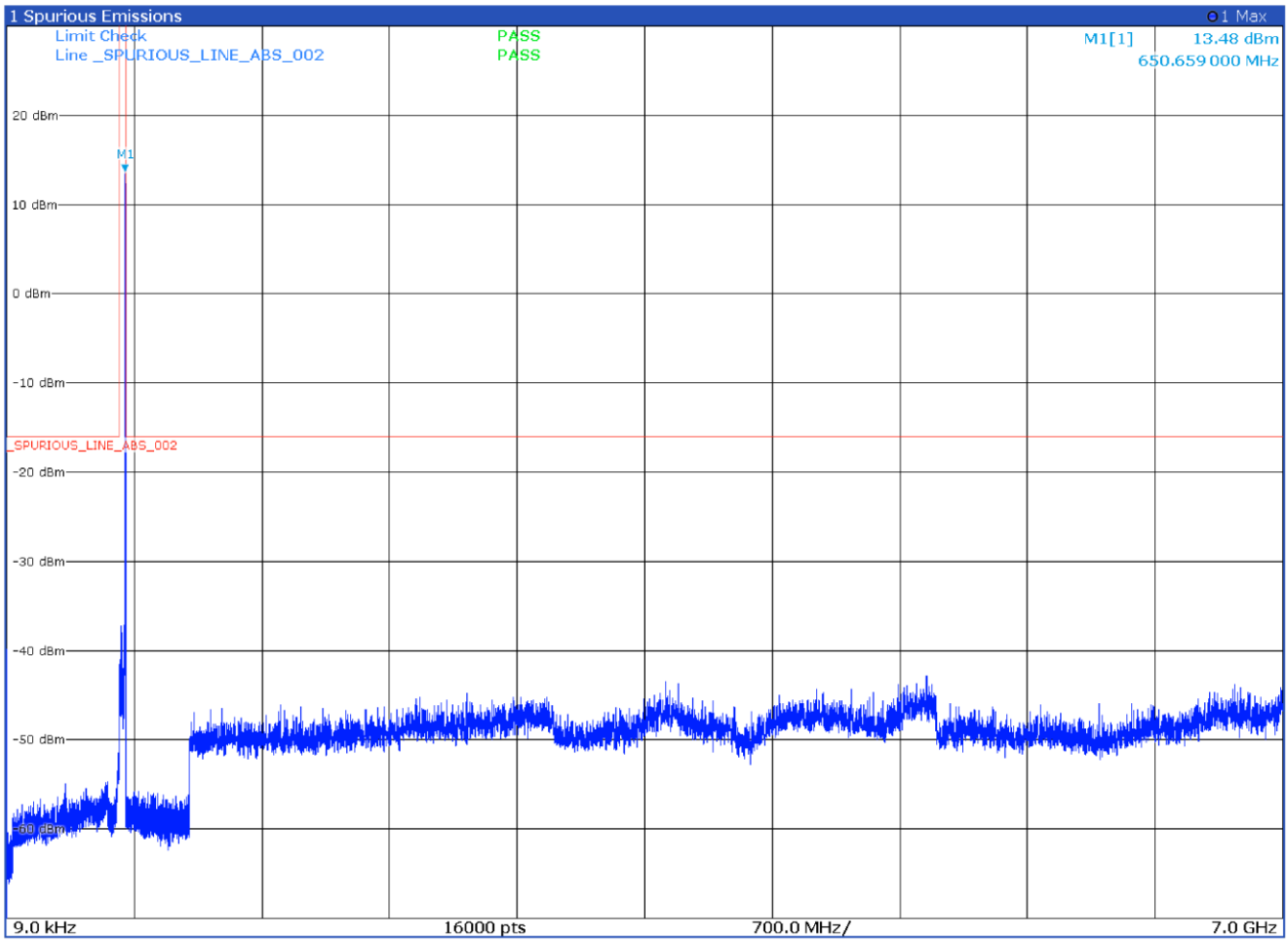
Test data, continued

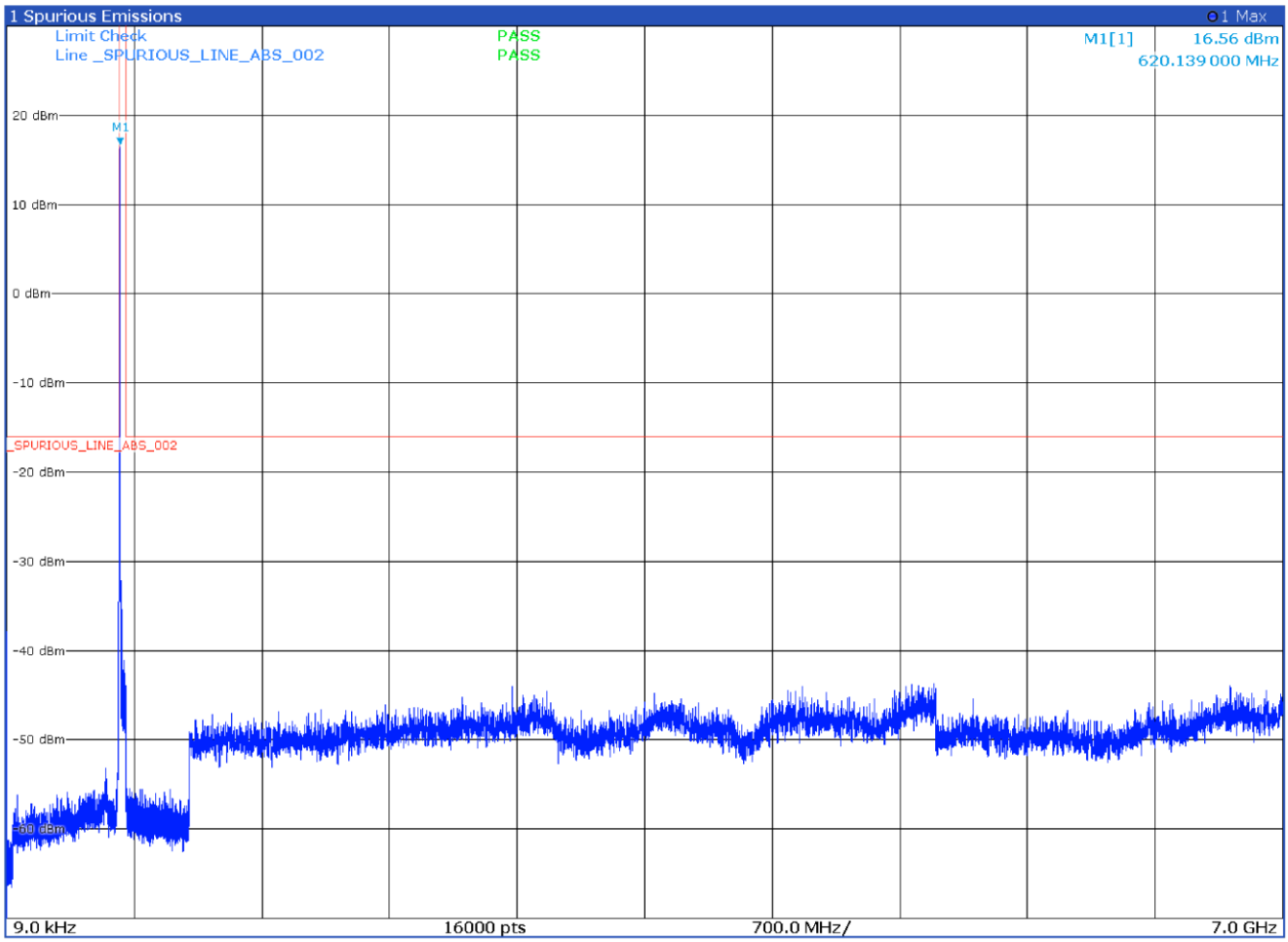


2 Result Summary

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 kHz	150.000 kHz	1.000 kHz	**133.996 50 kHz**	**-65.36 dBm**	**-49.36 dB**
150.000 kHz	30.000 MHz	10.000 kHz	**881.325 00 kHz**	**-39.79 dBm**	**-23.79 dB**
30.000 MHz	617.000 MHz	100.000 kHz	**616.853 25 MHz**	**-48.35 dBm**	**-32.35 dB**
617.000 MHz	652.000 MHz	100.000 kHz	**650.136 25 MHz**	**14.39 dBm**	**-35.61 dB**
652.000 MHz	1.000 GHz	100.000 kHz	**652.087 00 MHz**	**-36.98 dBm**	**-20.98 dB**
1.000 GHz	7.000 GHz	1.000 MHz	**5.046 62 GHz**	**-42.89 dBm**	**-26.89 dB**

