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DELTA Test Report

TEST Reg. no. 19

Radio parameter test of SAS-2

Performed for GN Hearing A/S

DANAK-1910913
Project no.: A506404-8

3 June 2010

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Title	Radio parameter test of SAS-2
Test object	SAS-2
Report no.	DANAK-1910913
Project no.	A506404-8
Test period	22 April - 2 June 2010
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	FCC CFR 47 Part 15, Subpart C RSS-Gen, Issue 7, June 2007 RSS-210, Issue 2, June 2007
Results	The test objects were found to be in compliance with the specifications, as listed in Chapter 1.
Test personnel	Claus Momme Thomsen Henrik Egeberg Nielsen Jan Askov

Date 3 June 2010

Project Manager

Jan Askov
Senior Specialist, Wireless
DELTA

Responsible

Claus Rømer Andersen
Team Manager, Wireless
DELTA

Table of contents

1. Summary of tests

Tests	Test methods	Rule Section	Results
Peak to Average Correction Factor (PACF)		15.35(C) RSS-Gen, 4.5	N.A.
Antenna requirement	Visual inspection	15.203 RSS-Gen, 7.1.4	Passed
Radio frequency voltage on mains	ANSI C63.4:2003	15.207 RSS-Gen, 7.2.2	Passed
Radiated emission, receiver	RSS-Gen:2007	RSS-Gen, 7.2.3	Passed
Radiated emission	ANSI C63.4:2003	15.209 RSS-Gen, 7.2.3.2	Passed
6 dB bandwidth	DTS guide:2005	15.247(a)(2) RSS-210, A8.2(a)	Passed
Conducted power output	DTS guide:2005	15.247(b)(3) RSS-210, A8.4	Passed
Conducted spurious emissions	DTS guide:2005	15.247(d) RSS-210, A8.5	Passed
Band-edge compliance of RF conducted emissions	DTS guide:2005	15.247(d) RSS-210, A8.5	Passed
Power spectral density	DTS guide:2005	15.247(e) RSS-210, A8.2(b)	Passed

Test Method: DTS guide:2005. Full name is “Measurement of Digital Transmission System operating under section 15.247, March 23, 2005”.

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 standard stated below.

- FCC CFR 47 Part 15, Subpart C
  Specific rule part 15.247
- RSS-210, Issue 7, June 2007
- RSS-Gen, Issue 2, June 2007

The test results relate only to the objects tested.

2. Test objects

2.1 Test objects

Test object 2.1.1

Name of test object	SAS-2
Model / type	SAS-2
Part no.	SAS-V3
Serial no.	1079100030
FCC ID	X26SAS-2
Manufacturer	GN Hearing A/S
Supply voltage	100-240 VAC (external power supply)
Software version	Spurious emission firmware: Tx and Rx Deltatest090210
Cycle time	0.5 ms / 1.0 ms
Comments	Supplied by external power supply

Test object 2.1.2

Name of test object	SAS-2
Model / type	SAS-2
Part no.	SAS-V3
Serial no.	1079100268
FCC ID	X26SAS-2
Manufacturer	GN Hearing A/S
Supply voltage	100-240 VAC (external power supply)
Software version	Spurious emission firmware: Tx and Rx Deltatest090210
Cycle time	0.5 ms / 1.0 ms
Comments	Antenna replaced by SMA connector and supplied by external power supply

2.2 Auxiliary equipment

Auxiliary equipment 2.2.1

Name of auxiliary equipment	Power supply for Stationary Audio Streamer
Model / type	FW7600/05
Part no.	PS-0001
Serial no.	0001
FCC ID	-
Manufacturer	FWHK
Supply voltage	100-240 VAC 50-60 Hz
Comments	Auxiliary equipment supplied by the client

Auxiliary equipment 2.2.2

Name of auxiliary equipment	Apple iPod music player
Model / type	iPod
Part no.	-
Serial no.	-
FCC ID	-
Manufacturer	Apple
Supply voltage	Battery
Comments	-
	Auxiliary equipment supplied by the client

Auxiliary equipment 2.2.3

Name of auxiliary equipment	PC Laptop
Model / type	ThinkPad T43
Part no.	2669-CTO
Serial no.	L3-KTDP6
FCC ID	-
Manufacturer	IBM
Supply voltage	100-240 VAC via adaptor for Test PC
Comments	Test PC
	Auxiliary equipment supplied by the client

3. General test conditions

3.1 Test setup during test

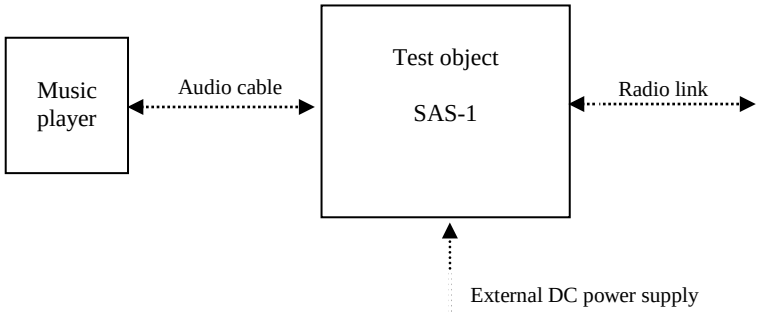


Figure 3.1.1 Block diagram of test object.

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).

Tests were performed at three frequencies:

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

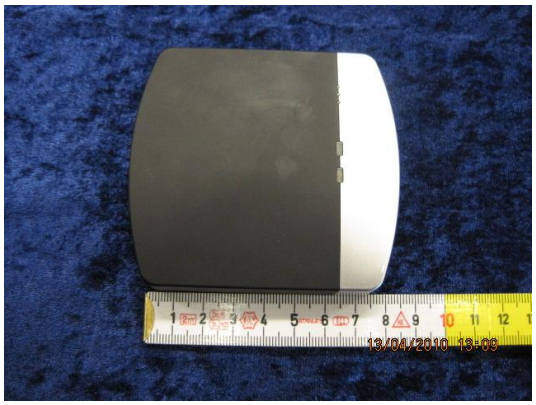
During relevant tests, the battery was replaced by an external DC power supply.

Intended use

SAS-2 is used to stream audio from an audio source (e.g. a TV) to hearing aids.

Size of the test object

The test object measures 90 x 8.5 x 20 mm.



3.2 Description of radio link

The radio of the test object has the following specified RF parameters:

Antenna	:	PCB antenna, gain: 1.5 dBi
Operating frequency range	:	2404 to 2478 MHz
Transmit power	:	20 dBm
Power level	:	No
No of channels	:	20
Bandwidth (Specification)	:	2 MHz
Channel separation	:	2 MHz
Modulation	:	GFSK
Data rate	:	2 Mbit/s
Duty cycle	:	10 % during normal mode
Transmit mode	:	Yes
Receive mode	:	Yes
Standby mode	:	Yes
Power supply	:	5 VDC from external power supply Specified max voltage: 5.5 VDC Specified min voltage: 4.4 VDC
Temperature category	:	-20 to +55 ºC.

3.3 Test sequence

The tests described in this test report were performed in the following sequence:

1. Measurement of radiated emission, 1 GHz - 25 GHz,
2. Measurement of radio frequency voltage on mains
3. Measurement of radiated emission, 30 MHz - 1000 MHz
4. Antenna requirement.
5. Measurement of radiated emission, 0.009 MHz - 30 MHz
6. Measurement of radiated emission, receiver, 1 GHz - 25 GHz,
7. Measurement of radiated emission, receiver, 30 MHz - 1000 MHz
8. Measurement of the 6 dB bandwidth
9. Measurement of conducted power output
10. Measurement of conducted spurious emissions
11. Measurement of power spectral density
12. Peak to Average Correction Factor (PACF)

4. Test results

4.1 Peak to Average Correction Factor (PACF)

Test object	SAS-2	Sheet	PACF-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100268	Date	2 June 2010
Client	GN Hearing A/S	Initials	JAS
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.35(c) and RSS-Gen, 4.5		
Characteristics	Temperature: 24ºC. Test voltage: 5.0V DC		
Test equipm.	49550 49183 49299 Uncertainty: 1•10-7		
SA Settings	RBW: 3 MHz VBW: 10 MHz SPAN: Zero-1ms DET: Peak CF: 2440 MHz Trace: Max Hold		

The measured value for the duty cycle (DC):

Max. Tx on time: 288.462 µs – Delta 2 (T1)
Period: 479.167 µs – Delta 3 (T1)

The calculated duty cycle is:

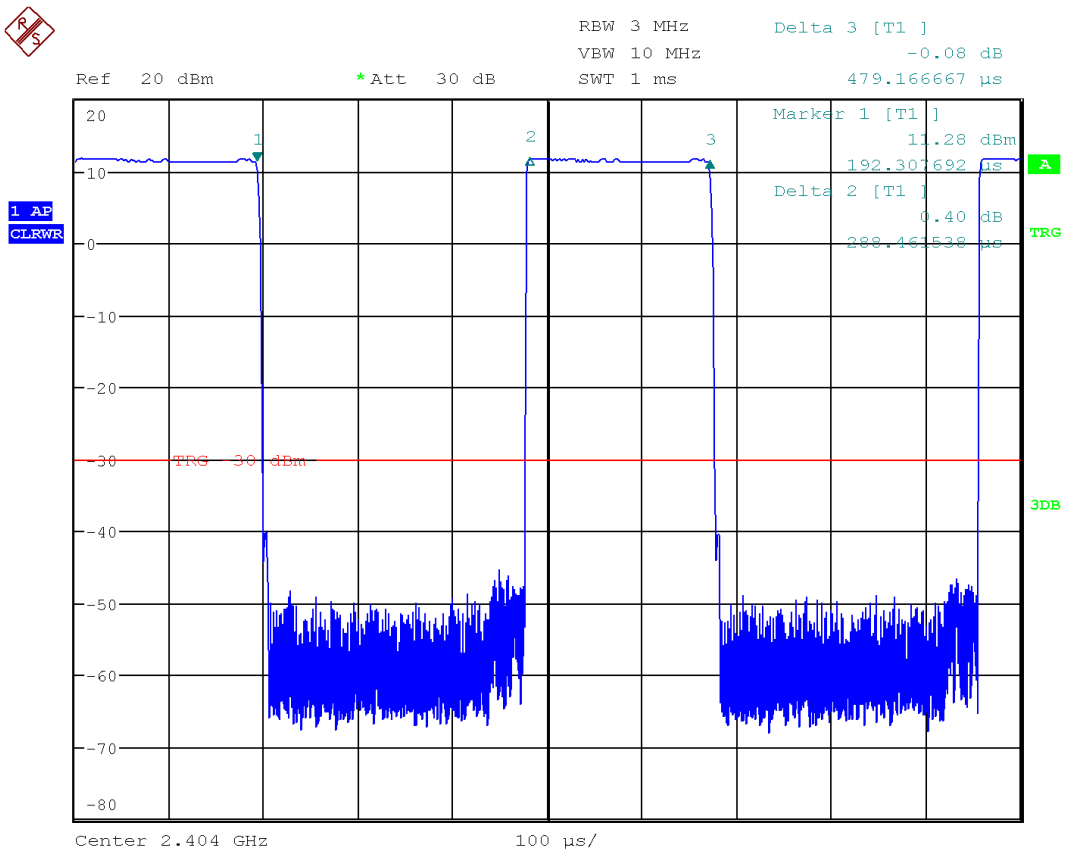
DC: (288.462 µs/479.167 µs) • 100% = 60.2 %

This corresponds to a Peak to Average Correction Factor of:

PACF: 20 log (0.602) = -4.41 dB

This is according to FCC CFR 47 Part 15, Subpart C, Section 15.35(c) and IC RSS-Gen, 4.5: For one complete pulse train, including blanking intervals and the pulse train does not exceed 0.1 seconds.

This PACF can be subtracted from the peak measurements to obtain the average values.



Comments Operating frequency is 2404 MHz, measured conducted

4.2 Antenna requirement

Test object	SAS-2	Sheet	ANT-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	28 May 2010
Client	GN Hearing A/S	Initials	JAS
Specification	FCC CFR 47 Part 15, Subpart C Section 15.203 and RSS-Gen, 7.1.4		

Test method	Visual inspection	

Evaluation criteria
Section 15.203 of the FCC rules and 7.1.4 of RSS-Gen states that the subject device must meet at least one of the following criteria:
(a) Antenna must be permanently attached to the unit.
(b) Antenna must use a unique type of connector to attach to the unit.
(c) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Evaluation result
The Stationary Audio Streamer has a permanently attached PCB antenna.

Evaluation result	The test object meets evaluation criterion (a)
Compliant	Yes
Comments	None

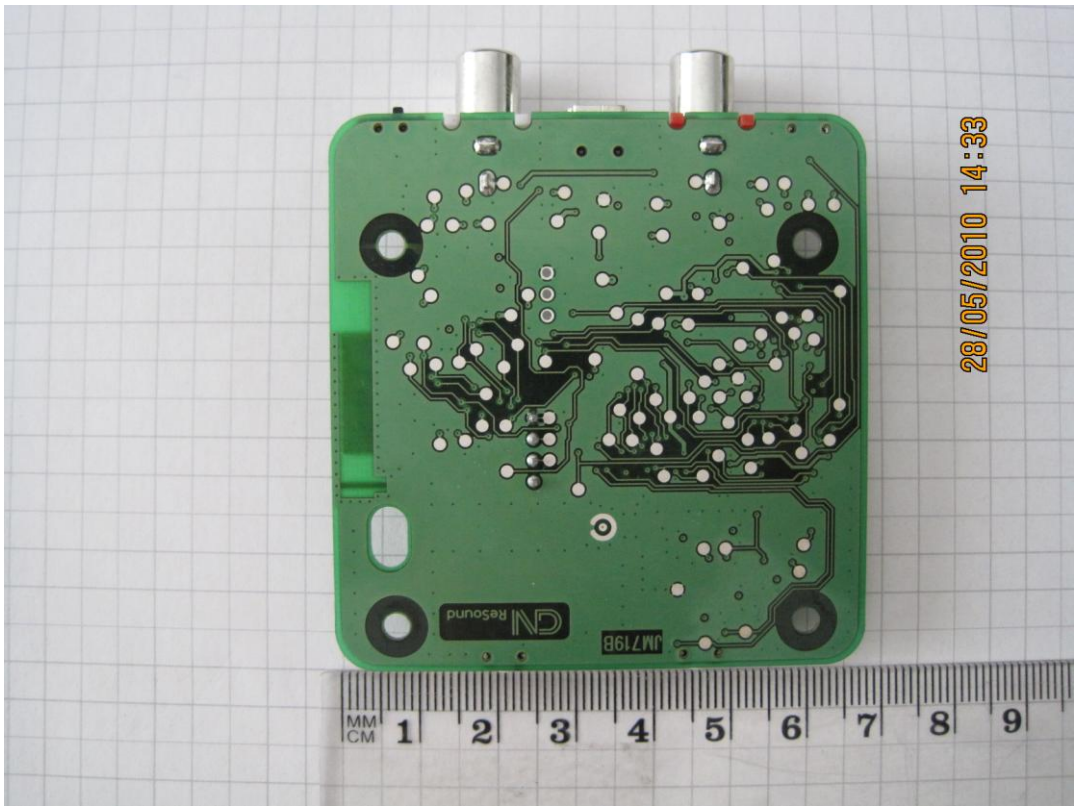


Photo 4.2.1 Test setup regarding measurement of antenna requirement

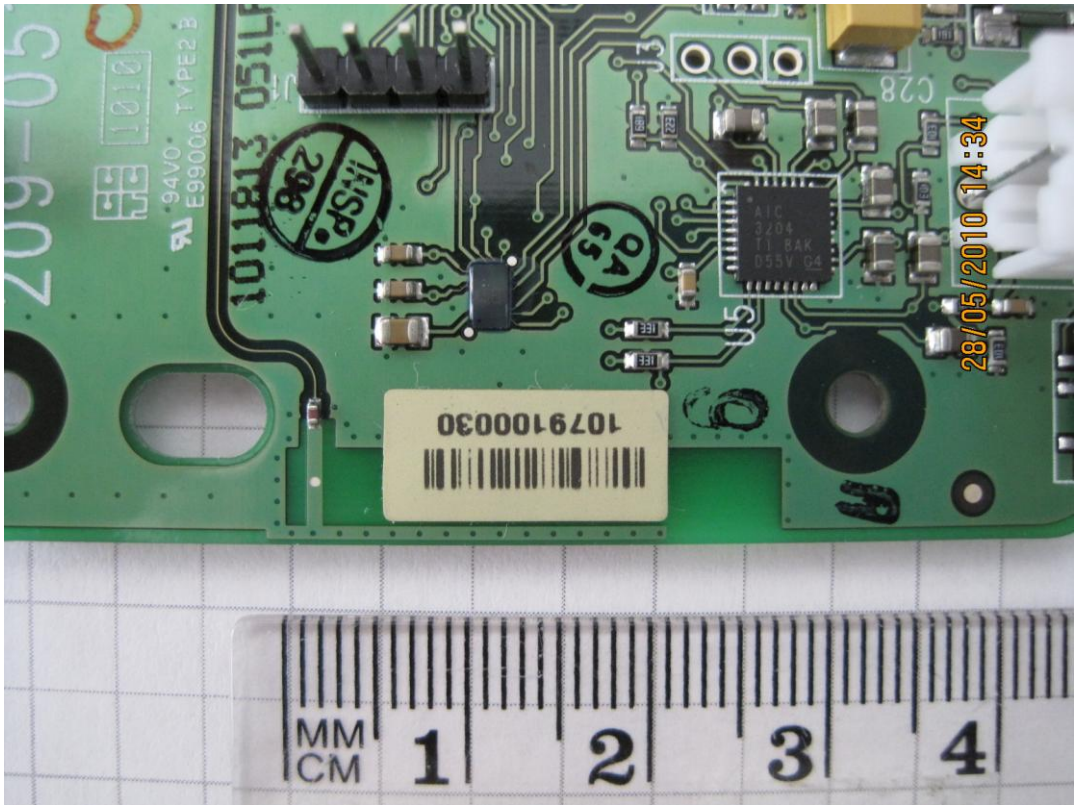
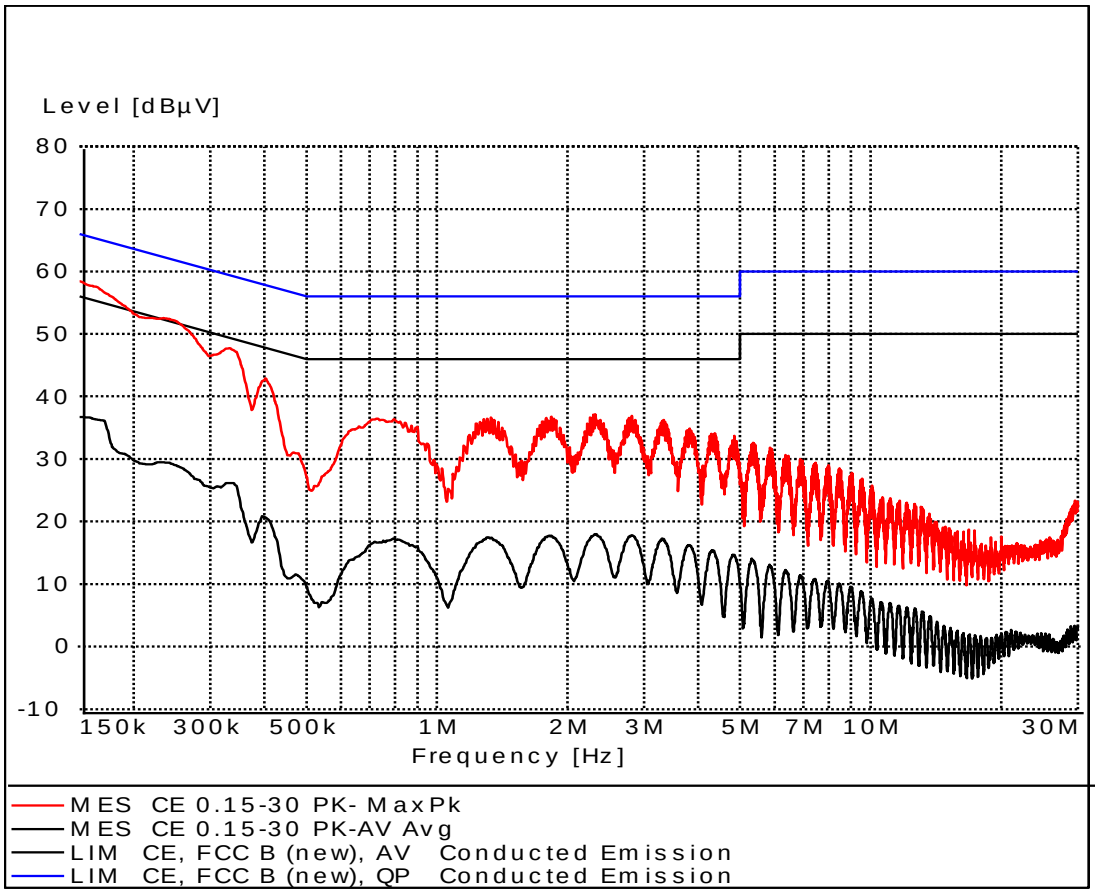


Photo 4.2.2 Test setup regarding measurement of antenna requirement

4.3 Measurement of radio frequency voltage on mains

Test object	SAS-2	Sheet	CE-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.207 and IC RSS-Gen, 7.2.2	Frequency	0.15-30 MHz

