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DELTA Test Report

TEST Reg. no. 19

Radio parameter test of SAS-3 according to FCC and IC specifications

Performed for GN Hearing A/S

DANAK-19/13230
Project no.: T205852-3

12 July 2013

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Title	Radio parameter test of SAS-3 according to FCC and IC specifications
Test object	SAS-3
Report no.	DANAK-19/13230
Project no.	T205852-3
Test period	24 June 2013 to 08 July 2013
Client	GN Hearing A/S Lautrupbjerg 7 DK-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 chapter 1 Summary of tests
Results	The test object was found to be in compliance with the specifications, as listed in Section 1
Test personnel	Peter Wolf Frandsen
Test site(s)	DELTA, Venlighedsvej 4, 2970 Hørsholm, Denmark

Date 12 July 2013

Project Manager

Peter Wolf Frandsen
Specialist, CTE
DELTA

Responsible

Claus Rømer Andersen
Business Manager, Consulting
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1. Summary of tests

The authorization procedures for the SAS-3 are:

- Declaration of Conformity by FCC Part 15 B, Class B (residential use).
- Certification by FCC Part 15 C.

Description	Test methods	Specification	Results
Measurement of radio frequency voltage on mains	ANSI C63.10:2009	47 CFR Part 15 B&C Subpart 15.107 15.207	Passed
Measurement of radiated emission	ANSI C63.10:2009	47 CFR Part 15 B&C Subpart 15.109 15.209 RSS-210, 2.5 RSS-Gen, 7.2.2	Passed
Measurement of maximum conducted output power	ANSI C63.10:2009	47 CFR Part 15C Subpart 15.247(b)(3) RSS-210, A8.4.4	Passed
Measurement of 6 dB bandwidth	ANSI C63.10:2009	47 CFR Part 15C Subpart 15.247(a)(2) RSS-210, A8.2.a	Passed
Measurement of 20 dB bandwidth	ANSI C63.10:2009	47 CFR Part 15C Subpart 15.215(c)	Passed
Measurement of band edge compliance	ANSI C63.10:2009	47 CFR Part 15C Subpart 15.205 15.209 15.247(d) RSS-210, 2.5 and A8.5	Passed
Measurement of conducted spurious emission	ANSI C63.10:2009	47 CFR Part 15C Subpart 15.247(d) RSS-210, A8.5	Passed
Measurement of power spectral density	ANSI C63.10:2009	47 CFR Part 15C Subpart 15.247(e) RSS-210, A8.2.b	Passed
Measurement of occupied bandwidth, IC	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 B, Class B
- 47 CFR Part 15, Subpart C (Specific rule part §15.247)
- RSS-210, Issue 8:2010
- RSS-Gen, Issue 3:2010

The test results relate only to the objects tested.

2. Test objects and auxiliary equipment

2.1 Test objects

Photo 2.1.1 Test objects.

Test object 2.1.1

Name of test object	SAS-3
Model / type	SAS-3
Part no.	SAS-3
Serial no.	B5-255
FCC ID	X26SAS-3
Manufacturer	GN Hearing A/S
Supply voltage	5 VDC through USB adaptor
Software version	Spurious emission firmware
Hardware version	-
Cycle time	1.5 ms
Highest frequency generated or used	2483.5 MHz
Comment	Radiated version

Test object 2.1.2

Name of test object	SAS-3
Model / type	SAS-3
Part no.	SAS-3
Serial no.	B5-185
FCC ID	X26SAS-3
Manufacturer	GN Hearing A/S
Supply voltage	5 VDC through USB adaptor
Software version	Spurious emission firmware
Hardware version	-
Cycle time	1.5 ms
Highest frequency generated or used	2483.5 MHz
Comment	Antenna replaced with SMA connector

2.2 Auxiliary equipment

Photo 2.2.1 Auxiliary equipment.

Auxiliary equipment 2.2.1

Name of auxiliary equipment	AC/DC adaptor
Model / type	FW7713
Part no.	-
Serial no.	0912K
FCC ID	-
Manufacturer	I.T.E power Supply
Supply voltage	100-240 VAC
Highest frequency generated or used	-
Comment	None

3. General test conditions

3.1 Test setup during test

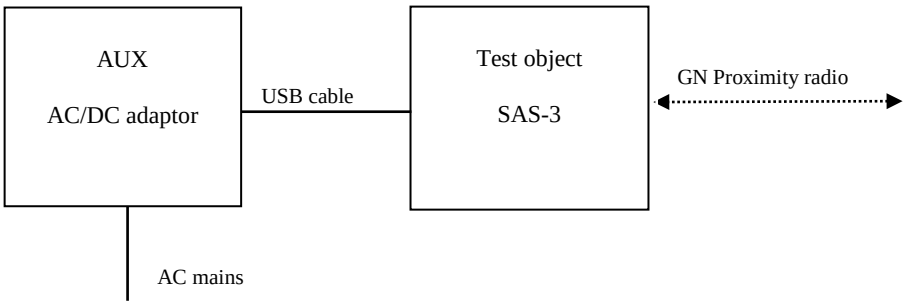


Figure 3.1.1 Block diagram of test object with cables and auxiliary equipment.

3.1.1 Description and intended use of test object

SAS-3 is used to stream audio from an audio source (e.g. a TV) to hearing aids.

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).

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

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

During relevant tests, the external DC power supply was used.

3.2 Radio specifications, receiver and transmitter, GN radio

Test object	SAS-3	Sheet	ANT-1
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	11 June 2013
Client	GN Hearing A/S		
Specification	See chapter 1 Summary of tests		

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 2478 MHz
Antenna	:	Permanently attached PCB antenna
Maximum gain	:	6.1 dBi
Conducted power, max avg.	:	9.5 dBm
Conducted power, max pk.	:	17.8 dBm
Power level	:	No
No. of channels	:	20
Bandwidth	:	
Occupied bandwidths (99 %)	:	2.1 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	:	5 VDC through a PSU with USB port
Specified min voltage	:	4.4 VDC
Specified max voltage	:	5.5 VDC
Temperature category	:	-20 to +55 ºC.
Emission Designator	:	2M10F7E
Max. TX spurious emission, average	:	202 (µV/m) @ 3 meter (Field Strength)
Max. TX spurious emission, peak	:	1365 (µV/m) @ 3 meter (Field Strength)

4. Test results

4.1 Duty cycle correction factor (δ)

Test object	SAS-3	Sheet	ANT-2
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	26 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: 5 VDC	Temperature Humidity	24 °C 53 % RH
Test equipm.	SRD lab Hørsholm 49183 49299	Uncertainty	0.01 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: Zero-1ms DET: Peak CF: 2440 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: 216 µs – Delta 3 (T1)

Period: 1456 µs – Delta 2 (T1).

The calculated duty cycle expressed in % is:

D(%) ((Max. Tx on time) µs / (period) µs) • 100% = 14.8 %.

The calculated duty cycle correction factor expressed in dB is:

δ(dB): 20 log (Max. Tx on time (µs) / period (µs)) = -16.6 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).

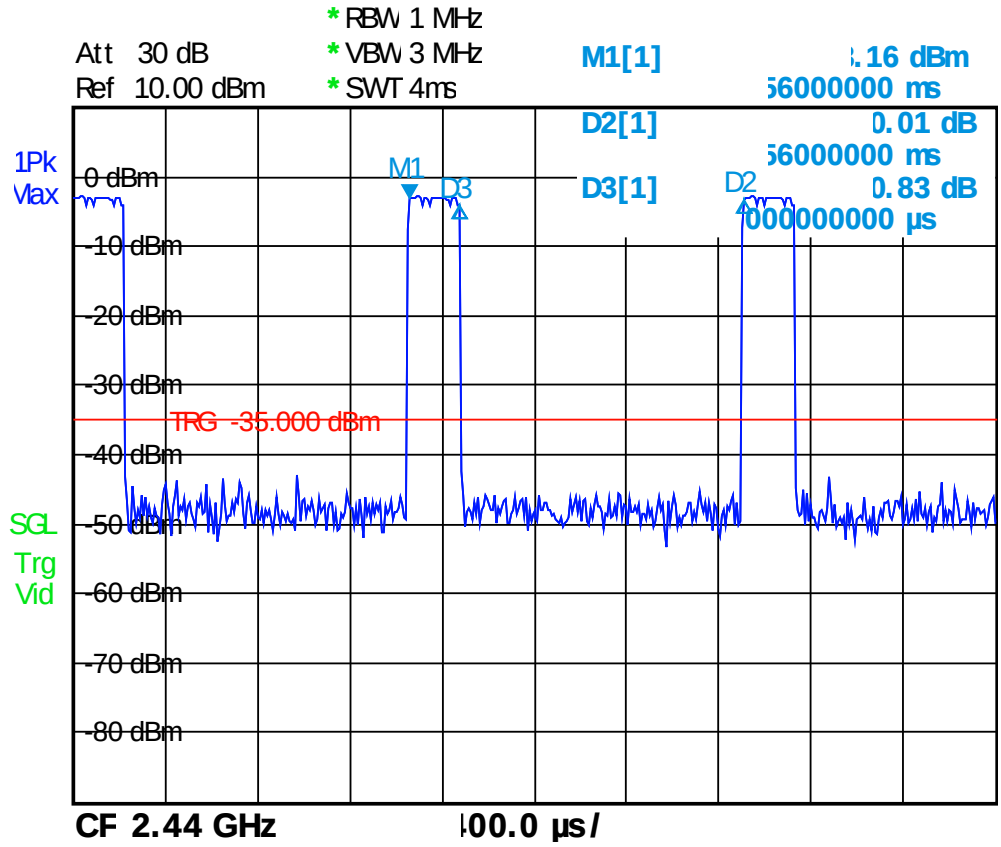
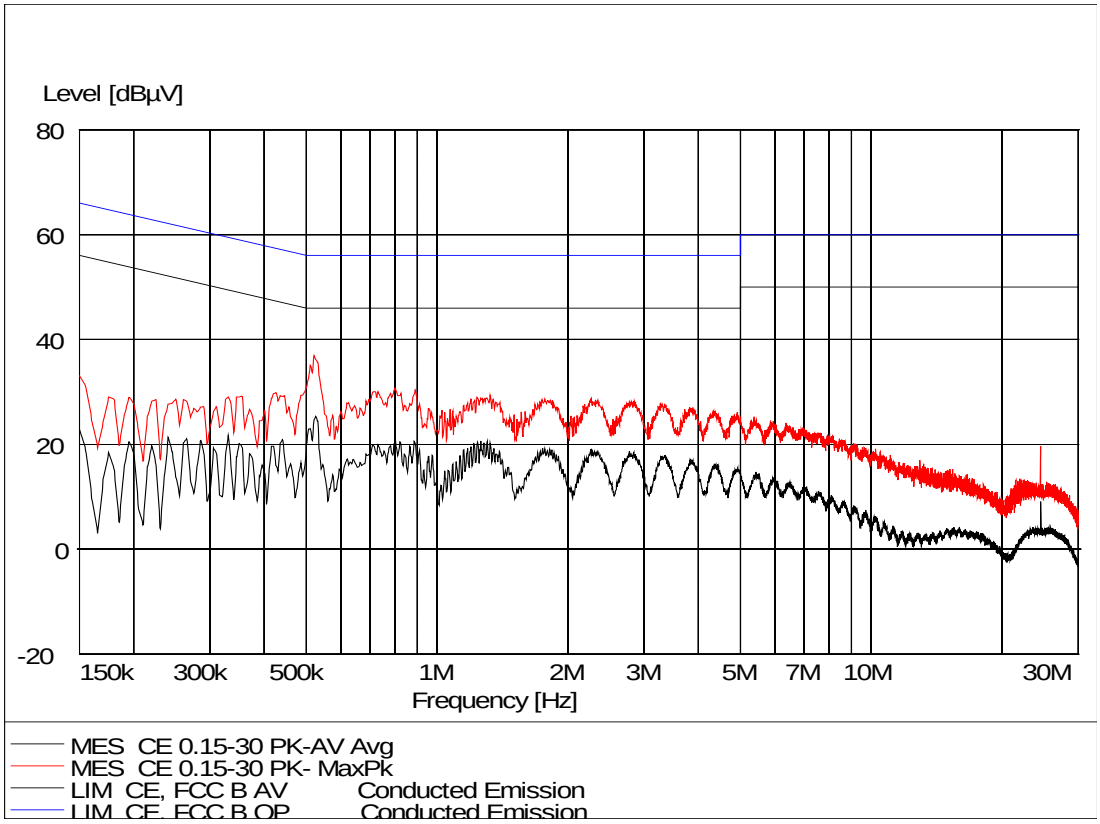


