

InterLab®

Final Report on

Parrot BEBOP DRONE

Report Reference: MDE_PARRO_1430_FCCc
according to FCC Part 15, subpart B
FCC ID: RKXMYKONOS3
IC: 5119A-MYKONOS3

Date: October 13, 2014

Test Laboratory:

7Layers AG
Borsigstr. 11
40880 Ratingen
Germany

Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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TAX No. 147/5869/0385

1 Administrative Data

1.1 Project Data

Project Responsible: Imad Hjije
Date Of Test Report: 2014/10/06
Date of first test: 2014/08/28
Date of last test: 2014/09/22

1.2 Applicant Data

Company Name: Parrot S.A.

Street: 174 quai de Jemmapes
City: 75010 Paris
Country: France

Contact Person: Mr. Imad Benyacoub

Phone: +33 (0) 1 48 03 74 07
Fax: +33 (0) 1 48 03 74 00
E-Mail: imad.benyacoub@parrot.com

1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:

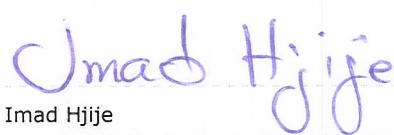
7 layers DE

<i>Company Name :</i>	7 layers AG
<i>Street :</i>	Borsigstrasse 11
<i>City :</i>	40880 Ratingen
<i>Country :</i>	Germany
<i>Contact Person :</i>	Mr. Michael Albert
<i>Phone :</i>	+49 2102 749 201
<i>Fax :</i>	+49 2102 749 444
<i>E Mail :</i>	Michael.Albert@7Layers.com

Laboratory Details

Lab ID	Identification	Accreditation Info
Lab 1	Conducted Emissions	DAkkS-Registration no. D-PL-12140-01-01
Lab 2	Radiated Emissions	DAkkS-Registration no. D-PL-12140-01-01

1.4 Signature of the Testing Responsible



Imad Hjije

responsible for tests performed in: Lab 1, Lab 2



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1.5 Signature of the Accreditation Responsible



Accreditation scope responsible person
 responsible for Lab 1, Lab 2



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2 Test Object Data

2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

OUT: Parrot BEBOP DRONE

Manufacturer:

Company Name: Please see applicant data

Contact Person: -

Parameter List:

Parameter name	Value
AC Power Supply	120v/60Hz (AC)
Antenna Gain	Antenna1: 1.04 dBi in 2.4 GHz and 0.8 dBi (SB1) / 2.12 dBi (SB3) in 5 GHz band
	Antenna2: 1.29 dBi in 2.4 GHz and 0.5 dBi (SB1) / 1.43 dBi (SB3) in 5 GHz band.
DC Power Supply	3.7 - 5.0 (V)

2.2 Detailed Description of OUT Samples

Sample : AB01

OUT Identifier	Parrot BeBob Drone
Sample Description	Parrot BEBOP DRONE
Serial No.	PI040306D14E000137
HW Status	HW07
SW Status	1.3.0
Nominal Voltage	4.2 V
	Normal Temp. 25 °C

2.3 OUT Features

Supported Features for OUT: BeBob Drone

Designation	Description	Supported Value(s)
Features for scope: FCC_v2		
AC	The OUT is powered by or connected to AC Mains	

2.4 Auxiliary Equipment

<i>AE No.</i>	<i>Type Designation</i>	<i>Serial No.</i>	<i>HW Status</i>	<i>SW Status</i>	<i>Description</i>
AE 03					Cable adapter usb / RJ45
AE 09					Ethernet Cable
AE 01					USB Cable
AE 04	Fujitsu LIFEBOOK E Series E781	DSCK013817			Laptop RE
AE 06	LG L17NB-3	504WAHS3J881			EMC TFT 1
AE 07	Logitech M-BT58	HC60915A2XC			Mouse
AE 08	Logitech Ultrax Media Keyboard	ST635J01624			Keyboard
AE 02	PI020572				Lithium-ion polymer rechargeable
AE 05	SED100P2-19.0	07Y17323A	120v/60Hz AC		AC Adapter

2.5 Operating Mode(s)

<i>Ref.-No.</i>	<i>Description</i>
1	WLAN TX on 2437 MHz, n-mode, LAN connection to laptop + ping via putty software. USB Connection between laptop and EUT.

