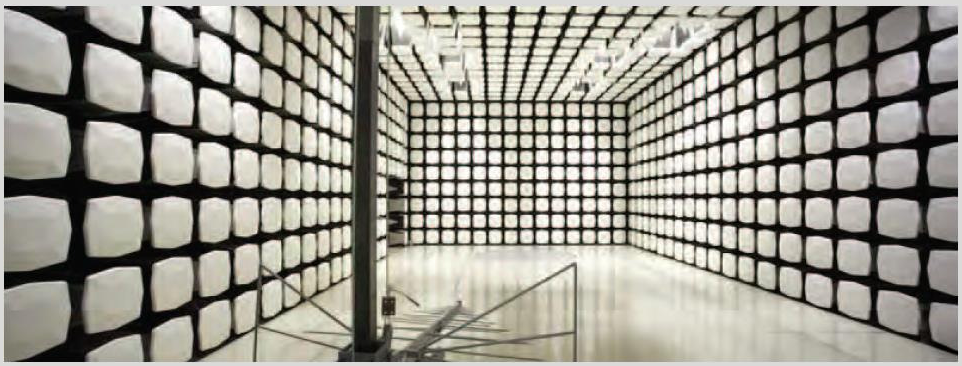
LightSpeed Aviation

Zulu 3

FCC 15.247:2017

Bluetooth Radio

Report # LISA0044



NVLAP Lab Code: 200630-0

CERTIFICATE OF TEST

Last Date of Test: March 15, 2017
LightSpeed Aviation
Model: Zulu 3

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2017	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	AC - Powerline Conducted Emissions	No	N/A	Not required - EUT powered from aircraft.
6.5, 6.6	Spurious Radiated Emissions	Yes	Pass	
7.5	Duty Cycle	Yes	Pass	
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	
7.8.6	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:

Kyle Holgate, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS

2017.6.12

United States

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

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

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

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

European Union

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

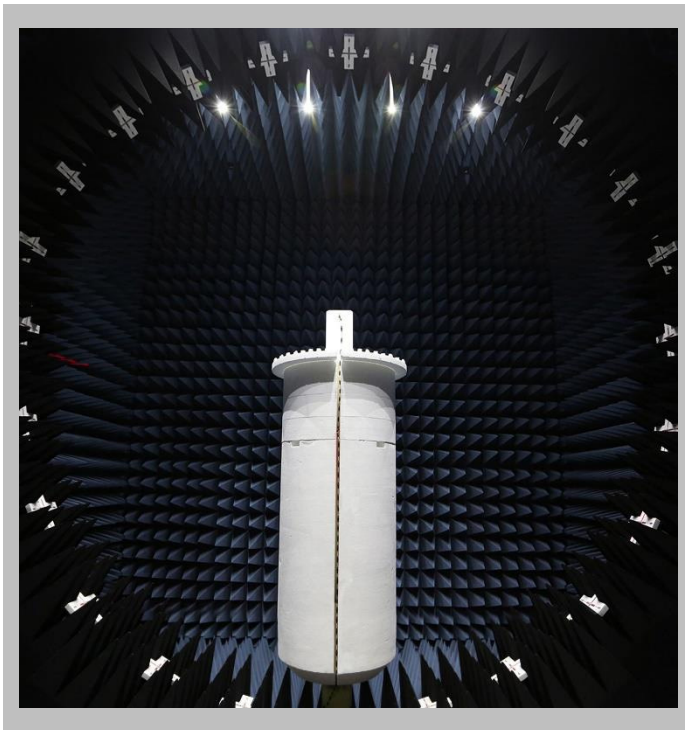
SCOPE

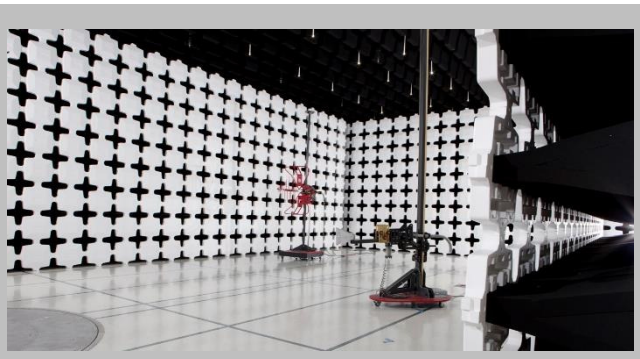
For details on the Scopes of our Accreditations, please visit:
http://portlandcustomer.element.com/ts/scope/scope.htm
http://gsi.nist.gov/global/docs/cabs/designations.html

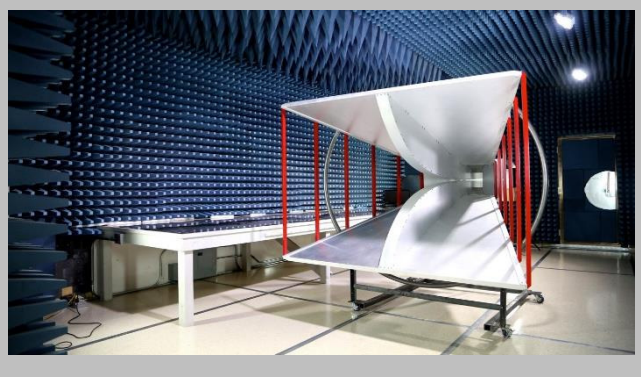
FACILITIES

2017.9.15

California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-*2*	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

TMU.2015.07.10

Measurement Uncertainty

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

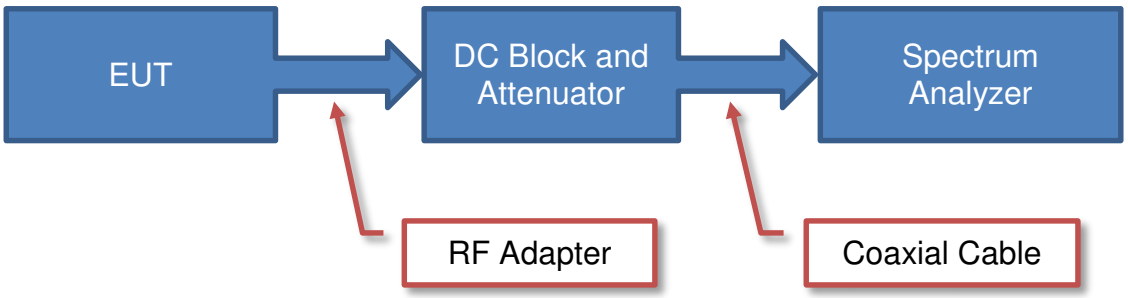
A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable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

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

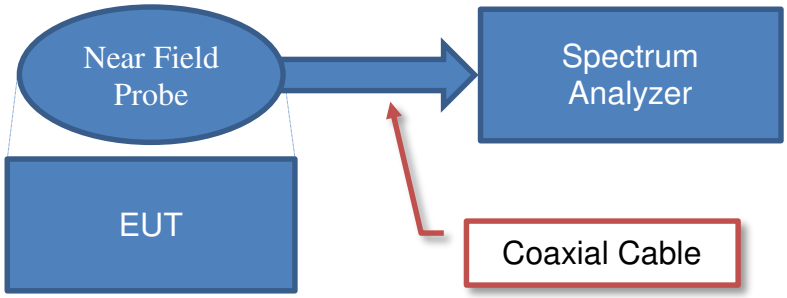
Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%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

Test Setup Block Diagrams

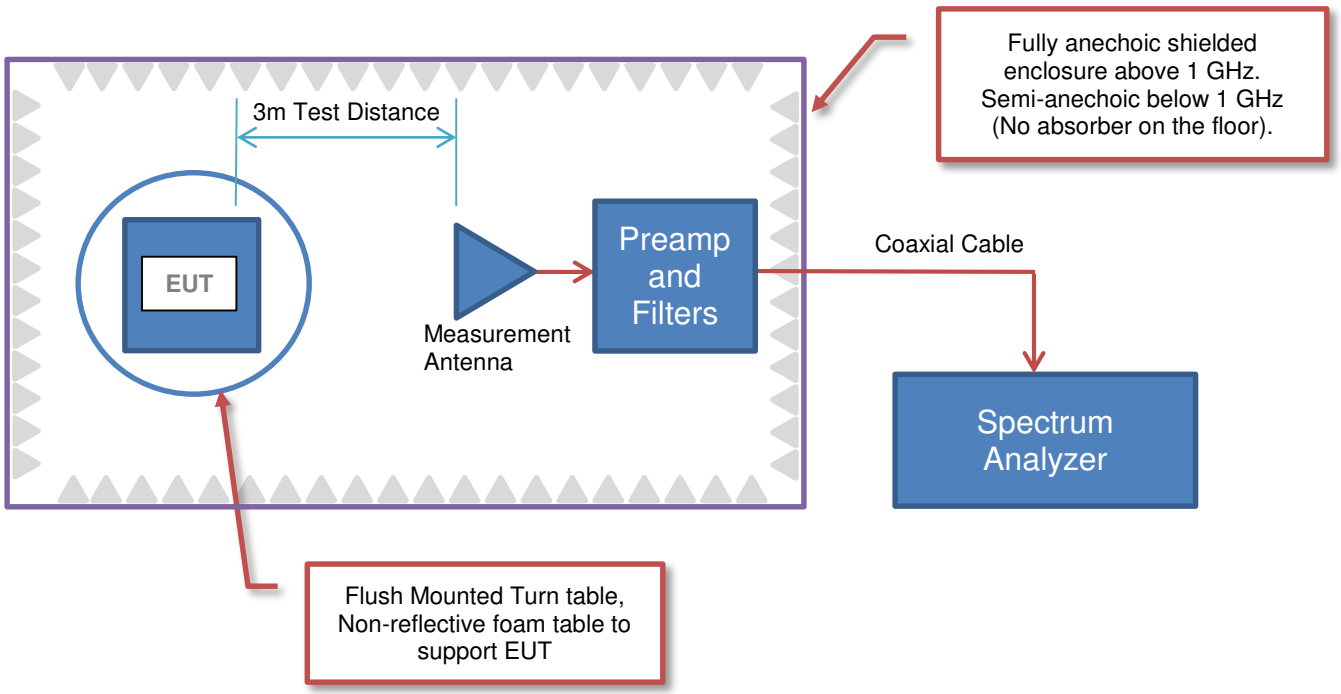
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions



PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	LightSpeed Aviation
Address:	6135 SW Jean Rd
City, State, Zip:	Lake Oswego, OR 97035
Test Requested By:	Ed Katz
Model:	Zulu 3
First Date of Test:	March 14, 2017
Last Date of Test:	March 15, 2017
Receipt Date of Samples:	March 14, 2017
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Transceiver unit with a Bluetooth radio which can take audio inputs from an aircraft panel via cables or the Bluetooth radio and provide the audio to the headset.

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

CONFIGURATIONS

Configuration LISA0043- 1

Software/Firmware Running during test	
Description	**Version**
CSR BlueCore Blue Test3	2.6.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Noise cancelling headset	LightSpeed Aviation	Zulu 3	100058479

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SPI to Ethernet adapter	CSR	DEV-SYS-1808-1A	268956
Ethernet to USB adapter	CSR	DEV-SYS-1808-1A	268956

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Remote Laptop	Dell	Precision M4500	Unknown

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
SPI Cable	No	0.2 m	No	Noise cancelling headset	SPI to Ethernet adapter
Cat5e	Yes	1.0 m	No	SPI to Ethernet adapter	Ethernet to USB adapter
USB Cable	Yes	2.0 m	No	Ethernet to USB adapter	Remote Laptop

Configuration LISA0043- 2

Software/Firmware Running during test	
Description	**Version**
CSR BlueCore Blue Test3	2.6.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Noise cancelling headset	LightSpeed Aviation	Zulu 3	100058512

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SPI to Ethernet adapter	CSR	DEV-SYS-1808-1A	268956
Ethernet to USB adapter	CSR	DEV-SYS-1808-1A	268956
Remote Laptop	Dell	Precision M4500	Unknown

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
SPI Cable	No	0.2 m	No	Noise cancelling headset	SPI to Ethernet adapter
Cat5e	Yes	1.0 m	No	SPI to Ethernet adapter	Ethernet to USB adapter
USB Cable	Yes	2.0 m	No	Ethernet to USB adapter	Remote Laptop

CONFIGURATIONS

Configuration LISA0043- 3

Software/Firmware Running during test	
Description	**Version**
CSR BlueCore Blue Test3	2.6.0

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Noise cancelling headset	LightSpeed Aviation	Zulu 3	66771

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
SPI to Ethernet adapter	CSR	DEV-SYS-1808-1A	268956
Ethernet to USB adapter	CSR	DEV-SYS-1808-1A	268956
Remote Laptop	Dell	Precision M4500	Unknown

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
SPI Cable	No	0.2 m	No	Noise cancelling headset	SPI to Ethernet adapter
Cat5e	Yes	1.0 m	No	SPI to Ethernet adapter	Ethernet to USB adapter
USB Cable	Yes	2.0 m	No	Ethernet to USB adapter	Remote Laptop

MODIFICATIONS

2017-1-25

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	3/14/2017	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.
2	3/14/2017	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.
3	3/14/2017	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.
4	3/14/2017	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.
5	3/14/2017	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.
6	3/14/2017	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.
7	3/14/2017	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.
8	3/14/2017	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.
9	3/14/2017	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
10	3/15/2017	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

PSA-ESCI 2017.01.26

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

Bluetooth Continuous Tx; Low channel 2402 MHz, Mid Channel 2440 MHz, High Channel 2480 MHz

POWER SETTINGS INVESTIGATED

Battery

CONFIGURATIONS INVESTIGATED

LISA0043 - 3

LISA0043 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26.5 GHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Cable	ESM Cable Corp.	KMKM-72	EVY	8/31/2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	8/31/2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	0 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2/6/2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	0 mo
Cable	None	Standard Gain Horns Cable	EVF	2/6/2017	12 mo
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2/7/2017	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	0 mo
Cable	N/A	Double Ridge Horn Cables	EVB	7/20/2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	7/20/2017	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AIZ	2/3/2016	24 mo
Attenuator	Coaxicom	3910-20	AXZ	4/19/2017	12 mo
Cable	N/A	Bilog Cables	EVA	2/6/2017	12 mo
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2/6/2017	12 mo
Antenna - Biconilog	Teseq	CBL 6141B	AXR	6/30/2016	24 mo
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/13/2017	12 mo

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.

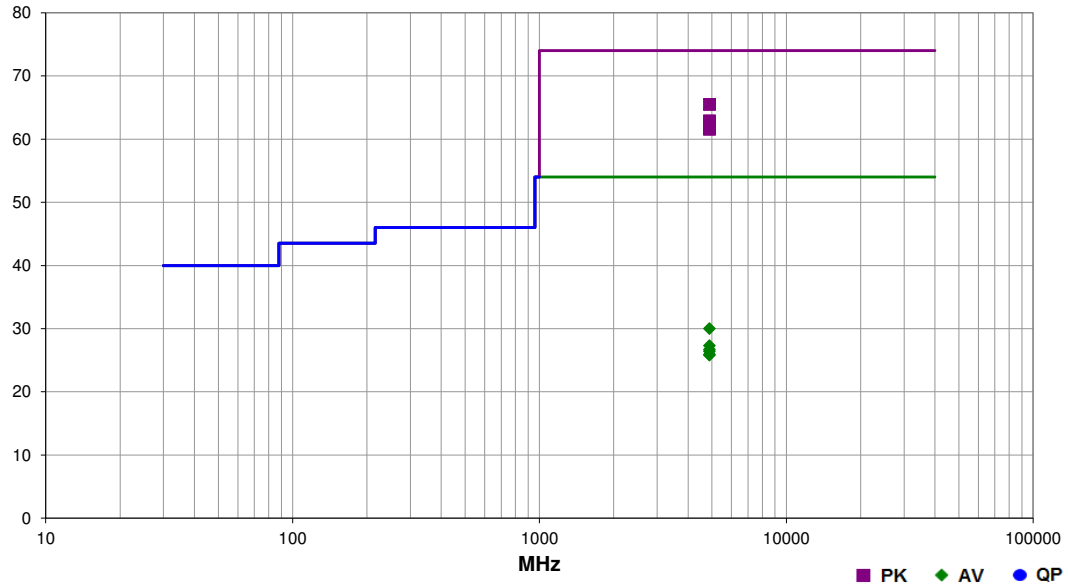
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.01.25 PSA-ESCI 2017.01.26

Work Order:	LISA0043	**Date:**	03/15/17	
Project:	None	**Temperature:**	25.2 °C	
Job Site:	EV01	**Humidity:**	44% RH	
Serial Number:	100058512	**Barometric Pres.:**	1013 mbar	**Tested by:** Jeff Alcoke and Brandon Hobbs
EUT:	Zulu 3			
Configuration:	2			
Customer:	LightSpeed Aviation			
Attendees:	Ed Katz and Yevgeniy Murzagildin			
EUT Power:	Battery			
Operating Mode:	Bluetooth Continuous Tx; Low channel 2402 MHz, Mid Channel 2440 MHz, High Channel 2480 MHz			
Deviations:	None			
Comments:	See comments below for radio Channel, Modulation and EUT orientation. A Duty Cycle Correction Factor (DCCF) was applied to the Average data. From eariler testing the Duty Cycle (D) was determined to be 0.029. Using procedure 7.5 in ANSI C63.10-2013, the DCCF is determined using 20*log(D), which give a DCCF of -30.8 dB.			

Test Specifications	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

Run #	12	**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
4884.292	54.7	10.8	1.0	252.0	0.0	0.0	Vert	PK	0.0	65.5	74.0	-8.5	Mid Channel, DH5, EUT on Side
4884.292	52.1	10.8	1.0	154.0	0.0	0.0	Horz	PK	0.0	62.9	74.0	-11.1	Mid Channel, DH5, EUT Vertical
4884.325	51.6	10.8	1.0	294.0	0.0	0.0	Horz	PK	0.0	62.4	74.0	-11.6	Mid Channel, DH5, EUT on Side
4883.900	51.4	10.8	1.0	93.0	0.0	0.0	Horz	PK	0.0	62.2	74.0	-11.8	Mid Channel, DH5, EUT Horizontal
4883.600	50.8	10.8	1.0	219.0	0.0	0.0	Vert	PK	0.0	61.6	74.0	-12.4	Mid Channel, DH5, EUT Horizontal
4884.208	50.8	10.8	2.5	282.0	0.0	0.0	Vert	PK	0.0	61.6	74.0	-12.4	Mid Channel, DH5, EUT Vertical
4884.017	50.0	10.8	1.0	252.0	-30.8	0.0	Vert	AV	0.0	30.0	54.0	-24.0	Mid Channel, DH5, EUT on Side
4884.008	47.3	10.8	1.0	154.0	-30.8	0.0	Horz	AV	0.0	27.3	54.0	-26.7	Mid Channel, DH5, EUT Vertical
4883.975	46.7	10.8	1.0	294.0	-30.8	0.0	Horz	AV	0.0	26.7	54.0	-27.3	Mid Channel, DH5, EUT on Side
4883.992	46.4	10.8	1.0	93.0	-30.8	0.0	Horz	AV	0.0	26.4	54.0	-27.6	Mid Channel, DH5, EUT Horizontal
4883.983	45.9	10.8	1.0	219.0	-30.8	0.0	Vert	AV	0.0	25.9	54.0	-28.1	Mid Channel, DH5, EUT Horizontal
4883.958	45.8	10.8	2.5	282.0	-30.8	0.0	Vert	AV	0.0	25.8	54.0	-28.2	Mid Channel, DH5, EUT Vertical

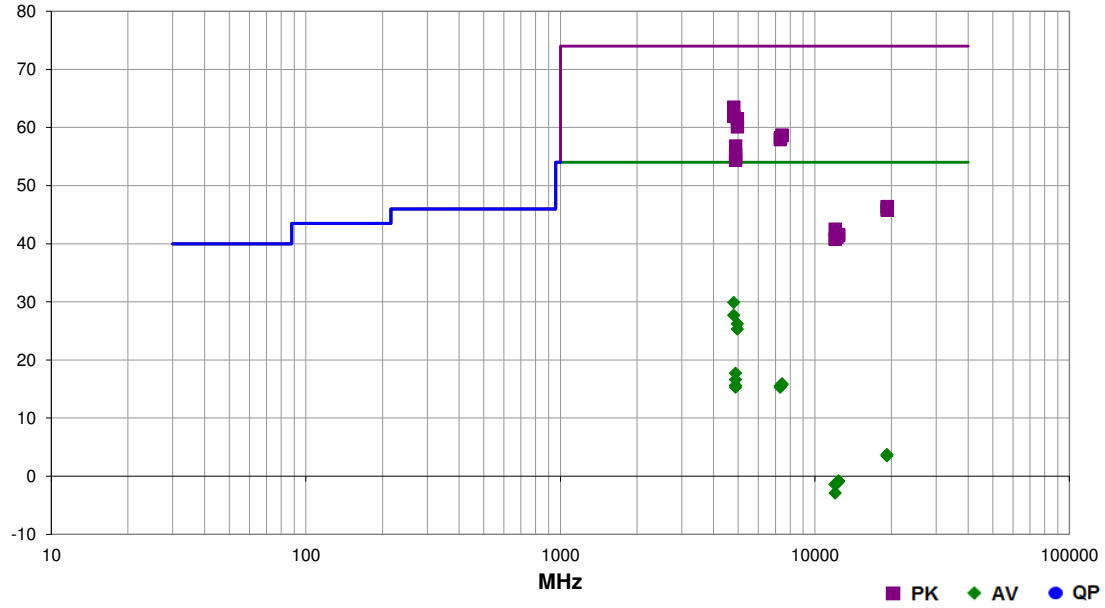
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.07.11 PSA-ESCI 2017.01.26

Work Order:	LISA0043	**Date:**	03/15/17		
Project:	None	**Temperature:**	22.8 °C		
Job Site:	EV01	**Humidity:**	35.9% RH		
Serial Number:	66771	**Barometric Pres.:**	1009 mbar	**Tested by:**	Jeff Alcoke
EUT:	Zulu 3				
Configuration:	3				
Customer:	LightSpeed Aviation				
Attendees:	Ed Katz				
EUT Power:	Battery				
Operating Mode:	Bluetooth Continuous Tx; Low channel 2402 MHz, Mid Channel 2440 MHz, High Channel 2480 MHz				
Deviations:	None				
Comments:	See comments below for radio Channel, Modulation and EUT orientation. A Duty Cycle Correction Factor (DCCF) was applied to the Average data. From eariler testing the Duty Cycle (D) was determined to be 0.029. Using procedure 7.5 in ANSI C63.10-2013, the DCCF is determined using 20*log(D), which give a DCCF of -30.8 dB.				

Test Specifications	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

Run #	19	**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
4803.933	53.2	10.3	1.0	328.0	0.0	0.0	Vert	PK	0.0	63.5	74.0	-10.5	Low Channel, DH5, EUT on Side
4803.933	51.6	10.3	1.0	194.0	0.0	0.0	Horz	PK	0.0	61.9	74.0	-12.1	Low Channel, DH5, EUT Vertical
4959.967	50.5	11.0	1.0	137.0	0.0	0.0	Vert	PK	0.0	61.5	74.0	-12.5	High Channel, DH5, EUT on Side
4959.983	49.1	11.0	1.0	189.0	0.0	0.0	Horz	PK	0.0	60.1	74.0	-13.9	High Channel, DH5, EUT Vertical
7442.150	39.3	19.4	1.0	153.0	0.0	0.0	Vert	PK	0.0	58.7	74.0	-15.3	High Channel, DH5, EUT on Side
7438.267	39.2	19.4	1.0	338.0	0.0	0.0	Horz	PK	0.0	58.6	74.0	-15.4	High Channel, DH5, EUT Vertical
7322.175	39.5	18.7	1.0	179.0	0.0	0.0	Vert	PK	0.0	58.2	74.0	-15.8	Mid Channel, DH5, EUT on Side
7318.533	39.2	18.7	1.0	9.0	0.0	0.0	Horz	PK	0.0	57.9	74.0	-16.1	Mid Channel, DH5, EUT Vertical
4879.992	46.0	10.8	1.0	341.0	0.0	0.0	Vert	PK	0.0	56.8	74.0	-17.2	Mid Channel, 2DH5, EUT on Side
4880.067	44.6	10.8	1.2	289.0	0.0	0.0	Horz	PK	0.0	55.4	74.0	-18.6	Mid Channel, 3DH5, EUT Vertical
4879.950	43.9	10.8	1.2	293.0	0.0	0.0	Horz	PK	0.0	54.7	74.0	-19.3	Mid Channel, 2DH5, EUT Vertical
4880.000	43.6	10.8	1.0	329.0	0.0	0.0	Vert	PK	0.0	54.4	74.0	-19.6	Mid Channel, 3DH5, EUT on Side
4803.983	50.4	10.3	1.0	328.0	-30.8	0.0	Vert	AV	0.0	29.9	54.0	-24.1	Low Channel, DH5, EUT on Side
4803.975	48.2	10.3	1.0	194.0	-30.8	0.0	Horz	AV	0.0	27.7	54.0	-26.3	Low Channel, DH5, EUT Vertical
19216.710	44.7	1.7	1.6	284.0	0.0	0.0	Vert	PK	0.0	46.4	74.0	-27.6	Low Channel, DH5, EUT on Side
4960.033	46.0	11.0	1.0	137.0	-30.8	0.0	Vert	AV	0.0	26.2	54.0	-27.8	High Channel, DH5, EUT on Side
19216.440	44.1	1.7	1.6	236.0	0.0	0.0	Horz	PK	0.0	45.8	74.0	-28.2	Low Channel, DH5, EUT Vertical
4959.992	45.1	11.0	1.0	189.0	-30.8	0.0	Horz	AV	0.0	25.3	54.0	-28.7	High Channel, DH5, EUT Vertical
12010.840	39.3	3.2	3.6	170.0	0.0	0.0	Horz	PK	0.0	42.5	74.0	-31.5	Low Channel, DH5, EUT Vertical
12397.820	37.7	3.9	3.3	245.0	0.0	0.0	Vert	PK	0.0	41.6	74.0	-32.4	High Channel, DH5, EUT on Side
12199.960	38.1	3.3	2.5	57.0	0.0	0.0	Vert	PK	0.0	41.4	74.0	-32.6	Mid Channel, DH5, EUT on Side
12398.220	37.5	3.9	1.0	98.0	0.0	0.0	Horz	PK	0.0	41.4	74.0	-32.6	High Channel, DH5, EUT Vertical
12201.830	37.8	3.3	1.0	26.0	0.0	0.0	Horz	PK	0.0	41.1	74.0	-32.9	Mid Channel, DH5, EUT Vertical

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
12010.250	37.6	3.2	3.6	357.0	0.0	0.0	Vert	PK	0.0	40.8	74.0	-33.2	Low Channel, DH5, EUT on Side
4880.042	37.7	10.8	1.0	341.0	-30.8	0.0	Vert	AV	0.0	17.7	54.0	-36.3	Mid Channel, 2DH5, EUT on Side
4880.025	36.6	10.8	1.2	289.0	-30.8	0.0	Horz	AV	0.0	16.6	54.0	-37.4	Mid Channel, 3DH5, EUT Vertical
7440.175	27.3	19.4	1.0	153.0	-30.8	0.0	Vert	AV	0.0	15.9	54.0	-38.1	High Channel, DH5, EUT on Side
7439.742	27.1	19.4	1.0	338.0	-30.8	0.0	Horz	AV	0.0	15.7	54.0	-38.3	High Channel, DH5, EUT Vertical
4880.042	35.6	10.8	1.2	293.0	-30.8	0.0	Horz	AV	0.0	15.6	54.0	-38.4	Mid Channel, 2DH5, EUT Vertical
7319.867	27.6	18.7	1.0	179.0	-30.8	0.0	Vert	AV	0.0	15.5	54.0	-38.5	Mid Channel, DH5, EUT on Side
7320.308	27.4	18.7	1.0	9.0	-30.8	0.0	Horz	AV	0.0	15.3	54.0	-38.7	Mid Channel, DH5, EUT Vertical
4879.967	35.3	10.8	1.0	329.0	-30.8	0.0	Vert	AV	0.0	15.3	54.0	-38.7	Mid Channel, 3DH5, EUT on Side
19214.230	32.8	1.7	1.6	284.0	-30.8	0.0	Vert	AV	0.0	3.7	54.0	-50.3	Low Channel, DH5, EUT on Side
19218.050	32.6	1.7	1.6	236.0	-30.8	0.0	Horz	AV	0.0	3.5	54.0	-50.5	Low Channel, DH5, EUT Vertical
12398.100	26.1	3.9	3.3	245.0	-30.8	0.0	Vert	AV	0.0	-0.8	54.0	-54.8	High Channel, DH5, EUT on Side
12399.390	26.0	3.9	1.0	98.0	-30.8	0.0	Horz	AV	0.0	-0.9	54.0	-54.9	High Channel, DH5, EUT Vertical
12199.550	26.3	3.3	2.5	57.0	-30.8	0.0	Vert	AV	0.0	-1.2	54.0	-55.2	Mid Channel, DH5, EUT on Side
12199.490	26.3	3.3	1.0	26.0	-30.8	0.0	Horz	AV	0.0	-1.2	54.0	-55.2	Mid Channel, DH5, EUT Vertical
12009.730	26.2	3.2	3.6	357.0	-30.8	0.0	Vert	AV	0.0	-1.4	54.0	-55.4	Low Channel, DH5, EUT on Side
12010.710	24.7	3.2	3.6	170.0	-30.8	0.0	Horz	AV	0.0	-2.9	54.0	-56.9	Low Channel, DH5, EUT Vertical

