GENTEX CORPORATION

Technical Report to the FCC
Gentex Corporation

Model: PL1N
FCC ID: NZLPL1N

1/14/2025

A report concerning approval for Gentex Corporation model PL1N
Please issue grant immediately upon review.

Measurements Made by:

Bolay.Pacheco Digitally signed by Bolay.Pacheco Date: 2025.02.25 11:11:41 -05'00'

Bolay Pacheco
Laboratory Validation Engineer III
Gentex Corporation

Report Reviewed by:

Michael Foster Digitally signed by Michael Foster Date: 2025.02.25 11:04:34 -05'00'

Michael Foster
Laboratory Regulatory Engineer I
Gentex Corporation

Measurements Made and Report Prepared by:

Patricia Szeszulski Digitally signed by Patricia Szeszulski Date: 2025.02.25 11:16:04 -05'00'

Patricia Szeszulski
Laboratory Validation Engineer II
Gentex Corporation

Report Approved by:

Jason Vargo Laboratory Lab Manager I Digitally signed by Jason Vargo Laboratory Lab Manager I Date: 2025.02.25 11:53:16 -05'00'

Jason Vargo
Laboratory Manager I
Gentex Corporation

Report Submitted by:

brian.miller Digitally signed by brian.miller Date: 2025.02.25 11:08:11 -05'00'

Brian Miller
Laboratory Group Leader – Regulatory II
Gentex Corporation

Test Report Revision

REV Number	Date	Author	Description
1.0	11/22/2024	Patricia Szeszulski	Initial release
2.0	1/14/2025	Patricia Szeszulski	Updated per reviewer's feedback

Results relate only to the items tested as received.

Compliance has been evaluated based on the Lab Manual section 7.6.2. The decision rule used regarding measurement uncertainty was to determine results solely on whether the measured values met the defined acceptance criteria without factoring in measurement uncertainty values.

1. General Information

1.1. Product Description

The Gentex Corporation Connected Smoke Nursery Model utilizes Bluetooth, WIFI, and Radar technology. It is powered by the AC electrical system of the home and has backup battery power.

The antenna system is an integral part of the unit. It cannot be altered nor replaced by the user. The service of this system is only available via Gentex Corporation

1.2. Related Grants

This device contains a modular transmitter with original FCC ID: 2AC7Z-ESPS3WROOM1 that covers 2.4GHz radio functionality under rule parts 47 CFR Part 15, Subpart C 15.247. Device will also have functionality that is covered under 47 CFR Part 15, Subpart C, Section 15.249. The device will have FCC ID # of NZLPL1N.

1.3. Test Methodology

Radiated Emissions testing was performed according to ANSI C63.10:2013. The power source for this product is the AC electrical system of the home. The DUT was placed into a representative test mode via an on-board connector and

A 120VAC 60Hz unshielded power cord was used to provide power to the EUT during testing

1.4. Test Facility

The 3-meter semi-anechoic chamber where these measurements were taken is located on the grounds of Gentex Corporation's Corporate Labs, in the city of Zeeland, county of Ottawa, state of Michigan, United States of America.

For radiated measurements above 1 GHz, RF absorbing material is placed between the antenna and EUT in accordance with ANSI C63.4:2014 Section 5.5 and chamber manufacturer's instructions.

Tabletop testing was conducted on a 3m turntable described in the site recertification report. The 3m chamber has been added to our A2LA scope of accreditation on 4/18/2019 and includes accreditation to ANSI C63.4:2014, ANSI C63.10:2013, and C63.26:2015. Our 3m chamber is registered with the ISED under Site# 4112A-2 and FCC under registration number 357351.

Corporate Mailing/Shipping Address	Site Address
Gentex Corporation	Gentex Corporation
600 N. Centennial Street	380 Riley Street
Zeeland, MI 49464	Zeeland, MI 49464

1.5. Accreditation

The Gentex Corporate EMC Lab is accredited to ISO/IEC 17025 by the American Association for Laboratory Accreditation (A2LA). Our laboratory scope and accreditation certificate #2529.01 are available from their web site www.a2la.org. Our scope of accreditation covers ANSI C63.4:2014, ANSI C63.10:2013, ANSI C63.26:2015 and Radiated Emissions at 3m, FCC 47 CFR Part 90, ISED RSS-137.

2. Product Labeling

2.1. Identifiers

The FCC Identifier assigned is FCC ID: NZLPL1N. This identifier will be labeled on the product housing.

The label will be printed on a label, which will be placed on the exterior of the housing and permanently affixed.

Because of the small size of the device and because the installation is inside a residential building, the following statements will appear in the user's manual. Refer to attachment "Users Manual.pdf" for the entire text of the user's manual.

This device complies with FCC Rule Part 15. Operation is subject to the following two conditions:
1. This device may not cause harmful interference
2. This device must accept any interference received, including interference that may cause undesired operation.

RF Exposure: This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than
20cm during normal operation.

2.2. Label Drawing and Location on Product

The label drawing is included in the "PL1N Label.pdf" attachment.

A diagram showing the location of the label on the assembly is included in the "Label and Location.pdf" attachment.

3. Test Configuration

Radiated Emission measurements presented in the report were made in accordance with ANSI C63.10-2014. The EUT was placed on a 1 x 1.5m non-metallic table elevated 80cm above a conducting ground plane for measurements below 1GHz and elevated to 1.5m for measurements above 1GHz. The harness was run down the edge of the test table to a power connection beneath the turntable.

For radiated measurements above 1 GHz, RF absorbing material is placed between the antenna and EUT in accordance with ANSI C63.4:2014 Section 5.5 and chamber manufacturer's instructions.

4. Test Procedures

Requirements

Per FCC KDB 996369 section VII and footnote 9, a transmitter module capable of transmitting simultaneously with another transmitter must be tested by following the simultaneous test procedures described in 15.31(k).

15.31(k) states that composite systems (i.e. systems which incorporate different devices contained in a single enclosure) shall be measured for compliance with the technical standards in accordance with procedures in 2.947(f).

Preliminary radiated measurements were performed to determine the frequencies where the significant emissions might be found. The DUT at was placed in the worst-case orientation, determined from the original certification, with the receive antenna set at 1m for emissions below 1GHz and at 1.5m for emissions above 1GH. The receive antenna was rotated between Horizontal and Vertical polarizations and positioned at a 3-meter distance from the DUT. The measurements were taken in the frequency range of 30MHz to 18GHz. Preliminary measurements were performed with the DUT operating on the center channel of the BLE 2402-2480 with 5.8 Radar transmitting, and with the 2412-2484 WIFI and 5.8 Radar transmitting. Worst case data rates of BLE and WIFI were tested which was determined from the original modular submission. A Quasi-peak detector was utilized for sweeps from 30-200MHz, a peak detector was utilized for sweeps from 200-1000MHz, and a peak and average detector was utilized for sweeps above 1 GHz.

All significant emissions found in the preliminary sweeps were then measured using a Quasi-Peak detector for frequencies below 1GHz and a Peak and average detector for frequencies above 1GHz at a distance of 3 meters. The measurements were made with a Bicon over the range of 30-200Mhz and with a log periodic over the range of 200-1000MHz. A double ridged waveguide antenna was utilized over the frequency range of 1GHz to 18GHz. The DUT was rotated so all sides were exposed to the receiving antenna and measurements were performed with both horizontal and vertical polarizations on the receiving antenna. The measuring antenna was raised and lowered from 1-4 meters for each antenna polarization to find the maximum reading.

