

TEST REPORT	
Secondo i seguenti Standard / According to following Standards	
Test Methods	FCC KDB447498: 2015-10
Test specification	FCC Part 1 Subpart I Section 1.1307: 2016
	Test plan: /
RF exposure evaluation, FCC section 1.1307 (b)(1) and section 2.1091	Conforme/Compliant
Richiedente/ Applicant's name :	Leonardo S.p.a.
Indirizzo / Address	Piazza Montegrappa, 4 – 00195 – Roma – Italy
Produttore / Manufacturer :	Leonardo S.p.a.
Indirizzo / Address	Piazza Montegrappa, 4 – 00195 – Roma – Italy
Dispositivo sottoposto ai test/ Device Under Test :	TRA-100B Mode S Transponder, model TAC-6003/03 Rev. 05 FCC ID 2AKB2TRA100B
Data di emissione/ Date of issue	18 th November 2016
Validità/ Validity	Vedi sezione 1.1 / See section 1.1
Test report redatto da/ Author of Test report	Loris Fruch
Tecnico/i di prova Engineer/s	Loris Fruch
Approvato da (+ firma) Approved by (+ signature)	Silvano Chialina Responsabile del laboratorio/ <i>Head of the Laboratory</i> Firmato digitalmente da SILVANO CHIALINA <i>Silvano Chialina</i> ...O = non presente C = IT
Laboratorio / Testing Laboratory . :	EmilabSrl
Indirizzo / Address	Via F.lli Solari 5/A – 33020 Amaro (UD) - Italy

Index

1.	INFORMAZIONI GENERALI / <i>GENERAL INFORMATION</i>	3
1.0	Laboratorio / <i>Testing Laboratory</i>	3
1.1	Campionamento e Documentazione / <i>Sampling and Documentation</i>	3
1.2	Specifiche del test / <i>Test specifications</i>	3
1.3	Svolgimento dei test e condizioni generali / <i>Test scheduling and general condition</i>	4
1.4	Espressione dei risultati finali / <i>Test case of final verdicts</i>	4
1.5	Incertezza / <i>Uncertainty</i>	4
1.6	Termini, Definizioni e Acronimi / <i>Terms, definitions and abbreviations</i>	5
2.0	APPARECCHIATURA SOTTOPOSTA A TEST/ <i>DEVICE UNDER TEST</i>	6
3.0	VALUTAZIONE DELL'ESPOSIZIONE DELL'OPERATORE/RF EXPOSURE EVALUATION	8
3.1	Requisiti / <i>Requirements</i> - RF exposure evaluation	9
3.2	Risultati del test / <i>Test Results</i> - RF exposure evaluation	9

1. Informazioni Generali / General Information

1.0 Laboratorio / Testing Laboratory

Luogo di Prova e partecipanti/ Testing location and participants:	
Testing Laboratory:	
Testing location/ address.....:	EmilabSrl Via F.lli Solari 5/A – 33020 Amaro (UD) – Italy Tel +39 0433 468625 Fax +39 0433 494739 Email: info@emilab.it
Partecipanti / Participants:	Loris Fruch

1.1 Campionamento e Documentazione / Sampling and Documentation

I campioni sono stati consegnati dal Cliente. I risultati dei test contenuti in questo documento si riferiscono esclusivamente al modello e numero di serie provato. E' responsabilità del costruttore assicurare che la produzione dei modelli in serie rispetti i requisiti del presente documento. Questo documento non può essere riprodotto in parte senza il consenso scritto del responsabile del laboratorio EMILAB.

EMILAB non si assume nessuna responsabilità per danni derivanti da interpretazioni che esulano dal contesto e dall'applicazione del presente documento.

The samples was delivered by customer. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. This report shall not be reproduced, except in full, without the written approval of the Issuing testing Emilab laboratory.

