TSI, Incorporated

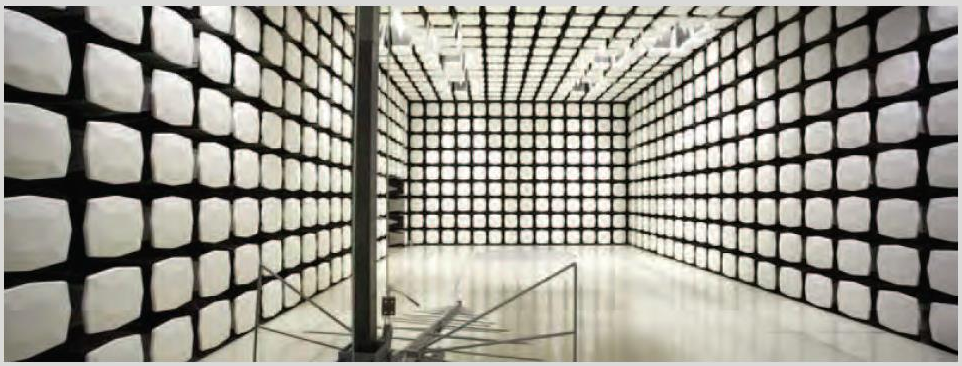
TSI Inc. OmniTrak

FCC 15.207:2023, FCC 15.247:2023

RSS-247 Issue 2:2017, RSS-Gen Issue 5:2018+A1:2019+A2:2021

Bluetooth Radio

Report: TSIN0196.3 Rev. 1, Issue Date: June 29, 2023



CERT #3310.05

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element
2023.04.17

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CERTIFICATE OF TEST

Last Date of Test: May 25, 2023
TSI, Incorporated
EUT: TSI Inc. OmniTrak

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2023	ANSI C63.10:2013, FCC KDB 558074 v05r02:2019
FCC 15.247:2023	
RSS-247 Issue 2:2017	
RSS-Gen Issue 5:2018+A1:2019+A2:2021	

Results

Test Description	Result	FCC Section(s)	RSS Section(s)	ANSI C63.10 Section(s)	Comments
Powerline Conducted Emissions	Pass	15.207	RSS-Gen 8.8	6.2	
Duty Cycle	Pass	KDB 558074 - 6.0	RSS-Gen 3.2	11.6	
DTS Bandwidth (6 dB)	Pass	15.247(a)(2), KDB 558074 - 8.2	RSS-247 5.2(a)	11.8.2	
Occupied Bandwidth (99%)	Pass	KDB 558074 - 2.1	RSS-Gen 6.7	6.9.3	
Output Power	Pass	15.247(b)(3), KDB 558074 - 8.3.1	RSS-247 5.4(d, f), RSS-Gen 6.12	11.9.1.1	
Equivalent Isotropic Radiated Power	Pass	15.247(b)(3), KDB 558074 - 8.3.1	RSS-247 5.4(d, f), RSS-Gen 6.12	11.9.1.1	
Power Spectral Density	Pass	15.247(e), KDB 558074 - 8.4	RSS-247 5.2(b)	11.10.2	
Band Edge Compliance	Pass	15.247(d), KDB 558074 - 8.5	RSS-247 5.5	11.11	
Spurious Conducted Emissions	Pass	15.247(d), KDB 558074 - 8.5	RSS-247 5.5	11.11	
Spurious Radiated Emissions	Pass	15.247(d), KDB 558074 - 8.6, 8.7	RSS-247 5.5, RSS-Gen 6.13, 8.10	11.12.1, 11.13.2, 6.5, 6.6	

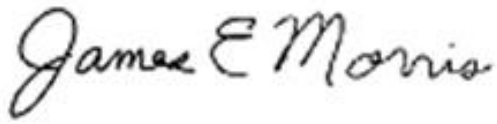
Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual 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.

CERTIFICATE OF TEST

Deviations From Test Standards

None

Approved By:



James Morris, Operations Manager

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REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
00	None		
01	Updated Certificate of Test	2023-06-29	3-4
	Updated Dates of Testing		12, 16
	Updated Configurations		14, 15
	Updated Data		22-35, 52-81, 102-110

ACCREDITATIONS AND AUTHORIZATIONS

element
2021.09.01

United States

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

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

Canada

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

European Union

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

United Kingdom

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

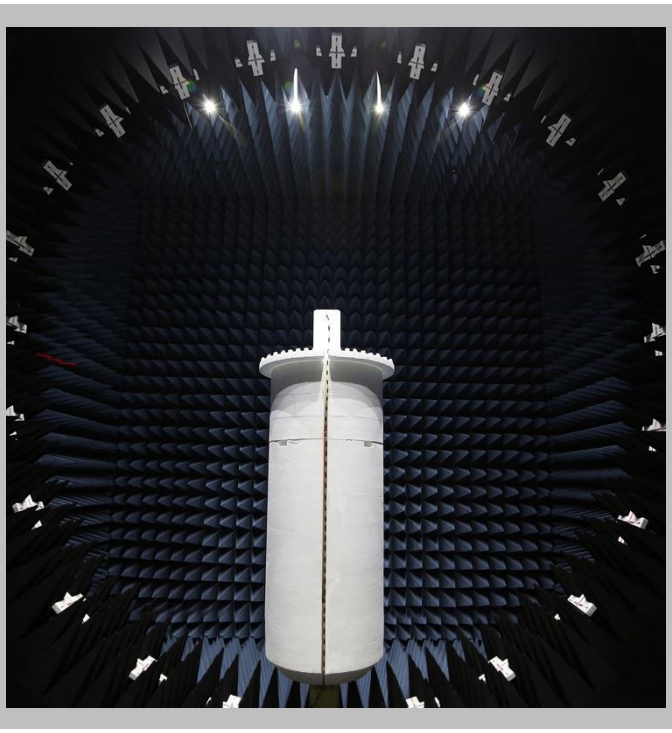
For details on the Scopes of our Accreditations, please visit:

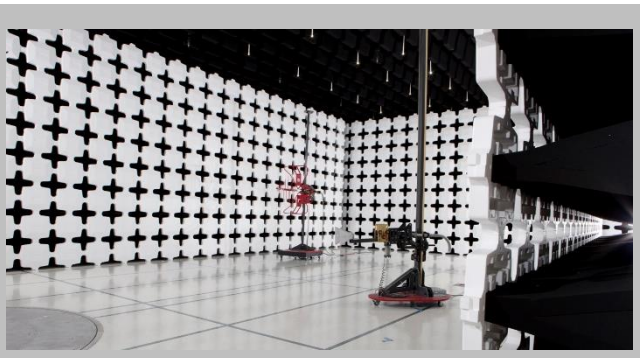
California Minnesota Oregon Texas Washington

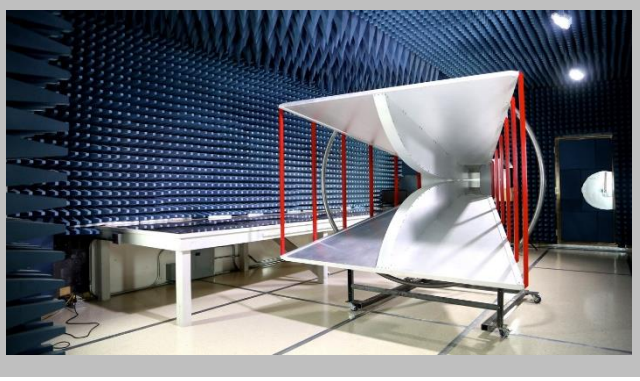
FACILITIES

element
2020.12.15

California	Minnesota	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-11 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
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157







MEASUREMENT UNCERTAINTY

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 in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

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

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	3.2 dB	-3.2 dB

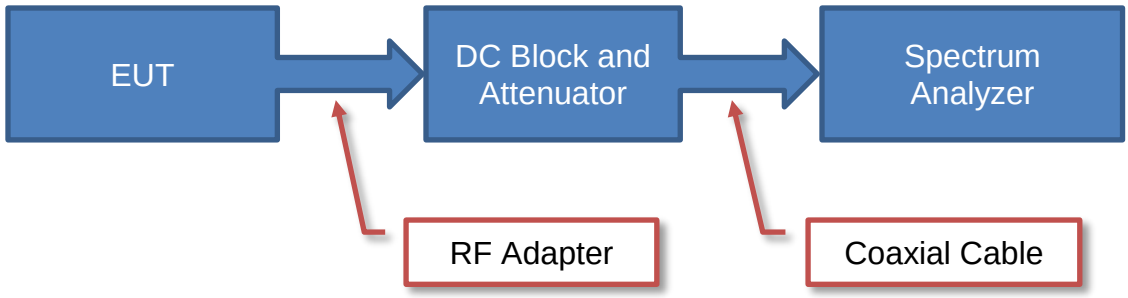
TEST SETUP BLOCK DIAGRAMS

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

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

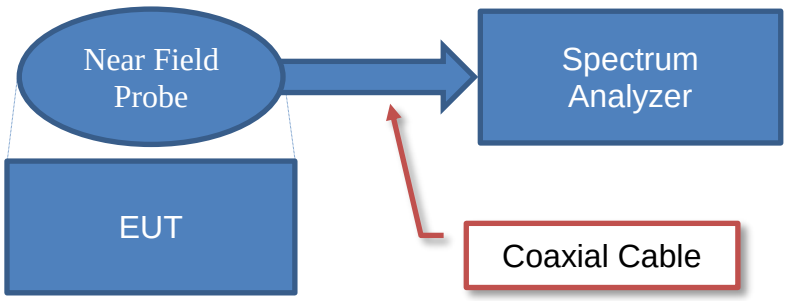
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

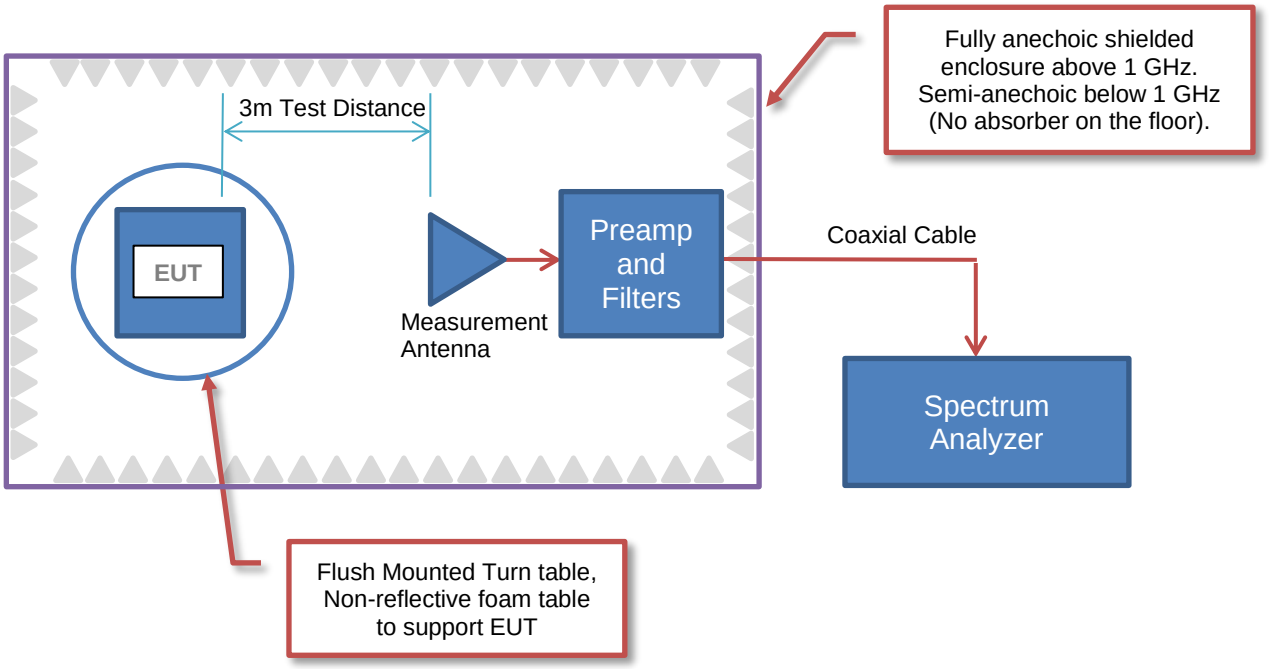


Sample Calculation (logarithmic units)

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

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)		Factor: Antenna Factor		Factor: Cable Factor		Factor: Amplifier Gain		Distance Adjustment Factor		External Attenuation		Field Strength
42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0	=	**33.5**

Conducted Emissions:

Measured Level (Amplitude)		Factor: Transducer Factor		Factor: Cable Factor		External Attenuation		Adjusted Level
26.7	+	0.3	+	0.1	+	20.0	=	**47.1**

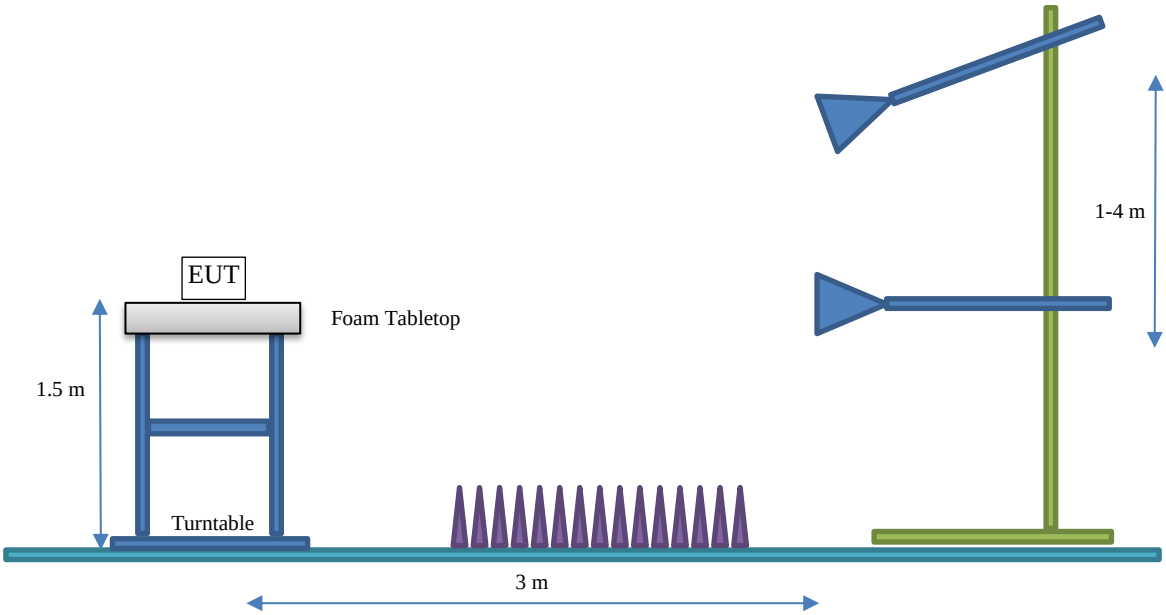
Radiated Power (ERP/EIRP) – Substitution Method:

Measured Level into Substitution Antenna (Amplitude dBm)		Substitution Antenna Factor (dBi)		EIRP to ERP (if applicable)		Measured power (dBm ERP/EIRP)
10.0	+	6.0	-	2.15	=	**13.9/16.0**

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

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



PRODUCT DESCRIPTION

Client and Equipment under Test (EUT) Information

Company Name:	TSI, Incorporated
Address:	500 Cardigan Road
City, State, Zip:	Shoreview, MN 55126
Test Requested By:	Jessica Pedersen
EUT:	TSI Inc. OmniTrak
First Date of Test:	February 20, 2023
Last Date of Test:	May 25, 2023
Receipt Date of Samples:	February 17, 2023
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 radio with 1 antenna type and 1 antenna port

Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247/RSS-247 requirements.

POWER SETTINGS AND ANTENNAS

The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information. The power settings below reflect the maximum power that the EUT is allowed to transmit at during normal operation.

ANTENNA GAIN (dBi)

Type	Provided by:	Frequency Range (MHz)	Gain (dBi)
Sward ST1714A-1B2-A (Flex Antenna)	Sward	2400-2483.5	0.17

The EUT was tested using the power settings provided by the manufacturer which were based upon:

☐ Test software settings Test software/firmware installed on EUT: sdk_nr5_v17.1.0/ble_sdk_app_dtm_serial (com port)
☒ Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types	Channel Position	Frequency Range (MHz)	Power Setting
1 Mbps, 2 Mbps, 125kbps, 500 kbps	Low, Mid, High	2400-2483.5	0 dBm

CONFIGURATIONS

Configuration TSIN0196-1

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Cradle/Phone	TSI, Incorporated	TSI-5	TSI55221200048

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Dell	Precision 3561	STD5LJML3

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Programming Cable	No	1.8m	No	Laptop	Cradle

Configuration TSIN0196-7

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Cradle/Phone	TSI, Incorporated	TSI-5	TSI55221200061

Configuration TSIN0196-12

Software/Firmware Running During Test	
Description	**Version**
Firmware	1.0.1 BLE Off

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Cradle/Phone	TSI, Incorporated	TSI-5	TSI55221200061

Peripherals in Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
USB Power Adapter	GlobTrek	WR9QA2000USBN23MDR6P	None

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Cable	No	1.8m	No	Cradle/Phone	USB Power Adapter

CONFIGURATIONS

Configuration TSIN0196-20

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Cradle/Phone	TSI, Incorporated	TSI-5	TSI5230200045

Remote Equipment Outside of Test Setup Boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Laptop	Lenovo	Ideapad 3i	PF3Y5T46

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
USB Programming Cable	Yes	1.8m	No	Laptop	Cradle

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2023-02-20	DTS Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2023-02-20	Occupied Bandwidth	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2023-03-15	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.
4	2023-03-30	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.
5	2023-05-25	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.
6	2023-05-25	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.
7	2023-05-25	Equivalent Isotropic Radiated Power (EIRP)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
8	2023-05-25	Power Spectral Density	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
9	2023-05-25	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	2023-05-25	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.2023.02.14.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.02.14.0

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	Gauss Instruments	TDEMI 30M	ARS	2022-04-20	2023-04-20
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2022-04-04	2023-04-04
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2023-03-09	2024-03-09
Filter - High Pass	TTE	H97-100K-50-720B	HGN	NCR	NCR

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	1.2 dB	-1.2 dB

CONFIGURATIONS INVESTIGATED

TSIN0196-12

MODES INVESTIGATED

Transmitting Bluetooth Low Energy 1 Mbps, Mid Channel 18, 2442 MHz

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.02.14.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.02.14.0

EUT:	TSI Inc. OmniTrak	Work Order:	TSIN0196
Serial Number:	TSI55221200061	Date:	2023-03-30
Customer:	TSI, Incorporated	Temperature:	21.3°C
Attendees:	Micah Larson	Relative Humidity:	18.5%
Customer Project:	None	Bar. Pressure (PMSL):	1021 mb
Tested By:	Ko Vorasarn	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	TSIN0196-12

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	13	Line:	High Line	Add. Ext. Attenuation (dB):	0

COMMENTS

Phone AC tested

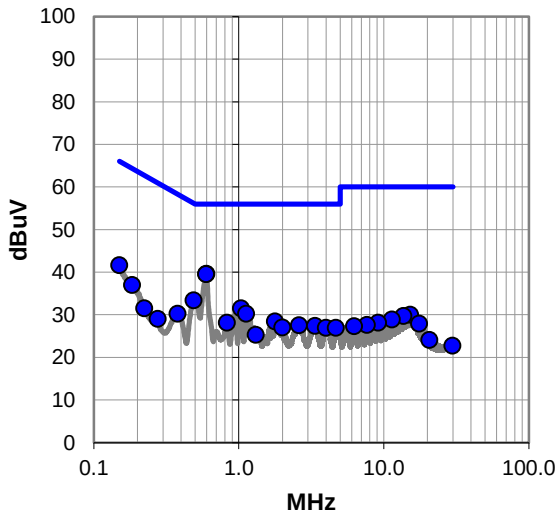
EUT OPERATING MODES

Transmitting Bluetooth Low Energy 1 Mbps, Mid Channel 18, 2442 MHz

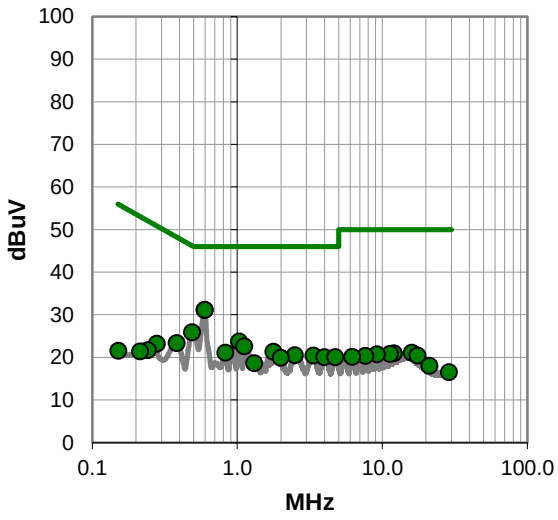
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.02.14.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.02.14.0

RESULTS - Run #13

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.597	19.5	20.1	39.6	56.0	-16.4
0.596	19.4	20.1	39.5	56.0	-16.5
0.489	13.3	20.1	33.4	56.2	-22.8
0.150	21.0	20.6	41.6	66.0	-24.4
1.036	11.4	20.1	31.5	56.0	-24.5
1.123	10.1	20.1	30.2	56.0	-25.8
0.184	16.6	20.4	37.0	64.3	-27.3
1.773	8.3	20.1	28.4	56.0	-27.6
0.829	8.0	20.1	28.1	56.0	-27.9
0.379	10.1	20.1	30.2	58.3	-28.1
2.608	7.3	20.2	27.5	56.0	-28.5
3.353	7.1	20.3	27.4	56.0	-28.6
2.001	6.9	20.1	27.0	56.0	-29.0
3.994	6.6	20.3	26.9	56.0	-29.1
4.666	6.6	20.3	26.9	56.0	-29.1
15.201	8.6	21.4	30.0	60.0	-30.0
13.658	8.5	21.2	29.7	60.0	-30.3
1.311	5.2	20.1	25.3	56.0	-30.7
11.409	7.7	21.2	28.9	60.0	-31.1
0.223	11.2	20.3	31.5	62.7	-31.2
0.277	8.9	20.1	29.0	60.9	-31.9
9.168	7.3	20.8	28.1	60.0	-31.9
17.552	6.5	21.4	27.9	60.0	-32.1
7.668	7.0	20.6	27.6	60.0	-32.4
6.239	6.8	20.5	27.3	60.0	-32.7

