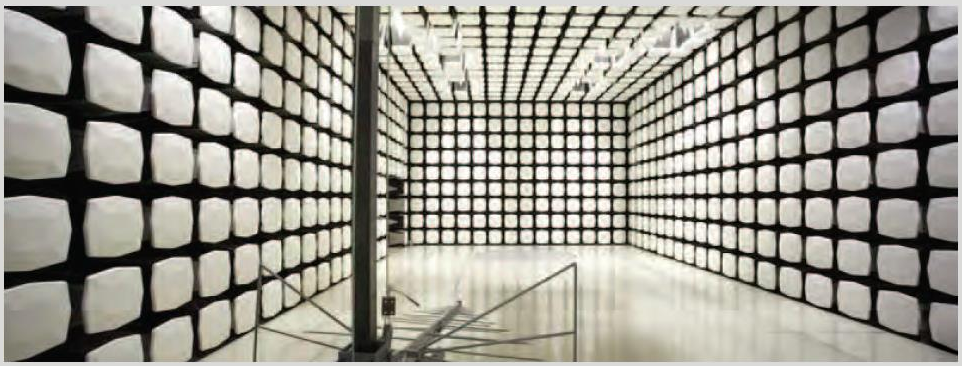
Apricity Code

JL Module

FCC 15.247:2020

2.4GHz Bluetooth (FHSS) Radio

Report: APRI0010, Issue Date: April 28, 2020



NVLAP LAB CODE: 200881-0

CERTIFICATE OF TEST

Last Date of Test: March 25, 2020
Apricity Code
EUT: JL Module

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2020	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
7.5	Duty Cycle	Yes	N/A	
7.8.2	Carrier Frequency Separation	Yes	Pass	
7.8.3	Number of Hopping Frequencies	Yes	Pass	
7.8.4	Dwell Time	Yes	Pass	
7.8.5	Output Power	Yes	Pass	
7.8.5	Equivalent Isotropic Radiated Power	Yes	Pass	
7.8.6	Band Edge Compliance	Yes	Pass	
7.8.6	Band Edge Compliance - Hopping Mode	Yes	Pass	
7.8.7	Occupied Bandwidth	Yes	Pass	
7.8.8	Spurious Conducted Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Eric Brandon, Department 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
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

United States

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

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) 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

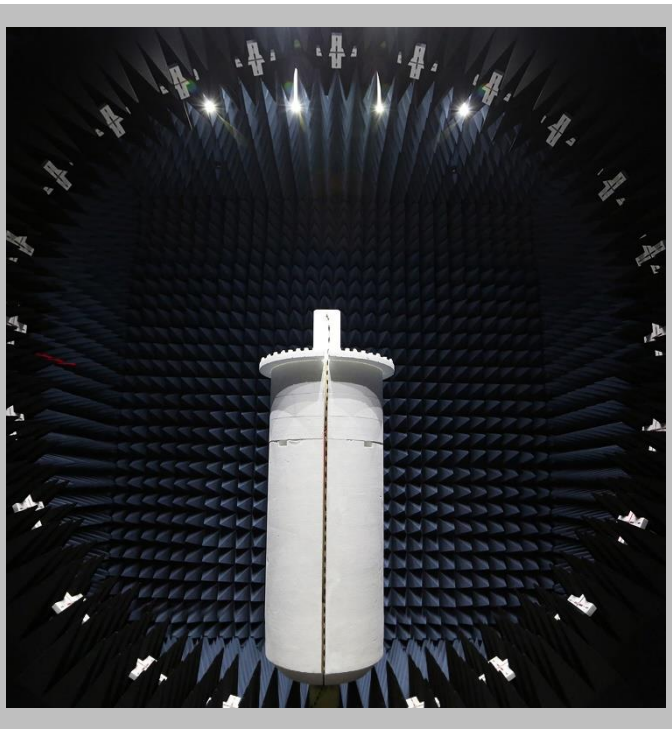
MIC – Recognized by MIC as a CAB for the acceptance of test data.

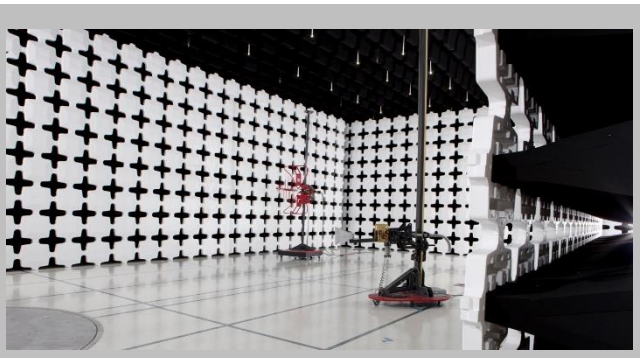
SCOPE

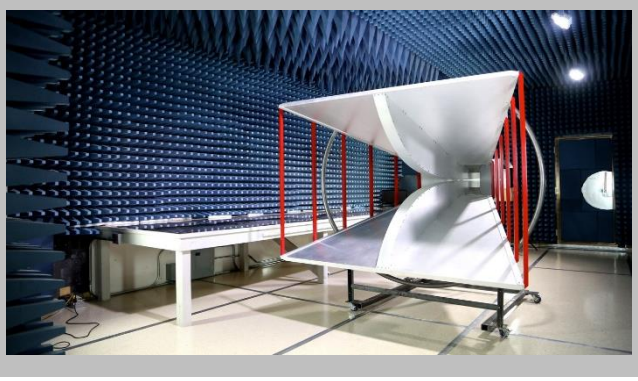
For details on the Scopes of our Accreditations, please visit:
https://www.nwemc.com/emc-testing-accreditations

FACILITIES

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP				
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 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/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

element
TMU.2015.07.10

Measurement Uncertainty

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

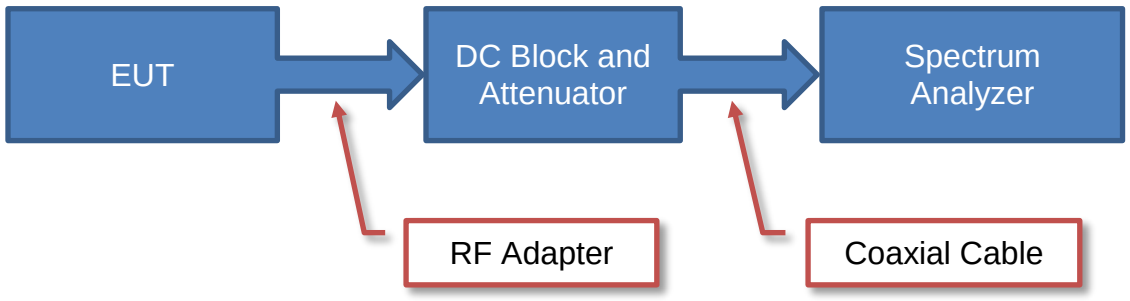
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

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

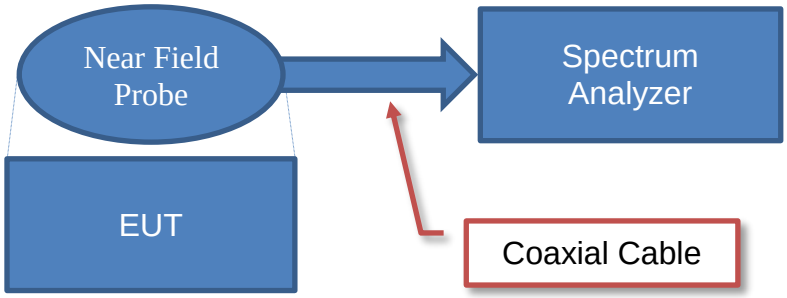
Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.6 dB	-2.6 dB

Test Setup Block Diagrams

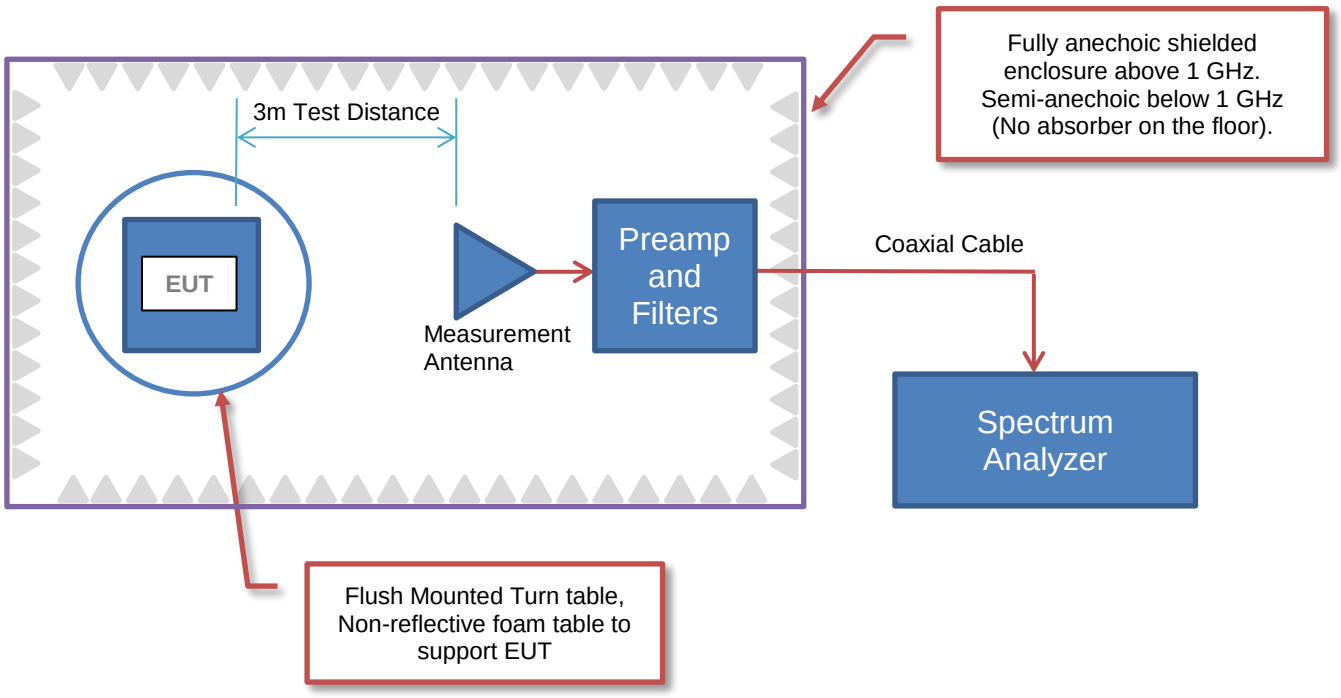
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Apricity Code
Address:	2789 NW Lolo Drive
City, State, Zip:	Bend, OR 97703
Test Requested By:	Justin Olexy
EUT:	JL Module
First Date of Test:	March 20, 2020
Last Date of Test:	March 25, 2020
Receipt Date of Samples:	March 19, 2020
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Bluetooth Class 2 device, with a U.FL connector to connect an external antenna

Testing Objective:
To demonstrate compliance of the Bluetooth (FHSS) radio to FCC 15.247 requirements.

CONFIGURATIONS

Configuration APRI0010- 1

Software/Firmware Running during test	
Description	**Version**
BlueTest3	3.2.2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
JL Module	Apricity Code	6001-003	4

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BTM Demonstrator Board	JL Audio	6003-001	2

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Inspiron 3583	4W5ZZX2
Power Supply (Laptop)	Dell	LA45NM140	CN-0KXTTW-LOC00-97N-39D5-A09

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.3 m	No	Laptop	BTM Demonstrator Board
AC Cable	No	0.9 m	No	AC Mains	Power Supply (Laptop)
DC Cable	No	1.8 m	Yes	Power Supply (Laptop)	Laptop

CONFIGURATIONS

Configuration APRI0010- 2

Software/Firmware Running during test	
Description	**Version**
BlueTest3	3.2.2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
JL Module	Apricity Code	6001-003	4
Patch Antenna	Yageo	ANTX100P112B24553	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BTM Demonstrator Board	JL Audio	6003-001	2

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Inspiron 3583	4W5ZZX2
Power Supply (Laptop)	Dell	LA45NM140	CN-0KXTTW-LOC00-97N-39D5-A09

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.3 m	No	Laptop	BTM Demonstrator Board
AC Cable	No	0.9 m	No	AC Mains	Power Supply (Laptop)
DC Cable	No	1.8 m	Yes	Power Supply (Laptop)	Laptop
Antenna Coax	Yes	0.1 m	No	Antenna	JL Module

CONFIGURATIONS

Configuration APRI0010- 3

Software/Firmware Running during test	
Description	**Version**
BlueTest3	3.2.2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
JL Module	Apricity Code	6001-003	4
Trace Antenna	Yageo	ANTX100P001B24003	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BTM Demonstrator Board	JL Audio	6003-001	2

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Inspiron 3583	4W5ZZX2
Power Supply (Laptop)	Dell	LA45NM140	CN-0KXTTW-LOC00-97N-39D5-A09

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.3 m	No	Laptop	BTM Demonstrator Board
AC Cable	No	0.9 m	No	AC Mains	Power Supply (Laptop)
DC Cable	No	1.8 m	Yes	Power Supply (Laptop)	Laptop
Antenna Coax	Yes	0.1 m	No	Antenna	JL Module

CONFIGURATIONS

Configuration APRI0010- 4

Software/Firmware Running during test	
Description	**Version**
BlueTest3	3.2.2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
JL Module	Apricity Code	6001-003	4
PCB Antenna	Yageo	ANTX100P011B24003	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BTM Demonstrator Board	JL Audio	6003-001	2

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Inspiron 3583	4W5ZZX2
Power Supply (Laptop)	Dell	LA45NM140	CN-0KXTTW-LOC00-97N-39D5-A09

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.3 m	No	Laptop	BTM Demonstrator Board
AC Cable	No	0.9 m	No	AC Mains	Power Supply (Laptop)
DC Cable	No	1.8 m	Yes	Power Supply (Laptop)	Laptop
Antenna Coax	Yes	0.1 m	No	Antenna	JL Module

CONFIGURATIONS

Configuration APRI0010- 5

Software/Firmware Running during test	
Description	**Version**
BlueTest3	3.2.2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
JL Module	Apricity Code	6001-003	4
Patch Antenna	Yageo	ANTX100P112B24553	None

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
BTM Demonstrator Board	JL Audio	6003-001	2
DC Power Supply	Agilent	U8002A	TPZ
Laptop	Dell	Inspiron 3583	4W5ZZX2

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Power Supply (Laptop)	Dell	LA45NM140	CN-0KXTTW-LOC00-97N-39D5-A09

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	Yes	1.3 m	No	Laptop	BTM Demonstrator Board
AC Cable	No	0.9 m	No	AC Mains	Power Supply (Laptop)
DC Cable	No	1.8 m	Yes	Power Supply (Laptop)	Laptop
Antenna Coax	Yes	0.1 m	No	Antenna	JL Module
DC Leads	No	1.0 m	No	DC Power Supply	USB Splice Cable
USB Splice Cable	Yes	1.0 m	No	Laptop	USB Cable

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2020-03-20	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	2020-03-25	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2020-03-25	Duty Cycle	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	2020-03-25	Carrier Frequency Separation	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	2020-03-25	Number of Hopping Frequencies	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	2020-03-25	Dwell Time	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	2020-03-25	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.
8	2020-03-25	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.
9	2020-03-25	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.
10	2020-03-25	Band Edge Compliance - Hopping Mode	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
11	2020-03-25	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.
12	2020-03-25	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

element
WTD.2020.02.17.0

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESR7	ARI	2019-07-08	2020-07-08
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2020-03-11	2021-03-11
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2020-03-15	2021-03-15
LISN	Solar Electronics	9252-50-R-24-BNC	LIQ	2019-10-04	2020-10-04

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	2.6 dB	-2.6 dB

CONFIGURATIONS INVESTIGATED

APRI0010-5

MODES INVESTIGATED

Continuous Transmit Bluetooth, Max power. Mid channel (2440 MHz), DH5

POWERLINE CONDUCTED EMISSIONS

EUT:	JL Module	Work Order:	APRI0010
Serial Number:	4	Date:	2020-03-25
Customer:	Apricity Code	Temperature:	21.8°C
Attendees:	None	Relative Humidity:	34.2%
Customer Project:	None	Bar. Pressure:	1012 mb
Tested By:	Dan Haas	Job Site:	MN03
Power:	5 VDC (via USB)	Configuration:	APRI0010-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2020	ANSI C63.10:2013

TEST PARAMETERS

Run #:	1	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Tested AC power (120VAC/60Hz) to DC Supply. 5 VDC to the BTM Demonstrator Board (via USB)

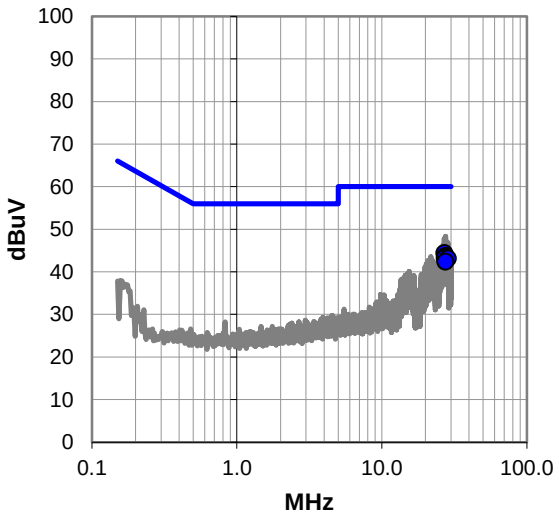
EUT OPERATING MODES

Continuous Transmit Bluetooth, Max power. Mid channel (2440 MHz), DH5

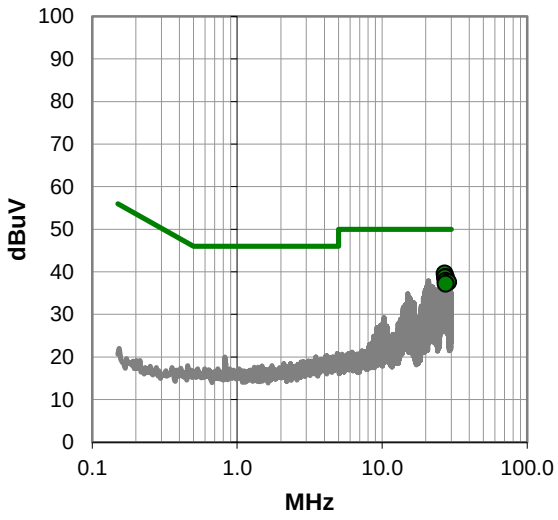
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2020.02.17.0

RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.080	23.1	21.3	44.4	60.0	-15.6
27.559	22.4	21.3	43.7	60.0	-16.3
27.522	22.1	21.3	43.4	60.0	-16.6
27.161	22.0	21.3	43.3	60.0	-16.7
28.522	21.6	21.5	43.1	60.0	-16.9
27.399	21.1	21.3	42.4	60.0	-17.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.080	18.3	21.3	39.6	50.0	-10.4
27.559	17.5	21.3	38.8	50.0	-11.2
27.161	17.4	21.3	38.7	50.0	-11.3
27.522	16.6	21.3	37.9	50.0	-12.1
28.522	16.1	21.5	37.6	50.0	-12.4
27.399	15.9	21.3	37.2	50.0	-12.8

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	JL Module	Work Order:	APRI0010
Serial Number:	4	Date:	2020-03-25
Customer:	Apricity Code	Temperature:	21.8°C
Attendees:	None	Relative Humidity:	34.2%
Customer Project:	None	Bar. Pressure:	1012 mb
Tested By:	Dan Haas	Job Site:	MN03
Power:	5 VDC (via USB)	Configuration:	APRI0010-5

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2020	ANSI C63.10:2013

TEST PARAMETERS

Run #:	2	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

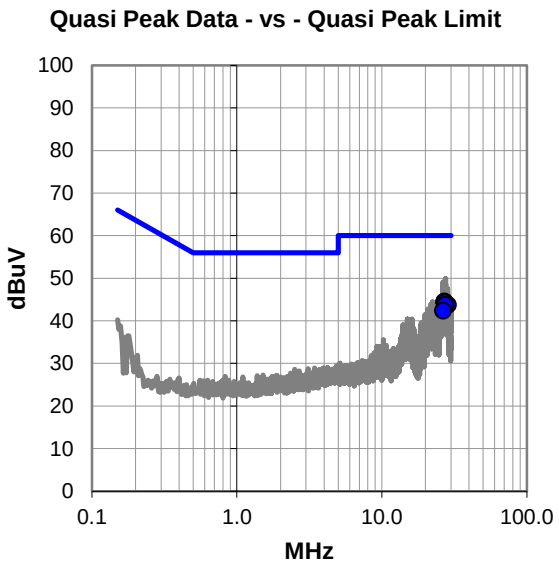
Tested AC power (120VAC/60Hz) to DC Supply. 5 VDC to the BTM Demonstrator Board (via USB)

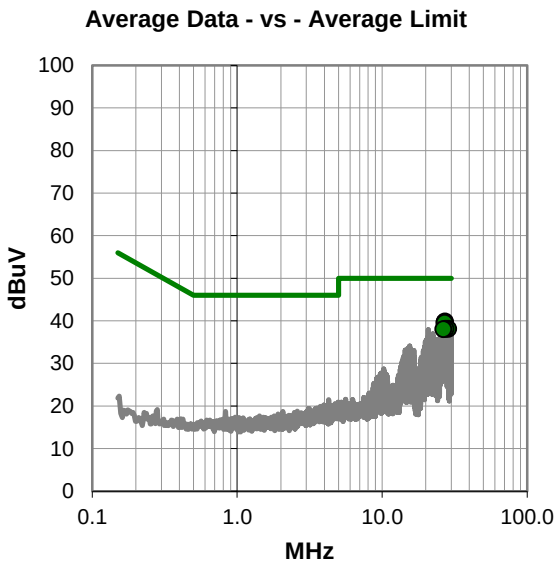
EUT OPERATING MODES

Continuous Transmit Bluetooth, Max power. Mid channel (2440 MHz), DH5

DEVIATIONS FROM TEST STANDARD

None





POWERLINE CONDUCTED EMISSIONS

element
WTD.2020.02.17.0

RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.040	23.2	21.3	44.5	60.0	-15.5
27.081	23.2	21.3	44.5	60.0	-15.5
27.120	23.0	21.3	44.3	60.0	-15.7
28.521	22.2	21.5	43.7	60.0	-16.3
27.481	22.4	21.3	43.7	60.0	-16.3
26.519	21.1	21.3	42.4	60.0	-17.6

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
27.120	18.5	21.3	39.8	50.0	-10.2
27.081	18.4	21.3	39.7	50.0	-10.3
27.040	18.2	21.3	39.5	50.0	-10.5
28.521	16.6	21.5	38.1	50.0	-11.9
27.481	16.8	21.3	38.1	50.0	-11.9
26.519	16.7	21.3	38.0	50.0	-12.0

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2019.11.08.1

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

Continuous Transmit Bluetooth, Max power. See comments for EUT orientation, transmit frequency, and data rate.

Continuous Transmit Bluetooth on Low channel (2402 MHz), Mid channel (2440 MHz), High channel (2480 MHz); Max power; DH5, 2DH5, and 3DH5. See comments for EUT orientation, transmit frequency, and data rate.

POWER SETTINGS INVESTIGATED

5 VDC (via USB)

CONFIGURATIONS INVESTIGATED

APRI0010 - 4

APRI0010 - 3

APRI0010 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26000 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Filter - Low Pass	Micro-Tronics	LPM50004	HGG	2019-09-17	12 mo
Filter - High Pass	Micro-Tronics	HPM50111	HFM	2019-09-18	12 mo
Attenuator	Coaxicom	3910-20	AXY	2019-09-17	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVX	2020-02-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	2020-02-18	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-12001800-30-10P	PAP	2020-02-18	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1064-9079 and SA18E-10	AOO	2020-02-18	12 mo
Amplifier - Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	2019-09-11	12 mo
Cable	Element	Biconilog Cable	MNX	2020-02-18	12 mo
Cable	Element	Standard Gain Cable	MNW	2020-02-18	12 mo
Cable	Element	Double Ridge Guide Horn Cables	MNV	2020-02-18	12 mo
Cable	ESM Cable Corp.	TTBJ141 KMKM-72	MNP	2019-09-11	12 mo
Antenna - Biconilog	Ametek	CBL 6141B	AYS	2019-03-19	24 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AHG	NCR	0 mo
Antenna - Standard Gain	ETS-Lindgren	3160-08	AJP	NCR	0 mo
Antenna - Standard Gain	ETS-Lindgren	3160-07	AJJ	NCR	0 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIB	2018-08-27	24 mo
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	2019-07-28	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVW	2020-01-17	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AIQ	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVV	2020-01-17	12 mo
Cable	ESM Cable Corp.	Standard Gain Horn Cables	MNJ	2020-03-10	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AXP	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	AVT	2020-01-17	12 mo
Cable	ESM Cable Corp.	Double Ridge Guide Horn Cables	MNI	2019-09-17	12 mo
Antenna - Double Ridge	ETS-Lindgren	3115	AJQ	2019-01-16	24 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AVO	2019-10-18	12 mo
Cable	ESM Cable Corp.	Bilog Cables	MNH	2019-10-18	12 mo
Antenna - Biconilog	ETS Lindgren	3142D	AXO	2019-09-03	24 mo

Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2019-12-23	12 mo

MEASUREMENT BANDWIDTHS

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

TEST DESCRIPTION

The 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.

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

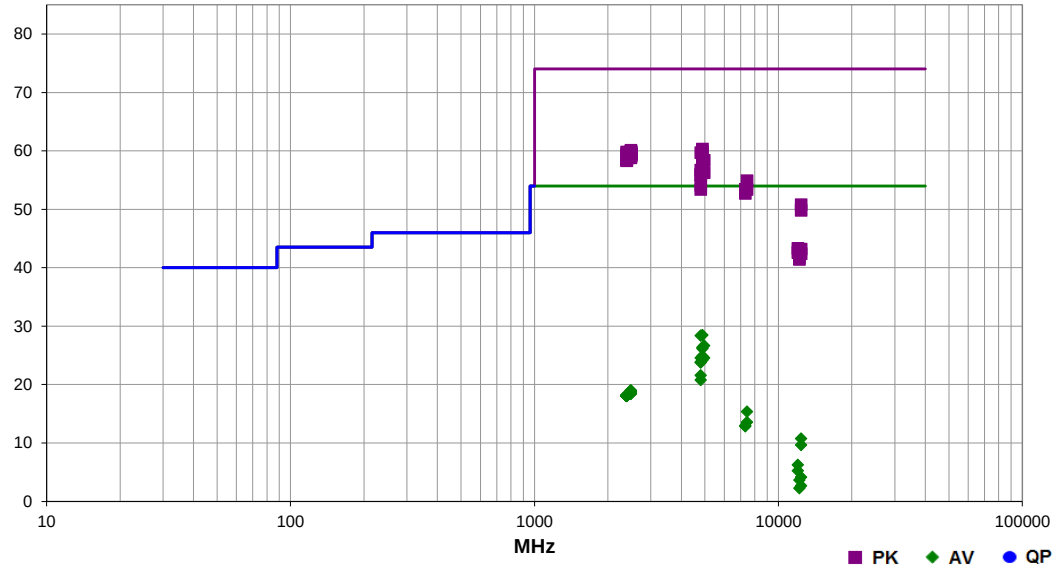
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	APRI0010	**Date:**	2020-03-20		
Project:	None	**Temperature:**	21.4 °C		
Job Site:	MN09	**Humidity:**	23.9% RH		
Serial Number:	4	**Barometric Pres.:**	1033 mbar	**Tested by:**	Dan Haas
EUT:	JL Module				
Configuration:	2				
Customer:	Apricity Code				
Attendees:	None				
EUT Power:	5 VDC (via USB)				
Operating Mode:	Continuous Transmit Bluetooth, Max power. See comments for EUT orientation, transmit frequency, and data rate.				
Deviations:	None				
Comments:	Test mode operates at 77% duty Cycle, Upward DCCF correction applied based on 10*log(1/Duty cycle) = 1.135. Operational worst case Duty cycle in any 100ms is 2.892ms. Downward DCCF correction applied based on 20*log(Duty Cycle) = -30.776. Total correction applied = -29.64.				

Test Specifications	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

Run #	16	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4880.333	55.0	5.3	1.9	124.0	0.0	0.0	Horz	PK	0.0	60.3	74.0	-13.7	EUT Vertical, Mid (2440 MHz), DH5
2484.227	43.0	-2.9	1.5	135.0	0.0	20.0	Vert	PK	0.0	60.1	74.0	-13.9	EUT Horizontal, High (2480 MHz), DH5
2485.367	42.8	-2.9	1.5	116.0	0.0	20.0	Vert	PK	0.0	59.9	74.0	-14.1	EUT on side, High (2480 MHz), 3DH5
2485.087	42.8	-2.9	1.2	32.0	0.0	20.0	Vert	PK	0.0	59.9	74.0	-14.1	EUT Horizontal, High (2480 MHz), 2DH5
4880.450	54.5	5.3	2.0	149.0	0.0	0.0	Horz	PK	0.0	59.8	74.0	-14.2	EUT Vertical, Mid (2440 MHz), 2DH5
2486.000	42.7	-2.9	1.1	123.0	0.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	EUT Vertical, High (2480 MHz), DH5
2386.787	43.0	-3.2	2.5	262.0	0.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	EUT Vertical, Low (2402 MHz), 3DH5
4804.575	54.5	5.2	1.9	123.0	0.0	0.0	Horz	PK	0.0	59.7	74.0	-14.3	EUT Vertical, Low (2402 MHz), DH5
2486.313	42.6	-2.9	2.0	222.0	0.0	20.0	Horz	PK	0.0	59.7	74.0	-14.3	EUT on side, High (2480 MHz), 2DH5
2485.940	42.5	-2.9	1.5	212.0	0.0	20.0	Vert	PK	0.0	59.6	74.0	-14.4	EUT on side, High (2480 MHz), DH5
2484.720	42.4	-2.9	2.5	227.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	EUT on side, High (2480 MHz), DH5
2485.267	42.4	-2.9	1.5	227.0	0.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	EUT Vertical, High (2480 MHz), 3DH5
2386.633	42.7	-3.2	3.3	97.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	EUT Horizontal, Low (2402 MHz), DH5
2487.087	42.3	-2.9	1.5	54.0	0.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Vertical, High (2480 MHz), DH5
2486.720	42.3	-2.9	1.5	7.0	0.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Vertical, High (2480 MHz), 3DH5
2487.467	42.3	-2.9	3.9	0.0	0.0	20.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Horizontal, High (2480 MHz), 3DH5
2486.553	42.2	-2.9	1.5	153.0	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT Horizontal, High (2480 MHz), DH5
2485.973	42.2	-2.9	1.5	326.0	0.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	EUT on side, High (2480 MHz), 2DH5
2483.747	42.1	-2.9	1.5	99.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vertical, High (2480 MHz), 2DH5
2386.753	42.4	-3.2	1.5	282.0	0.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	EUT on side, Low (2402 MHz), DH5
2483.547	42.0	-2.9	1.5	207.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT on side, High (2480 MHz), 3DH5
2485.813	42.0	-2.9	2.4	160.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Horizontal, High (2480 MHz), 2DH5
2387.013	42.3	-3.2	3.0	201.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Horizontal, Low (2402 MHz), 3DH5
2483.533	41.9	-2.9	1.5	139.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT Vertical, High (2480 MHz), 2DH5
2389.927	42.2	-3.2	1.5	276.0	0.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	EUT on side, Low (2402 MHz), 2DH5
2387.300	42.1	-3.2	3.2	26.0	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUT Vertical, Low (2402 MHz), 2DH5
2387.227	42.1	-3.2	1.5	337.0	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUT on side, Low (2402 MHz), 3DH5
2388.520	42.1	-3.2	1.5	290.0	0.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	EUT Vertical, Low (2402 MHz), 3DH5
2484.993	41.7	-2.9	1.5	47.0	0.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	EUT Horizontal, High (2480 MHz), 3DH5

