Sargent Manufacturing Company

TEST REPORT

SCOPE OF WORK
Emissions Testing – Aperio RF Module, Model IN100

REPORT NUMBER
105746284BOX-001.zigbee

ISSUE DATE
May 29, 2024

[REVISED DATE]
Original issue

DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. October 2022

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 105746284BOX-001.zigbee
Project Number: G105746284

Report Issue Date: May 29, 2024

Model(s) Tested: IN100
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC Part 15 Subpart C, Section 15.247: 04/2024
CFR47 FCC Part 15 Subpart C, Section 15.209: 04/2024
CFR47 FCC Part 15 Subpart B, Section 15.109: 04/2024
RSS-247 Issue 3 August 2023
ISED ICES-003 Issue 7 October 2020
KDB 558074 D01 15.247 Meas Guidance v05r02: 04/2019
RSS-Gen Issue 5 April 2018 +Amendment 1 March 2019

The product contains the following radio modules:
The Limited Module FCC ID containing all 4 radios:
FCC ID: U4A-SCYMCA1K
IC: 6982A-SCYMCA1K
Contains BLE Limited Module
FCC ID: Y88-MBM1CC2640
IC: 9504A-MBM1CC2640

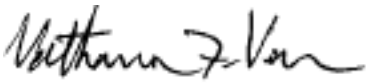
Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Sargent Manufacturing Company
100 Sargent Drive
New Haven, CT 6511
USA

Report prepared by

Kouma Sinn / Senior Staff Engineer

Report reviewed by



Vathana Ven / Senior Staff Engineer

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Maximum Peak Output CFR47 FCC Part 15 Subpart C, Section 15.247 (b)(3): 04/2024 RSS-247 Issue 3 August 2023	Pass
7	6 dB Bandwidth (DTS Bandwidth) and Occupied Bandwidth CFR47 FCC Part 15 Subpart C, Section 15.247 (a)(2): 04/2024 RSS-247 Issue 3 August 2023	Pass
8	Maximum Power Spectral Density CFR47 FCC Part 15 Subpart C, Section 15.247 (e): 04/2024 RSS-247 Issue 3 August 2023	Pass
9	Band Edge Compliance CFR47 FCC Part 15 Subpart C, Section 15.247 (d): 04/2024 RSS-247 Issue 3 August 2023	Pass
10	Transmitter spurious emissions CFR47 FCC Part 15 Subpart C, Section 15.247 (d): 04/2024 CFR47 FCC Part 15 Subpart C, Section 15.209: 04/2024 RSS-247 Issue 3 August 2023	Pass
11	Digital Device Radiated Spurious Emissions CFR47 FCC Part 15 Subpart B 15.109: 04/2024 ISED ICES-003 Issue 7 October 2020	Pass
---	AC Mains Conducted Emissions FCC 47CFR Part 15.107: 04/2024 ISED ICES-003 Issue 7 October 2020	N/A
12	Revision History	--

Notes: The EUT is battery powered. The radio does not transmit simultaneously in normal operation.

3 Client Information

This EUT was tested at the request of:

Client: Sargent Manufacturing Company
100 Sargent Drive
New Haven, CT 6511
USA

Contact: Paul Wehbe
Telephone: 203-498-5536
Email: paul.wehbe@assaabloy.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Sargent Manufacturing Company
100 Sargent Drive
New Haven, CT 6511
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Electronic access control system with Aperio RF Module (Plastic Enclosure)	Sargent Manufacturing Company	IN100	PCI24082CRAPES0003
Electronic access control system with Aperio RF Module (Metal Enclosure)	Sargent Manufacturing Company	IN100	PCI24081CRAPES0004

Receive Date:	04/02/2024
Received Condition:	Good
Type:	Production
Test Date(s):	04/03/2024-04/05/2024, 04/08/2024-04/10/2024

Description of Equipment Under Test (provided by client)
Electronic access control system. It contains the radio modules as below. The Limited Module FCC ID containing all 4 radios is: FCC ID: U4A-SCYMCA1K IC: 6982A-SCYMCA1K Contains BLE Limited Module FCC ID: Y88-MBM1CC2640 IC: 9504A-MBM1CC2640

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
9 V (6 x 1.5 V Batteries)	1.5 A	DC	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed to transmit continuously using HyperTerminal

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed to transmit continuously using HyperTerminal

ZigBee

Radio/Receiver Characteristics	
Frequency Band(s)	See FCC ID # U4A-SCYMCA1K
Modulation Type(s)	See FCC ID # U4A-SCYMCA1K
Maximum Output Power (Plastic Enclosure)	- 4.48 dBm (Conducted Power)
Maximum Output Power (Metal Enclosure)	- 6.37 dBm (Conducted Power)
Test Channels	Low, Mid, and High Channels
Occupied Bandwidth (Plastic Enclosure)	2.936 MHz
Occupied Bandwidth (Metal Enclosure)	3.417 MHz
DTS Bandwidth (Plastic Enclosure)	1.650 MHz
DTS Bandwidth (Metal Enclosure)	1.670 MHz
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	N/A
Equipment Type	Limited Module
Antenna Type and Gain	Integral, 1.8 dBi gain

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

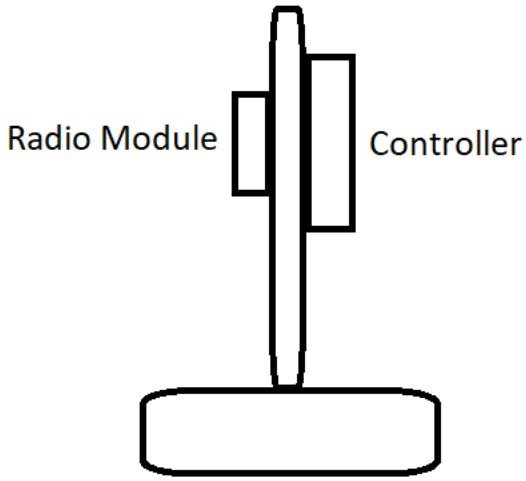
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	None	N/A	N/A	N/A	N/A

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	N/A	N/A	N/A

5.1 Method:

Configuration as required by ANSI C63.10-2013, RSS-Gen Issue 5 April 2018, and KDB 558074 D01 15.247 Meas Guidance v05r02: 04/2019.

5.2 EUT Block Diagram:



6 Maximum Peak Output Power

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, ANSI C63.10, and KDB 558074 D0115.247 Meas Guidancev05r02.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

6.2 Limits:

Limits – FCC Part §15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt or 30 dBm.

Notes: The limit for RSS-247 is the same as the FCC limits above.

6.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
HS001'	DC-18GHz cable 1.5m long	Huber & Suhner	SucoFlex 106A	HS001	01/30/2024	01/30/2025
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	07/19/2023	07/19/2024
145-408'	10m Chamber - 3m Track B In-floor Cable	Huber + Suhner	sucoflex 106-11000mm	001	07/19/2023	07/19/2024
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	10/16/2023	10/16/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024
145-019'	Active Loop Antenna (9 KHz to 30 MHz)	EMCO	6502/1	9902-3267	03/05/2024	03/05/2025

Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

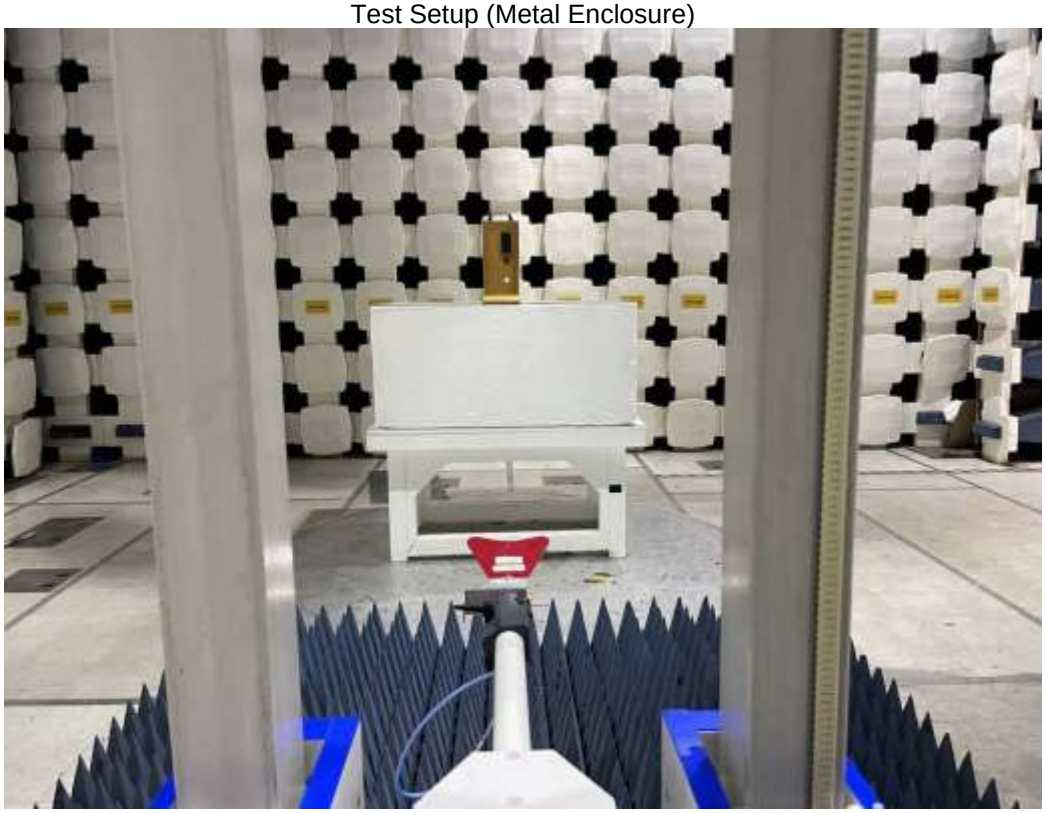
6.4 Results:

The sample tested was found to Comply.

6.5 Setup Photographs:

Test Setup (Plastic Enclosure)

Test Setup (Metal Enclosure)



6.6 Test Data:

Zigbee (Plastic Enclosure) EIRP

Frequency (MHz)	Field Strength (dBuV/m)	EIRP (dBm)	Conducted Power (dBm)	Conducted Power Limit (dBm)	Results
2405	92.14	-3.06	-4.86	30	Compliance
2440	92.52	-2.68	-4.48	30	Compliance
2480	91.17	-4.03	-5.83	30	Compliance

Zigbee (Metal Enclosure) EIRP

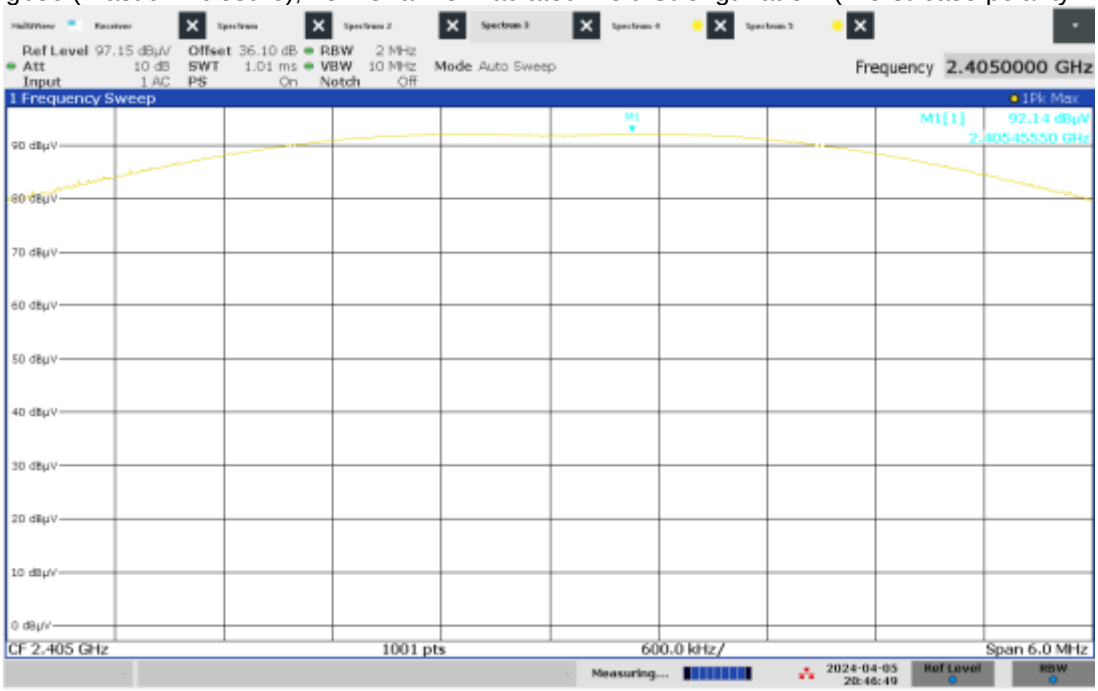
Frequency (MHz)	Field Strength (dBuV/m)	EIRP (dBm)	Conducted Power (dBm)	Conducted Power Limit (dBm)	Results
2405	90.63	-4.57	-6.37	30	Compliance
2440	89.12	-6.08	-7.88	30	Compliance
2480	89.30	-5.90	-7.70	30	Compliance

Notes: The EIRP was calculated from field strength with the formula below:

$$\mathrm{EIRP} = E_{\mathrm{Meas}} + 20\log\left(d_{\mathrm{Meas}}\right) - 104.7$$

Conducted Power = EIRP – Antenna Gain, 1.8 dBi

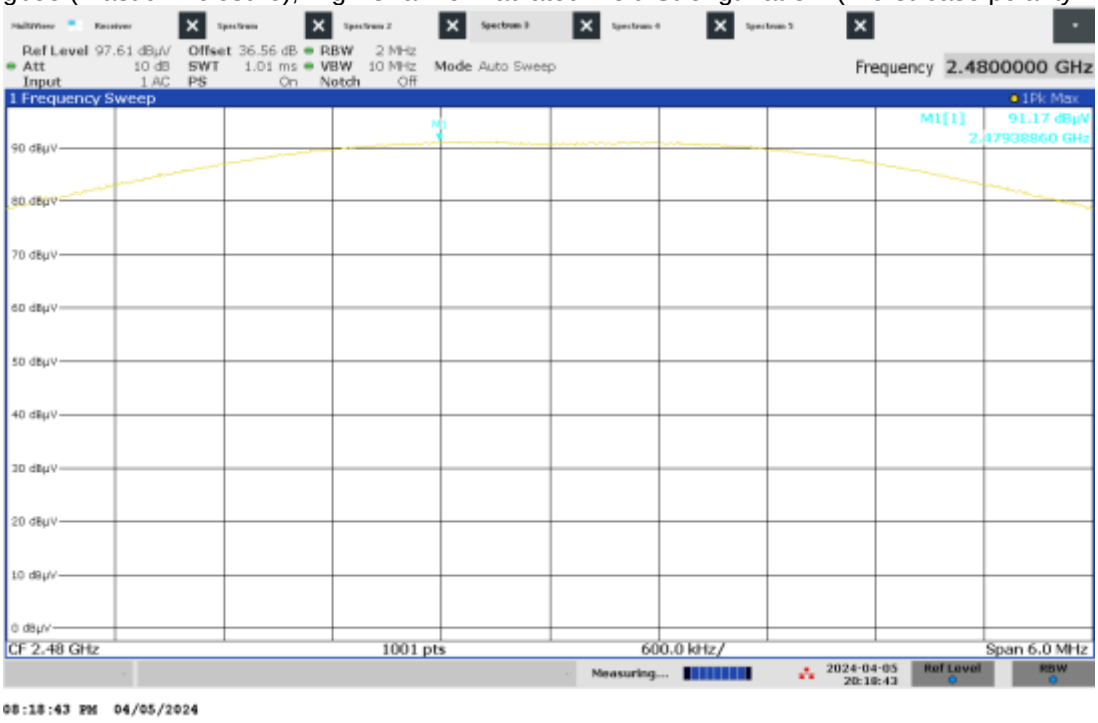
Zigbee (Plastic Enclosure), Low Channel Radiated Field Strength at 3m (Worst-case polarity: H)



Zigbee (Plastic Enclosure), Mid Channel Radiated Field Strength at 3m (Worst-case polarity: H)

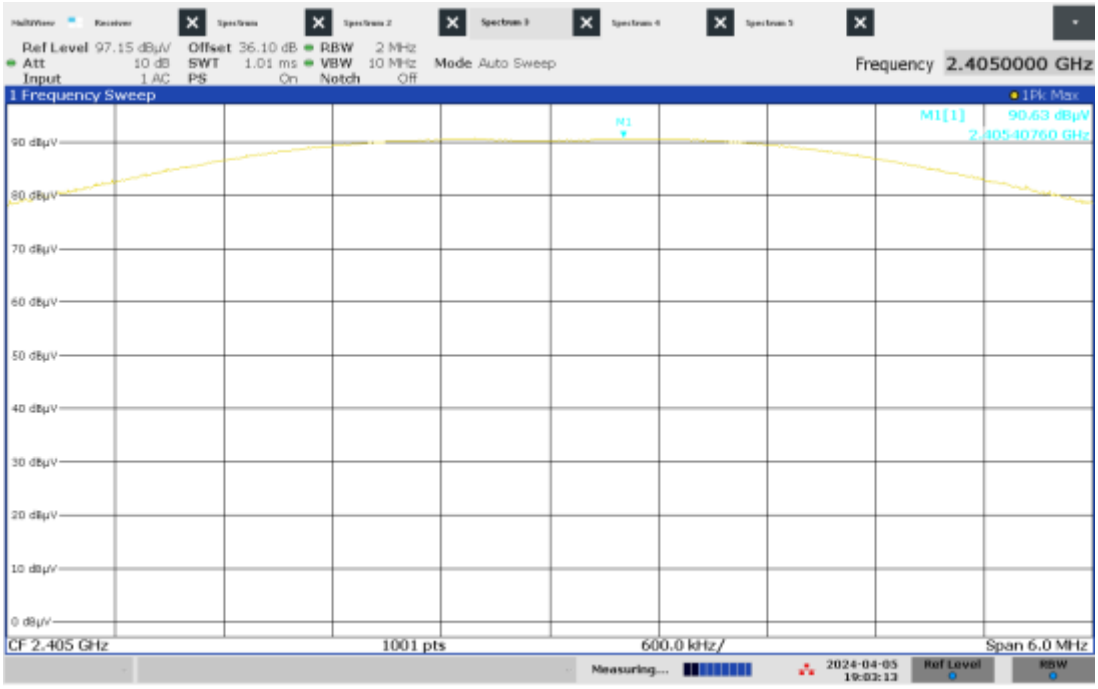
Notes: Cable loss and antenna factor were compensated internally as Reference Offset.

Zigbee (Plastic Enclosure), High Channel Radiated Field Strength at 3m (Worst-case polarity: H)

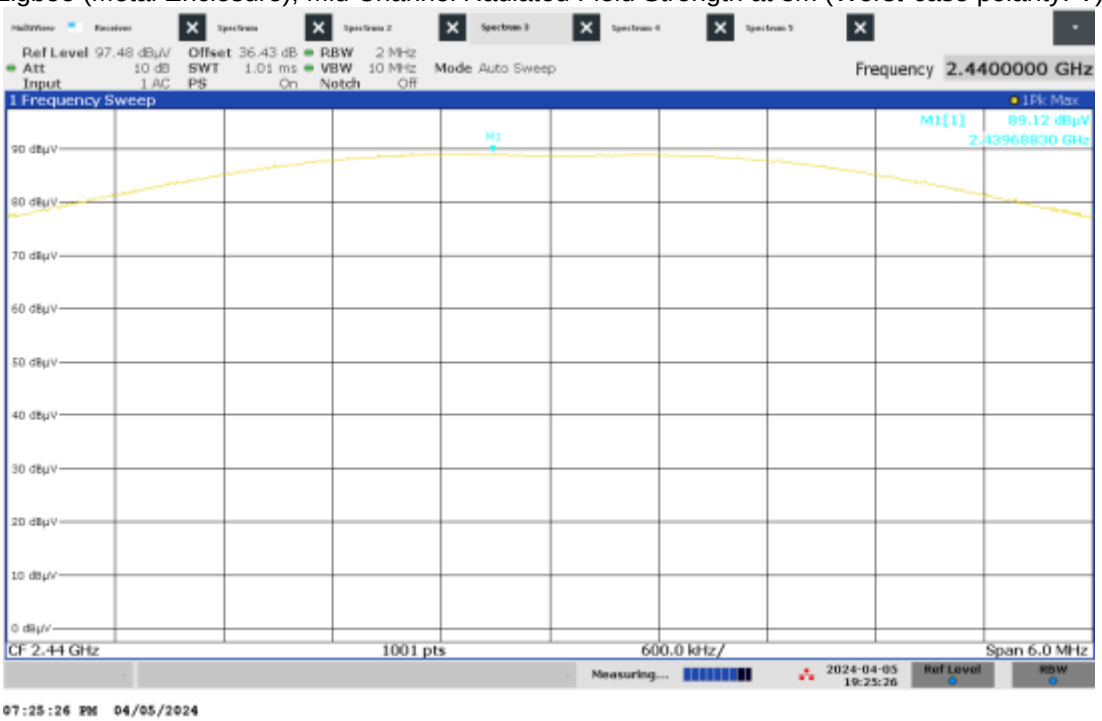


Notes: Cable loss and antenna factor were compensated internally as Reference Offset.

Zigbee (Metal Enclosure), Low Channel Radiated Field Strength at 3m (Worst-case polarity: V)

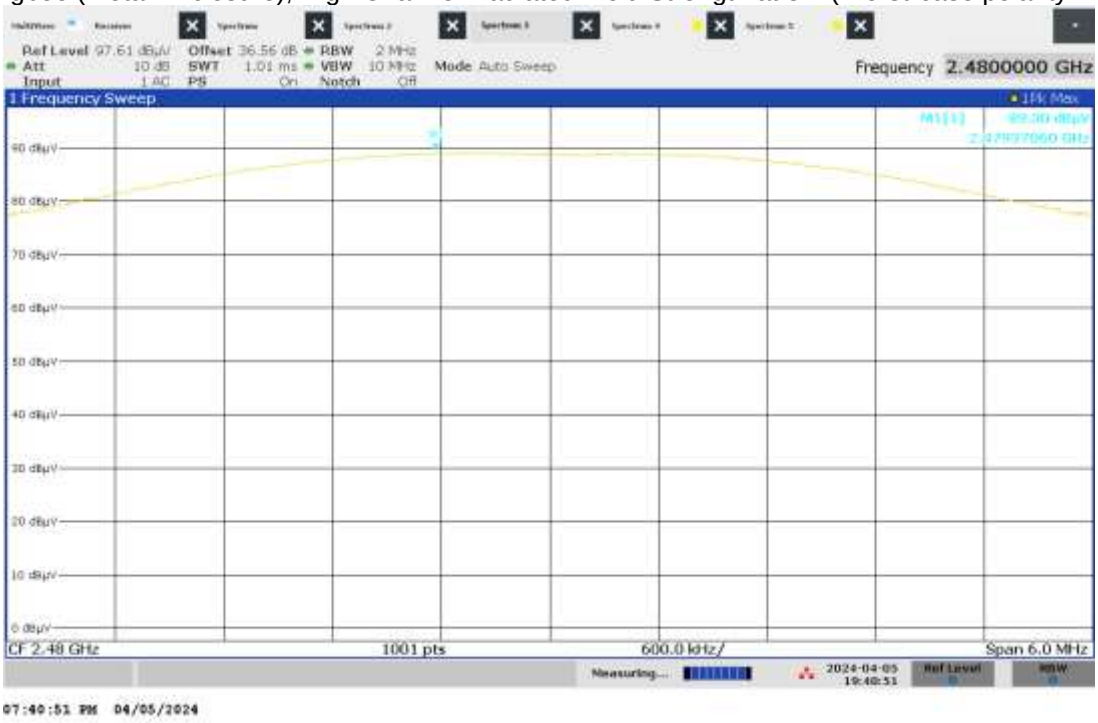


Zigbee (Metal Enclosure), Mid Channel Radiated Field Strength at 3m (Worst-case polarity: V)



Notes: Cable loss and antenna factor were compensated internally as Reference Offset.

Zigbee (Metal Enclosure), High Channel Radiated Field Strength at 3m (Worst-case polarity: V)



Notes: Cable loss and antenna factor were compensated internally as Reference Offset.

Product Standard: CFR47 FCC Part 15.247, RSS-247				Limit applied: See Report Section 6.2			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
04/05/2024	Kouma Sin	Vathana F. Ven	Internal battery	Continuous transmitting	22	27	988

Deviations, Additions, or Exclusions: None

7 6 dB Bandwidth (DTS Bandwidth) and Occupied Bandwidth

7.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Limit

DTS Bandwidth Limit:
FCC Part §15.247 (a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Occupied Bandwidth:
Upper and Lower Edges of OBW within 2400-2483.5 MHz

Notes: The limits for RSS-247 are the same as the FCC limits above.