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.594	11.0	20.1	31.1	46.0	-14.9
0.597	11.0	20.1	31.1	46.0	-14.9
0.489	5.8	20.1	25.9	46.2	-20.3
1.032	3.6	20.1	23.7	46.0	-22.3
1.120	2.5	20.1	22.6	46.0	-23.4
1.773	1.2	20.1	21.3	46.0	-24.7
0.829	1.0	20.1	21.1	46.0	-24.9
0.382	3.2	20.1	23.3	48.2	-24.9
2.503	0.3	20.2	20.5	46.0	-25.5
3.353	0.1	20.3	20.4	46.0	-25.6
3.994	-0.3	20.3	20.0	46.0	-26.0
4.750	-0.3	20.3	20.0	46.0	-26.0
1.999	-0.2	20.1	19.9	46.0	-26.1
1.311	-1.5	20.1	18.6	46.0	-27.4
0.278	3.1	20.1	23.2	50.9	-27.7
15.977	-0.3	21.4	21.1	50.0	-28.9
12.067	-0.3	21.2	20.9	50.0	-29.1
11.322	-0.4	21.2	20.8	50.0	-29.2
9.171	-0.1	20.8	20.7	50.0	-29.3
17.508	-1.0	21.4	20.4	50.0	-29.6
7.666	-0.3	20.6	20.3	50.0	-29.7
6.229	-0.4	20.5	20.1	50.0	-29.9
0.242	1.5	20.2	21.7	52.0	-30.3
0.214	1.1	20.3	21.4	53.0	-31.6
21.197	-3.7	21.7	18.0	50.0	-32.0

CONCLUSION

Pass

Tested By

POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.02.14.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.02.14.0

EUT:	TSI Inc. OmniTrak	Work Order:	TSIN0196
Serial Number:	TSI55221200061	Date:	2023-03-30
Customer:	TSI, Incorporated	Temperature:	21.3°C
Attendees:	Micah Larson	Relative Humidity:	18.5%
Customer Project:	None	Bar. Pressure (PMSL):	1021 mb
Tested By:	Ko Vorasarn	Job Site:	MN03
Power:	110VAC/60Hz	Configuration:	TSIN0196-12

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

TEST PARAMETERS

Run #:	14	Line:	Neutral	Add. Ext. Attenuation (dB):	0

COMMENTS

Phone AC tested

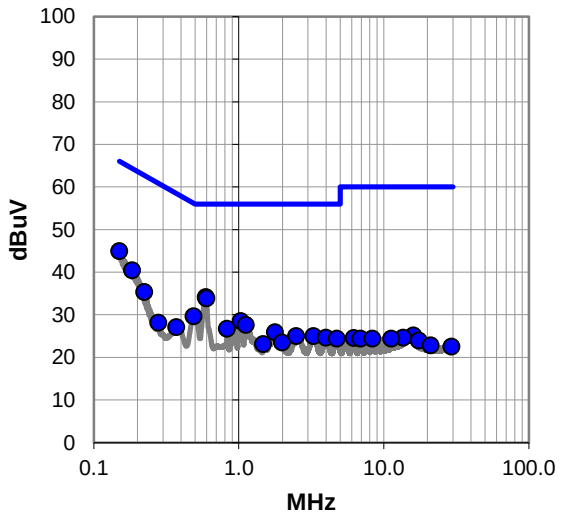
EUT OPERATING MODES

Transmitting Bluetooth Low Energy 1 Mbps, Mid Channel 18, 2442 MHz

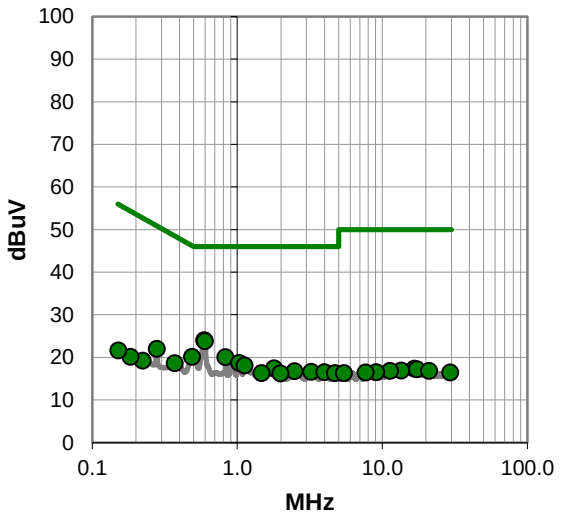
DEVIATIONS FROM TEST STANDARD

None

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



POWERLINE CONDUCTED EMISSIONS

element
WTD.2023.02.14.0
EmiR5 2022.07.06.0
PSA-ESCI 2023.02.14.0

RESULTS - Run #14

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.150	24.3	20.6	44.9	66.0	-21.1
0.592	14.0	20.1	34.1	56.0	-21.9
0.597	13.7	20.1	33.8	56.0	-22.2
0.184	20.0	20.4	40.4	64.3	-23.9
0.489	9.5	20.1	29.6	56.2	-26.6
0.223	15.0	20.3	35.3	62.7	-27.4
1.032	8.4	20.1	28.5	56.0	-27.5
1.120	7.5	20.1	27.6	56.0	-28.4
0.829	6.6	20.1	26.7	56.0	-29.3
1.778	5.8	20.1	25.9	56.0	-30.1
2.491	4.8	20.2	25.0	56.0	-31.0
3.270	4.7	20.3	25.0	56.0	-31.0
0.371	7.0	20.1	27.1	58.5	-31.4
3.986	4.3	20.3	24.6	56.0	-31.4
4.740	4.1	20.3	24.4	56.0	-31.6
1.990	3.4	20.1	23.5	56.0	-32.5
0.278	8.0	20.1	28.1	60.9	-32.8
1.470	3.0	20.1	23.1	56.0	-32.9
16.005	3.7	21.4	25.1	60.0	-34.9
13.580	3.4	21.2	24.6	60.0	-35.4
6.221	4.0	20.5	24.5	60.0	-35.5
6.920	3.8	20.6	24.4	60.0	-35.6
8.362	3.7	20.7	24.4	60.0	-35.6
11.264	3.2	21.2	24.4	60.0	-35.6
17.413	2.5	21.4	23.9	60.0	-36.1

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Margin (dB)
0.592	3.9	20.1	24.0	46.0	-22.0
0.597	3.7	20.1	23.8	46.0	-22.2
0.829	-0.1	20.1	20.0	46.0	-26.0
0.489	0.0	20.1	20.1	46.2	-26.1
1.029	-1.4	20.1	18.7	46.0	-27.3
1.123	-2.0	20.1	18.1	46.0	-27.9
1.796	-2.7	20.1	17.4	46.0	-28.6
0.278	1.9	20.1	22.0	50.9	-28.9
2.486	-3.5	20.2	16.7	46.0	-29.3
3.247	-3.7	20.3	16.6	46.0	-29.4
3.989	-3.8	20.3	16.5	46.0	-29.5
1.470	-3.8	20.1	16.3	46.0	-29.7
4.730	-4.0	20.3	16.3	46.0	-29.7
1.990	-3.9	20.1	16.2	46.0	-29.8
0.371	-1.5	20.1	18.6	48.5	-29.9
16.670	-4.1	21.4	17.3	50.0	-32.7
17.373	-4.2	21.4	17.2	50.0	-32.8
13.519	-4.3	21.2	16.9	50.0	-33.1
11.305	-4.4	21.2	16.8	50.0	-33.2
21.122	-4.9	21.7	16.8	50.0	-33.2
0.223	-1.1	20.3	19.2	52.7	-33.5
9.113	-4.3	20.8	16.5	50.0	-33.5
7.691	-4.2	20.6	16.4	50.0	-33.6
29.511	-5.9	22.3	16.4	50.0	-33.6
5.438	-4.1	20.4	16.3	50.0	-33.7

CONCLUSION

Pass

Tested By

DUTY CYCLE

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	S.M. Electronics	SA26B-20	TZP	2022-11-06	2023-11-06
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Agilent	N5182A	TIF	2020-08-29	2023-08-29
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2023-02-02	2024-02-02

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 2022.06.03.0 XMit 2023.02.14.0

EUT:	TSI Inc. OmniTrak			**Work Order:**	TSIN0196
Serial Number:	TSI5230200045			**Date:**	05/25/2023
Customer:	TSI, Incorporated			**Temperature:**	21.6°C
Attendees:	Micah Larson			**Humidity:**	40.9%
Project:	None			**Barometric Pres.:**	1022 mbar
Tested by:	Christopher Heintzelman	**Power:**	Internal Battery (3.7VDC)	**Job Site:**	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. The customer states that the USB does not charge the EUT while in the test mode, USB is for programming only. Payload length is 65535 (The payload length affects the duty cycle).

DEVIATIONS FROM TEST STANDARD

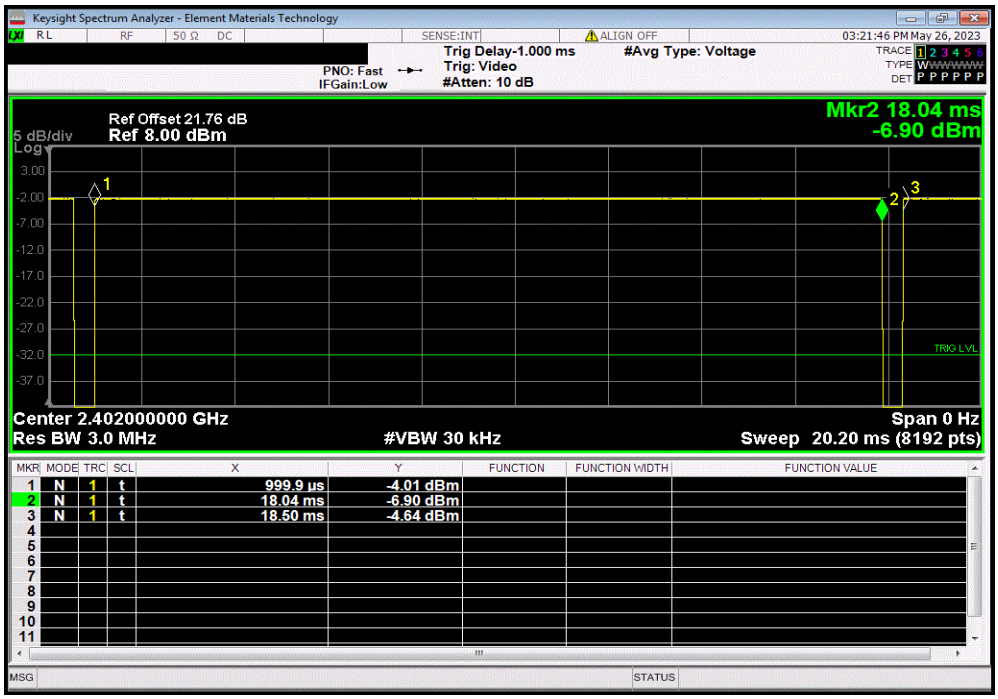
None

Configuration #	TSIN0196-20	Signature

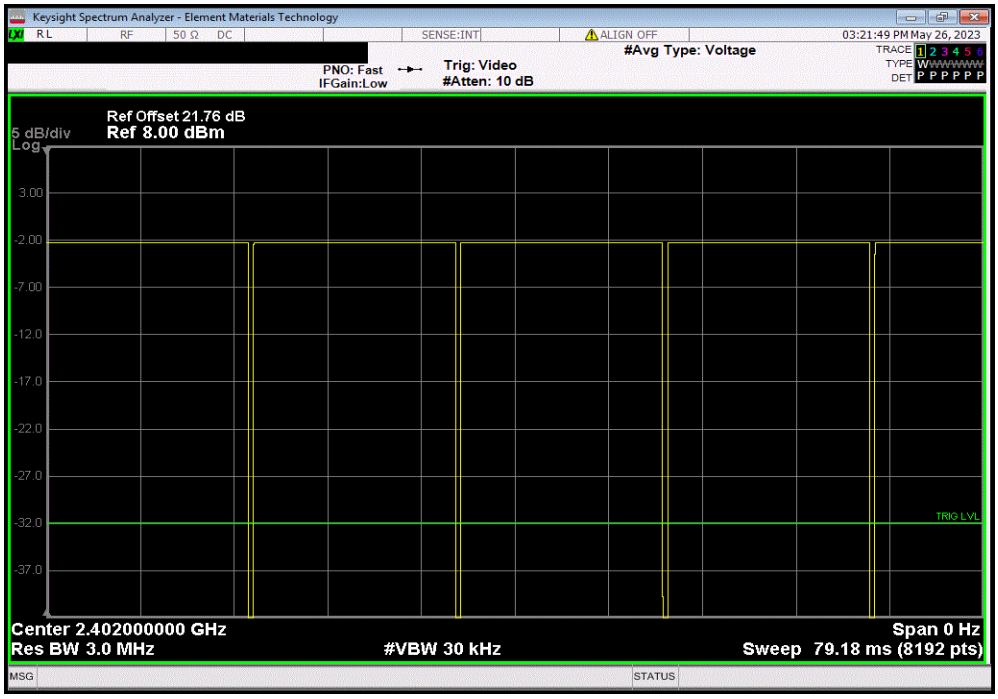
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
BLE/GFSK 125 kbps						
Low Channel, 2402 MHz	17.04 ms	17.498 ms	1	97.4	N/A	N/A
Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	17.045 ms	17.497 ms	1	97.4	N/A	N/A
Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	17.043 ms	17.497 ms	1	97.4	N/A	N/A
High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK 500 kbps						
Low Channel, 2402 MHz	4.559 ms	5 ms	1	91.2	N/A	N/A
Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	4.559 ms	5 ms	1	91.2	N/A	N/A
Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	4.558 ms	5 ms	1	91.2	N/A	N/A
High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK 1 Mbps						
Low Channel, 2402 MHz	2.137 ms	2.5 ms	1	85.4	N/A	N/A
Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	2.137 ms	2.5 ms	1	85.4	N/A	N/A
Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	2.137 ms	2.5 ms	1	85.4	N/A	N/A
High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A
BLE/GFSK 2 Mbps						
Low Channel, 2402 MHz	1.08 ms	1.875 ms	1	57.6	N/A	N/A
Low Channel, 2402 MHz	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	1.08 ms	1.875 ms	1	57.6	N/A	N/A
Mid Channel, 2442 MHz	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	1.08 ms	1.875 ms	1	57.6	N/A	N/A
High Channel, 2480 MHz	N/A	N/A	5	N/A	N/A	N/A

DUTY CYCLE

BLE/GFSK 125 kbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	17.04 ms	17.498 ms	1	97.4	N/A	N/A

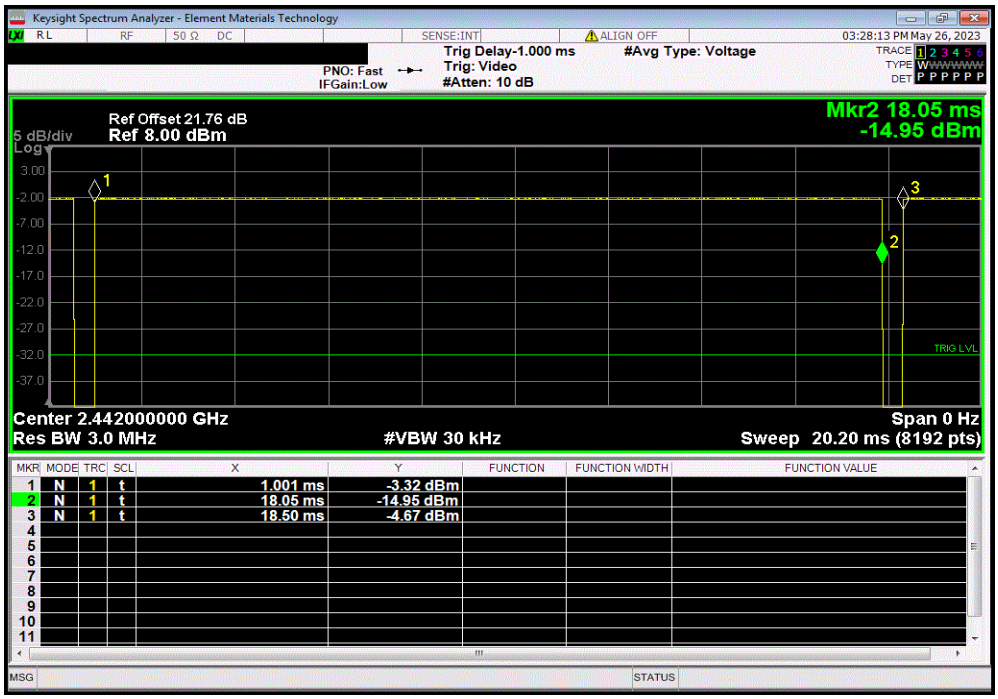


BLE/GFSK 125 kbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

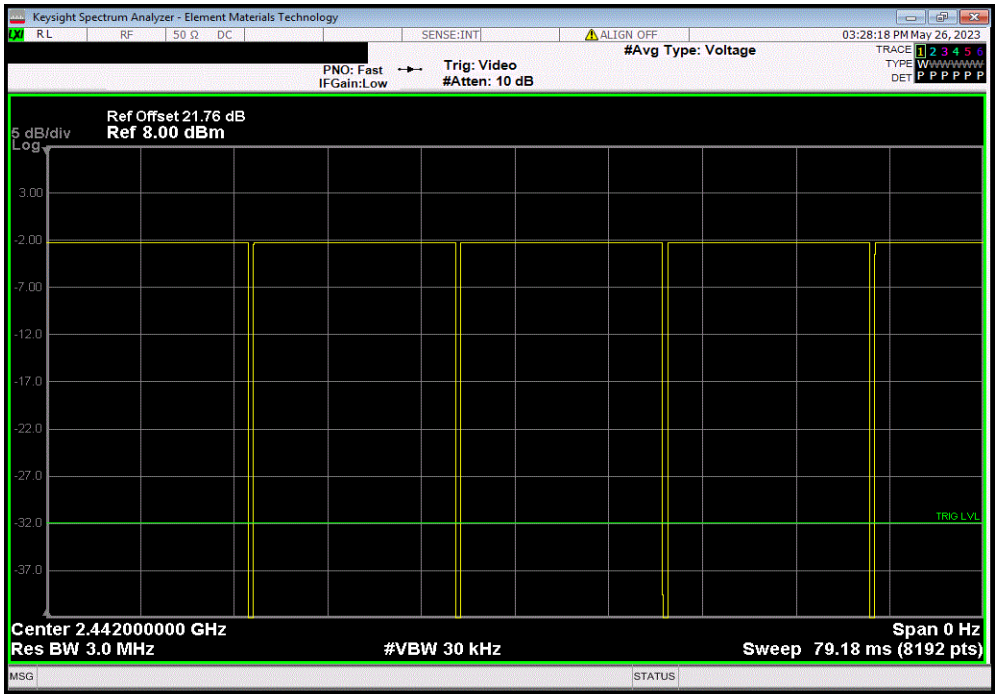


DUTY CYCLE

BLE/GFSK 125 kbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	17.045 ms	17.497 ms	1	97.4	N/A	N/A

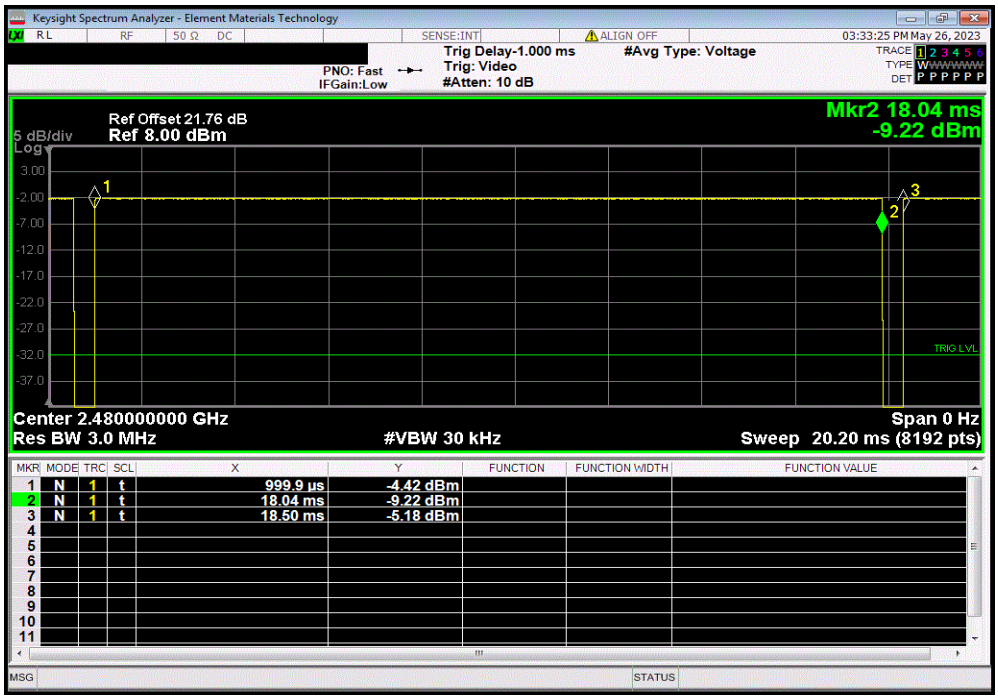


BLE/GFSK 125 kbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

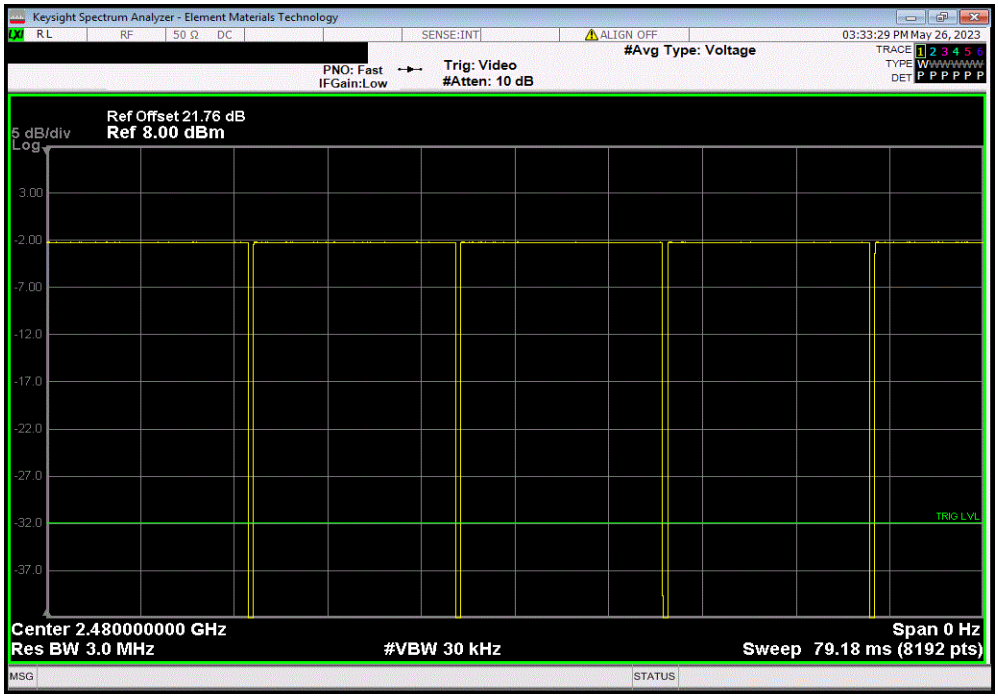


DUTY CYCLE

BLE/GFSK 125 kbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	17.043 ms	17.497 ms	1	97.4	N/A	N/A

