



Boston Scientific Corporation

Resonate Models:G447, D432, D433

LP0002:2018

MedRadio

Report # BSTN0897.1 Rev 01



NVLAP LAB CODE: 200881-0



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CERTIFICATE OF TEST

Last Date of Test: June 12, 2019
Boston Scientific Corporation
Resonate Models:G447, D432, D433

Radio Equipment Testing

Standards

Specification	Method
LP0002:2018	LP0002:2018

Results

Method Clause	Specification Clause	Test Description	Applied	Results	Comments
Appendix I, II.(VIII)	4.11.2.1, 4.11.5, 4.11.7.3	Emission Bandwidth	Yes	Pass	
Appendix I, II.(III, IV)	4.11.7.2(1)	Emission Mask	Yes	Pass	
Appendix I, II.(VI, VII)	4.11.8	Frequency Stability	Yes	Pass	
Appendix I, II.(III, IV)	4.11.7	Spurious Radiated Emissions	Yes	Pass	
Appendix I, II.(X)	4.11.6	Radiated Power (EIRP)	Yes	Pass	
Appendix I, II.(II)	4.11.11	Powerline Conducted Emissions	No	N/A	Not required for battery powered EUT.
Appendix I, II.(III, IV)	4.11.10	Receiver Spurious Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:



Matt Nuernberg, 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 (yyyy-mm-dd)	Page Number
01	Added model numbers	2019-08-27	1,2,8

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) and as a CAB for the acceptance of test data.

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

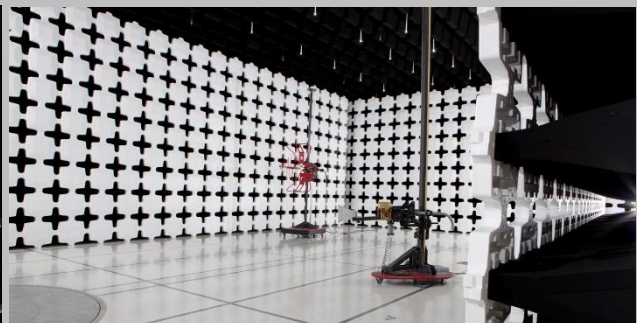
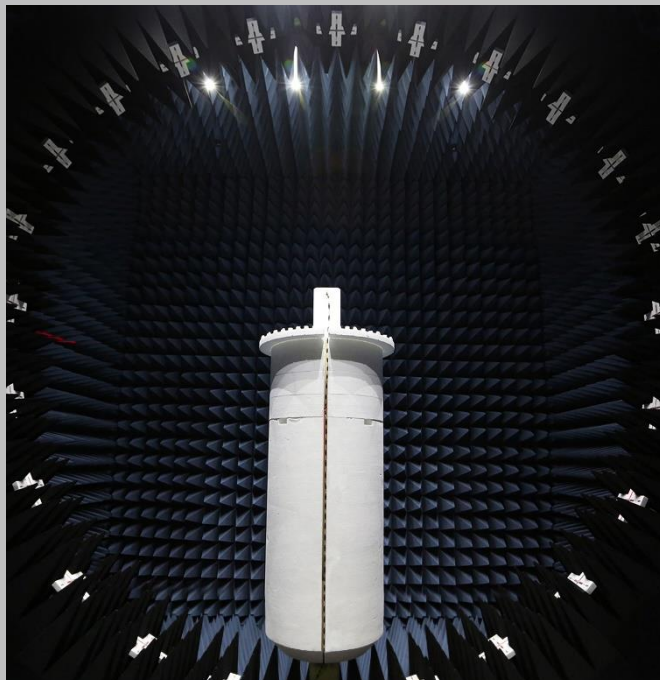
For details on the Scopes of our Accreditations, please visit:

<https://www.nwemc.com/emc-testing-accreditations>

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	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: 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	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRR, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157



MEASUREMENT UNCERTAINTY



WTD.2016.12.19

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.

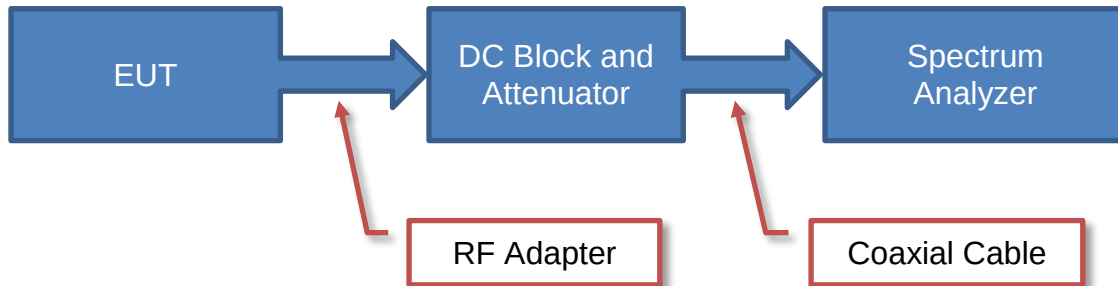
A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement 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.

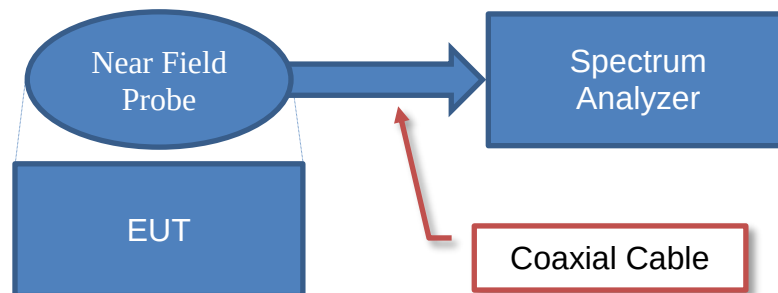
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

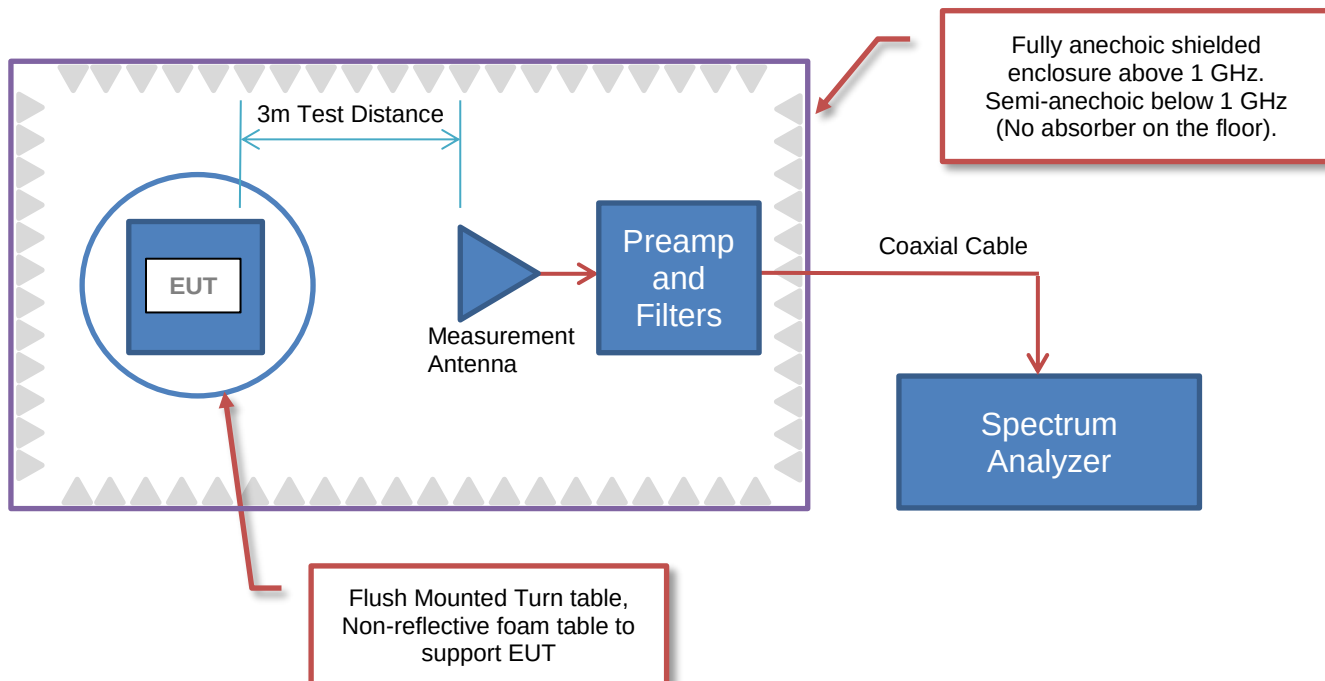
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Boston Scientific Corporation
Address:	4100 Hamline Ave North
City, State, Zip:	St. Paul, MN 55112
Test Requested By:	James Kippola
Model:	Resonate Models:G447, D432, D433
First Date of Test:	June 4, 2019
Last Date of Test:	June 12, 2019
Receipt Date of Samples:	June 4, 2019
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

The RESONATE models are medical devices belonging to the categories of Implantable Cardioverter Defibrillator (ICD) and Cardiac Resynchronization Therapy Defibrillator (CRT-D). They are intended to be used for detecting and treating life-threatening cardiac rhythms. These devices incorporate a radiofrequency (RF) telemetry function, and all models incorporate an electrically identical RF design. A bi-directional RF communication with the implantable device (during implant procedure and patient follow up) is enabled by the model 3120 Zoom Latitude programmer and the model 3140 Zoom Wireless Transmitter (ZWT), which connects to the model 3120 via USB connection. The model 3120 incorporates a near field inductively coupled coil (loop antenna), operating at approximately 57 kHz that is used during the initial interrogation/authentication with the implant. Following authentication the RF link is enabled for longer range communication at up to a 10 foot distance. The RF link operates in the 402-405 MHz band, implements Listen Before Talk (LBT) over ten communication channels, and conforms to the internationally recognized (U.S., Canada, Europe, Australia, Japan, etc.) radiated output power limit of 25 $\frac{1}{4}$ W. The 402-405 MHz radio uses an integrated antenna with a maximum allowed radiated output power of -16.1 dBm.

Explanation of Model Equivalency:

The RESONATE device models share an identical electrical and mechanical radiofrequency (RF) design, concerning the inductive (57 kHz) and MICS (402 – 405 MHz) telemetry function.

The model tested (G447) represents RF performance of all models in the RESONATE family (G447, D433, D432), and accounts for mechanical design differences. While there are no mechanical differences in the RF design between any of the listed models, conservative consideration is given to other mechanical structures (i.e. header and lead connectors) in proximity to the antenna which could minimally impact antenna performance. These variations are fully accounted for in the test sample chosen.

Testing Objective:

Seeking Taiwan authorization for the MedRadio transmitter to LP0002:2018.

PRODUCT DESCRIPTION

EUT Photo



PRODUCT DESCRIPTION



MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2019-06-04	Spurious Radiated 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.
2	2019-06-04	Radiated Power (EIRP)	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	2019-06-06	Receiver Spurious 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.
4	2019-06-12	Emission Bandwidth	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	2019-06-12	Emission Mask	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
6	2019-06-12	Frequency Stability	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

CONFIGURATIONS



Configuration BSTN0897- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Resonate	Boston Scientific Corporation	G447	176406

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Lead 1	Boston Scientific Corporation	IS-1	334209
Lead 2	Boston Scientific Corporation	GDT-LLHH	019333
Lead 3	Boston Scientific Corporation	IS-4	132896

Configuration BSTN0897- 2

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
Hybrid (Momentum, Resonate, Perciva, and Vigilant)	Boston Scientific Corporation	HYB107	Pilot A EDVT 41265542

Remote Equipment Outside of Test Setup Boundary			
Description	Manufacturer	Model/Part Number	Serial Number
DC Power Supply	Agilent	U8002A	TPZ
Programmer	Boston Scientific Corporation	3120	05204
Telemetry Wand	Boston Scientific Corporation	6577	N/A
DMM	Fluke	114	MMU

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable	No	1.8 m	No	DC Power Supply	AC Mains
AC Cable	No	1.8 m	No	Programmer	AC Mains
DC Leads	No	1.1 m	No	DC Power Supply	Hybrid
DC Leads	No	0.6 m	No	DC Power Supply	DMM
Telemetry Cable	No	3.0 m	No	Telemetry Wand	Programmer

EMISSIONS BANDWIDTH



XMIT 2019.05.15

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
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-18	2-Nov-19
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-18	2-Nov-19
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-18	25-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19

TEST DESCRIPTION

The measurement was made in a radiated configuration of the fundamental with the carrier fully maximized for its highest radiated power. Per LP0002:2018, the emission bandwidth was determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 20 dB down relative to the maximum level of the modulated carrier. A spectrum analyzer using a peak detector with no video filtering was used with a resolution bandwidth equal to approximately 1.0 percent of the emission bandwidth of the EUT.