EMILAB takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

1.2 Specifiche del test / Test specifications

Test performed according to:	
Test plan	/
Test specification	RF exposure evaluation, FCC section 1.1307 (b)(1) and section 2.1091
Test Method/Basic Standard	FCC KDB447498-RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES v.06: 2015-10

1.3 Svolgimento dei test e condizioni generali / *Test scheduling and general condition*

Svolgimento dei test/ Scheduling	
Data ricezione EUT	
<i>Date of receipt of EUT</i>	07/11/2016
Data esecuzione test	
<i>Date (s) of performance of tests</i>	08/11/2016 – 16/11/2016
Condizioni ambientali <i>/ Environment Conditions</i>	Se non diversamente specificato / <i>If not otherwise specified:</i> Temperature: 18-28°C Humidity: 20-90% Pressure: 87-108.56 kPa
Intervallo delle tarature/ <i>Calibration Interval</i>	Minimum 1 year

1.4 Espressione dei risultati finali / *Test case of final verdicts*

I GIUDIZI NON SONO SOGGETTI AD ACCREDITAMENTO <i>/ VERDICTS ARE NOT SUBJECT TO ACCREDITATION</i>	
- test case does not apply to the test object.. :	N/A
- test object does meet the requirement	Compliant or PASS
- test object does not meet the requirement . :	Not Compliant or FAIL

1.5 Incertezza / *Uncertainty*

L'incertezza estesa riportata è espressa come l'incertezza tipo moltiplicata per il fattore di copertura $k = 2$, che per una distribuzione normale corrisponde ad una probabilità di copertura di circa il 95 %.	
<i>The reported expanded uncertainty of measurements is stated as the standard uncertainty of measurement, multiplied by the coverage factor $k=2$, which for a normal distribution corresponding to a coverage probability of approximately 95%.</i>	

1.6 Termini, Definizioni e Acronimi / *Terms, definitions and abbreviations*

AC	Alternating Current
ACK	Acknowledgement
AFH	Adaptive Frequency Hopping
AM	Amplitude modulation
AVE det	Average Detector
BIT	Burst Interval Time
CAC	Channel Availability Check
BW	BandWidth
CCA	Clear Channel Assessment
CW	Continuous Wave
DAA	Detect And Avoid
DC	Duty CycleDFS
DFS	Dynamic Frequency Selection
DSSS	Direct Sequence Spread Spectrum
DUT	Device Under Test
EIRP	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EUT	Equipment Under Test
FAR	Fully Anechoic Room
FHSS	Frequency Hopping Spread Spectrum
HT20 High	Throughput in a 20 MHz channel
HT40 High	Throughput in a 40 MHz channel
LBT	Listen Before Talk
LPDA	Logarithmic Periodic Dipole Antenna
MCS	Modulation Coding Scheme
MIMO	Multiple Input, Multiple Output
MPE	Maximum Permissible Exposure
MU	Medium Utilisation
MS/s	Mega-Samples per second
NACK	Not Acknowledged
OATS	Open Air Test Site
OFDM	Orthogonal Frequency Division Multiplexing
OM	Operating Modes
OOB	Out Of Band
PK det	Peak Detector
PM	Pulse Modulation
Ppm	Parts per million
PPS	Pulses Per Second
PRF	Pulse Repetition Frequency
RBW	Resolution BandWidth
RE	Radiated Emission
RMS	Root Mean Square
RF	Radio Frequency
Rx	Receiver
SAC	Semi Anechoic Chamber
TEM	Transverse Electromagnetic
TL	Threshold Level
TPC	Transmit Power Control
Tx	Transmitter
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio

2.0 Apparecchiatura sottoposta a test/ *Device Under Test*

Descrizione/ <i>Description</i>	TRA-100B Mode S Transponder
Marchio commerciale / <i>Trade Mark</i>	
Produttore / <i>Manufacturer</i>	Leonardo S.p.a.
Modello / <i>Model/Type reference</i>	TAC-6003/03 Rev. 05
Voltage	115V
Current	380-400Hz
Frequency	<60W
Power	16LA00343/01
Numero EUT / <i>EUT Number</i>	S16419478
Serial Number	2AKB2TRA100B
Numero di campioni testati / <i>Number of samples tested</i>	1
Hardware stage/level	05
Software stage/level	TBR-6001/01.08 (revisione 08)
Firmware stage/level	TIS-5432/03.06 (revisione 06)
Modification stage	/
Operating Mode	/
Wiring harness	/
Monitoring	/

Info:

The EUT is an Aircraft station transmitter.

