



element

Abbott Laboratories

Gemini System (IPG)

Bluetooth Low Energy (DTS) Radio

FCC 15:247:2021

Report: ABBO0075.5 Rev. 1 Issue Date: February 3, 2022



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CERTIFICATE OF TEST



Last Date of Test: September 24, 2021
Abbott Laboratories
EUT: Gemini System

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2021	ANSI C63.10:2013; KDB 558074 D01 15.247 Measurement Guidance v05r02

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required as EUT is battery powered.
11.6	Duty Cycle	Yes	N/A	
11.8.2	Occupied Bandwidth	Yes	Pass	
11.9.1.1	Output Power	Yes	Pass	
11.9.1.1	Equivalent Isotropic Radiated Power	Yes	Pass	
11.10.2	Power Spectral Density	Yes	Pass	
11.11	Band Edge Compliance	Yes	Pass	
11.11	Spurious Conducted Emissions	Yes	Pass	
11.12.1, 11.13.2, 6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

Per FCC guidance, spurious radiated emissions testing was completed following the guidance in KDB publication 617965 on how to perform testing using tissue equivalent material. Criteria 4) in the test procedure described in KDB publication 617965 was modified to change 403.5 MHz to the operating frequency of Bluetooth LE frequency used in the device.

Approved By:

Adam Bruno, 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. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
01	Corrected serial numbers	2022-01-29	15,20,25,30,35,39
	Added 5VDC via USB	2022-01-29	15,20,25,30,35,39,50,51
	Added LF equipment and adjusted range investigated	2022-01-29	49
	Added comment on data sheet stating why (2) IPG's were used	2022-01-29	50,51
	Updated comment as EUT is battery powered. Added version and revision of KDB.	2022-01-29	2
	Added the above deviation to CoT	2022-01-29	2
	Client provided a clear explanation of the Gemini System which was added to the functional description	2022-01-29	9
	Added comments to explain the reference level offset and how the equipment is operating	2022-01-29	20,25,30,34,39
	Removed note about integration method. Added note stating EUT operating a 100% duty cycle	2022-01-29	50
	Added client provided info into the comments sections of the data	2022-01-29	50-53
	Added that 5VDC via USB is to power the IPG for testing purposes and not actual use.	2022-01-29	all

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

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

Canada

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

European Union

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

United Kingdom

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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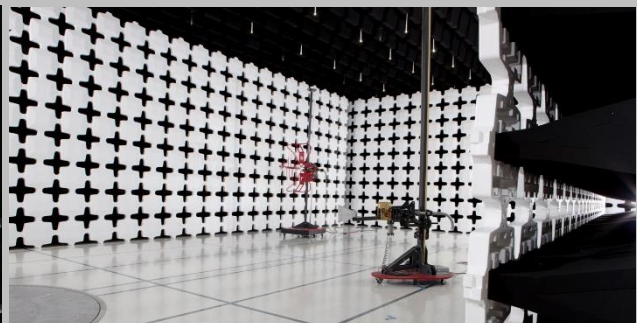
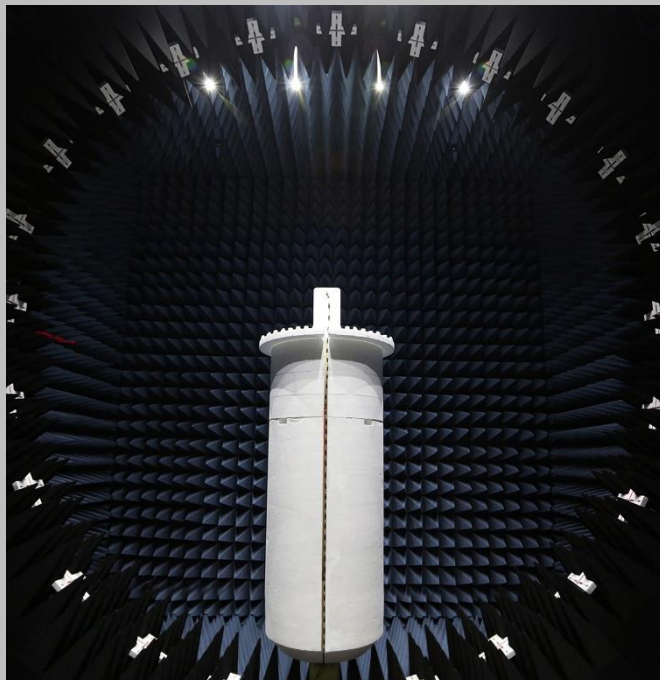
[Texas](#)

[Washington](#)

FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-11 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
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
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/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157



MEASUREMENT UNCERTAINTY



Measurement Uncertainty

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

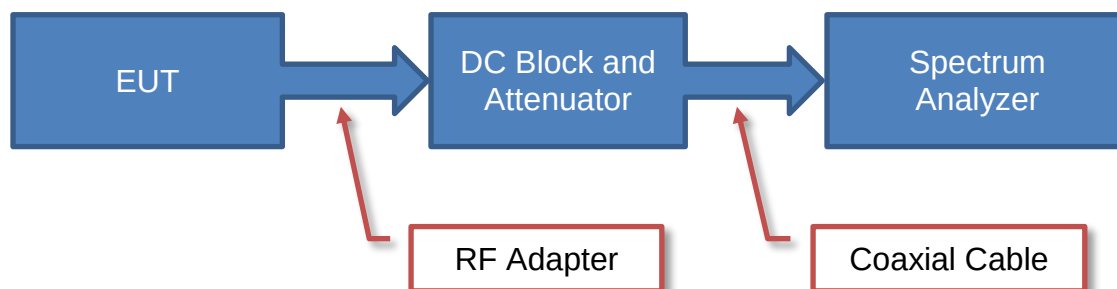
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. 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	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 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)	5.1 dB	-5.1 dB
AC Powerline Conducted Emissions (dB)	3.1 dB	-3.1 dB

TEST SETUP BLOCK DIAGRAMS

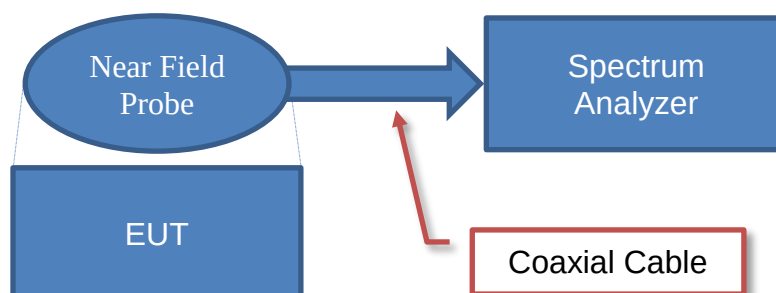
Antenna Port Conducted Measurements



Sample Calculation

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements

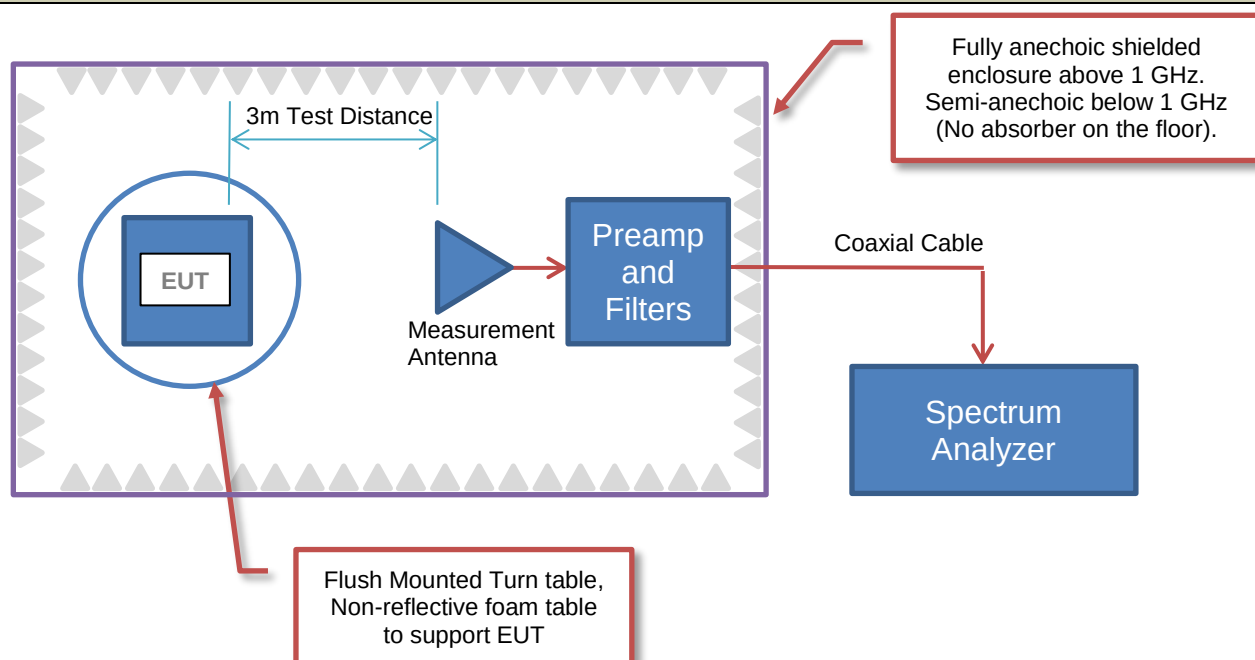


Sample Calculation

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

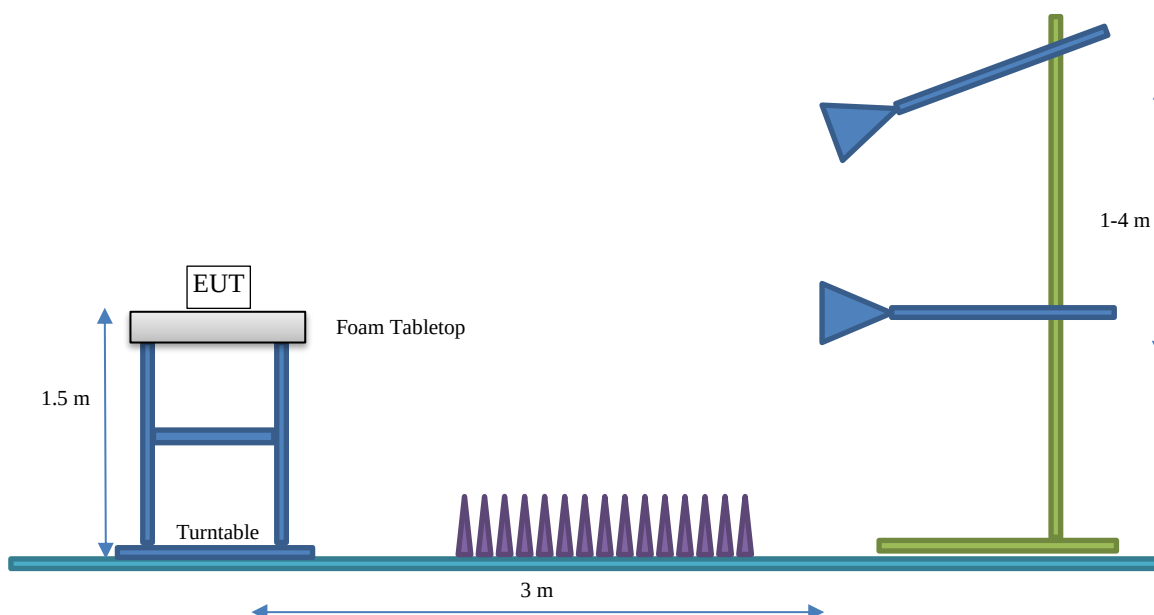
TEST SETUP BLOCK DIAGRAMS

Spurious Radiated Emissions



Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Abbott Laboratories
Address:	6901 Preston Rd
City, State, Zip:	Plano, TX 75024
Test Requested By:	Jeremiah Darden
EUT:	Gemini System
First Date of Test:	September 20, 2021
Last Date of Test:	September 24, 2021
Receipt Date of Samples:	September 20, 2021
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 Gemini rechargeable neurostimulation implantable pulse generator (IPG) is designed to deliver low-intensity electrical impulses to nerve structures. The system is intended to be used with leads and associated extensions that are compatible with the Gemini system. The IPG uses Bluetooth Low Energy (BLE) to communicate with a commercial off the shelf programmer/controller running Abbott software.

Gemini system background information: Components include a small rechargeable Implantable Pulse Generator (IPG), wireless portable Charger (Chgr) and Programmer software application for iOS-based Clinician Programmer (CP) and Patient Controller (PC) hardware. System components will be designed for compatibility with existing leads, extensions and accessories.

Testing Objective:

To demonstrate compliance of the Bluetooth radio Low Energy (DTS) radio to FCC 15.247 requirements.

CONFIGURATIONS



Configuration ABBO0075- 57

Software/Firmware Running during test	
Description	Version
IPG FW	80

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
IPG	Abbott Laboratories	32400/600054127	18976216
IPG	Abbott Laboratories	32400/600054127	18976214

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
IPG Lead (Asset 10715)	No	0.9m	No	IPG	Lead
IPG Lead (Asset 10716)	No	0.9m	No	IPG	Lead

Configuration ABBO0075- 59

Software/Firmware Running during test	
Description	Version
IPG FW	80

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
IPG	Abbott Laboratories	32400/600054127	18953849

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
Laptop	Dell	Latitude	98JL8S2

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
FTDI Cable (USB to UART Adapter)	Yes	1.5m	No	IPG	Laptop

POWER SETTINGS AND ANTENNAS



The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
Custom Monopole Antenna	Abbott	2400-2500	-2.92

POWER SETTINGS

Radio	Modulation	Channel	Power Setting (dBm)
BLE/GFSK	1 Mbps	Ch. 37 (2402 MHz)	6
	1 Mbps	Ch. 17 (2440 MHz)	6
	1 Mbps	Ch. 39 (2480 MHz)	6
	2 Mbps	Ch. 37 (2402 MHz)	6
	2 Mbps	Ch. 17 (2440 MHz)	6
	2 Mbps	Ch. 39 (2480 MHz)	6

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2021-09-20	Occupied 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.
2	2021-09-20	Output Power	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	2021-09-20	Equivalent Isotropic Radiated Power	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	2021-09-20	Power Spectral Density	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	2021-09-20	Band Edge Compliance	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	2021-09-20	Spurious 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.
7	2021-09-24	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE



TEST DESCRIPTION

The Duty Cycle (x) were measured for each of the EUT operating modes. The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum.

The duty cycle was calculated by dividing the transmission pulse duration (T) by the total period of a single on and total off time.

The EUT operates at 100% Duty Cycle.

OCCUPIED BANDWIDTH



XMIT 2020.12.30.0

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
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	2021-09-13	2022-09-13
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA18E 1913	TZV	2021-09-15	2022-09-15
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06

TEST DESCRIPTION

The EUT was set to the channels and modes listed in the datasheet.

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99.0% occupied bandwidth was also measured at the same time which can be needed during Output Power depending on the applicable method.

OCCUPIED BANDWIDTH



TSMTx 2021.03.19.1 XMR 2020.12.30.0

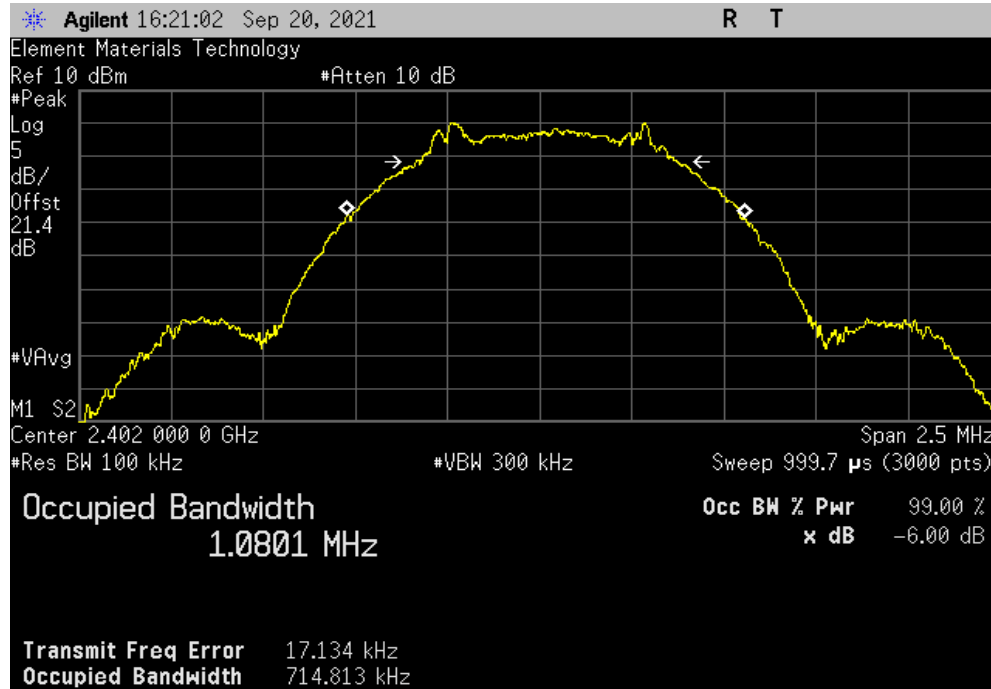
EUT: Gemini System (IPG)		Work Order: ABBO0075		
Serial Number: 18953849		Date: 20-Sep-21		
Customer: Abbott Laboratories		Temperature: 21.6 °C		
Attendees: Jeremiah Darden		Humidity: 49.4% RH		
Project: None		Barometric Pres.: 1015 mbar		
Tested by: Mark Baytan	Power: 5VDC via USB	Job Site: TX02		
TEST SPECIFICATIONS		Test Method		
FCC 15.247:2021		ANSI C63.10:2013		
COMMENTS				
21.4 dB reference level offset includes: DC block, 20dB attenuator, RF test cable, patch cable. Transmitting Bluetooth LE. See comments for channel and data rate. 5VDC via USB is used to power the IPG for testing purposes and does not represent actual use.				
DEVIATIONS FROM TEST STANDARD				
None				
Configuration #	59	Signature 		
		Value	Limit (±) Result	
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		714.813 kHz	500 kHz	Pass
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz		700.12 kHz	500 kHz	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		728.812 kHz	500 kHz	Pass
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		1.283 MHz	500 kHz	Pass
BLE/GFSK 2 Mbps Mid Channel, 2440 MHz		1.261 MHz	500 kHz	Pass
BLE/GFSK 2 Mbps High Channel, 2480 MHz		1.331 MHz	500 kHz	Pass