7.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
HS001'	DC-18GHz cable 1.5m long	Huber & Suhner	SucoFlex 106A	HS001	01/30/2024	01/30/2025
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	07/19/2023	07/19/2024
145-408'	10m Chamber - 3m Track B In-floor Cable	Huber + Suhner	sucoflex 106-11000mm	001	07/19/2023	07/19/2024
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	10/16/2023	10/16/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024

Software Utilized:

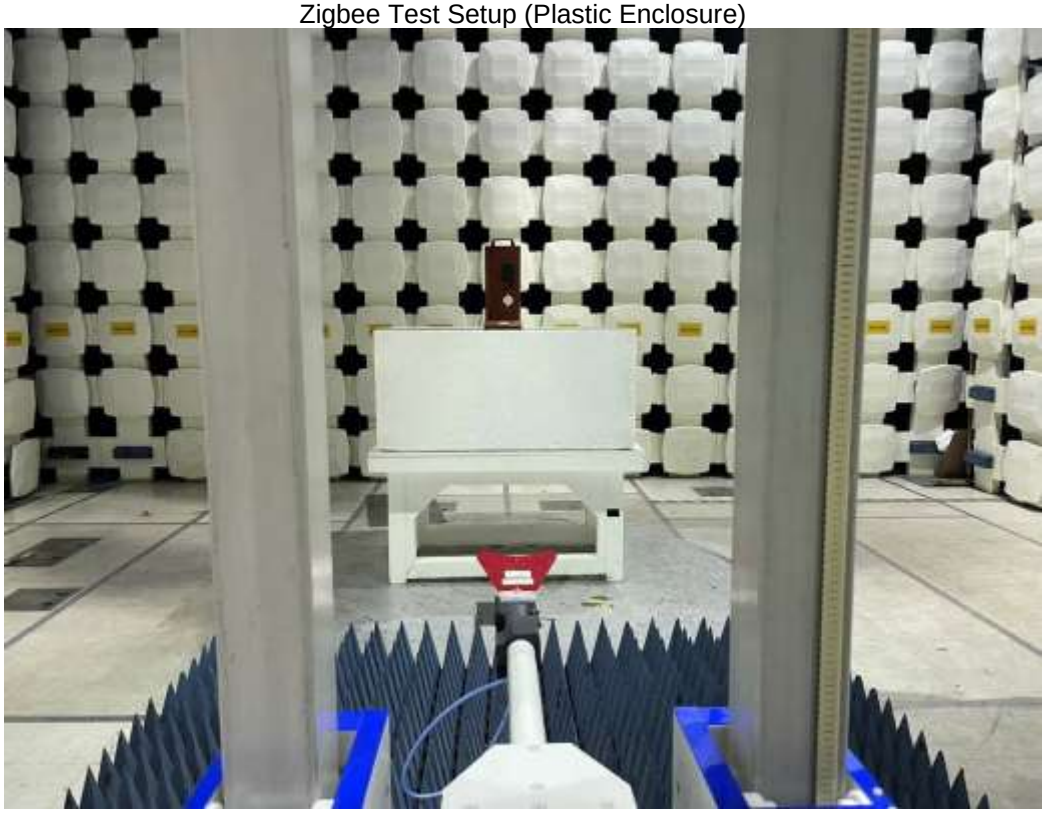
Name	Manufacturer	Version
None	N/A	N/A

7.4 Results:

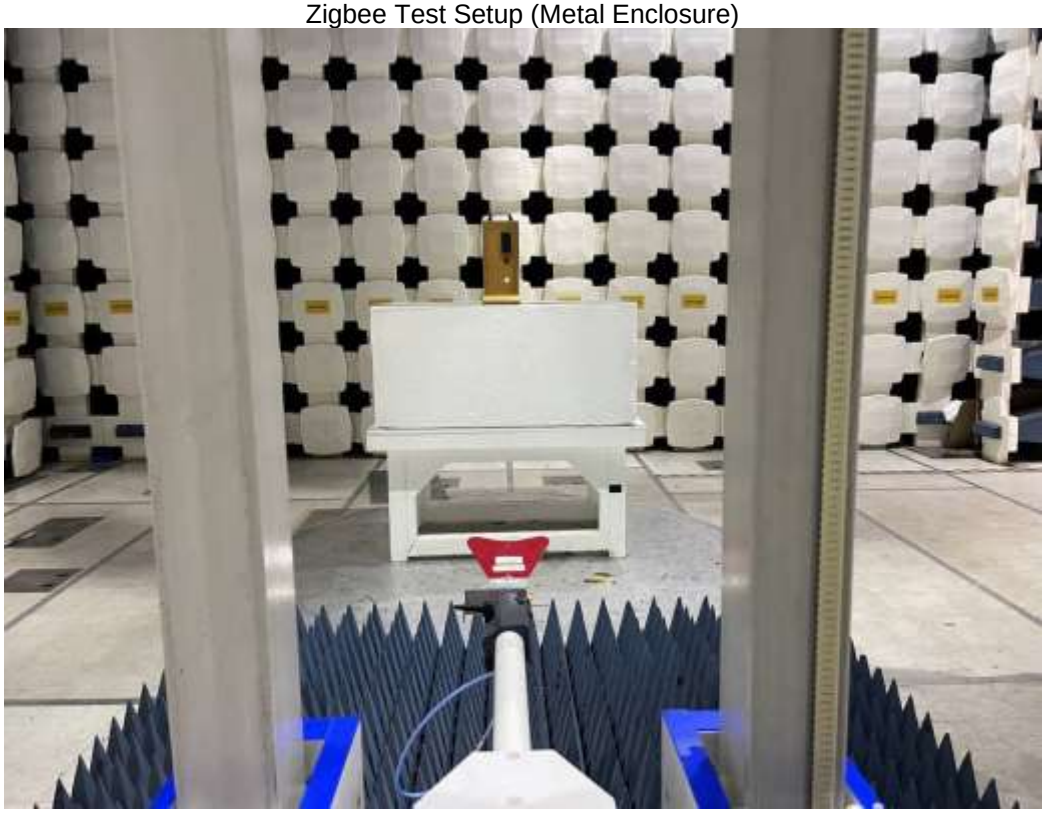
The sample tested was found to Comply.

7.5 Setup Photographs:

Zigbee Test Setup (Plastic Enclosure)



Zigbee Test Setup (Metal Enclosure)



7.6 Test Data:

Zigbee (Plastic Enclosure) DTS Bandwidth

Frequency (MHz)	DTS Bandwidth (6 dB Bandwidth) (kHz)	DTS Bandwidth Limit (kHz)	Results
2405	1.63	≥ 500	Compliance
2440	1.65	≥ 500	Compliance
2480	1.65	≥ 500	Compliance

Zigbee (Metal Enclosure) DTS Bandwidth

Frequency (MHz)	DTS Bandwidth (6 dB Bandwidth) (kHz)	DTS Bandwidth Limit (kHz)	Results
2405	1.67	≥ 500	Compliance
2440	1.64	≥ 500	Compliance
2480	1.67	≥ 500	Compliance

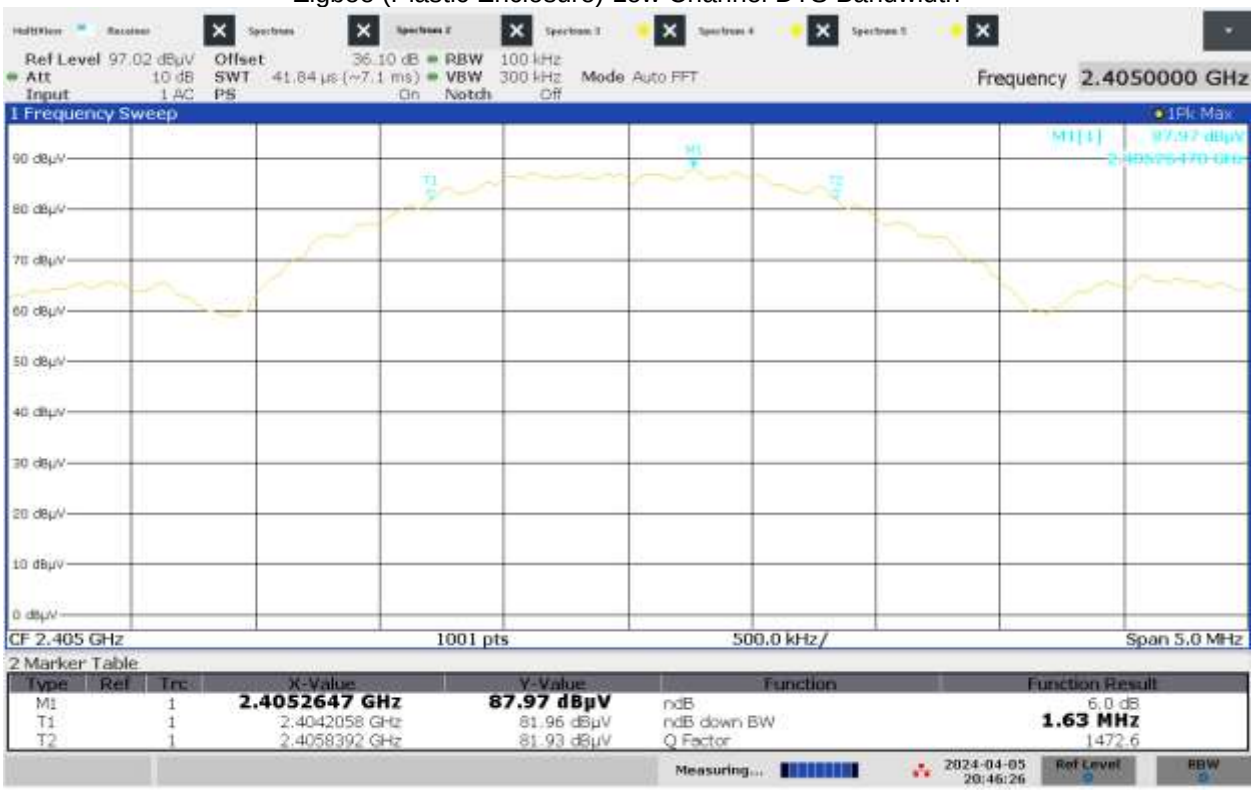
Zigbee (Plastic Enclosure) Occupied Bandwidth

Frequency (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth Limit	Results
2405	2.718	Upper and Lower Edges of OBW within 2400-2483.5 MHz	Compliance
2440	2.715	Upper and Lower Edges of OBW within 2400-2483.5 MHz	Compliance
2480	2.936	Upper and Lower Edges of OBW within 2400-2483.5 MHz	Compliance

Zigbee (Metal Enclosure) Occupied Bandwidth

Frequency (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth Limit	Results
2405	2.799	Upper and Lower Edges of OBW within 2400-2483.5 MHz	Compliance
2440	3.015	Upper and Lower Edges of OBW within 2400-2483.5 MHz	Compliance
2480	3.417	Upper and Lower Edges of OBW within 2400-2483.5 MHz	Compliance

Zigbee (Plastic Enclosure) Low Channel DTS Bandwidth



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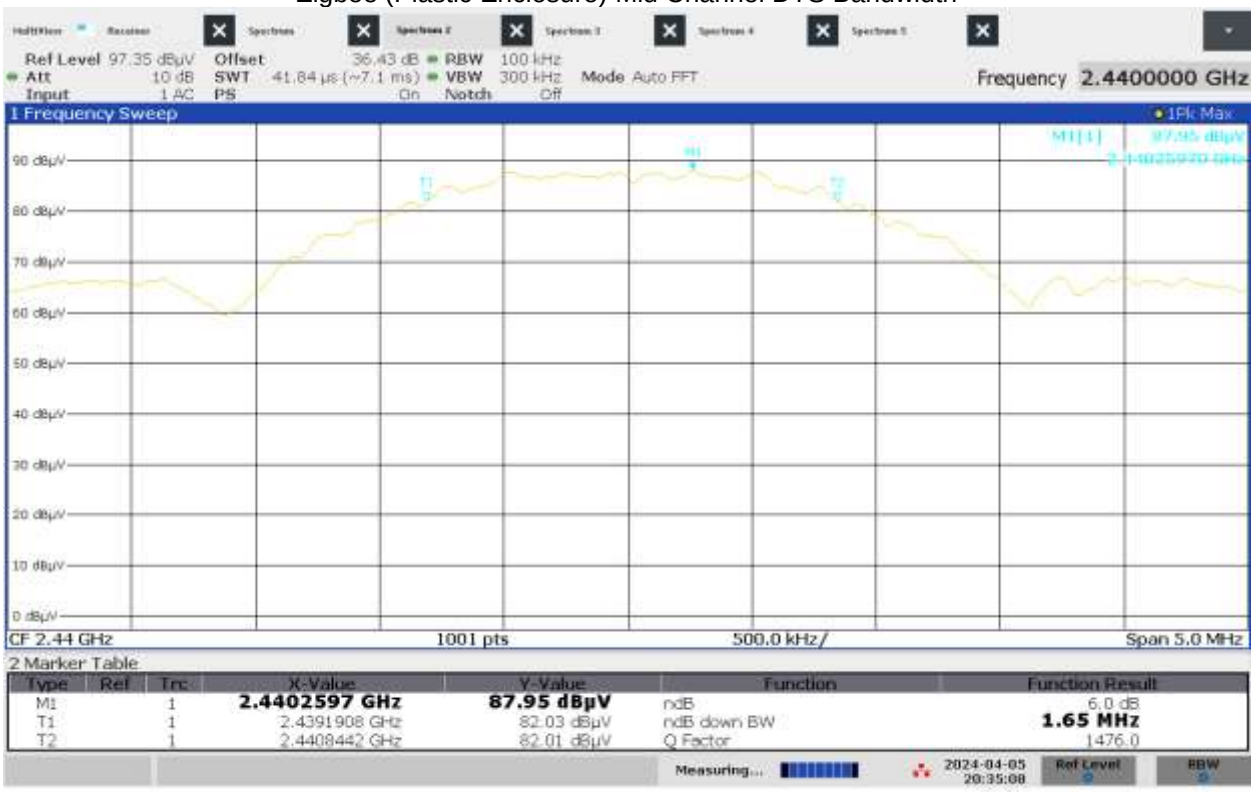
Zigbee (Plastic Enclosure) Mid Channel DTS Bandwidth



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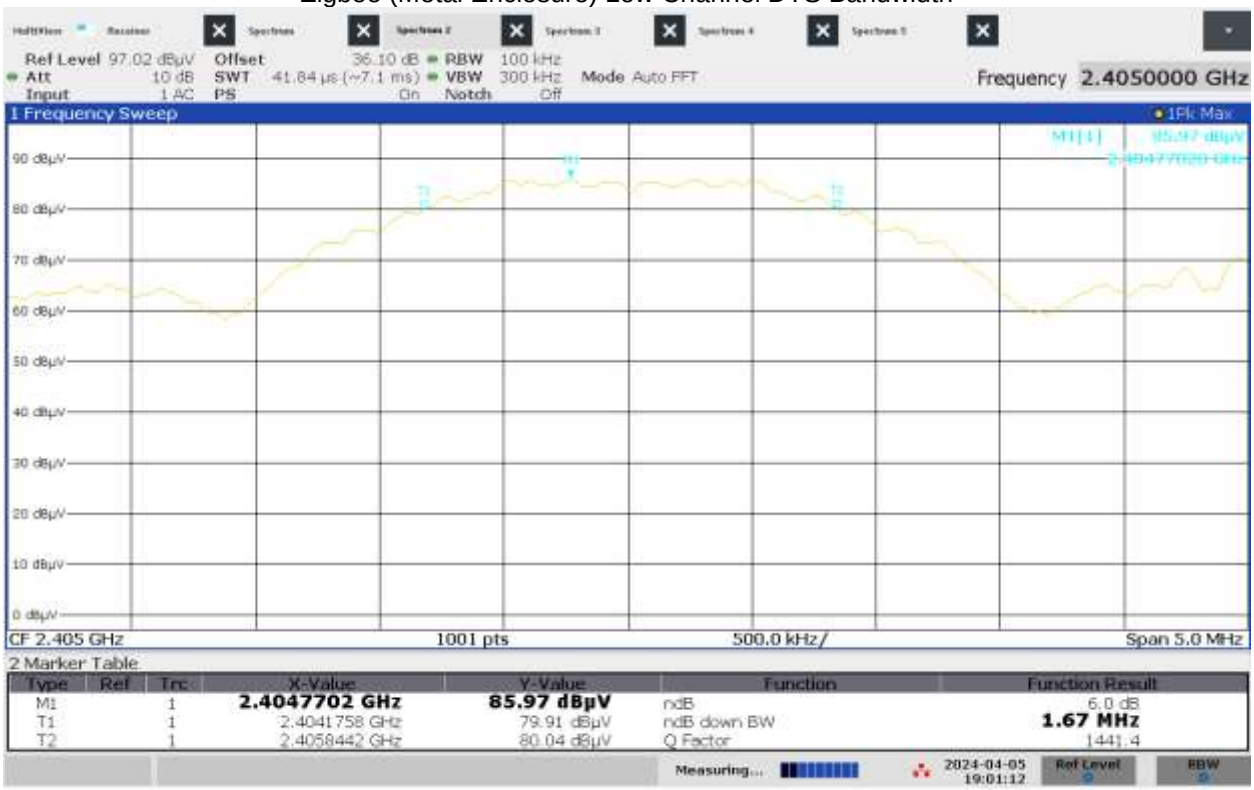
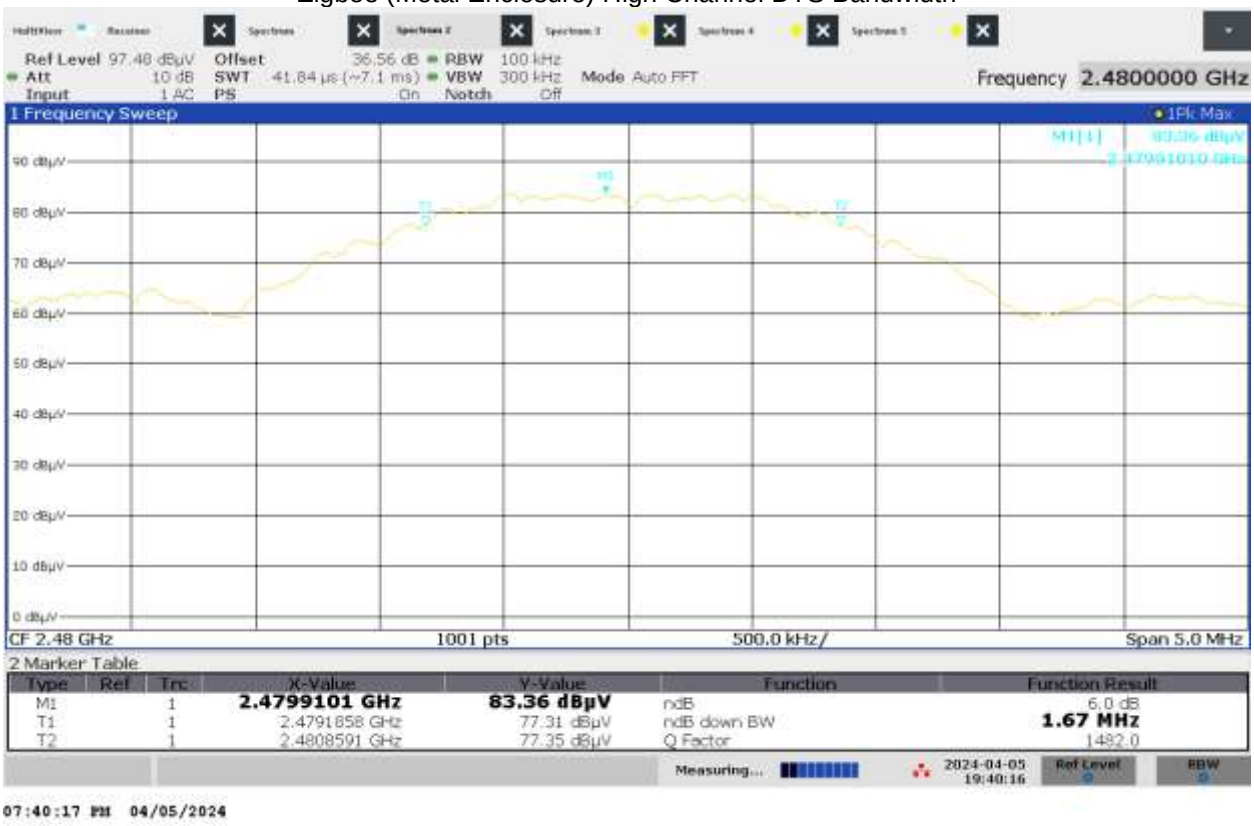
Zigbee (Plastic Enclosure) High Channel DTS Bandwidth

Zigbee (Metal Enclosure) Low Channel DTS Bandwidth

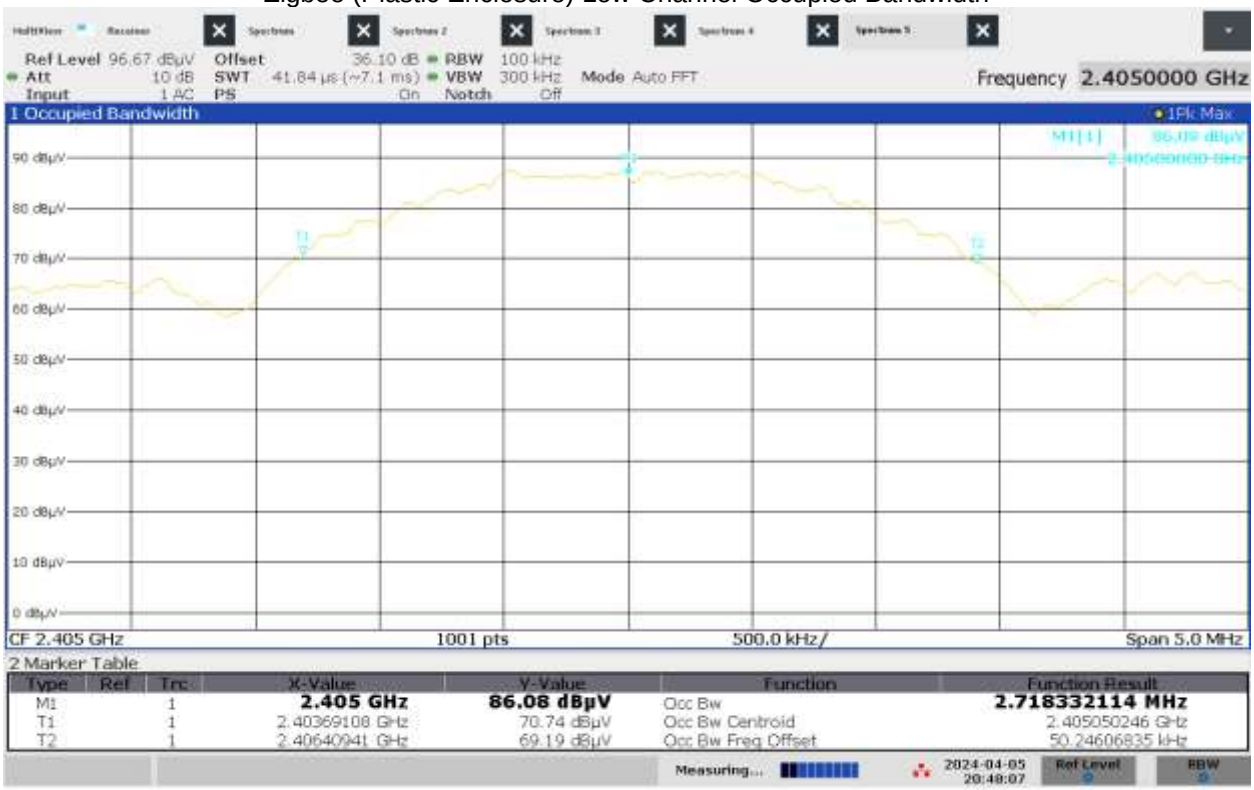


Zigbee (Metal Enclosure) Mid Channel DTS Bandwidth

Zigbee (Metal Enclosure) High Channel DTS Bandwidth



Zigbee (Plastic Enclosure) Low Channel Occupied Bandwidth



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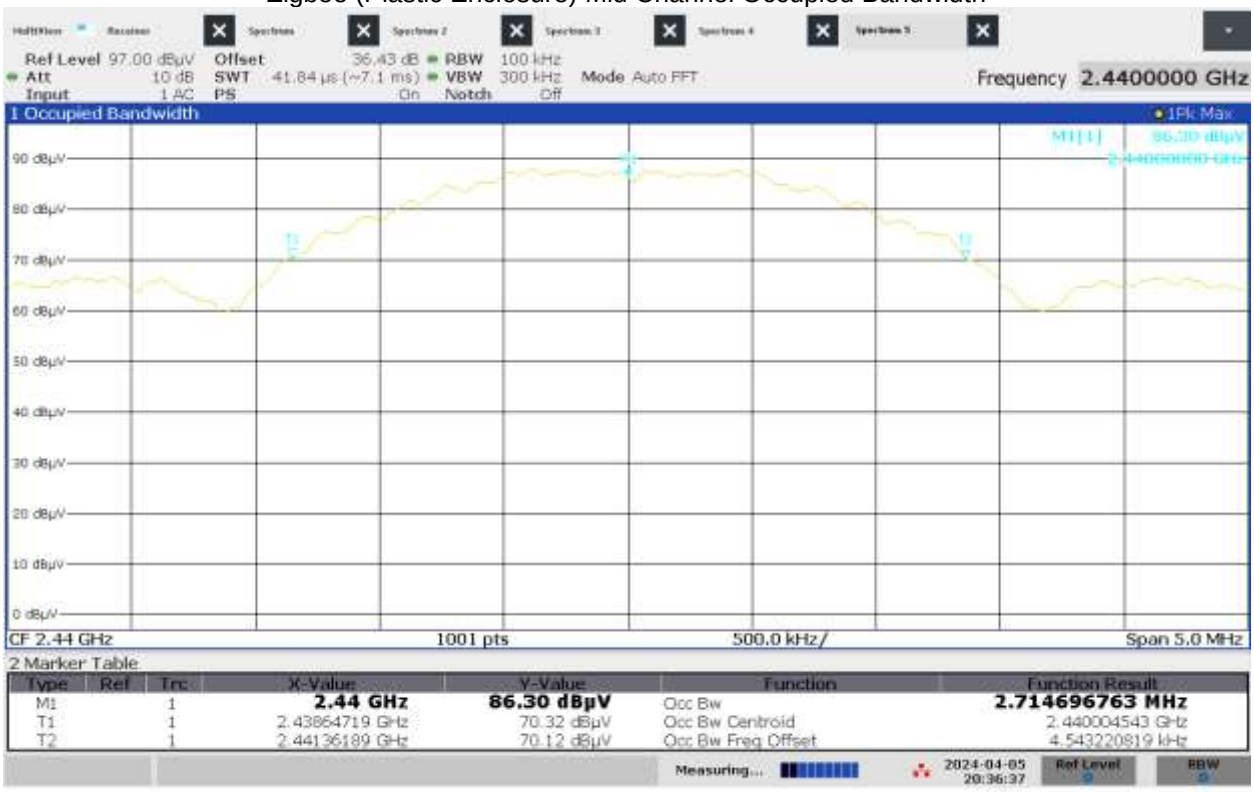
Zigbee (Plastic Enclosure) Mid Channel Occupied Bandwidth



