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DELTA Test Report

TEST Reg. no. 19

Radio parameter test of LO85 according to FCC and IC specifications

Performed for GN Hearing A/S

DANAK-19/14003
Project no.: T206529-4
Page 1 of 60

28 March 2014

DELTA
Venlighedsvej 4
2970 Hørsholm
Denmark

Tlf. +45 72 19 40 00
Fax +45 72 19 40 01
www.delta.dk
VAT No. 12275110

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Title	Radio parameter test of LO85 according to FCC and IC specifications
Test object	LO85
Report no.	DANAK-19/14003
Project no.	T206529-4
Test period	19 November 2013 to 3 December 2013
Client	GN Hearing A/S Lautrupbjerg 7 2750 Ballerup Denmark Tel.: +45 45 75 11 11
Contact person	Vinnie Nørager E-mail: vnoerager@gnresound.dk
Manufacturer	GN Hearing A/S
Specifications	See section 1 Summary of tests
Results	The test object was found to be in compliance with the specifications, as listed in Section 1
Test personnel	Claus Momme Thomsen Peter Wolf Frandsen
Test site	DELTA, Venlighedsvej 4, 2970 Hørsholm, Denmark

Date	28 March 2014
Project Manager	Peter Wolf Frandsen Specialist, EMC and Wireless DELTA
Responsible	Per Thåstrup Jensen Senior Technology Specialist, EMC DELTA

JAS/lko

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1. Summary of tests

The FCC authorization procedures for the LO85 are:

Certification by FCC Part 15 C

Tests	Test methods	Rule Section	Results
Measurement of radiated emission	ANCI C63.10:2009	47 CFR Part 15.209 47 CFR Part 15.249(a)(d)(e) RSS-210, 2.5 & A2.9	Passed
Measurement of field strength of fundamental	ANCI C63.10:2009	47 CFR Part 15.249(a)(e) RSS-210, 2.5 & A2.9	Passed
Measurement of 20 dB bandwidth	ANCI C63.10:2009	47 CFR Part 15.215(c)	Passed
Measurement of band edge compliance	ANCI C63.10:2009	47 CFR Part 15.209(a) 47 CFR Part 15.249(d)(e) RSS-210, 2.5 & A2.9	Passed
Measurement of occupied bandwidth	RSS-Gen, Issue 3:2010	RSS-Gen, 4.6.1	Passed
Measurement of radiated emission, receiver	NOTICE 2012-DRS0126	RSS-Gen, 6 RSS-210, 2.5	Not Applicable

The given result is based on a shared risk principle with respect to the measurement uncertainty.

Conclusion

The test objects mentioned in this report meet the requirements of the standards stated below.

- 47 CFR Part 15, Subpart C (Specific rule part §15.249)
- RSS-210, Issue 8:2010
- RSS-Gen, Issue 3:2010.

The test results relate only to the objects tested.

2. Test objects

Photo 2.1.1 Test objects.

2.1 Test objects

Test object 2.1.1

Name of test object	LO85
Model / type	LO85
Part no.	LO85
Serial no.	No 1
FCC ID	X26LO85
IC ID	6941C-LO85
Manufacturer	GN Hearing A/S
Supply voltage	1.45 VDC (Zinc air battery Typ. P13)
Software version	Special SRD software
Hardware version	-
Cycle time	2 ms
Highest frequency generated or used	2483.5 MHz
Comment	GN radio: Tx mode

Test object 2.1.2

Name of test object	LO85
Model / type	LO85
Part no.	LO85
Serial no.	No 2
FCC ID	X26LO85
IC ID	6941C-LO85
Manufacturer	GN Hearing A/S
Supply voltage	1.45 VDC (Zinc air battery Typ. P13)
Software version	Special SRD software
Hardware version	-
Cycle time	3 ms
Highest frequency generated or used	2483.5 MHz
Comment	Bluetooth LE radio: Tx mode

Test object 2.1.3

Name of test object	LO85
Model / type	LO85
Part no.	LO85
Serial no.	No 3
FCC ID	X26LO85
IC ID	6941C-LO85
Manufacturer	GN Hearing A/S
Supply voltage	1.45 VDC (Zinc air battery Typ. P13)
Software version	Special SRD software
Hardware version	-
Cycle time	2 ms
Highest frequency generated or used	2483.5 MHz
Comment	GN radio: Tx mode Antenna replaced with SMA connector

Test object 2.1.4

Name of test object	LO85
Model / type	LO85
Part no.	LO85
Serial no.	No 4
FCC ID	X26LO85
IC ID	6941C-LO85
Manufacturer	GN Hearing A/S
Supply voltage	1.45 VDC (Zinc air battery Typ. P13)
Software version	Special SRD software
Hardware version	-
Cycle time	3 ms
Highest frequency generated or used	2483.5 MHz
Comment	Bluetooth LE radio: Tx mode Antenna replaced with SMA connector

Test object 2.1.5

Name of test object	LO85
Model / type	LO85
Part no.	LO85
Serial no.	No 5
FCC ID	X26LO85
IC ID	6941C-LO85
Manufacturer	GN Hearing A/S
Supply voltage	1.45 VDC (Zinc air battery Typ. P13)
Software version	Special SRD software
Hardware version	-
Cycle time	2 ms
Highest frequency generated or used	2483.5 MHz
Comment	GN radio: Rx, Tx stdby

Test object 2.1.6

Name of test object	LO85
Model / type	LO85
Part no.	LO85
Serial no.	No 6
FCC ID	X26LO85
IC ID	6941C-LO85
Manufacturer	GN Hearing A/S
Supply voltage	1.45 VDC (Zinc air battery Typ. P13)
Software version	Special SRD software
Hardware version	-
Cycle time	3 ms
Highest frequency generated or used	2483.5 MHz
Comment	Bluetooth LE radio: Rx, Tx stdby

3. General test conditions

3.1 Test setup during test

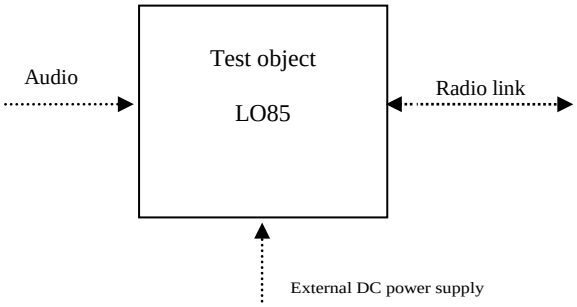


Figure 3.1.1 Block diagram of test object.

3.1.1 Description and intended use of test object

LO85 is a hearing aid used for alleviation of hearing loss also for children. It can receive audio signals and be configured via the radio link.

3.1.2 Test modes during tests

All test objects were running special test software

During test, the test objects were in continuous Tx mode (normal modulation, normal data packets with optimised repetition rate) and no attachment at the auxiliary port. The radio system is identical for the two protocols – The GN radio and the Bluetooth LE radio protocols.

GN radio protocol:
Tests were performed at three frequencies for the GN radio at worst case power settings:

- Low frequency: 2404 MHz
- Middle frequency: 2440 MHz
- High frequency: 2478 MHz

Bluetooth LE radio protocol:
Tests were performed at three frequencies for the Bluetooth LE radio at worst case power settings:

- Low frequency: 2402 MHz
- Middle frequency: 2440 MHz
- High frequency: 2480 MHz

During relevant tests, the external DC power supply was used.
External power supply is not used under intended use.

3.2 Radio specifications, receiver and transmitter, GN radio

Test object	LO85	Sheet	ANT-1
Type	LO85	Project no.	T206529-4
Serial no.	See section 2		
Client	GN Hearing A/S		

The radio of the test object has the following specified RF parameters. The below mentioned information regarding the receiver and the transmitter is declared by the manufacturer.

Type of equipment	:	Low power device (2400-2483.5 MHz)
Operating frequency range	:	2404 to 2478 MHz
Antenna	:	One permanently internal attached PCB antenna
Maximum gain	:	-6.1 dBi
Transmit		
Field Strength, max avg.	:	67.6 dBµV/m avg (2.4 mV/m) @ 3 meter
Field Strength, max pk.	:	87.3 dBµV/m pk (23.2 mV/m) @ 3 meter
Conducted power, max pk.	:	-1.86 dBm
Power level	:	1
No of channels	:	20
Bandwidth	:	
Occupied bandwidths (99 %)	:	2.3 MHz (Measured)
Channel separation	:	2 MHz
Modulation	:	GFSK
Data rate	:	2 Mbits
Duty cycle	:	10 % during normal mode
Transmit mode	:	Yes
Receive mode	:	Yes
Standby mode	:	Yes
Power supply	:	1.45 VDC Zinc-Air battery
Specified min voltage	:	1.16 VDC
Specified max voltage	:	1.45 VDC
Temperature category	:	-20 to +55 ºC.
Emission Designator	:	2M3F7E
Max. TX spurious emission, average	:	73 µV/m @ 3 meter (Field Strength)
Max. TX spurious emission, peak	:	700 µV/m @ 3 meter (Field Strength)

3.3 Radio specifications, receiver and transmitter, Bluetooth LE radio

Test object	LO85	Sheet	ANT-2
Type	LO85	Project no.	T206529-4
Serial no.	See section 2		
Client	GN Hearing A/S		

The radio of the test object has the following specified RF parameters. The below mentioned information regarding the receiver and the transmitter is declared by the manufacturer.

Type of equipment	:	Low power device (2400-2483.5 MHz)
Operating frequency range	:	2402 to 2480 MHz
Antenna	:	One permanently internal attached PCB antenna
Maximum gain	:	-5.1 dBi
Transmit		
Field Strength, max avg.	:	71.6 dBµV/m avg (3.8 mV/m) @ 3 meter
Field Strength, max pk.	:	88.3 dBµV/m pk (26 mV/m) @ 3 meter
Conducted power, max pk.	:	-1.87 dBm
Power level	:	1
No of channels	:	40
Bandwidth	:	
Occupied bandwidths (99 %)	:	1.4 MHz (Measured)
Channel separation	:	2 MHz
Modulation	:	GFSK
Data rate	:	2 Mbits
Duty cycle	:	10 % during normal mode
Transmit mode	:	Yes
Receive mode	:	Yes
Standby mode	:	No
Power supply	:	1.45 VDC Zinc-Air battery
Specified min voltage	:	1.16 VDC
Specified max voltage	:	1.45 VDC
Temperature category	:	-20 to +55 ºC.
Emission Designator	:	1M4F7E
Max. TX spurious emission, average	:	103 µV/m @ 3 meter (Field Strength)
Max. TX spurious emission, peak	:	700 µV/m @ 3 meter (Field Strength)

4. Test results

4.1 Duty cycle correction factor (δ), GN radio

Test object	LO85	Sheet	ANT-3
Type	LO85	Project no.	T206529-4
Serial no.	No 1	Date	22 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 31 % RH
Test equipm.	SRD lab Hørsholm 49550	Uncertainty	0.01 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: Zero DET: Peak CF: 2404 MHz Trace: Max Hold		

The duty cycle correction factor (δ) can be applied to the peak pulse amplitude to find the average emission. This is valid for one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

The duty cycle correction factor is determined as follows:

The measured value for the duty cycle (D) is:

Max. Tx on time: 192 µs – Delta 2 (T1)

Period: 1849 µs – Delta 3 (T1).

The calculated duty cycle expressed in % is:

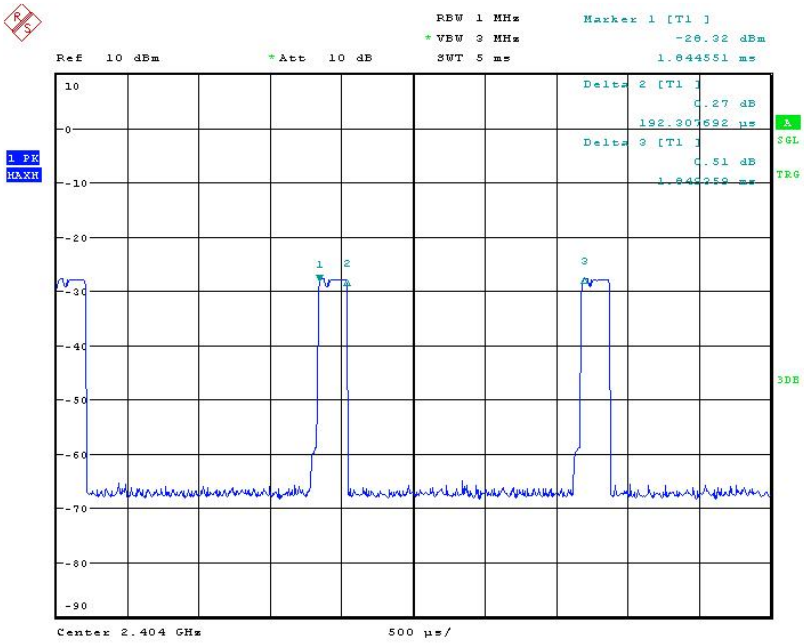
D(%) ((Max. Tx on time) µs / (period) µs) • 100% = 10.38 %.

