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RADIO TEST REPORT – REP006325

Type of assessment:

Final product testing

Applicant:

Trackman A/S

Product:

Launch monitor

Model:	Model variant:
TrackMan iO	n/a

FCC ID:	IC Registration number:
SFX-TMB0201	10140A-TMB0201

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.245

Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz, and 24075-24175 MHz.

- ISED RSS-210 Issue 10 December 2019, Amendment (April 2020)

Licence-Exempt Radio Apparatus: Category I Equipment

Date of issue: February 8, 2023

D. Guarnone	
Tested by	Signature
P. Barbieri	
Reviewed by	Signature

Test location

Company name	Nemko Spa
Address	Via del Carroccio, 4
City	Biassono
Province	MB
Postal code	20853
Country	Italy
Telephone	+39 039 220 12 01
Facsimile	+39 039 220 12 21
Website	www.nemko.com
Site number	FCC: 682159; IC: 9109A (10 m semi anechoic chamber)

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 Spa ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Trackman A/S
Address	Stubbeled, 2
City	Vedbaek
Province/State	-
Postal/Zip code	DK-2950
Country	Denmark

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.245	Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz, and 24075-24175 MHz.
RSS-210 Issue 10 December 2019, Amendment (April 2020)	Licence-Exempt Radio Apparatus: Category I Equipment

1.3 Test methods

ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-Gen Issue 5, April 2018 - Amendment 1 (March 2019) - Amendment 2 (February 2021)	General Requirements for Compliance of Radio Apparatus

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
REP006325	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.31(e)	Variation of power source	Choose an item.[1]
§15.203	Antenna requirement	Choose an item.[2]

Notes: [1]Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

[2]The Antennas are located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart C, test results

Part	Test description	Verdict
§2.1049	Occupied Bandwidth	Pass
§15.245(b)	Field Strength of Fundamental	Pass
§15.245(b)(1)	Harmonic emissions in the restricted bands below 17.7 GHz	Pass
§15.245(b)(1)(i)	Harmonic emissions in the restricted bands above 17.7 GHz of field disturbance sensors operating in the 24075–24175 MHz and for other field disturbance sensors designed for use only within a building or to open building doors	Pass
§15.245(b)(1)(ii)	Harmonic emissions in the restricted bands above 17.7 GHz of all other field disturbance sensors	Not applicable
§15.245(b)(1)(iii)	Harmonic emissions in the restricted bands above 17.7 GHz (for motor vehicles or aircraft)	Not applicable
§15.245(b)(3)	Field Strength of radiated emissions (except harmonics) and Band Edge	Pass

Note:

2.3 RSS-GEN, Issue 5, test results

Part	Test description	Verdict
6.7	99% Occupied Bandwidth	Pass
6.11	Frequency stability	Not applicable

Notes:

2.4 RSS-210, Issue 10, test results

Part	Test description	Verdict
§Annex F.1(a)	Field Strength of Fundamental	Pass
§Annex F.1(b)	Harmonic emissions in the restricted bands below 17.7 GHz	Pass
§Annex F.1(c)	Harmonic emissions in the restricted bands above 17.7 GHz	Pass
§Annex F.1(d)	Harmonic emissions in the restricted bands above 17.7 GHz (for motor vehicles or aircraft)	Not applicable
§Annex F.1(e)	Field Strength of radiated emissions (except harmonics) and Band Edge	Pass

Note:

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	January 16, 2023
Nemko sample ID number	PRJ00190640005

3.2 EUT information

Product name	TrackMan iO
Model	TrackMan iO
Model variant	n/a
Serial number	PRJ00190640005

3.3 Technical information

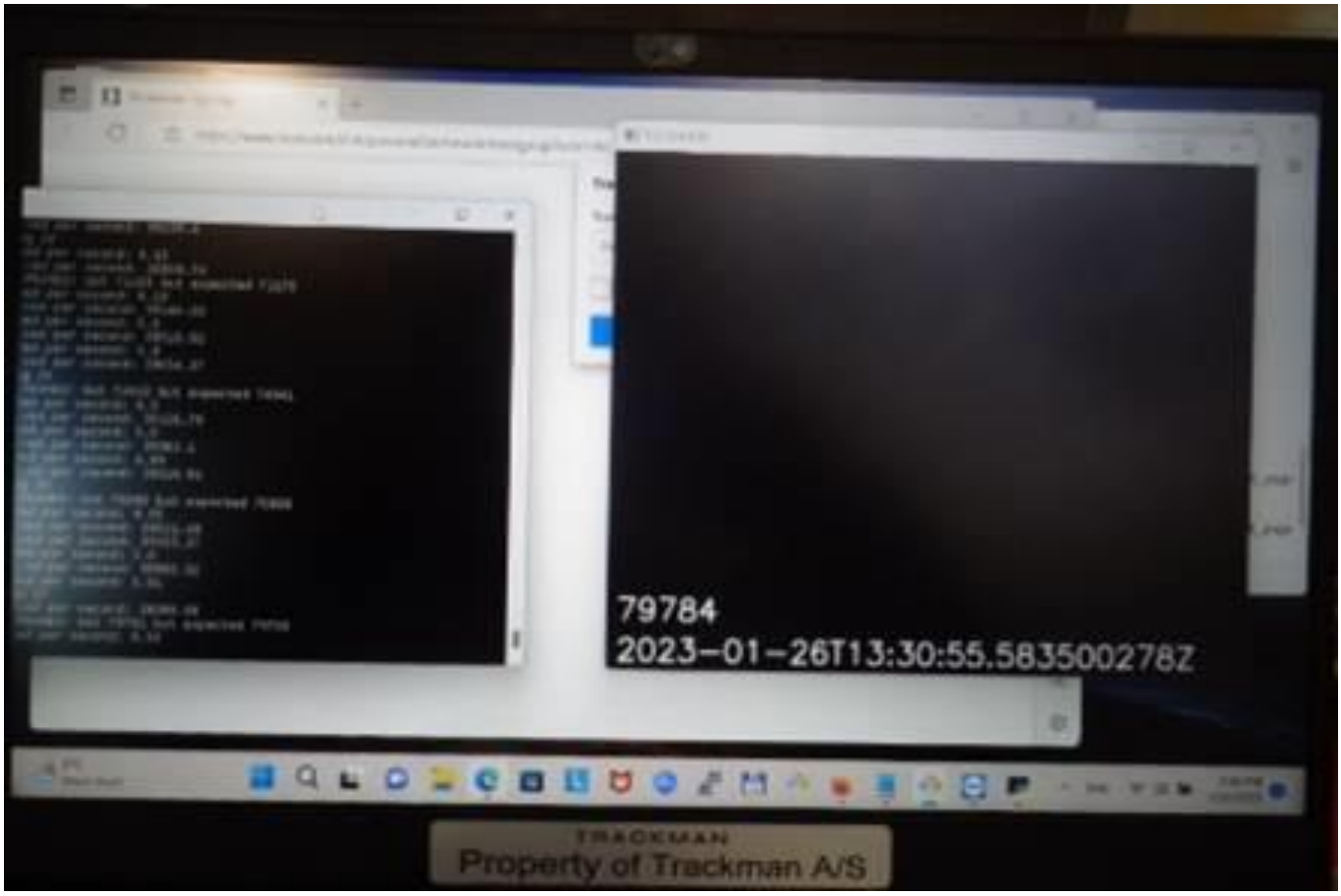
Applicant IC company number	10140A
IC UPN number	-TMB0201
All used IC test site(s) Reg. number	9109A
RSS number and Issue number	RSS-210 Issue 10 December 2019, Amendment (April 2020)
Frequency band	24.075 - 24.175 GHz
Frequency Min (MHz)	24082 (Ch. 2)
Frequency Max (MHz)	24161 (Ch. 1)
RF power Min (W), Conducted	0.00061
RF power Max (W), Conducted	0.00061
Field strength, dBµV/m @3 m	104.13 (Ch. 2)
Field strength, dBµV/m @3 m	103.85 (Ch. 1)
Measured BW (kHz) (99% dB)	79000
Calculated BW (kHz), as per TRC-43	N/A
Emission classification	79M0N0N
Transmitter spurious, dBµV/m @3 m	84.21
Power requirements	24 Vdc, 5A (AC/DC adapter)
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

Equipment under test is a radar for use during indoor golf training. The equipment under test is an Infrared LED transmitter for Golf radar application.
The EUT send 100 ms infrared (860 nm) pulse lighting data every second.
It is powered by AC/DC power supply.

3.5 EUT exercise details

The radar signal was executed through a telnet terminal using the commands provided by client and the IP address of the device.
An adapter was used for connecting the power port

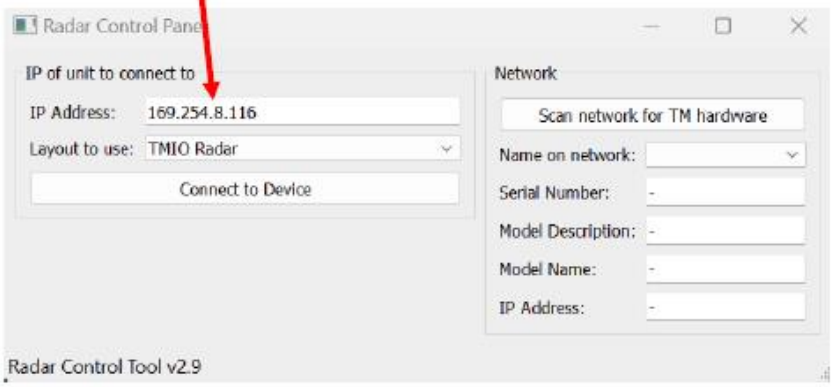


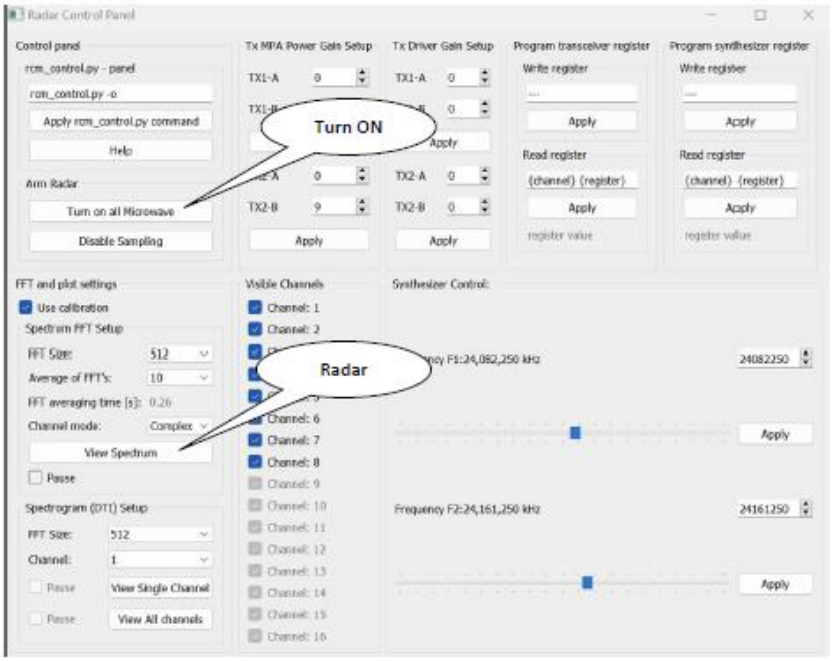
start radar_control_tool.exe

To change RADAR channel **start radar_control_tool.exe** from decktop.

Enter ip adress: 169.254.8.116 into the tool,

select Platform Radar layout, and push Connect to Device.





