3D Systems Corporation

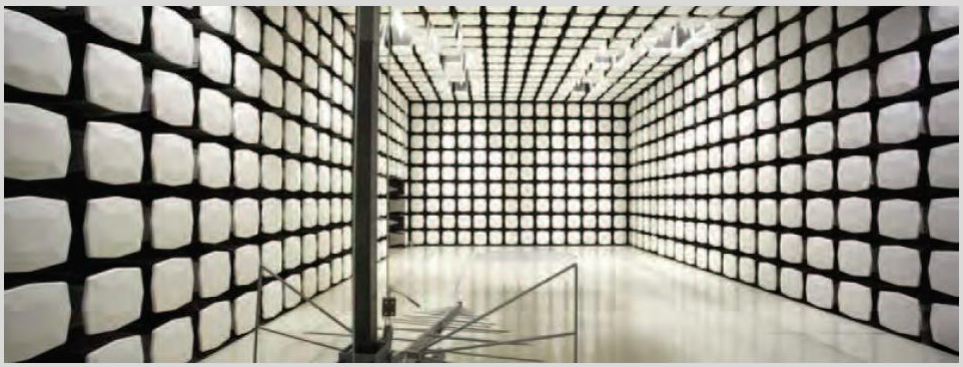
Skyetek M2

FCC 15.207:2017

FCC 15.225:2017

13.56 MHz Radio

Report # 3DSY0078



NVLAP Lab Code: 200630-0

CERTIFICATE OF TEST

2017-1-25

Last Date of Test: August 1, 2017
3D Systems Corporation
Model: Skyetek M2

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2017 FCC 15.225:2017	ANSI C63.10:2013

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	Field Strength of Spurious Emissions Less Than 30 MHz	Yes	Pass	
6.5	Field Strength of Spurious Emissions Greater Than 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. 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.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

2017.6.12

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 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

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

OFCA – Recognized by OFCA 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://portlandcustomer.element.com/ts/scope/scope.htm
http://gsi.nist.gov/global/docs/cabs/designations.html

MEASUREMENT UNCERTAINTY

TMU.2015.07.10

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 QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. 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.

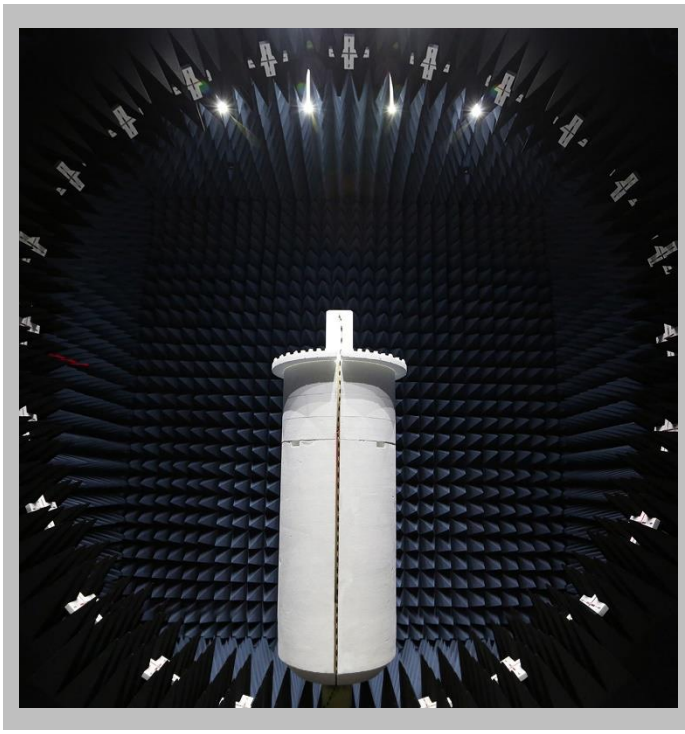
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

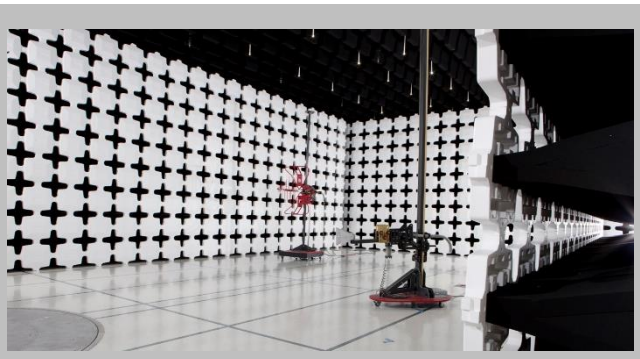
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

