Test Report

REP069683-1 This test report replaces the one identified with number REP069683 issued on November 27, 2024

Date of issue: February 13, 2025

Applicant:

Gridspertise S.r.l.
Via Ombrone, 2
00198 Roma – Italy

Product:

Semi-direct static electrical energy meter with G3 Hybrid PLC/RF communication module

Model: GLOBYSGNG3

Model variant:

FCC ID: 2BLES-GS0943

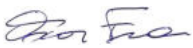
IC Registration number:

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.247
  Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz

Test location

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; IC: 9109A

Tested by	**Luis Anticona**
Test engineer signature	
Reviewed by	**Oscar Frau**
Reviewer signature	 Firmato digitalmente da Frau Oscar

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.

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Section 1. Report summary

1.1.1 Applicant and manufacturer

Company name	Gridspertise S.r.l.
Address	Via Ombrone, 2
City	Rome
Province/State	Rome
Postal/Zip code	00198
Country	Italy

1.1.2 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

1.1.3 Test methods

558074 D01 DTS 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
DA 00-705, Released March 30, 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
ANSI C63.10 v2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.1.4 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.

1.1.5 Exclusions

None

1.1.6 Test report revision history

Revision #	Details of changes made to test report
REP069683	Original report issued
REP069683-1	added tables with calculation for average value=pk-DCCF , in spurious emission graphs (clause 11)

Section 2. Summary of test results

2.1.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass[1]
§15.203	Antenna requirement	Pass[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.

2.1.2 FCC Part 15 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Pass
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Pass
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Not applicable
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(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(e)	Power spectral density for digitally modulated devices	Not applicable
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Section 3. Equipment under test (EUT) details

3.1.1 Sample information

Receipt date	November 11, 2024
Nemko sample ID number	-

3.1.2 EUT information

Product name	Semi-direct static electrical energy meter with G3 Hybrid PLC/RF communication module
Model	GLOBYSGNG3
Model variant	-
Serial number	GYS1M0000180

3.1.3 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	0.54 W (27.33 dBm)
Field strength, dBµV/m @ 3 m	N/A
Measured BW (kHz), 99% OBW	117.2 kHz
Type of modulation	FSK
Emission classification	W7D
Transmitter spurious, dBµV/m @ 3 m	51.1 dBµV/m
Antenna information (see clause 8.3)	Elicoidal internal antenna: peak gain 1.90 dBi; External cable antenna: peak gain 4 dBi
Embedded Radio Module	--

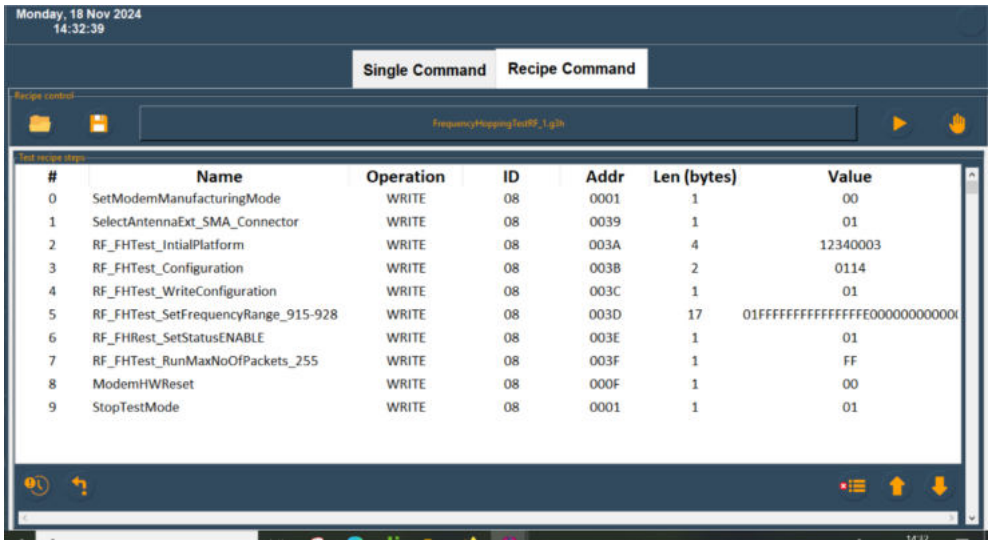
3.1.4 Product description and theory of operation

The EUT is a semi-direct static electrical energy meter with G3 Hybrid PLC/RF communication module. It's provided of two configurations, one with an internal antenna and one with an external antenna. For the version with external antenna the internal antenna is not removed by the EUT, but it's disabled by firmware command.

3.1.5 EUT 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:

#	Name	Operation	ID	Addr	Len (bytes)	Value
0	ReadMeterManufacturingMode	READ	12	FF09	1	
1	SetModemManufacturingMode	WRITE	08	0001	1	00
2	ReadModemManufacturingMode	READ	08	0001	1	
3	SelectAntennaExt_SMA_Connector	WRITE	08	0039	1	01
4	SelectAntennaInt_NO_SMA_Connector	WRITE	08	0039	1	00
5	SetFrequencyRF_Min_915.2	WRITE	08	0030	4	368CD800
6	SetFrequencyRF_Mid_921.2	WRITE	08	0030	4	36E86580
7	SetFrequencyRF_Max_927.8	WRITE	08	0030	4	374D1AC0
8	SetRFPower_27dBm	WRITE	08	0035	1	20
9	WriteDataRate_50	WRITE	08	0033	4	0000C350
10	WriteChannelSpace_200	WRITE	08	0034	4	00030D40

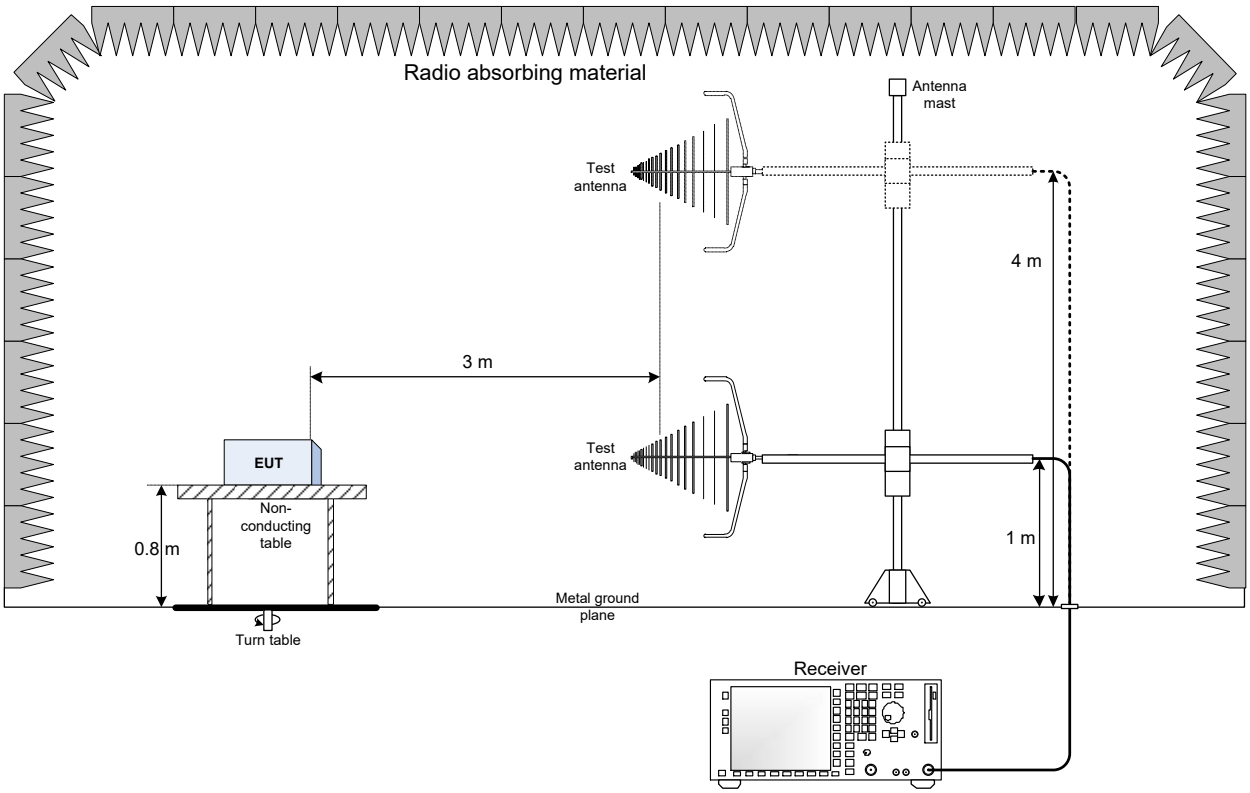


#	Name	Operation	ID	Addr	Len (bytes)	Value
0	SetModemManufacturingMode	WRITE	08	0001	1	00
1	SelectAntennaExt_SMA_Connector	WRITE	08	0039	1	01
2	RF_FHTest_IntialPlatform	WRITE	08	003A	4	12340003
3	RF_FHTest_Configuration	WRITE	08	003B	2	0114
4	RF_FHTest_WriteConfiguration	WRITE	08	003C	1	01
5	RF_FHTest_SetFrequencyRange_915-928	WRITE	08	003D	17	01FFFFFFFFFFFFFFFE000000000000
6	RF_FHRest_SetStatusENABLE	WRITE	08	003E	1	01
7	RF_FHTest_RunMaxNoOfPackets_255	WRITE	08	003F	1	FF
8	ModemHWReset	WRITE	08	000F	1	00
9	StopTestMode	WRITE	08	0001	1	01

Firmware version: 7.2.0

Transmitter state	Transmitter set in to continuous mode and in hopping mode.

3.1.6 EUT setup diagram


Radio absorbing material
Antenna mast
Test antenna
4 m
3 m
Test antenna
EUT
Non-conducting table
0.8 m
1 m
Metal ground plane
Turn table
Receiver

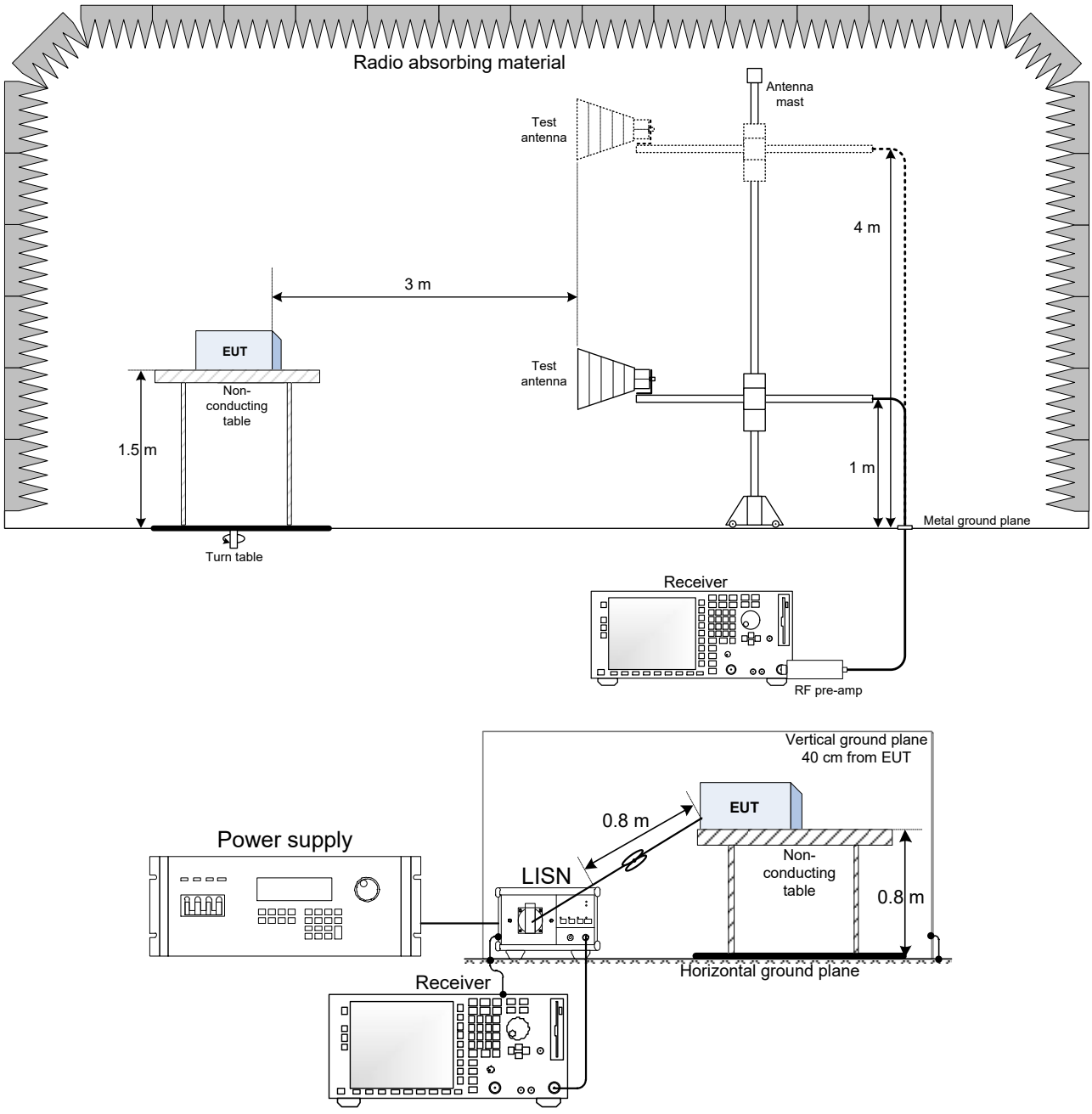


Figure 4.1-1: *Setup diagram*

3.1.7 EUT sub assemblies

Table 4.1-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
Personal computer	DELL	Latitude 5520	-

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.1.1 Technical judgment

None

4.1.2 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	20–70 %
Air pressure	860–1060 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

5.1.1 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, 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)

EUT	Type	Test	Range	Measurement Uncertainty	Notes
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.
EMI Receiver	Rohde & Schwarz	ESW44	101620	2024-09	2025-09
EMI Receiver	Rohde & Schwarz	ESU8	100202	2024-09	2025-09
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	2024-09	2026-09
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
Coaxial cable	Rosenberger+Huber-Suhner	RE03+RE04	1.510+1.511	2024-11	2025-11
Coaxial cable	Rosenberger+Huber-Suhner	RE04+RE05	1.511+1.512	2023-12	2024-12
Coaxial cable	Rosenberger+Huber-Suhner	RE01+RE02	1.654+1.655	2024-02	2025-02
Coaxial cable	Rosenberger+Huber+Suhner	CE01+CE02	1.498+1.632	2024-11	2025-11
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	Luis Anticona	Test date	November 19, 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	Luis Anticona	Test date	November 19, 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	928	13	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	Luis Anticona	Test date	November 19, 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 and the connector are 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
Helicoidal internal antenna	Electronic Connector Technology	P/N 81800V685	1.69 dBi @ 910 MHz 1.41 dBi @ 920 MHz 1.14 dBi @ 930 MHz	PCB
External cable antenna	Electronic Connector Technology	P/N 81800VXXX	4.12 dBi @ 910 MHz 3.95 dBi @ 920 MHz 3.73 dBi @ 930 MHz	SMA RA

8.4 FCC 15.207(a) power line conducted emissions limits

8.4.1 Definitions and limits

FCC:
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.

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 8.4-1: *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.

8.4.2 Test summary

Test date	November 19, 2024	Verdict	Pass
Test engineer	Luis Anticona	Sample tested	GLOBYSMGNG3

8.4.3 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	1000 ms

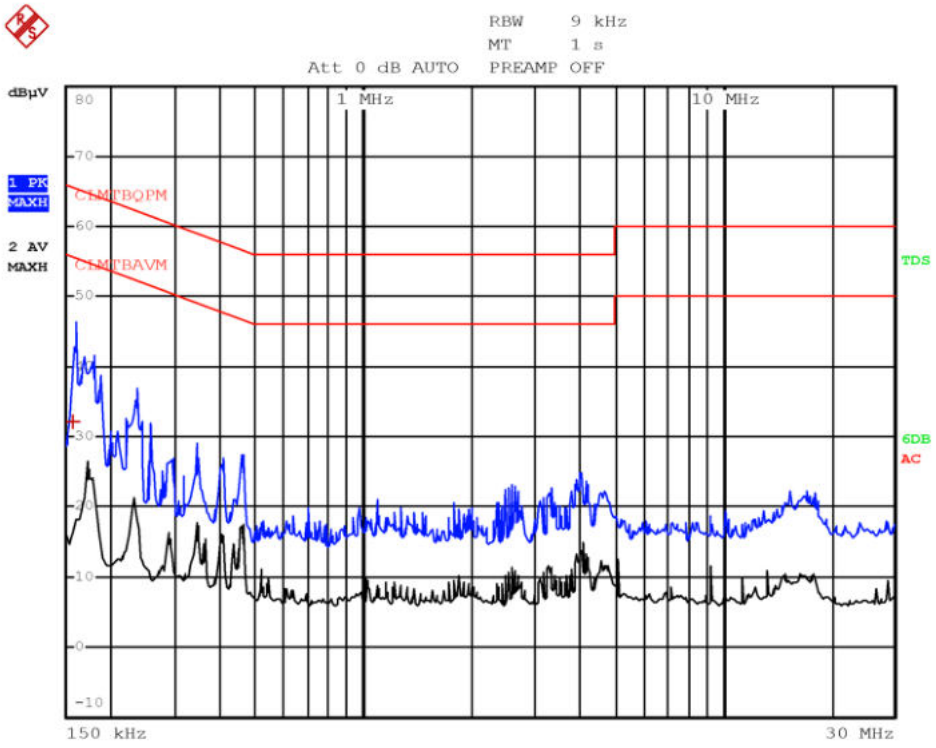
Receiver settings for final measurements:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Quasi-Peak and Average
Trace mode	Max Hold
Measurement time	1000 ms

8.4.4 Test equipment used

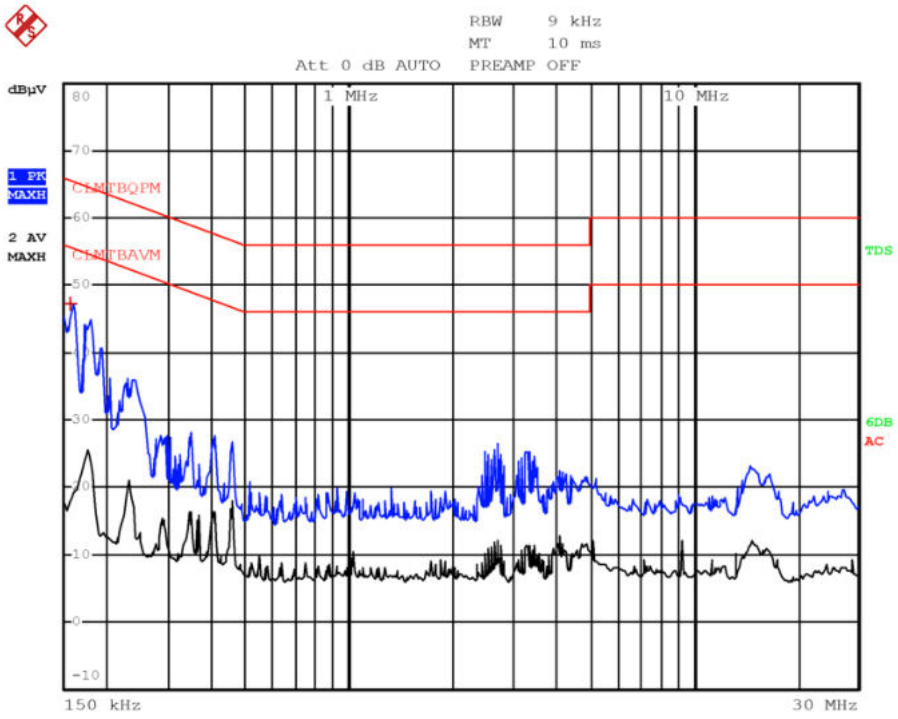
Equipment	Manufacturer	Model no.	Asset no.
EMI Receiver	Rohde & Schwarz	ESU8	100202
Cable set	Rosenberger+Huber+Suhner	CE01+CE02	1.498+1.632
LISN	Rohde & Schwarz	ENV432	101714
Attenuator	Aeroflex / Weinschel	2	CC8577

8.4.5 Test data



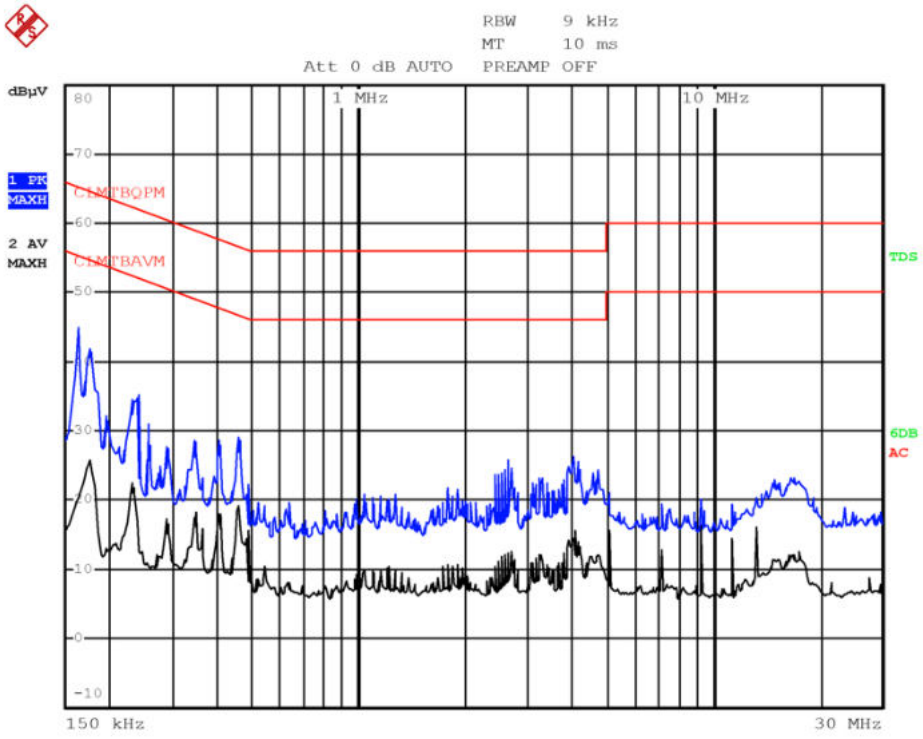
Plot 8.4-1: *Conducted emissions on phase line 1, 110V 60Hz*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1580	32.3	65.6	-33.3	QP

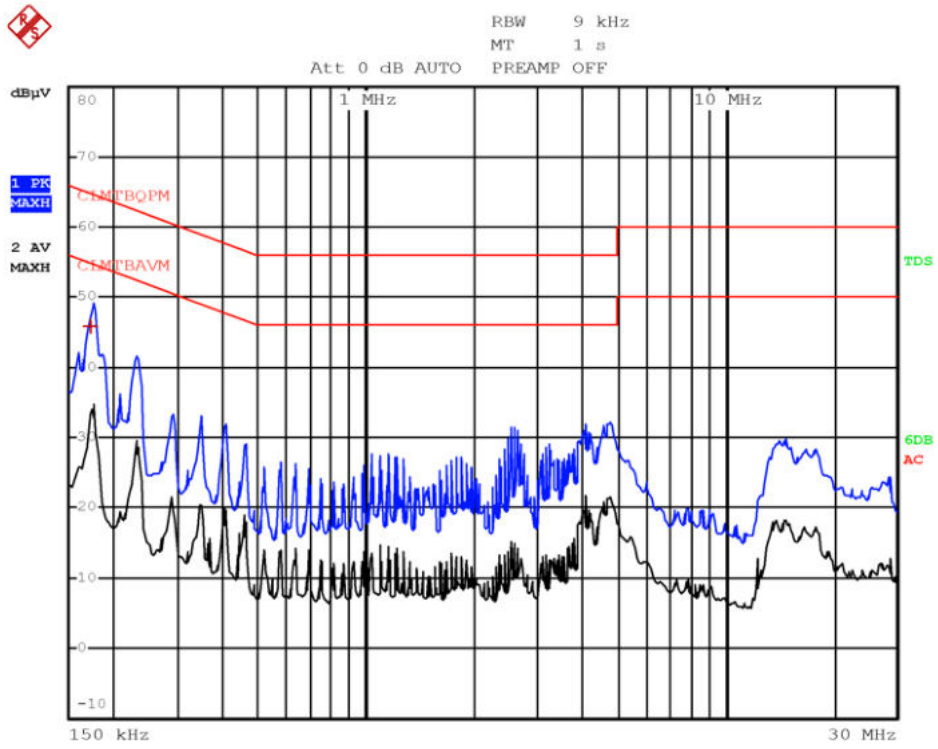


Plot 8.4-2: *Conducted emissions on phase line 2, 110V 60Hz*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1592	48.3	65.4	-17.1	QP