3.6 EUT setup diagram

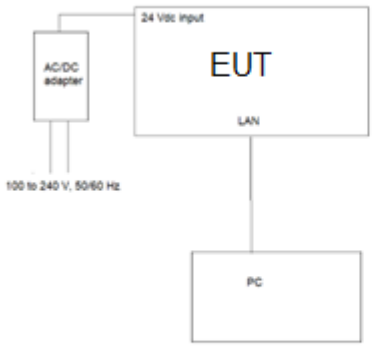


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
Laptop	Dell	Latitude	N/A

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	18–33 °C
Relative humidity	25–70 %
Air pressure	860–1060 hPa

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.
The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model	Serial N°
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703
Barometer	Castle	GPB 3300	072015

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, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002. The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	0.009 MHz ÷ 30 MHz	1.1 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
		Conducted spurious emissions	0.009 MHz ÷ 18 GHz	3.0 dB	(1)
			18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
	Radiated	Radiated spurious emissions	0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)

NOTES:
(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Semi-anechoic chamber	Nemko S.p.a.	10m semi-anechoic chamber	530	2021-09	2023-09
EMI Receiver	Rohde & Schwarz	ESW44	101620	2022-08	2023-08
EMI Receiver	Rohde & Schwarz	ESU8	100202	2022-09	2023-09
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767	2023-01	2024-01
Antenna Trilog 25MHz - 8GHz	Schwarzbeck Mess-Elektronik	VULB9162	9162-025	2021-07	2024-07
Antenna Trilog 25-2000 MHz	Schwarzbeck Mess-Elektronik	VULB9168	9168-242	2021-06	2024-06
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STLP 9148-152	2021-09	2024-09
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STPL 9148-123	2021-06	2024-06
Antenna loop	Rohde & Schwarz	HFH2-Z2	831 247/011	2020-12	2023-12
Antenna Loop Attiva+Power Inseter	Teseq	HLA6121+PI6121	45749	2020-07	2023-07
Broadband Amplifier	Schwarzbeck Mess-Elektronik	BBV9718C	00121	2022-03	2023-03
Preamplifier	Schwarzbeck Mess-Elektronik	BBV9718	BBV9718-137	2022-04	2023-04
RF Power Sensor	Rohde & Schwarz	NRP18AN	100990	2023-02	2024-02
RF Power Sensor	Rohde & Schwarz	NRP18AN	100987	2022-10	2023-10
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254	2022-05	2023-05
RF Signal Generator	Rohde & Schwarz	SMB100A	180431	2022-10	2023-10
RF Signal Generator	Rohde & Schwarz	SMA100B	104075	2022-08	2023-08
Barometer	Castle	GBP 3300	072015	2022-04	2023-04
Data logger con diagnosi in campo	Testo	175-H2	20012380/305	2022-12	2024-12
Data logger con diagnosi in campo	Testo	175-H2	38203337/703	2022-12	2024-12
3m Semi anechoic chamber	Comtest	SAC-3	1711-150	2022-09	2024-09
Pyramidal Horn Antenna 60-90 GHz	Sage	SAR-2013-121F-E2	17383.01	2021-07	2024-07
Pyramidal Horn Antenna 40-60 GHz	Sage	SAR-2507-19VF-R2	15715-01	2021-06	2024-06
Pyramidal Horn Antenna 140-220 GHz	Sage	SAZ-2410-05-S1	18490-01	Not Subject to Cal	
Pyramidal Horn Antenna 90-140 GHz	Sage	SAZ-2410-08-S1	17383.01	Not Subject to Cal	
Broadband Bench Top Amplifier	Sage	STB-1834034030-KFKF-L1	18490-01	2022-05	2023-05
Harmonic Mixer	Radiometer Physics	FS-Z140	101138	2019-04	2024-04
Harmonic Mixer	Radiometer Physics	FS-Z220	101034	2019-11	2024-11
Harmonic Mixer	Radiometer Physics	FS-Z60	100988	2021-01	2024-01
Harmonic Mixer	Radiometer Physics	FS-Z90	101670	2021-01	2024-01

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 2.1049: Fundamental Emission Bandwidth 10 dB bandwidth and 99%

8.1.1 Definitions and limits

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth. When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

8.1.2 Test summary

Test date	January 25, 2023	Temperature	19 °C
Test engineer	Daniele Guarnone	Air pressure	1004 mbar
Verdict	Pass	Relative humidity	69 %

8.1.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth	1 MHz & 3 MHz
Video bandwidth	≥ 3 MHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	100 ms

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Horn Antenna	RFSpin	DRH40	061106A40	3 Years	2023-04
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767	1 Year	2024-01

Notes: None

8.1.4 Test data

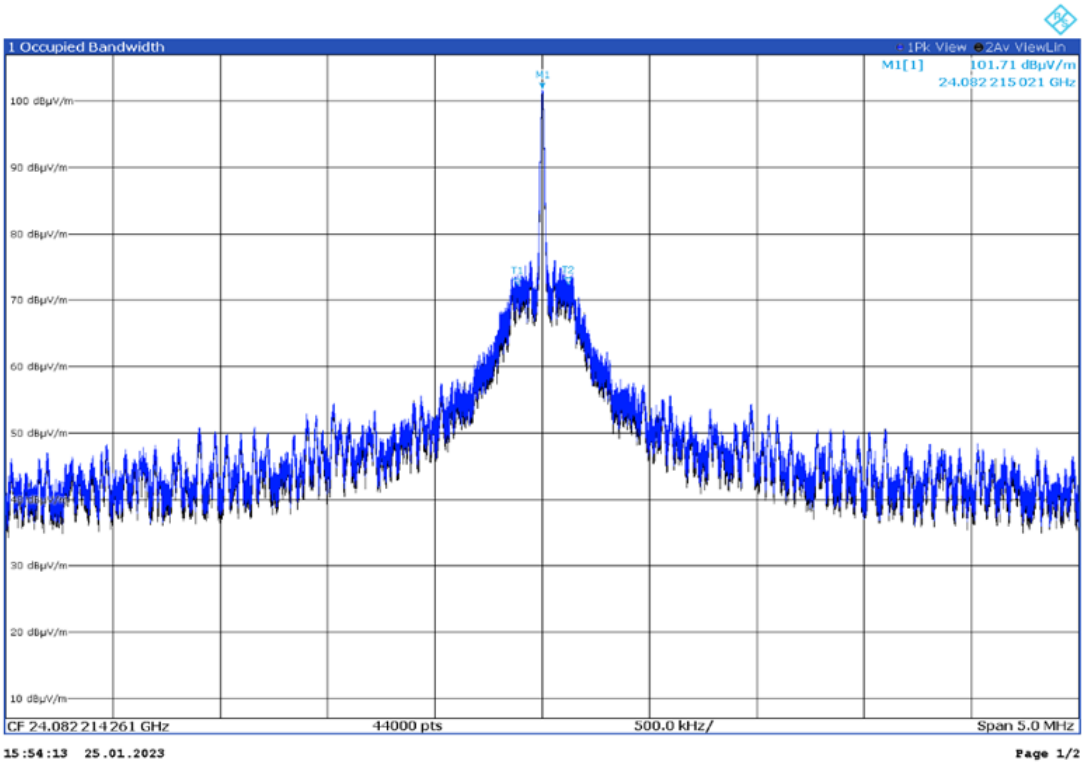
Lowest frequency band permitted	24.00 GHz
Highest frequency band permitted	24.25 GHz
10 dB BW (MHz) measured	0.01916 MHz
Lowest frequency band measured	24.082205 GHz
Highest frequency band measured	24.082224 GHz
Margin from the lowest frequency limit permitted (24 GHz)	82.205 MHz
Margin from the lowest frequency limit permitted (24.25 GHz)	167.68 MHz
Margin from the OBW limit permitted (250 MHz)	249.9804 MHz
Result (Fundamental within the permitted frequency range)	Pass

Table 8.1-1: Occupied bandwidth results (10 dB) low frequency

Lowest frequency band permitted	24.00 GHz
Highest frequency band permitted	24.25 GHz
10 dB BW (MHz) measured	0.01909 MHz
Lowest frequency band measured	24.161204 GHz
Highest frequency band measured	24.161224 GHz
Margin from the lowest frequency limit permitted (24 GHz)	161.204MHz
Margin from the lowest frequency limit permitted (24.25 GHz)	88.78 MHz
Margin from the OBW limit permitted (250 MHz)	249.981 MHz
Result (Fundamental within the permitted frequency range)	Pass

Table 8.1-2: Occupied bandwidth results (10 dB) high frequency

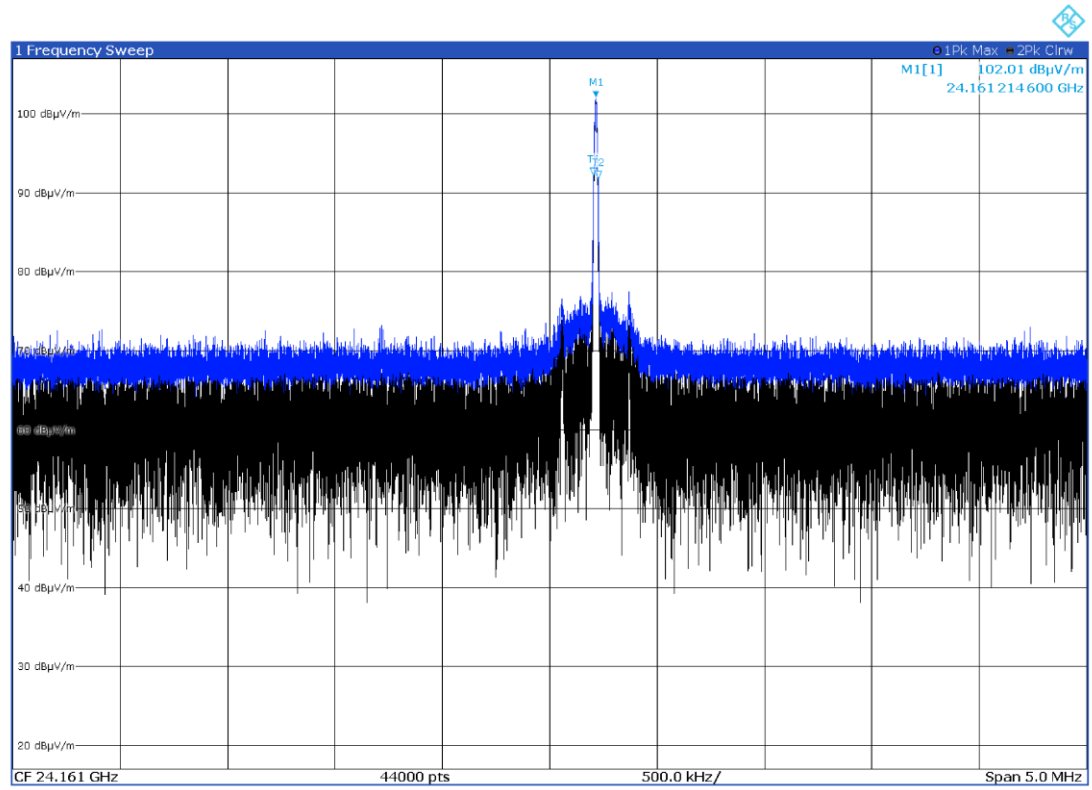
8.1.4 Test data, continued



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**24.082 214 239 GHz**	**101.39 dBµV/m**	ndB	10.0 dB
T1		1	24.082 205 227 GHz	91.61 dBµV/m	ndB down BW	**19.16 kHz**
T2		1	24.082 224 386 GHz	91.35 dBµV/m	Q Factor	1.3e+6

Figure 8.1-1: *Occupied bandwidth results (10 dB) low frequency plot*



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**24.161 214 6 GHz**	**102.01 dBµV/m**	ndB	10.0 dB
T1		1	24.161 20494 GHz	92.24 dBµV/m	ndB down BW	**19.09 kHz**
T2		1	24.161 22403 GHz	91.84 dBµV/m	Q Factor	1.3e+6

Figure 8.1-2: Occupied bandwidth results (10 dB) high frequency plot

8.2 RSS-Gen 6.7 Occupied bandwidth

8.2.1 Definitions and limits

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth.

