



CETECOM ICT Services consulting - testing - certification >>>

TEST REPORT



Test report no.: 1-4254/12-12-06

Testing laboratory

CETECOM ICT Services GmbH Untertuerkheimer Strasse 6 – 10 66117 Saarbruecken / Germany Phone: + 49 681 5 98 - 0 Fax: + 49 681 5 98 - 9075 Internet: <u>http://www.cetecom.com</u> e-mail: <u>ict@cetecom.com</u>

Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS) The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01 Area of Testing: Radio/Satellite Communications

Applicant

Sony Ericsson Mobile Communications AB Nya Vattentomet 22188 Lund / SWEDEN Phone: +46 46 19 30 00 Fax: +46 46 19 32 95 Contact: Håkan Sjöberg e-mail: <u>hakan.sjoberg@sonyericsson.com</u> Phone: +46 46 19 35 59

Manufacturer

Sony Ericsson Mobile Communications AB Nya Vattentornet 22188 Lund / SWEDEN

Test standard/s

 47 CFR Part 15
 Title 47 of the Code of Federal Regulations; Chapter I

 Part 15 - Radio frequency devices
 Part 15 - Radio frequency devices

 RSS - 210 Issue 8
 Spectrum Management and Telecommunications - Radio Standards Specification

 Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands):

 Category I Equipment

For further applied test standards please refer to section 3 of this test report.

	Test Item
Kind of test item: Model name:	GSM Mobile Phone GPRS/EGPRS 850/900/1800/1900; UMTS FDDI/FDDI/FDDV/FDDVIII; HSPA; BT2.1+EDR; WLAN b/g/n; GPS; RFID, FM Rx AAD-3880135-BV
FCC ID:	PY7A3880135
IC:	4170B-A3880135
Frequency:	ISM band 2400 MHz to 2483.5 MHz (lowest channel 01 – 2412 MHz, highest channel 11 – 2462 MHz)
Technology tested:	WLAN
Antenna:	Integrated PCB antenna
Power Supply:	3.7 V DC by Li - polymer battery
Temperature Range:	-20°C to +55 °C

Test report authorised:

Test performed:

2012-03-20

Stefan Bös Senior Testing Manager 2012-03-20

Marco Bertolino **Testing Manager**



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2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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In no case this test report can be considered as a Letter of Approval.

2.2 Application details

Date of receipt of order:	2012-02-16
Date of receipt of test item:	2012-02-21
Start of test:	2012-02-21
End of test:	2012-03-13
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	2010-10	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS - 210 Issue 8	2010-12	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment



4 Test environment

Temperature:	T _{nom} T _{max} T _{min}	 +22 °C during room temperature tests +55 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content:		39 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V _{nom} V _{max} V _{min}	 3.7 V DC by Li - polymer battery 4.1 V 3.3 V

5 Test item

Kind of test item	:	GSM Mobile Phone GPRS/EGPRS 850/900/1800/1900; UMTS FDDI/FDDI/FDDV/FDDVIII; HSPA; BT2.1+EDR; WLAN b/g/n; GPS; RFID, FM Rx			
Type identification	:	AAD-3880135-BV			
		Radiated units: CB511VRR1W, CB511VRTAR			
		Conducted units: CB511VRT91, CB511VRT9F			
S/N Serial number	•				
		Photo documentation: CB511VRTDK			
HW hardware status	:	No information available!			
SW software status	:	No information available!			
		ISM band 2400 MHz to 2483.5 MHz			
Frequency band [MHZ]	:	(lowest channel 01 – 2412 MHz, highest channel 11 – 2462 MHz)			
Type of radio transmission	:				
Use of frequency spectrum	:				
Channel access method	:	FDMA			
Type of modulation :		BPSK, QPSK, 16 – QAM & 64 – QAM			
Number of channels	:	11			
Antenna	:	Integrated PCB antenna			
Power supply	:	3.7 V DC by Li - polymer battery			
Temperature range : -20°C to +55 °C					

6 Test laboratories sub-contracted

None



7 Summary of measurement results

\boxtimes

No deviations from the technical specifications were ascertained

There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210, Issue 8, Annex 8	Passed	2012-04-02	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Mode	Pass	Fail	NA	NP	Remark
§15.247(b)(4) RSS 210 / A8.4(2)	Antenna gain	Nominal	Nominal	DSSS					complies
§15.247(e) RSS 210 / A8.2(b)	Power spectral density	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth of a FHSS system 6dB bandwidth	Nominal	Nominal	DSSS OFDM g & n	\mathbb{Z}				complies
§15.247(a)(2) RSS 210 / A8.2(a)	Spectrum bandwidth of a FHSS system 20dB bandwidth	Nominal	Nominal	DSSS OFDM g & n	\mathbb{Z}				complies
§15.247(b)(3) RSS-210 / A8.4(4)	Maximum output power	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies
§15.247(d) RSS-210 / A8.5	Band edge compliance conducted	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies
§15.205 RSS-210 / A8.5	Band edge compliance radiated	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions conducted	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies
§15.247(d) RSS-210 / A8.5	TX spurious emissions radiated	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies
§15.109 RSS-Gen.	RX spurious emissions radiated	Nominal	Nominal	-/-					complies
§15.209(a) RSS-Gen	TX spurious emissions radiated < 30 MHz	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies
§15.107(a)	Conducted emissions < 30 MHz	Nominal	Nominal	DSSS OFDM g & n	\boxtimes				complies

Note: NA = Not Applicable; NP = Not Performed



8 **RF** measurements

8.1 Description of test setup

8.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2009 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2009 clause 4.2.

Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber





9 kHz - 30 MHz:	active loop antenna
30 MHz – 1 GHz:	tri-log antenna
> 1 GHz:	horn antenna

The EUT is powered by an external power supply with nominal voltage. The signalling is performed from outside the chamber with a signalling unit (CMU200 or other) by air link using signalling antenna.



8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the communication base Station (CMU200 or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.



Picture 2: Diagram conducted measurements

8.2 Additional commer	nts	
Reference documents:	None	
Special test descriptions:	None	
Configuration descriptions:	None	
Test mode:		No test mode available. Iperf was used to ping another device with the largest support packet size
	\boxtimes	Special software is used. EUT is transmitting pseudo random data by itself



8.3 RSP100 test report cover sheet / performance test data

Test report number	13	1-4254/12-12-06
Equipment model number	:	AAD-3880135-BV
Certification number	4	4170B-A3880135
Manufacturer (complete address)	4	Sony Ericsson Mobile Communications AB Nya Vattentornet 22188 Lund / SWEDEN
Tested to radio standards specification no.	+	RSS 210, Issue 8, Annex 8
Open area test site IC No.	4	IC 3462C-1
Frequency range	ł	ISM band 2400 MHz to 2483.5 MHz (lowest channel 01 – 2412 MHz, highest channel 11 – 2462 MHz)
RF-power [W] (max.)	:	cond.: 135.21 mW (DSSS / b - mode) 188.80 mW (OFDM / g - mode) 185.78 mW (OFDM / n - mode) EIRP: 53.95 mW (DSSS / b - mode) 73.96 mW (OFDM / g - mode) 74.65 mW (OFDM / n - mode)
Occupied bandwidth (99%-BW) [kHz]	:	DSSS / b - mode: 17.47 MHz OFDM / g - mode: 17.40 MHz OFDM / n - mode: 18.60 MHz
Type of modulation	4	DSSS & OFDM technology with BPSK, QPSK, 16- and 64 QAM modulation.
Emission designator (TRC-43)	-	17M5G1D (DSSS / b - mode) 17M4G7D (OFDM / g - mode) 18M6G7D (OFDM / n - mode)
Antenna information	3	Integrated PCB antenna
Transmitter spurious (worst case) [dBµV/m @ 3	m]:	48 @ 9848 MHz
Receiver spurious (worst case) [dBµV/m @ 3	m]:	43 @ 12 GHz (noise floor)
	and the second second	

ATTESTATION: DECLARATION OF COMPLIANCE:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Laboratory manager:

2012-03-20 Date Marco Bertolino Name

totine

Signature



9 Measurement results

9.1 Maximum output power (conducted)

Description:

Measurement of the maximum output power conducted. This measurement is performed only at the middle channel in both modes and all data rates to determine the data rate per mode which results in the highest output power. This mode will be selected for all further measurements.

Measurement:

Measurement parameter				
Detector:	Peak			
Sweep time:	Auto			
Video bandwidth:	40 MHz			
Resolution bandwidth:	40 MHz			
Span:	Zero span			
Trace-Mode:	Max Hold			

Results:

DSSS / b – mode	Maxim	num Output Pow	ver Conducted	[dBm]
Data Rate [MBit/s]	1	2	5.5	11
Ch 6 - 2437 MHz	20.98	21.04	20.75	20.32
Measurement uncertainty		± 0.8	5 dB	

OFDM / g – mode		Maxin	num Out	put Pov	ver Con	ducted	[dBm]	
Data Rate [MBit/s]	6	9	12	18	24	36	48	54
Ch 6 - 2437 MHz	22.39	22.34	22.34	22.39	22.32	22.59	22.50	22.43
Measurement uncertainty				± 0.	5 dB			

OFDM / n – mode		Maxin	num Out	put Pov	ver Con	ducted	[dBm]	
Data Rate [MBit/s]	MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
Ch 6 - 2437 MHz	22.45	22.37	22.47	22.55	22.52	22.69	22.37	22.24
Measurement uncertainty				± 0.	5 dB			

Result: Selected data rate for all measurements:

DSSS / b – mode: OFDM / g – mode: OFDM / n – mode: 2 MBit/s 36 MBit/s MCS5



Plots: DSSS / b - mode

Plot 1: TX mode, middle channel, 1 MBit/s

IPE Max	1		MILTI	an on the
			HI	7.01702 m
20 dBm		and the state		
LD dBm				
D dBm		-	-	
-10 dBm	-			
20 dBm		-		
-30 dBm			_	
40 dBm				
-50 dBm				
50 dBm				

Plot 2: TX mode, middle channel, 2 MBit/s

M1 L10110 m 10 dBm 10 dBm -10 dBm 10 dBm -10 dBm 10 dBm -20 dBm 10 dBm -30 dBm 10 dBm -60 dBm 10 dBm		1	1		MILLI		21.04 dBm
10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm	20 dbm-	×1 ×		10		1 1	1,13113 (0)
D dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm	10 d6m	-					
10 dBm	0 dBm						-
20 dBm	10 dBm—		-			-	
30 d8m	20 dBm—						-
40 dBm	30 d8m-				-		-
50 dBm	40 d8m	-					-
-60 d8m-	50 dBm—	-				-	-
	-60 d8m-						