Figure 8.6-3: *Conducted spurious emissions of high channel, antenna port 1*

8.6.1 Test data

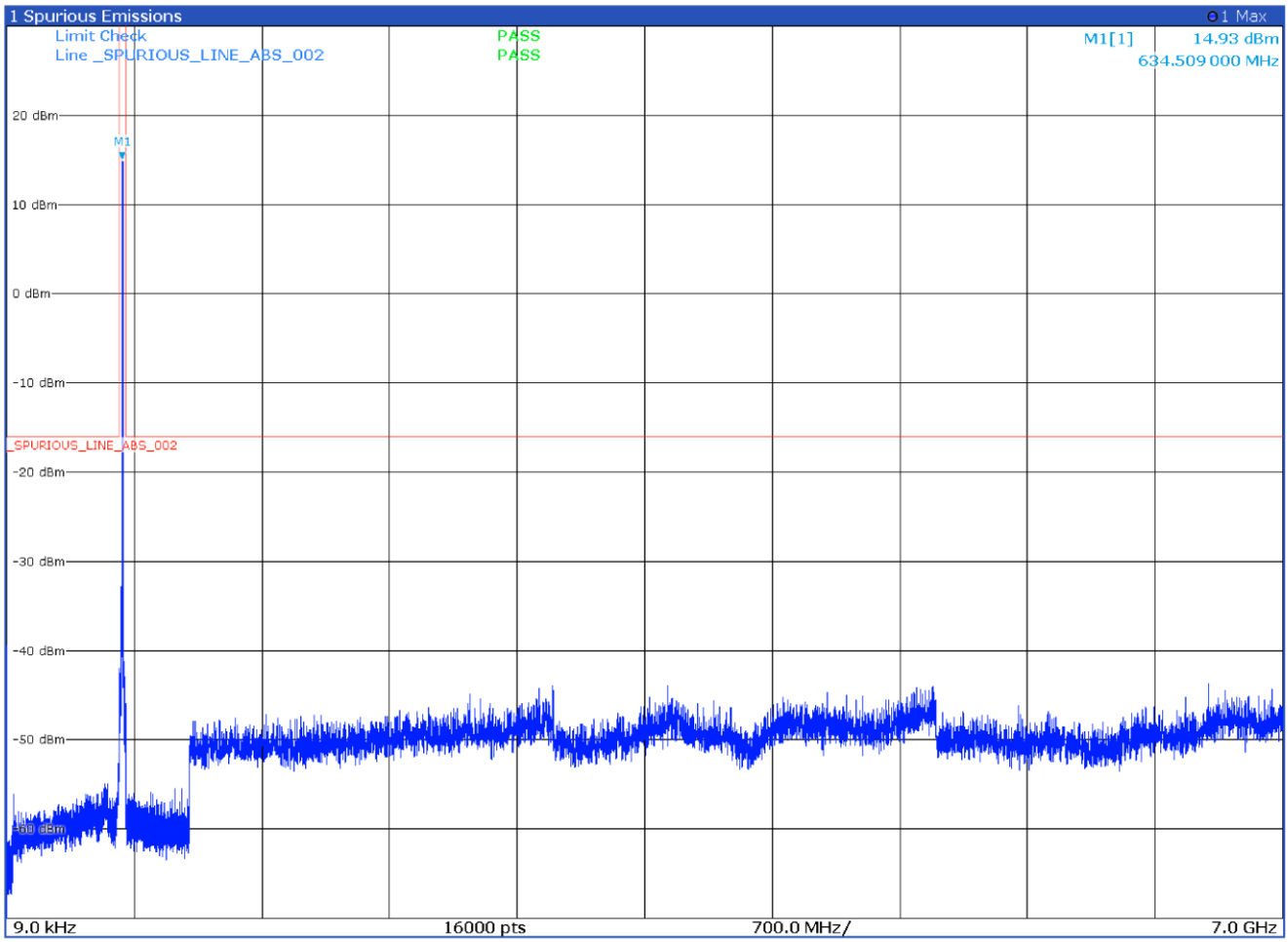


2 Result Summary

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 kHz	150.000 kHz	1.000 kHz	**126.100 50 kHz**	**-66.71 dBm**	**-50.71 dB**
150.000 kHz	30.000 MHz	10.000 kHz	**851.475 00 kHz**	**-37.89 dBm**	**-21.89 dB**
30.000 MHz	617.000 MHz	100.000 kHz	**616.853 25 MHz**	**-21.36 dBm**	**-5.36 dB**
617.000 MHz	652.000 MHz	100.000 kHz	**620.141 25 MHz**	**16.56 dBm**	**-33.44 dB**
652.000 MHz	1.000 GHz	100.000 kHz	**652.087 00 MHz**	**-50.13 dBm**	**-34.13 dB**
1.000 GHz	7.000 GHz	1.000 MHz	**5.087 88 GHz**	**-43.69 dBm**	**-27.69 dB**