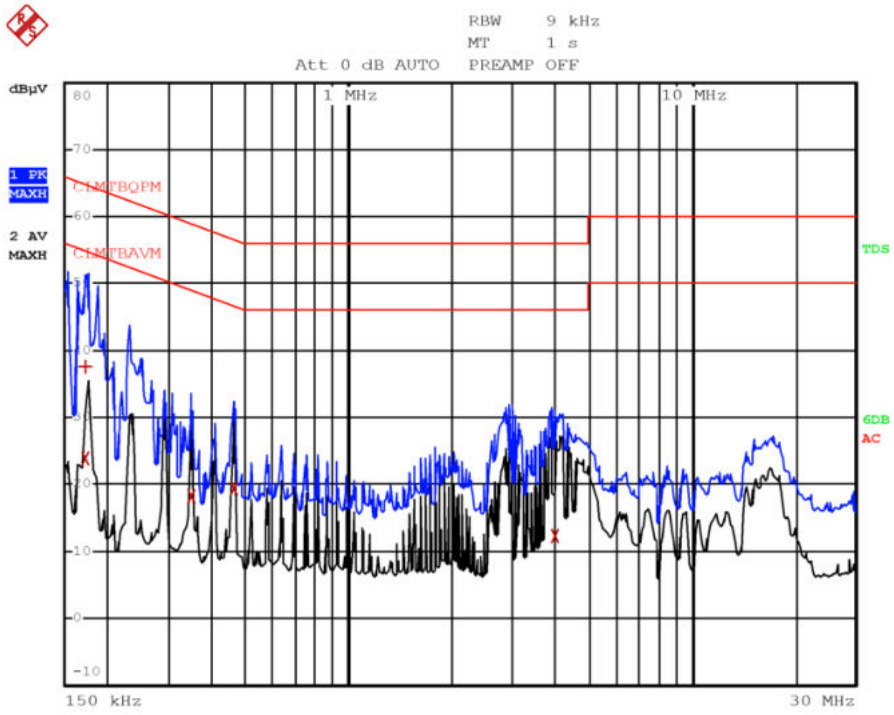


Plot 8.4-3: *Conducted emissions on phase line 3, 110V 60Hz*



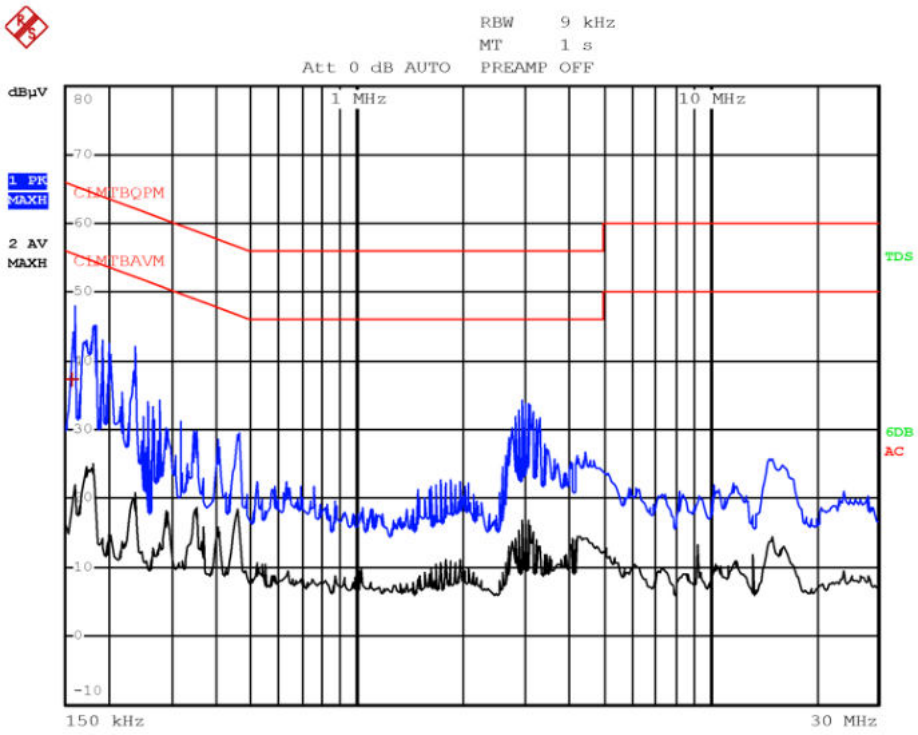
Plot 8.4-4: *Conducted emissions on neutral line, 110V 60Hz*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1740	45.8	64.8	-19.0	QP



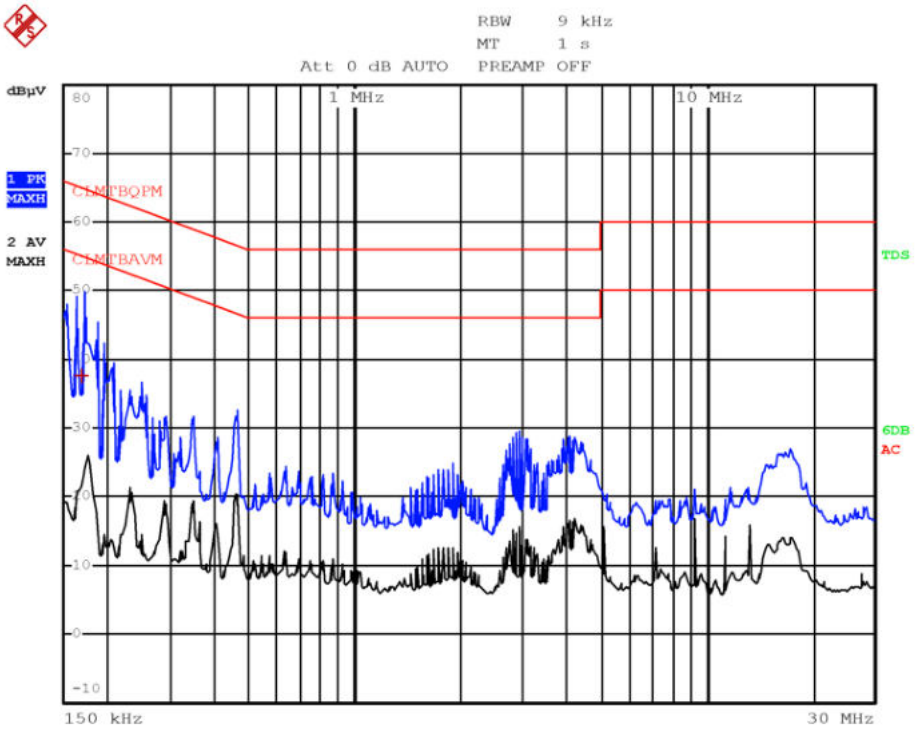
Plot 8.4-5: *Conducted emissions on phase line 1, 220V 60Hz*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1740	37.6	64.8	-27.2	QP
0.1740	24.1	54.8	-30.7	Av
0.3460	18.3	49.1	-30.8	Av
0.4620	19.4	46.7	-27.3	Av
3.9940	12.4	46.0	-33.6	Av



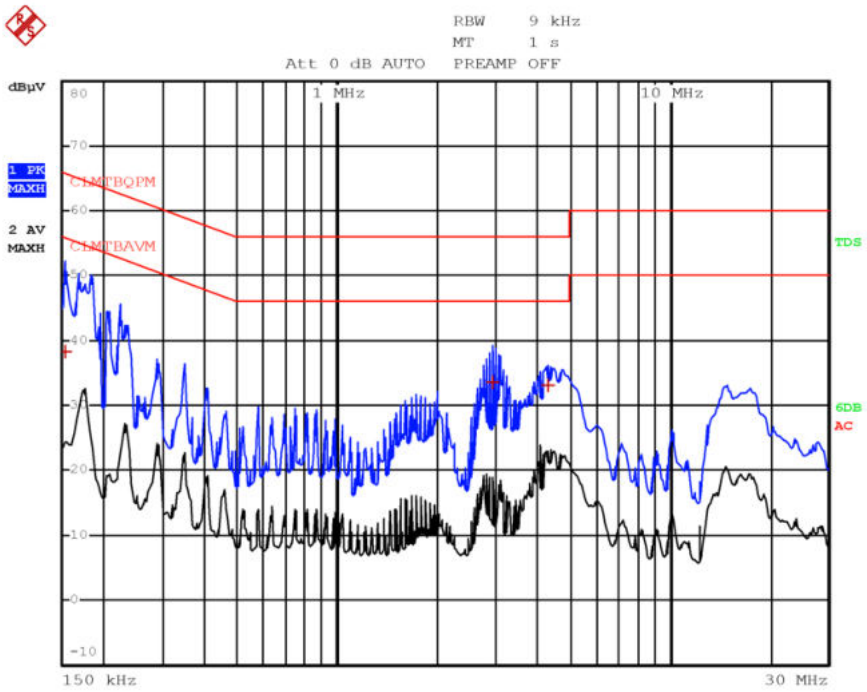
Plot 8.4-6: *Conducted emissions on phase line 2, 220V 60Hz*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1580	37.4	65.6	-28.2	QP



Plot 8.4-7: *Conducted emissions on phase line 3, 220V 60Hz*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1700	37.6	65.0	-27.4	QP



Plot 8.4-8: *Conducted emissions on neutral line, 220V 60Hz*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1540	38.4	65.8	-27.4	QP
2.9460	33.7	56.0	-22.3	QP
4.3300	33.1	56.0	-22.9	QP

Section 9. FCC 15.247(a)(1) Frequency Hopping Systems requirements

9.1 Definitions and limits

FCC:

(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.

(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.1.1 Test summary

Test date	November 25, 2024	Verdict	Pass
Test engineer	Luis Anticona	Sample tested	GLOBYSMGNG3

9.1.2 Observations, settings and special notes

Spectrum analyser settings for carrier frequency separation:

Resolution bandwidth	≥ 1 % of the span
Video bandwidth	≥ RBW
Frequency span	wide enough to capture the peaks of two adjacent channels
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for number of hopping frequencies:

Resolution bandwidth	≥ 1 % of the span
Video bandwidth	≥ RBW
Frequency span	the frequency band of operation
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for time of occupancy (dwell time):

Resolution bandwidth	1 MHz
Video bandwidth	≥ RBW
Frequency span	Zero span
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for 20 dB bandwidth:

Resolution bandwidth	≥ 1% of the 20 dB bandwidth
Video bandwidth	≥ RBW
Frequency span	approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

9.1.3 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	ESW44	101620
Cable set	Rosenberger	ST.ALO-02	1.650

9.1.4 Test data

Table 9.1-1: *20 dB bandwidth results*

Frequency, MHz	20 dB bandwidth, kHz
915.2	105.4
921.2	119.4
927.8	119.4

Table 9.1-2: *99% occupied bandwidth results*

Frequency, MHz	99% occupied bandwidth, kHz
915.2	117.9
921.2	117.9
927.8	117.7

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

Table 9.1-3: *Carrier frequency separation results*

Carrier frequency separation, kHz	Minimum limit, kHz	Margin, kHz
200.2	117.2	-83.0

Table 9.1-4: *Number of hopping frequencies results*

Number of hopping frequencies	Minimum limit	Margin
62	50	-13

Table 9.1-5: *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
10.4	3	31.2	400	-368.8