The calculated duty cycle correction factor expressed in dB is:

δ(dB): 20 log (Max. Tx on time (µs) / period (µs)) = -19.67 dB.

According to ANSI C63.10.2009 (section 4.2.3.2.4), FCC CFR 47 Part 15 Subpart C (Section 15.35(c)) and RSS-Gen (section 4.5) this correction factor can be applied for all emissions including the fundamental and harmonics above 1 GHz.

The corrected average is: PAverage(resulting) = Ppeak + DCCF (δ).



Date: 22.NOV.2013 12:50:39

Photo 4.1.1 Test setup regarding duty cycle correction factor (δ).

4.2 Duty cycle correction factor (δ), Bluetooth LE radio

Test object	LO85	Sheet	ANT-4
Type	LO85	Project no.	T206529-4
Serial no.	No 2	Date	22 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 31 % RH
Test equipm.	SRD lab Hørsholm 49550	Uncertainty	0.01 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: Zero DET: Peak CF: 2402 MHz Trace: Max Hold		

The duty cycle correction factor (δ) can be applied to the peak pulse amplitude to find the average emission. This is valid for one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

The duty cycle correction factor is determined as follows:

The measured value for the duty cycle (D) is:

Max. Tx on time: 417 µs – Delta 2 (T1)

Period: 2846 µs – Delta 3 (T1).

The calculated duty cycle expressed in % is:

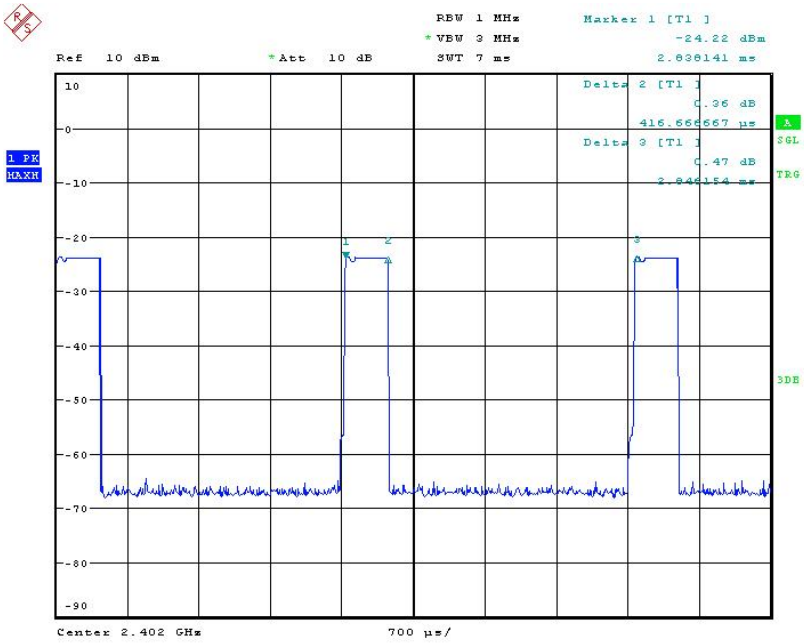
D(%) ((Max. Tx on time) µs / (period) µs) • 100% = 14.65 %.

The calculated duty cycle correction factor expressed in dB is:

δ(dB): 20 log (Max. Tx on time (µs) / period (µs)) = -16.68 dB.

According to ANSI C63.10.2009 (section 4.2.3.2.4), FCC CFR 47 Part 15 Subpart C (Section 15.35(c)) and RSS-Gen (section 4.5) this correction factor can be applied for all emissions including the fundamental and harmonics above 1 GHz.

The corrected average is: PAverage(resulting) = Ppeak + DCCF (δ).



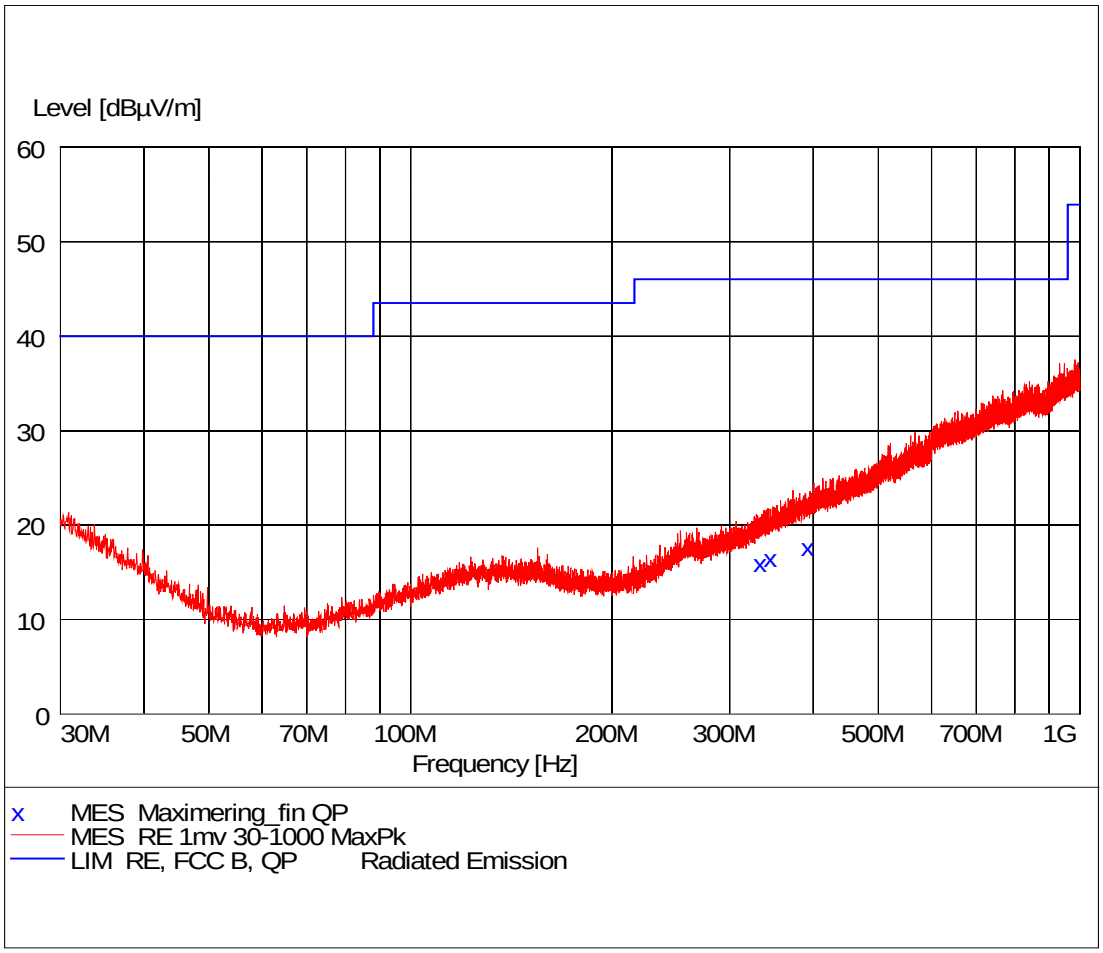
Date: 22.NOV.2013 12:49:15

Photo 4.2.1 Test setup regarding duty cycle correction factor (δ).

4.3 Measurement of radiated emission (below 1 GHz), GN radio

Test object	LO85	Sheet	RE_Spur-1
Type	LO85	Project no.	T206529-4
Serial no.	No 1	Date	03 Dec. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

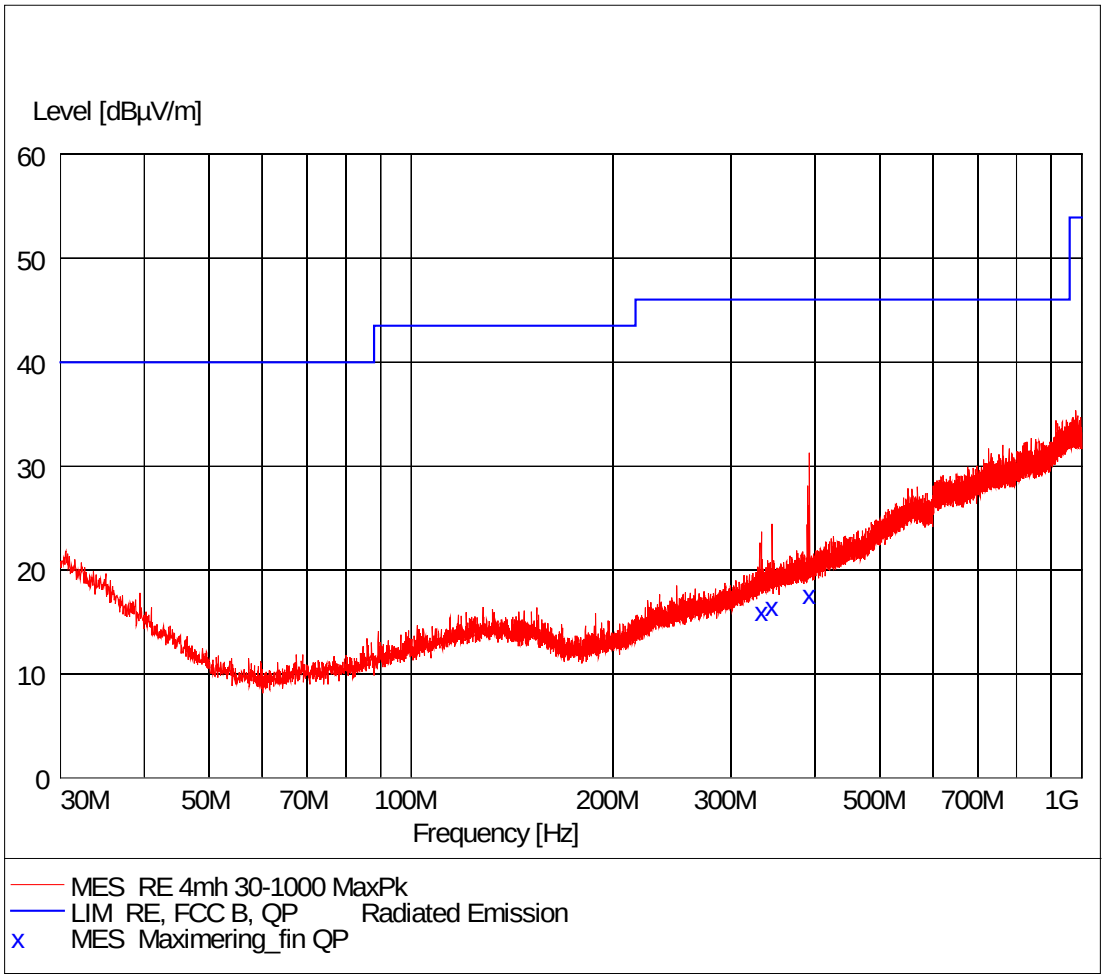
Test method Characteristics	ANSI C63.10:2009 Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Temperature Humidity	24 °C 29 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29861 49600 29797	Uncertainty	4.9 dB



Comments Continuous Tx - normal modulation - hopping between low, mid and high operating freq.

Test object	LO85	Sheet	RE_Spur-2
Type	LO85	Project no.	T206529-4
Serial no.	No 1	Date	03 Dec. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.10:2009 Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Temperature Humidity	24 °C 29 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29861 49600 29797	Uncertainty	4.9 dB



Comments Continuous Tx - normal modulation - hopping between low, mid and high operating freq.

Test object	LO85	Sheet	RE_Spur-3
Type	LO85	Project no.	T206529-4
Serial no.	No 1	Date	03 Dec. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.10:2009 Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Temperature Humidity	24 °C 29 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29861 49600 29797	Uncertainty	4.9 dB

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
333.360000	16.20	17.9	46.0	29.8	379.0	245.00	VERTICAL
345.540000	16.70	18.3	46.0	29.3	171.0	60.00	VERTICAL
392.100000	17.80	19.7	46.0	28.2	225.0	344.00	HORIZONTAL

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	2404, 2440 and 2478 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation. Test voltage: Internal battery

Photo 4.3.1 Test setup regarding measurement of radiated emission (below 1 GHz).

