

Reliant MSO, LLC

TEST REPORT

SCOPE OF WORK

EMISSIONS TESTING – SAFEST V1.1

REPORT NUMBER

105935432BOX-002

ISSUE DATE

10/07/2024

[REVISED DATE(s)]

10/10/2024, 10/28/2024

11/01/2024

DOCUMENT CONTROL NUMBER

Non-Specific Radio Report Shell Rev. October 2022

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EMISSIONS TEST REPORT (FULL COMPLIANCE)

Report Number: 105935432BOX-002

Project Number: G105935432

Report Issue Date: 10/07/2024

Report Revision Date(s): 10/10/2024, 10/28/2024, 11/01/2024

Model(s) Tested: SAFEST V1.1

Model(s) Partially Tested: None

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

Standards: CFR47 FCC Part 15 Subpart C Section 15.255:2024

CFR47 FCC Part 15 Subpart B:2024

KDB 364244 D01 Meas 15.255 Radars v01

Tested by:
Intertek
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Reliant MSO, LLC
100 Front Street
Worcester, MA 01608
USA

Report prepared by



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Kouma Sinn / Sr. EMC Staff Engineer

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Report Number: 105935432BOX-002	Issued: 10/07/2024 Revised: 10/10/2024, 10/28/2024, 11/01/2024
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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	Equivalent Isotropic Radiated Power (EIRP) CFR47 FCC Part 15 Subpart C Section 15.255(c)(2)	Pass
7	Peak Conducted Output Power CFR47 FCC Part 15 Subpart C Section 15.255(c)(2)	Pass
8	Occupied Bandwidth CFR47 FCC Part 2.1049	Pass
9	Radiated Spurious Emissions CFR47 FCC Part 15 Subpart C Section 15.255(d), 15.205, 15.209	Pass
10	Frequency Stability CFR47 FCC Part 15 Subpart C Section 15.255(f)	Pass
11	Line-conducted Emissions CFR47 FCC Part 15 Subpart C Section 15.207	Pass
12	Appendix A – Mixers/Horn Conversion Loss Verification	---
13	Appendix B – Mixers/Horn Verification Certificates	---
14	Appendix C – Horn Antenna Factors and Derivations	---
15	Revision History	---

3 Client Information

This EUT was tested at the request of:

Client: Reliant MSO, LLC
100 Front Street
Worcester, MA 01608
USA

Contact: Larry Garber
Telephone: 508-527-3803
Fax: 774-261-1108
Email: Lawrence.Garber@ReliantMedicalGroup.org

4 Description of Equipment Under Test and Variant Models

Manufacturer: Violet Manufacturing Department, Reliant MSO, LLC
100 Front Street
Worcester, MA 01608
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
SAFEST	Violet Manufacturing Department, Reliant MSO, LLC	SAFEST V1.1	1

Receive Date:	09/26/2024
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

64GHz mmWave wall-mounted radar device to monitor and wirelessly report activity of people exclusive in dry indoor locations.

The device contained the wireless radio module, FCC ID: 2AC7Z-ESPWROOMDA

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
5VDC	2.4 A	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	mmWave radar continuous sweep alone
2	mmWave radar continuous sweep with Wi-Fi
3	mmWave radar continuous sweep with Bluetooth Classic
4	mmWave radar continuous sweep with BLE

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	mmWave activity sensing

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Radio/Receiver Characteristics	
Frequency Band(s)	60.75-63.98 GHz
Modulation Type(s)	FMCW
Peak Equivalent Isotropic Radiated Power (EIRP)	-3.77 dB(m)
Peak Conducted Output Power	-11.51 dB(m)
Test Channels	Continuous Sweep
Occupied Bandwidth	3.198 GHz
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	Standalone
Antenna Type and Gain	Integral antenna, 7.74 dBi

Variant Models:

The following variant models were not tested as part of this evaluation and are not eligible for certification; 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

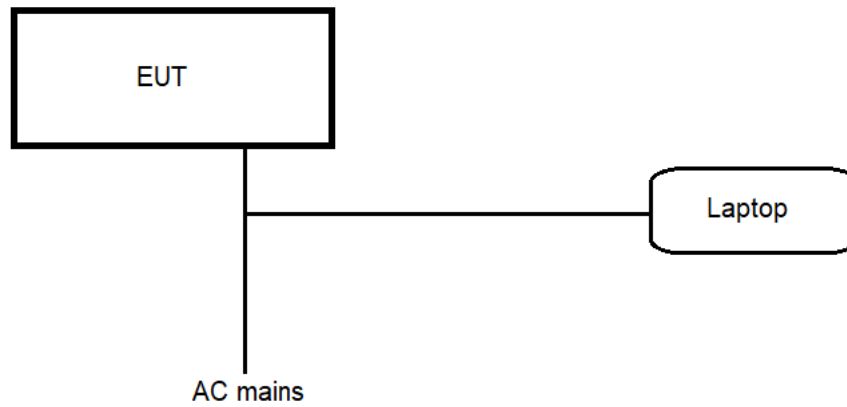
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	USB-C to USB-C 3.1 cable	2	Foil	N/A	AC adapter and USB-A to USB-A cable
2	USB-A to USB-A cable	15.24	Foil	N/A	PC

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	Frame Work	Laptop 16	Not labeled
AC adapter	45W PD Adapter	44909	Not labeled

5.1 Method:

Configuration as required by CFR47 FCC Part 15C:2024, 15.255. CFR47 FCC Part 15B:2024, KDB 364244 D01 Meas 15.255 Radars v01, and ANSI C63.10:2020.

5.2 EUT Block Diagram:



6 Peak Equivalent Isotropic Radiated Power (EIRP)

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.255, KDB 364244 D01 Meas 15.255 Radars v01, and ANSI C63.10.

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.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	5.0 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.9 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.1 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7 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 dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

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.

6.2 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
CBLHF2012-5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/27/2024	02/27/2025
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/22/2023	11/22/2024
OML3'	WR12 Harmonic Mixer, 60 to 90GHz	Oleson Microwave Lab	M12HWD	E21011-1	02/12/2024	02/12/2025
OML3'	OML Horn Antenna, 60 to 90GHz	Oleson Microwave Lab	M12RH	Not labeled	02/12/2024	02/12/2025

Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

6.3 Results:

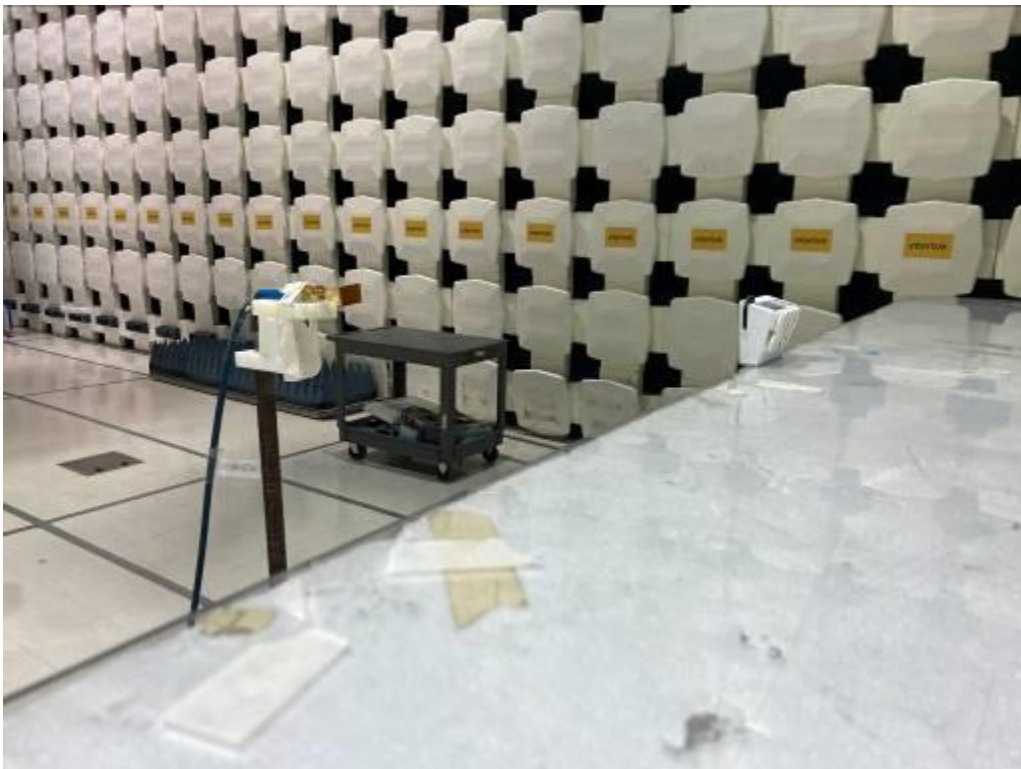
The sample tested was found to Comply.

§ 15.255 Operation within the band 57-71 GHz.

(c) **Radiated power limits.** Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP):

(2) Field disturbance sensors/radars shall not exceed -10 dBm peak conducted output power and 10 dBm peak EIRP.

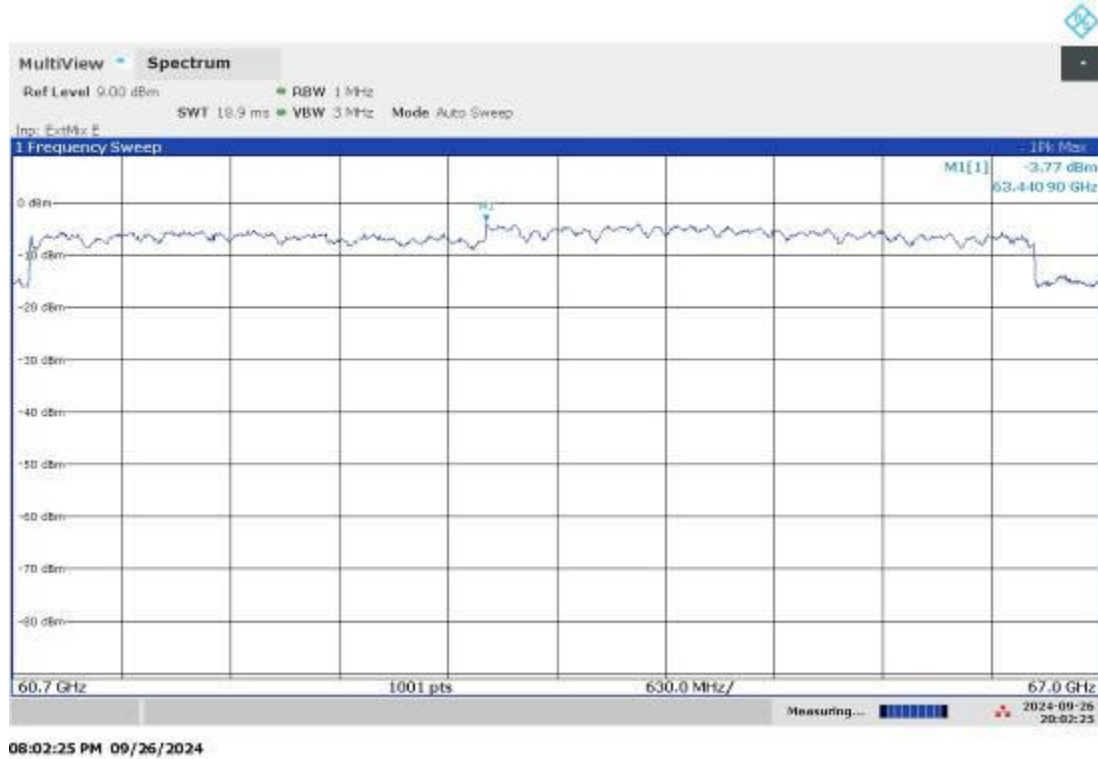
6.4 Setup Photographs:



Mixer/Horn Antenna was placed at far field of 0.52 m

6.5 Plots/Data:

EIRP with worst-case antenna polarity, worst-case orientation = - 3.77 dB(m)



Note 1: Hand scans were performed at close distance around the EUT with vertical and horizontal polarities to find the maximum emissions. The antenna was then moved and placed in a far field at 0.52 m.

Note 2: All factors, mixer conversion loss, antenna factors, cable factors, path loss factors, and distance factors were internally compensated.

Product Standard: CFR47 FCC Part 15.255				Limit applied: 10 dB(m) 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
09/26/2024	Vathana Ven <i>VSV</i>	N/A	120VAC 60Hz	Continuous sweep	24	48	1010

Deviations, Additions, or Exclusions: None

7 Peak Conducted Output Power

7.1 Method

Tests are performed in accordance with 15.255, KDB 364244 D01 Meas 15.255 Radars v01, and ANSI C63.10.

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.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	5.0 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.9 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.1 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7 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 dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V

AF = 7.4 dB/m

CF = 1.6 dB

AG = 29.0 dB

FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

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

NF = Net Reading in dB μ V

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0

UF = $10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$

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.

7.2 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
CBLHF2012-5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/27/2024	02/27/2025
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/22/2023	11/22/2024
OML3'	WR12 Harmonic Mixer, 60 to 90GHz	Oleson Microwave Lab	M12HWD	E21011-1	02/12/2024	02/12/2025
OML3'	OML Horn Antenna, 60 to 90GHz	Oleson Microwave Lab	M12RH	Not labeled	02/12/2024	02/12/2025

Software Utilized:

Name	Manufacturer	Version
None		

7.3 Results:

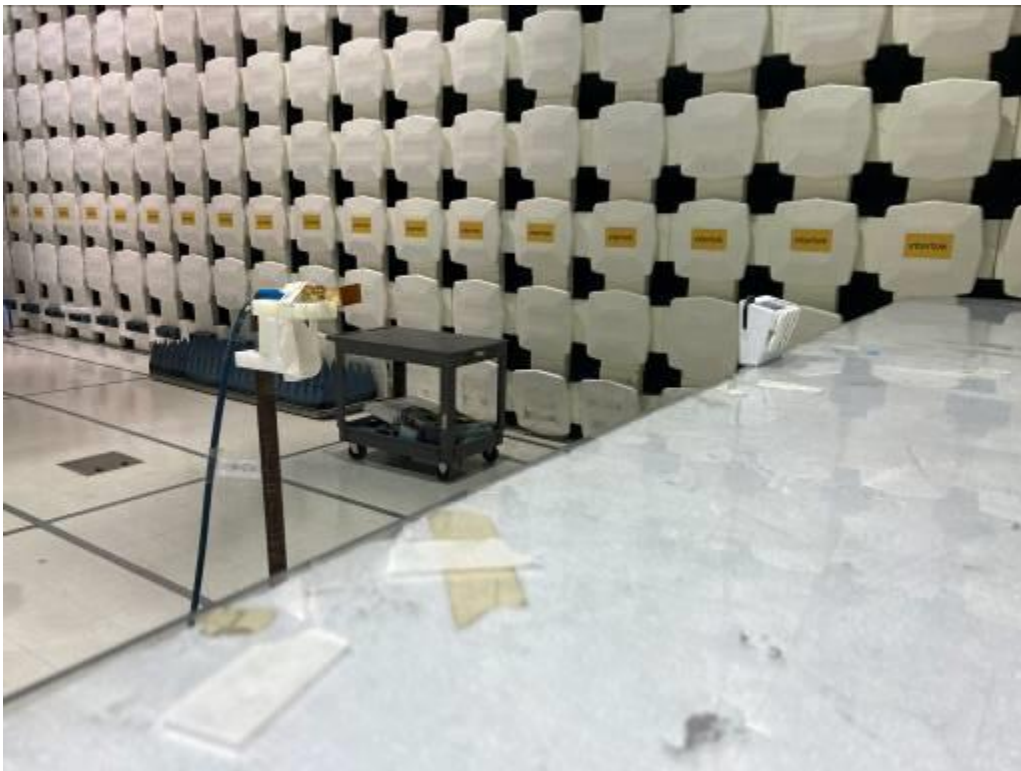
The sample tested was found to Comply.

§ 15.255 Operation within the band 57-71 GHz.

(c) **Radiated power limits.** Within the 57-71 GHz band, emission levels shall not exceed the following equivalent isotropically radiated power (EIRP):

(2) Field disturbance sensors/radars shall not exceed –10 dBm peak conducted output power and 10 dBm peak EIRP.

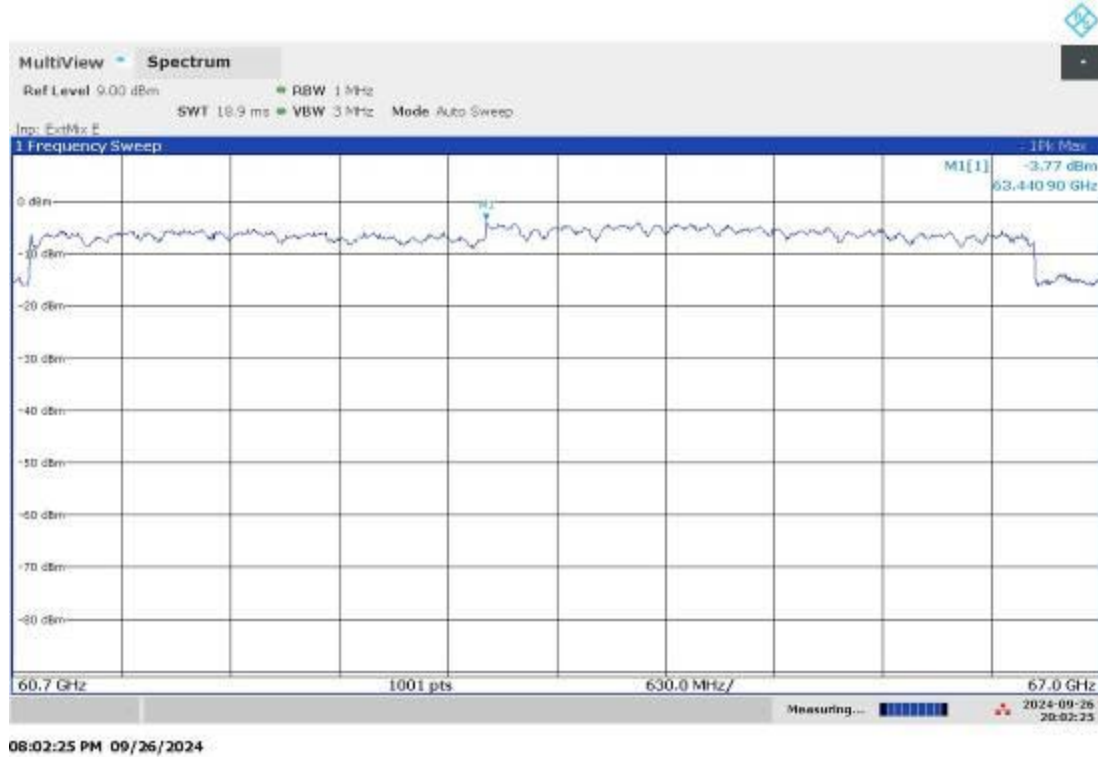
7.4 Setup Photographs:



Mixer/Horn Antenna was placed at far field of 0.52 m

7.5 Plots/Data:

EIRP with worst-case antenna polarity, worst-case orientation = - 3.77 dB(m) and Peak Conducted Output power = -11.51 dB(m)



Note 1: Hand scans were performed at close distance around the EUT with vertical and horizontal polarities to find the maximum emissions. The antenna was then moved and placed in a far field at 0.52 m.

Note 2: All factors, mixer conversion loss, antenna factors, cable factors, path loss factors, and distance factors were internally compensated.

Peak Conducted Output Power was obtained by using equation (23) of ANSI 63.10.

$$\text{EIRP} = P_{\text{cond}} + G_{\text{EUT}} \text{ or } P_{\text{cond}} = \text{EIRP} - G_{\text{EUT}}$$

$$P_{\text{cond}} = -3.77 \text{ dB(m)} - 7.74 \text{ dBi} = \underline{\underline{-11.51 \text{ dB(m)}}} \text{ which was below the limit of } -10 \text{ dB(m)}$$

Product Standard: CFR47 FCC Part 15.255					Limit applied: -10 dB(m) 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
09/26/2024	Vathana Ven <i>VSV</i>	N/A	120VAC 60Hz	Continuous sweep	24	48	1010

Deviations, Additions, or Exclusions: None

8 99% Occupied Bandwidth

8.1 Method

Tests are performed in accordance with CFR47 FCC Part 2.1049.

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 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
CBLHF2012-5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/27/2024	02/27/2025
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Schwartz	FSW43	100646	11/22/2023	11/22/2024
OML3'	WR12 Harmonic Mixer, 60 to 90GHz	Oleson Microwave Lab	M12HWD	E21011-1	02/12/2024	02/12/2025
OML3'	OML Horn Antenna, 60 to 90GHz	Oleson Microwave Lab	M12RH	Not labeled	02/12/2024	02/12/2025

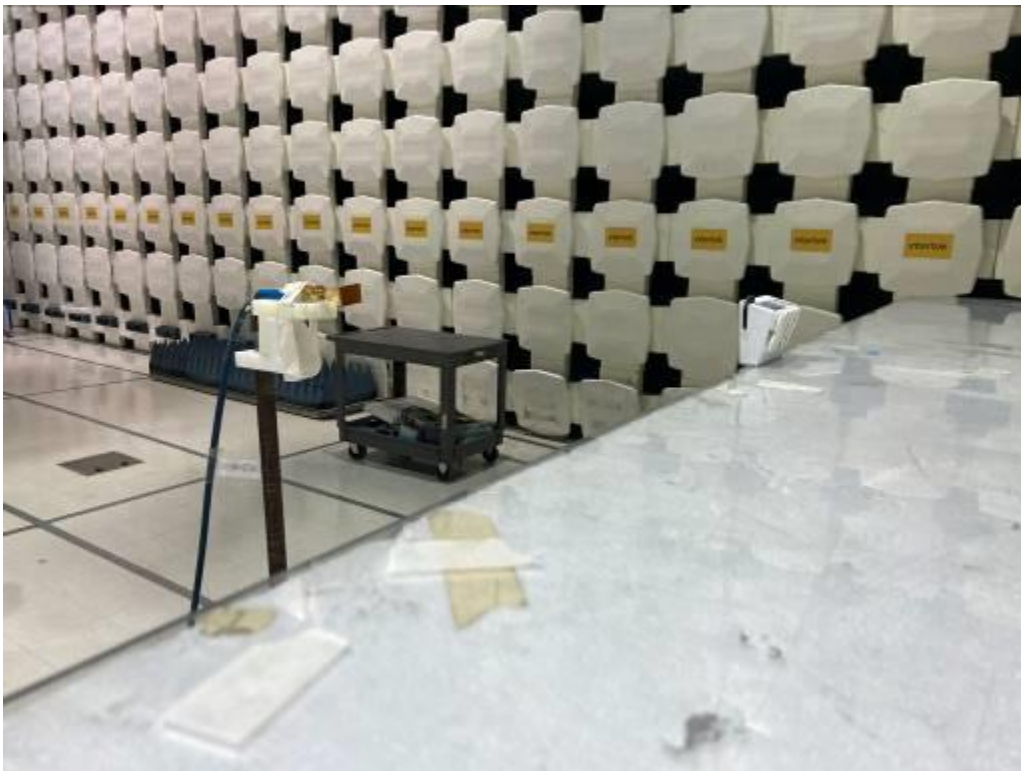
Software Utilized:

Name	Manufacturer	Version
None	N/A	N/A

8.3 Results:

The sample tested was found to Comply.

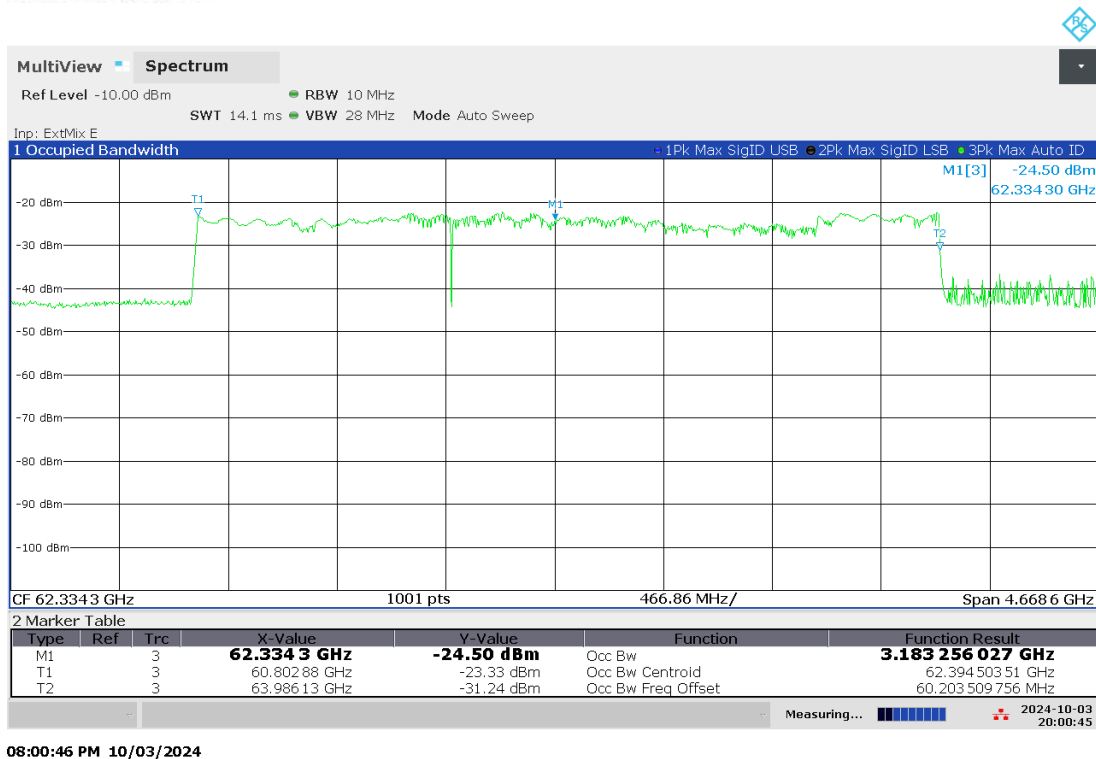
8.4 Setup Photographs:

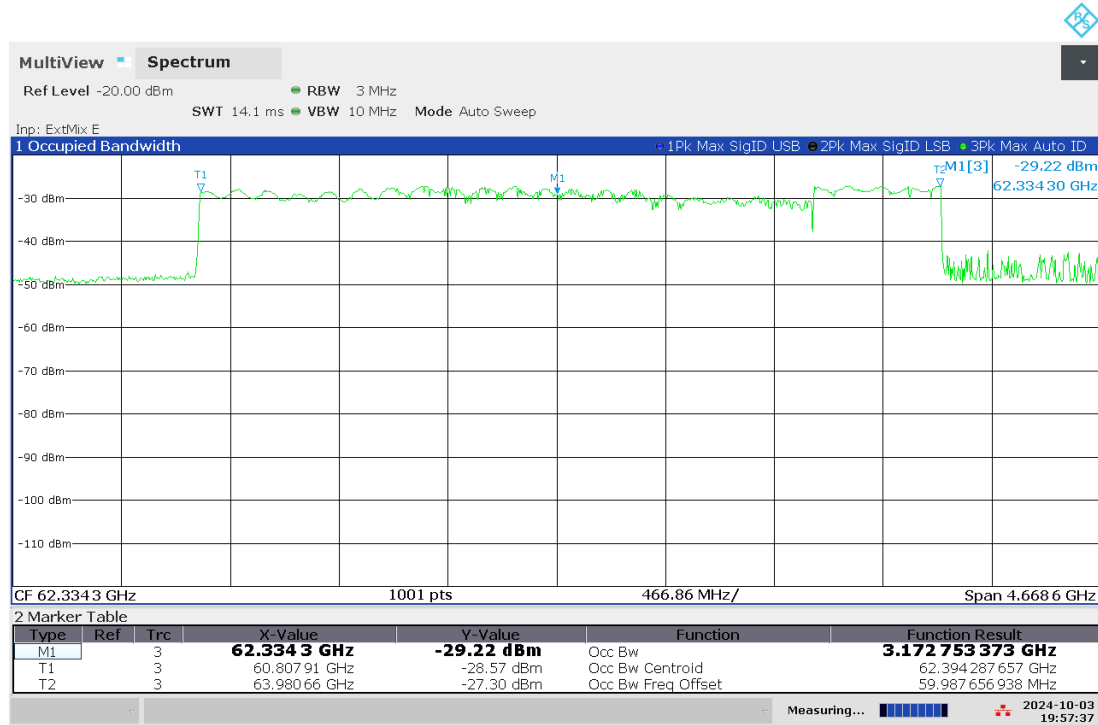


Mixer/Horn Antenna was placed at far field of 0.52 m

8.5 Plots/Data:

99% Occupied Bandwidth using different RBW, contained in 57-71 GHz Band





07:57:37 PM 10/03/2024

Note 1: Hand scans were performed at a close distance around the EUT with vertical and horizontal polarities to find the maximum emissions. The antenna was then moved and placed in a far field at 0.52 m.