Product family description:

The TRA-100B Transponder family is composed by the following equipment:

1. TRA-100B for Airbus platforms with code: TAC-6001/03.05
2. TRA-100B for Boeing platforms with code: TAC-6003/03.05
3. TRA-100B for EASA/FAA platforms with code: TAC-6004/03.05

Tested model: the device selected for the tests as representative of the above described family is the model TAC-6003/03 Rev. 05.

Justification: As stated in the Qualification Strategy document 6AA-FI100190 REV 03: 10/2016, the three P/Ns relevant the TRA-100B family share the same OSW TBR-6001/01 and the same HW/FW TAD-6001/03. The difference is related to the way in which the same SW is executed on the same HW: in fact at production time the setting of a specific register of the equipment dedicated PROM within DPIO HWCI is performed with the specific platform configuration parameter (HW P/N) related to each platform thus justifying the three different P/Ns associated to each of them. Some different functionalities are activated by the unique OSW CSCI that is triggered by the mentioned platform configuration code. In detail, during the equipment startup the platform configuration code is recovered from the specified PROM and stored into a dedicated FPGA register and then it is read by OSW CSCI and stored into a specific volatile memory register. At any time a platform dependent function is to be executed, the OSW CSCI checks the value of such a stored configuration code and then the required function is accordingly executed.

Specifically the main OSW CSCI functionalities differences are:

1. Boeing configuration uses ARINC labels 360 for flight ID, while Airbus one uses ARINC labels from 233 to 237
2. the Maintenance bus is used by Airbus configuration both in Normal and in Interactive Mode, while it is used only in Normal Mode by Boeing one
3. ARINC labels used for different ARINC ports can differ from a configuration to another one.

Complete and detailed information are recorded into Equipment Specification document (Ref. D6).

Basing on what detailed above, the three equipment configurations are therefore composed by the same OSW TBR-6001/01, the same HW/FW TAD-6001/03 and differs for identification labels (same material and dimensions, different text content).

EUT Hardware features

These information are confidentially and were provided to the FCC.

Auxiliary equipment for tests supplied by the applicant:

- Control PC with ARINC 429 PCB board model ALTADATA
- IFF-45TS IFF test bench

Test software installed on Control PC:

- Altaview Bus Analyser version 2.6.3.0;
- IFF-45TS Remote Control for Mode S, version 2.31 beta

3.0 Valutazione dell'esposizione dell'operatore/RF exposure evaluation

Technician	Loris Fruch		
Table No.	TEST: RF exposure evaluation, Section 2.1091 and Section 1.1307 (b)(1)		\
Method	FCC KDB447498: 2015-10 (Mobile device)		\
Parameters required prior to the test	Laboratory Ambient Temperature	18 to 28 °C	
	Relative Humidity	20 to 90 %	
Parameters recorded during the test	Laboratory Ambient Temperature	/	
	Relative Humidity	/	
Supplementary information:			
- FCC Requirement: System operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines section 1.1307 (b) (1) of FCC Rules: 47 CFR Part 1 Subpart I; - EUT Classification: mobile device; The antenna of this product, under normal use condition, are at least 20cm away from the body of the user. The distance from DUT to evaluation point was selected on the basis of par. FCC Rules: 47 CFR Part 2 Subpart J: section 2.1091. - Applicable limit: Maximum Permissible Exposure (MPE) according to section 1.1310 of FCC Rules: 47 CFR Part 1 Subpart I; - Field density at given distance from antenna is evaluated by means of the far field formula: $S = (PG) / 4\pi R^2$$S = \text{Power Density (mW/cm}^2\text{)}$$P = \text{Power of transmitter (in mW)}$$G = \text{Gain of antenna (linear scale)}$$R = 20\text{cm}$ - Antenna type: omnidirectional antenna;			
Limits for Maximum Permissible Exposure (MPE)			
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm²)
Limits for Occupational / controlled Exposures			
300 - 1500	--	--	f/300
1500 – 100000	--	--	5.0
Limits for General population / Uncontrolled Exposure			
300 - 1500	--	--	f/1500
1500 – 100000	--	--	1.0
where f = Frequency in MHz			