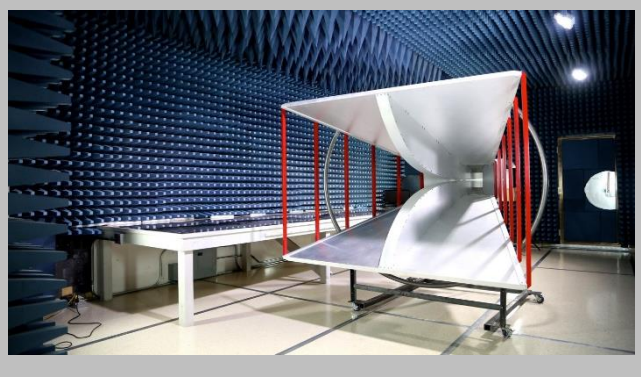
FACILITIES

2017.7.25

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157

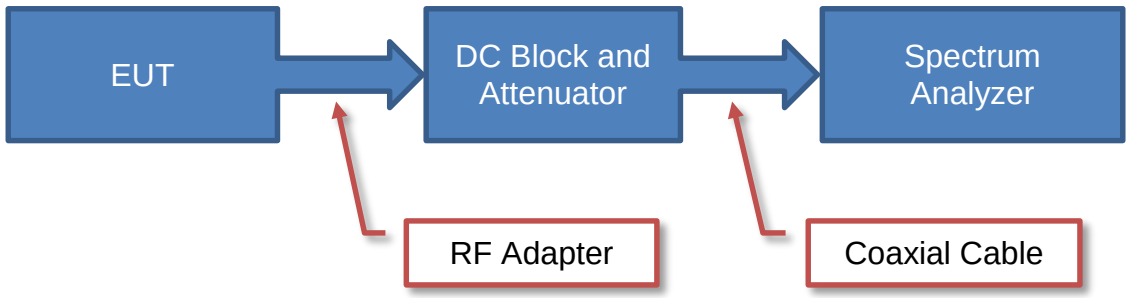




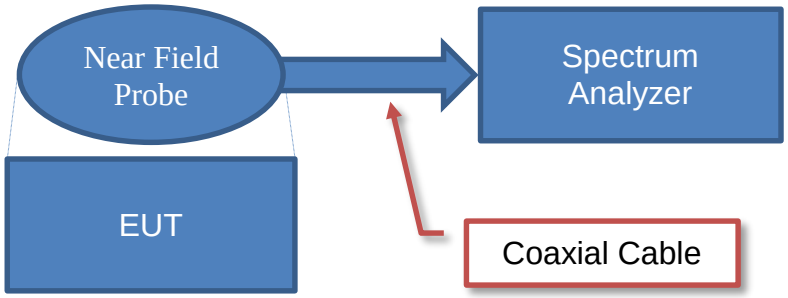


Test Setup Block Diagrams

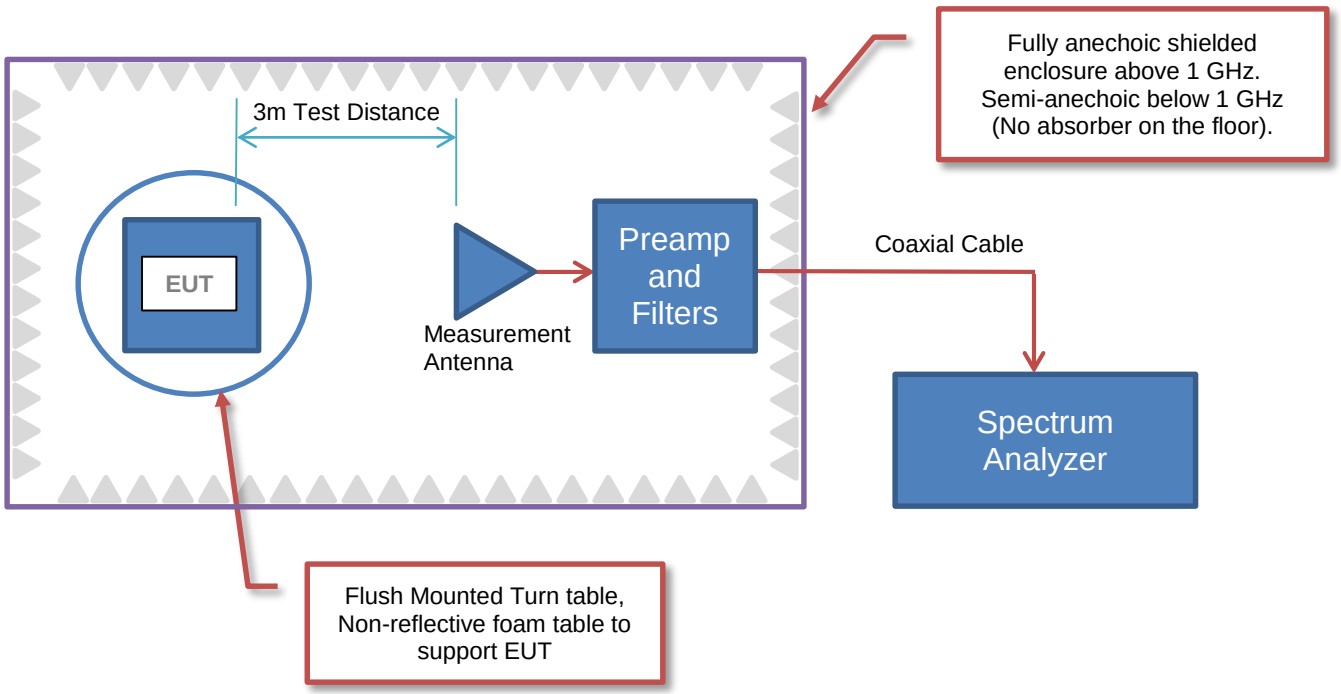
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	3D Systems Corporation
Address:	26600 SW Parkway
City, State, Zip:	Wilsonville, OR 97070-1000
Test Requested By:	Steve Wardle
Model:	Skyetek M2
First Date of Test:	July 31, 2017
Last Date of Test:	August 1, 2017
Receipt Date of Samples:	July 31, 2017
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
13.56 MHz RFID radio inside a ProJet® 6000 printer

Testing Objective:
To demonstrate compliance of the 13.56 MHz RFID radio to FCC 15.225 requirements

CONFIGURATIONS

Configuration 3DSY0078- 1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RFID Module (In Chassis)	SkyeTek	SkyeModule M2-MH	None
Host Interface Board (In Chassis)	SkyeTek	SP-IB-00-5.3	None
Multiplexer Board (In Chassis)	SkyeTek	Mux v1.3	None
Antenna Board (In Chassis)	SkyeTek	SP-AN-04-2.0	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC/DC Power Adapter	Dell	DA90PS1-00	None
Laptop	Dell	Latitude D630	None
3D Printer	3D Systems	ProJet 6000	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Serial Data Cable	Yes	2.0m	Yes	Laptop	Host Interface Board
DC Power Cable	Yes	1.7m	Yes	Laptop	AC/DC Power Adapter
AC Power Cable	No	1.7m	No	AC/DC Power Adapter	AC Mains
DC Power Cable	Yes	1.5m	Yes	AC/DC Power Adapter	Host Interface Board
Board to Board Connector	No	0.0m	No	RFID Module	Host Interface Board
Coax Cable	Yes	0.15m	No	RFID Module	Multiplexer Board
Coax Cable	Yes	0.9m	No	Mux Board	Antenna Board

Configuration 3DSY0078- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
3D Printer	3D Systems	ProJet 6000	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC Power Cable	No	2.0m	No	3D Printer	AC Mains

CONFIGURATIONS

Configuration 3DSY0078- 3

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
RFID Module (Not in Chassis)	SkyeTek	SkyeModule M2-MH	SM-M2-MH-2.2 2250140120
Host Interface Board (Not in Chassis)	SkyeTek	SP-IB-00-5.3	1411132070
Multiplexer Board (Not in Chassis)	SkyeTek	Mux v1.3	1403170048
Antenna Board (Not in Chassis)	SkyeTek	SP-AN-04-2.0	1304150675

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Latitude D630	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Serial Data Cable	Yes	2.0m	Yes	Laptop	Host Interface Board
DC Power Cable	Yes	1.5m	Yes	AC/DC Power Adapter	Host Interface Board
Board to Board Connector	No	0.0m	No	RFID Module	Host Interface Board
Coax Cable	Yes	0.15m	No	RFID Module	Multiplexer Board
Coax Cable	Yes	0.9m	No	Mux Board	Antenna Board

MODIFICATIONS

2017-1-25

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	7/31/2017	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	7/31/2017	Field Strength of Spurious 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 Element following the test.
3	7/31/2017	Field Strength of Spurious 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 Element following the test.
4	7/31/2017	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	8/1/2017	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

PSA-ESCI 2017.06.01

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.

MODES OF OPERATION

Cart antenna active

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

3DSY0078 - 2

SAMPLE CALCULATIONS

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Filter - High Pass	TTE	H97-100K-50-720B	HFX	1/9/2017	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	5/16/2017	12 mo
LISN	Solar Electronics	9252-50-R-24-BNC	LIR	10/4/2016	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	BWI (kHz)
0.15 - 30.0	1.0
30.0 - 400.0	10.0
400.0 - 1000.0	100.0
1000.0 - 6000.0	1000.0

MEASUREMENT UNCERTAINTY

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 for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

The test setup and procedures were in accordance with ANSI C63.10.

In the event that the operating frequency of 13.56 MHz is causing the product to fail the FCC 15.207 limits, the following guidance can be used:

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.

Per the FCC Guidance, the FCC will accept measurements on a 13.56 MHz transmitter done with a dummy load under the following conditions. (1) 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. (2) For the second portion of these tests, only the fundamental emission band of the transmitter needs to be retested.

POWERLINE CONDUCTED EMISSIONS

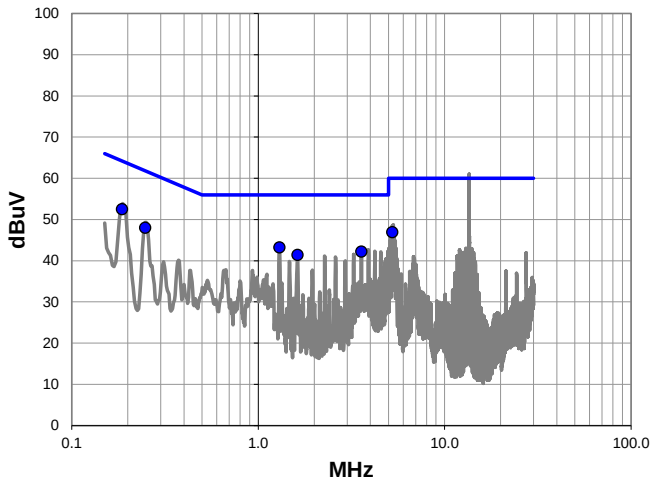
EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	3DSY0078	**Date:**	07/31/17		
Project:	None	**Temperature:**	23.8 °C		
Job Site:	EV11	**Humidity:**	43% RH		
Serial Number:	None	**Barometric Pres.:**	1023 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Skyetek M2				
Configuration:	2				
Customer:	3D Systems Corporation				
Attendees:	Steve Wardle				
EUT Power:	110VAC/60Hz				
Operating Mode:	Cart antenna active				
Deviations:	None				
Comments:	Antennas in ProJet 6000				

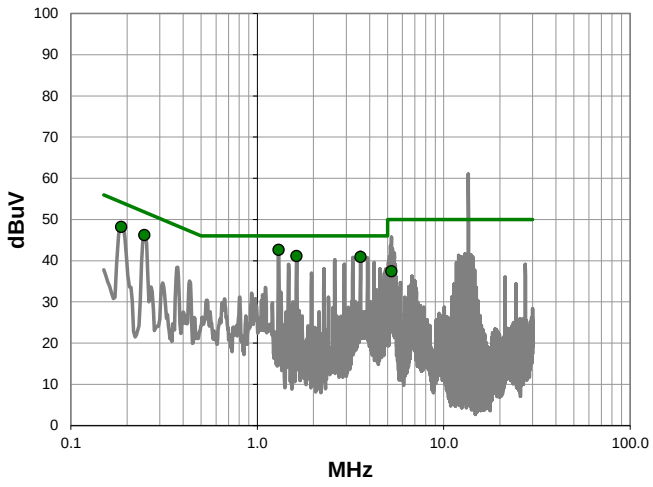
Test Specifications	**Test Method**
FCC 15.207:2017	ANSI C63.10:2013