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

8.2.2 Test summary

Test date	January 25, 2023	Temperature	19 °C
Test engineer	Daniele Guarnone	Air pressure	1004 mbar
Verdict	Pass	Relative humidity	69 %

8.2.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth	1 MHz & 3 MHz
Video bandwidth	≥ 3 MHz
Detector mode	Peak
Trace mode	Max Hold
Measurement time	100 ms

8.2.4 Test data

Lowest frequency band permitted	24.00 GHz
Highest frequency band permitted	24.25 GHz
99% BW (MHz) measured	0.238544 MHz
Lowest frequency band measured	24.082095 GHz
Highest frequency band measured	24.082334 GHz
Margin from the lowest frequency limit permitted (24 GHz)	82.095 MHz
Margin from the lowest frequency limit permitted (24.25 GHz)	167.68 MHz
Margin from the OBW limit permitted (250 MHz)	249.76 MHz
Result (Fundamental within the permitted frequency range)	Pass

Table 8.2-1: Occupied bandwidth results (99%) low frequency

Lowest frequency band permitted	24.00 GHz
Highest frequency band permitted	24.25 GHz
99% BW (MHz) measured	0.2981715 MHz
Lowest frequency band measured	24.161025 GHz
Highest frequency band measured	24.161363 GHz
Margin from the lowest frequency limit permitted (24 GHz)	161.025 MHz
Margin from the lowest frequency limit permitted (24.25 GHz)	88.67 MHz
Margin from the OBW limit permitted (250 MHz)	249.76 MHz
Result (Fundamental within the permitted frequency range)	Pass

Table 8.2-2: Occupied bandwidth results (99%) high frequency

8.2.4 Test data, continued

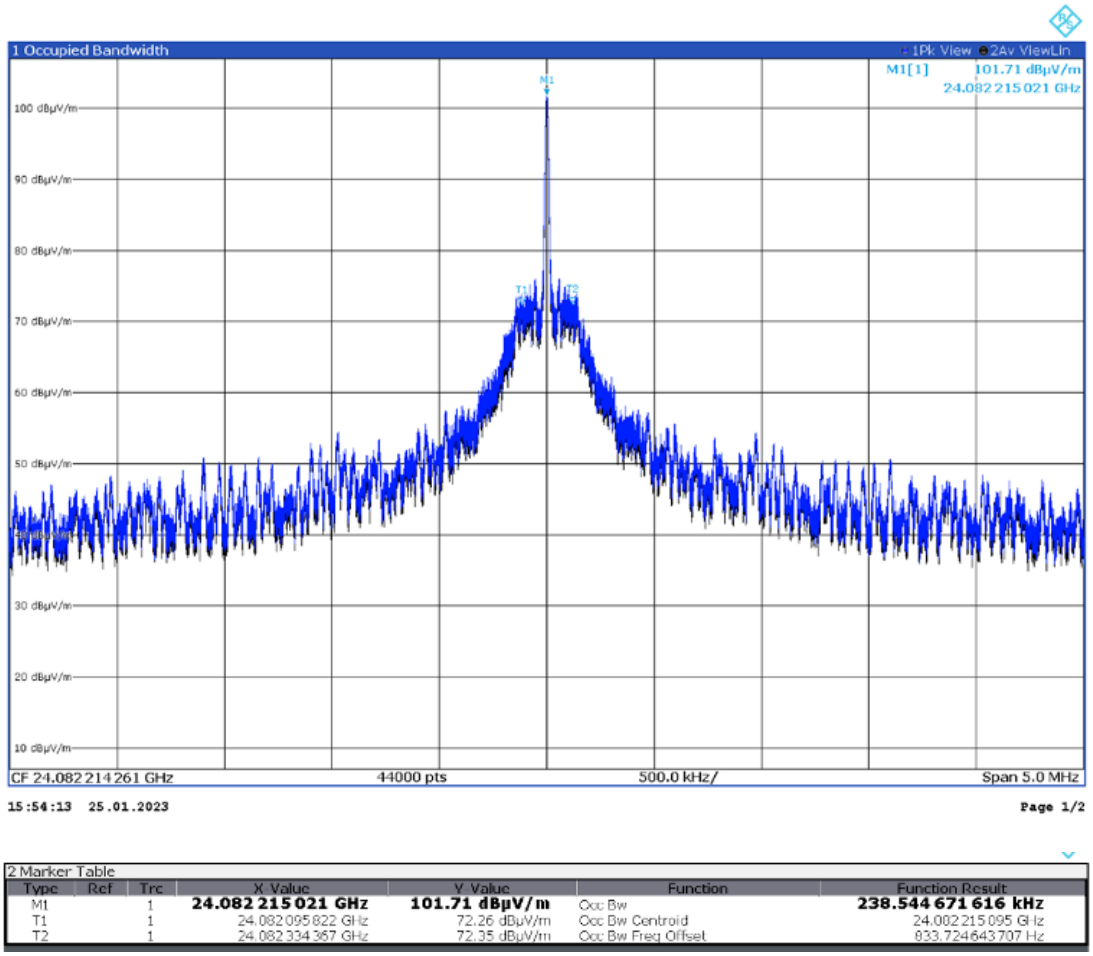
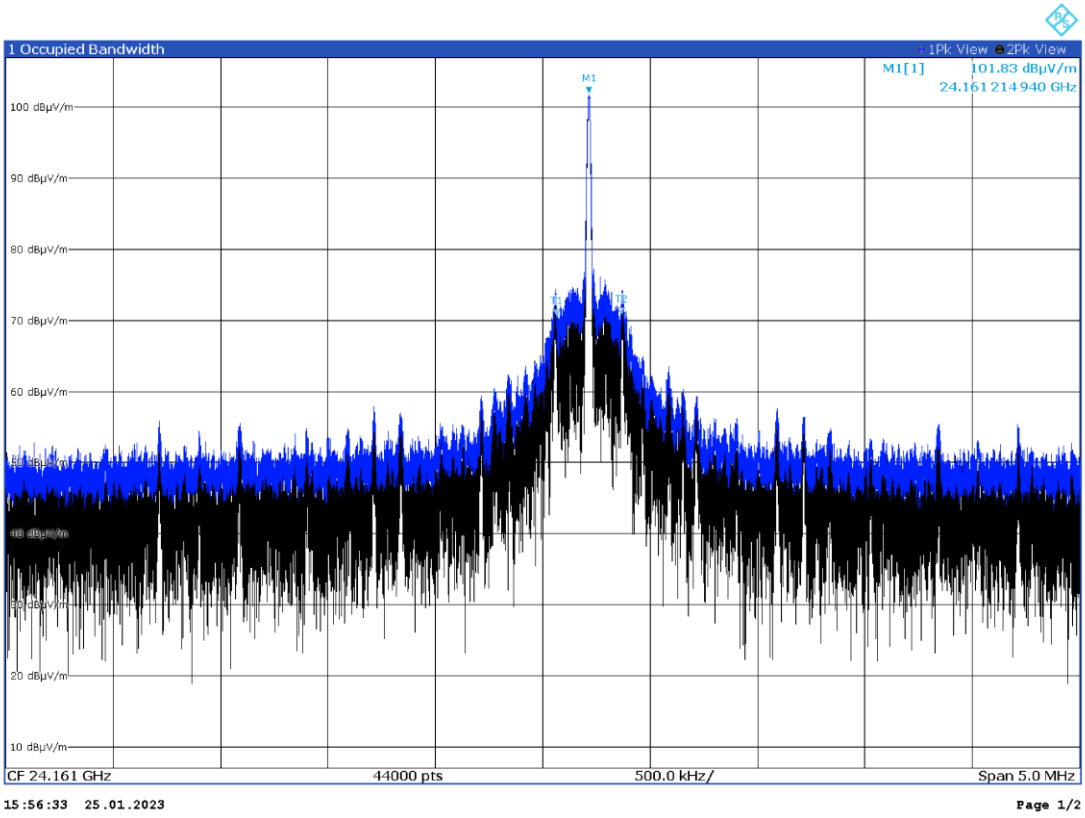


***Figure 8.2-1:** Occupied bandwidth results (99%) low frequency plot*



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**24.161 214 94 GHz**	**101.83 dBµV/m**	Occ Bw	**298.171 488 777 kHz**
T1		1	24.161 065 265 GHz	70.55 dBµV/m	Occ Bw Centroid	24.161 214 351 GHz
T2		1	24.161 363 437 GHz	70.84 dBµV/m	Occ Bw Freq Offset	214.351 120 937 kHz

Figure 8.2-2: *Occupied bandwidth results (99%) high frequency plot*

8.3 FCC 15.245 and RSS-210, Annex F1: Operation within the bands 902-928 MHz, 2435-2465 MHz, 5785-5815 MHz, 10500-10550 MHz, and 24075-24175 MHz.

8.3.1 Definitions and limits

FCC:

(a) Operation under the provisions of this section is limited to intentional radiators used as field disturbance sensors, excluding perimeter protection systems.

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902–928	500	1.6
2435–2465	500	1.6
5785–5815	500	1.6
10500–10550	2500	25.0
24075–24175	2500	25.0

IC:

F.1 Field disturbance sensors

This section sets out the requirements for field disturbance sensors operating in the frequency bands shown in table F1.

Perimeter protection systems, which employ a leaky transmission line as the radiating source, are excluded from the requirements of this annex.

Devices shall comply with the following requirements:

a. The average field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits shown in table F1.

Fundamental frequency (MHz)	Field strength (mV/m)	
	Fundamental emissions	Harmonic emissions
902–928	500	1.6
2435–2465	500	1.6
5785–5815	500	1.6
10500–10550	2500	25.0
24075–24175	2500	25.0

b. Additionally, harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are below 17.7 GHz shall meet the general field strength limits specified in RSS-Gen, regardless of the limits given in table F1.

c. Harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are at or above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 m:

i. 25 mV/m for the second and third harmonic emissions of field disturbance sensors operating in the band 24075-24175 MHz and for devices designed for use only within buildings or for intermittent use, such as to open building doors

ii. 7.5 mV/m for all other devices

d. Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation, unless their emissions in the restricted frequency bands as listed in RSS-Gen, other than the second and third harmonic emissions from devices operating in the band 24075-24175 MHz, comply with the general field strength limits specified in RSS-Gen.

Continuous operation of field disturbance sensors designed to be used in farm equipment (i.e. forklifts that are intended primarily for use indoors or for very specialized operations), or railroad locomotives, railroad cars, and other equipment that travel on fixed tracks, is permitted. A field disturbance sensor is considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g. putting a vehicle into reverse gear, activating a turn signal).

e. Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified in RSS-Gen, whichever is less stringent.

8.3.2 Test summary

Test date	January 23, 2023	Temperature	19 °C

Test engineer	Daniele Guarnone	Air pressure	1004 mbar
Verdict	Pass	Relative humidity	69 %
Test location	3 m semi anechoic chamber		

8.3.3 Observations, settings and special notes

Combined output power was calculated as follows:
According to ANSI C63.10-2013: EIRP [dBm] = E_{meas} [dBµV/m] + 20*Log(d_{meas} [m]) - 104.7)
CH1
Measured radiated FS = 103.85 dBµV/m → EIRP = 8.69 dBm → 7.40 mW
CH2
Measured radiated FS = 104.13 dBµV/m → EIRP = 8.97 dBm → 7.89 mW

Sum EIRP = CH1 + CH2 = 7.40 + 7.89 = 15.29 mW → 11.84 dBm

Max gain, declared by the manufacturer is 14 dBi.

Measured conducted output power = 11.84 dBm – 14 dBi = -2.16 dBm → 0.61 mW

This is a radiated test measurement and it was done at 3 meters of distance (far field). The worst case was considered for all the measurements (the maximum radiation of the antenna).
The field strength limits in paragraphs (a) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation, so, two measurements shall be done:
1) Measurement with peak detector
2) Measurement with average detector.

It is important to mention the peak value is 20 dB above the average value, so, the specific limit for the operation frequency of this product is:

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength of fundamental (dBµV/m) @ 3m - RMS	Field strength of fundamental (dBµV/m) @ 3m - Peak
24075–24175	2500	127.96	147.96

8.3.4 Setup details

EUT setup configuration	Table top
Test facility	3 m Semi anechoic chamber
Measuring distance	3 m
Antenna height variation	1.60 m (worst case)
Turn table position	0° (worst case)
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.

Spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Detector mode	RMS (Average power); Peak (Maximum power)
Trace mode	Max Hold
Measurement time	100 ms

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Horn Antenna	RFSpin	DRH40	061106A40	3 Years	2023-04
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767	1 Year	2024-01

Notes: None

Table 8.3-1: *Fundamental Emissions for FMCW transmitters equipment list*

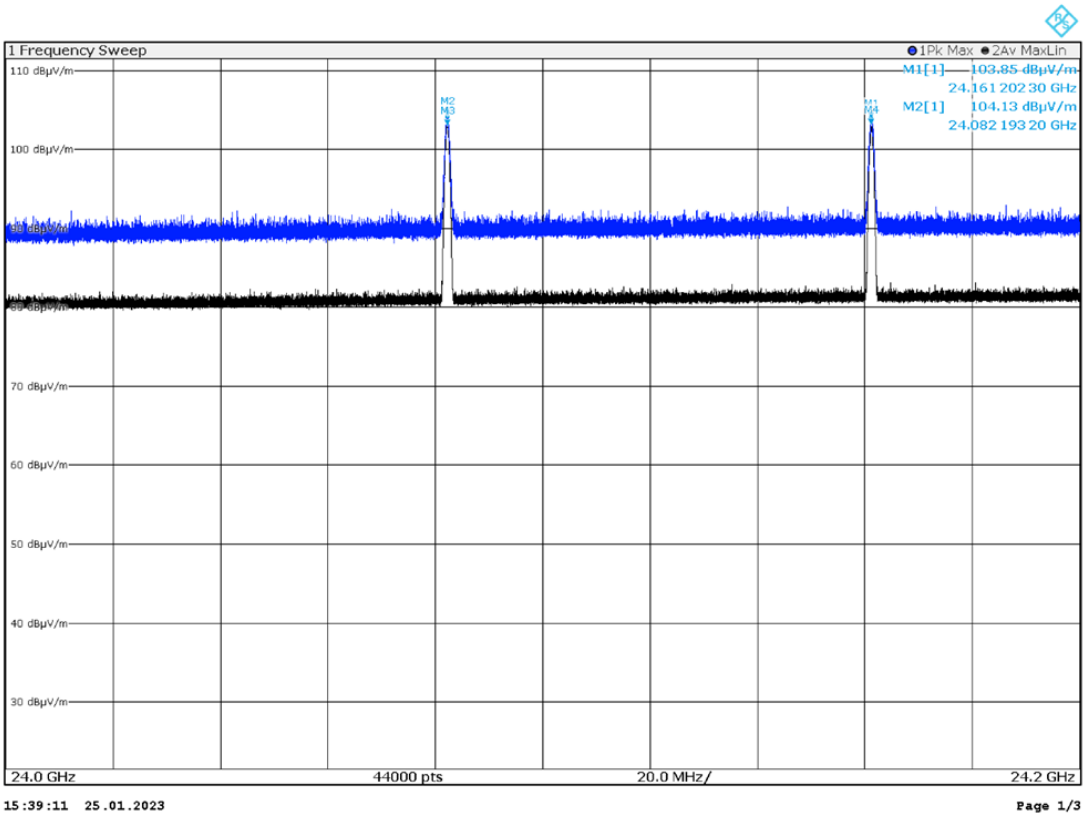
8.3.5 Test data

Frequency (MHz)	Measured Field strength (dBµV/m)	Limit EIRP (dBµV/m)	Margin (dB)
24.0822	104.13	147.96	-43.83
24.1612	103.85	147.96	-44.11

Table 8.3-1: Maximum peak power test results.

