



Boston Scientific Corporation

4100 Hamline Avenue North
St Paul, MN 55112

Product Name: FFR Link

Model: H7495551000

**LP0002:2018
13.56 MHz Radio**

Report # BSTN0852.1

Issue Date: August 15, 2018



NVLAP LAB CODE: 200881-0



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CERTIFICATE OF TEST

Last Date of Test: August 1, 2018
 Issue Date: August 15, 2018
 Boston Scientific Corporation
 Product Name: FFR Link
 Model: H7495551000

Radio Equipment Testing

Standards

Specification	Method
LP0002:2018	LP0002:2018

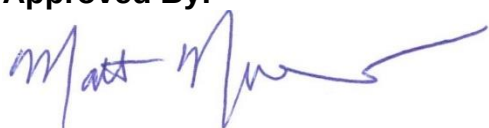
Results

Specification	Method	Test Description	Applied	Results	Comments
2.3	Appendix I, II.(II)	Powerline Conducted Emissions	Yes	Pass	
3.2.1.1	Appendix I, II.(IV)	Field Strength of Fundamental	Yes	Pass	
3.2.1.2	Appendix I, II.(IV)	Field Strength of Spurious Emissions Less than 30MHz	Yes	Pass	
3.2.1.2	Appendix I, II.(IV)	Field Strength of Spurious Emissions Greater than 30MHz	Yes	Pass	
3.2.1.3	Appendix I, II.(VI-VII)	Frequency Stability	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Matt Nuernberg, Operations Manager

Test Location:
 Element Materials Technology
 9349 W Broadway Ave.
 Brooklyn Park, MN 55445

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 (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 - 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

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.

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:

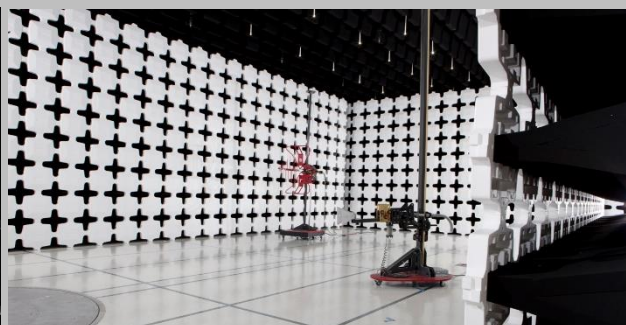
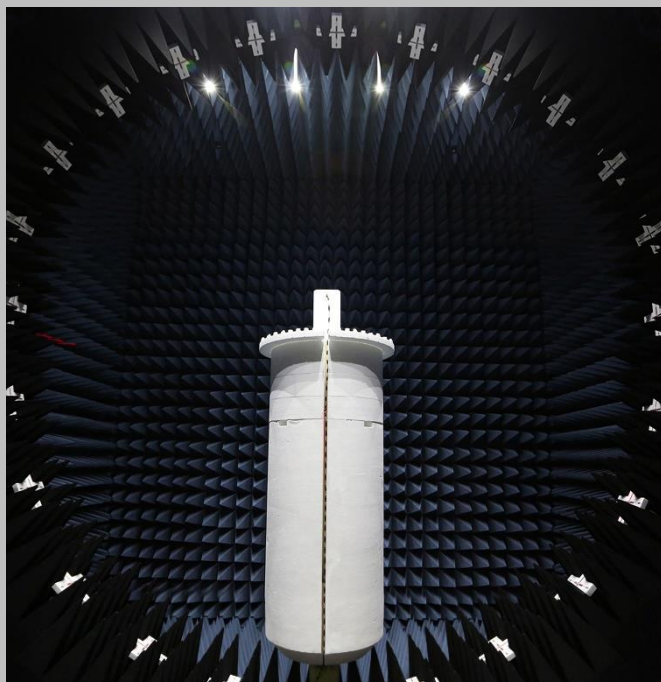
<http://portlandcustomer.element.com/ts/scope/scope.htm>

<http://gsi.nist.gov/global/docs/cabs/designations.html>

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	New York Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th 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/RRR, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157



EMISSIONS MEASUREMENTS



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.

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

Measurements were made using the bandwidths and detectors specified. No video filter was used.

Sample Calculations

Radiated Emissions:

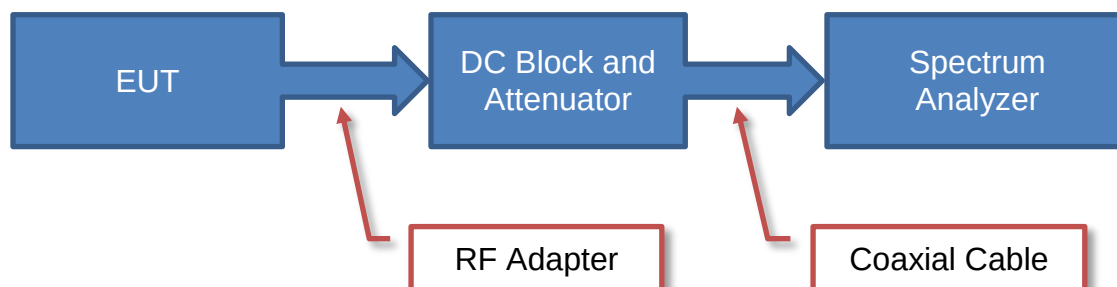
Field Strength	Measured Level	Antenna Factor	Cable Factor	Amplifier Gain	Distance Adjustment Factor	External Attenuation
33.5	42.6	28.6	3.1	40.8	0.0	0.0

Conducted Emissions:

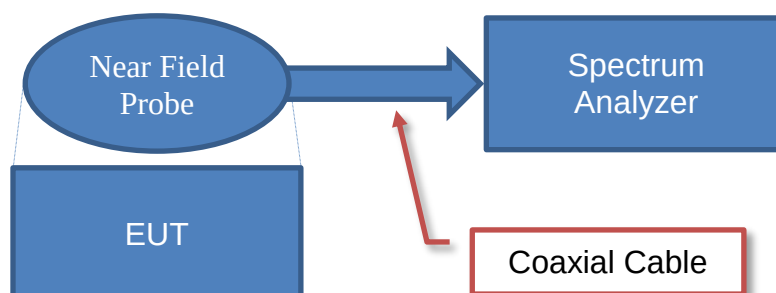
Adjusted Level	Measured Level	Transducer Factor	Cable Factor	External Attenuation
47.1	26.7	0.3	0.1	20.0

Test Setup Block Diagrams

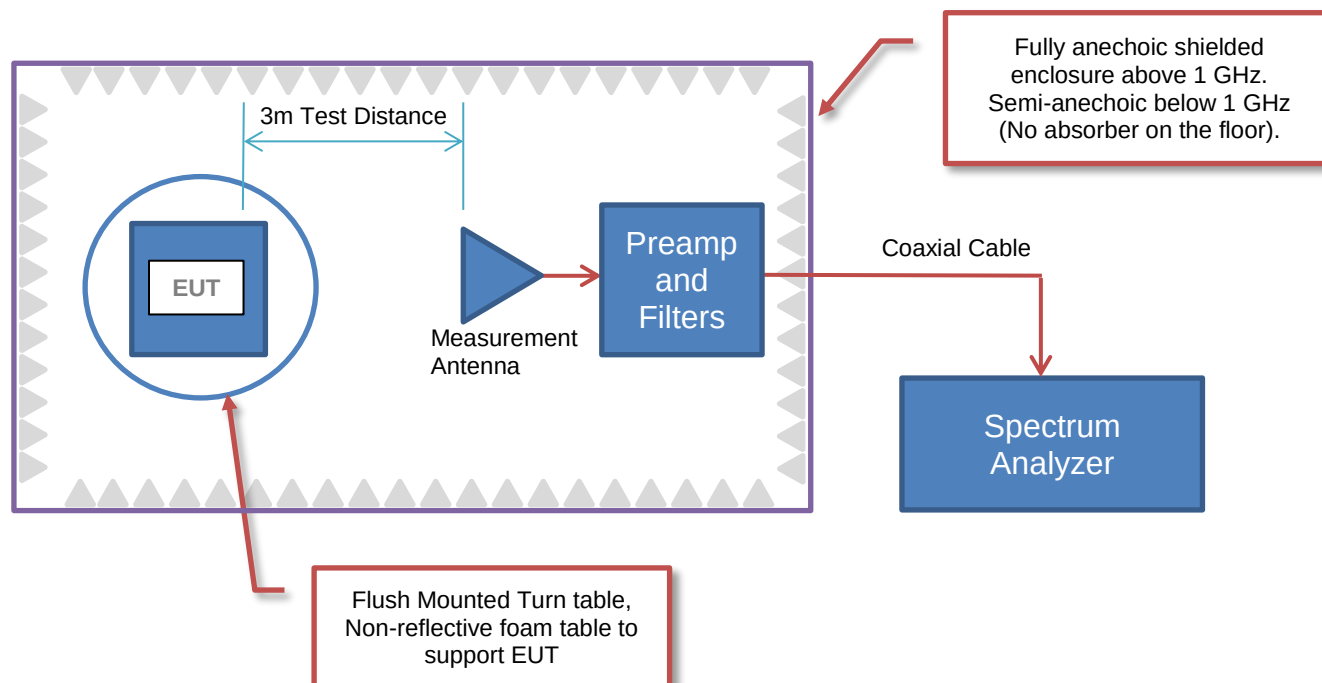
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	Boston Scientific Corporation
Address:	47215 Lakeview Blvd
City, State, Zip:	Fremont, CA 94538
Test Requested By:	Srividya Saptharishi
Model:	FFR Link (H7495551000)
First Date of Test:	July 20, 2018
Last Date of Test:	August 1, 2018
Receipt Date of Samples:	June 6, 2018
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 radio using RFID with 1 antenna type
Testing Objective:
To demonstrate compliance to LP0002 specifications.

CONFIGURATIONS



Configuration BSTN0852- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
FFR Link	Boston Scientific Corporation	IBP PT DV15	17FP0251

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable	No	1.0m	No	FFR Link	AC Mains
IPB in Cable	No	0.33 m	Yes	FFR Link	Unterminated
Pa Out Cable	No	3.7 m	Yes	FFR Link	Unterminated
Pd Out Cable	No	3.7 m	Yes	FFR Link	Unterminated

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	7/20/2018	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	7/20/2018	Field Strength of Spurious Emissions Less than 30MHz	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	7/20/2018	Field Strength of Spurious Emissions Greater than 30MHz	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	7/26/2018	Frequency Stability	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	8/1/2018	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. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. 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 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESR7	ARI	6/26/2018	6/26/2019
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	3/15/2018	3/15/2019
Cable - Conducted Cable Assembly	Northwest EMC	MNC	MNCC	1/24/2018	1/24/2019

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.4 dB	-2.4 dB

CONFIGURATIONS INVESTIGATED

BSTN0852-1

MODES INVESTIGATED

Transmitting 13.56 MHz RFID

POWERLINE CONDUCTED EMISSIONS



EUT:	FFR Link (H7495551000)	Work Order:	BSTN0852
Serial Number:	17FP0251	Date:	08/01/2018
Customer:	Boston Scientific Corporation	Temperature:	23.1°C
Attendees:	None	Relative Humidity:	48.9%
Customer Project:	None	Bar. Pressure:	1015 mb
Tested By:	Dustin Sparks	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	BSTN0852-1

TEST SPECIFICATIONS

Specification:	Method:
LP0002:2018	LP0002:2018

TEST PARAMETERS

Run #:	16	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

13.56 MHz RFID antenna attached

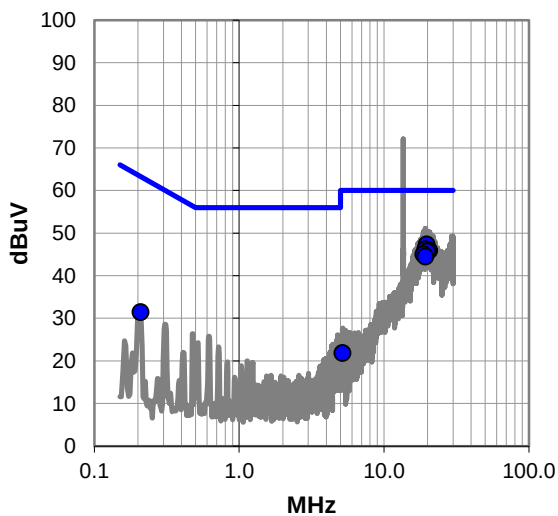
EUT OPERATING MODES

Transmitting 13.56 MHz RFID

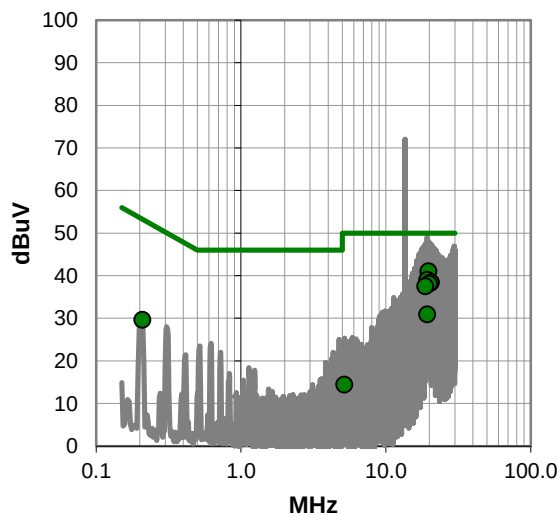
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #16