Run #	8	**Line:**	High Line	**Ext. Attenuation:**	0	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.186	52.1	0.4	52.5	64.2	-11.7
1.300	42.7	0.5	43.2	56.0	-12.8
5.238	45.9	1.0	46.9	60.0	-13.1
3.576	41.3	0.9	42.2	56.0	-13.8
0.248	47.6	0.4	48.0	61.8	-13.8
1.625	40.8	0.6	41.4	56.0	-14.6

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.300	42.1	0.5	42.6	46.0	-3.4
1.625	40.5	0.6	41.1	46.0	-4.9
3.576	40.0	0.9	40.9	46.0	-5.1
0.248	45.8	0.4	46.2	51.8	-5.6
0.186	47.8	0.4	48.2	54.2	-6.0
5.238	36.4	1.0	37.4	50.0	-12.6

POWERLINE CONDUCTED EMISSIONS

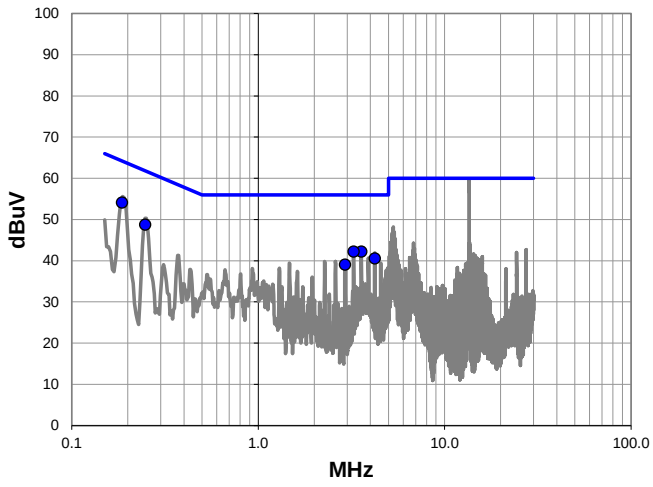
EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	3DSY0078	**Date:**	07/31/17		
Project:	None	**Temperature:**	23.8 °C		
Job Site:	EV11	**Humidity:**	43% RH		
Serial Number:	None	**Barometric Pres.:**	1023 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Skyetek M2				
Configuration:	2				
Customer:	3D Systems Corporation				
Attendees:	Steve Wardle				
EUT Power:	110VAC/60Hz				
Operating Mode:	Cart antenna active				
Deviations:	None				
Comments:	Antennas in ProJet 6000				

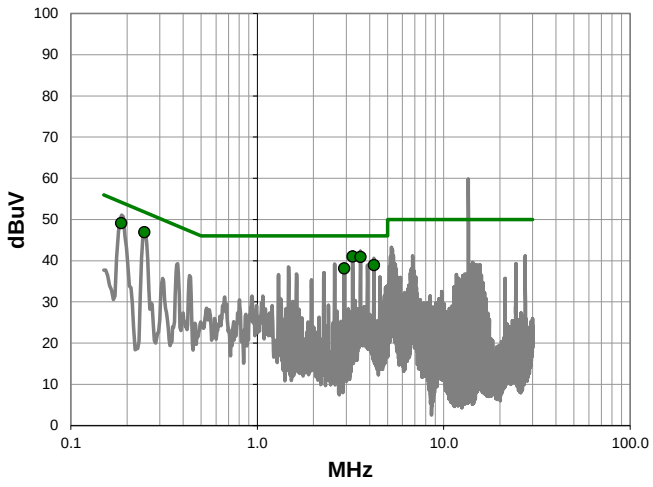
Test Specifications	**Test Method**
FCC 15.207:2017	ANSI C63.10:2013

Run #	9	**Line:**	Neutral	**Ext. Attenuation:**	0	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.186	53.7	0.4	54.1	64.2	-10.1
0.248	48.3	0.4	48.7	61.8	-13.1
3.575	41.3	0.9	42.2	56.0	-13.8
3.248	41.4	0.8	42.2	56.0	-13.8
4.223	39.6	0.9	40.5	56.0	-15.5
2.924	38.2	0.8	39.0	56.0	-17.0

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.248	46.5	0.4	46.9	51.8	-4.9
3.248	40.2	0.8	41.0	46.0	-5.0
3.575	40.0	0.9	40.9	46.0	-5.1
0.186	48.7	0.4	49.1	54.2	-5.1
4.223	38.0	0.9	38.9	46.0	-7.1
2.924	37.3	0.8	38.1	46.0	-7.9

POWERLINE CONDUCTED EMISSIONS

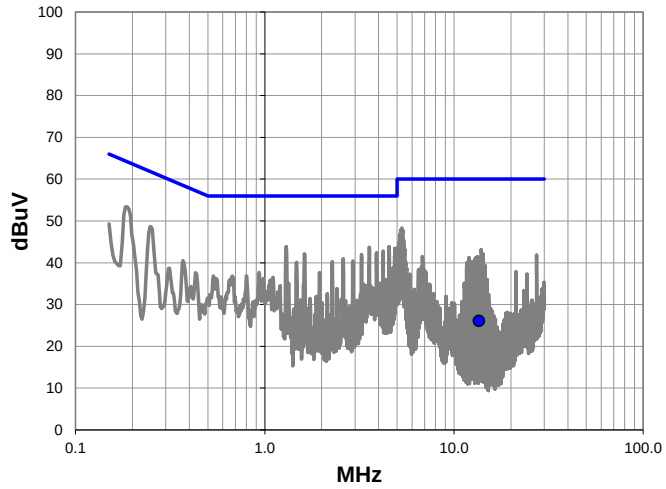
EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	3DSY0078	**Date:**	07/31/17		
Project:	None	**Temperature:**	23.8 °C		
Job Site:	EV11	**Humidity:**	43% RH		
Serial Number:	None	**Barometric Pres.:**	1023 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Skyetek M2				
Configuration:	2				
Customer:	3D Systems Corporation				
Attendees:	Steve Wardle				
EUT Power:	110VAC/60Hz				
Operating Mode:	Cart antenna active				
Deviations:	None				
Comments:	Antennas in ProJet 6000				

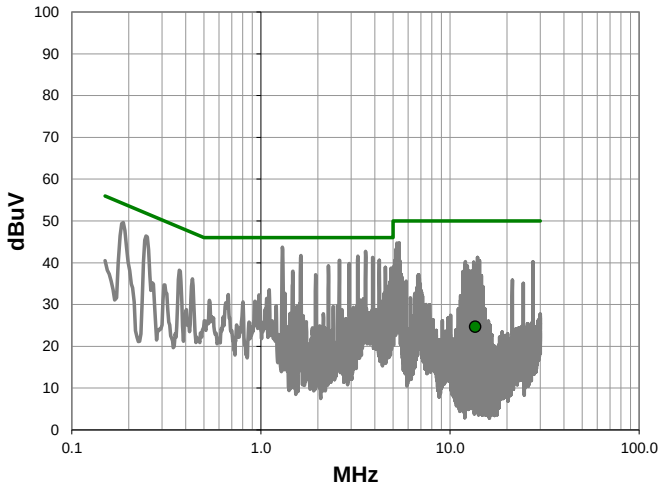
Test Specifications	**Test Method**
FCC 15.207:2017	ANSI C63.10:2013

Run #	11	**Line:**	High Line	**Ext. Attenuation:**	0	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.561	24.2	1.9	26.1	60.0	-33.9

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.561	22.8	1.9	24.7	50.0	-25.3