Plot 3: TX mode, middle channel, 5.5 MBit/s

Att 40 dB	SWT 10 ms VBW 401	MHz		
1PE Max		(0)[1]		20.75 dBn
20 uBm			1 1	5.60561 ms
LD dBm-				
D dBm			-	_
-10 dBm			-	
-20 dBm				
-30 dBm		-	-	-
-40 d8m				_
-50 dBm			-	_
-60 d8m				-
CF 2.437 GHz		1000 pts		1.0 ms/

Plot 4: TX mode, middle channel, 11 MBit/s

THE Max	9				100		
				(NB)	001	1441	20 33 dBg
SP dEm-		-	1	-	-	1 1	
D d6m	-	-		-	_		
dam	-	-		-	_		_
10 dBm		-			_		
20 dBm-	-	-					
30 d8m	-	-		_	_		_
40 dBm	_	-			_		
50 dBm	_	-	-	-			_
no dan					_		



Plots: OFDM / g - mode

Plot 1: TX mode, middle channel, 6 MBit/s

1PE Max		100		110 M
	663		M1[1]	22.39 dBr 2.67267 m
2D dBm		-		
LD dBm-				_
0 dam	_	-		
-10 dBm				
20 dBm		-		_
-30 d6m		-		
40 dBm	-	_		_
SD dBm				
50 dBm				

Plot 2: TX mode, middle channel, 9 MBit/s

1Pk Max		10-	and the second sec	
			83[11]	22.34 dBn 5 90599 m
2D dBm				
0 d6m				_
) dBm				-
10 dBm				_
20 dBm	-			
30 dBm		_		
40 dBm			_	-
50 dBm				-
60 dBm				-



Plot 3: TX mode, middle channel, 12 MBit/s

SGL TDF		a sa na na na na na na			
			M1[1]		12.34 dBm
20 dBm	1 1	-			
10 dBm					
D dBm		_			
-10 dBm	_				
-20 dBm		_		-	
-30 d8m	-	-		-	-
-40 d8m				_	_
-50 dBm		-			-
-60 d8m-					-
CE 2 497 CH+		1000 m	ts		1.0 ms/

Plot 4: TX mode, middle channel, 18 MBit/s

IPE Max.		ine	1000		
			M1[1]	M11	22.39 d8n
20 dBm	-				
10 d6m-		-			-
D dBm					-
-10 dBm-				-	-
20 dBm	-		-		-
-30 d6m	-				-
-40 dBm	-				
-50 d9m		-	-		-
-60 d8m	-				-
CF 2,437 GHz		1	100 nts		1.0 ms



Plot 5: TX mode, middle channel, 24 MBit/s

Att 40 SGL TDF	dE = SWT 10 m	s VBW 40 MHz			
Pirk Max			M1[1]	613	22.52 dBn
20 dBm		+		-	1
10 dBm-	-			-	-
D dBm	-			-	-
-10 dBm-	-				-
-20 dBm		-			-
-30 dBm	-				-
-40 dBm	-	_		-	
-50 dBm	-	_			-
-60 dBm				-	-
CF 2,437 CHz		1000	nts		1.0 m/s/

Plot 6: TX mode, middle channel, 36 MBit/s

A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	NY NO DE LA CARA DE LA	and the second of			
are man	KAD		M1[1]		22.59 dee
20 dBm					
10 d6m	-			-	
0 dBm				-	
-10 dBm			-	_	
20 dBm				-	
-30 d6m	-			-	
-40 d8m	-			-	
-50 dBm			-	-	
-60 d8m				-	
CF 2.437 GHz		10	00 pts		1.0 mis/



Plot 7: TX mode, middle channel, 48 MBit/s

SGL TDF	Sales a state	and the provest			
APE (Han			M1 [1]		22.50 dBn 5.33534 ms
20 dBm					
10 dBm					_
D dBm		-			-
-10 dBm					
-20 dBm	1 2				-
-30 dBm	-			-	-
-40 dBm	-			-	-
-50 dBm					-
-60 d8m	-				
			1000 pts		1.0 ms/

Plot 8: TX mode, middle channel, 54 MBit/s

are Man					
		41	M1[1]		22.43 d8n 4.00400 m
20 dBm				1	
10 dBm					
D dBm			-		-
-10 dBm					
-20 dBm		_	_		-
-30 dBm					
-40 dBm					
-50 dBm	-		_		-
-60 d8m					



Plots: OFDM / n - mode

Plot 1: TX mode, middle channel, MCS0

1PF Max				
			M1(1)	92-15 dBu 6,75676 m
2D dBm-		-		
10 dbm	-			-
D dem	-	-		
-10 dBm				
-20 dBm	-			
-30 d8m				
-40 dBm		_		
-50 d9m				
-60 dBm				