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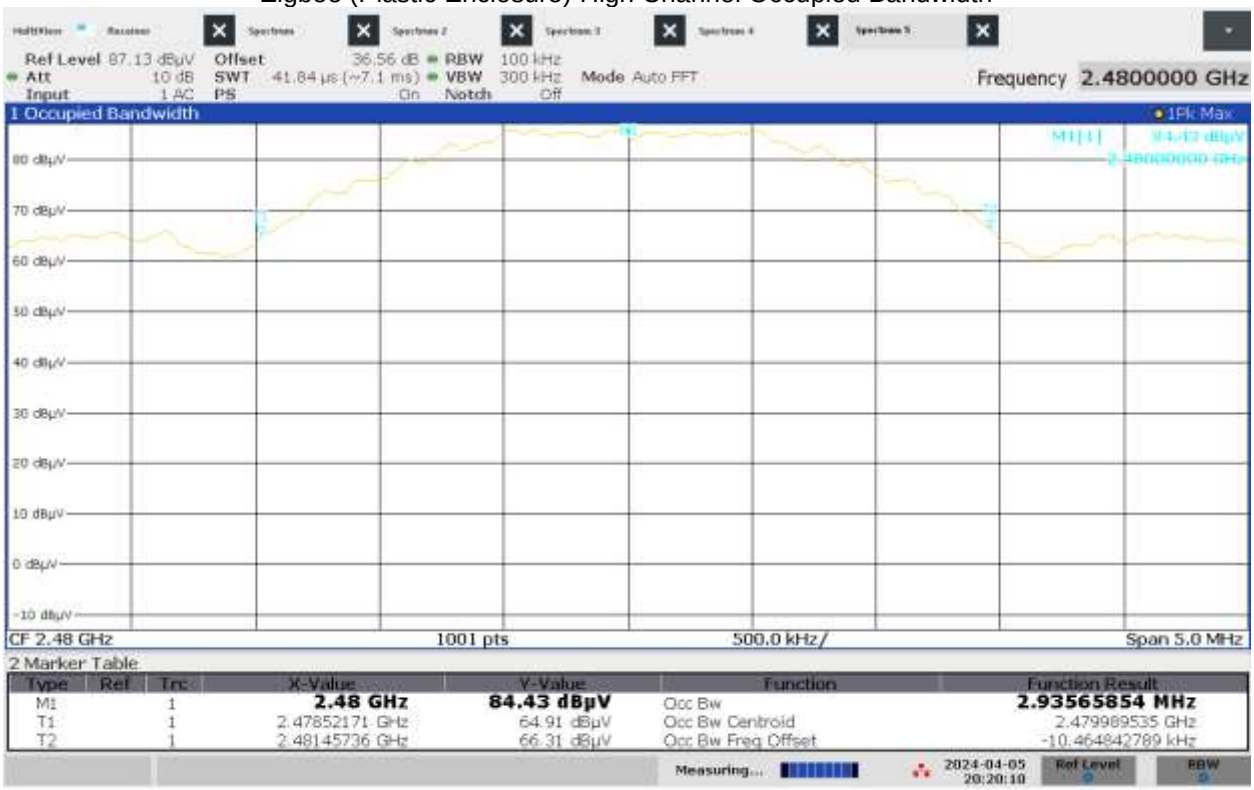
Zigbee (Plastic Enclosure) High Channel Occupied Bandwidth



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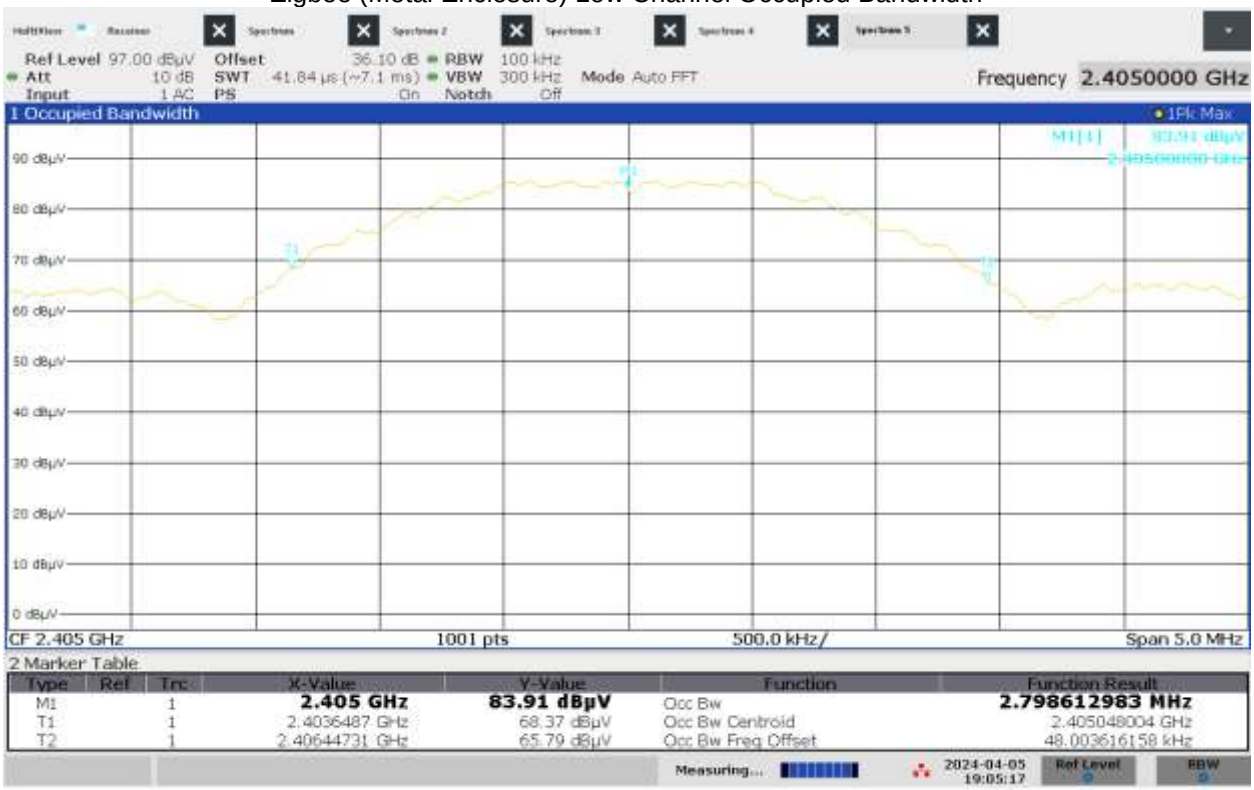
Zigbee (Metal Enclosure) Low Channel Occupied Bandwidth



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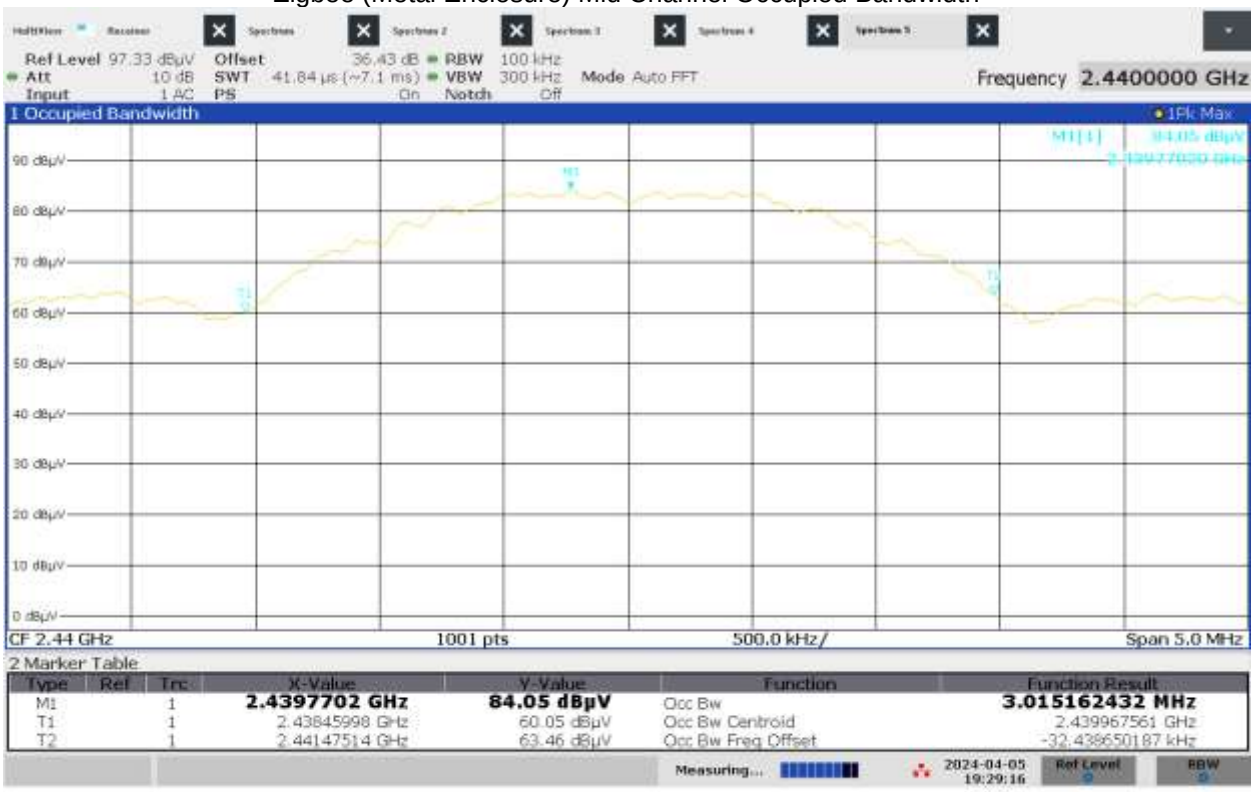
Zigbee (Metal Enclosure) Mid Channel Occupied Bandwidth



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Zigbee (Metal Enclosure) High Channel Occupied Bandwidth

Product Standard: CFR47 FCC Part 15.247, RSS-247				Limit applied: See Report Section 7.2			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
04/05/2024	Kouma Sin	Vathana F. Ven	Internal battery	Continuous transmitting	22	27	988

Deviations, Additions, or Exclusions: None

8 Maximum Power Spectral Density

8.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10, and KDB 558074 D0115.247Meas Guidancev05r02.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

8.2 Limit

§15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Notes: The limits for RSS-247 are the same as the FCC limits above.

8.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
HS001'	DC-18GHz cable 1.5m long	Huber & Suhner	SucoFlex 106A	HS001	01/30/2024	01/30/2025
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	07/19/2023	07/19/2024
145-408'	10m Chamber - 3m Track B In-floor Cable	Huber + Suhner	sucoflex 106-11000mm	001	07/19/2023	07/19/2024
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	10/16/2023	10/16/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024

Software Utilized:

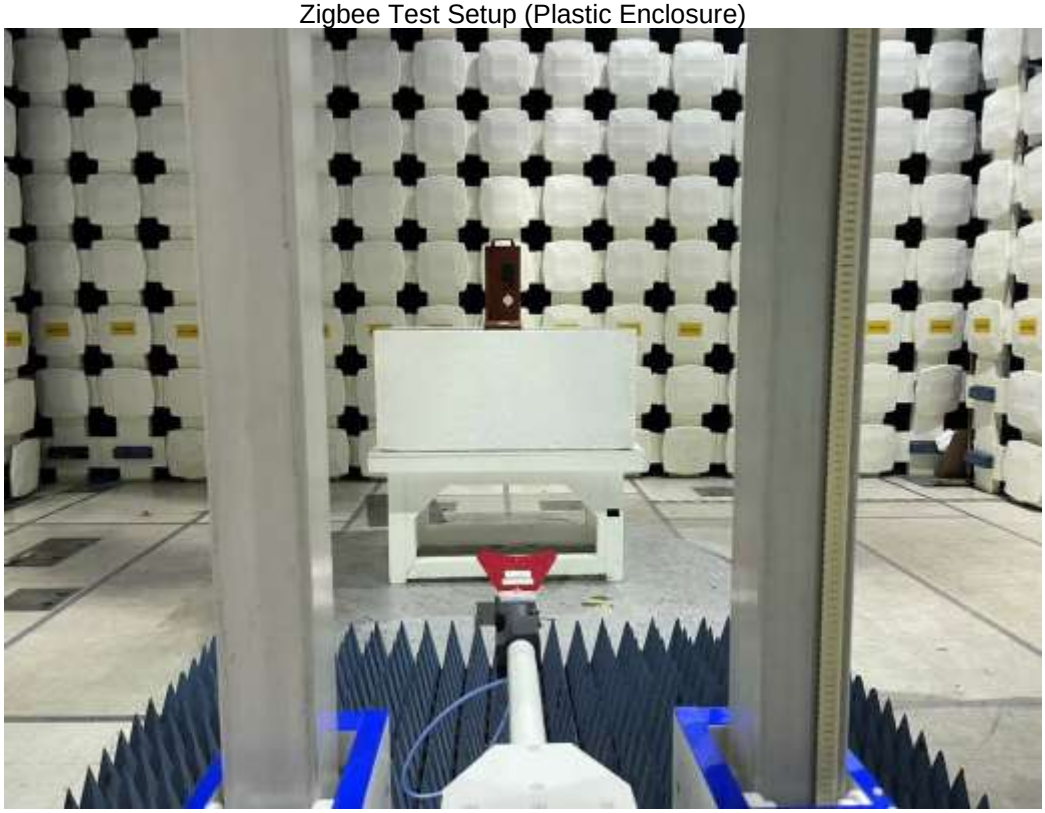
Name	Manufacturer	Version
None	N/A	N/A

8.4 Results:

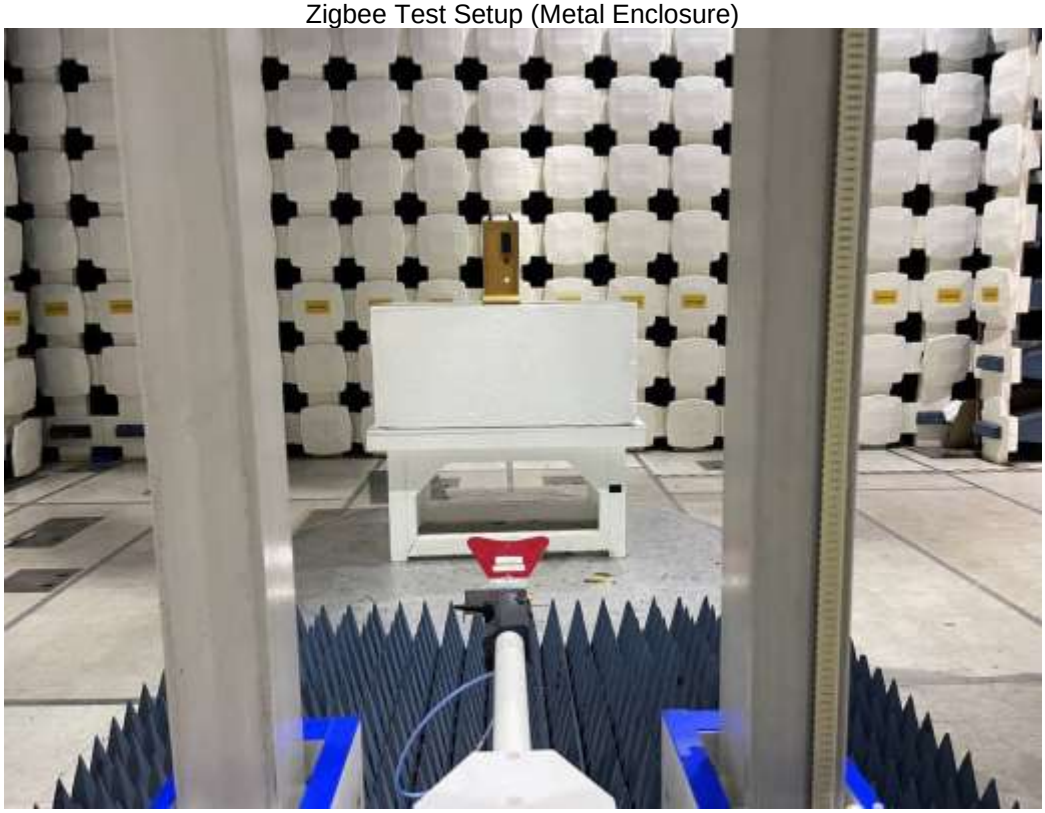
The sample tested was found to Comply.

8.5 Setup Photographs:

Zigbee Test Setup (Plastic Enclosure)



Zigbee Test Setup (Metal Enclosure)



8.6 Test Data:

Zigbee (Plastic Enclosure) Peak Power Spectral Density

Frequency (MHz)	Peak Power Spectral Density (dBuV/m)	Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2405	91.03	-4.17	8	Compliance
2440	76.37	-18.83	8	Compliance
2480	75.87	-19.33	8	Compliance

Zigbee (Metal Enclosure) Peak Power Spectral Density

Frequency (MHz)	Peak Power Spectral Density (dBuV/m)	Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2405	74.67	-20.53	8	Compliance
2440	72.18	-23.02	8	Compliance
2480	72.27	-22.93	8	Compliance

Notes: The Peak Power Spectral Density was calculated from field strength with the formula below:

$$\mathrm{EIRP} = E_{\mathrm{Meas}} + 20\log\left(d_{\mathrm{Meas}}\right) - 104.7$$

Zigbee (Plastic Enclosure) Low Channel Peak Power Spectral Density (Worst-case Polarity – H)

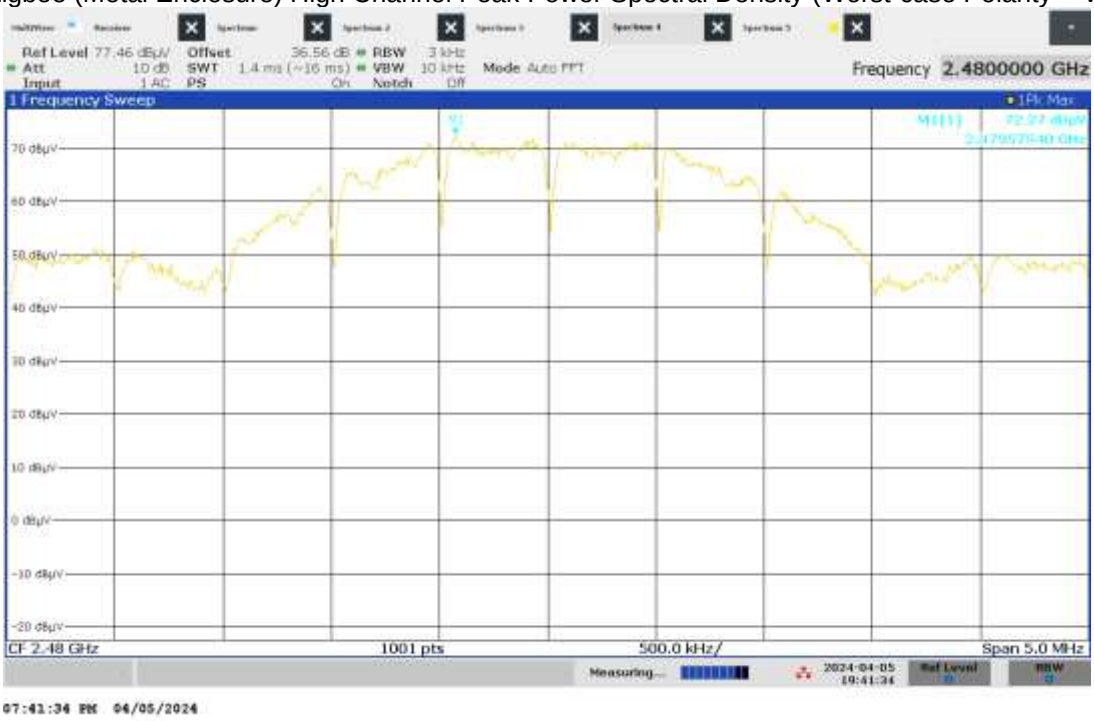
Zigbee (Plastic Enclosure) Mid Channel Peak Power Spectral Density (Worst-case Polarity – H)

Zigbee (Plastic Enclosure) High Channel Peak Power Spectral Density (Worst-case Polarity – H)

Zigbee (Metal Enclosure) Low Channel Peak Power Spectral Density (Worst-case Polarity – V)

Zigbee (Metal Enclosure) Mid Channel Peak Power Spectral Density (Worst-case Polarity – V)

Zigbee (Metal Enclosure) High Channel Peak Power Spectral Density (Worst-case Polarity – V)



Product Standard: CFR47 FCC Part 15.247, RSS-247				Limit applied: See Report Section 8.2			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
04/05/2024	Kouma Sin	Vathana F. Ven	Internal battery	Continuous transmitting	22	27	988

Deviations, Additions, or Exclusions: None

9 Band Edge Compliance

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, RSS 247, and ANSI C 63.10.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

9.2 Limit

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

Notes: The limits for RSS-247 are the same as the FCC limits above.

9.3 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV006'	Weather Station	Davis	6250	MS191218071	02/21/2023	02/21/2024
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	10/16/2023	10/16/2024
ROS011'	EMI Test Receiver	Rohde & Schwartz	ESW44	103296	06/28/2023	06/28/2024
145-420'	Receiver to floor cable	Utiflex	UFB311A-2-0591-70070	145-420	02/18/2023	02/18/2024
145-408'	10m Chamber - 3m Track B In-floor Cable	Huber + Suhner	sucoflex 106-11000mm	001	07/19/2023	07/19/2024
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	07/19/2023	07/19/2024
145-422'	10Amp Pre-amp to under floor	Utiflex	UFB311A-0-2756-70070	145-422	02/18/2023	02/18/2024
145-019'	Active Loop Antenna (9 KHz to 30 MHz)	EMCO	6502/1	9902-3267	03/05/2024	03/05/2025

Software Utilized:

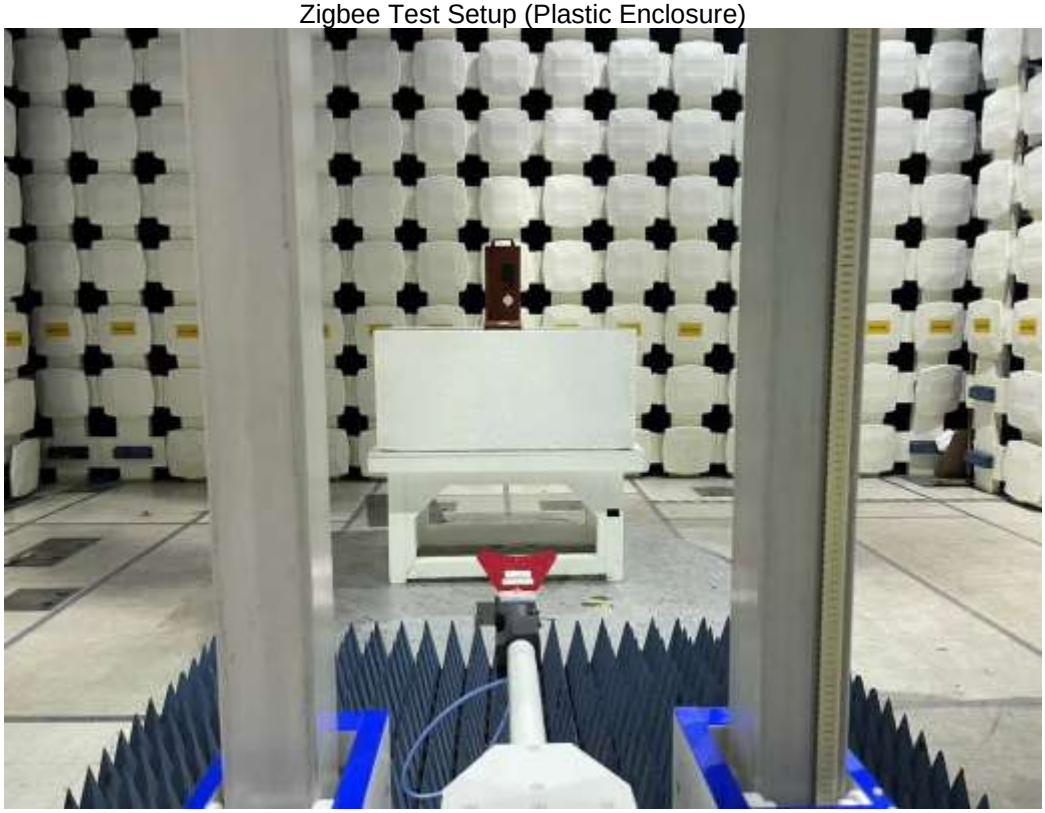
Name	Manufacturer	Version
None	N/A	N/A

9.4 Results:

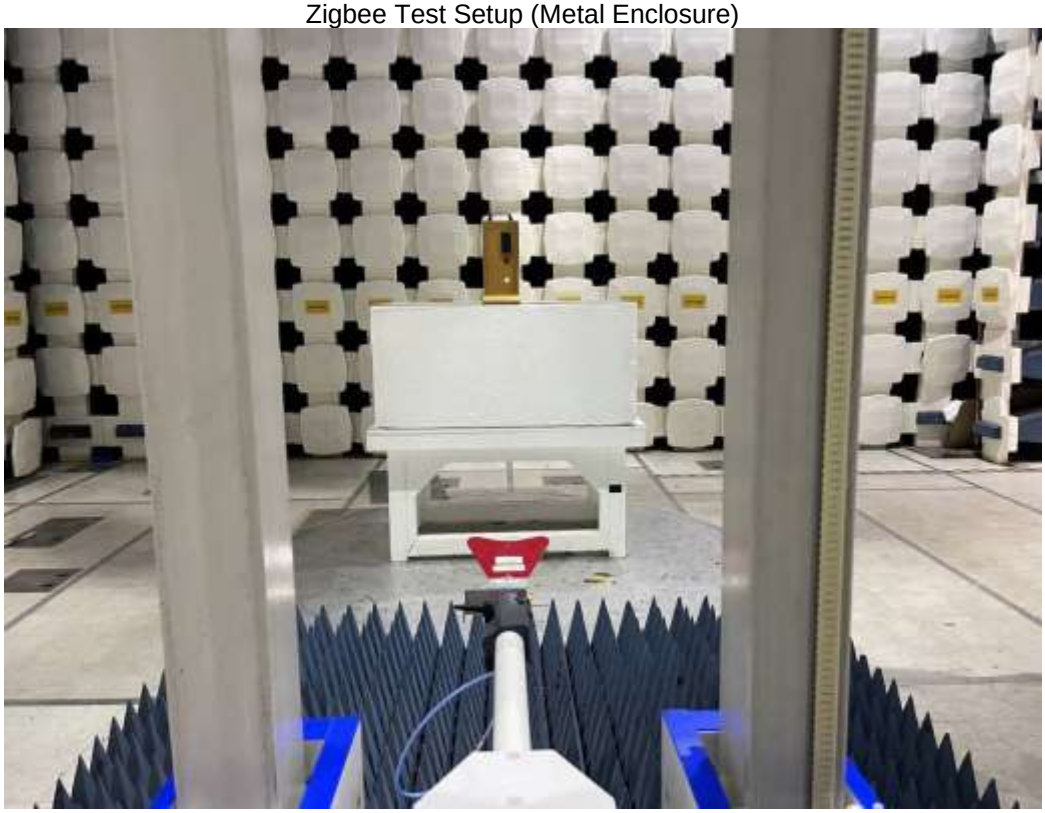
The sample tested was found to Comply.

