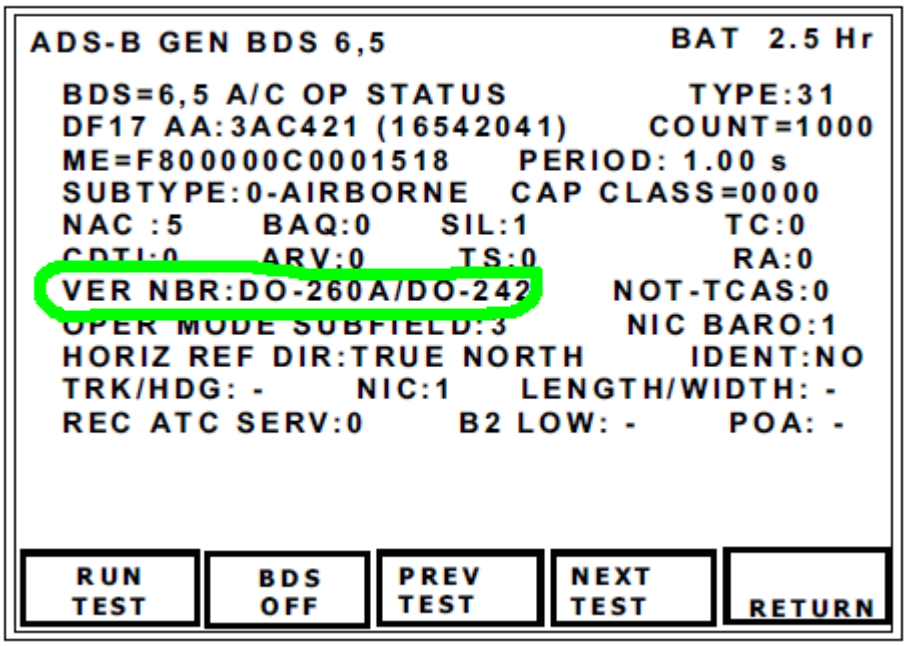
Validation of ADS-B installations (v2)

The following provides some general guidance for installers when checking ADS-B installations with a transponder ramp test set.[1] The IFR6000 is used as an example. Colour coding is used to indicate the relevant IFR6000 screen element.

NB: The aircraft GPS needs a clear view of the sky/ GPS constellation to be able to generate good HPL/NUC/NIC. So make sure this is the case before you test. Normally the results inside a hangar will not be acceptable.

Before you start you need to ensure that you know whether the transponder is DO260 (TSO166), DO260A (TSO166A) or DO260B (TSO166B) standard. The version number is available in BDS 6.5 “A/C OP status”.

ADS-B GEN BDS 6,5



ADS-B GEN BDS 6,5 Screen

[1] This is general guidance only. Installers must satisfy themselves that the installation is complaint with all appropriate standards, regulations etc

Flight ID :
Flight ID is normally set by the crew using an entry panel or FMS interface
The crew must set the Flight ID to match EXACTLY the flight plan field 7 – “Callsign”

For domestic flight legs using registration as callsign this is without the VH. If the flight plan does not include VH, then the flight id entry should not include VH

