

DELTA Test Report



Radio parameter test of VE312 according to
FCC and IC specifications

Performed for GN Hearing A/S

DANAK-19/13295

Project no.: T205853-3

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14 August 2013

DELTA

Venlighedsvej 4
2970 Hørsholm
Denmark

Tlf. +45 72 19 40 00

Fax +45 72 19 40 01

www.delta.dk

VAT No. 12275110

Title	Radio parameter test of VE312 according to FCC and IC specifications
Test object	VE312
Report no.	DANAK-19/13295
Project no.	T205853-3
Test period	15 to 16 July 2013
Client	GN Hearing A/S Lautrupbjerg 7 2750 Ballerup Denmark Tel.: +45 45 75 11 11
Contact person	Vinnie Nørager E-mail: vnoerager@gnresound.dk
Manufacturer	GN Hearing A/S
Specifications	See Section 1 Summary of tests
Results	The test object was found to be in compliance with the specifications, as listed in Section 1
Test personnel	Peter Wolf Frandsen
Test site(s)	DELTA, Venlighedsvej 4, 2970 Hørsholm, Denmark



Date 14 August 2013

Project Manager 

Peter Wolf Frandsen
Specialist, EMC & Wireless
DELTA

Responsible 

Claus Rømer Andersen
Business Manager, Consulting
ELTA



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1. Summary of tests

The authorization procedures for the VE312 are:

Certification by FCC Part 15 C

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

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

Conclusion

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

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

The test results relate only to the objects tested.



2. Test objects



Photo 2.1.1 Test objects.

2.1 Test objects

Test object 2.1.1

Name of test object	VE312
Model / type	VE312
Part no.	VE312
Serial no.	#3
FCC ID	X26VE312
IC ID	6941C-VE312
Manufacturer	GN Hearing A/S
Supply voltage	1.4 VDC (Zinc Air battery)
Software version	Spurious emission firmware
Hardware version	-
Cycle time	2 ms
Highest frequency generated or used	2483.5 MHz
Comment	GN radio During tests supplied by external power supply



Test object 2.1.2

Name of test object	VE312
Model / type	VE312
Part no.	VE312
Serial no.	#2
FCC ID	X26VE312
IC ID	6941C-VE312
Manufacturer	GN Hearing A/S
Supply voltage	1.4 VDC (Zinc Air battery)
Software version	Spurious emission firmware
Hardware version	-
Cycle time	4.5 ms
Highest frequency generated or used	2483.5 MHz
Comment	Bluetooth LE radio During tests supplied by external power supply

Test object 2.1.3

Name of test object	VE312
Model / type	VE312
Part no.	VE312
Serial no.	#14
FCC ID	X26VE312
IC ID	6941C-VE312
Manufacturer	GN Hearing A/S
Supply voltage	1.4 VDC (Zinc Air battery)
Software version	Spurious emission firmware
Hardware version	-
Cycle time	2 ms
Highest frequency generated or used	2483.5 MHz
Comment	GN radio Antenna replaced by SMA connector During tests supplied by external power supply



Test object 2.1.4

Name of test object	VE312
Model / type	VE312
Part no.	VE312
Serial no.	#18
FCC ID	X26VE312
IC ID	6941C-VE312
Manufacturer	GN Hearing A/S
Supply voltage	1.4 VDC (Zinc Air battery)
Software version	Spurious emission firmware
Hardware version	-
Cycle time	4.5 ms
Highest frequency generated or used	2483.5 MHz
Comment	Bluetooth LE radio Antenna replaced by SMA connector During tests supplied by external power supply



3. General test conditions

3.1 Test setup during test

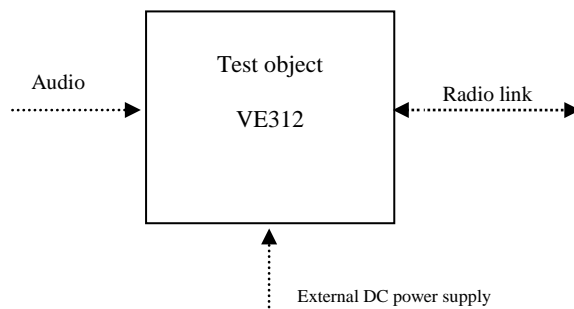


Figure 3.1.1 Block diagram of test object with cables.

3.1.1 Description and intended use of test object

VE312 is a hearing aid used for alleviation of hearing loss. It can receive audio signals and be configured via the radio link.

3.1.2 Test modes during tests

All test objects were running special test software

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

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.

Relevant tests are repeated with the additional modulation using the pay load. Related packed types are e.g. GFSK.

Tests were performed at three frequencies for the Bluetooth radio:

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

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

External power supply is not used under intended use.



3.2 Radio specifications, receiver and transmitter, GN radio

Test object	VE312	Sheet	ANT-1
Type	VE312	Project no.	T205853-3
Serial no.	See section 2	Date	16 July 2013
Client	GN Hearing A/S		
Specification	See Section 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	:	2404 to 2478 MHz
Antenna	:	Wire antennas with a unique antenna connector
Maximum gain	:	2.36 dBi (Antenna no.: 17002900)
Transmit		
Field Strength, max avg.	:	79.6 dB μ V/m avg (9.5 mV/m) @ 3 meter
Field Strength, max pk.	:	92.8 dB μ V/m pk (44 mV/m) @ 3 meter
Conducted power, max pk.	:	-1.2 dBm
Power level	:	1
No of channels	:	20
Bandwidth	:	
Occupied bandwidths (99 %)	:	2.2 MHz (Measured)
Channel separation	:	2 MHz
Modulation	:	GFSK
Data rate	:	2 Mbits
Duty cycle	:	10 % during normal mode
Transmit mode	:	Yes
Receive mode	:	Yes
Standby mode	:	Yes
Power supply	:	1.45 VDC Zinc-Air battery
Specified min voltage	:	1.16 VDC
Specified max voltage	:	1.45 VDC
Temperature category	:	-20 to +55 °C.
Emission Designator	:	2M2F7E
Max. TX spurious emission, average	:	234 μ V/m @ 3 meter (Field Strength)
Max. TX spurious emission, peak	:	1072 μ V/m @ 3 meter (Field Strength)



3.3 Radio specifications, receiver and transmitter, Bluetooth LE radio

Test object	VE312	Sheet	ANT-2
Type	VE312	Project no.	T205853-3
Serial no.	See section 2	Date	16 July 2013
Client	GN Hearing A/S		
Specification	See Section 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 2480 MHz
Antenna	:	Wire antennas with a unique antenna connector
Maximum gain	:	2.36 dBi (Antenna no.: 17002900)
Transmit		
Field Strength, max avg.	:	74.9 dB μ V/m avg (5.6 mV/m) @ 3 meter
Field Strength, max pk.	:	92.6 dB μ V/m pk (43 mV/m) @ 3 meter
Conducted power, max pk.	:	-1.7 dBm
Power level	:	1
No of channels	:	40
Bandwidth	:	
Occupied bandwidths (99 %)	:	1.3 MHz (Measured)
Channel separation	:	2 MHz
Modulation	:	GFSK
Data rate	:	2 Mbits
Duty cycle	:	10 % during normal mode
Transmit mode	:	Yes
Receive mode	:	Yes
Standby mode	:	No
Power supply	:	1.45 VDC Zinc-Air battery
Specified min voltage	:	1.16 VDC
Specified max voltage	:	1.45 VDC
Temperature category	:	-20 to +55 °C.
Emission Designator	:	1M3F7E
Max. TX spurious emission, average	:	130 μ V/m @ 3 meter (Field Strength)
Max. TX spurious emission, peak	:	933 μ V/m @ 3 meter (Field Strength)



4. Test results

4.1 Duty cycle correction factor (δ), GN Radio

Test object	VE312	Sheet	ANT-3
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: 1.4 VDC	Humidity	52 % RH
Test equipm.	SRD lab Hørsholm 49550	Uncertainty	0.01 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: Zero-1ms DET: Peak CF: Operation freq. 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: 392 μ s – Delta 3 (T1)

Period: 1792 μ s – Delta 2 (T1).

The calculated duty cycle expressed in % is:

$$D(\%) = ((\text{Max. Tx on time}) \mu\text{s} / (\text{period}) \mu\text{s}) \cdot 100\% = 21.9 \%$$

The calculated duty cycle correction factor expressed in dB is:

$$\delta(\text{dB}): 20 \log (\text{Max. Tx on time} (\mu\text{s}) / \text{period} (\mu\text{s})) = -13.2 \text{ dB}.$$

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: $P_{\text{Average}}(\text{resulting}) = P_{\text{peak}} + \text{DCCF} (\delta)$.



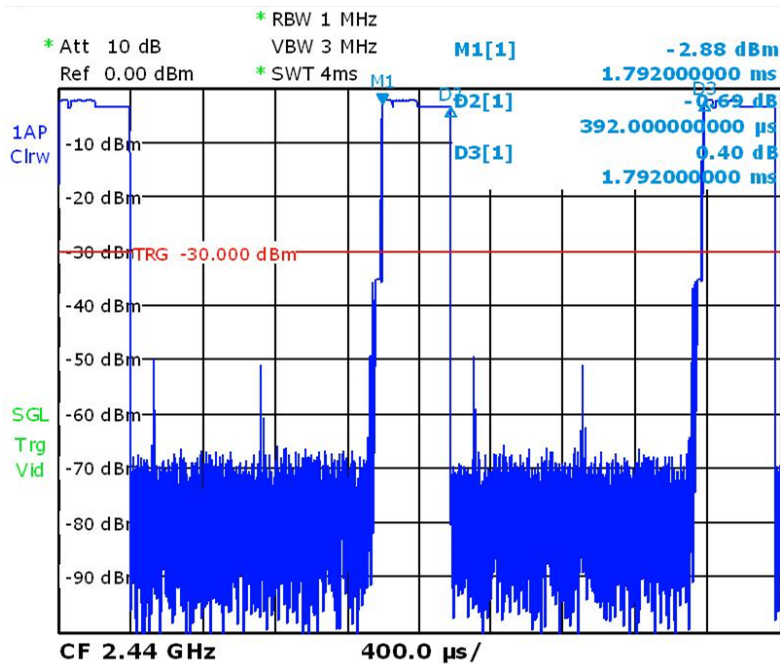


Photo 4.1.1 Test setup regarding duty cycle correction factor (δ).



