3D Systems, Inc.

Skytek M1

FCC 15.207:2014
FCC 15.225:2014

Report # 3DSY0018

NVLAP Lab Code: 200630-0

NORTHWEST EMC

WTD 13.9.30

CERTIFICATE OF TEST

Last Date of Test: October 27, 2014
3D Systems, Inc.
Model: Skytek M1

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2014 FCC 15.225:2014	ANSI C63.10:2009

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.4	Field Strength of Fundamental	Yes	Pass	
6.4	Spurious Radiated Emissions ≤ 30 MHz	Yes	Pass	
6.5	Spurious Radiated Emissions ≥ 30 MHz	Yes	Pass	
6.8	Frequency Stability	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Kyle Holgate, Operations Manager

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.

REVISION HISTORY

NORTHWEST EMC
REV 2014.10.14

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

REV 2014.10.08

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 - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

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

Korea

MSIP / 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

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

Vietnam

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

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/

MEASUREMENT UNCERTAINTY

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

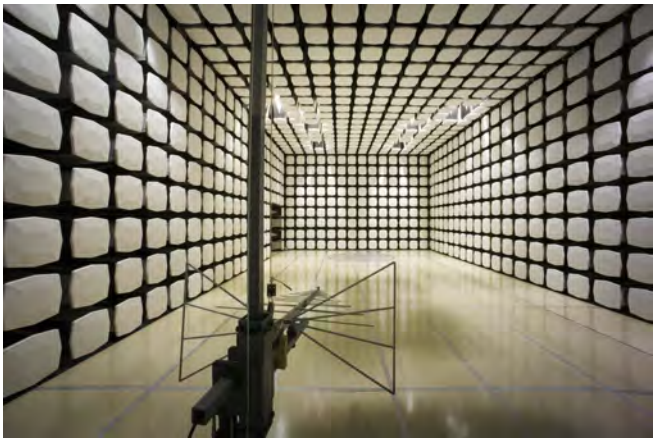
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.19 dB	-1.19 dB
Conducted Power (dB)	0.29 dB	-0.29 dB
Radiated Power via Substitution (dB)	0.71 dB	-0.71 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	2.9 dB	-2.9 dB

FACILITIES

NORTHWEST EMC
REV 2014.10.08

Oregon Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	**California** Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	**New York** Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	**Minnesota** Labs MN01-08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	**Washington** Labs NC01-05,SU02,SU07 19201 120th Ave. NE Bothell, WA 98011 (425) 984-6600
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-2	2834B-1, 2834B-2, 2834B-3		2834E-1	2834F-1
NVLAP				
NVLAP Lab Code: 200630-0	NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200629-0



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	3D Systems, Inc.
Address:	26600 SW Parkway
City, State, Zip:	Wilsonville, OR 97070-1000
Test Requested By:	Steve Wardle
Model:	Skytek M1
First Date of Test:	October 21, 2014
Last Date of Test:	October 27, 2014
Receipt Date of Samples:	October 21, 2014
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
13.56 MHz RFID module for use in 3D printers which reads in ISO15693 RFID tags attached to a cartridge or cap that is inserted into the machine by a user.

Testing Objective:
To demonstrate compliance to FCC Part 15.225 specifications.

CONFIGURATIONS

Configuration 3DSY0018- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RFID Device	3D Systems, Inc.	Skytek M1	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Laptop Computer	Dell	Latitude D610	591H6B1
DC Power Supply	Topward Electric	TPS-2000	TPD

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Leads	No	1m	No	DC Power Supply	RFID Device
AC Power	No	1.8m	No	AC Mains	DC Power Supply
Serial	Unknown	3m	No	RFID Device	Remote Laptop Computer

Configuration 3DSY0018- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RFID Device	3D Systems, Inc.	Skytek M1	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Laptop Computer	Dell	Latitude D610	591H6B1
DC Power Supply	Topward Electric	TPS-2000	TPD

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Leads	No	1m	No	DC Power Supply	RFID Device
AC Power	No	1.8m	No	AC Mains	DC Power Supply
Serial	Unknown	3m	No	RFID Device	Remote Laptop Computer

CONFIGURATIONS

Configuration 3DSY0018- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RFID Device	3D Systems, Inc.	Skytek M1	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Laptop Computer	Dell	Latitude D610	591H6B1
DC Power Supply	Topward Electric	TPS-2000	TPD

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
DC Leads	No	1m	No	DC Power Supply	RFID Device
AC Power	No	1.8m	No	AC Mains	DC Power Supply
Serial	Unknown	3m	No	RFID Device	Remote Laptop Computer

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	10/08/2014	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	10/08/2014	Spurious Radiated Emissions less than 30 MHz	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
3	10/08/2014	Spurious Radiated Emissions greater than 30 MHz	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
4	10/22/2014	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
5	10/27/2014	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50 Ω measuring port is terminated by a 50 Ω EMI meter or a 50 Ω resistive load. All 50 Ω measuring ports of the LISN are terminated by 50Ω.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
EV07 Cables	N/A	Conducted Cables	EVG	03/07/2014	12 mo
Attenuator, BNC MIF 2W 3GHZ 20DB	Fairview Microwave	SA03B-20	AQM	02/03/2014	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HHD	01/22/2014	12 mo
Receiver	Rohde & Schwarz	ESCI	ARH	02/05/2014	12 mo
LISN	Solar	9252-50-R-24-BNC	LIN	02/03/2014	12 mo

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.9 dB	-2.9 dB

CONFIGURATIONS INVESTIGATED

3DSY0018-1

MODES INVESTIGATED

RFID, Transmitting on 13.56 MHz.

FCC GUIDANCE

In the FCC-TCBC Conference Call Meeting Minutes from April 12, 2005, the FCC stated:

> "We are willing to accept measurements on a 13.56 MHz transmitter done with a dummy load under the following conditions. First, perform the AC line conducted tests with the antenna attached to make sure the device complies with the 15.207 limits outside the transmitter's fundamental emission band, and then retest with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band. For the second portion of these tests, only the fundamental emission band of the transmitter needs to be retested."

This procedure was followed for the AC powerline conducted emissions testing documented on the following pages. First, the measurements were made with the device transmitting through it's antenna. The transmitted field coupled onto the AC powerline which resulted in a failing emissions being measured at 13.56 MHz. All other emissions outside the 13.56 MHz band passed. The testing was repeated with a dummy load in place of the antenna and all the emissions passed, therefore the radio is deemed compliant with FCC 15.207 limits.

POWERLINE CONDUCTED EMISSIONS

EUT:	Skytek M1	Work Order:	3DSY0018
Serial Number:	None	Date:	10/27/2014
Customer:	3D Systems, Inc.	Temperature:	23°C
Attendees:	Steve Wardle	Relative Humidity:	43%
Customer Project:	None	Bar. Pressure:	1020 mb
Tested By:	Carl Engholm	Job Site:	EV07
Power:	5 VCD	Configuration:	3DSY0018-1

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.207:2014	ANSI C63.4:2009

TEST PARAMETERS

Run #:	40	Line:	High Line	Ext. Attenuation (dB):	20

COMMENTS

None

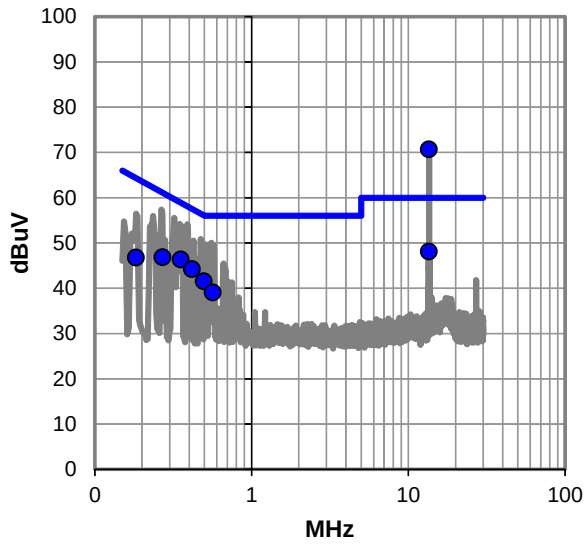
EUT OPERATING MODES

Transmitting, monitoring for errors

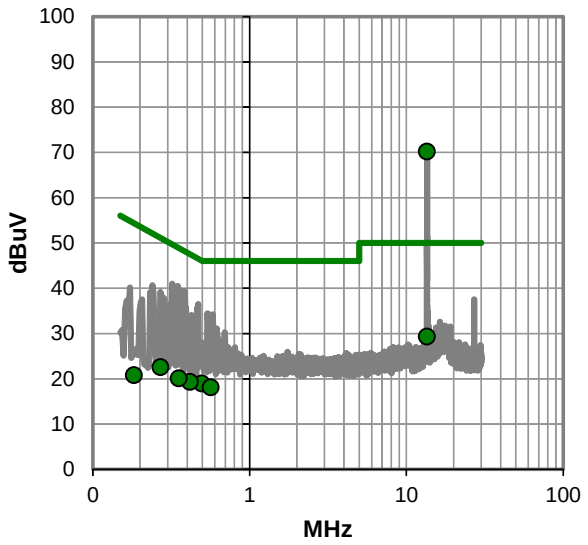
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #40

