



R051-24-10-106265-5/A Ed. 1

“This report cancels and replaces the test report n° R051-24-10-106265-5/A Ed.0”

<p>RADIO test report</p> <p>according to standard: FCC Part 15 (2010) Class 2 Permissive change</p> <p>Equipment under test: FHSS DIGITAL COMMUNICATION TERMINAL VOKKERO EVOLUTION 3</p> <p>FCC ID: U3Z-ARF7672</p> <p>Company: ADEUNIS RF</p>

DISTRIBUTION: Mr SAGUIN

Company: ADEUNIS RF

Number of pages: 24 including 2 annexes

Ed.	Date	Modified Page(s)	Written by		Technical Verification Quality Approval	
			Name	Visa	Name	Visa
1	14-Jun-11	6	L.Berthaud	LB		

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PRODUCT: FHSS DIGITAL COMMUNICATION TERMINAL

Trade mark: VOKKERO EVOLUTION 3

Reference / model: ARF7672AS/DU/DV

Serial number: not communicated

MANUFACTURER: ADEUNIS RF

COMPANY SUBMITTING THE PRODUCT:

Company: ADEUNIS RF

Address: 283 rue Louis Néel
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Responsible: Mr SAGUIN

DATE(S) OF TEST: 01, 06 and 08 April 2011

TESTING LOCATION: EMITECH ATLANTIQUE laboratory at ANGERS (49) FRANCE
EMITECH ATLANTIQUE open area test site in LA POUEZE (49)
FRANCE
FCC Registration Number: 101696/FRN: 0006 6490 08

TESTED BY: L. BERTHAUD

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1. INTRODUCTION

This document presents the result of RADIO test carried out on the following equipment: FHSS DIGITAL COMMUNICATION TERMINAL-VOKKERO EVOLUTION 3 in accordance with normative reference.

2. PRODUCT DESCRIPTION

ITU Emission code:	250KF7D
Class:	B (residential environment)
Utilization:	FHSS digital communication terminal
Antenna type and gain:	ANT-900MR Right-Angled SMA (0 dBi) PSKN3-9255 adjusted SMA (2.3 dBi) CD900 dip SMA (5 dBi + cable loss = 0 dBi)
Operating frequency range:	from 902.75 MHz to 927.75 MHz
Number of channels:	25
Channel spacing:	500 kHz
Frequency generation:	synthesizer
Modulation:	GFSK
Power source:	3.7 V rechargeable Li-Polymer batteries

Power level, frequency range and channels characteristics are not user adjustable.
The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

The standards and testing methods related throughout this report are those listed below. They are applied on the whole test report even though the extensions (version, date and amendment) are not repeated.

FCC Part 15 (2009)	Radio Frequency Devices
ANSI C63.4 (2003)	Methods of Measurement of Radio-Noise Emissions from Low-voltage Electrical and Electronics Equipment in the range of 9 kHz to 40 GHz.
KDB Publication 558074 (2005)	Measurement of Digital Transmission Systems Operating under Section 15.247
Public Notice DA 00-705	Filing and Measurement Guideline for Frequency Hopping Spread Spectrum Systems.

4. TEST METHODOLOGY

Radio performance tests procedures given in part 15:

Subpart B –Unintentional Radiators

Paragraph 107: Conducted limits

Paragraph 109: Radiated emission limits

Paragraph 111: Antenna power conduction limits for receivers

Subpart C – Intentional Radiators

Paragraph 203: Antenna requirement

Paragraph 205: Restricted bands of operation

Paragraph 207: Conducted limits

Paragraph 209: Radiated emission limits; general requirements

Paragraph 212: Modular transmitter

Paragraph 215: Additional provisions to the general radiated emission limitations

Paragraph 247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

5. ADD ATTACHMENTS FILES

- “Synoptic “*
- “Block diagram “*
- “External photos and Product labeling “*
- “Assembly of components “*
- “Internal photos “*
- “Layout pcb “*
- “Bil of materials “*
- “Schematics “*
- “Product description “*
- “User guide “*

