

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-12076-01-00

Test standard/s

Oticon A/S

Kongebakken 9

2765 Smørum / DENMARK

47 CFR Part 15	Code of Federal Regulations; Title 47: Telecommunication; Vol. 1: Part 15 – Radio Frequency Devices.
RSS - 210 Issue 8	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - 210 Issue 8 Amendment 1	RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015)

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

	Test Item					
Kind of test item:	Hearing Aid					
Model name:	Fusion 2 BTE13PP					
FCC ID:	U28FU2BTEPP					
IC:	1350B-FU2BTEPP					
Frequency:	3.84 MHz					
Technology tested:	Magnetic coupling					
Antenna:	Integrated ferrite coil antenna					
Power supply:	1.40 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:

Stefan Bös Lab Manager Radio Communications & EMC

Test performed:

Tobias Wittenmeier Testing Manager Radio Communications & EMC



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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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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:	2015-03-17
Date of receipt of test item:	2015-05-13
Start of test:	2015-05-19
End of test:	2015-05-21
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	01.10.2012	Code of Federal Regulations; Title 47: Telecommunication; Vol. 1: Part 15 – Radio Frequency Devices.
RSS - 210 Issue 8	01.12.2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - 210 Issue 8 Amendment 1	05.02.2015	RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015)
RSS - Gen Issue 4	01.11.2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus



4 Test environment

Temperature:	T _{nom} T _{max} T _{min}	 +22 °C during room temperature tests +35 °C during high temperature tests 0 °C during low temperature tests
Relative humidity content:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V _{nom} V _{max} V _{min}	1.40 V DC by zinc – air battery 1.40 V 1.26 V

5 Test item

Kind of test item	:	Hearing Aid			
Type identification	:	Fusion 2 BTE13PP			
Product Marketing Name (PMN)	:	Fusion 2 BTE13PP			
Host Marketing Name (HMN)	:	-/-			
Radio Module ID or HW Ver. ID (HVIN)	:	Fusion 2 BTE13PP			
FW Version ID Number (FVIN)	:	Fusion 2 BTE13PP			
S/N serial number	:	TX units: EUT No. 1: 40528436 EUT No. 2: 40528451 RX unit: EUT No. 3: 40526157			
		Photo unit: EUT No. 4: 40528248			
HW hardware status	:	PCB Rev 3			
SW software status	:	Fusion 2 esw – ver. 5.5.0.b			
Frequency band	:	3.84 MHz			
Type of radio transmission Use of frequency spectrum	:	modulated carrier			
Type of modulation	:	A1D			
Number of channels	:	1			
Antenna	:	Integrated ferrite coil antenna			
Power supply	:	1.40 V DC by zinc – air battery			
Temperature range	:	0°C to +35°C			

Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report:

1-9507/15-01-01_AnnexB 1-9507/15-01-01_AnnexD

6 Test laboratories sub-contracted

None



7 Description of the test setup

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 analysers 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 (Lab/Item).

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
- vlkl! 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



7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 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. 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.



Equipment table:

No.	Lab / Item	Equipment	Туре	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP	2719A14505	300000368	g		
2	45	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
3	45	Analyzer-Reference- System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
4	45	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
5	45	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
6	45	Turntable Interface- Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
7	45	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
8	45	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	26.01.2015	26.01.2016
9	45	Breitband Doppelsteg- Hornantenne	BBHA9120 B	Schwarzbeck	188	300003896	k	10.06.2013	10.06.2015





7.2 Shielded fully anechoic chamber



Equipment table:

No.	Lab / Item	Equipment	Туре	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
2	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne		
3	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
4	90	Amplifier	js42-00502650-28- 5a	Parzich GMBH	928979	300003143	ne		
5	90	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
6	90	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		



7.3 Conducted measurements



Equipment table:

No.	Lab / Item	Equipment	Туре	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Spectrum Analyzer 9kHz to 30GHz - 140+30dBm	FSP30	R&S	100886	300003575	k	26.08.2014	26.08.2016



8 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	Passed	2015-06-29	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Results
§ 15.35 (c) / RSS-GEN Issue 4 Section 4.5	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal					complies
§ 15.223 / RSS-210 Issue 8	Bandwidth of the modulated carrier	Nominal	Nominal					complies
§ 15.223 / RSS-210 Issue 8	Fieldstrength of fundamental	Nominal	Nominal					complies
§ 15.209 (a) / RSS-210 Issue 8	Fieldstrength of harmonics and spurious	Nominal	Nominal					complies
§ 15.109 / RSS-210 Issue 8	Receiver spurious emissions	Nominal	Nominal					complies
§ 15.107 / § 15.207	Conducted limits	Nominal	Nominal					-/-

Note: NA = Not Applicable; NP = Not Performed



9 Additional comments

Reference documents: Oticon Wireless Hearing Aids and Accessories EMC and RF Test Setup, May 2014, JNP, Oticon A/S.