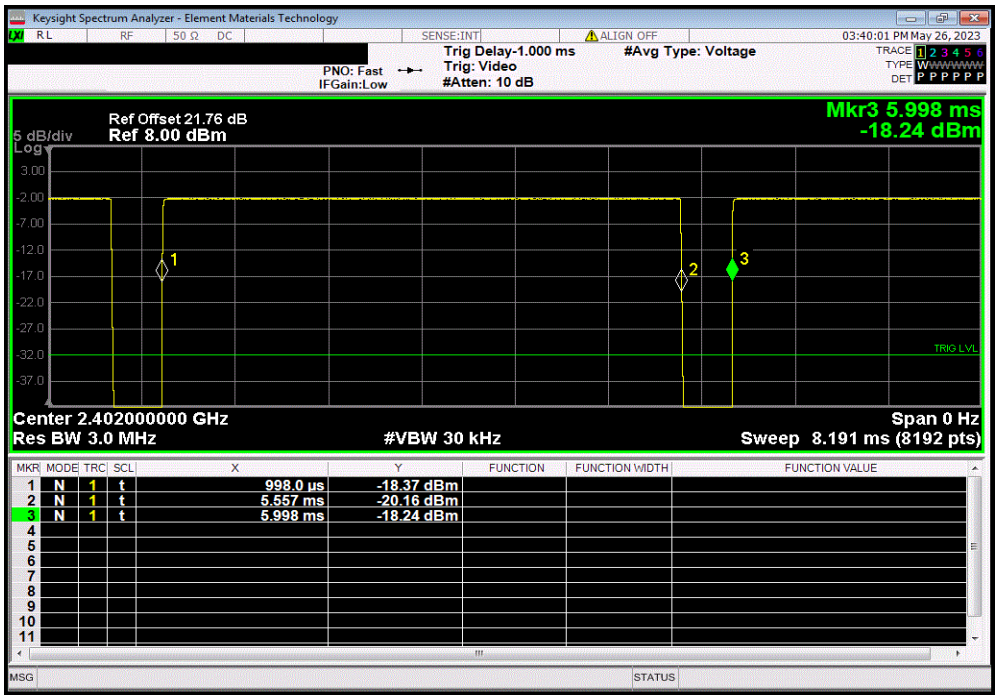


BLE/GFSK 125 kbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

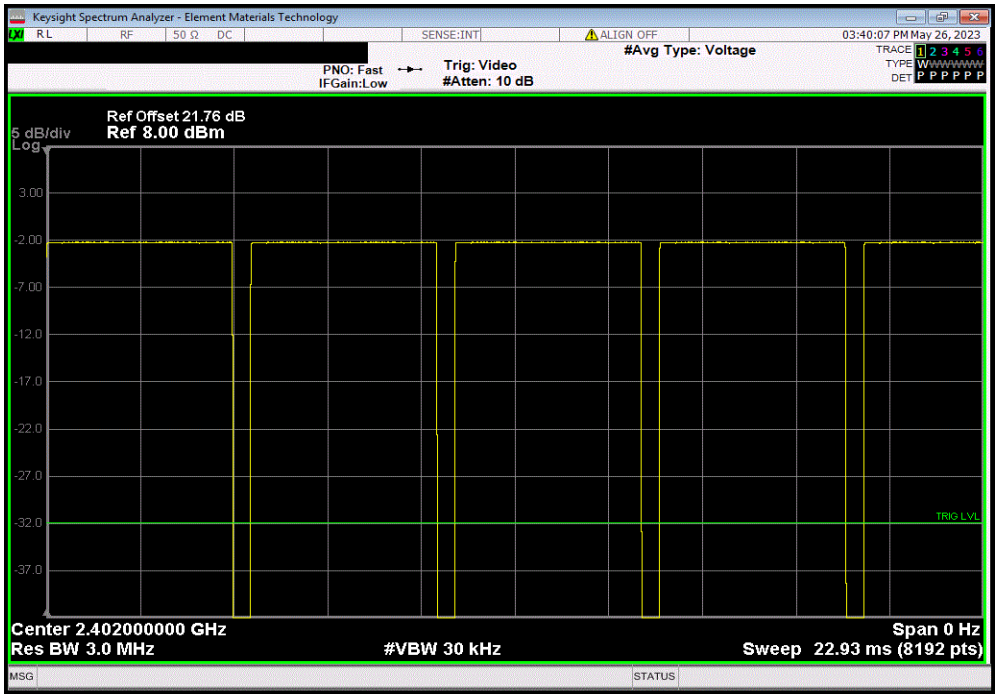


DUTY CYCLE

BLE/GFSK 500 kbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	4.559 ms	5 ms	1	91.2	N/A	N/A

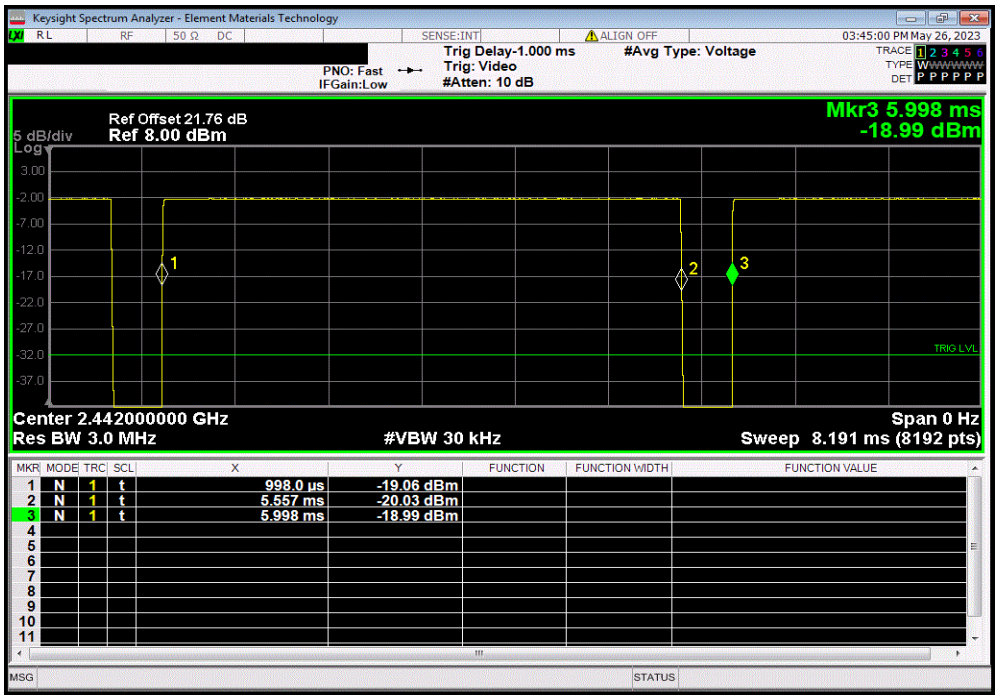


BLE/GFSK 500 kbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

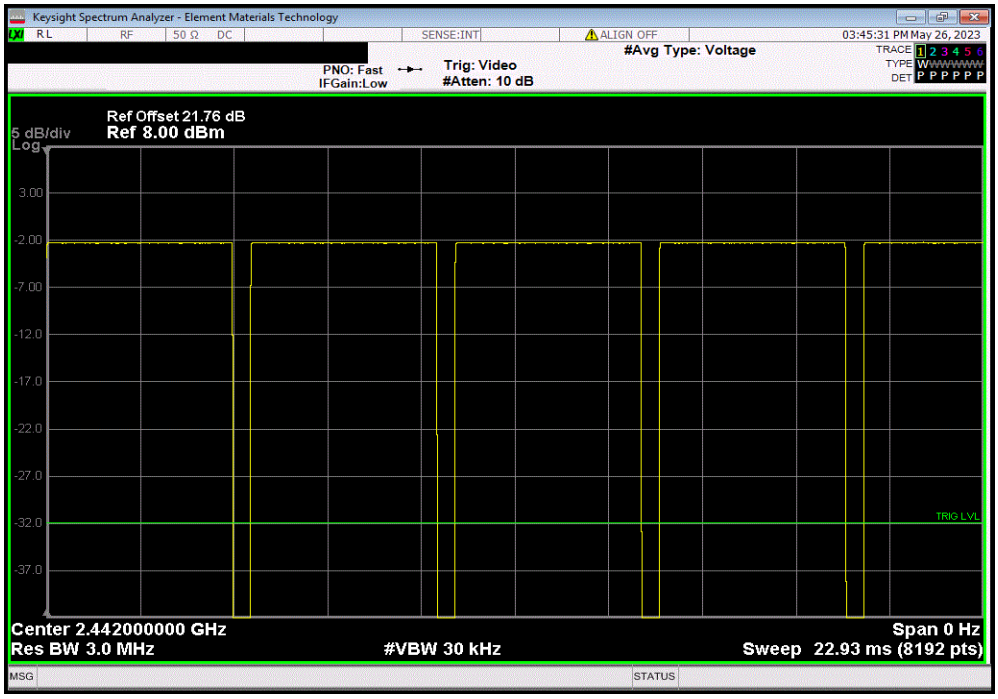


DUTY CYCLE

BLE/GFSK 500 kbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	4.559 ms	5 ms	1	91.2	N/A	N/A

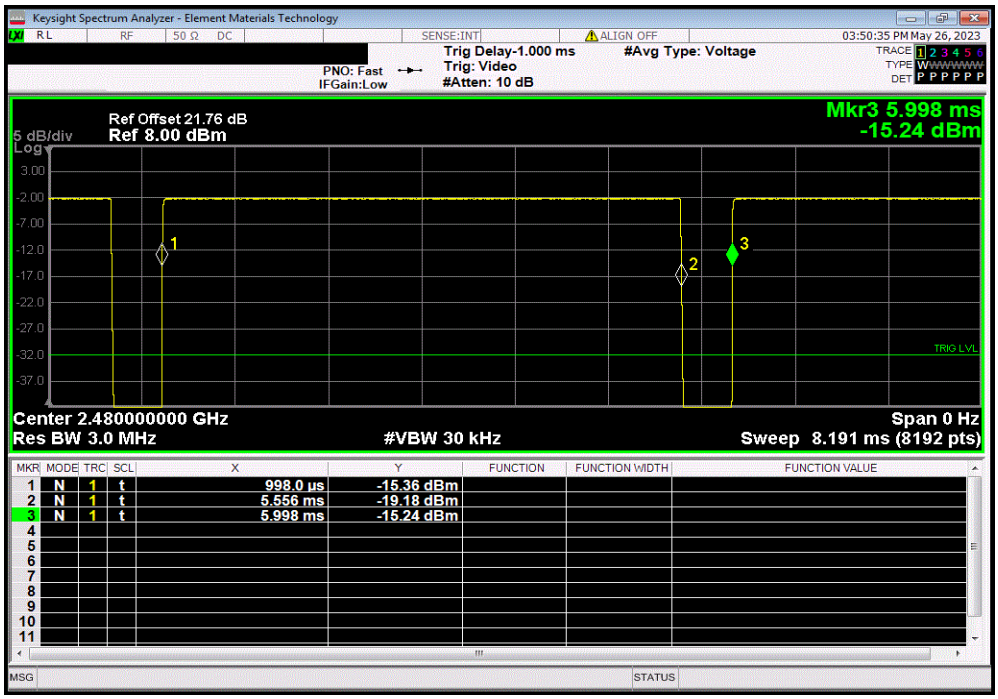


BLE/GFSK 500 kbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

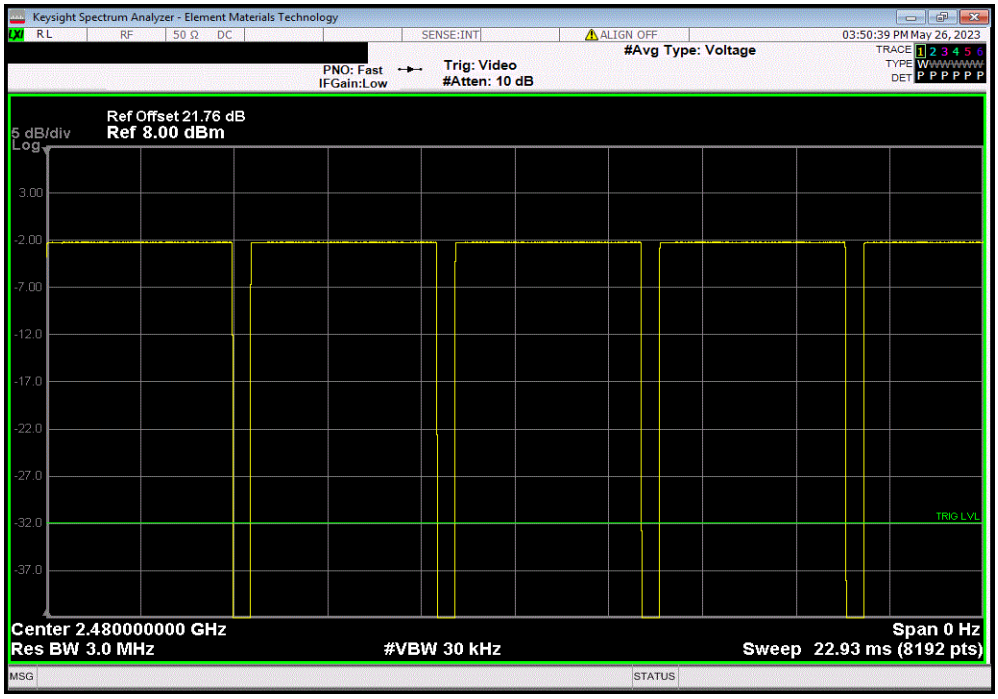


DUTY CYCLE

BLE/GFSK 500 kbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	4.558 ms	5 ms	1	91.2	N/A	N/A

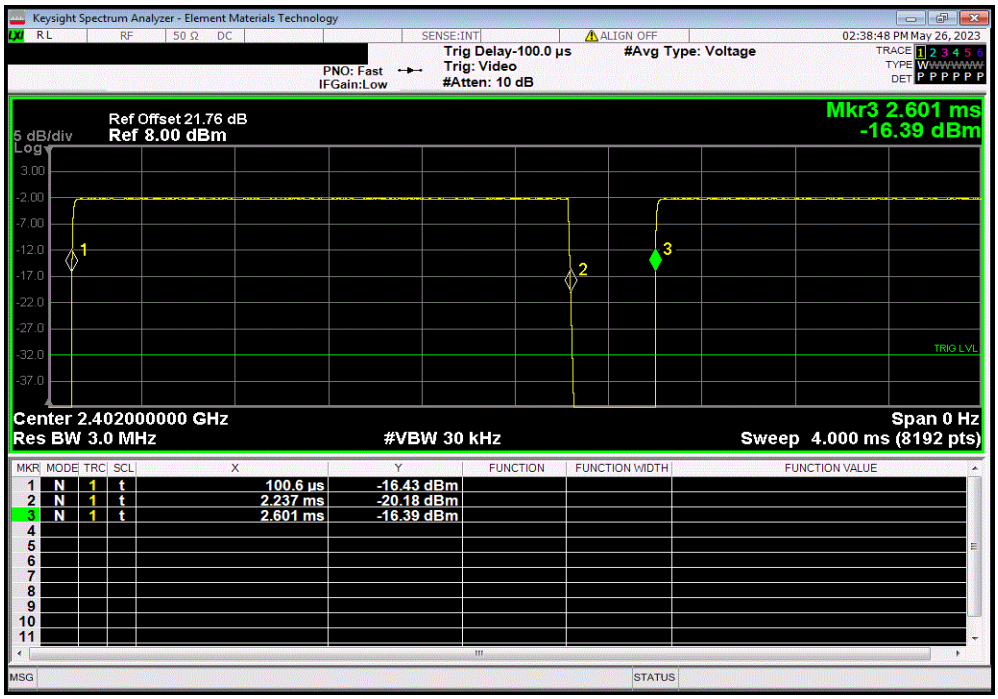


BLE/GFSK 500 kbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

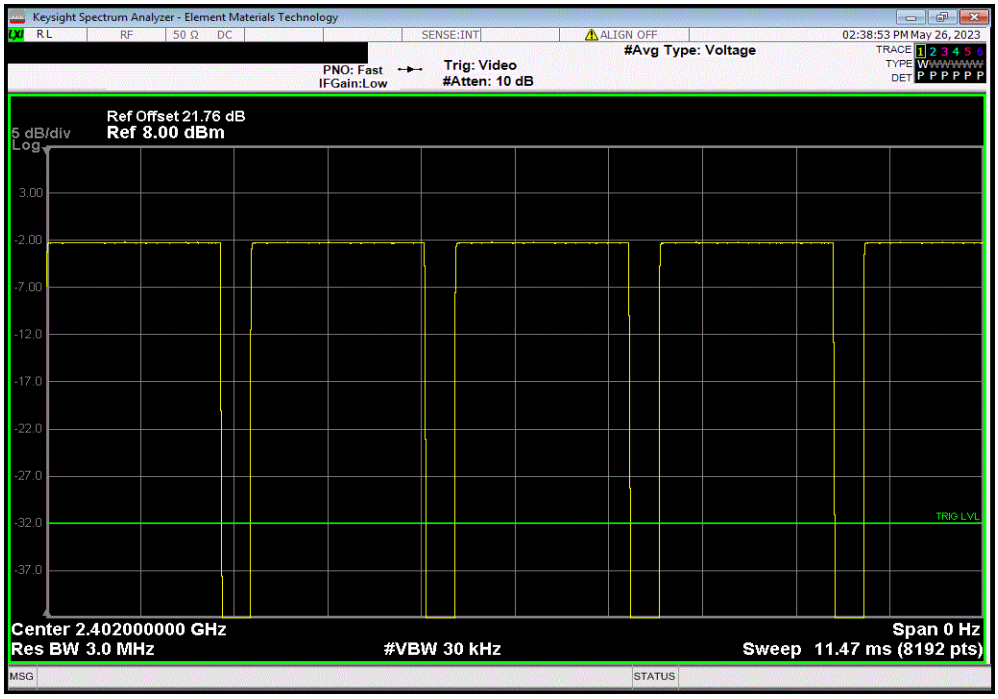


DUTY CYCLE

BLE/GFSK 1 Mbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.137 ms	2.5 ms	1	85.4	N/A	N/A

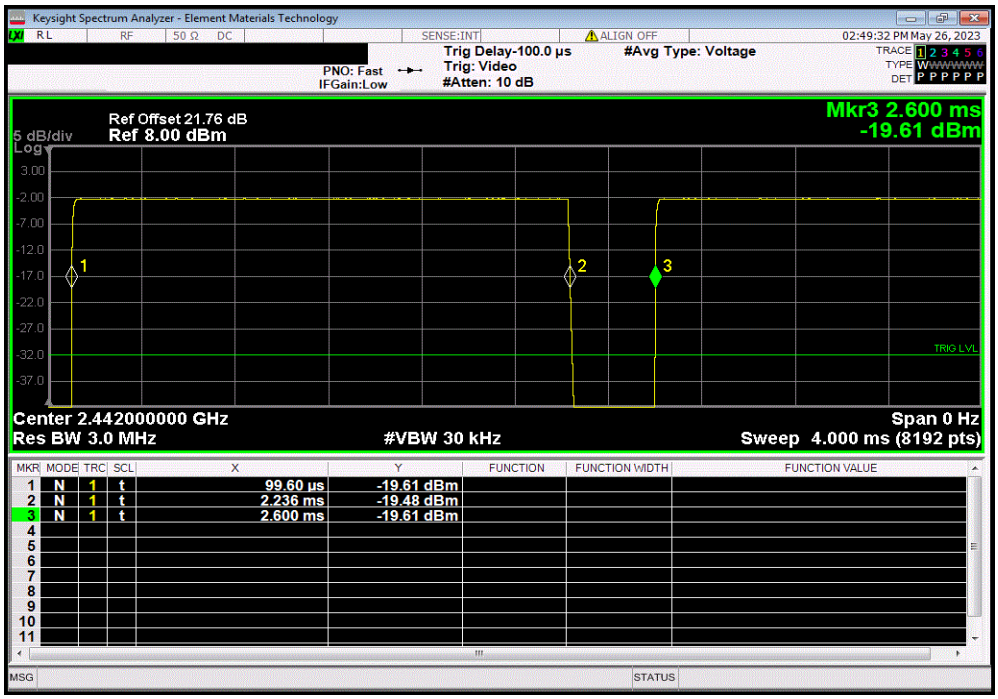


BLE/GFSK 1 Mbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

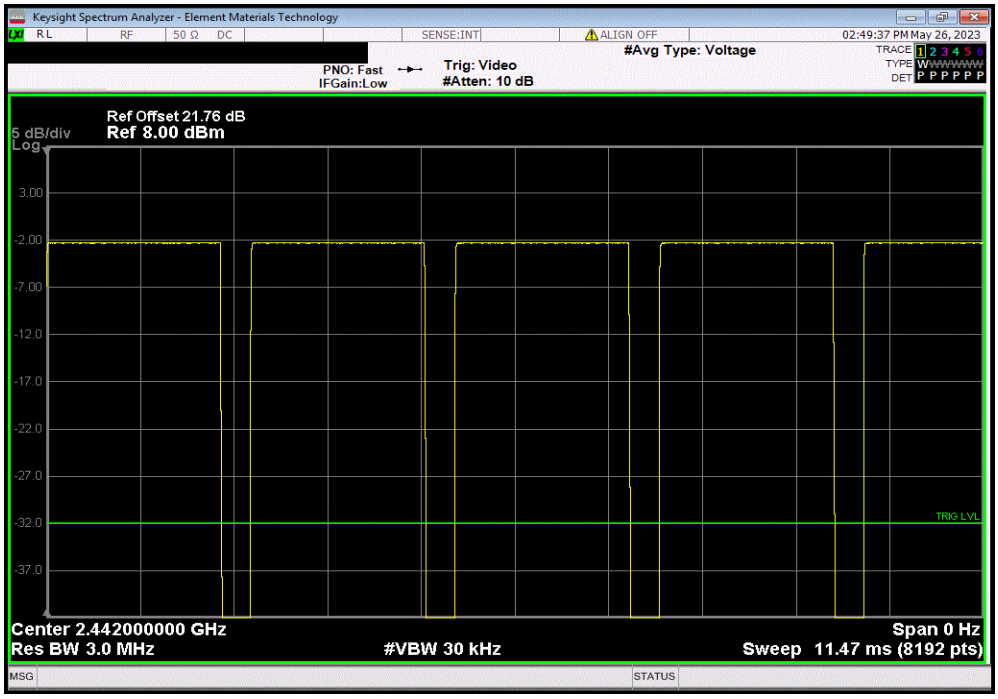


DUTY CYCLE

BLE/GFSK 1 Mbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.137 ms	2.5 ms	1	85.4	N/A	N/A

