PBCS Monitoring in NZZO

ICAO Africa and Latin America Regional Offices
Operational Data Link Seminar
8-11 August 2016
Accra, Ghana

PBCS - Post Implementation Monitoring

- **States participate in planning and implementation regional groups (PIRGs), and most use a regional monitoring agency to facilitate monitoring activities within their respective region.**
- **Individual states/ANSPs will need to provide the data and information and analysis that will portray regional performance measures.**
- **All stakeholders, ANSPs, operators, CSPs, airframe manufacturers need to actively participate in reporting and resolving problems .**

PBCS - Post Implementation Monitoring

- **Monitoring of data link performance in terms of RCP and RSP is an important part of the performance based system described in the ICAO global plan.**
- **To successfully achieve this performance monitoring on a global scale requires the use of a common data set.**
- **It is only through this common data set that RCP and RSP data can be aggregated from the individual ANSP level through to a regional level and then to a global level.**
- **This aggregation of performance data is in accordance with the guidelines provided in ICAO Doc 9883 Manual on Global Performance of the Air Navigation System**

PBCS - Post Implementation Monitoring

- **Individual ANSP will develop the data collection mechanisms, monitoring tools, and internal reporting requirements best suiting their own environment.**
- **All ANSP should collect and maintain a database of FANS1/A performance data using the data formats specified in PBCS Manual/GOLD Appendix D.**
- **These databases will provide the means to aggregate measures of ADS-C Required Surveillance Performance (RSP) and CPDLC Required Communication Performance (RCP) on a regional and global basis.**

ADS-C and CPDLC Data Points - .csv files

- **Comma separated value .csv files are used for data transfer**
- **File formats for both CPDLC RCP and ADS-C RSP**

ATSP,REGNO,ACTYPE,OPER,DATE,RGS,TYP,LAT,LONG,STIME,RTIME,DEL,COMTYP

KZAK	00345S	K35T	RCH	20121231	XXC	ADS	+14.2643737792969	+146.989002227783	23:59:48	00:00:04	16	SAT
KZAK	N381HA	A332	HAL	20121231	XXC	ADS	+27.6469230651855	-148.428039550781	23:59:59	00:00:14	15	SAT
KZAK	JA651J	B763	JAL	20130101	POR1	ADS	+55.1788330078125	-150.718002319336	00:00:11	00:00:23	12	SAT
KZAK	HL7554	A333	KAL	20130101	XXC	ADS	+26.7551422119141	+173.23070526123	00:00:14	00:00:32	18	SAT
KZAK	B6051	A346	CES	20130101	POR1	ADS	+53.3720970153809	-151.035919189453	00:00:48	00:01:03	15	SAT
KZAK	N853FD	B77L	FDX	20130101	AME1	ADS	+41.0397720336914	-141.536350250244	00:01:06	00:01:13	7	SAT
KZAK	N581HA	B763	HAL	20130101	IG1	ADS	+24.8431777954102	-153.609294891357	00:01:04	00:01:14	10	SAT
KZAK	N194DN	B763	DAL	20130101	POR1	ADS	+24.6246528625488	-168.518085479736	00:01:00	00:01:15	15	SAT
KZAK	N210UA	B772	UAL	20130101	HNL	ADS	+21.1150360107422	-157.826499938965	00:01:14	00:01:20	7	VHF
KZAK	N861NW	A332	DAL	20130101	XXC	ADS	+50.7877349853516	-145.053005218506	00:00:50	00:01:42	52	SAT
KZAK	JA822J	B788	JAL	20130101	POR1	ADS	+50.5645751953125	-144.649600982666	00:01:24	00:01:44	20	SAT
KZAK	9VSKI	A388	SIA	20130101	ACV	ADS	+42.0148086547852	-127.3952293396	00:02:13	00:02:18	5	VHF
KZAK	CFITW	B77W	ACA	20130101	XXC	ADS	+53.0013084411621	-149.994792938232	00:02:27	00:02:35	8	SAT
KZAK	B16703	B77W	EVA	20130101	XXC	ADS	+41.9997024536133	-139.995002746582	00:02:29	00:02:43	14	SAT
KZAK	JA609J	B763	JAL	20130101	POR1	ADS	+25.0821304321289	-175.780220031738	00:02:34	00:02:47	13	SAT
KZAK	HL7613	A388	KAL	20130101	AKN	ADS	+55.9580039978027	-153.797092437744	00:02:55	00:02:59	4	VHF
KZAK	JA605J	B763	JAL	20130101	POR1	ADS	+23.704891204834	-165.335483551025	00:03:08	00:03:20	12	SAT
KZAK	80102S	K35R	SOO	20130101	XXC	ADS	+15.7878684997559	+152.455730438232	00:04:09	00:04:26	17	SAT
KZAK	N581HA	B763	HAL	20130101	IG1	ADS	+24.6200180053711	-153.882751464844	00:04:08	00:04:32	24	SAT
KZAK	N77066	B764	UAL	20130101	MRYV	ADS	+36.6677284240723	-123.406162261963	00:04:45	00:04:49	4	VHF
KZAK	N589HA	B763	HAL	20130101	IG1	ADS	+23.0723190307617	+173.536605834961	00:04:40	00:04:57	17	SAT
KZAK	9MMRG	B772	MAS	20130101	SJC	ADS	+38.9527130126953	-122.769641876221	00:04:58	00:05:01	3	VHF
KZAK	BKPK	B77W	CPA	20130101	XXC	ADS	+48.0837249755859	-167.404346466064	00:04:47	00:05:04	17	SAT

Continuous Performance Improvement

- **Monitoring shows that the FANS1/A system is capable of meeting the RCP240 and RSP180 requirements.**
- **However, not all aircraft meet the requirements.**
- **For those aircraft not meeting the requirements the aim is to improve their performance by:**
  - **Identifying the performance problems by monitoring.**
  - **Reporting performance problems through a Central Reporting Agency that has buy in from all stakeholders.**
  - **Resolving the identified performance problems.**
  - **Providing feedback to stakeholders.**
- **Promote a culture of continuous performance improvement among all stakeholders**

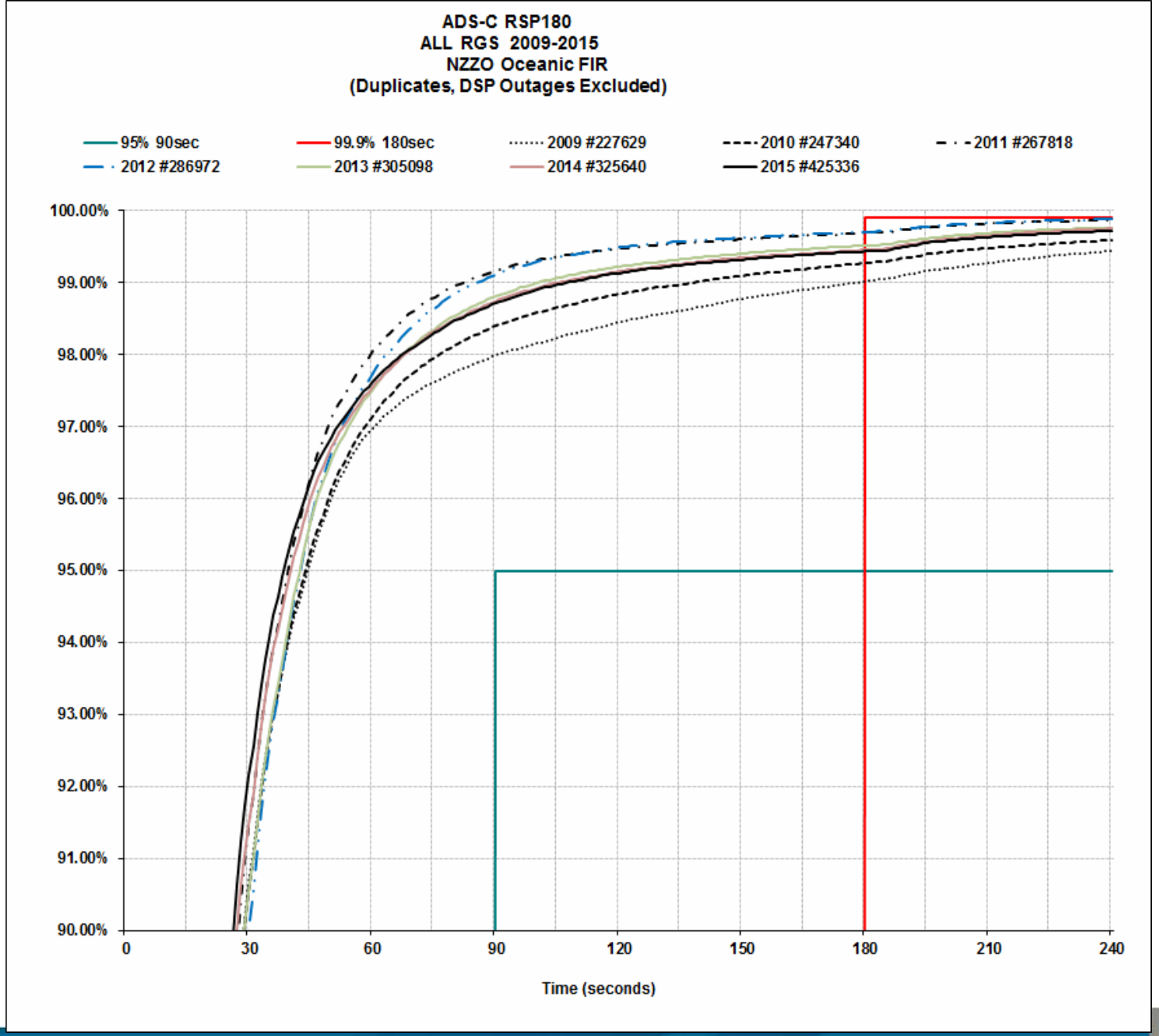
Monitoring methods

- **Requires automation to extract required data from the ground ATM system and create the .csv files required for analysis.**
- **Various methods are employed by ANSP to analyze the PBCS data . These range from:**
  - **Manual excel spreadsheet based analysis.**
  - **Analysis tools :**
    - **FAA GPAT tool.**
    - **Airways NZ on-line analysis application.**
  - **System automation.**

Current NZZO Monitoring
ADS-C Performance - RSP180

ADS-C Downlink Analysis - NZZO															
Media		2013			2014			2015			Jan-16			Feb-16		
		#	%	RSP180	#	%	RSP180	#	%	RSP180	#	%	RSP180	#	%	RSP180
I3	POR1	122126	40.03	99.40	111474	34.23	99.41	124733	29.32	99.46	11781	26.79	99.37	12055	27.42	99.29
	XXP/H	33662	11.03	99.64	48962	15.04	99.47	61425	14.44	99.38	5460	12.41	99.86	7056	16.05	99.60
	Total	155788	51.06	99.47	160902	49.41	99.42	186117	43.76	99.42	17241	39.20	99.62	19111	43.47	99.40
I4	APK1	13954	4.57	98.97	49161	15.10	99.29	73661	17.32	99.12	7258	16.50	98.86	7167	16.30	99.04
	AME1	1254	0.41	99.76	4330	1.33	99.84	6821	1.60	99.90	1320	3.00	99.62	1203	2.74	99.50
	XXA	6617	2.17	99.46	14145	4.34	99.55	20599	4.84	99.70	2043	4.65	99.90	2136	4.86	99.58
	Total	21825	7.15	99.17	67636	20.77	99.38	101081	23.76	99.29	10621	24.15	99.15	10506	23.90	99.20
SBB								466	0.11	99.57	151	0.34	100.00	156	0.36	98.73
MTSAT		33668	11.03	99.91	32665	10.03	99.79	51253	12.05	99.78	6860	15.60	99.68	5607	12.76	99.73
Iridium		2614	0.85	96.56	2889	0.89	95.47	3604	0.85	97.84	484	1.10	98.55	321	0.73	99.07
HFDL		2655	0.87	95.25	3730	1.15	94.02	5715	1.34	94.61	467	1.06	91.22	485	1.10	97.73
VHF		57096	18.71	99.91	59096	18.14	99.90	77059	18.13	99.87	8159	18.55	99.75	7773	17.68	99.67
ALL RGS		305098	100.00	99.52	325640	100.00	99.45	425336	100.00	99.44	43983	100.00	99.38	43959	100.00	99.42

- **No significant changes to overall performance in 2015**
- **Gradual transition from Inmarsat I3 to I4 continues**
- **Satellite performance generally good - but:**
  - **I4 APK1 – 99.12% at 180” is lower than expected. Further analysis later.**
  - **Iridium – 98.55% below 99.0% at 180” . Further analysis later**
- **HFDL – 94.61% at 180” is below standard. Further analysis later.**
- **In 2015 we recorded 425336 downlinks an 85% increase from 2009 when PBCS analysis started.**



ADS-C performance in NZZO FIR

Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	**RGS**	**Aircraft Type**	**Operating Company**	**Message Count**	**RSP <= 90 sec**	**RSP <= 180 sec**
RSP180 All Media 2015						
SATCOM I3	All	All	All	186084	98.84	99.42
SATCOM I4	All	All	All	101072	98.41	99.29
SATCOM SBB	All	All	All	466	98.28	99.57
SATCOM MTSAT	All	All	All	51252	99.19	99.78
SATCOM Iridium	All	All	All	3604	92.62	97.84
VHF All	All	All	All	77142	99.71	99.87
HF All	All	All	All	5697	86.01	94.63
All	All	All	All	425317	98.71	99.44

PBCS Certification

ADS-C performance in NZZO FIR

Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 ANZ B772 SATCOM 2015						
SATCOM I4	APK1	B772	ANZ	114	96.49	99.12
SATCOM I4	AME1	B772	ANZ	2853	99.68	99.89
SATCOM MTSAT	MTS1	B772	ANZ	41363	99.49	99.81