EMISSIONS BANDWIDTH



TMTx 2018.09.13 XMI 2019.05.15

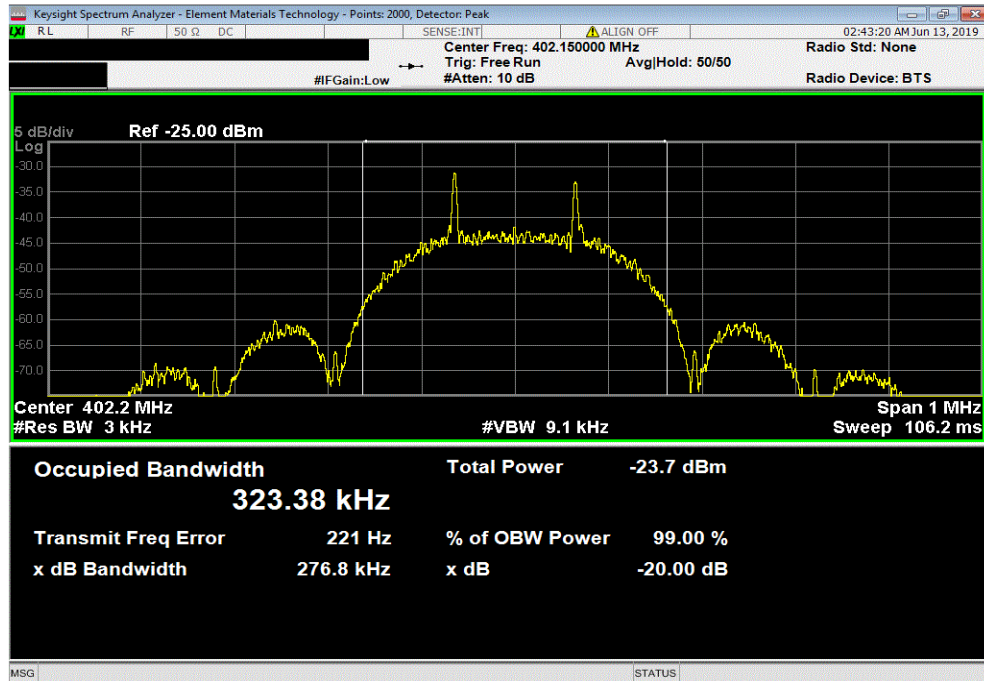
EUT: Resonate		Work Order: BSTN0897	
Serial Number: 176406		Date: 12-Jun-19	
Customer: Boston Scientific Corporation		Temperature: 21.2 °C	
Attendees: James Kippola		Humidity: 51.3% RH	
Project: None		Barometric Pres.: 1018 mbar	
Tested by: Andrew Rogstad		Power: Battery	
Job Site: MN05			
TEST SPECIFICATIONS			
LP0002:2018		Test Method	
LP0002:2018		LP0002:2018	
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Value	Limit (S)
Low Channel, 402.15 MHz		276.848 kHz	300 kHz
High Channel, 404.85 MHz		270.842 kHz	300 kHz
			Result
			Pass
			Pass

EMISSIONS BANDWIDTH

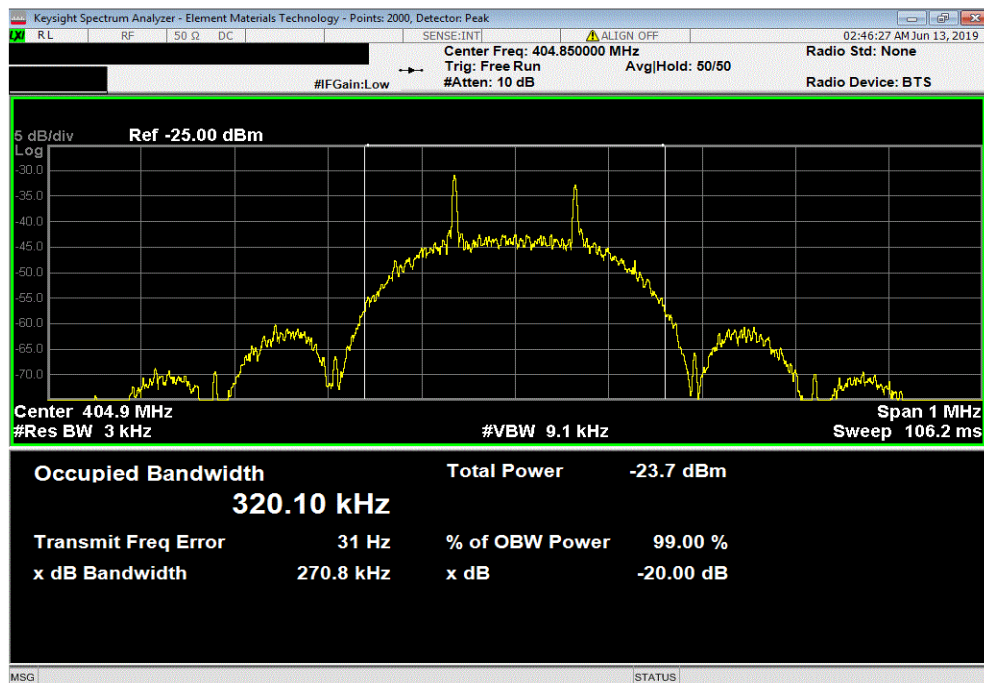


TMTx 2018.09.13 XMt 2019.05.15

Low Channel, 402.15 MHz						
				Value	Limit (S)	Result
				276.848 kHz	300 kHz	Pass



High Channel, 404.85 MHz						
				Value	Limit (S)	Result
				270.842 kHz	300 kHz	Pass



EMISSIONS BANDWIDTH



XMit 2019.05.15



EMISSIONS MASK



XMIT 2019.05.15

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
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-18	2-Nov-19
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-18	2-Nov-19
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-18	25-Jan-20
Analyzer - Spectrum Analyzer	Keysight	N9010A (EXA)	AFQ	13-Dec-18	13-Dec-19

TEST DESCRIPTION

The measurement was made in a radiated configuration of the fundamental with the carrier fully maximized for its highest radiated power. Per LP0002:2018 the emission mask was measured. Emissions more than 150 kHz away from the center frequency must be attenuated below the transmitter output power by at least 20 dB. This was evaluated by the Occupied Bandwidth measurement according to LP0002:2018. In addition, emissions 250 kHz or less above and below the MICS band (402-405 MHz) must be attenuated below the maximum permitted output power by at least 20 dB.

A spectrum analyzer was used to measure the emission mask. A spectrum analyzer using a peak detector with no video filtering was used with a resolution bandwidth equal to approximately 1.0 percent of the emission bandwidth of the EUT. However, various plots were made using different frequency spans and resolution bandwidths in an attempt to not only satisfy the measurement criteria, but to also show that all emissions outside of the occupied band are greatly attenuated.

EMISSIONS MASK



TMTx 2018.09.13 XMI 2019.05.15

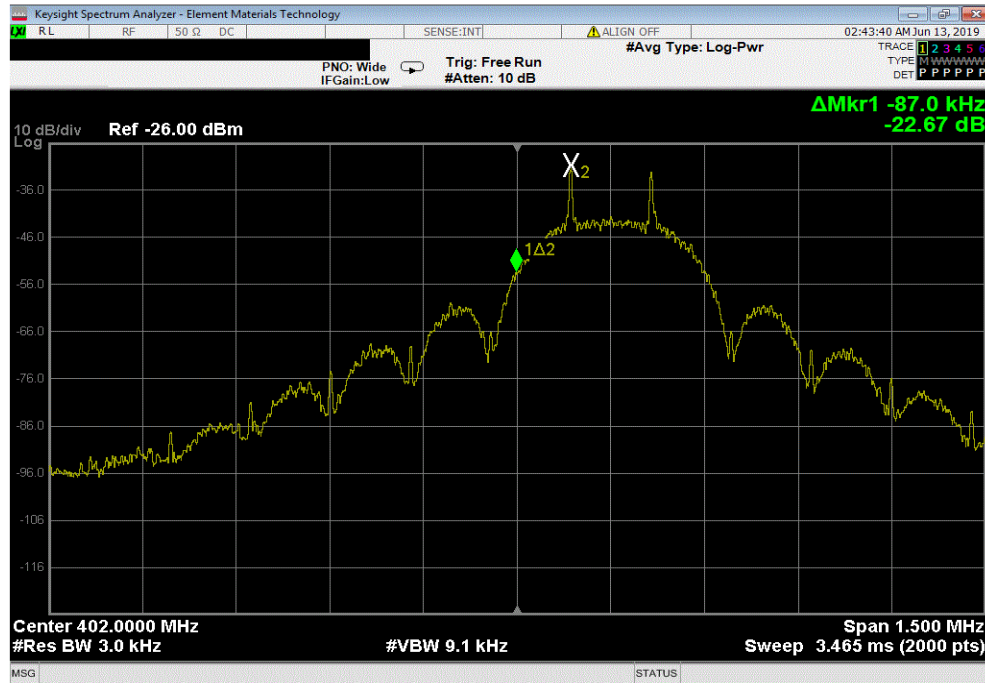
EUT: Resonate		Work Order: BSTN0897	
Serial Number: 176406		Date: 12-Jun-19	
Customer: Boston Scientific Corporation		Temperature: 21.2 °C	
Attendees: James Kippola		Humidity: 50.4% RH	
Project: None		Barometric Pres.: 1018 mbar	
Tested by: Andrew Rogstad	Power: Battery	Job Site: MN05	
TEST SPECIFICATIONS			
LP0002:2018		Test Method	
LP0002:2018		LP0002:2018	
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	1	Signature <i>Andrew Rogstad</i>	
		Value (dBc)	Limit ≤ (dBc) Result
Low Channel, 402.15 MHz		-22.67	-20 Pass
High Channel, 404.85 MHz		-22.44	-20 Pass

EMISSIONS MASK

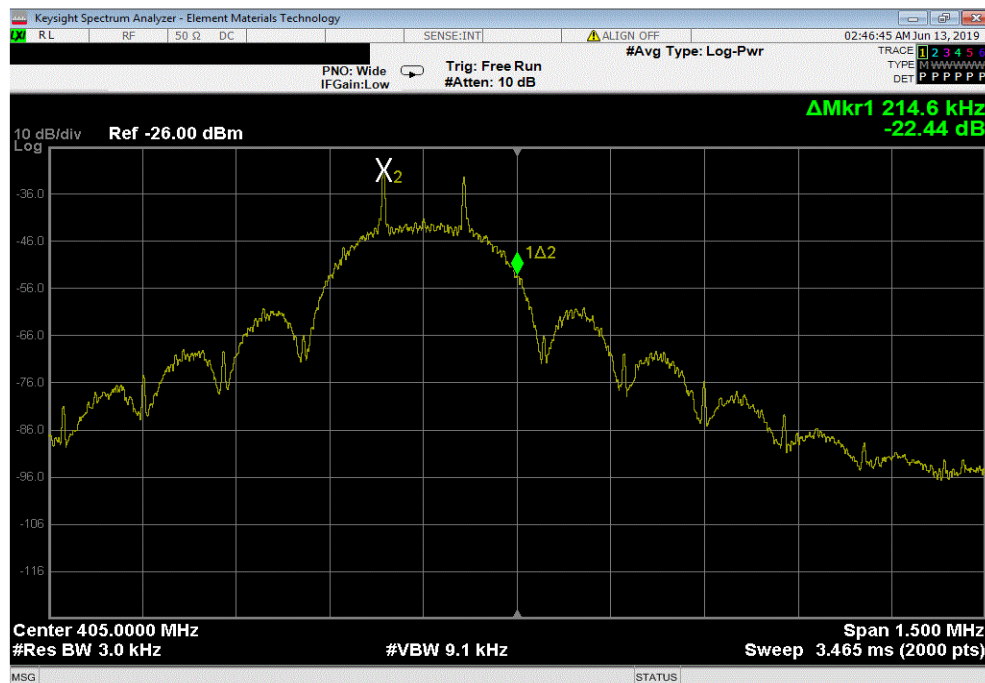


TMTx 2018.09.13 XMI 2019.05.15

Low Channel, 402.15 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-22.67	-20	Pass



High Channel, 404.85 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-22.44	-20	Pass



EMISSIONS MASK



XMit 2019.05.15



FREQUENCY STABILITY



XMIT 2019.05.15

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-32-3.5-SCT/AC	TBF	NCR	NCR
Thermometer	Omega Engineering, Inc.	HH311	DUB	10-Nov-17	10-Nov-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	1-May-19	1-May-20
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNO	7-Jun-19	7-Jun-20
Meter - Multimeter	Fluke	114	MMU	18-Jul-17	18-Jul-20
Power Supply - DC	Agilent	U8002A	TPZ	NCR	NCR
Generator - Signal	Agilent	E4422B	TGQ	15-Mar-18	15-Mar-21
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-18	5-Jul-19
Block - DC	Fairview Microwave	SD3379	AMI	7-Sep-18	7-Sep-19
Attenuator	Fairview Microwave	SA4014-20	AQI	7-Sep-18	7-Sep-19
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNU	11-Apr-19	11-Apr-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spectrum analyzer is configured with a precision frequency reference that exceeds the stability requirement of the transmitter. The EUT was placed inside a temperature / humidity chamber.

Variation of Supply Voltage

The primary supply voltage was varied from the nominal battery voltage to its lowest operating 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 (+25° and +45° C).

