Test report

REP047329-1TRFWL

Date of issue: July 30, 2024

Applicant:

Matrix Space

Product:

High performance millimeter-wave radar

Model:

MS01100

Variant(s):

N/A

FCC ID:

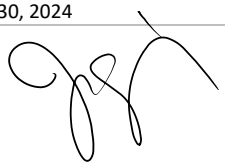
2BAC9MS0110001

Specifications:

- FCC CFR 47 Part 87
  Aviation Services
- FCC CFR 47 Part 2
  Frequency Allocations and Radio Treaty Matters, General Rules and Regulations

Lab and test locations

Company name	Nemko USA Inc.
Address	2210 Faraday Ave, Suite 150
City	Carlsbad
State	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
FCC Site Number	Test Firm Registration Number: 392943; Designation Number: US5058
ISED Test Site	2040B-3

Tested by	Martha Espinoza, Wireless Test Engineer
Reviewed by	James Cunningham, EMC/WL Manager
Review date	July 30, 2024
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC CFR 47 Part 2	Frequency Allocations and Radio Treaty Matters General Rules and Regulations
FCC CFR 47 Part 87	Aviation Services

1.2 Test methods

ANSI C63.26-2015	American National Standard of Procedures for Compliance Testing of Transmitters Used in Licensed Radio Services

1.3 Exclusions

None.

1.4 Statement of compliance

Testing was performed against all relevant requirements of the test standard(s).

A range of supported sample/chirp windows were evaluated. Full testing was performed on the worst-case with respect to transmitter output power. For this test the worst case is 16.67µs with 43MHz authorized Bandwidth

Results obtained indicate that the product under test complies in full with the tested requirements.

The test results relate only to the item(s) tested.

See “Section 2 Summary of test results” for full details.

1.5 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Issue Date	Details of changes made to test report
REP015157-1TRFEMC	July 30, 2024	Original report issued

Section 2 Summary of test results

2.1 FCC Part 2 and Part 87 test results

Part	Test description	Verdict
§2.1049 and Part 87.135 (a)	Bandwidth of emission	Pass
§2.1046 (a) and §87.131	Power and emissions	Pass
§87.139 (a)	Emission limitations	Pass
§2.1055 and §87.133 (a)	Frequency stability	Not tested[2]
§2.1051 and §87.139 (a)	Spurious emissions at antenna port	Not applicable[1]
§2.1053 and §87.139 (a)	Emission limitations	Pass

[1]Note: Conducted port not available.
[2]Note: Testing documented in report REP015157-1TRFWL and applicable for this document.

Section 3 Equipment under test (EUT) details

3.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

3.2 Sample information

Receipt date	24-June-2024
Nemko sample ID number	REP047329

3.3 Testing period

Test start date	24-June-2024
Test end date	26-June-2024

3.4 Applicant

Company name	Matrix Space
Address	141 South Bedford Drive
City	Burlington
State	MA
Postal/Zip code	01803
Country	United States

3.5 Manufacturer

Company name	Matrix Space
Address	141 South Bedford Drive
City	Burlington
State	MA
Postal/Zip code	01803
Country	United States

3.6 EUT information

Product name	High performance millimeter-wave radar
Model	MS01100
Variant(s)	N/A
Serial number	5B0124MDP00283
Part number	PTMSDP
Power requirements	5VDC
Description/theory of operation	Security and Surveillance Radar
Software details	N/A
Operating band	24.45-24.65GHz
Operational frequencies	24.49GHz 24.55GHz 24.61GHz
Antenna type	Non-detachable phased array
Antenna gain (declared)	17 dBi

3.7 EUT exercise and monitoring details

EUT description of the methods used to exercise the EUT and all relevant ports:

- The EUT was configured via an USB 3.0 interface via ssh Linux terminal window configuration. During the testing, the EUT was set into radar mode to transmit a number of multiple chirps in various representative processing intervals, or radar "frames", at a configurable rate, and transmitted via the integral antenna on Low, Mid and High channels at maximum power. The USB3.0 data interface was configured to its maximum UL/DL data rate of ~ 8 GBps, utilizing the Iperf test tool

EUT setup/configuration rationale:

- The 1024 sample, 16.67us windowed continuous chirp configuration was configured to produce the highest amplitude emissions relative to the FCC limit and represent normal operation by the end user. The antenna steering azimuth was set to 0 degrees antenna (boresight) which is the worst-case test configuration.
- The type and construction of cables used in the measurement set-up were consistent with normal or typical use. Cables with mitigation features (for example, screening, tighter/more twists per length, ferrite beads) have been noted below:
  - None
- The EUT was setup in a manner that was consistent with its typical arrangement and use. The measurement arrangement of the EUT, local ancillary equipment and associated cabling was representative of normal practice. Any deviations from typical arrangements have been noted below:
  - None

3.8 EUT setup details

Table 3.8-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number	Rev.
N/A	N/A	N/A	N/A	N/A

Table 3.8-2: *EUT interface ports*

Description	Qty.
USB 3.0 port	1
10 MHz Reference SMA port	1
1PPS sync SMA port	1

Table 3.8-3: *Support equipment*

Description	Brand name	Model/Part number	Serial number	Rev.
10 MHz Reference	GPS Disciplined Reference Oscillator	BG7TBL	N/A	2020-06-10
AC/DC ADAPTER 5V 40W	GlobTek, Inc.	GTM96600-4005-T3	various	L2
Laptop	HP	Envy	N/A	N/A

Table 3.8-4: *Inter-connection cables*

Cable description	From	To	Length (m)
USB 3.0 interface cable	Test PC	UUT / USB3.0 port	1
10 MHz reference cable	10MHz lab reference	UUT 10 MHz reference port.	1

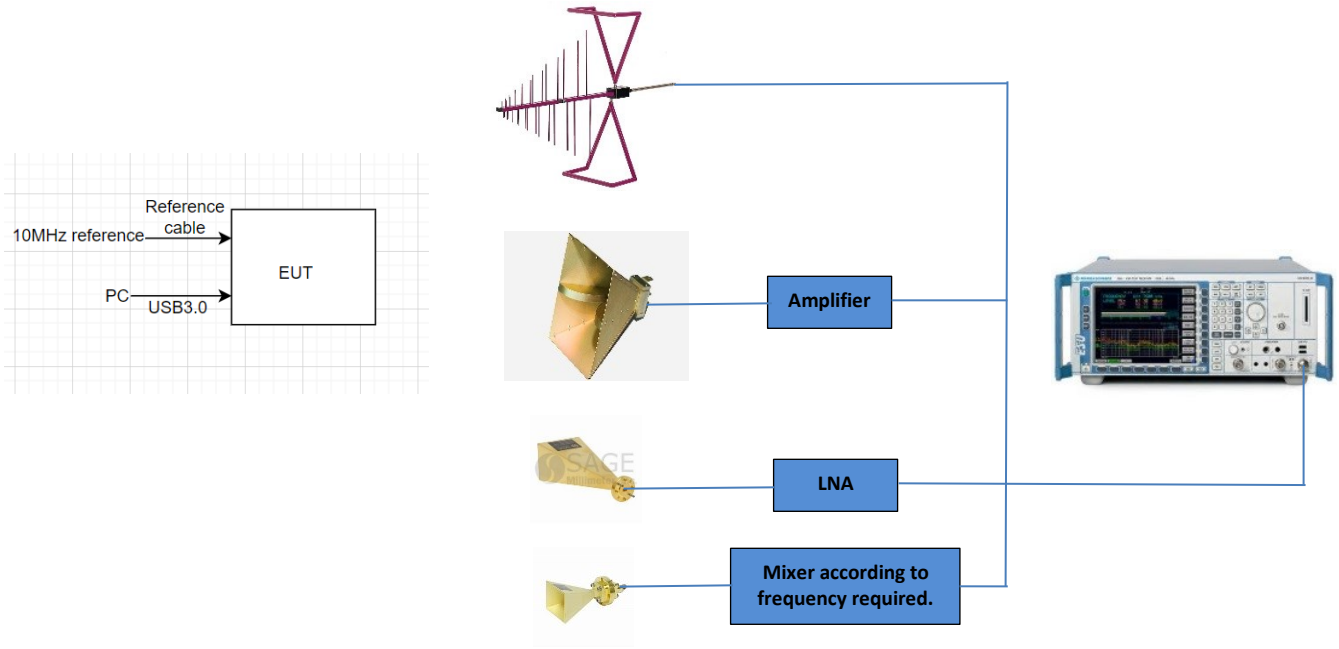


Figure 3.8-1: Test setup diagram.

Section 4 Engineering considerations

4.1 Modifications incorporated in the EUT

None.

4.2 Technical judgement

None.

4.3 Deviations from laboratory test procedures

None.

Section 5 Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	86–106 kPa

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage (5 VDC), or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6 Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4-2 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics, and limit modelling – Measurement instrumentation uncertainty. The expression of Uncertainty in EMC testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Table 6.1-1: *Measurement uncertainty calculations*

Measurement		**U_{cispr} dB**	**U_{lab} dB**
Conducted disturbance at AC mains and other port power using a V-AMN	9 kHz to 150 kHz	3.8	2.9
	150 kHz to 30 MHz	3.4	2.3
Conducted disturbance at telecommunication port using AAN	150 kHz to 30 MHz	5.0	4.3
Conducted disturbance at telecommunication port using CVP	150 kHz to 30 MHz	3.9	2.9
Conducted disturbance at telecommunication port using CP	150 kHz to 30 MHz	2.9	1.4
Conducted disturbance at telecommunication port using CP and CVP	150 kHz to 30 MHz	4.0	3.1
Radiated disturbance (electric field strength in a SAC)	30 MHz to 1 GHz	6.3	5.5
Radiated disturbance (electric field strength in a FAR)	1 GHz to 6 GHz	5.2	4.7
Radiated disturbance (electric field strength in a FAR)	6 GHz to 18 GHz	5.5	5.0

Notes: Compliance assessment:

If U_{lab} is less than or equal to U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit

If U_{lab} is greater than U_{cispr} then:

- compliance is deemed to occur is no measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by (U_{lab} - U_{cispr}), exceeds the disturbance limit

V-AMN: V type artificial mains network
AAN: Asymmetric artificial network
CP: Current probe
CVP: Capacitive voltage probe
SAC: Semi-anechoic chamber
FAR: Fully anechoic room

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: *Test equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
FSW Signal & Spectrum Analyzer	Rohde & Schwarz	FSW43	E1302	1 year	Jan-22-2025
System controller	Sunol Sciences	SC104V	E1191	NCR	NCR
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1121	1 year	Aug-23-2024
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	1 year	June-28-2026
Antenna, Horn	ETS-Lingren	3117-PA	E1139	1 year	Jan-11-2026
Standard Gain Horn Antenna	Eravant	SAZ-2410-42-S1	EW107	1 year	Dec-05-2024
Standard Gain Horn Antenna	Eravant	SAZ-2410-2-S1	EW108	1 year	Dec-05-2024
Low Noise Amplifier	Sage Millimeter	SBL-1834034030-KFKF-SI	E1228	VOU	VOU
Antenna, Horn	Sage Millimeter	SAR-2309-19-S2	E1144	NCR	NCR
Mixer	Rohde & Schwarz	FS-Z60	E1138	VOU	VOU
Antenna, Horn	Sage Millimeter	SAR-2408-15-S2	E1152	NCR	NCR
Mixer	Rohde & Schwarz	FS-Z75	E1324	VOU	VOU
Antenna, Horn	Sage Millimeter	SAR-2507-10-S2	E1146	NCR	NCR
Mixer	Rohde & Schwarz	FS-Z110	E1154	VOU	VOU

Notes: N/A – not applicable
NCR – no calibration required
VOU – verify on use

Table 7.1-2: *Test software details*

Manufacturer of Software	Details
Rohde & Schwarz	EMC 32 V10.60.15

Notes: None

Section 8 Testing data

8.1 Bandwidth of emission (99%)

8.1.1 References and limits

- FCC 47 CFR Part 87: §87.135
- Test method: ANSI C63.26-2014 (5.4.4)

(a) Occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 percent of the total mean power of a given emission.
(b) The authorized bandwidth is the maximum occupied bandwidth authorized to be used by a station.
(c) The necessary bandwidth for a given class of emission is the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

8.1.2 Test summary

Verdict	Pass		
Test date	June 24, 2024; June 25, 2024;	Temperature	22°C; 23°C;
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1006 mbar; 1003 mbar;
Test location	☐ Wireless bench ☒ Other: 3M Chamber	Relative humidity	53%; 51%;

8.1.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power.

Frequency	Bandwidth declared
24.49 GHz	23 MHz
24.55 GHz	23 MHz
24.61 GHz	23 MHz

Note 1: These bandwidths are declared only as reference, the measured value is shown in table 8.1-2 of this section.

Table 8.1-1: *Pulse description table*.

Testing was done at 3 meters with the antenna and turntable fixed. A maximization of the signal was done to define the position of the max power:
Antenna heigh: 158 cm Turntable: 355 Degrees (-5 Degrees)
Chirp time selected as worst case: 25.6 µs (1024 samples).

8.1.4 Setup details

EUT power input during test	5 VDC via AC/DC adaptor
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other

Receiver settings:

Resolution bandwidth	Approximately 1-5 % of the emission bandwidth
Video bandwidth	Approximately 3 x resolution bandwidth
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.1.5 Test data

Frequency	Bandwidth declared	Result
24.49 GHz	23 MHz	19.184 MHz
24.55 GHz	23 MHz	19.214 MHz
24.61 GHz	23 MHz	19.279 MHz

Table 8.1-2: *99% OBW results*.

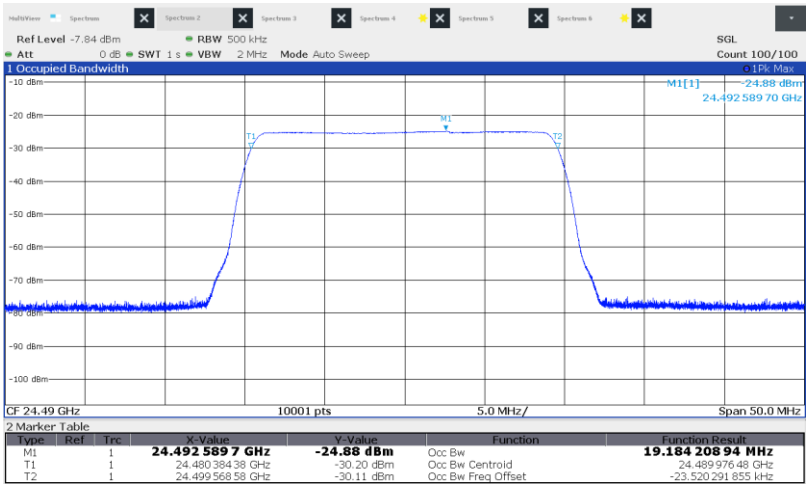


Figure 8.1-1: *99% OBW Low channel: 24.49 GHz 25.6 µs with 23 MHz authorized Bandwidth.*

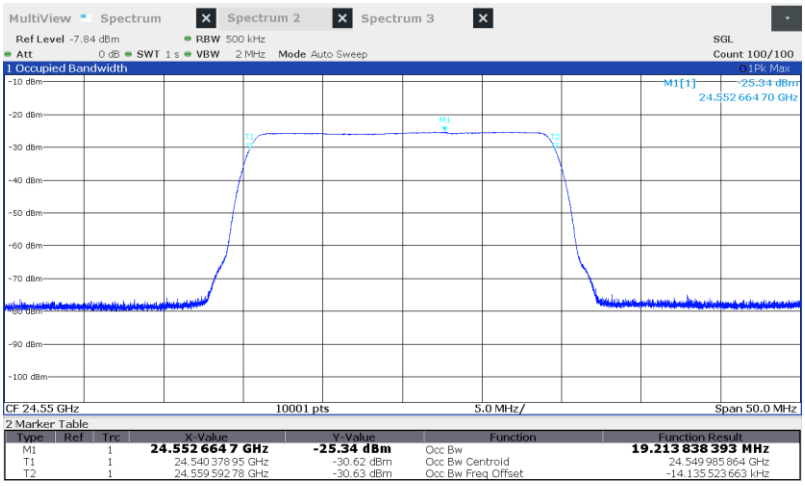


Figure 8.1-2: *99% OBW Middle channel: 24.55 GHz 25.6 µs with 23MHz authorized Bandwidth.*

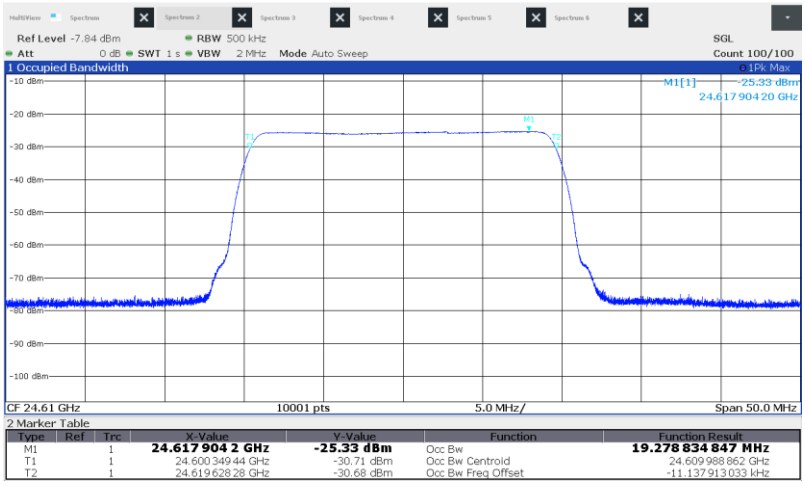


Figure 8.1-3: *99% OBW High channel: 24.61 GHz 25.6 µs with 23MHz authorized Bandwidth*

8.2 Bandwidth of emission (26 dB)

8.2.1 References and limits

- Test method: ANSI C63.26-2014 (5.4.3)

8.2.2 Test summary

Verdict	Pass		
Test date	June 24, 2024; June 25, 2024;	Temperature	22°C; 23°C;
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1006 mbar; 1003 mbar;
Test location	☐ Wireless bench ☒ Other: 3M Chamber	Relative humidity	53%; 51%;

8.2.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power following the cases shown on table 8.1-1 from section 8.1.3 of this document.

Testing was done at 3 meters with the antenna and turntable fixed. A maximization of the signal was done to define the position of the max power:
Antenna heigh: 158 cm Turntable: 355 Degrees (-5 Degrees)
Chirp time selected as worst case: 25.6 µs (1024 samples).

8.2.4 Setup details

EUT power input during test	5 VDC via AC/DC adaptor
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other

Receiver settings:

Resolution bandwidth	Approximately 1-5 % of the emission bandwidth
Video bandwidth	Approximately 3 x resolution bandwidth
Detector mode	Peak
Trace mode	Max Hold
Measurement time	Long enough for trace to stabilize

8.2.5 Test data

Frequency	Bandwidth
24.49 GHz	22.27 MHz
24.55 GHz	22.33 MHz
24.61 GHz	22.41 MHz

Table 8.2-1: *26 dB OBW results*.