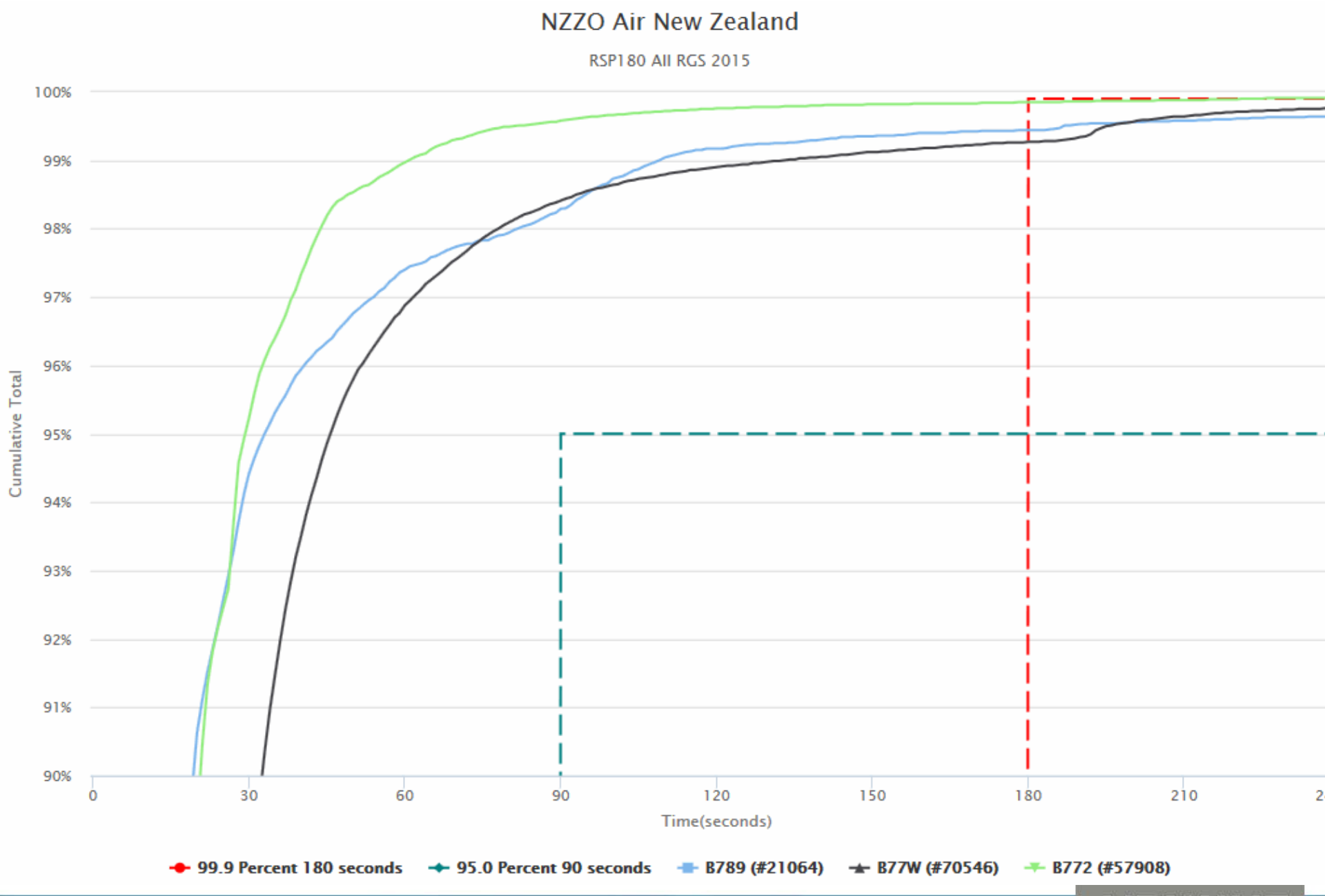
ADS-C performance in NZZO FIR

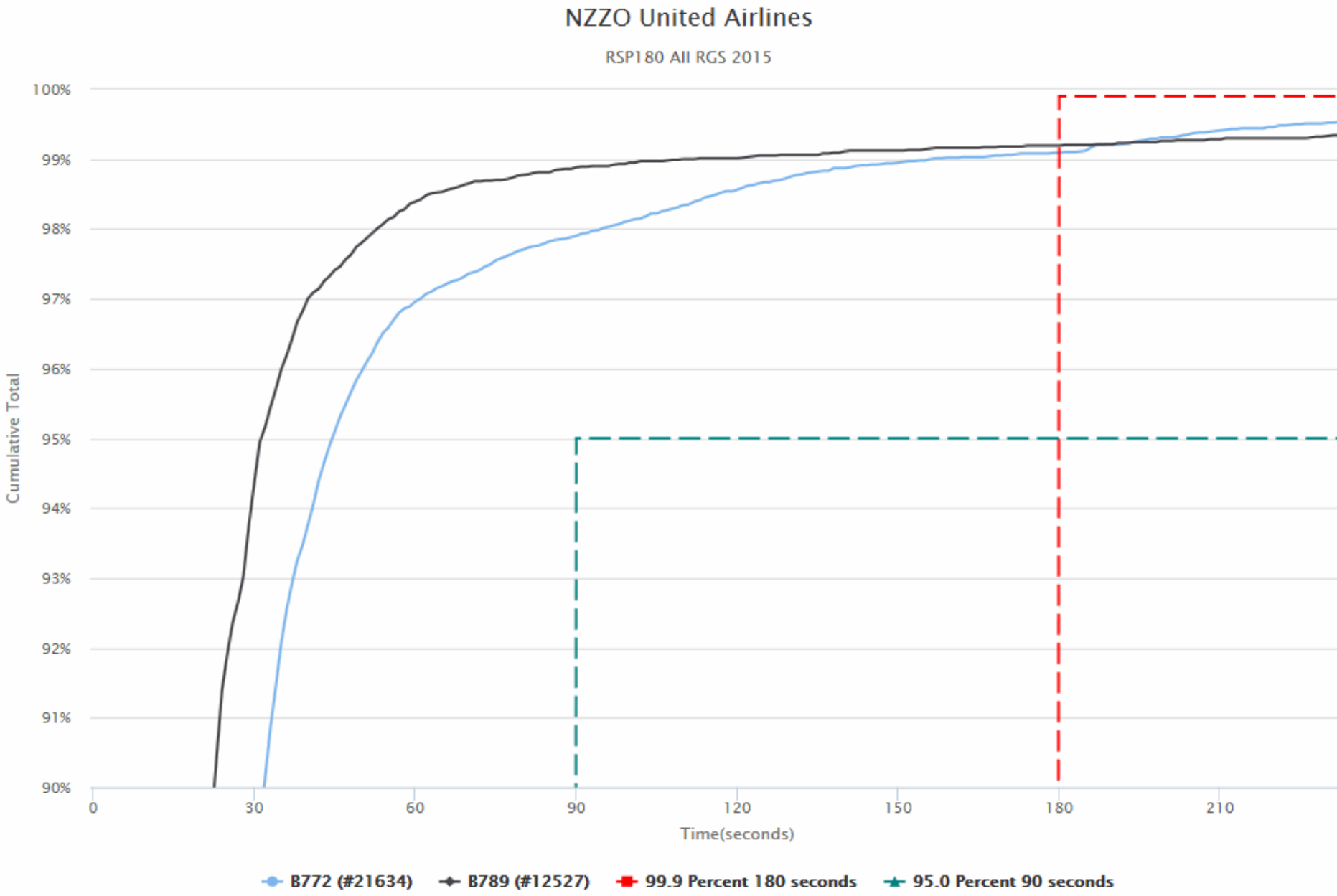
Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 ANZ B77W SATCOM 2015						
SATCOM I4	AME1	B77W	ANZ	3528	99.40	99.94
SATCOM I4	APK1	B77W	ANZ	58968	98.18	99.14

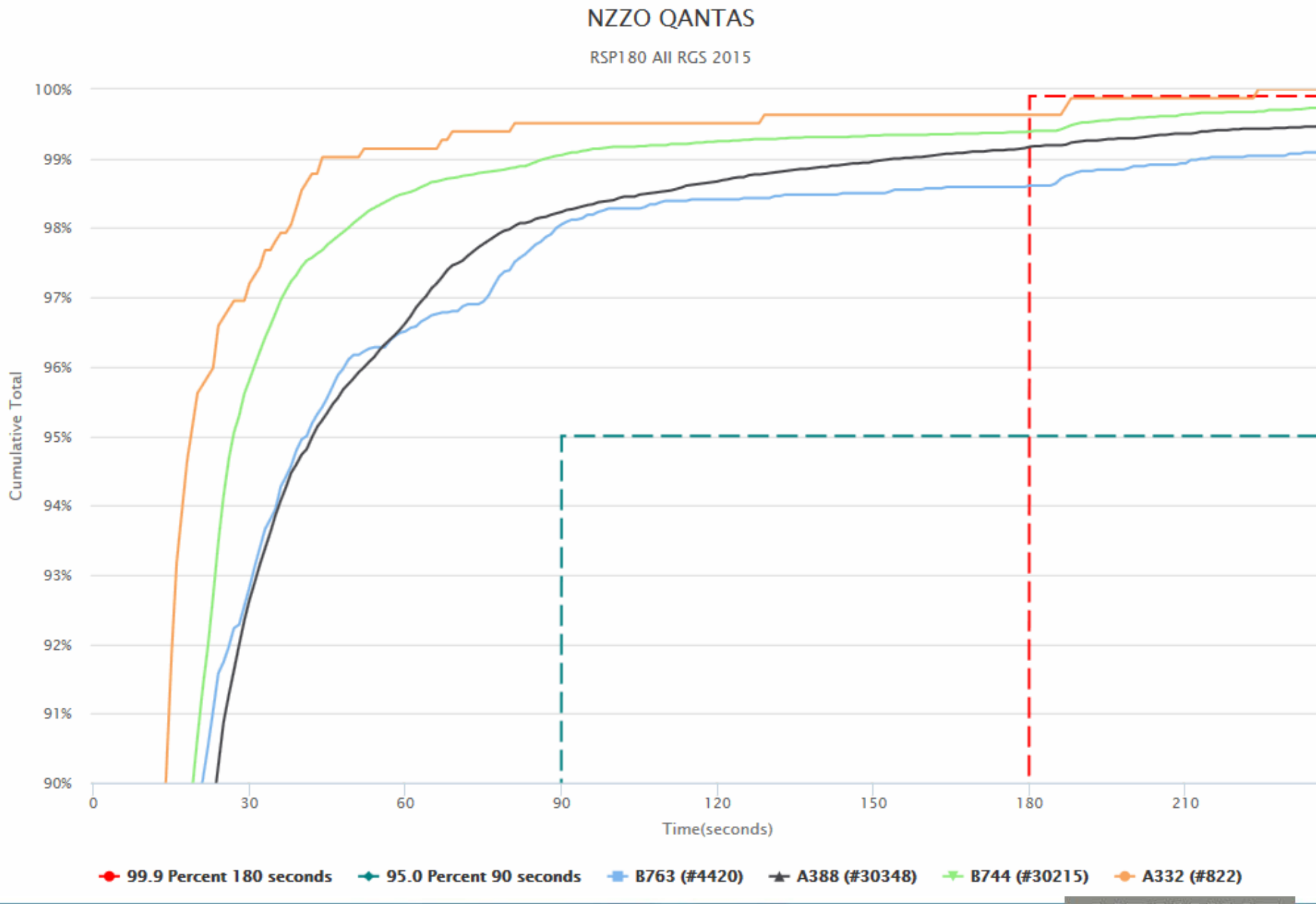
ADS-C performance in NZZO FIR

Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 ANZ B789 SATCOM 2015						
SATCOM I3	POR1	B789	ANZ	27	100.00	100.00
SATCOM I4	AME1	B789	ANZ	188	99.47	100.00
SATCOM I4	APK1	B789	ANZ	2140	93.97	97.06
SATCOM MTSAT	MTS1	B789	ANZ	9875	97.96	99.69

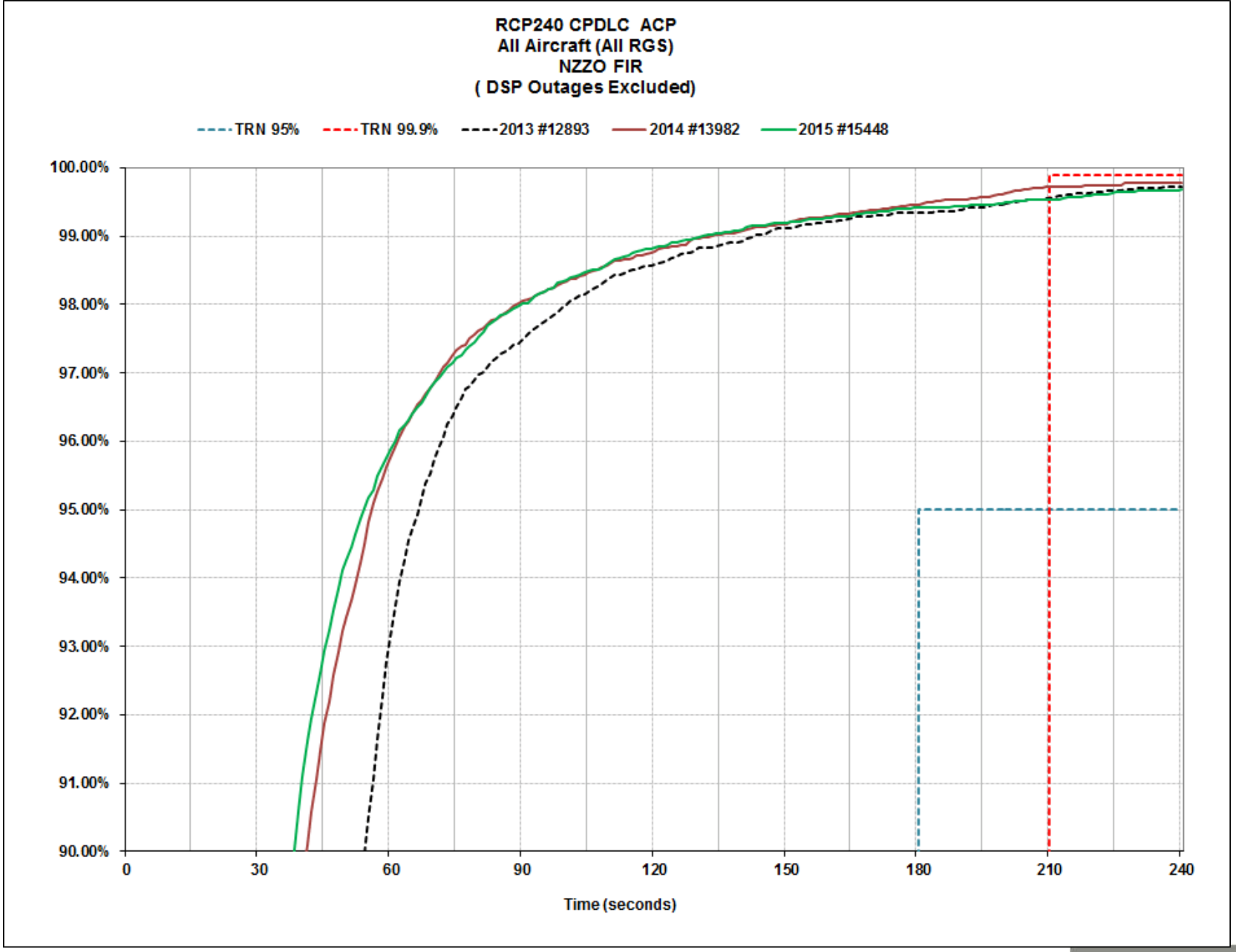
ADS-C performance in NZZO FIR						
Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 Air New Zealand All Media 2015						
SATCOM I4	AME1	B77W	ANZ	3528	99.40	99.94
SATCOM I4	APK1	B77W	ANZ	58968	98.18	99.14
SATCOM I4	AME1	B772	ANZ	2853	99.68	99.89
SATCOM I4	APK1	B789	ANZ	2140	93.97	97.06
SATCOM MTSAT	MTS1	B772	ANZ	41363	99.49	99.81
SATCOM MTSAT	MTS1	B789	ANZ	9875	97.96	99.69
VHF All	AKL1	B77W	ANZ	2420	99.79	99.96
VHF All	AKL2	B77W	ANZ	2568	99.53	99.96
VHF All	AKL7	B77W	ANZ	1635	99.82	100.00
VHF All	APW1	B77W	ANZ	1180	99.83	99.92
VHF All	AKL1	B772	ANZ	2945	99.93	100.00
VHF All	AKL2	B772	ANZ	6298	99.87	100.00
VHF All	APW1	B772	ANZ	1202	100.00	100.00
VHF All	NLK1	B772	ANZ	2667	99.93	99.96
VHF All	AKL1	B789	ANZ	872	100.00	100.00
VHF All	AKL2	B789	ANZ	1174	99.74	99.74
VHF All	AKL7	B789	ANZ	2840	99.79	99.86
VHF All	NLK1	B789	ANZ	3797	99.53	99.63

