Garrett Metal Detectors

Vortex

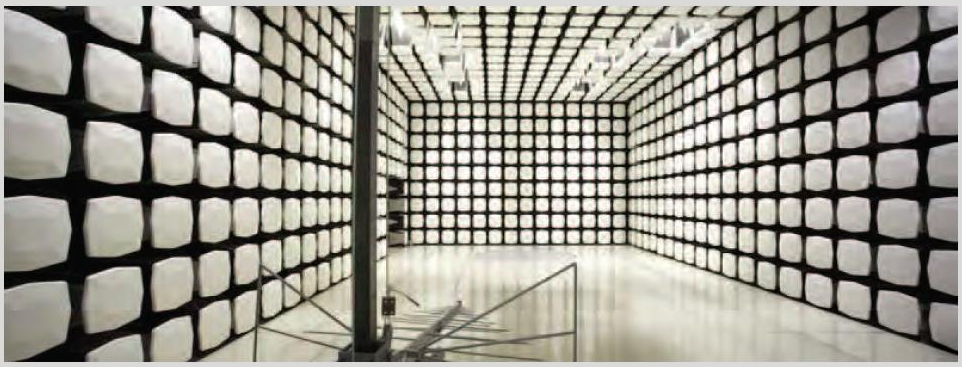
FCC 15.247:2024

RSS-Gen Issue 5:2018+A1:2019+A2:2021

RSS-247 Issue 3:2023

Low Power (SRD) DTS transceiver

Report: GARR0125.0 Rev. 0, Issue Date: July 8, 2024



CERT #3310.04

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element
2023.04.17

Section	Page Number

CERTIFICATE OF TEST

Last Date of Test: July 2, 2024
Garrett Metal Detectors
EUT: Vortex

Radio Equipment Testing

Standards

Specification	Method
FCC 15.247:2024	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	
RSS-247 Issue 3:2023	

Guidance

FCC KDB 558074 v05r02:2019

Results

Test Description	Result	FCC Section(s)	RSS Section(s)	ANSI C63.10 Section(s)	Comments
Powerline Conducted Emissions (Transmitter)	N/A	15.207	RSS-Gen 8.8	6.2	Not required for a battery powered EUT.
Spurious Radiated Emissions	Pass	15.247(d), KDB 558074 -8.6, 8.7	RSS-247 5.5	6.5, 6.6, 11.12.1, 11.13.2	
Duty Cycle	N/A	15.247, KDB 558074 -6.0	RSS-Gen 3.2	11.6	Duty Cycle at 100% - Characterization of radio operation
Output Power	Pass	15.247(b), KDB 558074 -8.3	RSS-247 5.4(d)	11.9.1.1	
Equivalent Isotropic Radiated Power (EIRP)	Pass	15.247(b), KDB 558074 -8.3	RSS-247 5.4(d)	11.9.1.1	
Band Edge Compliance	Pass	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	
DTS Bandwidth (6 dB)	Pass	15.247(a), 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	
Spurious Conducted Emissions	Pass	15.247(d), KDB 558074 -8.5	RSS-247 5.5	11.11	
Power Spectral Density	Pass	15.247(e), KDB 558074 -8.4	RSS-247 5.2(b)	11.10.2	
Powerline Conducted Emissions (Receiver)	N/A	15.101, 15.107	RSS-Gen 5.2	ANSI C63.4 - 12.2.4	Not included per FCC 15.101 as this will be covered under SDoC rules for the FCC. RSS-Gen section 7 stated receiver requirements only apply to standalone receivers operating in the 30-960 MHz band and this is not a standalone receiver.

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.

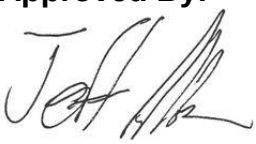
CERTIFICATE OF TEST

Radiated Emissions for Receiver	N/A	15.101, 15.109	RSS-Gen 5.2	ANSI C63.4 - 12.2.5	Not included per FCC 15.101 as this will be covered under SDoC rules for the FCC. RSS-Gen section 7 stated receiver requirements only apply to standalone receivers operating in the 30-960 MHz band and this is not a standalone receiver.

Deviations From Test Standards

None

Approved By:



Jeff Alcoke, 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
00	None		

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

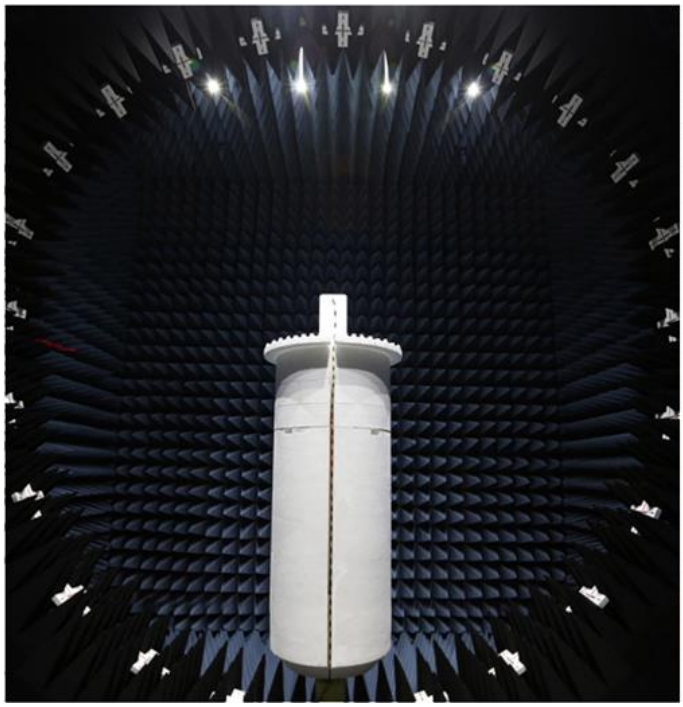
element
2023.09.21

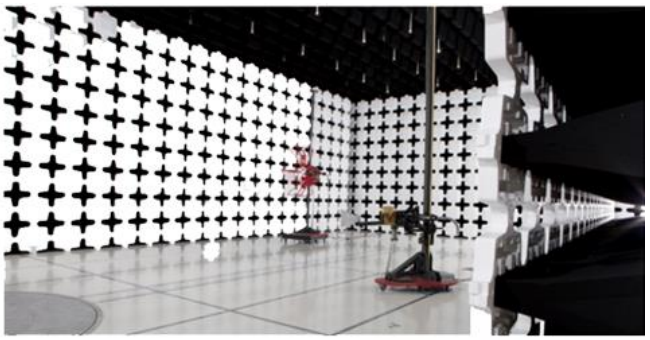
Testing was performed at the following location(s)

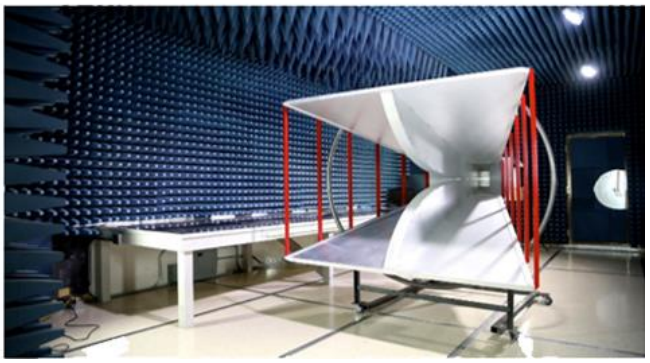
	Location	Labs (1)	Address	A2LA (2)	ISED (3)	BSMI (4)	VCCI (5)	CAB (6)	FDA (7)
☐	California	OC01-17	41 Tesla Irvine, CA 92618 (949) 861-8918	3310.04	2834B	SL2-IN-E-1154R	A-0029	US0158	TL-55
☐	Minnesota	MN01-11	9349 W Broadway Ave. Brooklyn Park, MN 55445 (612) 638-5136	3310.05	2834E	SL2-IN-E-1152R	A-0109	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				US0054	
☐	Texas	TX01-09	3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	3310.03	2834G	SL2-IN-E-1158R	A-0201	US0191	TL-54
☐	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

element
MU 2023-09-21

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	EV01 (+/-)	EV06 (+/-)
10kHz-30MHz	1.8	N/A
30MHz-1GHz 3m	4.6	N/A
1GHz-6GHz	5.1	N/A
6GHz-40GHz	5.2	N/A

AC Powerline Conducted Emissions Measurements (dB)

Range	EV06 (+/-)

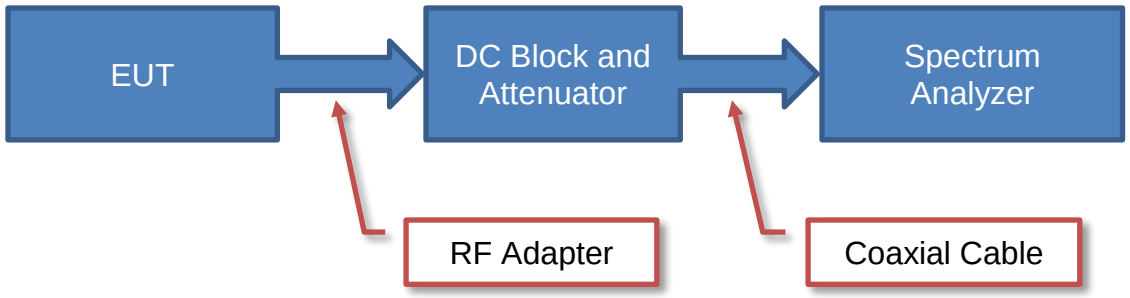
TEST SETUP BLOCK DIAGRAMS

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.