OCCUPIED BANDWIDTH

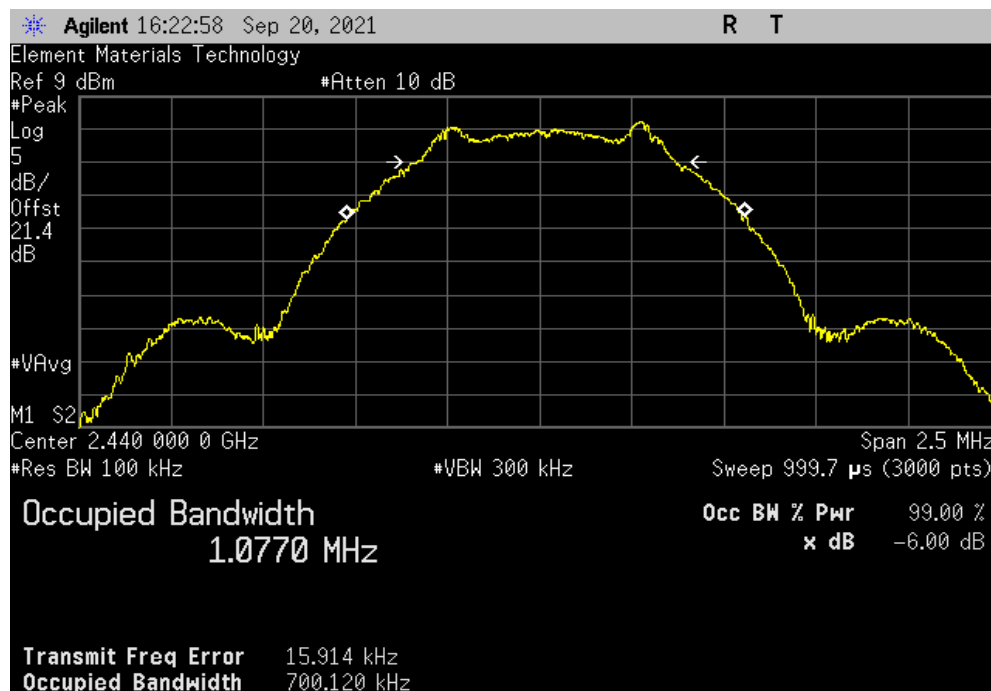


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				714.813 kHz	500 kHz	Pass



BLE/GFSK 1 Mbps Mid Channel, 2440 MHz						
				Value	Limit (≥)	Result
				700.12 kHz	500 kHz	Pass

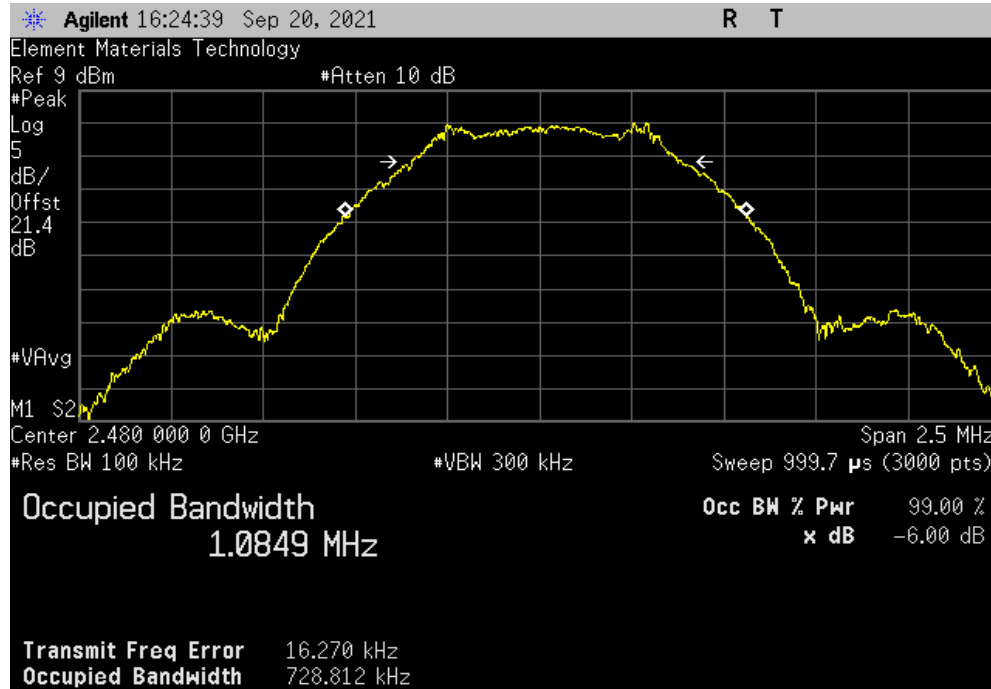


OCCUPIED BANDWIDTH

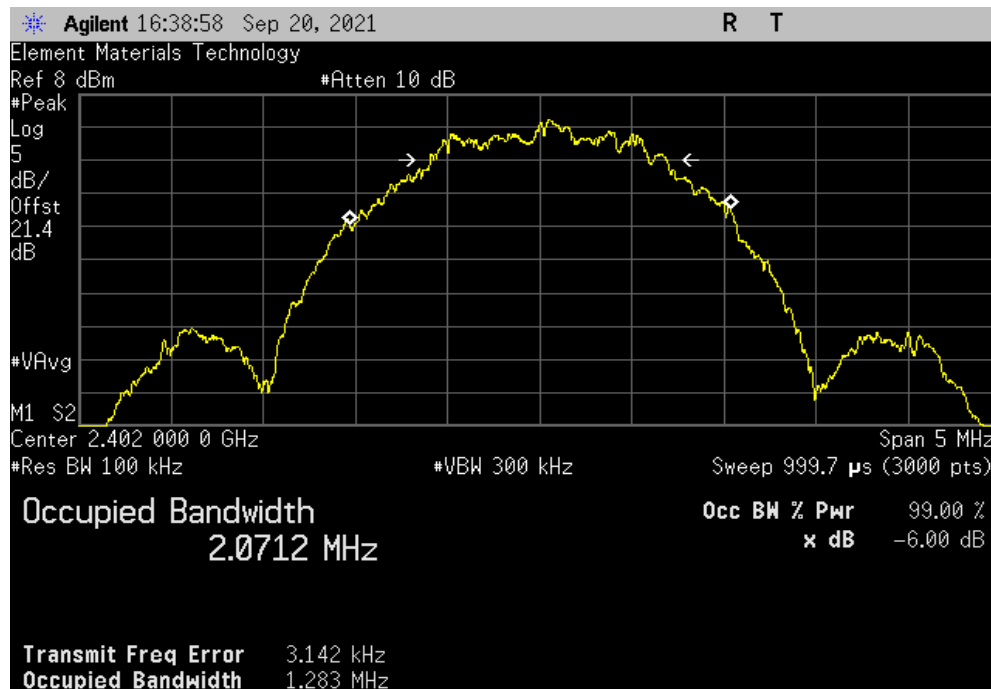


TUTX 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				728.812 kHz	500 kHz	Pass



BLE/GFSK 2 Mbps Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				1.283 MHz	500 kHz	Pass

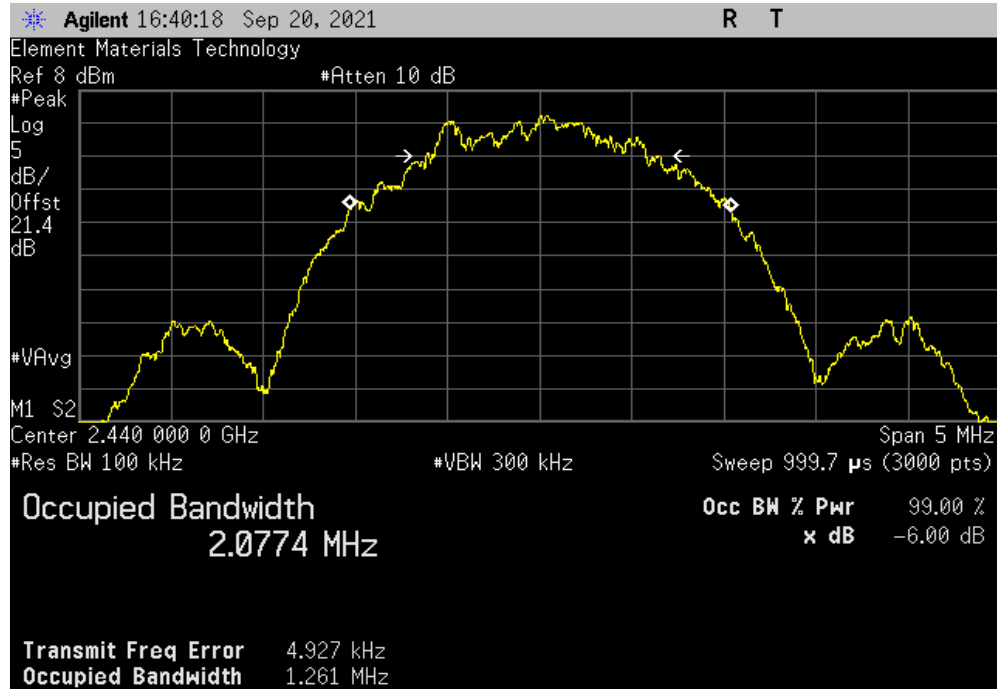


OCCUPIED BANDWIDTH

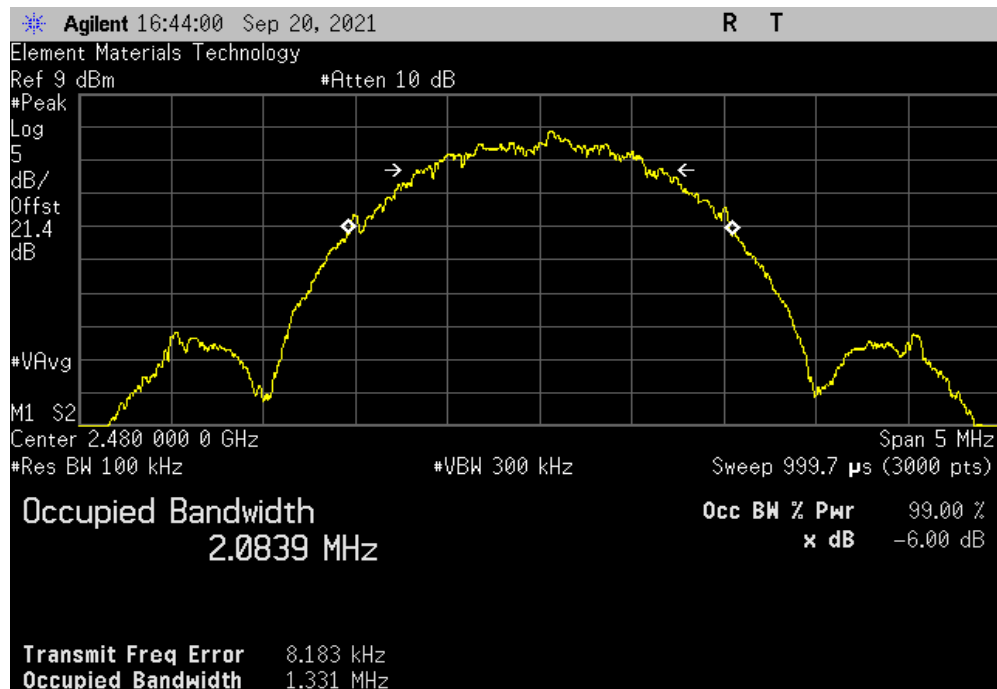


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps Mid Channel, 2440 MHz						
				Value	Limit (≥)	Result
				1.261 MHz	500 kHz	Pass



BLE/GFSK 2 Mbps High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				1.331 MHz	500 kHz	Pass



OUTPUT POWER



XMit 2020.12.30.0

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
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	2021-09-13	2022-09-13
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA18E 1913	TZV	2021-09-15	2022-09-15
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

OUTPUT POWER



TSTx 2021.03.19.1 XMR 2020.12.30.0

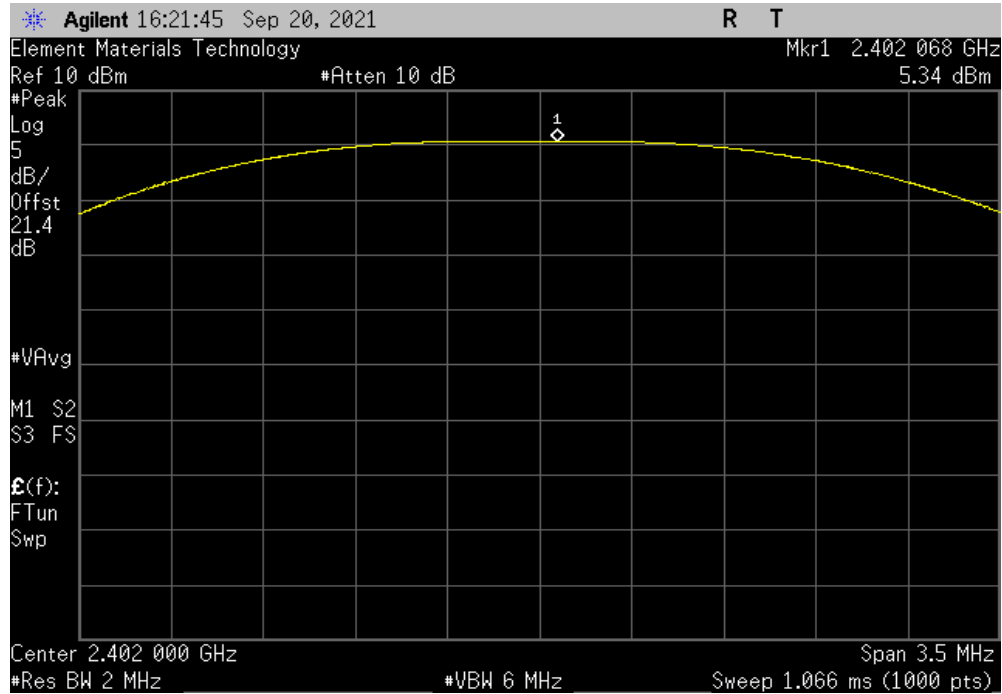
EUT: Gemini System (IPG)		Work Order: ABBO0075	
Serial Number: 18953849		Date: 20-Sep-21	
Customer: Abbott Laboratories		Temperature: 21.9 °C	
Attendees: Jeremiah Darden		Humidity: 48.1% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Mark Baytan		Power: 5VDC via USB	
		Job Site: TX02	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
21.4 dB reference level offset includes: DC block, 20dB attenuator, RF test cable, patch cable. Transmitting Bluetooth LE. See comments for channel and data rate. 5VDC via USB is used to power the IPG for testing purposes and does not represent actual use.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	59	Signature 	
		Out Pwr (dBm)	Limit (dBm)
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		5.344	30
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz		5.185	30
BLE/GFSK 1 Mbps High Channel, 2480 MHz		4.902	30
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		5.431	30
BLE/GFSK 2 Mbps Mid Channel, 2440 MHz		5.283	30
BLE/GFSK 2 Mbps High Channel, 2480 MHz		4.992	30
			Result
			Pass
			Pass
			Pass
			Pass
			Pass
			Pass

OUTPUT POWER

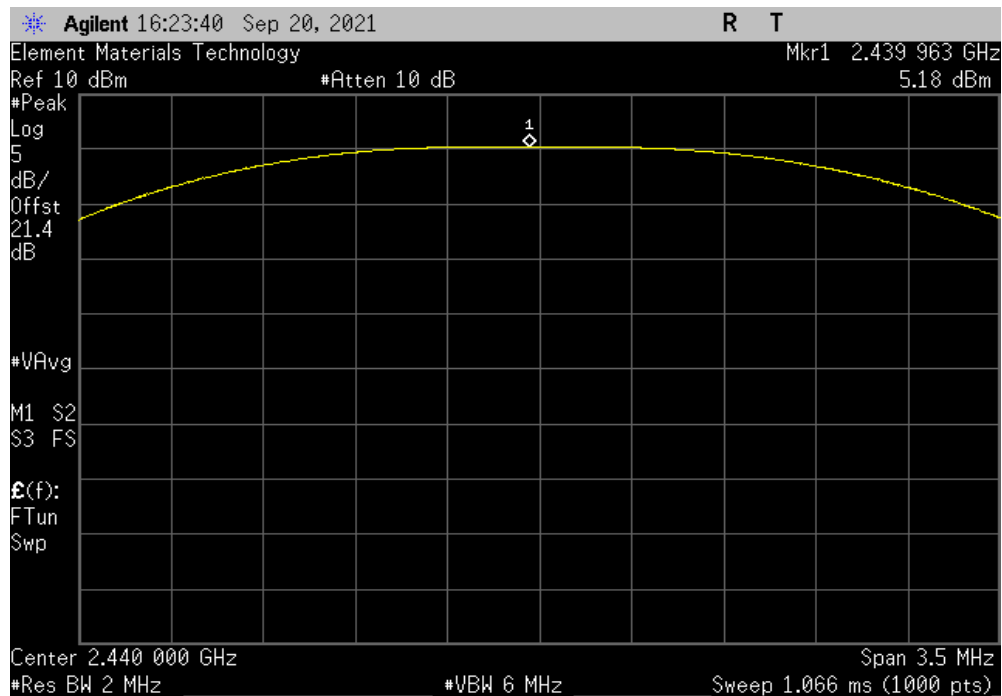


TbTx 2021.03.19.1 XM8 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.344	30	Pass



BLE/GFSK 1 Mbps Mid Channel, 2440 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.185	30	Pass