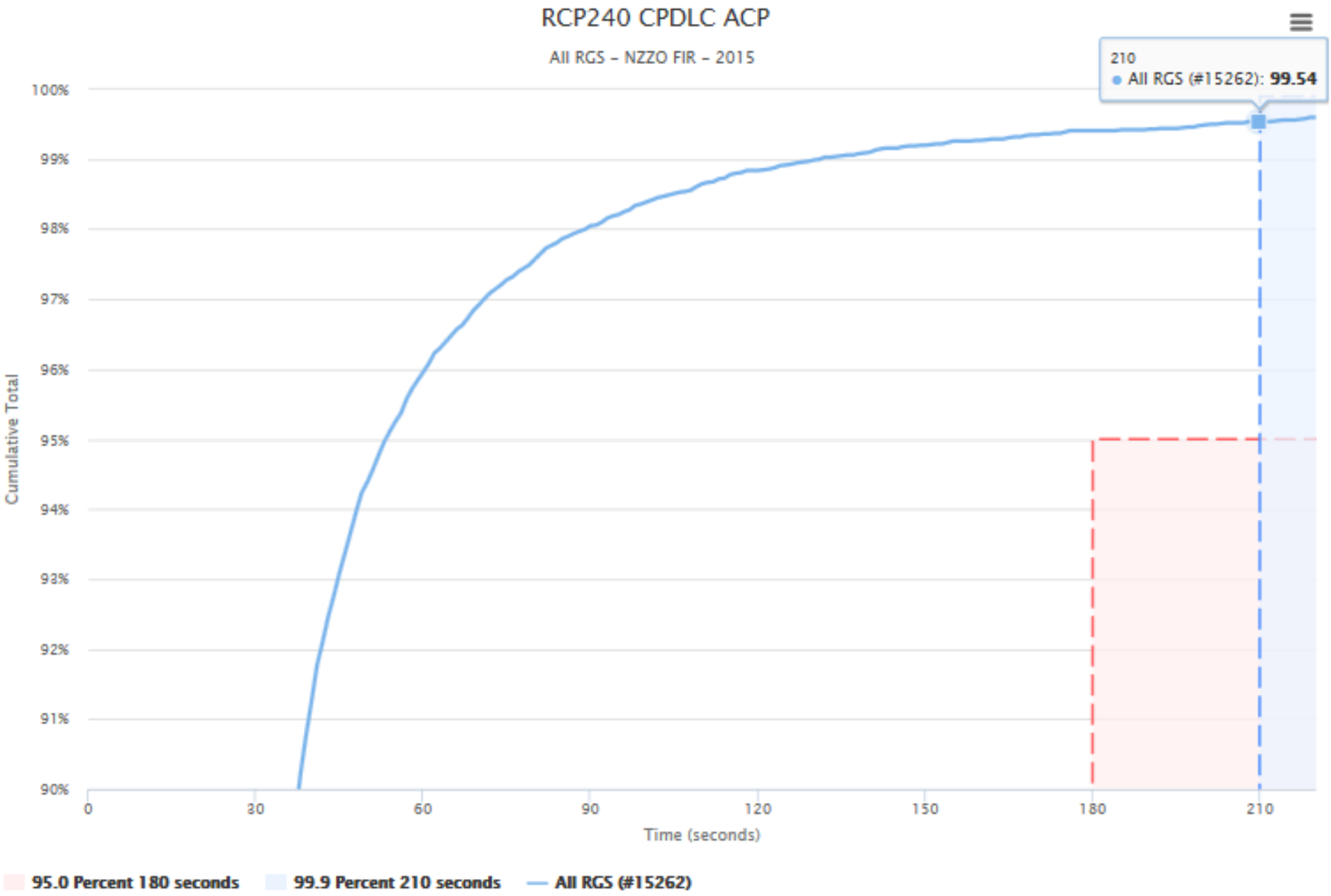


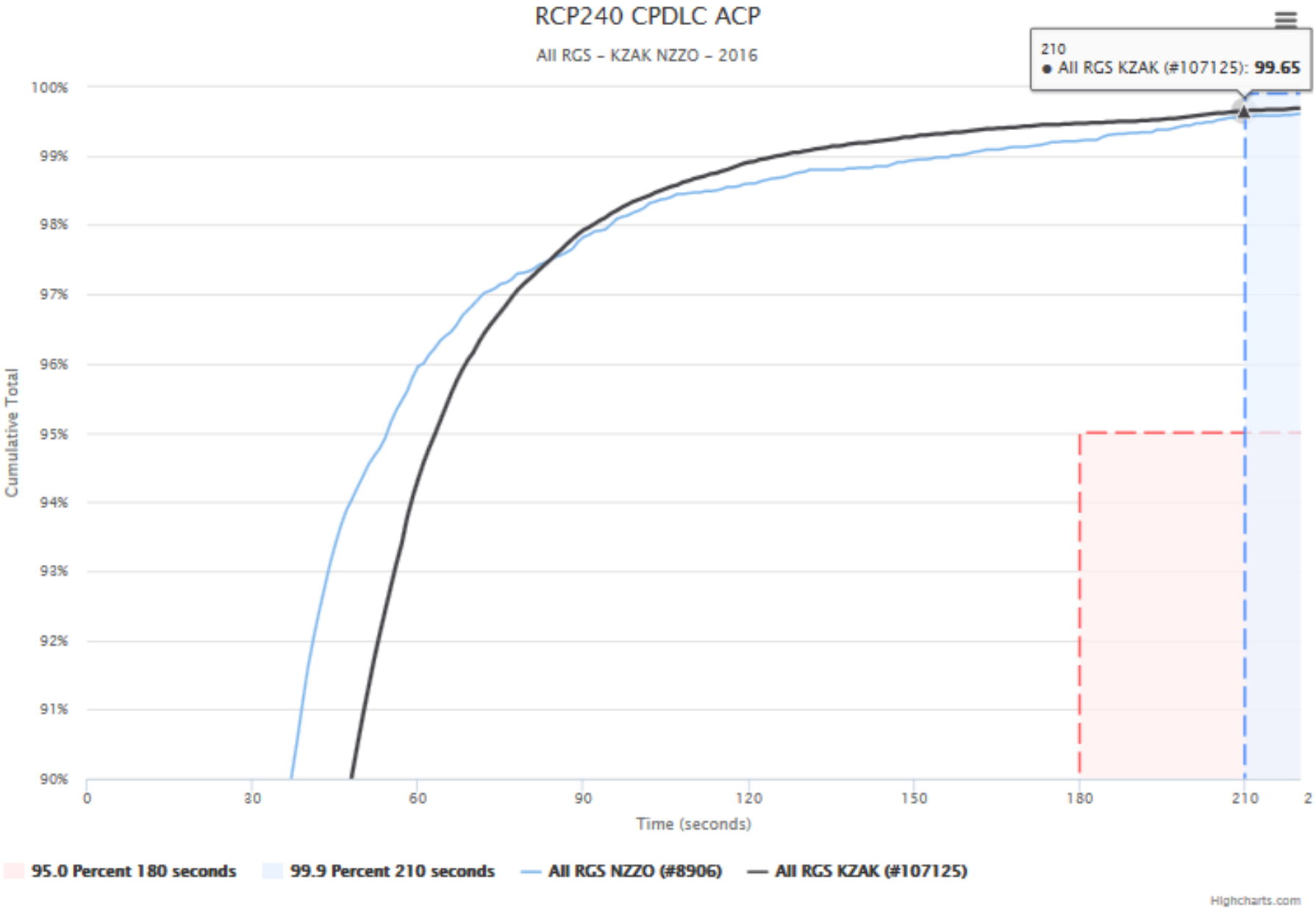


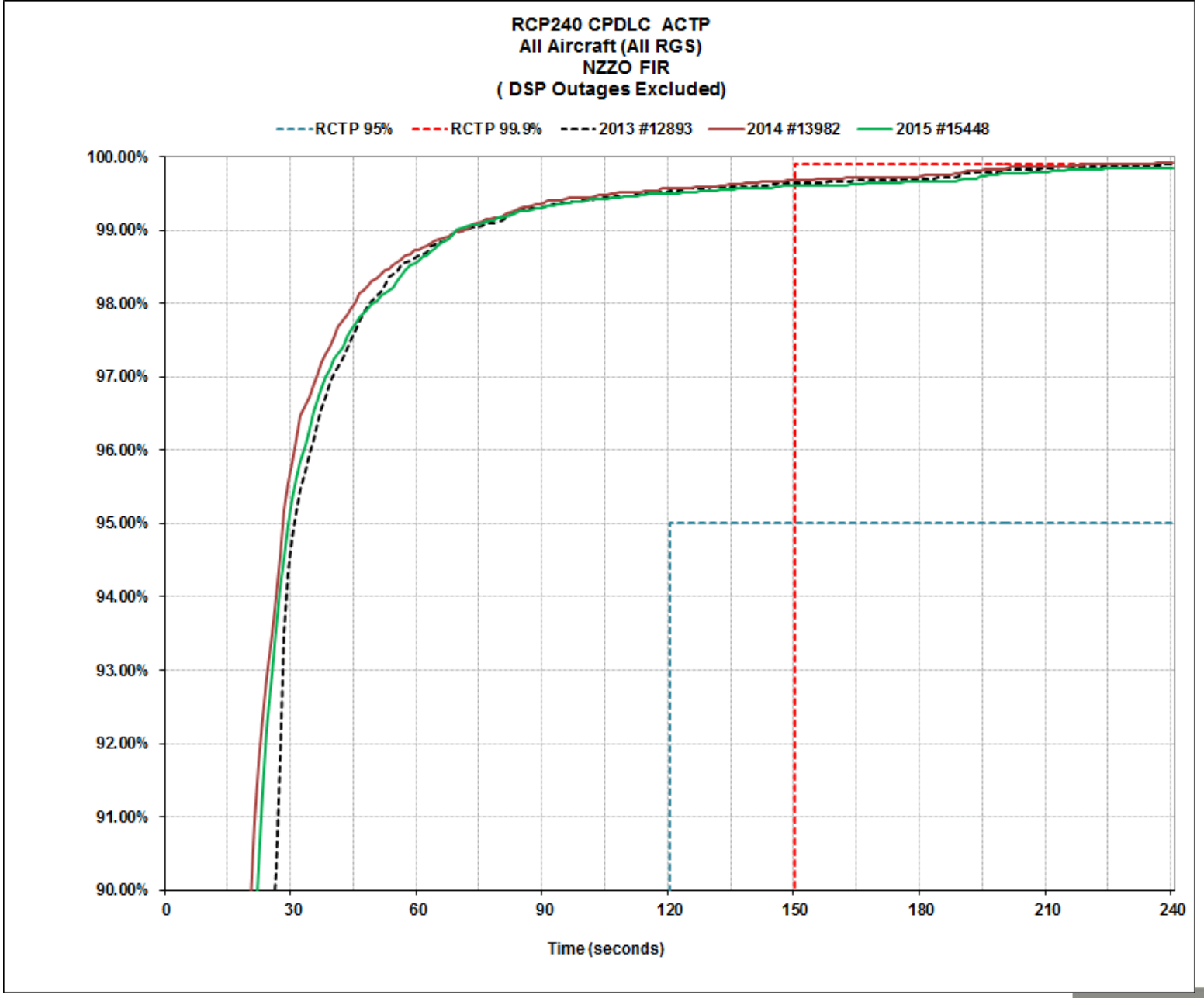


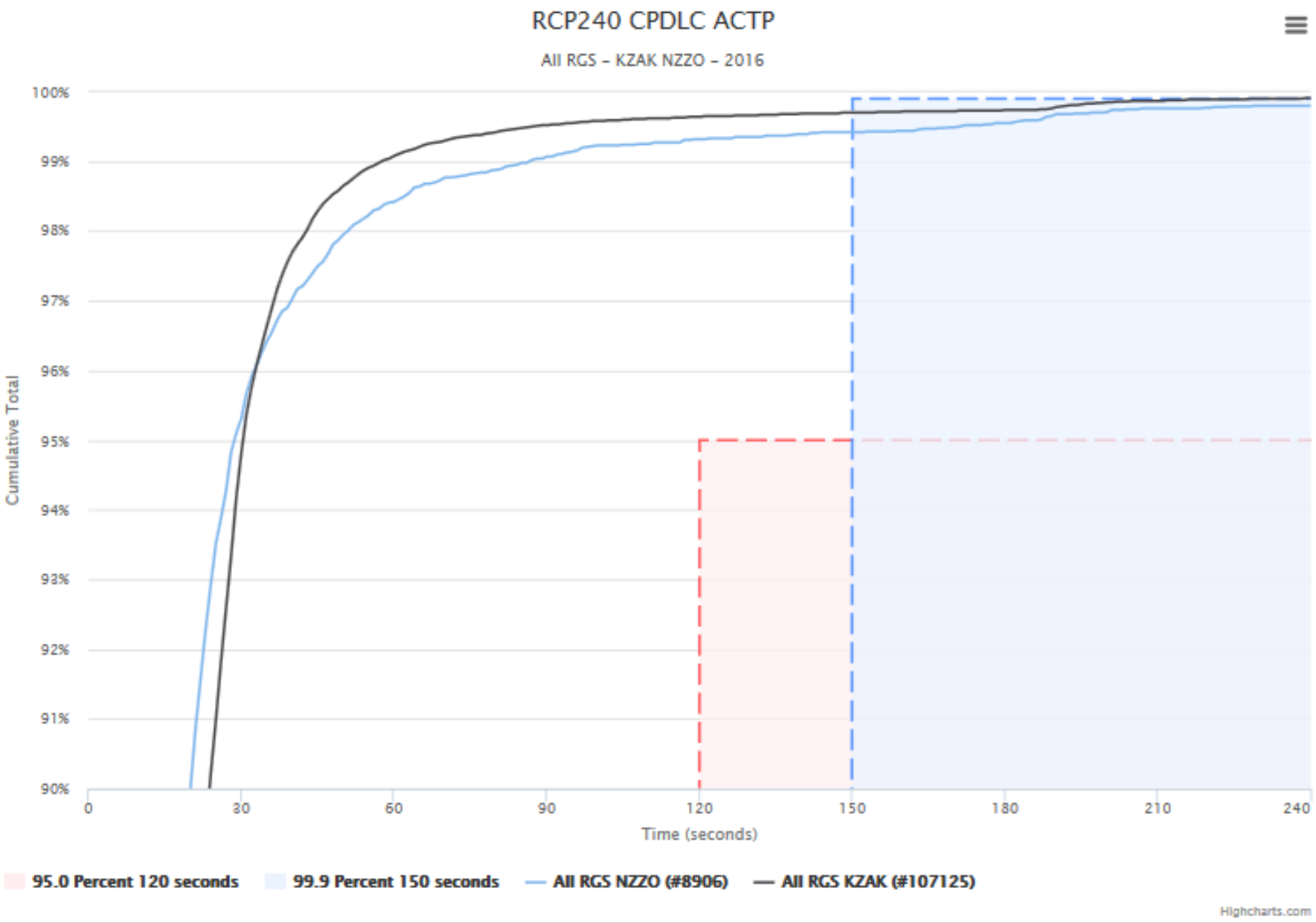
Current NZZO Monitoring
CPDLC Performance – RCP240