9.5 Setup Photographs:

Zigbee Test Setup (Plastic Enclosure)



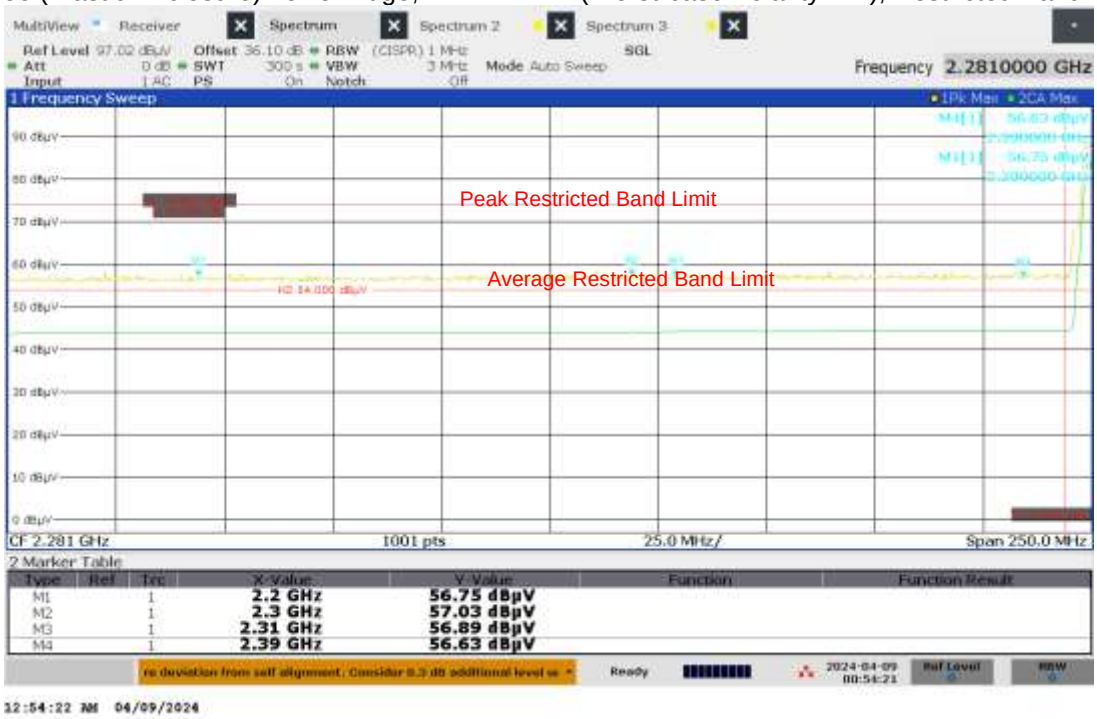
Zigbee Test Setup (Metal Enclosure)



9.6 Test Data:

Zigbee (Plastic Enclosure) Lower Edge, 100 kHz RBW (Worst-case Polarity – H), 20 dBc Limit

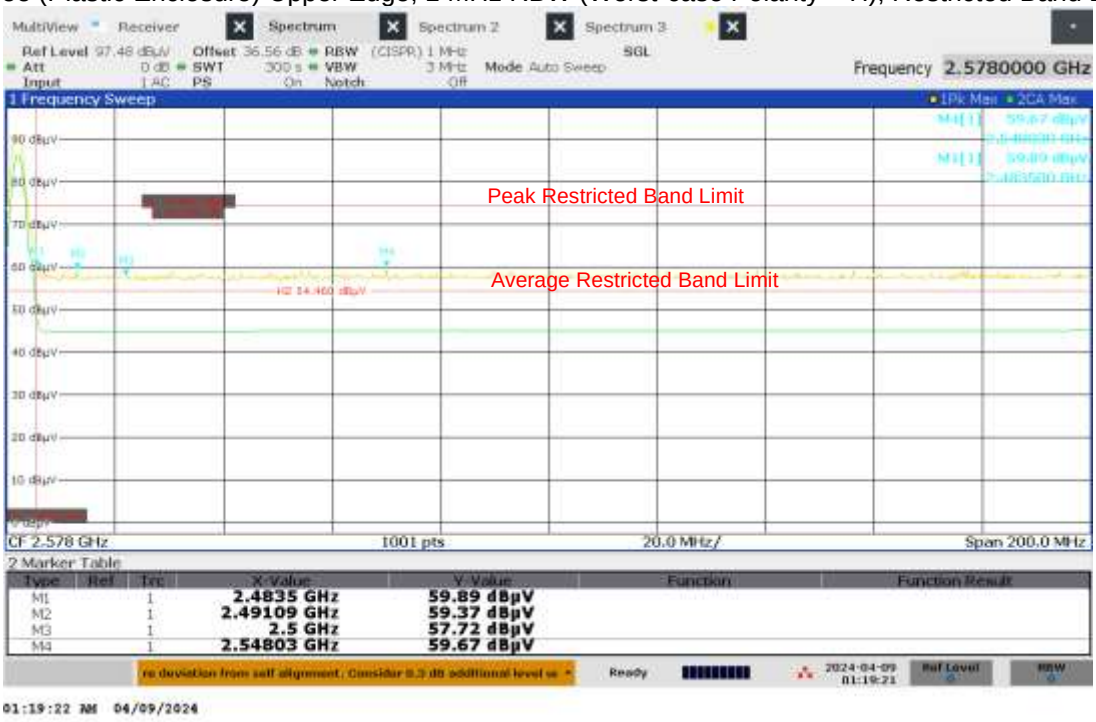
Zigbee (Plastic Enclosure) Lower Edge, 1 MHz RBW (Worst-case Polarity – H), Restricted Band Limit



Notes: Antenna factor and cable loss were compensated internally as dB off-set.

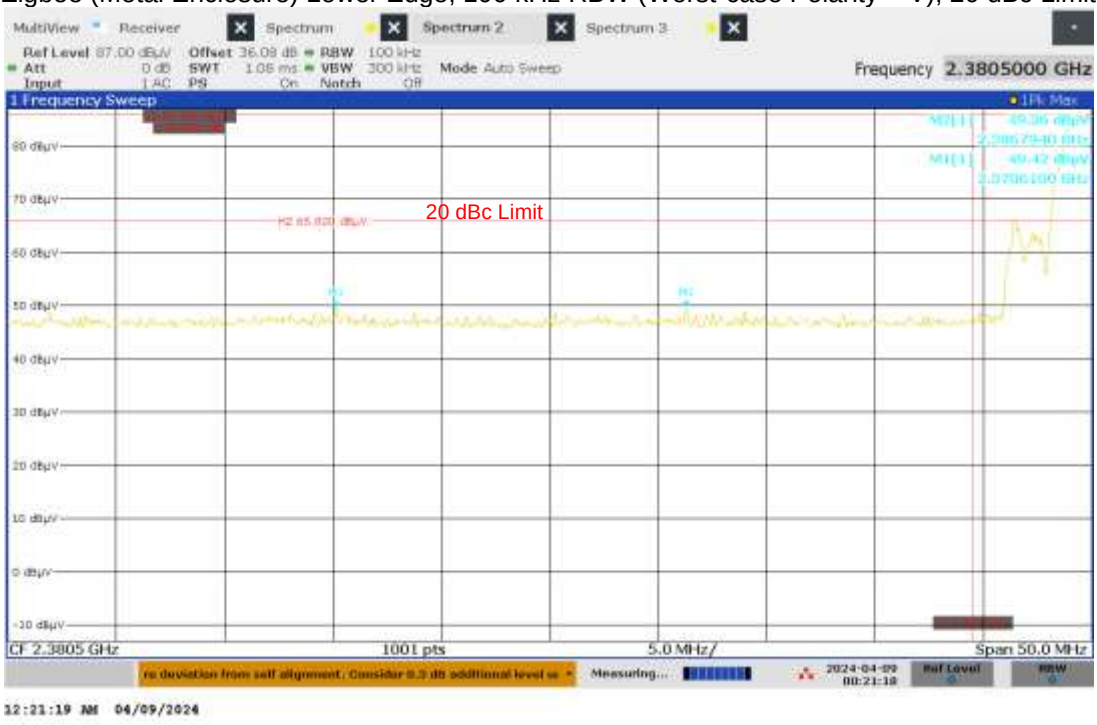
Zigbee (Plastic Enclosure) Upper Edge, 100 kHz RBW (Worst-case Polarity – H), 20 dBc Limit

Zigbee (Plastic Enclosure) Upper Edge, 1 MHz RBW (Worst-case Polarity – H), Restricted Band Limit

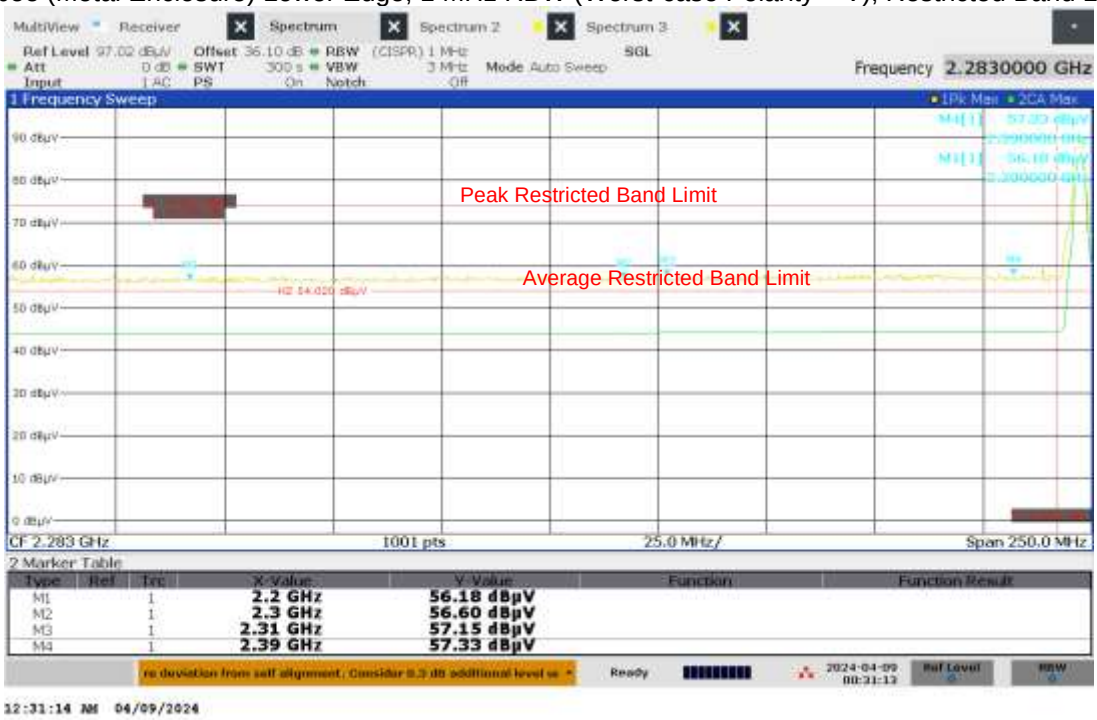


Notes: Antenna factor and cable loss were compensated internally as dB off-set.

Zigbee (Metal Enclosure) Lower Edge, 100 kHz RBW (Worst-case Polarity – V), 20 dBc Limit

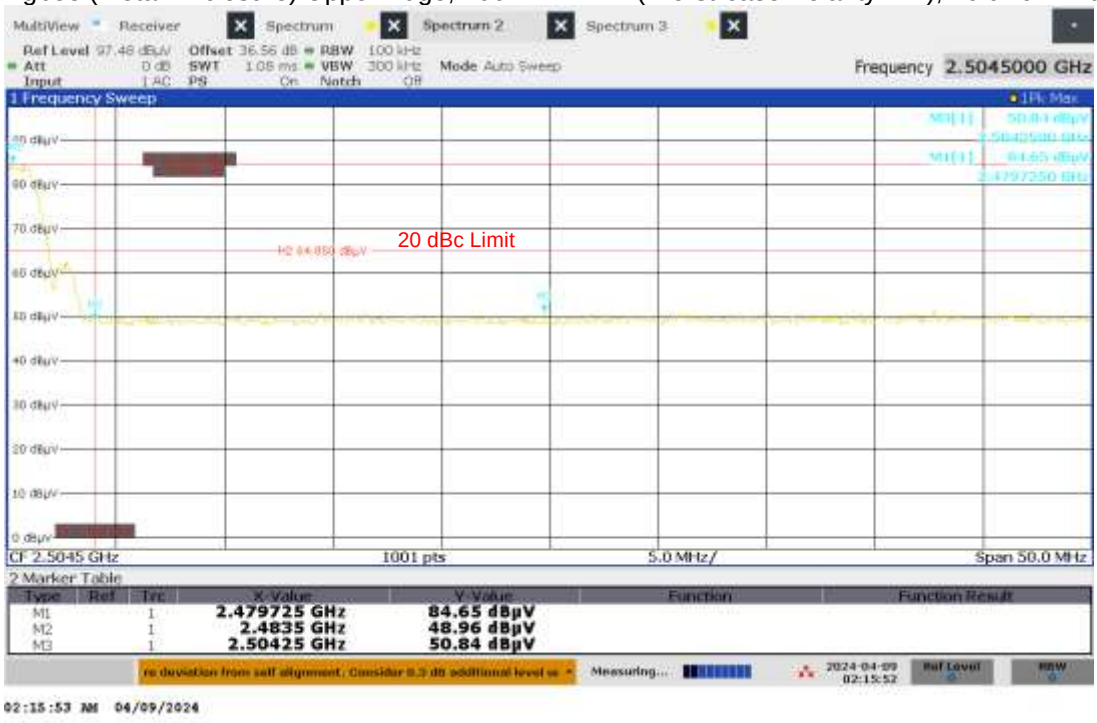


Zigbee (Metal Enclosure) Lower Edge, 1 MHz RBW (Worst-case Polarity – V), Restricted Band Limit

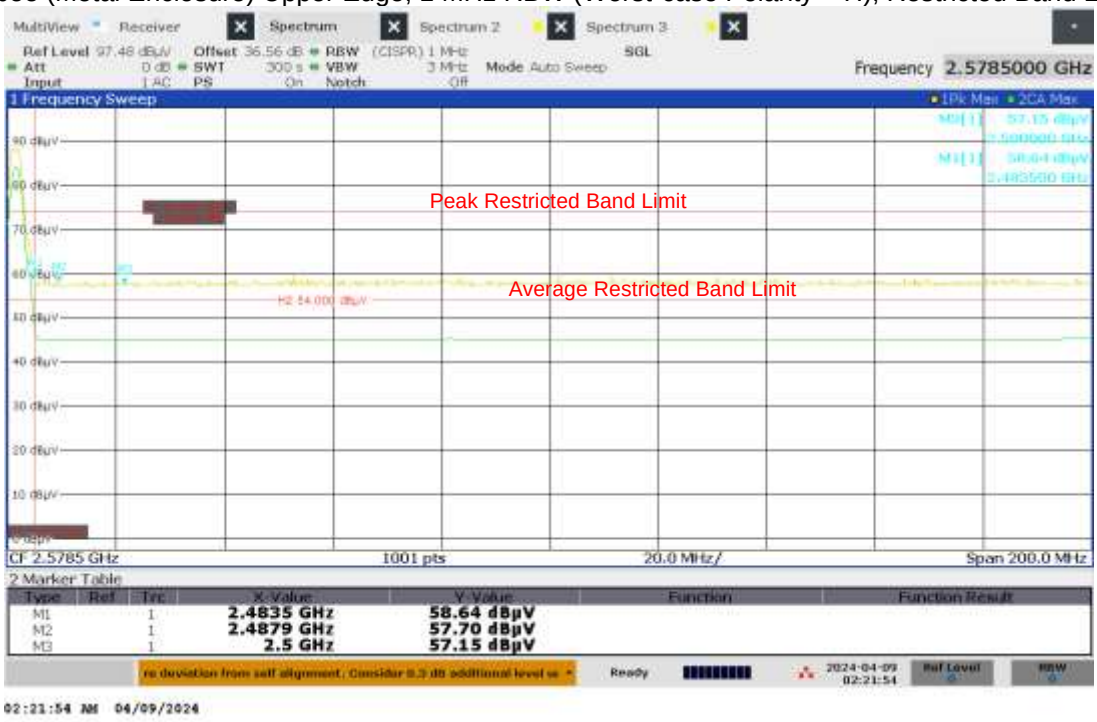


Notes: Antenna factor and cable loss were compensated internally as dB off-set.

Zigbee (Metal Enclosure) Upper Edge, 100 kHz RBW (Worst-case Polarity – H), 20 dBc Limit



Zigbee (Metal Enclosure) Upper Edge, 1 MHz RBW (Worst-case Polarity – H), Restricted Band Limit



Notes: Antenna factor and cable loss were compensated internally as dB off-set.

Product Standard: CFR47 FCC Part 15.247, RSS-247				Limit applied: See Report Section 9.2			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
04/09/2024	Kouma Sin	Vathana F. Ven	Internal battery	Continuous transmitting	26	21	1007

Deviations, Additions, or Exclusions: None

10 Transmitter spurious emissions

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, FCC Part 15 Subpart B, RSS 247, ISED ICES 003, ANSI C 63.10, and ANSI C 63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of

1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

10.2 Limits

Limits – FCC Part §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

Limits – FCC Part §15.209 (a) The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88–216	150	3
216–960	200	3
Above 960	500	3

Notes: The limits for RSS-247 are the same as the FCC limits above.

10.3 Test Equipment Used:

Test equipment used from 30-1000 MHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
145-406'	10m Track A In-floor Cable #1	Huber + Suhner	sucoflex 160-19220mm	001	07/19/2023	07/19/2024
145-414'	Cable 145-414	Huber + Suhner	3m Track A cable	145-414	07/19/2023	07/19/2024
147-326'	Immunity Cable	Huber + Suhner	Sucoflex 106	233089-005	07/19/2023	07/19/2024
PRE11'	50dB gain pre-amp	Pasternack	PRE11	PRE11	09/15/2023	09/15/2024
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	09/14/2023	09/14/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024

Test equipment used from 1-3 GHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
HS001'	DC-18GHz cable 1.5m long	Huber & Suhner	SucoFlex 106A	HS001	01/30/2024	01/30/2025
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	07/19/2023	07/19/2024
145-408'	10m Chamber - 3m Track B In-floor Cable	Huber + Suhner	sucoflex 106-11000mm	001	07/19/2023	07/19/2024
PRE12'	Pre-amplifier	Com Power	PAM-118A	18040117	12/26/2023	12/26/2024
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	10/16/2023	10/16/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024
REA008	band reject filter 2.4GHz	Reactel, Inc	12RX7-2441.75-x140 S	17-01	10/31/2023	10/31/2024

Test equipment used from 3-18 GHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
HS001'	DC-18GHz cable 1.5m long	Huber & Suhner	SucoFlex 106A	HS001	01/30/2024	01/30/2025
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	07/19/2023	07/19/2024
145-408'	10m Chamber - 3m Track B In-floor Cable	Huber + Suhner	sucoflex 106-11000mm	001	07/19/2023	07/19/2024
PRE12'	Pre-amplifier	Com Power	PAM-118A	18040117	12/26/2023	12/26/2024
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	10/16/2023	10/16/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024
REA004'	3GHz High Pass Filter	Reactel, Inc	7HSX-3G/18G-S11	06-1	02/27/2024	02/27/2025

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	2022.0.27.0

Test equipment used from 18-25 GHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024
CBLHF2012-5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/27/2024	02/27/2025
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/27/2024	02/27/2025
EMC018'	18-40GHz Pre-amp 40dB gain	The EMC Shop	PA40G	27490-01	07/18/2023	07/18/2024
REA006'	18GHz High Pass Filter	Reactel, Inc	7HS-18G/40G K11	(06)1	04/25/2023	04/25/2024
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	02/13/2024	02/13/2025

Software Utilized:

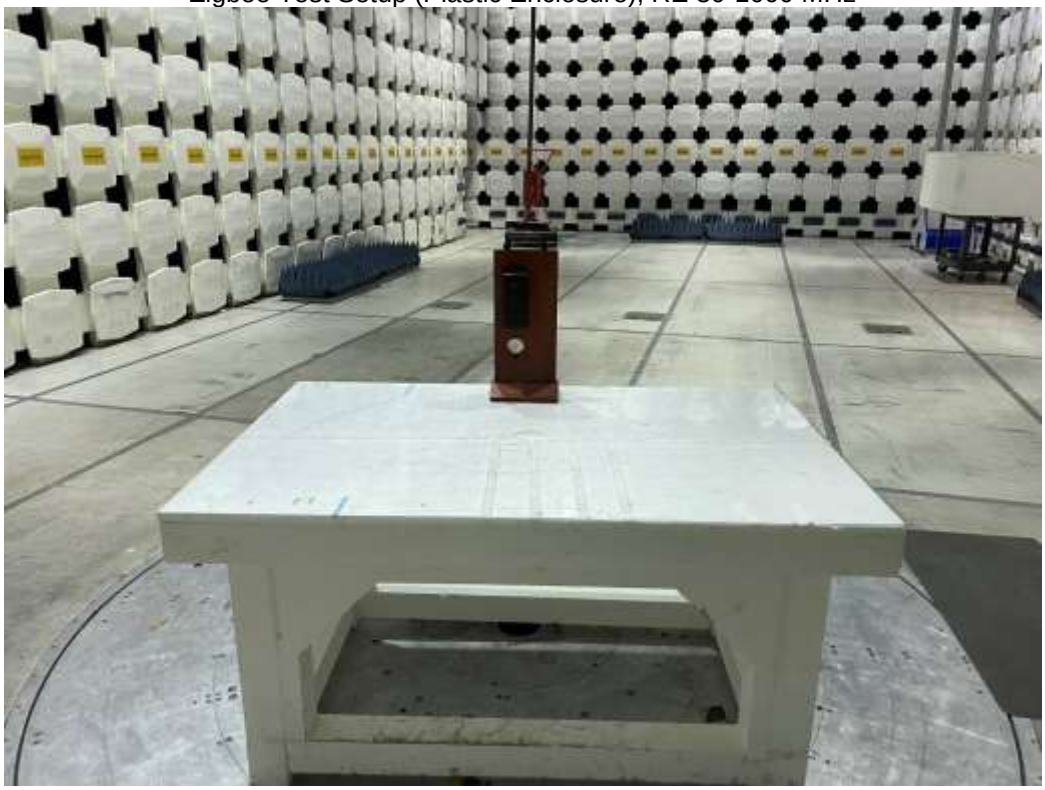
Name	Manufacturer	Version
None	N/A	N/A

10.4 Results:

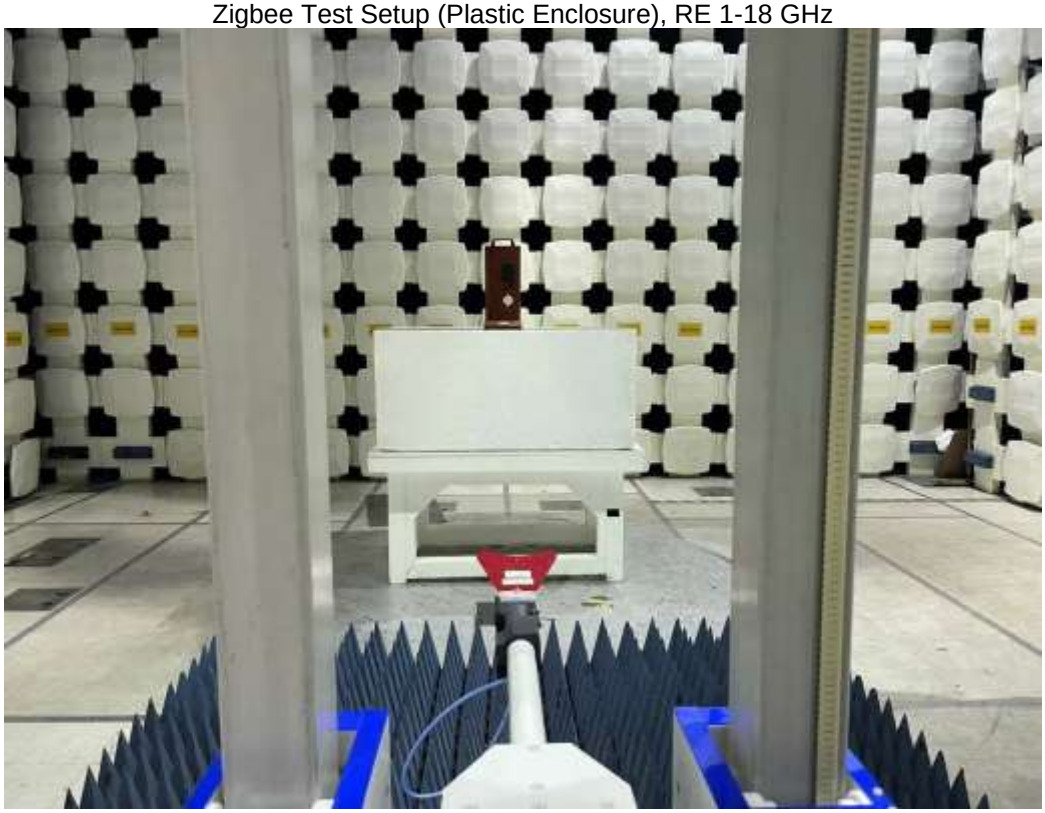
The sample tested was found to Comply.