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 20% 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



10 Measurement results

10.1 Timing of the transmitter

Measurement:

Measurement parameter		
Detector:	-/-	
Sweep time:	-/-	
Resolution bandwidth:	-/-	
Video bandwidth:	-/-	
Span:	-/-	
Trace-Mode:	-/-	

Limits:

FCC	IC
CFR 47 SUBCLAUSE §15.35(c)	RSS-GEN Issue4 Section 4.5
Timing of the	e transmitter
(c) Unless otherwise specified, e.g. Section 15.255(b) terms of the average value of the emission, and pulsed shall be determined by averaging over one complete pulse train does not exceed 0.1 seconds. As an altern 0.1 seconds) or in cases where the pulse train excee determined from the average absolute voltage during at its maximum value. The exact method of calculating application for certification or shall be retained in t), when the radiated emission limits are expressed in operation is employed, the measurement field strength pulse train, including blanking intervals, as long as the ative (provided the transmitter operates for longer than eds 0.1 seconds, the measured field strength shall be a 0.1 second interval during which the field strength is g the average field strength shall be submitted with any the measurement data file for equipment subject to

Duty cycle of the sample with test mode (EUT No. 1: 40528436): 20.6 %

In normal use the duty cycle is approximately 2.5 % (declared by the manufacturer).

<u>Result:</u> complies



10.2 Bandwidth of the modulated carrier

Measurement parameter			
Detector:	Peak		
Resolution bandwidth:	1 kHz		
Video bandwidth:	3 kHz		
Trace-Mode:	Max Hold		
Analyser function:	99 / 75 % power function		
Used test equipment:	See chapter 7.2		

Limits:

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

Result:

EUT No. 1: 40528436

	Occupied Bandwidth (kHz)
6 dB (75%)	94.0
20 dB (99%)	360.0

EUT No. 2: 40528451

	Occupied Bandwidth (kHz)
6 dB (75%)	96.0
20 dB (99%)	361.0



Plots of the measurements:

EUT No. 1: 40528436

Plot 1: 6dB (75%) - bandwidth



Date: 20.MAY.2015 08:14:01

Plot 2: 20dB (99%) - bandwidth



Date: 20.MAY.2015 08:14:21



EUT No. 2: 40528451

Plot 1: 6dB (75%) – bandwidth



Date: 20.MAY.2015 08:12:42

Plot 2: 20dB (99%) - bandwidth



Date: 20.MAY.2015 08:12:05



10.3 Field strength of the fundamental

Measurement:

Measurement parameter		
Detector:	Quasi Peak (CISPR)	
Resolution bandwidth:	10kHz	
Video bandwidth:	> 3x RBW	
Trace-Mode:	Max Hold	
Used test equipment:	See chapter 7.2	

Limits:

FCC		IC		
CFR Part SUBCLAUSE §	§ 15.223	RSS-210 Issue 8		
Fundamental Frequency (MHz)	Field strength o (μV/	f Fundamental Measurement distance m) (m)		
1.705 – 10.0	[15] [6dB-BW(kH Whichever	or z) / F(MHz) is higher	30	

Recalculation:

According to ANSI C63.10				
Frequency Formula Correction value				
3.84 MHz	$FS_{limit} = FS_{max} - 40 \log\left(\frac{d_{\mathit{vestrfel}}}{d_{\mathit{measure}}}\right) - 20 \log\left(\frac{d_{\mathit{vinit}}}{d_{\mathit{measure}}}\right)$	-51.4		

Results:

TEST CONDITIONS		MAXIMUM POWER (dBµV/m)		
Frequency		3.84 MHz	3.84 MHz	
EUT No. 1: 40528436*		at 1 m distance	at 30 m distance	
T _{nom}	V _{nom}	51.9 0.5		
EUT No. 2: 40528451		at 1 m distance	at 30 m distance	
T _{nom}	V _{nom}	51.6 0.2		
Measurement uncertainty		±30	∄B	

*Note: This sample was used for the spurious measurements.

Result: complies



10.4 Fieldstrength 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	
Used test equipment:	See chapter 7.1&7.2	

Limits:

FCC		IC		
Fi	eld strength of the ha	armonics and sp	urious.	
Frequency (MHz)	Field streng	gth (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 c	lBμV/m)	30	
30 – 88	100 (40 d	BμV/m)	3	
88 – 216	150 (43.5 dBμV/m)		3	
216 – 960	200 (46 d	BμV/m)	3	

Result:

	EMISSION LIMITATIONS						
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results			
	All emissions were more than 6 dB below the limit.						

Result: complies

Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)



Plots of the measurements EUT No. 1: 40528436

Plot 1: 9 kHz - 30 MHz





Plot 2: 30 MHz - 1000 MHz



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
38.627700	9.55	30.00	20.45	1000.0	120.000	200.0	Н	185	14.0
65.305950	5.51	30.00	24.49	1000.0	120.000	272.0	Н	142	9.4
88.162950	5.50	33.50	28.00	1000.0	120.000	400.0	V	32	10.0
105.934800	7.55	33.50	25.95	1000.0	120.000	350.0	Н	162	11.5
352.479750	12.23	36.00	23.77	1000.0	120.000	103.0	Н	97	16.1
663.197850	17.97	36.00	18.03	1000.0	120.000	277.0	V	119	21.2



10.5 Receiver spurious emissions

Measurement:

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

Limits:

FCC		IC		
SUBCLAUSE § 15.	109	RSS-210 Issue 8		
Field	Field strength of the harmonics and spurious.			
Frequency (MHz)	Field streng	gth (μV/m)	Measurement distance (m)	
30 – 88	100 (40 c	lBμv/m)	3	
88 – 216	150 (43.5 dBµV/m)		3	
216 – 960	200 (46 d	BµV/m)	3	

Result:

	EMISSION LIMITATIONS						
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results			
	All emissions were more than 10 dB below the limit.						