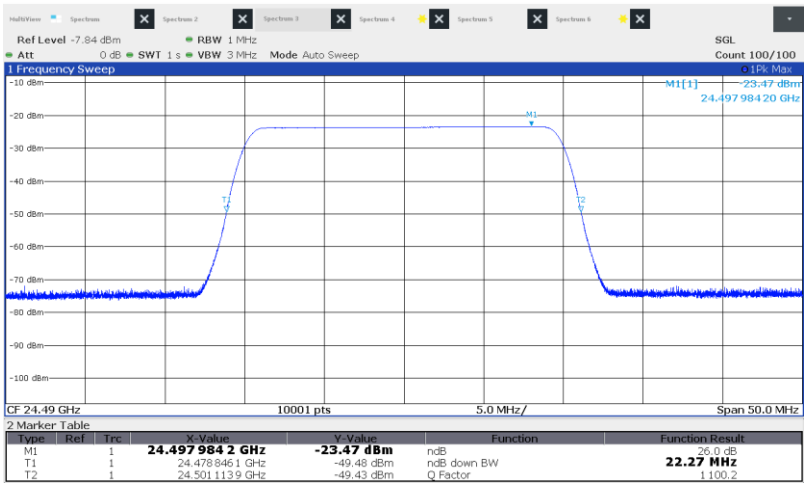


Figure 8.2-1: *26 dB OBW Low channel: 24.49 GHz 25.6 µs with 23MHz authorized Bandwidth.*

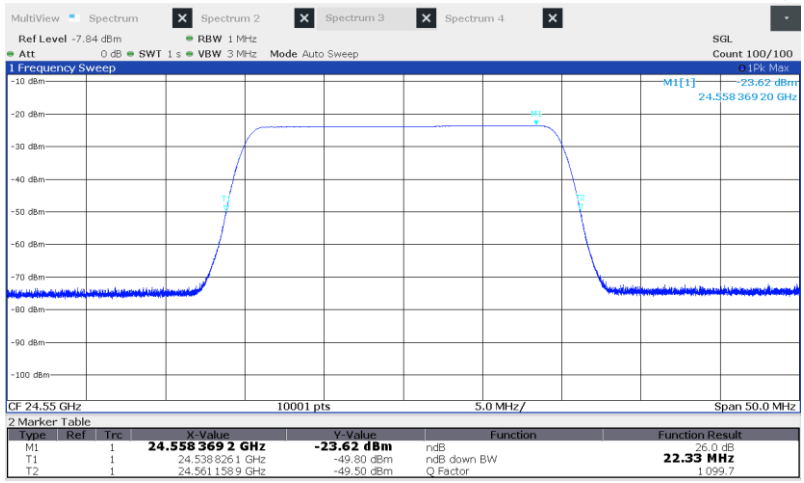


Figure 8.2-2: *26 dB OBW Middle channel: 24.55 GHz 25.6 µs with 23MHz authorized Bandwidth.*

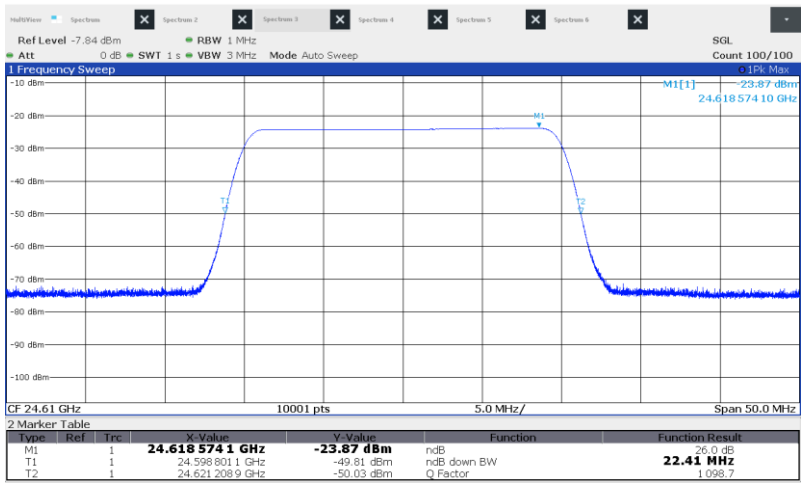


Figure 8.2-3: *26 dB OBW High channel: 24.61 GHz 25.6 µs with 23MHz authorized Bandwidth.*

8.3 Power and emissions

8.3.1 References and limits

- FCC 47 CFR Part 87: §87.131
- Test method: ANSI C63.26-2014 (5.2.4.4.2)

The following table lists authorized emissions and maximum power. Power must be determined by direct measurement.

Class of station	Frequency band/frequency	Authorized emission(s)[9]	Maximum power[1]
(Radionavigation)	Various[7]	Various[7]	Various.[7]

[7] Frequency, emission, and maximum power will be determined by appropriate standards during the certification process.

8.3.2 Test summary

Verdict	Pass		
Test date	June 24, 2024; June 25, 2024;	Temperature	22°C; 23°C;
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1006 mbar; 1003 mbar;
Test location	☐ Wireless bench ☒ Other: 3M Chamber	Relative humidity	53%; 51%;

8.3.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power following the cases shown on table 8.1-1 from section 8.1.3 of this document. All correction factors corresponding cables losses, receiving antenna gain, and air path losses were compensated to get the real EIRP value of the product. Both polarizations were evaluated, horizontal and vertical (linear polarization per client declaration) and only the worst case (max power) was taken for the testing purposes: vertical polarization. The duty cycle correction factor was added according to each frequency channel tested. Table 8.3-1 shows the constant duty cycle corresponding to each case.
The equation to calculate the total correction factor corresponding to each frequency tested is given by the following expression as well as the table with the corresponding duty cycle to each case:

$$E.I.R.P = P_r - G_r - 20\log_{10}\left(\frac{\lambda}{4\pi d}\right)$$

Adding cable losses and duty cycle correction factors (absolute values):

$$E.I.R.P = P_r - G_r - 20\log_{10}\left(\frac{\lambda}{4\pi d}\right) + L_{cable} + 10\log_{10}\left(\frac{1}{Duty\ cycle}\right)$$

Where:
P_r = Power received in the spectrum analyzer
λ = Wavelength of the signal
L_{cable} = Losses corresponding to interconnexion cables
d = Measuring distance (3 meters)
G_r = Receiving antenna gain
DC = Duty cycle declared

Frequency	Offset (dB)	Constant duty cycle
24.49 GHz	72.82	100%
24.55 GHz	72.84	100%
24.61 GHz	72.86	100%

Table 8.3-1: *Offset and Duty cycle table.*

Testing was done at 3 meters with the antenna and turntable fixed. A maximization of the signal was done to define the position of the max power:
Antenna heigh: 158 cm Turntable: 355 Degrees (-5 Degrees)
Chirp time selected as worst case: 25.6 µs (1024 samples).

8.3.4 Setup details

EUT power input during test	5 VDC via AC/DC adaptor
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other

Receiver settings:

Resolution bandwidth	Approximately 1-5 % of the emission bandwidth
Video bandwidth	Approximately 3 x resolution bandwidth
Detector mode	RMS
Trace mode	Average (at least 100 traces)
Measurement points	≥ (2xspan)/RBW
Span	2 times the authorized bandwidth

8.3.5 Test data

Frequency	Declared power	Measured Power (EIRP)
24.49 GHz	49 dBm	48.59 dBm
24.55 GHz	49 dBm	48.87 dBm
24.61 GHz	49 dBm	48.69 dBm

Table 8.3-2: *Power results (EIRP)*

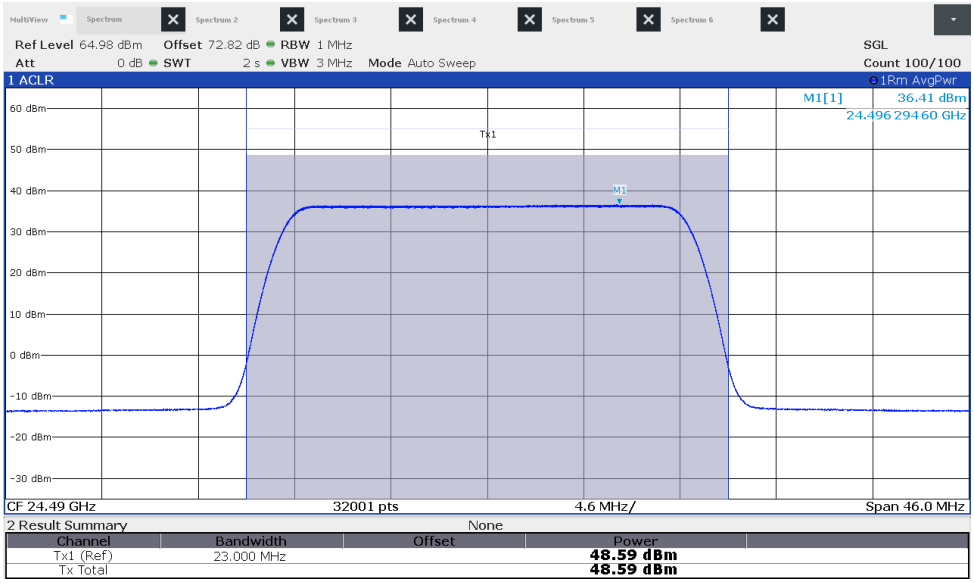


Figure 8.3-1: *EIRP Power, Low channel: 24.49 GHz 25.6 µs with 23 MHz authorized Bandwidth.*

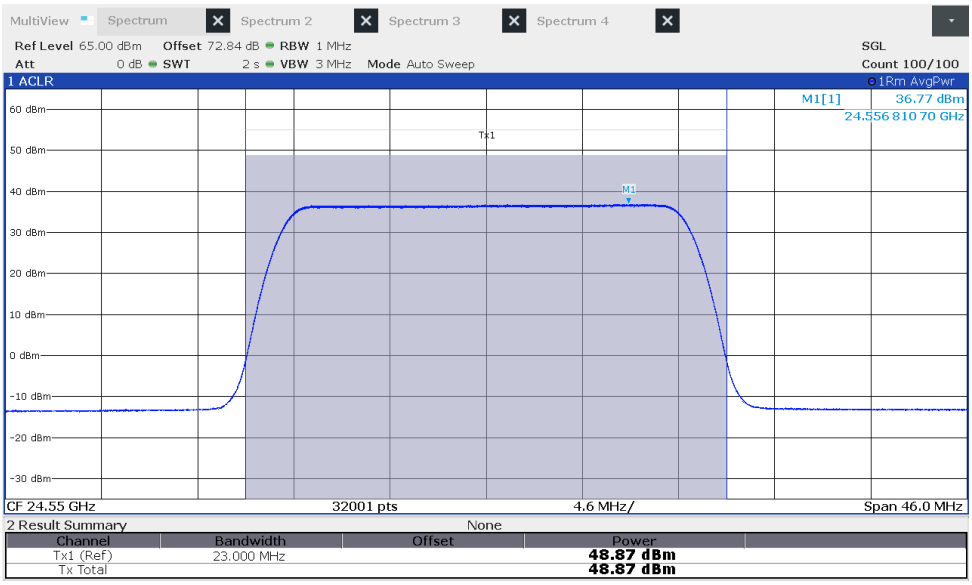


Figure 8.3-2: *EIRP Power, Middle channel: 24.55 GHz 25.6 µs with 23 MHz authorized Bandwidth.*

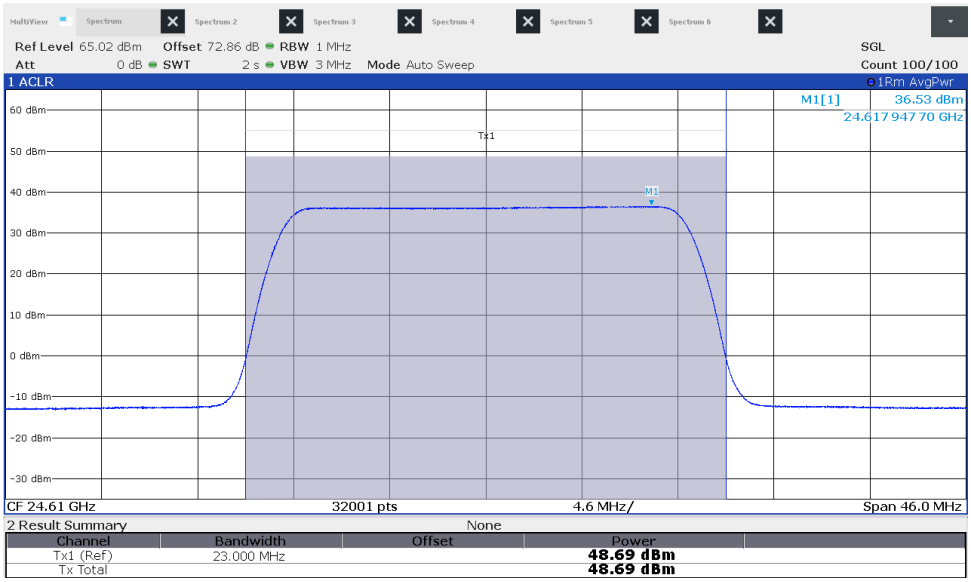


Figure 8.3-3: *EIRP Power, High channel: 24.61 GHz 25.6 µs with 23 MHz authorized Bandwidth.*

8.4 Emission limitations

8.4.1 References and limits

- FCC 47 CFR Part 87: §87.139
- Test method: ANSI C63.26-2014 (5.5)

(a) Except for ELTs and when using single sideband (R3E, H3E, J3E), or frequency modulation (F9) or digital modulation (F9Y) for telemetry or telecommand in the 1435–1525 MHz, 2345–2395 MHz, or 5091–5150 MHz band or digital modulation (G7D) for differential GPS, the mean power of any emissions must be attenuated below the mean power of the transmitter (pY) as follows:

(1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth the attenuation must be at least 25 dB;

(2) When the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth the attenuation must be at least 35 dB.

(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 40 dB; and the attenuation for aeronautical station transmitters must be at least 43 + 10 log10 pY dB.

8.4.2 Test summary

Verdict	Pass		
Test date	June 24, 2024; June 25, 2024;	Temperature	22°C; 23°C;
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1006 mbar; 1003 mbar;
Test location	☐ Wireless bench ☒ Other: 3M Chamber	Relative humidity	53%; 51%;

8.4.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power following the cases shown on table 8.1-1 from section 8.1.3 of this document. The width of the mask was defined according to the authorized bandwidth widest.

Testing was done at 3 meters with the antenna and turntable fixed. A maximization of the signal was done to define the position of the max power:
Antenna heigh: 158 cm Turntable: 355 Degrees (-5 Degrees)
Chirp time selected as worst case: 25.6 µs (1024 samples).

8.4.4 Setup details

EUT power input during test	5 VDC via AC/DC adaptor
EUT setup configuration	☒ Table-top ☐ Floor standing ☐ Other

Receiver settings:

Resolution bandwidth	Approximately 1-5 % of the emission bandwidth
Video bandwidth	Approximately 3 x resolution bandwidth
Detector mode	RMS
Trace mode	Average (at least 100 traces)
Span	Enough to see the spectrum under investigation

8.4.5 Test data

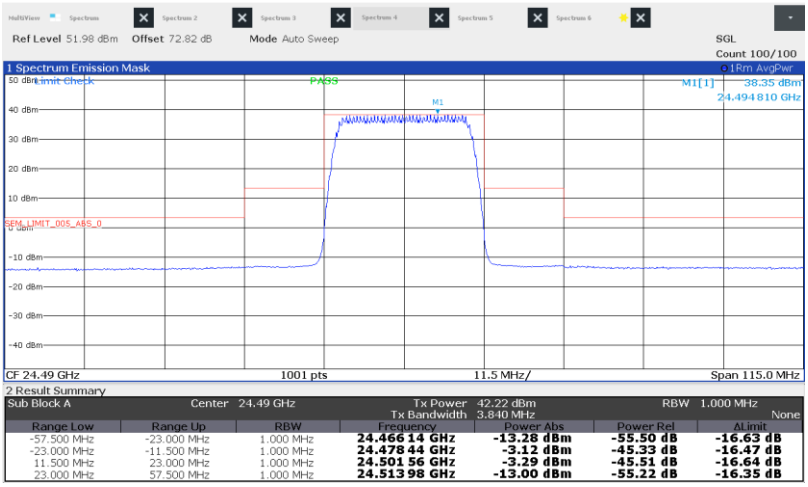


Figure 8.4-1: *Emission mask, Low channel: 24.49 GHz, 25.6 µs with 23 MHz authorized Bandwidth.*

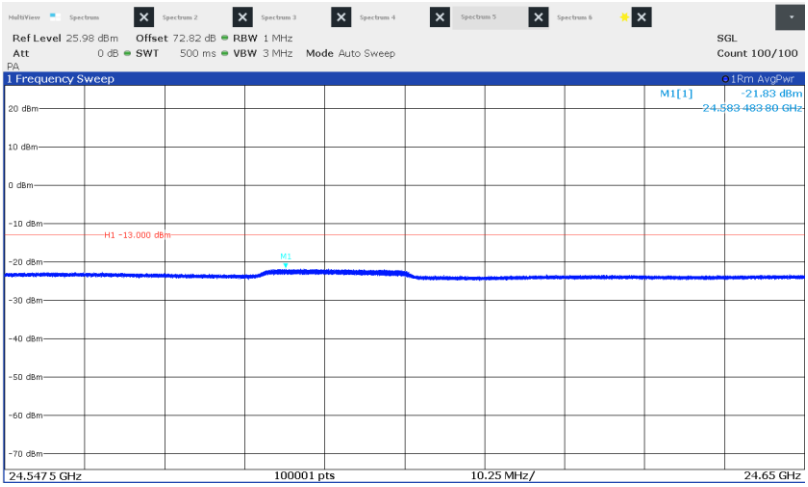


Figure 8.4-2: *Emission mask, Low channel: 24.49 GHz, 25.6 µs with 23 MHz authorized Bandwidth, high range 24.65 GHz.*

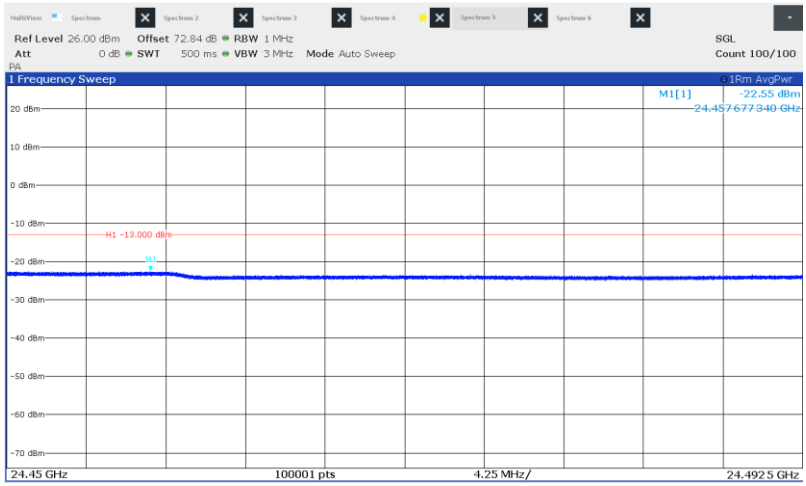


Figure 8.4-3: *Emission mask, Middle channel: 24.55 GHz, 25.6 µs with 23 MHz authorized Bandwidth, low range 24.45 GHz.*