Photo 4.1.1 Test setup regarding duty cycle correction factor (δ) .

4.2 Measurement of radio frequency voltage on mains

Test object	SAS-3	Sheet	CE-1
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	26 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	0.15-30 MHz

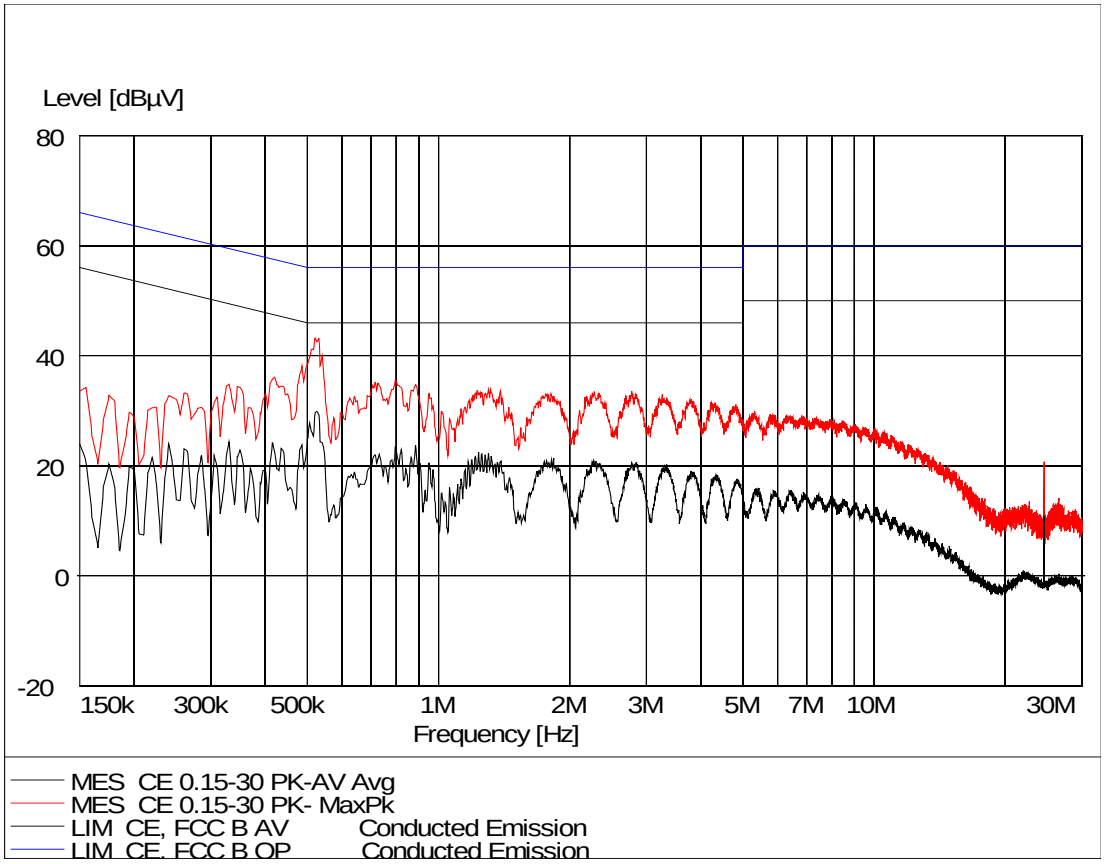
Test method Characteristics	ANSI C63.10:2009 Artificial mains network: 50 Ω, 50 µH	Temperature Humidity	24 °C 54 % RH
Detector	Peak and average	Bandwidth	10 kHz
Test equipm.	EMI room Hørsholm 29301 49421 49600 29861	Uncertainty	2.7 dB



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

Test object	SAS-3	Sheet	CE-2
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	26 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	0.15-30 MHz

Test method Characteristics	ANSI C63.10:2009 Artificial mains network: 50 Ω, 50 µH	Temperature Humidity	24 °C 54 % RH
Detector	Peak and average	Bandwidth	10 kHz
Test equipm.	EMI room Hørsholm 29301 49421 49600 29861	Uncertainty	2.7 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.

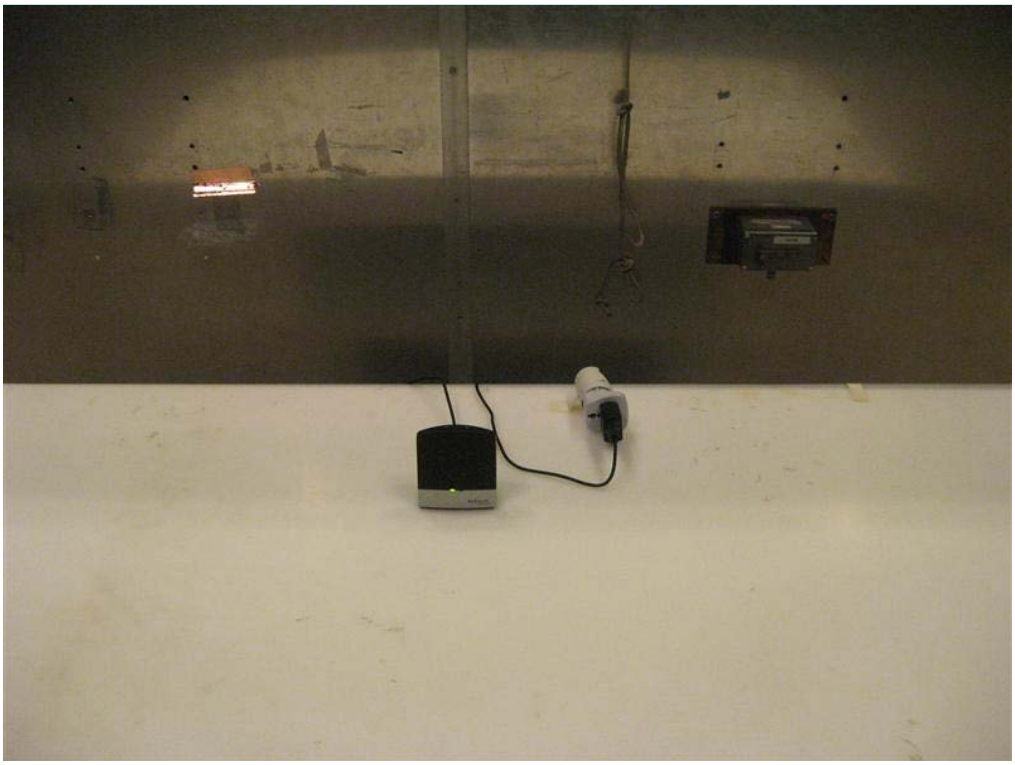
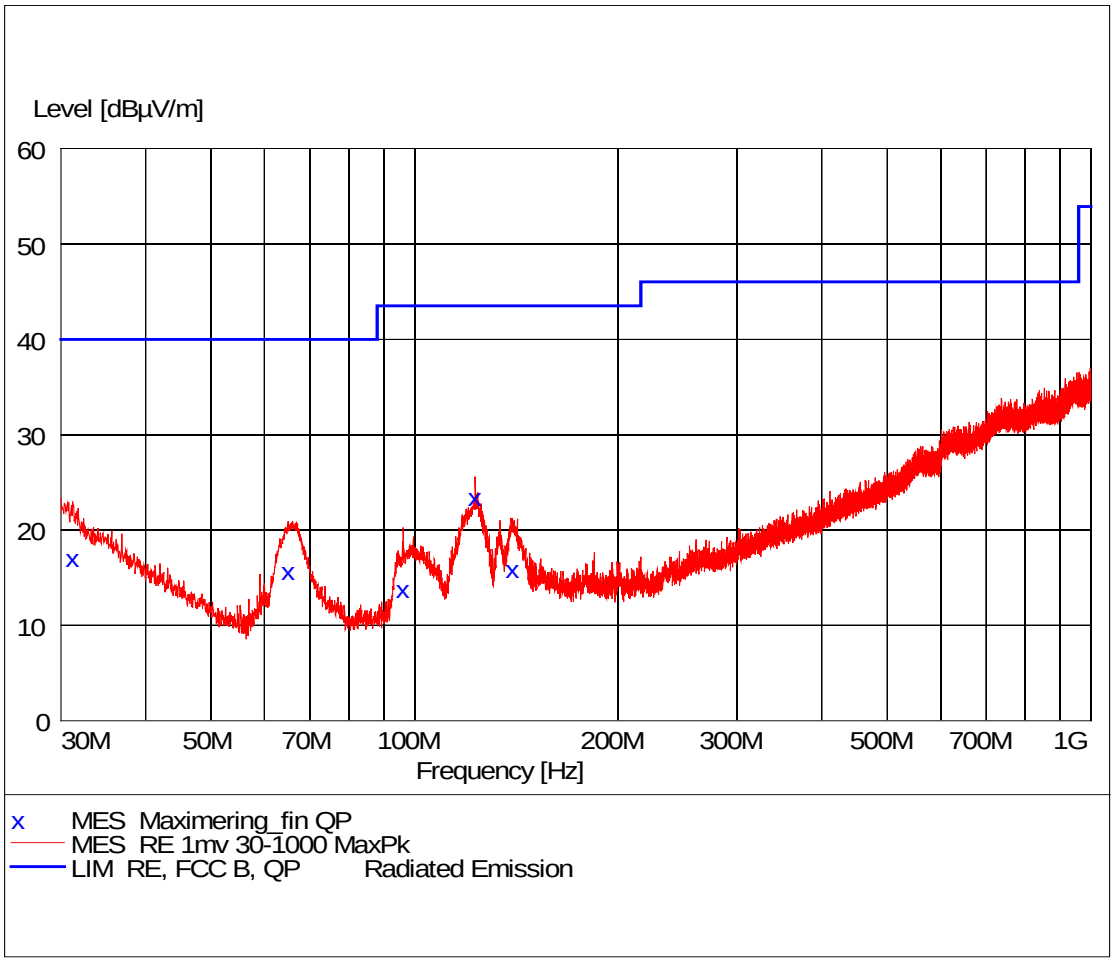


