



OrthAlign

Lantern Reusable Navigation Unit

FCC 15.247:2024

Bluetooth LE (DTS) radio

Report: ORTH0035.2 Rev. 1, Issue Date: January 2, 2025



TABLE OF CONTENTS

Section	Page Number
Certificate of Test	3
Revision History	4
Accreditations.....	5
Facilities	6
Measurement Uncertainty	7
Test Setup Block Diagrams.....	8
Product Description.....	11
Power Settings and Antenna Gain	12
Configurations	13
Modifications	14
Duty Cycle.....	15
DTS Bandwidth (6 dB)	18
Output Power	21
Equivalent Isotropic Radiated Power	24
Spurious Radiated Emissions	27
End of Report.....	35

CERTIFICATE OF TEST

Last Date of Test: October 16, 2024
 OrthAlign
 EUT: Lantern Reusable Navigation Unit

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2024	ANSI C63.10:2013

Guidance

FCC KDB 558074 v05r02:2019

Results

Test Description	Result	Specification Section(s)	Method Section(s)	Comments
Powerline Conducted Emissions	N/A	15.207	6.2	Not required for a battery powered EUT.
Duty Cycle	N/A	KDB 558074 -6.0	11.6	See data sheet.
DTS Bandwidth (6 dB)	Pass	15.247(a)(2), KDB 558074 -8.2	11.8.2	
Occupied Bandwidth (99%)	N/A	KDB 558074 -2.1	6.9.3	Not required to show compliance of the module in the host.
Output Power	Pass	15.247(b)(3), KDB 558074 -8.3.1	11.9.1.1	
Equivalent Isotropic Radiated Power	Pass	15.247(b)(3), KDB 558074 -8.3.1	11.9.1.1	
Power Spectral Density	N/A	15.247(e), KDB 558074 -8.4	11.10.2	Not required to show compliance of the module in the host.
Band Edge Compliance	N/A	15.247(d), KDB 558074 -8.5	11.11	Not required to show compliance of the module in the host.
Spurious Conducted Emissions	N/A	15.247(d), KDB 558074 -8.5	11.11	Not required to show compliance of the module in the host.
Spurious Radiated Emissions	Pass	15.247(d), KDB 558074 - 8.6, 8.7	11.12.1, 11.13.2, 6.5, 6.6	

Deviations From Test Standards

None

Approved By:



Jeff Alcock, Senior EMC Test Engineer
 Signed for and on behalf of Element

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
01	Antenna Gain updated from 4 to 5 dBi, Software SW0208, Rev. 4.0.0.99 added, units (dBm) added to power setting column header, Only 1Mbps Data Rate enabled on EUT (2 Mbps data rate removed from Power setting and antenna module)	2024-12-20	12
	Replaced all instances of SN: "See Configurations" with "2401016"	2024-12-20	16, 19, 22, 25, 28, 30
	Conducted configuration added. Direct connect test headers updated with conducted config (ORTH0035-2, SN: R243200116)	2024-12-20	13
	Updated gain from 4 to 5 dBi. EIRP recalculated	2024-12-20	25
	20 dB attenuator (TKQ) added to equipment list	2024-12-20	27
	Additional pre-scans added	2024-12-20	32-34
	20 dB external attenuation was used throughout band edge data. User error when accidentally switching filter from 10db to 20db and not adjusting "Attenuation override" Setting in Emissions software. Data adjusted accordingly	2024-12-20	31
	Unnecessary scans removed	2024-12-20	33
	Photos removed from data	2024-12-20	35-37 (previously)

ACCREDITATIONS AND AUTHORIZATIONS



United States

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

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

Canada

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

European Union

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

United Kingdom

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

Australia/New Zealand

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

Korea

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

Japan

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

Taiwan

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

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

Singapore

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

Israel

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

Hong Kong

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

Vietnam

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

SCOPE

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

[California](#)

[Minnesota](#)

[Oregon](#)

[Texas](#)

[Washington](#)

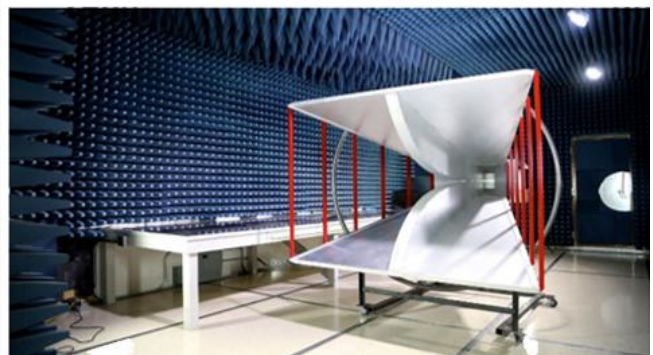
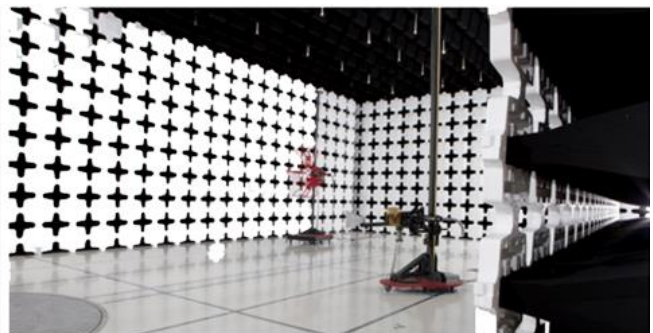
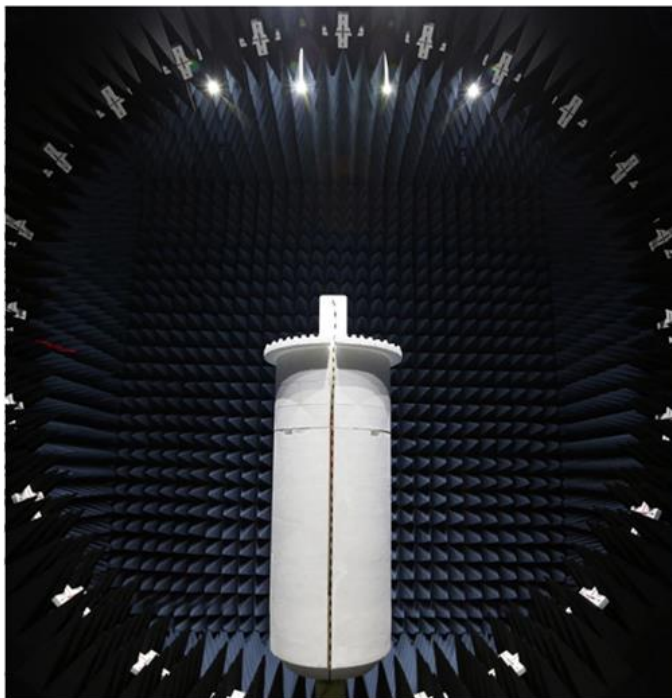
FACILITIES

Testing was performed at the following location(s)

	Location	Labs ⁽¹⁾	Address	A2LA ⁽²⁾	ISED ⁽³⁾	BSMI ⁽⁴⁾	VCCI ⁽⁵⁾	CAB ⁽⁶⁾	FDA ⁽⁷⁾
☒	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☐	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	US0175	TL-57
☐	Oregon	EV01-12	6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	3310.02	2834D	SL2-IN-E-1017	A-0108	US0017	TL-56
☐	Plano Texas	PT01-15	1701 E Plano Pkwy, Ste 150 Plano, TX 75074 (972) 509-2566	214.19	32637	SL2-IN-E-057R	A-0426	US0054	TL-137
☐	Washington	NC01-05	19201 120th Ave NE Bothell, WA 98011 (425) 984-6600	3310.06	2834F	SL2-IN-E-1153R	A-0110	US0157	TL-67
☐	Offsite	N/A	See Product Description	N/A	N/A	N/A	N/A	N/A	N/A

See data sheets for specific labs

- (1) The lab designations denote individual rooms within each location. (OC01, OC02, OC03, etc.)
- (2) A2LA Certificate No.
- (3) ISED Company No.
- (4) BSMI No.
- (5) VCCI Site Filing No.
- (6) CAB Identifier. Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA
- (7) FDA ASCA No.



MEASUREMENT UNCERTAINTY

Measurement Uncertainty

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

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

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

Various Measurements

Test	All Labs (+/-)
Frequency Accuracy (%)	0.0007
Amplitude Accuracy (dB)	1.2
Conducted Power (dB)	1.2
Radiated Power via Substitution (dB)	0.7
Temperature (degrees C)	0.7
Humidity (% RH)	2.5
Voltage (AC) (%)	1
Voltage (DC) (%)	0.7

Field Strength Measurements (dB)

Range	OC10 (+/-)	OC13 (+/-)
10kHz-30MHz	1.8	N/A
30MHz-1GHz 3m	4.6	N/A
1GHz-6GHz	5	N/A
6GHz-40GHz	5.1	N/A

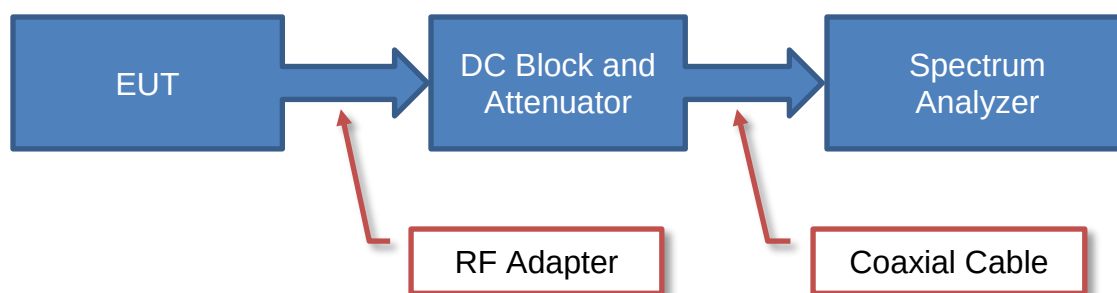
TEST SETUP BLOCK DIAGRAMS

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.