10.5 Setup Photographs:

Zigbee Test Setup (Plastic Enclosure), RE 30-1000 MHz

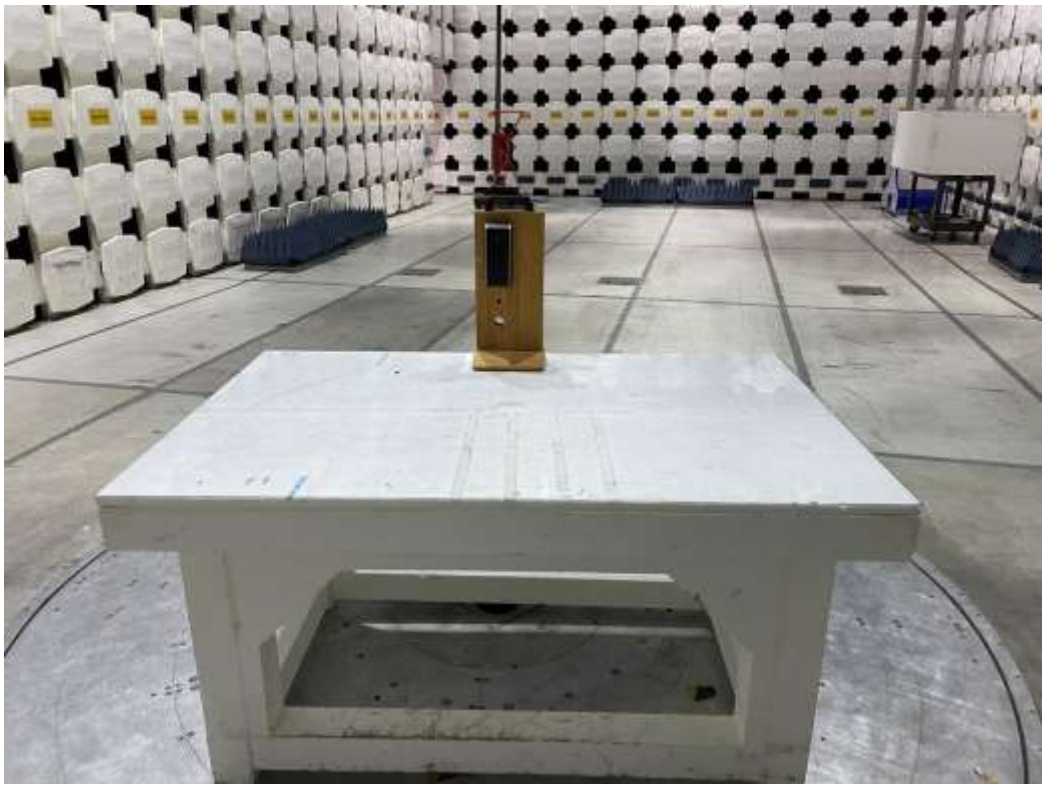


Zigbee Test Setup (Plastic Enclosure), RE 1-18 GHz

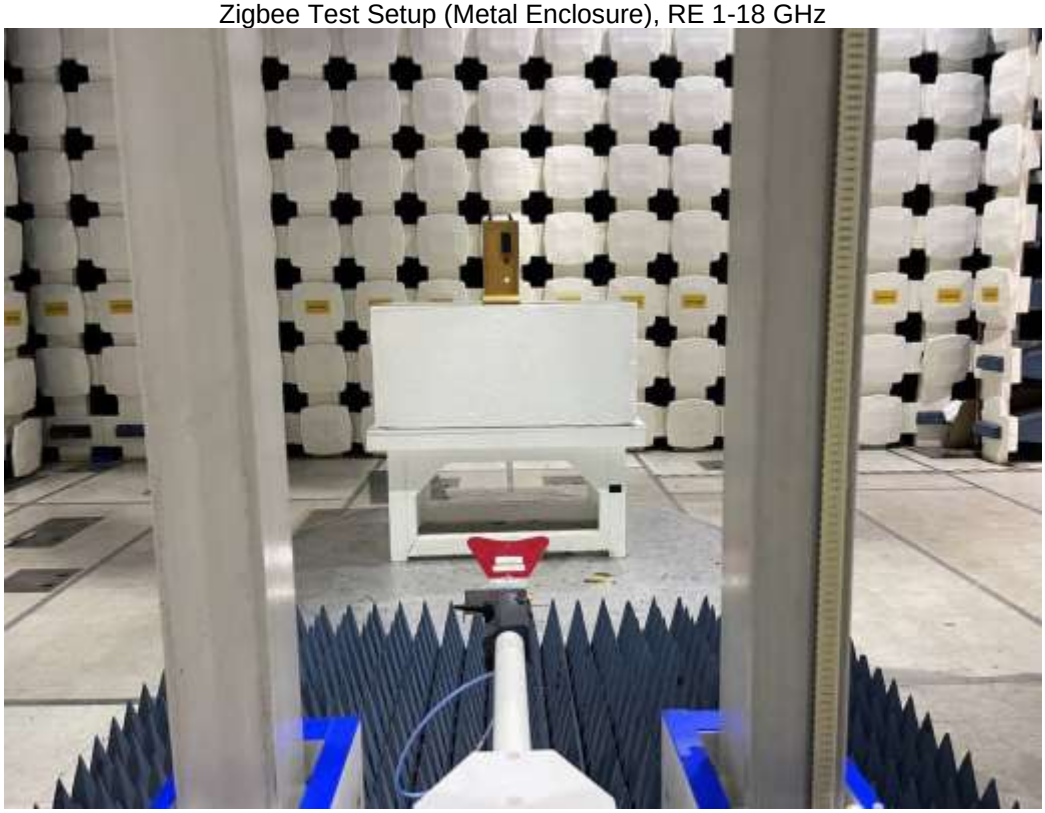


Zigbee Test Setup (Plastic Enclosure), RE 18-25 GHz

Zigbee Test Setup (Metal Enclosure), RE 30-1000 MHz



Zigbee Test Setup (Metal Enclosure), RE 1-18 GHz



Zigbee (Plastic Enclosure), RE 18-25 GHz

Zigbee (Metal Enclosure), RE 18-25 GHz

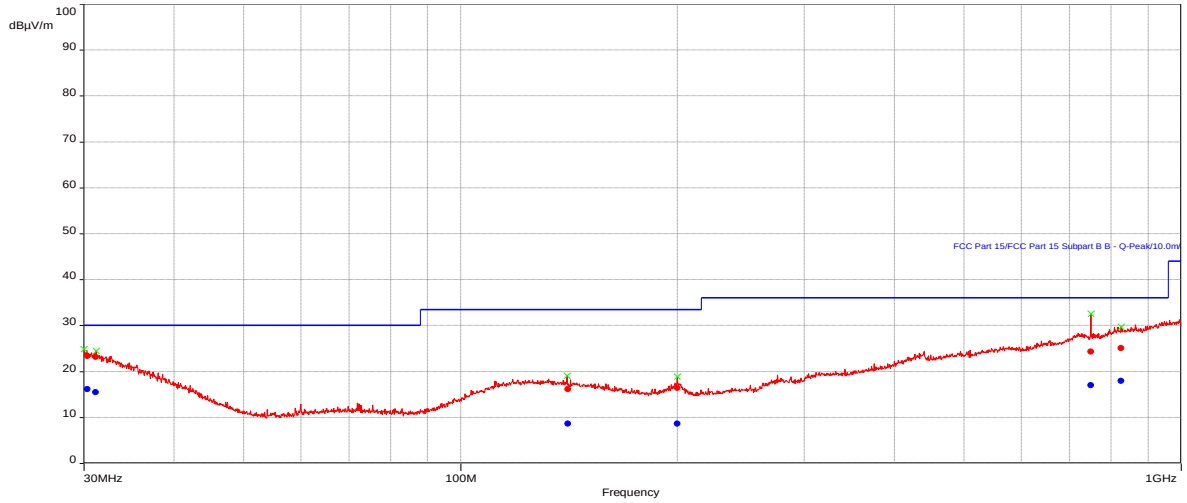
10.6 Plots/Data:

Zigbee (Plastic Enclosure) Tx Low Channel, RE 30-1000 MHz

Test Information:

Date and Time	4/2/2024 10:39:57 AM
Client and Project Number	Sargent / Assa Abloy
Engineer	Kouma Sinn
Temperature	23 C
Humidity	27 %
Atmospheric Pressure	1008 mbars
Comments	Scan 4: Zigbee (Plastic Enclosure), Tx Low Channel, RE 30-1000 MHz

Graph:



Results:

Peak (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.3344	23.39	--	--	338.40	4.00	Horizontal	120k	20	-12.80
31.167	23.19	--	--	87.00	4.00	Vertical	120k	20	-13.31
140.8357	16.18	--	--	240.40	1.62	Vertical	120k	20	-19.10
200.0251	16.49	--	--	333.70	2.67	Vertical	120k	20	-19.22
749.7861	24.30	--	--	267.50	2.06	Vertical	120k	20	-8.64
825.9062	25.14	--	--	0.00	1.00	Horizontal	120k	20	-7.10

QuasiPeak (PASS) (6)

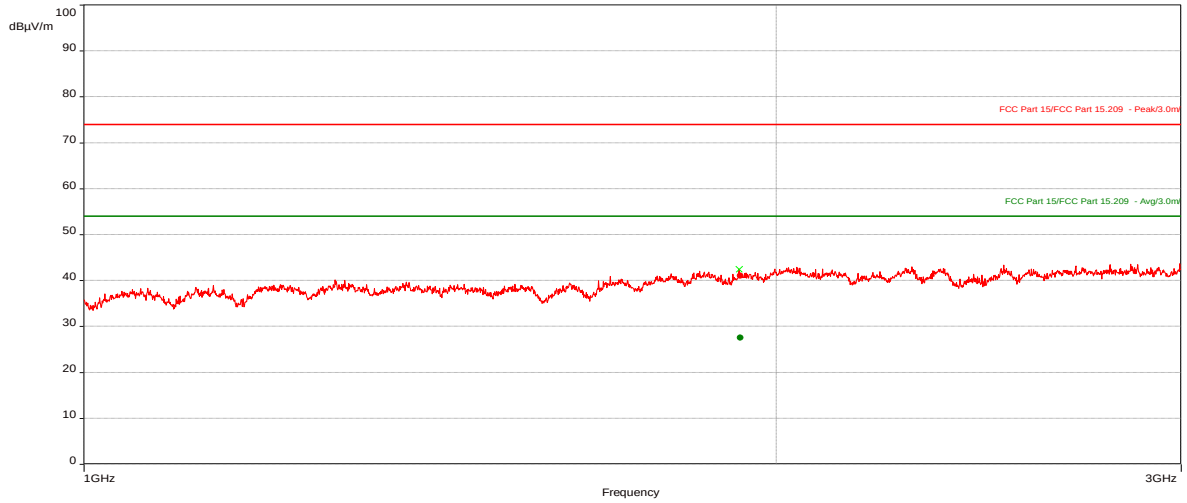
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.3344	16.13	30.00	-13.87	338.40	4.00	Horizontal	120k	20	-12.80
31.167	15.54	30.00	-14.46	87.00	4.00	Vertical	120k	20	-13.31
140.8357	8.70	33.50	-24.80	240.40	1.62	Vertical	120k	20	-19.10
200.0251	8.69	33.50	-24.81	333.70	2.67	Vertical	120k	20	-19.22
749.7861	17.03	36.00	-18.97	267.50	2.06	Vertical	120k	20	-8.64
825.9062	18.00	36.00	-18.00	0.00	1.00	Horizontal	120k	20	-7.10

Zigbee (Plastic Enclosure) Tx Low Channel, RE 1-3 GHz

Test Information:

Date and Time	4/4/2024 12:58:58 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 35: Zigbee (Plastic Enclosure), Tx Low Channel, RE 1-3 GHz

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
1929.633	41.09	74.00	-32.91	74.00	3.05	Vertical	1M	20	-18.88

AVG (PASS) (1)

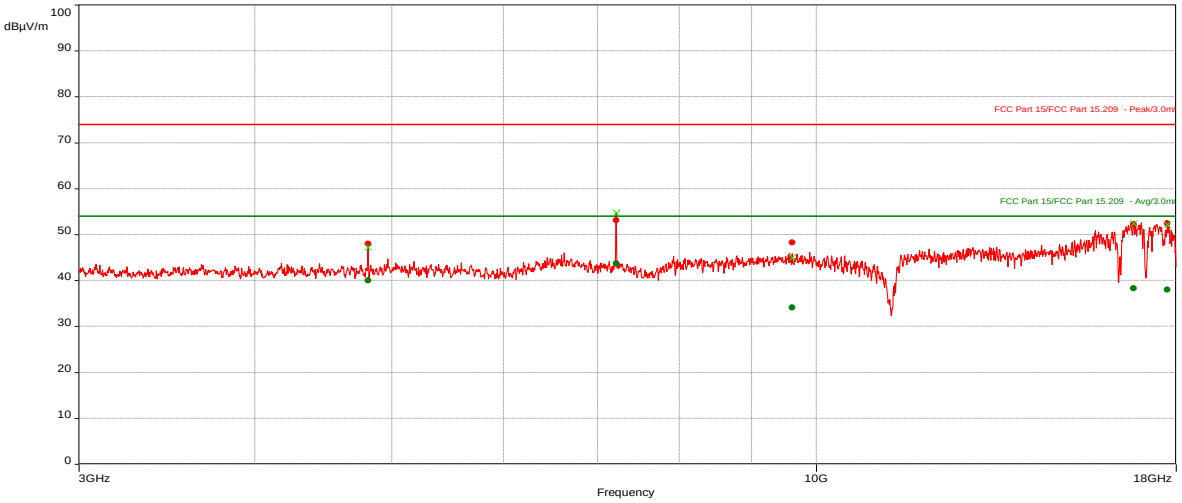
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
1929.633	27.61	54.00	-26.39	74.00	3.05	Vertical	1M	20	-18.88

Zigbee (Plastic Enclosure) Tx Low Channel, RE 3-18 GHz

Test Information:

Date and Time	4/4/2024 1:10:08 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 36: Zigbee (Plastic Enclosure), Tx Low Channel, RE 3-18 GHz

Graph:



Results:

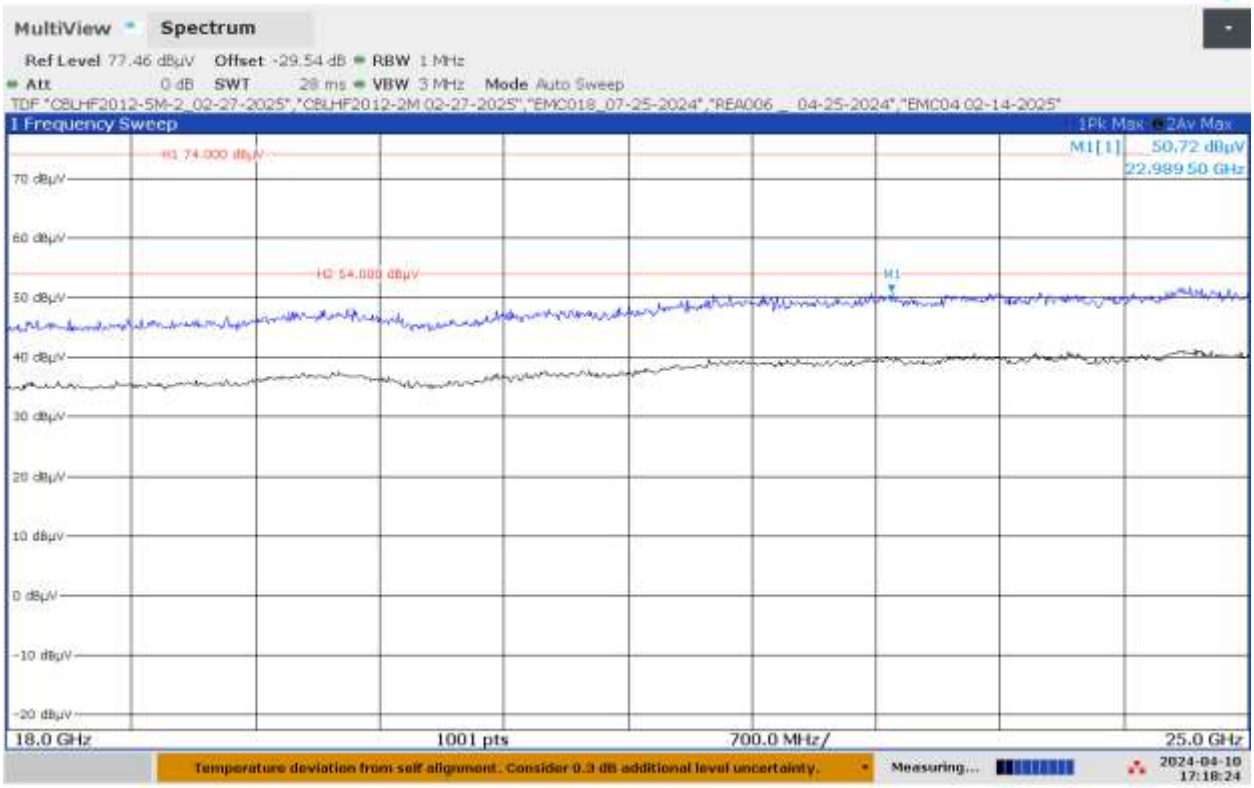
Peak (PASS) (5)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
4809.888	48.03	74.00	-25.97	360.00	1.00	Horizontal	1M	20	-13.54
7216.537	53.17	74.00	-20.83	265.60	4.00	Horizontal	1M	20	-10.24
9617.868	48.28	74.00	-25.72	0.00	1.00	Vertical	1M	20	-8.01
16798.035	52.31	74.00	-21.69	0.00	4.00	Vertical	1M	20	2.13
17749.398	52.49	74.00	-21.51	360.00	4.00	Horizontal	1M	20	2.35

AVG (PASS) (5)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
4809.888	39.98	54.00	-14.02	360.00	1.00	Horizontal	1M	20	-13.54
7216.537	43.73	54.00	-10.27	265.60	4.00	Horizontal	1M	20	-10.24
9617.868	34.18	54.00	-19.82	0.00	1.00	Vertical	1M	20	-8.01
16798.035	38.28	54.00	-15.72	0.00	4.00	Vertical	1M	20	2.13
17749.398	38.05	54.00	-15.95	360.00	4.00	Horizontal	1M	20	2.35

Zigbee (Plastic Enclosure) Tx Low Channel, RE 18-25 GHz



05:18:24 PM 04/10/2024

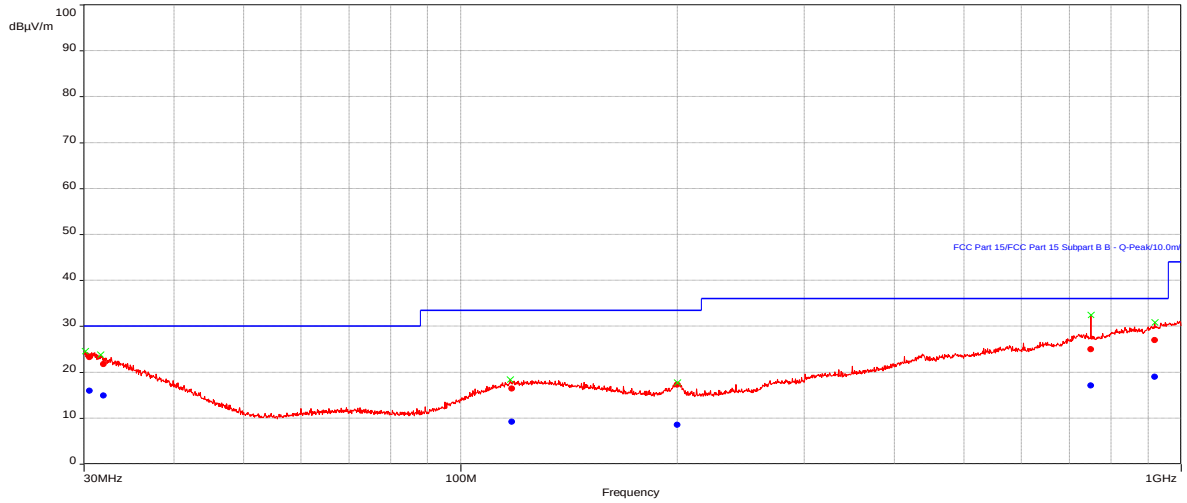
Notes: Testing was performed manually around the EUT at 10cm distance. No emission was detected above the test instrument noise floor. The cable loss, antenna factor, filter loss, and pre-amp gain were compensated as transducer factor (TDF) and the distance factor was compensated as Reference Offset

Zigbee (Plastic Enclosure) Tx Mid Channel, RE 30-1000 MHz

Test Information:

Date and Time	4/2/2024 12:32:25 PM
Client and Project Number	Sargent / Assa Abloy
Engineer	Kouma Sinn
Temperature	23 C
Humidity	27 %
Atmospheric Pressure	1008 mbars
Comments	Scan 5: Zigbee (Plastic Enclosure), Tx Mid Channel, RE 30-1000 MHz

Graph:



Results:

Peak (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.5828	23.33	--	--	175.00	4.00	Horizontal	120k	20	-12.95
31.9477	21.82	--	--	108.10	3.27	Horizontal	120k	20	-13.85
117.7817	16.49	--	--	44.90	3.15	Horizontal	120k	20	-18.91
199.9589	17.27	--	--	110.10	1.62	Horizontal	120k	20	-19.22
749.6962	25.00	--	--	267.40	2.47	Vertical	120k	20	-8.64
919.0882	26.98	--	--	126.30	4.00	Horizontal	120k	20	-5.76

QuasiPeak (PASS) (6)

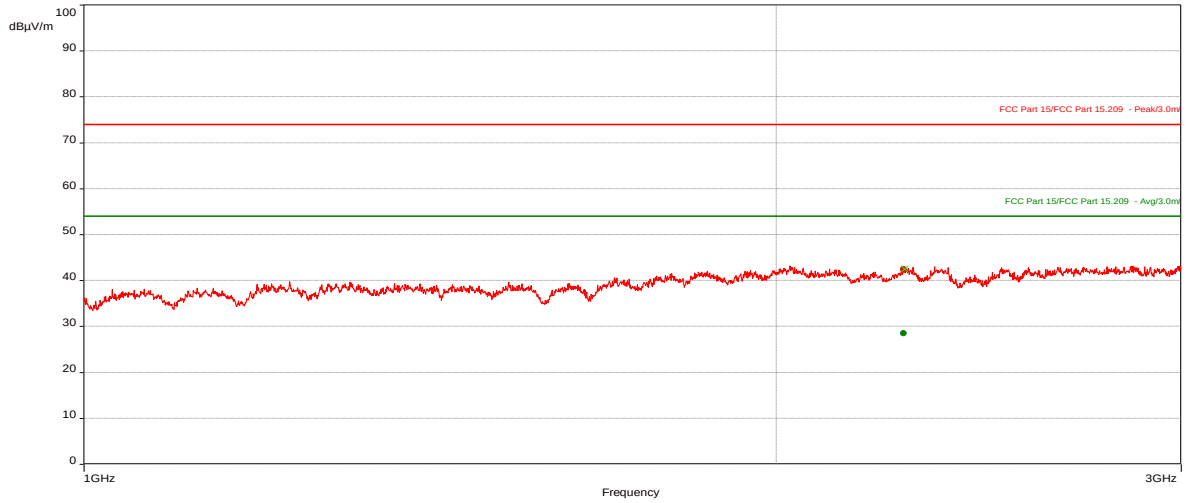
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.5828	16.01	30.00	-13.99	175.00	4.00	Horizontal	120k	20	-12.95
31.9477	14.94	30.00	-15.06	108.10	3.27	Horizontal	120k	20	-13.85
117.7817	9.23	33.50	-24.27	44.90	3.15	Horizontal	120k	20	-18.91
199.9589	8.58	33.50	-24.92	110.10	1.62	Horizontal	120k	20	-19.22
749.6962	17.07	36.00	-18.93	267.40	2.47	Vertical	120k	20	-8.64
919.0882	19.01	36.00	-16.99	126.30	4.00	Horizontal	120k	20	-5.76

Zigbee (Plastic Enclosure) Tx Mid Channel, RE 1-3 GHz

Test Information:

Date and Time	4/4/2024 12:44:05 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 34: Zigbee (Plastic Enclosure), Tx Mid Channel, RE 1-3 GHz

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
2272.044	42.46	74.00	-31.54	348.00	4.00	Vertical	1M	20	-18.08

AVG (PASS) (1)

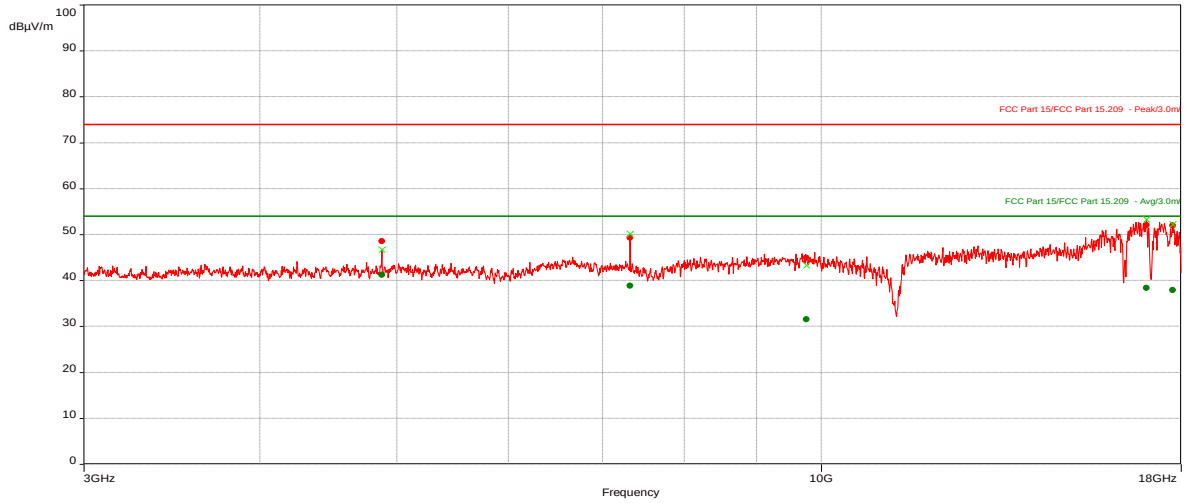
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
2272.044	28.55	54.00	-25.45	348.00	4.00	Vertical	1M	20	-18.08

Zigbee (Plastic Enclosure) Tx Mid Channel, RE 3-18 GHz

Test Information:

Date and Time	4/4/2024 1:49:55 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 37: Zigbee (Plastic Enclosure), Tx Mid Channel, RE 3-18 GHz

Graph:



Results:

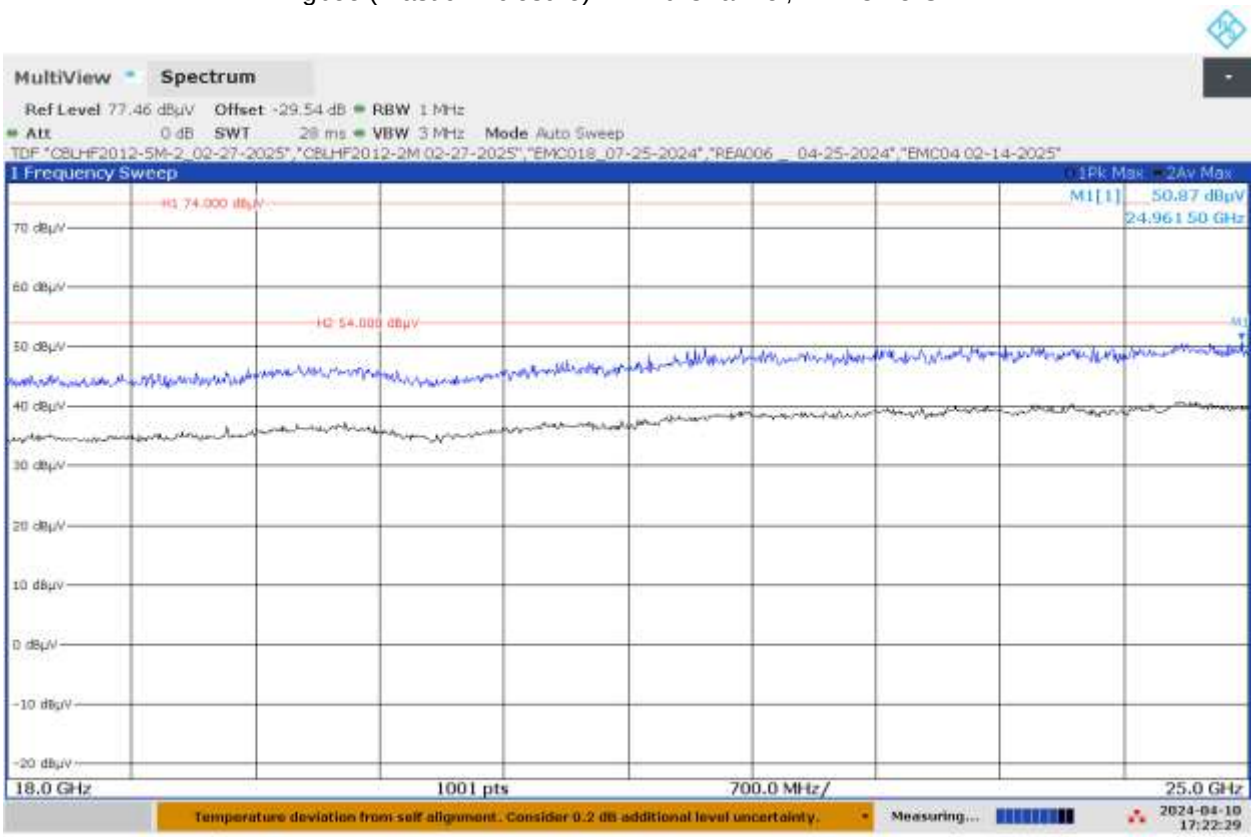
Peak (PASS) (5)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
4880.137	48.60	74.00	-25.4	0.00	1.00	Horizontal	1M	20	-13.49
7321.524	49.32	74.00	-24.68	0.00	4.00	Vertical	1M	20	-10.18
9763.329	44.94	74.00	-29.06	0.00	1.00	Vertical	1M	20	-7.69
17012.696	52.13	74.00	-21.87	265.50	4.00	Horizontal	1M	20	2.11
17758.972	52.01	74.00	-21.99	360.00	1.00	Horizontal	1M	20	2.34