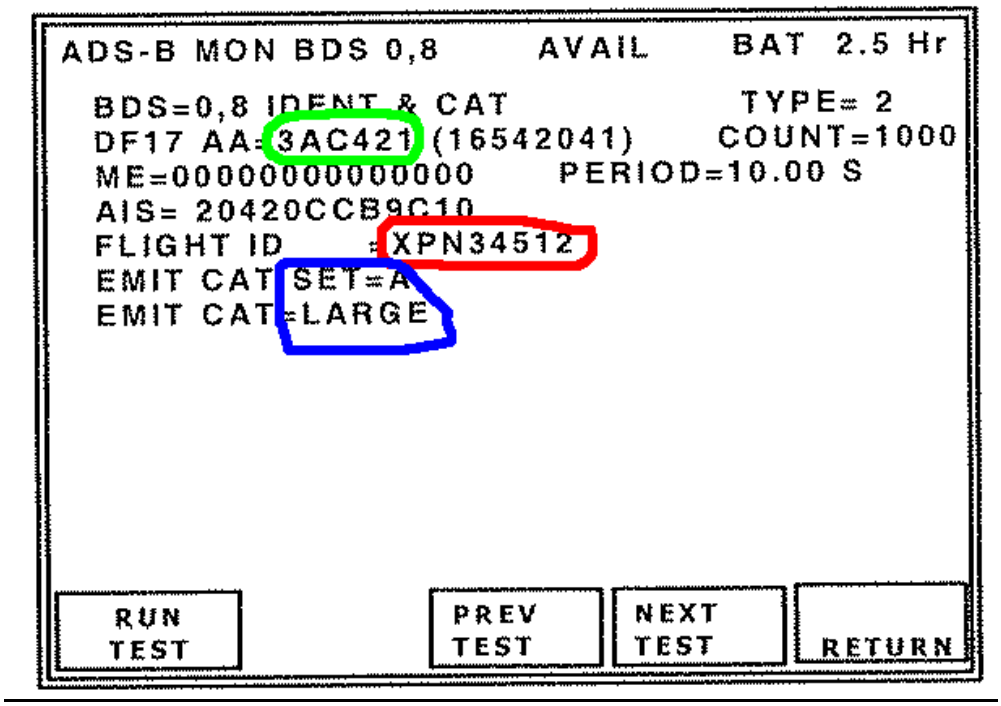
For some avionics, the flight ID can be pre-programmed, to the registration. The same rules apply. If the aircraft operates domestic flight legs only, it should not include the “VH”

Be very careful with the Garmin GTX33 and GTX330. An installation page allows you to put in the 24 bit code and the transponder purports to calculate the registration Flight ID. This does NOT work for Australian registered aircraft and can result in the incorrect transmission of “N” as the Flight ID.

DO NOT enter the 24 bit aircraft address into the Flight ID field.

24 bit aircraft address : Check 24 bit aircraft address as allocated by CASA

Emitter category : Check emitter category set and type are appropriate for the aircraft.



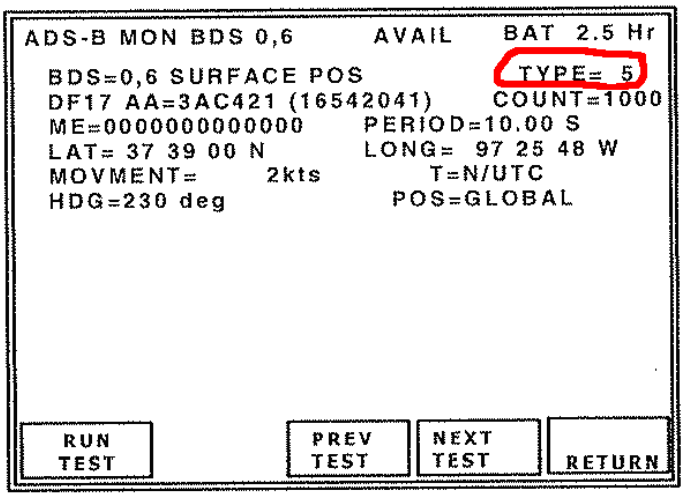
Integrity (NUC) =➔ Examine the "Type code" for DO260

For DO260 capable transponders only
It is important that the NUC be non zero (airborne) or not 8 (surface)

If the aircraft is transmitting **SURFACE** squits (eg: squat switch is active) then the type code needs to be 5,6 or 7

Type code	Rc	NUC	
5	<7.5m	9	
6	<25m	8	
7	<185.2m	7	
8	>185.2m	6	**Not useable – indicates no integrity**

SA ON GPS units sometimes generate HPL>185 metres and hence a surface squitter with NUC=6 can be transmitted even for "good" installations. For an installer, it is best to check airborne squitters first.



ADS-B MON BDS 0,6 Screen

If the aircraft is transmitting AIRBORNE squits then the type code needs to be 9-14

Note 1 : Just because a good NUC is transmitted, does not mean that the system is acceptable. The GPS and transponder must work properly together.

The integrity value transmitted by the aircraft must be truthful. For example, it would be dangerous for the transponder to transmit a fixed "good" NUC value because it would then not be advising the receiver/user of the radius of containment value (Rc).