4.2 Duty cycle correction factor (δ), BT radio

Test object	VE312	Sheet	ANT-4
Type	VE312	Project no.	T205853-3
Serial no.	#2	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: 1.4 VDC	Humidity	52 % RH
Test equipm.	SRD lab Hørsholm 49550	Uncertainty	0.01 dB
SA Settings	RBW: 1 MHz VBW: 3 MHz SPAN: Zero-1ms DET: Peak CF: Operation freq. 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: 580 μ s – Delta 3 (T1)

Period: 4440 μ s – Delta 2 (T1).

The calculated duty cycle expressed in % is:

$$D(\%) = ((\text{Max. Tx on time}) \mu\text{s} / (\text{period}) \mu\text{s}) \cdot 100\% = 13.1 \%$$

The calculated duty cycle correction factor expressed in dB is:

$$\delta(\text{dB}): 20 \log (\text{Max. Tx on time} (\mu\text{s}) / \text{period} (\mu\text{s})) = -17.7 \text{ dB}.$$

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: $P_{\text{Average}}(\text{resulting}) = P_{\text{peak}} + \text{DCCF} (\delta)$.



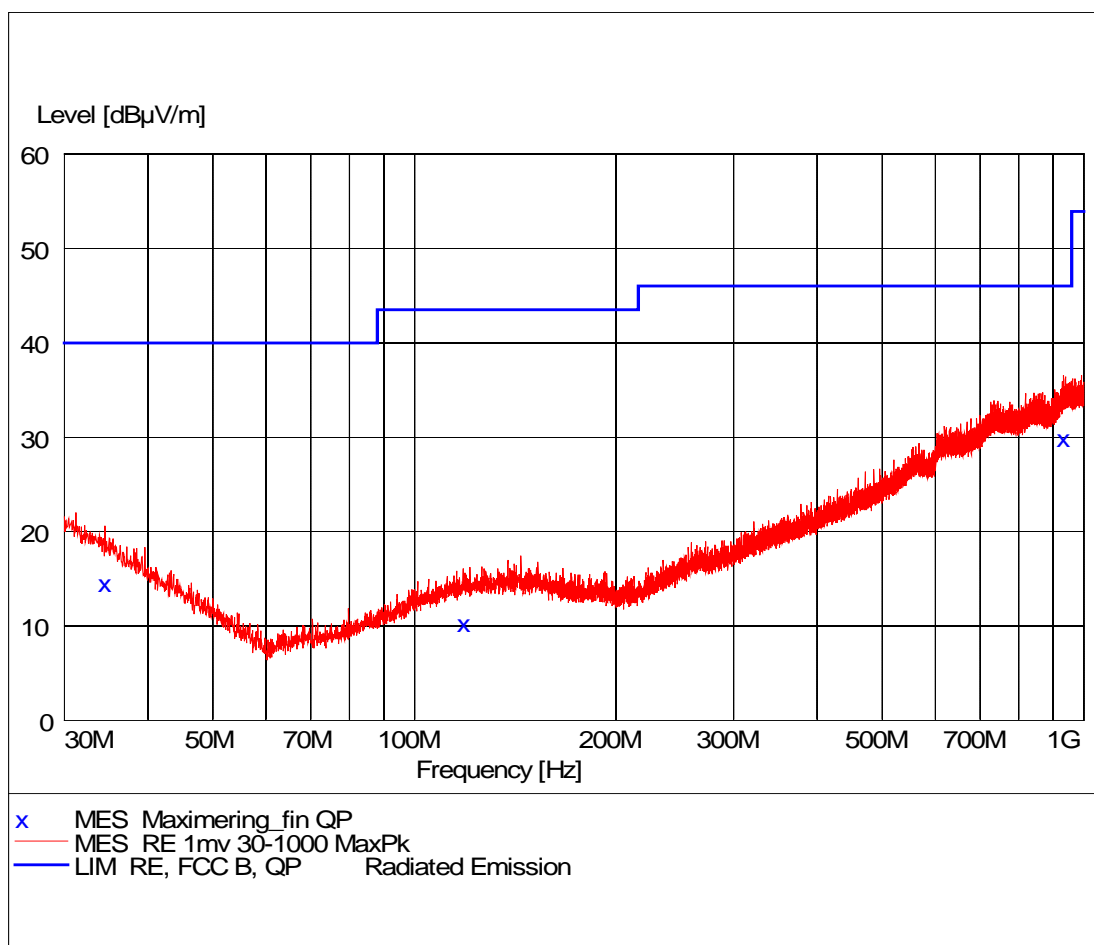


Photo 4.2.1 Test setup regarding duty cycle correction factor (δ).

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

Test object	VE312	Sheet	RE_Spur-1
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Pre-scan, antenna at 3 m, 1 m height, vert. pol.	Humidity	52 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49154 49600	Uncertainty	4.9 dB



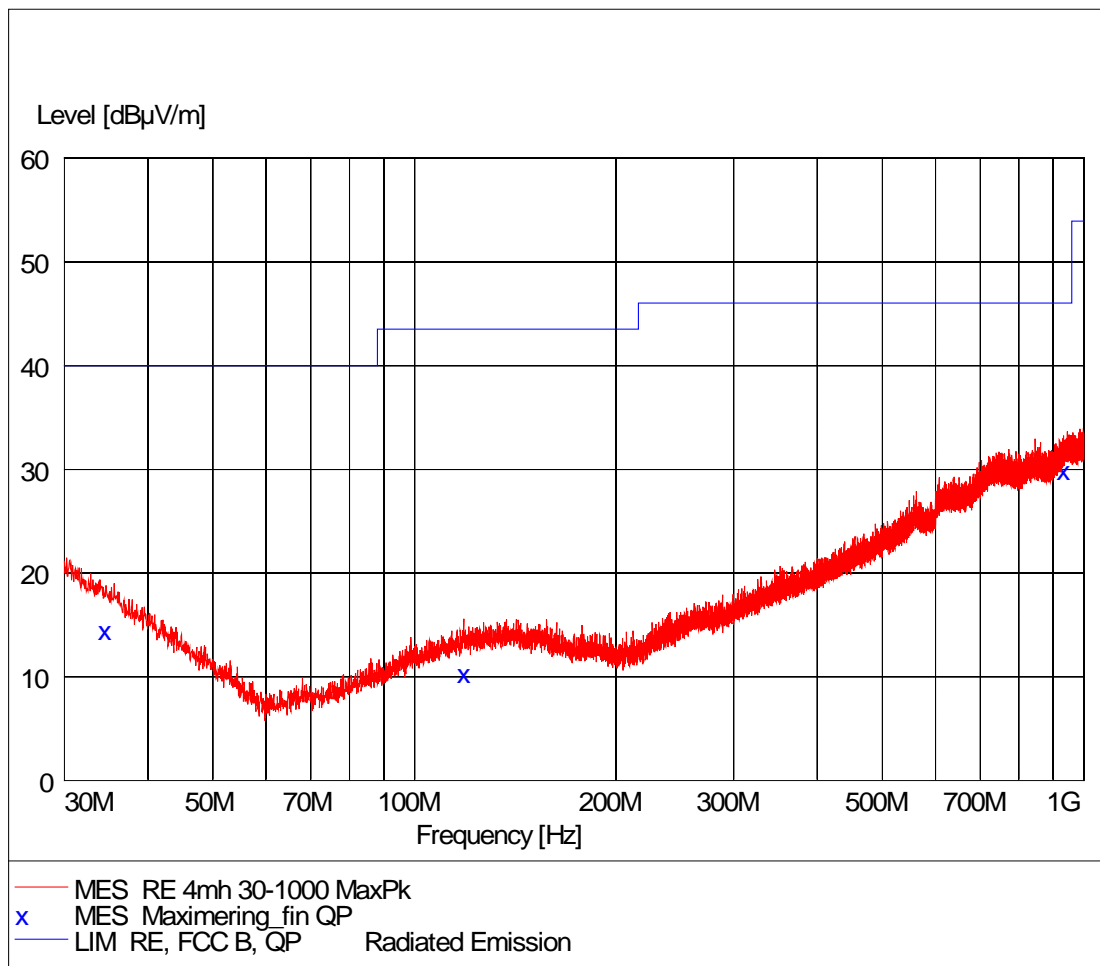
Comments

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



Test object	VE312	Sheet	RE_Spur-2
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Pre-scan, antenna at 3 m, 4 m height, hor. pol.	Humidity	52 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49154 49600	Uncertainty	4.9 dB



Comments

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



Test object	VE312	Sheet	RE_Spur-3
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 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	52 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49154 49600	Uncertainty	4.9 dB

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
34.500000	14.70	16.8	40.0	25.3	133.0	303.00	VERTICAL
118.440000	10.50	13.0	43.5	33.0	145.0	15.00	VERTICAL
931.920000	30.10	29.9	46.0	15.9	101.0	0.00	HORIZONTAL

Test result	The measured field strengths were below the limit
Test Port	Enclosure
Test frequency	2404, 2440 and 2478 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation Test voltage: External power supply at 1.5 VDC





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



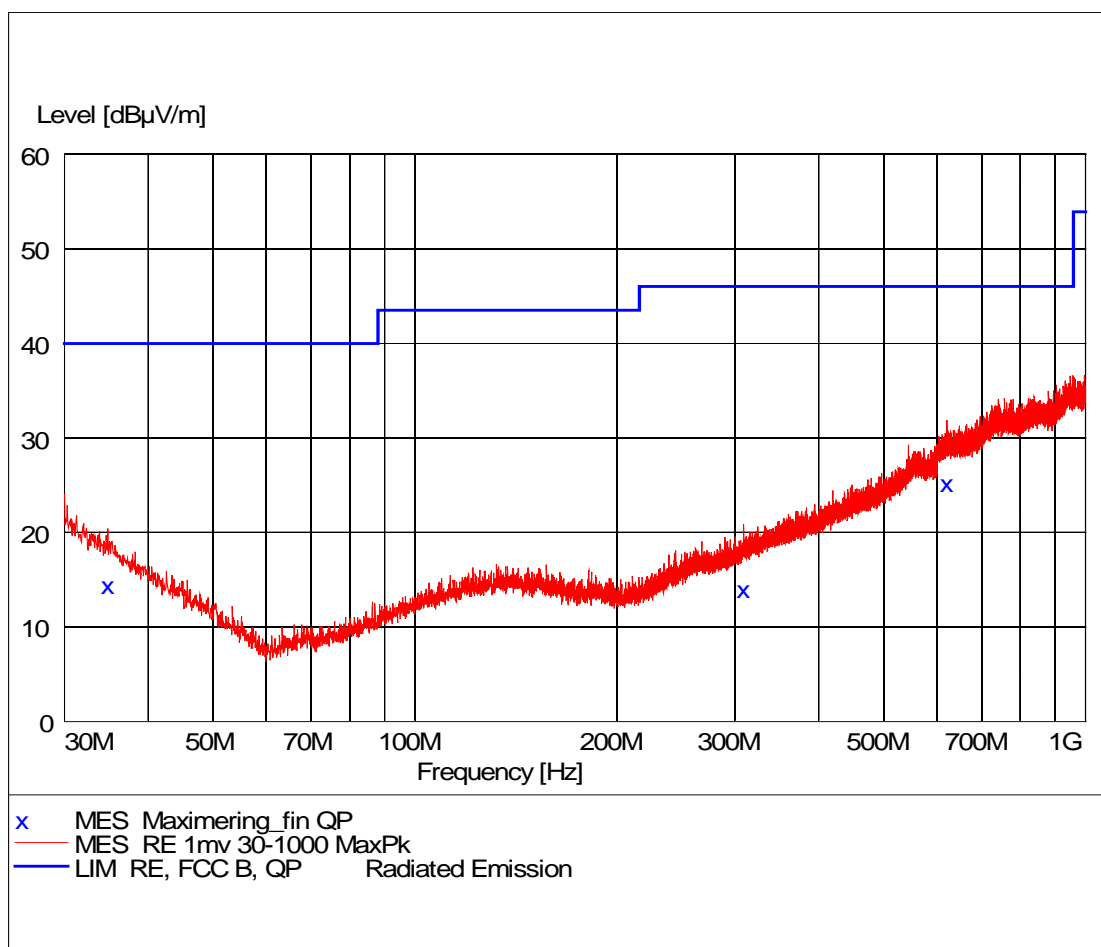
Photo 4.3.2 Test setup regarding measurement of radiated emission below 1 GHz.