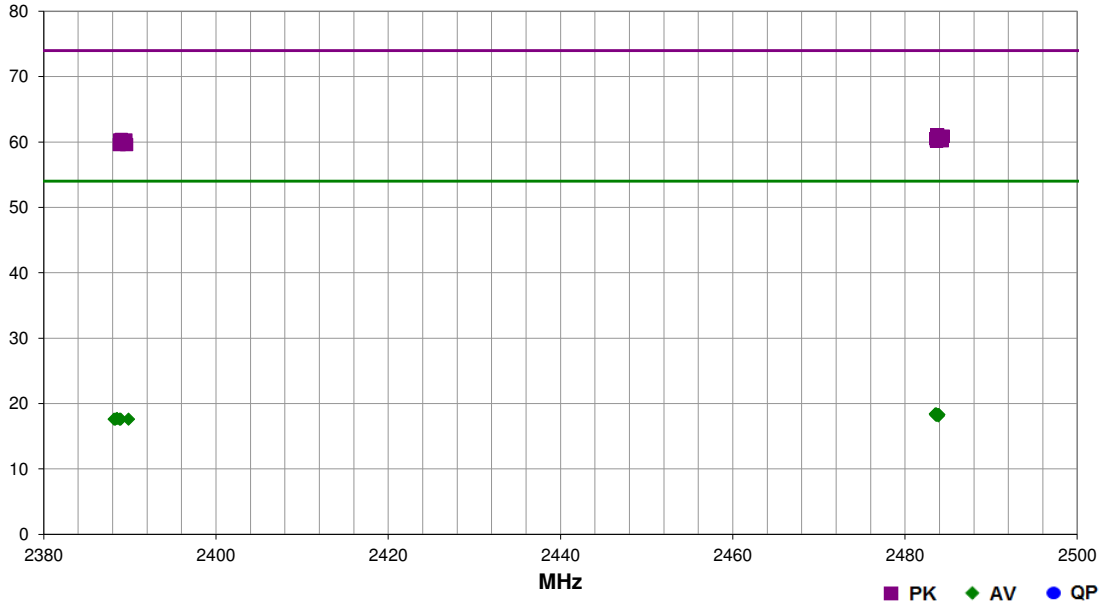
SPURIOUS RADIATED EMISSIONS

EmiR5 2017.07.11 PSA-ESCI 2017.01.26

Work Order:	LISA0043	**Date:**	03/15/17		
Project:	None	**Temperature:**	21.9 °C		
Job Site:	EV01	**Humidity:**	40.2% RH		
Serial Number:	66771	**Barometric Pres.:**	1008 mbar	**Tested by:**	Jeff Alcoke
EUT:	Zulu 3				
Configuration:	3				
Customer:	LightSpeed Aviation				
Attendees:	Ed Katz				
EUT Power:	Battery				
Operating Mode:	Bluetooth Continuous Tx; Low channel 2402 MHz, Mid Channel 2440 MHz, High Channel 2480 MHz				
Deviations:	None				
Comments:	See comments below for radio Channel, Modulation and EUT orientation. A Duty Cycle Correction Factor (DCCF) was applied to the Average data. From eariler testing the Duty Cycle (D) was determined to be 0.029. Using procedure 7.5 in ANSI C63.10-2013, the DCCF is determined using 20*log(D), which give a DCCF of -30.8 dB.				

Test Specifications	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

Run #	21	**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
2483.713	41.0	0.1	1.0	300.0	0.0	20.0	Horz	PK	0.0	61.1	74.0	-12.9	High Channel, 2DH5, EUT Horizontal
2483.803	41.0	0.1	1.0	332.0	0.0	20.0	Vert	PK	0.0	61.1	74.0	-12.9	High Channel, 3DH5, EUT Horizontal
2484.433	40.8	0.1	3.8	7.0	0.0	20.0	Vert	PK	0.0	60.9	74.0	-13.1	High Channel, DH5, EUT Horizontal
2484.093	40.4	0.1	2.1	293.0	0.0	20.0	Horz	PK	0.0	60.5	74.0	-13.5	High Channel, DH5, EUT Horizontal
2483.583	40.4	0.1	1.0	332.0	0.0	20.0	Vert	PK	0.0	60.5	74.0	-13.5	High Channel, 2DH5, EUT Horizontal
2484.063	40.3	0.1	1.0	322.0	0.0	20.0	Vert	PK	0.0	60.4	74.0	-13.6	High Channel, DH5, EUT on Side
2483.890	40.3	0.1	1.0	131.0	0.0	20.0	Horz	PK	0.0	60.4	74.0	-13.6	High Channel, DH5, EUT Vertical
2389.003	40.9	-0.5	1.0	22.0	0.0	20.0	Vert	PK	0.0	60.4	74.0	-13.6	Low Channel, DH5, EUT Horizontal
2389.540	40.8	-0.5	1.0	73.0	0.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7	Low Channel, 3DH5, EUT Horizontal
2388.803	40.8	-0.5	1.0	20.0	0.0	20.0	Vert	PK	0.0	60.3	74.0	-13.7	Low Channel, 2DH5, EUT Horizontal
2484.330	40.1	0.1	1.2	8.0	0.0	20.0	Vert	PK	0.0	60.2	74.0	-13.8	High Channel, DH5, EUT Vertical
2483.657	40.1	0.1	1.0	332.0	0.0	20.0	Horz	PK	0.0	60.2	74.0	-13.8	High Channel, 3DH5, EUT Horizontal
2389.203	40.7	-0.5	1.0	195.0	0.0	20.0	Horz	PK	0.0	60.2	74.0	-13.8	Low Channel, DH5, EUT Horizontal
2483.663	40.0	0.1	1.2	200.0	0.0	20.0	Horz	PK	0.0	60.1	74.0	-13.9	High Channel, DH5, EUT on Side
2388.770	40.1	-0.5	1.0	346.0	0.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	Low Channel, 3DH5, EUT Horizontal
2389.627	40.1	-0.5	1.0	305.0	0.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	Low Channel, 2DH5, EUT Horizontal
2483.530	29.1	0.1	1.2	200.0	-30.8	20.0	Horz	AV	0.0	18.4	54.0	-35.6	High Channel, DH5, EUT on Side
2483.660	29.1	0.1	1.0	300.0	-30.8	20.0	Horz	AV	0.0	18.4	54.0	-35.6	High Channel, 2DH5, EUT Horizontal
2483.680	29.0	0.1	1.0	322.0	-30.8	20.0	Vert	AV	0.0	18.3	54.0	-35.7	High Channel, DH5, EUT on Side
2483.953	29.0	0.1	2.1	293.0	-30.8	20.0	Horz	AV	0.0	18.3	54.0	-35.7	High Channel, DH5, EUT Horizontal
2483.657	29.0	0.1	3.8	7.0	-30.8	20.0	Vert	AV	0.0	18.3	54.0	-35.7	High Channel, DH5, EUT Horizontal
2483.603	29.0	0.1	1.2	8.0	-30.8	20.0	Vert	AV	0.0	18.3	54.0	-35.7	High Channel, DH5, EUT Vertical
2483.860	29.0	0.1	1.0	332.0	-30.8	20.0	Vert	AV	0.0	18.3	54.0	-35.7	High Channel, 2DH5, EUT Horizontal

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
2483.593	29.0	0.1	1.0	332.0	-30.8	20.0	Vert	AV	0.0	18.3	54.0	-35.7	High Channel, 3DH5, EUT Horizontal
2483.620	28.9	0.1	1.0	131.0	-30.8	20.0	Horz	AV	0.0	18.2	54.0	-35.8	High Channel, DH5, EUT Vertical
2483.873	28.8	0.1	1.0	332.0	-30.8	20.0	Horz	AV	0.0	18.1	54.0	-35.9	High Channel, 3DH5, EUT Horizontal
2388.523	29.0	-0.5	1.0	195.0	-30.8	20.0	Horz	AV	0.0	17.7	54.0	-36.3	Low Channel, DH5, EUT Horizontal
2389.843	28.9	-0.5	1.0	346.0	-30.8	20.0	Horz	AV	0.0	17.6	54.0	-36.4	Low Channel, 3DH5, EUT Horizontal
2388.940	28.9	-0.5	1.0	73.0	-30.8	20.0	Vert	AV	0.0	17.6	54.0	-36.4	Low Channel, 3DH5, EUT Horizontal
2388.807	28.9	-0.5	1.0	305.0	-30.8	20.0	Horz	AV	0.0	17.6	54.0	-36.4	Low Channel, 2DH5, EUT Horizontal
2388.317	28.9	-0.5	1.0	20.0	-30.8	20.0	Vert	AV	0.0	17.6	54.0	-36.4	Low Channel, 2DH5, EUT Horizontal
2388.180	28.9	-0.5	1.0	22.0	-30.8	20.0	Vert	AV	0.0	17.6	54.0	-36.4	Low Channel, DH5, EUT Horizontal

DUTY CYCLE

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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

TbtTx 2017.01.27 XMit 2017.01.26

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.9 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	46.6% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

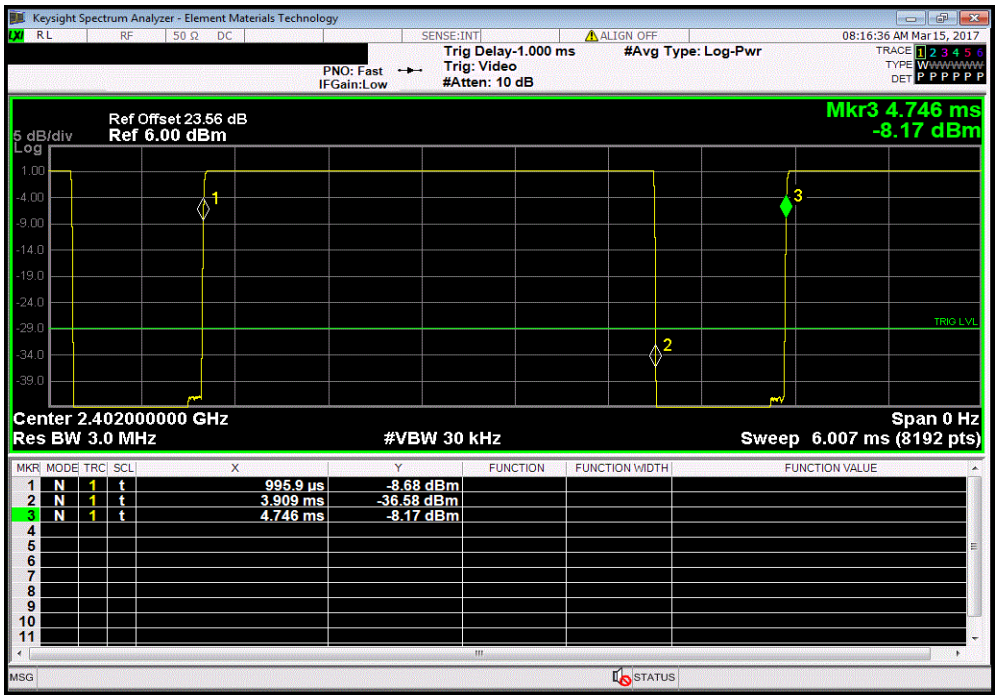
Configuration #	1	*Signature*

		Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
DH5, GFSK							
	Low Channel 2402 MHz	2.913 ms	3.75 ms	1	77.7	N/A	N/A
	Low Channel 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel 2441 MHz	2.913 ms	3.75 ms	1	77.7	N/A	N/A
	Mid Channel 2441 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel 2480 MHz	2.913 ms	3.75 ms	1	77.7	N/A	N/A
	High Channel 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
2DH5, pi/4-DQPSK							
	Low Channel 2402 MHz	2.922 ms	3.75 ms	1	77.9	N/A	N/A
	Low Channel 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel 2441 MHz	2.922 ms	3.75 ms	1	77.9	N/A	N/A
	Mid Channel 2441 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel 2480 MHz	2.922 ms	3.75 ms	1	77.9	N/A	N/A
	High Channel 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
3DH5, 8-DPSK							
	Low Channel 2402 MHz	2.923 ms	3.75 ms	1	77.9	N/A	N/A
	Low Channel 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
	Mid Channel 2441 MHz	2.923 ms	3.75 ms	1	77.9	N/A	N/A
	Mid Channel 2441 MHz	N/A	N/A	5	N/A	N/A	N/A
	High Channel 2480 MHz	2.923 ms	3.75 ms	1	78	N/A	N/A
	High Channel 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

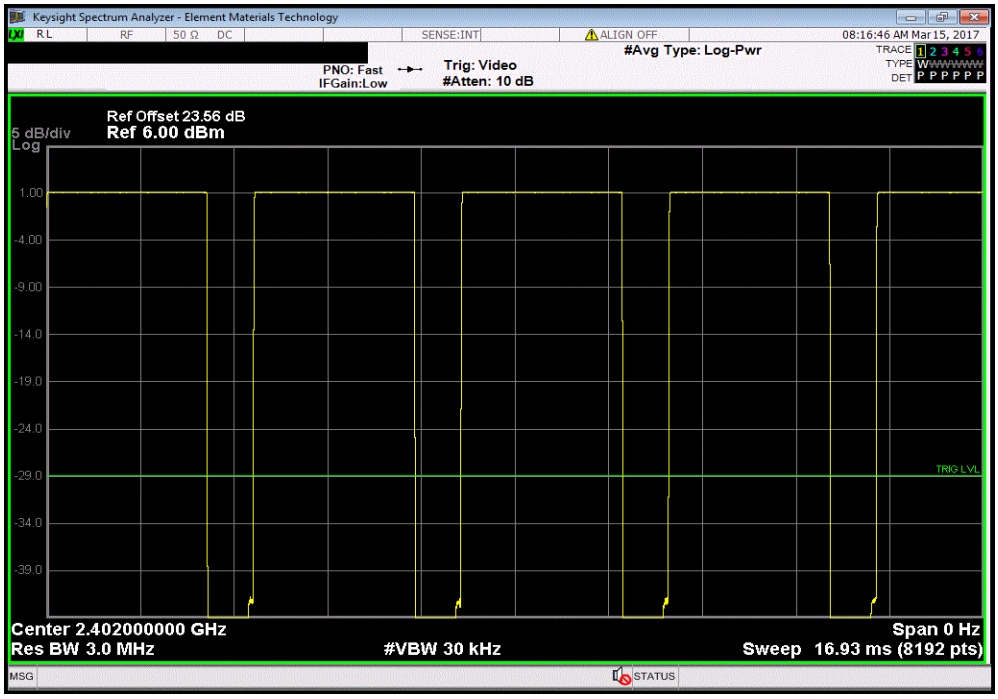
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

DH5, GFSK, Low Channel 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.913 ms	3.75 ms	1	77.7	N/A	N/A



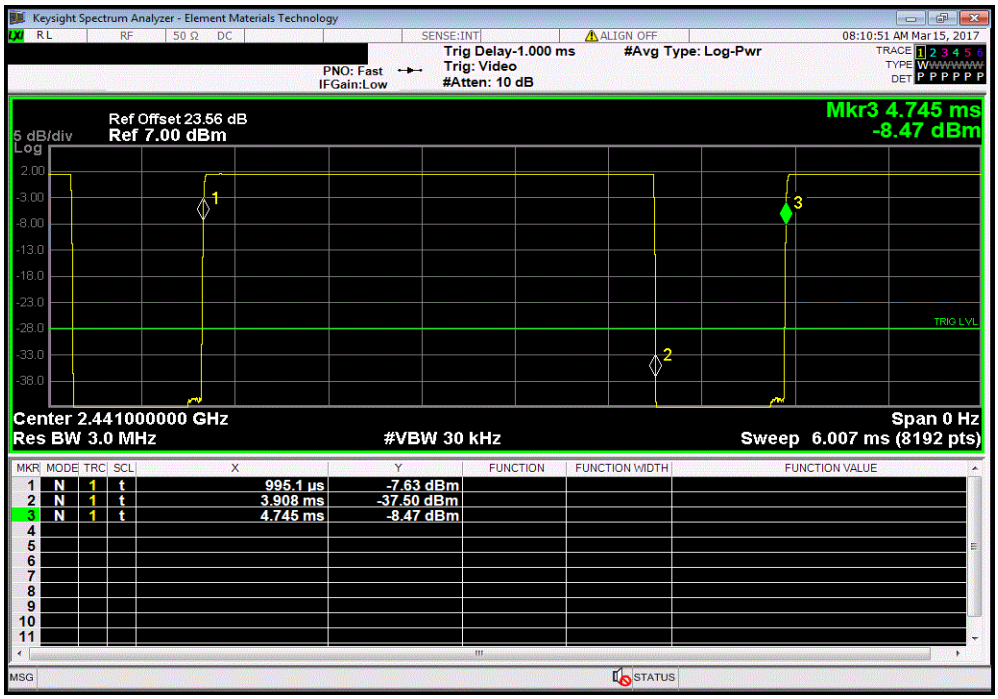
DH5, GFSK, Low Channel 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



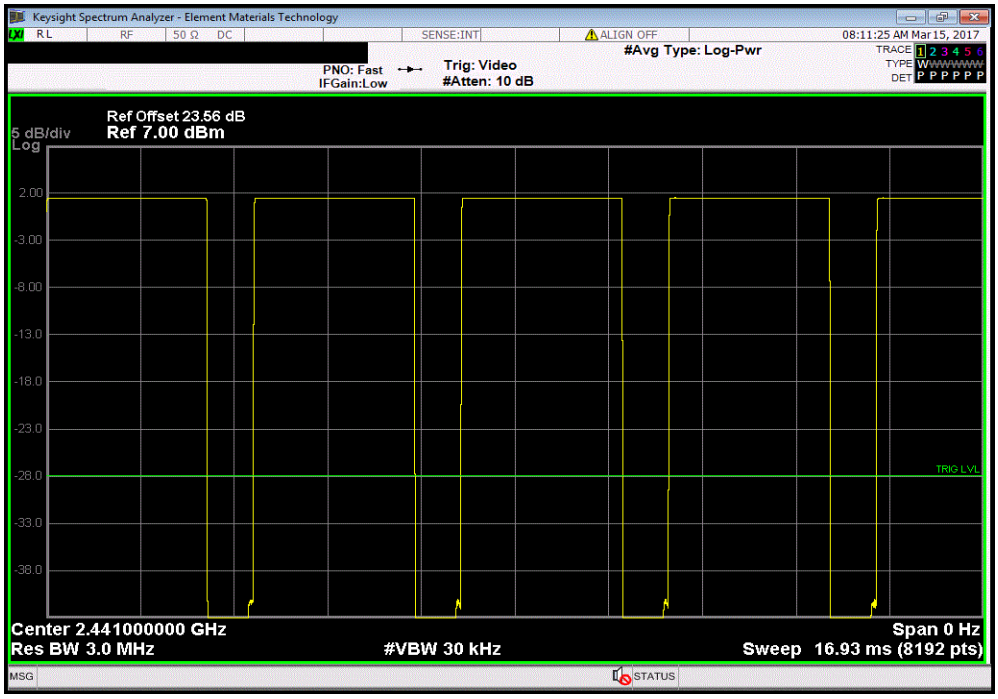
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

DH5, GFSK, Mid Channel 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.913 ms	3.75 ms	1	77.7	N/A	N/A



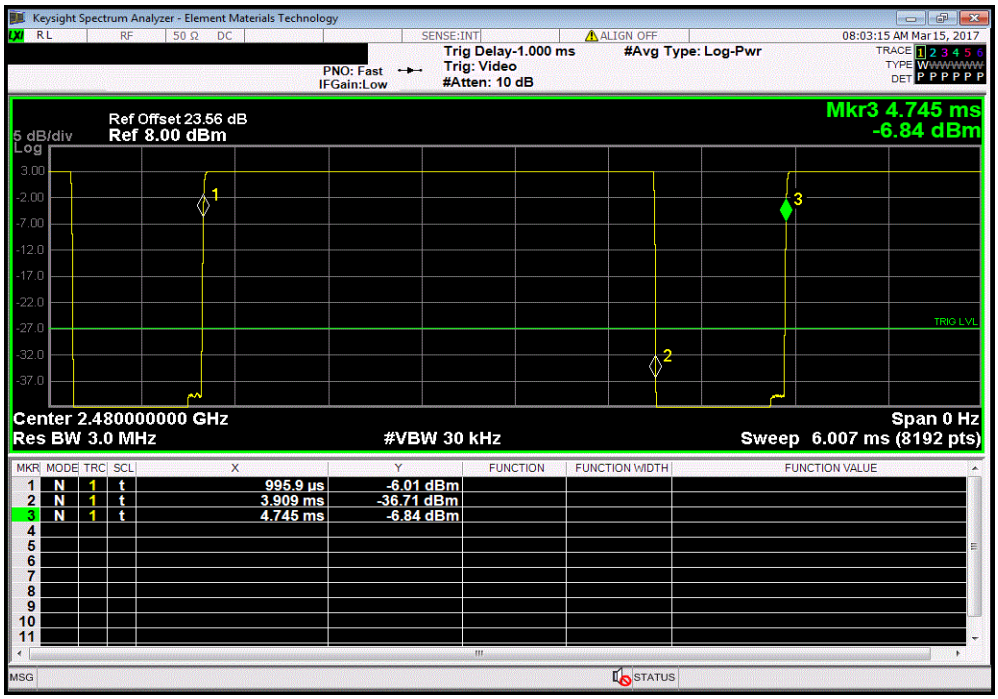
DH5, GFSK, Mid Channel 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



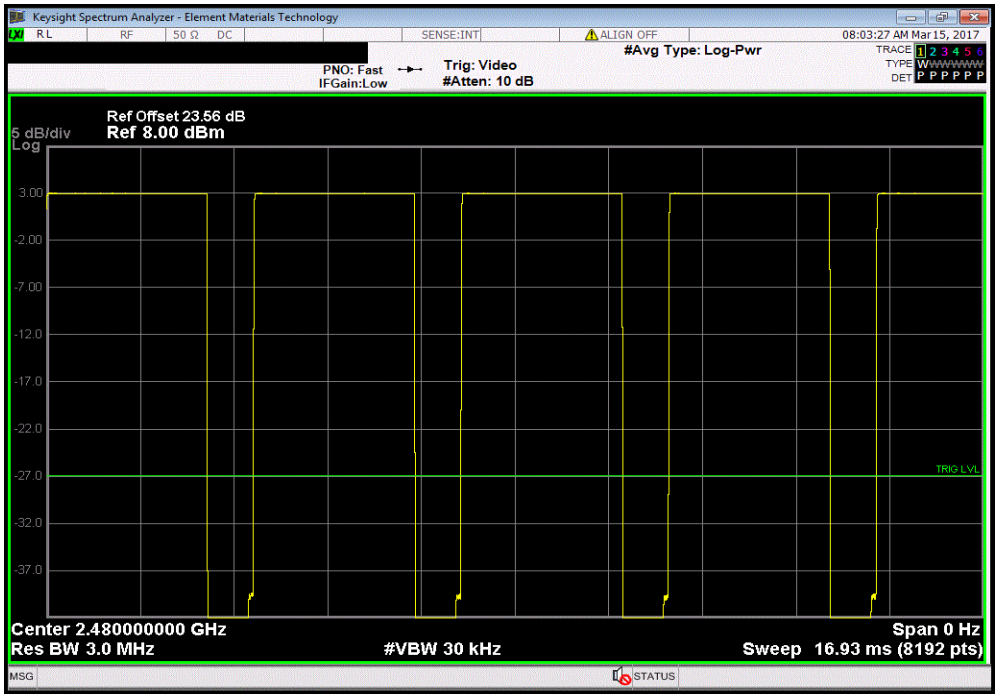
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

DH5, GFSK, High Channel 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.913 ms	3.75 ms	1	77.7	N/A	N/A



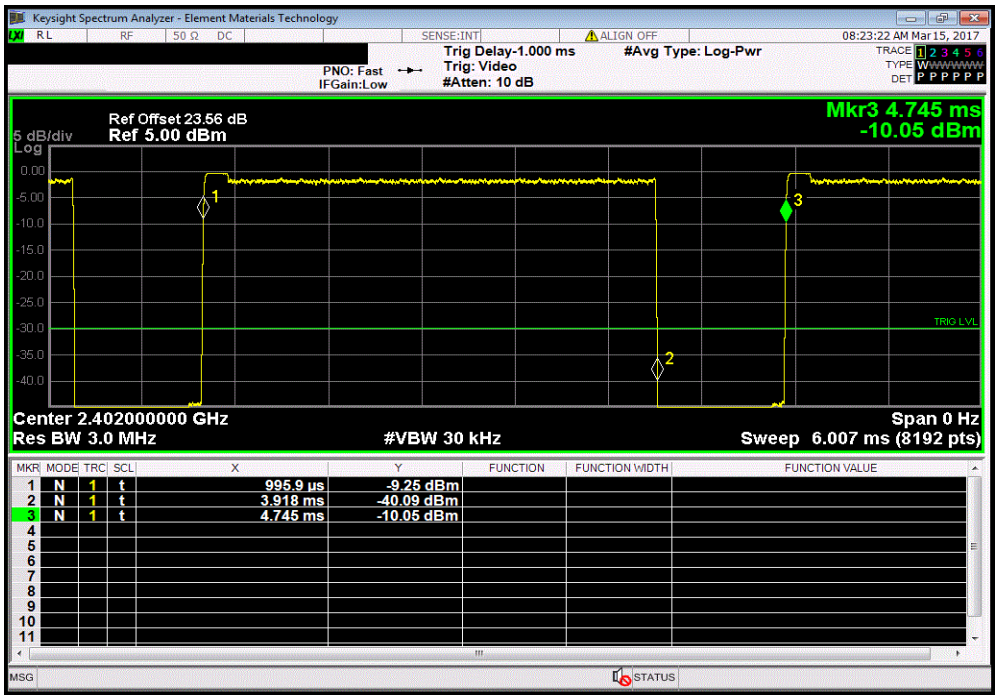
DH5, GFSK, High Channel 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



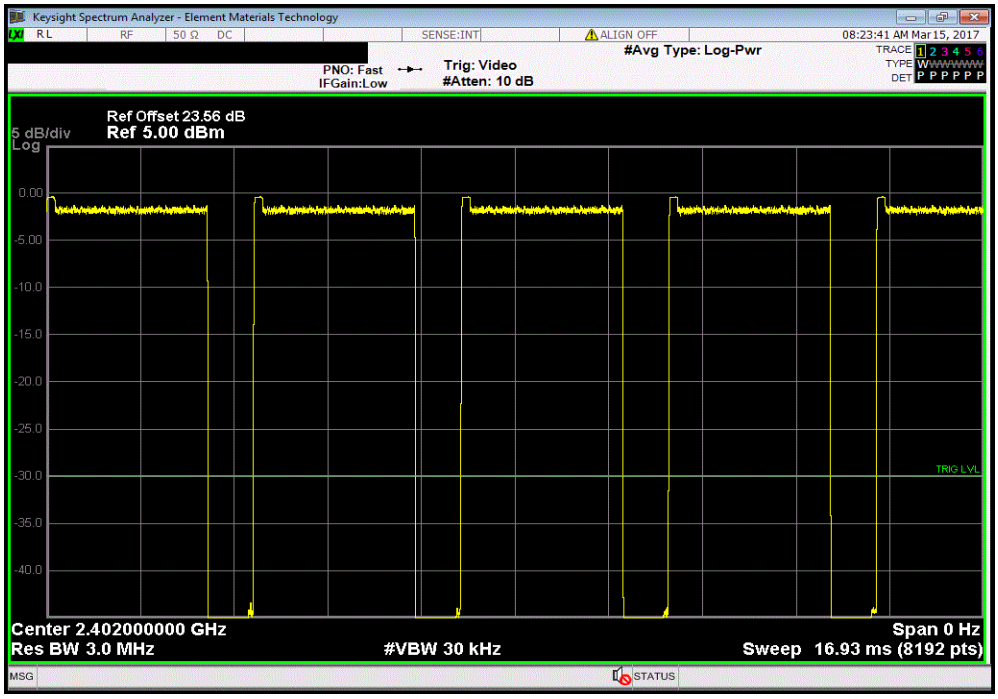
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