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	49.2	21.5	70.7	60.0	10.7
13.534	26.6	21.5	48.1	60.0	-11.9
0.353	25.8	20.5	46.3	58.9	-12.6
0.418	23.7	20.5	44.2	57.5	-13.3
0.270	26.3	20.5	46.8	61.1	-14.3
0.497	21.0	20.5	41.5	56.0	-14.5
0.566	18.5	20.5	39.0	56.0	-17.0
0.183	26.2	20.6	46.8	64.3	-17.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	48.7	21.5	70.2	50.0	20.2
13.534	7.8	21.5	29.3	50.0	-20.7
0.497	-1.6	20.5	18.9	46.0	-27.1
0.566	-2.4	20.5	18.1	46.0	-27.9
0.418	-1.2	20.5	19.3	47.5	-28.2
0.270	2.0	20.5	22.5	51.1	-28.6
0.353	-0.4	20.5	20.1	48.9	-28.8
0.183	0.2	20.6	20.8	54.3	-33.6

CONCLUSION

Fail

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Skytek M1	Work Order:	3DSY0018
Serial Number:	None	Date:	10/27/2014
Customer:	3D Systems, Inc.	Temperature:	23°C
Attendees:	Steve Wardle	Relative Humidity:	43%
Customer Project:	None	Bar. Pressure:	1020 mb
Tested By:	Carl Engholm	Job Site:	EV07
Power:	5 VCD	Configuration:	3DSY0018-1

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.207:2014	ANSI C63.4:2009

TEST PARAMETERS

Run #:	41	Line:	Neutral	Ext. Attenuation (dB):	20

COMMENTS

None

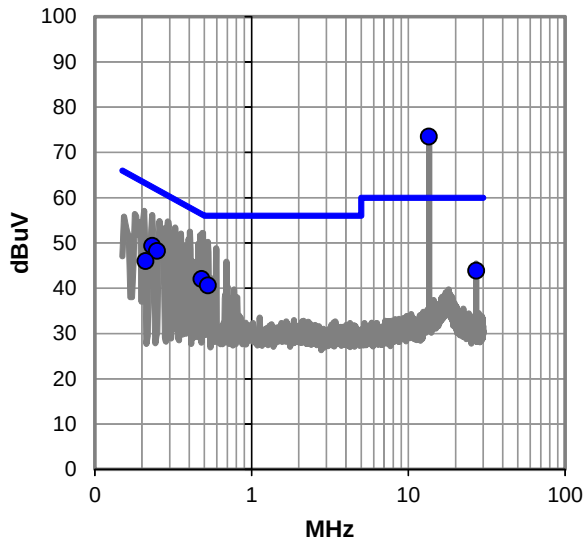
EUT OPERATING MODES

Transmitting, monitoring for errors

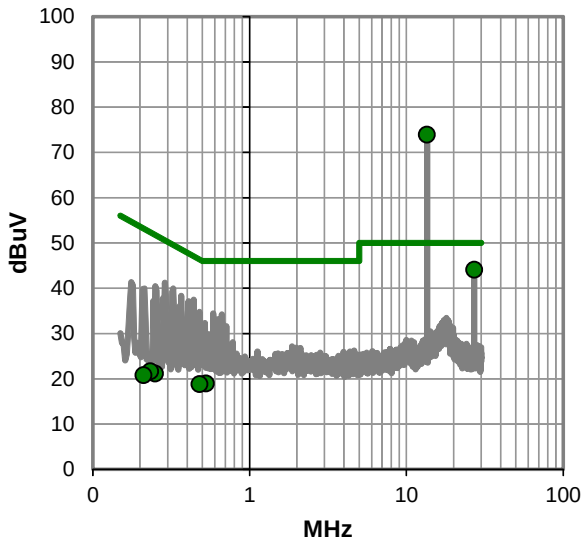
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #41

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	52.0	21.5	73.5	60.0	13.5
0.233	28.8	20.6	49.4	62.4	-13.0
0.249	27.7	20.6	48.3	61.8	-13.5
0.480	21.5	20.5	42.0	56.3	-14.3
0.528	20.1	20.5	40.6	56.0	-15.4
27.123	21.5	22.3	43.8	60.0	-16.2
0.210	25.4	20.6	46.0	63.2	-17.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	52.4	21.5	73.9	50.0	23.9
27.123	21.7	22.3	44.0	50.0	-6.0
0.528	-1.6	20.5	18.9	46.0	-27.1
0.480	-1.7	20.5	18.8	46.3	-27.5
0.249	0.6	20.6	21.2	51.8	-30.6
0.233	1.1	20.6	21.7	52.4	-30.7
0.210	0.2	20.6	20.8	53.2	-32.4

CONCLUSION

Fail

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Skytek M1	Work Order:	3DSY0018
Serial Number:	None	Date:	10/27/2014
Customer:	3D Systems, Inc.	Temperature:	23°C
Attendees:	Steve Wardle	Relative Humidity:	43%
Customer Project:	None	Bar. Pressure:	1020 mb
Tested By:	Carl Engholm	Job Site:	EV07
Power:	5 VCD	Configuration:	3DSY0018-1

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.207:2014	ANSI C63.4:2009

TEST PARAMETERS

Run #:	38	Line:	Neutral	Ext. Attenuation (dB):	20

COMMENTS

Antenna port open.

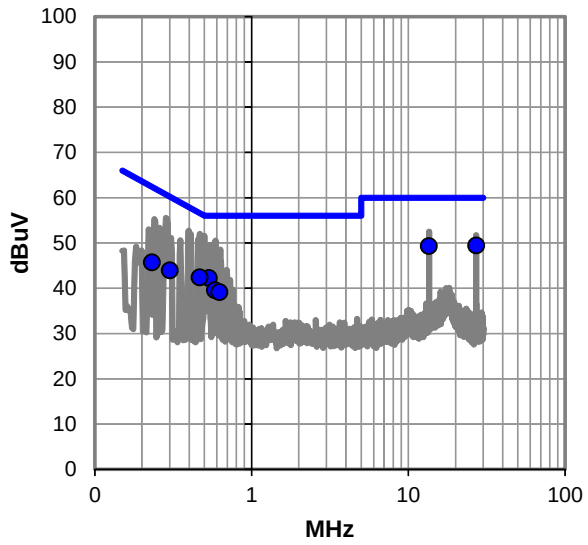
EUT OPERATING MODES

Transmitting, monitoring for errors

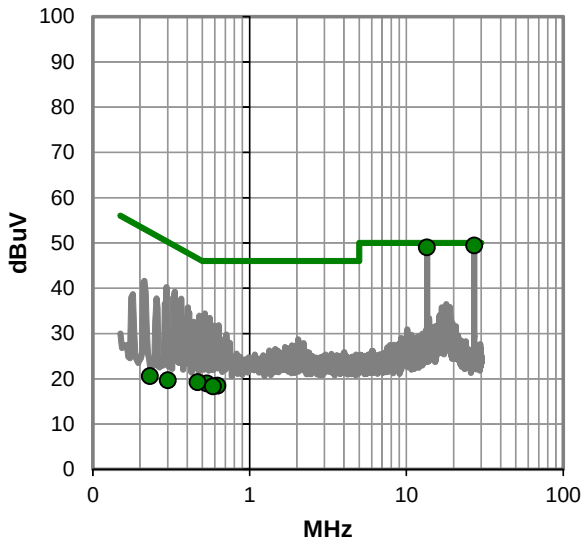
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #38