Measurement Period is 20 s

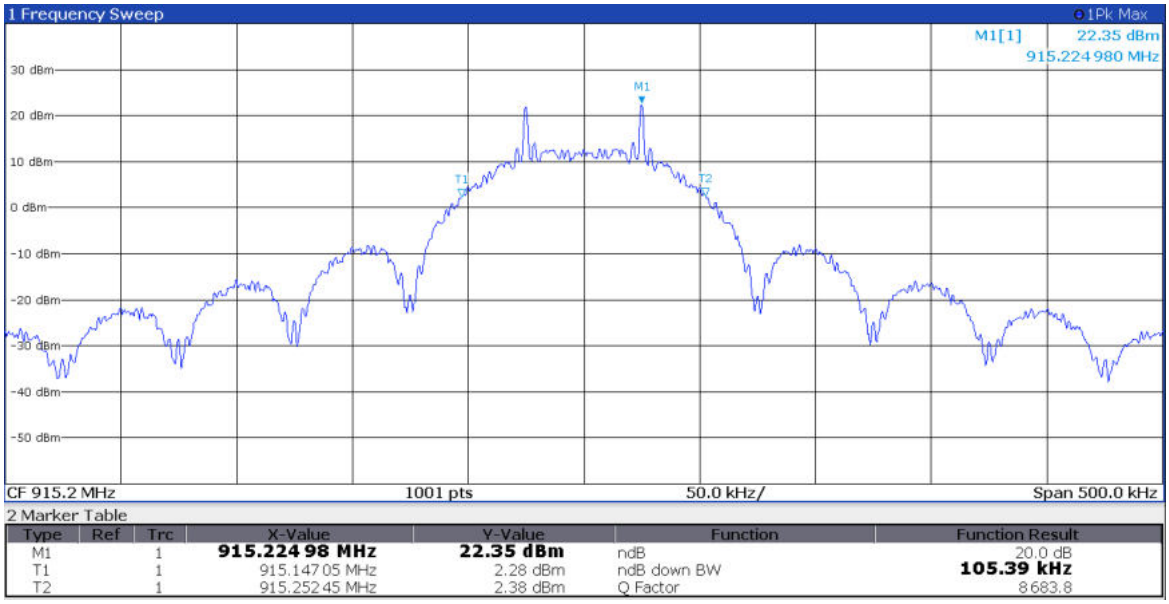


Figure 9.1-1: *20 dB bandwidth on low channel*

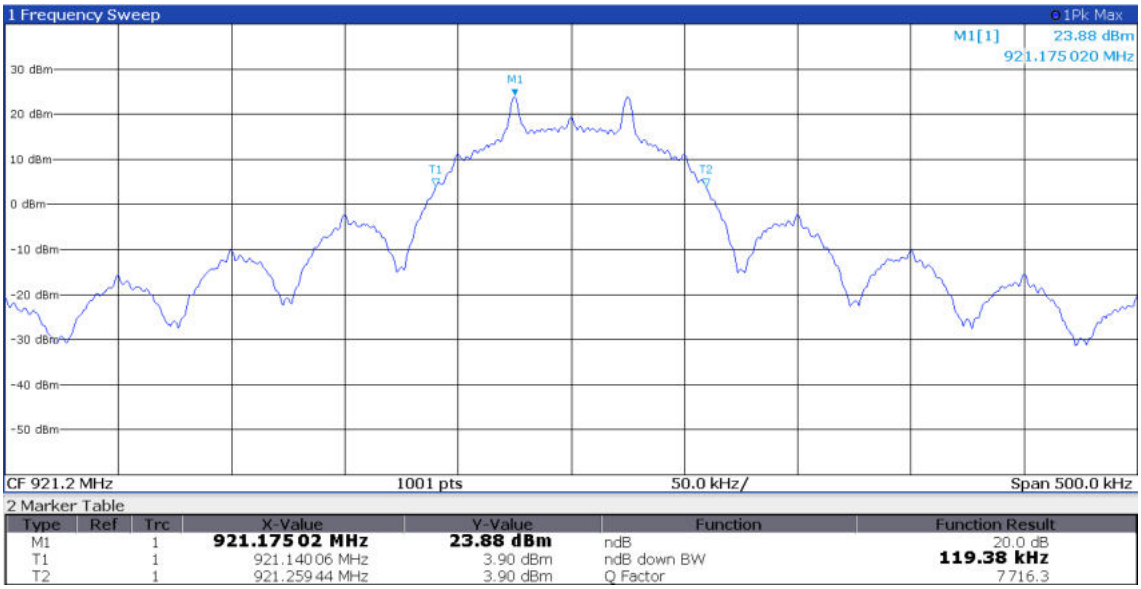


Figure 9.1-2: *20 dB bandwidth on mid channel*

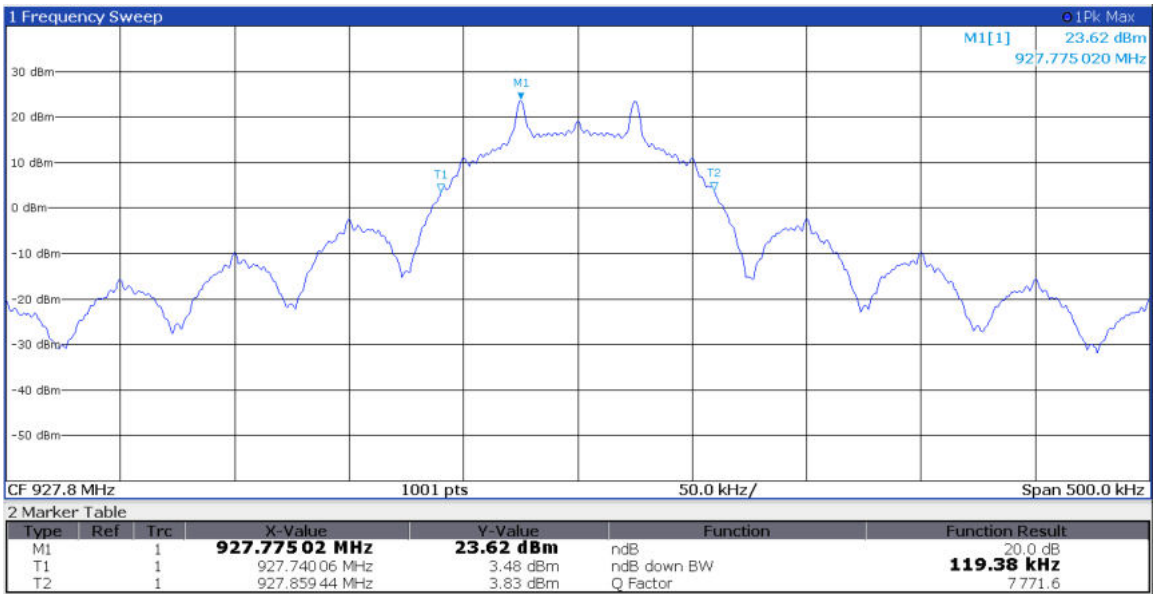


Figure 9.1-3: *20 dB bandwidth on high channel*

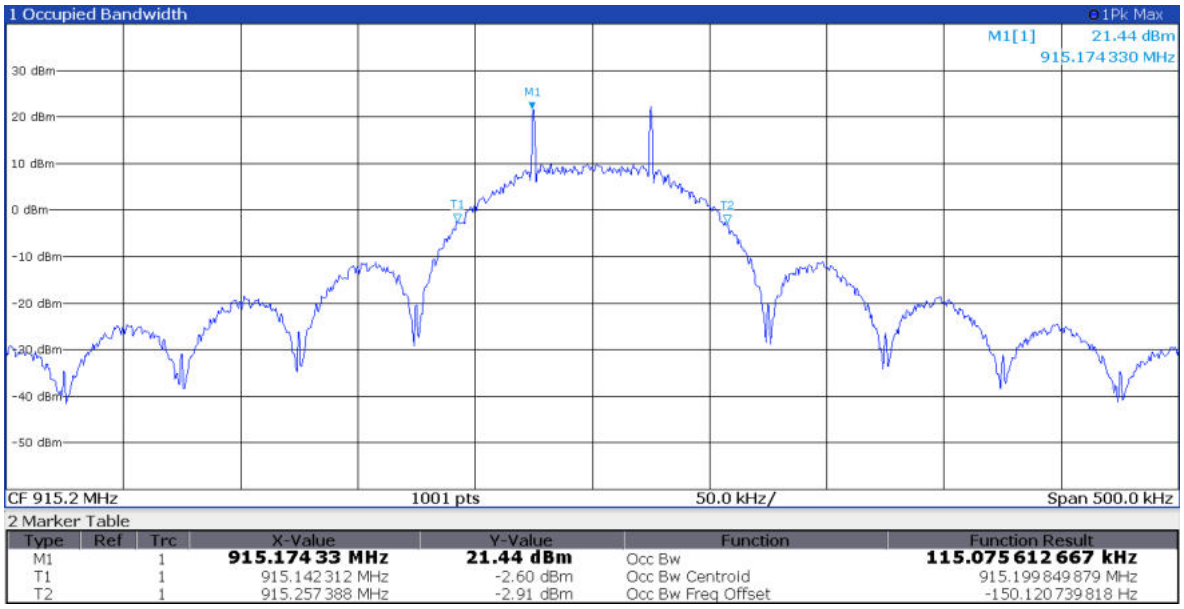


Figure 9.1-4: *99% bandwidth on low channel*

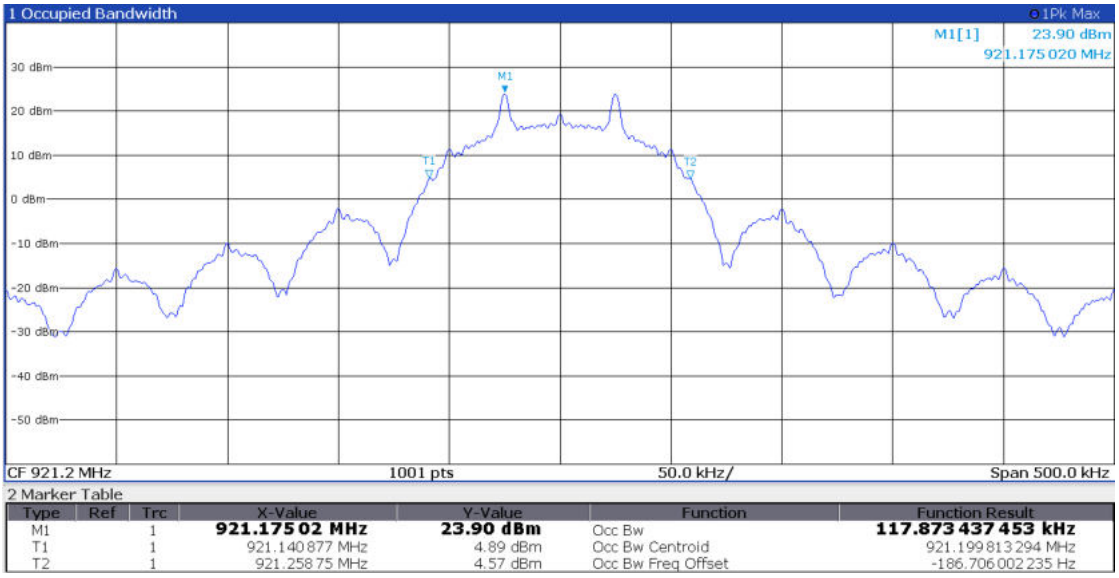


Figure 9.1-5: *99% bandwidth on mid channel*

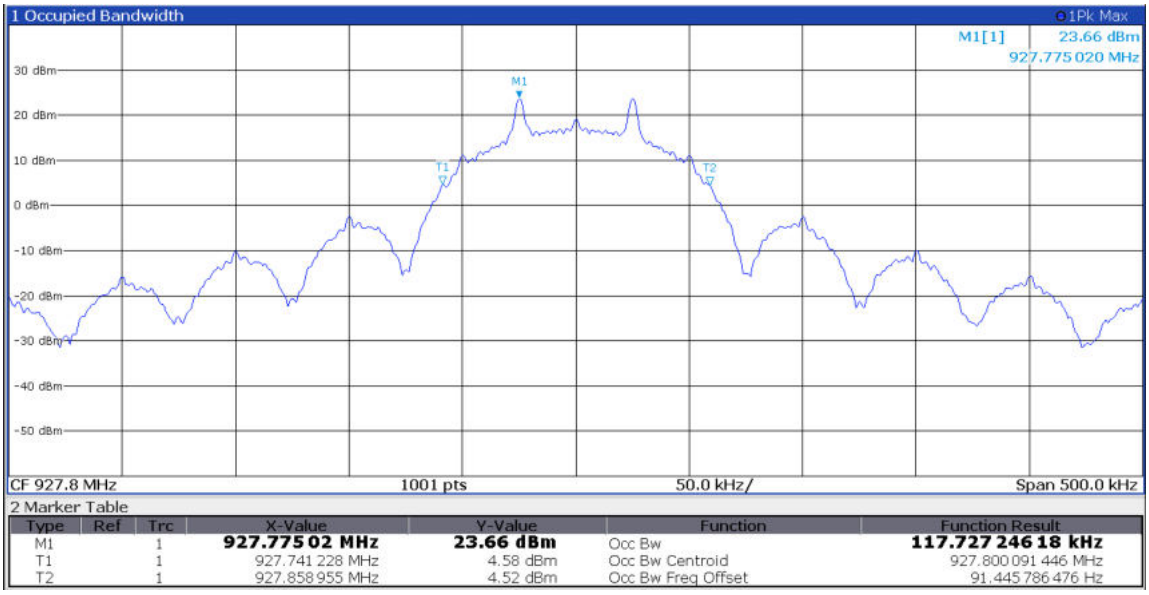


Figure 9.1-6: *99% bandwidth on high channel*

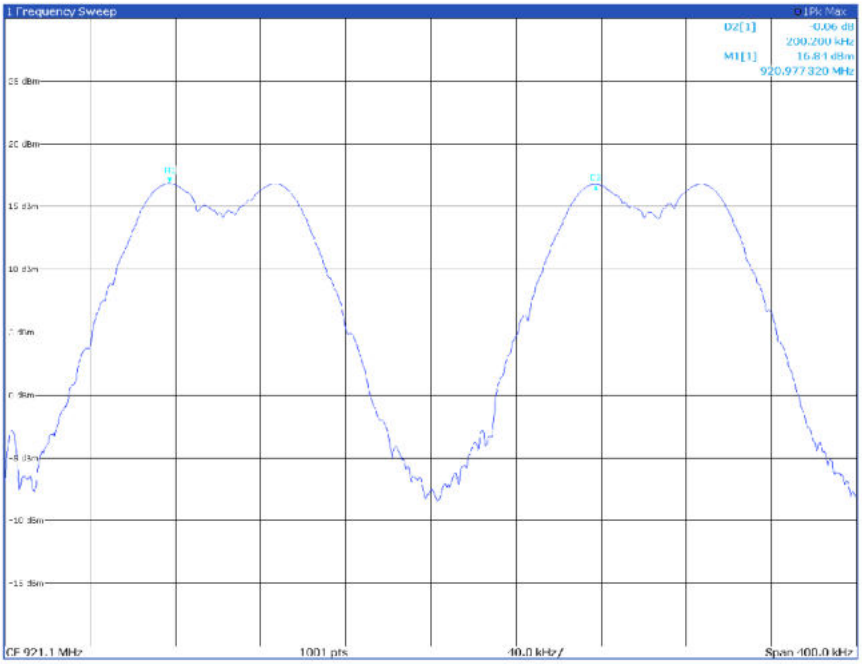


Figure 9.1-7: *Carrier frequency separation*

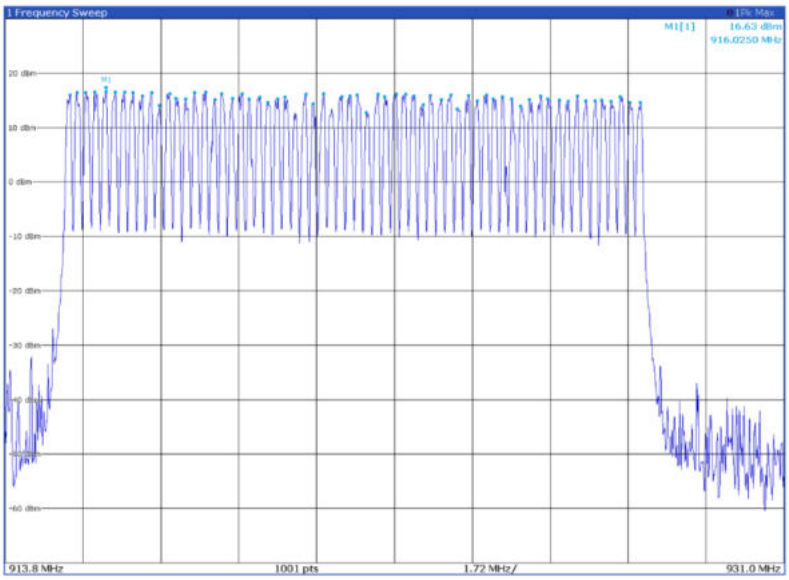


Figure 9.1-8: *Number of hopping channels*

2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	915.235000 MHz	16.038 dBm	32	921.781000 MHz	12.716 dBm
2	915.389000 MHz	16.400 dBm	33	922.039000 MHz	16.073 dBm
3	915.578000 MHz	16.417 dBm	34	922.177000 MHz	15.645 dBm
4	915.785000 MHz	16.519 dBm	35	922.434000 MHz	16.065 dBm
5	916.025000 MHz	16.628 dBm	36	922.641000 MHz	16.071 dBm
6	916.231000 MHz	16.563 dBm	37	922.830000 MHz	15.793 dBm
7	916.438000 MHz	16.504 dBm	38	923.036000 MHz	14.191 dBm
8	916.627000 MHz	16.449 dBm	39	923.190000 MHz	15.883 dBm
9	916.833000 MHz	15.789 dBm	40	923.431000 MHz	15.103 dBm
10	917.039000 MHz	16.463 dBm	41	923.637000 MHz	16.040 dBm
11	917.211000 MHz	14.001 dBm	42	923.792000 MHz	13.440 dBm
12	917.434000 MHz	16.240 dBm	43	924.032000 MHz	15.927 dBm
13	917.572000 MHz	15.395 dBm	44	924.221000 MHz	14.873 dBm
14	917.795000 MHz	15.212 dBm	45	924.428000 MHz	15.938 dBm
15	917.984000 MHz	16.393 dBm	46	924.582000 MHz	15.268 dBm
16	918.225000 MHz	16.496 dBm	47	924.788000 MHz	15.666 dBm
17	918.431000 MHz	15.146 dBm	48	924.995000 MHz	15.221 dBm
18	918.585000 MHz	16.257 dBm	49	925.184000 MHz	13.937 dBm
19	918.826000 MHz	15.345 dBm	50	925.373000 MHz	15.100 dBm
20	919.032000 MHz	16.166 dBm	51	925.630000 MHz	15.787 dBm
21	919.187000 MHz	15.268 dBm	52	925.785000 MHz	15.217 dBm
22	919.427000 MHz	15.582 dBm	53	926.043000 MHz	14.985 dBm
23	919.599000 MHz	14.643 dBm	54	926.232000 MHz	14.790 dBm
24	919.823000 MHz	15.209 dBm	55	926.438000 MHz	15.741 dBm
25	919.977000 MHz	15.540 dBm	56	926.627000 MHz	14.923 dBm
26	920.441000 MHz	16.151 dBm	57	926.833000 MHz	14.966 dBm
27	920.596000 MHz	14.365 dBm	58	926.971000 MHz	15.071 dBm
28	920.836000 MHz	16.249 dBm	59	927.177000 MHz	14.759 dBm
29	921.232000 MHz	15.703 dBm	60	927.383000 MHz	15.673 dBm
30	921.421000 MHz	15.779 dBm	61	927.589000 MHz	14.620 dBm
31	921.575000 MHz	16.003 dBm	62	927.830000 MHz	14.620 dBm

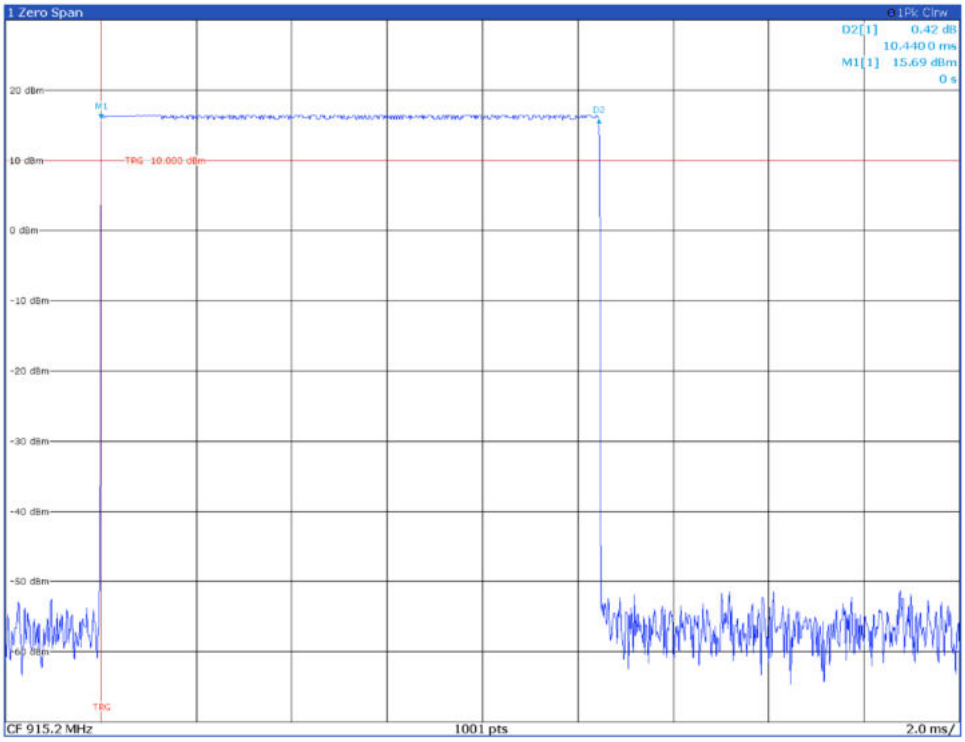


Figure 9.1-9: *Dwell time*

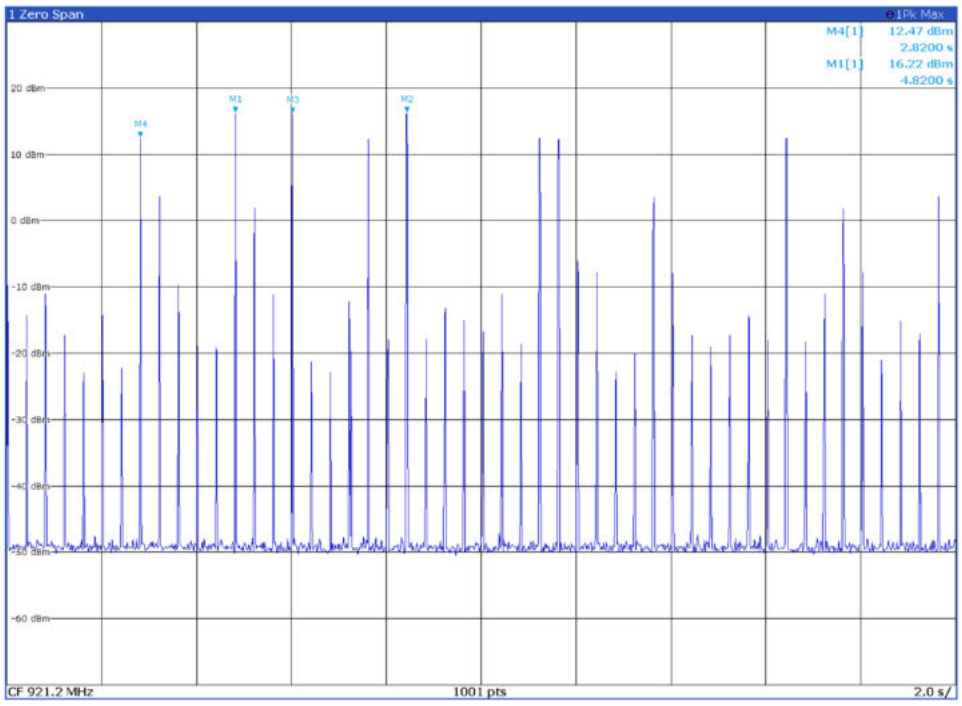


Figure 9.1-10: *Number of pulses*

Section 10. FCC 15.247(b) Transmitter output power and e.i.r.p. requirements

10.1 Definitions and limits

FCC:

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

(1) For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt (30 dBm). For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts (21 dBm).

(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.

Section 5.4(e)

Fixed point-to-point systems in the bands 2400–2483.5 MHz and 5725–5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding an e.i.r.p. of 4 W.

10.1.1 Test summary

Test date	November 25, 2024	Verdict	Pass
Test engineer	Luis Anticona	Sample tested	GLOBYSMGNG3

10.1.2 Observations, settings and special notes

Spectrum analyser settings for output power:

Resolution bandwidth	> the 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

10.1.3 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	ESW44	101620
Cable set	Rosenberger	ST.ALO-02	1.650

10.1.4 Test data

Table 10.1-1: *Output power and EIRP results for configuration with internal antenna*

Frequency, MHz	Output power, dBm	Output power limit, dBm	Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
915.2	27.33	30.00	-2.67	1.69	29.02	36.00	-6.98
921.2	27.20	30.00	-2.80	1.41	28.61	36.00	-7.39
927.8	26.89	30.00	-3.11	1.14	28.03	36.00	-7.97

EIRP = Output power + Antenna gain

Table 10.1-2: *Output power and EIRP results for configuration with external antenna*

Frequency, MHz	Output power, dBm	Output power limit, dBm	Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
915.2	27.33	30.00	-2.67	4.12	31.45	36	-4.55
921.2	27.20	30.00	-2.80	3.95	31.15	36	-4.85
927.8	26.89	30.00	-3.11	3.73	30.62	36	-5.38

Notes: EIRP = Output power + Antenna gain

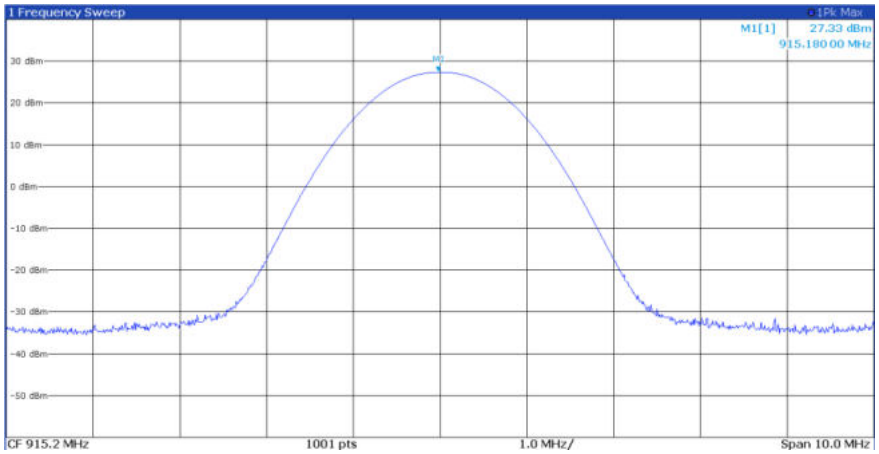


Figure 10.1-1: *Output power on low channel*

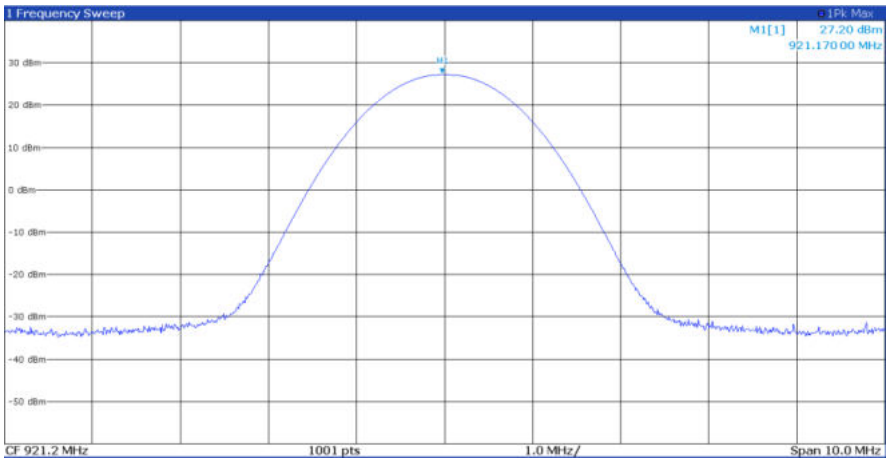


Figure 10.1-2: *Output power on mid channel*

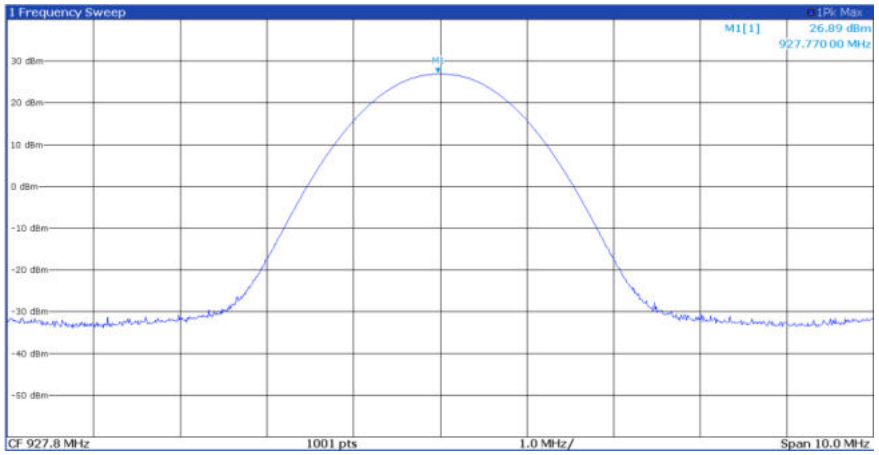


Figure 10.1-3: Output power on high channel

Section 11. FCC 15.247(d) Spurious (out-of-band) unwanted emissions

11.1 Definitions and limits

FCC:
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 11.1-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/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 11.1-2: *ISED 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 11.1-2 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 11.1-3: *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			

11.1.1 Test summary

Test date	November 21, 2024	Verdict	Pass
Test engineer	Luis Alberto	Sample tested	GLOBYSMGNG3

11.1.2 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.

In the tables below, only the 15.209 limits are show. Outside the FCC restricted frequency bands, the limit is 20 dB below the peak of the carrier measurement as show in the plot above the table. Average values in the graphics are not compensated with the DCCS and should not be taken into account.

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

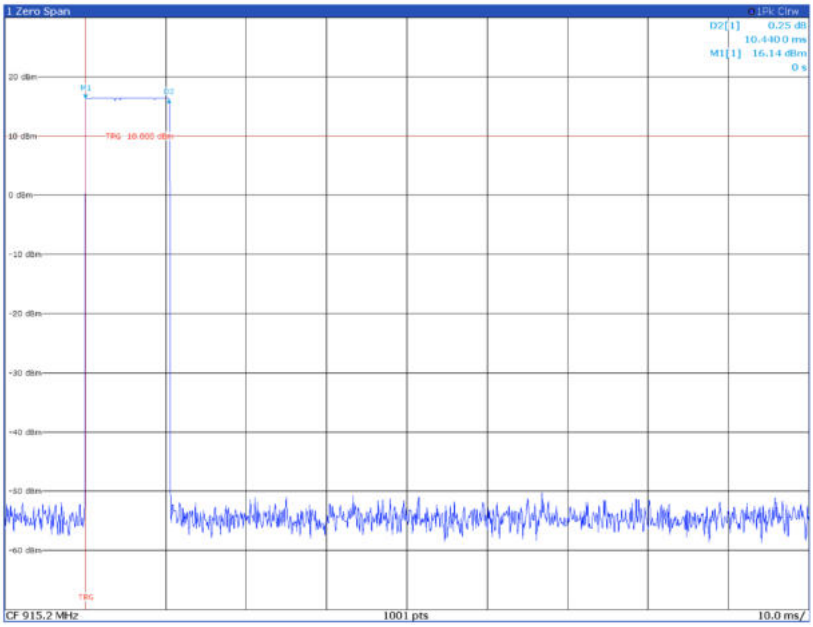
Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

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

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



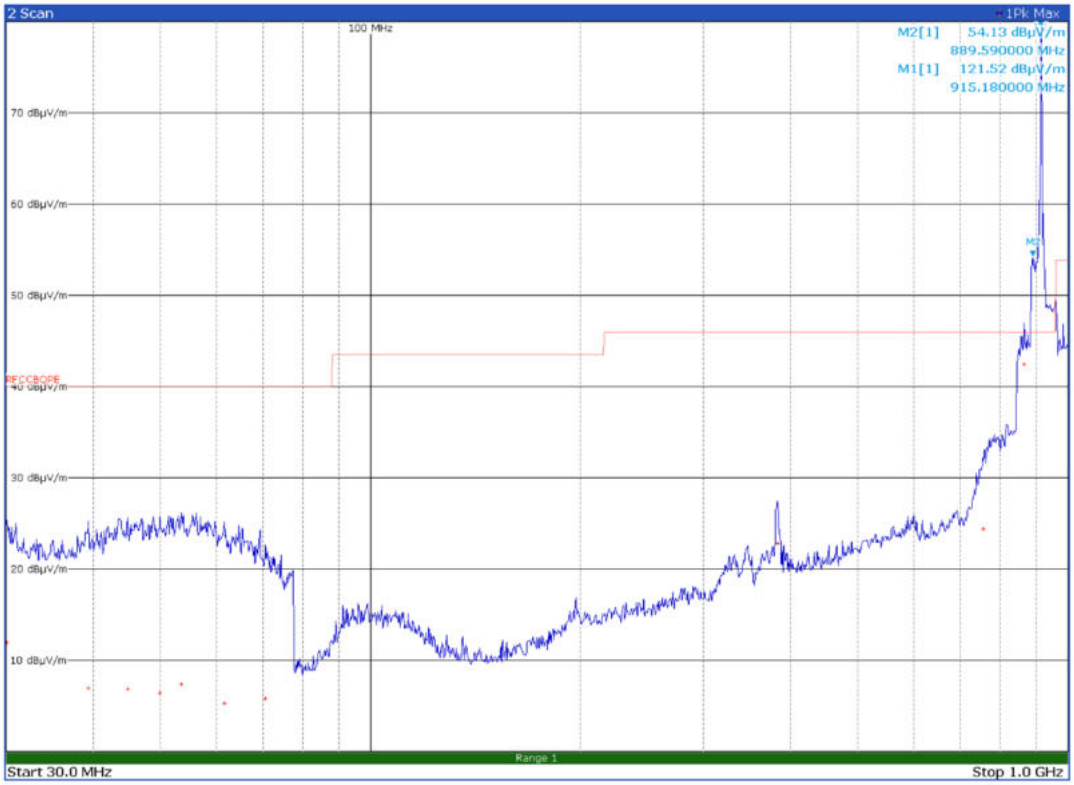
Duty cycle correction factor applied: 20 * LOG (Ton/100ms)= -19.6 dB

Av value = Pk value + DCCF

11.1.3 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
EMI Receiver	Rohde & Schwarz	ESW44	101620
EMI Receiver	Rohde & Schwarz	ESU8	100202
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
Cable set	Rosenberger	ST.ALO-02	1.650

11.1.4 Test data



Limit for 889.59 MHz peak is -20 dBc = 121.52 dBµV/m – 20 dB = 101.52 dBµV/m

Figure 11.1-1: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0600	12.0	40.0	-28.0	QP
39.3600	7.0	40.0	-33.0	QP
44.7900	6.8	40.0	-33.2	QP
49.8300	6.5	40.0	-33.5	QP
53.4900	7.4	40.0	-32.6	QP
61.6800	5.3	40.0	-34.7	QP
70.6500	5.9	40.0	-34.1	QP
382.9800	22.9	46.0	-23.1	QP
754.9500	24.4	46.0	-21.6	QP
865.1700	42.5	46.0	-3.5	QP

Limit exceeded by the carrier

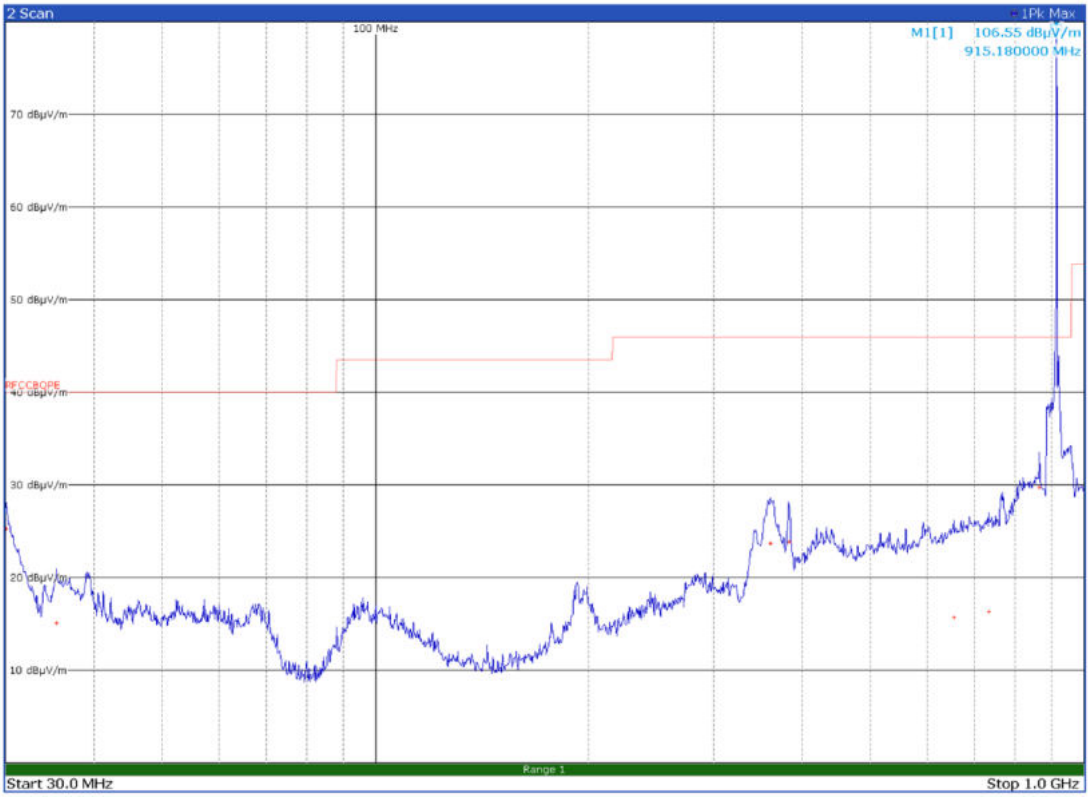


Figure 11.1-2: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0900	25.3	40.0	-14.7	QP
35.4300	15.2	40.0	-24.8	QP
360.6000	23.8	46.0	-22.2	QP
382.9800	23.9	46.0	-22.1	QP
655.1100	15.8	46.0	-30.2	QP
733.5900	16.4	46.0	-29.6	QP
865.1700	29.8	46.0	-16.2	QP