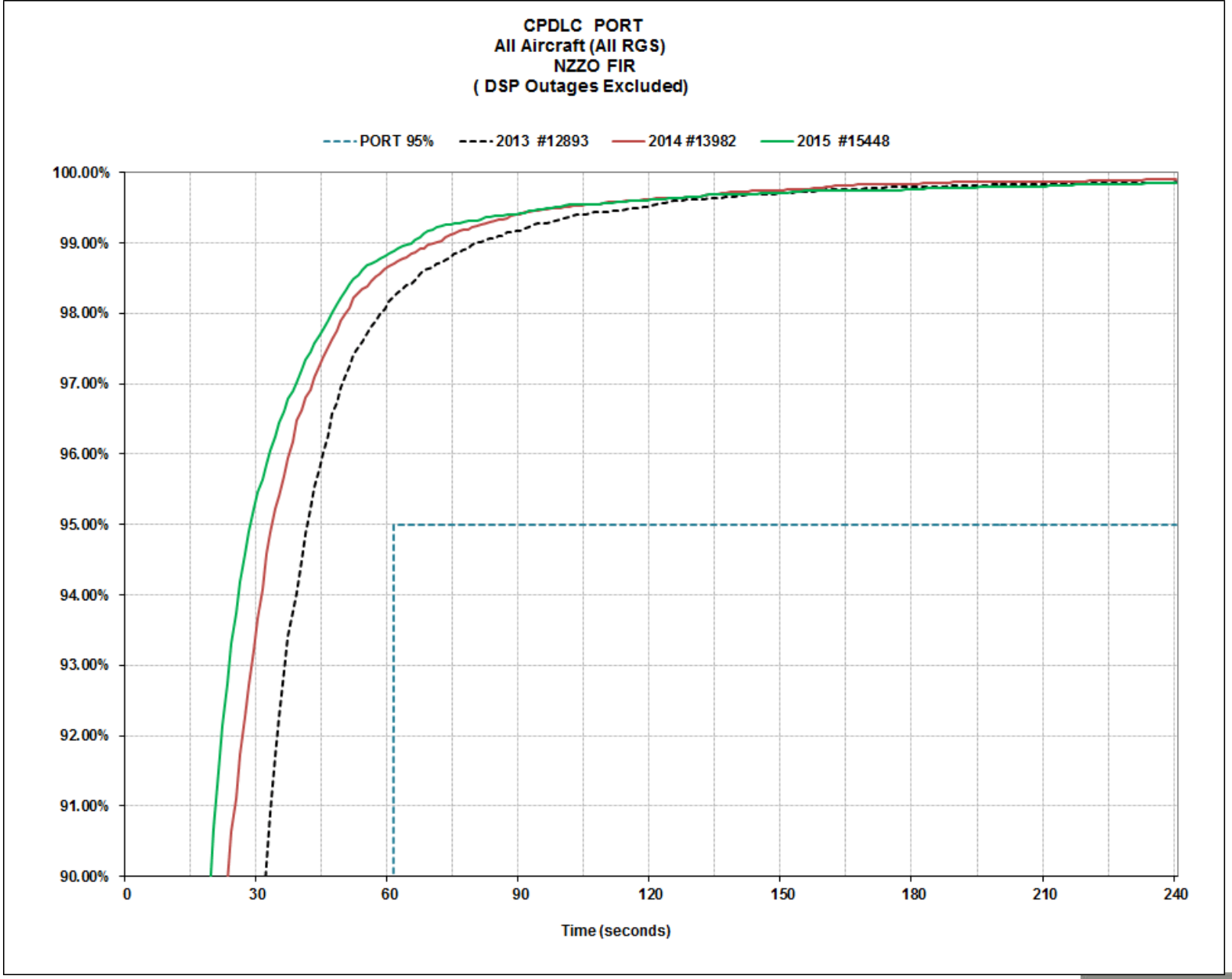


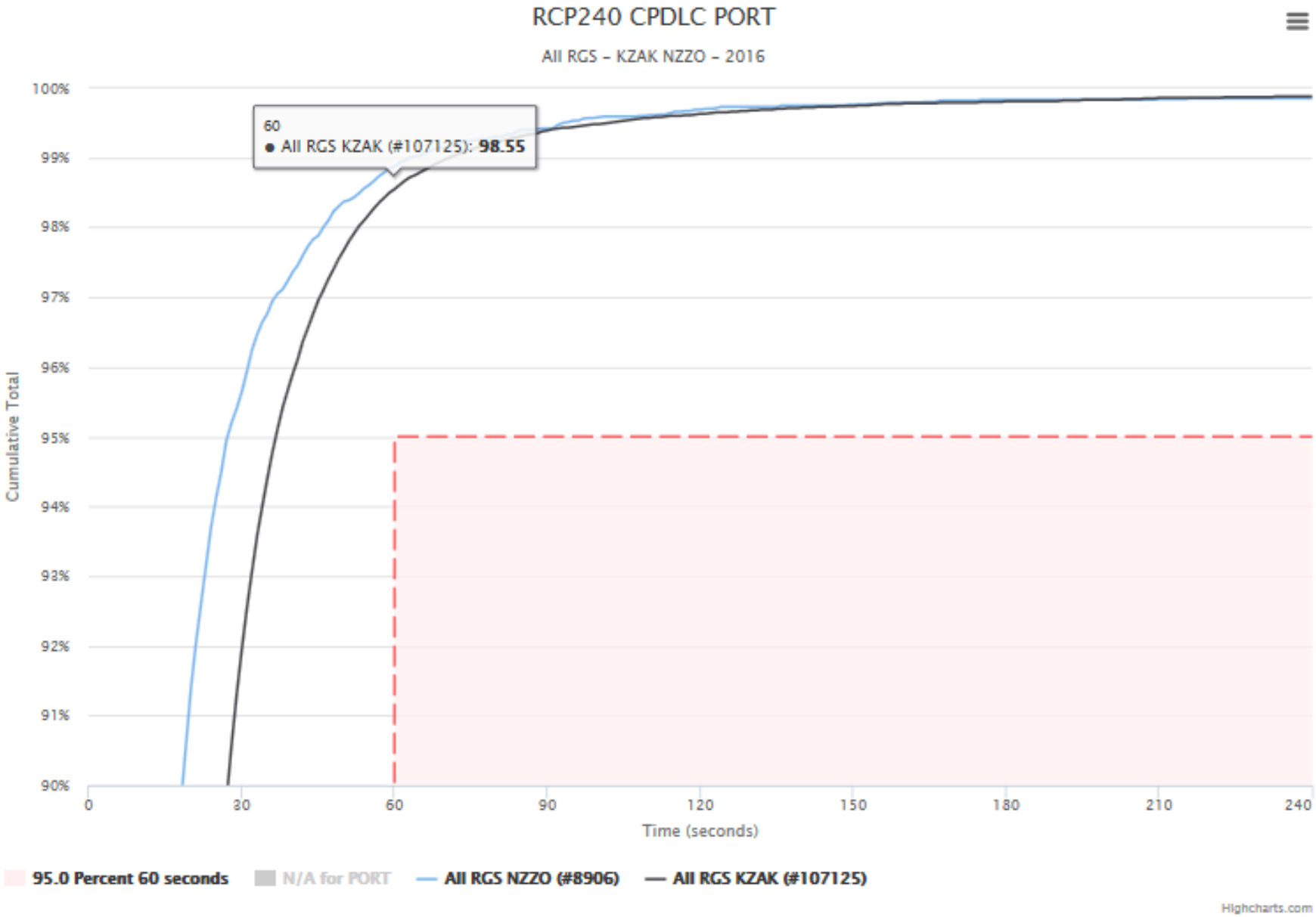










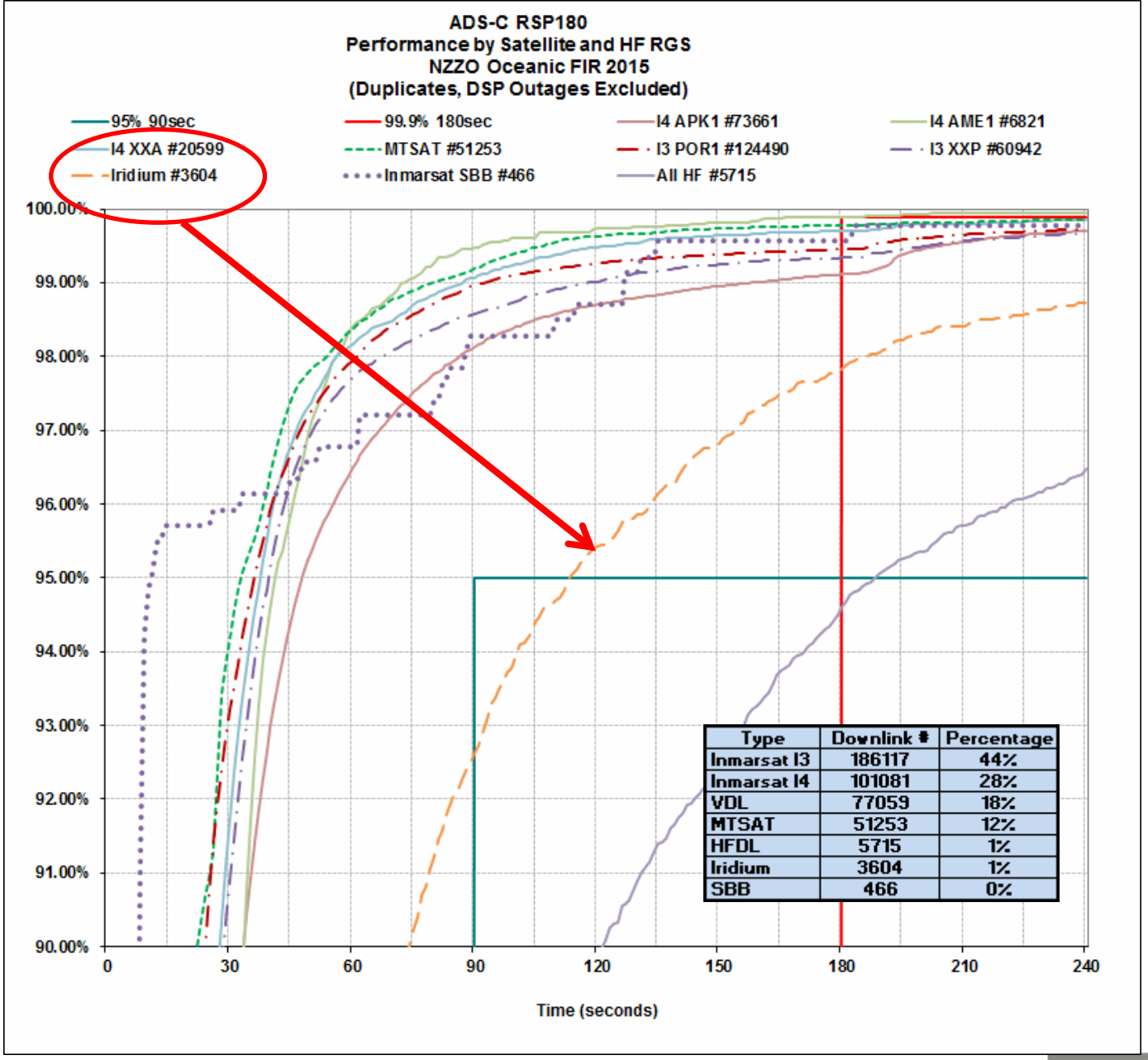


CPDLC Performance								
Colour Key Meets Criteria 99.0%-99.84% Under Criteria		Period 1 Jan 2015 - 31 Dec 2015					95% RCP240 Benchmark	99.9% RCP240 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Tail Number	ATSP	Message Count	RCP <= 120 sec	RCP <= 150 sec
Analysis by ACTP								
All	All	All	All	All	NZZO	15262	99.48	99.59

Media Type	RGS	Aircraft Type	Operating Company	Tail Number	ATSP	Message Count	RCP <= 180 sec	RCP <= 210 sec
Analysis by ACP								
All	All	All	All	All	NZZO	15262	99.41	99.54

Media Type	RGS	Aircraft Type	Operating Company	Tail Number	ATSP	Message Count	RCP <= 60 sec
Analysis by PORT							
All	All	All	All	All	NZZO	15262	98.89

Current NZZO Monitoring Iridium Performance



ADS-C Performance								
Colour Key Meets Criteria 99.0%-99.84% Under Criteria		Period 1 Jan 2015 - 31 Dec 2015					95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Tail Number	ATSP	Message Count	RSP <= 90 sec	RSP <= 180 sec
Analysis by								
SATCOM Iridium	IG1	All	All	All	All	2445	93.41	98.28
SATCOM Iridium	IGW1	All	All	All	All	1159	90.94	96.89