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2389.993	42.0	-3.2	1.5	134.0	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	EUT on side, Low (2402 MHz), 2DH5
2388.973	42.0	-3.2	2.6	117.0	0.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	EUT Horizontal, Low (2402 MHz), 3DH5
2389.700	41.9	-3.2	1.9	312.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT Horizontal, Low (2402 MHz), 2DH5
2387.507	41.9	-3.2	1.5	255.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT Vertical, Low (2402 MHz), DH5
2387.760	41.7	-3.2	1.5	56.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Vertical, Low (2402 MHz), 2DH5
2388.507	41.7	-3.2	1.5	9.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT on side, Low (2402 MHz), 3DH5
2389.453	41.7	-3.2	1.9	35.0	0.0	20.0	Horz	PK	0.0	58.5	74.0	-15.5	EUT on side, Low (2402 MHz), DH5
4959.675	52.9	5.5	2.0	140.0	0.0	0.0	Horz	PK	0.0	58.4	74.0	-15.6	EUT Vertical, High (2480 MHz), DH5
2386.120	41.6	-3.2	1.5	201.0	0.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	EUT Horizontal, Low (2402 MHz), 2DH5
2386.767	41.6	-3.2	2.7	38.0	0.0	20.0	Vert	PK	0.0	58.4	74.0	-15.6	EUT Horizontal, Low (2402 MHz), DH5
4879.983	53.0	5.3	1.8	129.0	0.0	0.0	Horz	PK	0.0	58.3	74.0	-15.7	EUT Vertical, Mid (2440 MHz), DH5
2388.300	41.5	-3.2	1.5	120.0	0.0	20.0	Vert	PK	0.0	58.3	74.0	-15.7	EUT Vertical, Low (2402 MHz), DH5
4880.708	52.5	5.3	2.0	141.0	0.0	0.0	Horz	PK	0.0	57.8	74.0	-16.2	EUT Vertical, Mid (2440 MHz), 3DH5
4803.775	51.5	5.2	3.9	117.0	0.0	0.0	Vert	PK	0.0	56.7	74.0	-17.3	EUT on side, Low (2402 MHz), DH5
4880.442	51.4	5.3	4.0	131.0	0.0	0.0	Vert	PK	0.0	56.7	74.0	-17.3	EUT on side, Mid (2440 MHz), DH5
4960.433	50.8	5.5	3.8	114.0	0.0	0.0	Vert	PK	0.0	56.3	74.0	-17.7	EUT on side, High (2480 MHz), DH5
4803.875	50.8	5.2	3.3	205.0	0.0	0.0	Vert	PK	0.0	56.0	74.0	-18.0	EUT Horizontal, Low (2402 MHz), DH5
4803.892	50.6	5.2	1.5	43.0	0.0	0.0	Horz	PK	0.0	55.8	74.0	-18.2	EUT on side, Low (2402 MHz), DH5
7440.433	40.4	14.5	3.1	62.0	0.0	0.0	Horz	PK	0.0	54.9	74.0	-19.1	EUT Vertical, High (2480 MHz), DH5
4803.883	48.9	5.2	1.6	119.0	0.0	0.0	Horz	PK	0.0	54.1	74.0	-19.9	EUT Horizontal, Low (2402 MHz), DH5
4803.783	48.2	5.2	1.5	49.0	0.0	0.0	Vert	PK	0.0	53.4	74.0	-20.6	EUT Vertical, Low (2402 MHz), DH5
7318.633	39.4	14.0	1.5	351.0	0.0	0.0	Vert	PK	0.0	53.4	74.0	-20.6	EUT on side, Mid (2440 MHz), DH5
7439.683	38.9	14.5	1.5	134.0	0.0	0.0	Vert	PK	0.0	53.4	74.0	-20.6	EUT on side, High (2480 MHz), DH5
7321.308	38.7	14.0	1.5	172.0	0.0	0.0	Horz	PK	0.0	52.7	74.0	-21.3	EUT Vertical, Mid (2440 MHz), DH5
12401.720	36.7	14.1	3.1	76.0	0.0	0.0	Vert	PK	0.0	50.8	74.0	-23.2	EUT on side, High (2480 MHz), DH5
12402.060	35.7	14.1	1.5	9.0	0.0	0.0	Horz	PK	0.0	49.8	74.0	-24.2	EUT Vertical, High (2480 MHz), DH5
4880.108	52.8	5.3	1.9	124.0	-29.6	0.0	Horz	AV	0.0	28.5	54.0	-25.5	EUT Vertical, Mid (2440 MHz), DH5
4804.092	52.8	5.2	1.9	123.0	-29.6	0.0	Horz	AV	0.0	28.4	54.0	-25.6	EUT Vertical, Low (2402 MHz), DH5
4960.133	50.8	5.5	2.0	140.0	-29.6	0.0	Horz	AV	0.0	26.7	54.0	-27.3	EUT Vertical, High (2480 MHz), DH5
4880.100	50.7	5.3	1.8	129.0	-29.6	0.0	Horz	AV	0.0	26.4	54.0	-27.6	EUT Vertical, Mid (2440 MHz), DH5
4880.067	50.5	5.3	2.0	149.0	-29.6	0.0	Horz	AV	0.0	26.2	54.0	-27.8	EUT Vertical, Mid (2440 MHz), 2DH5
4880.058	49.2	5.3	4.0	131.0	-29.6	0.0	Vert	AV	0.0	24.9	54.0	-29.1	EUT on side, Mid (2440 MHz), DH5
4804.067	49.0	5.2	3.9	117.0	-29.6	0.0	Vert	AV	0.0	24.6	54.0	-29.4	EUT on side, Low (2402 MHz), DH5
4960.100	48.7	5.5	3.8	114.0	-29.6	0.0	Vert	AV	0.0	24.6	54.0	-29.4	EUT on side, High (2480 MHz), DH5
4880.108	48.5	5.3	2.0	141.0	-29.6	0.0	Horz	AV	0.0	24.2	54.0	-29.8	EUT Vertical, Mid (2440 MHz), 3DH5
4804.092	48.3	5.2	3.3	205.0	-29.6	0.0	Vert	AV	0.0	23.9	54.0	-30.1	EUT Horizontal, Low (2402 MHz), DH5
4804.083	48.2	5.2	1.5	43.0	-29.6	0.0	Horz	AV	0.0	23.8	54.0	-30.2	EUT on side, Low (2402 MHz), DH5
12009.280	45.0	-1.7	3.1	114.0	0.0	0.0	Horz	PK	0.0	43.3	74.0	-30.7	EUT Vertical, Low (2402 MHz), DH5
12399.700	43.5	-0.3	1.6	21.0	0.0	0.0	Horz	PK	0.0	43.2	74.0	-30.8	EUT Vertical, High (2480 MHz), DH5
12009.870	44.3	-1.7	4.0	78.0	0.0	0.0	Vert	PK	0.0	42.6	74.0	-31.4	EUT on side, Low (2402 MHz), DH5
12399.930	42.7	-0.3	1.5	110.0	0.0	0.0	Vert	PK	0.0	42.4	74.0	-31.6	EUT on side, High (2480 MHz), DH5
12198.930	42.0	-0.3	1.6	10.0	0.0	0.0	Horz	PK	0.0	41.7	74.0	-32.3	EUT Vertical, Mid (2440 MHz), DH5
4804.075	46.0	5.2	1.6	119.0	-29.6	0.0	Horz	AV	0.0	21.6	54.0	-32.4	EUT Horizontal, Low (2402 MHz), DH5
12199.550	41.7	-0.3	1.9	114.0	0.0	0.0	Vert	PK	0.0	41.4	74.0	-32.6	EUT on side, Mid (2440 MHz), DH5
4804.083	45.2	5.2	1.5	49.0	-29.6	0.0	Vert	AV	0.0	20.8	54.0	-33.2	EUT Vertical, Low (2402 MHz), DH5
2483.500	31.5	-2.9	1.5	54.0	-29.6	20.0	Horz	AV	0.0	19.0	54.0	-35.0	EUT Vertical, High (2480 MHz), DH5
2483.627	31.5	-2.9	1.5	326.0	-29.6	20.0	Vert	AV	0.0	19.0	54.0	-35.0	EUT on side, High (2480 MHz), 2DH5
2483.540	31.5	-2.9	1.5	99.0	-29.6	20.0	Horz	AV	0.0	19.0	54.0	-35.0	EUT Vertical, High (2480 MHz), 2DH5
2484.273	31.3	-2.9	1.1	123.0	-29.6	20.0	Vert	AV	0.0	18.8	54.0	-35.2	EUT Vertical, High (2480 MHz), DH5
2483.613	31.3	-2.9	2.5	227.0	-29.6	20.0	Horz	AV	0.0	18.8	54.0	-35.2	EUT on side, High (2480 MHz), DH5
2483.520	31.2	-2.9	1.5	207.0	-29.6	20.0	Horz	AV	0.0	18.7	54.0	-35.3	EUT on side, High (2480 MHz), 3DH5
2483.727	31.2	-2.9	2.4	160.0	-29.6	20.0	Horz	AV	0.0	18.7	54.0	-35.3	EUT Horizontal, High (2480 MHz), 2DH5
2484.147	31.1	-2.9	1.5	212.0	-29.6	20.0	Vert	AV	0.0	18.6	54.0	-35.4	EUT on side, High (2480 MHz), DH5
2484.833	31.1	-2.9	1.5	153.0	-29.6	20.0	Horz	AV	0.0	18.6	54.0	-35.4	EUT Horizontal, High (2480 MHz), DH5
2484.140	31.1	-2.9	1.5	135.0	-29.6	20.0	Vert	AV	0.0	18.6	54.0	-35.4	EUT Horizontal, High (2480 MHz), DH5
2483.640	31.1	-2.9	1.5	116.0	-29.6	20.0	Vert	AV	0.0	18.6	54.0	-35.4	EUT on side, High (2480 MHz), 3DH5
2483.613	31.1	-2.9	3.9	0.0	-29.6	20.0	Horz	AV	0.0	18.6	54.0	-35.4	EUT Horizontal, High (2480 MHz), 3DH5
2484.427	31.1	-2.9	1.2	32.0	-29.6	20.0	Vert	AV	0.0	18.6	54.0	-35.4	EUT Horizontal, High (2480 MHz), 2DH5
2484.107	31.0	-2.9	1.5	7.0	-29.6	20.0	Horz	AV	0.0	18.5	54.0	-35.5	EUT Vertical, High (2480 MHz), 3DH5
2483.547	31.0	-2.9	1.5	227.0	-29.6	20.0	Vert	AV	0.0	18.5	54.0	-35.5	EUT Vertical, High (2480 MHz), 3DH5
2485.293	31.0	-2.9	1.5	47.0	-29.6	20.0	Vert	AV	0.0	18.5	54.0	-35.5	EUT Horizontal, High (2480 MHz), 3DH5
2485.153	31.0	-2.9	2.0	222.0	-29.6	20.0	Horz	AV	0.0	18.5	54.0	-35.5	EUT on side, High (2480 MHz), 2DH5
2483.513	31.0	-2.9	1.5	139.0	-29.6	20.0	Vert	AV	0.0	18.5	54.0	-35.5	EUT Vertical, High (2480 MHz), 2DH5
2388.940	31.0	-3.2	1.5	56.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), 2DH5
2387.547	31.0	-3.2	1.5	134.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT on side, Low (2402 MHz), 2DH5
2386.100	31.0	-3.2	1.5	201.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Horizontal, Low (2402 MHz), 2DH5
2389.053	31.0	-3.2	3.0	201.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT Horizontal, Low (2402 MHz), 3DH5
2389.787	31.0	-3.2	2.6	117.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Horizontal, Low (2402 MHz), 3DH5
2387.160	31.0	-3.2	3.3	97.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT Horizontal, Low (2402 MHz), DH5
2388.313	31.0	-3.2	2.7	38.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Horizontal, Low (2402 MHz), DH5
2386.247	30.9	-3.2	3.2	26.0	-29.6	20.0	Horz	AV	0.0	18.1	54.0	-35.9	EUT Vertical, Low (2402 MHz), 2DH5
2389.373	30.9	-3.2	1.5	276.0	-29.6	20.0	Vert	AV	0.0	18.1	54.0	-35.9	EUT on side, Low (2402 MHz), 2DH5
2386.453	30.9	-3.2	1.9	312.0	-29.6	20.0	Horz	AV	0.0	18.1	54.0	-35.9	EUT Horizontal, Low (2402 MHz), 2DH5
2387.407	30.9	-3.2	1.5	337.0	-29.6	20.0	Horz	AV	0.0	18.1	54.0	-35.9	EUT on side, Low (2402 MHz), 3DH5
2387.787	30.9	-3.2	1.5	9.0	-29.6	20.0	Vert	AV	0.0	18.1	54.0	-35.9	EUT on side, Low (2402 MHz), 3DH5
2386.073	30.9	-3.2	1.5	290.0	-29.6	20.0	Horz	AV	0.0	18.1	54.0	-35.9	EUT Vertical, Low (2402 MHz), 3DH5
2388.187	30.9	-3.2	2.5	262.0	-29.6	20.0	Vert	AV	0.0	18.1	54.0	-35.9	EUT Vertical, Low (2402 MHz), 3DH5
2389.740	30.9	-3.2	1.9	35.0	-29.6	20.0	Horz	AV	0.0	18.1	54.0	-35.9	EUT on side, Low (2402 MHz), DH5
2387.900	30.9	-3.2	1.5	282.0	-29.6	20.0	Vert	AV	0.0	18.1	54.0	-35.9	EUT on side, Low (2402 MHz), DH5
2387.160	30.9	-3.2	1.5	255.0	-29.6	20.0	Horz	AV	0.0	18.1	54.0	-35.9	EUT Vertical, Low (2402 MHz), DH5
2387.653	30.9	-3.2	1.5	120.0	-29.6	20.0	Vert	AV	0.0	18.1	54.0	-35.9	EUT Vertical, Low (2402 MHz), DH5
7440.300	30.5	14.5	3.1	62.0	-29.6	0.0	Horz	AV	0.0	15.4	54.0	-38.6	EUT Vertical, High (2480 MHz), DH5
7440.317	28.7	14.5	1.5	134.0	-29.6	0.0	Vert	AV	0.0	13.6	54.0	-40.4	EUT on side, High (2480 MHz), DH5
7320.658	28.6	14.0	1.5	351.0	-29.6	0.0	Vert	AV	0.0	13.0	54.0	-41.0	EUT on side, Mid (2440 MHz), DH5
7320.392	28.5	14.0	1.5	172.0	-29.6	0.0	Horz	AV	0.0	12.9	54.0	-41.1	EUT Vertical, Mid (2440 MHz), DH5
12400.830	26.3	14.1	3.1	76.0	-29.6	0.0	Vert	AV	0.0	10.8	54.0	-43.2	EUT on side, High (2480 MHz), DH5
12400.750	25.2	14.1	1.5	9.0	-29.6	0.0	Horz	AV	0.0	9.7	54.0	-44.3	EUT Vertical, High (2480 MHz), DH5
12010.870	37.6	-1.7	3.1	114.0	-29.6	0.0	Horz	AV	0.0	6.3	54.0	-47.7	EUT Vertical, Low (2402 MHz), DH5
12010.800	36.6	-1.7	4.0	78.0	-29.6	0.0	Vert	AV	0.0	5.3	54.0	-48.7	EUT on side, Low (2402 MHz), DH5
12399.660	34.1	-0.3	1.6	21.0	-29.6	0.0	Horz	AV	0.0	4.2	54.0	-49.8	EUT Vertical, High (2480 MHz), DH5
12200.890	33.6	-0.3	1.6	10.0	-29.6	0.0	Horz	AV	0.0	3.7	54.0	-50.3	EUT Vertical, Mid (2440 MHz), DH5
12399.650	32.6	-0.3	1.5	110.0	-29.6	0.0	Vert	AV	0.0	2.7	54.0	-51.3	EUT on side, High (2480 MHz), DH5
12199.620	32.2	-0.3	1.9	114.0	-29.6	0.0	Vert	AV	0.0	2.3	54.0	-51.7	EUT on side, Mid (2440 MHz), DH5

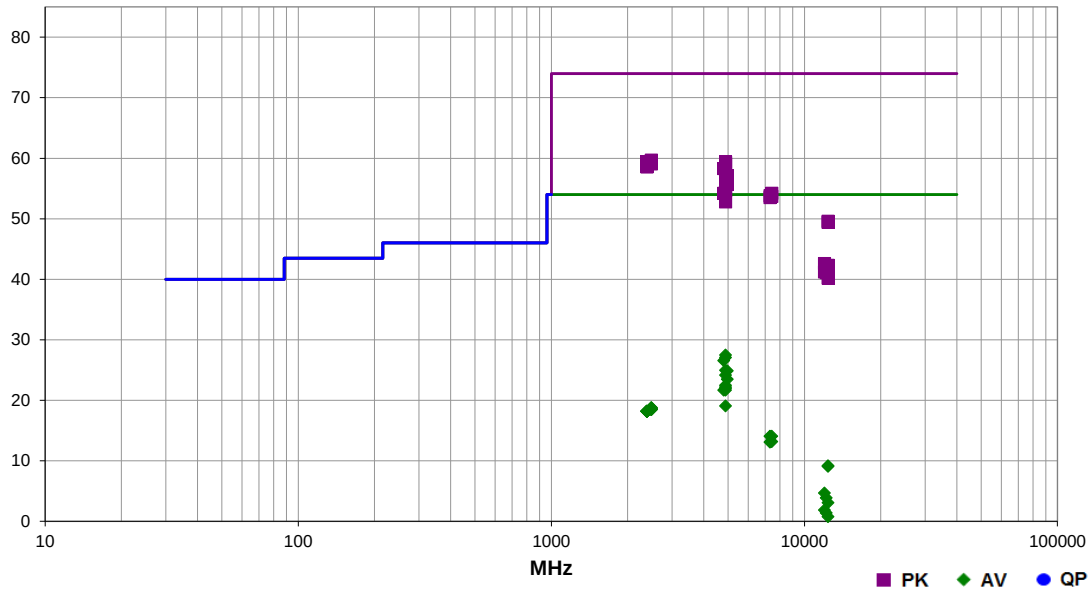
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	APRI0010	**Date:**	2020-03-24		
Project:	None	**Temperature:**	21.6 °C		
Job Site:	MN09	**Humidity:**	31% RH		
Serial Number:	4	**Barometric Pres.:**	1018 mbar	**Tested by:**	Dan Haas
EUT:	JL Module				
Configuration:	3				
Customer:	Apricity Code				
Attendees:	None				
EUT Power:	5 VDC (via USB)				
Operating Mode:	Continuous Transmit Bluetooth, Max power. See comments for EUT orientation, transmit frequency, and data rate.				
Deviations:	None				
Comments:	Test mode operates at 77% duty Cycle, Upward DCCF correction applied based on 10*log(1/Duty cycle) = 1.135. Operational worst case Duty cycle in any 100ms is 2.892ms. Downward DCCF correction applied based on 20*log(Duty Cycle) = -30.776. Total correction applied = -29.64.				

Test Specifications	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

Run #	60	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2486.880	42.6	-2.9	1.5	79.0	0.0	20.0	Horz	PK	0.0	59.7	74.0	-14.3	EUT Vertical, High (2480 MHz), DH5
2484.620	42.5	-2.9	1.5	223.0	0.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	EUT Horizontal, High (2480 MHz), DH5
2484.400	42.4	-2.9	1.5	188.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	EUT on side, High (2480 MHz), DH5
2483.900	42.4	-2.9	1.5	190.0	0.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	EUT on side, High (2480 MHz), DH5
4880.493	54.1	5.3	1.9	140.0	0.0	0.0	Horz	PK	0.0	59.4	74.0	-14.6	EUT Vertical, Mid (2440 MHz), DH5
2388.293	42.6	-3.2	1.5	136.0	0.0	20.0	Vert	PK	0.0	59.4	74.0	-14.6	EUT on side, Low (2402 MHz), DH5
2486.853	42.2	-2.9	1.5	4.0	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT Horizontal, High (2480 MHz), 2DH5
2484.280	42.2	-2.9	3.6	107.0	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT Vertical, High (2480 MHz), 3DH5
2486.833	42.1	-2.9	1.5	204.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vertical, High (2480 MHz), 2DH5
2387.413	42.4	-3.2	1.5	267.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vertical, Low (2402 MHz), DH5
4880.073	53.8	5.3	2.0	140.0	0.0	0.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT Vertical, Mid (2440 MHz), DH5
2486.287	42.0	-2.9	1.5	141.0	0.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	EUT Vertical, High (2480 MHz), DH5
2485.180	42.0	-2.9	3.6	89.0	0.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	EUT Horizontal, High (2480 MHz), DH5
2386.287	42.3	-3.2	1.5	231.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	EUT on side, Low (2402 MHz), DH5
2387.867	42.3	-3.2	1.5	56.0	0.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	EUT on side, Low (2402 MHz), 2DH5
2386.360	42.1	-3.2	1.5	321.0	0.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	EUT Vertical, Low (2402 MHz), DH5
2387.067	42.1	-3.2	1.5	42.0	0.0	20.0	Vert	PK	0.0	58.9	74.0	-15.1	EUT Horizontal, Low (2402 MHz), DH5
2388.967	41.8	-3.2	1.5	24.0	0.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	EUT Horizontal, Low (2402 MHz), DH5
2386.260	41.8	-3.2	1.5	10.0	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT on side, Low (2402 MHz), 3DH5
4804.387	53.1	5.2	3.3	136.0	0.0	0.0	Horz	PK	0.0	58.3	74.0	-15.7	EUT Vertical, Low (2402 MHz), DH5
4880.113	52.0	5.3	1.8	139.0	0.0	0.0	Horz	PK	0.0	57.3	74.0	-16.7	EUT Vertical, Mid (2440 MHz), 3DH5
4880.420	51.9	5.3	2.1	56.0	0.0	0.0	Horz	PK	0.0	57.2	74.0	-16.8	EUT on side, Mid (2440 MHz), DH5
4960.433	51.6	5.5	2.0	141.0	0.0	0.0	Horz	PK	0.0	57.1	74.0	-16.9	EUT Vertical, High (2480 MHz), DH5
4879.780	51.2	5.3	1.5	140.0	0.0	0.0	Horz	PK	0.0	56.5	74.0	-17.5	EUT Vertical, Mid (2440 MHz), 2DH5
4880.433	50.8	5.3	2.9	233.0	0.0	0.0	Vert	PK	0.0	56.1	74.0	-17.9	EUT Horizontal, Mid (2440 MHz), DH5

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4960.360	50.2	5.5	3.8	245.0	0.0	0.0	Vert	PK	0.0	55.7	74.0	-18.3	EUT Horizontal, High (2480 MHz), DH5
4880.293	49.4	5.3	2.5	71.0	0.0	0.0	Vert	PK	0.0	54.7	74.0	-19.3	EUT Vertical, Mid (2440 MHz), DH5
4879.747	49.4	5.3	3.2	137.0	0.0	0.0	Vert	PK	0.0	54.7	74.0	-19.3	EUT on side, Mid (2440 MHz), DH5
4804.527	49.0	5.2	4.0	280.0	0.0	0.0	Vert	PK	0.0	54.2	74.0	-19.8	EUT Horizontal, Low (2402 MHz), DH5
7440.200	39.7	14.5	1.6	67.0	0.0	0.0	Horz	PK	0.0	54.2	74.0	-19.8	EUT Vertical, High (2480 MHz), DH5
7320.487	39.8	14.0	1.9	56.0	0.0	0.0	Horz	PK	0.0	53.8	74.0	-20.2	EUT Vertical, Mid (2440 MHz), DH5
7440.500	39.2	14.5	1.5	252.0	0.0	0.0	Vert	PK	0.0	53.7	74.0	-20.3	EUT Horizontal, High (2480 MHz), DH5
7319.700	39.5	14.0	3.2	38.0	0.0	0.0	Vert	PK	0.0	53.5	74.0	-20.5	EUT Horizontal, Mid (2440 MHz), DH5
4880.547	47.5	5.3	1.5	173.0	0.0	0.0	Horz	PK	0.0	52.8	74.0	-21.2	EUT Horizontal, Mid (2440 MHz), DH5
12401.260	35.5	14.1	1.5	228.0	0.0	0.0	Horz	PK	0.0	49.6	74.0	-24.4	EUT Vertical, High (2480 MHz), DH5
12400.180	35.3	14.1	1.5	194.0	0.0	0.0	Vert	PK	0.0	49.4	74.0	-24.6	EUT Horizontal, High (2480 MHz), DH5
4880.093	51.8	5.3	1.9	140.0	-29.6	0.0	Horz	AV	0.0	27.5	54.0	-26.5	EUT Vertical, Mid (2440 MHz), DH5
4880.100	51.4	5.3	2.0	140.0	-29.6	0.0	Horz	AV	0.0	27.1	54.0	-26.9	EUT Vertical, Mid (2440 MHz), DH5
4804.113	51.0	5.2	3.3	136.0	-29.6	0.0	Horz	AV	0.0	26.6	54.0	-27.4	EUT Vertical, Low (2402 MHz), DH5
4880.107	49.3	5.3	2.1	56.0	-29.6	0.0	Horz	AV	0.0	25.0	54.0	-29.0	EUT on side, Mid (2440 MHz), DH5
4960.107	49.0	5.5	2.0	141.0	-29.6	0.0	Horz	AV	0.0	24.9	54.0	-29.1	EUT Vertical, High (2480 MHz), DH5
4880.087	48.5	5.3	2.9	233.0	-29.6	0.0	Vert	AV	0.0	24.2	54.0	-29.8	EUT Horizontal, Mid (2440 MHz), DH5
4960.060	47.6	5.5	3.8	245.0	-29.6	0.0	Vert	AV	0.0	23.5	54.0	-30.5	EUT Horizontal, High (2480 MHz), DH5
12010.940	44.3	-1.7	1.6	31.0	0.0	0.0	Horz	PK	0.0	42.6	74.0	-31.4	EUT Vertical, Low (2402 MHz), DH5
4880.160	46.8	5.3	1.8	139.0	-29.6	0.0	Horz	AV	0.0	22.5	54.0	-31.5	EUT Vertical, Mid (2440 MHz), 3DH5
12399.860	42.6	-0.3	1.6	22.0	0.0	0.0	Horz	PK	0.0	42.3	74.0	-31.7	EUT Vertical, High (2480 MHz), DH5
12199.920	42.5	-0.3	1.6	22.0	0.0	0.0	Horz	PK	0.0	42.2	74.0	-31.8	EUT Vertical, Mid (2440 MHz), DH5
4880.067	46.5	5.3	3.2	137.0	-29.6	0.0	Vert	AV	0.0	22.2	54.0	-31.8	EUT on side, Mid (2440 MHz), DH5
4880.060	46.3	5.3	2.5	71.0	-29.6	0.0	Vert	AV	0.0	22.0	54.0	-32.0	EUT Vertical, Mid (2440 MHz), DH5
4804.087	46.1	5.2	4.0	280.0	-29.6	0.0	Vert	AV	0.0	21.7	54.0	-32.3	EUT Horizontal, Low (2402 MHz), DH5
4880.193	46.0	5.3	1.5	140.0	-29.6	0.0	Horz	AV	0.0	21.7	54.0	-32.3	EUT Vertical, Mid (2440 MHz), 2DH5
12009.970	42.9	-1.7	1.8	233.0	0.0	0.0	Vert	PK	0.0	41.2	74.0	-32.8	EUT Horizontal, Low (2402 MHz), DH5
12201.370	41.4	-0.3	3.2	96.0	0.0	0.0	Vert	PK	0.0	41.1	74.0	-32.9	EUT Horizontal, Mid (2440 MHz), DH5
12399.830	40.5	-0.3	3.9	210.0	0.0	0.0	Vert	PK	0.0	40.2	74.0	-33.8	EUT Horizontal, High (2480 MHz), DH5
4880.100	43.4	5.3	1.5	173.0	-29.6	0.0	Horz	AV	0.0	19.1	54.0	-34.9	EUT Horizontal, Mid (2440 MHz), DH5
2485.500	31.3	-2.9	1.5	79.0	-29.6	20.0	Horz	AV	0.0	18.8	54.0	-35.2	EUT Vertical, High (2480 MHz), DH5
2485.227	31.3	-2.9	1.5	141.0	-29.6	20.0	Vert	AV	0.0	18.8	54.0	-35.2	EUT Vertical, High (2480 MHz), DH5
2484.060	31.2	-2.9	1.5	188.0	-29.6	20.0	Horz	AV	0.0	18.7	54.0	-35.3	EUT on side, High (2480 MHz), DH5
2483.520	31.1	-2.9	1.5	190.0	-29.6	20.0	Vert	AV	0.0	18.6	54.0	-35.4	EUT on side, High (2480 MHz), DH5
2483.640	31.1	-2.9	1.5	223.0	-29.6	20.0	Horz	AV	0.0	18.6	54.0	-35.4	EUT Horizontal, High (2480 MHz), DH5
2483.833	31.1	-2.9	3.6	89.0	-29.6	20.0	Vert	AV	0.0	18.6	54.0	-35.4	EUT Horizontal, High (2480 MHz), DH5
2484.820	31.0	-2.9	1.5	4.0	-29.6	20.0	Horz	AV	0.0	18.5	54.0	-35.5	EUT Horizontal, High (2480 MHz), 2DH5
2485.600	31.0	-2.9	1.5	204.0	-29.6	20.0	Horz	AV	0.0	18.5	54.0	-35.5	EUT Vertical, High (2480 MHz), 2DH5
2483.887	31.0	-2.9	3.6	107.0	-29.6	20.0	Horz	AV	0.0	18.5	54.0	-35.5	EUT Vertical, High (2480 MHz), 3DH5
2389.500	31.0	-3.2	1.5	267.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), DH5
2387.640	31.0	-3.2	1.5	321.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), DH5
2387.493	31.0	-3.2	1.5	231.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT on side, Low (2402 MHz), DH5
2386.027	31.0	-3.2	1.5	136.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT on side, Low (2402 MHz), DH5
2387.887	31.0	-3.2	1.5	24.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT Horizontal, Low (2402 MHz), DH5
2387.913	31.0	-3.2	1.5	42.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Horizontal, Low (2402 MHz), DH5
2389.640	31.0	-3.2	1.5	56.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT on side, Low (2402 MHz), 2DH5
2389.927	31.0	-3.2	1.5	10.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT on side, Low (2402 MHz), 3DH5
7319.740	29.7	14.0	3.2	38.0	-29.6	0.0	Vert	AV	0.0	14.1	54.0	-39.9	EUT Horizontal, Mid (2440 MHz), DH5
7440.020	29.2	14.5	1.6	67.0	-29.6	0.0	Horz	AV	0.0	14.1	54.0	-39.9	EUT Vertical, High (2480 MHz), DH5
7440.493	28.3	14.5	1.5	252.0	-29.6	0.0	Vert	AV	0.0	13.2	54.0	-40.8	EUT Horizontal, High (2480 MHz), DH5
7320.160	28.7	14.0	1.9	56.0	-29.6	0.0	Horz	AV	0.0	13.1	54.0	-40.9	EUT Vertical, Mid (2440 MHz), DH5
12401.460	24.7	14.1	1.5	194.0	-29.6	0.0	Vert	AV	0.0	9.2	54.0	-44.8	EUT Horizontal, High (2480 MHz), DH5
12400.650	24.6	14.1	1.5	228.0	-29.6	0.0	Horz	AV	0.0	9.1	54.0	-44.9	EUT Vertical, High (2480 MHz), DH5
12010.910	36.0	-1.7	1.6	31.0	-29.6	0.0	Horz	AV	0.0	4.7	54.0	-49.3	EUT Vertical, Low (2402 MHz), DH5
12200.930	33.8	-0.3	1.6	22.0	-29.6	0.0	Horz	AV	0.0	3.9	54.0	-50.1	EUT Vertical, Mid (2440 MHz), DH5
12399.630	33.0	-0.3	1.6	22.0	-29.6	0.0	Horz	AV	0.0	3.1	54.0	-50.9	EUT Vertical, High (2480 MHz), DH5
12010.980	33.2	-1.7	1.8	233.0	-29.6	0.0	Vert	AV	0.0	1.9	54.0	-52.1	EUT Horizontal, Low (2402 MHz), DH5
12200.950	31.3	-0.3	3.2	96.0	-29.6	0.0	Vert	AV	0.0	1.4	54.0	-52.6	EUT Horizontal, Mid (2440 MHz), DH5
12399.660	30.7	-0.3	3.9	210.0	-29.6	0.0	Vert	AV	0.0	0.8	54.0	-53.2	EUT Horizontal, High (2480 MHz), DH5

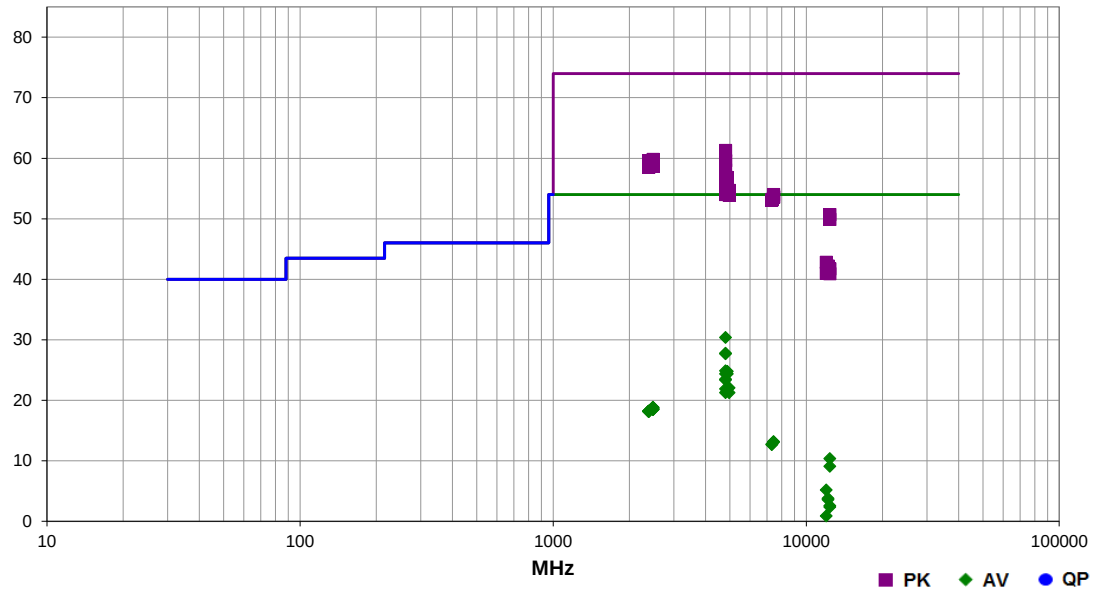
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.11.08.1

Work Order:	APRI0010	**Date:**	2020-03-23		
Project:	None	**Temperature:**	21.5 °C		
Job Site:	MN09	**Humidity:**	29.8% RH		
Serial Number:	4	**Barometric Pres.:**	1021 mbar	**Tested by:**	Dan Haas
EUT:	JL Module				
Configuration:	4				
Customer:	Apricity Code				
Attendees:	None				
EUT Power:	5 VDC (via USB)				
Operating Mode:	Continuous Transmit Bluetooth, Max power. See comments for EUT orientation, transmit frequency, and data rate.				
Deviations:	None				
Comments:	Test mode operates at 77% duty Cycle, Upward DCCF correction applied based on 10*log(1/Duty cycle) = 1.135. Operational worst case Duty cycle in any 100ms is 2.892ms. Downward DCCF correction applied based on 20*log(Duty Cycle) = -30.776. Total correction applied = -29.64.				

Test Specifications	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

Run #	44	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4804.087	56.1	5.2	3.3	133.0	0.0	0.0	Horz	PK	0.0	61.3	74.0	-12.7	EUT Vertical, Low (2402 MHz), 2DH5
2484.873	42.7	-2.9	3.0	43.0	0.0	20.0	Vert	PK	0.0	59.8	74.0	-14.2	EUT Vertical, High (2480 MHz), 3DH5
2484.007	42.6	-2.9	1.3	126.0	0.0	20.0	Vert	PK	0.0	59.7	74.0	-14.3	EUT Vertical, High (2480 MHz), DH5
4804.387	54.4	5.2	1.7	132.0	0.0	0.0	Horz	PK	0.0	59.6	74.0	-14.4	EUT Vertical, Low (2402 MHz), DH5
4803.700	54.4	5.2	3.3	133.0	0.0	0.0	Horz	PK	0.0	59.6	74.0	-14.4	EUT Vertical, Low (2402 MHz), DH5
2483.947	42.5	-2.9	1.5	121.0	0.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	EUT Vertical, High (2480 MHz), DH5
2387.307	42.8	-3.2	1.5	334.0	0.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	EUT Vertical, Low (2402 MHz), 3DH5
2484.427	42.4	-2.9	1.5	16.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	EUT on side, High (2480 MHz), DH5
2386.873	42.5	-3.2	2.1	238.0	0.0	20.0	Horz	PK	0.0	59.3	74.0	-14.7	EUT Vertical, Low (2402 MHz), DH5
2486.380	42.1	-2.9	1.5	109.0	0.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	EUT on side, High (2480 MHz), DH5
2486.467	42.1	-2.9	1.0	79.0	0.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	EUT Vertical, High (2480 MHz), 2DH5
2484.447	42.1	-2.9	4.0	257.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	EUT Vertical, High (2480 MHz), 3DH5
2487.120	41.9	-2.9	1.5	104.0	0.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	EUT Horizontal, High (2480 MHz), DH5
2484.840	41.9	-2.9	1.5	151.0	0.0	20.0	Horz	PK	0.0	59.0	74.0	-15.0	EUT Vertical, High (2480 MHz), 2DH5
2487.120	41.6	-2.9	1.5	19.0	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Horizontal, High (2480 MHz), DH5
2387.267	41.9	-3.2	1.5	314.0	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	EUT Vertical, Low (2402 MHz), DH5
2389.807	41.9	-3.2	1.5	29.0	0.0	20.0	Horz	PK	0.0	58.7	74.0	-15.3	EUT Vertical, Low (2402 MHz), 2DH5
2389.340	41.8	-3.2	1.5	102.0	0.0	20.0	Vert	PK	0.0	58.6	74.0	-15.4	EUT Vertical, Low (2402 MHz), 2DH5
2388.367	41.7	-3.2	1.5	218.0	0.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	EUT Vertical, Low (2402 MHz), 3DH5
4804.080	52.9	5.2	3.3	133.0	0.0	0.0	Horz	PK	0.0	58.1	74.0	-15.9	EUT Vertical, Low (2402 MHz), 3DH5
4803.720	51.8	5.2	1.7	64.0	0.0	0.0	Horz	PK	0.0	57.0	74.0	-17.0	EUT on side, Low (2402 MHz), DH5
4879.813	51.5	5.3	1.5	129.0	0.0	0.0	Horz	PK	0.0	56.8	74.0	-17.2	EUT Vertical, Mid (2440 MHz), DH5
4879.887	51.5	5.3	4.0	135.0	0.0	0.0	Vert	PK	0.0	56.8	74.0	-17.2	EUT on side, Mid (2440 MHz), DH5
4803.807	51.4	5.2	2.6	107.0	0.0	0.0	Vert	PK	0.0	56.6	74.0	-17.4	EUT on side, Low (2402 MHz), DH5
4803.807	50.4	5.2	2.9	99.0	0.0	0.0	Vert	PK	0.0	55.6	74.0	-18.4	EUT Vertical, Low (2402 MHz), DH5

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (dB)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4959.833	49.2	5.5	1.5	129.0	0.0	0.0	Horz	PK	0.0	54.7	74.0	-19.3	EUT Vertical, High (2480 MHz), DH5
4803.673	49.2	5.2	2.2	308.0	0.0	0.0	Vert	PK	0.0	54.4	74.0	-19.6	EUT Horizontal, Low (2402 MHz), DH5
4804.573	48.8	5.2	1.6	198.0	0.0	0.0	Horz	PK	0.0	54.0	74.0	-20.0	EUT Horizontal, Low (2402 MHz), DH5
7439.913	39.5	14.5	1.5	336.0	0.0	0.0	Horz	PK	0.0	54.0	74.0	-20.0	EUT Vertical, High (2480 MHz), DH5
4959.800	48.4	5.5	2.5	101.0	0.0	0.0	Vert	PK	0.0	53.9	74.0	-20.1	EUT on side, High (2480 MHz), DH5
7441.707	39.1	14.5	1.5	245.0	0.0	0.0	Vert	PK	0.0	53.6	74.0	-20.4	EUT on side, High (2480 MHz), DH5
7321.933	39.2	14.0	2.5	64.0	0.0	0.0	Vert	PK	0.0	53.2	74.0	-20.8	EUT on side, Mid (2440 MHz), DH5
7319.987	39.1	14.0	1.5	228.0	0.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	EUT Vertical, Mid (2440 MHz), DH5
12400.260	36.6	14.1	2.4	102.0	0.0	0.0	Vert	PK	0.0	50.7	74.0	-23.3	EUT on side, High (2480 MHz), DH5
4804.113	54.8	5.2	3.3	133.0	-29.6	0.0	Horz	AV	0.0	30.4	54.0	-23.6	EUT Vertical, Low (2402 MHz), 2DH5
12400.950	35.8	14.1	1.5	309.0	0.0	0.0	Horz	PK	0.0	49.9	74.0	-24.1	EUT Vertical, High (2480 MHz), DH5
4804.127	52.2	5.2	1.7	132.0	-29.6	0.0	Horz	AV	0.0	27.8	54.0	-26.2	EUT Vertical, Low (2402 MHz), DH5
4804.113	52.1	5.2	3.3	133.0	-29.6	0.0	Horz	AV	0.0	27.7	54.0	-26.3	EUT Vertical, Low (2402 MHz), DH5
4804.087	49.3	5.2	1.7	64.0	-29.6	0.0	Horz	AV	0.0	24.9	54.0	-29.1	EUT on side, Low (2402 MHz), DH5
4880.093	49.1	5.3	4.0	135.0	-29.6	0.0	Vert	AV	0.0	24.8	54.0	-29.2	EUT on side, Mid (2440 MHz), DH5
4804.100	48.8	5.2	2.6	107.0	-29.6	0.0	Vert	AV	0.0	24.4	54.0	-29.6	EUT on side, Low (2402 MHz), DH5
4880.120	48.7	5.3	1.5	129.0	-29.6	0.0	Horz	AV	0.0	24.4	54.0	-29.6	EUT Vertical, Mid (2440 MHz), DH5
4804.147	47.9	5.2	3.3	133.0	-29.6	0.0	Horz	AV	0.0	23.5	54.0	-30.5	EUT Vertical, Low (2402 MHz), 3DH5
4804.113	47.8	5.2	2.9	99.0	-29.6	0.0	Vert	AV	0.0	23.4	54.0	-30.6	EUT Vertical, Low (2402 MHz), DH5
12011.020	44.5	-1.7	1.7	28.0	0.0	0.0	Horz	PK	0.0	42.8	74.0	-31.2	EUT Vertical, Low (2402 MHz), DH5
12199.400	42.5	-0.3	3.4	82.0	0.0	0.0	Vert	PK	0.0	42.2	74.0	-31.8	EUT on side, Mid (2440 MHz), DH5
4960.113	46.2	5.5	1.5	129.0	-29.6	0.0	Horz	AV	0.0	22.1	54.0	-31.9	EUT Vertical, High (2480 MHz), DH5
12200.780	42.3	-0.3	1.5	25.0	0.0	0.0	Horz	PK	0.0	42.0	74.0	-32.0	EUT Vertical, Mid (2440 MHz), DH5
4804.107	46.3	5.2	2.2	308.0	-29.6	0.0	Vert	AV	0.0	21.9	54.0	-32.1	EUT Horizontal, Low (2402 MHz), DH5
12399.540	42.0	-0.3	2.9	91.0	0.0	0.0	Vert	PK	0.0	41.7	74.0	-32.3	EUT on side, High (2480 MHz), DH5
4804.087	45.7	5.2	1.6	198.0	-29.6	0.0	Horz	AV	0.0	21.3	54.0	-32.7	EUT Horizontal, Low (2402 MHz), DH5
4960.140	45.4	5.5	2.5	101.0	-29.6	0.0	Vert	AV	0.0	21.3	54.0	-32.7	EUT on side, High (2480 MHz), DH5
12009.310	42.7	-1.7	1.5	36.0	0.0	0.0	Vert	PK	0.0	41.0	74.0	-33.0	EUT on side, Low (2402 MHz), DH5
12399.410	41.2	-0.3	1.5	31.0	0.0	0.0	Horz	PK	0.0	40.9	74.0	-33.1	EUT Vertical, High (2480 MHz), DH5
2483.560	31.4	-2.9	3.0	43.0	-29.6	20.0	Vert	AV	0.0	18.9	54.0	-35.1	EUT Vertical, High (2480 MHz), 3DH5
2483.527	31.3	-2.9	1.5	121.0	-29.6	20.0	Horz	AV	0.0	18.8	54.0	-35.2	EUT Vertical, High (2480 MHz), DH5
2483.567	31.3	-2.9	1.3	126.0	-29.6	20.0	Vert	AV	0.0	18.8	54.0	-35.2	EUT Vertical, High (2480 MHz), DH5
2483.700	31.3	-2.9	1.0	79.0	-29.6	20.0	Vert	AV	0.0	18.8	54.0	-35.2	EUT Vertical, High (2480 MHz), 2DH5
2483.633	31.1	-2.9	1.5	16.0	-29.6	20.0	Horz	AV	0.0	18.6	54.0	-35.4	EUT on side, High (2480 MHz), DH5
2483.913	31.1	-2.9	1.5	109.0	-29.6	20.0	Vert	AV	0.0	18.6	54.0	-35.4	EUT on side, High (2480 MHz), DH5
2483.760	31.1	-2.9	1.5	104.0	-29.6	20.0	Horz	AV	0.0	18.6	54.0	-35.4	EUT Horizontal, High (2480 MHz), DH5
2483.580	31.1	-2.9	1.5	151.0	-29.6	20.0	Horz	AV	0.0	18.6	54.0	-35.4	EUT Vertical, High (2480 MHz), 2DH5
2483.733	31.0	-2.9	1.5	19.0	-29.6	20.0	Vert	AV	0.0	18.5	54.0	-35.5	EUT Horizontal, High (2480 MHz), DH5
2485.500	31.0	-2.9	4.0	257.0	-29.6	20.0	Horz	AV	0.0	18.5	54.0	-35.5	EUT Vertical, High (2480 MHz), 3DH5
2387.120	31.0	-3.2	2.1	238.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), DH5
2387.973	31.0	-3.2	1.5	314.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), DH5
2389.647	31.0	-3.2	1.5	29.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), 2DH5
2387.620	31.0	-3.2	1.5	102.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), 2DH5
2387.287	31.0	-3.2	1.5	334.0	-29.6	20.0	Horz	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), 3DH5
2388.040	31.0	-3.2	1.5	218.0	-29.6	20.0	Vert	AV	0.0	18.2	54.0	-35.8	EUT Vertical, Low (2402 MHz), 3DH5
7440.493	28.3	14.5	1.5	336.0	-29.6	0.0	Horz	AV	0.0	13.2	54.0	-40.8	EUT Vertical, High (2480 MHz), DH5
7440.487	28.2	14.5	1.5	245.0	-29.6	0.0	Vert	AV	0.0	13.1	54.0	-40.9	EUT on side, High (2480 MHz), DH5
7321.287	28.4	14.0	1.5	228.0	-29.6	0.0	Horz	AV	0.0	12.8	54.0	-41.2	EUT Vertical, Mid (2440 MHz), DH5
7319.240	28.3	14.0	2.5	64.0	-29.6	0.0	Vert	AV	0.0	12.7	54.0	-41.3	EUT on side, Mid (2440 MHz), DH5
12400.770	25.9	14.1	2.4	102.0	-29.6	0.0	Vert	AV	0.0	10.4	54.0	-43.6	EUT on side, High (2480 MHz), DH5
12401.490	24.6	14.1	1.5	309.0	-29.6	0.0	Horz	AV	0.0	9.1	54.0	-44.9	EUT Vertical, High (2480 MHz), DH5
12010.870	36.5	-1.7	1.7	28.0	-29.6	0.0	Horz	AV	0.0	5.2	54.0	-48.8	EUT Vertical, Low (2402 MHz), DH5
12200.830	33.7	-0.3	3.4	82.0	-29.6	0.0	Vert	AV	0.0	3.8	54.0	-50.2	EUT on side, Mid (2440 MHz), DH5
12199.650	33.5	-0.3	1.5	25.0	-29.6	0.0	Horz	AV	0.0	3.6	54.0	-50.4	EUT Vertical, Mid (2440 MHz), DH5
12399.640	32.5	-0.3	2.9	91.0	-29.6	0.0	Vert	AV	0.0	2.6	54.0	-51.4	EUT on side, High (2480 MHz), DH5
12399.540	32.3	-0.3	1.5	31.0	-29.6	0.0	Horz	AV	0.0	2.4	54.0	-51.6	EUT Vertical, High (2480 MHz), DH5
12010.970	32.2	-1.7	1.5	36.0	-29.6	0.0	Vert	AV	0.0	0.9	54.0	-53.1	EUT on side, Low (2402 MHz), DH5

DUTY CYCLE

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

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.