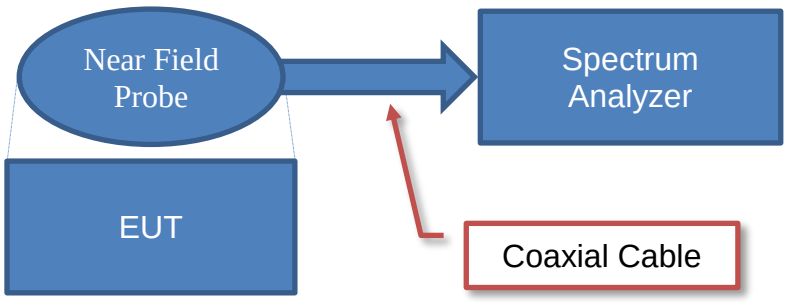
Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

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

Near Field Test Fixture Measurements

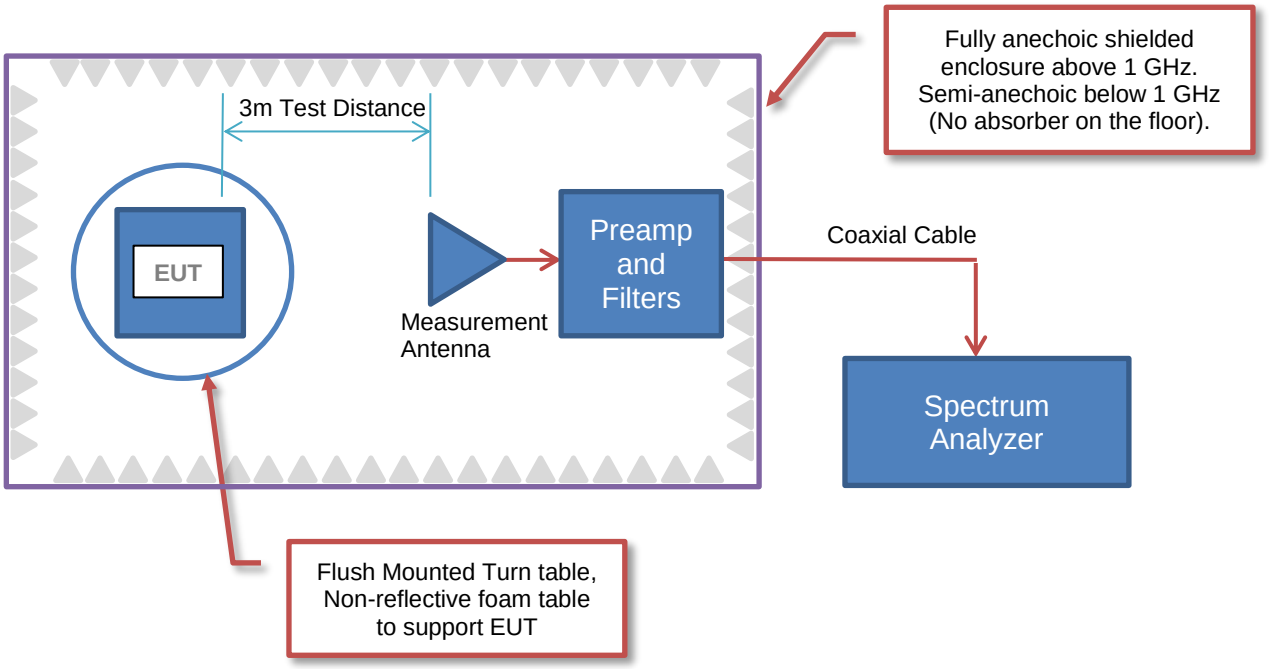


Sample Calculation (logarithmic units)

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**

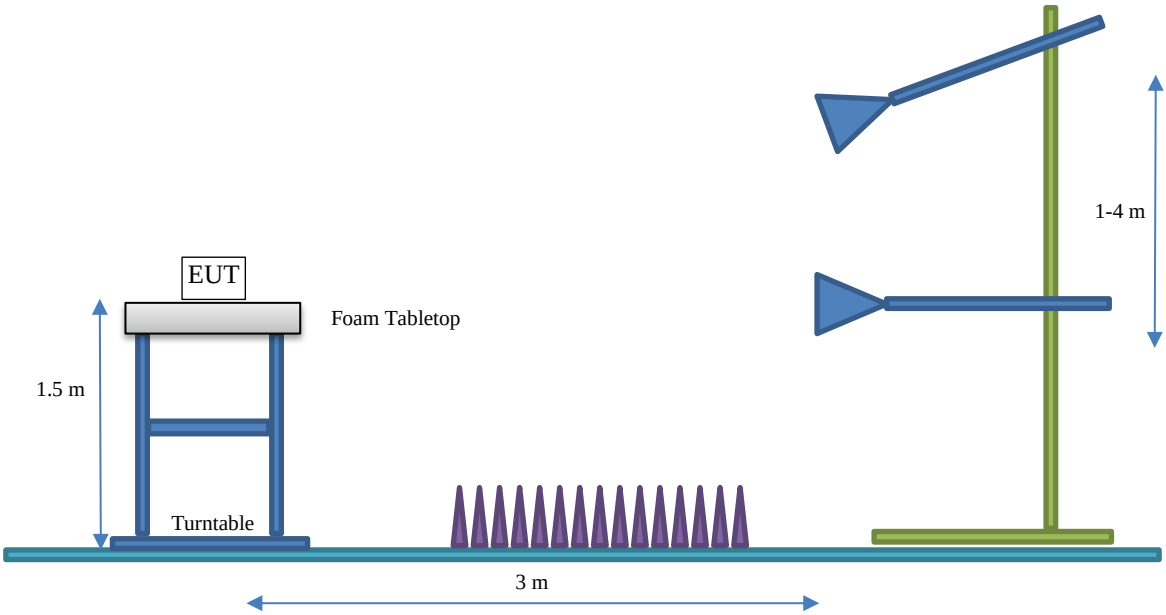
Radiated Power (ERP/EIRP) – Substitution Method:

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:	Garrett Metal Detectors
Address:	1881 West State Street
City, State, Zip:	Garland, TX 75042
Test Requested By:	Bob Podhrasky
EUT:	Vortex
First Date of Test:	June 25, 2024
Last Date of Test:	July 2, 2024
Receipt Date of Samples:	June 25, 2024
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:
Metal detector with 2.4 GHz radio

Testing Objective:
Seeking to demonstrate compliance of the Low Power (SRD) radio with operation under FCC 15.247:2024 and RSS-Gen Issue 5:2018+A1:2019+A2:2021, RSS-247 Issue 3:2023 specifications under technology category Other.

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)
Inverted F	Texas Instruments	2300 - 2700	3.3

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

☒ Test software settings Software / firmware used for testing: M158 VRT2 (1.53)
☐ Rated power settings

SETTINGS FOR ALL TESTS IN THIS REPORT

Radio Type	Modulation Type	Data Rate	Frequency (MHz)	Power Setting (dBm)
Pure Path	8FSK	5 Mbps	2406	3.5
			2438	
			2474	

CONFIGURATIONS

Configuration GARR0125-2

Software/Firmware Running During Test	
Description	**Version**
Firmware	M158 VRT2 (1.53)

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Metal Detector - Conducted	Garrett Metal Detectors	Vortex	64242239

Configuration GARR0125-4

Software/Firmware Running During Test	
Description	**Version**
Firmware	M158 VRT2 (1.53)

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Metal Detector	Garrett Metal Detectors	Vortex	64242240

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
Wired headphones	No	1.1	No	Metal Detector	Headphones

MODIFICATIONS

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2024-06-25	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.
2	2024-06-25	DTS Bandwidth (6 Db)	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	2024-06-25	Occupied Bandwidth (99%)	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	2024-06-25	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.
5	2024-06-26	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.
6	2024-06-26	Spurious Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
7	2024-06-26	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.
8	2024-07-02	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

TEST DESCRIPTION

The highest gain antenna of each type to be used with the EUT was tested. The EUT was configured for the required transmit frequencies (in no-hop, single channel mode) and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. A reference preview scan (pre-scan) is included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFO	2023-10-04	2024-10-04
Antenna - Loop	EMCO	6502	AOA	2022-07-13	2024-07-13
Antenna - Biconilog	EMCO	3142B	AXJ	2023-04-17	2025-04-17
Antenna - Double Ridge	EMCO	3115	AHC	2022-07-08	2024-07-08
Antenna - Standard Gain	ETS Lindgren	3160-07	AHU	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-08	AHV	NCR	NCR
Antenna - Standard Gain	ETS Lindgren	3160-09	AIV	NCR	NCR
Cable	N/A	Bilog Cables	EVA	2023-11-05	2024-11-05
Cable	N/A	Double Ridge Horn Cables	EVB	2024-03-14	2025-03-14
Cable	None	Standard Gain Horn Cables	EVF	2023-10-31	2024-10-31
Cable	ESM Cable Corp.	TTBJ141-KMKM-72	EVY	2023-07-10	2024-07-10
Amplifier - Pre-Amplifier	Miteq	AM-1616-1000	AOL	2023-11-05	2024-11-05
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAG	2024-03-14	2025-03-14
Amplifier - Pre-Amplifier	L-3 Narda-MITEQ	AMF-6F-08001200-30-10P	PAO	2023-10-31	2024-10-31
Amplifier - Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2023-10-31	2024-10-31
Amplifier - Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	2023-07-10	2024-07-10
Filter - Low Pass	Micro-Tronics	LPM50004	LFD	2024-02-12	2025-02-12
Attenuator	Coaxicom	3910-10	AWX	2024-02-12	2025-02-12
Filter - High Pass	Micro-Tronics	HPM50111	HFO	2023-11-06	2024-11-06

FREQUENCY RANGE INVESTIGATED

9 kHz TO 26.5 GHz

POWER INVESTIGATED

Battery

SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

CONFIGURATIONS INVESTIGATED

GARR0125-4

MODES INVESTIGATED

Transmitting Pure Path, 8FSK. Low Ch.= 2406 MHz, Mid Ch.= 2438 MHz, High Ch.= 2474 MHz.

SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242240	Date:	2024-07-01
Customer:	Garrett Metal Detectors	Temperature:	22.4°C
Attendees:	None	Relative Humidity:	48.8%
Customer Project:	None	Bar. Pressure (PMSL):	1020 mb
Tested By:	Christopher Ladwig	Job Site:	EV01
Power:	Battery	Configuration:	GARR0125-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

TEST PARAMETERS

Run #:	21	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

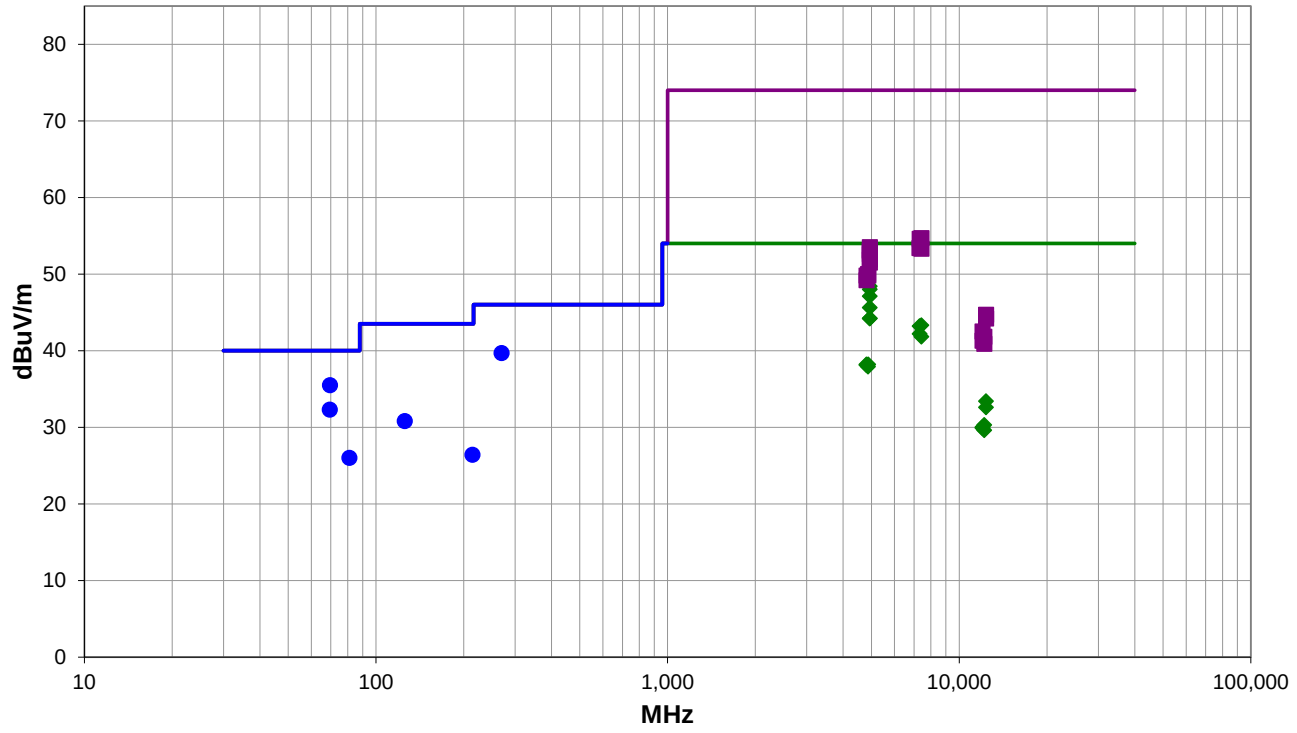
Please reference data comments below for channel and EUT orientation.

EUT OPERATING MODES

Transmitting Pure Path, 8FSK. Low Ch.= 2406 MHz, Mid Ch.= 2438 MHz, High Ch.= 2474 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 21 PK AV QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

RESULTS - Run #21

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
69.495	45.1	-9.6	2.5	9.0	3.0	0.0	Horz	QP	0.0	35.5	40.0	-4.5	EUT On Side, High Ch.
4941.917	38.4	10.0	1.0	332.0	3.0	0.0	Horz	AV	0.0	48.4	54.0	-5.6	EUT On Side, High Ch.
4941.983	38.0	10.0	2.4	311.0	3.0	0.0	Vert	AV	0.0	48.0	54.0	-6.0	EUT On Side, High Ch.
269.750	41.0	-1.3	1.0	37.0	3.0	0.0	Horz	QP	0.0	39.7	46.0	-6.3	EUT On Side, High Ch.
4941.958	37.1	10.0	2.7	270.0	3.0	0.0	Horz	AV	0.0	47.1	54.0	-6.9	EUT Horz, High Ch.
69.374	41.9	-9.6	2.7	298.0	3.0	0.0	Vert	QP	0.0	32.3	40.0	-7.7	EUT On Side, High Ch.
4942.008	35.6	10.0	1.5	245.0	3.0	0.0	Vert	AV	0.0	45.6	54.0	-8.4	EUT Horz, High Ch.
4941.950	34.2	10.0	1.5	10.0	3.0	0.0	Horz	AV	0.0	44.2	54.0	-9.8	EUT Vert, High Ch.
4941.983	34.2	10.0	1.5	125.0	3.0	0.0	Vert	AV	0.0	44.2	54.0	-9.8	EUT Vert, High Ch.
7421.258	28.5	14.8	1.7	291.0	3.0	0.0	Horz	AV	0.0	43.3	54.0	-10.7	EUT On Side, High Ch.
7314.633	28.5	14.7	1.5	291.0	3.0	0.0	Horz	AV	0.0	43.2	54.0	-10.8	EUT On Side, Mid Ch.
7316.033	27.5	14.7	1.5	226.0	3.0	0.0	Vert	AV	0.0	42.2	54.0	-11.8	EUT On Side, Mid Ch.
7420.658	27.0	14.8	1.5	281.0	3.0	0.0	Vert	AV	0.0	41.8	54.0	-12.2	EUT On Side, High Ch.
125.599	39.3	-8.5	2.4	153.0	3.0	0.0	Horz	QP	0.0	30.8	43.5	-12.7	EUT On Side, High Ch.
81.071	35.7	-9.7	2.5	193.0	3.0	0.0	Horz	QP	0.0	26.0	40.0	-14.0	EUT On Side, High Ch.
4874.833	28.4	9.8	1.5	0.0	3.0	0.0	Horz	AV	0.0	38.2	54.0	-15.8	EUT On Side, Mid Ch.
4810.425	28.4	9.8	1.5	21.0	3.0	0.0	Horz	AV	0.0	38.2	54.0	-15.8	EUT On Side, Low Ch.
4809.592	28.3	9.8	4.0	11.0	3.0	0.0	Vert	AV	0.0	38.1	54.0	-15.9	EUT On Side, Low Ch.
4874.042	28.1	9.8	1.7	312.0	3.0	0.0	Vert	AV	0.0	37.9	54.0	-16.1	EUT On Side, Mid Ch.
214.165	30.0	-3.6	1.0	179.0	3.0	0.0	Horz	QP	0.0	26.4	43.5	-17.1	EUT On Side, High Ch.
7421.725	39.9	14.8	1.7	291.0	3.0	0.0	Horz	PK	0.0	54.7	74.0	-19.3	EUT On Side, High Ch.
7315.917	39.9	14.7	1.5	291.0	3.0	0.0	Horz	PK	0.0	54.6	74.0	-19.4	EUT On Side, Mid Ch.
4941.908	43.5	10.0	1.5	262.0	3.0	0.0	Horz	PK	0.0	53.5	74.0	-20.5	EUT Horz, High Ch.
7312.075	38.7	14.7	1.5	226.0	3.0	0.0	Vert	PK	0.0	53.4	74.0	-20.6	EUT On Side, Mid Ch.
12368.630	32.4	1.0	1.9	95.0	3.0	0.0	Horz	AV	0.0	33.4	54.0	-20.6	EUT On Side, High Ch.
7420.583	38.5	14.8	1.5	281.0	3.0	0.0	Vert	PK	0.0	53.3	74.0	-20.7	EUT On Side, High Ch.
4941.975	43.1	10.0	1.5	345.0	3.0	0.0	Horz	PK	0.0	53.1	74.0	-20.9	EUT On Side, High Ch.
4941.958	43.0	10.0	1.5	260.0	3.0	0.0	Vert	PK	0.0	53.0	74.0	-21.0	EUT Horz, High Ch.
4941.717	42.6	10.0	2.6	268.0	3.0	0.0	Vert	PK	0.0	52.6	74.0	-21.4	EUT On Side, High Ch.
12369.130	31.6	1.0	3.2	115.0	3.0	0.0	Vert	AV	0.0	32.6	54.0	-21.4	EUT On Side, High Ch.
4941.875	41.9	10.0	1.5	125.0	3.0	0.0	Vert	PK	0.0	51.9	74.0	-22.1	EUT Vert, High Ch.
4942.300	41.5	10.0	1.5	10.0	3.0	0.0	Horz	PK	0.0	51.5	74.0	-22.5	EUT Vert, High Ch.
12191.420	29.5	0.8	1.2	3.0	3.0	0.0	Vert	AV	0.0	30.3	54.0	-23.7	EUT On Side, Mid Ch.
4874.192	40.2	9.8	1.5	0.0	3.0	0.0	Horz	PK	0.0	50.0	74.0	-24.0	EUT On Side, Mid Ch.
12031.180	29.3	0.7	3.2	84.0	3.0	0.0	Vert	AV	0.0	30.0	54.0	-24.0	EUT On Side, Low Ch.
12030.760	29.2	0.7	1.5	162.0	3.0	0.0	Horz	AV	0.0	29.9	54.0	-24.1	EUT On Side, Low Ch.
4875.750	40.0	9.8	1.7	312.0	3.0	0.0	Vert	PK	0.0	49.8	74.0	-24.2	EUT On Side, Mid Ch.
4812.583	40.0	9.8	1.5	21.0	3.0	0.0	Horz	PK	0.0	49.8	74.0	-24.2	EUT On Side, Low Ch.
12191.200	28.8	0.8	1.5	280.0	3.0	0.0	Horz	AV	0.0	29.6	54.0	-24.4	EUT On Side, Mid Ch.
4811.575	39.4	9.8	4.0	11.0	3.0	0.0	Vert	PK	0.0	49.2	74.0	-24.8	EUT On Side, Low Ch.

SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
12368.900	43.7	1.0	1.9	95.0	3.0	0.0	Horz	PK	0.0	44.7	74.0	-29.3	EUT On Side, High Ch.
12367.720	43.2	1.0	3.2	115.0	3.0	0.0	Vert	PK	0.0	44.2	74.0	-29.8	EUT On Side, High Ch.
12031.040	41.8	0.7	3.2	84.0	3.0	0.0	Vert	PK	0.0	42.5	74.0	-31.5	EUT On Side, Low Ch.
12192.470	41.0	0.8	1.2	3.0	3.0	0.0	Vert	PK	0.0	41.8	74.0	-32.2	EUT On Side, Mid Ch.
12032.240	40.6	0.7	1.5	162.0	3.0	0.0	Horz	PK	0.0	41.3	74.0	-32.7	EUT On Side, Low Ch.
12190.980	40.1	0.8	1.5	280.0	3.0	0.0	Horz	PK	0.0	40.9	74.0	-33.1	EUT On Side, Mid Ch.