For measurements from 4-18GHz the measuring receiver was moved inside the 3m chamber in order to meet ambient requirements

5. Conducted Emissions Measurements

Conducted Measurements are not required for this product.

6. Radiated Emissions Data

6.1. Date(s) Tested: 11/20/2024, 1/7/2024-1/8/2024

6.2. Test Method Deviations: None

6.3. Temperature and Humidity conditions

	Measured Value	Unit
Temperature	22.1-23.3	ºC
Humidity	46.2-50.1	%R.H.

6.4. Summary of Results

The plots of the peak preliminary spurious radiated emissions are presented below in section 7. As displayed in the sweep plots, the intermodulation product of simultaneous transmissions from the DUT did not generate any additional spurious radiated emissions, which exceeded the limits.

- **Measurement Uncertainty:** The standard uncertainty of measurement has been determined in accordance with the ISO Guide to the Expression of Uncertainty in Measurements. The estimation of measurement uncertainty reported is the expanded uncertainty for a coverage factor of k=2.26 and confidence interval of approximately 95%.

Expanded Uncertainty $U_{(k=2.26)}$ is as follows:

- Radiated Emissions – Bicon (30-250 MHz): 4.1 dB
- Radiated Emissions – LPA (250-1000 MHz): 5.0 dB
- Radiated Emissions – DRWG (26.5 GHz): 4.2 dB
- Frequency: 0.007 ppm

6.5. Test Equipment Setup and Procedure

6.5.1. Test Modes

Technology	Mode
WIFI	802.11b 1M, 802.11g 6M, 802.11n MCS20
BLE	M1 PRBS 9, M2 PRBS 9

6.5.2. Test Equipment Used

Equipment used			
ID / Serial #	**Manufacturer**	**Description**	**Cal / PM Due Date**
6595	Rohde and Schwarz	EMI Receiver (Firmware Version: 3.66 SP1)	11/19/2025
CF GCL	Megaphase/Pasternack	3m Chamber Port and Cables	4/30/2025
8893	Com-Power	AH-118 Horn	4/22/2027
7691	Com-Power	AH-118 Horn	7/5/2026
Tower 2	ETS-Lindgren	2171B Boresight Tower	VBU
PJ2246	ETS-Lindgren	Shielded Enclosure	3/31/2025
7187	Omega	iBTHX-W Virtual	9/24/2025
FLT009	Mini Circuits	XHFG-K4000	1/31/2025
6539	Stanley	Tape Measure	6/19/2026
H4554	87V	Multimeter	1/11/2025
S/N:2053240	Miteq	AMF-4D-00501800-24-10P	12/31/2025
SW30	Gentex	3m Chamber Software	3/31/2025
SW48	Gentex	Gentex Emissions Measurement Software	3/31/2025
CBL 119	Megaphase	KB18-N1S1-36	4/30/2025
CBL 103	Pasternack	PE341-60	4/30/2025
AT26	Pasternack	PE7004-6, 6dB fixed, DC - 18 GHz, 2W	1/31/2025

EMI Receiver Settings Emissions:

Detector Function: Peak
Resolution Bandwidth: 120 kHz (below 1GHz)
1MHz (above 1GHz)
Video Bandwidth: 3x Resolution Bandwidth

Bicon Sweep Measurement Settings

Start Frequency: 30 MHz
End Frequency: 88 MHz
Band: Band 1
Detector: QuasiPeak
Sweep Mode: FFT
Attenuator: 5 dB
Pre-Amp: Off
Max Hold Trace Mode: Off
Bandwidth Filter: EMI (6dB)
RBW: 120 kHz
Step Size: AUTO (30 kHz)
Dwell Time: 1000ms

LPA Sweep Measurement Settings
Start Frequency: 200 MHz
End Frequency: 1000 MHz
Detector: Peak
Sweep Mode: FFT
Attenuator: 5 dB
Pre-Amp: Off
Max Hold Trace Mode: Off
Bandwidth Filter: EMI (6dB)
RBW: 100 kHz
Step Size: AUTO (25 kHz)
Dwell Time: 10ms

Horn Sweep Measurement Settings
Start Frequency: 1000 MHz
End Frequency: 5000 MHz
Detector: Peak
Sweep Mode: FFT
Attenuator: AUTO
Pre-Amp: Off
Max Hold Trace Mode: Off
Bandwidth Filter: EMI (6dB)
RBW: 1000 kHz
Step Size: AUTO (250 kHz)
Dwell Time: 5ms

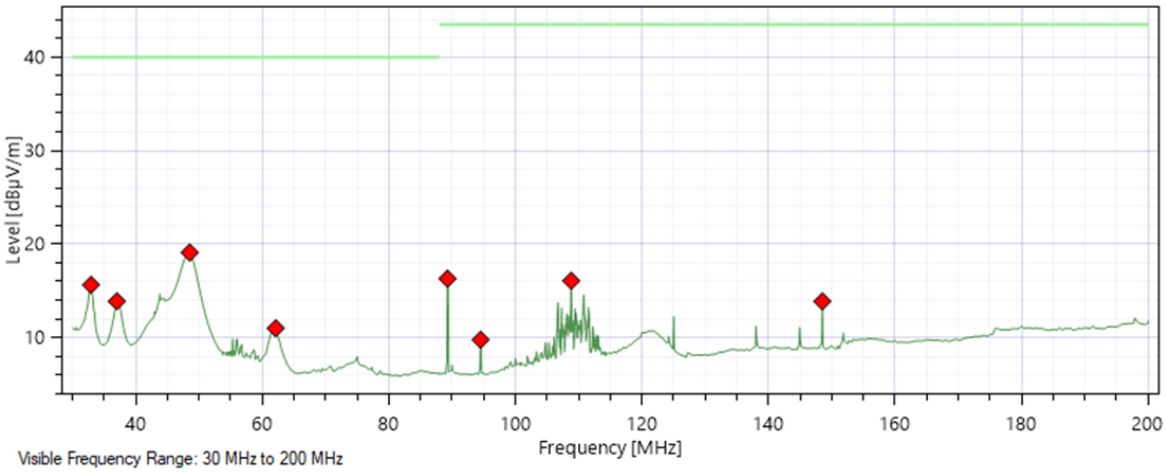
Start Frequency: 1000 MHz
End Frequency: 5000 MHz
Detector: CISPR Average
Sweep Mode: FFT
Attenuator: AUTO
Pre-Amp: Off
Max Hold Trace Mode: Off
Bandwidth Filter: EMI (6dB)
RBW: 1000 kHz
Step Size: AUTO (250 kHz)
Dwell Time: 5ms

Start Frequency: 4000 MHz
End Frequency: 18000 MHz
Detector: Peak
Sweep Mode: FFT
Attenuator: 0 dB
Pre-Amp: On
Max Hold Trace Mode: Off
Bandwidth Filter: EMI (6dB)
RBW: 1000 kHz
Step Size: AUTO (250 kHz)
Dwell Time: 5ms