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.122	27.1	22.3	49.4	60.0	-10.6
13.561	27.8	21.5	49.3	60.0	-10.7
0.534	21.7	20.5	42.2	56.0	-13.8
0.468	21.9	20.5	42.4	56.6	-14.2
0.302	23.4	20.5	43.9	60.2	-16.3
0.585	19.0	20.5	39.5	56.0	-16.5
0.232	25.1	20.6	45.7	62.4	-16.7
0.624	18.6	20.5	39.1	56.0	-16.9

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.122	27.1	22.3	49.4	50.0	-0.6
13.561	27.5	21.5	49.0	50.0	-1.0
0.534	-1.6	20.5	18.9	46.0	-27.1
0.468	-1.3	20.5	19.2	46.6	-27.4
0.624	-2.1	20.5	18.4	46.0	-27.6
0.585	-2.2	20.5	18.3	46.0	-27.7
0.302	-0.9	20.5	19.6	50.2	-30.6
0.232	0.0	20.6	20.6	52.4	-31.8

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	Skytek M1	Work Order:	3DSY0018
Serial Number:	None	Date:	10/27/2014
Customer:	3D Systems, Inc.	Temperature:	23°C
Attendees:	Steve Wardle	Relative Humidity:	43%
Customer Project:	None	Bar. Pressure:	1020 mb
Tested By:	Carl Engholm	Job Site:	EV07
Power:	5 VCD	Configuration:	3DSY0018-1

TEST SPECIFICATIONS

Specification: Equipment Class B	Method:
FCC 15.207:2014	ANSI C63.4:2009

TEST PARAMETERS

Run #:	39	Line:	High Line	Ext. Attenuation (dB):	20

COMMENTS

Antenna port open.

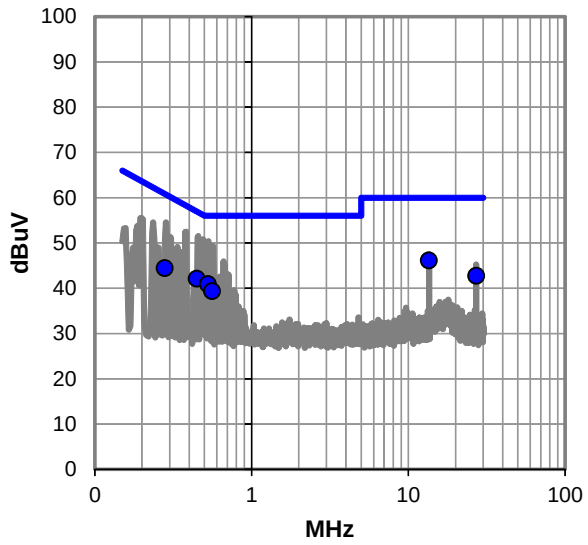
EUT OPERATING MODES

Transmitting, monitoring for errors

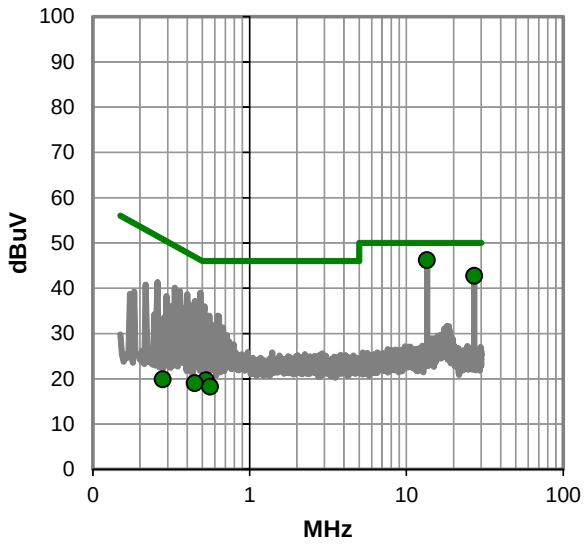
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #39

Quasi Peak Data - vs - Quasi Peak Limit

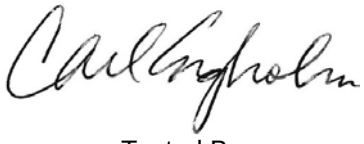
Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.560	24.6	21.5	46.1	60.0	-13.9
0.448	21.6	20.5	42.1	56.9	-14.8
0.526	20.4	20.5	40.9	56.0	-15.1
0.280	23.9	20.5	44.4	60.8	-16.4
0.561	18.8	20.5	39.3	56.0	-16.7
27.122	20.4	22.3	42.7	60.0	-17.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.560	24.7	21.5	46.2	50.0	-3.8
27.122	20.4	22.3	42.7	50.0	-7.3
0.526	-0.9	20.5	19.6	46.0	-26.4
0.561	-2.3	20.5	18.2	46.0	-27.8
0.448	-1.5	20.5	19.0	46.9	-27.9
0.280	-0.7	20.5	19.8	50.8	-31.0

CONCLUSION

Pass



Tested By

FIELD STRENGTH OF FUNDAMENTAL

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

RFID Transmitting at 13.56MHz

POWER SETTINGS INVESTIGATED

5 VDC

CONFIGURATIONS INVESTIGATED

3DSY0018 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	9 kHz	Stop Frequency	30 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
EV11 Cables	N/A	10m Test Distance Cables	EVL	8/14/2014	12 mo
Antenna, Loop	EMCO	6502	AOA	6/24/2014	36 mo
Spectrum Analyzer	Agilent	E4443A	AFB	2/12/2014	12 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

While scanning, fundamental carrier from the EUT was maximized by rotating the EUT, adjusting the measurement antenna height and orientation in 3 orthogonal planes, the EUT and/or associated antenna is positioned in 3 orthogonal planes (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

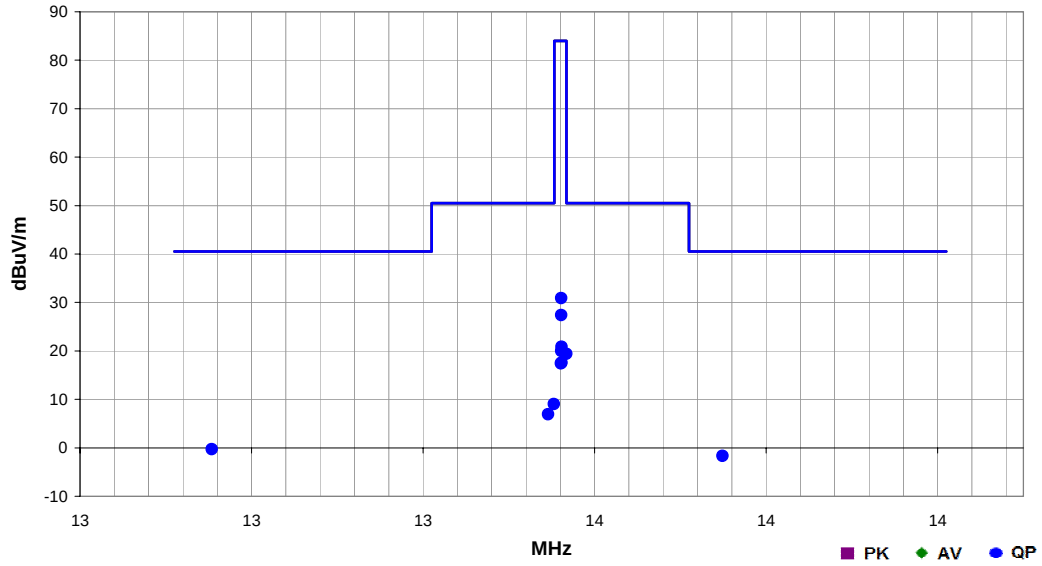
As outlined in 15.209(e) and 15.31(f)(2), measurements may be performed at a distance closer than what is specified with

FIELD STRENGTH OF FUNDAMENTAL

Work Order:	3DSY0018	**Date:**	10/08/14		
Project:	None	**Temperature:**	23.4 °C		
Job Site:	EV11	**Humidity:**	46.7% RH		
Serial Number:	None	**Barometric Pres.:**	1014.5 mbar	**Tested by:**	Jared Ison, Brandon Hobbs
EUT:	Skyetek, SkyeModule M1				
Configuration:	2				
Customer:	3D Systems, Inc.				
Attendees:	Steve Wardle				
EUT Power:	5 VDC				
Operating Mode:	hanks				
Deviations:	None				
Comments:	Please reference the data comments for EUT orientation and antenna postion.The EUT has a square antenna configuration which only allows for two orthogonal measurable axes.				

