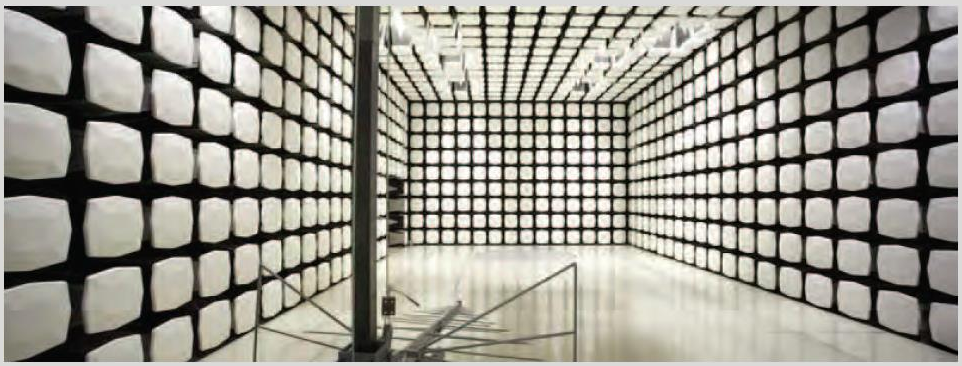
3D Systems Corporation

NextDent 300

FCC 2.1091:2025

RFID

Report: 3DSY0191.5 Rev. 0, Issue Date: July 30, 2025



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2023.04.17

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CERTIFICATE OF EVALUATION

element
2018-09-14
EXRPT.2024.05.10.0

Last Date of Evaluation: July 28, 2025
3D Systems Corporation
EUT: NextDent 300

RF Exposure Evaluation

Standards

Specification	Method
FCC 2.1091:2025	FCC 447498 D01 General RF Exposure Guidance v06

Results

Method Clause	Description	Applied	Results	Comments
7.1	Maximum Permissible Exposure	Yes	Pass	None

Deviations From Evaluation Standards

None

Approved By:

Donald Facteau, Process Architect

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

FDA - Recognized by the FDA as an Accreditation Scheme for Conformity Assessment (ASCA)-accredited testing laboratory for basic safety and essential performance.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:

California Minnesota Oregon Washington

FACILITIES

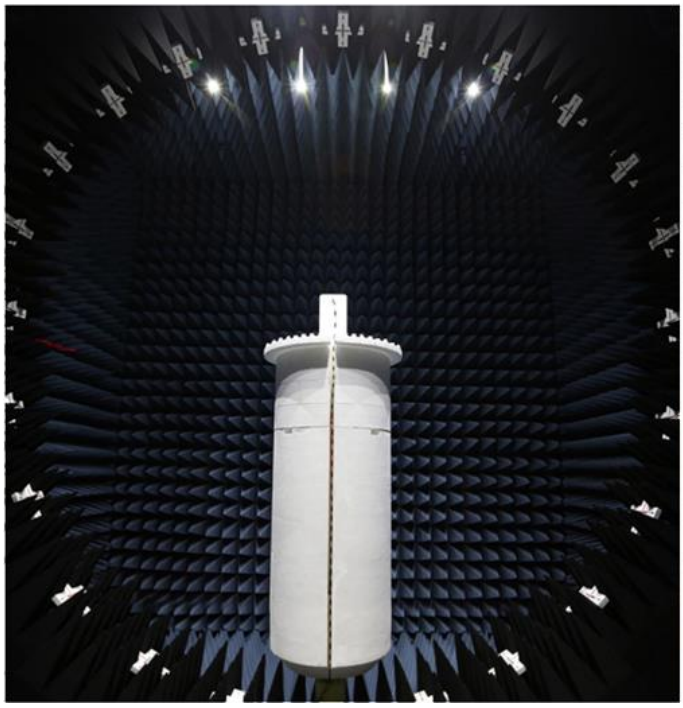
element
2025.01.03

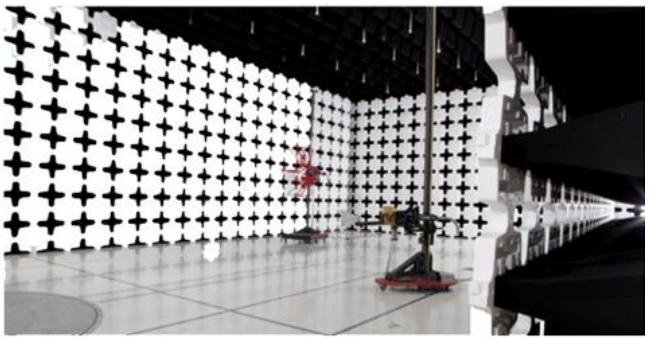
Testing was performed at the following location(s)