Limit exceeded by the carrier

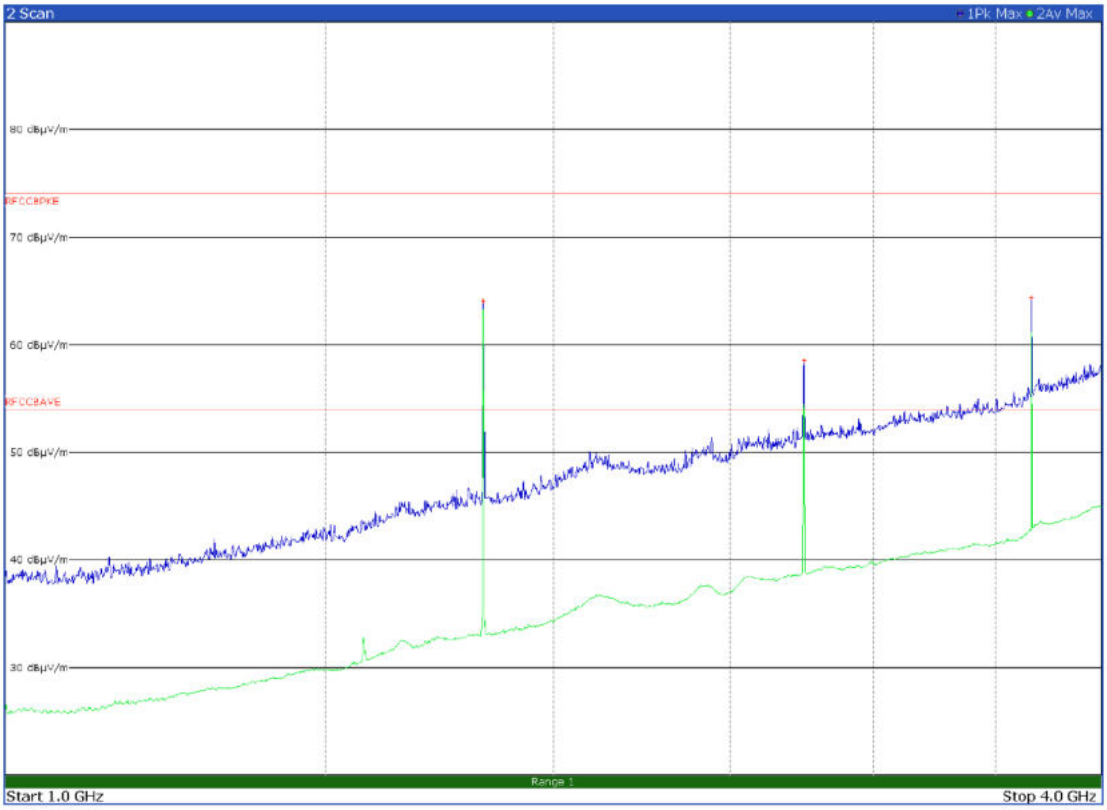


Figure 11.1-3: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1830.5000	64.1	74.0	-9.9	-19.6	44.5	54.0	-9.5
2745.7500	58.6	74.0	-15.4	-19.6	39.0	54.0	-15.0
3660.7500	64.8	74.0	-9.2	-19.6	45.2	54.0	-8.8

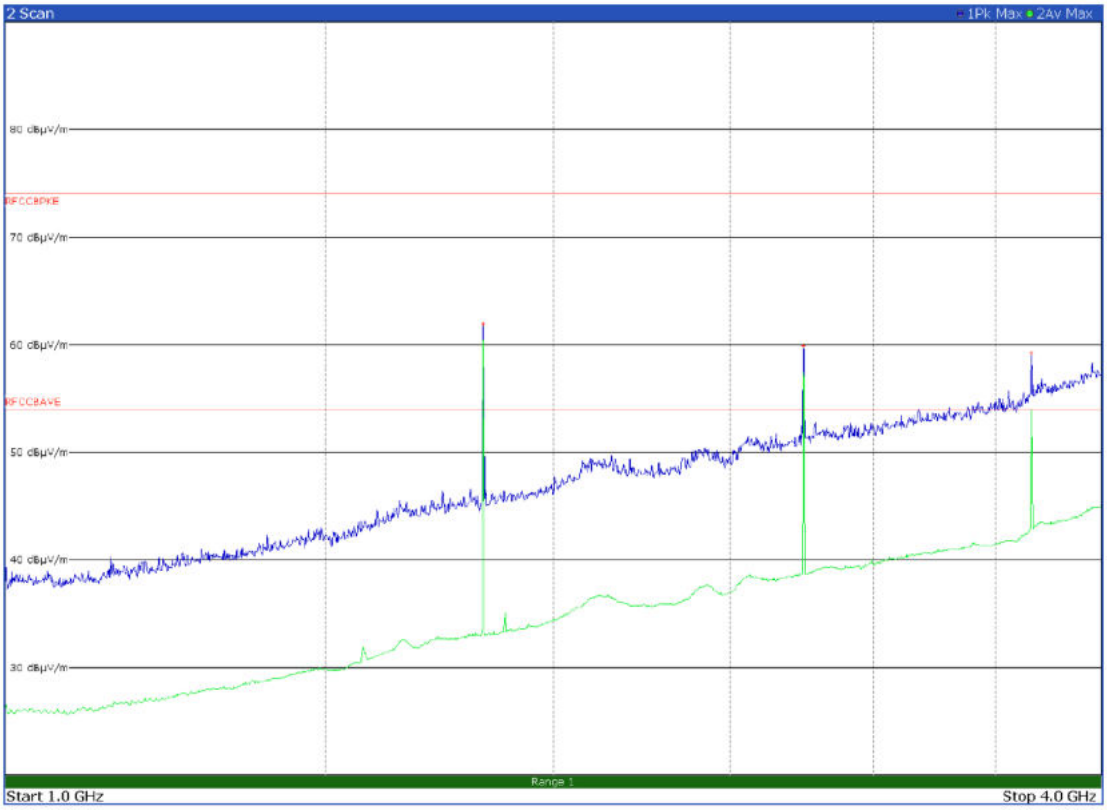


Figure 11.1-4: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1830.5000	62.0	74.0	-12.0	-19.6	42.4	54.0	-11.6
2745.5000	59.9	74.0	-14.1	-19.6	40.3	54.0	-13.7
3660.7500	59.3	74.0	-14.7	-19.6	39.7	54.0	-14.3

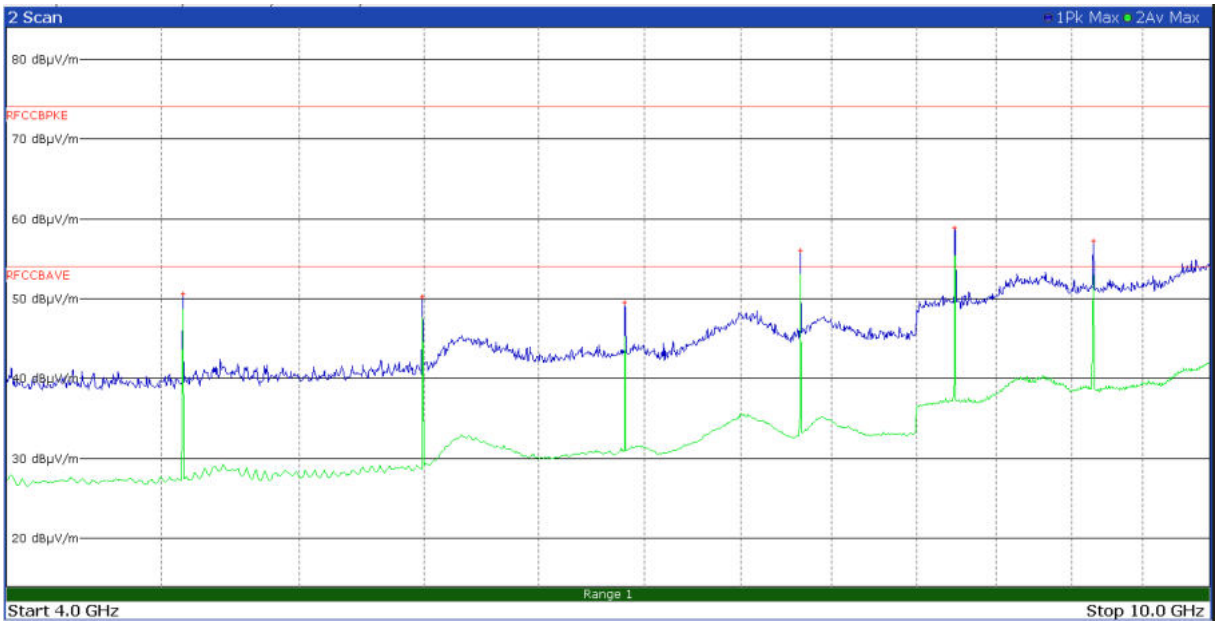


Figure 11.1-5: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4576.2500	50.6	74.0	-23.4	-19.6	31	54.0	-23
5491.0000	50.3	74.0	-23.7	-19.6	30.7	54.0	-23.3
6406.2500	49.6	74.0	-24.4	-19.6	30	54.0	-24
7321.7500	56.1	74.0	-17.9	-19.6	36.5	54.0	-17.5
8236.5000	58.9	74.0	-15.1	-19.6	39.3	54.0	-14.7
9152.2500	57.2	74.0	-16.8	-19.6	37.6	54.0	-16.4

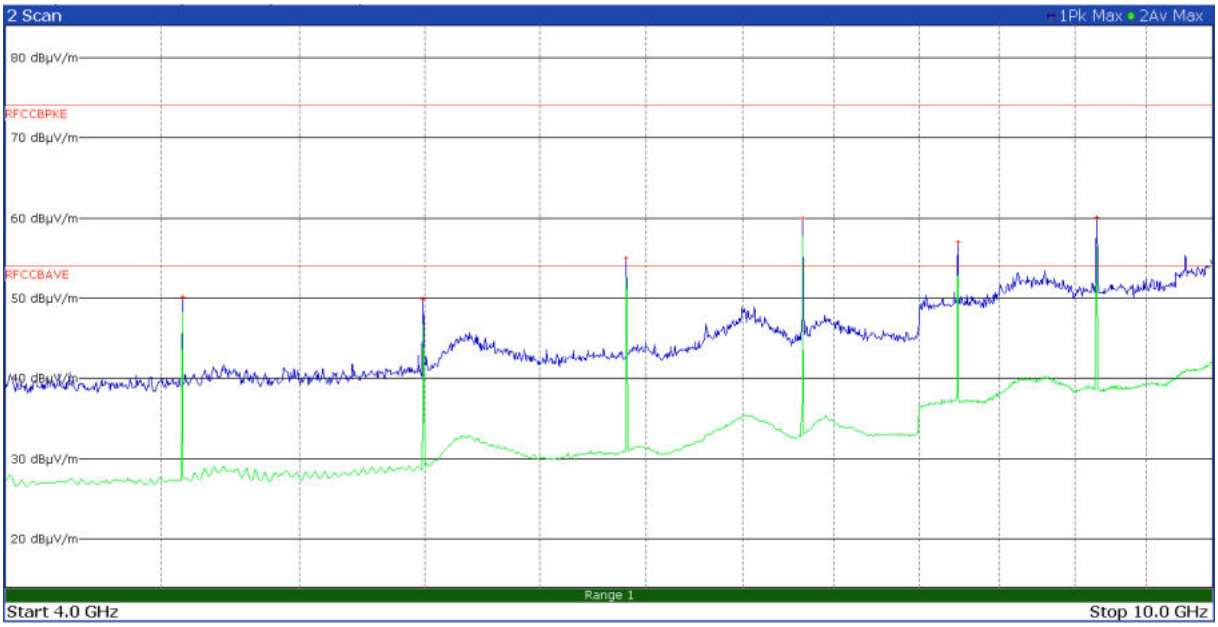
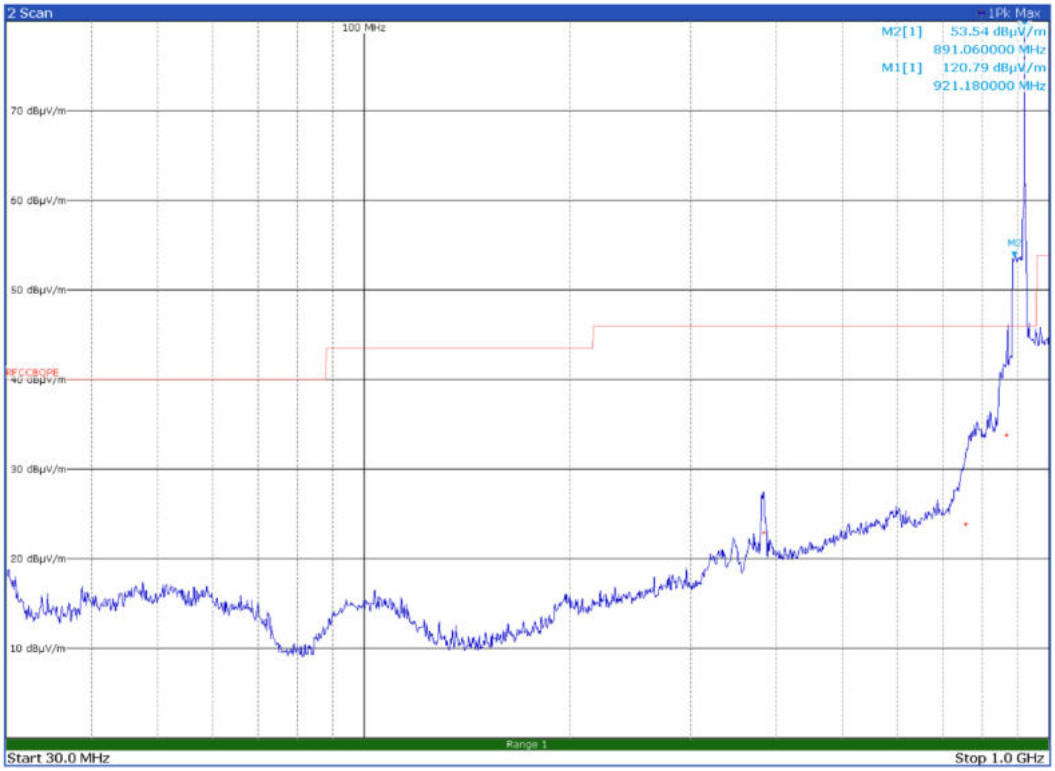


Figure 11.1-6: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4576.2500	50.2	74.0	-23.8	-19.6	30.6	54.0	-23.4
5491.2500	49.9	74.0	-24.1	-19.6	30.3	54.0	-23.7
6406.2500	55.0	74.0	-19.0	-19.6	35.4	54.0	-18.6
7321.7500	60.0	74.0	-14.0	-19.6	40.4	54.0	-13.6
8237.0000	57.1	74.0	-16.9	-19.6	37.5	54.0	-16.5
9151.7500	60.1	74.0	-13.9	-19.6	40.5	54.0	-13.5



Limit for 891.06 MHz peak is -20 dBc = 120.18 dBµV/m – 20 dB = 100.18 dBµV/m

Figure 11.1-7: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
382.9800	22.9	46.0	-23.1	QP
755.0100	23.9	46.0	-22.1	QP
866.8800	33.8	46.0	-12.2	QP

Limit exceeded by the carrier

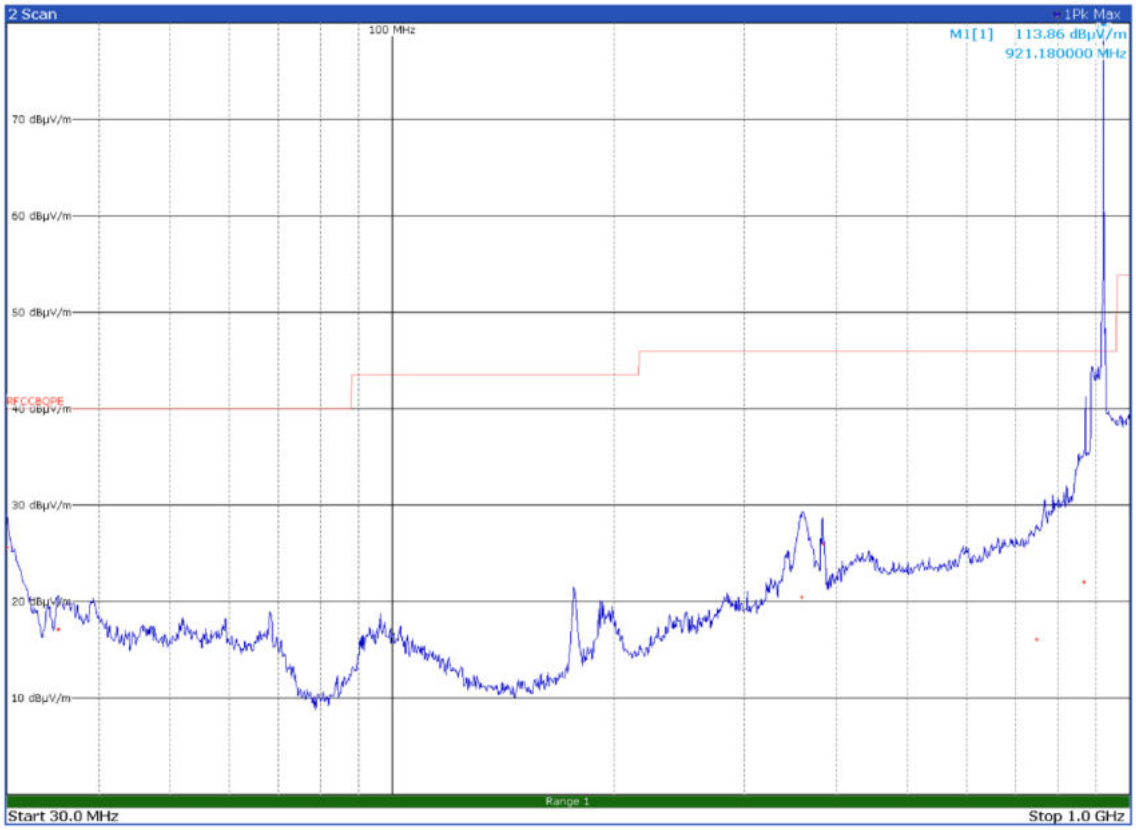


Figure 11.1-8: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0000	25.7	40.0	-14.3	QP
35.2200	17.2	40.0	-22.8	QP
359.1900	20.4	46.0	-25.6	QP
382.9800	26.0	46.0	-20.0	QP
747.3300	16.1	46.0	-29.9	QP
868.2000	22.1	46.0	-23.9	QP

Limit exceeded by the carrier

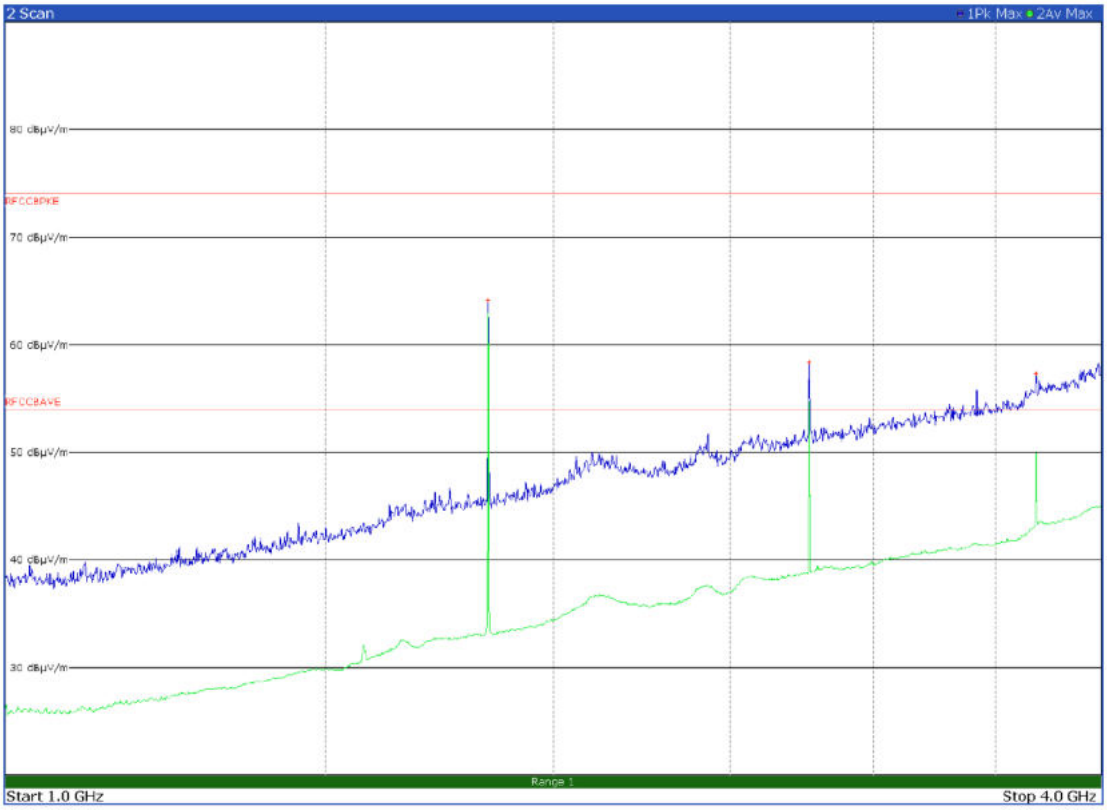


Figure 11.1-9: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1842.5000	64.2	74.0	-9.8	-19.6	44.6	54.0	-9.4
2763.5000	58.4	74.0	-15.6	-19.6	38.8	54.0	-15.2
3685.0000	57.3	74.0	-16.7	-19.6	37.7	54.0	-16.3

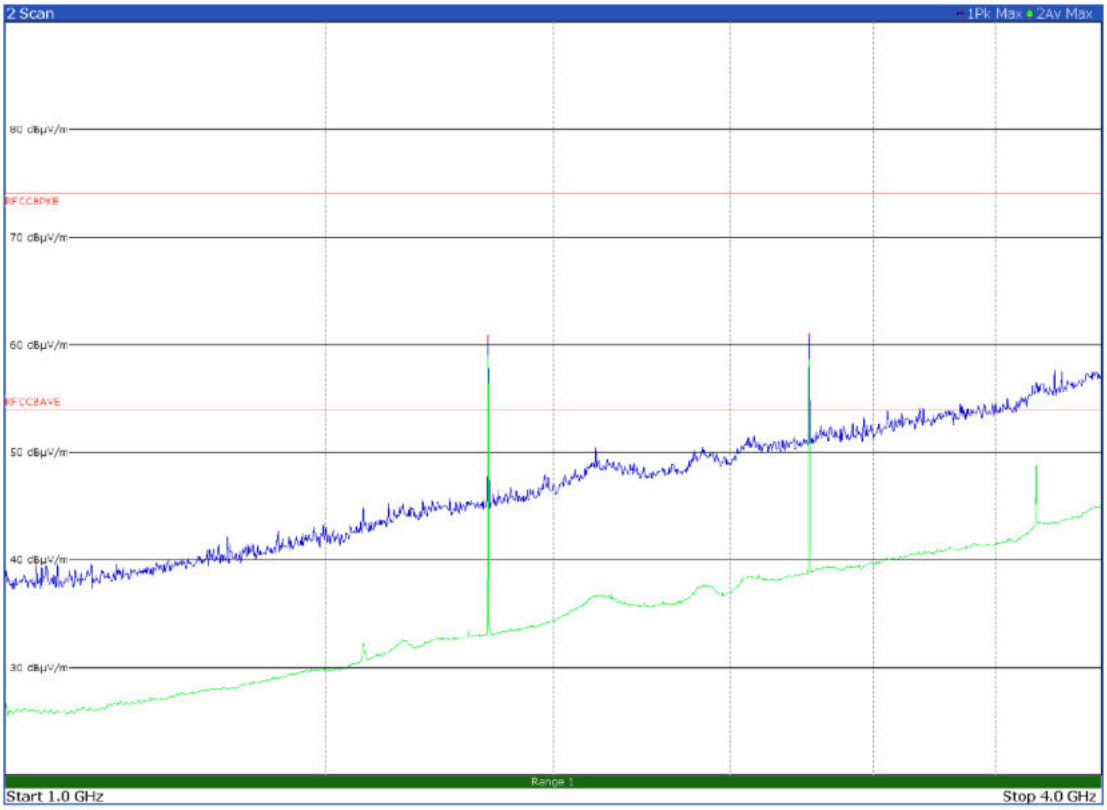


Figure 11.1-10: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1842.2500	60.8	74.0	-13.2	-19.6	41.2	54.0	-12.8
2763.5000	60.9	74.0	-13.1	-19.6	41.3	54.0	-12.7

