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DELTA Test Report



Radio parameter test of SAS-1

Performed for GN Hearing A/S

DANAK-1910853, Rev. B

Project no.: A506404-1

Page 1 of 56


14 April 2010

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Title	Radio parameter test of SAS-1
Test object	SAS-1
Report no.	DANAK-1910853, Rev. B
Project no.	A506404-1
Test period	22 December 2009 to 13 April 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
Results	The test objects were found to be in compliance with the specifications, as listed in Section 1
Test personnel	Claus Momme Thomsen Henrik Egeberg Nielsen Jan Askov

Date 14 April 2010

Project Manager 

Jan Askov
Senior Specialist, Wireless
DELTA

Responsible 

Claus Rømer Andersen
Team Manager, Wireless
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This report is a revision of the test report A506404-1 Rev. A dated 13 April 2010.

The revision has been made due to the following:

Units corrected on page 32, 34 and 36 (dB μ V changed to dB μ V/m).

Instrument list revised to include calibration date and calibration interval.

Table of contents		Page
1.	Summary of tests	5
2.	Test objects	6
2.1	Test objects	6
2.2	Auxiliary equipment	7
3.	General test conditions	8
3.1	Test setup during test	8
3.2	Description of radio link	9
3.3	Test sequence	10
4.	Test results	11
4.1	Antenna requirement	11
4.2	Measurement of radio frequency voltage on mains	13
4.3	Measurement of radiated emission, 0.009-30 MHz	16
4.4	Measurement of radiated emission, 30 MHz to 1000 MHz	21
4.5	Measurement of radiated emission, 1 GHz to 25 GHz	31
4.6	Measurement of the 6 dB bandwidth	38
4.7	Measurement of conducted power output	42
4.8	Measurement of conducted spurious emissions	46
4.9	Measurement of power spectral density	50
5.	National registrations and accreditations	54
5.1	DANAK Accreditation	54
5.2	FCC Registrations	54
5.3	VCCI Registrations	55
5.4	IC Registrations	55
6.	List of instruments	56

1. Summary of tests

Tests	Test methods	Rule Section	Results
Antenna requirement	Visual inspection	15.203	Passed
Radio frequency voltage on mains	ANSI C63.4:2003	15.207	Passed
Radiated emission	ANSI C63.4:2003	15.209	Passed
6 dB bandwidth	DTS guide:2005	15.247(a)(2)	Passed
Conducted power output	DTS guide:2005	15.247(b)(3)	Passed
Conducted spurious emissions	DTS guide:2005	15.247(c)	Passed
Power spectral density	DTS guide:2005	15.247(d)	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.

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-1
Model / type	SAS-1
Part no.	SAS-V3
Serial no.	0979000167
FCC ID	X26SAS-1
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-1
Model / type	SAS-1
Part no.	SAS-V3
Serial no.	0979000144
FCC ID	X26SAS-1
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

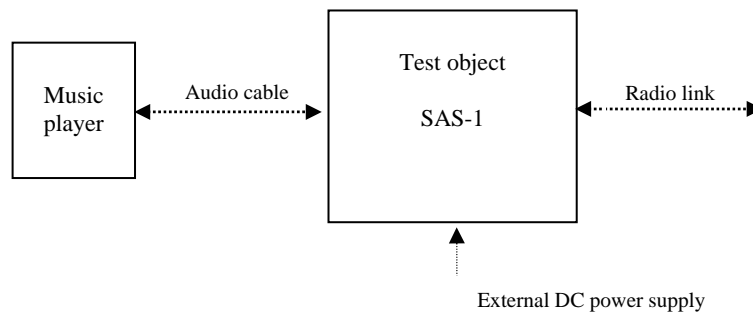


Figure 3.1.1 Block diagram of test object.

All test objects were running special test software.

During test, the test objects were in continuous Tx mode. (Normal modulation, normal data packets with optimized repetition rate)

Tests were performed at three frequencies

- Low frequency: 2404 MHz
- Middle frequency: 2441 MHz
- High frequency: 2478 MHz.

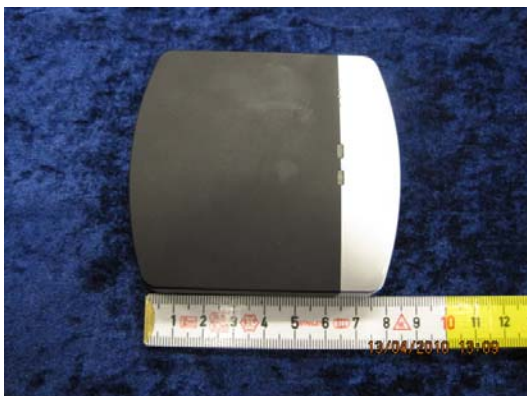
During relevant tests, the battery was replaced by an external DC power supply.

Intended use

SAS-1 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: 1.8 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 min voltage: 5.5 VDC Specified max voltage: 4.4 VDC
Temperature category	:	-20 to +55 °C.



3.3 Test sequence

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

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

4. Test results

4.1 Antenna requirement

Test object	SAS-1	Sheet	ANT-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	29 Mar. 2010
Client	GN Hearing A/S	Initials	JAS
Specification	FCC CFR 47 Part 15, Subpart C Section 15.203		

Test method	Visual inspection
<p>Evaluation criteria Section 15.203 of the rules 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.</p> <p>Evaluation result The Stationary Audio Streamer has a permanently attached PCB antenna.</p>	

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



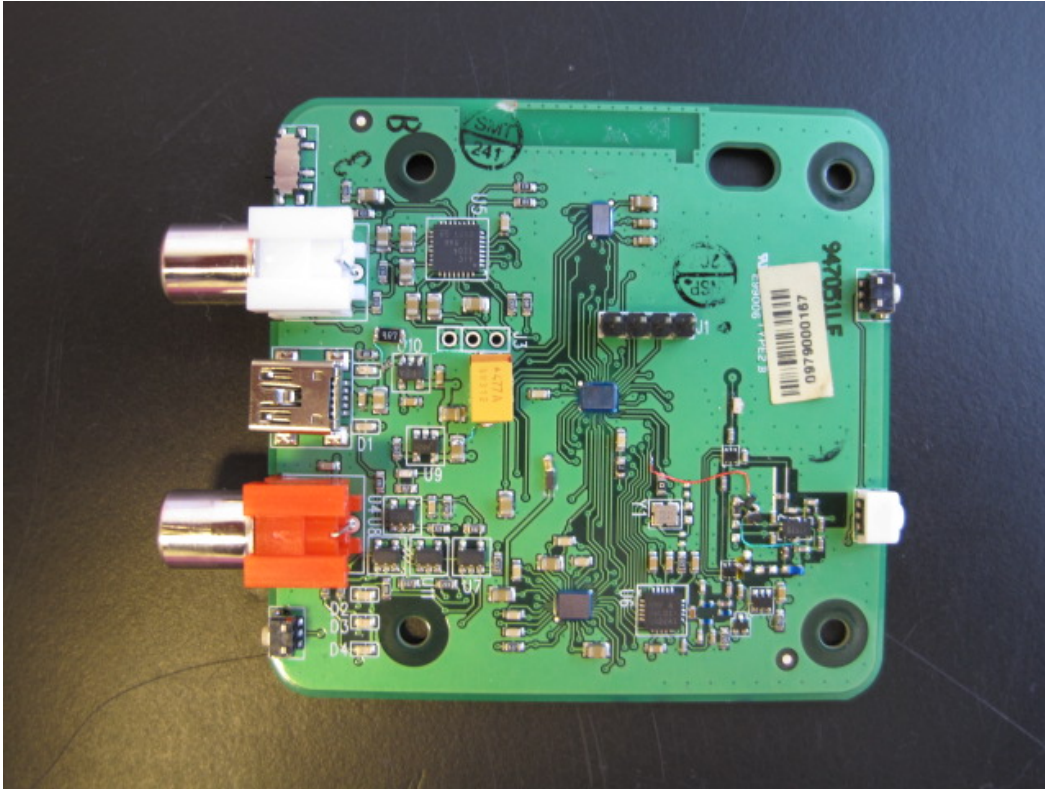


Photo 4.1.1 Test setup regarding measurement of antenna requirement

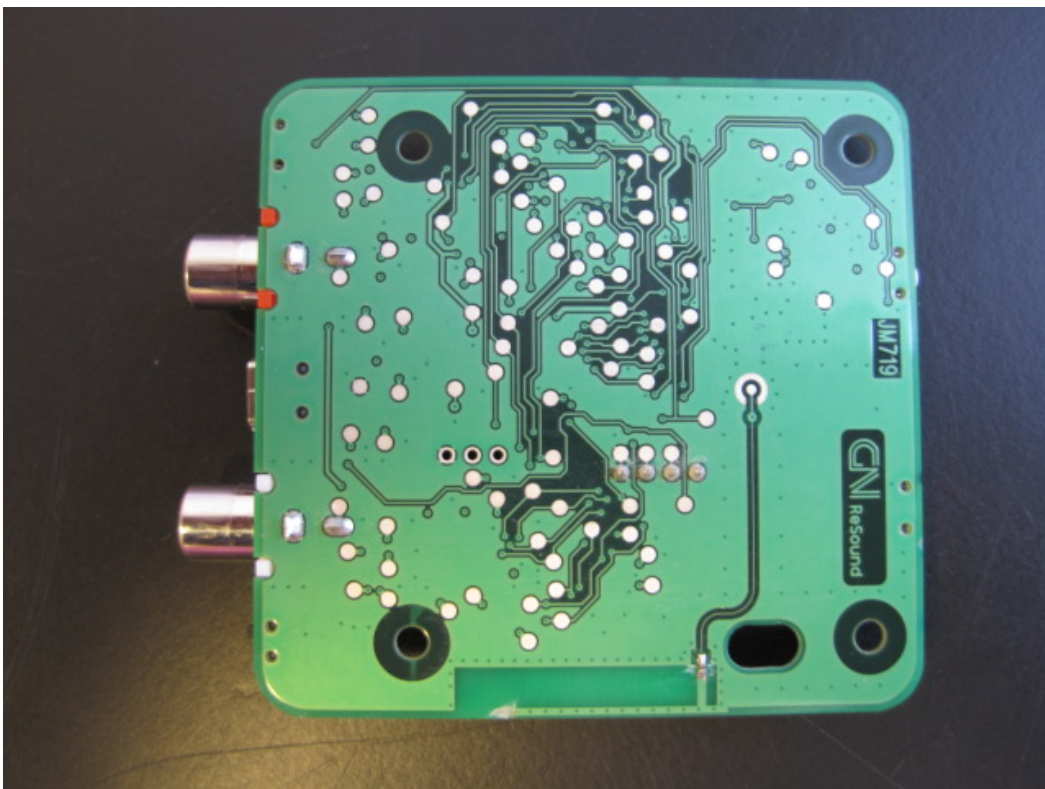


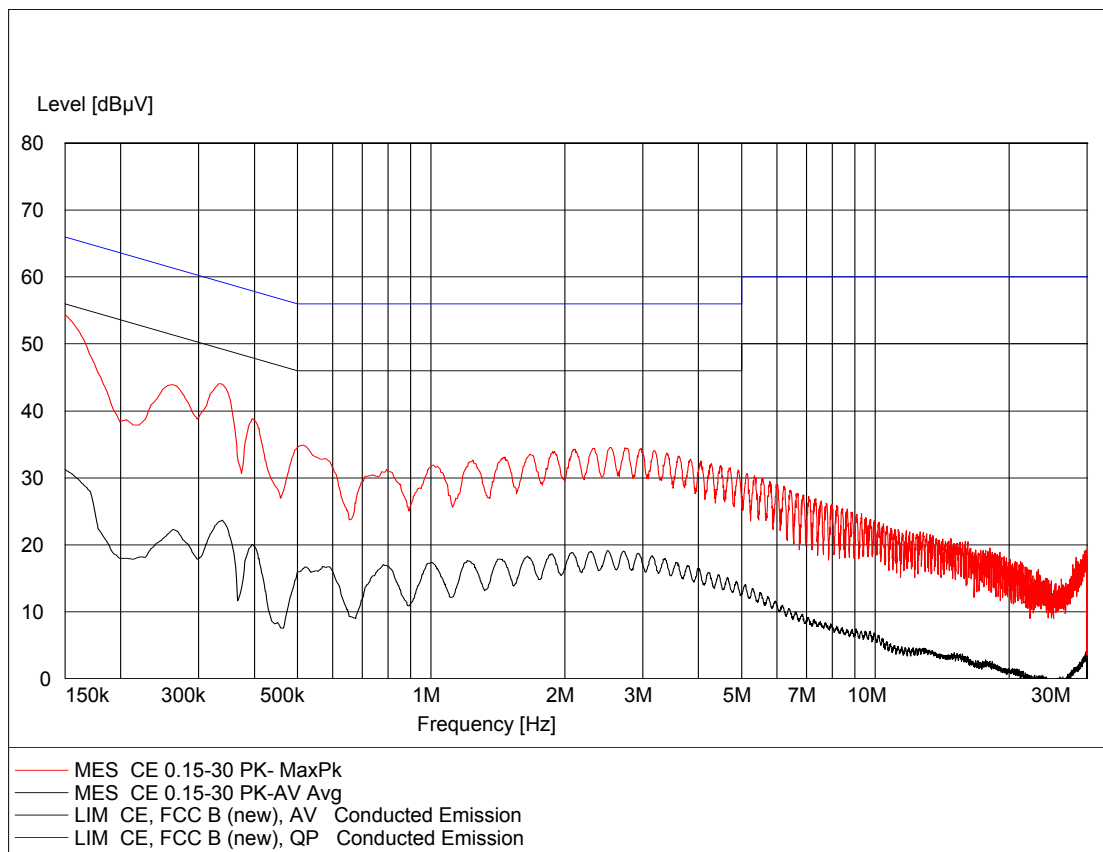
Photo 4.1.2 Test setup regarding measurement of antenna requirement



4.2 Measurement of radio frequency voltage on mains

Test object	SAS-1	Sheet	CE-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	08 Mar. 2010
Client	GN Hearing A/S	Initials	HEN
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.207	Frequency	0.15-30 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Artificial mains network: 50 Ω , 50 μ H	Humidity	23 % RH
Detector	Peak and average	Bandwidth	10 kHz
Test equipm.	EMI room Hørsholm 29301 29680 49600 29861	Uncertainty	4.9 dB