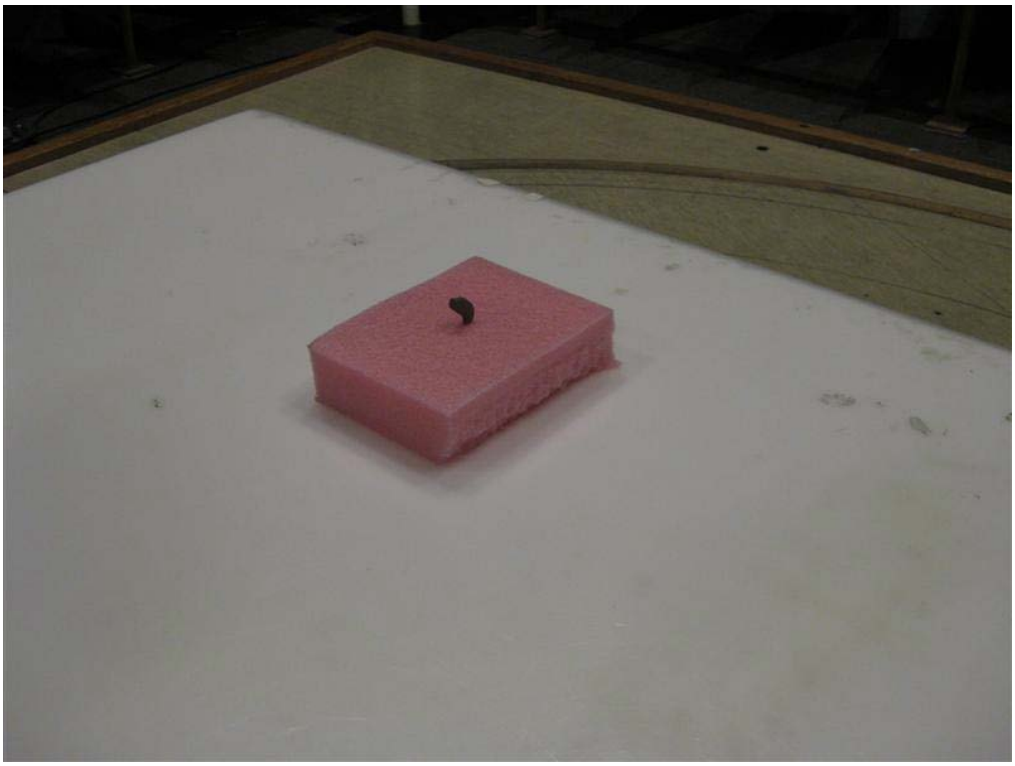
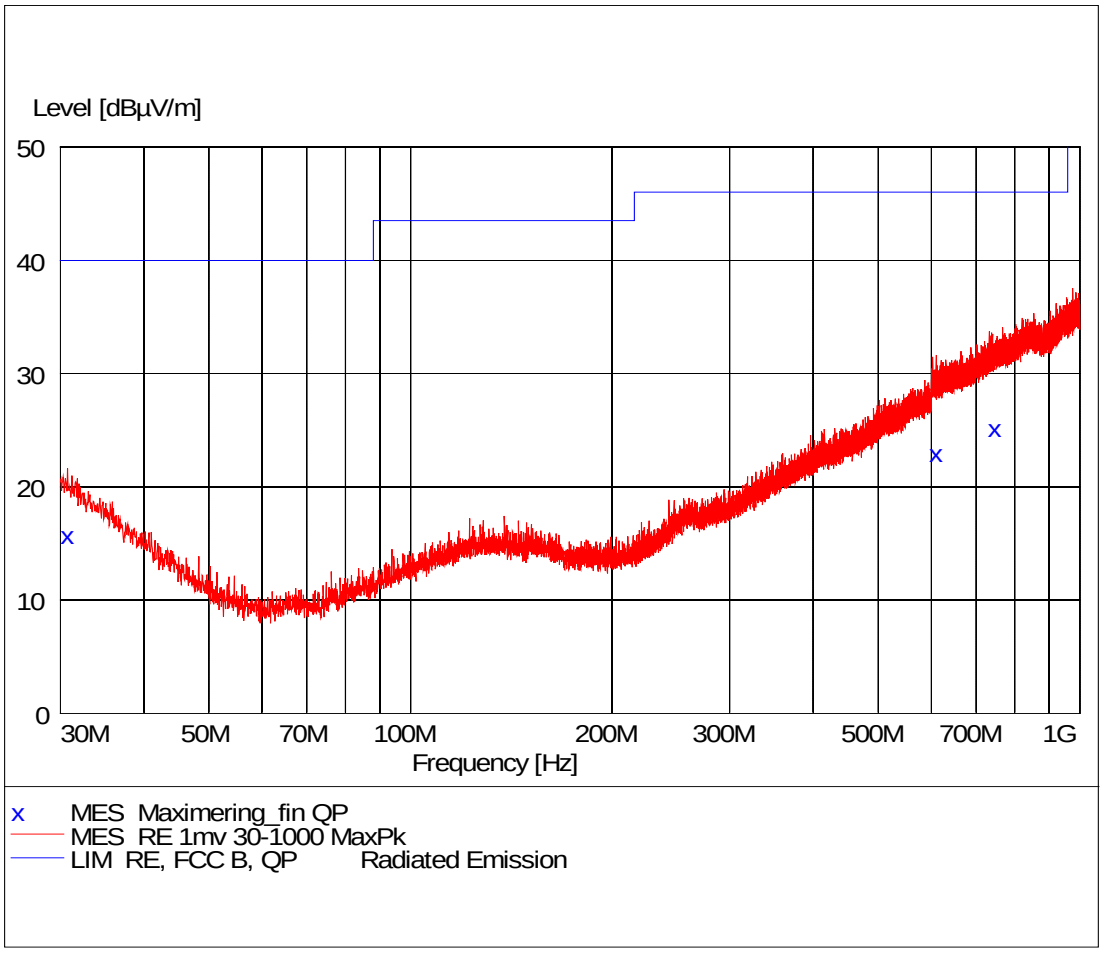


Photo 4.3.2 Test setup regarding measurement of radiated emission (below 1 GHz).

4.4 Measurement of radiated emission (below 1 GHz), Bluetooth LE radio

Test object	LO85	Sheet	RE_Spur-4
Type	LO85	Project no.	T206529-4
Serial no.	No 2	Date	26 Nov. 2013
Client	GN Hearing A/S	Initials	CMT
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

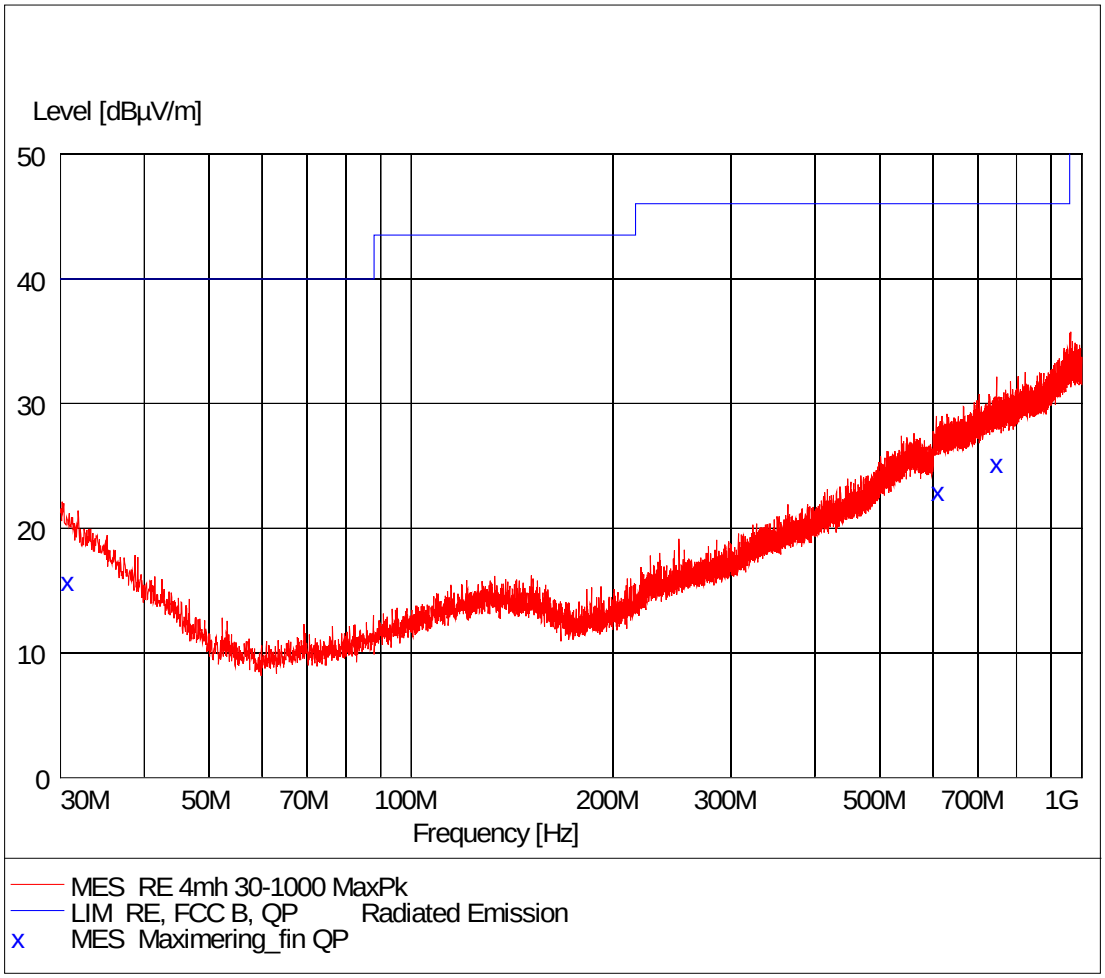
Test method Characteristics	ANSI C63.10:2009 Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Temperature Humidity	23 °C 23 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29861 49600 29797	Uncertainty	4.9 dB



Comments Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.

Test object	LO85	Sheet	RE_Spur-5
Type	LO85	Project no.	T206529-4
Serial no.	No 2	Date	26 Nov. 2013
Client	GN Hearing A/S	Initials	CMT
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.10:2009 Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Temperature Humidity	23 °C 23 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29861 49600 29797	Uncertainty	4.9 dB



Comments Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.

Test object	LO85	Sheet	RE_Spur-6
Type	LO85	Project no.	T206529-4
Serial no.	No 2	Date	26 Nov. 2013
Client	GN Hearing A/S	Initials	CMT
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.10:2009 Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Temperature Humidity	23 °C 23 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29861 49600 29797	Uncertainty	4.9 dB

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
30.730000	15.90	17.8	40.0	24.1	254.0	170.00	HORIZONTAL
610.260000	23.10	22.7	46.0	22.9	322.0	270.00	VERTICAL
747.360000	25.30	25.0	46.0	20.7	227.0	357.00	VERTICAL

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	2402, 2440 and 2480 MHz
Test mode	Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation. Test voltage: Internal battery

Photo 4.4.1 Test setup regarding measurement of radiated emission (below 1 GHz).

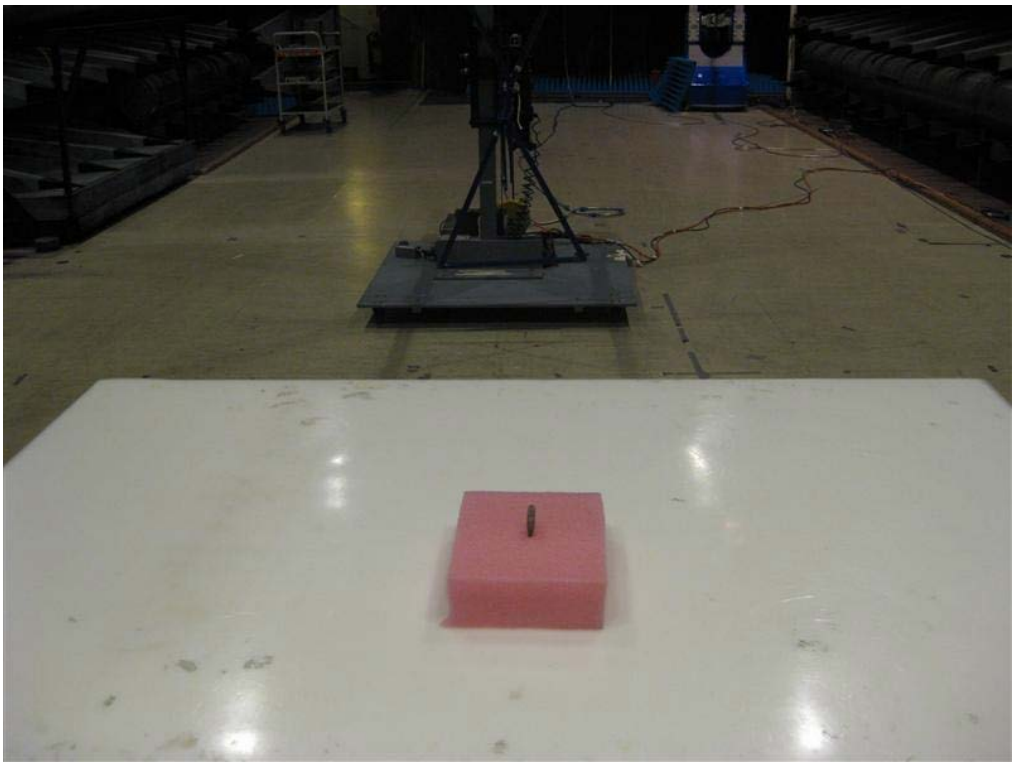
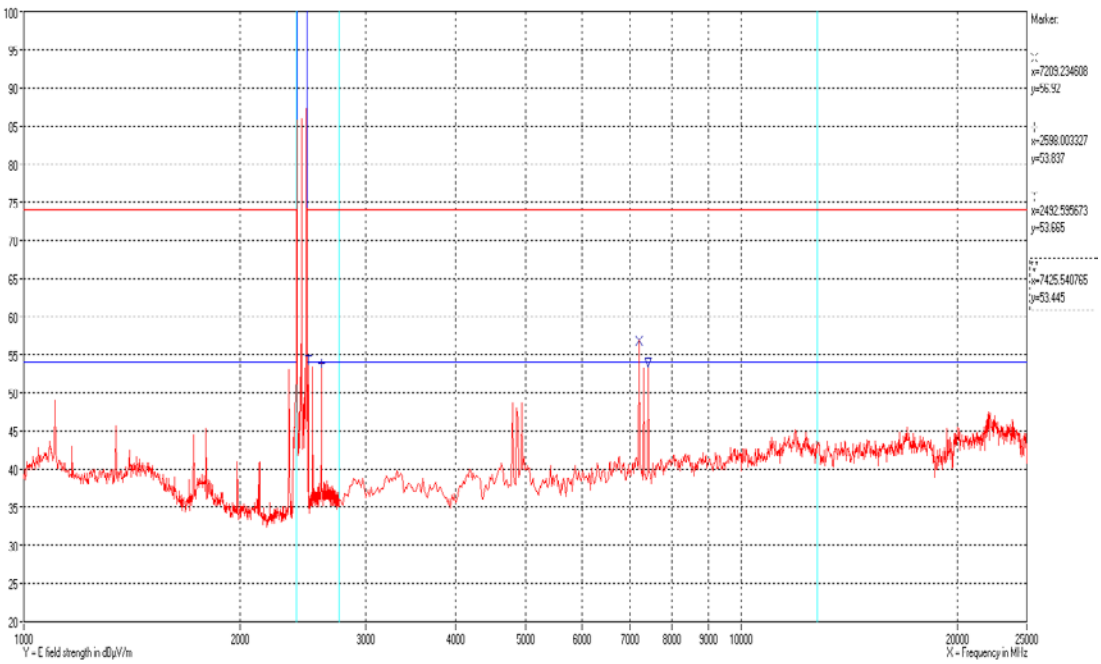