Photo 4.2.2 Test setup regarding measurement of radio frequency voltage on mains.

4.3 Measurement of radiated emission (below 1 GHz)

Test object	SAS-3	Sheet	RE_Spur-1
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	25 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	30-1000 MHz

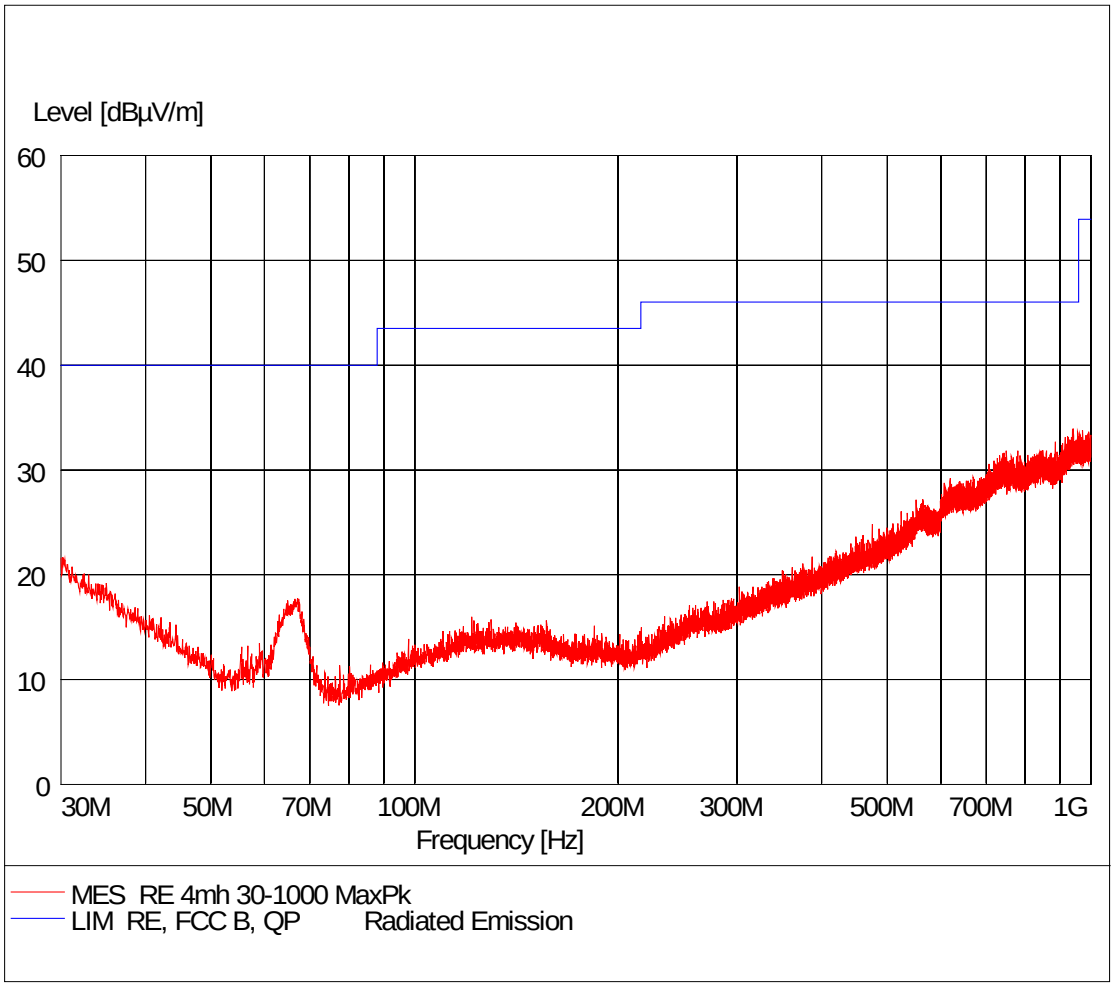
Test method	ANSI C63.10:2009	Temperature	23 °C
Characteristics	Pre-scan, Antenna at 3 m, 1 m height, vert. pol.	Humidity	54 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29301 29861 49600 29797	Uncertainty	4.9 dB



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

Test object	SAS-3	Sheet	RE_Spur-2
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	25 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	30-1000 MHz

Test method	ANSI C63.10:2009	Temperature	23 °C
Characteristics	Pre-scan, Antenna at 3 m, 4 m height, hor. pol.	Humidity	54 % RH
Detector	Peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29301 29861 49600 29797	Uncertainty	4.9 dB



Comments: Continuous Tx - normal modulation - hopping between lowest and highest operating freq.

Test object	SAS-3	Sheet	RE_Spur-3
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	25 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	30-1000 MHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Peak search ant. at 3 m, height: 1-4 m, v/h pol.	Humidity	53 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 29301 29861 49600 29797	Uncertainty	4.9 dB

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
31.200000	17.20	18.4	40.0	22.8	101.0	38.00	vertical
64.980000	15.90	6.6	40.0	24.1	101.0	358.00	vertical
96.240000	14.00	10.8	43.5	29.5	101.0	1.00	horizontal
122.890000	23.60	13.1	43.5	19.9	103.0	197.00	vertical
139.675000	16.10	13.3	43.5	27.4	101.0	1.00	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 lowest and highest operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation. Test voltage: Powered through USB port by AUX AC/DC adaptor.