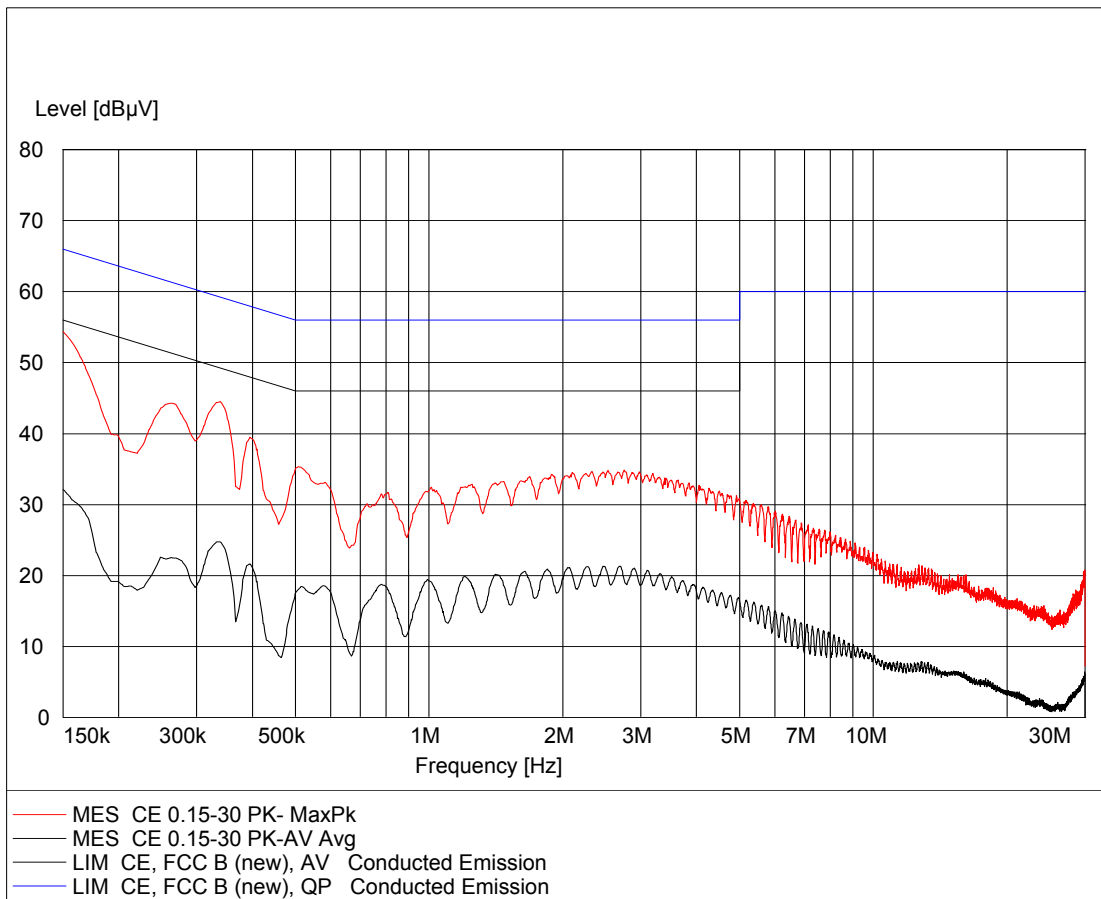


Line under test	Neutral
Test result	The measured voltages were below the limit
Comments	Mains voltage: 120 VAC



Test object	SAS-1	Sheet	CE-2
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	08 Mar. 2010
Client	GN Hearing A/S	Initials	HEN
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.207	Frequency	0.15-30 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Artificial mains network: 50 Ω, 50 μH	Humidity	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 4.2.1 Test setup regarding measurement of radio frequency voltage on mains.

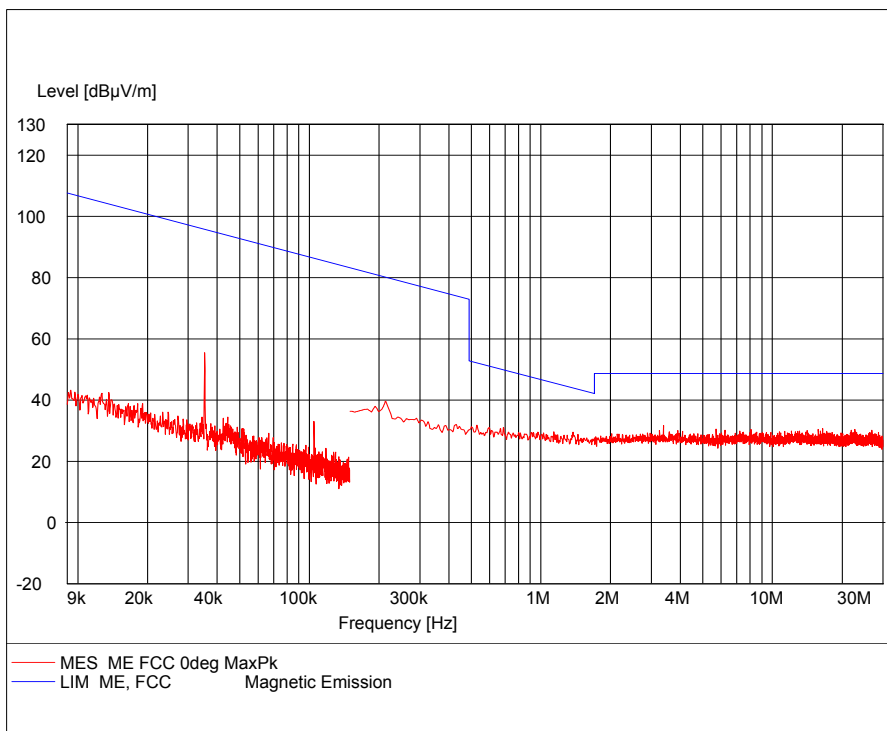


Photo 4.2.2 Test setup regarding measurement of radio frequency voltage on mains.

4.3 Measurement of radiated emission, 0.009-30 MHz

Test object	SAS-1	Sheet	ME-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	13 Apr. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	0.009-30 MHz

Test method	ANSI C63.4:2003	Temperature	22 °C
Characteristics	Loop antenna pos. X. Antenna distance 10 m.	Humidity	29 % RH
Detector	Peak	Bandwidth	200 Hz / 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

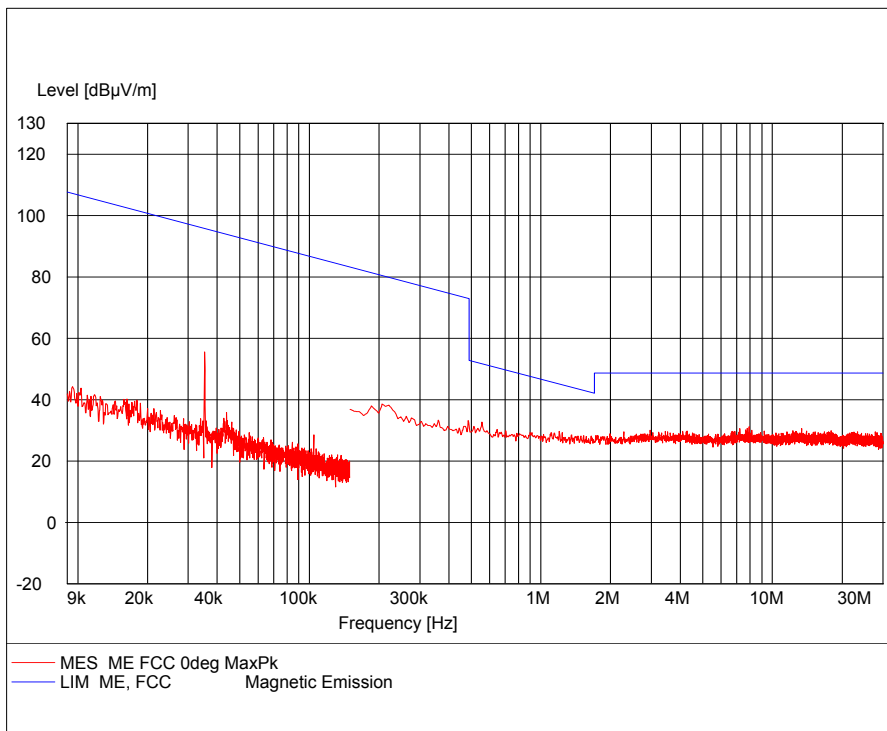
Comments Test frequency: 2441 MHz.
 The limit has been extrapolated to 10 m using an extrapolation factor of 40 dB / decade as specified in §15.31(f)(2):

$$L_2 = L_1 + 40 \cdot \log_{10}(D_1/D_2)$$



Test object	SAS-1	Sheet	ME-2
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	13 Apr. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	0.009-30 MHz

Test method	ANSI C63.4:2003	Temperature	22 °C
Characteristics	Loop antenna pos. Y. Antenna distance 10 m.	Humidity	29 % RH
Detector	Peak	Bandwidth	200 Hz / 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

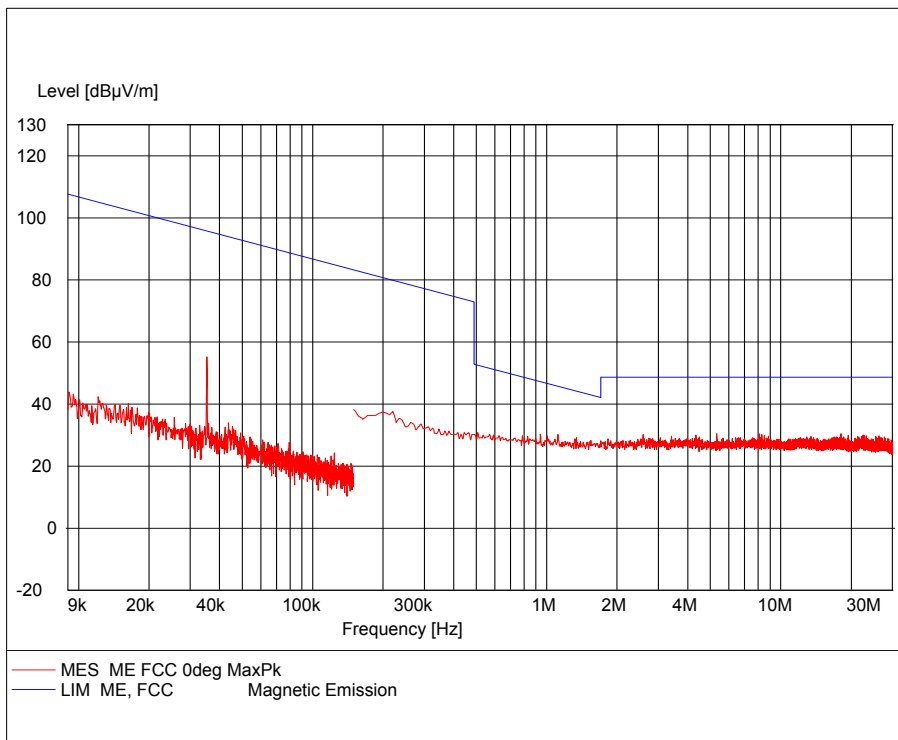
Comments Test frequency: 2441 MHz.
 The limit has been extrapolated to 10 m using an extrapolation factor of 40 dB / decade as specified in §15.31(f)(2):

$$L_2 = L_1 + 40 \cdot \log_{10}(D_1/D_2)$$



Test object	SAS-1	Sheet	ME-3
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	13 Apr. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	0.009-30 MHz

Test method	ANSI C63.4:2003	Temperature	22 °C
Characteristics	Loop antenna pos. Z. Antenna distance 10 m.	Humidity	29 % RH
Detector	Peak	Bandwidth	200 Hz / 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: 2441 MHz.
 The limit has been extrapolated to 10 m using an extrapolation factor of 40 dB / decade as specified in §15.31(f)(2):

$$L_2 = L_1 + 40 \cdot \log_{10}(D_1/D_2)$$



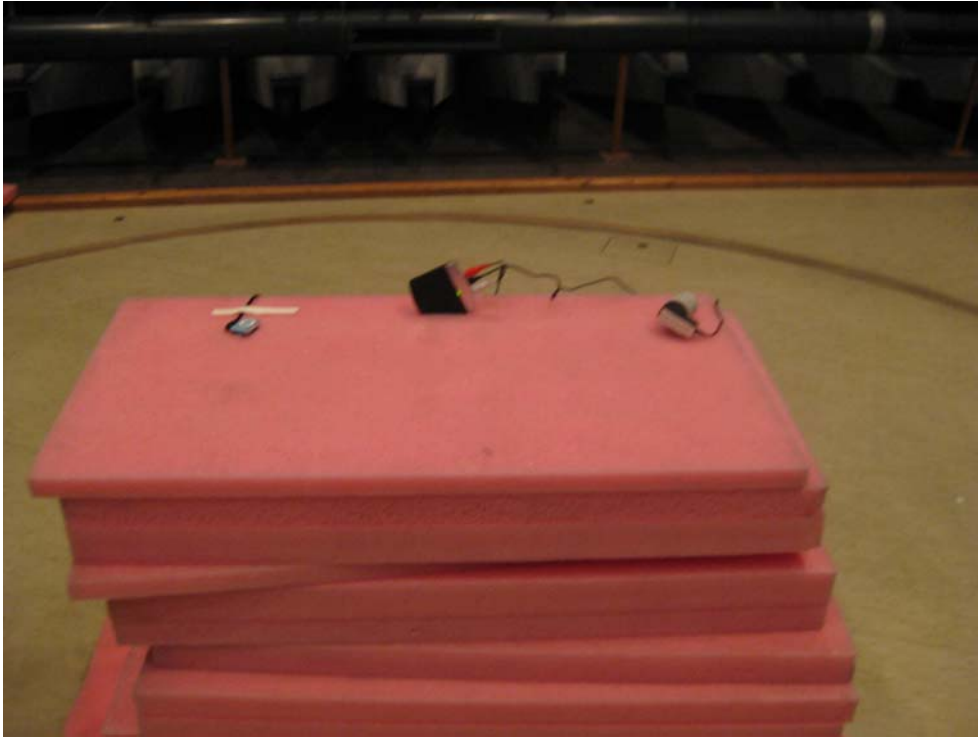


Photo 4.3.1 Test setup regarding measurement of radiated emission, 0.009-30 MHz.



Photo 4.3.2 Test setup regarding measurement of radiated emission, 0.009-30 MHz.