Ed.1 | **6. TEST EQUIPMENTS CALIBRATION DATES**

Equipment	Model	Type	last verification	Next verification	validity
728	11966C	Biconical antenna	18/11/2008	18/11/2012	17/01/2013
812	77-2	Multimeter	22/03/2011	22/03/2013	21/05/2013
1058	ESH3	Test receiver	24/01/2011	24/01/2013	25/03/2013
1204	EM-6961	Guide antenna	30/05/2008	30/05/2012	29/07/2012
1219	ESVS10	Test receiver	23/02/2009	23/02/2011	24/04/2011
1274	Emitech	OATS	28/01/2010	28/01/2012	28/03/2012
1406	6502	Loop antenna Logperiodic	13/01/2011	13/01/2013	14/03/2013
1999	HL223	antenna	18/11/2008	18/11/2012	17/01/2013
2648	DB97-1852	Pre-amplifier	30/04/2010	30/04/2011	29/06/2011
3182	80401A-510	Power sensor	28/05/2010	28/05/2012	27/07/2012
3479	8541B	Powermeter	28/05/2010	28/05/2012	27/07/2012
4088	FSP40	Spectrum analyzer	16/12/2009	16/12/2011	14/02/2012
6609	HPM11630 HP12/1200-	High-pass filter	21/03/2011	21/03/2013	20/05/2013
7310	5AA	High-pass filter	16/09/2009	16/09/2011	15/11/2011

7. TESTS AND CONCLUSIONS

7.1 unintentional radiator (subpart B)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAP	NAs	
FCC Part 15.107	CONDUCTED LIMITS			X		
FCC Part 15.109	RADIATED EMISSION LIMITS	X				Permissive change
FCC Part 15.111	ANTENNA POWER CONDUCTED LIMITS FOR RECEIVER	X				

NAP: Not Applicable

NAs: Not Asked

7.2 intentional radiator (subpart C)

Test procedure	Description of test	Respected criteria?				Comment
		Yes	No	NAP	NAs	
FCC Part 15.203	ANTENNA REQUIREMENT	X				Note 1
FCC Part 15.205	RESTRICTED BANDS OF OPERATION	X				
FCC Part 15.207	CONDUCTED LIMITS			X		
FCC Part 15.209	RADIATED EMISSION LIMITS; general requirements	X				Note 2
FCC Part 15.212	MODULAR TRANSMITTERS			X		
FCC part 15.215	ADDITIONAL PROVISIONS TO THE GENERAL RADIATED EMISSION LIMITATIONS					
	(a) Alternative to general radiated emission limits	X				
	(b) Unwanted emissions outside of §15.247 frequency bands	X				Note 3
	(c) 20 dB bandwidth and band-edge compliance				X	Permissive change
FCC Part 15.247	OPERATION WITHIN THE BANDS 902-928 MHZ, 2400-2483.5 MHZ and 5725-5850 MHZ					
	(a) (1) Hopping systems				X	Permissive change
	(a) (2) Digital modulation techniques			X		
	(b) Maximum peak output power	X				
	(c) Operation with directional antenna gains > 6 dBi			X		
	(d) Intentional radiator	X				
	(e) Peak power spectral density			X		
	(f) Hybrid system			X		
	(g) Frequency hopping requirements			X		
	(h) Frequency hopping intelligence			X		
	(i) RF exposure compliance	X				Note 4

NAP: Not Applicable

NAs: Not Asked

Note 1: Dedicated antenna. Professionally installed equipment.

Note 2: See FCC part 15.247 (d).

Note 3: See FCC part 15.209. Unwanted emissions levels are all below the fundamental emission field strength level.

Note 4: This equipment uses less than 0.5 W of output power with a high signal transmitting duty factor (section 3 from O and 65c).

Conclusion:

The sample of FHSS DIGITAL COMMUNICATION TERMINAL -VOKKERO EVOLUTION 3 submitted to the tests complies with the regulations of the standard FCC Part 15 in accordance with the limits or criteria defined in this report.

8. RADIATED EMISSION LIMITS

Standard: FCC Part 15

Test procedure: paragraph 109

Limit class: Class B

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver	Rohde & Schwarz ESH3	1058
Test receiver	Rohde & Schwarz ESVS10	1219
Spectrum analyzer	Rohde & Schwarz FSP40	4088
Loop antenna	EMCO 6502	1406
Biconical antenna	Hewlett Packard 11966 C	0728
Log periodic antenna	Rohde & Schwarz HL 223	1999
Double ridged guide antenna	Electrometrics EM 6961	1204
Preamplifier 1 to 18 GHz	DBS Microwave DB97-1852	2648
High pass filter	Micro-tronics HPM11630	6609
Open area test site	EMITECH	1274
Multimeter	Fluke 77-2	0812

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuths correspond to the front of the equipment under test.

