RADIO TEST REPORT – REP060763

Type of assessment:

Final product testing

Applicant:

Gridspertise S.r.l.

Via Ombrone, 2

00198 Roma – Italy

Product:

Data Concentrator Brand Gridspertise Model LVM G3 HYBRID GL0

Model:

LVM G3 HYBRID GL0

FCC ID:

2BLES-LVMG3GL0

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.247

Date of issue: September 23, 2024

P. Barbieri	Firmato digitalmente da Barbieri Paolo
Tested by	Signature
D. Guarnone	Firmato digitalmente da Guarnone Daniele
Reviewed by	Signature

Lab locations

Company name	Nemko S.p.A.
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

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 S.p.A. ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–585 MHz

1.2 Test methods

558074 D01 15.247 Meas Guidance v05r02 (April 2, 2019)	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
662911 D01 Multiple Transmitter Output v02r01 (October 31, 2013)	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
ANSI C63.10 v2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.3 Exclusions

None

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.3 above. 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 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
REP060763	September 23, 2024	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

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

2.2 Technical judgment

None

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	18 °C – 33 °C
Relative humidity	20 % – 70 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

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 no.	Asset no.	Cal cycle	Next cal.
Thermo-hygrometer	Testo	175-H2	20012380/305	2022-12	2024-12
Thermo-hygrometer	Testo	175-H2	38203337/703	2022-12	2024-12
Barometer	Castle	GPB 3300	072015	2024-04	2025-04

3.2 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 4 Measurement uncertainty

4.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2, ETSI TR 100 028-1, ETSI TR 100 028-2 and other specific test standards and is documented in Nemko Spa working manuals WML1002 and WML0078.

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 5 Information provided by the applicant

5.1 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 contained 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.

5.2 Applicant/Manufacture

Applicant name	Gridspertise S.r.l.
Applicant address	Via Ombrone, 2 00198 Roma – Italy
Manufacture name	Gridspertise S.r.l.
Manufacture address	Via Ombrone, 2 00198 Roma – Italy

5.3 EUT information

Product	Data Concentrator Brand Gridspertise Model LVM G3 HYBRID GL0
Model	LVM G3 HYBRID GL0
Serial number	0 000 009
Power supply requirements	3N~ 400 / 230 V 50 / 60 Hz 3N~ 210 / 120 V 50 / 60 Hz
Product description and theory of operation	Low Voltage Manager G3 Hybird, overvoltage category IV data concentrator, is the Gridspertise device used for mass market electricity and/or GAS meter reading system.

5.4 Radio technical information

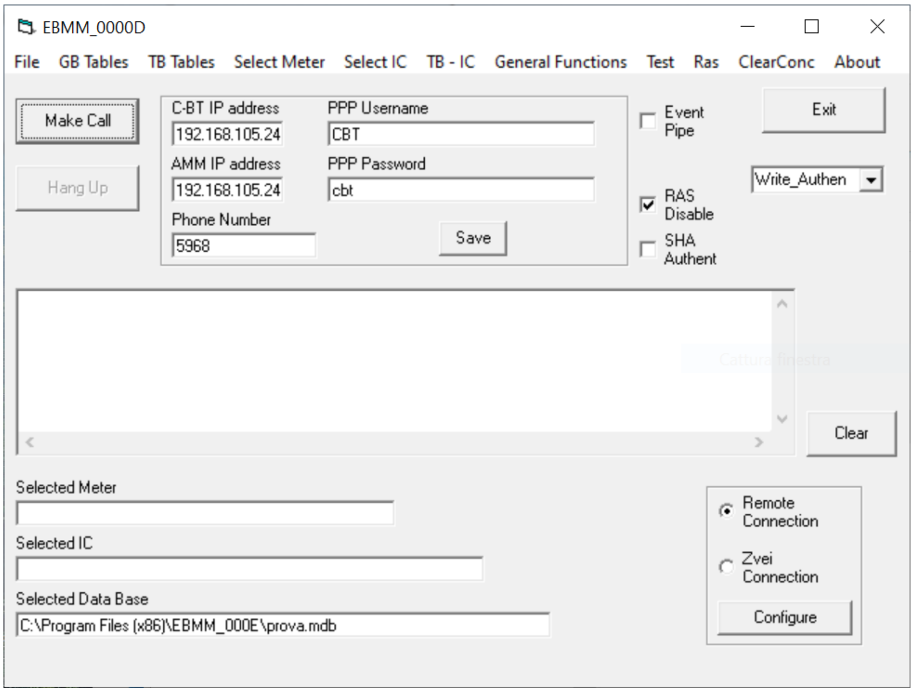
Category of Wideband Data Transmission equipment	☒ Frequency Hopping Spread Spectrum (FHSS) equipment ☐ Other types of Wideband Data Transmission equipment (e.g. DSSS, OFDM, etc.).
Frequency band	915 – 928 MHz
Frequency Min (MHz)	915.2 MHz
Frequency Max (MHz)	927.8 MHz
RF power Max (W), Conducted	0.347 W (25.4 dBm)
Field strength, dBµV/m @ 3 m	N/A
Measured BW (kHz), 99% OBW	73.3 kHz
Type of modulation	FSK
Emission classification	W7D
Transmitter spurious, dBµV/m @ 3 m	50.7 dBµV/m @ 9.216 GHz
Antenna information	Electric Connector Technology Co., Ltd P/N 81800V351 with 1.71 dBi gain max
Embedded Radio Module	Shenzhen Kaifa Technology (Chengdu) Co.,Ltd., type CX105-A (FCC ID: 2ASLRCX105-A)

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions

The EUT has been tested in TX mode forced at a single frequency of in hopping mode with the following software:



The following commands has been sent to the EUT:

915.2 MHz	360100040000368CD8001E
921.2 MHZ	36010004000036E865801E
927.8 MHz	360100040000374D1AC01E
Hopping	3601000A, 3601000B

Firmware version: 7.2.0

Transmitter state

Transmitter set in to continuous mode and in hopping mode.

5.5.2 EUT setup configuration

Table 5.5-1: *EUT interface ports*

Description	Qty.
AC Mains	1
Ethernet (normally not connected and used only for forcing the EUT is TX mode)	1

Table 5.5-2: *Support equipment*

Description	Brand name	Model, Part number, Serial number, Revision level
PC	Dell	Latitude 7480

Table 5.5-3: *Inter-connection cables*

Cable description	From	To	Length (m)
AC Mains	EUT	Mains	1.5
Ethernet	EUT	PC	1.5

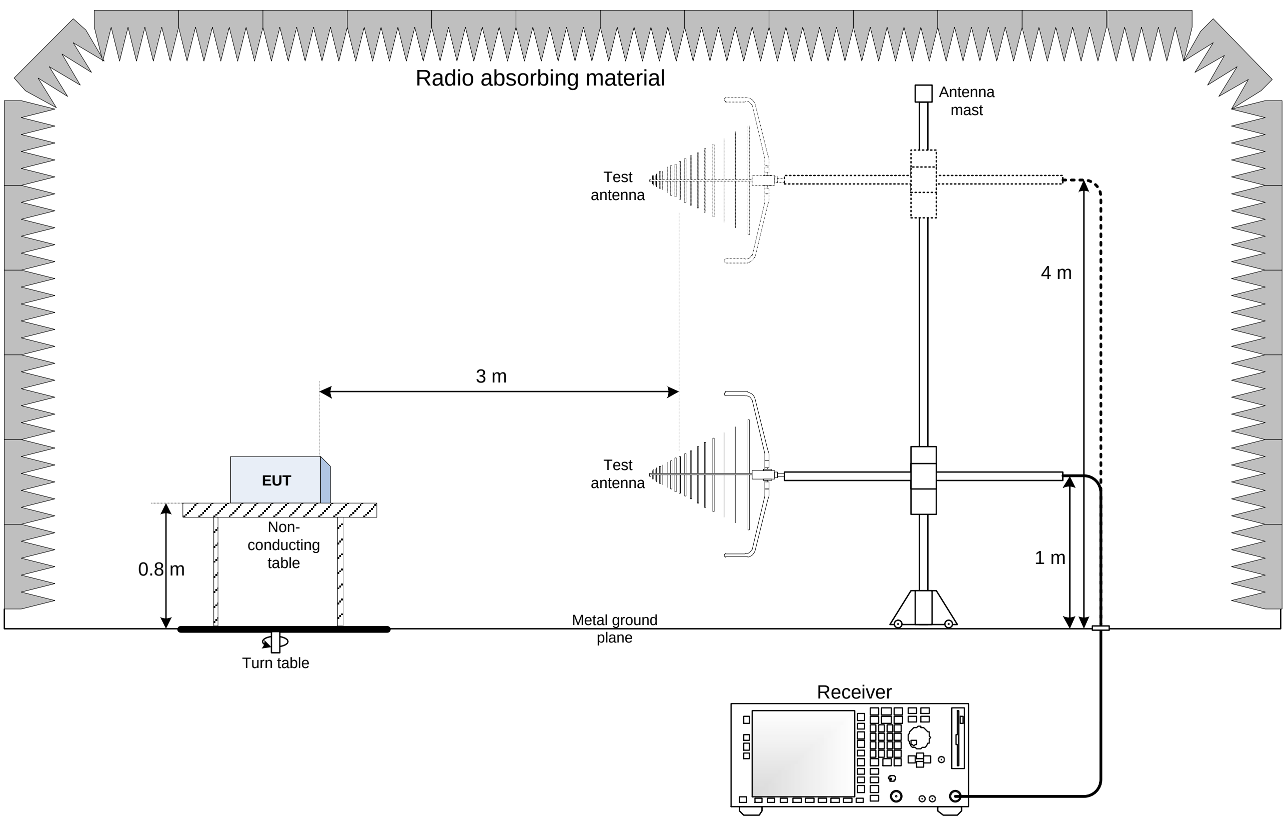


Figure 5.5-1: *Radiated testing below 1 GHz set-up*

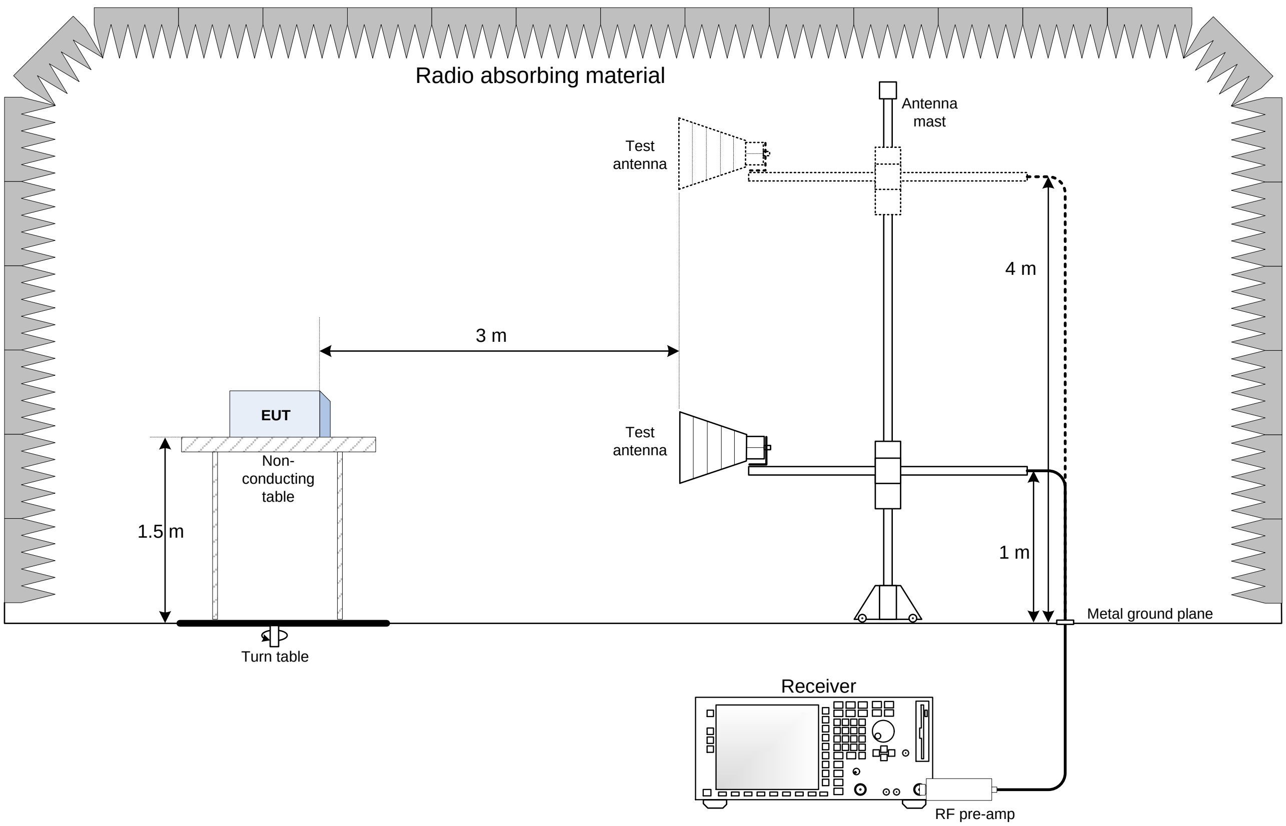


Figure 5.5-2: *Radiated testing above 1 GHz set-up*

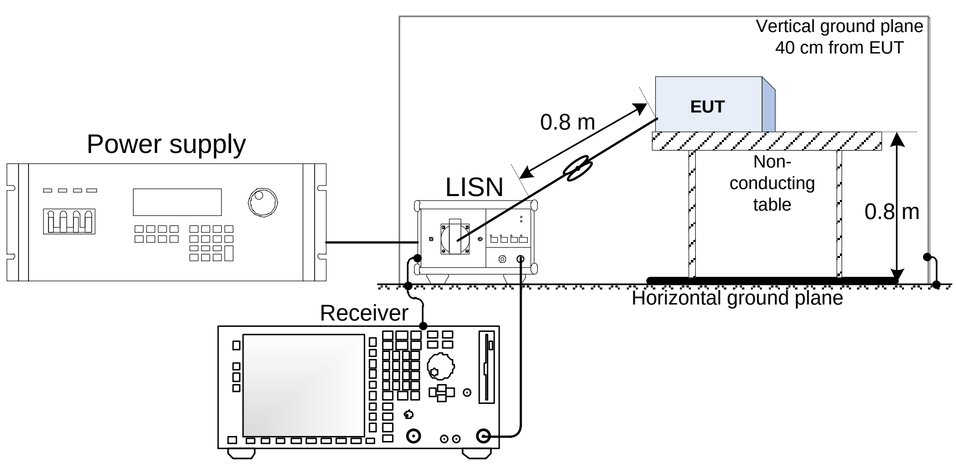


Figure 5.5-3: *Conducted testing*

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Nemko S.p.A. Via Del Carroccio, 4 – 20853 Biassono (MB) – Italy

6.2 Testing period

Test start date	September 20, 2024	Test end date	September 23, 2024

6.3 Sample information

Receipt date	September 20, 2024	Nemko sample ID number(s)	PRJ0058507001

6.4 FCC Part 15 Subpart A and C, general requirements test results

Table 6.4-1: *FCC general requirements results*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31l	Variation of power source	Pass
§15.31(m)	Number of tested frequencies	Pass
§15.203	Antenna requirement	Pass

Notes: EUT is an AC powered device.

6.5 FCC Part §15.247 test results for frequency hopping spread spectrum systems (FHSS)

Table 6.5-1: *FCC FHSS requirements results*

Part	Test description	Verdict
§15.247(a)(1)(i)	Requirements for operation in the 902–928 MHz band	Pass
§15.247(a)(1)(ii)	Requirements for operation in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Requirements for operation in the 2400–2483.5 MHz band	Not applicable
§15.247(b)(1)	Maximum peak output power in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power in the 902–928 MHz band	Pass
§15.247I(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247I(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable
§15.247(i)	Radiofrequency radiation exposure evaluation	Pass

Notes: --

6.6 FCC Part §15.247 test results for digital transmission systems (DTS)

Table 6.6-1: *FCC DTS requirements results*

Part	Test description	Verdict
§15.247(a)(2)	Minimum 6 dB bandwidth	Not applicable
§15.247(b)(3)	Maximum peak output power in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Not applicable
§15.247I(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247I(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Not applicable
§15.247I	Power spectral density	Not applicable
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Notes: --

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.
EMI Receiver	Rohde & Schwarz	ESW44	101620	2024-09	2025-09
EMI Receiver	Rohde & Schwarz	ESU8	100202	2024-09	2025-09
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767	2023-09	2024-09
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STLP 9148-152	2024-08	2027-08
Broadband Amplifier	Schwarzbeck Mess-Elektronik	BBV9718C	00121	2024-02	2025-02
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
3m Semi anechoic chamber	Comtest	SAC-3	1711-150	2022-09	2024-09
Software turntable and mast	Maturo	mcApp	8.1.0.5410	NCR	NCR
Cable set	Rosenberger and Huber + Suhner	RE01+RE02	1.654+1.655	2024-02	2025-02
10m Semi anechoic chamber	Comtest	SAC-10	530	2023-09	2025-09
Cable set	Rosenberger+Huber-Suhner	RE03+RE04	1.510+1.511	2023-11	2024-11
Cable set	Rosenberger+Huber-Suhner	RE04+RE05	1.511+1.512	2023-11	2024-11
Cable set	Rosenberger+Huber+Suhner	CE01+CE02	1.498+1.632	2023-11	2024-11
Cable set	Rosenberger	ST.ALO-02	1.650	2023-11	2024-11
LISN	Rohde & Schwarz	ENV432	101714	2024-09	2025-09
Attenuator	Aeroflex / Weinschel	2	CC8577	2024-02	2025-02

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

Section 8 Testing data

8.1 Variation of power source

8.1.1 References, definitions and limits

FCC §15.31 (e):

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

8.1.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	September 20, 2024

8.1.3 Observations, settings and special notes

The testing was performed as per ANSI C63.10 Section 5.13.

a) Where the device is intended to be powered from an external power adapter, the voltage variations shall be applied to the input of the adapter provided with the device at the time of sale. If the device is not marketed or sold with a specific adapter, then a typical power adapter shall be used.

b) For devices, where operating at a supply voltage deviating ±15% from the nominal rated value may cause damages or loss of intended function, test to minimum and maximum allowable voltage per manufacturer's specification and document in the report.

c) For devices with wide range of rated supply voltage, test at 15% below the lowest and 15% above the highest declared nominal rated supply voltage.

d) For devices obtaining power from an input/output (I/O) port (USB, firewire, etc.), a test jig is necessary to apply voltage variation to the device from a support power supply, while maintaining the functionalities of the device.

For battery-operated equipment, the equipment tests shall be performed using a variable power supply.

8.1.4 Test data

EUT Power requirements:	☒ AC	☐ DC	☐ Battery
If EUT is an AC or a DC powered, was the noticeable output power variation observed?	☐ YES	☒ NO	☐ N/A
If EUT is battery operated, was the testing performed using fresh batteries?	☐ YES	☐ NO	☒ N/A
If EUT is rechargeable battery operated, was the testing performed using fully charged batteries?	☐ YES	☐ NO	☒ N/A

8.2 Number of frequencies

8.2.1 References, definitions and limits

FCC §15.31:

(m) Measurements on intentional radiators or receivers shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table.

Table 8.2-1: *Frequency Range of Operation*

Frequency range over which the device operates (in each band)	Number of test frequencies required	Location of measurement frequency inside the operating frequency range
1 MHz or less	1	Center (middle of the band)
1–10 MHz	2	1 near high end, 1 near low end
Greater than 10 MHz	3	1 near high end, 1 near center and 1 near low end

Notes: "near" means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

8.2.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	September 20, 2024

8.2.3 Observations, settings and special notes

ANSI C63.10, Clause 5.6.2.1:

The number of channels tested can be reduced by measuring the center channel bandwidth first and then applying the following relaxations as appropriate:

a) For each operating mode, if the measured channel bandwidth on the middle channel is at least 150% of the minimum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

b) For multiple-input multiple-output (MIMO) systems, if the measured channel bandwidth on testing the middle channel exceeds the minimum permitted bandwidth by more than 50% on one transmit chain, then it is not necessary to repeat testing on the other chains.

c) If the measured channel bandwidth on the middle channel is less than 50% of the maximum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

ANSI C63.10, Clause 5.6.2.2:

For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

a) Band edge requirements—Measurements on the mode with the widest bandwidth can be used to cover the same channel (center frequency) on modes with narrower bandwidth that have the same or lower output power for each modulation family (e.g., OFDM and direct sequence spread spectrum).

b) Spurious emissions—Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).

c) In-band PSD—Measurements on the mode with the narrowest bandwidth can be used to cover all modes within the same modulation family of an equal or lower output power provided the result is less than 50% of the limit.

8.2.4 Test data

Table 8.2-2: *Test channels selection*

Start of Frequency range, MHz	End of Frequency range, MHz	Frequency range bandwidth, MHz	Low channel, MHz	Mid channel, MHz	High channel, MHz
915	930	15	915.2	921.2	927.8

8.3 Antenna requirement

8.3.1 References, definitions and limits

FCC §15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

FCC §15.247:

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.3.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	September 20, 2024

8.3.3 Observations, settings and special notes

None

8.3.4 Test data

Must the EUT be professionally installed?	☐ YES	☒ NO	
Does the EUT have detachable antenna(s)?	☒ YES	☐ NO	
If detachable, is the antenna connector(s) non-standard?	☐ YES	☐ NO	☒ N/A

Note: the antenna is inside the enclosure of the EUT and it's not accessible to the user without removing the screws.

Table 8.3-1: *Antenna information*

Antenna type	Manufacturer	Model number	Maximum gain	Connector type
Whip antenna	Electric Connector Technology Co., Ltd	P/N 81800V351	1.70 dBi @ 915.2 MHz 1.43 dBi @ 921.2 MHz 0.96 dBi @ 927.8 MHz	SMA

8.4 AC power line conducted emissions limits

8.4.1 References, 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.

ANSI C63.10, Clause 6.2:

If the EUT normally receives power from another device that in turn connects to the public utility ac power lines, measurements shall be made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.

For direct current (dc) powered devices where the ac power adapter is not supplied with the device, an "off-the-shelf" unmodified ac power adapter shall be used. If the device is supposed to be installed in a host (e.g., the device is a module or PC card), then it is tested in a typical compliant host.

Table 8.4-1: *Conducted emissions limit*

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

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

8.4.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	September 23, 2024

8.4.3 Test equipment used

Equipment	**Manufacturer**	**Model no.**	**Asset no.**
EMI Receiver	Rohde & Schwarz	ESU8	100202
Cable set	Rosenberger+Huber+Suhner	CE01+CE02	1.498+1.632
LISN	Rohde & Schwarz	ENV432	101714
Attenuator	Aeroflex / Weinschel	2	CC8577

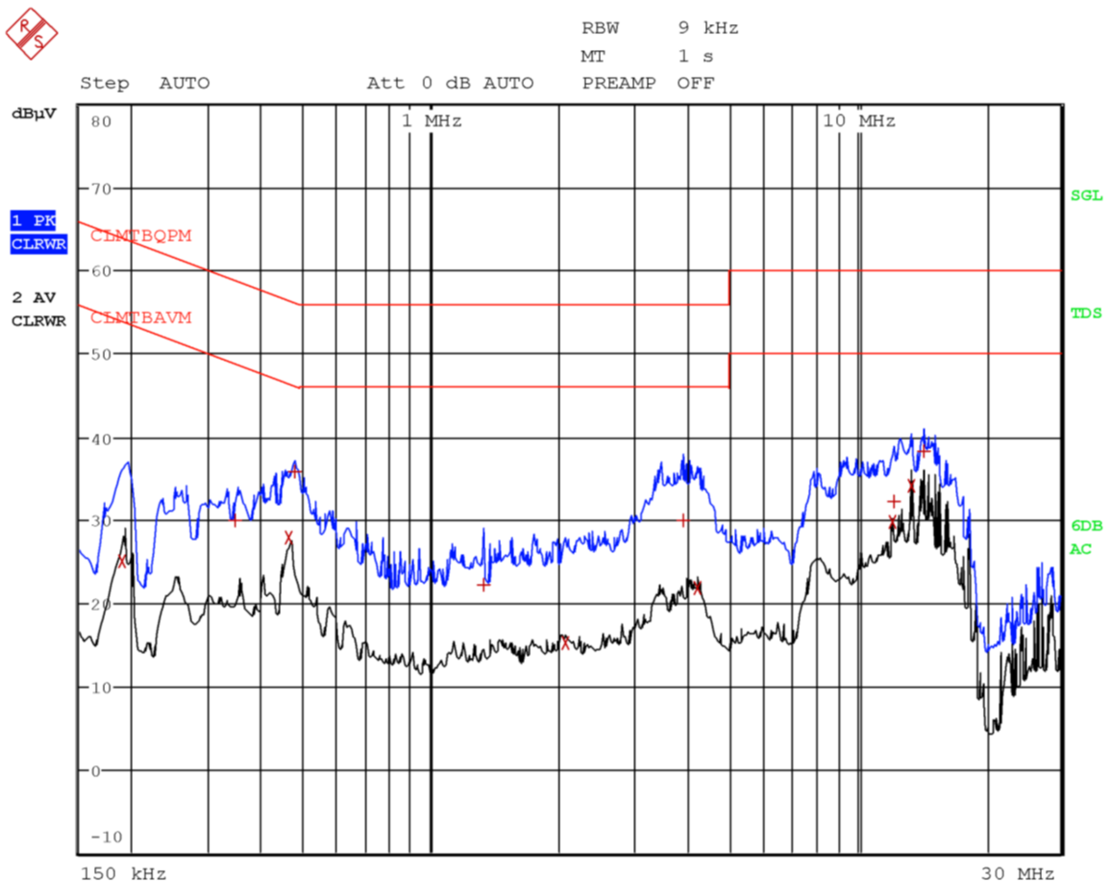
8.4.4 Observations, settings and special notes

Port under test – Coupling device	AC Mains – Artificial Mains Network (AMN)
EUT power input during test	110 - 220 V_{AC}, 50/60 Hz
EUT setup configuration	Table top
Measurement details	A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.
Additional notes:	– The EUT was set up as tabletop configuration per ANSI C63.10-2013 measurement procedure. – The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance. Correction factor (dB) = LISN factor IL (dB) + cable loss (dB) + attenuator (dB) – Emissions that were continuously present for a minimum of 1 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.