POWERLINE CONDUCTED EMISSIONS

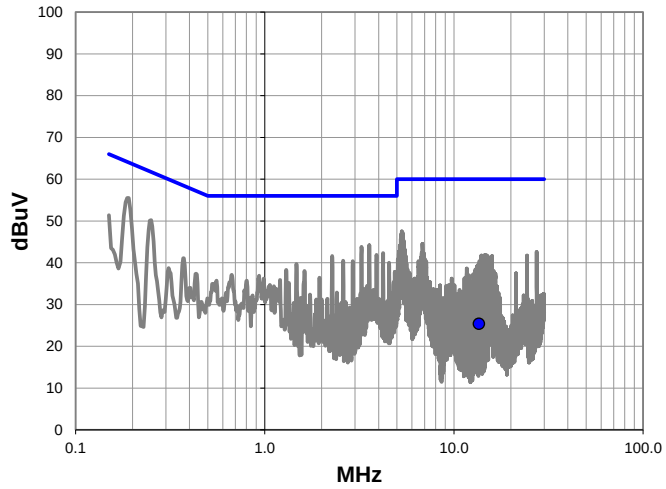
EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	3DSY0078	**Date:**	07/31/17		
Project:	None	**Temperature:**	23.8 °C		
Job Site:	EV11	**Humidity:**	43% RH		
Serial Number:	None	**Barometric Pres.:**	1023 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Skyetek M2				
Configuration:	2				
Customer:	3D Systems Corporation				
Attendees:	Steve Wardle				
EUT Power:	110VAC/60Hz				
Operating Mode:	Cart antenna active				
Deviations:	None				
Comments:	Antennas in ProJet 6000				

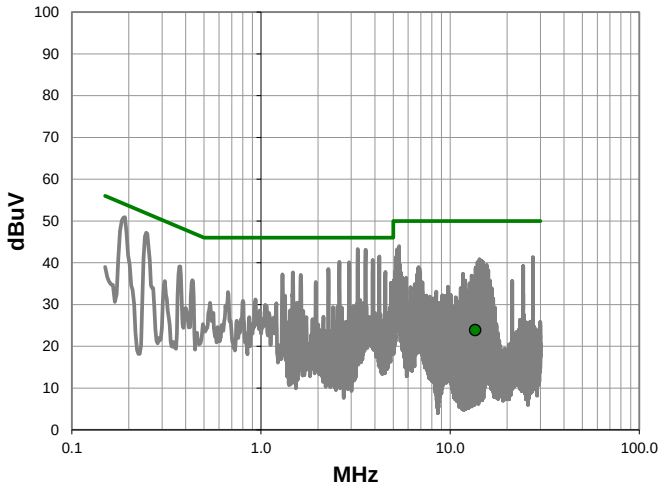
Test Specifications	**Test Method**
FCC 15.207:2017	ANSI C63.10:2013

Run #	12	**Line:**	Neutral	**Ext. Attenuation:**	0	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.561	23.5	1.9	25.4	60.0	-34.6

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
13.561	22.0	1.9	23.9	50.0	-26.1

FIELD STRENGTH OF FUNDAMENTAL

PSA-ESCI 2017.06.01

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

Cart antenna active

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

3DSY0078 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	12 MHz	Stop Frequency	15 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
Cable	None	10m Test Distance Cable	EVL	4/17/2017	12 mo
Antenna	EMCO	6502	AOA	7/6/2016	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	5/16/2017	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

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

The fundamental carrier of the EUT was maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The center of the loop antenna was maintained at 1m above the ground plane during the testing.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.4, 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 the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

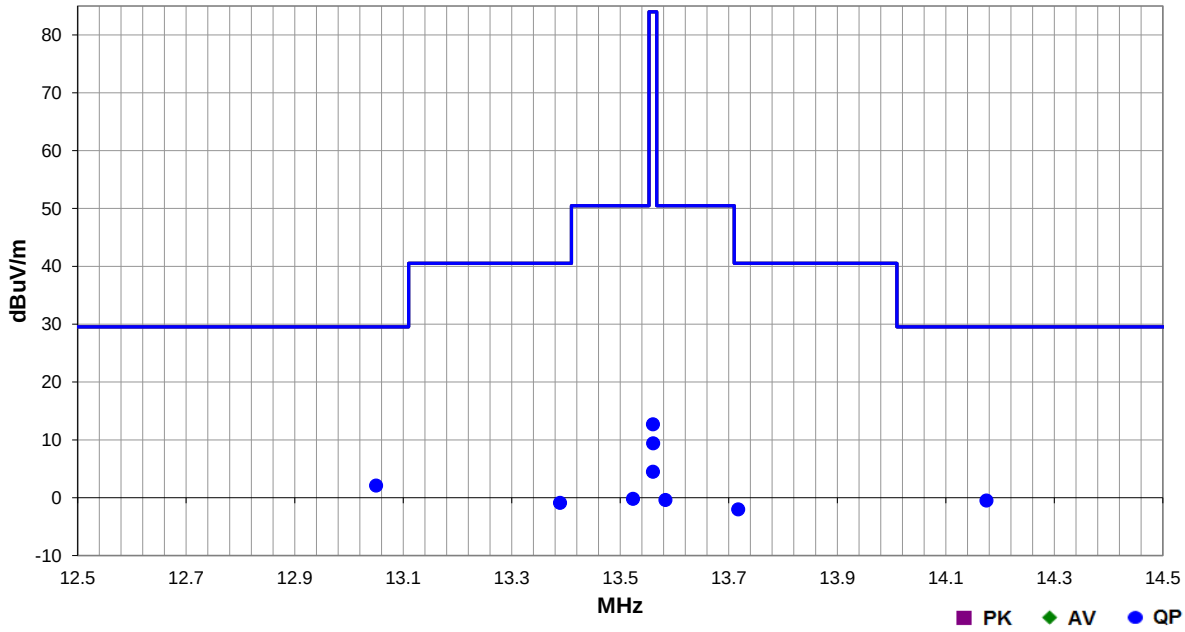
FIELD STRENGTH OF FUNDAMENTAL

EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	3DSY0078	**Date:**	07/31/17		
Project:	None	**Temperature:**	23.1 °C		
Job Site:	EV11	**Humidity:**	41.4% RH		
Serial Number:	None	**Barometric Pres.:**	1026 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Skyetek M2				
Configuration:	1				
Customer:	3D Systems Corporation				
Attendees:	Steve Wardle				
EUT Power:	110VAC/60Hz				
Operating Mode:	Cart antenna active				
Deviations:	None				
Comments:	Antennas in ProJet 6000, printer not powered. RFID powered by external AC to DC power adapter. Laptop connected via serial cable.				

Test Specifications	**Test Method**
FCC 15.225:2017	ANSI C63.10:2013

Run #	3	**Test Distance (m)**	10	**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
13.050	10.1	11.1	1.0	365.0	10.0	0.0	Horz	QP	-19.1	2.1	29.5	-27.4	Antenna Perp to EUT
14.175	7.5	11.1	1.0	365.0	10.0	0.0	Horz	QP	-19.1	-0.5	29.5	-30.0	Antenna Perp to EUT
13.389	7.1	11.1	1.0	365.0	10.0	0.0	Horz	QP	-19.1	-0.9	40.5	-41.4	Antenna Perp to EUT
13.717	6.0	11.1	1.0	-5.0	10.0	0.0	Horz	QP	-19.1	-2.0	40.5	-42.5	Antenna Perp to EUT
13.523	7.8	11.1	1.0	365.0	10.0	0.0	Horz	QP	-19.1	-0.2	50.5	-50.7	Antenna Perp to EUT
13.583	7.6	11.1	1.0	365.0	10.0	0.0	Horz	QP	-19.1	-0.4	50.5	-50.9	Antenna Perp to EUT
13.560	20.7	11.1	1.0	208.0	10.0	0.0	Horz	QP	-19.1	12.7	84.0	-71.3	Antenna Perp to EUT
13.561	17.4	11.1	1.0	311.0	10.0	0.0	Vert	QP	-19.1	9.4	84.0	-74.6	Antenna Par to GND
13.560	12.5	11.1	1.0	-5.0	10.0	0.0	Horz	QP	-19.1	4.5	84.0	-79.5	Antenna Par to EUT

FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz

PSA-ESCI 2017.06.01

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

Cart antenna active

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

3DSY0078 - 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
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	5/16/2017	12 mo
Cable	None	10m Test Distance Cable	EVL	4/17/2017	12 mo
Antenna	EMCO	6502	AOA	7/6/2016	24 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

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

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.4, 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 the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