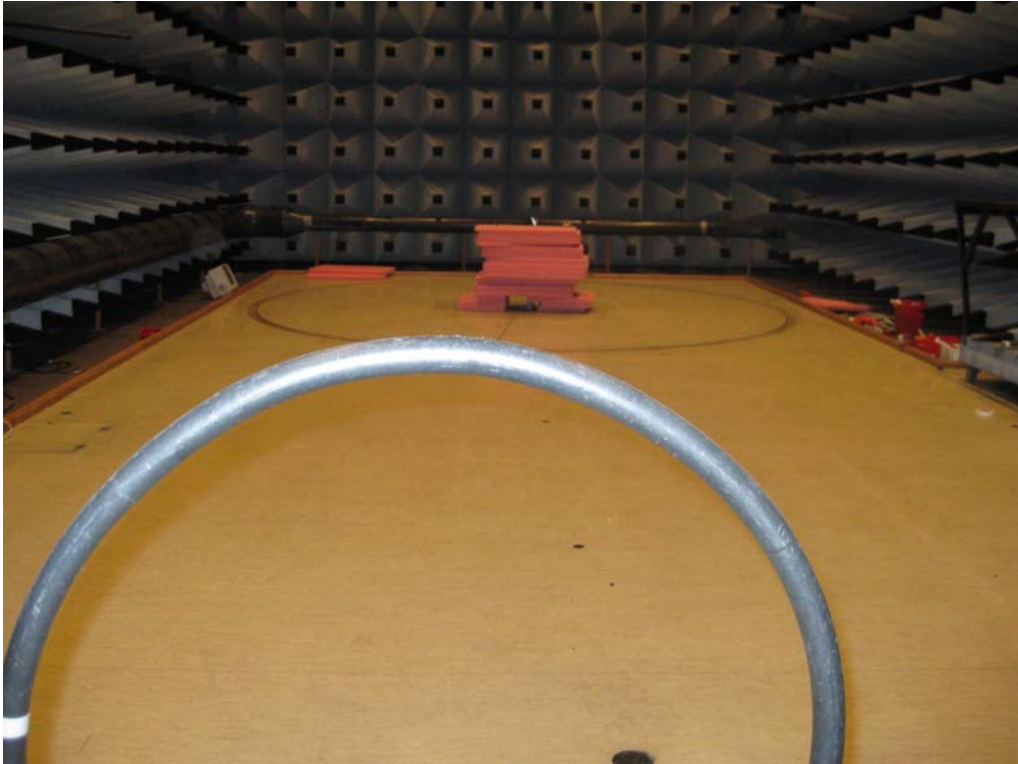


Photo 4.3.3 Test setup regarding measurement of radiated emission, 0.009-30 MHz.

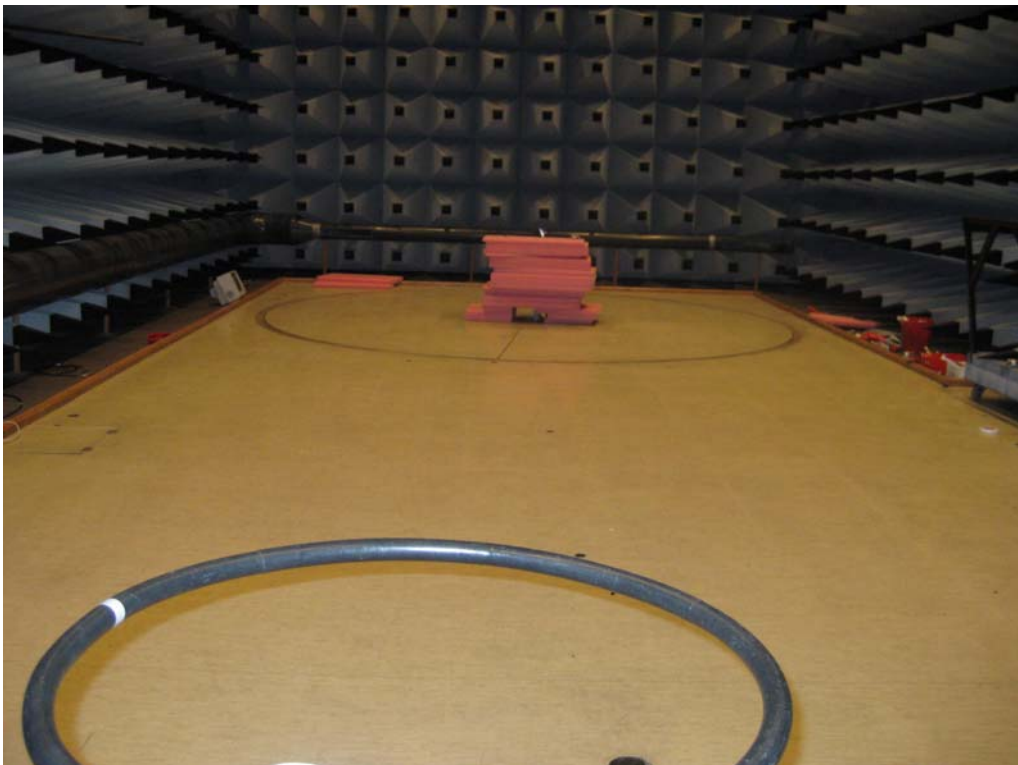


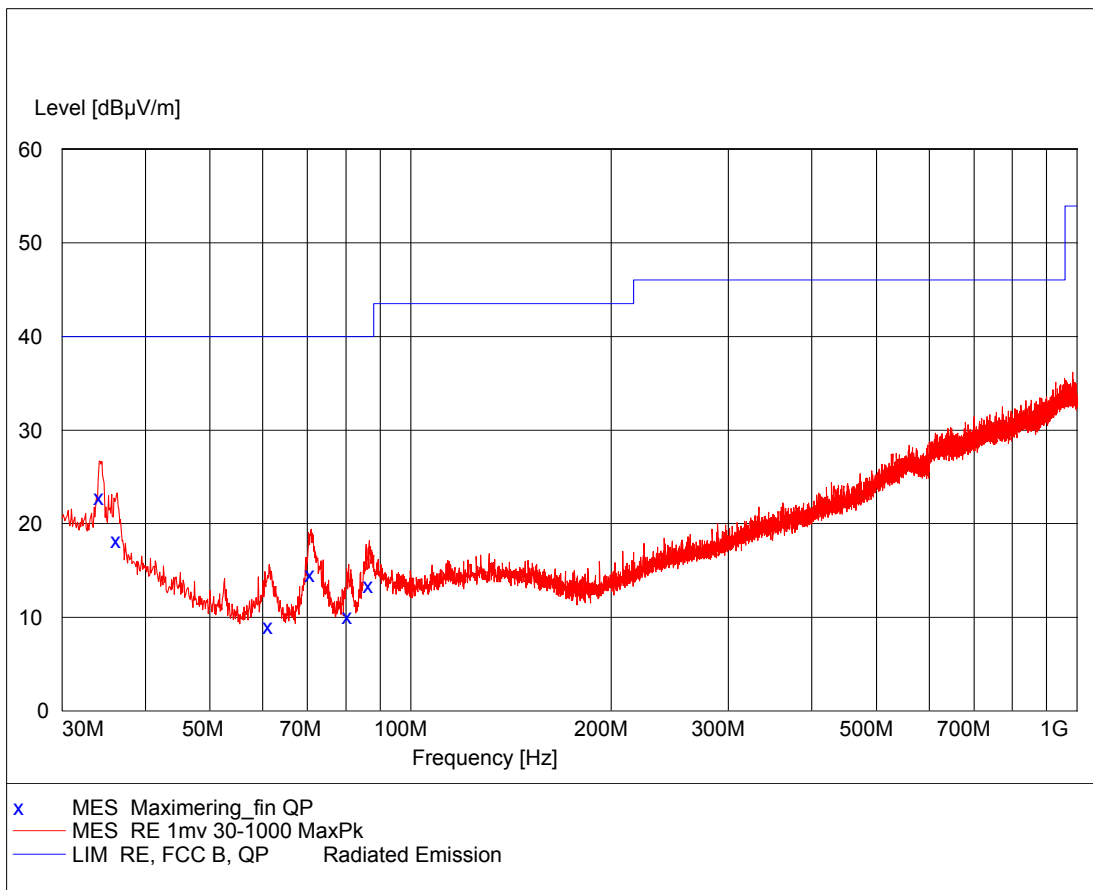
Photo 4.3.4 Test setup regarding measurement of radiated emission, 0.009-30 MHz.



4.4 Measurement of radiated emission, 30 MHz to 1000 MHz

Test object	SAS-1	Sheet	RE_Spur-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Humidity	23 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty	4.9 dB



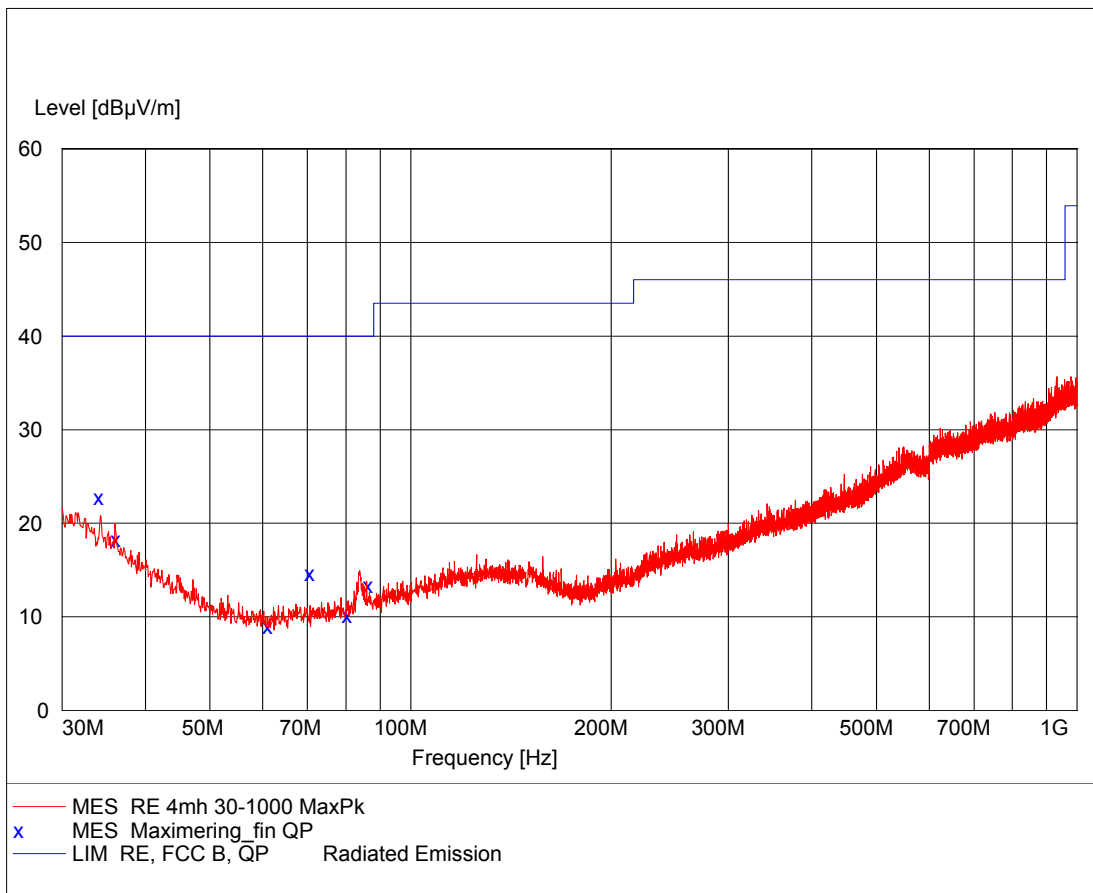
Comments

Operating frequency 2404 MHz



Test object	SAS-1	Sheet	RE_Spur-2
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Humidity	23 % 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-1	Sheet	RE_Spur-3
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

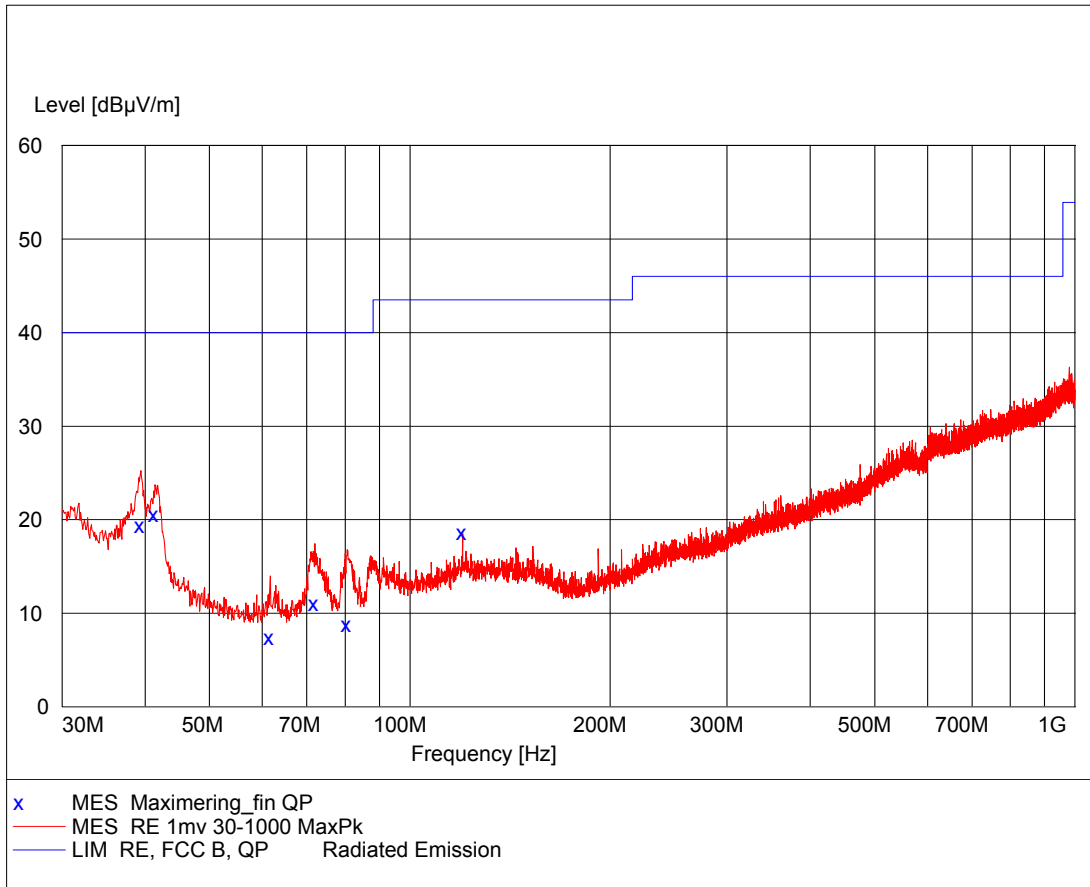
Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Humidity	23 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty	4.9 dB

