Antenna Gain Report
Jabra Speak2-75

Sep 50, 2024

Author	Revision	Comment
Niels Henrik Greve	1.0	Initial release
Niels Henrik Greve	2.0	Update

Table of Contents

1 Document Purpose

This document is intended for TA instances employed by GN Audio A/S and presents some relevant data with respect to the provided DUT(s) such as antenna Gain, implemented S/w version, conducted output power measurements etc, as well as serving as a supplements report carried out in GN Audio A7S own Labs.

1.1 Document Abbreviations

Acronym	Definition
BT	Blue tooth
BLE	Blue tooth Low Energy
BDR	Basic Date rate
DUT	Device Under test
EDR	Enhanced Date Rate
GN	Great Northern
R&D	Research& Development
RF	Radio Frequency
SW	Software
TA	Type Approval
TRP	Total Radiated Power

Table 1: Document abbreviations

1.2 References

Ref. No.	Released	Type	Documents Title	Revision
1	20220825	Test Instruction	Jabra speak2-75 Test Instruction	1.0
2	20220825	Product Description	Product Description Jabra Speak2-75	1.0

Table 2: Reference Documents

2.0 SW Version

The DUT have the SW version given by Table 3 installed, which may be an internal release by GN Audio A/S. In some case, this is due to the t need for enabling the DUT(s) for RF TEST mode, which will not be available to the end-user in a final commercialized version of the product

SW Version	Comments(s)
0.0.25	R&D TA Release (RF-test mode included)

Table 3: software version for DUT.

2.1 Conducted Power

Table 4 lists output Power values measured on conducted samples for Channel 0,39,78 respectively. These values are representative for any sample(s) measured in sections 2.3 below, as all samples have been fitted with the same Power Table and SW as stated in subsections 2.0 Above. The measurements have been done with a Bluetooth tester and the sample have been in test mode.

Channel	0	39	78	Comment
Frequency	2402 MHz	2441 MHz	2480 MHz	
Power	11.30 dBm	11.39 dBm	11.48 dBm	Conducted power
Units Bluetooth address: 08C8C26C46F6				

Figure 4: Conducted power measurements

2.2 Anechoic antenna Chamber:

The anechoic antenna is a ETS Lindgren Chamber, equipment with a EMS32 measurements system from R&S. The antenna measurements system gives a full 3D TRP measurements result. The chamber is part of GN research Lab. (figure 1.)

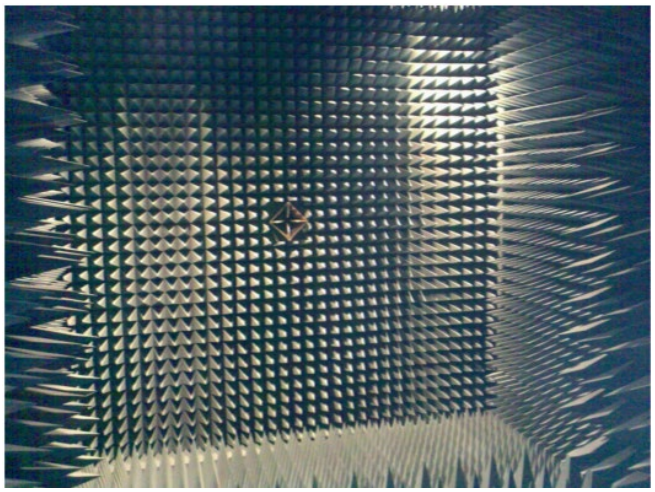


Figure 1: GN anechoic antenna chamber.

See more information in Appendix A:

2.3 Antenna measurements setup:
The Radiated sample is place inside GN anechoic chamber as indicated in figure 2 and figure 3.