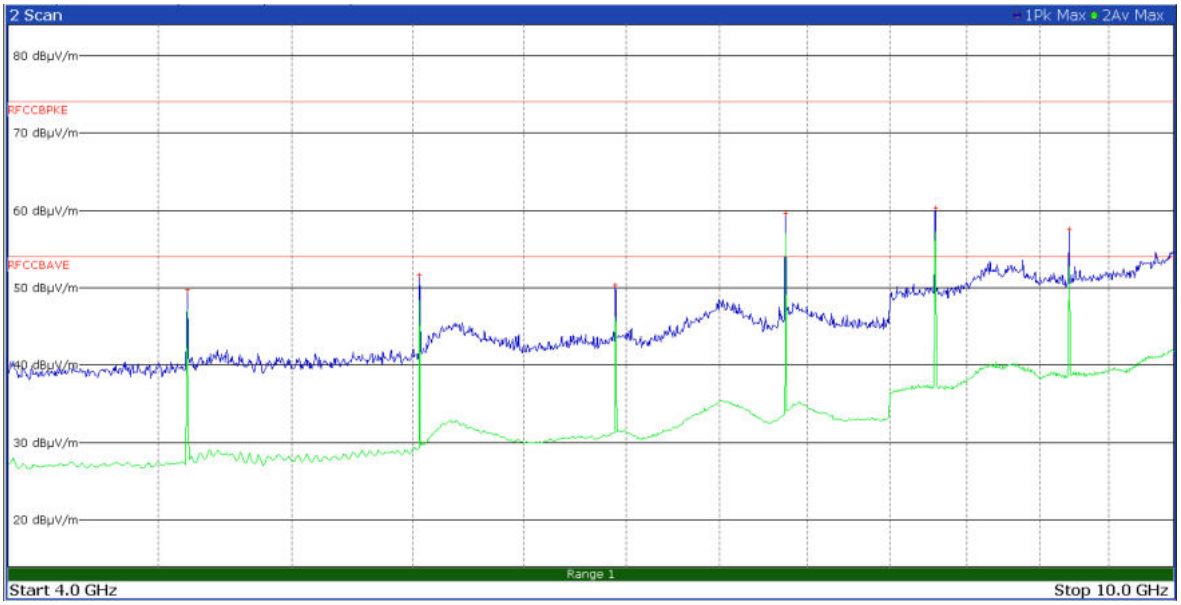


Figure 11.1-11: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4606.2500	50.2	74.0	-23.8	-19.6	30.6	54.0	-23.4
5527.2500	49.9	74.0	-24.1	-19.6	30.3	54.0	-23.7
6448.2500	55.0	74.0	-19.0	-19.6	35.4	54.0	-18.6
7369.7500	60.0	74.0	-14.0	-19.6	40.4	54.0	-13.6
8290.5000	57.1	74.0	-16.9	-19.6	37.5	54.0	-16.5
9211.7500	60.1	74.0	-13.9	-19.6	40.5	54.0	-13.5

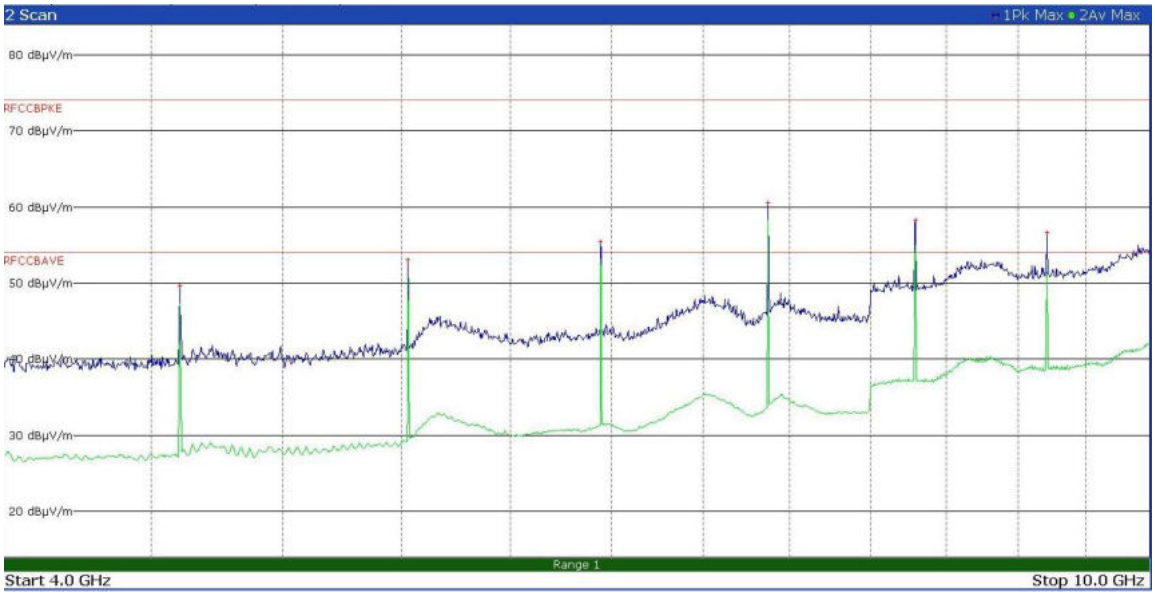
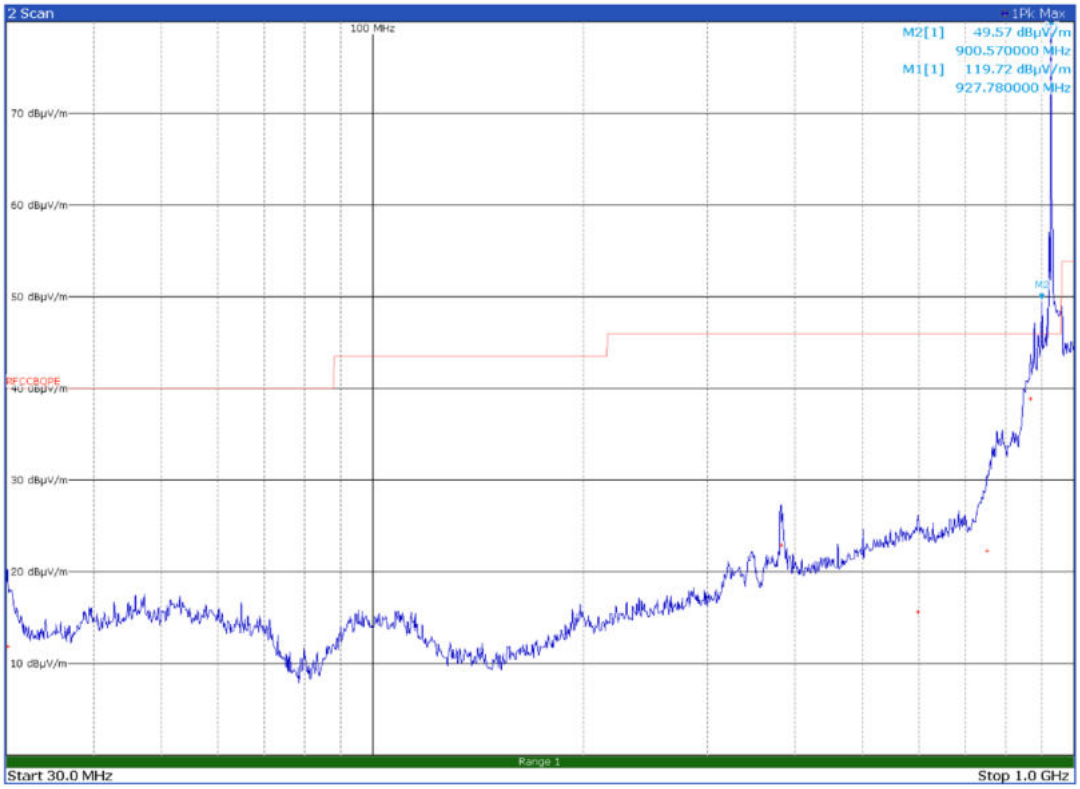


Figure 11.1-12: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4606.0000	49.7	74.0	-24.3	-19.6	30.1	54.0	-23.9
5527.0000	53.2	74.0	-20.8	-19.6	33.6	54.0	-20.4
6448.5000	55.5	74.0	-18.5	-19.6	35.9	54.0	-18.1
7369.7500	60.6	74.0	-13.4	-19.6	41.0	54.0	-13.0
8290.5000	58.4	74.0	-15.6	-19.6	38.8	54.0	-15.2
9211.7500	56.7	74.0	-17.3	-19.6	37.1	54.0	-16.9



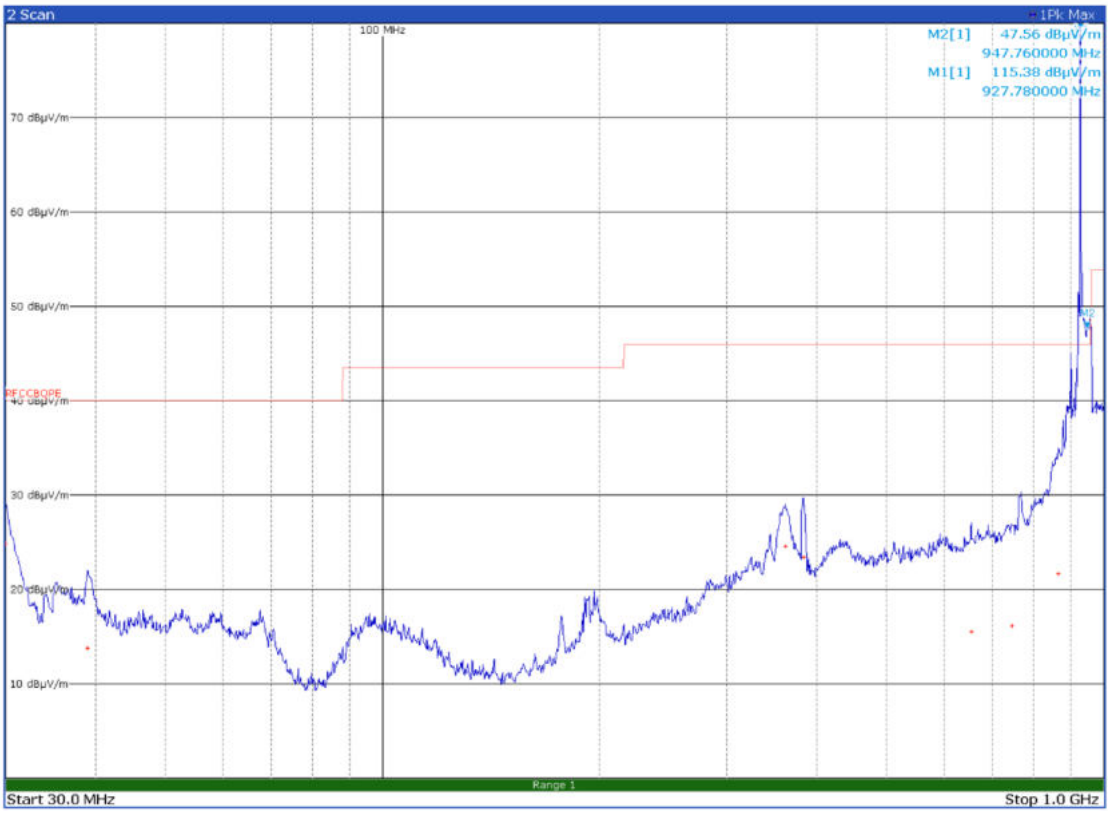
Limit for 900.57 MHz peak is -20 dBc = 119.72 dBµV/m – 20 dB = 99.72 dBµV/m

Figure 11.1-13: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.1500	11.9	40.0	-28.1	QP
381.9900	22.9	46.0	-23.1	QP
598.9200	15.6	46.0	-30.4	QP
751.1700	22.3	46.0	-23.7	QP
866.5200	38.9	46.0	-7.1	QP

Limit exceeded by the carrier



Limit for 947.76 MHz peak is -20 dBc = 115.38 dBµV/m – 20 dB = 95.38 dBµV/m

Figure 11.1-14: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0300	24.8	40.0	-15.2	QP
39.0000	13.8	40.0	-26.2	QP
361.7100	24.6	46.0	-21.4	QP
383.0100	23.5	46.0	-22.5	QP
654.7800	15.6	46.0	-30.4	QP
745.0800	16.2	46.0	-29.8	QP
865.5600	21.8	46.0	-24.2	QP

Limit exceeded by the carrier

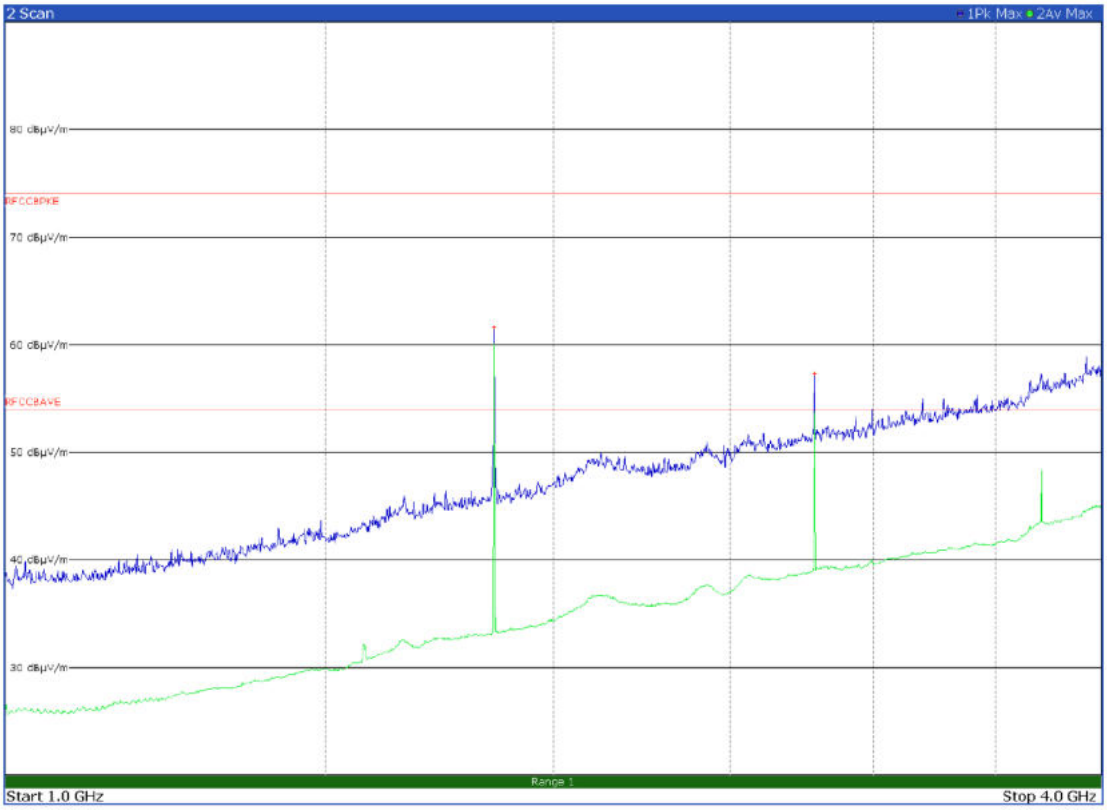


Figure 11.1-15: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1855.5000	61.6	74.0	-12.4	-19.6	42.0	54.0	-12.0
2783.5000	57.3	74.0	-16.7	-19.6	37.7	54.0	-16.3

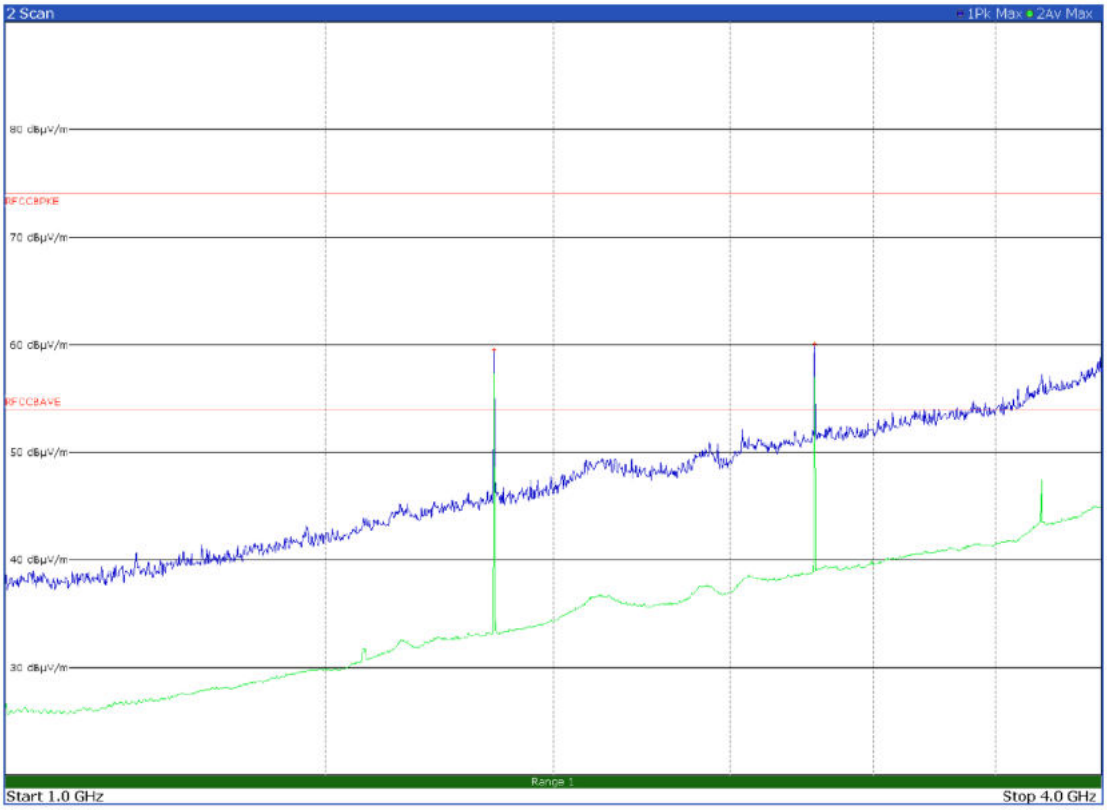


Figure 11.1-16: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1855.5000	59.6	74.0	-14.4	-19.6	40.0	54.0	-14.0
2783.2500	60.1	74.0	-13.9	-19.6	40.5	54.0	-13.5

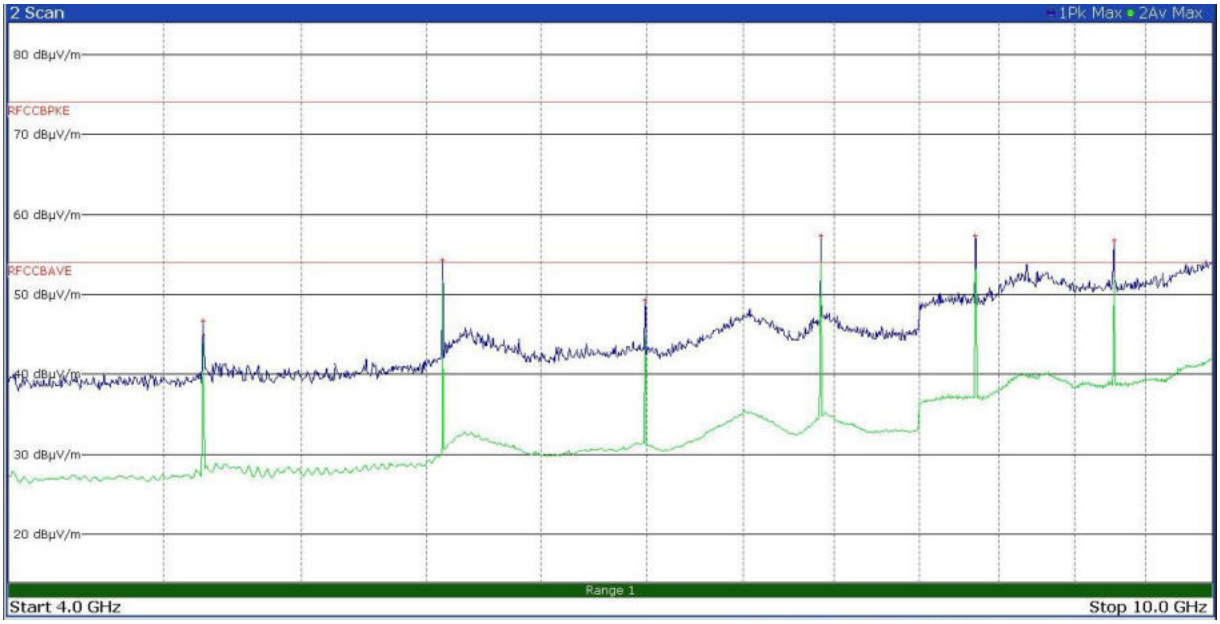


Figure 11.1-17: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4639.0000	46.8	74.0	-27.2	-19.6	27.2	54.0	-26.8
5567.0000	54.3	74.0	-19.7	-19.6	34.7	54.0	-19.3
6494.7500	49.3	74.0	-24.7	-19.6	29.7	54.0	-24.3
7422.5000	57.4	74.0	-16.6	-19.6	37.8	54.0	-16.2
8350.0000	57.4	74.0	-16.6	-19.6	37.8	54.0	-16.2
9278.2500	56.8	74.0	-17.2	-19.6	37.2	54.0	-16.8

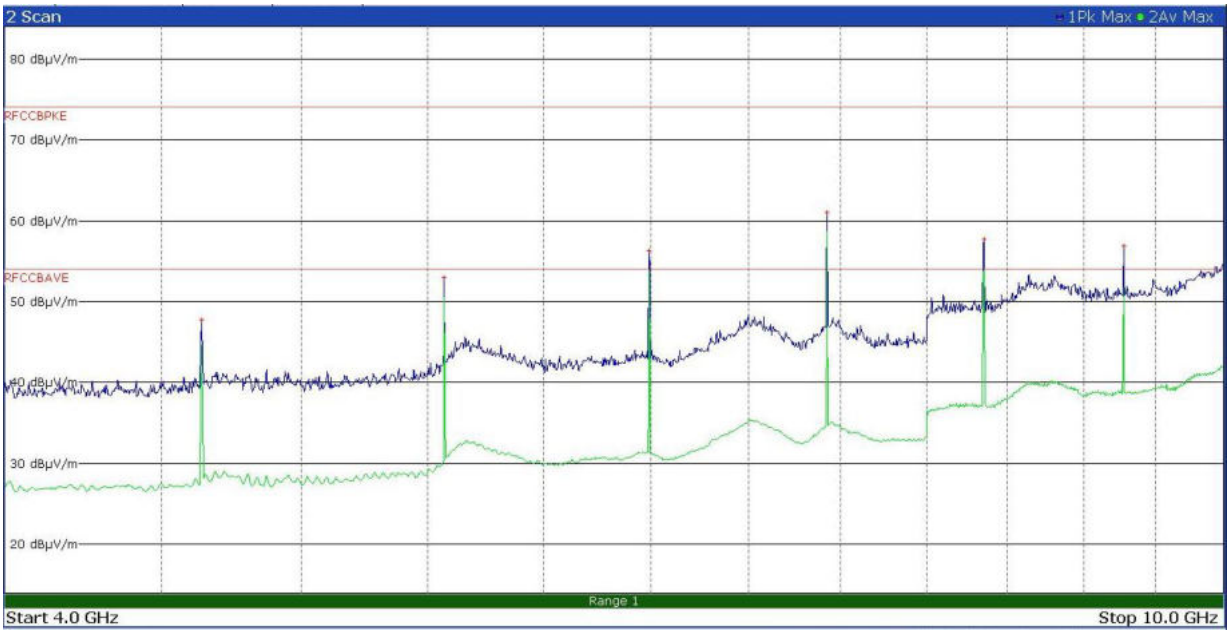


Figure 11.1-18: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

Internal antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4638.7500	47.8	74.0	-26.2	-19.6	28.2	54.0	-25.8
5567.0000	53.0	74.0	-21	-19.6	33.4	54.0	-20.6
6494.7500	56.3	74.0	-17.7	-19.6	36.7	54.0	-17.3
7422.2500	61.1	74.0	-12.9	-19.6	41.5	54.0	-12.5
8350.5000	57.8	74.0	-16.2	-19.6	38.2	54.0	-15.8
9277.7500	56.9	74.0	-17.1	-19.6	37.3	54.0	-16.7

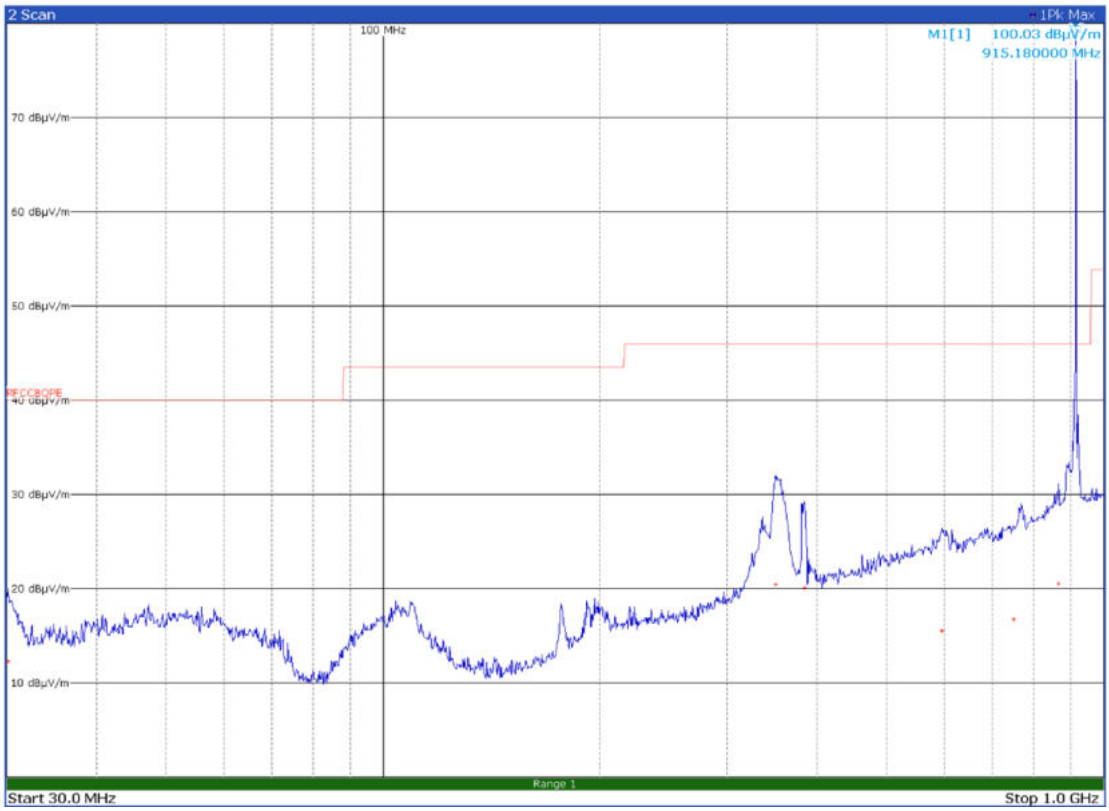


Figure 11.1-19: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.1500	12.3	40.0	-27.7	QP
350.1000	20.5	46.0	-25.5	QP
384.0300	20.1	46.0	-25.9	QP
596.0400	15.6	46.0	-30.4	QP
749.5500	16.8	46.0	-29.2	QP
865.2000	20.6	46.0	-25.4	QP

