A RADIO TEST REPORT

FOR

ANALOG DEVICES (IRE)

ON

EVAL-ADF7024DB2Z

DOCUMENT NO. TRA-022289-47-01-A

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Applicant	**:** Analog Devices (IRE)
Specification	**:** ETSI EN 300 220-2 V2.4.1 (2012-05) (Selected Clauses)
Apparatus	**:** EVAL-ADF7024DB2Z
Authorised by	**:** John Charters Digitally signed by John Charters DN: cn=John Charters, o=TRAC Global Ltd, ou=Radio Product Manager, email=john.charters@tracglobal.com, c=GB Date: 2014.10.09 16:33:22 +01'00'
	: Radio Product Manager
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Section 1: Introduction

1.1 General

This report contains an assessment of an apparatus based upon tests carried out on samples submitted to the Laboratory.

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1.2 Tests Requested By

This testing in this report was requested by :

Analog Devices (IRE)
Raheen Industrial Estate
Raheen
Limerick
Ireland

1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 22nd to 28th September 2014

EVAL-ADF7024DB2Z

The above equipment was a 868.3 MHz transmitter operating in the 868.0 MHz to 868.6 MHz band.

1.6 Essential Radio Test Suite And Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.7 to 1.9 of this test report.

This report contains an assessment of an apparatus against ETSI EN 300 220-2 V2.4.1 (2012-05) based upon tests carried out on samples submitted to the Laboratory.

Test Type	Application	Reference clause in ETSI EN 300 220-2 V2.4.1 (2012-05)	Appendix no in this report	Mod no.	Result
Effective Radiated Power (Transmitter Carrier ERP)	Test Fixture[#] Or Antenna	4.2.1.3	A1	0	Pass
Spurious Emissions: Transmitter Spurious Radiated Emissions (ERP) - Active	Cabinet and Antenna	4.2.1.8	A2	0	Pass
Spurious Emissions: Transmitter Spurious Conducted Emissions - Active	Antenna	4.2.1.8	A3	0	Pass

Note: Selected Clauses only Request by the client.

1.7 Summary of Compliance

The samples, as assessed, satisfied the relevant requirements of
ETSI EN 300 220-2 V2.4.1 (2012-05), as detailed in section 2.1 of this test report.

1.8 Notes Relating to the Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.8 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, “Pass” indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature : 17 to 23 °C
Humidity : 45 to 75 %
Barometric Pressure : 86 to 106 kPa

Note that temperature and humidity conditions can be found in the relevant test results appendix A.
All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.9 Deviations from Test Standards

As per the customer request testing was only performed to the following clauses.

- 7.3 Transmit – ERP;
- 7.8 Transmit - Unwanted emissions in the spurious domain

Section 2: Measurement Uncertainty

2.1 Application of Measurement Uncertainty

The interpretation of the results for the measurements described in the standard ETSI EN 300 220-1 V2.4.1 (2012-05) are as follows:

- The measured value related to the corresponding limit is used to decide whether an equipment meets the requirements of the standard.
- The measurement uncertainty value for the measurement of each parameter is recorded in section 2.3 of this report.
- All values of measurement uncertainty are equal to or lower than the values in the table (section 2.2)below as required by the standard.

2.2 Maximum measurement uncertainty values allowed by the standard

Parameter	Uncertainty
Radio frequency	± 1 x 10^{-7}
RF power, conducted	± 1.5 dB
Maximum frequency deviation: - within 300 Hz and 6 kHz of audio frequency - within 6 kHz and 25 kHz of audio frequency	 ±5 % ±3 dB
Adjacent channel power	±3 dB
Conducted spurious emission of transmitter, valid up to 6 GHz	±3 dB
Conducted emission of receivers	±3 dB
Radiated emission of transmitter, valid up to 6 GHz	±6 dB
Radiated emission of receiver, valid up to 6 GHz	±6 dB
RF level uncertainty for a given BER	±1.5 dB
Temperature	±1^{o}C
Humidity	±10 %

2.3 Measurement Uncertainty Values

For the test data recorded the following measurement uncertainty was calculated.