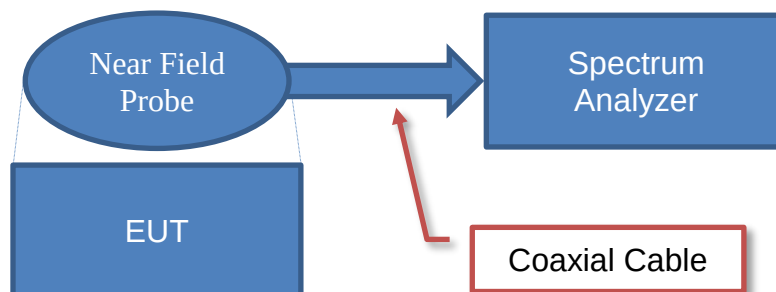
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

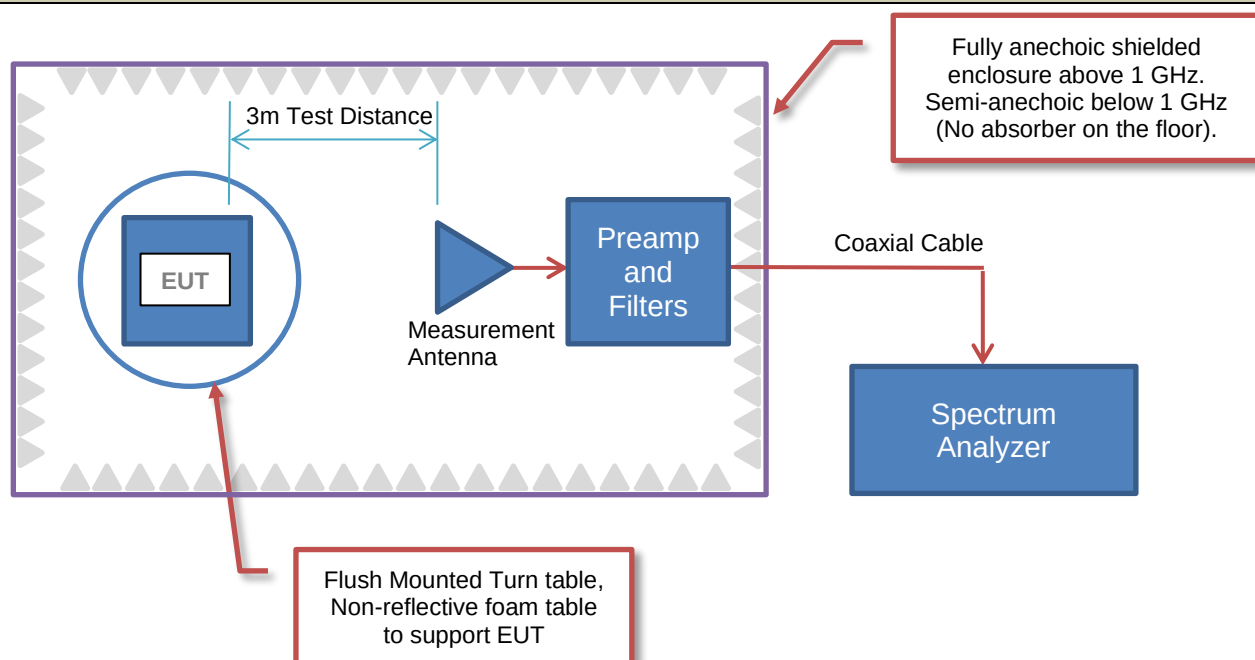


Sample Calculation (logarithmic units)

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			Distance Adjustment Factor	External Attenuation	Field Strength
	Antenna Factor	Cable Factor	Amplifier Gain			
42.6	28.6	3.1	40.8	0.0	0.0	33.5

Conducted Emissions:

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

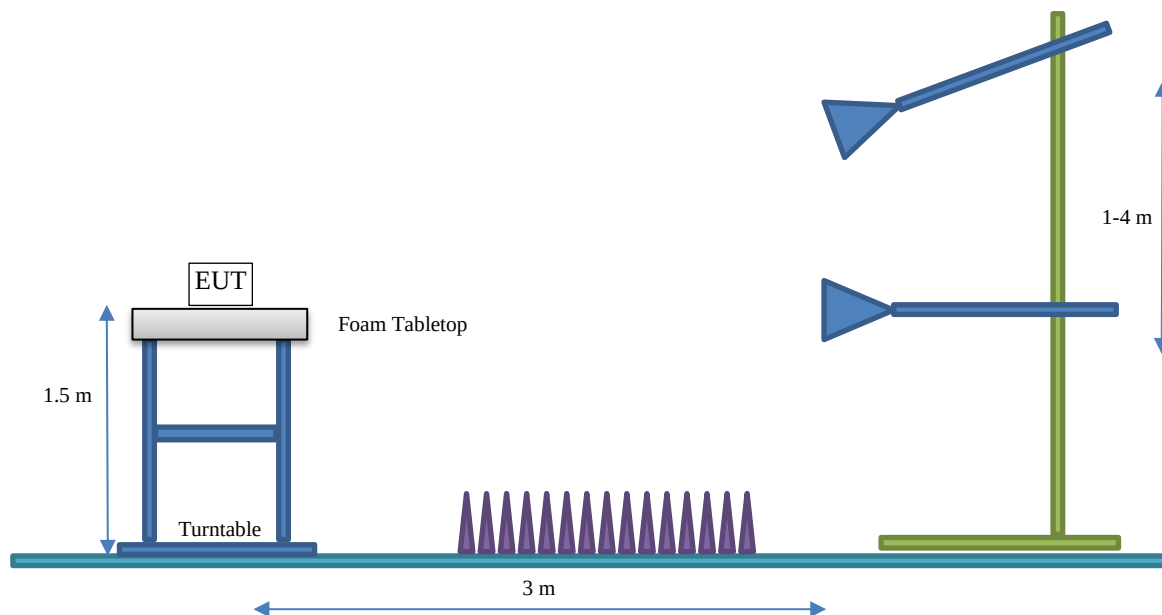
Radiated Power (ERP/EIRP) – Substitution Method:

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:	OrthAlign
Address:	153 Technology Dr, Suite 100
City, State, Zip:	Irvine, CA 92618
Test Requested By:	Kian Gholizadeh
EUT:	Lantern Reusable Navigation Unit
First Date of Test:	October 15, 2024
Last Date of Test:	October 16, 2024
Receipt Date of Samples:	October 15, 2024
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Surgical navigation device containing Wi-fi and Bluetooth Low Energy transmitter and receiver.
Testing Objective:
To demonstrate compliance of the Bluetooth radio to FCC 15.247 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)
FPC Antenna	Pulse/Larsen Antennas	2400 - 2500	5

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

- ☐ Test software settings Software/firmware used for testing: SW0208, Revision 4.0.0.99
- ☒ Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Modulation Types / Data Rates	Type	Channel	Frequency (MHz)	Power Setting (dBm)
BLE GFSK 1 Mbps	DTS	0 or 37	2402	7
		20 or 18	2442	7
		39	2480	7

CONFIGURATIONS



Configuration ORTH0035-1

EUT					
Description		Manufacturer	Model/Part Number	Serial Number	
Lantern Reusable Navigation Unit (Radiated)		OrthAlign	407002	2401016	
Peripherals in Test Setup Boundary					
Description		Manufacturer	Model/Part Number	Serial Number	
Laptop PC		Dell	Precision 3520	F8STZM2	
DC Power Supply		OrthAlign	DCP3010D	2019015178	
Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB to Ethernet Adapter Cable	Yes	10cm	No	Lantern Reusable Navigation Unit	Ethernet Cat 5 Cable
Ethernet Cat 5 Cable	No	10m	No	USB to Ethernet Adapter Cable	Laptop PC
DC Power Cables	No	10m	No	DC Power Supply	Lantern Reusable Navigation Unit

Configuration ORTH0035-2

EUT					
Description		Manufacturer	Model/Part Number	Serial Number	
Lantern Reusable Navigation Unit (Conducted)		OrthAlign	407002	R243200116	
Peripherals in Test Setup Boundary					
Description		Manufacturer	Model/Part Number	Serial Number	
Laptop PC		Dell	Precision 3520	F8STZM2	
DC Power Supply		OrthAlign	DCP3010D	2019015178	
Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
USB to Ethernet Adapter Cable	Yes	10cm	No	Lantern Reusable Navigation Unit	Ethernet Cat 5 Cable
Ethernet Cat 5 Cable	No	10m	No	USB to Ethernet Adapter Cable	Laptop PC
DC Power Cables	No	10m	No	DC Power Supply	Lantern Reusable Navigation Unit