Photo 4.4.2 Test setup regarding measurement of radiated emission (below 1 GHz).

4.5 Measurement of radiated emission (above 1 GHz), GN radio

Test object	LO85	Sheet	RE_Spur-7
Type	LO85	Project no.	T206529-4
Serial no.	No 1	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	23 °C 35 % RH
Detector	Peak	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49712 49625	Uncertainty	4.9 dB



Polarization	Vertical and horizontal peak measurements
Comments	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.

Test object	LO85	Sheet	RE_Spur-8
Type	LO85	Project no.	T206529-4
Serial no.	No 1	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	23 °C 35 % RH
Detector	Peak	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49712 49625	Uncertainty	4.9 dB

Frequency [MHz]	Transducer factor [dB]	Peak measurement [dBµV/m]	Peak limit [dBµV/m]	DCCF (δ) [dB]	Corrected average measurement [dBµV/m]	Average limit [dBµV/m]	Remarks
2492.6	33.7	53.7	74	-19.67	34.0	54	Passed
2598	34.1	53.8	74	-19.67	34.1	54	Passed
7209.2	38.1	56.9	74	-19.67	37.2	54	Passed
7425.5	37.2	53.4	74	-19.67	33.7	54	Passed
Note 1:							

Test result	The measured peak field strengths are below the peak limit The measured peak field strengths corrected with the DCCF (δ) are below the average limit Corrected average: PAverage(resulting) = Ppeak + DCCF (δ).
Test Port	Enclosure
Test frequency	2404, 2440 and 2478 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization. Test voltage: External power supply at 1.5 VDC

Photo 4.5.1 Test setup regarding measurement of radiated emission (above 1 GHz)

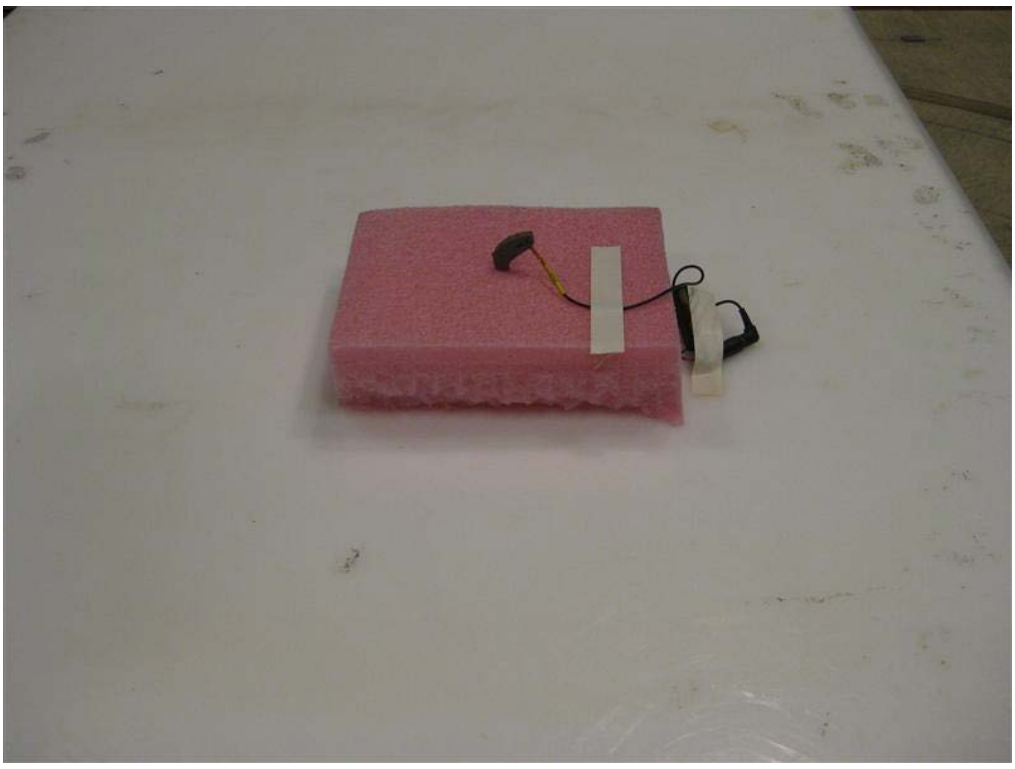
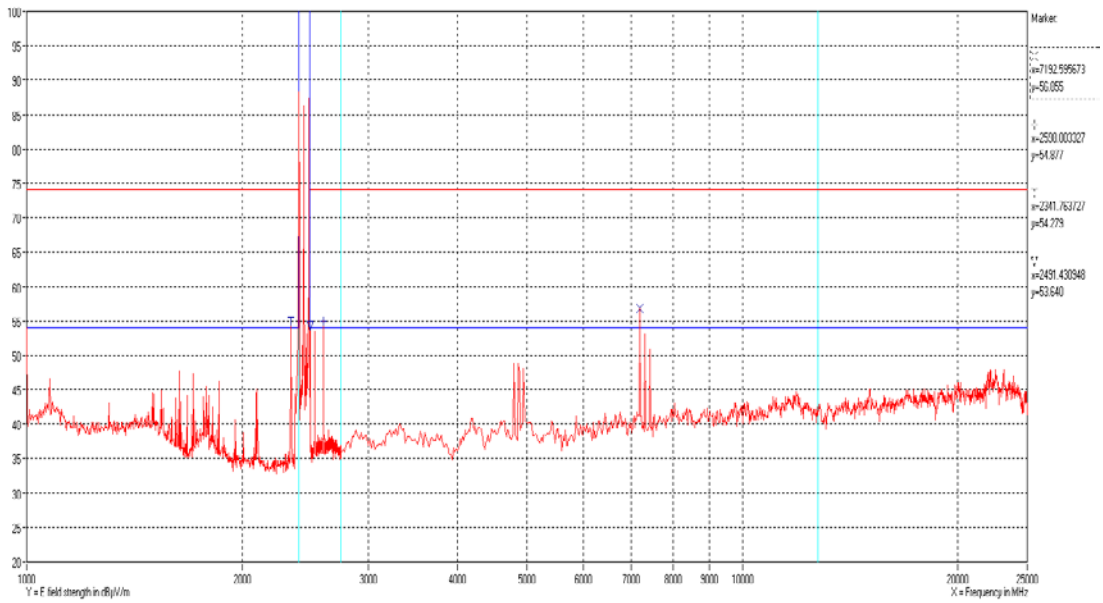


Photo 4.5.2 Test setup regarding measurement of radiated emission (above 1 GHz)

4.6 Measurement of radiated emission (above 1 GHz), Bluetooth LE radio

Test object	LO85	Sheet	RE_Spur-9
Type	LO85	Project no.	T206529-4
Serial no.	No 2	Date	02 Dec. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	24 °C 28 % RH
Detector	Peak	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49712 49625	Uncertainty	4.9 dB



Polarization	Vertical and horizontal peak measurements
Comments	Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.

Test object	LO85	Sheet	RE_Spur-10
Type	LO85	Project no.	T206529-4
Serial no.	No 2	Date	02 Dec. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	24 °C 28 % RH
Detector	Peak	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49712 49625	Uncertainty	4.9 dB

Frequency [MHz]	Transducer factor [dB]	Peak measurement [dBµV/m]	Peak limit [dBµV/m]	DCCF (δ) [dB]	Corrected average measurement [dBµV/m]	Average limit [dBµV/m]	Remarks
2341.8	32.9	54.3	74	-16.68	37.62	54	Passed
2491.4	34.1	53.6	74	-16.68	36.92	54	Passed
2598.0	34.4	54.9	74	-16.68	38.22	54	Passed
7192.6	37.7	56.9	74	-16.68	40.22	54	Passed
Note 1:							

Test result: The measured peak field strengths are below the peak limit

The measured peak field strengths corrected with the DCCF (δ) are below the average limit

Corrected average: PAverage(resulting) = Ppeak + DCCF (δ).

Test Port: Enclosure

Test frequency: 2402, 2440 and 2480 MHz

Test mode: Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.

Condition: Normal

Compliant: Yes

Comments: Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization.

Test voltage: External power supply at 1.5 VDC

Photo 4.6.1 Test setup regarding measurement of radiated emission (above 1 GHz)

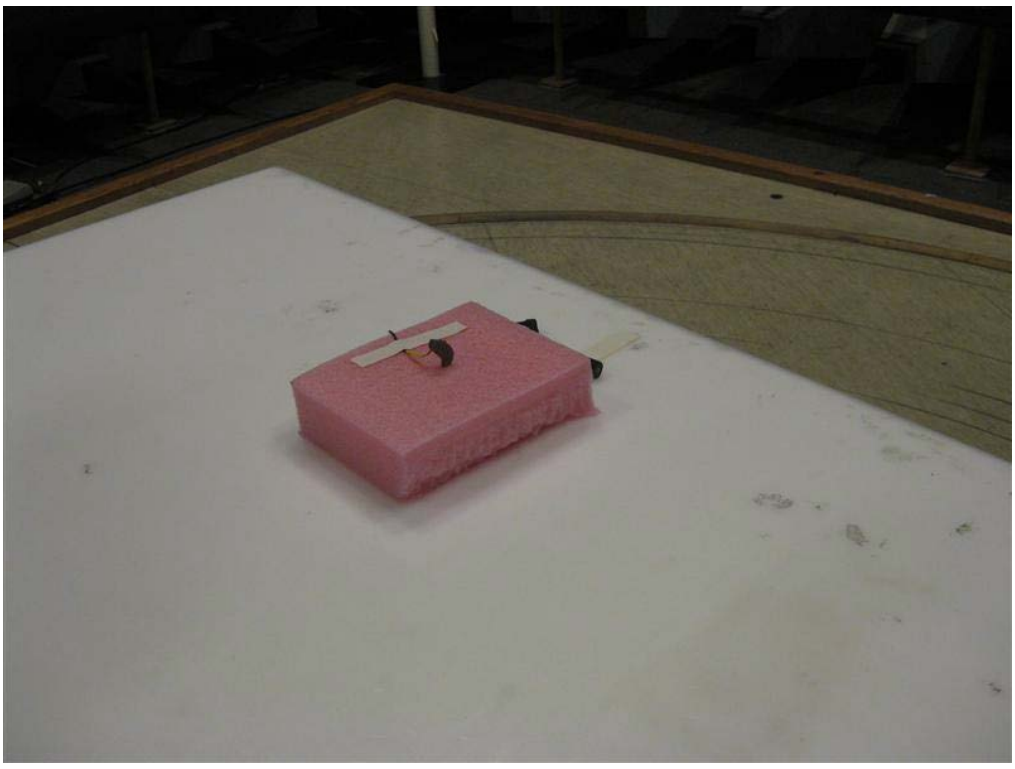


Photo 4.6.2 Test setup regarding measurement of radiated emission (above 1 GHz)

4.7 Measurement of field strength of fundamental, GN radio

Test object	LO85	Sheet	RE_Spur-11
Type	LO85	Project no.	T206529-4
Serial no.	No 1	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	23 °C 35 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49624 49625	Uncertainty	4.9 dB

Frequency [MHz]	Peak measurement [dBµV/m]	Peak limit [dBµV/m]	DCCF (δ) [dB]	Corrected average measurement [dBµV/m]	Average limit [dBµV/m]	Remarks
2404	85.7	114	-19.67	66.03	94	Passed
2440	86.1	114	-19.67	66.43	94	Passed
2478	87.3	114	-19.67	67.63	94	Passed

Test result	The measured peak field strengths are below the peak and average limits The measured peak field strengths corrected with the DCCF (δ) are below the average limit Corrected average: PAverage(resulting) = Ppeak + DCCF (δ).
Test Port	Enclosure
Test frequency	2404, 2440 and 2478 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization. Test voltage: External power supply at 1.5 VDC

Photo 4.7.1 Test setup regarding measurement of field strength of fundamental.