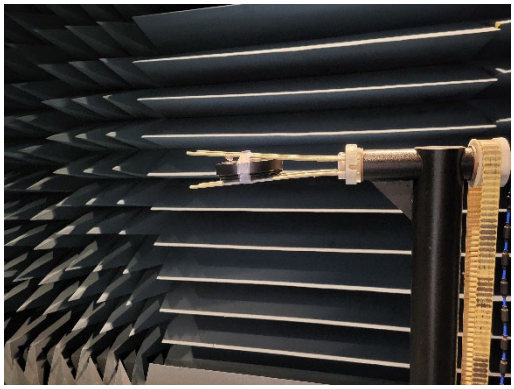


Figure 2: DUT in antenna chamber, sideview

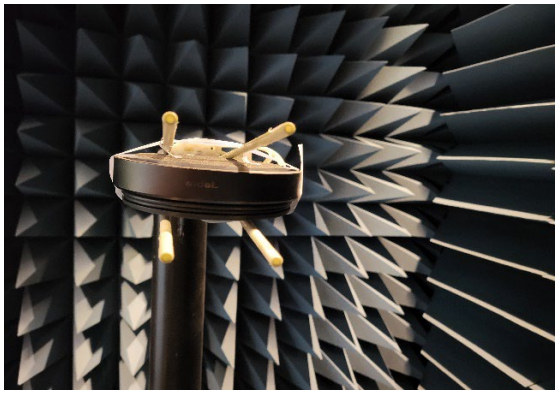


Figure 3: DUT in antenna chamber front view

The Dut is place in the chamber according to chamber test setup. The DUT position is positions in the center point of the turn table.

2.4 Radiated Performance:

The antenna measurements are highlighted in Table 5, all measurements are done in GN anechoic chamber. Three channel and frequency point is measured.

Channel		0	39	78	Units
Frequency		2402	2445	2480	[MHZ]
Sample ID	BT Address	Output power Conducted cable			
# 1	08C8C26C46F6	11.30	11.39	11.48	dBm
Bluetooth Adress for conducted units: 08C8C26C46F6					
	Radiated Power measured in GN Anechoic chamber				
	BT Address	2402 MHz	2441 MHz	2480 MHz	
# 2	TRP	11.06 dBm	11.33 dBm	10.64 dBm	dBm
	Peak EIRP	16.60 dBm	16.88 dBm	15.76 dBm	dBm
	Directivity dBi	5,55 dBi	5.55 dBi	5.12 dBi	dBi
	Efficiency dB	-0.24dB	-0.06 dB	0.84dB	dB
	Efficiency %	94.6 dB %	98.6 dB%	82.4 %	%
	Gain	5.3 dB	5.49dB	4.28dB	dB
Bluetooth Adress for radiated units: 50C275CC34B9					

Table 5: Radiated and conducted power.

2.4 Antenna information:
The antenna in the DUT under test is PIFA antenna manufacturer in metal sheet. The antenna have two ground legs and one feed legs. Se figure 4 and figure 5.

Frequency band: 2402-2480MHz
Impedance : 50 ohm
Radiation : omni-directional
Antenna type : PIFA
Material : Metal

Polarization : Vertical

Admitted power: < 12 dBm

Frequency	2402 MHz	2441MHz	2480 MHz
Antenna Gain	5.3 dB	5.49 dB	4.24 dB

Figure 4: Antenna in DUT antenna

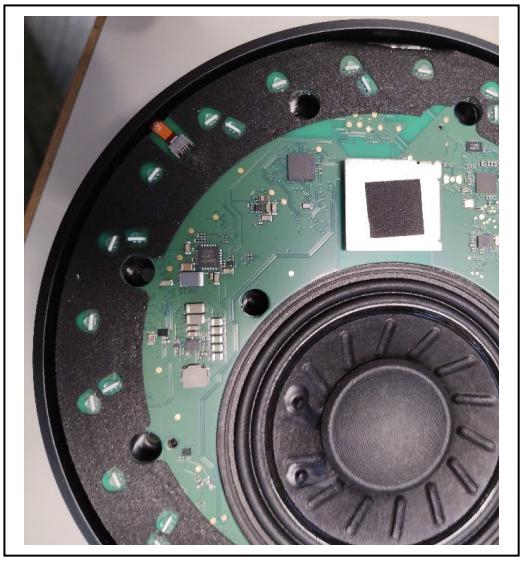
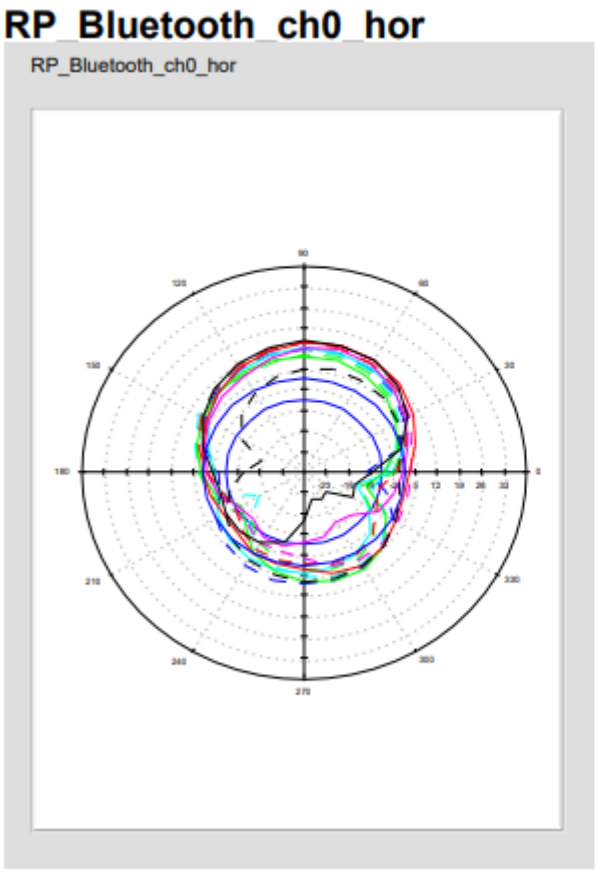