Test Specifications	**Test Method**
FCC 15.225:2014	ANSI C63.10:2009

Run #	7	**Test Distance (m)**	10	**Antenna Height(s)**	1 to 1(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
13.567	27.7	10.8	1.0	342.0	10.0	0.0	Horz	QP	-19.1	19.4	50.5	-31.1	Ant Perp to Gnd and Perp to EUT, EUT Vert
13.154	8.0	10.8	1.0	221.0	10.0	0.0	Horz	QP	-19.1	-0.3	40.5	-40.8	Ant Perp to Gnd and Perp to EUT, EUT Vert
13.553	17.3	10.8	1.0	343.0	10.0	0.0	Horz	QP	-19.1	9.0	50.5	-41.5	Ant Perp to Gnd and Perp to EUT, EUT Vert
13.749	6.6	10.8	1.0	20.0	10.0	0.0	Horz	QP	-19.1	-1.7	40.5	-42.2	Ant Perp to Gnd and Perp to EUT, EUT Vert
13.546	15.2	10.8	1.0	39.0	10.0	0.0	Horz	QP	-19.1	6.9	50.5	-43.6	Ant Perp to Gnd and Perp to EUT, EUT Vert
13.561	39.2	10.8	1.0	9.0	10.0	0.0	Horz	QP	-19.1	30.9	84.0	-53.1	Ant Perp to Gnd and Perp to EUT, EUT Vert
13.561	35.7	10.8	1.0	331.0	10.0	0.0	Horz	QP	-19.1	27.4	84.0	-56.6	Ant Perp to Gnd and Perp to EUT, EUT Horz
13.562	29.1	10.8	1.0	84.0	10.0	0.0	Horz	QP	-19.1	20.8	84.0	-63.2	Ant Perp to Gnd and Para to EUT, EUT Vert
13.561	28.3	10.8	1.0	30.0	10.0	0.0	Vert	QP	-19.1	20.0	84.0	-64.0	Ant Para to Gnd and Perp to EUT, EUT Vert
13.562	25.8	10.8	1.0	72.0	10.0	0.0	Horz	QP	-19.1	17.5	84.0	-66.5	Ant Perp to Gnd and Para to EUT, EUT Horz
13.561	25.7	10.8	1.0	21.0	10.0	0.0	Vert	QP	-19.1	17.4	84.0	-66.6	Ant Para to Gnd and Perp to EUT, EUT Horz

SPURIOUS RADIATED EMISSIONS <30MHz

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

RFID transmitting at 13.56MHz

POWER SETTINGS INVESTIGATED

5 VDC

CONFIGURATIONS INVESTIGATED

3DSY0018 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	9 kHz	Stop Frequency	30 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Spectrum Analyzer	Agilent	E4443A	AFB	2/12/2014	12 mo
EV11 Cables	N/A	10m Test Distance Cables	EVL	8/14/2014	12 mo
Antenna, Loop	EMCO	6502	AOA	6/24/2014	36 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and orientation in 3 orthogonal planes, the EUT and/or associated antenna is positioned in 3 orthogonal planes (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

As outlined in 15.209(e) and 15.31(f)(2), measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and

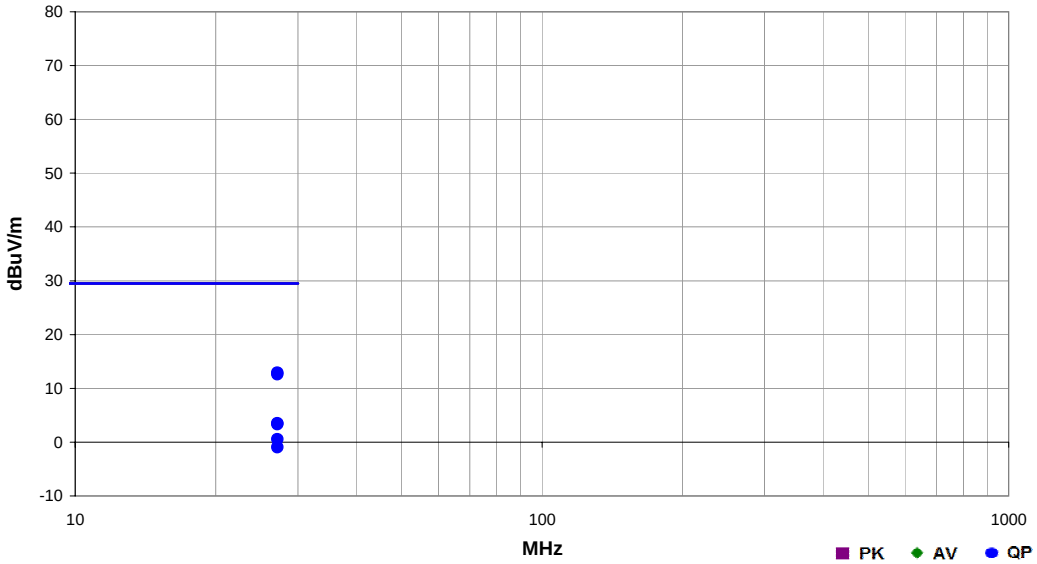
SPURIOUS RADIATED EMISSIONS <30MHz

Work Order:	3DSY0018	**Date:**	10/08/14		
Project:	None	**Temperature:**	23.4 °C		
Job Site:	EV11	**Humidity:**	47.5% RH		
Serial Number:	None	**Barometric Pres.:**	1014.5 mbar	**Tested by:**	Jared Ison, Brandon Hobbs
EUT:	Skyetek, SkyeModule M1				
Configuration:	2				
Customer:	3D Systems, Inc.				
Attendees:	Steve Wardle				
EUT Power:	5 VDC				
Operating Mode:	RFID transmitting at 13.56MHz				
Deviations:	None				
Comments:	Reference data comments EUT and antenna polarity/orientation. The EUT had only 2 measurable axes based on antenna symmetry.				

So

Test Specifications	**Test Method**
FCC 15.225:2014	ANSI C63.10:2009

Run #	8	**Test Distance (m)**	10	**Antenna Height(s)**	1 to 1(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
27.123	23.0	9.0	1.0	138.0	10.0	0.0	Horz	QP	-19.1	12.9	29.5	-16.6	Ant Perp to Gnd and Ant Perp to EUT, EUT Horz
27.123	22.7	9.0	1.0	105.0	10.0	0.0	Horz	QP	-19.1	12.6	29.5	-16.9	Ant Perp to Gnd and Ant Perp to EUT, EUT Vert
27.122	13.6	9.0	1.0	106.0	10.0	0.0	Vert	QP	-19.1	3.5	29.5	-26.0	Ant Para to Gnd and Ant Perp to EUT, EUT Vert
27.123	13.4	9.0	1.0	258.0	10.0	0.0	Vert	QP	-19.1	3.3	29.5	-26.2	Ant Para to Gnd and Ant Perp to EUT, EUT Horz
27.122	10.6	9.0	1.0	54.0	10.0	0.0	Horz	QP	-19.1	0.5	29.5	-29.0	Ant Perp to Gnd and Ant Para to EUT, EUT Horz
27.120	9.1	9.0	1.0	48.0	10.0	0.0	Horz	QP	-19.1	-1.0	29.5	-30.5	Ant Perp to Gnd and Ant Para to EUT, EUT Vert

SPURIOUS RADIATED EMISSIONS >30MHz

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

RFID transmitting at 13.56MHz

POWER SETTINGS INVESTIGATED

5 VDC

CONFIGURATIONS INVESTIGATED

3DSY0018 - 3

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	1000 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
EV01 Cables	N/A	Bilog Cables	EVA	2/18/2014	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	AOL	2/18/2014	12 mo
Antenna, Biconilog	EMCO	3141	AXE	8/29/2014	36 mo

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting while set at the operating channel.