2DH5, pi/4-DQPSK, Low Channel 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.922 ms	3.75 ms	1	77.9	N/A	N/A



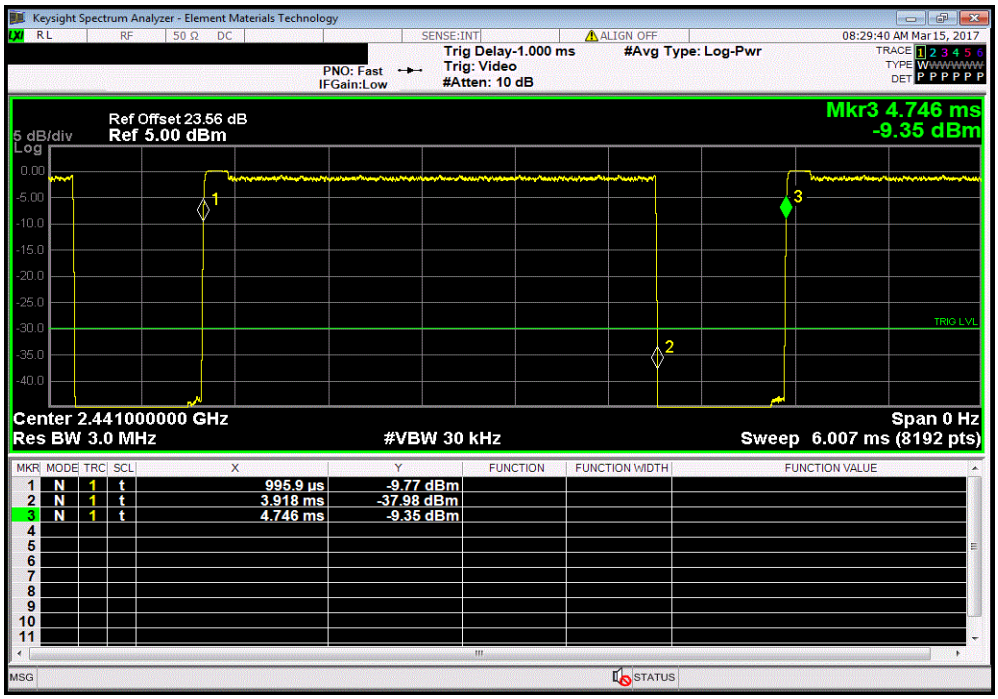
2DH5, pi/4-DQPSK, Low Channel 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



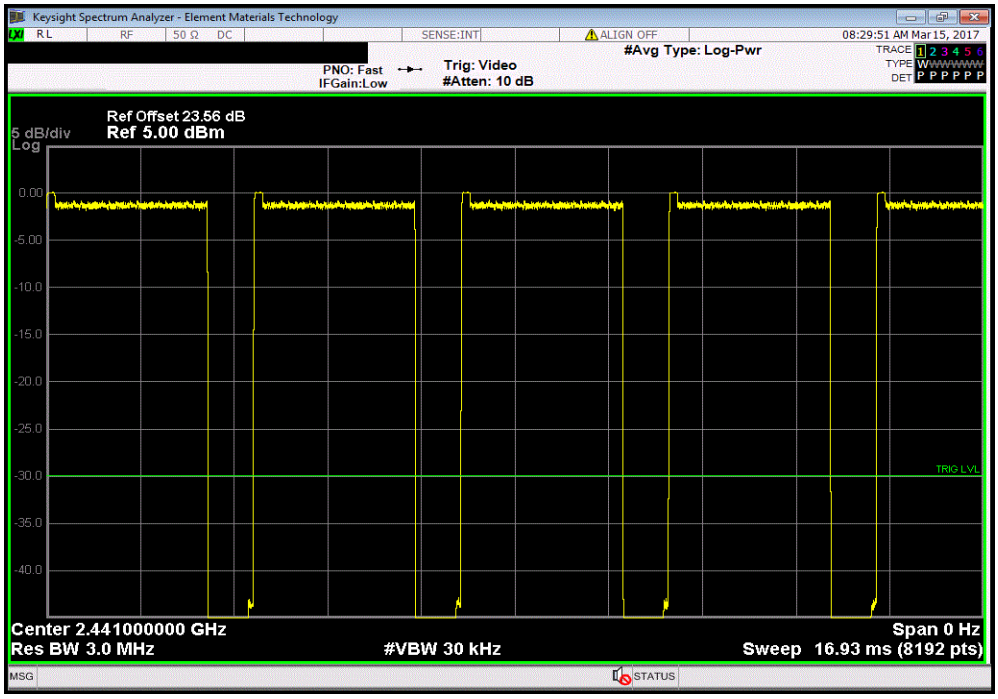
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

2DH5, pi/4-DQPSK, Mid Channel 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.922 ms	3.75 ms	1	77.9	N/A	N/A



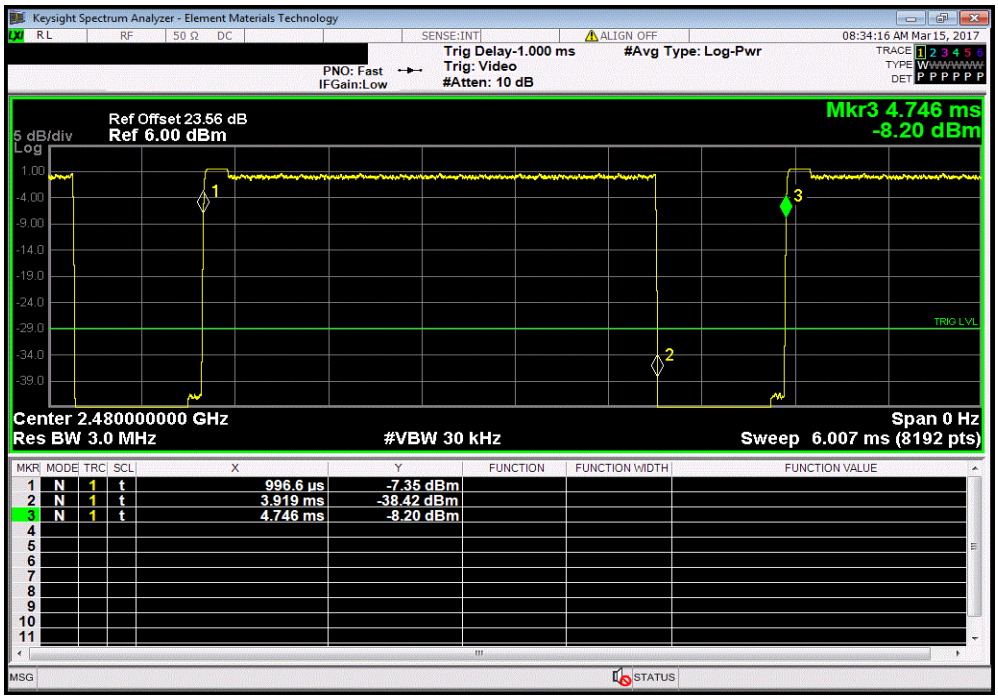
2DH5, pi/4-DQPSK, Mid Channel 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



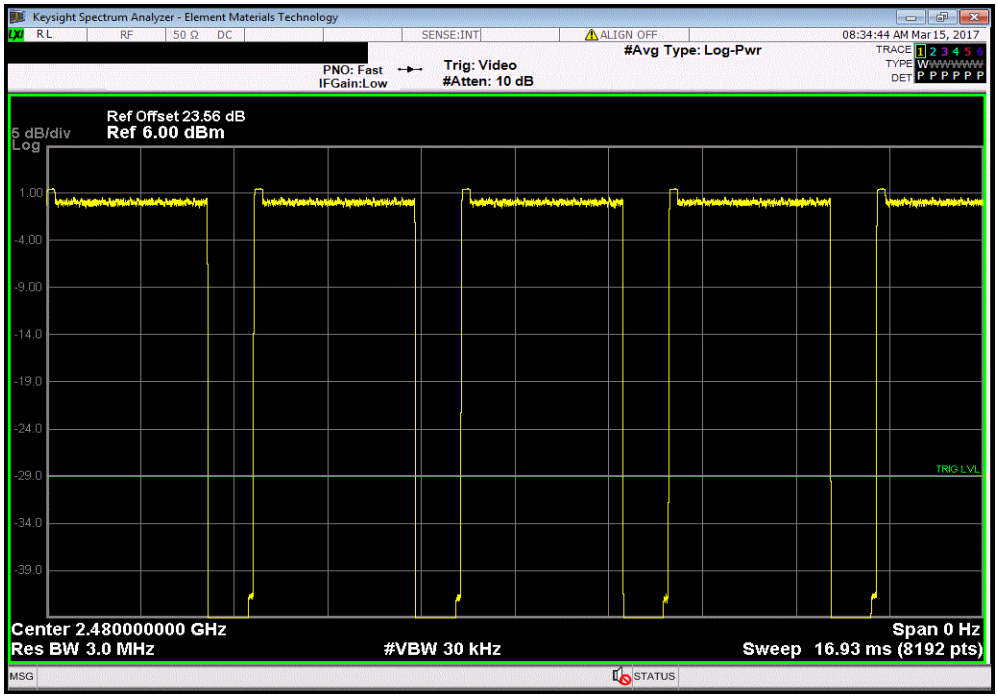
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

2DH5, pi/4-DQPSK, High Channel 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.922 ms	3.75 ms	1	77.9	N/A	N/A



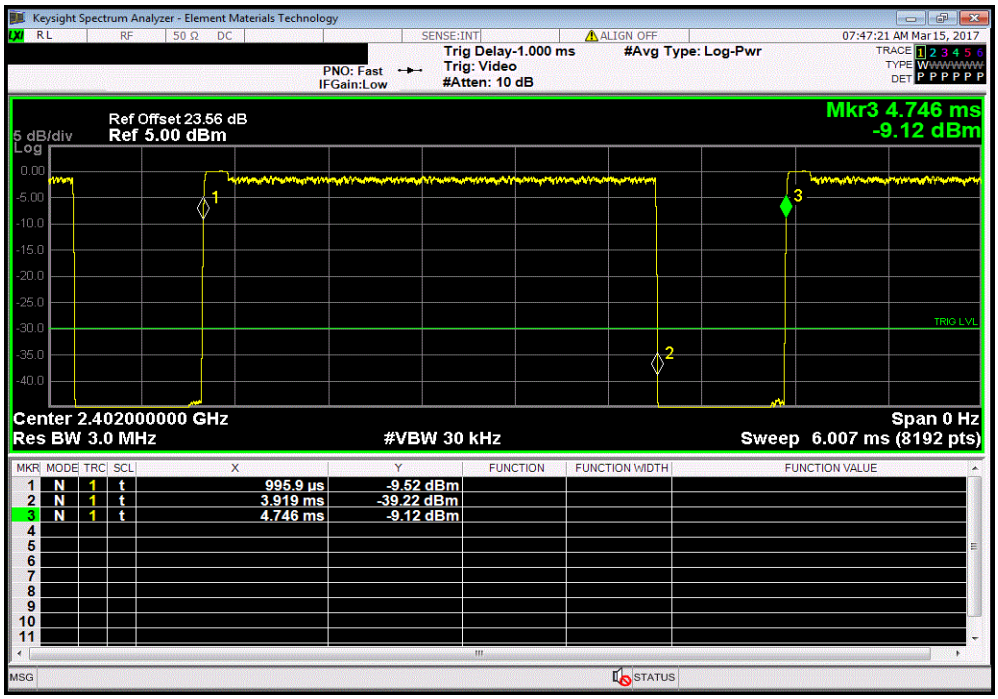
2DH5, pi/4-DQPSK, High Channel 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



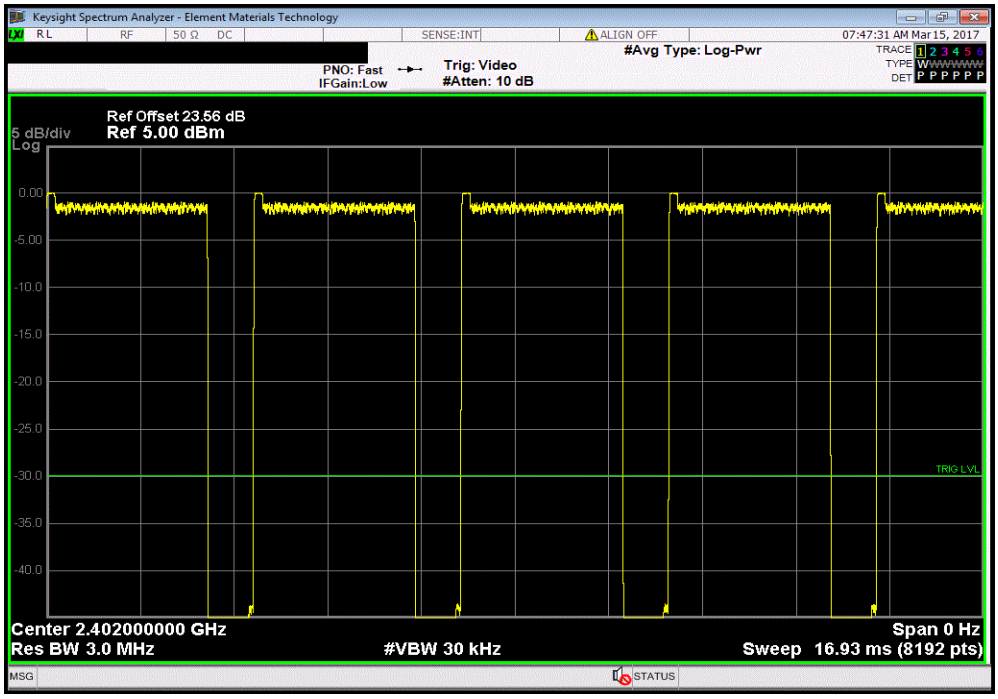
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

3DH5, 8-DPSK, Low Channel 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.923 ms	3.75 ms	1	77.9	N/A	N/A



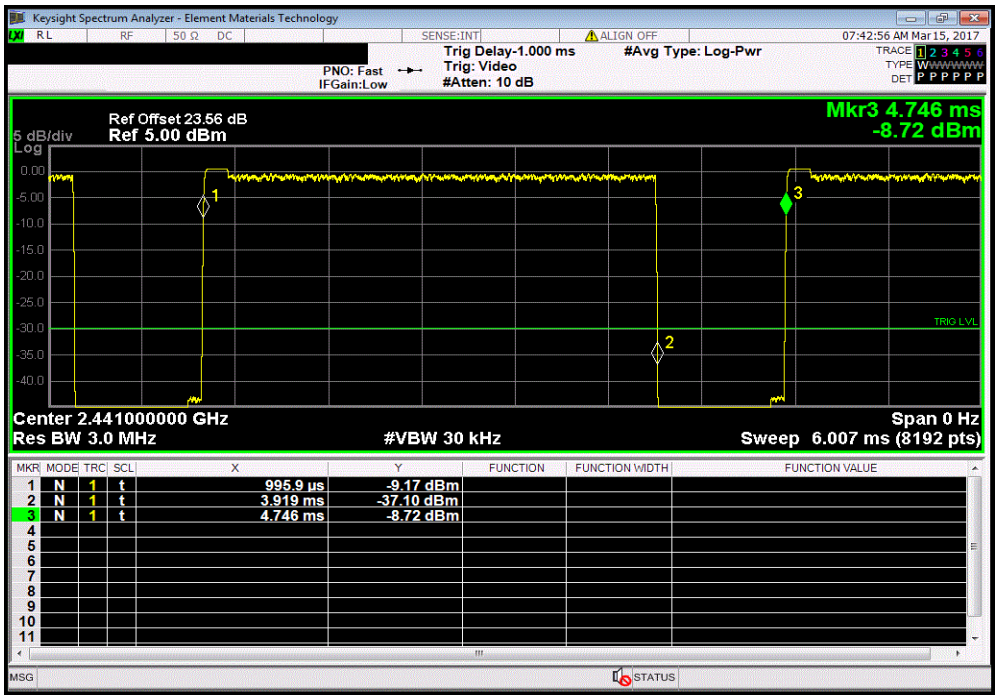
3DH5, 8-DPSK, Low Channel 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



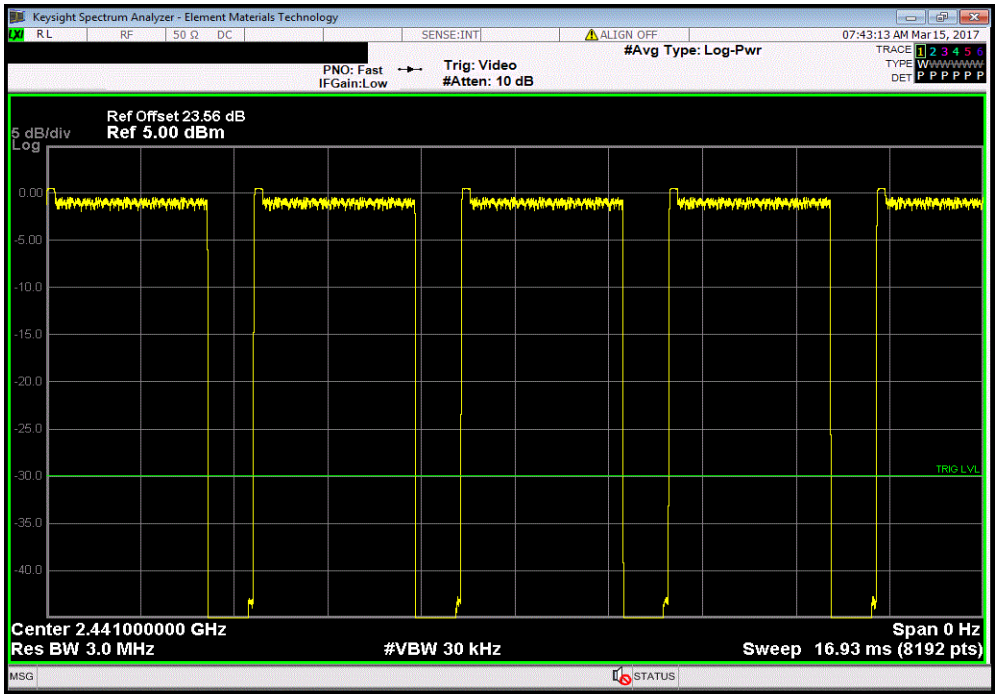
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

3DH5, 8-DPSK, Mid Channel 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.923 ms	3.75 ms	1	77.9	N/A	N/A



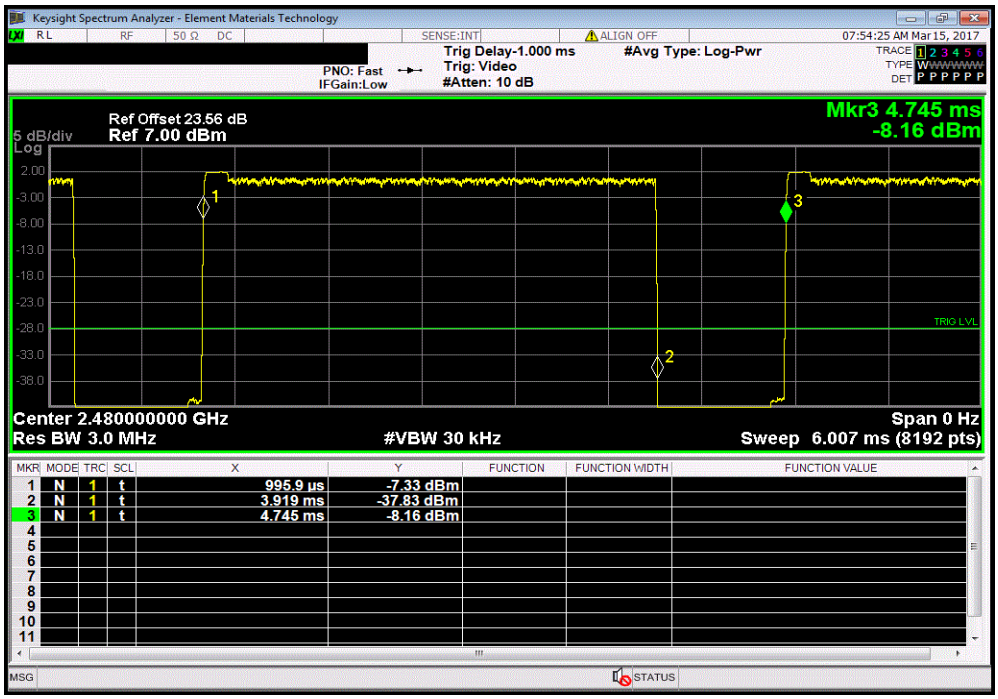
3DH5, 8-DPSK, Mid Channel 2441 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



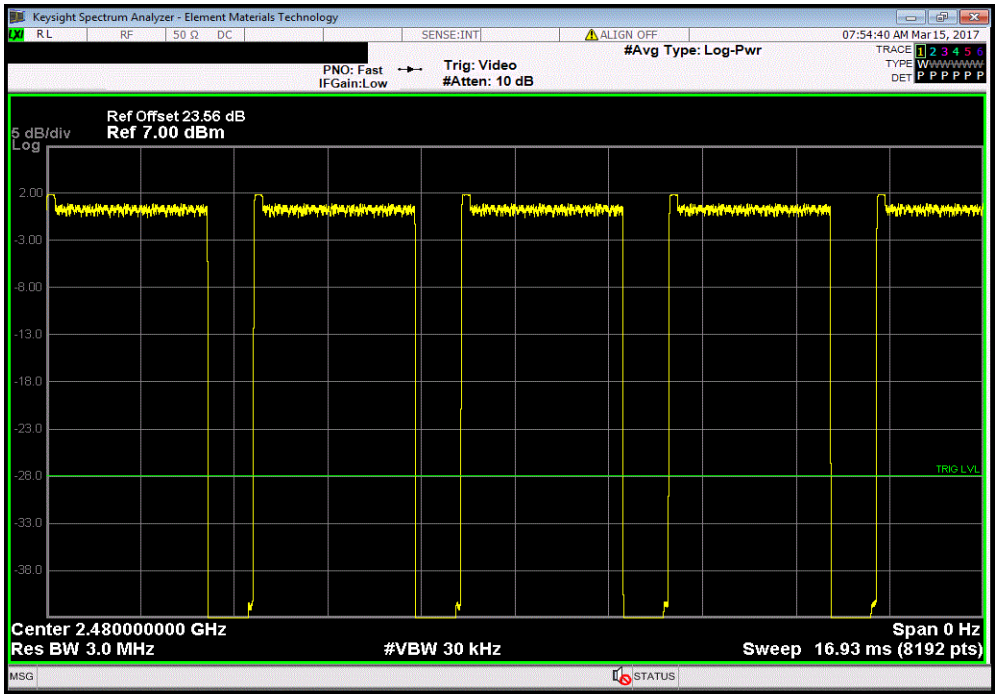
DUTY CYCLE

TbtTx 2017.01.27 XMit 2017.01.26

3DH5, 8-DPSK, High Channel 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.923 ms	3.75 ms	1	78	N/A	N/A



3DH5, 8-DPSK, High Channel 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



CARRIER FREQUENCY SEPARATION

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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

TbtTx 2017.01.27 XMit 2017.01.26

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.8 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	46.9% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

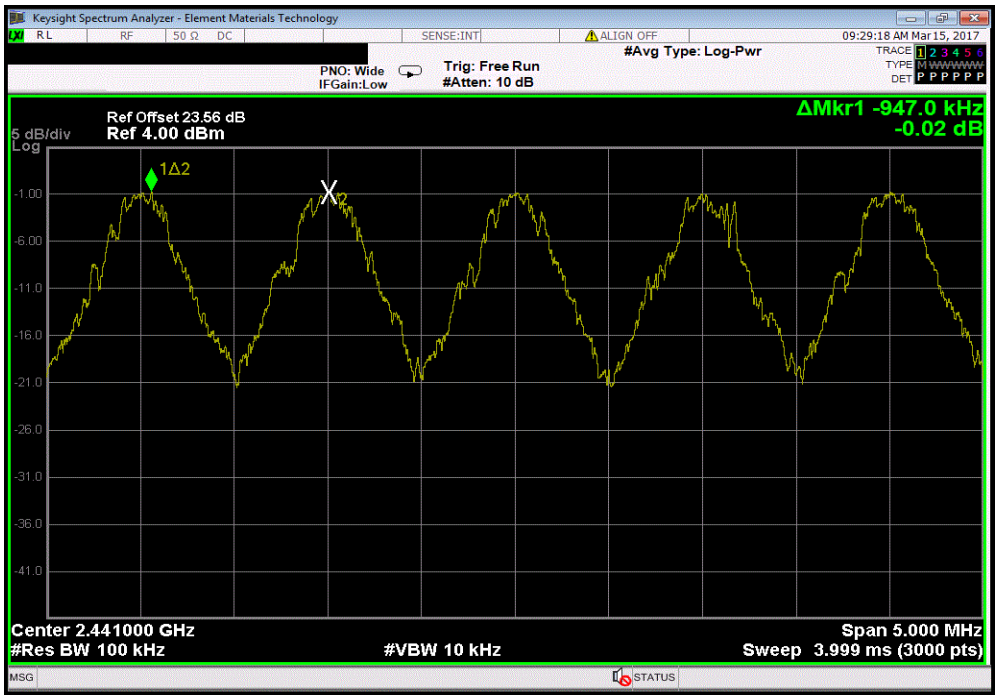
Configuration #	1	*Signature*

		Value	**Limit (≥)**	**Results**
Hopping Mode				
	DH5, GFSK			
	Mid Channel, 2441 MHz	1 MHz	1 MHz	Pass

CARRIER FREQUENCY SEPARATION

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, DH5, GFSK, Mid Channel, 2441 MHz						
				Value	Limit (≥)	Results
				1 MHz	1 MHz	Pass



NUMBER OF HOPPING FREQUENCIES

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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

TbtTx 2017.01.27 XMit 2017.01.26

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.9 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	46.8% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

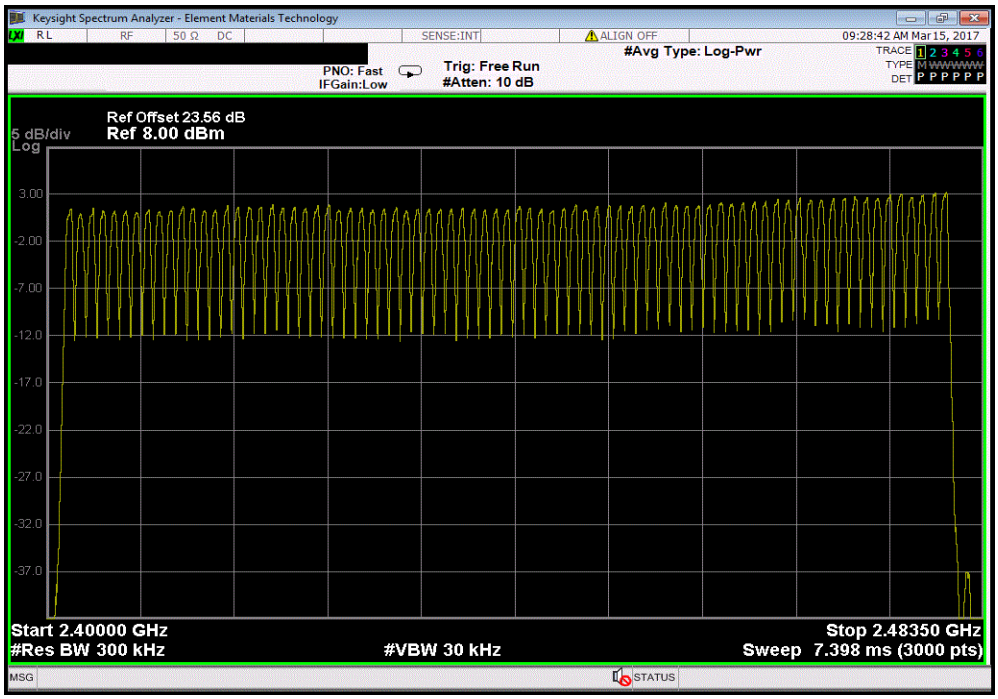
Configuration #	1	*Signature*

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

NUMBER OF HOPPING FREQUENCIES

TbtTx 2017.01.27 XMit 2017.01.26

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



DWELL TIME

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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