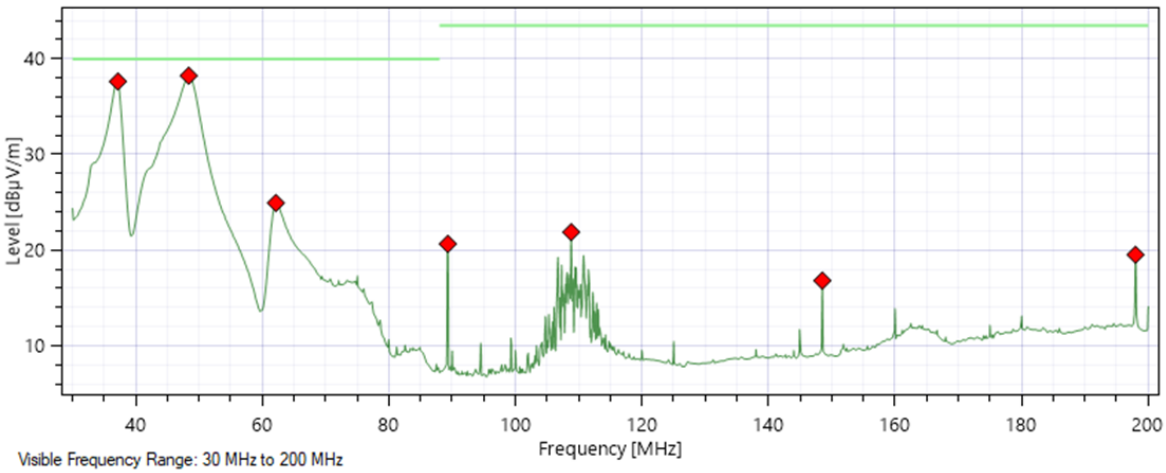
Start Frequency: 4000 MHz
End Frequency: 18000 MHz
Detector: CISPR Average
Sweep Mode: FFT
Attenuator: 0 dB
Pre-Amp: On
Max Hold Trace Mode: Off
Bandwidth Filter: EMI (6dB)
RBW: 1000 kHz
Step Size: AUTO (250 kHz)
Dwell Time: 5ms