2.6 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

<i>Setup No.</i>	<i>List of OUT samples</i>		<i>List of auxiliary equipment</i>	
	<i>Sample No.</i>	<i>Sample Description</i>	<i>AE No.</i>	<i>AE Description</i>
PC_AB01				
	Sample: AB01	Parrot BEBOP DRONE	AE 03	Cable adapter usb / RJ45
			AE 09	Ethernet Cable
			AE 01	USB Cable
			AE 04	Laptop RE
			AE 06	EMC TFT 1
			AE 07	Mouse
			AE 08	Keyboard
			AE 02	Lithium-ion polymer rechargeable
			AE 05	AC Adapter

3 Results

3.1 General

Documentation of tested devices:

Available at the test laboratory.

Interpretation of the test results:

The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

Note:

1. This report contains the abbreviated information content pertaining to services rendered. Supporting documentation not included herein is maintained and available at the laboratory.

2. All tests are performed under environmental conditions within the requirements of the specifications. Environmental conditions are available at the laboratory.

3.2 List of the Applicable Body

(Body for Scope: FCC_v2)

<i>Designation</i>	<i>Description</i>
FCC47CFRChIPART15bRADIO FREQUENCY DEVICES	Part 15, Subpart B - Unintentional Radiators

3.3 List of Test Specification

Test Specification: **FCC part 2 and 15**

Version 10-1-13 Edition

Title: PART 2 - GENERAL RULES AND REGULATIONS

PART 15 - RADIO FREQUENCY DEVICES

3.4 Summary

<i>Test Case Identifier / Name</i>		<i>Verdict</i>	<i>Date of Test</i>	<i>Lab Ref.</i>	<i>Setup</i>
15b.1 Conducted Emissions (AC Power Line) §15.107	15b.1; Mode = generating a high power consumption	Passed operating mode: 1	2014/09/22	Lab 1	PC_AB01
15b.2 Spurious Radiated Emissions §15.109	15b.2; Mode = generating a high power consumption	Passed operating mode: 1	2014/08/28	Lab 2	PC_AB01

3.5 Detailed Results

3.5.1 15b.1 Conducted Emissions (AC Power Line) §15.107

Test: 15b.1; Mode = generating a high power consumption

Result: Passed

Setup No.: PC_AB01

Date of Test: 2014/09/22 16:59

Body: FCC47CFRChIPART15bRADIO FREQUENCY DEVICES

Test Specification: FCC part 2 and 15

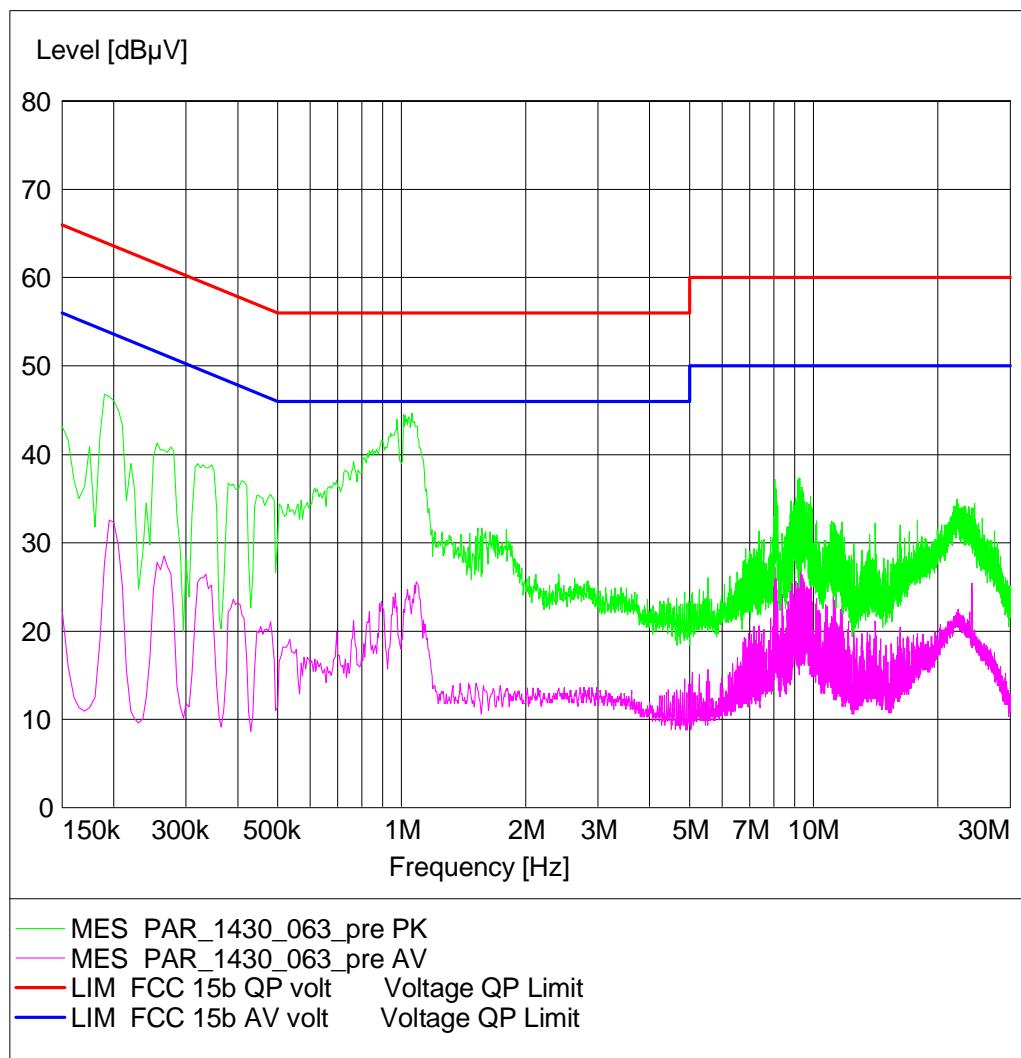
Detailed Results:

AC MAINS CONDUCTED

EUT: (DE1018005ab01)
 Manufacturer: Parrot
 Operating Condition: WLAN TX on 2437 MHz, n-mode, LAN connection to laptop + ping
 Test Site: 7 layers Ratingen
 Operator: URO
 Test Specification: ANSI C63.4; FCC 15.107 / 15.207
 Comment: computer peripheral setup ; 120 V / 60 Hz
 Start of Test: 22.09.2014 / 20:00:23

SCAN TABLE: "FCC Voltage"

Short Description:			FCC Voltage			
Start	Stop	Step	Detector	Meas.	IF	Transducer
Frequency	Frequency	Width		Time	Bandw.	
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak	20.0 ms	9 kHz	ESH3-Z5
Average						



3.5.2 15b.2 Spurious Radiated Emissions §15.109

Test: 15b.2; Mode = generating a high power consumption

Result:

Passed

Setup No.:

PC_AB01

Date of Test:

2014/08/28 17:15

Body:

FCC47CFRChIPART15bRADIO FREQUENCY DEVICES

Test Specification:

FCC part 2 and 15

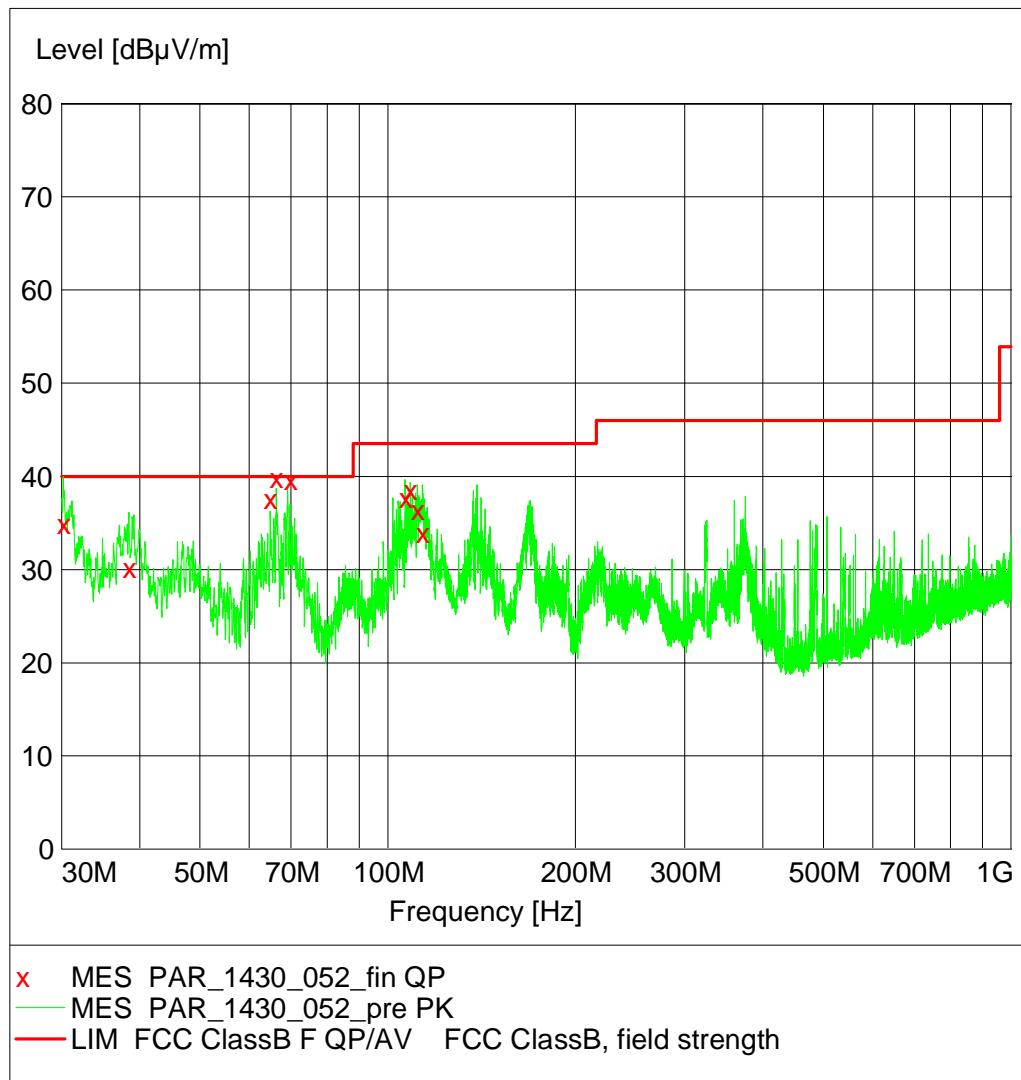
Detailed Results:

EMI RADIATED TEST

EUT: (DE1018005ab01)
 Manufacturer: Parrot
 Operating Condition: Datatransfer, 120V/60Hz, WLAN 2,4 GHz
 Test Site: 7 layers, Ratingen
 Operator: Rab
 Test Specification: FCC part 15 b, com. per.
 Comment: Horizontal EUT position
 Start of Test: 28.08.2014 / 14:35:48

SCAN TABLE: "FCC part 15 b"