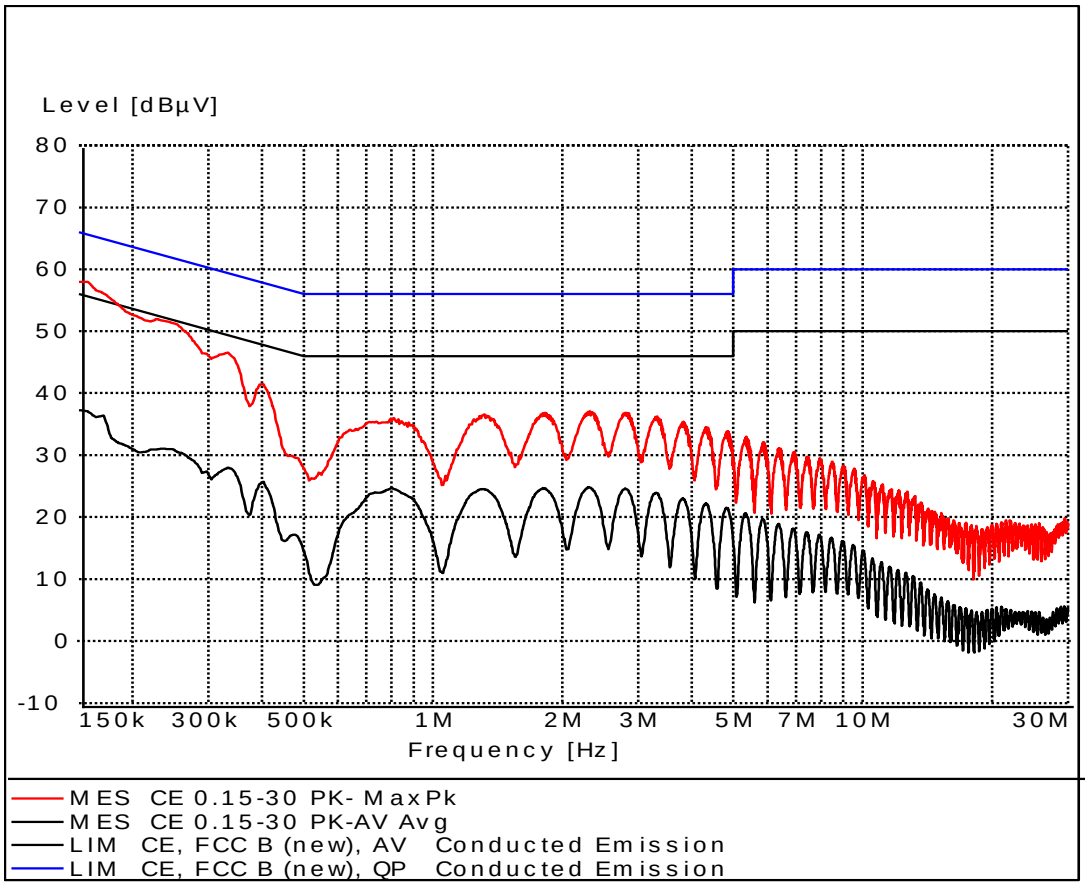
Test method Characteristics	ANSI C63.4:2003 Artificial mains network: 50 Ω, 50 µH	Temperature Humidity	22 °C 23 % RH
Detector	Peak and average	Bandwidth	10 kHz
Test equipm.	EMI room Hørsholm 29301 29680 49600 29861	Uncertainty 4.9 dB	



Line under test	Neutral
Test result	The measured voltages were below the limit
Comments	Mains voltage: 120 VAC

Test object	SAS-2	Sheet	CE-2
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	HEN
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.207 and IC RSS-Gen, 7.2.2	Frequency	0.15-30 MHz

Test method Characteristics	ANSI C63.4:2003 Artificial mains network: 50 Ω, 50 µH	Temperature Humidity	22 °C 23 % RH
Detector	Peak and average	Bandwidth	10 kHz
Test equipm.	EMI room Hørsholm 29301 29680 49600 29861	Uncertainty 4.9 dB	



Line under test	Line
Test result	The measured voltages were below the limit
Compliant	Yes
Comments	Mains voltage: 120 VAC

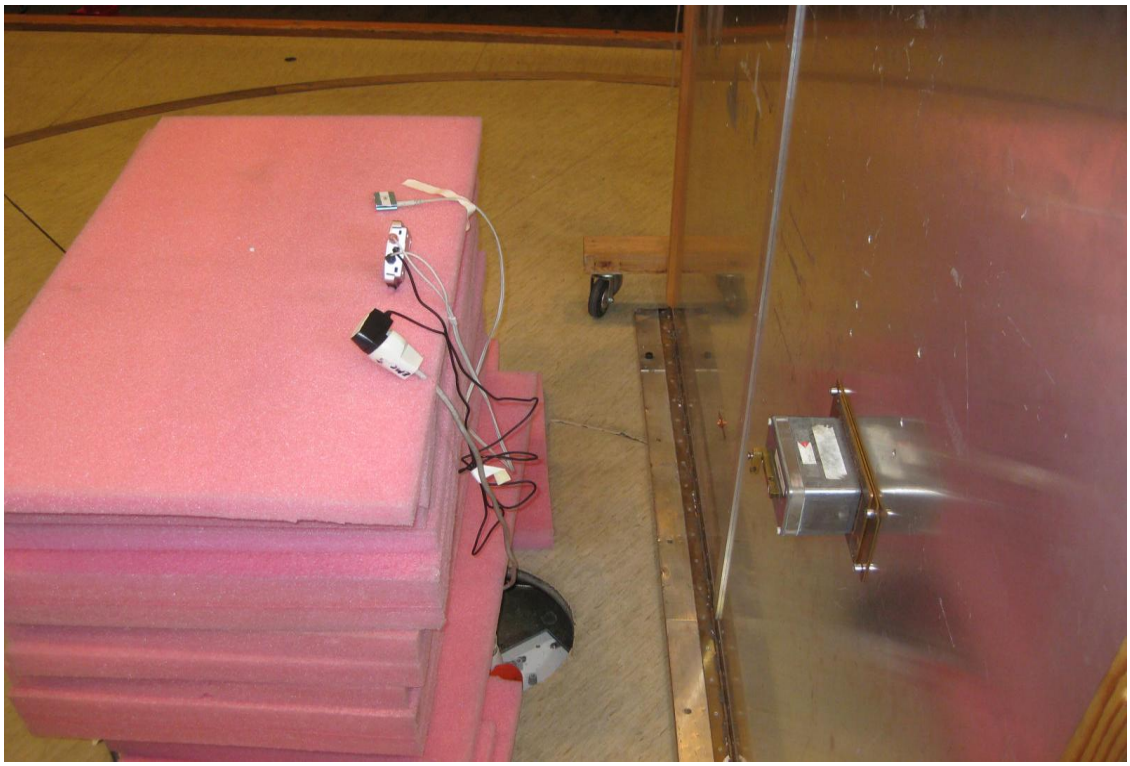


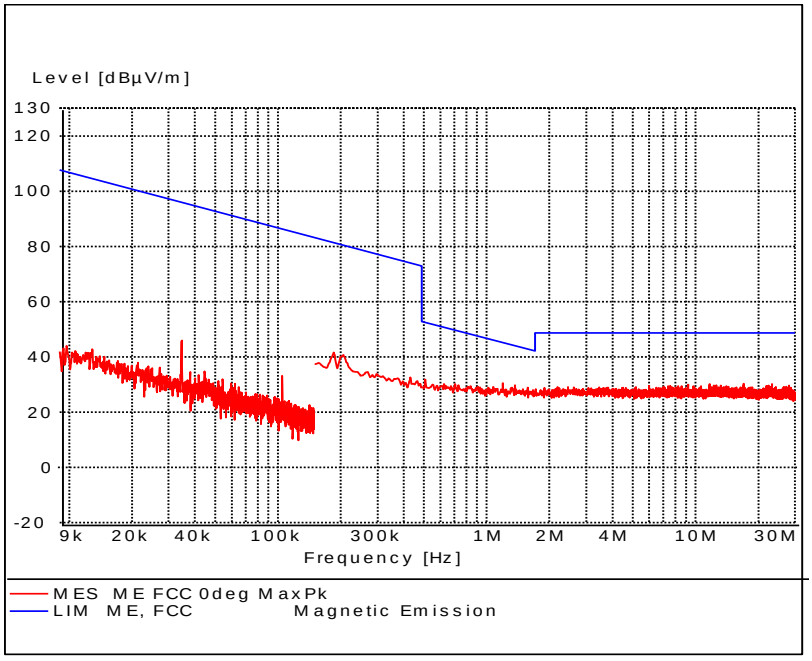
Photo 4.3.1 Test setup regarding measurement of radio frequency voltage on mains.

Photo 4.3.2 Test setup regarding measurement of radio frequency voltage on mains.

4.4 Measurement of radiated emission, 0.009 - 30 MHz

Test object	SAS-2	Sheet	ME-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-210, 2.2	Frequency	0.009-30 MHz

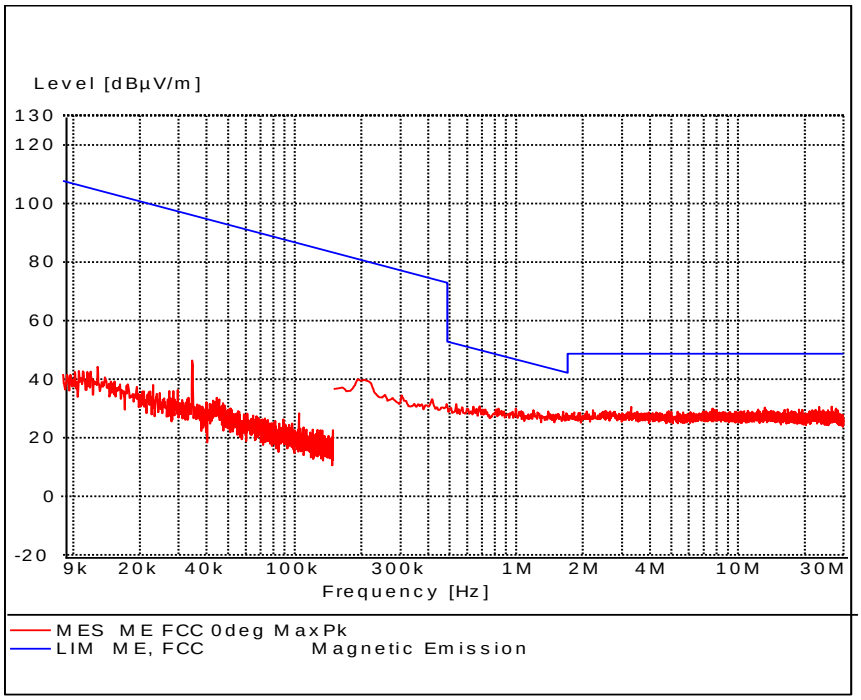
Test method Characteristics	ANSI C63.4:2003 Loop antenna pos. X. Antenna distance 10 m.	Temperature Humidity	21 °C 29 % RH
Detector	Peak	Bandwidth	0.2 kHz / 9 kHz
Test equipm.	EMI room Hørsholm 49600 29861 29332	Uncertainty 4 dB	



Test result	The measured field strengths are below the limit
Compliant	Yes
Comments	Test frequency: 2440 MHz. The limit has been extrapolated to 10 m using an extrapolation factor of 40 dB / decade as specified in §15.31(f)(2): $L_2 = L_1 + 40 \cdot \log_{10}(D_1/D_2)$

Test object	SAS-2	Sheet	ME-2
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-210, 2.2	Frequency	0.009-30 MHz

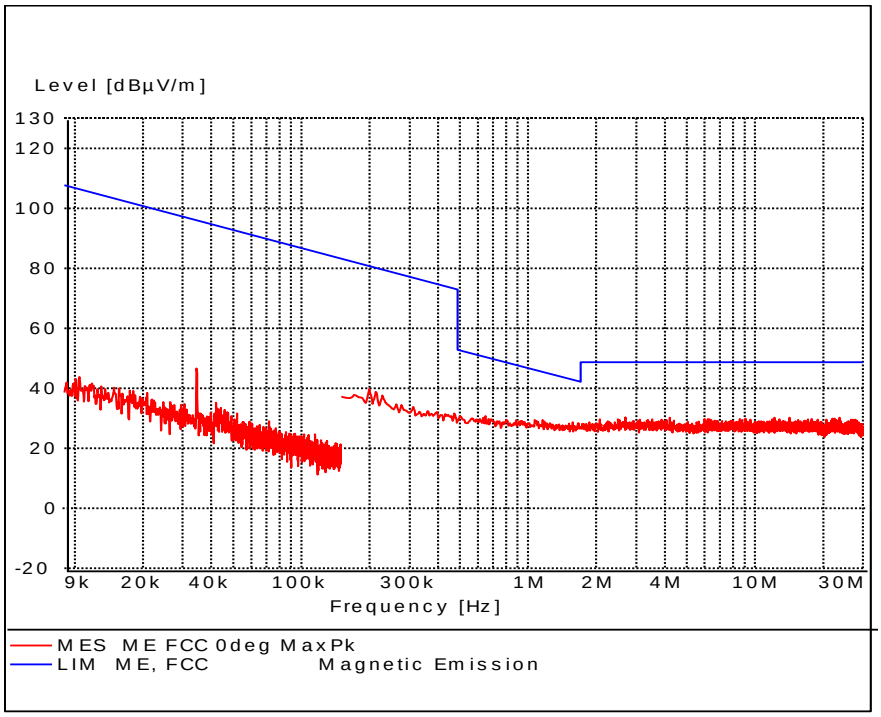
Test method Characteristics	ANSI C63.4:2003 Loop antenna pos. Y. Antenna distance 10 m.	Temperature Humidity	21 °C 29 % RH
Detector	Peak	Bandwidth	0.2 kHz / 9 kHz
Test equipm.	EMI room Hørsholm 49600 29861 29332	Uncertainty 4 dB	



Test result	The measured field strengths are below the limit
Compliant	Yes
Comments	Test frequency: 2440 MHz. The limit has been extrapolated to 10 m using an extrapolation factor of 40 dB / decade as specified in §15.31(f)(2): $L_2 = L_1 + 40 \cdot \log_{10}(D_1/D_2)$

Test object	SAS-2	Sheet	ME-3
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-210, 2.2	Frequency	0.009-30 MHz

Test method Characteristics	ANSI C63.4:2003 Loop antenna pos. Z. Antenna distance 10 m.	Temperature Humidity	21 °C 29 % RH
Detector	Peak	Bandwidth	0.2 kHz / 9 kHz
Test equipm.	EMI room Hørsholm 49600 29861 29332	Uncertainty 4 dB	



Test result	The measured field strengths are below the limit
Compliant	Yes
Comments	Test frequency: 2440 MHz. The limit has been extrapolated to 10 m using an extrapolation factor of 40 dB / decade as specified in §15.31(f)(2): $L_2 = L_1 + 40 \cdot \log_{10}(D_1/D_2)$

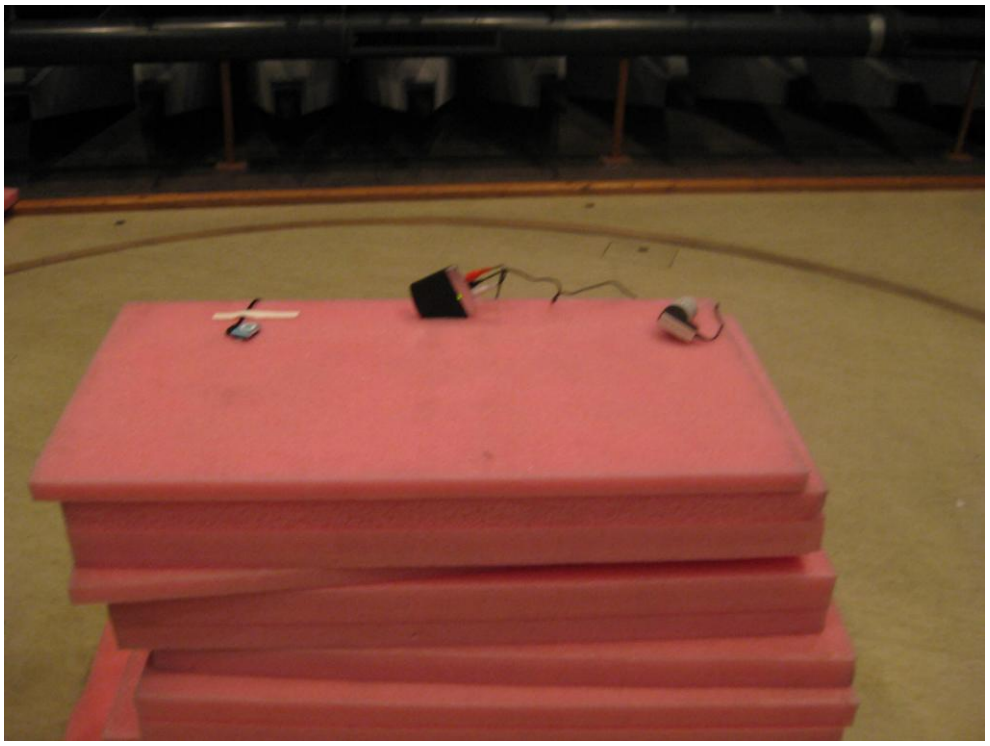


Photo 4.4.1 Test setup regarding measurement of radiated emission, 0.009 - 30 MHz.

Photo 4.4.2 Test setup regarding measurement of radiated emission, 0.009 - 30 MHz.

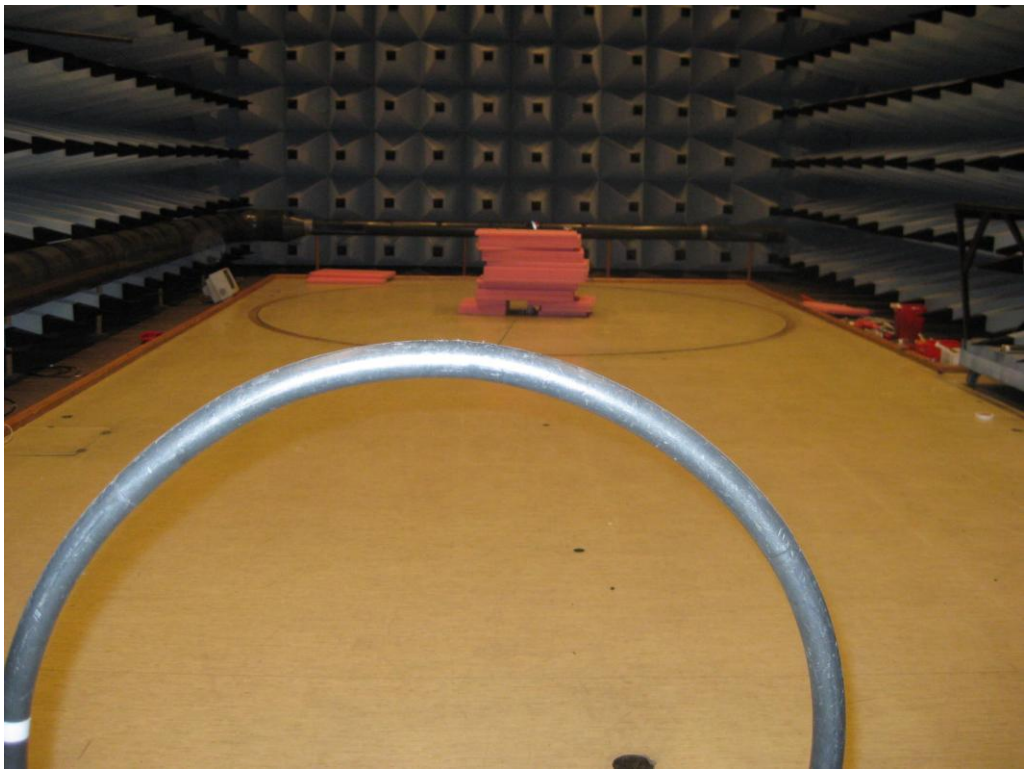


Photo 4.4.3 Test setup regarding measurement of radiated emission, 0.009 - 30 MHz.