Plot 2: TX mode, middle channel, MCS1

Spectrum 🕌	1. mar		in the					an V
Ref Level 30.00 Att SGL TDF	3 dBm 40 dB = SW	= RE T 10 ms - VE	W 40 MHz					
1PE Max			·					1000
			Has	0	1[1]10			22.37 d8u 4.22422 m
20 dBm		-		1		-		
LD dBm	_		-	-	-	-	-	-
0 dam	_	-	-	-		-	-	-
10 dBm		-	-	-	-	-	-	-
20 dBm	-	-	-	-	-	-	-	
-30 d6m		-	-	-	-	-	-	-
40 dBm	-		-	-			1	-
50 dBm	-	-		-		-	-	-
-60 d8m			-	-				-
CF 2.437 GHz			100	ID pts				1.0 ms/
1						-	405	



Plot 3: TX mode, middle channel, MCS2

TEL KING				
APA Plan		14	M1[1]	22-17 d8g 4.02489 m
20 dBm				
10 dBm		-		
D dBm	_	_	-	
-10 dBm				
-20 dBm	-	-		_
-30 d8m	-	_		
-40 d8m			_	_
-50 dBm	-			
-60 dBm				
(

Plot 4: TX mode, middle channel, MCS3

Ref Level 3 Att	0.00 dBm 40 dB = 1	SWT 10 ms	VBW 40 MH	2				
1PE Max	107	-	15					
			Mil		(M1[1]			22.55 dBn
2D dBm	-		-	1			1	- Anti-
10 d6m		_	-		-		-	-
0 dBm				-	-	-	-	-
-10 dBm	-	-	_	-	-	-	-	-
20 dBm	-	-	-	-	-	-	-	-
-30 d8m		-	-	-	-	-	-	+
40 dBm		-		-	-	-	-	+
-50 d9m		-		-	-	-	-	-
-60 d8m	-	-	-	-			-	-
				100	-	-	-	1.0.000/



Plot 5: TX mode, middle channel, MCS4

SGL TOF		12	
IPE Max	NLL	M1[1]	92.32 d8n 9.97927 m
20 dBm			
10 dBm			
D dêm			
-10 dBm			
-20 dBm		-	
-30 dBm			
-40 dBm			
-50 dBm			
-60 d8m			
CF 2.437 GHz		000 pts	1.0 ms/

Plot 6: TX mode, middle channel, MCS5

SGL TOF	14 45 Store	1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 - 1919 -		
The Max	41		(W1[1]	22.89 dBn
2D dBm				2.11211/0
10 dBm	-			
D dêm	_			
-10 dBm				
20 dBm	-			_
-30 d8m	-			
40 dBm	-			
-50 dBm	-			
-60 d8m				
CE 2 497 CU-		100	lū nts	1.0 ms/



Plot 7: TX mode, middle channel, MCS6

SGL TDF 1Pk Max			- Fol		-
· · · · ·			M1[1]	143	22.37 d8m 0.37030 mil
20 dBm					
10 dBm	-			-	-
D dBm		_		-	
-10 dBm	-	_			+
-20 dBm	-	_		-	-
-30 d8m					-
-40 dBm					+
-50 dBm		-			-
-60 d8m	-			-	-
CE 2 497 CH2		1000 -	its		1.0 ms/

Plot 8: TX mode, middle channel, MCS7

● 1PE Max					
			M1[1]	MIL	22.94 dBm 0.26027 mg
20 dBm					
10 dBm	-				-
D dBm		_		-	-
-10 dBm	-				-
-20 dBm		_			-
-30 dBm	-	-		-	-
-40 dBm					
-50 dBm	-				-
-60 dBm				-	-
CE 2 422 CH+		1000	nts		1.0 mm



9.2 Antenna gain

Measurement:

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal WLAN devices, the DSSS mode is used.

Measurement parameters:

Measurement parameter			
Detector:	Peak		
Sweep time:	Auto		
Video bandwidth:	3 MHz		
Resolution bandwidth:	3 MHz		
Trace-Mode:	Max hold		

Limits:

FCC	IC			
CFR Part 15.247 (b)(4)	RSS 210, Issue 8, A 8.4(2)			
Antenna Gain				
6 dBi				

Results:

T _{nom}	V _{nom}	lowe chanı 2412 M	est nel MHz	middle channel 2437 MHz	highest channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		18.49		18.57	18.96
Radiated power [dBm] Measured with DSSS modulation		14.80		14.49	14.37
Gain [dBi] Calculated		-3.69		-4.08	-4.59
Measurement uncertainty				± 1.5 dB (cond.) / ±	3 dB (rad.)

Result: Passed.



Plots:

Plot 1: lowest channel, conducted



Plot 2: middle channel, conducted





Plot 3: highest channel, conducted





9.3 Maximum output power

Description:

Measurement of the maximum output power conducted and radiated. The measurements are performed using the data rate producing the highest conducted output power. The determination of these data rates was performed at the beginning of the tests.

Measurement:

Measurement parameter			
Detector:	Peak		
Sweep time:	Auto		
Video bandwidth:	40 MHz		
Resolution bandwidth:	40 MHz		
Span:	Zero span		
Trace-Mode:	Max Hold		

Limits:

FCC	IC		
CFR Part 15.247 (b)(3)	RSS 210, Issue 8, A 8.4(4)		
Maximum Output Power			
Conducted: 1.0 W – Antenna Gain max. 6 dBi			

Results: DSSS / b - mode

DSSS / b – mode	Maximum Output Power [dBm]				
Frequency	2412 MHz	2437 MHz	2462 MHz		
Peak Output Power Conducted	21.01	21.00	21.31		
Output Power Radiated – EIRP*)	17.32	16.92	16.72		
Measurement uncertainty	± 1.5 dB (cond.) / ± 3 dB (rad.)				