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Power Meter) = **1.08dB**
Uncertainty in test result (Spectrum Analyser) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Frequency Counter) = **0.113ppm**
Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,
Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result – Up to 8.1GHz = **3.31dB**
Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**
Uncertainty in test result – Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**,
Uncertainty in time measurement = **0.59%,**
Uncertainty in Amplitude measurement = **0.82%**

[12] Power Line Conduction

Uncertainty in test result = **3.4dB**

[13] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[14] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[15] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[16] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[17] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[18] Receiver Threshold

Uncertainty in test result = **3.23dB**

[19] Transmission Time Measurement

Uncertainty in test result = **7.98%**

Section 3: Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A: Formal Transmitter Emission Test Results

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
EUT	: Equipment Under Test	ATS	: Alternative Test Site
SE	: Support Equipment	Ref	: Reference
L	: Live Power Line	Freq	: Frequency
N	: Neutral Power Line	MD	: Measurement Distance
E	: Earth Power Line	SD	: Spec Distance
Pk	: Peak Detector	Pol	: Polarisation
QP	: Quasi-Peak Detector	H	: Horizontal Polarisation
Av	: Average Detector	V	: Vertical Polarisation

A1 Effective Radiated Power

Test Details:	
Standard	ETSI EN 300 220-2 V2.4.1 (2012-05)
Reference clause	4.2.1.3
Application	Cabinet and Antenna / Test Fixture[#]
EUT sample number	S03,S08
Modification state	0
SE in test environment	S02
SE isolated from EUT	None
Ambient temperature °C	25
Relative humidity %	39
EUT set up	Refer to Appendix C

Test Conditions		ERP (dBm)		
		Measured power in (dBm)	Measured power in (mW)	Limit (mW)
Tnom:	V_{nom}	12.9	19.69	25

Notes: For equipment using DSSS or FHSS, the maximum power density in a in a 100kHz resolution bandwidth is recorded

Applicable [ ]

Not Applicable [X]

Limit ETSI EN 300 220-1 V2.4.1 (2012-05) Clause 7.3

Permitted Carrier powers in different SRD frequency in ETSI EN 300 220 - V2.4.1 (2012-05) Clause 7.2.3 table 5.

Carrier power limit, e.r.p

Frequency Bands/frequencies	Applications	Maximum radiated power, e.r.p. / power spectral density
868.0 – 868.6	Non specific use	25 mW

This limit is derived from ETSI EN 300 220 - V2.4.1 (2012-05)Clause 7.2.3 table 5.
Further information can be found in CEPT/ERC/REC 70-03 [i-1] and commission decision 2006.771/EC[i.4]

A2 Transmitter Spurious Radiated Emissions – Active

Test Details:	
Standard	ETSI EN 300 220-2 V2.4.1 (2012-05)
Reference clause	4.2.1.7
Frequency range	25 MHz to 6 GHz
Application	Cabinet and Antenna
EUT sample number	S03,S08
Modification state	0
SE in test environment	S02
SE isolated from EUT	None
Ambient temperature °C	25
Relative humidity %	39
EUT set up	Refer to Appendix C

The worst-case radiated emission measurements for spurious emissions and harmonics are listed below:

Ref No.	Freq (MHz)	Result (dBm)	Result (W)	Spec. Limit (W)	Margin (dB)	Summary
1	1736.600	-44.5	0.04μW	1μW	-14.5	PASS
2	2604.900	-38.3	0.15μW	1μW	-8.3	PASS
3	3473.200	-31.9	0.65μW	1μW	-1.9	PASS
4	4341.540	-38.3	0.15μW	1μW	-8.3	PASS
10	5209.850	-40.6	0.09μW	1μW	-10.6	PASS

No further emissions were detected within 10dB of the specification limit

Limit ETSI EN 300 220-1 V2.4.1 (2012-05) Clause 7.8.3

State	Frequency 47MHz to 74MHz 87.5 to 118MHz 174MHz to 230MHz 470MHz to 862MHz	Other Frequencies below 1000MHz	Frequencies above 1000MHz
Operating	4nW	250nW	1μW
Standby	2nW	2nW	20nW

Notes:

(a) The levels may have been rounded for display purposes.

(b) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels	✓			
Effect of Position of EUT cables & samples on emission levels	✓			

(i) Parameter defined by standard and / or single possible, refer to Appendix D
(ii) Parameter defined by client and / or single possible, refer to Appendix D
(iii) Parameter had a negligible effect on emission levels, refer to Appendix D
(iv) Worst case determined by initial measurement, refer to Appendix D

A3 Transmitter Spurious Conducted Emissions – Active

Test Details:	
Standard	ETSI EN 300 220-2 V2.4.1 (2012-05)
Reference clause	4.2.1.7
Frequency range	25 MHz to 6 GHz
Application	Antenna
EUT sample number	S03
Modification state	0
SE in test environment	S02
SE isolated from EUT	None
Ambient temperature °C	25
Relative humidity %	39
EUT set up	Refer to Appendix C

The worst-case radiated emission measurements for spurious emissions and harmonics are listed below:

Ref No.	Freq (MHz)	Result (dBm)	Result (W)	Spec. Limit (W)	Margin (dB)	Summary
1	1736.57	-45.40	0.03	1 μW	-15.40	PASS

No further emissions were detected within 10dB of the specification limit

Limit ETSI EN 300 220-1 V2.4.1 (2012-05) Clause 7.8.3

State	Frequency 47MHz to 74MHz 87.5 to 118MHz 174MHz to 230MHz 470MHz to 862MHz	Other Frequencies below 1000MHz	Frequencies above 1000MHz
Operating	4nW	250nW	1μW
Standby	2nW	2nW	20nW

Notes:

(a) The levels may have been rounded for display purposes.