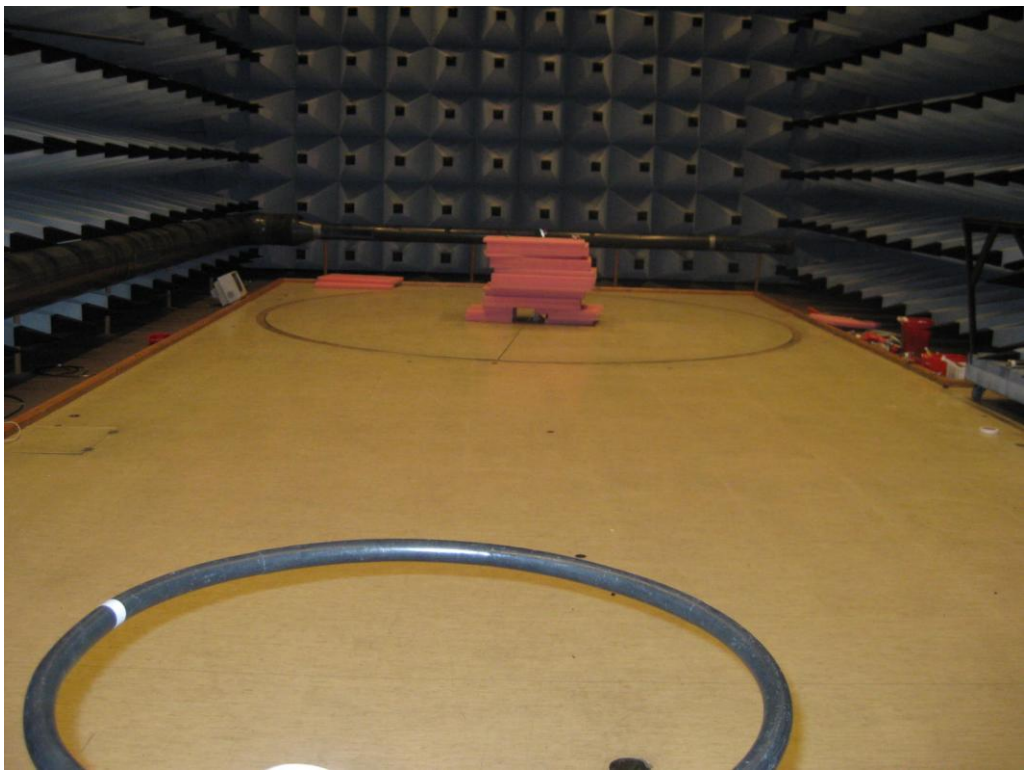
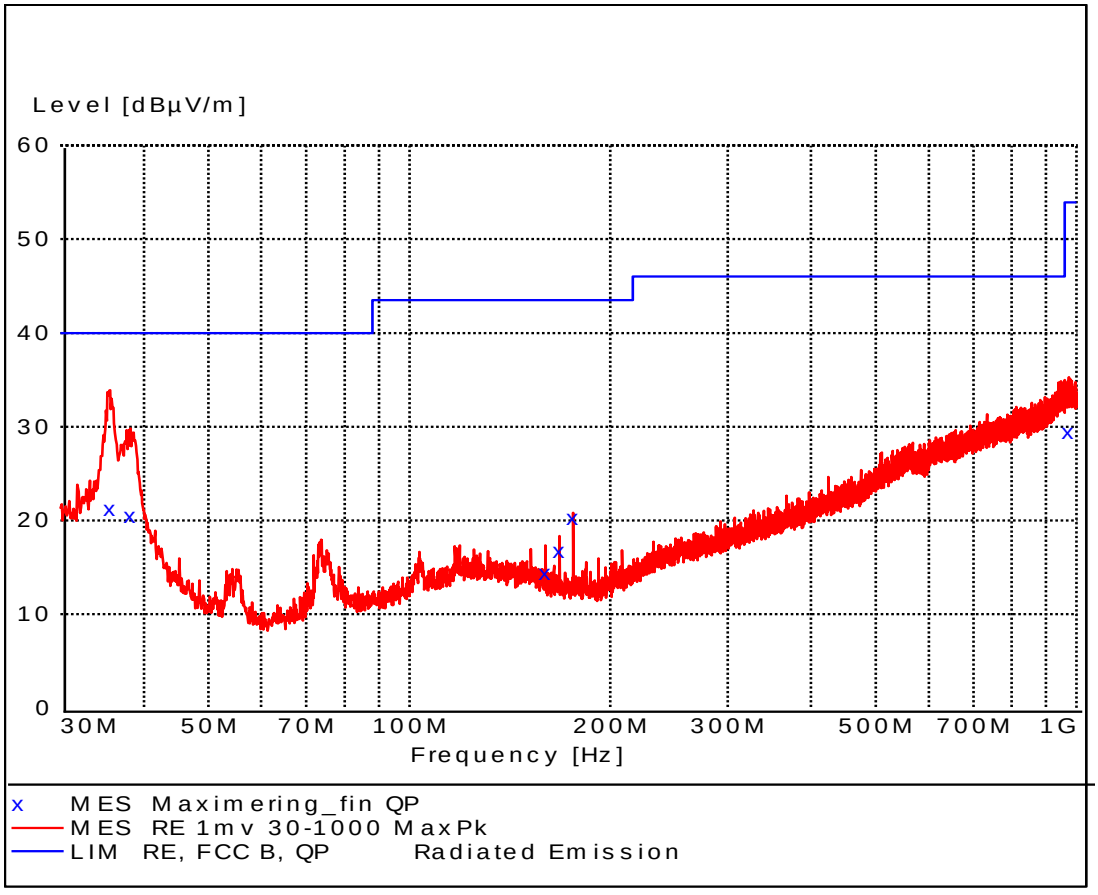


Photo 4.4.4 Test setup regarding measurement of radiated emission, 0.009 - 30 MHz.

4.5 Measurement of radiated emission, 30 MHz to 1000 MHz

Test object	SAS-2	Sheet	RE_Spur-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

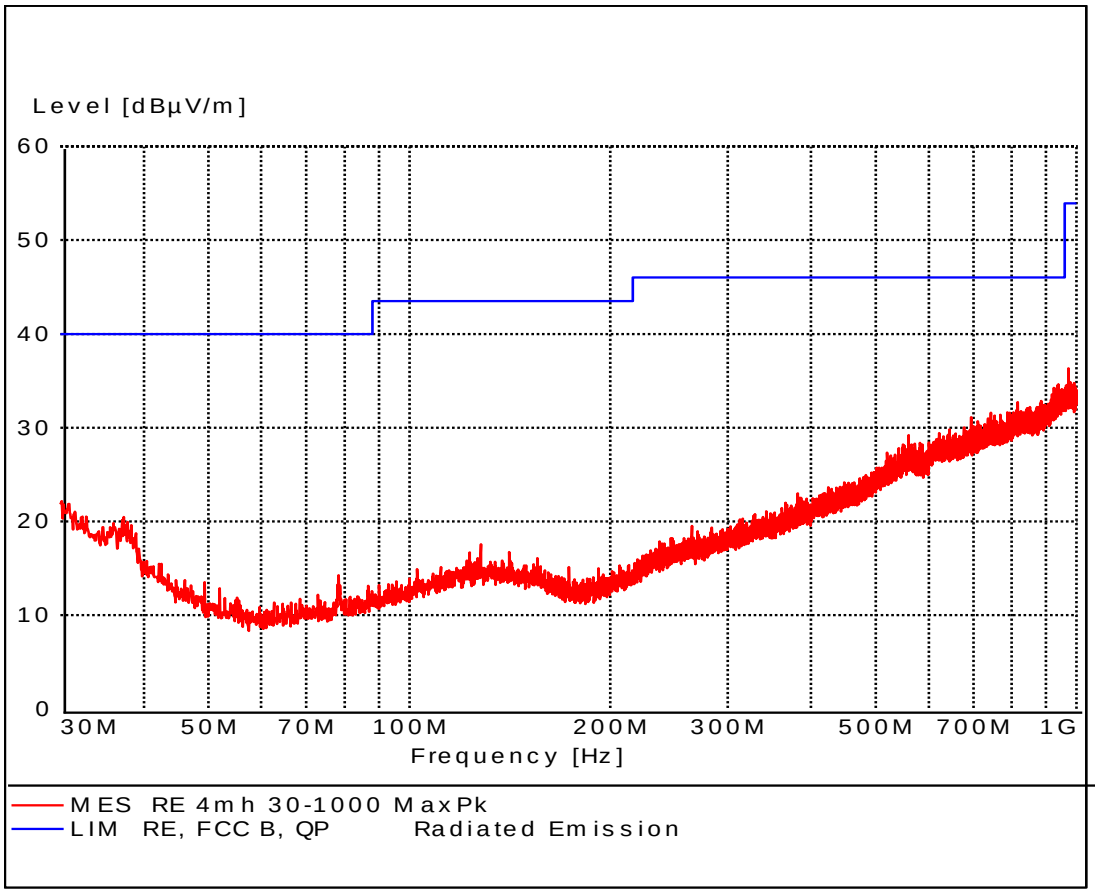
Test method Characteristics	ANSI C63.4:2003 Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Temperature Humidity	21 °C 28 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Operating frequency 2404 MHz

Test object	SAS-2	Sheet	RE_Spur-2
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.4:2003 Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Temperature Humidity	21 °C 28 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Operating frequency 2404 MHz

Test object	SAS-2	Sheet	RE_Spur-3
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

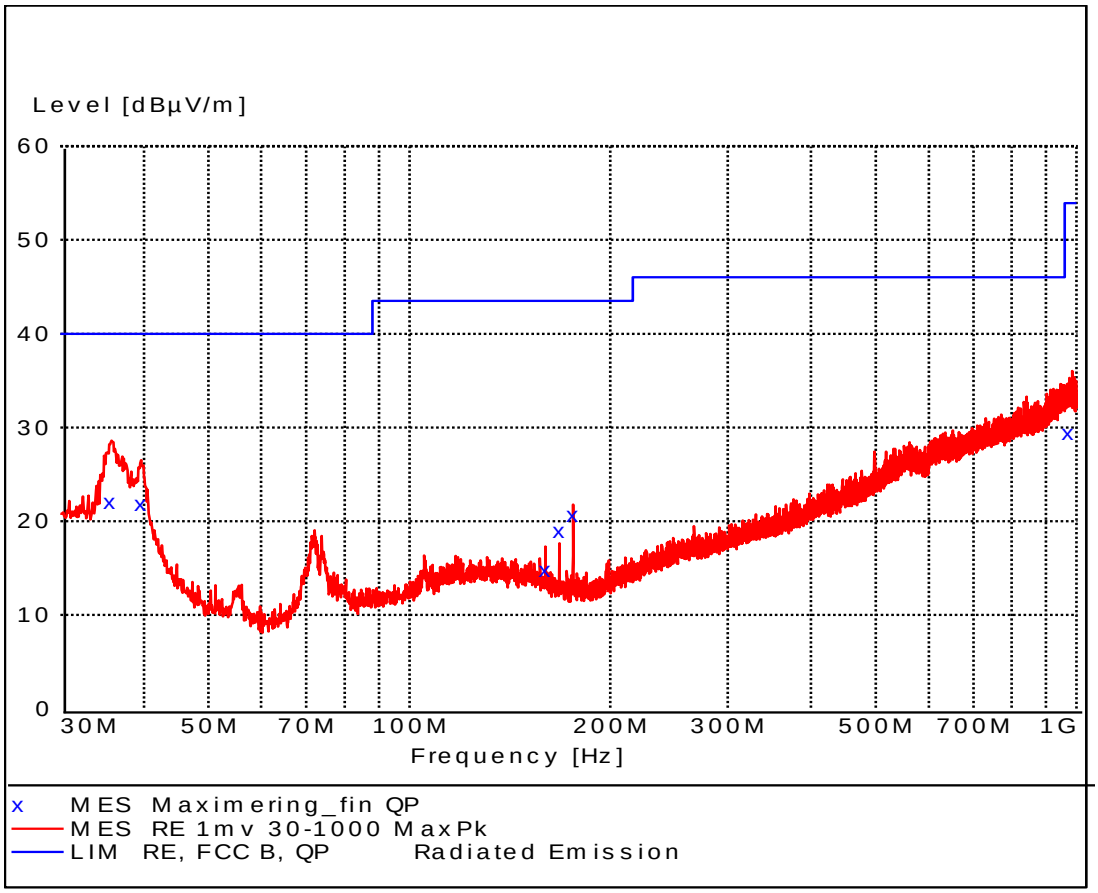
Test method Characteristics	ANSI C63.4:2003 Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Temperature Humidity	21 °C 28 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
35.600000	21.20	16.1	40.0	18.8	101.0	1.00	VERTICAL
38.200000	20.50	14.7	40.0	19.5	105.0	150.00	VERTICAL
160.000000	14.40	11.7	43.5	29.1	101.0	326.00	VERTICAL
168.000000	16.80	11.0	43.5	26.7	101.0	287.00	VERTICAL
176.000000	20.30	10.6	43.5	23.2	101.0	305.00	VERTICAL
972.500000	29.40	29.7	53.9	24.5	118.0	39.00	VERTICAL

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	2404 MHz
Test mode	Continuous Tx - normal modulation - hopping on
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation

Test object	SAS-2	Sheet	RE_Spur-4
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

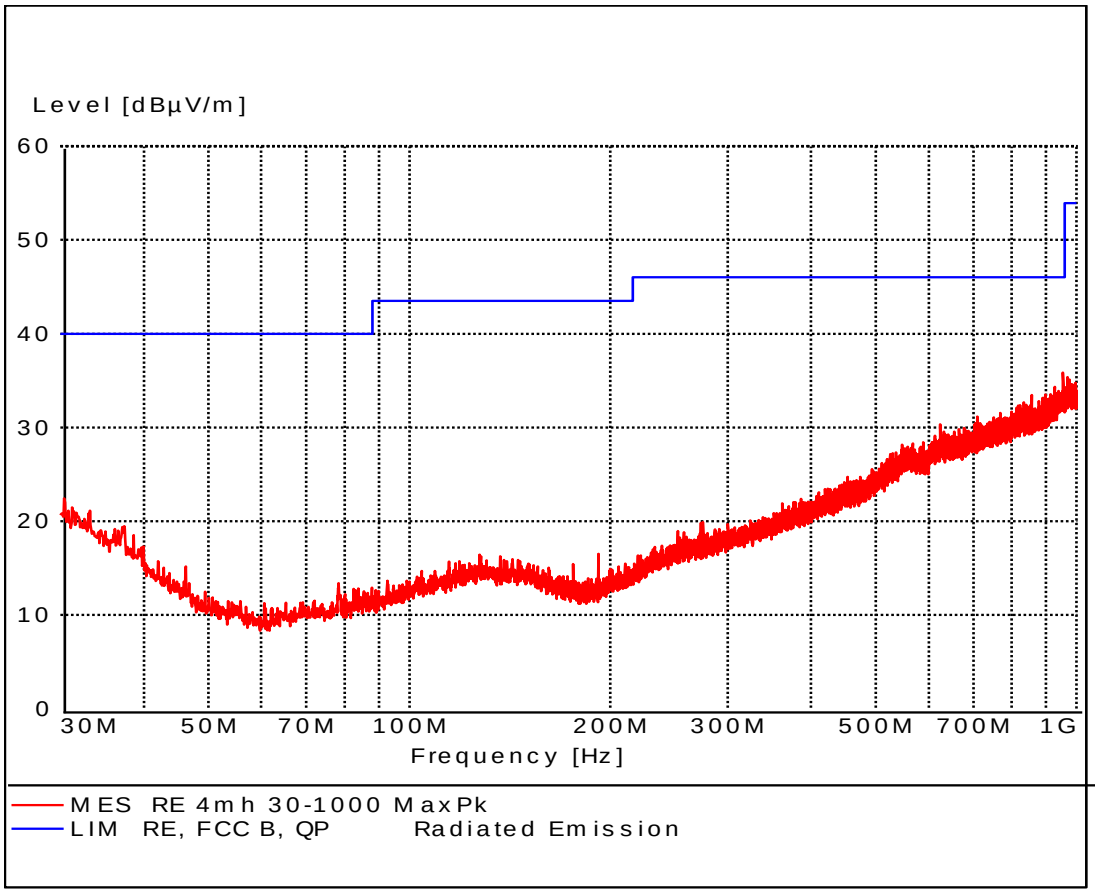
Test method Characteristics	ANSI C63.4:2003 Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Temperature Humidity	21 °C 28 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Operating frequency 2440 MHz

Test object	SAS-2	Sheet	RE_Spur-5
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.4:2003 Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Temperature Humidity	21 °C 28 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Operating frequency 2440 MHz

Test object	SAS-2	Sheet	RE_Spur-6
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

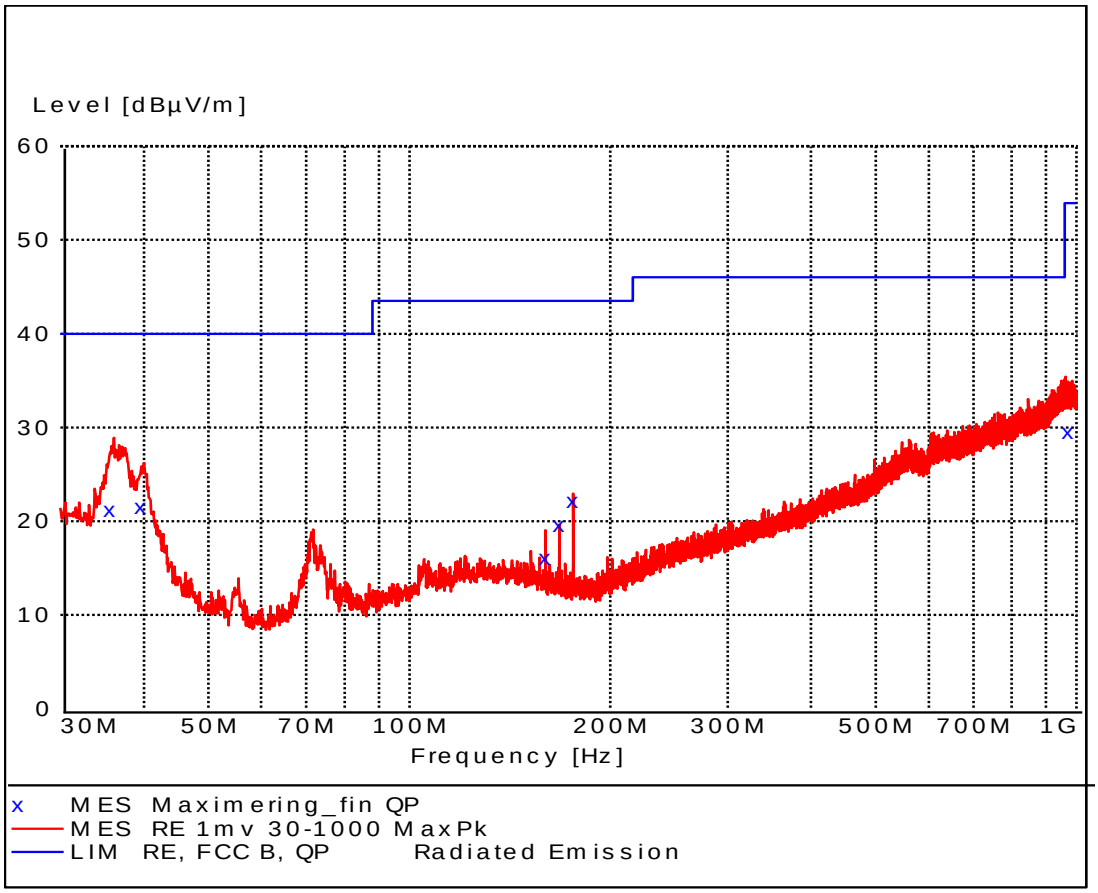
Test method Characteristics	ANSI C63.4:2003 Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Temperature Humidity	21 °C 28 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
35.600000	22.10	16.1	40.0	17.9	117.0	1.00	VERTICAL
39.600000	21.90	14.0	40.0	18.1	105.0	74.00	VERTICAL
160.000000	14.80	11.7	43.5	28.7	101.0	220.00	VERTICAL
168.000000	18.90	11.0	43.5	24.6	101.0	285.00	VERTICAL
176.000000	20.70	10.6	43.5	22.8	101.0	291.00	VERTICAL
972.500000	29.40	29.7	53.9	24.5	159.0	233.00	VERTICAL

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	2440 MHz
Test mode	Continuous Tx - normal modulation - hopping on
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation

Test object	SAS-2	Sheet	RE_Spur-7
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

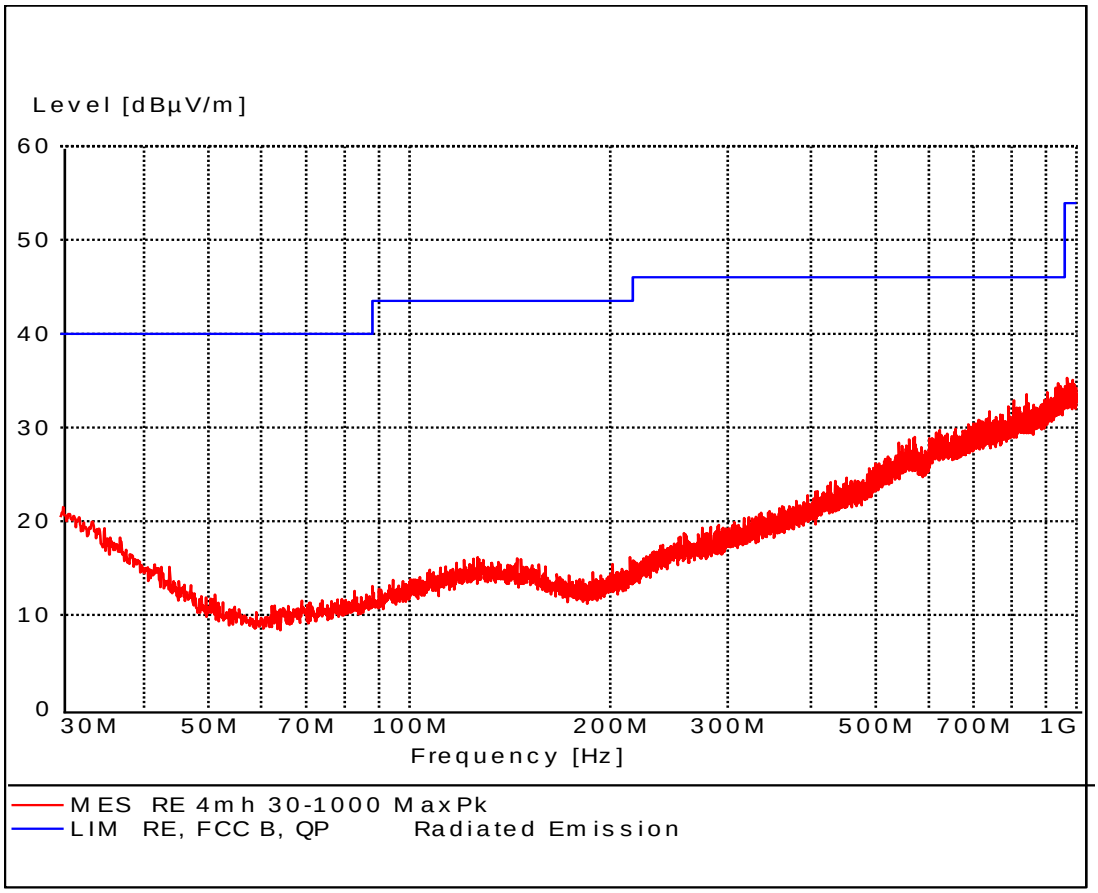
Test method Characteristics	ANSI C63.4:2003 Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Temperature Humidity	21 °C 28 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Operating frequency 2478 MHz