Product Standard: CFR47 FCC Part 2.1049				Limit applied: Contained in 57-71 GHz Band 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
10/03/2024	Vathana Ven <i>VSV</i>	N/A	120VAC 60Hz	Continuous sweep	23	49	1009

Deviations, Additions, or Exclusions: None

9 Radiated Spurious Emissions

9.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.255(d), KDB 364244 D01 Meas 15.255 Radars v01, and ANSI C63.10.

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.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
Radiated Emissions, 10m	30-1000 MHz	5.0 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.9 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.1 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7 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 dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

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.

Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024

Revised: 10/10/2024, 10/28/2024, 11/01/2024

Assume a receiver reading of 52.0 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V

AF = 7.4 dB/m

CF = 1.6 dB

AG = 29.0 dB

FS = 32 dB μ V/m

To convert from dB μ V to μ V or mV the following was used:

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

NF = Net Reading in dB μ V

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0

UF = $10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$

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.

9.2 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
CBLHF2012 -5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/27/2024	02/27/2025
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/22/2023	11/22/2024
OML3'	WR12 Harmonic Mixer, 60 to 90GHz	Oleson Microwave Lab	M12HWD	E21011-1	02/12/2024	02/12/2025
OML3'	OML Horn Antenna, 60 to 90GHz	Oleson Microwave Lab	M12RH	Not labeled	02/12/2024	02/12/2025
OML4'	WR19 Harmonic Mixer, 40 to 60GHz	Oleson Microwave Lab	M19HWD	U21011-1	02/12/2024	02/12/2025
OML2'	WR08 Harmonic Mixer, 90 to 140GHz	Oleson Microwave Lab	M08HWA	F21011-1	02/12/2024	02/12/2025
OML4'	OML Horn Antenna, 40 to 60GHz	Oleson Microwave Lab	M19RH	Not labeled	02/12/2024	02/12/2025
OML2'	OML Horn Antenna, 90 to 140 GHz	Oleson Microwave Lab	M08RH	Not labeled	02/12/2024	02/12/2025
OML5'	WR05 Harmonic Mixer, 140 to 220 GHz	Oleson Microwave Lab	M05RH	G21011-1	02/12/2024	02/12/2025
OML5'	OML Horn Antenna, 140 to 220 GHz	Oleson Microwave Lab	M05RH	Not labeled	02/12/2024	02/12/2025
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	07/11/2024	07/11/2025
PRE10'	30-1000MHz pre-amp	ITS	PRE10	PRE10	02/27/2024	02/27/2025
ROS014'	Receiver 1Hz-44GHz	Rhode & Schwarz	ESW 44	103232	06/10/2024	06/10/2025
147-509'	Turntable controller	EMCO	2090	00094617	VBU	Verified
147-510'	Mast Controller	EMCO	2090	00094618	VBU	Verified
145-420'	Receiver to floor cable	Utiflex	UFB311A-2-0591-70070	145-420	02/27/2024	02/27/2025
PRE12'	Pre-amplifier	Com Power	PAM-118A	18040117	05/02/2024	05/02/2025
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	10/26/2023	10/26/2024
REA008'	band reject filter 2.4GHz	Reactel, Inc	12RX7-2441.75-x140 S	17-01	10/31/2023	10/31/2024
REA004'	3GHz High Pass Filter	Reactel, Inc	7HSX-3G/18G-S11	06-1	02/27/2024	02/27/2025
ROS005-1'	Signal and Spectrum Analyzer	Rohde and Shwartz	FSW43	100646	11/22/2023	11/22/2024
CBLHF2012 -2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/27/2024	02/27/2025
CBLHF2012 -5M-2'	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/27/2024	02/27/2025
EMC018'	18-40GHz Pre-amp 40dB gain	The EMC Shop	PA40G	27490-01	08/06/2024	08/06/2025
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	02/13/2024	02/13/2025
REA001'	6.0GHz High Pass Filter	Reactel, Inc	11HS-6G/18G-S11	06-1	02/27/2024	02/27/2025
CBL052'	9kHz-1GHz BNC cable 25 ft long	Belden	RG58A/U	CBL052	01/09/2024	01/09/2025
145019'	Active Loop Antenna (9 KHz to 30 MHz)	EMCO	6502/1	9902-3267	03/05/2024	03/05/2025

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	NEXIO	2023.0.9.0

9.3 Results:

The sample tested was found to Comply.

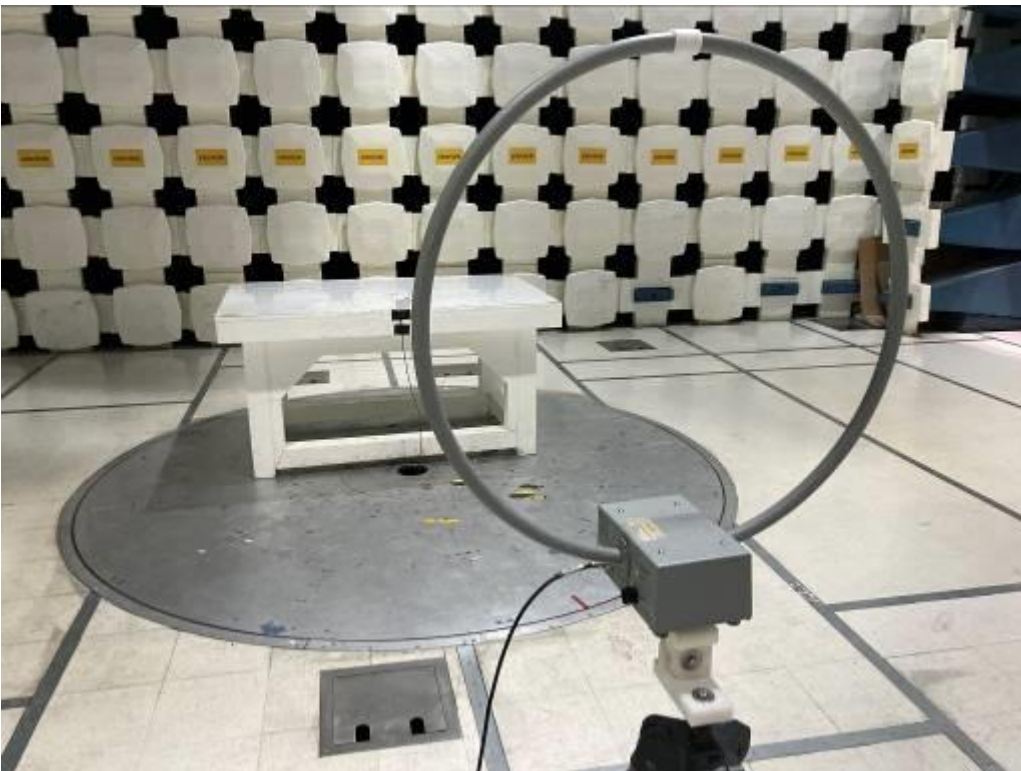
§ 15.255 Operation within the band 57-71 GHz.

(d) Limits on spurious emissions

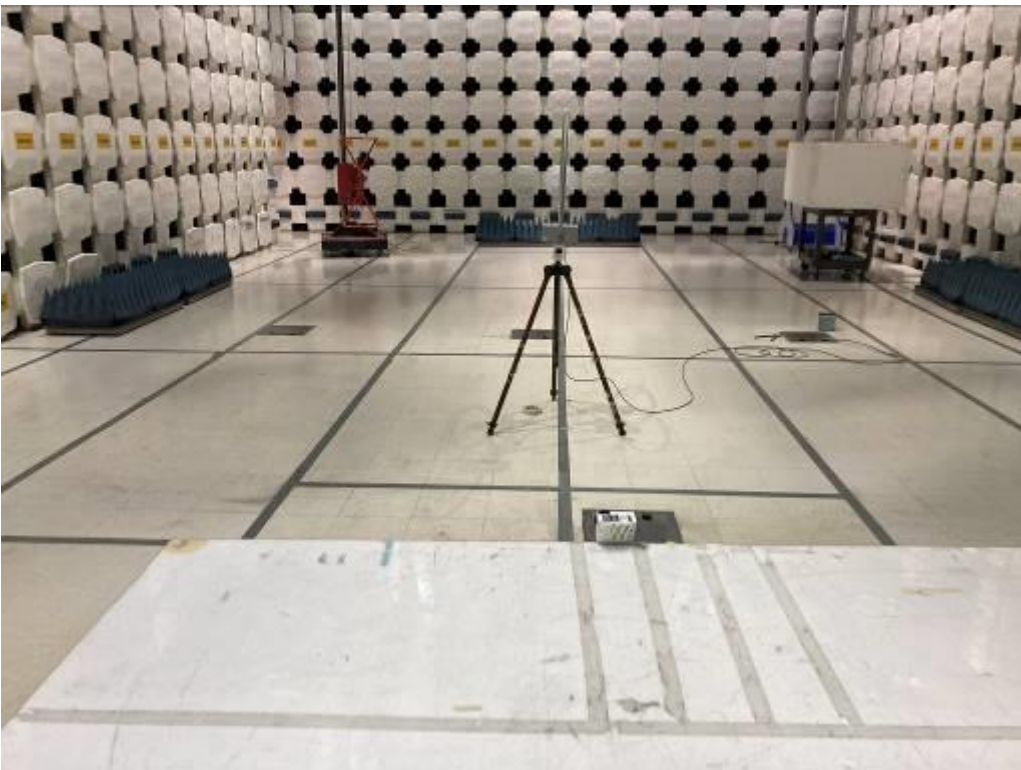
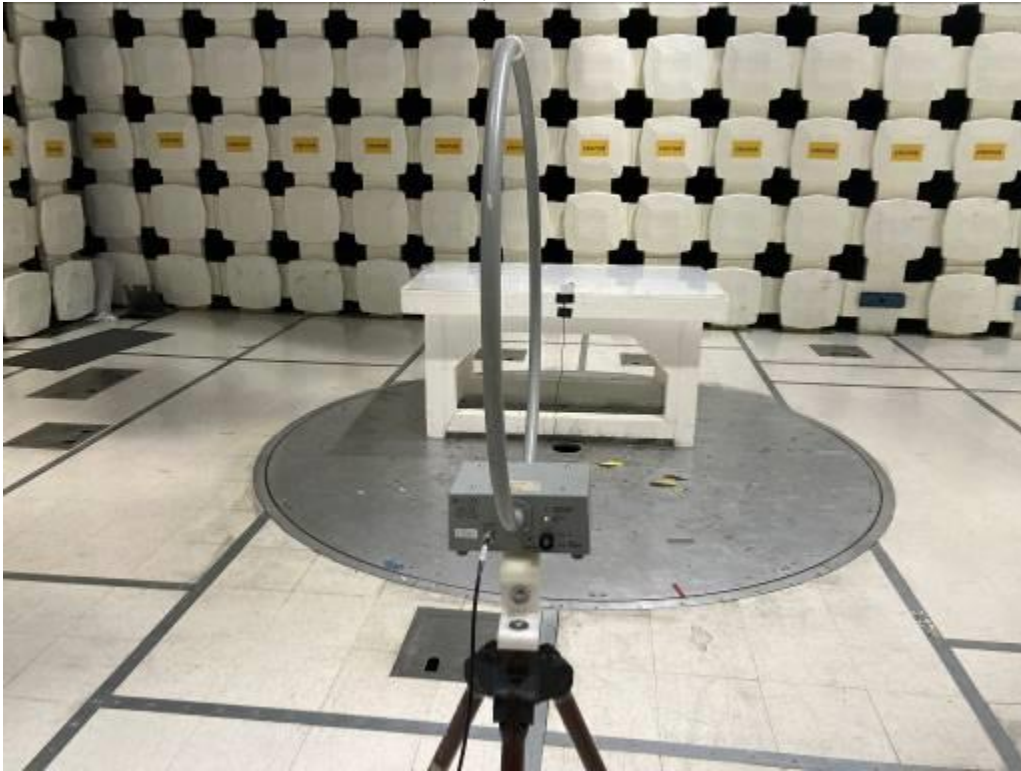
- (1) The power density of any emissions outside the 57-71 GHz band shall consist solely of spurious emissions.
- (2) Radiated emissions below 40 GHz shall not exceed the general limits in [§ 15.209](#).
- (3) Between 40 GHz and 200 GHz, the level of these emissions shall not exceed 90 pW/cm² at a distance of 3 meters.
- (4) The levels of the spurious emissions shall not exceed the level of the fundamental emission.

9.4 Setup Photographs:

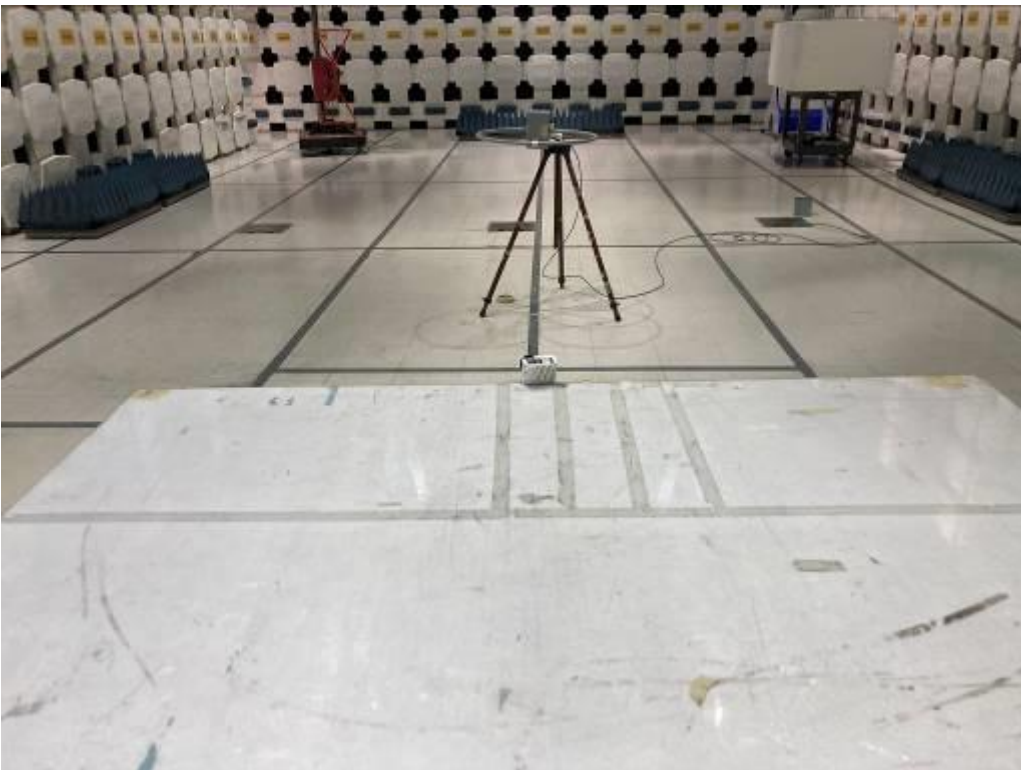
9 kHz-30 MHz, Antenna on X-Axis



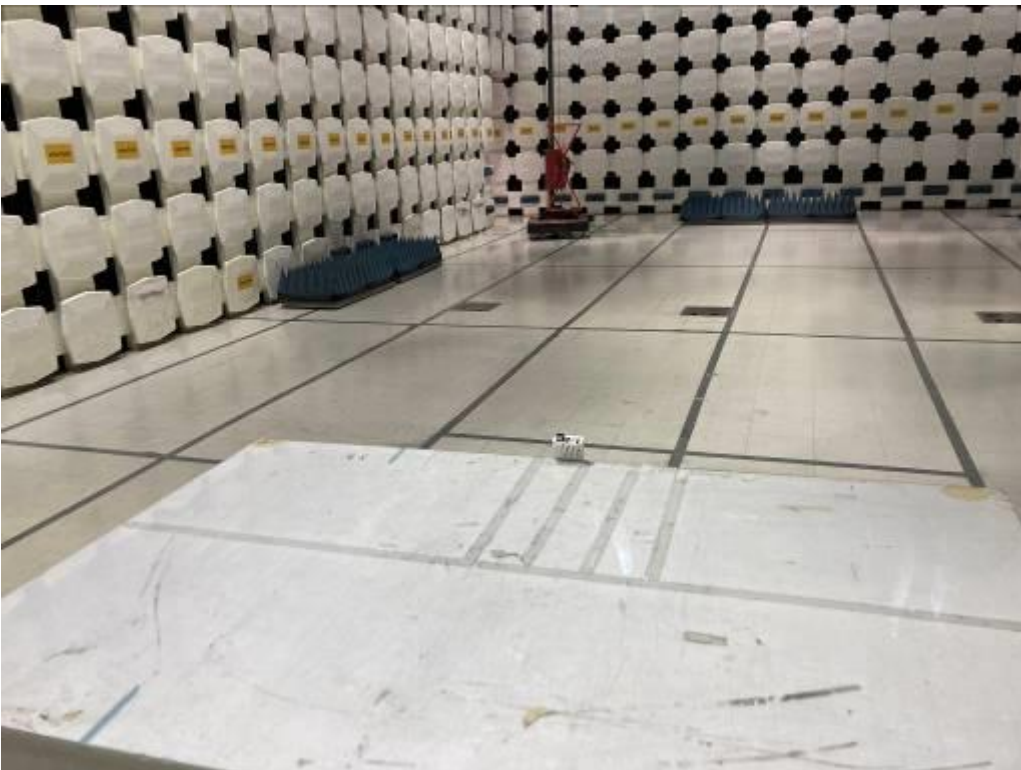
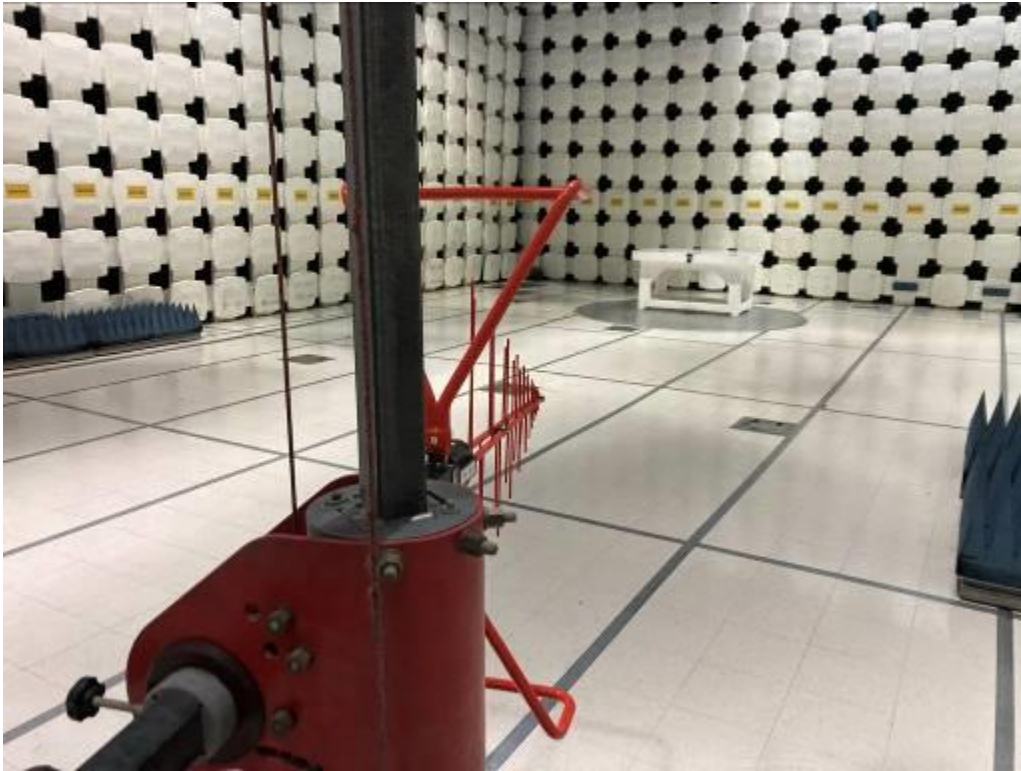
9 kHz-30 MHz, Antenna on Y-Axis



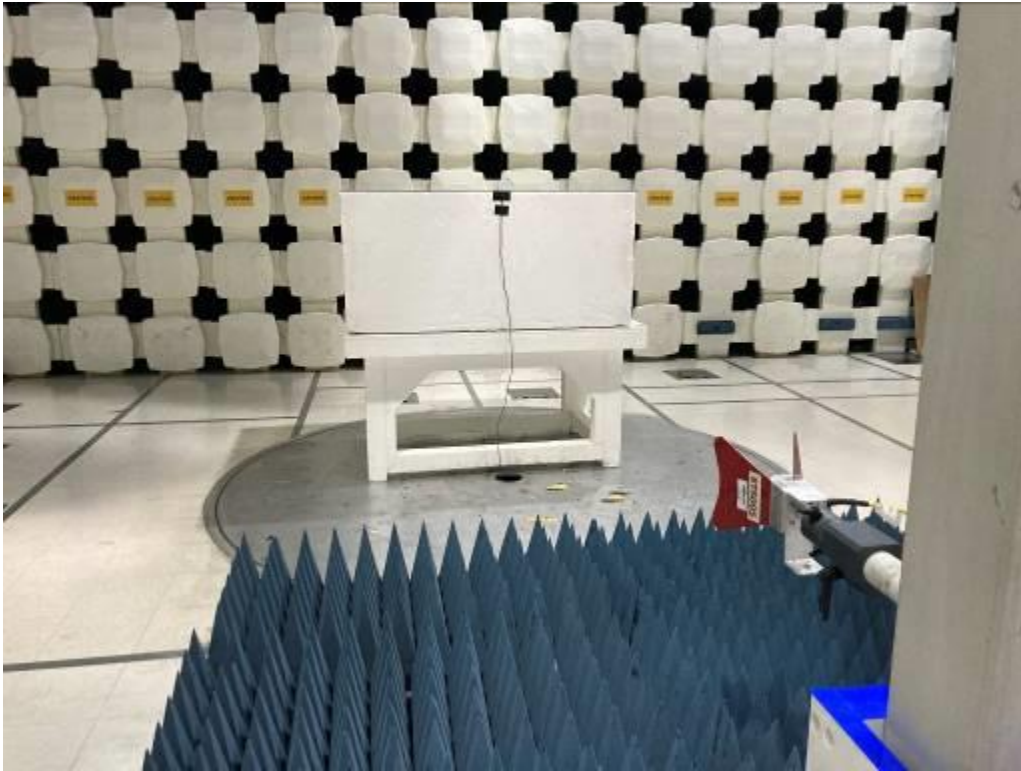
9 kHz-30 MHz, Antenna on Z-Axis



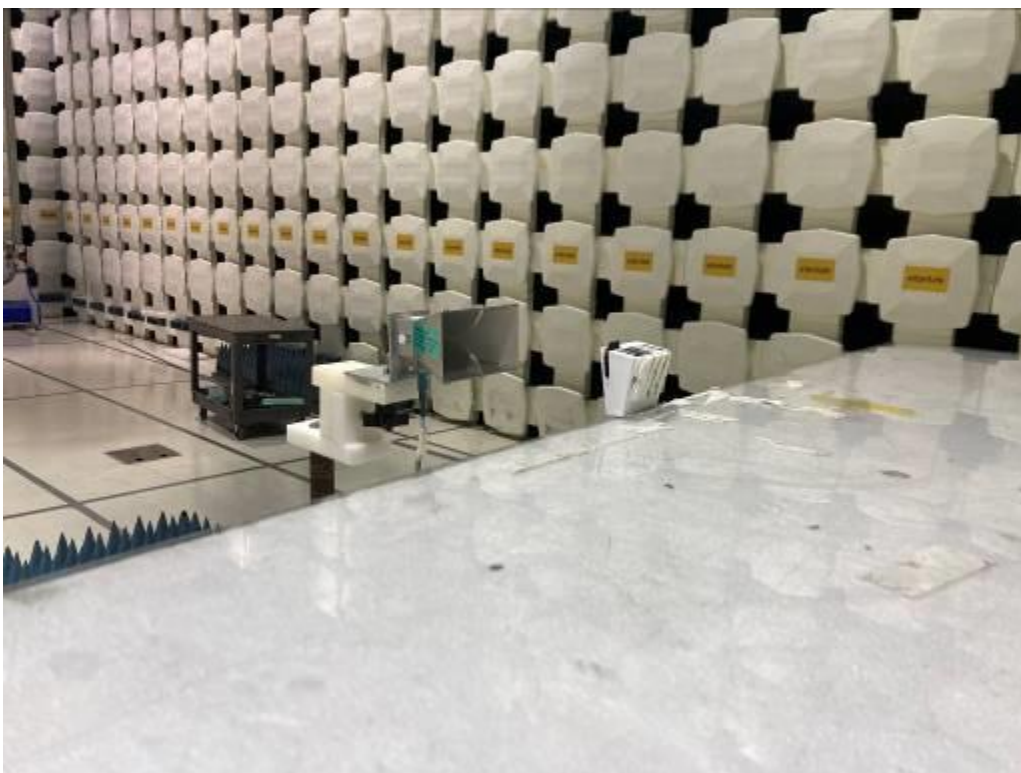
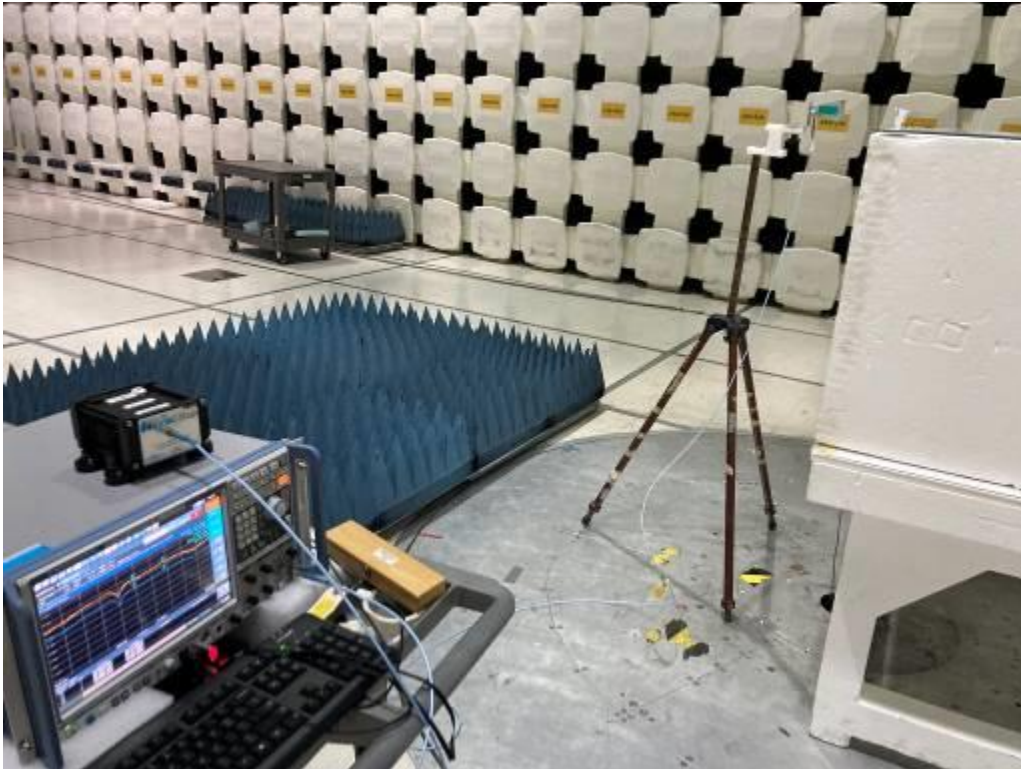
30-1000 MHz