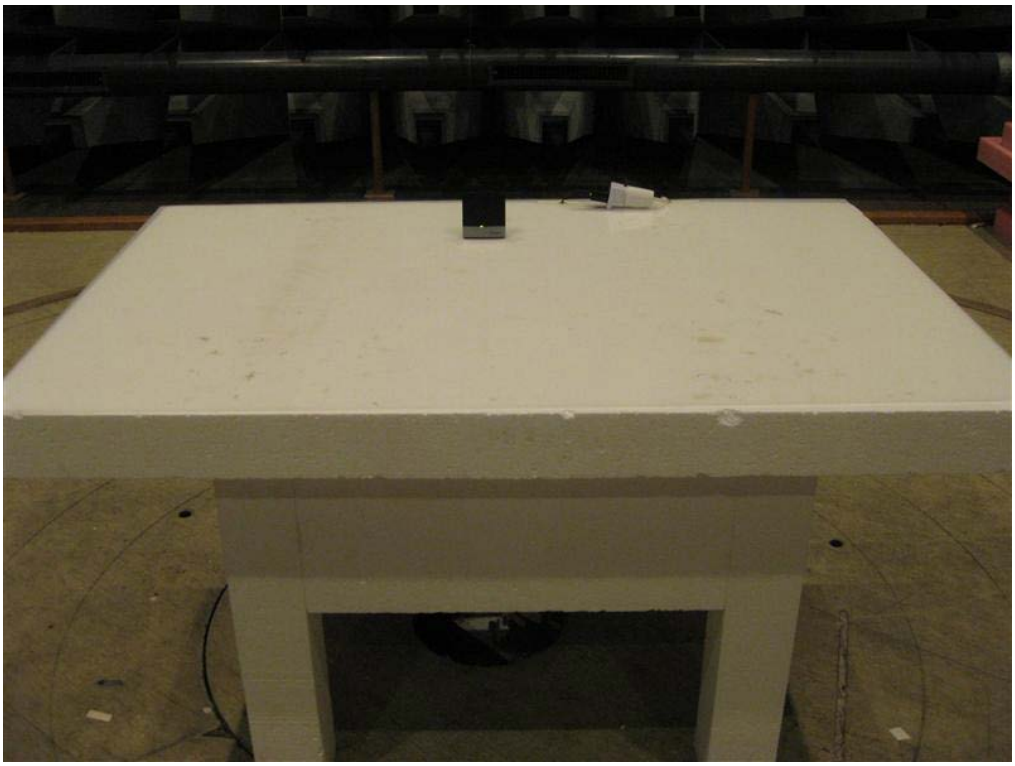


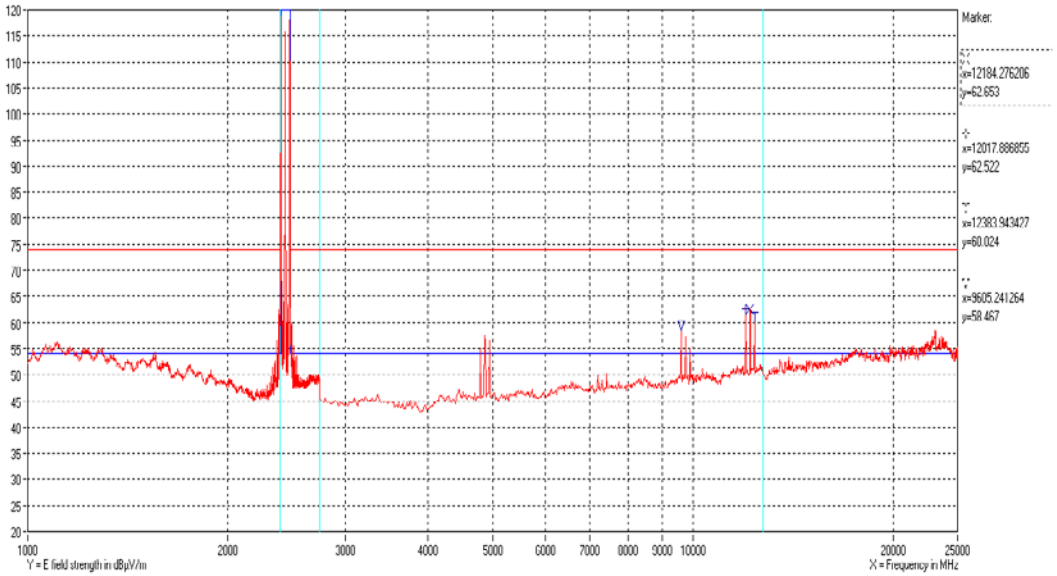
Photo 4.3.1 Test setup regarding measurement of radiated emission (below 1 GHz).

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

4.4 Measurement of radiated emission (above 1 GHz)

Test object	SAS-3	Sheet	RE_Spur-4
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	26 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	1-25 GHz

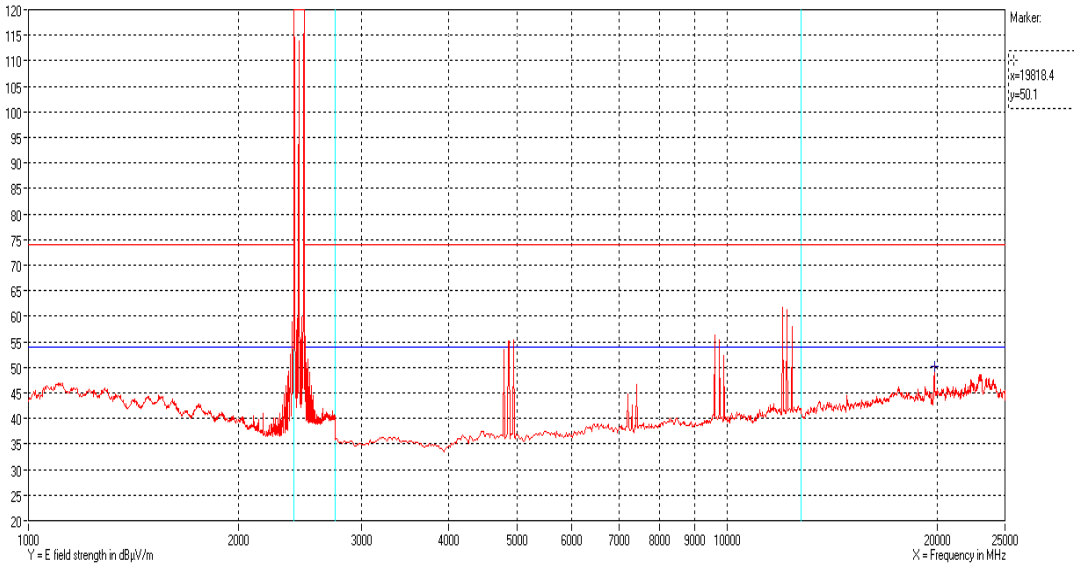
Test method Characteristics	ANSI C63.10:2009 Complete search, Antenna distance 3 m.	Temperature Humidity	24 °C 54 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49624 49625	Uncertainty	4.9 dB



Polarization	Vertical and horizontal peak measurements
Comments	Continuous Tx - normal modulation - hopping between low, mid and high operating freq. In the frequency range below 2 GHz and above 10 GHz, the peak noise floor is above the 54 dBµV/m average limit and this peak noise floor is generated by the measurement setup. Measured with 1 MHz video BW.

Test object	SAS-3	Sheet	RE_Spur-5
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	26 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 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 54 % 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



Polarization	Vertical and horizontal peak measurements
Comments	Continuous Tx - normal modulation - hopping between low, mid and high operating freq. Measured with 30 kHz Video BW to reduce the noise floor and show that no harmonics are present below 2 GHz and above 10 GHz.

Test object	SAS-3	Sheet	RE_Spur-6
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-255	Date	26 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 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 54 % 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]	Transducer factor [dB]	Peak measurement [dBµV/m]	Peak limit [dBµV/m]	DCCF (δ) [dB]	Corrected average measurement [dBµV/m]	Average limit [dBµV/m]	Remarks
4797	61.1	55.2	74	-16.6	38.6	54	Passed
4863	60.9	57.4	74	-16.6	40.8	54	Passed
4946	60.8	56.6	74	-16.6	40.0	54	Passed
9605	49.9	58.5	74	-16.6	41.9	54	Passed
9755	49.0	57.3	74	-16.6	40.7	54	Passed
9905	49.3	55.1	74	-16.6	38.5	54	Passed
12018	47.7	62.5	74	-16.6	45.9	54	Passed
12184	48.0	62.7	74	-16.6	46.1	54	Passed
12384	47.6	60.0	74	-16.6	43.4	54	Passed

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 5 VDC through USB port.

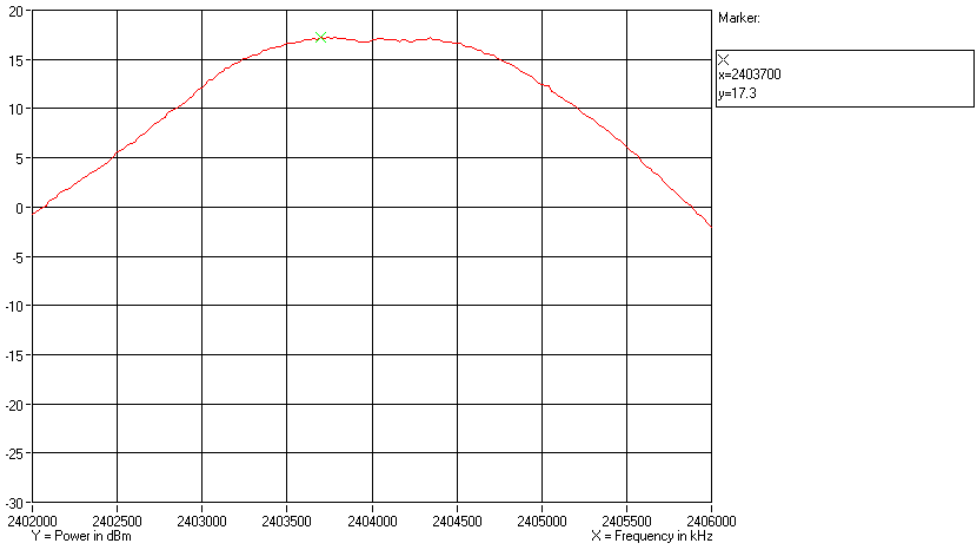
Photo 4.4.1 Test setup regarding measurement of radiated emission (above 1 GHz).

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

4.5 Measurement of maximum conducted output power

Test object	SAS-3	Sheet	PROF-1
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

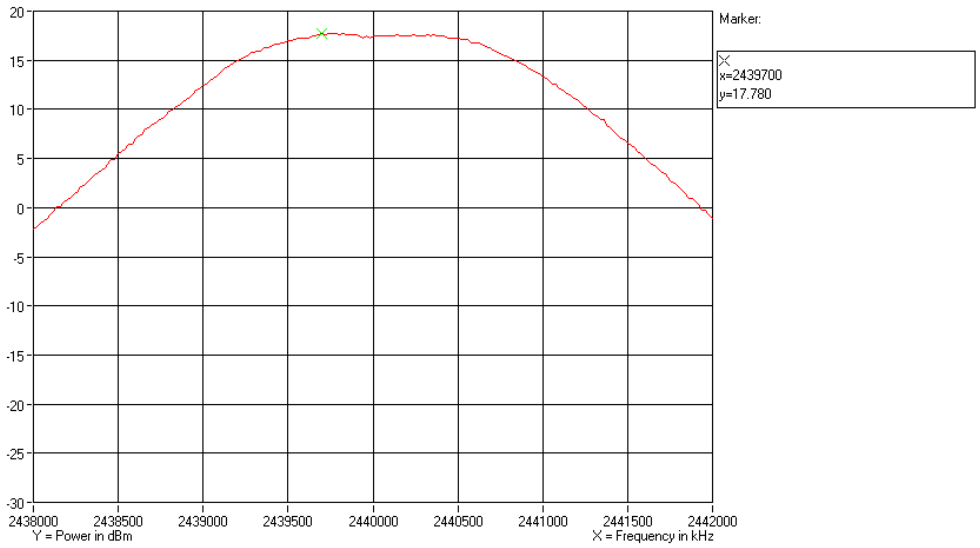
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: 4 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2404 MHz

Test object	SAS-3	Sheet	PROF-2
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