Test object	SAS-2	Sheet	RE_Spur-8
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.4:2003 Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Temperature Humidity	21 °C 28 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Operating frequency 2478 MHz

Test object	SAS-2	Sheet	RE_Spur-9
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	4 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 209 and IC RSS-Gen, 7.2.3.2	Frequency	30-1000 MHz

Test method Characteristics	ANSI C63.4:2003 Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Temperature Humidity	21 °C 28 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
35.600000	21.20	16.1	40.0	18.8	105.0	358.00	VERTICAL
39.600000	21.50	14.0	40.0	18.5	101.0	47.00	VERTICAL
160.000000	16.10	11.7	43.5	27.4	105.0	333.00	VERTICAL
168.000000	19.60	11.0	43.5	23.9	101.0	274.00	VERTICAL
176.000000	22.20	10.6	43.5	21.3	101.0	292.00	VERTICAL
972.500000	29.50	29.7	53.9	24.4	105.0	281.00	VERTICAL

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	2478 MHz
Test mode	Continuous Tx - normal modulation - hopping on
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation

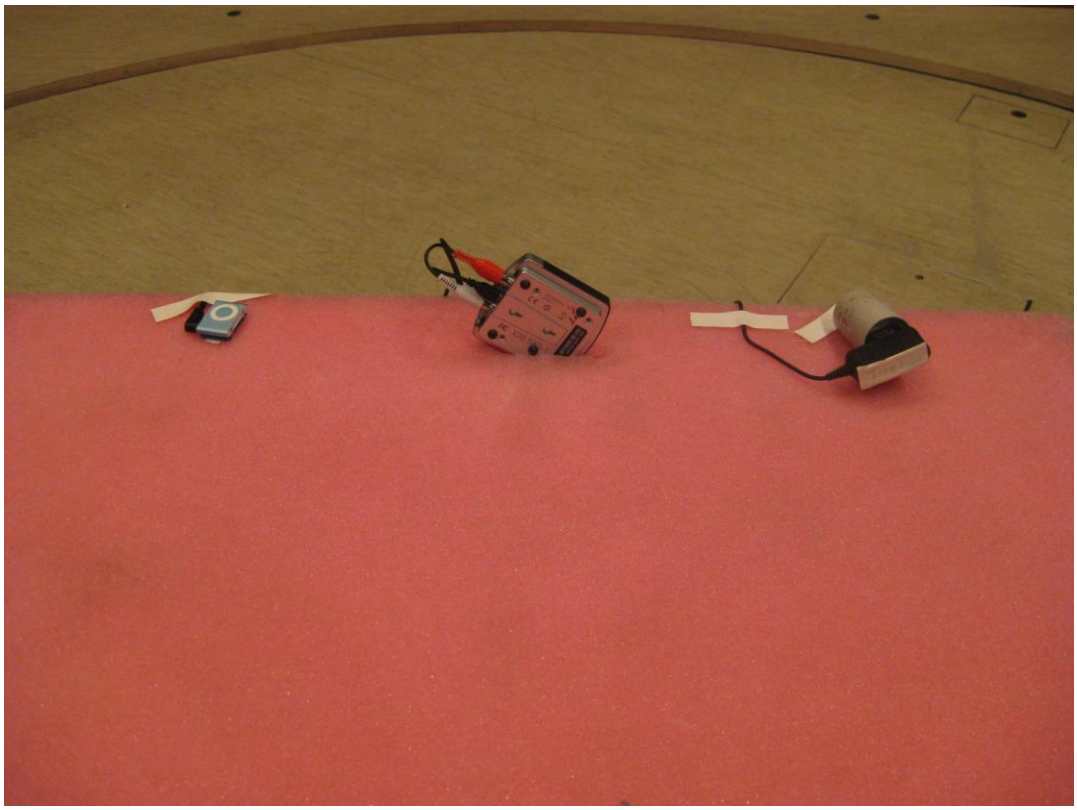


Photo 4.5.1 Test setup regarding measurement of radiated emission, 30 to 1000 MHz.

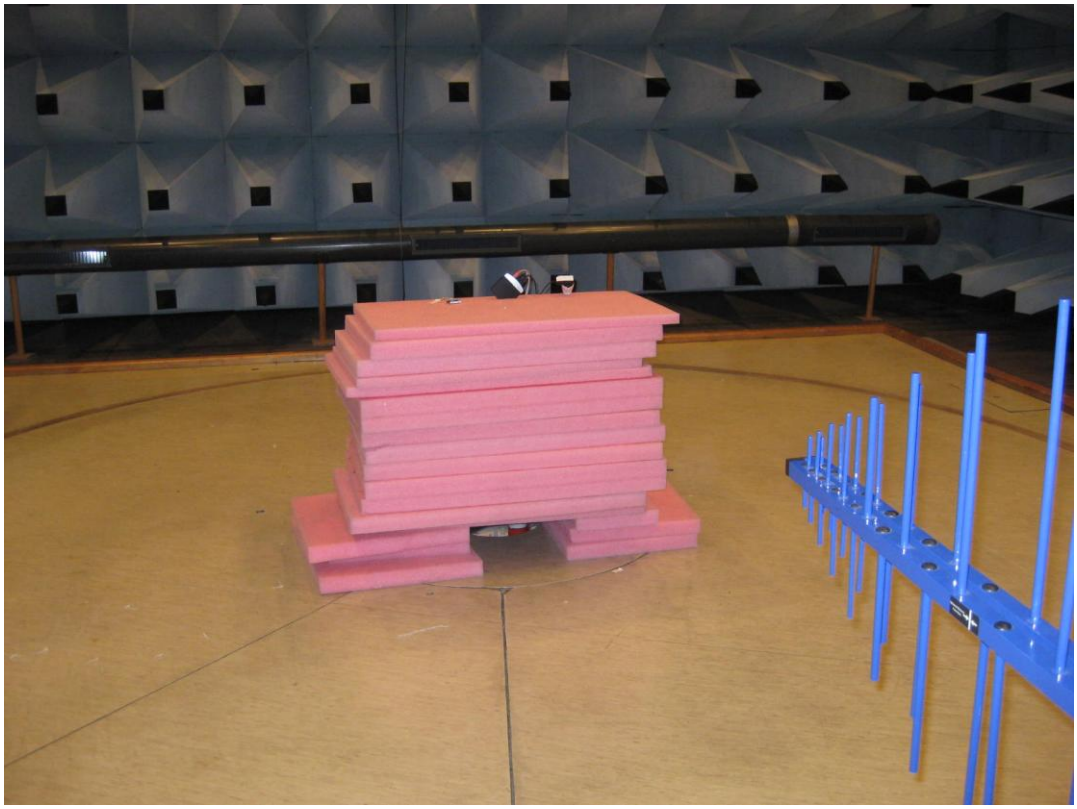
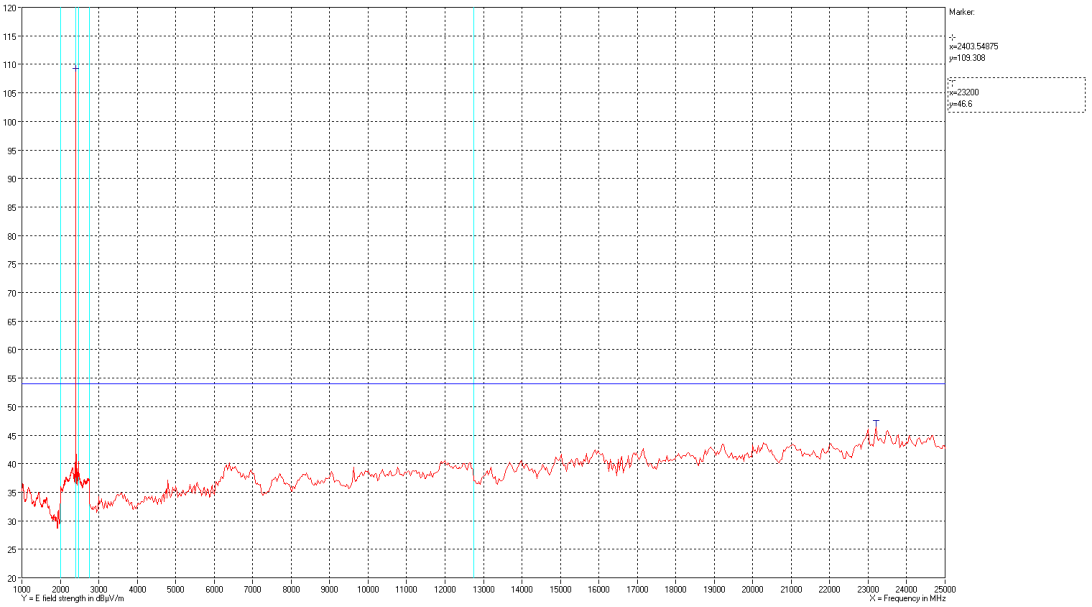


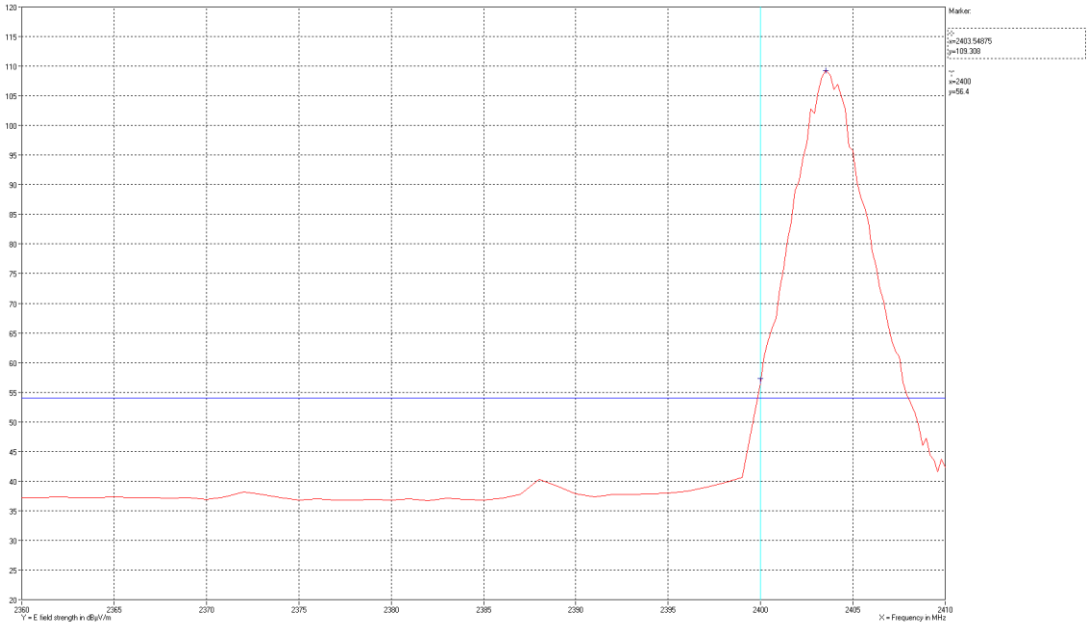
Photo 4.5.2 Test setup regarding measurement of radiated emission, 30 to 1000 MHz.

4.6 Measurement of radiated emission, 1 GHz to 25 GHz

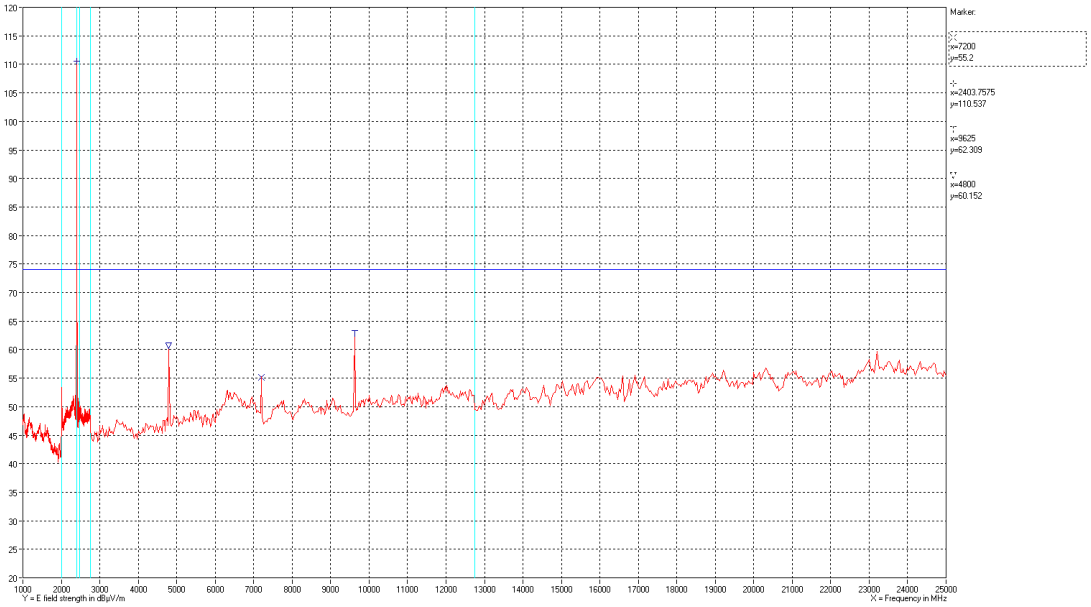
Test object	SAS-2	Sheet	RE_Spur-10
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	22 Apr. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 209 and IC RSS-Gen, 7.2.3.2	Frequency	1-25 GHz

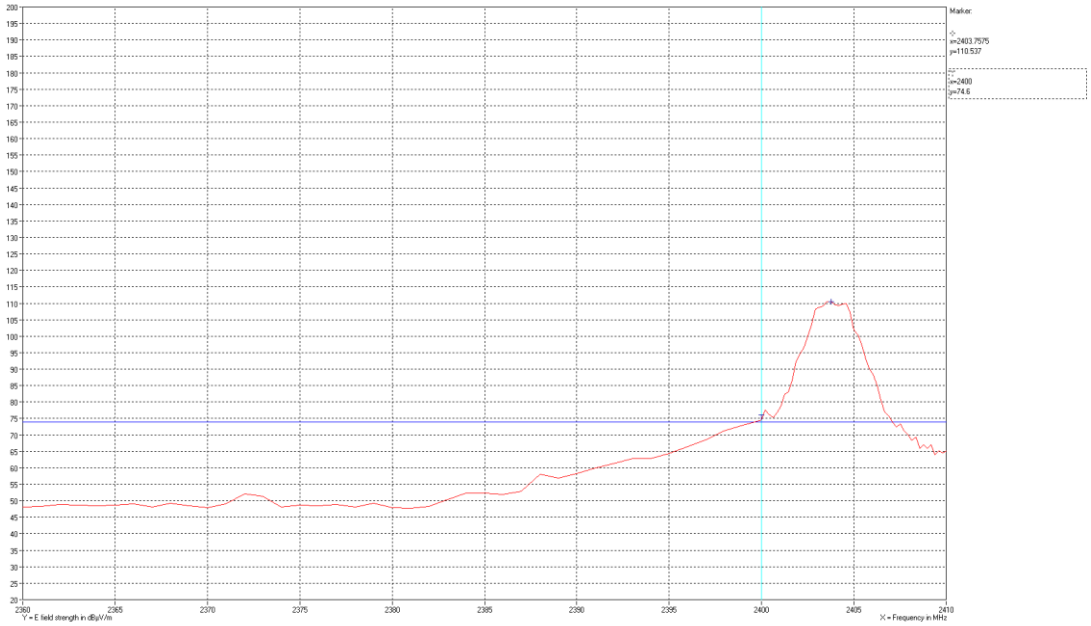
Test method Characteristics	ANSI C63.4:2003 Complete search, Antenna distance 3 m.	Temperature Humidity	24 °C 23 % RH
Detector	Peak and average for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49600 49624 49625 49183 49299 29678 29962	Uncertainty 4.9 dB	





Polarization	Horizontal and vertical
Comments	Average





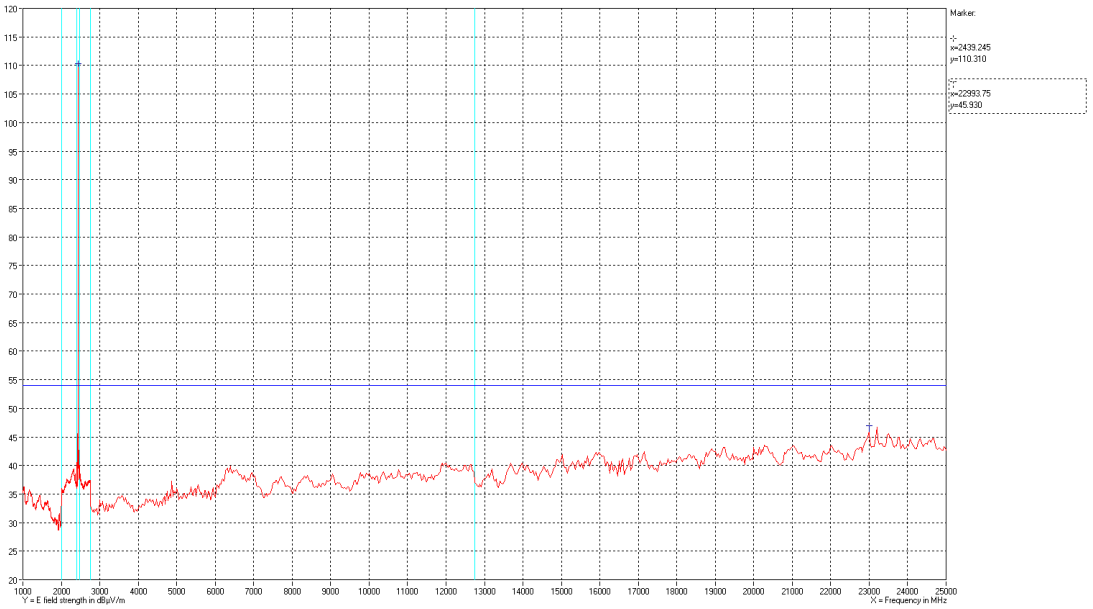
Polarization	Horizontal and vertical
Comments	Peak

Frequency	Average	Peak	PACF	Measured level at band edge	Limit
2402 MHz	56.4 dBµV/m		4.4 dB	52.0 dBµV/m	54 dBµV/m
2402 MHz	-	74.6 dBµV/m	4.4 dB	70.2 dBµV/m	74 dBµV/m

Test result	The measured corrected average field strengths are below the average limit. The measured corrected peak field strengths are below the peak limit (Peak limit = Average limit + 20 dB). ,
Test Port	Enclosure
Test frequency	2404 MHz
Test mode	Continuous Tx - normal modulation - hopping on
Condition	Normal
Compliant	Yes
Comments (Avg/Pk)	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization.

