Certification Test Report

Module FCC ID: 2AJVE-FIDOX4DART
Module IC: 21981- FIDOX4DART
Module Model: X4

FCC Rule Part: 15.247
ISED Canada's Radio Standards Specification: RSS-247

TÜV SÜD Report Number: RD72154330.100

Host Manufacturer: FLIR Detection, Inc.
Host Model: Fido X4

Test Begin Date: February 21, 2020
Test End Date: March 25, 2020

Report Issue Date: March 31, 2020

A2LA Cert. No. 2955.18

This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, ANSI, or any agency of the Federal Government.

Prepared by:

Chris Gormley
RF Wireless Engineer
TÜV SÜD America Inc.

Reviewed by:

Kirby Munroe
Technical Manager, US Wireless
TÜV SÜD America, Inc.

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2320 Presidential Dr Suite 101, Durham NC 27703-8077, Ph: 919-748-4615

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1 GENERAL

1.1 Purpose

The purpose of this report is to support a Class II Permissive Change application for a preapproved module integrated into a specific host (FLIR FIDO-X4) with new antenna for Part 15 Subpart C of the FCC's Code of Federal Regulations and Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 Certification.

1.2 Product Description

The FLIR FIDO-X4 is a handheld, battery-powered explosives trace detector that can utilize vapor and particle testing modes to detect trace amounts of explosives.

Technical Information:

Module: X4
Module FCC ID: 2AJVE-FIDOX4DART
Module IC ID: 21981- FIDOX4DART

Table 1.2-1: 802.11b/g/n radio

Detail	Description
Frequency Range	2412 – 2462 MHz
Number of Channels	11
Modulation Format	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
Data Rates	802.11b: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps 802.11g: 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps 802.11n HT20: 6.5Mbps, 13Mbps, 19.5Mbps, 26Mbps, 39Mbps, 52Mbps, 58.5Mbps, 65Mbps
Antenna Type / Gain	Patch antenna with 2.5dBi gain

Manufacturer Information:

FLIR Detection Inc
1024 S. Innovation Way
Stillwater, OK 74074

EUT Serial Numbers: 475479-1

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

No deviation from the test method was applied.

For radiated emissions, the EUT was evaluated in three orthogonal orientations and for all power modes to identify the worst-case configuration. The worst-case configuration was in the Z-orientation (upright).

Software Power Setting: 20000 (100%) for all channels

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America Inc.
2320 Presidential Drive, Suite 101
Durham, NC 27703
Phone: (919) 748-4615

2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America Inc. (Durham) is accredited to ISO/IEC 17025 by A2LA accreditation program, and has been issued certificate number 2955.18 in recognition of this accreditation. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC and Innovation, Science and Economic Development (ISED) Canada.

FCC Designation Number: US1245
FCC Test Firm Registration Number: 238628
ISED Canada Company Number: 20446

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 18' x 28' x 18' shielded enclosure. The chamber is lined with Samwha Electronics Co. LTD Ferrite Absorber, model number SFA300 (HSN-1). The ferrite tile is 10cm x 10 cm and weighs approximately 1.4lbs. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber. On top of the ferrite tiles is DMAS HT-45 (Dutch Microwave Absorber Solutions) hybrid absorber on all walls except the wall behind the antenna mast which has a shorter DMAS HT-25 absorber.

The turntable is 1.50m in diameter and is located 150cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using short #6 copper wire. The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the turntable. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane.

Behind the turntable is a 2' x 6' x 1.5' deep shielded pit used for support equipment if necessary. The pit is equipped with 2 - 4" PVC chase from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