CONCLUSION

Pass

Tested By

SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242240	Date:	2024-07-02
Customer:	Garrett Metal Detectors	Temperature:	22.1°C
Attendees:	None	Relative Humidity:	45.3%
Customer Project:	None	Bar. Pressure (PMSL):	1024 mb
Tested By:	Christopher Ladwig	Job Site:	EV01
Power:	Battery	Configuration:	GARR0125-4

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

TEST PARAMETERS

Run #:	24	Test Distance (m):	3	Ant. Height(s) (m):	1 to 4(m)

COMMENTS

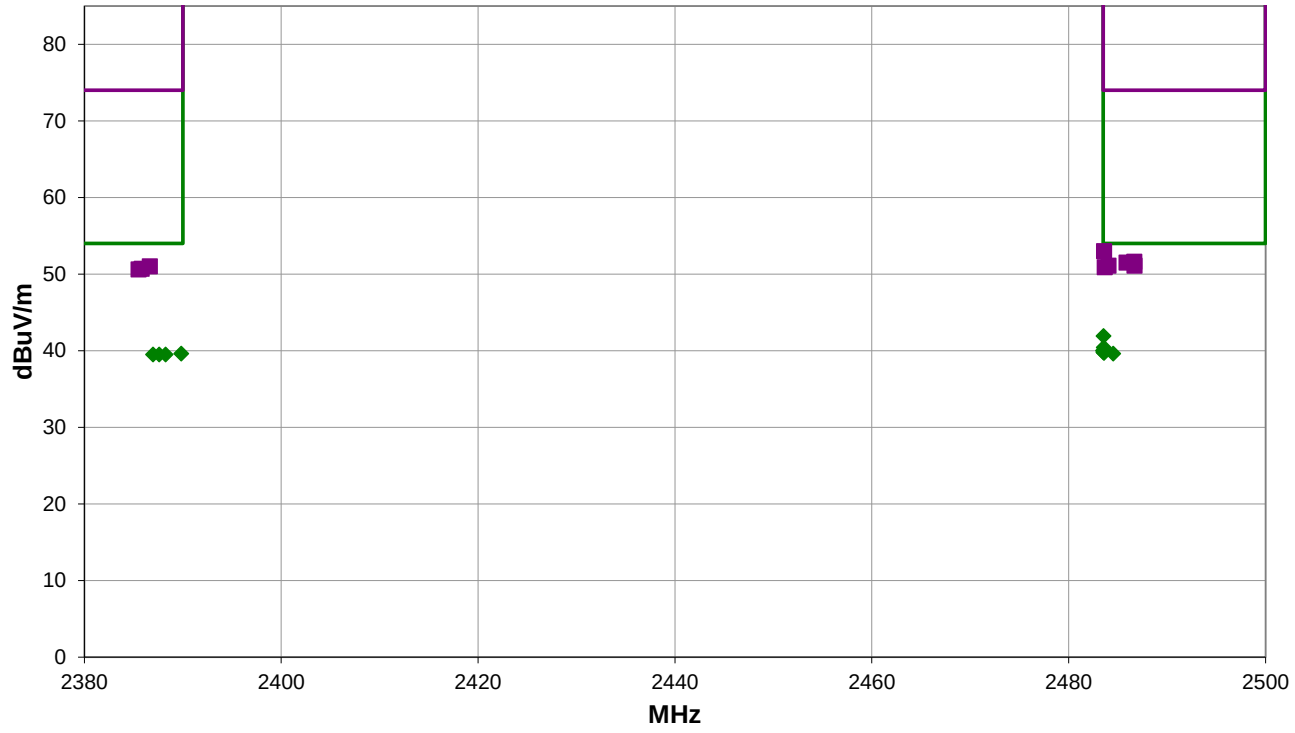
Please reference data comments below for channel and EUT orientation.

EUT OPERATING MODES

Transmitting Pure Path, 8FSK. Low Ch.= 2406 MHz, Mid Ch.= 2438 MHz, High Ch.= 2474 MHz

DEVIATIONS FROM TEST STANDARD

None



Run #: 24 ■ PK ◆ AV ● QP

SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

RESULTS - Run #24

Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
2483.550	33.1	-1.2	1.5	301.0	3.0	10.0	Horz	AV	0.0	41.9	54.0	-12.1	EUT Horz, High Ch.
2483.575	31.6	-1.2	1.5	59.0	3.0	10.0	Vert	AV	0.0	40.4	54.0	-13.6	EUT Horz, High Ch.
2483.500	31.2	-1.2	1.5	51.0	3.0	10.0	Horz	AV	0.0	40.0	54.0	-14.0	EUT On Side, High Ch.
2483.542	31.0	-1.2	1.5	134.0	3.0	10.0	Vert	AV	0.0	39.8	54.0	-14.2	EUT Vert, High Ch.
2483.600	30.9	-1.2	1.5	335.0	3.0	10.0	Horz	AV	0.0	39.7	54.0	-14.3	EUT Vert, High Ch.
2389.858	31.1	-1.5	3.58	231.0	3.0	10.0	Horz	AV	0.0	39.6	54.0	-14.4	EUT On Side, Low Ch.
2484.542	30.8	-1.2	2.08	47.0	3.0	10.0	Vert	AV	0.0	39.6	54.0	-14.4	EUT On Side, High Ch.
2387.600	31.0	-1.5	3.15	166.0	3.0	10.0	Vert	AV	0.0	39.5	54.0	-14.5	EUT On Side, Low Ch.
2386.975	31.1	-1.6	1.5	47.0	3.0	10.0	Horz	AV	0.0	39.5	54.0	-14.5	EUT Horz, Low Ch.
2388.250	31.0	-1.5	2.4	261.0	3.0	10.0	Vert	AV	0.0	39.5	54.0	-14.5	EUT Horz, Low Ch.
2483.608	44.2	-1.2	1.5	301.0	3.0	10.0	Horz	PK	0.0	53.0	74.0	-21.0	EUT Horz, High Ch.
2486.667	42.8	-1.2	1.5	59.0	3.0	10.0	Vert	PK	0.0	51.6	74.0	-22.4	EUT Horz, High Ch.
2485.875	42.7	-1.2	1.5	100.0	3.0	10.0	Vert	PK	0.0	51.5	74.0	-22.5	EUT On Side, High Ch.
2484.050	42.3	-1.2	1.5	335.0	3.0	10.0	Horz	PK	0.0	51.1	74.0	-22.9	EUT Vert, High Ch.
2486.692	42.3	-1.2	1.5	134.0	3.0	10.0	Vert	PK	0.0	51.1	74.0	-22.9	EUT Vert, High Ch.
2386.650	42.6	-1.6	3.15	166.0	3.0	10.0	Vert	PK	0.0	51.0	74.0	-23.0	EUT On Side, Low Ch.
2483.667	42.1	-1.2	2.45	319.0	3.0	10.0	Horz	PK	0.0	50.9	74.0	-23.1	EUT On Side, High Ch.
2385.808	42.3	-1.6	2.4	261.0	3.0	10.0	Vert	PK	0.0	50.7	74.0	-23.3	EUT Horz, Low Ch.
2385.500	42.2	-1.6	1.5	47.0	3.0	10.0	Horz	PK	0.0	50.6	74.0	-23.4	EUT Horz, Low Ch.

CONCLUSION

Pass

Tested By

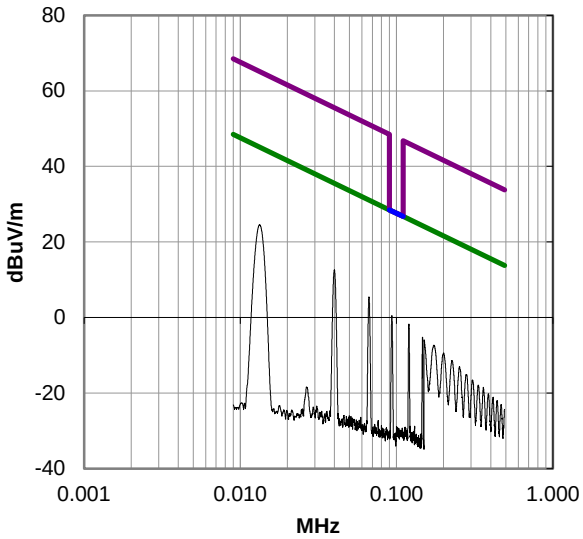
SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

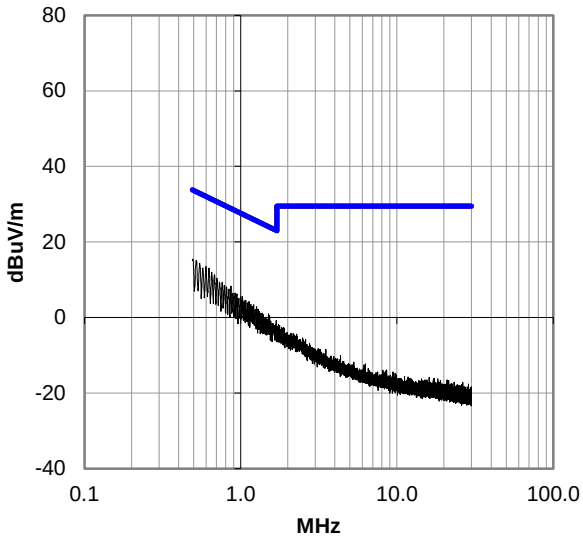
PRESCAN DATA

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.