Frequency (MHz)	Measured Field strength (dBµV/m)	Limit EIRP (dBµV/m)	Margin (dB)
24.0822	102.87	127.96	-25.09
24.1612	102.97	127.96	-24.99

Table 8.3-2: Maximum RMS power test results.



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	24.161 202 3 GHz	103.85 dBµV/m		
M2		1	24.082 193 2 GHz	104.13 dBµV/m		
M3		2	24.082 206 8 GHz	102.87 dBµV/m		
M4		2	24.161 193 2 GHz	102.97 dBµV/m		

Figure 8.3-1: Maximum peak power and RMS plot (24.00– 24.250 GHZ)

8.4 FCC 15.245 and RSS-210, Annex F1: Harmonic emissions

8.4.1 Definitions and limits

FCC:

(b) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902–928	500	1.6
2435–2465	500	1.6
5785–5815	500	1.6
10500–10550	2500	25.0
24075–24175	2500	25.0

(1) Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in § 15.205, shall not exceed the field strength limits shown in § 15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For the second and third harmonics of field disturbance sensors operating in the 24075–24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075–24175 MHz band, fully comply with the limits given in § 15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

(2) Field strength limits are specified at a distance of 3 meters.

(3) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(4) The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in § 15.35 for limiting peak emissions apply.

IC:

F.1 Field disturbance sensors

This section sets out the requirements for field disturbance sensors operating in the frequency bands shown in table F1.

Perimeter protection systems, which employ a leaky transmission line as the radiating source, are excluded from the requirements of this annex.

Devices shall comply with the following requirements:

a. The average field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits shown in table F1.

Fundamental frequency (MHz)	Field strength (mV/m)	
	Fundamental emissions	Harmonic emissions
902–928	500	1.6
2435–2465	500	1.6
5785–5815	500	1.6
10500–10550	2500	25.0
24075–24175	2500	25.0

b. Additionally, harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are below 17.7 GHz shall meet the general field strength limits specified in RSS-Gen, regardless of the limits given in table F1.

c. Harmonic emissions falling into restricted frequency bands listed in RSS-Gen and that are at or above 17.7 GHz shall not exceed the following field strength limits measured at a distance of 3 m:

i. 25 mV/m for the second and third harmonic emissions of field disturbance sensors operating in the band 24075-24175 MHz and for devices designed for use only within buildings or for intermittent use, such as to open building doors

ii. 7.5 mV/m for all other devices

d. Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation, unless their emissions in the restricted frequency bands as listed in RSS-Gen, other than the second and third harmonic emissions from devices operating in the band 24075-24175 MHz, comply with the general field strength limits specified in RSS-Gen.
Continuous operation of field disturbance sensors designed to be used in farm equipment (i.e. forklifts that are intended primarily for use indoors or for very specialized operations), or railroad locomotives, railroad cars, and other equipment that travel on fixed tracks, is permitted.
A field disturbance sensor is considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g. putting a vehicle into reverse gear, activating a turn signal).

e. Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits specified in RSS-Gen, whichever is less stringent.

Table 8.4-1: FCC §15.209 and RSS-Gen – Radiated emission limits

Frequency, MHz	Field strength of emissions µV/m	Field strength of emissions dBµV/m	Measurement distance, m
0.009–0.490	2400/F *(F in kHz)*	$67.6 - 20 \times \log_{10}$(F) *(F in kHz)*	300
0.490–1.705	24000/F *(F in kHz)*	$87.6 - 20 \times \log_{10}$(F) *(F in kHz)*	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

8.4.1 Definitions and limits, continued

Table 8.4-2: IC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677-5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

Note: Certain frequency bands listed in Table 8.4-2 and above 38.6 GHz are designated for low-power license-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.4-3: FCC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.4.2 Test summary

Test date:	January 25, 2023	Temperature:	20 °C
Test engineer:	Daniele Guarnone	Air pressure:	1008 mbar
Test location:	3m semi anechoic chamber	Relative humidity:	52 %
Verdict:	Pass		

Notes:

According to paragraph (d) of this section, the limits for the spurious emissions (except harmonics for USA) are defined by the next rule:

Emissions radiated outside of the specified frequency bands, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Frequency (MHz)	Field Strength (dBµV/m)	Measurement distance (meters)
30–88	40	3
88 - 216	43.52	3
216 – 960	46.02	3
Above 960	53.97	3

FCC 15.209 Limits

Based on this affirmation to this case, the limits were chosen as follow (see section 7.1.6 for maximum EIRP details):

Maximum EIRP	Limit: Maximum EIRP – 50 dB
104.13 dBµV/m	54.13 dBµV/m

Following the previous rule, the limit level above 1 GHz in average detector is 54.0 dBµv/m which was chosen to be the lesser attenuation. Below 1 GHz the corresponding FCC 15.209 limit shall be applied too using a Quasi-peak detector. The distance is all the cases is 3 m unless otherwise specified.

For frequencies above 1000 MHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

8.4.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 220 GHz.
EUT was set to transmit with 100 % duty cycle.

EUT setup configuration	Table top
Test facility	3m Semi Anechoic Chamber (SAC)
Measuring distance	3 m (Up 40 GHz) 1 m (up 60 GHz) 0.30 m (Up 140 GHz) 0.10 m (Up 220 GHz)
Antenna height variation	1–4 m (Up 40 GHz) 1.70 m (Up 220 GHz)
Turn table position	0–360° (Up 40 GHz) 0° (Up 220 GHz)
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/spectrum analyzer settings for frequencies below 1 GHz:

Resolution bandwidth:	120 kHz
Video bandwidth:	300 kHz
Detector mode:	– Peak (Preview measurement) – Quasi-peak (Final measurement)
Trace mode:	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 1000 ms (Quasi-peak final measurement)

Receiver/spectrum analyzer settings for frequencies above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	– Peak (Preview measurement) – Peak and CAverage (Final measurement)
Trace mode:	Max Hold
Measurement time	– 100 ms (Peak preview measurement) – 100 ms (Peak and CAverage final measurement)

8.4.4 Test data

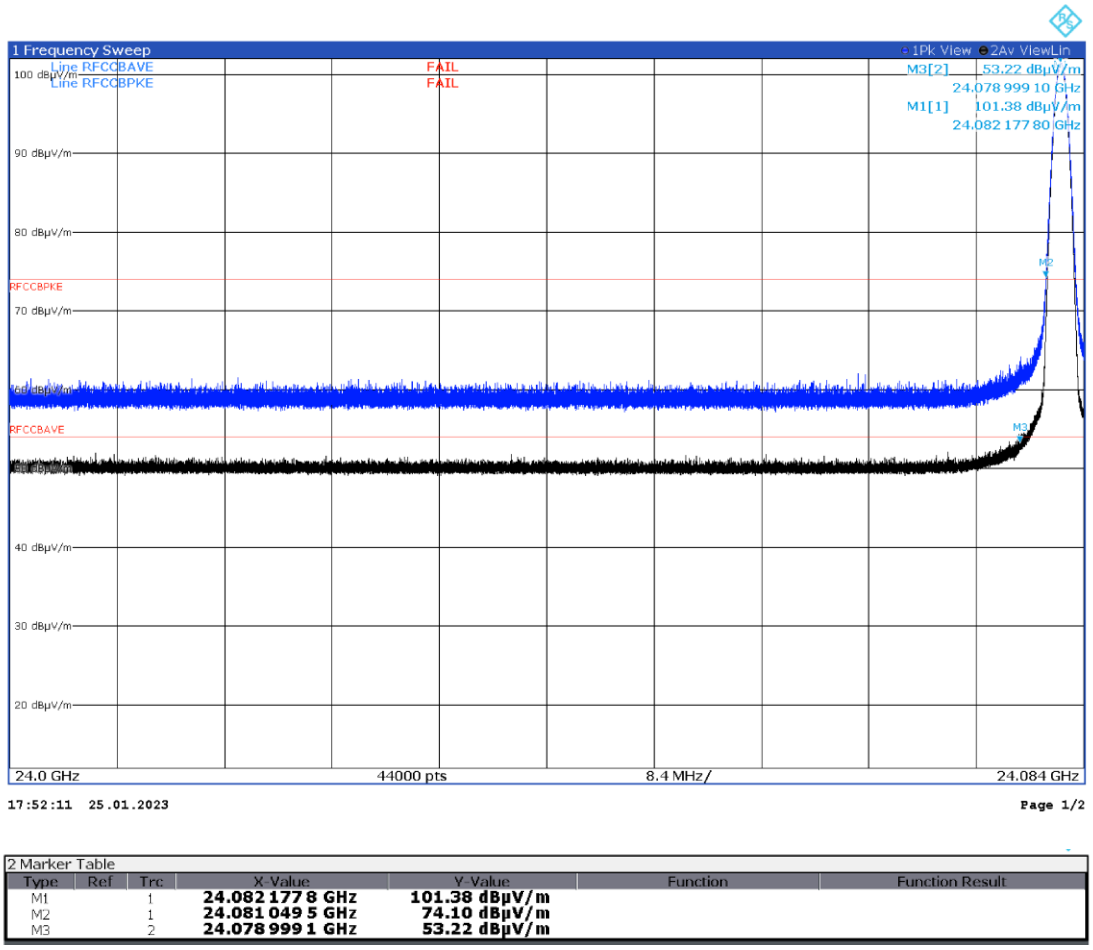


Figure 8.4-1: Band Edges plot – Low edge

Notes: [1] Field strength (dB V/m) = receiver/spectrum analyzer value (dB V) + correction factor (dB)
Correction factors = antenna factor ACF (dB) + cable loss (dB)

The maximum measured value observed over a period of 15 seconds was recorded.

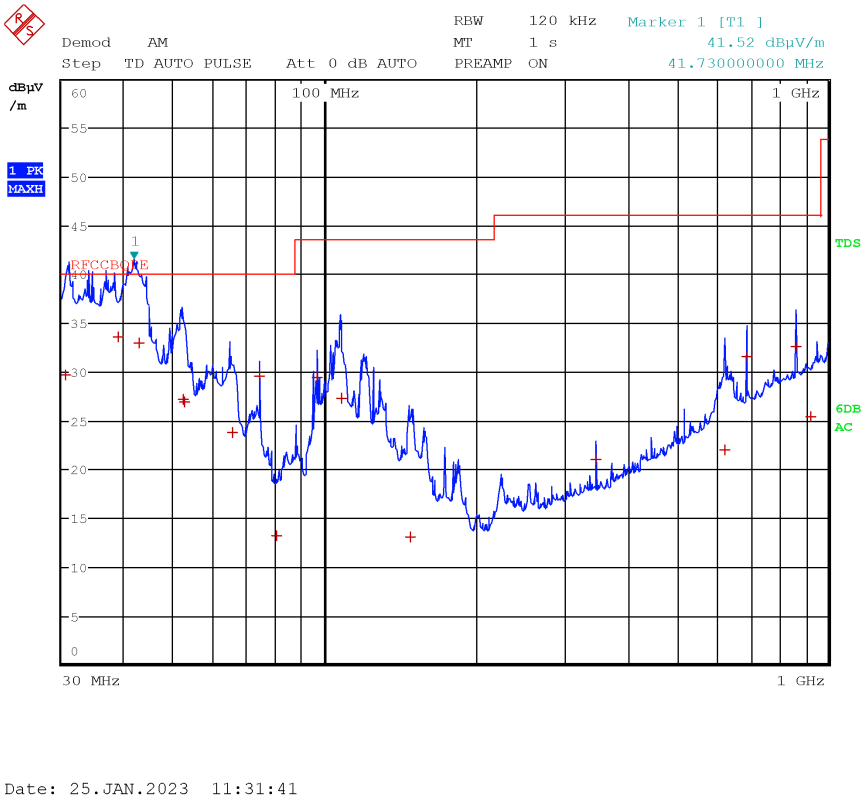


Figure 8.4-2: *Radiated emissions plot – Field strength measured from 30 to 1000 MHZ, vertical*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.5400	29.8	40.0	-10.2	QP
38.7900	33.7	40.0	-6.3	QP
42.6900	33.0	40.0	-7.0	QP
52.3500	27.2	40.0	-12.8	QP
52.6200	27.0	40.0	-13.0	QP
65.6100	23.7	40.0	-16.3	QP
74.2500	29.7	40.0	-10.3	QP
80.1600	13.2	40.0	-26.8	QP
96.5400	29.5	43.5	-14.0	QP
107.8800	27.4	43.5	-16.1	QP
147.8100	13.1	43.5	-30.4	QP
345.6000	21.1	46.0	-24.9	QP
625.0200	22.1	46.0	-23.9	QP
691.2000	31.6	46.0	-14.4	QP
864.0000	32.7	46.0	-13.3	QP
927.8400	25.4	46.0	-20.6	QP

Table 8.4-2: *Radiated emissions results – Field strength measured from 30 to 1000 MHZ, vertical*

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] The maximum measured value observed over a period of 15 seconds was recorded.
[4] The spectral plot is a summation of a vertical and horizontal scan.