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
34.200000	22.80	16.9	40.0	17.2	110.0	292.00	VERTICAL
36.300000	18.20	15.7	40.0	21.8	114.0	285.00	VERTICAL
61.300000	9.00	8.0	40.0	31.0	121.0	44.00	VERTICAL
70.900000	14.60	9.0	40.0	25.4	117.0	161.00	VERTICAL
80.700000	10.10	9.6	40.0	29.9	112.0	149.00	VERTICAL
86.700000	13.40	10.3	40.0	26.6	122.0	130.00	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-1	Sheet	RE_Spur-4
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Humidity	23 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty	4.9 dB



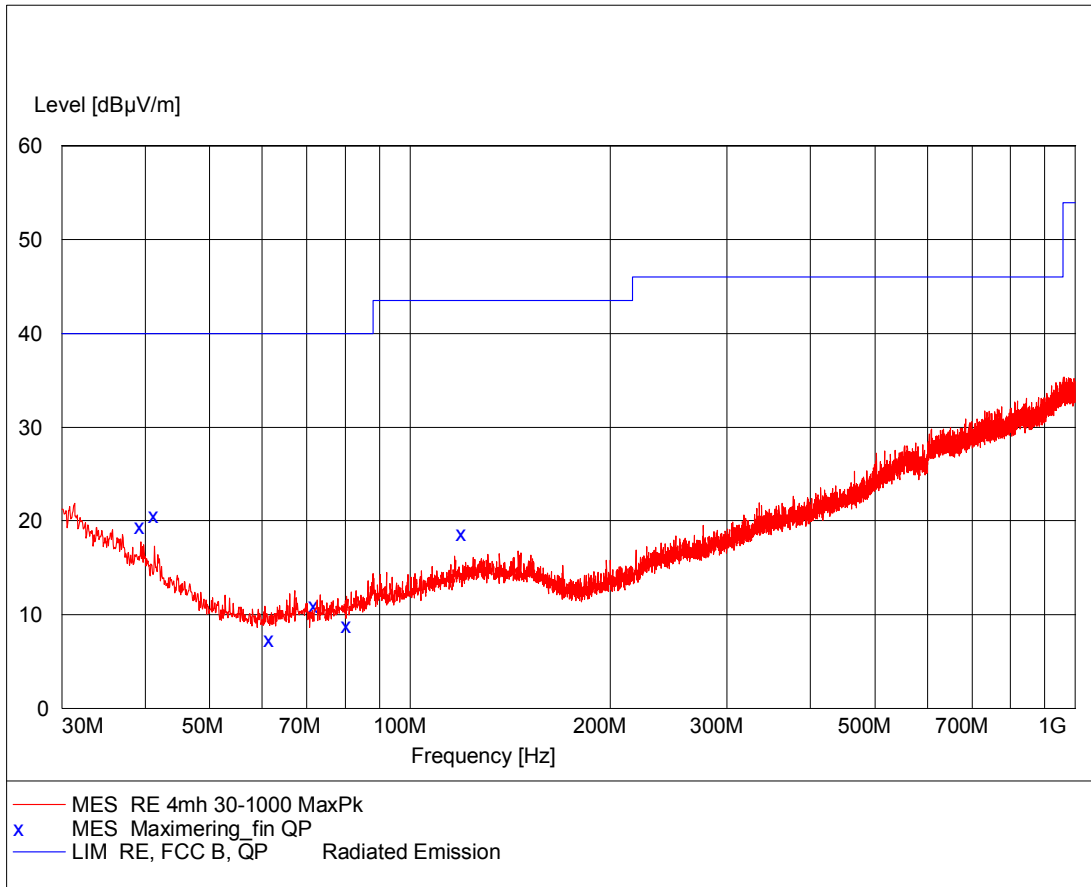
Comments

Operating frequency 2441 MHz



Test object	SAS-1	Sheet	RE_Spur-5
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Humidity	23 % 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 2441 MHz



Test object	SAS-1	Sheet	RE_Spur-6
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

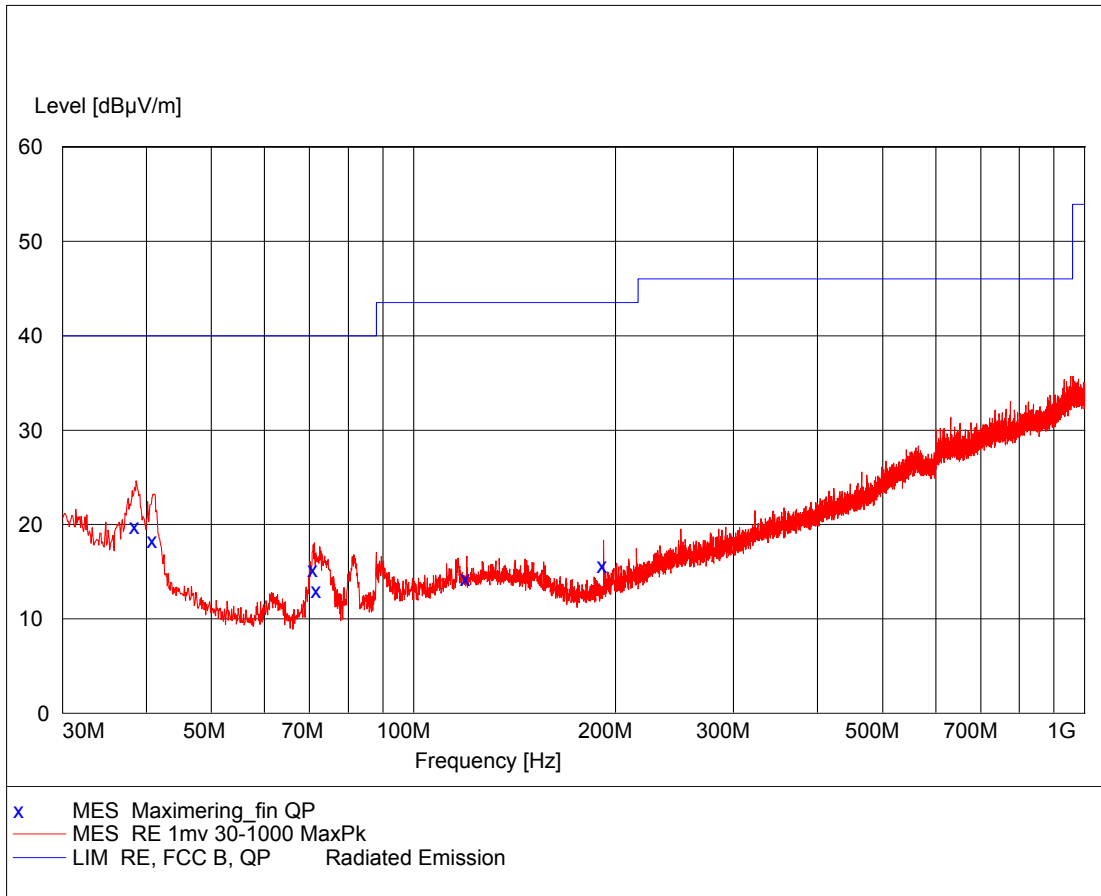
Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Humidity	23 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty	4.9 dB

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
39.400000	19.40	14.1	40.0	20.6	144.0	135.00	VERTICAL
41.400000	20.50	13.2	40.0	19.5	118.0	177.00	VERTICAL
61.700000	7.40	8.1	40.0	32.6	117.0	45.00	VERTICAL
72.000000	11.00	9.0	40.0	29.0	126.0	160.00	VERTICAL
80.600000	8.80	9.6	40.0	31.2	128.0	13.00	VERTICAL
120.000000	18.60	13.1	43.5	24.9	106.0	105.00	VERTICAL

Test result	The measured field strengths are below the limit
Test Port	Enclosure
Test frequency	2441 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-1	Sheet	RE_Spur-7
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Humidity	23 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty	4.9 dB

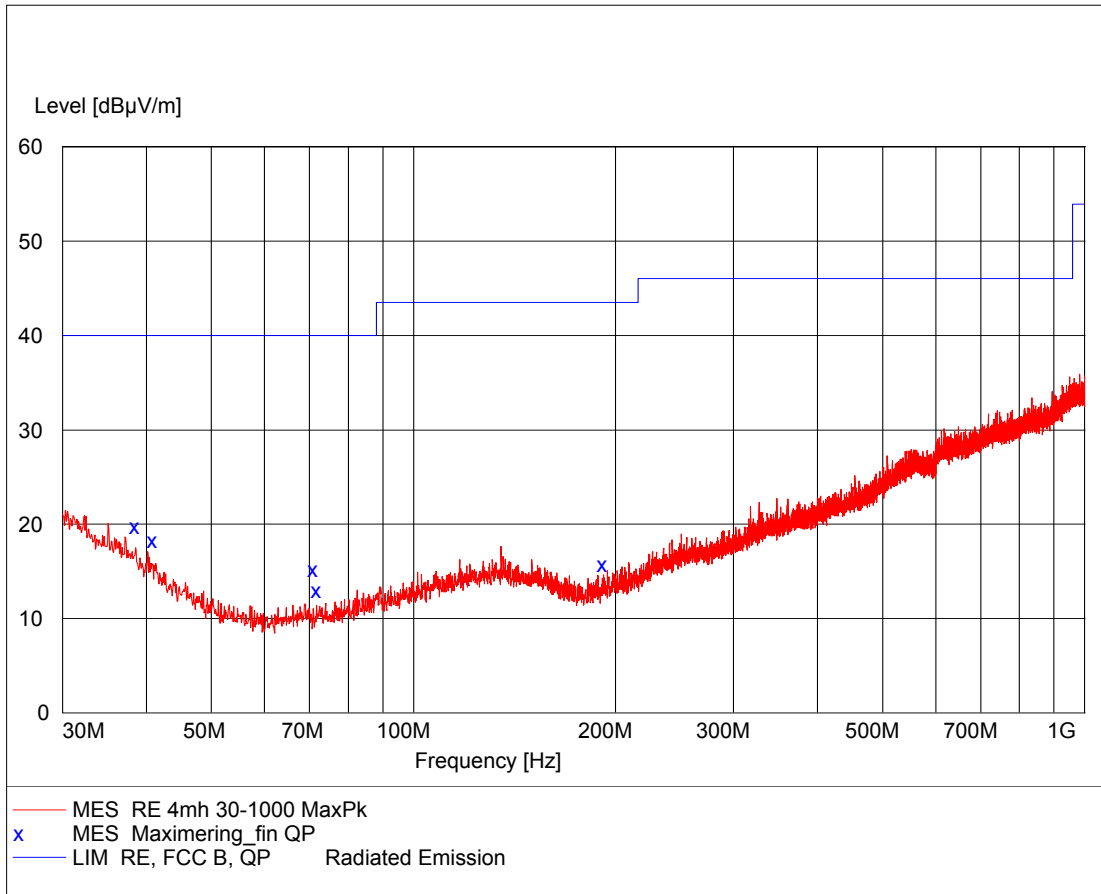


Comments

Operating frequency 2478 MHz

Test object	SAS-1	Sheet	RE_Spur-8
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	30-1000 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Humidity	23 % 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-1	Sheet	RE_Spur-9
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	12 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 209	Frequency	30-1000 MHz

Test method	ANSI C63.4:2003	Temperature	21 °C
Characteristics	Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Humidity	23 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49600 29797 29861 49183 49299 29678 29962	Uncertainty	4.9 dB

Frequency	Level	Transd	Limit	Margin	Height	Azimuth	Polarisation
MHz	dB μ V/m	dB	dB μ V/m	dB	cm	deg	
38.600000	19.80	14.5	40.0	20.2	105.0	270.00	VERTICAL
41.000000	18.30	13.3	40.0	21.7	104.0	224.00	VERTICAL
71.200000	15.20	9.0	40.0	24.8	138.0	272.00	VERTICAL
72.000000	13.00	9.0	40.0	27.0	120.0	123.00	VERTICAL
120.000000	14.30	13.1	43.5	29.2	104.0	272.00	VERTICAL
192.000000	15.70	10.8	43.5	27.8	104.0	320.00	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 4.4.1 Test setup regarding measurement of radiated emission, 30 to 1000 MHz.