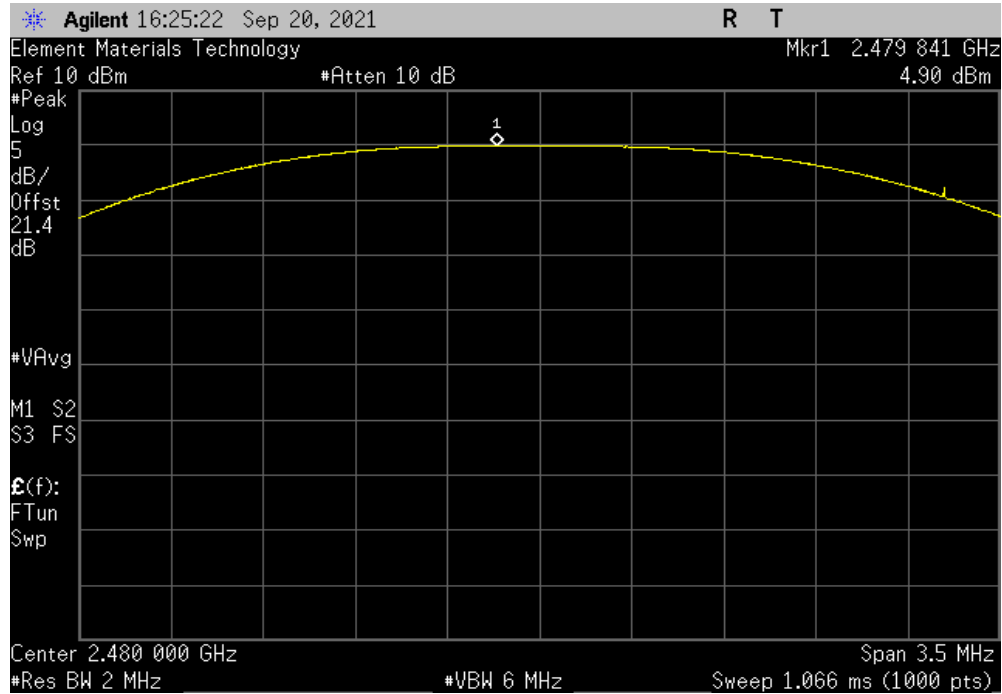


OUTPUT POWER

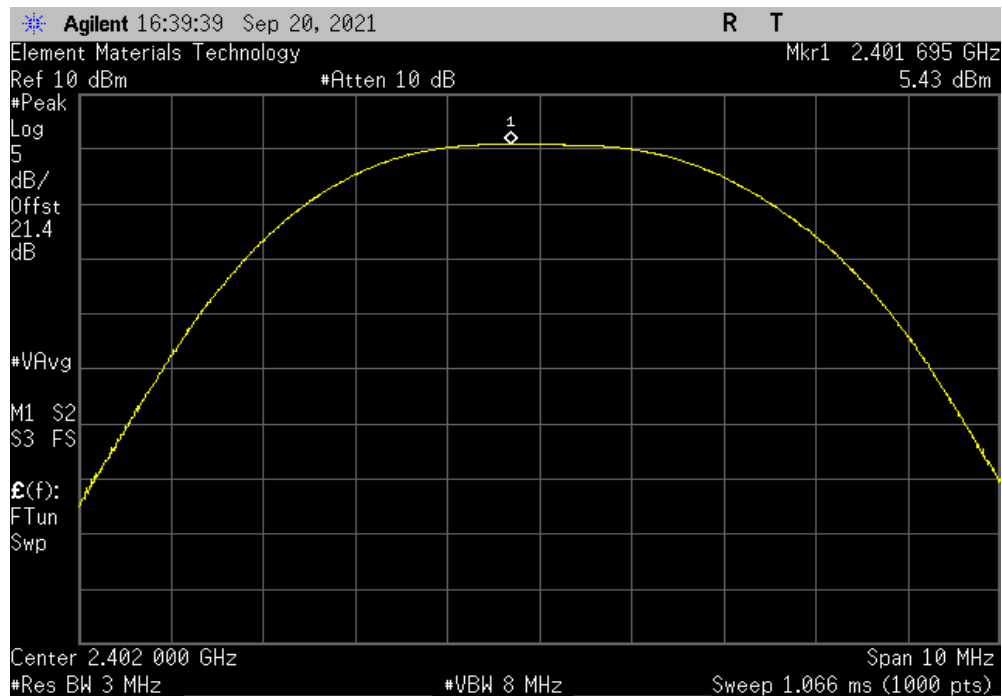


TbTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.902	30	Pass



BLE/GFSK 2 Mbps Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.431	30	Pass

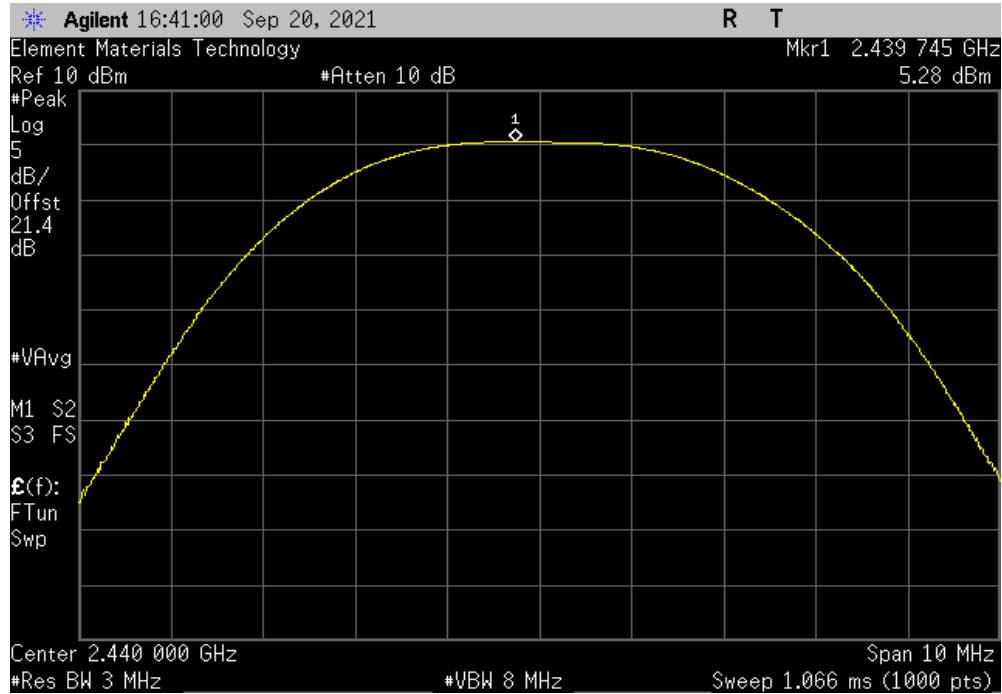


OUTPUT POWER

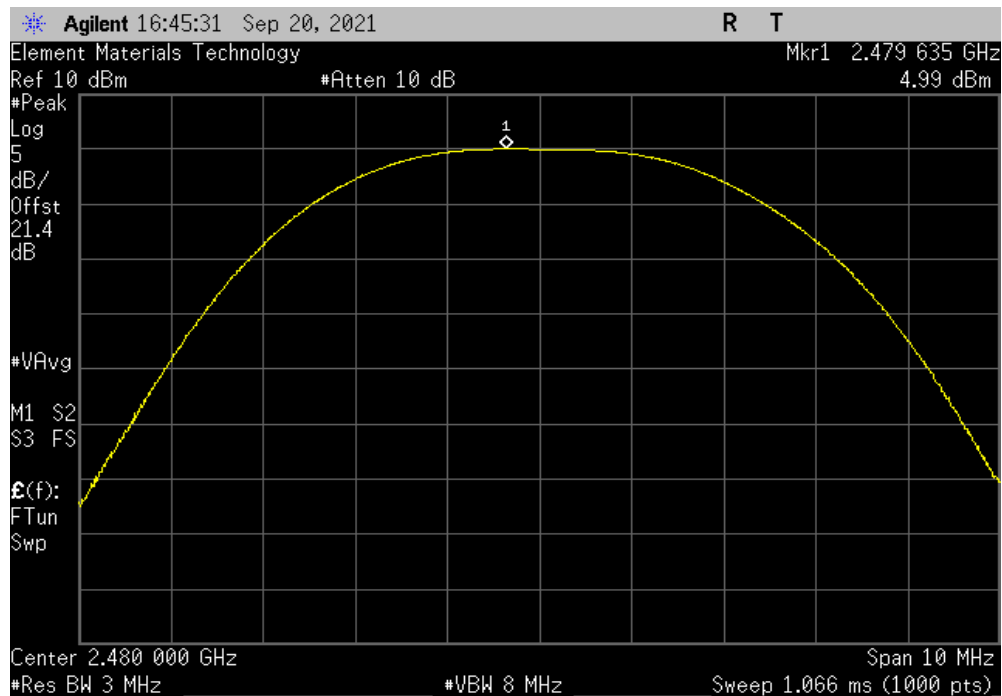


TUTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps Mid Channel, 2440 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				5.283	30	Pass



BLE/GFSK 2 Mbps High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.992	30	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



XMIT 2020.12.30.0

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TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	2021-09-13	2022-09-13
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA18E 1913	TZV	2021-09-15	2022-09-15
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06

TEST DESCRIPTION

The transmit frequency was set to the required channels in each band. The transmit power was set to its default maximum.

Prior to measuring peak transmit power the DTS bandwidth (B) was measured.

The method found in ANSI C63.10:2013 Section 11.9.1.1 was used because the RBW on the analyzer was greater than the DTS Bandwidth of the radio.

Equivalent Isotropic Radiated Power (EIRP) = Max Measured Power + Antenna gain (dBi)

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



TestTx 2021.03.19.1 XMR 2020.12.30.0

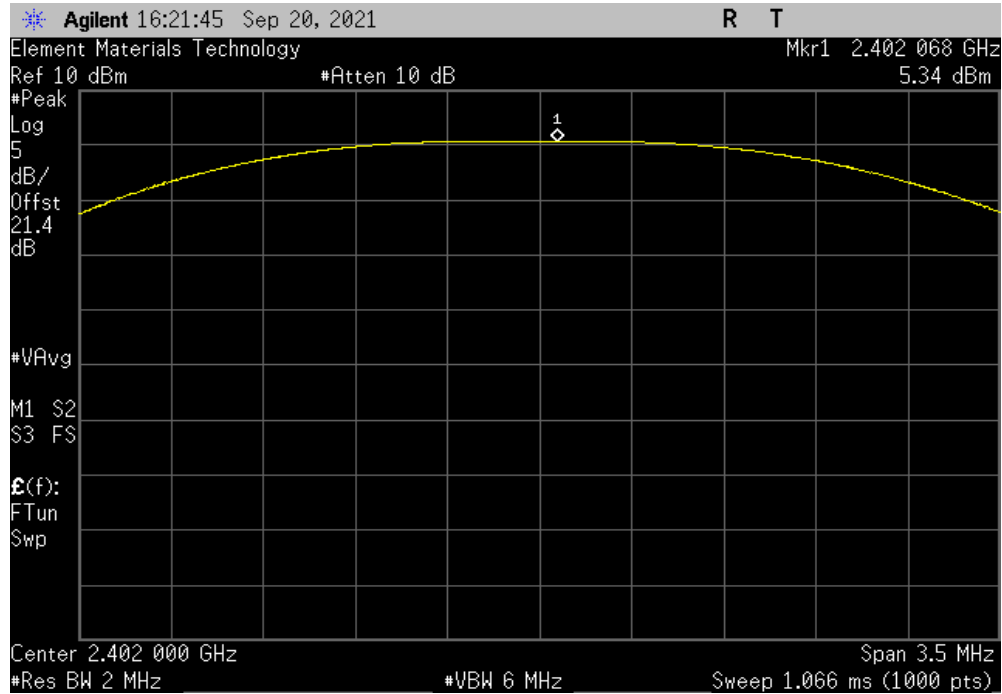
EUT: Gemini System (IPG)		Work Order: ABBO0075	
Serial Number: 18953849		Date: 20-Sep-21	
Customer: Abbott Laboratories		Temperature: 24.6 °C	
Attendees: Jeremiah Darden		Humidity: 41.3% RH	
Project: None		Barometric Pres.: 1015 mbar	
Tested by: Mark Baytan	Power: 5VDC via USB	Job Site: TX02	
TEST SPECIFICATIONS			
FCC 15.247:2021		Test Method	
		ANSI C63.10:2013	
COMMENTS			
21.4 dB reference level offset includes: DC block, 20dB attenuator, RF test cable, patch cable. Transmitting Bluetooth LE. See comments for channel and data rate. 5VDC via USB is used to power the IPG for testing purposes and does not represent actual use.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	59	Signature 	
		Out Pwr (dBm)	Antenna Gain (dBi)
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		5.344	-2.92
BLE/GFSK 1 Mbps Mid Channel, 2440 MHz		5.185	-2.92
BLE/GFSK 1 Mbps High Channel, 2480 MHz		4.902	-2.92
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		5.431	-2.92
BLE/GFSK 2 Mbps Mid Channel, 2440 MHz		5.283	-2.92
BLE/GFSK 2 Mbps High Channel, 2480 MHz		4.992	-2.92
		EIRP (dBm)	EIRP Limit (dBm)
		2.424	36
		2.265	36
		1.982	36
		2.511	36
		2.363	36
		2.072	36
			Result
			Pass
			Pass
			Pass
			Pass
			Pass
			Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

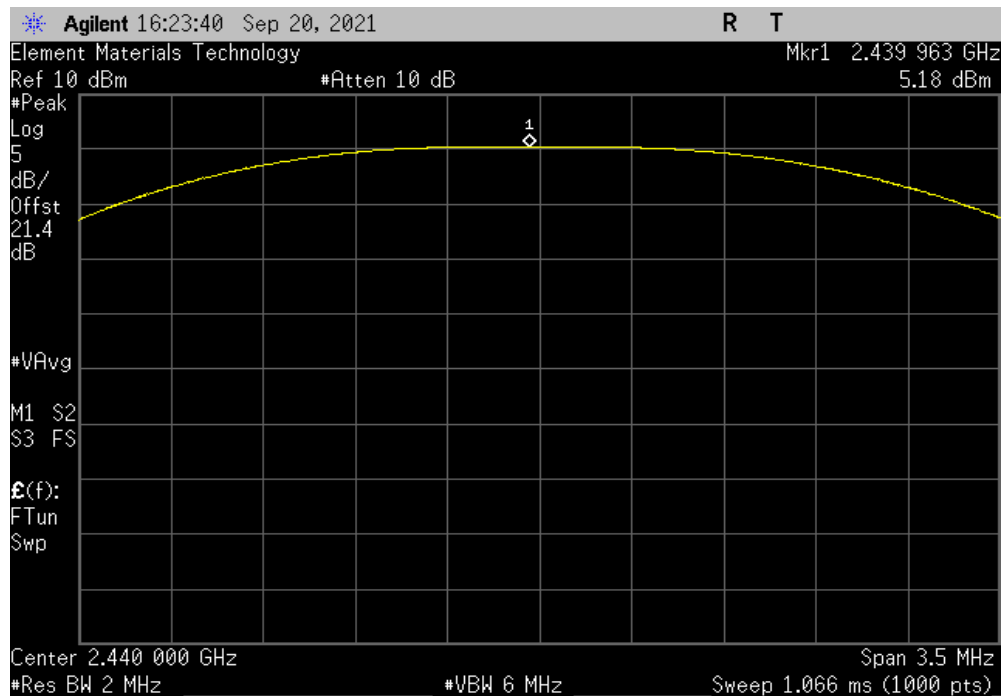


TUTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.344	-2.92	2.424	36	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2440 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.185	-2.92	2.265	36	Pass	

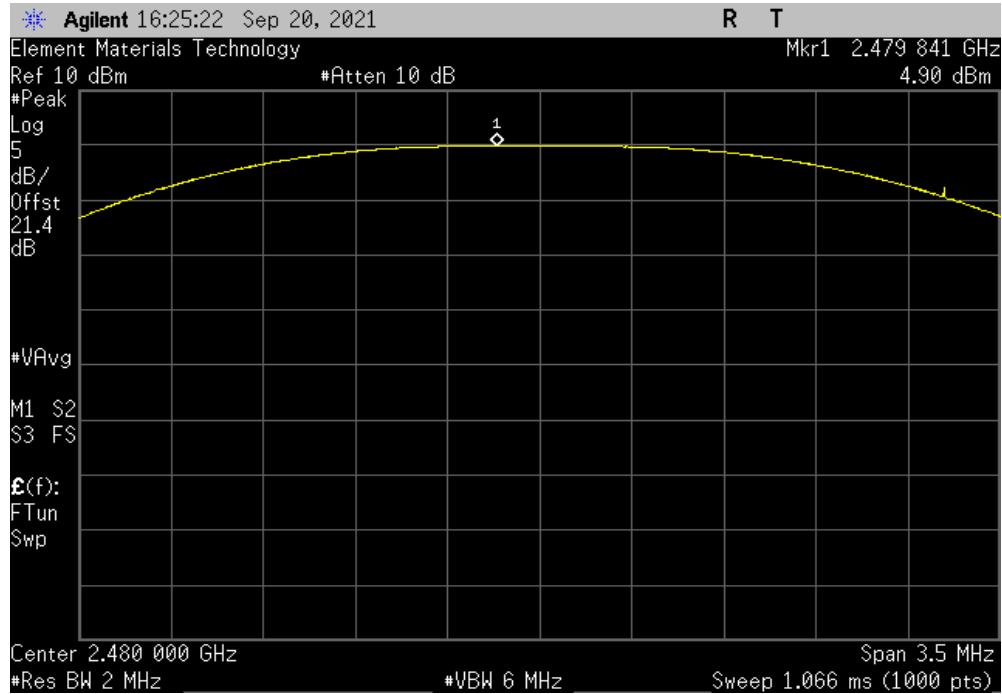


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

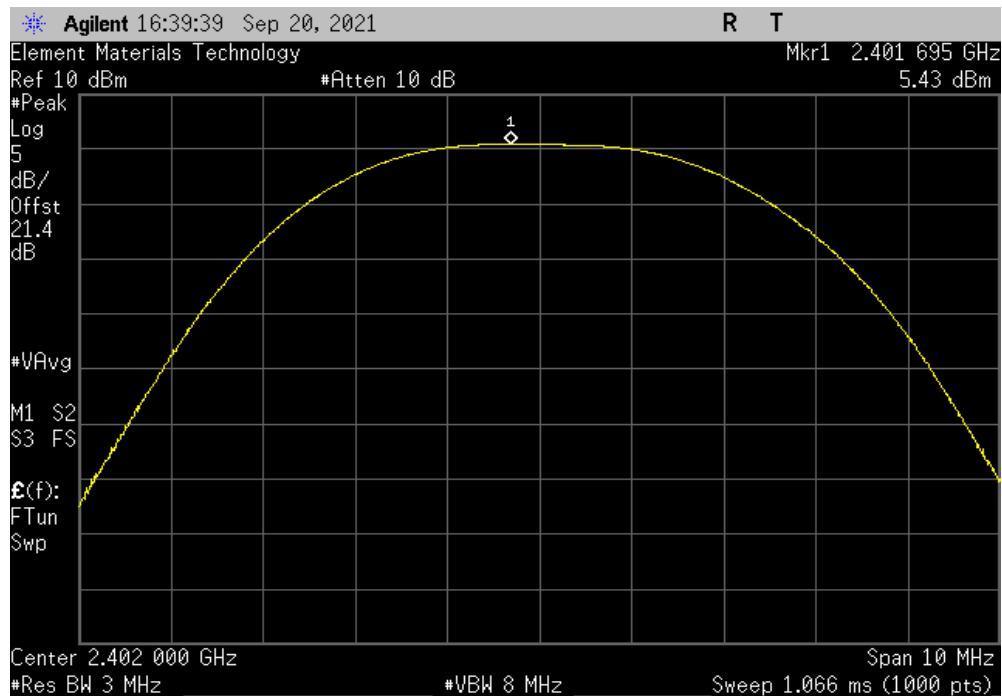


TbTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	4.902	-2.92	1.982	36	Pass	



BLE/GFSK 2 Mbps Low Channel, 2402 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.431	-2.92	2.511	36	Pass	

