**CETECOM™****CETECOM ICT Services**
consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-4852/12-04-02-B

Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH

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Internet: <http://www.cetecom.com>e-mail: ict@cetecom.com**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

Oticon A/S

Kongebakken 9

2765 Smørum / DENMARK

Phone: +45 39 17 71 00

Contact: Jørgen Peter Hanuscheck

e-mail: jnp@oticon.dk

Phone: +45 39 13 85 38

Manufacturer

Oticon A/S

Kongebakken 9

2765 Smørum / DENMARK

Test standard/s

47 CFR Part 15

Title 47 of the Code of Federal Regulations; Chapter I
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

RSS - Gen Issue 3

General Requirements and Information for the Certification of Radiocommunication
Equipment

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

Test Item

Kind of test item: Hearing Aid**Model name:** BTE/RITE Fusion 2**FCC ID:** U28FU2BTERIT**IC:** 1350B-FU2BTERIT

Frequency: 3.84 MHz

Technology tested: Magnetic coupling

Antenna: Integrated coil antenna

Power Supply: 1.4 V DC by Zinc – Air - Battery

Temperature Range: 0°C to +35 °C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorised:

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2012.11.23 06:40:33 +01'00'Marco Bertolino
Testing Manager

Test performed:

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c=DE
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Tobias Wittenmeier

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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.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2012-09-20
Date of receipt of test item:	2012-09-24
Start of test:	2012-09-24
End of test:	2012-09-24
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
RSS - Gen Issue 3	2010-12	General Requirements and Information for the Certification of Radiocommunication Equipment

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+35 °C during high temperature tests
	T_{min}	0 °C during low temperature tests
Relative humidity content:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	1.4 V DC by Zinc – Air - Battery
	V_{max}	1.4 V
	V_{min}	1.26 V

5 Test item

Kind of test item	:	Hearing Aid
Type identification	:	BTE/RITE Fusion 2
S/N serial number	:	TX units: EUT No. 1: 21528838 EUT No. 2: 21527645 EUT No. 3: 21528831 RX units: EUT No. 4: 21528851 EUT No. 5: 21527638 Photo unit: EUT No. 6: 21527644
HW hardware status	:	Rev. 6
SW software status	:	23-090.7.1
Frequency band [MHz]	:	EUT No. 1: 3.831 MHz EUT No. 2: 3.838 MHz EUT No. 3: 3.836 MHz
Type of radio transmission	:	Modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	A1D
Number of channels	:	1
Antenna	:	Integrated coil antenna
Power supply	:	1.4 V DC by Zinc – Air - Battery
Temperature range	:	0°C to +35 °C

6 Test laboratories sub-contracted

None

7 Summary of measurement results



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	Passed	2012-11-23	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Results
§ 15.35 (c) / RSS-GEN Issue 3 Section 4.5	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.223 / RSS-GEN Issue 3	Bandwidth of the modulated carrier	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.223 / RSS-210 Issue 8	Fieldstrength of fundamental	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.209 (a) / RSS-210 Issue 8	Fieldstrength of harmonics and spurious	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.109 / RSS-210 Issue 8	Receiver spurious emissions	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.107 / § 15.207	Conducted limits	Nominal	Nominal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	-/-