Figure 5: DUT PIFA antenna top view

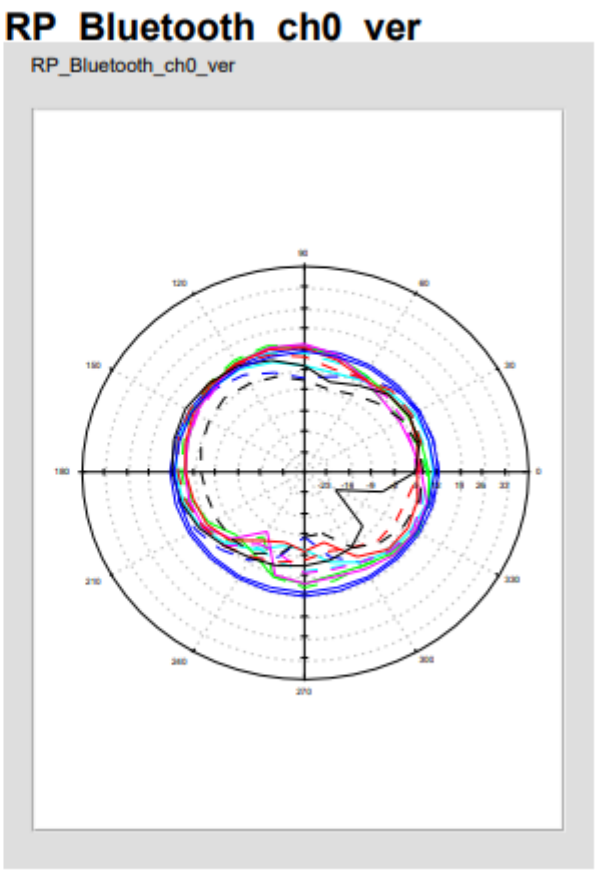
3.0 Total Radiated Power.

The following figures are extracted to present a convenient overview of the DUT's Free space Radiation pattern. Value for any individual points measured can be accesses in the enclosed reports.

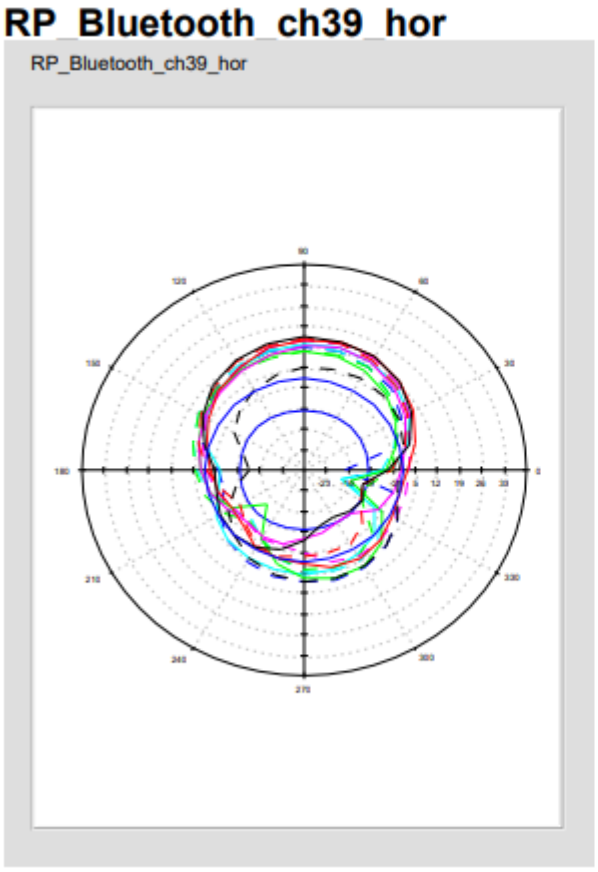
3.1 2D Radiation Patterns (Free space):