7. Intermodulation Spurious Emissions

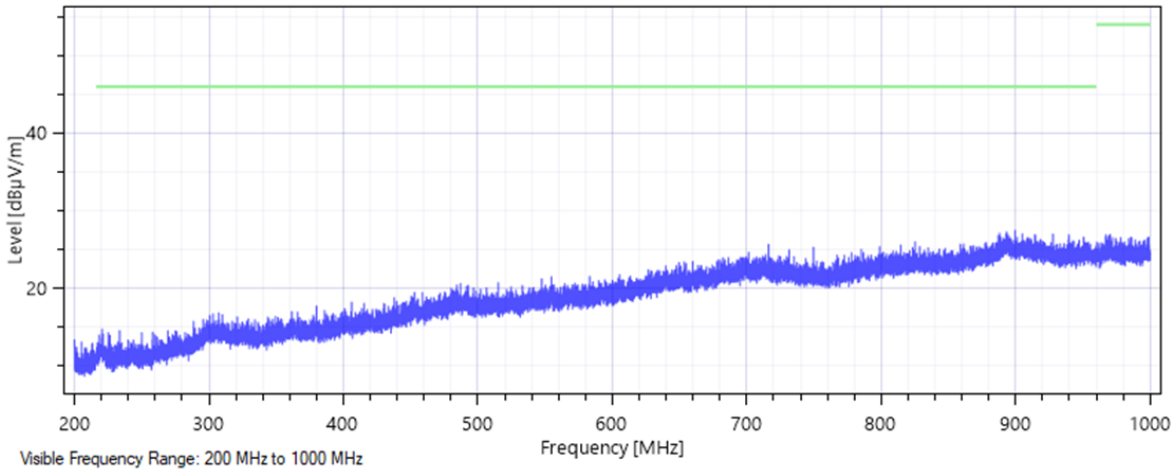
WIFI 30-200 MHz Horizontal



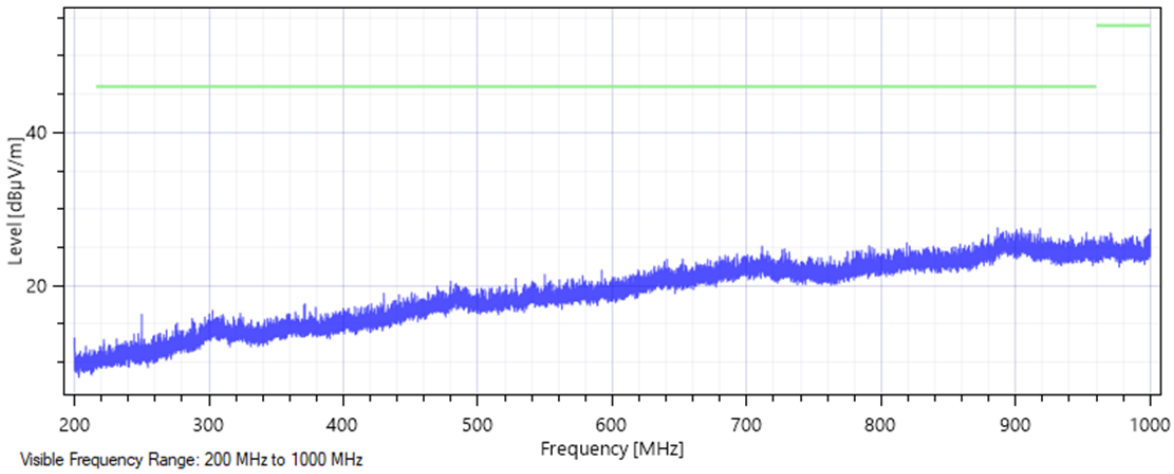
WIFI 30-200 MHz Vertical



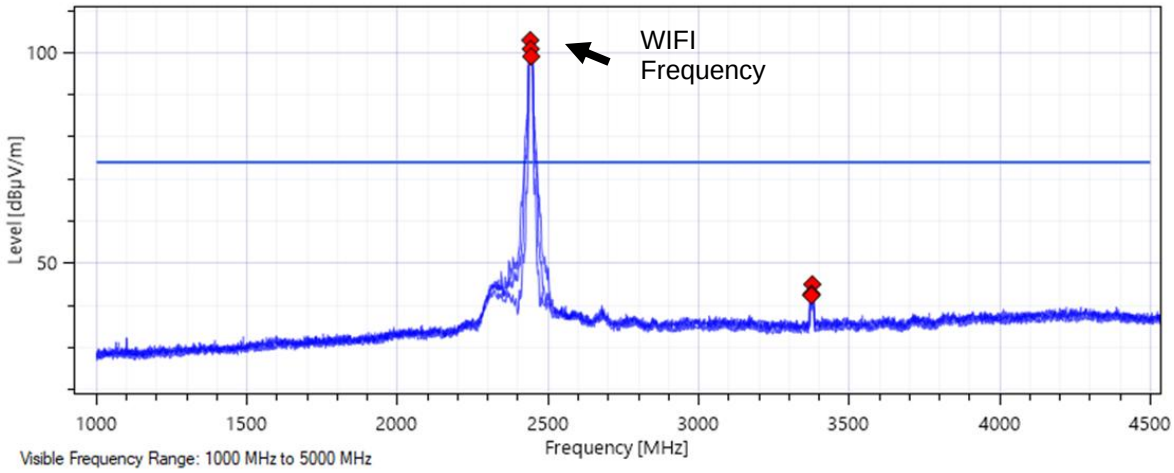
WIFI 200-1000 MHz Horizontal



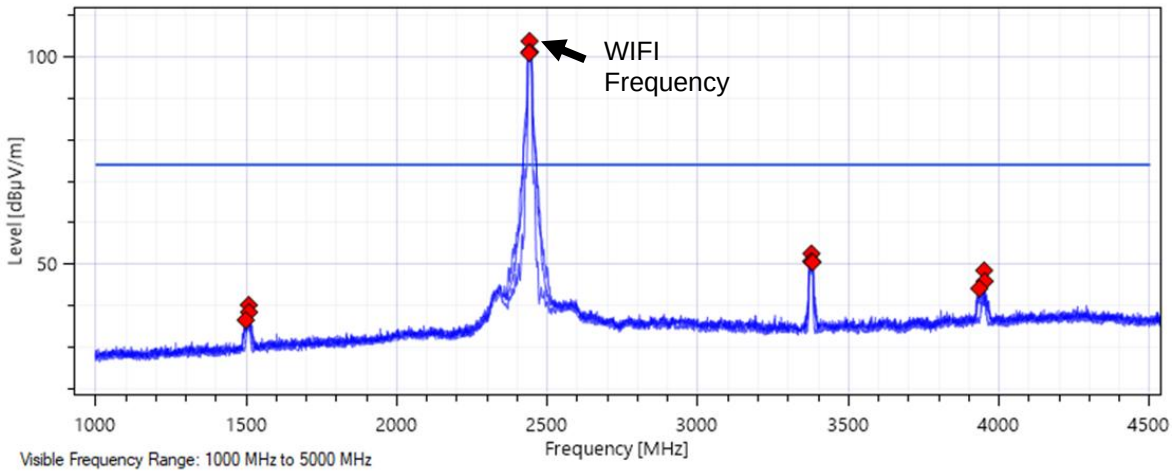
WIFI 200-1000 MHz Vertical



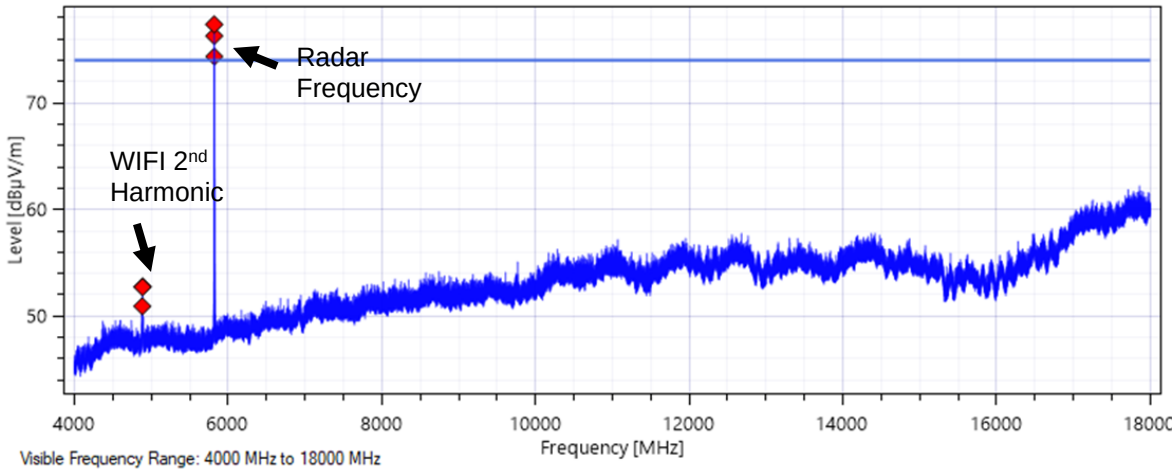
WIFI 1000-4500 MHz Peak Horizontal



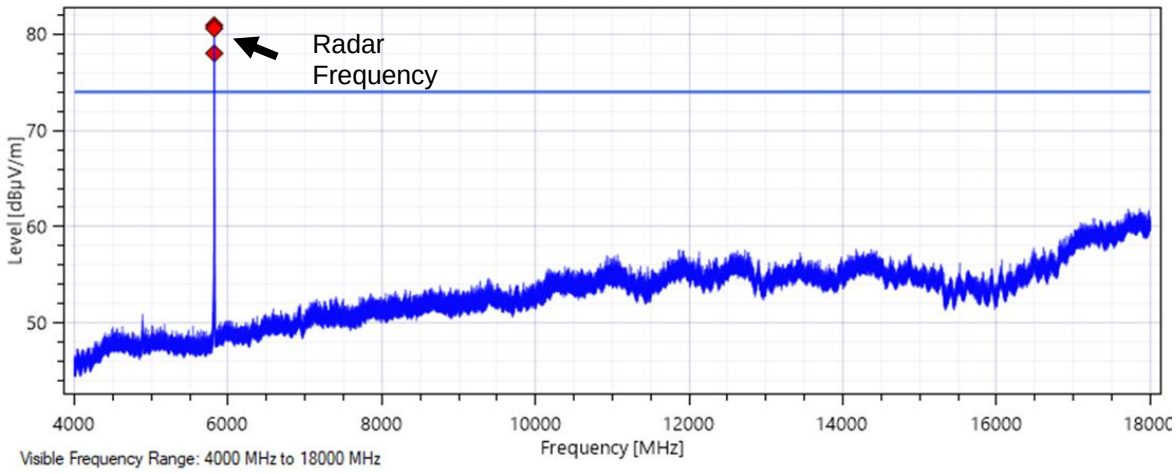
WIFI 1000-4500 MHz Peak Vertical



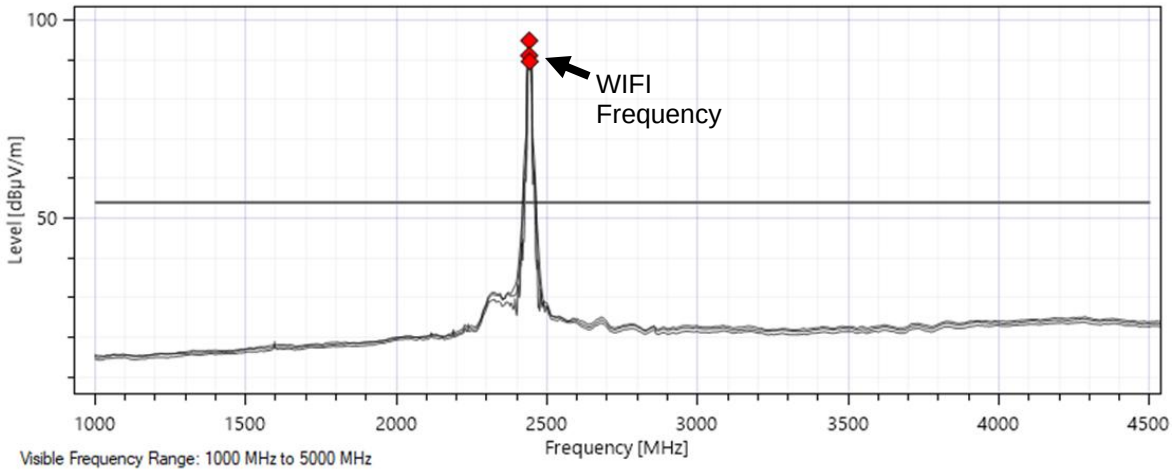
WIFI 4000-18000 MHz Peak Horizontal