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
19.734	45.2	2.1	47.3	60.0	-12.7
19.320	44.1	2.1	46.2	60.0	-13.8
20.496	43.7	2.2	45.9	60.0	-14.1
19.881	43.6	2.1	45.7	60.0	-14.3
18.724	43.0	2.0	45.0	60.0	-15.0
19.285	42.4	2.1	44.5	60.0	-15.5
0.209	31.1	0.3	31.4	63.2	-31.8
5.161	21.3	0.5	21.8	60.0	-38.2

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
19.734	38.9	2.1	41.0	50.0	-9.0
19.320	36.9	2.1	39.0	50.0	-11.0
20.496	36.2	2.2	38.4	50.0	-11.6
19.881	36.0	2.1	38.1	50.0	-11.9
18.724	35.5	2.0	37.5	50.0	-12.5
19.285	28.8	2.1	30.9	50.0	-19.1
0.209	29.3	0.3	29.6	53.2	-23.6
5.161	13.9	0.5	14.4	50.0	-35.6

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS



EUT:	FFR Link (H7495551000)	Work Order:	BSTN0852
Serial Number:	17FP0251	Date:	08/01/2018
Customer:	Boston Scientific Corporation	Temperature:	23.1°C
Attendees:	None	Relative Humidity:	48.9%
Customer Project:	None	Bar. Pressure:	1015 mb
Tested By:	Dustin Sparks	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	BSTN0852-1

TEST SPECIFICATIONS

Specification:	Method:
LP0002:2018	LP0002:2018

TEST PARAMETERS

Run #:	17	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

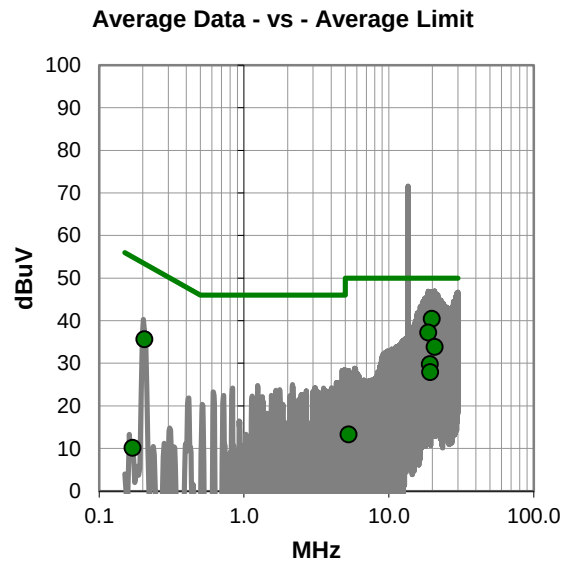
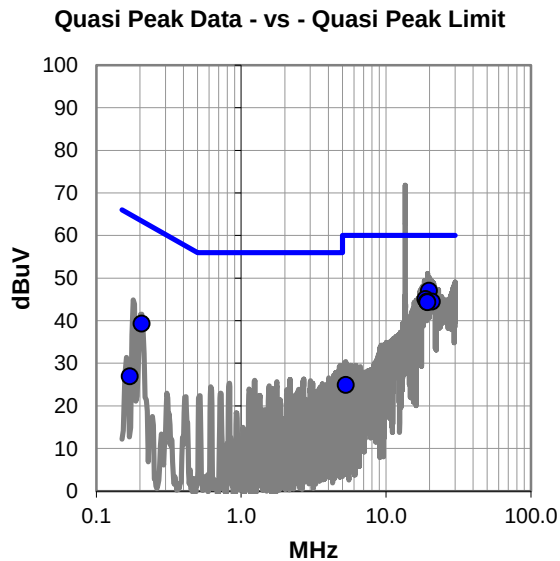
13.56 MHz RFID antenna attached

EUT OPERATING MODES

Transmitting 13.56 MHz RFID

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #17

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
19.790	44.9	2.1	47.0	60.0	-13.0
18.719	43.1	2.0	45.1	60.0	-14.9
20.702	42.3	2.2	44.5	60.0	-15.5
19.262	42.4	2.1	44.5	60.0	-15.5
19.328	42.2	2.1	44.3	60.0	-15.7
0.205	39.0	0.3	39.3	63.4	-24.1
5.275	24.4	0.5	24.9	60.0	-35.1
0.170	26.6	0.3	26.9	65.0	-38.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
19.790	38.3	2.1	40.4	50.0	-9.6
18.719	35.2	2.0	37.2	50.0	-12.8
20.702	31.6	2.2	33.8	50.0	-16.2
0.205	35.3	0.3	35.6	53.4	-17.8
19.262	27.7	2.1	29.8	50.0	-20.2
19.328	25.8	2.1	27.9	50.0	-22.1
5.275	12.8	0.5	13.3	50.0	-36.7
0.170	9.8	0.3	10.1	55.0	-44.9

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS



EUT:	FFR Link (H7495551000)	Work Order:	BSTN0852
Serial Number:	17FP0251	Date:	07/31/2018
Customer:	Boston Scientific Corporation	Temperature:	22.2°C
Attendees:	None	Relative Humidity:	52.6%
Customer Project:	None	Bar. Pressure:	1018 mb
Tested By:	Dustin Sparks	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	BSTN0852-1

TEST SPECIFICATIONS

Specification:	Method:
LP0002:2018	LP0002:2018

TEST PARAMETERS

Run #:	9	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

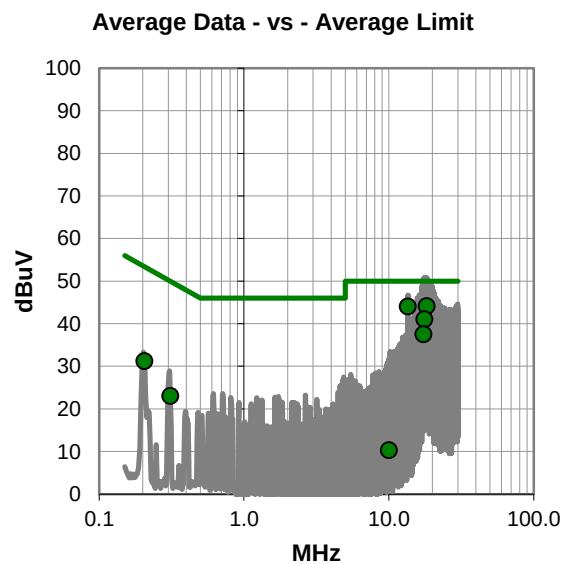
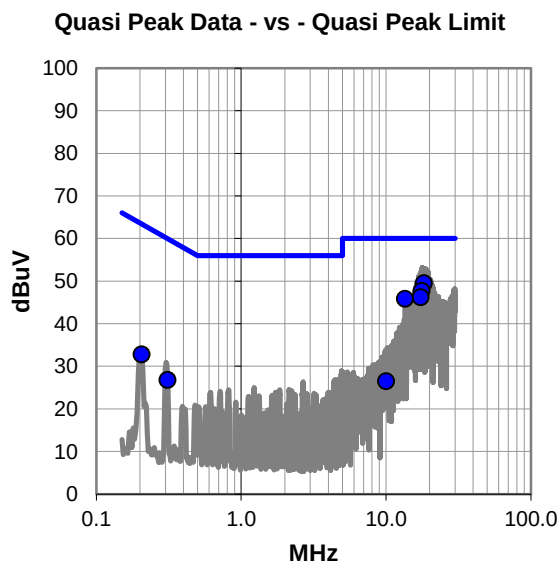
RFID antenna replaced with 50 ohm dummy load per FCC KDB 174176 guidance.

EUT OPERATING MODES

Transmitting 13.56 MHz RFID

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #9

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
18.295	47.5	2.0	49.5	60.0	-10.5
17.642	45.8	1.9	47.7	60.0	-12.3
17.323	44.4	1.8	46.2	60.0	-13.8
13.560	44.5	1.3	45.8	60.0	-14.2
0.206	32.5	0.3	32.8	63.4	-30.6
0.310	26.6	0.2	26.8	60.0	-33.2
10.004	25.5	1.0	26.5	60.0	-33.5

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
18.295	42.1	2.0	44.1	50.0	-5.9
13.560	42.7	1.3	44.0	50.0	-6.0
17.642	39.1	1.9	41.0	50.0	-9.0
17.323	35.7	1.8	37.5	50.0	-12.5
0.206	30.9	0.3	31.2	53.4	-22.2
0.310	22.8	0.2	23.0	50.0	-27.0
10.004	9.3	1.0	10.3	50.0	-39.7

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS



EUT:	FFR Link (H7495551000)	Work Order:	BSTN0852
Serial Number:	17FP0251	Date:	07/31/2018
Customer:	Boston Scientific Corporation	Temperature:	22.2°C
Attendees:	None	Relative Humidity:	52.6%
Customer Project:	None	Bar. Pressure:	1018 mb
Tested By:	Dustin Sparks	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	BSTN0852-1

TEST SPECIFICATIONS

Specification:	Method:
LP0002:2018	LP0002:2018

TEST PARAMETERS

Run #:	10	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

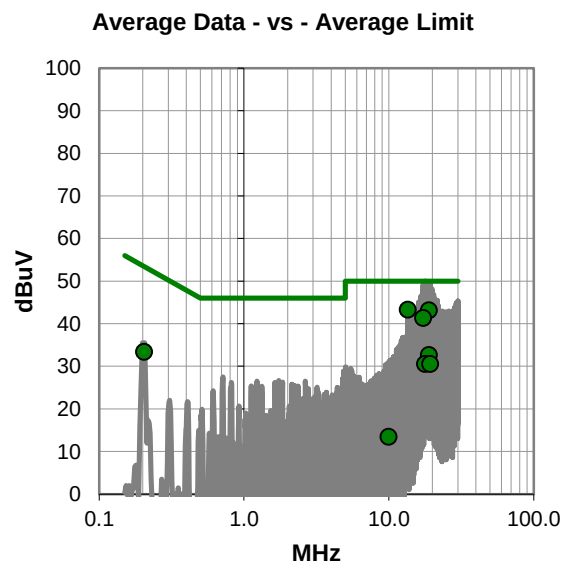
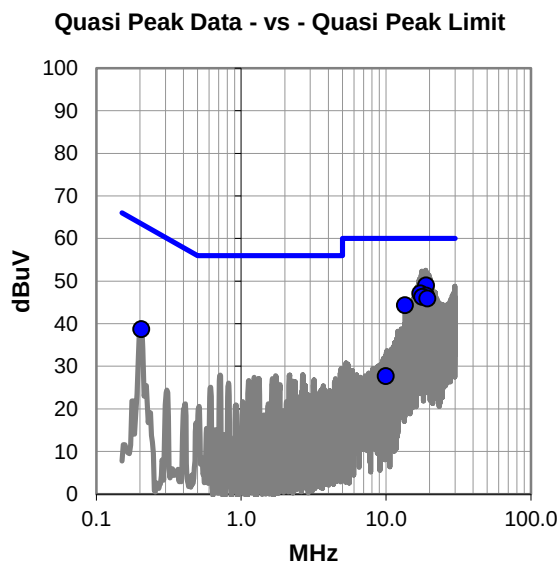
RFID antenna replaced with 50 ohm dummy load per FCC KDB 174176 guidance.