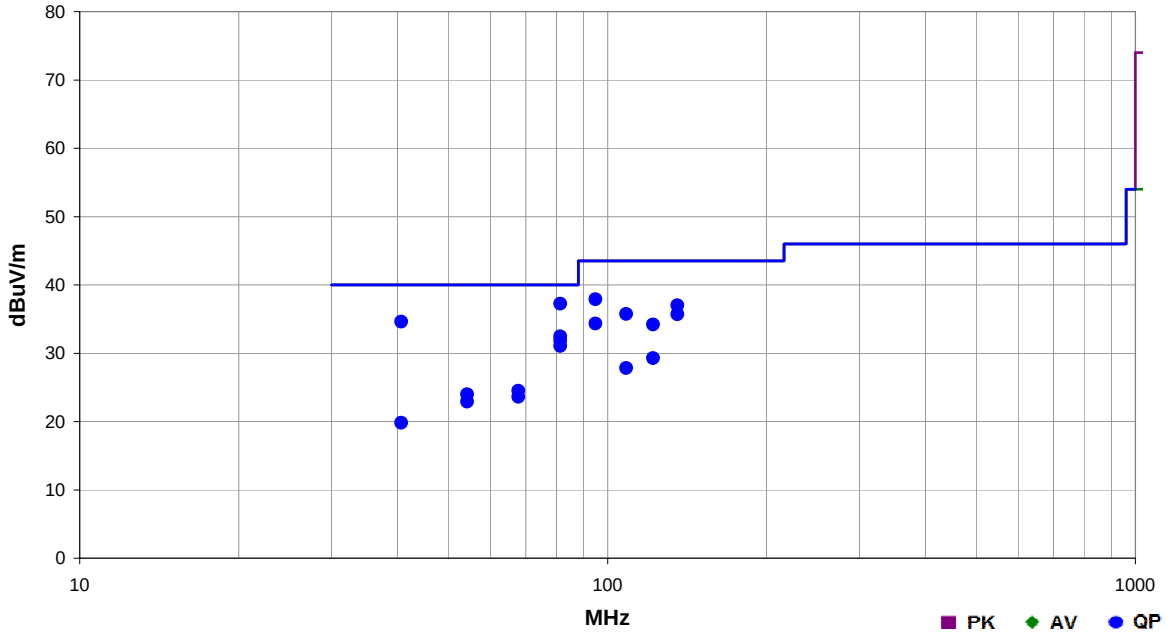
While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.10:2009).

SPURIOUS RADIATED EMISSIONS >30MHz

Work Order:	3DSY0018	**Date:**	10/08/14		
Project:	None	**Temperature:**	23 °C		
Job Site:	EV01	**Humidity:**	41.3% RH		
Serial Number:	1	**Barometric Pres.:**	1014 mbar	**Tested by:**	Jared Ison
EUT:	Colder Custom Device				
Configuration:	3				
Customer:	3D Systems, Inc.				
Attendees:	Steve Wardle				
EUT Power:	5 VDC				
Operating Mode:	RFID transmitting at 13.56MHz				
Deviations:	None				
Comments:	Reference data comments EUT and antenna polatrity/oreintation. EUT only had two measureable axes due to antenna symetery.				

Test Specifications	**Test Method**
FCC 15.225:2014	ANSI C63.10:2009

Run #	8	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
81.373	48.4	-11.2	1.0	156.0	3.0	0.0	Vert	QP	0.0	37.2	40.0	-2.8	Tx, EUT Horz
40.693	40.9	-6.3	1.0	310.0	3.0	0.0	Vert	QP	0.0	34.6	40.0	-5.4	Tx, EUT Horz
94.935	47.8	-9.9	1.0	330.0	3.0	0.0	Vert	QP	0.0	37.9	43.5	-5.6	Tx, EUT Horz
135.620	47.3	-10.3	2.2	256.0	3.0	0.0	Horz	QP	0.0	37.0	43.5	-6.5	Tx, EUT Horz
81.376	43.6	-11.2	1.0	285.0	3.0	0.0	Vert	QP	0.0	32.4	40.0	-7.6	Tx, EUT Vert
108.497	45.5	-9.8	1.0	272.0	3.0	0.0	Vert	QP	0.0	35.7	43.5	-7.8	Tx, EUT Horz
135.620	46.0	-10.3	1.0	15.0	3.0	0.0	Vert	QP	0.0	35.7	43.5	-7.8	Tx, EUT Horz
81.373	43.0	-11.2	2.0	87.0	3.0	0.0	Horz	QP	0.0	31.8	40.0	-8.2	Tx, EUT Horz
81.375	42.2	-11.2	2.3	267.0	3.0	0.0	Horz	QP	0.0	31.0	40.0	-9.0	Tx, EUT Vert
94.935	44.2	-9.9	2.5	238.0	3.0	0.0	Horz	QP	0.0	34.3	43.5	-9.2	Tx, EUT Horz
122.059	44.6	-10.4	1.0	101.0	3.0	0.0	Vert	QP	0.0	34.2	43.5	-9.3	Tx, EUT Horz
122.059	39.7	-10.4	2.6	227.0	3.0	0.0	Horz	QP	0.0	29.3	43.5	-14.2	Tx, EUT Horz
67.817	35.6	-11.1	1.0	325.0	3.0	0.0	Vert	QP	0.0	24.5	40.0	-15.5	Tx, EUT Horz
108.497	37.6	-9.8	3.2	254.0	3.0	0.0	Horz	QP	0.0	27.8	43.5	-15.7	Tx, EUT Horz
54.251	33.9	-9.9	3.9	74.0	3.0	0.0	Horz	QP	0.0	24.0	40.0	-16.0	Tx, EUT Horz
67.813	34.7	-11.1	3.9	62.0	3.0	0.0	Horz	QP	0.0	23.6	40.0	-16.4	Tx, EUT Horz
54.251	32.8	-9.9	1.0	161.0	3.0	0.0	Vert	QP	0.0	22.9	40.0	-17.1	Tx, EUT Horz
40.695	26.1	-6.3	1.0	78.0	3.0	0.0	Horz	QP	0.0	19.8	40.0	-20.2	Tx, EUT Horz

FREQUENCY STABILITY

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval (mo)
Attenuator, 30db 'N'	Fairview Microwave	SA18N5WA-30	TLE	12/30/2013	12
Humidity Temperature Meter	Omega	HH311	DUH	2/19/2013	36
Humidity and Temperature Chamber	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	0
DC Power Supply	Topward	TPS-2000	TPD	NCR	0
Multimeter	Tektronix	DMM912	MMH	2/5/2013	36
Spectrum Analyzer	Agilent	E4440A	AFD	7/14/2014	24
Near Field Probe	EMCO	7405	IPD	NCR	0

TEST DESCRIPTION

Variation of Supply Voltage
The primary supply voltage was varied from 85% to 115% of the nominal voltage. A DC lab supply was used to vary the supply voltage.

Variation of Ambient Temperature
Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (-20° to +50° C) and at 10°C intervals.

A near field probe measurement was made on the EUT's antenna using a spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

FREQUENCY STABILITY

EUT:	Skyetek M1			**Work Order:**	3DSY0018
Serial Number:	None			**Date:**	10/22/14
Customer:	3D Systems, Inc.			**Temperature:**	22.1°C
Attendees:	Steve Wardle			**Humidity:**	49%
Project:	None			**Barometric Pres.:**	1008.14
Tested by:	Brandon Hobbs	**Power:**	5 VDC Nominal	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.225:2014	ANSI C63.10:2009

COMMENTS

The product was operating in CW mode.