ADS-C Performance								
Colour Key Meets Criteria 99.0%-99.84% Under Criteria		Period 1 Jan 2016 - 30 Jun 2016					95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Tail Number	ATSP	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 Iridium SATCOM								
SATCOM Iridium	IG1	All	All	All	NZZO	718	97.49	99.44
SATCOM Iridium	IGW1	All	All	All	NZZO	1162	94.14	98.45

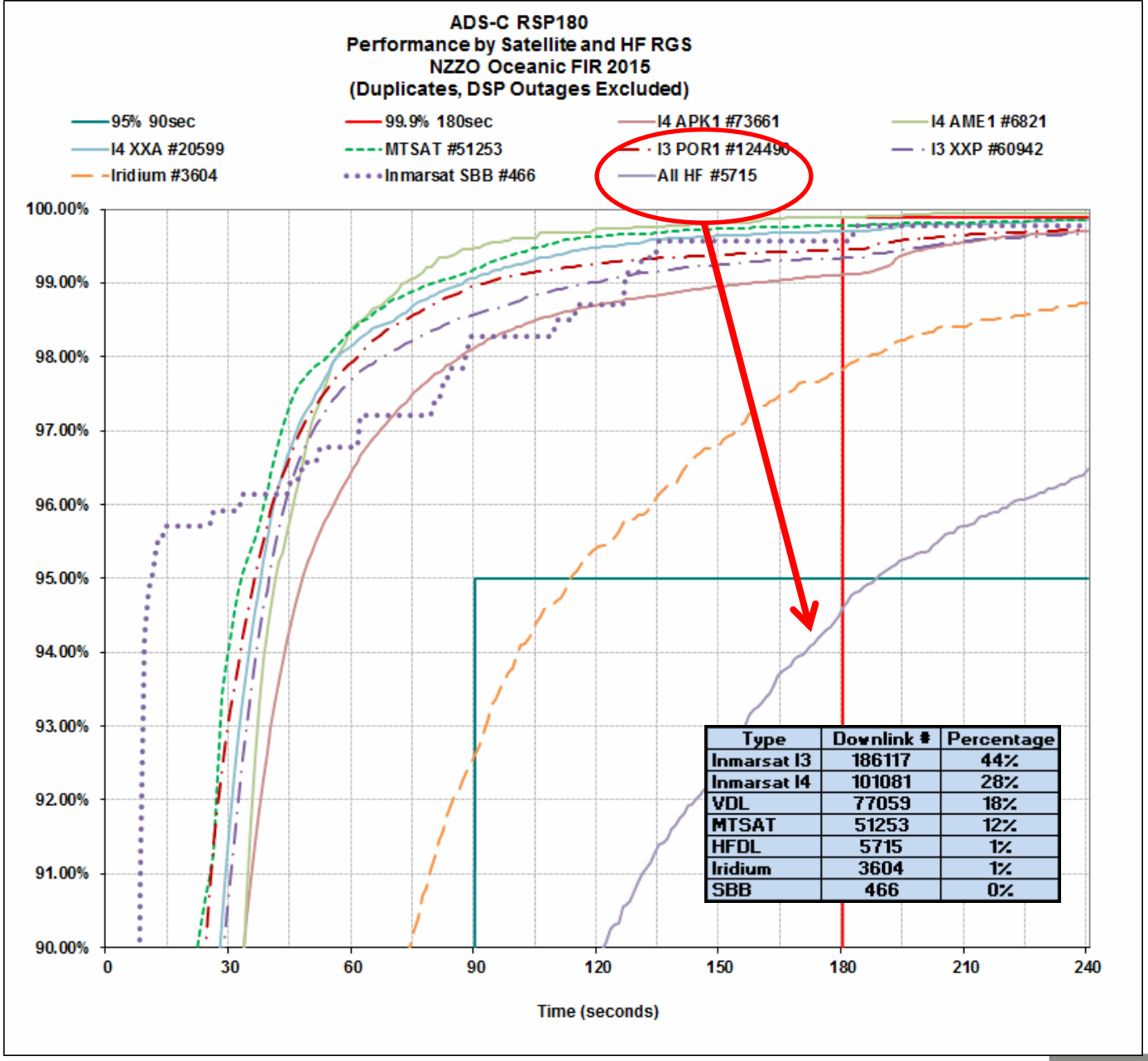
ADS-C Performance								
Colour Key Meets Criteria 99.0%-99.84% Under Criteria		Period 1 Jan 2016 - 30 Jun 2016					95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Tail Number	ATSP	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 Iridium RC SATCOM NZZO								
SATCOM Iridium	IG1	B744	GTI	All	NZZO	602	98.5	99.5
SATCOM Iridium	IG1	B763	HAL	All	NZZO	103	93.2	100

ADS-C Performance								
Colour Key Meets Criteria 99.0%-99.84% Under Criteria		Period 1 Jan 2016 - 30 Jun 2016					95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Tail Number	ATSP	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 Iridium SATCOM KZAK NZZO								
SATCOM Iridium	IG1	All	All	All	All	95130	96.35	98.86
SATCOM Iridium	IGW1	All	All	All	All	52610	96.1	98.35

ADS-C performance in NZZO FIR

Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	**RGS**	**Aircraft Type**	**Operating Company**	**Message Count**	**RSP <= 90 sec**	**RSP <= 180 sec**
RSP180 Iridium Satcom						
SATCOM Iridium	IGW1	A320	ACI	987	90.37	96.35
SATCOM Iridium	IG1	B744	CKS	16	93.75	93.75
SATCOM Iridium	IG1	B744	GTI	1015	98.03	99.61
SATCOM Iridium	IG1	B763	HAL	1384	90.03	97.40
SATCOM Iridium	IG1	B721	PVT	30	93.33	96.67
SATCOM Iridium	IGW1	B752	PVT	158	94.30	100.00
SATCOM Iridium	IGW1	CL60	PVT	14	92.86	100.00
RSP180 All Media						
All	All	A320	ACI	1836	94.44	97.88

Current NZZO Monitoring HFDL Performance



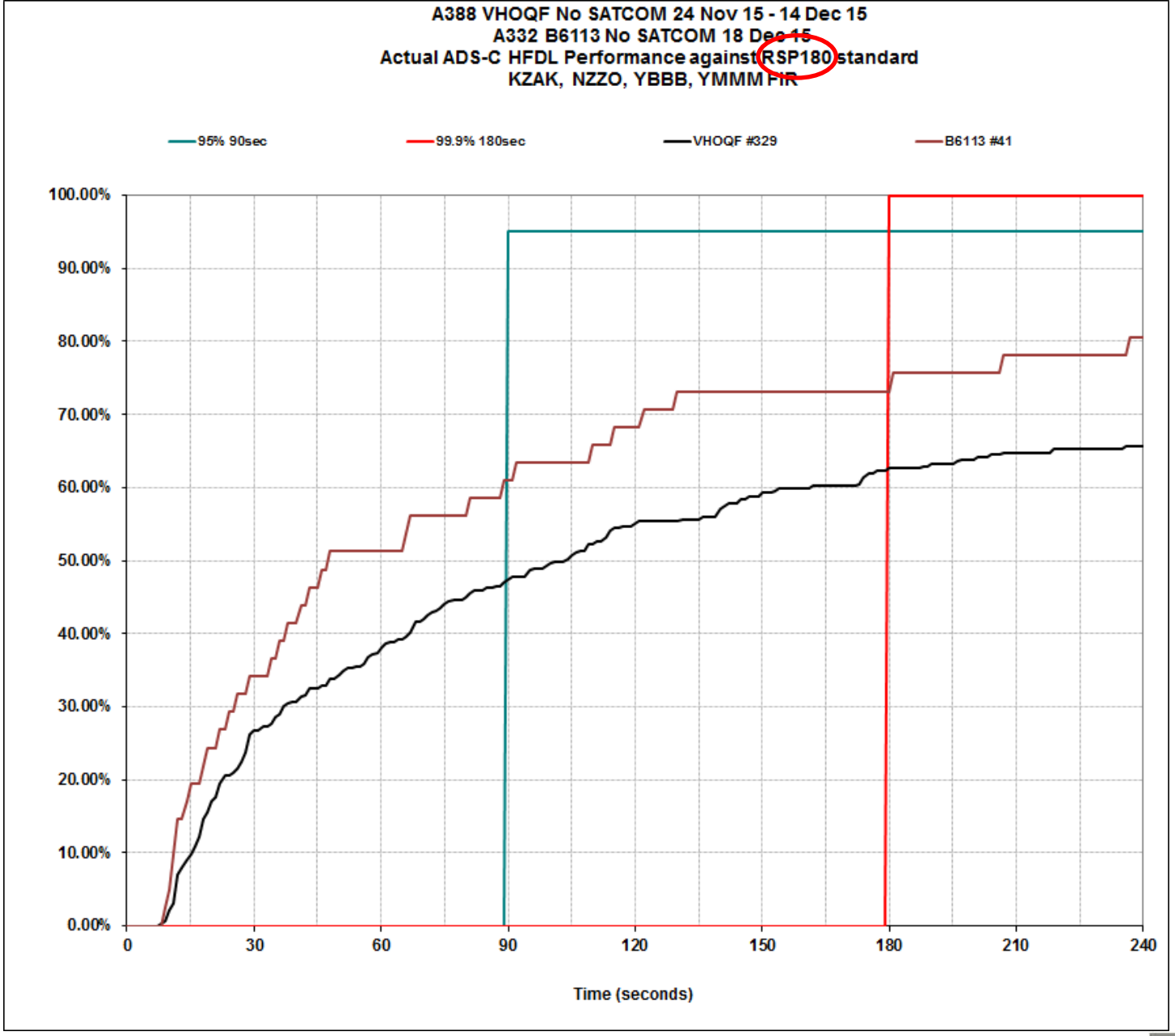
ADS-C performance in NZZO FIR						
Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 HFDL Operations						
HF All	All	All	All	5697	86.01	94.63

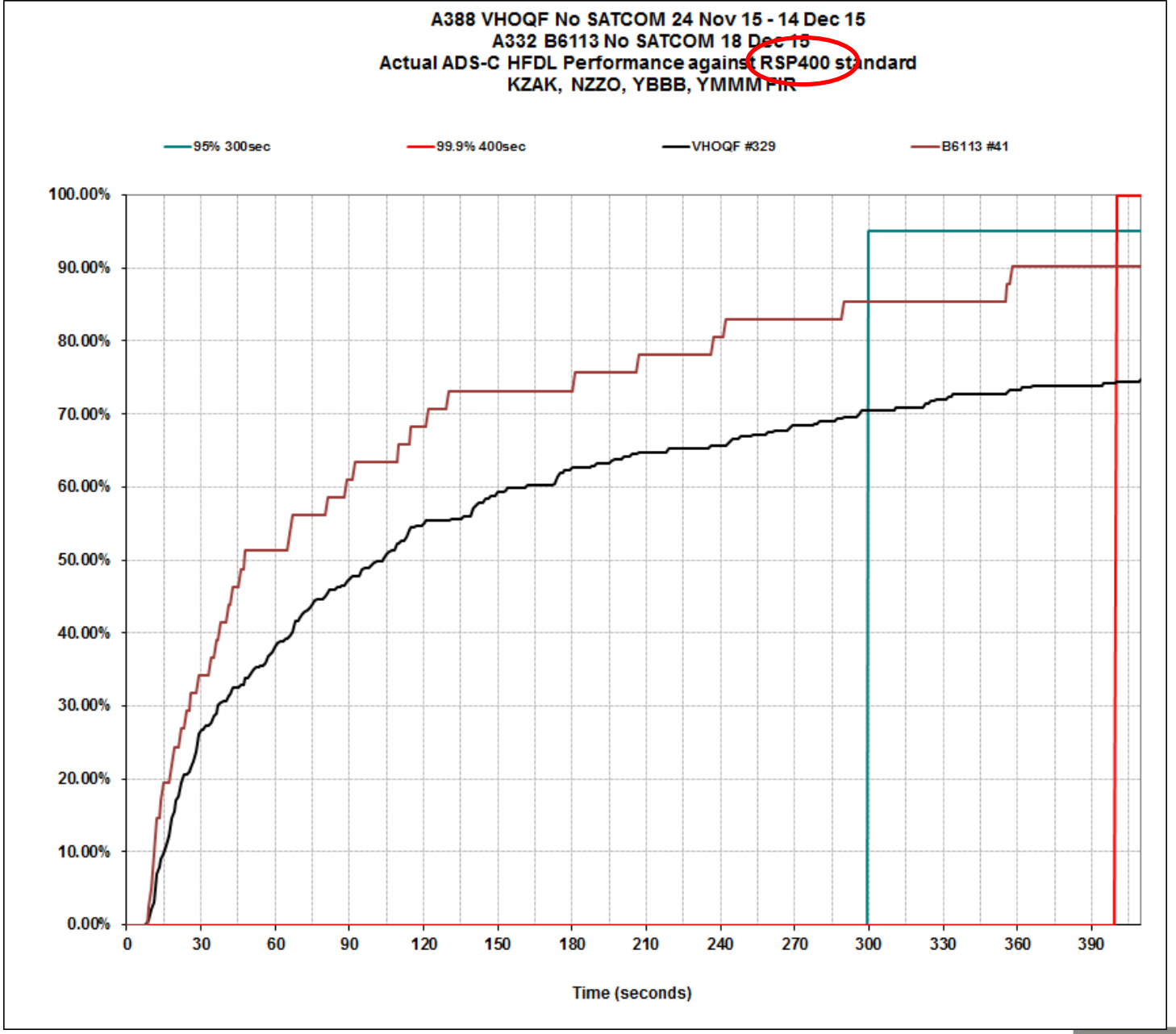
ADS-C performance in NZZO FIR						
Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 HFDL Operations						
HF All	All	A332	All	1260	81.59	93.02
HF All	All	A388	All	4403	87.64	95.41
HF All	All	B763	All	5		
HF All	All	B788	All	3	66.67	100.00
HF All	All	B789	All	22	36.36	50.00
HF All	All	MD11	All	4	75.00	100.00

ADS-C performance in NZZO FIR						
Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 HFDL Operations 2015						
HF All	All	A332	CES	118	88.14	97.46
HF All	All	A332	FJI	964	81.64	92.74
HF All	All	A388	QFA	2879	88.29	95.38
HF All	All	A388	UAE	1377	86.56	95.28

ADS-C performance in NZZO FIR						
Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 Qantas A388						
SATCOM All	All	A388	QFA	24152	99.21	99.53
VHF All	All	A388	QFA	3317	99.76	99.88
HF All	All	A388	QFA	2879	88.29	95.38

ADS-C performance in NZZO FIR						
Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Period 01 Jan 15 - 31 Dec 15				95% RSP180 Benchmark	99.9% RSP180 Benchmark
Media Type	RGS	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
RSP180 UAE A388						
SATCOM All	All	A388	UAE	10791	99.36	99.68
VHF All	All	A388	UAE	4585	99.98	99.98
HF All	All	A388	UAE	1377	86.56	95.28





Individual HFDL performance for each QFA A388 - NZZO 2015

Tail #	# Message	95% 90sec	99.9% 180sec
OQC	288	95.13	98.26
OQH	286	89.51	98.25
OQD	191	91.62	97.9
OQB	282	90.42	97.51
OQL	202	89.6	97.02
OQE	214	91.58	96.26
OQI	310	87.74	95.48
OQG	278	91.36	95.32
OQA	233	73.58	94.84
OQJ	186	87.09	94.62
0QK	144	82.63	93.05
OQF	265	73.58	85.28

Individual HFDL performance for OQF operating no SATCOM

Tail #	# Message	95% 90sec	99.9% 180sec
OQF	107	48.59	69.15

- **With implementation of PBCS and ICAO FPL “P “ codes:**
  - **Operating with no SATCOM on HFDL will mean that aircraft is not meeting RSP180 or RSP400.**
  - **ATSP automation systems will place increasing reliance on the accuracy of FPL information.**
  - **PBCS AOC and crew training will need to capture that if operating with HFDL and no SATCOM then aircraft will not meet RCP or RSP standards.**

Current NZZO Monitoring FPL Consistency?