EUT OPERATING MODES

Transmitting 13.56 MHz RFID

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #10

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
18.951	47.0	2.0	49.0	60.0	-11.0
17.253	45.3	1.8	47.1	60.0	-12.9
18.932	44.6	2.0	46.6	60.0	-13.4
17.779	44.4	1.9	46.3	60.0	-13.7
19.348	43.8	2.1	45.9	60.0	-14.1
13.561	43.0	1.3	44.3	60.0	-15.7
0.204	38.4	0.3	38.7	63.4	-24.7
9.990	26.7	1.0	27.7	60.0	-32.3

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
13.561	42.0	1.3	43.3	50.0	-6.7
18.951	41.1	2.0	43.1	50.0	-6.9
17.253	39.5	1.8	41.3	50.0	-8.7
18.932	30.6	2.0	32.6	50.0	-17.4
17.779	28.6	1.9	30.5	50.0	-19.5
19.348	28.4	2.1	30.5	50.0	-19.5
0.204	33.1	0.3	33.4	53.4	-20.0
9.990	12.4	1.0	13.4	50.0	-36.6

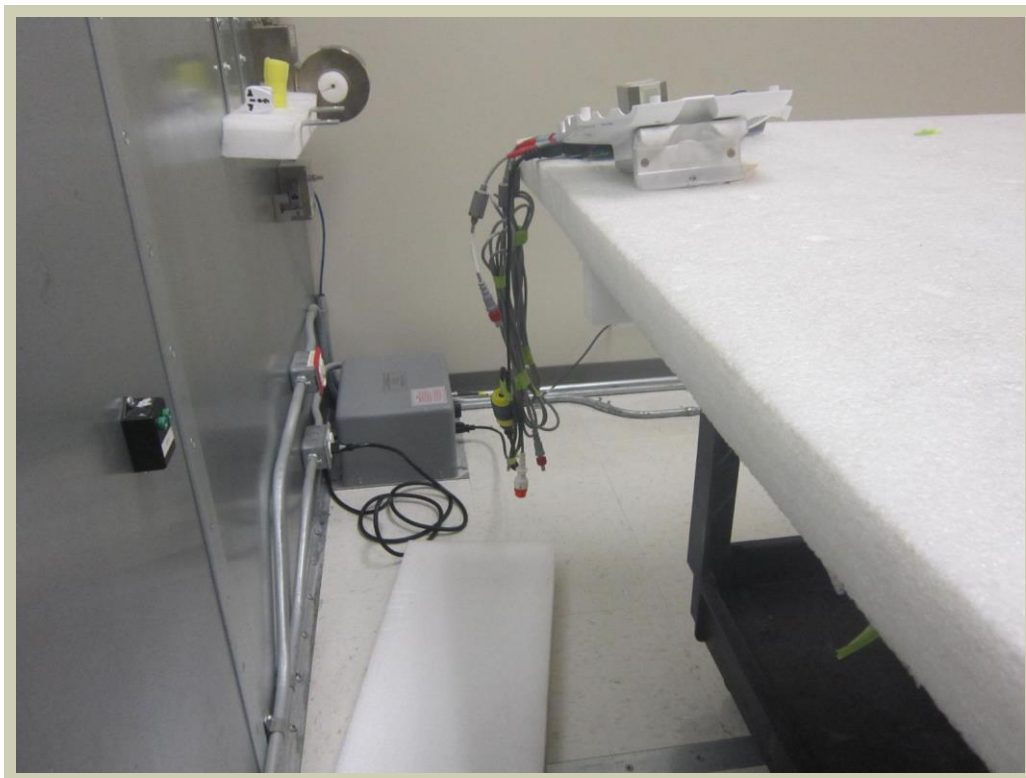
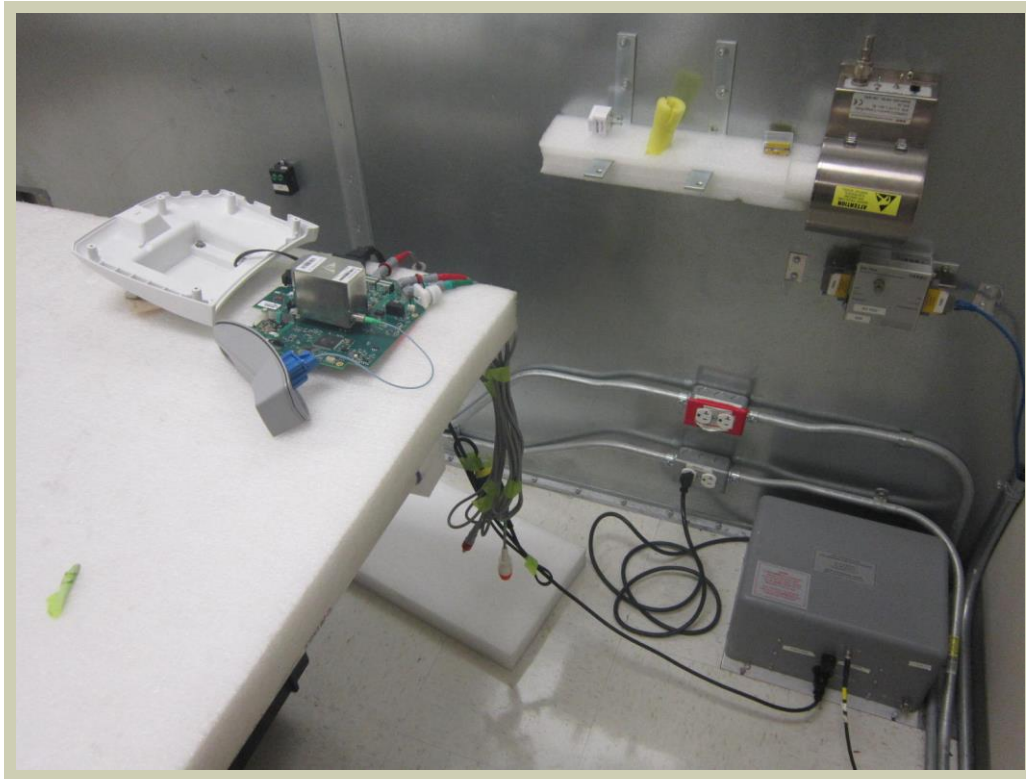
CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS



FIELD STRENGTH OF FUNDAMENTAL



PSA-ESCI 2018.05.04

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

Tx at 13.56 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

BSTN0852 - 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	E4440A	AFD	2-Aug-2017	12 mo
Cable	ESM Cable Corp.	Antenna Loop Cable	MNE	16-Feb-2018	12 mo
Antenna - Loop	ETS Lindgren	6502	AOB	16-May-2017	24 mo

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. 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

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



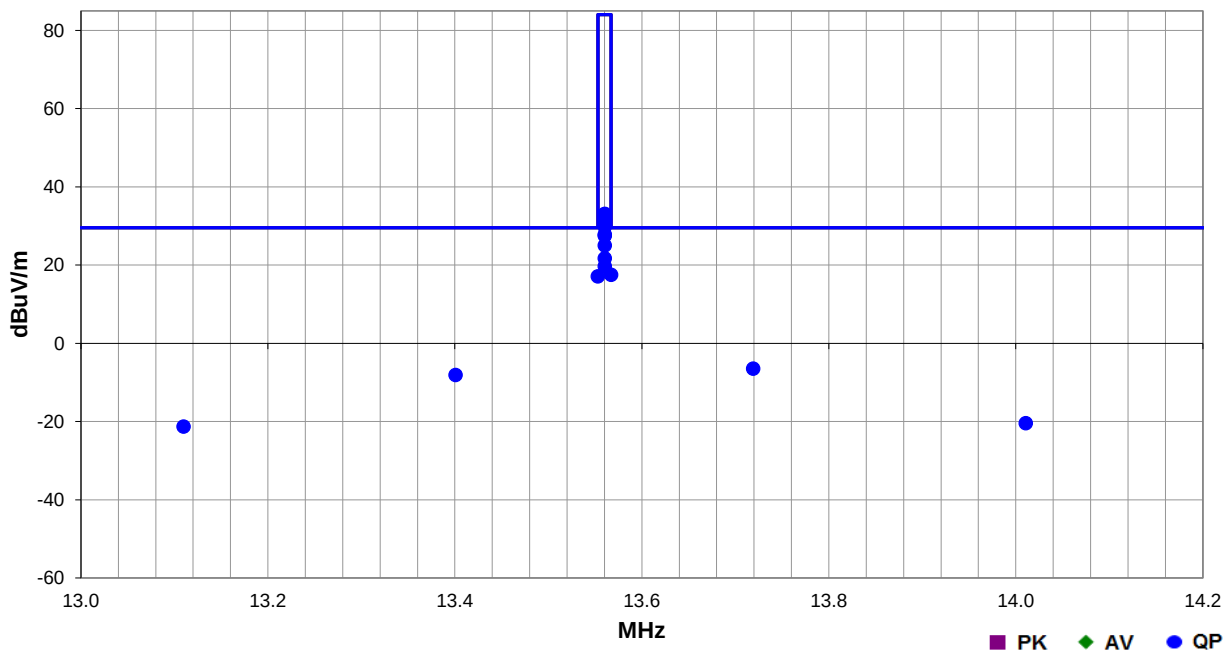
EmiR5 2018.05.07

PSA-ESCI 2018.05.04

Work Order:	BSTN0852	Date:	20-Jul-2018	
Project:	None	Temperature:	21.5 °C	
Job Site:	MN04	Humidity:	53.5% RH	
Serial Number:	0000	Barometric Pres.:	1012 mbar	
EUT:	FFR Link (H7495551000)			
Configuration:	1			
Customer:	Boston Scientific Corporation			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Tx at 13.56 MHz			
Deviations:	None			
Comments:	None			

Test Specifications	Test Method
LP0002:2018	LP0002:2018

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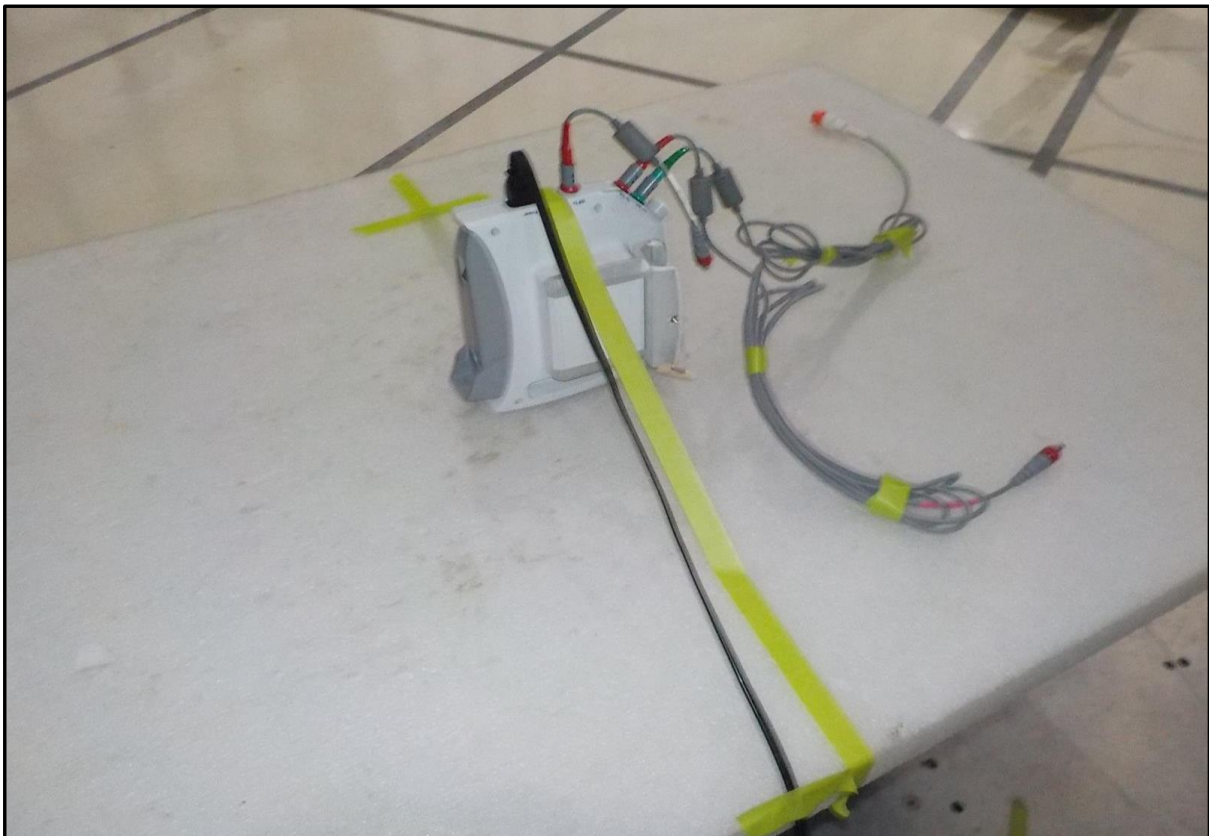
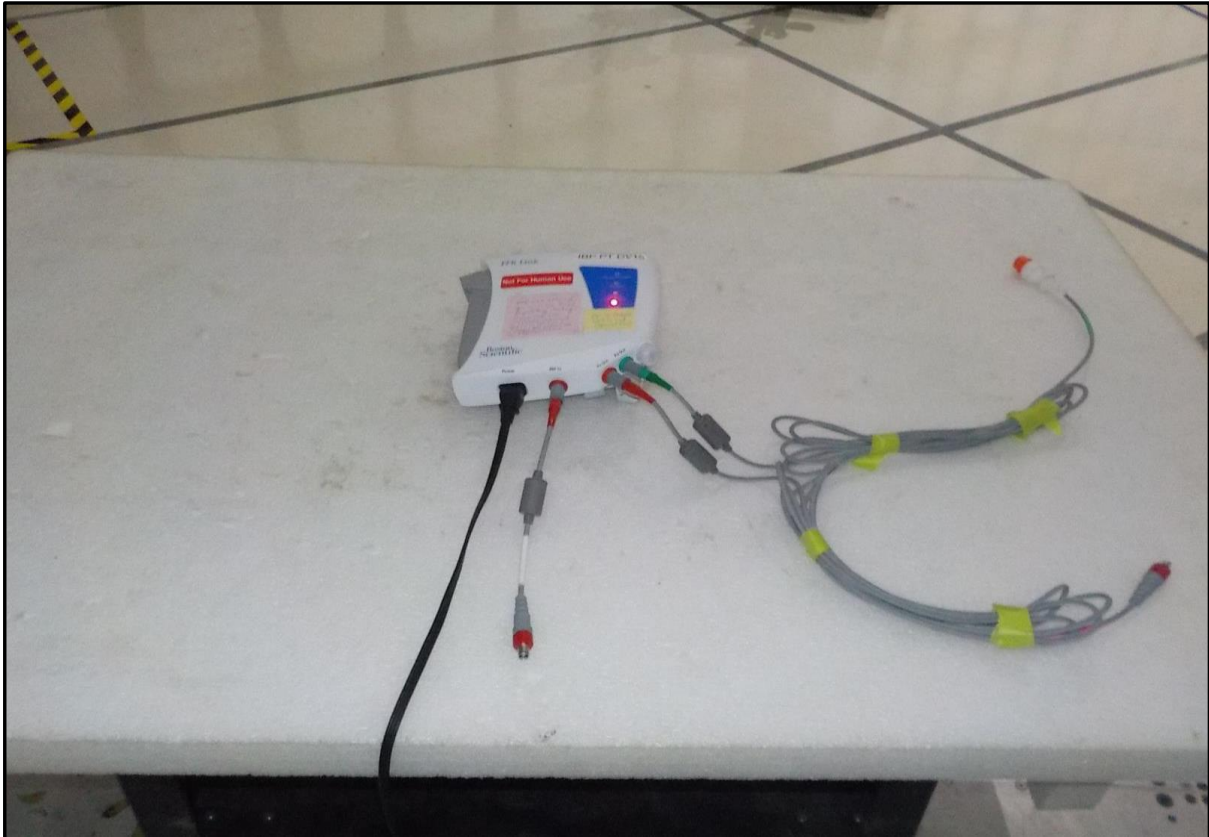