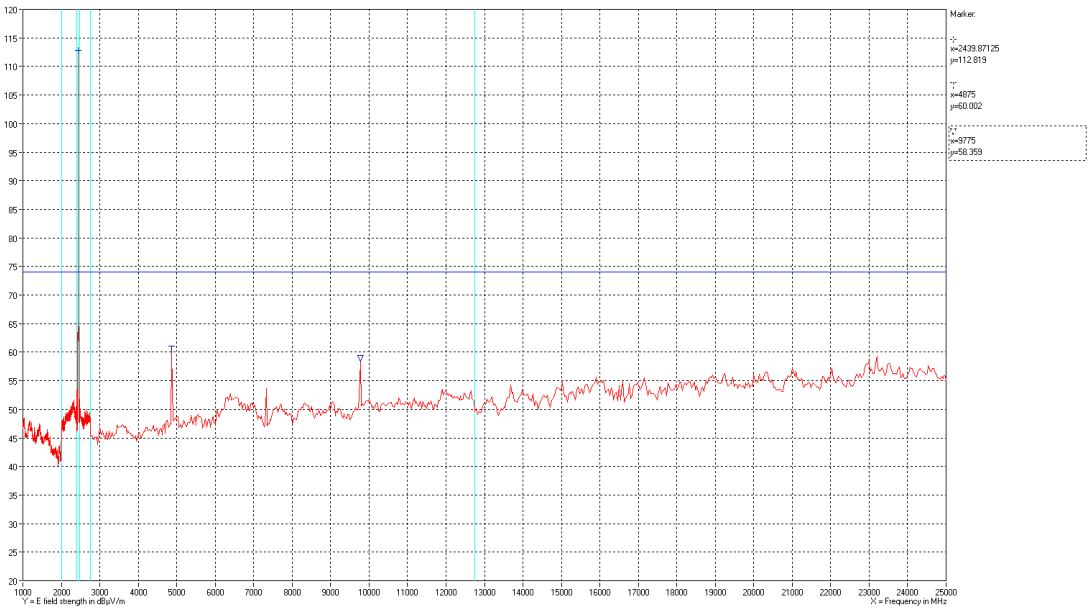
Test object	SAS-2	Sheet	RE_Spur-11
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	22 Apr. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209 and IC RSS-Gen, 7.2.3.2	Frequency	1-25 GHz

Test method Characteristics	ANSI C63.4:2003 Complete search, Antenna distance 3 m.	Temperature Humidity	24 °C 23 % RH
Detector	Peak and average for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49600 49624 49625 49183 49299 29678 29962	Uncertainty 4.9 dB	



Polarization Horizontal and vertical

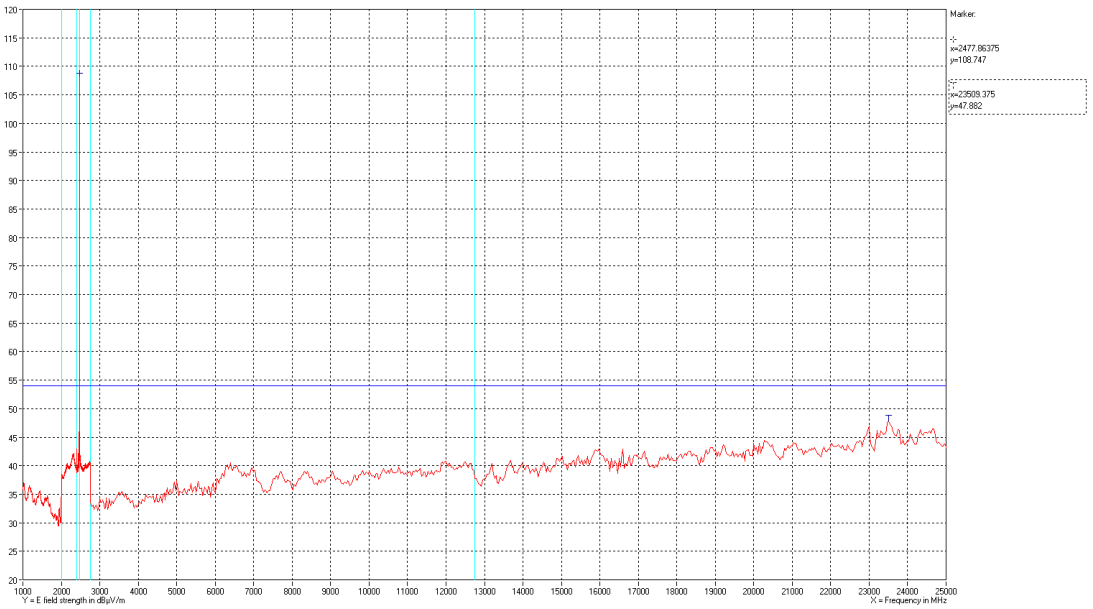
Comments Average

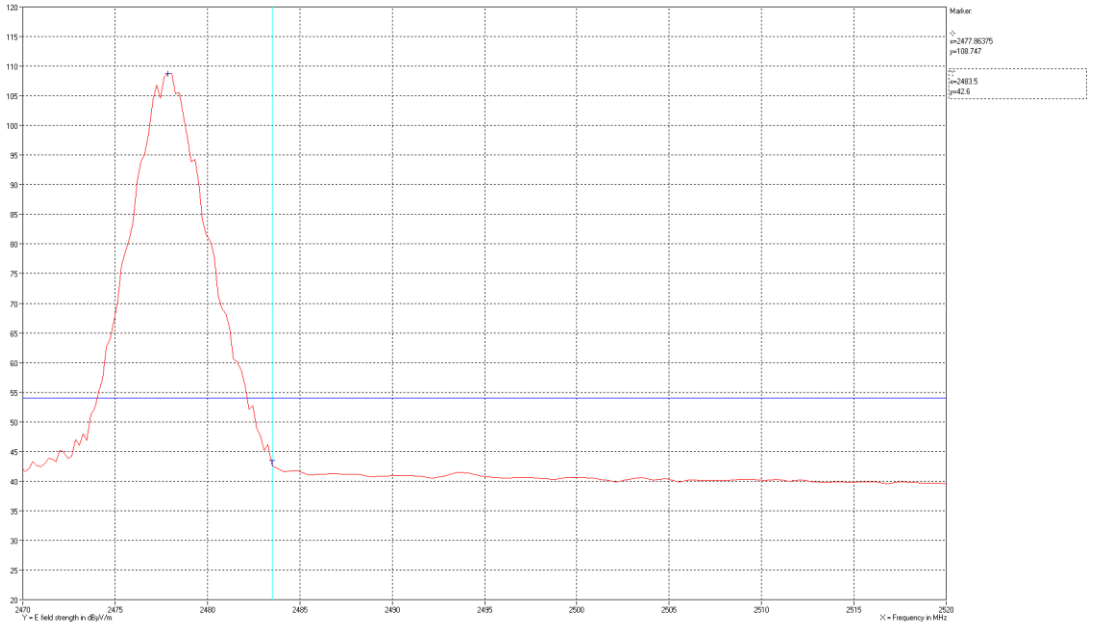


Polarization	Horizontal and vertical
Comments	Peak
Test result	The measured average field strengths are below the average limit. The measured peak field strengths are below the peak limit (Peak limit = Average limit + 20 dB). The average field strengths are below the average limit.
Test Port	Enclosure
Test frequency	2440 MHz
Test mode	Continuous Tx - normal modulation - hopping on
Condition	Normal
Compliant	Yes
Comments (Avg/Pk)	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization.

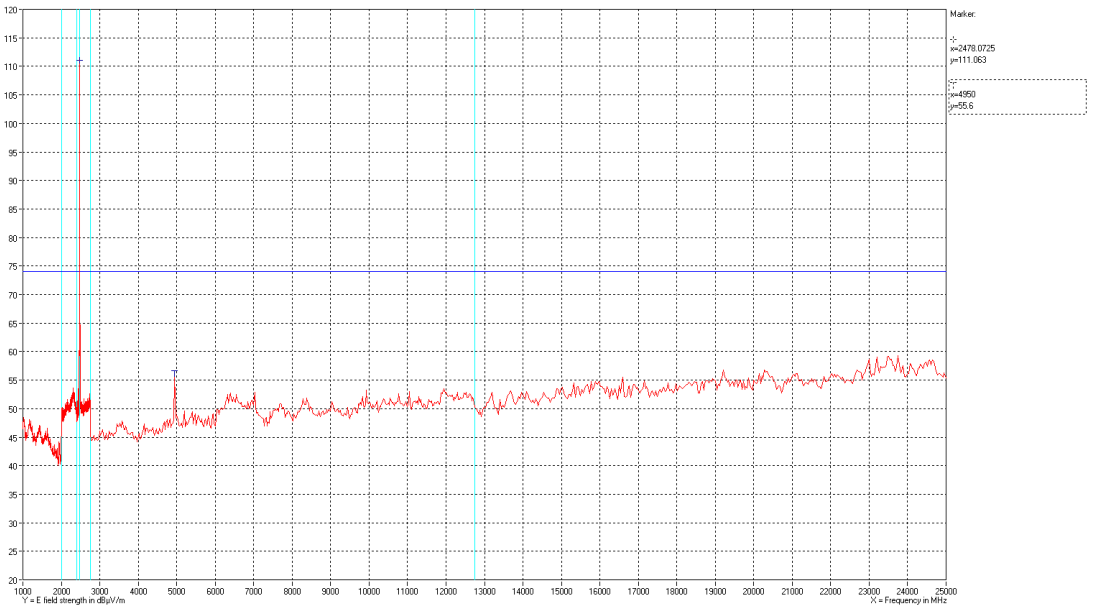
Test object	SAS-2	Sheet	RE_Spur-12
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	1 June 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	1-25 GHz

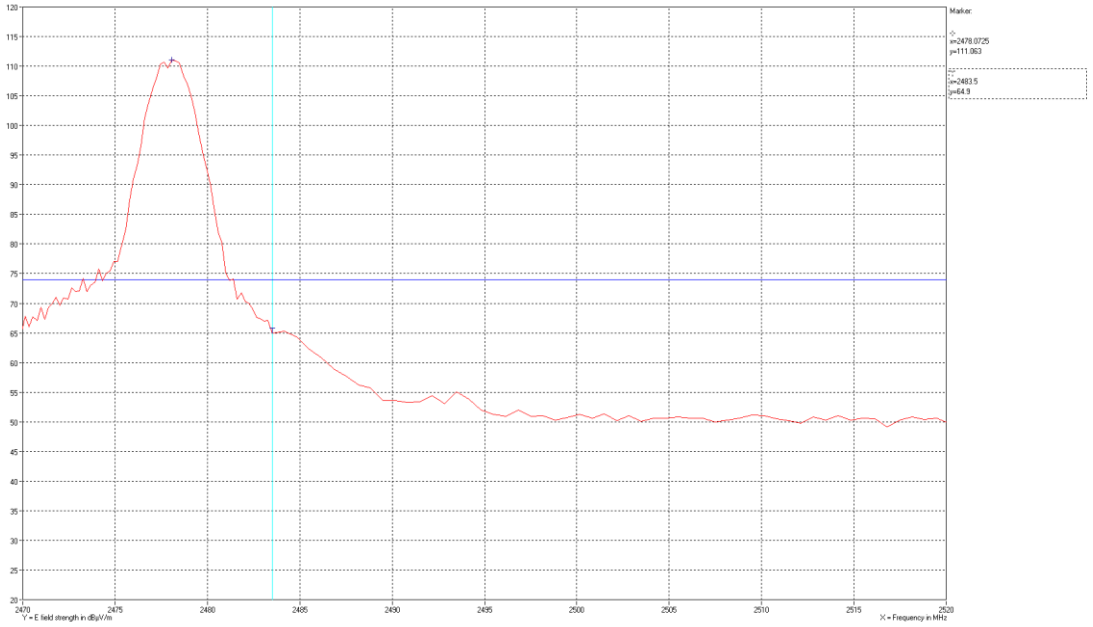
Test method Characteristics	ANSI C63.4:2003 Complete search, Antenna distance 3 m.	Temperature Humidity	23 °C 27 % RH
Detector	Peak and average for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49600 49624 49625 49183 49299 29678 29962	Uncertainty 4.9 dB	





Polarization	Horizontal and vertical
Comments	Average





Polarization	Horizontal and vertical
Comments	Peak

Test result	The measured average field strengths are below the average limit corrected for duty cycle. The measured peak field strengths are below the peak limit corrected for duty cycle. (Peak limit = Average limit + 20 dB). Measured level at band edge: Band edge 2483.5 MHz Average 42.6 dBµV/m Peak 64.9 dBµV/m
Test Port	Enclosure
Test frequency	2478 MHz
Test mode	Continuous Tx - normal modulation - hopping on
Condition	Normal
Compliant	Yes
Comments (Avg/Pk)	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization.

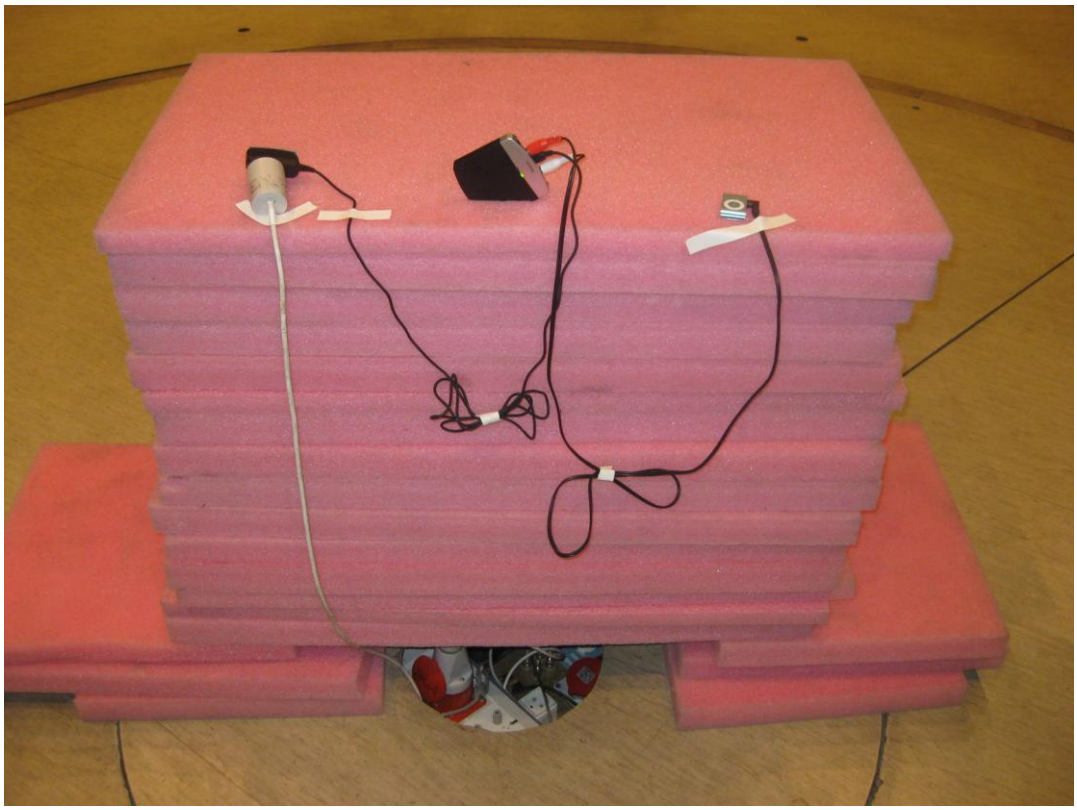


Photo 4.6.1 Test setup regarding measurement of radiated emission, 1 GHz to 25 GHz.

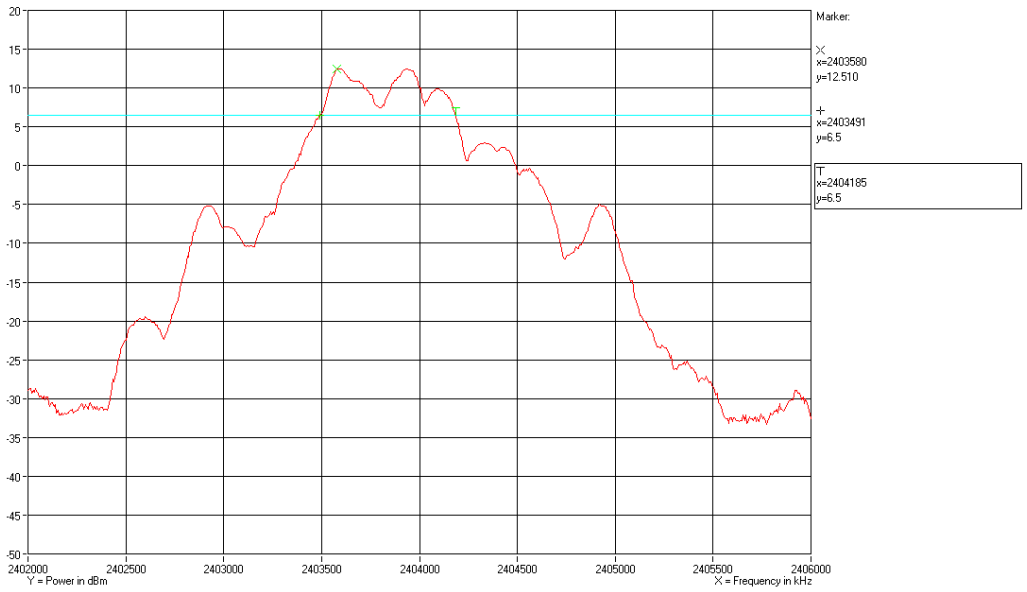
Photo 4.6.2 Test setup regarding measurement of radiated emission, 1 GHz to 25 GHz.

4.7 Measurement of the 6 dB bandwidth

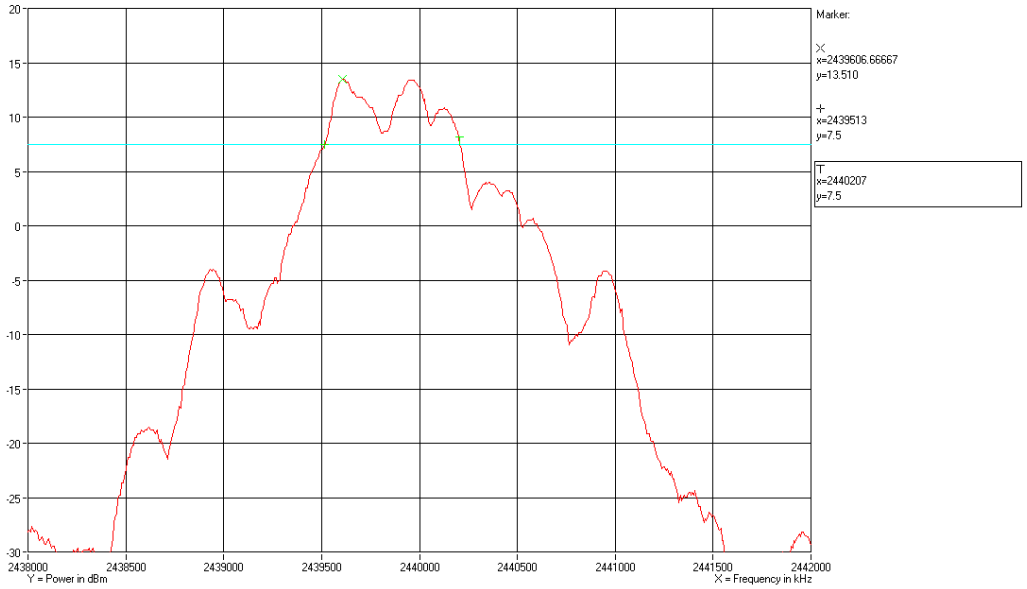
Test object	SAS-2	Sheet	BW-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100268	Date	1 June 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(a)(2) and IC RSS-210, A8.2(a)		

Test method Characteristics	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005 Temperature: 23ºC. Test voltage: 5.0VDC			
Test equipm.	49321 49183 49299		Uncertainty 1.1 dB	
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 4 MHz DET: Peak CF: 2404 MHz, 2440 MHz, 2478 MHz Trace: Max Hold			
	Measured	Measured 6 dB bandwidth	Limit	Comment
Operating frequency:	2404 MHz			
Lowest frequency Highest frequency	2403.491 MHz 2404.185 MHz	694 kHz	>500 kHz	Ok
Operating frequency: Lowest frequency Highest frequency	2440 MHz 2439.513 MHz 2440.207 MHz	694 kHz	>500 kHz	Ok
Operating frequency: Lowest frequency Highest frequency	2478 MHz 2477.511MHz 2478.212 MHz	701 kHz	>500 kHz	Ok
Note 1:				

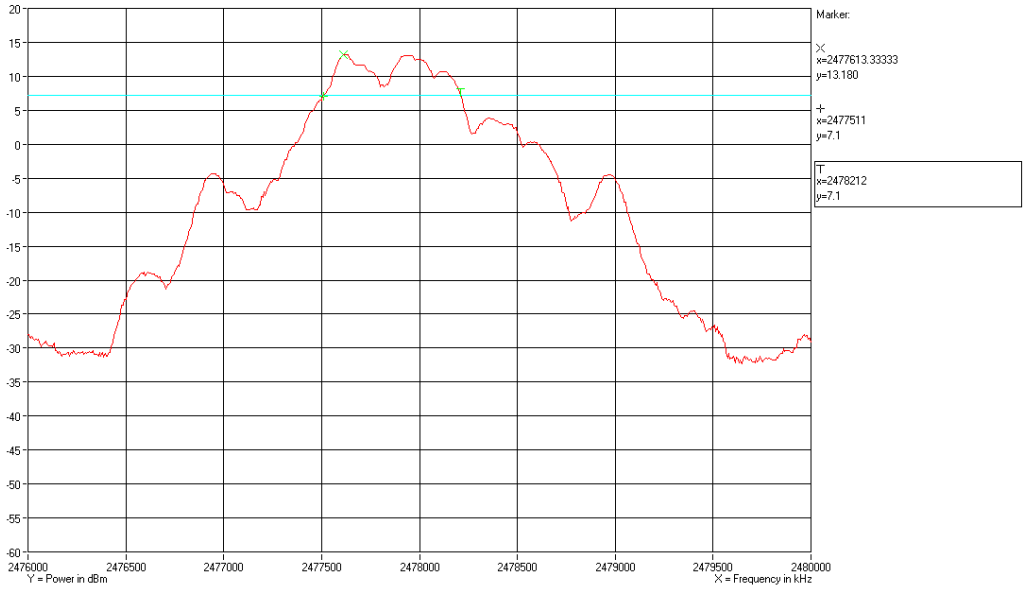
Band edge criteria	6 dB bandwidth
Test result	The measured 6 dB bandwidth was within limit designated in 15.247(a)(2) and the measured bandwidth was within limit designated in RSS-210, A8.2(a)
Test modulation	Continuous Tx - normal modulation - hopping on
Compliant	Yes
Comments	Conducted measurement