Important note: The lowest frequency response in the plot it is produced by the PoE which feed the EUT. Several ferrites were added for decreasing the exceeded signal above the limit. However, once the lowest frequency passed the limit, the working on the PoE with ferrites was stopped, because the PoE response, it is not part of this test.

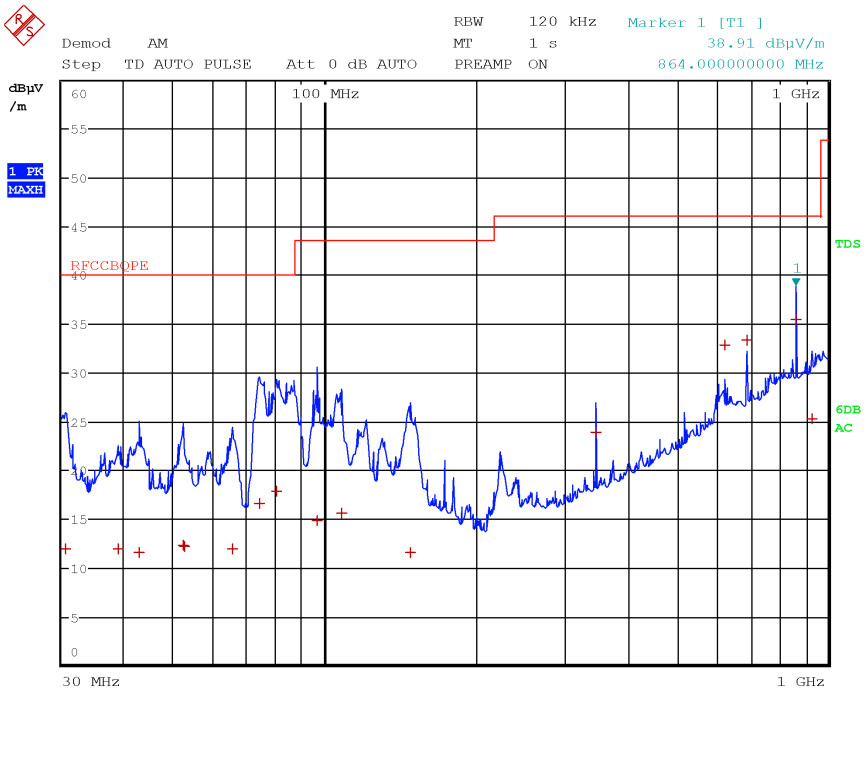


Figure 8.4-3: *Radiated emissions plot – Field strength measured from 30 to 1000 MHZ., horizontal*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.5400	12.0	40.0	-28.0	QP
38.7900	12.0	40.0	-28.0	QP
42.6900	11.6	40.0	-28.4	QP
52.3500	12.4	40.0	-27.6	QP
52.6200	12.2	40.0	-27.8	QP
65.6100	11.9	40.0	-28.1	QP
74.2500	16.6	40.0	-23.4	QP
80.1600	17.8	40.0	-22.2	QP
96.5400	14.9	43.5	-28.6	QP
107.8800	15.6	43.5	-27.9	QP
147.8100	11.6	43.5	-31.9	QP
345.6000	23.9	46.0	-22.1	QP
625.0200	32.9	46.0	-13.1	QP
691.2000	33.4	46.0	-12.6	QP
864.0000	35.5	46.0	-10.5	QP
927.8400	25.3	46.0	-20.7	QP

Table 8.4-3: *Radiated emissions results – Field strength measured from 30 to 1000 MHZ., horizontal*

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] The maximum measured value observed over a period of 15 seconds was recorded.
[4] The spectral plot is a summation of a vertical and horizontal scan.

Important note: The lowest frequency response in the plot it is produced by the PoE which feed the EUT. Several ferrites were added for decreasing the exceeded signal above the limit. However, once the lowest frequency passed the limit, the working on the PoE with ferrites was stopped, because the PoE response, it is not part of this test.

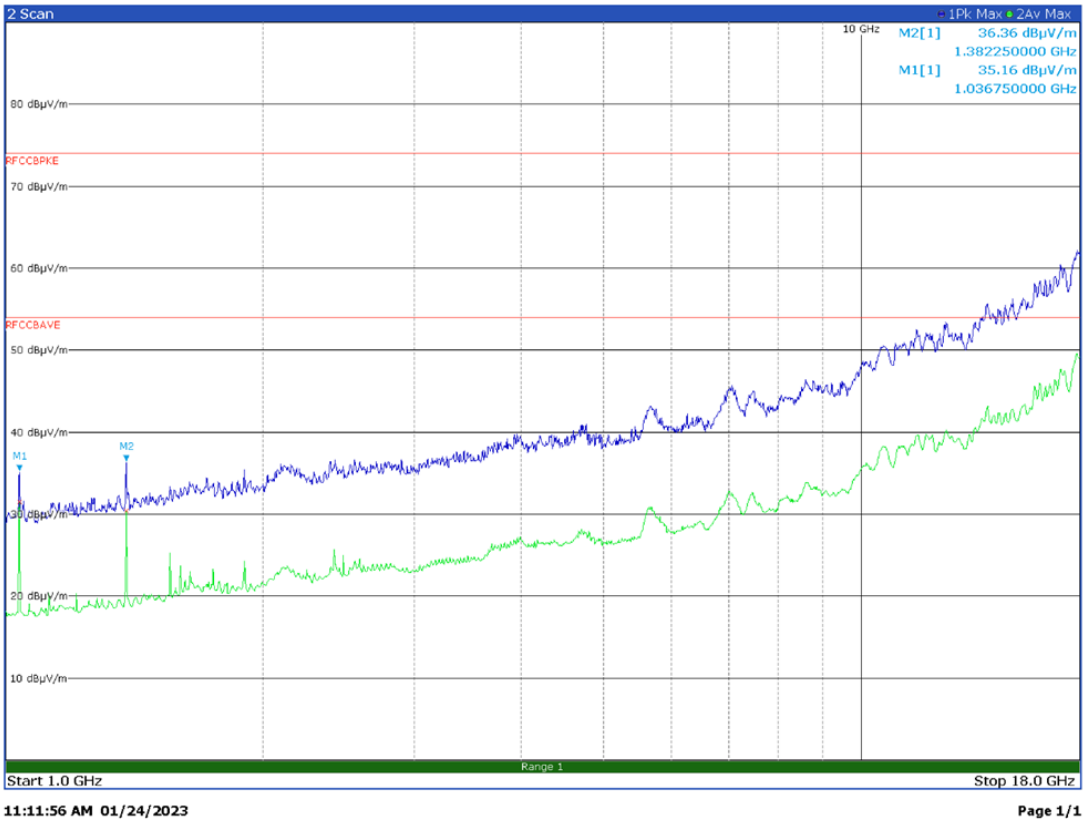


Figure 8.4-4: *Radiated emissions plot – Field strength measured from 1 to 18 GHZ., horizontal*

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] The maximum measured value observed over a period of 15 seconds was recorded.
[4] The spectral plot is a summation of a vertical and horizontal scan.

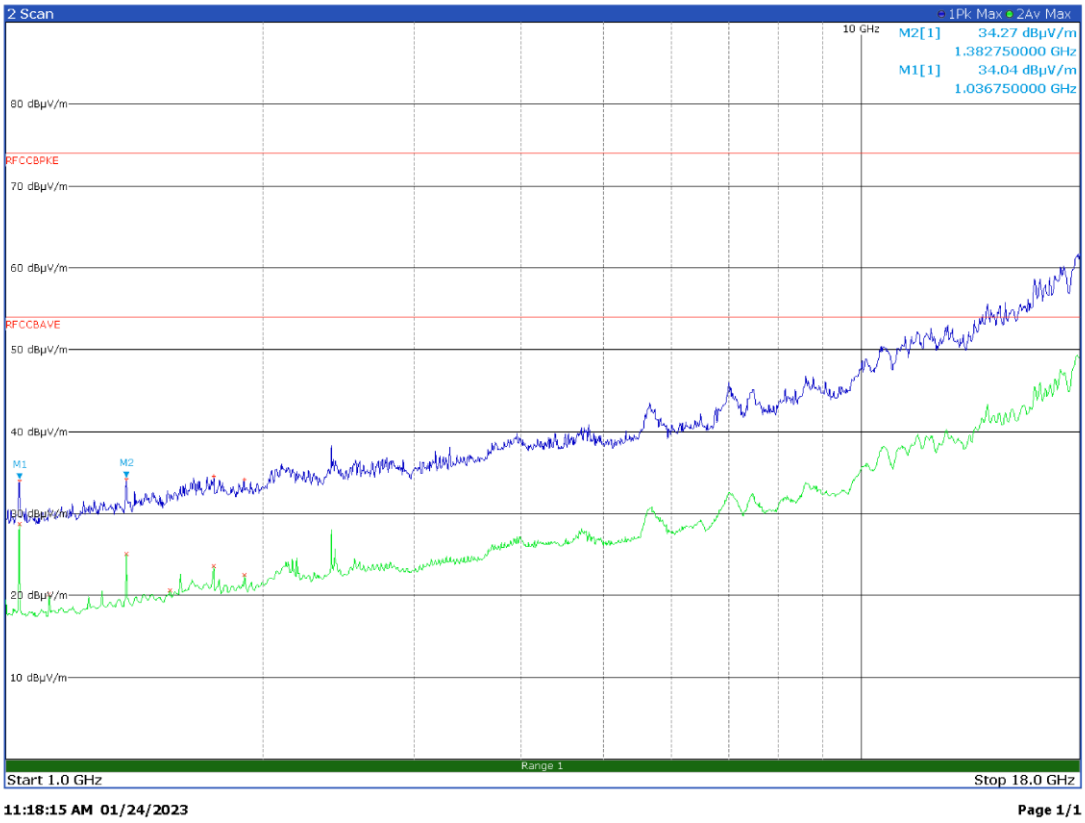
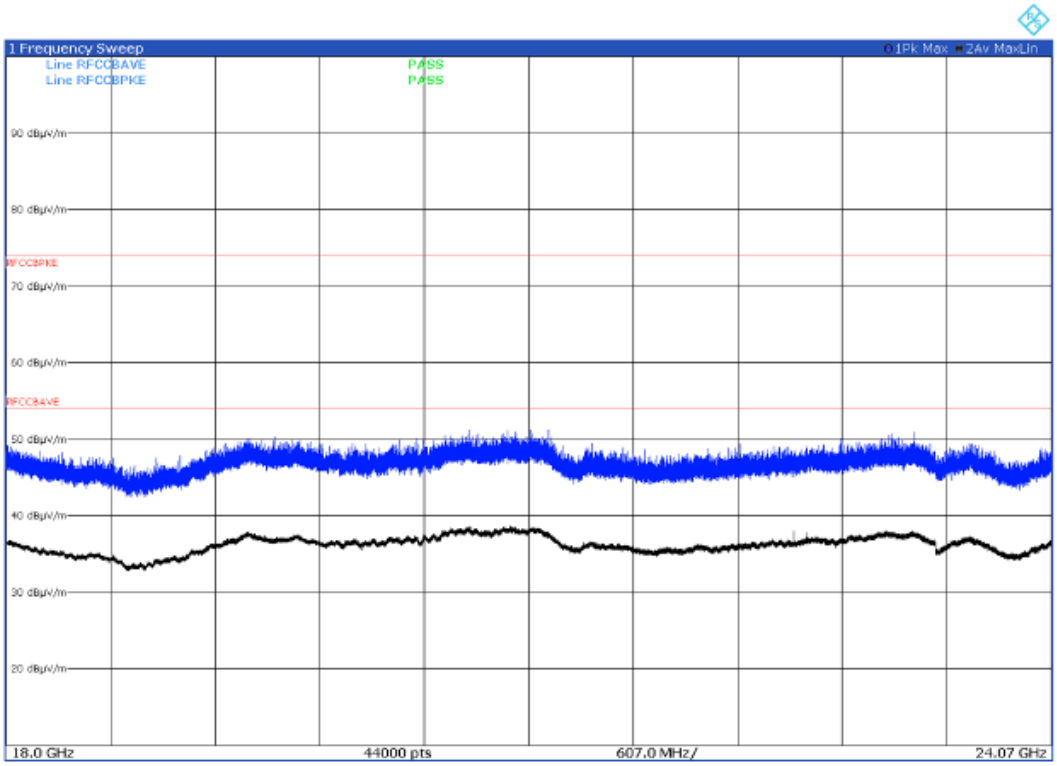