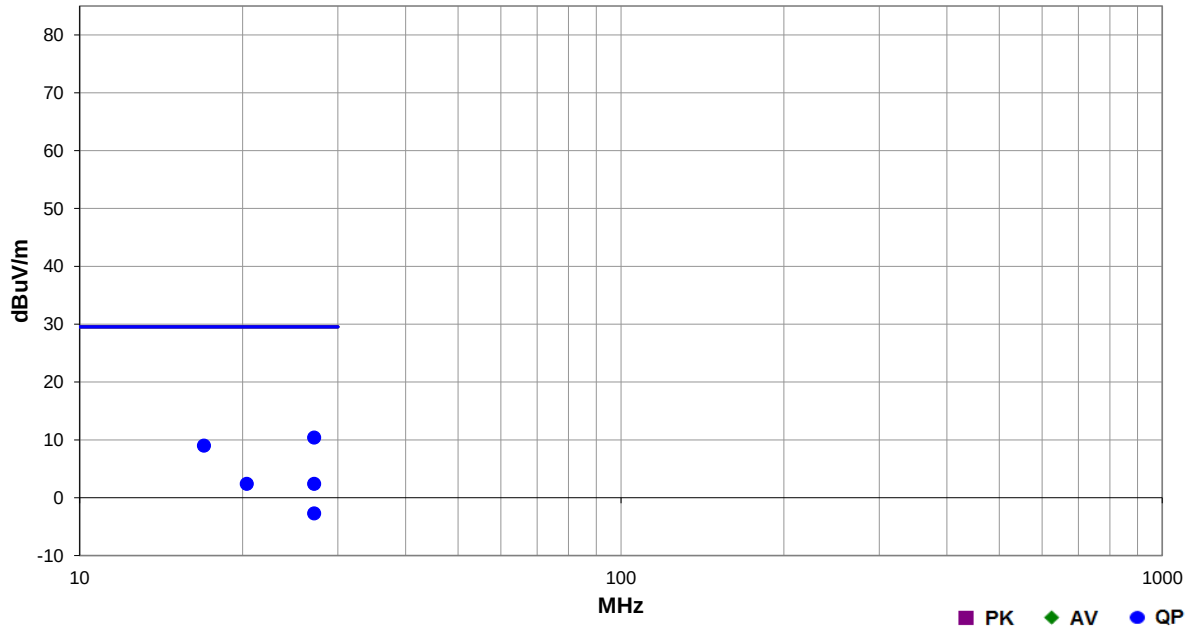
FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz

EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	3DSY0078	**Date:**	07/31/17		
Project:	None	**Temperature:**	23.4 °C		
Job Site:	EV11	**Humidity:**	42.4% RH		
Serial Number:	None	**Barometric Pres.:**	1025 mbar	**Tested by:**	Travis Pow
EUT:	Skyetek M2				
Configuration:	1				
Customer:	3D Systems Corporation				
Attendees:	Steve Wardle				
EUT Power:	110VAC/60Hz				
Operating Mode:	Cart antenna active				
Deviations:	None				
Comments:	Antennas in ProJet 6000, printer not powered. RFID powered by external AC to DC power adapter. Laptop connected via serial cable.				

Test Specifications	**Test Method**
FCC 15.225:2017	ANSI C63.10:2013

Run #	4	**Test Distance (m)**	10	**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
27.121	20.2	9.3	1.0	-5.0	10.0	0.0	Horz	QP	-19.1	10.4	29.5	-19.1	Antenna Perp to EUT
16.968	17.2	10.9	1.0	-5.0	10.0	0.0	Horz	QP	-19.1	9.0	29.5	-20.5	Antenna Perp to EUT
27.121	12.2	9.3	1.0	-5.0	10.0	0.0	Vert	QP	-19.1	2.4	29.5	-27.1	Antenna Par to GND
20.349	10.8	10.7	1.0	363.0	10.0	0.0	Horz	QP	-19.1	2.4	29.5	-27.1	Antenna Par to EUT
27.120	7.1	9.3	1.0	-5.0	10.0	0.0	Horz	QP	-19.1	-2.7	29.5	-32.2	Antenna Par to EUT

FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz

PSA-ESCI 2017.06.01

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

Cart antenna active

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

3DSY0078 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	140 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
Analyzer - Spectrum Analyzer	Agilent	E4443A	AFB	5/16/2017	12 mo
Cable	None	3m Test Distance Cable	EVM	4/17/2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1551	AOY	4/17/2017	12 mo
Antenna - Biconilog	EMCO	3141	AXG	7/17/2017	24 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

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

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These “pre-scans” are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit.

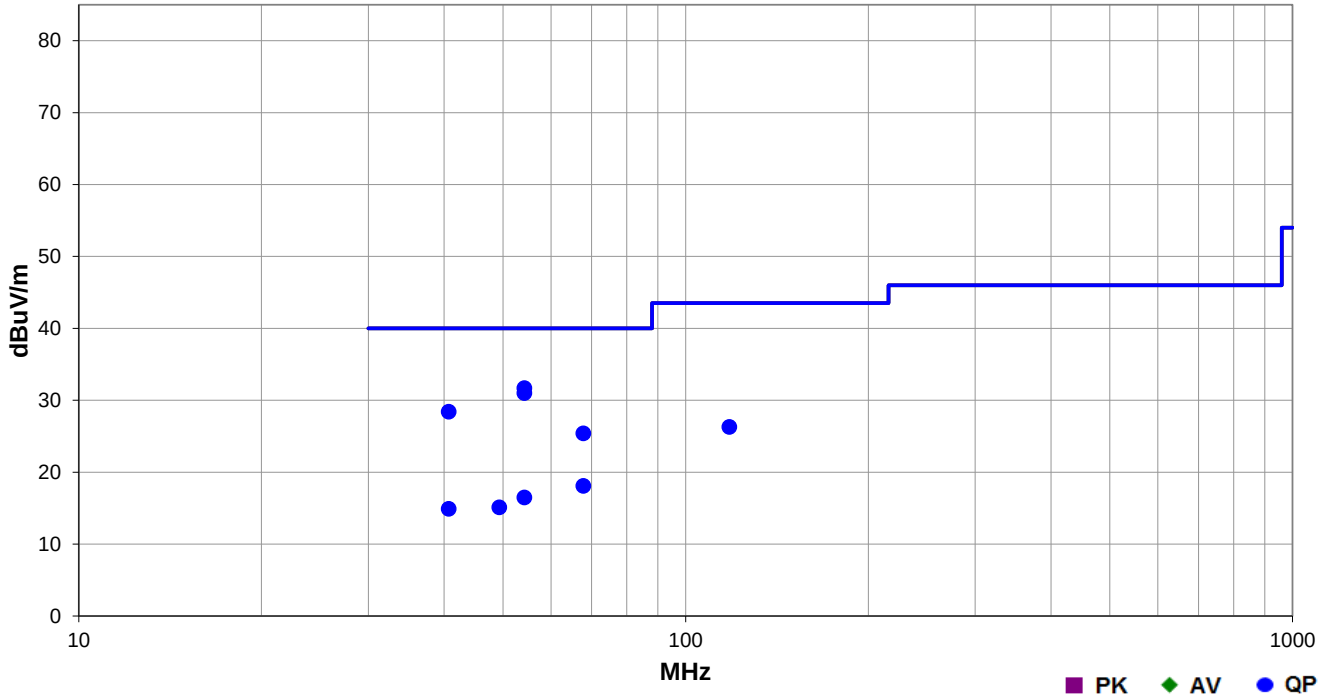
FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz

EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	3DSY0078	**Date:**	07/31/17		
Project:	None	**Temperature:**	23.6 °C		
Job Site:	EV11	**Humidity:**	43% RH		
Serial Number:	None	**Barometric Pres.:**	1024 mbar	**Tested by:**	Travis Pow and Rod Peloquin
EUT:	Skyetek M2				
Configuration:	1				
Customer:	3D Systems Corporation				
Attendees:	Steve Wardle				
EUT Power:	110VAC/60Hz				
Operating Mode:	Cart antenna active				
Deviations:	None				
Comments:	Antennas in ProJet 6000, printer not powered. RFID powered by external AC to DC power adapter. Laptop connected via serial cable.				