If the transmit duty cycle < 98 percent, burst gating may have been used during some of the other tests in this report to only take the measurement during the burst duration.

DUTY CYCLE

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.3 °C**
Attendees:	**None**			**Humidity:**	**32.8% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

DEVIATIONS FROM TEST STANDARD

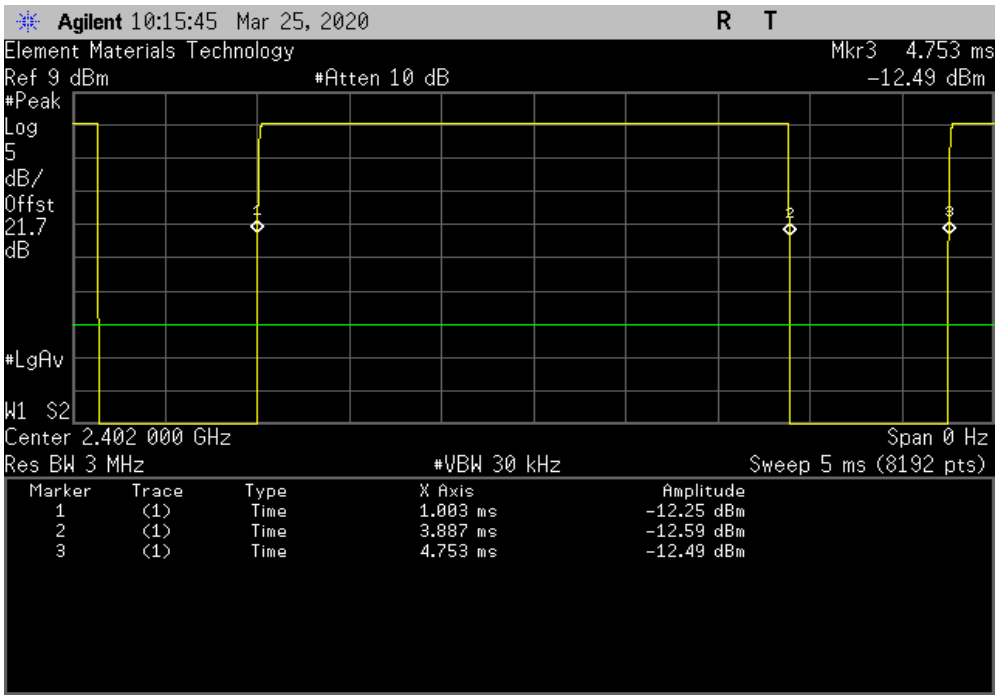
None

Configuration #	**1**	*Signature*

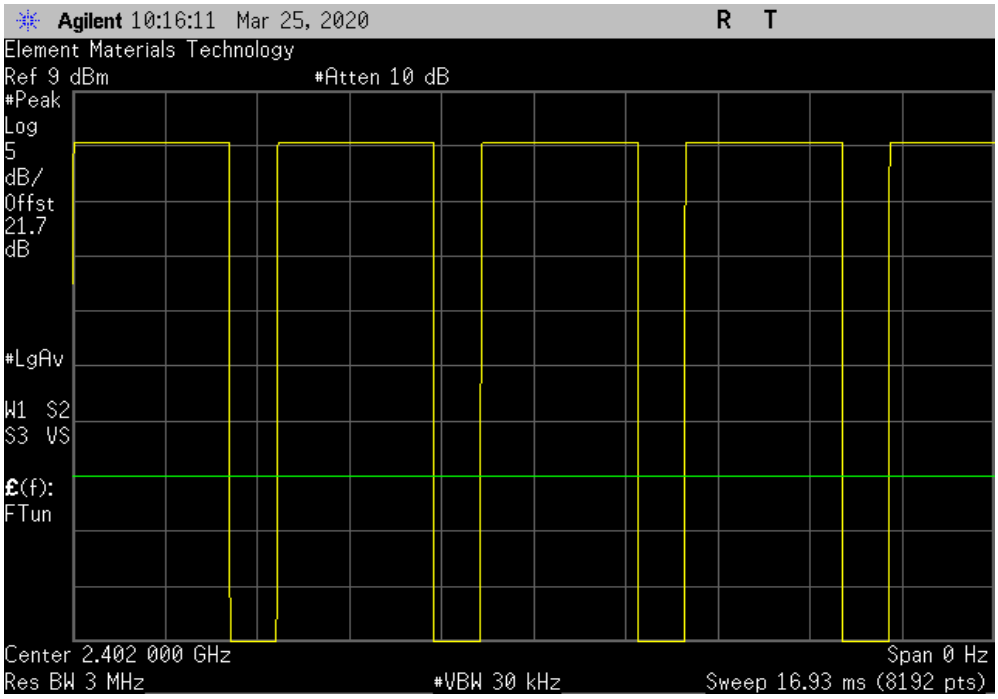
		Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
DH5, GFSK							
	Low Channel	2.884 ms	3.75 ms	1	76.9	N/A	N/A
	Low Channel	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel	2.884 ms	3.75 ms	1	76.9	N/A	N/A
	Mid Channel	N/A	N/A	5	N/A	N/A	N/A
	High Channel	2.884 ms	3.75 ms	1	76.9	N/A	N/A
	High Channel	N/A	N/A	5	N/A	N/A	N/A
2DH5, pi/4-DQPSK							
	Low Channel	2.893 ms	3.75 ms	1	77.1	N/A	N/A
	Low Channel	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel	2.892 ms	3.75 ms	1	77.1	N/A	N/A
	Mid Channel	N/A	N/A	5	N/A	N/A	N/A
	High Channel	2.892 ms	3.75 ms	1	77.1	N/A	N/A
	High Channel	N/A	N/A	5	N/A	N/A	N/A
3DH5, 8-DPSK							
	Low Channel	2.893 ms	3.75 ms	1	77.2	N/A	N/A
	Low Channel	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel	2.893 ms	3.75 ms	1	77.2	N/A	N/A
	Mid Channel	N/A	N/A	5	N/A	N/A	N/A
	High Channel	2.893 ms	3.75 ms	1	77.2	N/A	N/A
	High Channel	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

DH5, GFSK, Low Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.884 ms	3.75 ms	1	76.9	N/A	N/A

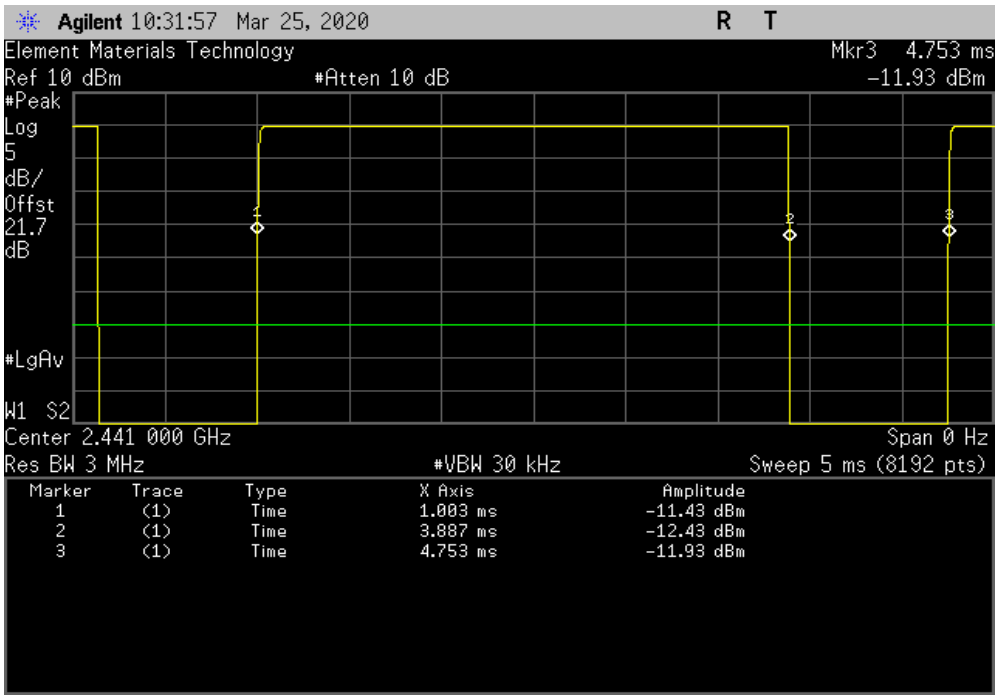


DH5, GFSK, Low Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

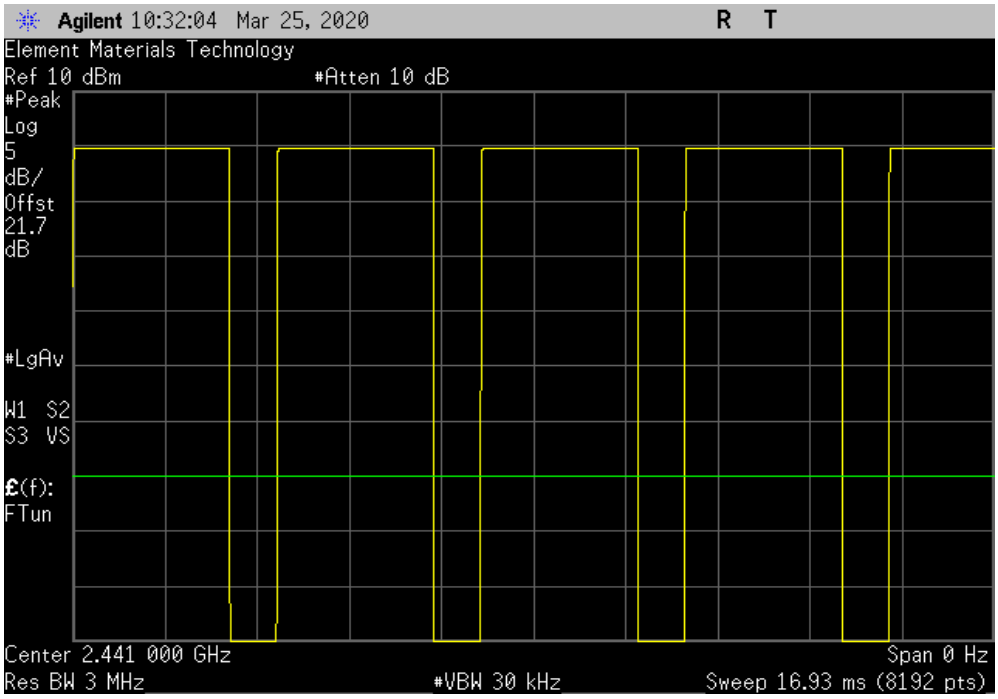


DUTY CYCLE

DH5, GFSK, Mid Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.884 ms	3.75 ms	1	76.9	N/A	N/A

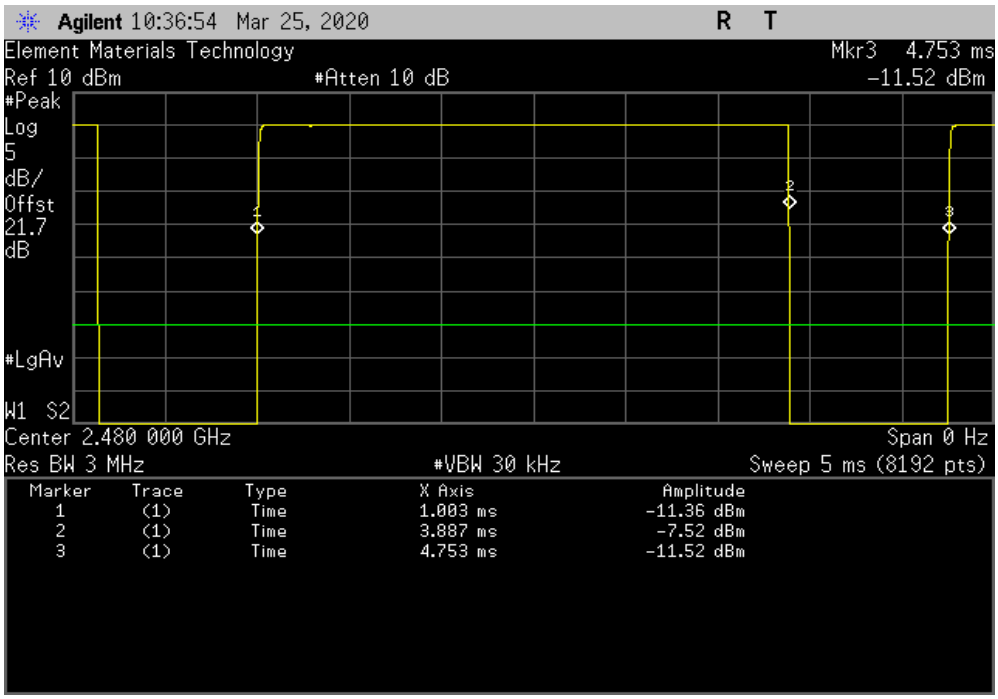


DH5, GFSK, Mid Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

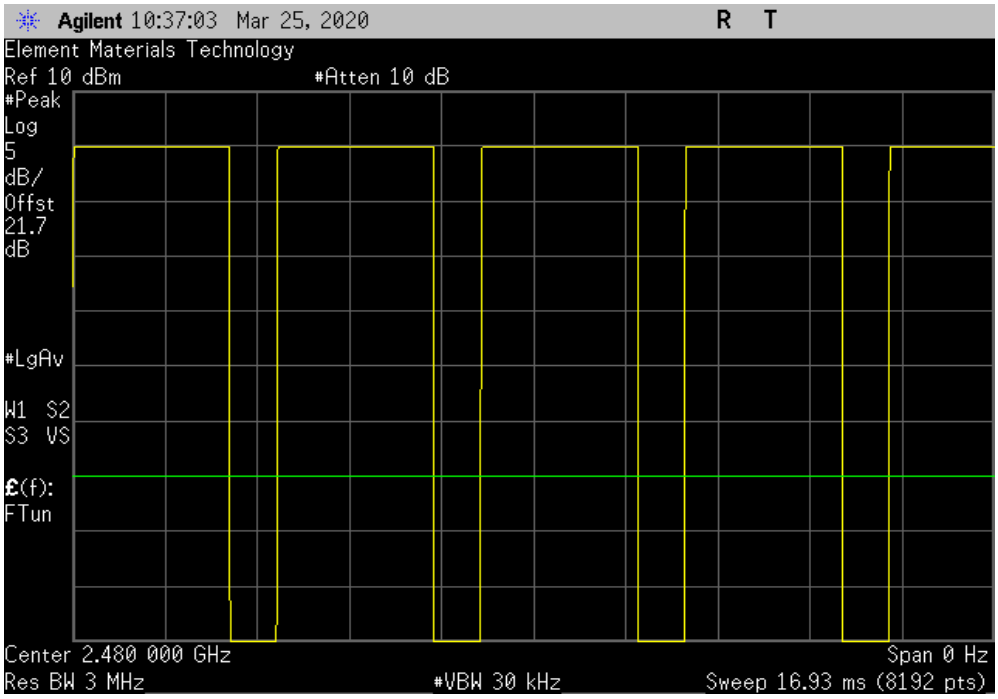


DUTY CYCLE

DH5, GFSK, High Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.884 ms	3.75 ms	1	76.9	N/A	N/A

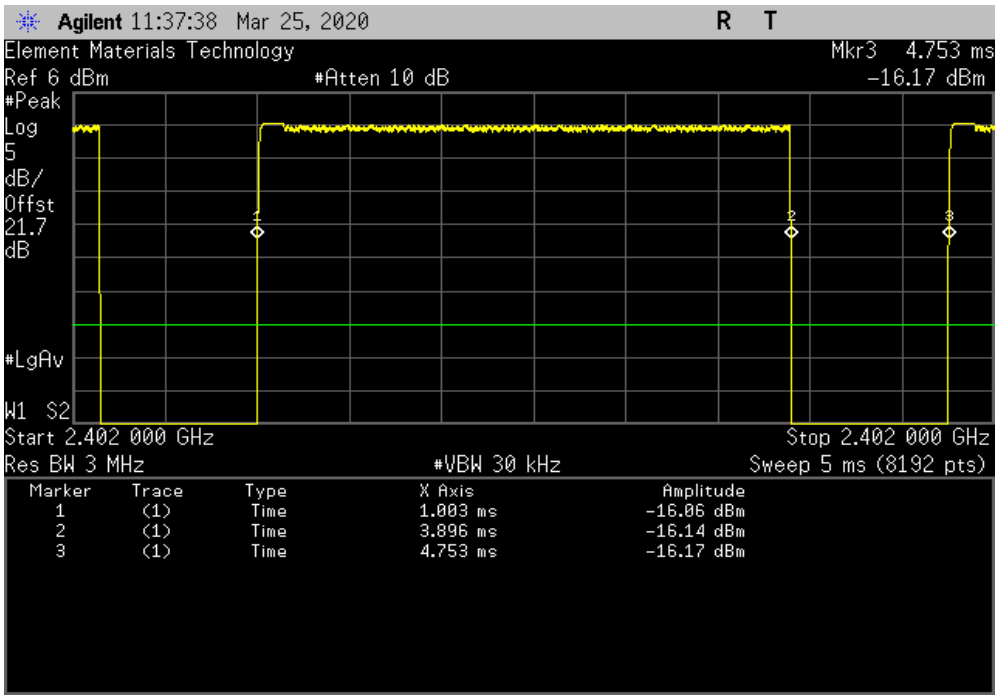


DH5, GFSK, High Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

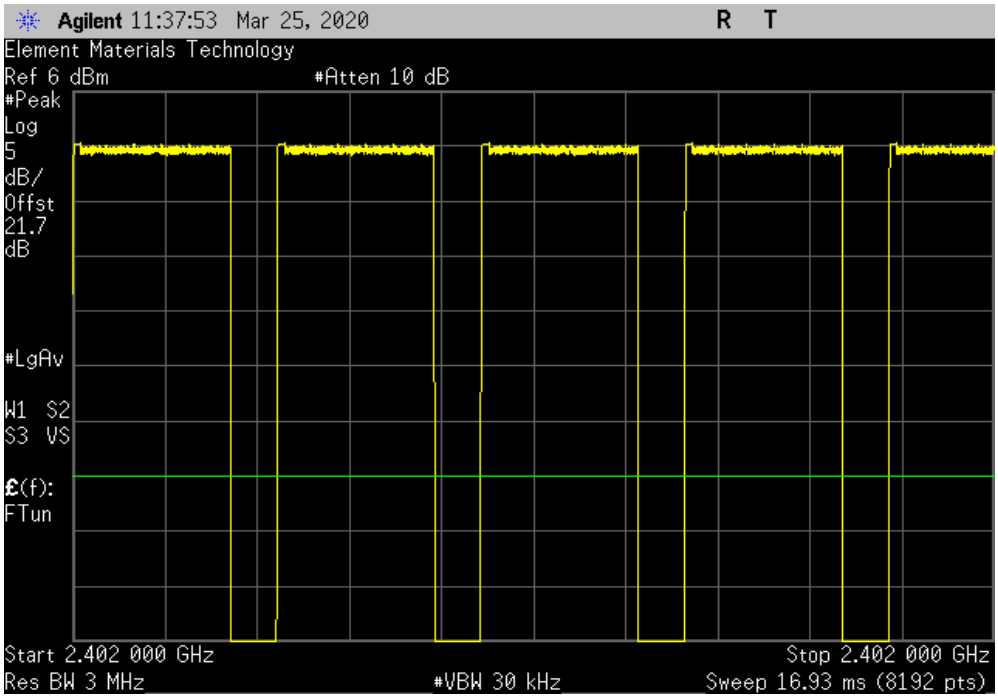


DUTY CYCLE

2DH5, pi/4-DQPSK, Low Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.893 ms	3.75 ms	1	77.1	N/A	N/A

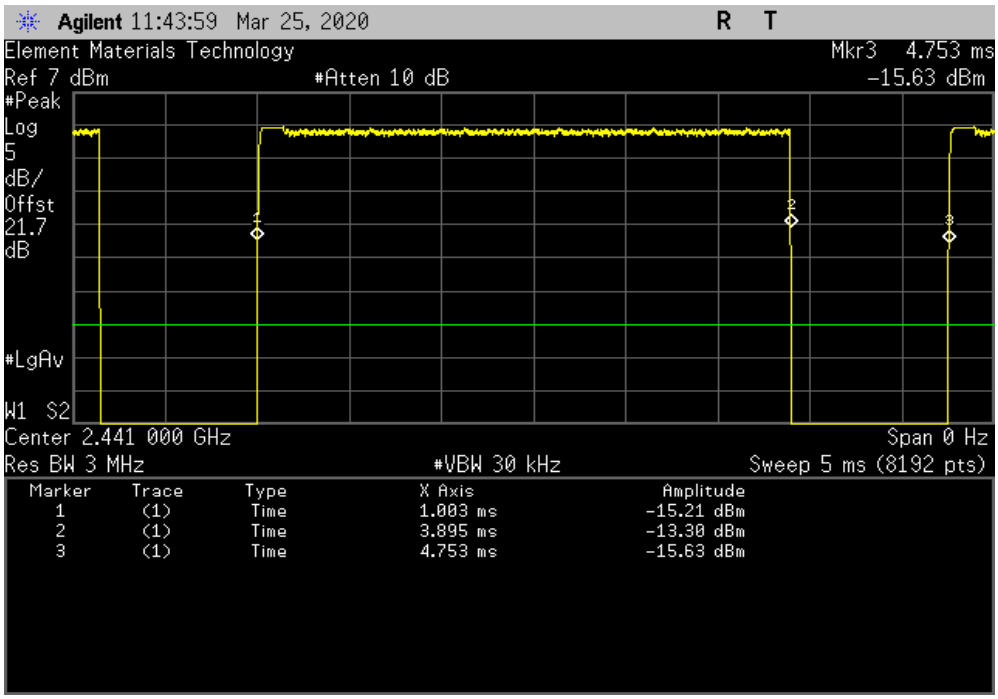


2DH5, pi/4-DQPSK, Low Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

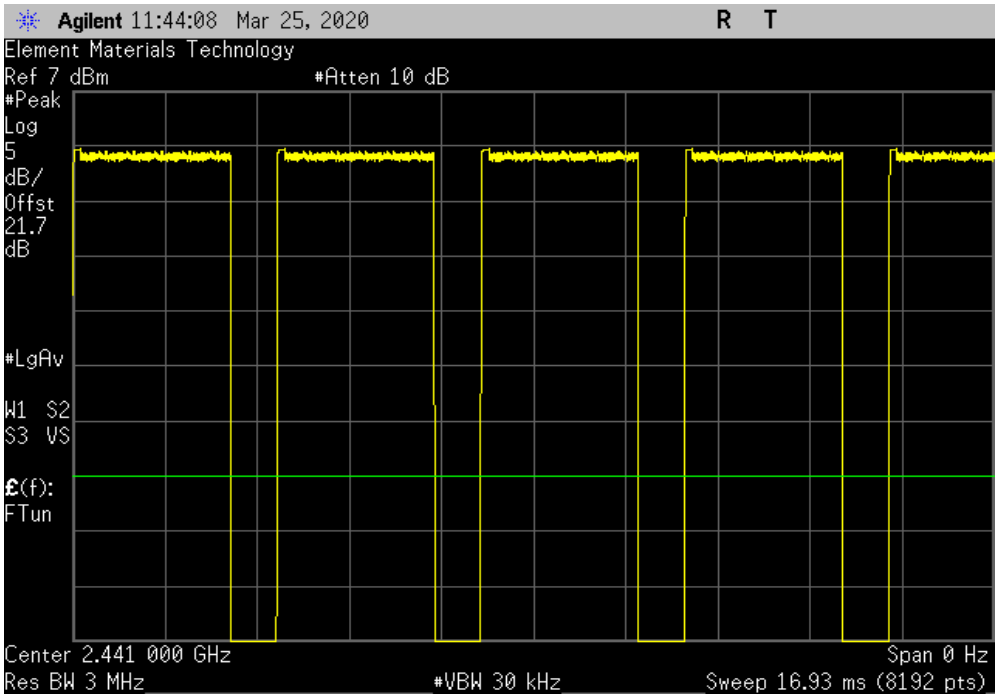


DUTY CYCLE

2DH5, pi/4-DQPSK, Mid Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.892 ms	3.75 ms	1	77.1	N/A	N/A

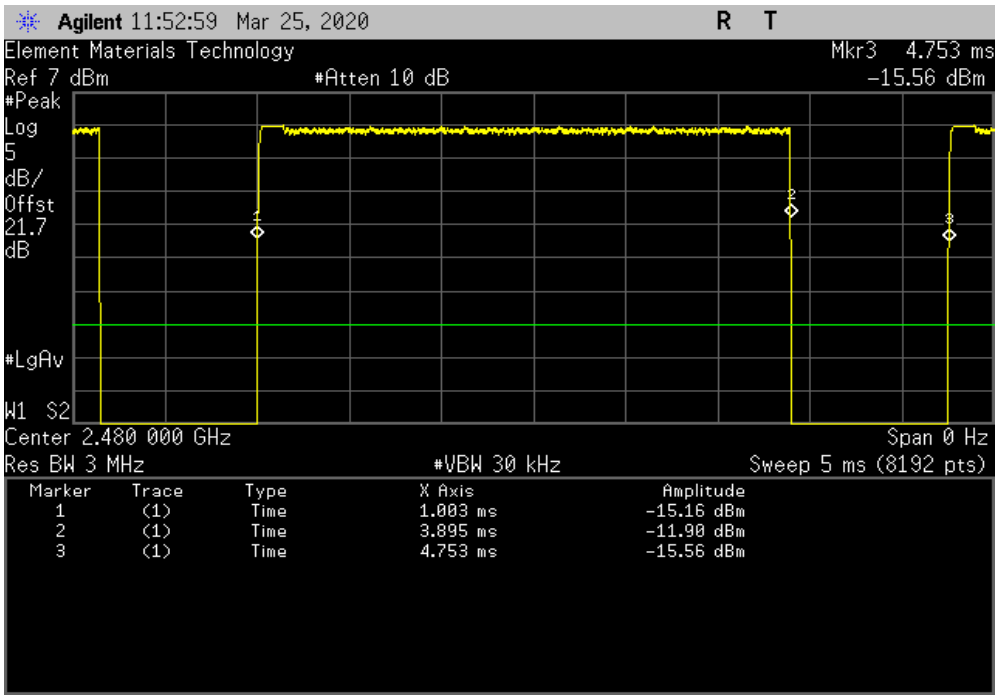


2DH5, pi/4-DQPSK, Mid Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

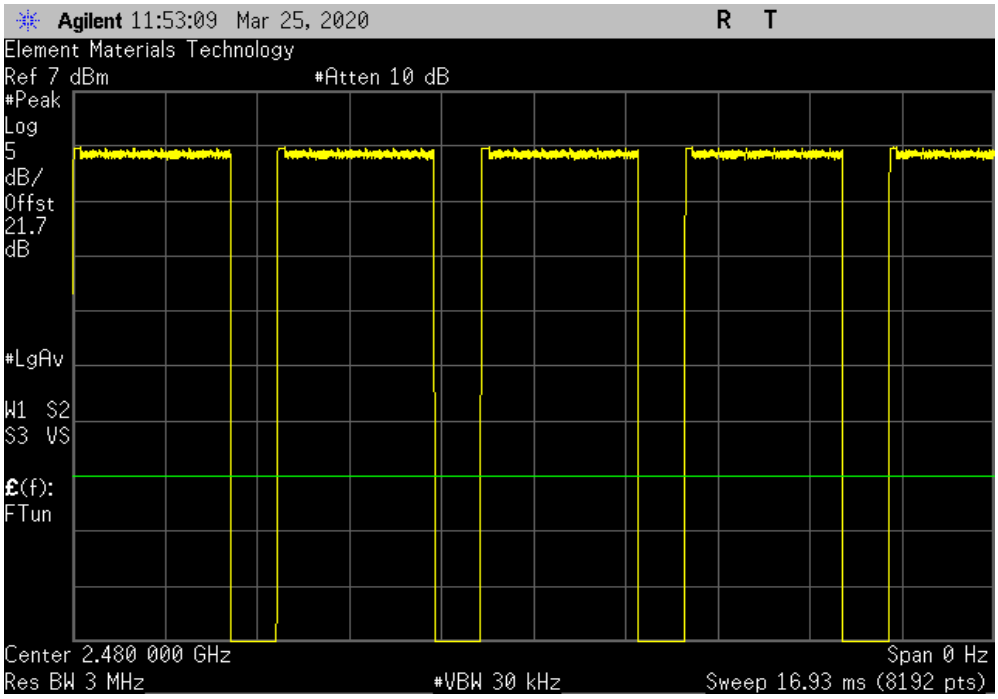


DUTY CYCLE

2DH5, pi/4-DQPSK, High Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.892 ms	3.75 ms	1	77.1	N/A	N/A

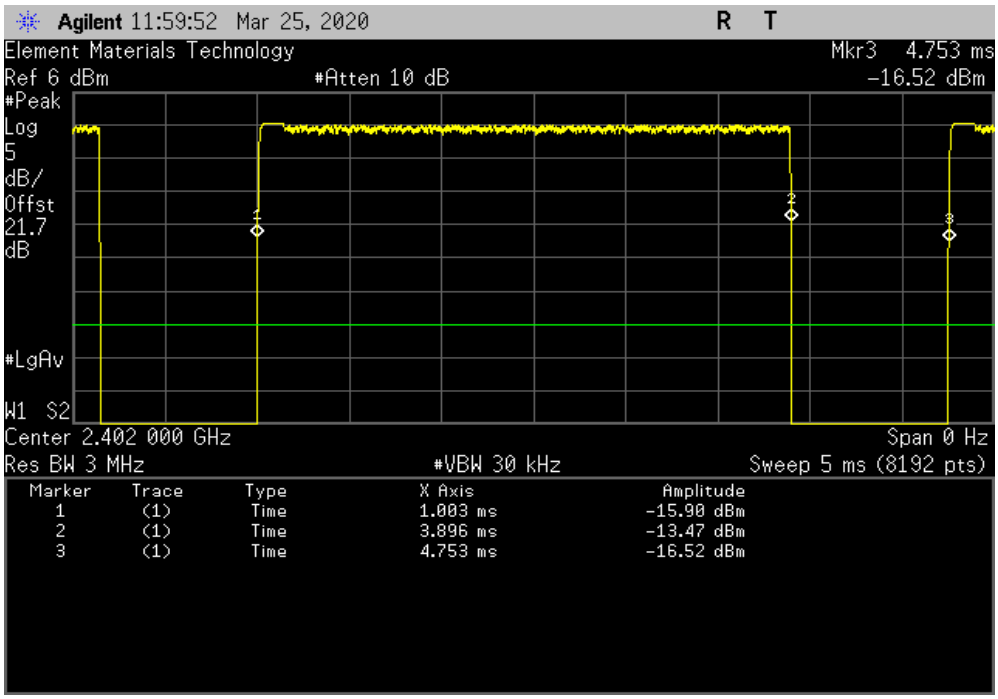


2DH5, pi/4-DQPSK, High Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

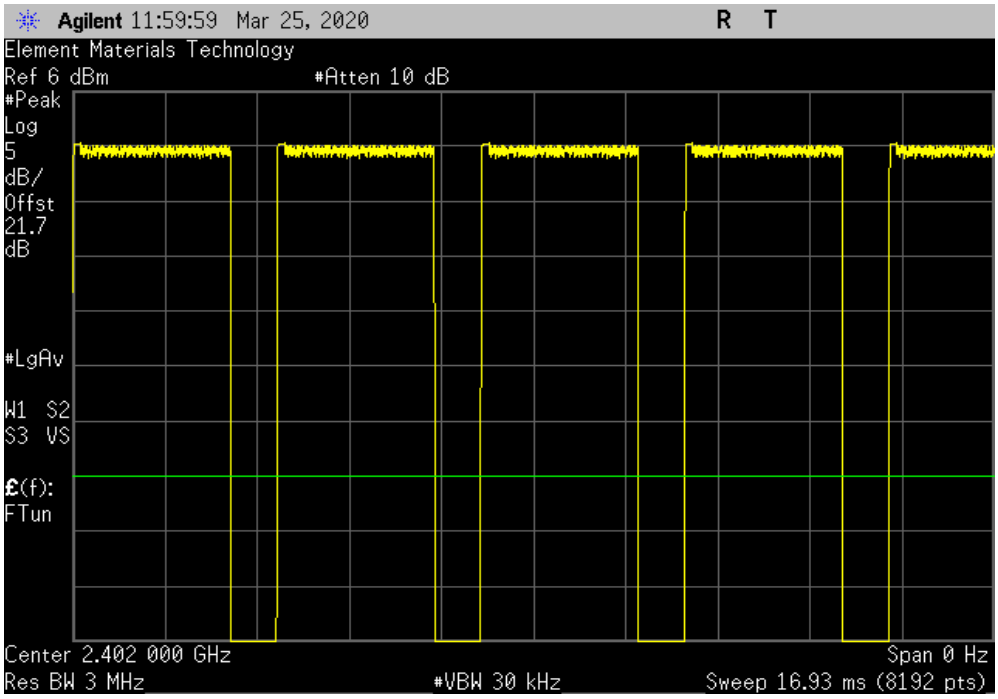


DUTY CYCLE

3DH5, 8-DPSK, Low Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.893 ms	3.75 ms	1	77.2	N/A	N/A

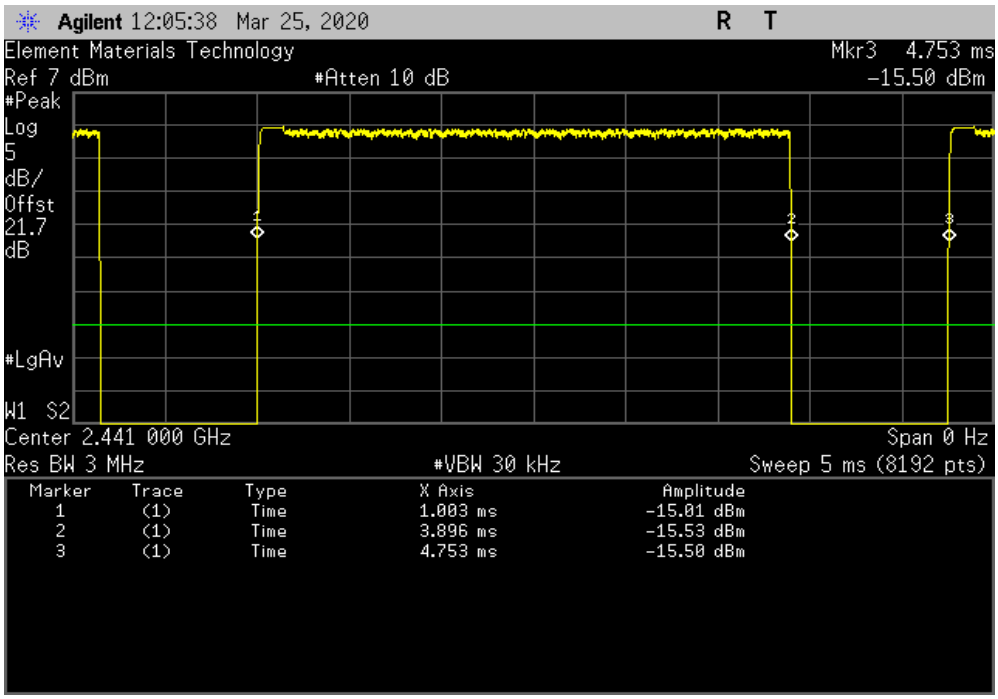


3DH5, 8-DPSK, Low Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

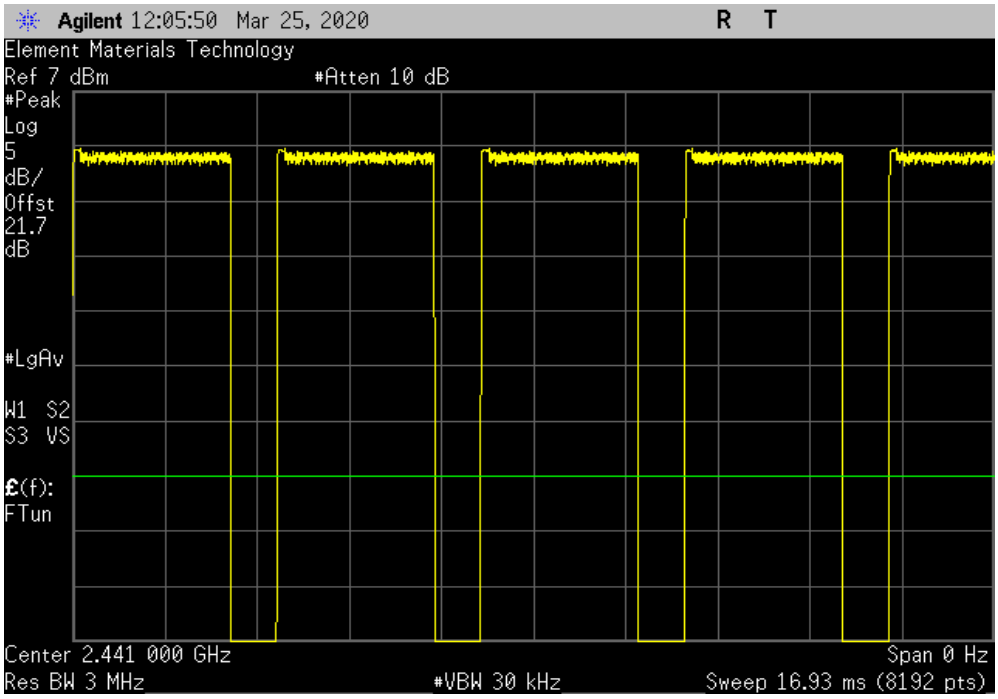


DUTY CYCLE

3DH5, 8-DPSK, Mid Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.893 ms	3.75 ms	1	77.2	N/A	N/A

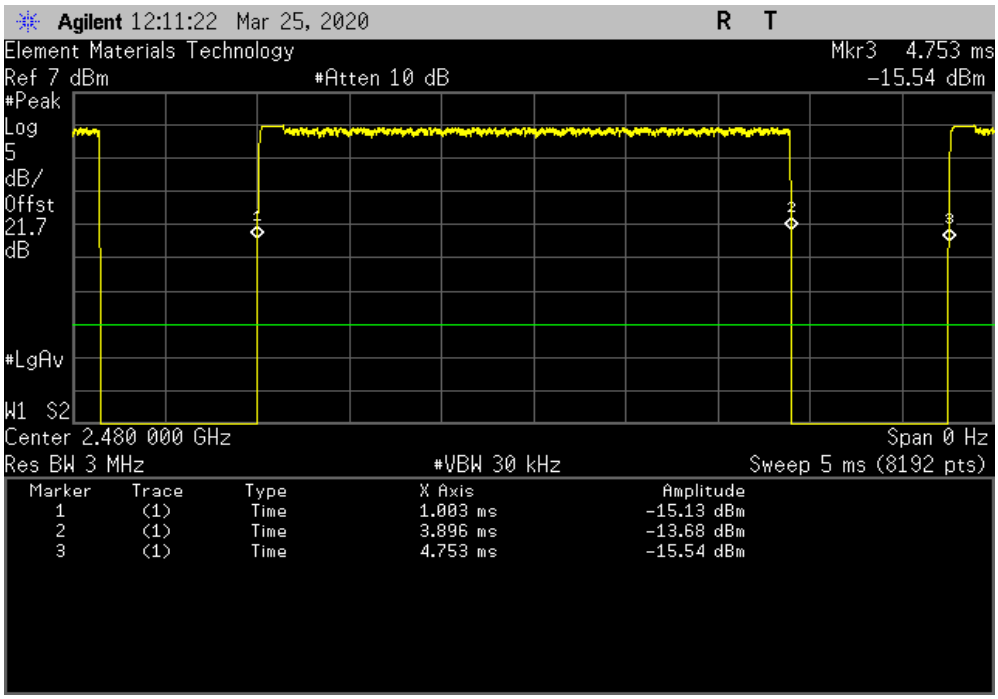


3DH5, 8-DPSK, Mid Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

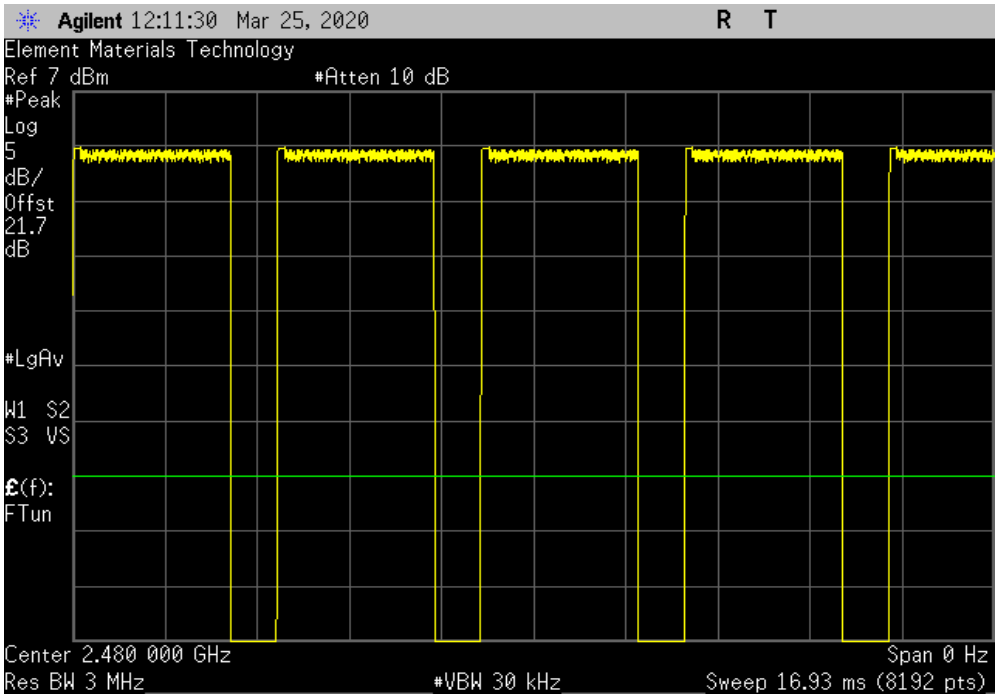


DUTY CYCLE

3DH5, 8-DPSK, High Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.893 ms	3.75 ms	1	77.2	N/A	N/A



3DH5, 8-DPSK, High Channel						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



CARRIER FREQUENCY SEPARATION

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The channel carrier frequencies in the 2400-2483.5MHz band must be separated by 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Or, if the output power is less than 125 mW, the channel separation can be 25 kHz or 2/3 of the 20dB bandwidth. The EUT was operated in pseudorandom hopping mode. The spectrum was scanned across two adjacent peaks. The separation between the peaks of these channels was measured.

