationship between smoke density as measured in dB/m and %obs/m to 10 %obs/m.

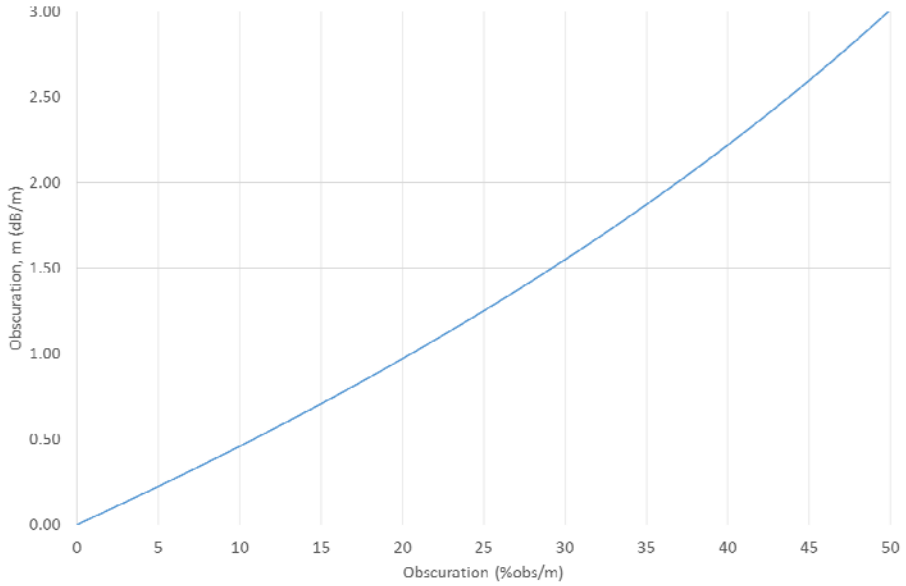

Figure 5. Relationship between smoke density as measured in dB/m and %obs/m to 50 %obs/m.