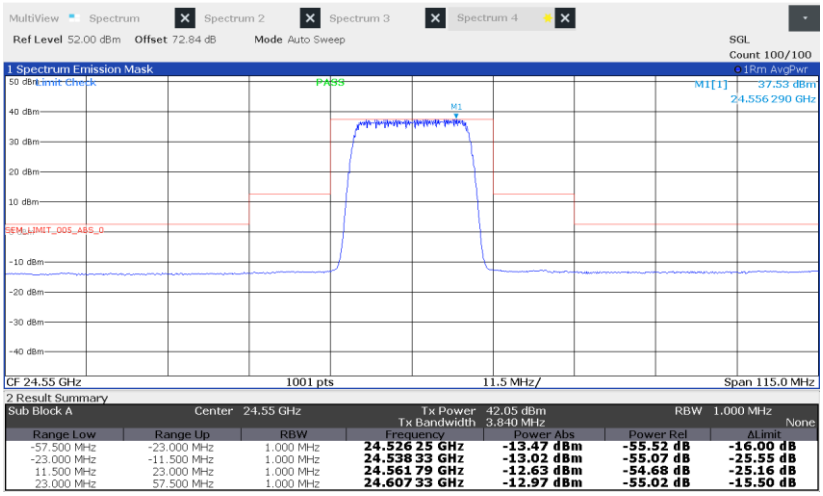


Figure 8.4-4: *Emission mask, Middle channel: 24.55 GHz, 25.6 µs with 23 MHz authorized Bandwidth.*

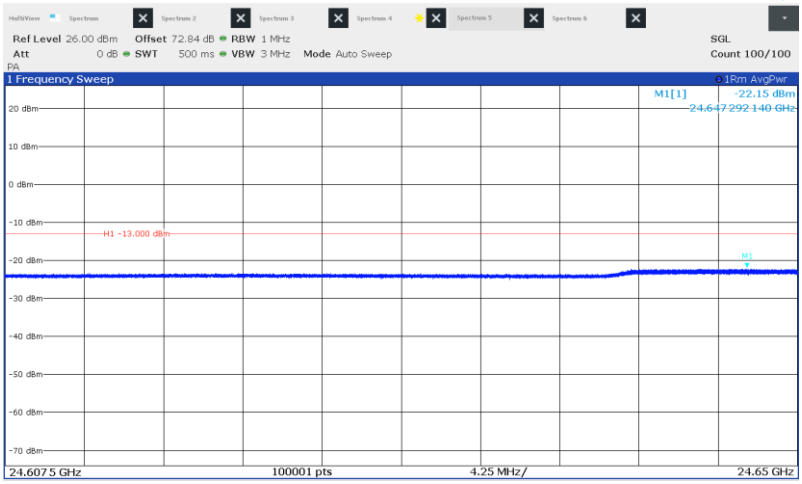


Figure 8.4-5: *Emission mask, Middle channel: 24.55 GHz, 25.6 µs with 23 MHz authorized Bandwidth, high range 24.65 GHz.*

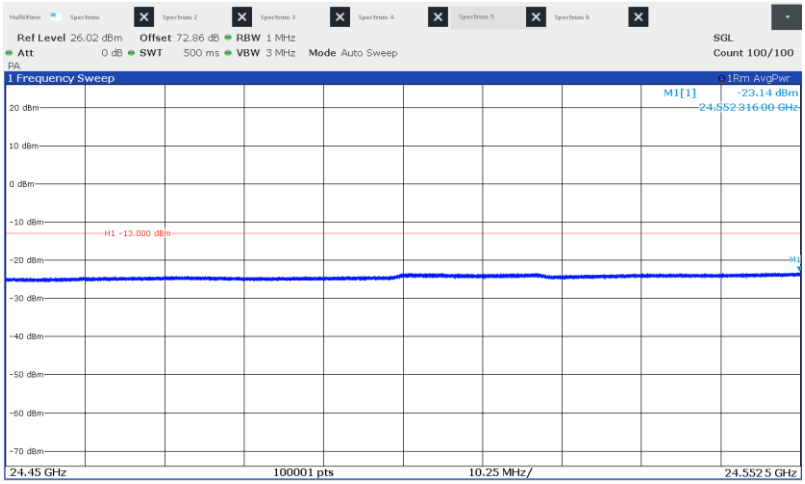


Figure 8.4-6: *Emission mask, High channel: 24.61 GHz, 25.6 µs with 23 MHz authorized Bandwidth, low range 24.45 GHz.*

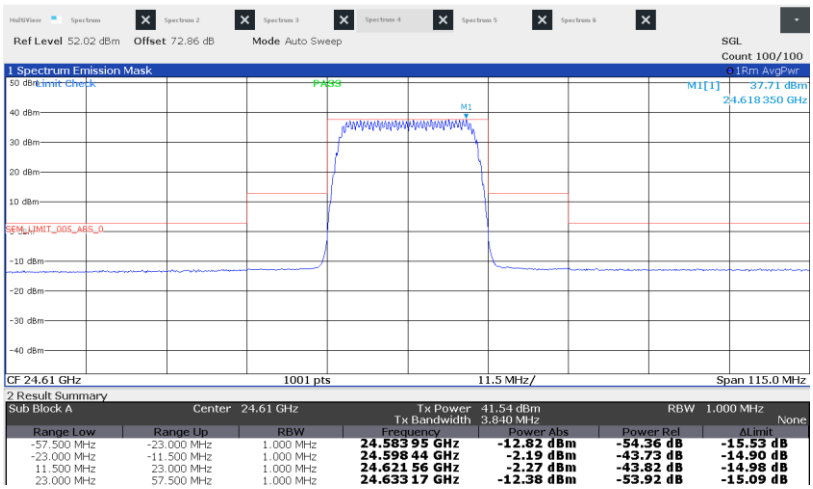


Figure 8.4-7: *Emission mask, High channel: 24.61 GHz, 25.6 µs with 23 MHz authorized Bandwidth.*

8.5 Transmitter spurious emissions

8.5.1 References and limits

- FCC 47 CFR Part 87: §87.139
- Test method: ANSI C63.4 (5.5)

(a) Except for ELTs and when using single sideband (R3E, H3E, J3E), or frequency modulation (F9) or digital modulation (F9Y) for telemetry or telecommand in the 1435–1525 MHz, 2345–2395 MHz, or 5091–5150 MHz band or digital modulation (G7D) for differential GPS, the mean power of any emissions must be attenuated below the mean power of the transmitter (pY) as follows:

(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 40 dB; and the attenuation for aeronautical station transmitters must be at least 43 + 10 log10 pY dB.

- FCC 47 CFR Part 2: §2.1057

(a) In all of the measurements set forth in §§ 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

8.5.2 Test summary

Verdict	Pass		
Test date	June 25, 2024; June 26, 2024	Temperature	23°C; 21°C
Test engineer	Martha Espinoza, Wireless Test Engineer	Air pressure	1003 mbar; 1005 mbar
Test location	☐ Wireless bench ☒ Other: 3M Chamber	Relative humidity	51 %; 52%

8.5.3 Notes

Testing was performed with the transmitter operating on a fixed channel at full power and at distance of 3 meters.
Chirp time selected as worst case: 25.6 µs (1024 samples).

8.5.4 Setup details

EUT power input during test	5 VDC via AC/DC adaptor
EUT setup configuration	☒ Table-top (Above 1 GHz: 1.5m) ☐ Floor standing ☐ Other: Tripod mounted
Antenna height variation	1–4 m
Turn table position	0–360°
Measurement details	A preview measurement was generated with receiver in continuous scan or sweep mode while the EUT was rotated, and antenna adjusted to maximize radiated emission. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver settings (below 1 GHz):

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak (preview measurements) Quasi-peak (final measurements)
Trace mode	Max Hold
Measurement time	5000 ms (final measurements)

Receiver settings (from 1 -40 GHz):

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	Peak (preview measurements) Peak and average (final measurements)
Trace mode	Max Hold
Measurement time	5000 ms (final measurements)

Spectrum analyzer settings (above 40 GHz):

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	RMS
Trace mode	Average (at least 100 traces)

8.5.5 Test data

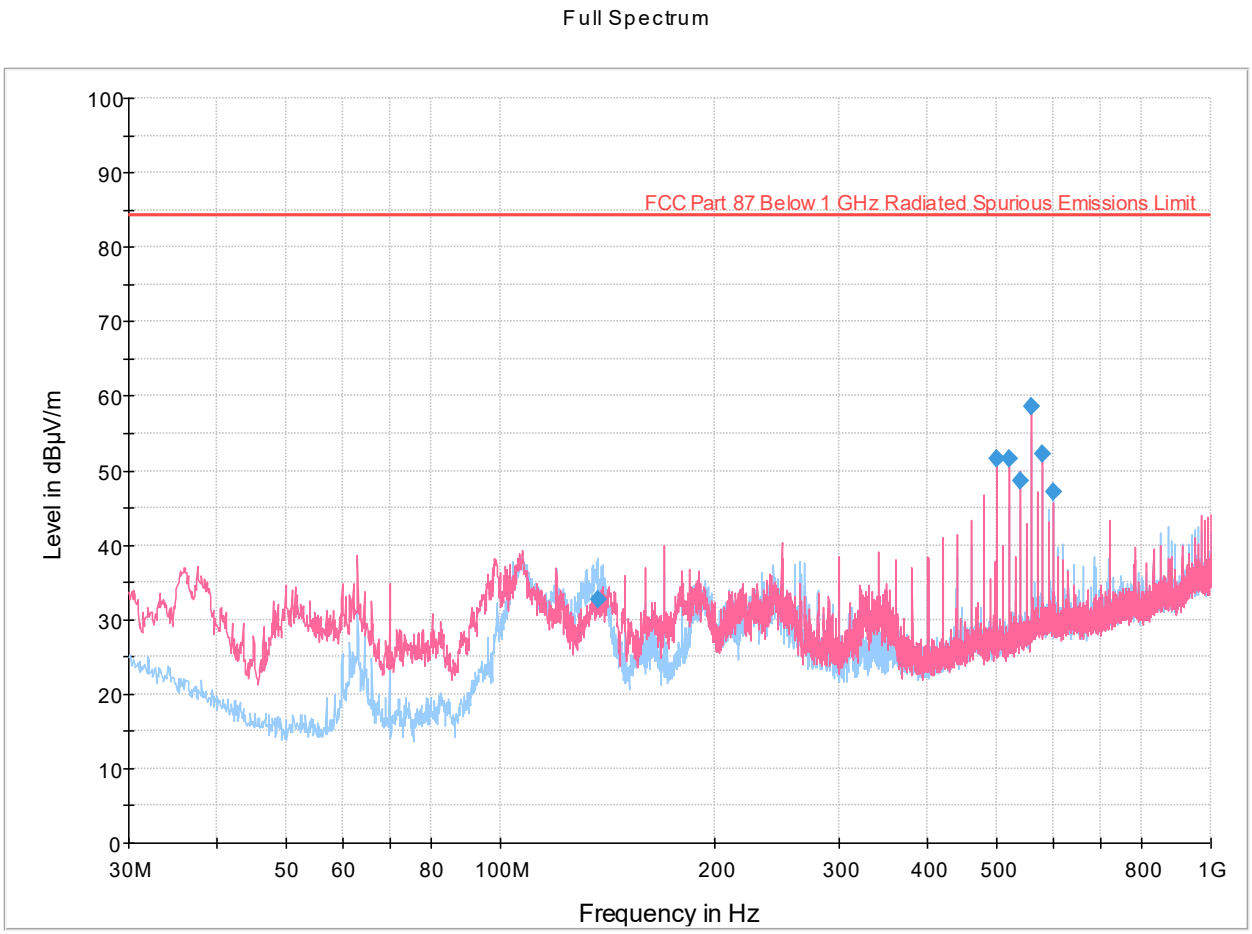


Figure 8.5-1: *Radiated emissions spectral plot (30 MHz - 1 GHz) 24.49GHz low channel with 23 MHz authorized Bandwidth.*

Table 8.5-1*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
137.362000	32.63	84.38	51.75	5000.0	120.000	220.0	H	79.0	18.7
500.005000	51.57	84.38	32.81	5000.0	120.000	100.0	V	113.0	26.6
520.004000	51.63	84.38	32.75	5000.0	120.000	100.0	V	101.0	27.3
539.986000	48.61	84.38	35.77	5000.0	120.000	107.0	V	79.0	28.2
560.008000	58.55	84.38	25.83	5000.0	120.000	100.0	V	66.0	28.8
579.990000	52.25	84.38	32.13	5000.0	120.000	100.0	V	46.0	29.5
599.989000	47.10	84.38	37.28	5000.0	120.000	100.0	H	0.0	29.3

Notes:
[1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

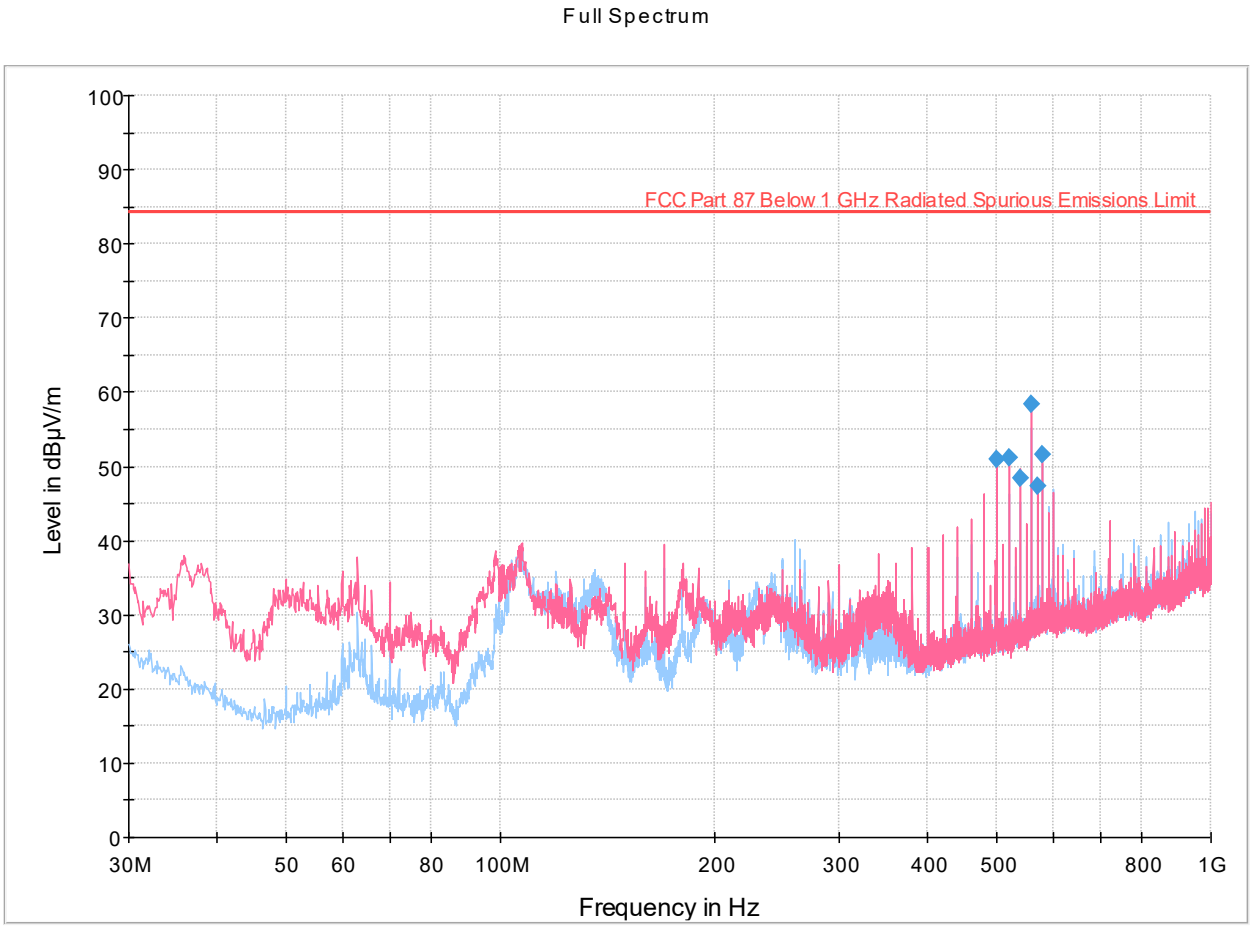


Figure 8.5-2: *Radiated emissions spectral plot (30 MHz - 1 GHz) 24.55GHz middle channel with 23 MHz authorized Bandwidth.*

Table 8.5-2*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
500.005000	50.91	84.38	33.47	5000.0	120.000	100.0	V	110.0	26.6
520.004000	51.09	84.38	33.29	5000.0	120.000	100.0	V	100.0	27.3
539.986000	48.51	84.38	35.87	5000.0	120.000	104.0	V	76.0	28.2
560.008000	58.37	84.38	26.01	5000.0	120.000	100.0	V	66.0	28.8
569.999000	47.27	84.38	37.11	5000.0	120.000	120.0	V	66.0	29.4
579.990000	51.65	84.38	32.73	5000.0	120.000	100.0	V	42.0	29.5

Notes:
[1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

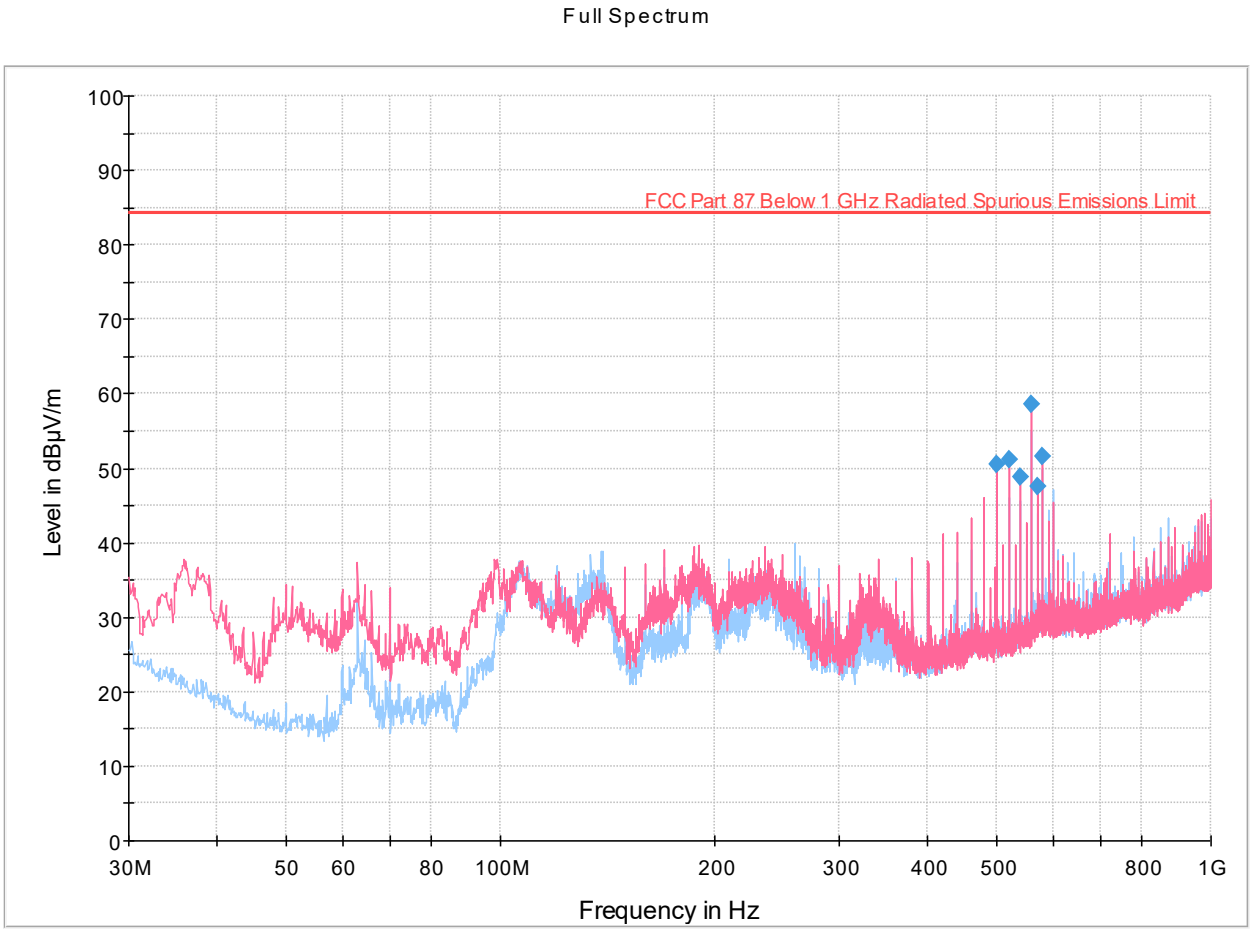


Figure 8.5-3: *Radiated emissions spectral plot (30 MHz - 1 GHz) 24.61 GHz High channel with 23 MHz authorized Bandwidth.*