FREQUENCY STABILITY



TbTx 2018.09.13 XMt 2019.05.15

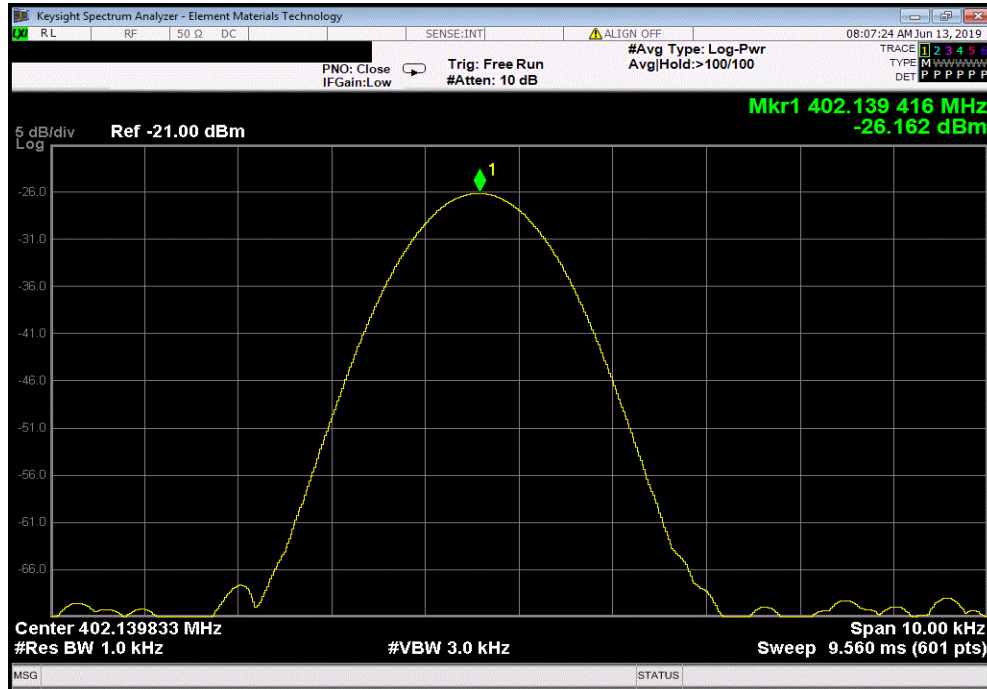
EUT: Resonate		Work Order: BSTN0897	
Serial Number: 41265542		Date: 12-Jun-19	
Customer: Boston Scientific Corporation		Temperature: 21.4 °C	
Attendees: James Kippola		Humidity: 47.4% RH	
Project: None		Barometric Pres.: 1018 mbar	
Tested by: Andrew Rogstad		Power: Battery	
Job Site: MN05			
TEST SPECIFICATIONS			
LP0002:2018		Test Method	
LP0002:2018		LP0002:2018	
COMMENTS			
None			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	BSTN0897-2	Signature <i>Andrew Rogstad</i>	
		Measured Value (MHz)	Assigned Value (MHz)
		Error (ppm)	Limit (ppm)
			Results
Low Channel, 402.15 MHz			
Extreme Temperature (+45C)			
	Nominal Voltage (3 VDC)	402.1394163	402.15
		26.3	100
	Pass		
Extreme Temperature (+25C)			
	Nominal Voltage (3 VDC)	402.1415333	402.15
		21.1	100
	Pass		
Nominal Temperature			
	Nominal Voltage (3 VDC)	402.141754	402.15
		20.5	100
	Pass		
	Lowest Rated Voltage (1.65 VDC)	402.141737	402.15
		20.6	100
	Pass		
High Channel, 404.85 MHz			
Extreme Temperature (+45C)			
	Nominal Voltage (3 VDC)	404.839216	404.85
		26.6	100
	Pass		
Extreme Temperature (+25C)			
	Nominal Voltage (3 VDC)	404.8413507	404.85
		21.4	100
	Pass		
Nominal Temperature			
	Nominal Voltage (3 VDC)	404.841601	404.85
		20.8	100
	Pass		
	Lowest Rated Voltage (1.65 VDC)	404.841584	404.85
		20.8	100
	Pass		

FREQUENCY STABILITY

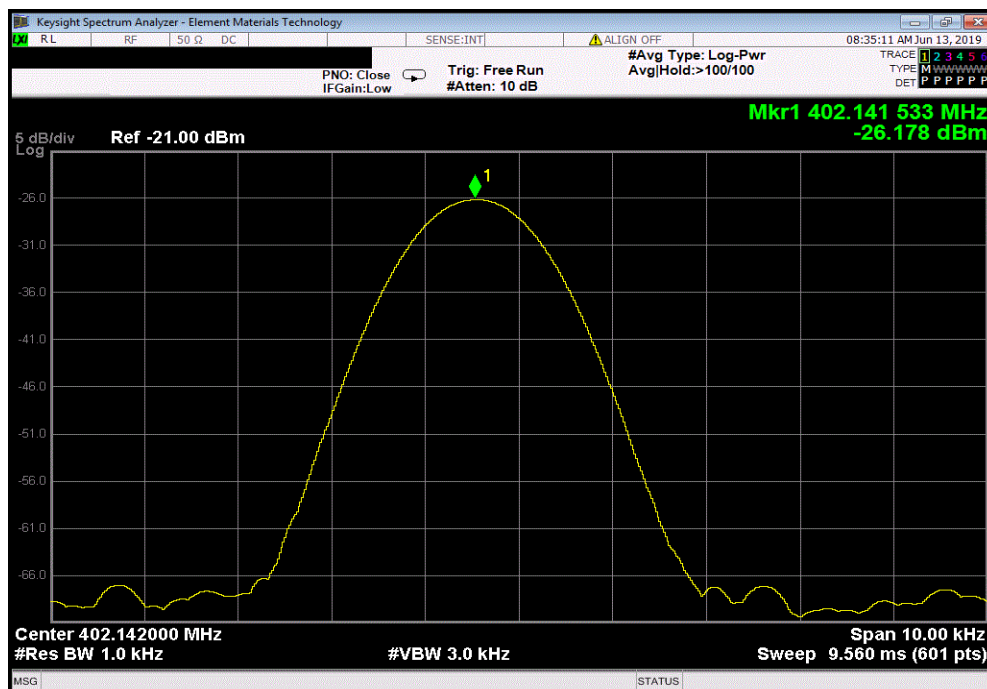


TMTx 2018.09.13 XMI 2019.05.15

Low Channel, 402.15 MHz, Extreme Temperature (+45C), Nominal Voltage (3 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	402.1394163	402.15	26.3	100	Pass	



Low Channel, 402.15 MHz, Extreme Temperature (+25C), Nominal Voltage (3 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	402.1415333	402.15	21.1	100	Pass	

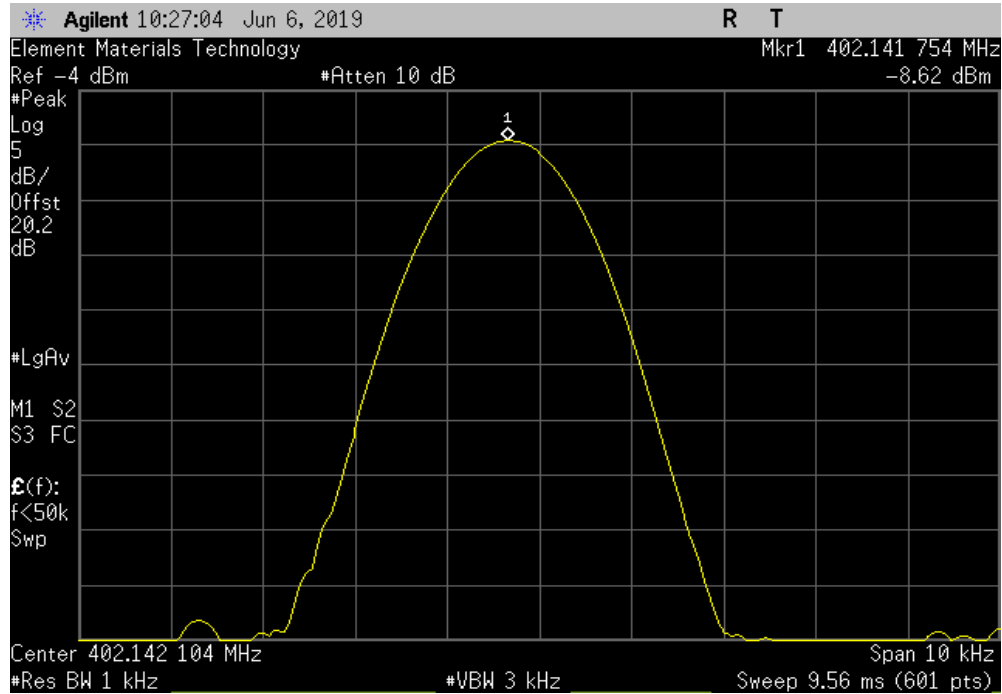


FREQUENCY STABILITY

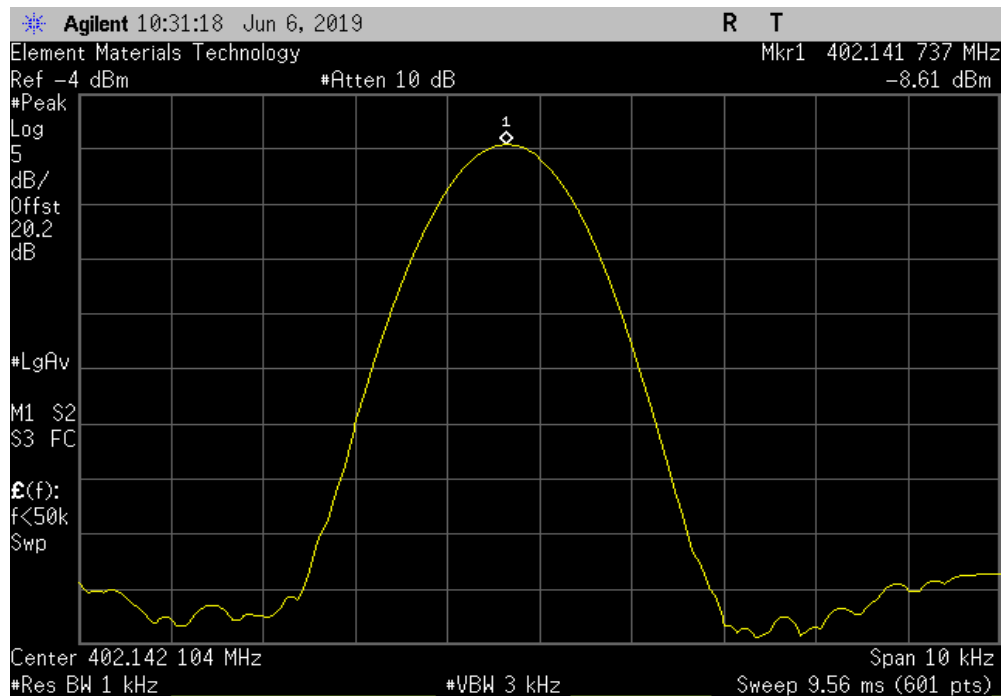


TMTx 2018.09.13 XMI 2019.05.15

Low Channel, 402.15 MHz, Nominal Temperature, Nominal Voltage (3 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	402.141754	402.15	20.5	100	Pass	



Low Channel, 402.15 MHz, Nominal Temperature, Lowest Rated Voltage (1.65 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	402.141737	402.15	20.6	100	Pass	