1-18 GHz



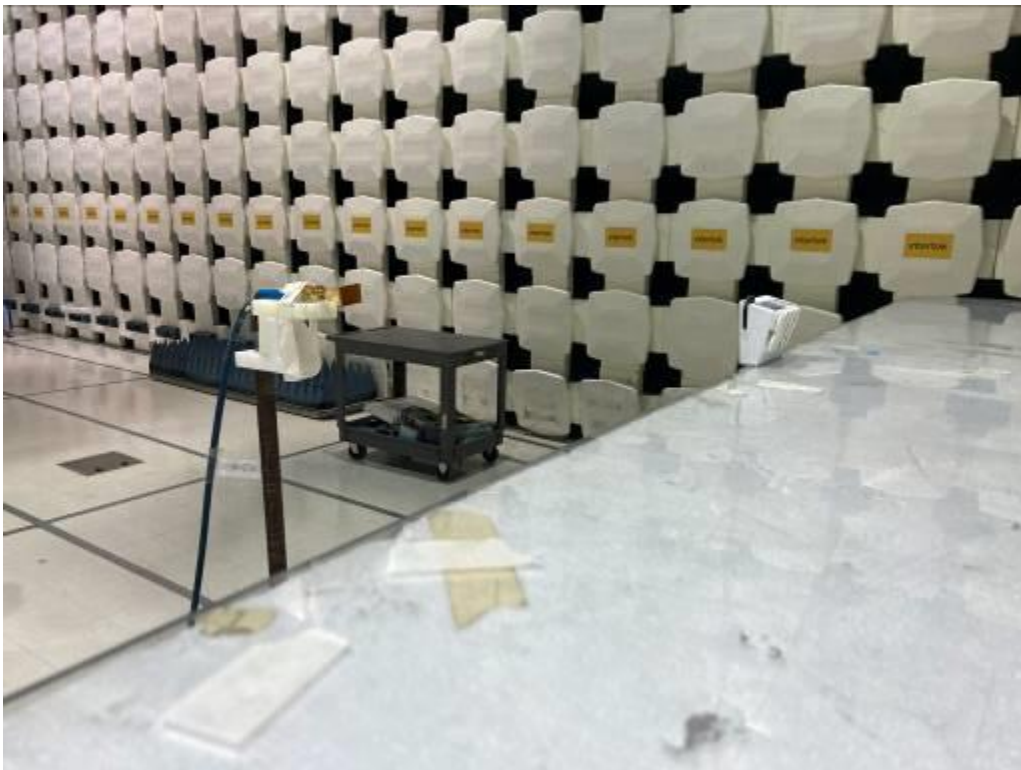
18-40 GHz



40-60GHz



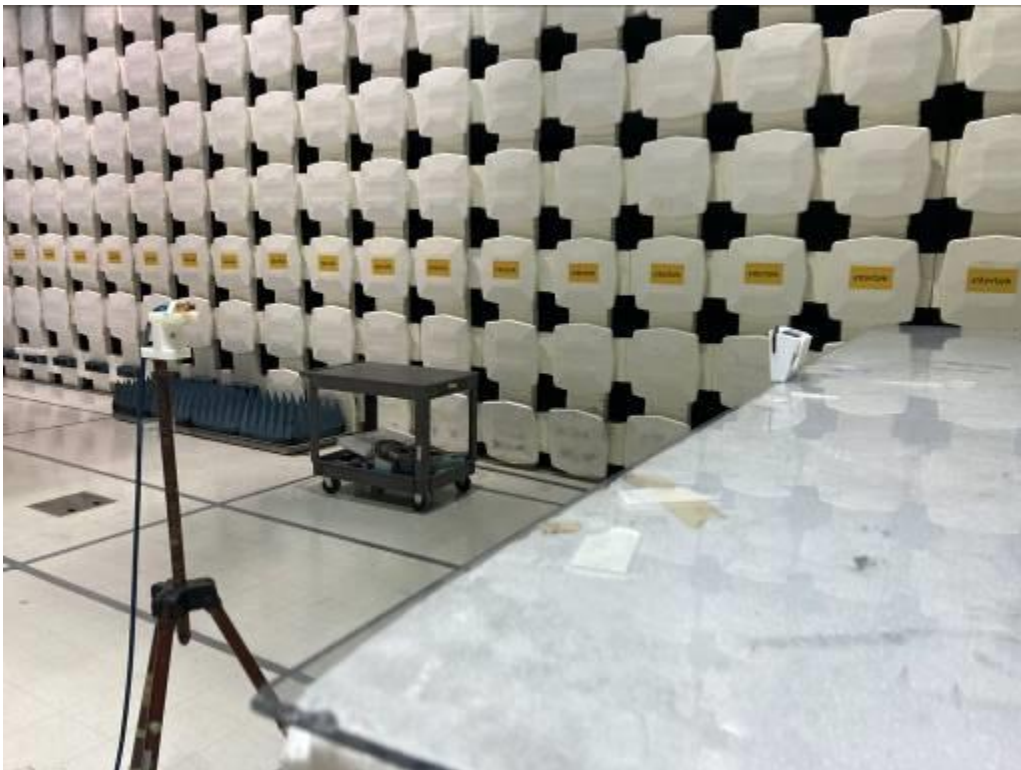
60-90 GHz



90-140 GHz



140-200 GHz



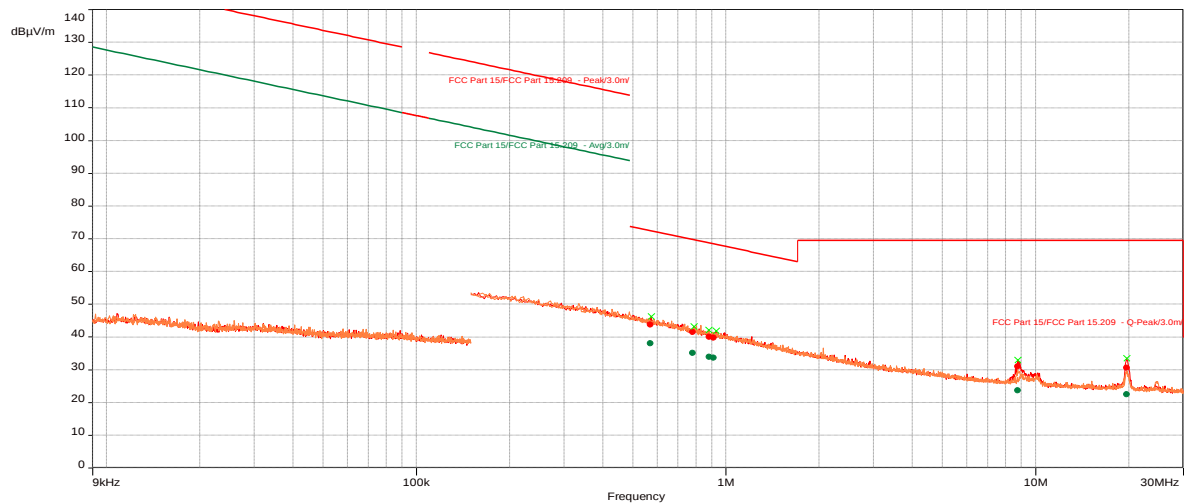
9.5 Plots/Data:

Spurious emissions 9kHz-30MHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi

Test Information:

Date and Time	10/1/2024 4:15:23 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#1_RE 9kHz-30MHz Loop antenna, Electric Field, 3M Location (FCC 15.209) Tx mode, 60 GHz Radar and 2.4 GHz WiFi

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Pol.	RBW	Meas.Time	Correction (dB)
0.5711	43.76	72.48	-28.71	185.50	Horizontal	9k	0.10	11.05
0.7798	41.54	69.76	-28.22	66.20	Horizontal	9k	0.10	11.07
0.88282	40.08	68.68	-28.60	223.10	Horizontal	9k	0.10	11.06
0.91077	39.87	68.42	-28.55	126.20	Horizontal	9k	0.10	11.10
8.75817	31.04	69.54	-38.50	310.30	Horizontal	9k	0.10	10.84
19.66662	30.60	69.54	-38.94	261.00	Horizontal	9k	0.10	10.33

QuasiPeak (PASS) (6)

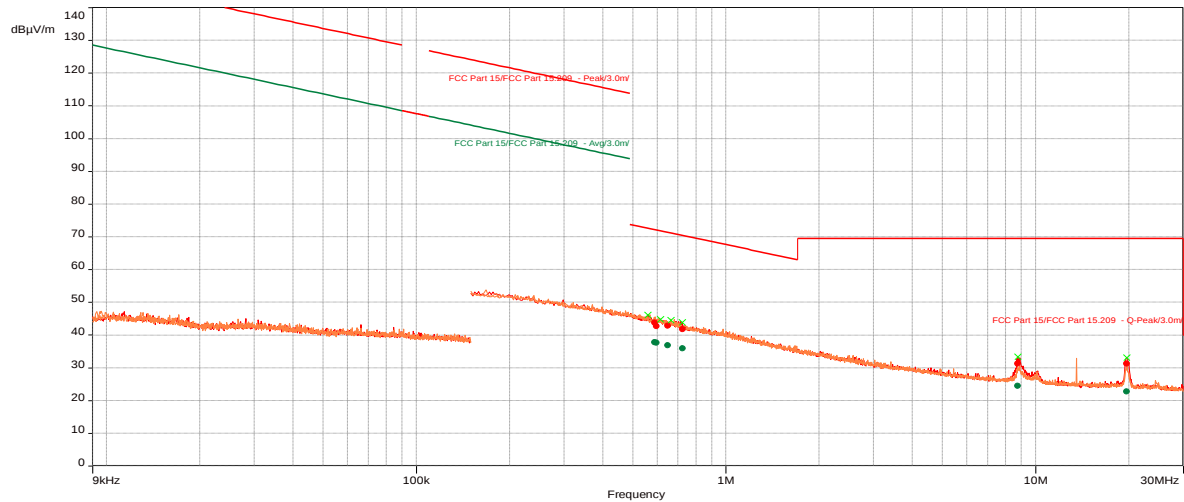
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Pol.	RBW	Meas.Time	Correction (dB)
0.5711	38.11	72.48	-34.37	185.50	Horizontal	9k	0.10	11.05
0.7798	35.17	69.76	-34.59	66.20	Horizontal	9k	0.10	11.07
0.88282	33.97	68.68	-34.71	223.10	Horizontal	9k	0.10	11.06
0.91077	33.74	68.42	-34.68	126.20	Horizontal	9k	0.10	11.10
8.75817	23.76	69.54	-45.78	310.30	Horizontal	9k	0.10	10.84
19.66662	22.53	69.54	-47.01	261.00	Horizontal	9k	0.10	10.33

Spurious emissions 9kHz-30MHz, Tx mode, 60GHz Radar and 2.4 GHz BT

Test Information:

Date and Time	10/1/2024 4:47:29 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#2_RE 9kHz-30MHz Loop antenna, Electric Field, 3M Location (FCC 15.209) Tx mode, 60 GHz Radar and 2.4 GHz BT

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Pol.	RBW	Meas.Time	Correction (dB)
0.58868	43.78	72.21	-28.43	17.60	Horizontal	9k	0.10	11.07
0.59509	42.78	72.11	-29.33	342.10	Horizontal	9k	0.10	11.07
0.64841	42.82	71.35	-28.53	125.90	Horizontal	9k	0.10	11.07
0.72385	41.76	70.41	-28.65	131.00	Horizontal	9k	0.10	11.07
8.76165	31.32	69.54	-38.22	17.50	Horizontal	9k	0.10	10.84
19.67682	31.27	69.54	-38.27	55.20	Horizontal	9k	0.10	10.33

QuasiPeak (PASS) (6)

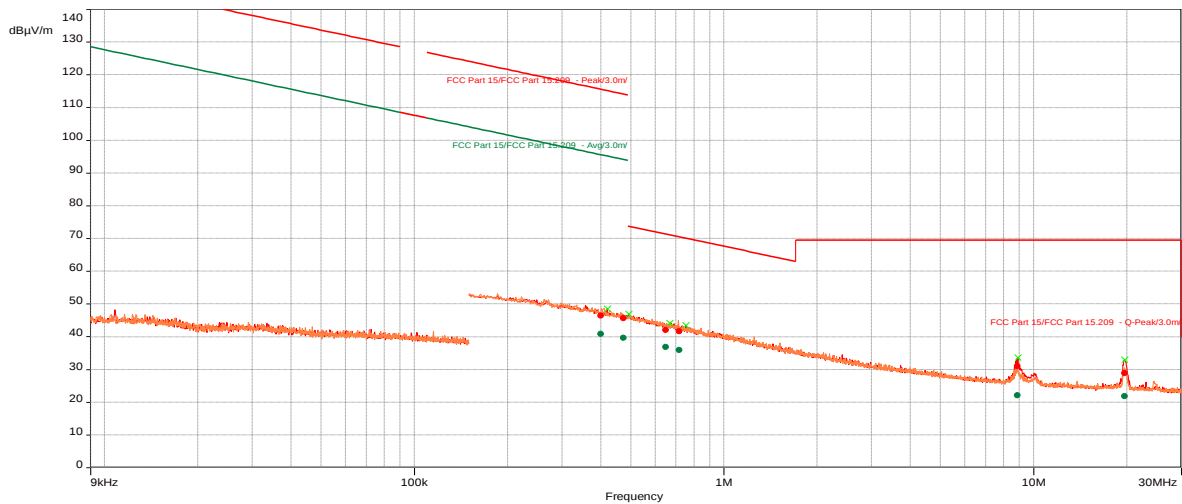
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Pol.	RBW	Meas.Time	Correction (dB)
0.58868	37.87	72.21	-34.34	17.60	Horizontal	9k	0.10	11.07
0.59509	37.71	72.11	-34.40	342.10	Horizontal	9k	0.10	11.07
0.64841	36.93	71.35	-34.42	125.90	Horizontal	9k	0.10	11.07
0.72385	35.99	70.41	-34.42	131.00	Horizontal	9k	0.10	11.07
8.76165	24.53	69.54	-45.01	17.50	Horizontal	9k	0.10	10.84
19.67682	22.76	69.54	-46.78	55.20	Horizontal	9k	0.10	10.33

Spurious emissions 9kHz-30MHz, Tx mode, 60GHz Radar and 2.4 GHz BLE

Test Information:

Date and Time	10/1/2024 5:16:48 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#3_RE 9kHz-30MHz Loop antenna, Electric Field, 3M Location (FCC 15.209) Tx mode, 60 GHz Radar and 2.4 GHz BLE

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Pol.	RBW	Meas.Time	Correction (dB)
0.39913	46.49	77.00	-30.51	190.20	Horizontal	9k	0.10	10.77
0.47292	45.69	74.10	-28.41	315.40	Horizontal	9k	0.10	10.92
0.65044	42.06	71.35	-29.29	217.60	Horizontal	9k	0.10	11.07
0.71675	41.62	70.49	-28.88	163.40	Horizontal	9k	0.10	11.07
8.88296	30.97	69.54	-38.57	12.30	Horizontal	9k	0.10	10.82
19.716	28.92	69.54	-40.62	12.20	Horizontal	9k	0.10	10.33

QuasiPeak (PASS) (6)

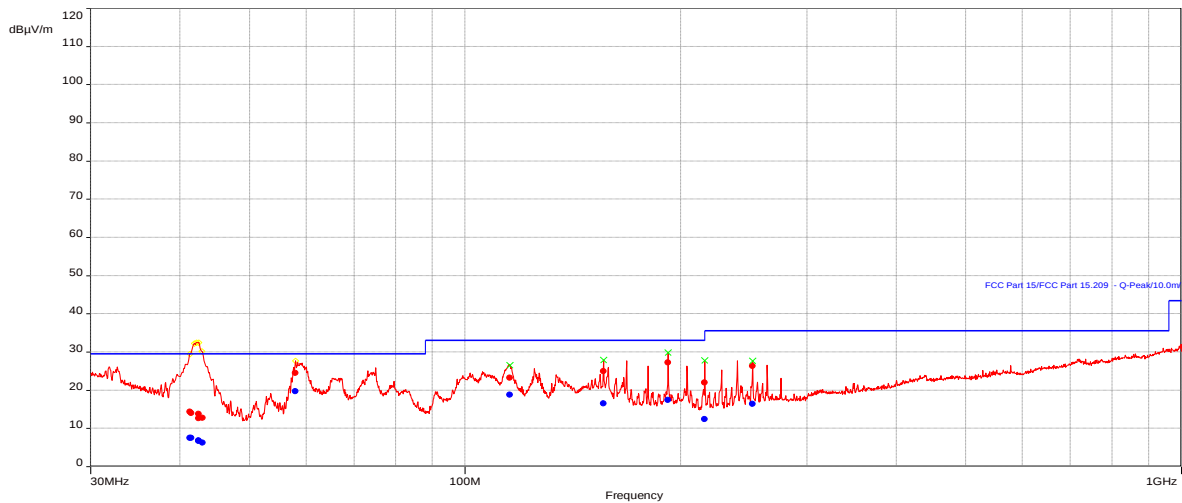
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Pol.	RBW	Meas.Time	Correction (dB)
0.39913	40.91	77.00	-36.09	190.20	Horizontal	9k	0.10	10.77
0.47292	39.67	74.10	-34.44	315.40	Horizontal	9k	0.10	10.92
0.65044	36.92	71.35	-34.43	217.60	Horizontal	9k	0.10	11.07
0.71675	35.98	70.49	-34.51	163.40	Horizontal	9k	0.10	11.07
8.88296	22.14	69.54	-47.40	12.30	Horizontal	9k	0.10	10.82
19.716	21.80	69.54	-47.74	12.20	Horizontal	9k	0.10	10.33

Spurious emissions 30-1000MHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi

Test Information:

Date and Time	10/1/2024 7:24:15 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#6_RE 30-1000MHz_120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz WiFi

Graph:



Results:

Peak (PASS) (11)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
41.31	14.38	29.54	-15.16	277.80	2.44	Horizontal	120k	0.10	-20.63
41.4715	14.07	29.54	-15.47	147.10	4.00	Horizontal	120k	0.10	-20.74
42.4464	13.83	29.54	-15.71	88.00	3.89	Horizontal	120k	0.10	-21.44
42.4859	12.71	29.54	-16.83	360.00	3.28	Horizontal	120k	0.10	-21.47
43.0152	12.83	29.54	-16.71	348.00	3.81	Horizontal	120k	0.10	-21.89
57.984	24.53	29.54	-5.01	201.60	4.00	Vertical	120k	0.10	-25.95
115.4536	23.31	33.06	-9.75	158.10	4.00	Vertical	120k	0.10	-19.19
156.0075	24.97	33.06	-8.09	12.10	1.98	Vertical	120k	0.10	-20.14
192.0075	27.24	33.06	-5.82	28.30	2.21	Vertical	120k	0.10	-20.63
216.0074	22.00	33.06	-11.06	44.70	2.21	Vertical	120k	0.10	-21.52
252.012	26.36	35.56	-9.20	71.70	1.30	Vertical	120k	0.10	-20.50

QuasiPeak (PASS) (11)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
41.31	7.59	29.54	-21.95	277.80	2.44	Horizontal	120k	0.10	-20.63
41.4715	7.52	29.54	-22.02	147.10	4.00	Horizontal	120k	0.10	-20.74
42.4464	6.85	29.54	-22.69	88.00	3.89	Horizontal	120k	0.10	-21.44
42.4859	6.79	29.54	-22.75	360.00	3.28	Horizontal	120k	0.10	-21.47
43.0152	6.34	29.54	-23.20	348.00	3.81	Horizontal	120k	0.10	-21.89
57.984	19.72	29.54	-9.82	201.60	4.00	Vertical	120k	0.10	-25.95
115.4536	18.82	33.06	-14.24	158.10	4.00	Vertical	120k	0.10	-19.19
156.0075	16.54	33.06	-16.52	12.10	1.98	Vertical	120k	0.10	-20.14
192.0075	17.44	33.06	-15.62	28.30	2.21	Vertical	120k	0.10	-20.63
216.0074	12.47	33.06	-20.59	44.70	2.21	Vertical	120k	0.10	-21.52
252.012	16.46	35.56	-19.10	71.70	1.30	Vertical	120k	0.10	-20.50

Intertek

Report Number: 105935432BOX-002

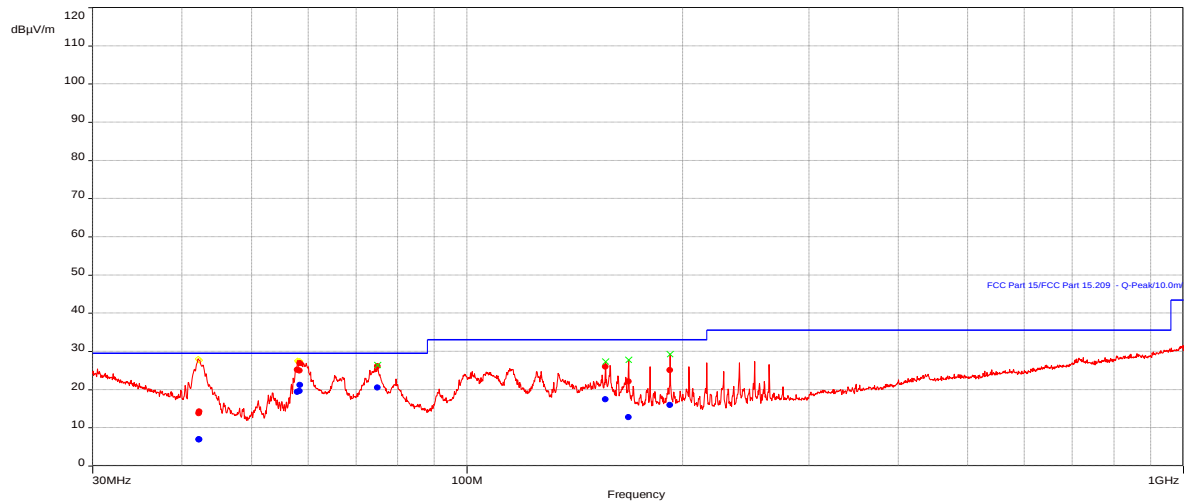
Issued: 10/07/2024
Revised: 10/10/2024, 10/28/2024, 11/01/2024

Spurious emissions 30-1000MHz, Tx mode, 60GHz Radar and 2.4 GHz BT

Test Information:

Date and Time	10/1/2024 6:43:04 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#5_RE 30-1000MHz_120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BT

Graph:



Results:

Peak (PASS) (9)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
42.2278	13.84	29.54	-15.70	125.80	3.89	Horizontal	120k	0.10	-21.27
42.2805	14.28	29.54	-15.26	6.80	3.96	Horizontal	120k	0.10	-21.31
57.9975	25.25	29.54	-4.29	218.10	4.00	Vertical	120k	0.10	-25.95
58.3919	24.96	29.54	-4.58	234.20	4.00	Vertical	120k	0.10	-25.91
58.4009	26.96	29.54	-2.58	304.00	2.28	Vertical	120k	0.10	-25.90
75.018	26.17	29.54	-3.37	299.80	4.00	Vertical	120k	0.10	-25.06
156.0045	26.01	33.06	-7.05	28.20	1.30	Vertical	120k	0.10	-20.14
168.0135	22.17	33.06	-10.89	39.00	4.00	Vertical	120k	0.10	-20.37
192.006	25.15	33.06	-7.91	50.00	2.23	Vertical	120k	0.10	-20.63