Figure 8.4-5: *Radiated emissions plot – Field strength measured from 1 to 18 GHZ., vertical*

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] The maximum measured value observed over a period of 15 seconds was recorded.
[4] The spectral plot is a summation of a vertical and horizontal scan.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2Av MaxLin
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PASS
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RFCCBAVE
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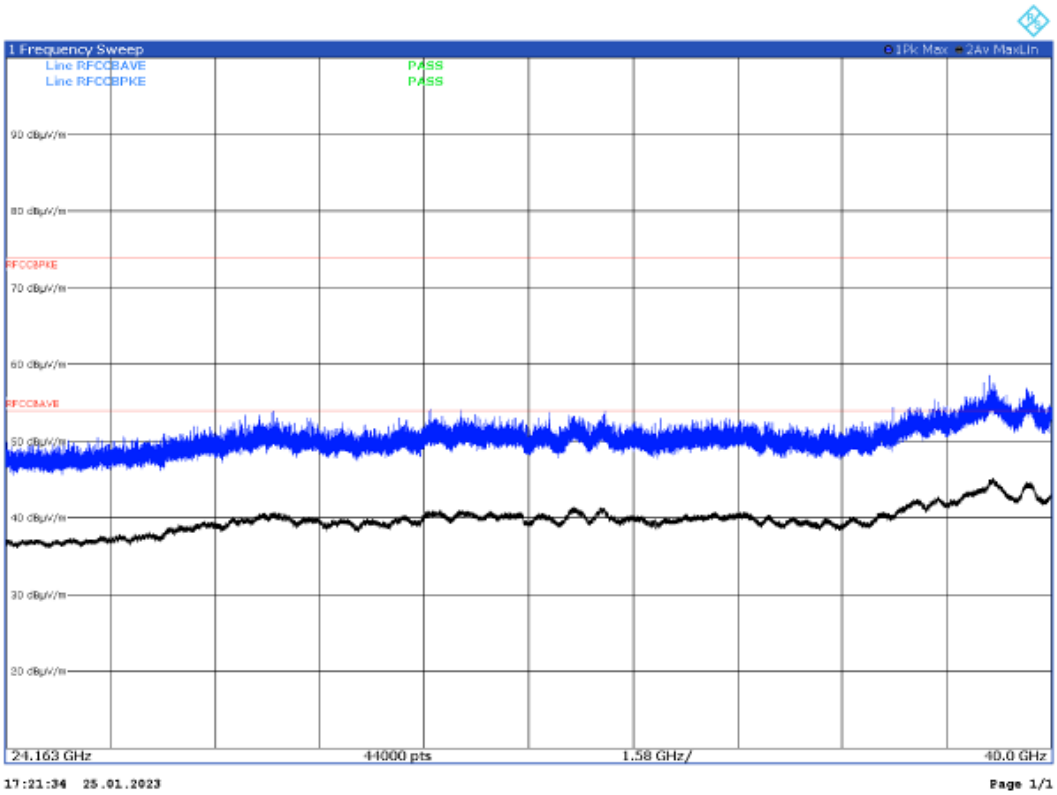
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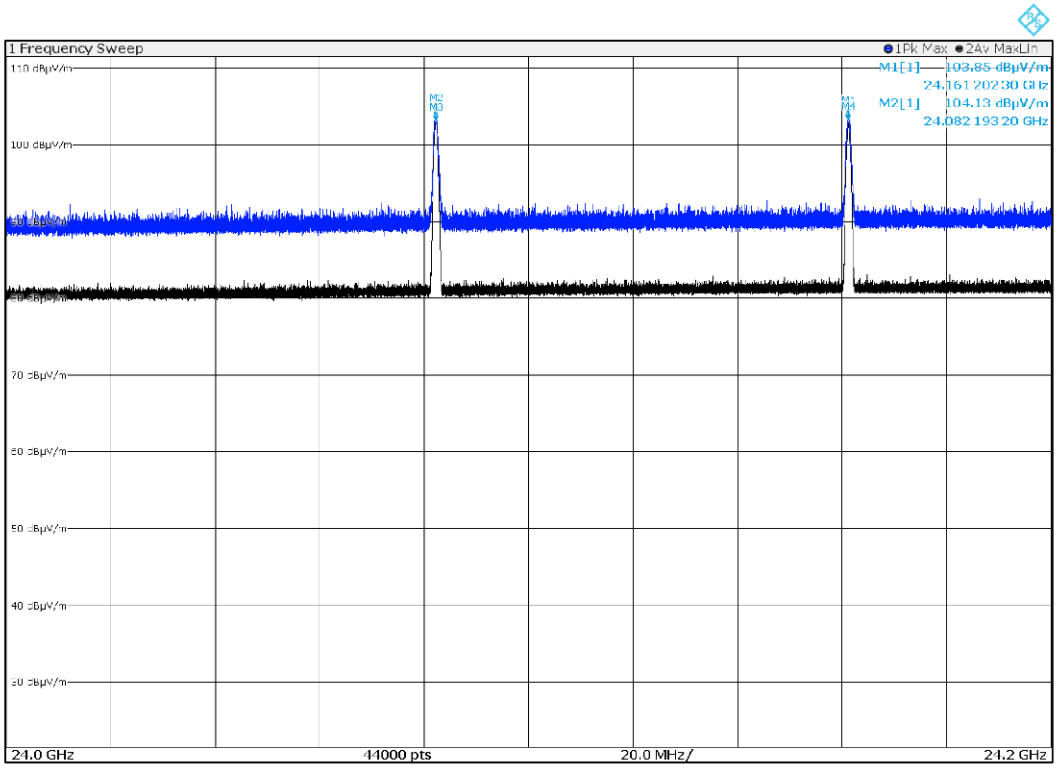
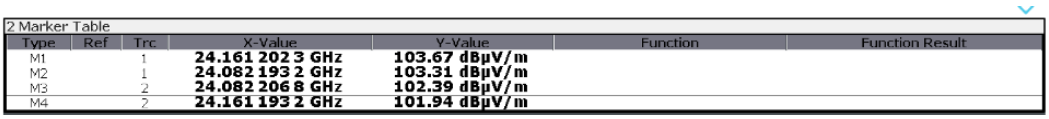
Page 1/1



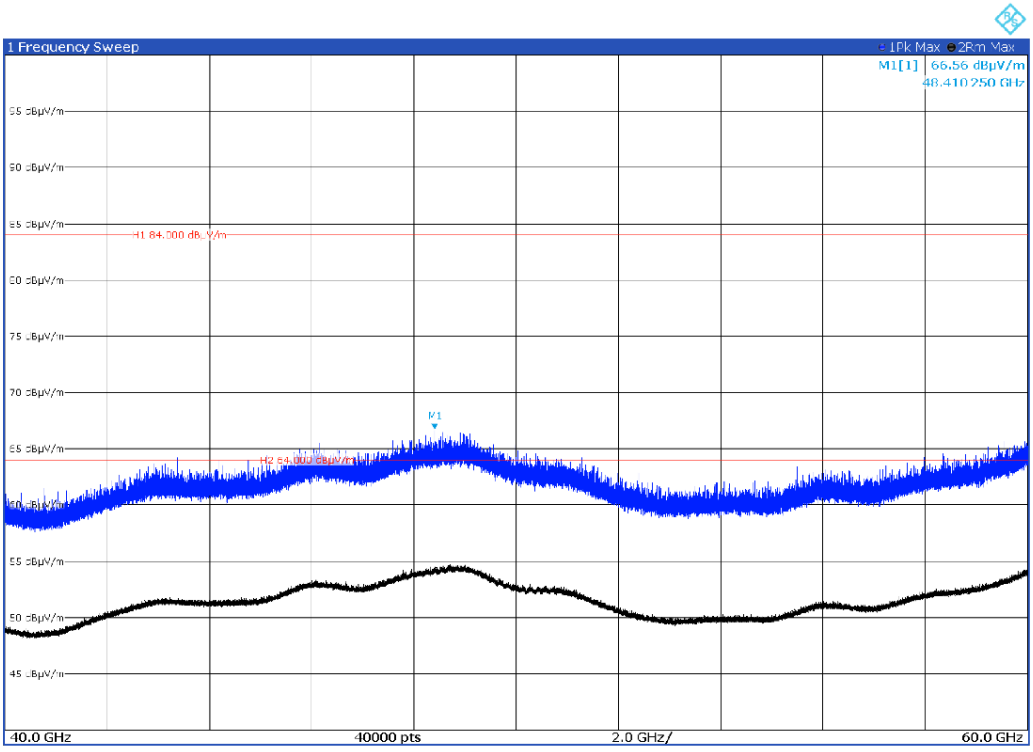


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	24.161 202 3 GHz	103.67 dBµV/m		
M2		1	24.082 193 2 GHz	103.31 dBµV/m		
M3		2	24.082 206 8 GHz	102.39 dBµV/m		
M4		2	24.161 193 2 GHz	101.94 dBµV/m		

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
24.0821932	103.3	127.0	-23.7	PK
24.0821932	102.4	107.0	-4.6	AV
24.1612023	103.4	127.0	-23.6	PK
24.0821932	101.9	107.0	-5.1	AV

Table 8.4-6: *Radiated emissions results – Field strength measured from 18 to 40 GHz*



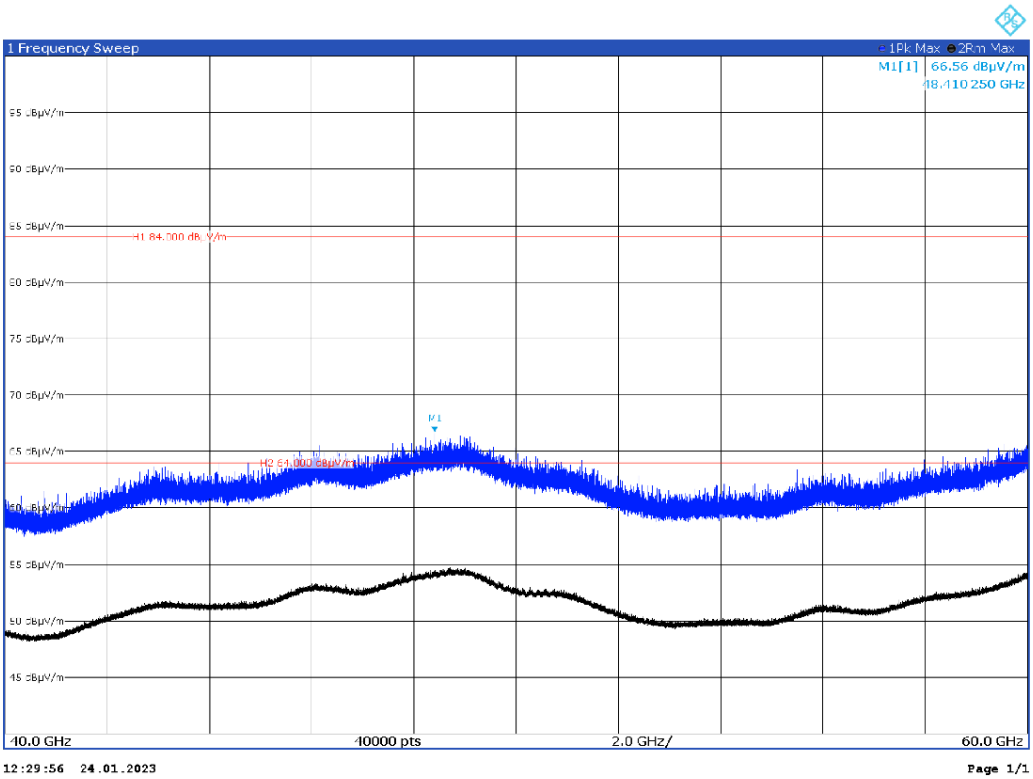
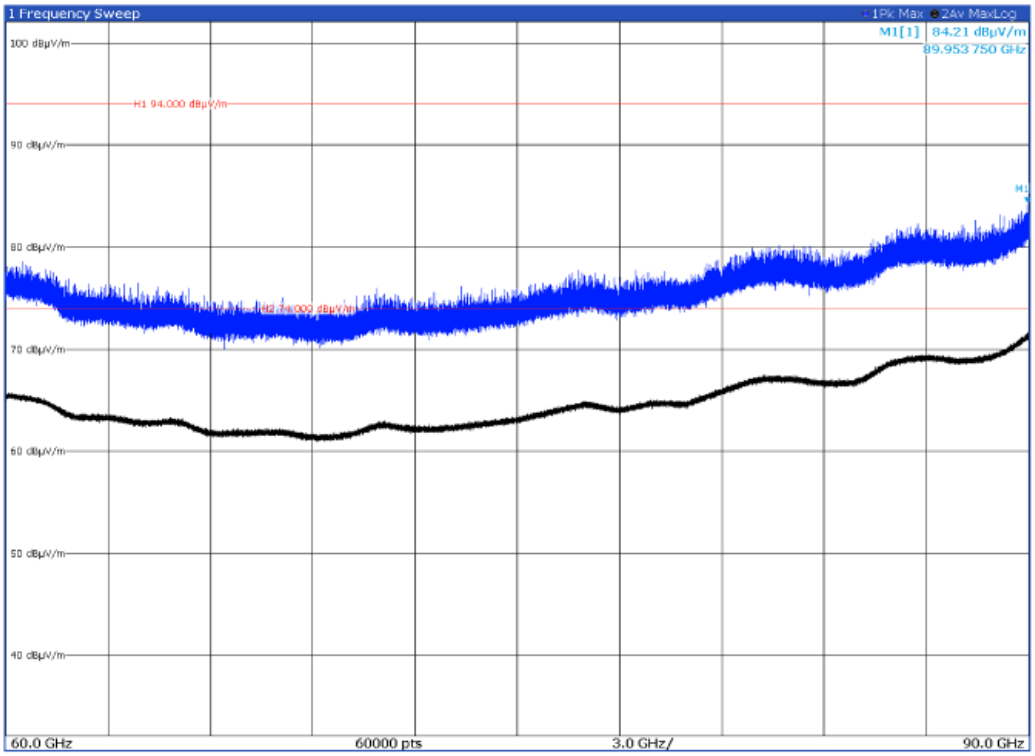