Table 8.5-3*: Radiated emissions results*

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
500.005000	50.48	84.38	33.90	5000.0	120.000	100.0	V	110.0	26.6
520.004000	51.07	84.38	33.31	5000.0	120.000	100.0	V	99.0	27.3
539.986000	48.88	84.38	35.50	5000.0	120.000	100.0	V	76.0	28.2
560.008000	58.64	84.38	25.74	5000.0	120.000	100.0	V	69.0	28.8
569.999000	47.52	84.38	36.86	5000.0	120.000	104.0	V	53.0	29.4
579.990000	51.65	84.38	32.73	5000.0	120.000	100.0	V	42.0	29.5

Notes:
[1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

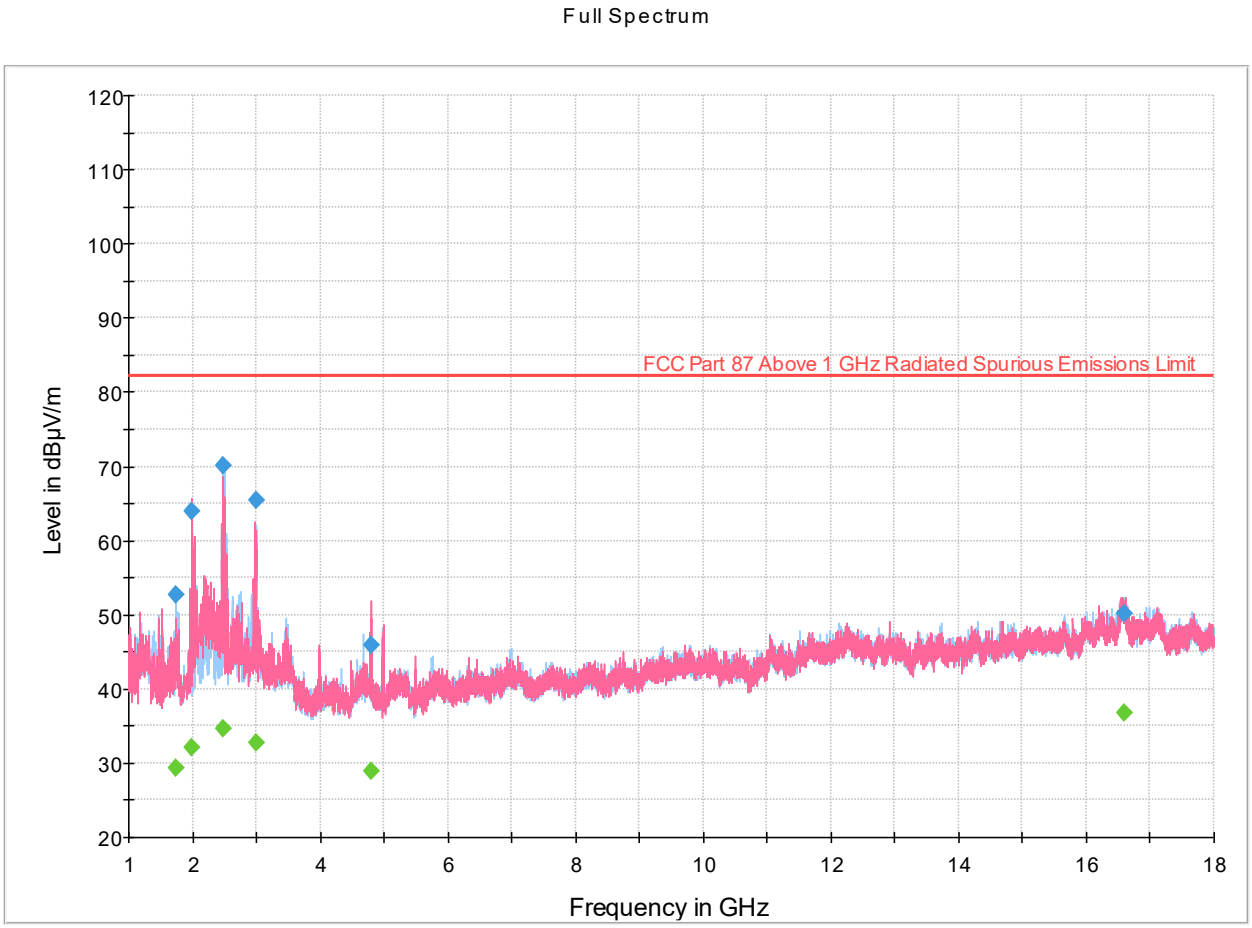


Figure 8.5-4: *Radiated emissions spectral plot (1 GHz - 18 GHz) 24.49 GHz Low channel with 23 MHz authorized Bandwidth.*

Table 8.5-4*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1743.933333	---	29.41	82.23	52.82	5000.0	1000.000	120.0	H	144.0	-11.2
1743.933333	52.80	---	82.23	29.43	5000.0	1000.000	120.0	H	144.0	-11.2
1994.533333	---	32.15	82.23	50.08	5000.0	1000.000	196.0	V	68.0	-11.1
1994.533333	63.97	---	82.23	18.26	5000.0	1000.000	196.0	V	68.0	-11.1
2490.988889	70.05	---	82.23	12.18	5000.0	1000.000	111.0	H	158.0	-8.4
2490.988889	---	34.66	82.23	47.57	5000.0	1000.000	111.0	H	158.0	-8.4
2987.222222	65.44	---	82.23	16.79	5000.0	1000.000	183.0	V	166.0	-6.8
2987.222222	---	32.72	82.23	49.51	5000.0	1000.000	183.0	V	166.0	-6.8
4794.955556	46.00	---	82.23	36.23	5000.0	1000.000	100.0	V	20.0	-1.1
4794.955556	---	28.91	82.23	53.32	5000.0	1000.000	100.0	V	20.0	-1.1
16588.788889	50.06	---	82.23	32.17	5000.0	1000.000	362.0	H	336.0	17.3
16588.788889	---	36.79	82.23	45.44	5000.0	1000.000	362.0	H	336.0	17.3

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

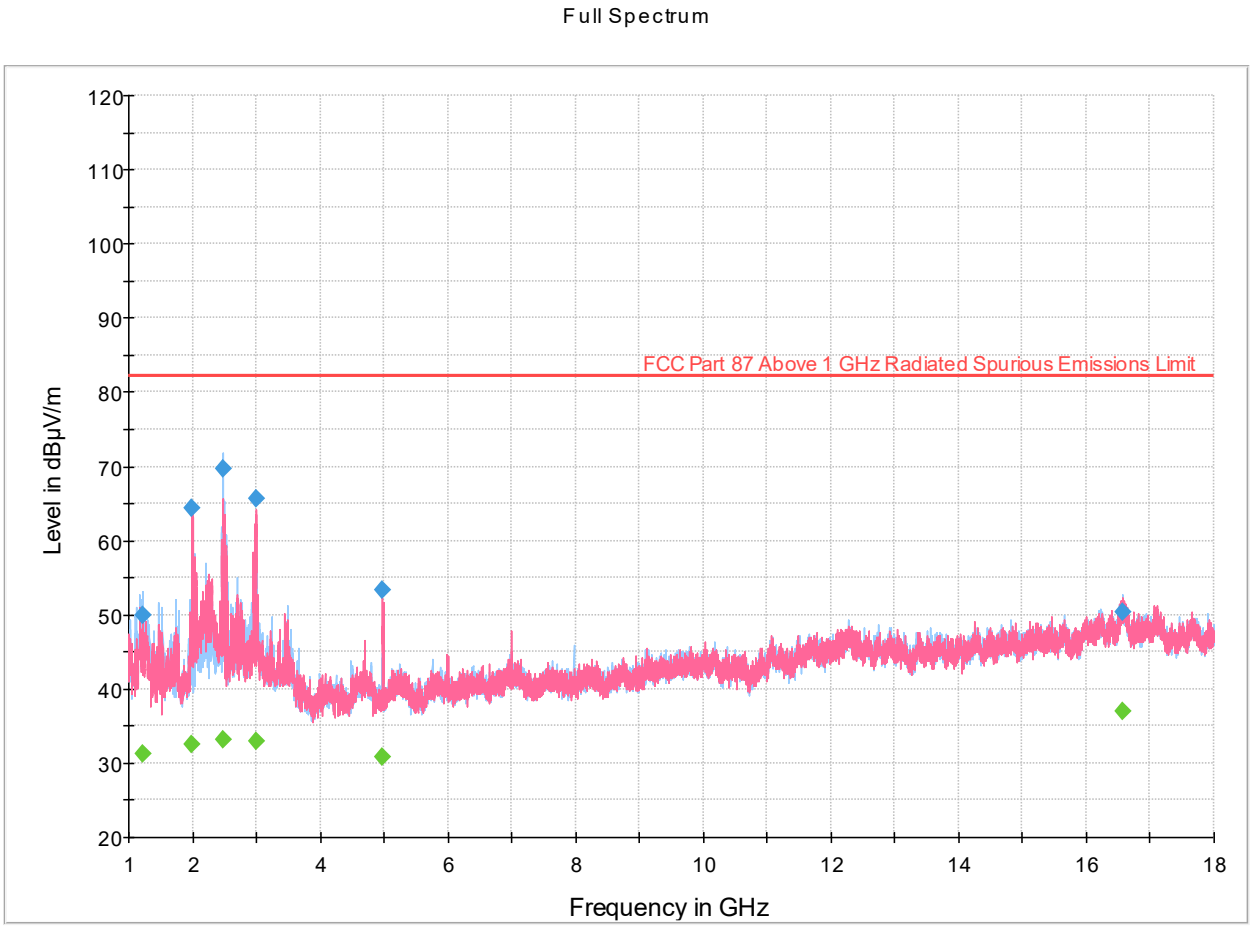


Figure 8.5-5: *Radiated emissions spectral plot (1 GHz - 18 GHz) 24.55 GHz Middle channel with 23MHz authorized Bandwidth.*

Table 8.5-5*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1217.911111	---	31.23	82.23	51.00	5000.0	1000.000	133.0	H	121.0	-12.9
1217.911111	49.98	---	82.23	32.25	5000.0	1000.000	133.0	H	121.0	-12.9
1992.677778	---	32.44	82.23	49.79	5000.0	1000.000	131.0	V	78.0	-11.1
1992.677778	64.33	---	82.23	17.90	5000.0	1000.000	131.0	V	78.0	-11.1
2488.188889	69.79	---	82.23	12.44	5000.0	1000.000	138.0	H	154.0	-8.4
2488.188889	---	33.08	82.23	49.15	5000.0	1000.000	138.0	H	154.0	-8.4
2992.266667	65.69	---	82.23	16.54	5000.0	1000.000	181.0	V	168.0	-6.8
2992.266667	---	33.03	82.23	49.20	5000.0	1000.000	181.0	V	168.0	-6.8
4982.688889	53.32	---	82.23	28.91	5000.0	1000.000	133.0	V	76.0	-1.8
4982.688889	---	30.72	82.23	51.51	5000.0	1000.000	133.0	V	76.0	-1.8
16574.433333	50.29	---	82.23	31.94	5000.0	1000.000	215.0	H	0.0	17.2
16574.433333	---	36.96	82.23	45.27	5000.0	1000.000	215.0	H	0.0	17.2

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

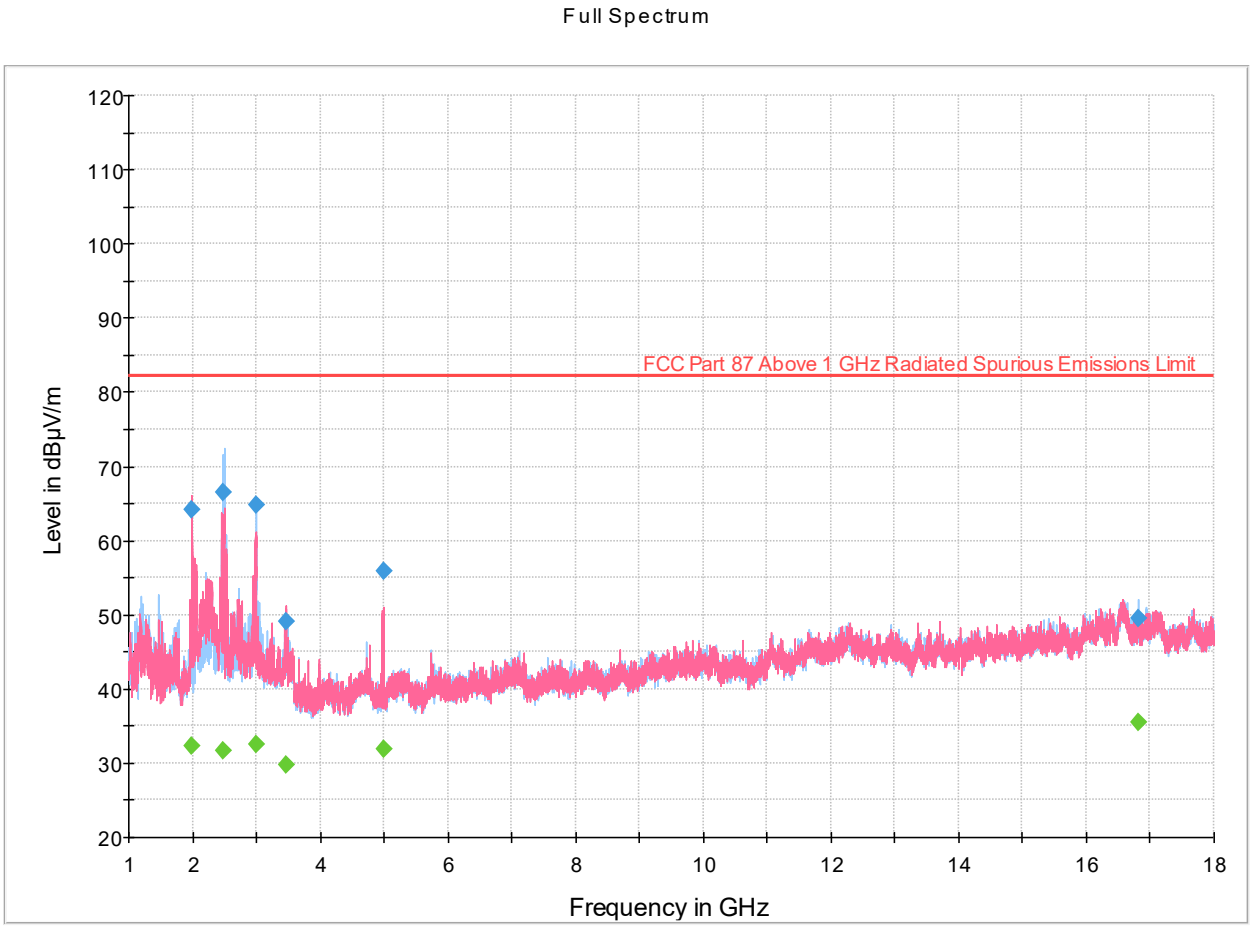


Figure 8.5-6: *Radiated emissions spectral plot (1 GHz - 18 GHz) 24.61 GHz High channel with 23MHz authorized Bandwidth.*

Table 8.5-6*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1997.922222	64.14	---	82.23	18.09	5000.0	1000.000	107.0	V	80.0	-11.2
1997.922222	---	32.34	82.23	49.89	5000.0	1000.000	107.0	V	80.0	-11.2
2489.966667	---	31.59	82.23	50.64	5000.0	1000.000	222.0	H	148.0	-8.4
2489.966667	66.56	---	82.23	15.67	5000.0	1000.000	222.0	H	148.0	-8.4
2998.666667	---	32.48	82.23	49.75	5000.0	1000.000	107.0	H	167.0	-6.8
2998.666667	64.90	---	82.23	17.33	5000.0	1000.000	107.0	H	167.0	-6.8
3464.277778	---	29.68	82.23	52.55	5000.0	1000.000	113.0	V	112.0	-5.4
3464.277778	49.07	---	82.23	33.16	5000.0	1000.000	113.0	V	112.0	-5.4
4994.133333	55.95	---	82.23	26.28	5000.0	1000.000	123.0	V	77.0	-1.8
4994.133333	---	31.88	82.23	50.35	5000.0	1000.000	123.0	V	77.0	-1.8
16818.755556	---	35.51	82.23	46.72	5000.0	1000.000	361.0	H	262.0	15.3
16818.755556	49.47	---	82.23	32.76	5000.0	1000.000	361.0	H	262.0	15.3

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

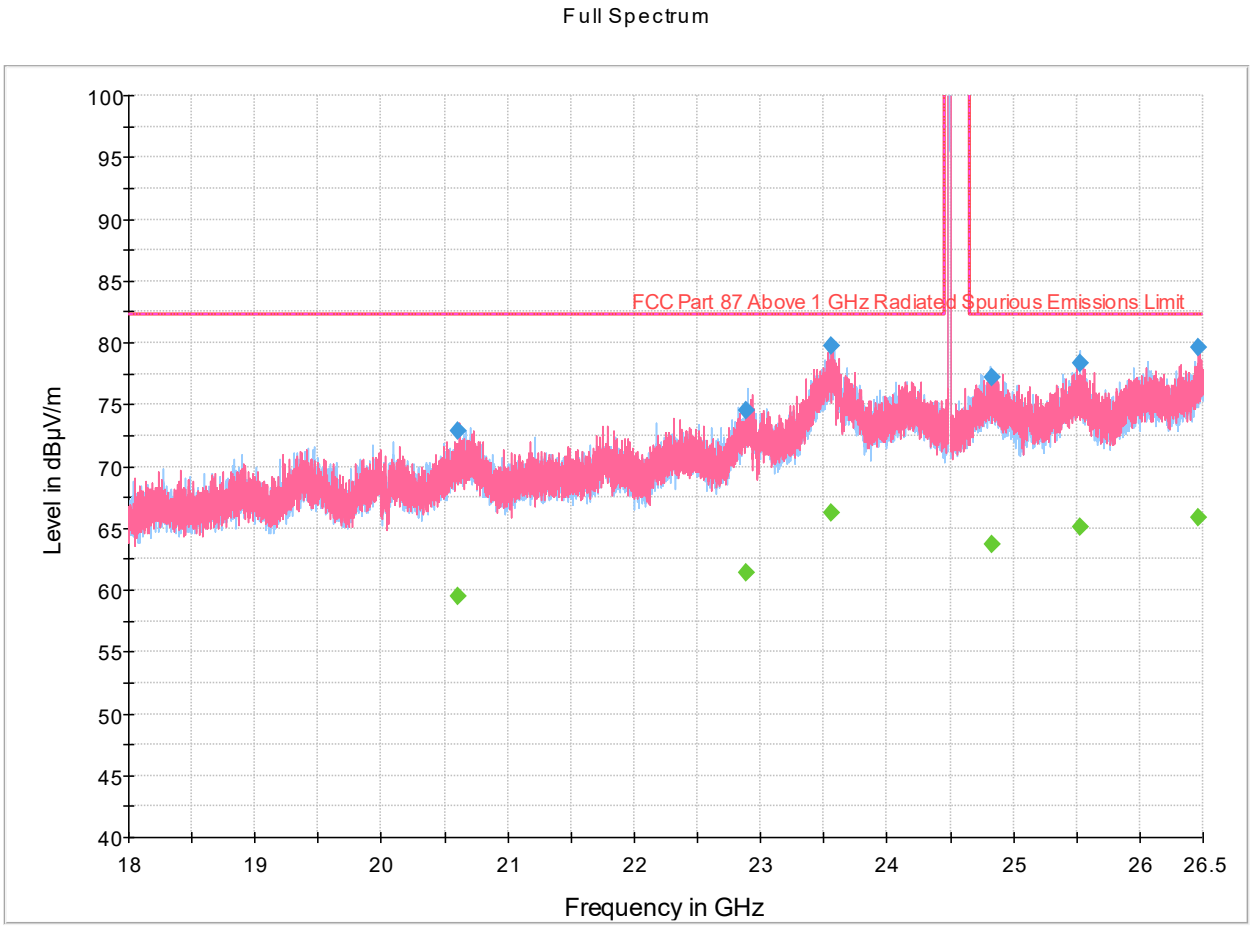


Figure 8.5-7: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) 24.49 GHz Low channel with 23MHz authorized Bandwidth.*