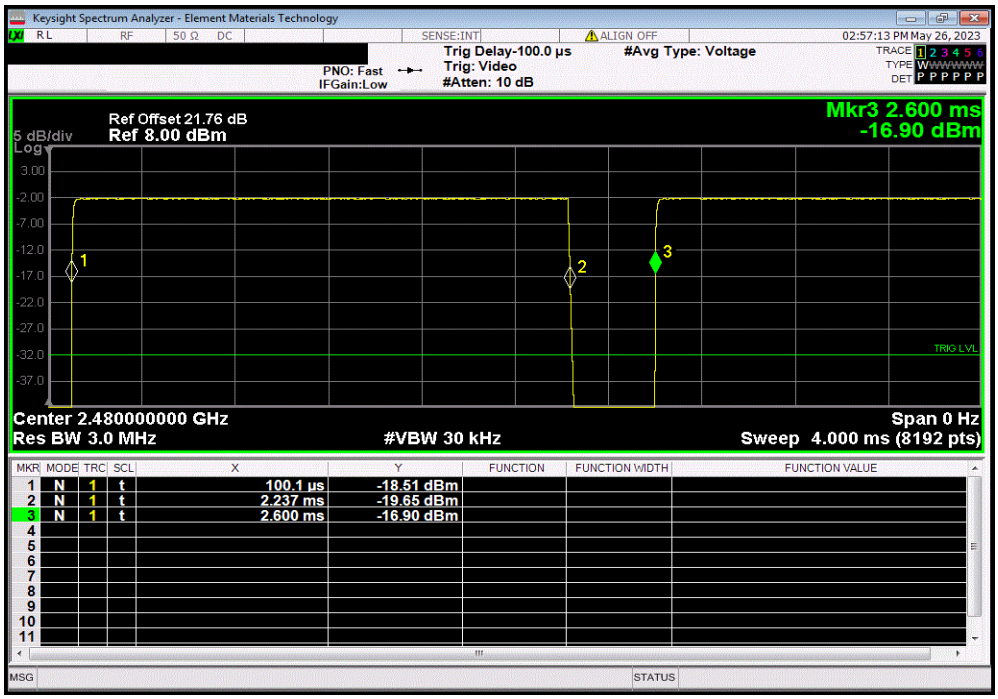


BLE/GFSK 1 Mbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

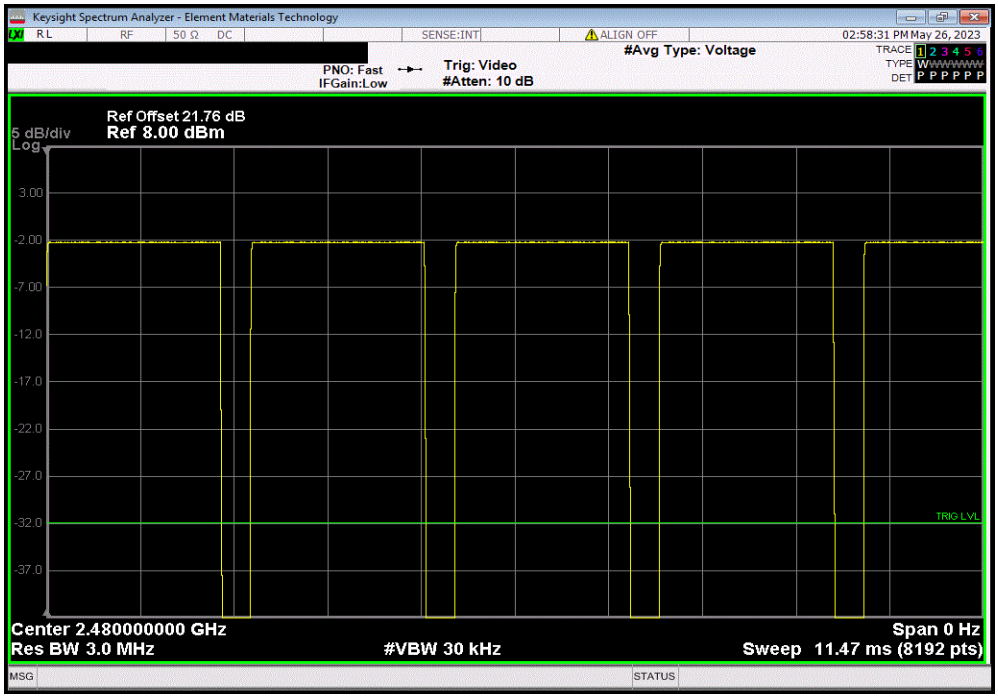


DUTY CYCLE

BLE/GFSK 1 Mbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	2.137 ms	2.5 ms	1	85.4	N/A	N/A

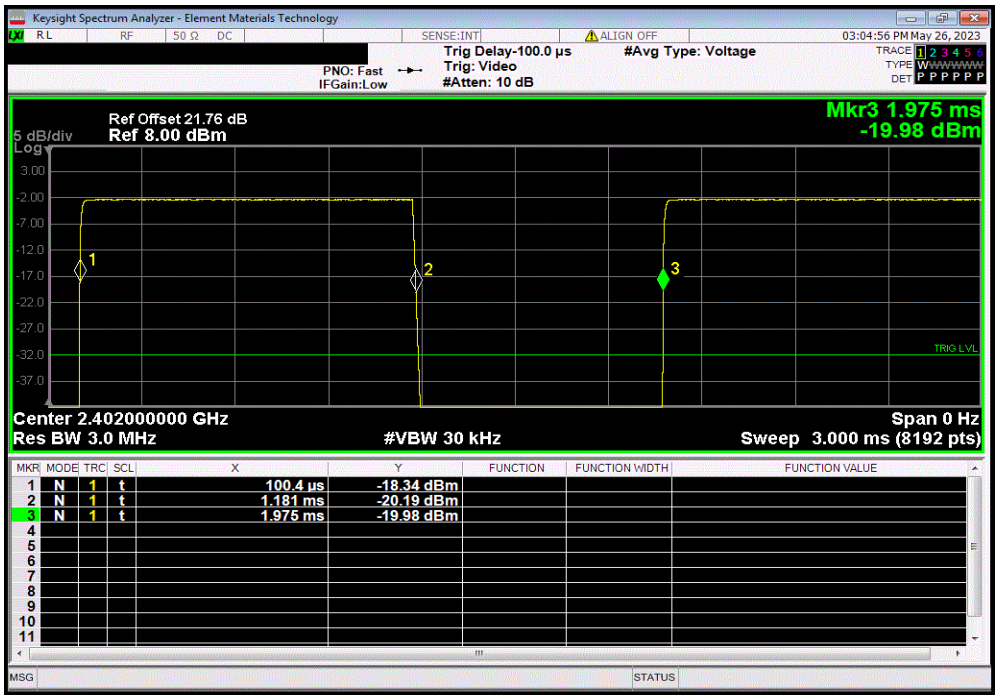


BLE/GFSK 1 Mbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

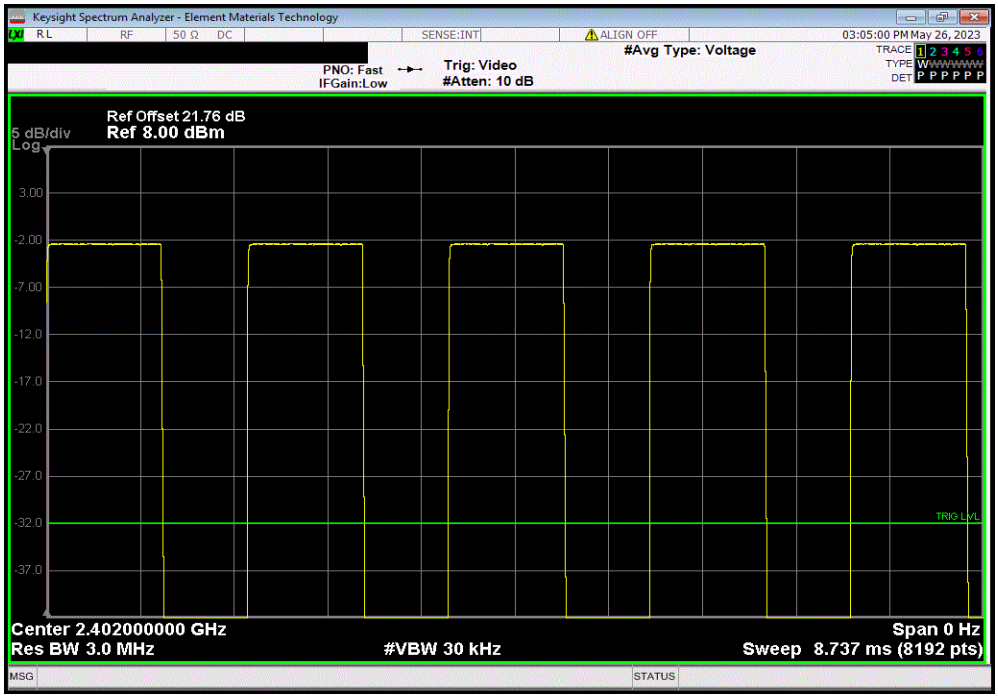


DUTY CYCLE

BLE/GFSK 2 Mbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.08 ms	1.875 ms	1	57.6	N/A	N/A

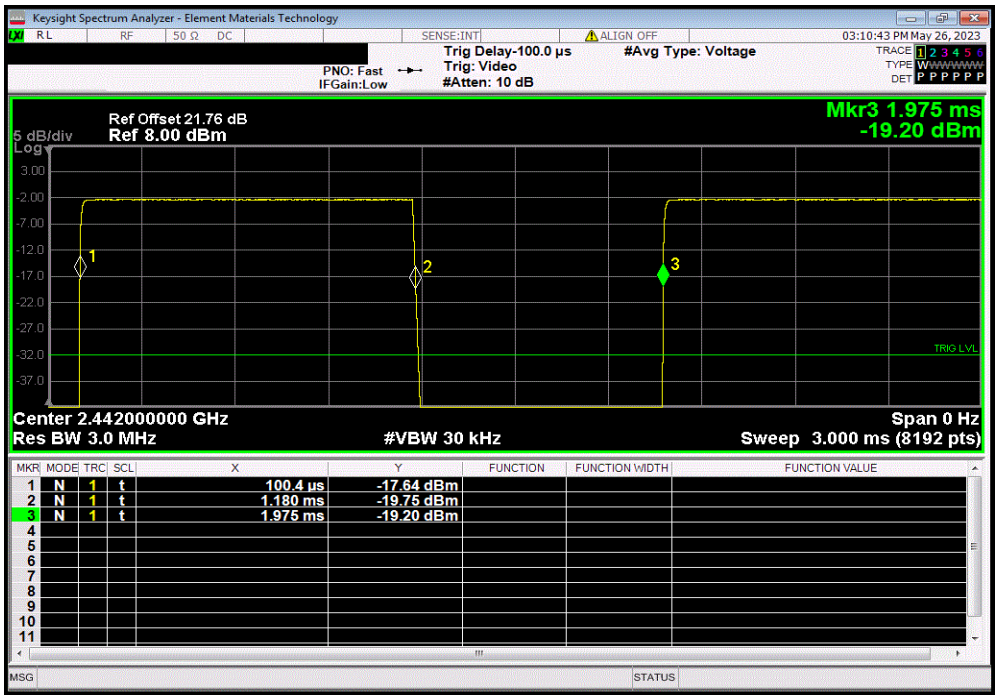


BLE/GFSK 2 Mbps, Low Channel, 2402 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

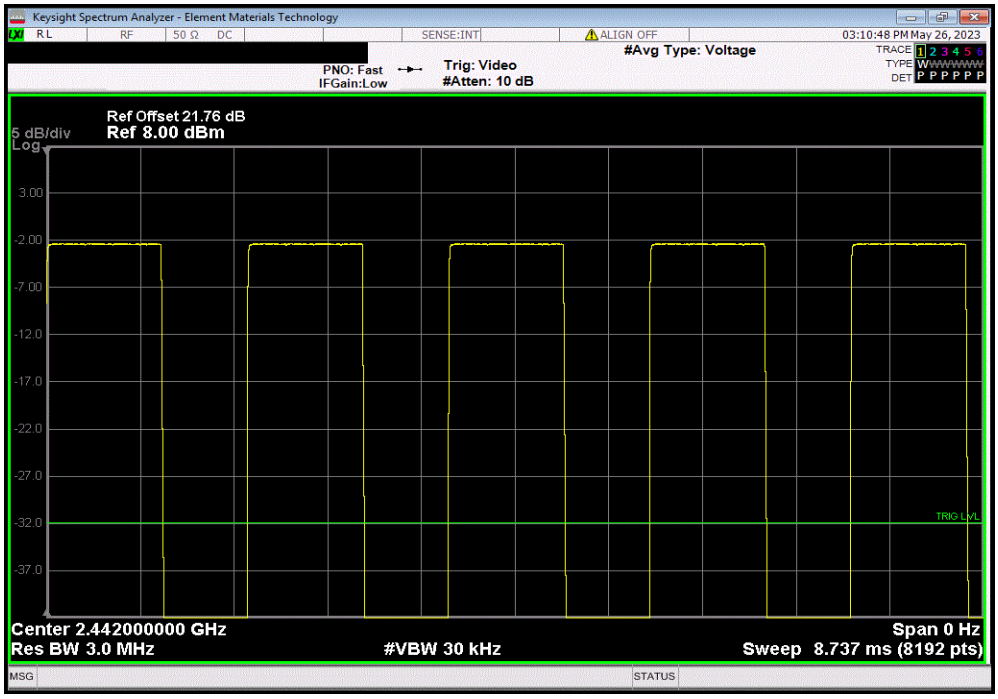


DUTY CYCLE

BLE/GFSK 2 Mbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.08 ms	1.875 ms	1	57.6	N/A	N/A

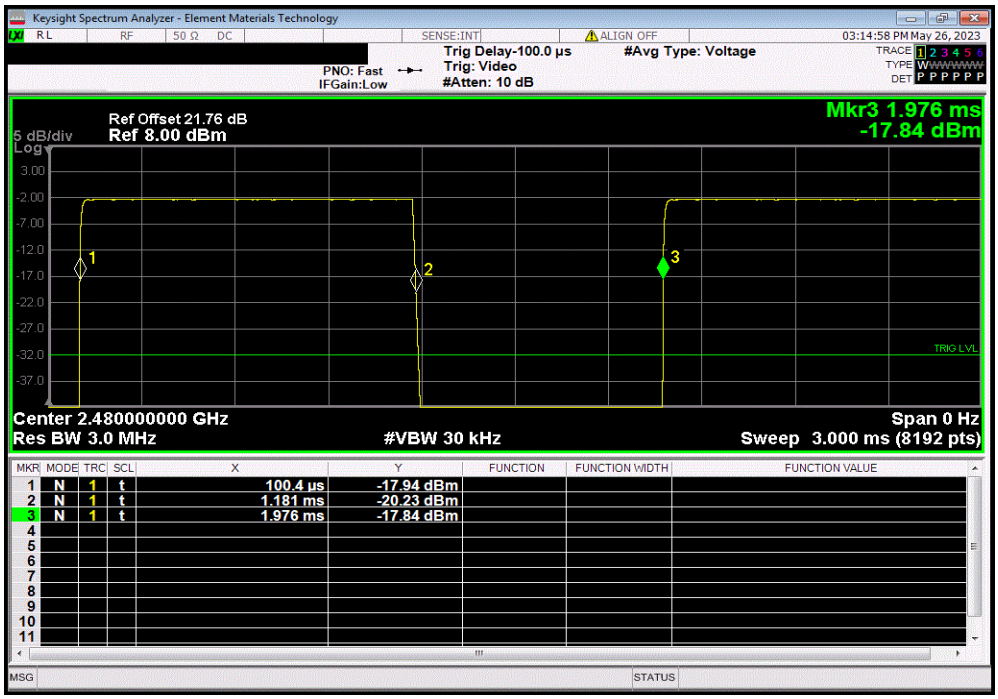


BLE/GFSK 2 Mbps, Mid Channel, 2442 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A

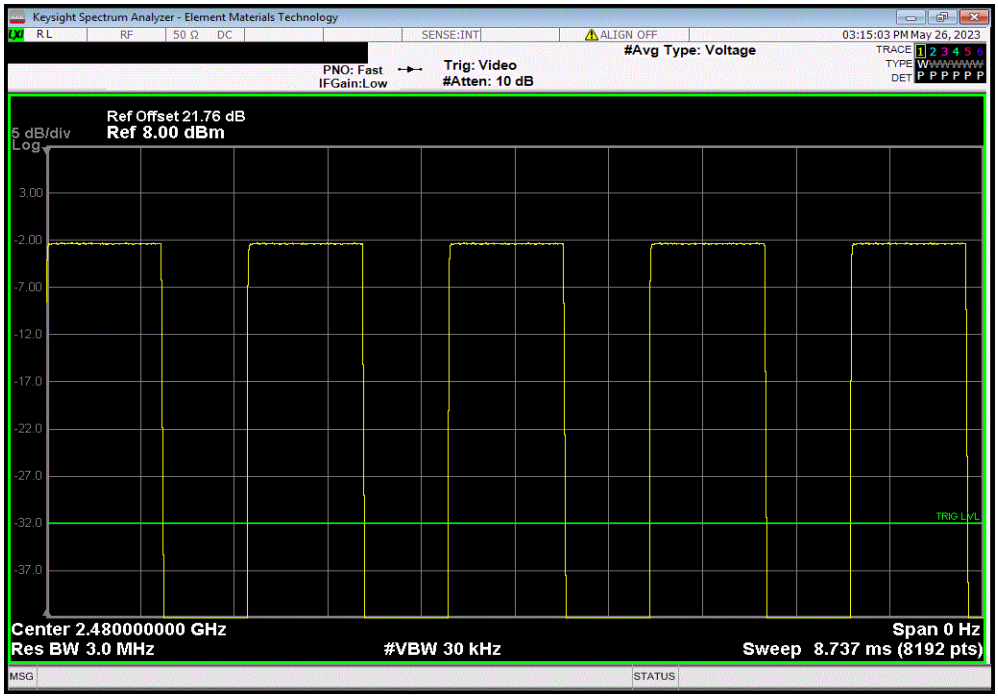


DUTY CYCLE

BLE/GFSK 2 Mbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	1.08 ms	1.875 ms	1	57.6	N/A	N/A



BLE/GFSK 2 Mbps, High Channel, 2480 MHz						
	Pulse Width	Period	Number of Pulses	Value (%)	Limit (%)	Results
	N/A	N/A	5	N/A	N/A	N/A



DTS BANDWIDTH

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	S.M. Electronics	SA26B-20	RFW	2023-02-07	2024-02-07
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Thermometer	Omega Engineering, Inc.	HH311	DUB	2020-10-05	2023-10-05
Chamber - Temperature/Humidity	Weiss Technik	MCBH-1.2-.33-.33-H/AC	MTC	NCR	NCR
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

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

The 6dB DTS bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

DTS BANDWIDTH

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	TSI Inc. OmniTrak			**Work Order:**	TSIN0196
Serial Number:	TSI55221200048			**Date:**	02/20/23
Customer:	TSI, Incorporated			**Temperature:**	22.6°C
Attendees:	Shadman Ahmed			**Humidity:**	23.5%
Project:	None			**Barometric Pres.:**	999 mbar
Tested by:	Christopher Heintzelman	**Power:**	5VDC Battery	**Job Site:**	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017	ANSI C63.10:2013

COMMENTS

Test performed in the temperature chamber reading 23C. Reference level offset includes measurement cable, DC block, and attenuator.