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
13.567	46.7	10.8	1.0	7.0	3.0	0.0	Para EUT	QP	-40.0	17.5	29.5	-12.0	EUT on side
13.553	46.3	10.8	1.0	17.0	3.0	0.0	Para EUT	QP	-40.0	17.1	29.5	-12.4	EUT on side
13.719	22.7	10.8	1.0	188.0	3.0	0.0	Para EUT	QP	-40.0	-6.5	29.5	-36.0	EUT on side
13.401	21.1	10.8	1.0	14.0	3.0	0.0	Para EUT	QP	-40.0	-8.1	29.5	-37.6	EUT on side
14.011	8.8	10.8	1.0	184.0	3.0	0.0	Para EUT	QP	-40.0	-20.4	29.5	-49.9	EUT on side
13.110	7.9	10.8	1.0	184.0	3.0	0.0	Para EUT	QP	-40.0	-21.3	29.5	-50.8	EUT on side
13.560	62.3	10.8	1.0	11.0	3.0	0.0	Para EUT	QP	-40.0	33.1	84.0	-50.9	EUT on side
13.560	62.2	10.8	1.0	0.0	3.0	0.0	Para EUT	QP	-40.0	33.0	84.0	-51.0	EUT vert
13.560	60.8	10.8	1.0	94.0	3.0	0.0	Perp EUT	QP	-40.0	31.6	84.0	-52.4	EUT vert
13.560	59.0	10.8	1.0	93.0	3.0	0.0	Perp EUT	QP	-40.0	29.8	84.0	-54.2	EUT on side
13.560	57.0	10.8	1.0	306.0	3.0	0.0	Para GND	QP	-40.0	27.8	84.0	-56.2	EUT horz
13.560	56.7	10.8	1.0	220.0	3.0	0.0	Para GND	QP	-40.0	27.5	84.0	-56.5	EUT vert
13.560	54.2	10.8	1.0	0.0	3.0	0.0	Para GND	QP	-40.0	25.0	84.0	-59.0	EUT on side
13.560	50.9	10.8	1.0	291.0	3.0	0.0	Para EUT	QP	-40.0	21.7	84.0	-62.3	EUT horz
13.560	48.9	10.8	1.0	193.0	3.0	0.0	Perp EUT	QP	-40.0	19.7	84.0	-64.3	EUT horz

FIELD STRENGTH OF FUNDAMENTAL



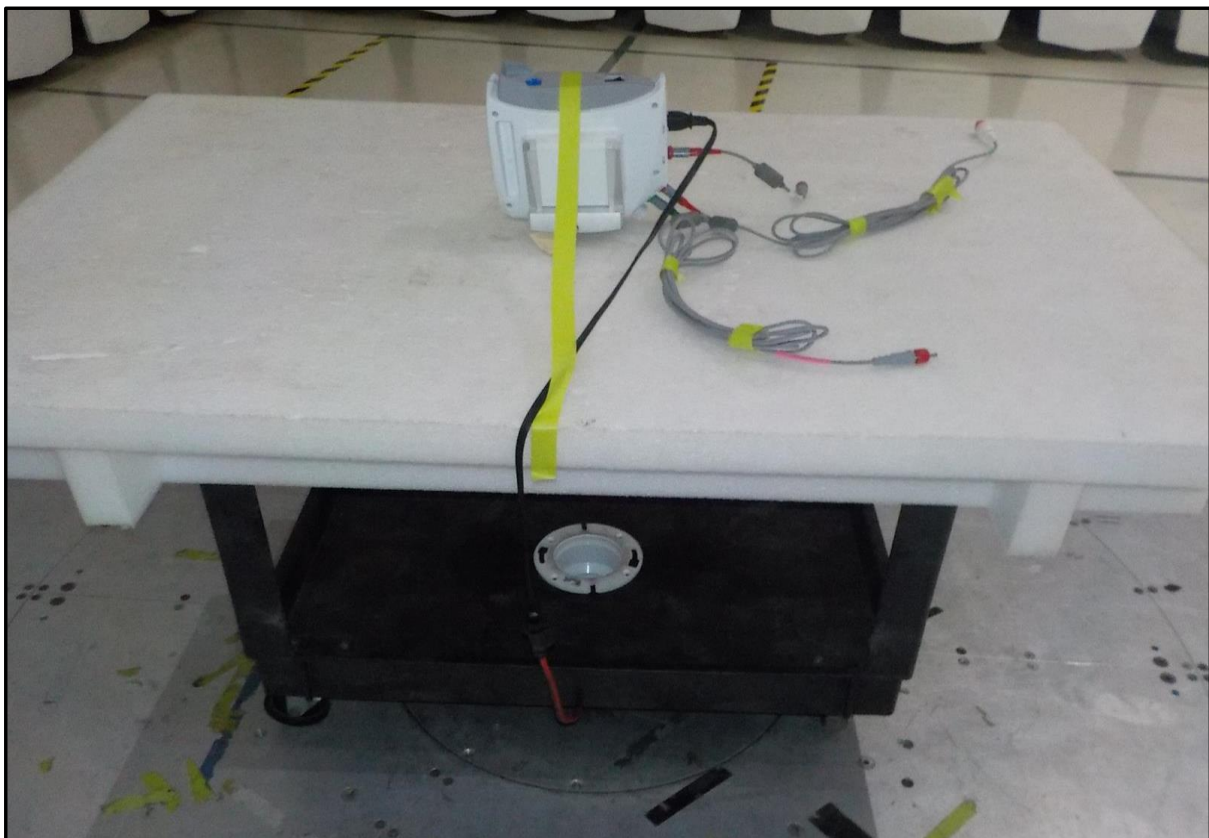
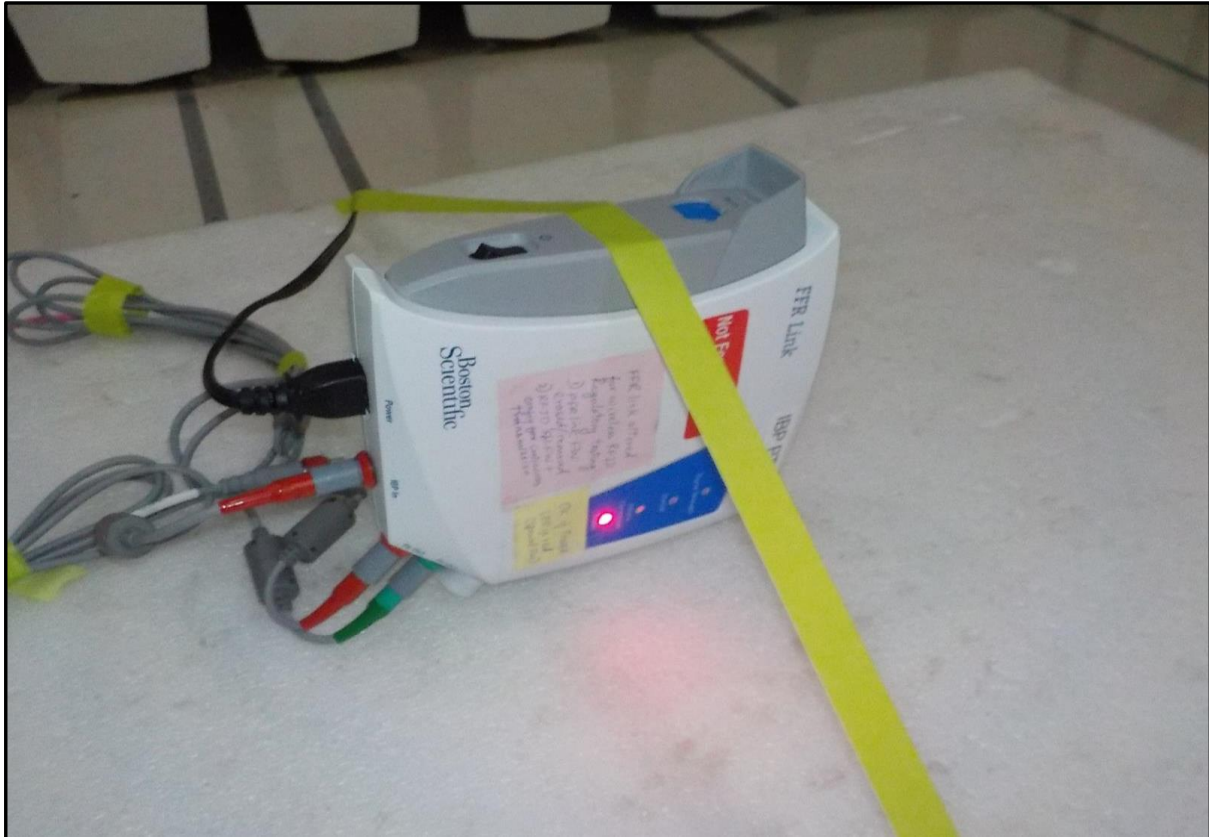
PSA-ESCI 2018.05.04



FIELD STRENGTH OF FUNDAMENTAL



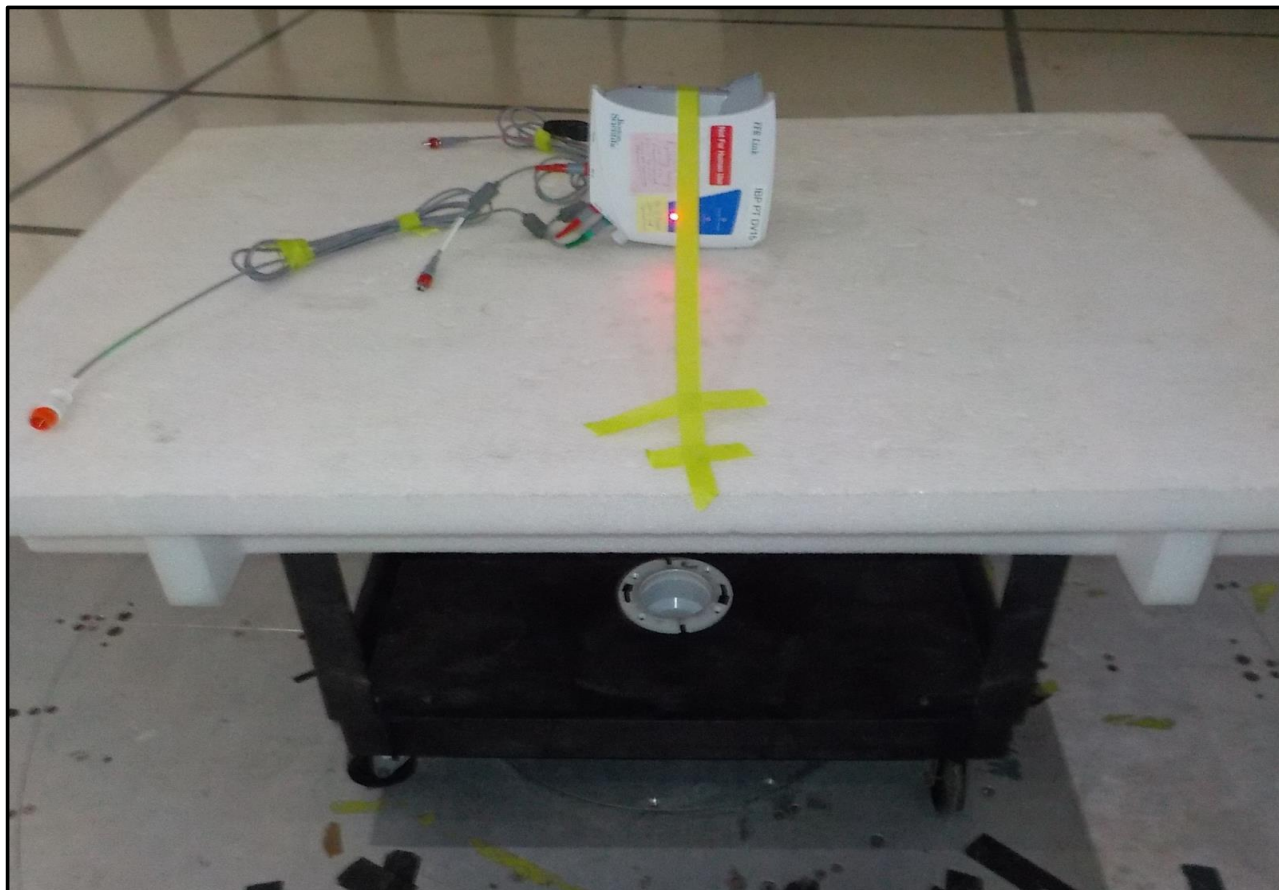
PSA-ESCI 2018.05.04



FIELD STRENGTH OF FUNDAMENTAL



PSA-ESCI 2018.05.04



FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz



PSA-ESCI 2018.05.04

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

Tx at 13.56 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

BSTN0852 - 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	E4440A	AFD	2-Aug-2017	12 mo
Cable	ESM Cable Corp.	Antenna Loop Cable	MNE	16-Feb-2018	12 mo
Antenna - Loop	ETS Lindgren	6502	AOB	16-May-2017	24 mo