Receiver settings:

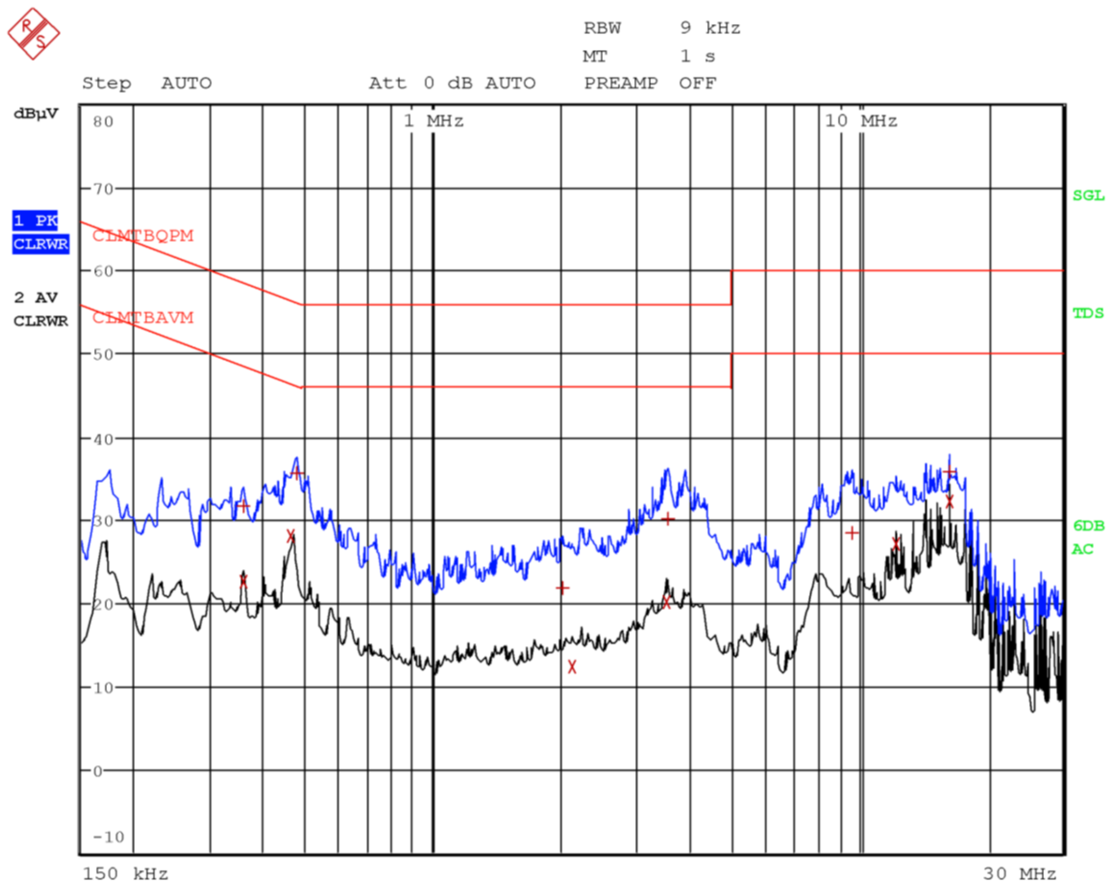
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (Preview), Quasi-peak and CAverage (Final)
Trace mode	Max Hold
Measurement time	100 ms (Preview), 160 ms (Final)

8.4.5 Test data



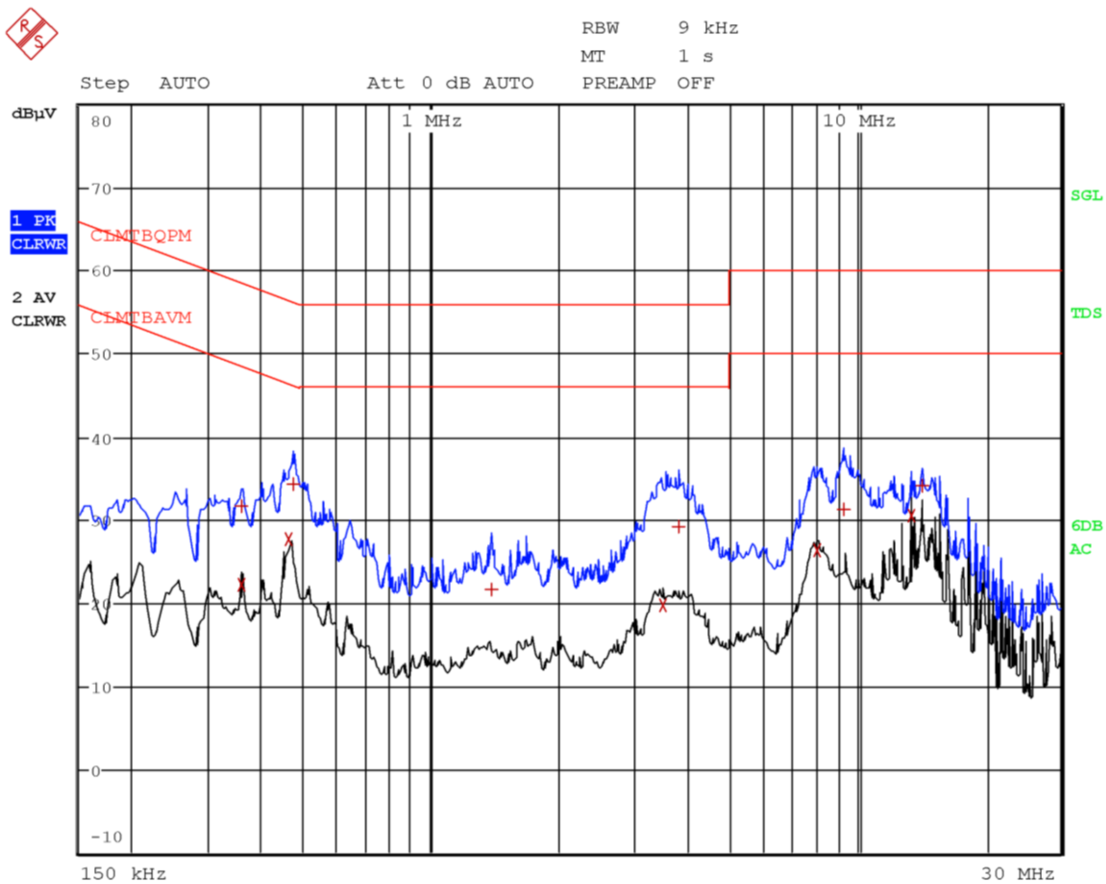
Plot 8.4-1: *Conducted emissions on phase 1 line*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1900	25.2	54.0	-28.8	Av
0.3500	30.0	59.0	-29.0	QP
0.4660	27.9	46.6	-18.7	Av
0.4780	35.8	56.4	-20.6	QP
1.3260	22.3	56.0	-33.7	QP
2.0580	15.3	46.0	-30.7	Av
3.8980	30.1	56.0	-25.9	QP
4.2220	21.8	46.0	-24.2	Av
12.1380	29.8	50.0	-20.2	Av
12.1740	32.2	60.0	-27.8	QP
13.4180	34.2	50.0	-15.8	Av
14.2740	38.4	60.0	-21.6	QP



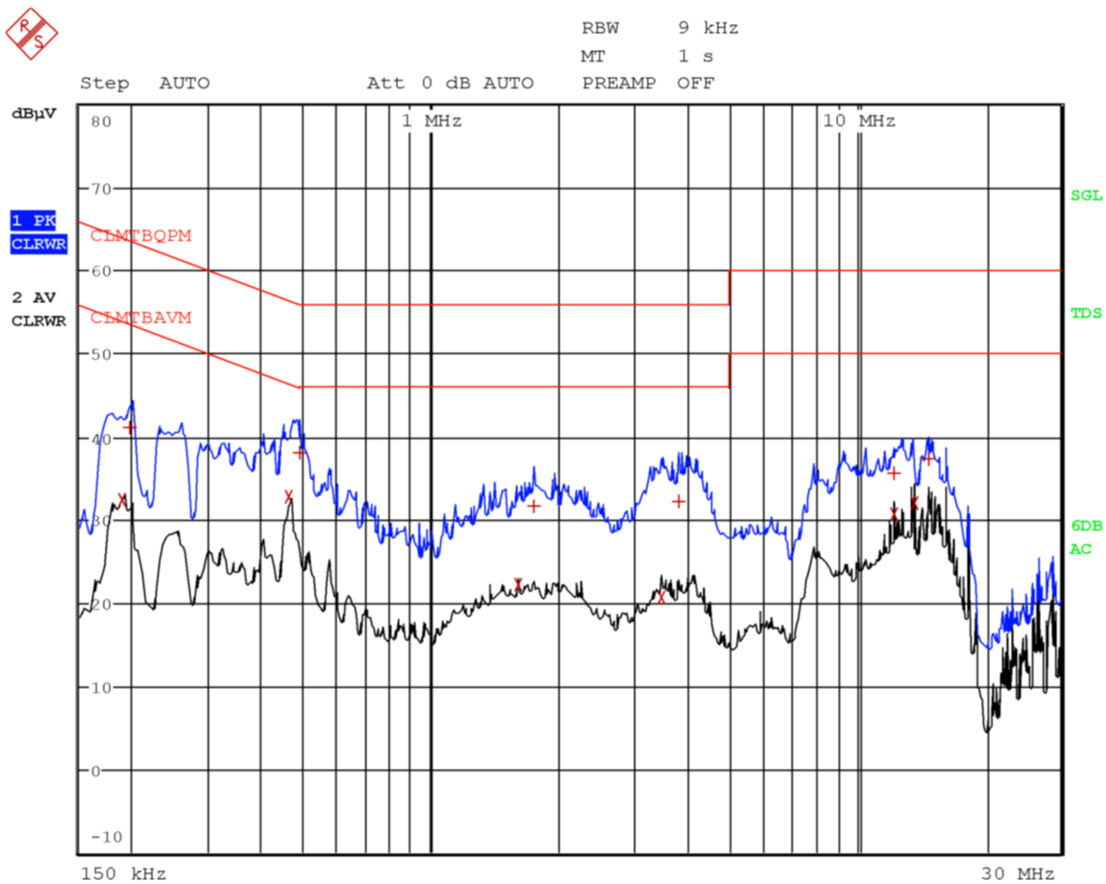
Plot 8.4-2: *Conducted emissions on phase 2 line*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.3580	31.8	58.8	-27.0	QP
0.3580	22.7	48.8	-26.1	Av
0.4660	28.2	46.6	-18.4	Av
0.4780	35.8	56.4	-20.6	QP
2.0100	22.0	56.0	-34.0	QP
2.1100	12.5	46.0	-33.5	Av
3.5340	20.2	46.0	-25.8	Av
3.5660	30.2	56.0	-25.8	QP
9.6100	28.5	60.0	-31.5	QP
12.1980	27.3	50.0	-22.7	Av
16.2260	32.2	50.0	-17.8	Av
16.2300	35.8	60.0	-24.2	QP



Plot 8.4-3: *Conducted emissions on phase 3 line*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.3580	31.8	58.8	-27.0	QP
0.3580	22.3	48.8	-26.5	Av
0.4660	27.8	46.6	-18.8	Av
0.4700	34.4	56.5	-22.1	QP
1.3780	21.6	56.0	-34.4	QP
3.4940	19.8	46.0	-26.2	Av
3.8060	29.2	56.0	-26.8	QP
8.0700	26.5	50.0	-23.5	Av
9.2820	31.4	60.0	-28.6	QP
13.4180	30.6	50.0	-19.4	Av
14.2140	34.2	60.0	-25.8	QP



Plot 8.4-4: *Conducted emissions on neutral line*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1900	32.6	54.0	-21.4	Av
0.1980	41.2	63.7	-22.5	QP
0.4660	32.8	46.6	-13.8	Av
0.4900	38.1	56.2	-18.1	QP
1.5980	22.4	46.0	-23.6	Av
1.7380	31.8	56.0	-24.2	QP
3.4540	20.7	46.0	-25.3	Av
3.8020	32.4	56.0	-23.6	QP
12.1980	35.8	60.0	-24.2	QP
12.1980	30.7	50.0	-19.3	Av
13.6020	32.1	50.0	-17.9	Av
14.7020	37.4	60.0	-22.6	QP

8.5 Frequency Hopping Systems requirements, 900 MHz operation

8.5.1 References, definitions and limits

FCC §15.247:

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Table 8.5-1: *Summary of the basic requirements*

$P_{max\text{-}pk} \leq 1$ W	$P_{max\text{-}pk} \leq 0.125$ W
$N_{ch} \geq 75$	$N_{ch} \geq 15$
$\Delta f \geq$ MAX { 25 kHz, $BW_{20\,dB}$ }	$\Delta f \geq$ MAX [MAX { 25 kHz, 0.67×$BW_{20\,dB}$ } OR MAX{25 kHz, $BW_{20\,dB}$}]
max. $BW_{20\,dB}$ not specified	max. $BW_{20\,dB}$ not specified
$t_{ch} \leq 0.4$ s for T = 0.4×Nch	$t_{ch} \leq 0.4$ s for T = 0.4×Nch

Note: t_{ch} = average time of occupancy; T = period; N_{ch} = # hopping frequencies; BW = bandwidth; Δf = hopping channel carrier frequency separation

8.5.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	September 23, 2024

8.5.3 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
Cable set	Rosenberger	ST.ALO-02	1.650

8.5.4 Observations, settings and special notes

Carrier frequency separation was tested per ANSI C63.10 subclause 7.8.2. Spectrum analyser settings:

Resolution bandwidth	Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
Video bandwidth	≥ RBW
Frequency span	Wide enough to capture the peaks of two adjacent channels
Detector mode	Peak
Trace mode	Max Hold

Number of hopping frequencies was tested per ANSI C63.10 subclause 7.8.3. Spectrum analyser settings:

Resolution bandwidth	To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
Video bandwidth	≥ RBW
Frequency span	The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
Detector mode	Peak
Trace mode	Max Hold

Time of occupancy (dwell time) was tested per ANSI C63.10 subclause 7.8.4. Spectrum analyser settings:

Resolution bandwidth	shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
Video bandwidth	≥ RBW
Frequency span	Zero span, centered on a hopping channel.
Detector mode	Peak
Trace mode	Max Hold

20 dB bandwidth was tested per ANSI C63.10 subclause 6.9.2. Spectrum analyser settings:

Resolution bandwidth	≥ 1–5% of the 20 dB bandwidth
Video bandwidth	≥ RBW
Frequency span	approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

8.5.5 Test data

Table 8.5-2: *20 dB bandwidth results*

Frequency, MHz	20 dB bandwidth, kHz
915.2	77.9
921.2	77.4
927.8	76.4

Table 8.5-3: *99% occupied bandwidth results*

Frequency, MHz	99% occupied bandwidth, kHz
915.2	73.2
921.2	72.7
927.8	73.3

Notes: There is no 99% occupied bandwidth limit in the standard's requirements the measurement results provided for information purposes only.

Table 8.5-4: *Carrier frequency separation results*

Carrier frequency separation, kHz	Minimum limit, kHz	Margin, kHz
200	77.9	122.1

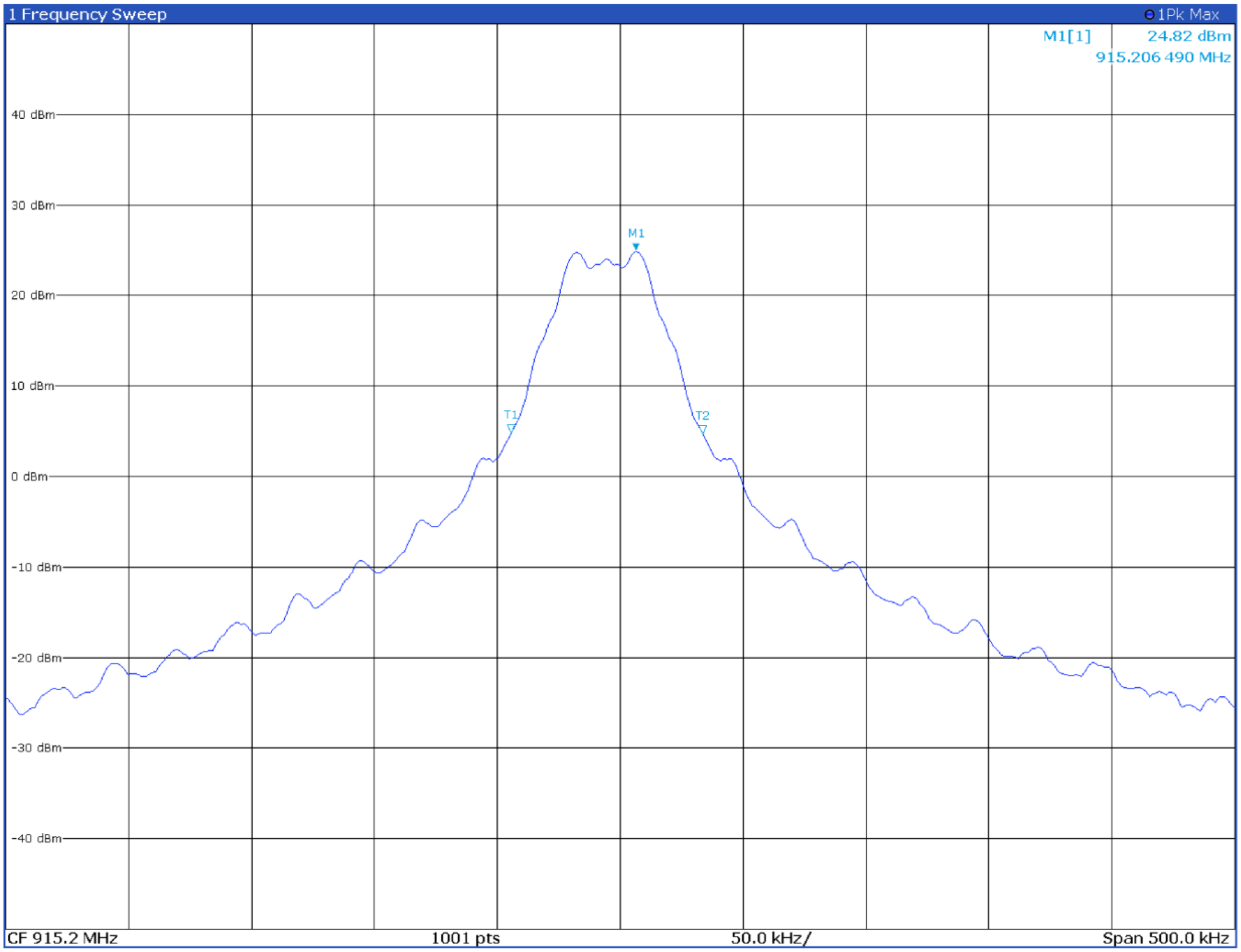
Table 8.5-5: *Number of hopping frequencies results*

Number of hopping frequencies	Minimum limit	Margin
64	50	14

Table 8.5-6: *Average time of occupancy results*

Dwell time of each pulse, ms	Number of pulses within period	Total dwell time within period, ms	Limit, ms	Margin, ms
9.5	3	28.5	400	-371.5

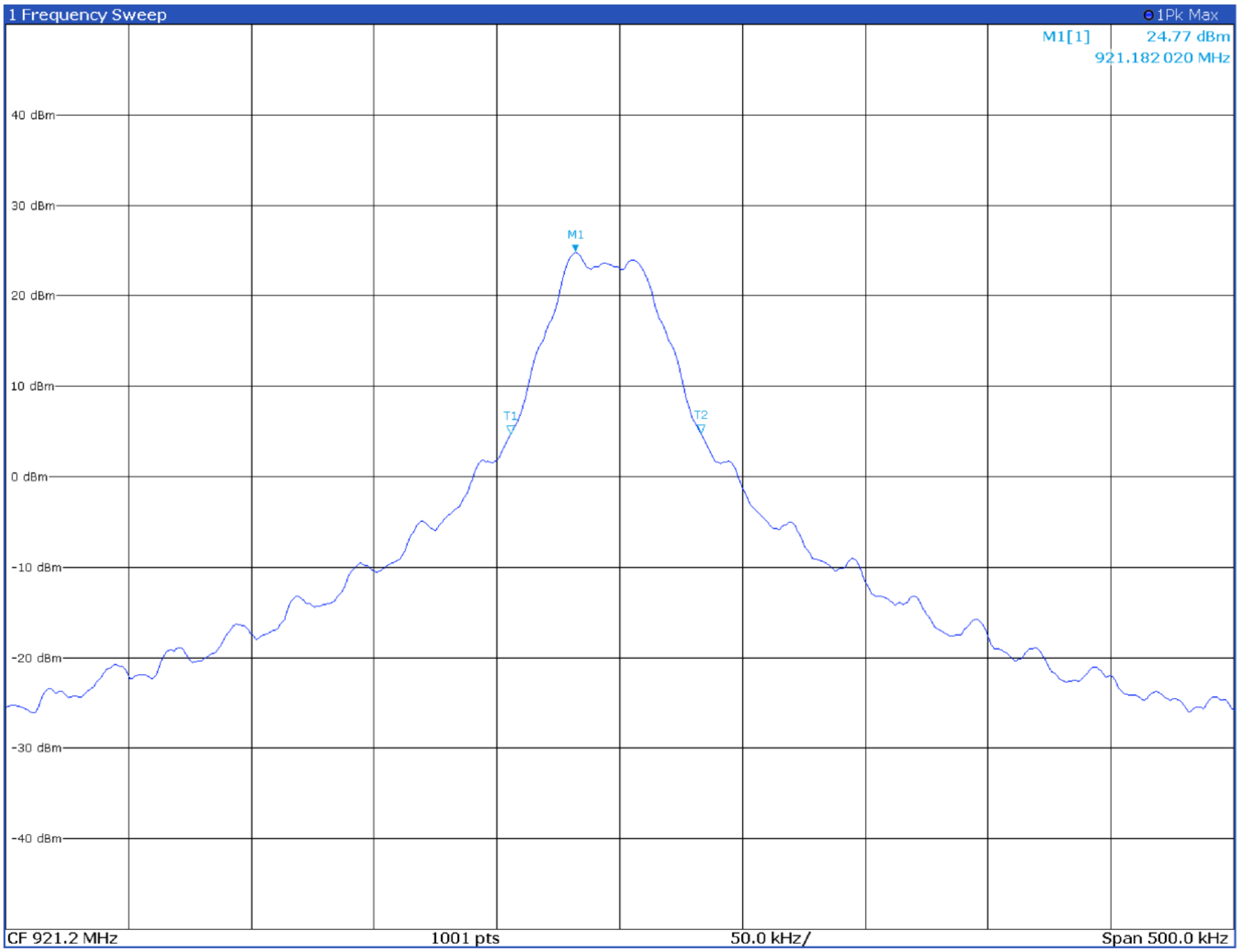
Notes: Measurement Period is 20 s



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**915.206 49 MHz**	**24.82 dBm**	ndB	20.0 dB
T1		1	915.155 54 MHz	4.79 dBm	ndB down BW	**77.92 kHz**
T2		1	915.233 47 MHz	4.75 dBm	Q Factor	11 745

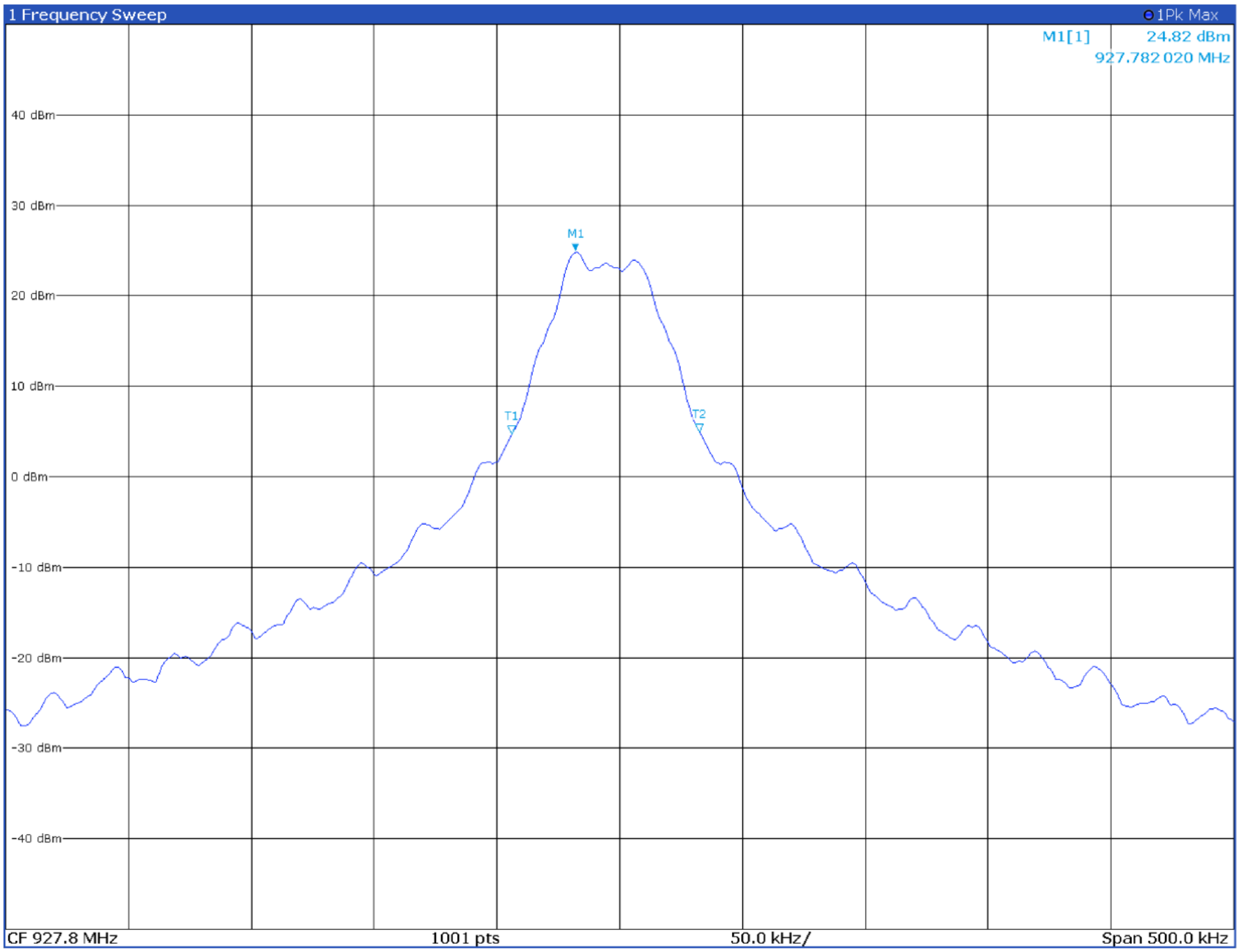
Figure 8.5-1: *20 dB bandwidth on low channel*



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**921.182 02 MHz**	**24.77 dBm**	ndB	20.0 dB
T1		1	921.155 54 MHz	4.73 dBm	ndB down BW	**77.42 kHz**
T2		1	921.232 97 MHz	4.79 dBm	Q Factor	11 898