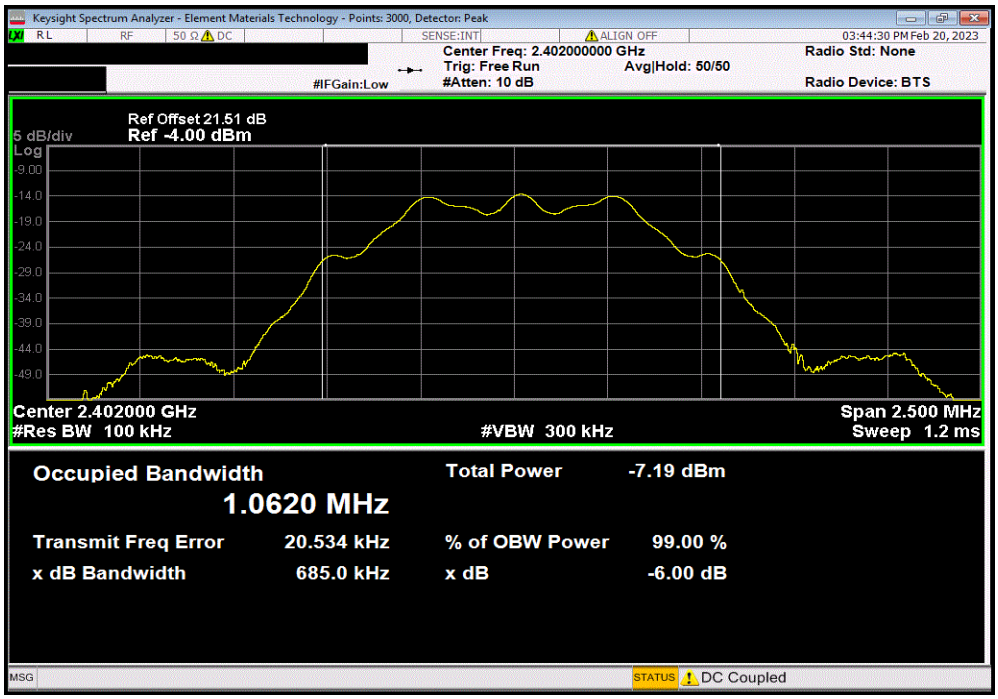
DEVIATIONS FROM TEST STANDARD

None

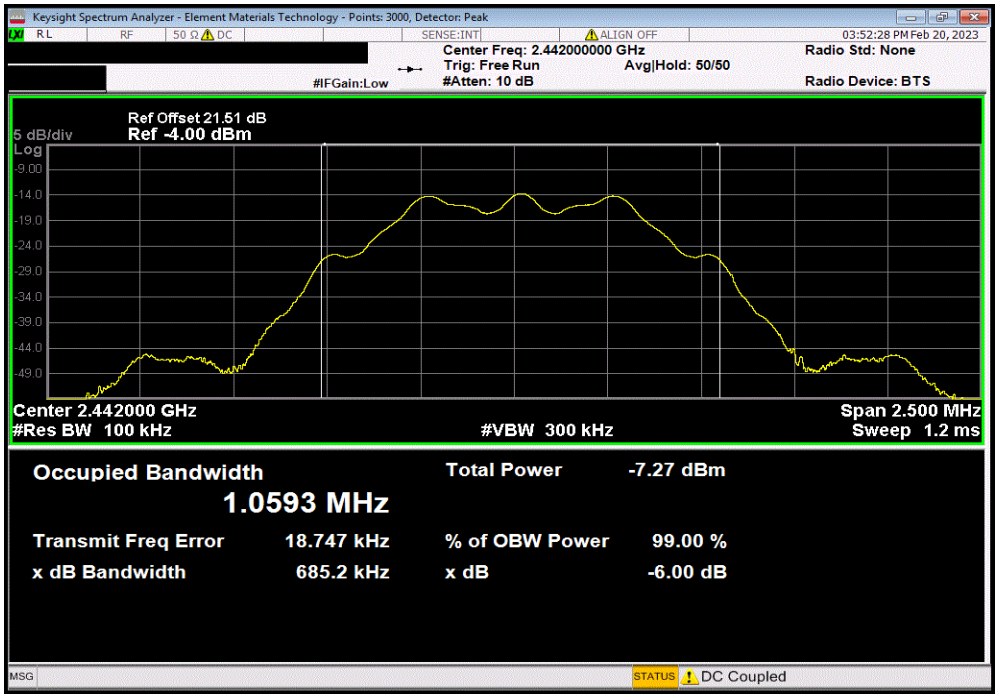
Configuration #	TSIN0196-1	Signature

		Value	Limit (≥)	Result
BLE/GFSK 125 kbps				
	Low Channel, 2402 MHz	685.02 kHz	500 kHz	Pass
	Mid Channel, 2442 MHz	685.241 kHz	500 kHz	Pass
	High Channel, 2480 MHz	686.648 kHz	500 kHz	Pass
BLE/GFSK 500 kbps				
	Low Channel, 2402 MHz	665.008 kHz	500 kHz	Pass
	Mid Channel, 2442 MHz	660.58 kHz	500 kHz	Pass
	High Channel, 2480 MHz	661.742 kHz	500 kHz	Pass
BLE/GFSK 1 Mbps				
	Low Channel, 2402 MHz	670.063 kHz	500 kHz	Pass
	Mid Channel, 2442 MHz	669.147 kHz	500 kHz	Pass
	High Channel, 2480 MHz	667.978 kHz	500 kHz	Pass
BLE/GFSK 2 Mbps				
	Low Channel, 2402 MHz	1.195 MHz	500 kHz	Pass
	Mid Channel, 2442 MHz	1.19 MHz	500 kHz	Pass
	High Channel, 2480 MHz	1.19 MHz	500 kHz	Pass

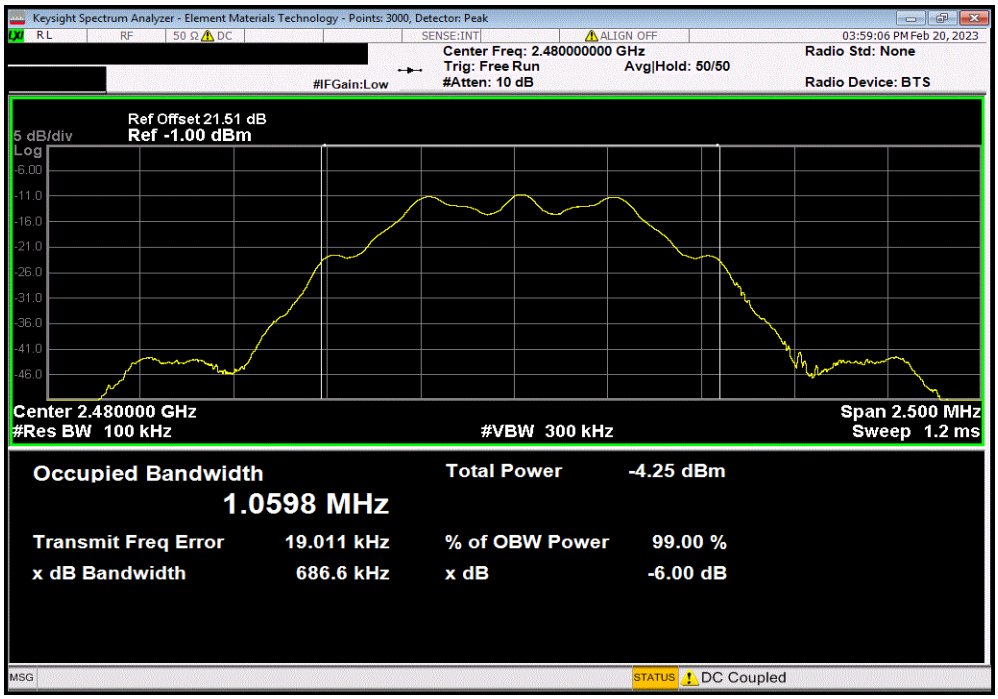
BLE/GFSK 125 kbps, Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				685.02 kHz	500 kHz	Pass



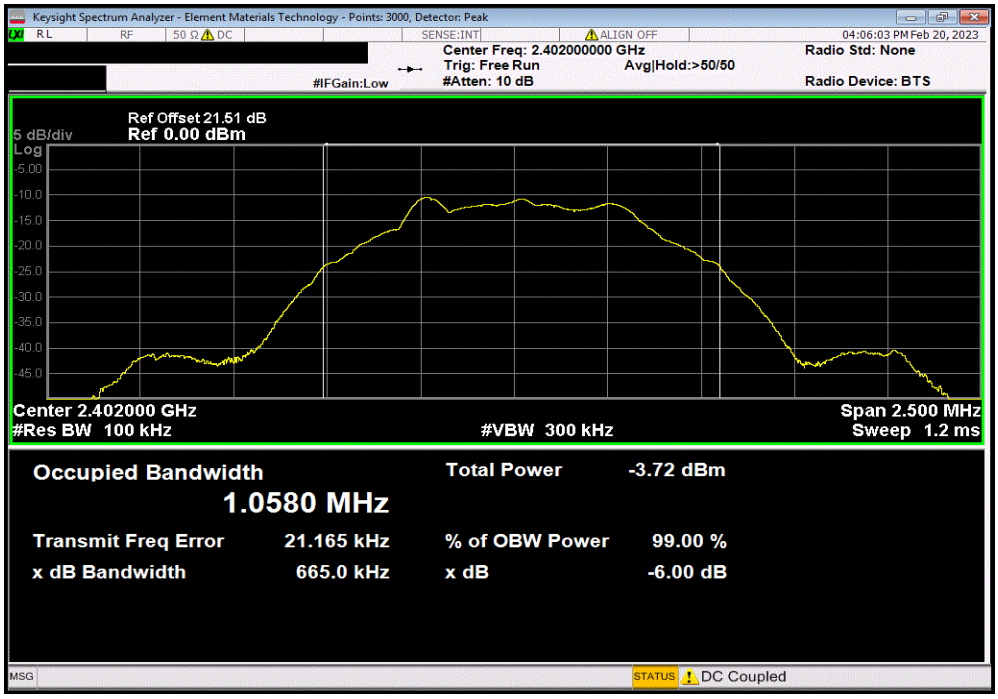
BLE/GFSK 125 kbps, Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				685.241 kHz	500 kHz	Pass



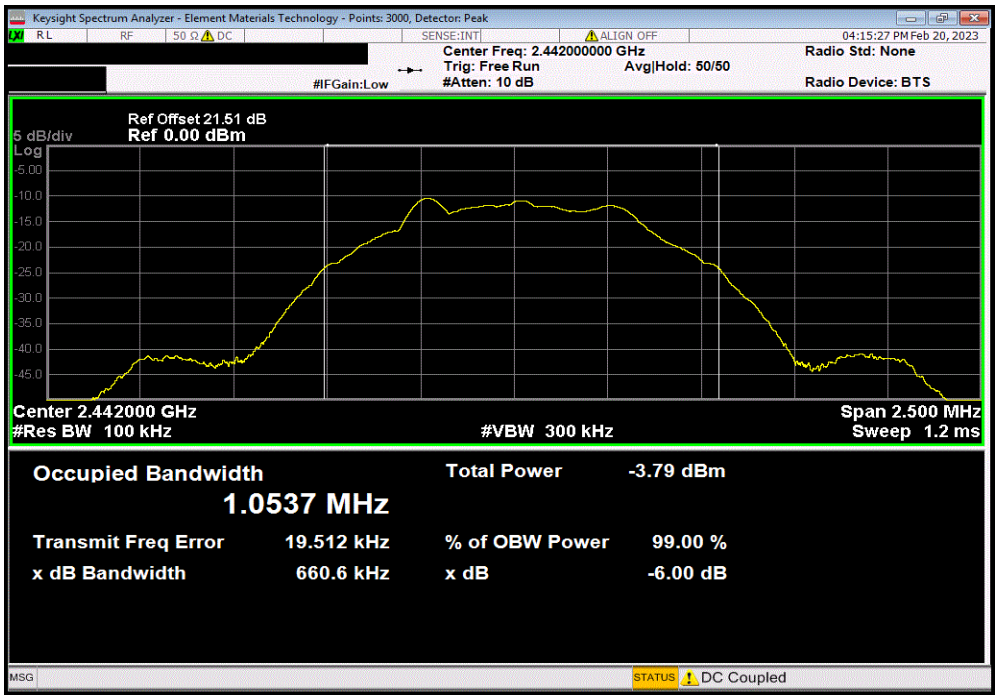
BLE/GFSK 125 kbps, High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				686.648 kHz	500 kHz	Pass



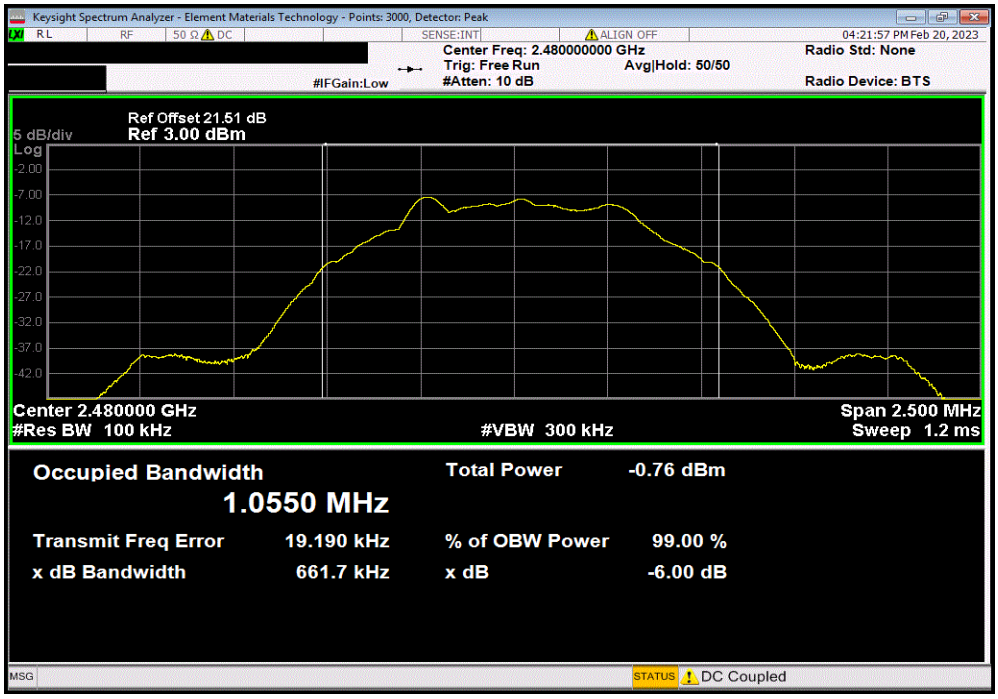
BLE/GFSK 500 kbps, Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				665.008 kHz	500 kHz	Pass



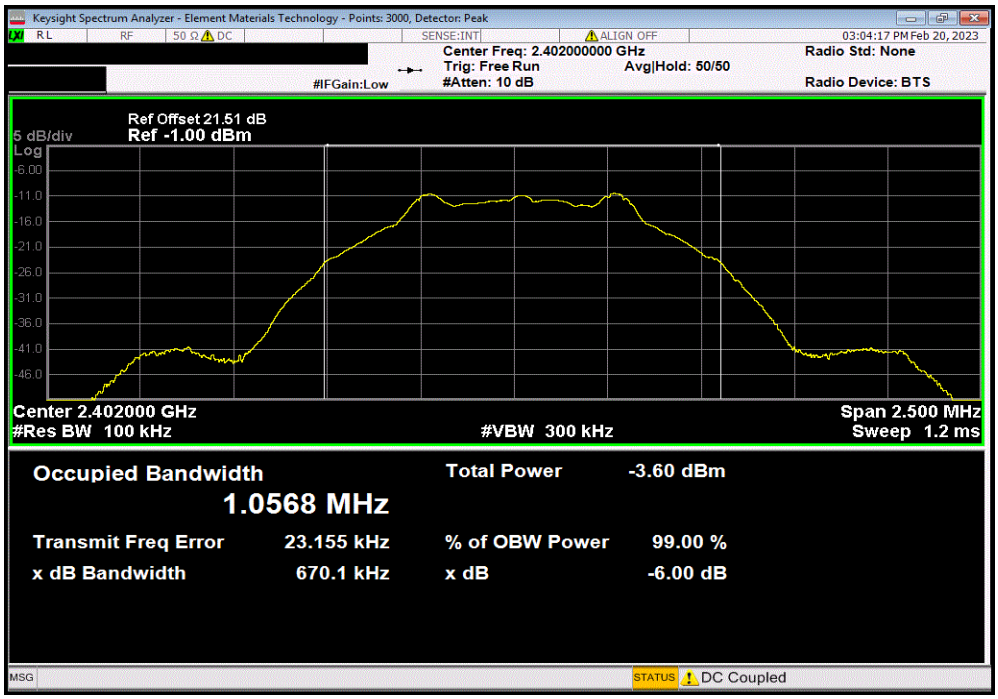
BLE/GFSK 500 kbps, Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				660.58 kHz	500 kHz	Pass



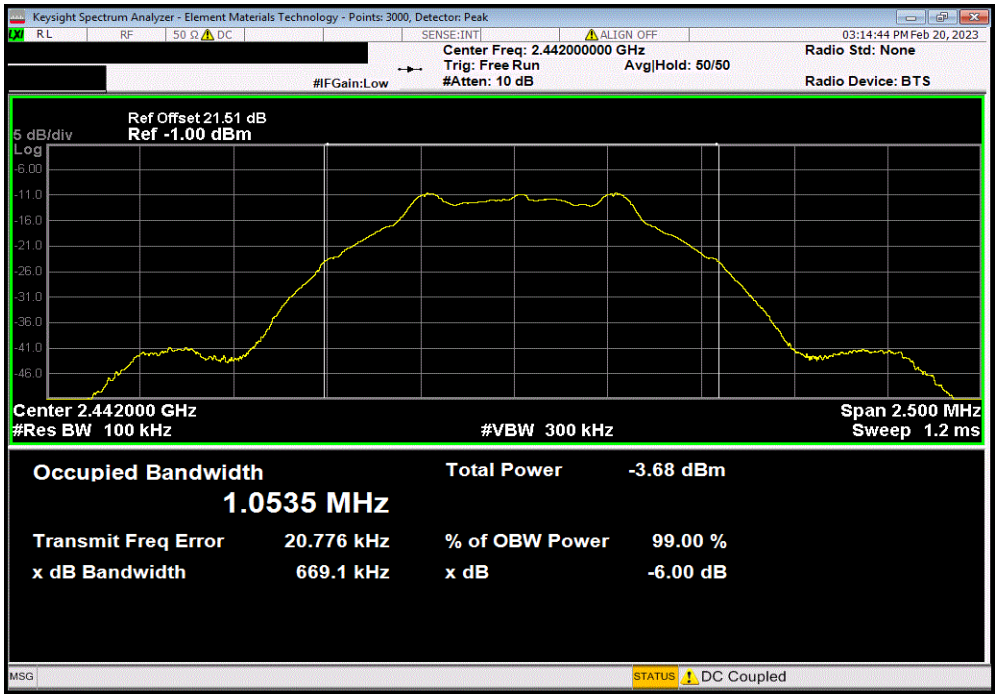
BLE/GFSK 500 kbps, High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				661.742 kHz	500 kHz	Pass



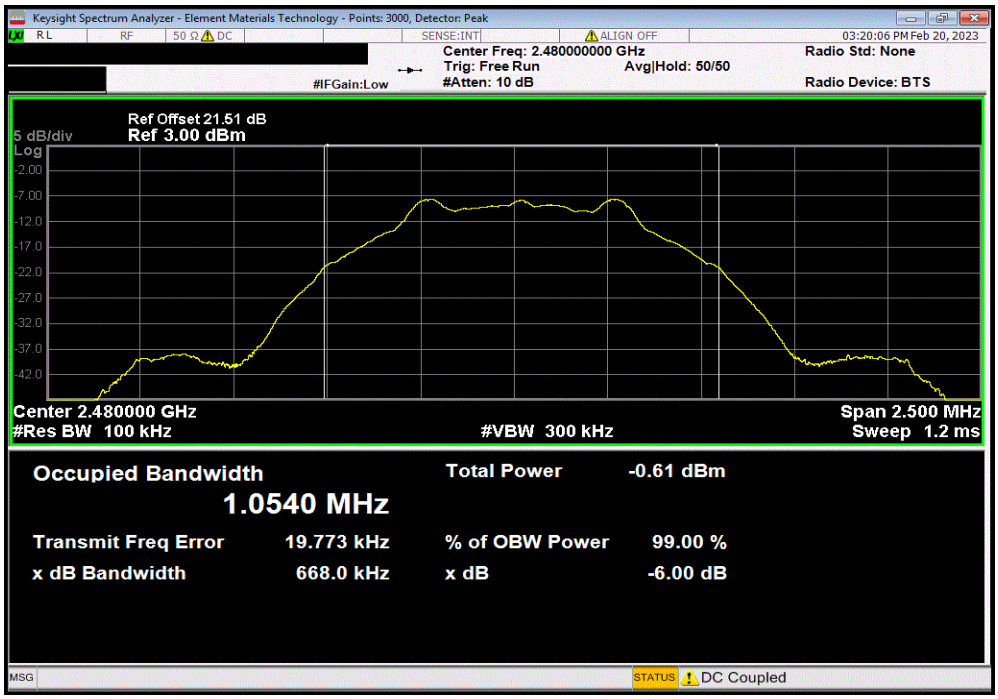
BLE/GFSK 1 Mbps, Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				670.063 kHz	500 kHz	Pass