Figure 8.4-7: *Radiated emissions plot – Field strength measured from 40 to 60 GHz, Rx antenna in horizontal and vertical polarization, respectively*



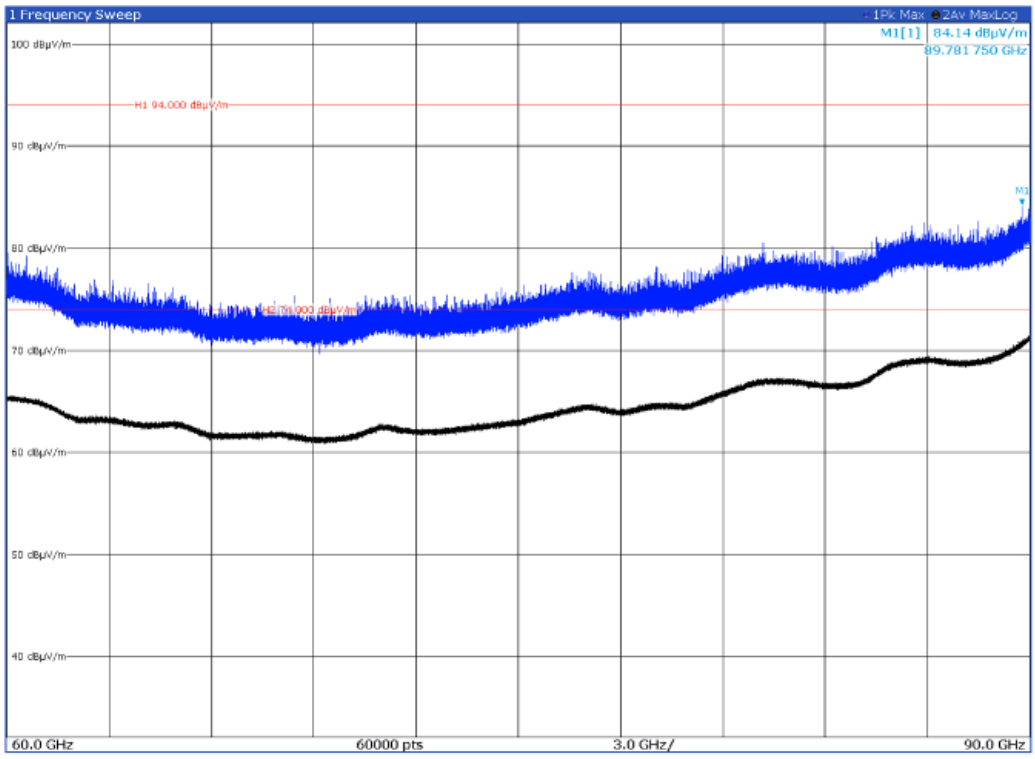


Figure 8.4-8: *Radiated emissions plot – Field strength measured from 60 to 90 GHz, Rx antenna in horizontal and vertical polarization, respectively.*

For these ranges, the measurement distance was different to 3 meters, because above 40 GHz, the test setup has not a pre-amplifier, which favors the increasing the noise floor.
For compensating this situation, the measurements were done a close distance to the receiving antenna and the limit level was extrapolated.
The extrapolation of the limit level and the new distance, were calculated with the follow equation:
Measurement distance for 40 GHz to 60 GHz = 1 m,

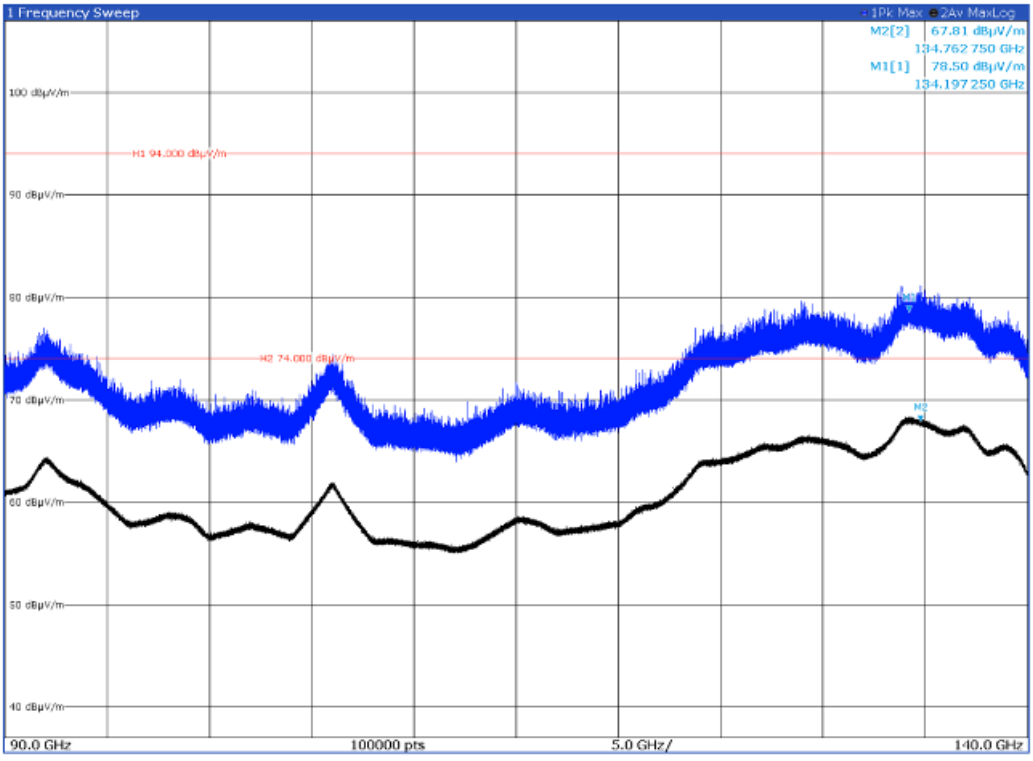
limit correction = 87.96 +20*log10(3/1) = 97.5 dBµV/m for second and third harmonic;
for other spurious limt = 54 dBµV/m +20 *log10(3/1) = 64.0 dBµV/m

Measurement distance for 60 GHz to 140 GHz = 0.3 m,

limit correction = 87.96 +20*log10(3/0.3) = 107.9 dBµV/m for second and third harmonic;
for other spurious limt = 54 dBµV/m +20 *log10(3/0.3) = 74.0 dBµV/m

Measurement distance for 140 GHz to 220 GHz = 0.1 m,

limit correction = 87.96 +20*log10(3/0.1) = 112 dBµV/m for second and third harmonic
for other spurious limt = 54 dBµV/m +20 *log10(3/0.1) = 84.0 dBµV/m



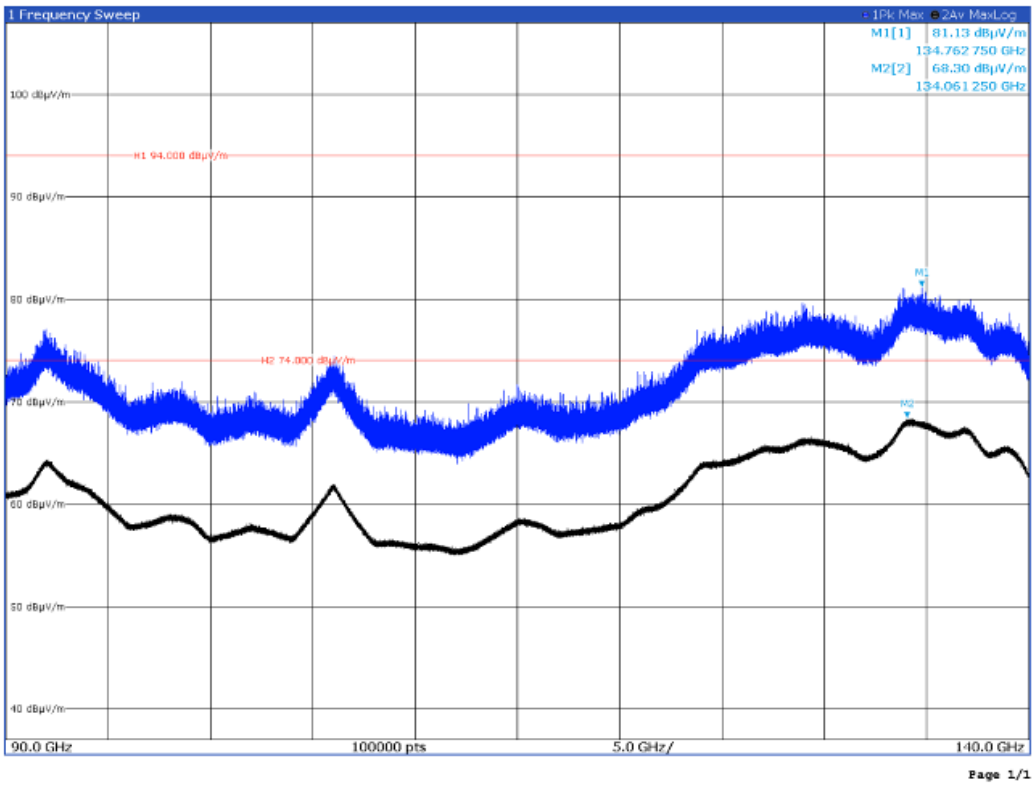
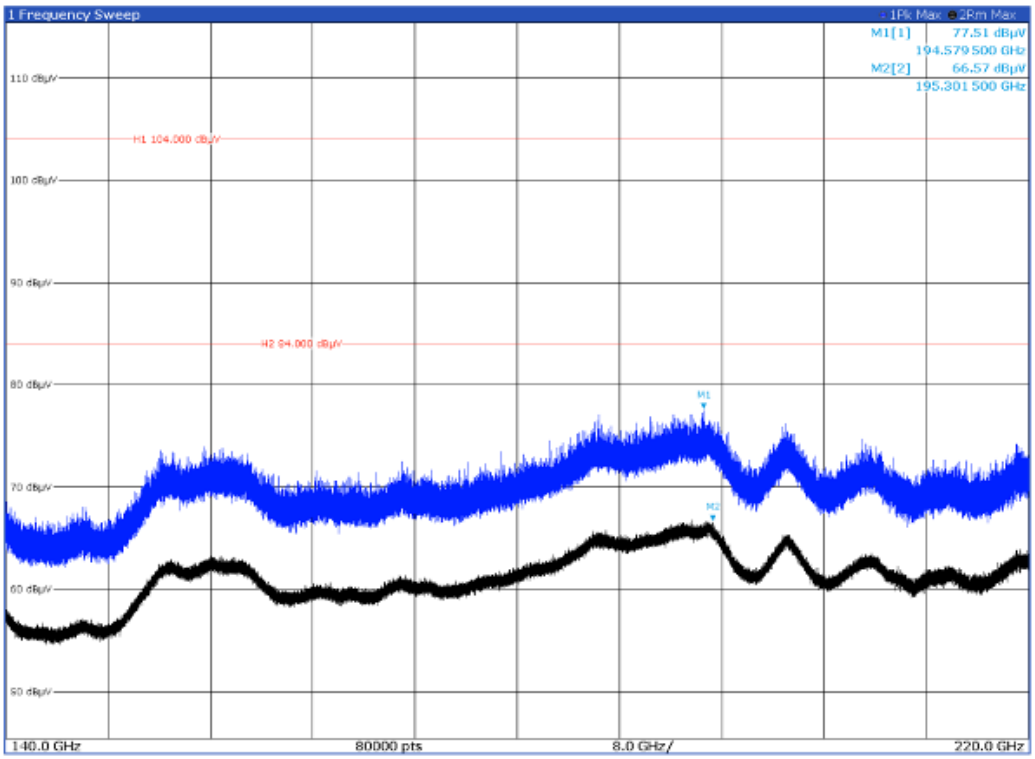