Result: Passed



Plots of the measurements: EUT No. 3: 40526157, RX MODE

Plot 1: 30 MHz - 1000 MHz, vertical & horizontal polarization, RX MODE



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
36.824250	10.13	30.00	19.87	1000.0	120.000	272.0	Н	143	13.9
40.020150	10.51	30.00	19.49	1000.0	120.000	174.0	Н	95	14.0
43.506300	9.67	30.00	20.33	1000.0	120.000	103.0	Н	276	13.9
53.331900	7.91	30.00	22.09	1000.0	120.000	101.0	Н	207	12.1
57.889200	7.12	30.00	22.88	1000.0	120.000	104.0	V	141	11.1
849.000600	20.30	36.00	15.70	1000.0	120.000	102.0	Н	95	23.4



10.6 Conducted limits

Not applicable!

The EUT is battery powered only!

No possibility to connect to the mains power supply!



11 Observations

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



Annex A Document history

Version	Applied changes	Date of release
	Initial release	2015-06-24
-A	Correction of photo annex	2015-06-29

Annex B Further information

<u>Glossary</u>

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN		Product marketing name
HMN		Host marketing name
HVIN		Hardware version identification number
FVIN		Firmware version identification number



Annex C Accreditation Certificate

Front side of certificate	Back side of certificate	
DARKS Devission Aktreditierungsstelle		
Deutsche Akkreditierungsstelle GmbH	Deutsche Akkreditierungsstelle GmbH	
Bellehene gemäß § 8 Absatz 1 AkkStelleG i V.m. § 1 Absatz 1 AkkStelleGBV Unterzeichnerin der Multilateralen Abkommen von EA, IIAC und IAF zur gegenseitigen Anerkennung	Standort Berlin Standort Frankfurt am Main Stundort Spittelmarkt 10 Gartenstra 5 6 Bundesa 10117 Serlin 60594 Frankfurt am Main 38116 Br	Braunschweig lice 100 au nschweig
Die Deutsche Akkreditierungsstelle GmbH oestätigt hiermit, dass das Prüflaboratorium		
CETECOM ICT Services GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken		
die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:		
Drahtgebundene Kommunikation einschileßlich xDSL VolP und DECT Akustik Funk einschileßlich VVLAN Short Range Devices (SRD) RFID Wilbüllnuk (SSM / DCS, Over the Air (DTA) Performance) Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive Produktionshehen SAR und Hearing Aid Compatibility (NAC) Umweitsämulation Smart Card Terminals Bluetooth Wi-Fi- Services	Die auszugsweise Veröffentlichung der Akkreditierungsenlande besarf der verhörigen s Zusämmung der Deutsche Akkreditierungstelle GribH (DAMKS, Ausgenenmen dwon) Weiserveroreitung des Deutslichtes durch die umseitig genomme kundermittlikkewertun unseitä dierter Form. Er dahrt der Anstehn erweicht werdens dass in die Akkreditierung auch auf Barrei die über den durch die DAMS bestätigten Akkreditierungsbernich in nausgehen. Die Akkreditierung erfolgte gemößt das Gesetnes beier die Akkreditierungsbernich (N. 755/2008 dass Urgalaufen und des Parts vom 9. Juli 2006 über die Veroritung (2014). 755/2008 dass Urgalaufen in Zusammenhang mit der Vermankrung (2014). 755/2008 dass Urgalaufen Die Dakten im die Urgalaufen der Veroritung (2014). 755/2008 dass Urgalaufen und des Parts vom 9. Juli 2006 über die Veroritung (2014). 2014 2016, 2014 2016, 2014 2016). Die DAKS ist Unterzechneis der Malitatienten Akteromen auf gegenste Begen Arethe- Europeren ein genernten für Azereitänken (2014). Die Unterzeichner eines enrimmen für der Akterotiken Elgans Barnen Barn.	chriftlichen ist die soparate gastelle in che entreoct, llect) vom n Parlaments berwachung 30, nnung der V) und r Abkommen
Aktreditionungsnummer D-PI-12076-01 und ist giltig 17.01.2018. Sie besteht aus diesem Deckblant, der Rückseite des Deckblants und der folgenden Anlage mit Ingesamt 77 Seiten. Registrierungsnummer der Urkunde: D-PL-12076-01-00	Der aktue le Slund der Vilglindschaft kann folgenden Websetten ertnommen werden: FA: www.suropean-accreditation.org IIAC: www.suce. IAR: www.sicf.nu	
Frankfort an Main, 07.52.221.4		

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