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2024-10-15	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.
2	2024-10-16	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.
3	2024-10-16	Duty Cycle	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2024-10-16	Equivalent Isotropic Radiated Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
5	2024-10-16	Output Power	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

DUTY CYCLE

TEST DESCRIPTION

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 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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	2023-12-05	2024-12-05
Block - DC	Fairview Microwave	SD3379	ANG	2024-07-11	2025-07-11
Attenuator	Fairview Microwave	SA18H-20	UAX	2024-07-11	2025-07-11
Cable	Micro-Coax	UFD150A-1-0720-200200	OCA	2024-10-02	2025-10-02
Generator - Signal	Agilent	E8257D	TGU	2023-11-08	2026-11-08
Meter - Multimeter	Fluke	107	MBF	2024-04-12	2025-04-12

DUTY CYCLE

EUT:	Lantern Reusable Navigation Unit	Work Order:	ORTH0035
Serial Number:	R243200116	Date:	2024-10-16
Customer:	OrthAlign	Temperature:	21.6°C
Attendees:	Steven Devinentis, Kian Gholizadeh	Relative Humidity:	58.4%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Mark Baytan	Job Site:	OC13
Power:	5VDC	Configuration:	ORTH0035-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013

COMMENTS

Reference level offset accounted for within the measurements.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

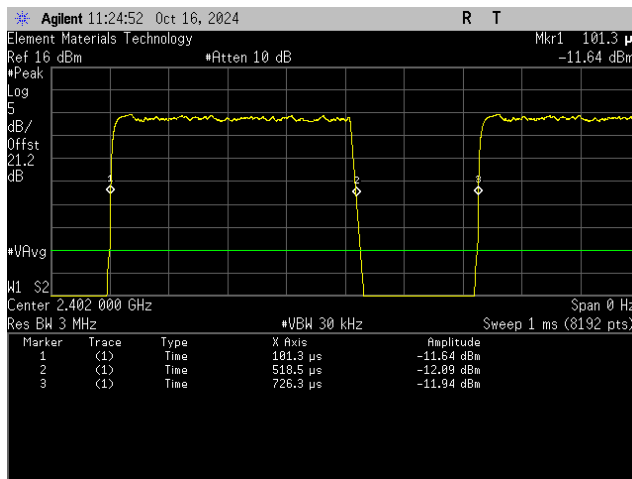


Tested By

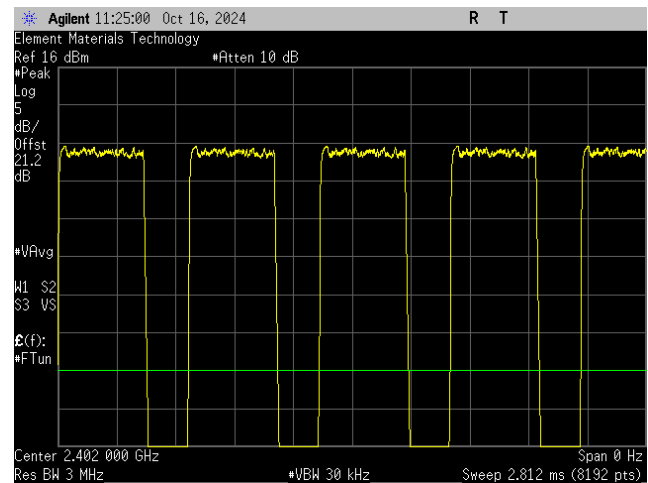
TEST RESULTS

	Pulse Width	Period	Number of Pulses	Value (%)	Limit N/A ()	Results
BLE/GFSK 1 Mbps						
Low Channel, 2402 MHz	417.166 us	625 us	1	66.7	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
Mid Channel, 2442 MHz	417.178 us	625.1 us	1	66.7	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A
High Channel, 2480 MHz	417.412 us	625.1 us	1	66.8	N/A	N/A
	N/A	N/A	5	N/A	N/A	N/A

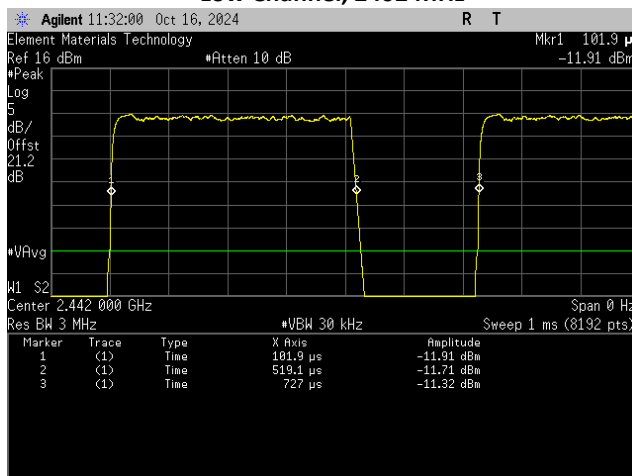
DUTY CYCLE



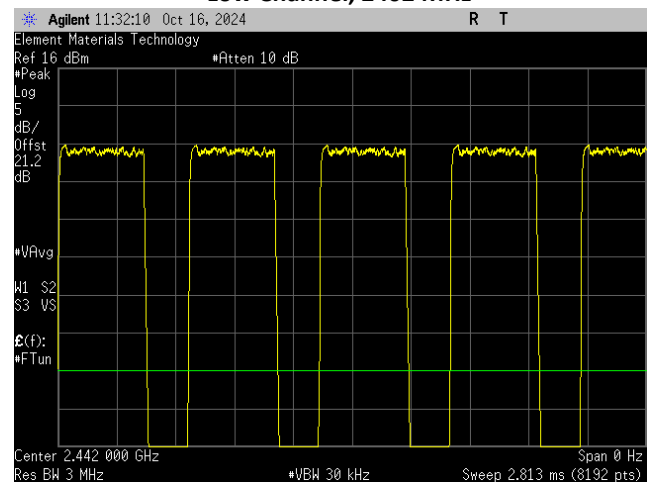
**BLE/GFSK 1 Mbps
Low Channel, 2402 MHz**



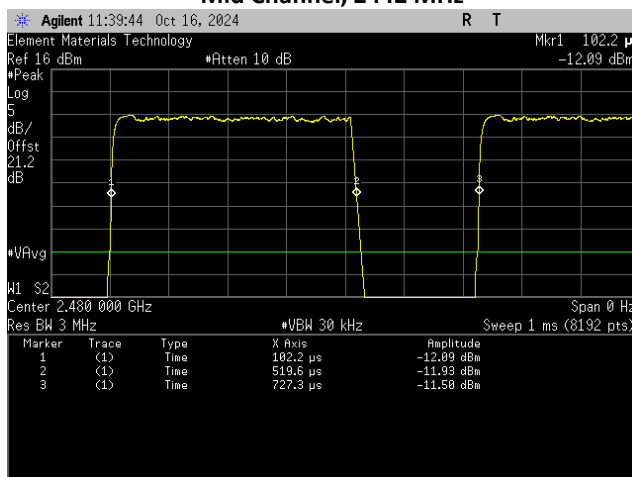
**BLE/GFSK 1 Mbps
Low Channel, 2402 MHz**



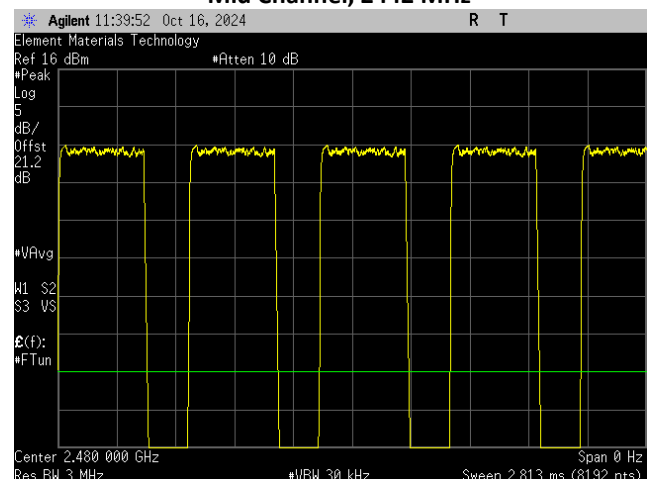
**BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz**



**BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz**



**BLE/GFSK 1 Mbps
High Channel, 2480 MHz**



**BLE/GFSK 1 Mbps
High Channel, 2480 MHz**

DTS BANDWIDTH (6 dB)

TEST DESCRIPTION

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 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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	2023-12-05	2024-12-05
Block - DC	Fairview Microwave	SD3379	ANG	2024-07-11	2025-07-11
Attenuator	Fairview Microwave	SA18H-20	UAX	2024-07-11	2025-07-11
Cable	Micro-Coax	UFD150A-1-0720-200200	OCA	2024-10-02	2025-10-02
Generator - Signal	Agilent	E8257D	TGU	2023-11-08	2026-11-08
Meter - Multimeter	Fluke	107	MBF	2024-04-12	2025-04-12

DTS BANDWIDTH (6 dB)

EUT:	Lantern Reusable Navigation Unit	Work Order:	ORTH0035
Serial Number:	R243200116	Date:	2024-10-16
Customer:	OrthAlign	Temperature:	21.6°C
Attendees:	Steven Devinentis, Kian Gholizadeh	Relative Humidity:	58.4%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Mark Baytan	Job Site:	OC13
Power:	5VDC	Configuration:	ORTH0035-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013