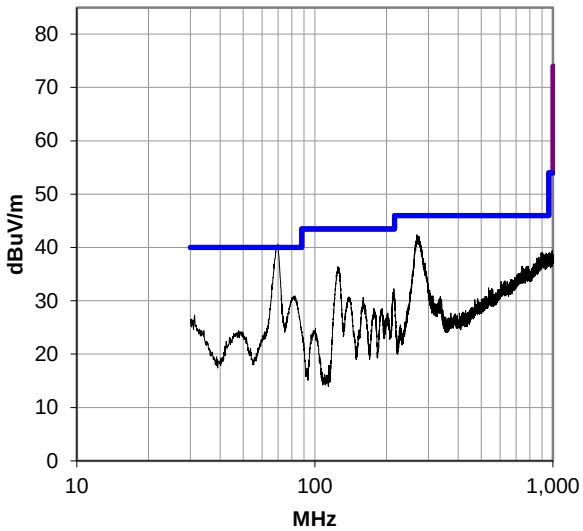
0.009-0.49 MHz, Run 36



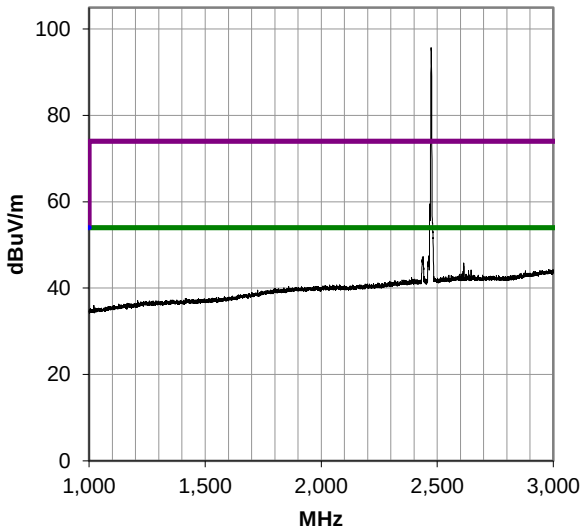
0.49-30 MHz, Run 35



30-1000 MHz, Run 32



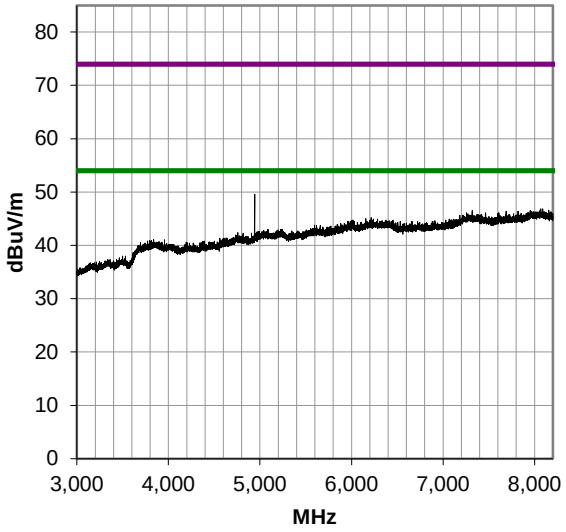
1000-3000 MHz, Run 18



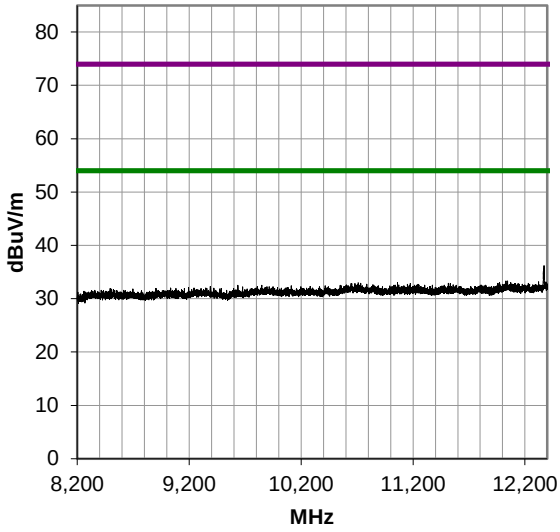
SPURIOUS RADIATED EMISSIONS

element
WTD.2024.01.16.0
EmiR5 2023.08.29.0
PSA-ESCI 2023.12.23.0

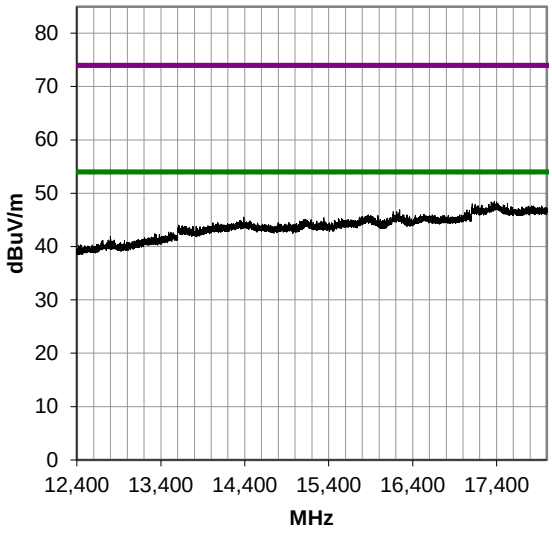
3000-8200 MHz, Run 19



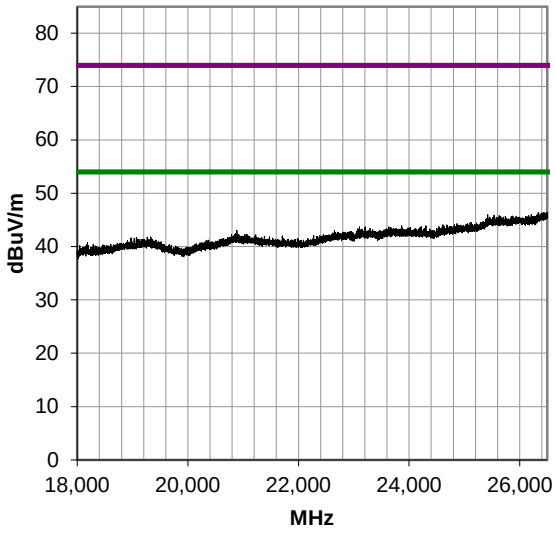
8200-12400 MHz, Run 20



12400-18000 MHz, Run 21



18000-26500 MHz, Run 27



DUTY CYCLE

element
2023/09/26

TEST DESCRIPTION

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 test software provided for operation in a fixed, single channel mode allows the EUT to operate continuously at 100% Duty Cycle.

OUTPUT POWER

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

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	AAW	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMW	2024-03-13	2025-03-13
Attenuator	S.M. Electronics	SA26B-20	AUY	2024-03-13	2025-03-13
Cable	Micro-Coax	UFD150A-1-0720-200200	EVI	2023-11-22	2024-11-22
Generator - Signal	Keysight	N5182B	TEU	2024-04-18	2027-04-18

OUTPUT POWER

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242239	Date:	2024-06-25
Customer:	Garrett Metal Detectors	Temperature:	22°C
Attendees:	None	Relative Humidity:	48.5%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Ladwig	Job Site:	EV06
Power:	Battery	Configuration:	GARR0125-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

Reference Level Offset included: DC block, 20 dB attenuator, and measurement cable.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

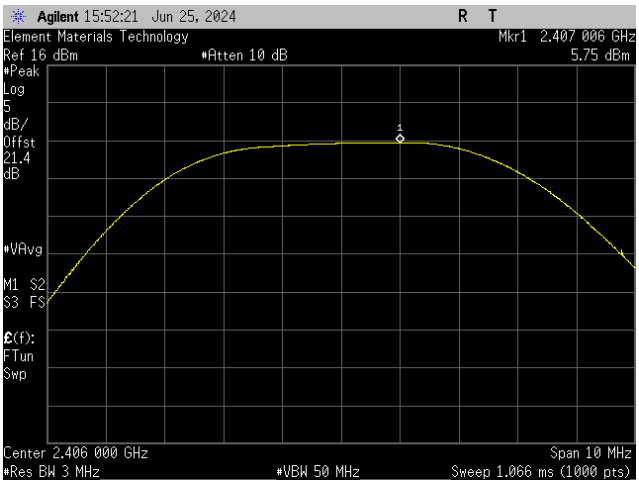
Tested By

TEST RESULTS

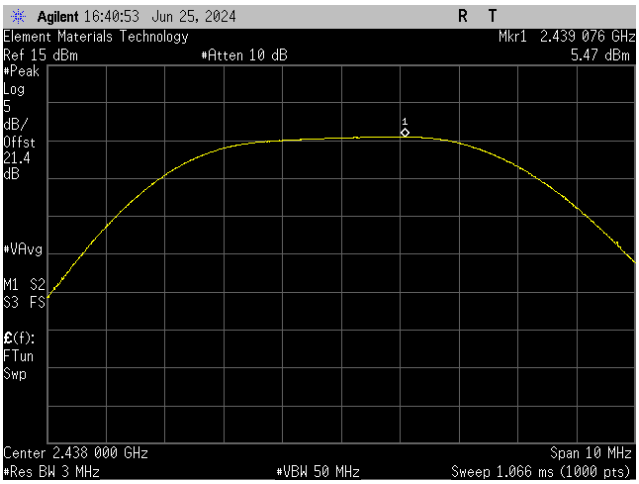
	Out Pwr (dBm)	Limit (dBm)	Result
Pure Path, 8FSK, 5 Mbps			
Low Channel, 2406 MHz	5.748	30	Pass
Mid Channel, 2438 MHz	5.47	30	Pass
High Channel, 2474 MHz	5.53	30	Pass

OUTPUT POWER

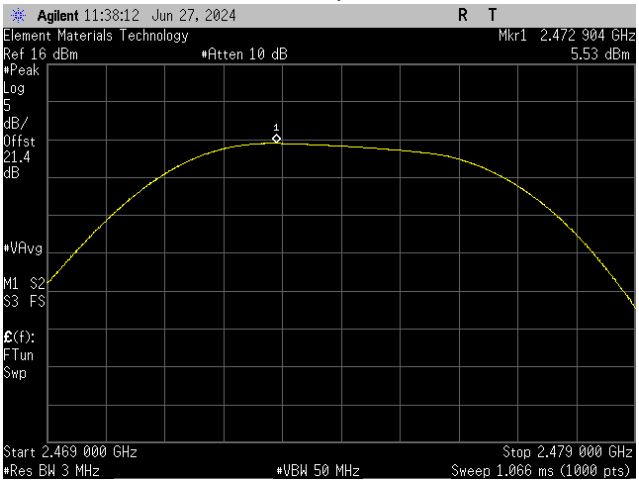
element
TbtTx 2024.05.24.1
WTD.2024.01.16.0



Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



Pure Path, 8FSK, 5 Mbps
Mid Channel, 2438 MHz



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

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	AAW	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMW	2024-03-13	2025-03-13
Attenuator	S.M. Electronics	SA26B-20	AUY	2024-03-13	2025-03-13
Cable	Micro-Coax	UFD150A-1-0720-200200	EVI	2023-11-22	2024-11-22
Generator - Signal	Keysight	N5182B	TEU	2024-04-18	2027-04-18

EQUIVALENT ISOTROPIC RADIATED POWER (EIRP)

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242239	Date:	2024-06-25
Customer:	Garrett Metal Detectors	Temperature:	21.9°C
Attendees:	None	Relative Humidity:	48.6%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Ladwig	Job Site:	EV06
Power:	Battery	Configuration:	GARR0125-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

Tested By

TEST RESULTS

	Out Pwr (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Result
Pure Path, 8FSK, 5 Mbps					
Low Channel, 2406 MHz	5.748	3.3	9.048	36	Pass
Mid Channel, 2438 MHz	5.47	3.3	8.77	36	Pass
High Channel, 2474 MHz	5.53	3.3	8.83	36	Pass

BAND EDGE COMPLIANCE

element
TbtTx 2024.06.21.0 BETA 1
WTD.2024.01.16.0

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

The spectrum was scanned below the lower band edge and above the higher band edge. The analyzer screen captures for this test show an example of the emission mask for the test mode also used during the radiated spurious emissions at the restricted band edges test.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMW	2024-03-13	2025-03-13
Attenuator	S.M. Electronics	SA26B-20	AUY	2024-03-13	2025-03-13
Cable	Micro-Coax	UFD150A-1-0720-200200	EVI	2023-11-22	2024-11-22
Generator - Signal	Keysight	N5182B	TEU	2024-04-18	2027-04-18

BAND EDGE COMPLIANCE

element
TbtTx 2024.06.21.0 BETA 1
WTD.2024.01.16.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242239	Date:	2024-06-26
Customer:	Garrett Metal Detectors	Temperature:	22°C
Attendees:	None	Relative Humidity:	47.8%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Ladwig	Job Site:	EV06
Power:	Battery	Configuration:	GARR0125-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

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

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

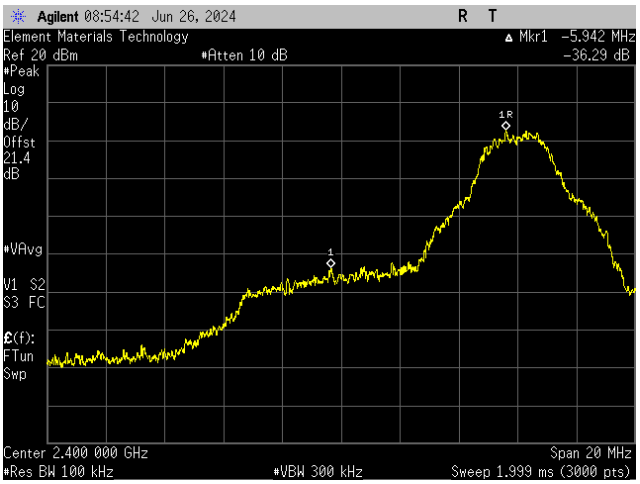
Tested By

TEST RESULTS

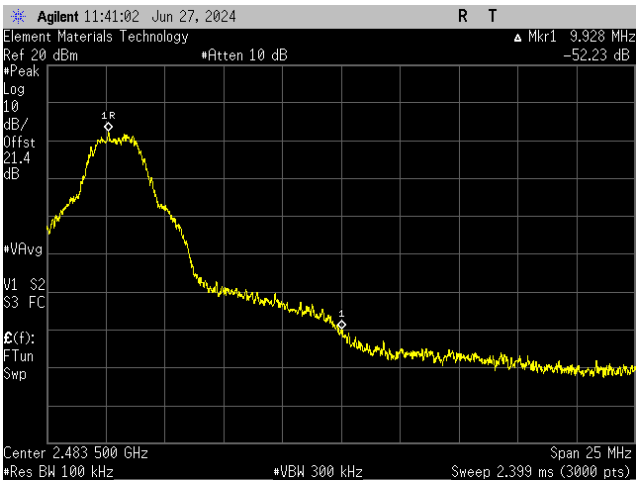
	Value (dBc)	Limit ≤ (dBc)	Result
Pure Path, 8FSK, 5 Mbps			
Low Channel, 2406 MHz	-36.29	-20	Pass
High Channel, 2474 MHz	-52.23	-20	Pass

BAND EDGE COMPLIANCE

element
TbtTx 2024.06.21.0 BETA 1
WTD.2024.01.16.0



Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz

DTS BANDWIDTH (6 dB)

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

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	AAW	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMW	2024-03-13	2025-03-13
Attenuator	S.M. Electronics	SA26B-20	AUY	2024-03-13	2025-03-13
Cable	Micro-Coax	UFD150A-1-0720-200200	EVI	2023-11-22	2024-11-22
Generator - Signal	Keysight	N5182B	TEU	2024-04-18	2027-04-18

DTS BANDWIDTH (6 dB)

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242239	Date:	2024-06-25
Customer:	Garrett Metal Detectors	Temperature:	22°C
Attendees:	None	Relative Humidity:	48.7%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Ladwig	Job Site:	EV06
Power:	Battery	Configuration:	GARR0125-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

Reference Level Offset included: DC block, 20 dB attenuator, and measurement cable.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

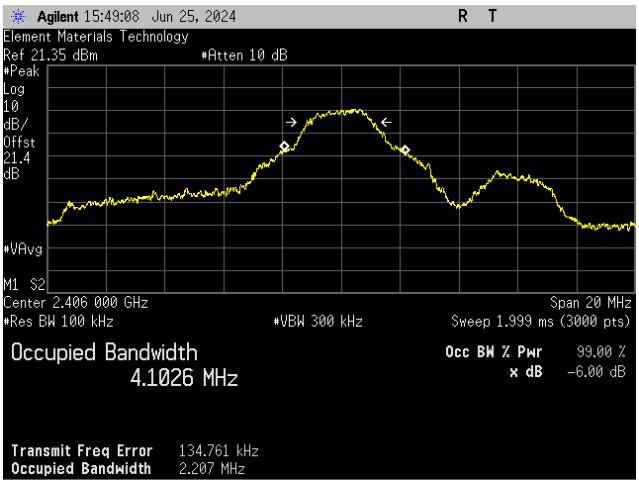
Pass

Tested By

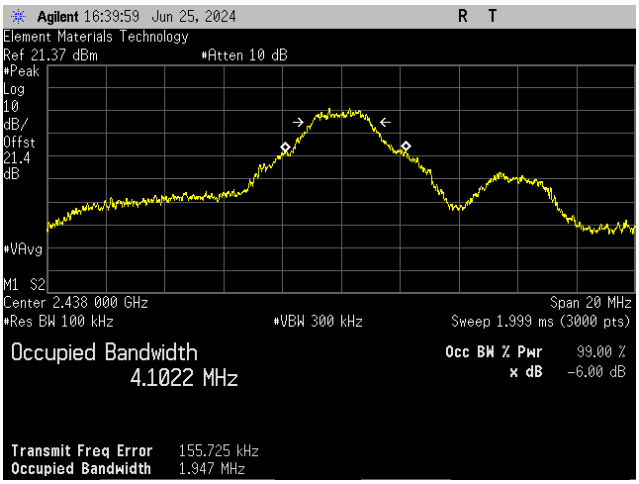
TEST RESULTS

	Value	Limit (≥)	Result
Pure Path, 8FSK, 5 Mbps			
Low Channel, 2406 MHz	2.207 MHz	500 kHz	Pass
Mid Channel, 2438 MHz	1.947 MHz	500 kHz	Pass
High Channel, 2474 MHz	2.063 MHz	500 kHz	Pass

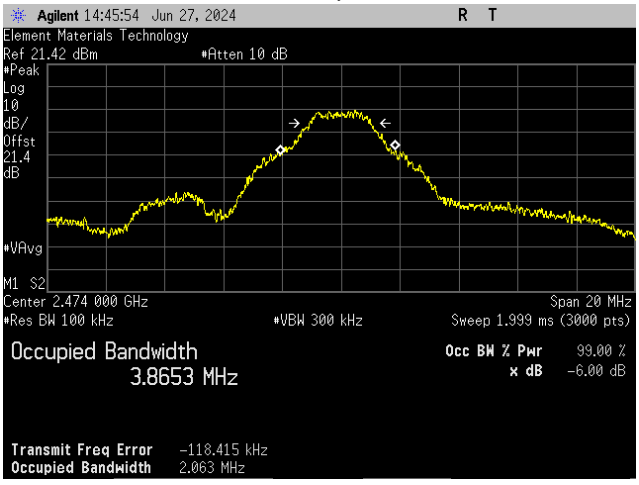
DTS BANDWIDTH (6 dB)



Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



Pure Path, 8FSK, 5 Mbps
Mid Channel, 2438 MHz



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz

OCCUPIED BANDWIDTH (99%)

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

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 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.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMW	2024-03-13	2025-03-13
Attenuator	S.M. Electronics	SA26B-20	AUY	2024-03-13	2025-03-13
Cable	Micro-Coax	UFD150A-1-0720-200200	EVI	2023-11-22	2024-11-22
Generator - Signal	Keysight	N5182B	TEU	2024-04-18	2027-04-18

OCCUPIED BANDWIDTH (99%)

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242239	Date:	2024-06-25
Customer:	Garrett Metal Detectors	Temperature:	21.9°C
Attendees:	None	Relative Humidity:	48.6%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Ladwig	Job Site:	EV06
Power:	Battery	Configuration:	GARR0125-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-Gen Issue 5:2018+A1:2019+A2:2021	ANSI C63.10:2013

COMMENTS

Reference Level Offset included: DC block, 20 dB attenuator, and measurement cable.