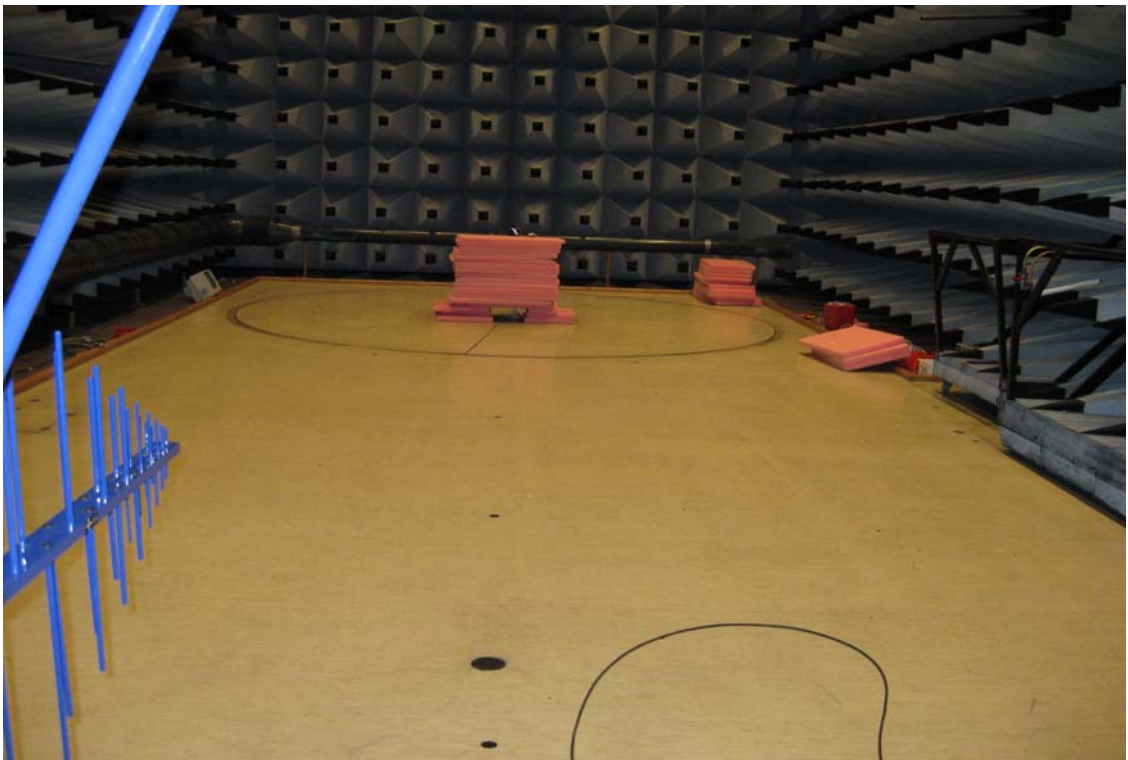
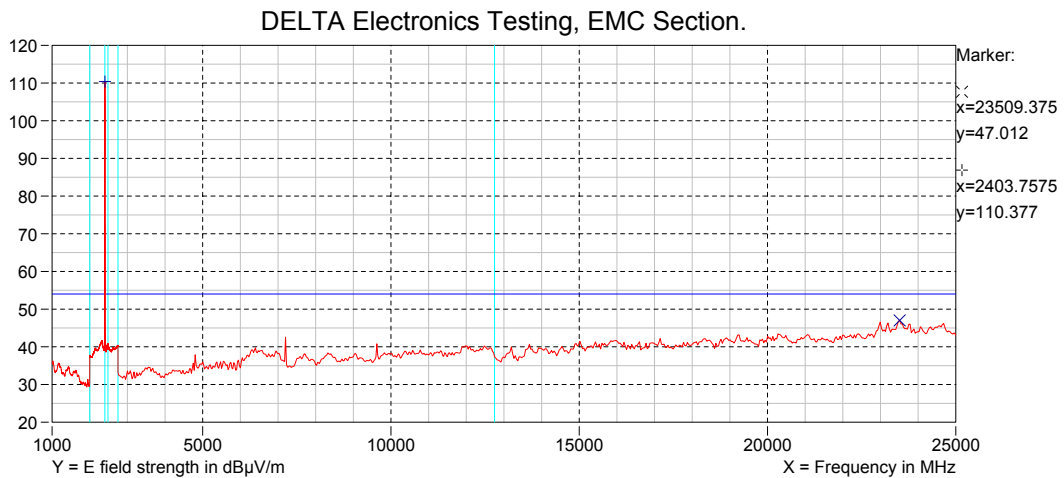


Photo 4.4.2 Test setup regarding measurement of radiated emission, 30 to 1000 MHz.

4.5 Measurement of radiated emission, 1 GHz to 25 GHz

Test object	SAS-1	Sheet	RE_Spur-10
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	5 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 209	Frequency	1-25 GHz

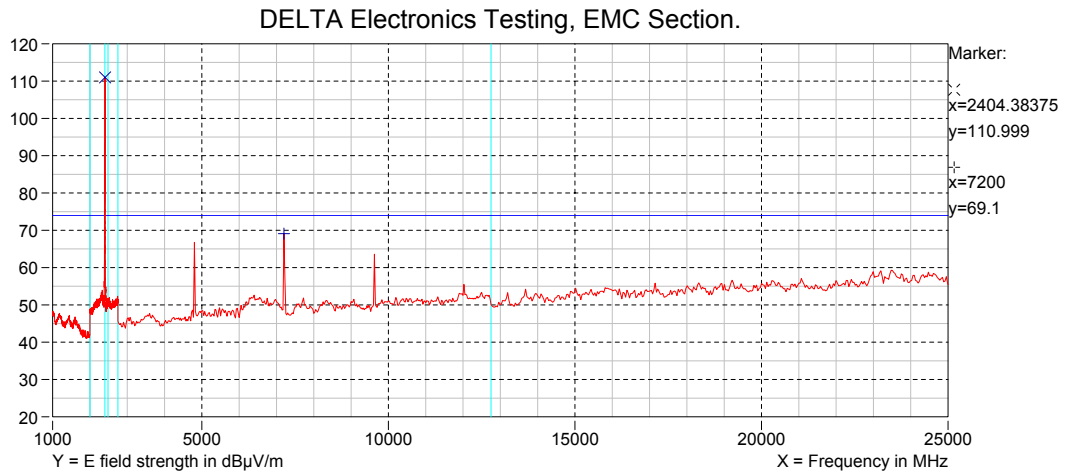
Test method	ANSI C63.4:2003	Temperature	22 °C
Characteristics	Complete search, Antenna distance 3 m.	Humidity	23 % RH
Detector	Peak and average for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49600 49624 49625 49183 49299 29678 29962	Uncertainty	4.9 dB



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 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.

Measured level at band edge

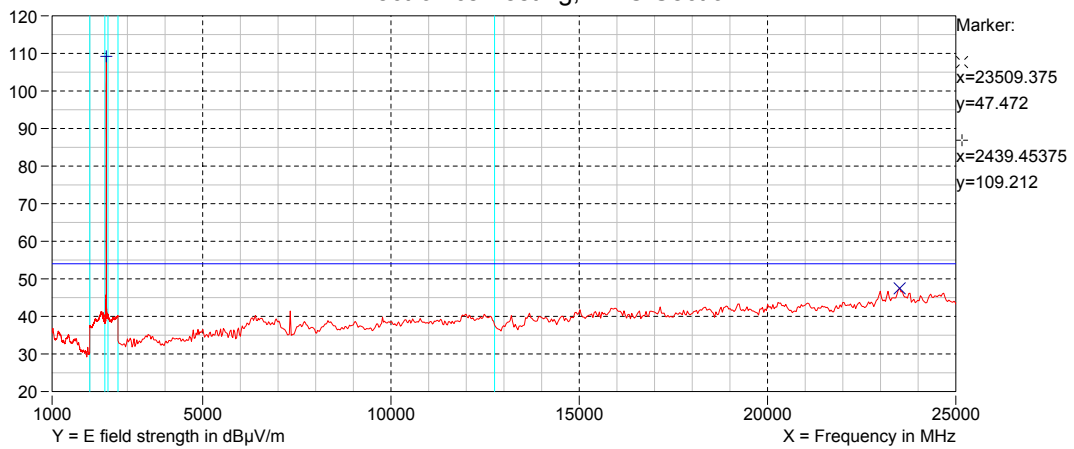
Band edge	2400 MHz	2483.5 MHz
Average	42.1 dBµV/m	42.1 dBµV/m
Peak	50.7 dBµV/m	67.5 dBµV/m



Test object	SAS-1	Sheet	RE_Spur-11
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	8 Mar. 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	ANSI C63.4:2003	Temperature	22 °C
Characteristics	Complete search, Antenna distance 3 m.	Humidity	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

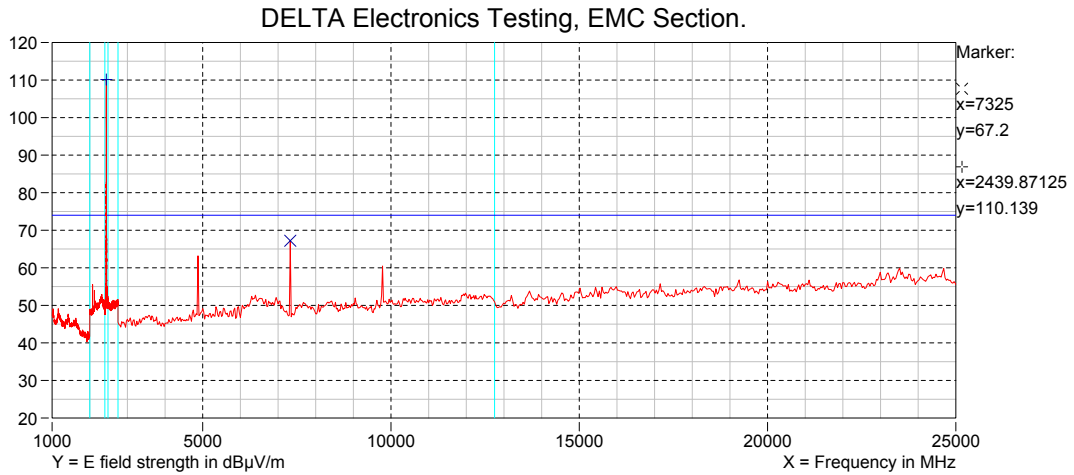
DELTA Electronics Testing, EMC Section.



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 2441 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.

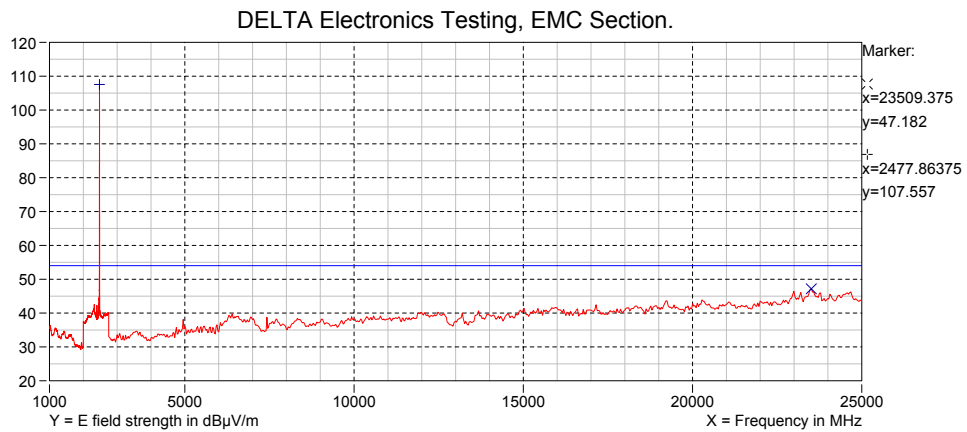
Measured level at band edge

Band edge	2400 MHz	2483.5 MHz
Average	38.8 dBµV/m	40.1 dBµV/m
Peak	48.7 dBµV/m	50.6 dBµV/m



Test object	SAS-1	Sheet	RE_Spur-12
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000167	Date	9 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.209	Frequency	1-25 GHz

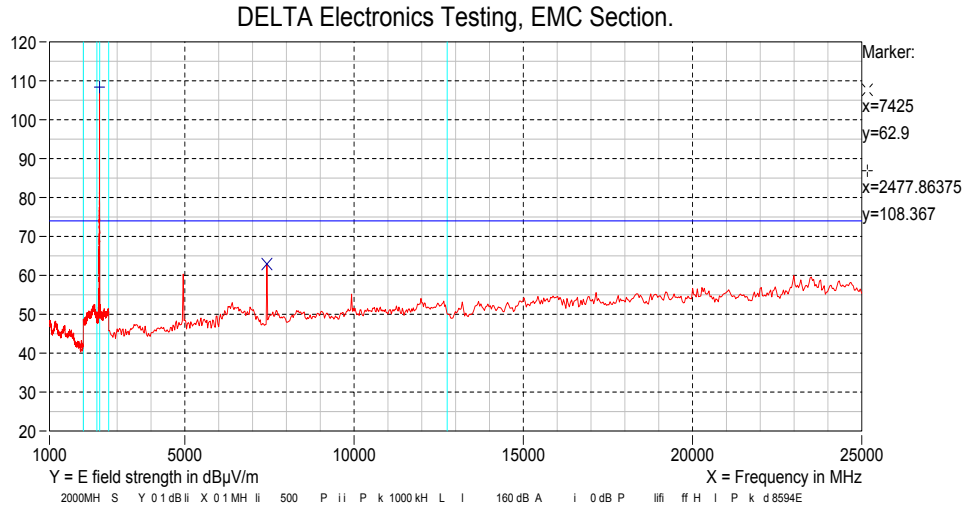
Test method	ANSI C63.4:2003	Temperature	22 °C
Characteristics	Complete search, Antenna distance 3 m.	Humidity	23 % RH
Detector	Peak and average for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49600 49624 49625 49183 49299 29678 29962	Uncertainty	4.9 dB



Polarization Horizontal and vertical

Comments Average





Polarization	Horizontal and vertical
Comments	Peak
Test result	The measured average field strengths are below the average limit corrected for duty cycle. The measured peak field strengths are below the peak limit corrected for duty cycle. (Peak limit = Average limit + 20 dB).
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.

Measured level at band edge

Band edge	2400 MHz	2483.5 MHz
Average	42.5 dBµ V/m	25.3 dBµ V/m
Peak	68.6 dBµ V/m	65.8 dBµ V/m



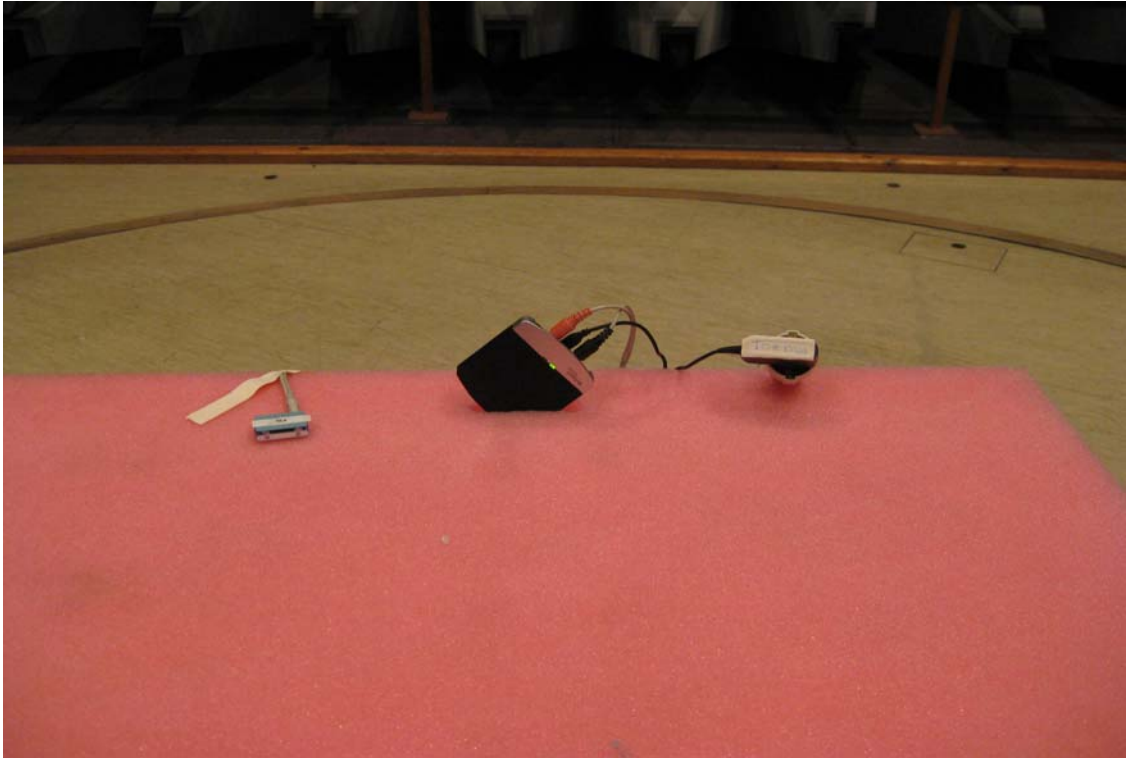


Photo 4.5.1 Test setup regarding measurement of radiated emission, 1 GHz to 25 GHz.