COMMENTS

Reference level offset accounted for within the measurements.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

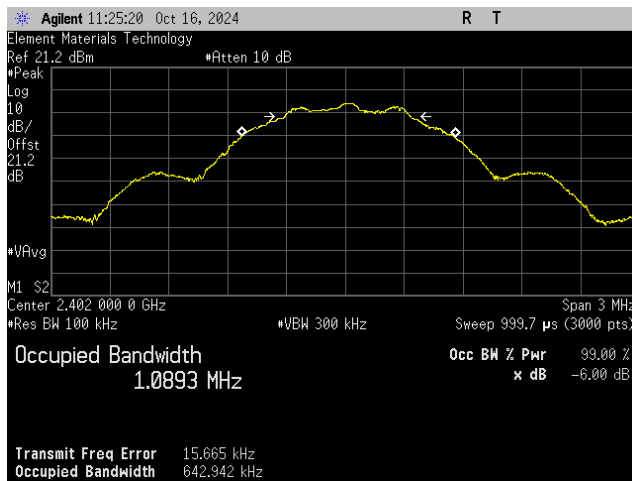


Tested By

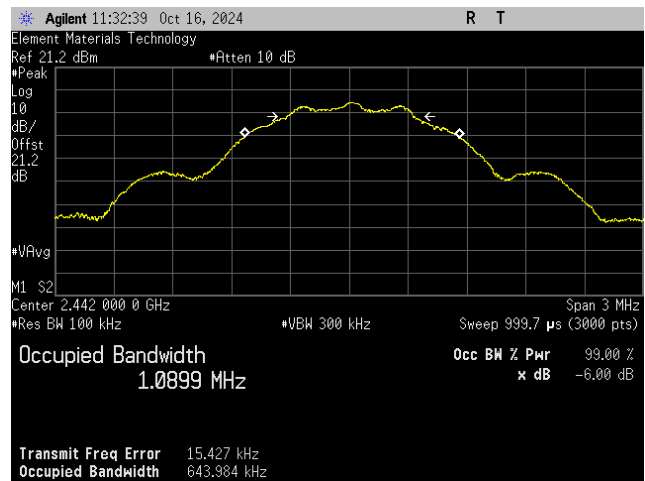
TEST RESULTS

		Value	Limit (Z)	Result
BLE/GFSK 1 Mbps				
	Low Channel, 2402 MHz	642.942 kHz	500 kHz	Pass
	Mid Channel, 2442 MHz	643.984 kHz	500 kHz	Pass
	High Channel, 2480 MHz	650.375 kHz	500 kHz	Pass

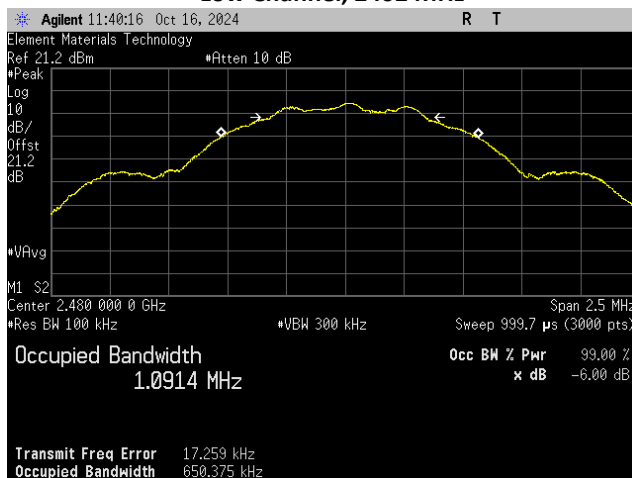
DTS BANDWIDTH (6 dB)



BLE/GFSK 1 Mbps
Low Channel, 2402 MHz



BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz



BLE/GFSK 1 Mbps
High Channel, 2480 MHz

OUTPUT POWER

TEST DESCRIPTION

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 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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	2023-12-05	2024-12-05
Block - DC	Fairview Microwave	SD3379	ANG	2024-07-11	2025-07-11
Attenuator	Fairview Microwave	SA18H-20	UAX	2024-07-11	2025-07-11
Cable	Micro-Coax	UFD150A-1-0720-200200	OCA	2024-10-02	2025-10-02
Generator - Signal	Agilent	E8257D	TGU	2023-11-08	2026-11-08
Meter - Multimeter	Fluke	107	MBF	2024-04-12	2025-04-12

OUTPUT POWER

EUT:	Lantern Reusable Navigation Unit	Work Order:	ORTH0035
Serial Number:	R243200116	Date:	2024-10-16
Customer:	OrthAlign	Temperature:	21.6°C
Attendees:	Steven Devinentis, Kian Gholizadeh	Relative Humidity:	58.4%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Mark Baytan	Job Site:	OC13
Power:	5VDC	Configuration:	ORTH0035-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013

COMMENTS

Reference level offset accounted for within the measurements.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

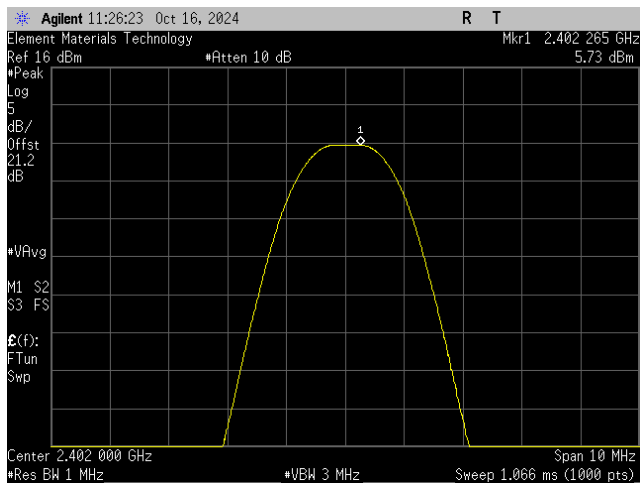


Tested By

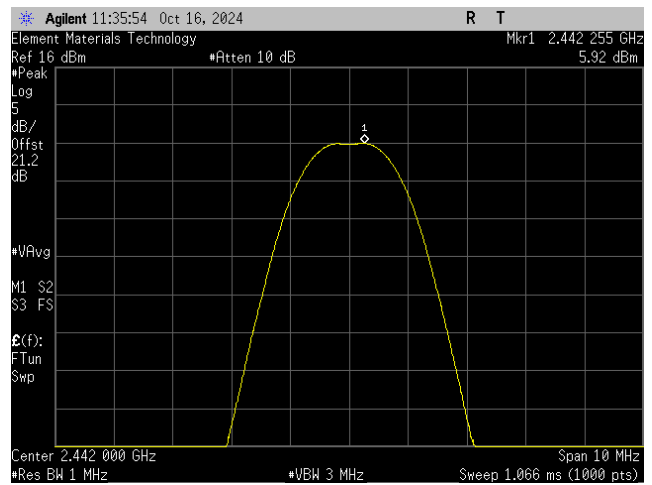
TEST RESULTS

	Out Pwr (dBm)	Limit (dBm)	Result
BLE/GFSK 1 Mbps			
Low Channel, 2402 MHz	5.728	30	Pass
Mid Channel, 2442 MHz	5.923	30	Pass
High Channel, 2480 MHz	6.03	30	Pass

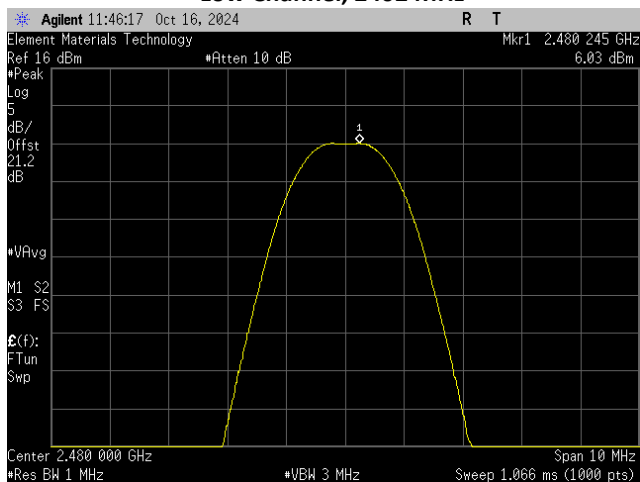
OUTPUT POWER



**BLE/GFSK 1 Mbps
Low Channel, 2402 MHz**



**BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz**



**BLE/GFSK 1 Mbps
High Channel, 2480 MHz**

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

TEST DESCRIPTION

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 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.