Test Specifications	**Test Method**
FCC 15.225:2017	ANSI C63.10:2013

Run #	5	**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)
54.246	61.4	-29.7	1.0	311.0	3.0	0.0	Vert	QP	0.0	31.7	40.0	-8.3
54.247	60.7	-29.7	1.0	304.0	3.0	0.0	Vert	QP	0.0	31.0	40.0	-9.0
40.687	54.4	-26.0	1.0	60.0	3.0	0.0	Vert	QP	0.0	28.4	40.0	-11.6
67.807	56.1	-30.7	1.0	289.0	3.0	0.0	Vert	QP	0.0	25.4	40.0	-14.6
118.016	55.7	-29.4	1.0	294.0	3.0	0.0	Vert	QP	0.0	26.3	43.5	-17.2
67.808	48.8	-30.7	3.0	322.0	3.0	0.0	Horz	QP	0.0	18.1	40.0	-21.9
54.247	46.2	-29.7	4.0	15.0	3.0	0.0	Horz	QP	0.0	16.5	40.0	-23.5
49.322	44.0	-28.9	2.0	266.0	3.0	0.0	Vert	QP	0.0	15.1	40.0	-24.9
40.687	40.9	-26.0	2.1	273.0	3.0	0.0	Horz	QP	0.0	14.9	40.0	-25.1

FREQUENCY STABILITY

XMit 2017.02.08

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.	Cal. Due
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-8-2-SCT/AC	TBI	NCR	NCR
Probe - Near Field Set	EMCO	7405	IPD	NCR	NCR
Attenuator	S.M. Electronics	SA26B-20	AUY	5/30/2017	5/30/2018
Block - DC	Fairview Microwave	SD3379	AMW	6/5/2017	6/5/2018
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFP	8/10/2016	8/10/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	5/30/2017	5/30/2018
Power Supply - AC	Instek	APS-9050	TPK	NCR	NCR
Thermometer	Omegaette	HH311	DTY	1/21/2015	1/21/2018

TEST DESCRIPTION

A near-field probe was placed near the transmitter. A low-loss coaxial cable was used to connect the near-field probe to the spectrum analyzer. The spectrum analyzer is equipped with a precision frequency reference that exceeds the stability requirement of the EUT.

Measurements were made on the single transmit frequency as called out on the data sheets. Testing was done while the EUT was continuously polling.

The primary supply voltage was varied from 85 % to 115% of the nominal voltage while at ambient temperature. Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range of -20 ° to +50° C and at 10°C intervals.

The requirement of a frequency tolerance of ±0.01% is equivalent to 100 ppm
The formula to check for compliance is:

ppm = (Measured Frequency / Measured Nominal Frequency - 1) * 1,000,000

FREQUENCY STABILITY

XMit 2017.02.08

EUT:	Skyetek M2			**Work Order:**	3DSY0078
Serial Number:	None			**Date:**	08/01/17
Customer:	3D Systems Corporation			**Temperature:**	24 °C
Attendees:	Steve Wardle			**Humidity:**	43.4% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Travis Pow and Rod Peloquin	**Power:**	110VAC/60Hz	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.225:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

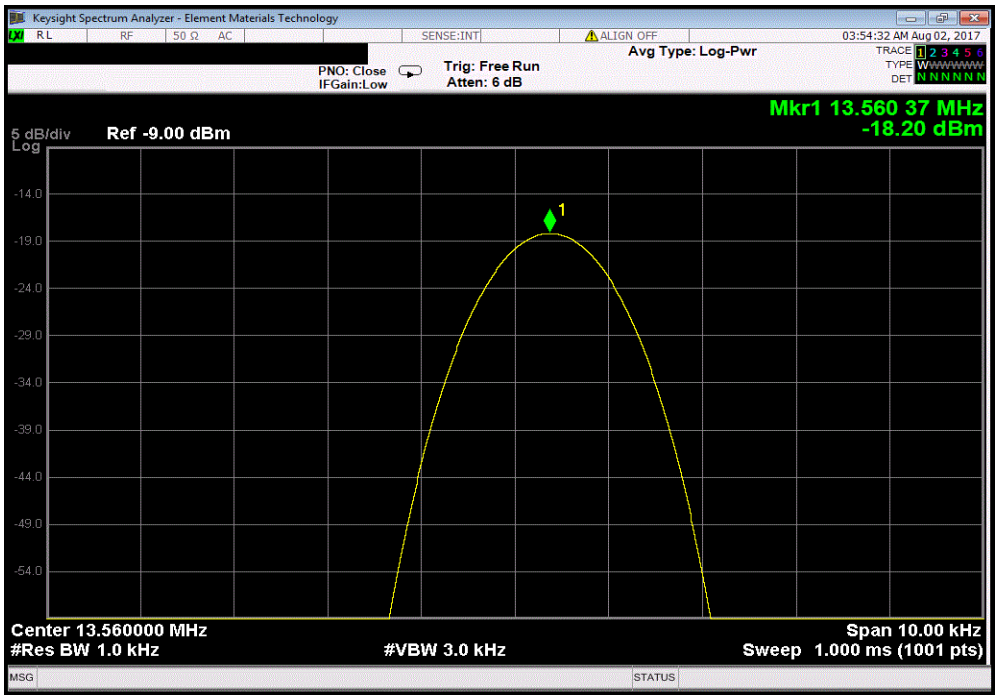
Configuration #	3	Signature

		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
50°C						
	100% at 110VAC/60Hz	13.56037	13.56	27	100	Pass
40°C						
	100% at 110VAC/60Hz	13.56039	13.56	29	100	Pass
30°C						
	100% at 110VAC/60Hz	13.56042	13.56	31	100	Pass
20°C						
	115% at 110VAC/60Hz	13.56046	13.56	34	100	Pass
	100% at 110VAC/60Hz	13.56046	13.56	34	100	Pass
	85% at 110VAC/60Hz	13.56046	13.56	34	100	Pass
10°C						
	100% at 110VAC/60Hz	13.56049	13.56	36	100	Pass
0°C						
	100% at 110VAC/60Hz	13.56052	13.56	38	100	Pass
-10°C						
	100% at 110VAC/60Hz	13.56052	13.56	38	100	Pass
-20°C						
	100% at 110VAC/60Hz	13.5605	13.56	37	100	Pass