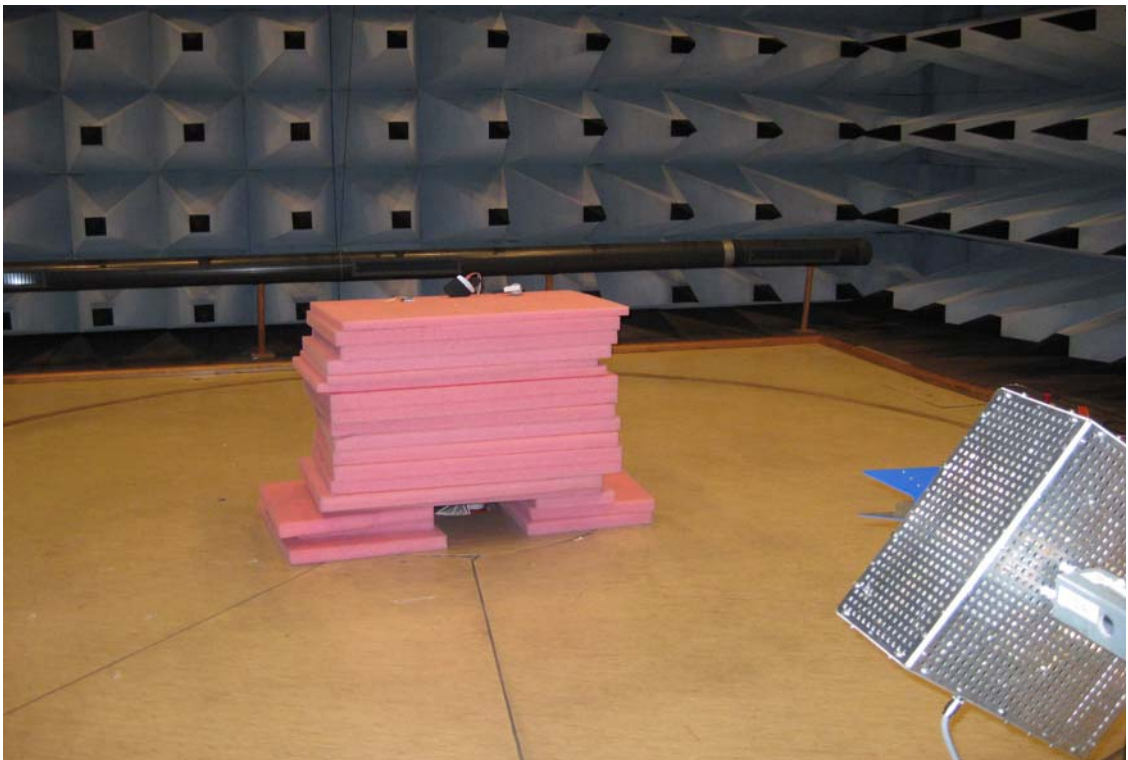


Photo 4.5.2 Test setup regarding measurement of radiated emission, 1 GHz to 25 GHz.

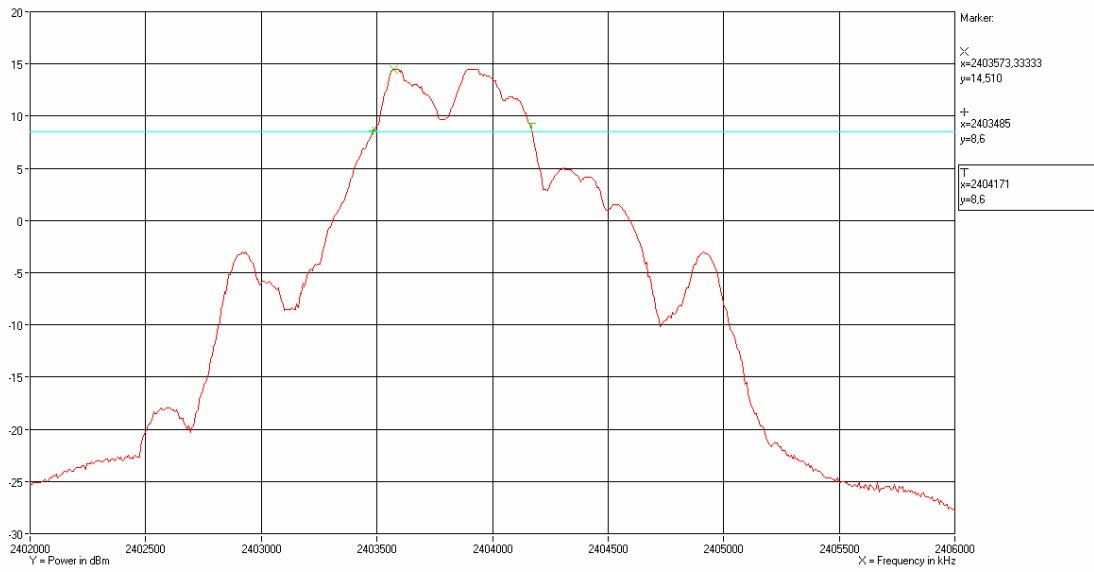
4.6 Measurement of the 6 dB bandwidth

Test object	SAS-1	Sheet	BW-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000144	Date	17 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(a)(2)		

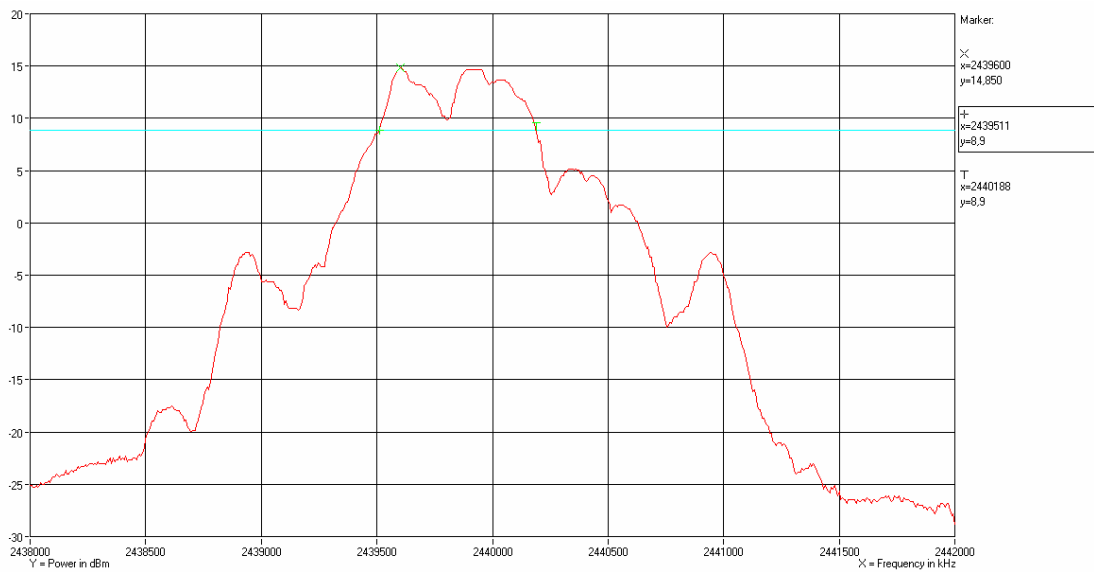
Test method	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005			
Characteristics	Temperature: 22°C. Test voltage: 5.0VDC			
Test equipm.	49321 49183 49299	Uncertainty 1.1 dB		
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 4 MHz DET: Peak CF: 2404 MHz, 2440 MHz, 2478 MHz Trace: Max Hold			
	Measured	Measured 6 dB bandwidth	Limit	Comment
Operating frequency:	2404 MHz			
Lowest frequency	2403.485 MHz	686 kHz	>500 kHz	Ok
Highest frequency	2404.171 MHz			
Operating frequency:	2441 MHz			
Lowest frequency	2439.511 MHz	677 kHz	>500 kHz	Ok
Highest frequency	2440.188 MHz			
Operating frequency:	2478 MHz			
Lowest frequency	2477.519 MHz	678 kHz	>500 kHz	Ok
Highest frequency	2478.197 MHz			
Note 1:				

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



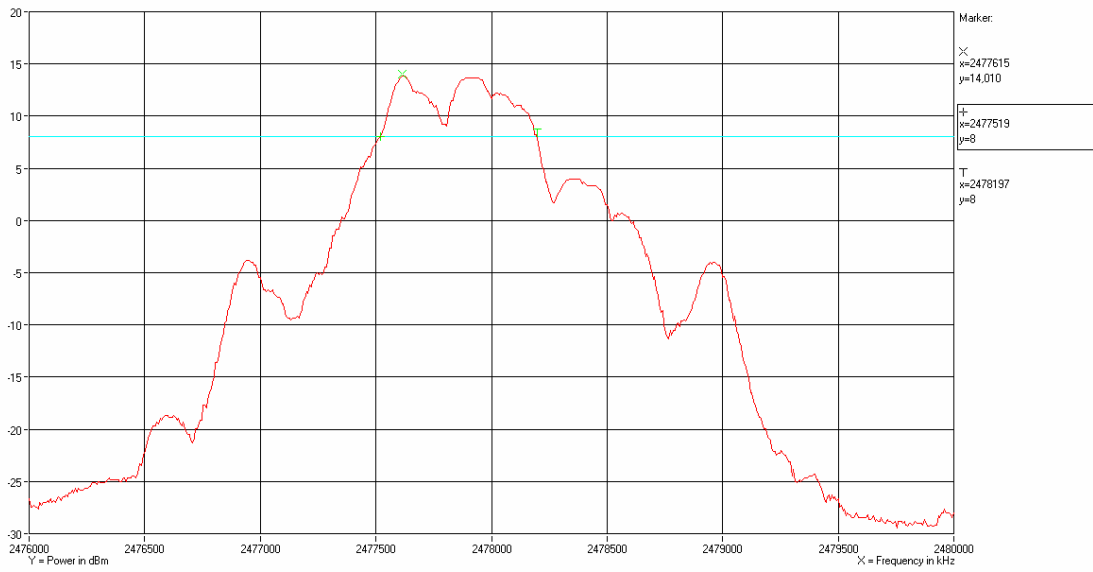


Test frequency 2404 MHz



Test frequency 2441 MHz





Test frequency

2478 MHz



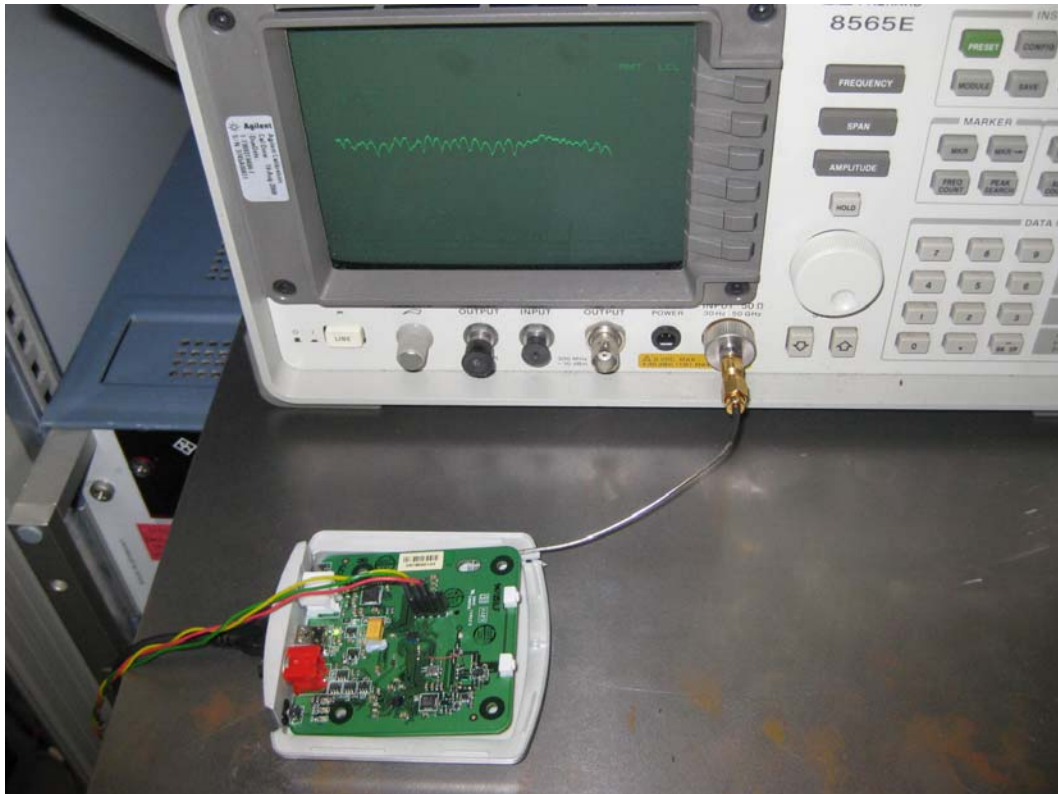


Photo 4.6.1 Test setup regarding measurement of the 6 dB bandwidth.



Photo 4.6.2 Test setup regarding measurement of the 6 dB bandwidth.