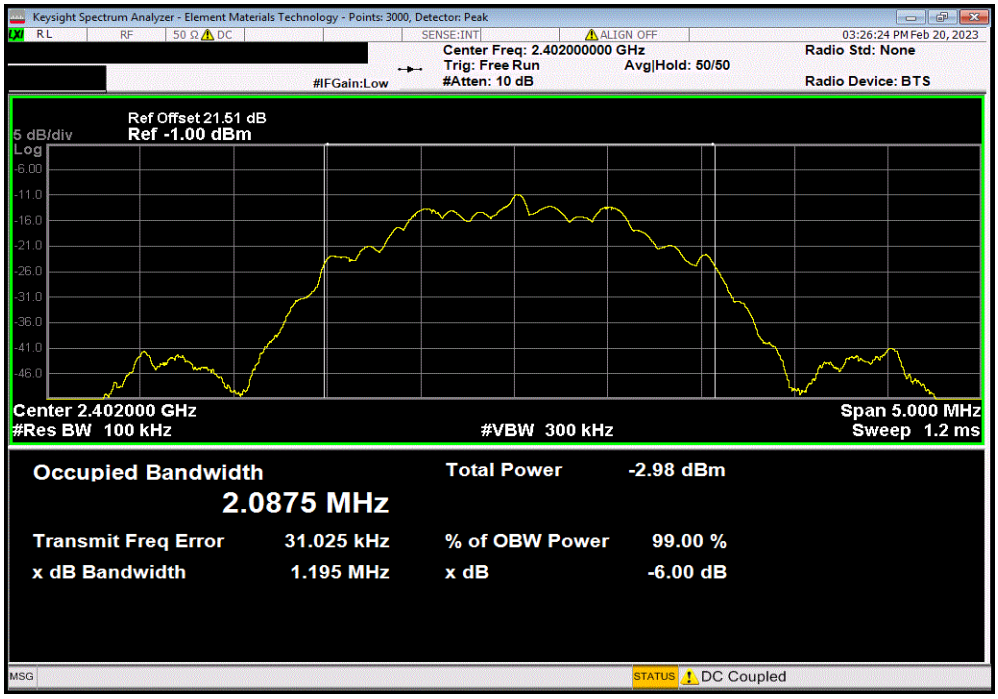
BLE/GFSK 1 Mbps, Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				669.147 kHz	500 kHz	Pass



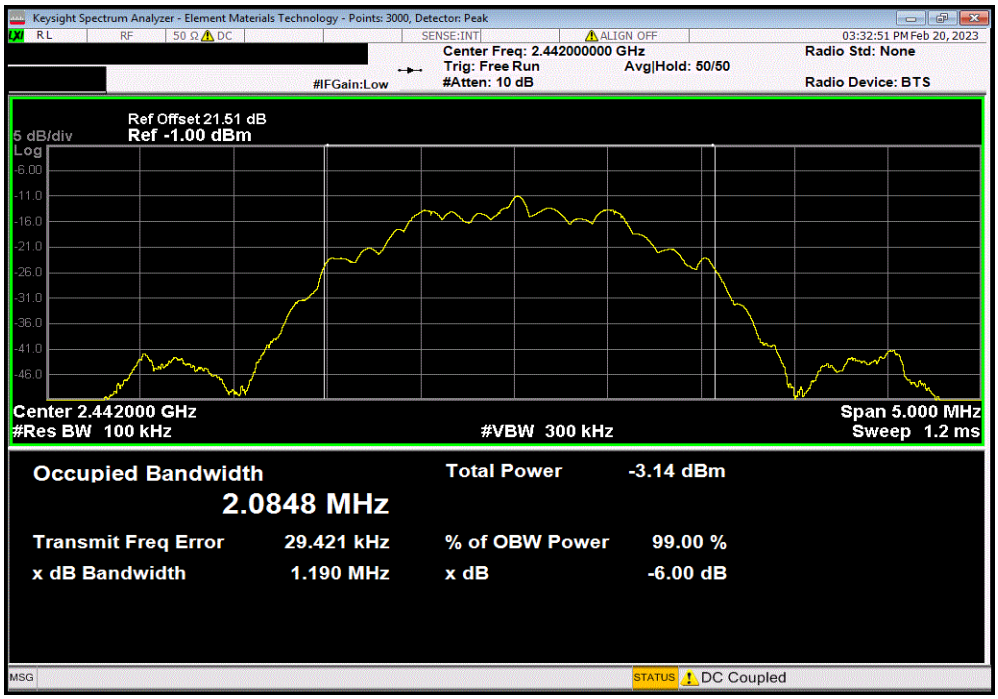
BLE/GFSK 1 Mbps, High Channel, 2480 MHz						
				Value	Limit (≥)	Result
				667.978 kHz	500 kHz	Pass



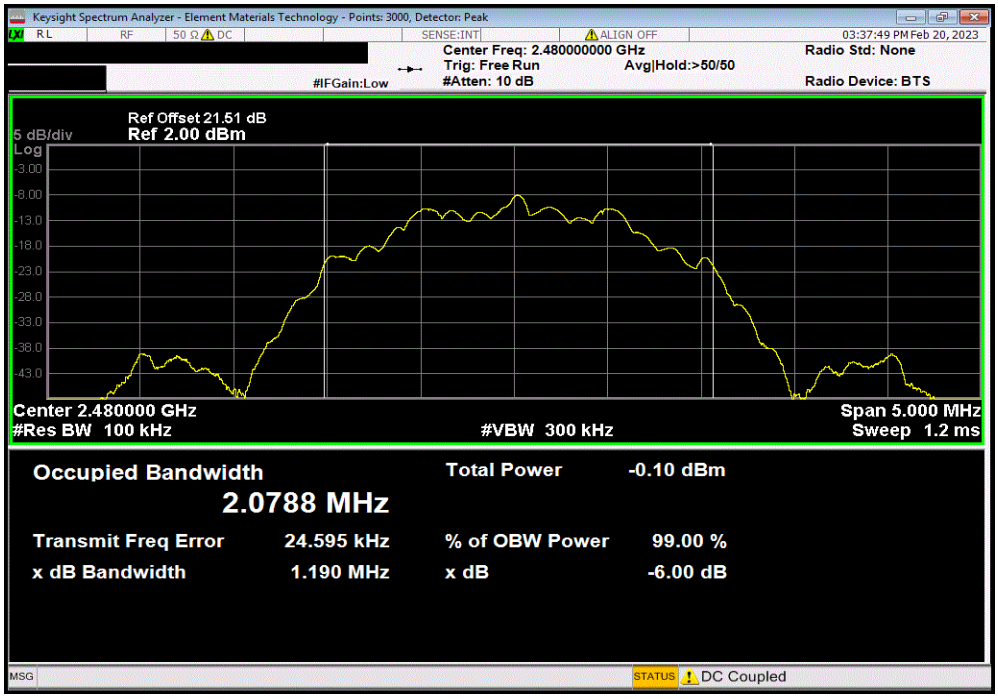
BLE/GFSK 2 Mbps, Low Channel, 2402 MHz						
				Value	Limit (≥)	Result
				1.195 MHz	500 kHz	Pass



BLE/GFSK 2 Mbps, Mid Channel, 2442 MHz						
				Value	Limit (≥)	Result
				1.19 MHz	500 kHz	Pass



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



OCCUPIED BANDWIDTH

XMit 2022.12.28.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	S.M. Electronics	SA26B-20	RFW	2023-02-07	2024-02-07
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Thermometer	Omegaette	HH311	DUY	2020-09-04	2023-09-04
Chamber - Temperature/Humidity	Weiss Technik	MCBH-1.2-.33-.33-H/AC	MTC	NCR	NCR
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Keysight	N5171B (EXG)	TEY	2023-01-23	2026-01-23
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	2022-04-25	2023-04-25

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

The 99% occupied bandwidth was measured with the EUT configured for continuous modulated operation.

Per ANSI C63.10:2013, 6.9.3, the spectrum analyzer was configured as follows:

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) of the spectrum analyzer was set to the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) bandwidth was set to at least 3 times the resolution bandwidth. The analyzer sweep time was set to auto to prevent video filtering or averaging. A sample detector was used unless the device was not able to be operated in a continuous transmit mode, in which case a peak detector was used.

The spectrum analyzer occupied bandwidth measurement function was used to sum the power of the transmission in linear terms to obtain the 99% bandwidth.

OCCUPIED BANDWIDTH

element

TbtTx 2022.06.03.0 XMit 2022.12.28.0

EUT:	TSI Inc. OmniTrak			**Work Order:**	TSIN0196
Serial Number:	TSI55221200048			**Date:**	02/20/2023
Customer:	TSI, Incorporated			**Temperature:**	22.6°C
Attendees:	Shadman Ahmed			**Humidity:**	23.6%
Project:	None			**Barometric Pres.:**	999 mbar
Tested by:	Christopher Heintzelman	**Power:**	5VDC Battery	**Job Site:**	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Test performed in the temperature chamber reading 23C. Reference level offset includes measurement cable, DC block, and attenuator.

DEVIATIONS FROM TEST STANDARD

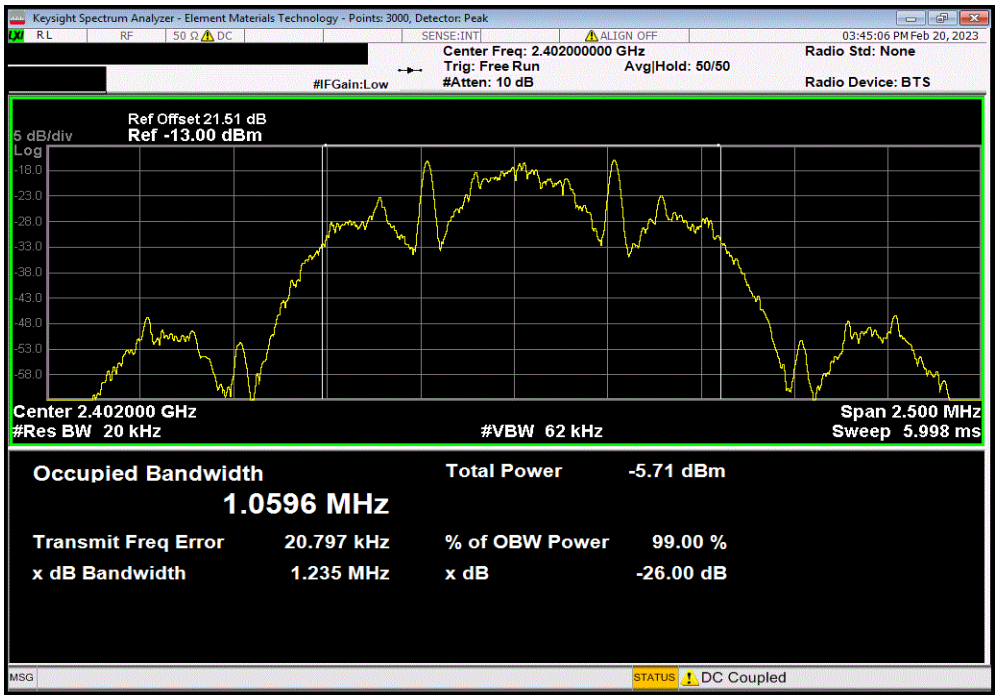
None

Configuration #	TSIN0196-1	Signature

		Value	Limit	Result
BLE/GFSK 125 kbps				
	Low Channel, 2402 MHz	1.06 MHz	N/A	N/A
	Mid Channel, 2442 MHz	1.059 MHz	N/A	N/A
	High Channel, 2480 MHz	1.049 MHz	N/A	N/A
BLE/GFSK 500 kbps				
	Low Channel, 2402 MHz	1.027 MHz	N/A	N/A
	Mid Channel, 2442 MHz	1.02 MHz	N/A	N/A
	High Channel, 2480 MHz	1.034 MHz	N/A	N/A
BLE/GFSK 1 Mbps				
	Low Channel, 2402 MHz	1.05 MHz	N/A	N/A
	Mid Channel, 2442 MHz	1.045 MHz	N/A	N/A
	High Channel, 2480 MHz	1.046 MHz	N/A	N/A
BLE/GFSK 2 Mbps				
	Low Channel, 2402 MHz	2.101 MHz	N/A	N/A
	Mid Channel, 2442 MHz	2.1 MHz	N/A	N/A
	High Channel, 2480 MHz	2.088 MHz	N/A	N/A

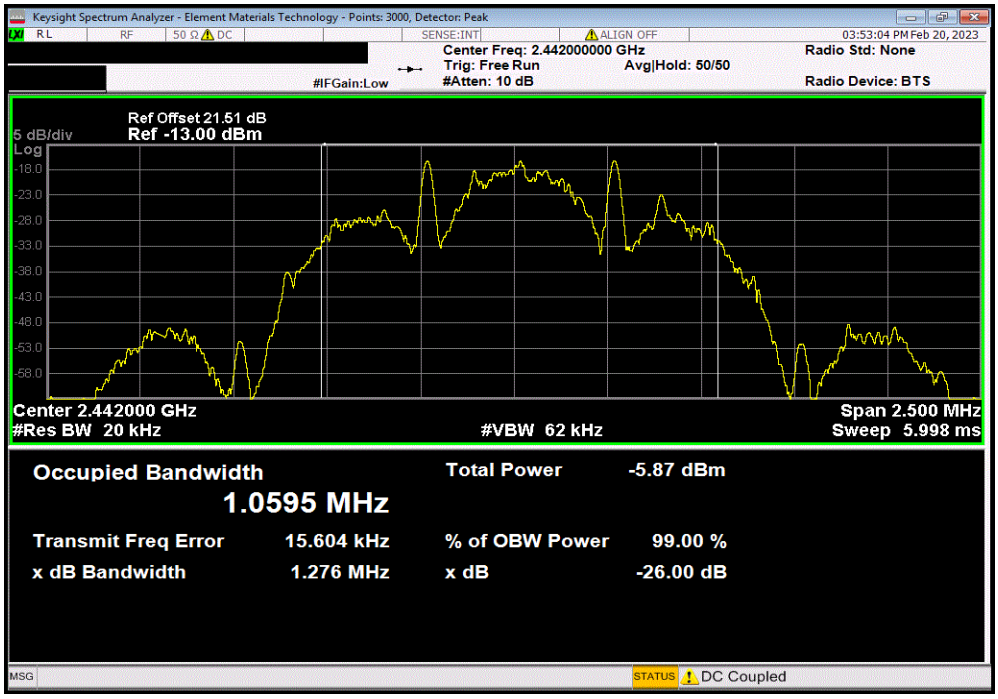
BLE/GFSK 125 kbps, Low Channel, 2402 MHz

				Value	Limit	Result
				1.06 MHz	N/A	N/A



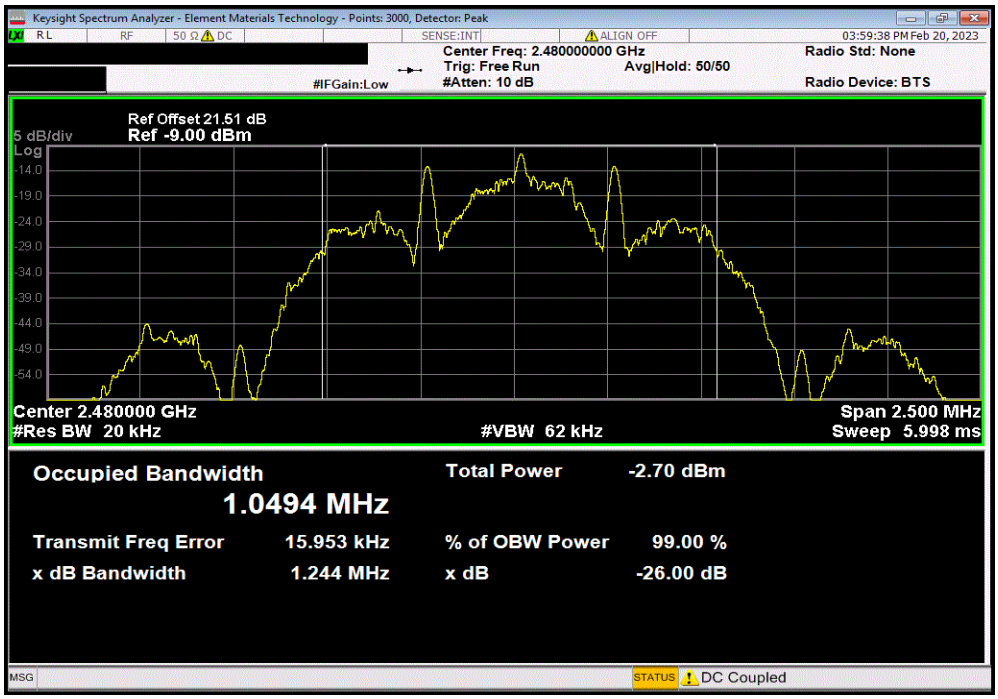
BLE/GFSK 125 kbps, Mid Channel, 2442 MHz

				Value	Limit	Result
				1.059 MHz	N/A	N/A



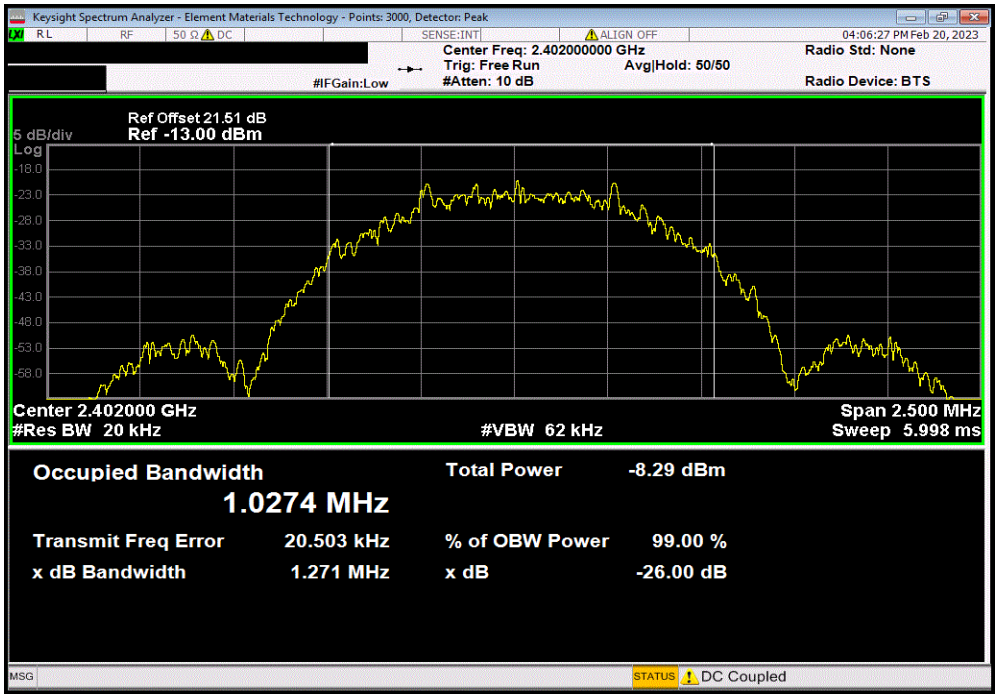
BLE/GFSK 125 kbps, High Channel, 2480 MHz

				Value	Limit	Result
				1.049 MHz	N/A	N/A



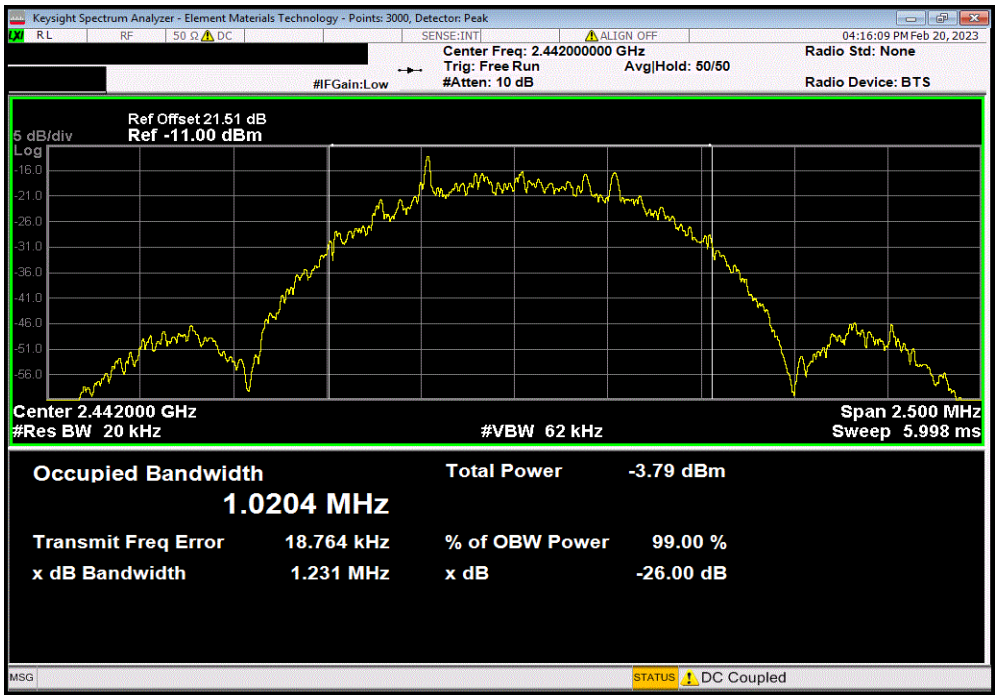
BLE/GFSK 500 kbps, Low Channel, 2402 MHz

				Value	Limit	Result
				1.027 MHz	N/A	N/A



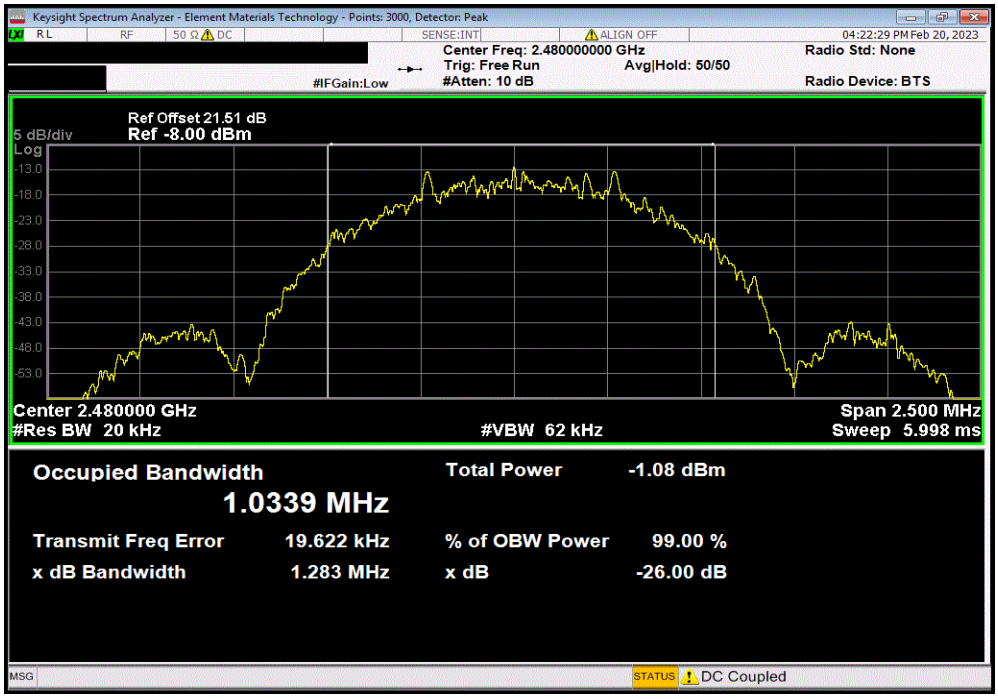
BLE/GFSK 500 kbps, Mid Channel, 2442 MHz