AVG (PASS) (5)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
4880.137	41.24	54.00	-12.76	0.00	1.00	Horizontal	1M	20	-13.49
7321.524	38.85	54.00	-15.15	0.00	4.00	Vertical	1M	20	-10.18
9763.329	31.54	54.00	-22.46	0.00	1.00	Vertical	1M	20	-7.69
17012.696	38.45	54.00	-15.55	265.50	4.00	Horizontal	1M	20	2.11
17758.972	37.95	54.00	-16.05	360.00	1.00	Horizontal	1M	20	2.34

Zigbee (Plastic Enclosure) Tx Mid Channel, RE 18-25 GHz



05:22:30 PM 04/10/2024

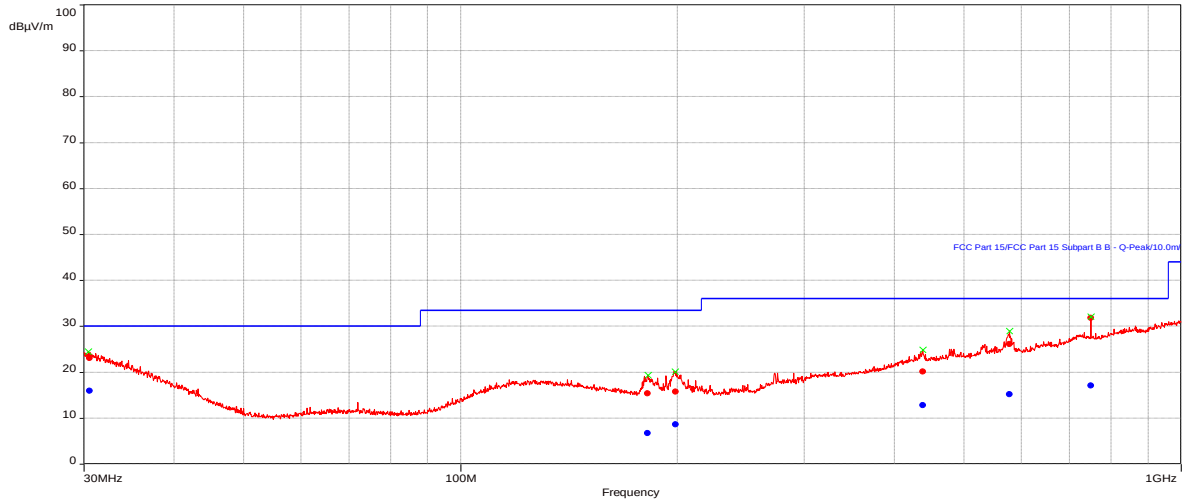
Notes: Testing was performed manually around the EUT at 10cm distance. No emission was detected above the test instrument noise floor. The cable loss, antenna factor, filter loss, and pre-amp gain were compensated as transducer factor (TDF) and the distance factor was compensated as Reference Offset

Zigbee (Plastic Enclosure) Tx High Channel, RE 30-1000 MHz

Test Information:

Date and Time	4/2/2024 1:42:52 PM
Client and Project Number	Sargent / Assa Abloy
Engineer	Kouma Sinn
Temperature	23 C
Humidity	27 %
Atmospheric Pressure	1008 mbars
Comments	Scan 6: Zigbee (Plastic Enclosure), Tx High Channel, RE 30-1000 MHz

Graph:



Results:

Peak (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.5636	23.15	30.00	-6.85	66.50	4.00	Horizontal	120k	20	-12.94
181.691	15.38	33.50	-18.12	343.50	1.62	Horizontal	120k	20	-20.91
198.8409	15.80	33.50	-17.70	201.70	1.69	Vertical	120k	20	-19.27
437.8486	20.12	36.00	-15.88	213.00	2.99	Horizontal	120k	20	-14.44
577.6351	26.12	36.00	-9.88	6.60	2.99	Horizontal	120k	20	-11.68
749.8309	31.89	36.00	-4.11	137.10	4.00	Vertical	120k	20	-8.65

QuasiPeak (PASS) (6)

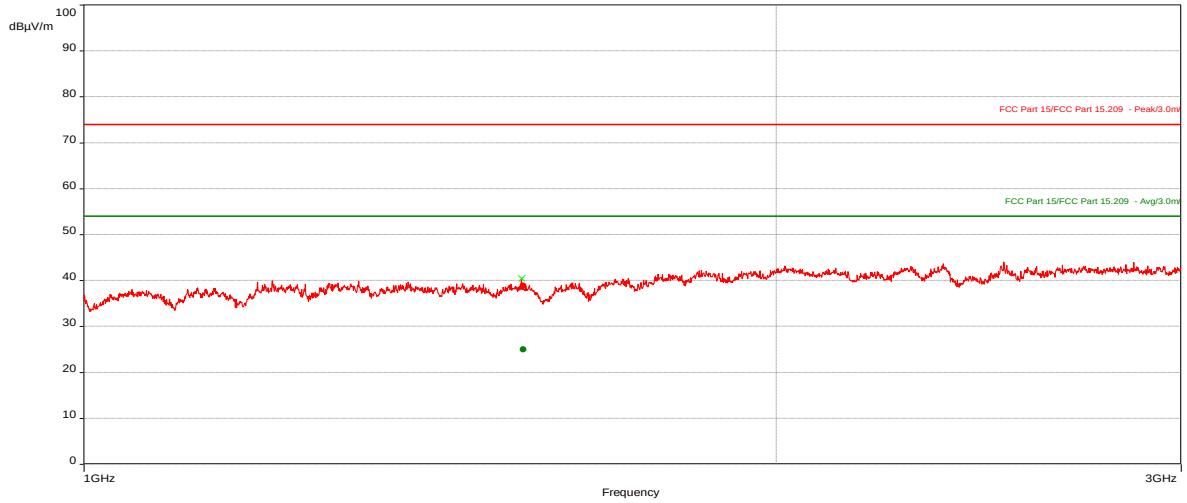
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.5636	16.02	30.00	-13.98	66.50	4.00	Horizontal	120k	20	-12.94
181.691	6.79	33.50	-26.71	343.50	1.62	Horizontal	120k	20	-20.91
198.8409	8.70	33.50	-24.80	201.70	1.69	Vertical	120k	20	-19.27
437.8486	12.83	36.00	-23.17	213.00	2.99	Horizontal	120k	20	-14.44
577.6351	15.19	36.00	-20.81	6.60	2.99	Horizontal	120k	20	-11.68
749.8309	17.15	36.00	-18.85	137.10	4.00	Vertical	120k	20	-8.65

Zigbee (Plastic Enclosure) Tx High Channel, RE 1-3 GHz

Test Information:

Date and Time	4/4/2024 12:29:26 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 33: Zigbee (Plastic Enclosure), Tx High Channel, RE 1-3 GHz

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
1552.482	38.84	74.00	-35.16	74.30	1.00	Horizontal	1M	20	-22.30

AVG (PASS) (1)

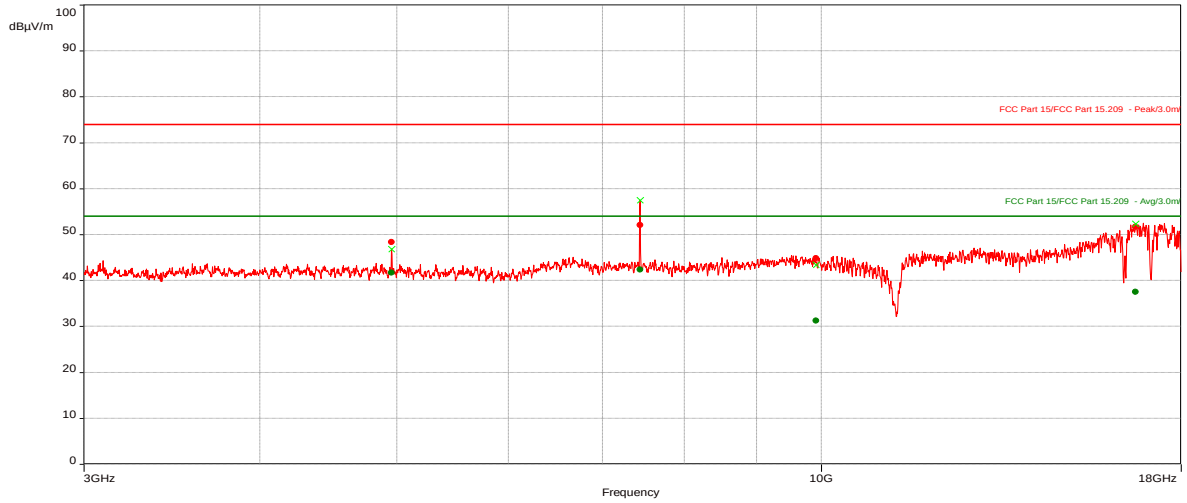
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
1552.482	24.99	54.00	-29.01	74.30	1.00	Horizontal	1M	20	-22.30

Zigbee (Plastic Enclosure) Tx High Channel, RE 3-18 GHz

Test Information:

Date and Time	4/4/2024 2:32:00 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 38: Zigbee (Plastic Enclosure), Tx High Channel, RE 3-18 GHz

Graph:



Results:

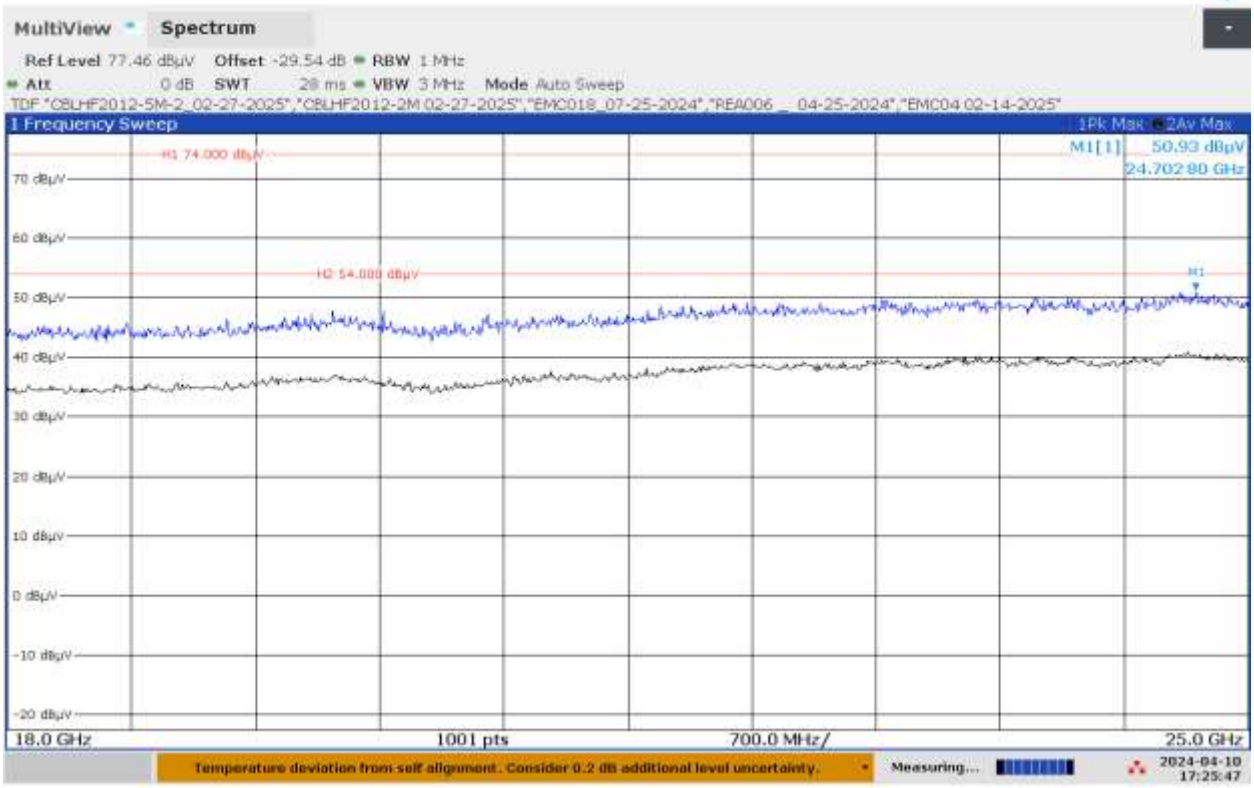
Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
4960.013	48.41	74.00	-25.59	0.00	1.00	Horizontal	1M	20	-13.45
7441.45	52.08	74.00	-21.92	265.60	4.00	Horizontal	1M	20	-10.16
9921.022	44.90	74.00	-29.1	265.70	1.00	Horizontal	1M	20	-7.40
16708.057	51.69	74.00	-22.31	265.50	4.00	Vertical	1M	20	1.92

AVG (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
4960.013	41.71	54.00	-12.29	0.00	1.00	Horizontal	1M	20	-13.45
7441.45	42.41	54.00	-11.59	265.60	4.00	Horizontal	1M	20	-10.16
9921.022	31.25	54.00	-22.75	265.70	1.00	Horizontal	1M	20	-7.40
16708.057	37.52	54.00	-16.48	265.50	4.00	Vertical	1M	20	1.92

Zigbee (Plastic Enclosure) Tx High Channel, RE 18-25 GHz



05:25:47 PM 04/10/2024

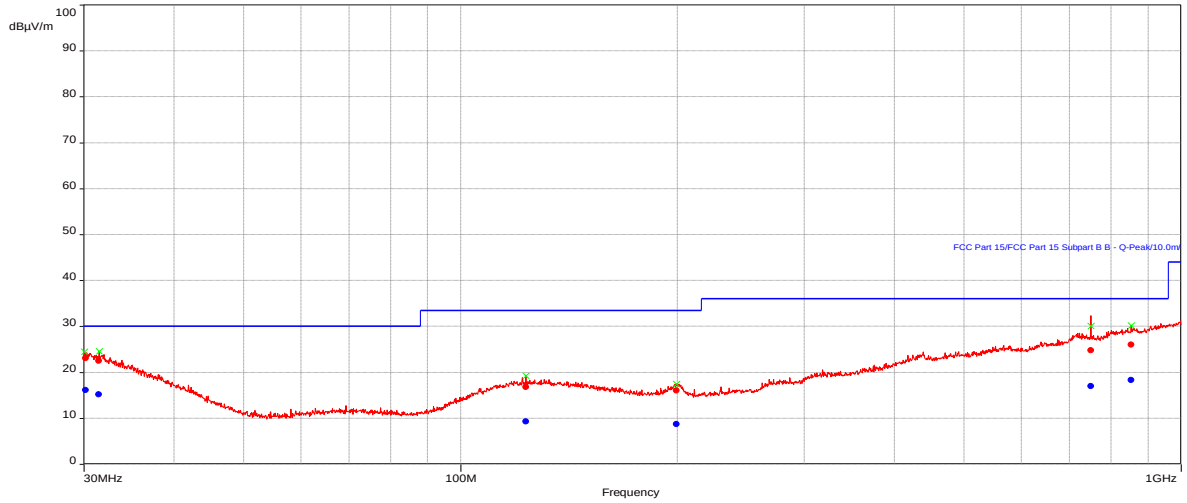
Notes: Testing was performed manually around the EUT at 10cm distance. No emission was detected above the test instrument noise floor. The cable loss, antenna factor, filter loss, and pre-amp gain were compensated as transducer factor (TDF) and the distance factor was compensated as Reference Offset

Zigbee (Metal Enclosure) Tx Low Channel, RE 30-1000 MHz

Test Information:

Date and Time	4/3/2024 1:15:34 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	1004 mbars
Comments	Scan 14: Zigbee (Metal Enclosure), Tx Low Channel, RE 30-1000 MHz

Graph:



Results:

Peak (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.1504	23.10	--	--	272.90	1.55	Vertical	120k	20	-12.70
31.4716	22.55	--	--	120.50	4.00	Horizontal	120k	20	-13.51
123.2653	16.80	--	--	338.10	4.00	Horizontal	120k	20	-18.55
199.2858	16.09	--	--	33.80	2.21	Vertical	120k	20	-19.23
749.9882	24.78	--	--	175.00	3.42	Vertical	120k	20	-8.66
853.252	26.09	--	--	299.80	3.59	Horizontal	120k	20	-6.59

QuasiPeak (PASS) (6)

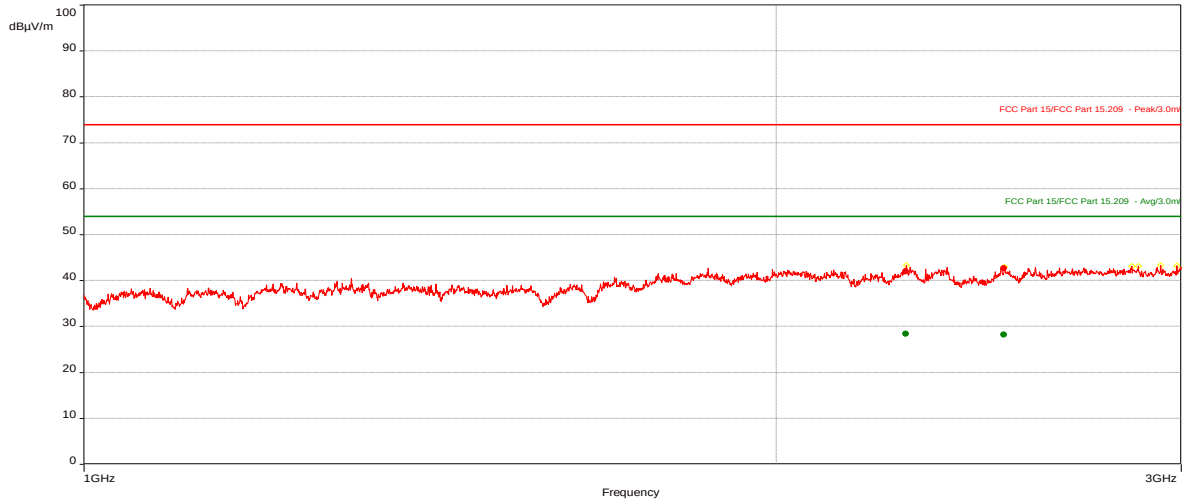
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.1504	16.20	30.00	-13.80	272.90	1.55	Vertical	120k	20	-12.70
31.4716	15.25	30.00	-14.75	120.50	4.00	Horizontal	120k	20	-13.51
123.2653	9.35	33.50	-24.15	338.10	4.00	Horizontal	120k	20	-18.55
199.2858	8.78	33.50	-24.72	33.80	2.21	Vertical	120k	20	-19.23
749.9882	17.01	36.00	-18.99	175.00	3.42	Vertical	120k	20	-8.66
853.252	18.31	36.00	-17.69	299.80	3.59	Horizontal	120k	20	-6.59

Zigbee (Metal Enclosure) Tx Low Channel, RE 1-3 GHz

Test Information:

Date and Time	4/4/2024 8:46:23 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 50: Zigbee (Metal Enclosure), Tx Low Channel, RE 1-3 GHz

Graph:



Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
2277.514	42.00	74.00	-32.00	230.80	4.00	Vertical	1M	20	-18.04
2512.527	42.67	74.00	-31.33	113.00	3.05	Horizontal	1M	20	-17.12

AVG (PASS) (2)

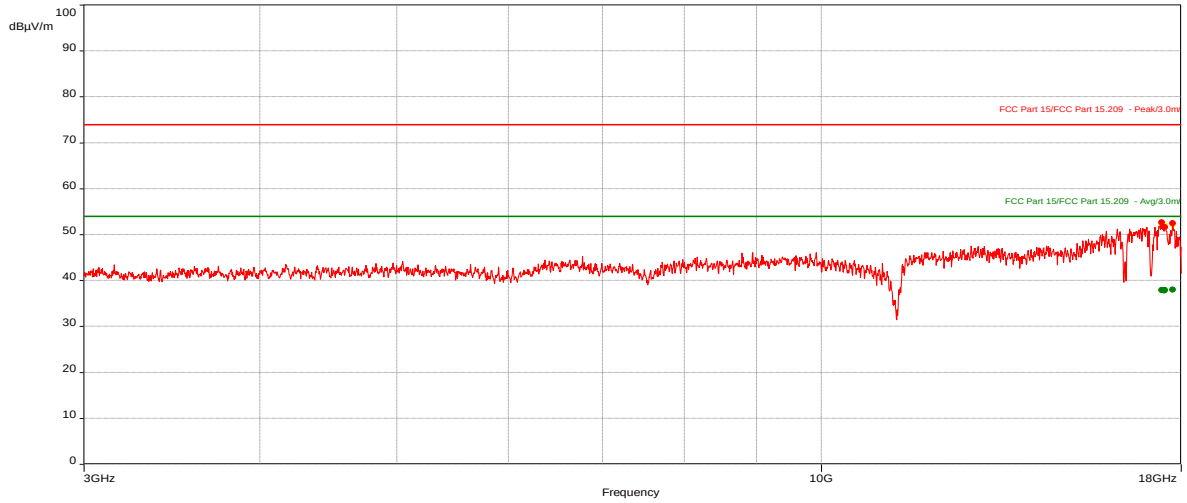
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
2277.514	28.38	54.00	-25.62	230.80	4.00	Vertical	1M	20	-18.04
2512.527	28.20	54.00	-25.80	113.00	3.05	Horizontal	1M	20	-17.12

Zigbee (Metal Enclosure) Tx Low Channel, RE 3-18 GHz

Test Information:

Date and Time	4/4/2024 10:00:32 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 53: Zigbee (Metal Enclosure), Tx Low Channel, RE 3-18 GHz

Graph:



Results:

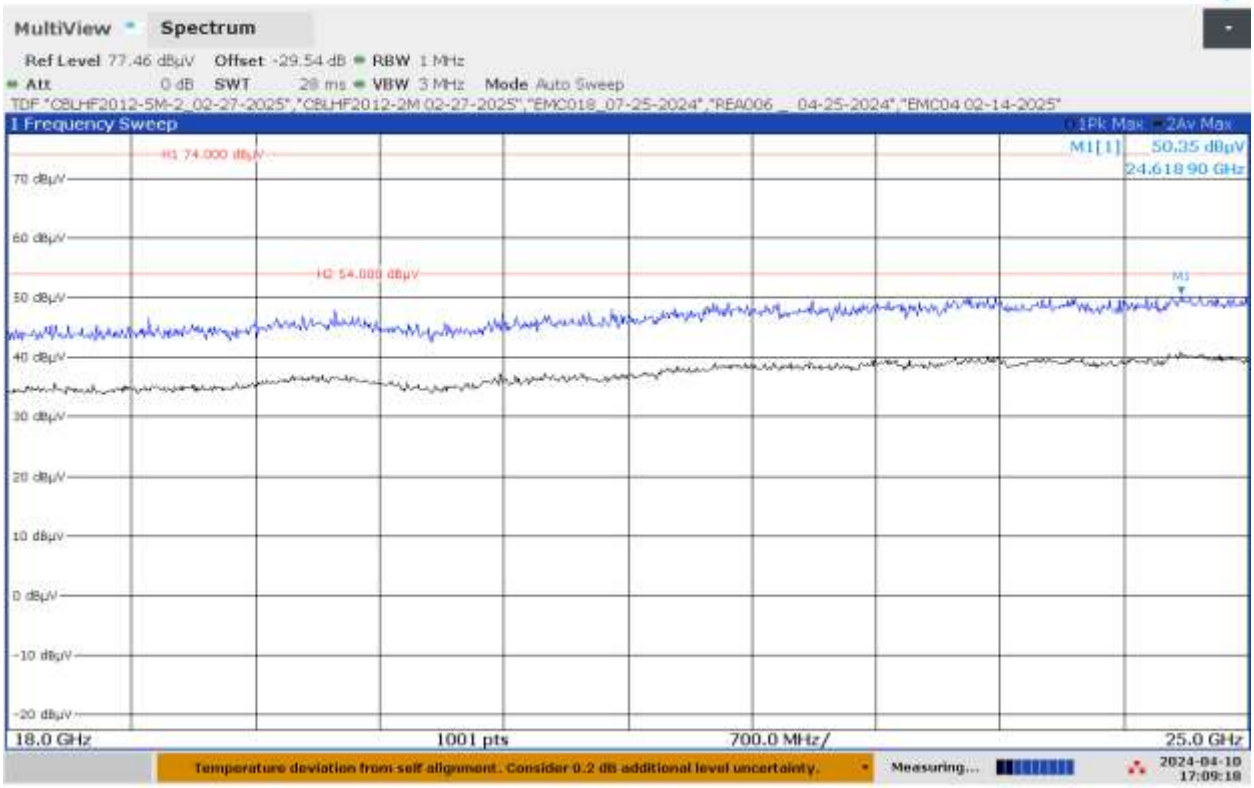
Peak (PASS) (4)

Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
17446.821	1	52.66	74.00	-21.34	265.40	4.00	Horizontal	1M	0.00	2.12
17524.587	1	51.62	74.00	-22.38	265.40	4.00	Horizontal	1M	0.00	2.16
17528.28	1	51.60	74.00	-22.40	265.40	1.00	Vertical	1M	0.00	2.16
17753.053	1	52.46	74.00	-21.54	360.00	4.00	Horizontal	1M	0.00	2.35

AVG (PASS) (4)

Frequency (MHz)	SR	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
17446.821	1	37.97	54.00	-16.03	265.40	4.00	Horizontal	1M	0.00	2.12
17524.587	1	37.82	54.00	-16.18	265.40	4.00	Horizontal	1M	0.00	2.16
17528.28	1	37.92	54.00	-16.08	265.40	1.00	Vertical	1M	0.00	2.16
17753.053	1	38.01	54.00	-15.99	360.00	4.00	Horizontal	1M	0.00	2.35