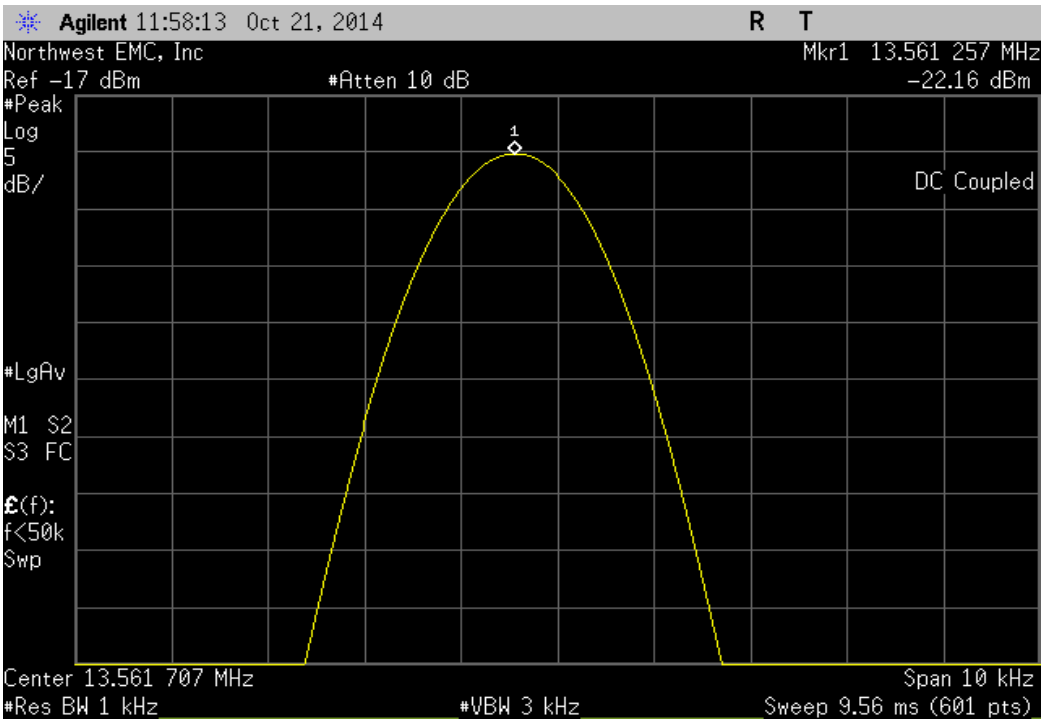
DEVIATIONS FROM TEST STANDARD

None

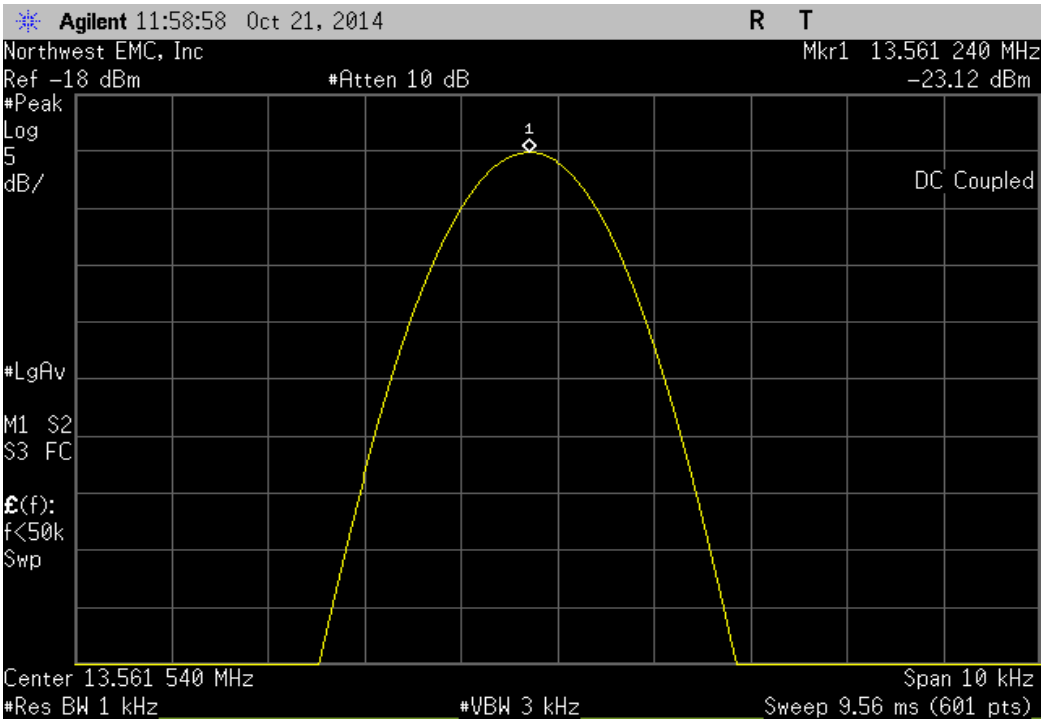
Configuration #	1	Signature

	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
RFID 13.56MHz					
Voltage: 115%	13.561257	13.56	92.7	100	Pass
Voltage: 100%	13.56124	13.56	91.5	100	Pass
Voltage: 85%	13.56124	13.56	91.5	100	Pass
Temperature: +50°	13.561157	13.56	85.3	100	Pass
Temperature: +40°	13.561157	13.56	85.3	100	Pass
Temperature: +30°	13.561173	13.56	86.5	100	Pass
Temperature: +20°	13.561207	13.56	89	100	Pass
Temperature: +10°	13.561257	13.56	92.7	100	Pass
Temperature: 0°	13.56129	13.56	95.1	100	Pass
Temperature: -10°	13.56129	13.56	95.1	100	Pass
Temperature: -20°	13.561257	13.56	92.7	100	Pass

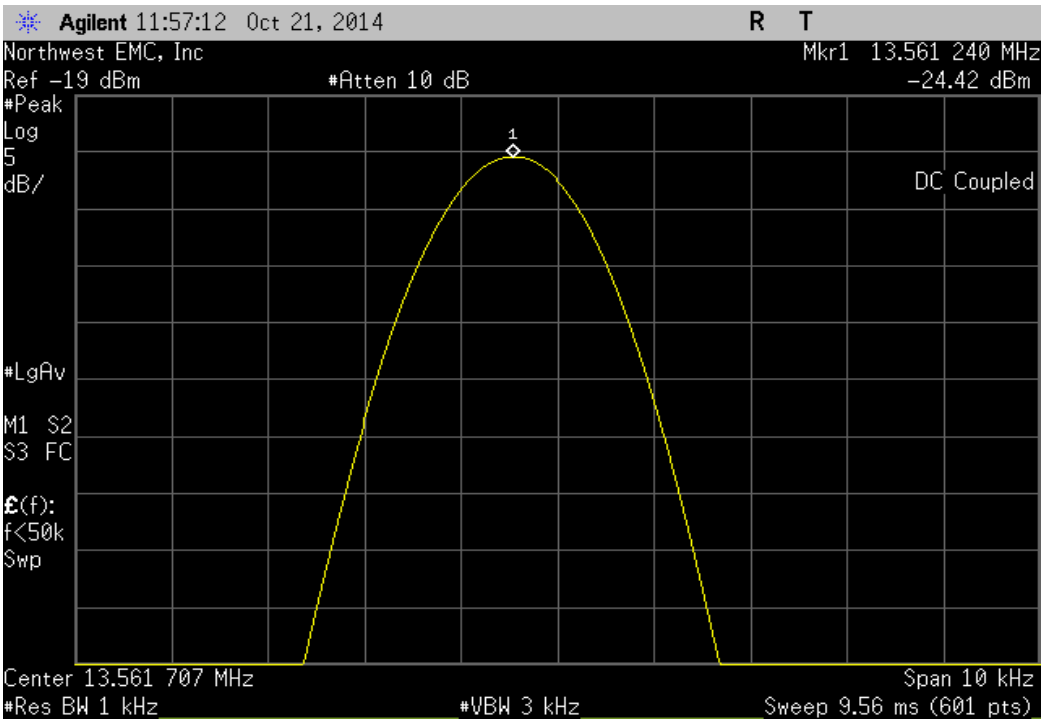
RFID 13.56MHz, Voltage: 115%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561257	13.56	92.7	100	Pass



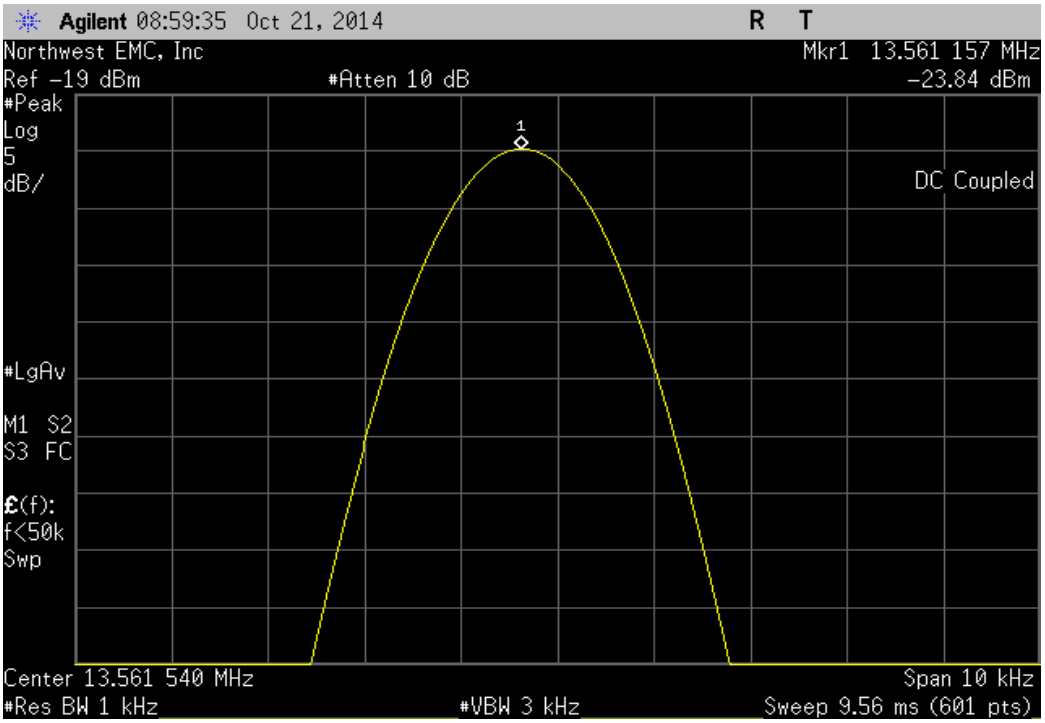
RFID 13.56MHz, Voltage: 100%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56124	13.56	91.5	100	Pass