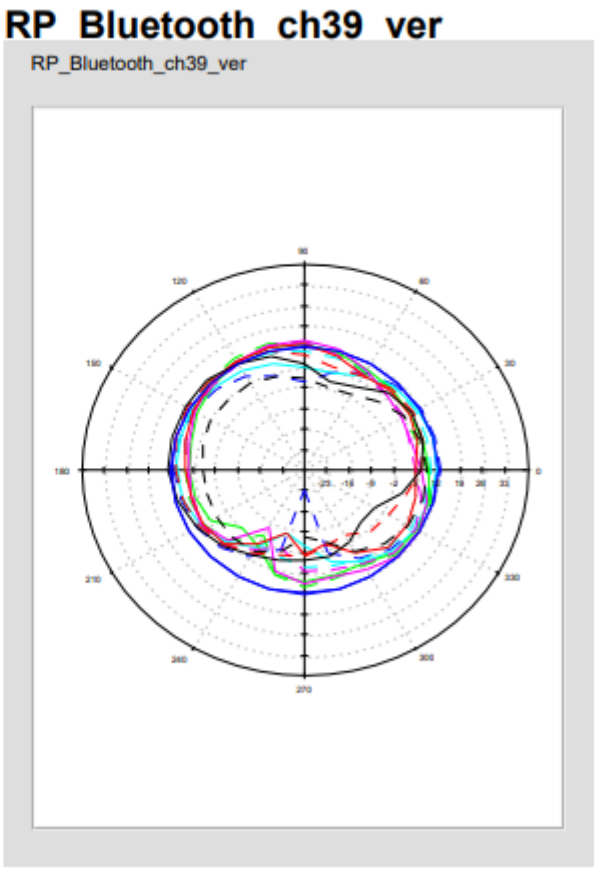
Horizontal Polarization @ CH0



Vertical Polarization @ CH0

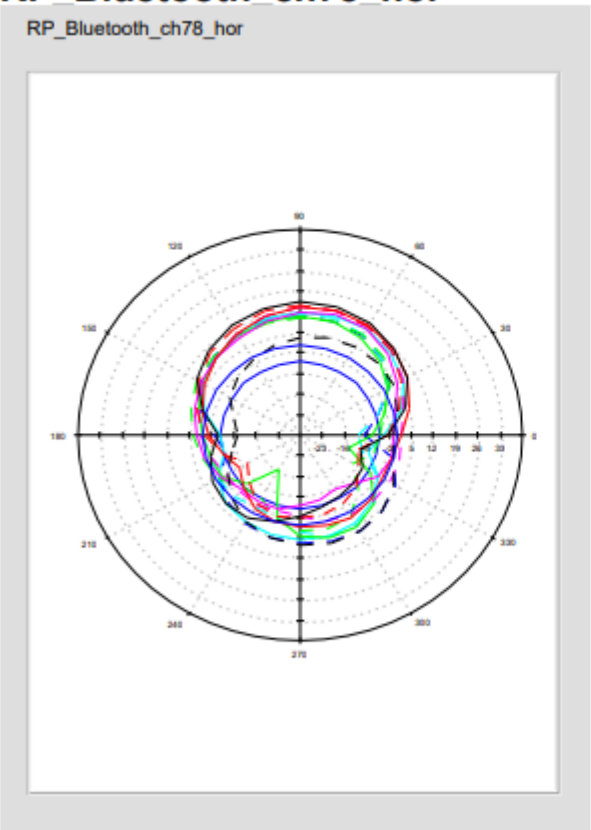


Horizontal Polarization @ CH39



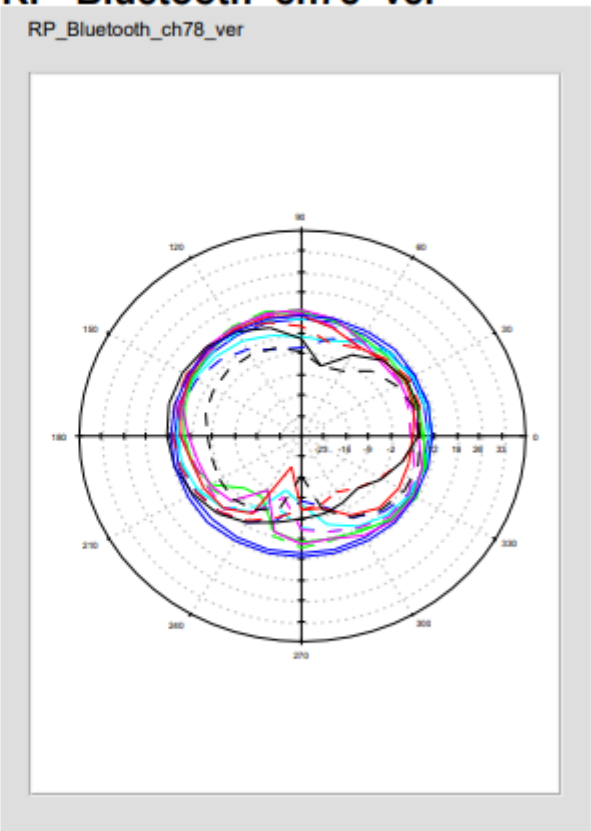
Vertical Polarization @ CH39

RP_Bluetooth_ch78_hor



Horizontal Polarization @ CH78

RP_Bluetooth_ch78_ver



Vertical Polarization @ CH78

4.0 Conclusion

The radiated power from the DUT goes from 11.06dBm to 10.64dBm. The conducted power number are from 11.3dBm to 11.48dBm. This gives the following number for conducted power and radiated power.

	2402 MHz	2441 MHz	2480 MHz
Conducted power	11,3 dBm	11.39 dBm	11.48 dBm
Radiated power	11.06 dBm	11.33	10.64 dBm

	2402 MHz	2441 MHz	2480 MHz
Antenna Gain	5.3 dB	5.49dB	4.24dB

Appendix A : GN anechoic Chamber setup:

Anechoic chamber instrumentation setup:

Test Location: GN Research Lab RF-Anechoic, Ballerup, Denmark

Equipment List - OTA Test

MgnNo.	Description	Vendor	Model	Calibration Status
031	Vector Network Analyzer	R&S	ZVRE	OK