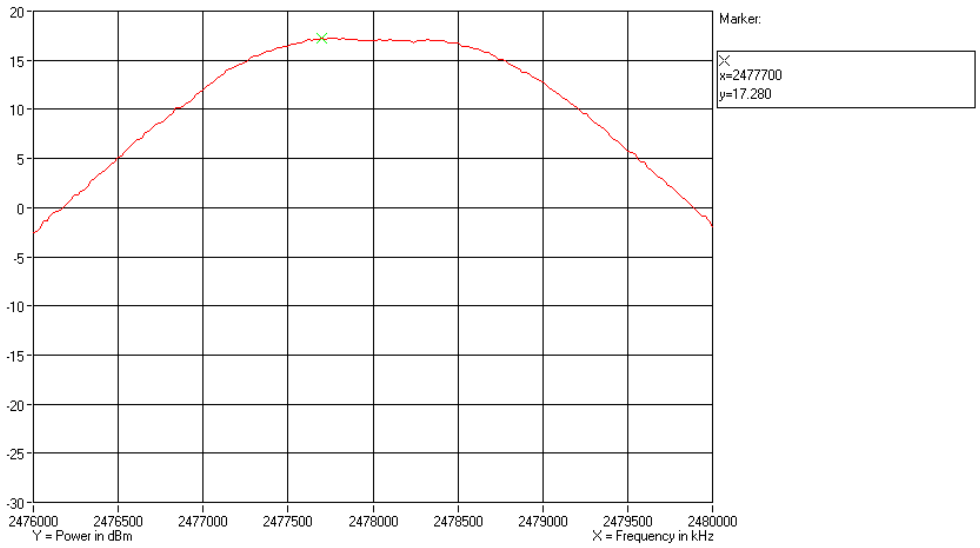
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: 4 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	SAS-3	Sheet	PROF-1
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: 4 MHz DET: Peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2478 MHz

Test object	SAS-3	Sheet	PROF-3
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty:	1.1 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: 4 MHz DET: Peak CF: Operating freq. Trace: Max. hold		

Operating frequency [MHz]	Conducted peak measurement [dBm]	Limit [dBm]	Remarks
2404	17.23	< 29.9	Passed
2440	17.78	< 29.9	Passed
2478	17.28	< 29.9	Passed
Note 1: Antenna gain is 6.1 dBi and the limit is corrected for the gain above +6 dBi			

Test result	The measured conducted power output are below the limit
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 5 VDC through USB port.

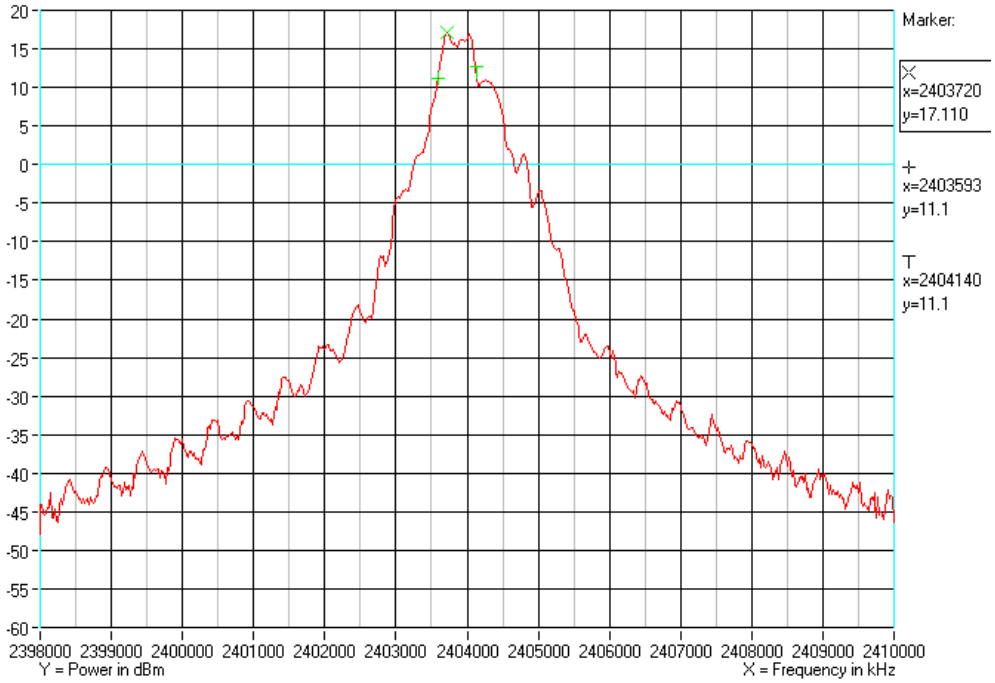
Photo 4.5.1 Test setup regarding measurement of maximum conducted output power.

Photo 4.5.2 Test setup regarding measurement of maximum conducted output power.

4.6 Measurement of 6 dB bandwidth

Test object	SAS-3	Sheet	PROF-4
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

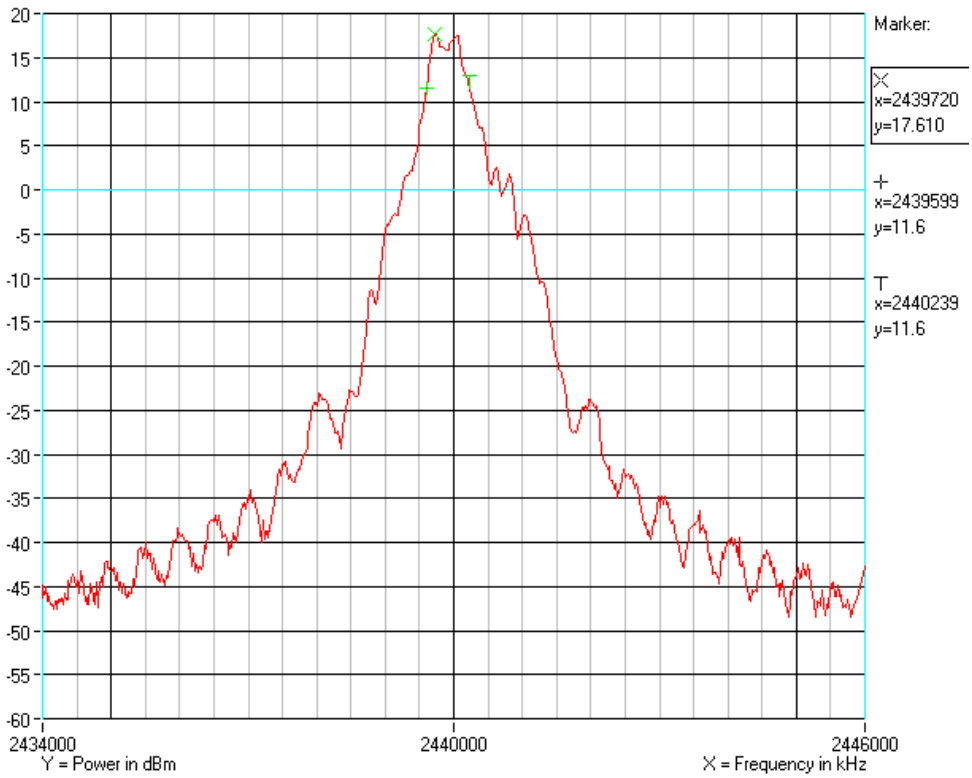
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2404 MHz

Test object	SAS-3	Sheet	PROF-5
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

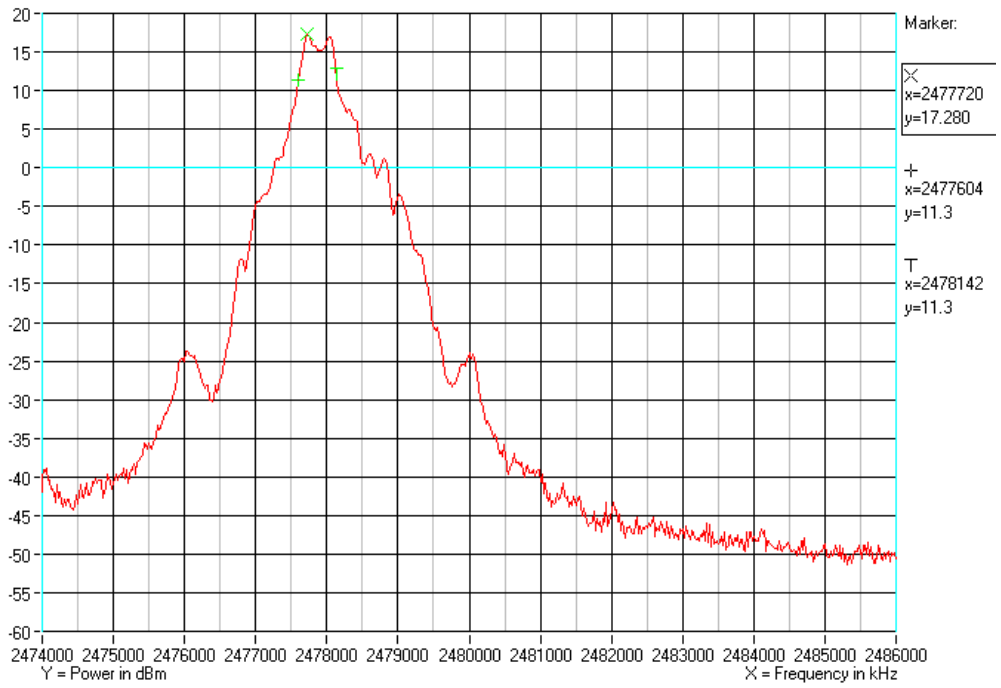
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	SAS-3	Sheet	PROF-2
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	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	SAS-3	Sheet	PROF-6
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	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]	6 dB bandwidth [kHz]	Limit [kHz]	Remarks
2404	2403.5	2404.1	547	> 500	Passed
2440	2439.6	2440.2	640	> 500	Passed
2478	2477.6	2478.1	538	> 500	Passed
Note 1:					

Band edge criteria	6 dB bandwidth
Test result	The measured 6 dB bandwidth are within limit designated in 15.247(a)(2)
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 5 VDC through USB port.