TbtTx 2017.01.27 XMit 2017.01.26

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.9 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	46.8% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

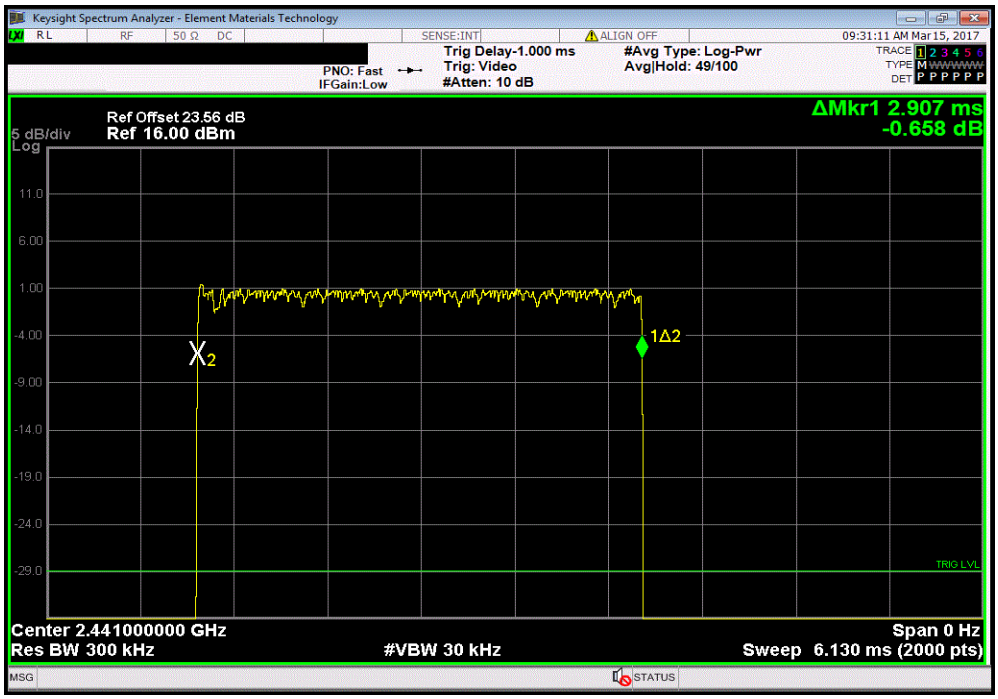
Configuration #	1	*Signature*

	Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
Hopping Mode							
DH5, GFSK							
Mid Channel, 2441 MHz	2.907	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	2.907	N/A	22	5	319.77	400	Pass
2DH5, pi/4-DQPSK							
Mid Channel, 2441 MHz	2.919	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	2.919	N/A	22	5	321.09	400	Pass
3DH5, 8-DPSK							
Mid Channel, 2441 MHz	2.919	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	2.919	N/A	22	5	321.09	400	Pass

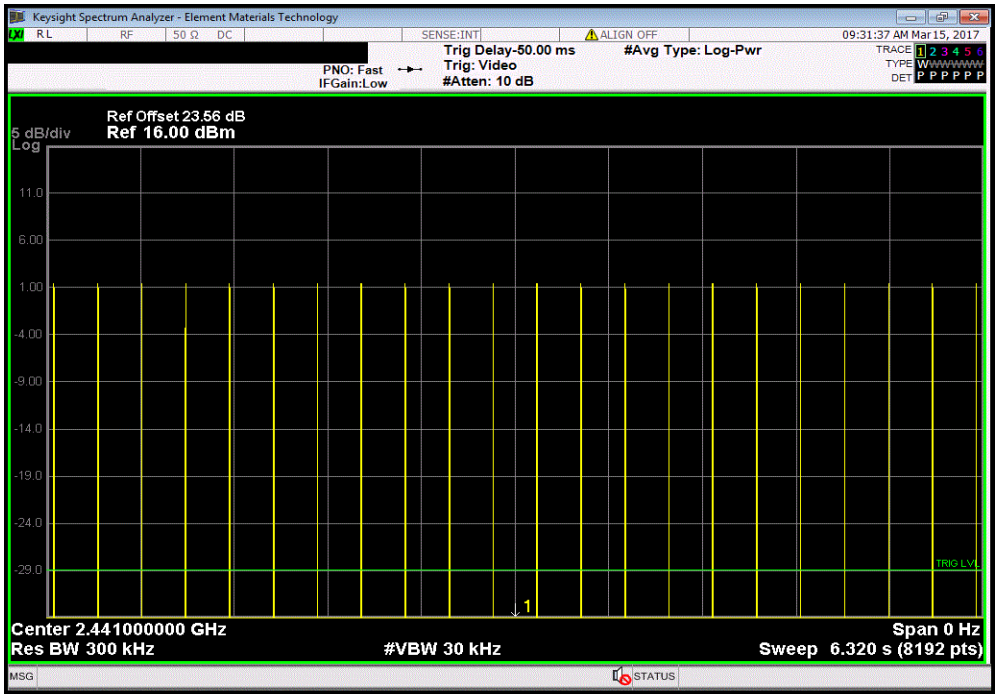
DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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
2.907	N/A	N/A	N/A	N/A	N/A	N/A



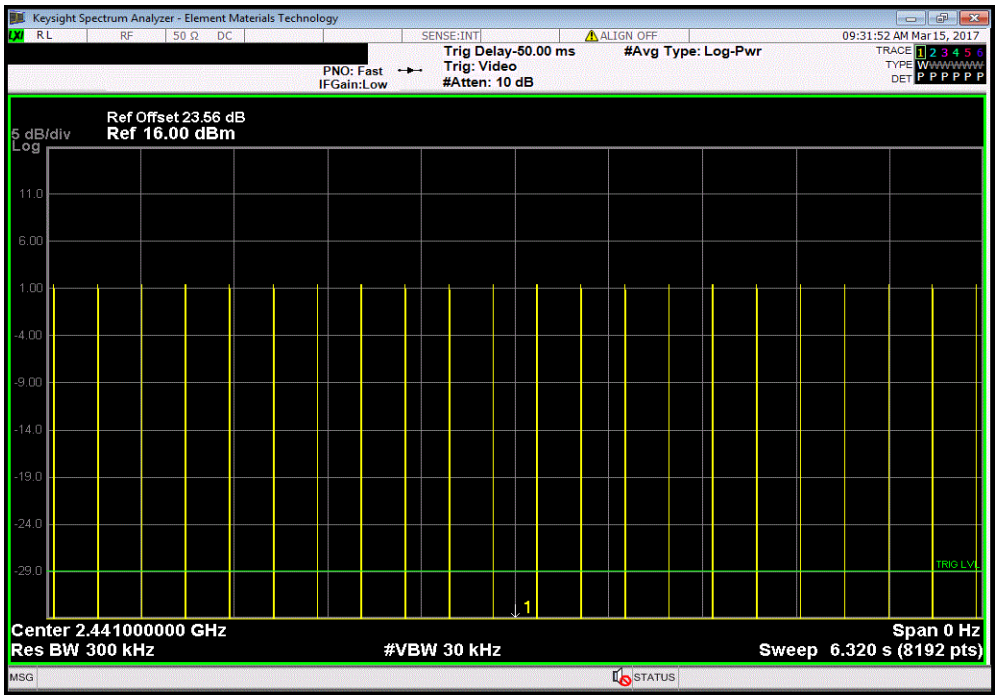
Hopping Mode, DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



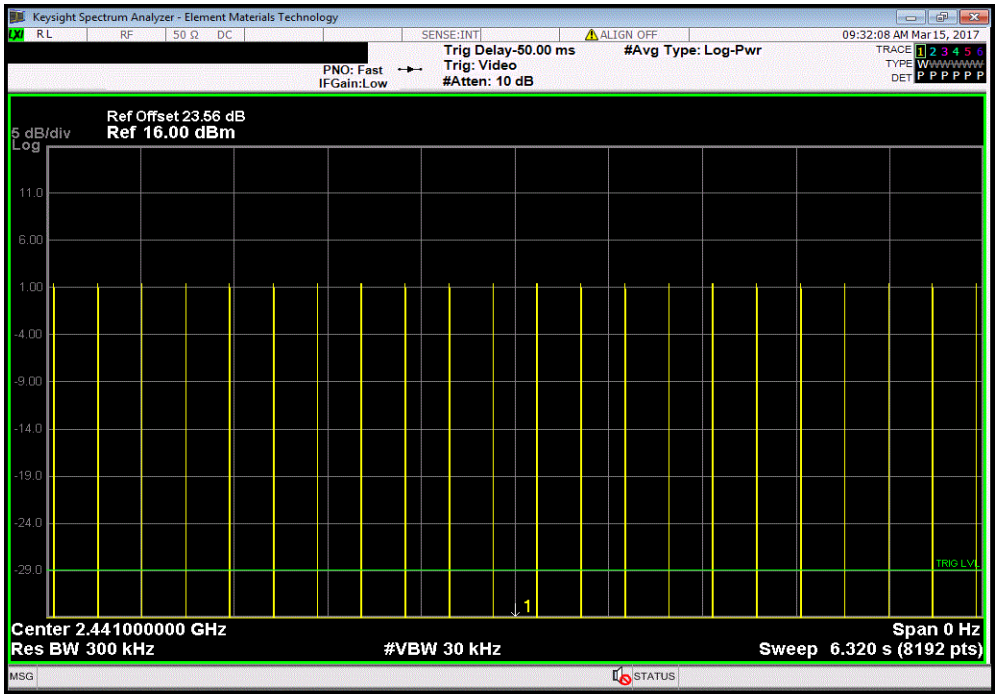
DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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



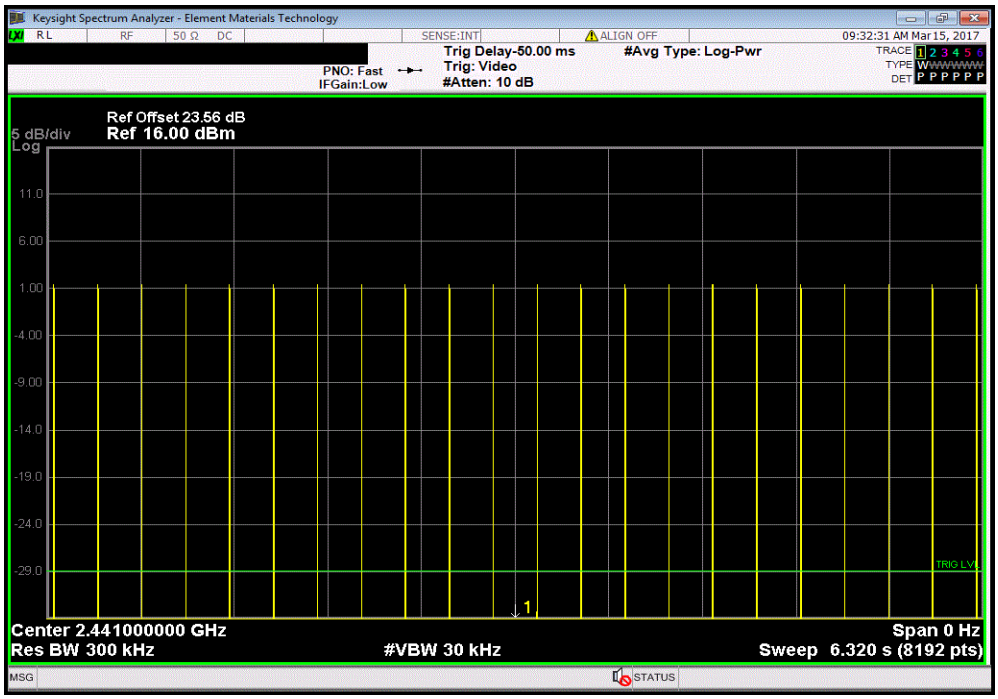
Hopping Mode, DH5, GFSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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, 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
2.907	N/A	22	5	319.77	400	Pass

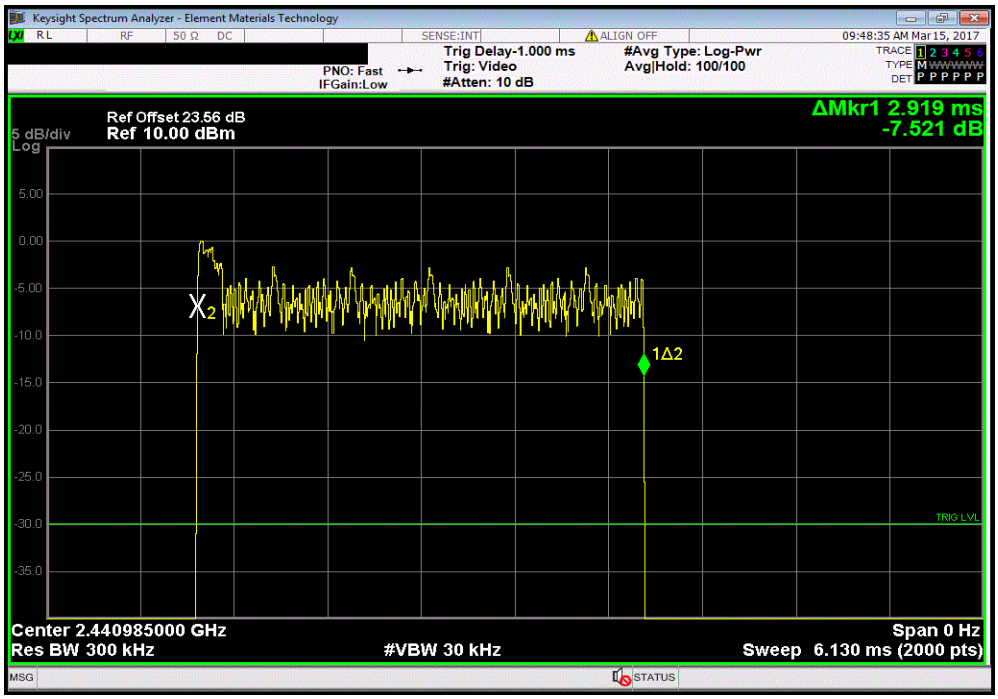
Calculation Only

No Screen Capture Required

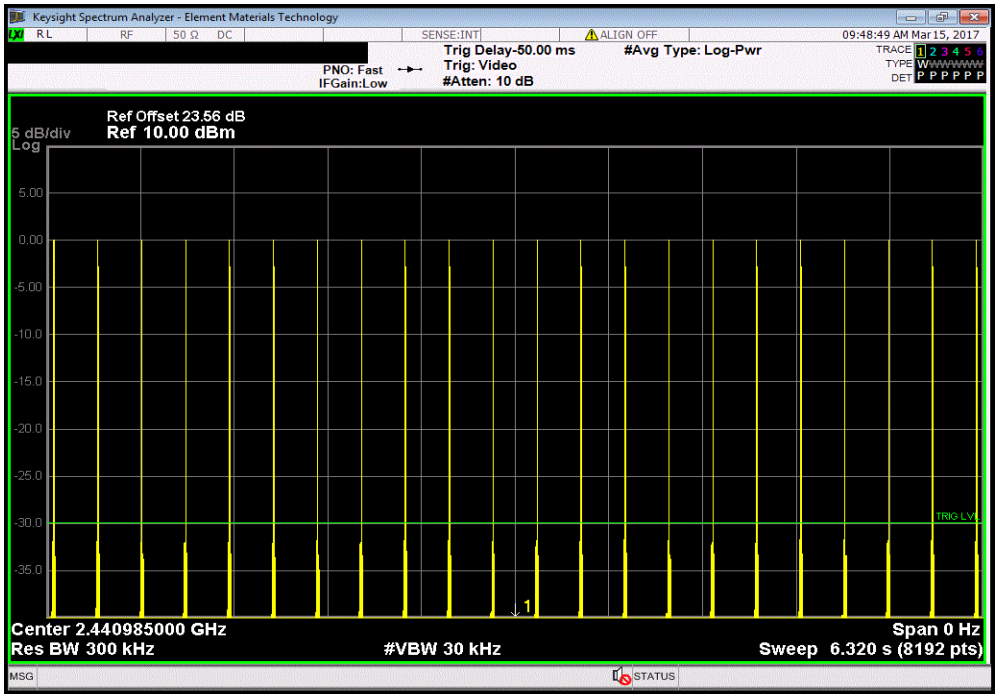
DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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
2.919	N/A	N/A	N/A	N/A	N/A	N/A



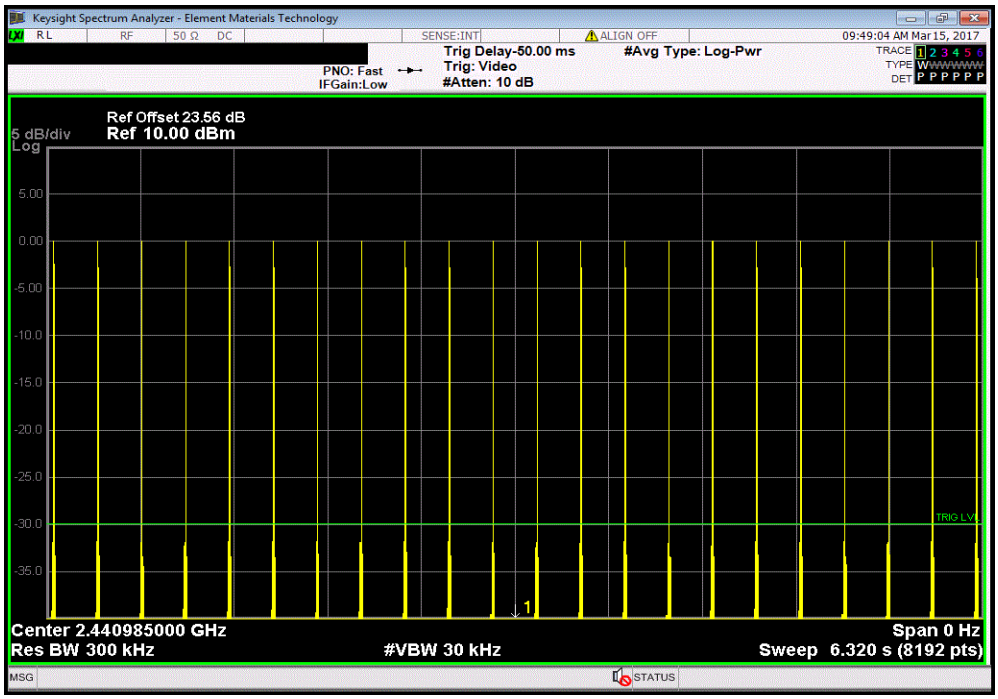
Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



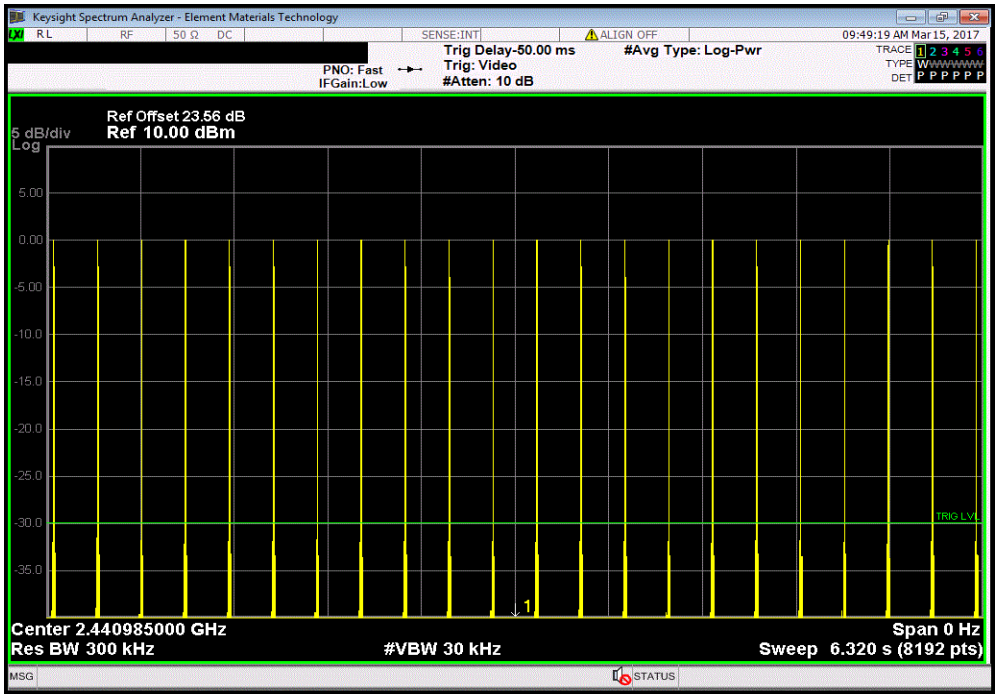
DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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



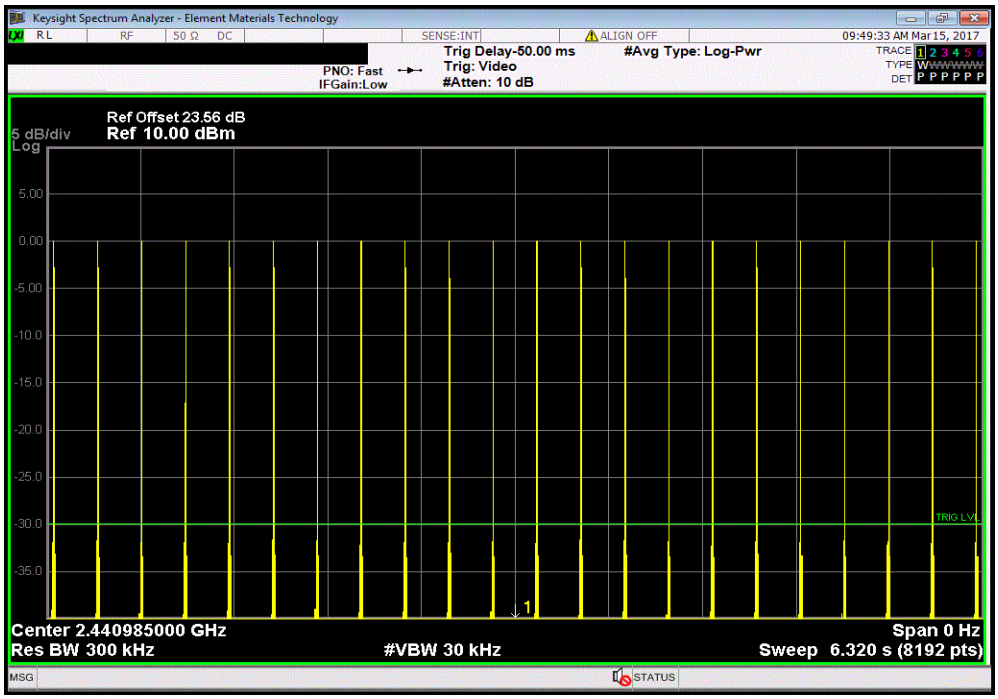
Hopping Mode, 2DH5, pi/4-DQPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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, 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
2.919	N/A	22	5	321.09	400	Pass

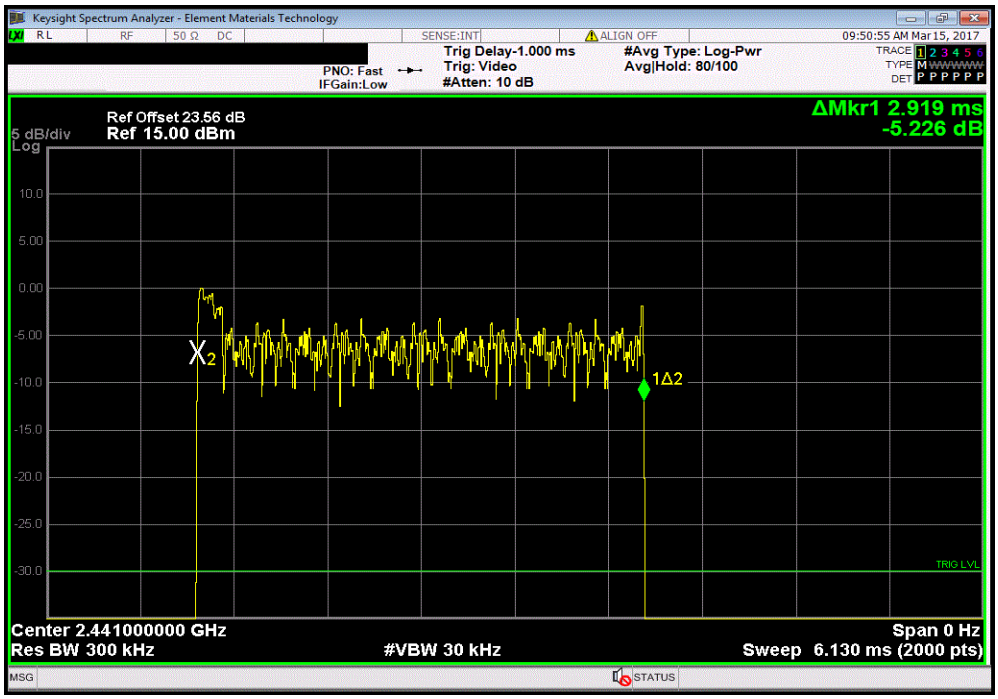
Calculation Only

No Screen Capture Required

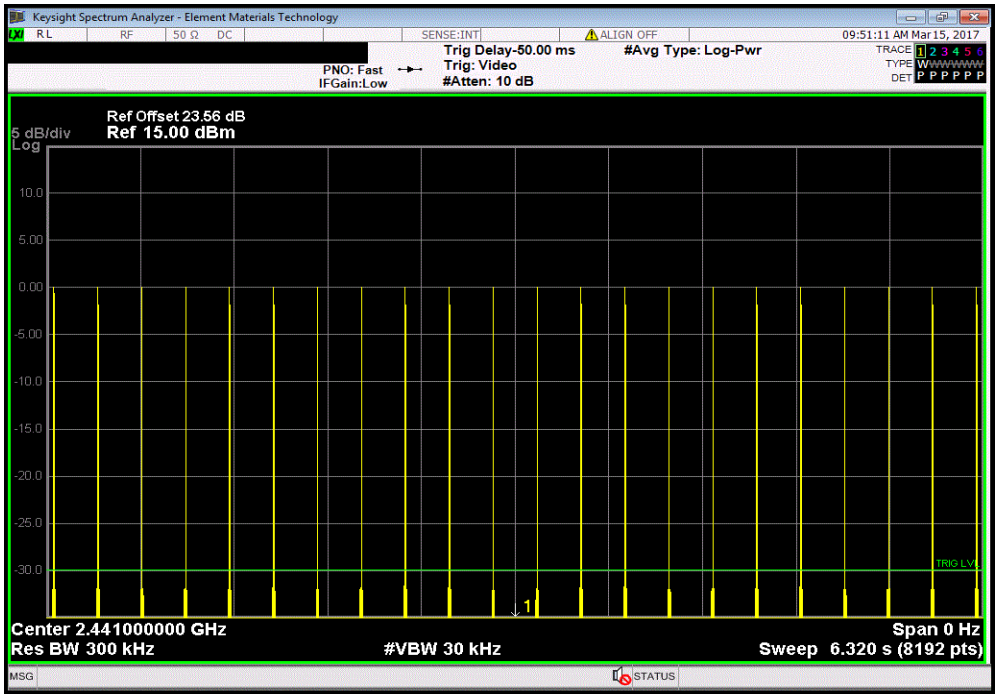
DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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
2.919	N/A	N/A	N/A	N/A	N/A	N/A