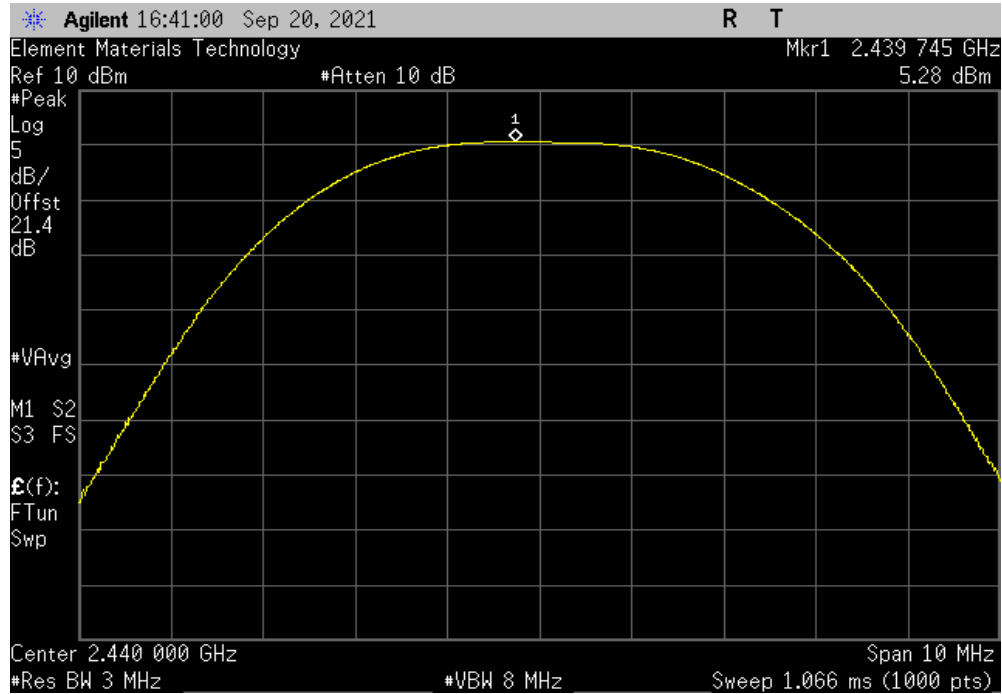


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

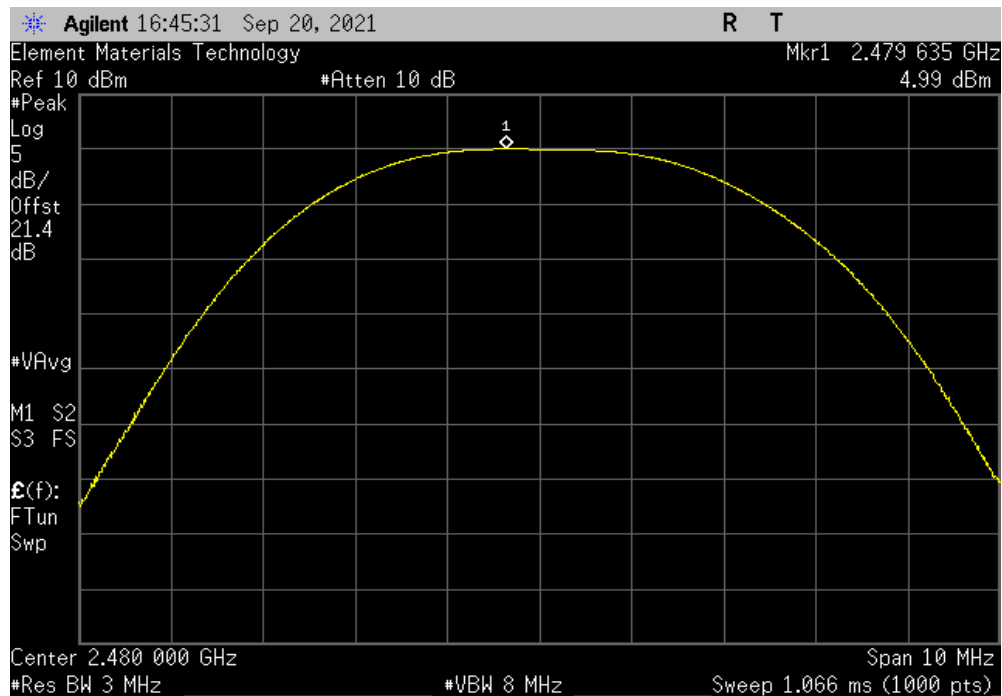


TUTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps Mid Channel, 2440 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	5.283	-2.92	2.363	36	Pass	



BLE/GFSK 2 Mbps High Channel, 2480 MHz						
	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result	
	4.992	-2.92	2.072	36	Pass	



POWER SPECTRAL DENSITY

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
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	2021-09-13	2022-09-13
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA18E 1913	TZV	2021-09-15	2022-09-15
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06

TEST DESCRIPTION

The maximum power spectral density measurements was measured using the channels and modes as called out on the following data sheets.

Per the procedure outlined in ANSI C63.10 the peak power spectral density was measured in a 3 kHz RBW.

POWER SPECTRAL DENSITY



TSMTx 2021.03.19.1 XMR 2020.12.30.0

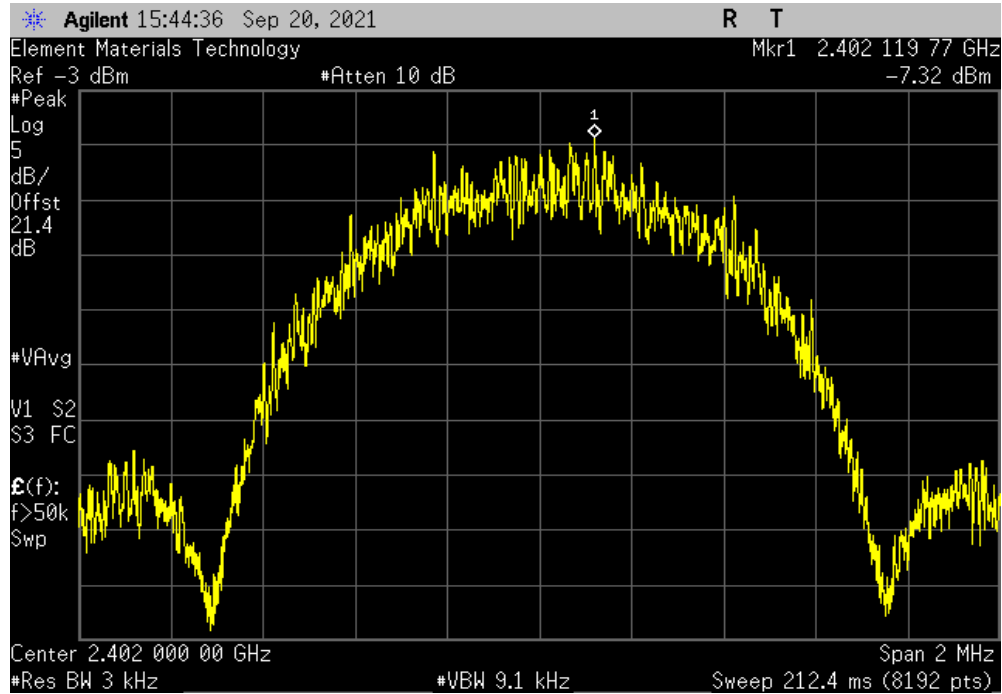
EUT: Gemini System (IPG)		Work Order: ABBO0075	
Serial Number: 18953849		Date: 20-Sep-21	
Customer: Abbott Laboratories		Temperature: 24.2 °C	
Attendees: Jeremiah Darden		Humidity: 41.4% RH	
Project: None		Barometric Pres.: 1014 mbar	
Tested by: Mark Baytan	Power: 5VDC via USB	Job Site: TX02	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
21.4 dB reference level offset includes: DC block, 20dB attenuator, RF test cable, patch cable. Transmitting Bluetooth LE. See comments for channel and data rate. 5VDC via USB is used to power the IPG for testing purposes and does not represent actual use.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	59	Signature 	
		Value dBm/3kHz	Limit < dBm/3kHz
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-7.315	8
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		-7.921	8
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-7.019	8
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		-9.571	8
BLE/GFSK 2 Mbps Mid Channel, 2442 MHz		-11.142	8
BLE/GFSK 2 Mbps High Channel, 2480 MHz		-10.196	8
			Results
			Pass
			Pass
			Pass
			Pass
			Pass
			Pass

POWER SPECTRAL DENSITY

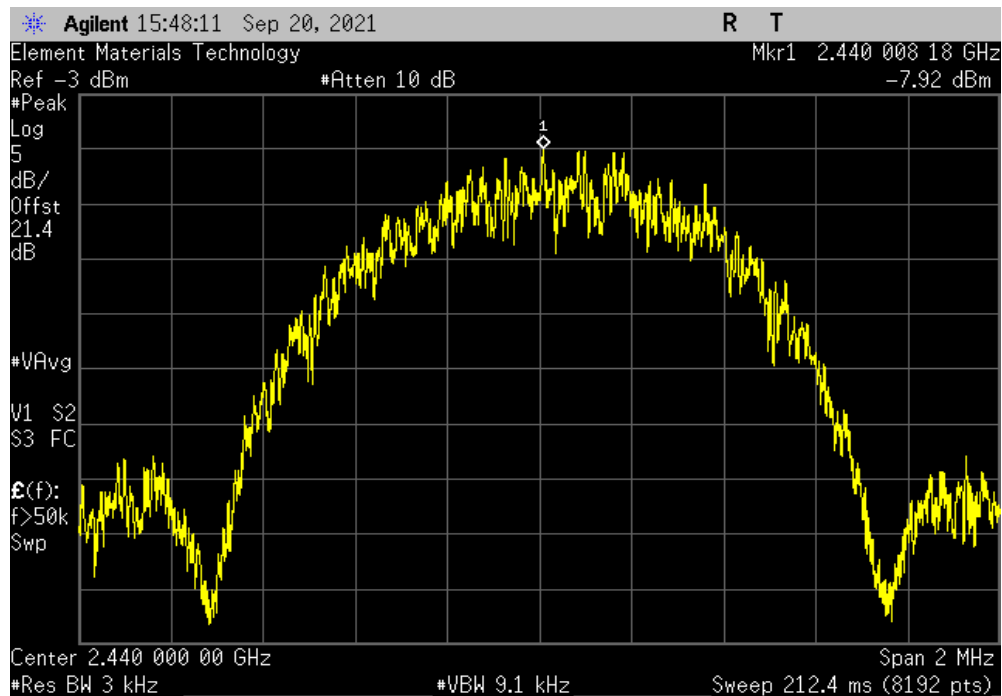


TbTx 2021.03.19.1 XM8 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-7.315	8	Pass			



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-7.921	8	Pass			

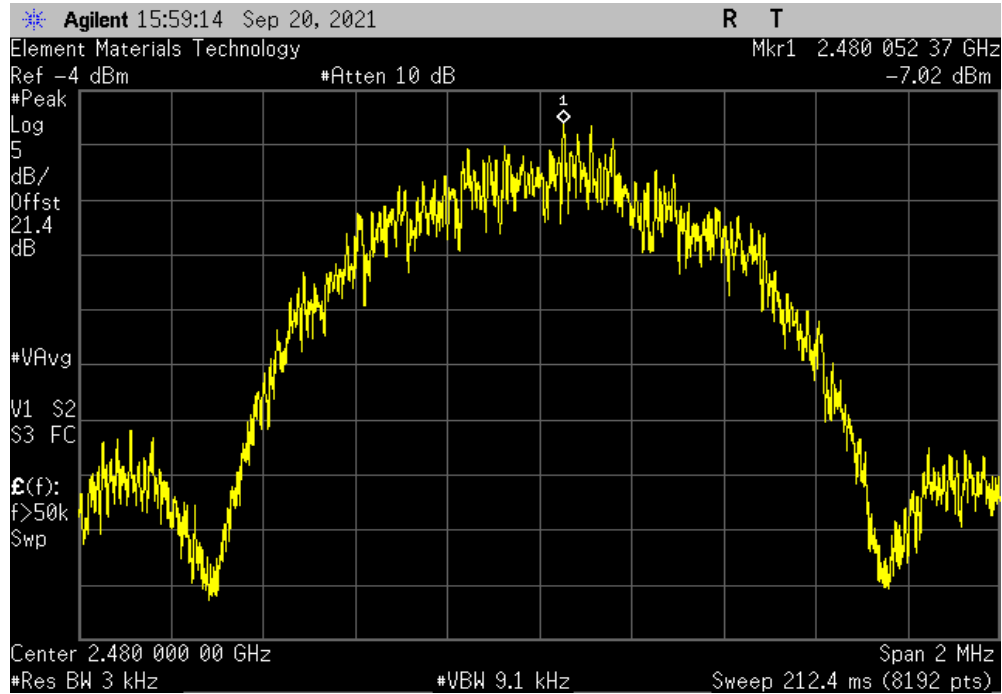


POWER SPECTRAL DENSITY

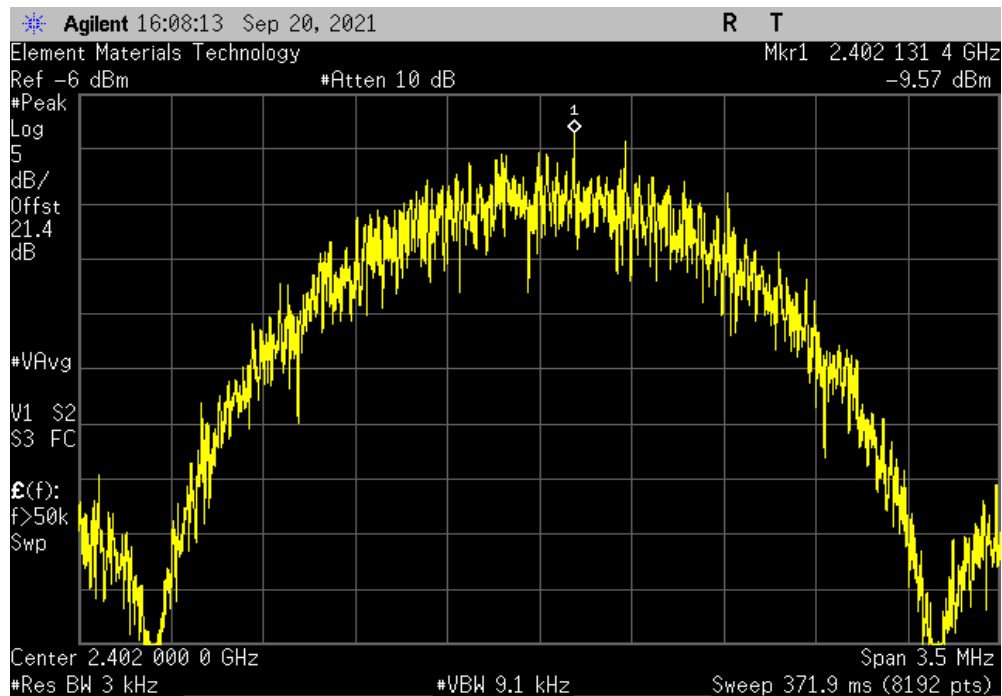


TbTx 2021.03.10.1 XM8 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-7.019	8	Pass			



BLE/GFSK 2 Mbps Low Channel, 2402 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-9.571	8	Pass			

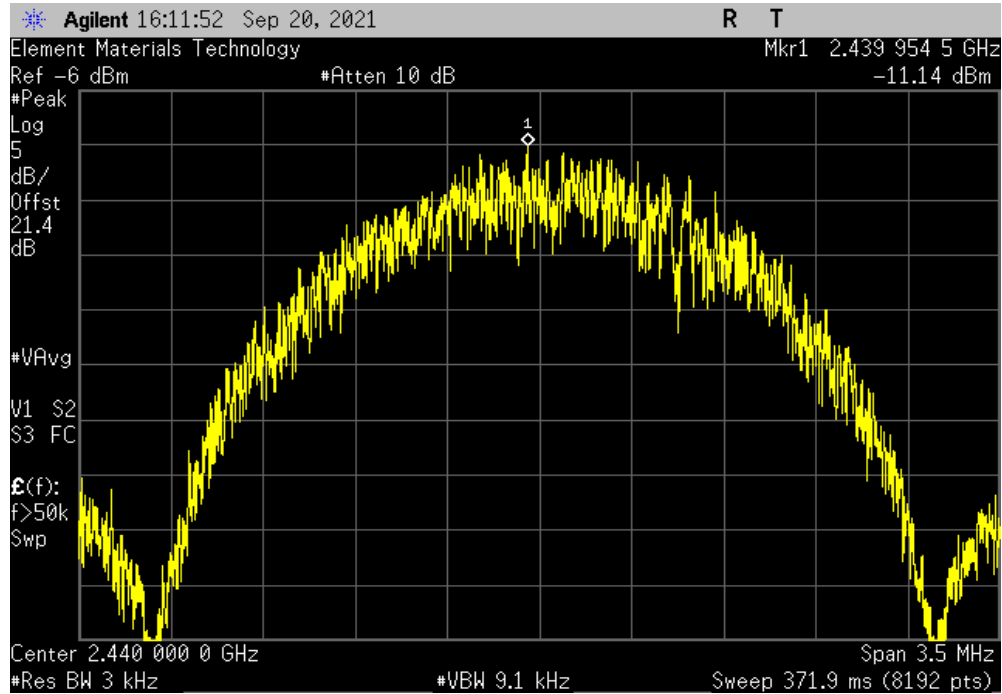


POWER SPECTRAL DENSITY

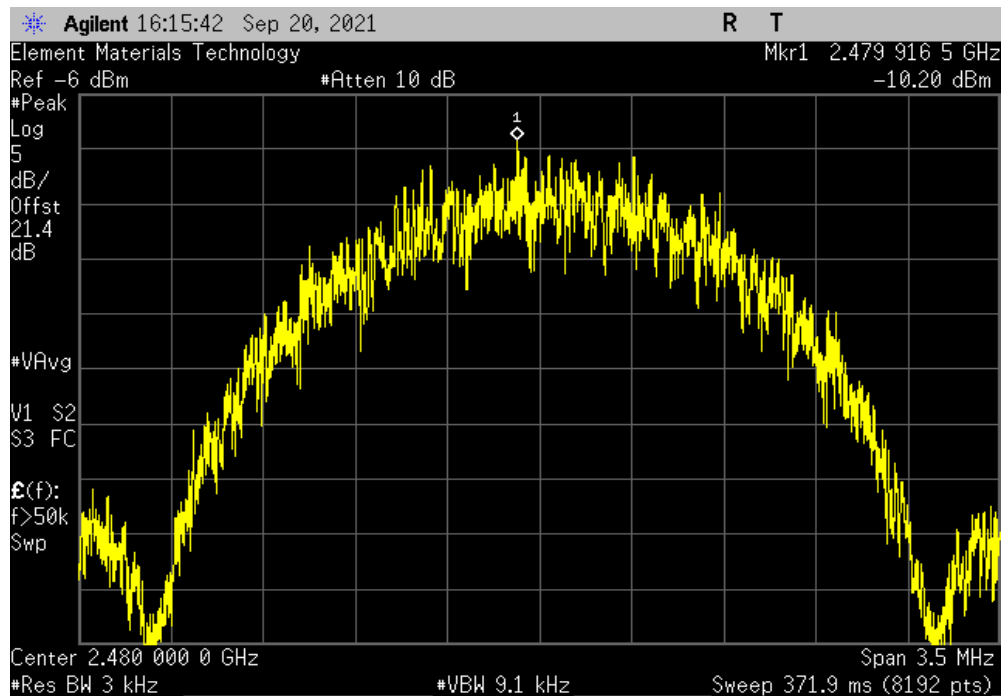


TUTx 2021.03.19.1 XM8 2020.12.30.0

BLE/GFSK 2 Mbps Mid Channel, 2442 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-11.142	8	Pass			



BLE/GFSK 2 Mbps High Channel, 2480 MHz						
	Value	Limit	Results			
	dBm/3kHz	< dBm/3kHz				
	-10.196	8	Pass			



BAND EDGE COMPLIANCE

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
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	2021-09-13	2022-09-13
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA18E 1913	TZV	2021-09-15	2022-09-15
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06