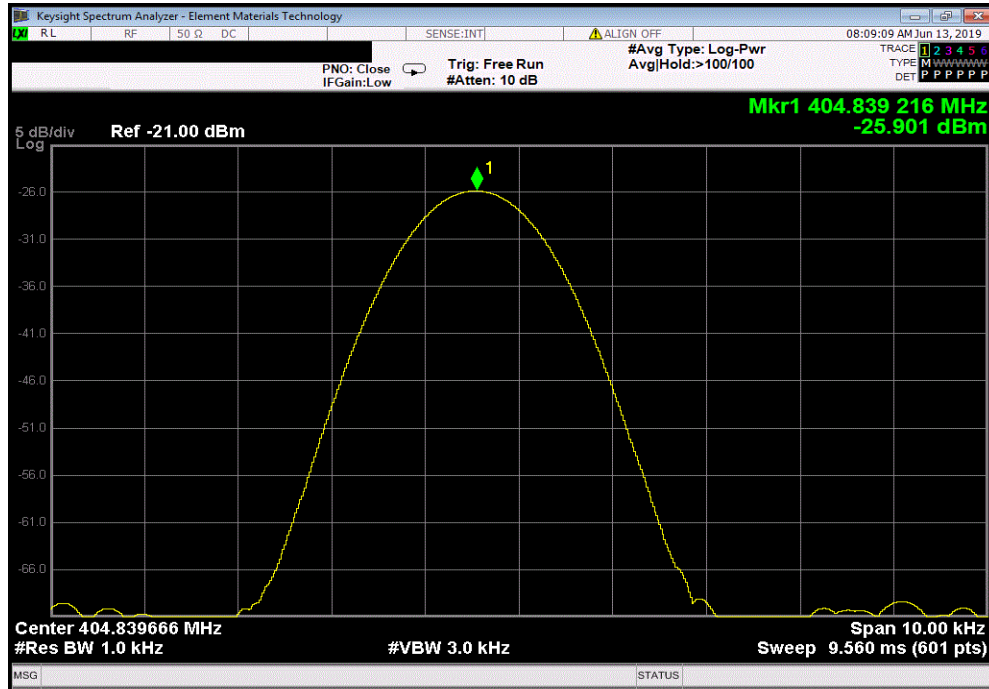


FREQUENCY STABILITY

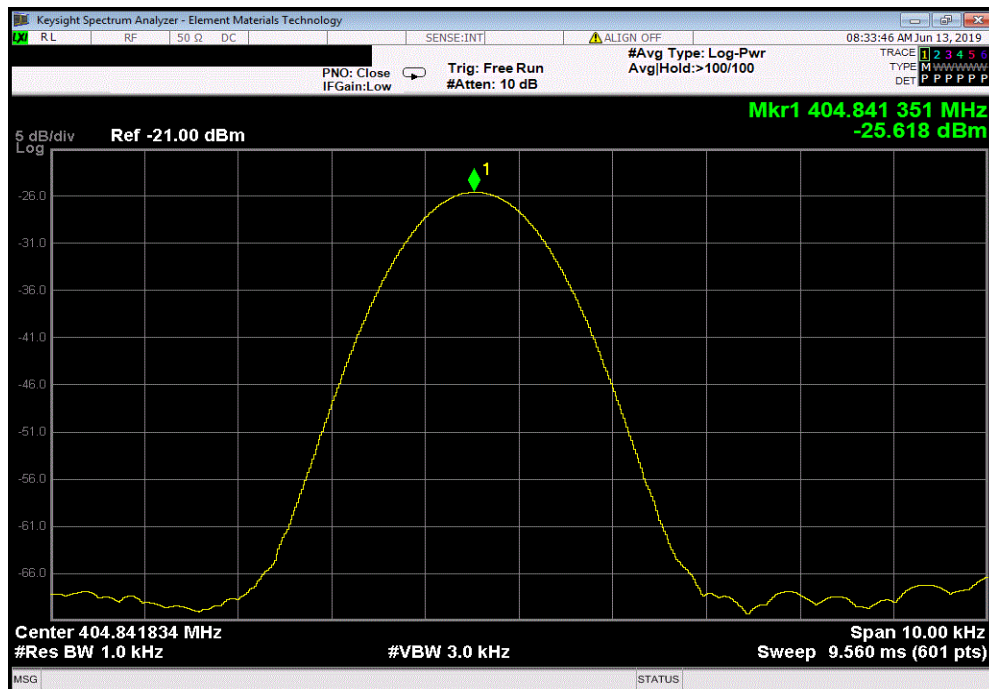


TMTx 2018.09.13 XMI 2019.05.15

High Channel, 404.85 MHz, Extreme Temperature (+45C), Nominal Voltage (3 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	404.839216	404.85	26.6	100	Pass	



High Channel, 404.85 MHz, Extreme Temperature (+25C), Nominal Voltage (3 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	404.8413507	404.85	21.4	100	Pass	

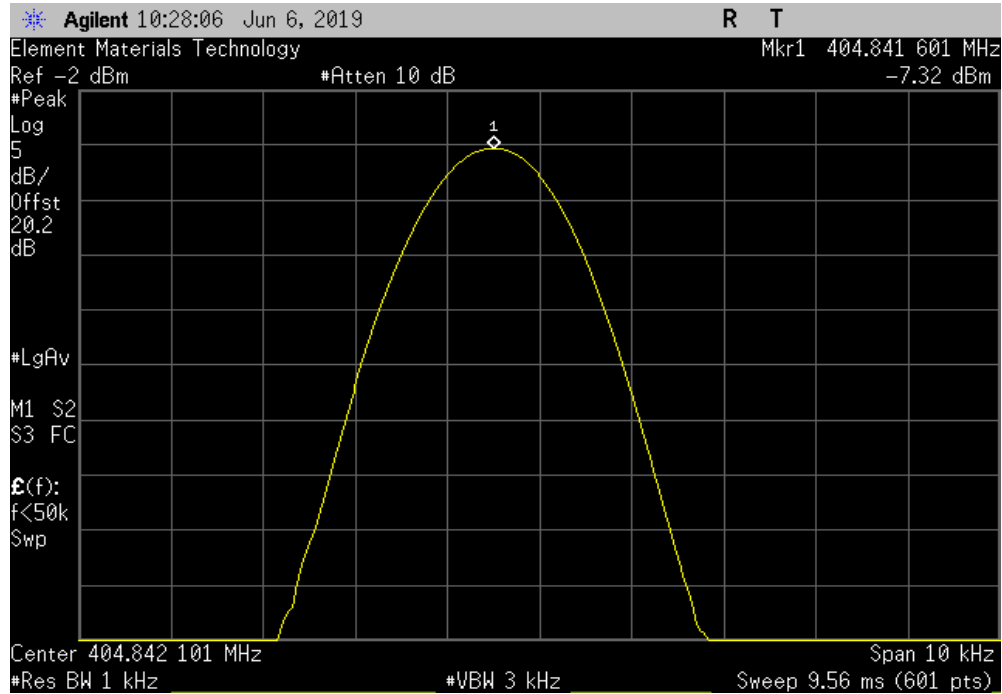


FREQUENCY STABILITY

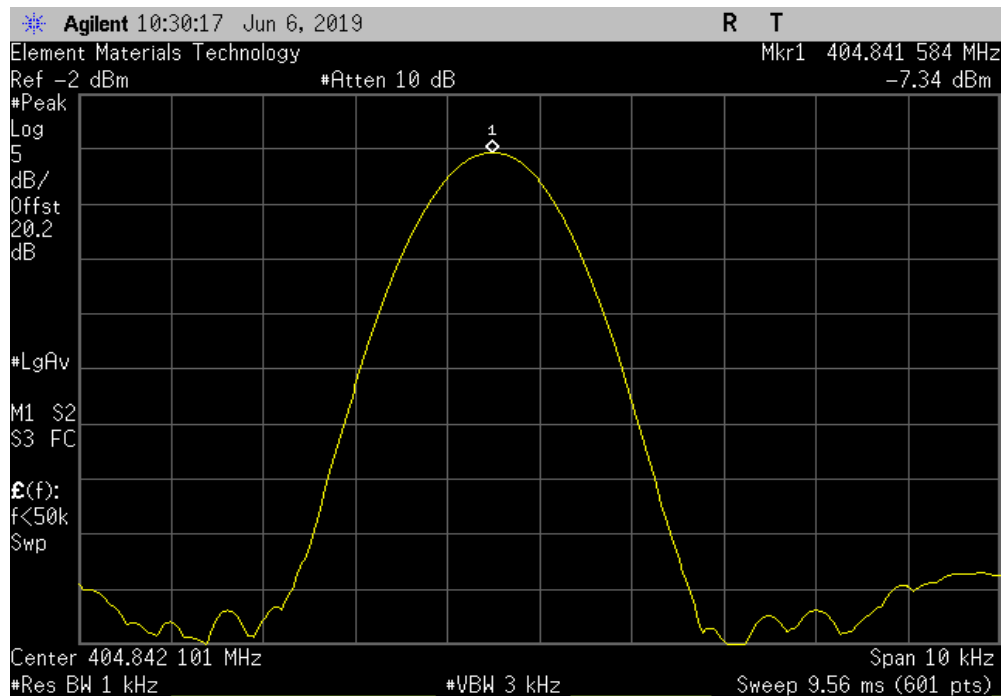


TMTx 2018.09.13 XMI 2019.05.15

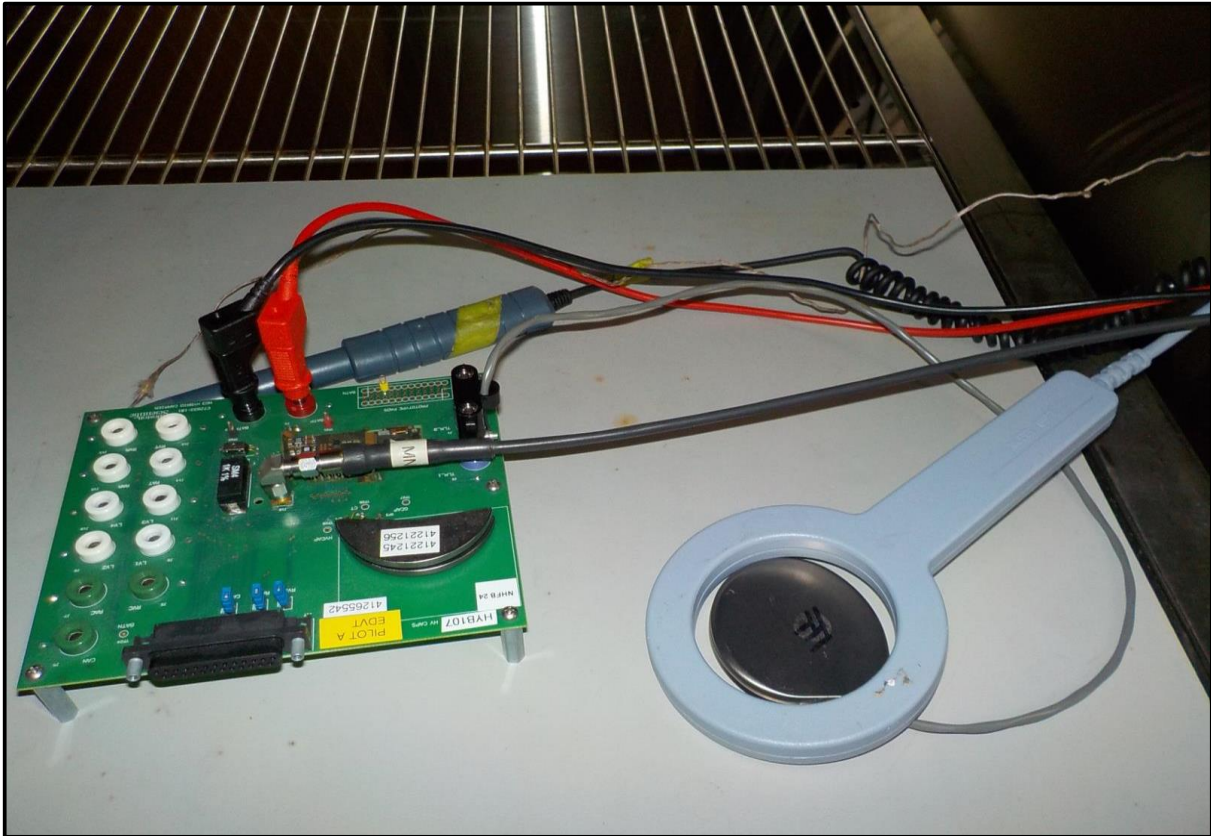
High Channel, 404.85 MHz, Nominal Temperature, Nominal Voltage (3 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	404.841601	404.85	20.8	100	Pass	