092	Spectrum Analyzer	R&S	FSU8	OK
218	Turntable/ mast controller	ETS	2090	OK
414	Comparison Noise Emitter	York EMC	CNEIII	OK
602	BT/Comm. Tester	R&S	CMU 200	OK
752	Dipole Antenna	ETS	3126-1880	OK
753	Dipole Antenna	ETS	3126-2450	OK
765	Switch Driver	HP/Agilent	11713A	OK
791	Laptop PC	Lenovo	W540	OK
793	Switch Driver	HP/Agilent	11713A	OK
794	Antenna Horn	ETS	3164-04	OK
956	Spectrum Analyzer	R&S	FPL1007	OK

Table 1: GN anechoic Chamber instrumentation.

The RF-Anechoic chamber is a Fully Anechoic ETS-Lindgren APM Chamber "Based on AMS 8500".
Internal dimensions are 7.28 x 3.60 x 3.60 m.
The chamber is specified to be used in the frequency range 0.7-6GHz:

Frequency	Guaranteed Reflection Level
0.7 GHz	- 24 dB
0.8 GHz	- 29 dB
1.8 GHz	- 37 dB
2.5 GHz	- 41 dB
6.0 GHz	- 50 dB

Range Calibration of the chamber covers the frequency ranges 1.73-2.03GHz, 2.3-2.6GHz and 1-4GHz.

The equipment consists of PC-controlled hardware for antenna pattern tests - see paragraph 4 "Functional diagram".

Table 2: Chamber specifications.