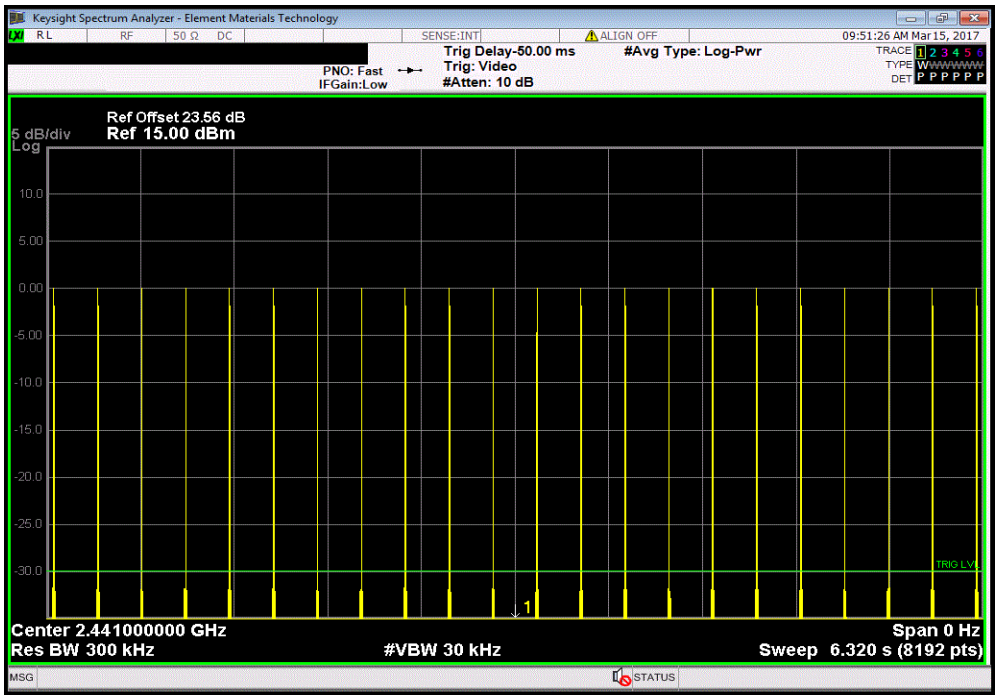
Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



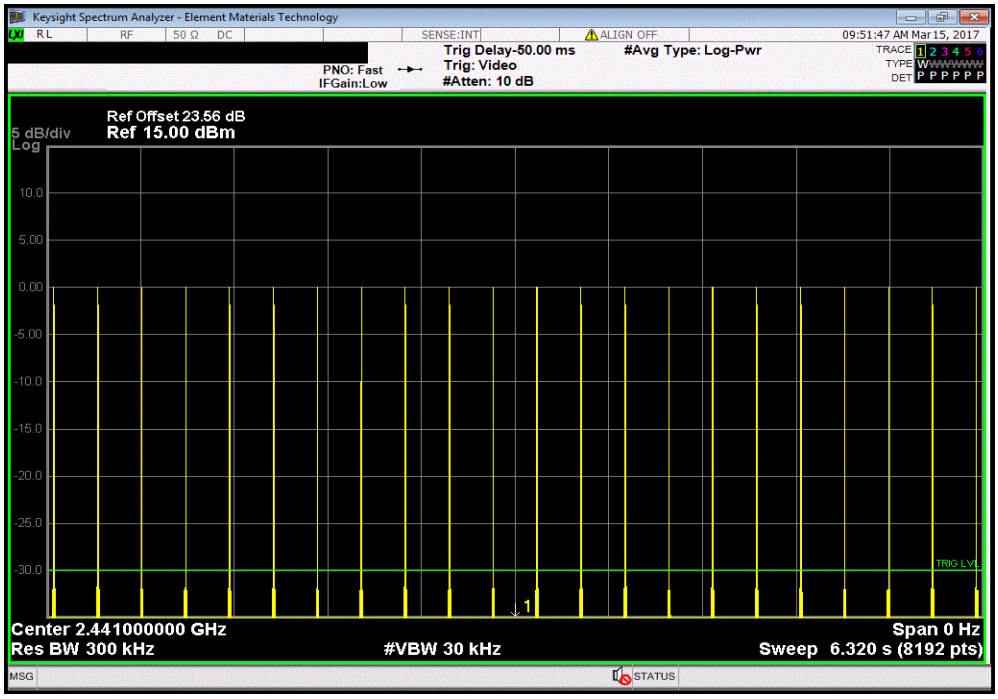
DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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



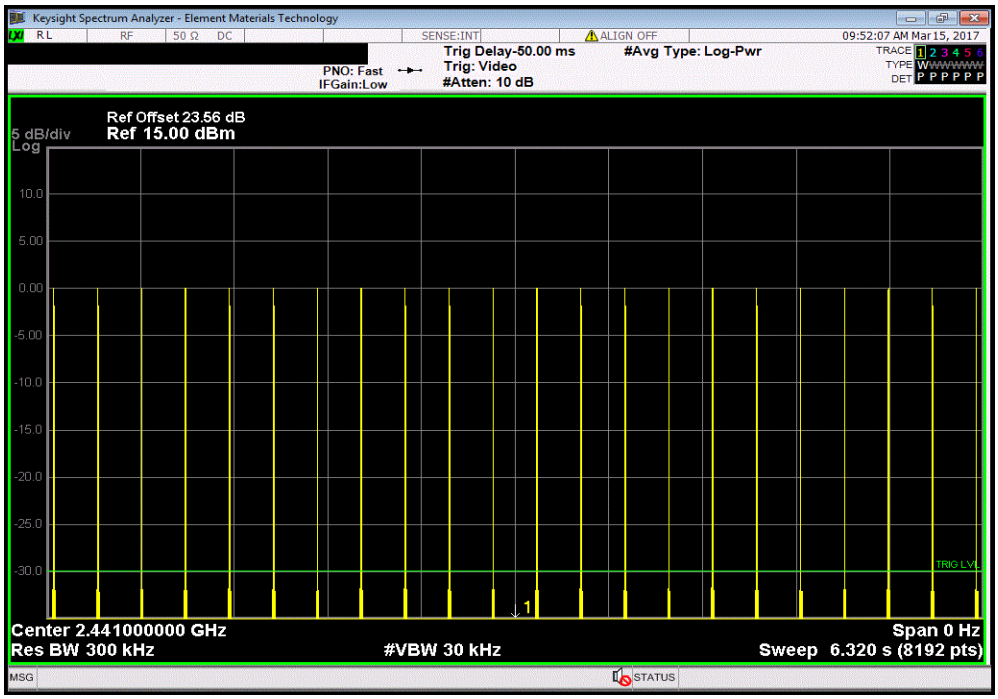
Hopping Mode, 3DH5, 8-DPSK, Mid Channel, 2441 MHz						
Pulse Width (ms)	Number of Pulses	Average No. of Pulses	Scale Factor	On Time (ms) During 31.6 s	Limit (ms)	Results
N/A	22	N/A	N/A	N/A	N/A	N/A



DWELL TIME

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 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, 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
2.919	N/A	22	5	321.09	400	Pass

Calculation Only

No Screen Capture Required

OUTPUT POWER

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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.

De Facto EIRP Limit: The EUT meets the de facto EIRP limit of +27dBm.

OUTPUT POWER

TbtTx 2017.01.27 XMit 2017.01.26

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.9 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	46.7% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

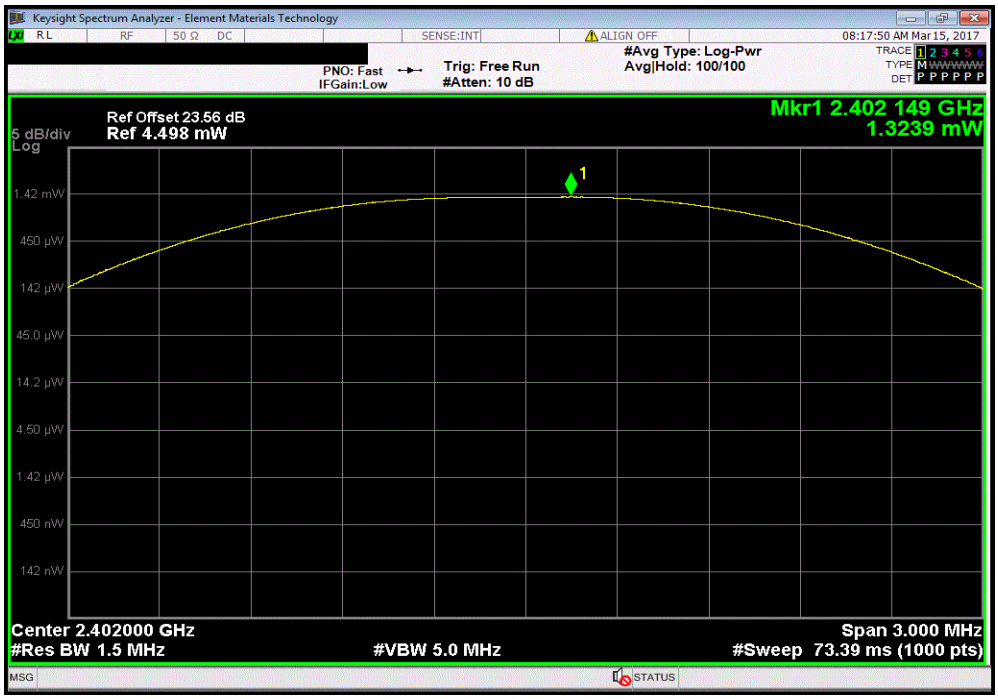
Configuration #	1	*Signature*

		Value	Limit (<)	Result
DH5, GFSK				
	Low Channel 2402 MHz	1.324 mW	125 mW	Pass
	Mid Channel 2441 MHz	1.433 mW	125 mW	Pass
	High Channel 2480 MHz	2.016 mW	125 mW	Pass
2DH5, pi/4-DQPSK				
	Low Channel 2402 MHz	1.089 mW	125 mW	Pass
	Mid Channel 2441 MHz	1.199 mW	125 mW	Pass
	High Channel 2480 MHz	1.645 mW	125 mW	Pass
3DH5, 8-DPSK				
	Low Channel 2402 MHz	1.253 mW	125 mW	Pass
	Mid Channel 2441 MHz	1.389 mW	125 mW	Pass
	High Channel 2480 MHz	1.913 mW	125 mW	Pass

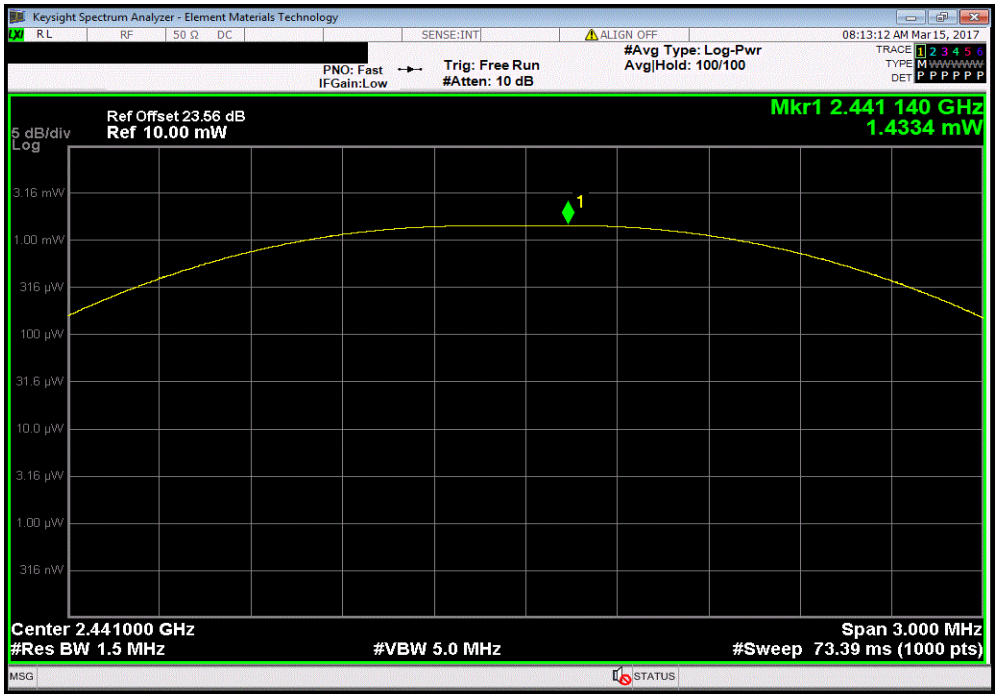
OUTPUT POWER

TbtTx 2017.01.27 XMit 2017.01.26

DH5, GFSK, Low Channel 2402 MHz						
				Value	Limit (<)	Result
				1.324 mW	125 mW	Pass



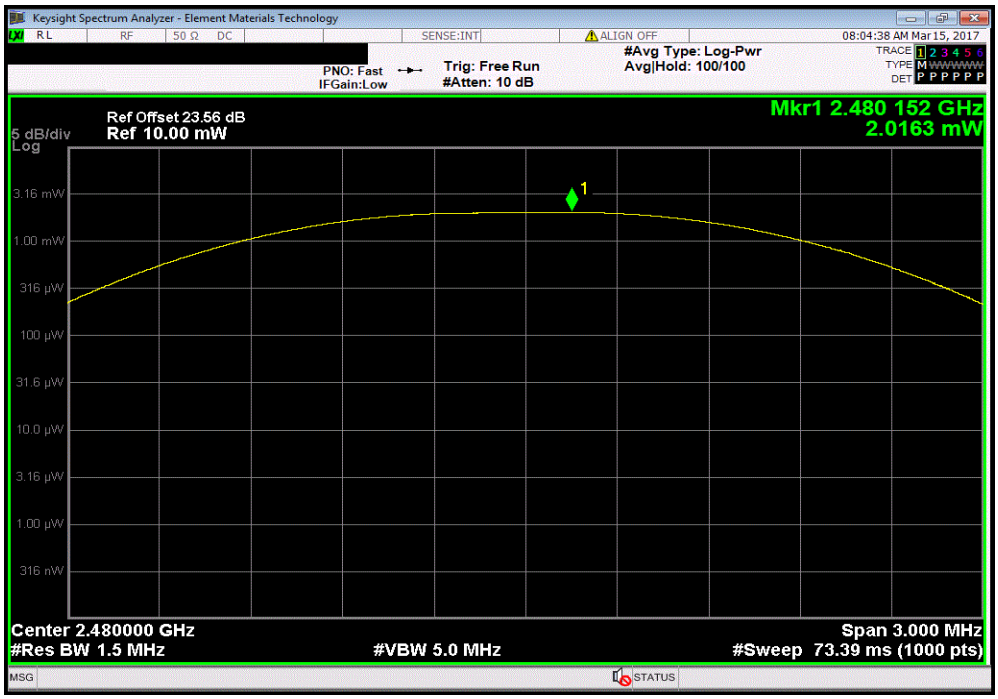
DH5, GFSK, Mid Channel 2441 MHz						
				Value	Limit (<)	Result
				1.433 mW	125 mW	Pass



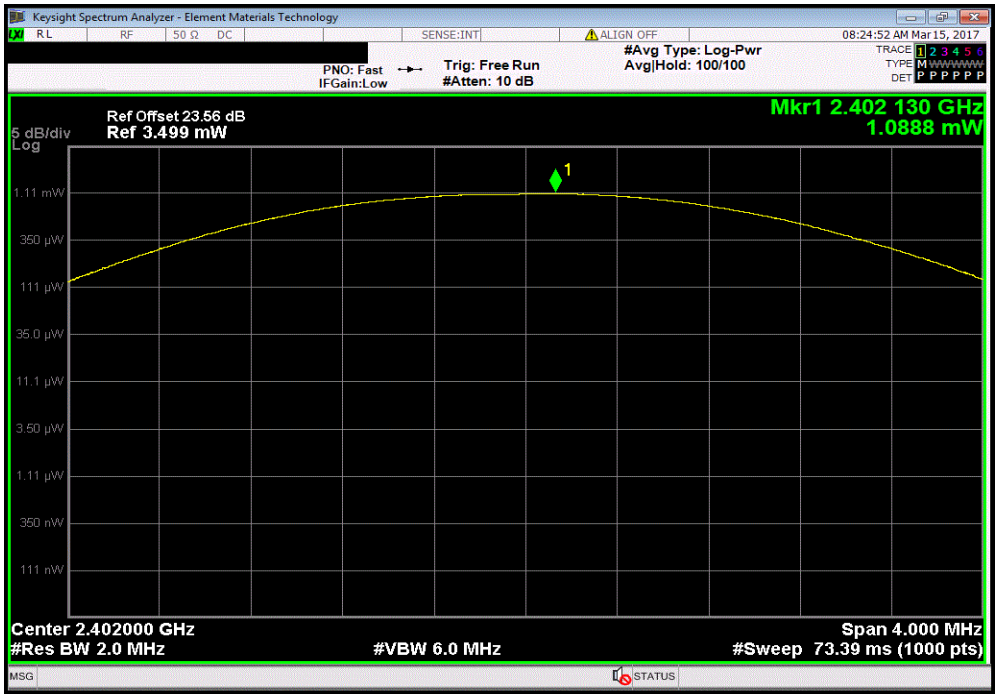
OUTPUT POWER

TbtTx 2017.01.27 XMit 2017.01.26

DH5, GFSK, High Channel 2480 MHz						
				Value	Limit (<)	Result
				2.016 mW	125 mW	Pass



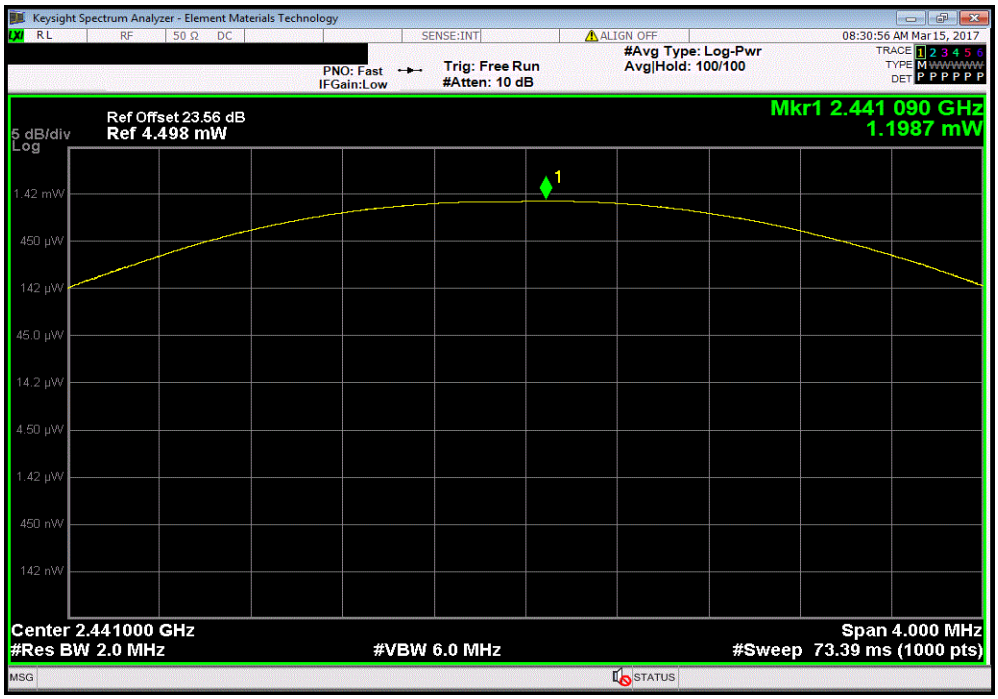
2DH5, pi/4-DQPSK, Low Channel 2402 MHz						
				Value	Limit (<)	Result
				1.089 mW	125 mW	Pass



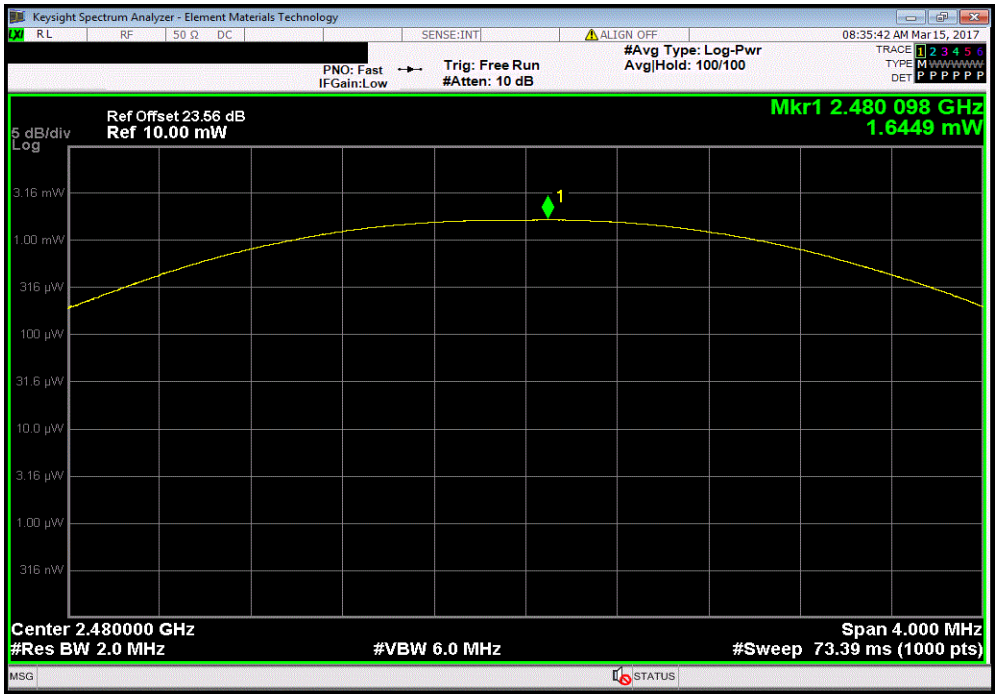
OUTPUT POWER

TbtTx 2017.01.27 XMit 2017.01.26

2DH5, pi/4-DQPSK, Mid Channel 2441 MHz						
				Value	Limit (<)	Result
				1.199 mW	125 mW	Pass



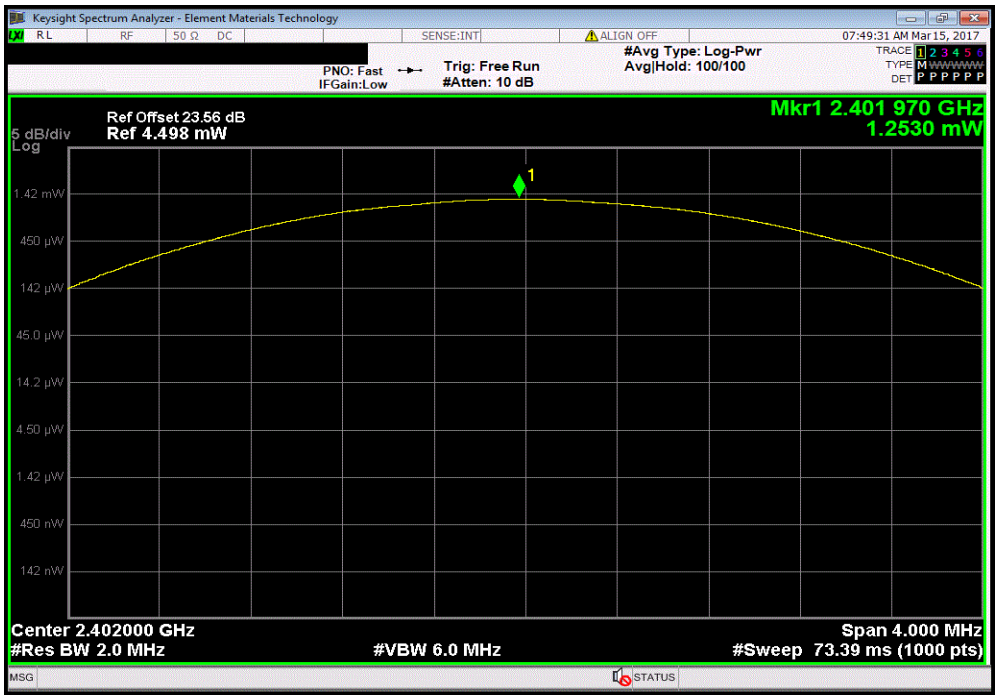
2DH5, pi/4-DQPSK, High Channel 2480 MHz						
				Value	Limit (<)	Result
				1.645 mW	125 mW	Pass



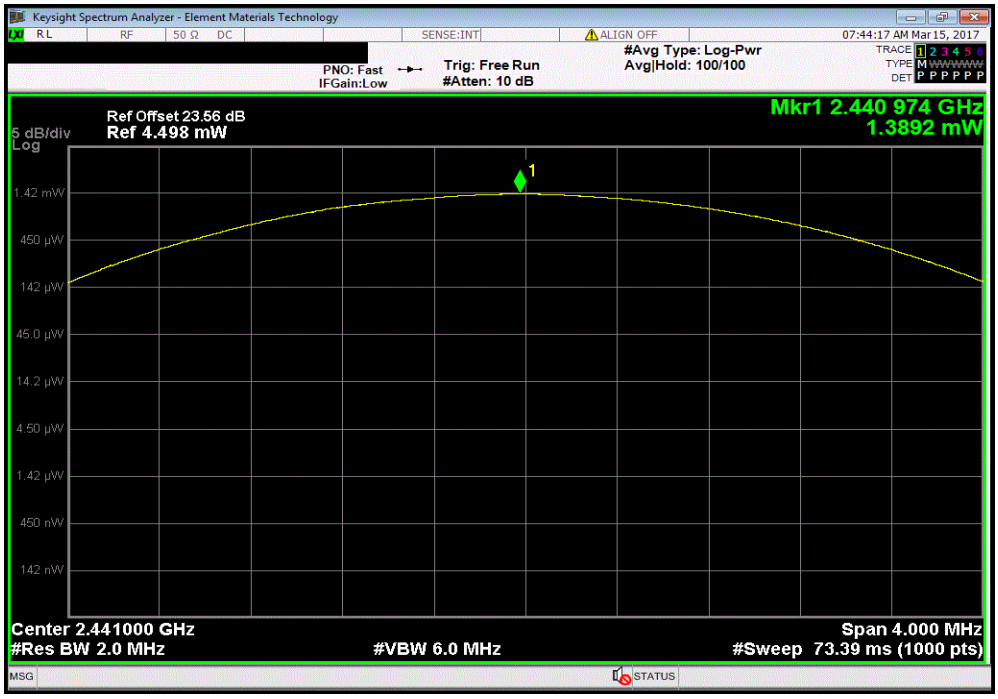
OUTPUT POWER

TbtTx 2017.01.27 XMit 2017.01.26

3DH5, 8-DPSK, Low Channel 2402 MHz						
				Value	Limit (<)	Result
				1.253 mW	125 mW	Pass

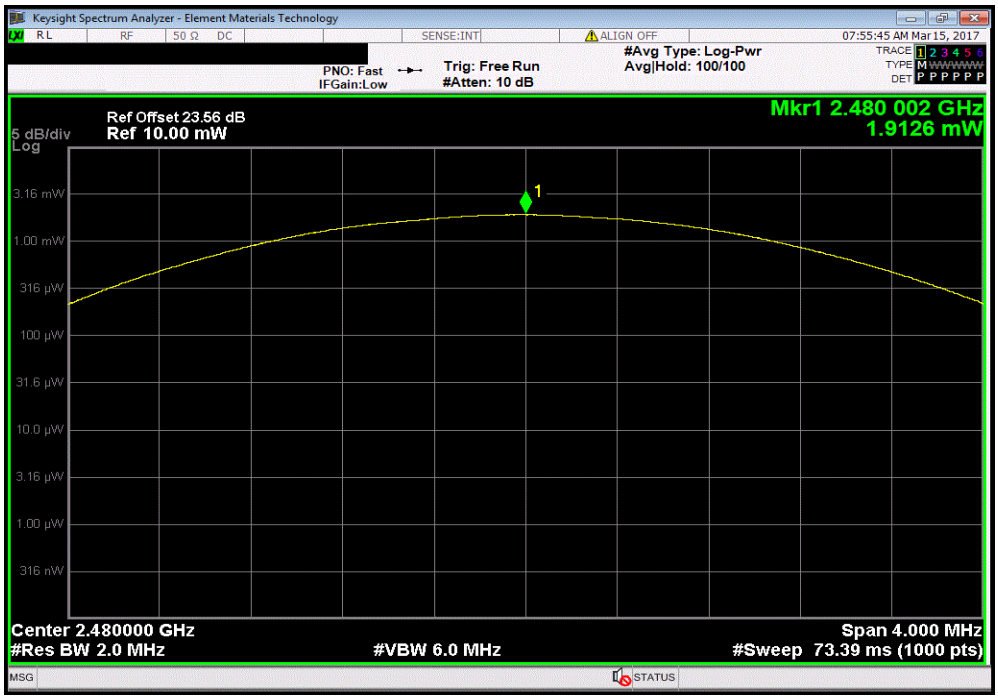


3DH5, 8-DPSK, Mid Channel 2441 MHz						
				Value	Limit (<)	Result
				1.389 mW	125 mW	Pass