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

Test object	VE312	Sheet	RE_Spur-4
Type	VE312	Project no.	T205853-3
Serial no.	#2	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Pre-scan, antenna at 3 m, 1 m height, vert. pol.	Humidity	52 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49154 49600	Uncertainty	4.9 dB



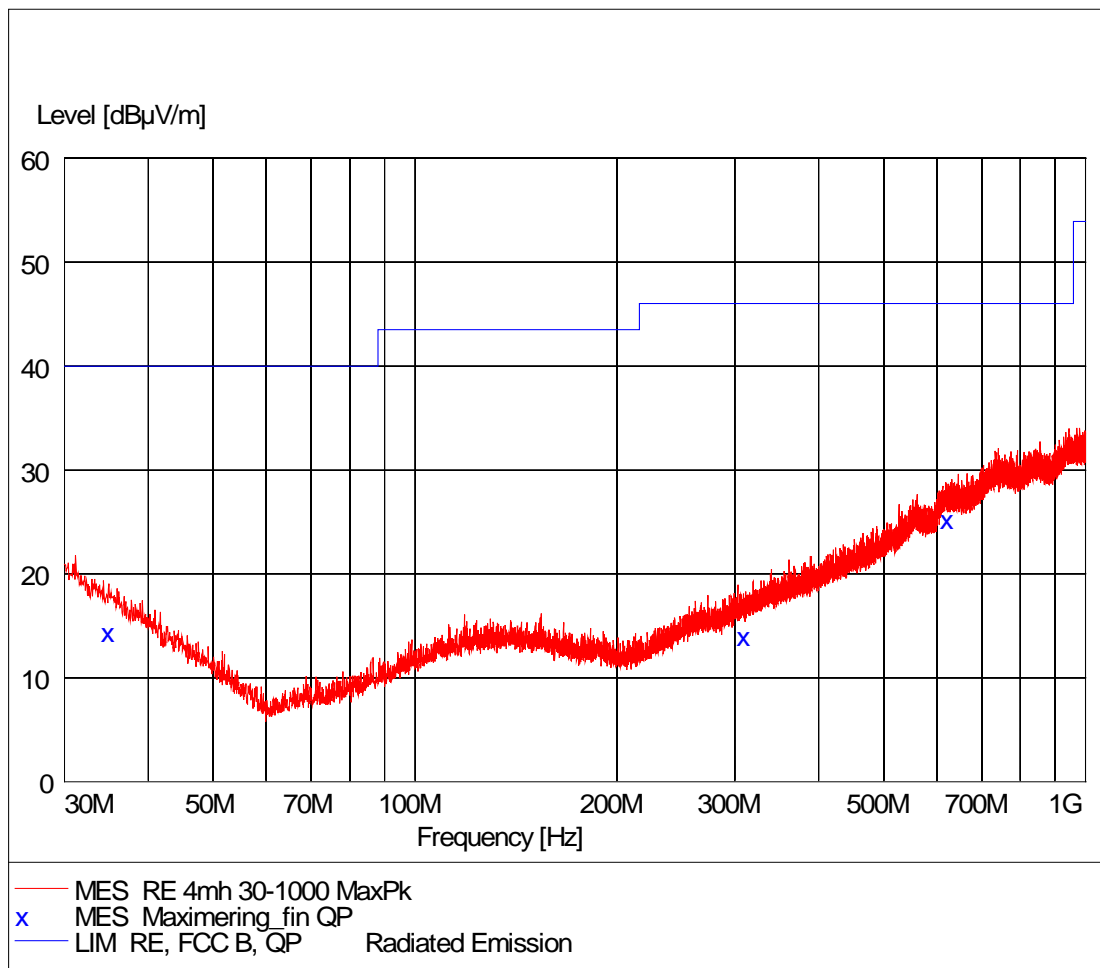
Comments

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



Test object	VE312	Sheet	RE_Spur-5
Type	VE312	Project no.	T205853-3
Serial no.	#2	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	30-1000 MHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Pre-scan, antenna at 3 m, 4 m height, hor. pol.	Humidity	52 % RH
Detector	Peak and quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49154 49600	Uncertainty	4.9 dB



Comments

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



Test object	VE312	Sheet	RE_Spur-6
Type	VE312	Project no.	T205853-3
Serial no.	#2	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 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	52 % RH
Detector	Quasi peak	Bandwidth	120 kHz
Test equipm.	EMI room Hørsholm 49154 49600	Uncertainty	4.9 dB

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
34.800000	14.60	16.7	40.0	25.4	117.0	75.00	VERTICAL
309.120000	14.20	16.1	46.0	31.8	378.0	38.00	VERTICAL
621.120000	25.40	25.0	46.0	20.6	297.0	1.00	HORIZONTAL

Test result	The measured field strengths were below the limit
Test Port	Enclosure
Test frequency	2402, 2440 and 2480 MHz
Test mode	Continuous Tx - normal modulation - hopping between low, mid and high operating freq.
Condition	Normal
Compliant	Yes
Comments	Final maximal measurements by variation of turntable azimuth, antenna height, and antenna polarisation Test voltage: External power supply at 1.5 VDC





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



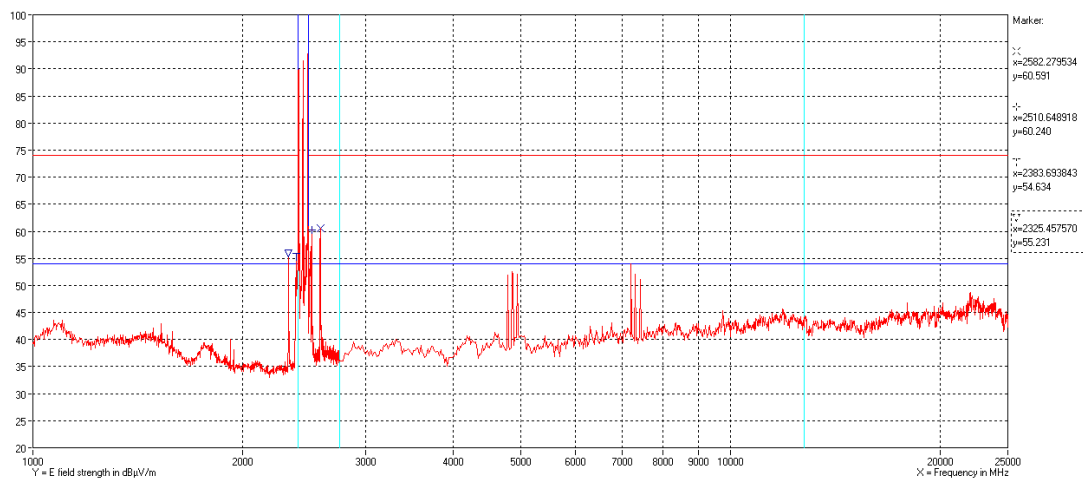
Photo 4.4.2 Test setup regarding measurement of radiated emission below 1 GHz.



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

Test object	VE312	Sheet	RE_Spur-7
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		Frequency 1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	53 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	Uncertainty	4.9 dB



Polarization

Vertical and horizontal peak measurements

Comments

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



Test object	VE312	Sheet	RE_Spur-8
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	53 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	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
2325	53.0	55.2	74	-13.2	42.0	54	Passed
2384	52.9	54.6	74	-13.2	41.4	54	Passed
2511	52.8	60.2	74	-13.2	47.0	54	Passed
2582	52.7	60.6	74	-13.2	47.4	54	Passed
Note 1:							

Test result The measured peak field strengths were below the peak limit
The measured peak field strengths corrected with the DCCF (δ) are below the average limit
Corrected average: $P_{\text{Average}}(\text{resulting}) = P_{\text{peak}} + \text{DCCF}(\delta)$.