3.1 Requisiti / Requirements - RF exposure evaluation

FCC Section 1.1310 Table 1 defines the MPE power density limits for 1090MHz under the frequency range from 300 to 1500MHz as follows:

- (A) Controlled Exposures 3.63mW/cm^2
- (B) Uncontrolled Exposure 727uW/cm^2

The EUT system antennas are mounted along the fuselage of air aircraft. These locations are accessible to airport maintenance personnel only and are in general not accessible to the general population.

In addition, airline maintenance and ramp operating procedures do not allow the system to utilize any of the bottom mounted radiating antennas when in the airport gate area where maintenance personnel have access to the aircraft.

These limited access restrictions placed upon the EUT falls under the definition of section (A) Controlled Exposures which requires a MPE power density limit of no more than 3.63mW/cm^2 averaged over a 6 minute period.

FCC Section 2.1091(b) defines a "mobile device" as "a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitters radiating structures and the body of the user(s) or nearby persons."

Since the EUT antennas mounting locations, along the top and bottom of the fuselage of air aircraft, are inaccessible in normal usage to any personnel and are located greater than 20 centimeters from any personnel, it falls under the definition mobile device in Section 2.1091(b).

The EUT does not fall into any of the categories described in Section 2.1091(c) that are subject to routine environmental evaluation for RF exposure.

As such, the EUT is "... categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use".

3.2 Risultati del test / Test Results - RF exposure evaluation

The EUT does not exceed the MPE limits of 3.63 mW/cm^2 average power in a 6 minutes period at a distance of 20cm, see tables below.

In operation, this antenna is on the exterior of an aircraft fuselage, and passengers inside are shielded from even this radiation by the aircraft's grounding skin. When on the ground the only emitting antennas are located along the top of the fuselage of an aircraft.

Antenna Output: TOP

Operating Mode	Freq. (MHz)	Tune-up Tolerance (dB) (*)	Peak Output Power (dBm)	Peak Output Power + tolerance (dBm)	Peak Output Power (mW)	Ant. Gain (dBi)	Distance at evaluation point (cm)	Duty cycle (%)	Power Density (mW/cm ²)	Power Density Limit (mW/cm ²)	Result (Pass/Fail)
120 Mode S Long	1090,0	0,8	57,1	57,9	616595,0	0,0	20	0,69	0,846	3,63	Pass
1200 ATCRBS	1090,0	1,5	55,0	56,5	446683,6	0,0	20	0,90	0,800	3,63	Pass
1200 ATCRBS + 120 Mode S Long	1090,0	0,9	57,0	57,9	616595,0	0,0	20	1,59	1,950	3,63	Pass

Antenna Output: BOTTOM

Operating Mode	Freq. (MHz)	Tune-up Tolerance (dB) (*)	Peak Output Power (dBm)	Peak Output Power + tolerance (dBm)	Peak Output Power (mW)	Ant. Gain (dBi)	Distance at evaluation point (cm)	Duty cycle (%)	Power Density (mW/cm ²)	Power Density Limit (mW/cm ²)	Result (Pass/Fail)
120 Mode S Long	1090,0	0,9	57,0	57,9	616595,0	0,0	20	0,69	0,846	3,63	Pass
1200 ATCRBS	1090,0	1,5	55,0	56,5	446683,6	0,0	20	0,90	0,800	3,63	Pass
1200 ATCRBS + 120 Mode S Long	1090,0	0,9	57,0	57,9	616595,0	0,0	20	1,59	1,950	3,63	Pass

Note: the output power values comes from Emilab Test Report No.: 16-02555

(*) Tune-up tolerance is calculated considering the difference from the measured power and the maximum peak power indicated by the manufacturer equal to 629W = 57.9dBm with a limit of 1.5dBm