Note: NA = Not Applicable; NP = Not Performed

8 RF measurement testing

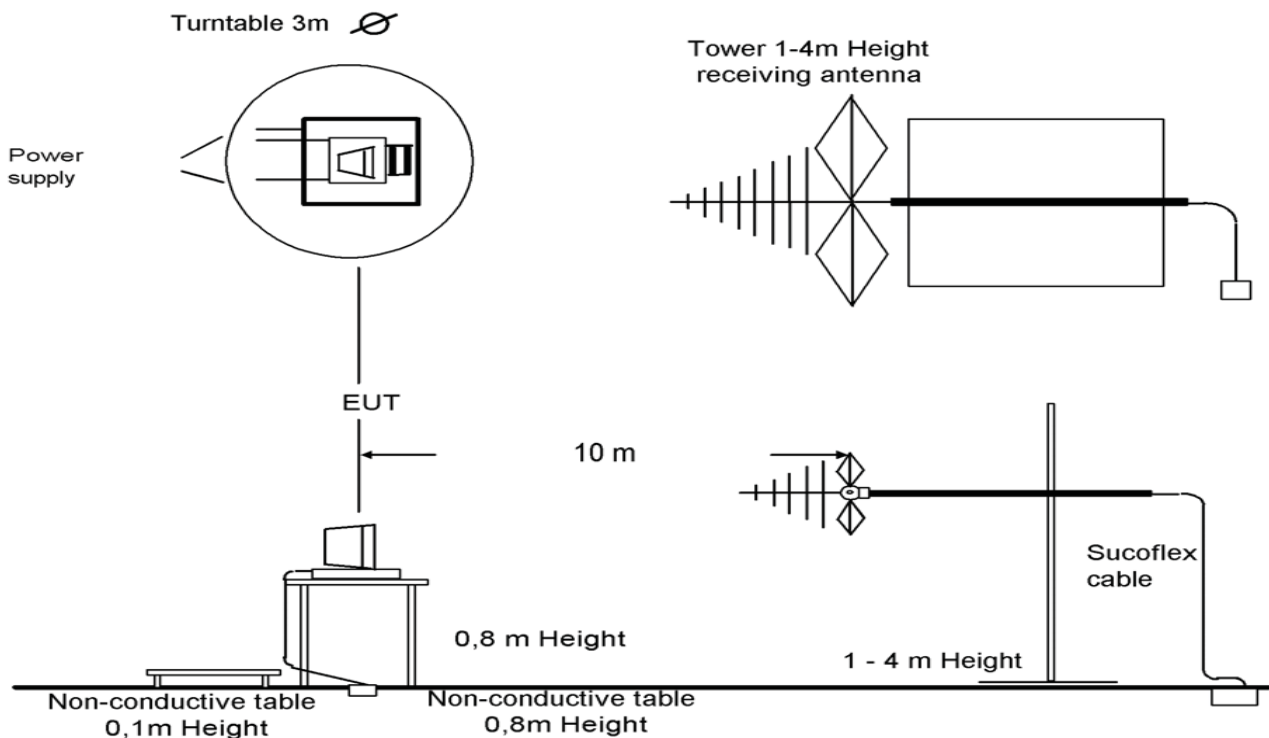
8.1 Description of test setup

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 C63.4-2003 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 C63.4-2003 clause 4.2.

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

Semi anechoic chamber



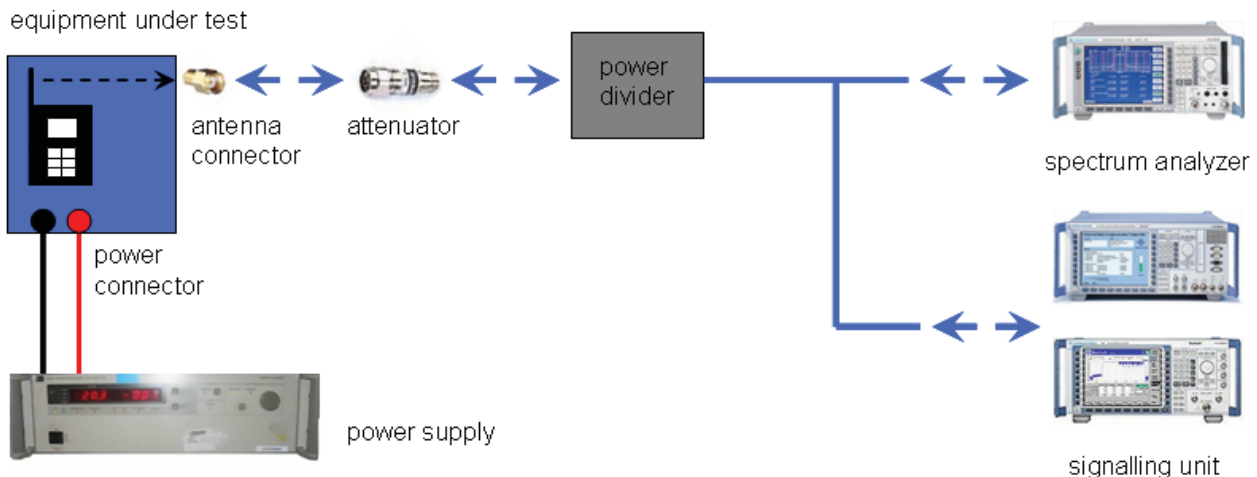
Picture 1: Diagram radiated measurements

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 comments

Reference documents: Oticon Wireless Hearing Aids – RF Test Setup 2012.