OUTPUT POWER

3DH5, 8-DPSK, High Channel 2480 MHz						
				Value	Limit (<)	Result
				1.913 mW	125 mW	Pass



BAND EDGE COMPLIANCE

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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 2017.01.27 XMit 2017.01.26

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.9 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	46.8% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

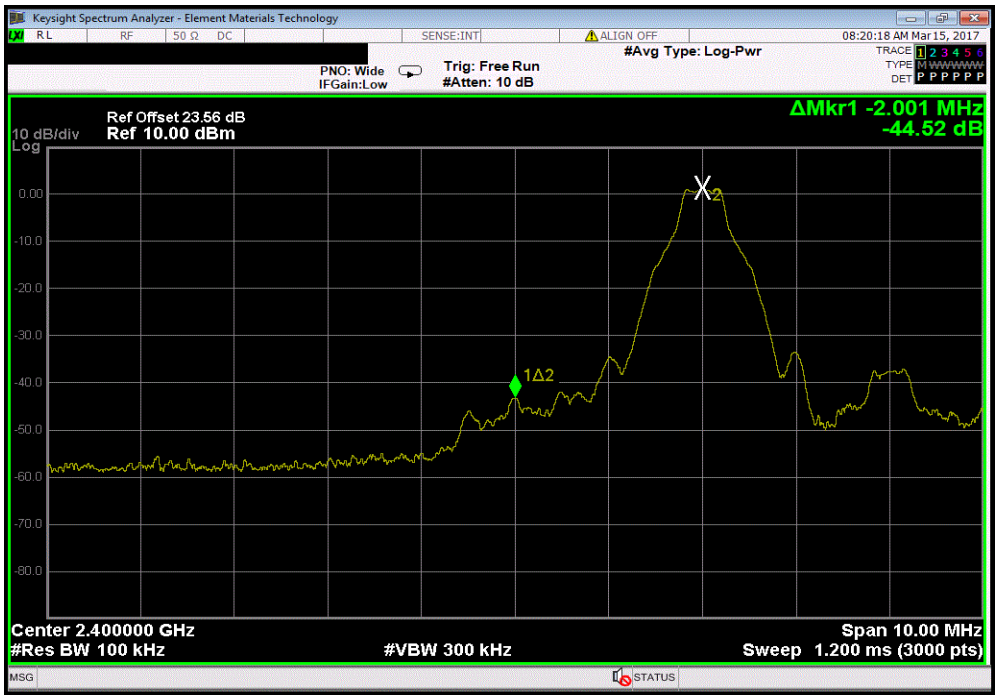
None

Configuration #	1	*Signature*

		Value (dBc)	Limit ≤ (dBc)	Result
DH5, GFSK				
	Low Channel 2402 MHz	-44.52	-20	Pass
	High Channel 2480 MHz	-46.98	-20	Pass
2DH5, pi/4-DQPSK				
	Low Channel 2402 MHz	-46.24	-20	Pass
	High Channel 2480 MHz	-44.06	-20	Pass
3DH5, 8-DPSK				
	Low Channel 2402 MHz	-44.76	-20	Pass
	High Channel 2480 MHz	-45.8	-20	Pass

BAND EDGE COMPLIANCE

DH5, GFSK, Low Channel 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-44.52	-20	Pass

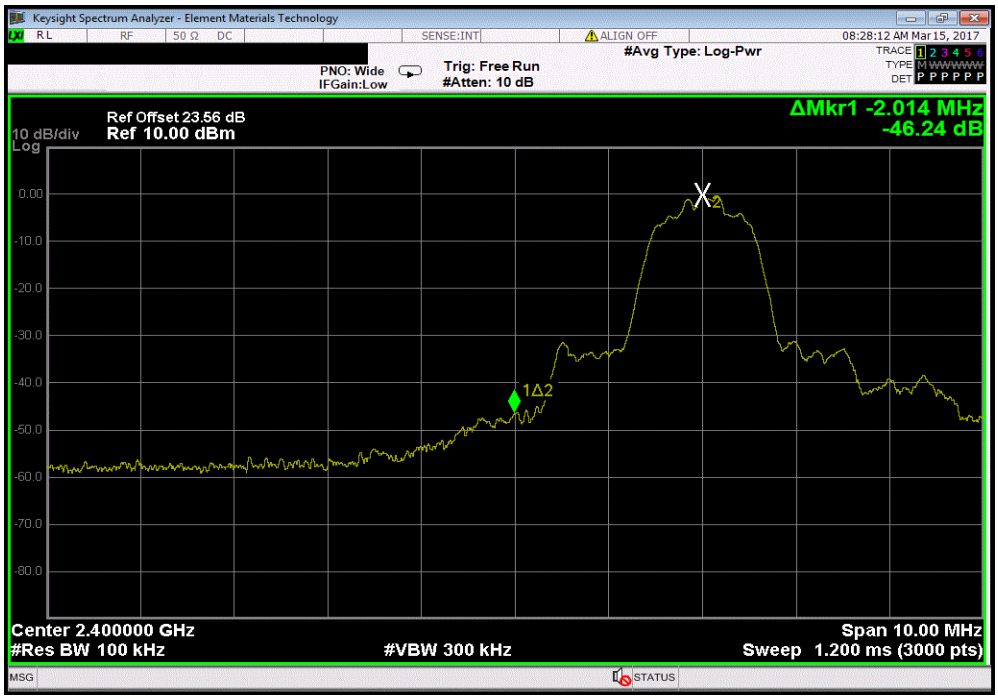


DH5, GFSK, High Channel 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-46.98	-20	Pass

BAND EDGE COMPLIANCE

TbtTx 2017.01.27 XMit 2017.01.26

2DH5, pi/4-DQPSK, Low Channel 2402 MHz							
					Value (dBc)	Limit ≤ (dBc)	Result
					-46.24	-20	Pass

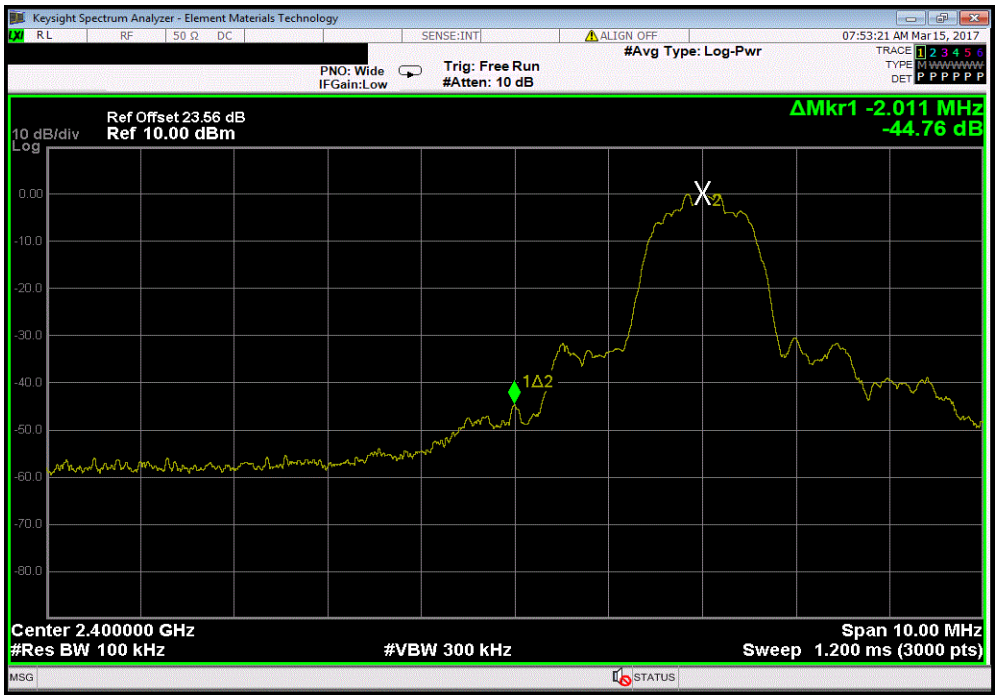


2DH5, pi/4-DQPSK, High Channel 2480 MHz							
					Value (dBc)	Limit ≤ (dBc)	Result
					-44.06	-20	Pass

BAND EDGE COMPLIANCE

TbtTx 2017.01.27 XMit 2017.01.26

3DH5, 8-DPSK, Low Channel 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-44.76	-20	Pass



3DH5, 8-DPSK, High Channel 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-45.8	-20	Pass

BAND EDGE COMPLIANCE - HOPPING MODE

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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

TbtTx 2017.01.27 XMit 2017.01.26

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.6 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	47.2% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

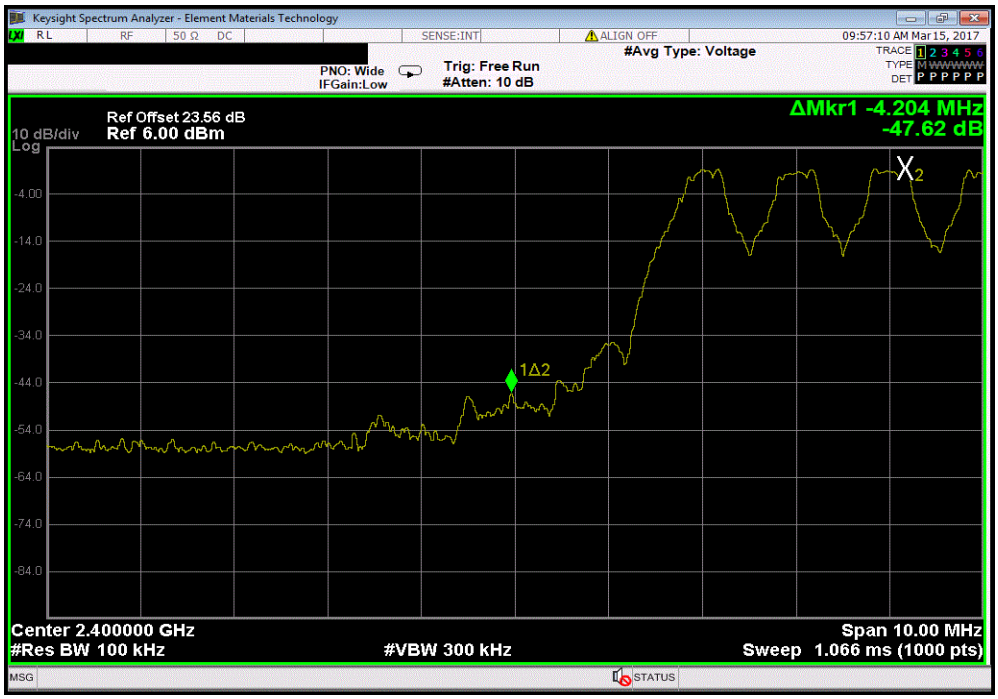
Configuration #	1	Signature

		Value (dBc)	Limit ≤ (dBc)	Result
Hopping Mode				
	DH5, GFSK			
	Low Channel, 2402 MHz	-47.62	-20	Pass
	High Channel, 2480 MHz	-56.58	-20	Pass
	2DH5, pi/4-DQPSK			
	Low Channel, 2402 MHz	-47.49	-20	Pass
	High Channel, 2480 MHz	-45.59	-20	Pass
	3DH5, 8-DPSK			
	Low Channel, 2402 MHz	-48.68	-20	Pass
	High Channel, 2480 MHz	-47.16	-20	Pass

BAND EDGE COMPLIANCE - HOPPING MODE

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, DH5, GFSK, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-47.62	-20	Pass

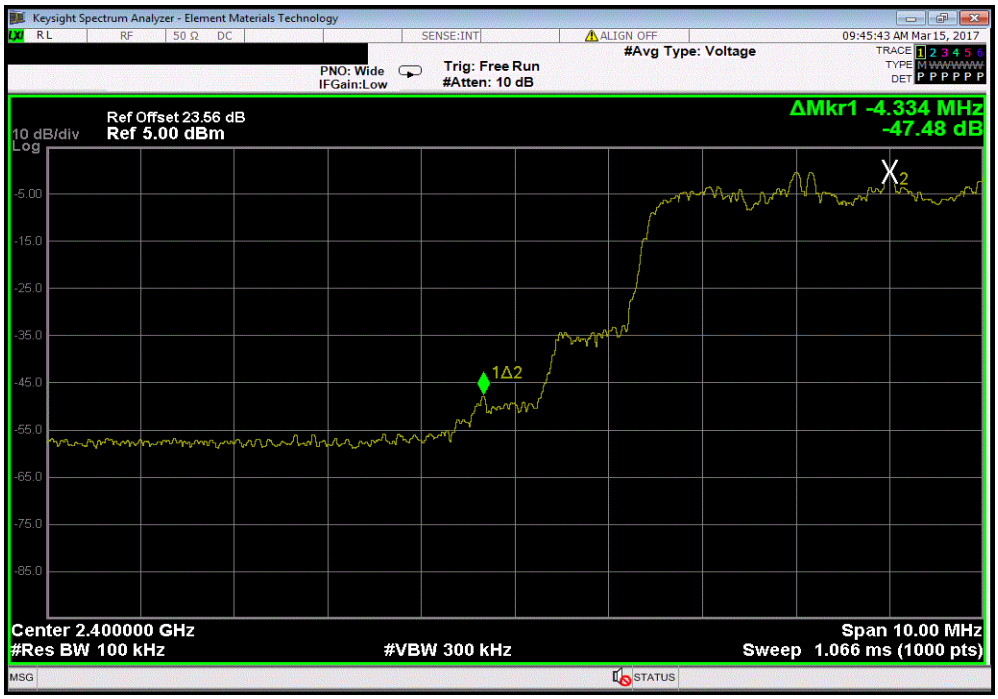


Hopping Mode, DH5, GFSK, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-56.58	-20	Pass

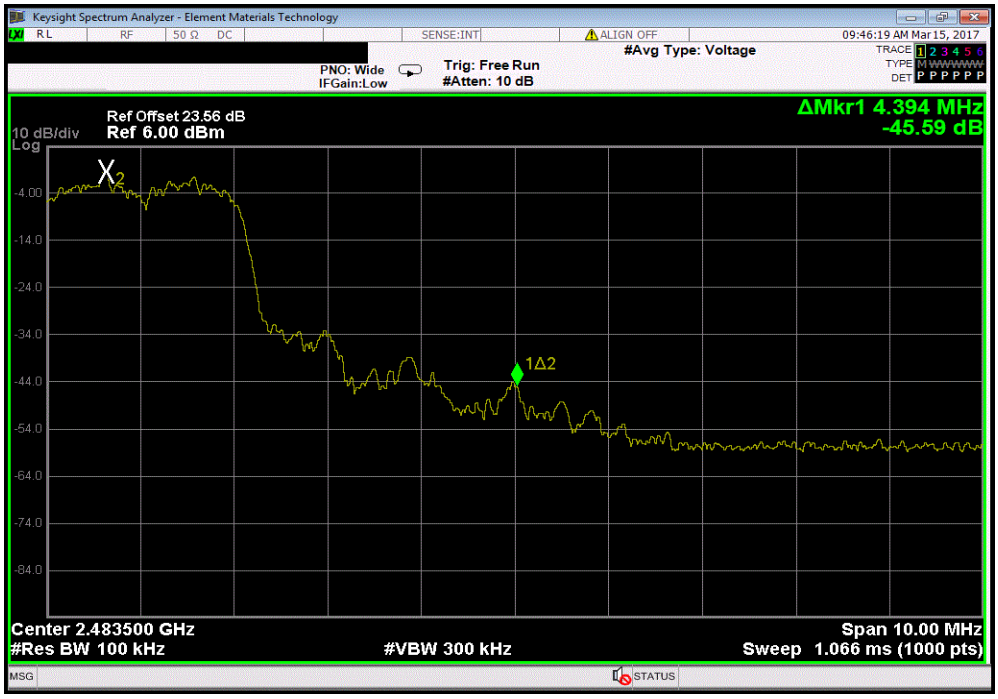
BAND EDGE COMPLIANCE - HOPPING MODE

TbtTx 2017.01.27 XMit 2017.01.26

Hopping Mode, 2DH5, pi/4-DQPSK, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-47.49	-20	Pass

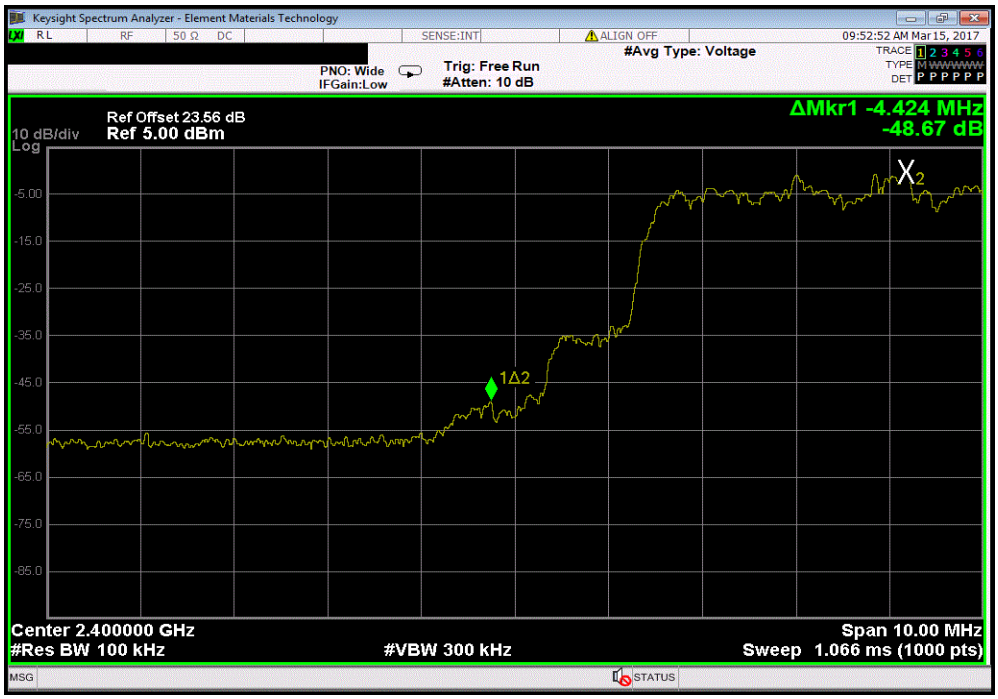


Hopping Mode, 2DH5, pi/4-DQPSK, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-45.59	-20	Pass



BAND EDGE COMPLIANCE - HOPPING MODE

Hopping Mode, 3DH5, 8-DPSK, Low Channel, 2402 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-48.68	-20	Pass



Hopping Mode, 3DH5, 8-DPSK, High Channel, 2480 MHz						
				Value (dBc)	Limit ≤ (dBc)	Result
				-47.16	-20	Pass

OCCUPIED BANDWIDTH

XMit 2017.09.21

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
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	13-Apr-17	13-Apr-18
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	30-May-17	30-May-18
Attenuator	S.M. Electronics	SA26B-20	AUY	30-May-17	30-May-18
Block - DC	Fairview Microwave	SD3379	AMQ	NCR	NCR
Generator - Signal	Keysight	N5182B	TFU	27-Oct-15	27-Oct-18

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 2017.01.27 XMit 2017.09.21

EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	10058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation Ed Katz and Yevgeniy Murzagildin			**Temperature:**	23.9 °C
Attendees:	Ed Katz			**Humidity:**	46.8% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0 VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	Test Method
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

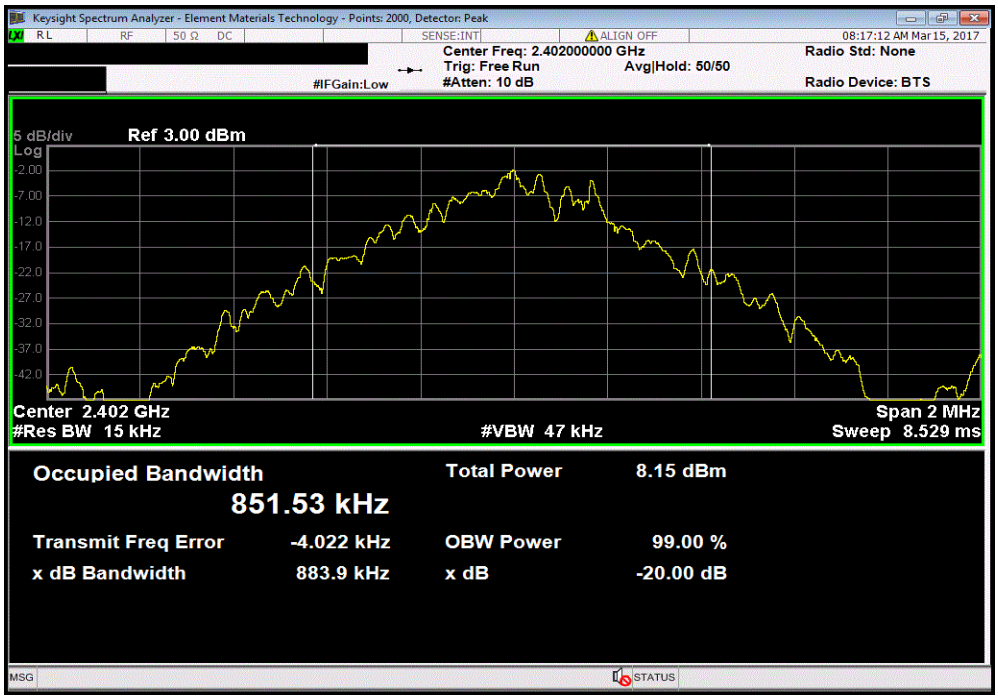
Configuration #	1	Signature

		Value	Limit (<)	Result
DH5, GFSK				
	Low Channel 2402 MHz	883.938 kHz	1.5 MHz	Pass
	Mid Channel 2441 MHz	919.115 kHz	1.5 MHz	Pass
	High Channel 2480 MHz	921.381 kHz	1.5 MHz	Pass
2DH5, pi/4-DQPSK				
	Low Channel 2402 MHz	1.206 MHz	1.5 MHz	Pass
	Mid Channel 2441 MHz	1.205 MHz	1.5 MHz	Pass
	High Channel 2480 MHz	1.205 MHz	1.5 MHz	Pass
3DH5, 8-DPSK				
	Low Channel 2402 MHz	1.25 MHz	1.5 MHz	Pass
	Mid Channel 2441 MHz	1.251 MHz	1.5 MHz	Pass
	High Channel 2480 MHz	1.251 MHz	1.5 MHz	Pass

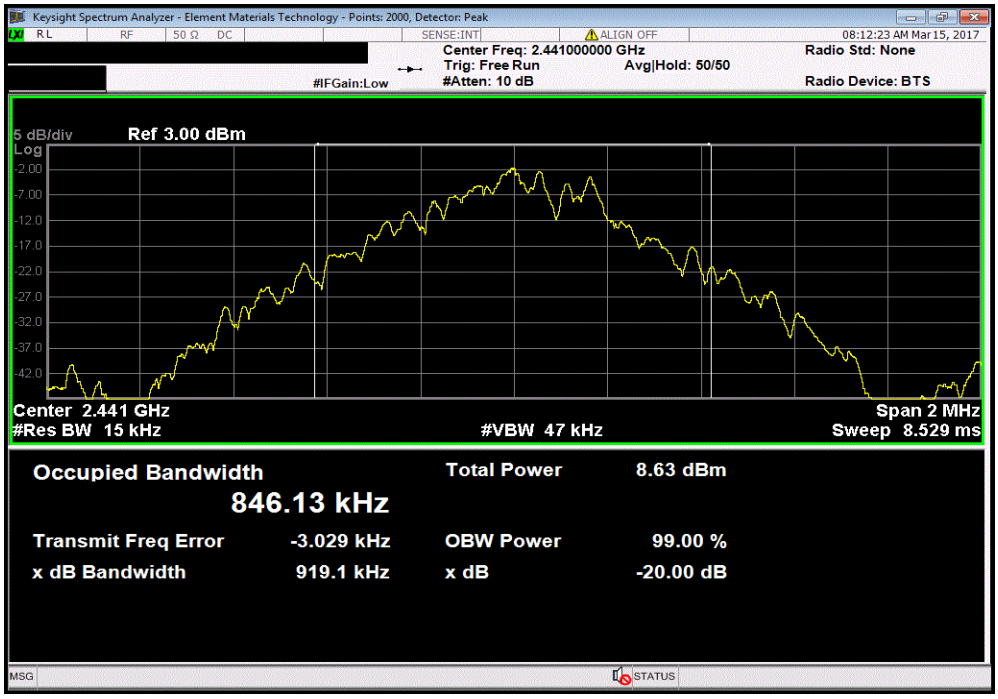
OCCUPIED BANDWIDTH

TbtTx 2017.01.27 XMit 2017.09.21

DH5, GFSK, Low Channel 2402 MHz						
				Value	Limit (<)	Result
				883.938 kHz	1.5 MHz	Pass



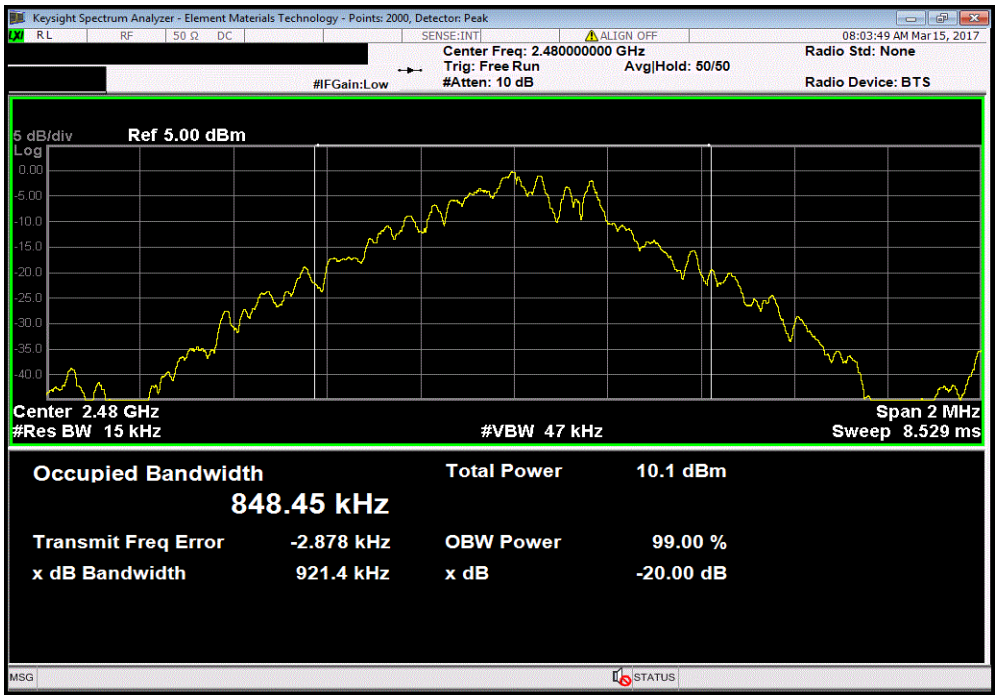
DH5, GFSK, Mid Channel 2441 MHz						
				Value	Limit (<)	Result
				919.115 kHz	1.5 MHz	Pass