RFID 13.56MHz, Voltage: 85%						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56124	13.56	91.5	100	Pass

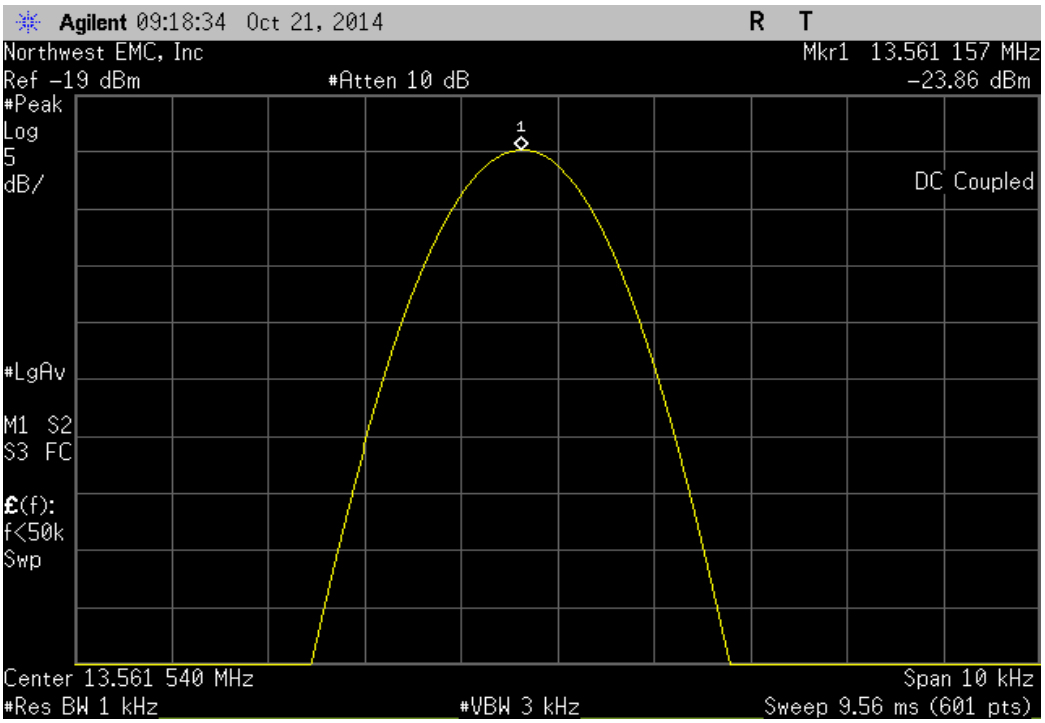


RFID 13.56MHz, Temperature: +50°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561157	13.56	85.3	100	Pass

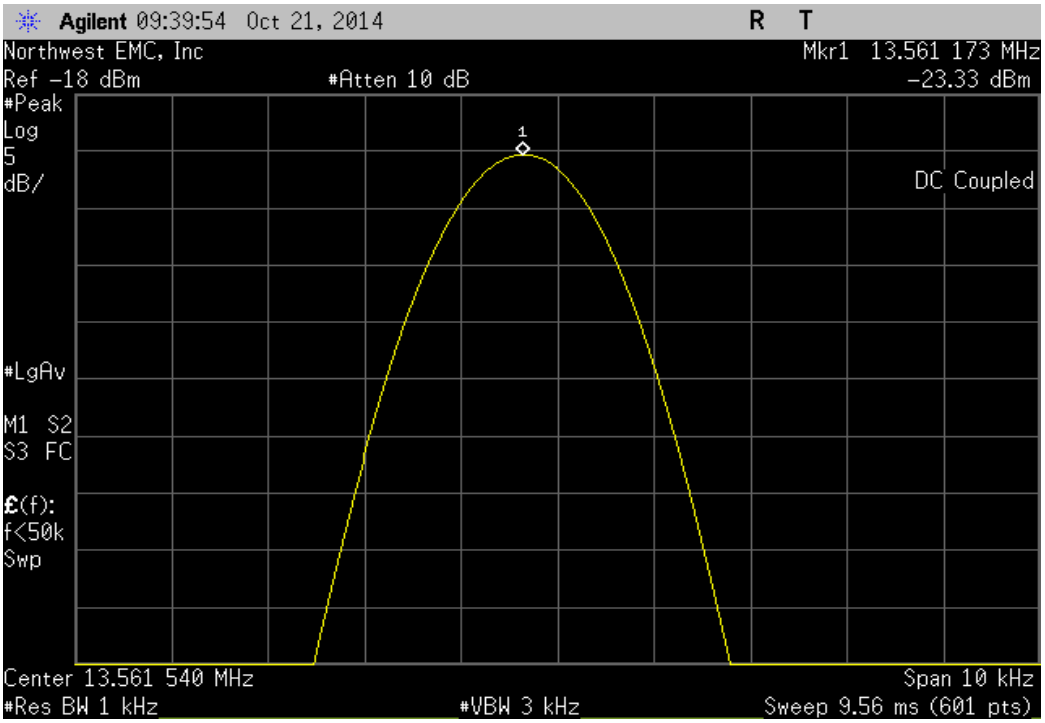


FREQUENCY STABILITY

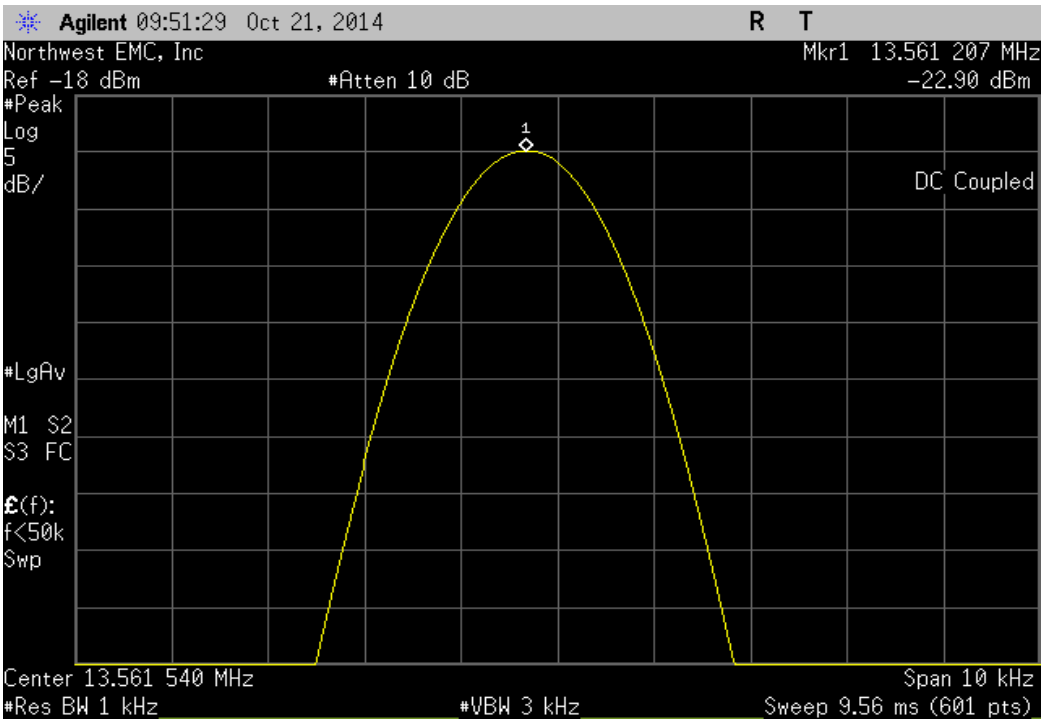
RFID 13.56MHz, Temperature: +40°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561157	13.56	85.3	100	Pass