Table 8.5-7*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20610.450000	72.86	---	82.23	9.37	5000.0	1000.000	364.0	V	268.0	57.2
20610.450000	---	59.53	82.23	22.70	5000.0	1000.000	364.0	V	268.0	57.2
22882.775000	74.57	---	82.23	7.66	5000.0	1000.000	393.0	H	264.0	59.2
22882.775000	---	61.41	82.23	20.82	5000.0	1000.000	393.0	H	264.0	59.2
23563.187500	79.72	---	82.23	2.51	5000.0	1000.000	235.0	V	292.0	63.3
23563.187500	---	66.23	82.23	16.00	5000.0	1000.000	235.0	V	292.0	63.3
24825.400000	77.23	---	82.23	5.00	5000.0	1000.000	317.0	H	232.0	60.9
24825.400000	---	63.71	82.23	18.52	5000.0	1000.000	317.0	H	232.0	60.9
25526.193750	78.35	---	82.23	3.88	5000.0	1000.000	278.0	H	0.0	61.5
25526.193750	---	65.12	82.23	17.11	5000.0	1000.000	278.0	H	0.0	61.5
26465.931250	79.66	---	82.23	2.57	5000.0	1000.000	353.0	V	282.0	62.6
26465.931250	---	65.87	82.23	16.36	5000.0	1000.000	353.0	V	282.0	62.6

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

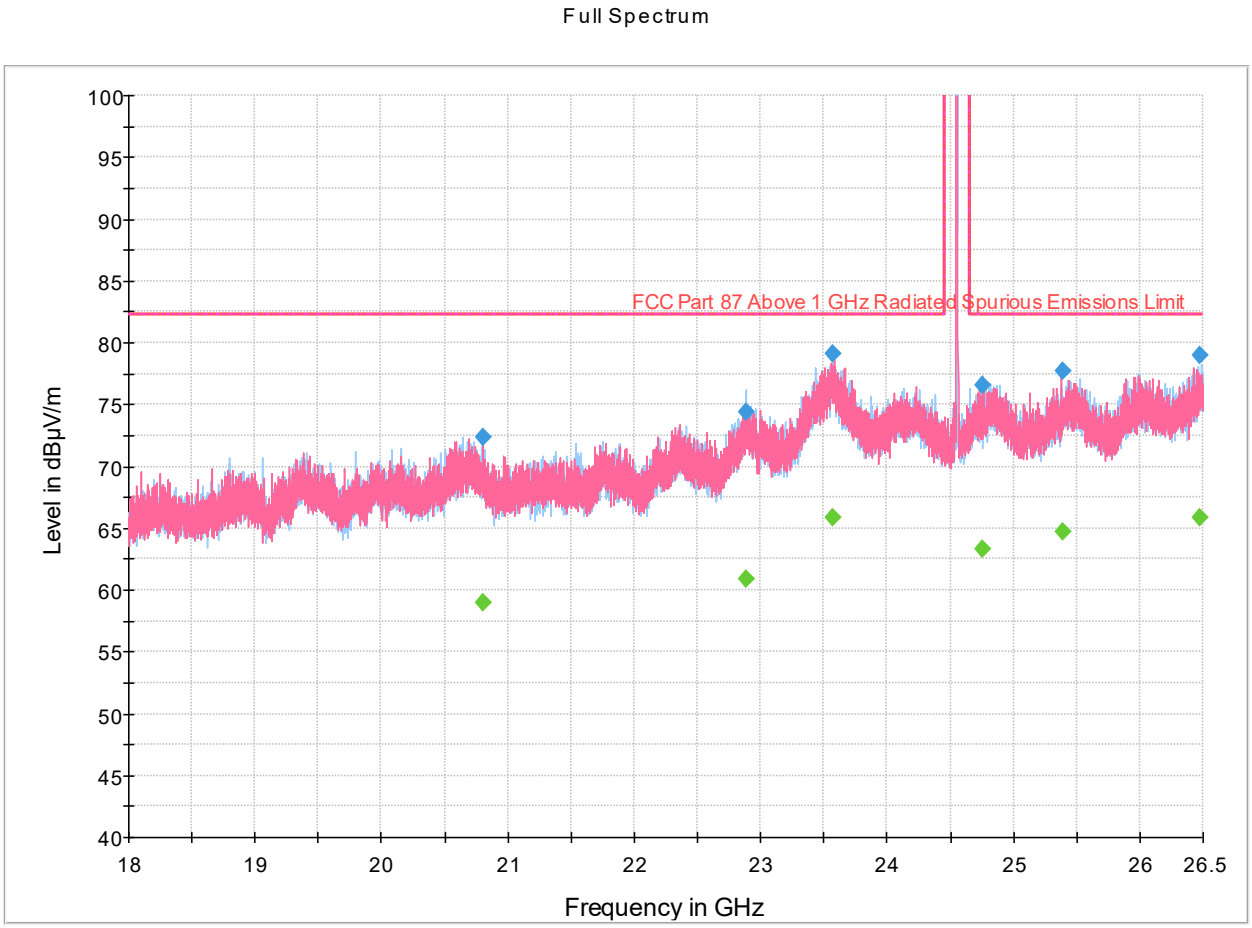


Figure 8.5-8: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) 24.55 GHz Middle channel with 23MHz authorized Bandwidth.*

Table 8.5-8*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20799.968750	72.39	---	82.23	9.84	5000.0	1000.000	164.0	V	0.0	57.2
20799.968750	---	59.01	82.23	23.22	5000.0	1000.000	164.0	V	0.0	57.2
22889.118750	---	60.93	82.23	21.30	5000.0	1000.000	104.0	H	70.0	59.2
22889.118750	74.36	---	82.23	7.87	5000.0	1000.000	104.0	H	70.0	59.2
23571.943750	79.12	---	82.23	3.11	5000.0	1000.000	289.0	V	235.0	63.3
23571.943750	---	65.90	82.23	16.33	5000.0	1000.000	289.0	V	235.0	63.3
24756.856250	76.56	---	82.23	5.67	5000.0	1000.000	104.0	H	103.0	60.8
24756.856250	---	63.36	82.23	18.87	5000.0	1000.000	104.0	H	103.0	60.8
25390.562500	---	64.67	82.23	17.56	5000.0	1000.000	196.0	V	207.0	60.8
25390.562500	77.70	---	82.23	4.53	5000.0	1000.000	196.0	V	207.0	60.8
26480.925000	79.04	---	82.23	3.19	5000.0	1000.000	281.0	H	0.0	62.7
26480.925000	---	65.81	82.23	16.42	5000.0	1000.000	281.0	H	0.0	62.7

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

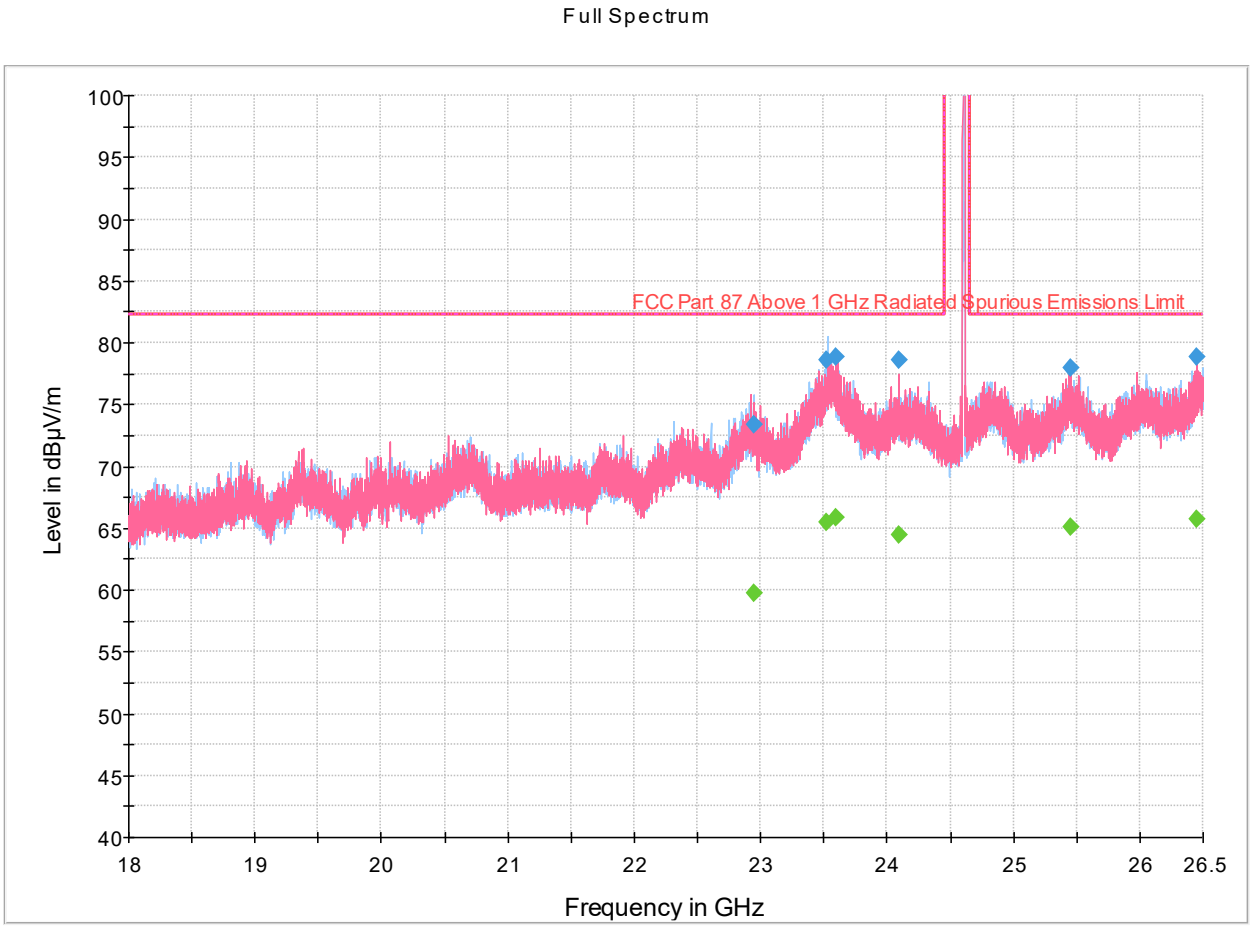


Figure 8.5-9: *Radiated emissions spectral plot (18 GHz - 26.5 GHz) 24.61 GHz High channel with 23 MHz authorized Bandwidth.*

Table 8.5-9*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22946.718750	---	59.81	82.23	22.42	5000.0	1000.000	226.0	H	0.0	59.0
22946.718750	73.41	---	82.23	8.82	5000.0	1000.000	226.0	H	0.0	59.0
23523.925000	---	65.51	82.23	16.72	5000.0	1000.000	114.0	H	273.0	62.9
23523.925000	78.65	---	82.23	3.58	5000.0	1000.000	114.0	H	273.0	62.9
23600.906250	78.86	---	82.23	3.37	5000.0	1000.000	207.0	V	39.0	63.2
23600.906250	---	65.82	82.23	16.41	5000.0	1000.000	207.0	V	39.0	63.2
24088.662500	78.63	---	82.23	3.60	5000.0	1000.000	152.0	V	0.0	61.4
24088.662500	---	64.51	82.23	17.72	5000.0	1000.000	152.0	V	0.0	61.4
25450.600000	78.00	---	82.23	4.23	5000.0	1000.000	127.0	V	22.0	61.1
25450.600000	---	65.07	82.23	17.16	5000.0	1000.000	127.0	V	22.0	61.1
26456.050000	78.90	---	82.23	3.33	5000.0	1000.000	324.0	V	0.0	62.6
26456.050000	---	65.80	82.23	16.43	5000.0	1000.000	324.0	V	0.0	62.6

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

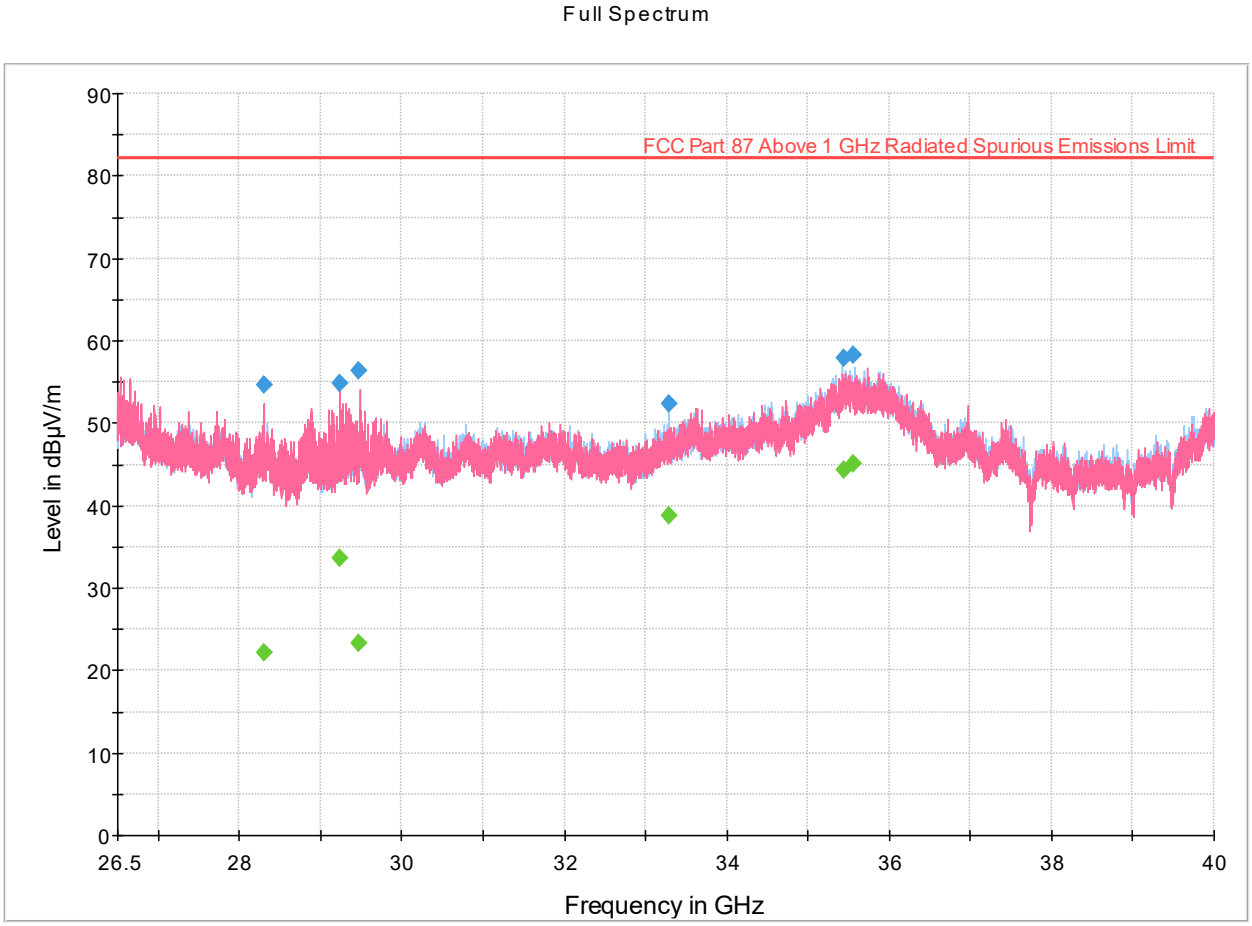


Figure 8.5-10: *Radiated emissions spectral plot (26.5 GHz - 40 GHz) 24.49GHz Low channel with 23MHz authorized Bandwidth.*

Table 8.5-10*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
28298.706250	---	22.24	82.23	59.99	5000.0	1000.000	150.0	V	352.0	15.3
28298.706250	54.70	---	82.23	27.53	5000.0	1000.000	150.0	V	352.0	15.3
29240.593750	---	33.68	82.23	48.55	5000.0	1000.000	150.0	V	322.0	16.2
29240.593750	54.80	---	82.23	27.43	5000.0	1000.000	150.0	V	322.0	16.2
29474.012500	56.32	---	82.23	25.91	5000.0	1000.000	151.0	V	4.0	16.7
29474.012500	---	23.25	82.23	58.98	5000.0	1000.000	151.0	V	4.0	16.7
33284.875000	---	38.80	82.23	43.43	5000.0	1000.000	103.0	H	18.0	18.6
33284.875000	52.29	---	82.23	29.94	5000.0	1000.000	103.0	H	18.0	18.6
35432.331250	---	44.35	82.23	37.88	5000.0	1000.000	123.0	H	11.0	26.1
35432.331250	57.84	---	82.23	24.39	5000.0	1000.000	123.0	H	11.0	26.1
35566.918750	58.37	---	82.23	23.86	5000.0	1000.000	112.0	H	222.0	26.6
35566.918750	---	45.19	82.23	37.04	5000.0	1000.000	112.0	H	222.0	26.6