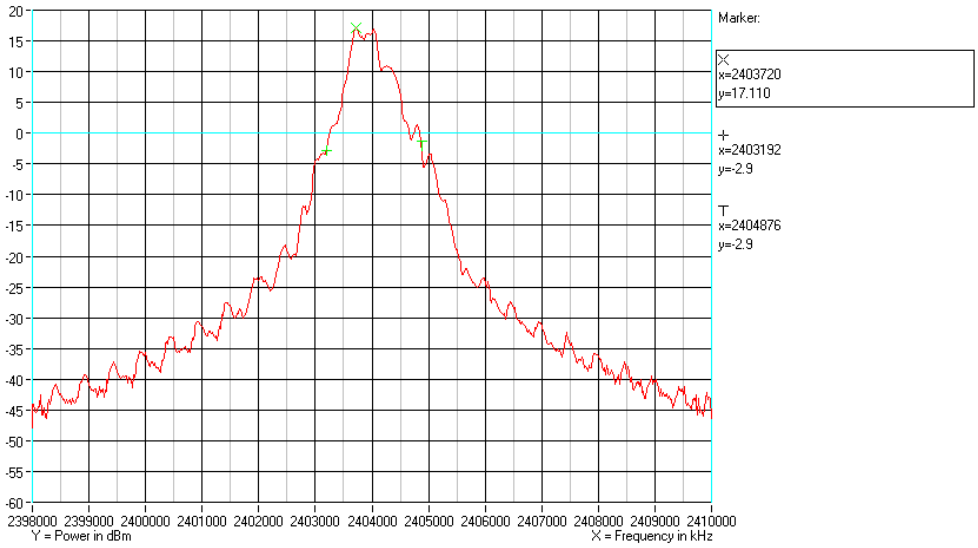
Photo 4.6.1 Test setup regarding measurement of 6 dB bandwidth.

Photo 4.6.2 Test setup regarding measurement of 6 dB bandwidth.

4.7 Measurement of 20 dB bandwidth

Test object	SAS-3	Sheet	PROF-7
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

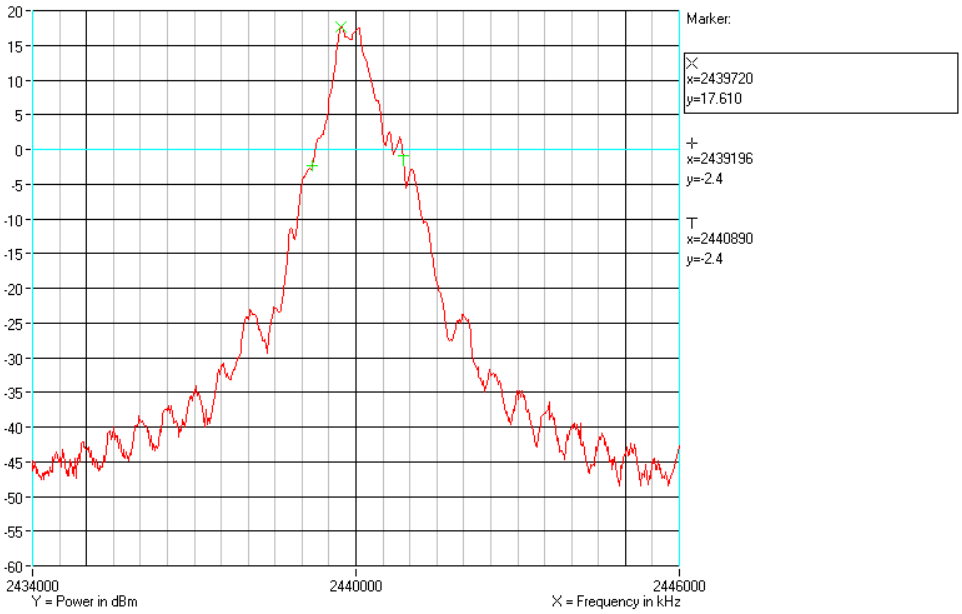
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5.0 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2404 MHz

Test object	SAS-3	Sheet	PROF-8
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

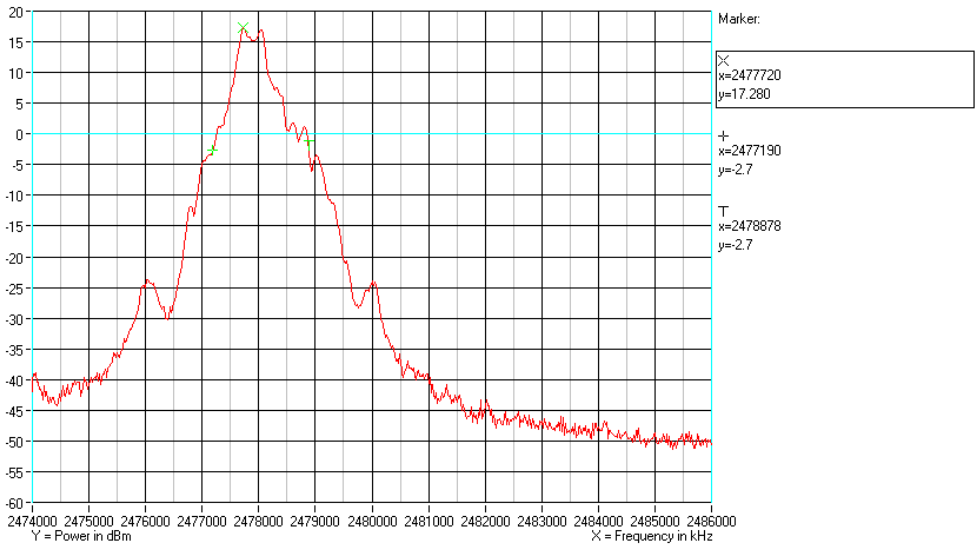
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5.0 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	SAS-3	Sheet	PROF-3
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5.0 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	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	SAS-3	Sheet	PROF-9
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5.0 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	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	2403.1	2404.9	20 dBc
2440	2439.2	2440.9	20 dBc
2478	2477.2	2478.9	20 dBc
Note 1:			

Operating frequency [MHz]	Measured [MHz]	Limit [MHz]	Remarks
Lowest frequency	2403.1	2400.00	Passed
Highest frequency	2478.9	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	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 5 VDC through USB port.

Photo 4.7.1 Test setup regarding measurement of 20 dB bandwidth.

Photo 4.7.2 Test setup regarding measurement of 20 dB bandwidth.

4.8 Measurement of band edge compliance

Test object	SAS-3	Sheet	PROF-10
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	04 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 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 40 % RH
Detector	Peak and average for 1GHz to 25 GHz	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	102	61.1	40.9	54	-
2400	2404	Peak	118.6	61.1	57.5	74	-
2483.5	2478	Average	101.3	67.8	33.5	54	-
2483.5	2478	Peak	117.9	67.8	50.1	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 on

Condition: Normal

Compliant: Yes

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

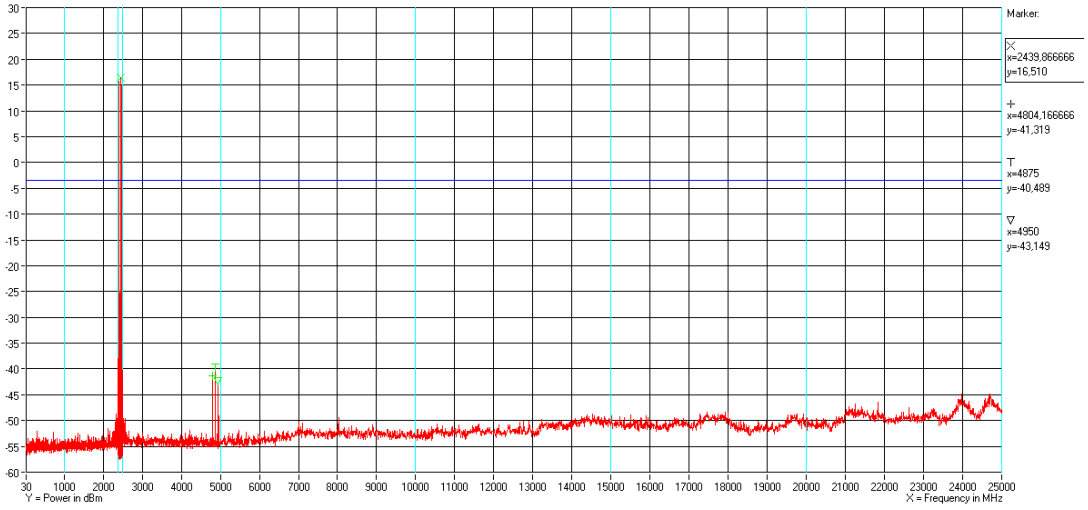
Marker-delta method for band-edge measurements was used to correct the measurements for the peak and average field strengths at band edge according to ANSI C63.10:2009 Section 6.9.3.

Test voltage: External power supply at 5 VDC through USB port.

4.9 Measurement of conducted spurious emissions

Test object	SAS-3	Sheet	PROF-11
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	08 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	30 MHz-25 GHz

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 43 % RH
Test equipm.	SRD lab Hørsholm 49321	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz DET: Peak Trace: Max. hold		



Comments None

Test object	SAS-3	Sheet	PROF-12
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	08 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	30 MHz-25 GHz

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 43 % RH
Test equipm.	SRD lab Hørsholm 49321	Uncertainty:	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz DET: Peak Trace: Max. hold		

Frequency [MHz]	Peak measurement [dBm]	Limit [dBm]	Remarks
4804	-41.3	-3.5	-
4875	-40.5	-3.5	-
4950	-43.1	-3.5	-
Note 1:			

Test result	The measured conducted spurious emissions are within limit designated in 15.247(d)
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	Limit at least 20 dB below intentional radiator for peak measurements. Test voltage: External power supply at 5 VDC through USB port.