Test frequency 2404 MHz



Test frequency 2440 MHz



Test frequency 2478 MHz

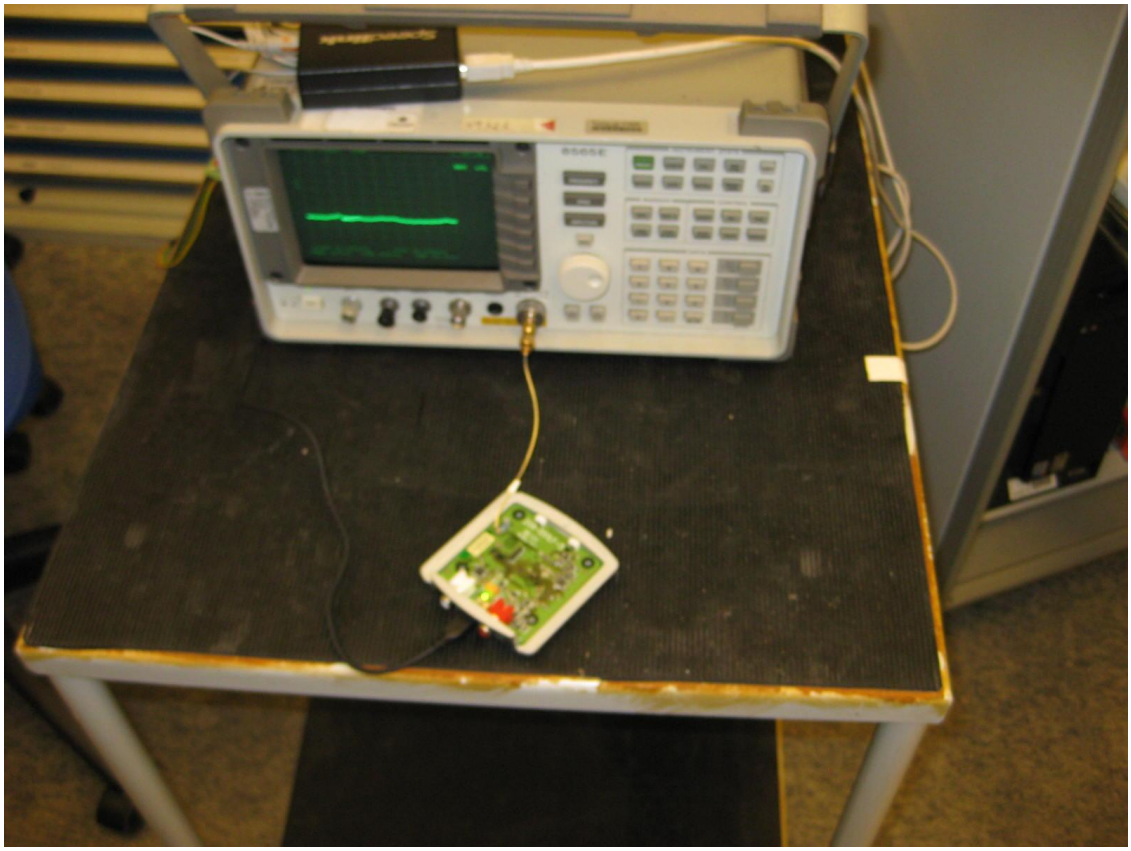


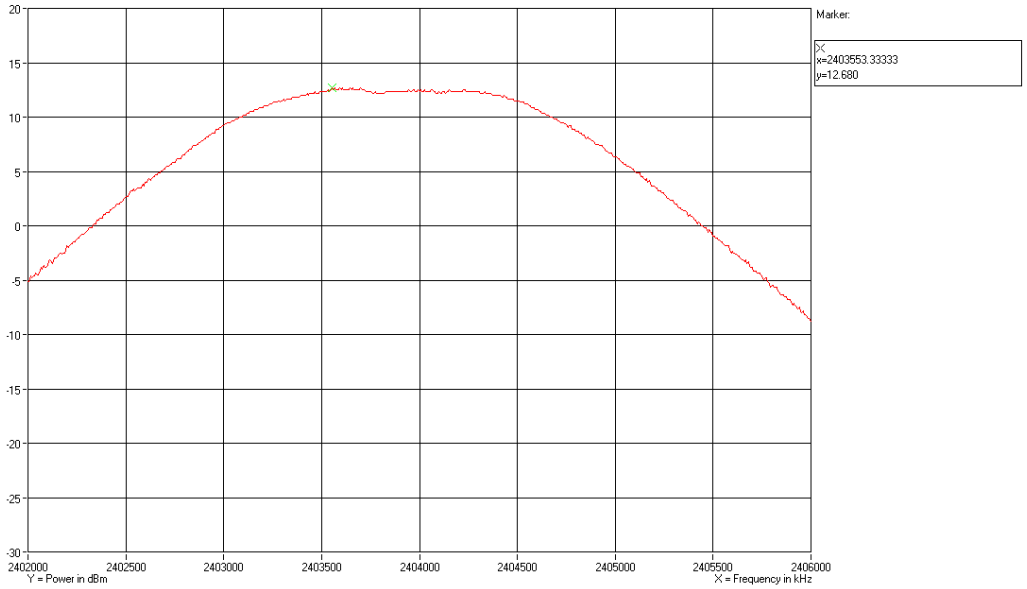
Photo 4.7.1 Test setup regarding measurement of the 6 dB bandwidth.

4.8 Measurement of conducted power output

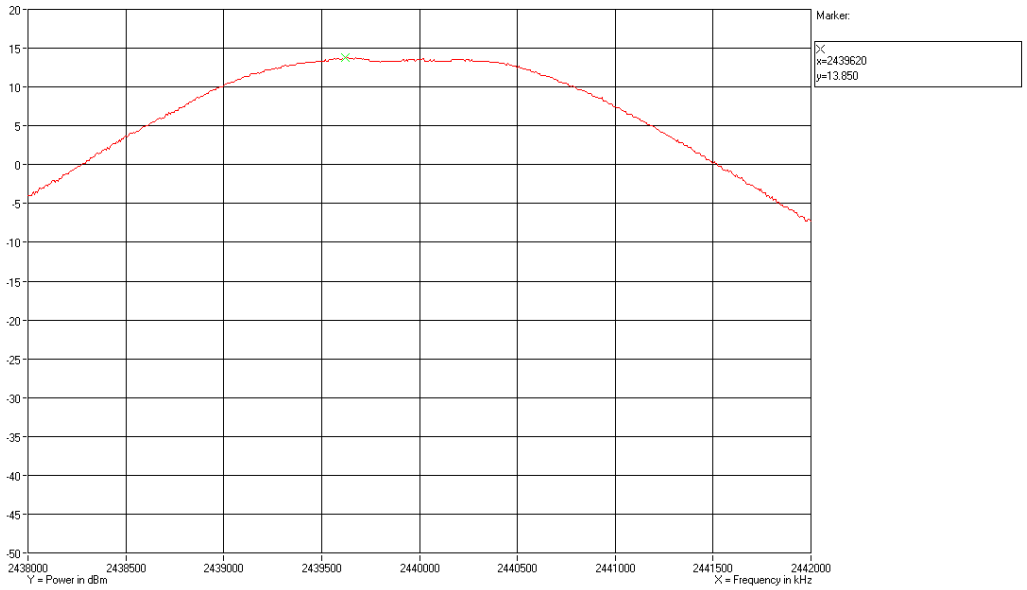
Test object	SAS-2	Sheet	CP-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100268	Date	1 June 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(b)(3) and RSS-210, A8.4		

Test method Characteristics	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005 Temperature: 22ºC. Test voltage: 5.0V DC		
Test equipm.	49321 49183 49299	Uncertainty 1.1 dB	
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: 4 MHz DET: Peak CF: 2404 MHz, 2440 MHz, 2478 MHz Trace: Max Hold		
Test result			
Operating frequency:	Measured Power	Limit	Comment
2404 MHz	12.68 dBm	< 30 dBm	Ok
2440 MHz	13.85 dBm	< 30 dBm	Ok
2478 MHz	13.35 dBm	< 30 dBm	Ok
Note 1:			

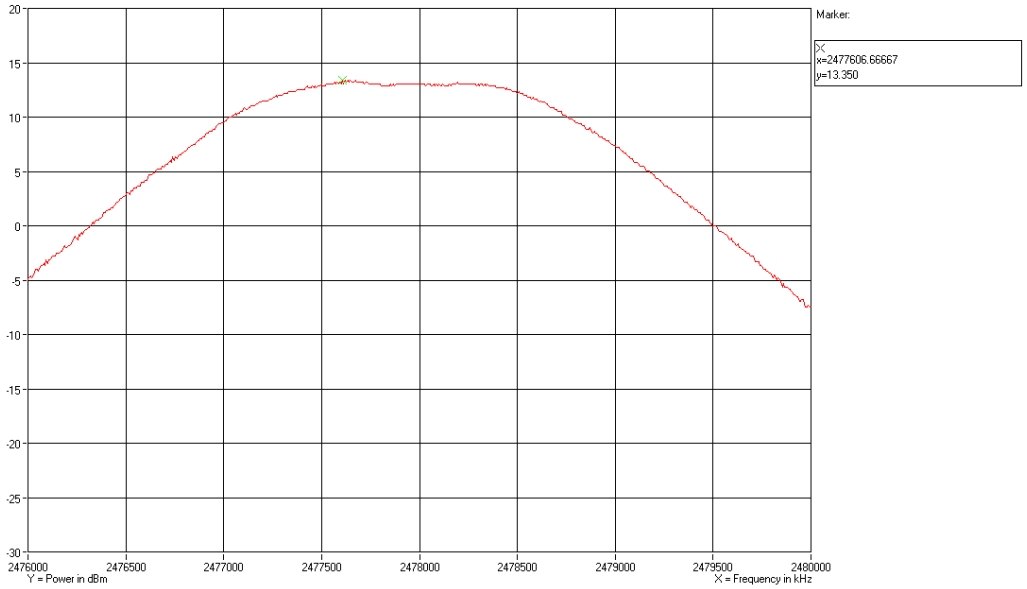
Test modulation	Continuous Tx - normal modulation - hopping on
Compliant	Yes
Comments	Conducted measurement



Test frequency 2404 MHz



Test frequency 2440 MHz



Test frequency 2478 MHz

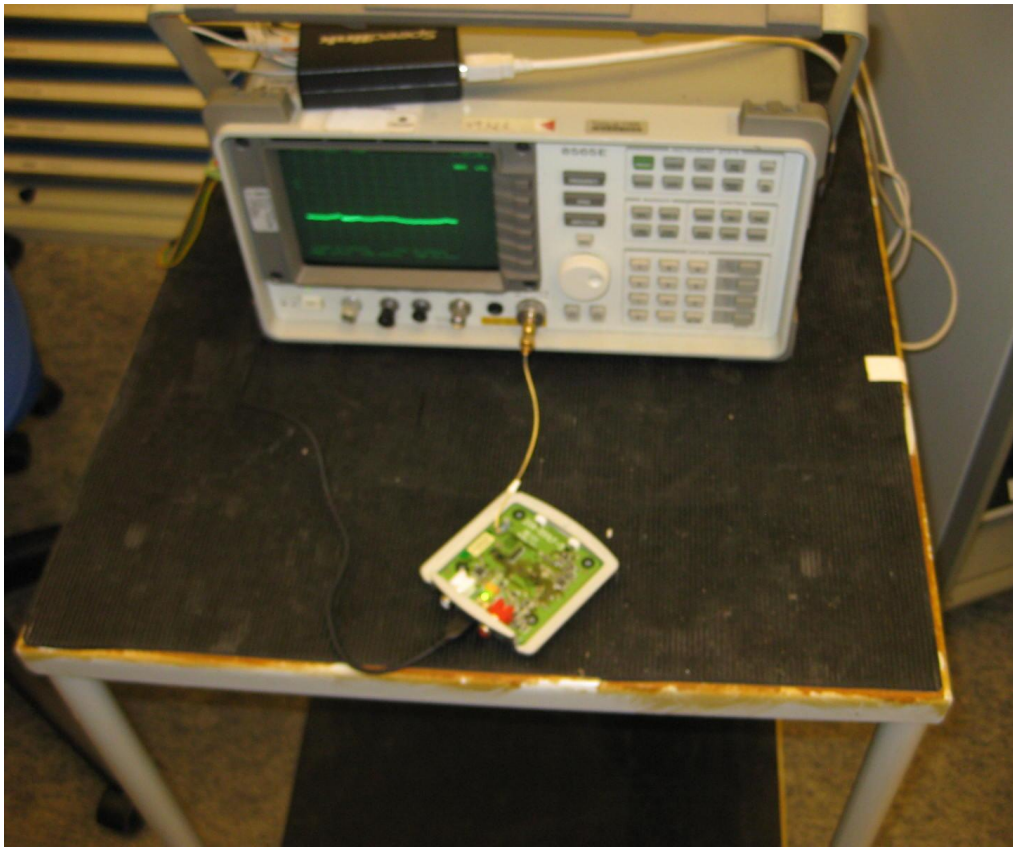


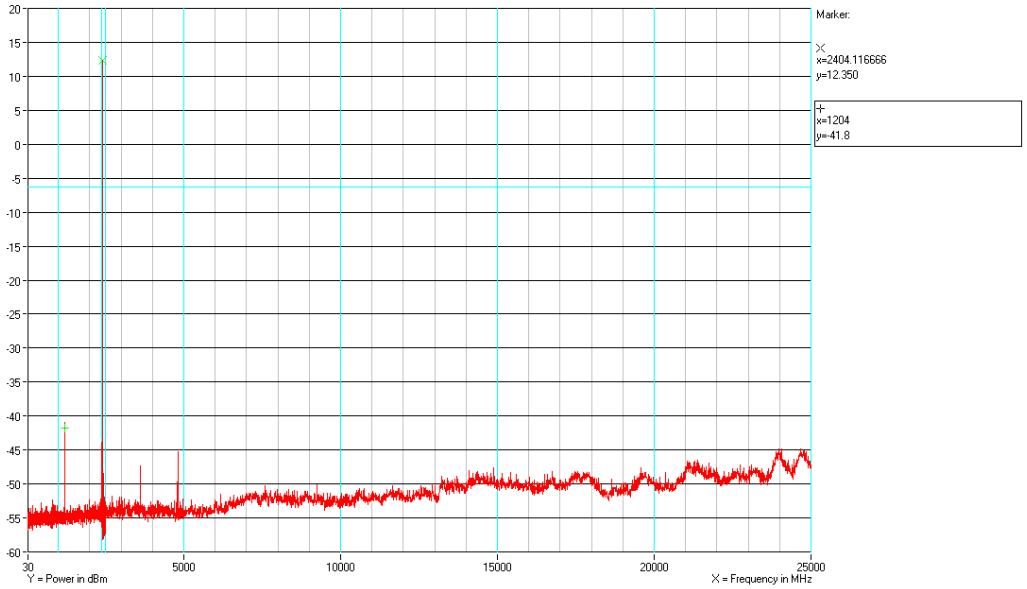
Photo 4.8.1 Test setup regarding measurement of conducted power output.

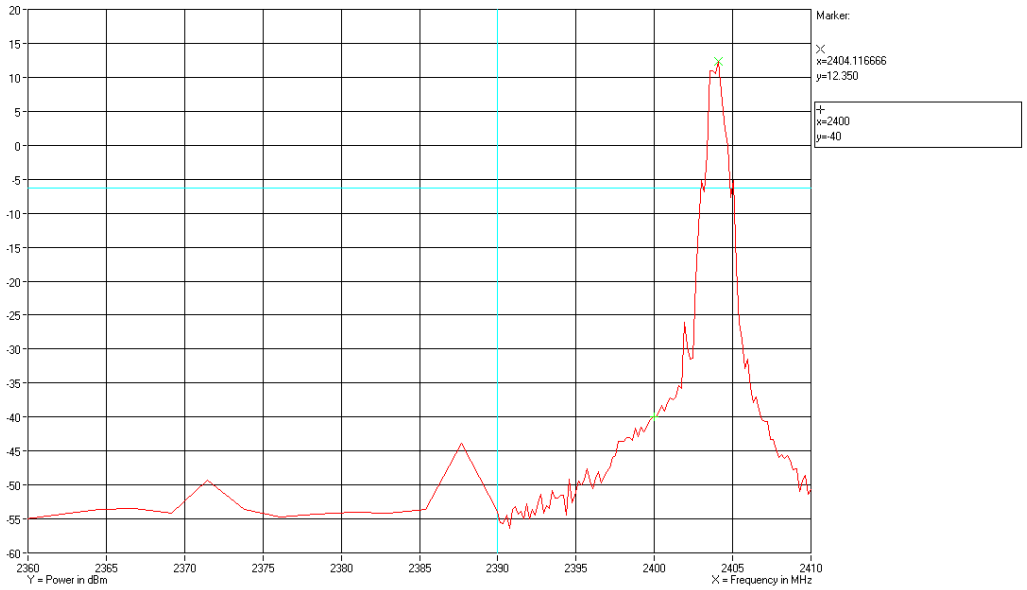
4.9 Measurement of conducted spurious emissions

Test object	SAS-2	Sheet	Con_spur-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100268	Date	1 June 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(d) and RSS-210, A8.5		

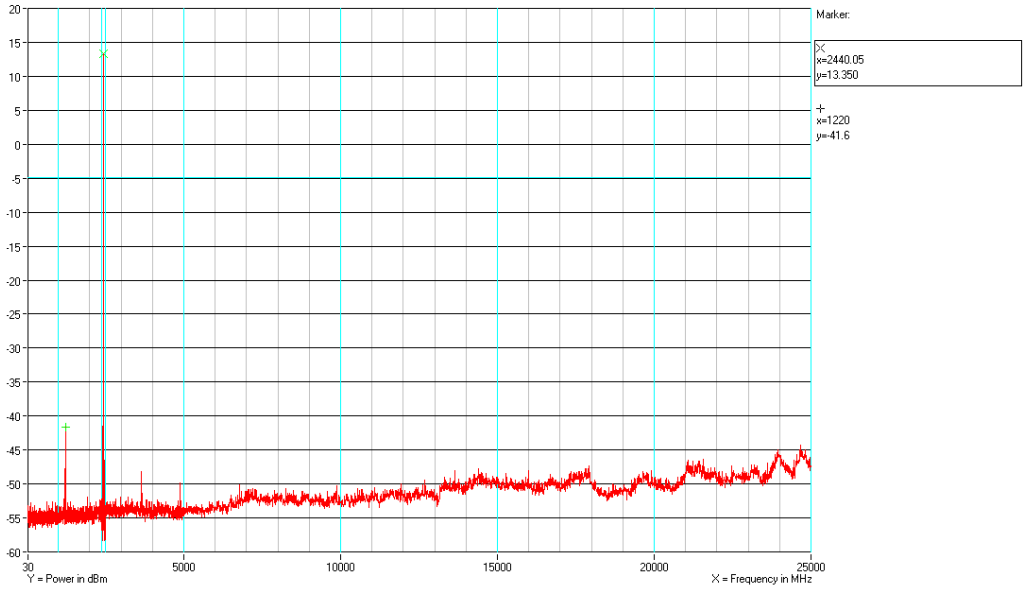
Test method Characteristics	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005 Temperature: 22 ºC. Test voltage: 5.0 V DC	
Test equipm.	49321 49183 49299	Uncertainty 1.1 dB
SA Settings	RBW: 100 KHz VBW: 300 kHz Frequency Start: 30 MHz Frequency Stop: 25 GHz DET: Peak Trace: Max Hold	
Note 1:		

Test result	The measured conducted spurious emissions were within the level designated in FCC 15.247(d) and IC RSS-210, A8.5 including band edge.
Test modulation	Continuous Tx - normal modulation - hopping on
Compliant	Yes
Comments	Conducted measurement