TEST DESCRIPTION

The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

BAND EDGE COMPLIANCE



TSTx 2021.03.19.1 XMR 2020.12.30.0

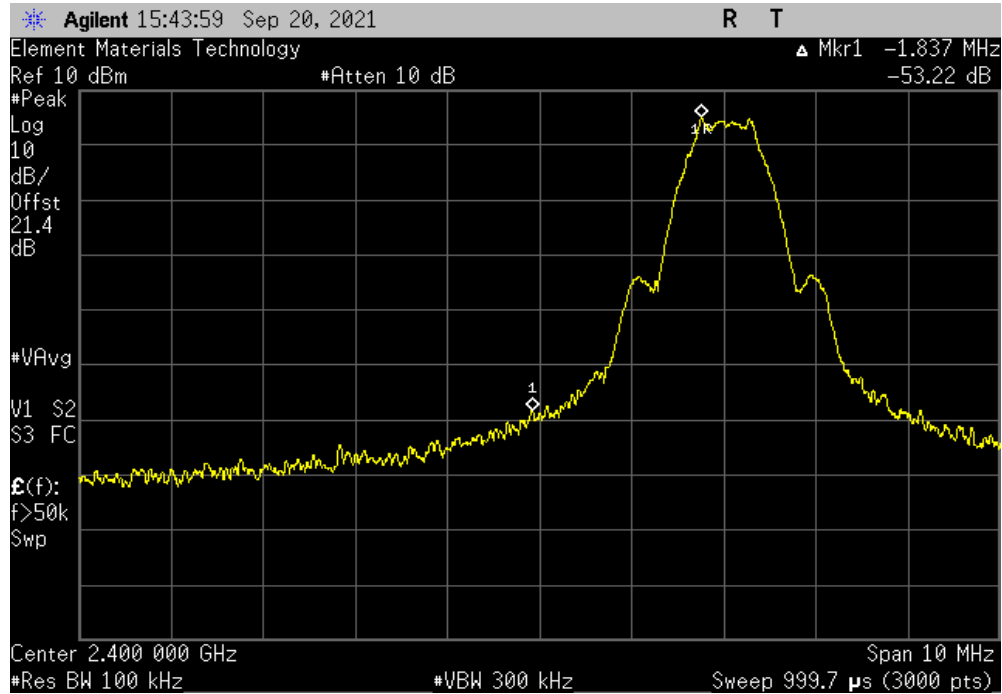
EUT: Gemini System (IPG)		Work Order: ABBO0075	
Serial Number: 18953849		Date: 20-Sep-21	
Customer: Abbott Laboratories		Temperature: 23.5 °C	
Attendees: Jeremiah Darden		Humidity: 42.2% RH	
Project: None		Barometric Pres.: 1014 mbar	
Tested by: Mark Baytan	Power: 5VDC via USB	Job Site: TX02	
TEST SPECIFICATIONS		Test Method	
FCC 15.247:2021		ANSI C63.10:2013	
COMMENTS			
21.4 dB reference level offset includes: DC block, 20dB attenuator, RF test cable, patch cable. Transmitting Bluetooth LE. See comments for channel and data rate. 5VDC via USB is used to power the IPG for testing purposes and does not represent actual use.			
DEVIATIONS FROM TEST STANDARD			
None			
Configuration #	59	Signature 	
		Value (dBc)	Limit ≤ (dBc) Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		-53.22	-20 Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		-60.14	-20 Pass
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		-32	-20 Pass
BLE/GFSK 2 Mbps High Channel, 2480 MHz		-53.93	-20 Pass

BAND EDGE COMPLIANCE

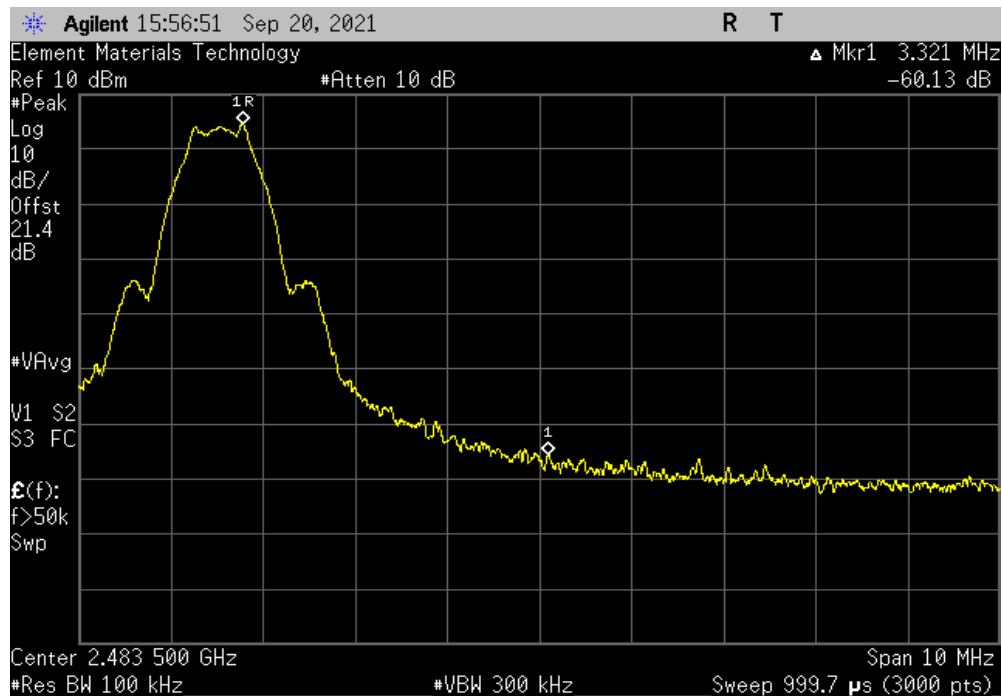


TbTx 2021.03.10.1 XM8 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-53.22	-20	Pass



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-60.14	-20	Pass

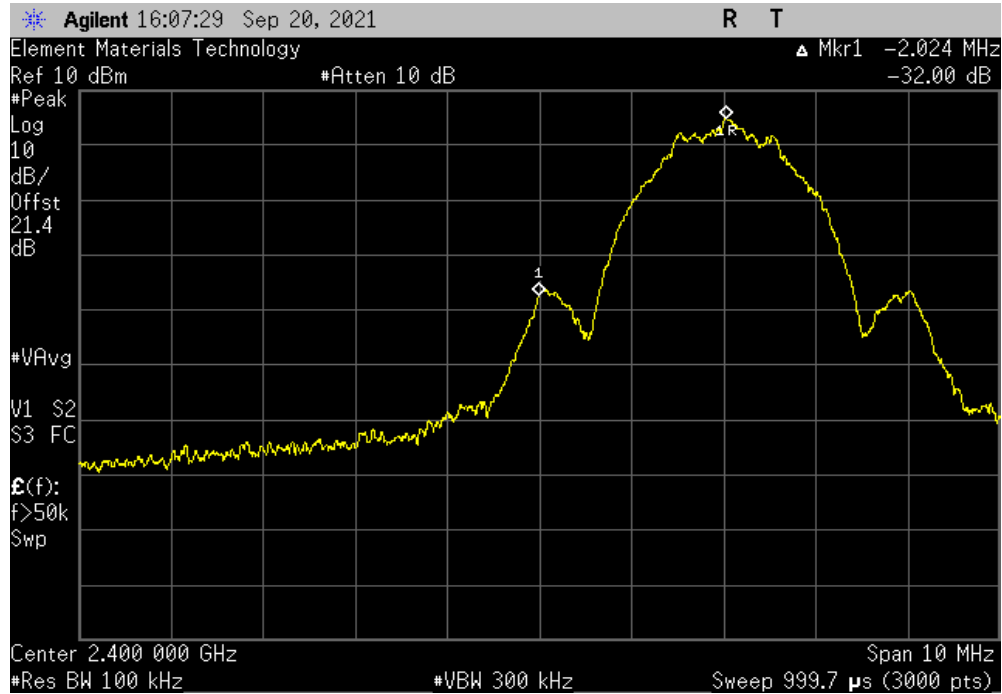


BAND EDGE COMPLIANCE

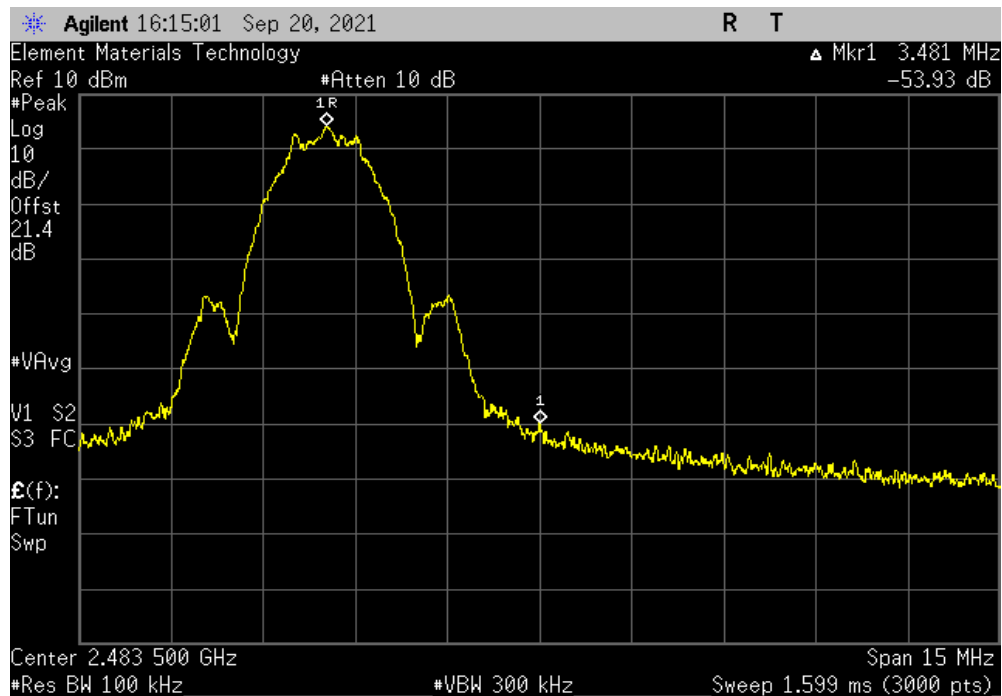


TUTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-32	-20	Pass



BLE/GFSK 2 Mbps High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-53.93	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

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
Generator - Signal	Keysight	N5182B	TEV	2021-04-27	2024-04-27
Cable	Micro-Coax	UFD150A-1-0720-200200	TXG	2021-09-13	2022-09-13
Block - DC	Fairview Microwave	SD3379	AMT	2021-09-14	2022-09-14
Attenuator	Fairview Microwave	SA18E 1913	TZV	2021-09-15	2022-09-15
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06

TEST DESCRIPTION

The spurious RF conducted emissions were measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet. For each transmit frequency, the fundamental was measured with a 100 kHz resolution bandwidth and the highest value was recorded. The rest of the spectrum was then measured with a 100 kHz resolution bandwidth and the highest value was found. The difference between the value found on the fundamental and the rest of the spectrum was compared against the limit to determine compliance.

SPURIOUS CONDUCTED EMISSIONS



TestTx 2021.03.19.1 XMR 2020.12.30.0

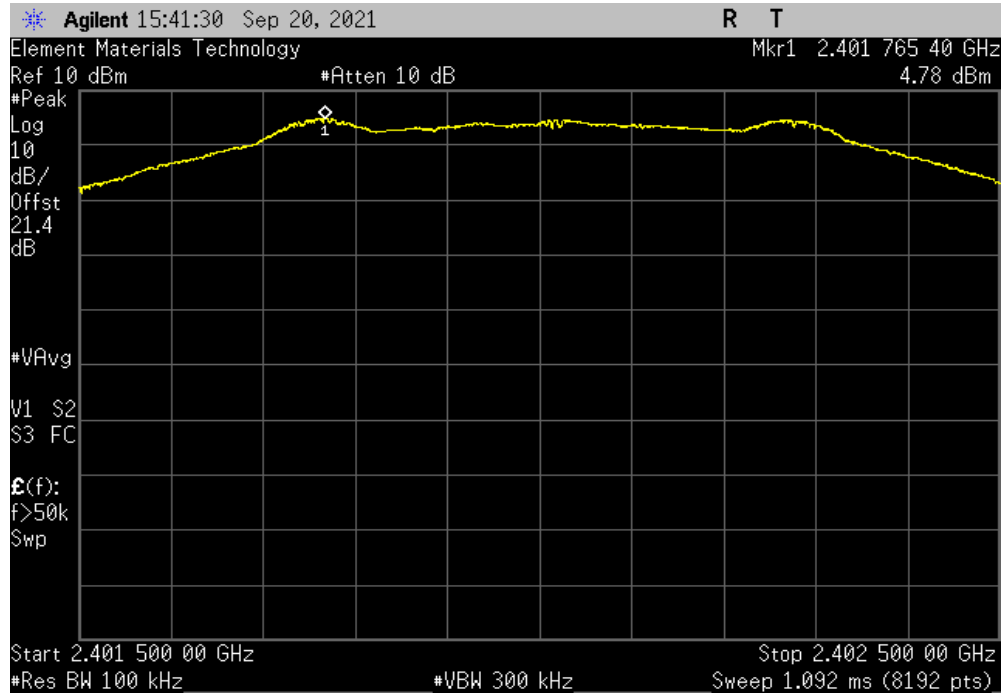
EUT: Gemini System (IPG)		Work Order: ABBO0075				
Serial Number: 18953849		Date: 20-Sep-21				
Customer: Abbott Laboratories		Temperature: 24.4 °C				
Attendees: Jeremiah Darden		Humidity: 41.2% RH				
Project: None		Barometric Pres.: 1014 mbar				
Tested by: Mark Baytan		Power: 5VDC via USB				
Job Site: TX02						
TEST SPECIFICATIONS		Test Method				
FCC 15.247:2021		ANSI C63.10:2013				
COMMENTS						
21.4 dB reference level offset includes: DC block, 20dB attenuator, RF test cable, patch cable. Transmitting Bluetooth LE. See comments for channel and data rate. 5VDC via USB is used to power the IPG for testing purposes and does not represent actual use.						
DEVIATIONS FROM TEST STANDARD						
None						
Configuration #	59	Signature 				
		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		Fundamental	2401.77	N/A	N/A	N/A
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		30 MHz - 12.5 GHz	2338	-58.71	-20	Pass
BLE/GFSK 1 Mbps Low Channel, 2402 MHz		12.5 GHz - 25 GHz	14201.6	-58.61	-20	Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		Fundamental	2440.02	N/A	N/A	N/A
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		30 MHz - 12.5 GHz	5203.1	-56.9	-20	Pass
BLE/GFSK 1 Mbps Mid Channel, 2442 MHz		12.5 GHz - 25 GHz	13615.6	-57.84	-20	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		Fundamental	2480.28	N/A	N/A	N/A
BLE/GFSK 1 Mbps High Channel, 2480 MHz		30 MHz - 12.5 GHz	2543.5	-57.97	-20	Pass
BLE/GFSK 1 Mbps High Channel, 2480 MHz		12.5 GHz - 25 GHz	14200	-57.72	-20	Pass
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		Fundamental	2402.03	N/A	N/A	N/A
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		30 MHz - 12.5 GHz	5197	-57.33	-20	Pass
BLE/GFSK 2 Mbps Low Channel, 2402 MHz		12.5 GHz - 25 GHz	13919.2	-57.14	-20	Pass
BLE/GFSK 2 Mbps Mid Channel, 2442 MHz		Fundamental	2440.04	N/A	N/A	N/A
BLE/GFSK 2 Mbps Mid Channel, 2442 MHz		30 MHz - 12.5 GHz	7055.9	-60.15	-20	Pass
BLE/GFSK 2 Mbps Mid Channel, 2442 MHz		12.5 GHz - 25 GHz	13623.2	-57.28	-20	Pass
BLE/GFSK 2 Mbps High Channel, 2480 MHz		Fundamental	2480.02	N/A	N/A	N/A
BLE/GFSK 2 Mbps High Channel, 2480 MHz		30 MHz - 12.5 GHz	2543.5	-58.92	-20	Pass
BLE/GFSK 2 Mbps High Channel, 2480 MHz		12.5 GHz - 25 GHz	13284.4	-57.06	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

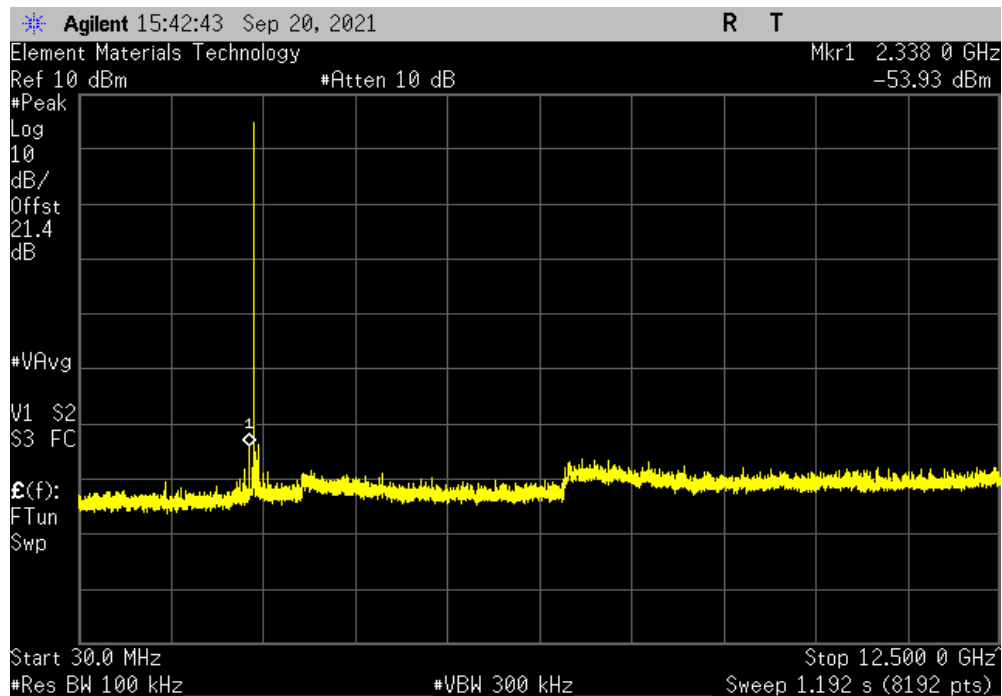


TbTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	2401.77	N/A	N/A	N/A		



BLE/GFSK 1 Mbps Low Channel, 2402 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	2338	-58.71	-20	Pass		