Short Description:		FCC part 15 b				
Start	Stop	Step	Detector	Meas.	IF	Transducer
Frequency	Frequency	Width			Time	Bandw.
30.0 MHz	1.0 GHz	60.0 kHz	MaxPeak	1.0 ms	120 kHz	HL562



MEASUREMENT RESULT: "PAR_1430_052_fin_QP"

28.08.2014 15:29

Frequency MHz	Level dB μ V/m	Transd dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
30.180000	34.90	21.0	40.0	5.1	101.0	22.00	VERTICAL
38.460000	30.20	16.7	40.0	9.8	100.0	97.00	VERTICAL
64.800000	37.60	7.0	40.0	2.4	243.0	0.00	VERTICAL
66.300000	39.90	7.5	40.0	0.1	210.0	337.00	VERTICAL
69.120000	39.80	8.6	40.0	0.2	162.0	357.00	VERTICAL
69.720000	39.60	8.8	40.0	0.4	209.0	0.00	VERTICAL
106.680000	37.70	11.6	43.5	5.8	104.0	23.00	VERTICAL
108.780000	38.50	11.7	43.5	5.0	112.0	22.00	VERTICAL
111.660000	36.40	11.9	43.5	7.1	101.0	43.00	VERTICAL
113.760000	33.90	12.0	43.5	9.6	106.0	22.00	VERTICAL

4 Test Equipment Details

4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

Test Equipment Anechoic Chamber

<i>Lab ID:</i>	Lab 2	<i>Calibration Details</i>	<i>Last Execution</i>	<i>Next Exec.</i>
<i>Manufacturer:</i>	Frankonia			
<i>Description:</i>	Anechoic Chamber for radiated testing			
<i>Type:</i>	10.58x6.38x6.00 m ³			
		NSA (FCC)	2014/01/09	2017/01/09