Limit exceeded by the carrier

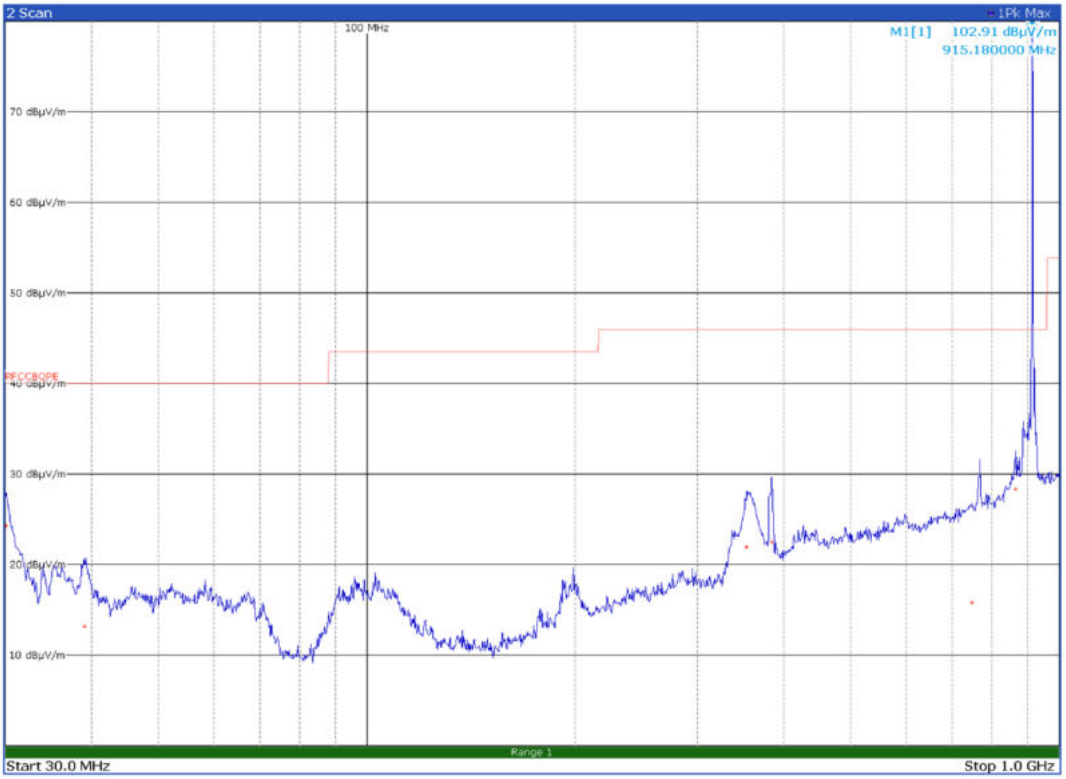


Figure 11.1-20: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.0900	24.3	40.0	-15.7	QP
39.0300	13.2	40.0	-26.8	QP
353.7300	22.0	46.0	-24.0	QP
384.0000	22.5	46.0	-23.5	QP
747.9600	15.9	46.0	-30.1	QP
865.2300	28.4	46.0	-17.6	QP

Limit exceeded by the carrier

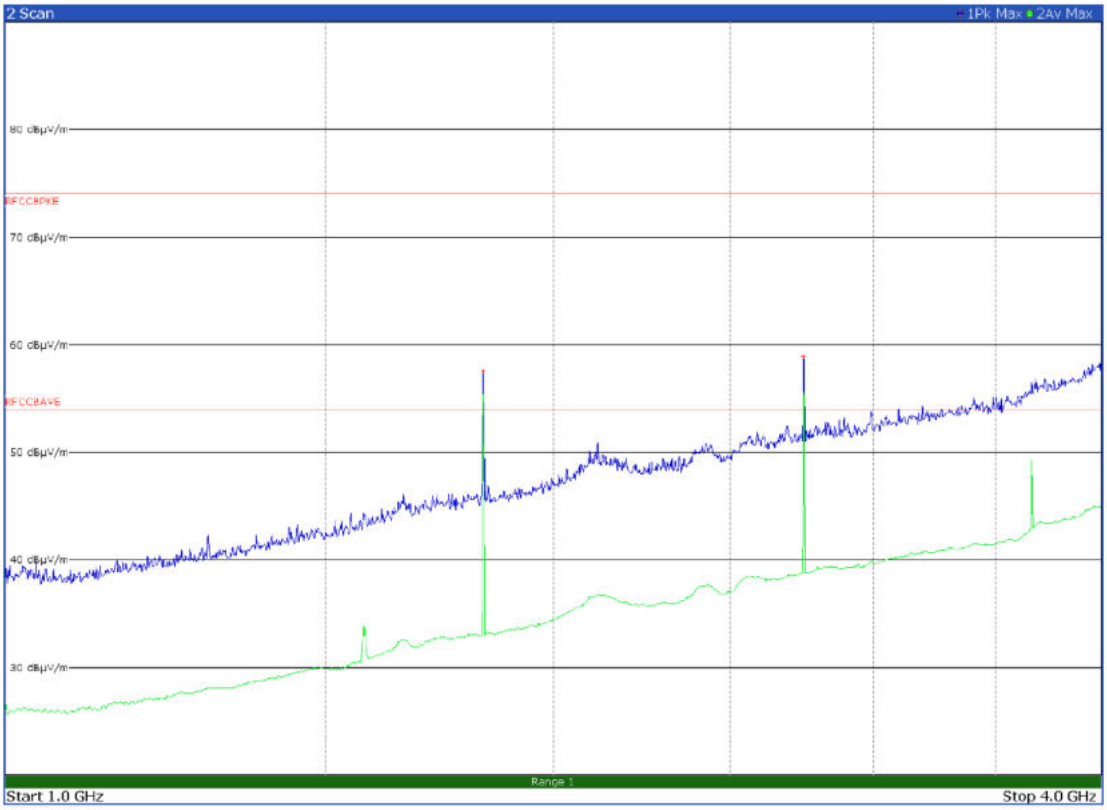


Figure 11.1-21: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1830.5000	57.6	74.0	-16.4	-19.6	38.0	54.0	-16.0
2745.5000	59.0	74.0	-15.0	-19.6	39.4	54.0	-14.6

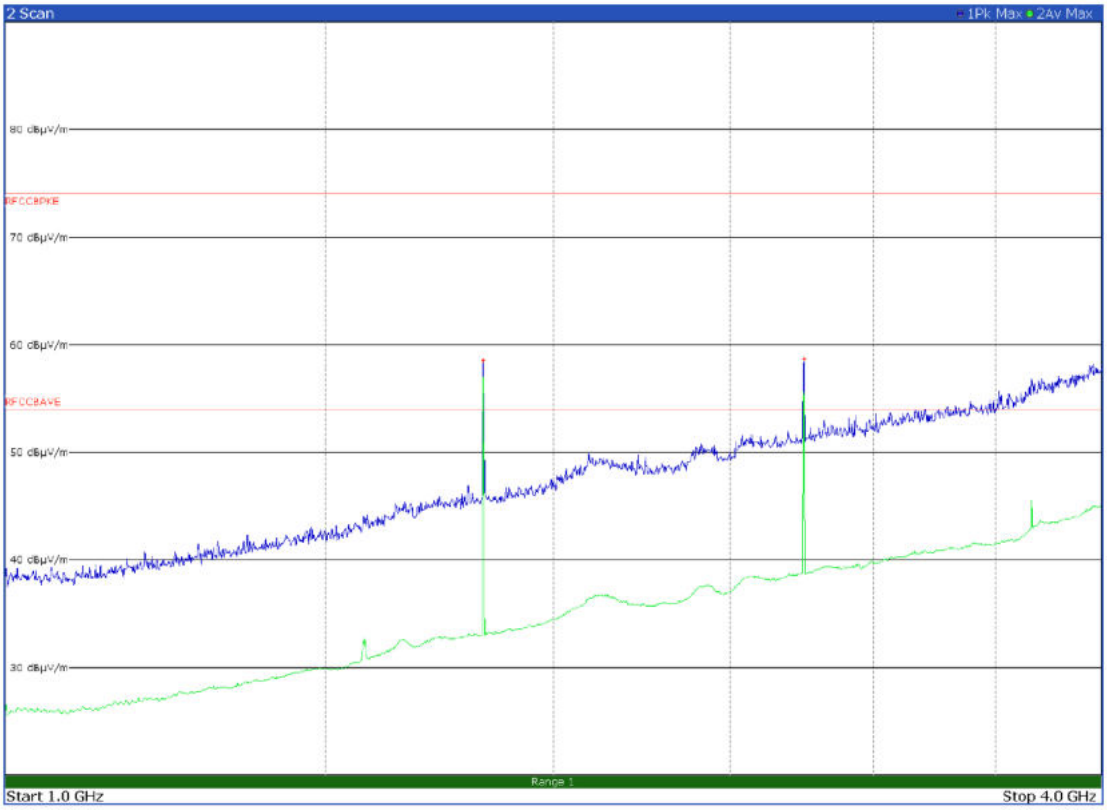


Figure 11.1-22: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1830.5000	57.2	74.0	-16.8	-19.6	37.6	54.0	-16.4
2745.5000	57.8	74.0	-16.2	-19.6	38.2	54.0	-15.8

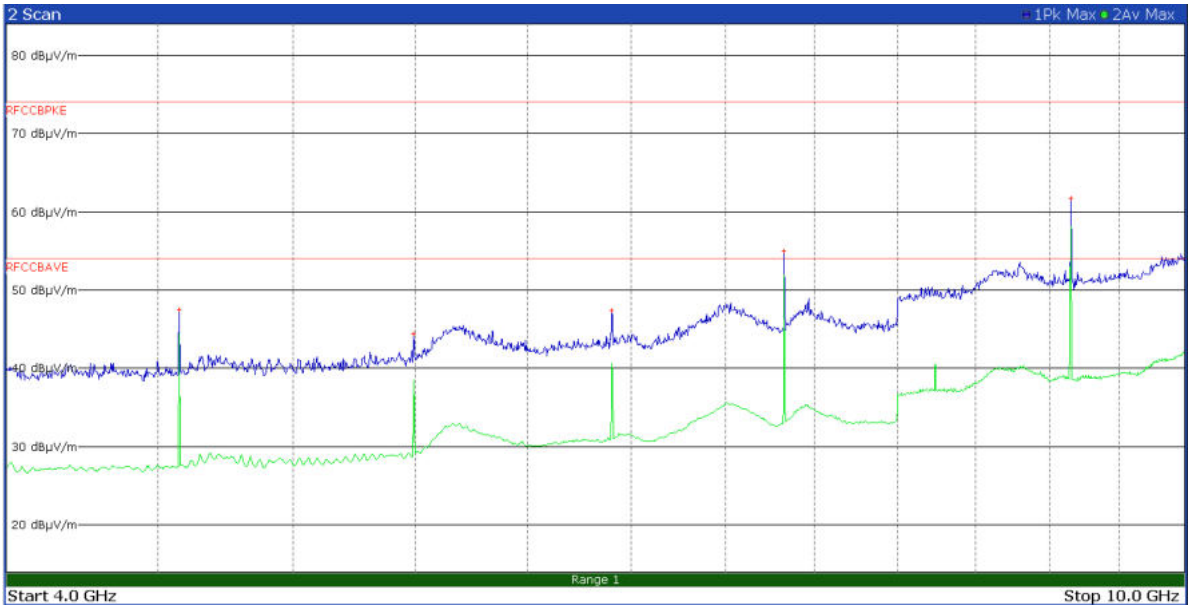


Figure 11.1-23: *Radiated spurious emissions on low channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4576.0000	47.6	74.0	-26.4	-19.6	28.0	54.0	-26.0
5491.0000	44.5	74.0	-29.5	-19.6	24.9	54.0	-29.1
6406.2500	47.4	74.0	-26.6	-19.6	27.8	54.0	-26.2
7321.7500	55.0	74.0	-19.0	-19.6	35.4	54.0	-18.6
9152.2500	61.7	74.0	-12.3	-19.6	42.1	54.0	-11.9

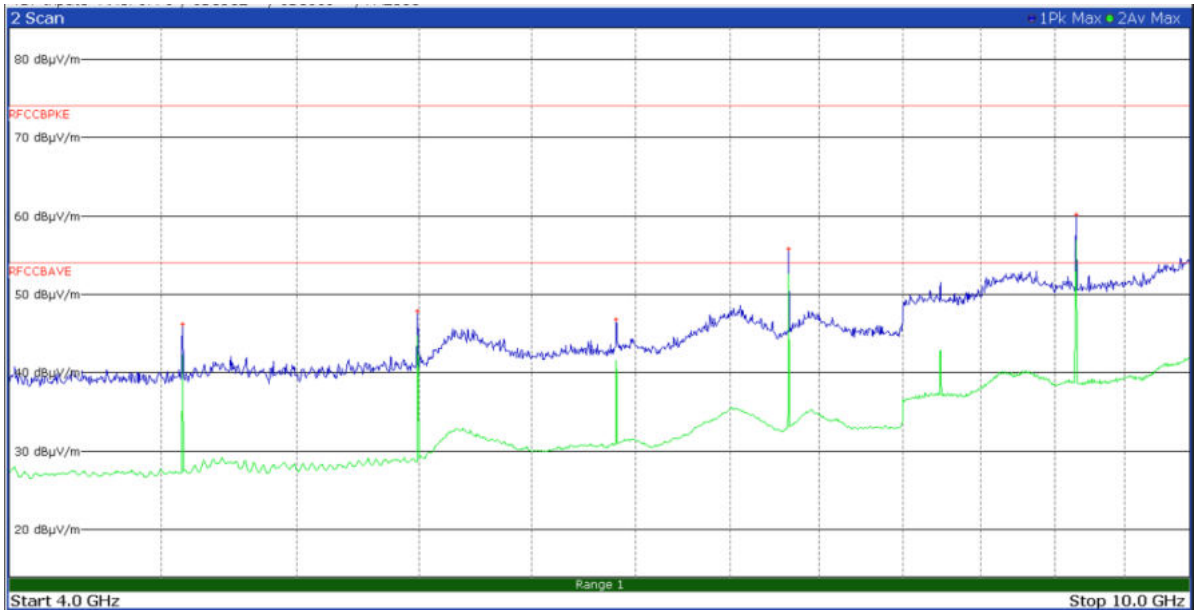


Figure 11.1-24: *Radiated spurious emissions on low channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4575.7500	46.3	74.0	-27.7	-19.6	26.7	54.0	-27.3
5491.0000	47.9	74.0	-26.1	-19.6	28.3	54.0	-25.7
6406.5000	46.8	74.0	-27.2	-19.6	27.2	54.0	-26.8
7321.7500	55.8	74.0	-18.2	-19.6	36.2	54.0	-17.8
9151.7500	60.3	74.0	-13.7	-19.6	40.7	54.0	-13.3

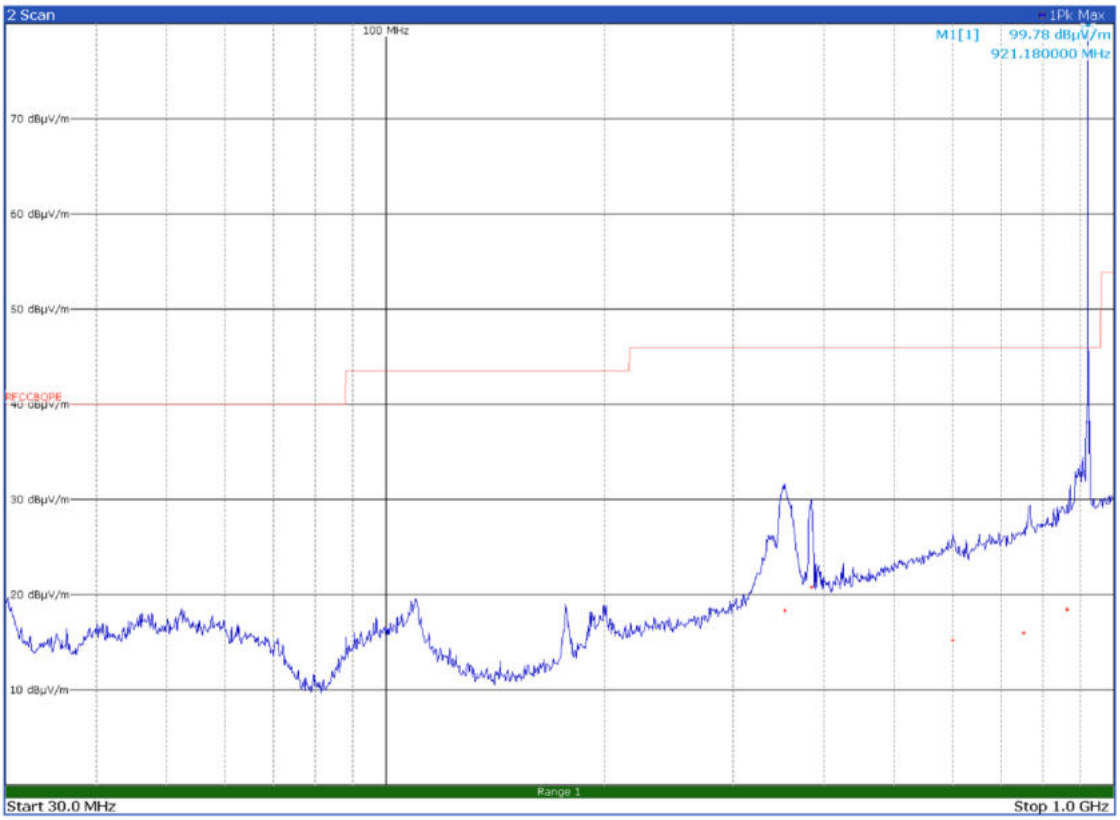


Figure 11.1-25: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
353.3100	18.4	46.0	-27.6	QP
384.0300	20.8	46.0	-25.2	QP
600.7800	15.2	46.0	-30.8	QP
752.5200	16.0	46.0	-30.0	QP
861.9900	18.5	46.0	-27.5	QP

Limit exceeded by the carrier

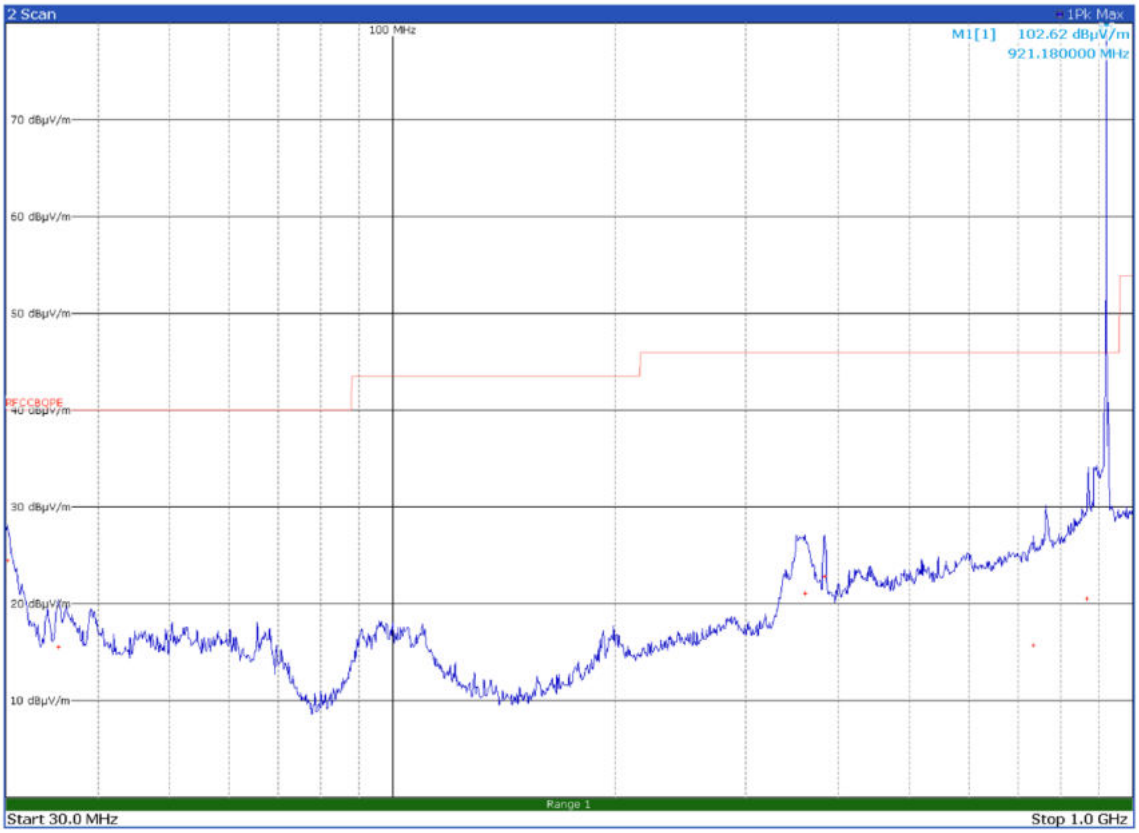


Figure 11.1-26: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.1500	24.6	40.0	-15.4	QP
35.3400	15.6	40.0	-24.4	QP
360.8400	21.1	46.0	-24.9	QP
383.0100	22.8	46.0	-23.2	QP
733.5900	15.7	46.0	-30.3	QP
866.9100	20.6	46.0	-25.4	QP

Limit exceeded by the carrier

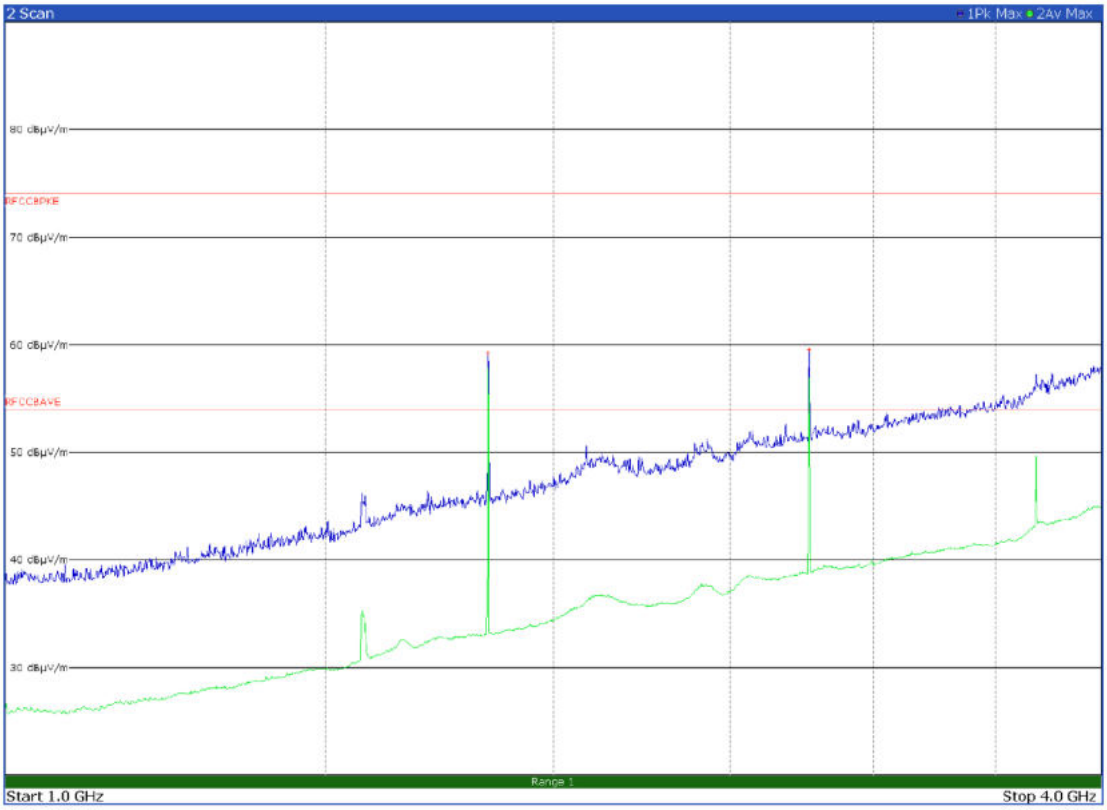


Figure 11.1-27: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1842.5000	59.3	74.0	-14.7	-19.6	39.7	54.0	-14.3
2763.5000	59.6	74.0	-14.4	-19.6	40.0	54.0	-14.0