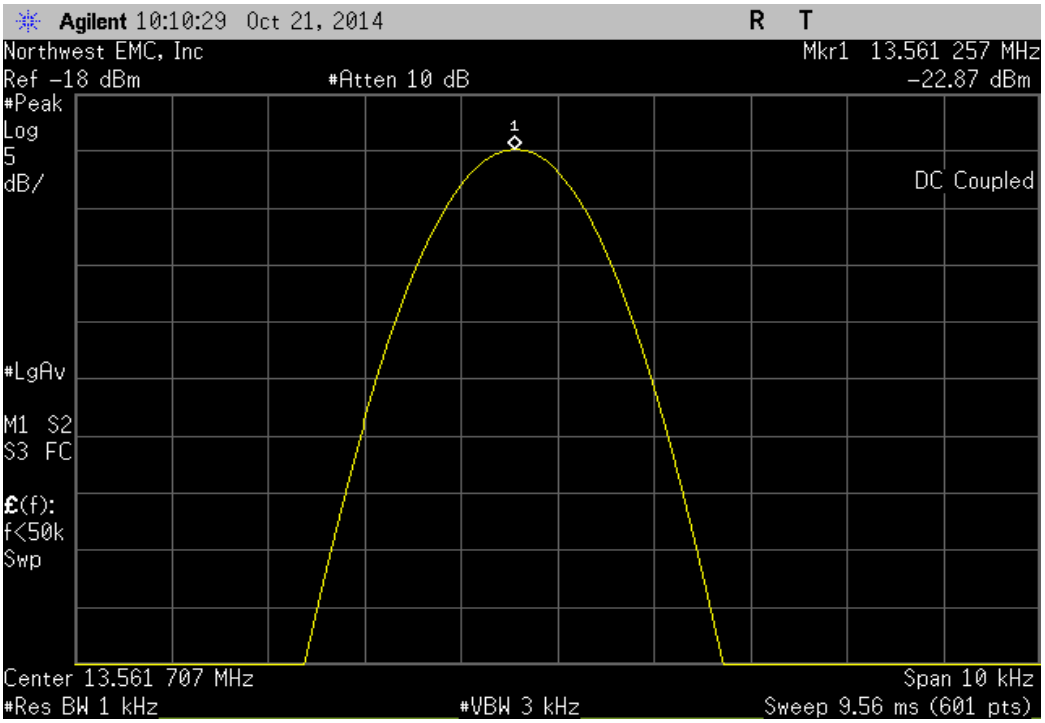
RFID 13.56MHz, Temperature: +30°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561173	13.56	86.5	100	Pass



RFID 13.56MHz, Temperature: +20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561207	13.56	89	100	Pass

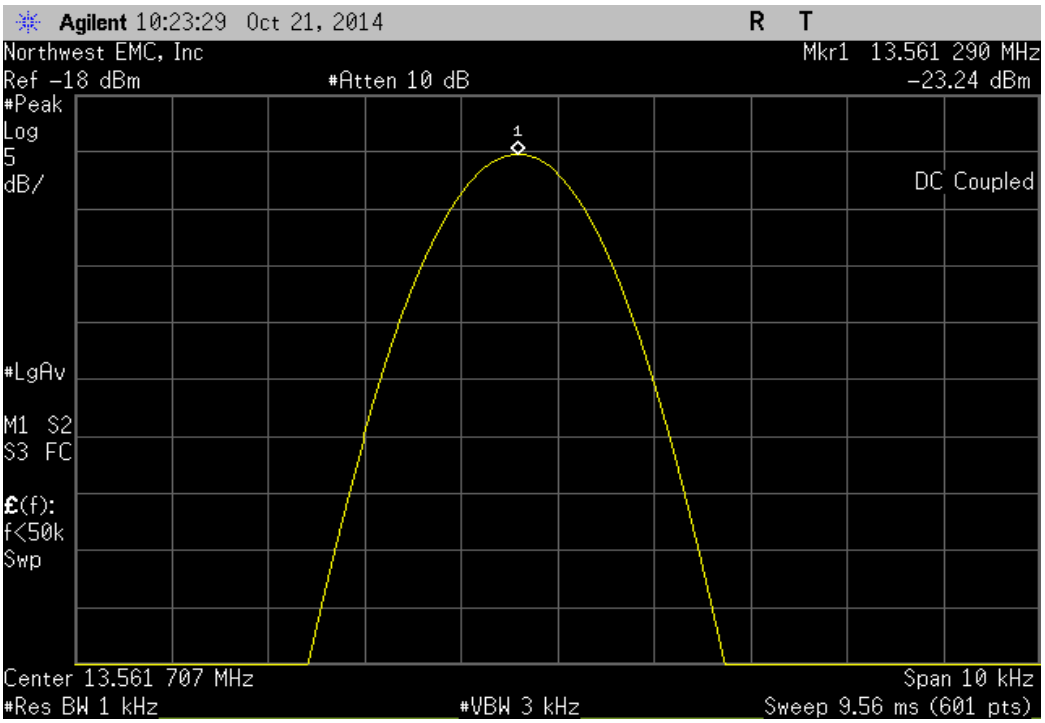


RFID 13.56MHz, Temperature: +10°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561257	13.56	92.7	100	Pass

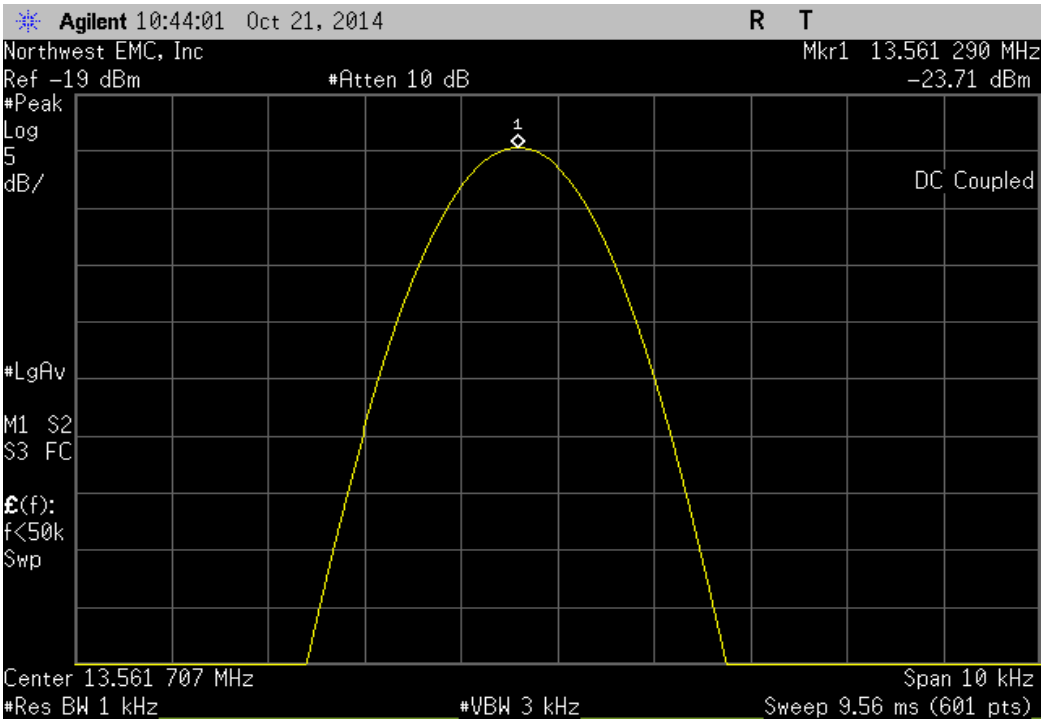


FREQUENCY STABILITY

RFID 13.56MHz, Temperature: 0°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56129	13.56	95.1	100	Pass



RFID 13.56MHz, Temperature: -10°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.56129	13.56	95.1	100	Pass



FREQUENCY STABILITY

RFID 13.56MHz, Temperature: -20°						
		Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results
		13.561257	13.56	92.7	100	Pass