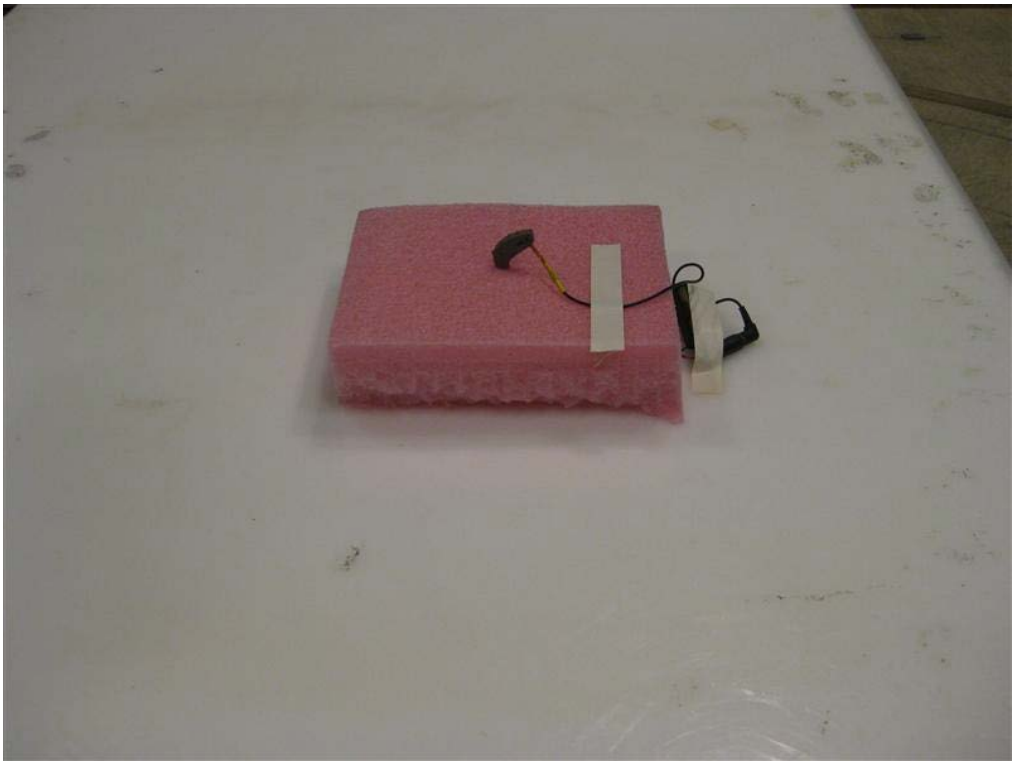


Photo 4.7.2 Test setup regarding measurement of field strength of fundamental.

4.8 Measurement of field strength of fundamental, Bluetooth LE radio

Test object	LO85	Sheet	RE_Spur-12
Type	LO85	Project no.	T206529-4
Serial no.	No 2	Date	02 Dec. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	24 °C 28 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49624 49625	Uncertainty	4.9 dB

Frequency [MHz]	Peak measurement [dBµV/m]	Peak limit [dBµV/m]	DCCF (δ) [dB]	Corrected average measurement [dBµV/m]	Average limit [dBµV/m]	Remarks
2402	88.3	114	-16.68	71.62	94	Passed
2440	86.3	114	-16.68	69.62	94	Passed
2480	87.4	114	-16.68	70.72	94	Passed

Test result	The measured peak field strengths are below the peak and average limits The measured peak field strengths corrected with the DCCF (δ) are below the average limit Corrected average: PAverage(resulting) = Ppeak + DCCF (δ).
Test Port	Enclosure
Test frequency	2402, 2440 and 2480 MHz
Test mode	Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization. Test voltage: External power supply at 1.5 VDC

Photo 4.8.1 Test setup regarding measurement of field strength of fundamental.

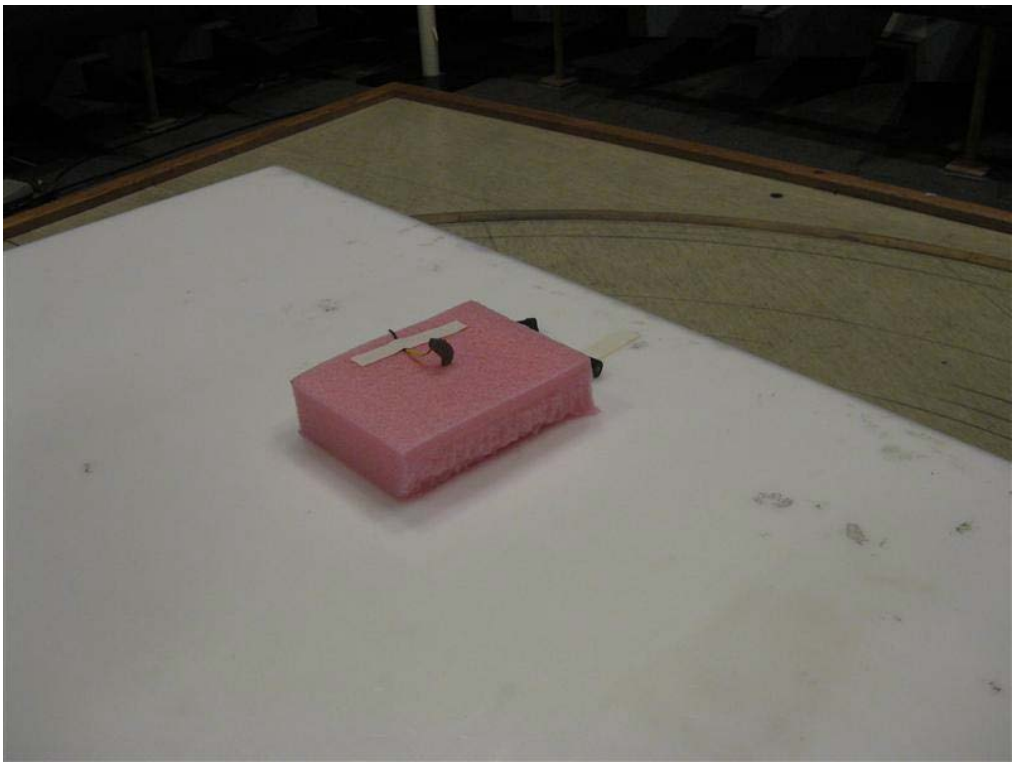
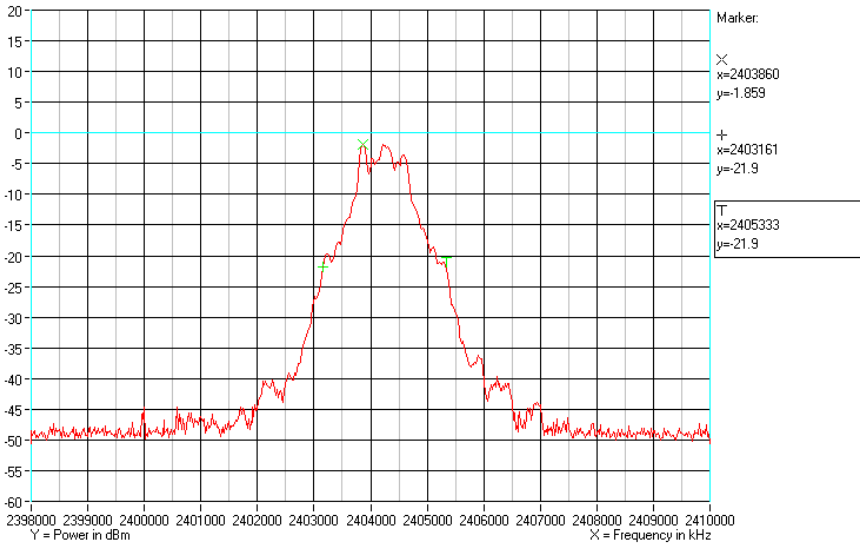


Photo 4.8.2 Test setup regarding measurement of field strength of fundamental.

4.9 Measurement of 20 dB bandwidth, GN radio

Test object	LO85	Sheet	PROF-1
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

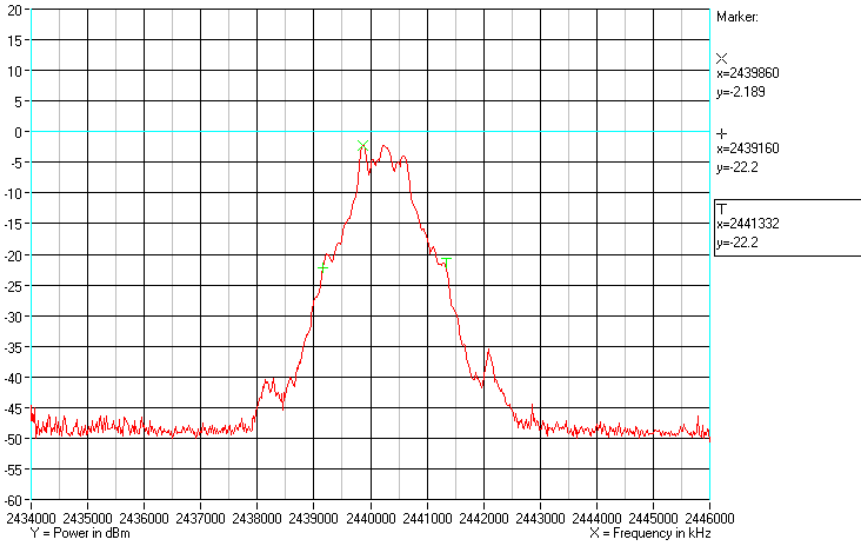
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2404 MHz

Test object	LO85	Sheet	PROF-2
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

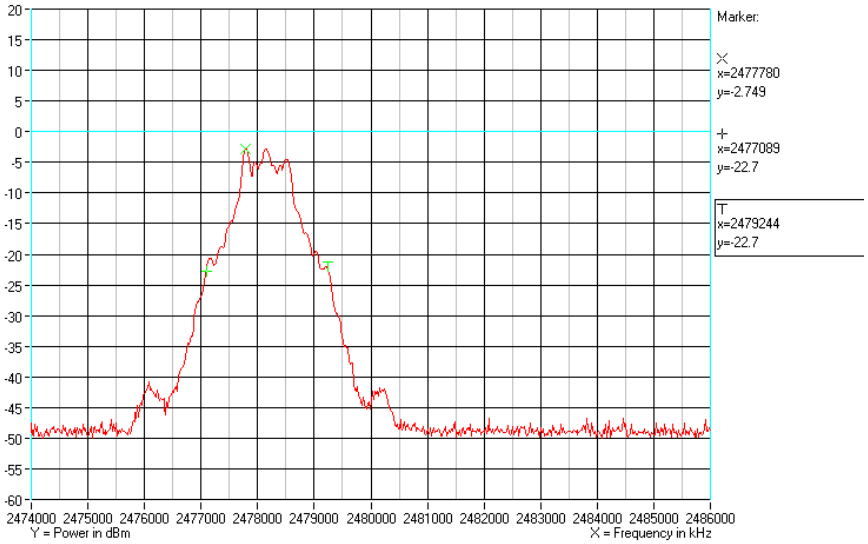
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	LO85	Sheet	PROF-1
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2478 MHz

Test object	LO85	Sheet	PROF-3
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty:	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		

Operating frequency [MHz]	Low frequency [MHz]	High frequency [MHz]	Remarks
2404	2403.2	2405.3	-
2440	2439.2	2441.3	-
2478	2477.1	2479.2	-
Note 1:			