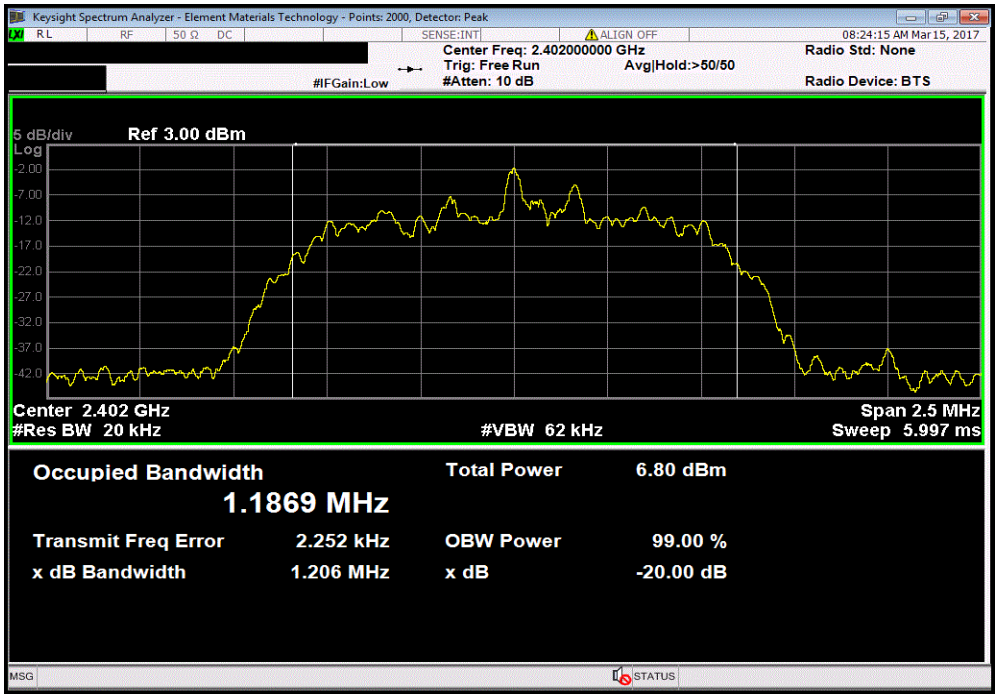
OCCUPIED BANDWIDTH

TbtTx 2017.01.27 XMit 2017.09.21

DH5, GFSK, High Channel 2480 MHz						
				Value	Limit (<)	Result
				921.381 kHz	1.5 MHz	Pass



2DH5, pi/4-DQPSK, Low Channel 2402 MHz						
				Value	Limit (<)	Result
				1.206 MHz	1.5 MHz	Pass



OCCUPIED BANDWIDTH

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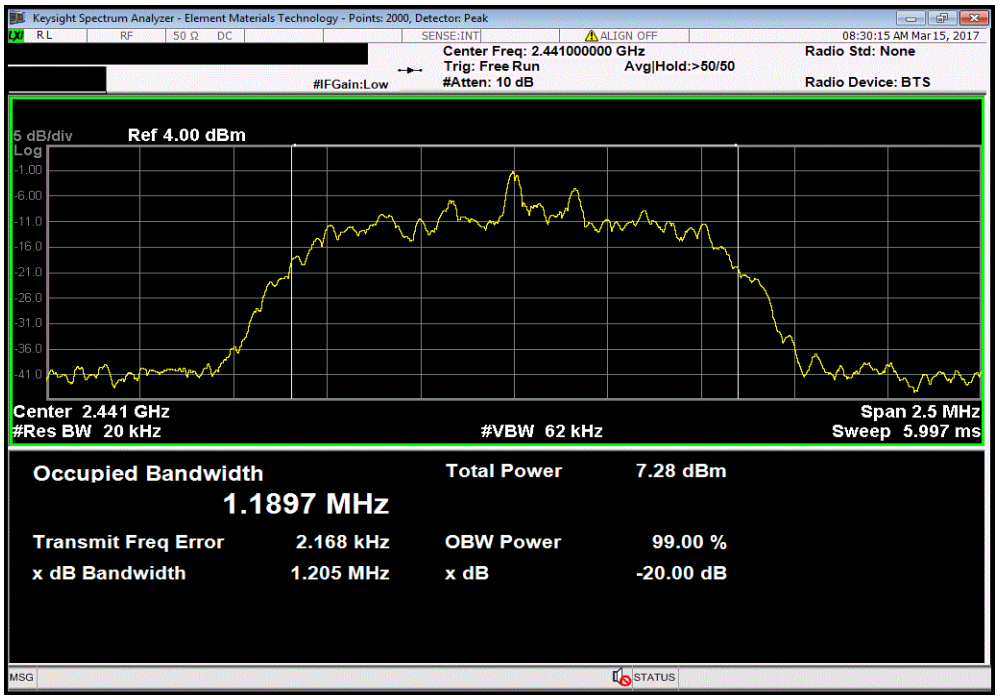
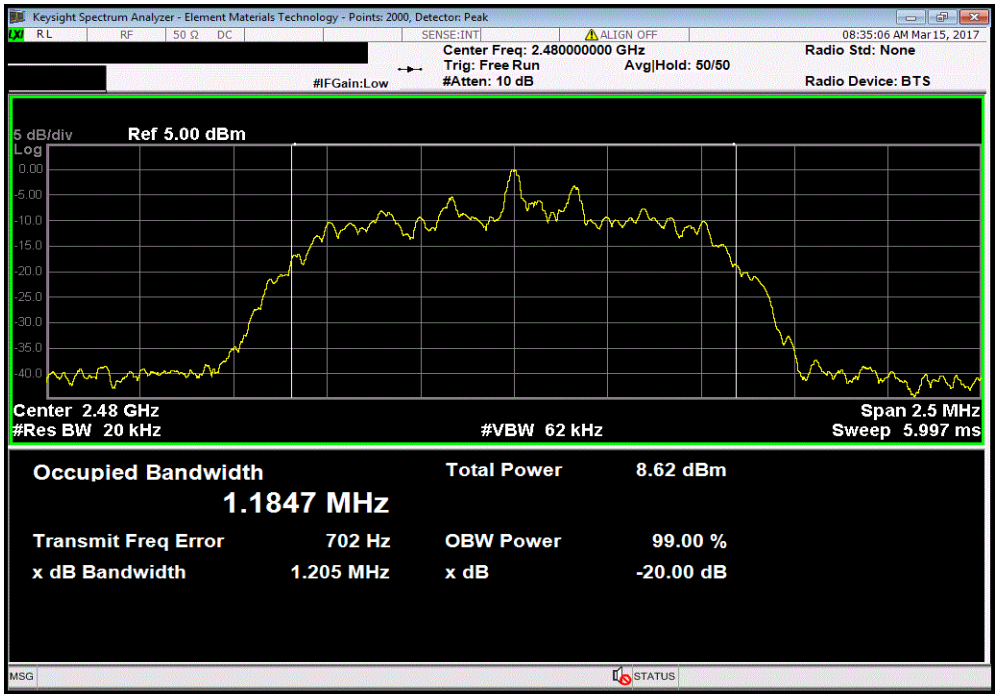
2DH5, pi/4-DQPSK, Mid Channel 2441 MHz						
				Value	Limit (<)	Result
				1.205 MHz	1.5 MHz	Pass



2DH5, pi/4-DQPSK, High Channel 2480 MHz						
				Value	Limit (<)	Result
				1.205 MHz	1.5 MHz	Pass



OCCUPIED BANDWIDTH

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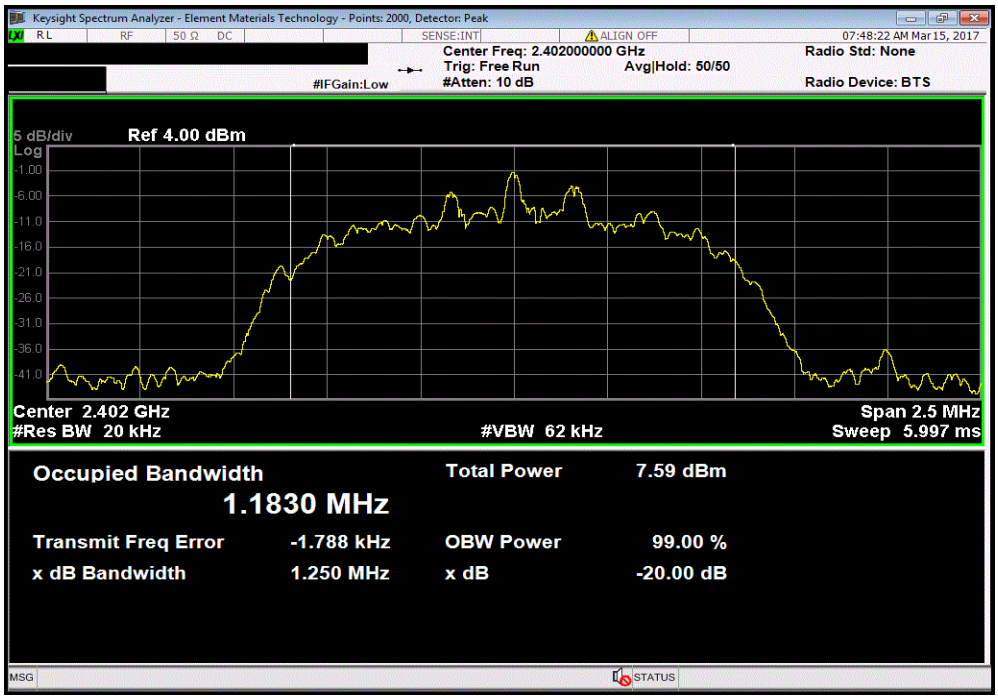
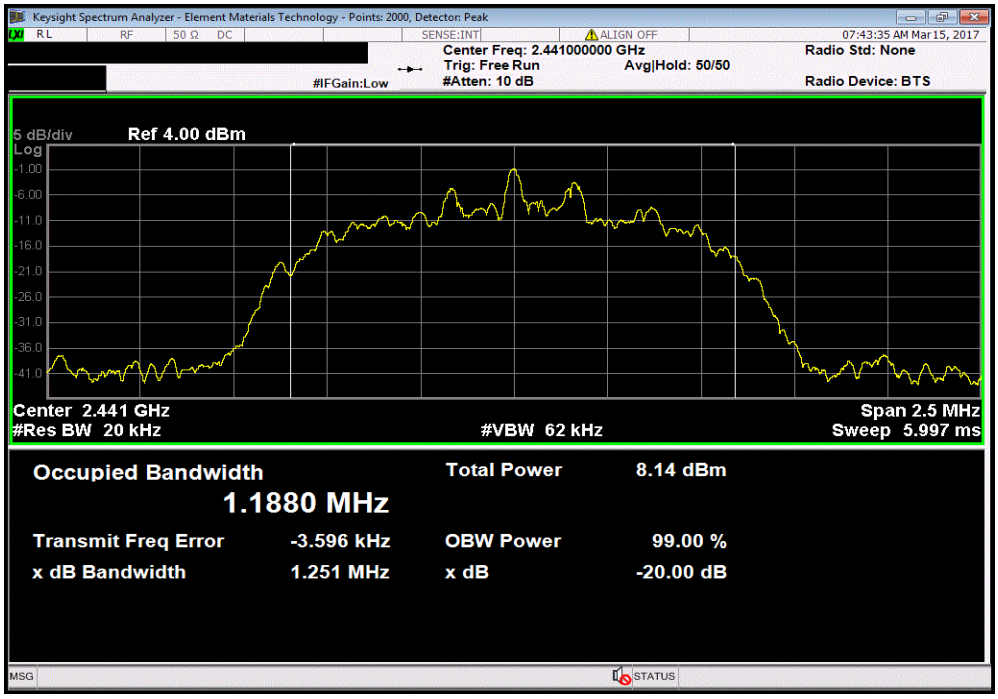
3DH5, 8-DPSK, Low Channel 2402 MHz						
				Value	Limit (<)	Result
				1.25 MHz	1.5 MHz	Pass



3DH5, 8-DPSK, Mid Channel 2441 MHz						
				Value	Limit (<)	Result
				1.251 MHz	1.5 MHz	Pass



OCCUPIED BANDWIDTH

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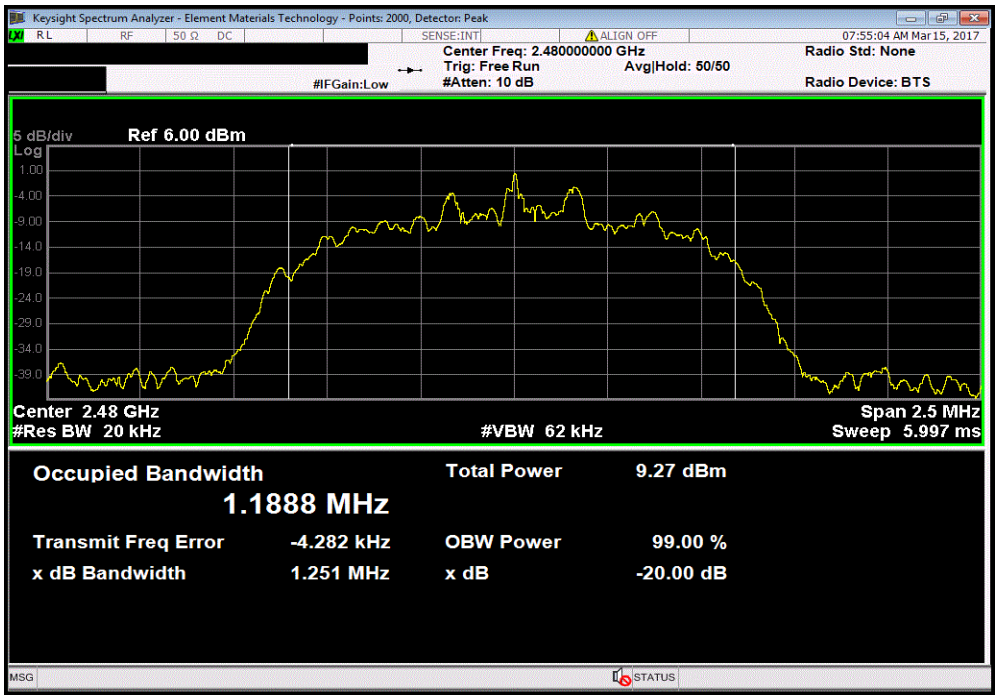
3DH5, 8-DPSK, High Channel 2480 MHz						
				Value	Limit (<)	Result
				1.251 MHz	1.5 MHz	Pass



SPURIOUS CONDUCTED EMISSIONS

XMit 2017.01.26

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Keysight	N5182B	TFU	10/27/2015	10/27/2018
Block - DC	Fairview Microwave	SD3379	AMQ	6/8/2016	6/8/2017
Attenuator	S.M. Electronics	SA26B-20	AUY	6/27/2016	6/27/2017
Cable	Micro-Coax	UFD150A-1-0720-200200	EVH	6/7/2016	6/7/2017
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	4/11/2016	4/11/2017

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

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EUT:	Zulu 3			**Work Order:**	LISA0043
Serial Number:	100058479			**Date:**	03/14/17
Customer:	LightSpeed Aviation			**Temperature:**	23.9 °C
Attendees:	Ed Katz and Yevgeniy Murzagildin			**Humidity:**	46.7% RH
Project:	None			**Barometric Pres.:**	1018 mbar
Tested by:	Jeff Alcoke and Brandon Hobbs	**Power:**	3.0VDC (Battery)	**Job Site:**	EV06

TEST SPECIFICATIONS	**Test Method**
FCC 15.247:2017	ANSI C63.10:2013

COMMENTS

None

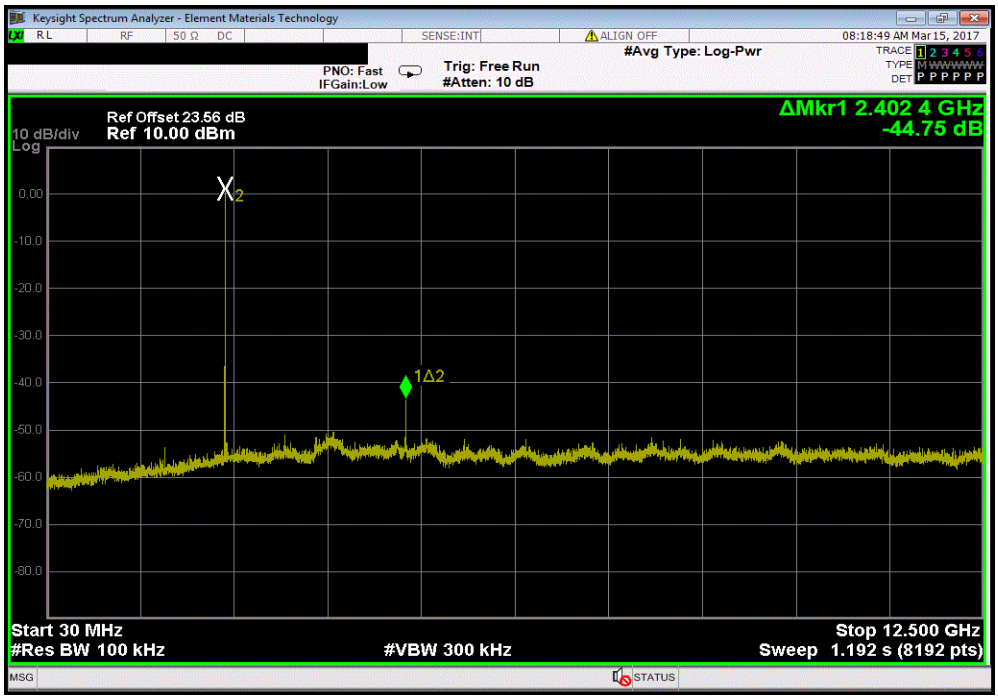
DEVIATIONS FROM TEST STANDARD

None

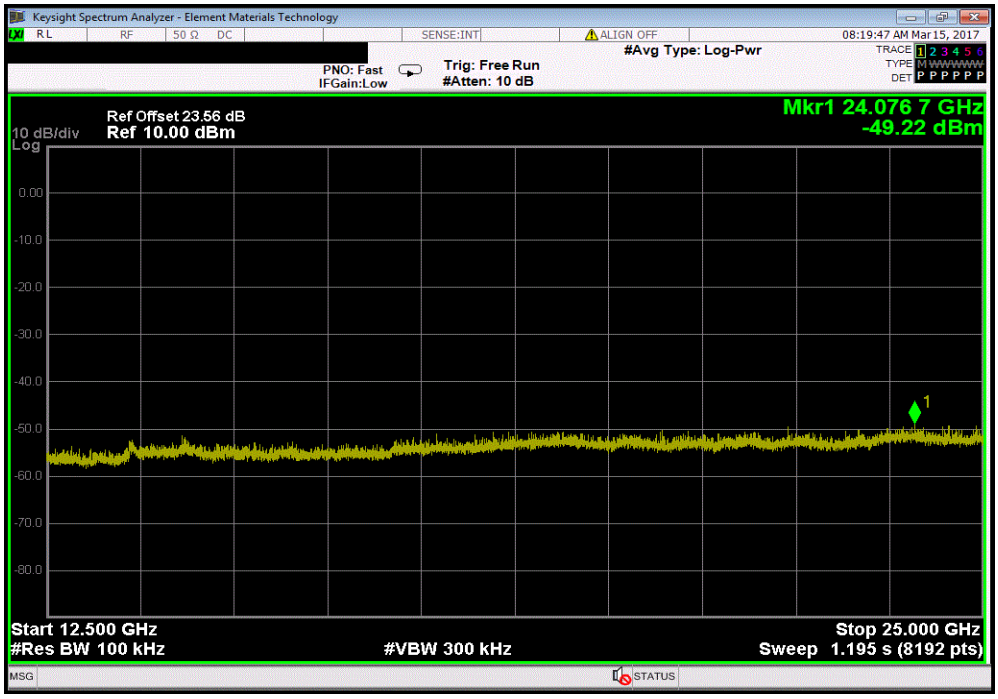
Configuration #	1	*Signature*

		Frequency Range	Max Value (dBc)	Limit ≤ (dBc)	Result
DH5, GFSK					
	Low Channel 2402 MHz	30 MHz - 12.5 GHz	-44.75	-20	Pass
	Low Channel 2402 MHz	12.5 GHz - 25 GHz	-50.35	-20	Pass
	Mid Channel 2441 MHz	30 MHz - 12.5 GHz	-44.23	-20	Pass
	Mid Channel 2441 MHz	12.5 GHz - 25 GHz	-50.28	-20	Pass
	High Channel 2480 MHz	30 MHz - 12.5 GHz	-46.09	-20	Pass
	High Channel 2480 MHz	12.5 GHz - 25 GHz	-52.25	-20	Pass
2DH5, pi/4-DQPSK					
	Low Channel 2402 MHz	30 MHz - 12.5 GHz	-46.2	-20	Pass
	Low Channel 2402 MHz	12.5 GHz - 25 GHz	-45.54	-20	Pass
	Mid Channel 2441 MHz	30 MHz - 12.5 GHz	-44.57	-20	Pass
	Mid Channel 2441 MHz	12.5 GHz - 25 GHz	-48.01	-20	Pass
	High Channel 2480 MHz	30 MHz - 12.5 GHz	-47.22	-20	Pass
	High Channel 2480 MHz	12.5 GHz - 25 GHz	-46.78	-20	Pass
3DH5, 8-DPSK					
	Low Channel 2402 MHz	30 MHz - 12.5 GHz	-47.29	-20	Pass
	Low Channel 2402 MHz	12.5 GHz - 25 GHz	-48.68	-20	Pass
	Mid Channel 2441 MHz	30 MHz - 12.5 GHz	-45.6	-20	Pass
	Mid Channel 2441 MHz	12.5 GHz - 25 GHz	-49.38	-20	Pass
	High Channel 2480 MHz	30 MHz - 12.5 GHz	-45.7	-20	Pass
	High Channel 2480 MHz	12.5 GHz - 25 GHz	-47.78	-20	Pass

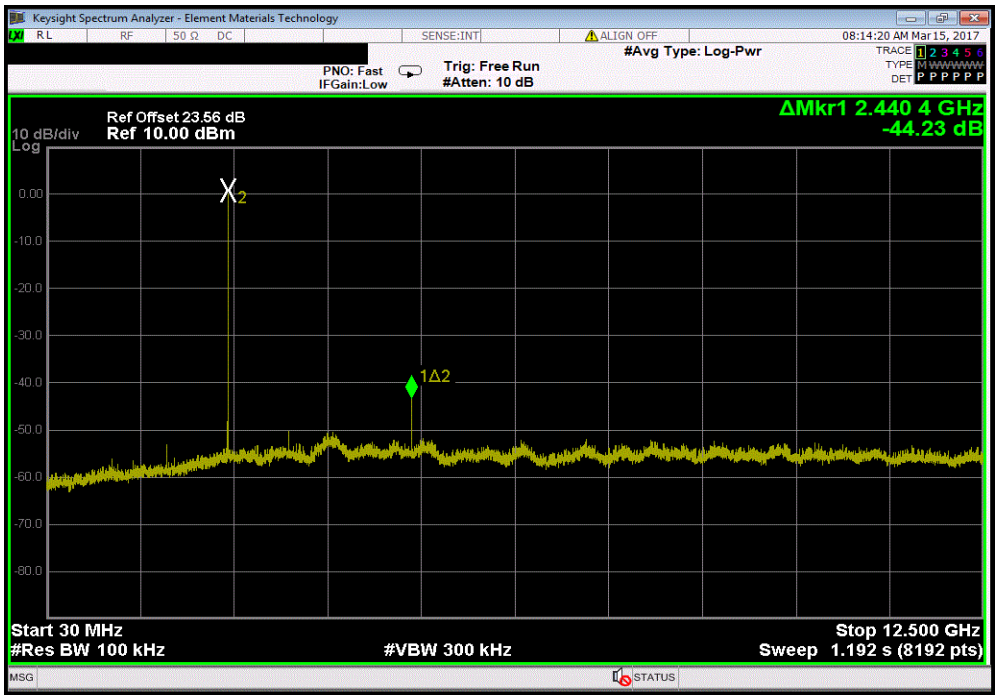
DH5, GFSK, Low Channel 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-44.75	-20	Pass



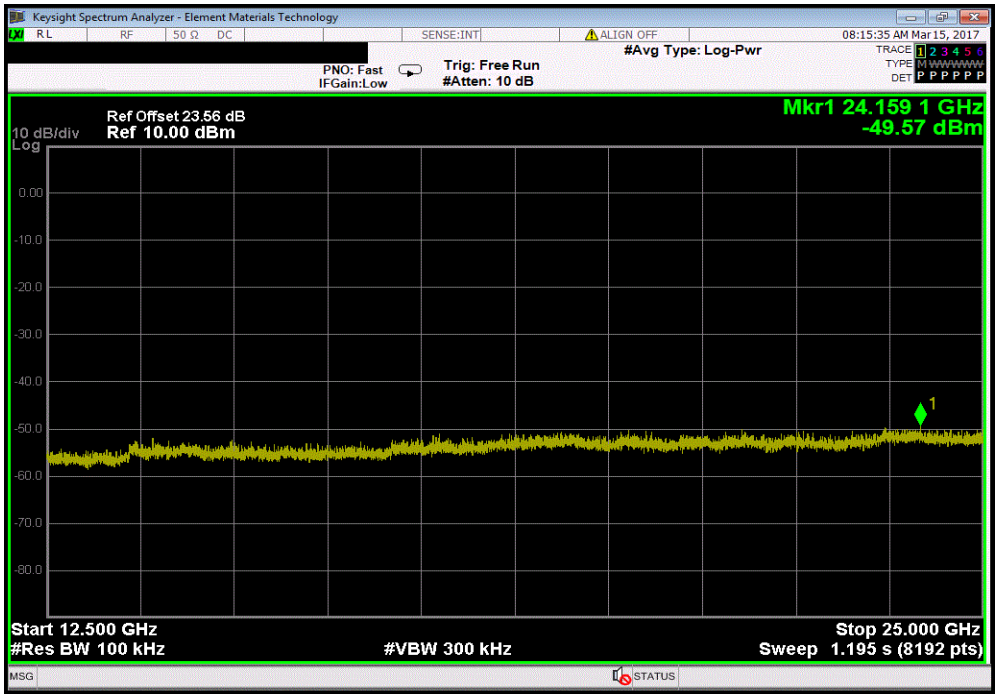
DH5, GFSK, Low Channel 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-50.35	-20	Pass



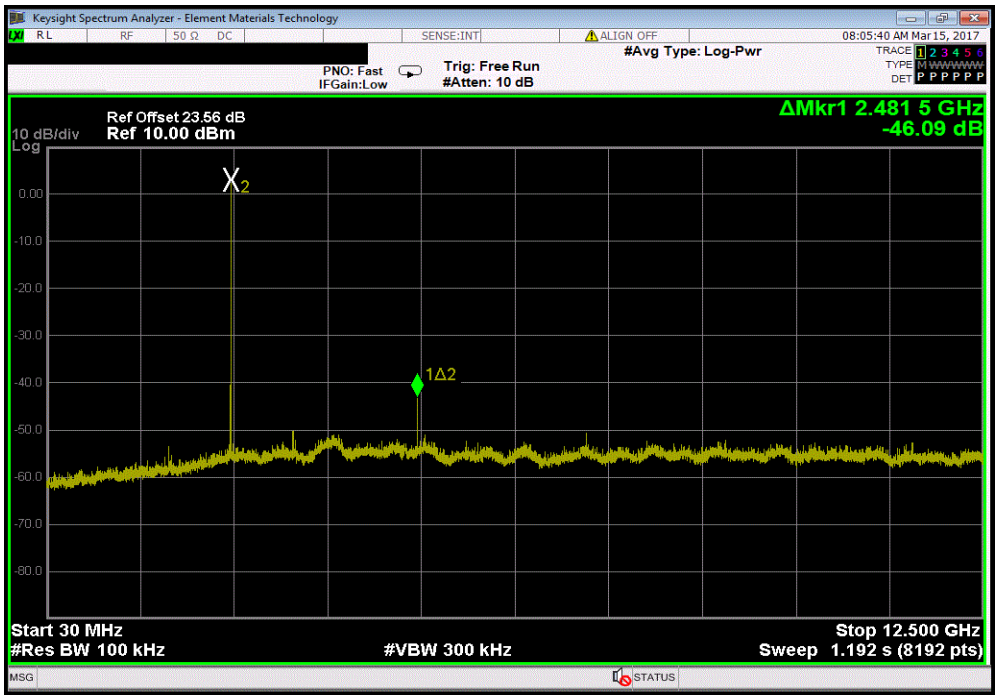
DH5, GFSK, Mid Channel 2441 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-44.23	-20	Pass