***Figure 8.5-2:** 20 dB bandwidth on mid channel*

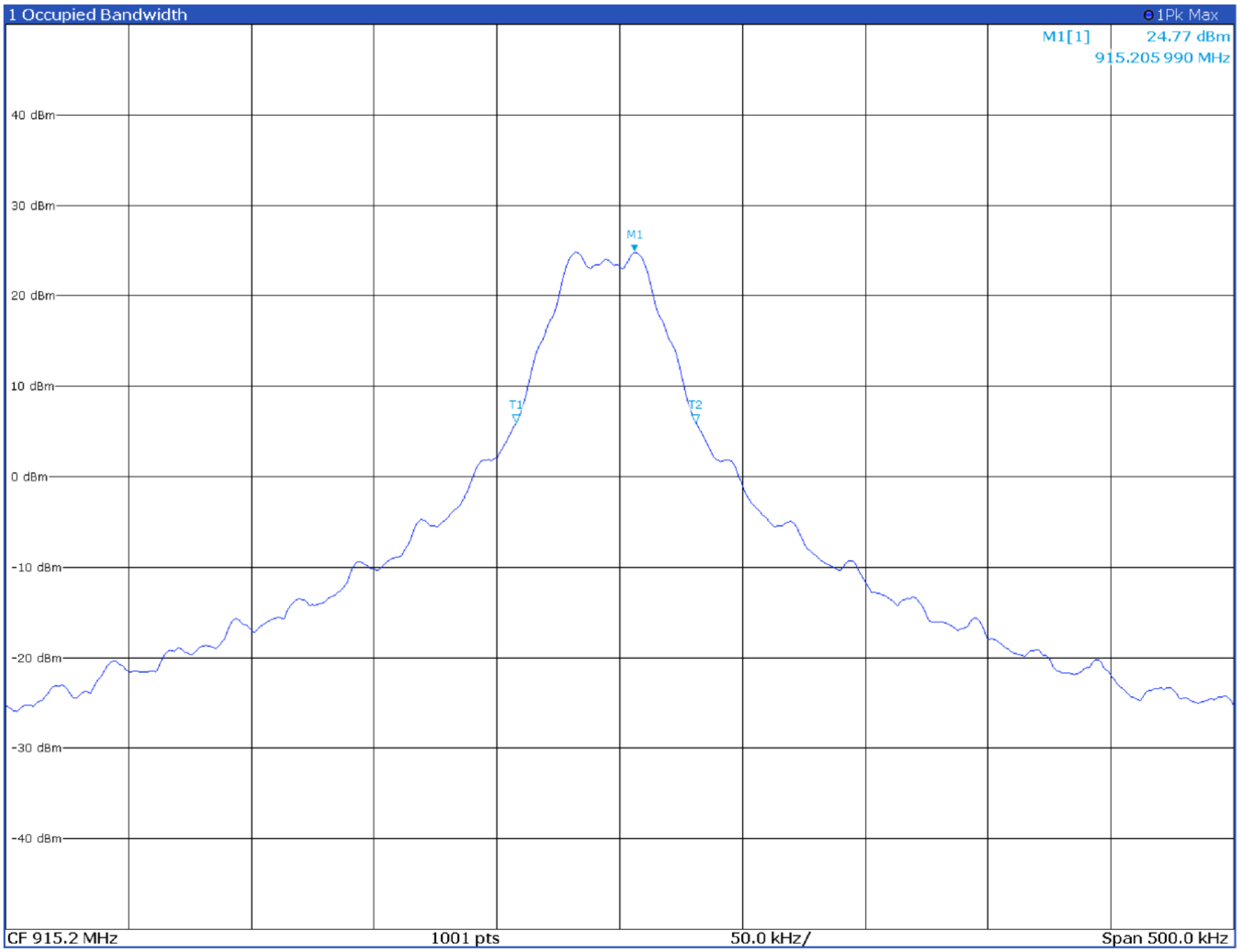


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**927.782 02 MHz**	**24.82 dBm**	ndB	20.0 dB
T1		1	927.756 04 MHz	4.69 dBm	ndB down BW	**76.42 kHz**
T2		1	927.832 47 MHz	4.95 dBm	Q Factor	12 140

Figure 8.5-3: *20 dB bandwidth on high channel*

Test data, continued

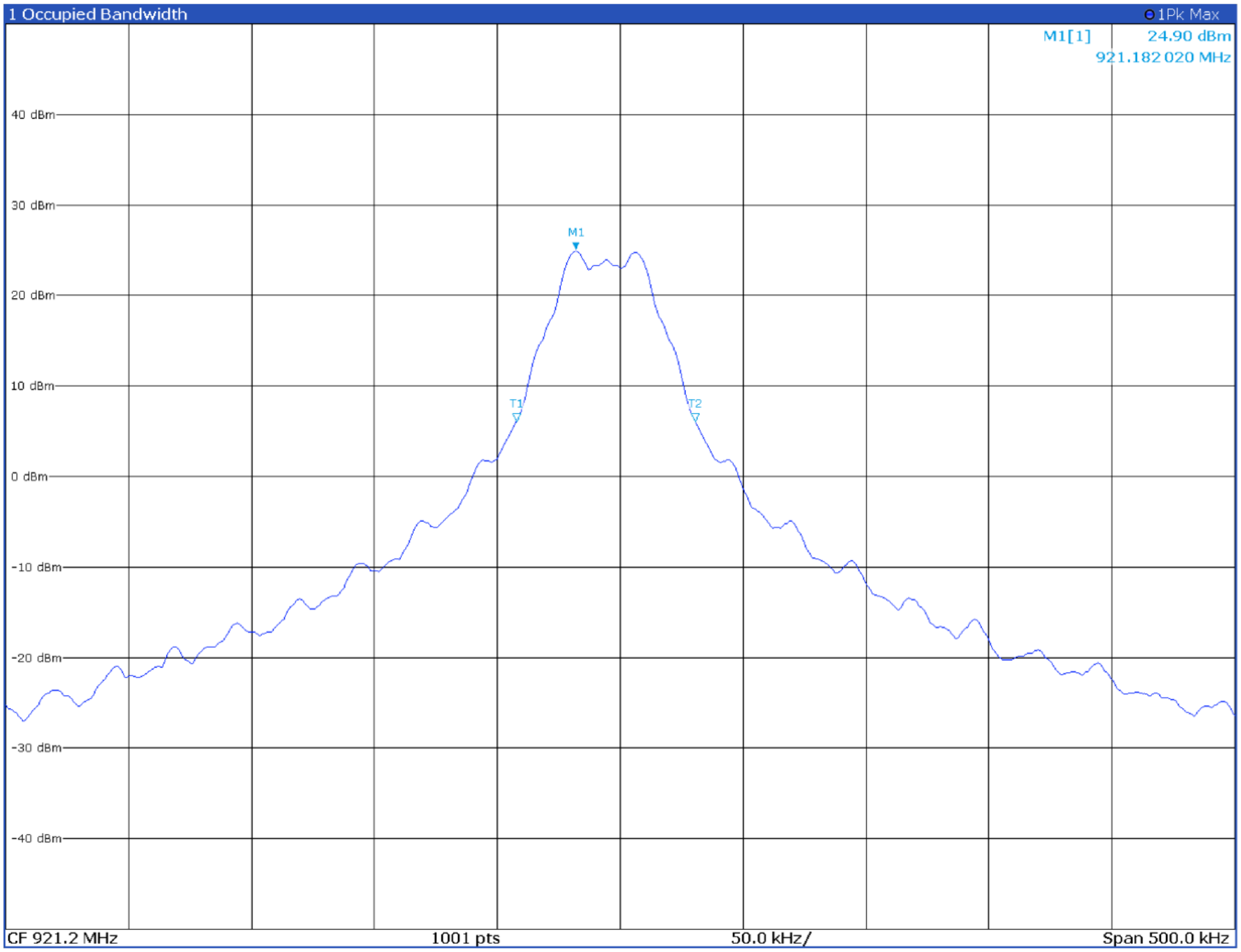


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**915.205 99 MHz**	**24.77 dBm**	Occ Bw	**73.170 329 749 kHz**
T1		1	915.157 786 MHz	5.90 dBm	Occ Bw Centroid	915.194 370 911 MHz
T2		1	915.230 956 MHz	5.97 dBm	Occ Bw Freq Offset	-5.629 088 573 kHz

Figure 8.5-4: *99% bandwidth on low channel*

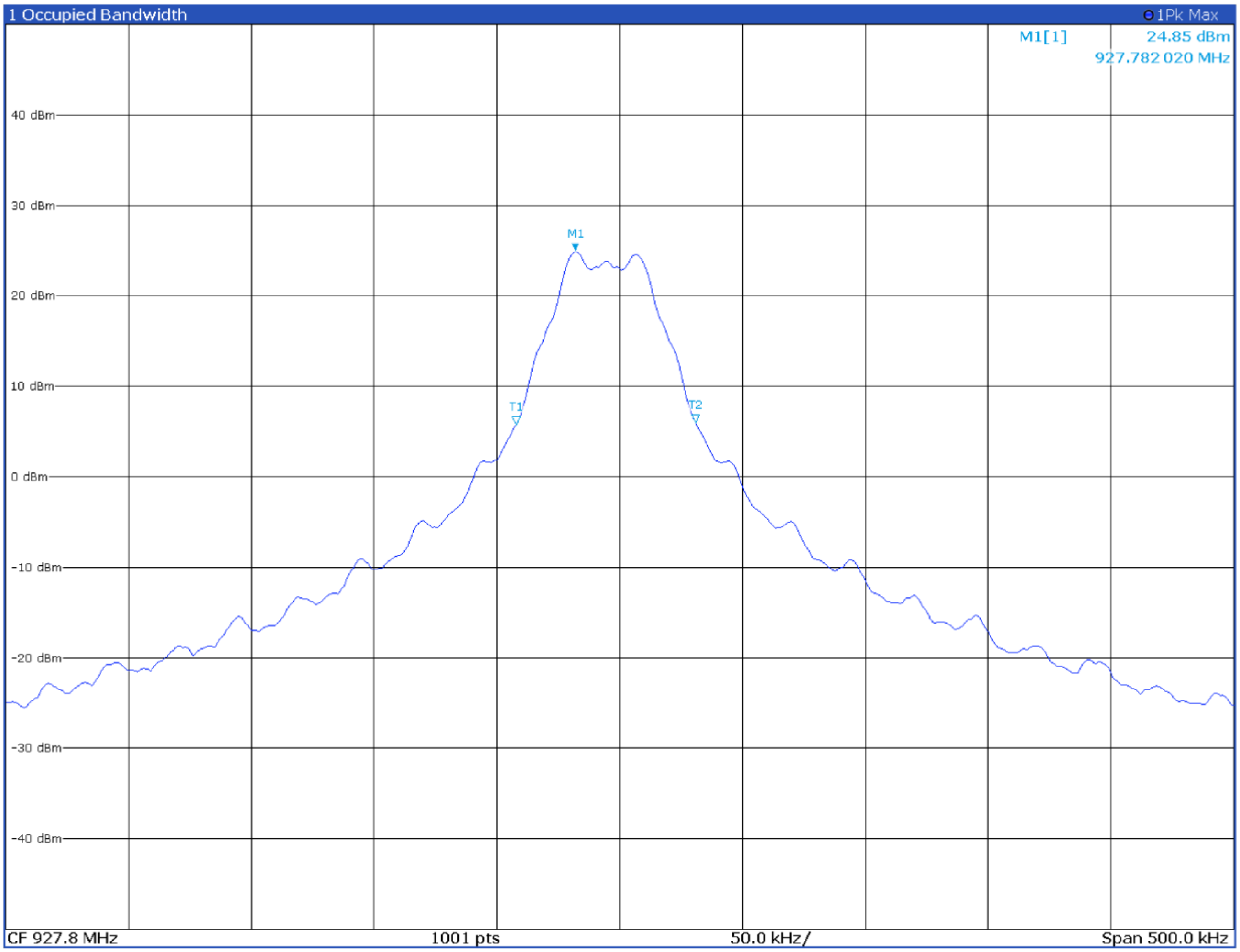
Test data, continued



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**921.182 02 MHz**	**24.90 dBm**	Occ Bw	**72.730 842 836 kHz**
T1		1	921.157 662 MHz	6.02 dBm	Occ Bw Centroid	921.194 027 563 MHz
T2		1	921.230 393 MHz	6.04 dBm	Occ Bw Freq Offset	-5.972 436 609 kHz

Figure 8.5-5: *99% bandwidth on mid channel*



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**927.782 02 MHz**	**24.85 dBm**	Occ Bw	**73.274 364 136 kHz**
T1		1	927.757 772 MHz	5.70 dBm	Occ Bw Centroid	927.794 409 5 MHz
T2		1	927.831 047 MHz	5.90 dBm	Occ Bw Freq Offset	-5.590 500 379 kHz

Figure 8.5-6: *99% bandwidth on high channel*

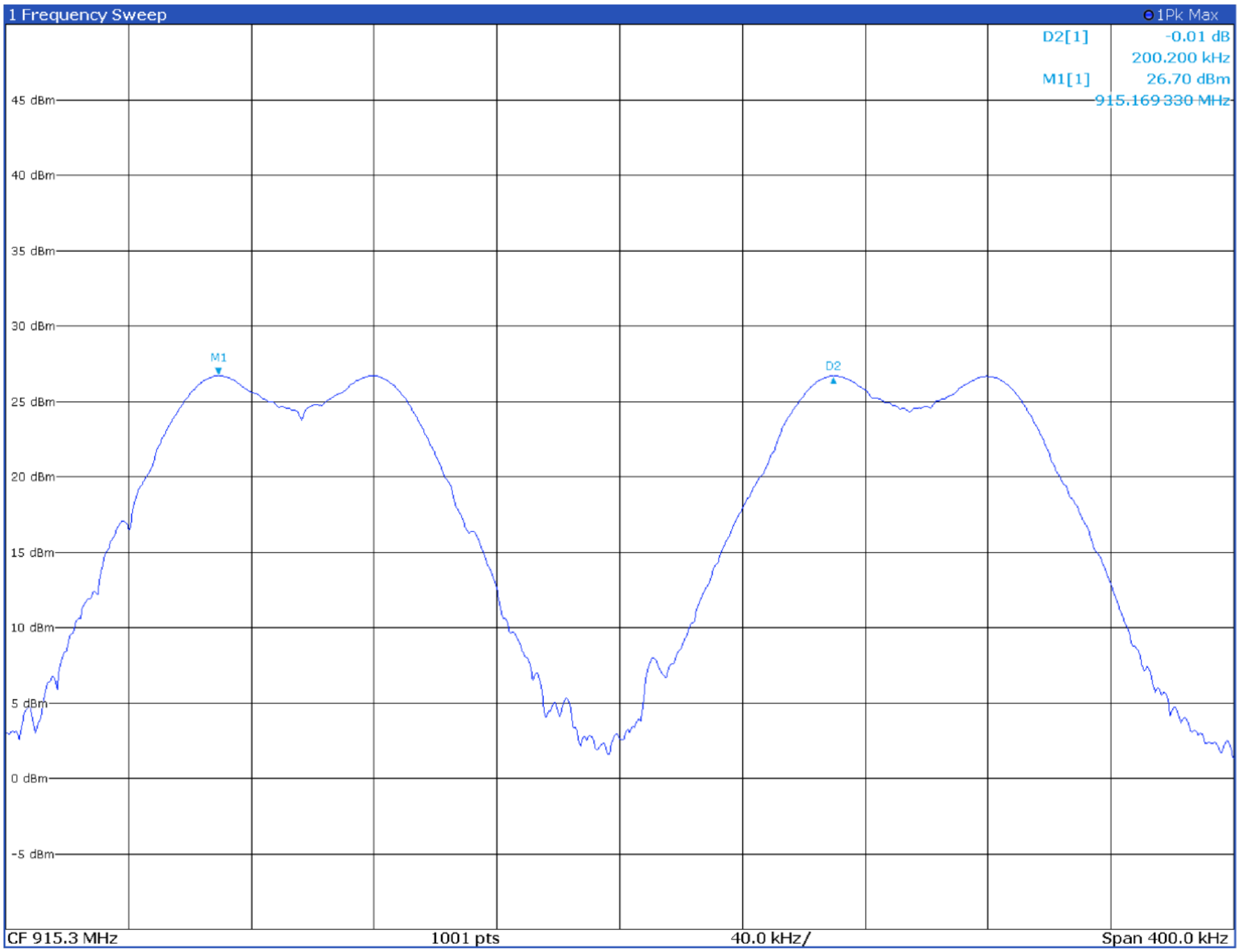


Figure 8.5-7: *Carrier frequency separation*

Test data, continued

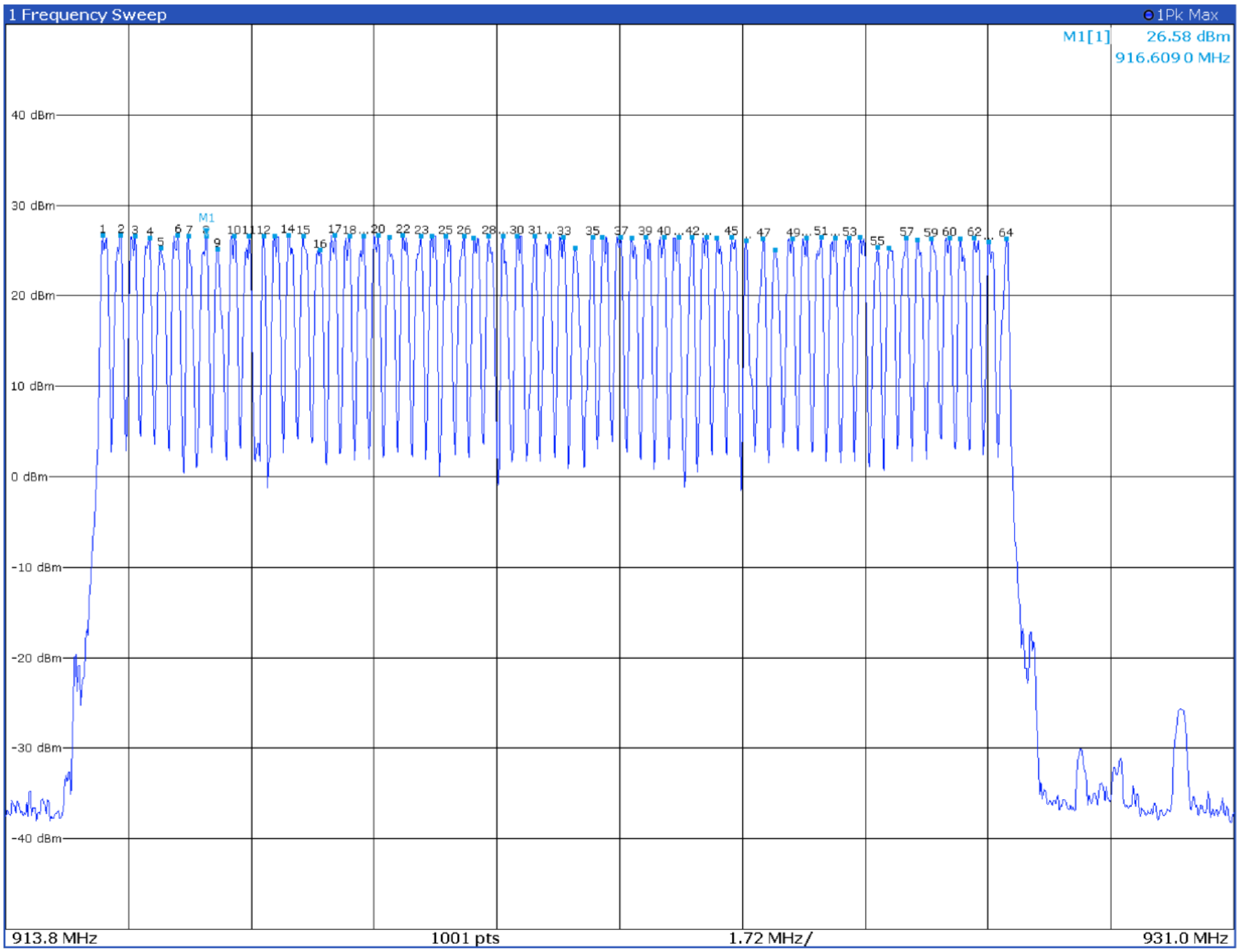


Figure 8.5-8: *Number of hopping channels*

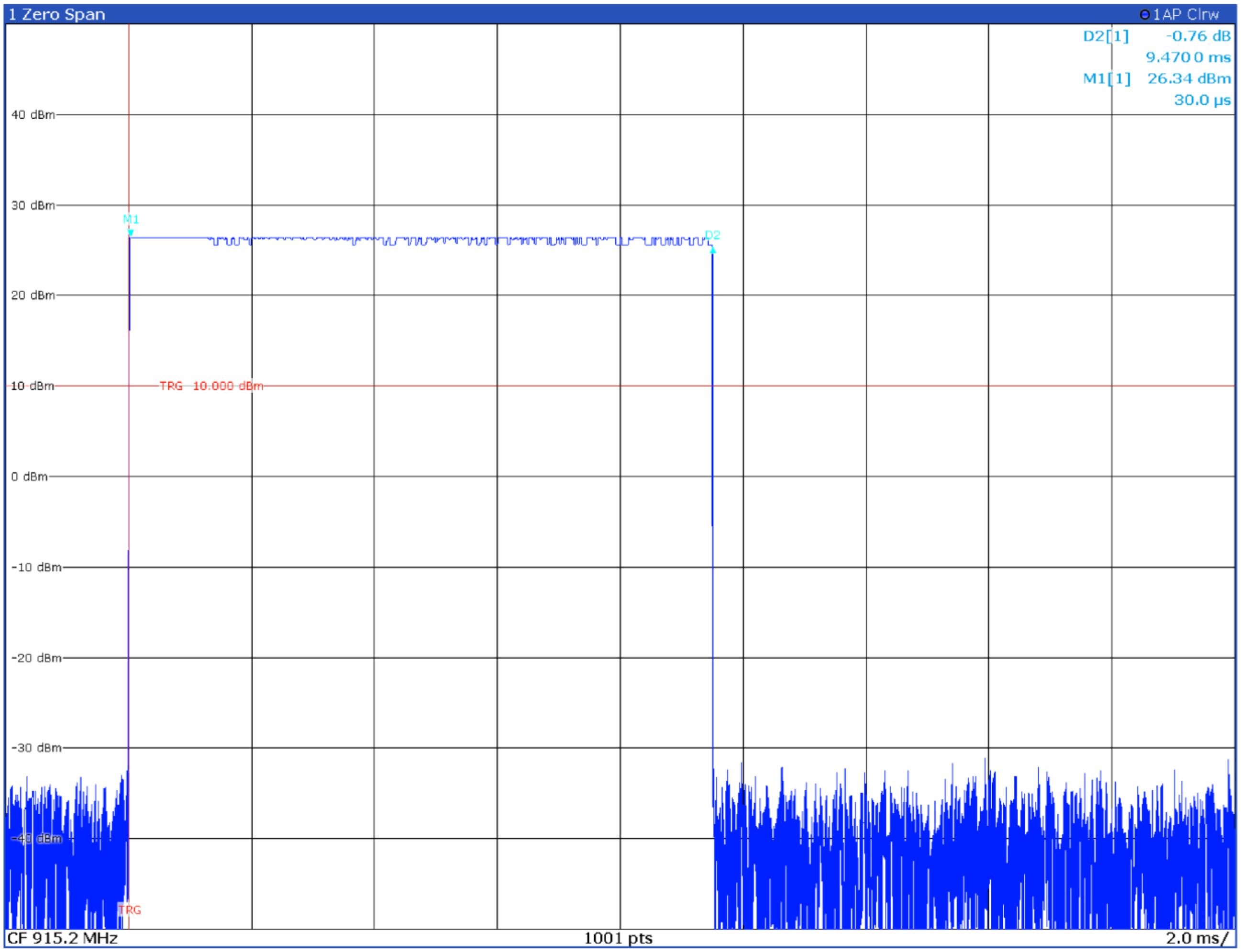


Figure 8.5-9: *Dwell time*

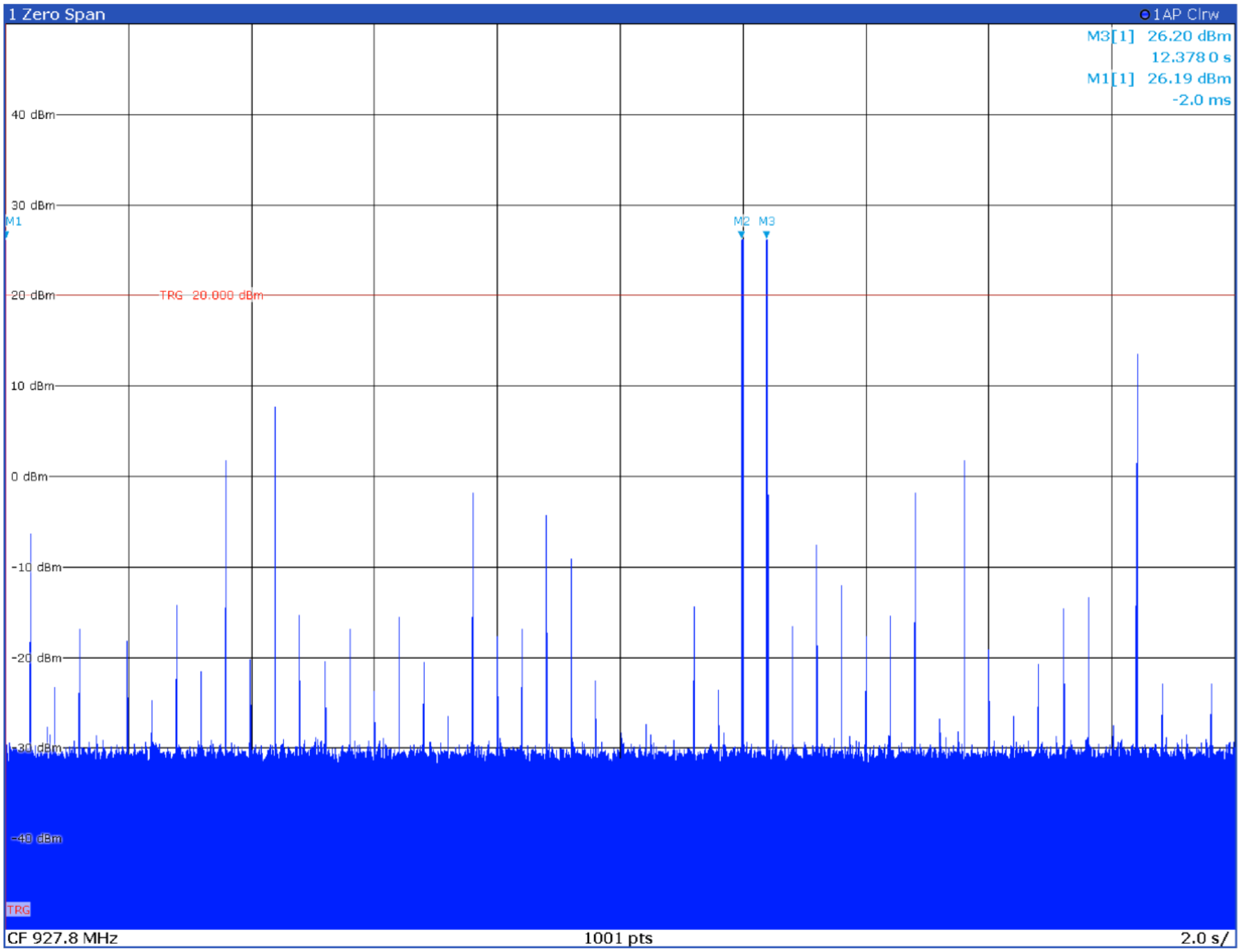


Figure 8.5-10: *Number of pulses*

8.6 Transmitter output power and e.i.r.p. requirements for FHSS 900 MHz

8.6.1 References, definitions and limits

FCC §15.247:

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(2) For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.6.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	September 23, 2024

8.6.3 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
Cable set	Rosenberger	ST.ALO-02	1.650

8.6.4 Observations, settings and special notes

Conducted output power was tested per ANSI C63.10 subclause 7.8.5. The hopping shall be disabled for this test. Spectrum analyser settings:

Resolution bandwidth	> 20 dB bandwidth of the emission being measured
Video bandwidth	≥ RBW
Frequency span	approximately 5 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

8.6.5 Test data

Table 8.6-1: *Output power and EIRP results*

Frequency, MHz	Output power, dBm	Output power limit, dBm	Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
915.2	25.4	30.00	-4.6	1.70	27.1	36.00	-8.9
921.2	25.3	30.00	-4.7	1.43	26.7	36.00	-9.3
927.8	25.0	30.00	-5.0	0.96	26.0	36.00	-10.0