Operating frequency [MHz]	Measured [MHz]	Limit [MHz]	Remarks
Lowest frequency	2403.2	2400.00	Passed
Highest frequency	2479.2	2483.50	Passed

Band edge criteria	20 dB bandwidth
Test result	The measured 20 dB bandwidth are within limit designated in 15.215(c)
Test port	Antenna replaced by SMA connector
Test frequency	2404, 2440 and 2478 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Test voltage: External power supply at 1.5 VDC

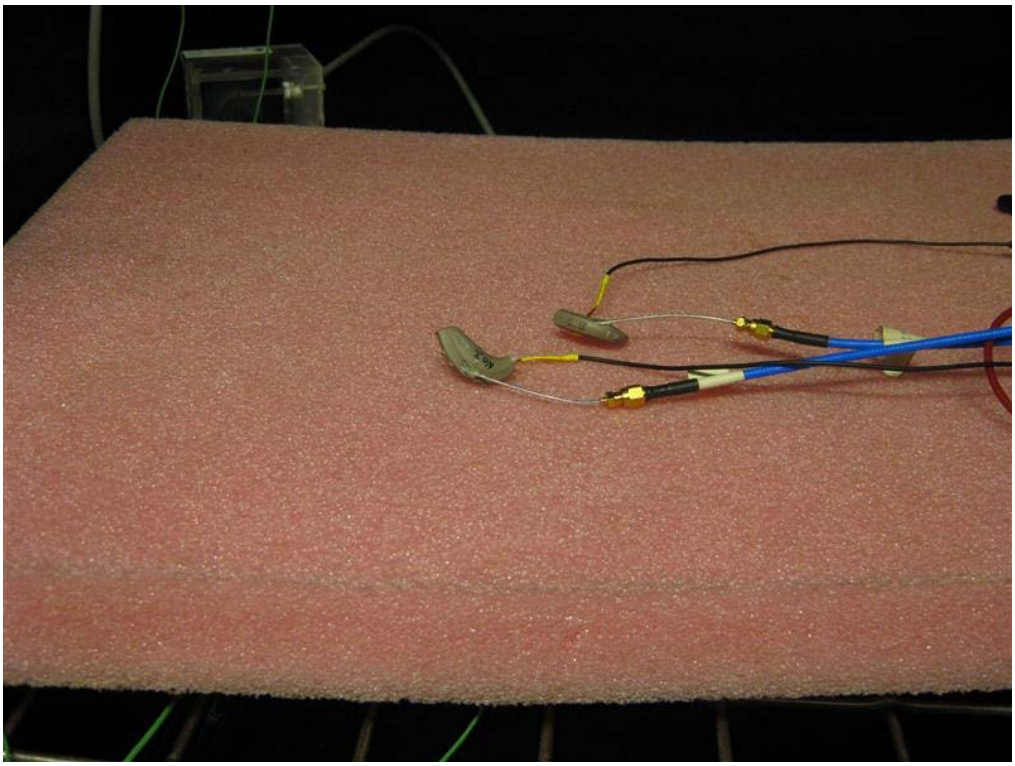


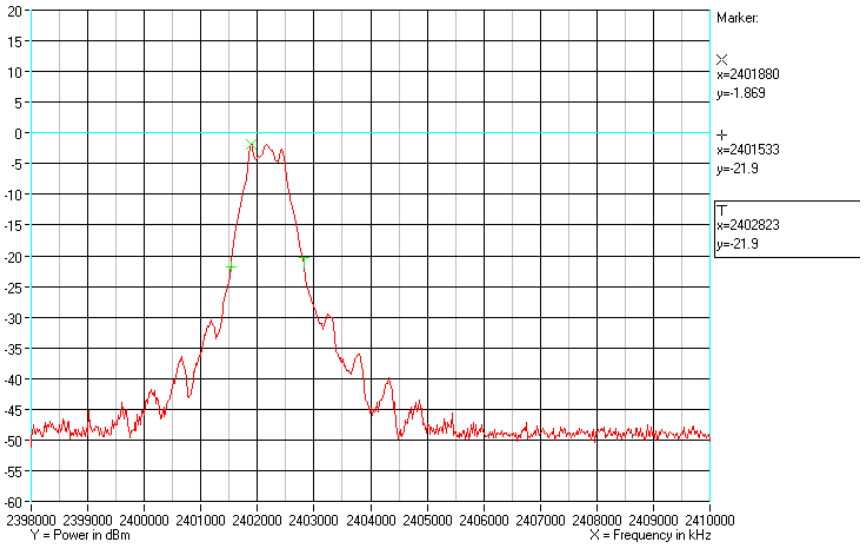
Photo 4.9.1 Test setup regarding measurement of 20 dB bandwidth

Photo 4.9.2 Test setup regarding measurement of 20 dB bandwidth

4.10 Measurement of 20 dB bandwidth, Bluetooth LE radio

Test object	LO85	Sheet	PROF-4
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

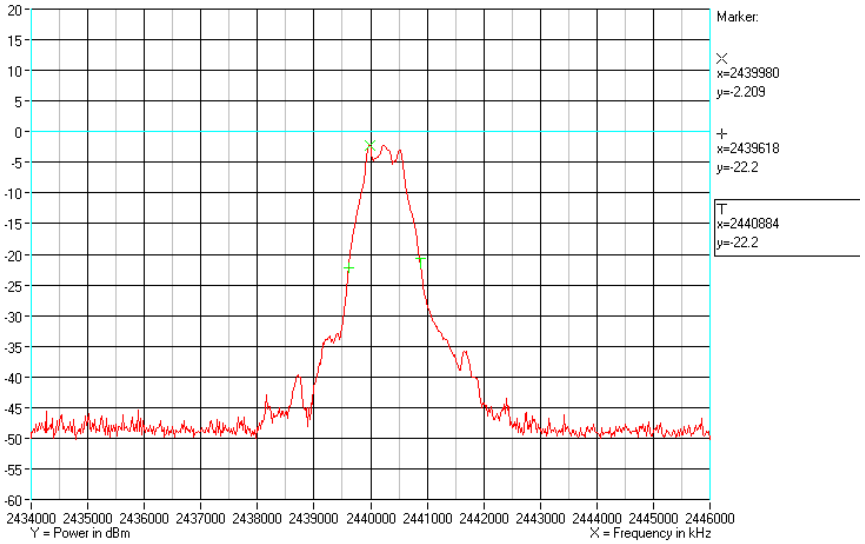
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2402 MHz

Test object	LO85	Sheet	PROF-5
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

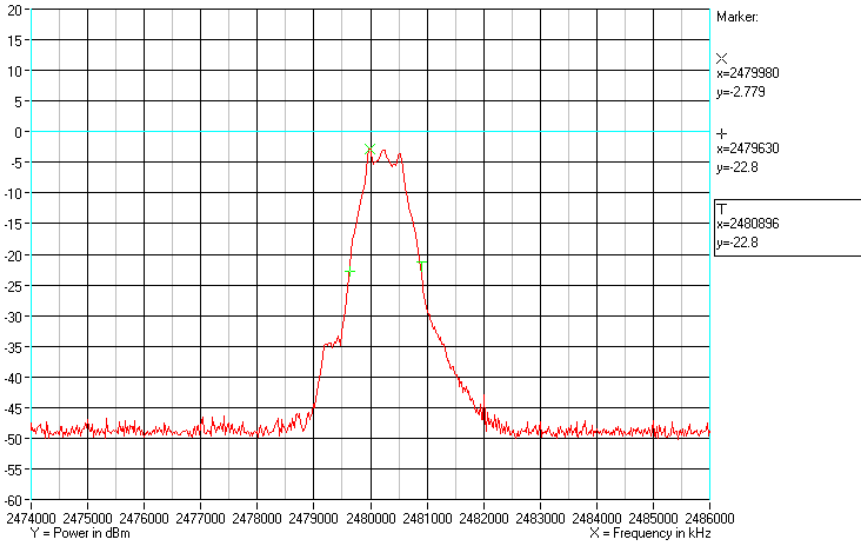
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	LO85	Sheet	PROF-2
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2480 MHz

Test object	LO85	Sheet	PROF-6
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty:	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		

Operating frequency [MHz]	Low frequency [MHz]	High frequency [MHz]	Remarks
2402	2401.5	2402.8	-
2440	2439.6	2440.9	-
2480	2479.6	2480.9	-
Note 1:			

Operating frequency [MHz]	Measured [MHz]	Limit [MHz]	Remarks
Lowest frequency	2401.5	2400.00	Passed
Highest frequency	2480.9	2483.50	Passed

Band edge criteria	20 dB bandwidth
Test result	The measured 20 dB bandwidth are within limit designated in 15.215(c)
Test port	Antenna replaced by SMA connector
Test frequency	2402, 2440 and 2480 MHz
Test mode	Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Test voltage: External power supply at 1.5 VDC

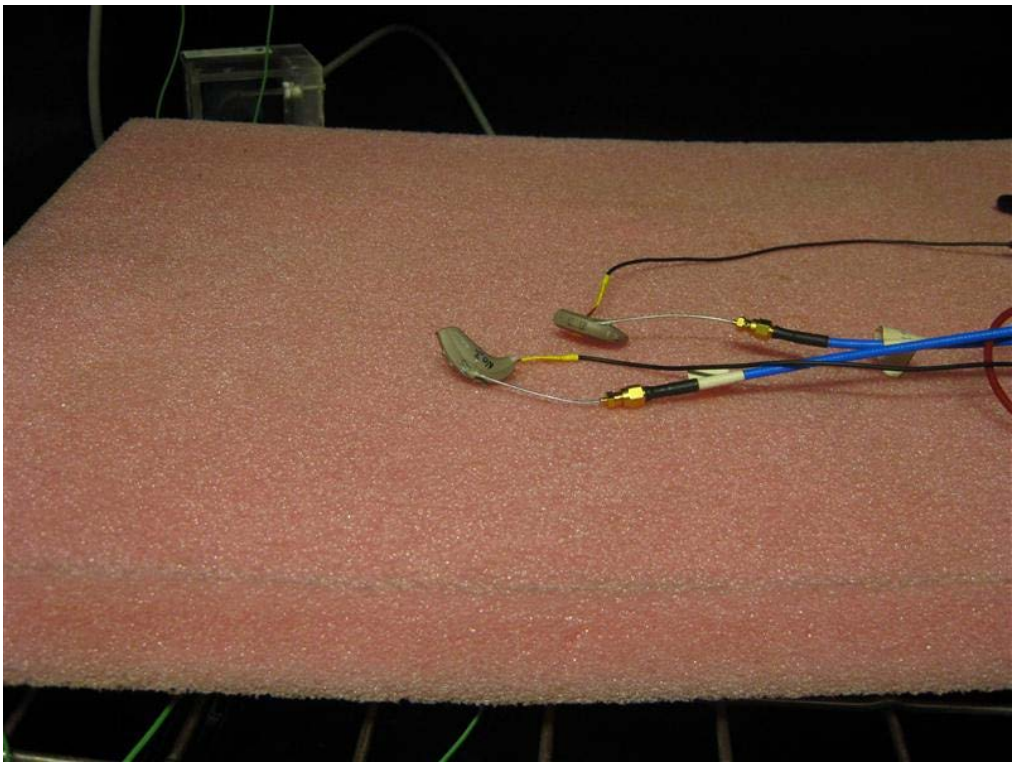


Photo 4.10.1 Test setup regarding measurement of 20 dB bandwidth

Photo 4.10.2 Test setup regarding measurement of 20 dB bandwidth

4.11 Measurement of band edge compliance, GN radio

Test object	LO85	Sheet	PROF-7
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	22 °C 33 % RH
Detector	Peak and average	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49624 49625	Uncertainty	4.9 dB

Band Edge frequency [MHz]	Operating frequency [MHz]	Average / Peak	Fundamental field strengths [dBµV/m]	Marker-delta method [dB]	Corrected [dBµV/m]	Limit at Band Edge [dBµV/m]	Remarks
2400	2404	Average	66.0	42.8	23.2	54	-
2400	2404	Peak	85.7	42.8	42.9	74	-
2483.5	2478	Average	67.6	46.1	21.5	54	-
2483.5	2478	Peak	87.3	46.1	41.2	74	-

Test result: The measured and corrected peak and average field strengths at the band edge are below the peak and average limits.

Test Port: Enclosure and Antenna connector

Test frequency: 2404 and 2478 MHz

Test mode: Continuous Tx - normal modulation - hopping between low, mid and high operating freq.

Condition: Normal

Compliant: Yes

Comments: Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation.

Marker-delta method for band-edge measurements was used to correct the measurements for the peak and average field strengths at band edge according to ANSI C63.10:2009 Section 6.9.3.

Test voltage: External power supply at 1.5 VDC.