CARRIER FREQUENCY SEPARATION

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	JL Module			**Work Order:**	APRI0010
Serial Number:	4			**Date:**	25-Mar-20
Customer:	Apricity Code			**Temperature:**	22.8 °C
Attendees:	None			**Humidity:**	32.1% RH
Project:	None			**Barometric Pres.:**	1009.9 mbar
Tested by:	Kyle McMullan	**Power:**	5 VDC (via USB)	**Job Site:**	MN09

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

DEVIATIONS FROM TEST STANDARD

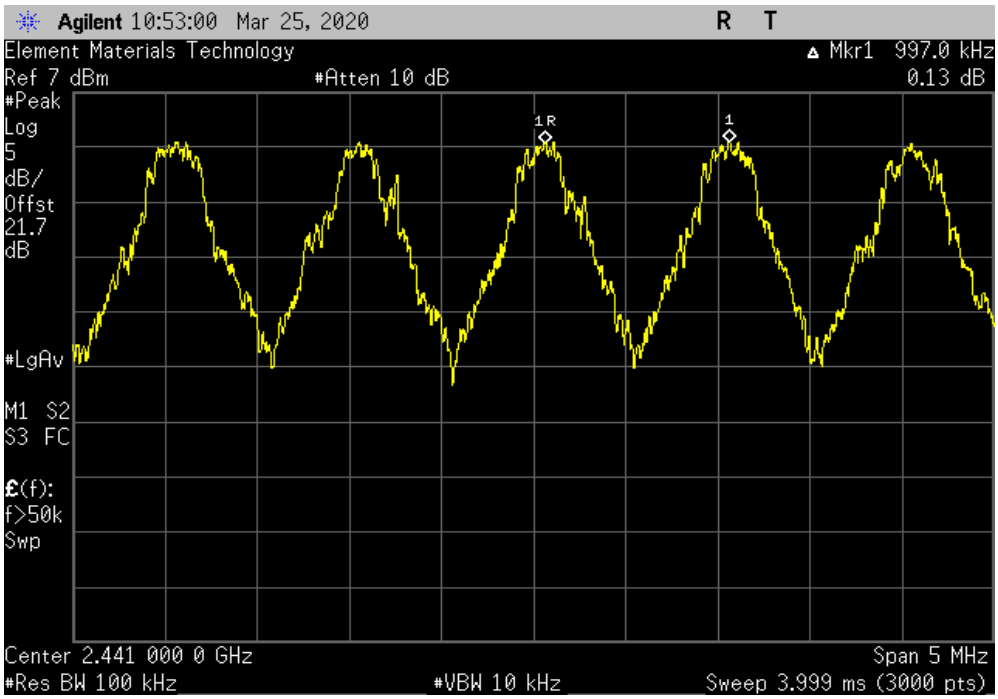
None

Configuration #	1	*Signature*

		Value	**Limit (≥)**	**Results**
Hopping Mode (All Channels)				
DH5, GFSK				
Mid Channel, 2441 MHz		0.997 MHz	0.9 MHz	Pass

CARRIER FREQUENCY SEPARATION

Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
				Value	Limit (≥)	Results
				0.997 MHz	0.9 MHz	Pass



NUMBER OF HOPPING FREQUENCIES

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The number of hopping frequencies was measured across the authorized band. The hopping function of the EUT was enabled.

NUMBER OF HOPPING FREQUENCIES

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.3 °C**
Attendees:	**None**			**Humidity:**	**32.2% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

DEVIATIONS FROM TEST STANDARD

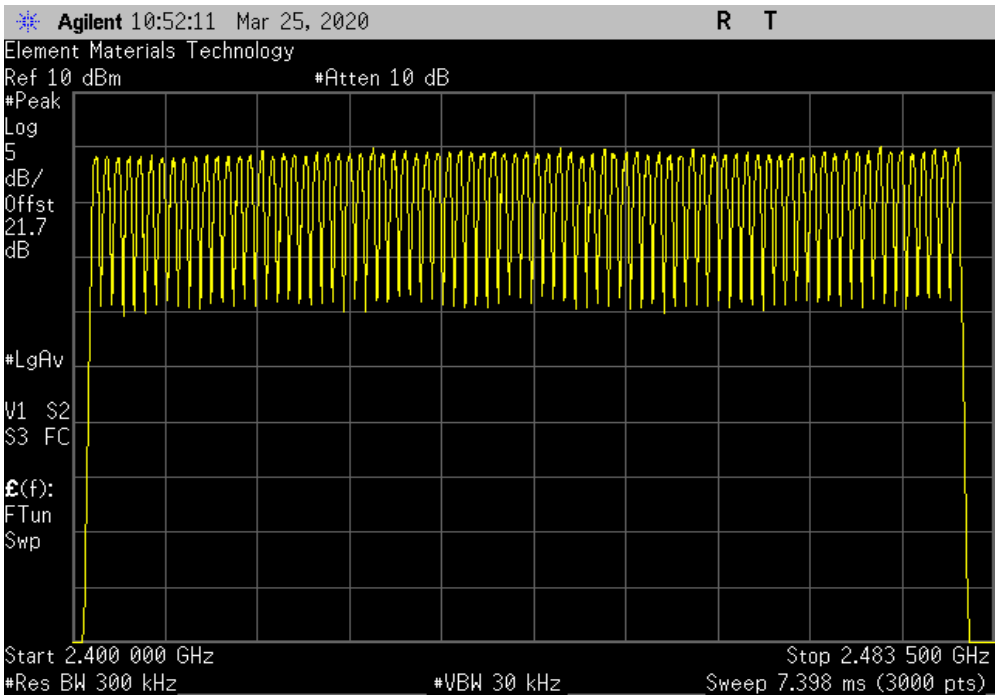
None

Configuration #	**1**	*Signature*

	Number of Channels	**Limit (≥)**	**Results**
Hopping Mode (All Channels)			
DH5, GFSK			
Mid Channel, 2441 MHz	79	15	Pass

NUMBER OF HOPPING FREQUENCIES

Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
				Number of Channels	Limit (≥)	Results
				79	15	Pass



DWELL TIME

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The hopping function of the EUT was enabled.

The dwell time limit is based on the Number of Hopping Channels * 400 mS. For Bluetooth this would be 79 Channels * 400mS = 31.6 Sec.

On Time During 31.6 Sec = Pulse Width * Average Number of Pulses * Scale Factor

- Average Number of Pulses is based on 4 samples.

- Scale Factor = 31.6 Sec / Screen Capture Sweep Time = 31.6 Sec / 6.32 Sec = 5

DWELL TIME

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22 °C**
Attendees:	**None**			**Humidity:**	**32.8% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

DEVIATIONS FROM TEST STANDARD

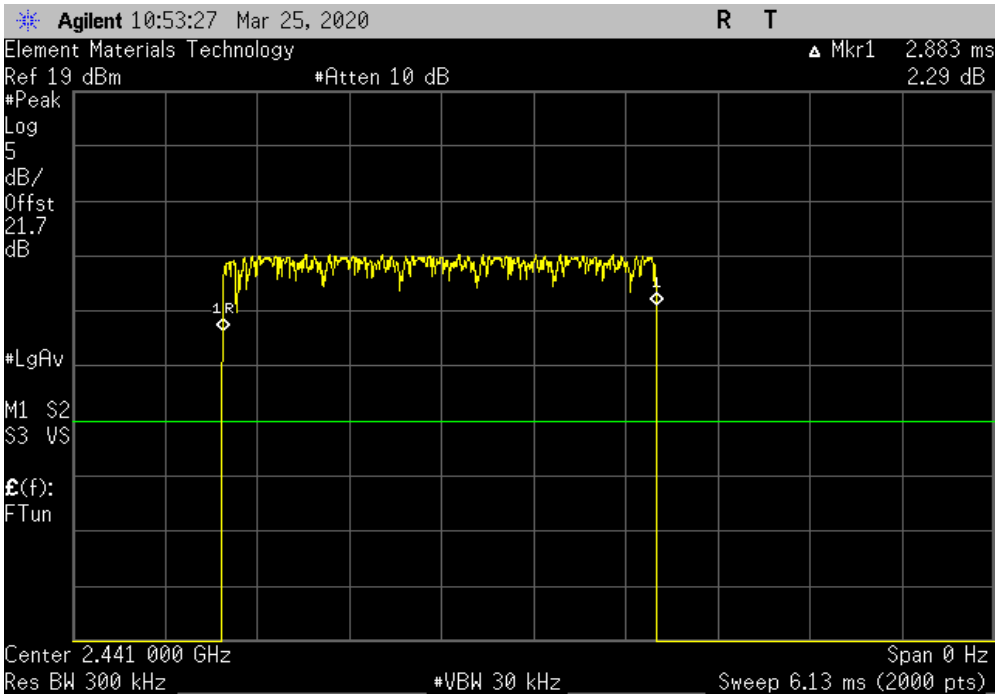
None

Configuration #	**1**	*Signature*

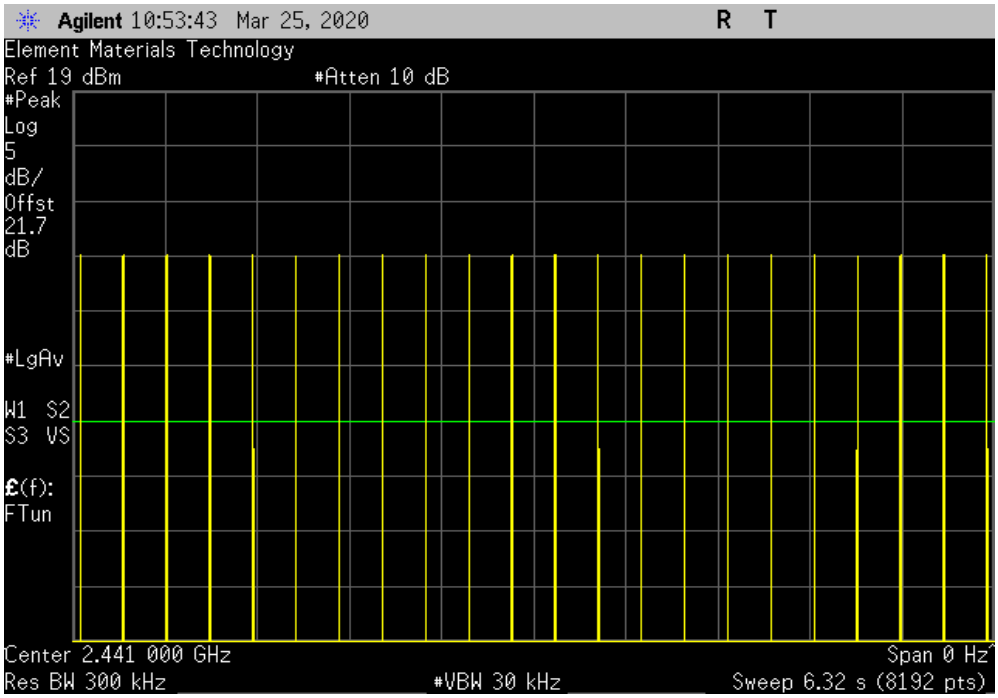
	Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
Hopping Mode (All Channels)							
DH5, GFSK							
Mid Channel, 2441 MHz	2.883	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	2.883	N/A	22	5	317.13	400	Pass
2DH5, pi/4-DQPSK							
Mid Channel, 2441 MHz	2.892	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	2.892	N/A	22	5	318.12	400	Pass
3DH5, 8-DPSK							
Mid Channel, 2441 MHz	2.892	N/A	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	N/A	22	N/A	N/A	N/A	N/A	N/A
Mid Channel, 2441 MHz	2.892	N/A	22	5	318.12	400	Pass

DWELL TIME

Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.883	N/A	N/A	N/A	N/A	N/A	N/A

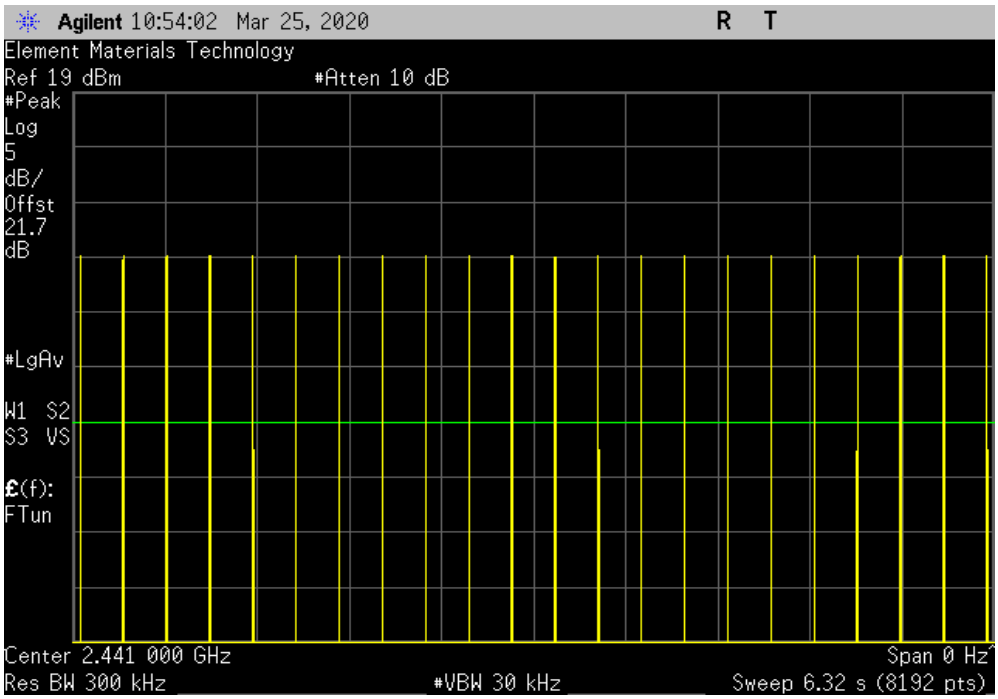


Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A

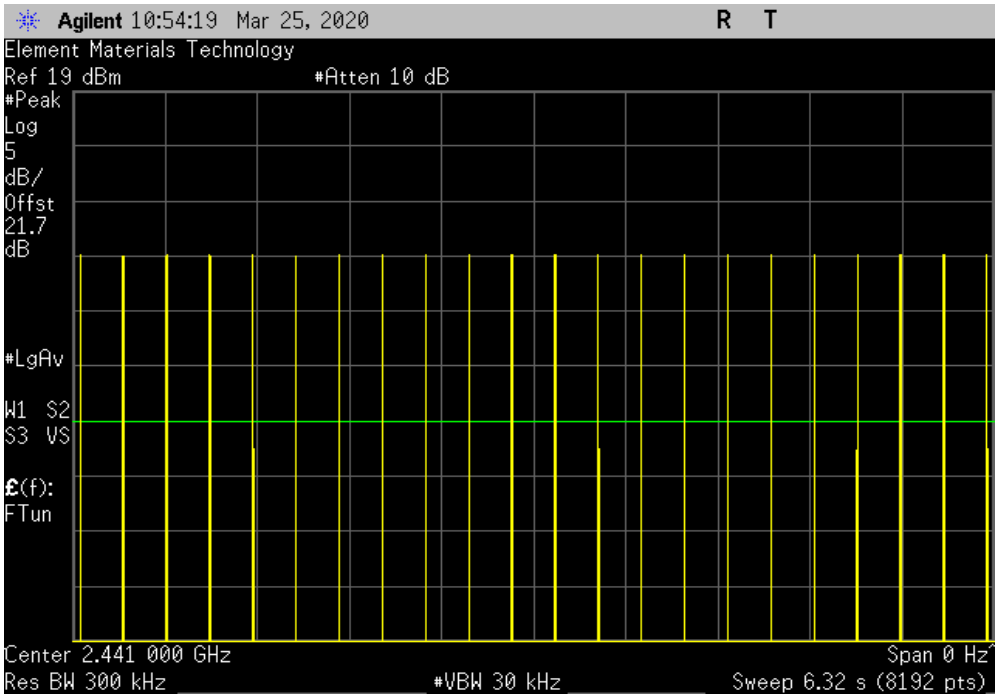


DWELL TIME

Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A

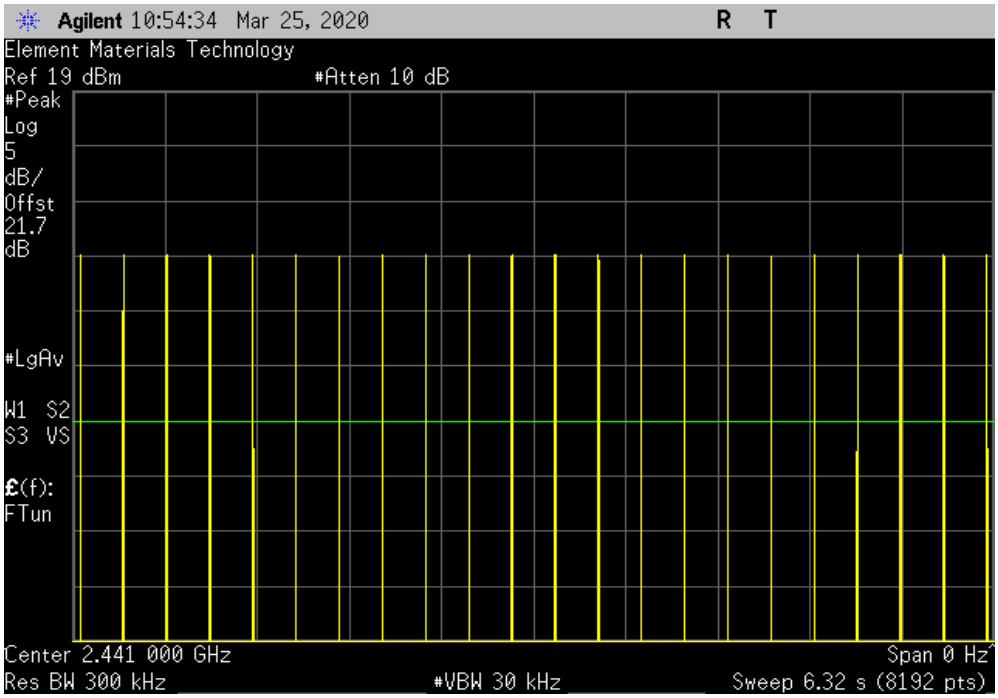


Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



DWELL TIME

Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



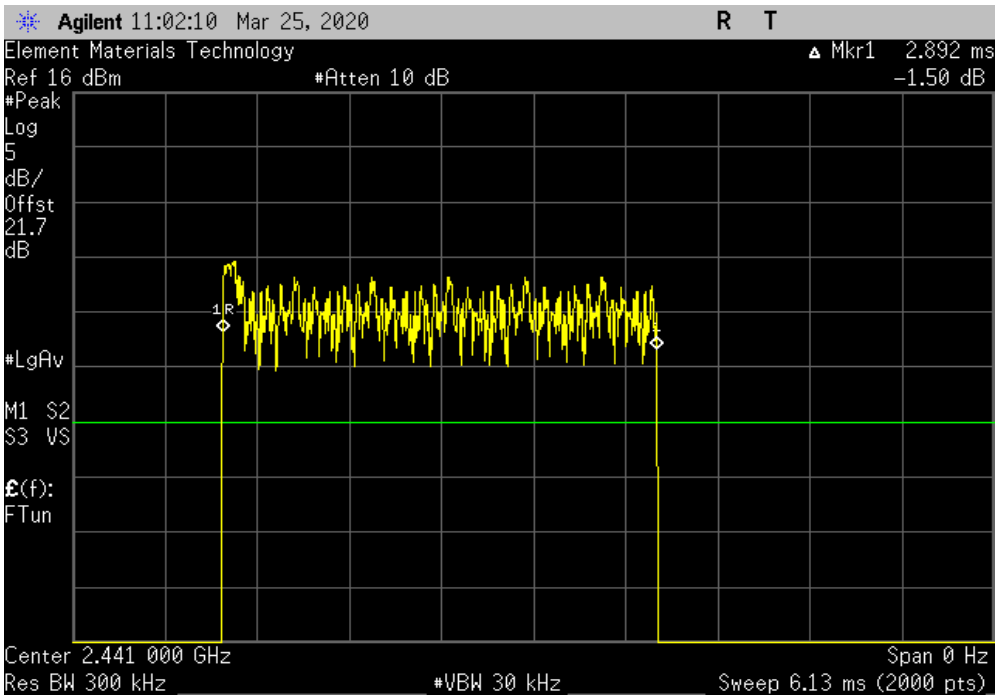
Hopping Mode (All Channels), DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.883	N/A	22	5	317.13	400	Pass

Calculation Only

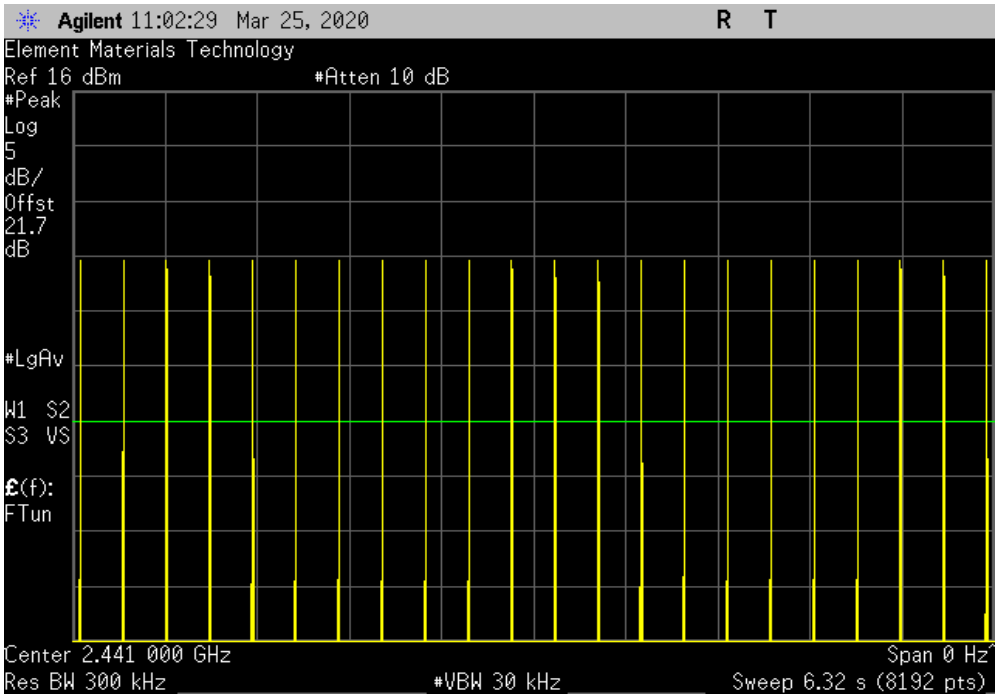
No Screen Capture Required

DWELL TIME

Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.892	N/A	N/A	N/A	N/A	N/A	N/A

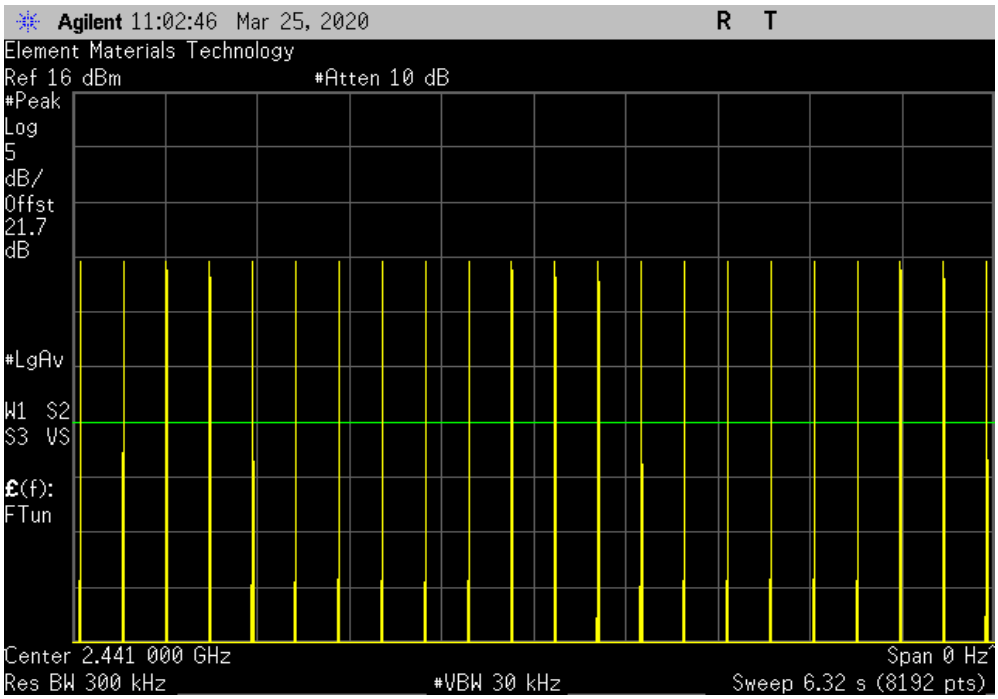


Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A

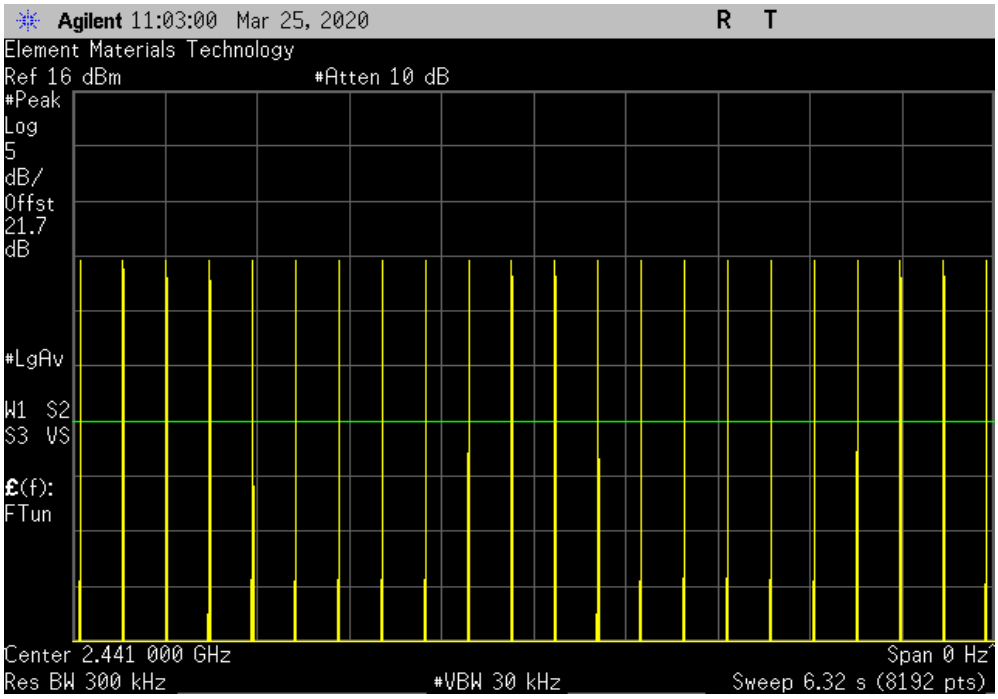


DWELL TIME

Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A

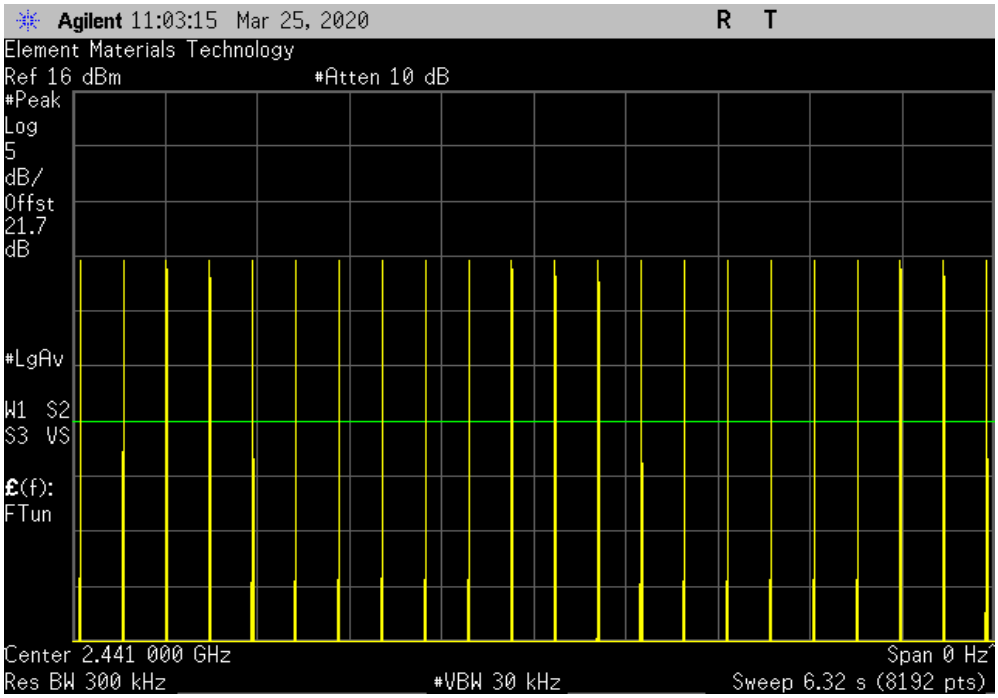


Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



DWELL TIME

Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



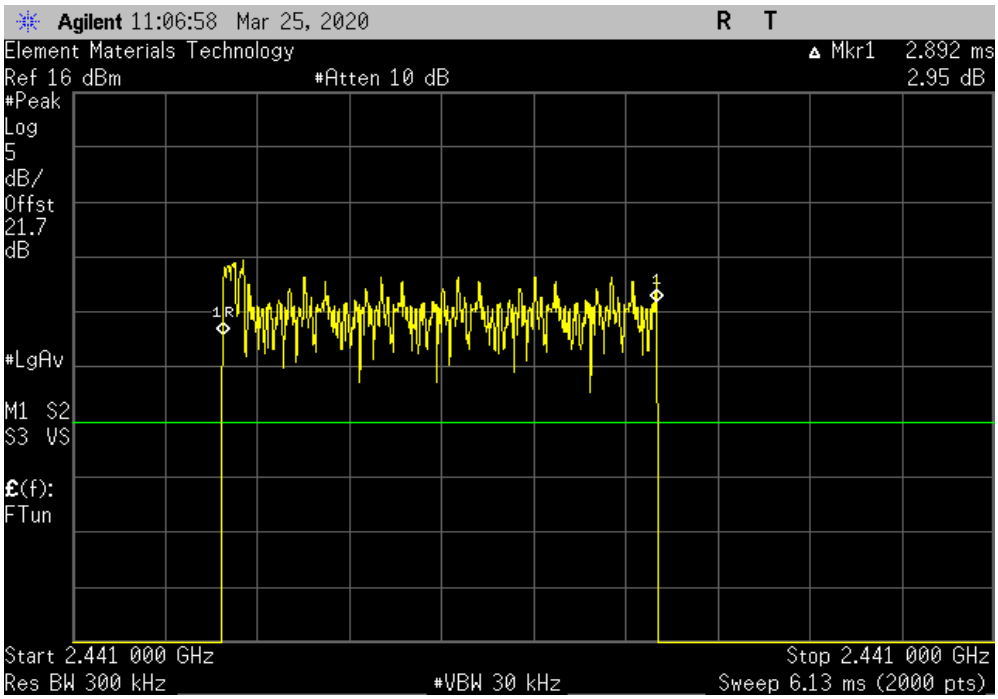
Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.892	N/A	22	5	318.12	400	Pass

Calculation Only

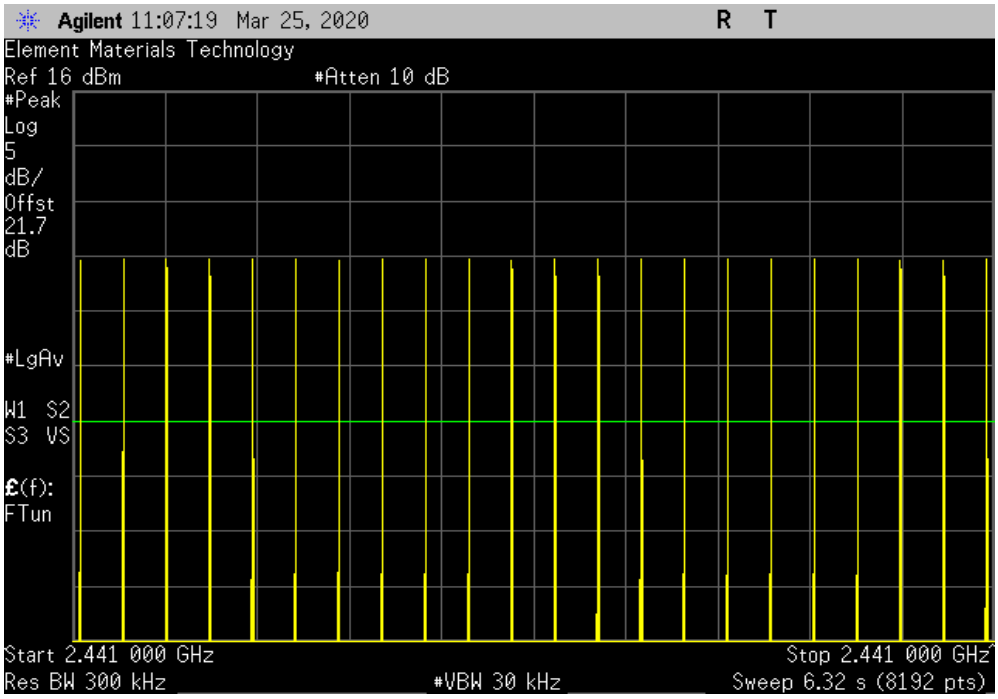
No Screen Capture Required

DWELL TIME

Hopping Mode (All Channels), 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.892	N/A	N/A	N/A	N/A	N/A	N/A