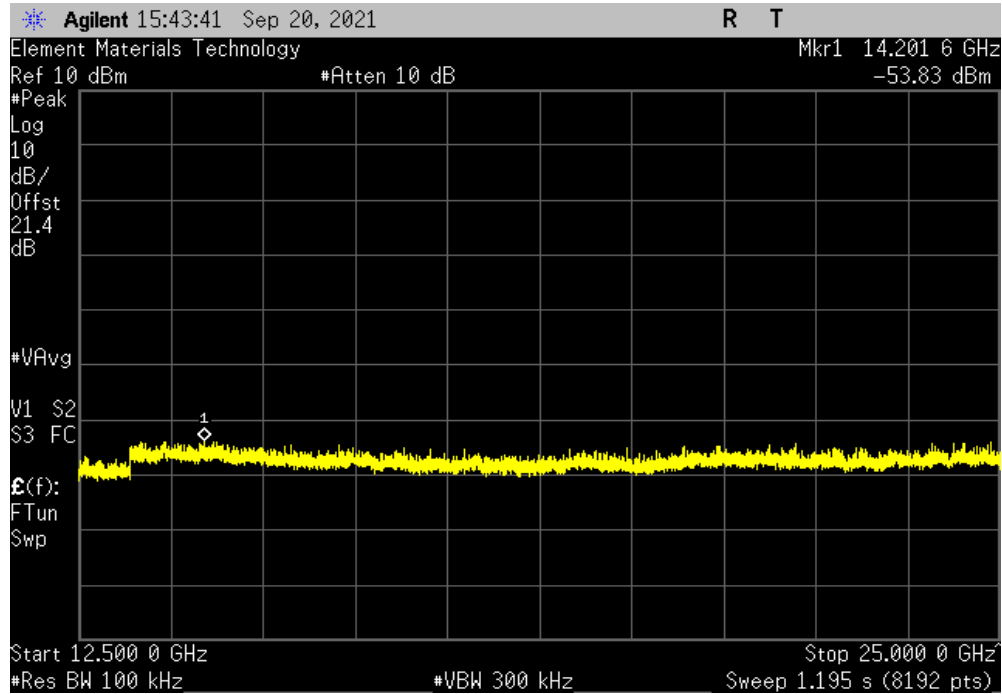


SPURIOUS CONDUCTED EMISSIONS

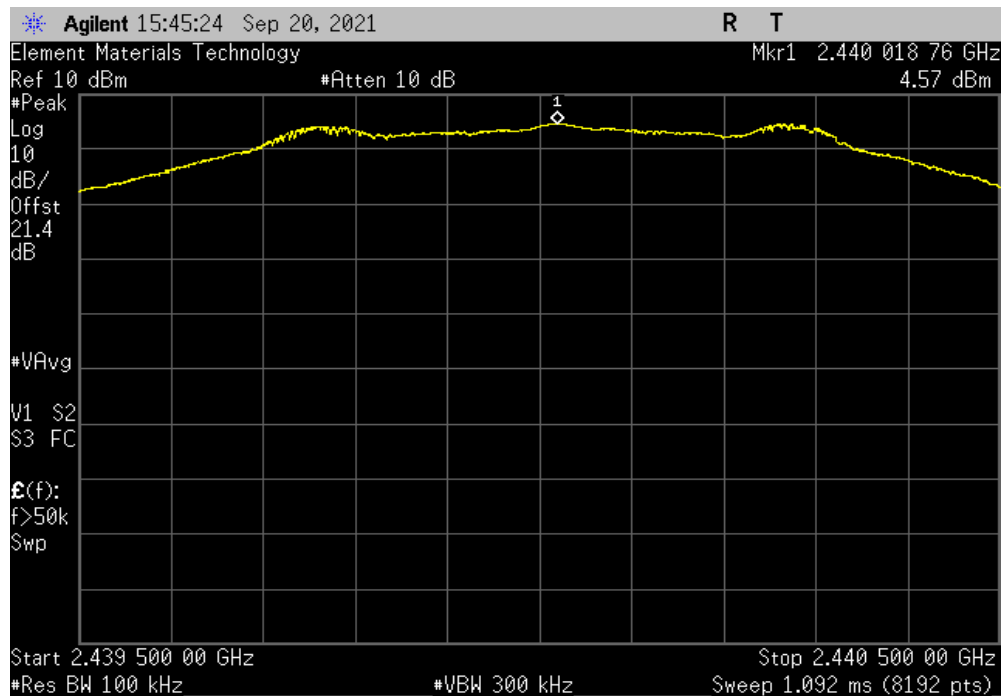


TbTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	14201.6	-58.61	-20	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2440.02	N/A	N/A	N/A	

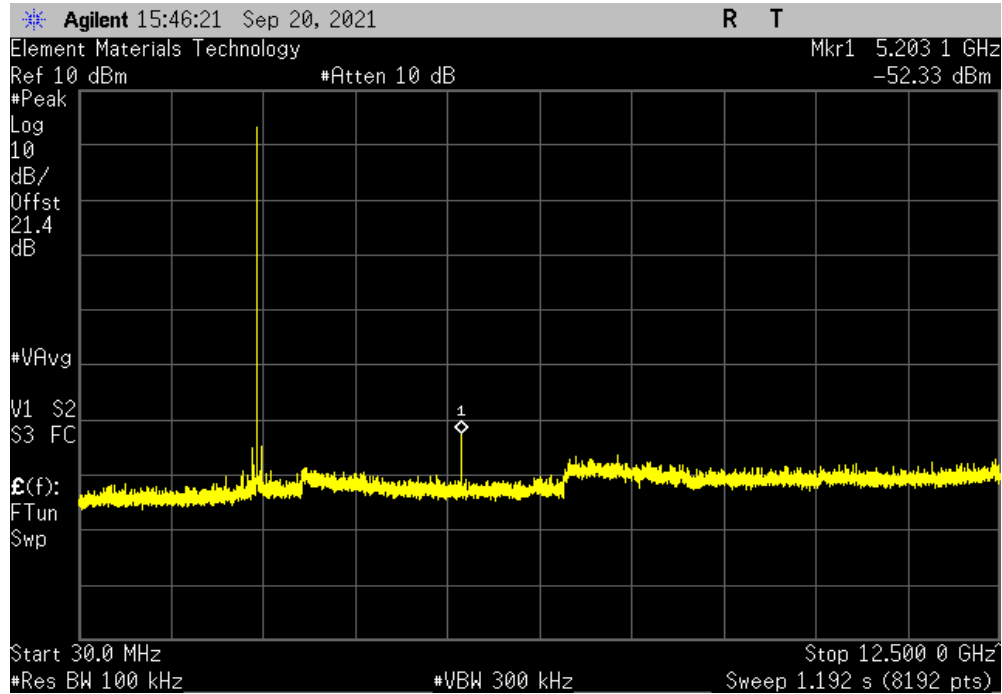


SPURIOUS CONDUCTED EMISSIONS

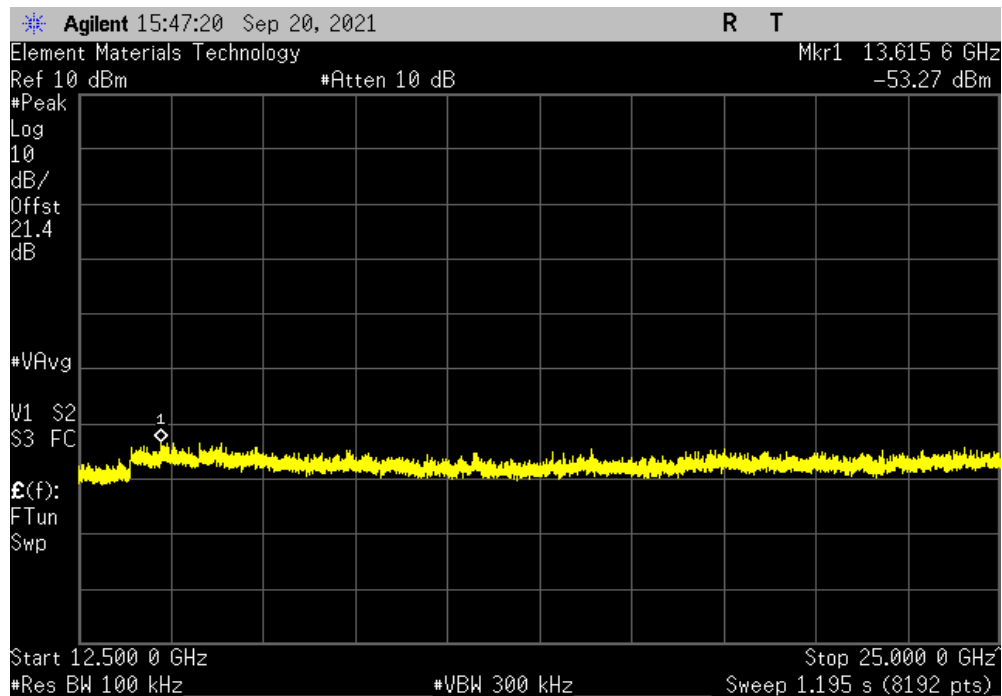


TUTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	5203.1	-56.9	-20	Pass	



BLE/GFSK 1 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	13615.6	-57.84	-20	Pass	

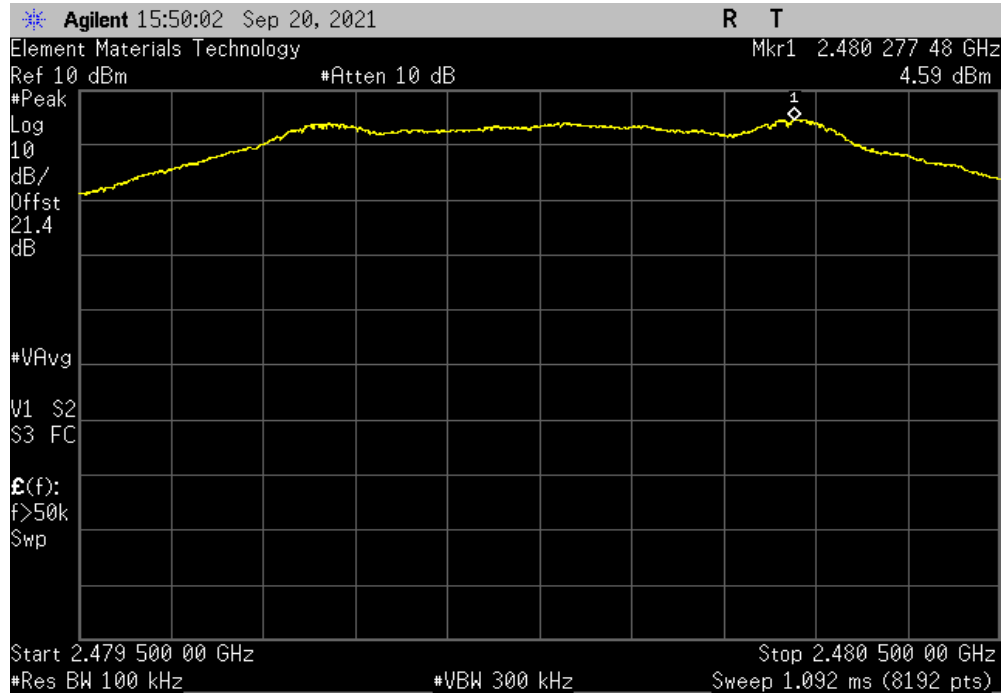


SPURIOUS CONDUCTED EMISSIONS

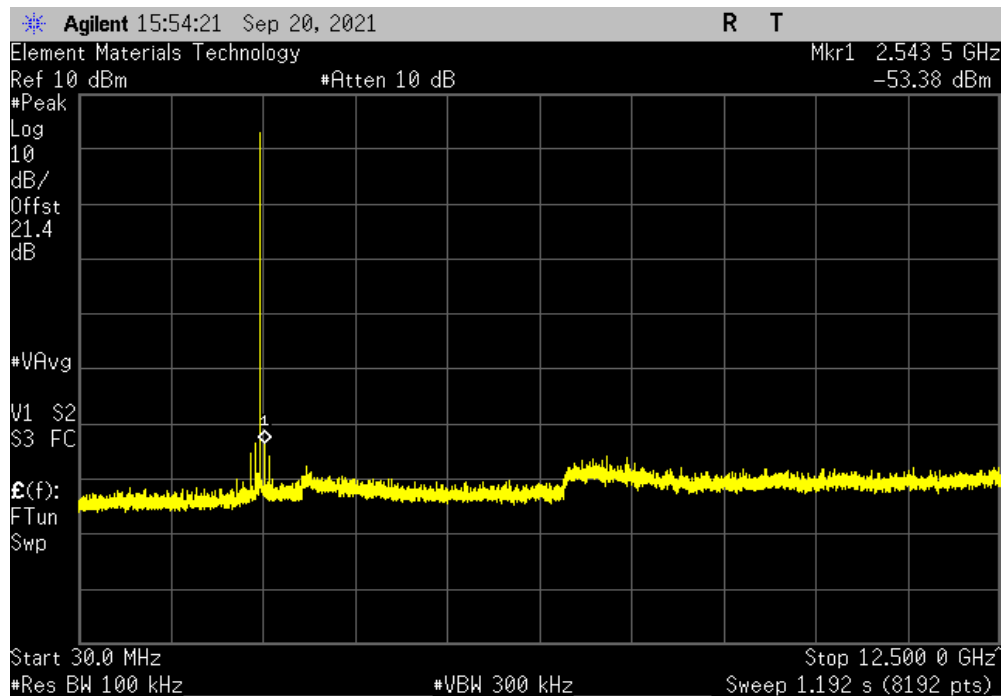


TbTx 2021.03.19.1 XM8 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	2480.28	N/A	N/A	N/A		



BLE/GFSK 1 Mbps High Channel, 2480 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	2543.5	-57.97	-20	Pass		

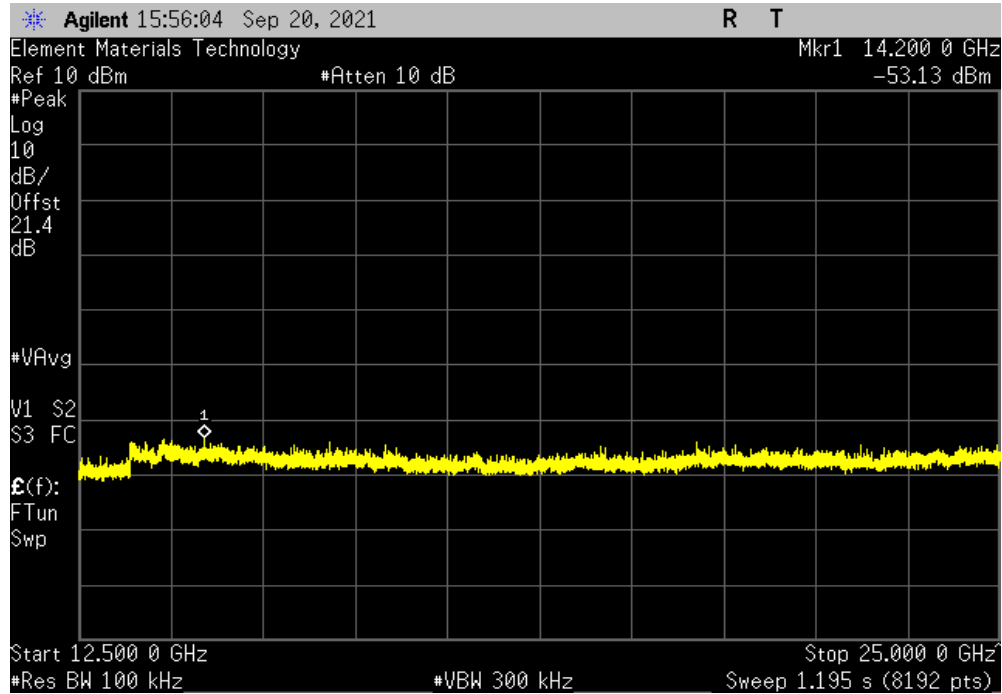


SPURIOUS CONDUCTED EMISSIONS

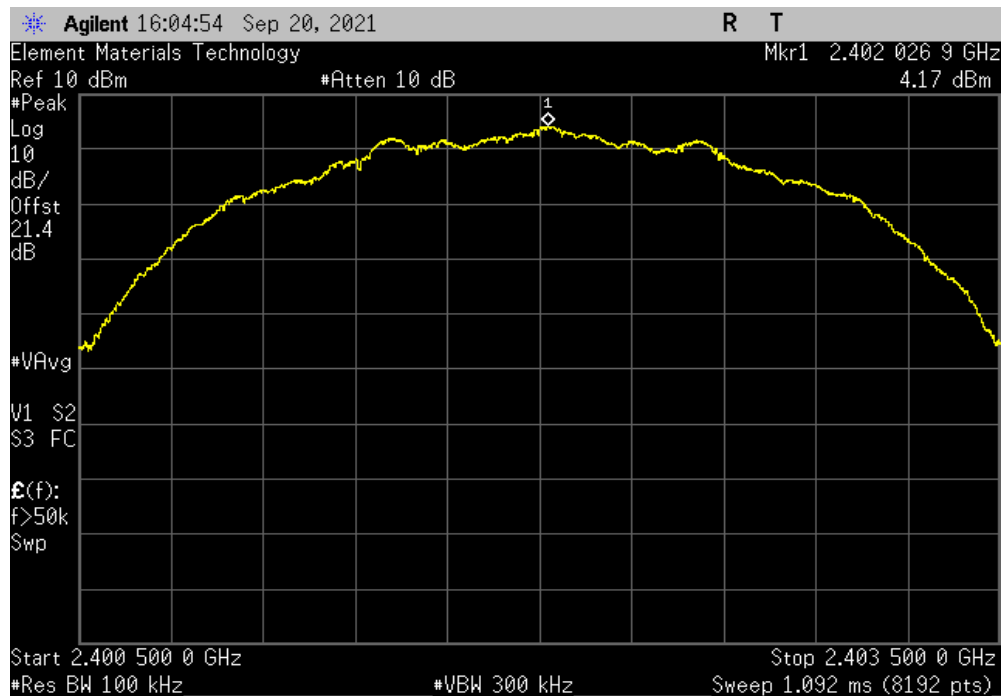


TbTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 1 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	14200	-57.72	-20	Pass	



BLE/GFSK 2 Mbps Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2402.03	N/A	N/A	N/A	