Figure 8.6-4: *Conducted spurious emissions of low channel, antenna port 2*

8.6.1 Test data

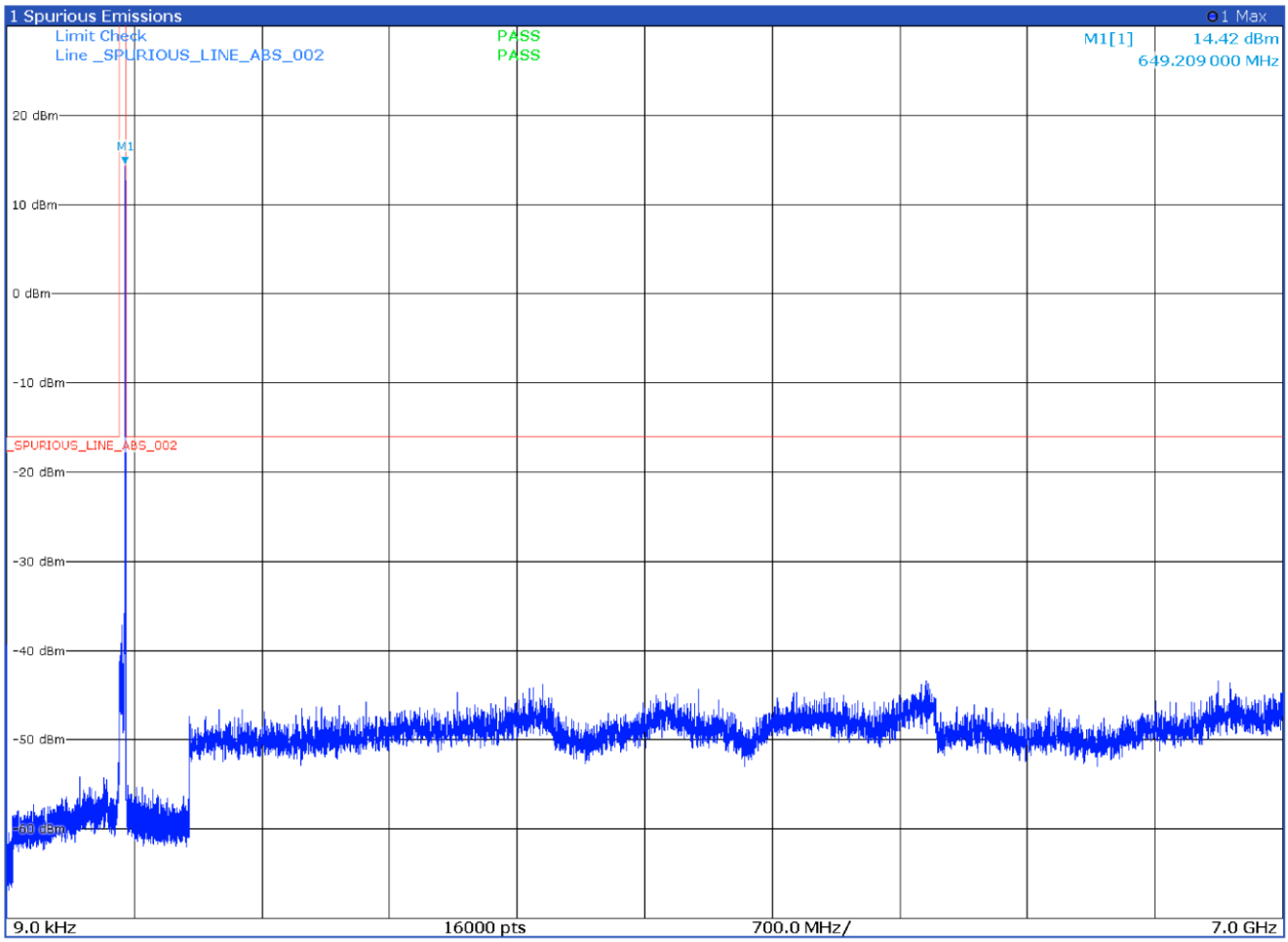


2 Result Summary

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 kHz	150.000 kHz	1.000 kHz	**126.241 50 kHz**	**-67.44 dBm**	**-51.44 dB**
150.000 kHz	30.000 MHz	10.000 kHz	**881.325 00 kHz**	**-39.44 dBm**	**-23.44 dB**
30.000 MHz	617.000 MHz	100.000 kHz	**616.853 25 MHz**	**-49.75 dBm**	**-33.75 dB**
617.000 MHz	652.000 MHz	100.000 kHz	**634.211 25 MHz**	**15.50 dBm**	**-34.50 dB**
652.000 MHz	1.000 GHz	100.000 kHz	**652.087 00 MHz**	**-50.59 dBm**	**-34.59 dB**
1.000 GHz	7.000 GHz	1.000 MHz	**6.592 37 GHz**	**-43.71 dBm**	**-27.71 dB**

Figure 8.6-5: *Conducted spurious emissions of mid channel, antenna port 2*

Test data, continued



2 Result Summary

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
9.000 kHz	150.000 kHz	1.000 kHz	**136.252 50 kHz**	**-66.29 dBm**	**-50.29 dB**
150.000 kHz	30.000 MHz	10.000 kHz	**881.325 00 kHz**	**-39.36 dBm**	**-23.36 dB**
30.000 MHz	617.000 MHz	100.000 kHz	**616.853 25 MHz**	**-48.11 dBm**	**-32.11 dB**
617.000 MHz	652.000 MHz	100.000 kHz	**649.208 75 MHz**	**14.42 dBm**	**-35.58 dB**
652.000 MHz	1.000 GHz	100.000 kHz	**652.087 00 MHz**	**-35.25 dBm**	**-19.25 dB**
1.000 GHz	7.000 GHz	1.000 MHz	**5.042 88 GHz**	**-43.34 dBm**	**-27.34 dB**

Figure 8.6-6: *Conducted spurious emissions of high channel, antenna port 2*

8.7 Spurious emissions radiated measurements

8.7.1 References, definitions and limits

FCC §27.53(g)

For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-131, Clause 5.2

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

RSS-130, Clause 4.7.1

General unwanted emissions limits

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

8.7.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	January 27, 2022

8.7.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
All measurements were performed using peak detector according to note 4 of 935210 D05 Indus Booster Basic Meas v01r04 paragraph 3.6.3.
Testing was performed with RF ports terminated with 50 Ohm load.
In the graphics below, no radiated spurious emission found and the limit is exceeded only by the carrier.

Spectrum analyser settings:

Resolution bandwidth:	100 kHz and 1 MHz
Video bandwidth:	VBW ≥ 3 × RBW
Detector mode:	Peak
Trace mode:	Max Hold

Input signal frequency

Low channel	619.5 MHz
Middle channel	634.5 MHz
High channel	649.5 MHz

8.7.4 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
EMI Receiver	Rohde & Schwarz	ESW44	101620
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397
Antenna Trilog 25MHz - 8GHz	Schwarzbeck Mess-Elektronik	VULB9162	9162-025
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STLP 9148-152
Double Ridge Horn Antenna	RFSpin	DRH40	061106A40
Broadband Amplifier	Schwarzbeck Mess-Elektronik	BBV9718C	00121
Broadband Bench Top Amplifier	Sage	STB-1834034030-KFKF-L1	18490-01
Controller	Maturo	FCU3.0	10041
Tilt antenna mast	Maturo	TAM4.0-E	10042
Turntable	Maturo	TT4.0-5T	2.527
Semi-anechoic chamber	Nemko S.p.a.	10m semi-anechoic chamber	530

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

8.7.5 Test data

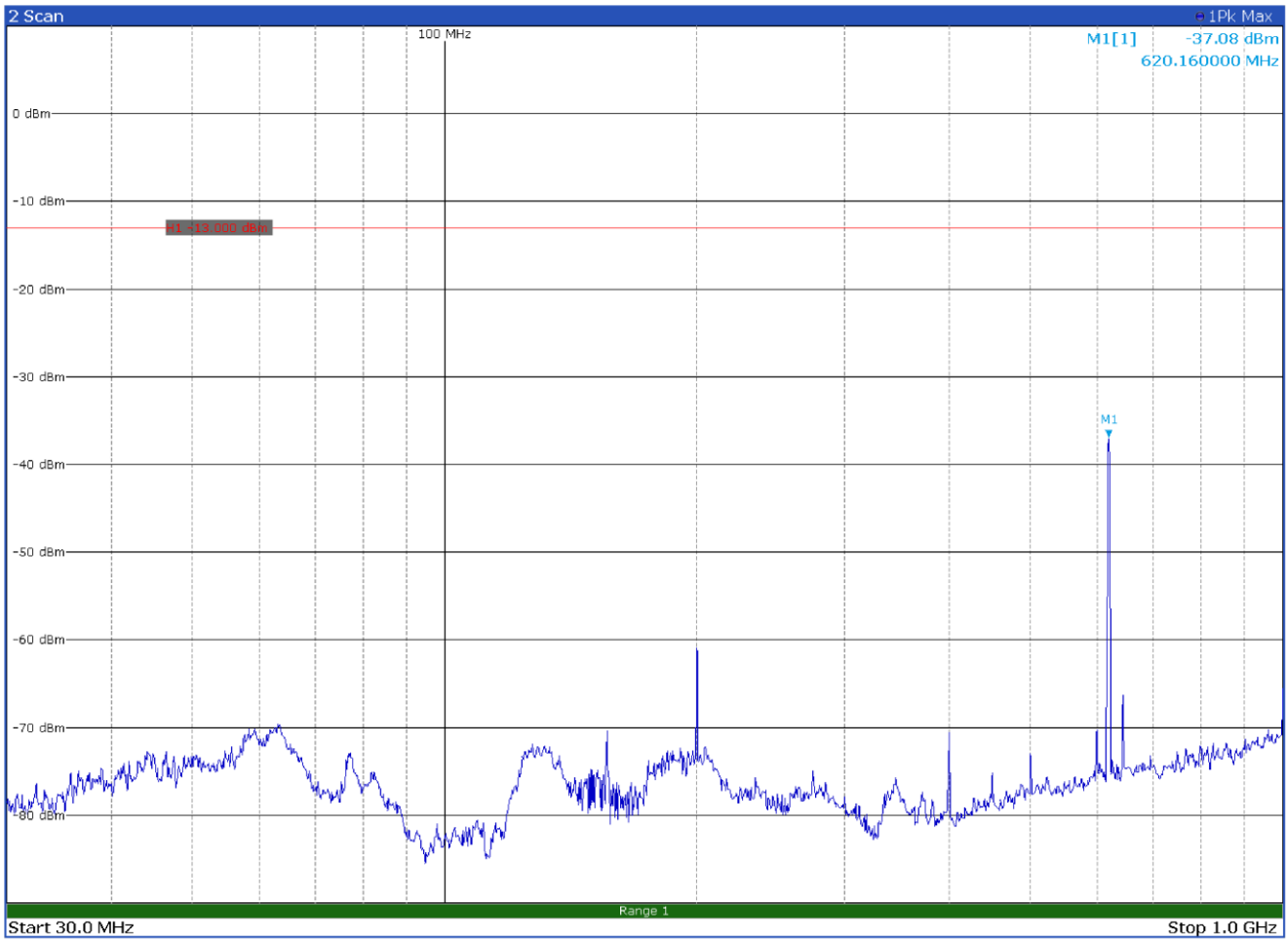


Figure 8.7-1: *Radiated spurious emissions below 1 GHz, low channel with antenna in horizontal polarization*