Figure 8.4-9: *Radiated emissions plot – Field strength measured from 90 to 140 GHz, Rx antenna in horizontal and vertical polarization, respectively*



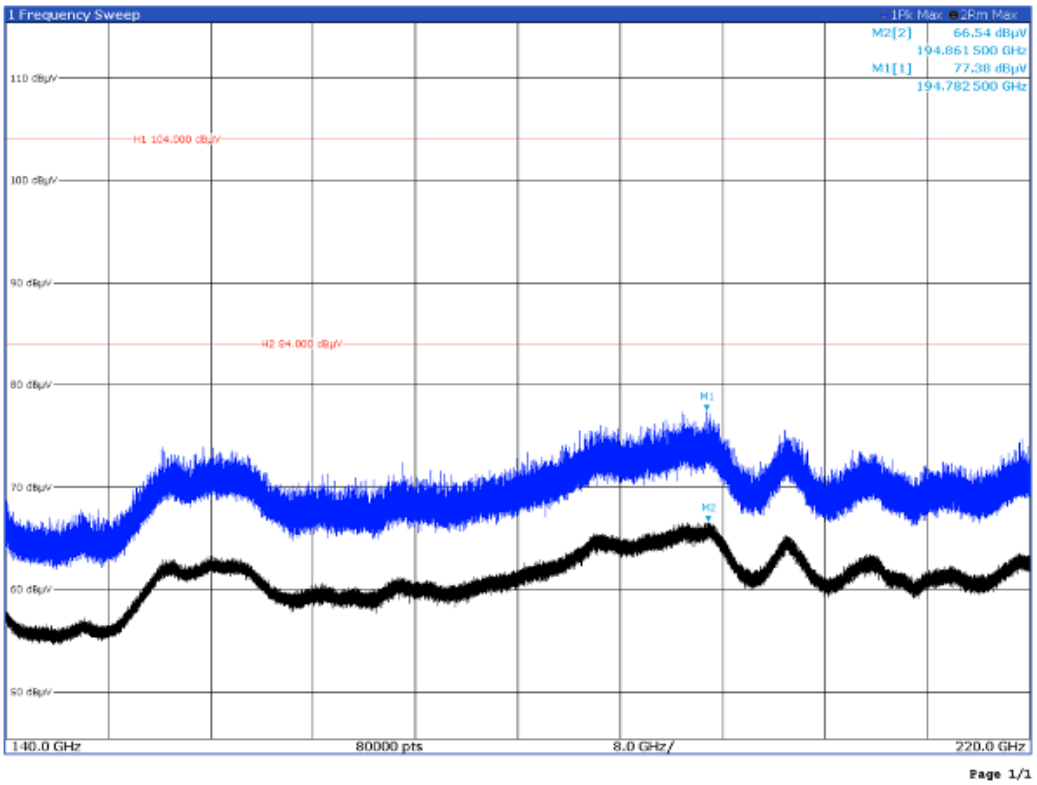


Figure 8.4-10: *Radiated emissions plot – Field strength measured from 140 to 220 GHz, Rx antenna in horizontal and vertical polarization, respectively.*

8.5 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits

8.5.1 Definitions and limits

FCC §15.207(a):
Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

IC:
A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz, shall not exceed the limits in table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Table 8.5-1: Conducted emissions limit

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average**
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - The level decreases linearly with the logarithm of the frequency.
** - A linear average detector is required.

8.5.2 Test summary

Test date	January 26, 2023	Temperature	20 °C
Test engineer	Daniele Guarnone	Air pressure	1008 mbar
Verdict	Pass	Relative humidity	52 %

8.5.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. 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 for preview measurements:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average
Trace mode	Max Hold
Measurement time	100 ms

Receiver settings for final measurements:

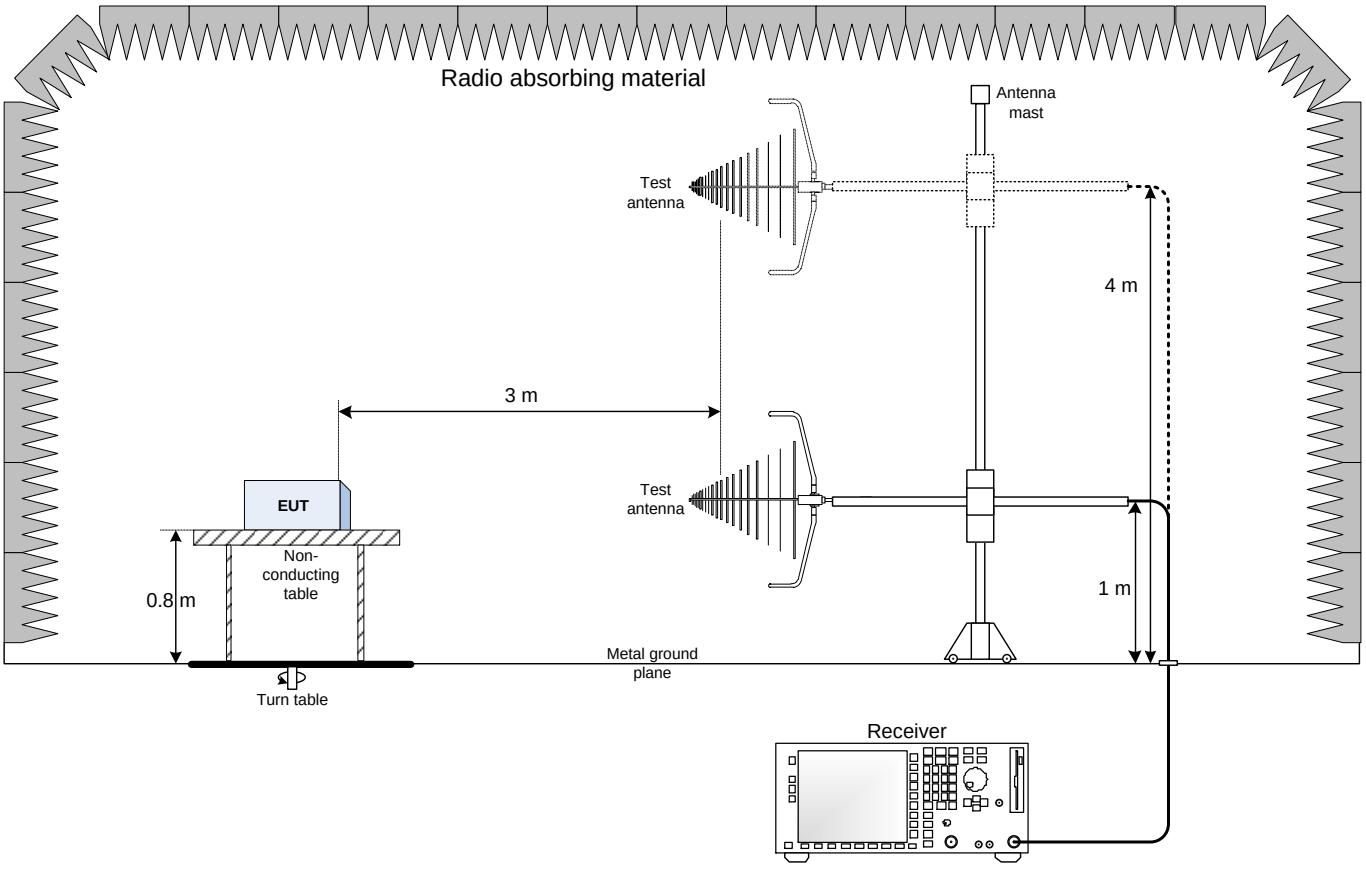
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Quasi-Peak and Average
Trace mode	Max Hold
Measurement time	100 ms

8.5.4 Test data

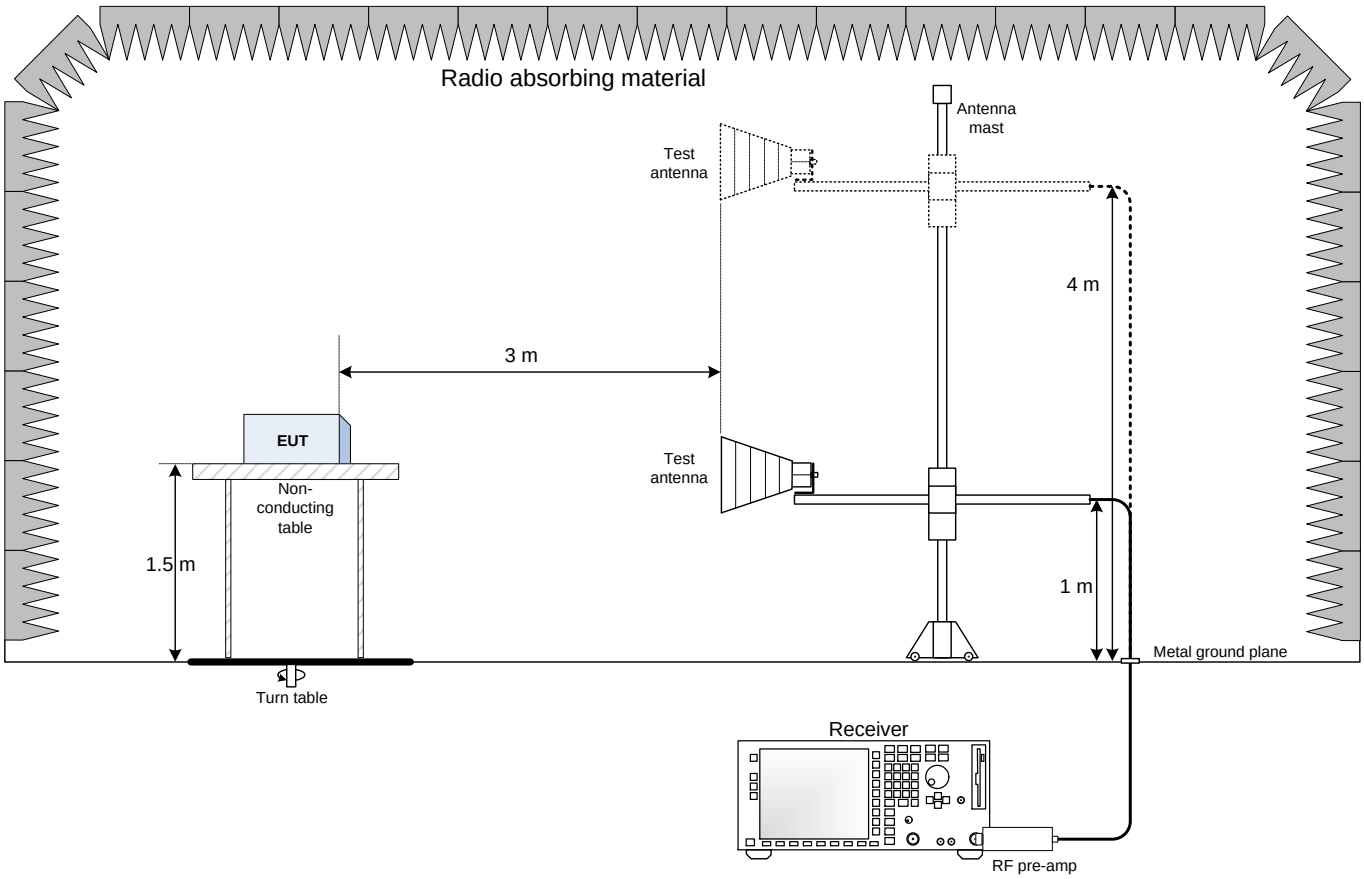
See test reports No.: REP006321 and REP006323.

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 Conducted emissions set-up