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. 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 = Average Detector

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

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



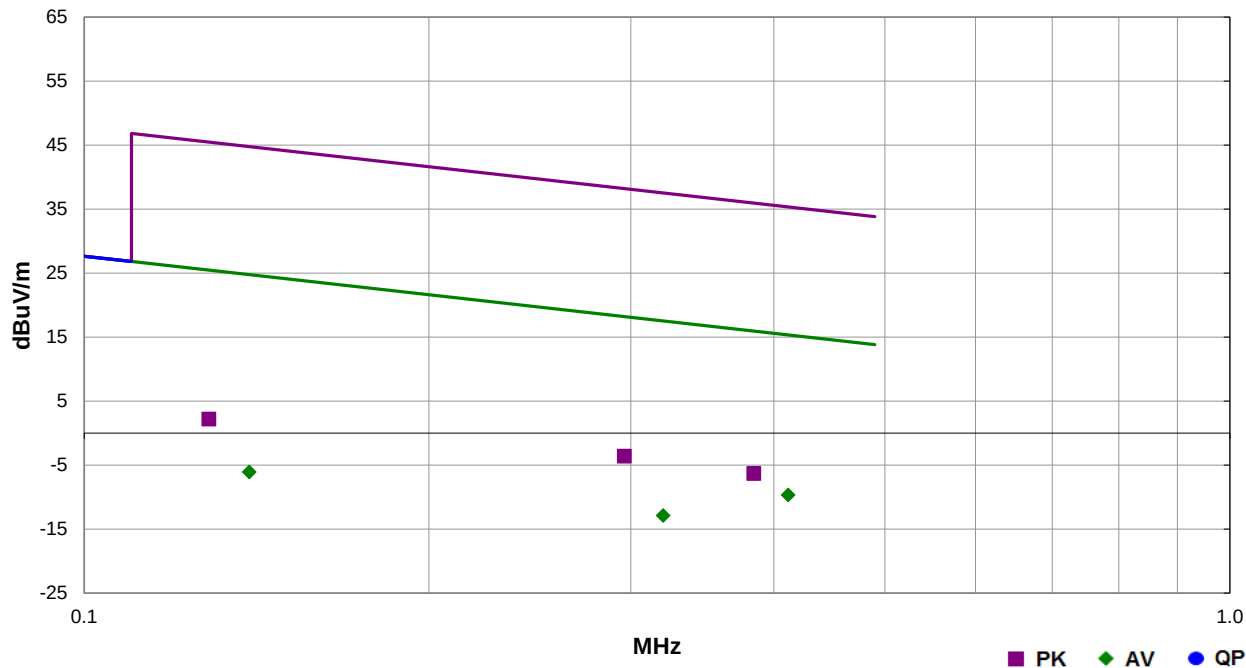
EmiR5 2018.05.07

PSA-ESCI 2018.05.04

Work Order:	BSTN0852	Date:	20-Jul-2018	
Project:	None	Temperature:	21.5 °C	
Job Site:	MN04	Humidity:	52.9% RH	
Serial Number:	17FP0251	Barometric Pres.:	1013 mbar	Tested by: Andrew Rogstad/Dustin Sparks
EUT:	FFR Link (H7495551000)			
Configuration:	1			
Customer:	Boston Scientific Corporation			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Tx at 13.56 MHz			
Deviations:	None			
Comments:	See data comments for EUT and antenna orientation			

Test Specifications	Test Method
LP0002:2018	LP0002:2018

Run #	11	Test Distance (m)	3	Antenna Height(s)	1(m)	Results	Pass
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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
0.412	18.9	11.4	1.0	353.0	3.0	0.0	Para EUT	AV	-40.0	-9.7	15.3	-25.0	EUT on side
0.320	15.7	11.4	1.0	119.0	3.0	0.0	Para EUT	AV	-40.0	-12.9	17.5	-30.4	EUT on side
0.139	22.3	11.6	1.0	231.0	3.0	0.0	Para EUT	AV	-40.0	-6.1	24.7	-30.8	EUT on side
0.296	25.0	11.4	1.0	119.0	3.0	0.0	Para EUT	PK	-40.0	-3.6	38.2	-41.8	EUT on side
0.384	22.3	11.4	1.0	353.0	3.0	0.0	Para EUT	PK	-40.0	-6.3	35.9	-42.2	EUT on side
0.128	30.6	11.6	1.0	231.0	3.0	0.0	Para EUT	PK	-40.0	2.2	45.5	-43.3	EUT on side

FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz



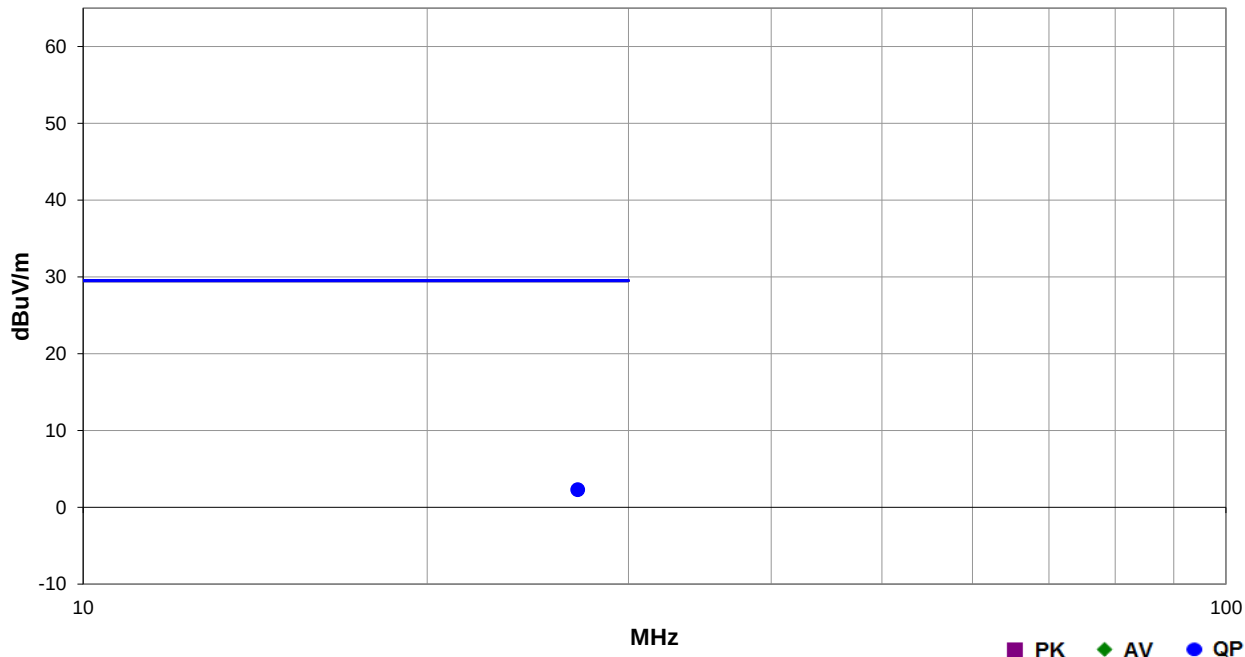
EmiRS 2018.05.07

PSA-ESCI 2018.05.04

Work Order:	BSTN0852	Date:	20-Jul-2018	
Project:	None	Temperature:	21.5 °C	
Job Site:	MN04	Humidity:	52.9% RH	
Serial Number:	17FP0251	Barometric Pres.:	1013 mbar	Tested by: Andrew Rogstad/Dustin Sparks
EUT:	FFR Link (H7495551000)			
Configuration:	1			
Customer:	Boston Scientific Corporation			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Tx at 13.56 MHz			
Deviations:	None			
Comments:	See data comments for EUT and antenna orientation			

Test Specifications		Test Method	
LP0002:2018		LP0002:2018	

Run #	13	Test Distance (m)	3	Antenna Height(s)	1(m)	Results	Pass
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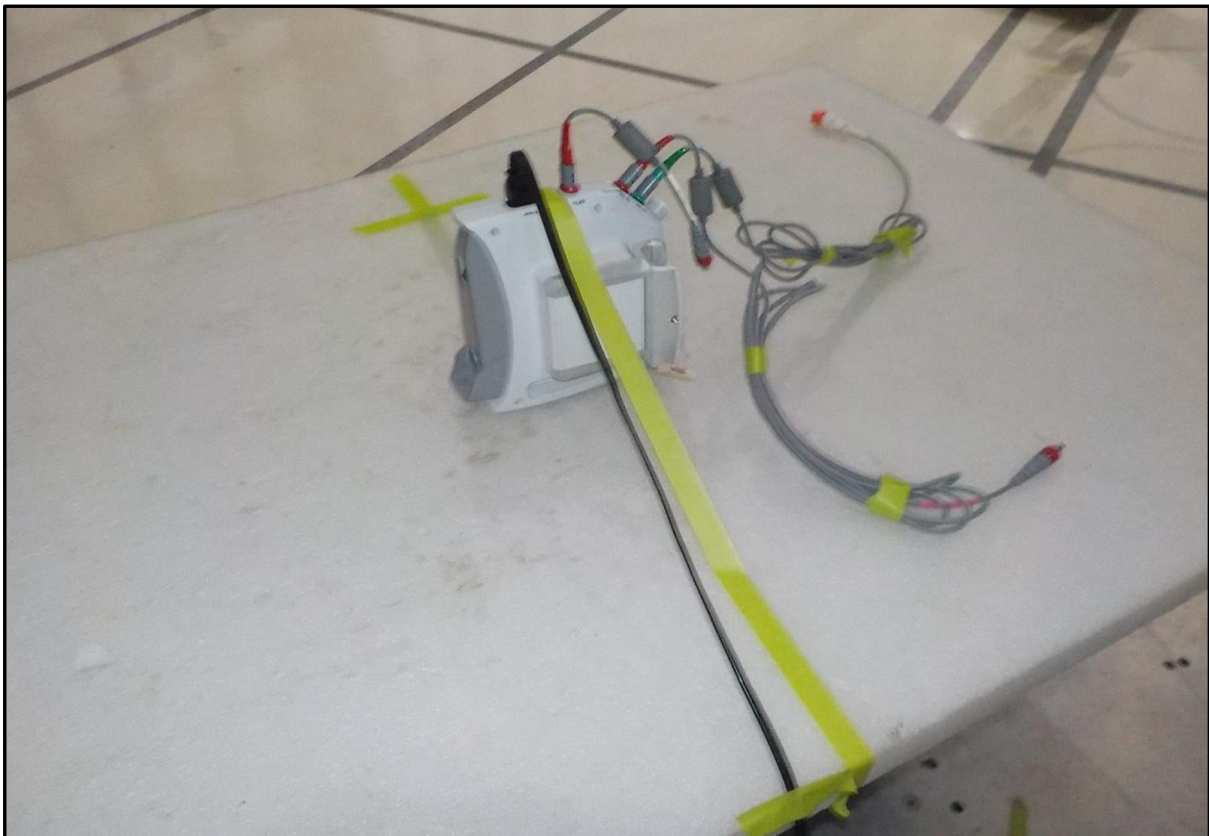
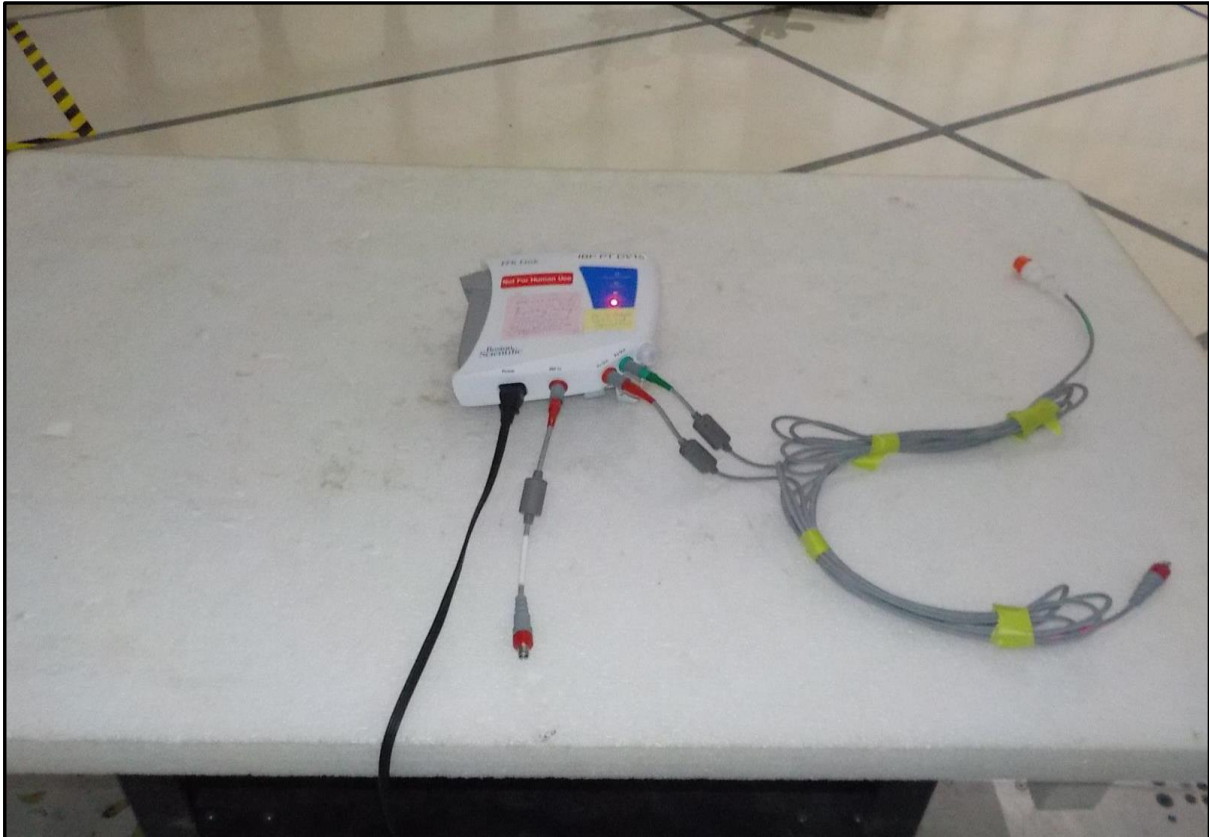