QuasiPeak (PASS) (9)

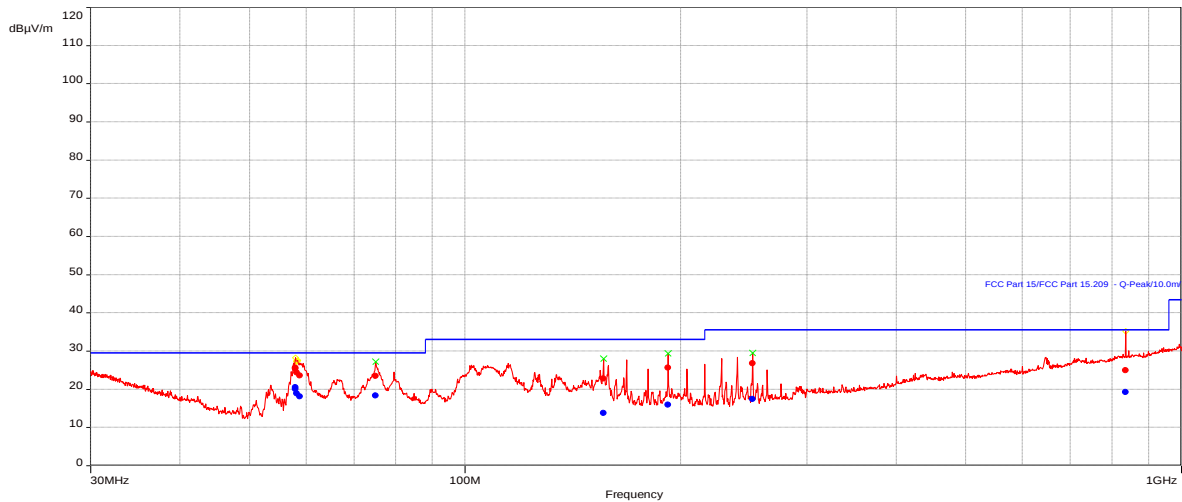
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
42.2278	7.01	29.54	-22.53	125.80	3.89	Horizontal	120k	0.10	-21.27
42.2805	7.01	29.54	-22.53	6.80	3.96	Horizontal	120k	0.10	-21.31
57.9975	19.42	29.54	-10.12	218.10	4.00	Vertical	120k	0.10	-25.95
58.3919	19.67	29.54	-9.87	234.20	4.00	Vertical	120k	0.10	-25.91
58.4009	21.28	29.54	-8.26	304.00	2.28	Vertical	120k	0.10	-25.90
75.018	20.57	29.54	-8.97	299.80	4.00	Vertical	120k	0.10	-25.06
156.0045	17.41	33.06	-15.65	28.20	1.30	Vertical	120k	0.10	-20.14
168.0135	12.77	33.06	-20.29	39.00	4.00	Vertical	120k	0.10	-20.37
192.006	15.97	33.06	-17.09	50.00	2.23	Vertical	120k	0.10	-20.63

Spurious emissions 30-1000MHz, Tx mode, 60GHz Radar and 2.4 GHz BLE

Test Information:

Date and Time	10/1/2024 5:53:27 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#4_RE 30-1000MHz_120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BLE

Graph:



Results:

Peak (PASS) (9)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
57.945	25.50	29.54	-4.04	342.50	4.00	Vertical	120k	0.10	-25.95
57.998	25.68	29.54	-3.86	304.30	4.00	Vertical	120k	0.10	-25.95
58.1675	24.45	29.54	-5.09	352.70	4.00	Vertical	120k	0.10	-25.93
58.7569	23.60	29.54	-5.94	142.40	4.00	Vertical	120k	0.10	-25.87
75.0194	23.48	29.54	-6.06	245.20	4.00	Vertical	120k	0.10	-25.06
156.0104	22.85	33.06	-10.21	293.50	4.00	Vertical	120k	0.10	-20.14
191.9925	25.62	33.06	-7.44	169.20	2.98	Vertical	120k	0.10	-20.63
252.0045	26.80	35.56	-8.76	163.80	1.39	Vertical	120k	0.10	-20.50
836.1153	25.01	35.56	-10.55	153.00	3.81	Vertical	120k	0.10	-7.50

QuasiPeak (PASS) (9)

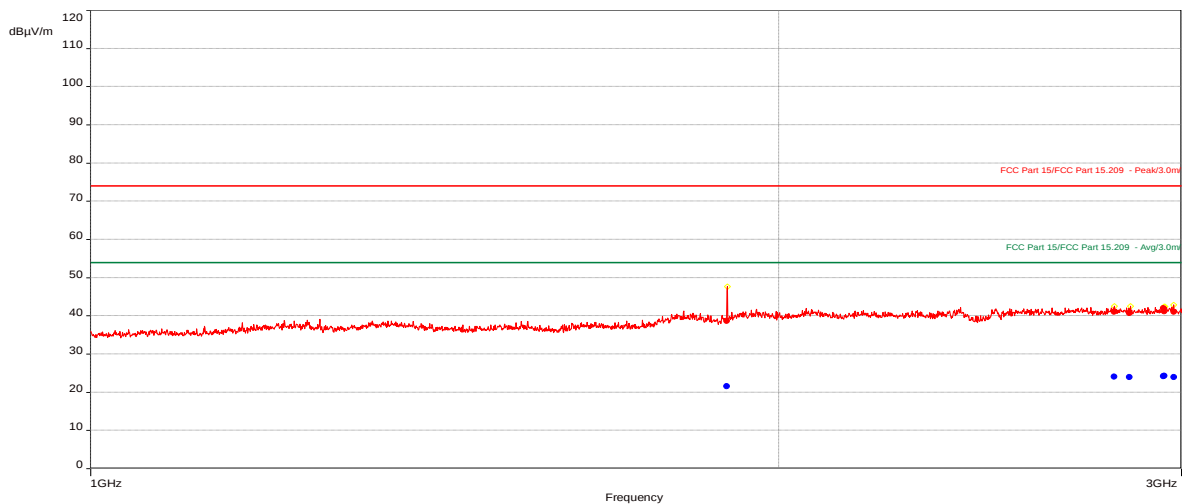
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
57.945	20.12	29.54	-9.42	342.50	4.00	Vertical	120k	0.10	-25.95
57.998	20.52	29.54	-9.02	304.30	4.00	Vertical	120k	0.10	-25.95
58.1675	18.98	29.54	-10.56	352.70	4.00	Vertical	120k	0.10	-25.93
58.7569	18.13	29.54	-11.41	142.40	4.00	Vertical	120k	0.10	-25.87
75.0194	18.41	29.54	-11.13	245.20	4.00	Vertical	120k	0.10	-25.06
156.0104	13.81	33.06	-19.25	293.50	4.00	Vertical	120k	0.10	-20.14
191.9925	16.02	33.06	-17.04	169.20	2.98	Vertical	120k	0.10	-20.63
252.0045	17.44	35.56	-18.12	163.80	1.39	Vertical	120k	0.10	-20.50
836.1153	19.33	35.56	-16.23	153.00	3.81	Vertical	120k	0.10	-7.50

Spurious emissions 1-3GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi

Test Information:

Date and Time	10/1/2024 8:30:21 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#7_RE 1 to 3 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz WiFi

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
1897.901	38.73	74.00	-35.27	191.60	1.44	Vertical	1M	0.00	-16.43
2804.563	41.04	74.00	-32.96	113.10	4.00	Horizontal	1M	0.00	-13.57
2847.679	40.79	74.00	-33.21	152.80	1.00	Horizontal	1M	0.00	-13.50
2946.629	41.94	74.00	-32.06	347.90	1.00	Horizontal	1M	0.00	-13.22
2949.04	41.20	74.00	-32.8	74.40	1.00	Horizontal	1M	0.00	-13.21
2977.26	41.05	74.00	-32.95	269.60	4.00	Horizontal	1M	0.00	-13.10

AVG (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
1897.901	21.62	54.00	-32.38	191.60	1.44	Vertical	1M	0.00	-16.43
2804.563	24.09	54.00	-29.91	113.10	4.00	Horizontal	1M	0.00	-13.57
2847.679	23.95	54.00	-30.05	152.80	1.00	Horizontal	1M	0.00	-13.50
2946.629	24.19	54.00	-29.81	347.90	1.00	Horizontal	1M	0.00	-13.22
2949.04	24.29	54.00	-29.71	74.40	1.00	Horizontal	1M	0.00	-13.21
2977.26	24.00	54.00	-30.00	269.60	4.00	Horizontal	1M	0.00	-13.10

Intertek

Report Number: 105935432BOX-002

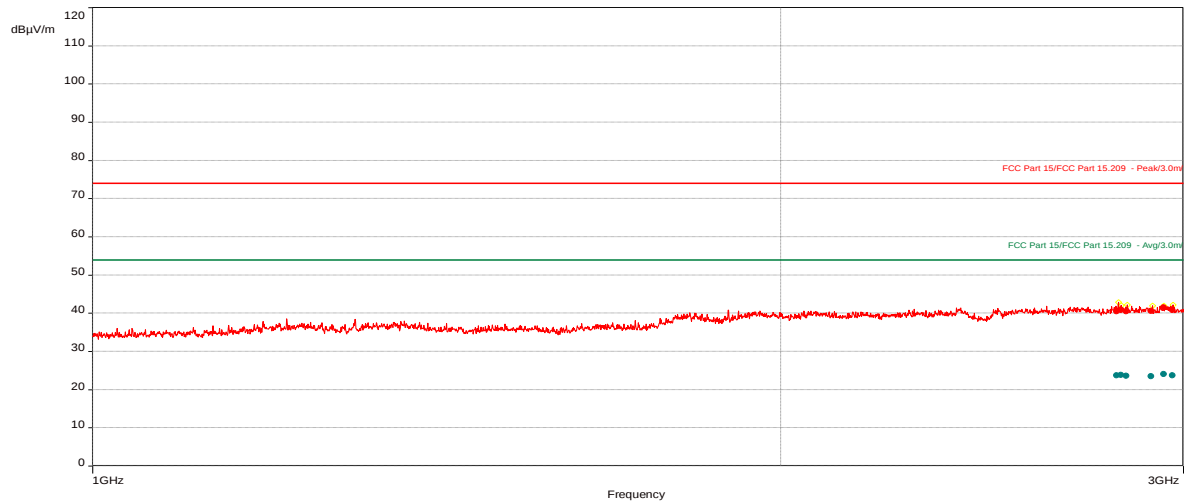
Issued: 10/07/2024
Revised: 10/10/2024, 10/28/2024, 11/01/2024

Spurious emissions 1-3GHz, Tx mode, 60GHz Radar and 2.4 GHz BT

Test Information:

Date and Time	10/1/2024 8:58:02 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#8_RE 1 to 3 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BT

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
2805.385	40.54	74.00	-33.46	360.00	2.51	Vertical	1M	0.00	-13.56
2817.077	40.89	74.00	-33.11	230.10	1.00	Vertical	1M	0.00	-13.55
2832.704	40.48	74.00	-33.52	360.00	1.44	Horizontal	1M	0.00	-13.53
2904.046	40.67	74.00	-33.33	152.30	3.58	Horizontal	1M	0.00	-13.34
2941.137	41.49	74.00	-32.51	191.80	3.05	Vertical	1M	0.00	-13.23
2967.102	40.87	74.00	-33.13	360.00	1.44	Horizontal	1M	0.00	-13.14

AVG (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
2805.385	23.76	54.00	-30.24	360.00	2.51	Vertical	1M	0.00	-13.56
2817.077	23.89	54.00	-30.11	230.10	1.00	Vertical	1M	0.00	-13.55
2832.704	23.63	54.00	-30.37	360.00	1.44	Horizontal	1M	0.00	-13.53
2904.046	23.49	54.00	-30.51	152.30	3.58	Horizontal	1M	0.00	-13.34
2941.137	24.04	54.00	-29.96	191.80	3.05	Vertical	1M	0.00	-13.23
2967.102	23.72	54.00	-30.28	360.00	1.44	Horizontal	1M	0.00	-13.14

Intertek

Report Number: 105935432BOX-002

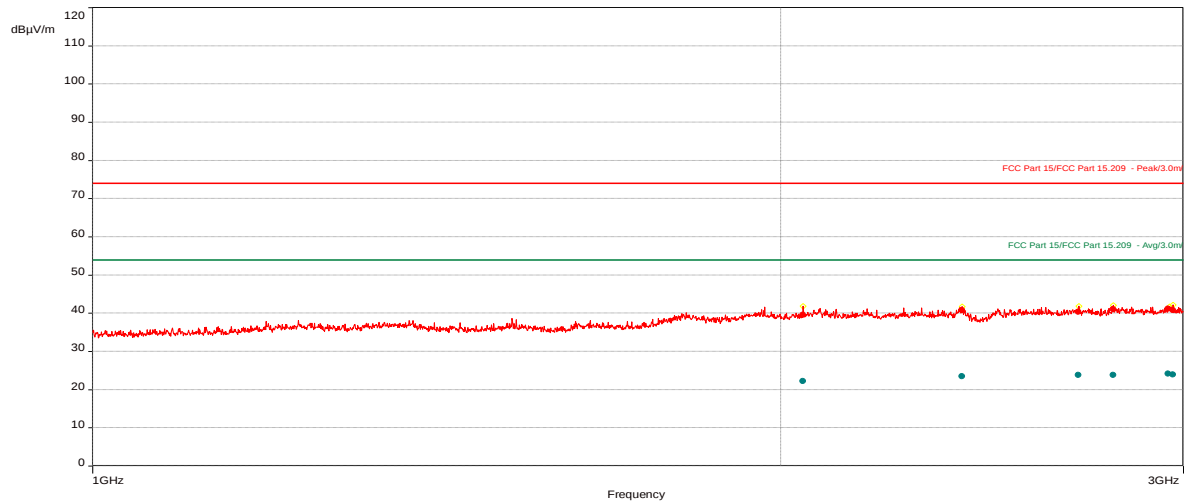
Issued: 10/07/2024
Revised: 10/10/2024, 10/28/2024, 11/01/2024

Spurious emissions 1-3GHz, Tx mode, 60GHz Radar and 2.4 GHz BLE

Test Information:

Date and Time	10/1/2024 9:26:17 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#9_RE 1 to 3 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BLE

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
2044.901	39.62	74.00	-34.38	191.60	3.05	Vertical	1M	0.00	-15.57
2400.413	40.83	74.00	-33.17	360.00	1.44	Horizontal	1M	0.00	-14.43
2698.977	40.42	74.00	-33.58	230.60	3.05	Horizontal	1M	0.00	-13.77
2795.3	41.03	74.00	-32.97	34.90	1.98	Horizontal	1M	0.00	-13.59
2954.496	41.23	74.00	-32.77	74.00	1.00	Vertical	1M	0.00	-13.19
2969.374	40.79	74.00	-33.21	152.10	1.44	Horizontal	1M	0.00	-13.13

AVG (PASS) (6)

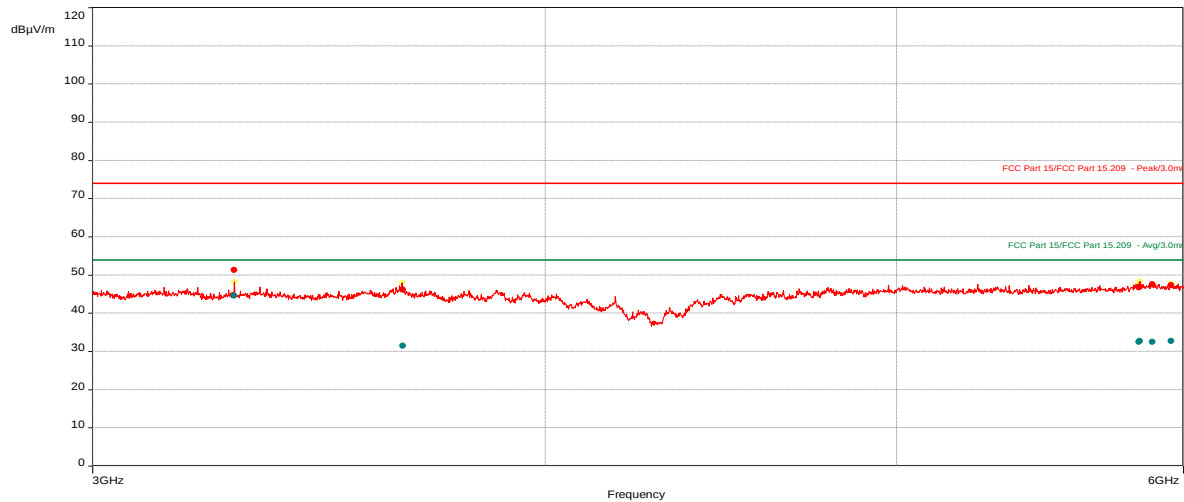
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
2044.901	22.25	54.00	-31.75	191.60	3.05	Vertical	1M	0.00	-15.57
2400.413	23.48	54.00	-30.52	360.00	1.44	Horizontal	1M	0.00	-14.43
2698.977	23.81	54.00	-30.19	230.60	3.05	Horizontal	1M	0.00	-13.77
2795.3	23.83	54.00	-30.17	34.90	1.98	Horizontal	1M	0.00	-13.59
2954.496	24.22	54.00	-29.78	74.00	1.00	Vertical	1M	0.00	-13.19
2969.374	24.01	54.00	-29.99	152.10	1.44	Horizontal	1M	0.00	-13.13

Spurious emissions 3-6GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi

Test Information:

Date and Time	10/1/2024 10:56:13 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#12_RE 3 to 6 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz WiFi

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
3282.613	51.31	74.00	-22.69	223.40	1.69	Vertical	1M	0.00	-12.65
3654.368	46.16	74.00	-27.84	223.40	3.26	Horizontal	1M	0.00	-11.83
5833.217	46.81	74.00	-27.19	109.60	3.26	Vertical	1M	0.00	-7.97
5835.811	46.85	74.00	-27.15	223.40	1.69	Horizontal	1M	0.00	-7.96
5883.225	47.61	74.00	-26.39	360.00	4.00	Vertical	1M	0.00	-7.83
5953.015	47.37	74.00	-26.63	337.00	4.00	Horizontal	1M	0.00	-7.55

AVG (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
3282.613	44.66	54.00	-9.34	223.40	1.69	Vertical	1M	0.00	-12.65
3654.368	31.49	54.00	-22.51	223.40	3.26	Horizontal	1M	0.00	-11.83
5833.217	32.55	54.00	-21.45	109.60	3.26	Vertical	1M	0.00	-7.97
5835.811	32.73	54.00	-21.27	223.40	1.69	Horizontal	1M	0.00	-7.96
5883.225	32.55	54.00	-21.45	360.00	4.00	Vertical	1M	0.00	-7.83
5953.015	32.73	54.00	-21.27	337.00	4.00	Horizontal	1M	0.00	-7.55

Intertek

Report Number: 105935432BOX-002

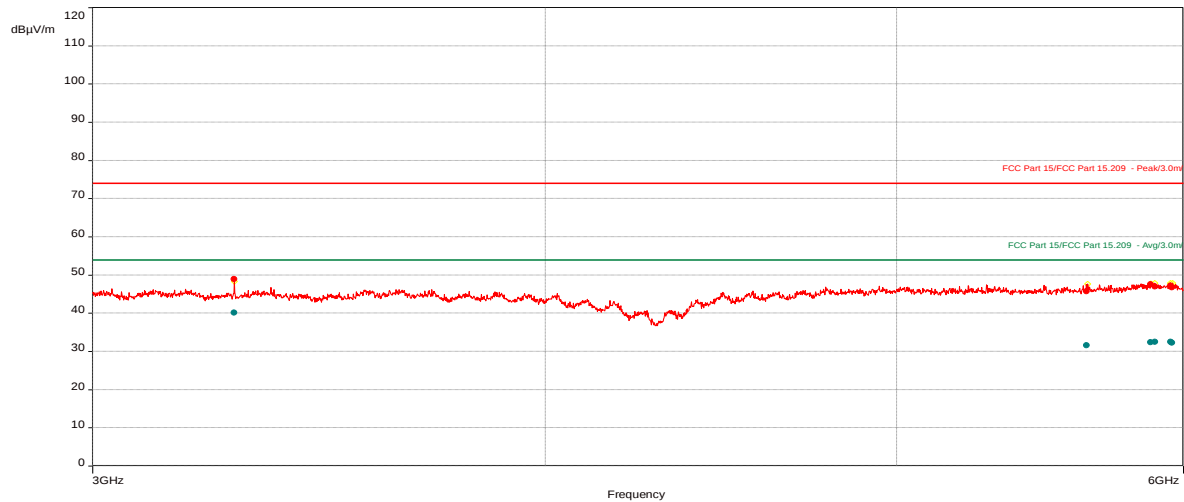
Issued: 10/07/2024
Revised: 10/10/2024, 10/28/2024, 11/01/2024

Spurious emissions 3-6GHz, Tx mode, 60GHz Radar and 2.4 GHz BT

Test Information:

Date and Time	10/1/2024 10:27:46 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#11_RE 3 to 6 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BT

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
3282.787	48.94	74.00	-25.06	223.30	1.69	Vertical	1M	0.00	-12.65
5642.185	45.74	74.00	-28.26	223.10	1.00	Horizontal	1M	0.00	-8.47
5876.9	47.54	74.00	-26.46	166.50	3.26	Horizontal	1M	0.00	-7.85
5892.296	47.05	74.00	-26.95	0.00	3.26	Horizontal	1M	0.00	-7.80
5951.448	47.20	74.00	-26.8	109.50	1.00	Horizontal	1M	0.00	-7.55
5957.589	46.74	74.00	-27.26	360.00	1.00	Horizontal	1M	0.00	-7.54

AVG (PASS) (6)

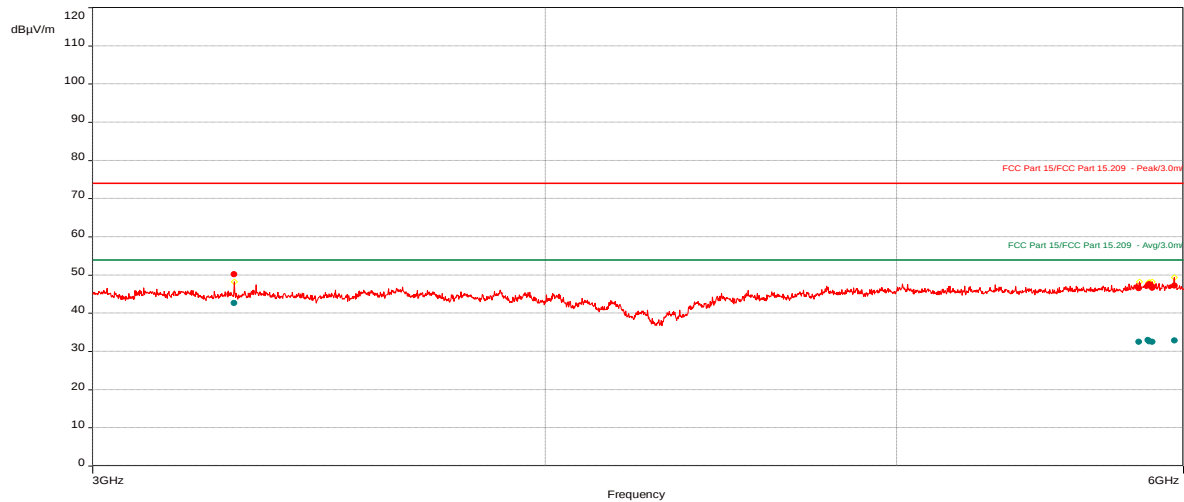
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
3282.787	40.11	54.00	-13.89	223.30	1.69	Vertical	1M	0.00	-12.65
5642.185	31.66	54.00	-22.34	223.10	1.00	Horizontal	1M	0.00	-8.47
5876.9	32.40	54.00	-21.60	166.50	3.26	Horizontal	1M	0.00	-7.85
5892.296	32.52	54.00	-21.48	0.00	3.26	Horizontal	1M	0.00	-7.80
5951.448	32.51	54.00	-21.49	109.50	1.00	Horizontal	1M	0.00	-7.55
5957.589	32.34	54.00	-21.66	360.00	1.00	Horizontal	1M	0.00	-7.54

Spurious emissions 3-6GHz, Tx mode, 60GHz Radar and 2.4 GHz BLE

Test Information:

Date and Time	10/1/2024 9:59:28 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	48 %
Atmospheric Pressure	1009 mbars
Comments	Scan#10_RE 3 to 6 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BLE

Graph:



Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
3282.575	50.24	74.00	-23.76	109.80	1.69	Vertical	1M	0.00	-12.65
5833.715	46.54	74.00	-27.46	360.00	3.26	Vertical	1M	0.00	-7.97
5866.506	47.26	74.00	-26.74	279.80	4.00	Horizontal	1M	0.00	-7.88
5871.151	47.55	74.00	-26.45	280.10	3.26	Vertical	1M	0.00	-7.87
5882.998	46.61	74.00	-27.39	223.30	4.00	Horizontal	1M	0.00	-7.83
5966.757	47.18	74.00	-26.82	166.60	1.00	Vertical	1M	0.00	-7.53

AVG (PASS) (6)