Test data, continued

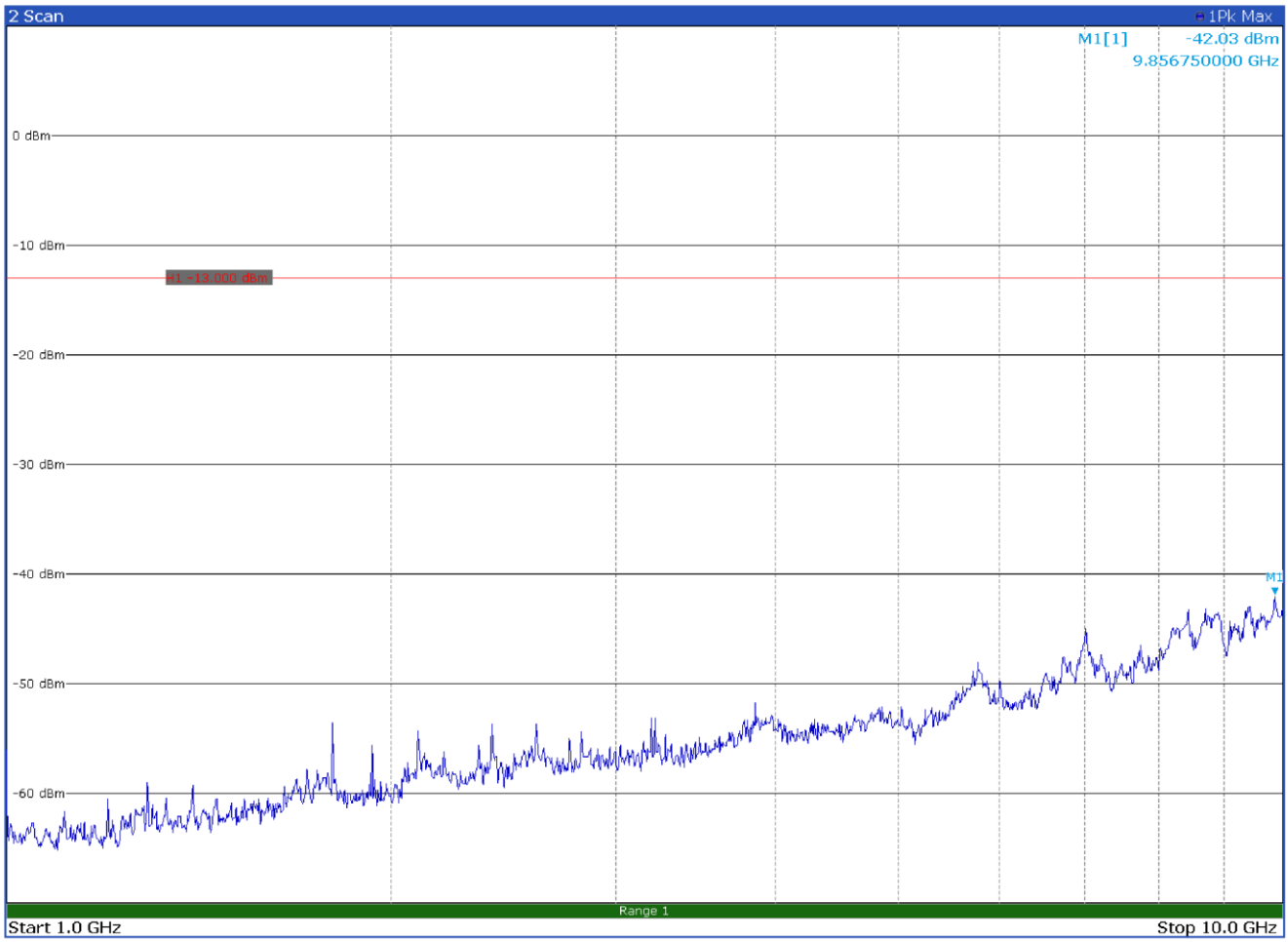


Figure 8.7-2: *Radiated spurious emissions from 1 GHz to 10 GHz, low channel with antenna in horizontal polarization*

Test data, continued

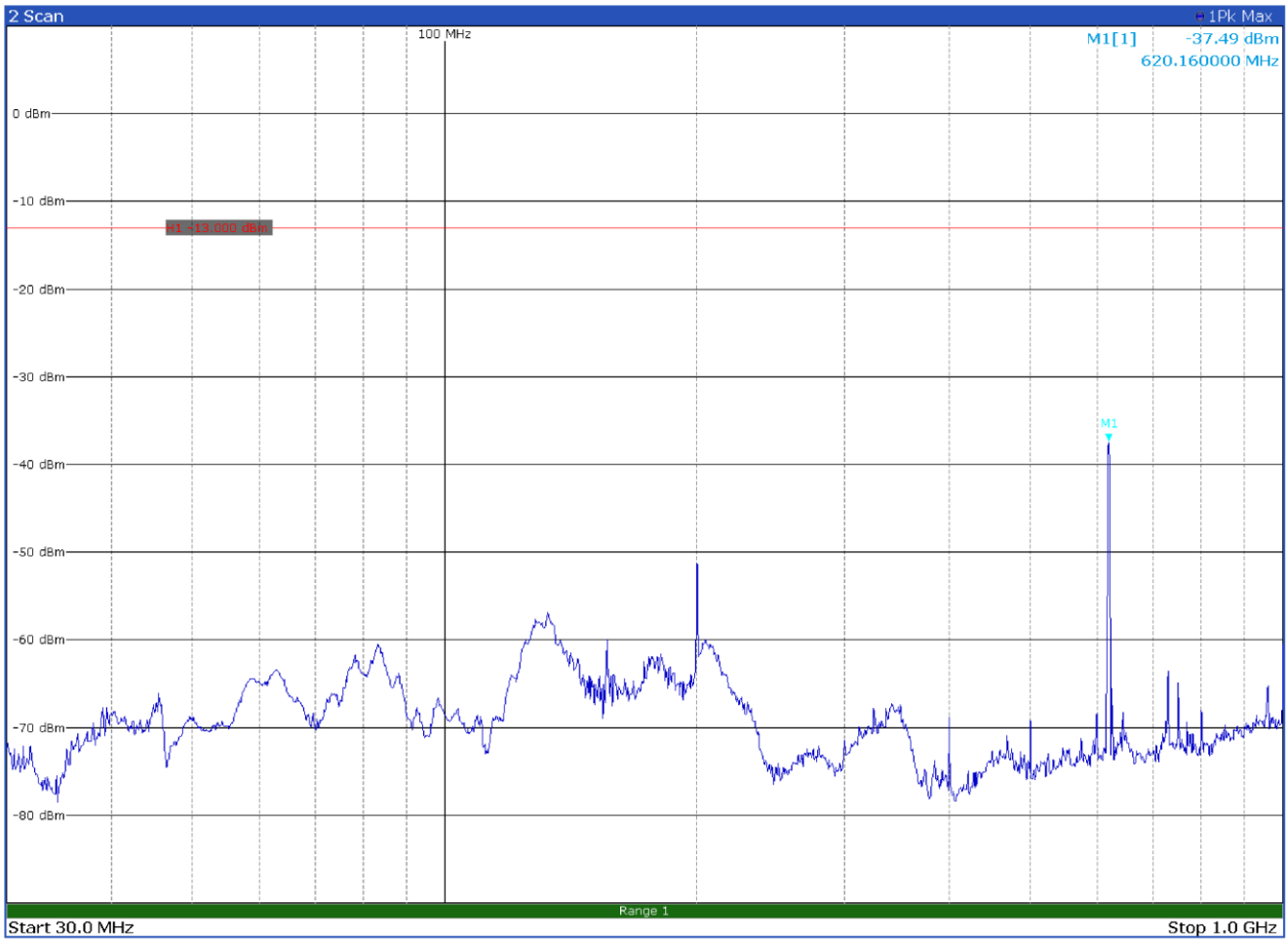


Figure 8.7-3: *Radiated spurious emissions below 1 GHz, low channel with antenna in vertical polarization*