Manufacturer statement:

The RF-carrier frequency in Oticons wireless hearing aids, targeted for 3.84 MHz, is in the current Fusion platform generated by an RC-oscillator in turn feeding an LC-tank circuit in the transceiver. In other words, there is NO stable crystal oscillator and NO closed phase lock loop keeping the oscillator frequency in place. Furthermore, due to tolerances of the self induction of the antenna coil, which is part of the RF-tank circuit, and tolerances of the parallel capacitors, the initial carrier frequency tolerance of the RF-carrier is about plus and minus 2.5%. Finally due to the configuration of the RF-carrier frequency generating parts as described above an uncorrelated temperature drift of about plus and minus 2.5% can be added to the initial tolerance, resulting in an overall frequency accuracy of about plus minus 5.0% worst case!

Note: The EUT with the maximum field strength was used to perform the radiated spurious emissions tests!

Manufacturer declaration:

The provided test sample for radiated measurements had a transmitter duty cycle of 22% for ease of test, while the transmitter duty cycle in normal use is approximately 2.5%.

Special test descriptions: We perform the radiated pre-scans in different spherical positions and consolidate the results in one result plot. The test procedure includes scans in the theta axes every 120° and in phi axes @ 0° and 90° for both polarizations vertical & horizontal or magnetic emissions.

Configuration descriptions: None

8.3 RSP100 test report cover sheet / performance test data

Test Report Number	:	1-4852/12-04-02-B
Equipment Model Number	:	BTE/RITE Fusion 2
Certification Number	:	1350B-FU2BTERIT
Manufacturer (complete Address)	:	Oticon A/S Kongebakken 9 2765 Smørum / DENMARK
Tested to radio standards specification no.	:	RSS 210, Issue 8
Open Area Test Site IC No.	:	IC 3462C-1
Frequency Range or fixed frequency	:	3.831 MHz
Field Strength [dBµV/m] (@30m)	:	53.0 dBµV/m @ 1m (-7.0 dBµV/m@30m)
Occupied bandwidth (99%-BW) [kHz]	:	363 kHz
Type of modulation	:	A1D
Emission Designator (TRC-43)	:	363KA1D
Antenna Information	:	Integrated coil antenna
Transmitter Spurious (worst case) [dBµV/m @ 10m]:		20.6 dBµV/m @ 745.8 MHz
Receiver Spurious (worst case) [dBµV/m @ 10m]:		20.8 dBµV/m (noise floor)

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:

2012-11-23

Date

Tobias Wittenmeier

Name



Signature

9 Measurement results

9.1 Bandwidth of the modulated carrier

Limits:

FCC	IC
CFR Part SUBCLAUSE § 15.223	RSS-210 Issue 8
Bandwidth of the modulated carrier	