Notes: EIRP = Output power + Antenna gain

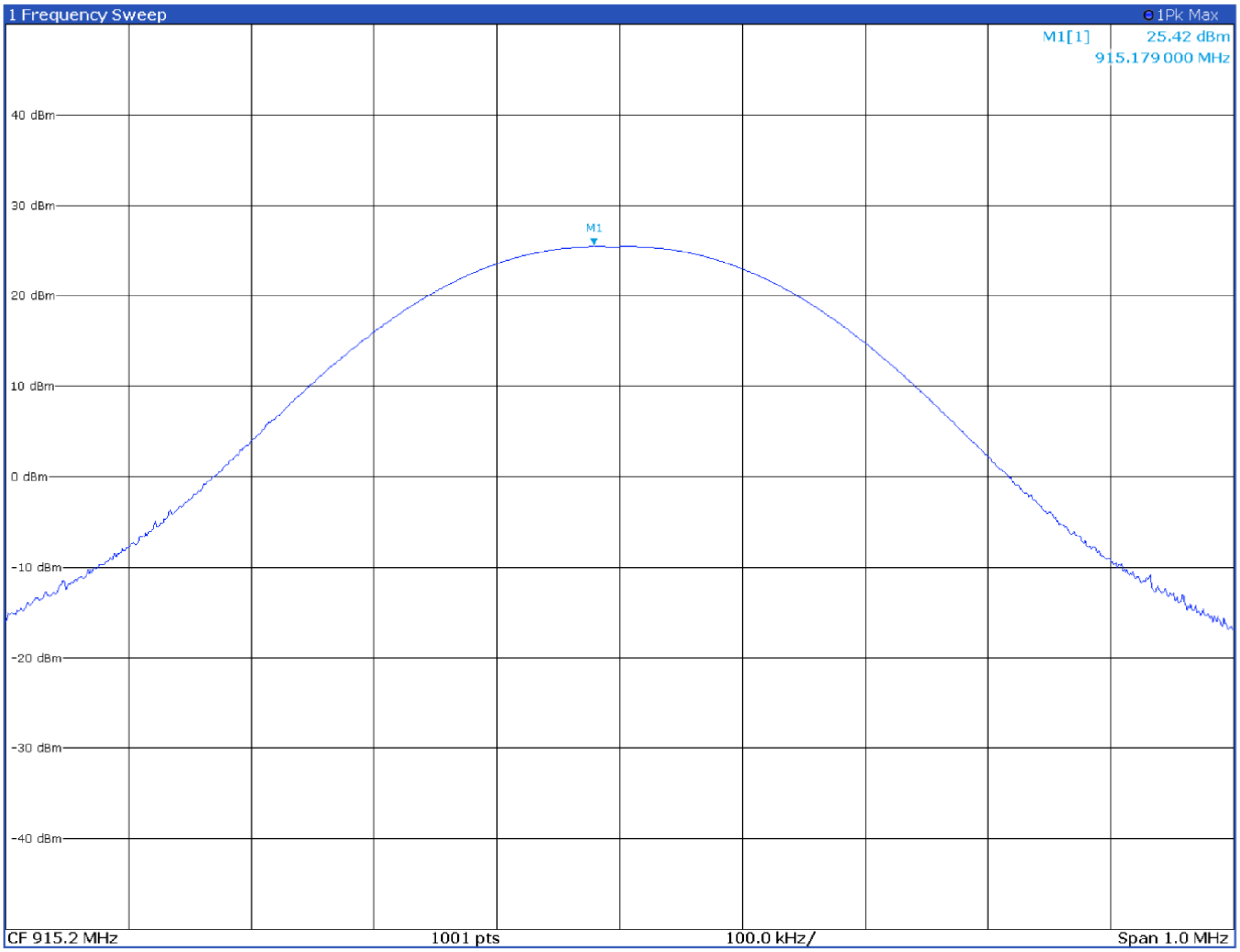


Figure 8.6-1: *Output power on low channel*

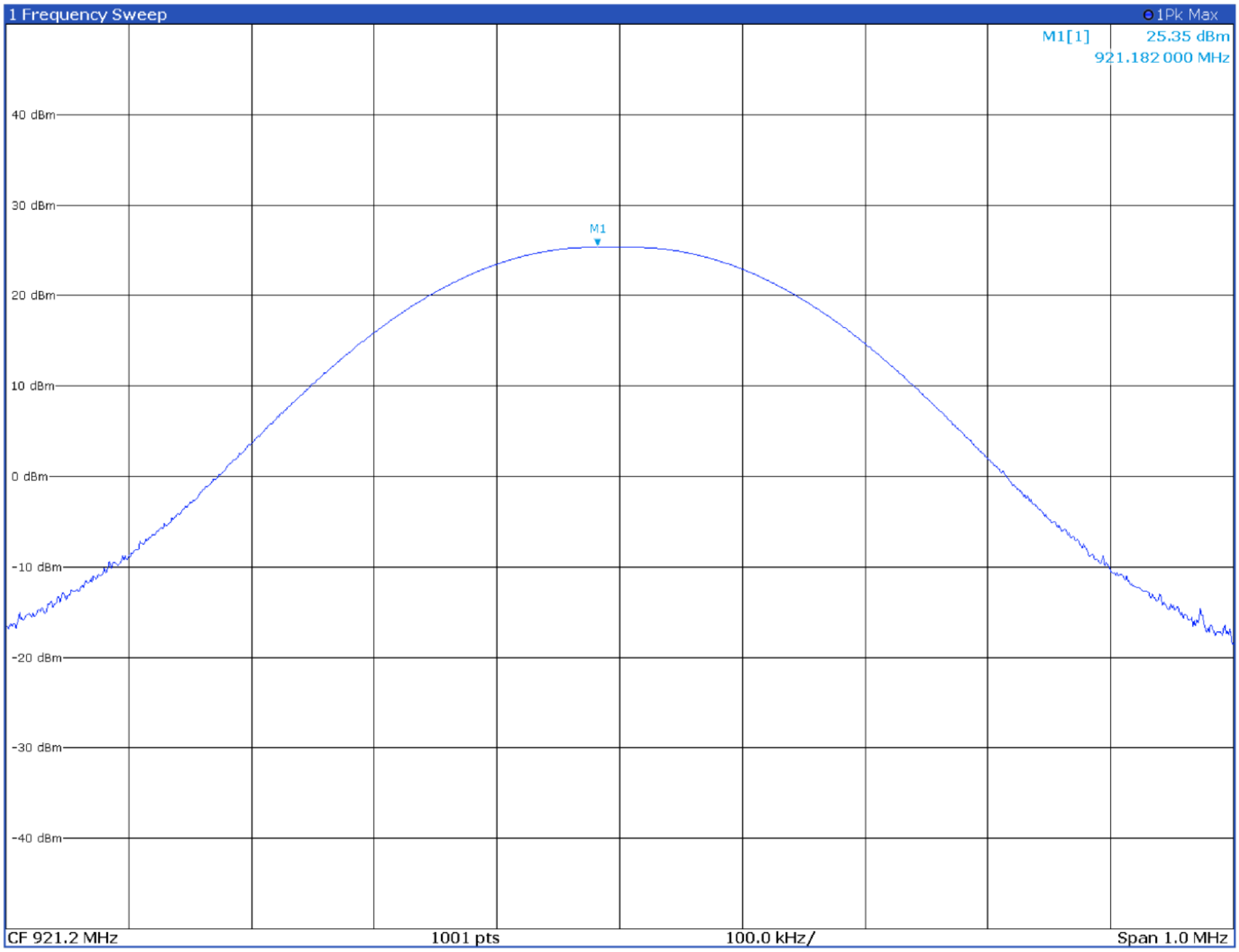


Figure 8.6-2: *Output power on mid channel*

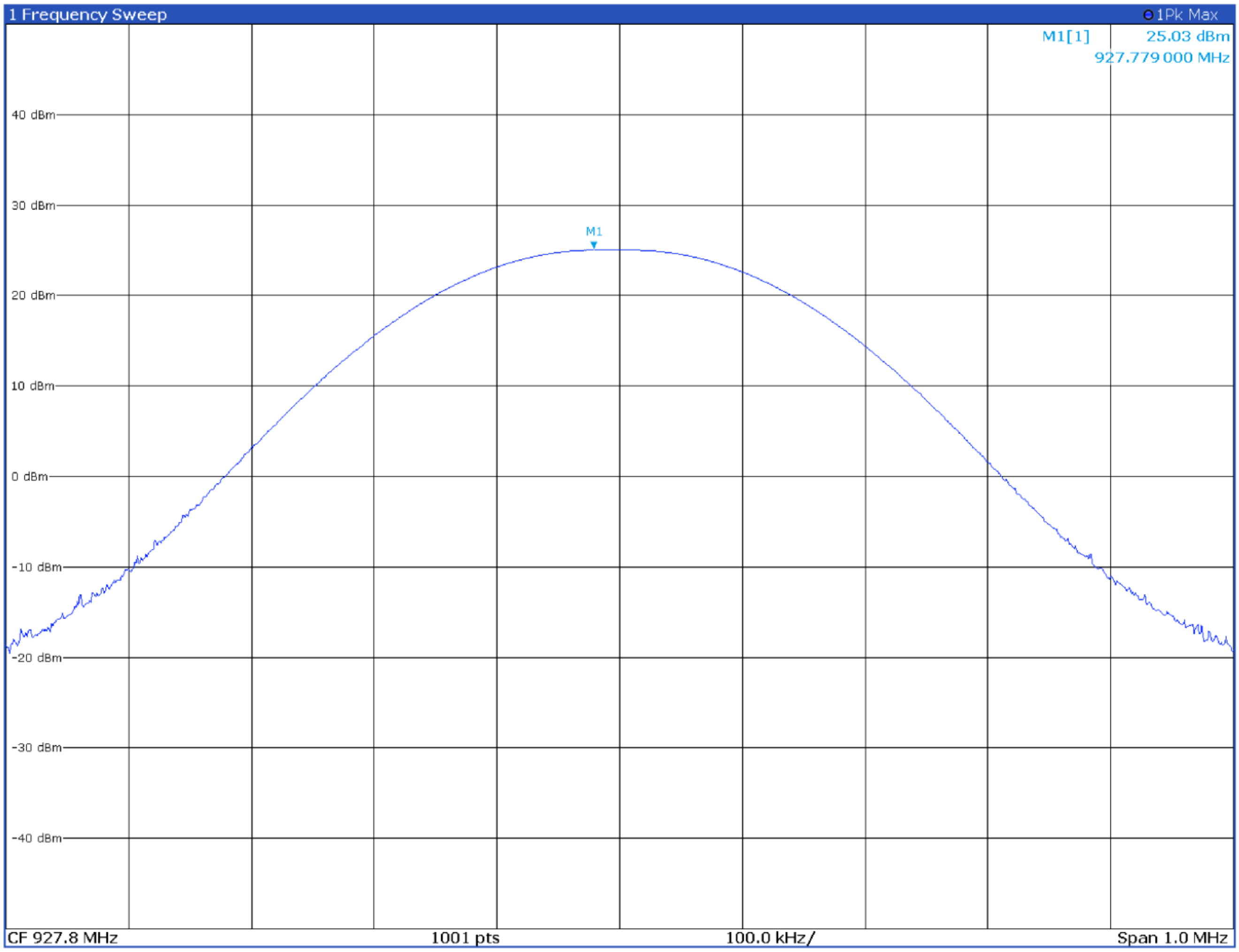


Figure 8.6-3: *Output power on high channel*

8.7 Spurious (out-of-band) unwanted emissions

8.7.1 References, definitions and limits

FCC §15.247:

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

Table 8.7-1: *FCC §15.209– Radiated emission limits*

	Field strength of emissions		
Frequency, MHz	**μV/m**	**dBμV/m**	**Measurement distance, m**
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	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.

Table 8.7-2: *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			

8.7.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	September 20, 2024

8.7.3 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
EMI Receiver	Rohde & Schwarz	ESW44	101620
EMI Receiver	Rohde & Schwarz	ESU8	100202
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STLP 9148-152
Broadband Amplifier	Schwarzbeck Mess-Elektronik	BBV9718C	00121
Controller	Maturo	FCU3.0	10041
Tilt antenna mast	Maturo	TAM4.0-E	10042
Turntable	Maturo	TT4.0-5T	2.527
3m Semi anechoic chamber	Comtest	SAC-3	1711-150
Software turntable and mast	Maturo	mcApp	8.1.0.5410
Cable set	Rosenberger and Huber + Suhner	RE01+RE02	1.654+1.655
10m Semi anechoic chamber	Comtest	SAC-10	530
Cable set	Rosenberger+Huber-Suhner	RE03+RE04	1.510+1.511
Cable set	Rosenberger+Huber-Suhner	RE04+RE05	1.511+1.512
Cable set	Rosenberger+Huber+Suhner	CE01+CE02	1.498+1.632
Cable set	Rosenberger	ST.ALO-02	1.650
LISN	Rohde & Schwarz	ENV432	101714
Attenuator	Aeroflex / Weinschel	2	CC8577

8.7.4 Observations, settings and special notes

- As part of the current assessment, the test range of 9 kHz to 10th harmonic has been fully considered and compared to the actual frequencies utilized within the EUT. Since the EUT contains a transmitter in the 900 MHz range, the EUT has been deemed compliant without formal testing in the 9 kHz to 30 MHz test range, therefore formal test results (tabular data and/or plots) are not provided within this test report.
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3 m.
- Since fundamental power was tested using the maximum peak conducted output power procedure to demonstrate compliance, the spurious emissions limit is −20 dBc/100 kHz.

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for conducted spurious emissions measurements:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.7.5 Test data

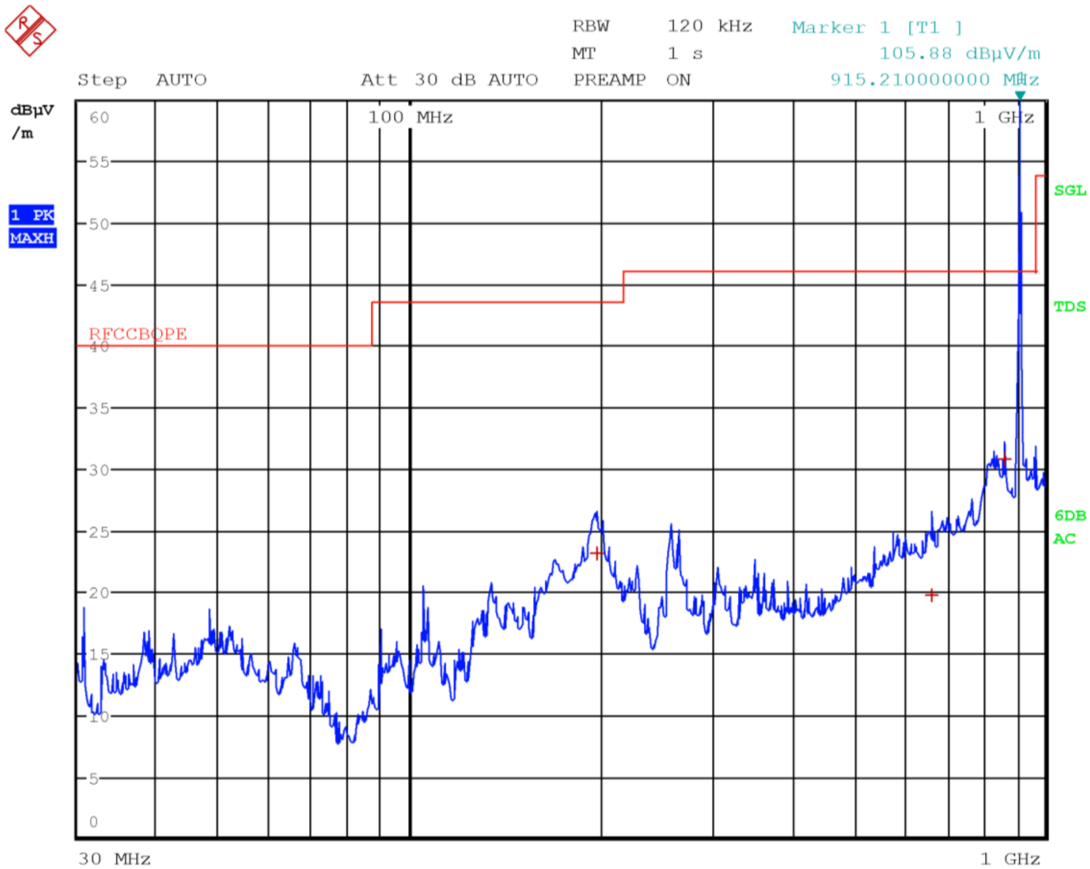


Figure 8.7-1: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
196.5600	23.2	43.5	-20.3	QP
663.2700	19.8	46.0	-26.2	QP
865.2000	30.9	46.0	-15.1	QP
915.2100	105.2	--	--	QP

Limit exceeded by the carrier

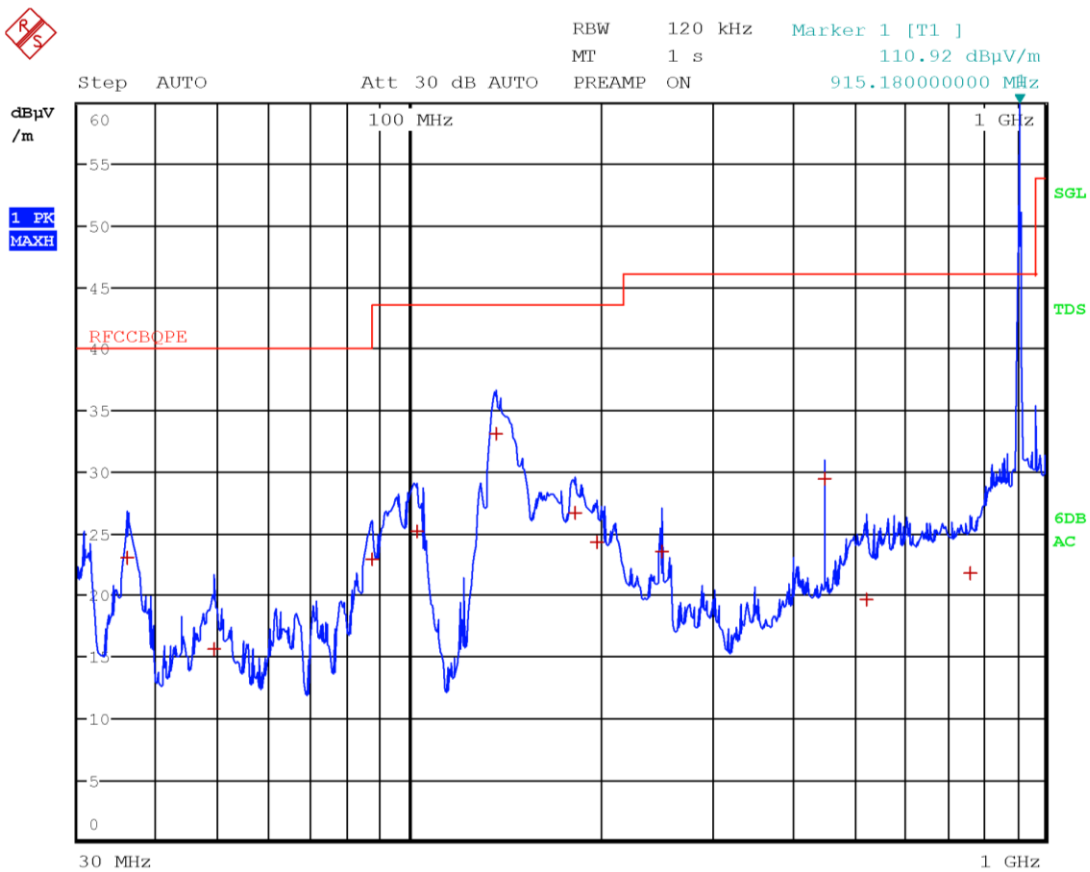


Figure 8.7-2: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
35.9700	23.1	40.0	-16.9	QP
49.0800	15.7	40.0	-24.3	QP
87.2700	23.0	40.0	-17.0	QP
102.5700	25.1	43.5	-18.4	QP
136.5300	33.2	43.5	-10.3	QP
181.6800	26.7	43.5	-16.8	QP
196.5300	24.3	43.5	-19.2	QP
249.9900	23.5	46.0	-22.5	QP
450.0000	29.4	46.0	-16.6	QP
522.9600	19.6	46.0	-26.4	QP
763.5300	21.7	46.0	-24.3	QP
915.1800	111.1	--	--	QP

Limit exceeded by the carrier

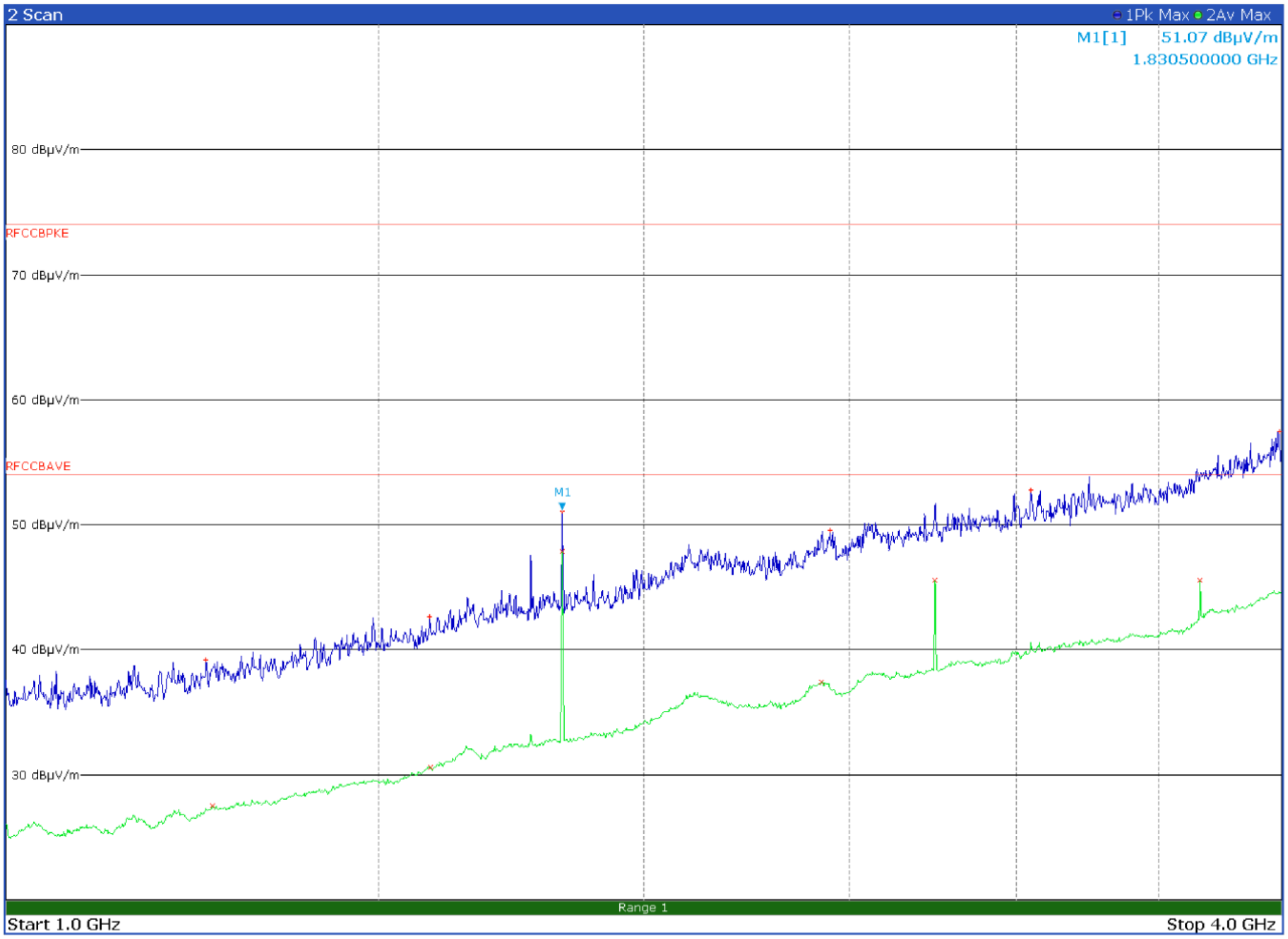


Figure 8.7-3: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1242.7500	39.2	74.0	-34.8	Pk
1251.0000	27.5	54.0	-26.5	Av
1585.0000	42.7	74.0	-31.3	Pk
1585.7500	30.7	54.0	-23.3	Av
1830.5000	51.1	74.0	-22.9	Pk
1830.5000	47.9	54.0	-6.1	Av
2426.2500	37.5	54.0	-16.5	Av
2448.2500	49.6	74.0	-24.4	Pk
2745.5000	45.6	54.0	-8.4	Av
3046.7500	52.8	74.0	-21.2	Pk
3660.7500	45.6	54.0	-8.4	Av
3991.0000	57.5	74.0	-16.5	Pk

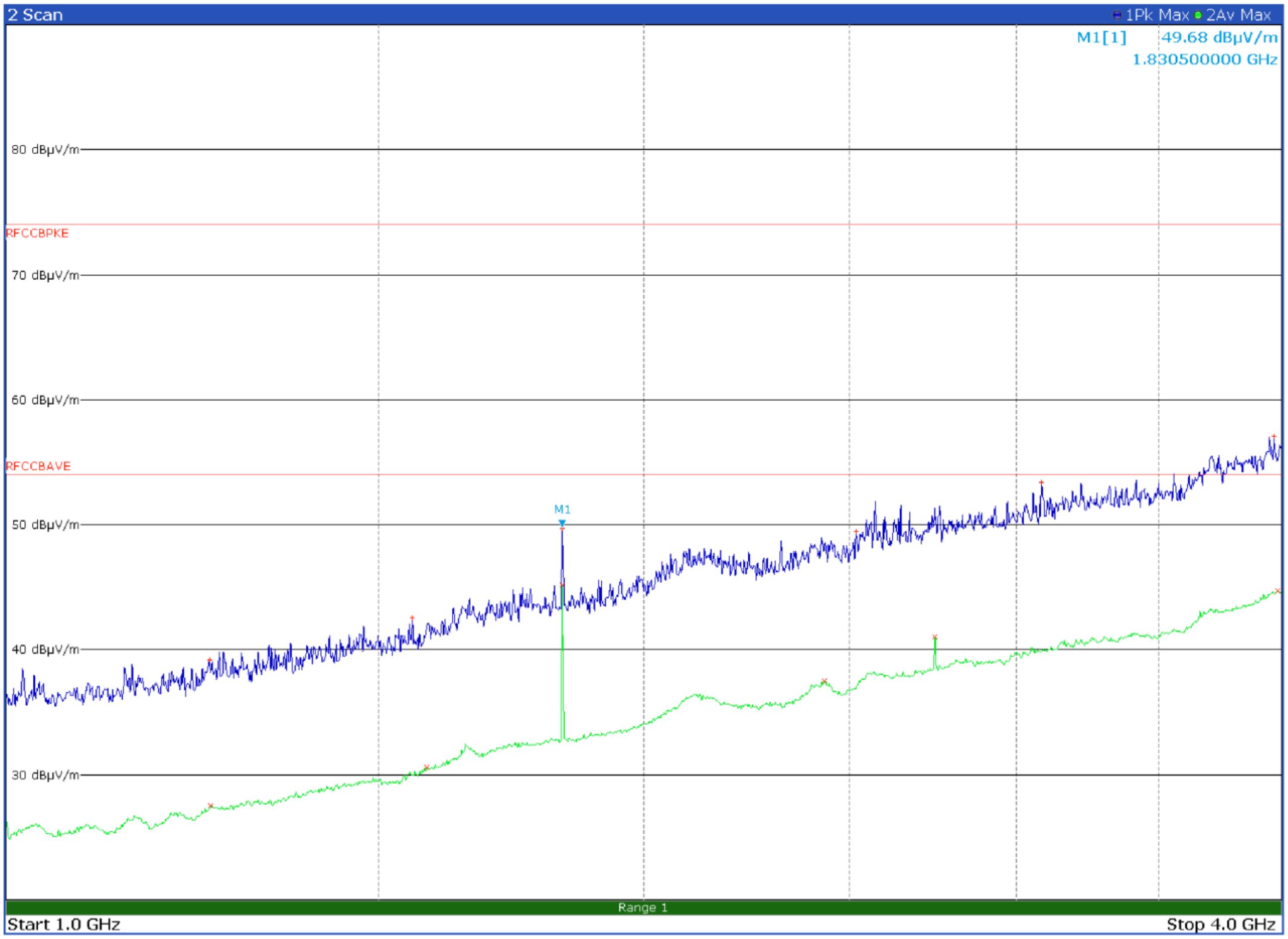


Figure 8.7-4: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1247.2500	39.2	74.0	-34.8	Pk
1249.0000	27.5	54.0	-26.5	Av
1555.5000	42.6	74.0	-31.4	Pk
1580.5000	30.6	54.0	-23.4	Av
1830.5000	49.7	74.0	-24.3	Pk
1830.5000	45.2	54.0	-8.8	Av
2433.5000	37.5	54.0	-16.5	Av
2518.5000	49.5	74.0	-24.5	Pk
2745.5000	41.1	54.0	-12.9	Av
3081.2500	53.5	74.0	-20.5	Pk
3966.2500	57.1	74.0	-16.9	Pk
3983.5000	44.8	54.0	-9.2	Av