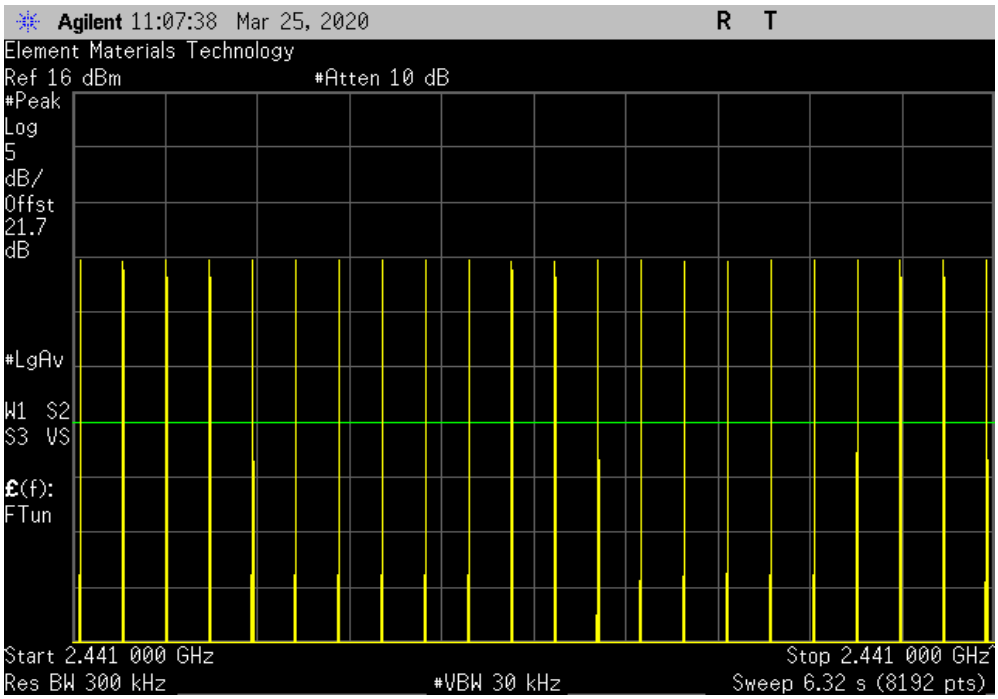


Hopping Mode (All Channels), 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A

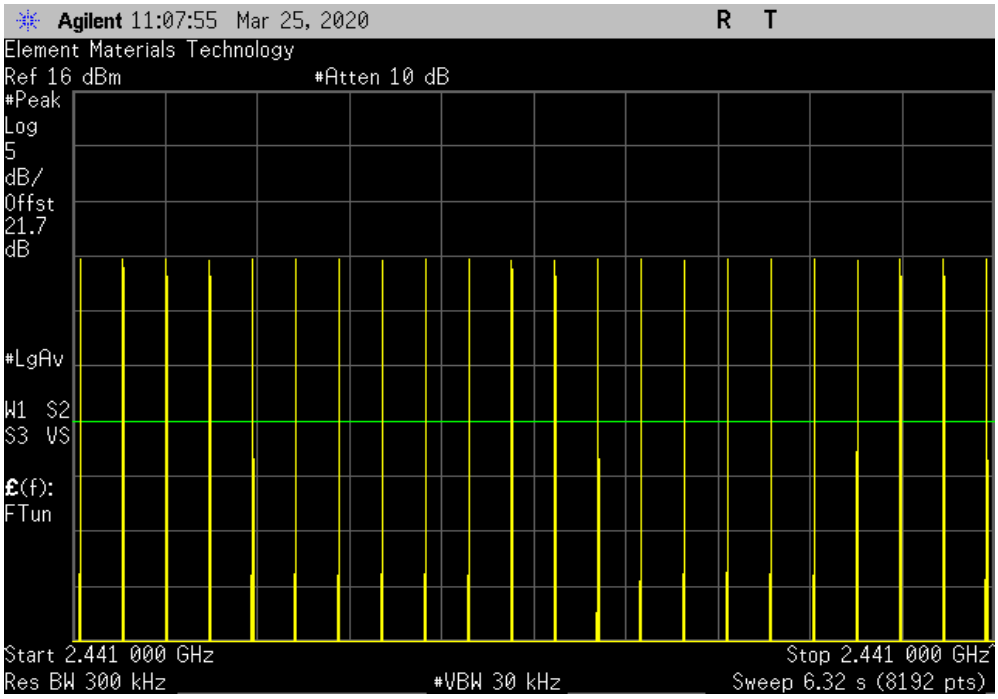


DWELL TIME

Hopping Mode (All Channels), 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



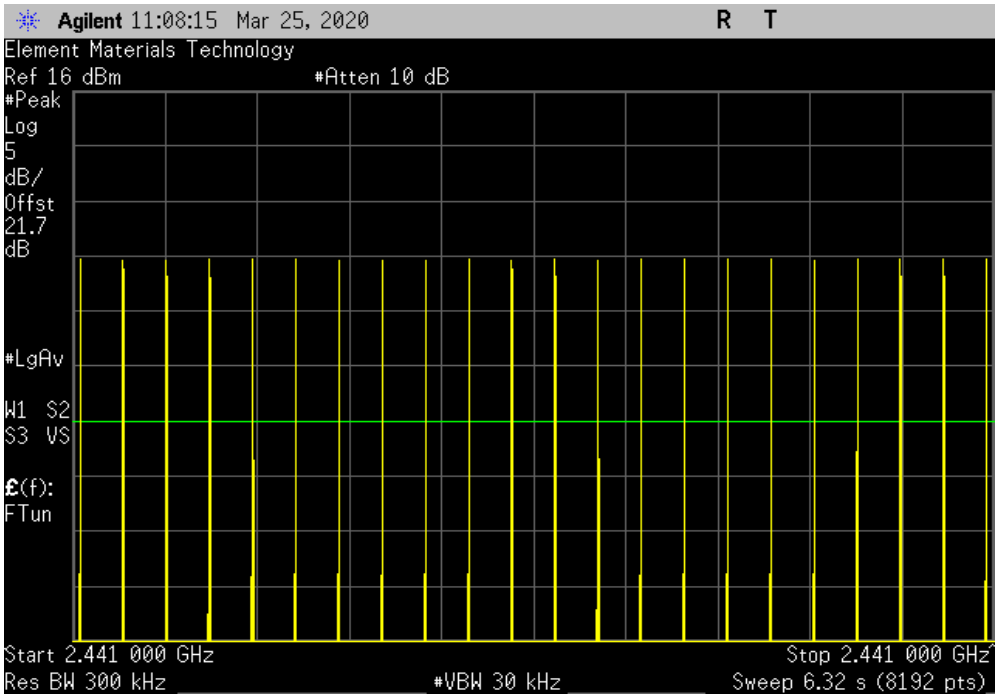
Hopping Mode (All Channels), 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2019.08.30.0 XMit 2019.09.05

Hopping Mode (All Channels), 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



Hopping Mode (All Channels), 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
2.892	N/A	22	5	318.12	400	Pass

Calculation Only

No Screen Capture Required

OUTPUT POWER

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

OUTPUT POWER

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.2 °C**
Attendees:	**None**			**Humidity:**	**32.8% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

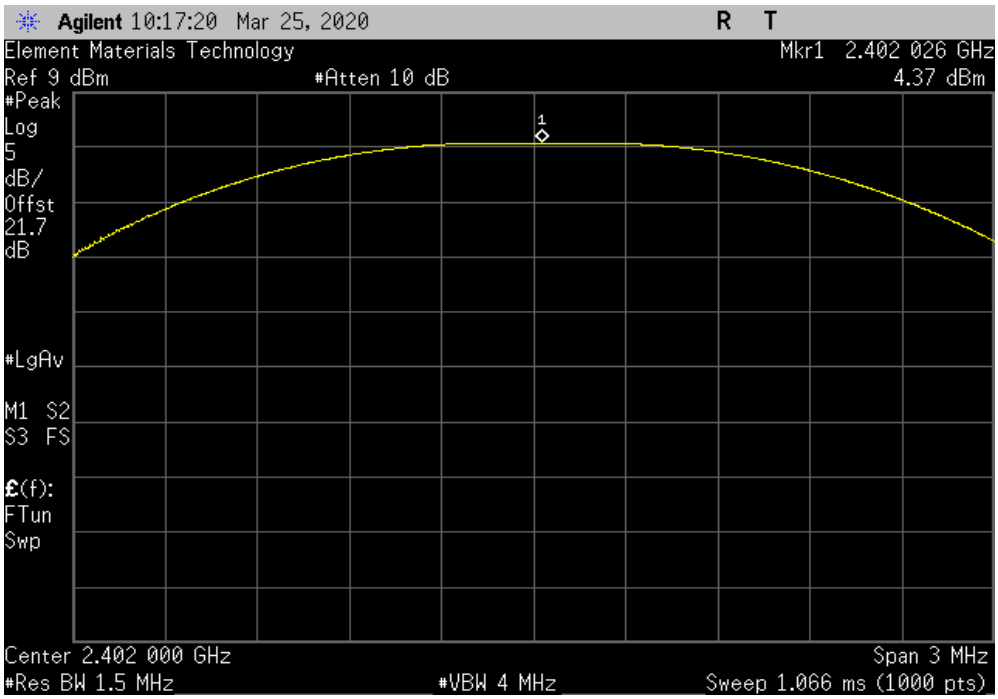
DEVIATIONS FROM TEST STANDARD

None

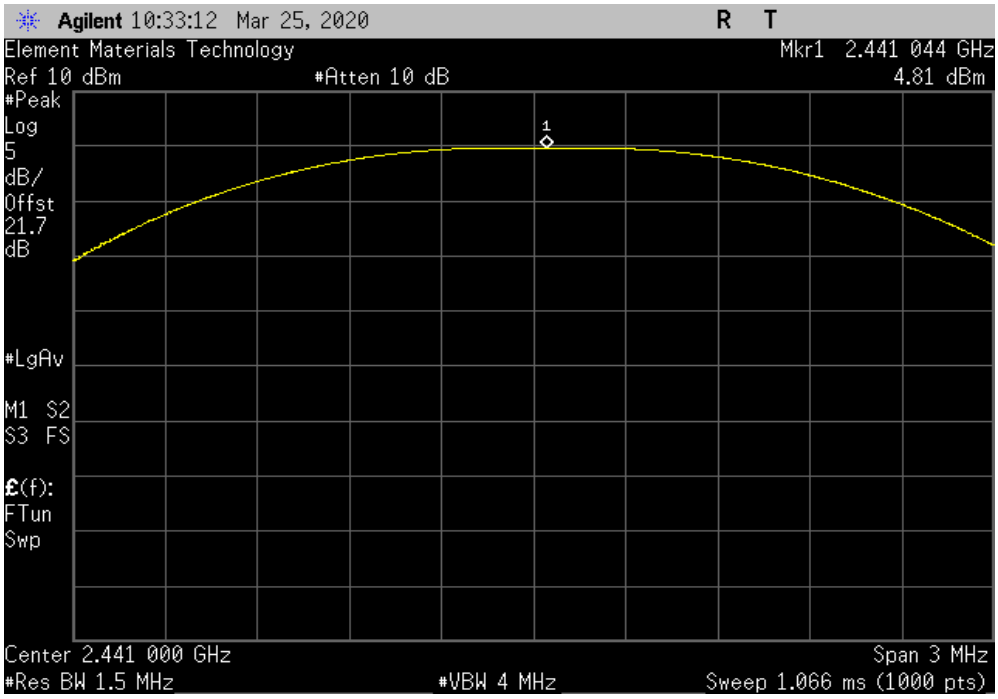
Configuration #	**1**	*Signature*

		Out Pwr (dBm)	**Limit (dBm)**	**Result**
DH5, GFSK				
	Low Channel	4.368	21	Pass
	Mid Channel	4.81	21	Pass
	High Channel	4.996	21	Pass
2DH5, pi/4-DQPSK				
	Low Channel	3.434	21	Pass
	Mid Channel	3.828	21	Pass
	High Channel	4.036	21	Pass
3DH5, 8-DPSK				
	Low Channel	4.039	21	Pass
	Mid Channel	4.426	21	Pass
	High Channel	4.6	21	Pass

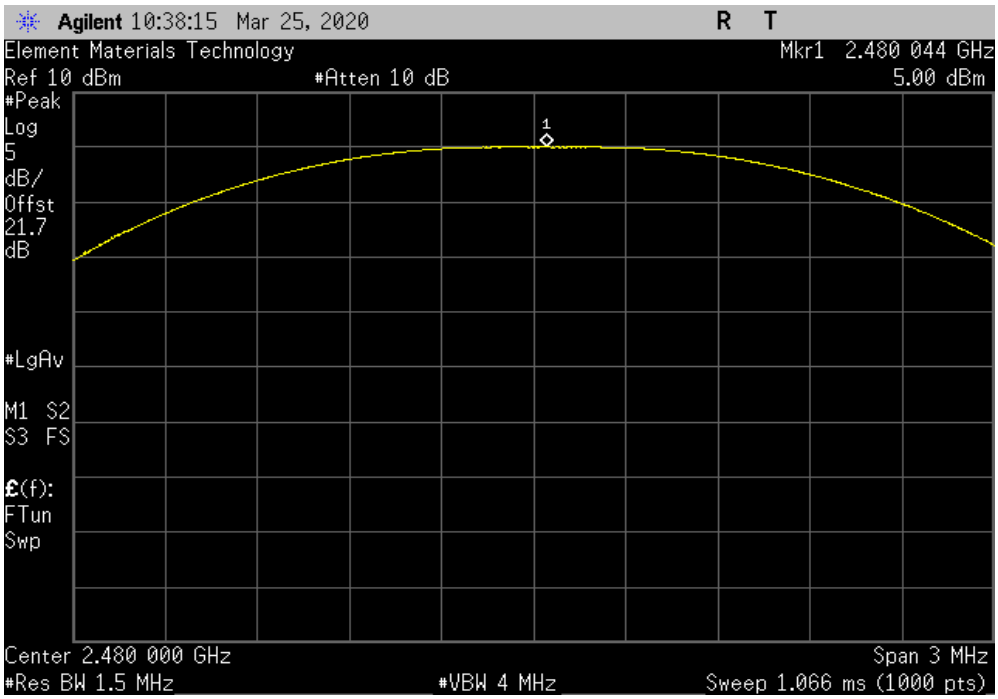
DH5, GFSK, Low Channel						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.368	21	Pass



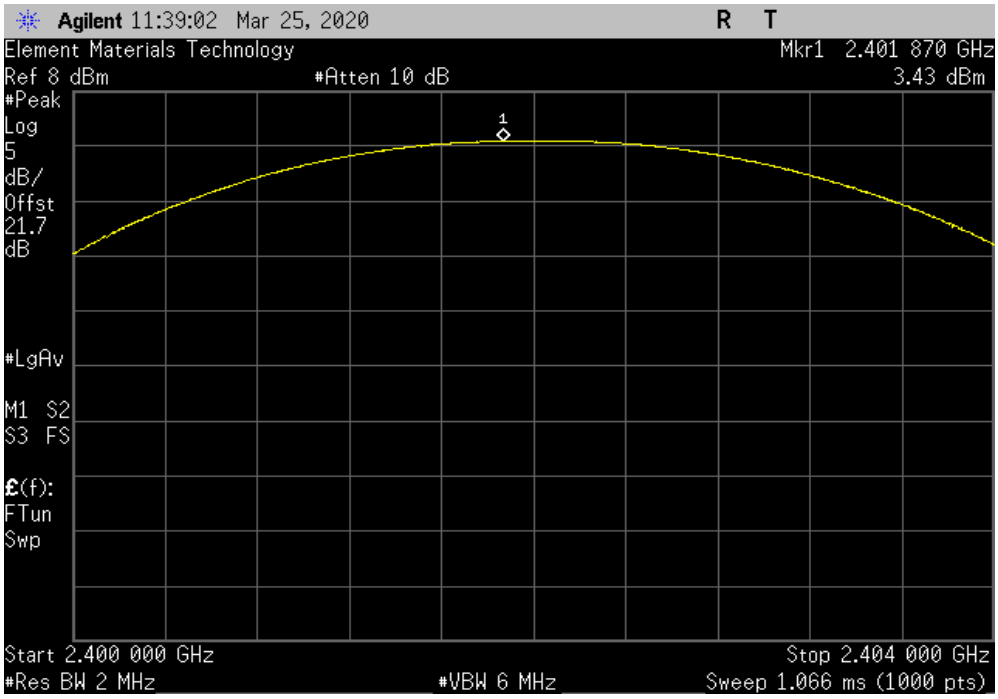
DH5, GFSK, Mid Channel						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.81	21	Pass



DH5, GFSK, High Channel						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.996	21	Pass

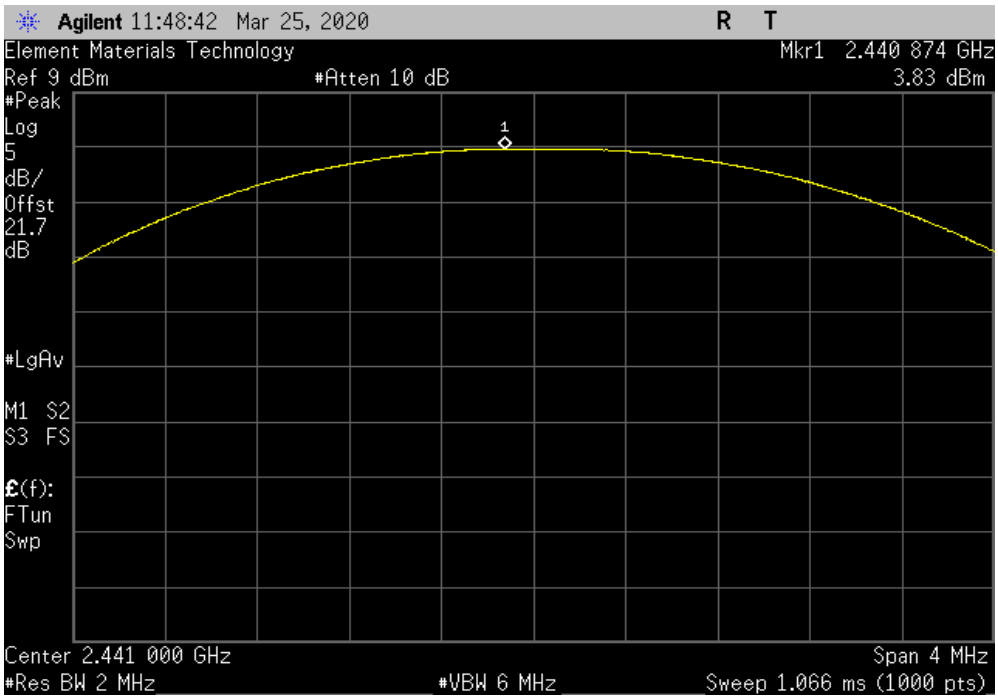


2DH5, pi/4-DQPSK, Low Channel						
				Out Pwr (dBm)	Limit (dBm)	Result
				3.434	21	Pass

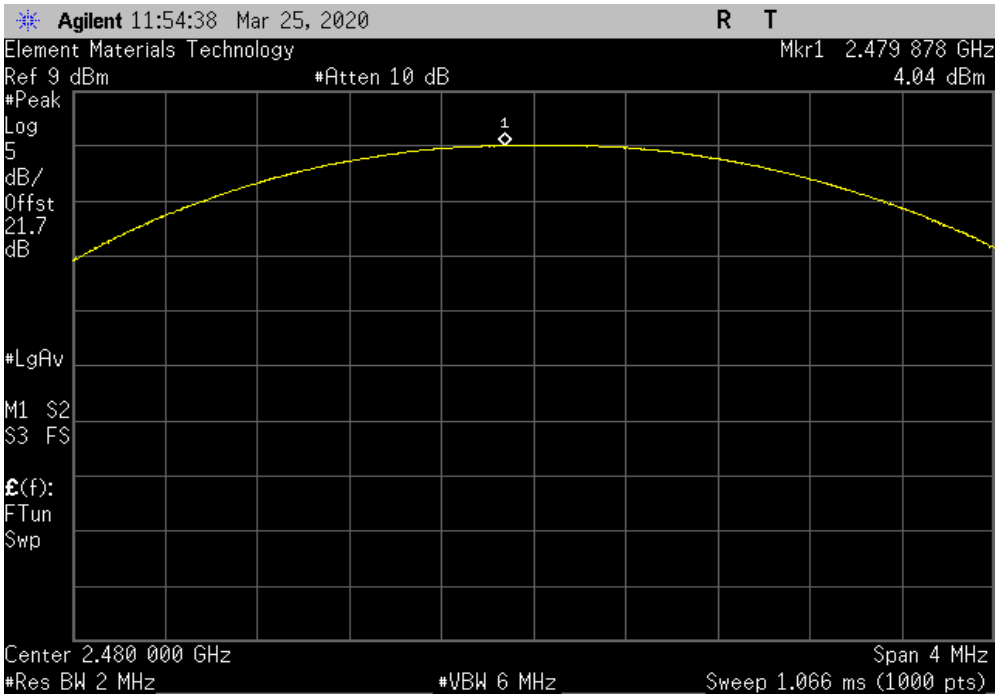


OUTPUT POWER

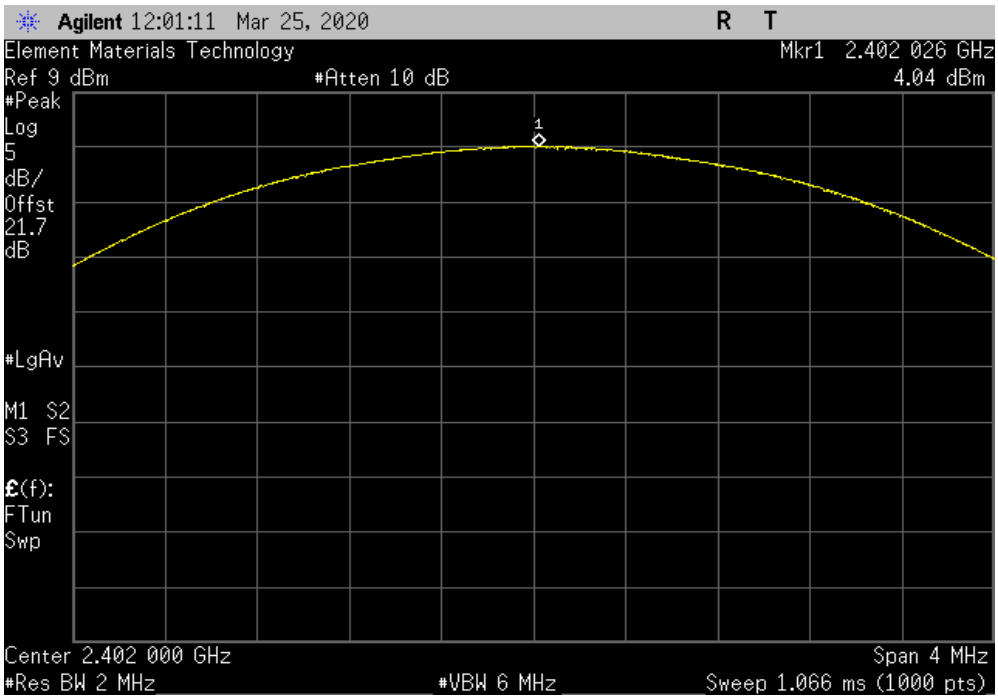
2DH5, pi/4-DQPSK, Mid Channel							
					Out Pwr (dBm)	Limit (dBm)	Result
					3.828	21	Pass



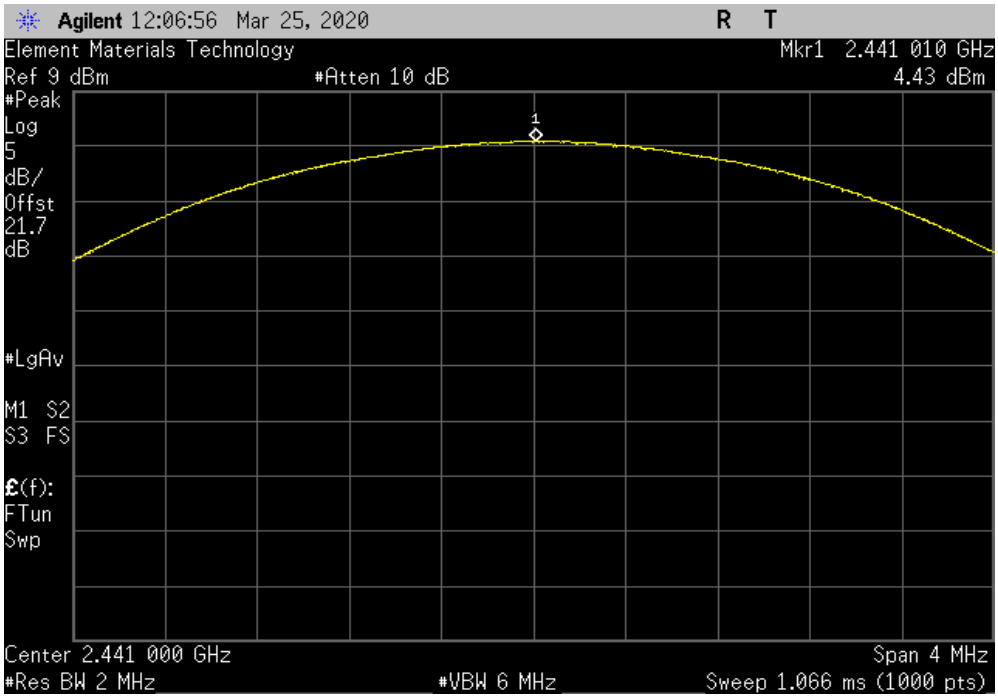
2DH5, pi/4-DQPSK, High Channel							
					Out Pwr (dBm)	Limit (dBm)	Result
					4.036	21	Pass



3DH5, 8-DPSK, Low Channel						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.039	21	Pass

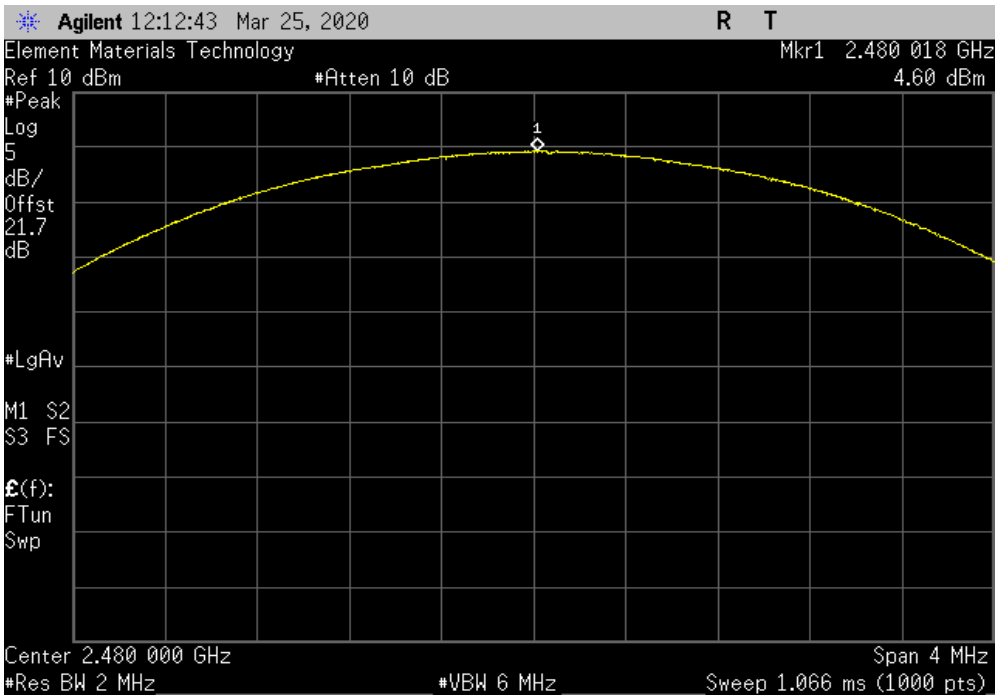


3DH5, 8-DPSK, Mid Channel						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.426	21	Pass



OUTPUT POWER

3DH5, 8-DPSK, High Channel						
				Out Pwr (dBm)	Limit (dBm)	Result
				4.6	21	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The peak output power was measured with the EUT set to low, medium and high transmit frequencies. The EUT was transmitting in a no hop mode at the data rate(s) listed in the datasheet.

The method found in ANSI C63.10:2013 Section 7.8.5 was used for a FHSS radio.

The highest antenna gain was added to the output power to calculate the EIRP using the following equation:
Output Power (dBm) + Antenna Gain (dBi) = EIRP

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.4 °C**
Attendees:	**None**			**Humidity:**	**32.3% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

DEVIATIONS FROM TEST STANDARD

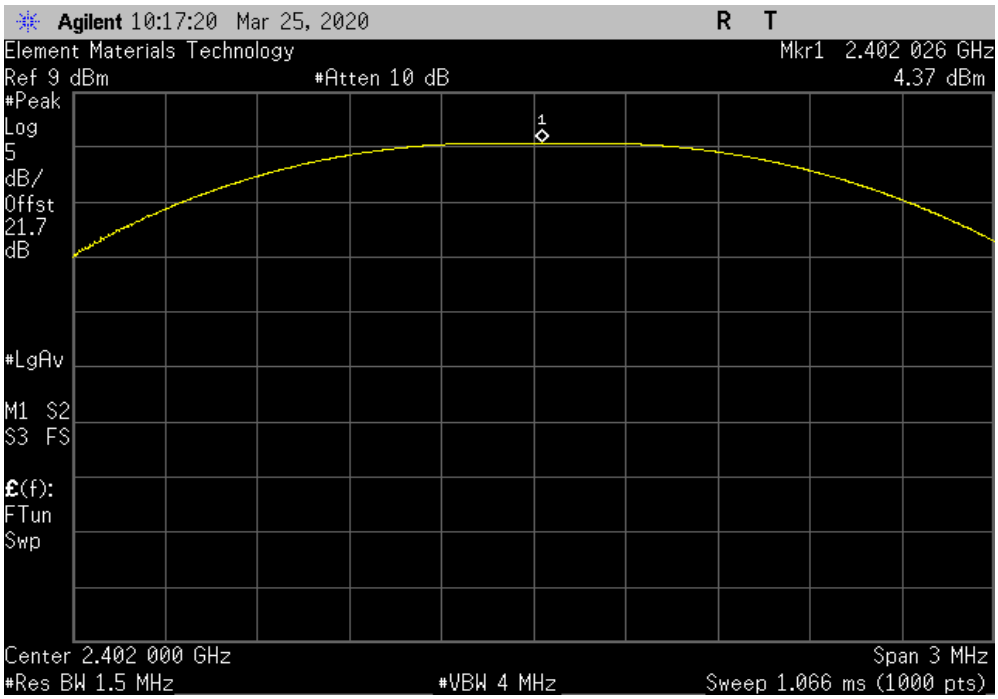
None

Configuration #	**1**	*Signature*

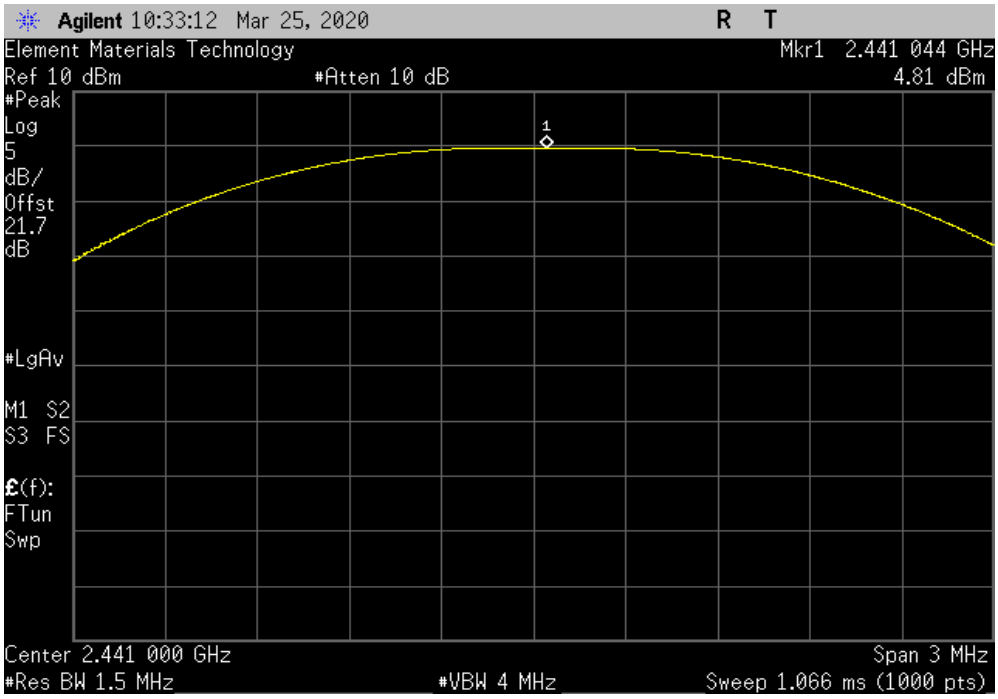
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
DH5, GFSK						
	Low Channel	4.368	4.4	8.768	27	Pass
	Mid Channel	4.81	4.4	9.21	27	Pass
	High Channel	4.996	4.4	9.396	27	Pass
2DH5, pi/4-DQPSK						
	Low Channel	3.434	4.4	7.834	27	Pass
	Mid Channel	3.828	4.4	8.228	27	Pass
	High Channel	4.036	4.4	8.436	27	Pass
3DH5, 8-DPSK						
	Low Channel	4.039	4.4	8.439	27	Pass
	Mid Channel	4.426	4.4	8.826	27	Pass
	High Channel	4.6	4.4	9	27	Pass

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

DH5, GFSK, Low Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		4.368	4.4	8.768	27	Pass

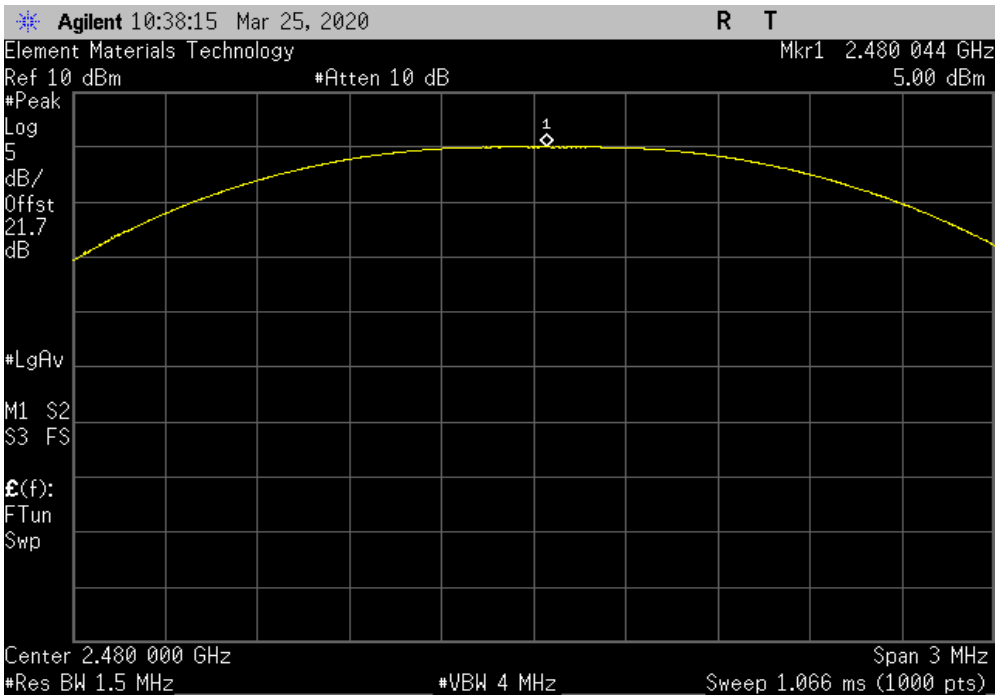


DH5, GFSK, Mid Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		4.81	4.4	9.21	27	Pass

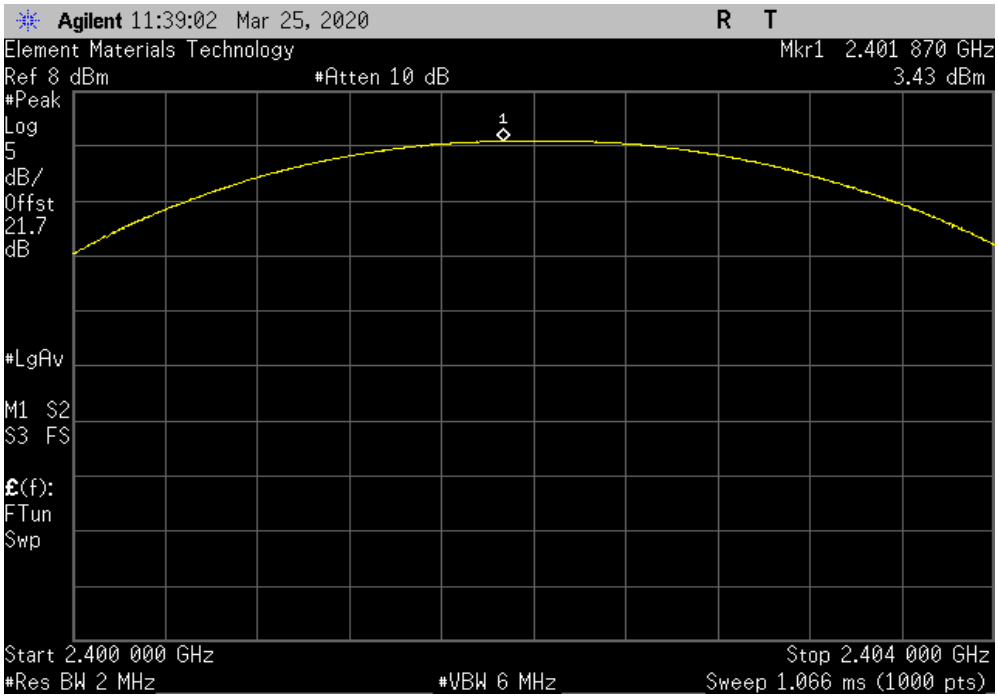


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

DH5, GFSK, High Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		4.996	4.4	9.396	27	Pass