Test data, continued

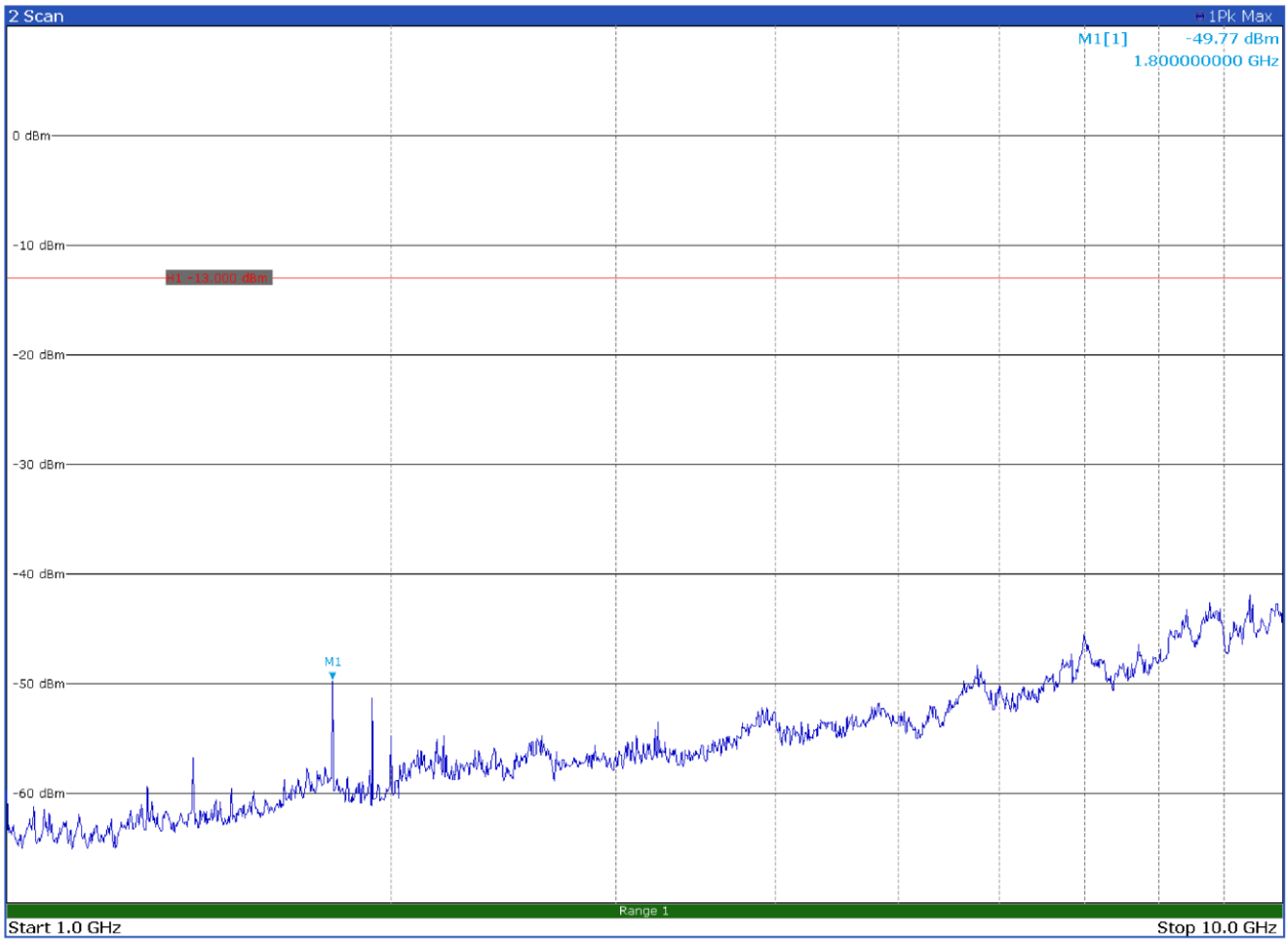


Figure 8.7-4: *Radiated spurious emissions from 1 GHz to 10 GHz, low channel with antenna in vertical polarization*

Test data, continued

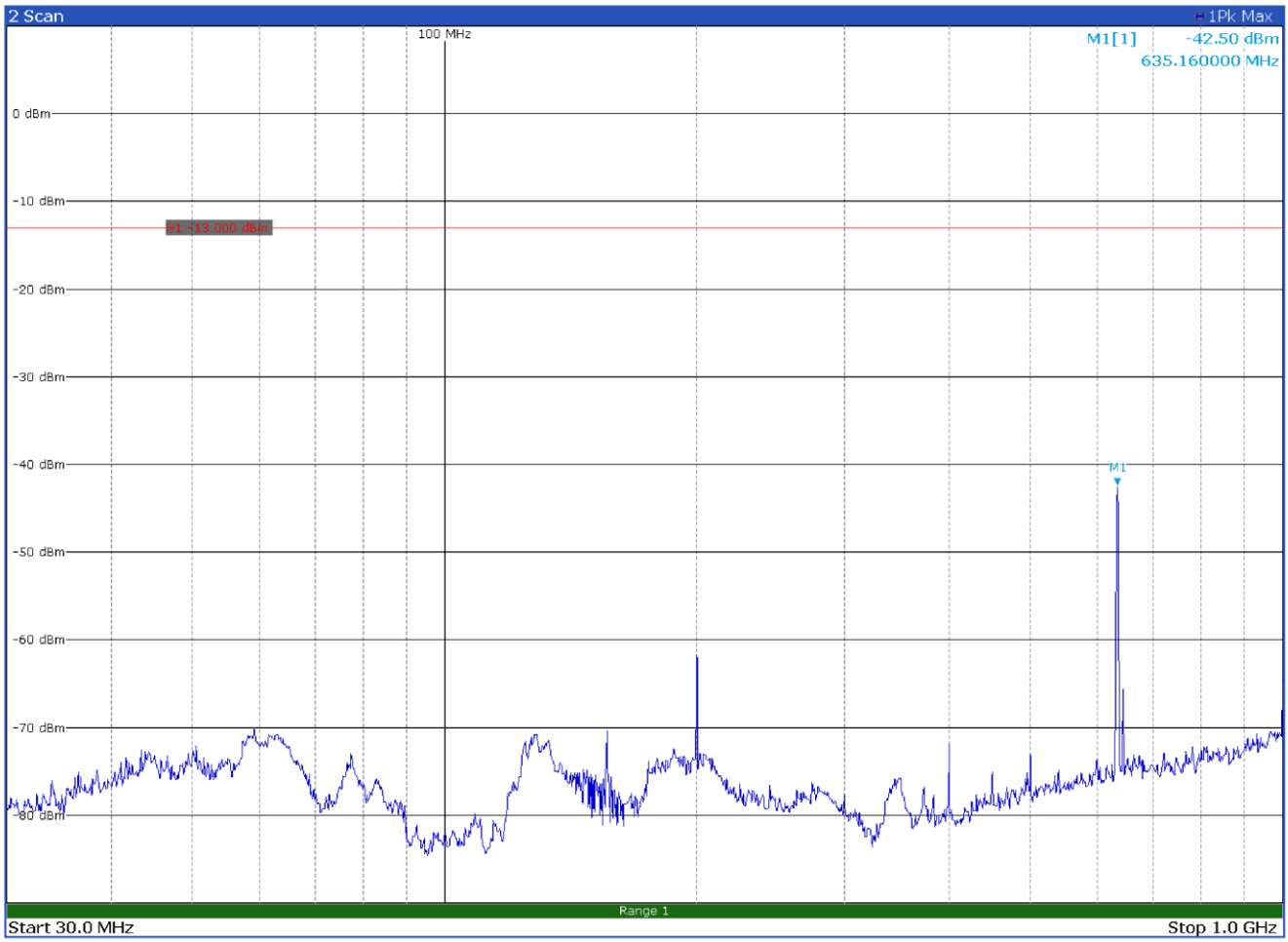


Figure 8.7-5: *Radiated spurious emissions below 1 GHz, mid channel with antenna in horizontal polarization*