Zigbee (Metal Enclosure) Tx Low Channel, RE 18-25 GHz



05:09:18 PM 04/10/2024

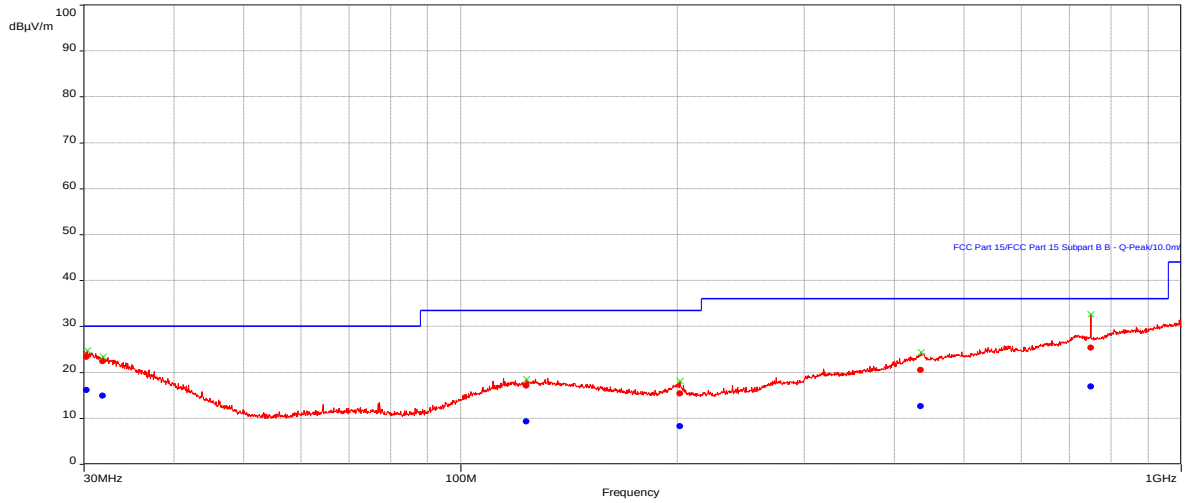
Notes: Testing was performed manually around the EUT at 10cm distance. No emission was detected above the test instrument noise floor. The cable loss, antenna factor, filter loss, and pre-amp gain were compensated as transducer factor (TDF) and the distance factor was compensated as Reference Offset

Zigbee (Metal Enclosure) Tx Mid Channel, RE 30-1000 MHz

Test Information:

Date and Time	4/3/2024 1:55:40 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	1004 mbars
Comments	Scan 15: Zigbee (Metal Enclosure), Tx Mid Channel, RE 30-1000 MHz

Graph:



Results:

Peak (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.2687	23.39	--	--	169.30	4.00	Horizontal	120k	20	-12.77
31.8587	22.44	--	--	277.60	2.54	Vertical	120k	20	-13.78
123.4889	17.12	--	--	294.70	1.69	Vertical	120k	20	-18.54
201.5566	15.44	--	--	332.50	2.63	Horizontal	120k	20	-19.39
435.1692	20.51	--	--	131.60	1.00	Vertical	120k	20	-14.45
749.9297	25.43	--	--	158.90	2.76	Horizontal	120k	20	-8.66

QuasiPeak (PASS) (6)

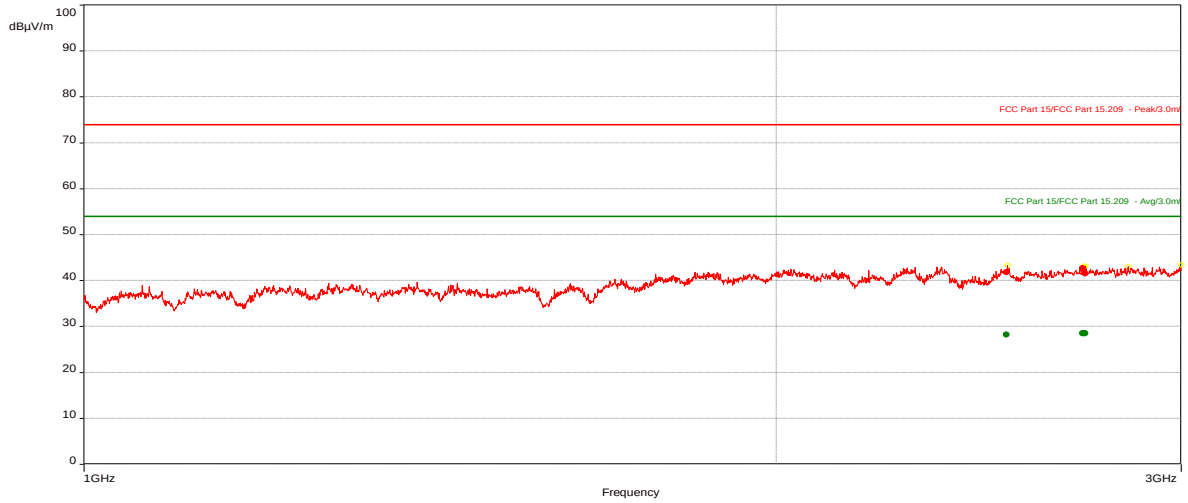
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.2687	16.12	30.00	-13.88	169.30	4.00	Horizontal	120k	20	-12.77
31.8587	14.94	30.00	-15.06	277.60	2.54	Vertical	120k	20	-13.78
123.4889	9.36	33.50	-24.14	294.70	1.69	Vertical	120k	20	-18.54
201.5566	8.24	33.50	-25.26	332.50	2.63	Horizontal	120k	20	-19.39
435.1692	12.66	36.00	-23.34	131.60	1.00	Vertical	120k	20	-14.45
749.9297	16.97	36.00	-19.03	158.90	2.76	Horizontal	120k	20	-8.66

Zigbee (Metal Enclosure) Tx Mid Channel, RE 1-3 GHz

Test Information:

Date and Time	4/4/2024 8:22:16 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 49: Zigbee (Metal Enclosure), Tx Mid Channel, RE 1-3 GHz

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
2518.333	41.85	74.00	-32.15	231.20	3.58	Horizontal	1M	20	-17.11
2718.776	42.72	74.00	-31.28	347.40	3.05	Horizontal	1M	20	-16.87
2722.6	42.21	74.00	-31.79	309.20	4.00	Vertical	1M	20	-16.87
2725.923	41.59	74.00	-32.41	74.10	3.58	Horizontal	1M	20	-16.88

AVG (PASS) (4)

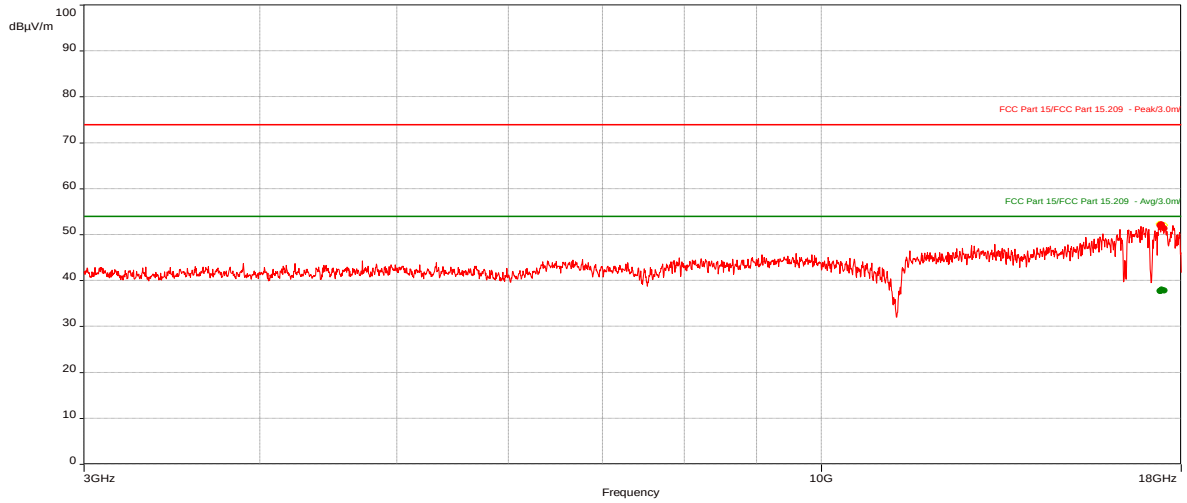
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
2518.333	28.25	54.00	-25.75	231.20	3.58	Horizontal	1M	20	-17.11
2718.776	28.56	54.00	-25.44	347.40	3.05	Horizontal	1M	20	-16.87
2722.6	28.53	54.00	-25.47	309.20	4.00	Vertical	1M	20	-16.87
2725.923	28.51	54.00	-25.49	74.10	3.58	Horizontal	1M	20	-16.88

Zigbee (Metal Enclosure) Tx Mid Channel, RE 3-18 GHz

Test Information:

Date and Time	4/4/2024 9:32:24 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 52: Zigbee (Metal Enclosure), Tx Mid Channel, RE 3-18 GHz

Graph:



Results:

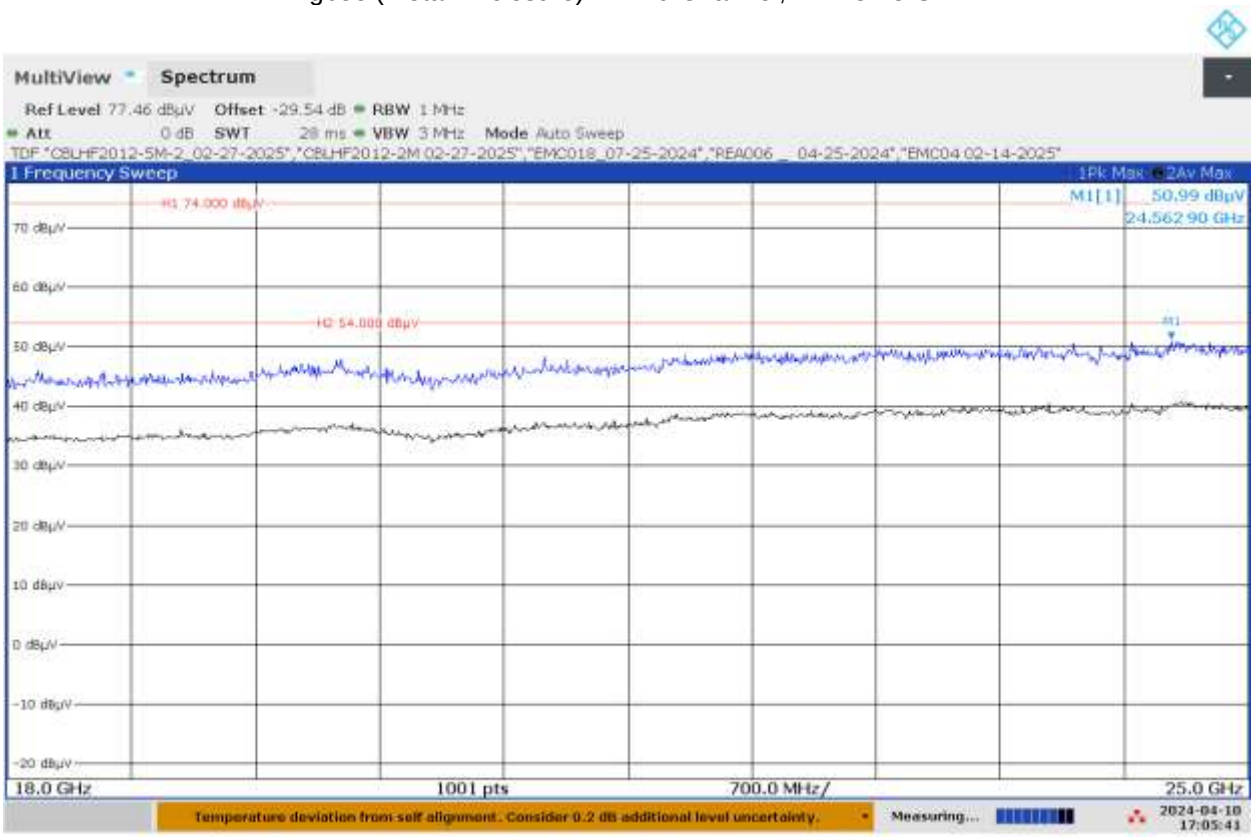
Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
17387.248	51.99	74.00	-22.01	360.00	4.00	Vertical	1M	0.00	2.00
17416.673	52.16	74.00	-21.84	0.00	4.00	Vertical	1M	0.00	2.06
17448.575	52.22	74.00	-21.78	360.00	1.00	Horizontal	1M	0.00	2.12
17520.852	51.37	74.00	-22.63	265.50	4.00	Horizontal	1M	0.00	2.16

AVG (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
17387.248	37.76	54.00	-16.24	360.00	4.00	Vertical	1M	0.00	2.00
17416.673	37.77	54.00	-16.23	0.00	4.00	Vertical	1M	0.00	2.06
17448.575	38.07	54.00	-15.93	360.00	1.00	Horizontal	1M	0.00	2.12
17520.852	37.86	54.00	-16.14	265.50	4.00	Horizontal	1M	0.00	2.16

Zigbee (Metal Enclosure) Tx Mid Channel, RE 18-25 GHz



05:05:41 PM 04/10/2024

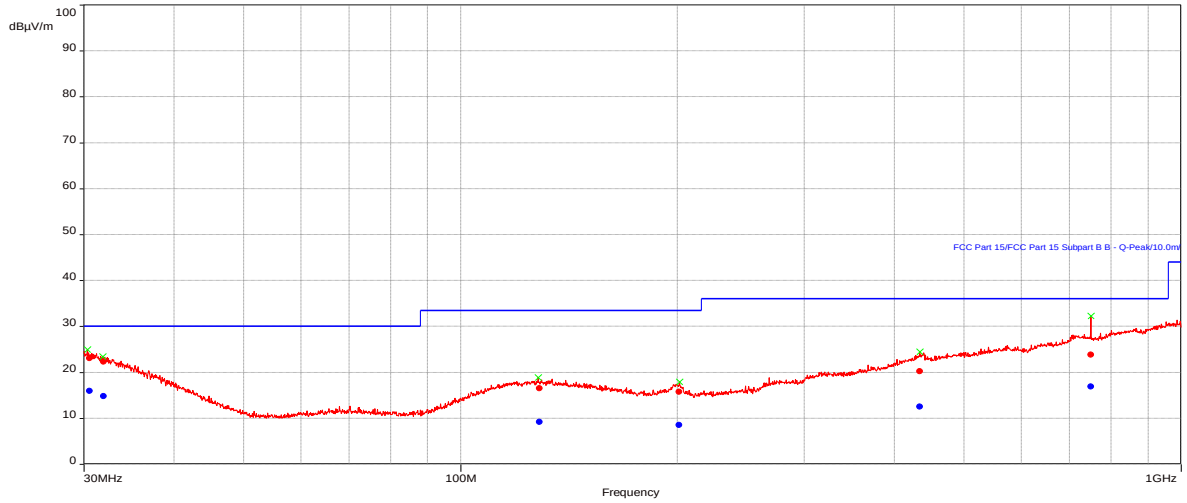
Notes: Testing was performed manually around the EUT at 10cm distance. No emission was detected above the test instrument noise floor. The cable loss, antenna factor, filter loss, and pre-amp gain were compensated as transducer factor (TDF) and the distance factor was compensated as Reference Offset

Zigbee (Metal Enclosure) Tx High Channel, RE 30-1000 MHz

Test Information:

Date and Time	4/3/2024 3:14:45 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	1004 mbars
Comments	Scan 16: Zigbee (Metal Enclosure), Tx High Channel, RE 30-1000 MHz

Graph:



Results:

Peak (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.5396	23.06	30.00	-6.94	306.50	2.37	Horizontal	120k	20	-12.92
31.9393	22.36	30.00	-7.64	0.00	4.00	Horizontal	120k	20	-13.84
128.7526	16.50	33.50	-17.00	262.10	3.83	Vertical	120k	20	-18.50
201.074	15.76	33.50	-17.74	310.50	2.99	Vertical	120k	20	-19.25
434.0939	20.21	36.00	-15.79	99.00	3.74	Vertical	120k	20	-14.54
750.0478	23.85	36.00	-12.15	343.70	4.00	Horizontal	120k	20	-8.66

QuasiPeak (PASS) (6)

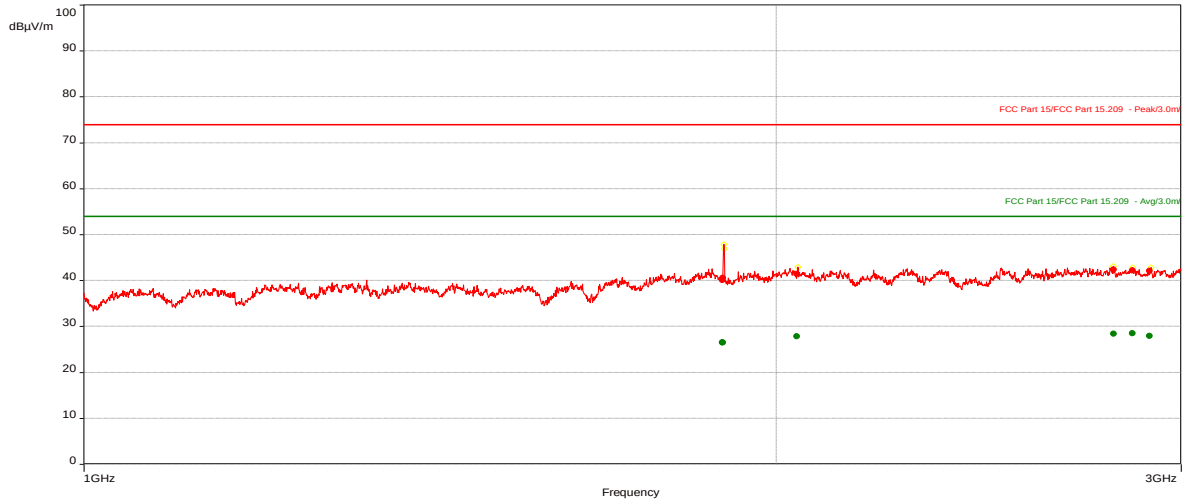
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.5396	15.94	30.00	-14.06	306.50	2.37	Horizontal	120k	20	-12.92
31.9393	14.85	30.00	-15.15	0.00	4.00	Horizontal	120k	20	-13.84
128.7526	9.22	33.50	-24.28	262.10	3.83	Vertical	120k	20	-18.50
201.074	8.59	33.50	-24.91	310.50	2.99	Vertical	120k	20	-19.25
434.0939	12.58	36.00	-23.42	99.00	3.74	Vertical	120k	20	-14.54
750.0478	16.94	36.00	-19.06	343.70	4.00	Horizontal	120k	20	-8.66

Zigbee (Metal Enclosure) Tx High Channel, RE 1-3 GHz

Test Information:

Date and Time	4/4/2024 7:53:03 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 48: Zigbee (Metal Enclosure), Tx High Channel, RE 1-3 GHz

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
1895.567	40.12	74.00	-33.88	74.00	1.98	Vertical	1M	20	-19.01
1896.206	40.59	74.00	-33.41	347.40	4.00	Vertical	1M	20	-19.00
2041.518	41.44	74.00	-32.56	348.70	3.58	Horizontal	1M	20	-18.11
2803.96	42.40	74.00	-31.60	308.80	1.98	Horizontal	1M	20	-16.71
2857.15	42.18	74.00	-31.82	347.10	3.05	Vertical	1M	20	-16.76
2907.246	42.10	74.00	-31.9	230.90	4.00	Horizontal	1M	20	-16.66

AVG (PASS) (6)

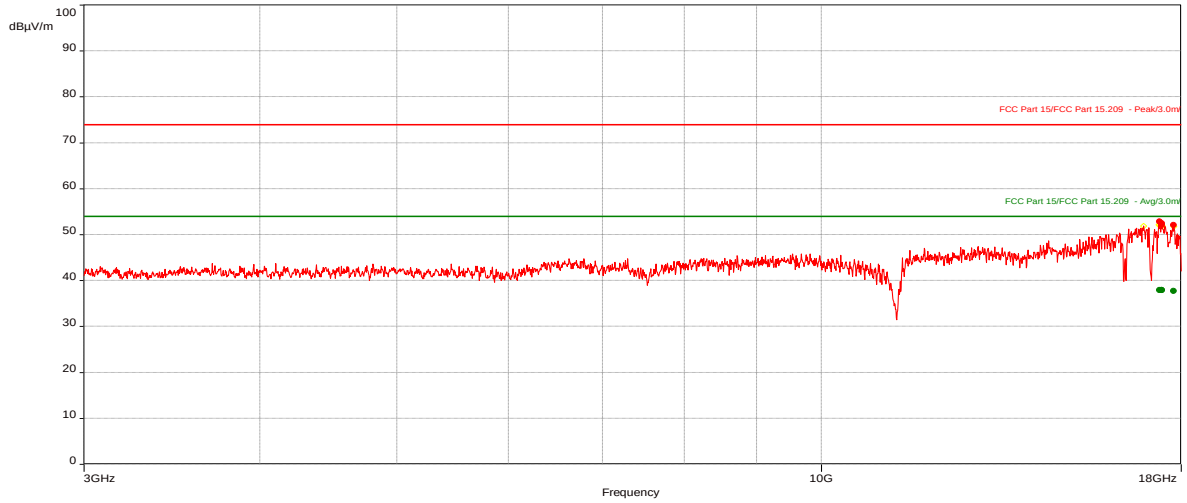
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
1895.567	26.54	54.00	-27.46	74.00	1.98	Vertical	1M	20	-19.01
1896.206	26.56	54.00	-27.44	347.40	4.00	Vertical	1M	20	-19.00
2041.518	27.88	54.00	-26.12	348.70	3.58	Horizontal	1M	20	-18.11
2803.96	28.44	54.00	-25.56	308.80	1.98	Horizontal	1M	20	-16.71
2857.15	28.54	54.00	-25.46	347.10	3.05	Vertical	1M	20	-16.76
2907.246	28.00	54.00	-26.00	230.90	4.00	Horizontal	1M	20	-16.66

Zigbee (Metal Enclosure) Tx High Channel, RE 3-18 GHz

Test Information:

Date and Time	4/4/2024 9:02:48 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Vathana Ven
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	984 mbars
Comments	Scan 51: Zigbee (Metal Enclosure), Tx High Channel, RE 3-18 GHz

Graph:



Results:

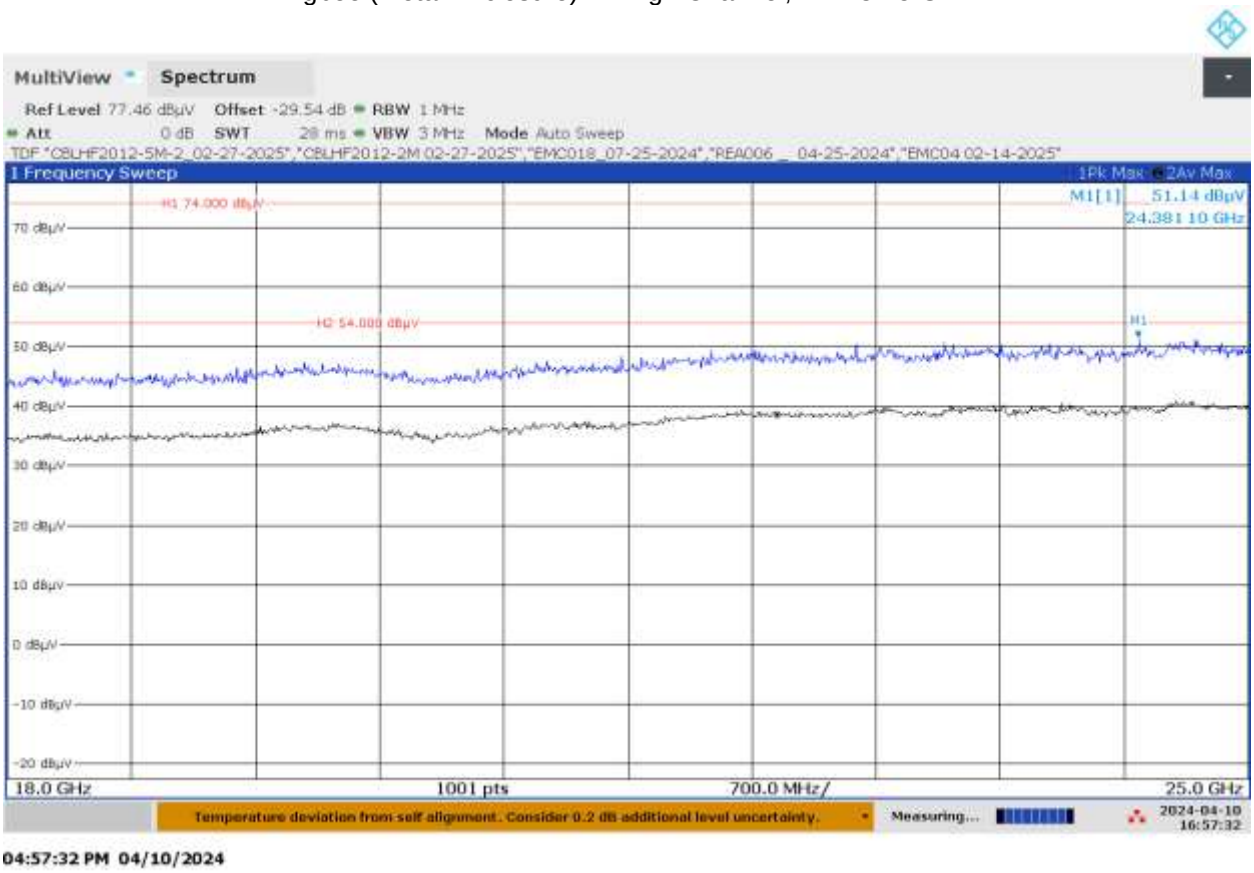
Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
17384.953	52.90	74.00	-21.10	360.00	1.00	Horizontal	1M	20	2.00
17444.906	52.09	74.00	-21.91	0.00	4.00	Vertical	1M	20	2.12
17445.262	52.50	74.00	-21.50	360.00	4.00	Vertical	1M	20	2.12
17789.519	52.08	74.00	-21.92	0.00	1.00	Vertical	1M	20	2.33

AVG (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
17384.953	37.96	54.00	-16.04	360.00	1.00	Horizontal	1M	20	2.00
17444.906	37.91	54.00	-16.09	0.00	4.00	Vertical	1M	20	2.12
17445.262	37.93	54.00	-16.07	360.00	4.00	Vertical	1M	20	2.12
17789.519	37.71	54.00	-16.29	0.00	1.00	Vertical	1M	20	2.33

Zigbee (Metal Enclosure) Tx High Channel, RE 18-25 GHz



04:57:32 PM 04/10/2024

Notes: Testing was performed manually around the EUT at 10cm distance. No emission was detected above the test instrument noise floor. The cable loss, antenna factor, filter loss, and pre-amp gain were compensated as transducer factor (TDF) and the distance factor was compensated as Reference Offset

Product Standard: CFR47 FCC Part 15.247, CFR47 FCC Part 15.209, RSS-247				Limit applied: See Report Section 10.2 Pretest Verification w/BB source: Yes			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
04/02/2024	Kouma Sinn	N/A	Battery Powered	Continuous Transmitting	23	27	1008
04/03/2024	Kouma Sinn	N/A	Battery Powered	Continuous Transmitting	22	28	1004
04/04/2024	Kouma Sinn	N/A	Battery Powered	Continuous Transmitting	22	28	984

Deviations, Additions, or Exclusions: None

11 Digital Device Radiated Spurious Emissions

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, ISED ICES-003, and ANSI C 63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of

1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the "Level" includes all losses and gains and is compared directly in the "Margin" column to the "Limit". The "Correction" includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the "Level" column.