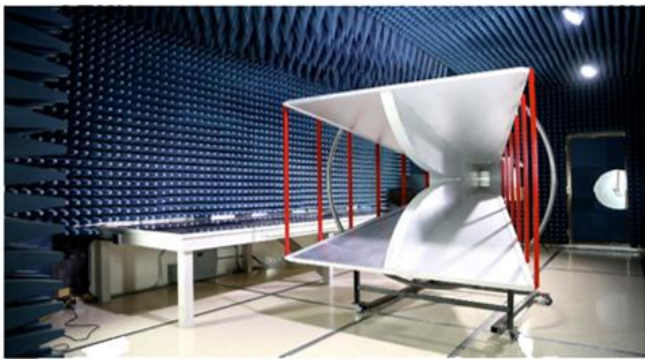
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☐	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☒	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

(1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
(2) A2LA Certificate No.
(3) ISED Company No.
(4) BSMI No.
(5) VCCI Site Filing No.
(6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MOC, NCC, OFCA
(7) FDA ASCA No.







PRODUCT DESCRIPTION

Client and Equipment Under Evaluation Information

Company Name:	3D Systems Corporation
Address:	333 Three D Systems Circle
City, State, Zip:	Rock Hill, OR 29730
Evaluation Requested By:	Mufeed Yacoub
EUT:	NextDent 300
Date of Evaluation:	7/28/2025

Information Provided by the Party Requesting the Evaluation

Functional Description of the Equipment:

The 3D Systems, NextDent 300 uses an internally designed 13.56MHz RFID implementation for consumable material bottle management. At the heart of the RFID reader are eight Texas Instruments TRF7970A 13.56MHz RFID integrated circuit transceiver devices which are located on two different controller circuit boards (four per board). These transceiver integrated circuits are connected to Eight identical remote antenna boards via coax cable, one for each transceiver device. The individual antenna boards are located in close proximity to the material bottles.

A custom Field Programmable Gate Array (FPGA), also located on the two controller boards, interfaces with the transceiver devices.

The RFID chips share two different SPI interfaces (one on the DMC board and one on the SMDM board). Each of the eight RFID chips can only be transmitted sequentially. During normal operations (the material Drawer is closed), the unit loops through all chips, once a minute. When the material Drawer is open, or the service key is turned, the unit loops through all chips once a second.

The RFID design uses the ISO 15693 standard operating at 13.56MHz with passive RFID tag targets. This RFID implementation has a 3D Systems designed circuit board antennas permanently installed in a mechanically enclosed consumable material drawer assembly that are intended to only be serviceable by 3D Systems personnel. The remote antennas are a five turn PCB loop antenna design, tuned to 13.56MHz with a Q of 9.9.

The transceivers have programmable maximum output power with an absolute maximum of +23dBm (200mW) into a 50 ohm load when using the +5V power supply, which is used in this implementation. The on-chip transceiver RF power supply regulator is programmable to slightly reduce power for improved power supply noise rejection. The RF signal control can also be placed under automatic gain control (AGC). The 13.56MHz operation is fixed frequency set by an Abracon ABM8G-13.560MHZ-18-D2Y-T crystal oscillator with a frequency tolerance of ±20ppm and stability of ±30ppm

Objective:

To demonstrate compliance with FCC requirements for RF exposure for 2.1091 mobile/fixed devices

RF EXPOSURE CONDITION

element
2018-07-17

The following RF Exposure conditions were used for the assessment documented in this report:	
Intended Use	Mobile
Location on Body (if applicable)	n/a
How is the Device Used	The NextDent 300 is used at distance greater than 20 cm from the user
Radios Contained in the Same Host Device	RFID
Simultaneous Transmitting Radios	None
Body Worn Accessories	n/a
Environment	General Population/Uncontrolled Exposure

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

element
EXRPT.2024.05.10.0

OVERVIEW

Human exposure to RF emissions from mobile devices (47 CFR §2.1091) may be evaluated based on the MPE limits adopted by the FCC for electric and magnetic field strength and/or power density, as appropriate, since exposures are assumed to occur at distances of 20 cm or more from persons. IEEE C95.1:2019 specifies a minimum separation distance of 20 cm for performing reliable field measurements to determine adherence to MPE limits. If the minimum separation distance between a transmitter and nearby persons is more than 20 cm under normal operating conditions, compliance with MPE limits may be determined at such distance from the transmitter. The field strength and power density limits adopted by the FCC are based on whole-body averaged exposure and the assumption of RF field levels relate most accurately to estimating whole-body averaged SAR. This means some local values of exposures exceeding the stated field strength and power density limits may not necessarily imply non-compliance if the spatial average of spatially averaged RF fields over the exposed portions of a person's body does not exceed the limits.