3.1 PC Primary Software information

Operating System:	Microsoft Windows
Software for Radiation Pattern Tests:	Rohde & Schwartz AMS32/EMC32
Software for Radiation Pattern Tests:	ETS EMQuest

Table 3: Software information's:

5 Facility validation

5.1 Fully Anechoic Chamber Acceptance Test

5.1.1 Chamber installation 2006

After installation of the Fully Anechoic Chamber an Acceptance Test was performed by an accredited testing laboratory, Seibersdorf Research, and described in their Test Report No. EH-H10/05, dated 13/7-2006.
The report "Test-report_fac-RF-Chamber.pdf" is located on GN-servers.
Results in summary:
The "Free Space VSWR" shows a reflectivity below the specified Guaranteed Reflection Level at 836.5 MHz (-29 dB) and 1880 MHz (-37 dB).

5.1.2 Chamber upgrade 2012

After upgrade of the Fully Anechoic Chamber with a new Continous Rotation Mast, new motorbases etc. an Acceptance Test was performed by an accredited testing laboratory, Seibersdorf Laboratories, and described in their Test Report No. EH-H01/12, dated 2012-02-02.
The report "H-495 Test Report FAC-RF-Chamber.pdf" is located on GN-servers.
Results in summary:
The "Free Space VSWR" shows a reflectivity below the specified Guaranteed Reflection Level at 1880 MHz (-37 dB) and 2450 MHz (-41 dB).

5.2 Calibration procedures

A Range Calibration is performed in the frequency ranges 1.73-2.03GHz, 2.3-2.6GHz and 1-4GHz whenever stuctural changes to the signal path are made. This calibration includes the total signal path used in the antenna measurements (chamber, antenna, cables, switches etc). The procedure is described in the document "Performing_Range_Calibrations_using_EMQuest.pdf" located on GN-servers. And for the EMC32-Software in the integrated help system via the Help menu.

Key instruments - marked with red frames in the "Functional diagram" - must be marked and calibrated according to "6 Resource Requirements, chapter 6.4".
Key instruments are having a significant effect on the accuracy or validity of test results.

5.3 Validation procedures

5.3.1 Regular facility validation

Validation is done at least according to the interval specified in "CD Tasks".
Test-templates for this are found in the R&S AMS32/EMC32 software under "Test Templates" - "OTA Auto Test" - "_Facility Validation".

Test and Report must be saved in the folder "__FacilityValidation" using the normal procedures.

EUT is a reference RF-source (CNEIII, Mgn No. 414) mounted in a fixture on the mast as shown in the pictures below.

If the resulting TRP (Total Radiated Power / "Tot. Rad. Pwr.") is between -17.8 and -18.8 dBm the validation is approved.