Test data, continued

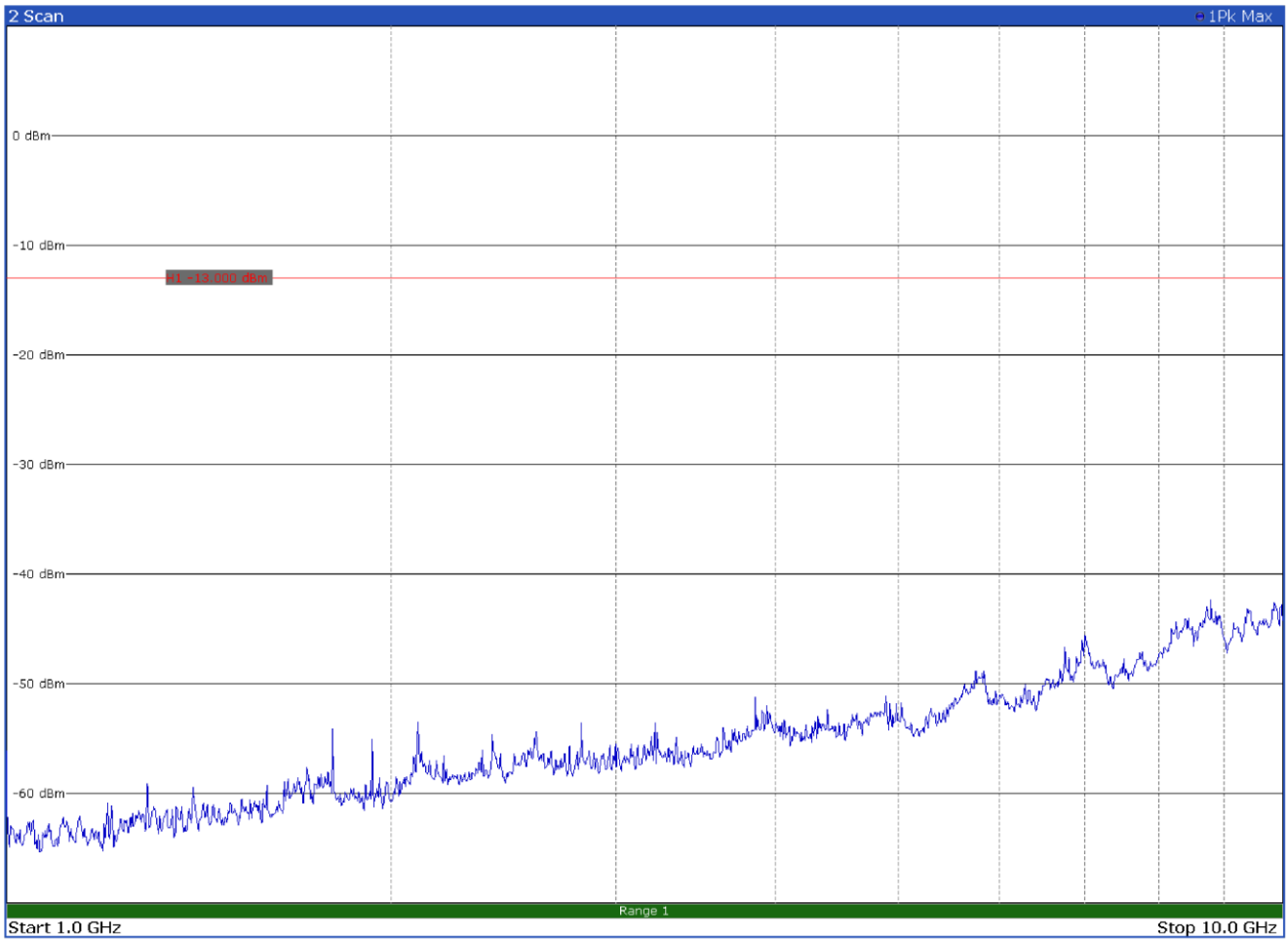


Figure 8.7-6: *Radiated spurious emissions from 1 GHz to 10 GHz, mid channel with antenna in horizontal polarization*

Test data, continued

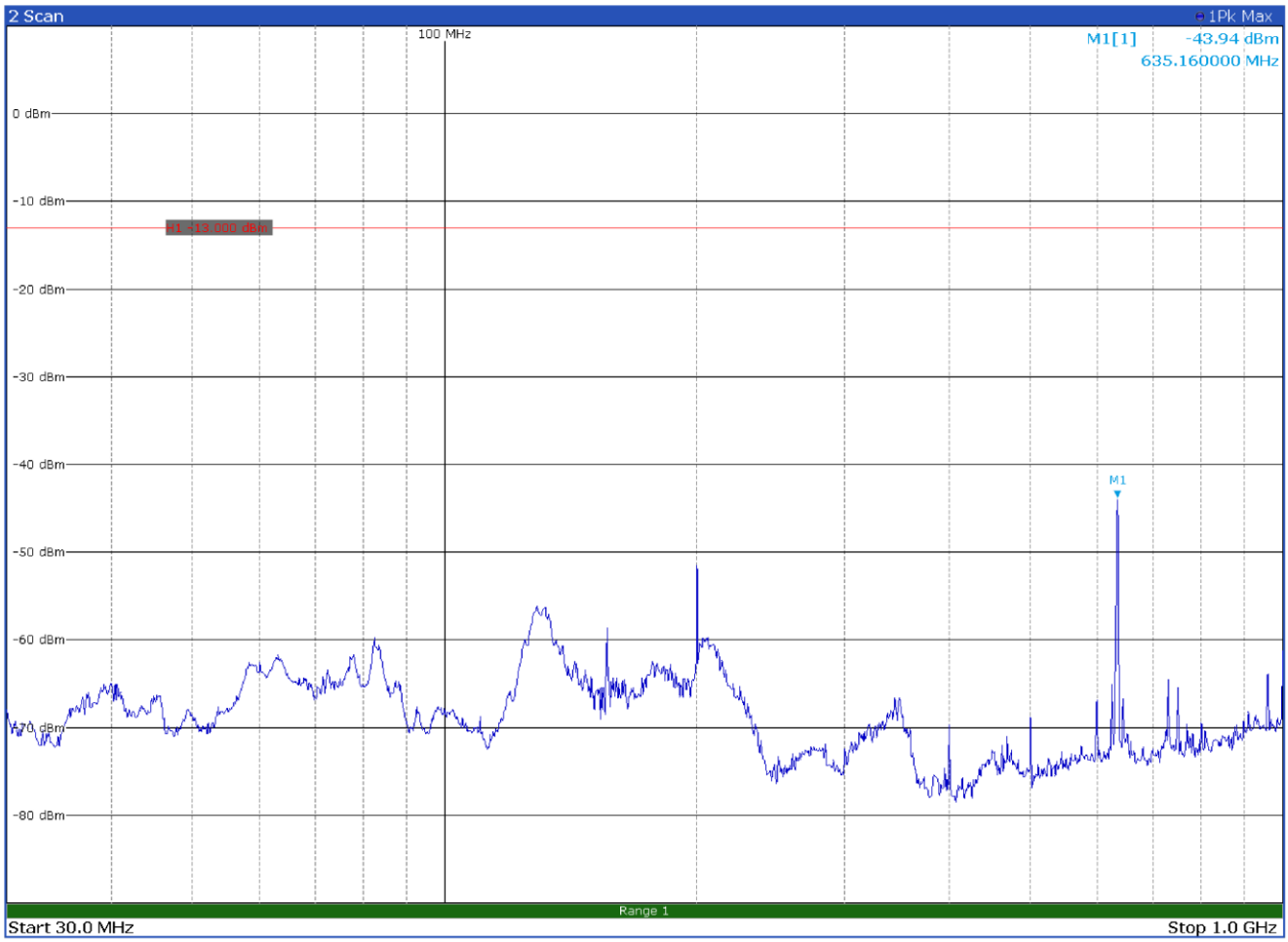


Figure 8.7-7: *Radiated spurious emissions below 1 GHz, mid channel with antenna in vertical polarization*