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

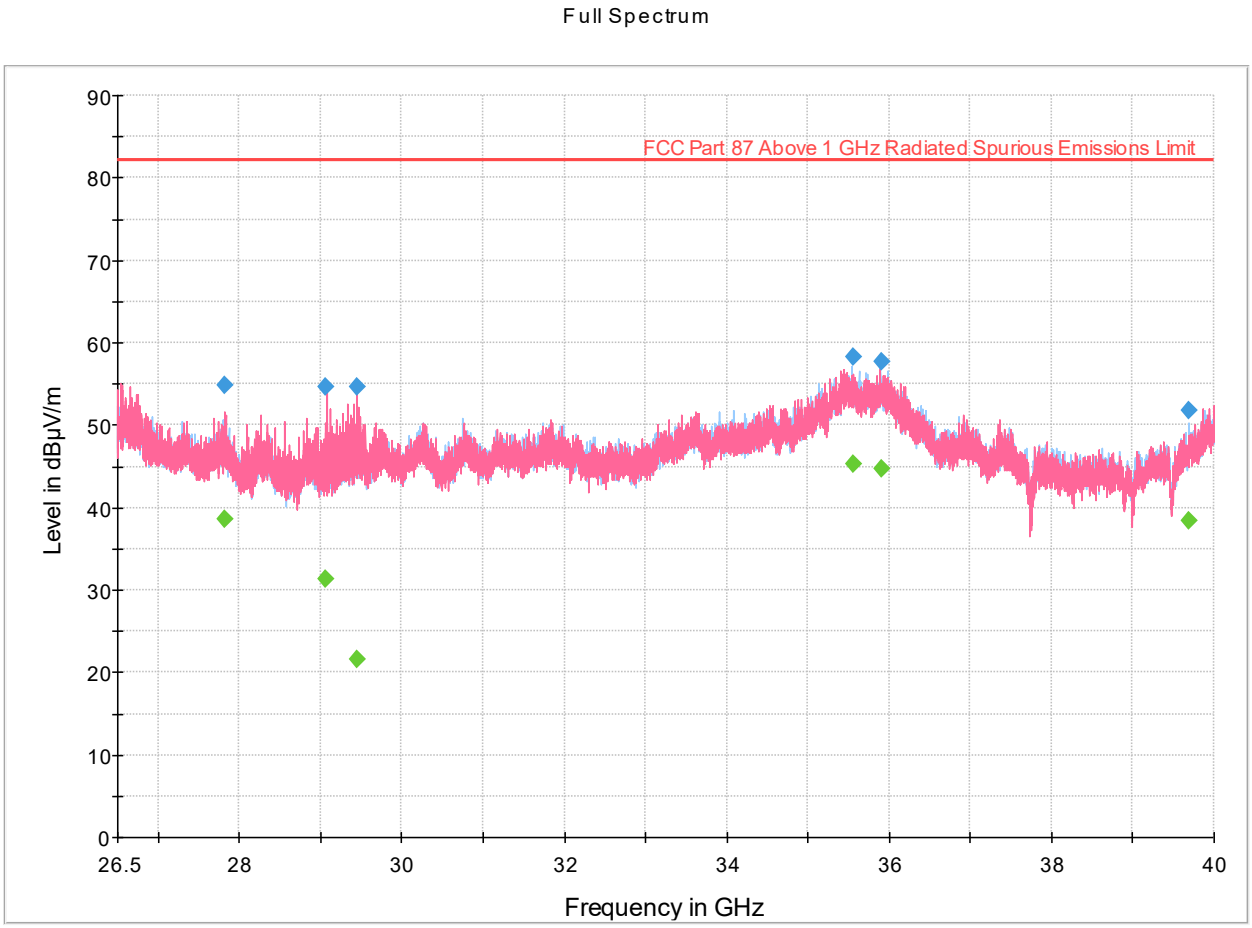


Figure 8.5-11: *Radiated emissions spectral plot (26.5 GHz - 40 GHz) 24.55 GHz Middle channel with 23 MHz authorized Bandwidth.*

Table 8.5-11*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
27824.087500	---	38.56	82.23	43.67	5000.0	1000.000	155.0	V	328.0	15.3
27824.087500	54.85	---	82.23	27.38	5000.0	1000.000	155.0	V	328.0	15.3
29057.106250	54.56	---	82.23	27.67	5000.0	1000.000	144.0	V	331.0	15.9
29057.106250	---	31.42	82.23	50.81	5000.0	1000.000	144.0	V	331.0	15.9
29449.018750	---	21.52	82.23	60.71	5000.0	1000.000	149.0	V	350.0	16.6
29449.018750	54.71	---	82.23	27.52	5000.0	1000.000	149.0	V	350.0	16.6
35557.487500	58.34	---	82.23	23.89	5000.0	1000.000	140.0	V	116.0	26.6
35557.487500	---	45.36	82.23	36.87	5000.0	1000.000	140.0	V	116.0	26.6
35902.243750	---	44.69	82.23	37.54	5000.0	1000.000	111.0	H	11.0	27.1
35902.243750	57.78	---	82.23	24.45	5000.0	1000.000	111.0	H	11.0	27.1
39694.450000	---	38.49	82.23	43.74	5000.0	1000.000	100.0	H	316.0	20.0
39694.450000	51.81	---	82.23	30.42	5000.0	1000.000	100.0	H	316.0	20.0

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

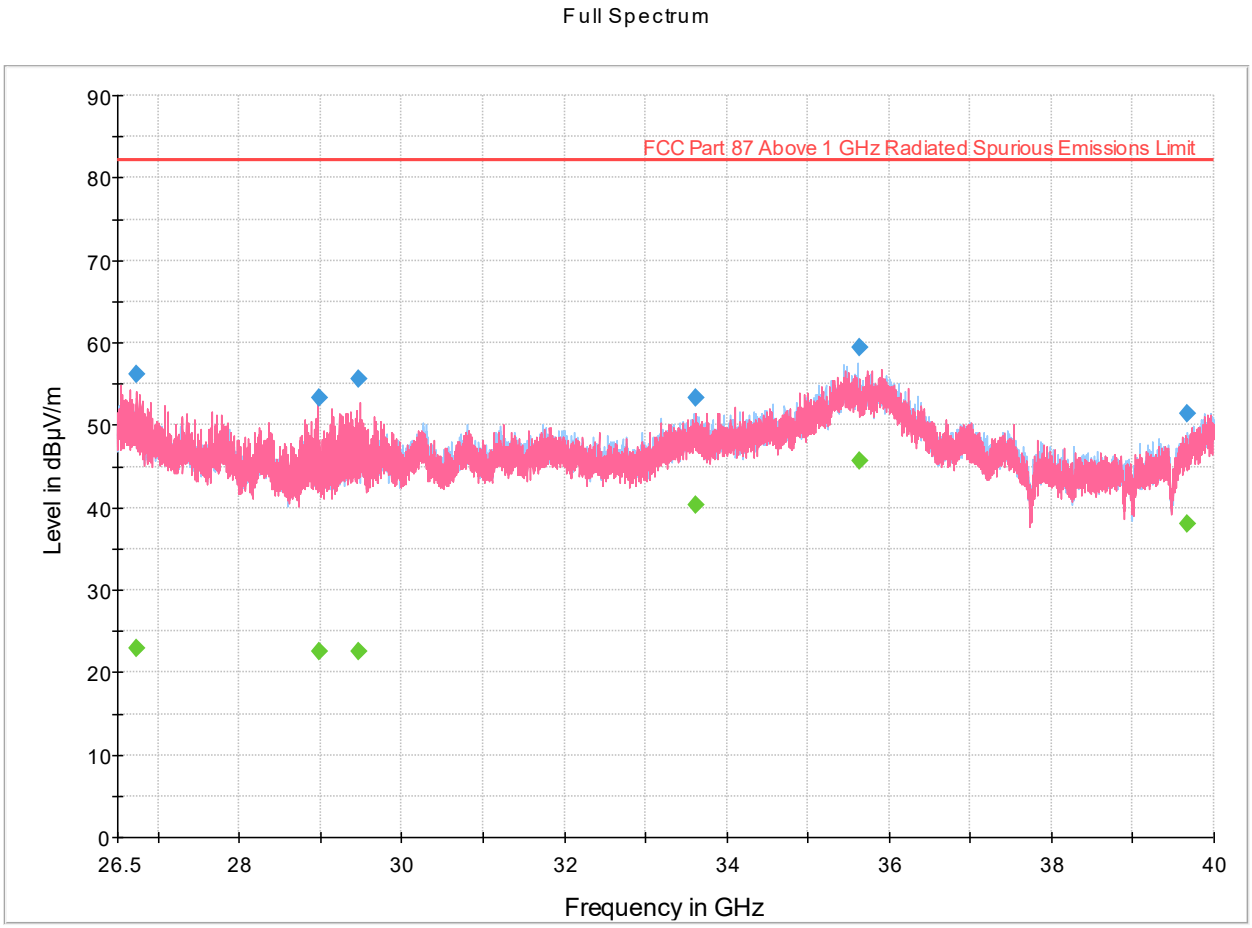


Figure 8.5-12: *Radiated emissions spectral plot (26.5 GHz - 40 GHz) 24.61 GHz High channel with 23 MHz authorized Bandwidth.*

Table 8.5-12*: Radiated emissions results*

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
26735.481250	---	22.96	82.23	59.27	5000.0	1000.000	148.0	V	356.0	17.7
26735.481250	56.14	---	82.23	26.09	5000.0	1000.000	148.0	V	356.0	17.7
28974.456250	---	22.53	82.23	59.70	5000.0	1000.000	144.0	V	11.0	15.8
28974.456250	53.25	---	82.23	28.98	5000.0	1000.000	144.0	V	11.0	15.8
29474.331250	---	22.61	82.23	59.62	5000.0	1000.000	154.0	V	11.0	16.7
29474.331250	55.54	---	82.23	26.69	5000.0	1000.000	154.0	V	11.0	16.7
33609.212500	---	40.23	82.23	42.00	5000.0	1000.000	150.0	V	158.0	19.8
33609.212500	53.27	---	82.23	28.96	5000.0	1000.000	150.0	V	158.0	19.8
35626.918750	59.34	---	82.23	22.89	5000.0	1000.000	102.0	H	359.0	26.7
35626.918750	---	45.76	82.23	36.47	5000.0	1000.000	102.0	H	359.0	26.7
39662.500000	51.48	---	82.23	30.75	5000.0	1000.000	100.0	H	356.0	19.7
39662.500000	---	37.97	82.23	44.26	5000.0	1000.000	100.0	H	356.0	19.7

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
[2] Correction factors = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 5 seconds and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions has been recorded.

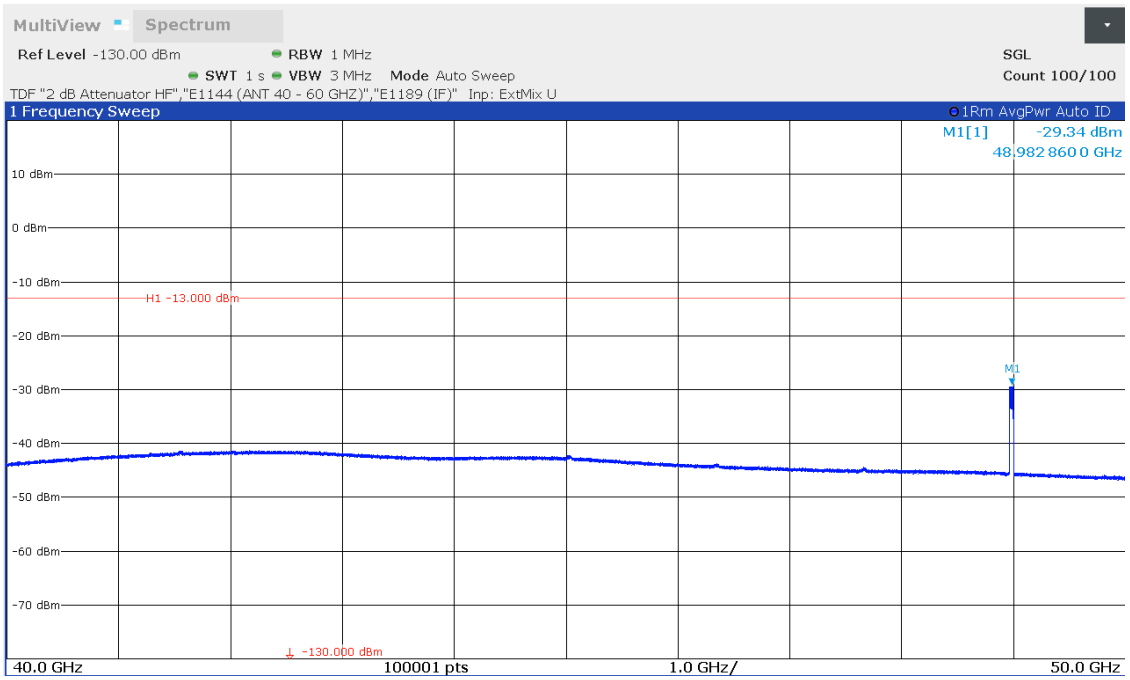


Figure 8.5-13: *Unwanted emissions spurious band plot – Field strength measured, 40 -50 GHz, horizontal polarization, Low channel 24.49 GHz with 23MHz authorized Bandwidth.*

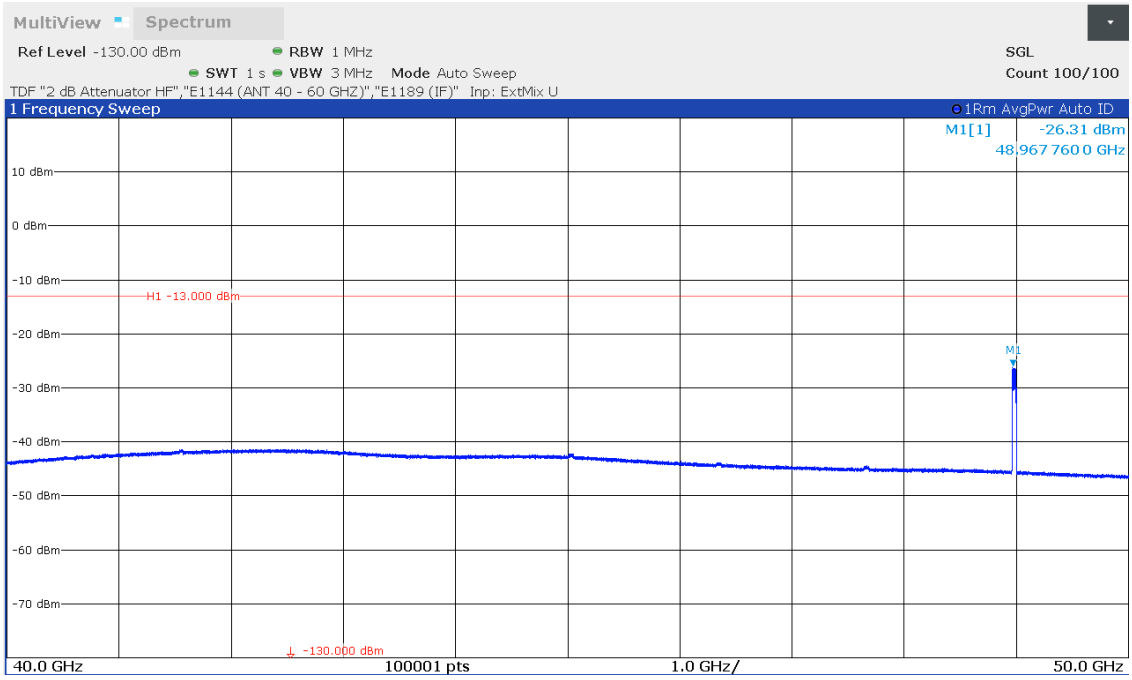


Figure 8.5-14: *Unwanted emissions spurious band plot – Field strength measured, 40-50 GHz, vertical polarization, Low channel 24.49 GHz with 23MHz authorized Bandwidth.*

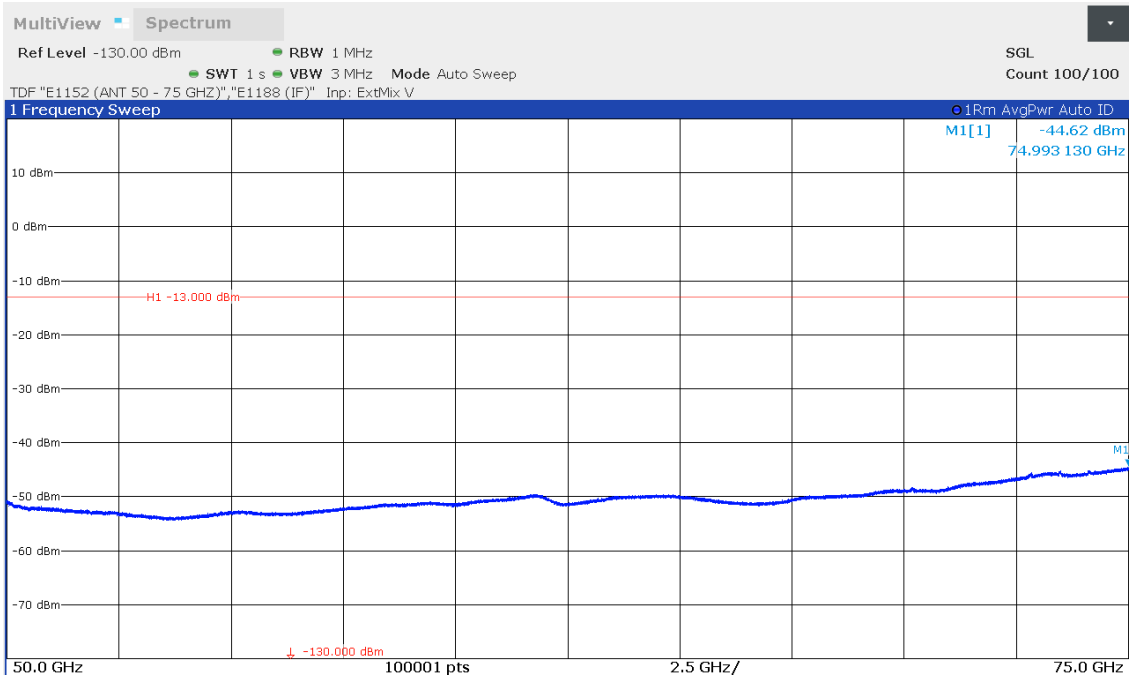


Figure 8.5-15: *Unwanted emissions spurious band plot – Field strength measured 50-75 GHz, horizontal polarization, Low channel 24.49 GHz with 23MHz authorized Bandwidth.*

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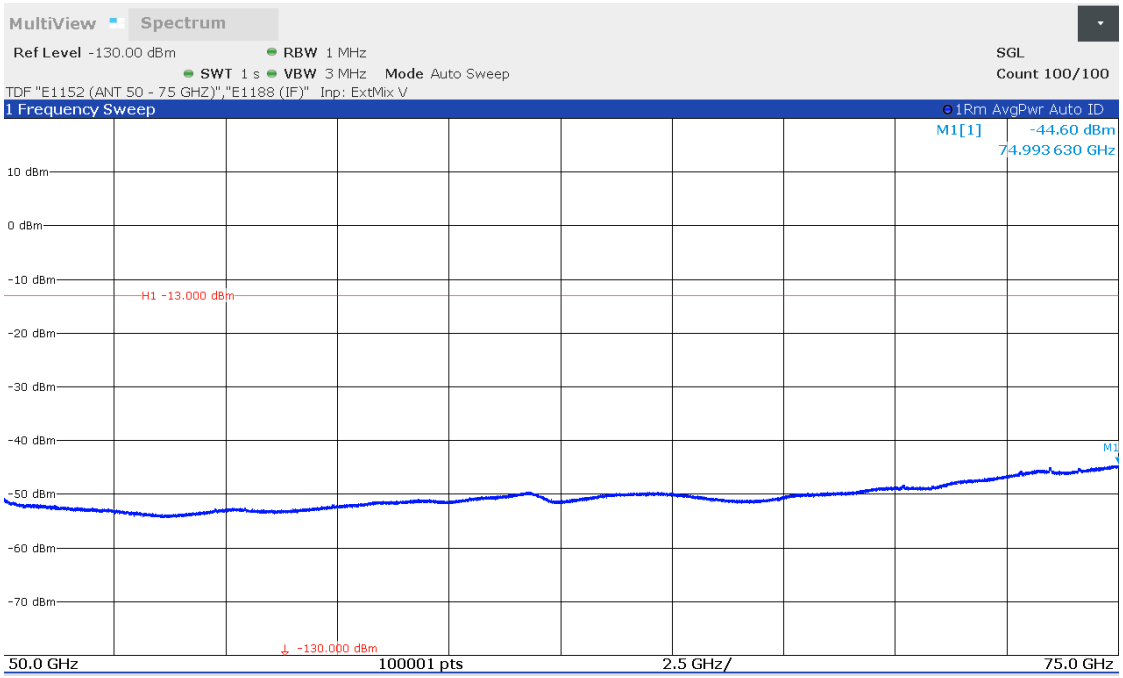