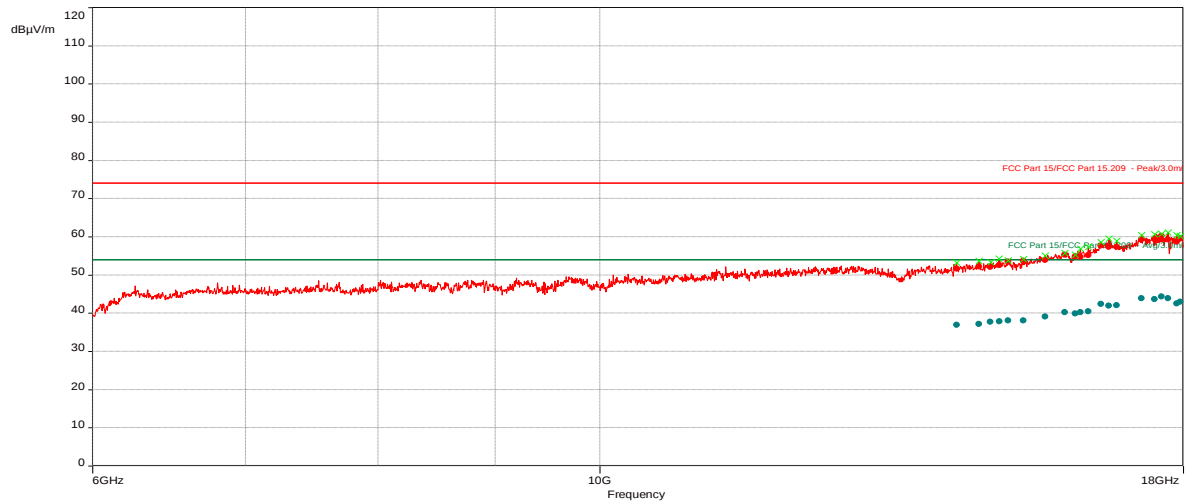
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
3282.575	42.72	54.00	-11.28	109.80	1.69	Vertical	1M	0.00	-12.65
5833.715	32.52	54.00	-21.48	360.00	3.26	Vertical	1M	0.00	-7.97
5866.506	32.95	54.00	-21.05	279.80	4.00	Horizontal	1M	0.00	-7.88
5871.151	32.58	54.00	-21.42	280.10	3.26	Vertical	1M	0.00	-7.87
5882.998	32.51	54.00	-21.49	223.30	4.00	Horizontal	1M	0.00	-7.83
5966.757	32.83	54.00	-21.17	166.60	1.00	Vertical	1M	0.00	-7.53

Spurious emissions 6-18GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi

Test Information:

Date and Time	10/2/2024 4:24:23 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	43 %
Atmospheric Pressure	1006 mbars
Comments	Scan#13_RE 6 to 18 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz WiFi

Graph:



Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024

Revised: 10/10/2024, 10/28/2024, 11/01/2024

Results:

Peak (PASS) (20)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
14327.466	51.63	74.00	-22.37	212.40	3.94	Horizontal	1M	0.00	3.04
14649.887	52.20	74.00	-21.8	0.00	4.00	Horizontal	1M	0.00	3.61
14821.044	52.16	74.00	-21.84	0.00	3.94	Horizontal	1M	0.00	3.82
14954.644	52.54	74.00	-21.46	212.50	4.00	Vertical	1M	0.00	3.94
15087.133	53.47	74.00	-20.53	0.00	3.94	Vertical	1M	0.00	4.11
15323.667	53.74	74.00	-20.26	212.50	4.00	Vertical	1M	0.00	4.64
15662.086	53.96	74.00	-20.04	0.00	4.00	Vertical	1M	0.00	4.92
15975.123	55.29	74.00	-18.71	360.00	3.94	Vertical	1M	0.00	5.61
16144.934	54.84	74.00	-19.16	360.00	3.94	Horizontal	1M	0.00	6.02
16228.55	54.78	74.00	-19.22	360.00	3.94	Vertical	1M	0.00	6.13
16356.41	55.18	74.00	-18.82	212.40	1.00	Vertical	1M	0.00	6.34
16566.9	57.75	74.00	-16.25	0.00	4.00	Vertical	1M	0.00	7.00
16700.404	57.40	74.00	-16.6	0.00	3.94	Horizontal	1M	0.00	7.45
16830.569	57.36	74.00	-16.64	0.00	4.00	Horizontal	1M	0.00	7.73
17257.809	59.27	74.00	-14.73	360.00	4.00	Horizontal	1M	0.00	7.86
17485.215	59.45	74.00	-14.55	360.00	3.94	Vertical	1M	0.00	8.09
17607.186	60.18	74.00	-13.82	360.00	3.94	Vertical	1M	0.00	8.34
17724.852	59.32	74.00	-14.68	360.00	1.00	Horizontal	1M	0.00	8.53
17882.82	58.75	74.00	-15.25	212.40	3.94	Horizontal	1M	0.00	8.68
17947.241	59.54	74.00	-14.46	360.00	4.00	Vertical	1M	0.00	8.77

AVG (PASS) (20)

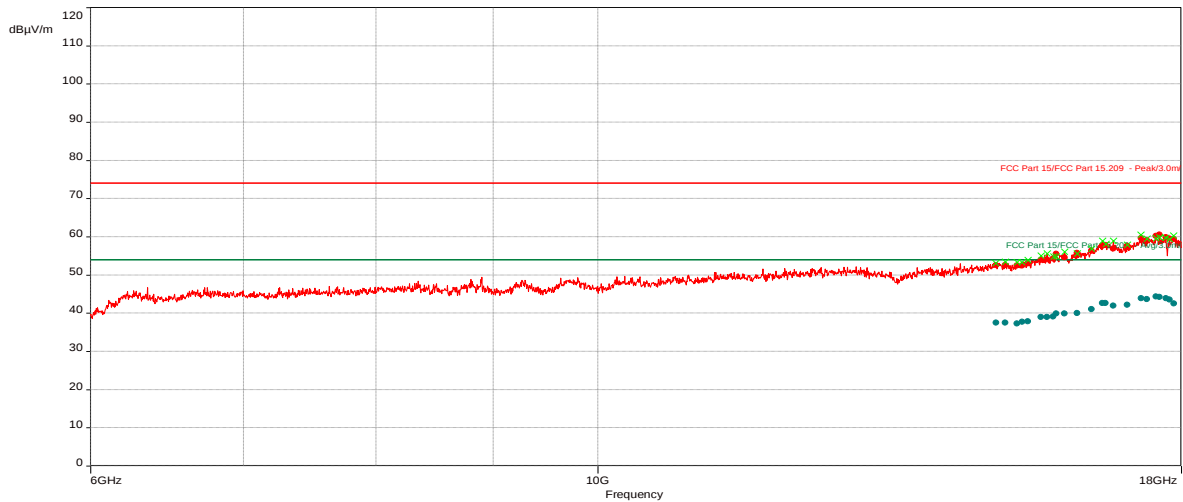
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
14327.466	37.00	54.00	-17.00	212.40	3.94	Horizontal	1M	0.00	3.04
14649.887	37.24	54.00	-16.76	0.00	4.00	Horizontal	1M	0.00	3.61
14821.044	37.74	54.00	-16.26	0.00	3.94	Horizontal	1M	0.00	3.82
14954.644	37.85	54.00	-16.15	212.50	4.00	Vertical	1M	0.00	3.94
15087.133	38.15	54.00	-15.85	0.00	3.94	Vertical	1M	0.00	4.11
15323.667	38.13	54.00	-15.87	212.50	4.00	Vertical	1M	0.00	4.64
15662.086	39.19	54.00	-14.81	0.00	4.00	Vertical	1M	0.00	4.92
15975.123	40.25	54.00	-13.75	360.00	3.94	Vertical	1M	0.00	5.61
16144.934	39.98	54.00	-14.02	360.00	3.94	Horizontal	1M	0.00	6.02
16228.55	40.27	54.00	-13.73	360.00	3.94	Vertical	1M	0.00	6.13
16356.41	40.47	54.00	-13.53	212.40	1.00	Vertical	1M	0.00	6.34
16566.9	42.50	54.00	-11.50	0.00	4.00	Vertical	1M	0.00	7.00
16700.404	42.03	54.00	-11.97	0.00	3.94	Horizontal	1M	0.00	7.45
16830.569	42.13	54.00	-11.87	0.00	4.00	Horizontal	1M	0.00	7.73
17257.809	43.90	54.00	-10.10	360.00	4.00	Horizontal	1M	0.00	7.86
17485.215	43.69	54.00	-10.31	360.00	3.94	Vertical	1M	0.00	8.09
17607.186	44.37	54.00	-9.63	360.00	3.94	Vertical	1M	0.00	8.34
17724.852	43.96	54.00	-10.04	360.00	1.00	Horizontal	1M	0.00	8.53
17882.82	42.59	54.00	-11.41	212.40	3.94	Horizontal	1M	0.00	8.68
17947.241	42.97	54.00	-11.03	360.00	4.00	Vertical	1M	0.00	8.77

Spurious emissions 6-18GHz, Tx mode, 60GHz Radar and 2.4 GHz BT

Test Information:

Date and Time	10/2/2024 6:14:48 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	43 %
Atmospheric Pressure	1006 mbars
Comments	Scan#14_RE 6 to 18 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BT

Graph:



Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024

Revised: 10/10/2024, 10/28/2024, 11/01/2024

Results:

Peak (PASS) (23)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
14935.058	52.56	74.00	-21.44	212.50	4.00	Vertical	1M	0.00	3.93
15078.112	52.55	74.00	-21.45	360.00	1.00	Vertical	1M	0.00	4.10
15253.223	52.44	74.00	-21.56	0.00	4.00	Horizontal	1M	0.00	4.49
15332.851	52.51	74.00	-21.49	360.00	1.00	Horizontal	1M	0.00	4.67
15426.761	53.11	74.00	-20.89	212.20	3.94	Vertical	1M	0.00	4.84
15629.324	53.99	74.00	-20.01	0.00	4.00	Vertical	1M	0.00	4.85
15725.311	54.06	74.00	-19.94	360.00	3.94	Vertical	1M	0.00	5.05
15823.194	54.27	74.00	-19.73	212.50	3.94	Horizontal	1M	0.00	5.26
15872.98	55.59	74.00	-18.41	360.00	4.00	Vertical	1M	0.00	5.36
16004.238	54.70	74.00	-19.3	0.00	3.94	Vertical	1M	0.00	5.70
16210.081	55.76	74.00	-18.24	212.40	1.00	Vertical	1M	0.00	6.10
16443.929	56.36	74.00	-17.64	212.40	1.00	Horizontal	1M	0.00	6.61
16626.236	57.78	74.00	-16.22	212.40	1.00	Horizontal	1M	0.00	7.21
16679.829	57.85	74.00	-16.15	360.00	4.00	Vertical	1M	0.00	7.39
16808.718	56.95	74.00	-17.05	0.00	4.00	Horizontal	1M	0.00	7.71
17049.467	57.56	74.00	-16.44	212.30	4.00	Vertical	1M	0.00	7.75
17286.317	59.72	74.00	-14.28	360.00	4.00	Horizontal	1M	0.00	7.86
17389.24	59.06	74.00	-14.94	212.40	1.00	Vertical	1M	0.00	7.93
17548.477	60.25	74.00	-13.75	212.50	1.00	Horizontal	1M	0.00	8.24
17606.842	60.54	74.00	-13.46	212.40	1.00	Horizontal	1M	0.00	8.34
17723.883	59.89	74.00	-14.11	360.00	4.00	Horizontal	1M	0.00	8.53
17787.698	59.61	74.00	-14.39	212.30	4.00	Vertical	1M	0.00	8.59
17864.889	59.45	74.00	-14.55	0.00	3.94	Horizontal	1M	0.00	8.66

AVG (PASS) (23)

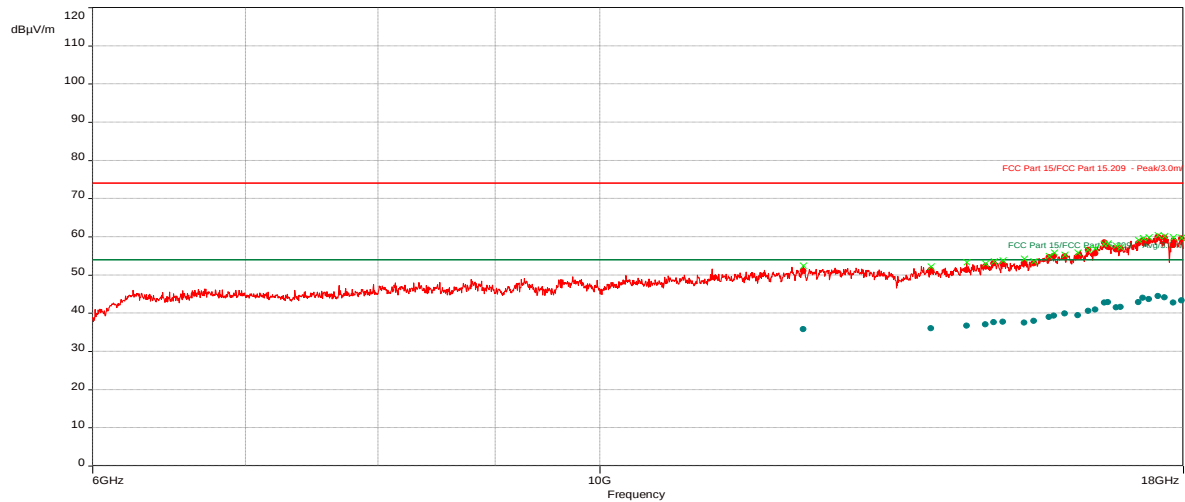
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
14935.058	37.57	54.00	-16.43	212.50	4.00	Vertical	1M	0.00	3.93
15078.112	37.48	54.00	-16.52	360.00	1.00	Vertical	1M	0.00	4.10
15253.223	37.33	54.00	-16.67	0.00	4.00	Horizontal	1M	0.00	4.49
15332.851	37.71	54.00	-16.29	360.00	1.00	Horizontal	1M	0.00	4.67
15426.761	37.83	54.00	-16.17	212.20	3.94	Vertical	1M	0.00	4.84
15629.324	39.02	54.00	-14.98	0.00	4.00	Vertical	1M	0.00	4.85
15725.311	39.03	54.00	-14.97	360.00	3.94	Vertical	1M	0.00	5.05
15823.194	39.13	54.00	-14.87	212.50	3.94	Horizontal	1M	0.00	5.26
15872.98	39.97	54.00	-14.03	360.00	4.00	Vertical	1M	0.00	5.36
16004.238	39.88	54.00	-14.12	0.00	3.94	Vertical	1M	0.00	5.70
16210.081	40.08	54.00	-13.92	212.40	1.00	Vertical	1M	0.00	6.10
16443.929	41.12	54.00	-12.88	212.40	1.00	Horizontal	1M	0.00	6.61
16626.236	42.65	54.00	-11.35	212.40	1.00	Horizontal	1M	0.00	7.21
16679.829	42.63	54.00	-11.37	360.00	4.00	Vertical	1M	0.00	7.39
16808.718	42.04	54.00	-11.96	0.00	4.00	Horizontal	1M	0.00	7.71
17049.467	42.20	54.00	-11.80	212.30	4.00	Vertical	1M	0.00	7.75
17286.317	43.98	54.00	-10.02	360.00	4.00	Horizontal	1M	0.00	7.86
17389.24	43.65	54.00	-10.35	212.40	1.00	Vertical	1M	0.00	7.93
17548.477	44.40	54.00	-9.60	212.50	1.00	Horizontal	1M	0.00	8.24
17606.842	44.25	54.00	-9.75	212.40	1.00	Horizontal	1M	0.00	8.34
17723.883	43.92	54.00	-10.08	360.00	4.00	Horizontal	1M	0.00	8.53
17787.698	43.62	54.00	-10.38	212.30	4.00	Vertical	1M	0.00	8.59
17864.889	42.57	54.00	-11.43	0.00	3.94	Horizontal	1M	0.00	8.66

Spurious emissions 6-18GHz, Tx mode, 60GHz Radar and 2.4 GHz BLE

Test Information:

Date and Time	10/2/2024 8:22:19 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	43 %
Atmospheric Pressure	1006 mbars
Comments	Scan#15_RE 6 to 18 GHz120VAC 60Hz_Tx mode_60 GHz Radar radio and 2.4 GHz BLE

Graph:



Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024
Revised: 10/10/2024, 10/28/2024, 11/01/2024

Results:

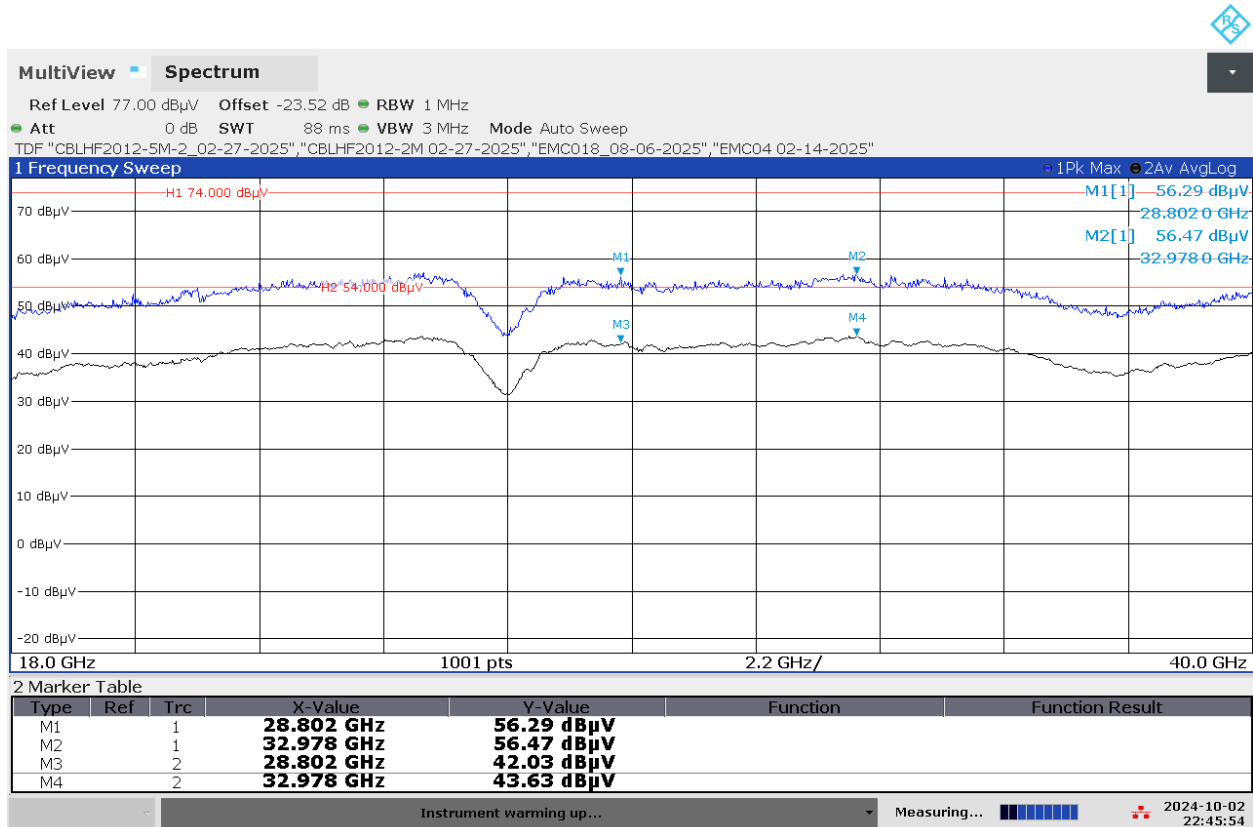
Peak (PASS) (25)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
12275.694	51.15	74.00	-22.85	360.00	3.94	Vertical	1M	0.00	1.64
13960.57	51.30	74.00	-22.7	0.00	1.00	Horizontal	1M	0.00	2.40
14473.497	51.39	74.00	-22.61	360.00	3.94	Vertical	1M	0.00	3.41
14748.706	52.31	74.00	-21.69	212.40	4.00	Vertical	1M	0.00	3.72
14874.753	53.01	74.00	-20.99	360.00	1.00	Horizontal	1M	0.00	3.89
15008.097	52.97	74.00	-21.03	212.40	1.00	Horizontal	1M	0.00	4.00
15338.779	53.14	74.00	-20.86	360.00	4.00	Vertical	1M	0.00	4.68
15482.911	53.06	74.00	-20.94	212.40	3.94	Vertical	1M	0.00	4.80
15721.889	54.62	74.00	-19.38	0.00	1.00	Horizontal	1M	0.00	5.05
15802.105	54.93	74.00	-19.07	212.40	1.00	Vertical	1M	0.00	5.21
15973.546	54.84	74.00	-19.16	212.50	3.94	Vertical	1M	0.00	5.60
16186.018	54.91	74.00	-19.09	360.00	3.94	Horizontal	1M	0.00	6.07
16354.447	56.56	74.00	-17.44	212.50	4.00	Horizontal	1M	0.00	6.33
16470.254	55.68	74.00	-18.32	212.40	1.00	Vertical	1M	0.00	6.70
16623.532	58.49	74.00	-15.51	212.50	3.94	Horizontal	1M	0.00	7.20
16683.879	57.41	74.00	-16.59	360.00	4.00	Vertical	1M	0.00	7.40
16822.236	56.65	74.00	-17.35	360.00	3.94	Vertical	1M	0.00	7.73
16900.327	56.88	74.00	-17.12	212.50	4.00	Vertical	1M	0.00	7.73
17207.024	58.28	74.00	-15.72	360.00	3.94	Vertical	1M	0.00	7.88
17283.545	58.97	74.00	-15.03	0.00	3.94	Vertical	1M	0.00	7.86
17387.28	58.86	74.00	-15.14	212.30	3.94	Vertical	1M	0.00	7.93
17547.753	60.02	74.00	-13.98	0.00	4.00	Horizontal	1M	0.00	8.24
17666.26	59.73	74.00	-14.27	360.00	1.00	Horizontal	1M	0.00	8.43
17821.402	57.85	74.00	-16.15	360.00	3.94	Horizontal	1M	0.00	8.62
17972.819	59.54	74.00	-14.46	0.00	1.00	Horizontal	1M	0.00	8.81

AVG (PASS) (25)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW	Meas.Time	Correction (dB)
12275.694	35.85	54.00	-18.15	360.00	3.94	Vertical	1M	0.00	1.64
13960.57	36.09	54.00	-17.91	0.00	1.00	Horizontal	1M	0.00	2.40
14473.497	36.75	54.00	-17.25	360.00	3.94	Vertical	1M	0.00	3.41
14748.706	37.13	54.00	-16.87	212.40	4.00	Vertical	1M	0.00	3.72
14874.753	37.65	54.00	-16.35	360.00	1.00	Horizontal	1M	0.00	3.89
15008.097	37.74	54.00	-16.26	212.40	1.00	Horizontal	1M	0.00	4.00
15338.779	37.58	54.00	-16.42	360.00	4.00	Vertical	1M	0.00	4.68
15482.911	37.99	54.00	-16.01	212.40	3.94	Vertical	1M	0.00	4.80
15721.889	39.02	54.00	-14.98	0.00	1.00	Horizontal	1M	0.00	5.05
15802.105	39.39	54.00	-14.61	212.40	1.00	Vertical	1M	0.00	5.21
15973.546	39.98	54.00	-14.02	212.50	3.94	Vertical	1M	0.00	5.60
16186.018	39.53	54.00	-14.47	360.00	3.94	Horizontal	1M	0.00	6.07
16354.447	40.58	54.00	-13.42	212.50	4.00	Horizontal	1M	0.00	6.33
16470.254	40.98	54.00	-13.02	212.40	1.00	Vertical	1M	0.00	6.70
16623.532	42.80	54.00	-11.20	212.50	3.94	Horizontal	1M	0.00	7.20
16683.879	42.85	54.00	-11.15	360.00	4.00	Vertical	1M	0.00	7.40
16822.236	41.53	54.00	-12.47	360.00	3.94	Vertical	1M	0.00	7.73
16900.327	41.63	54.00	-12.37	212.50	4.00	Vertical	1M	0.00	7.73
17207.024	42.88	54.00	-11.12	360.00	3.94	Vertical	1M	0.00	7.88
17283.545	44.00	54.00	-10.00	0.00	3.94	Vertical	1M	0.00	7.86
17387.28	43.66	54.00	-10.34	212.30	3.94	Vertical	1M	0.00	7.93
17547.753	44.50	54.00	-9.50	0.00	4.00	Horizontal	1M	0.00	8.24
17666.26	44.13	54.00	-9.87	360.00	1.00	Horizontal	1M	0.00	8.43
17821.402	42.75	54.00	-11.25	360.00	3.94	Horizontal	1M	0.00	8.62
17972.819	43.34	54.00	-10.66	0.00	1.00	Horizontal	1M	0.00	8.81

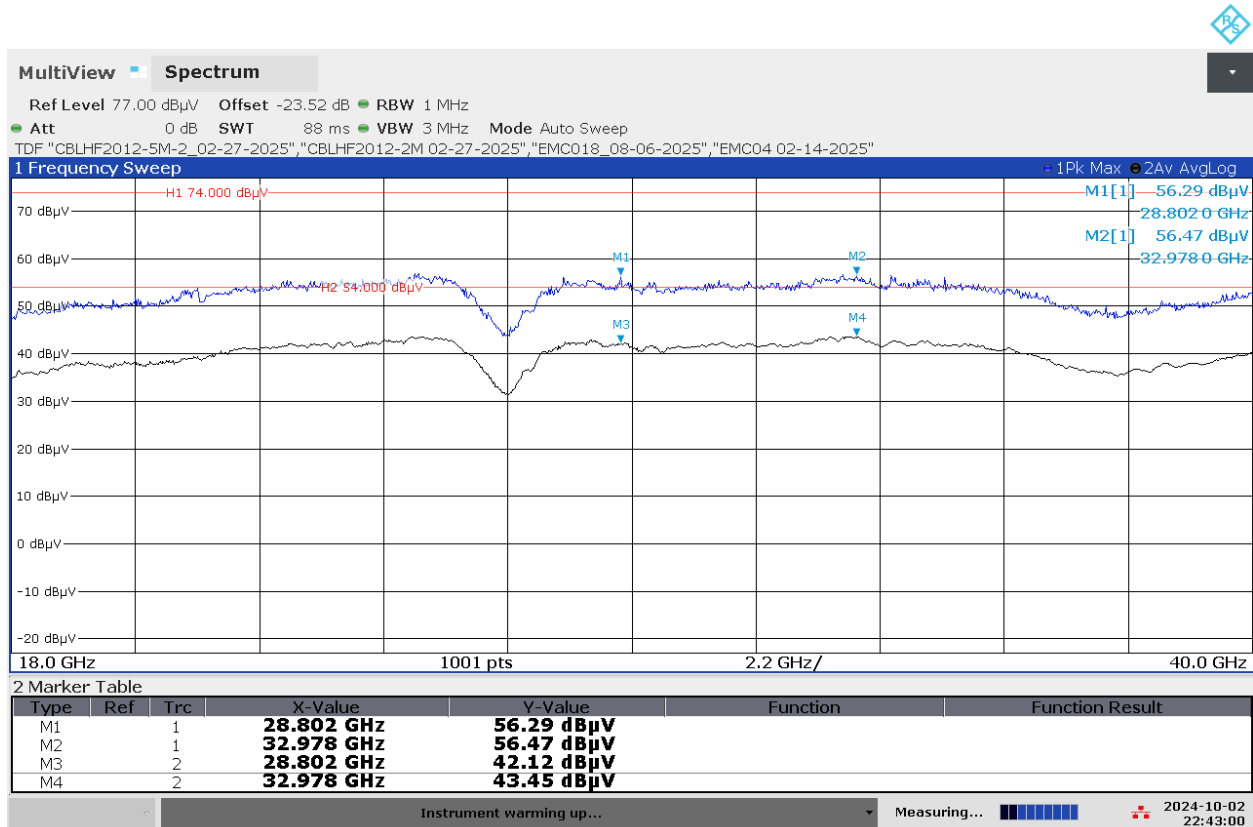
Spurious emissions 18-40GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi



10:45:54 PM 10/02/2024

Note: All factors, antenna factors, cable factors, and distance factors were internally compensated. No emissions were detected above the measuring noise floor when antenna was located at 20cm from the EUT.