Test data, continued

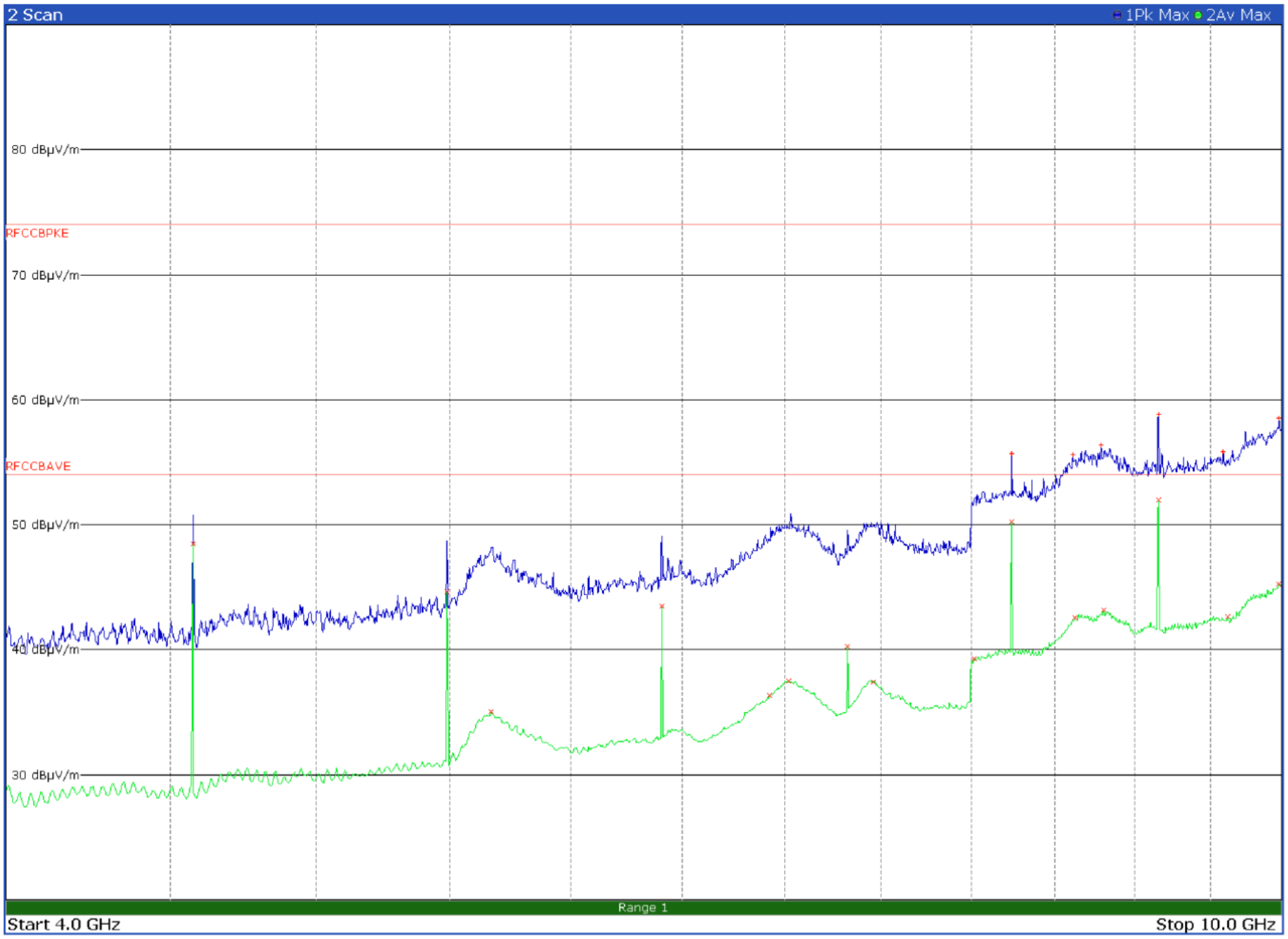


Figure 8.7-5: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4576.0000	48.5	54.0	-5.5	Av
5491.2500	44.7	54.0	-9.3	Av
5666.5000	35.1	54.0	-18.9	Av
6406.5000	43.5	54.0	-10.5	Av
6923.2500	36.4	54.0	-17.6	Av
7017.2500	37.5	54.0	-16.5	Av
7321.5000	40.3	54.0	-13.7	Av
7460.7500	37.4	54.0	-16.6	Av
8020.5000	39.3	54.0	-14.7	Av
8236.7500	55.7	74.0	-18.3	Pk
8236.7500	50.3	54.0	-3.7	Av
8607.5000	55.6	74.0	-18.4	Pk
8622.7500	42.6	54.0	-11.4	Av
8785.0000	56.4	74.0	-17.6	Pk
8800.7500	43.2	54.0	-10.8	Av
9151.7500	58.9	74.0	-15.1	Pk
9152.0000	51.8	54.0	-2.2	Av
9590.0000	55.9	74.0	-18.1	Pk
9620.5000	42.7	54.0	-11.3	Av
9980.5000	45.3	54.0	-8.7	Av
9981.2500	58.6	74.0	-15.4	Pk

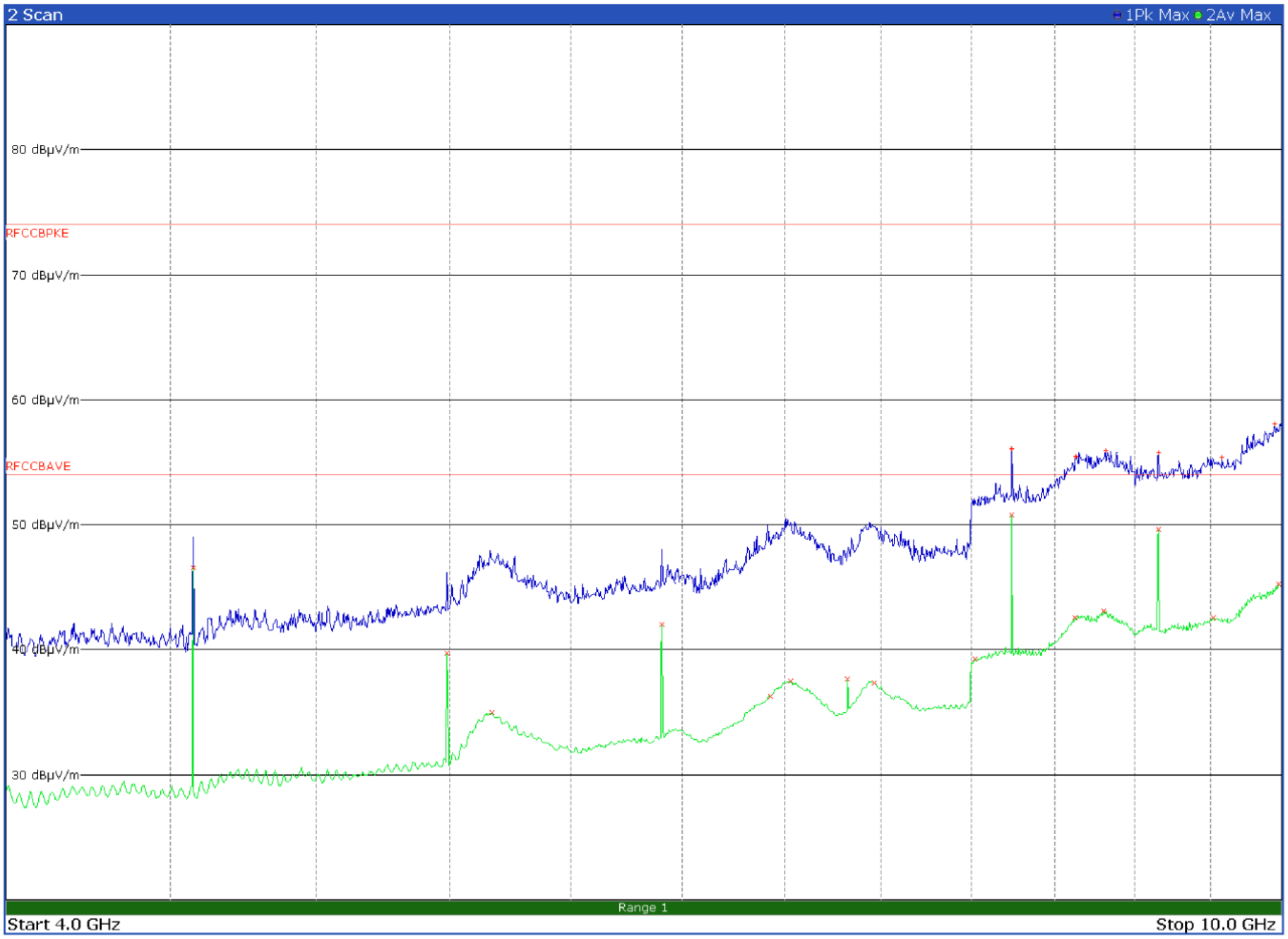


Figure 8.7-6: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4576.0000	46.6	54.0	-7.4	Av
5491.2500	39.8	54.0	-14.2	Av
5672.5000	35.0	54.0	-19.0	Av
6406.2500	42.1	54.0	-11.9	Av
6927.7500	36.3	54.0	-17.7	Av
7030.0000	37.6	54.0	-16.4	Av
7321.5000	37.7	54.0	-16.3	Av
7463.7500	37.4	54.0	-16.6	Av
8022.7500	39.3	54.0	-14.7	Av
8236.7500	50.8	54.0	-3.2	Av
8237.0000	56.1	74.0	-17.9	Pk
8620.2500	42.6	54.0	-11.4	Av
8624.7500	55.5	74.0	-18.5	Pk
8801.7500	43.2	54.0	-10.8	Av
8812.2500	55.9	74.0	-18.1	Pk
9152.0000	55.8	74.0	-18.2	Pk
9152.0000	49.7	54.0	-4.3	Av
9523.0000	42.6	54.0	-11.4	Av
9582.5000	55.4	74.0	-18.6	Pk
9952.7500	58.1	74.0	-15.9	Pk
9980.2500	45.3	54.0	-8.7	Av

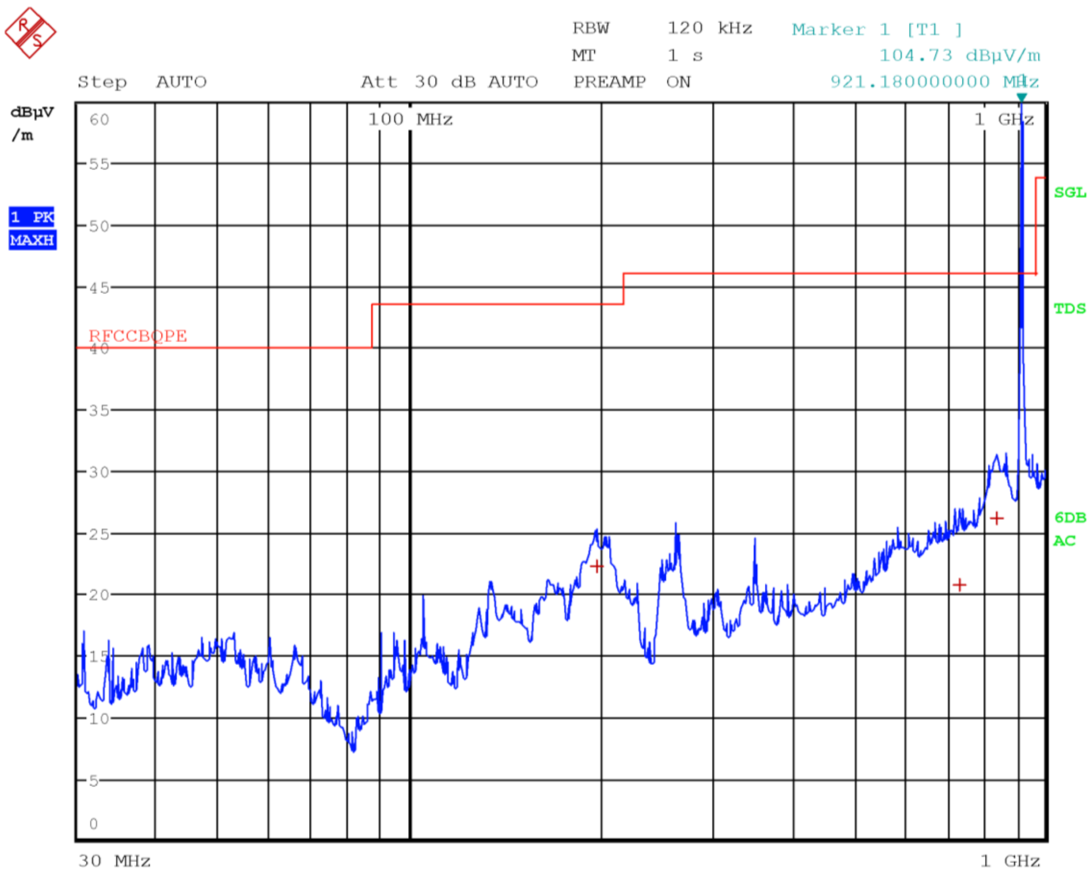


Figure 8.7-7: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
197.4000	22.3	43.5	-21.2	QP
734.8800	20.8	46.0	-25.2	QP
838.4700	26.2	46.0	-19.8	QP
921.1800	104.2	--	--	QP

Limit exceeded by the carrier

Test data, continued

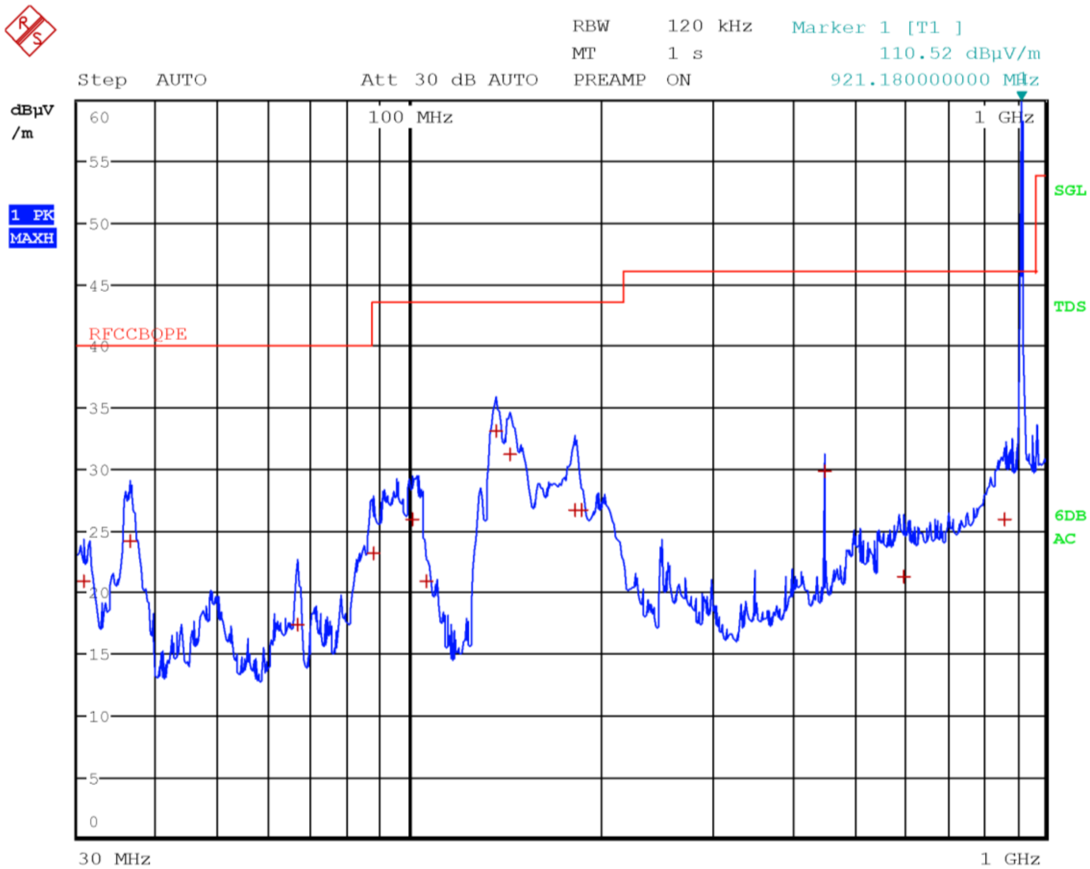


Figure 8.7-8: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.6600	20.9	40.0	-19.1	QP
36.3000	24.2	40.0	-15.8	QP
66.5100	17.4	40.0	-22.6	QP
87.6600	23.2	40.0	-16.8	QP
101.1900	26.0	43.5	-17.5	QP
136.8000	33.1	43.5	-10.4	QP
143.7900	31.3	43.5	-12.2	QP
182.4000	26.7	43.5	-16.8	QP
186.2700	26.7	43.5	-16.8	QP
450.0000	29.9	46.0	-16.1	QP
600.9600	21.3	46.0	-24.7	QP
864.8400	26.0	46.0	-20.0	QP
921.1800	110.4	--	--	QP

Limit exceeded by the carrier

Test data, continued

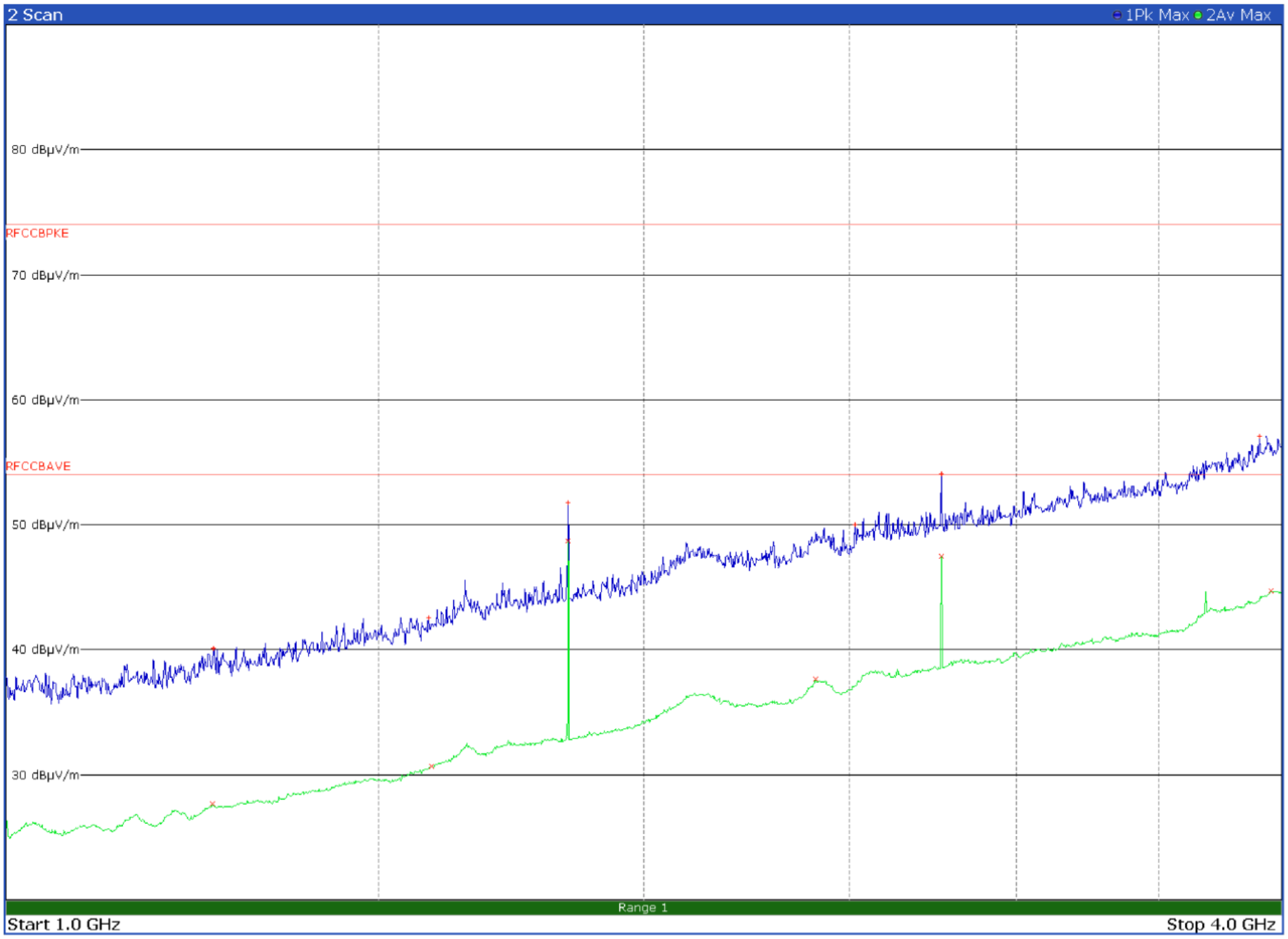


Figure 8.7-9: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1251.2500	27.7	54.0	-26.3	Av
1253.5000	40.2	74.0	-33.8	Pk
1582.5000	42.6	74.0	-31.4	Pk
1587.2500	30.7	54.0	-23.3	Av
1842.2500	51.8	74.0	-22.2	Pk
1842.5000	48.7	54.0	-5.3	Av
2410.0000	37.7	54.0	-16.3	Av
2516.0000	50.1	74.0	-23.9	Pk
2763.5000	54.1	74.0	-19.9	Pk
2763.5000	47.5	54.0	-6.5	Av
3905.2500	57.1	74.0	-16.9	Pk
3953.5000	44.7	54.0	-9.3	Av

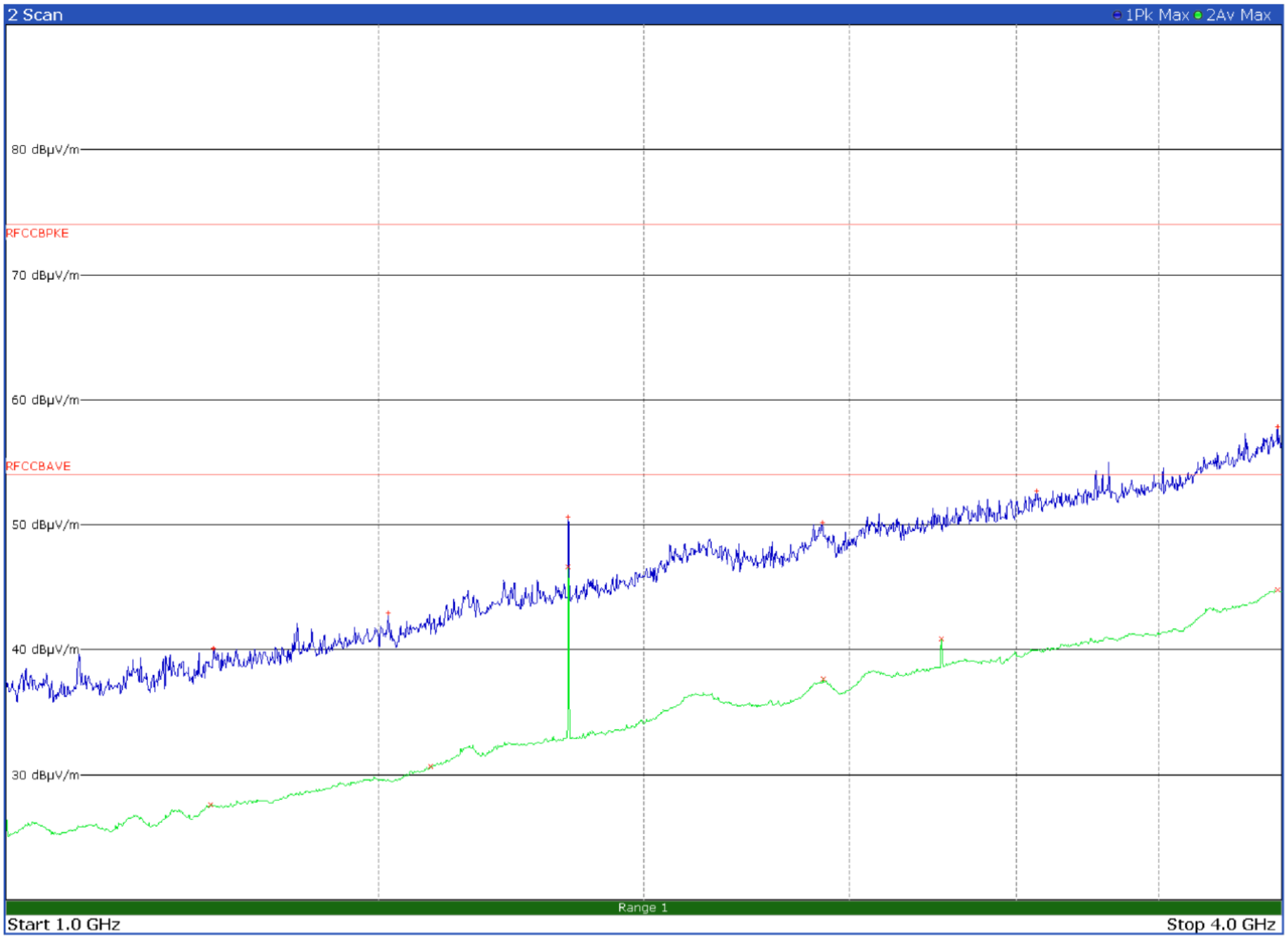


Figure 8.7-10: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1249.2500	27.6	54.0	-26.4	Av
1253.5000	40.1	74.0	-33.9	Pk
1515.2500	43.0	74.0	-31.0	Pk
1586.0000	30.7	54.0	-23.3	Av
1842.5000	50.7	74.0	-23.3	Pk
1842.5000	46.7	54.0	-7.3	Av
2427.5000	50.2	74.0	-23.8	Pk
2430.0000	37.7	54.0	-16.3	Av
2763.5000	41.0	54.0	-13.0	Av
3064.5000	52.8	74.0	-21.2	Pk
3982.0000	57.9	74.0	-16.1	Pk
3984.5000	44.8	54.0	-9.2	Av