Figure 8.5-16: *Unwanted emissions spurious band plot – Field strength measured 50-75 GHz, vertical polarization, Low channel 24.49 GHz with 23MHz authorized Bandwidth.*

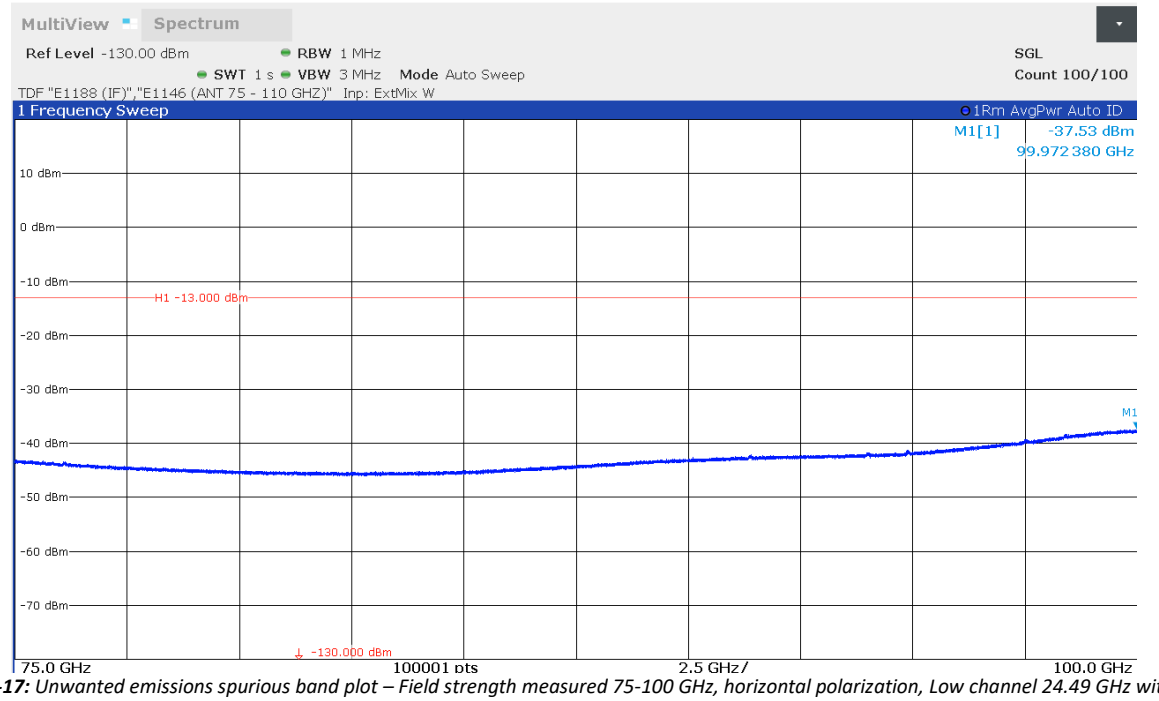

Figure 8.5-17: *Unwanted emissions spurious band plot – Field strength measured 75-100 GHz, horizontal polarization, Low channel 24.49 GHz with 23MHz authorized Bandwidth.*

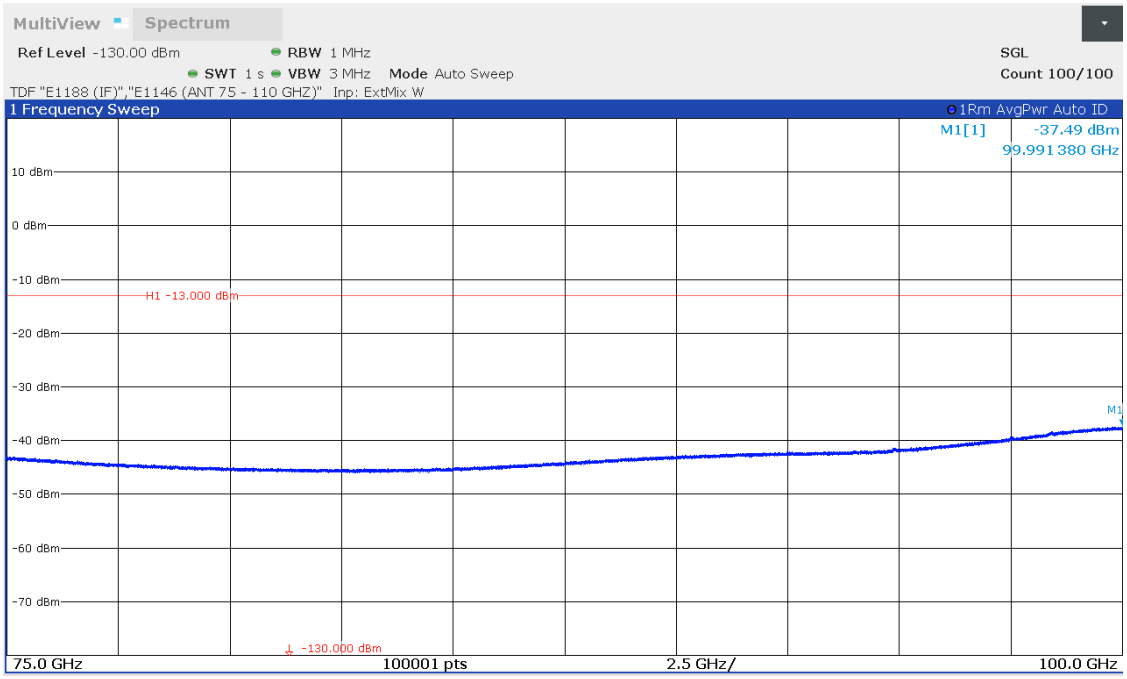

Figure 8.5-18: *Unwanted emissions spurious band plot – Field strength measured 75-100 GHz, vertical polarization, Low channel 24.49 GHz with 23MHz authorized Bandwidth.*

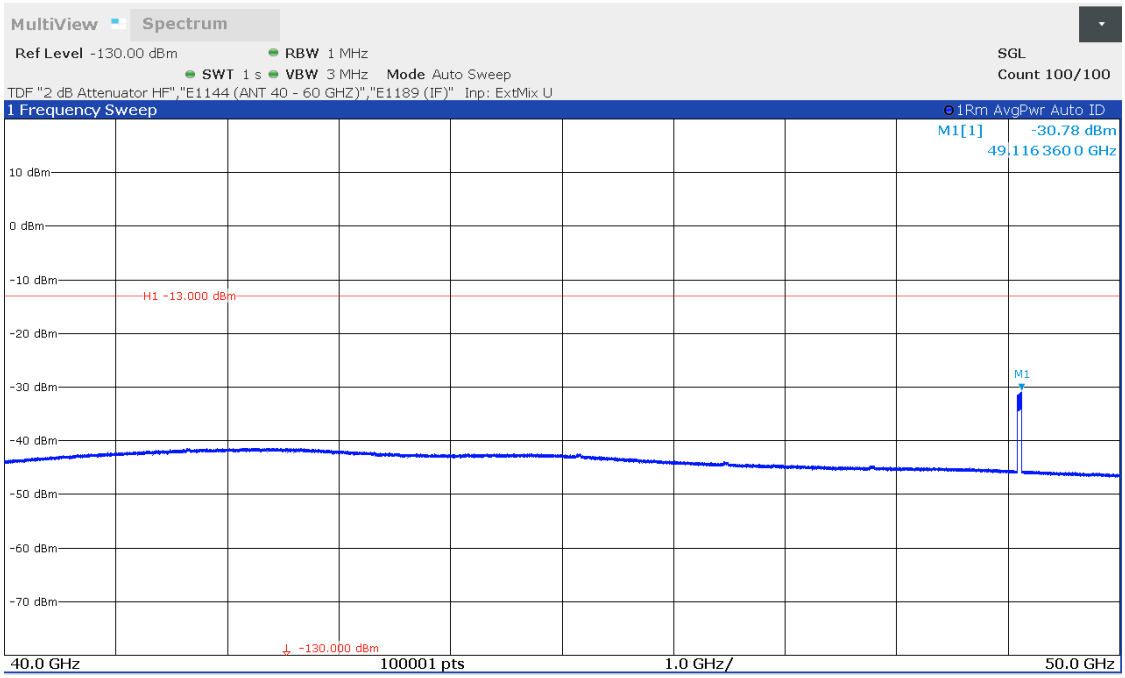

Figure 8.5-19: *Unwanted emissions spurious band plot – Field strength measured, 40 -50 GHz, horizontal polarization, Middle channel 24.55 GHz with 23MHz authorized Bandwidth.*

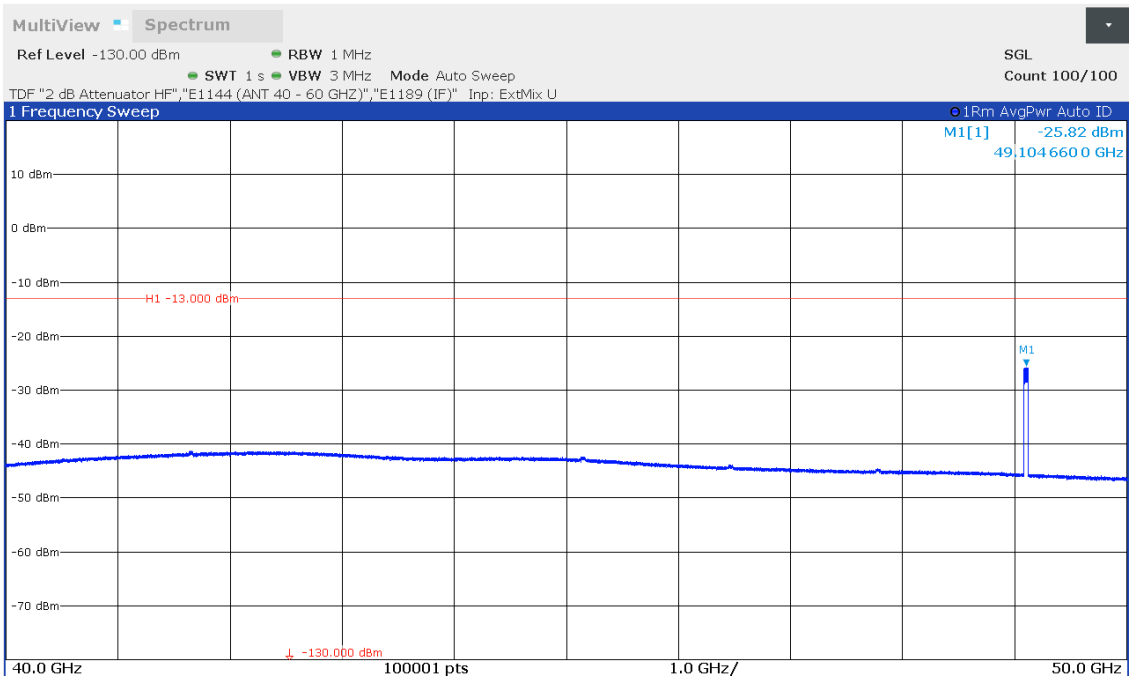

Figure 8.5-20: *Unwanted emissions spurious band plot – Field strength measured, 40-50 GHz, vertical polarization, Middle channel 24.55 GHz with 23MHz authorized Bandwidth.*

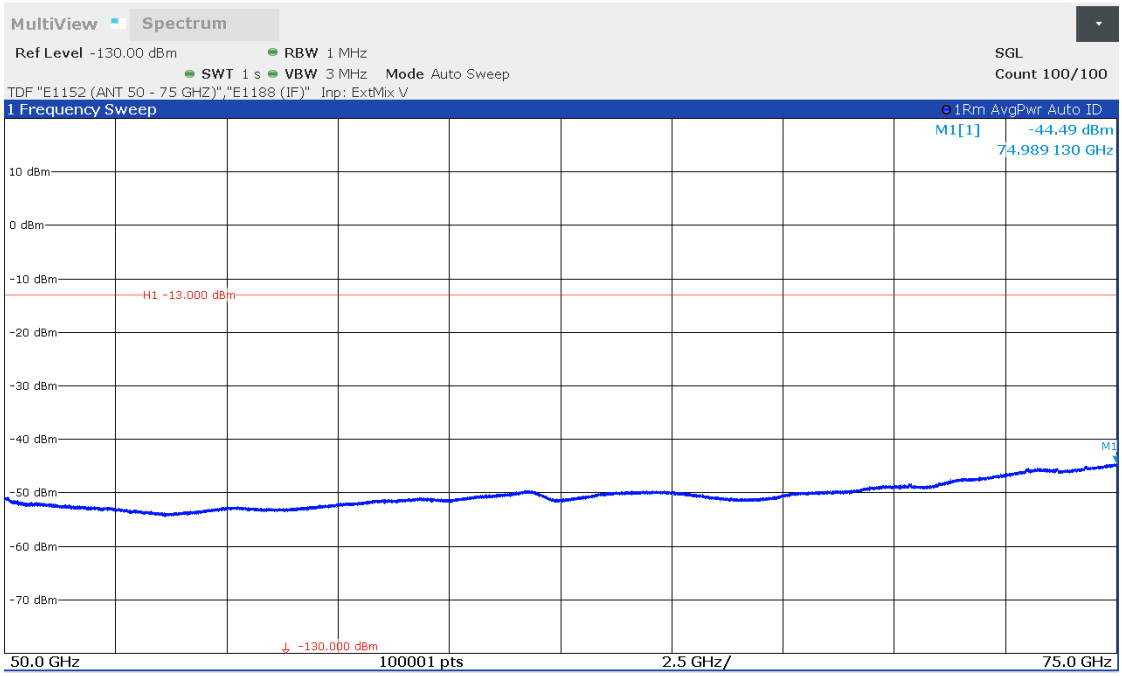

Figure 8.5-21: *Unwanted emissions spurious band plot – Field strength measured 50-75 GHz, horizontal polarization, Middle channel 24.55 GHz with 23 MHz authorized Bandwidth.*

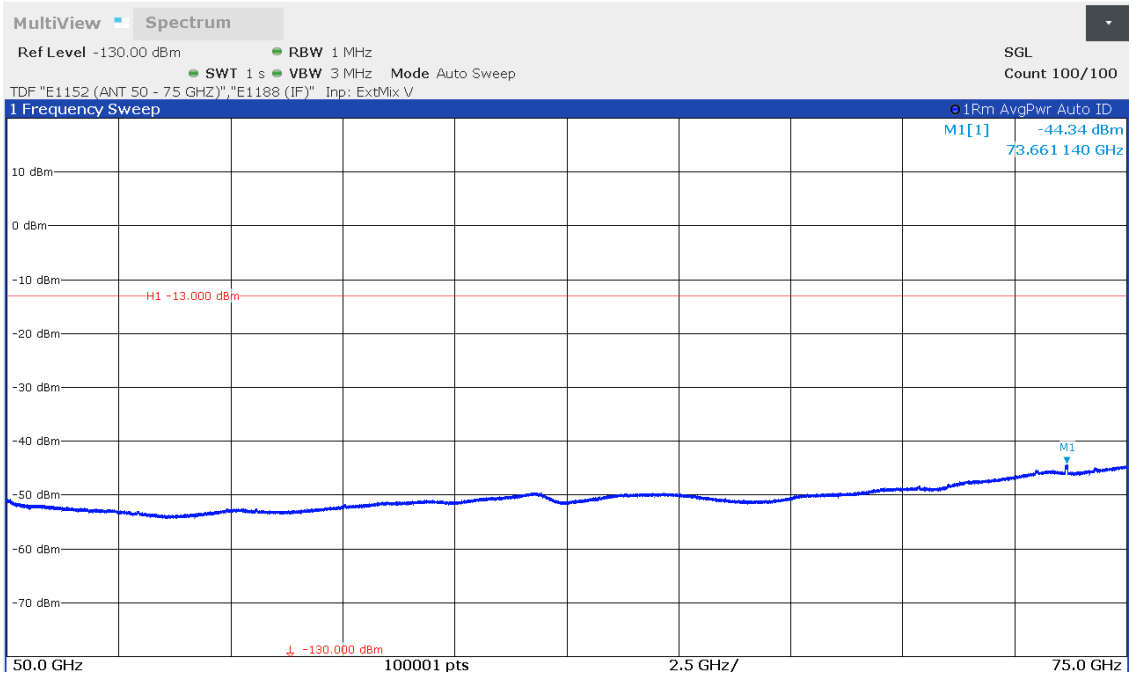

Figure 8.5-22: *Unwanted emissions spurious band plot – Field strength measured 50-75 GHz, vertical polarization, Middle channel 24.55 GHz with 23 MHz authorized Bandwidth.*

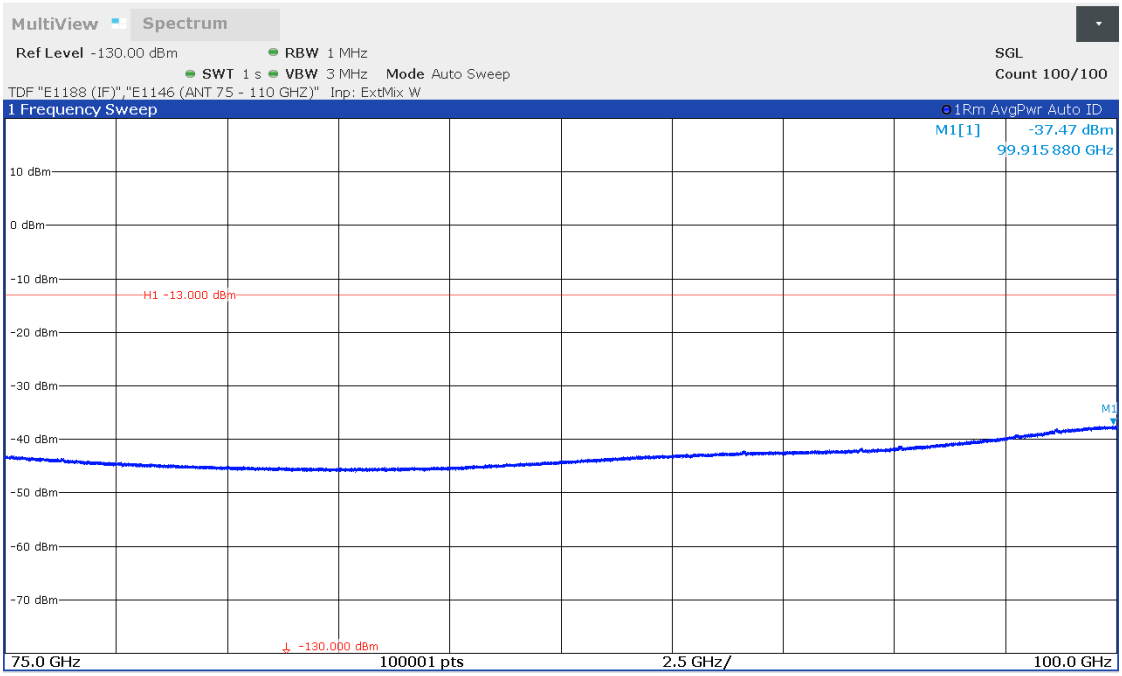

Figure 8.5-23: *Unwanted emissions spurious band plot – Field strength measured 75-100 GHz, horizontal polarization, Middle channel 24.55 GHz with 23 MHz authorized Bandwidth.*