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

N/A

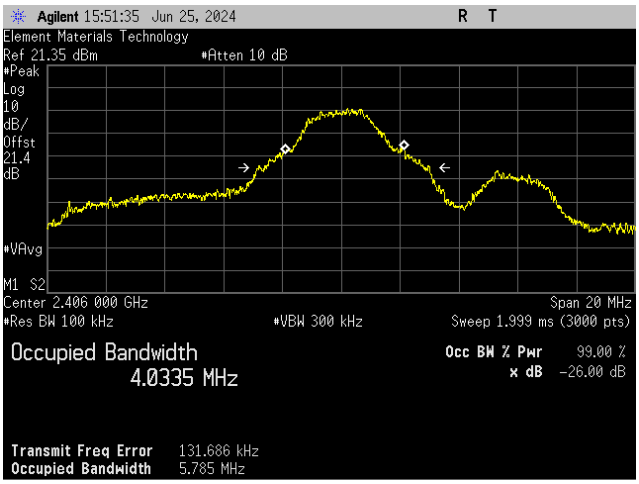
Tested By

TEST RESULTS

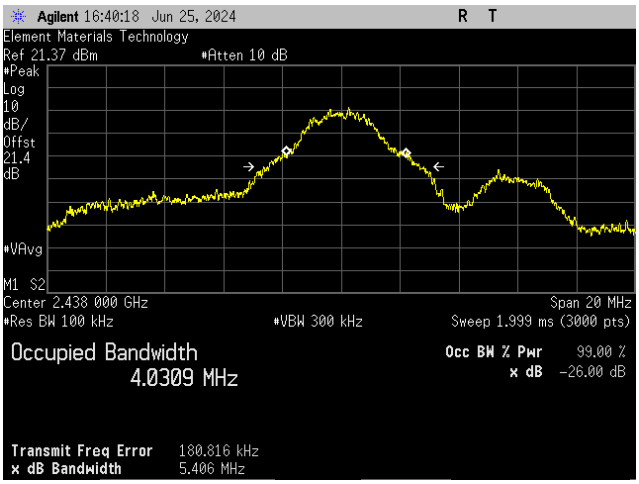
	Value	Limit	Result
Pure Path, 8FSK, 5 Mbps			
Low Channel, 2406 MHz	4.034 MHz	N/A	N/A
Mid Channel, 2438 MHz	4.031 MHz	N/A	N/A
High Channel, 2474 MHz	3.845 MHz	N/A	N/A

OCCUPIED BANDWIDTH (99%)

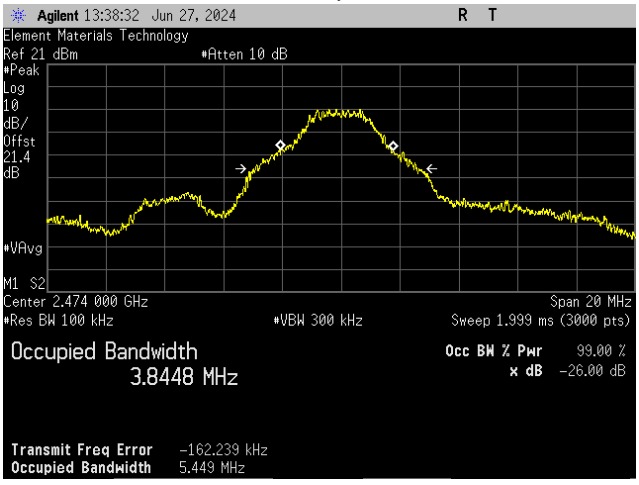
element
TbtTx 2024.05.24.1
WTD.2024.01.16.0



Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



Pure Path, 8FSK, 5 Mbps
Mid Channel, 2438 MHz



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2024.06.21.0 BETA 1
WTD.2024.01.16.0

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

The reference level offset for the fundamental screen capture was based on a measured value of the loss between the spectrum analyzer and the EUT which was verified at the time of test. The remaining screen capture(s) use an internal transducer factor on the analyzer to correct the displayed trace based on the cable loss over frequency. The reference level offset for the additional screen capture(s) is then based on the expected attenuator value and any other losses.

Fundamental Offset = Ref Lvl Offset showing measured composite factor of all losses

Remaining Screen capture(s) Offset = “Internal” cable loss factor not shown on screen capture + Ref Lvl Offset showing expected attenuator value and any other losses

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMW	2024-03-13	2025-03-13
Attenuator	S.M. Electronics	SA26B-20	AUY	2024-03-13	2025-03-13
Cable	Micro-Coax	UFD150A-1-0720-200200	EVI	2023-11-22	2024-11-22
Generator - Signal	Keysight	N5182B	TEU	2024-04-18	2027-04-18

SPURIOUS CONDUCTED EMISSIONS

element
TbtTx 2024.06.21.0 BETA 1
WTD.2024.01.16.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242239	Date:	2024-06-26
Customer:	Garrett Metal Detectors	Temperature:	22°C
Attendees:	None	Relative Humidity:	47.9%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Ladwig	Job Site:	EV06
Power:	Battery	Configuration:	GARR0125-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

None

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

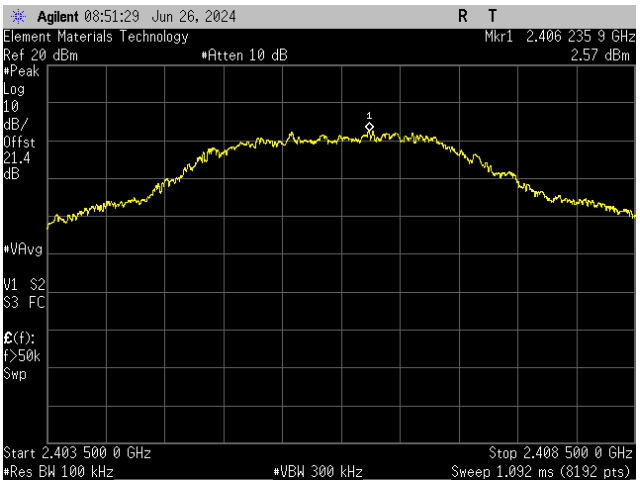
Tested By

TEST RESULTS

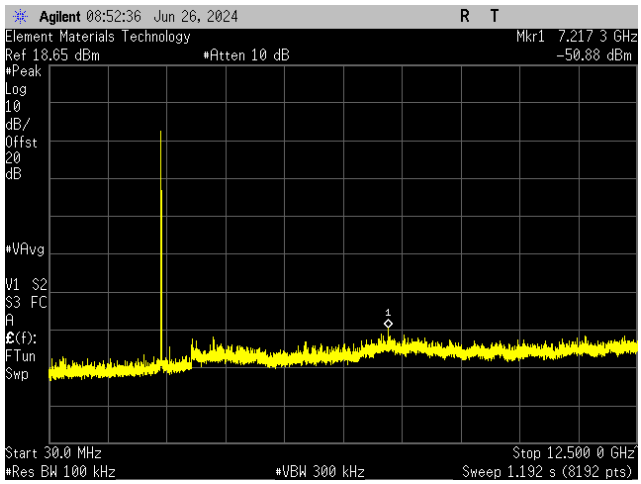
	Frequency Range	Measured Freq (MHz)	Max Value (dBc)	Limit ≤ (dBc)	Result
Pure Path, 8FSK, 5 Mbps					
Low Channel, 2406 MHz	Fundamental	2406.24	N/A	N/A	N/A
	30 MHz - 12.5 GHz	7217.3	-53.45	-20	Pass
	12.5 GHz - 25 GHz	24658.2	-50.42	-20	Pass
Mid Channel, 2438 MHz	Fundamental	2438.25	N/A	N/A	N/A
	30 MHz - 12.5 GHz	12451.3	-54.24	-20	Pass
	12.5 GHz - 25 GHz	24476.6	-49.97	-20	Pass
High Channel, 2474 MHz	Fundamental	2473.6	N/A	N/A	N/A
	30 MHz - 12.5 GHz	7130.5	-54.33	-20	Pass
	12.5 GHz - 25 GHz	24771.1	-49.53	-20	Pass

SPURIOUS CONDUCTED EMISSIONS

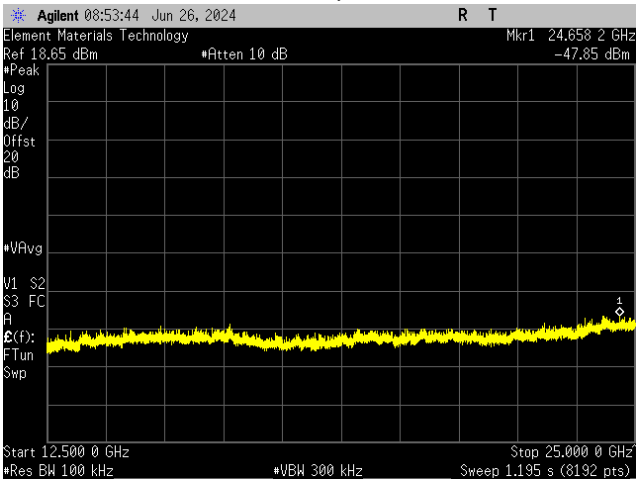
element
TbtTx 2024.06.21.0 BETA 1
WTD.2024.01.16.0



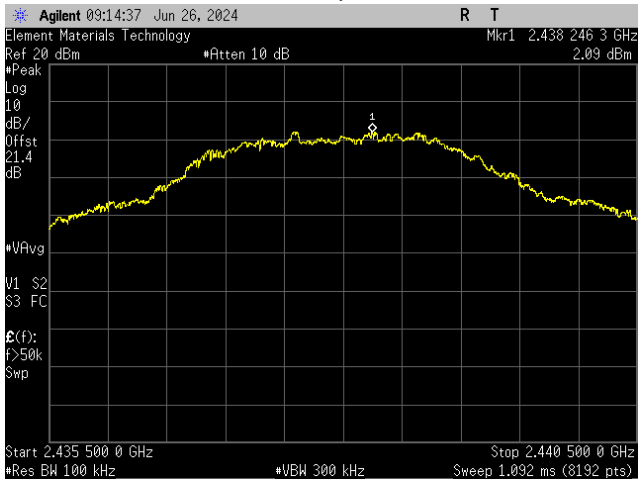
Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