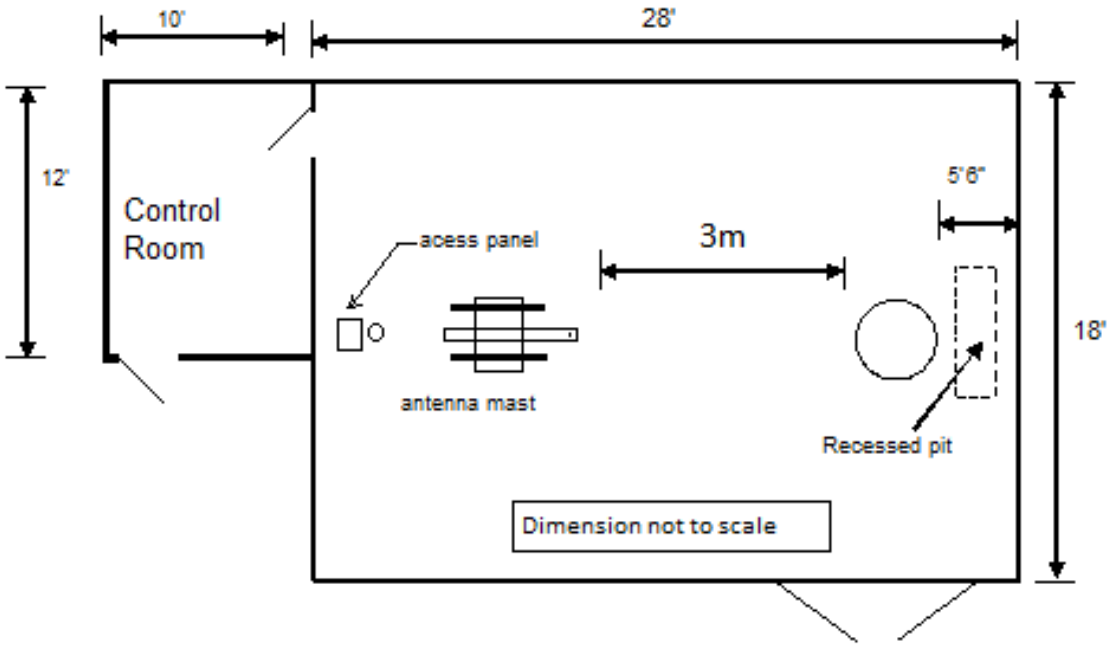

Figure 2.3-1: Semi-Anechoic Chamber Test Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2020
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2020
- FCC KDB 558074 D01 DTS Meas Guidance v05r02 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, April 2, 2019
- ISED Canada Radio Standards Specification: RSS-247, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, Issue 2, February 2017
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 5, March 2019, Amendment 1

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

Asset ID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
DEMC3002	Rohde & Schwarz	ESU40	Receiver	100346	1/22/2020	1/22/2021
DEMC3006	Rohde & Schwarz	TS-PR18	Amplifier	122006	1/23/2020	1/23/2021
DEMC3012	Rohde & Schwarz	EMC32-EB	Software	100731	NCR	NCR
DEMC3014	EMCO	3115	Antenna	9901-5653	4/12/2019	4/12/2021
DEMC3020	Rohde & Schwarz	SMB100A	Signal Generator	175943	1/22/2020	1/22/2021
DEMC3027	Micro-Tronics	BRM50702	2.4GHz Notch Filter	175	1/27/2020	1/27/2021
DEMC3032	Hasco, Inc.	HLL142-S1-S1-192/WA	Cable	3075	1/23/2020	1/23/2021
DEMC3038	Florida RF Labs	NMSE-290AW-60.0-NMSE	Cable Set	1448	1/27/2020	1/27/2021
DEMC3039	Florida RF Labs	NMSE-290AW-396.0-NMSE	Cable Set	1447	1/27/2020	1/27/2021
DEMC3042	Aeroflex Inmet	18N10W-10	Attenuator	1444	1/27/2020	1/27/2021
DEMC3045	Aeroflex Inmet	18N10W-20	Attenuator	1437	1/27/2020	1/27/2021
DEMC3161	TESEQ	CBL-6112D	Antenna	51323	2/18/2020	2/18/2021

DMAS MT-25 RF absorber material was used on the floor for all final measurements above 1 GHz.
NCR = No Calibration Required
Firmware Version: 4.73 SP4
Software Version: EMC32-B 10.50.00

5 EUT ANDSUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	EUT	FLIRFLIR Detection, Inc.	FIDO-X4	475479-1
2	PC	Hewlett Packard	M6-k125dx	CND40305RD

Notes: The PC was only used to configure the radios prior to testing and was not connected to the EUT during testing.

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

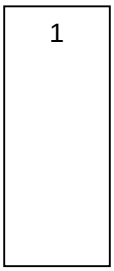

Figure 6-1: Test Setup Block Diagram

Table 6-1: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A				

*Note: No cables were required for the duration of testing as the unit is battery operated and standalone.

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: 15.203

The antenna is connected via a non-standard IPEX MHFI connector.

7.2 Radiated Spurious Emissions

7.2.1.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a RBW of 120 kHz and a VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

7.2.1.2 Duty Cycle Correction

The Duty Cycle Correction was not required.