Test Port Enclosure

Test frequency 2404, 2440 and 2478 MHz

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

Condition Normal

Compliant Yes

Comments Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization
Test voltage: External power supply at 1.5 VDC



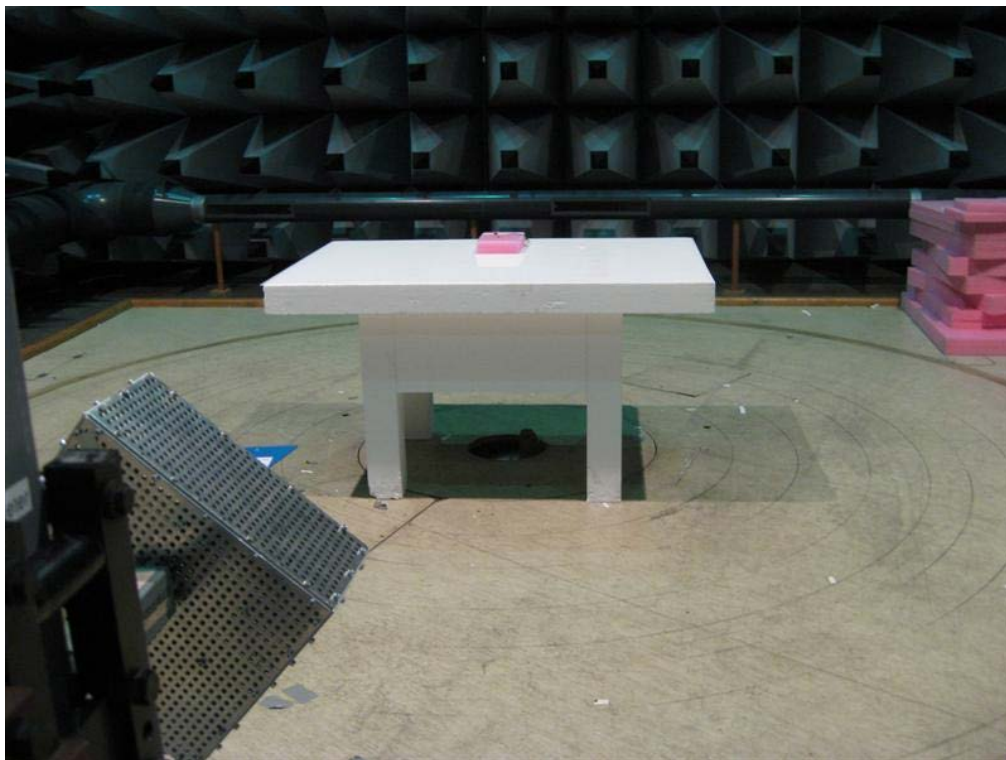


Photo 4.5.1 Test setup regarding measurement of radiated emission above 1 GHz .

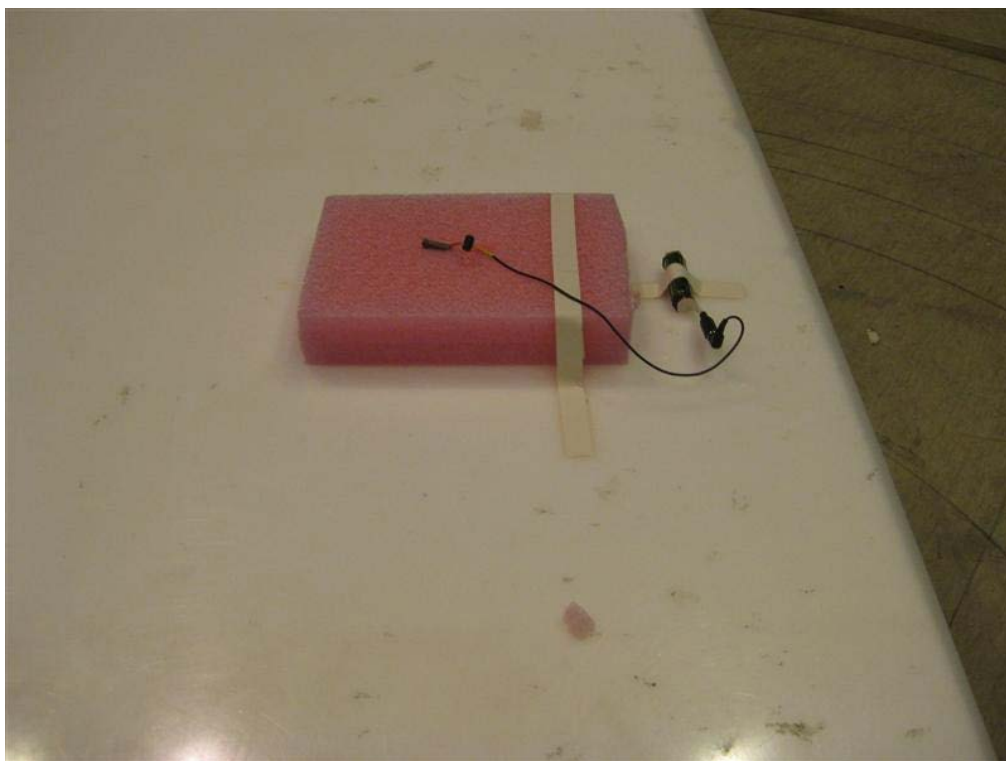
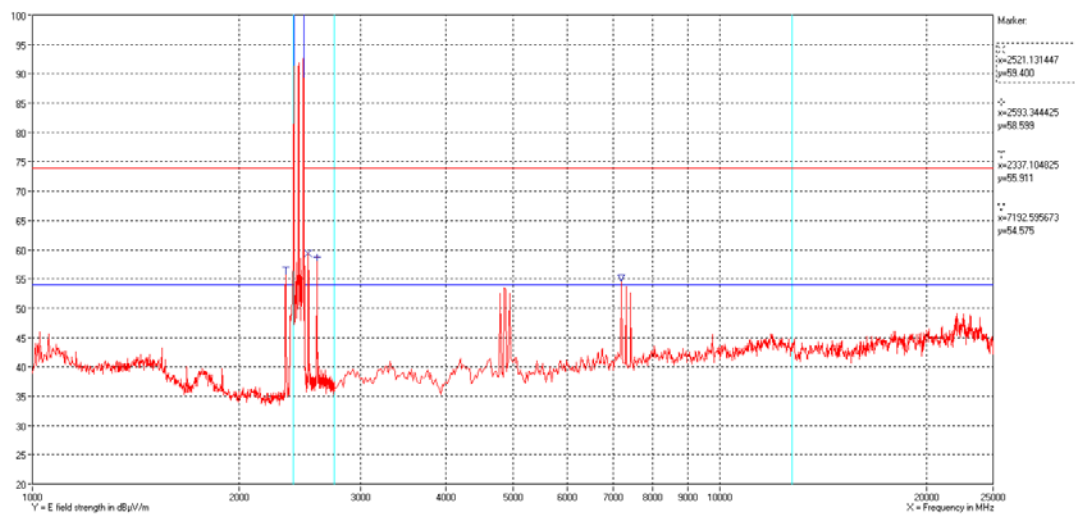


Photo 4.5.2 Test setup regarding measurement of radiated emission above 1 GHz.

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

Test object	VE312	Sheet	RE_Spur-9
Type	VE312	Project no.	T205853-3
Serial no.	#2	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	53 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	Uncertainty	4.9 dB



Polarization

Vertical and horizontal peak measurements

Comments

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



Test object	VE312	Sheet	RE_Spur-10
Type	VE312	Project no.	T205853-3
Serial no.	#2	Date	15 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	53 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	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
2521	52.6	59.4	74	-17.7	42.3	54	Passed
2593	52.5	58.6	74	-17.7	40.9	54	Passed
2337	52.4	55.9	74	-17.7	38.2	54	Passed
7193	77.8	54.6	74	-17.7	36.9	54	Passed
Note 1:							

Test result The measured peak field strengths were below the peak limit
The measured peak field strengths corrected with the DCCF (δ) were below the average limit
Corrected average: $P_{\text{Average}}(\text{resulting}) = P_{\text{peak}} + \text{DCCF}(\delta)$.

Test Port Enclosure

Test frequency 2402, 2440 and 2480 MHz

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

Condition Normal

Compliant Yes

Comments Final maximal measurements by variation of turntable azimuth, antenna height and antenna polarization
Test voltage: External power supply at 1.5 VDC





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

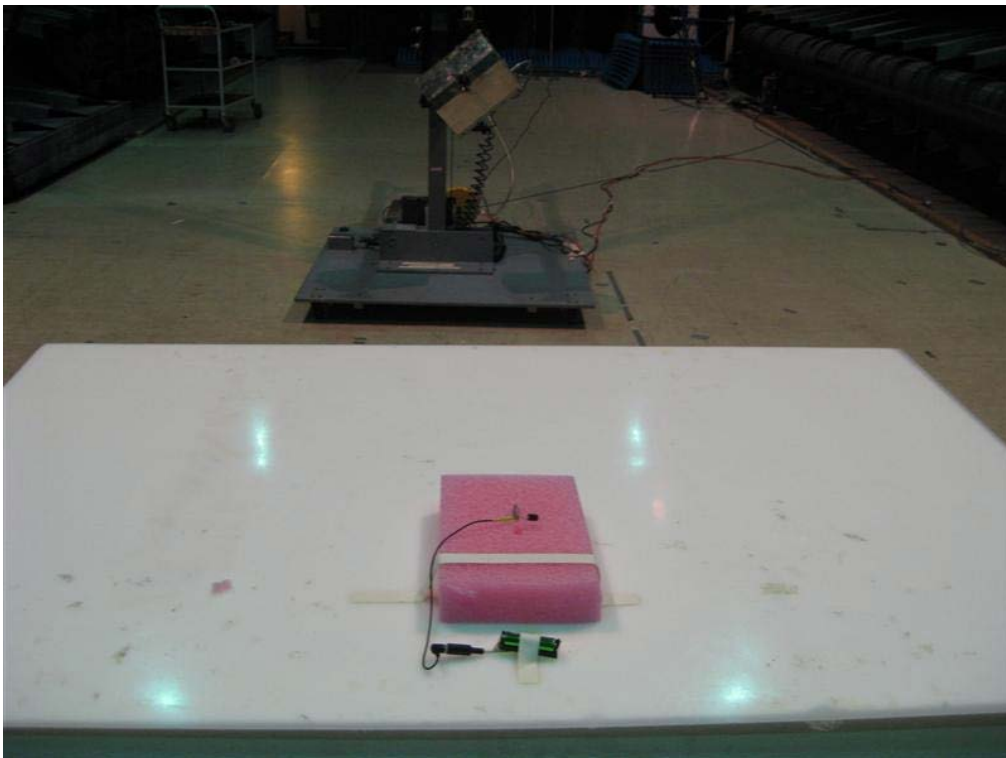


Photo 4.6.2 Test setup regarding measurement of radiated emission above 1 GHz.

4.7 Measurement of field strength of fundamental, GN radio

Test object	VE312	Sheet	RE_Spur-11
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	53 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	Uncertainty	4.9 dB

Frequency [MHz]	Peak measurement [dBμV/m]	Peak limit [dBμV/m]	DCCF (δ) [dB]	Corrected average measurement [dBμV/m]	Average limit [dBμV/m]	Remarks
2404	89.9	114	-13.2	76.7	94	Passed
2440	91.5	114	-13.2	78.3	94	Passed
2478	92.8	114	-13.2	79.6	94	Passed

Test result

The measured peak field strengths were below the peak and average limits

The measured peak field strengths corrected with the DCCF (δ) were below the peak and average limits

Corrected average: $P_{\text{Average}}(\text{resulting}) = P_{\text{peak}} + \text{DCCF}(\delta)$.