Single Devices for Anechoic Chamber

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m ³	none	Frankonia
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18		2014/01/09 2017/01/08
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita

Test Equipment Auxiliary Equipment for Conducted emissions
Lab ID:

 Manufacturer:
 Description:

Lab 1

 Rohde & Schwarz GmbH & Co.KG
 EMI Conducted Auxiliary Equipment

Single Devices for Auxiliary Equipment for Conducted emissions

Single Device Name	Type	Serial Number	Manufacturer
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber&Suhner
Impedance Stabilization Network	ISN T800	36159	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/02/06 2016/02/28
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ENY41	100002	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/03/01 2015/03/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ST08	36292	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/01/10 2016/01/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN T8-Cat6	32187	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/01/08 2016/01/31
One-Line V-Network	ESH 3-Z6	100489	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	standard calibration		2014/06/18 2017/11/30
One-Line V-Network	ESH 3-Z6	100570	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2013/11/25 2016/11/24
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standart Calibration		2013/03/01 2015/02/28
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2013/03/01 2015/02/28

Test Equipment Auxiliary Equipment for Radiated emissions
Lab ID:

Description:

Serial Number:

Lab 2

Equipment for emission measurements

see single devices

Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AM 4.0	AM4.0/180/11920 513	Maturo GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	Schwarzbeck
Biconical dipole	VUBA 9117 <i>Calibration Details</i> Standard Calibration	9117-108	Schwarzbeck <i>Last Execution</i> 2012/01/18 <i>Next Exec.</i> 2015/01/17
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01-2	Kabel Kusch
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02-2	Rosenberger Micro-Coax
Double-ridged horn	HF 906 <i>Calibration Details</i> Standard Calibration	357357/001	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> 2012/05/18 <i>Next Exec.</i> 2015/05/17
Double-ridged horn	HF 906 <i>Calibration Details</i> Standard Calibration	357357/002	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> 2012/06/26 <i>Next Exec.</i> 2015/06/25
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright
Horn Antenna Schwarzbeck 15-26 GHz BBHA 9170	BBHA 9170		
Log.-per. Antenna	HL 562 Ultralog <i>Calibration Details</i> Standard Calibration	100609	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> 2012/12/18 <i>Next Exec.</i> 2015/12/17
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG
Loop Antenna	HFH2-Z2 <i>Calibration Details</i> Standard calibration	829324/006	Rohde & Schwarz GmbH & Co. KG <i>Last Execution</i> 2011/10/27 <i>Next Exec.</i> 2014/10/26

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5-10kg/024/3790709	Maturo GmbH

Test Equipment Auxiliary Test Equipment

Lab ID: Lab 2
Manufacturer: see single devices
Description: Single Devices for various Test Equipment
Type: various
Serial Number: none

Single Devices for Auxiliary Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Customized calibration		2013/12/04 2015/12/03
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorenwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard		2014/02/10 2016/02/09
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard		2012/06/13 2015/06/12
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/07/29 2015/07/28
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG

Test Equipment Digital Signalling Devices
Lab ID:
Lab 1, Lab 2
Description:

Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Bluetooth Signalling Unit CBT	CBT	100589	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/24 2014/11/23
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/01/27 2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/28 2014/11/27
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Hardware:		2007/07/16
	B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04		
	Software:		
	K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22		
	Firmware:		
	μ P1 8v50 02.05.06		

Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/12/07 2014/12/06
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	HW options:		2007/01/02
	B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02		
	SW options:		
	K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10,		
	Firmware:		
	μ P1 8v40 01.12.05		

	SW:		2008/11/03
	K62, K69		
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG

Test Equipment Emission measurement devices

Lab ID: **Lab 1, Lab 2**
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Emission measurement devices

Single Device Name	Type	Serial Number	Manufacturer
Personal Computer	Dell	30304832059	Dell
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/05/13 2015/05/12
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/05/13 2015/05/12
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/01/07 2016/01/31
	<i>HW/SW Status</i>		<i>Date of Start</i> <i>Date of End</i>
	Firmware-Update 4.34.4 from 3.45 during calibration		2009/12/03