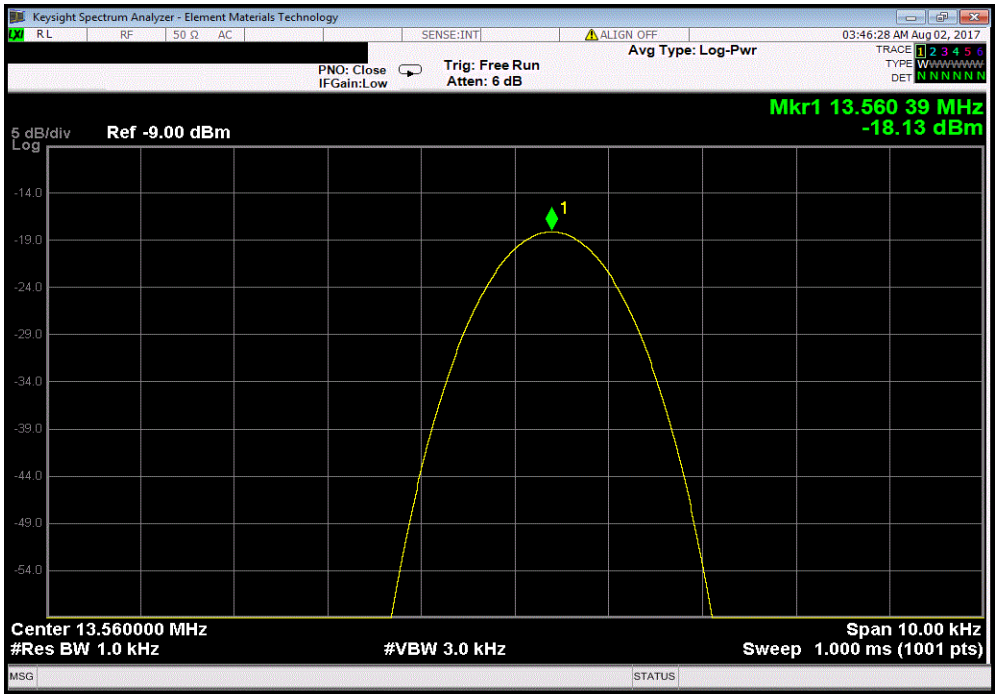
FREQUENCY STABILITY

XMit 2017.02.08

50°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56037	13.56	27	100	Pass



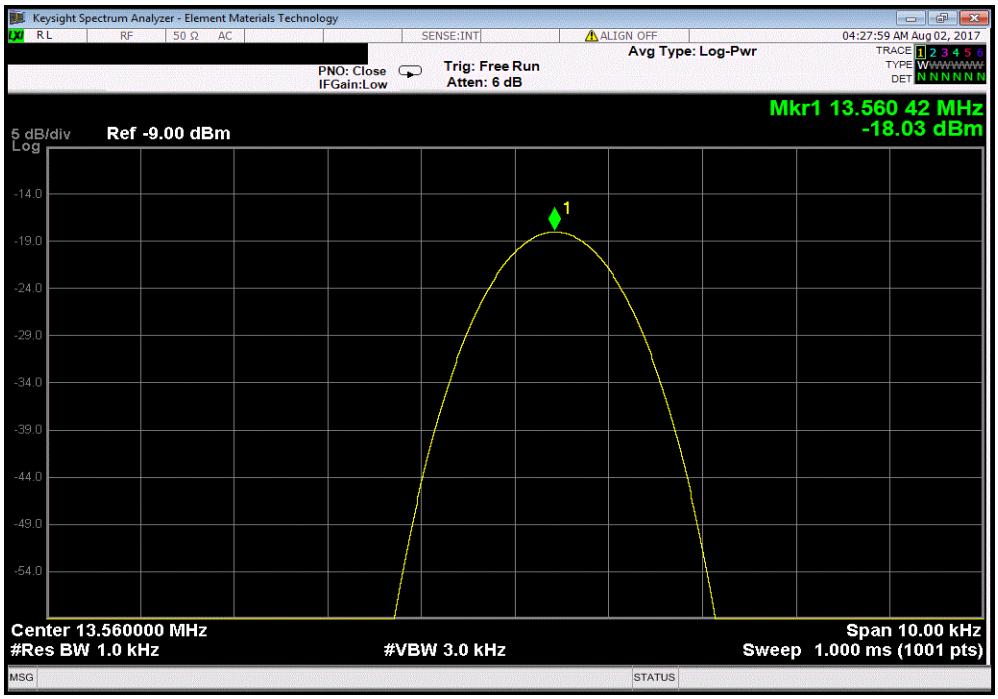
40°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56039	13.56	29	100	Pass



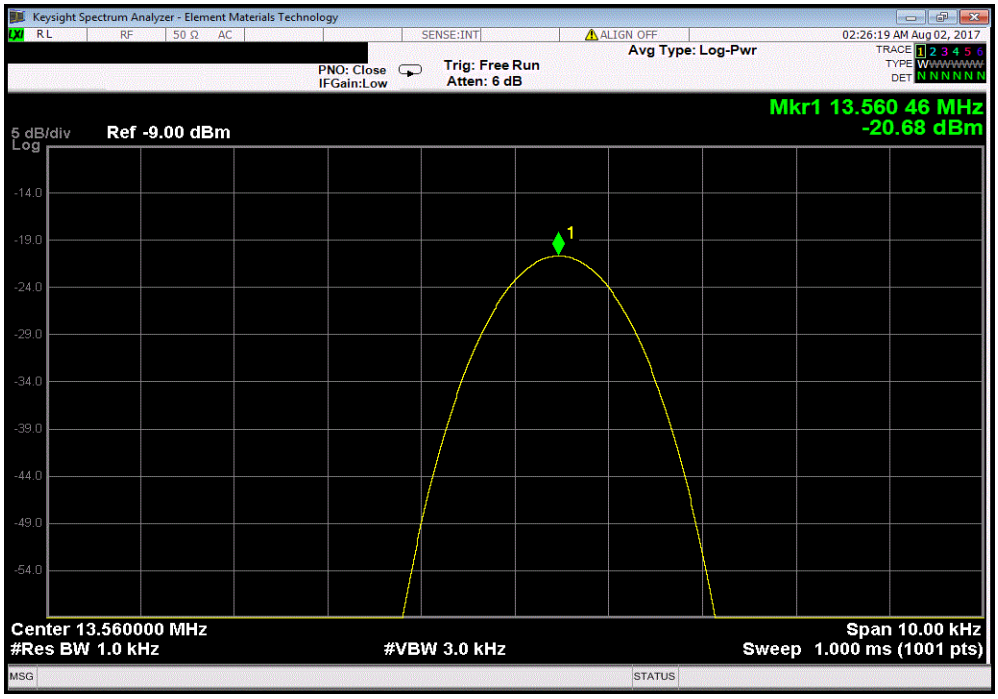
FREQUENCY STABILITY

XMit 2017.02.08

30°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56042	13.56	30.97345133	100	Pass



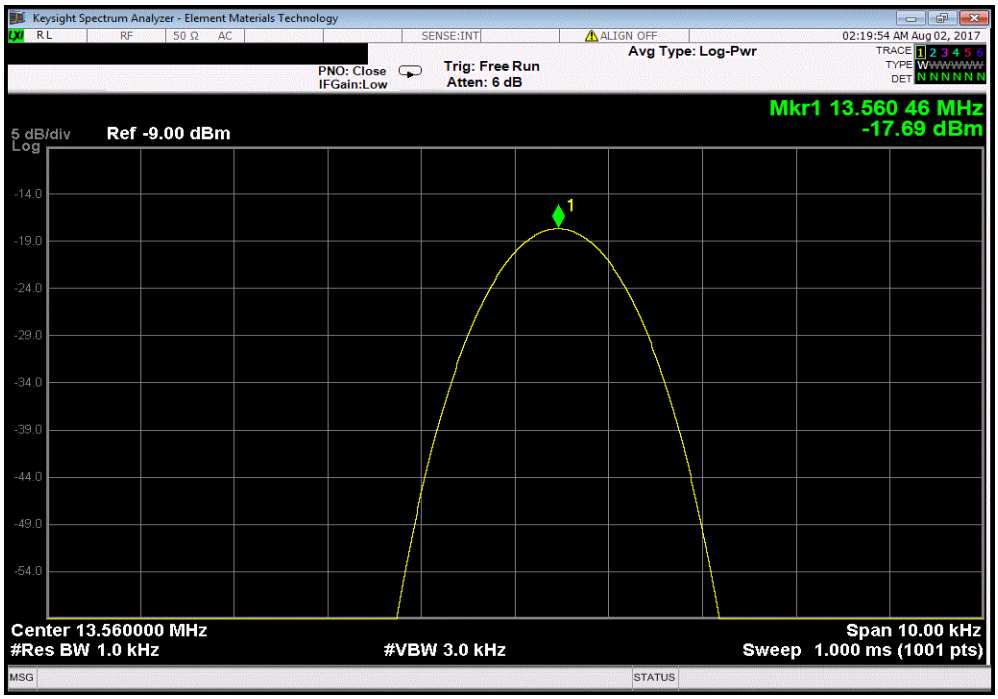
20°C, 115% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56046	13.56	33.92330383	100	Pass



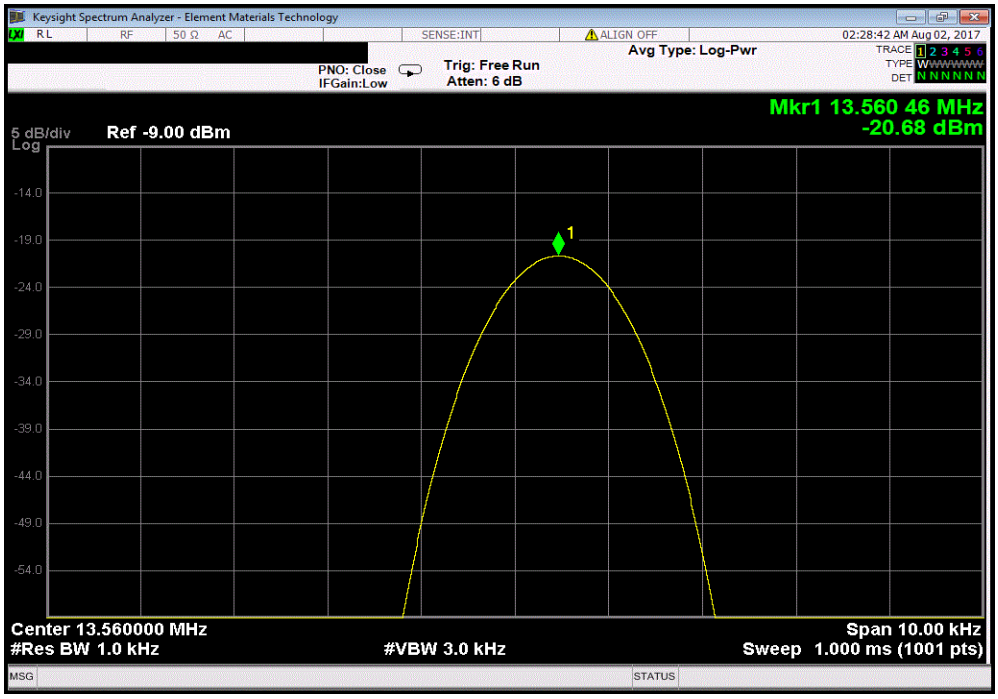
FREQUENCY STABILITY

XMit 2017.02.08

20°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56046	13.56	33.92330383	100	Pass