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
27.091	13.0	9.3	1.0	112.0	3.0	0.0	Para EUT	QP	-20.0	2.3	29.5	-27.2	EUT on side

FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz



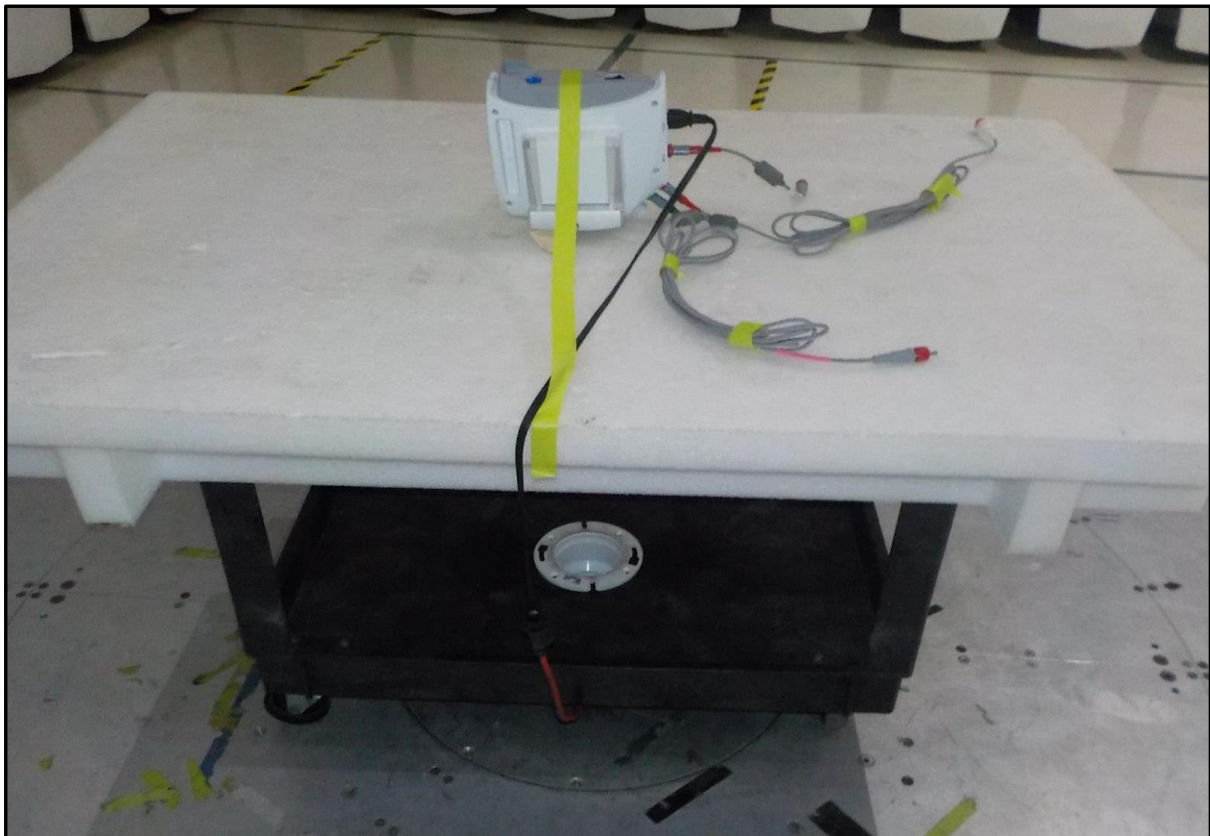
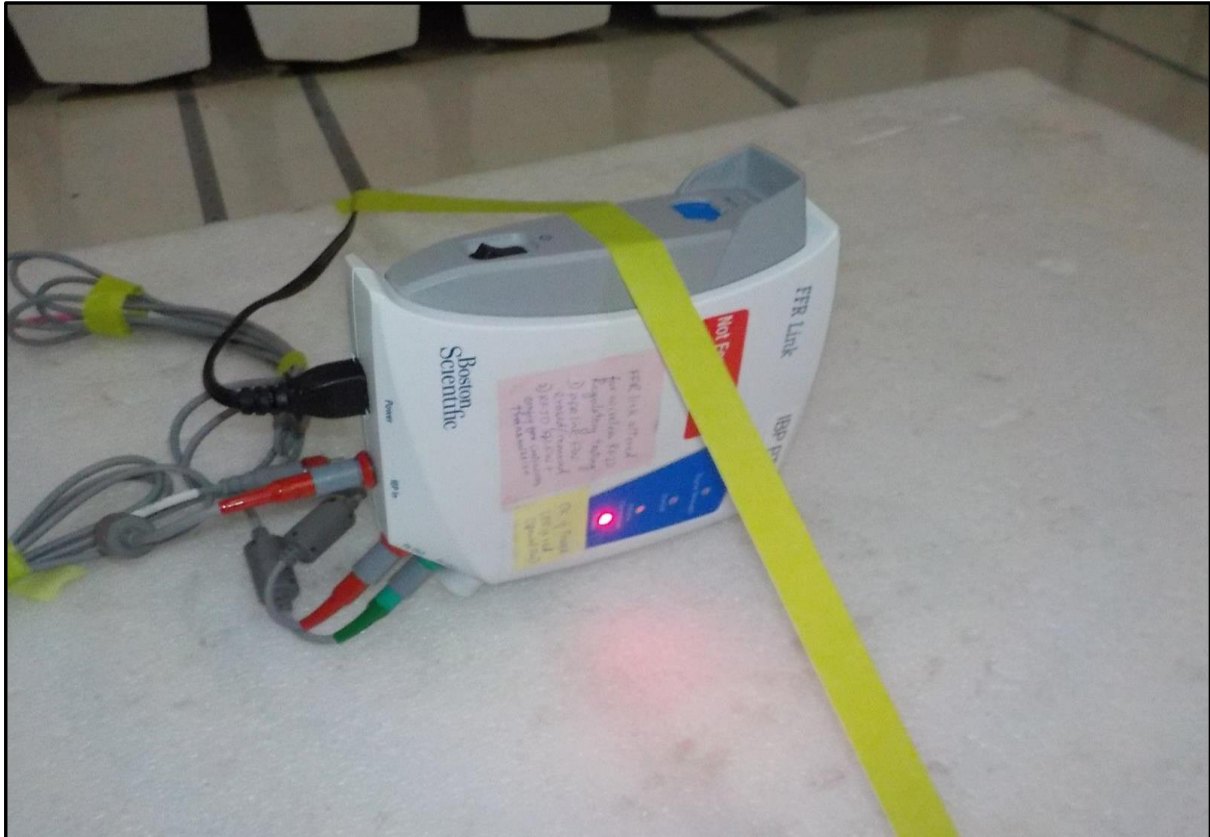
PSA-ESCI 2018.05.04



FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz



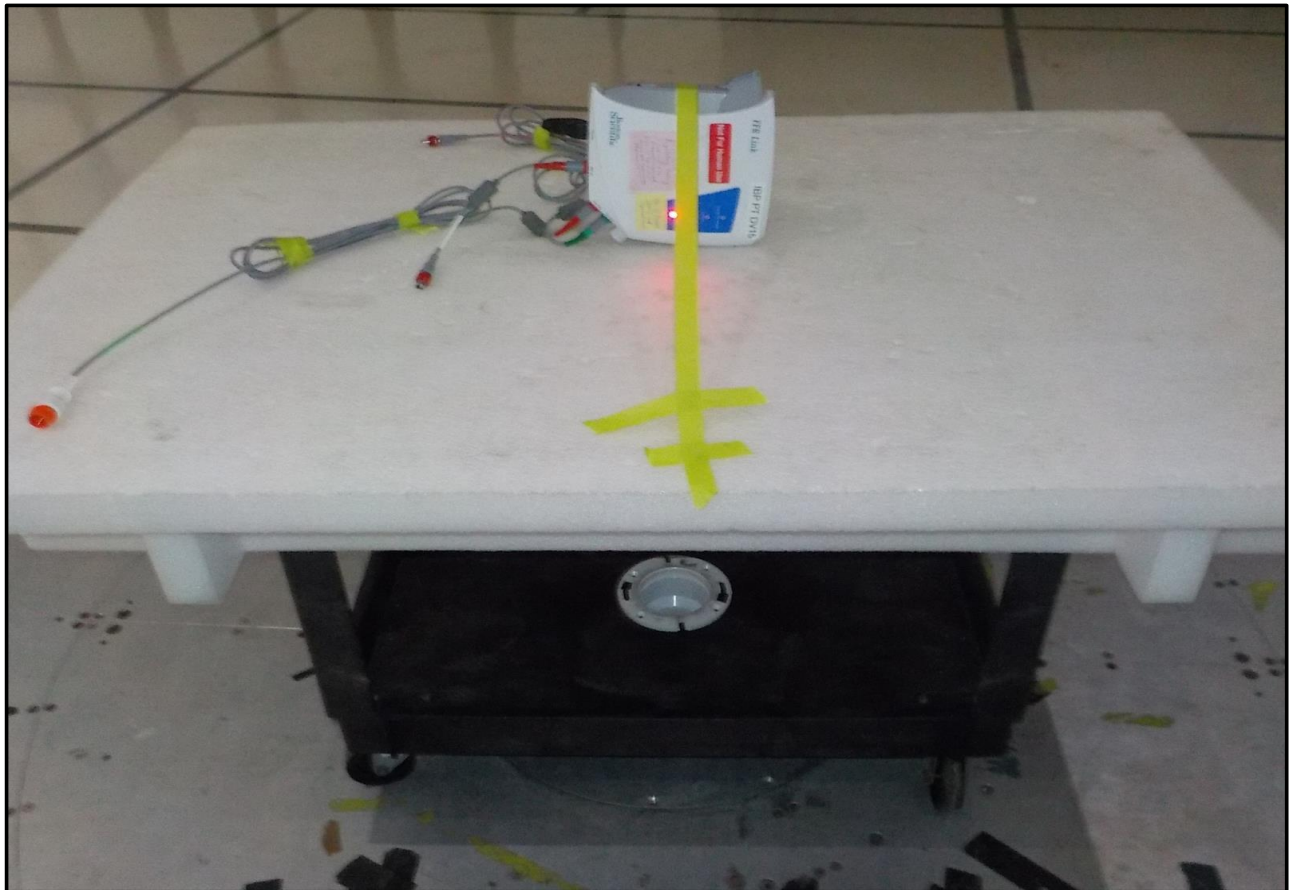
PSA-ESCI 2018.05.04



FIELD STRENGTH OF SPURIOUS EMISSIONS LESS THAN 30 MHz



PSA-ESCI 2018.05.04



FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz



PSA-ESCI 2018.05.04

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

Tx at 13.56 MHz

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

BSTN0852 - 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	E4440A	AFD	2-Aug-2017	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	HGW	14-Sep-2017	12 mo
Cable	ESM Cable Corp.	MN04 Bilog Cables	MND	24-Feb-2018	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1551	PAC	2-Jul-2018	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXN	20-Nov-2017	24 mo

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. 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