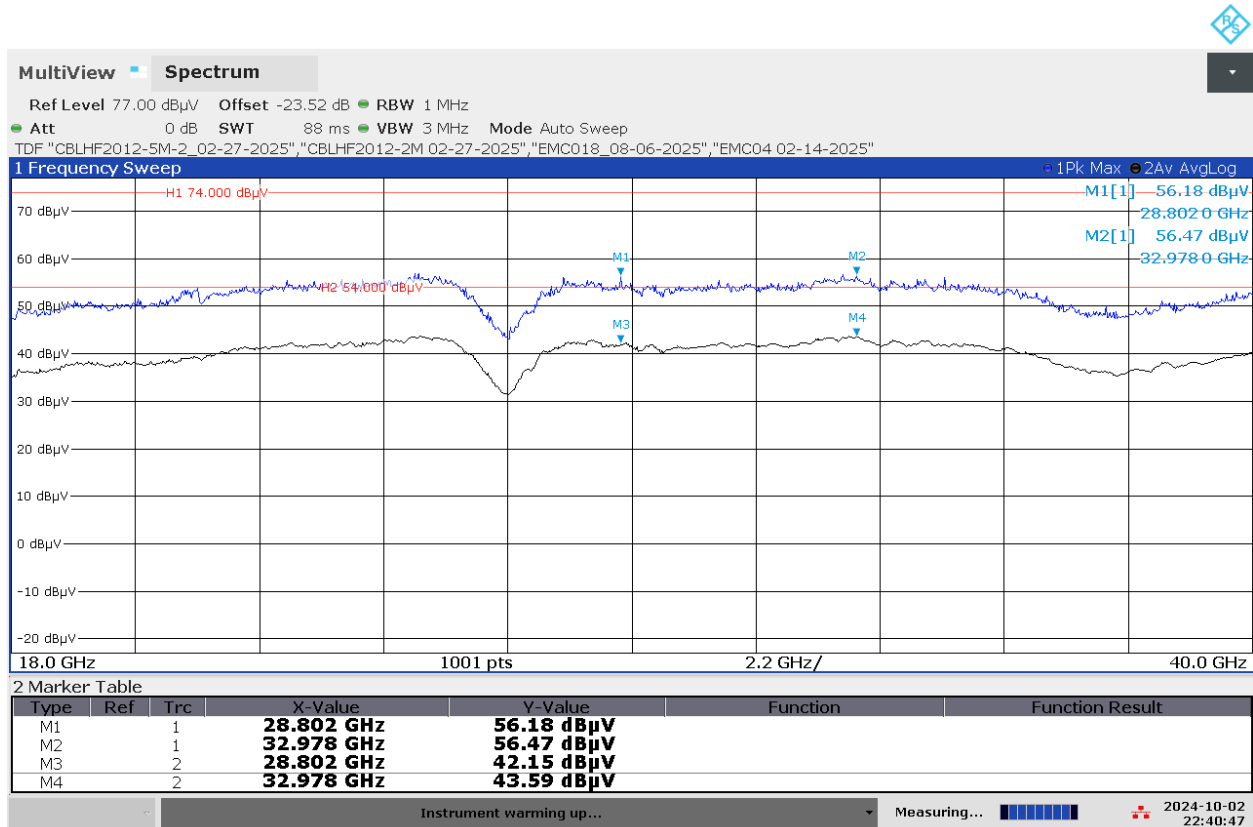
Spurious emissions 18-40GHz, Tx mode, 60GHz Radar and 2.4 GHz BT



10:43:01 PM 10/02/2024

Note: All factors, antenna factors, cable factors, and distance factors were internally compensated. No emissions were detected above the measuring noise floor when antenna was located at 20cm from the EUT.

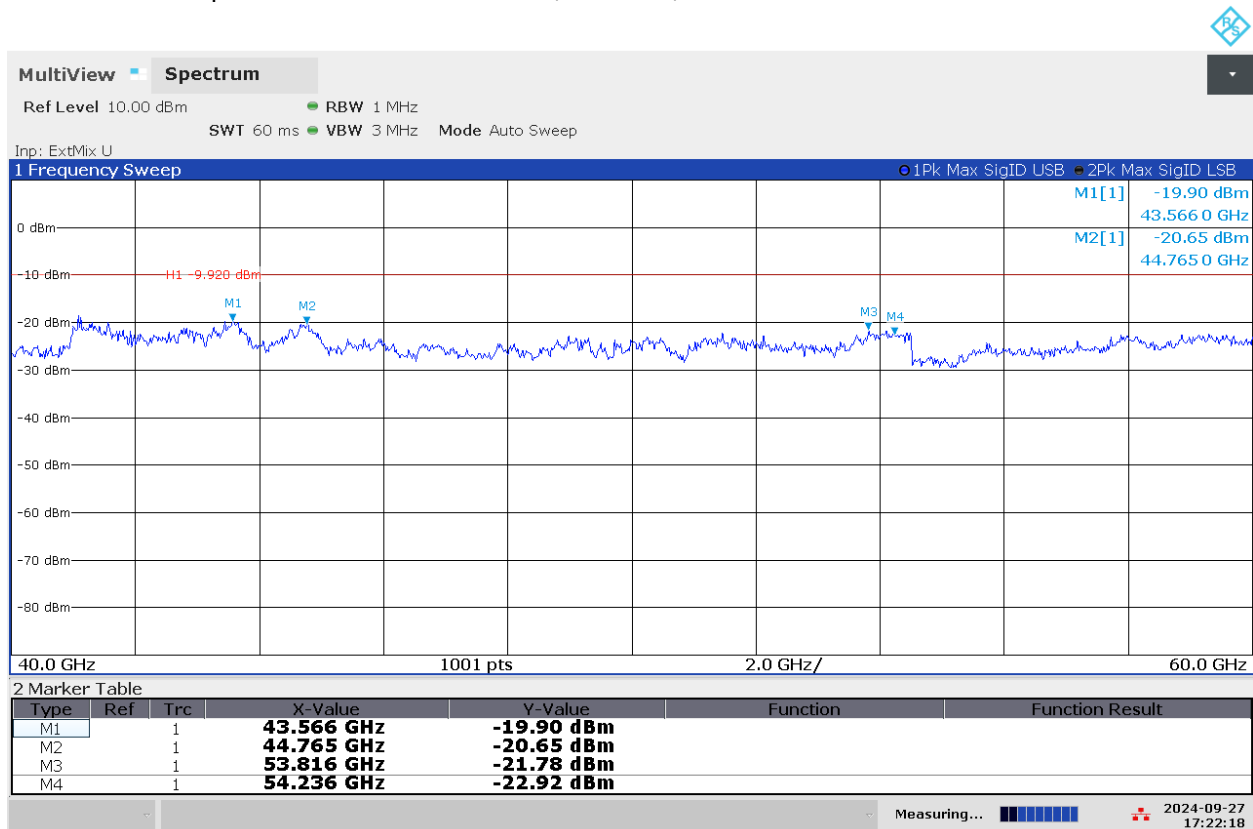
Spurious emissions 18-40GHz, Tx mode, 60GHz Radar and 2.4 GHz BLE



10:40:48 PM 10/02/2024

Note: All factors, antenna factors, cable factors, and distance factors were internally compensated. No emissions were detected above the measuring noise floor when antenna was located at 20cm from the EUT.

Spurious emissions 40-60GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi



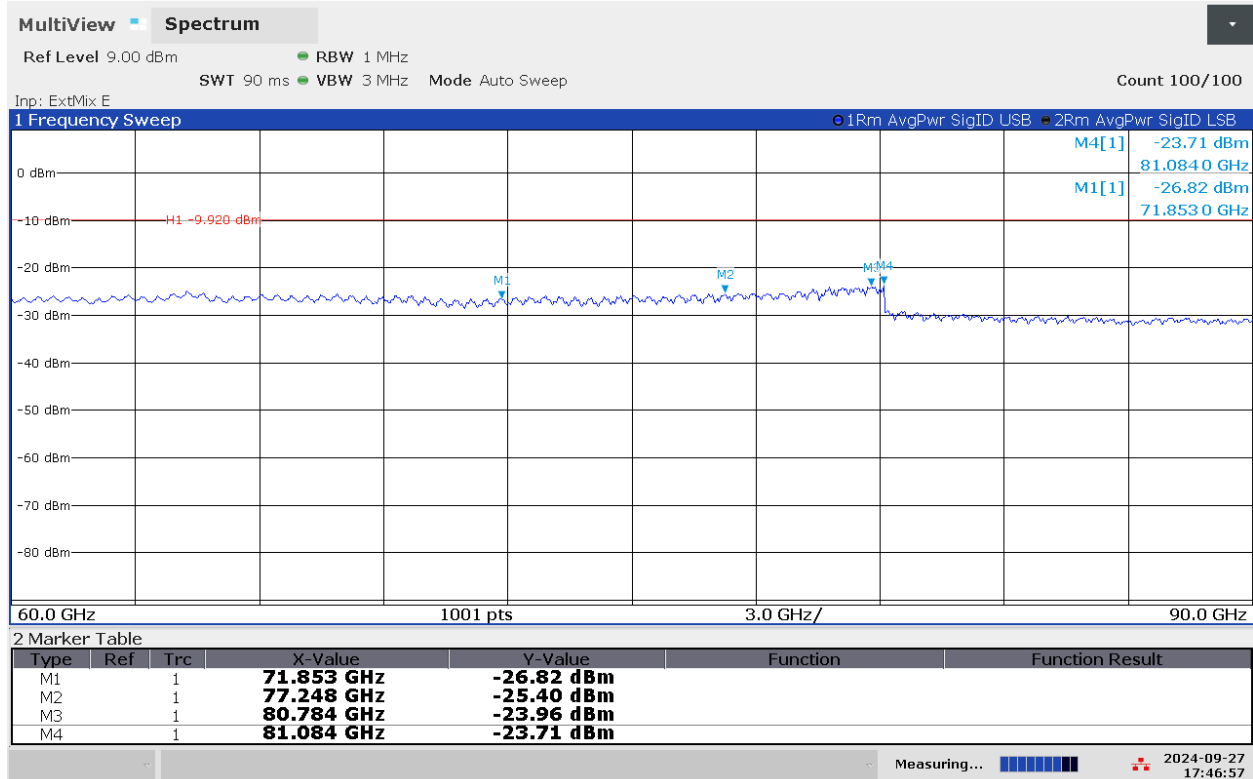
05:22:19 PM 09/27/2024

Note 1: Hand scans were performed at close distance around the EUT with vertical and horizontal polarities to find the maximum emissions. No emissions were detected above the measuring noise floor. The antenna was then moved and placed in a far field at 1m.

Note 2: All factors, mixer conversion loss, antenna factors, cable factors, path loss factors, and distance factors were internally compensated.

Note 3: The plot above was of the equipment noise floor.

Spurious emissions 60-90GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi



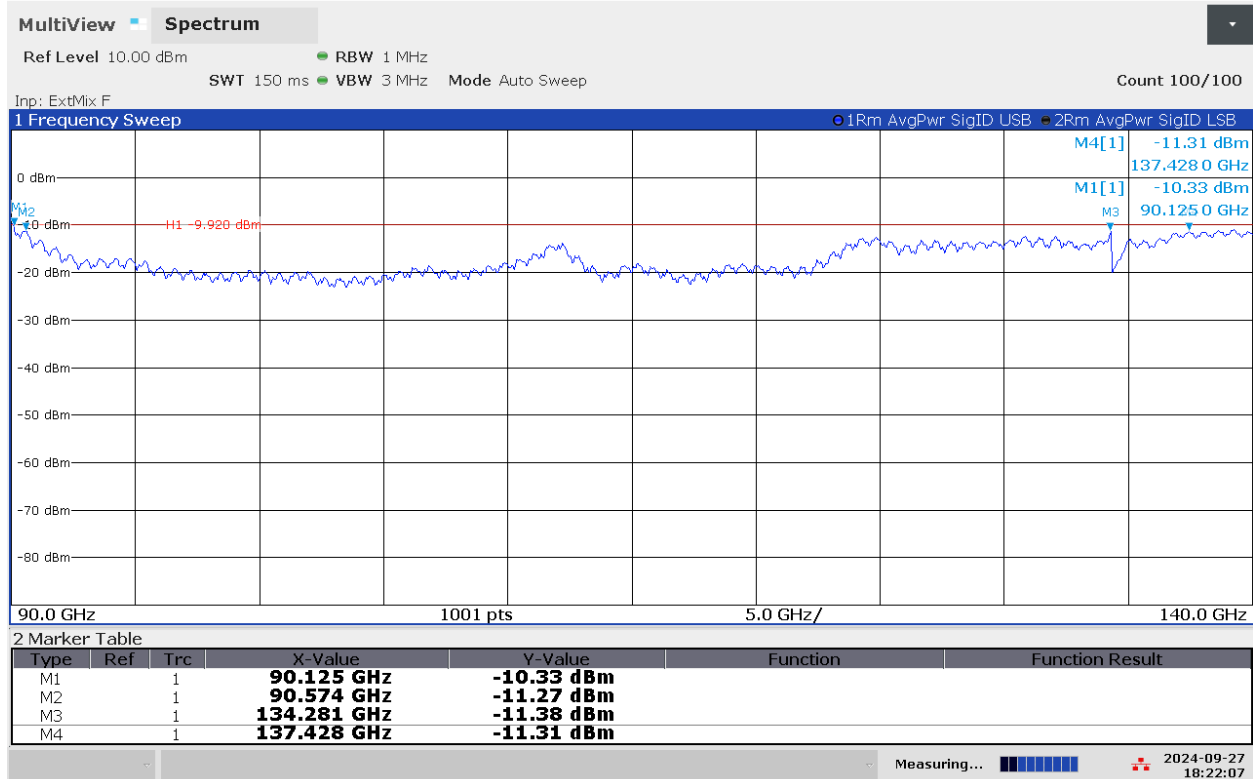
05:46:58 PM 09/27/2024

Note 1: Hand scans were performed at close distance around the EUT with vertical and horizontal polarities to find the maximum emissions. No emissions were detected above the measuring noise floor. The antenna was then moved and placed in a far field at 1m.

Note 2: All factors, mixer conversion loss, antenna factors, cable factors, path loss factors, and distance factors were internally compensated.

Note 3: The plot above was of the equipment noise floor.

Spurious emissions 90-140GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi



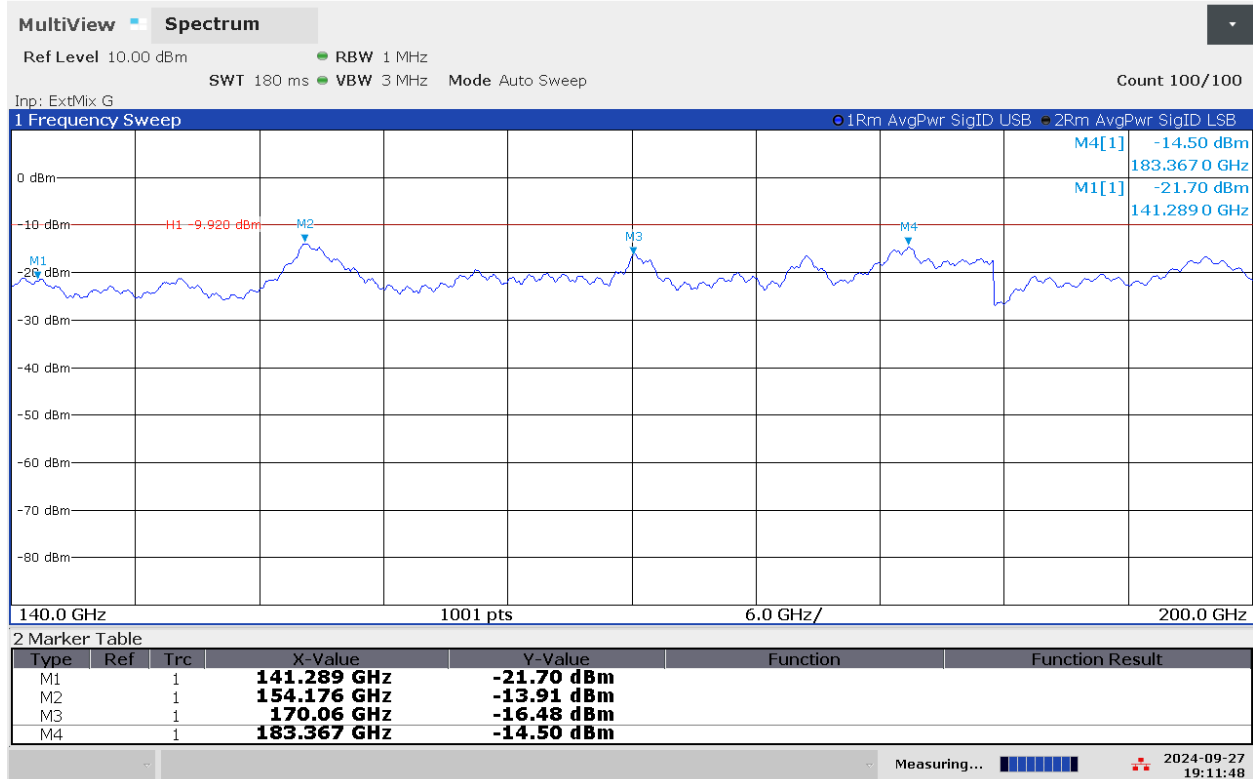
06:22:07 PM 09/27/2024

Note 1: Hand scans were performed at close distance around the EUT with vertical and horizontal polarities to find the maximum emissions. No emissions were detected above the measuring noise floor. The antenna was then moved and placed in a far field at 1m.

Note 2: All factors, mixer conversion loss, antenna factors, cable factors, path loss factors, and distance factors were internally compensated.

Note 3: The plot above was of the equipment noise floor.

Spurious emissions 140-200GHz, Tx mode, 60GHz Radar and 2.4 GHz WiFi



07:11:49 PM 09/27/2024

Note 1: Hand scans were performed at close distance around the EUT with vertical and horizontal polarities to find the maximum emissions. No emissions were detected above the measuring noise floor. The antenna was then moved and placed in a far field at 1m.

Note 2: All factors, mixer conversion loss, antenna factors, cable factors, path loss factors, and distance factors were internally compensated.

Note 3: The plot above was of the equipment noise floor.

	Product Standard: 15.255(d)			Limit applied: 90 pW/cm ² or -9.92 dBm 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
09/27/2024	Vathana Ven	N/A	120VAC 60Hz	Continuous sweep	23	45	1009
10/02/2024	Vathana Ven	N/A	120VAC 60Hz	Continuous sweep	24	48	1009
10/02/2024	Vathana Ven	N/A	120VAC 60Hz	Continuous sweep	24	43	1006

Deviations, Additions, or Exclusions: None

Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024

Revised: 10/10/2024, 10/28/2024, 11/01/2024

10 Frequency stability

10.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.255(f), KDB 364244 D01 Meas 15.255 Radars v01, ANSI C63.10.

TEST SITE: Safety Lab

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV009	weather station	Davis Instruments	6351 Vantage VUE	DAV009	04/05/2024	04/05/2025
CBLHF2012-5M-2	5m 9kHz-40GHz Coaxial Cable - SET2	Huber & Suhner	SF102	252676002	02/27/2024	02/27/2025
ROS005-1	Signal and Spectrum Analyzer	Rohde and Schwartz	FSW43	100646	11/22/2023	11/22/2024
SAF785	Programmable AC Source	QuadTech	31015A	QT31015A0066	04/26/2024	04/26/2025
SAF1637	Environmental chamber	Russell Tech	GD-16-3-3-AC	07235255	08/23/2024	08/23/2025
FLU15	Digital Multimeter	Fluke	87-5	23500638	02/27/2024	02/27/2025
OML3'	WR12 Harmonic Mixer, 60 to 90GHz	Oleson Microwave Lab	M12HWD	E21011-1	02/12/2024	02/12/2025
OML3'	OML Horn Antenna, 60 to 90GHz	Oleson Microwave Lab	M12RH	Not labeled	02/12/2024	02/12/2025

Software Utilized:

Name	Manufacturer	Version
EMI Boxborough.xls	Intertek	08/27/2010

10.3 Results:

The sample tested was found to Comply.

§ 15.255 Operation within the band 57-71 GHz

(f) **Frequency stability.** Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to + 50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

10.4 Setup Photographs:



Report Number: 105935432BOX-002	Issued: 10/07/2024 Revised: 10/10/2024, 10/28/2024, 11/01/2024
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10.5 Plots/Data:

Frequency Stability

Company: Reliant MSO
Model #: SAFEST V1.1
Serial #: Sample #1

Test Equipment Used:
SAF1637, ROS005-1, CBLHF2012-5M-2, M12HWA, DAV009, SAF785, FLU15

Engineer(s): Vathana Ven
Project #: G105935432
Standard: FCC Part 15.255
Limit: PPM

Location: Safety 23 deg C 49% 1009 mB

Nominal f: 60 GHz

Voltage: 120 VAC

%	Voltage Volts	F low (GHz)	F high (GHz)	Limit (within 57-71 GHz)
-15%	102	60.8017000	63.97850	57-71 GHz
-10%	108	60.8017000	63.978500	57-71 GHz
-5%	114	60.801700	63.978500	57-71 GHz
+0%	120	60.811700	63.978500	57-71 GHz
+5%	126	60.806700	63.983500	57-71 GHz
+10%	132	60.806700	63.978500	57-71 GHz
+15%	138	60.806700	63.978500	57-71 GHz

Temp Celsius	F low (GHz)	F high (GHz)	Limit (within 57-71 GHz)
-30	60.801700	63.9835	57-71 GHz
-20	60.801700	63.98350	57-71 GHz
-10	60.806700	63.97850	57-71 GHz
0	60.806700	63.9835	57-71 GHz
10	60.806700	63.9835	57-71 GHz
20	60.806700	63.9835	57-71 GHz
30	60.808200	63.9787	57-71 GHz
40	60.808200	63.9787	57-71 GHz
50	60.808200	63.9787	57-71 GHz

Note: Bandwidth of the fundamental emissions contained within the authorized frequency band over a temperature range of -30 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage.

Product Standard: CFR47 FCC Part 15.255(f)				Limit applied: Must contained in 57-71 GHz Pretest Verification w/ signal generator: N/A			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
10/03/2024	Vathana Ven <i>VSV</i>	N/A	120VAC 60Hz	Continuous sweep	23	49	1009

Deviations, Additions, or Exclusions: None

11 AC Mains Conducted Emissions

11.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.207 and ANSI C63.4.

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.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucisp
AC Line Conducted Emissions	150 kHz - 30 MHz	1.5 dB	3.4 dB
Telco Port Emissions	150 kHz - 30 MHz	3.3 dB	5.0 dB
AC Line Conducted Emissions	9 kHz - 150 MHz	1.5 dB	3.4 dB

As shown in the table above our conducted 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 Calculations

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where NF = Net Reading in dB μ V

RF = Reading from receiver in dB μ V

LF = LISN or ISN Correction Factor in dB

CF = Cable Correction Factor in dB

AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

NF = Net Reading in dB μ V

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 285.1 \mu\text{V/m}$$

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 LISN Factor, Attenuator, and Cable Loss. These are already accounted for in the "Level" column.

Report Number: 105935432BOX-002	Issued: 10/07/2024 Revised: 10/10/2024, 10/28/2024, 11/01/2024
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11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV009'	weather station	Davis Instruments	6351 Vantage VUE	DAV009	04/05/2024	04/05/2025
CBL052'	9kHz-1GHz BNC cable 25 ft long	Belden	RG58A/U	CBL052	01/09/2024	01/09/2025
LISN53'	Single Phase LISN 20 Amp	Com Power	LI-220C	20070071	12/22/2023	12/22/2024
ROS002'	9kHz to 3GHz EMI Test Receiver	Rohde & Schwartz	ESCI 1166.5950K03	100067	08/02/2024	08/02/2025
WEI30'	20 dB 18GHz 5W Attenuator	Weinschel	WA2-20-0403	WEI30	02/13/2024	02/13/2025
LISN55'	Single Phase LISN 20Amp	Com Power	LI-220C	20070073	12/22/2023	12/22/2024
147-306'	Signal Generator	Rohde & Schwarz	SML03	102824	02/27/2024	02/27/2025
FLU13'	Digital Multimeter	Fluke	87-5	23500632	01/12/2024	01/12/2025

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	2022.0.27.0

11.3 Results:

The sample tested was found to Comply.