Test Equipment Shielded Room 02

Lab ID: **Lab 1**
Manufacturer: Frankonia
Description: Shielded Room for conducted testing
Type: 12 qm
Serial Number: none

Test Equipment T/A Logger 13

Lab ID: **Lab 1, Lab 2**
Description: Lufft Opus10 TPR
Type: Opus10 TPR
Serial Number: 13936

Single Devices for T/A Logger 13

Single Device Name	Type	Serial Number	Manufacturer
ThermoAirpressure Datalogger 13 (Environ)	Opus10 TPR (8253.00)	13936	Lufft Mess- und Regeltechnik GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Customized calibration		2013/02/07 2015/02/06

Test Equipment T/H Logger 02

Lab ID: **Lab 1**
Description: Lufft Opus10
Serial Number: 7489

Single Devices for T/H Logger 02

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro Datalogger 02 (Environ)	Opus10 THI (8152.00)	7489	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			
	Customized calibration	Last Execution 2013/02/07	Next Exec. 2015/02/06

Test Equipment T/H Logger 12

Lab ID: **Lab 2**
Description: Lufft Opus10
Serial Number: 12482

Single Devices for T/H Logger 12

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro Datalogger 12 (Environ)	Opus10 THI (8152.00)	12482	Lufft Mess- und Regeltechnik GmbH
<i>Calibration Details</i>			
	Customized calibration	Last Execution 2013/01/07	Next Exec. 2015/01/06

5 Annex

5.1 Additional Information for Report

Test Description

Conducted emissions (AC power line)

Standard FCC Part 15 Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009. The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was connected to a 50 μ H || 50 Ohm Line Impedance Stabilization Network (LISN), which meets the requirements of ANSI C63.4-2009, Annex B, in the frequency range of the measurements. The LISN's unused connections were terminated with 50 Ohm loads. AC Power supply voltage for EUT: 120 V 60 Hz (if not stated within the measurement plot and/or test result).

The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.

Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.107, Class B Limit

Frequency Range (MHz)	QP Limit (dB μ V)	AV Limit (dB μ V)
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

FCC Part 15, Subpart B, §15.107, Class A Limit

Frequency Range (MHz)	QP Limit (dB μ V)	AV Limit (dB μ V)
0.15 - 0.5	79	66
0.5 - 30	73	60

Used conversion factor: Limit (dB μ V) = 20 log (Limit (μ V)/1 μ V).

NOTES:

A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

The chosen operating mode is selected as representative mode to generate "worst-case" conditions, i.e. high power consumption.

Spurious radiated emissions

Standard FCC Part 15, Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description

Measurement below 1 GHz:

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009.

The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The influence of the EUT support table that is used between 30-1000 MHz was evaluated.

The test was performed at the distance of 3 m between the EUT and the receiving antenna. The measurement procedure is implemented into the EMI test software ES-K1 from R&S. The radiated emissions measurements were made in a typical installation configuration. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is also performed while the EUT is powered from both AC and DC (battery) power in order to find the worst-case operating condition. AC Power supply voltage for EUT: 120 V 60 Hz (if not stated within the measurement plot and/or test result).

Step 1: Preliminary scan (test to identify the highest amplitudes relative to the limit)

Intention of this step is, to determine the radiated EMI-profile of the EUT.

Settings for step 1:

- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 μ s
- Turntable angle range: -180° to +180°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarization: Horizontal + Vertical

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2:

A further measurement will be performed on the frequencies determined in step 1. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

Settings for step 2:

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: -180° to +180°
- Turntable step size: 45°
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m

- Polarizations: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45°
- Antenna height: 0.5 m

Step 3: final measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by +/- 22.5° around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by +/- 25 cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100ms
- Turntable angle range: -22.5° to +22.5° around the determined value
- Height variation range: -0.25 m to +0.25 m around the determined value

Step 4: Final measurement (with QP detector)

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak(< 1GHz)
- Measured frequencies: in step 3 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

Measurement above 1 GHz:

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:
 The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse-linear-distance-squared for the power density measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–25 GHz) are used, the steps 2-4 as described before, are omitted. Step 1 was performed at one height of the receiving antenna only.