11.2 Limit

§15.109 Radiated emission limits.

The field strength of radiated emissions form unintentional radiators at a distance of 3 meters shall not exceed the following values.

Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dBμV/m)
30-88	100	40.00
88-216	150	43.52
216-960	200	46.02
Above 960	500	54.00

Notes: The limits for ISED ICES-003 are the same as the FCC limits above.

11.3 Test Equipment Used:

Test equipment used from 30-1000 MHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
145-406'	10m Track A In-floor Cable #1	Huber + Suhner	sucoflex 160-19220mm	001	07/19/2023	07/19/2024
145-414'	Cable 145-414	Huber + Suhner	3m Track A cable	145-414	07/19/2023	07/19/2024
147-326'	Immunity Cable	Huber + Suhner	Sucoflex 106	233089-005	07/19/2023	07/19/2024
PRE11'	50dB gain pre-amp	Pasternack	PRE11	PRE11	09/15/2023	09/15/2024
145106'	Bilog Antenna (30MHz - 5GHz)	Sunol Sciences	JB5	A111003	09/14/2023	09/14/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024

Test equipment used from 1-13 GHz

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV007'	Weather Station Vantage Vue	Davis	6250	MS191212003	03/27/2024	03/27/2025
IW001'	2 meter cable	Insulated Wire	2801-NPS	001	07/19/2023	07/19/2024
HS001'	DC-18GHz cable 1.5m long	Huber & Suhner	SucoFlex 106A	HS001	01/30/2024	01/30/2025
HS002'	DC-18GHz cable 1.5M long	Huber & Suhner	SucoFlex 106A	HS002	07/19/2023	07/19/2024
145-408'	10m Chamber - 3m Track B In-floor Cable	Huber + Suhner	sucoflex 106-11000mm	001	07/19/2023	07/19/2024
PRE12'	Pre-amplifier	Com Power	PAM-118A	18040117	12/26/2023	12/26/2024
ETS002'	1-18GHz DRG Horn Antenna	ETS Lindgren	3117	00143260	10/16/2023	10/16/2024
ROS011'	ESW44 receiver 1Hz-44GHz	Rhode and Schwarz	ESW44	103296	06/28/2023	06/28/2024

Software Utilized:

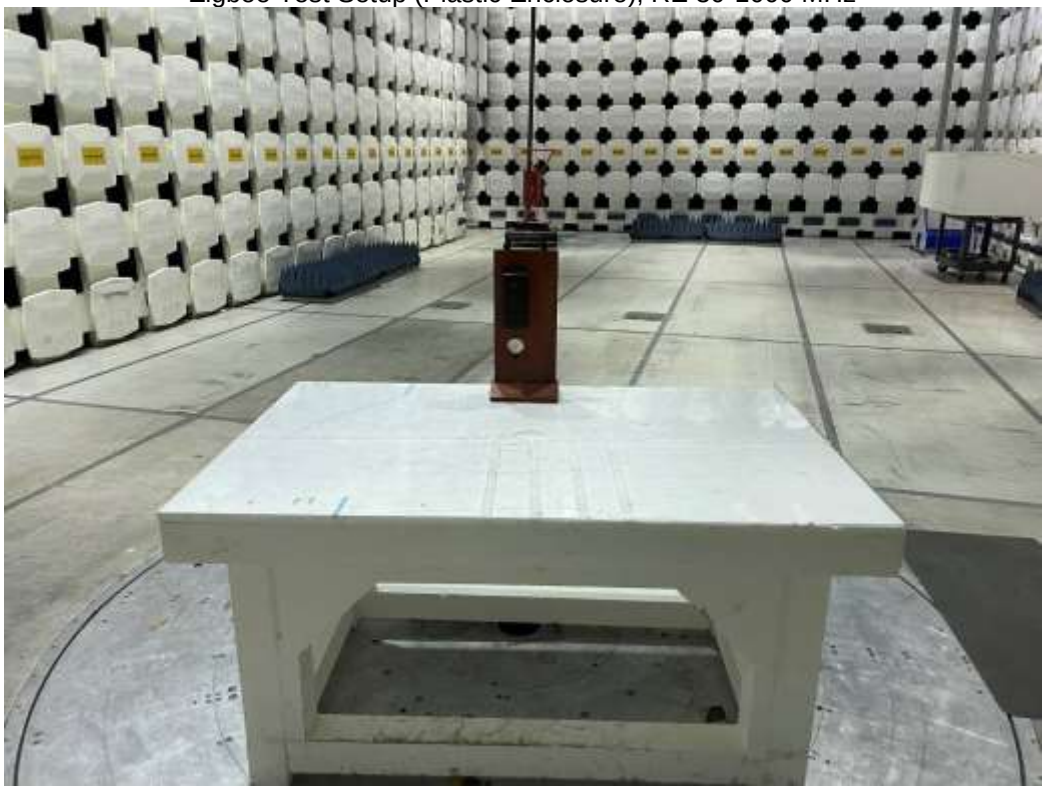
Name	Manufacturer	Version
BAT-EMC	Nexio	2022.0.27.0

11.4 Results:

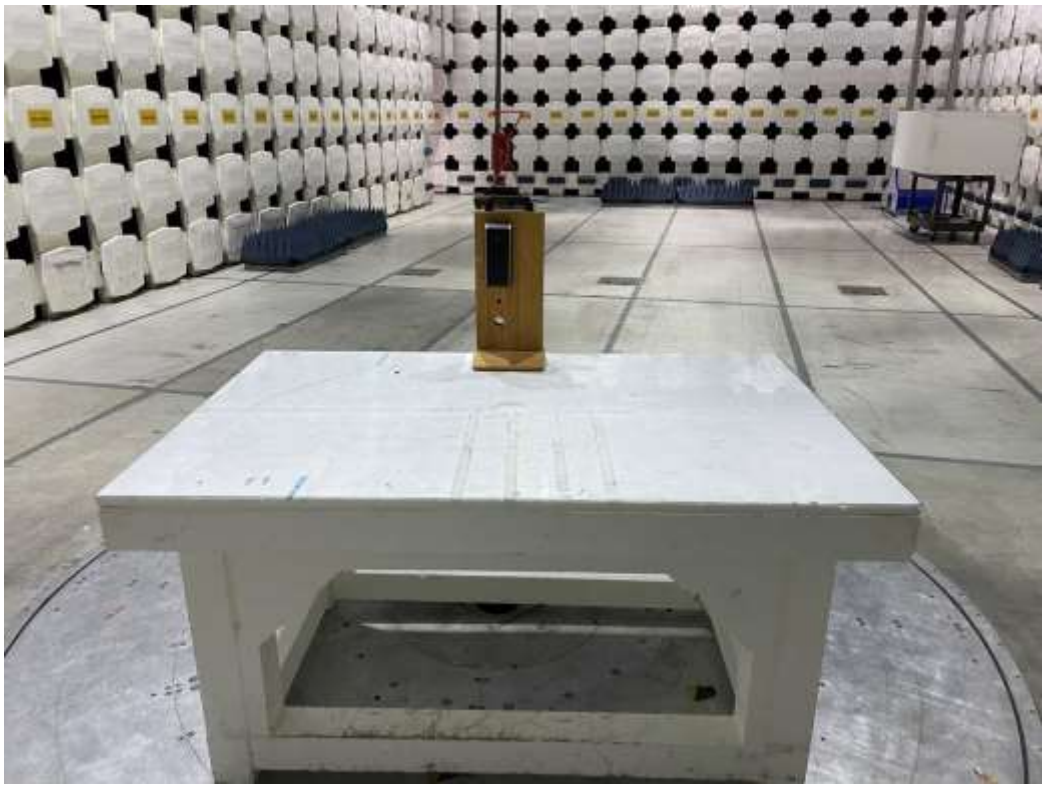
The sample tested was found to Comply.

11.5 Setup Photographs:

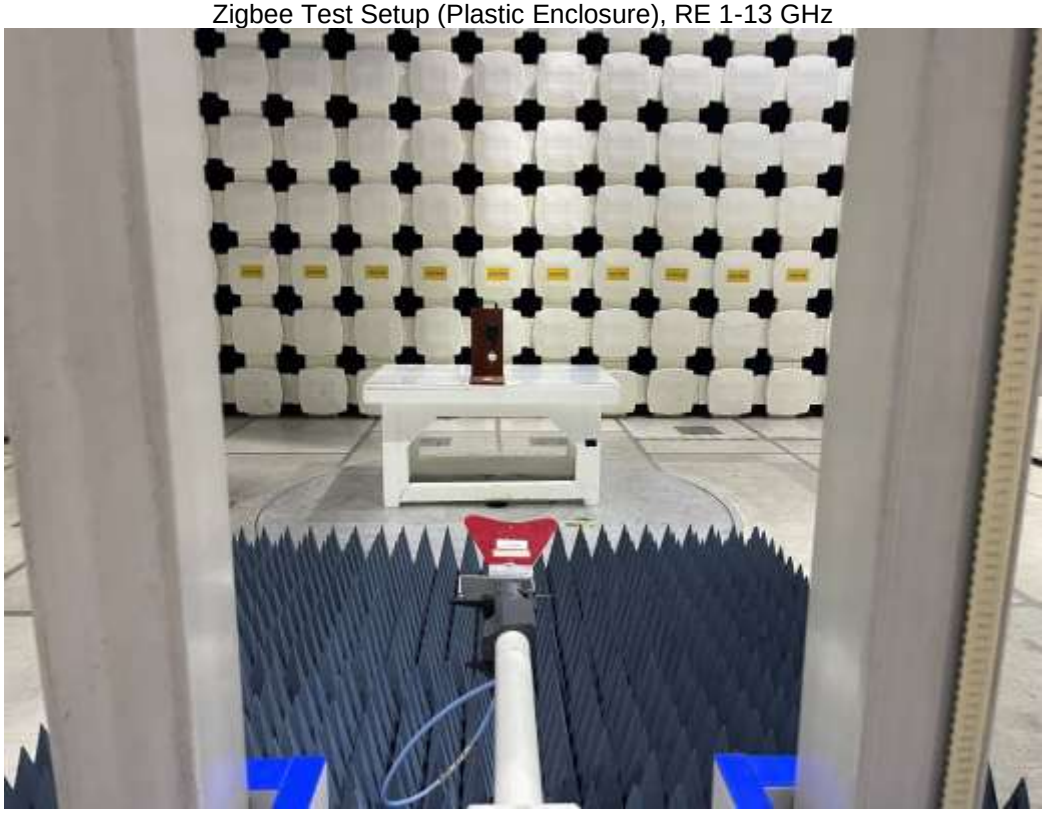
Zigbee Test Setup (Plastic Enclosure), RE 30-1000 MHz



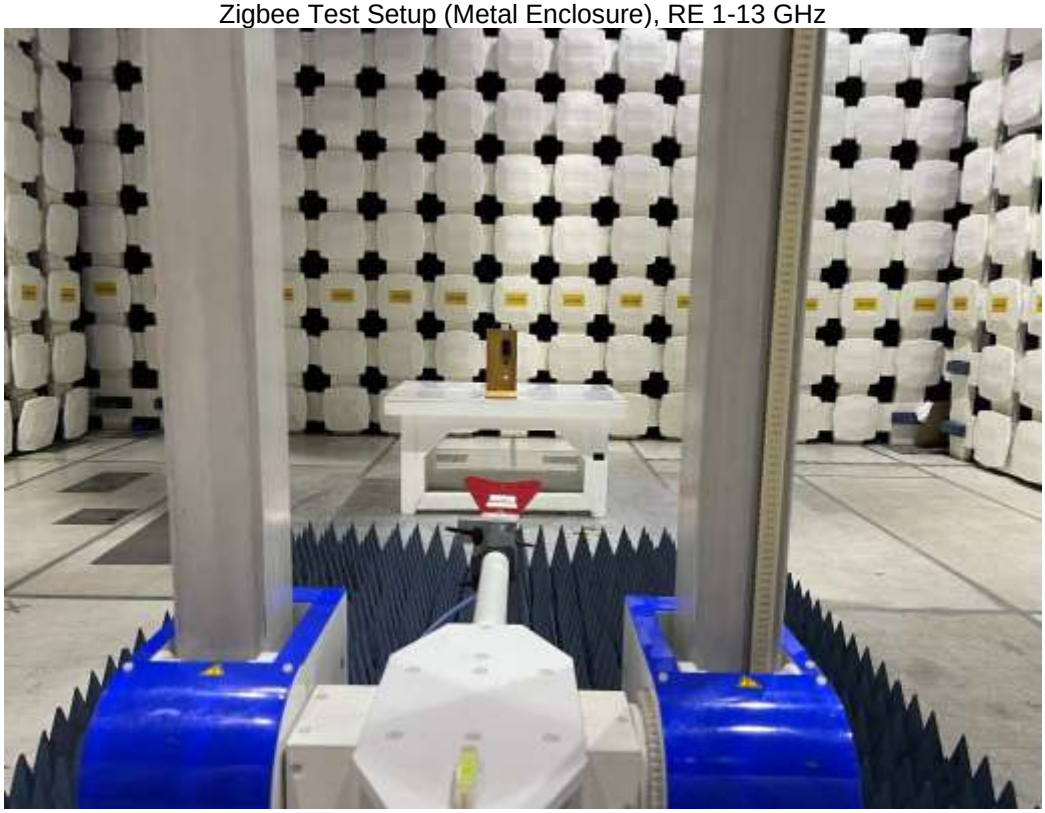
Zigbee Test Setup (Metal Enclosure), RE 30-1000 MHz



Zigbee Test Setup (Plastic Enclosure), RE 1-13 GHz



Zigbee Test Setup (Metal Enclosure), RE 1-13 GHz



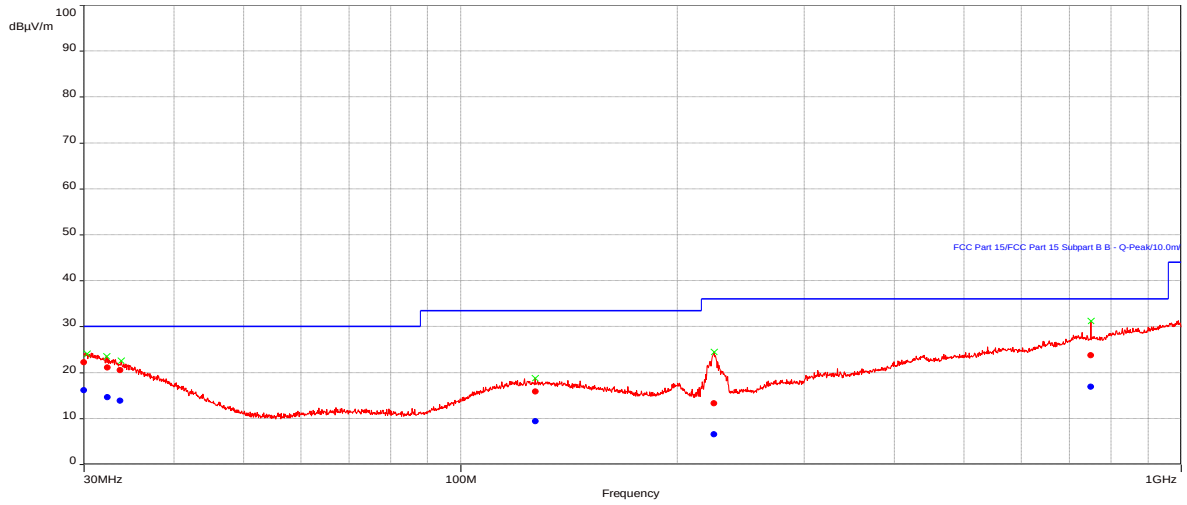
11.6 Plots/Data:

Zigbee (Plastic Enclosure) Radiated Emissions From 30-1000 MHz With Radio in Standby Mode

Test Information:

Date and Time	4/8/2024 10:12:37 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	26 deg C
Humidity	21 %
Atmospheric Pressure	1007 mbars
Comments	Scan 61: Zigbee (Plastic Enclosure), Standby Mode, RE 30-1000 MHz

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (20)	Correction (dB)
30.0022	22.24	--	--	310.50	4.00	Horizontal	120k	20	-12.62
32.3803	21.13	--	--	23.10	2.81	Vertical	120k	20	-14.10
33.7037	20.58	--	--	130.60	3.29	Horizontal	120k	20	-14.94
126.9959	15.92	--	--	99.00	3.21	Horizontal	120k	20	-18.52
224.7063	13.28	--	--	115.10	2.52	Horizontal	120k	20	-20.94
749.7306	23.80	--	--	72.00	4.00	Horizontal	120k	20	-8.64

QuasiPeak (PASS) (6)

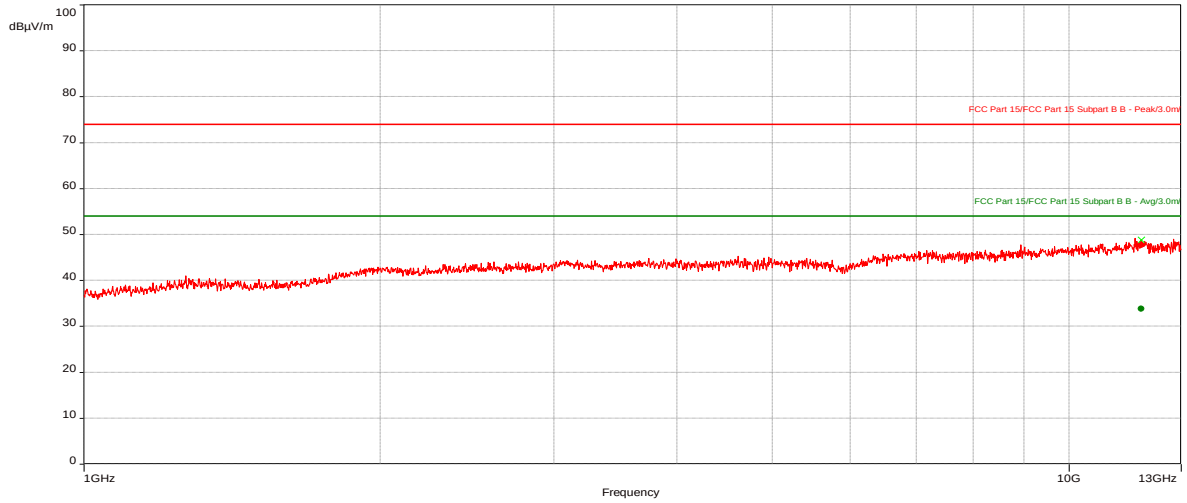
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (20)	Correction (dB)
30.0022	16.21	30.00	-13.79	310.50	4.00	Horizontal	120k	20	-12.62
32.3803	14.67	30.00	-15.33	23.10	2.81	Vertical	120k	20	-14.10
33.7037	13.85	30.00	-16.15	130.60	3.29	Horizontal	120k	20	-14.94
126.9959	9.38	33.50	-24.12	99.00	3.21	Horizontal	120k	20	-18.52
224.7063	6.59	36.00	-29.41	115.10	2.52	Horizontal	120k	20	-20.94
749.7306	16.92	36.00	-19.08	72.00	4.00	Horizontal	120k	20	-8.64

Zigbee (Plastic Enclosure) Radiated Emissions From 1-13 GHz With Radio in Standby Mode

Test Information:

Date and Time	4/8/2024 9:24:54 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	26 deg C
Humidity	21 %
Atmospheric Pressure	1007 mbars
Comments	Scan 60: Zigbee (Plastic Enclosure), Standby Mode, RE 1-13 GHz

Graph:



Results:

Peak (PASS) (1)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
11840.236	47.68	74	-26.32	360.00	1.00	Horizontal	1M	20	-4.55

AVG (PASS) (1)

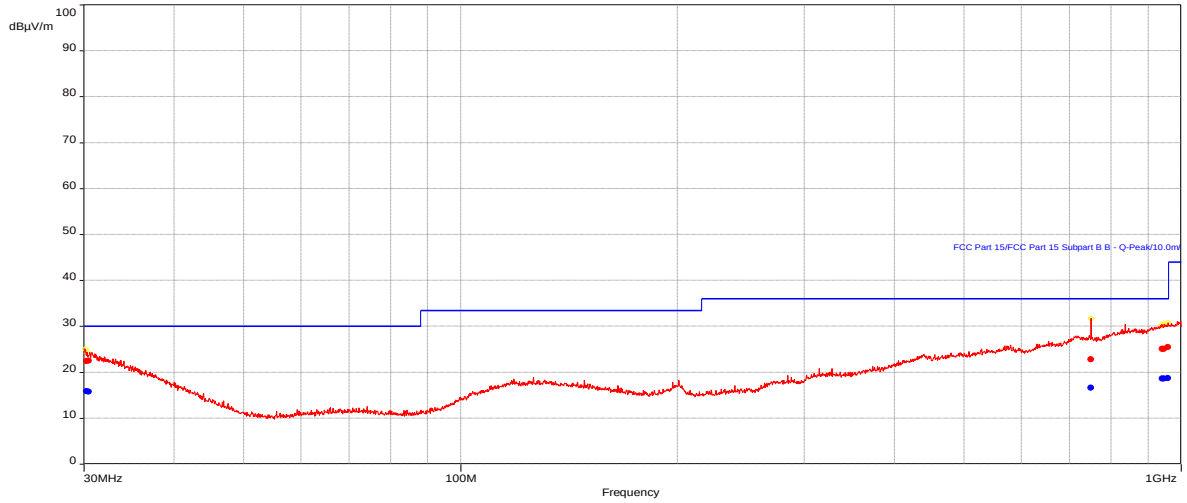
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
11840.236	33.89	54.00	-20.11	360.00	1.00	Horizontal	1M	20	-4.55

Zigbee (Metal Enclosure) Radiated Emissions From 30-1000 MHz With Radio in Standby Mode

Test Information:

Date and Time	4/10/2024 2:45:03 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	22 deg C
Humidity	28 %
Atmospheric Pressure	1009 mbars
Comments	Scan 64: Zigbee (Metal Enclosure), Standby Mode, RE 30-1000 MHz

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.2701	22.45	--	--	332.90	4.00	Vertical	120k	20	-12.77
30.4601	22.56	--	--	218.70	2.68	Horizontal	120k	20	-12.88
749.9925	22.78	--	--	126.30	3.55	Vertical	120k	20	-8.66
941.3075	25.14	--	--	273.10	2.67	Vertical	120k	20	-5.45
947.1955	25.11	--	--	34.00	4.00	Vertical	120k	20	-5.40
958.726	25.45	--	--	224.10	4.00	Vertical	120k	20	-5.17

QuasiPeak (PASS) (6)

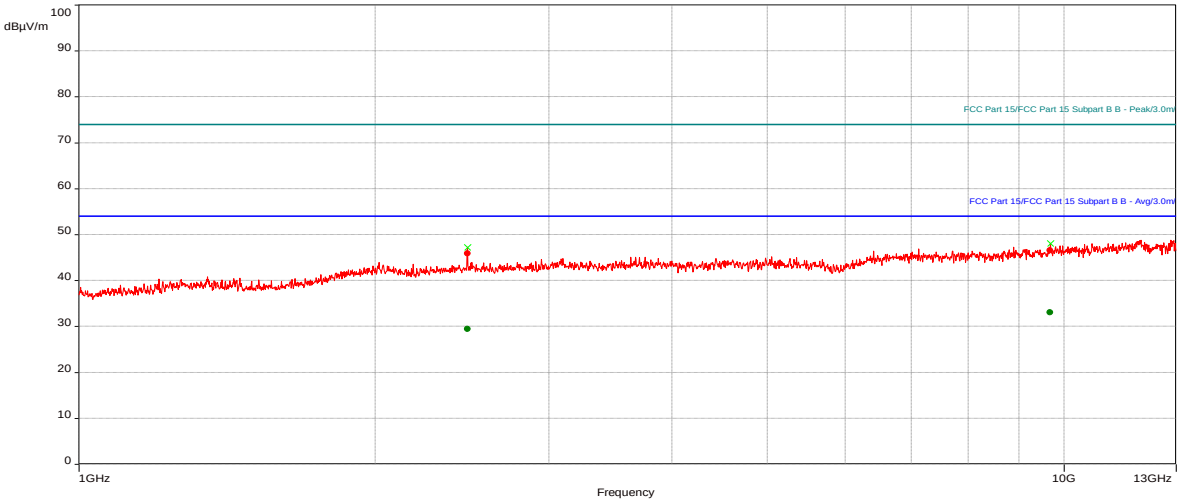
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (s)	Correction (dB)
30.2701	15.85	30.00	-14.15	332.90	4.00	Vertical	120k	20	-12.77
30.4601	15.78	30.00	-14.22	218.70	2.68	Horizontal	120k	20	-12.88
749.9925	16.61	36.00	-19.39	126.30	3.55	Vertical	120k	20	-8.66
941.3075	18.64	36.00	-17.36	273.10	2.67	Vertical	120k	20	-5.45
947.1955	18.65	36.00	-17.35	34.00	4.00	Vertical	120k	20	-5.40
958.726	18.72	36.00	-17.28	224.10	4.00	Vertical	120k	20	-5.17

Zigbee (Metal Enclosure) Radiated Emissions From 1-13 GHz With Radio in Standby Mode

Test Information:

Date and Time	4/8/2024 8:38:00 PM
Client and Project Number	Sargent Assa Abloy
Engineer	Kouma Sinn
Temperature	26 deg C
Humidity	21 %
Atmospheric Pressure	1007 mbars
Comments	Scan 57: Zigbee (Metal Enclosure), Standby Mode, RE 1-13 GHz

Graph:



Results:

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (20)	Correction (dB)
2480.449	45.93	74	-28.07	212.40	3.94	Vertical	1M	20	-17.21
9687.618	46.61	74	-27.39	212.40	4.00	Vertical	1M	20	-7.86

AVG (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time (20)	Correction (dB)
2480.449	29.46	54.00	-24.54	212.40	3.94	Vertical	1M	20	-17.21
9687.618	33.09	54.00	-20.91	212.40	4.00	Vertical	1M	20	-7.86

Product Standard: FCC 47CFR15 Part 15 Subpart B, ISED ICES-003				Limit applied: See Report Section 11.2 Pretest Verification w/BB source:Yes			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
04/08/2024	Kouma Sinn	Vathana Ven	Internal battery	Standby	26	21	1007
04/10/2024	Kouma Sinn	Vathana Ven	Internal battery	Standby	22	28	1009

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	05/29/2024	105746284BOX-001.zigbee	KPS	VFV	Original Issue