During the period 24 November 2015 – 14 December 2015 Qantas A388 VH-OQF operated with
no SATCOM using HFDL and VDL only. This was correctly indicated in the FPL - files HF and VDL.

(FPL-QFA94-IS
-A388/H-SADE2E3FGHI**J2J4**RWYZ/LB1

On 18 December 2015 Air China A332 B6113 operated no SATCOM and operated HFDL and VDL only. This was not correctly indicated in the FPL – files HF, VDL , and SATCOM.

(FPL-CCA783-IS
-A332/H-SDE3FGHI**J3J4J5**RWYZ/LB1D1

A review of FPL indicates some inconsistency in filing the J codes. For example:

(FPL-CCA784-IS **(This flight operates SAT/VHF/HFDL – files OK)**
-A332/H-SDE3FGHI**J2J3J4J5**RWYZ/LB1D1

(FPL-CES779-IS **(This flight operates SAT/VHF/HFDL – files only SATCOM)**
-A332/H-SDE2E3FGHI**J5**M1RWY/LB1

(FPL-FJI811-IS **(This flight operates SAT/VHF/HFDL – files only HF and SATCOM)**
-A332/H-SDE3FGHI**J2J5**LRWXY/LB1D1

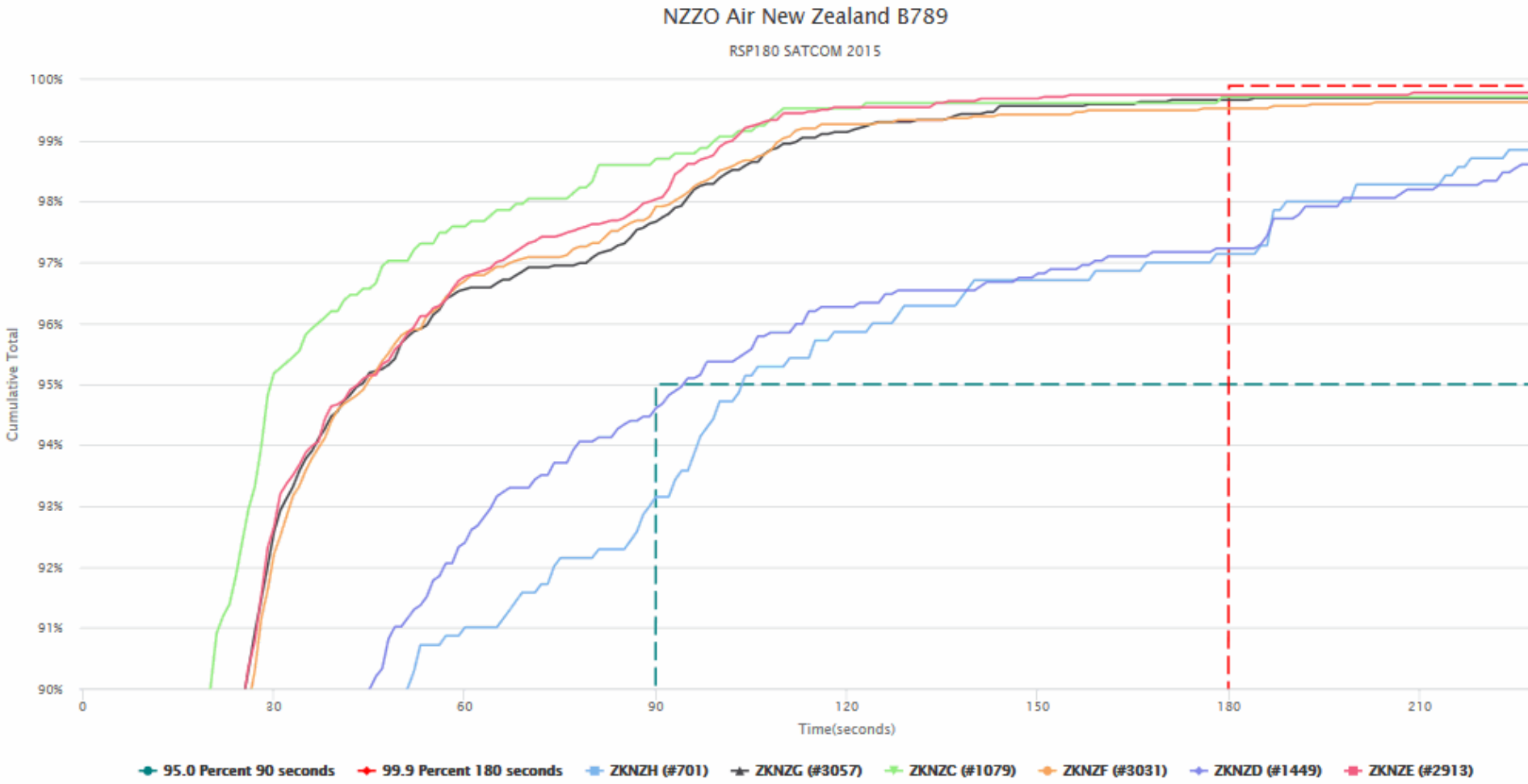
(FPL-KAL129-IS **(This flight operates SAT/VHF/HFDL – files only**

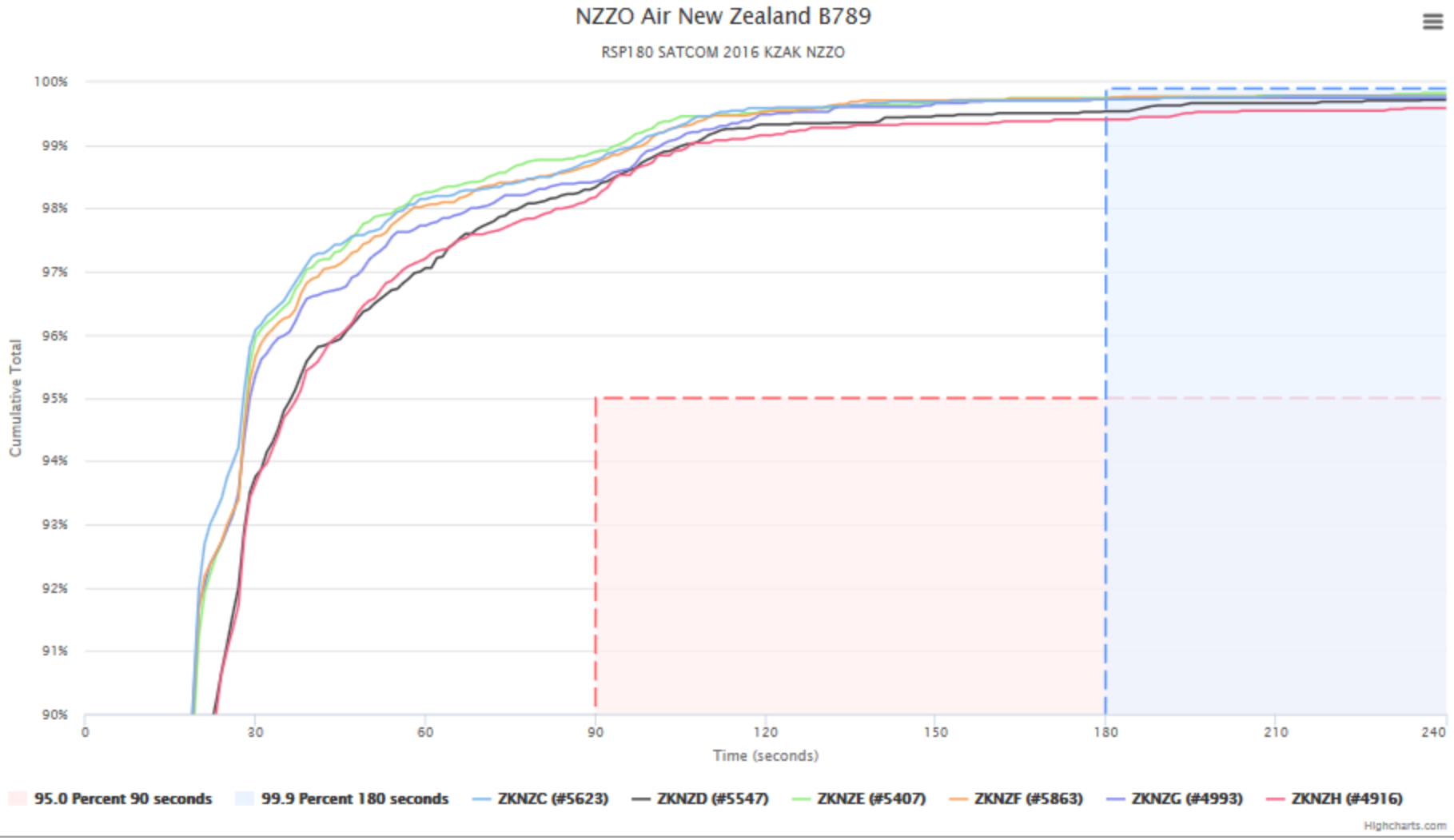
B787 Performance in NZZO

A case study on identifying, reporting on, and resolving data link issues through post-implementation monitoring

- **Reviewing Inmarsat I4 performance in late 2015 shows a significant deterioration in overall performance for Air New Zealand B789 :**

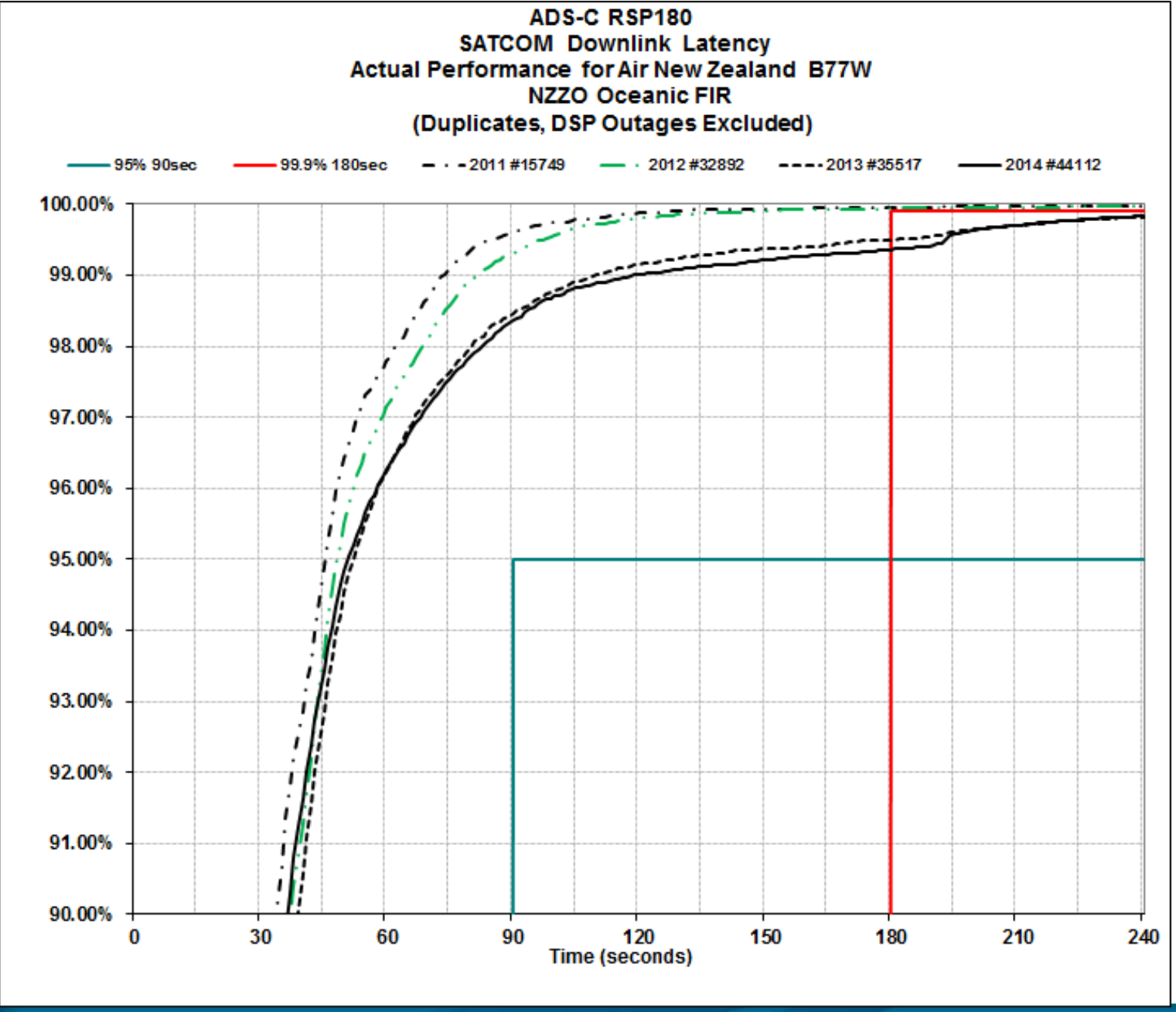
  - **Investigation shows performance deterioration is caused by two tails ZQ-NZF and ZQ-NZD.**
  - **These were the last two aircraft delivered to ANZ and commenced operations in late 2015.**
  - **Analysis shows both aircraft operating on the Inmarsat I4 while the rest of the fleet were operating on MTSAT as programmed in the aircraft software.**
  - **ANZ advised that all the fleet had identical software loads.**
  - **After checking with SITA , ANZ advised us that the aircraft had not been setup for operations on MTSAT although they had received positive confirmation of this when the aircraft entered service.**
  - **This oversight has now been corrected and performance on these two aircraft has returned to normal.**
  - **Performance impact is shown on following slides.**