It is important that the transmitted NUC truly represents the containment radius as calculated by the GPS receiver and output to the transponder as HPL (typically label 130). HPL is calculated by the GPS receiver based on which GPS satellites it is receiving and the assumed satellite geometry (as downlinked to the GPS receiver ephemeris). It does not depend on actual measurements of the received satellites.

Aircraft in the same position should calculate almost the same HPL value when exposed to the same satellite constellation. There are some differences depending on the algorithm assumptions used by the particular GPS receiver (eg SA on, default position noise etc).

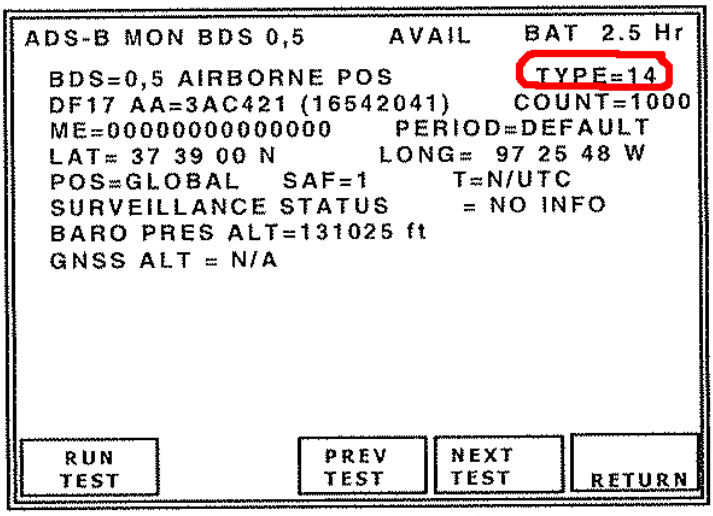
Note 2 : Aircraft with a clear view of the sky should be generating HPL values below 0.2 nautical miles a very large percentage of the time. Therefore we normally expect to see NUC=8,7,6. Airservices sees that nearly all aircraft output NUC=5 to 8 all the time. A NUC=4 only occurs very rarely when there is a GPS constellation issue.

If you are seeing NUC=4 or 3 then something is probably wrong because real HPLs do not get this low.

Some transponders limit the transmitted NUC to 5. Some transponders incorrectly transmit NUC one value lower than they should.

Type code	Rc	NUC	Useable by ATC	Airservices observed frequency of type code (as expected)
9	<7.5m	9	Yes	Rare
10	<25m	8		Common
11	<185.2m	7		Common
12	<0.2 nm	6		Common
13	<0.5 nm	5		Less common
14	<1.0 nm	4		Infrequent
15	<2.0 nm	3	No	Unlikely
16	<10 nm	2		
17	<20 nm	1		
18	> 20 nm	0	**Not useable – indicates no integrity**	

A "good" installation needs to transmit a NUC of at least 5, 6 or 7. (A lower NUC value for any period indicates something is wrong)



ADS-B MON BDS 0,5 Screen

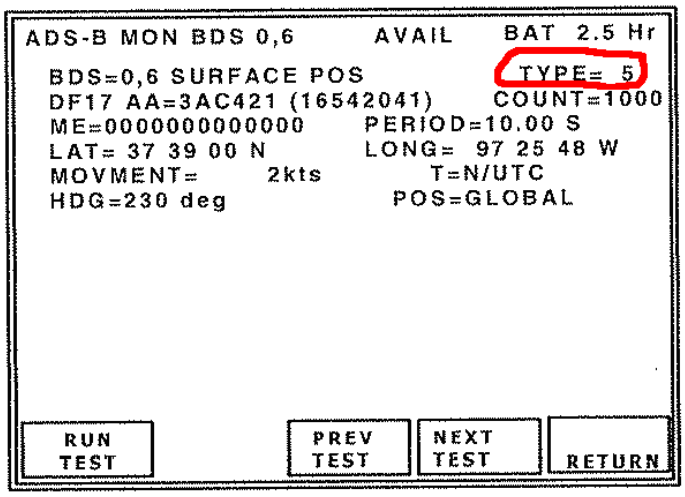
Integrity (NIC) =➔ Examine the "Type code" for DO260A & DO260B