*) calculated with Antenna gain

Result: Passed.



Results: OFDM / g – mode

OFDM / g – mode	Maximum Output Power [dBm]				
Frequency	2412 MHz	2437 MHz	2462 MHz		
Peak Output Power Conducted	22.38	22.59	22.76		
Output Power Radiated – EIRP*)	18.69	18.51	18.17		
Measurement uncertainty	± 1.	5 dB (cond.) / ± 3 dB (rad.)		

*) calculated with Antenna gain

Result: Passed.

Results: OFDM / n – mode

OFDM / n – mode	Maximum Output Power [dBm]				
Frequency	2412 MHz	2437 MHz	2462 MHz		
Peak Output Power Conducted	22.42	22.58	22.69		
Output Power Radiated – EIRP*)	18.73	18.50	18.10		
Measurement uncertainty	± 1.	5 dB (cond.) / ± 3 dB (rad.)		

*) calculated with Antenna gain

Result: Passed.



Plots: DSSS / b - mode

Plot 1: TX mode, lowest channel

The Max		10 ¹		
		MIL	MILLI MIL	
20 dBm+			1 1	
10 dBm				
D dBm				
-10 dBm	_			
-20 dBm				-
-30 dBm			-	_
40 dBm	_		_	_
-50 dBm			-	_
50 dBm				

Plot 2: TX mode, middle channel

	M1	M1 M1		
20 dBm	x			
10 dBm				
0 dêm				
-10 dBm				
20 dBm—				
-30 d8m				
40 d8m				
50 d9m—	-			
-60 d8m-				
	CUT		1000 str	1.0.002



Plot 3: TX mode, highest channel

Att SGL TDF	6 d8 = SWT 1	oms VBW 40 MHz		
• 1Pk Max.			M1[1] M1	21.31 dBm 6.79680 ms
50 geu	1			
10 dBm-	-			
D dBm				
-10 dBm-				
-20 dBm	-			
-30 d8m			8	
-40 dBm				
-50 dBm				
-60 dBm	-			-
CE 2 462 CH+	-	100	0 nts	1.0 mr/



Plots: OFDM / g - mode

Plot 1: TX mode, lowest channel

SGL TDF		100					-
	8/1		0	1111	_		22.50 dee
20 dBm			-	1		1	2.01291 M
10 dBm			-			-	-
D dBm				-		-	-
-10 dBm	-		-	-		-	-
-20 dBm	-		-	-	-	-	-
-30 d8m	-			-	_	-	-
40 dBm	-	-		-		-	-
50 dBm-			-	-	-	-	-
-60 dBm			-		-	-	-
CE 2 412 CH+			000 pts				1.0 m

Plot 2: TX mode, middle channel

SGL TDF	0 0E = 5W1 10 0S	YON HU MILE		
ML Max			(1)(1)	22.59 d 0 0
20 dBm	-	-	1	270,23 0
10 dBm				_
0 dam	_			
-10 dBm				
20 dBm		_	-	
-30 dBm				
40 dBm				
SD dBm-				
-60 d8m				
CF 2.437 GHz		1000 1	its	1.0 ms/



Plot 3: TX mode, highest channel

1[1] 22-764 9-455966



Plots: OFDM / n - mode

Plot 1: TX mode, lowest channel

		101 (11)	\$2.12 dBn 5.67568 w
20 dBm			
10 dBm-			
D dêm			-
-10 dBm	-		
-20 dBm			-
-30 dBm			
-40 dBm			
-SD dBm-			
-60 d8m			
CF 2.412 CHz		1000 nts	1.0 ms/

Plot 2: TX mode, middle channel

THE Max								
-			1		W1[1]	_	1413	99.58 den 0.400.31 m
2D dBm								
LD dBm-	-		-			-	-	-
o dam	-			-	-	-	-	-
10 dBm			-			-	-	-
20 dBm	-		-	-	-	-	-	-
30 d8m	-	-		-	-	-	-	-
40 dēm			-			-	-	-
50 dBm		-	-	-		-	-	-
in line				-				I



Plot 3: TX mode, highest channel

Ref Level 30.0	3 dBm	· RBW 40 MHz		4
SGL TOF	40 dB = SWT 1	0 ms VBW 40 MHz		
• 1PE Max		(C)	and the second second	
			MITI ML	\$2.69 dBm 6.76679 ms
2D dBm				
10 dBm	-			
D dBm	_			
-10 dBm	1			
-20 dBm	-			
-30 dBm				
-40 d8m				
-50 dBm				
-60 d8m				-
CF 2.462 GHz		100	Ipts	1.0 ms/
1				405



9.4 Power spectral density

Description:

Measurement of the power spectral density of a digital modulated system. The measurement is repeated for both modulations at the lowest, middle and highest channel.