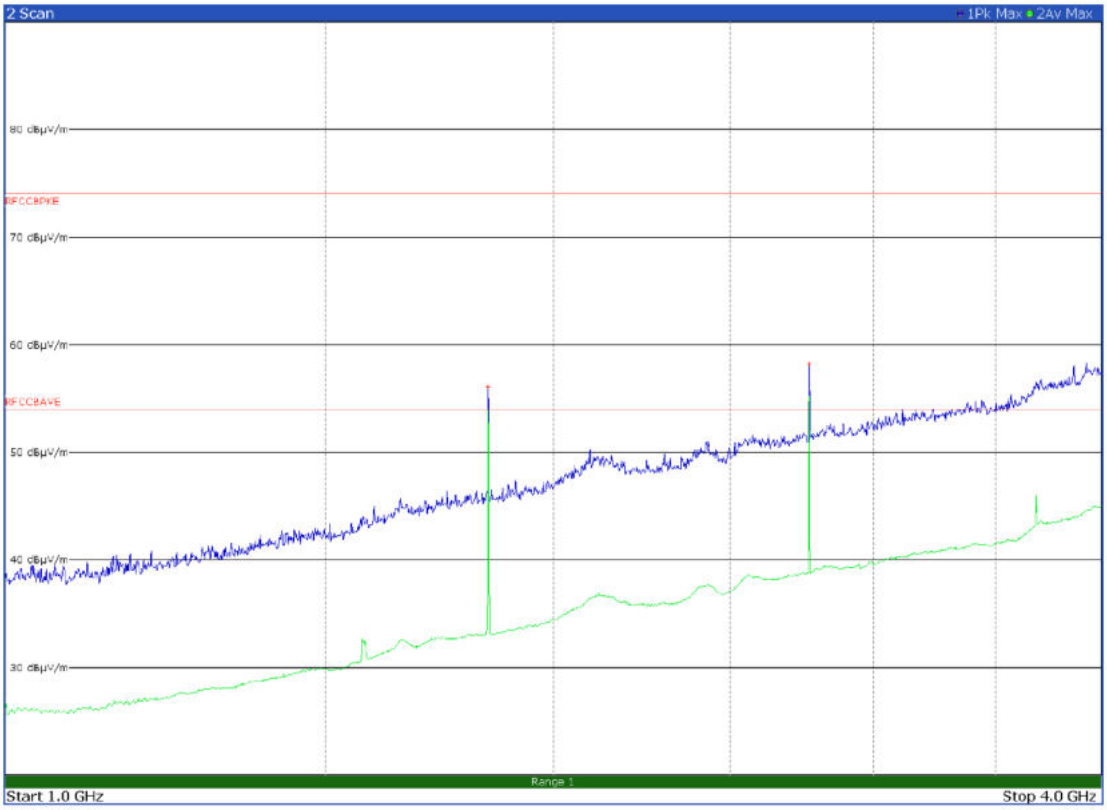


Figure 11.1-28: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1842.5000	56.1	74.0	-17.9	-19.6	36.5	54.0	-17.5
2763.7500	58.3	74.0	-15.7	-19.6	38.7	54.0	-15.3

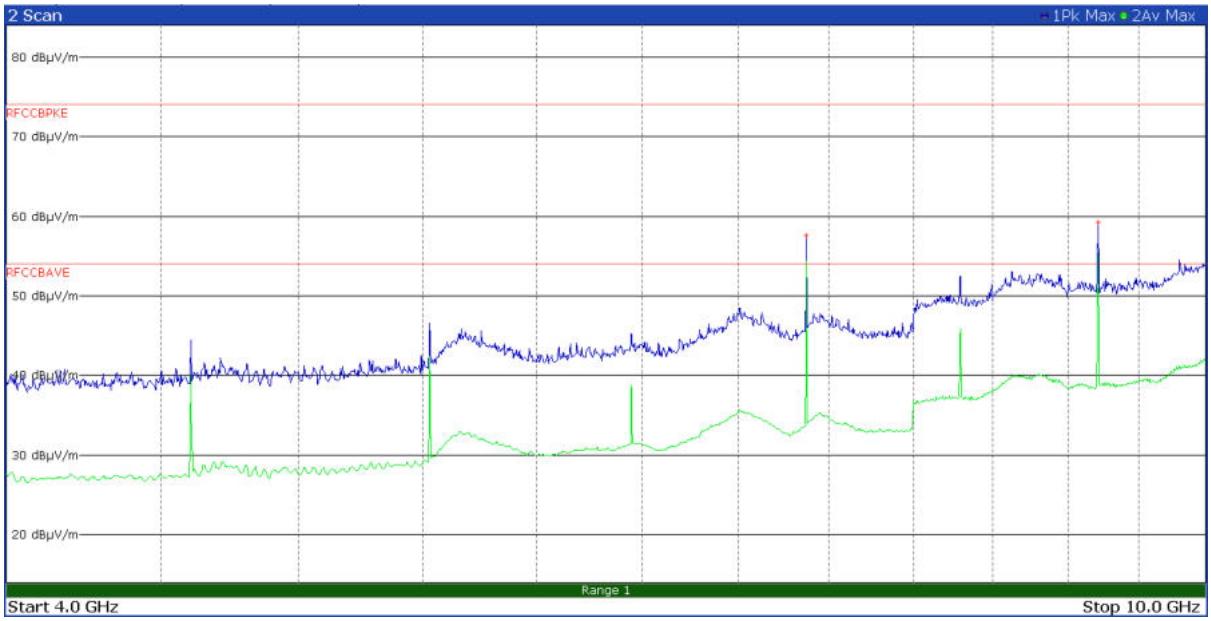


Figure 11.1-29: *Radiated spurious emissions on mid channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
7369.7500	57.6	74.0	-16.4	-19.6	38.0	54.0	-16.0
9212.2500	59.3	74.0	-14.7	-19.6	39.7	54.0	-14.3

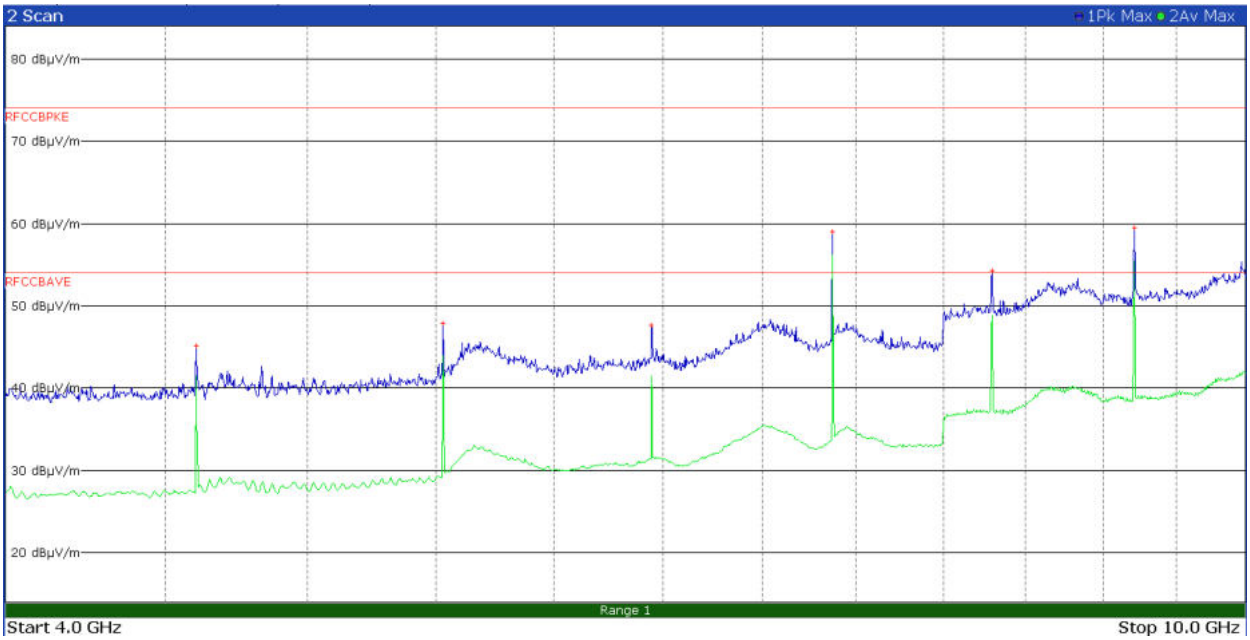


Figure 11.1-30: *Radiated spurious emissions on mid channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4606.2500	45.2	74.0	-28.8	-19.6	25.6	54.0	-28.4
5527.0000	48.0	74.0	-26.0	-19.6	28.4	54.0	-25.6
6448.5000	47.7	74.0	-26.3	-19.6	28.1	54.0	-25.9
7369.7500	59.0	74.0	-15.0	-19.6	39.4	54.0	-14.6
8291.0000	54.3	74.0	-19.7	-19.6	34.7	54.0	-19.3
9212.2500	59.5	74.0	-14.5	-19.6	39.9	54.0	-14.1

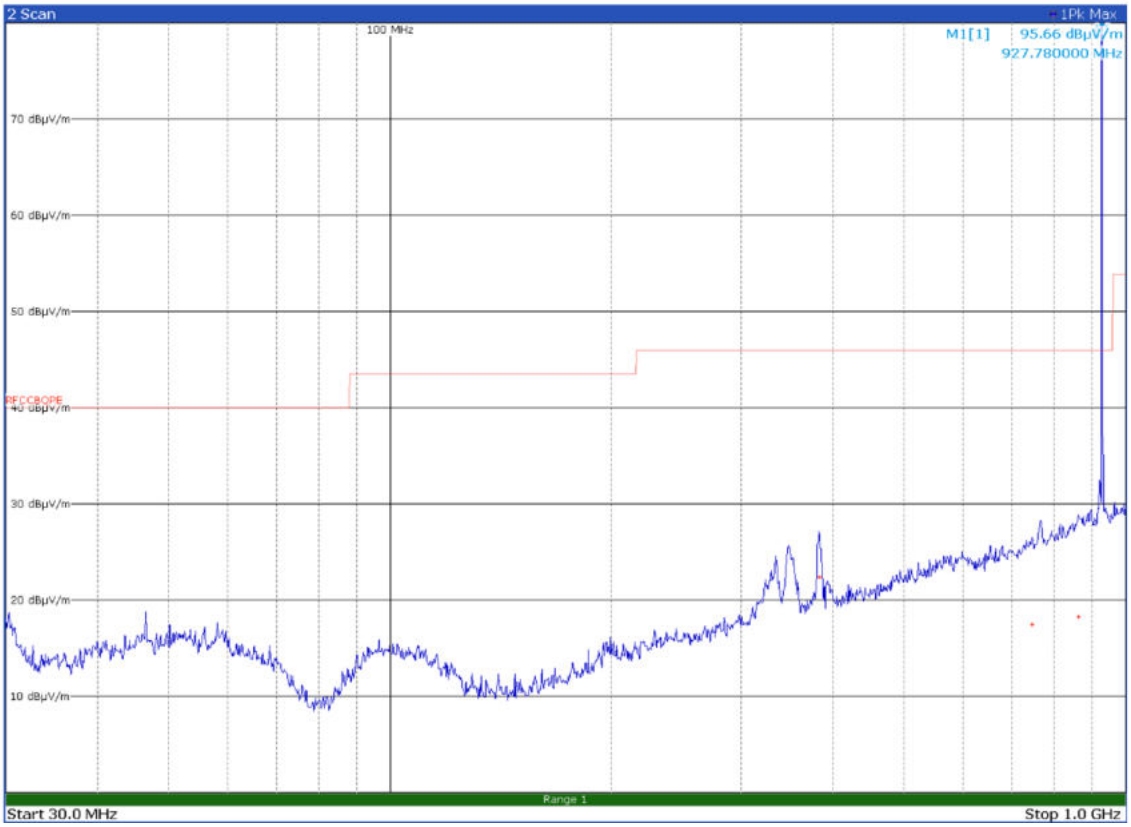


Figure 11.1-31: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 30 to 1000 MHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
382.9800	22.5	46.0	-23.5	QP
745.5000	17.5	46.0	-28.5	QP
861.8100	18.3	46.0	-27.7	QP

Limit exceeded by the carrier

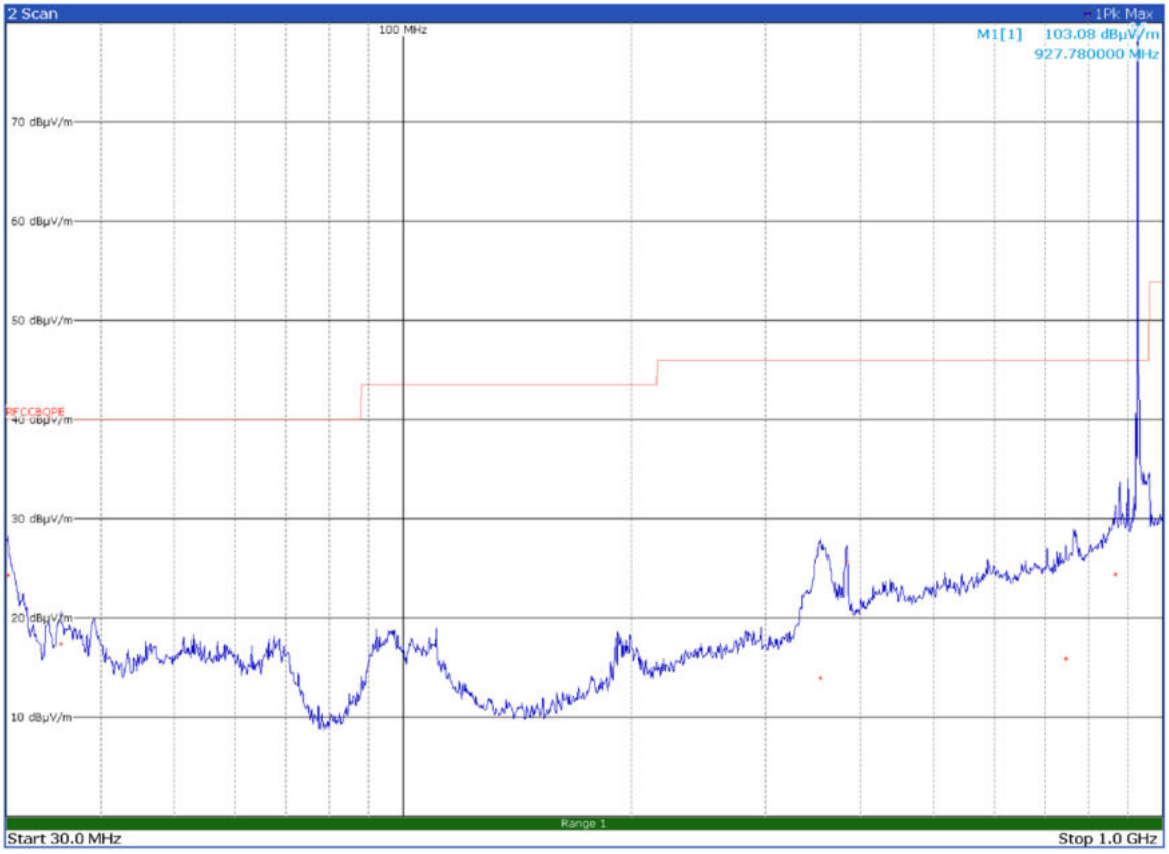


Figure 11.1-32: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 30 to 1000 MHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.1500	24.3	40.0	-15.7	QP
35.4000	17.4	40.0	-22.6	QP
353.9400	14.0	46.0	-32.0	QP
384.0000	25.8	46.0	-20.2	QP
746.7300	15.9	46.0	-30.1	QP
866.6700	24.4	46.0	-21.6	QP

Limit exceeded by the carrier

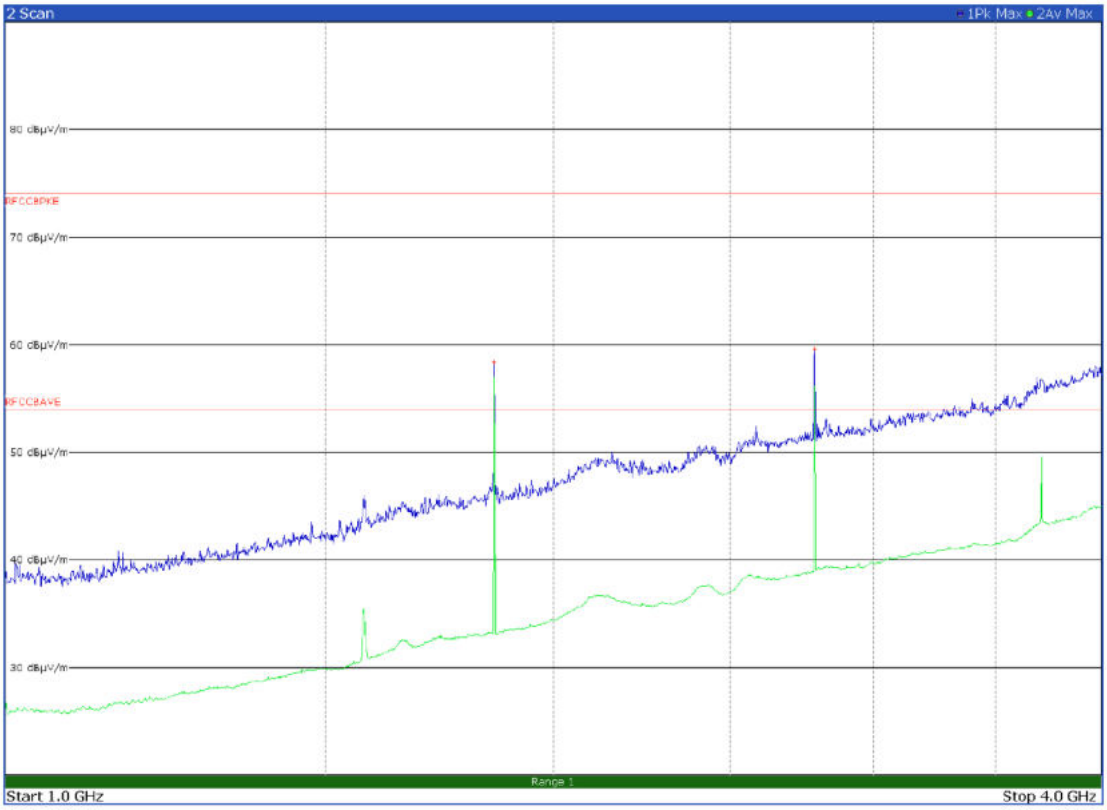


Figure 11.1-33: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 1 to 4 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1855.5000	58.4	74.0	-15.6	-19.6	38.8	54.0	-15.2
2775.2500	59.8	74.0	-14.2	-19.6	40.2	54.0	-13.8

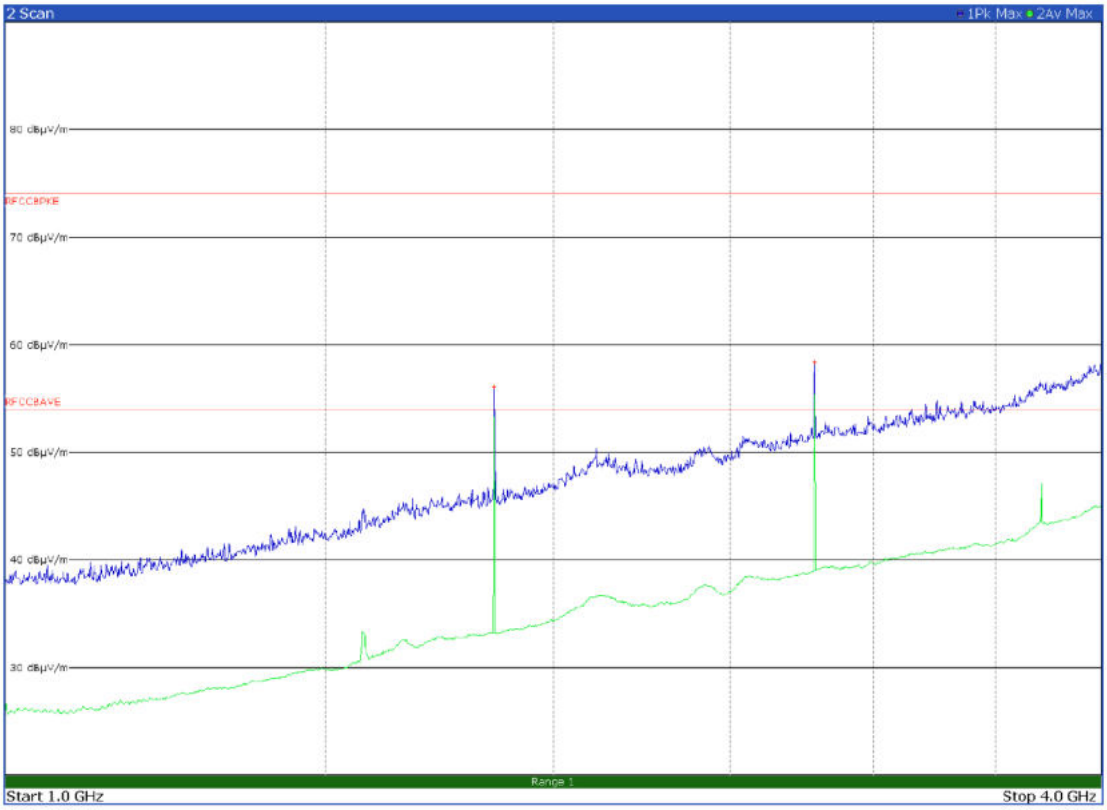


Figure 11.1-34: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 1 to 4 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1855.5000	56.1	74.0	-17.9	-19.6	36.5	54.0	-17.5
2783.5000	58.4	74.0	-15.6	-19.6	38.8	54.0	-15.2

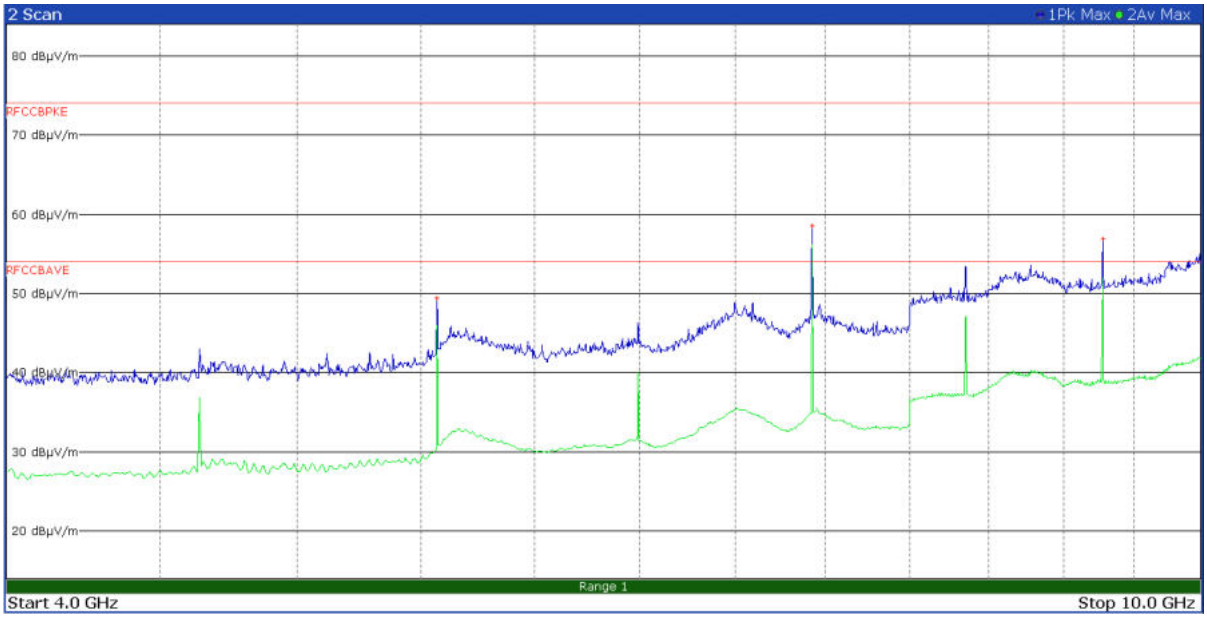


Figure 11.1-35: *Radiated spurious emissions on high channel with antenna in horizontal polarization – Frequency range 4 to 10 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5567.0000	49.5	74.0	-24.5	-19.6	29.9	54.0	-24.1
7422.2500	58.5	74.0	-15.5	-19.6	38.9	54.0	-15.1
9277.7500	56.9	74.0	-17.1	-19.6	37.3	54.0	-16.7