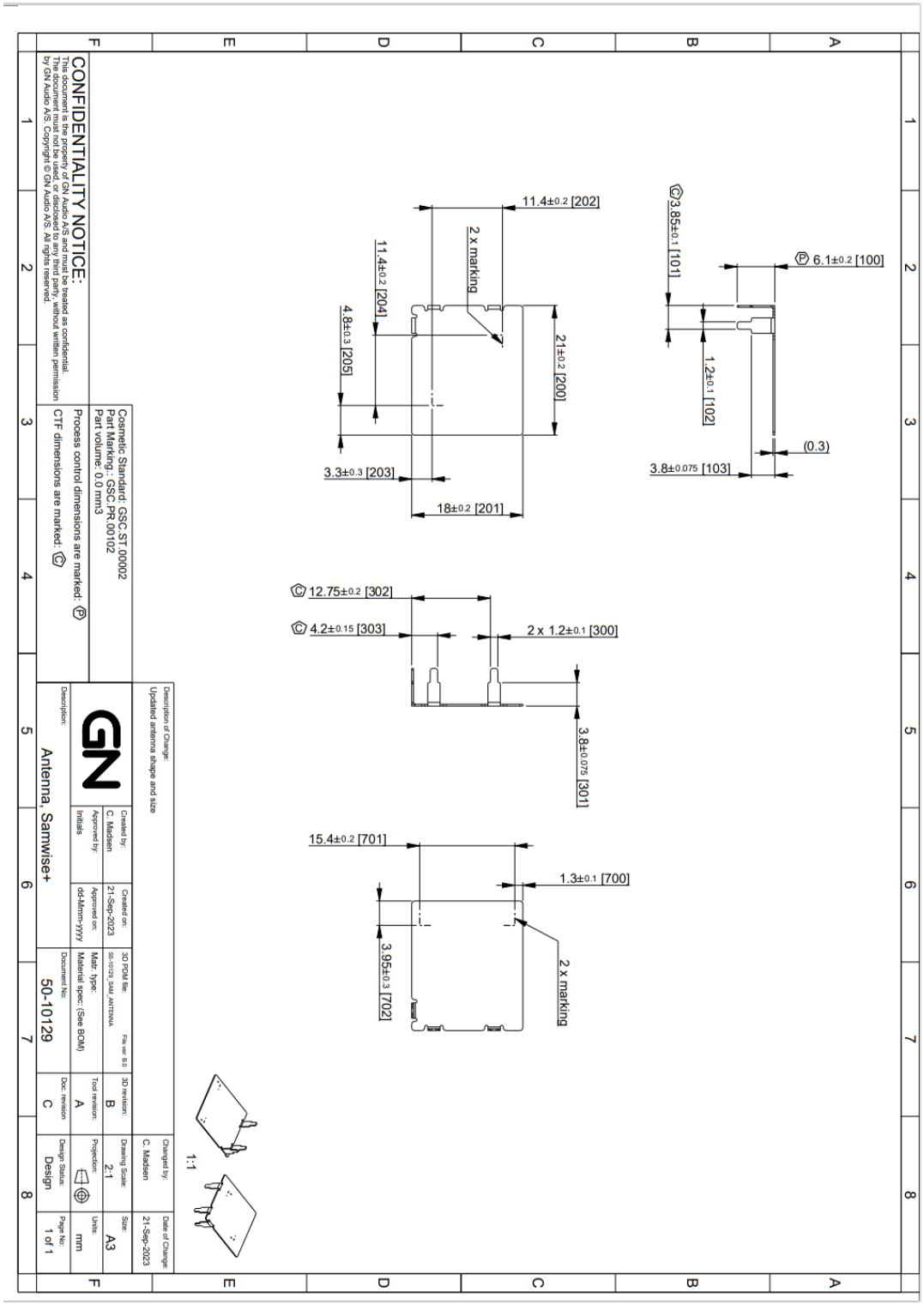
If the resulting TRP is outside this range the validation is rejected.
In this case actions according to "7 Process Requirements, chapter 7.10" must be taken.

Regular Facility Validation results must be added to the RF-Anechoic Validation Log, located in the folder "R:_RF_Anechoic__FacilityValidation\"

5.3.2 Facility validation before measurements intended for product validation

Before measurements intended for product validation a facility validation is required.
This validation shall be done according to the procedures above.

Table 4: Facility Validation.


CONFIDENTIALITY NOTICE:
Cosmetic Standard: GSC.ST.00002
Part Marking:: GSC.PR.00102
Part volume: 0.0 mm3
Process control dimensions are marked: Ⓒ
CTF dimensions are marked: Ⓟ
Description of Change:
Updated antenna shape and size
Description:
Antenna, Samwise+
Created by: C. Madsen
Approved by: Initials
Created on: 21-Sep-2023
Approved on: dd-Mmm-yyyy
3D PDM file: 50-10129_SAM_ANTENNA
Matr. type:
Material spec: (See BOM)
3D revision: B
Tool revision: A
Drawing Scale: 2:1
Projection:
Design Status: Design
Changed by: C. Madsen
Date of Change: 21-Sep-2023
Size: A3
Units: mm
Page No: 1 of 1
Document No: 50-10129
Doc. revision: C
11.4±0.2 [202]
2 x marking
11.4±0.2 [204]
4.8±0.3 [205]
21±0.2 [200]
3.3±0.3 [203]
18±0.2 [201]
Ⓒ3.85±0.1 [101]
Ⓟ 6.1±0.2 [100]
1.2±0.1 [102]
(0.3)
3.8±0.075 [103]
Ⓒ 12.75±0.2 [302]
Ⓒ 4.2±0.15 [303]
2 x 1.2±0.1 [300]
3.8±0.075 [301]
15.4±0.2 [701]
1.3±0.1 [700]
3.95±0.3 [702]
2 x marking
1:1

Revision History:

Maintenance interval: _ _ _ _ _ (Half-yearly / Yearly / Bi-yearly).

Rev	Date	Editor	Reviewer(s)	Description
A	YYYY.MM.DD	Name	Name	Initial version