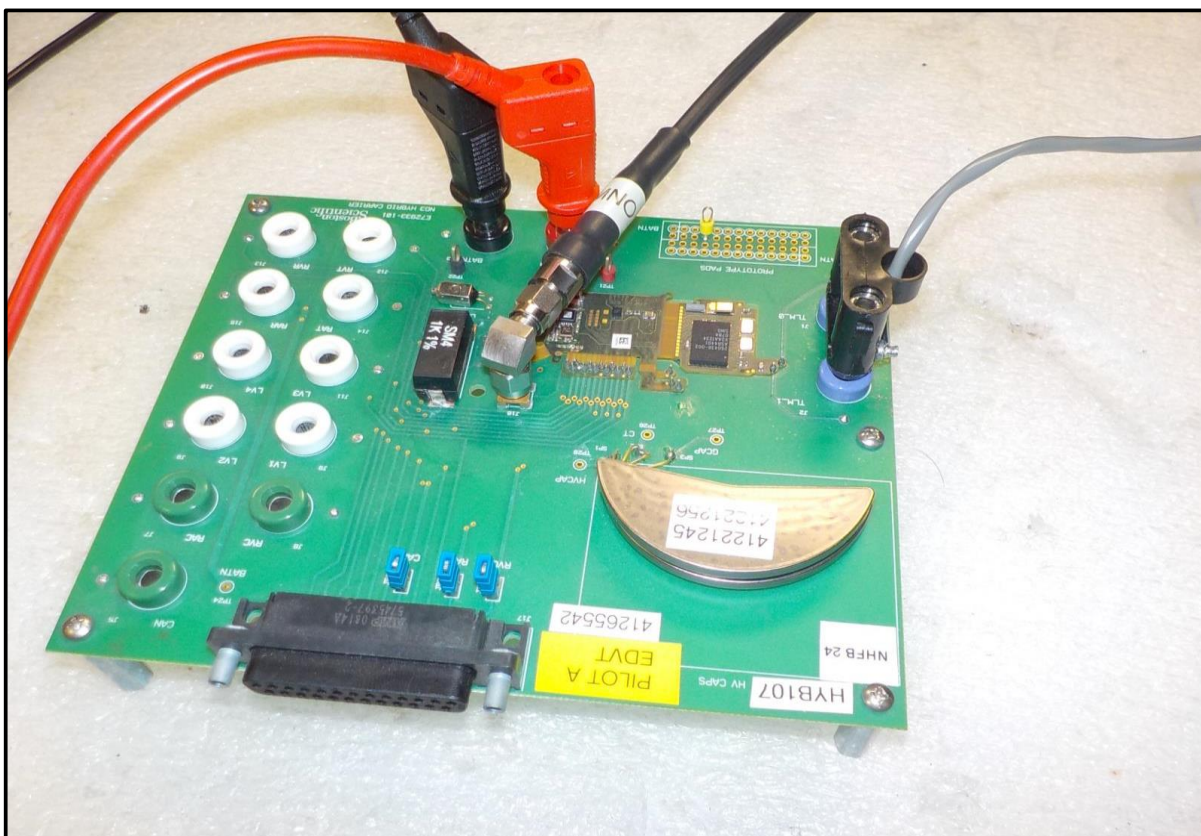
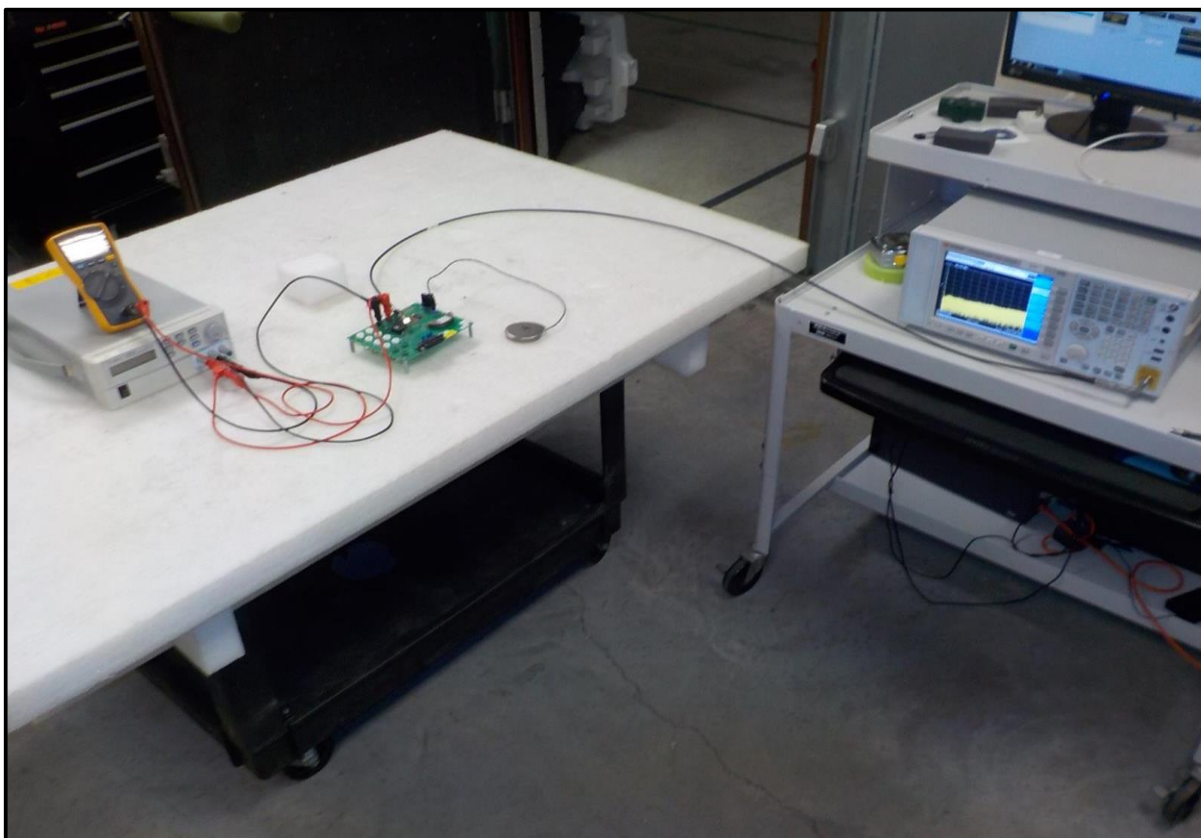
High Channel, 404.85 MHz, Nominal Temperature, Lowest Rated Voltage (1.65 VDC)						
	Measured Value (MHz)	Assigned Value (MHz)	Error (ppm)	Limit (ppm)	Results	
	404.841584	404.85	20.8	100	Pass	



FREQUENCY STABILITY



FREQUENCY STABILITY



SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2019.05.10

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 MICS low channel (402.15 MHz) and high channel (404.85 MHz), Modulated

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

BSTN0897 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	5000 MHz
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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
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	8-Feb-2019	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	24-Sep-2018	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-2018	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	12 mo

TEST DESCRIPTION

The highest gain of each type of antenna to be used with the EUT was tested. For each configuration, the spectrum was scanned throughout the specified range. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per LP0002:2018). A preamp was used for this test in order to provide sufficient measurement sensitivity.

Per LP0002:2018 4.11.7, field strength measurements were performed and compared to the specified limits.

SPURIOUS RADIATED EMISSIONS



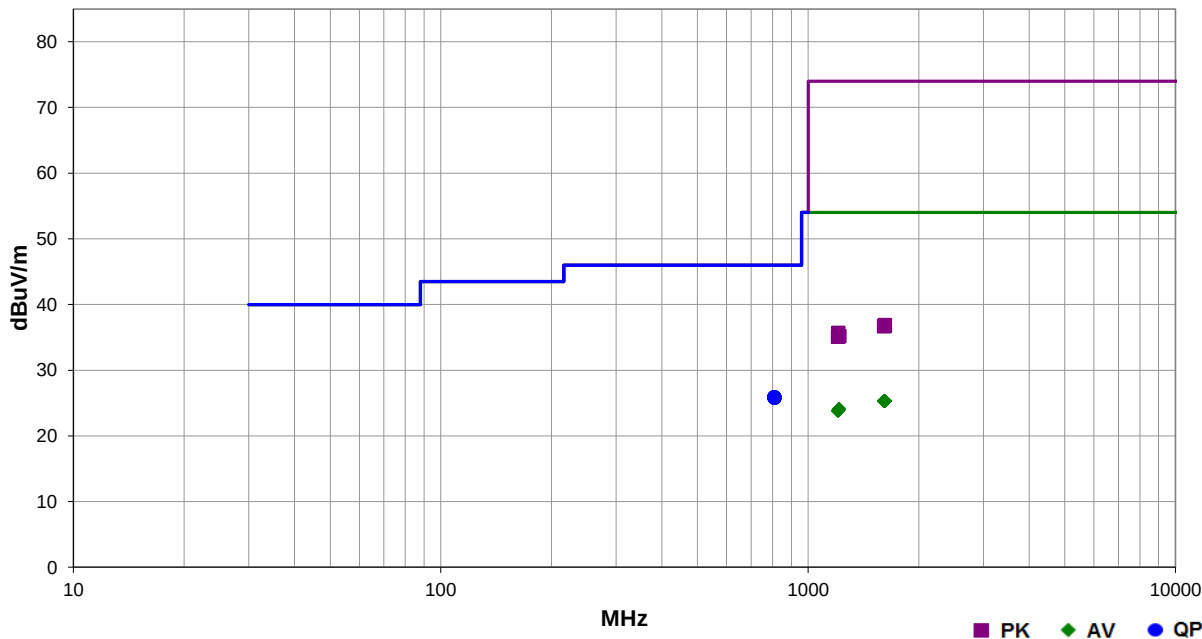
EmiRS 2019.05.20

PSA-ESCI 2019.05.10

Work Order:	BSTN0897	Date:	4-Jun-2019	
Project:	None	Temperature:	24.3 °C	
Job Site:	MN05	Humidity:	50.5% RH	
Serial Number:	176406	Barometric Pres.:	1008 mbar	
Tested by: Andrew Rogstad				
EUT:	Resonate			
Configuration:	1			
Customer:	Boston Scientific Corporation			
Attendees:	James Kippola			
EUT Power:	Battery			
Operating Mode:	Tx MICS low channel (402.15 MHz) and high channel (404.85 MHz), Modulated			
Deviations:	None			
Comments:	See data comments for EUT orientation and Tx channel			