7.2.1.3 Measurement Results

Performed by: Chris Gormley / Al Servais

Table 7.2.1.3-1: Radiated Spurious Emissions Tabulated Data – 802.11b 1Mbps

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
2390	38.2	24.8	H	-3.08	35.12	21.72	74.0	54.0	38.88	32.28
2390	38.1	24.7	V	-3.08	35.02	21.62	74.0	54.0	38.98	32.38
4824	40.80	29.90	H	3.79	44.59	33.69	74.0	54.0	29.41	20.31
4824	43.40	38.10	V	3.79	47.19	41.89	74.0	54.0	26.81	12.11
12060	36.30	22.90	H	13.37	49.67	36.27	74.0	54.0	24.33	17.73
12060	35.90	22.80	V	13.37	49.27	36.17	74.0	54.0	24.73	17.83
14472	37.10	23.20	H	13.70	50.80	36.90	74.0	54.0	23.20	17.10
14472	36.70	23.10	V	13.70	50.40	36.80	74.0	54.0	23.60	17.20
19296	34.60	20.50	H	8.90	43.50	29.40	74.0	54.0	30.50	24.60
19296	33.50	20.50	V	8.90	42.40	29.40	74.0	54.0	31.60	24.60
Mid Channel										
4874	40.90	32.10	H	3.82	44.72	35.92	74.0	54.0	29.28	18.08
4874	45.00	40.50	V	3.82	48.82	44.32	74.0	54.0	25.18	9.68
7311	37.50	24.30	H	8.33	45.83	32.63	74.0	54.0	28.17	21.37
7311	37.80	24.20	V	8.33	46.13	32.53	74.0	54.0	27.87	21.47
12185	36.50	22.40	H	12.93	49.43	35.33	74.0	54.0	24.57	18.67
12185	35.90	22.30	V	12.93	48.83	35.23	74.0	54.0	25.17	18.77
High Channel										
2483.5	38.60	24.70	H	-3.26	35.34	21.44	74.0	54.0	38.66	32.56
2483.5	38.60	25.20	V	-3.26	35.34	21.94	74.0	54.0	38.66	32.06
4924	39.50	27.20	H	3.86	43.36	31.06	74.0	54.0	30.64	22.94
4924	41.70	33.40	V	3.86	45.56	37.26	74.0	54.0	28.44	16.74
7386	37.10	23.60	H	8.68	45.78	32.28	74.0	54.0	28.22	21.72
7386	37.30	23.60	V	8.68	45.98	32.28	74.0	54.0	28.02	21.72
12310	36.00	22.50	H	12.49	48.49	34.99	74.0	54.0	25.51	19.01
12310	35.70	22.40	V	12.49	48.19	34.89	74.0	54.0	25.81	19.11

Note: All other emissions related to the transmitter were attenuated below the noise floor of the measurement instrumentation or a function of the other digital circuitry.

Table 7.2.1.3-2: Radiated Spurious Emissions Tabulated Data – 802.11g 6Mbps

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
4824	42.10	28.60	H	3.79	45.89	32.39	74.0	54.0	28.11	21.61
4824	42.40	28.70	V	3.79	46.19	32.49	74.0	54.0	27.81	21.51
12060	41.80	28.20	H	13.37	55.17	41.57	74.0	54.0	18.83	12.43
12060	42.10	28.10	V	13.37	55.47	41.47	74.0	54.0	18.53	12.53
Mid Channel										
4874	42.30	28.60	H	3.82	46.12	32.42	74.0	54.0	27.88	21.58
4874	42.10	28.50	V	3.82	45.92	32.32	74.0	54.0	28.08	21.68
7311	42.50	28.50	H	8.33	50.83	36.83	74.0	54.0	23.17	17.17
7311	42.00	28.50	V	8.33	50.33	36.83	74.0	54.0	23.67	17.17
12185	41.80	28.10	H	12.93	54.73	41.03	74.0	54.0	19.27	12.97
12185	41.40	28.10	V	12.93	54.33	41.03	74.0	54.0	19.67	12.97
High Channel										
4924	41.90	28.60	H	3.86	45.76	32.46	74.0	54.0	28.24	21.54
4924	42.60	28.60	V	3.86	46.46	32.46	74.0	54.0	27.54	21.54
7386	42.10	28.60	H	8.68	50.78	37.28	74.0	54.0	23.22	16.72
7386	42.20	28.50	V	8.68	50.88	37.18	74.0	54.0	23.12	16.82
12310	41.90	28.30	H	12.49	54.39	40.79	74.0	54.0	19.61	13.21
12310	42.20	28.30	V	12.49	54.69	40.79	74.0	54.0	19.31	13.21

Note: All other emissions related to the transmitter were attenuated below the noise floor of the measurement instrumentation.