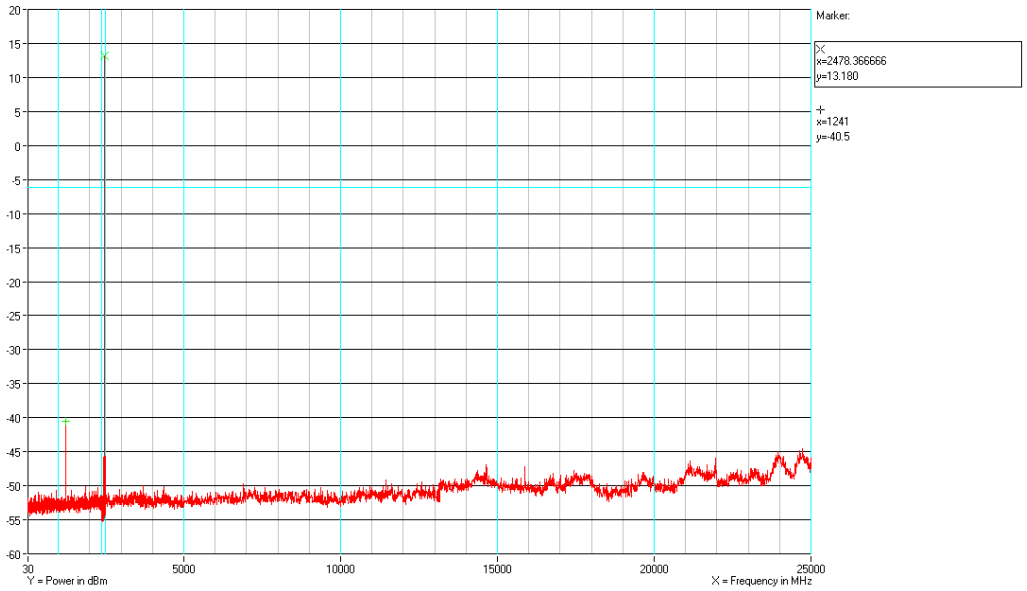


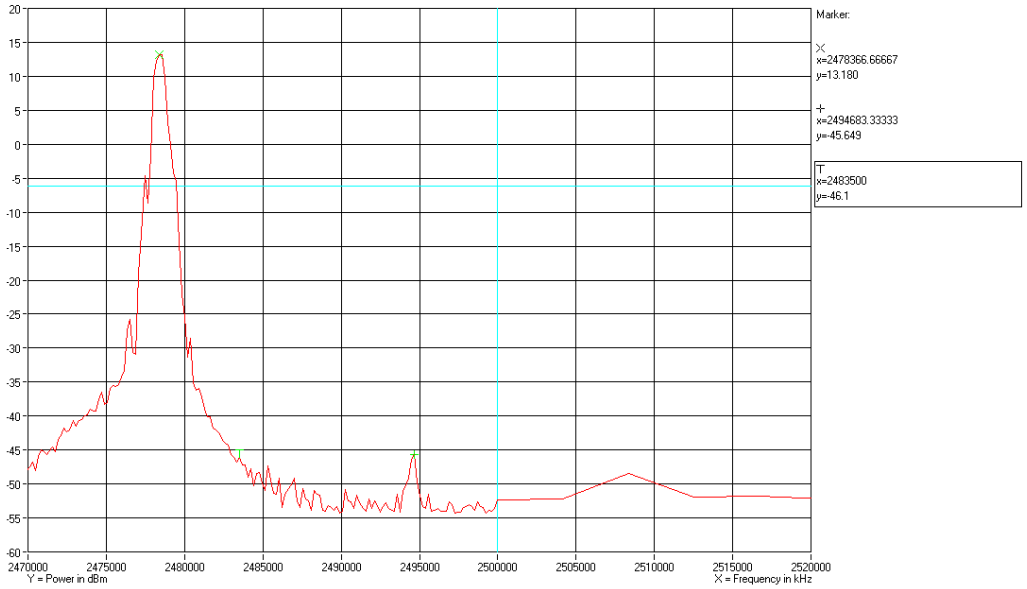


Test frequency 2404 MHz



Test frequency 2440 MHz





Test frequency 2478 MHz

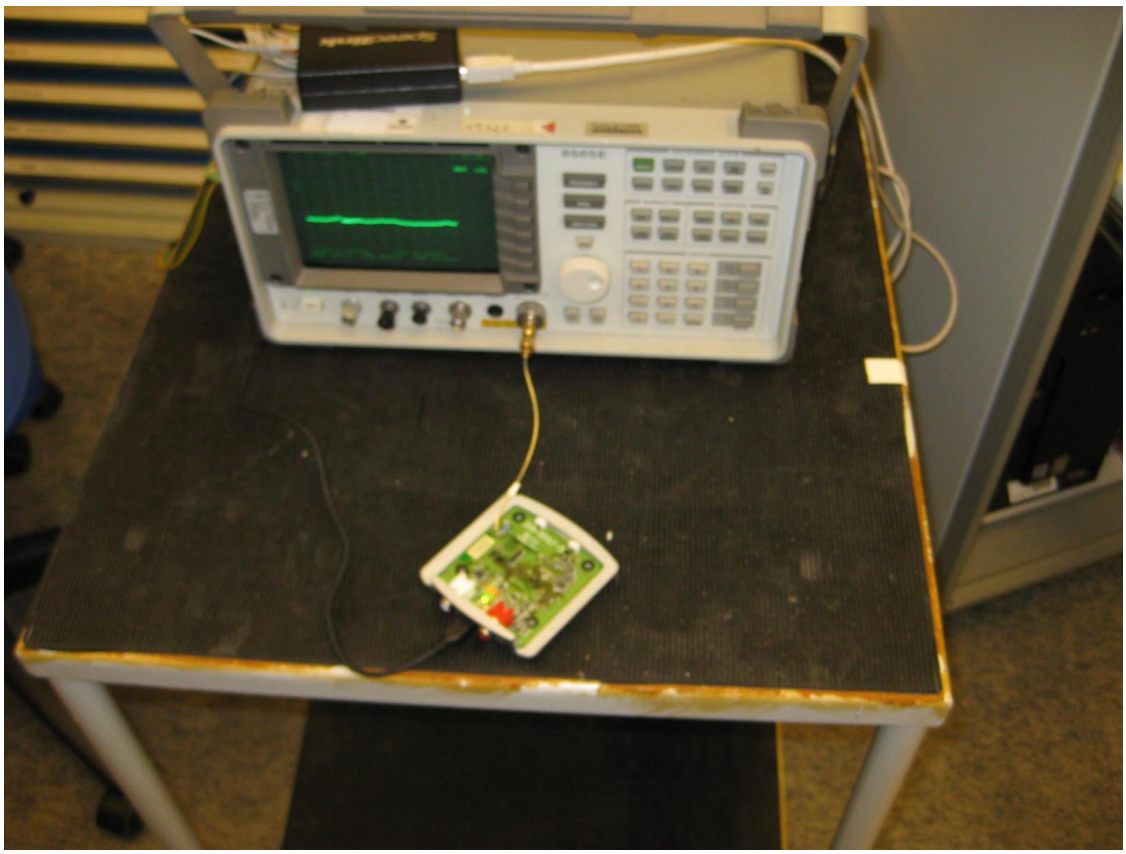


Photo 4.9.1 Test setup regarding measurement of conducted spurious emission.

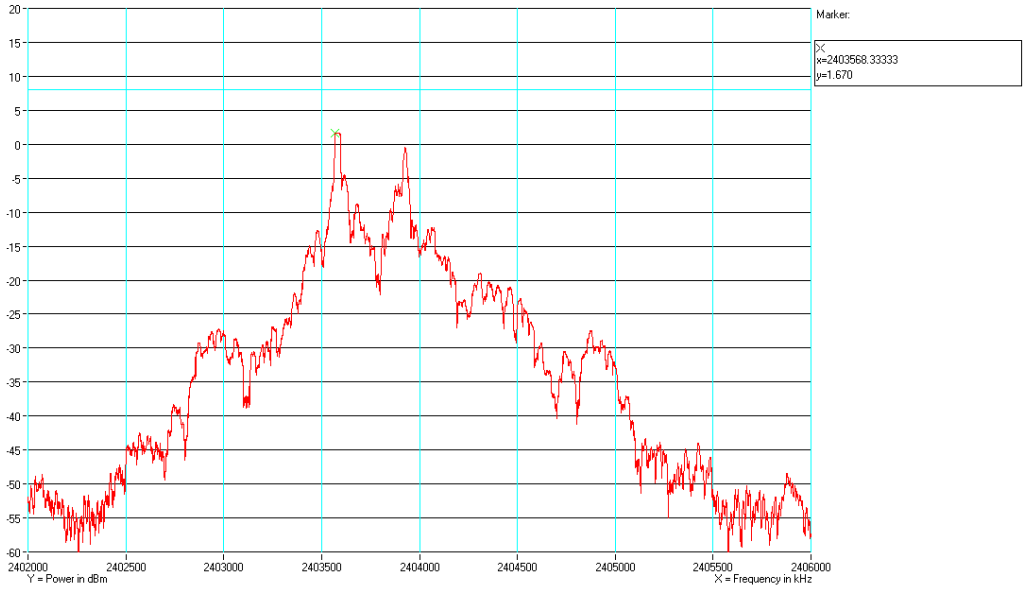
4.10 Measurement of power spectral density

Test object	SAS-2	Sheet	PSD-1
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100268	Date	1 June 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(e) and RSS-210, A8.2(b)		

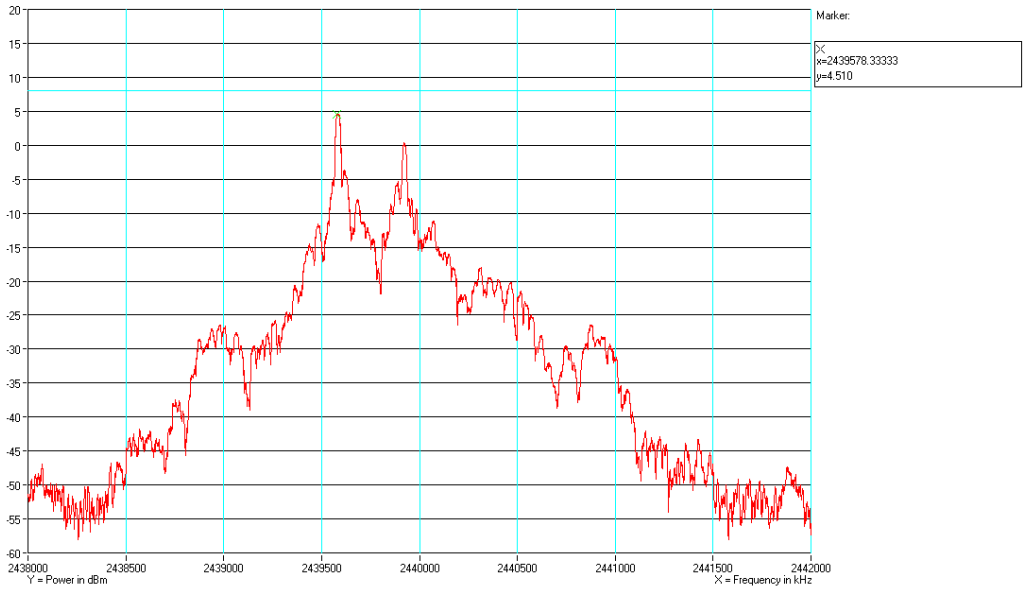
Test method Characteristics	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005 Temperature: 22 ºC. Test voltage: 5.0 V DC	
Test equipm.	49321 49183 49299	Uncertainty 1.1 dB
SA Settings	RBW: 3 KHz VBW: 10 kHz SPAN: 4 MHz DET: Peak CF: 2404 MHz, 2440 MHz, 2478 MHz Trace: Max Hold Sweep Time: 167000 ms	
Note 1:		

Test result			
Operating frequency:	Measured	Limit	Comment
2404 MHz	1.67 dBm	< 8 dBm	Ok
2440 MHz	4.51 dBm	< 8 dBm	Ok
2478 MHz	1.67 dBm	< 8 dBm	Ok
Note 1:			

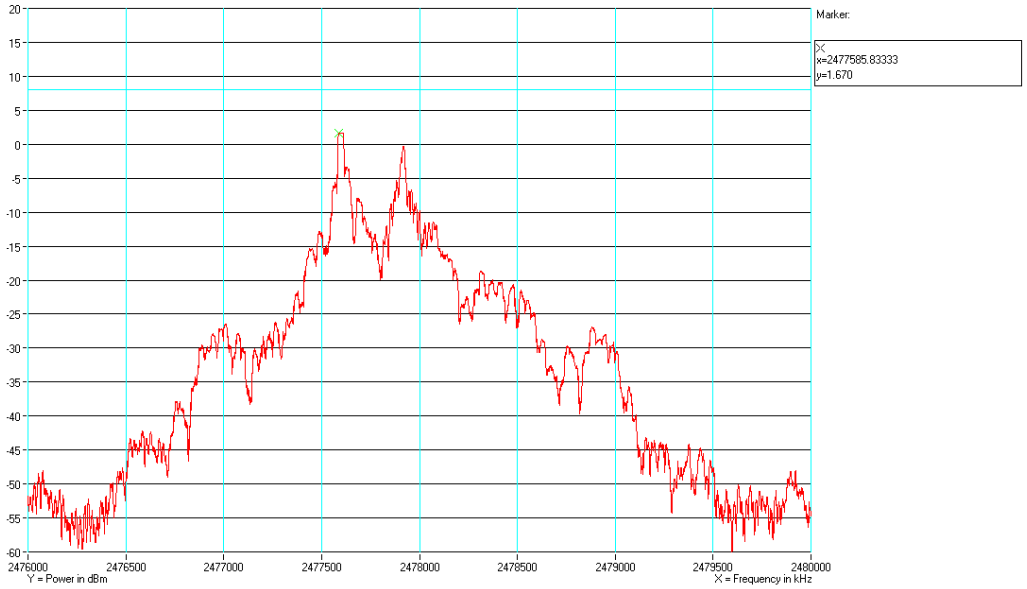
Test result	The measured power spectral density was within the level designated in 15.247(e) and the measured bandwidth was within limit designated in RSS-210, A8.2(b)
Test modulation	Continuous Tx - normal modulation - hopping on
Compliant	Yes
Comments	Conducted measurement



Test frequency 2404 MHz



Test frequency 2440 MHz



Test frequency 2478 MHz

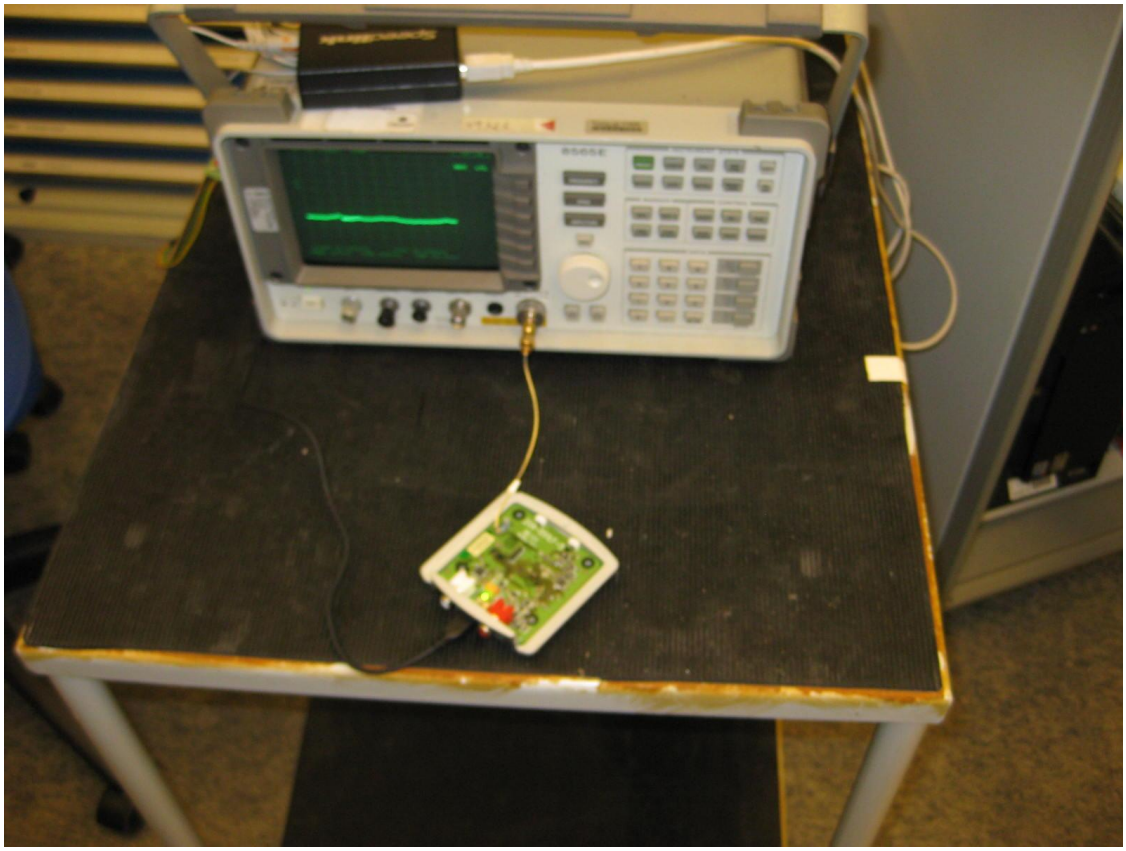
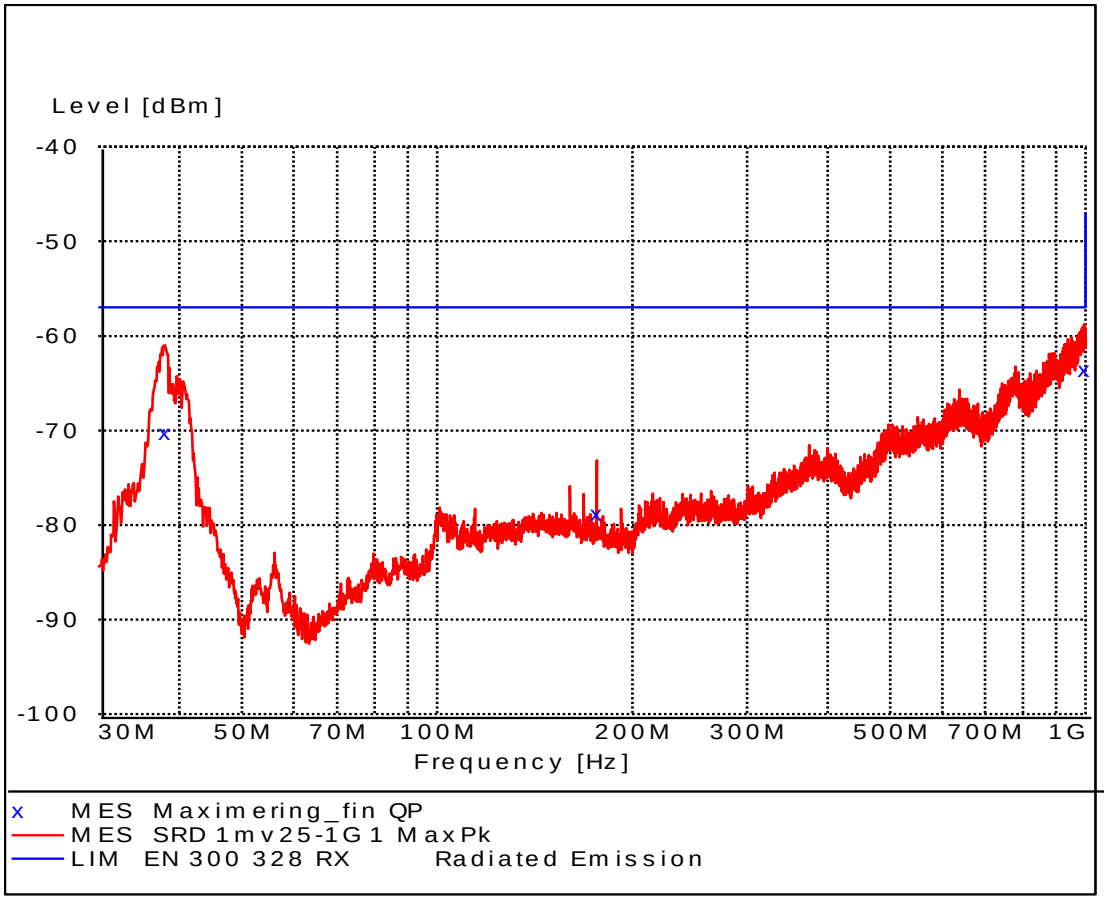


Photo 4.10.1 Test setup regarding measurement of power spectral density.

4.11 Measurement of radiated emission, receiver, 30 MHz to 1000 MHz

Test object	SAS-2	Sheet	RE_Spur-13
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	IC RSS-Gen, 7.2.3	Frequency	30-1000 MHz

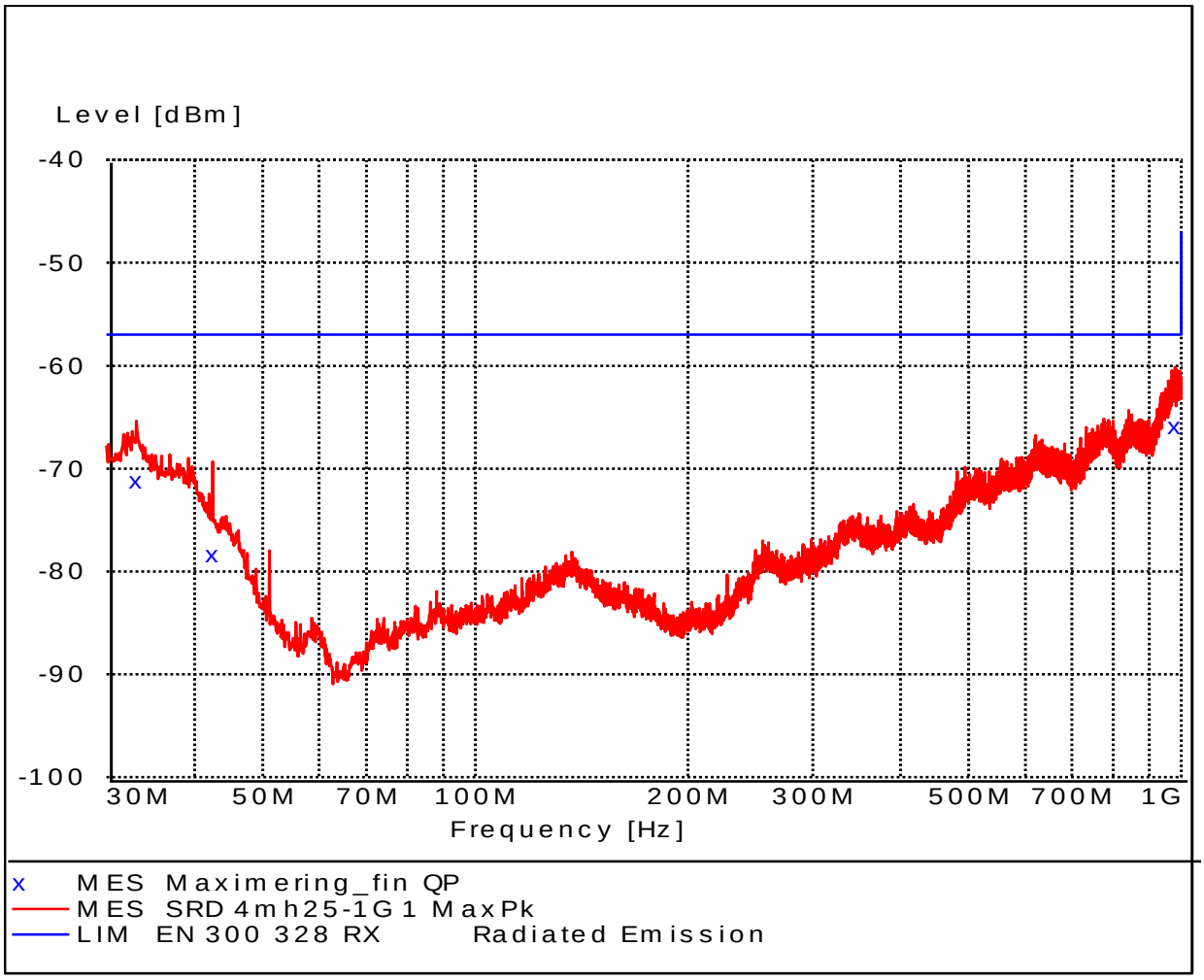
Test method Characteristics	EN 300 328 V1.7.1:2006 Pre-scan, Antenna at 10 m, 1 m height, vert. pol.	Temperature Humidity	21 °C 26 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Hopping between lowest and highest operating freq.