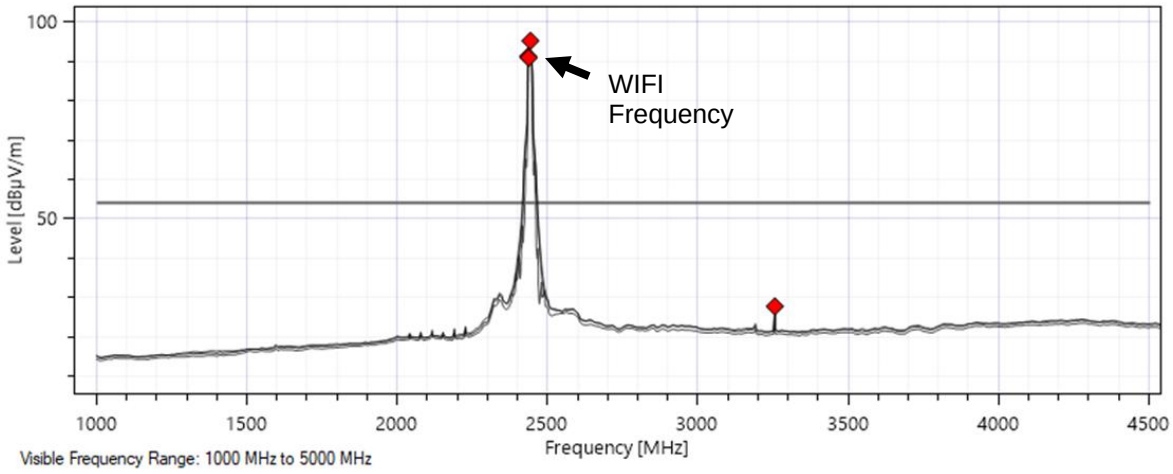
WIFI 4000-18000 MHz Peak Vertical



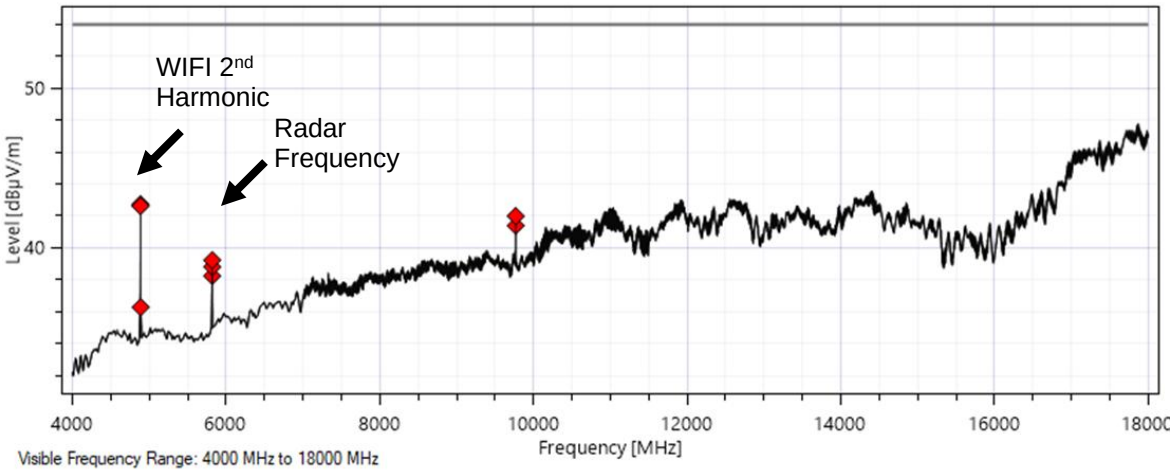
WIFI 1000-4500 MHz Average Horizontal



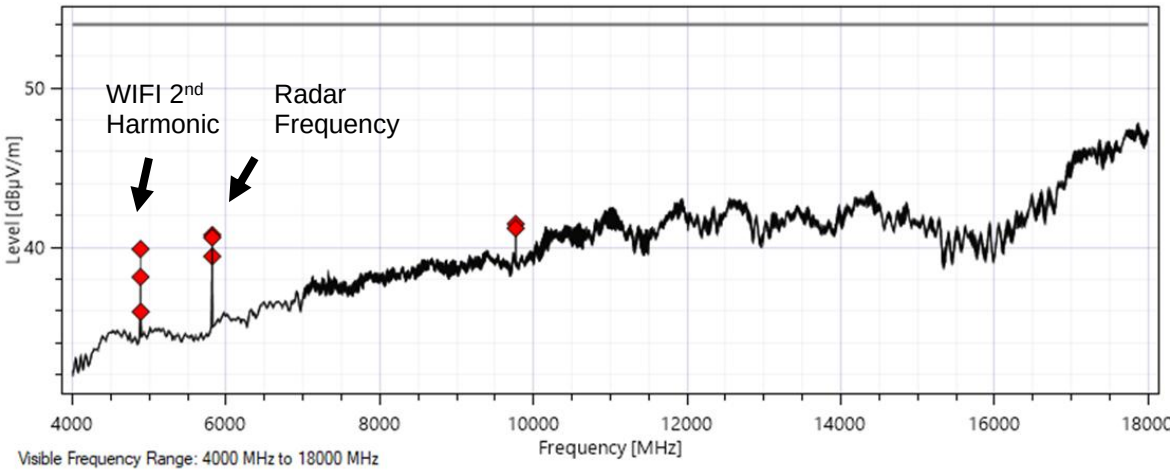
WIFI 1000-4500 MHz Average Vertical



WIFI 4000-18000 MHz Average Horizontal



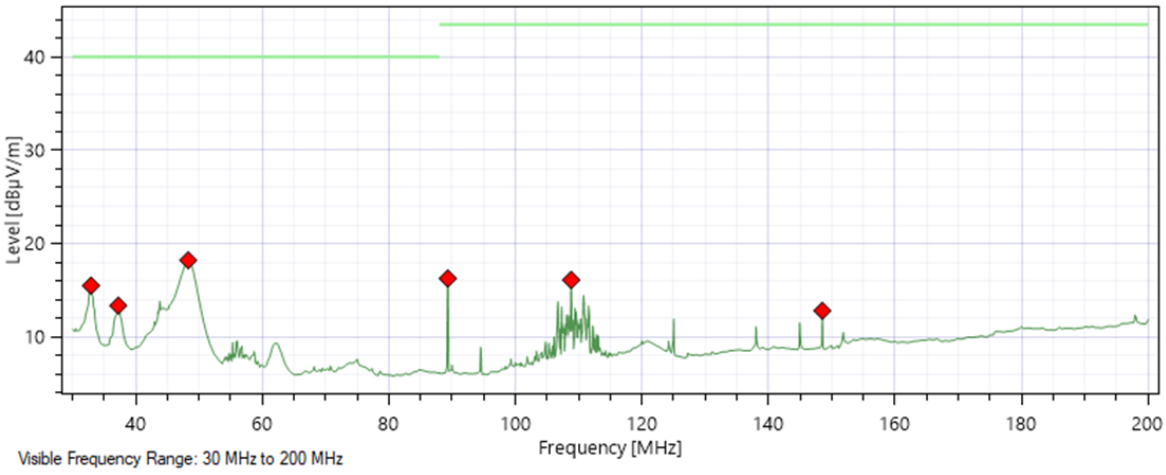
WIFI 4000-18000 MHz Average Vertical



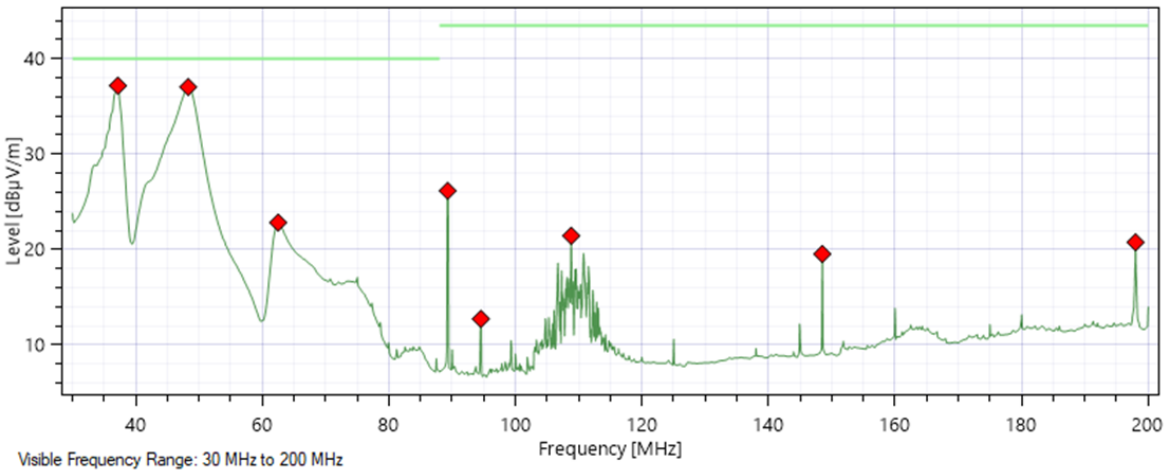
WIFI Emissions

Test Mode	Detector	Worst-Case Orientation	Antenna Polarization	Frequencies (MHz)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)
WIFI	Quasi-Peak	Side	V	37.2	37.64	40	-2.36
WIFI	Quasi-Peak	Side	V	48.26	38.2	40	-1.8
WIFI	Quasi-Peak	Side	V	62	24.9	40	-15.1
WIFI	Quasi-Peak	Side	V	89.3	20.65	43.5	-22.85
WIFI	Quasi-Peak	Side	V	108.9	21.9	43.5	-21.6
WIFI	Quasi-Peak	Side	V	149	16.8	43.5	-26.7
WIFI	Quasi-Peak	Side	V	198	19.52	43.5	-23.98
WIFI	Peak	Side	V	1508	40.22	74	-33.78
WIFI	Peak	Side	V	3377	52.6	74	-21.4
WIFI	Peak	Side	V	3950	48.6	74	-25.4
WIFI	Peak	Side	H	4884	52.8	74	-21.2
WIFI	Average	Side	V	3256	27.7	54	-26.3
WIFI	Average	Side	H	4884	42.734	54	-11.266
WIFI	Average	Side	H	9768	47.995	54	-6.005