Frequency range: From 9 kHz to 5000 MHz (highest frequency used: 927.75 MHz).

Detection mode: Quasi-peak (F < 1 GHz) Average (F > 1 GHz)

Bandwidth: 120 kHz (F < 1 GHz) 1 MHz (F > 1 GHz)

Distance of antenna: 3 meters

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal (only the highest level is recorded)

Equipment under test operating condition:

The equipment is blocked in standby / reception mode.

Results:

Ambient temperature (°C): 18
Relative humidity (%): 62

Power source:

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 4.18
Voltage at the end of test (V): 4.16
Percentage of voltage drop during the test (%): 0.5

Not any spurious has been detected with the three antenna models.

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Test conclusion:

RESPECTED STANDARD

9. MAXIMUM PEAK OUTPUT POWER

Standard: FCC Part 15

Test procedure: paragraph 15.247 (b)

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Spectrum analyzer	Rohde & Schwarz FSP40	4088
Power meter	Gigatronics 8541B	3479
Power sensor	Gigatronics 80401A	3182
Multimeter	Fluke 77-2	0812

Test set up:

The measure is realized in conducted mode with a calibrated peak power responding power meter.

Equipment under test operating condition:

The equipment under test is blocked in continuous transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 23
Relative humidity (%): 32

Power source:

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 4.18
Voltage at the end of test (V): 4.12
Percentage of voltage drop during the test (%): 1.4

Sample n° 1 low channel

	P* (W)	Limit(W)
Normal test conditions	229.1×10^{-3}	250×10^{-3}

Power charge compared to previous version: 0 dB

Middle channel

	P* (W)	Limit(W)
Normal test conditions	223.9×10^{-3}	250×10^{-3}

Power charge compared to previous version: 0 dB

High channel

	P* (W)	Limit(W)
Normal test conditions	229.1×10^{-3}	250×10^{-3}

Power charge compared to previous version: 0 dB

Test conclusion:

RESPECTED STANDARD

10. INTENTIONAL RADIATOR

Standard: FCC Part 15

Test procedure: paragraph 15.205
paragraph 15.209
paragraph 15.247 (d)

Test equipments:

TYPE	BRAND	EMITECH NUMBER
Test receiver	Rohde & Schwarz ESH3	1058
Test receiver	Rohde & Schwarz ESVS10	1219
Spectrum analyzer	Rohde & Schwarz FSP40	4088
Loop antenna	EMCO 6502	1406
Biconical antenna	Hewlett Packard 11966 C	0728
Log periodic antenna	Rohde & Schwarz HL 223	1999
Double ridged guide antenna	Electrometrics EM 6961	1204
Preamplifier 1 to 18 GHz	DBS Microwave DB97-1852	2648
High pass filter	Micro-tronics HP12/1200-5AA	7310
Open area test site	EMITECH	1274
Multimeter	Fluke 77-2	0812

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 0.8 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

Frequency range: From 9 kHz to 10th harmonic of the highest fundamental frequency (927.75 MHz).

Bandwidth: 120 kHz (F < 1 GHz) or 100 kHz, following 15.205 or 15.247
1 MHz (F > 1 GHz) or 100 kHz, following 15.205 or 15.247

Distance of antenna: between 30 m and 3 m according the frequencies and the limits.

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal, only the highest level is recorded.

Equipment under test operating condition:

The equipment under test is blocked in continuous transmission mode, modulated by internal data signal, at the highest output power level which the transmitter is intended to operate.