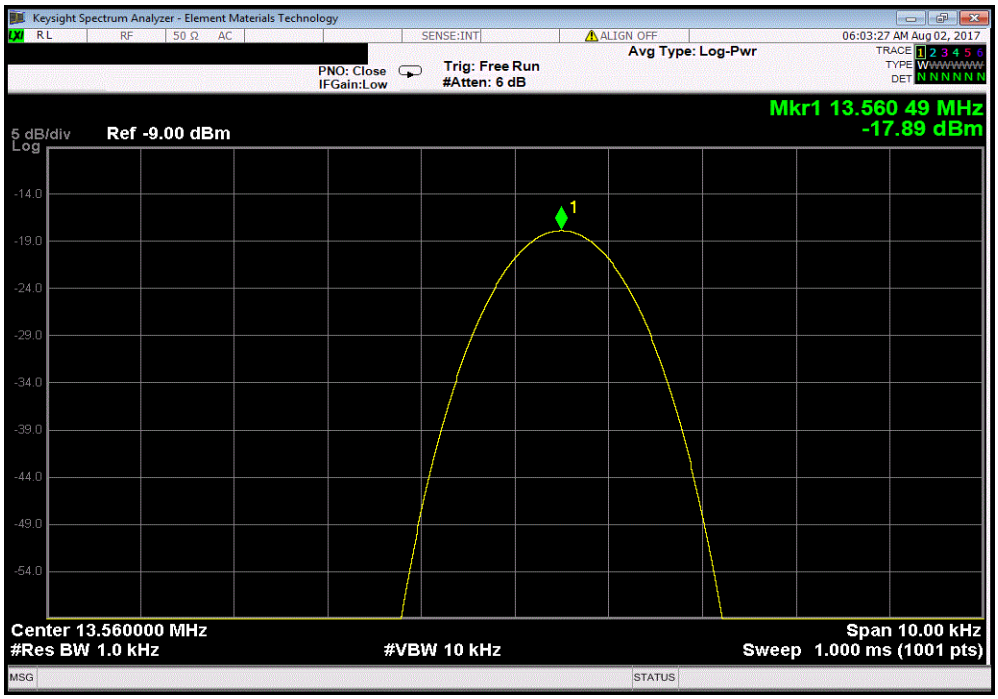
20°C, 85% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56046	13.56	33.92330383	100	Pass



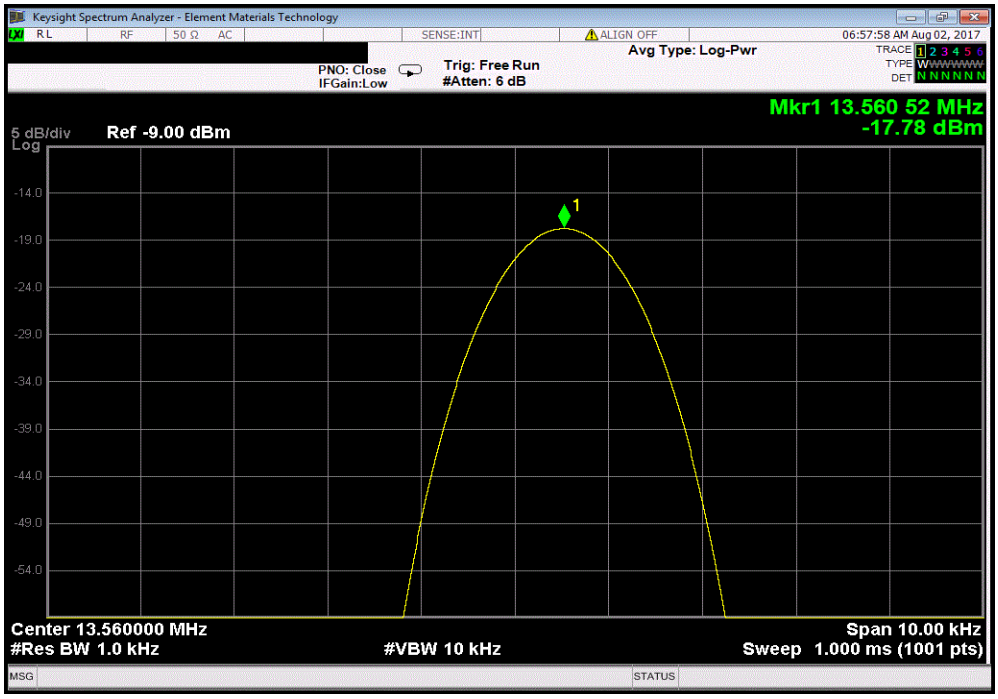
FREQUENCY STABILITY

XMit 2017.02.08

10°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56049	13.56	36.13569322	100	Pass



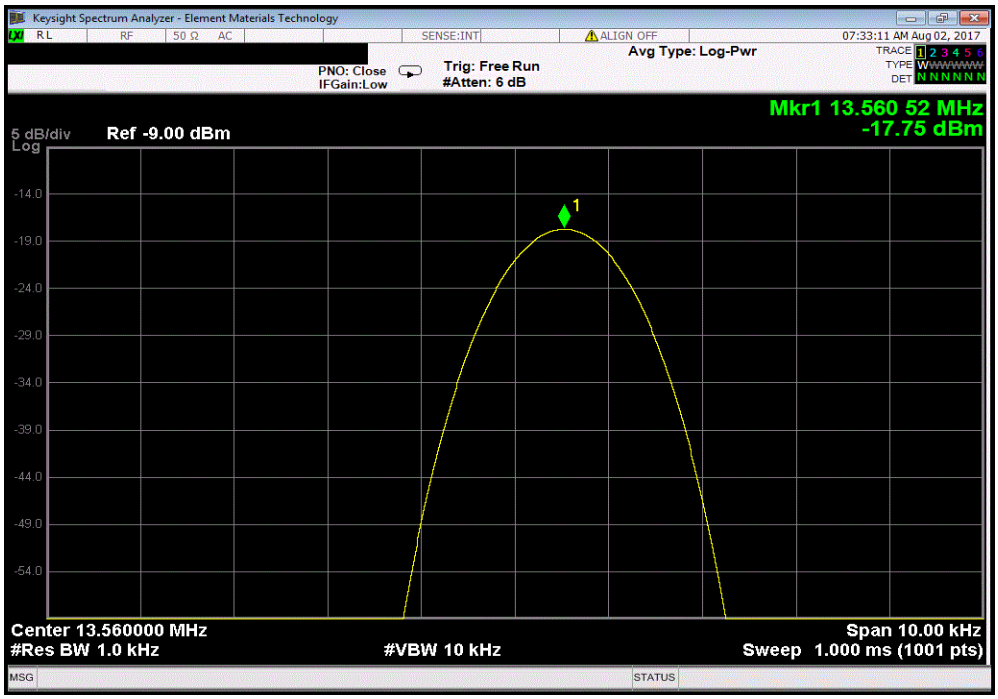
0°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56052	13.56	38.3480826	100	Pass



FREQUENCY STABILITY

XMit 2017.02.08

-10°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.56052	13.56	38.3480826	100	Pass



-20°C, 100% at 110VAC/60Hz						
		Measured Value (MHz)	Assigned Value (MHz)	Error ppm	Limit ppm	Result
		13.5605	13.56	36.87315634	100	Pass