COMPLIANCE WITH FCC REQUIREMENTS IN 47 CFR §2.1091

47 CFR §2.1091
"A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the RF source's radiating structure(s) and the body of the user or nearby persons. In this context, the term "fixed location" means that the device is physically secured at one location and is not able to be easily moved to another location while transmitting. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal desktop computer, are considered to be mobile devices if they meet the 20-centimeter separation requirement."

The device will only be used with a separation distance between the antenna and the body of the user or nearby persons as shown in the table below and can therefore be considered a mobile transmitter per 47 CFR 2.1091(b).

COMPLIANCE WITH FCC KDB 447498 D01 General RF Exposure Guidance v06

"KDB 447498 D01 General RF Exposure Guidance v06" provides the procedures, requirements, and authorization policies for mobile and portable devices.

Devices operating in standalone mobile device exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously are covered in section 7.1. Devices containing multiple transmitters capable of simultaneous transmissions are covered in section 7.2.

By meeting the requirements in sections 7.1 and 7.2, as applicable, mobile equipment meets the requirements of 47 CFR §1.1310.

LIMITS

Limits for General Population /Uncontrolled Exposure: 47 CFR §1.1310

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
0.3 - 1.34	614	1.63	*(100)	30
1.34 - 30	824/f	2.19/f	*($180/f^2$)	30
30 - 300	27.5	0.073	0.2	30
300 - 1500			f/1500	30
1500 - 100000			1	30

f = frequency in MHz
* = Plane-wave equivalent power density

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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EXRPT.2024.05.10.0

POWER DENSITY

The exposure level for the radio is evaluated at a 20 cm distance from the radio's transmitting antenna using the general equation:

$$S = \frac{P * G}{4 * \pi * R^2}$$

Where: S = power density (mW/cm^2)
P = power input to the antenna (mW)
G = numeric power gain relative to an isotropic radiator
R = distance to the center of the radiation of the antenna (20 cm = limit for MPE estimates)
P*G = EIRP

Solving for S, the maximum power density 20 cm from the transmitting antenna is determined. This level is then compared to the applicable limit for the transmit frequency. If limits were not met at the 20 cm boundary the evaluation distance is increased until the limit is met as shown in the table below.

For co-located radios, the ratio of the calculated level to the limit is determined. The ratios for each co-located radio are summed. If the sum is less than or equal to one, then the device is excluded from testing and is deemed compliant.

MAXIMUM PERMISSIBLE EXPOSURE (MPE)

element
EXRPT.2024.05.10.0

APPARENT POWER

When the transmitted signal is measured as a field strength value (dBµV/m), this value is converted to a power level using the following derivation (the field strength value has been distance corrected to 3 m):

Step 1 – Per ANSI C63.10:2020 section 10.3.9 equation (34), the relationship between EIRP and field strength is as follows:

$$EIRP_{meas} = E_{meas} - 95.3$$

Where:
$EIRP_{meas}$ is the equivalent isotropically radiated power in dBm as converted from a measured value
E_{meas} is the field strength at a 3 m measurement distance in dBµV/m. To convert from the specification measurement distance to 3 m, a 40 dB/decade adjustment was applied.

Step 2 – If a power tolerance or a tune-up value is provided, the reported power should be scaled accordingly:

$$EIRP = EIRP_{meas} + Tolerance$$

Where:
EIRP is the maximum equivalent isotropically radiated power in dBm
$EIRP_{meas}$ is the equivalent isotropically radiated power in dBm as converted from a measured value
Tolerance is either the tolerance provided in dB or the positive tune-up tolerance range in dB

Step 3 – Convert the EIRP value to linear terms

$$EIRP(mW) = 10^{\frac{EIRP\ (dBm)}{10}}$$

Where:

EIRP is the maximum equivalent isotropically radiated power, in terms of either mW or dBm

When the transmitted field strength value is reported as a magnetic field strength value, (dBµA/m), the value is converted to an electric field strength, (dBµV/m), by adding the free-space impedance, 20log(377 ohm) ~ 51.5 dBohm to the magnetic field strength (in logarithmic terms).

ASSESSMENT

The standalone MPE and summed MPE ratios are summarized in the following table:

Radio	Frequency Range (MHz)	Field Strength (dBuV/m @ 30m)	Power Tolerance (dB)	Duty Cycle	Minimum Separation Distance (cm)	Calculated Power Density (mW/cm^2)	Limit (mW/cm^2)	Compliant
RFID	13.56	1.61	0.0	100.0%	20	0.0	1.0	yes

The information in the table above was obtained from:

The client provided information. The worst case measured value was used in these calculations. Measured field strength values from ElectroMagnetic Investigations Report Number: 3DS20250726-01 and Element Report Number: 3DSY0191.9 Rev. 01.

Evaluator: Nolan De Ramos

End of Test Report