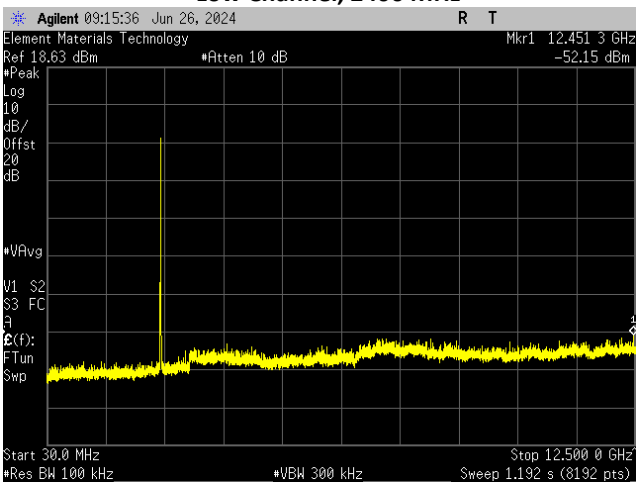
Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



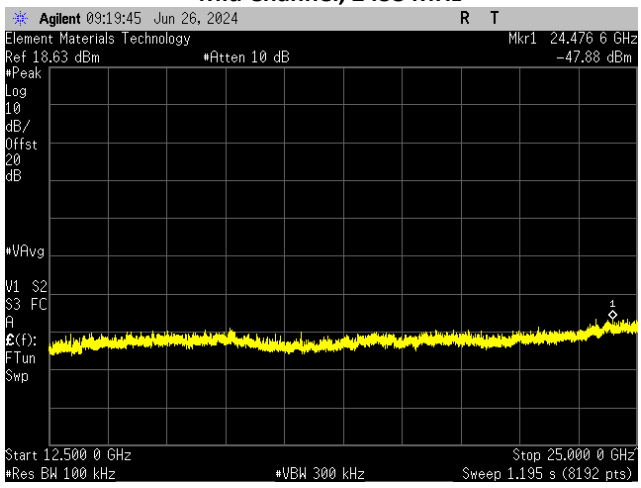
Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



Pure Path, 8FSK, 5 Mbps
Mid Channel, 2438 MHz



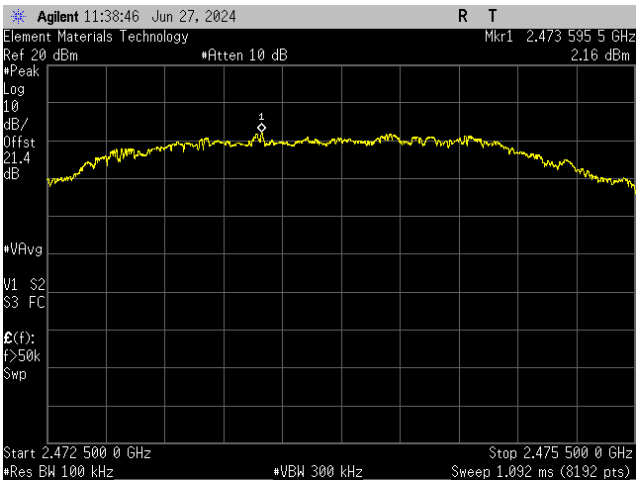
Pure Path, 8FSK, 5 Mbps
Mid Channel, 2438 MHz



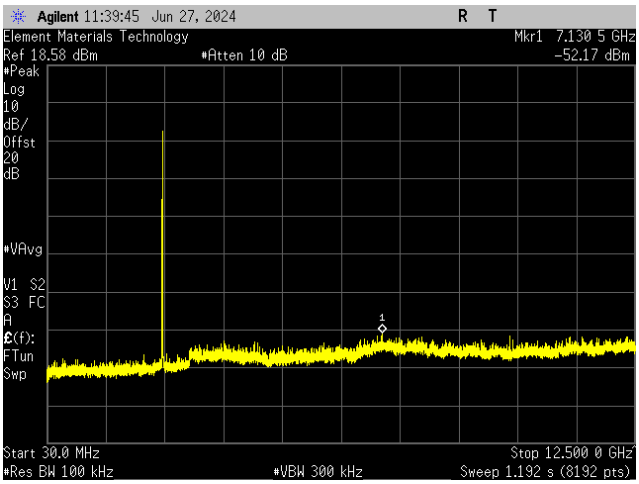
Pure Path, 8FSK, 5 Mbps
Mid Channel, 2438 MHz

SPURIOUS CONDUCTED EMISSIONS

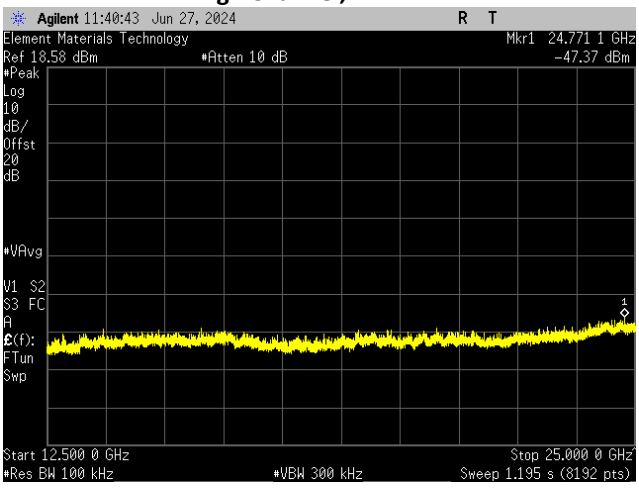
element
TbtTx 2024.06.21.0 BETA 1
WTD.2024.01.16.0



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz

POWER SPECTRAL DENSITY

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

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

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Analyzer - Spectrum Analyzer	Agilent	E4440A	AAW	2024-02-14	2025-02-14
Block - DC	Fairview Microwave	SD3379	AMW	2024-03-13	2025-03-13
Attenuator	S.M. Electronics	SA26B-20	AUY	2024-03-13	2025-03-13
Cable	Micro-Coax	UFD150A-1-0720-200200	EVI	2023-11-22	2024-11-22
Generator - Signal	Keysight	N5182B	TEU	2024-04-18	2027-04-18

POWER SPECTRAL DENSITY

element
TbtTx 2024.05.24.1
WTD.2024.01.16.0

EUT:	Vortex	Work Order:	GARR0125
Serial Number:	64242239	Date:	2024-06-26
Customer:	Garrett Metal Detectors	Temperature:	22°C
Attendees:	None	Relative Humidity:	48.4%
Customer Project:	None	Bar. Pressure (PMSL):	1014 mbar
Tested By:	Christopher Ladwig	Job Site:	EV06
Power:	Battery	Configuration:	GARR0125-2

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.247:2024	ANSI C63.10:2013
RSS-247 Issue 3:2023	ANSI C63.10:2013

COMMENTS

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

DEVIATIONS FROM TEST STANDARD

None

CONCLUSION

Pass

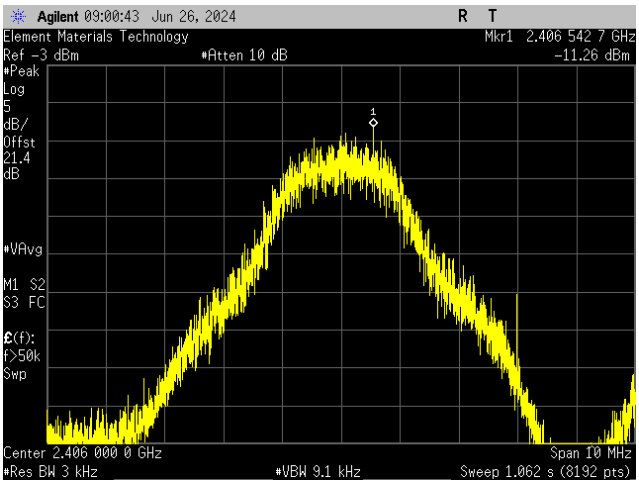
Tested By

TEST RESULTS

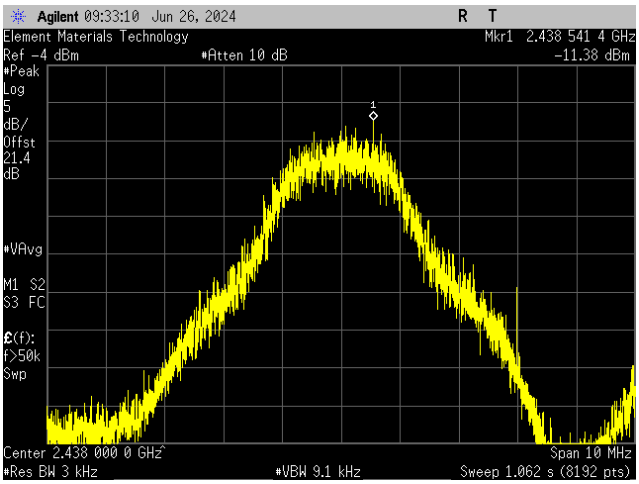
	Value dBm/3kHz	Limit ≤ (dBm/3kHz)	Results
Pure Path, 8FSK, 5 Mbps			
Low Channel, 2406 MHz	-11.258	8	Pass
Mid Channel, 2438 MHz	-11.375	8	Pass
High Channel, 2474 MHz	-12.110	8	Pass

POWER SPECTRAL DENSITY

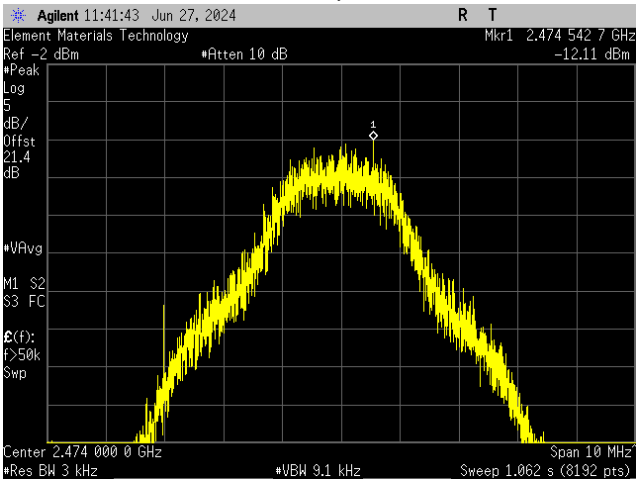
element
TbtTx 2024.05.24.1
WTD.2024.01.16.0



Pure Path, 8FSK, 5 Mbps
Low Channel, 2406 MHz



Pure Path, 8FSK, 5 Mbps
Mid Channel, 2438 MHz



Pure Path, 8FSK, 5 Mbps
High Channel, 2474 MHz

End of Test Report