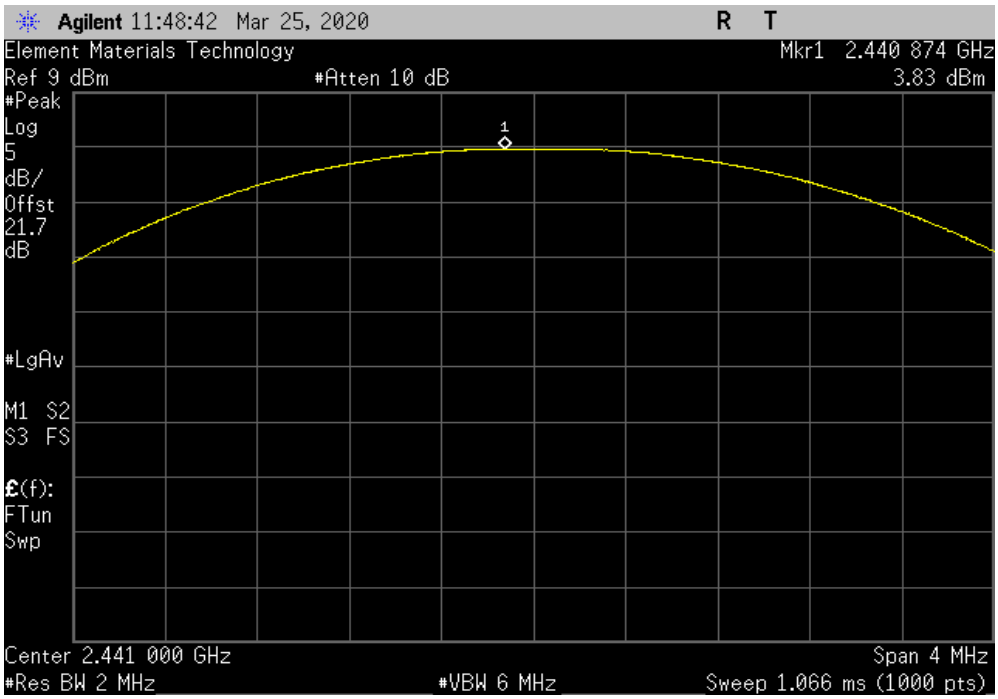


2DH5, pi/4-DQPSK, Low Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		3.434	4.4	7.834	27	Pass

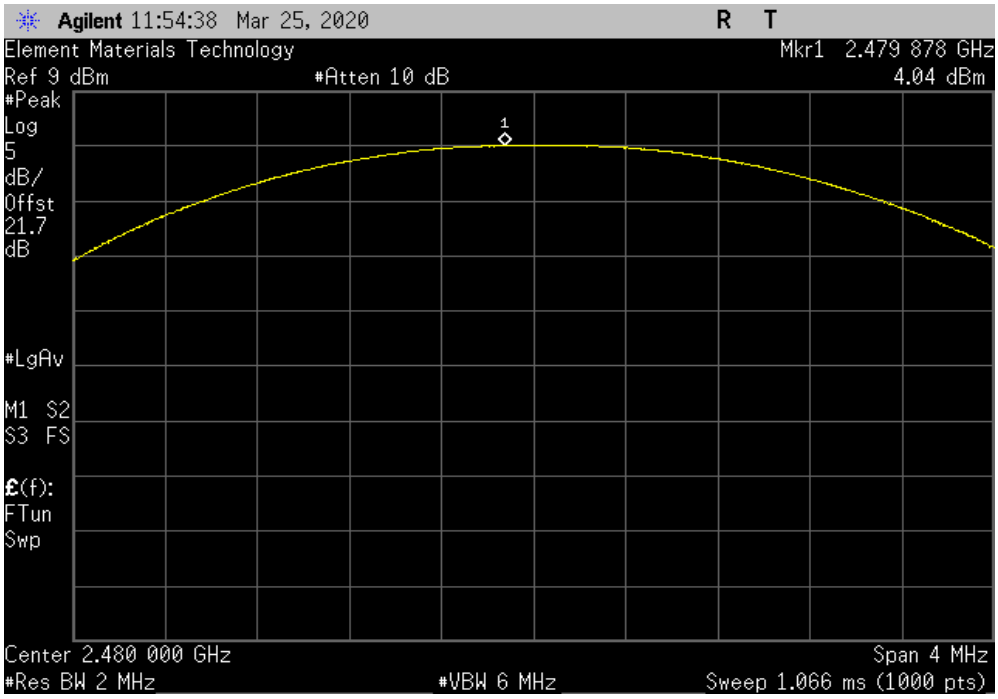


EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

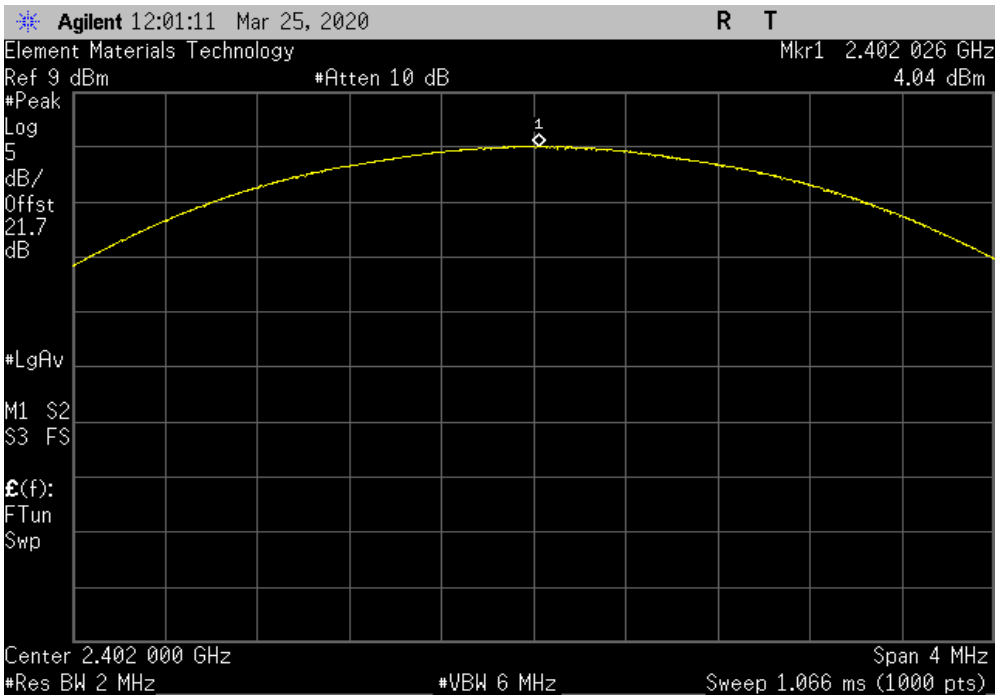
2DH5, pi/4-DQPSK, Mid Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		3.828	4.4	8.228	27	Pass



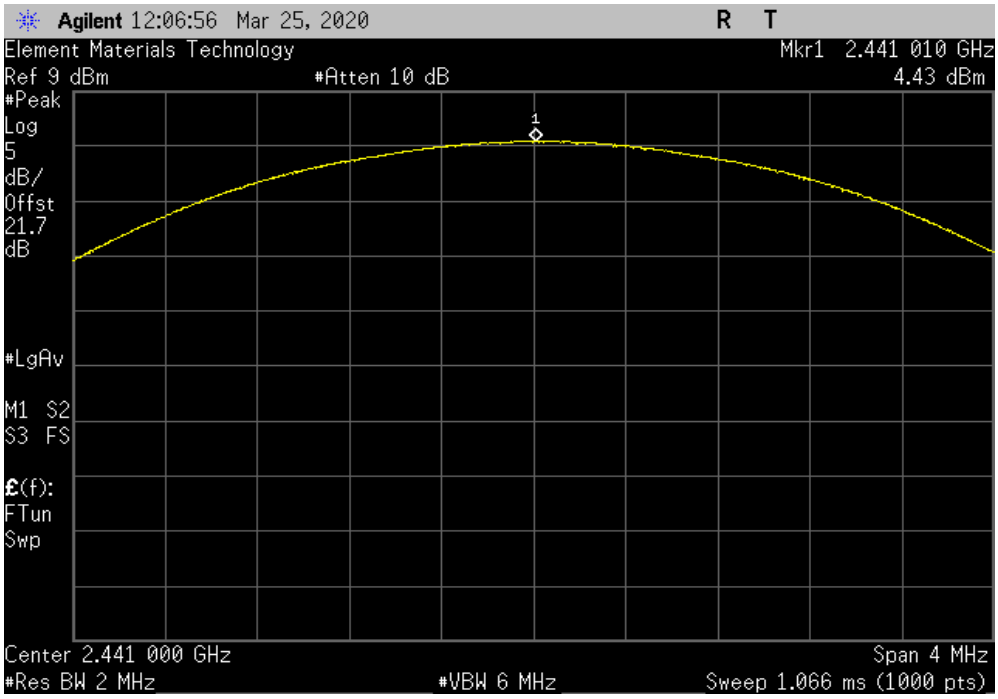
2DH5, pi/4-DQPSK, High Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		4.036	4.4	8.436	27	Pass



3DH5, 8-DPSK, Low Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		4.039	4.4	8.439	27	Pass



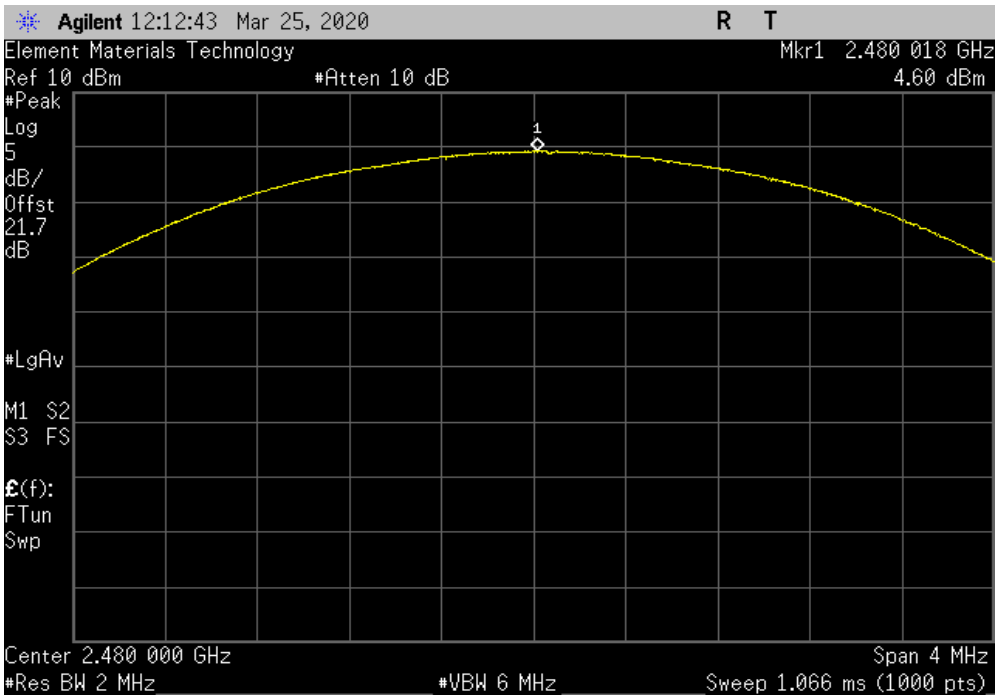
3DH5, 8-DPSK, Mid Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		4.426	4.4	8.826	27	Pass



EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TbtTx 2019.08.30.0 XMit 2019.09.05

3DH5, 8-DPSK, High Channel						
		Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
		4.6	4.4	9	27	Pass



BAND EDGE COMPLIANCE

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Cable	Fairview Microwave	LMR240 NM-BNCM, 9m	MNZ	17-Oct-19	17-Oct-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The EUT was transmitting at the data rate(s) listed in the datasheet in a no hop mode. The channels closest to the band edges were selected.

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

BAND EDGE COMPLIANCE

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.6 °C**
Attendees:	**None**			**Humidity:**	**32.1% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

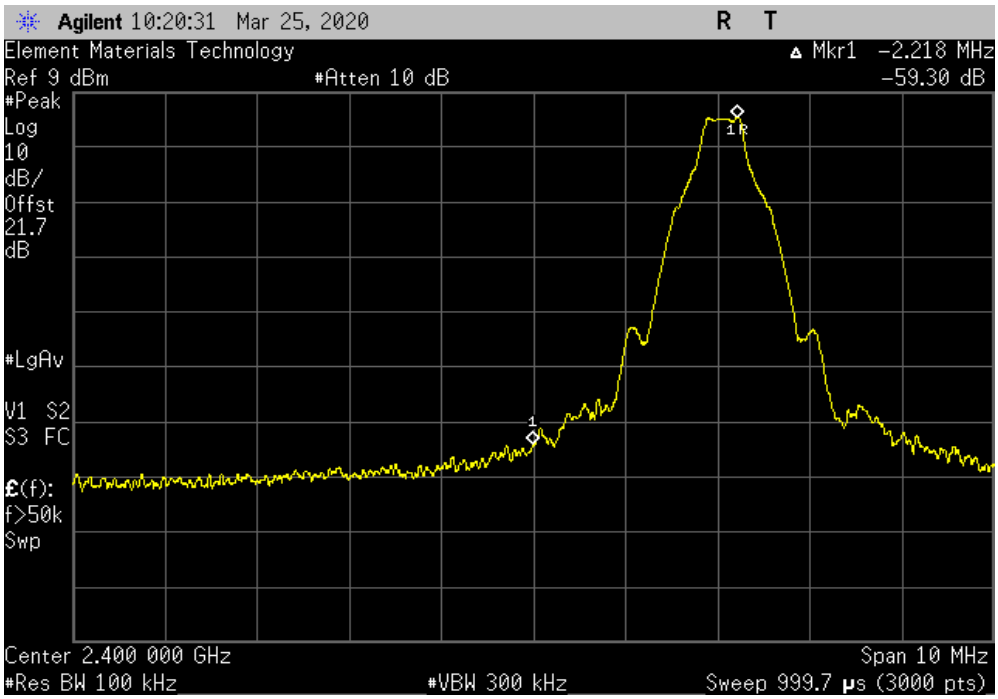
DEVIATIONS FROM TEST STANDARD

None

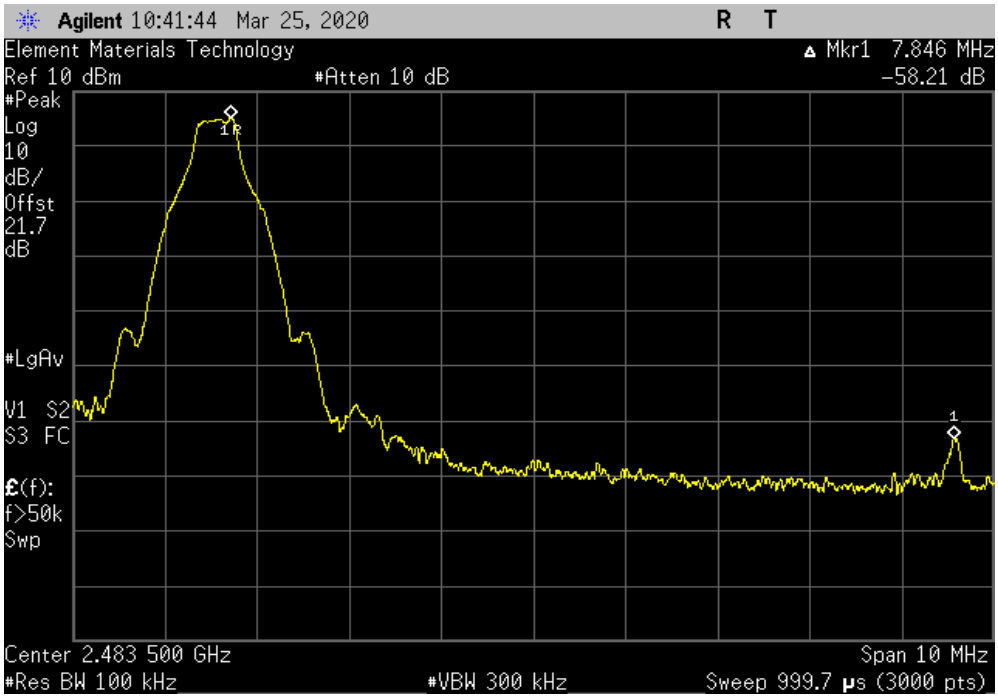
Configuration #	**1**	*Signature*

		Value (dBc)	**Limit ≤ (dBc)**	**Result**
DH5, GFSK				
	Low Channel	-59.3	-20	Pass
	High Channel	-58.21	-20	Pass
2DH5, pi/4-DQPSK				
	Low Channel	-56.68	-20	Pass
	High Channel	-55.19	-20	Pass
3DH5, 8-DPSK				
	Low Channel	-51.23	-20	Pass
	High Channel	-56.86	-20	Pass

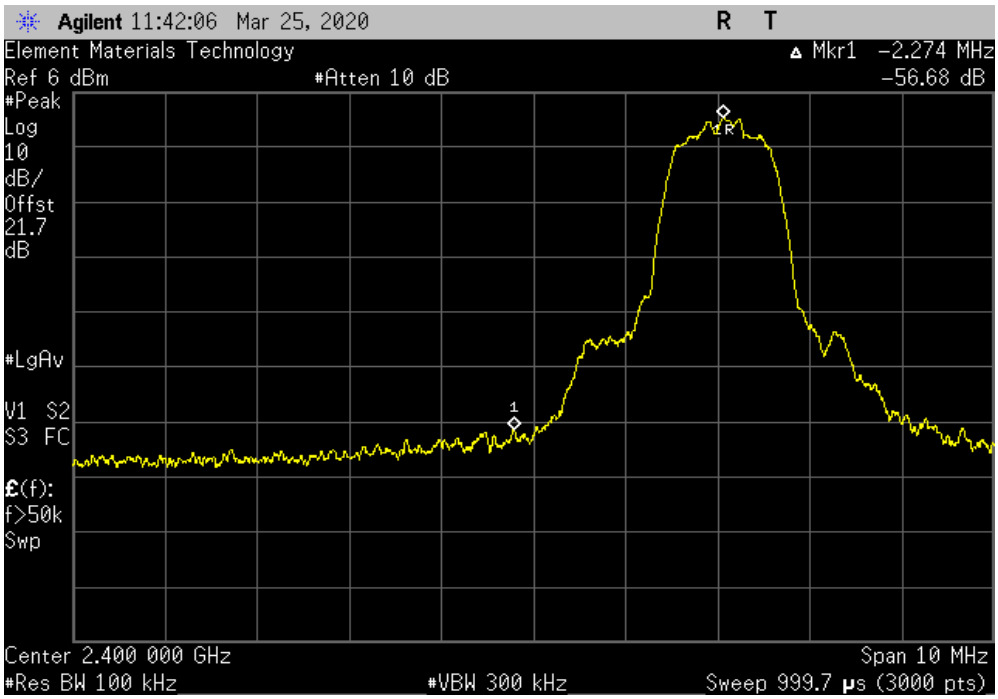
DH5, GFSK, Low Channel						
				Value (dBc)	Limit ≤ (dBc)	Result
				-59.3	-20	Pass



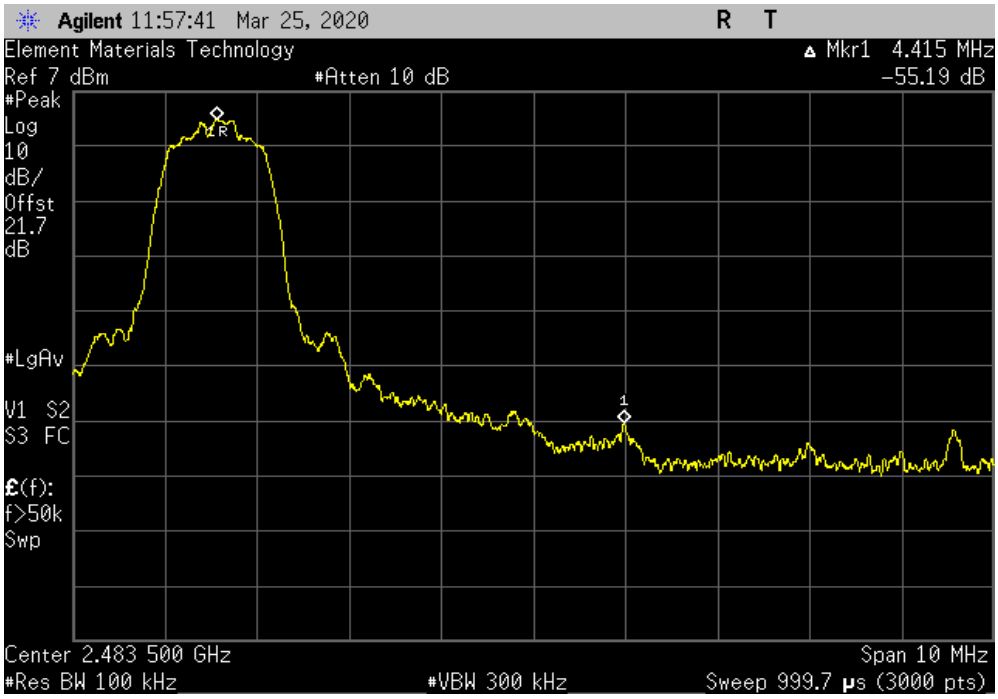
DH5, GFSK, High Channel						
				Value (dBc)	Limit ≤ (dBc)	Result
				-58.21	-20	Pass



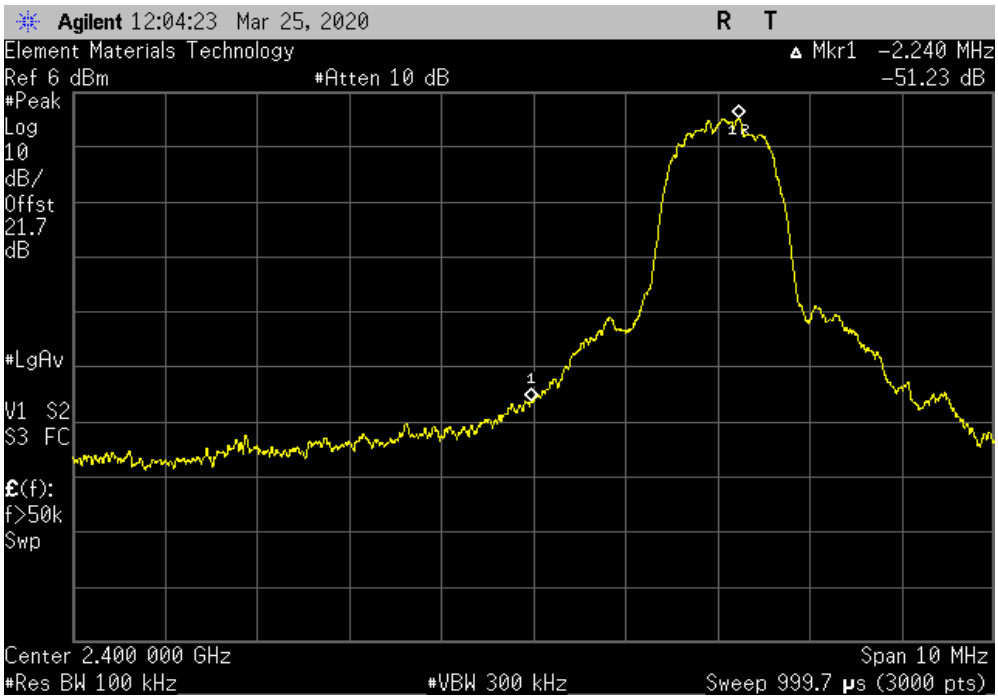
2DH5, pi/4-DQPSK, Low Channel						
				Value (dBc)	Limit ≤ (dBc)	Result
				-56.68	-20	Pass



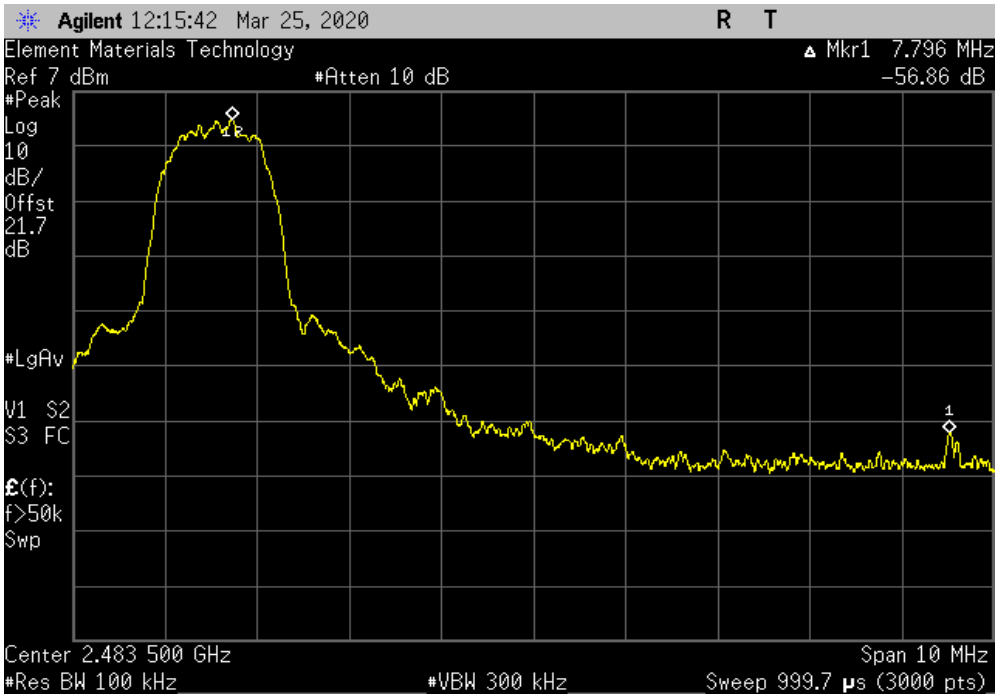
2DH5, pi/4-DQPSK, High Channel						
				Value (dBc)	Limit ≤ (dBc)	Result
				-55.19	-20	Pass



3DH5, 8-DPSK, Low Channel						
				Value (dBc)	Limit ≤ (dBc)	Result
				-51.23	-20	Pass



3DH5, 8-DPSK, High Channel						
				Value (dBc)	Limit ≤ (dBc)	Result
				-56.86	-20	Pass



BAND EDGE COMPLIANCE -HOPPING MODE

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to its normal pseudo-random hopping sequence. 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 -HOPPING MODE

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.2 °C**
Attendees:	**None**			**Humidity:**	**32.6% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

DEVIATIONS FROM TEST STANDARD

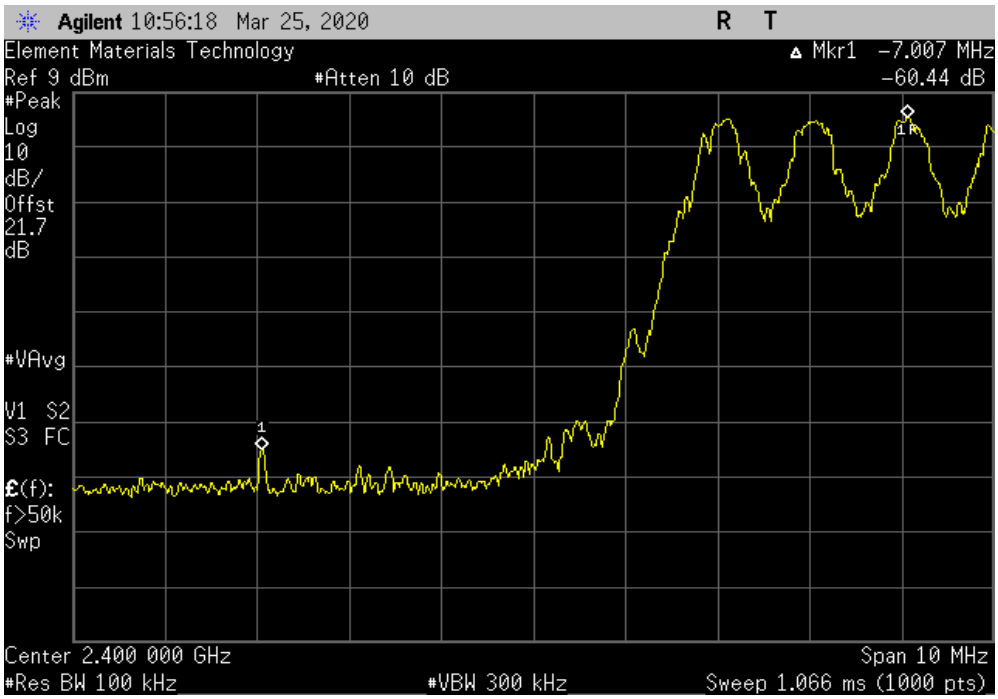
None

Configuration #	**1**	*Signature*

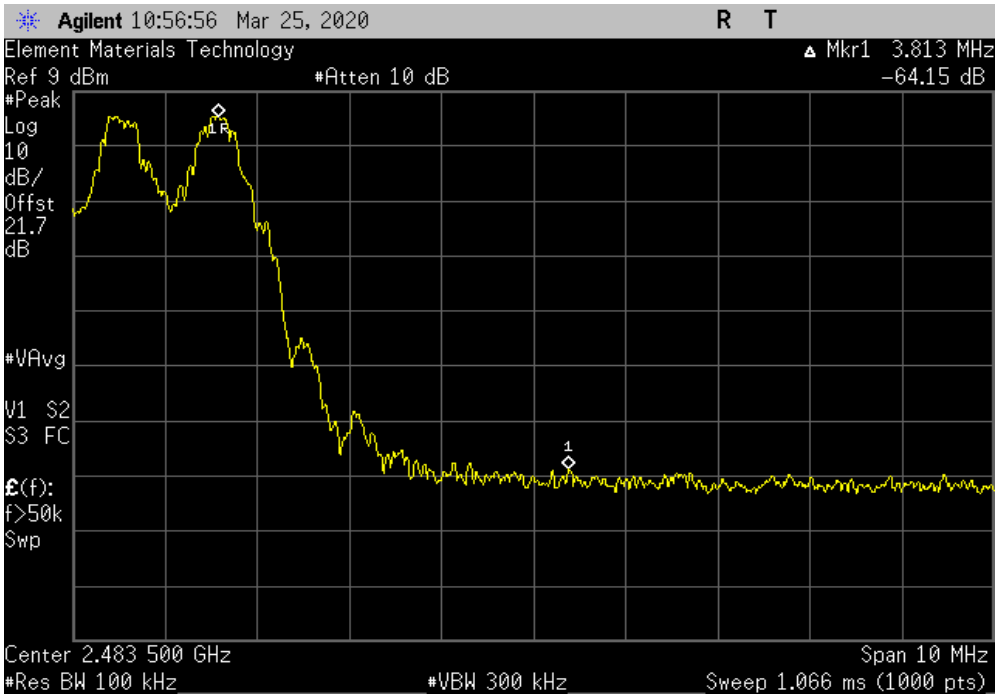
	Value (dBc)	**Limit ≤ (dBc)**	**Result**
Hopping Mode (All Channels)			
DH5, GFSK			
Low Channel, 2402 MHz	-60.44	-20	Pass
High Channel, 2480 MHz	-64.15	-20	Pass
2DH5, pi/4-DQPSK			
Low Channel, 2402 MHz	-56.42	-20	Pass
High Channel, 2480 MHz	-56.93	-20	Pass
3DH5, 8-DPSK			
Low Channel, 2402 MHz	-57.01	-20	Pass
High Channel, 2480 MHz	-59.74	-20	Pass

BAND EDGE COMPLIANCE -HOPPING MODE

Hopping Mode (All Channels), DH5, GFSK, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-60.44	-20	Pass

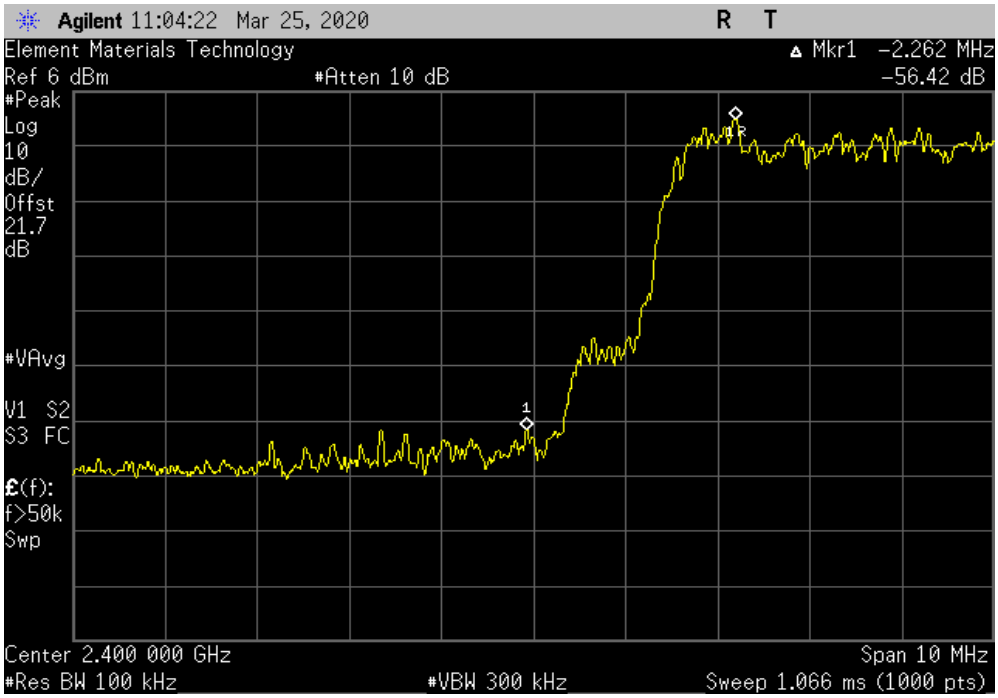


Hopping Mode (All Channels), DH5, GFSK, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-64.15	-20	Pass

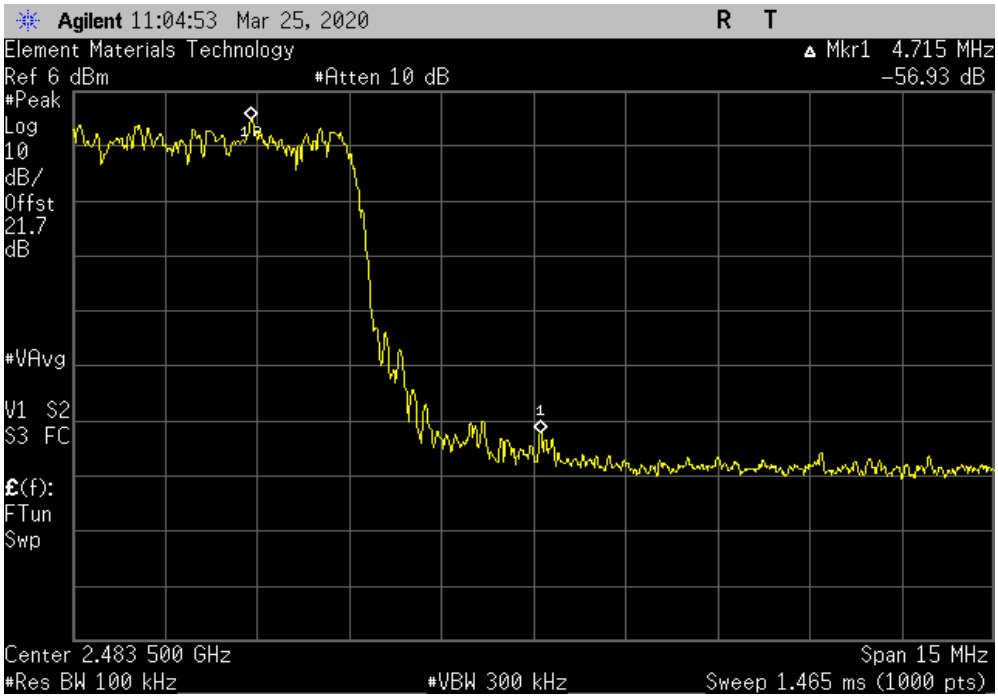


BAND EDGE COMPLIANCE -HOPPING MODE

Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-56.42	-20	Pass

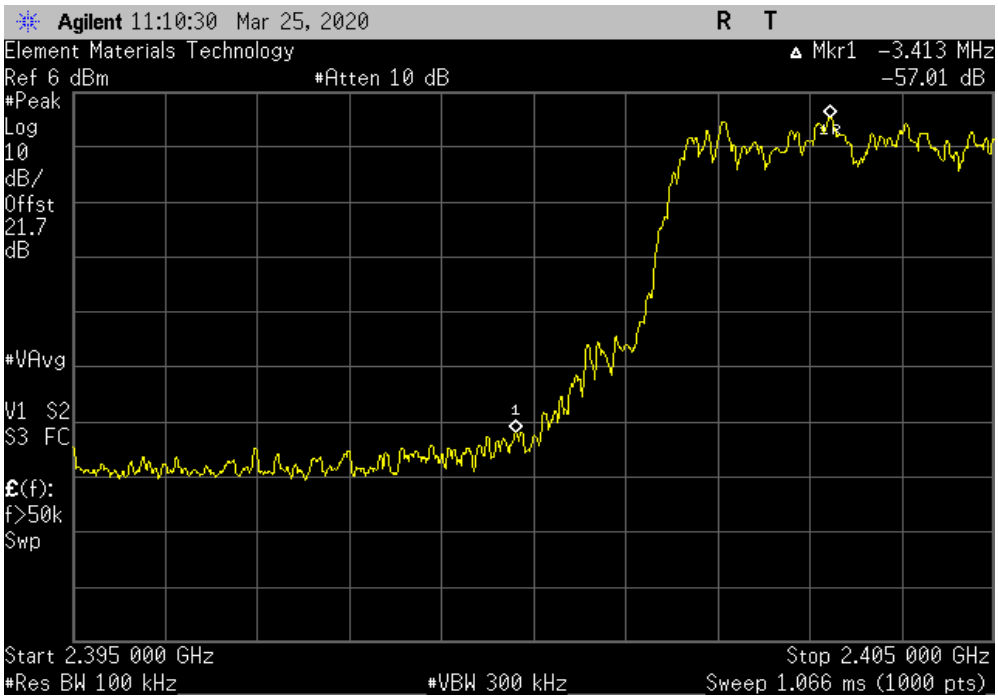


Hopping Mode (All Channels), 2DH5, pi/4-DQPSK, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-56.93	-20	Pass

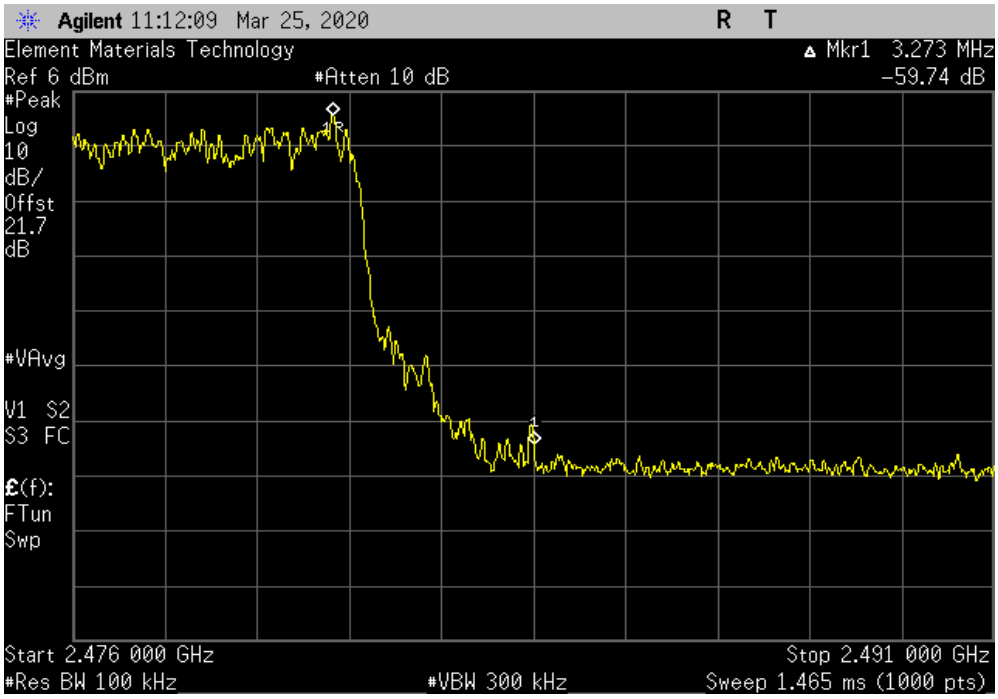


BAND EDGE COMPLIANCE -HOPPING MODE

Hopping Mode (All Channels), 3DH5, 8-DPSK, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-57.01	-20	Pass



Hopping Mode (All Channels), 3DH5, 8-DPSK, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-59.74	-20	Pass



OCCUPIED BANDWIDTH

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The 20 dB occupied bandwidth was measured with the EUT set to low, medium and high transmit frequencies in the band. The EUT was transmitting at the data rate(s) listed in the datasheet in a no-hop mode.