Test Specifications	Test Method
LP0002:2018	LP0002:2018

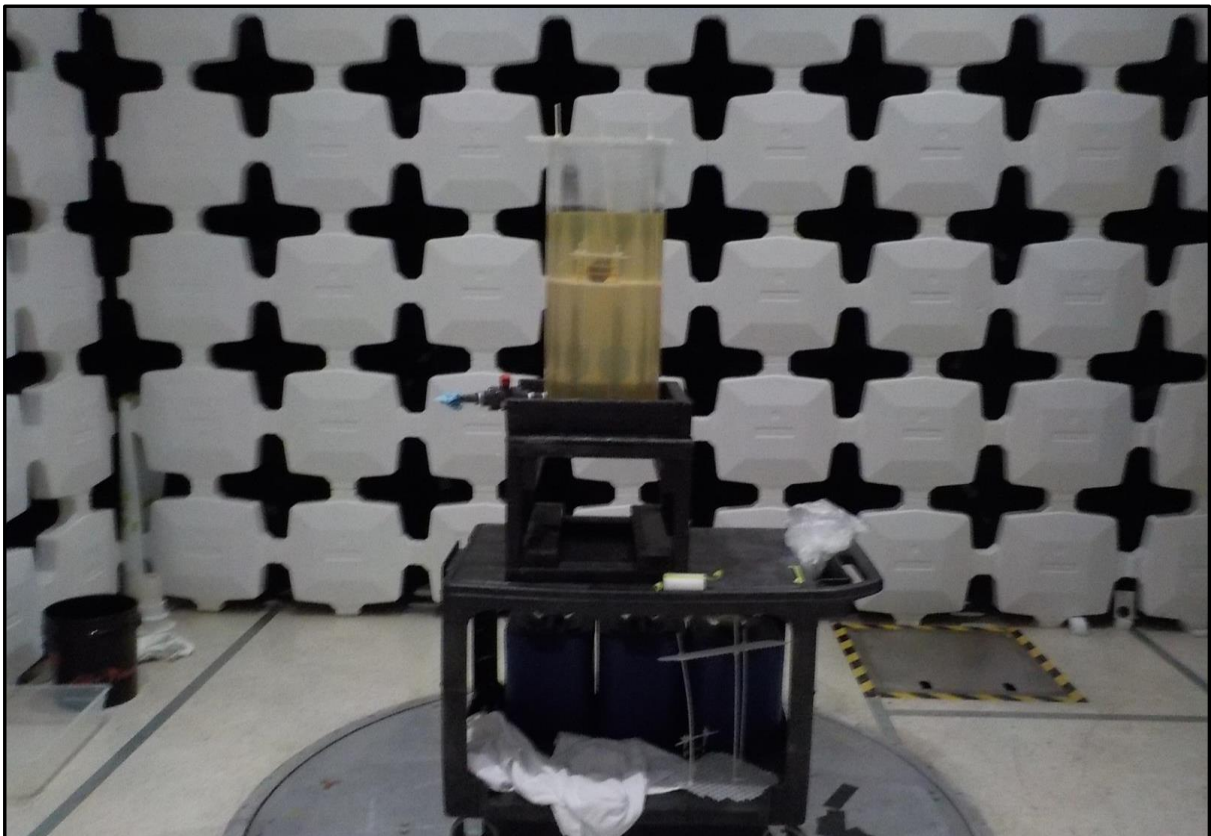
Run #	8	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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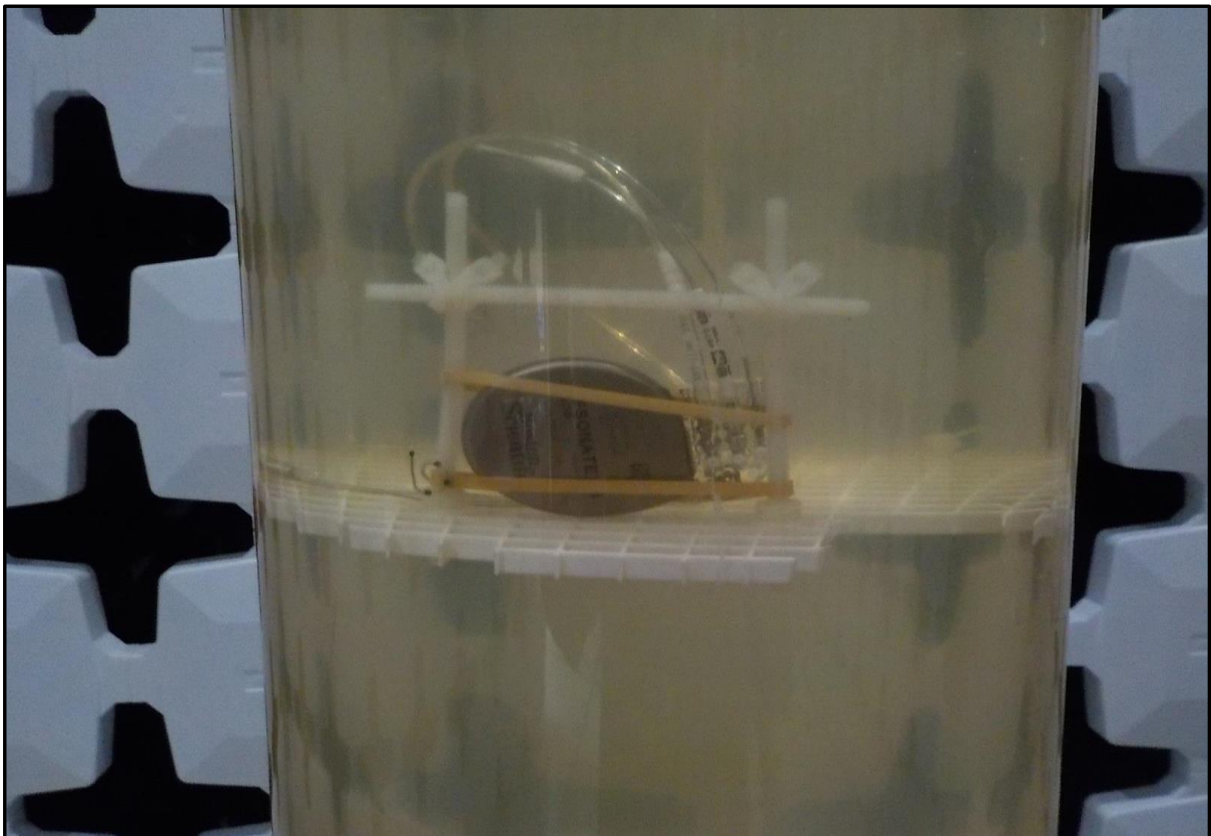
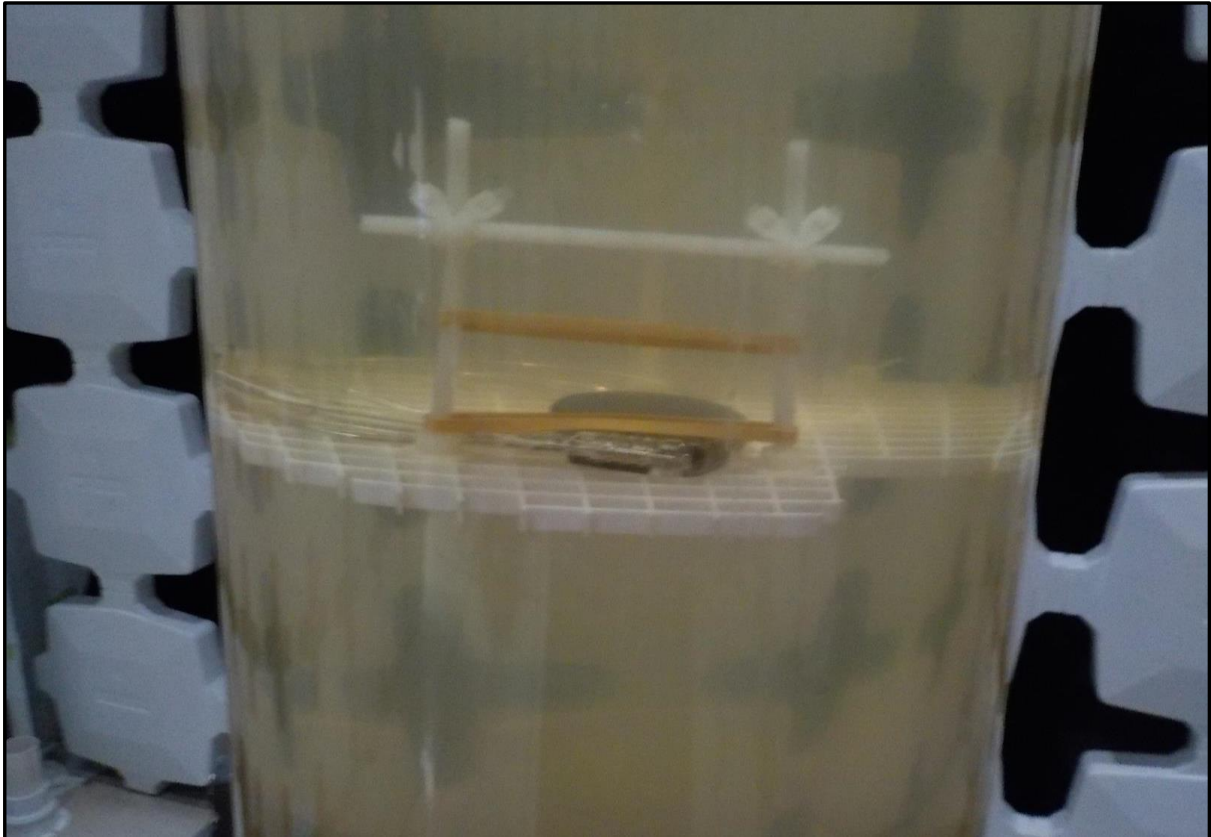
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
809.432	16.2	9.7	1.0	231.0	3.0	0.0	Horz	QP	0.0	25.9	46.0	-20.1	EUT vert, High ch.
809.428	16.2	9.7	1.0	289.9	3.0	0.0	Horz	QP	0.0	25.9	46.0	-20.1	EUT horz, High ch
809.378	16.2	9.7	1.0	202.0	3.0	0.0	Vert	QP	0.0	25.9	46.0	-20.1	EUT horz, High ch
809.387	16.2	9.7	1.0	281.0	3.0	0.0	Horz	QP	0.0	25.9	46.0	-20.1	EUT vert, Low ch
809.402	16.2	9.7	3.6	358.9	3.0	0.0	Vert	QP	0.0	25.9	46.0	-20.1	EUT vert, Low ch
809.828	16.2	9.6	1.0	217.0	3.0	0.0	Vert	QP	0.0	25.8	46.0	-20.2	EUT vert, High ch.
809.740	16.2	9.6	1.0	202.0	3.0	0.0	Horz	QP	0.0	25.8	46.0	-20.2	EUT on side, High ch
809.590	16.2	9.6	1.0	264.0	3.0	0.0	Vert	QP	0.0	25.8	46.0	-20.2	EUT on side, High ch
1608.250	31.3	-6.0	2.4	261.0	3.0	0.0	Horz	AV	0.0	25.3	54.0	-28.7	EUT vert, Low ch.
1610.417	31.3	-6.0	1.5	2.9	3.0	0.0	Vert	AV	0.0	25.3	54.0	-28.7	EUT vert, Low ch.
1621.067	31.2	-5.9	1.5	153.9	3.0	0.0	Horz	AV	0.0	25.3	54.0	-28.7	EUT vert, High ch.
1619.125	31.2	-5.9	1.5	304.0	3.0	0.0	Vert	AV	0.0	25.3	54.0	-28.7	EUT vert, High ch.
1215.183	31.6	-7.5	3.2	95.0	3.0	0.0	Horz	AV	0.0	24.1	54.0	-29.9	EUT vert, High ch.
1212.625	31.5	-7.5	4.0	289.0	3.0	0.0	Vert	AV	0.0	24.0	54.0	-30.0	EUT vert, High ch.
1206.142	31.5	-7.7	1.5	58.0	3.0	0.0	Horz	AV	0.0	23.8	54.0	-30.2	EUT vert, Low ch.
1208.325	31.5	-7.7	1.5	117.0	3.0	0.0	Vert	AV	0.0	23.8	54.0	-30.2	EUT vert, Low ch.
1617.292	42.8	-5.9	1.5	153.9	3.0	0.0	Horz	PK	0.0	36.9	74.0	-37.1	EUT vert, High ch.

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
1619.042	42.7	-5.9	1.5	304.0	3.0	0.0	Vert	PK	0.0	36.8	74.0	-37.2	EUT vert, High ch.
1608.467	42.7	-6.0	2.4	261.0	3.0	0.0	Horz	PK	0.0	36.7	74.0	-37.3	EUT vert, Low ch.
1610.717	42.7	-6.0	1.5	2.9	3.0	0.0	Vert	PK	0.0	36.7	74.0	-37.3	EUT vert, Low ch.
1208.150	43.4	-7.7	1.5	117.0	3.0	0.0	Vert	PK	0.0	35.7	74.0	-38.3	EUT vert, Low ch.
1214.142	42.7	-7.5	3.2	95.0	3.0	0.0	Horz	PK	0.0	35.2	74.0	-38.8	EUT vert, High ch.
1216.092	42.7	-7.5	4.0	289.0	3.0	0.0	Vert	PK	0.0	35.2	74.0	-38.8	EUT vert, High ch.
1206.117	42.8	-7.7	1.5	58.0	3.0	0.0	Horz	PK	0.0	35.1	74.0	-38.9	EUT vert, Low ch.

SPURIOUS RADIATED EMISSIONS



SPURIOUS RADIATED EMISSIONS



RADIATED POWER (EIRP)



PSA-ESCI 2019.05.10

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MODES OF OPERATION

Tx MICS low channel (402.15 MHz) and high channel (404.85 MHz), CW

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

BSTN0897 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	402 MHz	Stop Frequency	405 MHz
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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
Power Sensor	Agilent	N8481A	SQN	16-Jul-2018	12 mo
Meter - Power	Agilent	N1913A	SQL	16-Jul-2018	12 mo
Generator - Signal	Agilent	N5183A	TIK	30-Apr-2019	36 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-2018	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	12 mo
Antenna - Dipole	EMCO	3121C-DB4	ADI	18-Mar-2019	36 mo

TEST DESCRIPTION

Per LP0002:2018 Section 4.11.6.1, the maximum radiated field strength for a MICS transmitter is 25uW EIRP. The Field Strength of the Fundamental data was converted to EIRP via the substitution method called out in Appendix I, II.(X) in LP0002:2018.

The Field Strength of the Fundamental was measured in the far-field at an FCC Listed Semi-anechoic Chamber. Spectrum analyzer and linearly polarized antennas were used to measure the radiated field strength of the fundamental.

The orientation of the EUT and measurement antenna were manipulated to maximize the level of emissions. The turntable azimuth was varied to maximize the level of radiated emissions. The height of the measurement antenna was also varied from 1 to 4 meters. The amplitude and frequency of the emissions were noted.

The EUT was configured to transmit in a fixture that simulates the human torso. The dimensions of the test fixture and the characteristics of the tissue substitute material met the requirements 95.2569(c) and FCC KDB 617965. The height of the transmitter was 1.5-meter above the reference ground plane.

RADIATED POWER (EIRP)