				Value	Limit	Result
				1.02 MHz	N/A	N/A



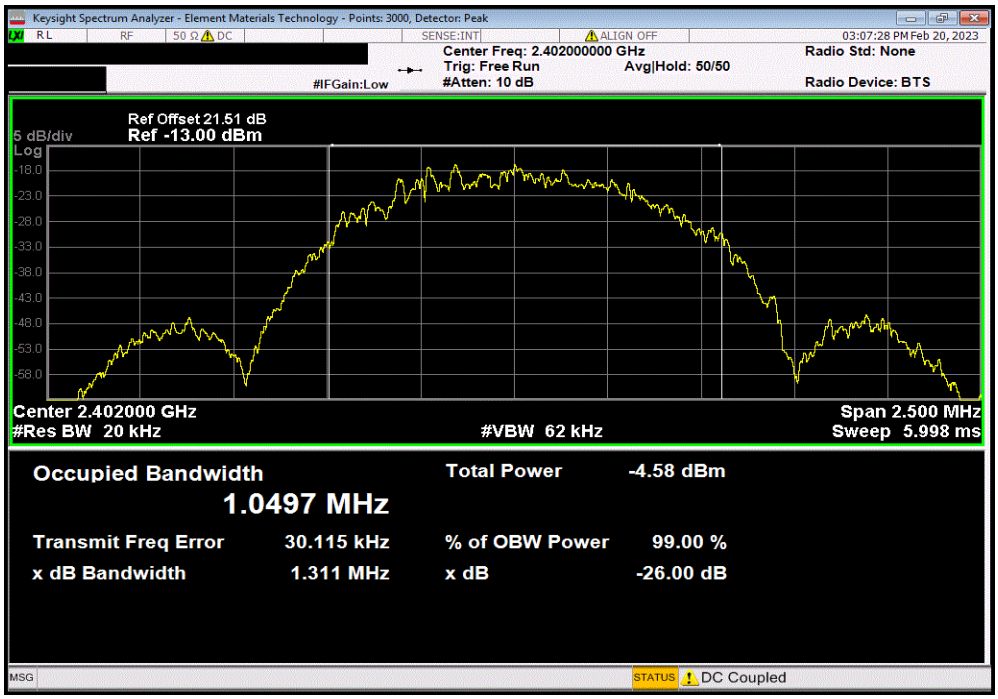
BLE/GFSK 500 kbps, High Channel, 2480 MHz

				Value	Limit	Result
				1.034 MHz	N/A	N/A



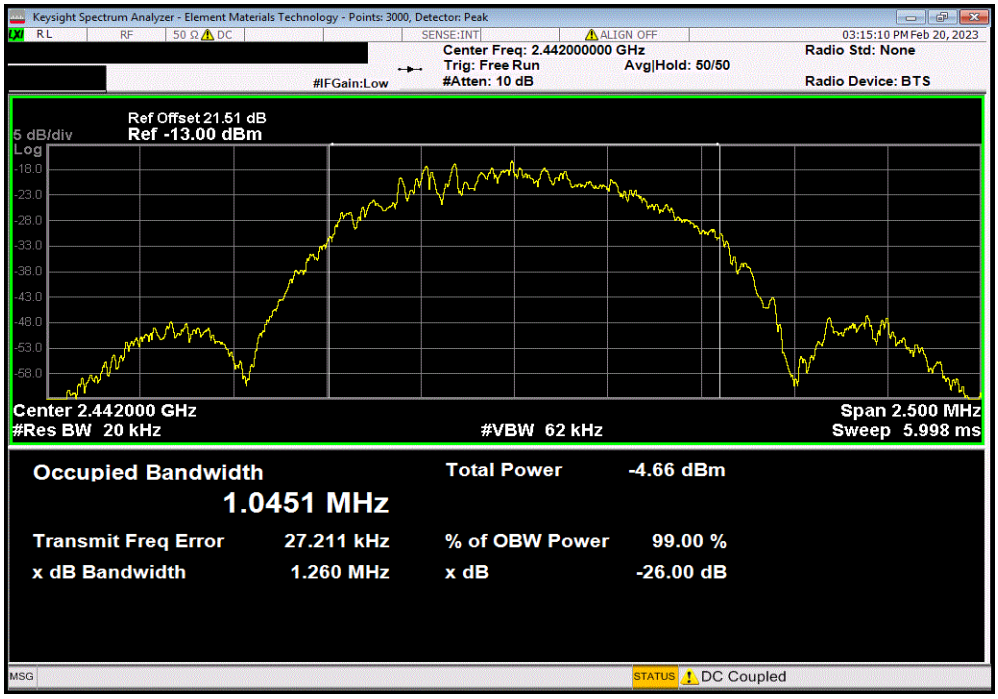
BLE/GFSK 1 Mbps, Low Channel, 2402 MHz

				Value	Limit	Result
				1.05 MHz	N/A	N/A



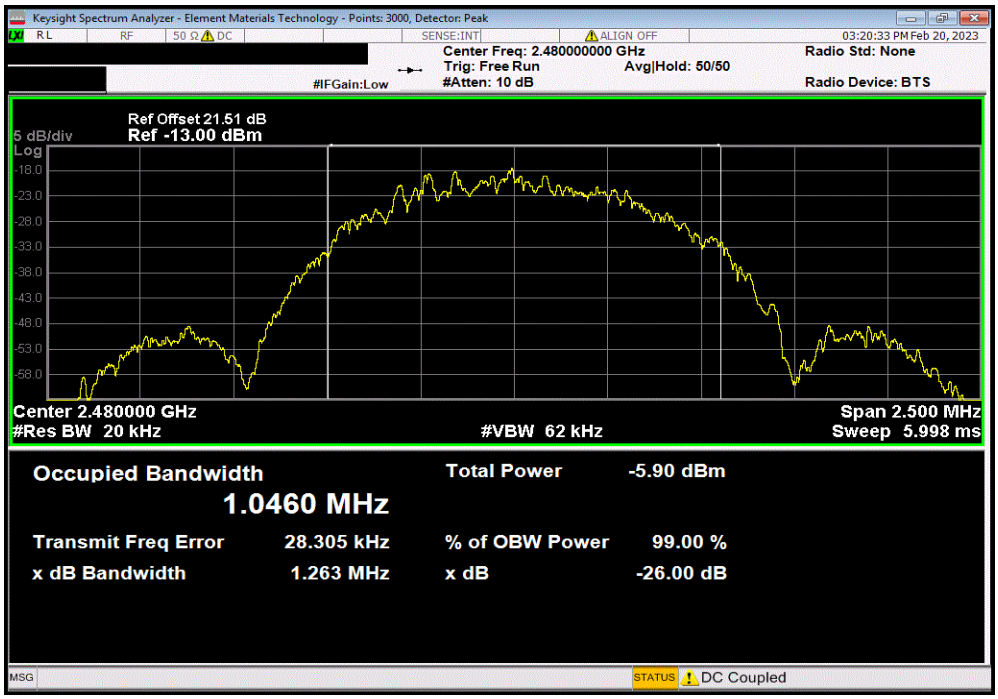
BLE/GFSK 1 Mbps, Mid Channel, 2442 MHz

				Value	Limit	Result
				1.045 MHz	N/A	N/A



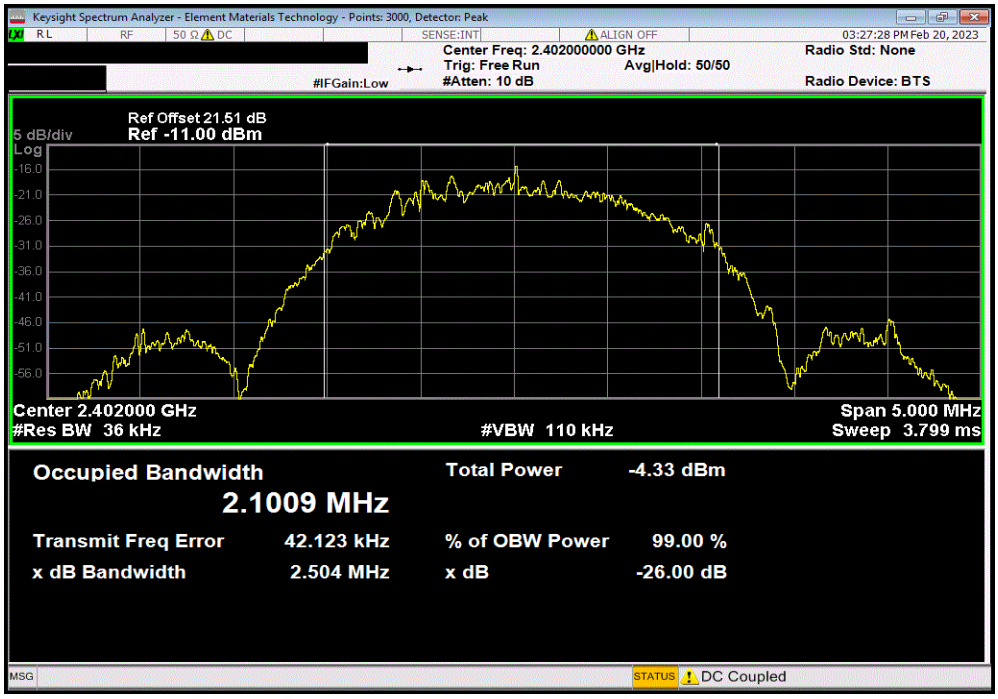
BLE/GFSK 1 Mbps, High Channel, 2480 MHz

				Value	Limit	Result
				1.046 MHz	N/A	N/A



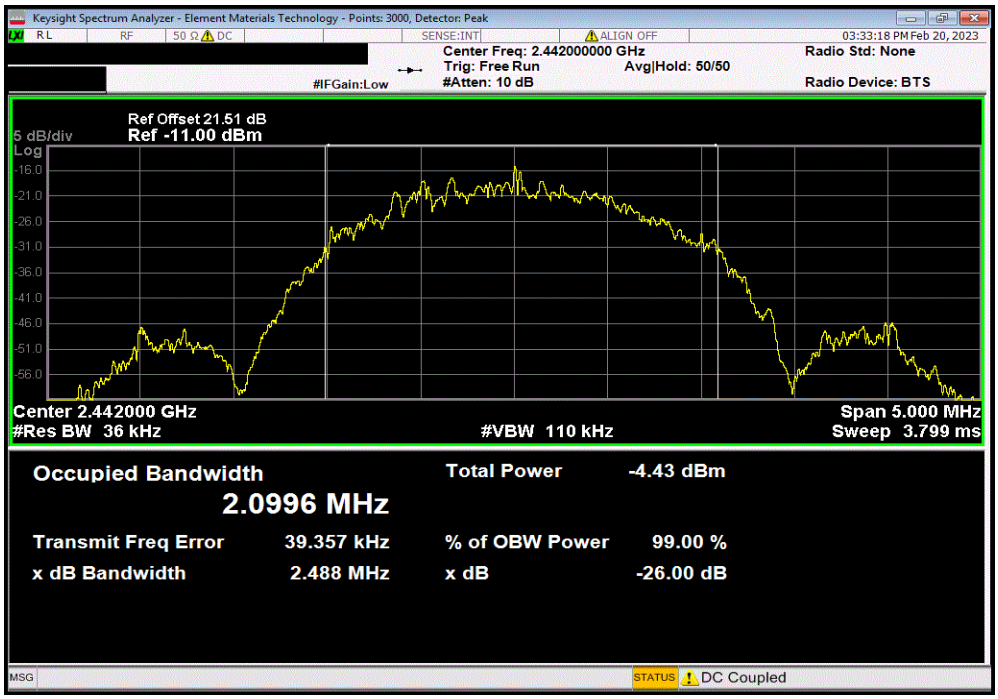
BLE/GFSK 2 Mbps, Low Channel, 2402 MHz

				Value	Limit	Result
				2.101 MHz	N/A	N/A



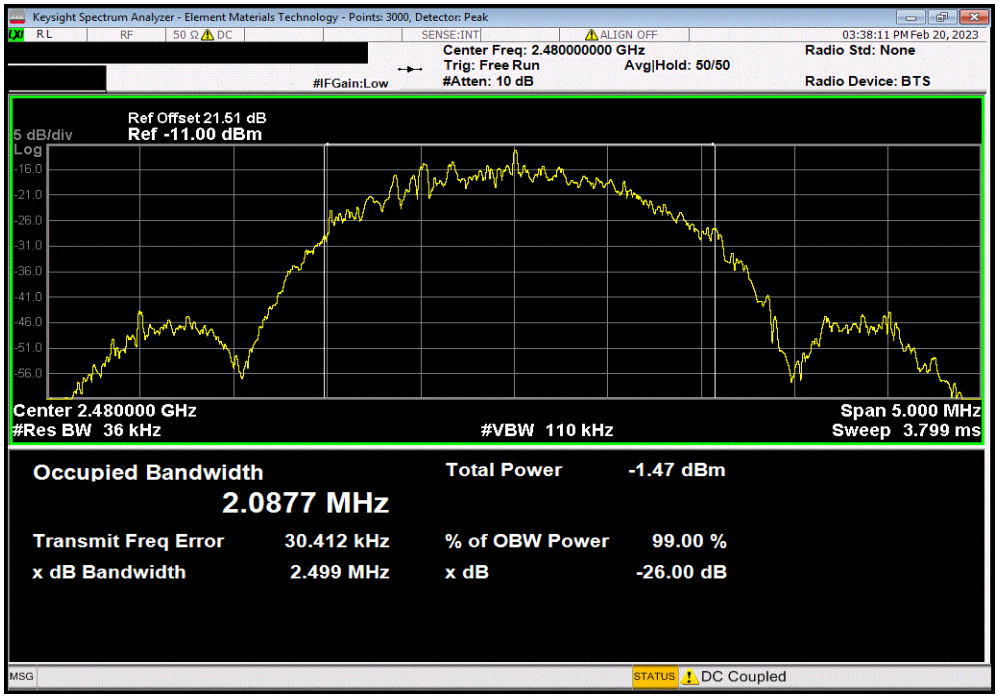
BLE/GFSK 2 Mbps, Mid Channel, 2442 MHz

				Value	Limit	Result
				2.1 MHz	N/A	N/A



BLE/GFSK 2 Mbps, High Channel, 2480 MHz

				Value	Limit	Result
				2.088 MHz	N/A	N/A



OUTPUT POWER

XMit 2023.02.14.0

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Attenuator	S.M. Electronics	SA26B-20	TZP	2022-11-06	2023-11-06
Block - DC	Fairview Microwave	SD3379	AMZ	2022-11-06	2023-11-06
Cable	Micro-Coax	UFD150A-1-0720-200200	MNL	2022-09-10	2023-09-10
Generator - Signal	Agilent	N5182A	TIF	2020-08-29	2023-08-29
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFN	2023-02-02	2024-02-02

TEST DESCRIPTION

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer.

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

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

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

OUTPUT POWER

TbtTx 2022.06.03.0 XMit 2023.02.14.0

EUT:	TSI Inc. OmniTrak			**Work Order:**	TSIN0196
Serial Number:	TSI5230200045			**Date:**	05/25/2023
Customer:	TSI, Incorporated			**Temperature:**	21.7°C
Attendees:	Micah Larson			**Humidity:**	40.8%
Project:	None			**Barometric Pres.:**	1022 mbar
Tested by:	Christopher Heintzelman	**Power:**	Internal Battery (3.7VDC)	**Job Site:**	MN11

TEST SPECIFICATIONS	Test Method
FCC 15.247:2023	ANSI C63.10:2013
RSS-247 Issue 2:2017; RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference level offset includes measurement cable, attenuator, and DC block. The customer states that the USB does not charge the EUT while in the test mode, USB is for programming only. Payload length is 65535.

DEVIATIONS FROM TEST STANDARD

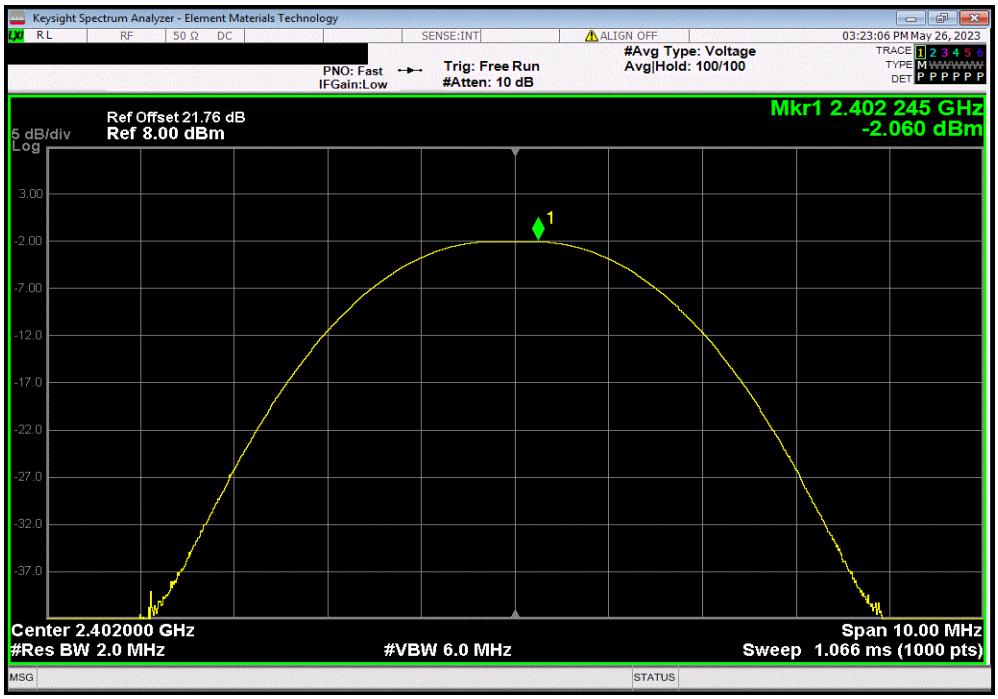
None

Configuration #	TSIN0196-20	Signature

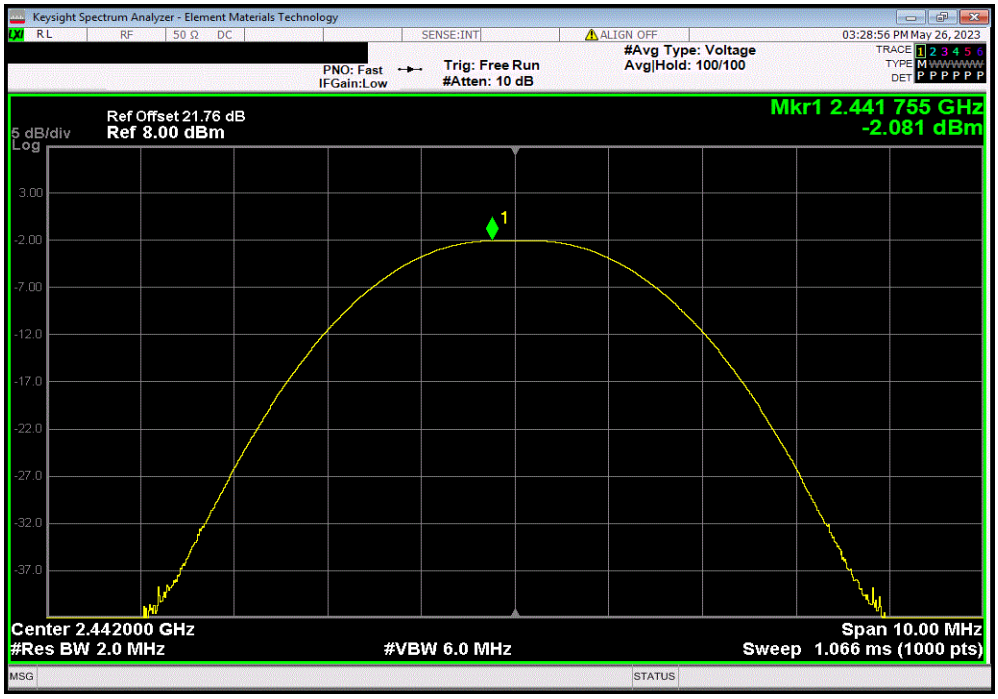
		Out Pwr (dBm)	Limit (dBm)	Result
BLE/GFSK 125 kbps				
	Low Channel, 2402 MHz	-2.06	30	Pass
	Mid Channel, 2442 MHz	-2.081	30	Pass
	High Channel, 2480 MHz	-2.042	30	Pass
BLE/GFSK 500 kbps				
	Low Channel, 2402 MHz	-1.993	30	Pass
	Mid Channel, 2442 MHz	-2.029	30	Pass
	High Channel, 2480 MHz	-1.976	30	Pass
BLE/GFSK 1 Mbps				
	Low Channel, 2402 MHz	-2.004	30	Pass
	Mid Channel, 2442 MHz	-2.021	30	Pass
	High Channel, 2480 MHz	-1.959	30	Pass
BLE/GFSK 2 Mbps				
	Low Channel, 2402 MHz	-1.901	30	Pass
	Mid Channel, 2442 MHz	-1.899	30	Pass
	High Channel, 2480 MHz	-1.848	30	Pass