Detector: Peak, Average (simultaneously)

RBW = VBW = 1 MHz; above 7 GHz 100 kHz

Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.109, Radiated Emission Limits

Frequency Range (MHz)	Class B Limit (dB μ V/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Frequency Range (MHz)	Class A Limit (dB μ V/m) / @ 3 m!
30 – 88	49.5
88 – 216	54.0
216 – 960	56.9
above 960	60.0

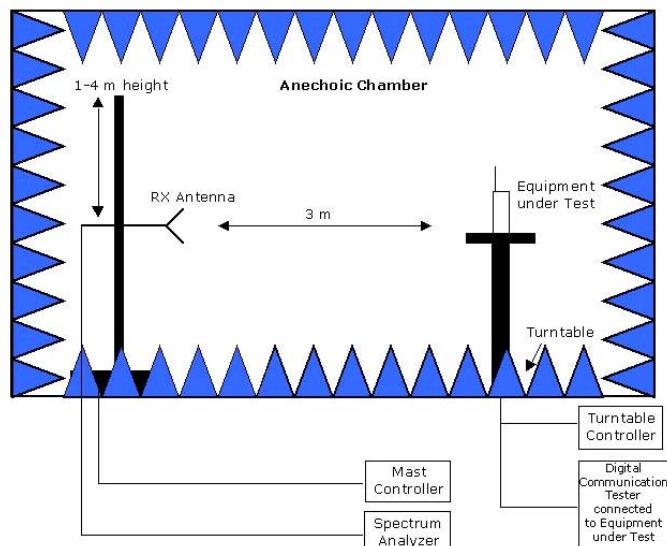
§15.35(b)

..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: Limit (dB μ V/m) = 20 log (Limit (μ V/m)/1 μ V/m)

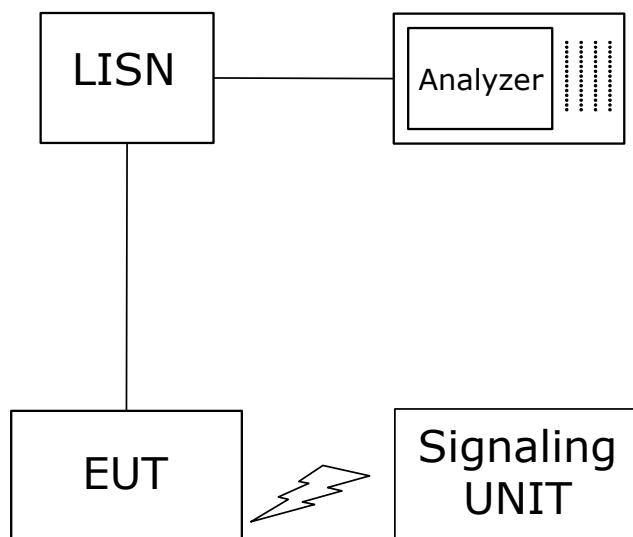
NOTE: A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

Setup Drawings



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.



Setup in the shielded room for conducted measurements at AC mains port

Correlation of measurement requirements from FCC and IC

Measurement	FCC reference	IC reference
Conducted Emissions (AC Power Line)	§15.107	ICES-001 Issue 4 or ICES-003 Issue 5 or RSS- Gen Issue 3
Radiated Spurious Emissions	§15.109	ICES-001 Issue 4 or ICES-003 Issue 5 or RSS- Gen Issue 3

Remarks:

1. FCC Part 15 subpart B, ICES 003 and CISPR 22 contain different definitions of Class A and Class B limits, i.e. which class is applicable to which kind of EUT. ICES 003 and CISPR 22 distinguish between the location where the EUT is intended to operate whilst FCC refers to the method of commercial distribution (distributive trades).
2. The correct assignment of the appropriate class to the concrete EUT is not scope of this test report!
3. A radio apparatus that is specifically subject to an Industry Canada Radio Standard Specification (RSS) and which contains an ITE is not subject to ICES-003 provided the ITE is used only to enable operation of the radio apparatus and the ITE does not control additional functions or capabilities.
4. ISM (Industrial, Scientific or Medical) radio frequency generators, though they may contain ITE, are excluded from the definition of ITE and are not subject to ICES-003. They are instead subject to the Interference-Causing Equipment Standard ICES-001, which specifically addresses ISM radio frequency generators.
5. The kind of EUT (ITE, ISM, Radio) determines which IC Standard is applicable.

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