Test Port Enclosure

Test frequency 2404, 2440 and 2478 MHz

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

Condition Normal

Compliant Yes

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

Test voltage: External power supply at 1.5 VDC



4.8 Measurement of field strength of fundamental, Bluetooth LE radio

Test object	VE312	Sheet	RE_Spur-12
Type	VE312	Project no.	T205853-3
Serial no.	#3	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		Frequency 1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	53 % RH
Detector	Peak for 1 GHz to 25 GHz	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	Uncertainty	4.9 dB

Frequency [MHz]	Peak measurement [dBμV/m]	Peak limit [dBμV/m]	DCCF (δ) [dB]	Corrected average measurement [dBμV/m]	Average limit [dBμV/m]	Remarks
2402	91.3	114	-17.7	73.6	94	Passed
2440	91.8	114	-17.7	74.1	94	Passed
2480	92.6	114	-17.7	74.9	94	Passed

Test result The measured peak field strengths were below the peak and average limits

The measured peak field strengths corrected with the DCCF (δ) were below the peak and average limits

Corrected average: $P_{\text{Average(resulting)}} = P_{\text{peak}} + \text{DCCF}(\delta)$

Test Port Enclosure

Test frequency 2402, 2440 and 2480 MHz

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

Condition Normal

Compliant Yes

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

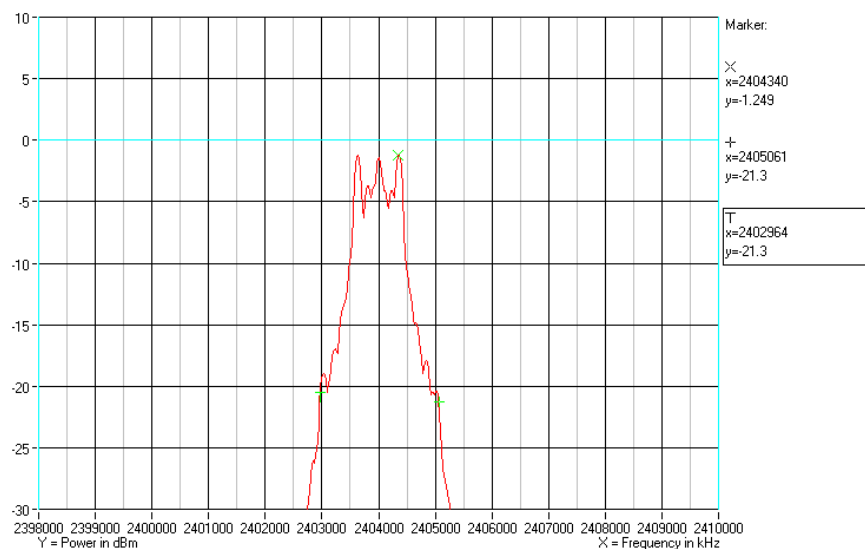
Test voltage: External power supply at 1.5 VDC



4.9 Measurement of 20 dB bandwidth, GN radio

Test object	VE312	Sheet	PROF-1
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



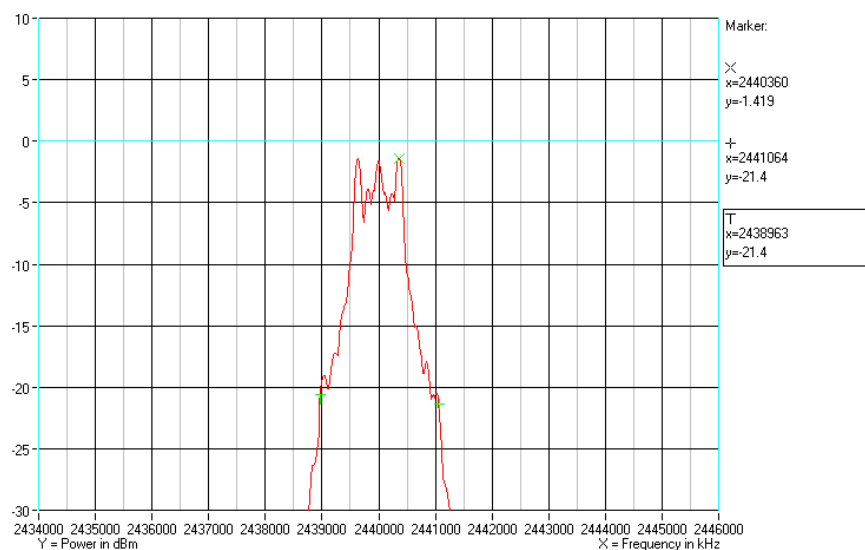
Comments

Operating frequency: 2404 MHz.



Test object	VE312	Sheet	PROF-2
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



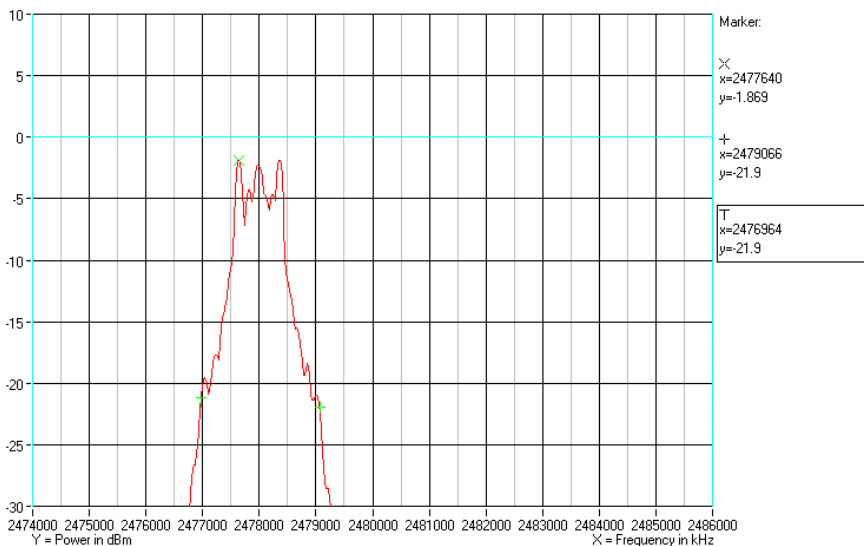
Comments

Operating frequency: 2440 MHz.



Test object	VE312	Sheet	PROF-1
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	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	VE312	Sheet	PROF-3
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	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	2402.9	2405.1	-
2440	2438.9	2441.1	-
2478	2476.9	2479.1	-

Note 1:

Operating frequency [MHz]	Measured [MHz]	Limit [MHz]	Remarks
Lowest frequency	2402.9	2400.00	Passed
Highest frequency	2479.1	2483.50	Passed

Band edge criteria 20 dB bandwidth

Test result The measured 20 dB bandwidth were within the limit designated in 15.215(c)

Test port Antenna replaced by SMA connector

Test frequency 2404, 2440 and 2478 MHz

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

Condition Normal

Compliant Yes

Comments Test voltage: External power supply at 1.5 VDC



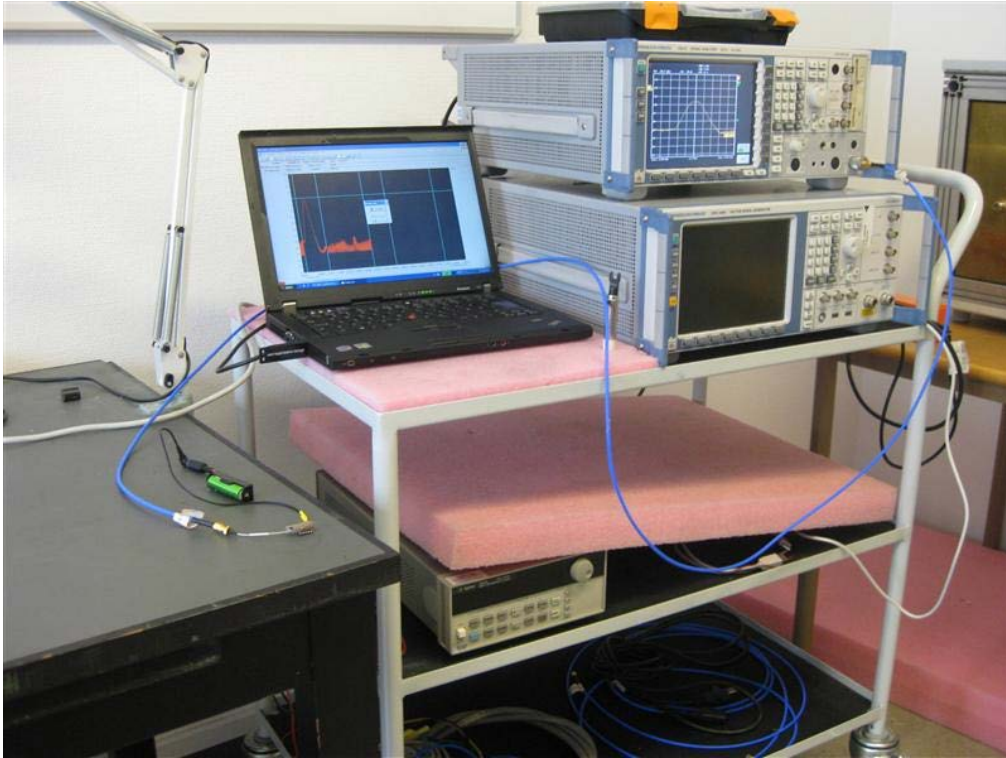
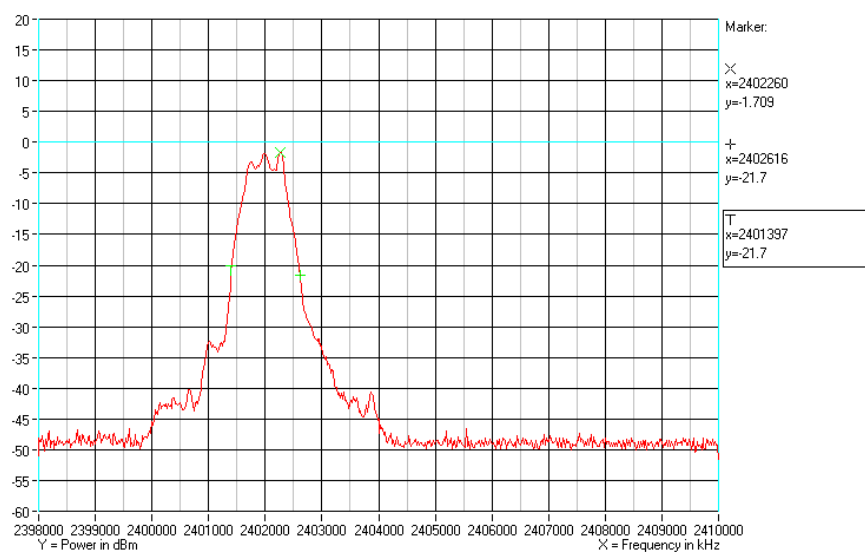


Photo 4.9.1 Test setup regarding measurement of 20 dB bandwidth.