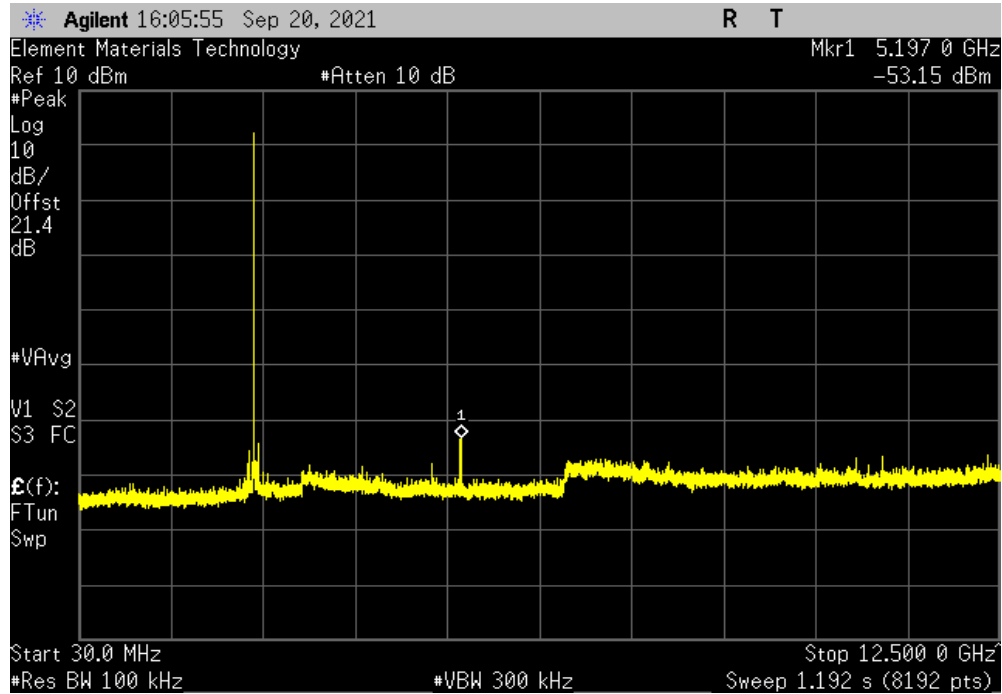


SPURIOUS CONDUCTED EMISSIONS

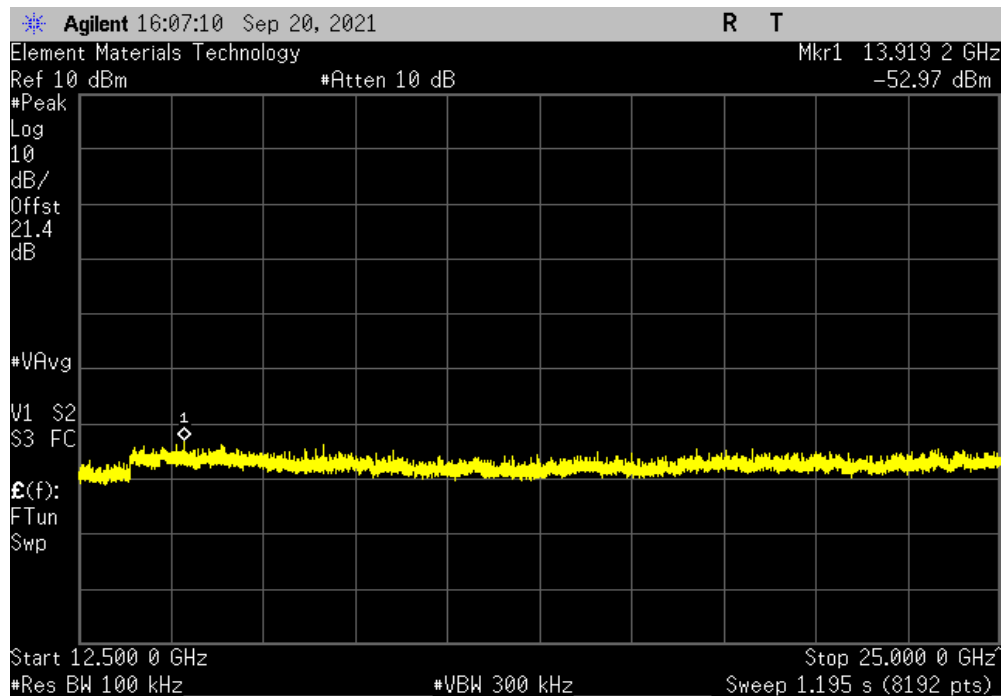


TbTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	5197	-57.33	-20	Pass	



BLE/GFSK 2 Mbps Low Channel, 2402 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	13919.2	-57.14	-20	Pass	

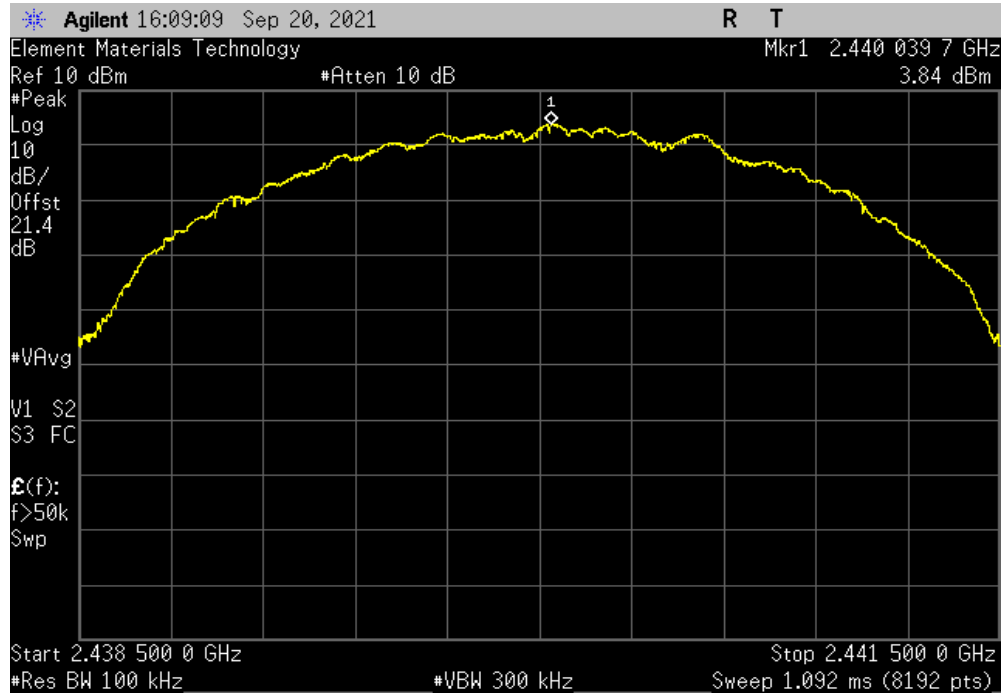


SPURIOUS CONDUCTED EMISSIONS

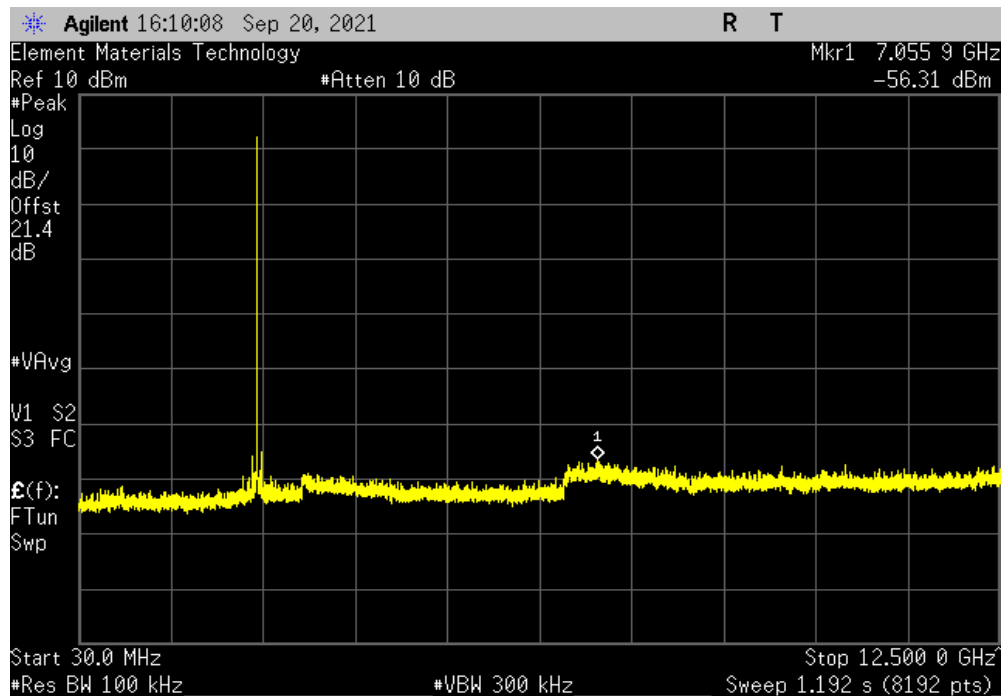


TUTx 2021.03.10.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps Mid Channel, 2442 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
Fundamental	2440.04	N/A	N/A	N/A		



BLE/GFSK 2 Mbps Mid Channel, 2442 MHz						
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result		
30 MHz - 12.5 GHz	7055.9	-60.15	-20	Pass		

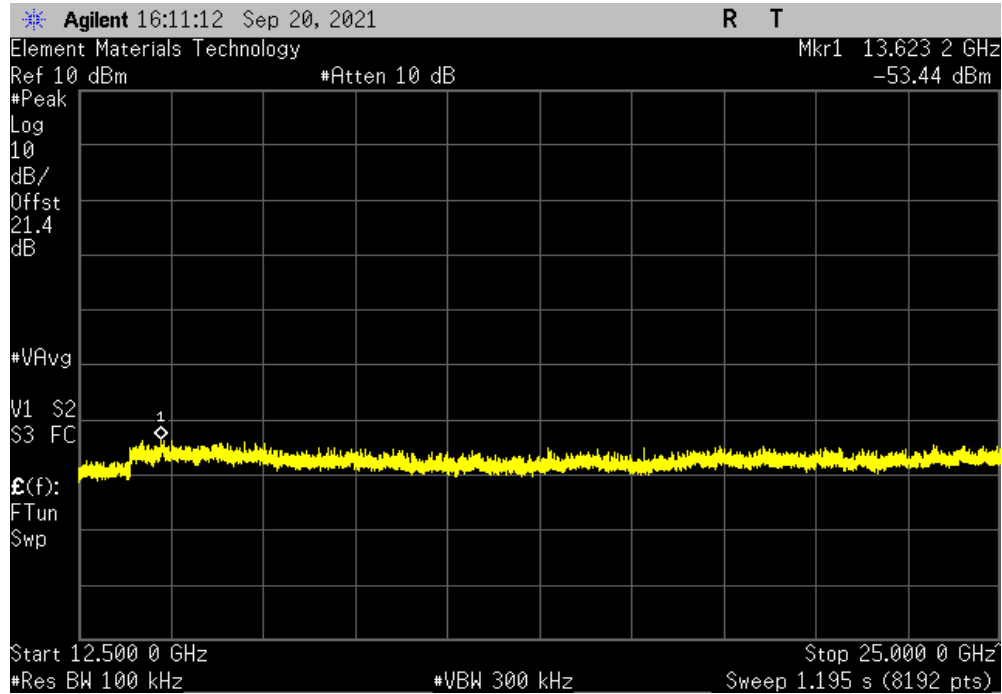


SPURIOUS CONDUCTED EMISSIONS

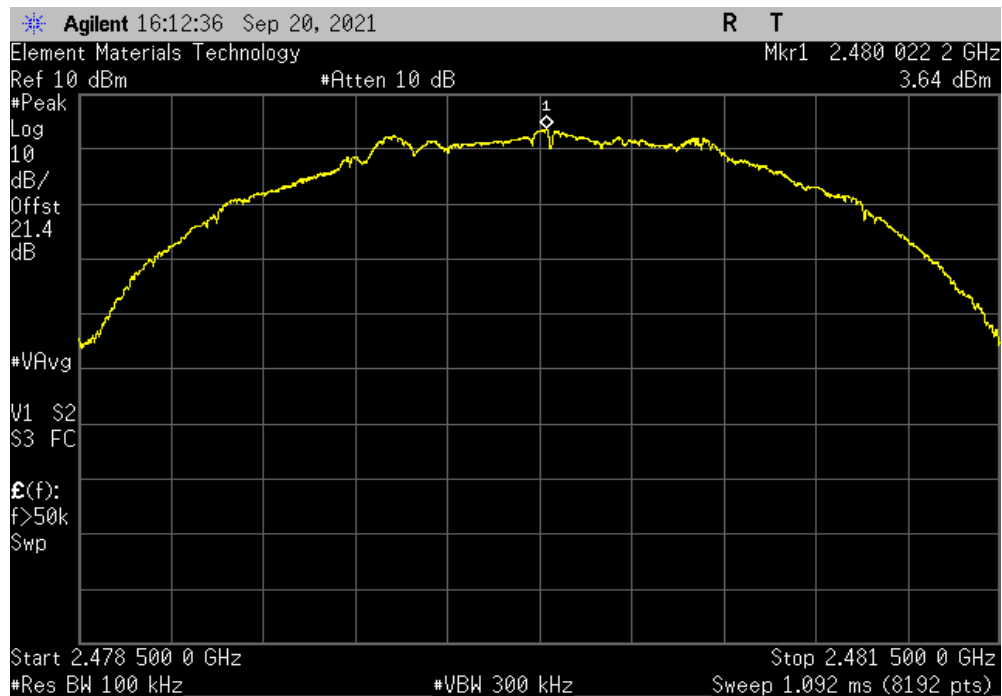


TbTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps Mid Channel, 2442 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	13623.2	-57.28	-20	Pass	



BLE/GFSK 2 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
Fundamental	2480.02	N/A	N/A	N/A	

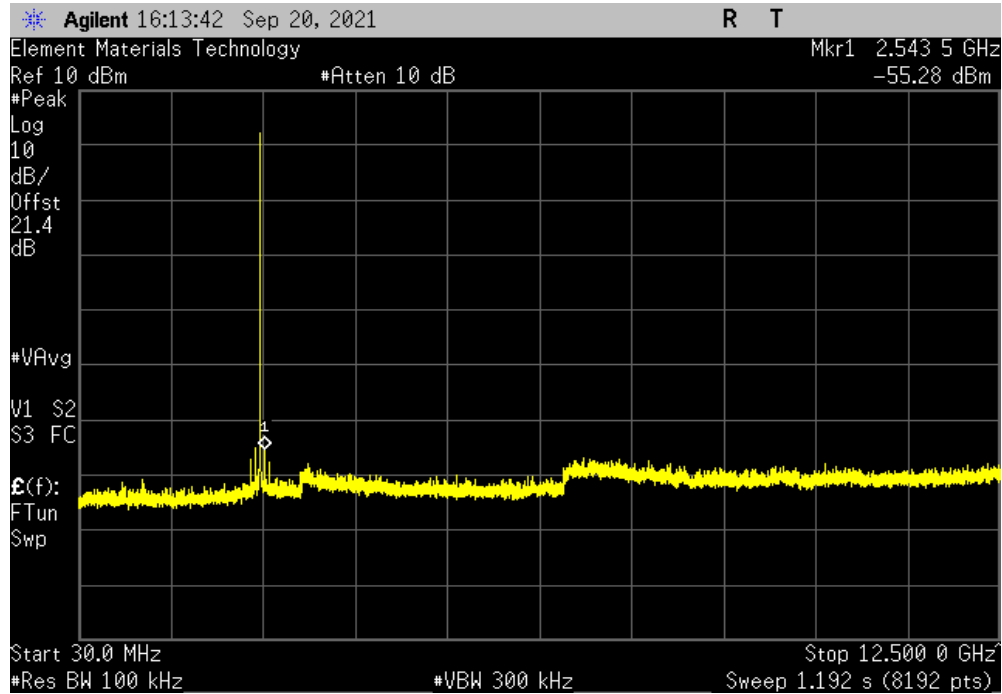


SPURIOUS CONDUCTED EMISSIONS

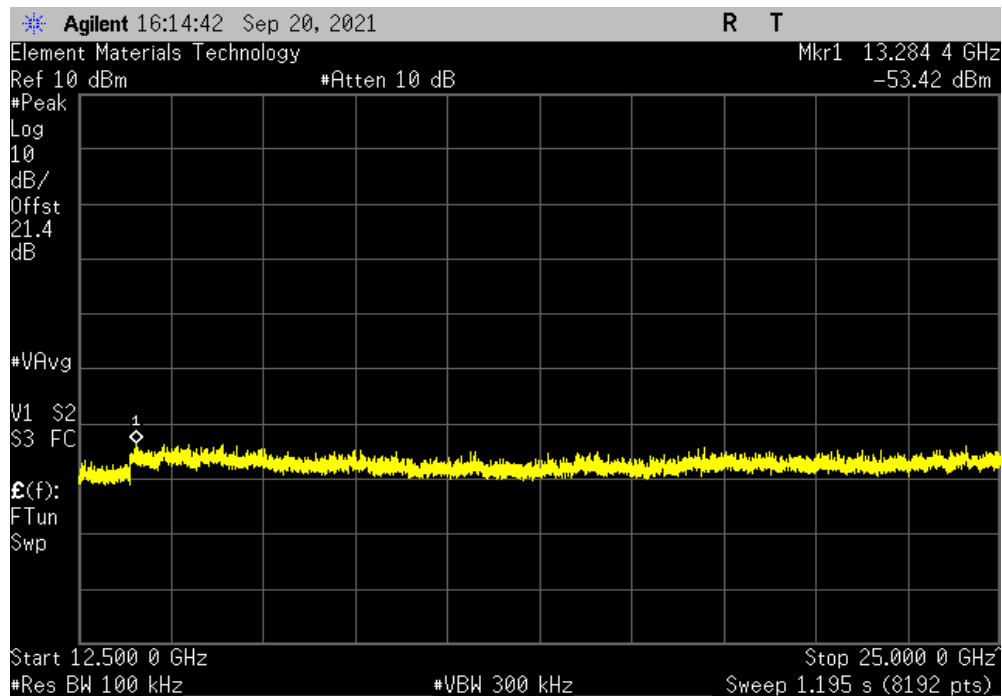


TbTx 2021.03.19.1 XMR 2020.12.30.0

BLE/GFSK 2 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
30 MHz - 12.5 GHz	2543.5	-58.92	-20	Pass	



BLE/GFSK 2 Mbps High Channel, 2480 MHz					
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result	
12.5 GHz - 25 GHz	13284.4	-57.06	-20	Pass	



SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2021.03.17.0

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

Transmitting BLE: Low Ch 37 (2402 MHz), Mid Ch 17 (2440 MHz), High Ch 39 (2480 MHz). See comments for channel and data rates. Power Setting = 6 dBm

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

ABBO0075 - 57

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	40 GHz
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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.	Cal. Due
Antenna - Biconilog	ETS Lindgren	3143B	AYF	2020-06-25	2022-06-25
Filter - Low Pass	Micro-Tronics	LPM50004	HHB	2021-07-27	2022-07-27
Amplifier - Pre-Amplifier	Fairview Microwave	FMAM63001	PAS	2021-05-24	2022-05-24
Cable	Northwest EMC	RE 9kHz - 1GHz	TXB	2021-05-24	2022-05-24
Cable	Northwest EMC	18-40GHz	TXE	2021-09-13	2022-09-13
Amplifier - Pre-Amplifier	Miteq	JSDWK42-18004000-60-5P	PAM	2021-09-15	2022-09-15
Antenna - Double Ridge	A.H. Systems, Inc.	SAS-574	AXW	2020-09-02	2022-09-02
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	PAL	2021-09-13	2022-09-13
Antenna - Standard Gain	ETS Lindgren	3160-08	AJG	NCR	NCR
Cable	Northwest EMC	8-18GHz	TXD	2021-04-30	2022-04-30
Amplifier - Pre-Amplifier	Cernex	CBL01084020-xx	PAX	2021-02-23	2022-02-23
Antenna - Standard Gain	ETS Lindgren	3160-07	AJF	NCR	NCR
Cable	Northwest EMC	1-8.2 GHz	TXC	2021-05-24	2022-05-24
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	2021-05-24	2022-05-24
Antenna - Double Ridge	ETS Lindgren	3115	AJL	2020-10-20	2022-10-20
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2021-01-06	2022-01-06

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

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). 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.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of $10 \cdot \log(1/dc)$.