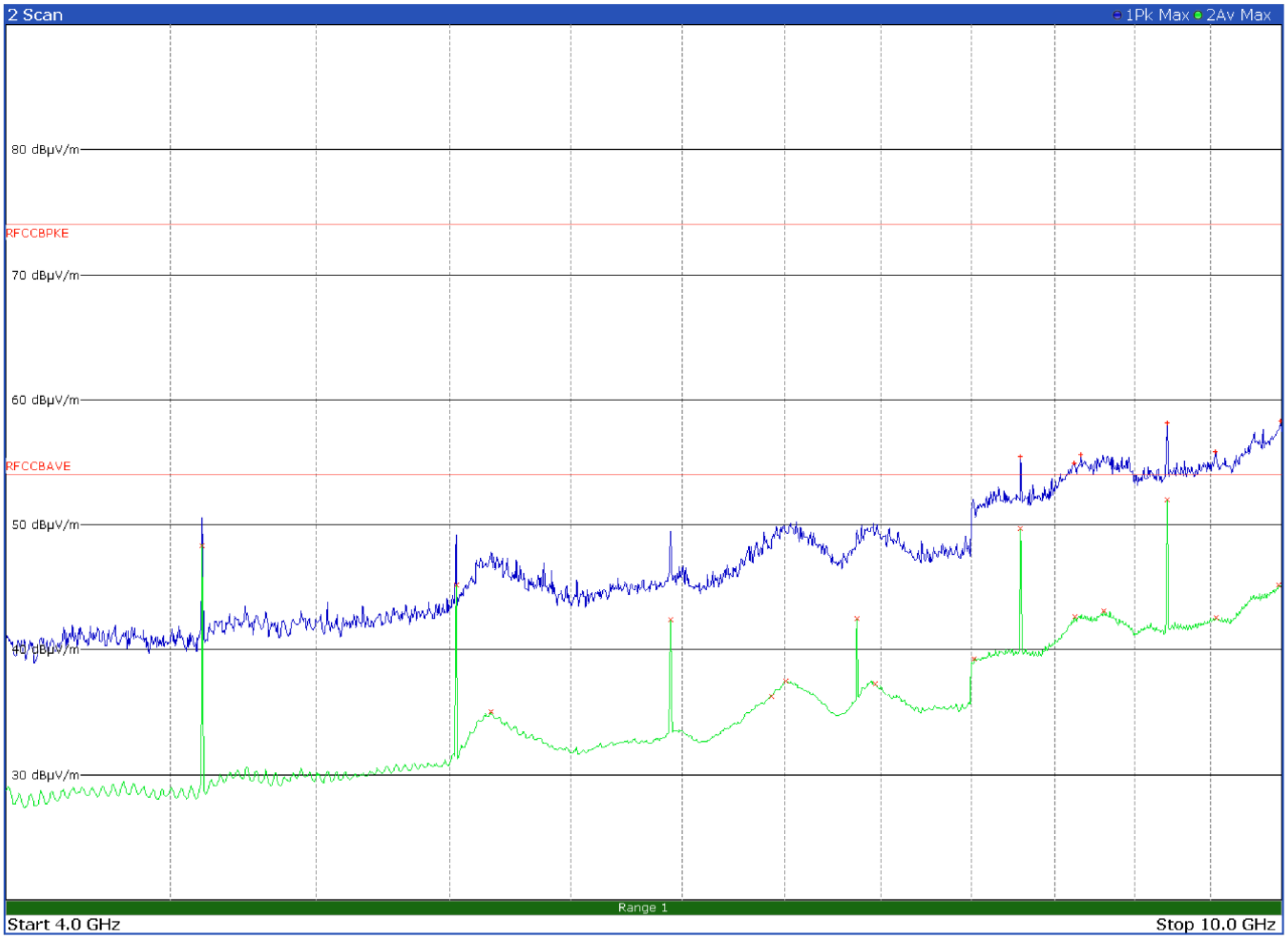


Figure 8.7-11: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4606.0000	48.4	54.0	-5.6	Av
5527.2500	45.2	54.0	-8.8	Av
5666.5000	35.1	54.0	-18.9	Av
6448.2500	42.5	54.0	-11.5	Av
6930.7500	36.3	54.0	-17.7	Av
7002.7500	37.5	54.0	-16.5	Av
7369.5000	42.6	54.0	-11.4	Av
7471.2500	37.3	54.0	-16.7	Av
8021.0000	39.3	54.0	-14.7	Av
8290.5000	55.5	74.0	-18.5	Pk
8290.7500	49.8	54.0	-4.2	Av
8617.2500	55.0	74.0	-19.0	Pk
8620.2500	42.7	54.0	-11.3	Av
8658.0000	55.6	74.0	-18.4	Pk
8801.5000	43.1	54.0	-10.9	Av
9211.7500	58.2	74.0	-15.8	Pk
9212.0000	52.1	54.0	-1.9	Av
9538.2500	55.9	74.0	-18.1	Pk
9540.2500	42.6	54.0	-11.4	Av
9981.0000	45.2	54.0	-8.8	Av
9993.2500	58.4	74.0	-15.6	Pk

Test data, continued

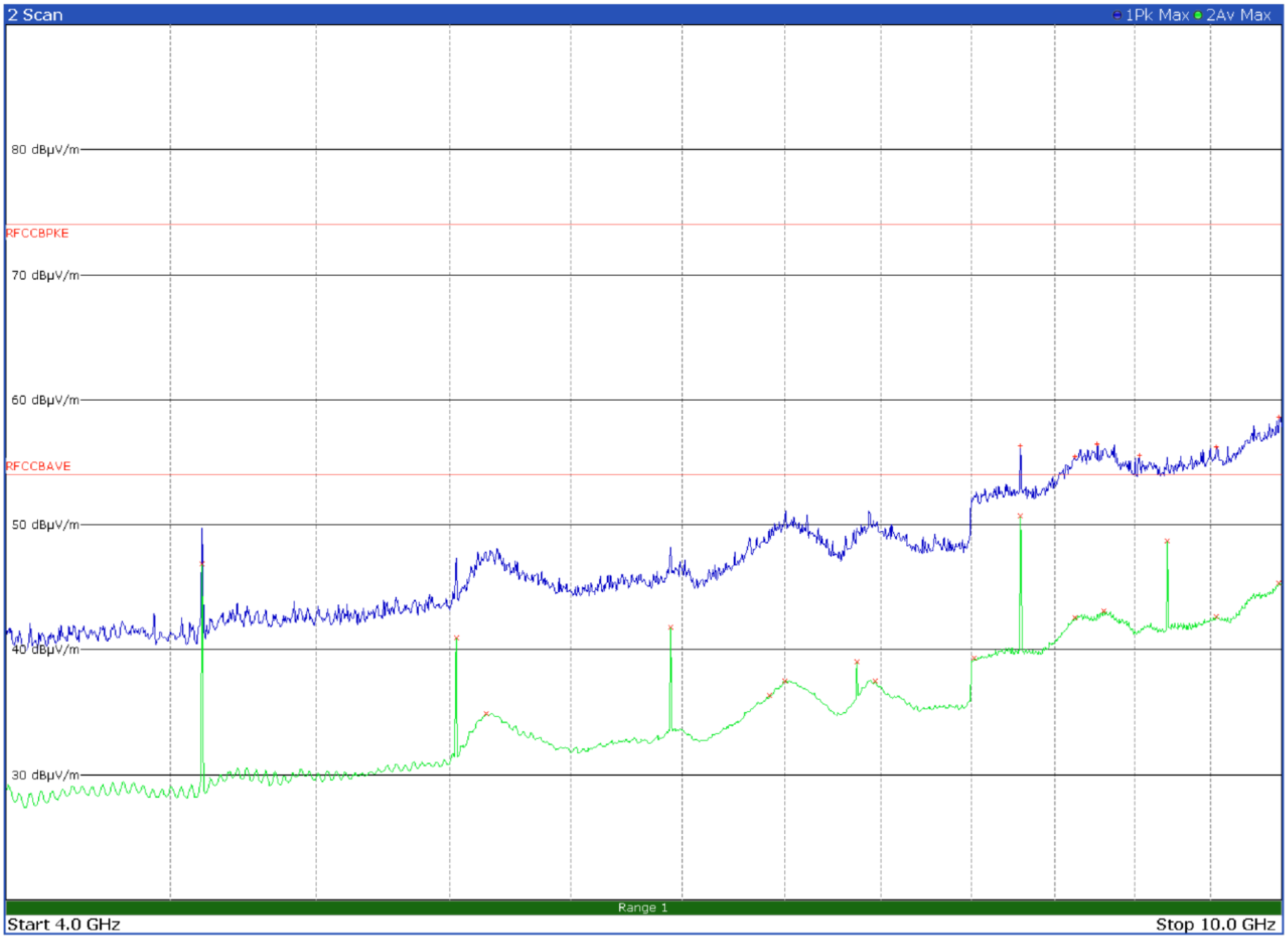


Figure 8.7-12: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4606.0000	46.9	54.0	-7.1	Av
5527.2500	41.0	54.0	-13.0	Av
5648.7500	35.0	54.0	-19.0	Av
6448.2500	41.9	54.0	-12.1	Av
6924.2500	36.4	54.0	-17.6	Av
6999.2500	37.6	54.0	-16.4	Av
7369.5000	39.1	54.0	-14.9	Av
7468.5000	37.5	54.0	-16.5	Av
8021.0000	39.4	54.0	-14.6	Av
8290.7500	56.4	74.0	-17.6	Pk
8290.7500	50.7	54.0	-3.3	Av
8619.7500	55.5	74.0	-18.5	Pk
8621.2500	42.6	54.0	-11.4	Av
8761.7500	56.5	74.0	-17.5	Pk
8800.2500	43.2	54.0	-10.8	Av
9028.2500	55.6	74.0	-18.4	Pk
9212.0000	48.8	54.0	-5.2	Av
9543.5000	56.3	74.0	-17.7	Pk
9544.0000	42.7	54.0	-11.3	Av
9980.7500	58.7	74.0	-15.3	Pk
9981.5000	45.4	54.0	-8.6	Av

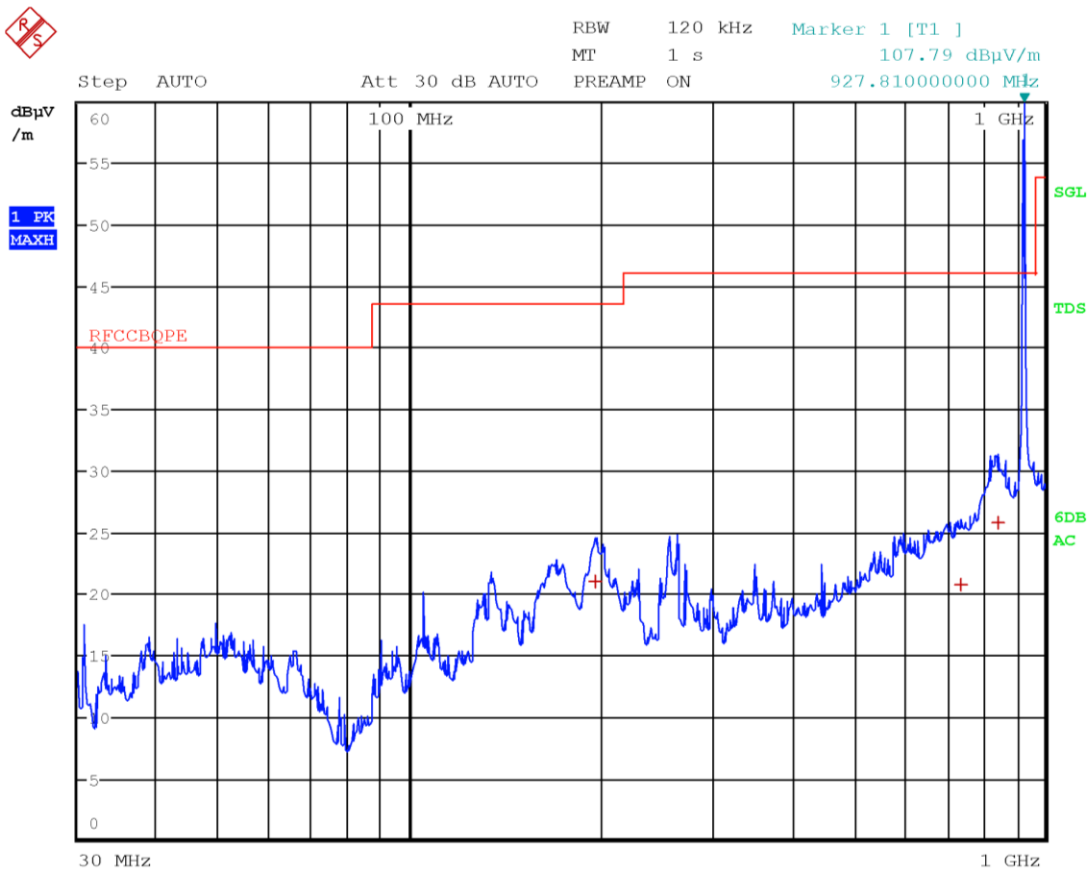


Figure 8.7-13: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
196.3200	21.0	43.5	-22.5	QP
738.6300	20.8	46.0	-25.2	QP
846.6000	25.8	46.0	-20.2	QP
927.8100	107.5	--	--	QP

Limit exceeded by the carrier

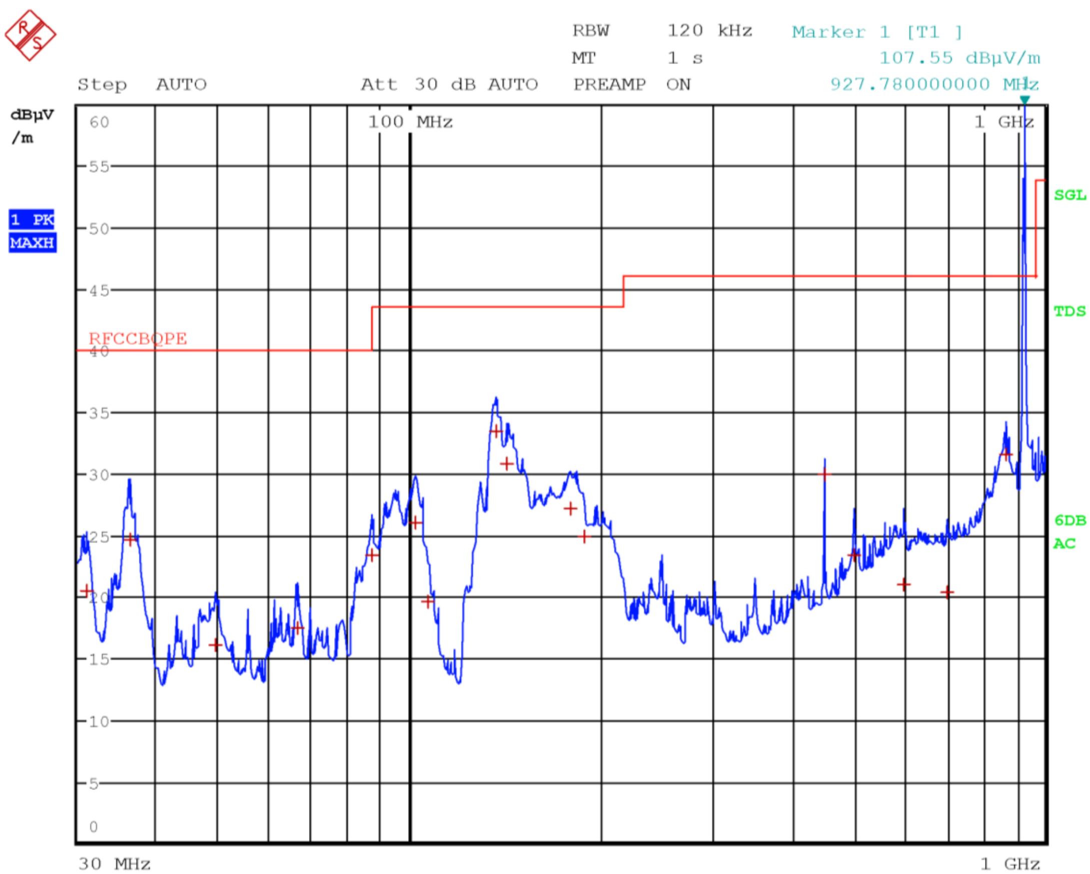


Figure 8.7-14: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.9900	20.5	40.0	-19.5	QP
36.2100	24.7	40.0	-15.3	QP
66.6600	17.5	40.0	-22.5	QP
87.3000	23.5	40.0	-16.5	QP
102.0300	26.1	43.5	-17.4	QP
136.9200	33.6	43.5	-9.9	QP
142.4700	30.9	43.5	-12.6	QP
179.0400	27.2	43.5	-16.3	QP
188.2800	24.9	43.5	-18.6	QP
450.0000	30.0	46.0	-16.0	QP
600.2100	21.1	46.0	-24.9	QP
700.6500	20.4	46.0	-25.6	QP
866.6400	31.6	46.0	-14.4	QP
927.7800	109.0	--	--	QP

Limit exceeded by the carrier

Test data, continued

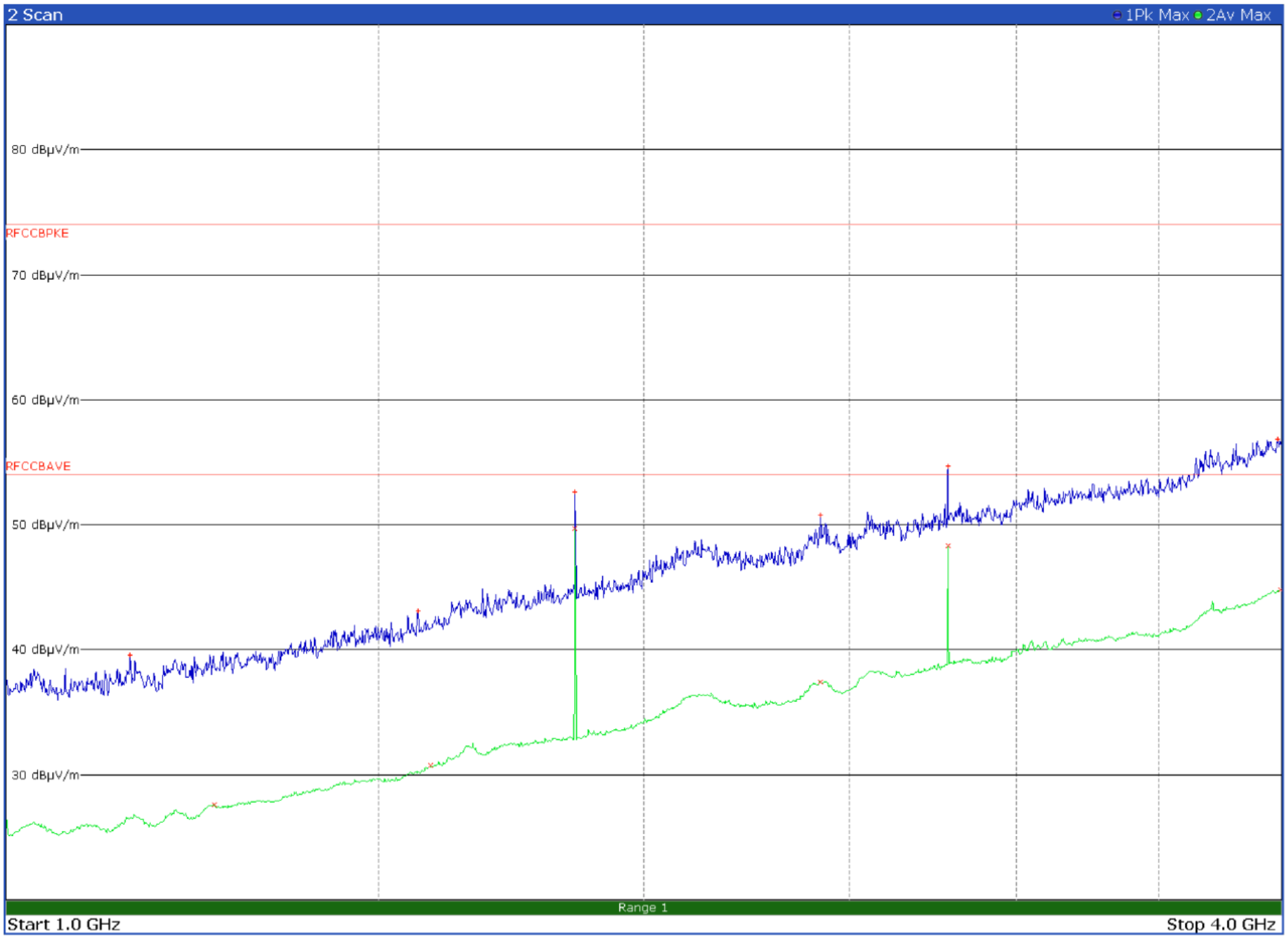


Figure 8.7-15: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1144.2500	39.7	74.0	-34.3	Pk
1254.2500	27.6	54.0	-26.4	Av
1564.2500	43.2	74.0	-30.8	Pk
1585.7500	30.8	54.0	-23.2	Av
1855.5000	52.7	74.0	-21.3	Pk
1855.5000	49.7	54.0	-4.3	Av
2422.7500	37.5	54.0	-16.5	Av
2423.2500	50.9	74.0	-23.1	Pk
2783.2500	54.8	74.0	-19.2	Pk
2783.5000	48.4	54.0	-5.6	Av
3982.7500	56.9	74.0	-17.1	Pk
3996.7500	44.8	54.0	-9.2	Av

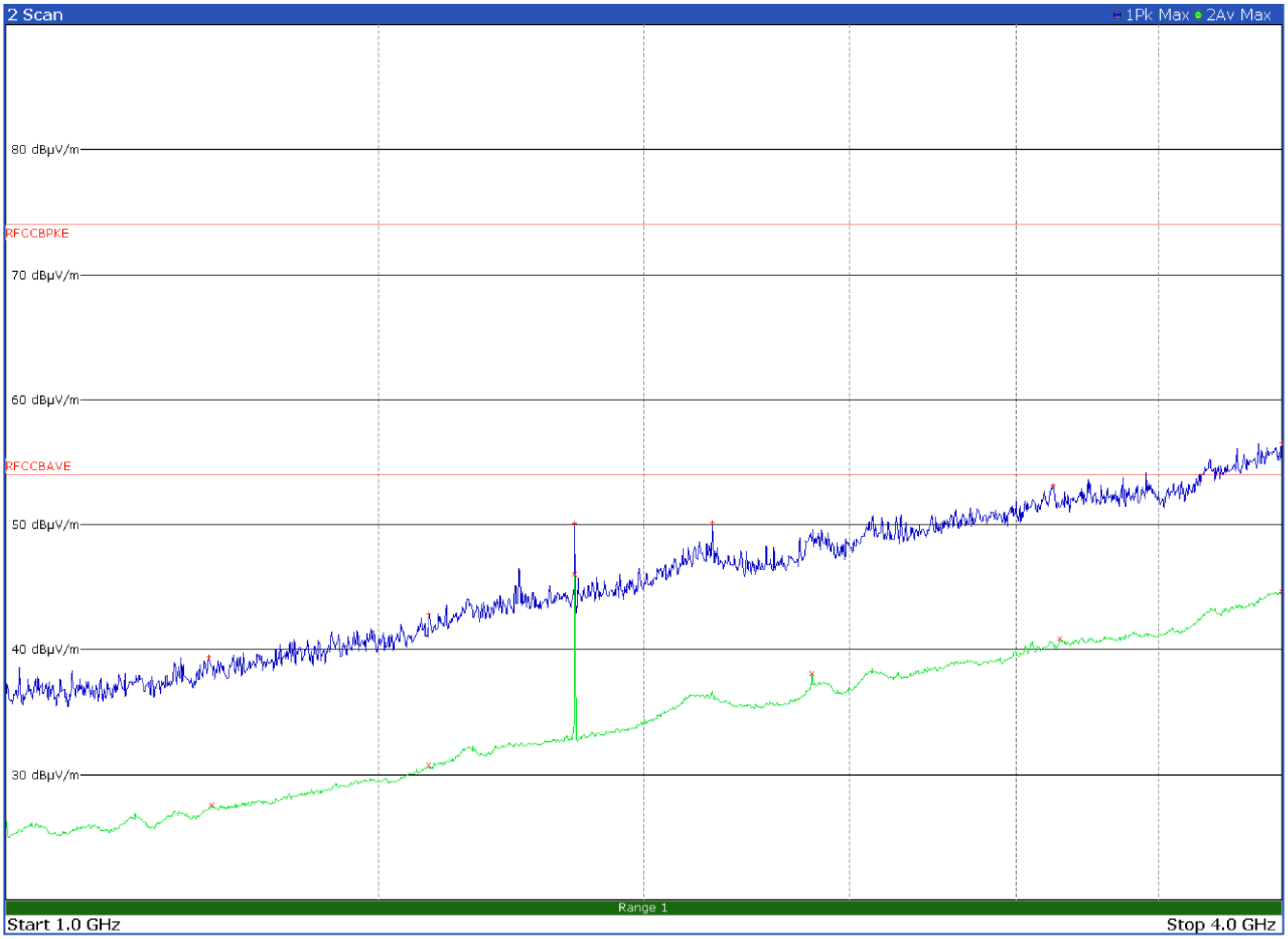


Figure 8.7-16: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1246.0000	39.5	74.0	-34.5	Pk
1250.5000	27.6	54.0	-26.4	Av
1582.7500	30.8	54.0	-23.2	Av
1583.7500	42.9	74.0	-31.1	Pk
1855.5000	50.1	74.0	-23.9	Pk
1855.5000	46.1	54.0	-7.9	Av
2154.0000	50.2	74.0	-23.8	Pk
2402.0000	38.2	54.0	-15.8	Av
3119.7500	53.2	74.0	-20.8	Pk
3144.5000	40.9	54.0	-13.1	Av
3998.7500	56.6	74.0	-17.4	Pk
3998.7500	44.7	54.0	-9.3	Av