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AFA	2023-12-05	2024-12-05
Block - DC	Fairview Microwave	SD3379	ANG	2024-07-11	2025-07-11
Attenuator	Fairview Microwave	SA18H-20	UAX	2024-07-11	2025-07-11
Cable	Micro-Coax	UFD150A-1-0720-200200	OCA	2024-10-02	2025-10-02
Generator - Signal	Agilent	E8257D	TGU	2023-11-08	2026-11-08
Meter - Multimeter	Fluke	107	MBF	2024-04-12	2025-04-12

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



EUT:	Lantern Reusable Navigation Unit	Work Order:	ORTH0035
Serial Number:	R243200116	Date:	2024-10-16
Customer:	OrthAlign	Temperature:	21.6°C
Attendees:	Steven Devinentis, Kian Gholizadeh	Relative Humidity:	58.4%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Mark Baytan	Job Site:	OC13
Power:	5VDC	Configuration:	ORTH0035-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013

COMMENTS

Reference level offset accounted for within the measurements.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

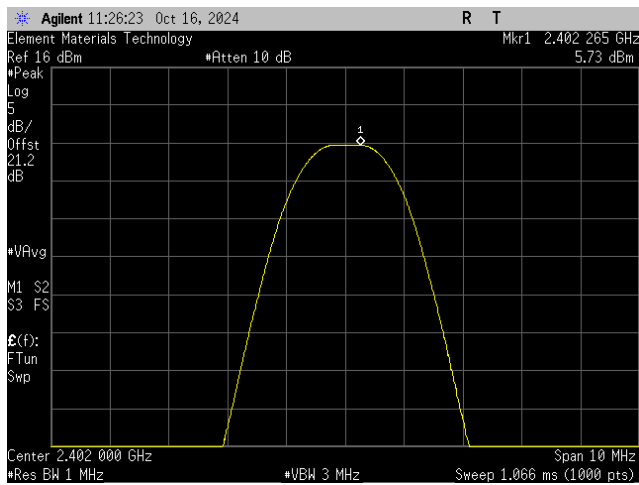
Pass

Tested By

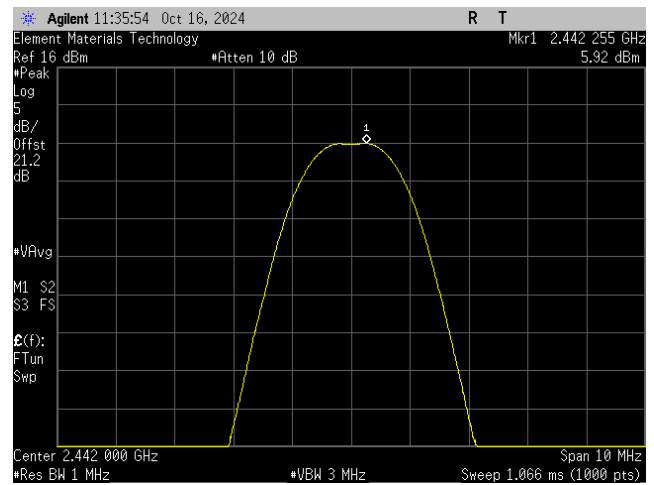
TEST RESULTS

	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
BLE/GFSK 1 Mbps					
Low Channel, 2402 MHz	5.728	5	10.728	36	Pass
Mid Channel, 2442 MHz	5.923	5	10.923	36	Pass
High Channel, 2480 MHz	6.03	5	11.03	36	Pass

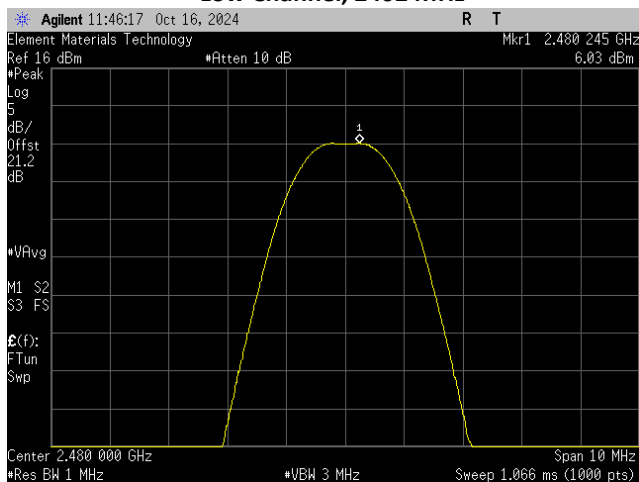
EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)



**BLE/GFSK 1 Mbps
Low Channel, 2402 MHz**



**BLE/GFSK 1 Mbps
Mid Channel, 2442 MHz**



**BLE/GFSK 1 Mbps
High Channel, 2480 MHz**

SPURIOUS RADIATED EMISSIONS

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, a final radiated emissions test was performed. The frequency range investigated (scanned), is also noted in this report. Radiated emissions measurements were made at the EUT azimuth and antenna height such that the maximum radiated emissions level was detected. This required the use of a turntable and an antenna positioner. The preferred method of a continuous azimuth search was utilized for frequency scans of the EUT field strength with both polarities of the measuring antenna. A calibrated, linearly polarized antenna was positioned at the specified distance from the periphery of the EUT. Tests were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. Though specified in the report, the measurement distance was 3 meters or 10 meters (from antenna to boundary of EUT). At any measurement distance, the antenna height was varied from 1 meter to 4 meters. These height scans apply for both horizontal and vertical polarization, except that for vertical polarization the minimum height of the center of the antenna was increased so that the lowest point of the bottom of the antenna cleared the ground surface by at least 25 cm.

The EUT arrangement is configured as equivalent to that occurring in normal use. Tabletop equipment is placed on a 0.8 meter high non-conductive table & for Floor-standing equipment, it is placed on, but insulated from a ground reference plane by the use of its own rollers or stand-off supports. If measurements above 1 GHz were required, the test setup was modified to meet the regulatory requirements for higher frequency measurements. If required, RF absorber was placed on the floor between the measurement antenna and EUT. If required, per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables.

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.

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
Analyzer - Spectrum Analyzer	Agilent	E4446A	AAY	2024-01-25	2025-01-25
Antenna - Double Ridge	ETS Lindgren	3115	AIR	2024-07-23	2026-07-23
Cable	Northwest EMC	1-8GHz RE Cables	OCJ	2024-05-08	2025-05-08
Amplifier - Pre-Amplifier	Cernex	CBL01084020-xx	PAX	2024-05-08	2025-05-08
Attenuator	Fairview Microwave	SA18H-20	TKQ	2024-05-08	2025-05-08
Filter - High Pass	Micro-Tronics	HPM50111	HHX	2024-05-08	2025-05-08
Antenna - Standard Gain	ETS Lindgren	3160-07	AHR	NCR	NCR
Cable	Northwest EMC	8-18GHz RE Cables	OCO	2024-03-19	2025-03-19
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AOE	2024-03-19	2025-03-19
Antenna - Standard Gain	ETS Lindgren	3160-08	AHT	NCR	NCR
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AOF	2024-03-19	2025-03-19
Attenuator	Fairview Microwave	SA18H-20	TKQ	2024-05-08	2025-05-08

FREQUENCY RANGE INVESTIGATED

1000 MHz TO 18000 MHz

POWER INVESTIGATED

5VDC

CONFIGURATIONS INVESTIGATED

ORTH0035-1

MODES INVESTIGATED

Transmitting Bluetooth Low Energy, Low Channel, 1 Mbps, 2402 MHz, 64% Duty Cycle
Transmitting Bluetooth Low Energy, Mid Channel, 1 Mbps, 2442 MHz, 64% Duty Cycle
Transmitting Bluetooth Low Energy, High Channel, 1 Mbps, 2480 MHz, 64% Duty Cycle
Transmitting Bluetooth Low Energy, 1Mbps, Low Channel 2402 MHz, 64% Duty Cycle
Transmitting Bluetooth Low Energy, 1 Mbps, High Channel 2480 MHz, 64% Duty Cycle

SPURIOUS RADIATED EMISSIONS

EUT:	Lantern Reusable Navigation Unit	Work Order:	ORTH0035
Serial Number:	2401016	Date:	2024-10-15
Customer:	OrthAlign	Temperature:	21.9°C
Attendees:	Steven Devincentis, Kian Gholizadeh	Relative Humidity:	54.9%
Customer Project:	None	Bar. Pressure (PMSL):	1017 mb
Tested By:	Matthew Ng	Job Site:	OC10
Power:	5VDC	Configuration:	ORTH0035-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013

TEST PARAMETERS

Run #:	5	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
--------	---	--------------------	---	---------------------	-----------