OUTPUT POWER

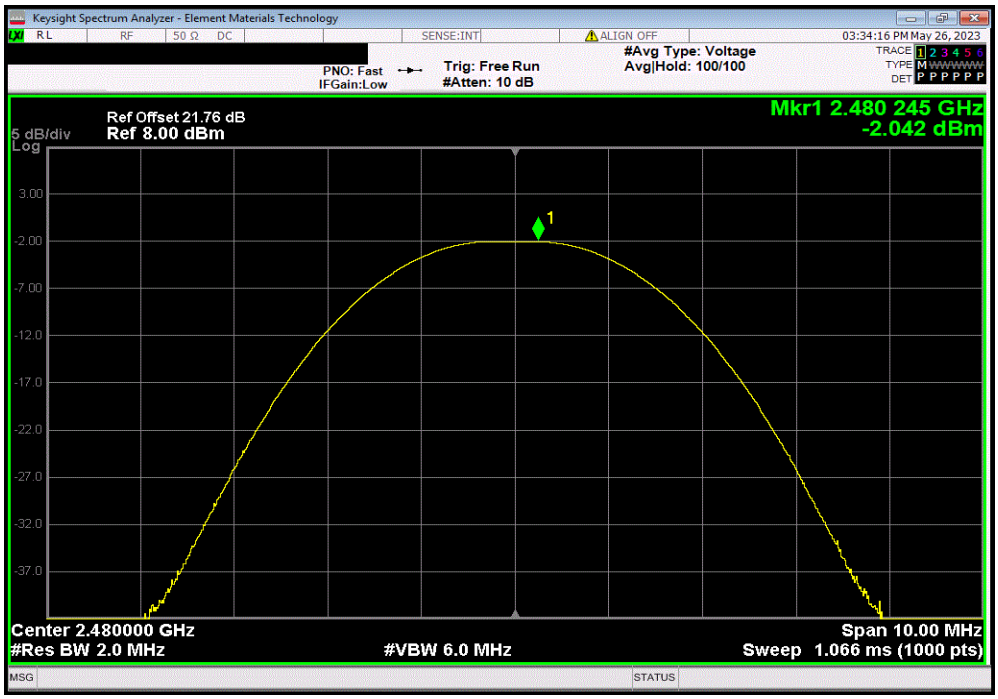
BLE/GFSK 125 kbps, Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.06	30	Pass



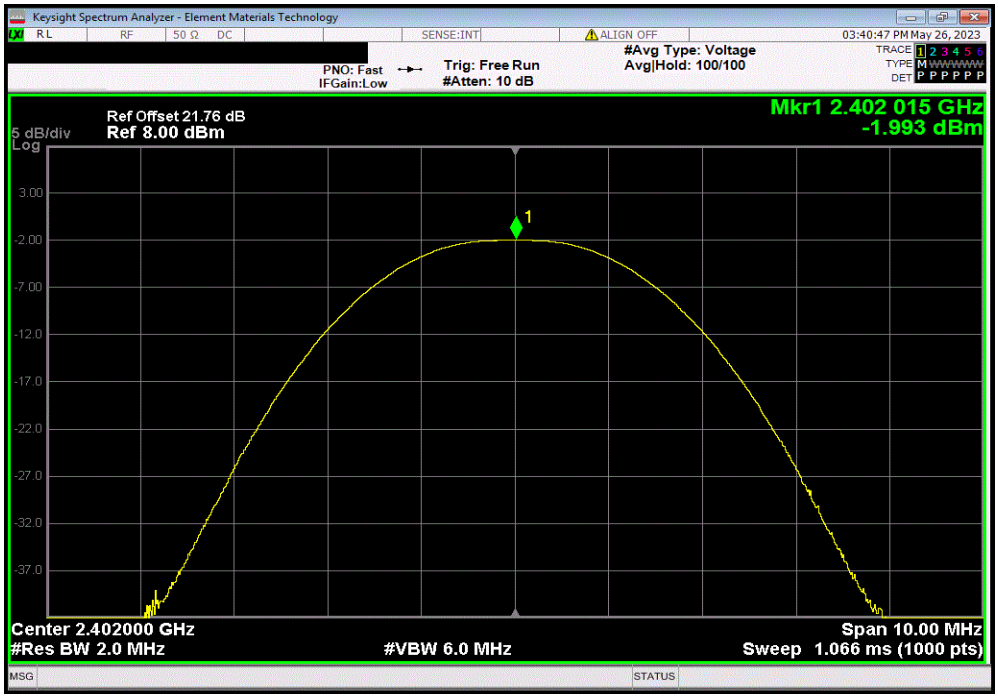
BLE/GFSK 125 kbps, Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.081	30	Pass



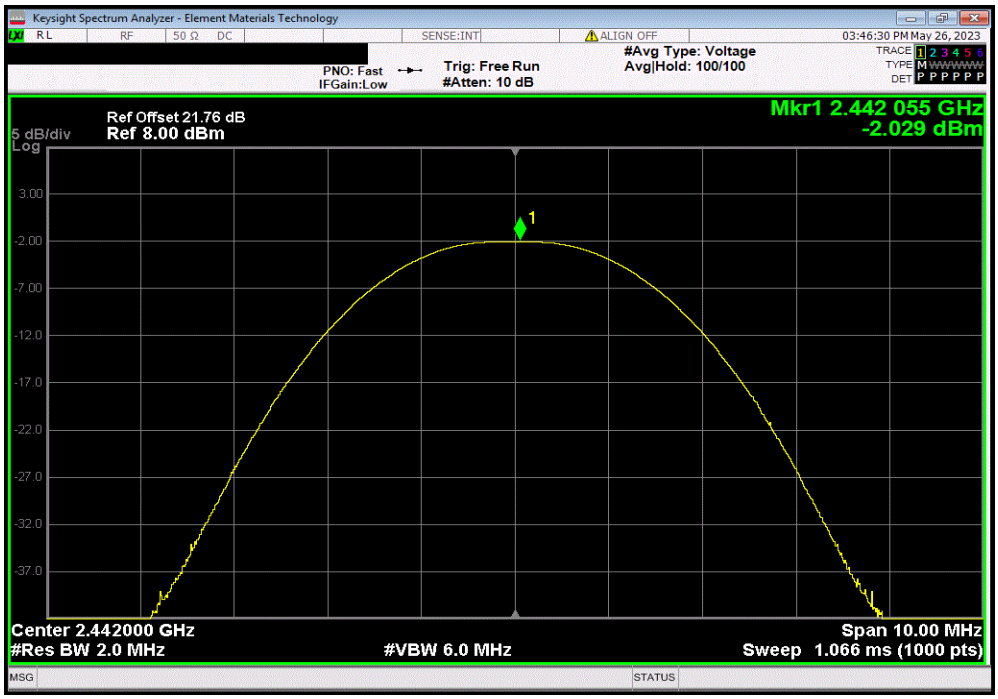
BLE/GFSK 125 kbps, High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.042	30	Pass



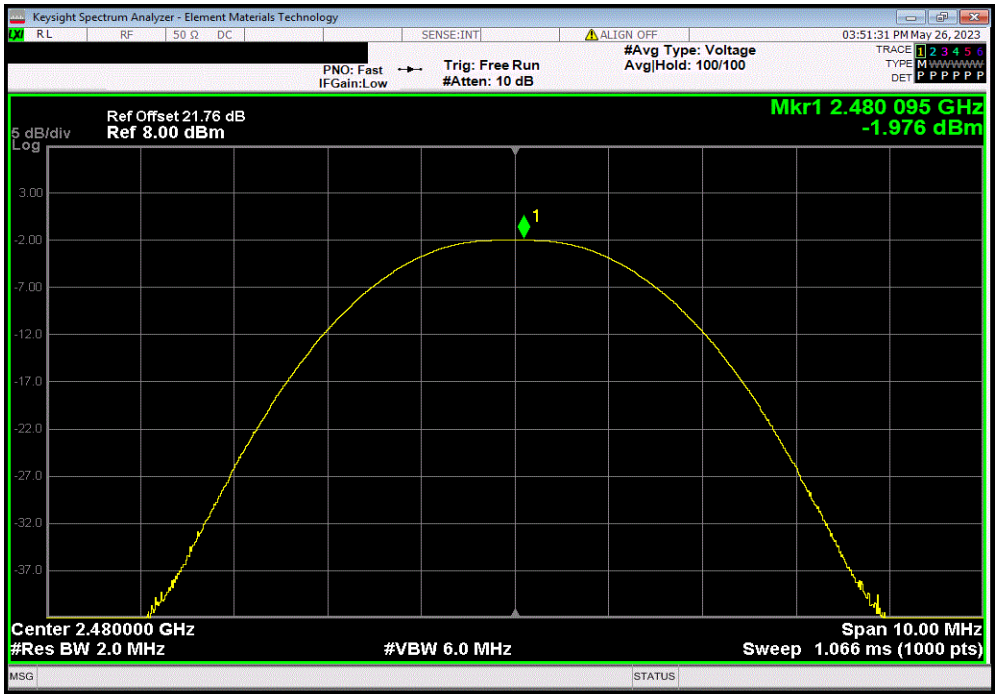
BLE/GFSK 500 kbps, Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.993	30	Pass



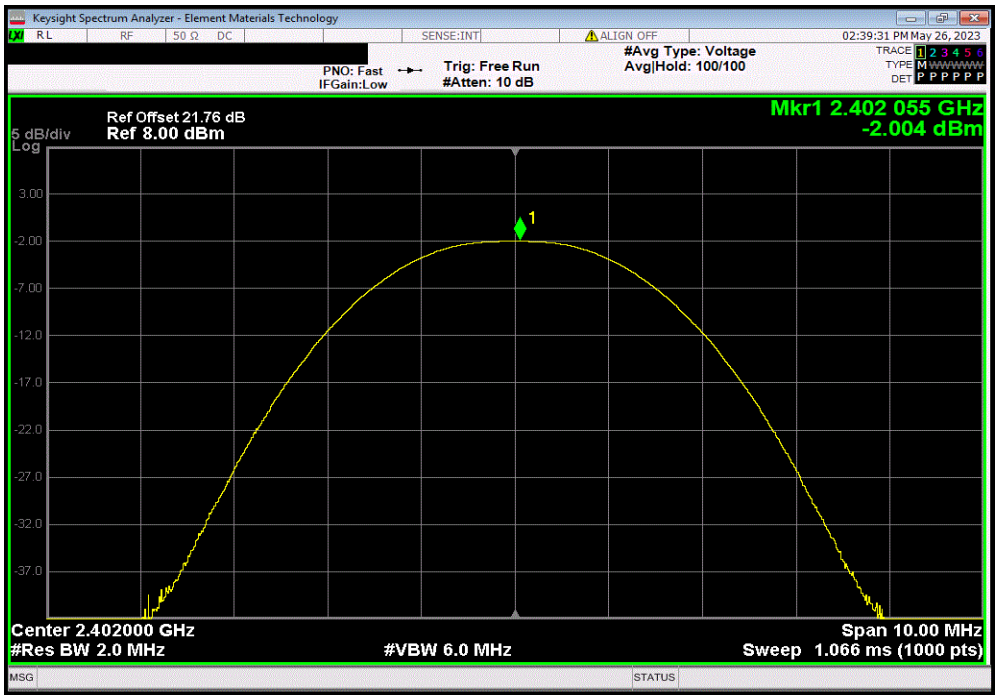
BLE/GFSK 500 kbps, Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.029	30	Pass



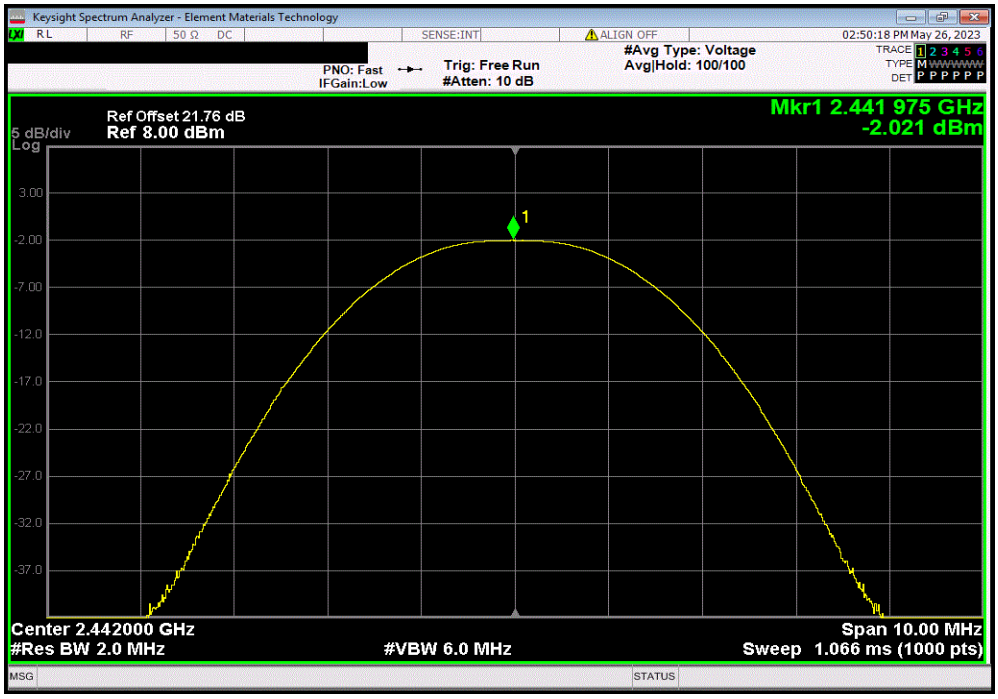
BLE/GFSK 500 kbps, High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.976	30	Pass



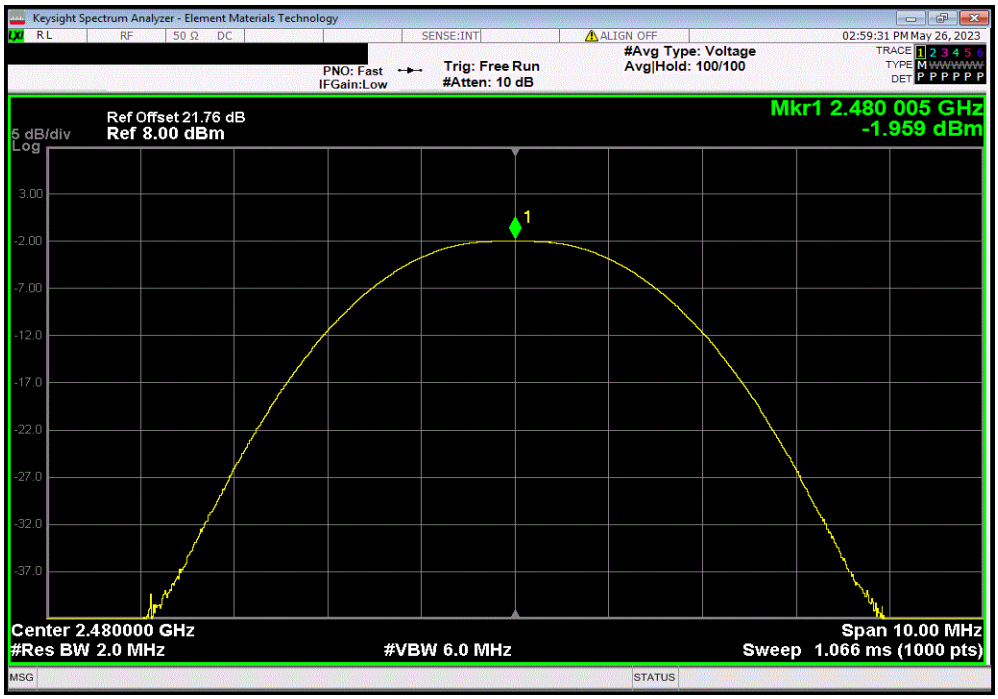
BLE/GFSK 1 Mbps, Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.004	30	Pass



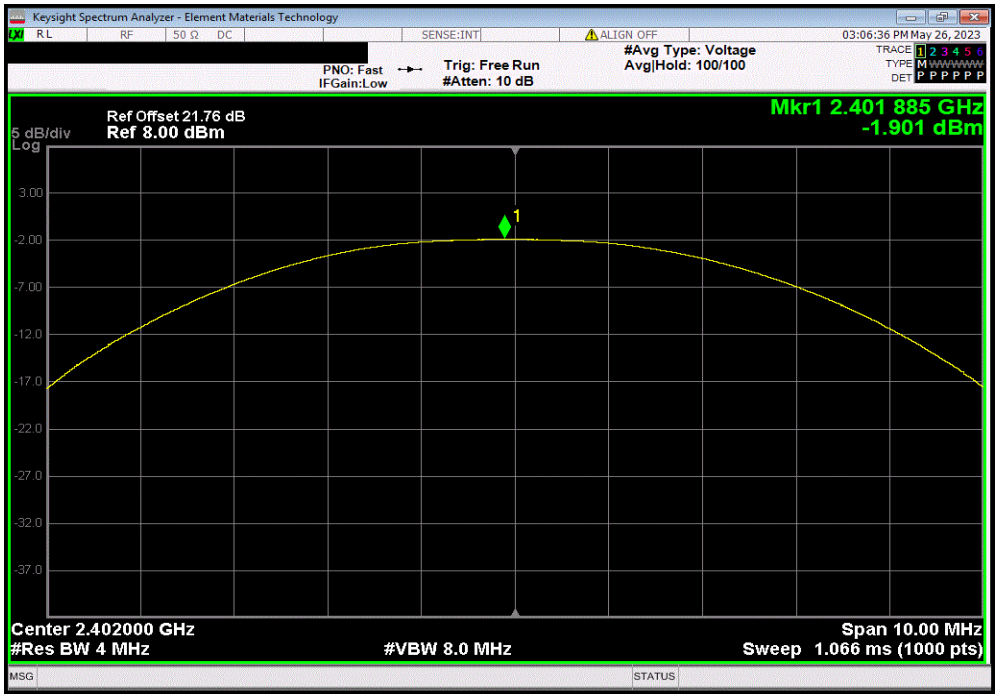
BLE/GFSK 1 Mbps, Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-2.021	30	Pass



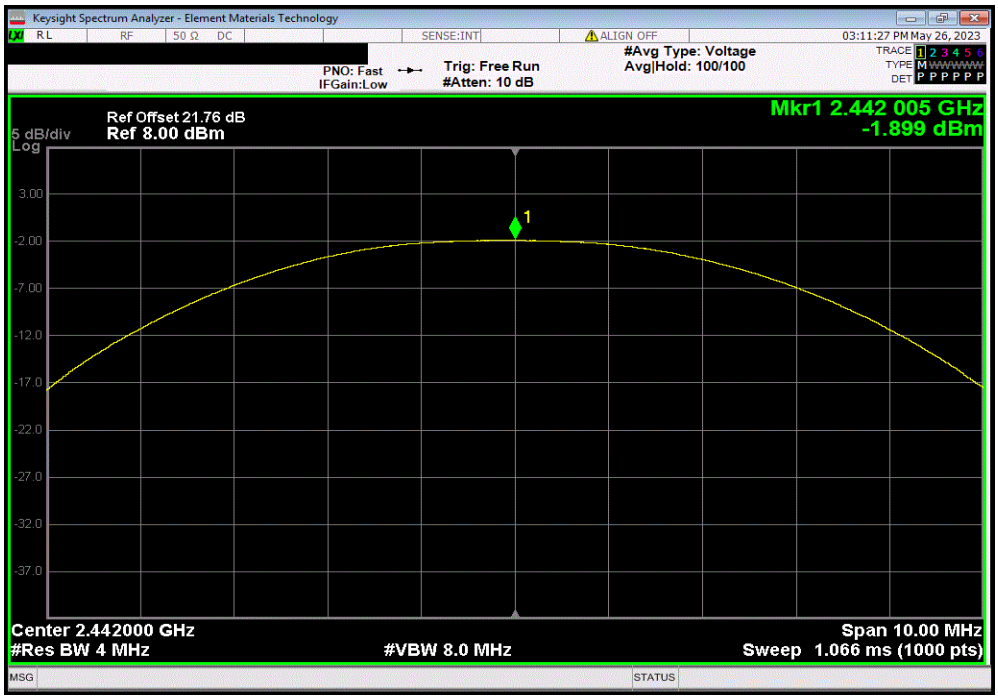
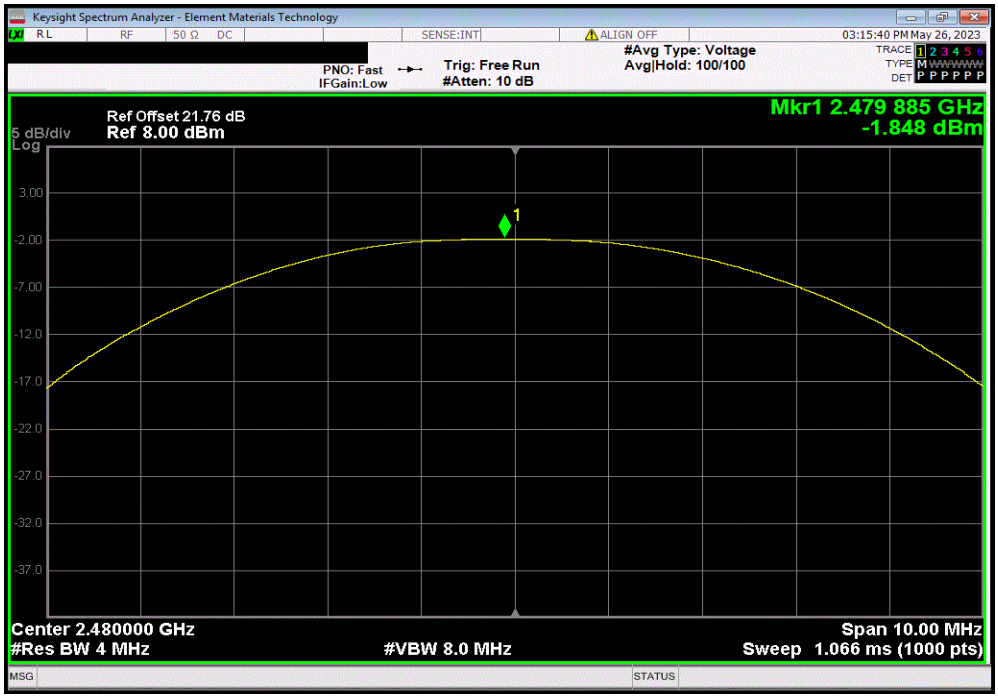
BLE/GFSK 1 Mbps, High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.959	30	Pass



BLE/GFSK 2 Mbps, Low Channel, 2402 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.901	30	Pass



BLE/GFSK 2 Mbps, Mid Channel, 2442 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.899	30	Pass



BLE/GFSK 2 Mbps, High Channel, 2480 MHz						
				Out Pwr (dBm)	Limit (dBm)	Result
				-1.848	30	Pass