11.4 Setup Photographs:



11.5 Plots/Data:

Tx mode, 60GHz Radar and 2.4 GHz WiFi

Test Information:

Date and Time	9/27/2024 8:31:55 PM
Client and Project Number	Reliant MSO LIC_G105935432
Engineer	Vathana Ven
Temperature	24 deg C
Humidity	52 %
Atmospheric Pressure	1006 mbars
Comments	Scan#2_Single Phase Under 20 Amp_150kHz to 30 MHz ESCI_2.4 GHz WiFi/60-64 GHz radio

Graph:

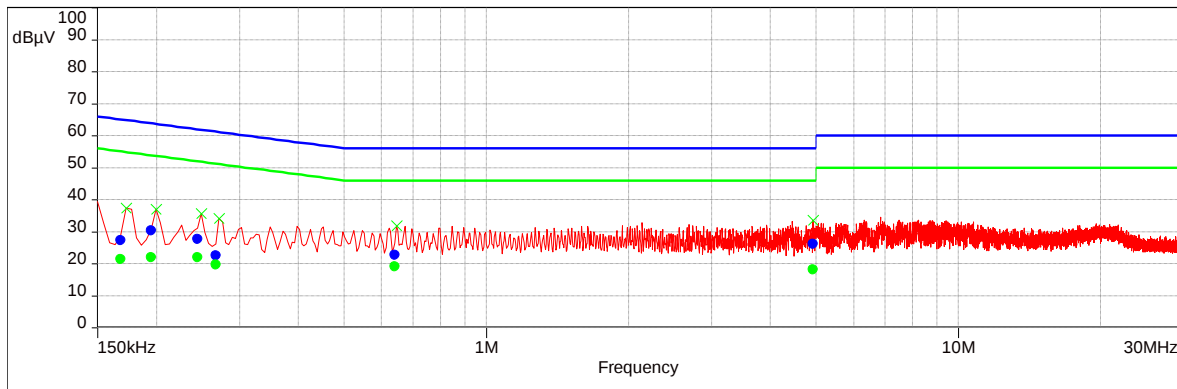
- Conducted Emissions Limit Lines/FCC Part 15 Subpart B CE Main Ports B - Average/
- Conducted Emissions Limit Lines/FCC Part 15 Subpart B CE Main Ports B - QPeak/
- × Peak (Manual finals) (RF Output Measure)
- Peak (RF Output Measure)
- AVG Level (Average(Pass)) (RF Output Measure)
- QP Level (QuasiPeak(Pass)) (RF Output Measure)

Sub-range 1

Frequencies: 150 kHz - 30 MHz (Mode: Lin - Step: 4.5 kHz)

Settings: RBW: 9kHz, VBW: Auto, Sweep time: 5 ms/Pts, Attenuation: Auto, Sweep count: 1, Preamp: Off, LN Preamp: Off, Preselector: On

Line:RF Output Measure



test name Scan#2_Single Phase Under 20 Amp_150kHz to 30 MHz ESCI_2.4 GHz WiFi/60-64 GHz radio_Alt PS Time ate 27/9/2024 20:39

Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024

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Results:

QuasiPeak(Pass) (6)

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dB)	Line	RBW	Meas.Time	Correction (dB)
0.16892	27.31	65.06	-37.74	Phase 1	9k	0.01	19.90
0.19586	30.22	63.82	-33.60	Phase 1	9k	0.01	19.88
0.24538	27.57	61.94	-34.38	Phase 1	9k	0.01	19.87
0.2679	22.47	61.21	-38.74	Neutral	9k	0.01	19.87
0.64148	22.65	56.00	-33.35	Phase 1	9k	0.01	19.89
4.91636	26.13	56.00	-29.87	Phase 1	9k	0.01	20.07

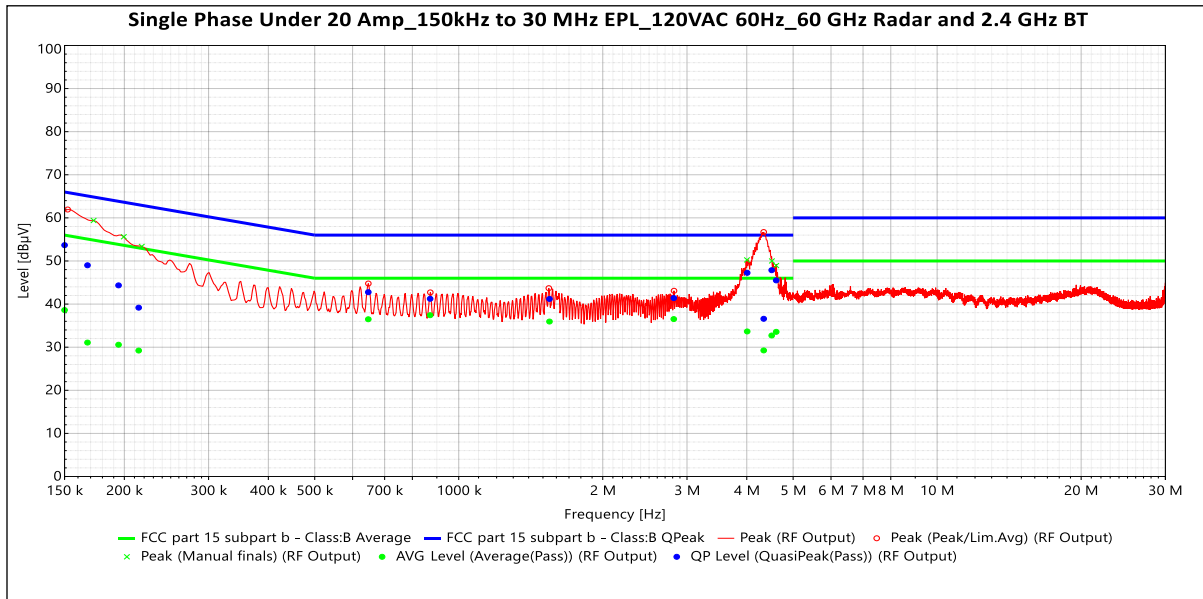
Average(Pass) (6)

Frequency (MHz)	AVG Level (dBμV)	AVG Limit (dBμV)	AVG Margin (dB)	Line	RBW	Meas.Time	Correction (dB)
0.16892	21.38	55.06	-33.68	Phase 1	9k	0.01	19.90
0.19586	21.96	53.82	-31.87	Phase 1	9k	0.01	19.88
0.24538	22.01	51.94	-29.93	Phase 1	9k	0.01	19.87
0.2679	19.68	51.21	-31.53	Neutral	9k	0.01	19.87
0.64148	19.12	46.00	-26.88	Phase 1	9k	0.01	19.89
4.91636	18.15	46.00	-27.85	Phase 1	9k	0.01	20.07

Tx mode, 60GHz Radar and 2.4 GHz BT

DATE	10/03/2024
ENGINEER	Vathana Ven
CLIENT AND PROJECT	Reliant MSO_G105935432

EUT: Line conducted emissions



Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024

Revised: 10/10/2024, 10/28/2024, 11/01/2024

Finals

Final source: Average(Pass)

Frequency	Line	Correction (dB)	AVG Level (dBμV)	AVG Limit (dBuV)	AVG Margin (dB)	RBW (Hz)	Meas.Time (s)
150.005 kHz	Phase 1	19.766	38.609	56	-17.391	9 k	5
167.505 kHz	Neutral	19.753	31.072	55.059	-23.986	9 k	5
194.505 kHz	Phase 1	19.733	30.566	53.821	-23.255	9 k	5
214.303 kHz	Neutral	19.728	29.216	53	-23.784	9 k	5
647.11 kHz	Neutral	19.728	36.479	46	-9.521	9 k	5
871.441 kHz	Phase 1	19.722	37.416	46	-8.584	9 k	5
1.547745 MHz	Phase 1	19.732	35.945	46	-10.055	9 k	5
2.815073 MHz	Phase 1	19.756	36.518	46	-9.482	9 k	5
4.008835 MHz	Phase 1	19.778	33.653	46	-12.347	9 k	5
4.340219 MHz	Phase 1	19.784	29.249	46	-16.751	9 k	5
4.510005 MHz	Phase 1	19.788	32.708	46	-13.292	9 k	5
4.60957 MHz	Phase 1	19.789	33.562	46	-12.438	9 k	5

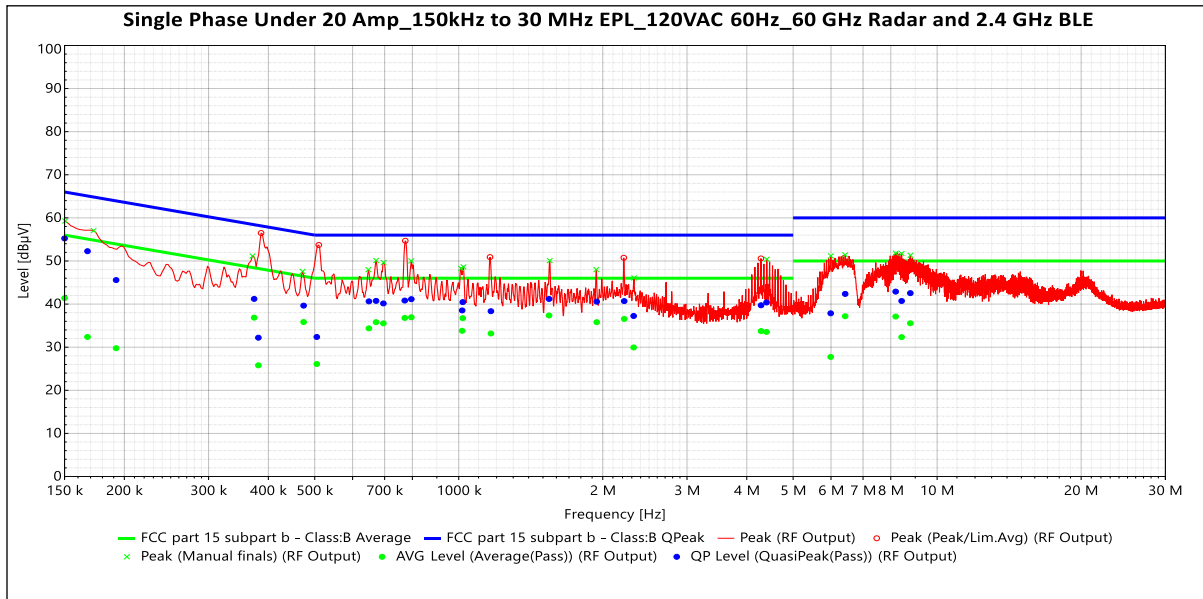
Final source: QuasiPeak(Pass)

Frequency	Line	Correction (dB)	RBW (Hz)	Meas.Time (s)	QP Level (dBμV)	QP Limit (dBuV)	QP Margin (dB)
150.005 kHz	Phase 1	19.766	9 k	5	53.673	66	-12.327
167.505 kHz	Neutral	19.753	9 k	5	48.995	65.059	-16.064
194.505 kHz	Phase 1	19.733	9 k	5	44.345	63.821	-19.476
214.303 kHz	Neutral	19.728	9 k	5	39.173	63	-23.827
647.11 kHz	Neutral	19.728	9 k	5	42.756	56	-13.244
871.441 kHz	Phase 1	19.722	9 k	5	41.23	56	-14.77
1.547745 MHz	Phase 1	19.732	9 k	5	41.188	56	-14.812
2.815073 MHz	Phase 1	19.756	9 k	5	41.399	56	-14.601
4.008835 MHz	Phase 1	19.778	9 k	5	47.251	56	-8.749
4.340219 MHz	Phase 1	19.784	9 k	5	36.591	56	-19.409
4.510005 MHz	Phase 1	19.788	9 k	5	47.862	56	-8.138
4.60957 MHz	Phase 1	19.789	9 k	5	45.504	56	-10.496

Tx mode, 60GHz Radar and 2.4 GHz BLE

DATE	10/03/2024
ENGINEER	Vathana Ven
CLIENT AND PROJECT	Reliant MSO_G105935432

EUT: Line conducted emissions



Intertek

Report Number: 105935432BOX-002

Issued: 10/07/2024

Revised: 10/10/2024, 10/28/2024, 11/01/2024

Finals

Final source: Average(Pass)

Frequency	Line	Correction (dB)	AVG Level (dBμV)	AVG Limit (dBuV)	AVG Margin (dB)	RBW (Hz)	Meas.Time (s)
150.005 kHz	Phase 1	19.766	41.391	56	-14.609	9 k	5
167.505 kHz	Phase 1	19.753	32.377	55.059	-22.682	9 k	5
192.255 kHz	Phase 1	19.734	29.76	53.917	-24.157	9 k	5
373.567 kHz	Neutral	19.723	36.861	48.439	-11.578	9 k	5
381.255 kHz	Neutral	19.723	25.791	48.241	-22.45	9 k	5
473.998 kHz	Neutral	19.722	35.826	46.444	-10.618	9 k	5
505.005 kHz	Neutral	19.722	26.091	46	-19.909	9 k	5
649.048 kHz	Neutral	19.728	34.373	46	-11.627	9 k	5
671.81 kHz	Neutral	19.729	35.795	46	-10.205	9 k	5
695.871 kHz	Neutral	19.73	35.531	46	-10.469	9 k	5
771.242 kHz	Neutral	19.733	36.79	46	-9.21	9 k	5
796 kHz	Neutral	19.734	36.945	46	-9.055	9 k	5
1.016745 MHz	Neutral	19.742	33.796	46	-12.204	9 k	5
1.019563 MHz	Neutral	19.742	36.73	46	-9.27	9 k	5
1.167495 MHz	Neutral	19.745	33.184	46	-12.816	9 k	5
1.544635 MHz	Neutral	19.752	37.362	46	-8.638	9 k	5
1.942936 MHz	Neutral	19.76	35.8	46	-10.2	9 k	5
2.217686 MHz	Neutral	19.765	36.554	46	-9.446	9 k	5
2.320755 MHz	Neutral	19.767	29.938	46	-16.062	9 k	5
4.284868 MHz	Neutral	19.803	33.727	46	-12.273	9 k	5
4.399755 MHz	Neutral	19.806	33.551	46	-12.449	9 k	5
5.990505 MHz	Neutral	19.84	27.743	50	-22.257	9 k	5
6.424119 MHz	Neutral	19.85	37.179	50	-12.821	9 k	5
8.190661 MHz	Neutral	19.891	37.109	50	-12.891	9 k	5
8.429401 MHz	Neutral	19.897	32.329	50	-17.671	9 k	5
8.790344 MHz	Neutral	19.906	35.549	50	-14.451	9 k	5

Final source: QuasiPeak(Pass)

Frequency	Line	Correction (dB)	RBW (Hz)	Meas.Time (s)	QP Level (dBμV)	QP Limit (dBuV)	QP Margin (dB)
150.005 kHz	Phase 1	19.766	9 k	5	55.23	66	-10.77
167.505 kHz	Phase 1	19.753	9 k	5	52.273	65.059	-12.786
192.255 kHz	Phase 1	19.734	9 k	5	45.568	63.917	-18.349
373.567 kHz	Neutral	19.723	9 k	5	41.201	58.439	-17.238
381.255 kHz	Neutral	19.723	9 k	5	32.204	58.241	-26.037
473.998 kHz	Neutral	19.722	9 k	5	39.637	56.444	-16.807
505.005 kHz	Neutral	19.722	9 k	5	32.367	56	-23.633
649.048 kHz	Neutral	19.728	9 k	5	40.634	56	-15.366
671.81 kHz	Neutral	19.729	9 k	5	40.742	56	-15.258
695.871 kHz	Neutral	19.73	9 k	5	40.152	56	-15.848
771.242 kHz	Neutral	19.733	9 k	5	40.825	56	-15.175
796 kHz	Neutral	19.734	9 k	5	41.145	56	-14.855
1.016745 MHz	Neutral	19.742	9 k	5	38.534	56	-17.466
1.019563 MHz	Neutral	19.742	9 k	5	40.448	56	-15.552
1.167495 MHz	Neutral	19.745	9 k	5	38.352	56	-17.648
1.544635 MHz	Neutral	19.752	9 k	5	41.186	56	-14.814
1.942936 MHz	Neutral	19.76	9 k	5	40.571	56	-15.429

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Frequency	Line	Correction (dB)	RBW (Hz)	Meas.Time (s)	QP Level (dBμV)	QP Limit (dBuV)	QP Margin (dB)
2.217686 MHz	Neutral	19.765	9 k	5	40.693	56	-15.307
2.320755 MHz	Neutral	19.767	9 k	5	37.244	56	-18.756
4.284868 MHz	Neutral	19.803	9 k	5	39.719	56	-16.281
4.399755 MHz	Neutral	19.806	9 k	5	40.367	56	-15.633
5.990505 MHz	Neutral	19.84	9 k	5	37.862	60	-22.138
6.424119 MHz	Neutral	19.85	9 k	5	42.355	60	-17.645
8.190661 MHz	Neutral	19.891	9 k	5	42.89	60	-17.11
8.429401 MHz	Neutral	19.897	9 k	5	40.72	60	-19.28
8.790344 MHz	Neutral	19.906	9 k	5	42.539	60	-17.461

Product Standard: CFR47 FCC Part 15.207				Limit applied: Class B Pretest Verification w/ signal generator: Yes			
Test Date	Test Personnel/ Initials	Supervising Engineer/ Initials	Input Voltage	Mode	Atmospheric Data		
					Temp C°	Relative Humidity %	Atmospheric Pressure mbar
09/27/2024	Vathana Ven <i>VSV</i>	N/A	120VAC 60Hz	Continuous sweep	24	52	1006
10/03/2024	Vathana Ven <i>VSV</i>	N/A	120VAC 60Hz	Continuous sweep	23	49	1009

Deviations, Additions, or Exclusions: None

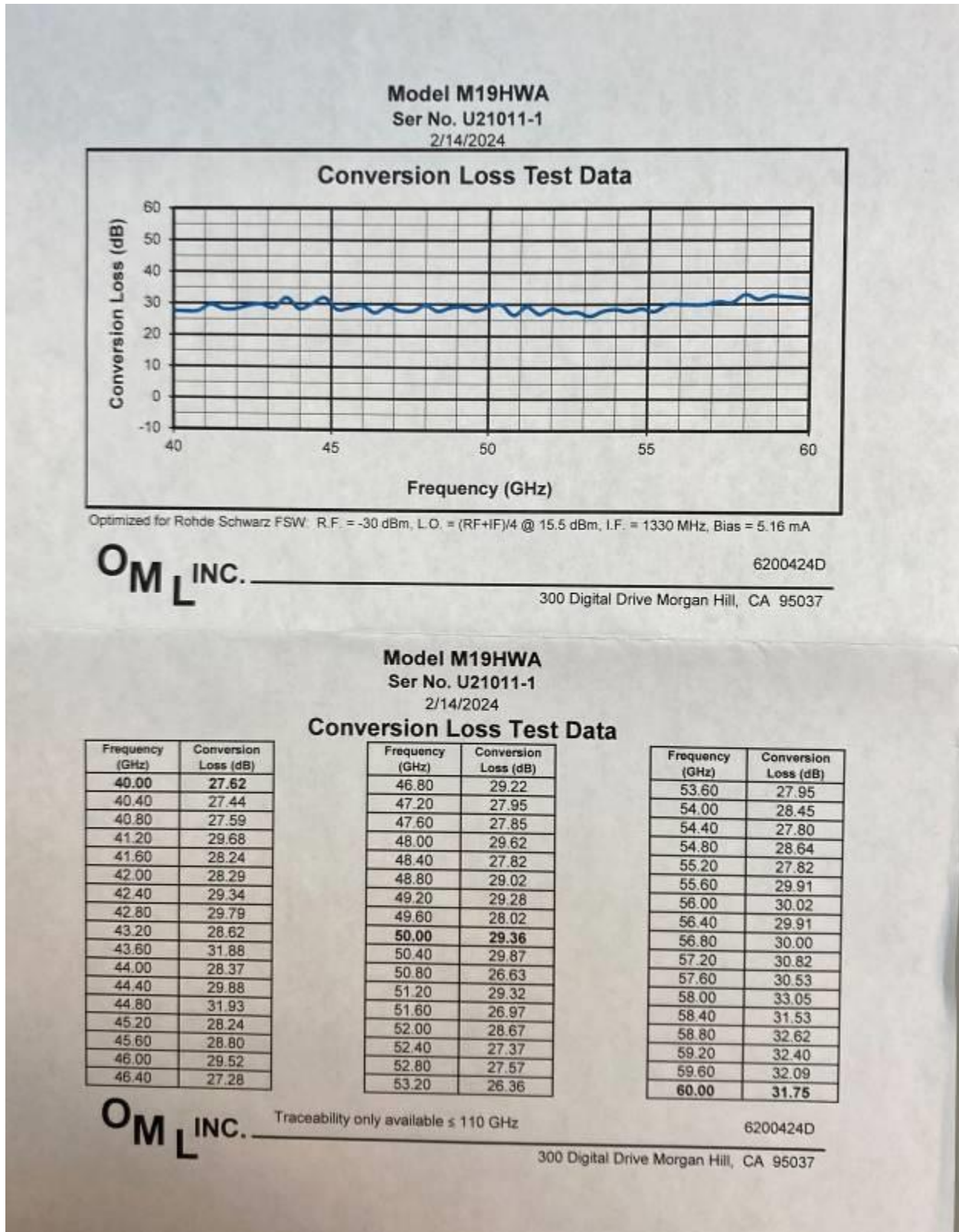
Intertek

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12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	10/07/2024	105935432BOX-002	VFV <i>VFV</i>	KPS <i>KPS</i>	Original Issue
1	10/10/2024	105935432BOX-002	VFV <i>VFV</i>	KPS <i>KPS</i>	Fixed typo on pages 5 and 6
2	10/28/2024	105935432BOX-002	VFV <i>VFV</i>	KPS <i>KPS</i>	Added Appendix C – Horn Antenna Factors and Derivations on page 88 to address the TCB reviewer's comments
3	11/01/2024	105935432BOX-002	VFV <i>VFV</i>		Fixed typo for the model through out the test report, changed V1.1 to SAFEST V1.1

13 Appendix A – Mixer Conversion Loss

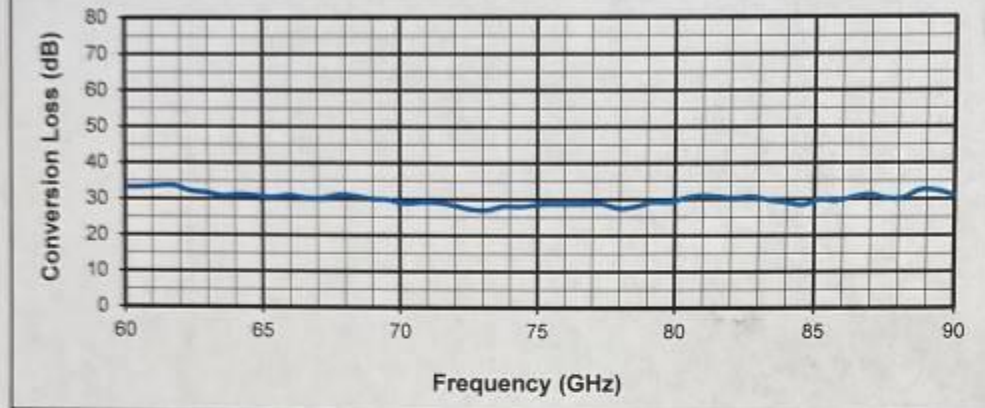


Model M12HWA

Ser No. E21011-1

2/13/2024

Conversion Loss Test Data



Optimized for Rohde Schwarz FSW: R.F. = -30 dBm, L.O. = (RF+IF)/6 @ 15.5 dBm, I.F. = 1330 MHz, Bias = 11.66 mA

OML INC.

6200424C

300 Digital Drive Morgan Hill, CA 95037

Model M12HWA

Ser No. E21011-1

2/13/2024

Conversion Loss Test Data

Frequency (GHz)	Conversion Loss (dB)
60.00	33.23
60.60	33.32
61.20	33.56
61.80	33.70
62.40	32.22
63.00	31.78
63.60	30.88
64.20	31.27
64.80	30.93
65.40	30.48
66.00	31.03
66.60	30.37
67.20	30.27
67.80	31.24
68.40	30.84
69.00	30.05
69.60	29.86

Frequency (GHz)	Conversion Loss (dB)
70.20	28.87
70.80	29.18
71.40	29.10
72.00	28.36
72.60	27.28
73.20	27.08
73.80	28.16
74.40	28.01
75.00	28.55
75.60	28.75
76.20	28.71
76.80	28.76
77.40	28.79
78.00	27.56
78.60	28.06
79.20	29.26
79.80	29.19

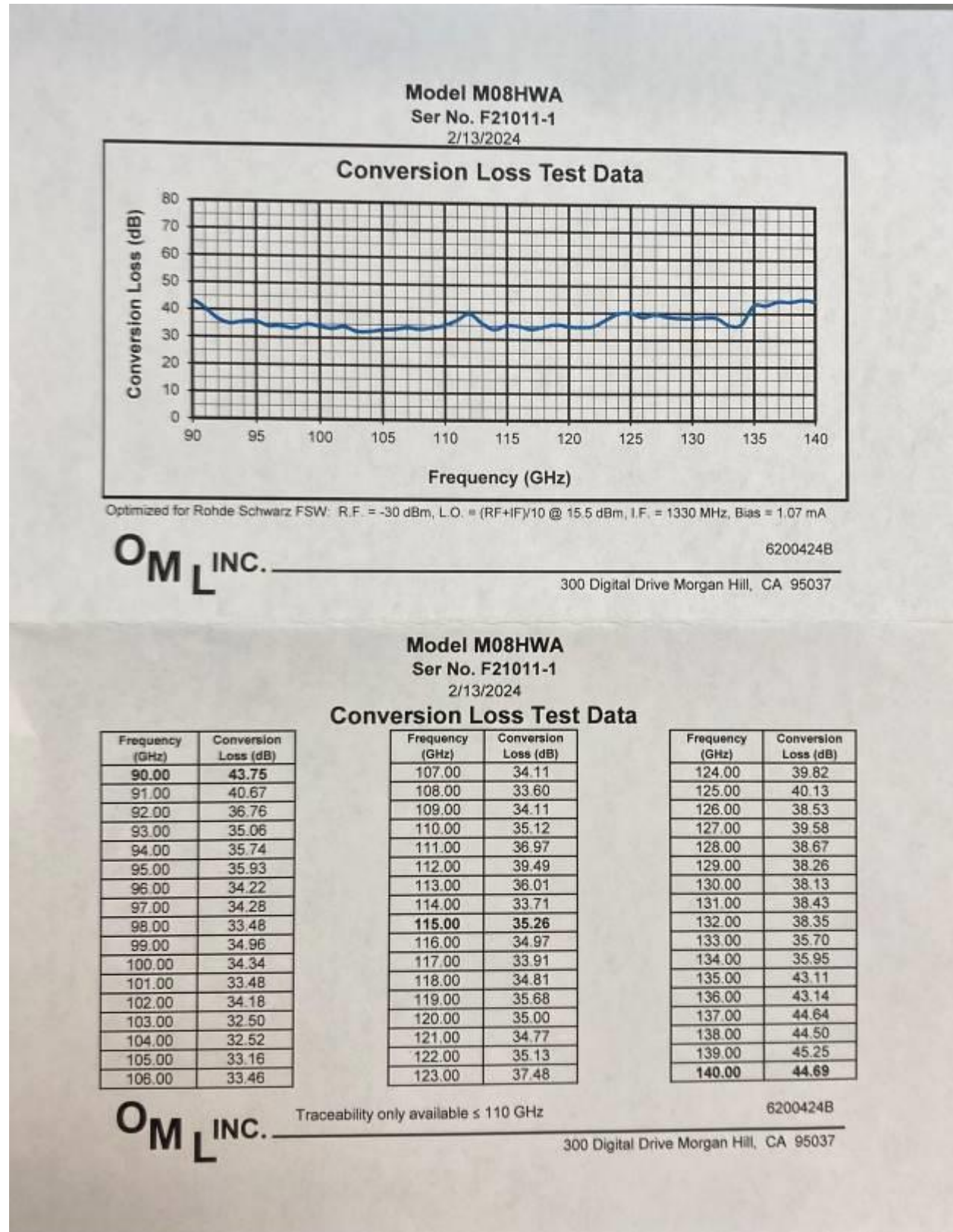
Frequency (GHz)	Conversion Loss (dB)
80.40	30.41
81.00	31.08
81.60	30.70
82.20	30.36
82.80	30.75
83.40	29.76
84.00	29.18
84.60	28.37
85.20	29.84
85.80	29.52
86.40	30.54
87.00	31.32
87.60	30.22
88.20	30.40
88.80	32.55
89.40	32.34
90.00	31.05

OML INC.