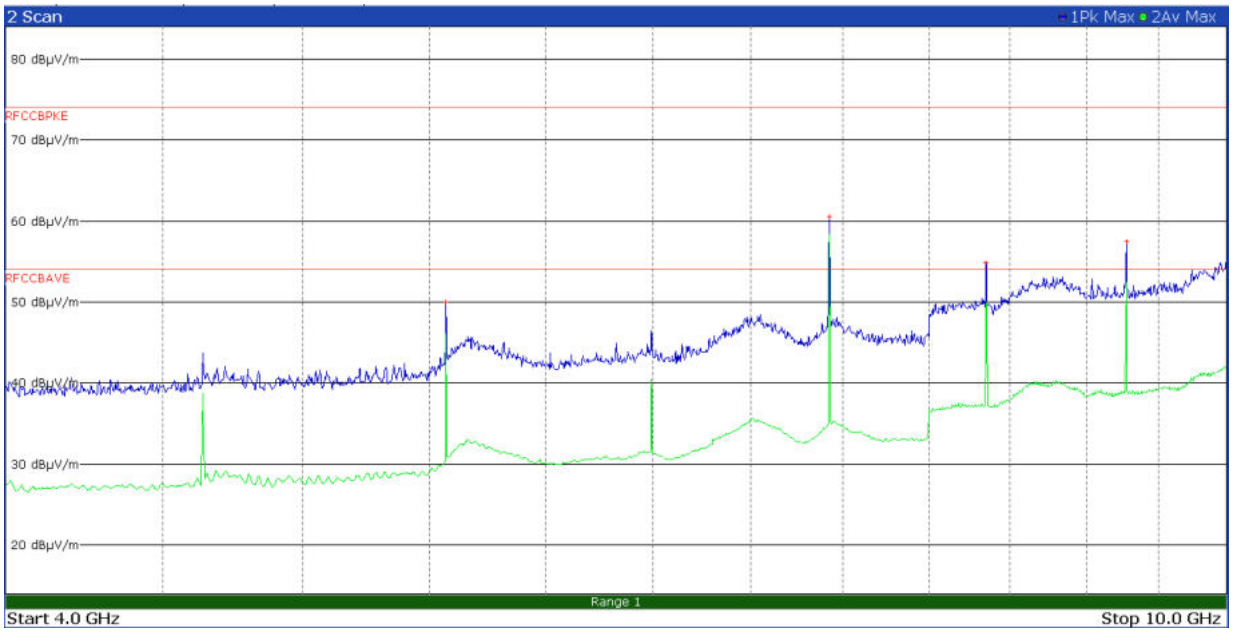


Figure 11.1-36: *Radiated spurious emissions on high channel with antenna in vertical polarization – Frequency range 4 to 10 GHz*

External antenna configuration

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	DCCF	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
5567.0000	50.1	74.0	-23.9	-19.6	30.5	54.0	-23.5
7422.2500	60.6	74.0	-13.4	-19.6	41.0	54.0	-13.0
8350.0000	55.0	74.0	-19.0	-19.6	35.4	54.0	-18.6
9277.7500	57.5	74.0	-16.5	-19.6	37.9	54.0	-16.1

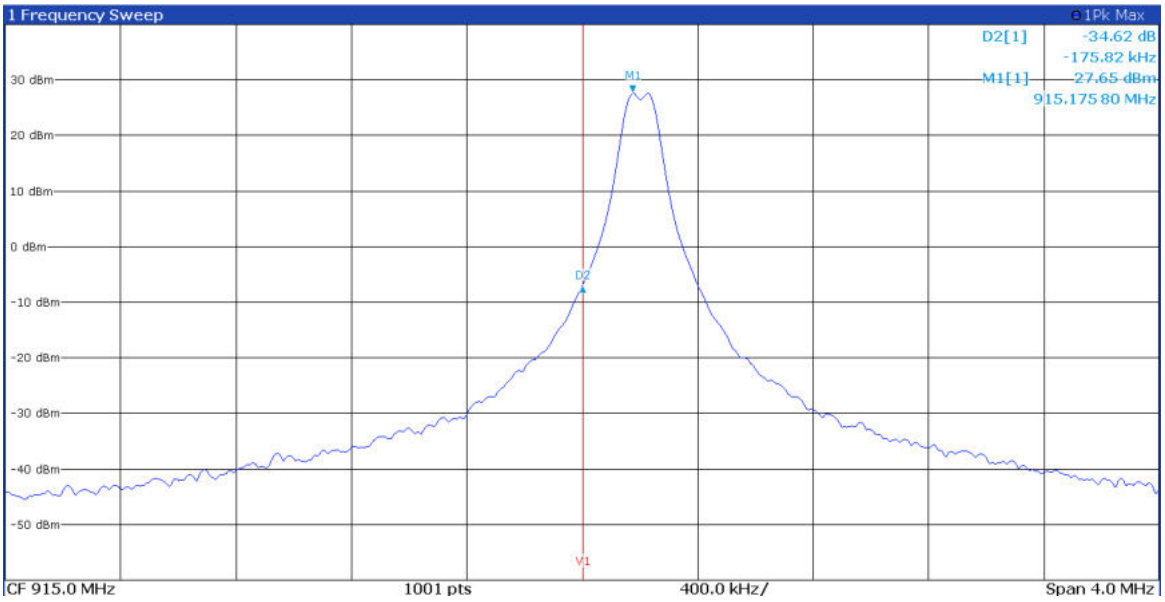


Figure 11.1-37: *Band edge spurious emissions at 915 MHz* (low frequency)

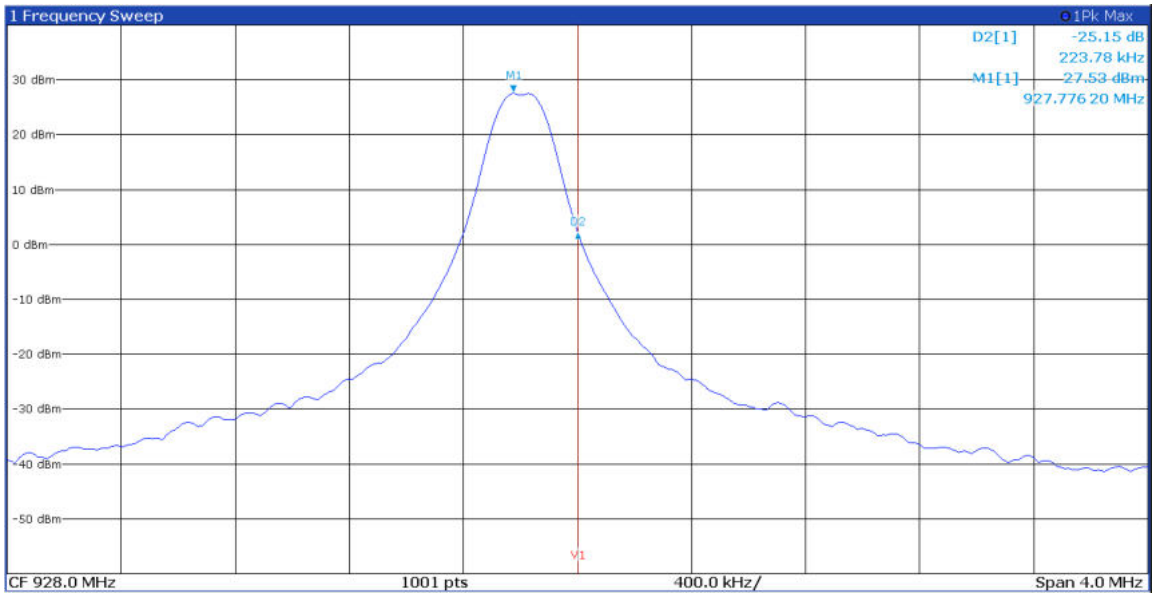


Figure 11.1-38: *Band edge spurious emissions at 928 MHz* (high frequency)

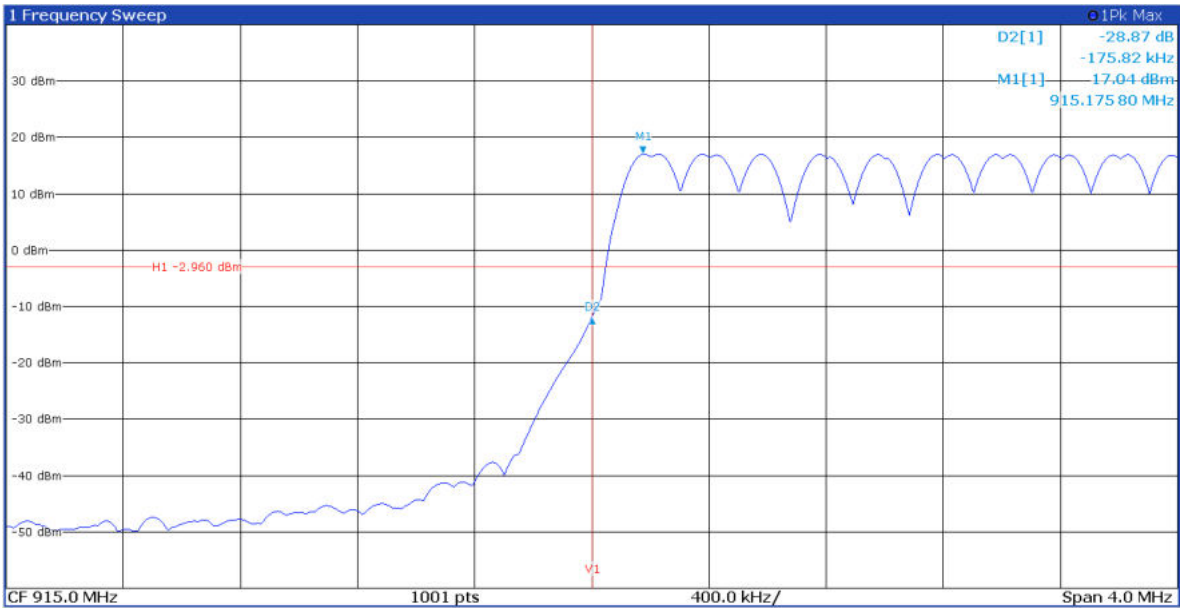


Figure 11.1-39: *Band edge spurious emissions at 915 MHz* (hopping mode)

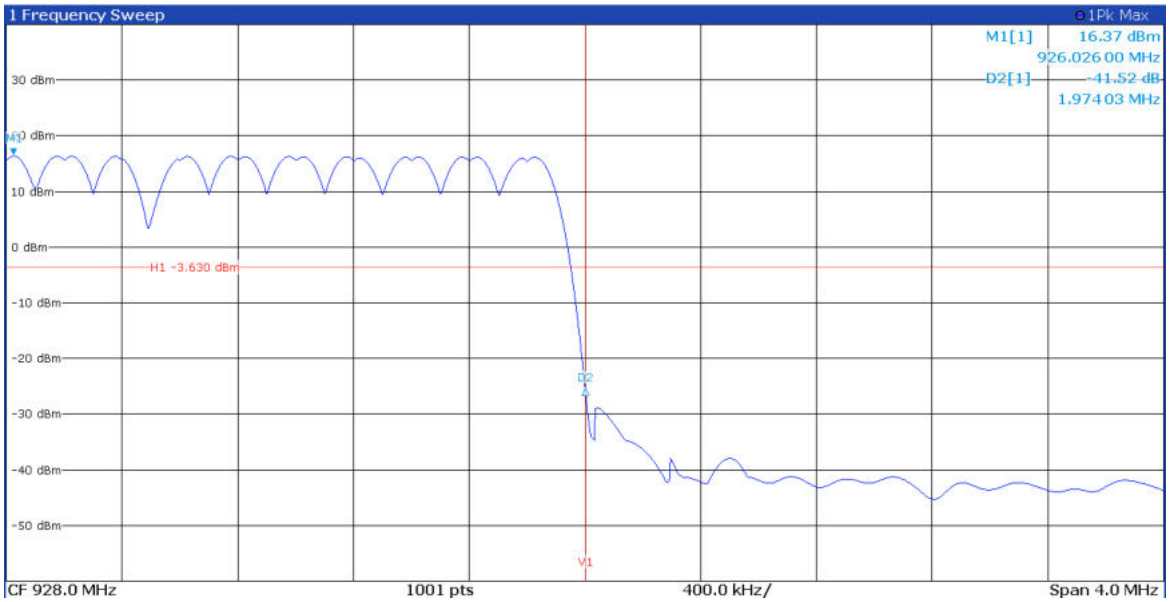


Figure 11.1-40: *Band edge spurious emissions at 928 MHz* (hopping mode)

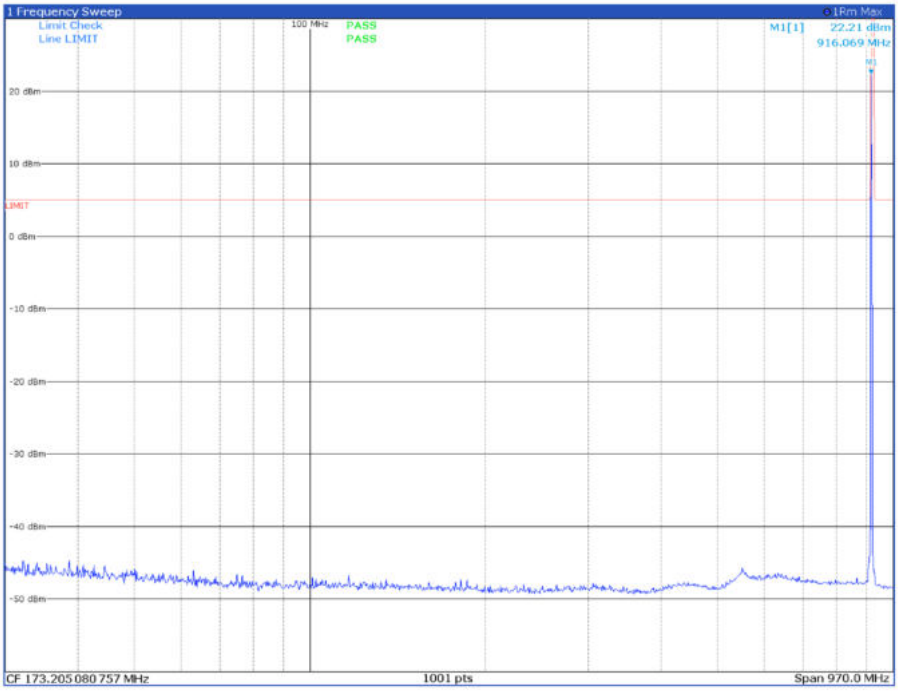


Figure 11.1-41: *Conducted spurious emissions on* low channel – Frequency range 30 to 1000 MHz

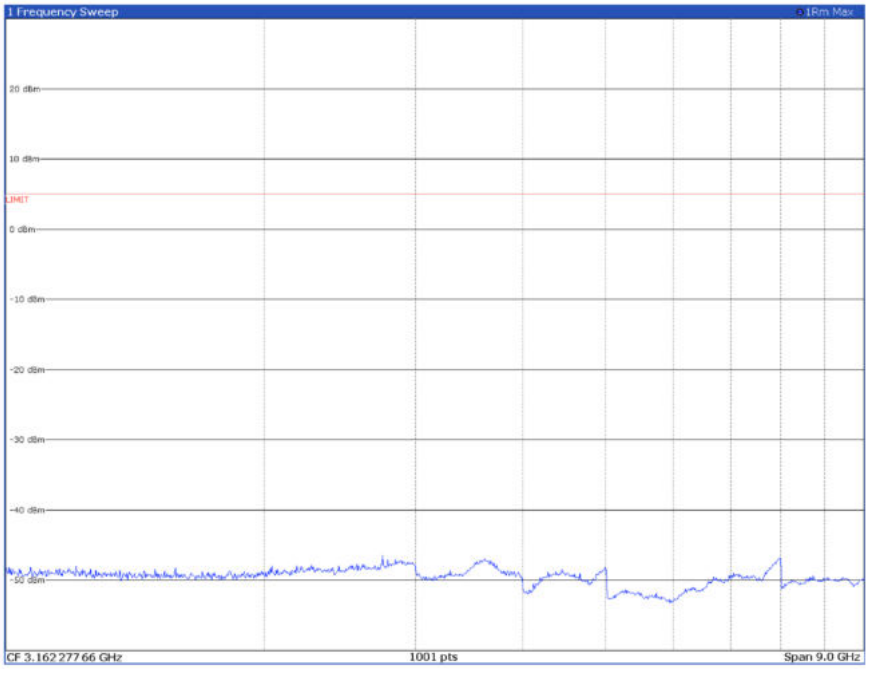


Figure 11.1-42: *Conducted spurious emissions on* low channel – Frequency range 1 to 10 GHz

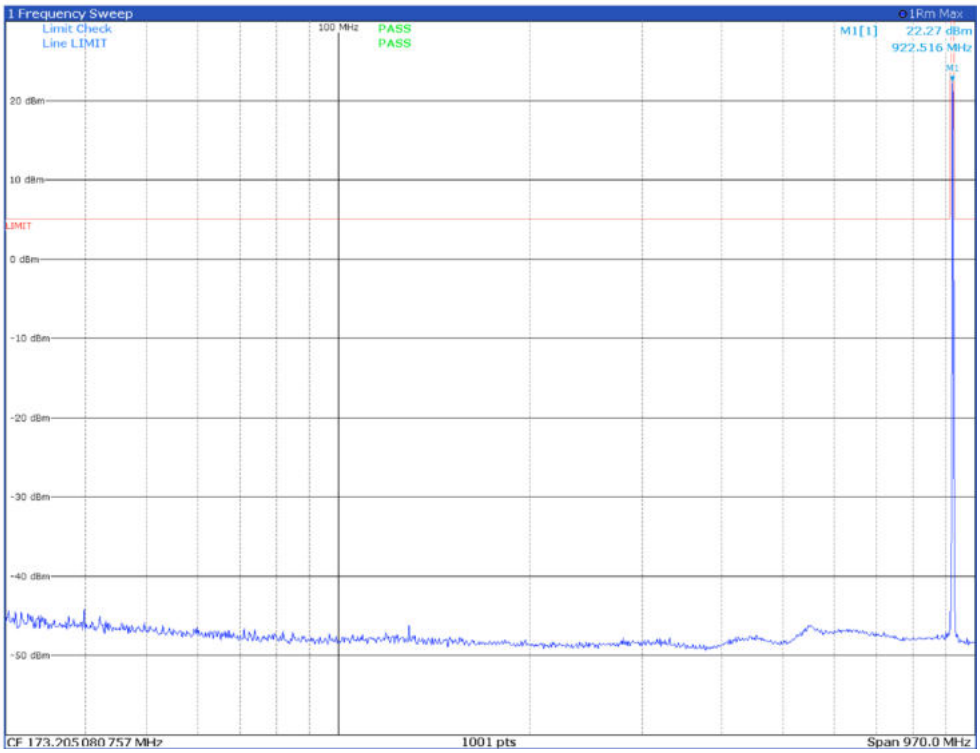


Figure 11.1-43: *Conducted spurious emissions on mid* channel – Frequency range 30 to 1000 MHz

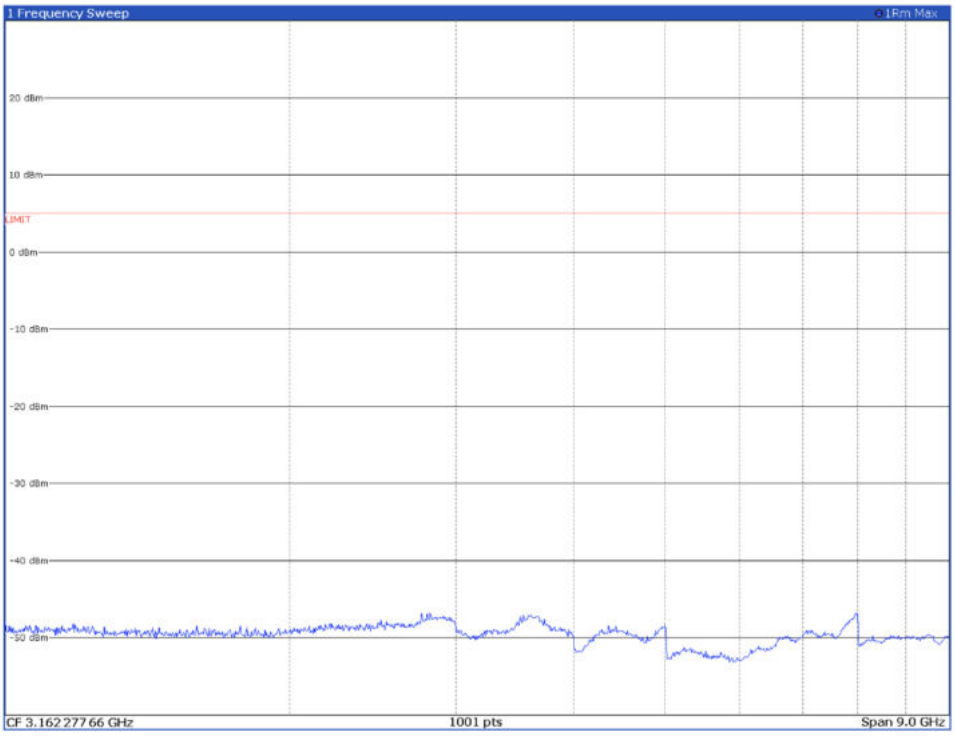


Figure 11.1-44: *Conducted spurious emissions on mid* channel – Frequency range 1 to 10 GHz

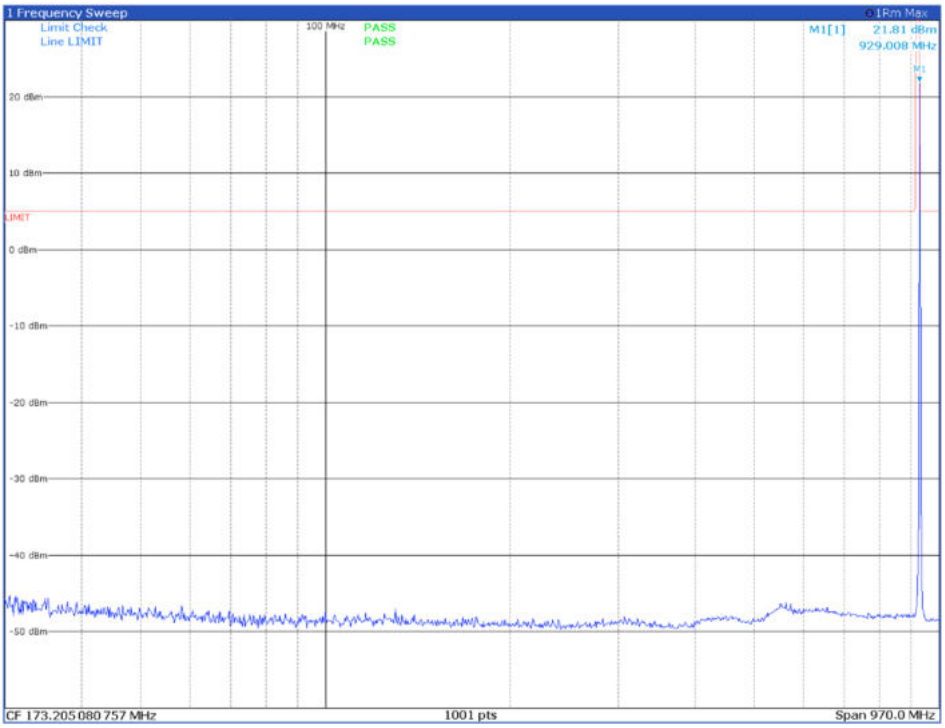


Figure 11.1-45: *Conducted spurious emissions on high* channel – Frequency range 30 to 1000 MHz

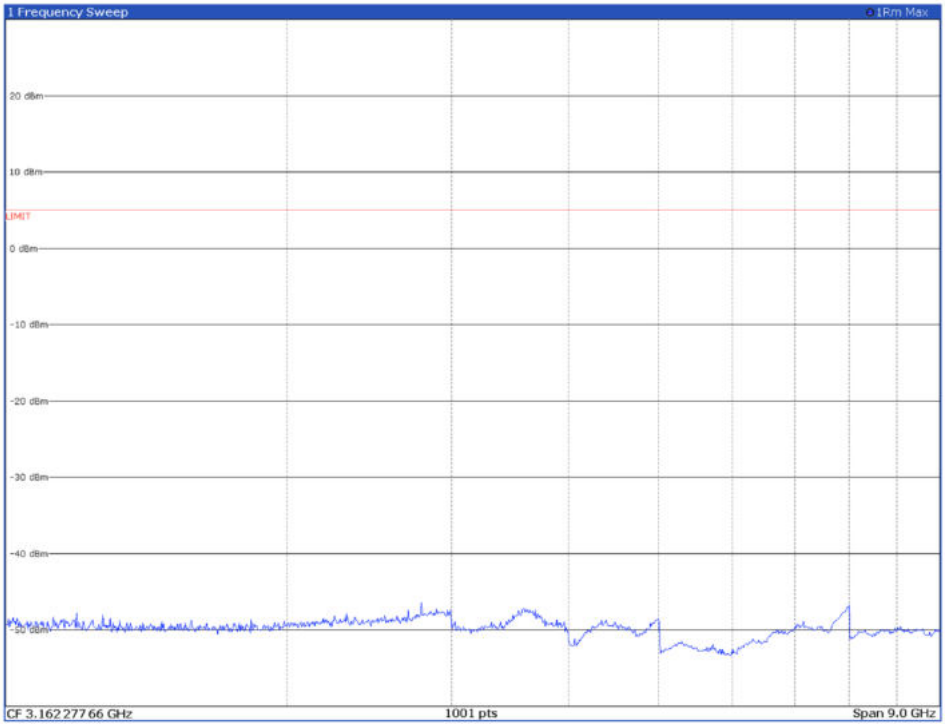


Figure 11.1-46: *Conducted spurious emissions on high* channel – Frequency range 1 to 10 GHz

Section 12. Photos

12.1 EUT

See “Annex I - Test Setup photos” exhibit.

End of report