4.10 Measurement of 20 dB bandwidth, Bluetooth LE radio

Test object	VE312	Sheet	PROF-4
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



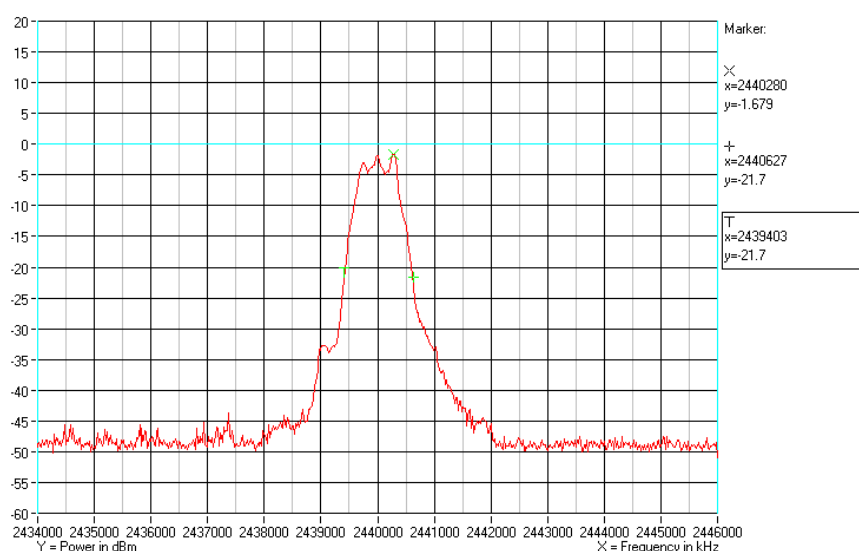
Comments

Operating frequency: 2402 MHz.



Test object	VE312	Sheet	PROF-5
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



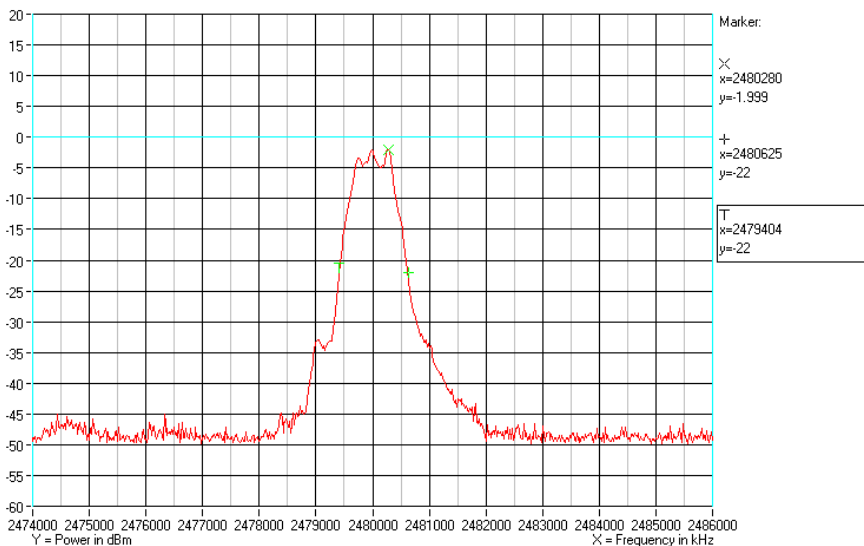
Comments

Operating frequency: 2440 MHz.



Test object	VE312	Sheet	PROF-2
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



Comments

Operating frequency: 2480 MHz.



Test object	VE312	Sheet	PROF-6
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	ANSI C63.10:2009		Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC		Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm	49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold			

Operating frequency [MHz]	Low frequency [MHz]	High frequency [MHz]	Remarks
2402	2401.4	2402.6	-
2440	2439.4	2440.6	-
2480	2479.4	2480.6	-

Note 1:

Operating frequency [MHz]	Measured [MHz]	Limit [MHz]	Remarks
Lowest frequency	2401.4	2400.00	Passed
Highest frequency	2480.6	2483.50	Passed

Band edge criteria 20 dB bandwidth

Test result The measured 20 dB bandwidth were within the limit designated in 15.215(c)

Test port Antenna replaced by SMA connector

Test frequency 2402, 2440 and 2480 MHz

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

Condition Normal

Compliant Yes

Comments Test voltage: External power supply at 1.5 VDC



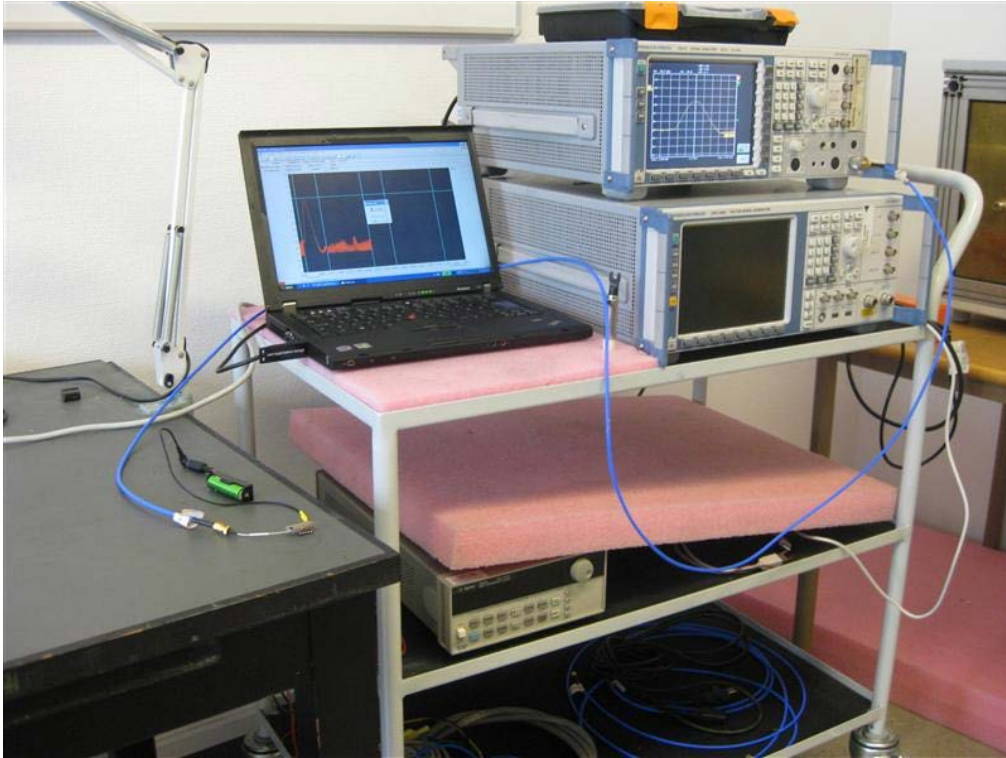


Photo 4.10.1 Test setup regarding measurement of 20 dB bandwidth.

4.11 Measurement of band edge compliance, GN radio

Test object	VE312	Sheet	PROF-7
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, antenna distance 3 m	Humidity	53 % RH
Detector	Peak and average	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	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	76.7	46.25	30.45	54	-
2400	2404	Peak	89.9	46.25	43.65	74	-
2483.5	2478	Average	79.6	46.63	32.97	54	-
2483.5	2478	Peak	92.8	46.63	46.17	74	-
Note 1:							

Test result The measured and corrected peak and average field strengths at the band edge were 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 1.5 VDC



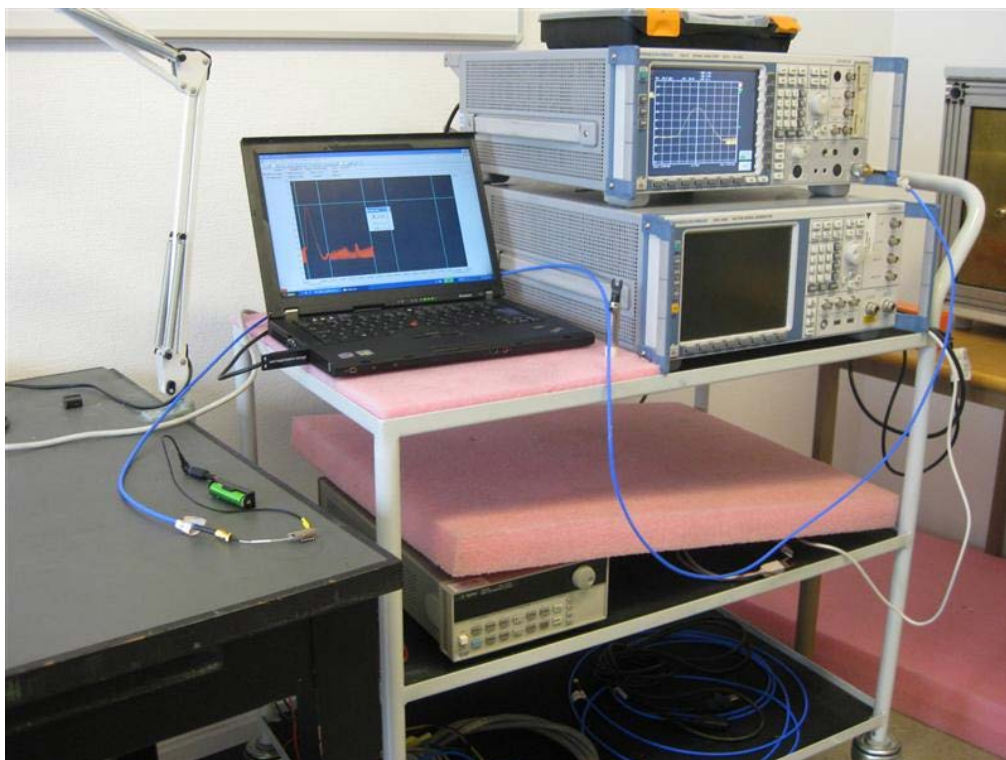


Photo 4.11.1 Test setup regarding measurement of band edge compliance.