Test data, continued

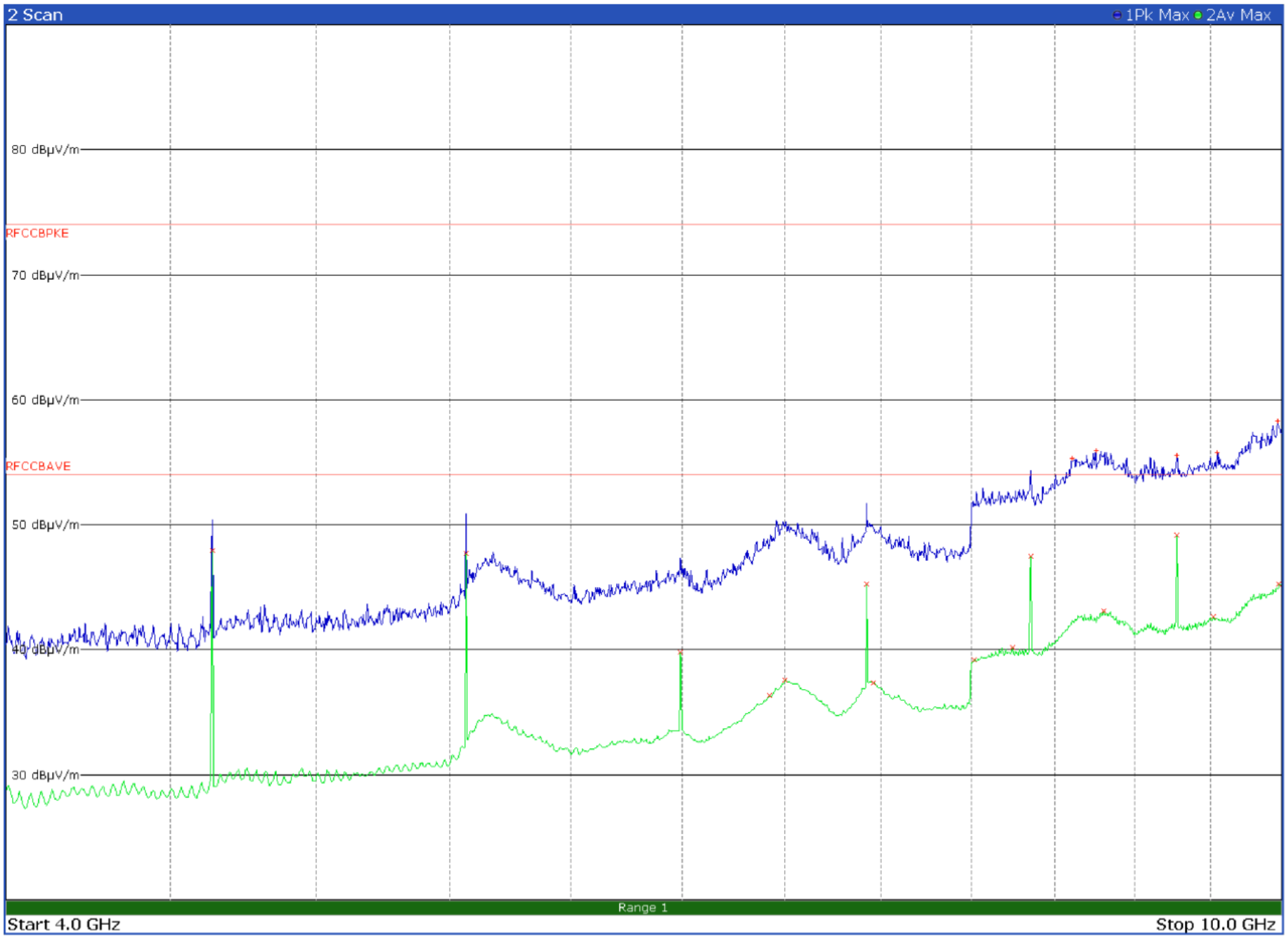


Figure 8.7-17: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4639.0000	48.0	54.0	-6.0	Av
5566.7500	47.8	54.0	-6.2	Av
6494.5000	39.8	54.0	-14.2	Av
6923.7500	36.4	54.0	-17.6	Av
6999.5000	37.6	54.0	-16.4	Av
7422.2500	45.3	54.0	-8.7	Av
7460.7500	37.4	54.0	-16.6	Av
8021.2500	39.3	54.0	-14.7	Av
8242.5000	40.2	54.0	-13.8	Av
8350.2500	47.5	54.0	-6.5	Av
8601.7500	55.3	74.0	-18.7	Pk
8750.5000	56.0	74.0	-18.0	Pk
8800.7500	43.2	54.0	-10.8	Av
9277.7500	55.6	74.0	-18.4	Pk
9278.0000	49.2	54.0	-4.8	Av
9520.7500	42.7	54.0	-11.3	Av
9550.7500	55.8	74.0	-18.2	Pk
9972.0000	58.4	74.0	-15.6	Pk
9982.0000	45.3	54.0	-8.7	Av

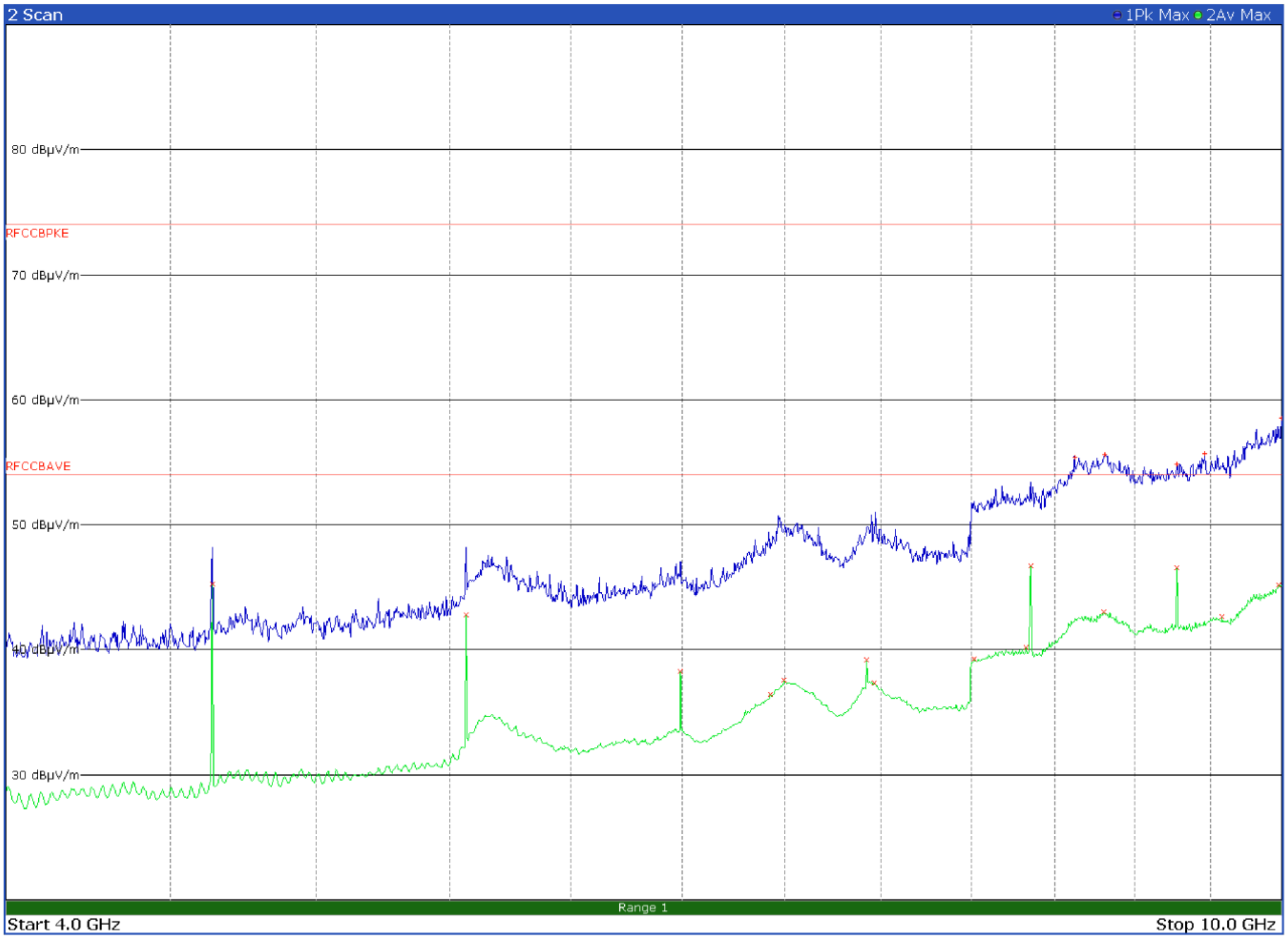


Figure 8.7-18: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4639.0000	45.3	54.0	-8.7	Av
5566.7500	42.8	54.0	-11.2	Av
6494.5000	38.3	54.0	-15.7	Av
6925.5000	36.4	54.0	-17.6	Av
6997.2500	37.6	54.0	-16.4	Av
7422.5000	39.2	54.0	-14.8	Av
7465.7500	37.4	54.0	-16.6	Av
8021.2500	39.3	54.0	-14.7	Av
8321.2500	40.2	54.0	-13.8	Av
8350.2500	46.8	54.0	-7.2	Av
8618.5000	55.4	74.0	-18.6	Pk
8802.2500	43.1	54.0	-10.9	Av
8809.7500	55.7	74.0	-18.3	Pk
9277.7500	54.9	74.0	-19.1	Pk
9278.0000	46.6	54.0	-7.4	Av
9464.2500	55.7	74.0	-18.3	Pk
9580.5000	42.7	54.0	-11.3	Av
9980.5000	45.2	54.0	-8.8	Av
9998.5000	58.6	74.0	-15.4	Pk

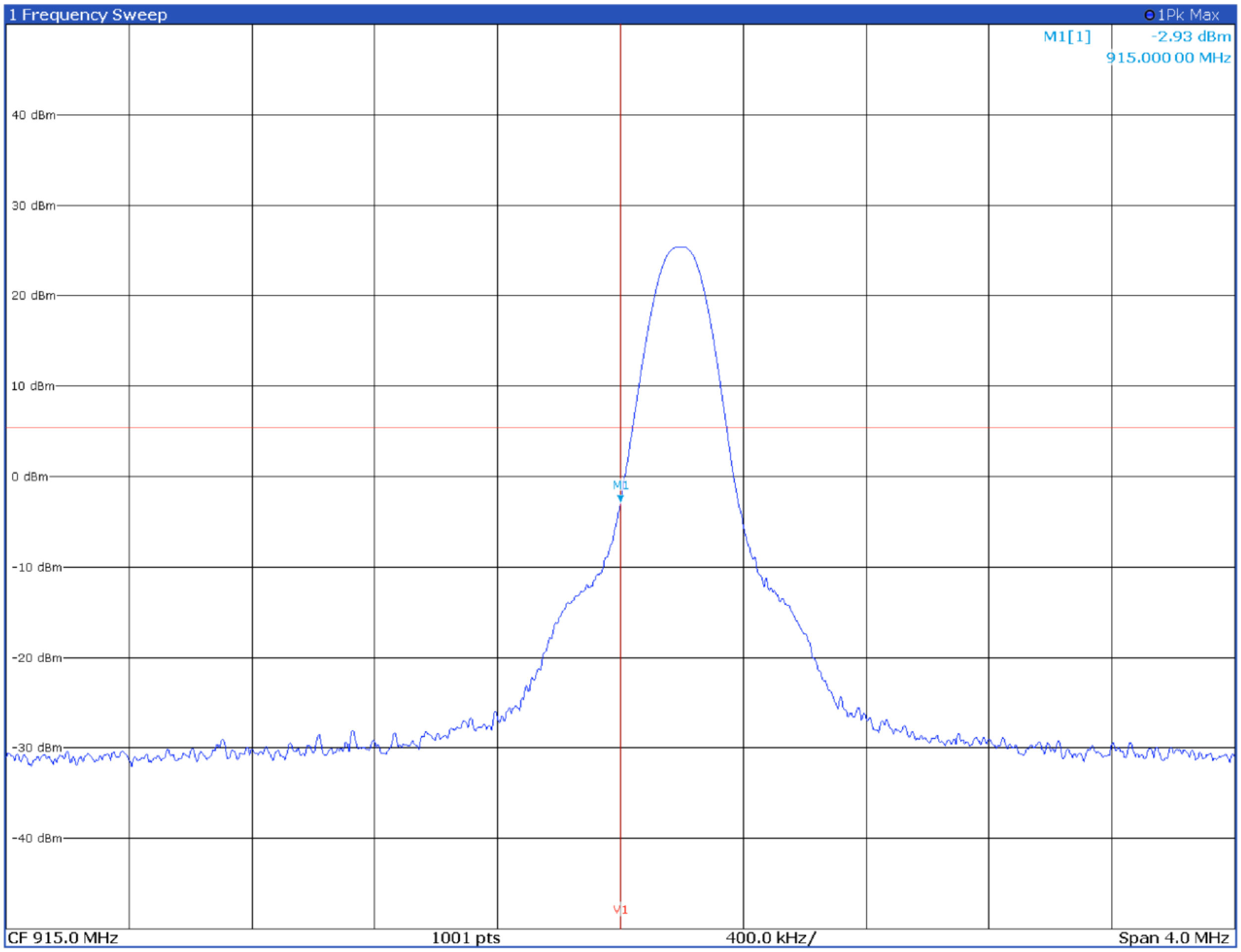


Figure 8.7-19: *Band edge spurious emissions at 915 MHz* (low frequency)

Test data, continued

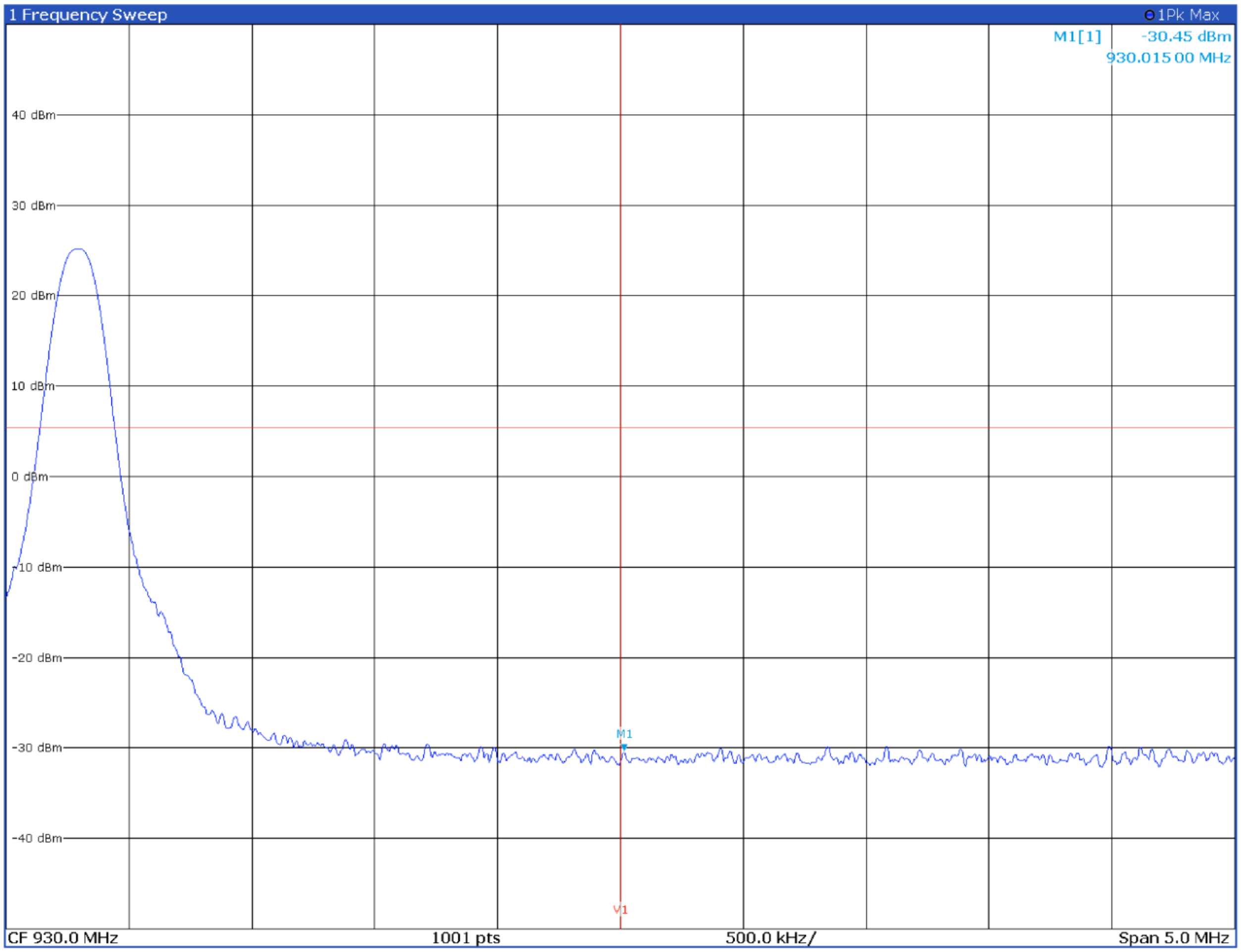


Figure 8.7-20: *Band edge spurious emissions at 930 MHz* (high frequency)

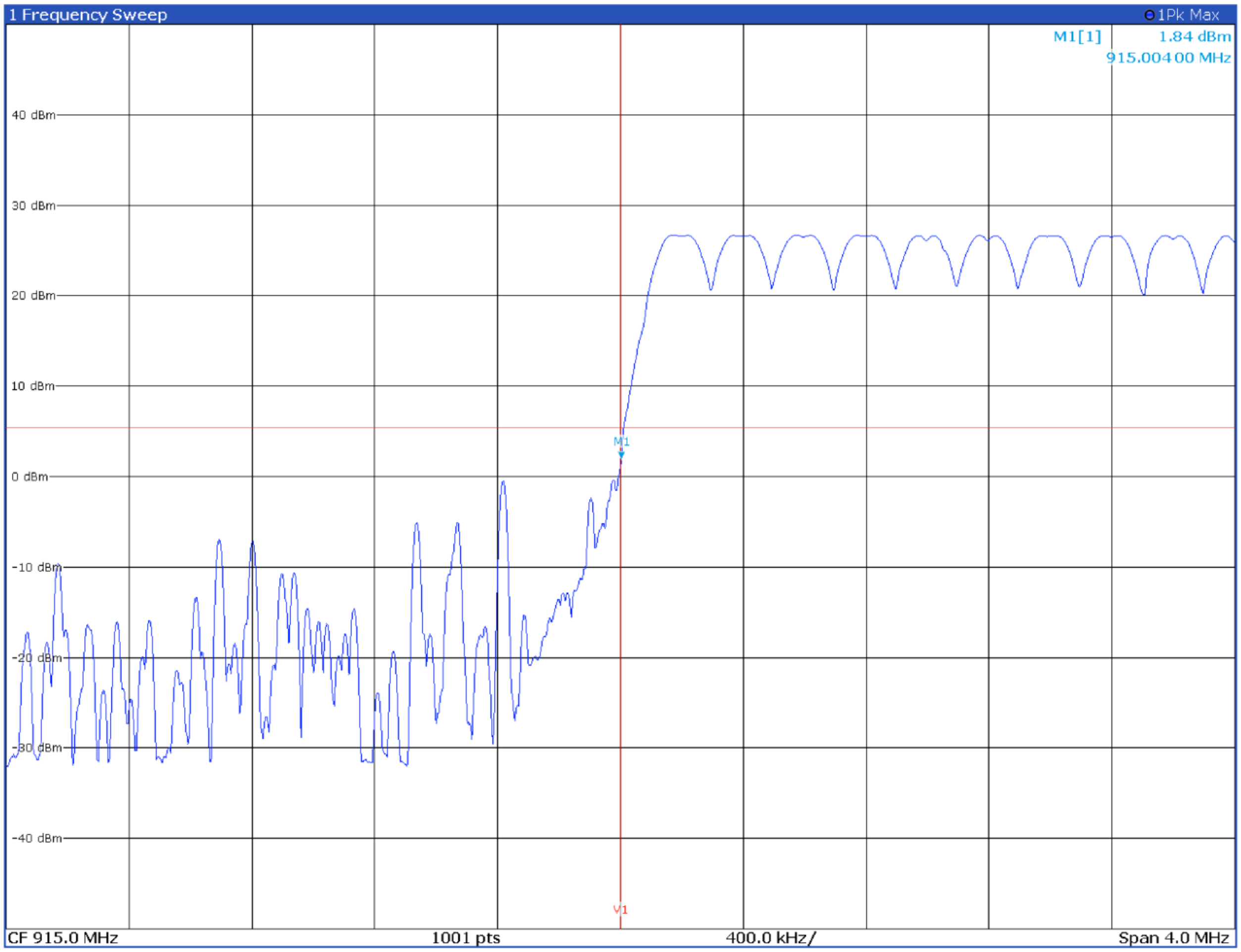


Figure 8.7-21: *Band edge spurious emissions at 915 MHz* (hopping mode)

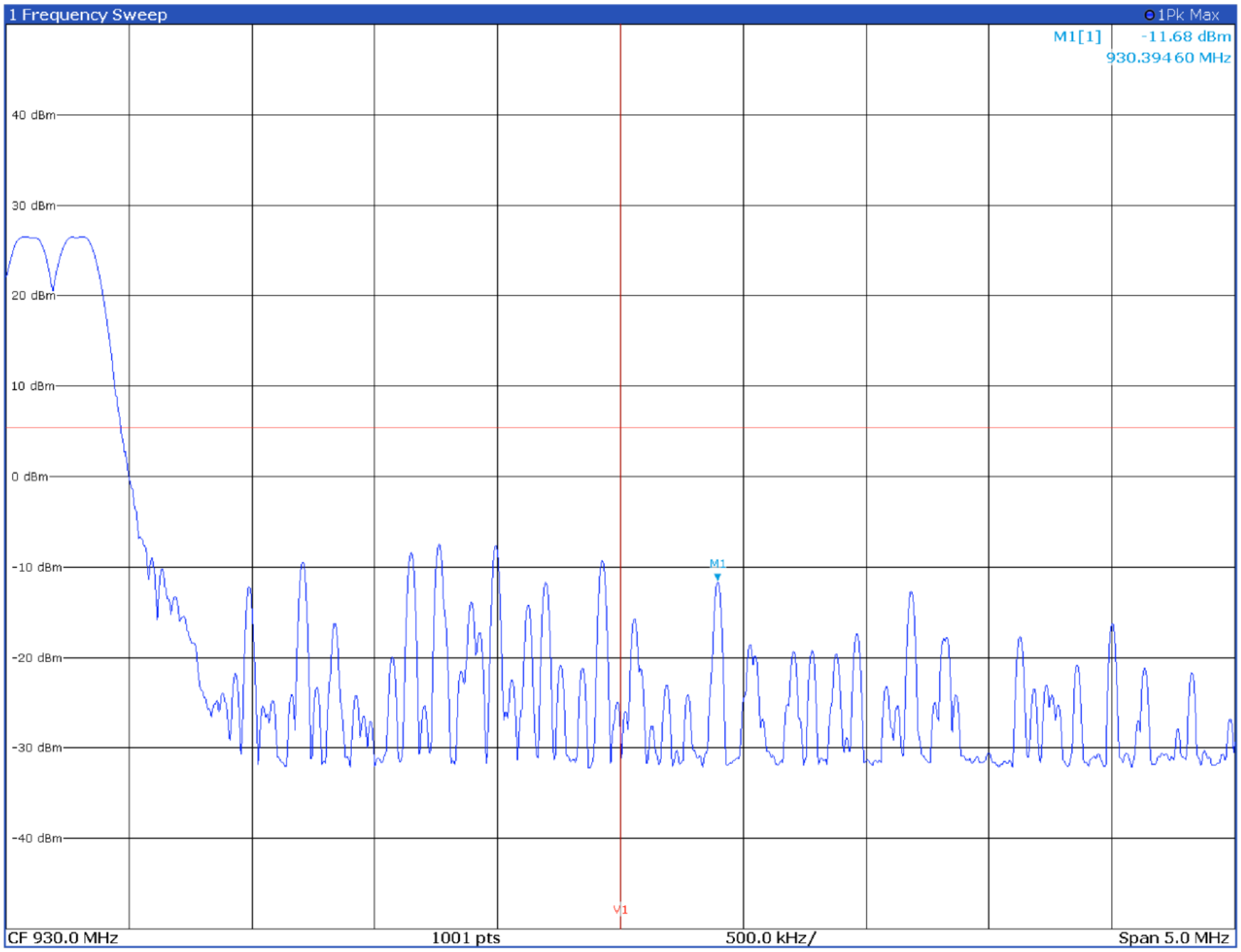


Figure 8.7-22: *Band edge spurious emissions at 930 MHz* (hopping mode)

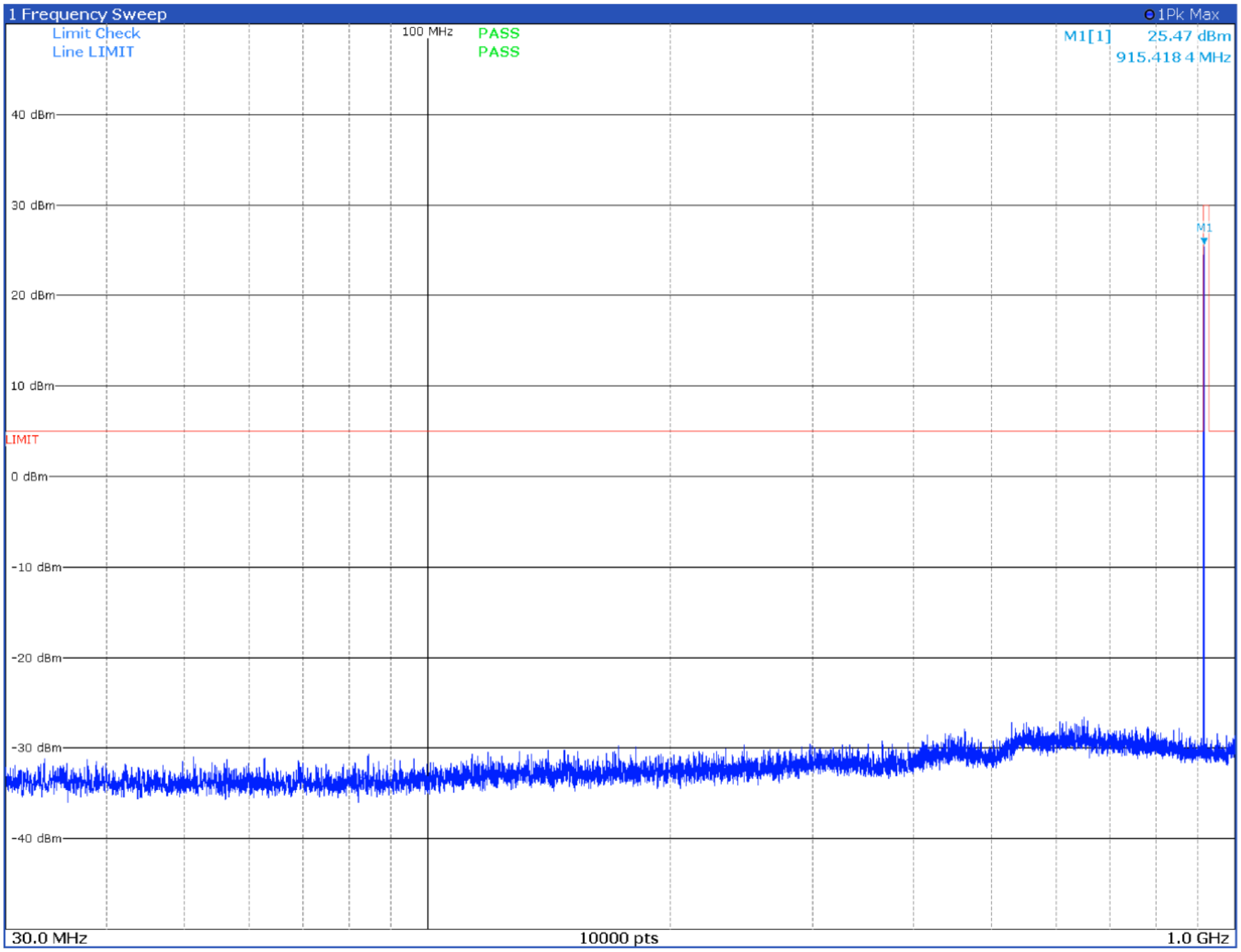


Figure 8.7-23: *Conducted spurious emissions on* low channel – Frequency range 30 to 1000 MHz