Measurement:

Measurement parameter				
Detector:	Peak			
Sweep time:	Auto			
Video bandwidth:	100 kHz			
Resolution bandwidth:	100 kHz			
Span:	> EBW			
Trace-Mode:	Max Hold			

Limits:

FCC	IC						
CFR Part 15.247 (e)	RSS 210, Issue 8, A 8.2(b)						
Power Spectral Density							
The transmitter power spectral density conducted from the t any 3 kHz band during any time interval of continuous trans second	The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second duration						

Results:

Modulation	Power Spectral density [dBm/3kHz]					
Frequency	2412 MHz	2437 MHz	2462 MHz			
DSSS / b – mode	-5.61	-5.49	-5.05			
OFDM / g – mode	-11.53	-11.58	-11.02			
OFDM / n – mode	-12.25	-12.21	-12.19			
Measurement uncertainty		± 1.5 dB	•			

Result: Passed.



9.5 Spectrum bandwidth of a FHSS system – 6 dB bandwidth

Description:

Measurement of the 6 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter					
Detector:	Peak				
Sweep time:	Auto				
Video bandwidth:	100 kHz				
Resolution bandwidth:	100 kHz				
Span:	See plots				
Trace-Mode:	Max Hold				

Limits:

FCC	IC					
CFR Part 15.247 (a)(2)	RSS 210, Issue 8, A 8.2(a)					
Spectrum Bandwidth of a FHSS System – 6 dB Bandwidth						
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.						

Results:

Modulation	6 dB BANDWIDTH [MHz]					
Frequency	2412 MHz	2437 MHz	2462 MHz			
DSSS / b – mode	10.08	10.09	10.08			
OFDM / g – mode	16.36	16.35	16.43			
OFDM / n – mode	17.54	17.56	17.54			
Measurement uncertainty		± 100 kHz				

Result: Passed.

Plots: DSSS / b - mode

Plot 1: TX mode, lowest channel, 6 dB bandwidth



Plot 2: TX mode, middle channel, 6 dB bandwidth





Plot 3: TX mode, highest channel, 6 dB bandwidth





Plots: OFDM / g - mode

Plot 1: TX mode, lowest channel, 6 dB bandwidth

Spectre	100	*									(III) V
Ref Lev Att SGL TOP	vel 2	10.00 d8m 80 0E	SWT 10	RB1	W 100 kHz W 100 kHz	Mod	e Auto	6weep			
1 IPK Mar	1			_		1					and the second s
LD dBm-		-		M3 Lade	in the state of the state	. de	no notice la			2.40	0.00 dBn 378332 CHu 6 10 dBu 698390 CH
-10 dBm-				A				- All			
-20 dBm-	Anna	MINIM	mallwork.W						Monthely	WHAN Income	MILINAL
-50 dBm-	-						_			-	- WW
-60 d8m- -70 d8m-	-	-		-			-			-	
CF 2.413	2 GH	z		-	1000	1 pt:	5	-	-	Spa	n 50-0 MHz
Marker Type 1	Ref	Tec	Stimulu	1	Response		Func	tion	Fu	nction Resul	t
M1 D2 M3	MI	1	2 403783 16 3633 2 4069	32 GH2 86 MH2 93 GH2	0.00 d8 0.15 (6.10 d8	m SS m					
-							_	-		- 445	

Plot 2: TX mode, middle channel, 6 dB bandwidth





Plot 3: TX mode, highest channel, 6 dB bandwidth

Spoctr	um	*							_		(III) V
Ref Le Att SGL TD	F	20.00.d8n 30.d5	a = SWT 10	s NB	W 100 kHz W 100 kHz	Mod	e Auto	Sweep			
1 IPK Ma	18			_							
LD dBm-				Mit de	and white the	t.	NA J. A.L.	itil atil Lutikaz		2.45	-0.26 dBn 377832 GH 5.05 dBn 698300 GH
-10 dBm	_			June		1	diaman, o	TRANK			
-20 dBm	-	I. JAME MA	www.w	1		-	_		- Mushing	Western.	
-30 dBm	MIN	WW. TSTA								animy way	WHITHWAR
-50 dBm	+	_	_		-	-	_				
-60.d8m	-		-	_			-			-	-
-70 d8m											
CF 2.46	2 Gł	iz			1000	1 pts	5			Spa	n 50-0 MHz
Marker	Ref	Terl	Stimulus	1	Resnance	-1	Eune	tion 1	Eu	nction Resul	
M1	17.01	1	2.4537783	2 GHZ	-0.26 di	Sm	, And		14	1141017 1634	
D2 M3	MI	1	36.4333 2.45698	6 MHz 3 GHz	0.16 5.95 di	58 Im					
	-	1					-	-	-	- 445	



Plots: OFDM / n - mode

Plot 1: TX mode, lowest channel, 6 dB bandwidth

-Spectrum 10 Ref Level 20.00 dBm RBW 100 kHz. 30 dB ... SWT 10 5 ... VBW 100 KH2 AIL Mode Auto Sweep SGL TOF 1Pk Mas 011[1] 1.41 dBr 2.40320338 GH LD dBm MU[1] 1.64 dBm 14 probat for the forthe forthe forthe designation of the 2-40690800 GHa D dêm -10 dBm and a way the second second -2D dBm Music gampage applied by particular -30 dBm -50 dBm 60.d8m--70 d8m-CF 2.412 GHz 10001 pts Span 50.0 MHz Marker Type | Ref | Trc | Stimulus Response Function **Function Result** 2 40320338 GHz Mt 1.41 dBm D2 M3 17.54325 MHz 141 0.08 68 2 406988 GHz 4.64 dBm 1

Plot 2: TX mode, middle channel, 6 dB bandwidth





Plot 3: TX mode, highest channel, 6 dB bandwidth





9.6 Spectrum bandwidth of a FHSS system – 20 dB bandwidth

Description:

Measurement of the 20 dB bandwidth of the modulated signal.