(b) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels	✓			
Effect of Position of EUT cables & samples on emission levels	✓			

(i) Parameter defined by standard and / or single possible, refer to Appendix D
(ii) Parameter defined by client and / or single possible, refer to Appendix D
(iii) Parameter had a negligible effect on emission levels, refer to Appendix D
(iv) Worst case determined by initial measurement, refer to Appendix D

Appendix B: Supporting Graphical Data

This appendix contains no graphical data.

Appendix C: Additional Test and Sample Details

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

Sample No: Sxx Mod w

where:

xx = sample number eg. S01
w = modification number eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

Positioning of cards in a chassis.
Setting of any internal switches.
Circuit board jumper settings.
Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as “single possible configuration”.

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

C1) Test samples

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S01	Board EVAL-ADF7xxxMB4Z	None
S02	Board EVAL-ADF7xxxMB4Z	None
S03	Board EVAL-ADF7024DB2Z	None
S04	Board EVAL-ADF7024DB2Z	None
S05	Board EVAL-ADF7023DB2Z	None
S06	Board EVAL-ADF7023DB2Z	None
S07	USB Cable	None
S08	868 MHz Antenna	None
S09	915 MHz Antenna	None

C2) EUT Operating Mode During Testing.

During testing, the EUT was exercised as described in the following tables :

Test	Description of Operating Mode: Transmit
Carrier power & Spurious Emissions	The device will be configured for GFSK modulation, 50kbps data rate and 25KHz frequency deviation for all tests (FCC and ETSI);

C3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The table below describes the termination of EUT ports:

Sample : S03 & S08
Tests : Radiated

Port	Description of Cable Attached	Cable length	Equipment Connected
Header	None	0	S02

Sample : S03
Tests : Conducted

Port	Description of Cable Attached	Cable length	Equipment Connected
Antenna	Coaxial	<1m	Measurement System
Header	None	0	S02

C5 Details of Equipment Used

TRaC No	Equipment Type	Equipment Description	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
UH004	ESVS10	Receiver	R&S	27/02/2014	12	27/02/2015
UH028	UHALP 9108	Log Periodic Ant	Schwarbeck	08/07/2013	24	08/07/2015
UH029	VHBA 9123	Bicone Antenna	Schwarbeck	19/08/2013	24	19/08/2015
UH281	FSU46	Spectrum Analyser	R&S	26/03/2014	12	26/03/2015
UH403	ESCI 7	Recevier	R&S	20/08/2014	12	20/08/2015
UH405	FSU26	Spectrum Analyser	R&S	16/04/2014	12	16/04/2015
UH420	CBL6112	Bilog	Chase	25/07/2014	24	25/07/2016
UH456	ESR7	EMI Receiver	R&S	16/04/2014	12	16/04/2015
L138	3115	1-18GHz Horn	EMCO	17/10/2013	24	17/10/2015
L139	3115	1-18GHz Horn	EMCO	20/09/2013	24	20/09/2015
L176	2042	Signal Generator	Marconi	29/11/2013	12	29/11/2014
L254	2042	Signal Generator	Marconi	08/01/2014	12	08/01/2015
L193	VHA 9103 balu	Bicone Antenna	Chase	25/06/2014	24	25/06/2016
L203	UPA6108	Log Periodic Ant	Chase	25/06/2014	24	25/06/2016
L290	CBL611/A	Bilog	Chase	13/12/2012	24	13/12/2014
L317	ESVS10	Receiver	R&S	12/02/2014	12	12/02/2015
L352	ESVS10	Receiver	R&S	21/03/2014	12	21/03/2015
REF909	FSU26	Spectrum Analyser	R&S	12/02/2014	12	12/02/2015
REF916	SMBV100A	Signal Generator	R&S	19/02/2014	12	19/02/2015
REF977	SH4141	High Pass Filter	BSC	25/02/2013	24	25/02/2015

Appendix D: Additional Information

No additional information is included within this test report.