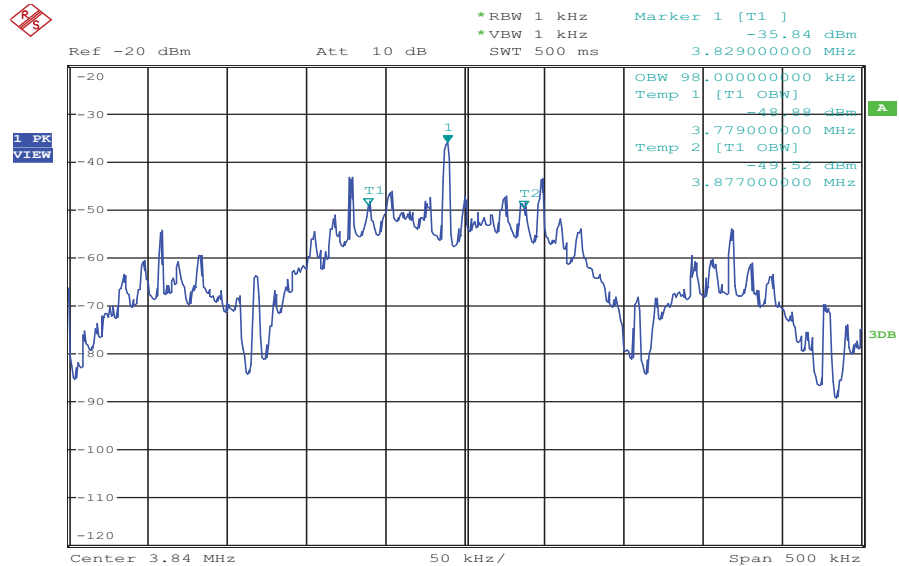
Measured with the integrated OBW-function of the spectrum analyser (measurement criteria is the integrated power in %)

Result: (Tested sample: EUT No. 1/ 21528838)

	Occupied Bandwidth
6 dB (75%)	98 kHz
20 dB (99%)	363 kHz

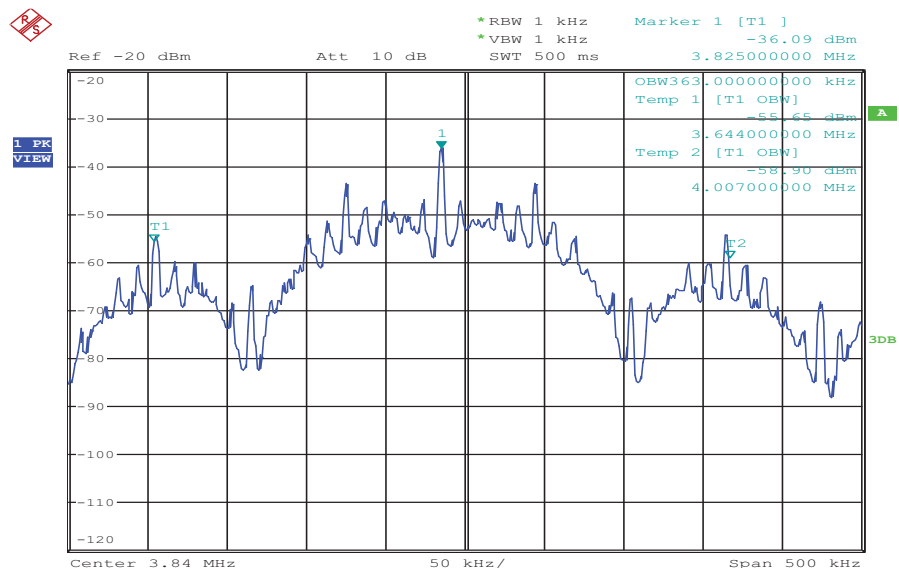
Plots of the measurement (Tested sample: EUT No. 1/ 21528838)

Plot 1: 6dB (75%) – bandwidth



Date: 7.NOV.2012 14:05:50

Plot 2: 20dB (99%) – bandwidth



Date: 7.NOV.2012 14:07:24

9.2 Field strength of the fundamental

Measurement:

Measurement parameter	
Detector:	Quasi Peak (CISPR)
Resolution bandwidth:	10kHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
CFR Part SUBCLAUSE § 15.223		RSS-210 Issue 8
Fundamental Frequency (MHz)	Field strength of Fundamental ($\mu\text{V/m}$)	Measurement distance (m)
1.705 – 10.0	[15] or [6dB-BW(kHz) / F(MHz)] Whichever is higher	30

Results:

TEST CONDITIONS		MAXIMUM POWER (dB $\mu\text{V/m}$)	
Frequency		3.8 MHz	3.8 MHz
EUT 1: 21528838		at 1 m distance	at 30 m distance
T _{nom}	V _{nom}	53.0	-7.5*
EUT 2: 21527645		at 1 m distance	at 30 m distance
T _{nom}	V _{nom}	50.0	-10.0*
EUT 3: 21528831		at 1 m distance	at 30 m distance
T _{nom}	V _{nom}	51.5	-8.5*
Measurement uncertainty		±3dB	

Recalculation to a measurement distance of 30m with a correction of 40 dB/decade.