Table 7.2.1.3-3: Radiated Spurious Emissions Tabulated Data – 802.11n HT20 6.5Mbps

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
4824	41.90	28.60	H	3.79	45.69	32.39	74.0	54.0	28.31	21.61
4824	42.30	28.50	V	3.79	46.09	32.29	74.0	54.0	27.91	21.71
12060	42.00	28.10	H	13.37	55.37	41.47	74.0	54.0	18.63	12.53
12060	41.50	28.10	V	13.37	54.87	41.47	74.0	54.0	19.13	12.53
Mid Channel										
4874	42.40	28.60	H	3.82	46.22	32.42	74.0	54.0	27.78	21.58
4874	42.30	28.60	V	3.82	46.12	32.42	74.0	54.0	27.88	21.58
7311	41.90	28.60	H	8.33	50.23	36.93	74.0	54.0	23.77	17.07
7311	41.60	28.30	V	8.33	49.93	36.63	74.0	54.0	24.07	17.37
12185	41.90	28.10	H	12.93	54.83	41.03	74.0	54.0	19.17	12.97
12185	42.10	28.10	V	12.93	55.03	41.03	74.0	54.0	18.97	12.97
High Channel										
4924	42.90	28.50	H	3.86	46.76	32.36	74.0	54.0	27.24	21.64
4924	41.90	28.50	V	3.86	45.76	32.36	74.0	54.0	28.24	21.64
7386	42.00	28.40	H	8.68	50.68	37.08	74.0	54.0	23.32	16.92
7386	41.10	28.40	V	8.68	49.78	37.08	74.0	54.0	24.22	16.92
12310	41.80	28.30	H	12.49	54.29	40.79	74.0	54.0	19.71	13.21
12310	41.20	28.30	V	12.49	53.69	40.79	74.0	54.0	20.31	13.21

Note: All other emissions related to the transmitter were attenuated below the noise floor of the measurement instrumentation.