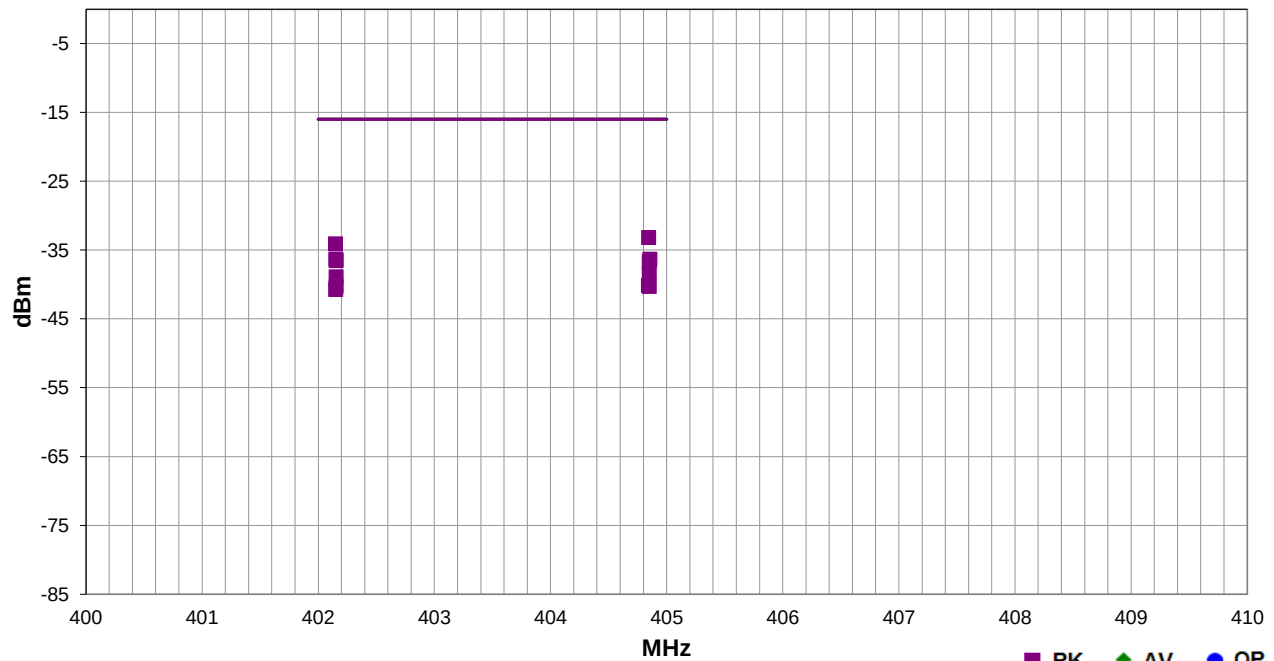


EmiR5 2019.05.20

PSA-ESCI 2019.05.10

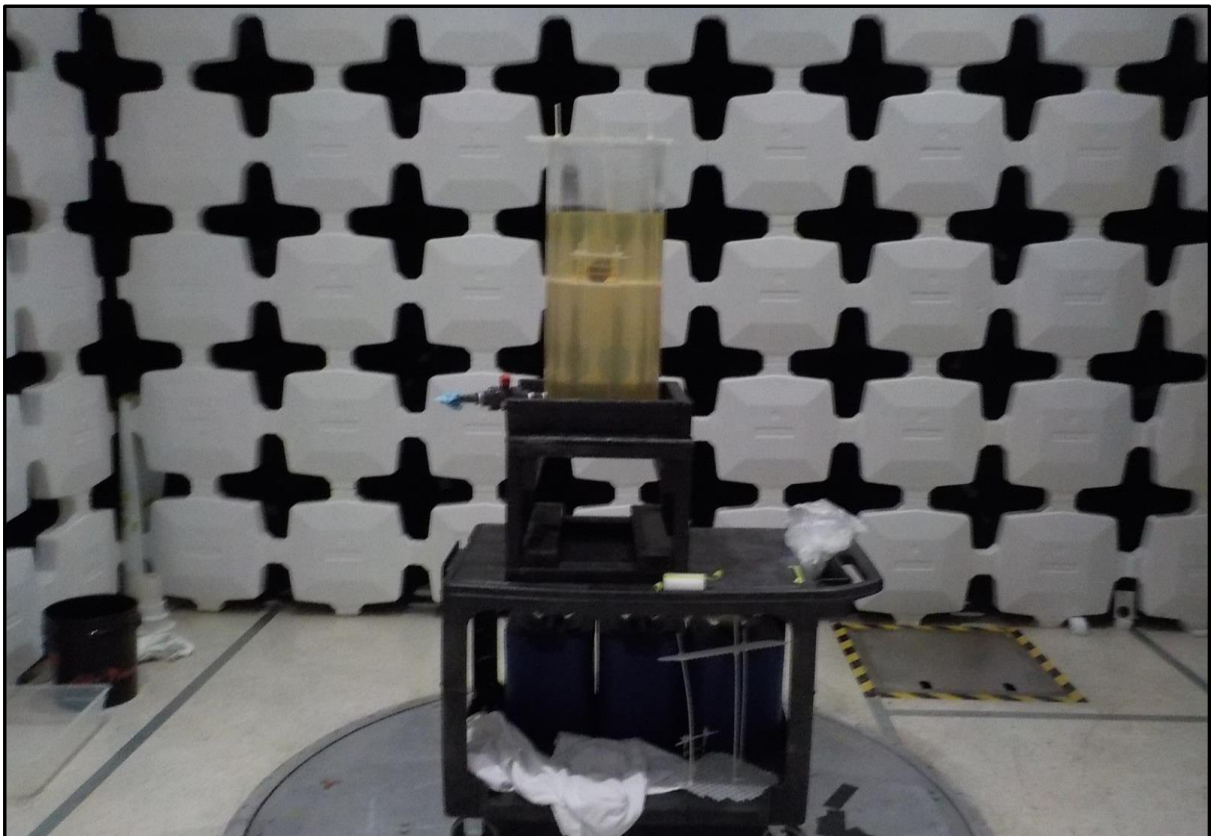
Work Order:	BSTN0897	Date:	4-Jun-2019	
Project:	None	Temperature:	23.6 °C	
Job Site:	MN05	Humidity:	48.1% RH	
Serial Number:	176406	Barometric Pres.:	1012 mbar	
EUT:		Resonate		
Configuration:	1			
Customer:	Boston Scientific Corporation			
Attendees:	James Kippola			
EUT Power:	Battery			
Operating Mode:	Tx MICS low channel (402.15 MHz) and high channel (404.85 MHz), CW			
Deviations:	None			
Comments:	See data comments for EUT orientation and Tx channel			

Test Specifications				Test Method			
LP0002:2018				LP0002:2018			
Run #	3	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass

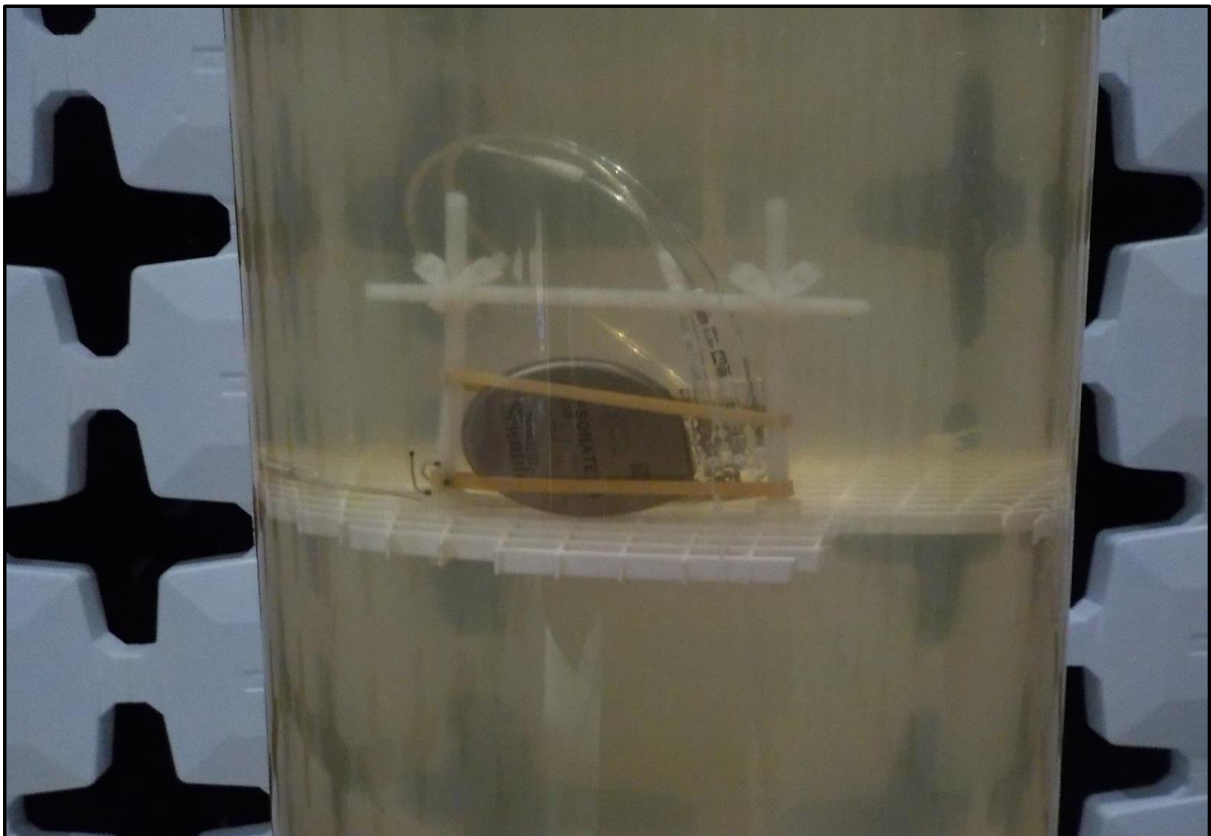
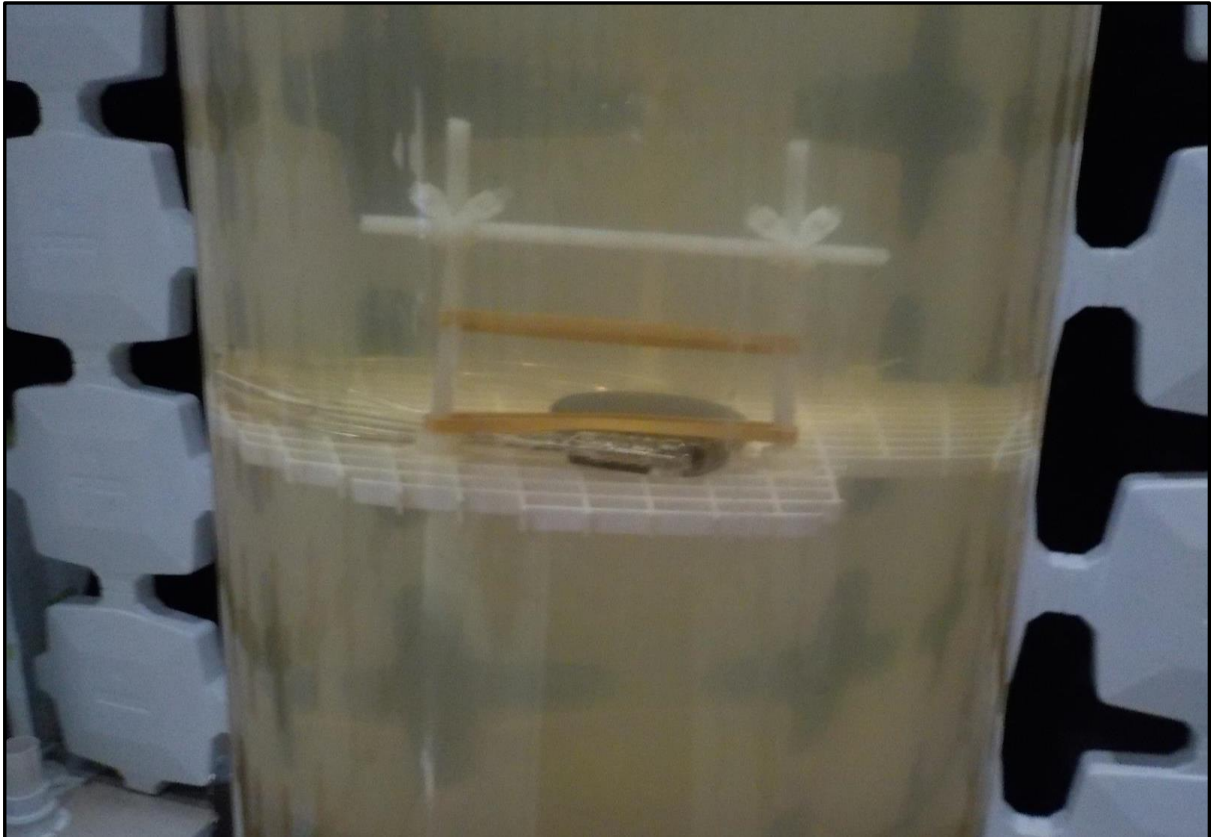


Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
404.845	1.5	9.0	Vert	PK	481.9E-9	-33.2	-16.0	-17.2	EUT vert, High ch
402.148	1.5	4.0	Vert	PK	390.8E-9	-34.1	-16.0	-18.1	EUT vert, Low ch
404.855	1.0	278.0	Horz	PK	233.3E-9	-36.3	-16.0	-20.3	EUT vert, High ch
402.152	1.1	66.0	Horz	PK	232.8E-9	-36.3	-16.0	-20.3	EUT on side, Low ch
402.153	1.0	270.0	Horz	PK	222.3E-9	-36.5	-16.0	-20.5	EUT vert, Low ch
404.850	2.0	40.0	Horz	PK	212.8E-9	-36.7	-16.0	-20.7	EUT on side, High ch
404.850	1.5	333.9	Vert	PK	145.5E-9	-38.4	-16.0	-22.4	EUT on side, High ch
402.153	1.5	343.9	Vert	PK	129.4E-9	-38.9	-16.0	-22.9	EUT on side, Low ch
404.843	1.9	224.0	Horz	PK	97.3E-9	-40.1	-16.0	-24.1	EUT horz, High ch
404.850	1.6	333.0	Vert	PK	94.0E-9	-40.3	-16.0	-24.3	EUT horz, High ch
402.153	1.6	340.0	Vert	PK	93.8E-9	-40.3	-16.0	-24.3	EUT horz, Low ch
402.150	1.9	225.0	Horz	PK	84.5E-9	-40.7	-16.0	-24.7	EUT horz, Low ch

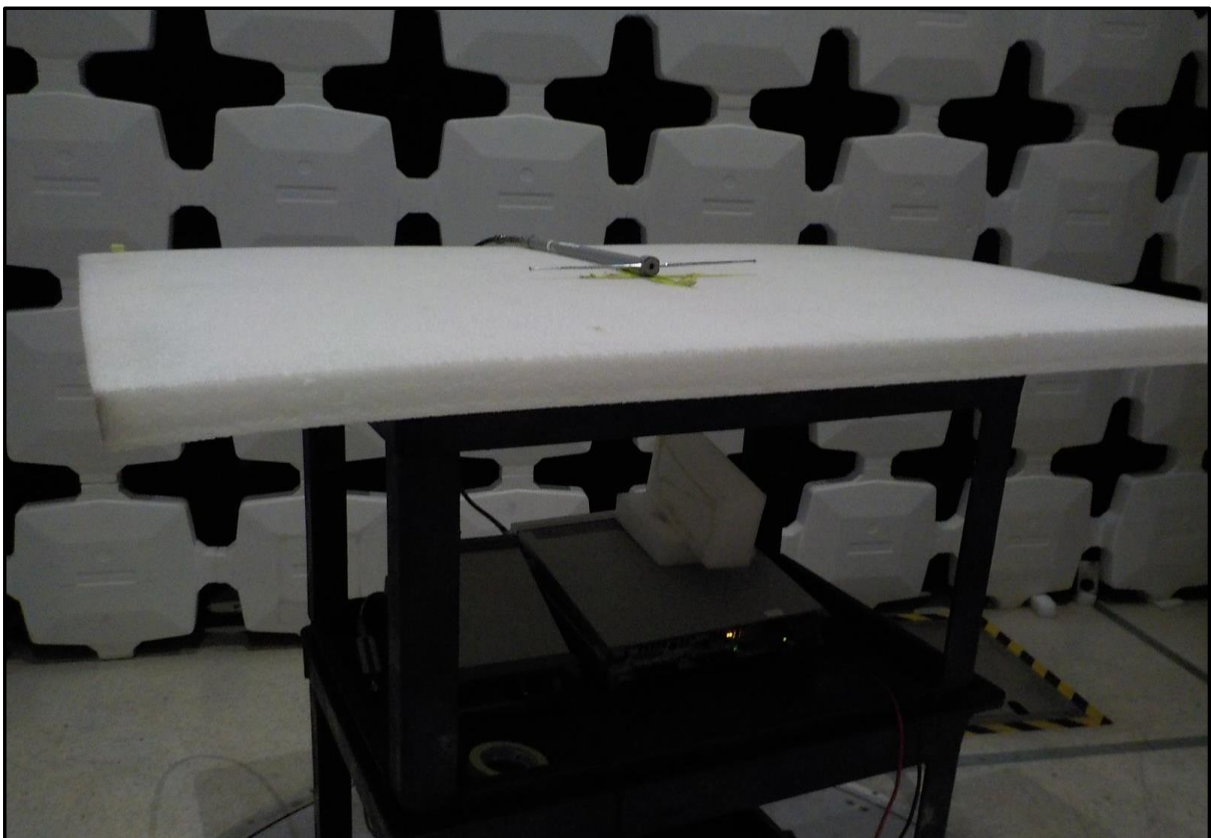
RADIATED POWER (EIRP)



RADIATED POWER (EIRP)



RADIATED POWER (EIRP)



RECEIVER SPURIOUS EMISSIONS



PSA-ESCI 2019.05.10

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

Rx MICS low channel (402.15 MHz) and high channel (404.85 MHz)

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

BSTN0897 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	5000 MHz
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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
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	8-Feb-2019	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cable	MNI	24-Sep-2018	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2-Nov-2018	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2-Nov-2018	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AYD	25-Jan-2018	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFG	5-Jul-2018	12 mo

TEST DESCRIPTION

The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for receive mode. For each configuration, the spectrum was scanned throughout the specified range. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per LP0002:2018). A preamp was used for this test in order to provide sufficient measurement sensitivity.