Test data, continued

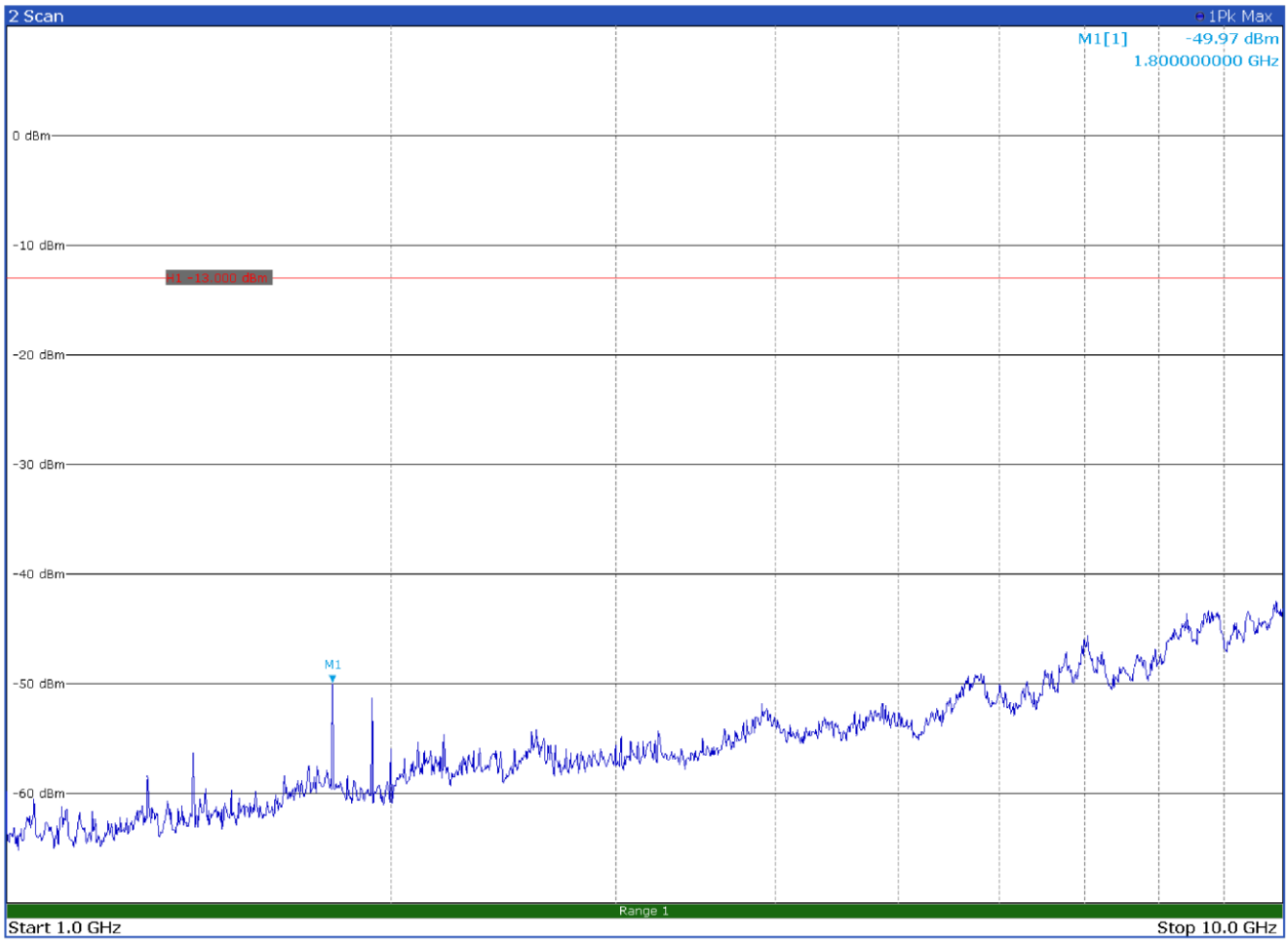


Figure 8.7-8: *Radiated spurious emissions from 1 GHz to 10 GHz, mid channel with antenna in vertical polarization*

Test data, continued

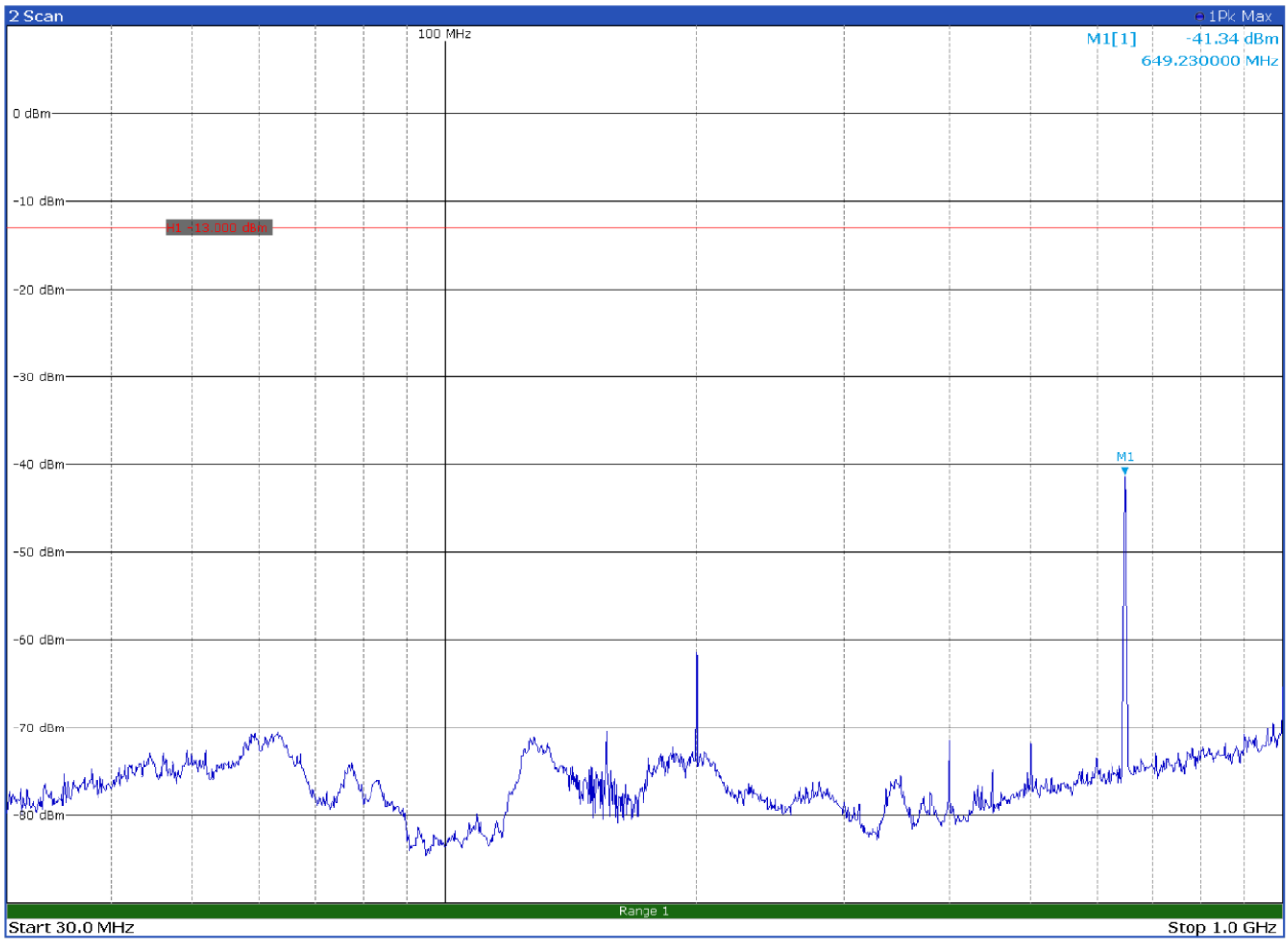


Figure 8.7-9: *Radiated spurious emissions below 1 GHz, high channel with antenna in horizontal polarization*