COMMENTS

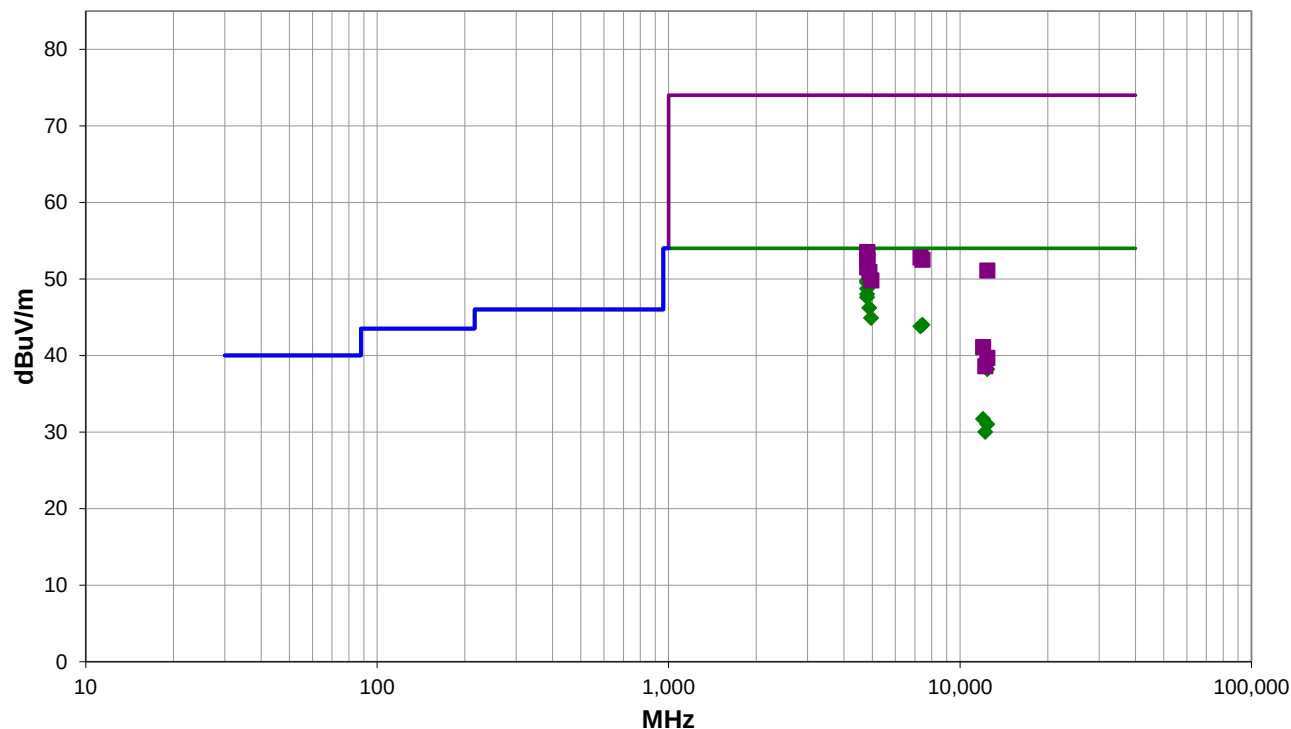
None

EUT OPERATING MODES

Transmitting Bluetooth Low Energy, Low Channel, 1 Mbps, 2402 MHz, 64% Duty Cycle
Transmitting Bluetooth Low Energy, Mid Channel, 1 Mbps, 2442 MHz, 64% Duty Cycle
Transmitting Bluetooth Low Energy, High Channel, 1 Mbps, 2480 MHz, 64% Duty Cycle

DEVIATIONS FROM TEST STANDARD

None



Run #: 5

PK AV QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #5

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4804.508	51.7	-3.8	1.0	271.0	1.9	0.0	Vert	AV	0.0	49.8	54.0	-4.2	Tx Low Channel, 1 Mbps, EUT Horz
4804.442	51.6	-3.8	1.5	223.0	1.9	0.0	Horz	AV	0.0	49.7	54.0	-4.3	Tx Low Channel, 1 Mbps, EUT Horz
4803.992	51.4	-3.8	4.0	345.0	1.9	0.0	Horz	AV	0.0	49.5	54.0	-4.5	Tx Low Channel, 1 Mbps, EUT on Side
4804.058	50.6	-3.8	2.6	269.0	1.9	0.0	Vert	AV	0.0	48.7	54.0	-5.3	Tx Low Channel, 1 Mbps, EUT on Side
4804.425	49.9	-3.8	1.5	236.0	1.9	0.0	Horz	AV	0.0	48.0	54.0	-6.0	Tx Low Channel, 1 Mbps, EUT Vert
4804.475	49.5	-3.8	1.5	1.0	1.9	0.0	Vert	AV	0.0	47.6	54.0	-6.4	Tx Low Channel, 1 Mbps, EUT Vert
4883.983	47.9	-3.6	1.3	6.0	1.9	0.0	Vert	AV	0.0	46.2	54.0	-7.8	Tx Mid Channel, 1 Mbps, EUT Horz
4960.125	46.4	-3.4	1.3	250.0	1.9	0.0	Vert	AV	0.0	44.9	54.0	-9.1	Tx High Channel, 1 Mbps, EUT Horz
7438.083	35.2	6.9	1.5	127.0	1.9	0.0	Vert	AV	0.0	44.0	54.0	-10.0	Tx High Channel, 1 Mbps, EUT Horz
7324.308	35.3	6.6	1.5	303.0	1.9	0.0	Vert	AV	0.0	43.8	54.0	-10.2	Tx Mid Channel, 1 Mbps, EUT Horz
12400.200	24.0	12.3	1.5	320.0	1.9	0.0	Vert	AV	0.0	38.2	54.0	-15.8	Tx High Channel, 1 Mbps, EUT Horz
4804.642	57.3	-3.8	1.5	223.0	0.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	Tx Low Channel, 1 Mbps, EUT Horz
4804.583	57.2	-3.8	1.0	271.0	0.0	0.0	Vert	PK	0.0	53.4	74.0	-20.6	Tx Low Channel, 1 Mbps, EUT Horz
7323.933	46.2	6.6	1.5	303.0	0.0	0.0	Vert	PK	0.0	52.8	74.0	-21.2	Tx Mid Channel, 1 Mbps, EUT Horz
4804.000	56.4	-3.8	4.0	345.0	0.0	0.0	Horz	PK	0.0	52.6	74.0	-21.4	Tx Low Channel, 1 Mbps, EUT on Side
4803.575	56.4	-3.8	2.6	269.0	0.0	0.0	Vert	PK	0.0	52.6	74.0	-21.4	Tx Low Channel, 1 Mbps, EUT on Side
7441.858	45.6	6.9	1.5	127.0	0.0	0.0	Vert	PK	0.0	52.5	74.0	-21.5	Tx High Channel, 1 Mbps, EUT Horz
4804.175	56.1	-3.8	1.5	236.0	0.0	0.0	Horz	PK	0.0	52.3	74.0	-21.7	Tx Low Channel, 1 Mbps, EUT Vert
12010.130	33.4	-3.6	1.5	305.0	1.9	0.0	Vert	AV	0.0	31.7	54.0	-22.3	Tx Low Channel, 1 Mbps, EUT Horz
4804.417	55.3	-3.8	1.5	1.0	0.0	0.0	Vert	PK	0.0	51.5	74.0	-22.5	Tx Low Channel, 1 Mbps, EUT Vert
12402.490	38.9	12.2	1.5	320.0	0.0	0.0	Vert	PK	0.0	51.1	74.0	-22.9	Tx High Channel, 1 Mbps, EUT Horz
12399.160	31.9	-2.8	1.9	238.0	1.9	0.0	Vert	AV	0.0	31.0	54.0	-23.0	Tx High Channel, 1 Mbps, EUT Horz
4884.183	54.5	-3.6	1.3	6.0	0.0	0.0	Vert	PK	0.0	50.9	74.0	-23.1	Tx Mid Channel, 1 Mbps, EUT Horz
12211.330	31.8	-3.7	1.0	303.0	1.9	0.0	Vert	AV	0.0	30.0	54.0	-24.0	Tx Mid Channel, 1 Mbps, EUT Horz
4960.417	53.2	-3.4	1.3	250.0	0.0	0.0	Vert	PK	0.0	49.8	74.0	-24.2	Tx High Channel, 1 Mbps, EUT Horz
12011.070	44.7	-3.6	1.5	305.0	0.0	0.0	Vert	PK	0.0	41.1	74.0	-32.9	Tx Low Channel, 1 Mbps, EUT Horz
12397.650	42.5	-2.8	1.9	238.0	0.0	0.0	Vert	PK	0.0	39.7	74.0	-34.3	Tx High Channel, 1 Mbps, EUT Horz
12211.080	42.3	-3.7	1.0	303.0	0.0	0.0	Vert	PK	0.0	38.6	74.0	-35.4	Tx Mid Channel, 1 Mbps, EUT Horz

CONCLUSION

Pass



Tested By

SPURIOUS RADIATED EMISSIONS

EUT:	Lantern Reusable Navigation Unit	Work Order:	ORTH0035
Serial Number:	See Configurations	Date:	2024-10-15
Customer:	OrthAlign	Temperature:	22.1°C
Attendees:	Steven Devincentis, Kian Gholizadeh	Relative Humidity:	58%
Customer Project:	None	Bar. Pressure (PMSL):	1016 mb
Tested By:	Matthew Ng	Job Site:	OC10
Power:	5VDC	Configuration:	ORTH0035-1

TEST PARAMETERS

Run #:	8	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)
--------	---	--------------------	---	---------------------	-----------