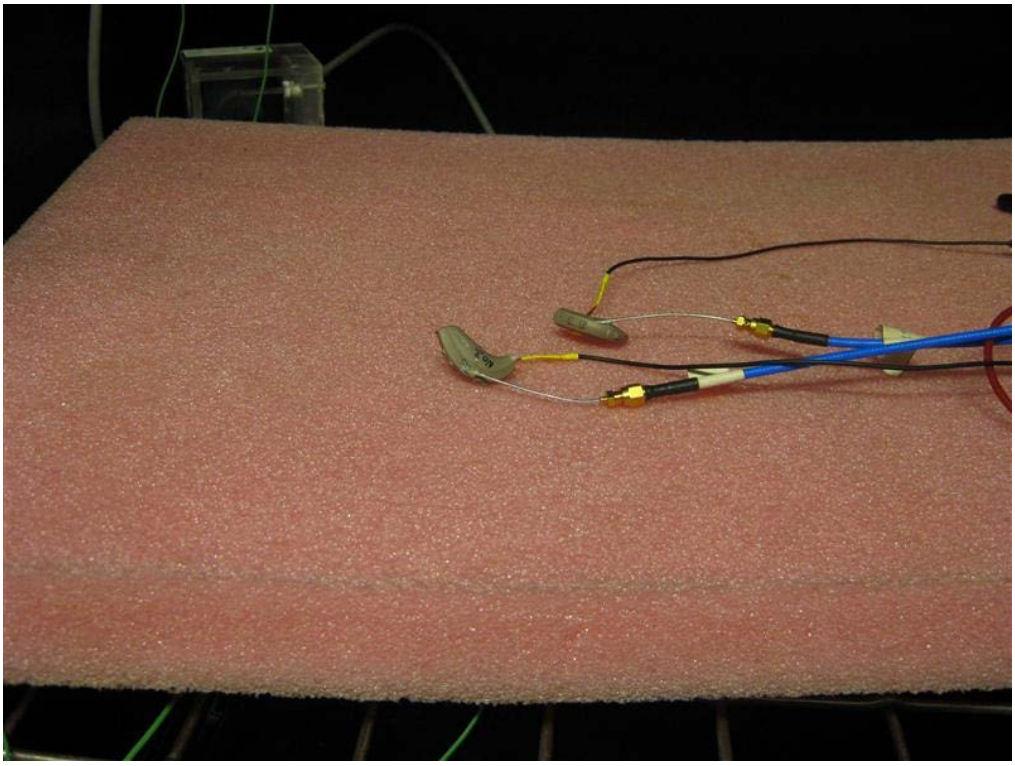


Photo 4.11.1 Test setup regarding measurement of band edge compliance.

Photo 4.11.2 Test setup regarding measurement of band edge compliance.

4.12 Measurement of band edge compliance, Bluetooth LE radio

Test object	LO85	Sheet	PROF-8
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	22 °C 33 % RH
Detector	Peak and average	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49624 49625	Uncertainty	4.9 dB

Band Edge frequency [MHz]	Operating frequency [MHz]	Average / Peak	Fundamental field strengths [dBµV/m]	Marker-delta method [dB]	Corrected [dBµV/m]	Limit at Band Edge [dBµV/m]	Remarks
2400	2404	Average	71.6	44.2	27.4	54	-
2400	2404	Peak	88.3	44.2	44.1	74	-
2483.5	2478	Average	70.7	45.5	25.2	54	-
2483.5	2478	Peak	87.4	45.5	41.9	74	-

Test result: The measured and corrected peak and average field strengths at the band edge are below the peak and average limits.

Test Port: Enclosure and Antenna connector

Test frequency: 2402 and 2480 MHz

Test mode: Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.

Condition: Normal

Compliant: Yes

Comments: Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation.

Marker-delta method for band-edge measurements was used to correct the measurements for the peak and average field strengths at band edge according to ANSI C63.10:2009 Section 6.9.3.

Test voltage: External power supply at 1.5 VDC.

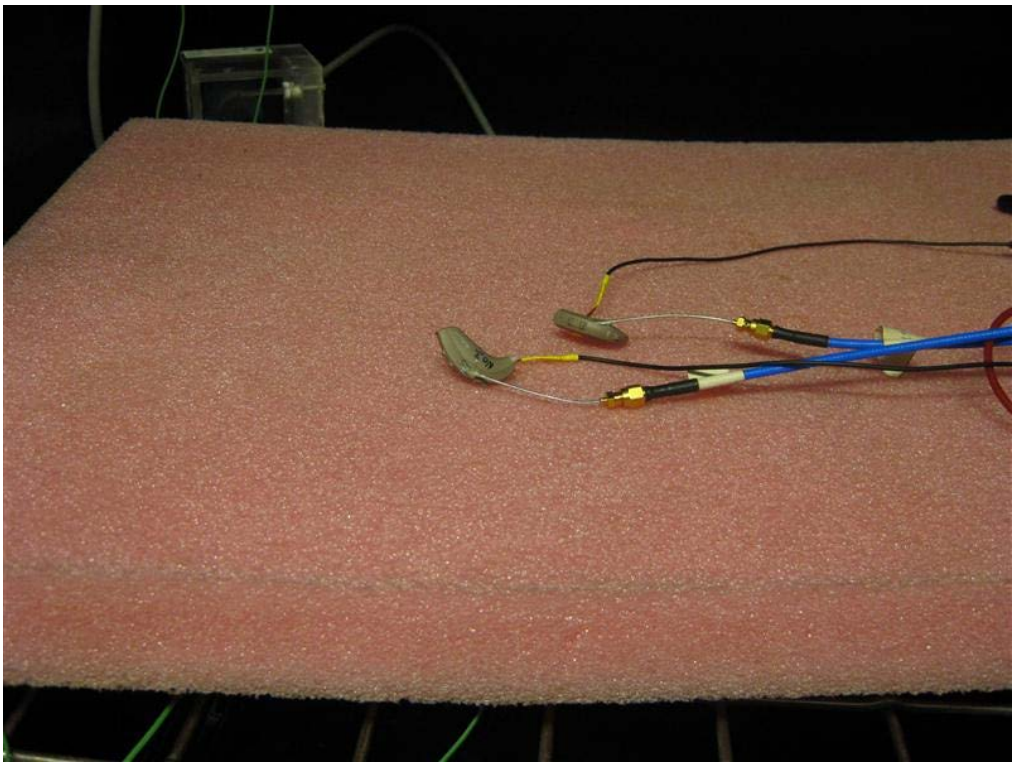


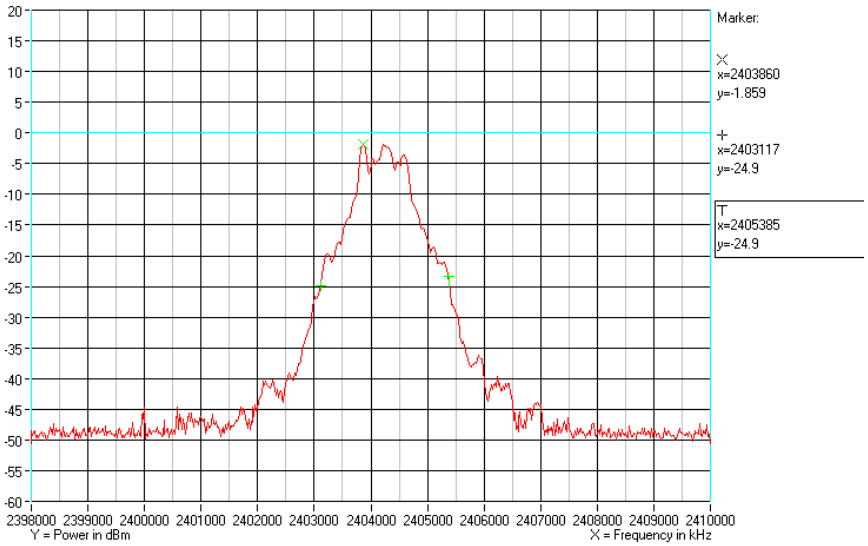
Photo 4.12.1 Test setup regarding measurement of band edge compliance.

Photo 4.12.2 Test setup regarding measurement of band edge compliance.

4.13 Measurement of occupied bandwidth, IC, GN radio

Test object	LO85	Sheet	PROF-9
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

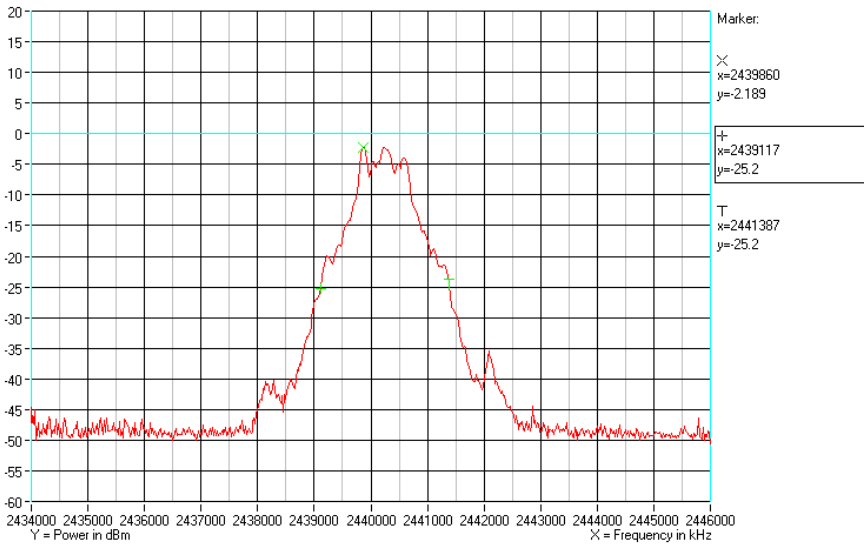
Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2404 MHz

Test object	LO85	Sheet	PROF-10
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

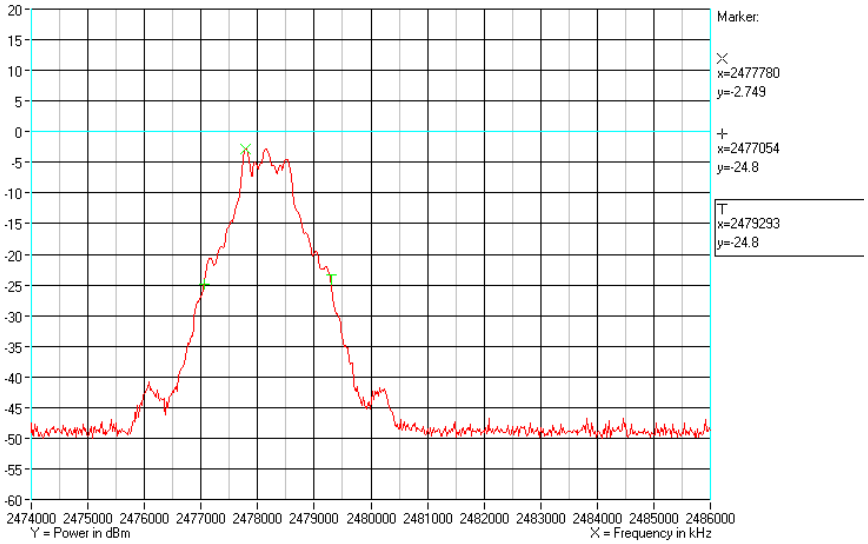
Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	LO85	Sheet	PROF-11
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2478 MHz

Test object	LO85	Sheet	PROF-12
Type	LO85	Project no.	T206529-4
Serial no.	No 3	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		

Operating frequency [MHz]	Low frequency [MHz]	High frequency [MHz]	Measured 99% emission bandwidth [MHz]
2404	2403.1	2405.4	2.3
2440	2439.1	2441.4	2.3
2478	2477.1	2479.3	2.2
Note 1:			

Band edge criteria	Measured 99 % emission bandwidth (23 dBc)
Test port	Antenna replaced by SMA connector
Test frequency	2404, 2440 and 2478 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Comments	Test voltage: External power supply at 1.5 VDC