Result: **Passed**

Noise floor: 26.5 dB μ V/m

***Note:**

- Calculation: Measured maximum field strength @ 1 m: 53.0 dB μ V/m (EUT No.1 / 21528838)

Correction factor from 1m to 10m: -40 dB (40 dB / decade)

53.0 dB μ V/m @ 1 meter - 40 dB = 13.0 dB μ V/m @ 10 meter

Correction factor from 1m to 30m: -60 dB (40 dB / decade)

56.5 dB μ V/m @ 1 meter - 60 dB = -7.0 dB μ V/m @ 30 meter

9.3 Field strength of the harmonics and spurious

Measurement:

Measurement parameter	
Detector:	Average / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	3 kHz – 120 kHz
Video bandwidth:	Comparable to RBW
Trace-Mode:	Max hold

Limits:

FCC		IC
SUBCLAUSE § 15.209		RSS-210 Issue 8
Field strength of the harmonics and spurious.		
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dBµV/m)	30
30 – 88	100 (40 dBµV/m)	3
88 – 216	150 (43.5 dBµV/m)	3
216 – 960	200 (46 dBµV/m)	3

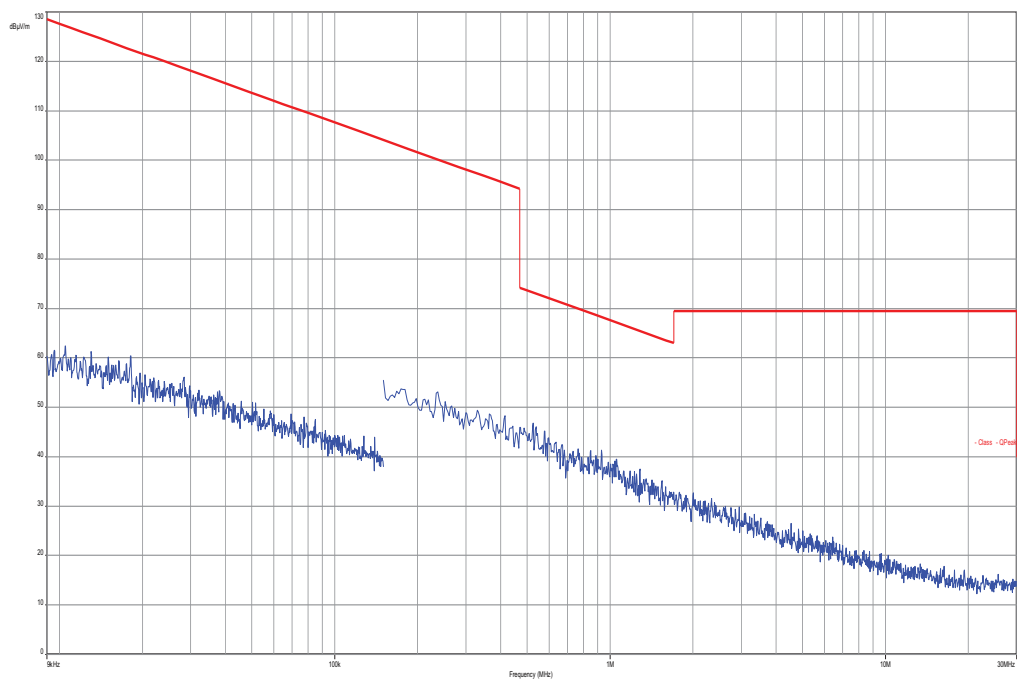
Result: (Tested sample: EUT No. 1/ 21528838)

EMISSION LIMITATIONS				
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
No critical peaks detected. All detected emissions are below the limit!				

Result: The result of the measurement is passed.