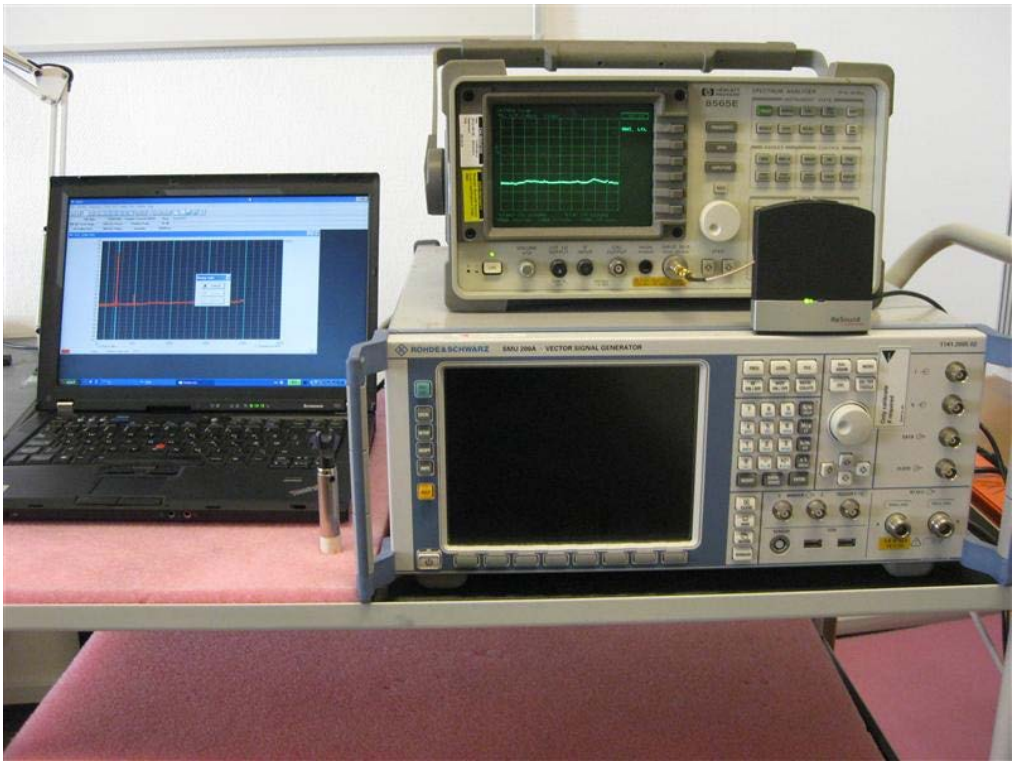


Photo 4.9.1 Test setup regarding measurement of conducted spurious emissions.

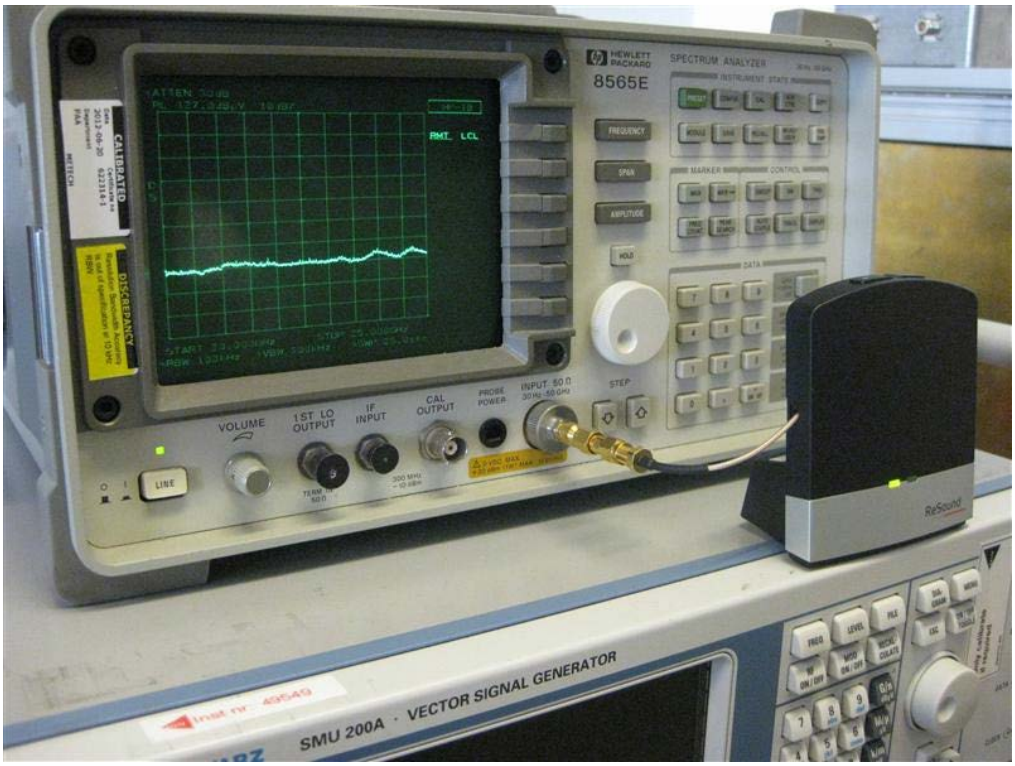
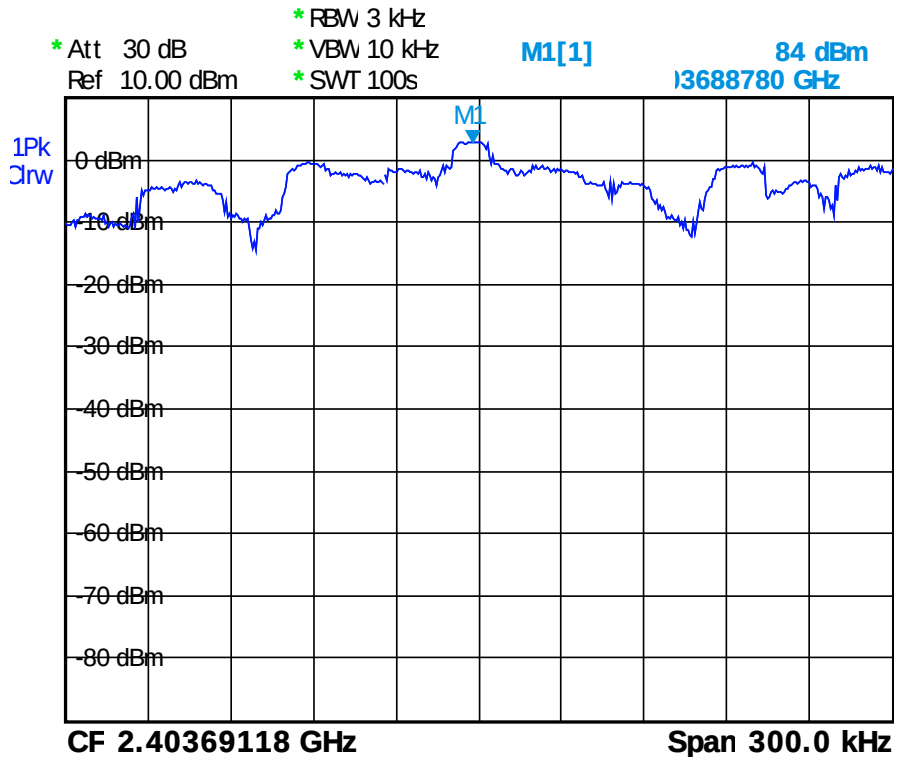


Photo 4.9.2 Test setup regarding measurement of conducted spurious emissions.

4.10 Measurement of power spectral density

Test object	SAS-3	Sheet	PROF-13
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	04 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests	Frequency	2.4-2.48 GHz

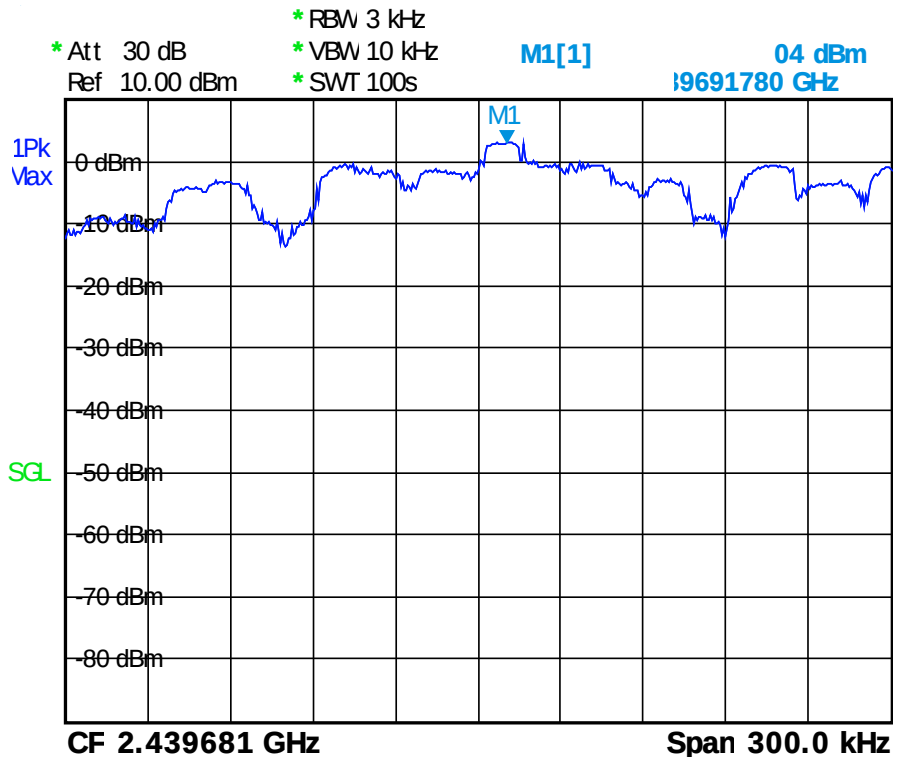
Test method	ANSI C63.10:2009	Temperature	22 °C
Characteristics	Test voltage: External power supply at 5 VDC	Humidity	42 % RH
Test equipm.	SRD lab 49548	Uncertainty	1.1 dB
SA Settings	RBW: 3 kHz VBW: 10 kHz SPAN: 300 kHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2404 MHz

Test object	SAS-3	Sheet	PROF-14
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	04 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