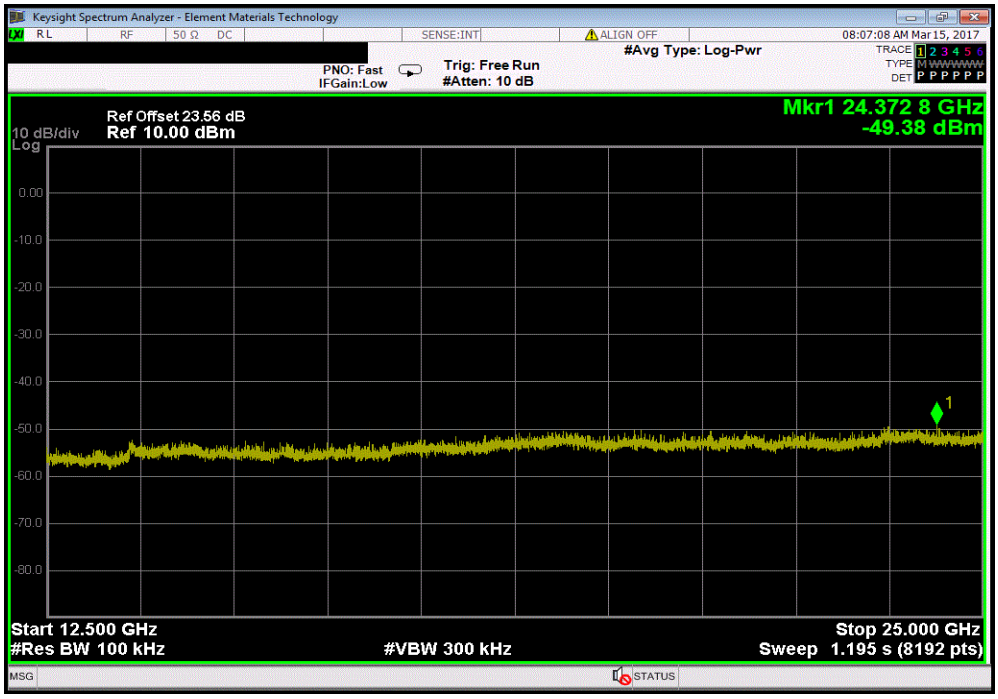
DH5, GFSK, Mid Channel 2441 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-50.28	-20	Pass



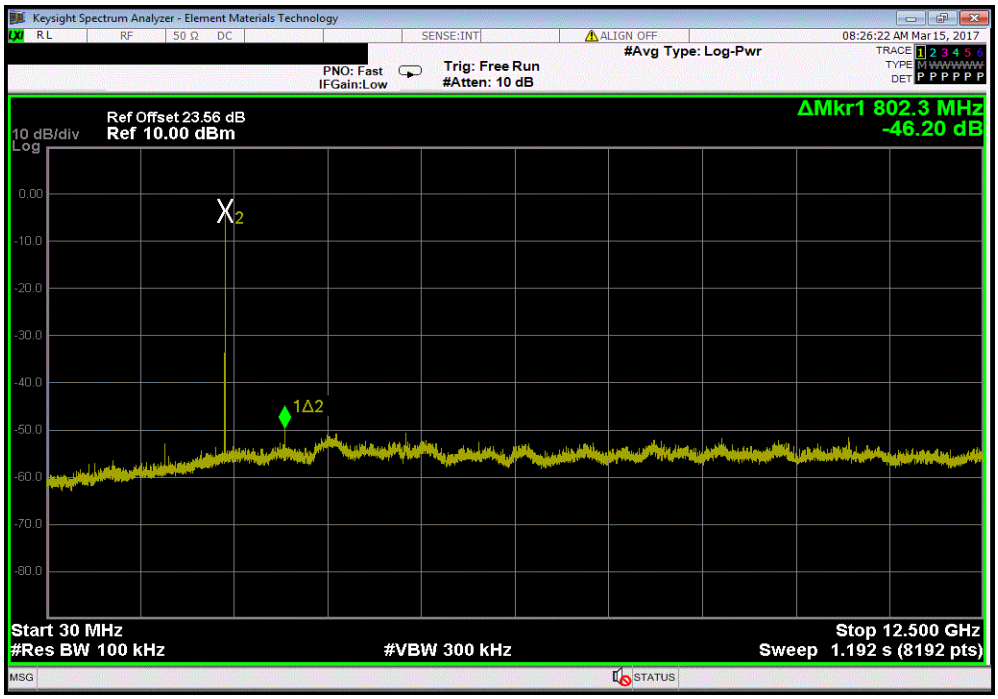
DH5, GFSK, High Channel 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-46.09	-20	Pass



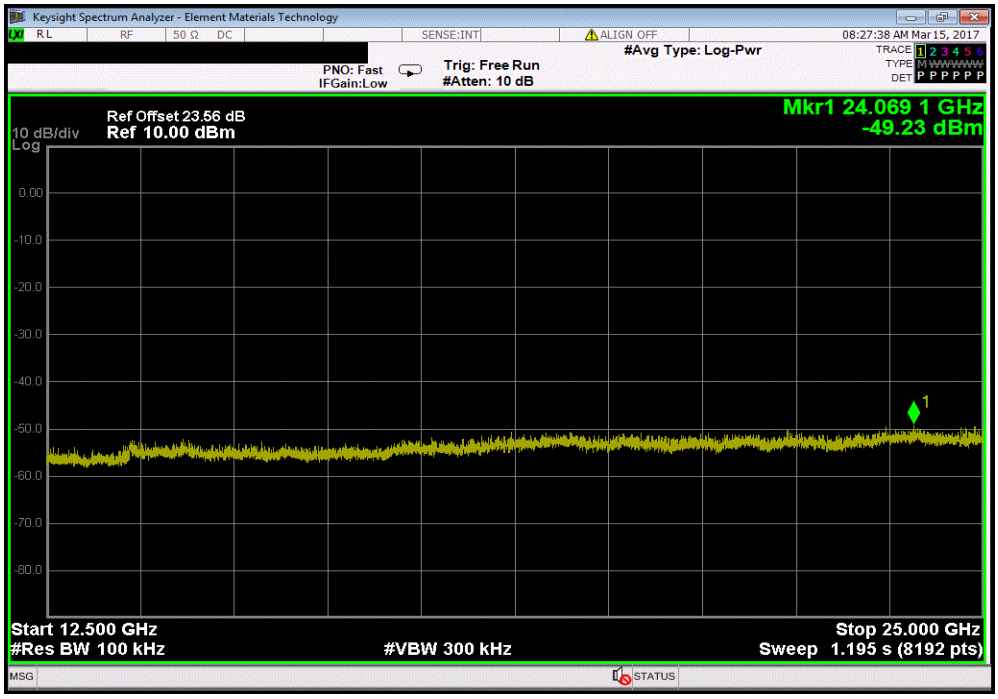
DH5, GFSK, High Channel 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-52.25	-20	Pass



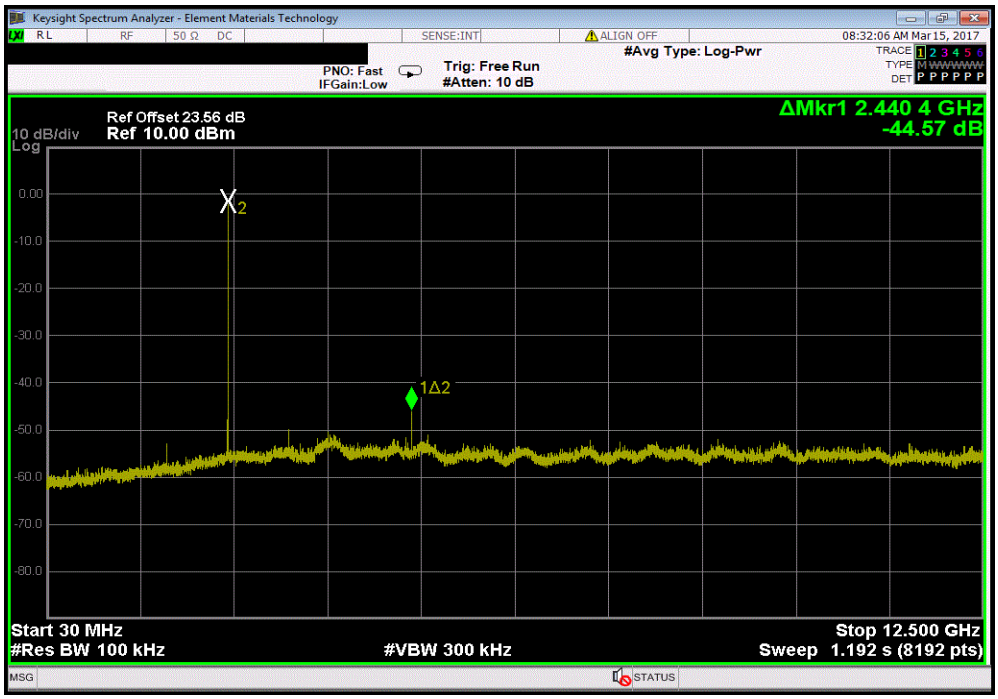
2DH5, pi/4-DQPSK, Low Channel 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-46.2	-20	Pass



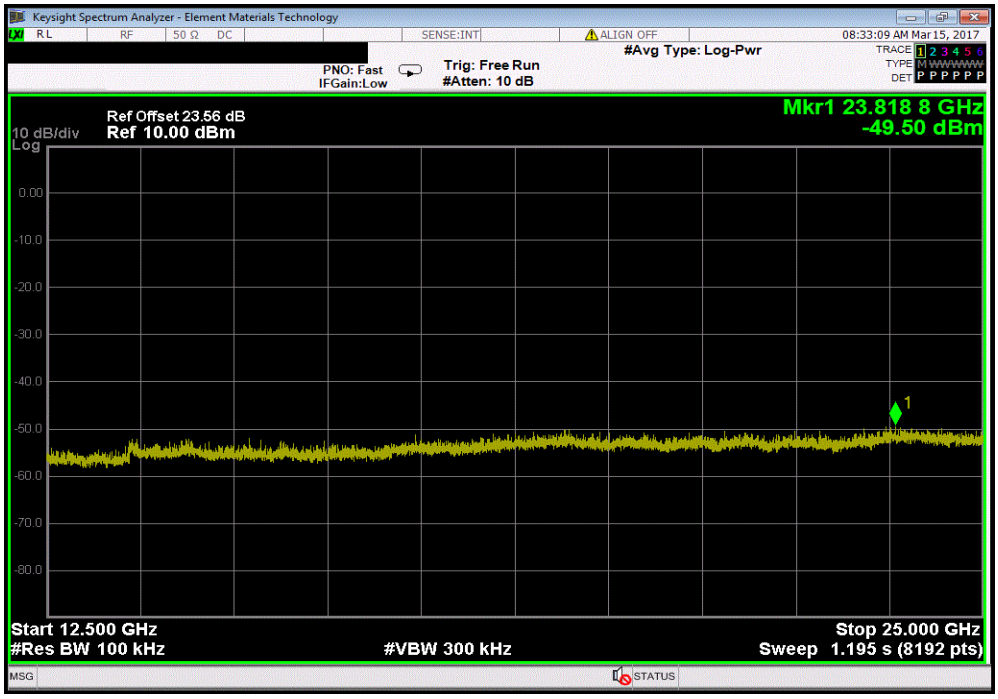
2DH5, pi/4-DQPSK, Low Channel 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-45.54	-20	Pass



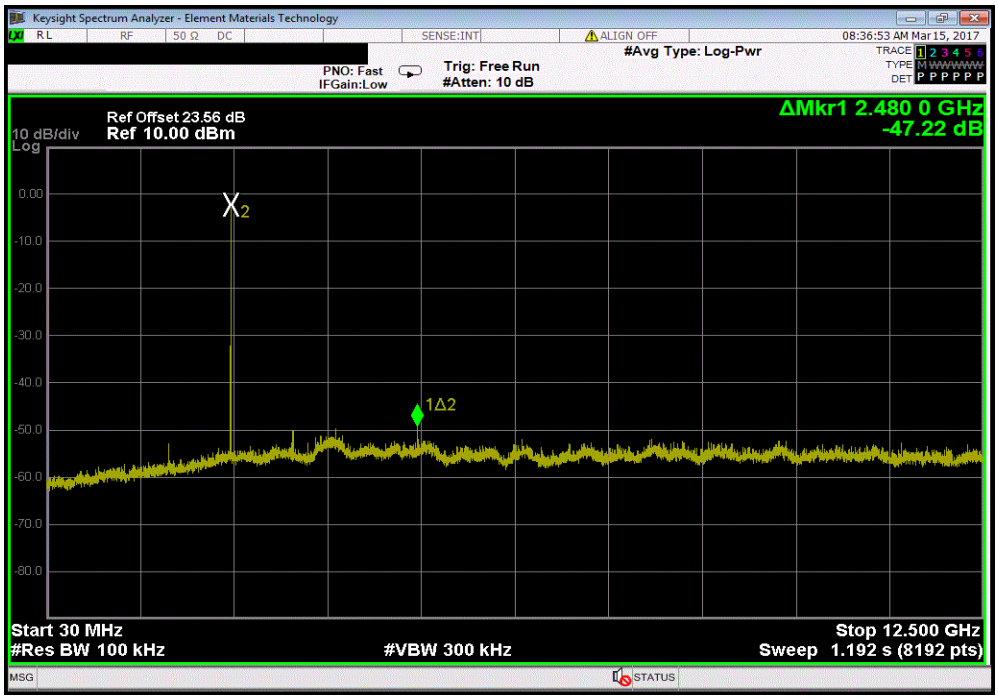
2DH5, pi/4-DQPSK, Mid Channel 2441 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-44.57	-20	Pass



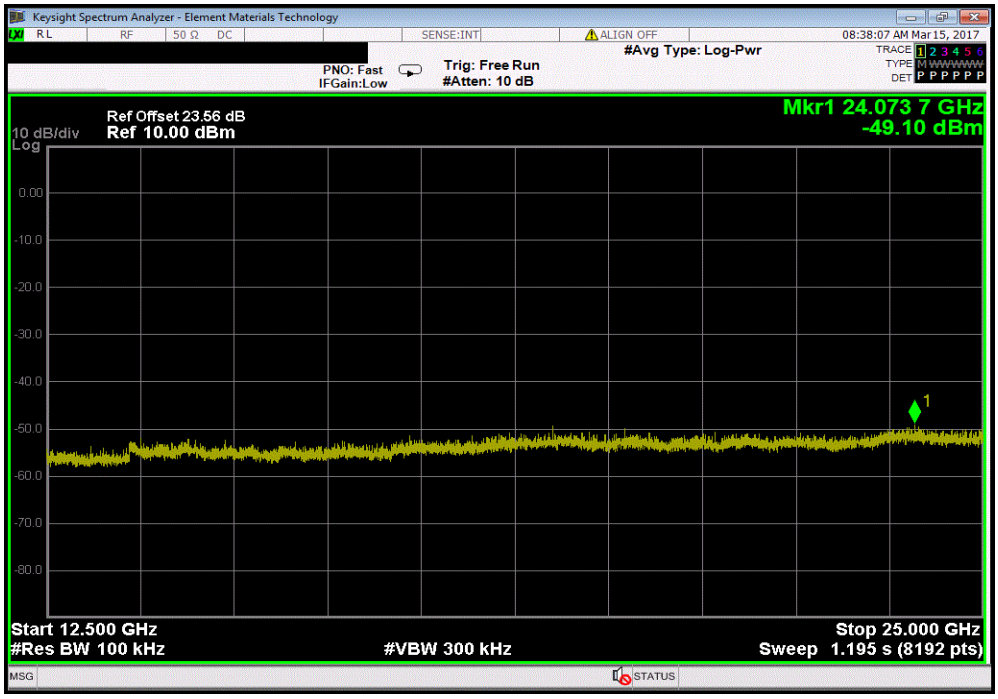
2DH5, pi/4-DQPSK, Mid Channel 2441 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-48.01	-20	Pass



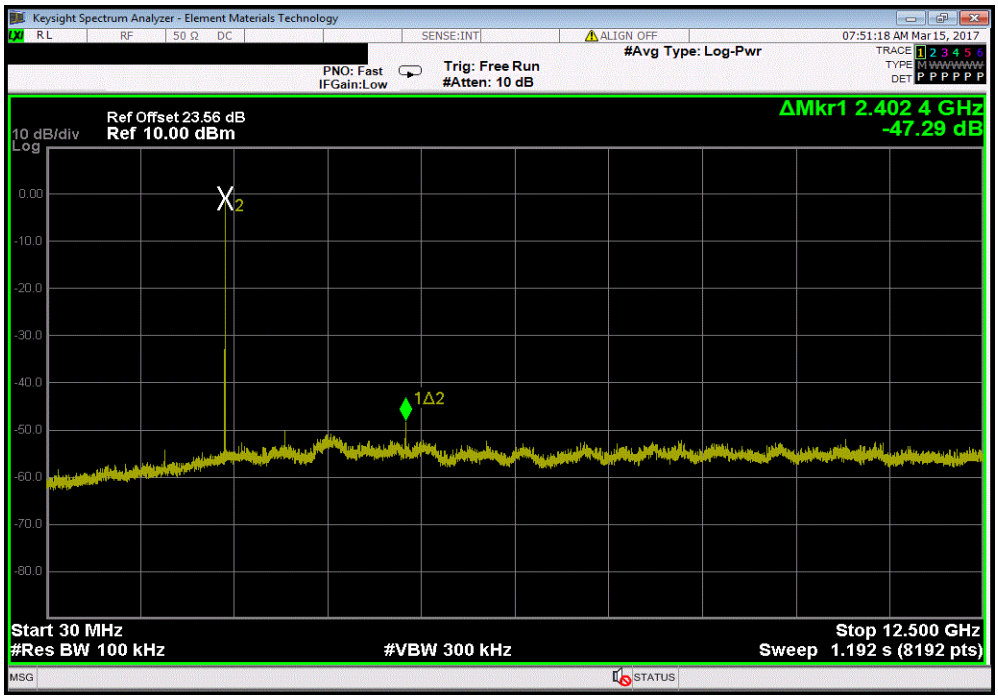
2DH5, pi/4-DQPSK, High Channel 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
30 MHz - 12.5 GHz		-47.22	-20	Pass



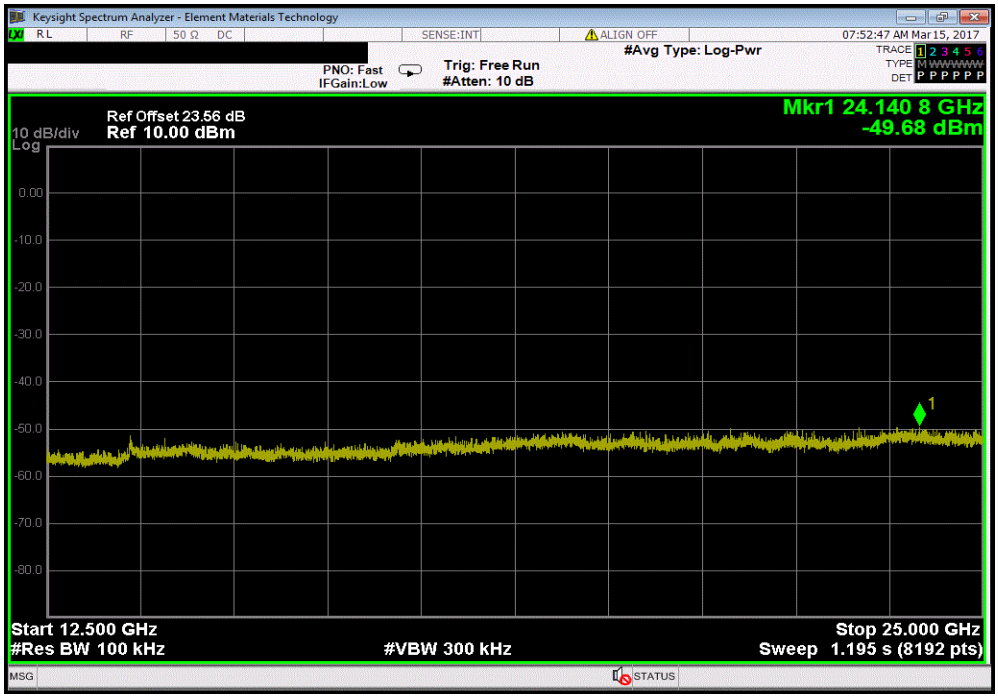
2DH5, pi/4-DQPSK, High Channel 2480 MHz				
Frequency Range		**Max Value (dBc)**	**Limit ≤ (dBc)**	**Result**
12.5 GHz - 25 GHz		-46.78	-20	Pass



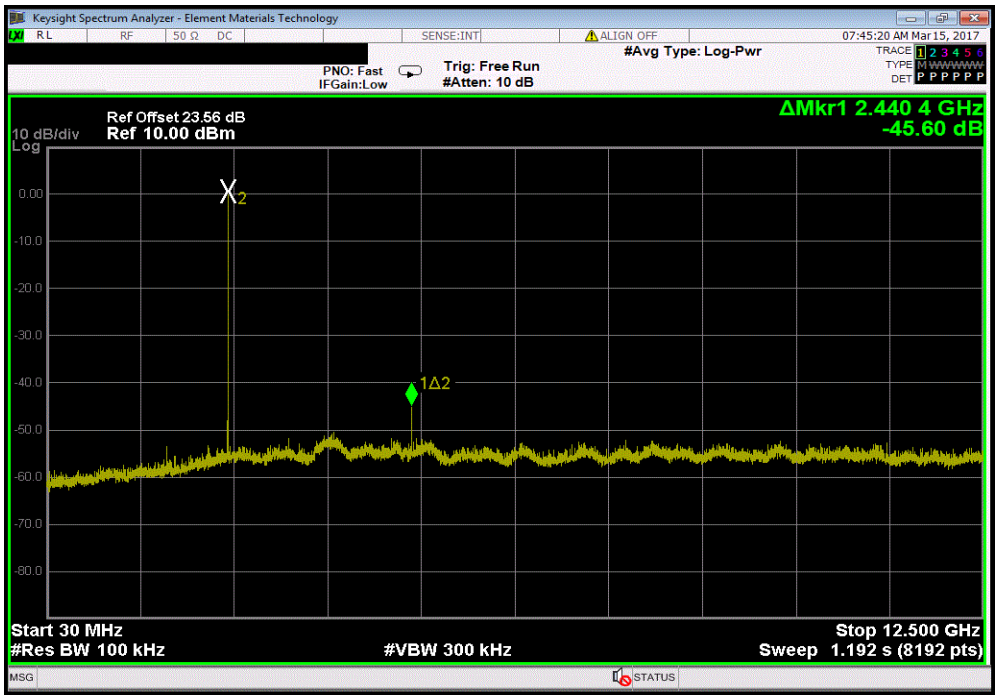
3DH5, 8-DPSK, Low Channel 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-47.29	-20	Pass



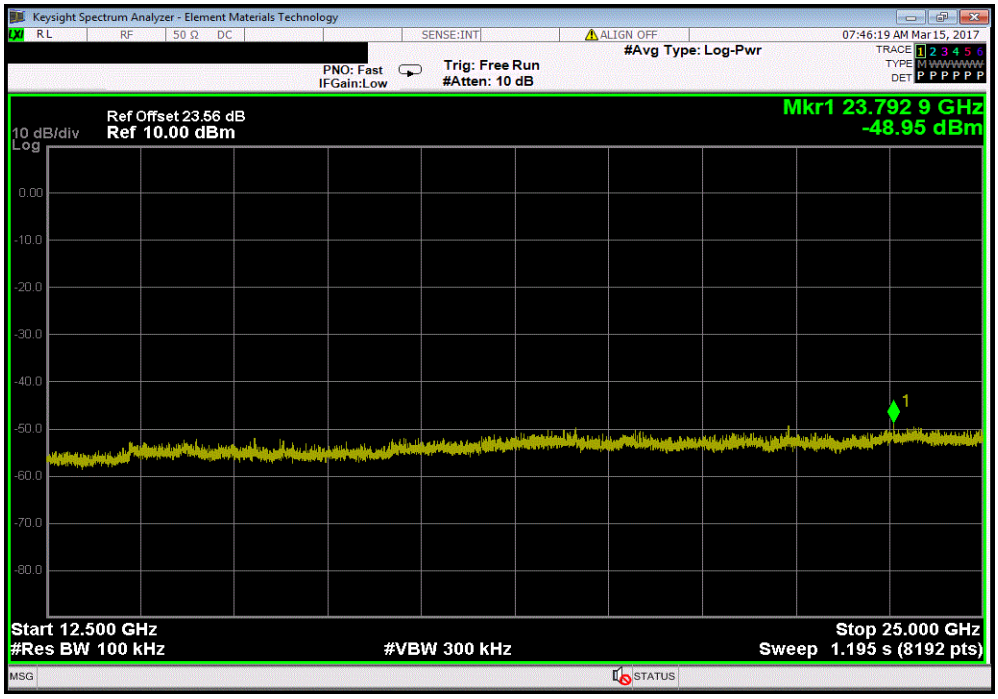
3DH5, 8-DPSK, Low Channel 2402 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-48.68	-20	Pass



3DH5, 8-DPSK, Mid Channel 2441 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-45.6	-20	Pass



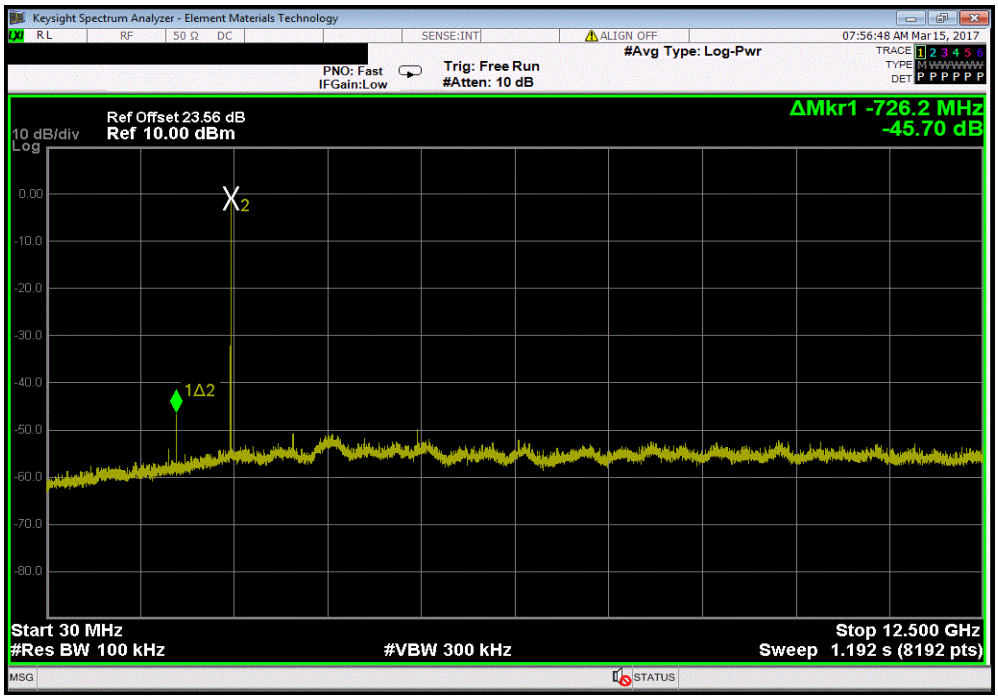
3DH5, 8-DPSK, Mid Channel 2441 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-49.38	-20	Pass



SPURIOUS CONDUCTED EMISSIONS

TbtTx 2017.01.27 XMit 2017.01.26

3DH5, 8-DPSK, High Channel 2480 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
30 MHz - 12.5 GHz		-45.7	-20	Pass



3DH5, 8-DPSK, High Channel 2480 MHz				
Frequency Range		Max Value (dBc)	Limit ≤ (dBc)	Result
12.5 GHz - 25 GHz		-47.78	-20	Pass