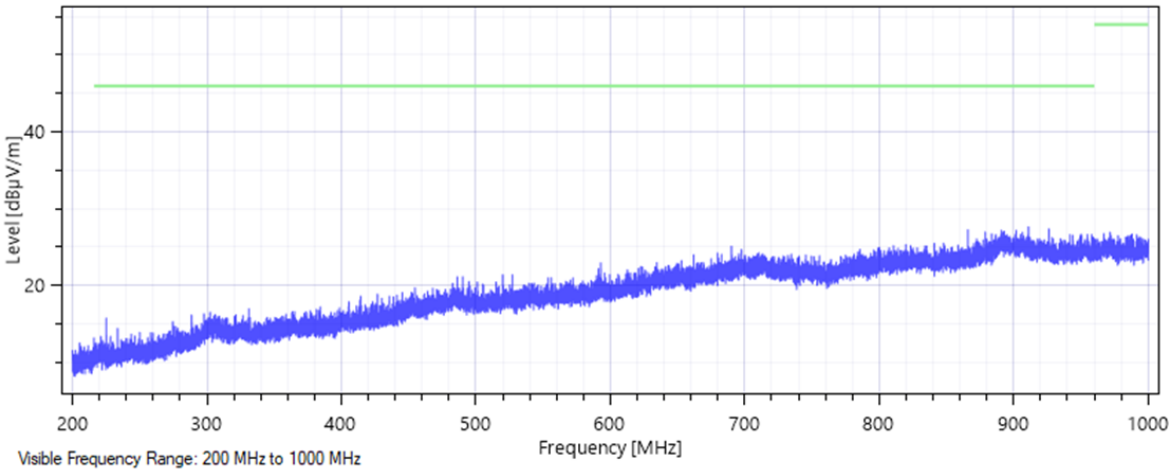
BLE 30-200 MHz Horizontal



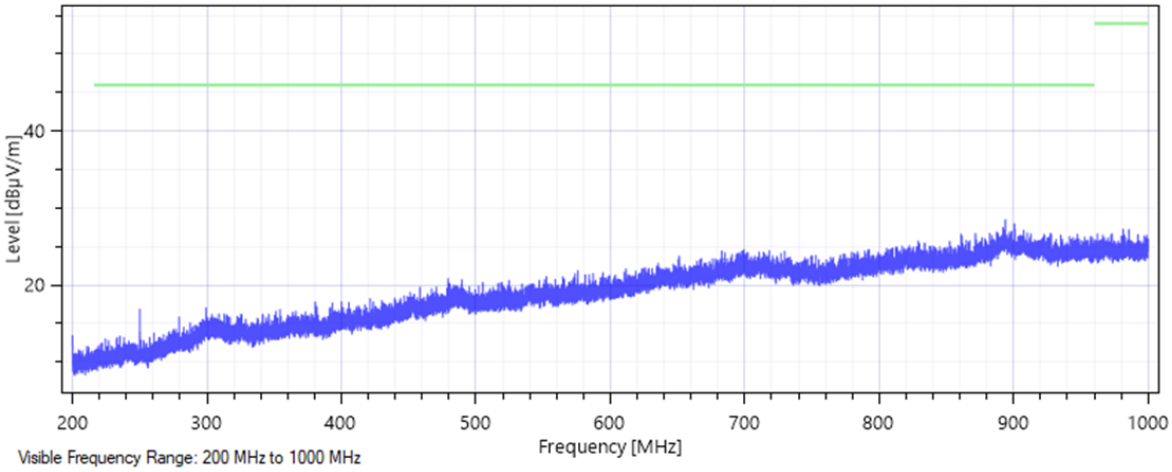
BLE 30-200 MHz Vertical



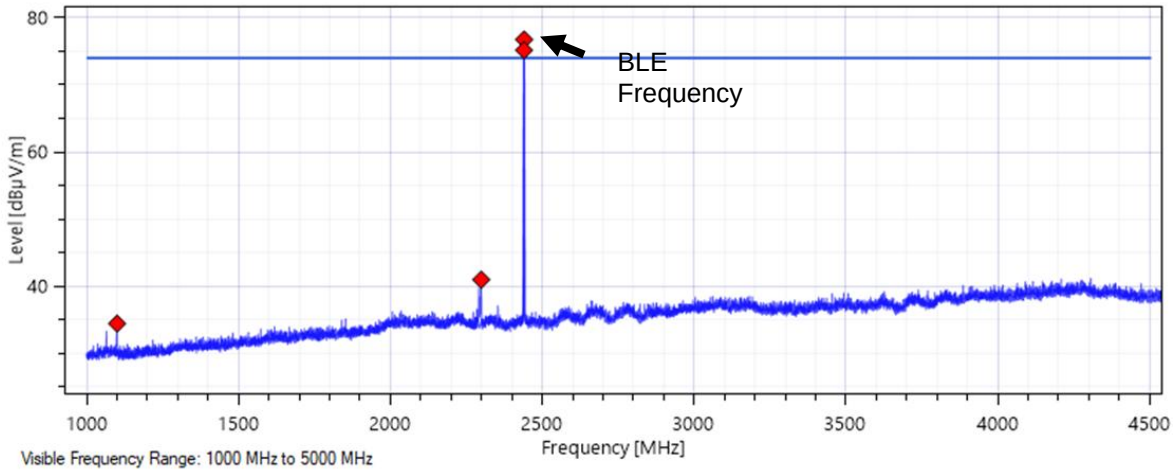
BLE 200-1000 MHz Horizontal



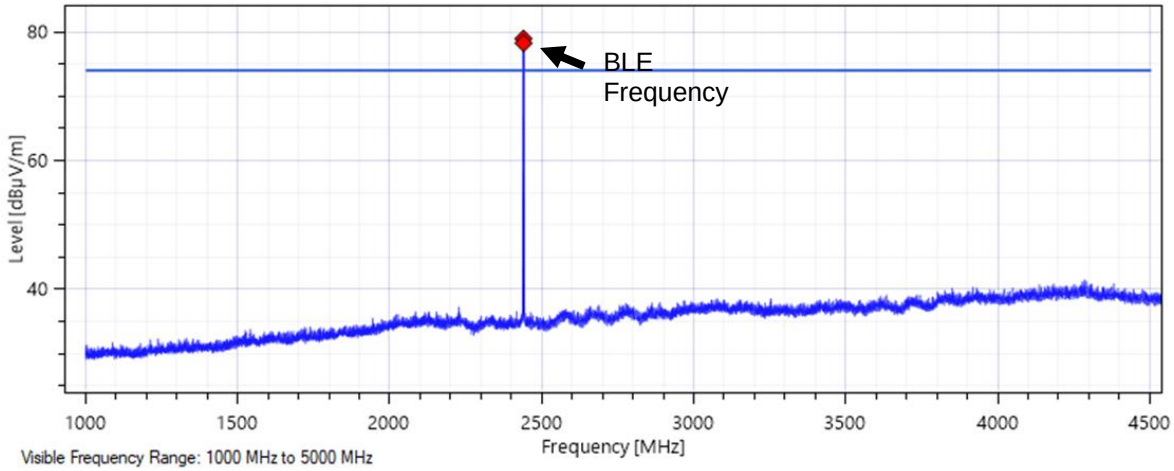
BLE 200-1000 MHz Vertical



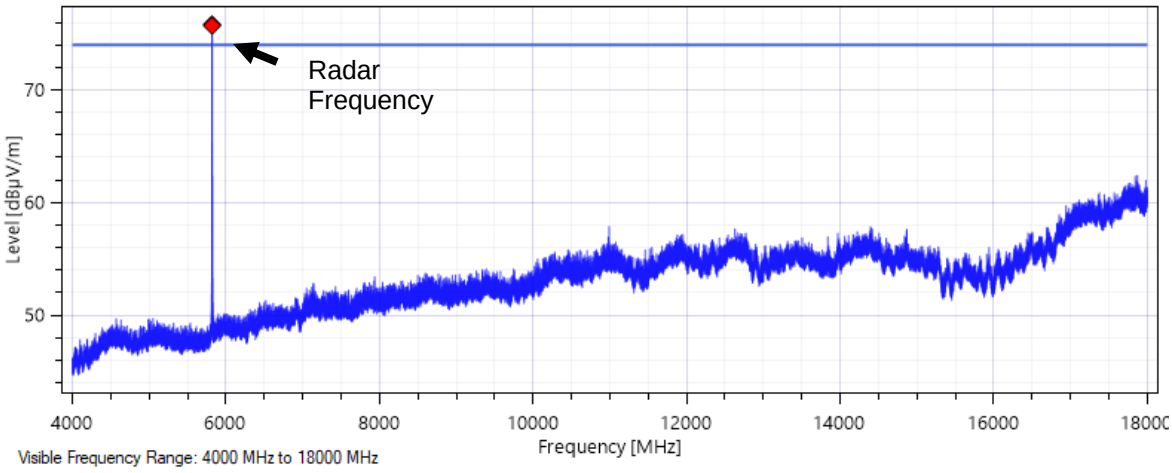
BLE 1000-4500 MHz Peak Horizontal



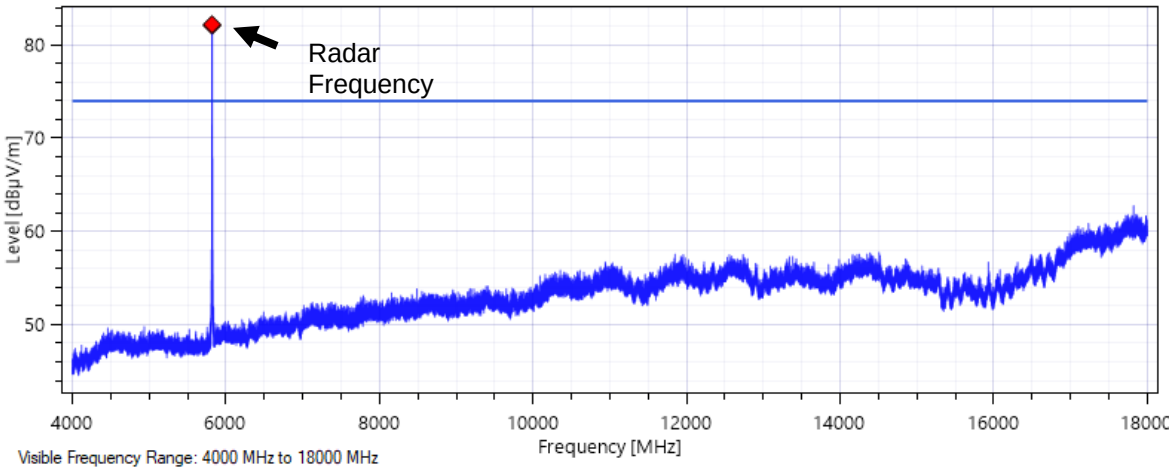
BLE 1000-4500 MHz Peak Vertical



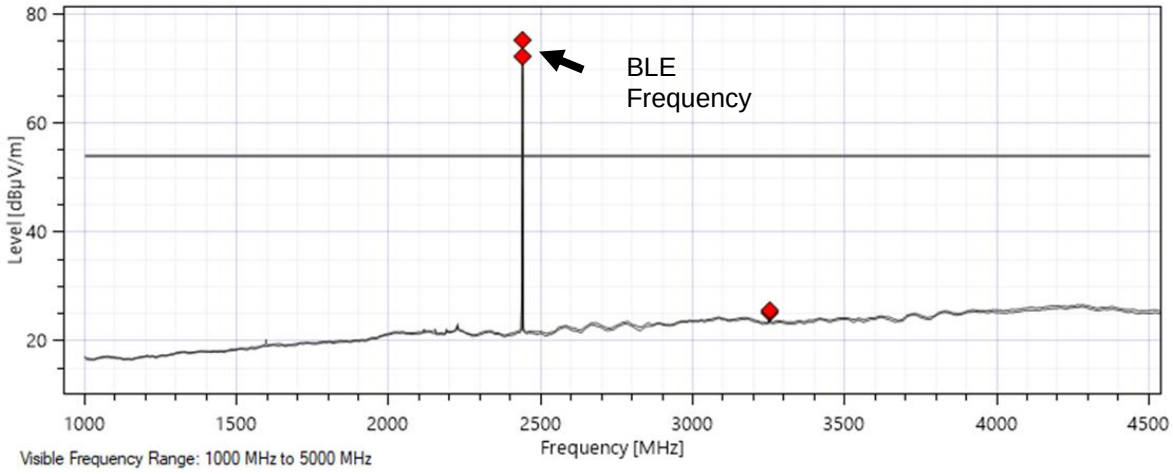
BLE 4000-18000 MHz Peak Horizontal



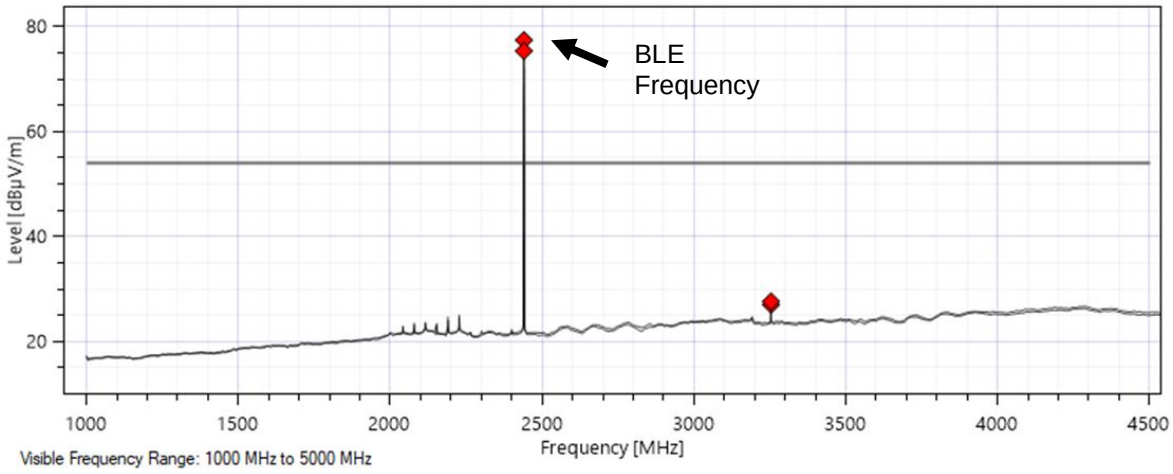
BLE 4000-18000 MHz Peak Vertical



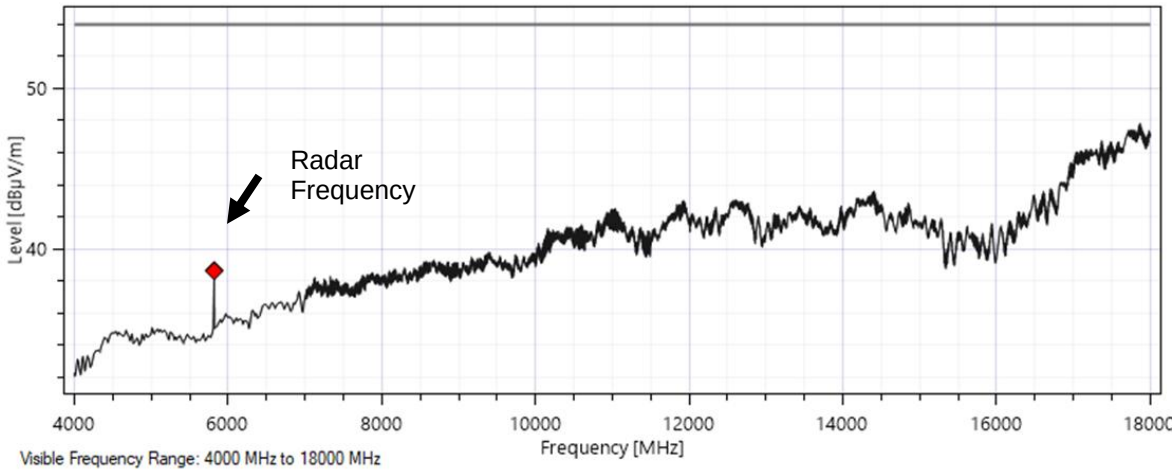
BLE 1000-4500 MHz Average Horizontal



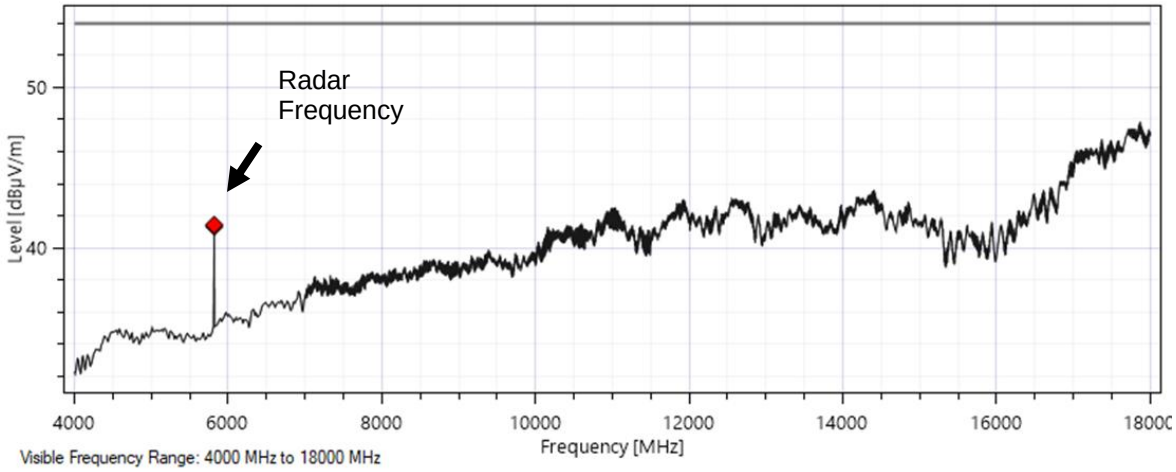
BLE 1000-4500 MHZ Average Vertical



BLE 4000-18000 MHz Average Horizontal



BLE 4000-18000 MHz Average Vertical



BLE Emissions

Test Mode	Detector	Worst-Case Orientation	Antenna Polarization	Frequencies (MHz)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)
BLE	Quasi-Peak	Side	V	37.17	37.2	40	-2.8
BLE	Quasi-Peak	Side	V	48.26	37.05	40	-2.95
BLE	Quasi-Peak	Side	V	62	22.8	40	-17.2
BLE	Quasi-Peak	Side	V	89.3	26.16	43.5	-17.34
BLE	Quasi-Peak	Side	V	94.5	12.73	43.5	-30.77
BLE	Quasi-Peak	Side	V	108.9	21.44	43.5	-22.06
BLE	Quasi-Peak	Side	V	148	19.54	43.5	-23.96
BLE	Quasi-Peak	Side	V	198	20.8	43.5	-22.7
BLE	Peak	Side	H	1100	34.467	74	-39.533
BLE	Peak	Side	H	2299	41.01	74	-32.99
BLE	Average	Side	V	3253.25	27.66	54	-26.34