Plots of the measurements: Radiated unit No. 1 / 21528838 (TX-mode)

Plot 1: 9 kHz – 30 MHz, magnetic emissions @ 3m



Plot 2: 30 MHz – 1000 MHz, vertical & horizontal polarization

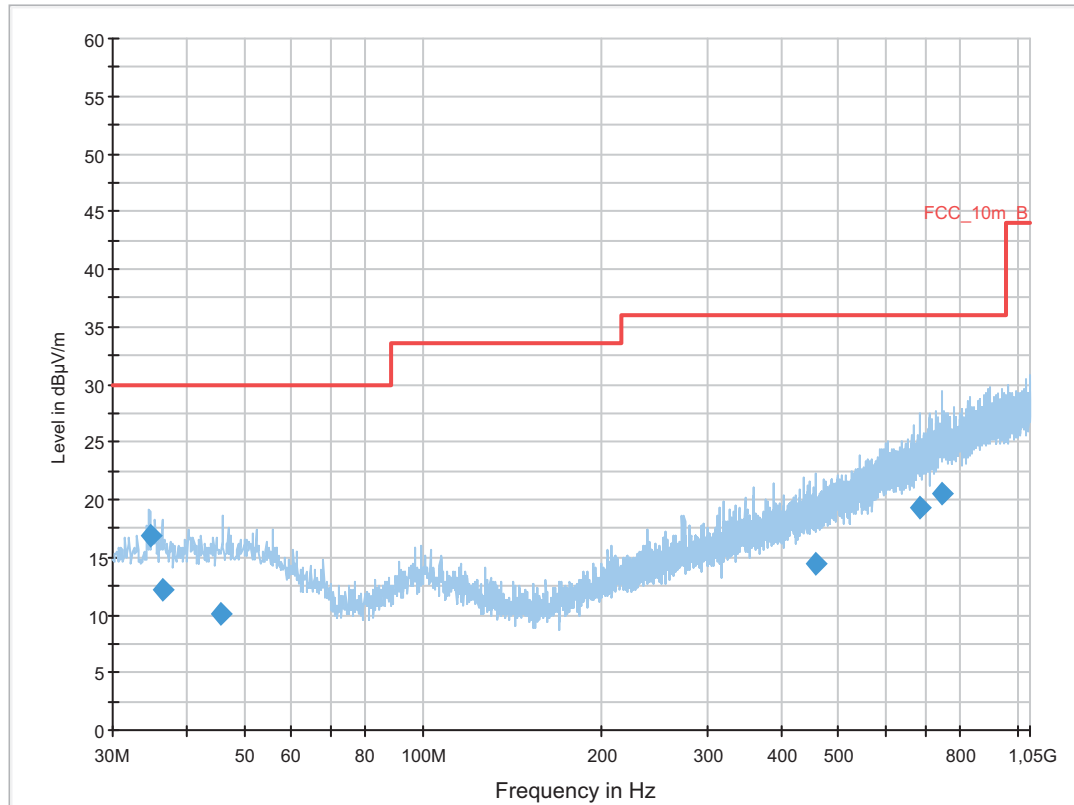
Common Information

EUT: BTE/RITE Fusion 2
 Serial Number: 21528838
 Test Description: FCC part 15 C class B @ 10 m
 Operating Conditions: TX high duty cycle
 Operator Name: Wolsdorfer
 Comment: battery powered 1,4 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESCI 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
34.706550	16.9	1000.0	120.000	140.0	V	-5.0	13.0	13.1	30.0	
36.368550	12.2	1000.0	120.000	170.0	V	272.0	13.1	17.8	30.0	
45.522150	10.2	1000.0	120.000	170.0	V	-5.0	13.3	19.8	30.0	
458.514900	14.4	1000.0	120.000	98.0	H	80.0	17.8	21.6	36.0	
686.205900	19.2	1000.0	120.000	170.0	H	280.0	22.1	16.8	36.0	
745.788750	20.6	1000.0	120.000	170.0	V	178.0	23.6	15.4	36.0	

9.4 Receiver spurious emissions

Measurement:

Measurement parameter	
Detector:	Average / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	3 kHz - 120 kHz
Video bandwidth:	Comparable to RBW
Trace-Mode:	Max hold