For DO260A or DO260B capable transponders only

It is important that NIC be non zero

If the aircraft is transmitting SURFACE squits (eg: squat switch is active) then the type code needs to be 5,6 or 7

Type code	HPL	NIC	
5	<7.5m	11	
6	<25m	10	
7	<185.2m	9 or 8	
8	>185.2m	0	**Not useable – indicates no integrity**



ADS-B MON BDS 0,6 Screen

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If the aircraft is transmitting AIRBORNE squits then the type code needs to be 9-15

Note 1 : Just because a good NIC is transmitted, does not mean that the system is acceptable. The GPS and transponder must work properly together.

The integrity value transmitted by the aircraft must be truthful. For example, it would be dangerous for the transponder to transmit a fixed "good" NIC value because it would then not be advising the receiver/user of the radius of containment value (Rc).

It is important that the transmitted NIC truly represents the containment radius as calculated by the GPS receiver and output to the transponder as HPL (typically label 130). HPL is calculated by the GPS receiver based on which GPS satellites it is receiving and the assumed satellite geometry (as downlinked to the GPS receiver ephemeris). It does not depend on actual measurements of the received satellites.

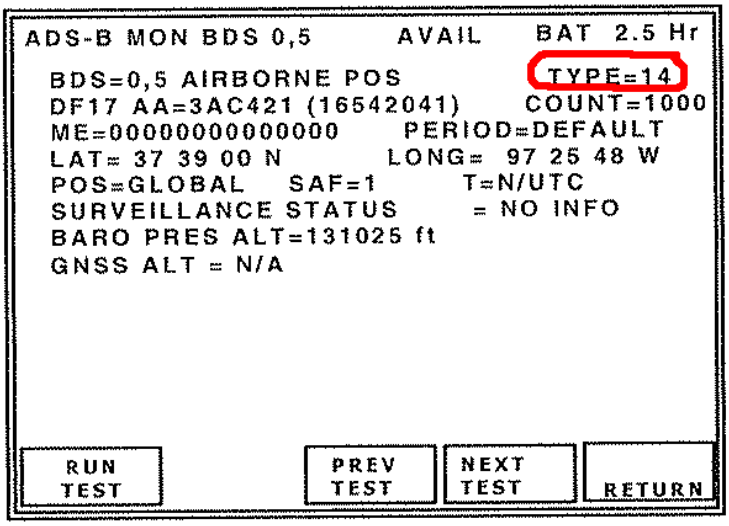
Aircraft in the same position should calculate almost the same HPL value when exposed to the same satellite constellation. There are some differences depending on the algorithm assumptions used by the particular GPS receiver (eg SA on, default position noise etc).

Note 2 : Aircraft with a clear view of the sky should be generating HPL values below 0.2 nautical miles a very large percentage of the time. Therefore we normally expect to see NIC=7,8,9. Airservices sees that nearly all aircraft output NIC=6,7,8, 9 all the time. A NIC=5, 4 only occurs very rarely when there is a GPS constellation issue.

If you are seeing NIC= 5 or 4 then something is probably wrong because real HPLs do not get this low often.

Type code	Rc	NIC	Useable by ATC	Airservices observed frequency of type code (as expected)
9	<7.5m	11	Yes	Rare
10	<25m	10		Common
11	<185.2m	9 or 8		Common
12	<0.2 nm	7		Common
13	<0.5 nm	6		Less common
14	<1.0 nm	5		Infrequent
15	<2.0 nm	4		Unlikely
16	<10 nm	3 or 2	No	
17	<20 nm	1		
18	> 20 nm	0	**Not useable – indicates no integrity**	

A "good" installation needs to transmit a NIC of at least 6, 7 or 8. A lower NIC for any period indicates something is wrong.