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

FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz

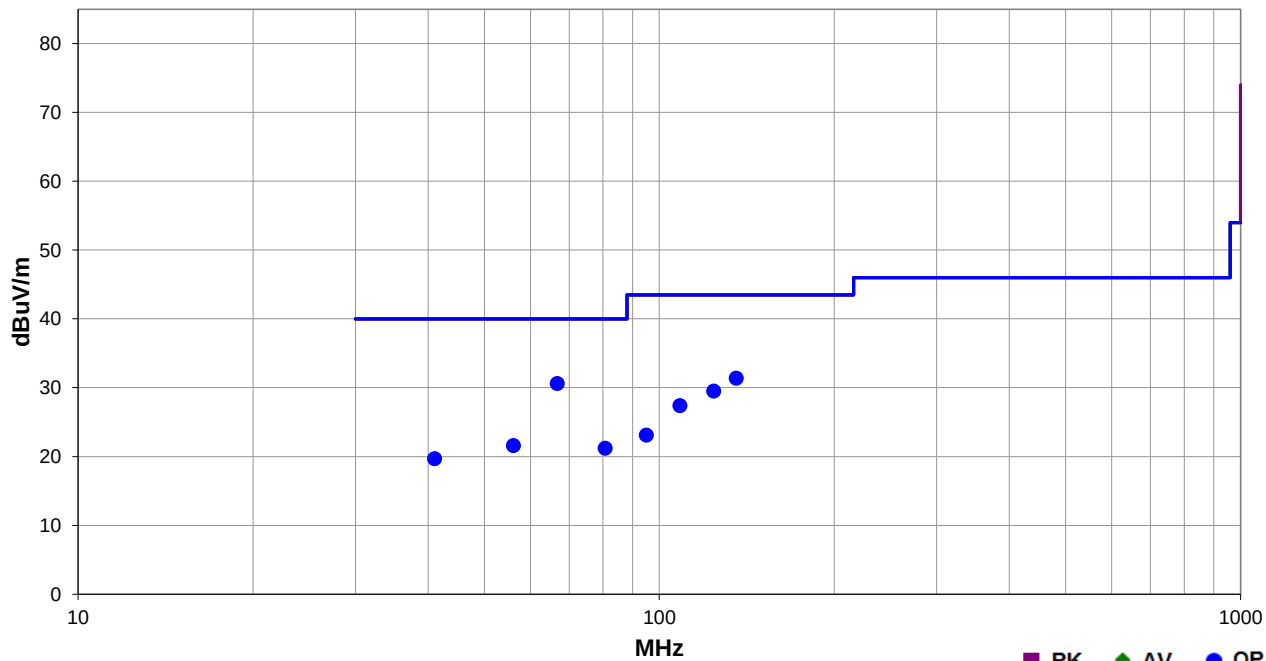


EmiRS 2018.05.07

PSA-ESCI 2018.05.04

Work Order:	BSTN0852	Date:	20-Jul-2018	
Project:	None	Temperature:	21.5 °C	
Job Site:	MN04	Humidity:	52.6% RH	
Serial Number:	17FP0251	Barometric Pres.:	1013 mbar	Tested by: Andrew Rogstad/Dustin Sparks
EUT:	FFR Link (H7495551000)			
Configuration:	1			
Customer:	Boston Scientific Corporation			
Attendees:	None			
EUT Power:	110VAC/60Hz			
Operating Mode:	Tx at 13.56 MHz			
Deviations:	None			
Comments:	See data comments for EUT and antenna orientation			

Test Specifications				Test Method			
LP0002:2018				LP0002:2018			
Run #	18	Test Distance (m)	10	Antenna Height(s)	1 to 4(m)	Results	Pass

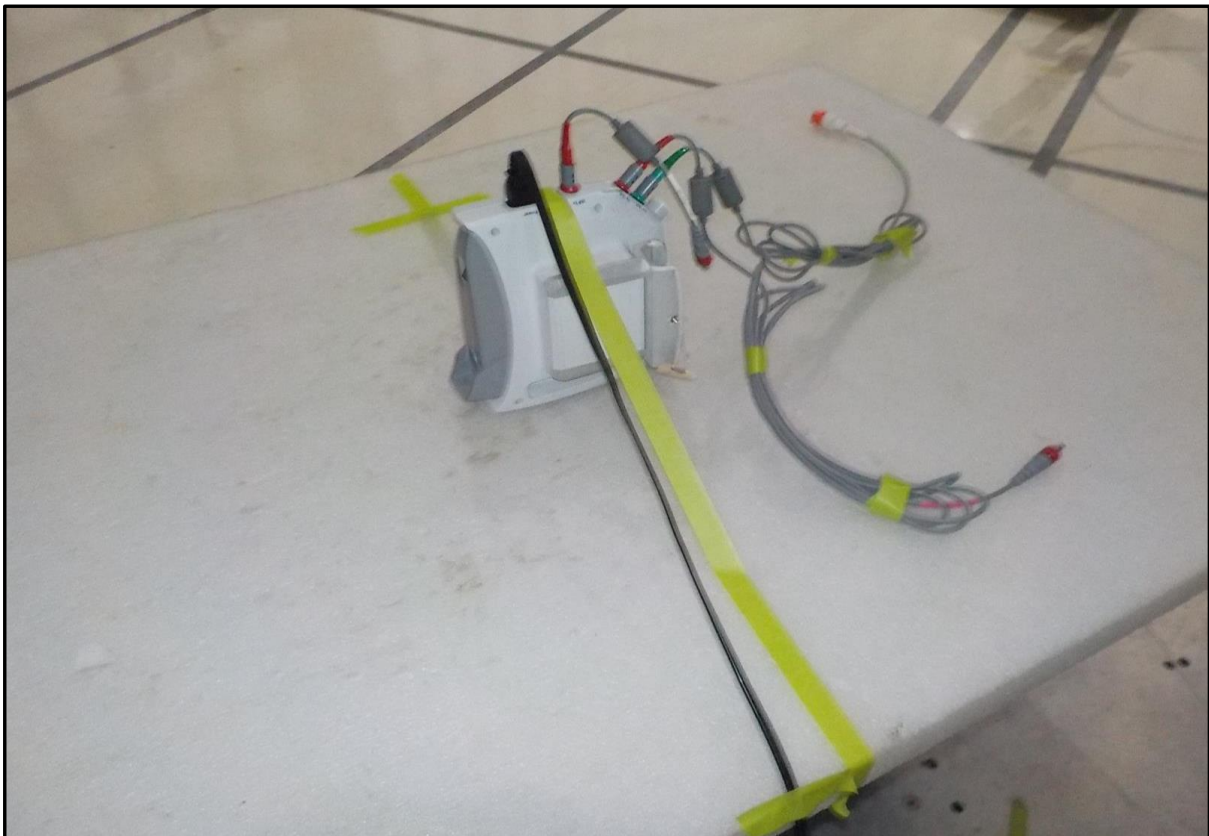
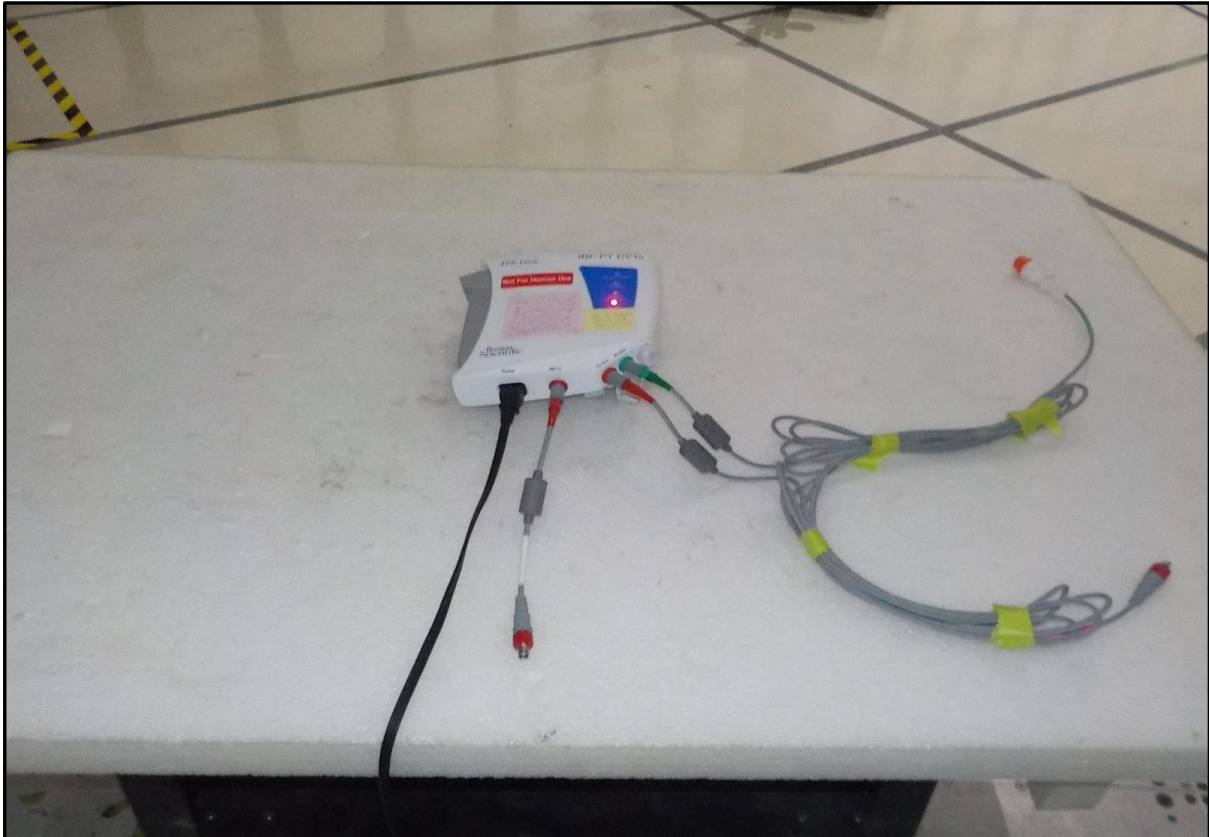


Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
66.707	52.4	-32.3	3.6	0.0	10.0	0.0	Para EUT	QP	10.5	30.6	40.0	-9.4	EUT on side
135.603	52.6	-31.7	3.9	27.0	10.0	0.0	Para EUT	QP	10.5	31.4	43.5	-12.1	EUT on side
123.990	50.4	-31.4	3.6	42.0	10.0	0.0	Para EUT	QP	10.5	29.5	43.5	-14.0	EUT on side
108.489	47.5	-30.6	1.0	91.0	10.0	0.0	Para EUT	QP	10.5	27.4	43.5	-16.1	EUT on side
56.077	43.3	-32.2	4.0	243.0	10.0	0.0	Para EUT	QP	10.5	21.6	40.0	-18.4	EUT on side
80.668	43.4	-32.7	4.0	28.0	10.0	0.0	Para EUT	QP	10.5	21.2	40.0	-18.8	EUT on side
41.049	37.5	-28.3	2.6	255.0	10.0	0.0	Para EUT	QP	10.5	19.7	40.0	-20.3	EUT on side
94.942	43.4	-30.8	3.9	206.0	10.0	0.0	Para EUT	QP	10.5	23.1	43.5	-20.4	EUT on side

FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz



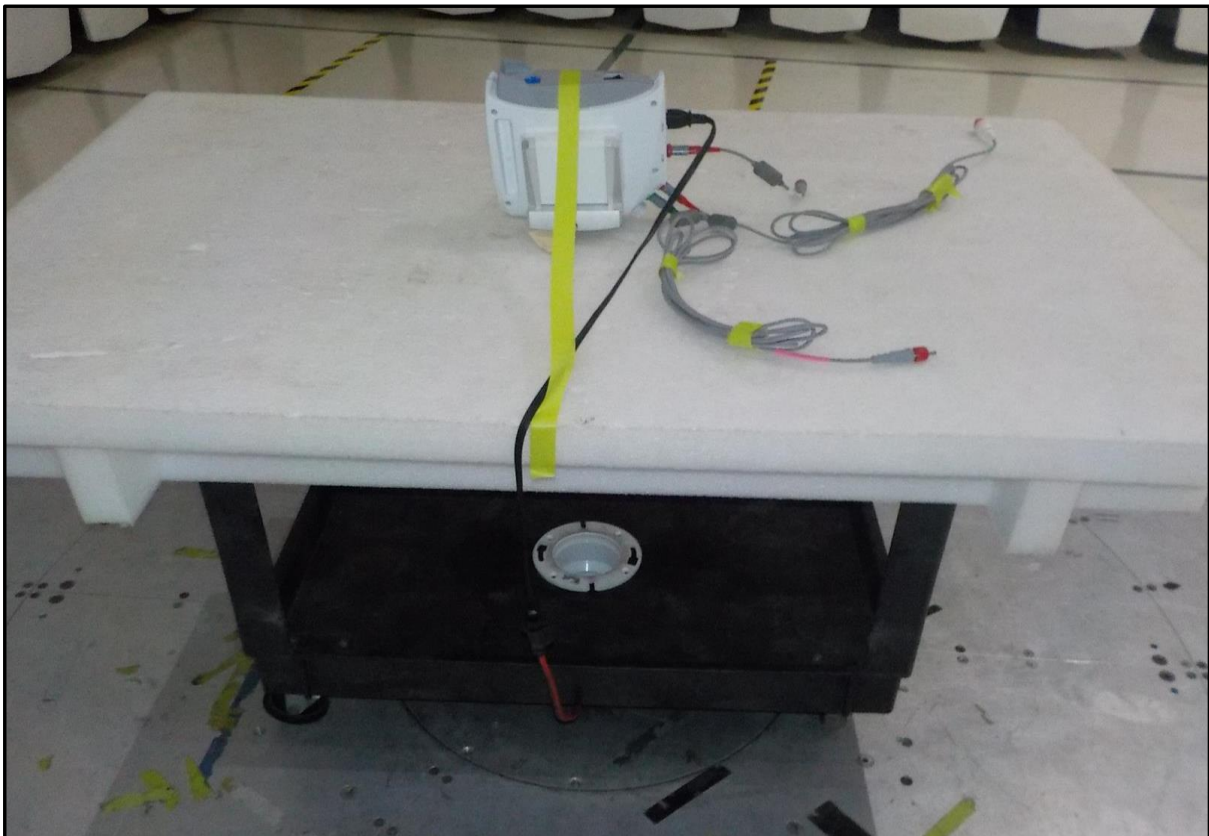
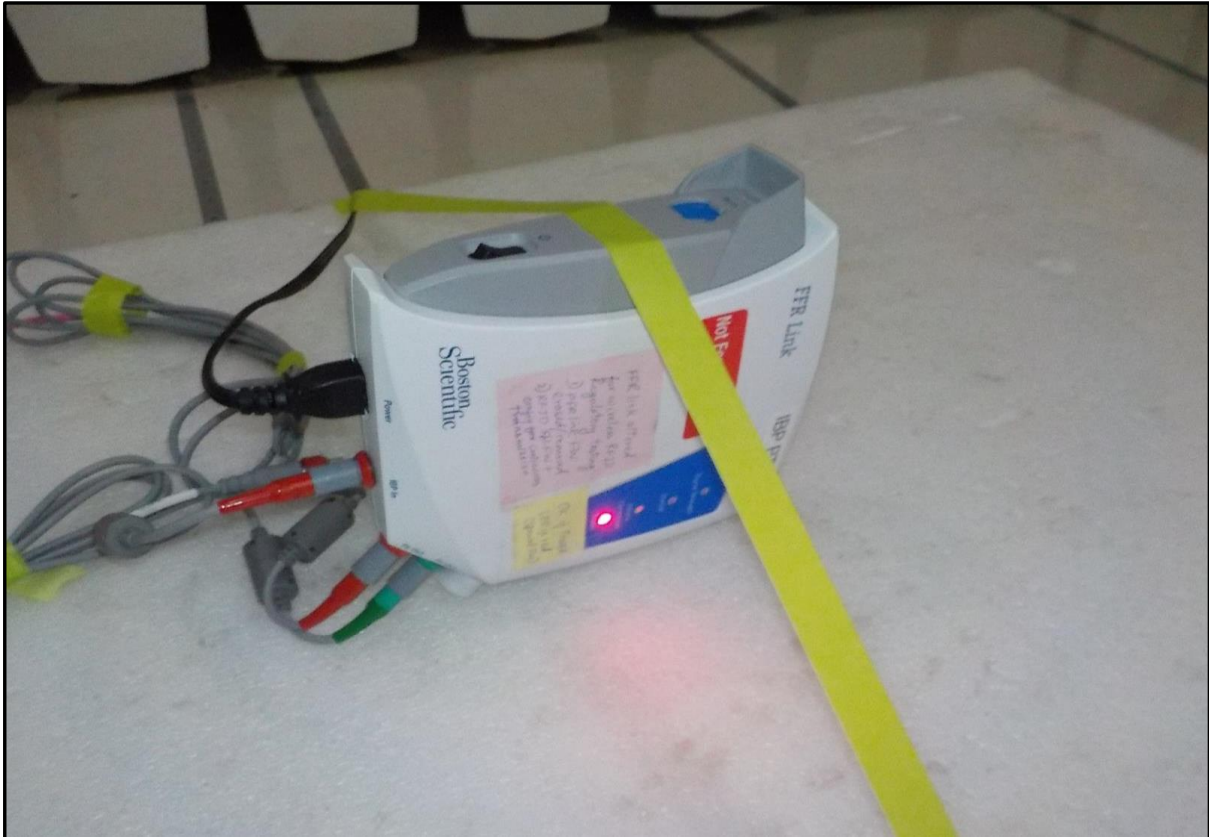
PSA-ESCI 2018.05.04



FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz



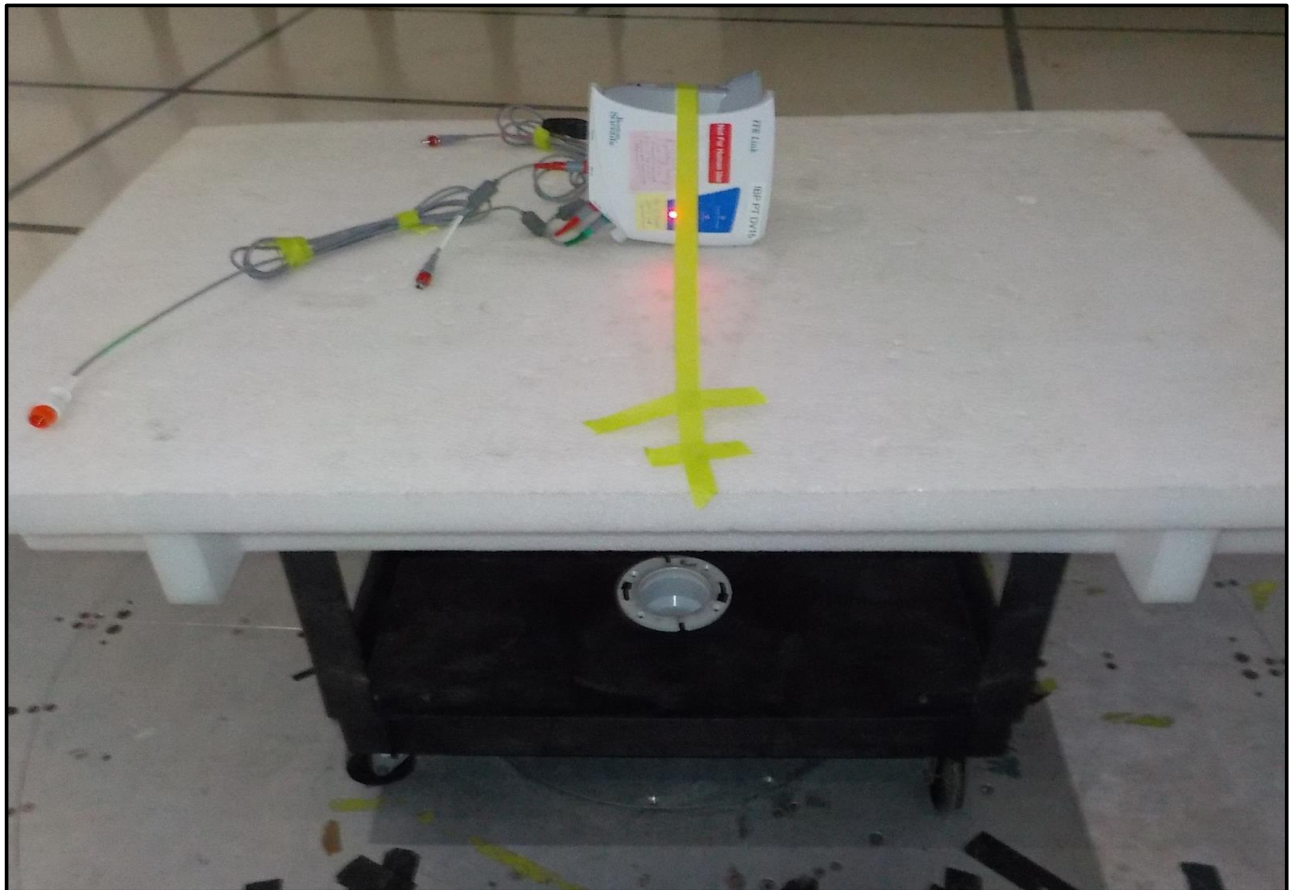
PSA-ESCI 2018.05.04



FIELD STRENGTH OF SPURIOUS EMISSIONS GREATER THAN 30 MHz



PSA-ESCI 2018.05.04



FREQUENCY STABILITY



XMIT 2017.12.13

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
Meter - Multimeter	Fluke	114	MMU	18-Jul-17	18-Jul-20
Chamber - Temperature/Humidity	Cincinnati Sub Zero (CSZ)	ZPH-32-3.5-SCT/AC	TBF	NCR	NCR
Thermometer	Omega Engineering, Inc.	HH311	DUB	10-Nov-17	10-Nov-20
Probe - Near Field Set	ETS Lindgren	7405	IPO	NCR	NCR
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	15-Mar-18	15-Mar-19
Block - DC	Fairview Microwave	SD3379	AMI	12-Sep-17	12-Sep-18
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	27-Apr-18	27-Apr-19

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 $\pm 0.01\%$ is equivalent to 100 ppm
The formula to check for compliance is:

$$\text{ppm} = (\text{Measured Frequency} / \text{Measured Nominal Frequency} - 1) * 1,000,000$$

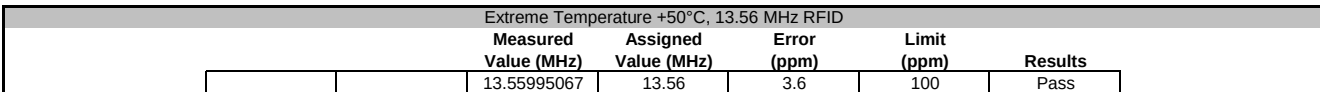
FREQUENCY STABILITY



TbTx 2017.12.14 XMt 2017.12.13

EUT: FFR Link (H7495551000)		Work Order: BSTN0852	
Serial Number: 17FP0251		Date: 26-Jul-18	
Customer: Boston Scientific Corporation		Temperature: 21.4 °C	
Attendees: None		Humidity: 51.4% RH	
Project: None		Barometric Pres.: 1019 mbar	
Tested by: Dustin Sparks		Power: 110VAC/60Hz	
Test Method		Job Site: MN08	
TEST SPECIFICATIONS		Test Method	
LP0002:2018		LP0002:2018	
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Dustin Sparks</i>	
		Measured Value (MHz)	Assigned Value (MHz)
		Error (ppm)	Limit (ppm)
			Results
+20°C, Normal Voltage			
	13.56 MHz RFID	13.560016	13.56
		1.2	100
			Pass
+20°C, Extreme Voltage +15%			
	13.56 MHz RFID	13.56001667	13.56
		1.2	100
			Pass
+20°C, Extreme Voltage -15%			
	13.56 MHz RFID	13.56003367	13.56
		2.5	100
			Pass
Extreme Temperature +50°C			
	13.56 MHz RFID	13.55995067	13.56
		3.6	100
			Pass
Extreme Temperature +40°C			
	13.56 MHz RFID	13.55996633	13.56
		2.5	100
			Pass
Extreme Temperature +30°C			
	13.56 MHz RFID	13.55998267	13.56
		1.3	100
			Pass
Extreme Temperature +10°C			
	13.56 MHz RFID	13.56006667	13.56
		4.9	100
			Pass
Extreme Temperature 0°C			
	13.56 MHz RFID	13.5601	13.56
		7.4	100
			Pass
Extreme Temperature -10°C			
	13.56 MHz RFID	13.56013333	13.56
		9.8	100
			Pass
Extreme Temperature -20°C			
	13.56 MHz RFID	13.56015	13.56
		11.1	100
			Pass

+20°C, Extreme Voltage -15%, 13.56 MHz RFID						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	13.56003367	13.56	2.5	100	Pass	



[illegible]

Keysight Spectrum Analyzer - Element Materials Technology

RL RF 50 Ω DC SENSE:INT ALIGN OFF 09:07:27 AM Jul 27, 2018

PNO: Close IFGain:Low Trig: Free Run #Atten: 10 dB #Avg Type: Log-Pwr Avg|Hold:>100/100

TRACE 1 2 3 4 5 6 TYPE M W W W W W W W DET P P P P P P P

5 dB/div Log Ref -26.00 dBm

Mkr1 13.559 983 MHz -30.862 dBm

The figure is a screenshot of a Keysight Spectrum Analyzer. The main display area shows a frequency spectrum with a yellow trace. A single, prominent peak is visible, centered at 13.560166 MHz. The peak is marked with a green diamond and the number '1'. The vertical axis represents power in dBm, ranging from -71.0 to -31.0. The horizontal axis represents frequency, with a center frequency of 13.560166 MHz and a span of 10.00 kHz. The resolution bandwidth (RBW) is 3.0 kHz, and the sweep time is 9.560 ms (601 pts). The reference level is -26.00 dBm. The peak power is -30.862 dBm. The trace is labeled 'Mkr1'. The background is black with a white grid. The top of the screen shows various status indicators and settings, including 'RL', 'RF', '50 Ω ', 'DC', 'SENSE:INT', 'ALIGN OFF', and the date '09:07:27 AM Jul 27, 2018'. The bottom of the screen shows the center frequency, resolution bandwidth, span, and sweep time.

Center 13.560166 MHz
#Res BW 1.0 kHz #VBW 3.0 kHz Span 10.00 kHz
Sweep 9.560 ms (601 pts)

[illegible][illegible]

FREQUENCY STABILITY



XMit 2017.12.13