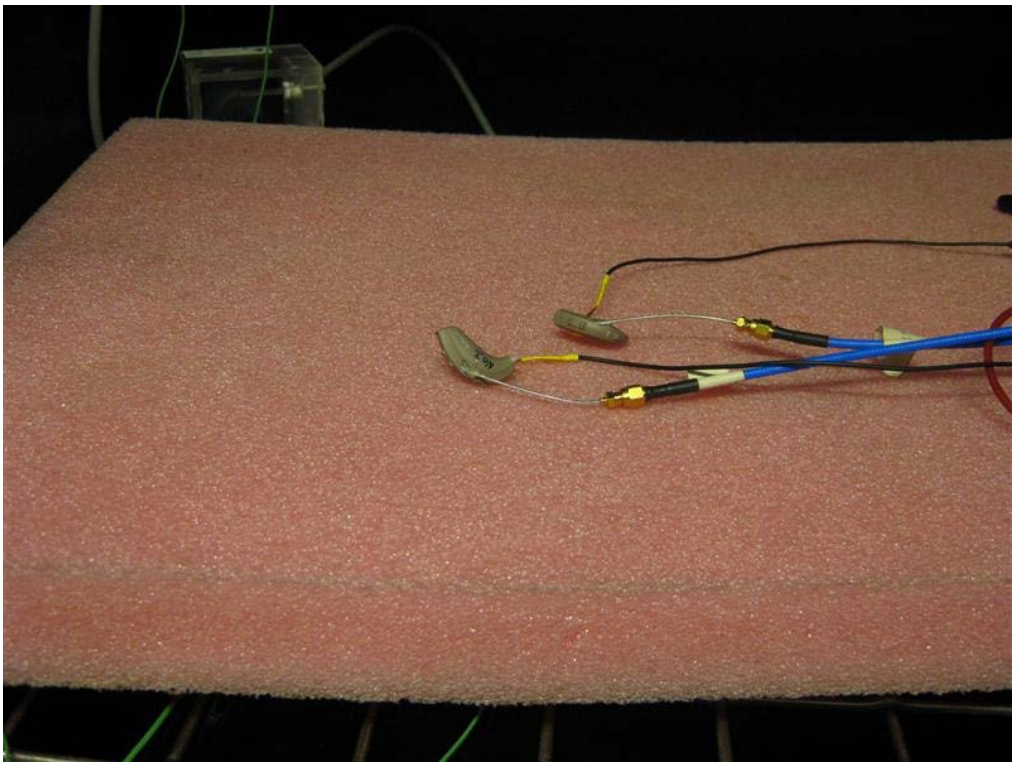


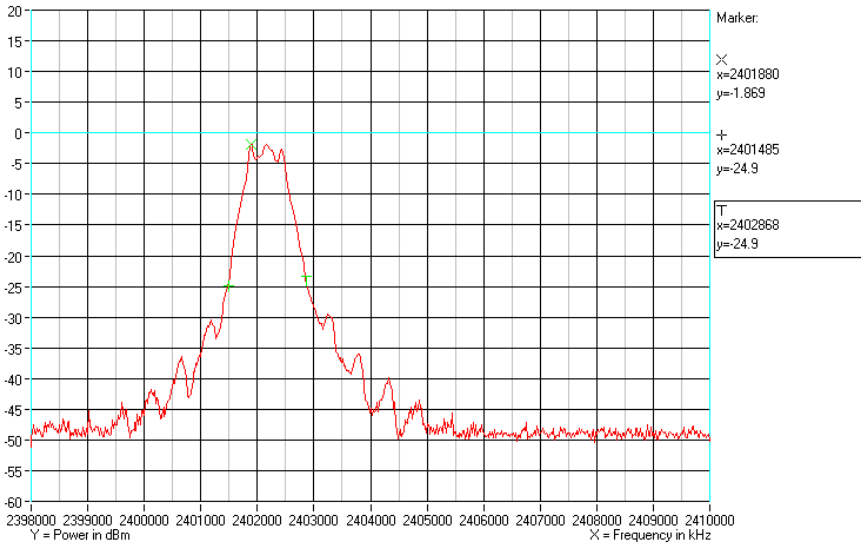
Photo 4.13.1 Test setup regarding measurement of occupied bandwidth, IC, GN radio

Photo 4.13.2 Test setup regarding measurement of occupied bandwidth, IC, GN radio

4.14 Measurement of occupied bandwidth, IC, Bluetooth LE radio

Test object	LO85	Sheet	PROF-13
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

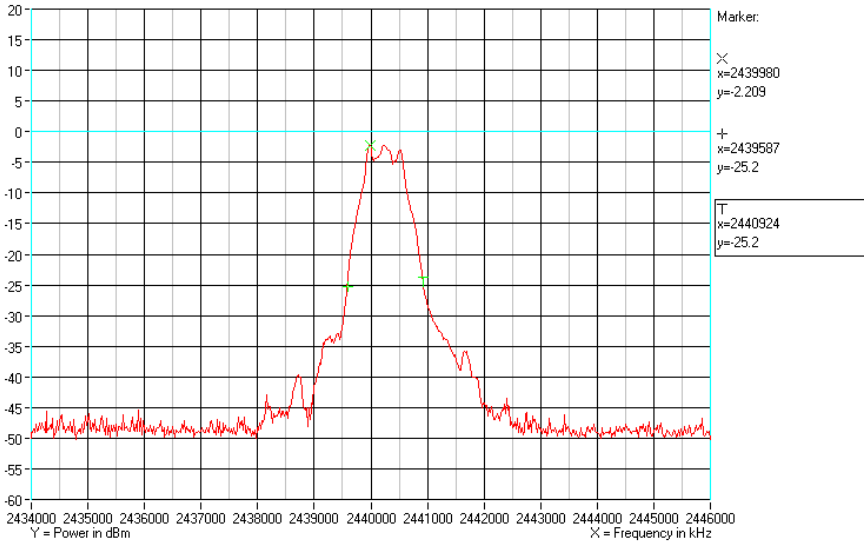
Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2402 MHz

Test object	LO85	Sheet	PROF-14
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

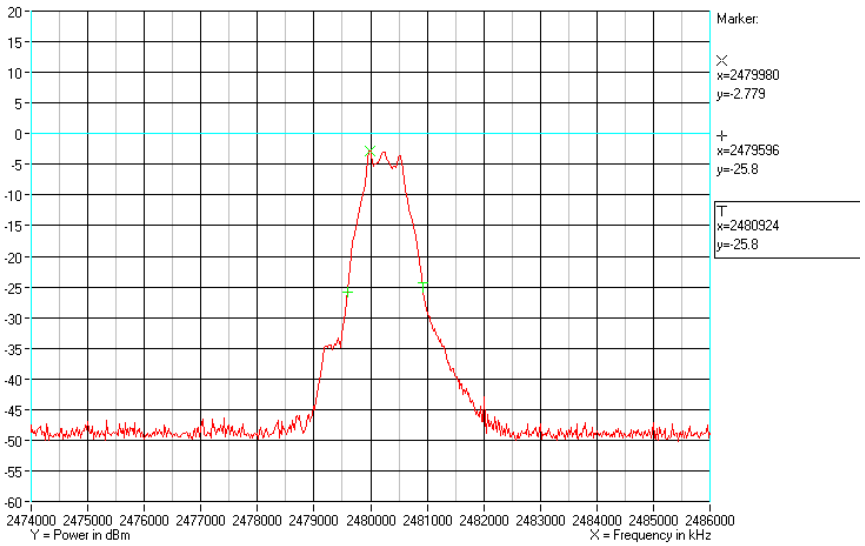
Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	LO85	Sheet	PROF-15
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2480 MHz

Test object	LO85	Sheet	PROF-16
Type	LO85	Project no.	T206529-4
Serial no.	No 4	Date	19 Nov. 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 1.5 VDC	Temperature Humidity	22 °C 33 % RH
Test equipm.	Climatic chamber EVFGT-47 49550 49663	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: Max. hold		

Operating frequency [MHz]	Low frequency [MHz]	High frequency [MHz]	Measured 99% emission bandwidth [MHz]
2402	2401.5	2402.9	1.4
2440	2439.6	2440.9	1.3
2480	2479.6	2480.9	1.3
Note 1:			

Band edge criteria	Measured 99 % emission bandwidth (23 dBc)
Test port	Antenna replaced by SMA connector
Test frequency	2402, 2440 and 2480 MHz
Test mode	Continuous Tx - GFSK modulation - hopping between low, mid and high operating freq.
Condition	Normal
Comments	Test voltage: External power supply at 1.5 VDC

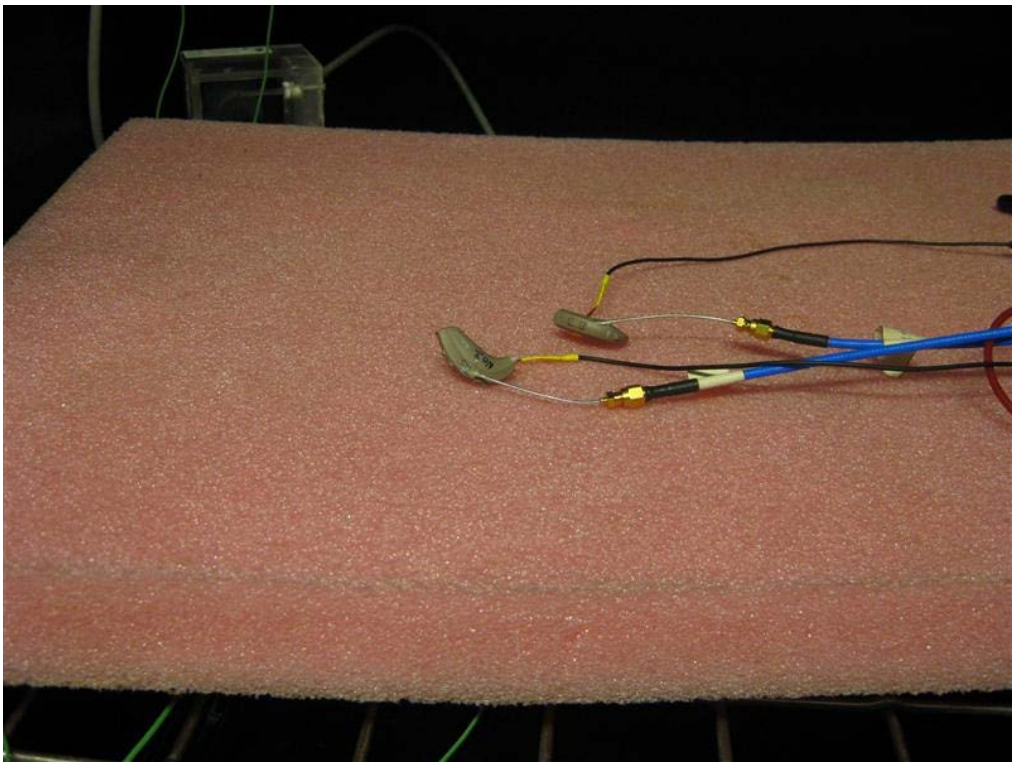


Photo 4.14.1 Test setup regarding measurement of occupied bandwidth, IC, Bluetooth LE radio

Photo 4.14.2 Test setup regarding measurement of occupied bandwidth, IC, Bluetooth LE radio

5. National registrations and accreditations

5.1 DANAK Accreditation

Organization: Danish Accreditation and Metrology Fund - DANAK, see www.danak.dk and www.ilac.org

Registration Number: 19

Area Number: C

DANAK is part of ILAC (International Laboratory Accreditation Cooperation) including its MRA (Mutual Recognition Arrangement). The MRA includes the Australian NATA and Canadian SCC.

5.2 FCC Registrations

Organization: Federal Communications Commission, USA

Registration Number: 90529

Facilities: EMC room 2 Hørsholm (EMC-2)
EMC room 3 Hørsholm (EMC-3)
EMC room 4 Hørsholm (EMC-4)
EMI room Hørsholm (EMC-5)

5.3 VCCI Registrations

Organization: Voluntary Control Council for Interference by Information Technology, Japan

Member Number: 910

Facilities:

EMC room 2 Hørsholm (EMC-2):	C-707 and T-1547
EMC room 3 Hørsholm (EMC-3):	C-2532 and T-1548
EMC room 4 Hørsholm (EMC-4):	C-2533 and T-1549
EMI room Hørsholm (EMC-5):	R-1180, C-706, T-1550 and G-470

5.4 IC Registrations

Organization: Industry Canada, Certification and Engineering Bureau

Registration Number: IC4187A-5

Facilities: EMI room Hørsholm (EMC-5)

6. List of instruments

No	Category/Action	Manufacturer	Type no	Cal. date	Cal. exp.
29797	BILOG ANTENNA, 30-2000 MHz	CHASE ELECTRICS LTD	CBL 6111A	07-06-2013	07-06-2015
29861	EMI-SOFTWARE Ver. 1.60	ROHDE & SCHWARZ	ES-K1, PART: 1026.6790.02	-	-
49086	REMI EMISSION SOFTWARE PACKAGE v. 2.133, ROOM 5	NeWeTec	REMI	-	-
49550	SIGNAL ANLYZER	ROHDE & SCHWARZ	FSQ8	09-07-2013	09-07-2014
49600	SPECTRUM ANALYZER / MEASUREMENT RECEIVER	ROHDE & SCHWARZ	ESU40	08-01-2013	08-01-2014
49624	DUAL RIDGE HORN ANTENNA – 1GHZ-26GHZ (2GHZ-32GHZ)	SATIMO	SH2000	19-09-2011	19-09-2014
49625	SRD COAX SWITCH MATRIX USED IN 1GHZ TO 26GHZ SRD ANTENNASYSTEM	DELTA	COAX SWITCH MATRIX	17-06-2013	17-06-2014
49663	DC POWER SUPPLY	Agilent	66319D	26-11-2013	26-11-2014
49712	DUAL RIDGE HORN ANTENNA – 1GHZ-26GHZ (2GHZ-32GHZ)	SATIMO	SH2000	23-04-2012	23-04-2015