Measurement:

Measurement parameter				
Detector:	Peak			
Sweep time:	Auto			
Video bandwidth:	100 kHz			
Resolution bandwidth:	100 kHz			
Span:	See plots			
Trace-Mode:	Max Hold			

Limits:

FCC	IC			
CFR Part 15.247 (a)(2)	RSS 210, Issue 8, A 8.2(a)			
Spectrum Bandwidth of a FHSS System – 20 dB Bandwidth				
Systems using digital modulation techniques may operate in the 2400–2483.5 MHz band. The minimum 6 dB bandwidth shall be at least 500 kHz.				

Results:

Modulation	20 dB BANDWIDTH [MHz]			
Frequency	2412 MHz	2437 MHz	2462 MHz	
DSSS / b – mode	17.47	17.20	17.18	
OFDM / g – mode	17.40	17.34	17.35	
OFDM / n – mode	18.60	18.58	18.59	
Measurement uncertainty		± 100 kHz		

Result: Passed

Plots: DSSS / b - mode

Plot 1: TX mode, lowest channel, 20 dB bandwidth

-Spectrum # Ref Level 20.00 dBm - RBW 100 kHz AIL 30 dB 🗰 SWT 10 5 🗰 VBW 100 KH2 Mode Auto Sweep SGL TOP 1 PK MAR 611[1] 10.40 881 2.40302837 CH LD dBme m(i) 0.30 dBu 2.41201242 GHz D dêm -10 dBm -20 dBm--30 dBm 40 dBm **L**oftin 60.d8m -70 dBm-Span 50.0 MHz CF 2.412 GHz 10001 pts Marker Type | Ref | Trc | Stimulus Response Function **Function Result** 2 40332837 GHz Mt 13.48 dBm t D2 M3 2.09.68 3.30 dBm 141 17.47325 MHz 2.41281242 GHz 1

Plot 2: TX mode, middle channel, 20 dB bandwidth





Plot 3: TX mode, highest channel, 20 dB bandwidth



Plots: OFDM / g - mode

Plot 1: TX mode, lowest channel, 20 dB bandwidth





Plot 2: TX mode, middle channel, 20 dB bandwidth



Plot 3: TX mode, highest channel, 20 dB bandwidth



Plots: OFDM / n - mode

Plot 1: TX mode, lowest channel, 20 dB bandwidth

-Spectrum # Ref Level 20.00 dBm RBW 100 kHz 30 dB - SWT 10 s - VBW 100 kH2 Mode Auto Sweep AIL SGL TOP 1PK Mas 513[1] 15.62 dBr 2.48277342 CH LD dBme 面山 1.30 (80) o hadridge better hits when history 2. +1697700 GHa D dêm -10 dBm of the manufacture and the second -20 dBm Mandapare and a second second and and a -30 dBm -50 dBm -60 d8m--70 d8m-CF 2.412 GHz 10001 pts Span 50.0 MHz Marker Type | Ref | Trc | Stimulus Response Function Function Result 2 40277342 GHz Mt 15.62 dBm 18.60314 MHz D2 M3 -0.26 d8 4.38 d8m 641 2.416977 GHz

Plot 2: TX mode, middle channel, 20 dB bandwidth





Plot 3: TX mode, highest channel, 20 dB bandwidth





9.7 Band edge compliance conducted

Description:

Measurement of the conducted band edge compliance. EUT is measured at the lower and upper band edge in both modes.

Measurement:

Measurement parameter				
Detector:	Peak			
Sweep time:	Auto			
Video bandwidth:	500 kHz			
Resolution bandwidth:	100 kHz			
Span:	Lower Band Edge: 2300 – 2425 MHz Upper Band Edge: 2450 – 2500 MHz			
Trace-Mode:	Max Hold			

Limits:

FCC	IC			
CFR Part 15.247 (d)	RSS 210, Issue 8, A 8.5			
Band Edge Compliance Conducted				
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, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.				

Results:

Scenario	Band Edge Compliance Conducted [dB]			
Modulation	DSSS / b – mode	OFDM / g – mode	OFDM / n – mode	
Lower Band Edge – Channel 1	> 20 dB (see plot 1)	> 20 dB (see plot 3)	> 20 dB (see plot 5)	
Upper Band Edge – Channel 11	> 20 dB (see plot 2)	> 20 dB (see plot 4)	> 20 dB (see plot 6)	
Measurement uncertainty		± 1.5 dB		

<u>Result:</u> Passed



Plots: DSSS / b - mode

Plot 1: TX mode, lower band edge



Plot 2: TX mode, upper band edge





Plots: OFDM / g - mode

Plot 1: TX mode, lower band edge



Plot 2: TX mode, upper band edge





Plots: OFDM / n - mode

Plot 1: TX mode, lower band edge



Plot 2: TX mode, upper band edge





9.8 Band edge compliance radiated

Description:

Measurement of the radiated band edge compliance. The EUT is turned in the position that results in the maximum level at the band edge. Then a sweep over the corresponding restricted band is performed. The EUT is set to channel 1 for the lower restricted band and to channel 11 for the upper restricted band. The measurement is repeated for all modulations. Measurement distance is 3m.