OCCUPIED BANDWIDTH

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.3 °C**
Attendees:	**None**			**Humidity:**	**32.6% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

DEVIATIONS FROM TEST STANDARD

None

Configuration #	**1**	*Signature*

		Value	**Limit (<)**	**Result**
DH5, GFSK				
	Low Channel	924.694 kHz	1.5 MHz	Pass
	Mid Channel	927.608 kHz	1.5 MHz	Pass
	High Channel	924.245 kHz	1.5 MHz	Pass
2DH5, pi/4-DQPSK				
	Low Channel	1.34 MHz	1.5 MHz	Pass
	Mid Channel	1.341 MHz	1.5 MHz	Pass
	High Channel	1.339 MHz	1.5 MHz	Pass
3DH5, 8-DPSK				
	Low Channel	1.316 MHz	1.5 MHz	Pass
	Mid Channel	1.311 MHz	1.5 MHz	Pass
	High Channel	1.329 MHz	1.5 MHz	Pass

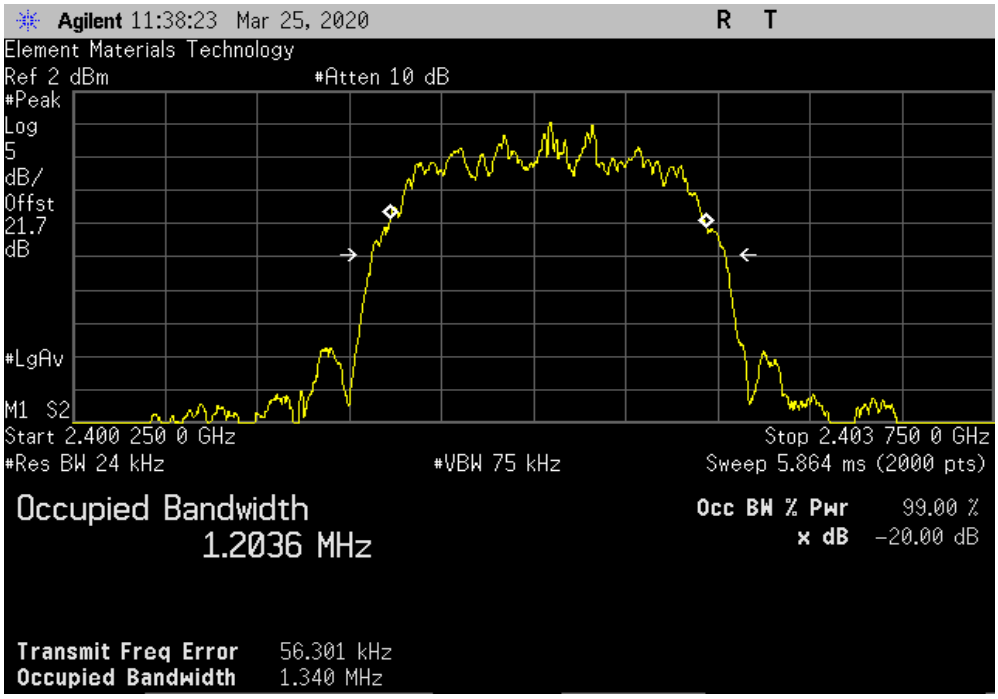
DH5, GFSK, Low Channel						
				Value	Limit (<)	Result
				924.694 kHz	1.5 MHz	Pass

DH5, GFSK, Mid Channel						
				Value	Limit (<)	Result
				927.608 kHz	1.5 MHz	Pass

OCCUPIED BANDWIDTH

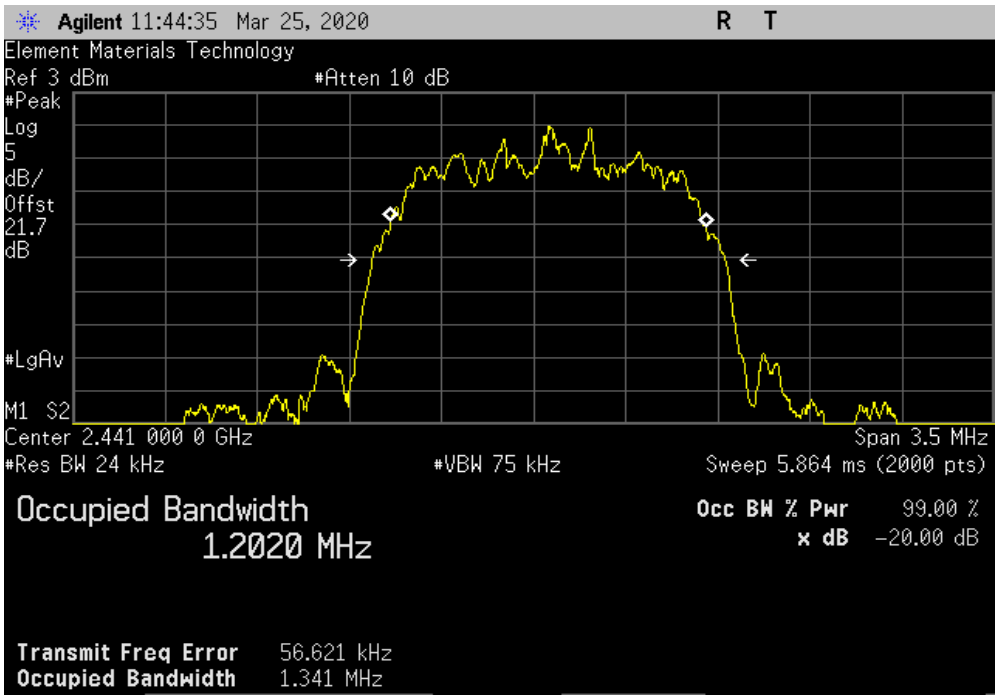
DH5, GFSK, High Channel						
				Value	Limit (<)	Result
				924.245 kHz	1.5 MHz	Pass

2DH5, pi/4-DQPSK, Low Channel						
				Value	Limit (<)	Result
				1.34 MHz	1.5 MHz	Pass

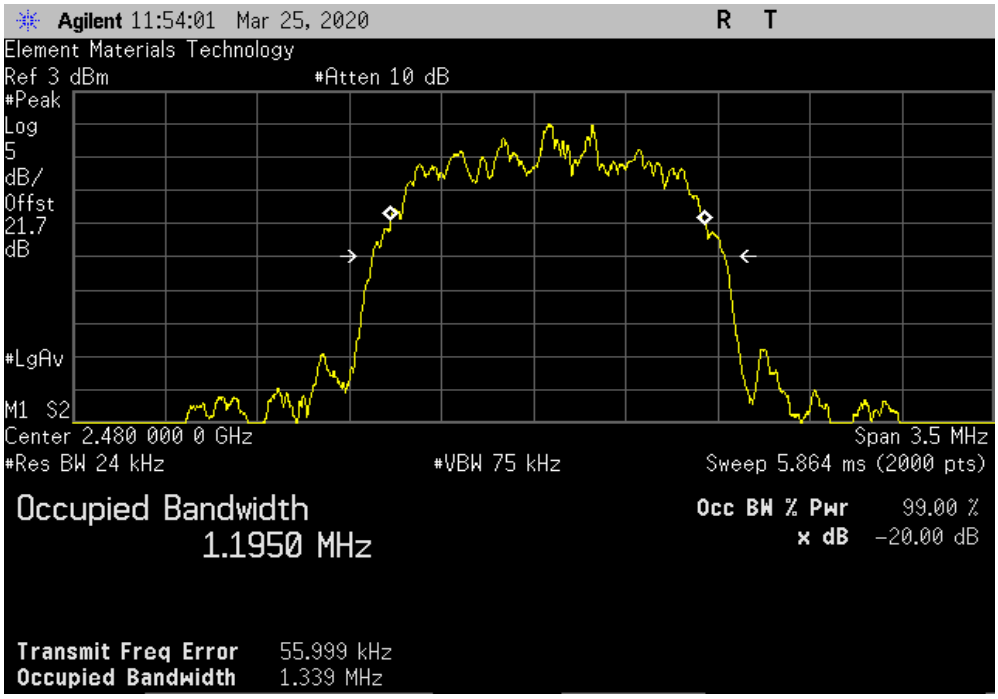


OCCUPIED BANDWIDTH

2DH5, pi/4-DQPSK, Mid Channel						
				Value	Limit (<)	Result
				1.341 MHz	1.5 MHz	Pass

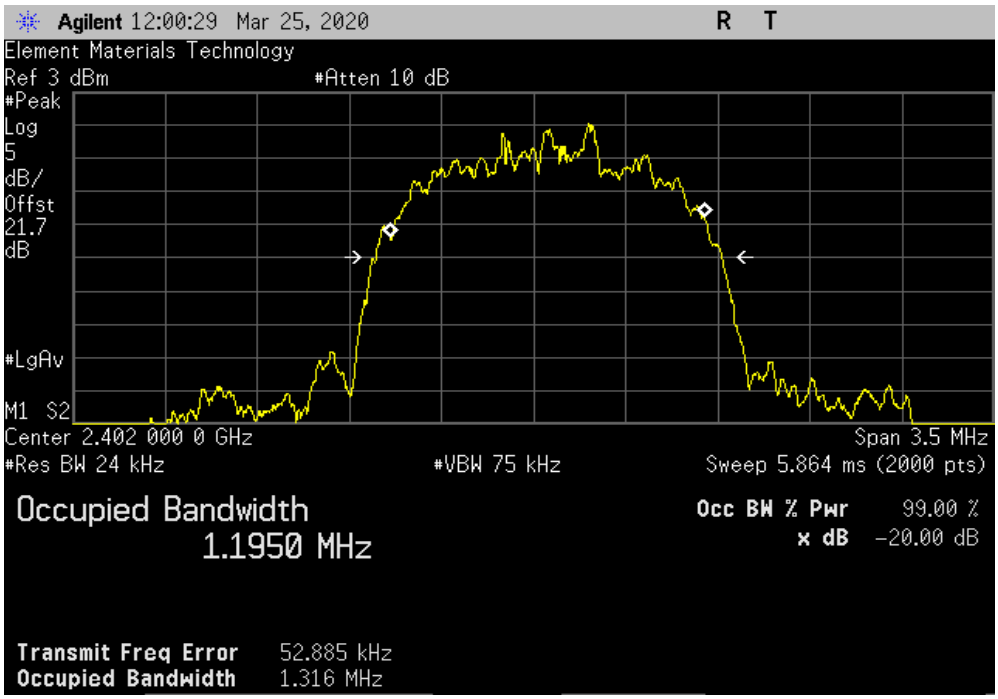


2DH5, pi/4-DQPSK, High Channel						
				Value	Limit (<)	Result
				1.339 MHz	1.5 MHz	Pass

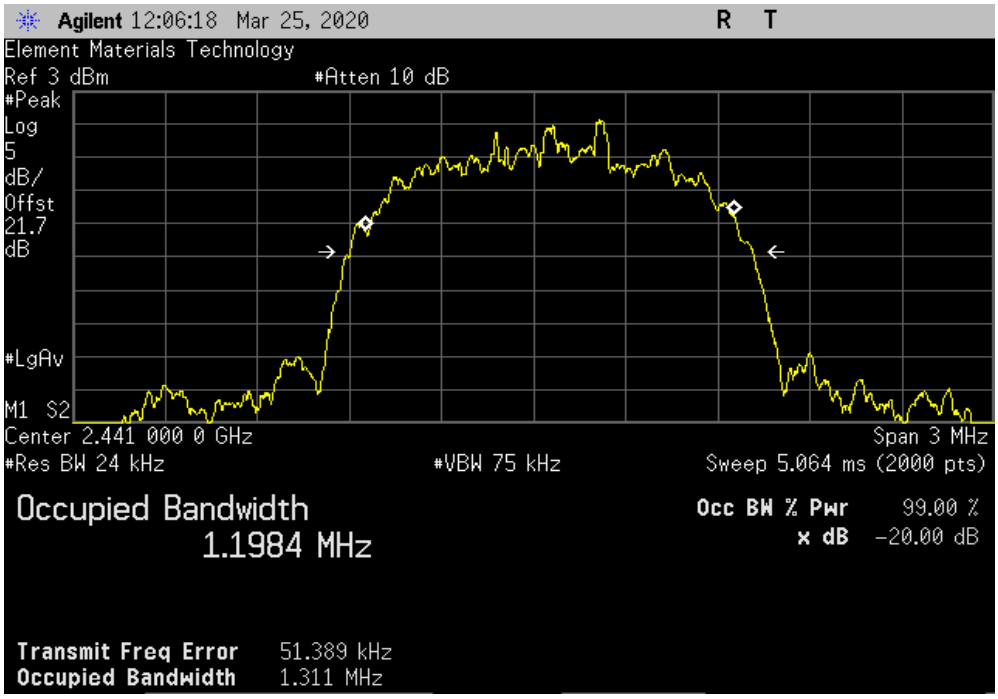


OCCUPIED BANDWIDTH

3DH5, 8-DPSK, Low Channel						
				Value	Limit (<)	Result
				1.316 MHz	1.5 MHz	Pass



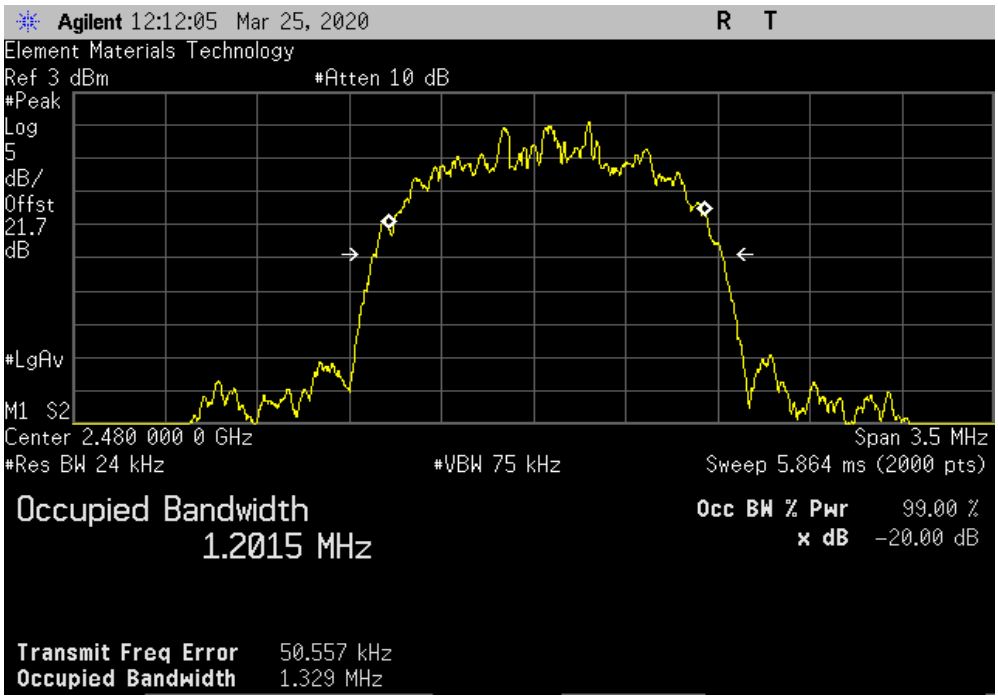
3DH5, 8-DPSK, Mid Channel						
				Value	Limit (<)	Result
				1.311 MHz	1.5 MHz	Pass



OCCUPIED BANDWIDTH

TbtTx 2019.08.30.0 XMit 2019.09.05

3DH5, 8-DPSK, High Channel						
				Value	Limit (<)	Result
				1.329 MHz	1.5 MHz	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2019.09.05

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	Agilent	N5183A	TIK	30-Apr-19	30-Apr-22
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	MNU	11-Apr-19	11-Apr-20
Attenuator	S.M. Electronics	SA26B-20	TZP	9-Nov-19	9-Nov-20
Block - DC	Fairview Microwave	SD3379	AMZ	9-Nov-19	9-Nov-20
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFD	28-Jul-19	28-Jul-20

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. 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 in a no-hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

SPURIOUS CONDUCTED EMISSIONS

element

TbtTx 2019.08.30.0 XMit 2019.09.05

EUT:	**JL Module**			**Work Order:**	**APRI0010**
Serial Number:	**4**			**Date:**	**25-Mar-20**
Customer:	**Apricity Code**			**Temperature:**	**22.2 °C**
Attendees:	**None**			**Humidity:**	**32.9% RH**
Project:	**None**			**Barometric Pres.:**	**1009.9 mbar**
Tested by:	**Kyle McMullan**	**Power:**	**5 VDC (via USB)**	**Job Site:**	**MN09**

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2020	ANSI C63.10:2013

COMMENTS

Reference level offset includes 20 dB attenuator, DC block, and measurement cable.

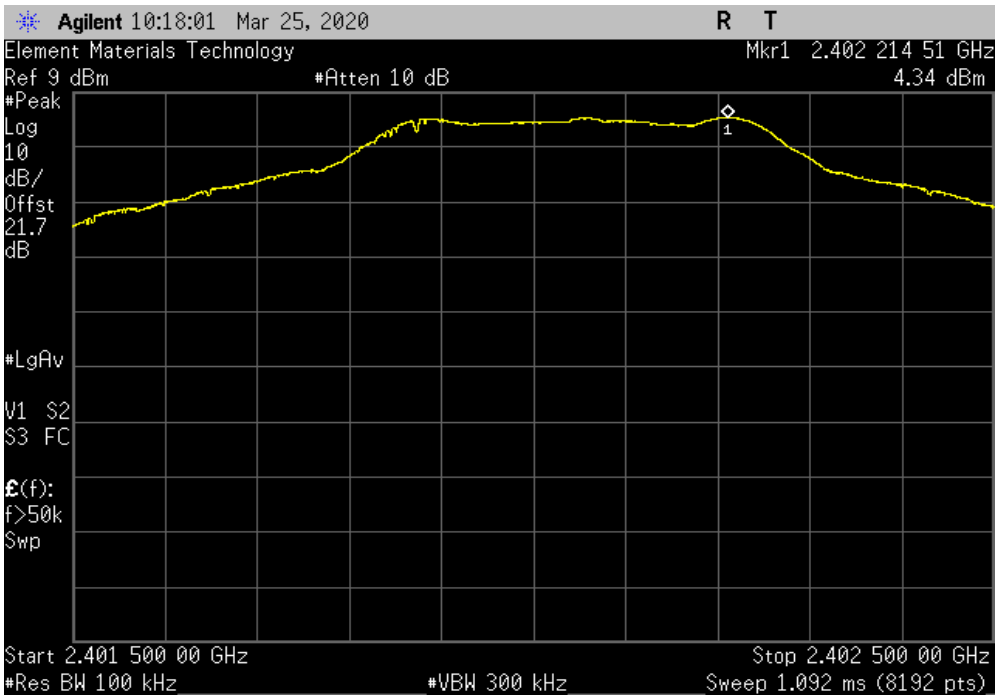
DEVIATIONS FROM TEST STANDARD

None

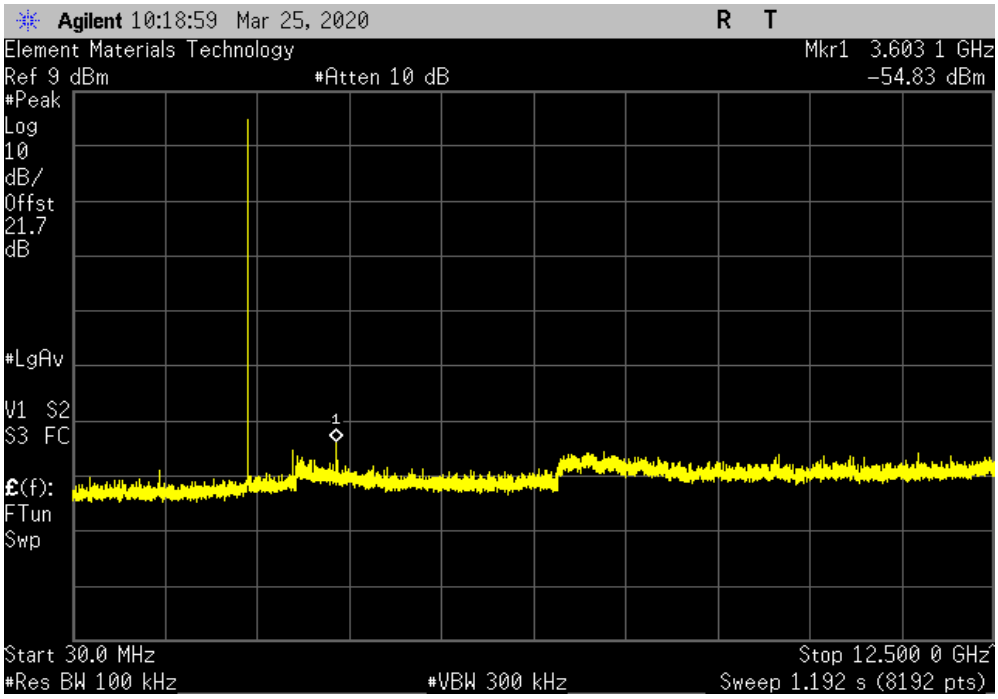
Configuration #	**1**	*Signature*

		Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
DH5, GFSK						
	Low Channel	Fundamental	2402.21	N/A	N/A	N/A
	Low Channel	30 MHz - 12.5 GHz	3603.1	-59.17	-20	Pass
	Low Channel	12.5 GHz - 25 GHz	13612.5	-57.79	-20	Pass
	Mid Channel	Fundamental	2441.22	N/A	N/A	N/A
	Mid Channel	30 MHz - 12.5 GHz	7110.7	-60.78	-20	Pass
	Mid Channel	12.5 GHz - 25 GHz	13580.5	-58.04	-20	Pass
	High Channel	Fundamental	2480.21	N/A	N/A	N/A
	High Channel	30 MHz - 12.5 GHz	7022.4	-61.34	-20	Pass
	High Channel	12.5 GHz - 25 GHz	13656.8	-57.75	-20	Pass
2DH5, pi/4-DQPSK						
	Low Channel	Fundamental	2402.06	N/A	N/A	N/A
	Low Channel	30 MHz - 12.5 GHz	7037.6	-57.4	-20	Pass
	Low Channel	12.5 GHz - 25 GHz	14216.8	-54.57	-20	Pass
	Mid Channel	Fundamental	2441.06	N/A	N/A	N/A
	Mid Channel	30 MHz - 12.5 GHz	6669.2	-57.26	-20	Pass
	Mid Channel	12.5 GHz - 25 GHz	14296.2	-54.72	-20	Pass
	High Channel	Fundamental	2480.05	N/A	N/A	N/A
	High Channel	30 MHz - 12.5 GHz	2488.7	-57.25	-20	Pass
	High Channel	12.5 GHz - 25 GHz	13649.1	-54.13	-20	Pass
3DH5, 8-DPSK						
	Low Channel	Fundamental	2401.89	N/A	N/A	N/A
	Low Channel	30 MHz - 12.5 GHz	7278.2	-57.7	-20	Pass
	Low Channel	12.5 GHz - 25 GHz	13209.6	-54.82	-20	Pass
	Mid Channel	Fundamental	2440.89	N/A	N/A	N/A
	Mid Channel	30 MHz - 12.5 GHz	7326.9	-57.92	-20	Pass
	Mid Channel	12.5 GHz - 25 GHz	22625.4	-55.24	-20	Pass
	High Channel	Fundamental	2480.22	N/A	N/A	N/A
	High Channel	30 MHz - 12.5 GHz	7290.3	-57.4	-20	Pass
	High Channel	12.5 GHz - 25 GHz	13636.9	-54.71	-20	Pass

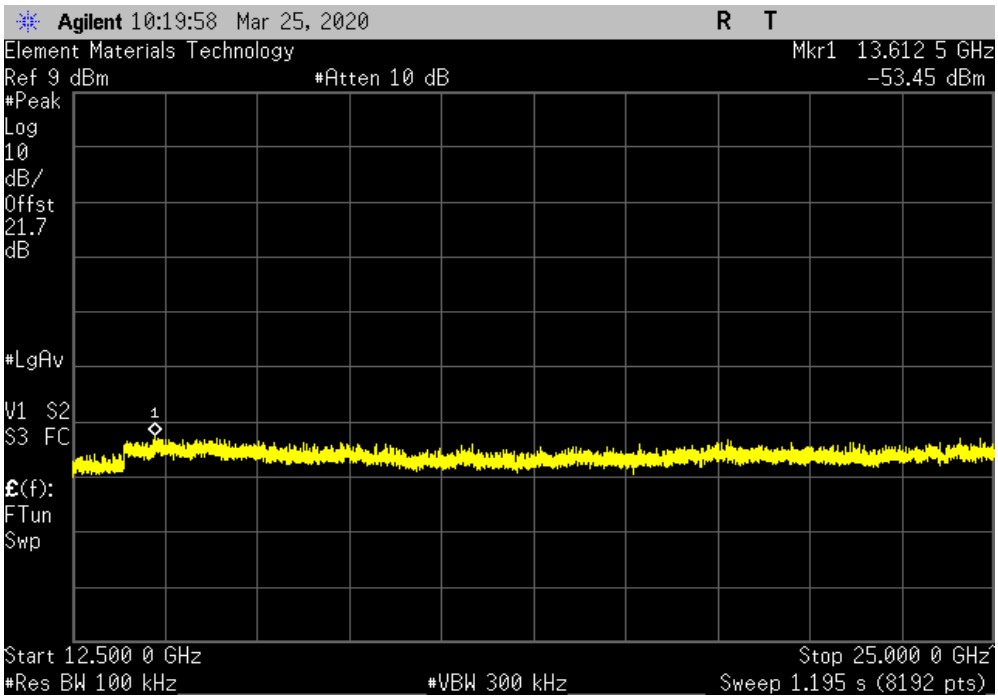
DH5, GFSK, Low Channel					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2402.21	N/A	N/A	N/A



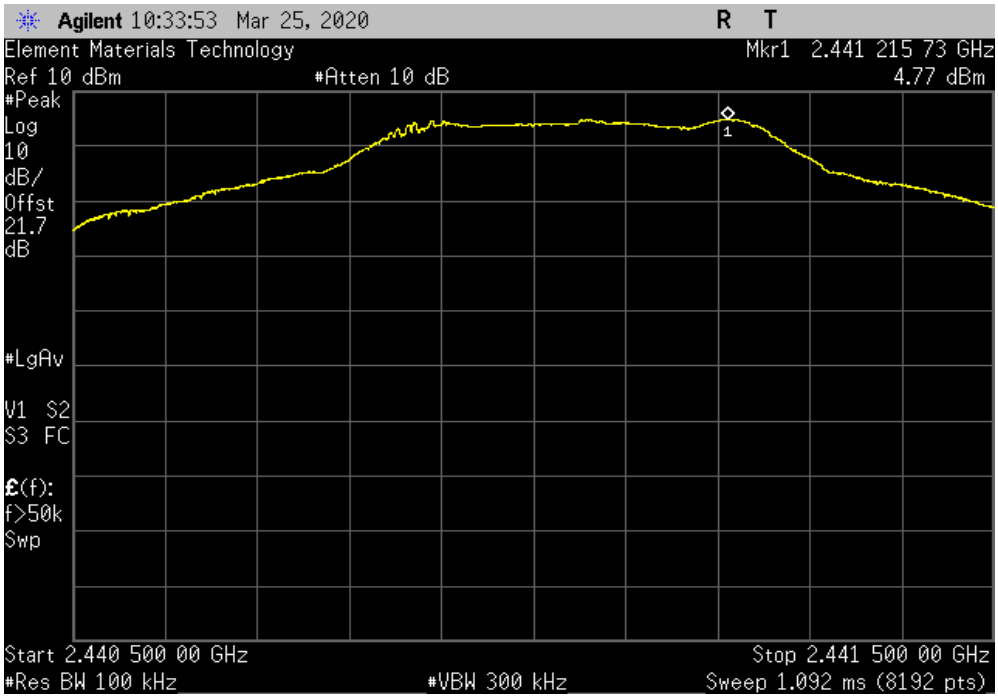
DH5, GFSK, Low Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	3603.1	-59.17	-20	Pass



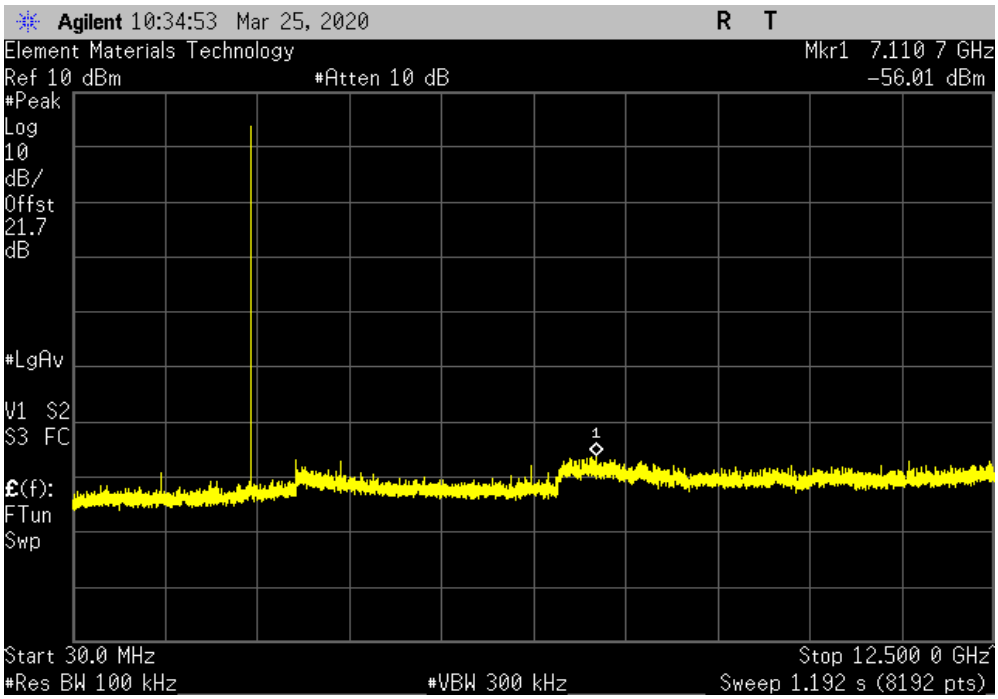
DH5, GFSK, Low Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	13612.5	-57.79	-20	Pass



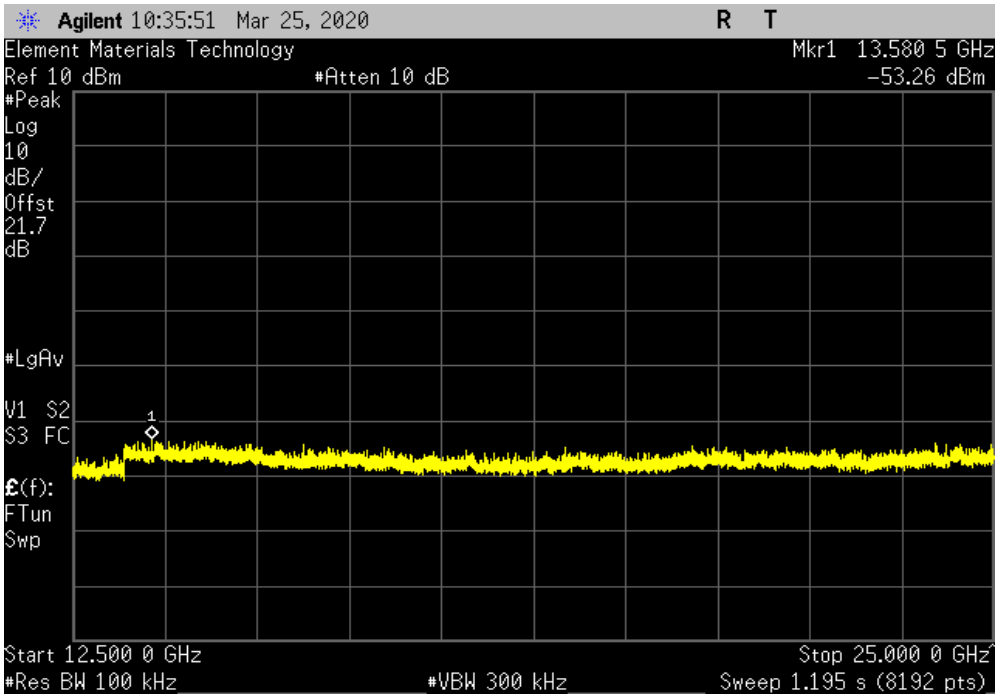
DH5, GFSK, Mid Channel					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental		2441.22	N/A	N/A	N/A



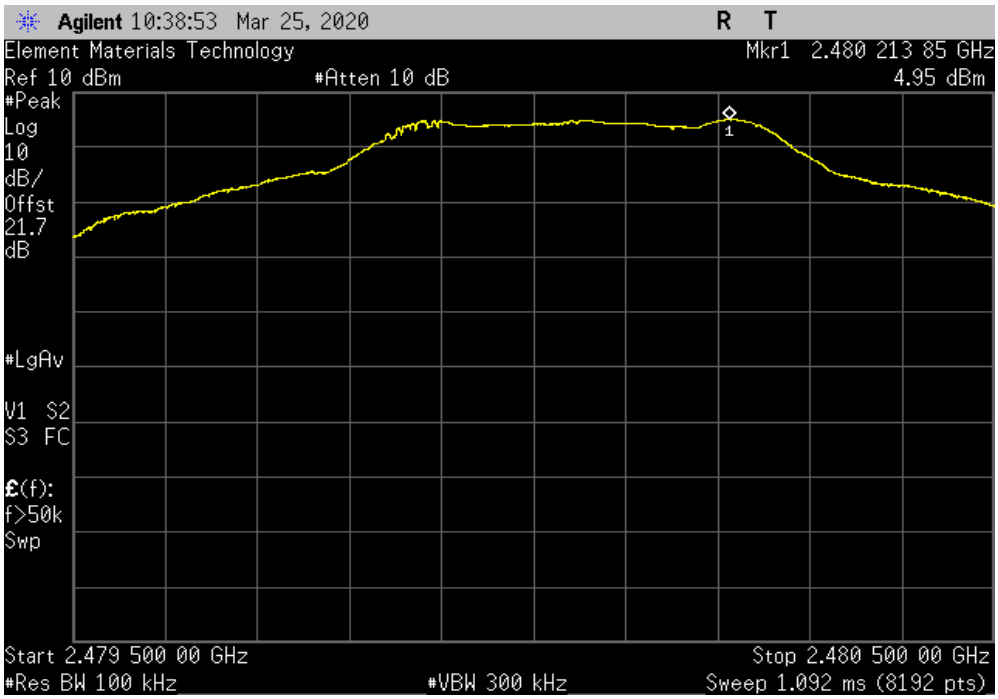
DH5, GFSK, Mid Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz	7110.7	-60.78	-20	Pass



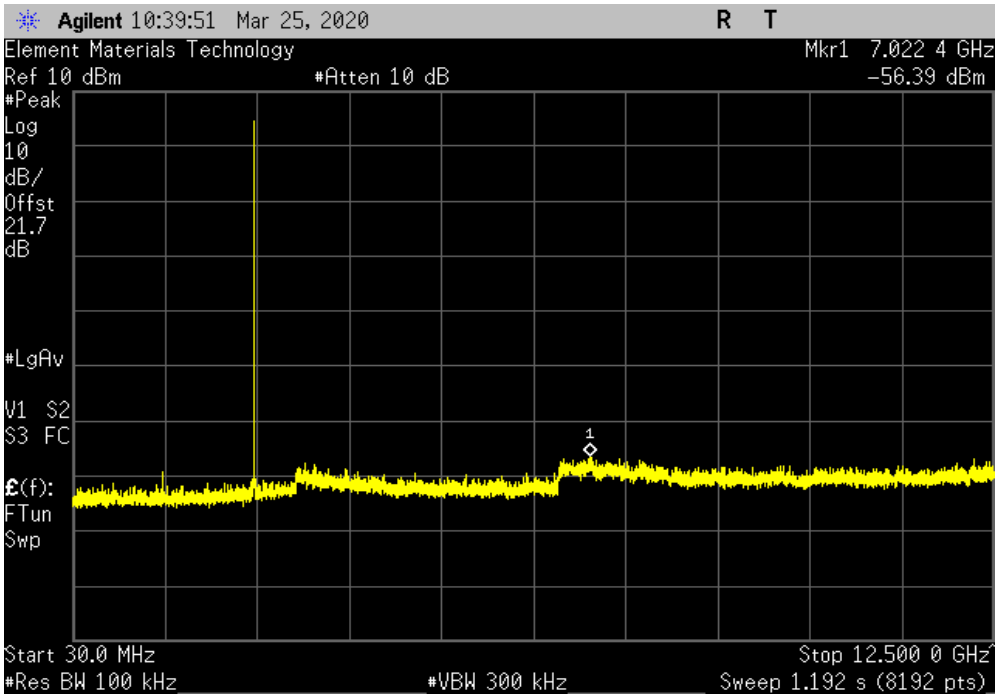
DH5, GFSK, Mid Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	13580.5	-58.04	-20	Pass



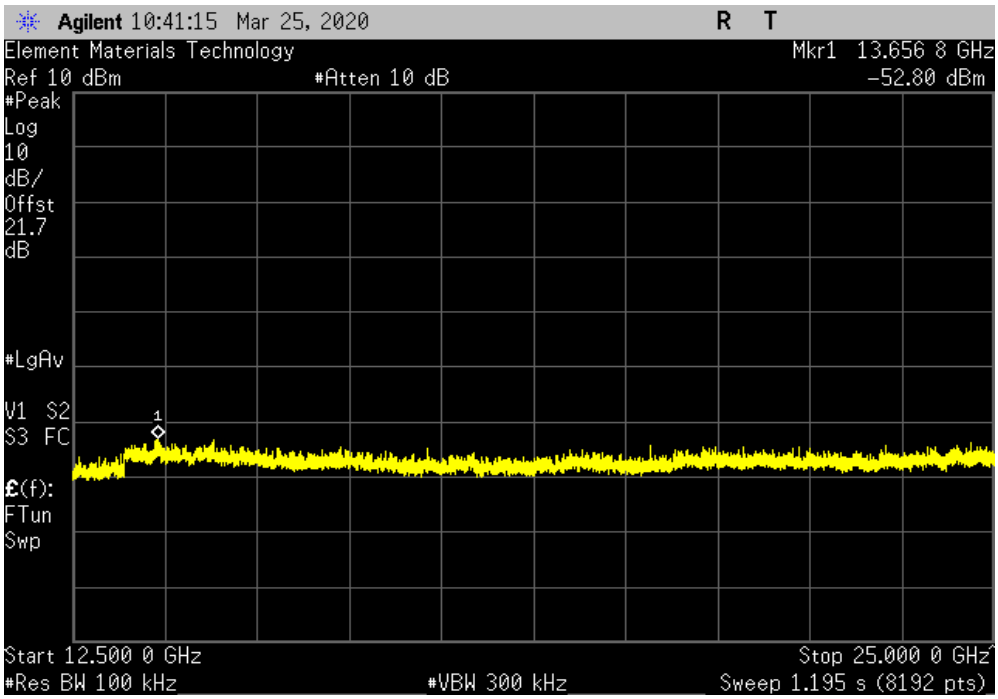
DH5, GFSK, High Channel					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2480.21	N/A	N/A	N/A