Results:

Ambient temperature (°C): 17.5
 Relative humidity (%): 64

Power source:

We used for power source the internal battery of the equipment and we noted:

Voltage at the beginning of test (V): 4.18
 Voltage at the end of test (V): 4.09
 Percentage of voltage drop during the test (%): 2.1

Antenna: ANT-900 MR

Low channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1805.5	P	120	50	100	H	64.4	97.6	33.2
2708.3	Av	100	300	1000	H	28.1	54*	25.9
2708.3	P	100	300	1000	H	59.3	74*	14.7
3611	Av	100	0	1000	V	25.6	54*	28.4
3611	P	100	0	1000	V	54.7	74*	19.3

Middle channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1830.5	P	115	50	100	H	64.3	97.6	33.3
2745.7	Av	100	290	1000	H	27.7	54*	26.3
2745.7	P	100	290	1000	H	58.9	74*	15.1
3661	Av	105	0	1000	V	26.1	54*	27.9
3661	P	105	0	1000	V	55.2	74*	18.8

High channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1855.5	P	110	50	100	H	64.4	97.6	33.2
2783.2	Av	100	300	1000	H	28.1	54*	25.9
2783.2	P	100	300	1000	H	59.3	74*	14.7
3711	Av	100	0	1000	V	25.4	54*	28.6
3711	P	100	0	1000	V	54.5	74*	19.5

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section.

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 117.6 dBµV/m.

So the applicable limit is 97.6 dBµV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Antenna: PSKN3-9255

Low channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1805.5	P	115	0	100	V	61.1	102.1	41
2708.3	Av	110	0	1000	V	21.4	54*	32.6
2708.3	P	110	0	1000	V	52.6	74*	21.4
3611	Av	100	0	1000	V	22.1	54*	31.9
3611	P	100	0	1000	V	51.2	74*	22.8

Middle channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1830.5	P	110	0	100	V	60.3	102.1	41.8
2745.7	Av	110	0	1000	V	21.6	54*	32.4
2745.7	P	110	0	1000	V	52.8	74*	21.2
3661	Av	110	0	1000	V	22.4	54*	31.6
3661	P	110	0	1000	V	51.5	74*	22.5

High channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1855.5	P	100	0	100	V	60.5	102.1	41.6
2783.3	Av	110	0	1000	V	22.1	54*	31.9
2783.3	P	110	0	1000	V	53.3	74*	20.7
3710.9	Av	110	0	1000	V	22.9	54*	31.1
3710.9	P	110	0	1000	V	52	74*	22

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section.

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 122.1 dBµV/m.

So the applicable limit is 102.1 dBµV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Antenna: CD900

Low channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1805.4	P	100	0	100	V	54.8	97.5	42.7
2708.3	Av	100	0	1000	V	16.6	54*	37.4
2708.3	P	100	0	1000	V	47.8	74*	26.2
3610.9	Av	100	0	1000	V	16.2	54*	37.8
3610.9	P	100	0	1000	V	45.3	74*	28.7

Middle channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1830.5	P	100	0	100	V	54.1	97.5	43.4
2745.6	Av	100	0	1000	V	15.9	54*	38.1
2745.6	P	100	0	1000	V	47.1	74*	26.9
3661	Av	100	0	1000	V	15.6	54*	38.4
3661	P	100	0	1000	V	44.7	74*	29.3

High channel

FREQUENCIES (MHz)	Detector P: Peak QP: Quasi-Peak Av: Average	Antenna height (cm)	Azimuth (degree)	resolution bandwidth (kHz)	Polarization H: Horizontal V: Vertical	Field strength (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1855.4	P	100	0	100	V	55.1	97.5	42.4
2783.2	Av	100	0	1000	V	17.2	54*	36.8
2783.2	P	100	0	1000	V	48.4	74*	25.6
3710.9	Av	100	0	1000	V	16.8	54*	37.2
3710.9	P	100	0	1000	V	45.9	74*	28.1

* restricted bands of operation in 15.205, this limit corresponding at the 15.209 section.

Note: any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

Applicable limits: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The highest level recorded in a 100 kHz bandwidth is 117.5 dBµV/m.

So the applicable limit is 97.5 dBµV/m.

In addition, radiated emissions which fall in the restricted band, as defined in section 15.205 (a), must also comply with the radiated emission limits specified in section 15.209 (a) (see section 15.205 (c)).

Test conclusion:

RESPECTED STANDARD

□□□ End of report, 2 annexes to be forwarded □□□

ANNEX 1: PHOTOS OF THE EQUIPMENT UNDER TEST

GENERAL VIEW



PRINTED CIRCUIT BOARD: FACE 1



PRINTED CIRCUIT BOARD: FACE 2



ANT-900MR



PSKN3-9255



CD900



ANNEX 2: TEST SET UP

RADIATED MEASUREMENTS

ANT-900 MR



PSKN3-9255



CD900