Measurement:

Measurement parameter				
Detector:	Peak			
Sweep time:	Auto			
Video bandwidth:	10 Hz			
Resolution bandwidth:	1 MHz			
Span:	Lower Band: 2300 – 2400 MHz higher Band: 2480 – 2500 MHz			
Trace-Mode:	Max Hold			

Limits:

FCC	IC		
CFR Part 15.205	RSS 210, Issue 8, A 8.5		
Band Edge Compliance Radiated			
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, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).			

54 dBµV/m AVG

Results:

Scenario	Band Edge Compliance Conducted [dB]			
Modulation	DSSS / b – mode	OFDM / g – mode	OFDM / n – mode	
Lower Band Edge – Channel 1	> 20 dB	> 20 dB	> 20 dB	
Upper Band Edge – Channel 11	> 20 dB	> 20 dB	> 20 dB	
Measurement uncertainty		± 3 dB		

Result: Passed.



Plots: DSSS / b - mode

Plot 1: TX mode, lower band edge, vertical polarization



Plot 2: TX mode, upper band edge, vertical polarization





Plot 3: TX mode, lower band edge, horizontal polarization



Plot 4: TX mode, upper band edge, horizontal polarization





Plots: OFDM / g - mode

Plot 1: TX mode, lower band edge, vertical polarization



Plot 2: TX mode, upper band edge, vertical polarization





Plot 3: TX mode, lower band edge, horizontal polarization



Plot 4: TX mode, upper band edge, horizontal polarization





Plots: OFDM / n - mode

Plot 1: TX mode, lower band edge, vertical polarization



Plot 2: TX mode, upper band edge, vertical polarization





Plot 3: TX mode, lower band edge, horizontal polarization



Plot 4: TX mode, upper band edge, horizontal polarization





9.9 TX spurious emissions conducted

Description:

Measurement of the conducted spurious emissions in transmit mode. The measurement is performed at channel 1, 6 and 11. The measurement is repeated for all modulations.

Measurement:

Measurement parameter					
Detector:	Peak				
Sweep time:	Auto				
Video bandwidth:	F < 1 GHz:				
Resolution bandwidth:	F < 1 GHz:				
Span:	9 kHz to 25 GHz				
Trace-Mode:	Max Hold				

Limits:

FCC	IC			
CFR Part 15.247(d)	RSS 210, Issue 8, A 8.5			
TX Spurious Emissions Conducted				
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, based on either ar RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is nor required				



Results: DSSS / b - mode

TX Spurious Emissions Conducted								
DSSS - mode								
f [MHz]		amplit emis [dE	ude of sion 8m]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results		
2412		14	61	30 dBm		Operating frequency		
No critic emissior	No critical peaks detected. All detected emissions are below the 20 dBc criteria.			-20 dBc		complies		
-								
2437		14	61	30 dBm		Operating frequency		
No critic emissior	al peaks detected as are below the 2	I. All detect	ted eria.			complies		
				-20 dBC				
2462		9.03		30 dBm		Operating frequency		
No critic emissior	al peaks detected	I. All detec 0 dBc crite	ted eria.	20 dPa		complies		
				-20 060				
Measu	Measurement uncertainty			± 3 dB				

Result: Passed.

Results: OFDM / g – mode

TX Spurious Emissions Conducted								
OFDM - mode								
f [MHz]		amplit emis [dE	ude of sion [m]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results		
2412		6.	55	30 dBm		Operating frequency		
No critic emissior	No critical peaks detected. All detected emissions are below the 20 dBc criteria.			-20 dBc		complies		
2437		6.	55	30 dBm		Operating frequency		
No critic emissior	cal peaks detected ns are below the 2	I. All detec	ted eria.			complies		
				-20 UBC				
2462		6.76		30 dBm		Operating frequency		
No critic emissior	cal peaks detected	I. All detect	ted eria.	20 dPa		complies		
				-20 000				
Meas	Measurement uncertainty			± 3 dB				

Result: Passed.



Results: OFDM / n – mode

TX Spurious Emissions Conducted								
OFDM - mode								
f [MHz]		amplit emis [dE	ude of sion 8m]	limit max. allowed emission power	actual attenuation below frequency of operation [dB]	results		
2412		5.	11	30 dBm		Operating frequency		
No critical peaks detected. All detected emissions are below the 20 dBc criteria.			-20 dBc		complies			
2437		5.	11	30 dBm		Operating frequency		
No critic emission	al peaks detected as are below the 2	l. All detec 0 dBc crite	ted eria.	00 JD-		complies		
				-20 dBc				
2462		5.05		30 dBm		Operating frequency		
No critic emission	al peaks detected as are below the 2	 All detection dBc crite 	ted eria.			complies		
				-20 060				
Measurement uncertainty					± 3 dB			

Result: Passed



Plots: DSSS / b - mode

Plot 1: TX mode, lowest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.



Plot 2: TX mode, middle channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.



Plot 3: TX mode, highest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.



Plots: OFDM / g - mode

Plot 1: TX mode, lowest channel, up to 25 GHz



The peak at the beginning of the plot is the LO from the SA.