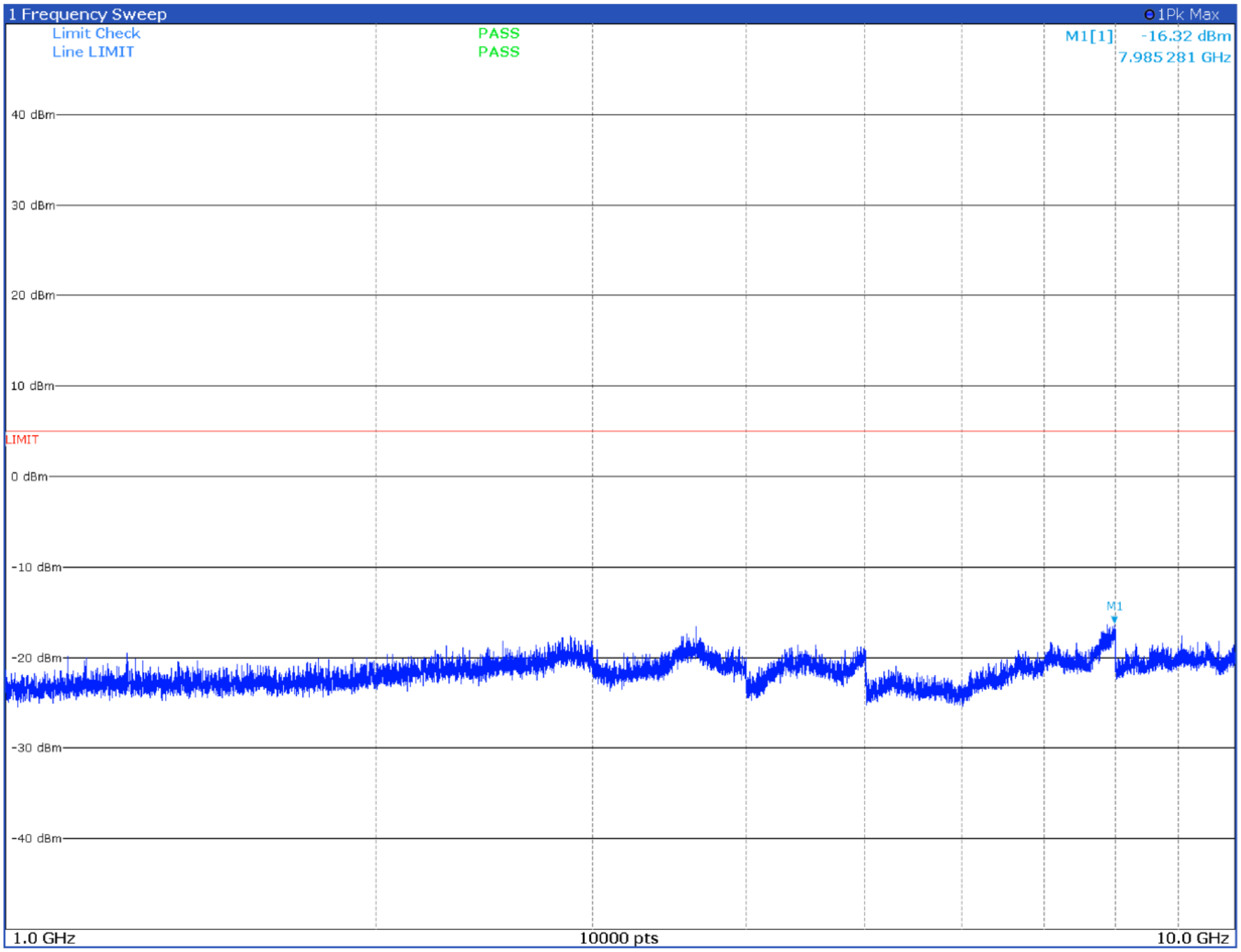


Figure 8.7-24: *Conducted spurious emissions on* low channel – Frequency range 1 to 10 GHz

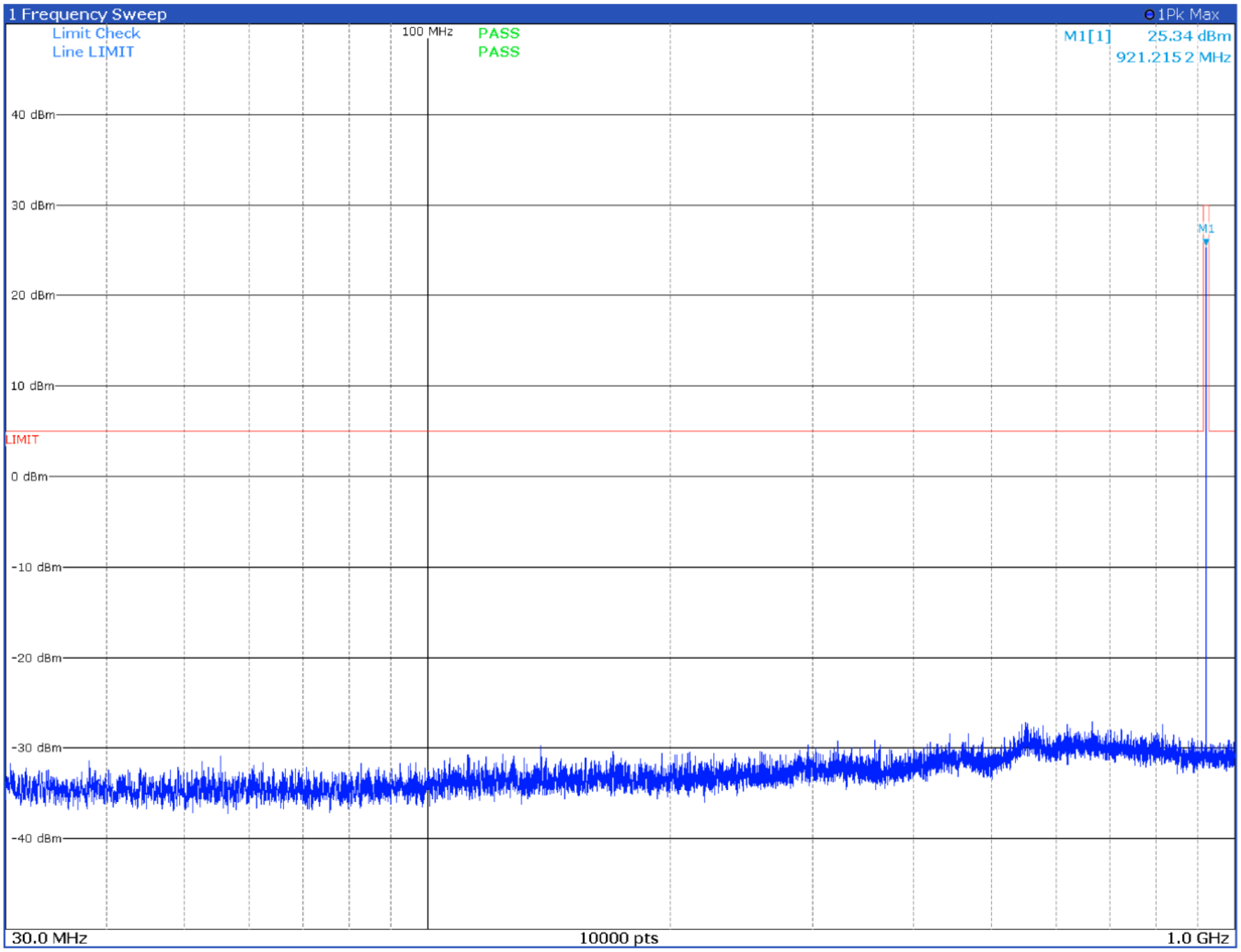


Figure 8.7-25: *Conducted spurious emissions on* mid channel – Frequency range 30 to 1000 MHz

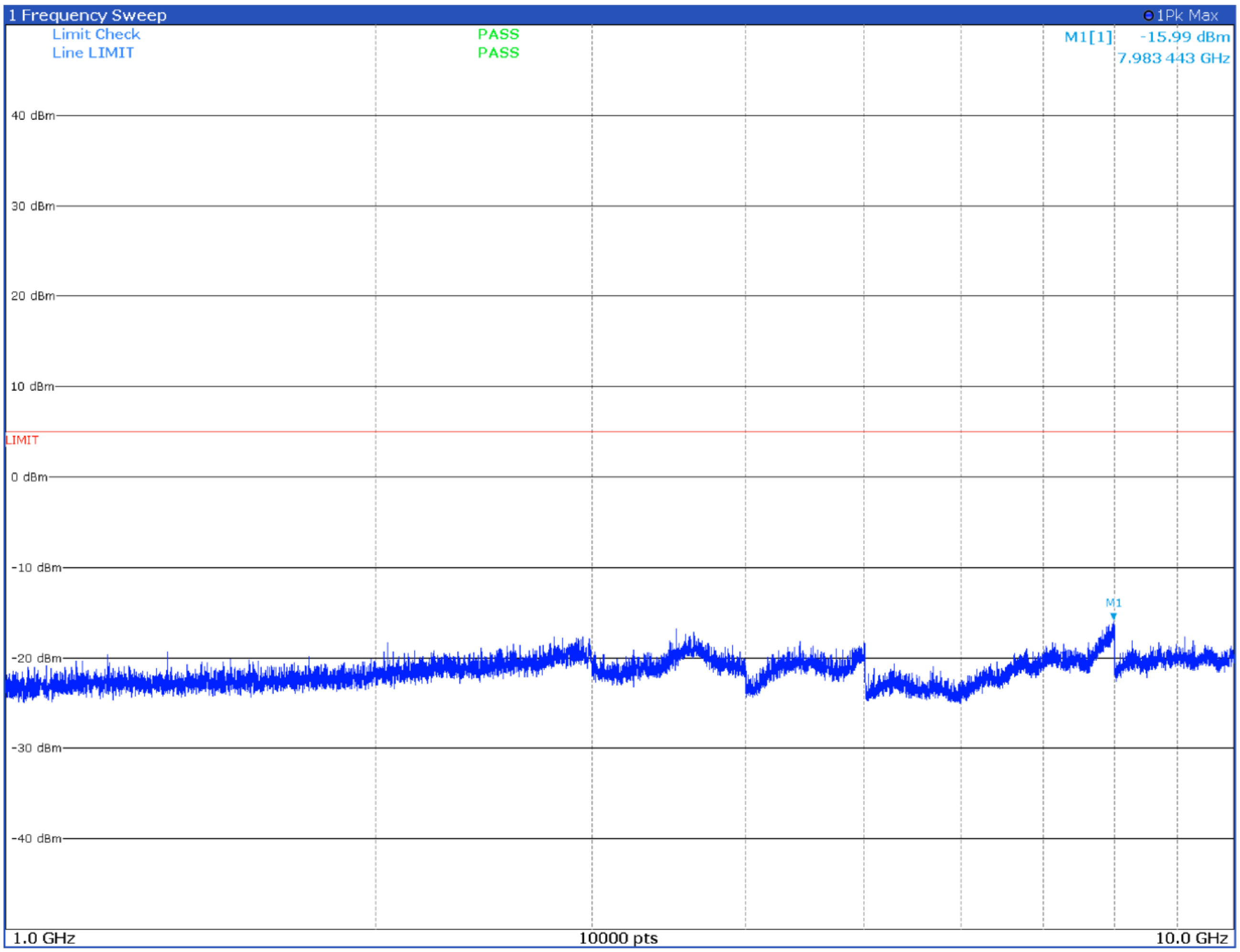


Figure 8.7-26: *Conducted spurious emissions on* mid channel – Frequency range 1 to 10 GHz

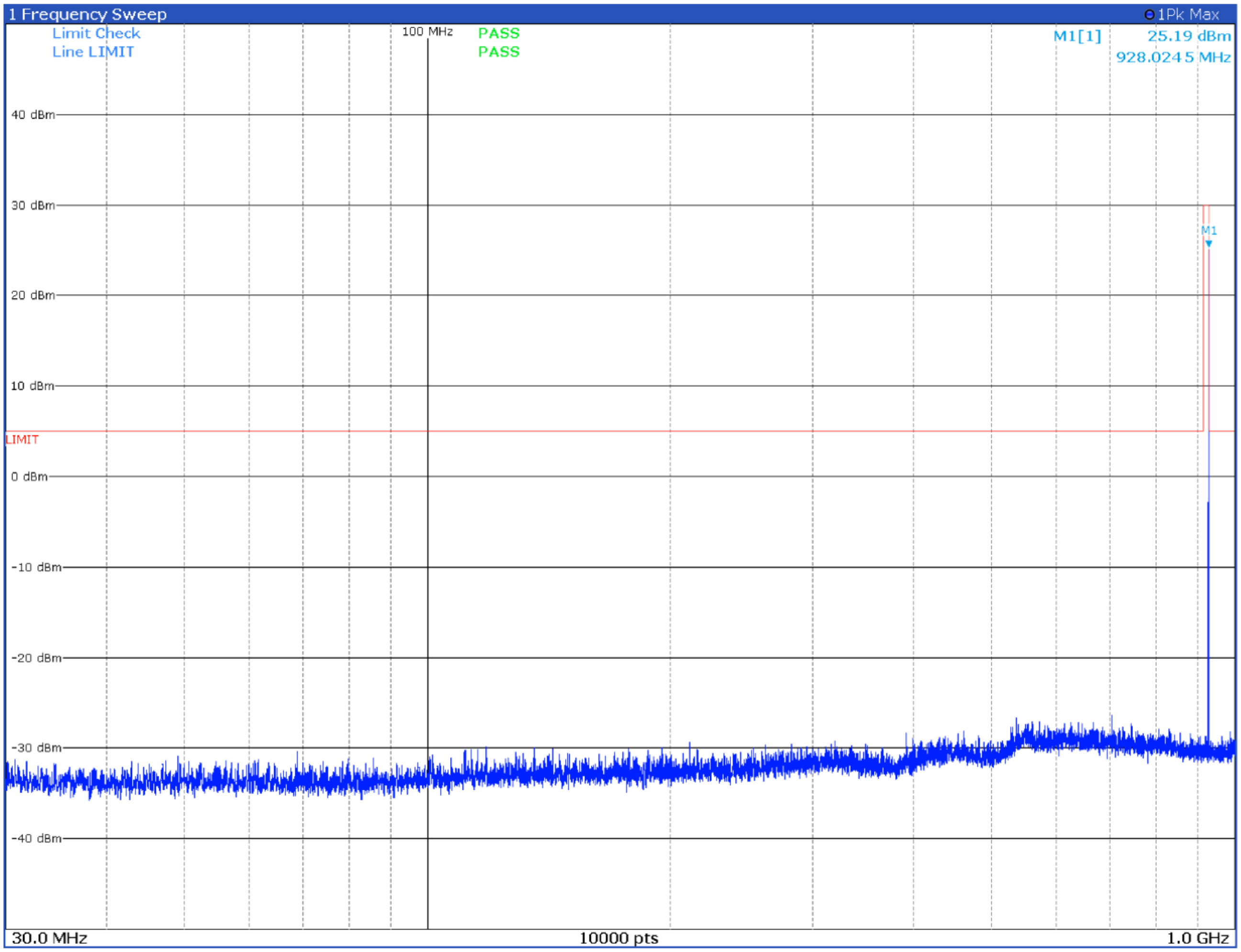


Figure 8.7-27: *Conducted spurious emissions on* high channel – Frequency range 30 to 1000 MHz

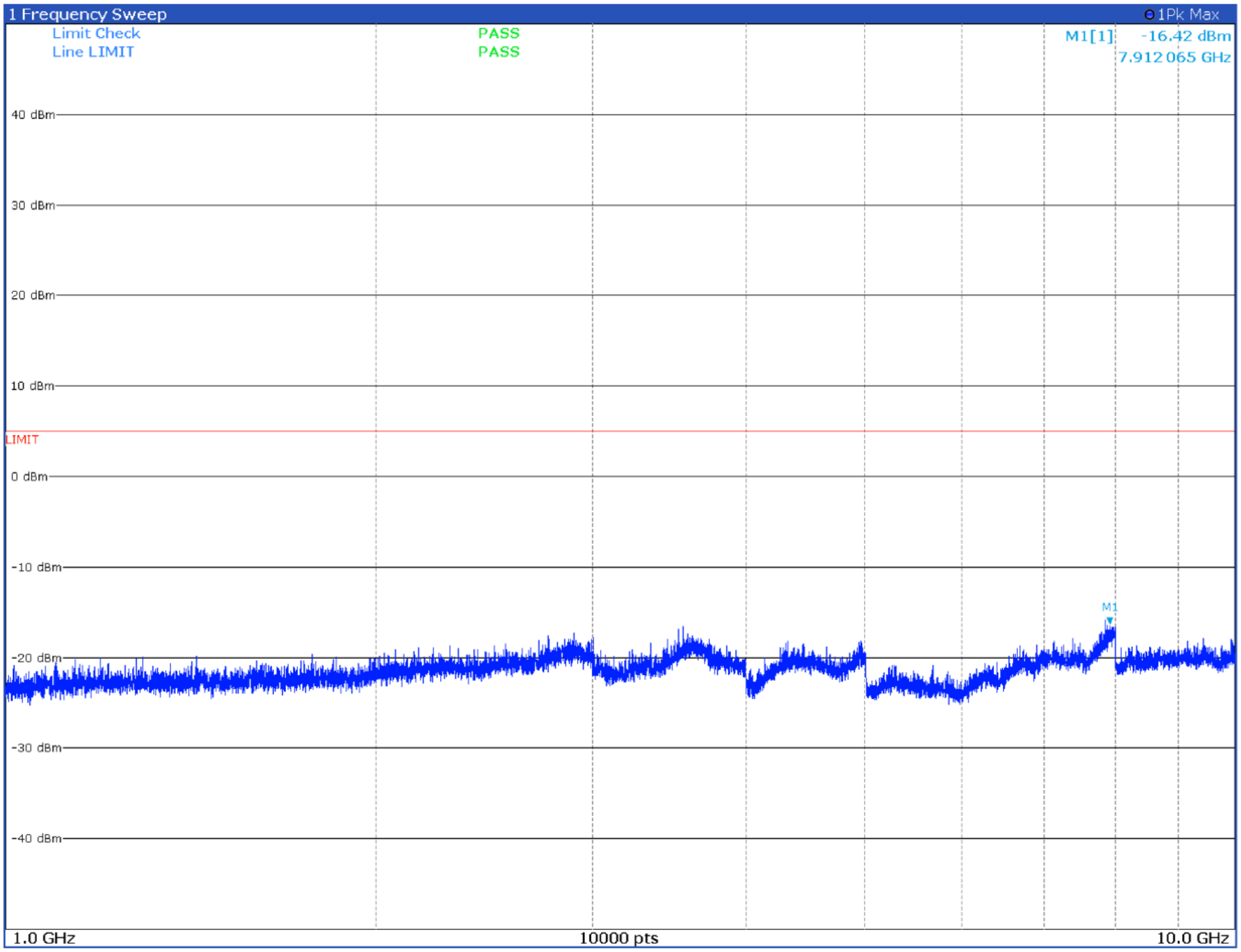


Figure 8.7-28: *Conducted spurious emissions on* high channel – Frequency range 1 to 10 GHz

Section 9 EUT photos

9.1 EUT photos

Figure 9.1-1: *Front view photo*

Figure 9.1-2: *Rear view photo*

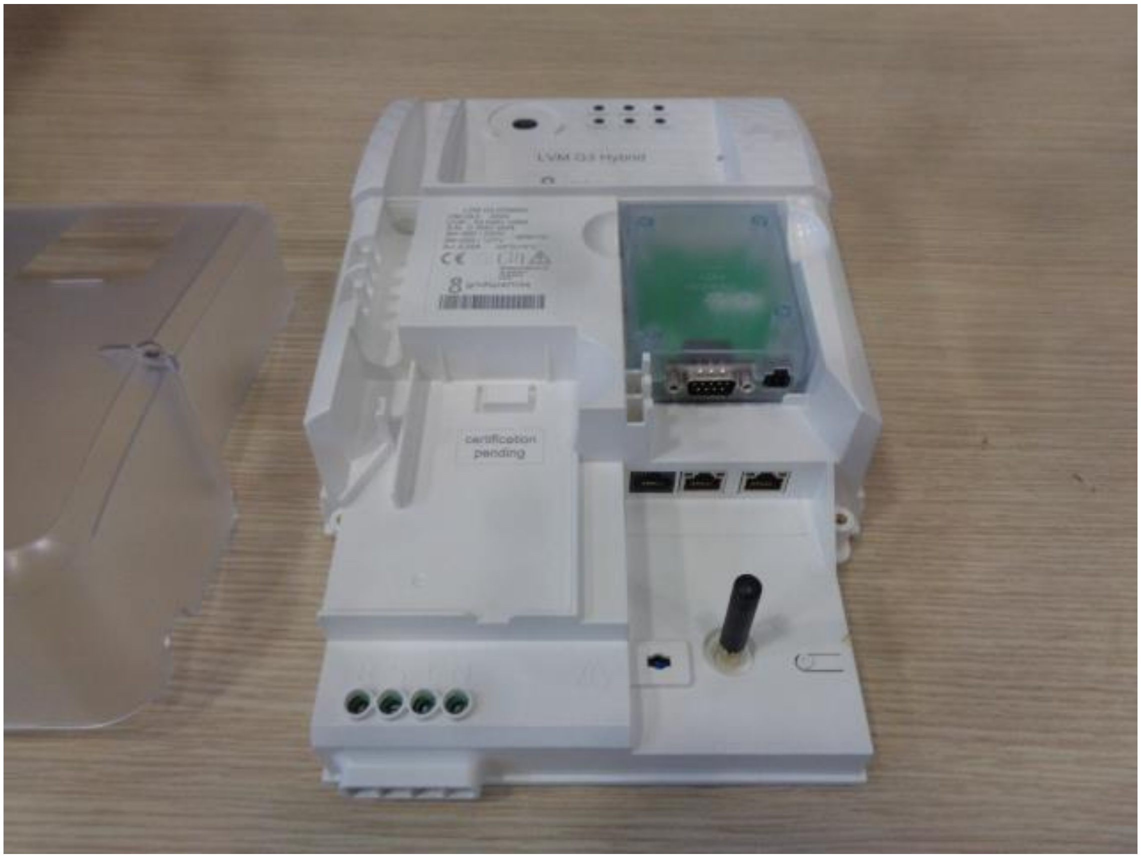


Figure 9.1-3: *Inside photo*

9.2 Setup photos

Figure 9.2-1: *Radiated emissions below 1 GHz*

Figure 9.2-2: *Radiated emissions above 1 GHz*

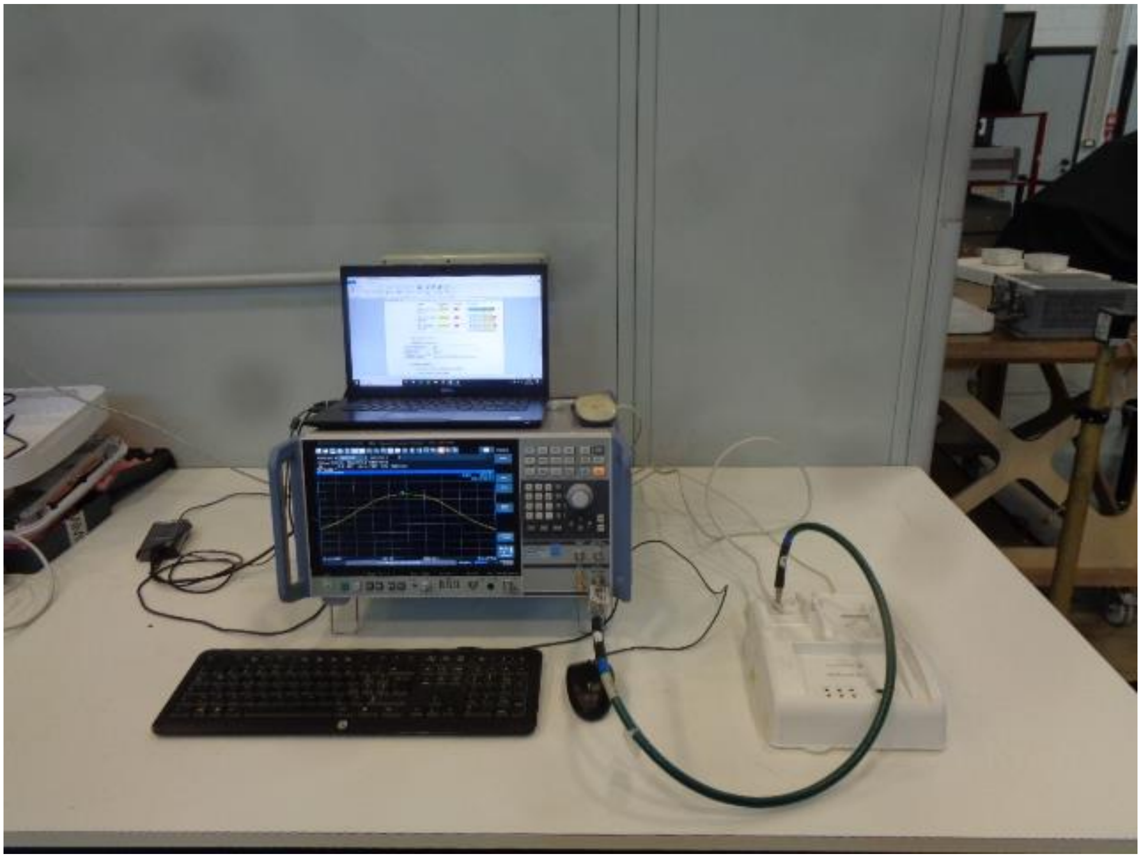


Figure 9.2-3: *Conducted emissions at the antenna port*

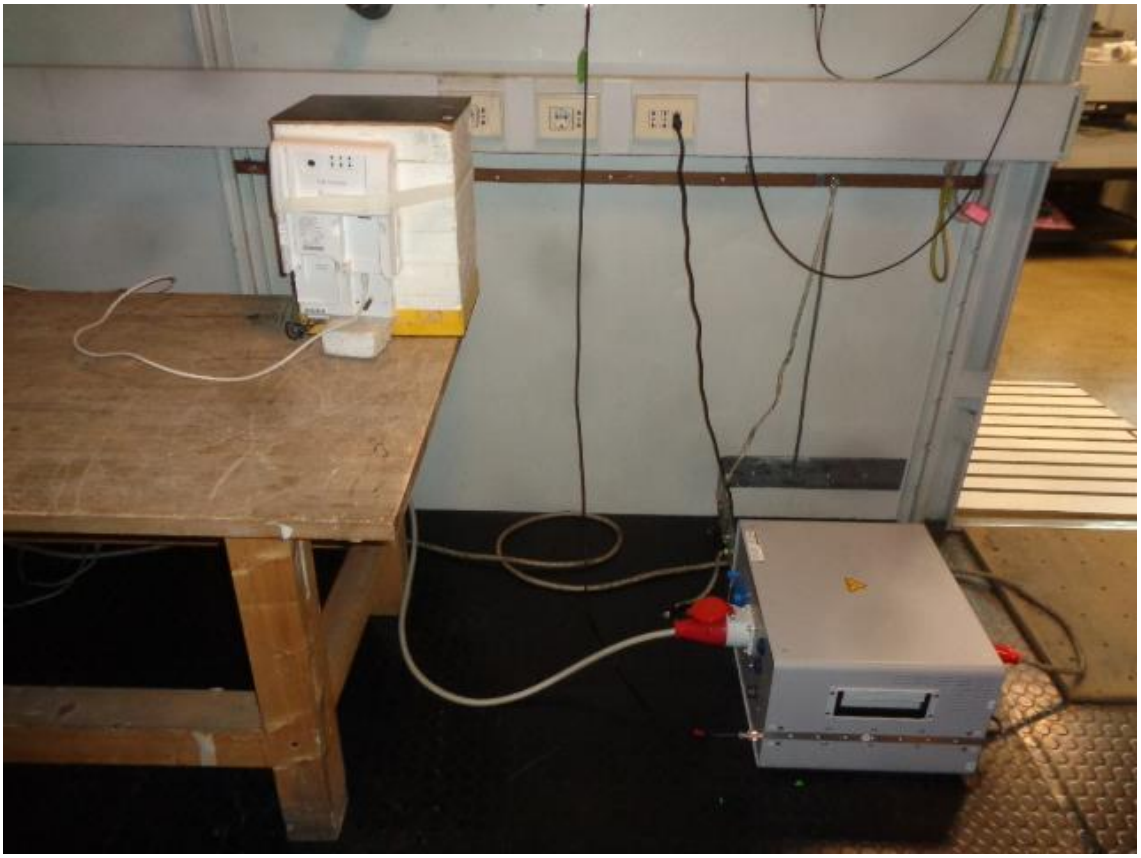


Figure 9.2-4: *Conducted emissions at the AC mains port*

End of the test report