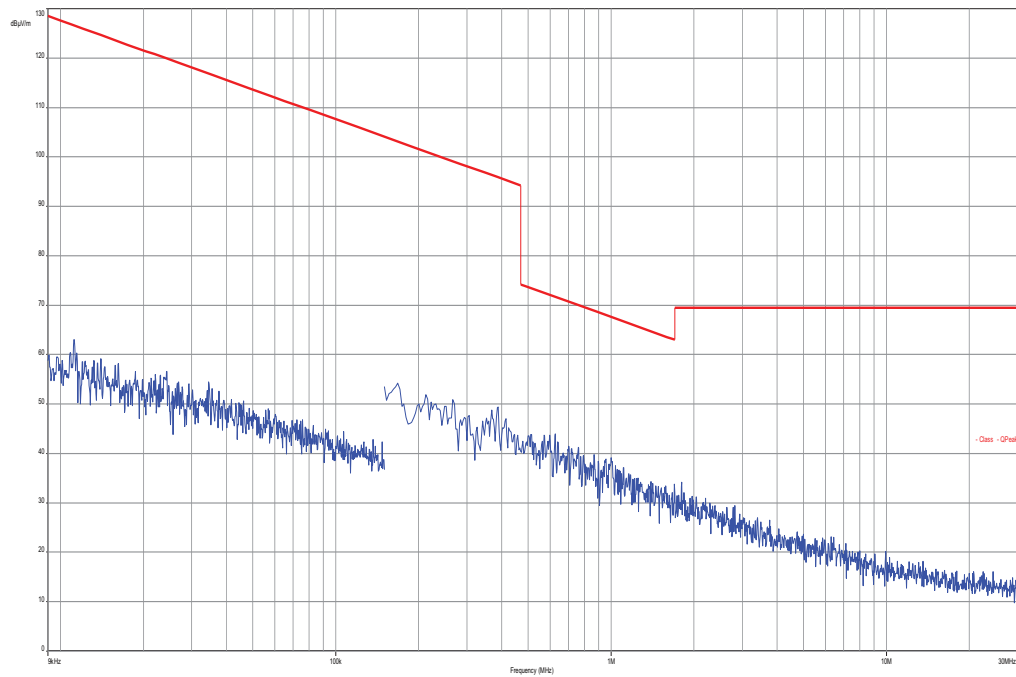
Limits:

FCC		IC
SUBCLAUSE § 15.109		RSS-210 Issue 8
Field strength of the harmonics and spurious.		
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dBµV/m)	30
30 – 88	100 (40 dBµV/m)	3
88 – 216	150 (43.5 dBµV/m)	3
216 – 960	200 (46 dBµV/m)	3

Result: (Tested sample: EUT No. 4 / 21528851 (RX – mode))

EMISSION LIMITATIONS				
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
No critical peaks detected. All detected emissions are below the limit!				

Result: Passed

Plots of the measurements: Radiated unit No. 4 / 21528851 (RX – mode)**Plot 1:** 9 kHz – 30 MHz, magnetic emissions @ 3m