B77W on Inmarsat I4 Performance

A case study on identifying, reporting on, and resolving data link issues through post-implementation monitoring



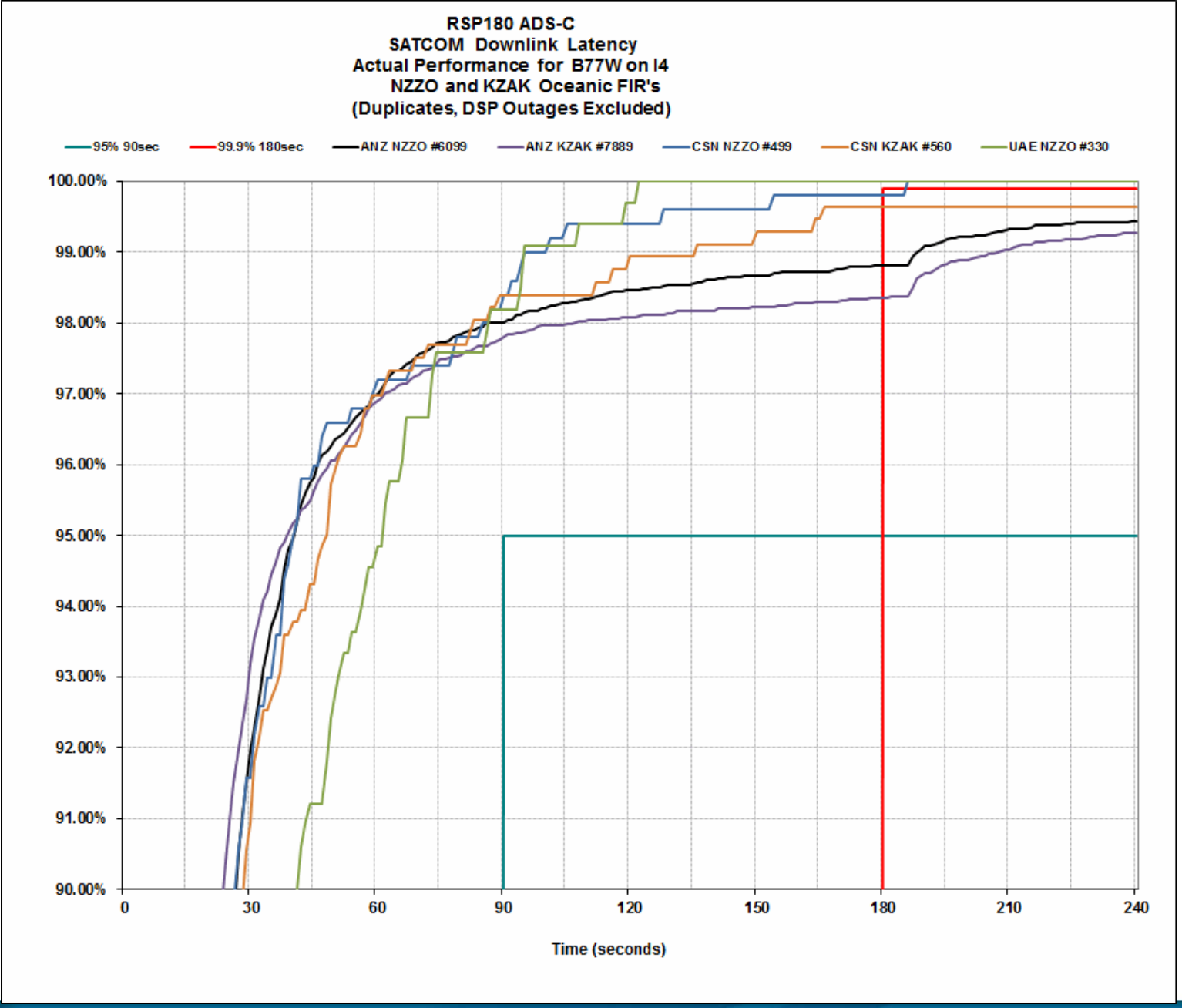
Notes:

In 2011 and 2912 ANZ B77W fleet was meeting the RSP180 requirements. On Inmarsat I3

In 2013 the fleet started a gradual transition to the Inmarsat I4 which was completed by the end of 2014.

During the transition to the I4 the performance deterioration was noted and a problem report was raised.

Investigation is ongoing and the following slides depict some of the analysis completed by Airways.



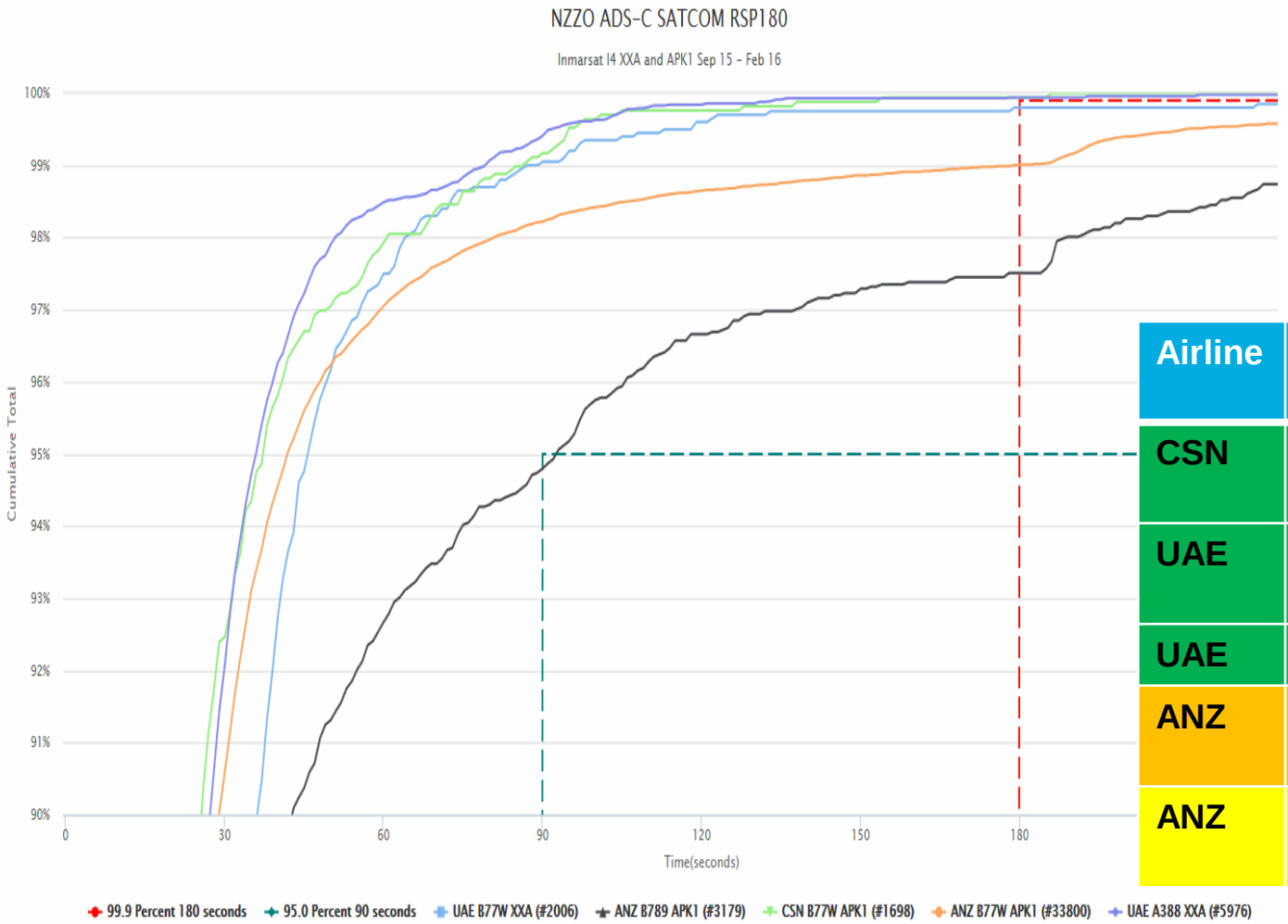
Notes:

In January KZAK and NZZO both show ANZ B77W performance below 99% 180".

UAE B77W performance in NZZO operating on Tasman Sea routes meets the spec 99.9% 180"

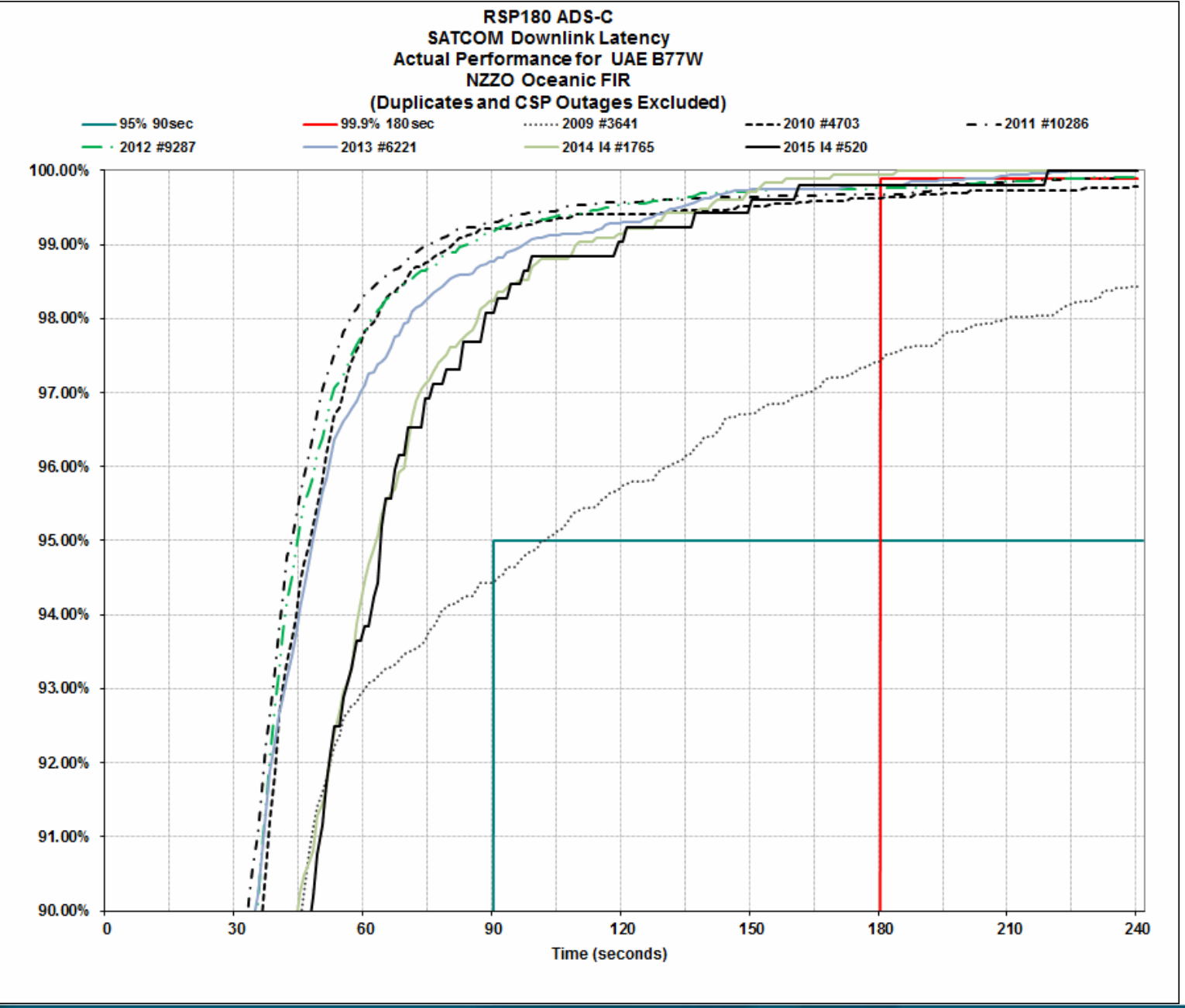
CSN B77W operating on Northern Tasman Sea routes in NZZO nearly meets spec and is well above 99% 180"

CSN B77W operating in KZAK slightly down on performance seen in NZZO.



Airline	Type	RGS	RSP 180
CSN	B77 W	APK 1	99.9
UAE	B77 W	XXA	99.8
UAE	A388	XXA	99.9
ANZ	B77 W	APK 1	99.0
ANZ	B789	APK 1	97.5

- This graph illustrates the difference between three fleets (CSN B77W on SITA APK1, UAE A388 and B77W on Rockwell Collins/ARINC XXA) which meet the RSP180 requirement and the two ANZ fleets operating SITA APK1.
- The CSN and UAE fleets operate on Tasman Sea routes while the ANZ fleets operate mainly on Pacific routes

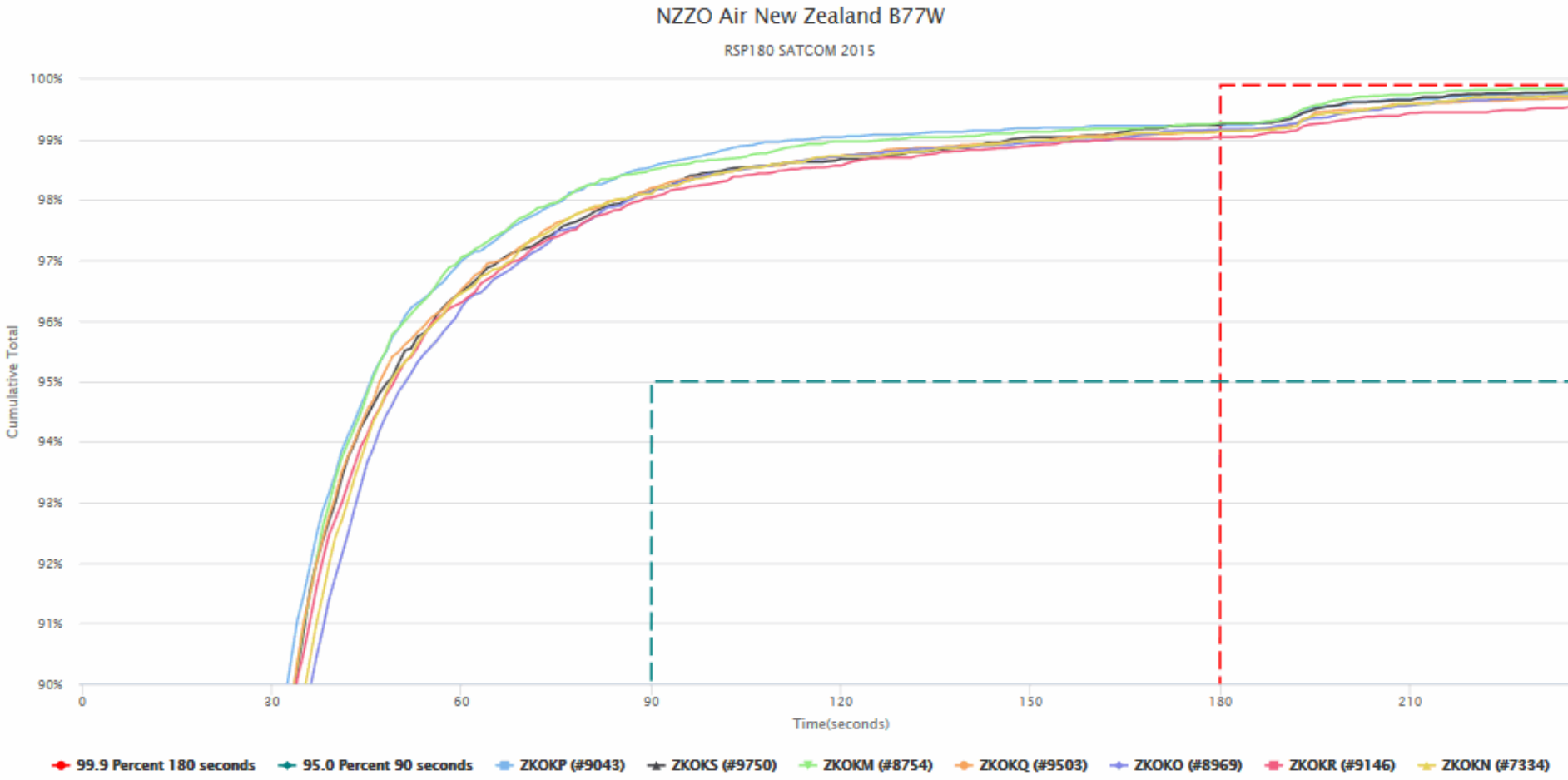


Notes:

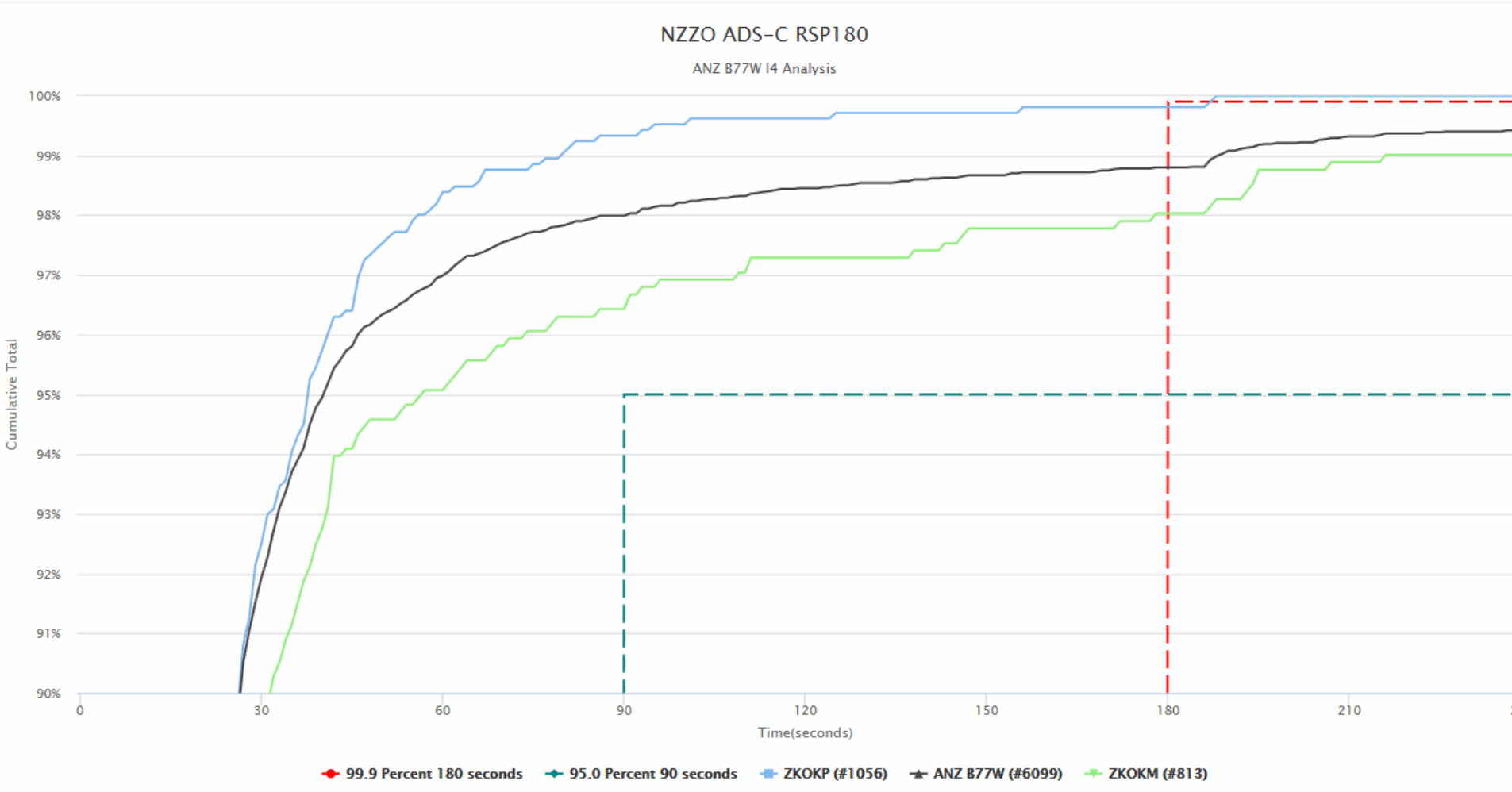
In 2009 the UAE B77W fleet performance was severely impacted by VHF transition issues that were also seen on other fleets and subsequently resolved

Performance of this since 2010 meets the standard.

The UAE fleet is also using the Inmarsat I4.

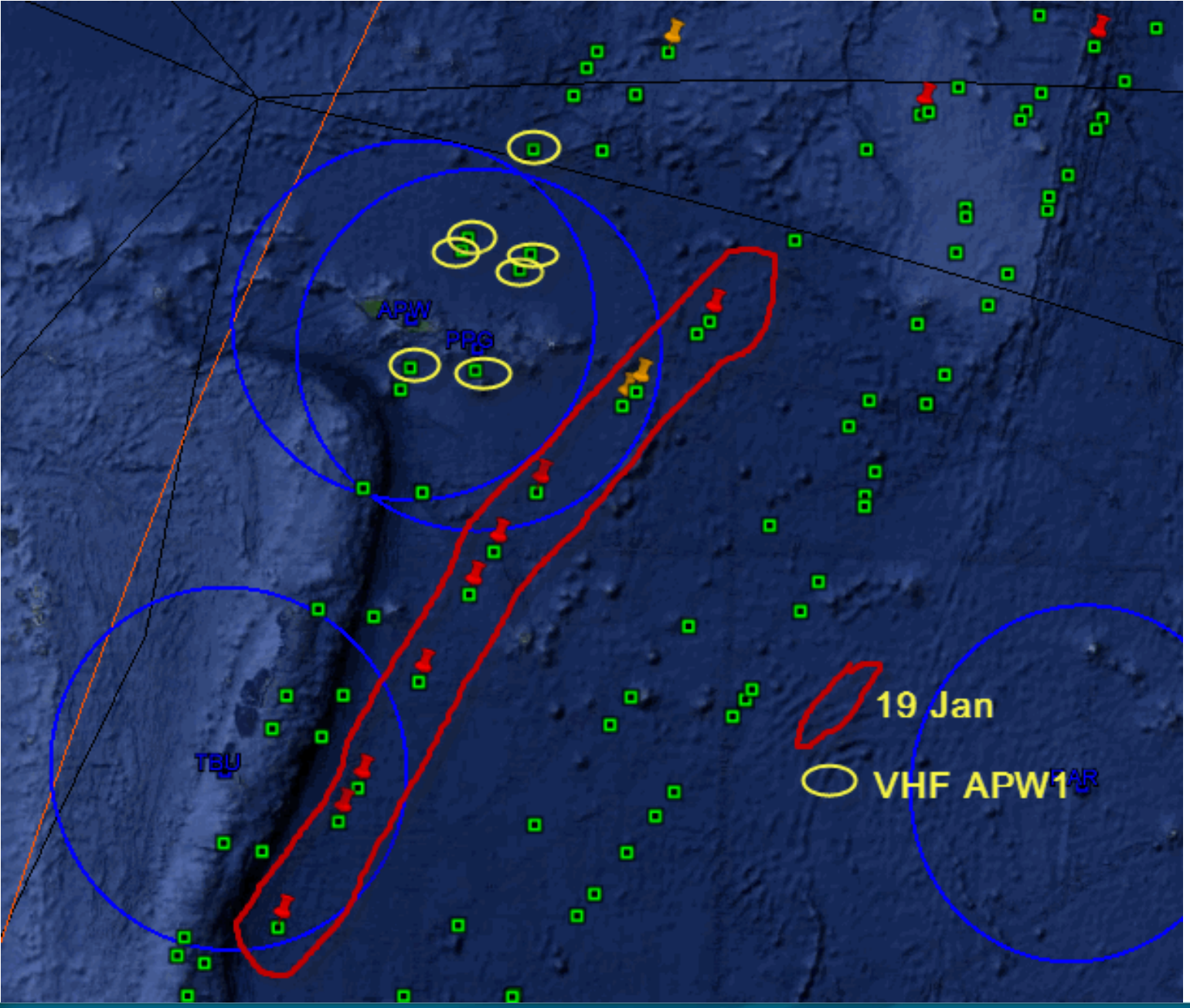


Notes: This graph illustrates that no significant difference exists between different tail numbers in the ANZ fleet.

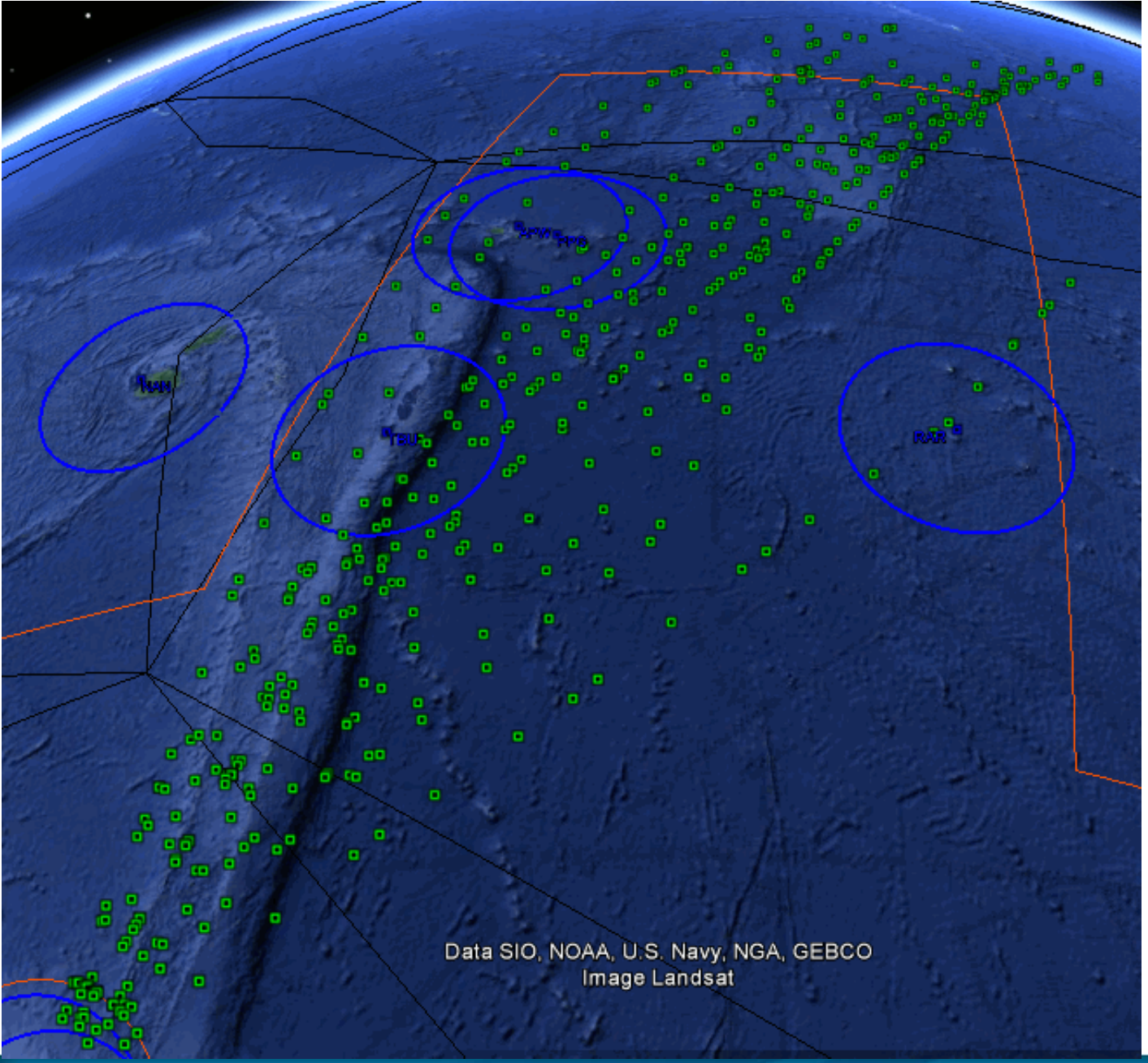


Notes: Analysis for January 2016. Smaller data-set shows wide r variability.

Note: Fleet average is below 99% 180 seconds. Best performing tail (ZKOKP) nearly meets the specification while the lowest performing tail (ZKOKM) just meets 98% 180 seconds .



Notes: ZK-OKM January 2016 routes with delays showing those reports using VHF and the flight on 19 January with multiple delays indicated on consecutive reports.



This shows the remaining pacific flights flown by ZKOKM that experienced no ADS-C latency delays in January 2016 These are all UPR routes between NZAA and NAM.

- **To date no resolution on reason for performance drop when the fleet switched to the I4 from the I3**

- **On occasional flights we see numerous consecutive delays. For example 19 January in Pacific and 20 January in Tasman, and most recently 18 March in Pacific with 5 consecutive delayed messages with latency between 10-22 minutes over the period 1357-1455 UTC and 5 consecutive delayed messages between 6-23 minutes over the period 1508-1611 UTC.**

- **Inmarsat and SITA have carried out independent investigations in addition to the CRA investigation. Some areas for further investigation have been identified. The investigation continues……..**

Thank you

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