COMMENTS

Band Edge Measurements

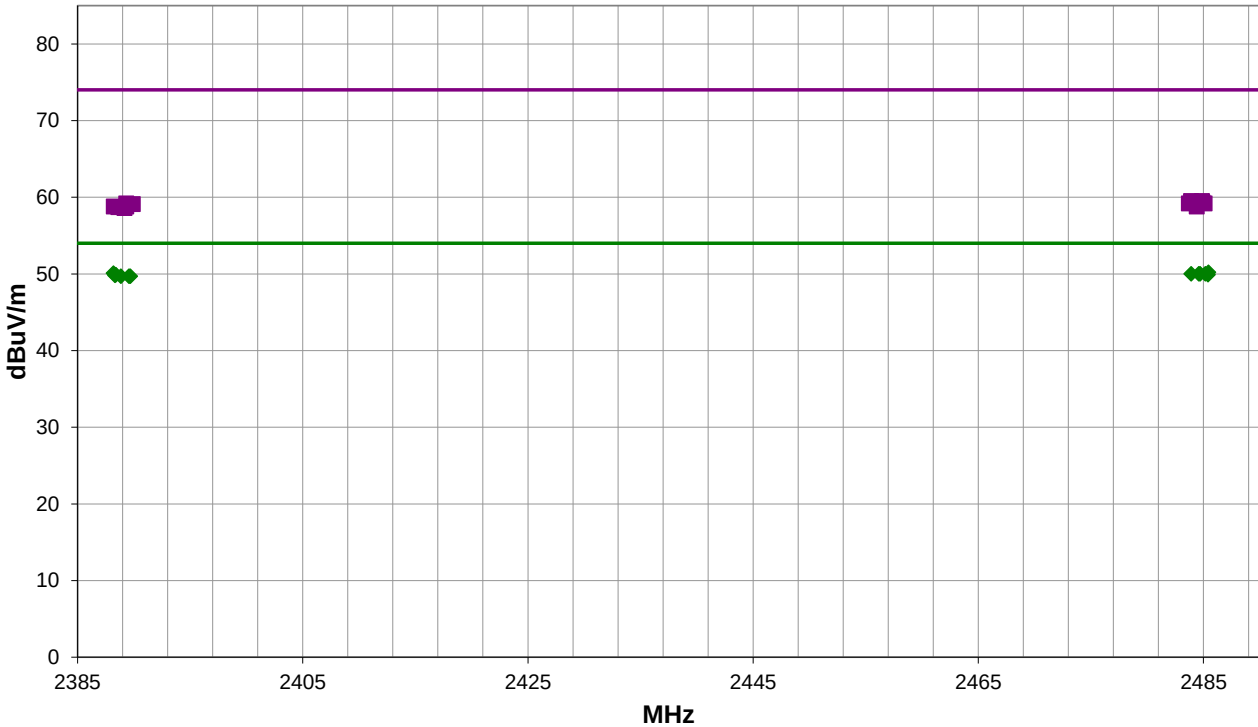
EUT OPERATING MODES

Transmitting Bluetooth Low Energy, 1Mbps, Low Channel 2402 MHz, 64% Duty Cycle

Transmitting Bluetooth Low Energy, 1 Mbps, High Channel 2480 MHz, 64% Duty Cycle

DEVIATIONS FROM TEST STANDARD

None



Run #: 8

■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

RESULTS - Run #8

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Duty Cycle Correction Factor (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2485.450	40.4	-12.1	3.7	193.0	1.9	20.0	Horz	AV	0.0	50.2	54.0	-3.8	Tx High Channel, 1 Mbps, EUT Horz
2388.187	40.6	-12.4	1.5	296.0	1.9	20.0	Horz	AV	0.0	50.1	54.0	-3.9	Tx Low Channel, 1 Mbps, EUT Horz
2484.717	40.2	-12.1	1.5	360.0	1.9	20.0	Vert	AV	0.0	50.0	54.0	-4.0	Tx High Channel, 1 Mbps, EUT Vert
2484.590	40.2	-12.1	1.5	253.0	1.9	20.0	Horz	AV	0.0	50.0	54.0	-4.0	Tx High Channel, 1 Mbps, EUT Vert
2483.917	40.2	-12.1	1.5	195.0	1.9	20.0	Horz	AV	0.0	50.0	54.0	-4.0	Tx High Channel, 1 Mbps, EUT on Side
2485.177	40.2	-12.1	1.9	357.0	1.9	20.0	Vert	AV	0.0	50.0	54.0	-4.0	Tx High Channel, 1 Mbps, EUT on Side
2388.413	40.4	-12.4	1.5	251.0	1.9	20.0	Vert	AV	0.0	49.9	54.0	-4.1	Tx Low Channel, 1 Mbps, EUT Horz
2485.413	40.1	-12.1	1.8	94.0	1.9	20.0	Vert	AV	0.0	49.9	54.0	-4.1	Tx High Channel, 1 Mbps, EUT Horz
2388.327	40.3	-12.4	3.1	90.0	1.9	20.0	Vert	AV	0.0	49.8	54.0	-4.2	Tx Low Channel, 1 Mbps, EUT Vert
2389.573	40.2	-12.4	1.3	36.0	1.9	20.0	Horz	AV	0.0	49.7	54.0	-4.3	Tx Low Channel, 1 Mbps, EUT Vert
2388.860	40.2	-12.4	1.5	194.0	1.9	20.0	Horz	AV	0.0	49.7	54.0	-4.3	Tx Low Channel, 1 Mbps, EUT on Side
2389.683	40.2	-12.4	1.5	260.0	1.9	20.0	Vert	AV	0.0	49.7	54.0	-4.3	Tx Low Channel, 1 Mbps, EUT on Side
2483.893	51.6	-12.1	3.7	193.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	Tx High Channel, 1 Mbps, EUT Horz
2484.860	51.6	-12.1	1.5	253.0	0.0	20.0	Horz	PK	0.0	59.5	74.0	-14.5	Tx High Channel, 1 Mbps, EUT Vert
2484.927	51.4	-12.1	1.8	94.0	0.0	20.0	Vert	PK	0.0	59.3	74.0	-14.7	Tx High Channel, 1 Mbps, EUT Horz
2389.330	51.6	-12.4	1.5	260.0	0.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	Tx Low Channel, 1 Mbps, EUT on Side
2485.093	51.3	-12.1	1.5	360.0	0.0	20.0	Vert	PK	0.0	59.2	74.0	-14.8	Tx High Channel, 1 Mbps, EUT Vert
2483.690	51.3	-12.1	1.5	195.0	0.0	20.0	Horz	PK	0.0	59.2	74.0	-14.8	Tx High Channel, 1 Mbps, EUT on Side
2389.903	51.5	-12.4	1.3	36.0	0.0	20.0	Horz	PK	0.0	59.1	74.0	-14.9	Tx Low Channel, 1 Mbps, EUT Vert
2388.217	51.2	-12.4	1.5	296.0	0.0	20.0	Horz	PK	0.0	58.8	74.0	-15.2	Tx Low Channel, 1 Mbps, EUT Horz
2389.313	51.2	-12.4	1.5	251.0	0.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	Tx Low Channel, 1 Mbps, EUT Horz
2484.390	50.9	-12.1	1.9	357.0	0.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	Tx High Channel, 1 Mbps, EUT on Side
2388.617	51.1	-12.4	3.1	90.0	0.0	20.0	Vert	PK	0.0	58.7	74.0	-15.3	Tx Low Channel, 1 Mbps, EUT Vert
2389.170	51.0	-12.4	1.5	194.0	0.0	20.0	Horz	PK	0.0	58.6	74.0	-15.4	Tx Low Channel, 1 Mbps, EUT on Side

CONCLUSION

Pass

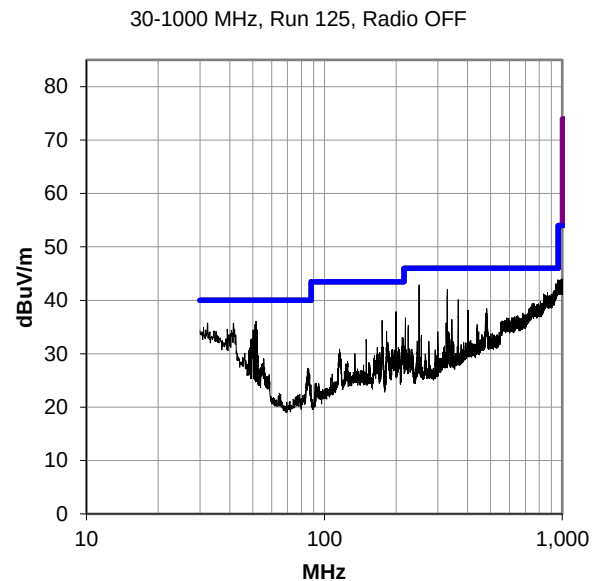
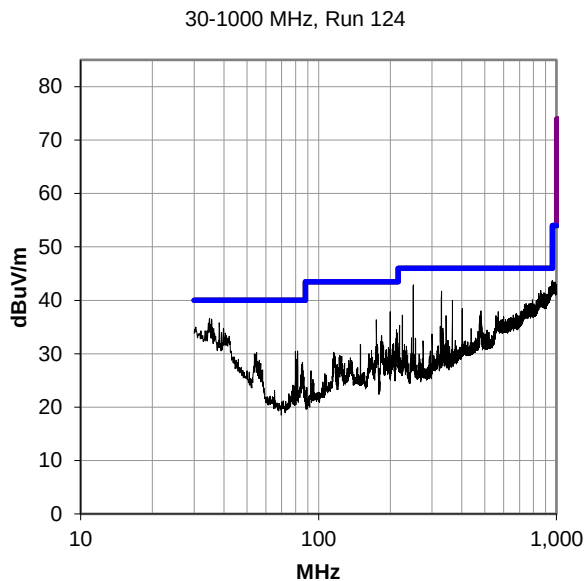
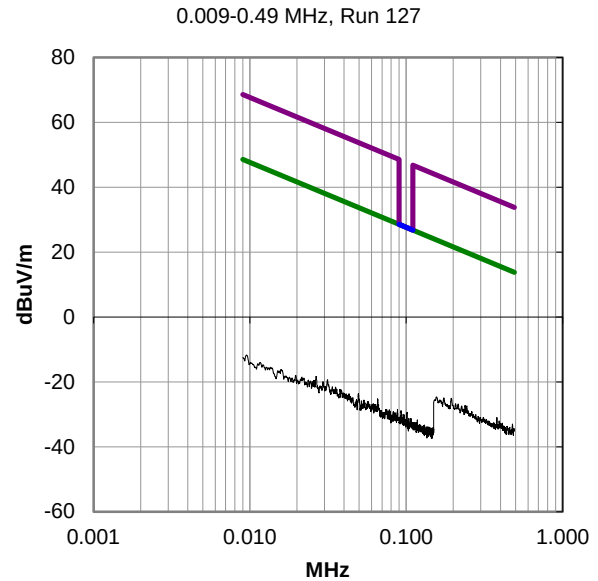
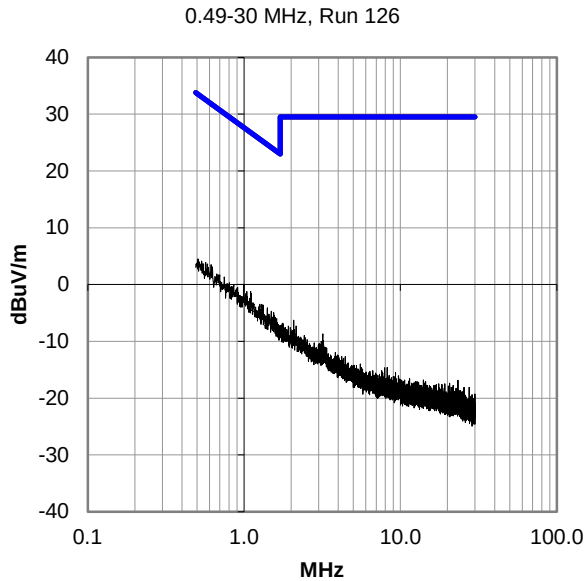