Traceability only available ≤ 110 GHz

6200424C

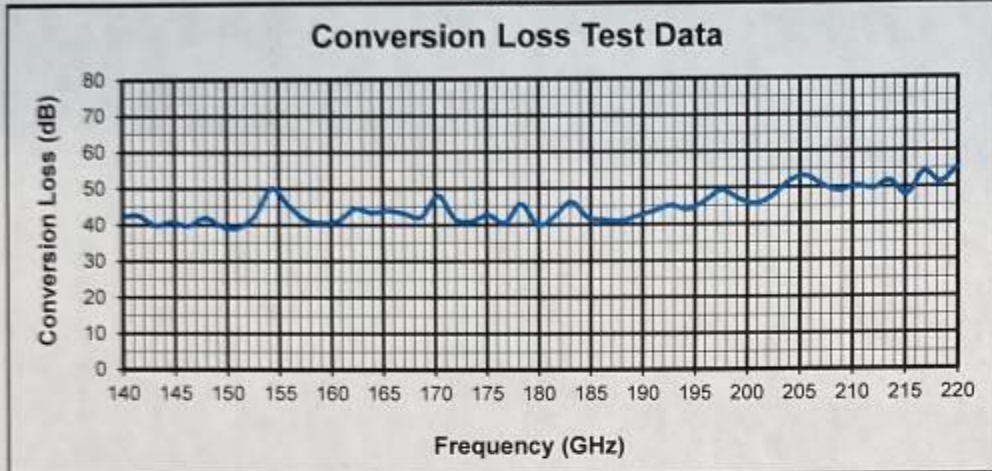
300 Digital Drive Morgan Hill, CA 95037



Model M05HWA

Ser No. G21011-1

2/12/2024

Conversion Loss Test Data

Optimized for Rohde Schwarz FSW: R.F. = -30 dBm, L.O. = (RF+IF)/14 @ 15.5 dBm, I.F. = 1330 MHz, Bias = 0.84 mA

OML INC.

6200424A

300 Digital Drive Morgan Hill, CA 95037

Model M05HWA

Ser No. G21011-1

2/12/2024

Conversion Loss Test Data

Frequency (GHz)	Conversion Loss (dB)
140.00	42.19
141.60	42.57
143.20	39.88
144.80	40.79
146.40	39.75
148.00	41.94
149.60	39.64
151.20	39.24
152.80	42.54
154.40	50.03
156.00	45.42
157.60	41.52
159.20	40.54
160.80	41.10
162.40	44.45
164.00	43.33
165.60	43.88

Frequency (GHz)	Conversion Loss (dB)
167.20	43.03
168.80	42.17
170.40	48.01
172.00	41.67
173.60	40.93
175.20	42.66
176.80	40.47
178.40	45.60
180.00	39.83
181.60	42.33
183.20	46.24
184.80	41.85
186.40	41.28
188.00	40.96
189.60	42.40
191.20	43.72
192.80	45.19

Frequency (GHz)	Conversion Loss (dB)
194.40	44.04
196.00	46.25
197.60	49.27
199.20	46.92
200.80	45.58
202.40	47.50
204.00	51.53
205.60	53.07
207.20	50.55
208.80	48.94
210.40	50.42
212.00	49.55
213.60	51.68
215.20	47.85
216.80	54.09
218.40	51.30
220.00	55.24

OML INC.

Traceability only available ≤ 110 GHz

6200424A

300 Digital Drive Morgan Hill, CA 95037

14 Appendix B – Mixer Verification Certificates

Certificate of Compliance

Certificate No: 6200424D-U21011-1

Manufacturer: OML, Inc.

Model/Part No: M19HWA **Serial/ID No:** U21011-1

Description: WR-19 Harmonic Mixer, 40 to 60 GHz w/ Horn Antenna

Date of Test: February 14, 2024
Temperature: (23 +/- 5) deg C **Humidity:** 20 to 65% RH
Procedure:

This certifies that the above product was tested in compliance with OML specifications using applicable OML's procedures.

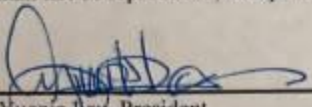
As Received : Physical Condition: Good
Within Tolerance: Yes

As Shipped: At the completion of the test, the product COMPLIED with the performance capability.

Remarks: Performance Verification Service

Traceability Information: Traceability is to national standards administered by U.S. NIST, NRC Canada, Euromet members (NPL, PTB, BNM, etc.) or other recognized standards laboratories. Some measurements are traceable to natural physical constants, consensus standards or ratio type measurements. Supporting documentation relative to traceability is available for review by appointment.
In the absence of power standards above 110 GHz, power measurements and conversion loss measurements above 110 GHz are to confirm operation functionality and traceable only to OML.

This certificate shall not be reproduced, except in full, without the written approval of OML.


Yuenie Lai, President

02/15/2024
Date

OML Inc. _____
300 Digital Drive, Morgan Hill, CA 95037 USA Tel. (408) 779 2698 Fax (408) 778 0491

Certificate of Compliance

Certificate No: 6200424C-E21011-1

Manufacturer: OML, Inc.

Model/Part No: M12HWA

Serial/ID No: E21011-1

Description: WR-12 Harmonic Mixer, 60 to 90 GHz w/ Horn Antenna

Date of Test: February 13, 2024

Temperature: (23 +/- 5) deg C

Humidity: 20 to 65% RH

Procedure:

This certifies that the above product was tested in compliance with OML specifications using applicable OML's procedures.

As Received : Physical Condition: Good
Within Tolerance: Yes

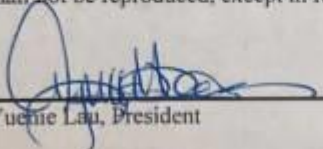
As Shipped: At the completion of the test, the product **COMPLIED** with the performance capability.

Remarks: Performance Verification Service

Traceability Information: Traceability is to national standards administered by U.S. NIST, NRC Canada, Euromet members (NPL, PTB, BNM, etc.) or other recognized standards laboratories. Some measurements are traceable to natural physical constants, consensus standards or ratio type measurements. Supporting documentation relative to traceability is available for review by appointment.

In the absence of power standards above 110 GHz, power measurements and conversion loss measurements above 110 GHz are to confirm operation functionality and traceable only to OML.

This certificate shall not be reproduced, except in full, without the written approval of OML.


Yuenie Lau, President

02/15/2024

Date

OML Inc.

300 Digital Drive, Morgan Hill, CA 95037 USA Tel. (408) 779 2698 Fax (408) 778 0491

Certificate of Compliance

Certificate No: 6200424B-F21011-1

Manufacturer: OML, Inc.

Model/Part No: M08HWA

Serial/ID No: F21011-1

Description: WR-08 Harmonic Mixer, 90 to 140 GHz w/ Horn Antenna

Date of Test: February 13, 2024

Temperature: (23 +/- 5) deg C

Humidity: 20 to 65% RH

Procedure:

This certifies that the above product was tested in compliance with OML specifications using applicable OML's procedures.

As Received : Physical Condition: Good

Within Tolerance: Yes

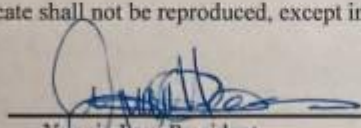
As Shipped: At the completion of the test, the product COMPLIED with the performance capability.

Remarks: Performance Verification Service

Traceability Information: Traceability is to national standards administered by U.S. NIST, NRC Canada, Euromet members (NPL, PTB, BNM, etc.) or other recognized standards laboratories. Some measurements are traceable to natural physical constants, consensus standards or ratio type measurements. Supporting documentation relative to traceability is available for review by appointment.

In the absence of power standards above 110 GHz, power measurements and conversion loss measurements above 110 GHz are to confirm operation functionality and traceable only to OML.

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Yuenie Hau, President

02/15/2024

Date

OML Inc.

300 Digital Drive, Morgan Hill, CA 95037 USA Tel. (408) 779 2698 Fax (408) 778 0491

Certificate of Compliance

Certificate No: 6200424A-G21011-1

Manufacturer: OML, Inc.

Model/Part No: M05HWA

Serial/ID No: G21011-1

Description: WR-05 Harmonic Mixer, 140 to 220 GHz w/ Horn Antenna

Date of Test: February 12, 2024

Temperature: (23 +/- 5) deg C

Humidity: 20 to 65% RH

Procedure:

This certifies that the above product was tested in compliance with OML specifications using applicable OML's procedures.

As Received : Physical Condition: Good

Within Tolerance: Yes

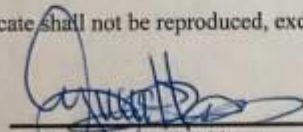
As Shipped: At the completion of the test, the product COMPLIED with the performance capability.

Remarks: Performance Verification Service

Traceability Information: Traceability is to national standards administered by U.S. NIST, NRC Canada, Euromet members (NPL, PTB, BNM, etc.) or other recognized standards laboratories. Some measurements are traceable to natural physical constants, consensus standards or ratio type measurements. Supporting documentation relative to traceability is available for review by appointment.

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Yuehio Lau, President

02/15/2024

Date

OML Inc.

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Intertek

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Standard gain horn antenna inspection

Intertek

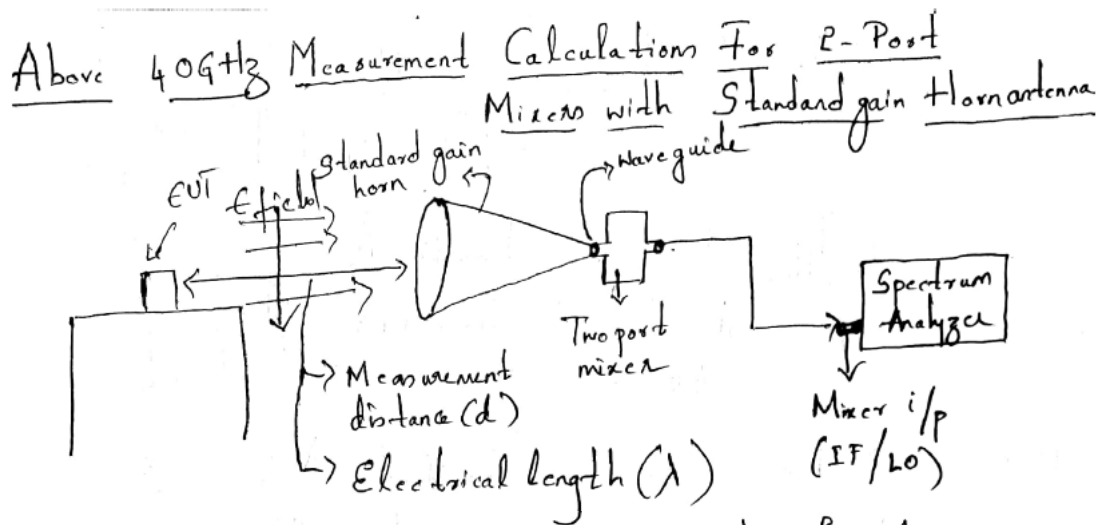
Equipment visual inspection

Equipment	Frequency (GHz)	Date	Initial
WR-19	40-60	9/25/2022	VFV
WR-12	60-90	9/25/2022	VFV
WR-8.0	90-140	9/25/2022	VFV
WR-5	140-220	9/25/2022	VFV

The Mixers and horn antennas were visually inspected for damage prior to testing.

No damaged was observed.

15 Appendix C – Horn Antenna Factors and Derivations



The above is the measurement setup for doing measurements with a 2-port mixer. Please note that the Coaxial output from mixer goes to the dual I/F/LO port on the S.A, the FSW SA has diplexer inbuilt to the SA, if you are using a different analyzer you need an external diplexer.

The basic equation still holds good for measurement

$$E(\text{dB}\mu\text{V}/\text{m}) = V_{\text{on SA}}(\text{dB}\mu\text{V}) + AF + \text{Mixer Conversion Loss} + \text{Cable loss (dB)}$$

However the AF values are not readily available and have to be derived.

We have cable loss @ 40GHz which can be used for all the measurements above 40GHz as the mixer always down converts the frequency.

AF derivation:-

AF is defined as ratio of $\frac{E_{\text{field (incident)}}}{V_{\text{received (antenna terminals)}}$

$$\text{Power density (mwc)} = \underbrace{E}_{\text{E field}} \cdot \underbrace{H}_{\text{H field}} = \frac{|E|^2}{\underbrace{\eta}_{\text{intrinsic impedance}}} \quad \text{--- (1)}$$

$$\text{Power received} = P_{\text{incident}} \times A_e \quad \text{--- (2)}$$

Wave length $\leftarrow$ $A_e = \frac{\lambda^2 G}{4\pi}$ $\leftarrow$ Antenna gain (numeric) $\leftarrow$ effective aperture of antenna

$$\text{(3) in (2)} \Rightarrow \text{Power received} = P_{\text{incident}} \times \frac{\lambda^2 G}{4\pi} \quad \text{--- (4)}$$

$$\lambda (\text{wavelength}) = \frac{v \rightarrow \text{velocity of light}}{f \rightarrow \text{frequency}} \quad \text{--- (5)}$$

$$\text{(5) in (4)} \Rightarrow \text{Power received} = P_{\text{incident}} \times \frac{v^2 G}{4\pi f^2 \eta \times 10^3 \times f^2} = \frac{E^2 v^2 G}{4\pi f^2 \eta \times 10^3 \times f^2} \quad \text{--- (6)}$$

from Ohm's law $P = \frac{V^2}{Z_{\text{load}}}$ $\rightarrow$ Impedance

Equating (7) & (6) $\frac{V^2}{E^2} = \frac{v^2 G Z_{\text{load}}}{\eta 4\pi f^2}$

$$\frac{E}{V} = \sqrt{\frac{\eta 4\pi f^2}{v^2 G Z_{\text{load}}}}$$

$\frac{E}{V}$ is defined as AF so $AF = \sqrt{\frac{\eta 4\pi f^2}{v^2 G Z_{\text{load}}}}$

Antenna impedance (377 Ω for free space) $\rightarrow$ frequency $\rightarrow$ load impedance $\rightarrow$ Antenna gain (numeric) $\rightarrow$ velocity of light

$$AF = \frac{1}{\lambda} \sqrt{\frac{\eta \times 4\pi}{G Z_{\text{load}}}} \quad \rightarrow \text{Antenna impedance is } 50 \Omega$$

$$AF_{(\text{numeric})} = \frac{1}{\lambda} \sqrt{\frac{377 \times 4 \times 3.14}{50 G}} = \frac{9.73}{\lambda \sqrt{G}} \quad \rightarrow \text{Eqn for wavelength numeric antenna factor}$$

Now to get the values in dB

$$AF(dB/m) = 20 \log \left(\frac{9.73}{\frac{V}{f} \times \sqrt{G}} \right)$$

$$AF(dB/m) = 20 \log \left(\frac{9.73}{\frac{8 \times 10^8}{f(G+3)} \times \sqrt{G}} \right)$$

$$AF(dB/m) = 20 \log \left(\frac{9.73}{\frac{0.3}{f(G+3)} \times \sqrt{G}} \right)$$

$$AF(dB/m) = 20 \log \left(\frac{f(G+3) \times 32.433}{\sqrt{G}} \right)$$

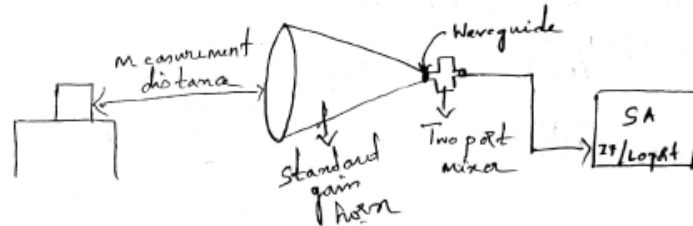
$$AF(dB/m) = 20 \log(f(G+3)) - 20 \log(G^{1/2})$$

$$AF(dB/m) = 20 \log(f(G+3)) + 20 \log(32.433) - 10 \log(G)$$

$$AF(dB/m) = 20 \log(f(G+3)) - AG(dBi) + 30.21$$

Conversion from AG to AF $\rightarrow$ Eqn

All the wave horn antennas have a standard gain of 24dBi at any given freq AF can be calculated.



Going back to the basic equation

$$E(\text{dB}\mu\text{V}/\text{m}) = V_{\text{on(SA)}}(\text{dB}\mu\text{V}) + AF + \text{Mixer CL} + \text{Cable loss}$$

AF is derived, Mixer CL (from datasheet), CL (use 40 GHz value)

Notes about measurement distance :-

It's very hard to meet the noise floor for these measurements, however it is critical to be in the far field during measurements

To make sure you are in the far field check for the following equations

$$R > \frac{2D^2}{\lambda} \rightarrow \text{max linear dimension of antenna} \rightarrow \text{wavelength} = \frac{v(\text{velocity of light } 3 \times 10^8)}{f(\text{frequency})}$$

$$R \gg D \text{ (greater greater)}$$

$$R \gg L \text{ (")}$$

↳ i.e. fers to 10 times however if it is difficult to meet noise floor at least set to (1xλ)

Antenna Factors for Model M19HWA, 40-60 GHz

f(GHz)	AF	Numeric Gain	dBi Gain
40	38.22525	251.1886	24
40.4	38.31168	251.1886	24
40.8	38.39725	251.1886	24
41.2	38.48199	251.1886	24
41.6	38.56592	251.1886	24
42	38.64904	251.1886	24
42.4	38.73137	251.1886	24
42.8	38.81293	251.1886	24
43.2	38.89373	251.1886	24
43.6	38.97378	251.1886	24
44	39.0531	251.1886	24
44.4	39.13171	251.1886	24
44.8	39.20961	251.1886	24
45.2	39.28682	251.1886	24
45.6	39.36335	251.1886	24
46	39.43921	251.1886	24
46.4	39.51441	251.1886	24
46.8	39.58897	251.1886	24
47.2	39.66289	251.1886	24
47.6	39.73619	251.1886	24
48	39.80888	251.1886	24
48.4	39.88096	251.1886	24
48.8	39.95245	251.1886	24
49.2	40.02335	251.1886	24
49.6	40.09368	251.1886	24
50	40.16345	251.1886	24
50.4	40.23266	251.1886	24
50.8	40.30132	251.1886	24
51.2	40.36945	251.1886	24
51.6	40.43704	251.1886	24
52	40.50412	251.1886	24
52.4	40.57068	251.1886	24
52.8	40.63673	251.1886	24
53.2	40.70228	251.1886	24
53.6	40.76735	251.1886	24
54	40.83193	251.1886	24
54.4	40.89603	251.1886	24
54.8	40.95966	251.1886	24
55.2	41.02283	251.1886	24
55.6	41.08555	251.1886	24
56	41.14781	251.1886	24
56.4	41.20963	251.1886	24
56.8	41.27102	251.1886	24
57.2	41.33197	251.1886	24
57.6	41.3925	251.1886	24
58	41.45261	251.1886	24
58.4	41.51231	251.1886	24
58.8	41.5716	251.1886	24

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59.2	41.63048	251.1886	24
59.6	41.68898	251.1886	24
60	41.74708	251.1886	24

Antenna Factors for Model M12HWA, 60-90 GHz

f(GHz)	AF	Numeric Gain	dBi Gain
60	41.64708	257.0396	24.1
60.6	41.7335	257.0396	24.1
61.2	41.81908	257.0396	24.1
61.8	41.90382	257.0396	24.1
62.4	41.98774	257.0396	24.1
63	42.07086	257.0396	24.1
63.6	42.15319	257.0396	24.1
64.2	42.23475	257.0396	24.1
64.8	42.31555	257.0396	24.1
65.4	42.39561	257.0396	24.1
66	42.47493	257.0396	24.1
66.6	42.55354	257.0396	24.1
67.2	42.63144	257.0396	24.1
67.8	42.70864	257.0396	24.1
68.4	42.78517	257.0396	24.1
69	42.86103	257.0396	24.1
69.6	42.93624	257.0396	24.1
70.2	43.01079	257.0396	24.1
70.8	43.08472	257.0396	24.1
71.4	43.15801	257.0396	24.1
72	43.2307	257.0396	24.1
73.2	43.37427	257.0396	24.1
73.8	43.44518	257.0396	24.1
74.4	43.51551	257.0396	24.1
75	43.58528	257.0396	24.1
75.6	43.65449	257.0396	24.1
76.2	43.72315	257.0396	24.1
76.8	43.79127	257.0396	24.1
77.4	43.85887	257.0396	24.1
78	43.92594	257.0396	24.1
78.6	43.9925	257.0396	24.1
79.2	44.05855	257.0396	24.1
79.8	44.12411	257.0396	24.1
80.4	44.18917	257.0396	24.1
81	44.25375	257.0396	24.1
81.6	44.31785	257.0396	24.1
82.2	44.38149	257.0396	24.1
82.8	44.44466	257.0396	24.1
83.4	44.50737	257.0396	24.1
84	44.56964	257.0396	24.1
84.6	44.63146	257.0396	24.1
85.2	44.69284	257.0396	24.1
85.8	44.7538	257.0396	24.1
86.4	44.81433	257.0396	24.1
87	44.87444	257.0396	24.1
87.6	44.93413	257.0396	24.1
88.2	44.99342	257.0396	24.1
88.8	45.05231	257.0396	24.1

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89.4	45.1108	257.0396	24.1
90	45.1689	257.0396	24.1

Antenna Factors for Model M08HWA, 90-140 GHz

f(GHz)	AF	Numeric Gain	dBi Gain
90	45.0689	263.0268	24.2
91	45.16488	263.0268	24.2
92	45.25981	263.0268	24.2
93	45.35371	263.0268	24.2
94	45.44661	263.0268	24.2
95	45.53852	263.0268	24.2
96	45.62948	263.0268	24.2
97	45.71949	263.0268	24.2
98	45.80857	263.0268	24.2
99	45.89675	263.0268	24.2
100	45.98405	263.0268	24.2
101	46.07048	263.0268	24.2
102	46.15605	263.0268	24.2
103	46.24079	263.0268	24.2
104	46.32472	263.0268	24.2
105	46.40784	263.0268	24.2
106	46.49017	263.0268	24.2
107	46.57173	263.0268	24.2
108	46.65253	263.0268	24.2
109	46.73258	263.0268	24.2
110	46.8119	263.0268	24.2
111	46.89051	263.0268	24.2
112	46.96841	263.0268	24.2
113	47.04562	263.0268	24.2
114	47.12215	263.0268	24.2
115	47.19801	263.0268	24.2
116	47.27321	263.0268	24.2
117	47.34777	263.0268	24.2
118	47.42169	263.0268	24.2
119	47.49499	263.0268	24.2
120	47.56768	263.0268	24.2
121	47.63976	263.0268	24.2
122	47.71125	263.0268	24.2
123	47.78215	263.0268	24.2
124	47.85248	263.0268	24.2
125	47.92225	263.0268	24.2
126	47.99146	263.0268	24.2
127	48.06012	263.0268	24.2
128	48.12825	263.0268	24.2
129	48.19584	263.0268	24.2
130	48.26292	263.0268	24.2
131	48.32948	263.0268	24.2
132	48.39553	263.0268	24.2
133	48.46108	263.0268	24.2
134	48.52615	263.0268	24.2
135	48.59073	263.0268	24.2
136	48.65483	263.0268	24.2
137	48.71846	263.0268	24.2

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138	48.78163	263.0268	24.2
139	48.84435	263.0268	24.2
140	48.90661	263.0268	24.2

Antenna Factors for Model M05HWA, 140-220 GHz

f(GHz)	AF	Numeric Gain	dBi Gain
140	48.90661	263.0268	24.2
141.6	49.00532	263.0268	24.2
143.2	49.10291	263.0268	24.2
144.8	49.19942	263.0268	24.2
146.4	49.29487	263.0268	24.2
148	49.38928	263.0268	24.2
149.6	49.48268	263.0268	24.2
151.2	49.57509	263.0268	24.2
152.8	49.66652	263.0268	24.2
154.4	49.757	263.0268	24.2
156	49.84654	263.0268	24.2
157.6	49.93517	263.0268	24.2
159.2	50.02291	263.0268	24.2
160.8	50.10977	263.0268	24.2
162.4	50.19577	263.0268	24.2
164	50.28093	263.0268	24.2
165.6	50.36526	263.0268	24.2
167.2	50.44878	263.0268	24.2
168.8	50.5315	263.0268	24.2
170.4	50.61344	263.0268	24.2
172	50.69462	263.0268	24.2
173.6	50.77504	263.0268	24.2
175.2	50.85473	263.0268	24.2
176.8	50.9337	263.0268	24.2
178.4	51.01195	263.0268	24.2
180	51.0895	263.0268	24.2
181.6	51.16637	263.0268	24.2
183.2	51.24256	263.0268	24.2
184.8	51.31809	263.0268	24.2
186.4	51.39297	263.0268	24.2
188	51.46721	263.0268	24.2
189.6	51.54082	263.0268	24.2
191.2	51.61381	263.0268	24.2
192.8	51.68619	263.0268	24.2
194.4	51.75798	263.0268	24.2
196	51.82917	263.0268	24.2
197.6	51.89979	263.0268	24.2
199.2	51.96984	263.0268	24.2
200.8	52.03932	263.0268	24.2
129	48.19584	263.0268	24.2
130	48.26292	263.0268	24.2
131	48.32948	263.0268	24.2
132	48.39553	263.0268	24.2
133	48.46108	263.0268	24.2
134	48.52615	263.0268	24.2
135	48.59073	263.0268	24.2
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139	48.84435	263.0268	24.2
140	48.90661	263.0268	24.2