4.7 Measurement of conducted power output

Test object	SAS-1	Sheet	CP-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000144	Date	17 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(b)(3)		

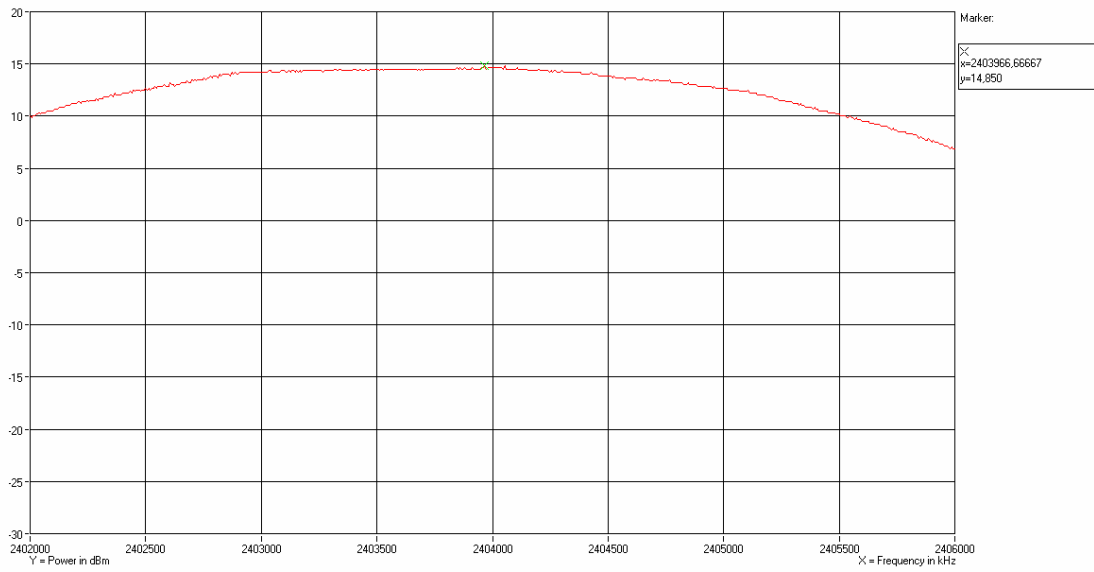
Test method	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005		
Characteristics	Temperature: 22°C. Test voltage: 5.0V DC		
Test equipm.	49321 49183 49299	Uncertainty 1.1 dB	
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: 4 MHz DET: Peak CF: 2404 MHz, 2440 MHz, 2478 MHz Trace: Max Hold		
Test result	Measured	Limit	Comment
Operating frequency:	2404 MHz		
Lowest frequency	14.85 dBm	<30 dBm	Ok
Operating frequency:	2441 MHz		
Lowest frequency	15.18 dBm	<30 dBm	Ok
Operating frequency:	2478 MHz		
Lowest frequency	14.35 dBm	<30 dBm	Ok
Note 1:			

Test modulation Continuous Tx - normal modulation - hopping on

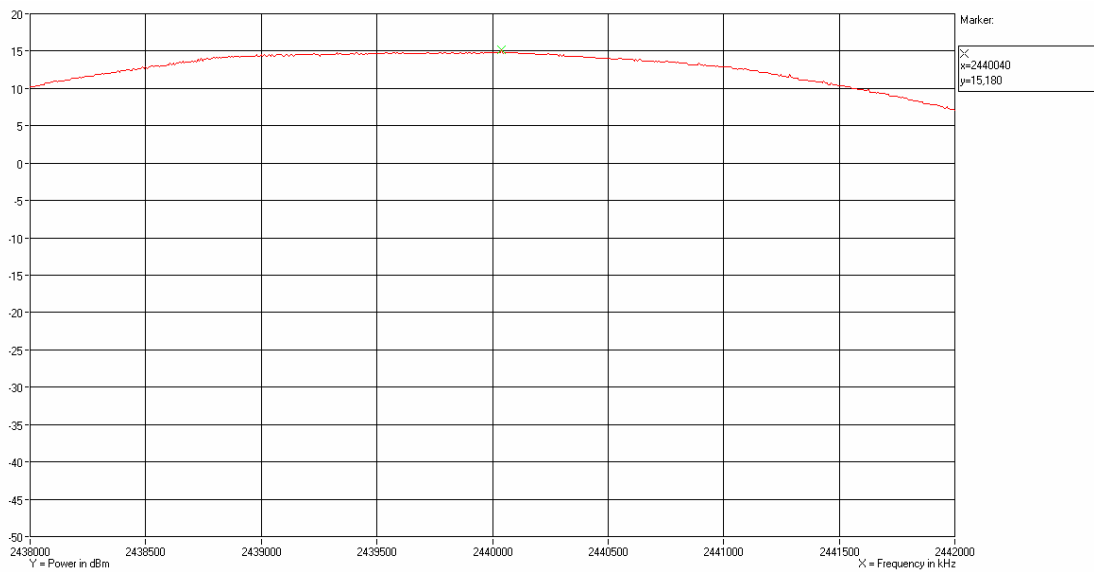
Compliant Yes

Comments Conducted measurement



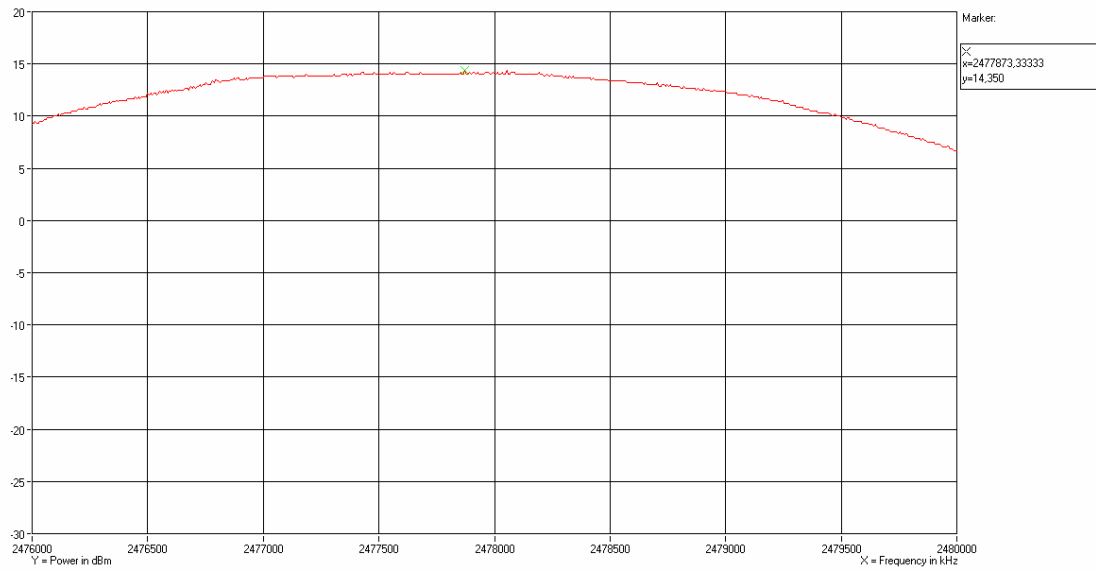


Test frequency 2404 MHz



Test frequency 2441 MHz





Test frequency 2478 MHz



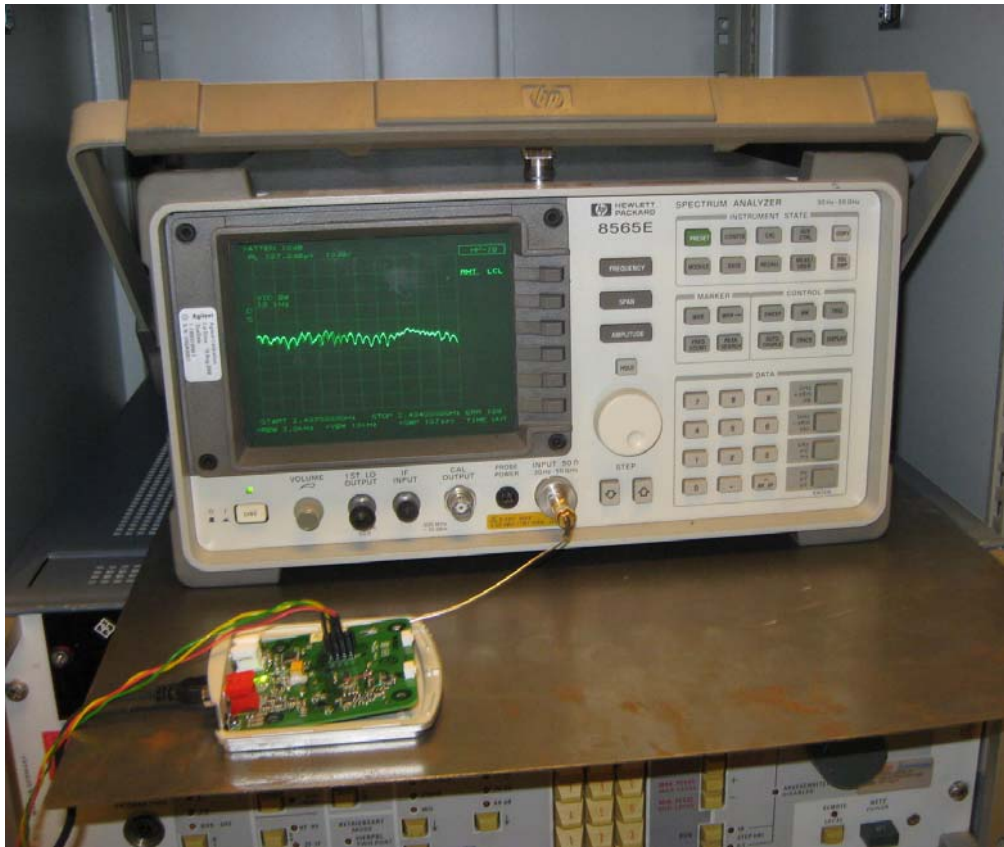


Photo 4.7.1 Test setup regarding measurement of conducted power output.

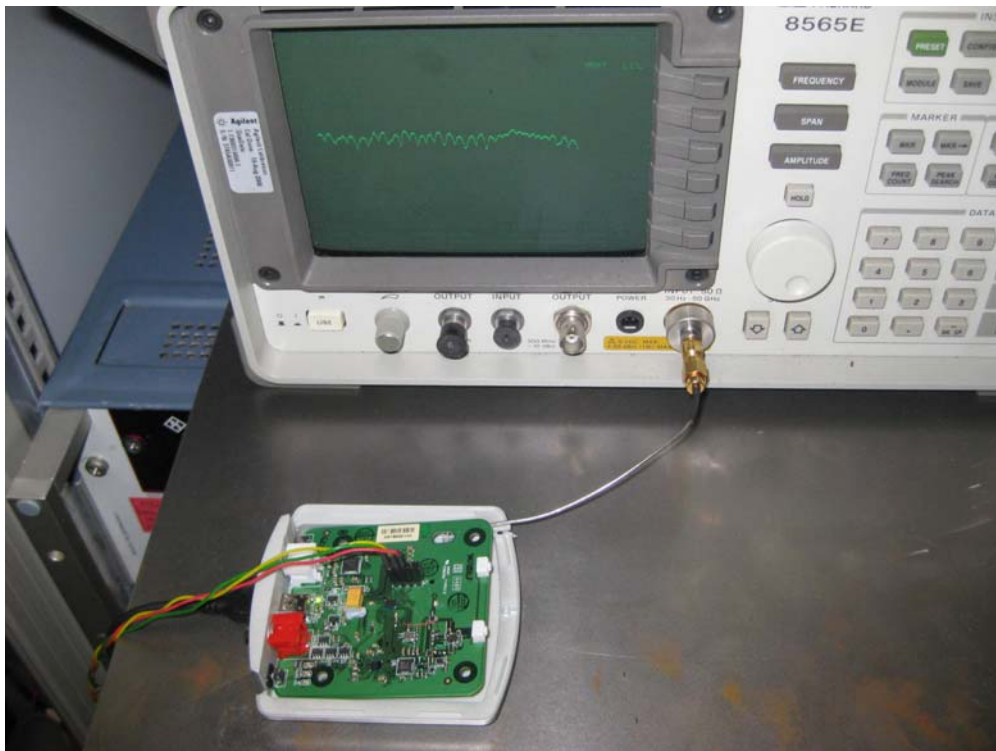


Photo 4.7.2 Test setup regarding measurement of conducted power output.

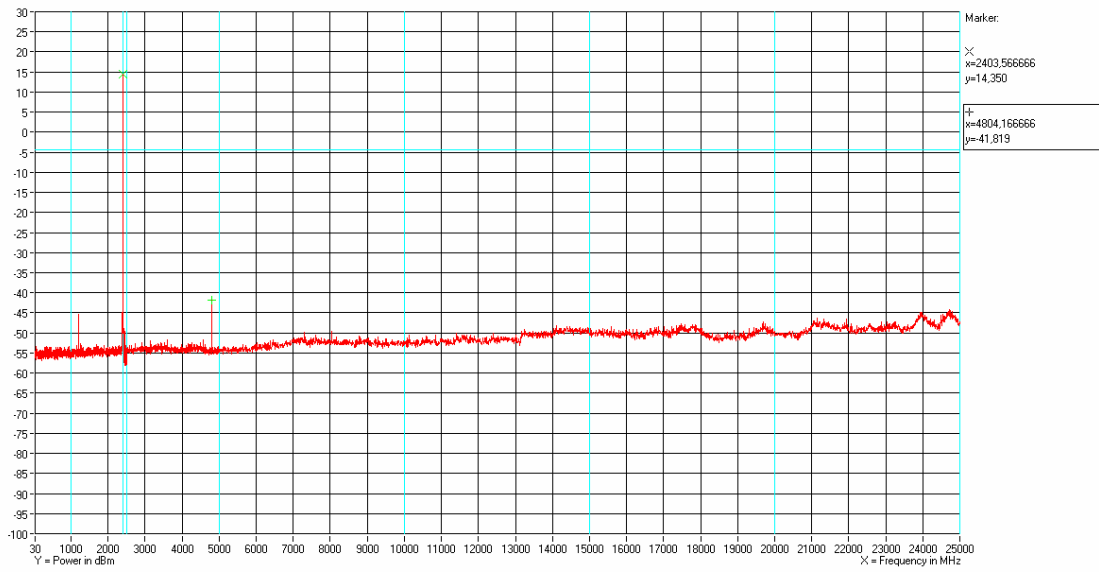


4.8 Measurement of conducted spurious emissions

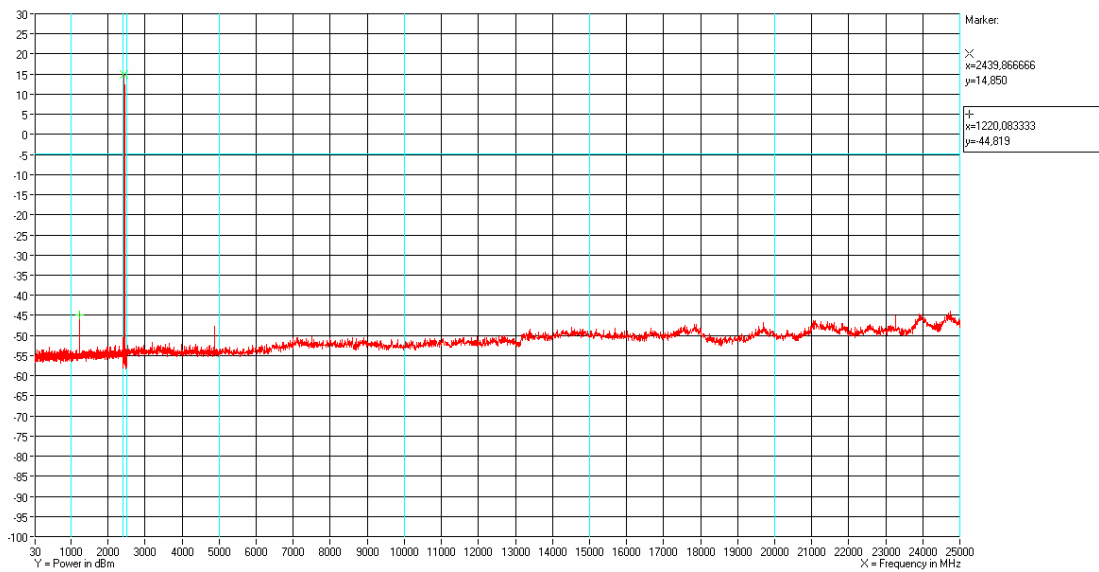
Test object	SAS-1	Sheet	Con_spur-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000144	Date	17 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(c)		