RECEIVER SPURIOUS EMISSIONS

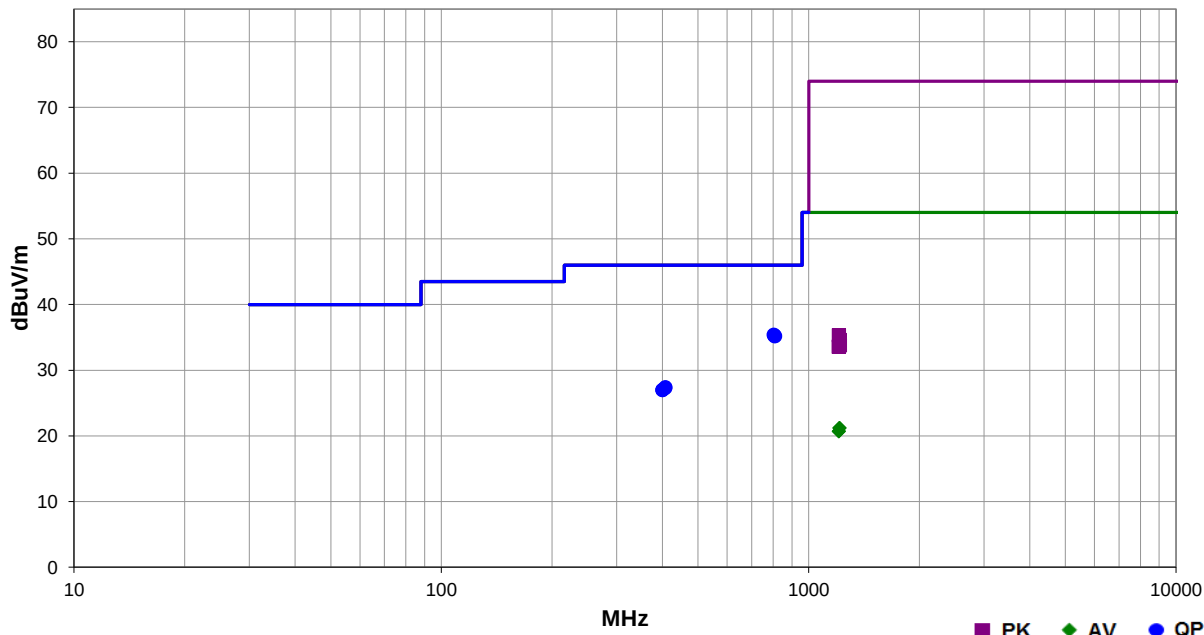


EmiRS 2019.05.20 PSA-ESCI 2019.05.10

Work Order:	BSTN0897	Date:	6-Jun-2019	
Project:	None	Temperature:	21.6 °C	
Job Site:	MN05	Humidity:	58.7% RH	
Serial Number:	176406	Barometric Pres.:	1015 mbar	
Tested by: Andrew Rogstad				
EUT:	Resonate			
Configuration:	1			
Customer:	Boston Scientific Corporation			
Attendees:	James Kippola			
EUT Power:	Battery			
Operating Mode:	Rx MICS low channel (402.15 MHz) and high channel (404.85 MHz)			
Deviations:	None			
Comments:	See data comments for EUT orientation and Rx channel			

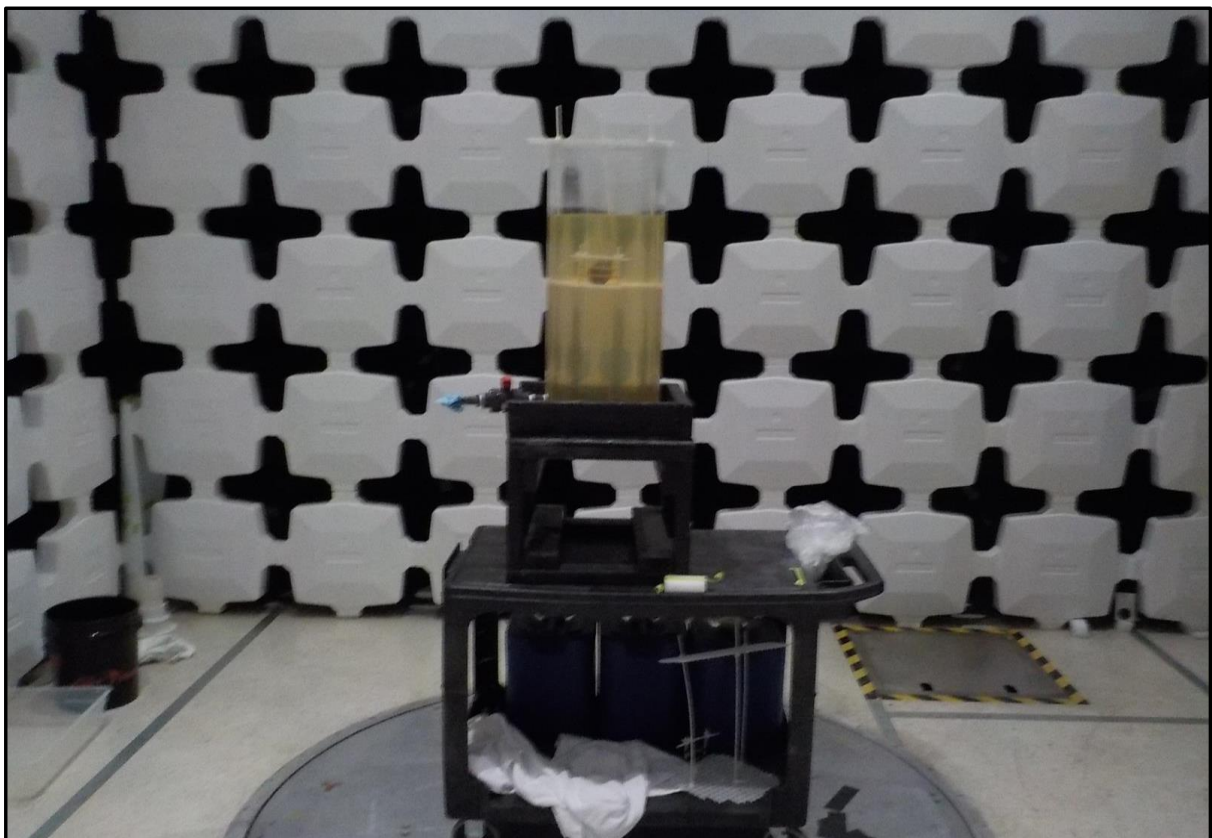
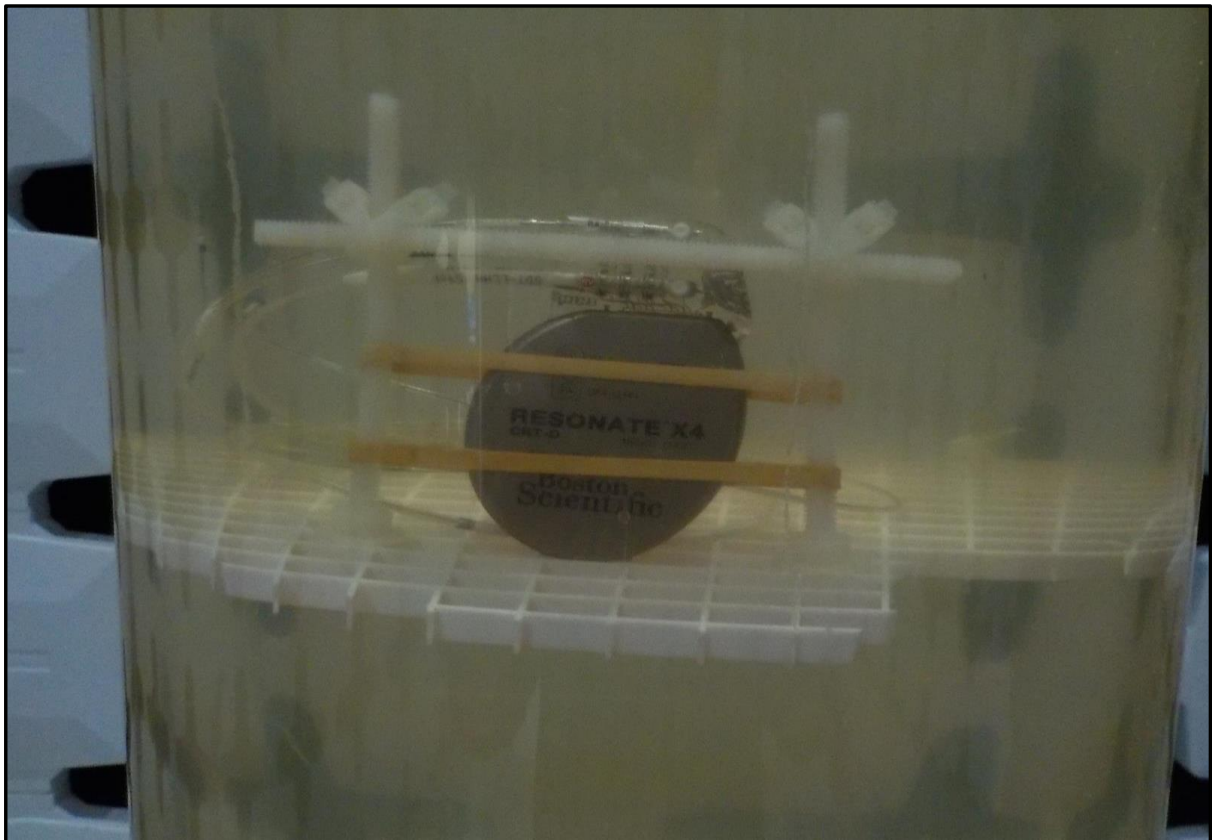
Test Specifications	LP0002:2018	Test Method	LP0002:2018
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Run #	11	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (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
803.226	25.7	9.7	3.8	42.9	3.0	0.0	Horz	QP	0.0	35.4	46.0	-10.6	EUT vert, Low Ch
805.618	25.7	9.6	1.5	12.0	3.0	0.0	Vert	QP	0.0	35.3	46.0	-10.7	EUT vert, Low Ch
809.827	25.6	9.6	1.5	94.0	3.0	0.0	Horz	QP	0.0	35.2	46.0	-10.8	EUT vert, High Ch.
807.292	25.6	9.6	1.5	156.9	3.0	0.0	Vert	QP	0.0	35.2	46.0	-10.8	EUT vert, High Ch.
407.104	25.4	2.0	1.5	167.9	3.0	0.0	Vert	QP	0.0	27.4	46.0	-18.6	EUT vert, High Ch.
406.732	25.3	2.0	1.5	142.0	3.0	0.0	Horz	QP	0.0	27.3	46.0	-18.7	EUT vert, High Ch.
399.677	25.4	1.6	1.4	221.0	3.0	0.0	Horz	QP	0.0	27.0	46.0	-19.0	EUT vert, Low Ch
399.660	25.4	1.6	2.5	311.9	3.0	0.0	Vert	QP	0.0	27.0	46.0	-19.0	EUT vert, Low Ch
1212.217	28.7	-7.5	1.5	77.0	3.0	0.0	Horz	AV	0.0	21.2	54.0	-32.8	EUT vert, High ch.
1213.733	28.7	-7.5	1.5	27.0	3.0	0.0	Vert	AV	0.0	21.2	54.0	-32.8	EUT vert, High ch.
1208.842	28.4	-7.7	1.5	238.0	3.0	0.0	Vert	AV	0.0	20.7	54.0	-33.3	EUT vert, Low Ch.
1208.850	28.4	-7.7	1.5	88.9	3.0	0.0	Horz	AV	0.0	20.7	54.0	-33.3	EUT vert, Low Ch.
1207.783	43.0	-7.7	1.5	238.0	3.0	0.0	Vert	PK	0.0	35.3	74.0	-38.7	EUT vert, Low Ch.
1214.000	42.1	-7.5	1.5	27.0	3.0	0.0	Vert	PK	0.0	34.6	74.0	-39.4	EUT vert, High ch.
1215.283	41.3	-7.5	1.5	77.0	3.0	0.0	Horz	PK	0.0	33.8	74.0	-40.2	EUT vert, High ch.
1207.017	41.3	-7.7	1.5	88.9	3.0	0.0	Horz	PK	0.0	33.6	74.0	-40.4	EUT vert, Low Ch.

RECEIVER SPURIOUS EMISSIONS



RECEIVER SPURIOUS EMISSIONS