Test object	SAS-2	Sheet	RE_Spur-14
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	IC RSS-Gen, 7.2.3	Frequency	30-1000 MHz

Test method Characteristics	EN 300 328 V1.7.1:2006 Pre-scan, Antenna at 10 m, 4 m height, hor. pol.	Temperature Humidity	21 °C 26 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	



Comments Hopping between lowest and highest operating freq.

Test object	SAS-2	Sheet	RE_Spur-15
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	10 May 2010
Client	GN Hearing A/S	Initials	CMT
Specification	IC RSS-Gen, 7.2.3	Frequency	30-1000 MHz

Test method Characteristics	EN 300 328 V1.7.1:2006 Peak search ant. at 10 m, height: 1-4 m, v/h pol.	Temperature Humidity	21 °C 26 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty 4.9 dB	

Frequency MHz	Level dBm	Transd dB	Limit dBm	Margin dB	Height cm	Azimuth deg	Polarisation
33.100000	-71.20	-81.8	-57.0	14.2	341.0	246.00	horzontal
42.400000	-78.30	-89.2	-57.0	21.3	268.0	185.00	horzontal
977.800000	-65.90	-78.9	-57.0	8.9	396.0	190.00	horzontal
38.000000	-70.30	-96.8	-57.0	13.3	101.0	111.00	vertical
176.000000	-78.80	-95.7	-57.0	21.8	101.0	308.00	vertical
996.000000	-63.60	-76.8	-57.0	6.6	400.0	267.00	vertical

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	2404 MHz / 2478 MHz
Test mode	Continuous Rx - normal modulation - hopping on Hopping between lowest and highest operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation. The radiated substitution test method of EN 300 328 was used to demonstrate compliance with the limits for RSS-Gen, Section 7.2.3.

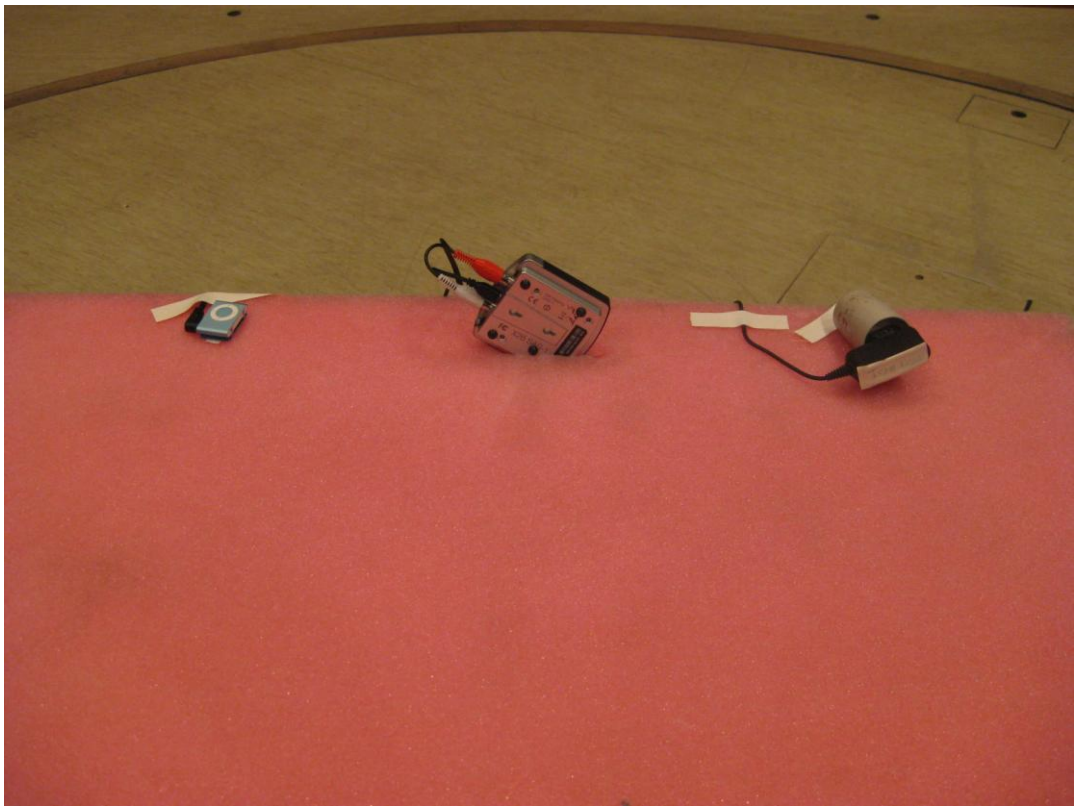


Photo 4.11.1 Test setup regarding measurement of radiated emission, receiver, 30 to 1000 MHz.

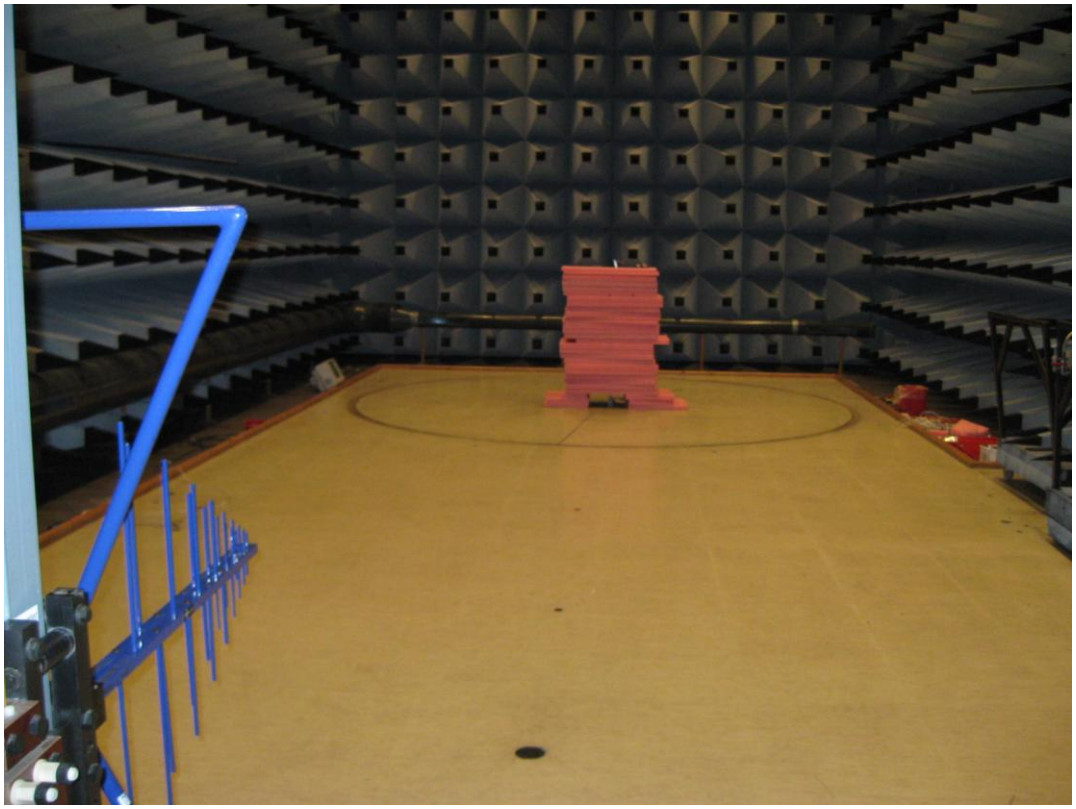
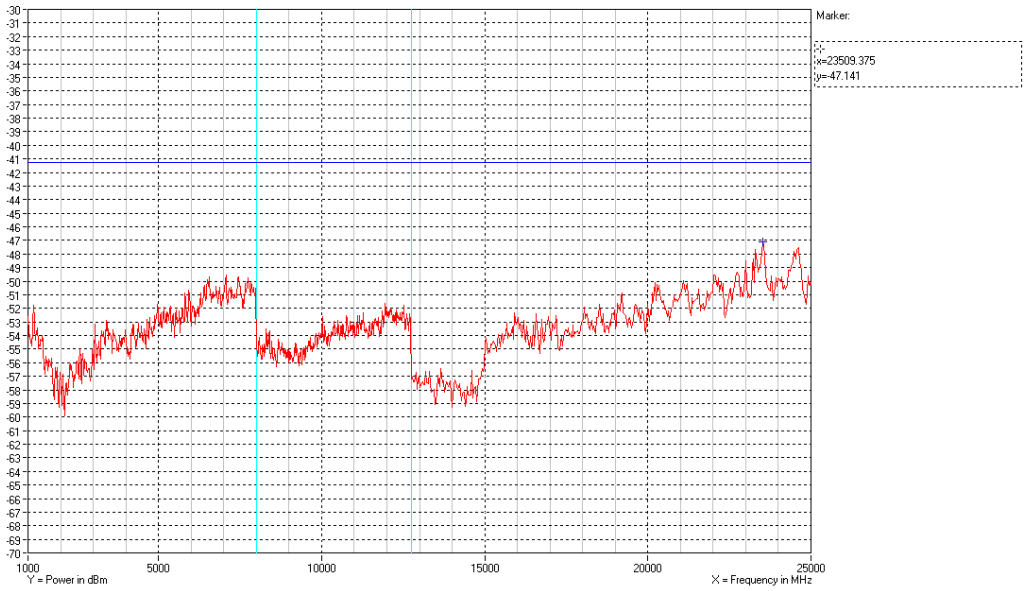


Photo 4.11.2 Test setup regarding measurement of radiated emission, receiver, 30 to 1000 MHz.

4.12 Measurement of radiated emission, receiver, 1 GHz to 25 GHz

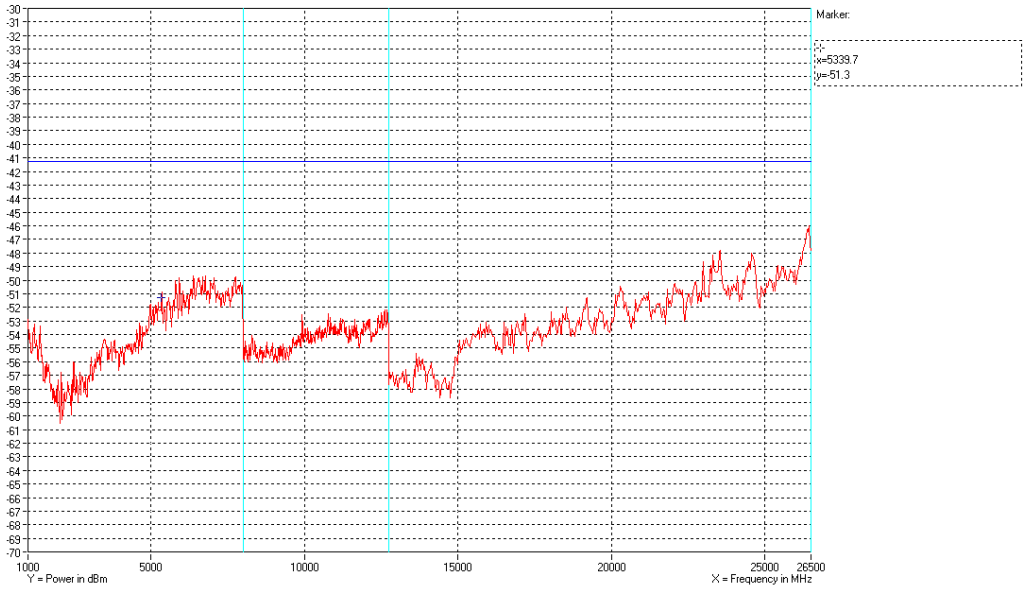
Test object	SAS-2	Sheet	RE_Spur-16
Type	SAS-2	Project no.	A506404-8
Serial no.	1079100030	Date	11 May. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	IC RSS-Gen, 7.2.3	Frequency	1-25 GHz

Test method Characteristics	EN 300 328 V1.7.1:2006 Complete search, Antenna distance 3 m.	Temperature Humidity	24 °C 23 % RH
Detector	Peak and average for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49600 49624 49625 49183 49299 29678 29962	Uncertainty 4.9 dB	



Polarization Vertical peak measurements

Comments Hopping between lowest and highest operating freq.



Polarization	Horizontal peak measurements
Comments	Hopping between lowest and highest operating freq.
Test result	The measured corrected average field strengths are below the average limit. The measured corrected peak field strengths are below the peak limit (Peak limit = Average limit + 20 dB).
Test Port	Enclosure
Test frequency	2404 MHz / 2478 MHz
Test mode	Continuous Rx - normal modulation - hopping on Hopping between lowest and highest operating freq.
Condition	Normal
Compliant	Yes
Comments (Avg/Pk)	Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization. The radiated substitution test method of EN 300 328 was used to demonstrate compliance with the limits for RSS-Gen, Section 7.2.3.

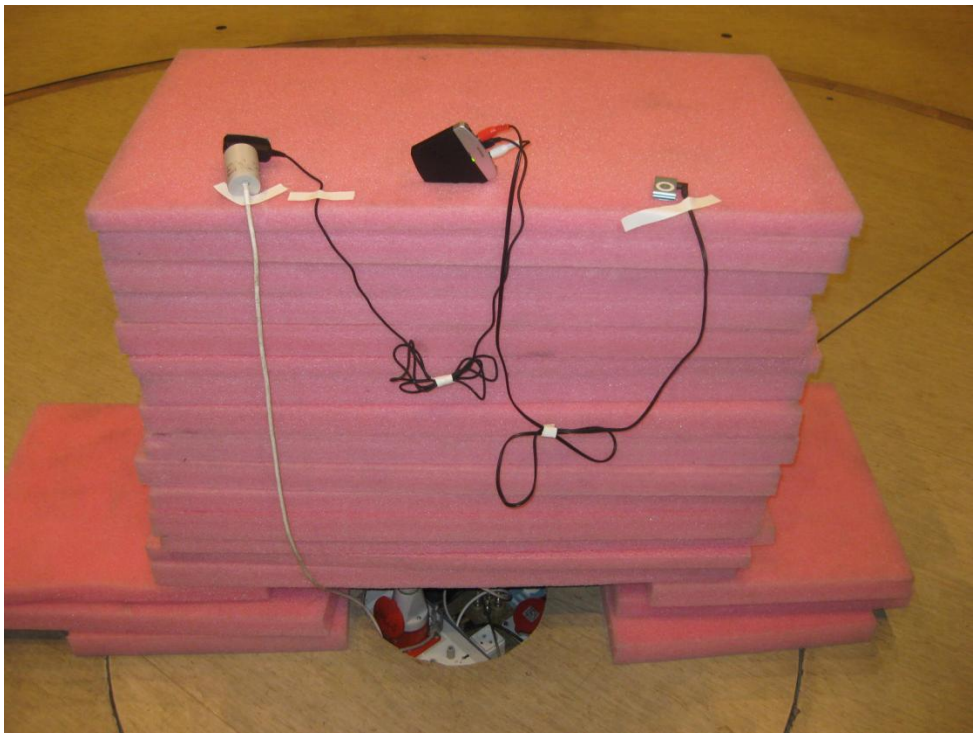


Photo 4.12.1 Test setup regarding measurement of radiated emission, receiver, 1 GHz to 25 GHz.

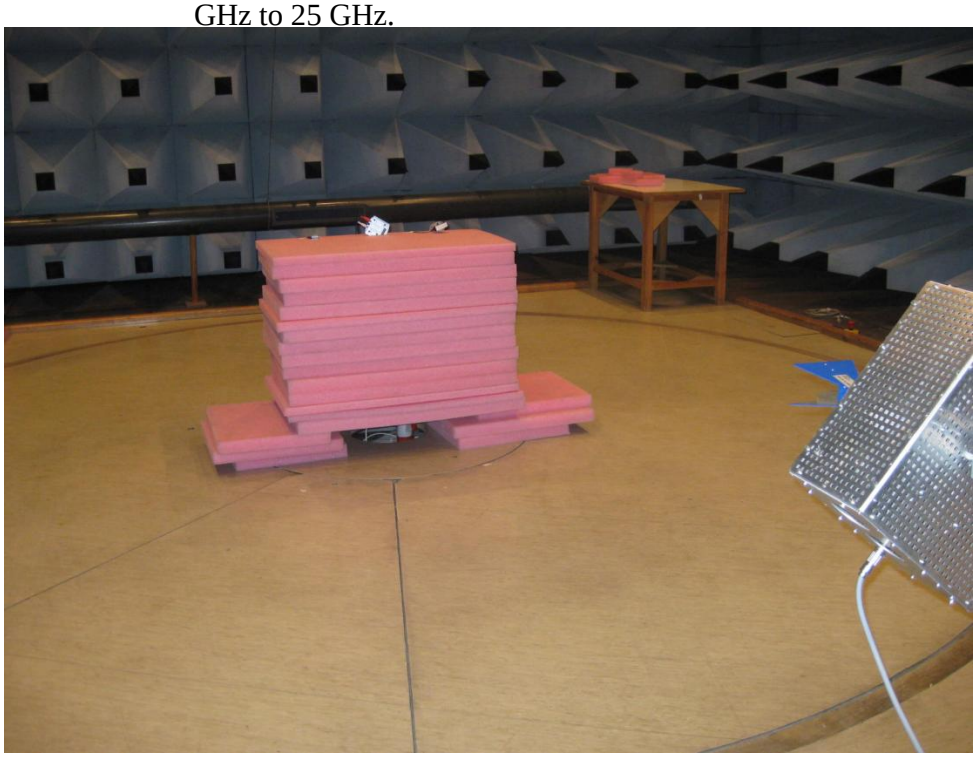


Photo 4.12.2 Test setup regarding measurement of radiated emission, receiver, 1 GHz to 25 GHz.

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.

CISPR 22 is equivalent to AS/NZS CISPR 22, and therefore this report can be used for applying the **Australian C-Tick mark** for IT equipment, when this test has been passed.

CISPR 22:2002 is equivalent to ICES-003:2004, and therefore this report can be used for approval in Canada for IT equipment, when this test has been passed.

5.2 FCC Registrations

Organization: Federal Communications Commission, USA

Registration Number: 90529

Facilities: OATS Hørsholm (EMC-0)
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:

OATS Hørsholm (EMC-0):	R-691
EMC room 2 Hørsholm (EMC-2):	C-707, T-246 and T-1547
EMC room 3 Hørsholm (EMC-3):	C-2532, T-247 and T-1548
EMC room 4 Hørsholm (EMC-4):	C-2533, T-248 and T1549
EMI room Hørsholm (EMC-5):	R-1180, C-706, T-249 and T-1550

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.	Description	Manufacturer	Type No.	Cal. date	Cal. interval
29797	BILOG ANTENNA, 30-2000 MHz	CHASE ELEC-TRICS LTD	CBL 6111A	16-07-2008	2 years
29861	EMI-SOFTWARE VER. 1.60	ROHDE & SCHWARZ	ES-K1, PART: 1026.6790. 02	-	-
49183	POWER SUPPLY	TTI	PL 320	-	-
49299	MULTIMETER	FLUKE	87-4	03-03-2010	1 year
49321	SPECTRUM ANA-LYZER, 50 GHz WITH OPTION 006	HEWLETT-PACKARD	8565E	13-10-2009	1 year
49550	SIGNAL ANLYZER	ROHDE & SCHWARZ	FSQ8	07-08-2009	1 year
49600	SPECTRUM ANA-LYZER / MEAS-UREMENT RE-CEIVER	ROHDE & SCHWARZ	ESU40	18-03-2010	1 year
49622	CABLE 3.25 M PC3.5 MALE-FEMALE SU-COFLEX 104	HUBER+SUHNE R		07-02-2010	1 year
49623	CABLE 16 M PC3.5 MALE-MALE SUCOFLEX 104PB	HUBER+SUHNE R		07-02-2010	1 year
49624	DUAL RIDGE HORN ANTENNA – 1GHz – 26 GHz (2 GHz – 32 GHz)	SATIMO	SH2000	08-11-2009	2 years
49625	SRD COAX SWITCH MATRIX USED IN 1GHz – 26 GHz SRD AN-TENNASYSTEM	DELTA	COAX SWITCH MATRIX	07-02-2010	1 year
29332	ACTIVE LOOP ANTENNA	ROHDE & SCHWARZ	HFH-Z2	08-06-2008	2 years