Test method	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005		
Characteristics	Temperature: 22 °C. Test voltage: 5.0 V DC		
Test equipm.	49321 49183 49299	Uncertainty 1.1 dB	
SA Settings	RBW: 100 KHz VBW: 300 kHz SPAN: 24970 MHz DET: Peak CF: 12515 MHz Trace: Max Hold		
Note 1:			

Test result	The measured conducted spurious emissions were within the level designated in 15.247(c)
Test modulation	Continuous Tx - normal modulation - hopping on
Compliant	Yes
Comments	Conducted measurement

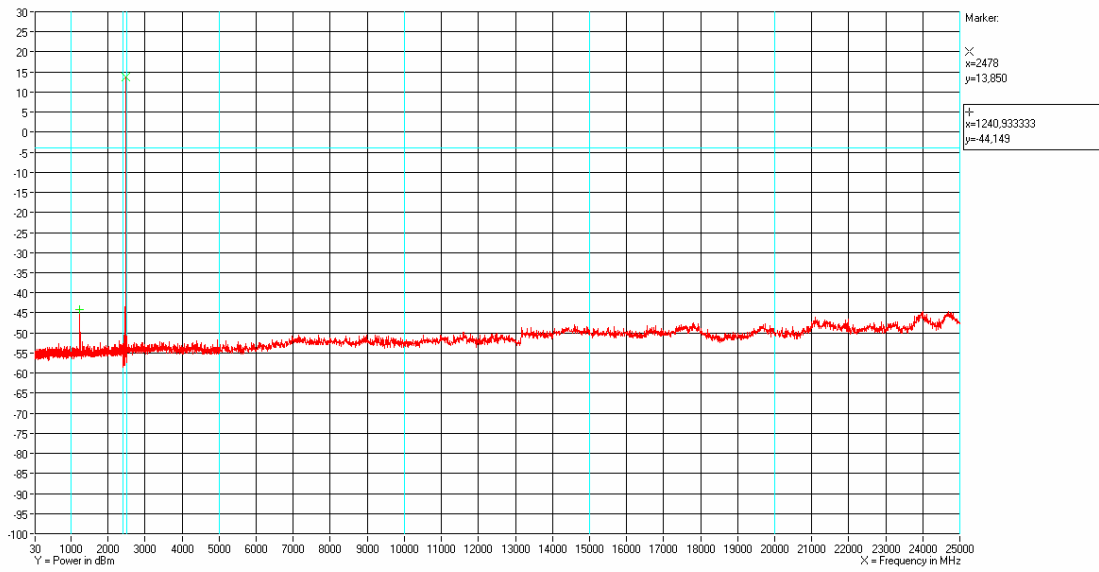


Test frequency 2404 MHz



Test frequency 2441 MHz





Test frequency 2478 MHz





Photo 4.8.1 Test setup regarding measurement of conducted spurious emission.



Photo 4.8.2 Test setup regarding measurement of conducted spurious emission.

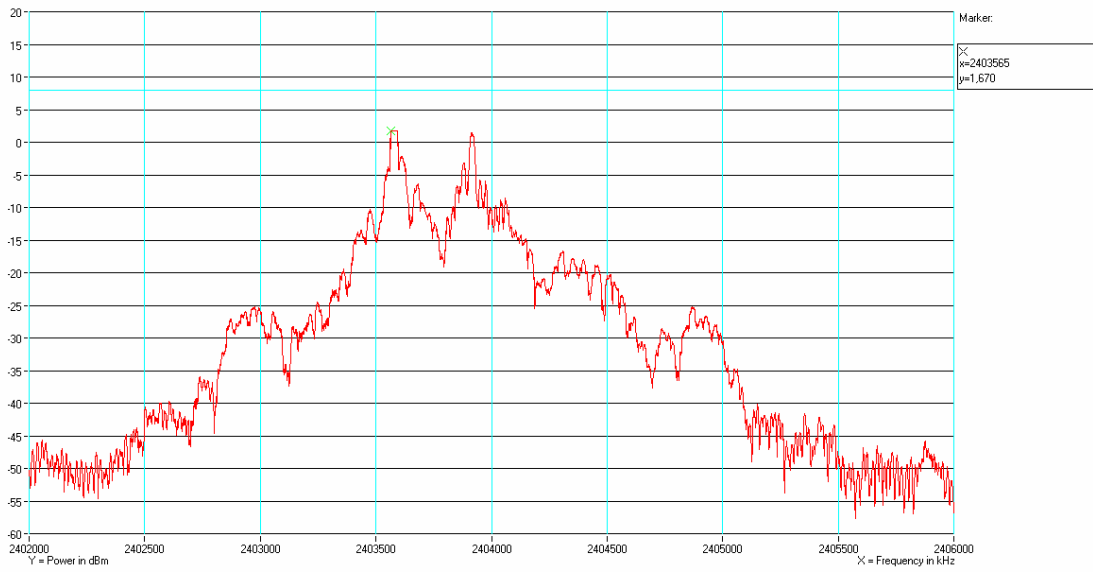


4.9 Measurement of power spectral density

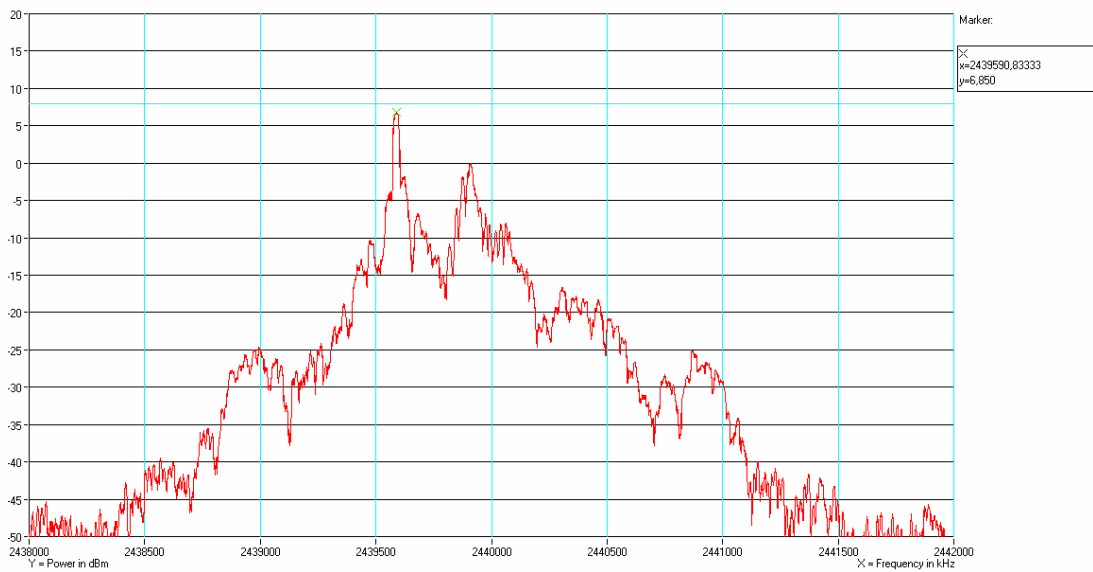
Test object	SAS-1	Sheet	PSD-1
Type	SAS-1	Project no.	A506404-1
Serial no.	0979000144	Date	18 Mar. 2010
Client	GN Hearing A/S	Initials	CMT
Specification	FCC CFR 47 Part 15, Subpart C, Section 15.247(d)		

Test method	Measurement of Digital Transmission System operating under section 15.247, March 23, 2005		
Characteristics	Temperature: 22 °C. 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	The measured power spectral density was within the level designated in 15.247(d)
Test modulation	Continuous Tx - normal modulation - hopping on
Compliant	Yes
Comments	Conducted measurement

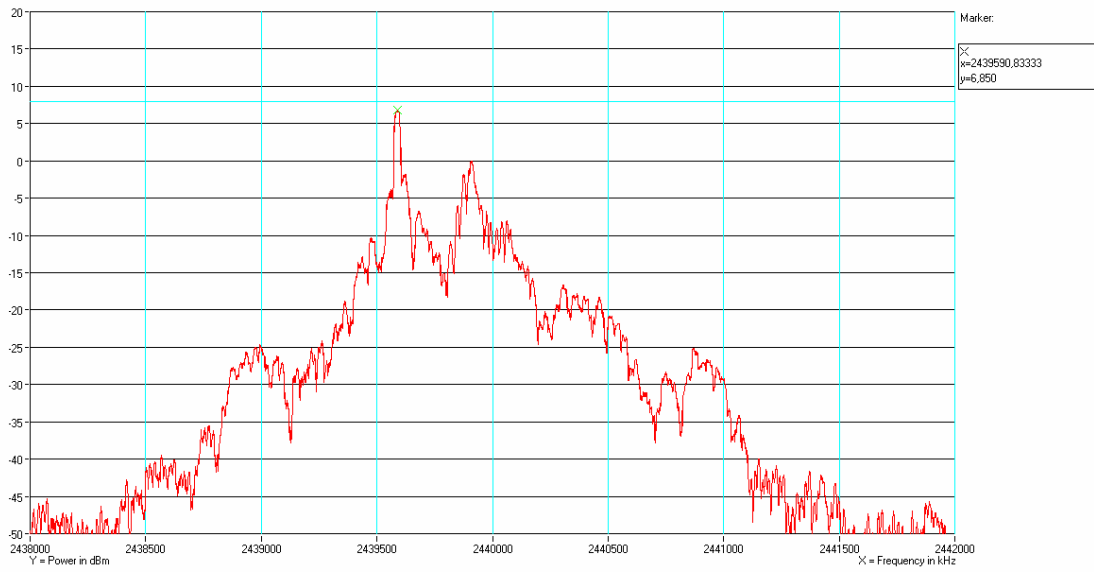


Test frequency 2404 MHz



Test frequency 2441 MHz





Test frequency 2478 MHz





Photo 4.9.1 Test setup regarding measurement of power spectral density.

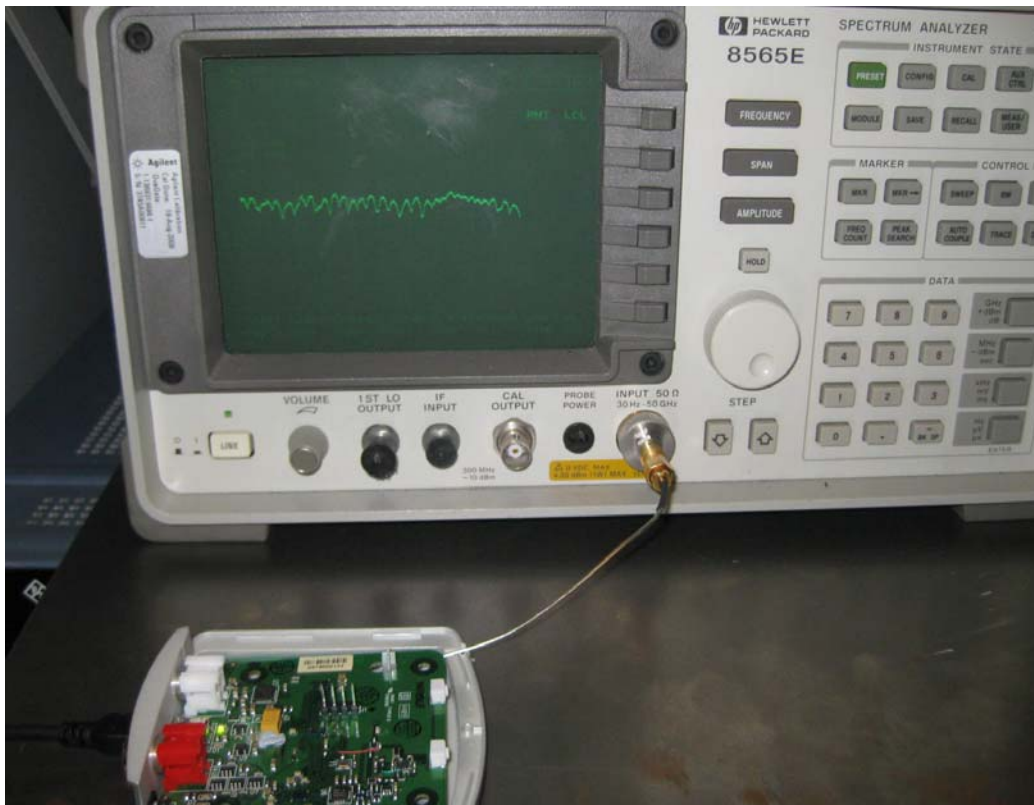


Photo 4.9.2 Test setup regarding measurement of power spectral density.



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 ANALYZER	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	08-05-2008	2 years