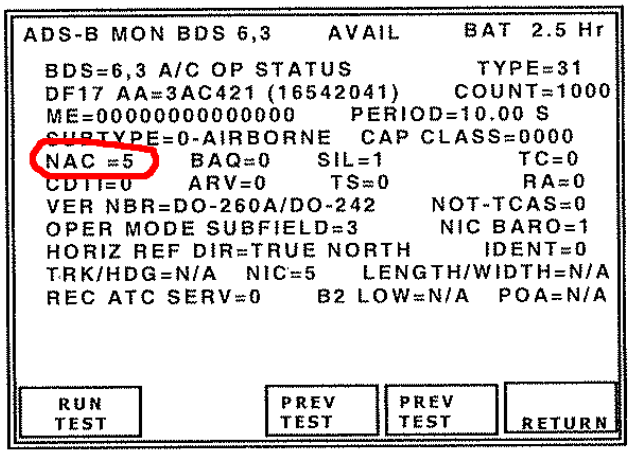


ADS-B MON BDS 0,5 Screen

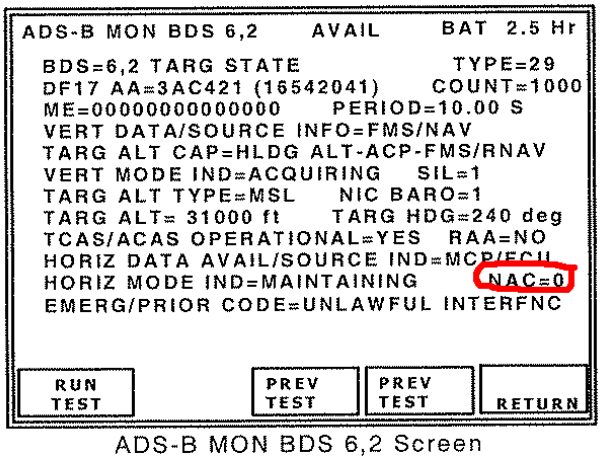
Accuracy (NAC) – DO260A/B - Examine the "NAC" value (no equivalent for DO260)

It is important that NAC be non zero. NAC is reported in Type 31 and Type 29 messages
The aircraft HFOM needs to be 5-11

HFOM	NAC	
<3m	11	
<10m	10	
<30m	9	
<.05 nm	8	
<0.1 nm	7	
<0.3 nm	6	
<0.5 nm	5	
<1.0 nm	4	**Not used by ATC**
<2.0 nm	3	**Not used by ATC**
<4 nm	2	**Not used by ATC**
<10 nm	1	**Not used by ATC**
> 20 nm	0	**Not useable – indicates no accuracy**



ADS-B MON BDS 6,3 Screen

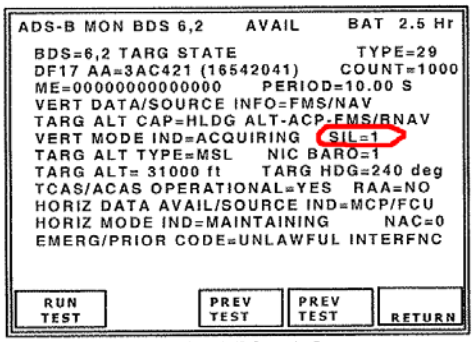


ADS-B MON BDS 6,2 Screen

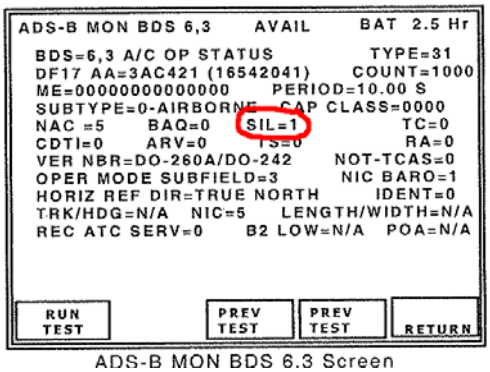
Integrity (SIL) – DO260A/B - Examine the "SIL" value (no equivalent for DO260)

It is important that SIL be value 2 or 3 if using a GPS with HPL calculation & FDE. SIL should only be set to value 2 or 3 if the GPS is an approved position source for ADS-B. SIL is reported in Type 31 and Type 29 messages

SIL	
0	No integrity
1	**Inadequate integrity**
2	Acceptable integrity
3	Acceptable integrity



ADS-B MON BDS 6,2 Screen



ADS-B MON BDS 6.3 Screen