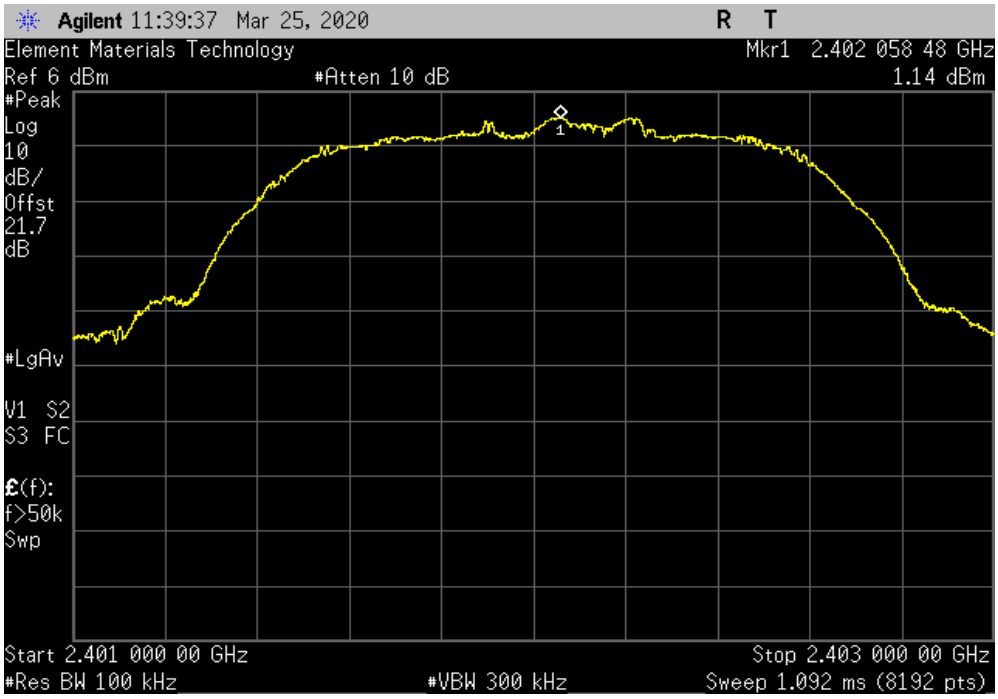
DH5, GFSK, High Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	7022.4	-61.34	-20	Pass



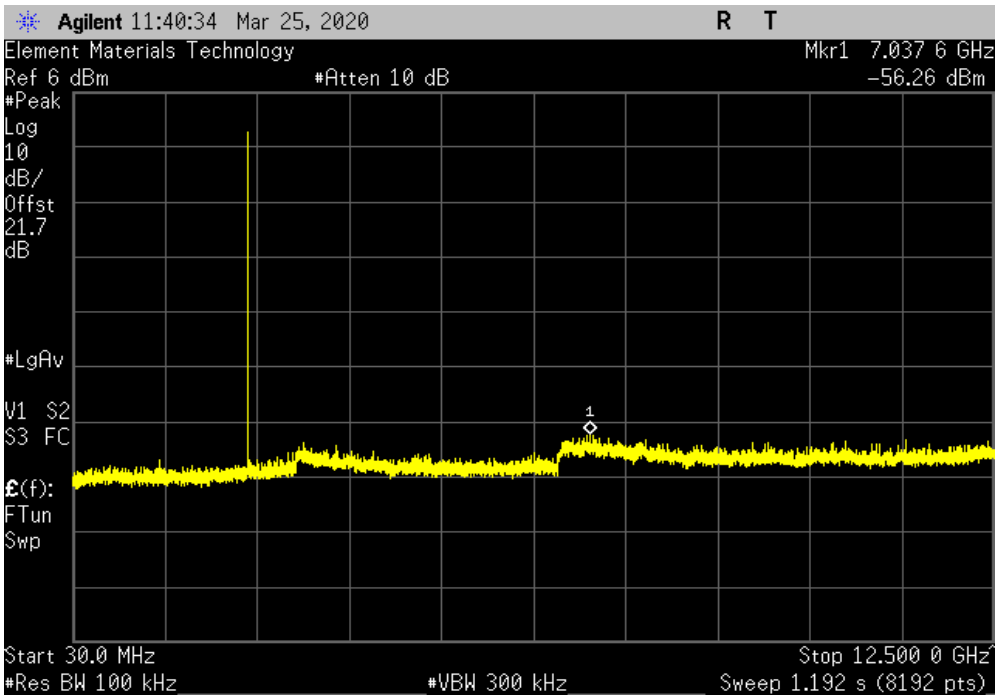
DH5, GFSK, High Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	13656.8	-57.75	-20	Pass



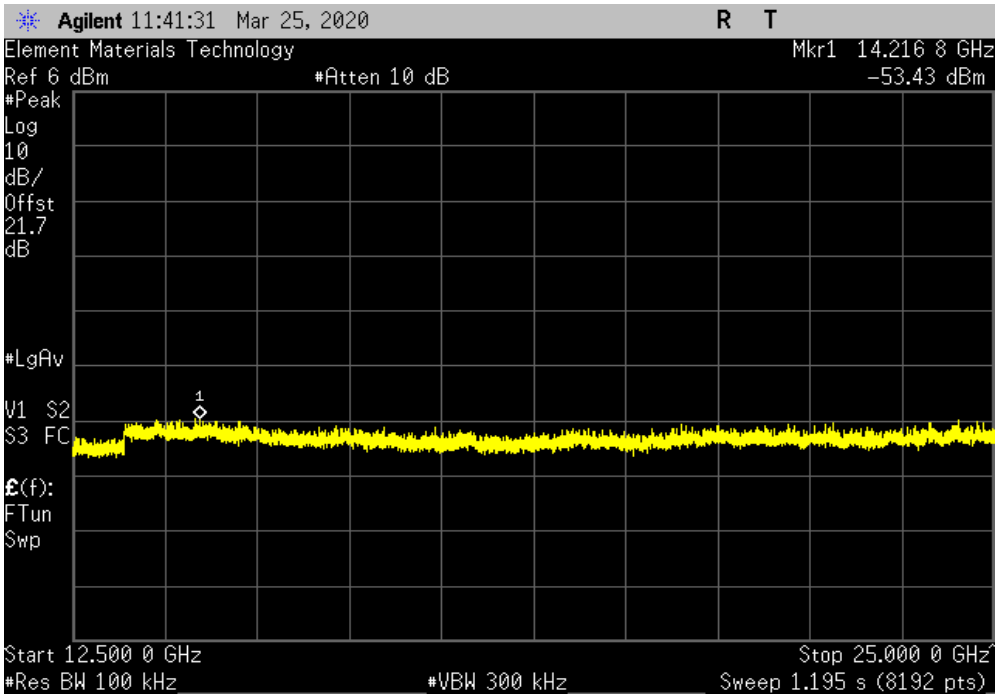
2DH5, pi/4-DQPSK, Low Channel					
Frequency Range		**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental	2402.06	N/A	N/A	N/A



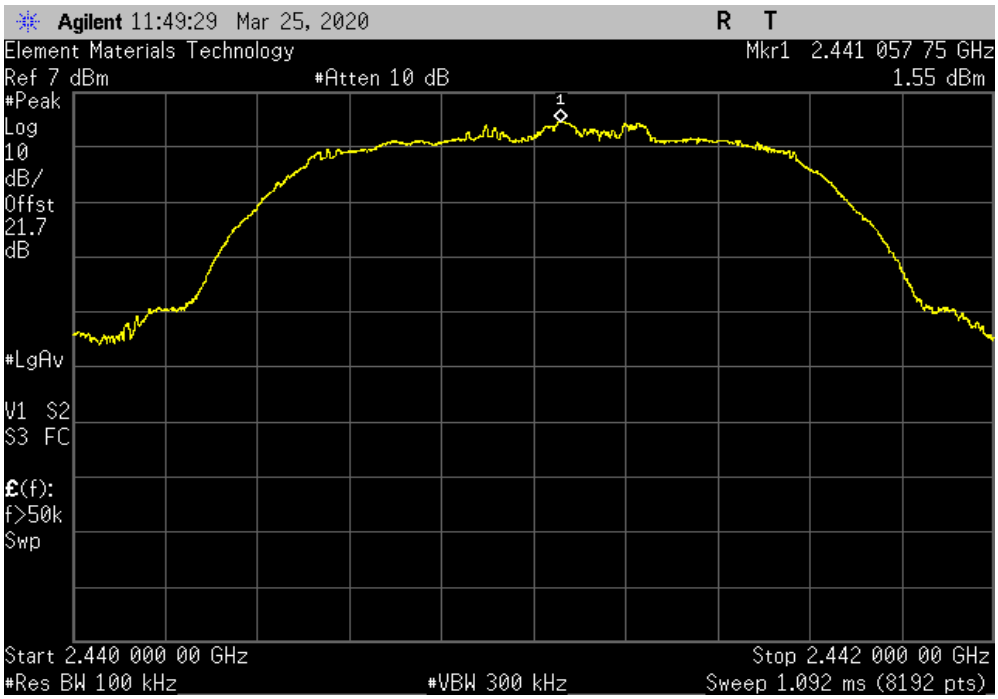
2DH5, pi/4-DQPSK, Low Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz	7037.6	-57.4	-20	Pass



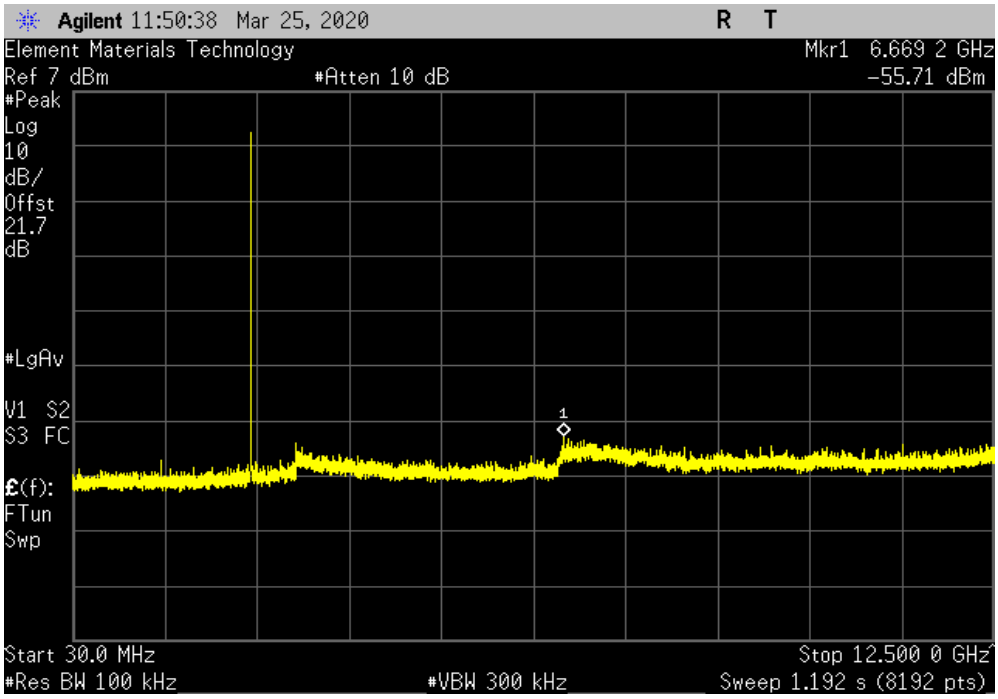
2DH5, pi/4-DQPSK, Low Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	14216.8	-54.57	-20	Pass



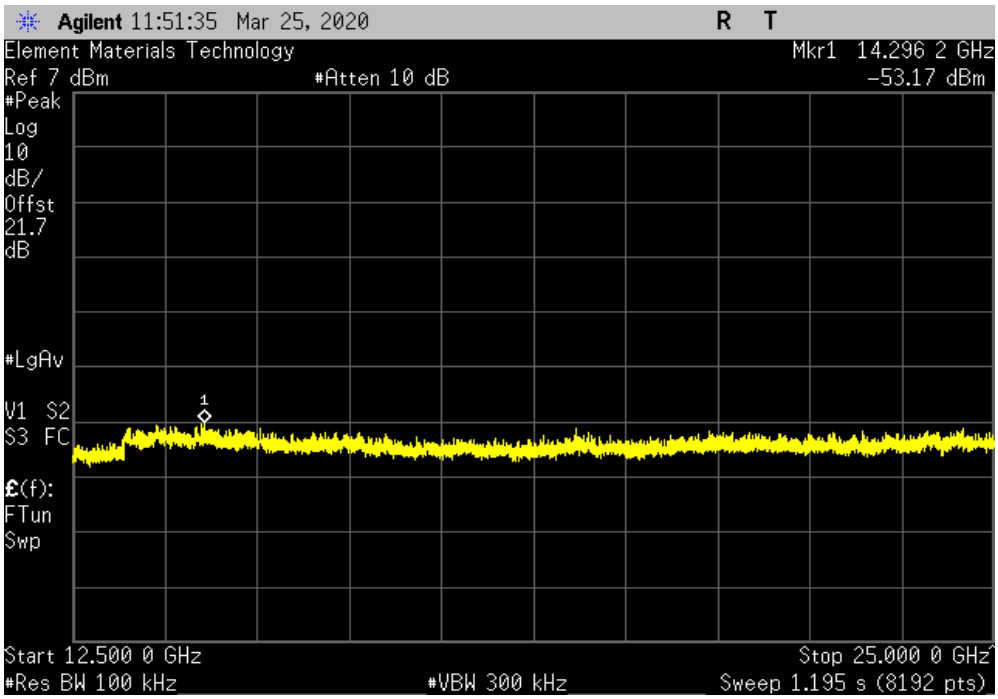
2DH5, pi/4-DQPSK, Mid Channel					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2441.06	N/A	N/A	N/A



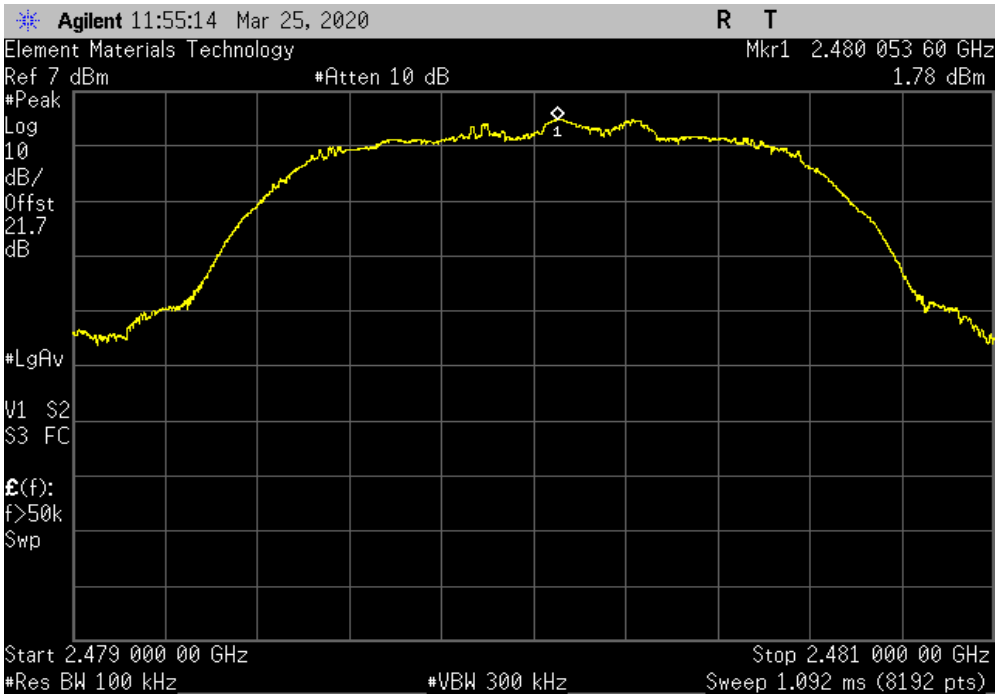
2DH5, pi/4-DQPSK, Mid Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	6669.2	-57.26	-20	Pass



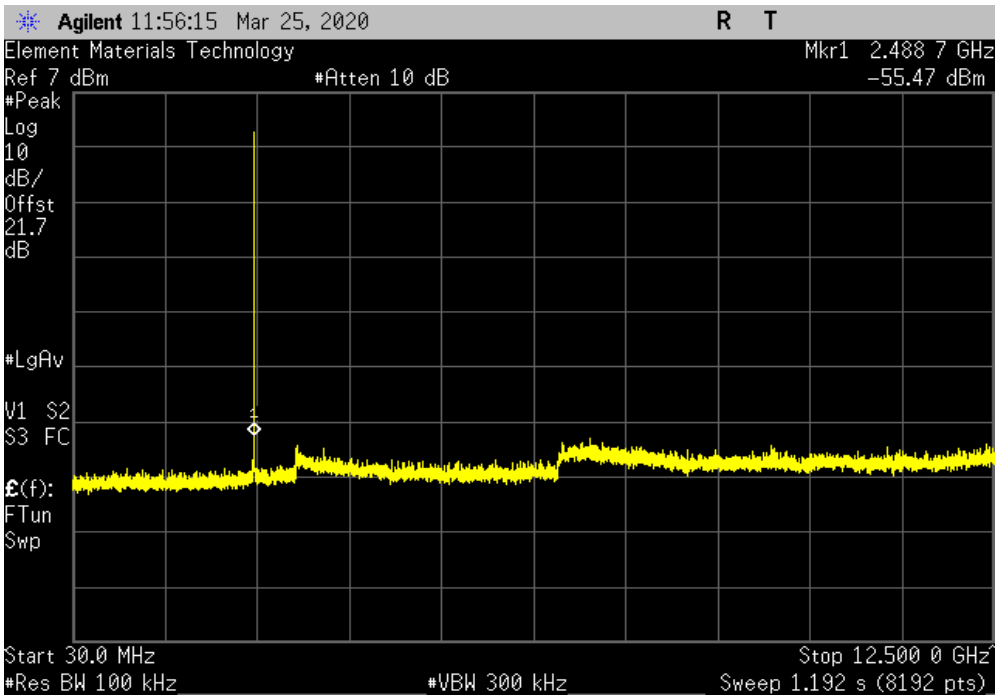
2DH5, pi/4-DQPSK, Mid Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	14296.2	-54.72	-20	Pass



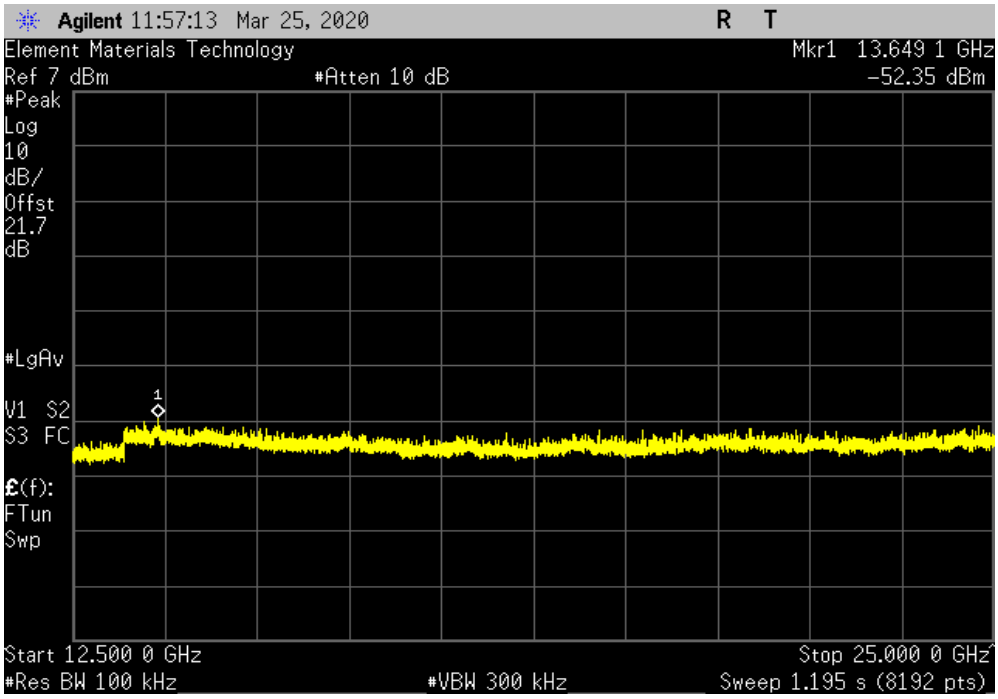
2DH5, pi/4-DQPSK, High Channel					
Frequency Range		**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
	Fundamental	2480.05	N/A	N/A	N/A



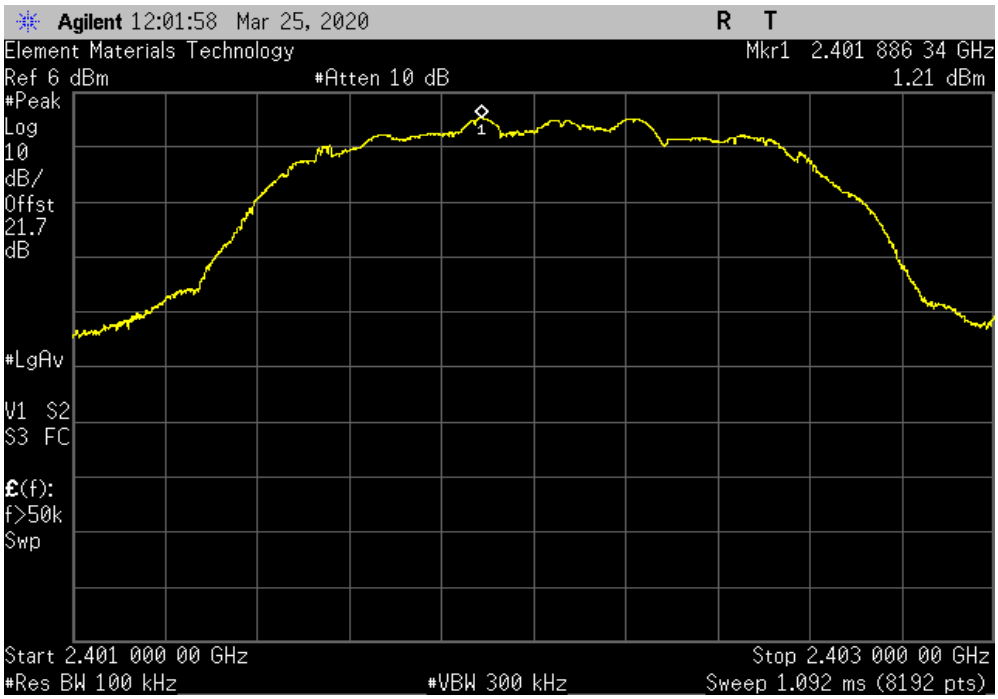
2DH5, pi/4-DQPSK, High Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz	2488.7	-57.25	-20	Pass



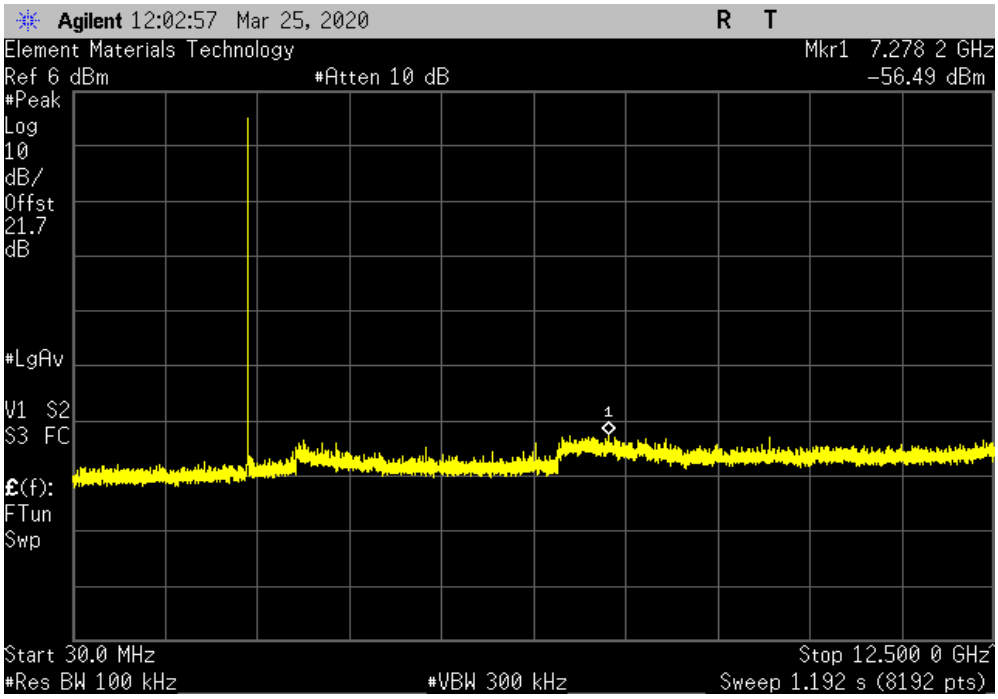
2DH5, pi/4-DQPSK, High Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	13649.1	-54.13	-20	Pass



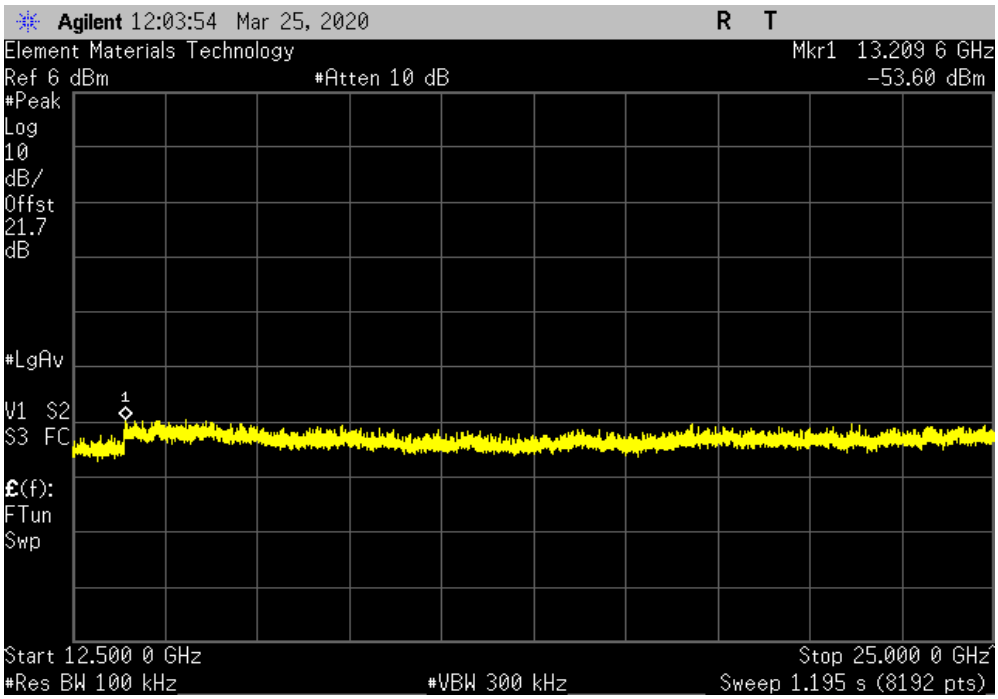
3DH5, 8-DPSK, Low Channel					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2401.89	N/A	N/A	N/A



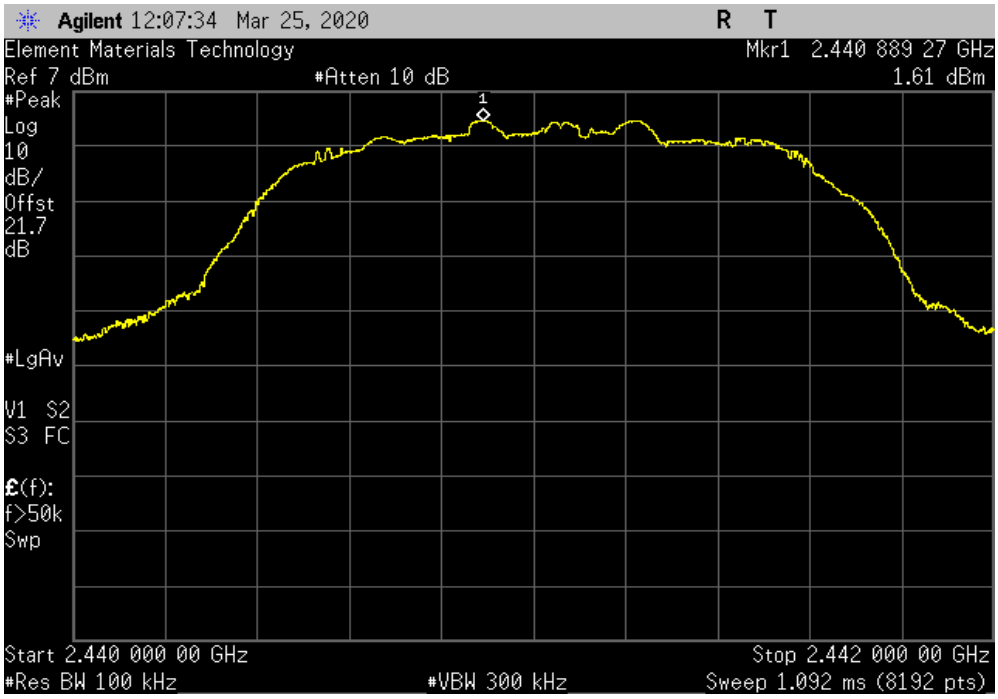
3DH5, 8-DPSK, Low Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	7278.2	-57.7	-20	Pass



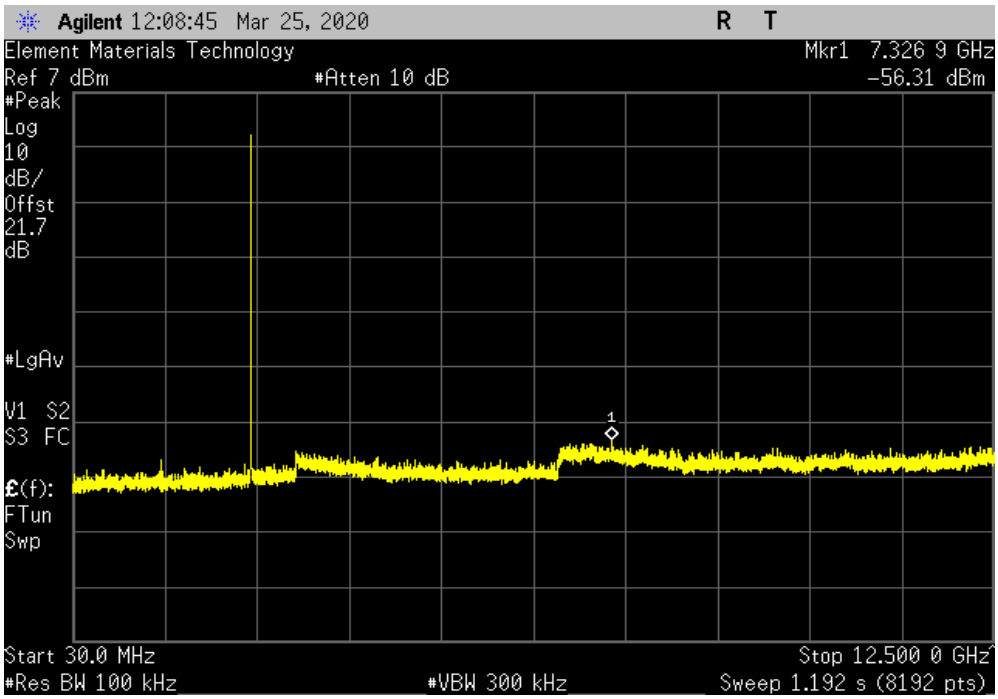
3DH5, 8-DPSK, Low Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz	13209.6	-54.82	-20	Pass



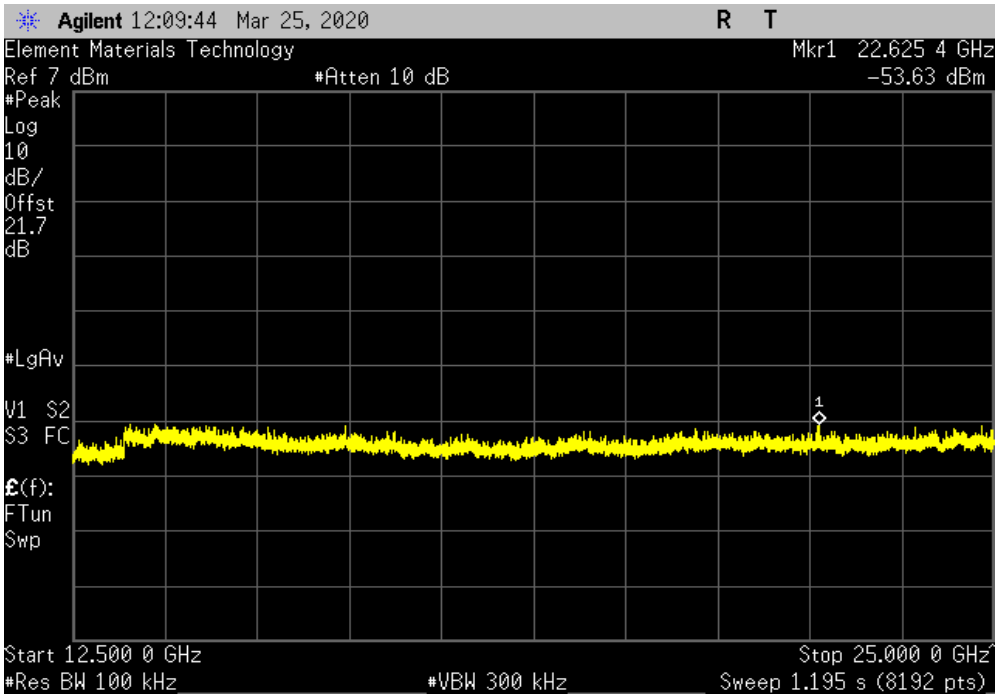
3DH5, 8-DPSK, Mid Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Fundamental	2440.89	N/A	N/A	N/A



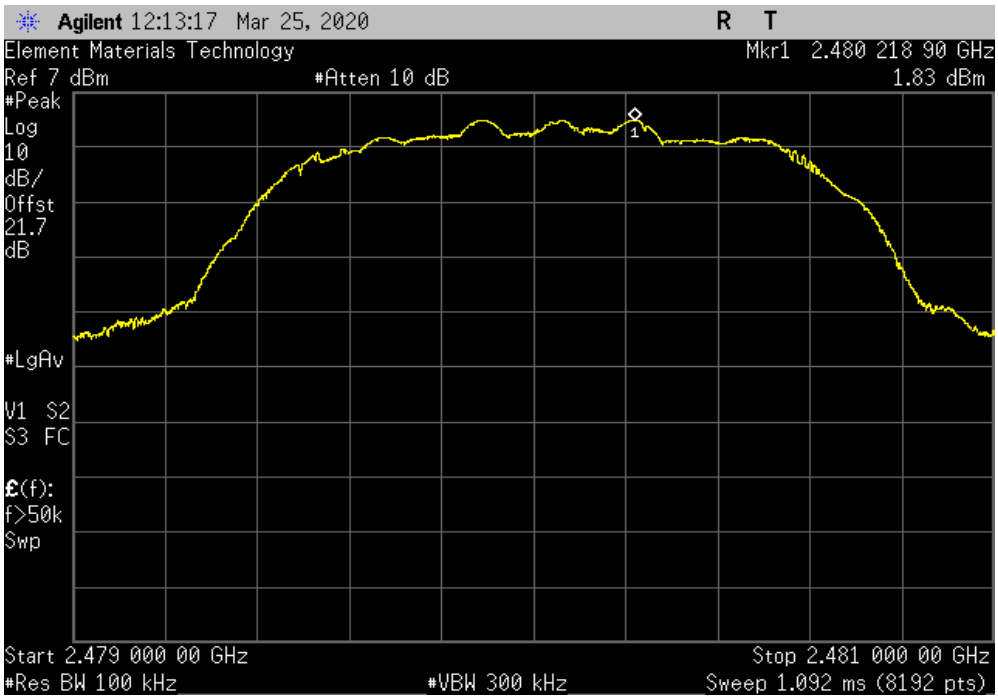
3DH5, 8-DPSK, Mid Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz	7326.9	-57.92	-20	Pass



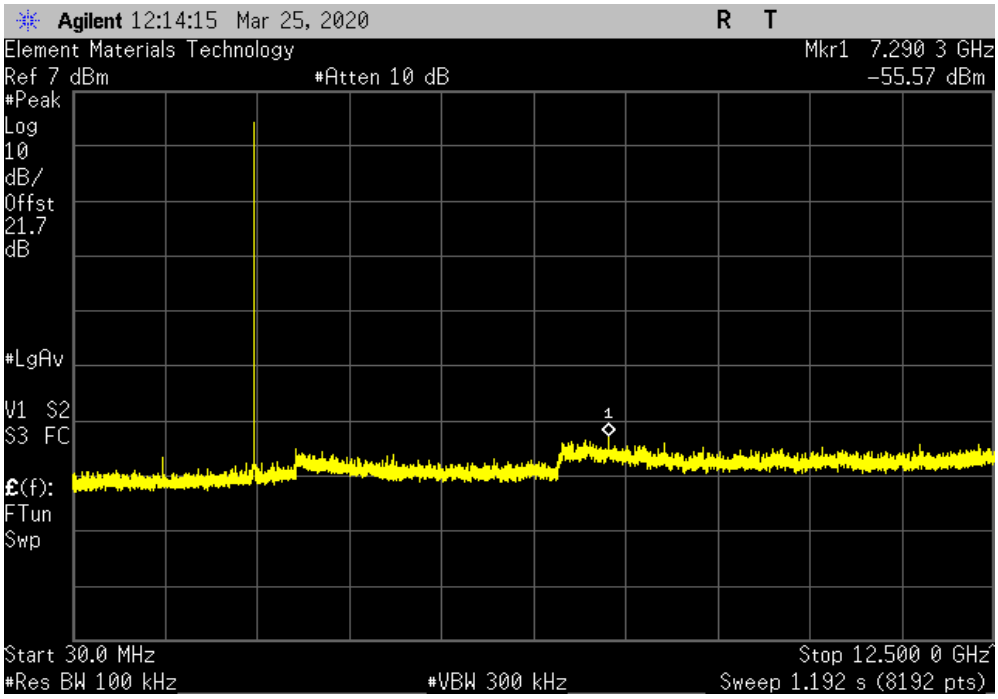
3DH5, 8-DPSK, Mid Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	22625.4	-55.24	-20	Pass



3DH5, 8-DPSK, High Channel					
Frequency Range		Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
	Fundamental	2480.22	N/A	N/A	N/A



3DH5, 8-DPSK, High Channel				
Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz	7290.3	-57.4	-20	Pass



3DH5, 8-DPSK, High Channel				
Frequency Range	**Measured Freq (MHz)**	**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz	13636.9	-54.71	-20	Pass