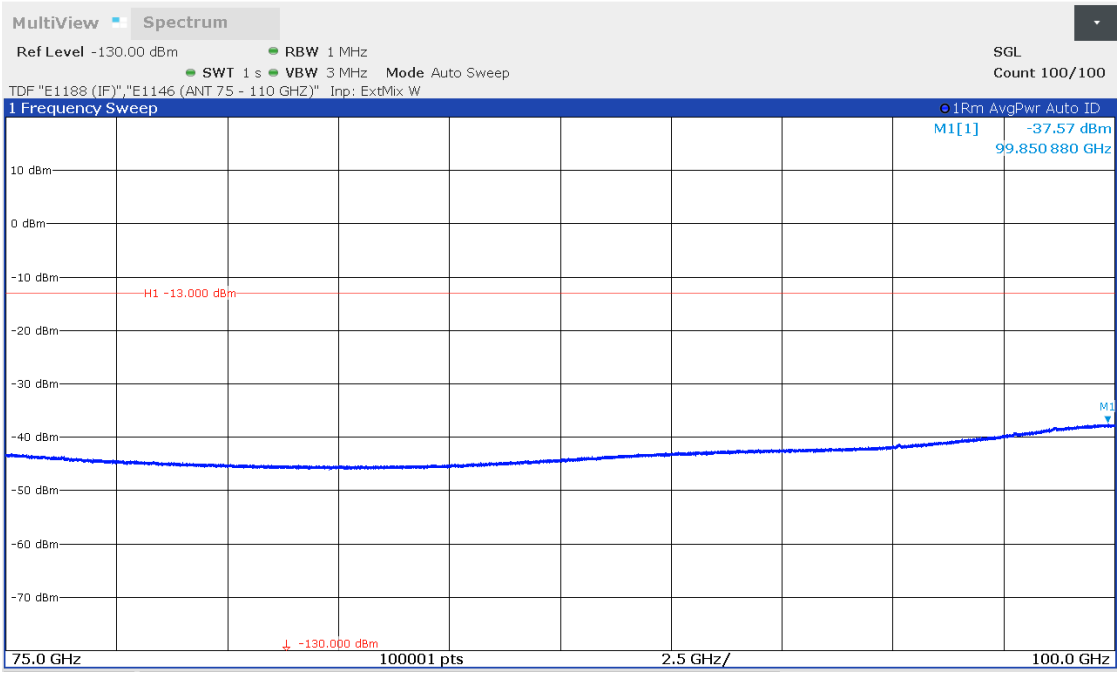

Figure 8.5-24: *Unwanted emissions spurious band plot – Field strength measured 75-100 GHz, vertical polarization, Middle channel 24.55 GHz with 23 MHz authorized Bandwidth.*

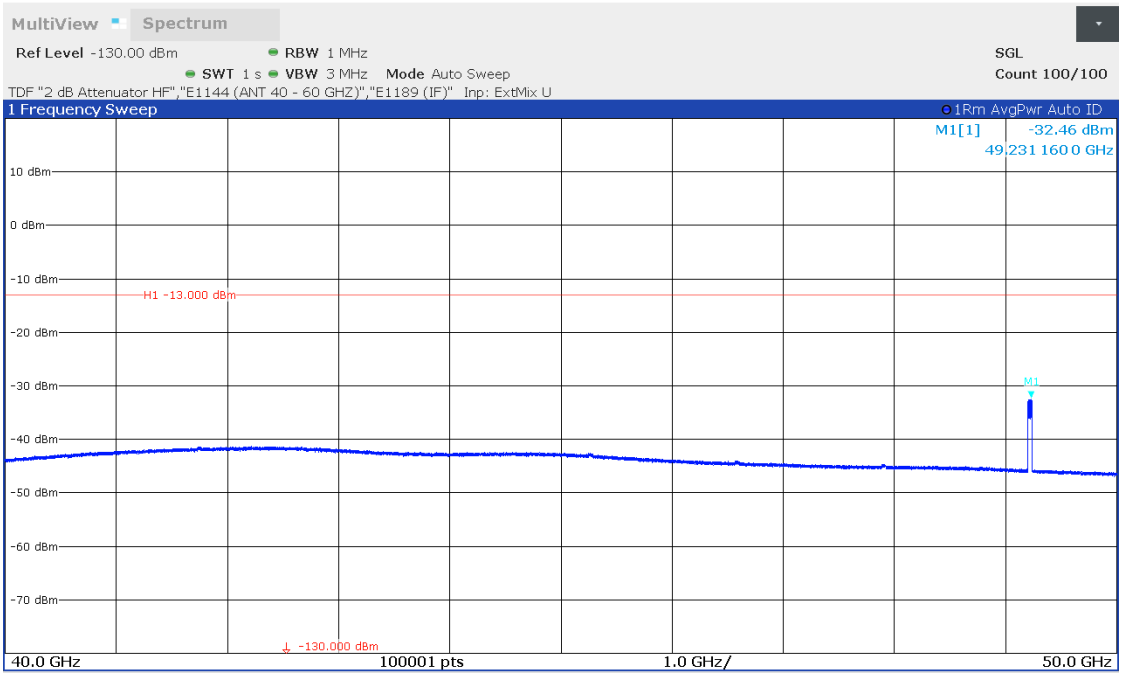

Figure 8.5-25: *Unwanted emissions spurious band plot – Field strength measured, 40 -50 GHz, horizontal polarization, High channel 24.61 GHz with 23 MHz authorized Bandwidth.*

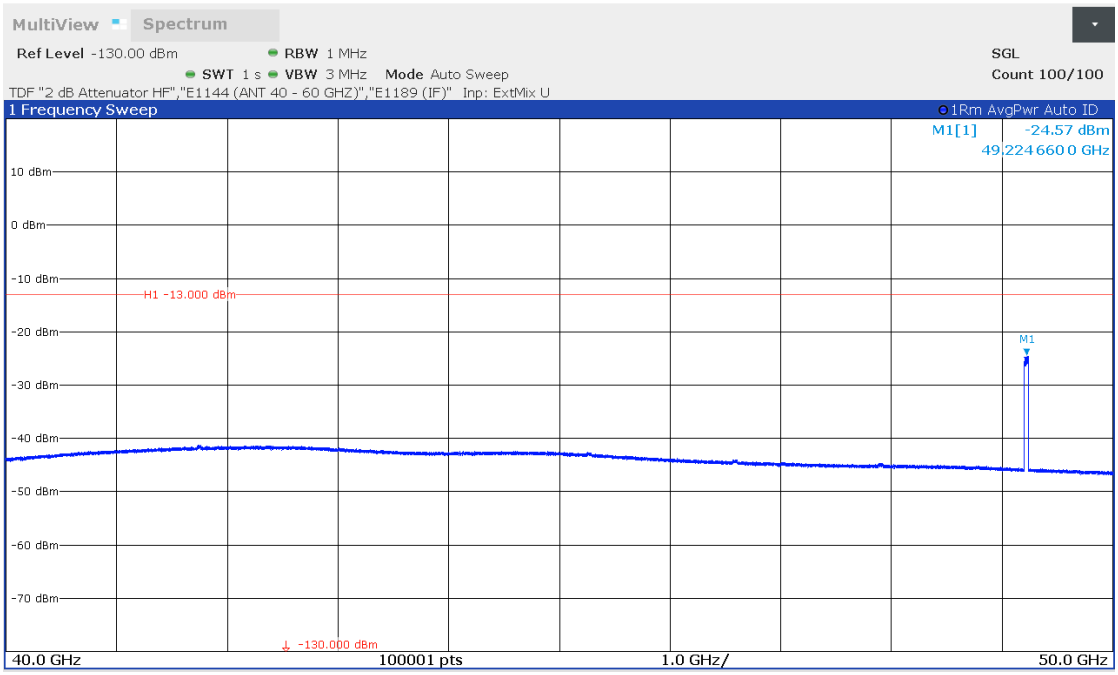

Figure 8.5-26: *Unwanted emissions spurious band plot – Field strength measured, 40-50 GHz, vertical polarization, High channel 24.61 GHz with 23 MHz authorized Bandwidth.*

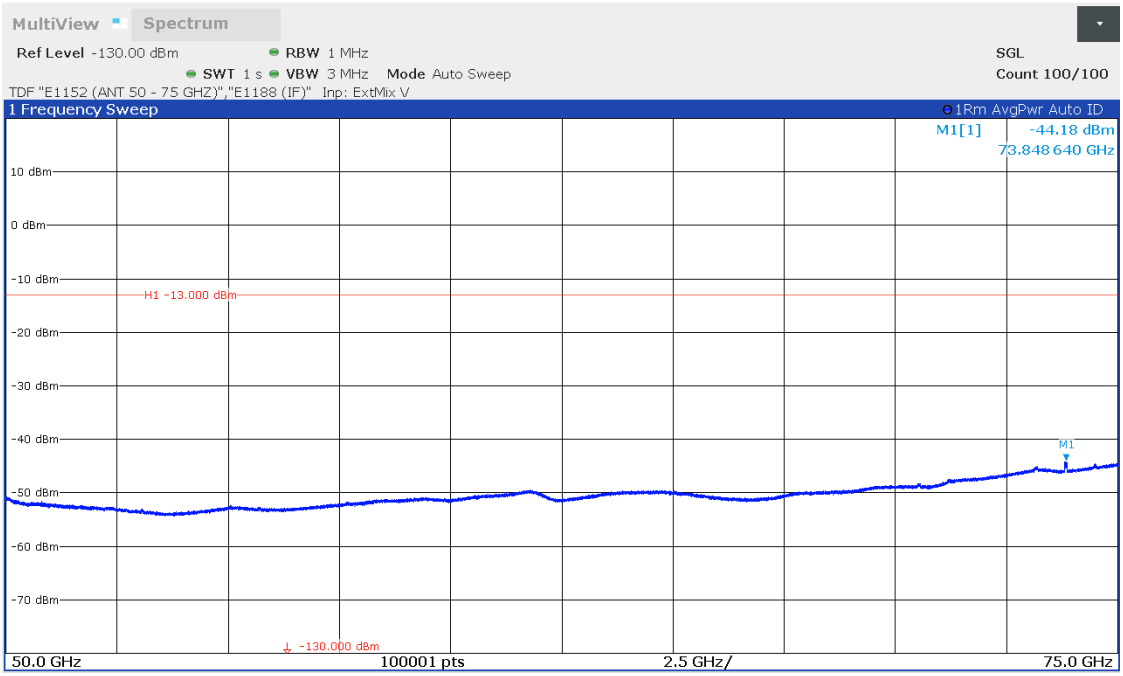

Figure 8.5-27: *Unwanted emissions spurious band plot – Field strength measured 50-75 GHz, horizontal polarization, High channel 24.61 GHz with 23 MHz authorized Bandwidth.*

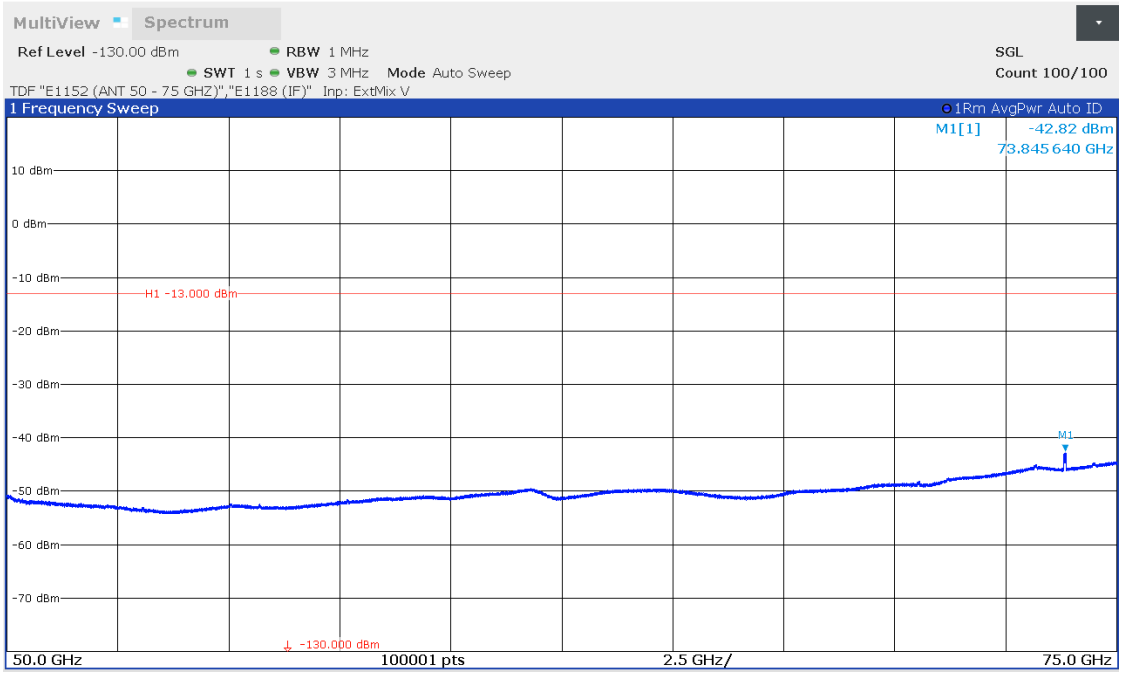

Figure 8.5-28: *Unwanted emissions spurious band plot – Field strength measured 50-75 GHz, vertical polarization, High channel 24.61 GHz with 23MHz authorized Bandwidth.*

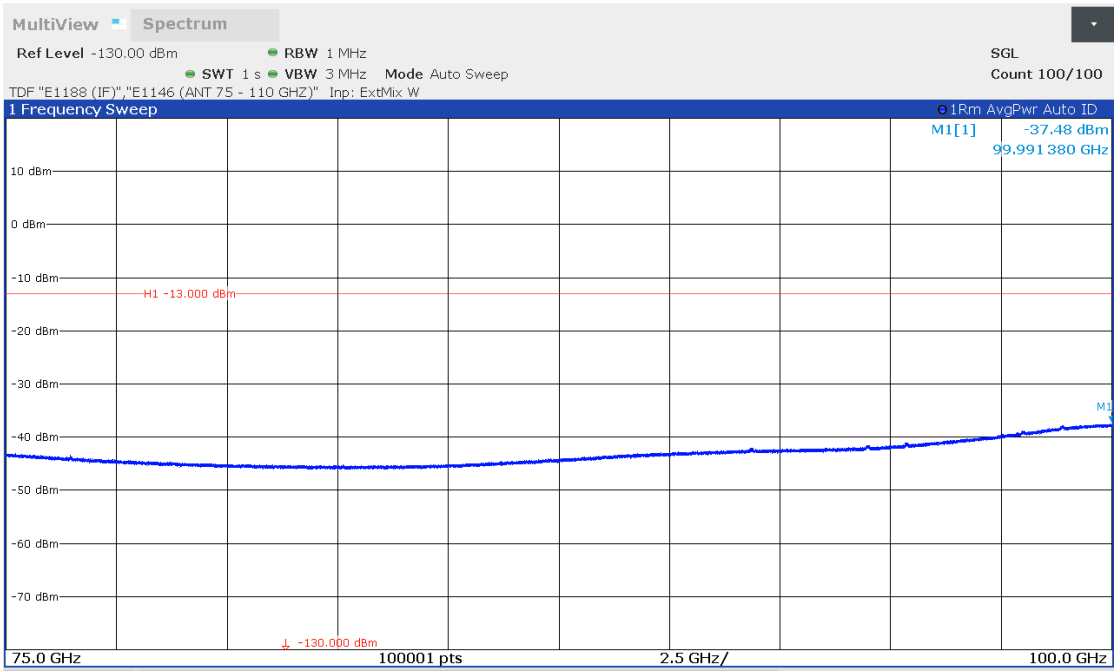

Figure 8.5-29: *Unwanted emissions spurious band plot – Field strength measured 75-100 GHz, horizontal polarization, High channel 24.61 GHz with 23 MHz authorized Bandwidth.*

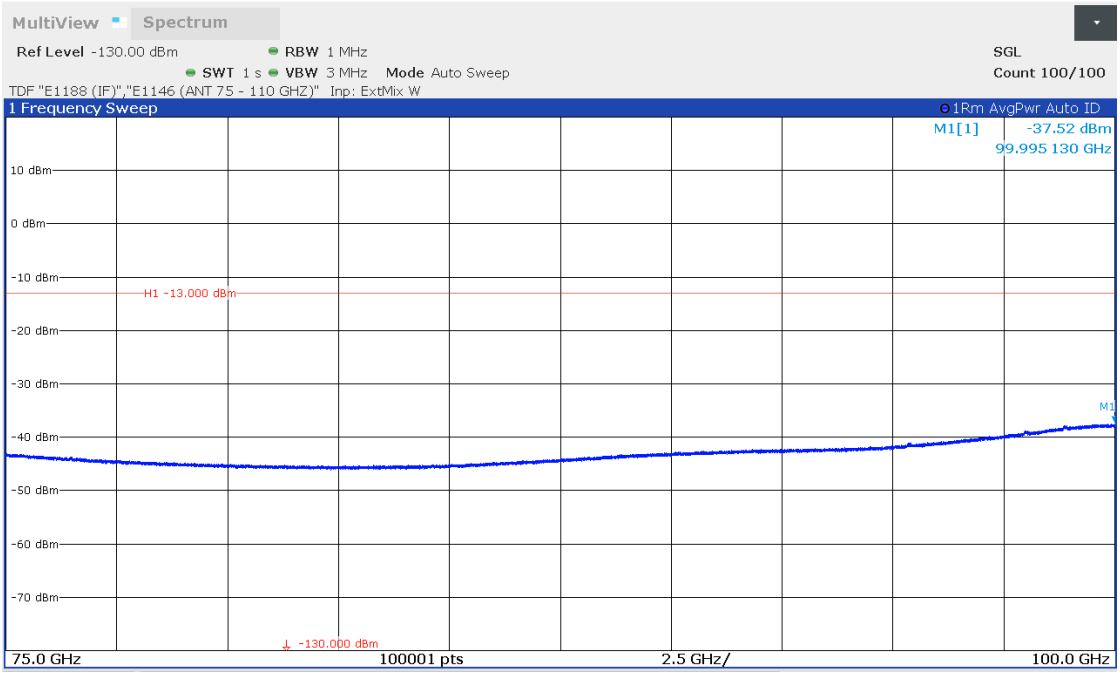

Figure 8.5-30: *Unwanted emissions spurious band plot – Field strength measured 75-100 GHz, vertical polarization, High channel 24.61 GHz with 43MHz authorized Bandwidth.*

8.6 Frequency stability

8.6.1 References and limits

- FCC 47 CFR Part 87: §87.133
- Test method: ANSI C63.26 (5.6.3)

(a) Except as provided in paragraphs (c), (d), (f), and (g) of this section, the carrier frequency of each station must be maintained within these tolerances:

Frequency band (lower limit exclusive, upper limit inclusive), and categories of stations	Tolerance[1]	Tolerance[2]
Radionavigation stations	5000	5000

8.6.2 Test summary

Verdict	Not tested		
Test date		Temperature	
Test engineer		Air pressure	
Test location	☐ Wireless bench ☐ 10 m semi-anechoic chamber ☐ 3 m semi-anechoic chamber ☐ Other: Environmental chamber	Relative humidity	

8.6.3 Notes

Not tested. See report REP015157-1TRFWL for this test.

End of test report