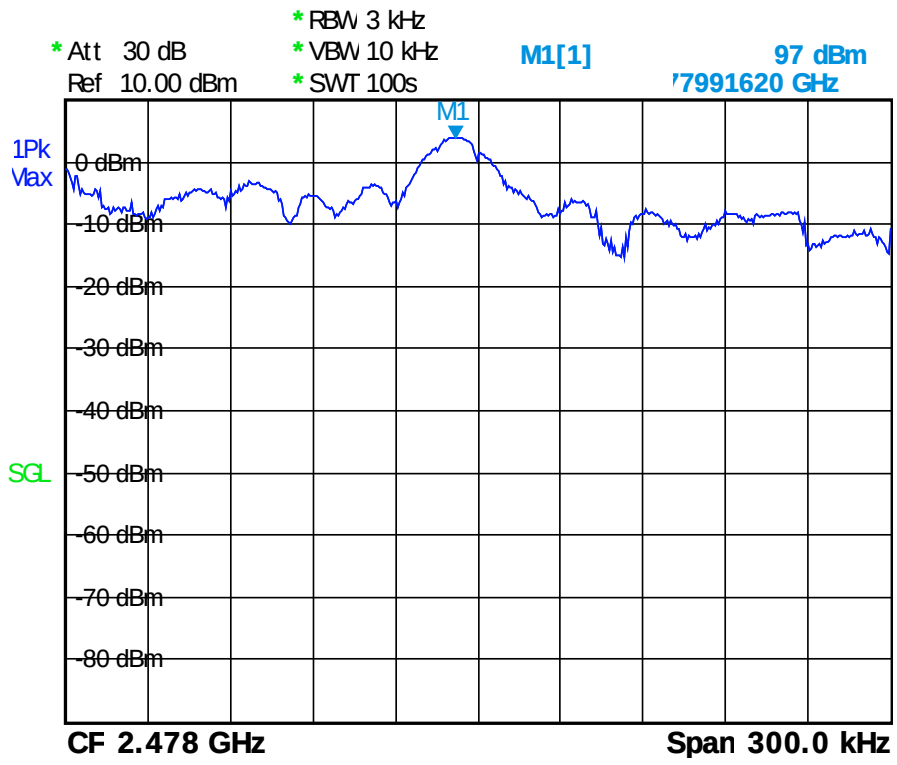
Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 42 % RH
Test equipm.	SRD lab 49548	Uncertainty	1.1 dB
SA Settings	RBW: 3 kHz VBW: 10 kHz SPAN: 300 kHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	SAS-3	Sheet	PROF-4
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	04 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 42 % RH
Test equipm.	SRD lab 49548	Uncertainty	1.1 dB
SA Settings	RBW: 3 kHz VBW: 10 kHz SPAN: 300 kHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2478 MHz

Test object	SAS-3	Sheet	PROF-15
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	04 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	ANSI C63.10:2009 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 42 % RH
Test equipm.	SRD lab 49548	Uncertainty	1.1 dB
SA Settings	RBW: 3 kHz VBW: 10 kHz SPAN: 300 kHz DET: peak CF: Operating freq. Trace: Max. hold		

Operating Frequency [MHz]	Measured Power [dBm]	Limit [dBm]	Remarks
2404	2.84	8	Passed
2440	3.04	8	Passed
2478	3.97	8	Passed
Note 1:			

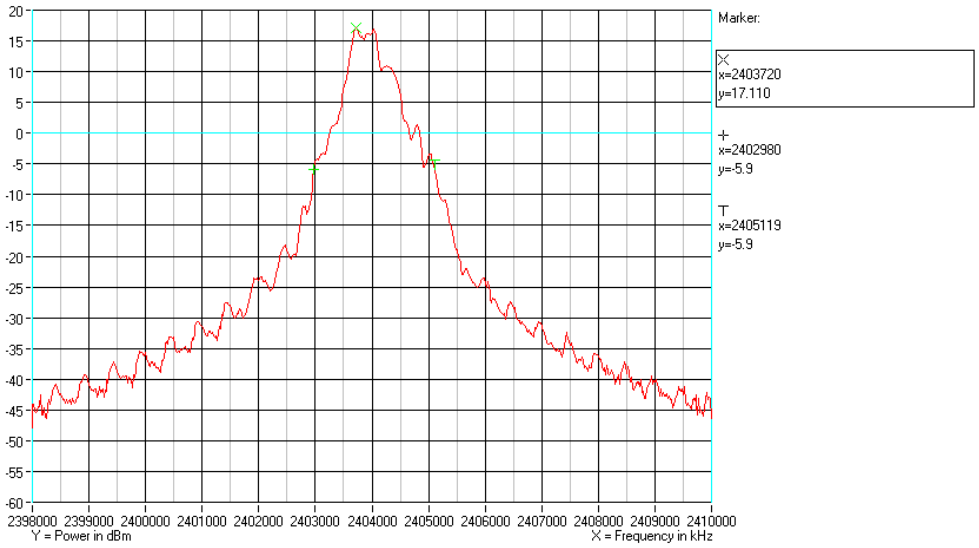
Test result	The measured power levels are within the level designated in 15.247(e)
Test Port	Antenna replaced by SMA connector
Test frequency	2404, 2440 and 2478 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Test voltage: External power supply at 5 VDC through USB port.

Photo 4.10.1 Test setup regarding measurement of power spectral density.

4.11 Measurement of occupied bandwidth, IC

Test object	SAS-3	Sheet	PROF-16
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

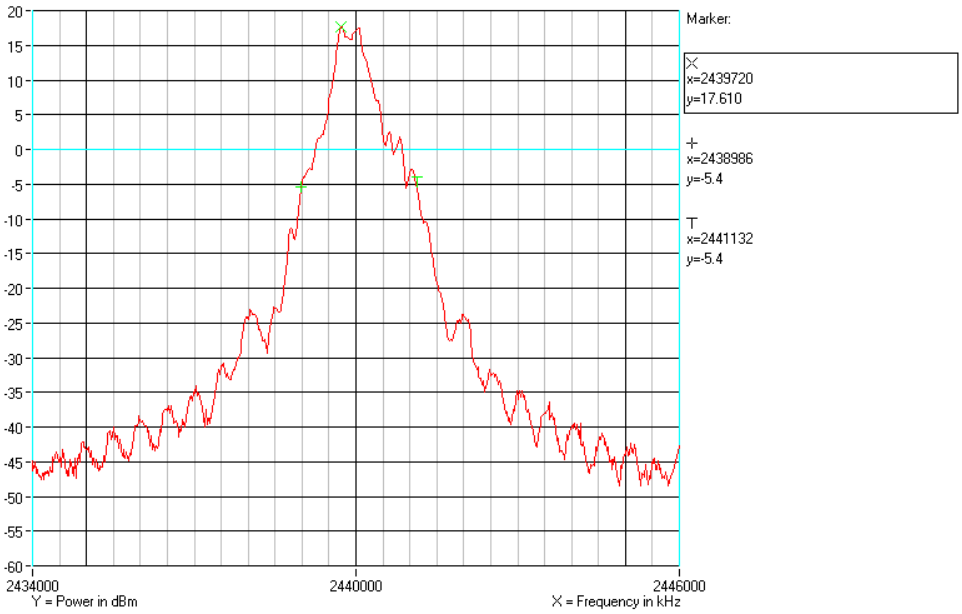
Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2404 MHz

Test object	SAS-3	Sheet	PROF-17
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

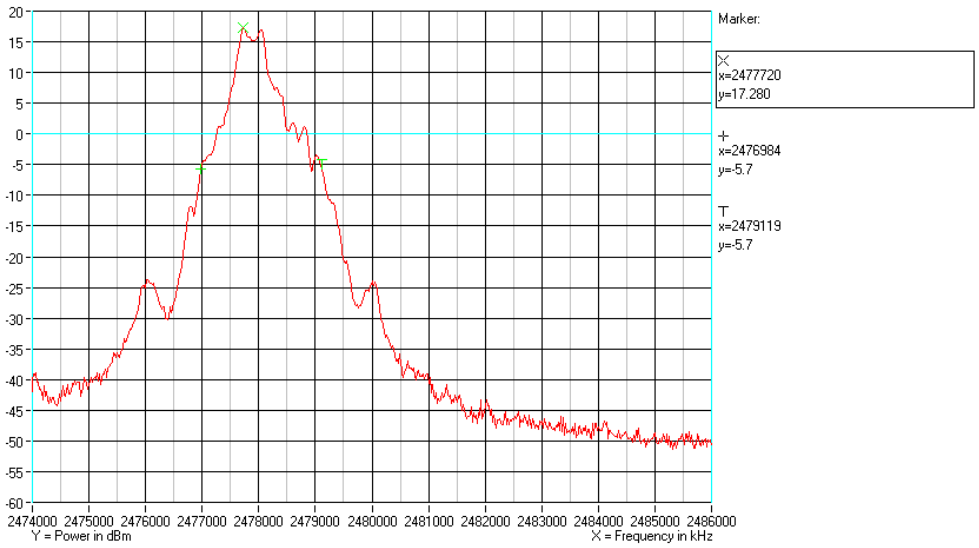
Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: peak CF: Operating freq. Trace: Max. hold		



Comments Operating frequency: 2440 MHz

Test object	SAS-3	Sheet	PROF-18
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	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	SAS-3	Sheet	PROF-19
Type	SAS-3	Project no.	T205852-3
Serial no.	B5-185	Date	28 June 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See chapter 1 Summary of tests		

Test method Characteristics	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1 Test voltage: External power supply at 5 VDC	Temperature Humidity	22 °C 40 % RH
Test equipm.	Climatic chamber EVFGT-17 49183 49321	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	2403.0	2405.1	2.1
2440	2439.0	2441.1	2.1
2478	2477.0	2479.1	2.1
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 5 VDC through USB port.

Photo 4.11.1 Test setup regarding measurement of occupied bandwidth, IC.

Photo 1.1.2 Test setup regarding measurement of occupied bandwidth, IC.

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 22:2008 is equivalent to CAN/CSA CISPR 22-10 specified in ICES-003:2012, 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: 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.
29301	ARTIFICIAL MAINS NETWORK	ROHDE & SCHWARZ	ESH2-Z5	05-02-2013	05-02-2014
29797	BILOG ANTENNA, 30-2000 MHz	CHASE ELECTRICS LTD	CBL 6111A	26-10-2011	26-10-2013
29861	EMI-SOFTWARE Ver. 1.60	ROHDE & SCHWARZ	ES-K1, PART: 1026.6790.02	N.A.	N.A.
49086	REMI EMISSION SOFTWARE PACKAGE v. 2.133, ROOM 5	NeWeTec	REMI	N.A.	N.A.
49183	POWER SUPPLY	TTI	PL 320		
49299	DIGITAL MULTIMETER	Fluke	87-4	05-11-2012	05-11-2013
49321	SPECTRUM ANALYZER, 50GHz with option 006	HEWLETT-PACKARD	8565E	20-06-2012	20-07-2013
49421	IMPULSE VOLTAGE LIMITER (BNC)	ROHDE & SCHWARZ	ESH3/Z2	21-06-2013	21-06-2014
49548	VECTOR NETWORK ANALYZER	ROHDE & SCHWARZ	ZVL6	08-01-2013	08-01-2014
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	11-05-2012	11-05-2014