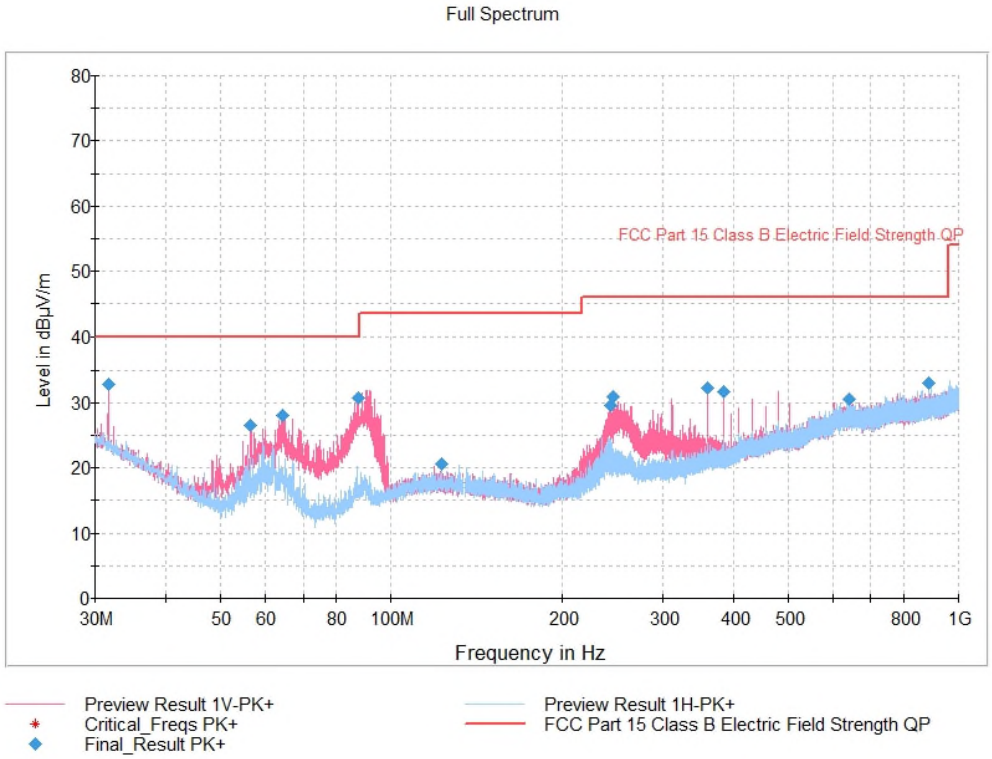

Figure 7.2.1.3-1: Emission Profile 802.11 – Below 1GHz

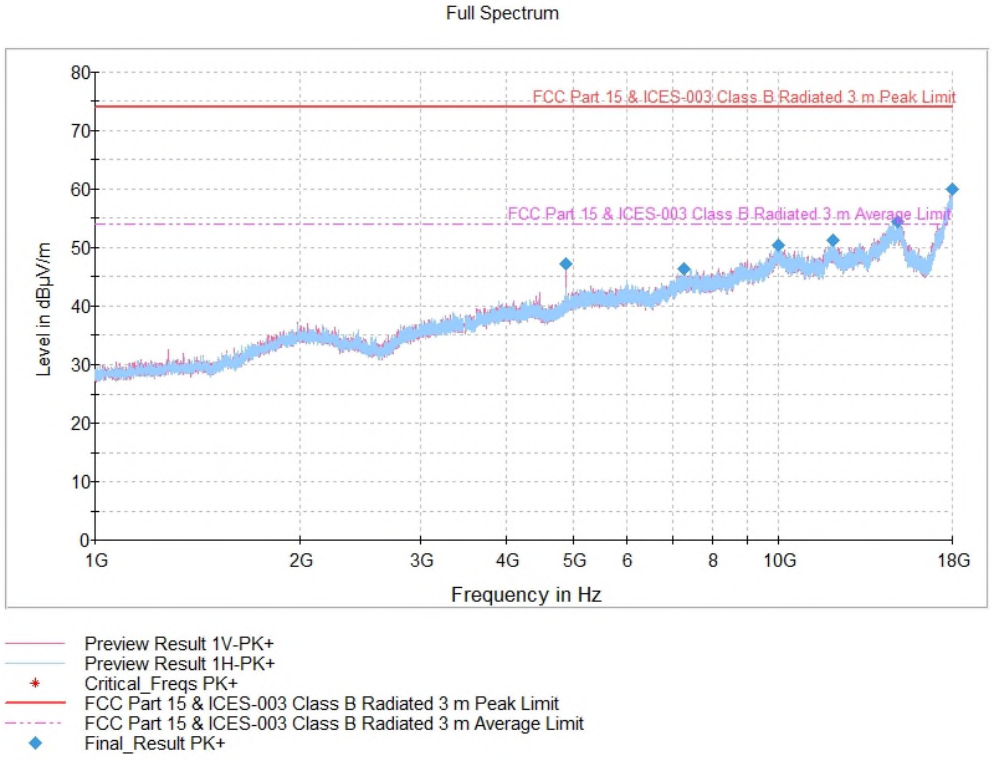

Figure 7.2.1.3-2: Emission Profile 802.11 – 1 to 18GHz

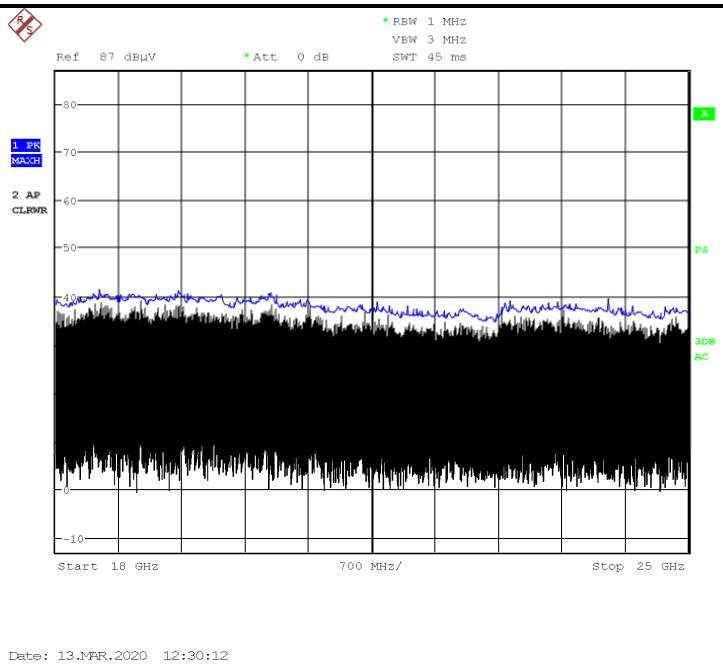

Figure 7.2.1.3-3: Emission Profile 802.11 – Above 18GHz

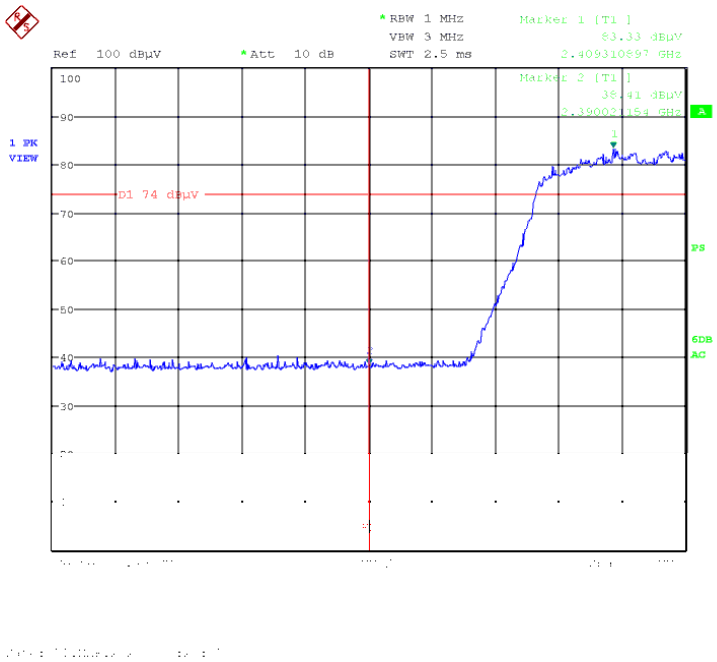

Figure 7.2.1.3-4: Low Channel Band Edge 802.11

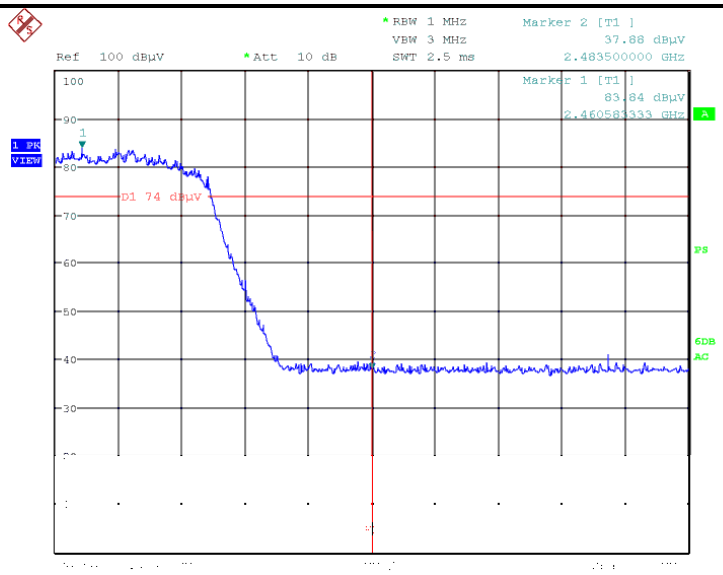

Figure 7.2.1.3-5: High Channel Band Edge 802.11

7.2.1.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 45.00 + 3.77 = 48.77dBuV/m
Margin: 74dBuV/m – 48.77dBuV/m = 25.23dB

Example Calculation: Average

Corrected Level: 35.30 + 3.77 = 39.07dBuV
Margin: 54dBuV – 39.07dBuV = 14.93dB

8 MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures (U_{Lab}) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

Parameter	U_{lab}
Occupied Channel Bandwidth	**± 0.004%**
RF Conducted Output Power	**± 0.689 dB**
Power Spectral Density	**±0.5 dB**
Antenna Port Conducted Emissions	**± 2.717 dB**
Radiated Emissions	**± 5.877 dB**
Temperature	**± 0.860 °C**
Radio Frequency	**±2.832 x 10-8**
AC Power Line Conducted Emissions	**±2.85**

9 CONCLUSION

In the opinion of TÜV SÜD America Inc. the Fido Portable Trace Detector, manufactured by FLIR Detection, Inc. meets the requirements of FCC Part 15 subpart C and ISED Canada Radio Standards Specification: RSS-247 for the tests documented herein.

END REPORT