Tested By

SPURIOUS RADIATED EMISSIONS

PRESCAN DATA

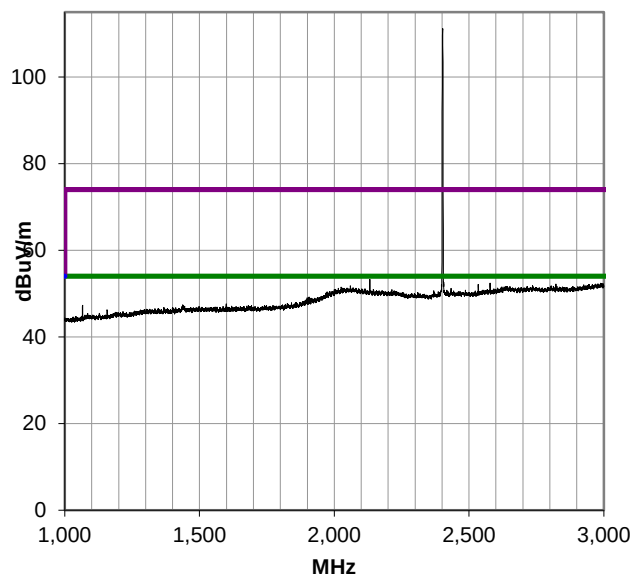
Radiated spurious emissions from the EUT are initially reviewed with Pre-scans (Preview scans). Pre-scans are performed, with the EUT transmitting on the lowest applicable data rate, for both vertical and horizontal polarizations. The Pre-scan plots below are shown with a peak detector and RBW for the following frequency ranges: 9 kHz RBW (< 30 MHz); 120 kHz RBW (30 - 1000 MHz); 1 MHz RBW (> 1 GHz). In the case where unintentional emissions are observed, an ambient or idle pre-scan with the radio off, will be shown for comparison.



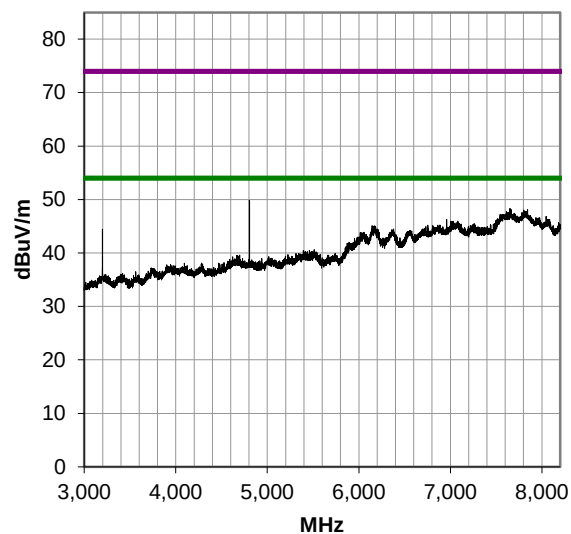
1000-3000 MHz, Run 2

SPURIOUS RADIATED EMISSIONS

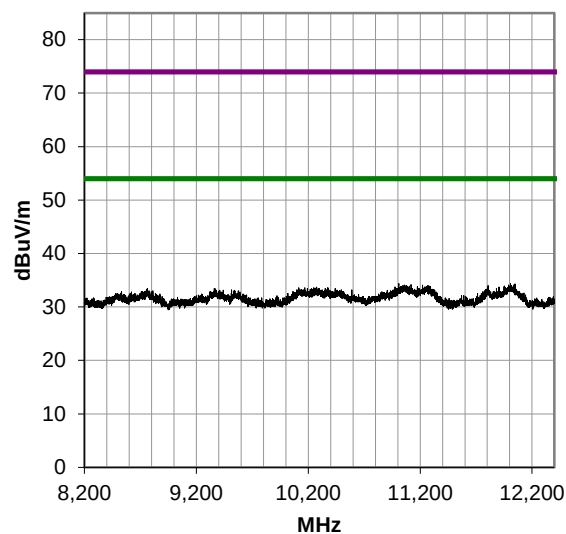
1000-3000 MHz, Run 2



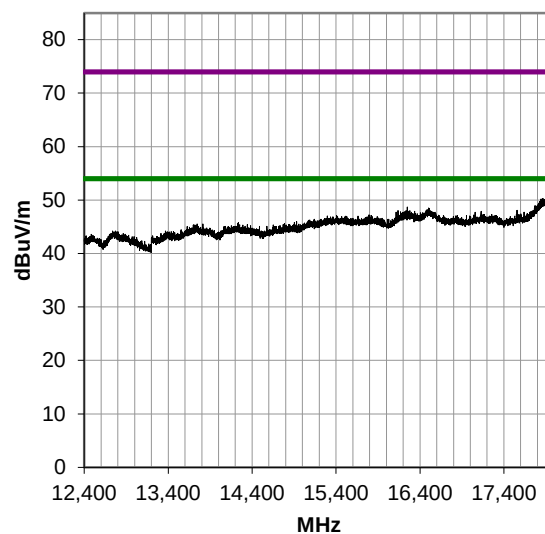
3000-8200 MHz, Run 3



8200-12400 MHz, Run 4

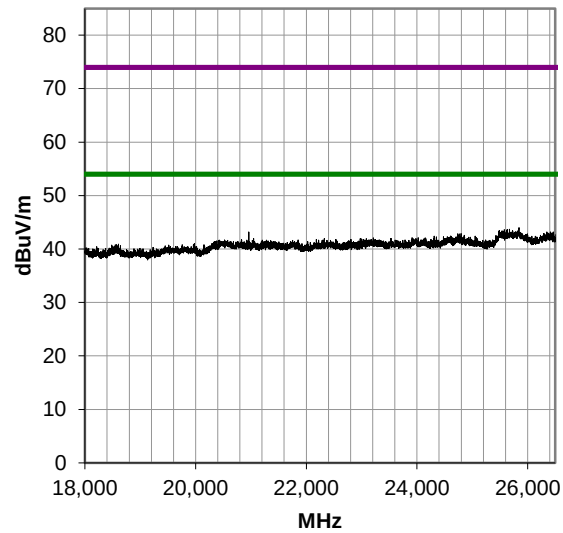


12400-18000 MHz, Run 5

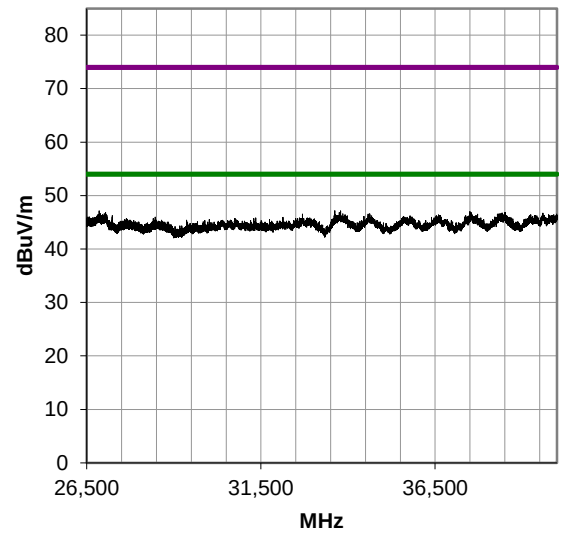


SPURIOUS RADIATED EMISSIONS

18000-26500 MHz, Run 67



26500-40000 MHz, Run 66



End of Test Report