4.12 Measurement of band edge compliance, Bluetooth LE radio

Test object	VE312	Sheet	PROF-8
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests	Frequency	1-25 GHz

Test method	ANSI C63.10:2009	Temperature	24 °C
Characteristics	Complete search, Antenna distance 3 m.	Humidity	53 % RH
Detector	Peak and average	Bandwidth	1 MHz
Test equipm.	EMI room Hørsholm 49086 49600 49625 49712	Uncertainty	4.9 dB

Band Edge frequency [MHz]	Operating frequency [MHz]	Average / Peak	Fundamental field strengths [dB μ V/m]	Marker-delta method [dB]	Corrected [dB μ V/m]	Limit at Band Edge [dB μ V/m]	Remarks
2400	2404	Average	73.6	43.7	29.9	54	-
2400	2404	Peak	91.3	43.7	47.6	74	-
2483.5	2478	Average	74.9	46.9	28.0	54	-
2483.5	2478	Peak	92.6	46.9	45.7	74	-
Note 1:							

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

Test Port Enclosure and antenna connector

Test frequency 2402 and 2480 MHz

Test mode Continuous Tx - GFSK modulation - hopping 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 1.5 VDC



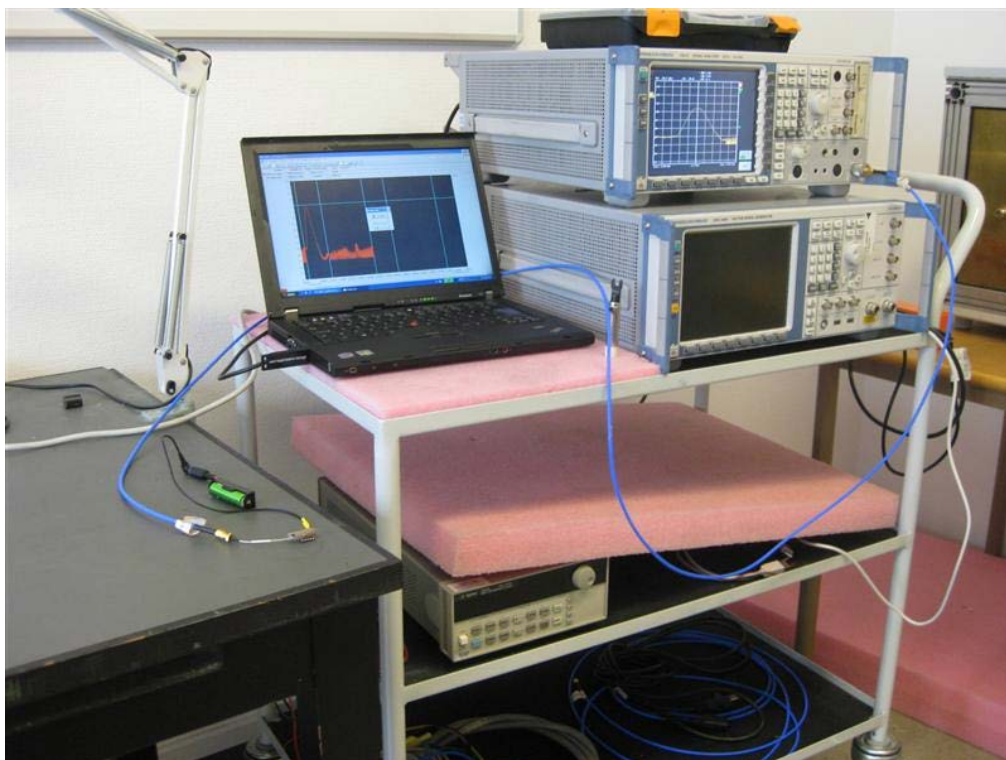
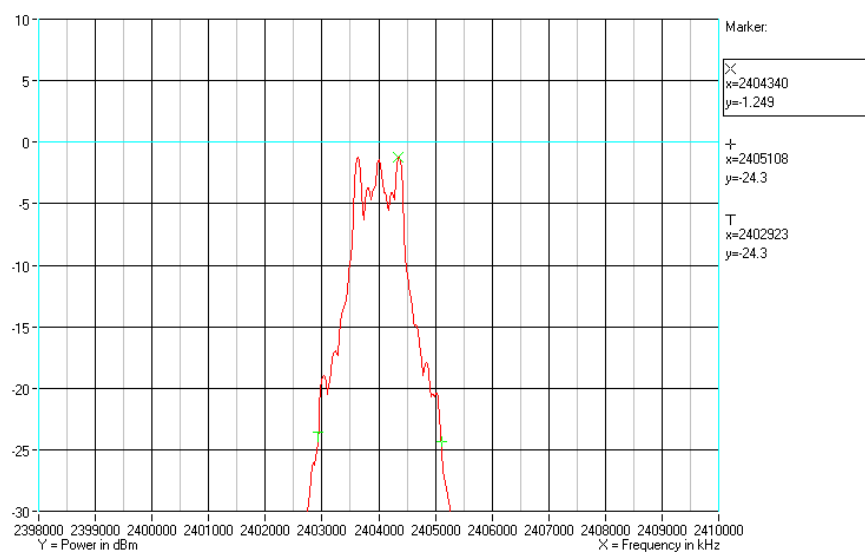


Photo 4.12.1 Test setup regarding measurement of band edge compliance.

4.13 Measurement of occupied bandwidth, IC, GN radio

Test object	VE312	Sheet	PROF-9
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



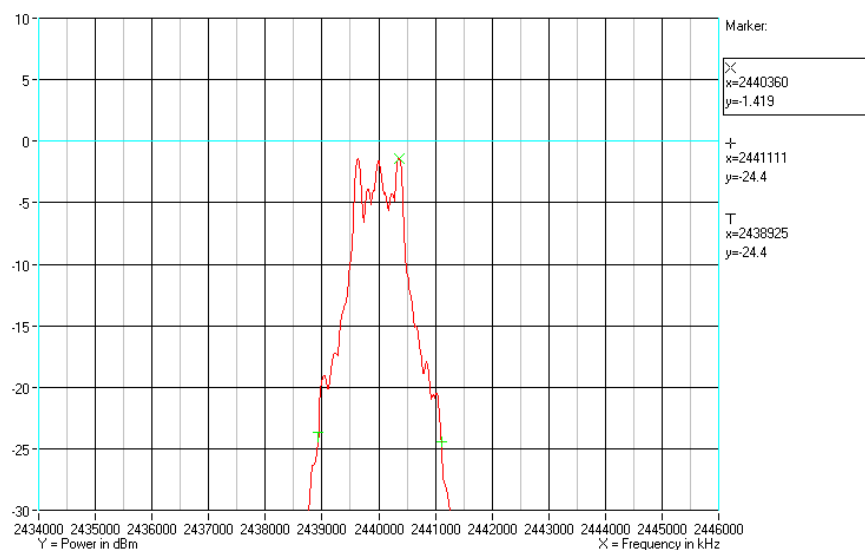
Comments

Operating frequency: 2404 MHz.



Test object	VE312	Sheet	PROF-10
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



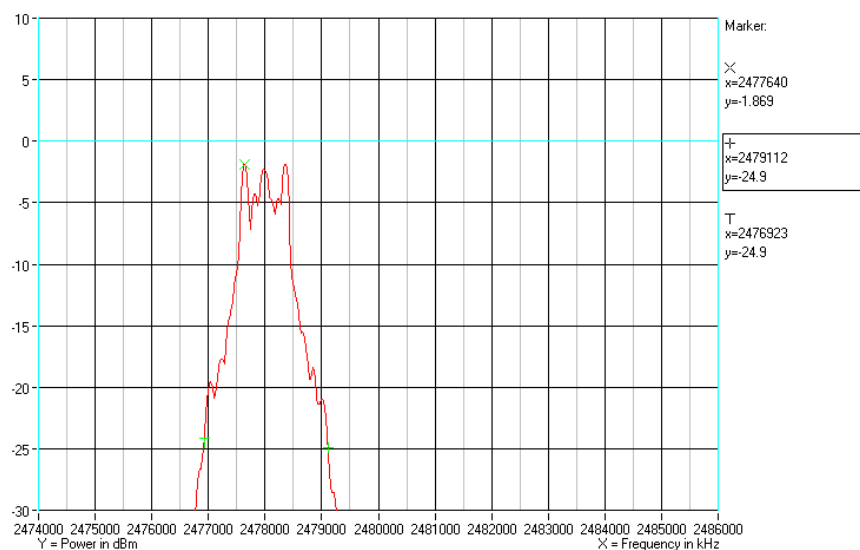
Comments

Operating frequency: 2440 MHz.



Test object	VE312	Sheet	PROF-11
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	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	VE312	Sheet	PROF-12
Type	VE312	Project no.	T205853-3
Serial no.	#14	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	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	2402.9	2405.1	2.2
2440	2438.9	2441.1	2.2
2478	2476.9	2479.1	2.2
Note 1:			