SPURIOUS RADIATED EMISSIONS

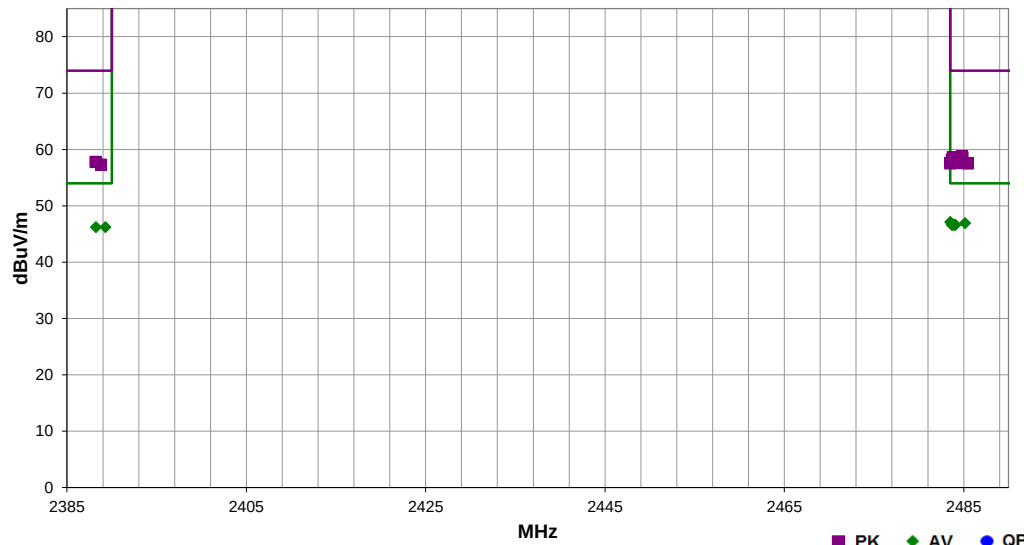


EmiRS 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ABBO0075	Date:	2021-09-21		
Project:	None	Temperature:	21.5 °C		
Job Site:	TX02	Humidity:	51.7% RH		
Serial Number:	See Configuration	Barometric Pres.:	1020 mbar	Tested by:	Mark Baytan
EUT:	Gemini System (IPG and Leads)				
Configuration:	57				
Customer:	Abbott Laboratories				
Attendees:	Jeremiah Darden, Manaswini Ravisankar				
EUT Power:	Battery				
Operating Mode:	Transmitting BLE: Low Ch 37 (2402 MHz), High Ch 39 (2480 MHz). See comments for channel and data rates. Power Setting = 6 dBm. Duty Cycle 100%.				
Deviations:	IPG in plexiglass phantom (30in tall, 15in diameter) with fluid tissue solution (Measured at 2450MHz: $\epsilon_r=52.6$, $\sigma = 1.99$ S/m). Temperature of solution is the same as the ambient temperature of the chamber: 21.5 °C. The mount is a custom holding bracket made out of plastic photopolymer that holds the IPG without obstructing the monopole antenna or the main structure. This bracket is held in place using a 0.5 by 0.5 inch rod that clips onto the top of the phantom and attaches to the mount using a plastic screw. The IPG requires recharging in its intended use which limits the implant depth in the torso. The compatible wireless charger has to be within 2.5cm or closer to the IPG. To simulate a nominal implant depth, the IPG was placed in the phantom at a 1.3cm distance from the phantom sidewall. The phantom Fluid Tissue equivalent material in between the IPG and side wall would be representative.				
Comments:	Internal battery drain is increased beyond nominal usage due to the >98% BLE duty cycle specified by the standards and methods in this report. This increased power usage causes the battery to drain faster than normal. To avoid testing delays at the compliance lab, two IPG's were used across the specified testing. Both IPG's are production equivalents and from the same product batch, therefore they are equivalent for the purposes of this report.				

Test Specifications	Test Method
FCC 15.247:2021	ANSI C63.10:2013

Run #	75	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
2483.503	32.5	-5.4	1.5	316.9	3.0	20.0	Horz	AV	0.0	47.1	54.0	-6.9	High Ch, EUT Vert, 1 Mbps
2485.160	32.3	-5.4	1.63	38.0	3.0	20.0	Vert	AV	0.0	46.9	54.0	-7.1	High Ch, EUT Vert, 1 Mbps
2483.743	32.1	-5.4	1.63	38.0	3.0	20.0	Vert	AV	0.0	46.7	54.0	-7.3	High Ch, EUT Vert, 2 Mbps
2484.090	32.0	-5.4	1.5	290.0	3.0	20.0	Horz	AV	0.0	46.6	54.0	-7.4	High Ch, EUT on Side, 1 Mbps
2483.903	32.0	-5.4	1.5	316.9	3.0	20.0	Vert	AV	0.0	46.6	54.0	-7.4	High Ch, EUT on Side, 1 Mbps
2484.033	32.0	-5.4	1.5	145.0	3.0	20.0	Horz	AV	0.0	46.6	54.0	-7.4	High Ch, EUT Horz, 1 Mbps
2483.710	32.0	-5.4	1.5	291.9	3.0	20.0	Vert	AV	0.0	46.6	54.0	-7.4	High Ch, EUT Horz, 1 Mbps
2483.717	32.0	-5.4	1.5	316.9	3.0	20.0	Horz	AV	0.0	46.6	54.0	-7.4	High Ch, EUT Vert, 2 Mbps
2389.287	32.0	-5.8	1.5	99.9	3.0	20.0	Horz	AV	0.0	46.2	54.0	-7.8	Low Ch, EUT Vert, 1 Mbps
2388.237	32.0	-5.8	1.06	141.9	3.0	20.0	Vert	AV	0.0	46.2	54.0	-7.8	Low Ch, EUT Vert, 1 Mbps
2484.807	44.2	-5.4	1.63	38.0	3.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	High Ch, EUT Vert, 1 Mbps
2484.860	44.0	-5.4	1.5	316.9	3.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	High Ch, EUT Vert, 1 Mbps
2483.777	44.0	-5.4	1.5	291.9	3.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	High Ch, EUT Horz, 1 Mbps
2483.680	43.6	-5.4	1.5	145.0	3.0	20.0	Horz	PK	0.0	58.2	74.0	-15.8	High Ch, EUT Horz, 1 Mbps
2388.180	43.6	-5.8	1.06	141.9	3.0	20.0	Vert	PK	0.0	57.8	74.0	-16.2	Low Ch, EUT Vert, 1 Mbps
2484.420	43.1	-5.4	1.63	38.0	3.0	20.0	Vert	PK	0.0	57.7	74.0	-16.3	High Ch, EUT Vert, 2 Mbps
2484.853	43.0	-5.4	1.5	316.9	3.0	20.0	Vert	PK	0.0	57.6	74.0	-16.4	High Ch, EUT on Side, 1 Mbps
2485.440	42.9	-5.4	1.5	290.0	3.0	20.0	Horz	PK	0.0	57.5	74.0	-16.5	High Ch, EUT on Side, 1 Mbps
2483.507	42.9	-5.4	1.5	316.9	3.0	20.0	Horz	PK	0.0	57.5	74.0	-16.5	High Ch, EUT Vert, 2 Mbps
2388.793	43.1	-5.8	1.5	99.9	3.0	20.0	Horz	PK	0.0	57.3	74.0	-16.7	Low Ch, EUT Vert, 1 Mbps

SPURIOUS RADIATED EMISSIONS

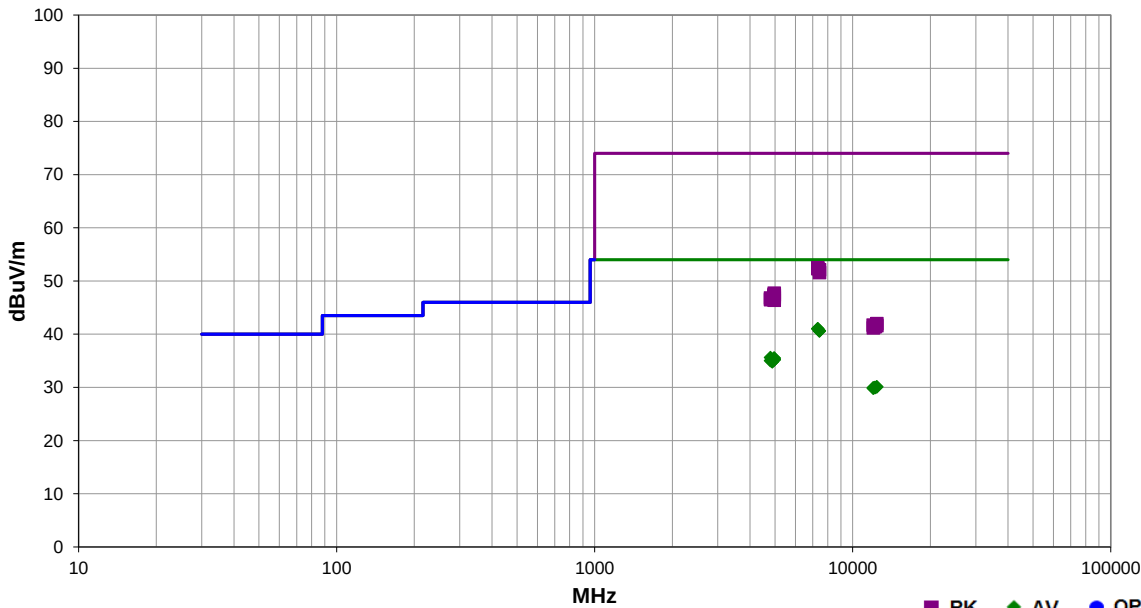


EmiRS 2021.06.24.0 PSA-ESCI 2021.03.17.0

Work Order:	ABBO0075	Date:	2021-09-24	
Project:	None	Temperature:	21.1 °C	
Job Site:	TX02	Humidity:	44.2% RH	
Serial Number:	See Configuration	Barometric Pres.:	1022 mbar	Tested by: Mark Baytan
EUT:	Gemini System (IPG and Leads)			
Configuration:	57			
Customer:	Abbott Laboratories			
Attendees:	Jeremiah Darden, Manaswini Ravisankar			
EUT Power:	Battery			
Operating Mode:	Transmitting BLE: Low Ch 37 (2402 MHz), Mid Ch 17 (2440 MHz), High Ch 39 (2480 MHz). See comments for channel and data rates. Power Setting = 6 dBm. Duty Cycle 100%.			
Deviations:	IPG in plexiglass phantom (30in tall, 15in diameter) with fluid tissue solution (Measured at 2450MHz: $\epsilon_r=52.6$, $\sigma = 1.99$ S/m). Temperature of solution is the same as the ambient temperature of the chamber: 21.5 °C. The mount is a custom holding bracket made out of plastic photopolymer that holds the IPG without obstructing the monopole antenna or the main structure. This bracket is held in place using a 0.5 by 0.5 inch rod that clips onto the top of the phantom and attaches to the mount using a plastic screw. The IPG requires recharging in its intended use which limits the implant depth in the torso. The compatible wireless charger has to be within 2.5cm or closer to the IPG. To simulate a nominal implant depth, the IPG was placed in the phantom at a 1.3cm distance from the phantom sidewall. The phantom Fluid Tissue equivalent material in between the IPG and side wall would be representative.			
Comments:	Internal battery drain is increased beyond nominal usage due to the >98% BLE duty cycle specified by the standards and methods in this report. This increased power usage causes the battery to drain faster than normal. To avoid testing delays at the compliance lab, two IPG's were used across the specified testing. Both IPG's are production equivalents and from the same product batch, therefore they are equivalent for the purposes of this report.			

Test Specifications	Test Method
FCC 15.247:2021	ANSI C63.10:2013

Run #	78	Test Distance (m)	3	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
7319.727	29.1	11.9	1.5	100.9	3.0	0.0	Horz	AV	0.0	41.0	54.0	-13.0	Mid Ch, EUT Vert, 1 Mbps
7319.503	29.1	11.9	1.5	129.9	3.0	0.0	Vert	AV	0.0	41.0	54.0	-13.0	Mid Ch, EUT Vert, 1 Mbps
7439.230	28.5	12.1	1.5	289.0	3.0	0.0	Horz	AV	0.0	40.6	54.0	-13.4	High Ch, EUT Vert, 1 Mbps
7440.853	28.5	12.1	1.5	297.0	3.0	0.0	Vert	AV	0.0	40.6	54.0	-13.4	High Ch, EUT Vert, 1 Mbps
4803.903	30.0	5.6	1.5	10.9	3.0	0.0	Vert	AV	0.0	35.6	54.0	-18.4	Low Ch, EUT Vert, 1 Mbps
4960.903	29.5	6.0	1.5	280.9	3.0	0.0	Horz	AV	0.0	35.5	54.0	-18.5	High Ch, EUT Vert, 1 Mbps
4959.730	29.5	6.0	1.5	22.9	3.0	0.0	Vert	AV	0.0	35.5	54.0	-18.5	High Ch, EUT Vert, 1 Mbps
4959.053	29.3	6.0	2.5	356.0	3.0	0.0	Vert	AV	0.0	35.3	54.0	-18.7	High Ch, EUT on Side, 1 Mbps
4959.253	29.3	6.0	1.5	4.9	3.0	0.0	Vert	AV	0.0	35.3	54.0	-18.7	High Ch, EUT Horz, 1 Mbps
4960.440	29.2	6.0	2.7	210.0	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	High Ch, EUT on Side, 1 Mbps
4959.370	29.2	6.0	3.5	231.9	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	High Ch, EUT Horz, 1 Mbps

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	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
4960.847	29.2	6.0	1.5	171.9	3.0	0.0	Horz	AV	0.0	35.2	54.0	-18.8	High Ch, EUT Vert, 2 Mbps
4959.003	29.2	6.0	1.5	144.0	3.0	0.0	Vert	AV	0.0	35.2	54.0	-18.8	High Ch, EUT Vert, 2 Mbps
4803.960	29.4	5.6	1.5	272.0	3.0	0.0	Horz	AV	0.0	35.0	54.0	-19.0	Low Ch, EUT Vert, 1 Mbps
4880.143	29.0	5.8	3.3	193.0	3.0	0.0	Horz	AV	0.0	34.8	54.0	-19.2	Mid Ch, EUT Vert, 1 Mbps
4879.580	29.0	5.8	1.5	310.9	3.0	0.0	Vert	AV	0.0	34.8	54.0	-19.2	Mid Ch, EUT Vert, 1 Mbps
7319.407	40.6	11.9	1.5	100.9	3.0	0.0	Horz	PK	0.0	52.5	74.0	-21.5	Mid Ch, EUT Vert, 1 Mbps
7319.277	40.4	11.9	1.5	129.9	3.0	0.0	Vert	PK	0.0	52.3	74.0	-21.7	Mid Ch, EUT Vert, 1 Mbps
7439.797	40.0	12.1	1.5	297.0	3.0	0.0	Vert	PK	0.0	52.1	74.0	-21.9	High Ch, EUT Vert, 1 Mbps
7440.463	39.5	12.1	1.5	289.0	3.0	0.0	Horz	PK	0.0	51.6	74.0	-22.4	High Ch, EUT Vert, 1 Mbps
12399.780	31.7	-1.6	1.5	304.9	3.0	0.0	Horz	AV	0.0	30.1	54.0	-23.9	High Ch, EUT Vert, 1 Mbps
12399.940	31.7	-1.6	1.5	238.9	3.0	0.0	Vert	AV	0.0	30.1	54.0	-23.9	High Ch, EUT Vert, 1 Mbps
12199.760	31.9	-1.9	1.5	276.0	3.0	0.0	Horz	AV	0.0	30.0	54.0	-24.0	Mid Ch, EUT Vert, 1 Mbps
12010.770	32.8	-2.9	1.5	309.9	3.0	0.0	Horz	AV	0.0	29.9	54.0	-24.1	Low Ch, EUT Vert, 1 Mbps
12200.900	31.8	-1.9	1.5	351.0	3.0	0.0	Vert	AV	0.0	29.9	54.0	-24.1	Mid Ch, EUT Vert, 1 Mbps
12010.990	32.7	-2.9	1.5	174.0	3.0	0.0	Vert	AV	0.0	29.8	54.0	-24.2	Low Ch, EUT Vert, 1 Mbps
4959.647	41.7	6.0	1.5	4.9	3.0	0.0	Vert	PK	0.0	47.7	74.0	-26.3	High Ch, EUT Horz, 1 Mbps
4959.563	41.4	6.0	1.5	280.9	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	High Ch, EUT Vert, 1 Mbps
4960.003	41.4	6.0	1.5	171.9	3.0	0.0	Horz	PK	0.0	47.4	74.0	-26.6	High Ch, EUT Vert, 2 Mbps
4960.393	41.3	6.0	2.7	210.0	3.0	0.0	Horz	PK	0.0	47.3	74.0	-26.7	High Ch, EUT on Side, 1 Mbps
4959.700	41.0	6.0	2.5	356.0	3.0	0.0	Vert	PK	0.0	47.0	74.0	-27.0	High Ch, EUT on Side, 1 Mbps
4960.067	40.8	6.0	3.5	231.9	3.0	0.0	Horz	PK	0.0	46.8	74.0	-27.2	High Ch, EUT Horz, 1 Mbps
4803.577	41.2	5.6	1.5	10.9	3.0	0.0	Vert	PK	0.0	46.8	74.0	-27.2	Low Ch, EUT Vert, 1 Mbps
4879.430	40.8	5.8	3.3	193.0	3.0	0.0	Horz	PK	0.0	46.6	74.0	-27.4	Mid Ch, EUT Vert, 1 Mbps
4879.860	40.8	5.8	1.5	310.9	3.0	0.0	Vert	PK	0.0	46.6	74.0	-27.4	Mid Ch, EUT Vert, 1 Mbps
4959.240	40.5	6.0	1.5	22.9	3.0	0.0	Vert	PK	0.0	46.5	74.0	-27.5	High Ch, EUT Vert, 1 Mbps
4803.087	40.9	5.6	1.5	272.0	3.0	0.0	Horz	PK	0.0	46.5	74.0	-27.5	Low Ch, EUT Vert, 1 Mbps
4960.960	40.4	6.0	1.5	144.0	3.0	0.0	Vert	PK	0.0	46.4	74.0	-27.6	High Ch, EUT Vert, 2 Mbps
12399.360	43.6	-1.6	1.5	304.9	3.0	0.0	Horz	PK	0.0	42.0	74.0	-32.0	High Ch, EUT Vert, 1 Mbps
12009.220	44.6	-2.9	1.5	309.9	3.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	Low Ch, EUT Vert, 1 Mbps
12399.150	43.2	-1.6	1.5	238.9	3.0	0.0	Vert	PK	0.0	41.6	74.0	-32.4	High Ch, EUT Vert, 1 Mbps
12200.730	43.4	-1.9	1.5	276.0	3.0	0.0	Horz	PK	0.0	41.5	74.0	-32.5	Mid Ch, EUT Vert, 1 Mbps
12199.630	43.3	-1.9	1.5	351.0	3.0	0.0	Vert	PK	0.0	41.4	74.0	-32.6	Mid Ch, EUT Vert, 1 Mbps
12010.740	44.1	-2.9	1.5	174.0	3.0	0.0	Vert	PK	0.0	41.2	74.0	-32.8	Low Ch, EUT Vert, 1 Mbps

End of Test Report