Plot 2: 30 MHz – 1000 MHz, vertical & horizontal polarization

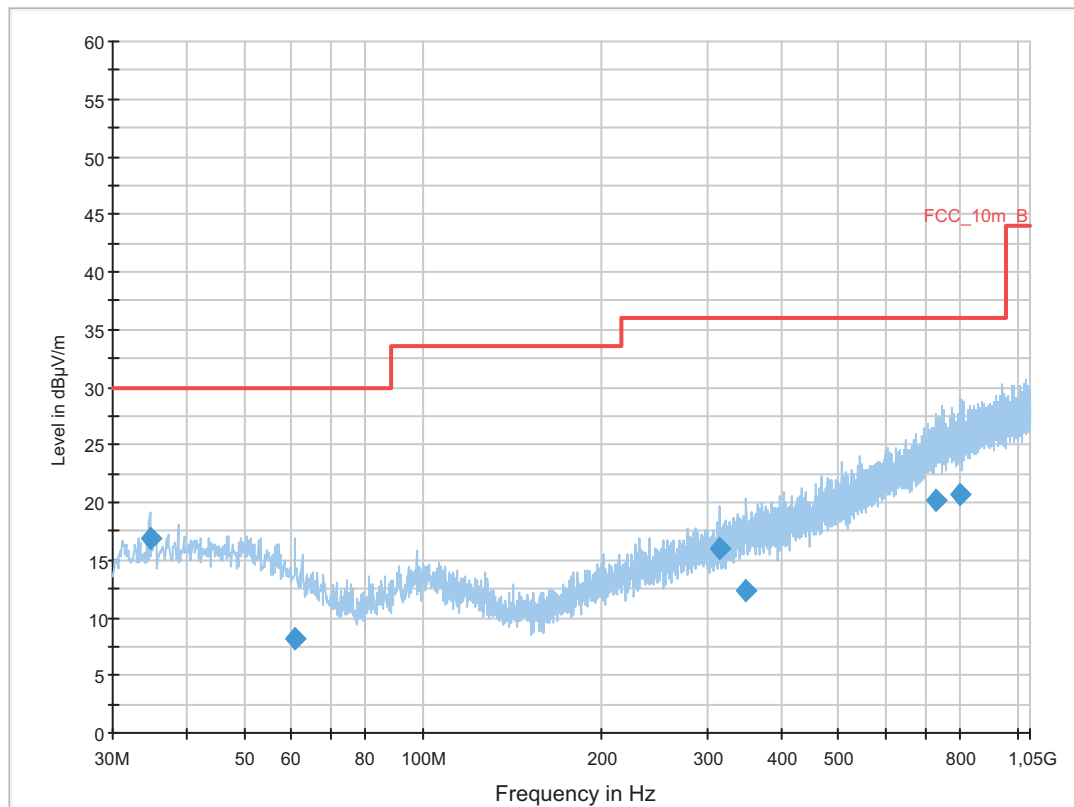
Common Information

EUT: BTE/RITE Fusion 2
 Serial Number: 21528851
 Test Description: FCC part 15 B class B @ 10 m
 Operating Conditions: TX power off
 Operator Name: Wolsdorfer
 Comment: battery powered 1,4 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESC1 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB



Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
34.698600	16.9	1000.0	120.000	135.0	V	261.0	13.0	13.1	30.0	
60.862800	8.1	1000.0	120.000	170.0	H	178.0	11.4	21.9	30.0	
314.960250	16.1	1000.0	120.000	170.0	V	280.0	15.0	19.9	36.0	
349.671600	12.4	1000.0	120.000	170.0	V	280.0	16.1	23.6	36.0	
726.313500	20.2	1000.0	120.000	170.0	H	90.0	23.1	15.8	36.0	
800.333100	20.8	1000.0	120.000	143.0	H	88.0	23.8	15.2	36.0	

10 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Labor/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	22.08.2012	22.08.2013
2	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
3	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
4	Spec.A. 2_2e	System rack for EMI measurement solution	85900	HP I.V.	*	300000222	ne		
5	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	06.01.2012	06.01.2014
6	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
7	n. a.	Relais Matrix	PSU	R&S	890167/024	300001168	ne		
8	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
9	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
10	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
11	n. a.	Band Reject filter	WRCG185 5/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
12	n. a.	Band Reject filter	WRCG240 0/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
13	n. a.	Highpass Filter	WHKX2.9/1 8G-12SS	Wainwright	1	300003492	ev		
14	n. a.	Highpass Filter	WHK1.1/15 G-10SS	Wainwright	3	300003255	ev		
15	n. a.	Highpass Filter	WHKX7.0/1 8G-8SS	Wainwright	18	300003789	ne		
16	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	14.10.2011	14.10.2014
17	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	19.12.2011	19.12.2012

Agenda: Kind of Calibration

k calibration / calibrated
 ne not required (k, ev, izw, zw not required)
 ev periodic self verification
 Ve long-term stability recognized
 vIKI! Attention: extended calibration interval
 NK! Attention: not calibrated

EK limited calibration
 zw cyclical maintenance (external cyclical maintenance)
 izw internal cyclical maintenance
 g blocked for accredited testing
 *) next calibration ordered / currently in progress

11 Observations

No observations exceeding those reported with the single test cases have been made.