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



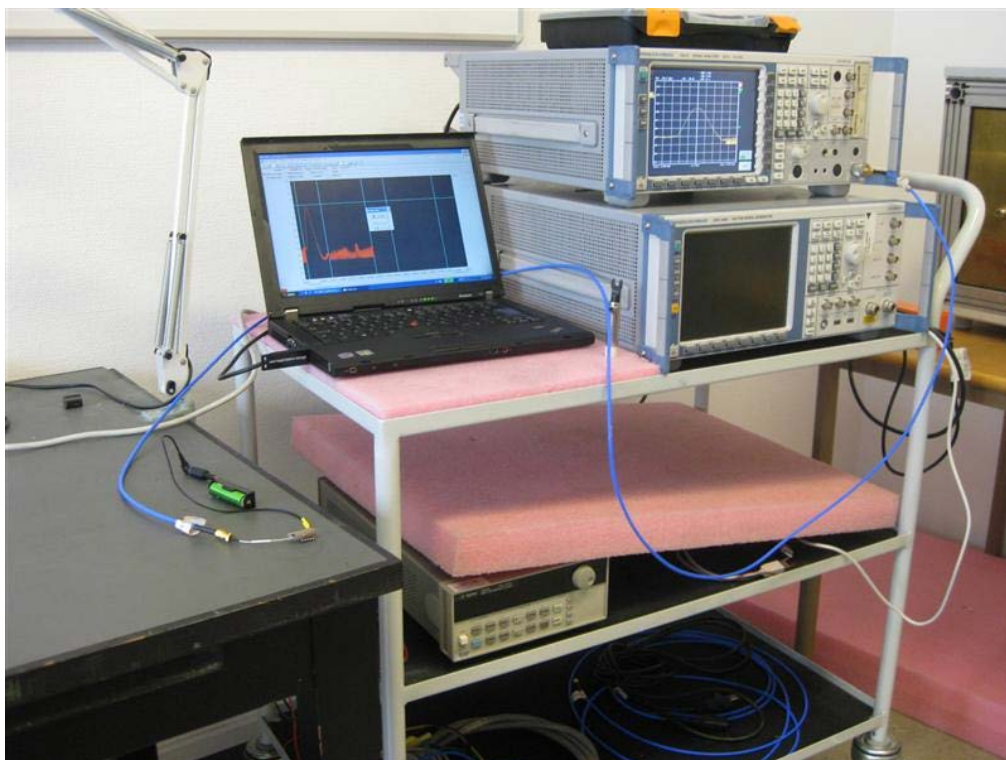
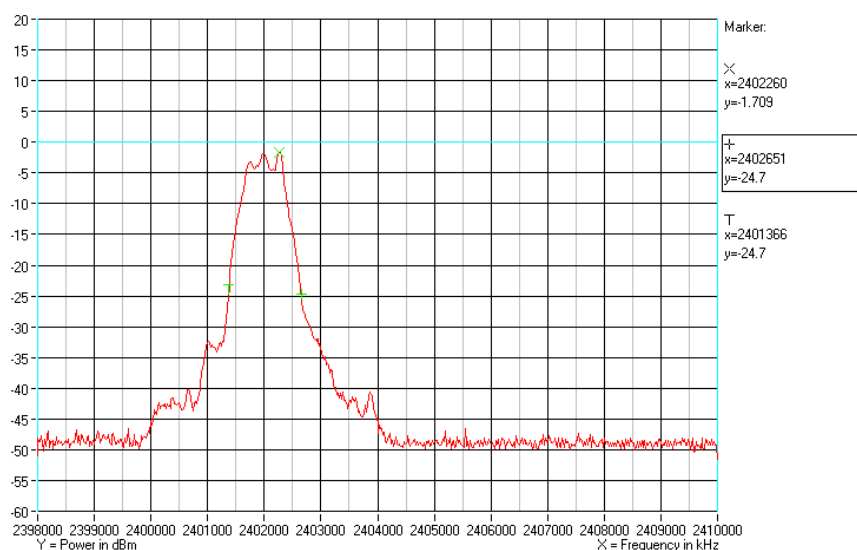


Photo 4.13.1 Test setup regarding measurement of occupied bandwidth.

4.14 Measurement of occupied bandwidth, IC, Bluetooth LE radio

Test object	VE312	Sheet	PROF-13
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



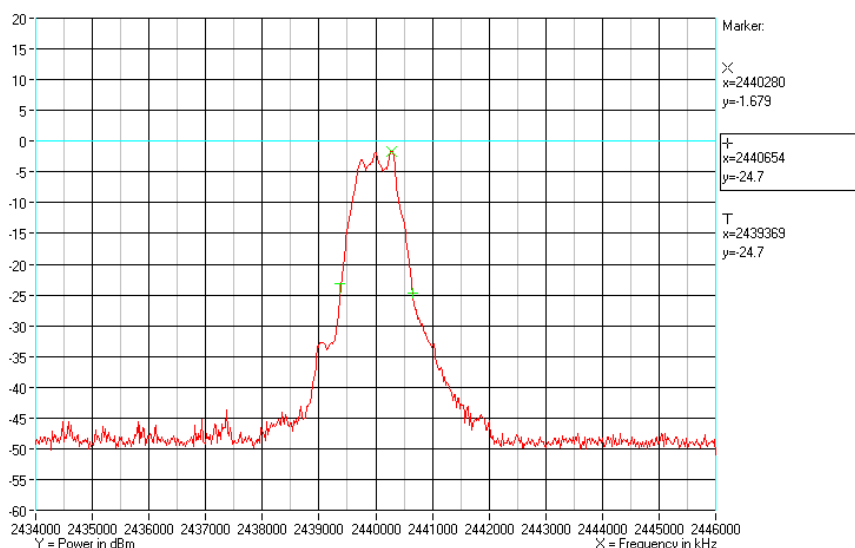
Comments

Operating frequency: 2402 MHz.



Test object	VE312	Sheet	PROF-14
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



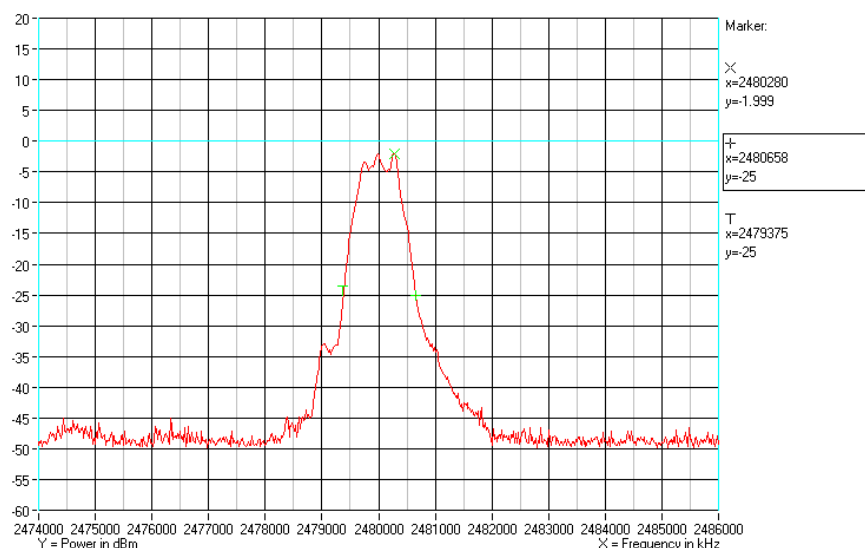
Comments

Operating frequency: 2440 MHz.



Test object	VE312	Sheet	PROF-15
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		



Comments

Operating frequency: 2480 MHz.



Test object	VE312	Sheet	PROF-16
Type	VE312	Project no.	T205853-3
Serial no.	#18	Date	16 July 2013
Client	GN Hearing A/S	Initials	PWF
Specification	See section 1 Summary of tests		

Test method	IC Standard RSS-Gen, Issue 3:2010 - Section 4.6.1	Temperature	24 °C
Characteristics	Test voltage: External power supply at 1.5 VDC	Humidity	53 % RH
Test equipm.	SRD Lab Hørsholm 49550	Uncertainty	1.1 dB
SA Settings	RBW: 100 kHz VBW: 300 kHz SPAN: 12 MHz DET: Peak CF: Operating freq. Trace: max. hold		

Operating frequency [MHz]	Low frequency [MHz]	High frequency [MHz]	Measured 99% emission bandwidth [MHz]
2402	2401.4	2402.7	1.3
2440	2439.4	2440.7	1.3
2480	2479.4	2480.7	1.3
Note 1:			

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



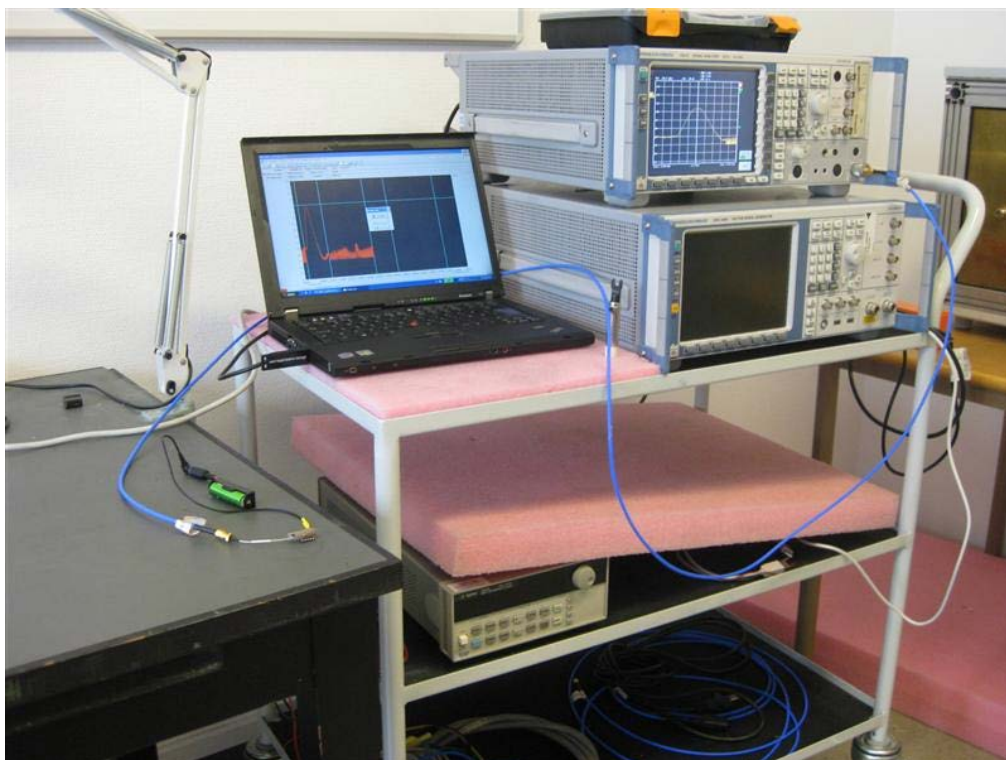


Photo 4.14.1 Test setup regarding measurement of occupied bandwidth.

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.	Description	Manufacturer	Type no.	Cal. date	Cal. exp.
49086	REMI EMISSION SOFTWARE PACKAGE v. 2.133, ROOM 5	NeWeTec	REMI		
49154	BILOG ANTENNA	CHASE	CBL6111A	19-07-2011	19-07-2013
49183	POWER SUPPLY	TTI	PL 320		
49299	DIGITAL MULTIMETER	Fluke	87-4	05-11-2012	05-11-2013
49550	SIGNAL ANALYZER	ROHDE & SCHWARZ	FSQ8	09-07-2013	09-07-2014
49600	SPECTRUM ANALYZER / MEASUREMENT RECEIVER	ROHDE & SCHWARZ	ESU40	08-01-2013	08-01-2014
49625	SRD COAX SWITCH MATRIX USED IN 1 GHz TO 26 GHz SRD ANTENNA SYSTEM	DELTA	COAX SWITCH MATRIX	11-06-2013	11-06-2014
49712	DUAL RIDGE HORN ANTENNA – 1 GHz – 26 GHz (2 GHz – 32 GHz)	SATIMO	SH2000	19-09-2012	19-09-2014