Test data, continued

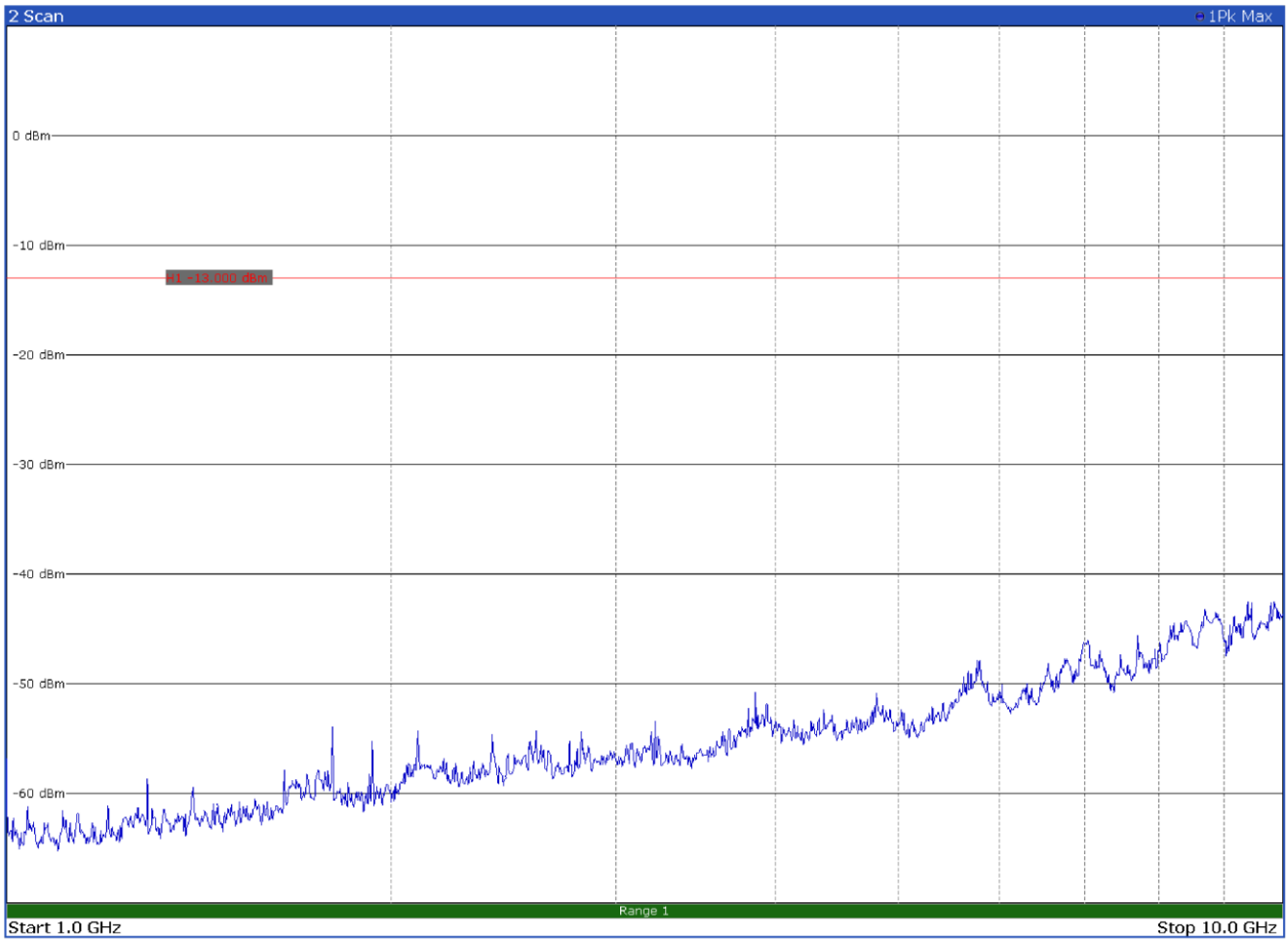


Figure 8.7-10: *Radiated spurious emissions from 1 GHz to 10 GHz, high channel with antenna in horizontal polarization*

Test data, continued

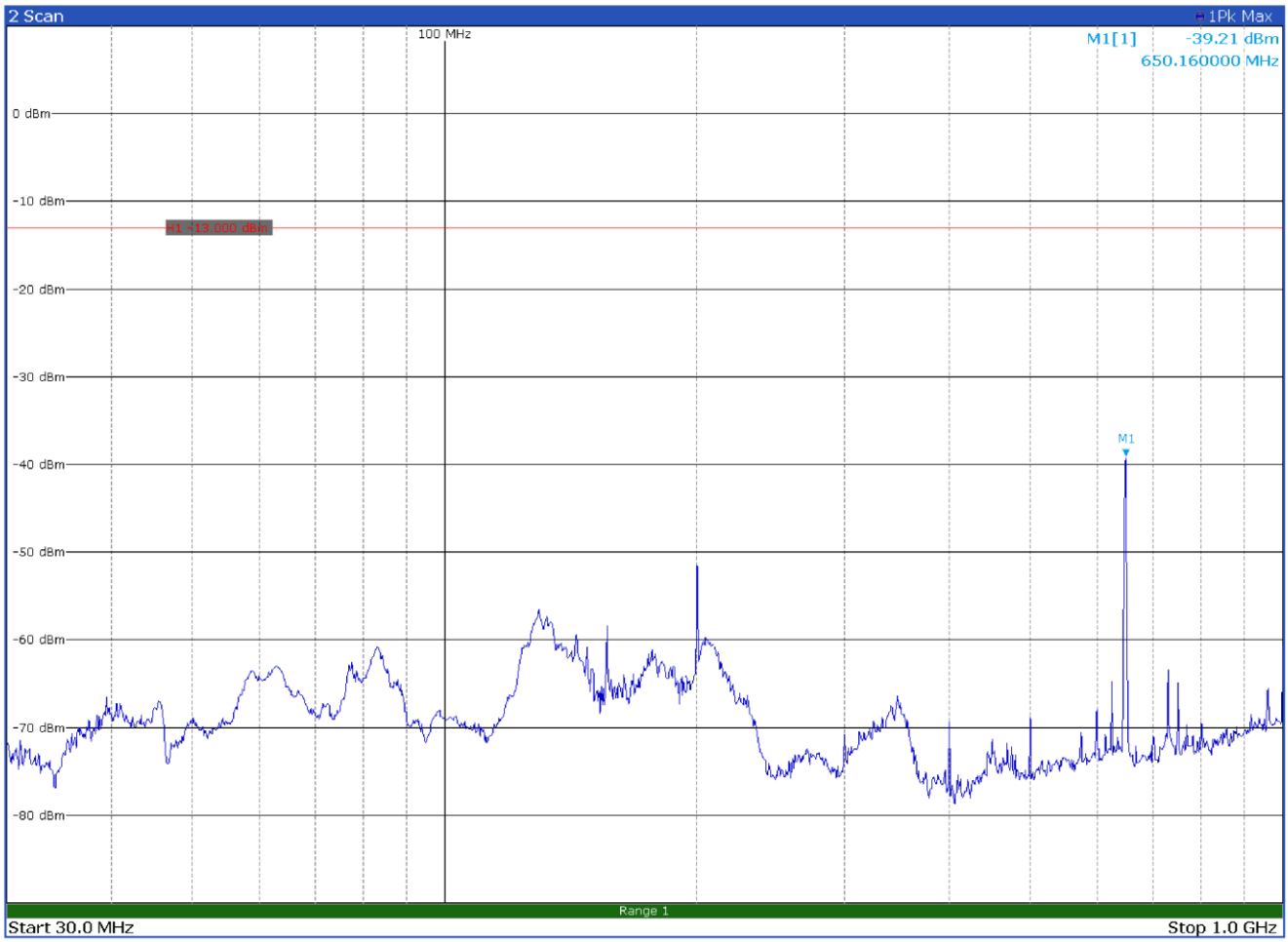


Figure 8.7-11: *Radiated spurious emissions below 1 GHz, high channel with antenna in vertical polarization*

Test data, continued

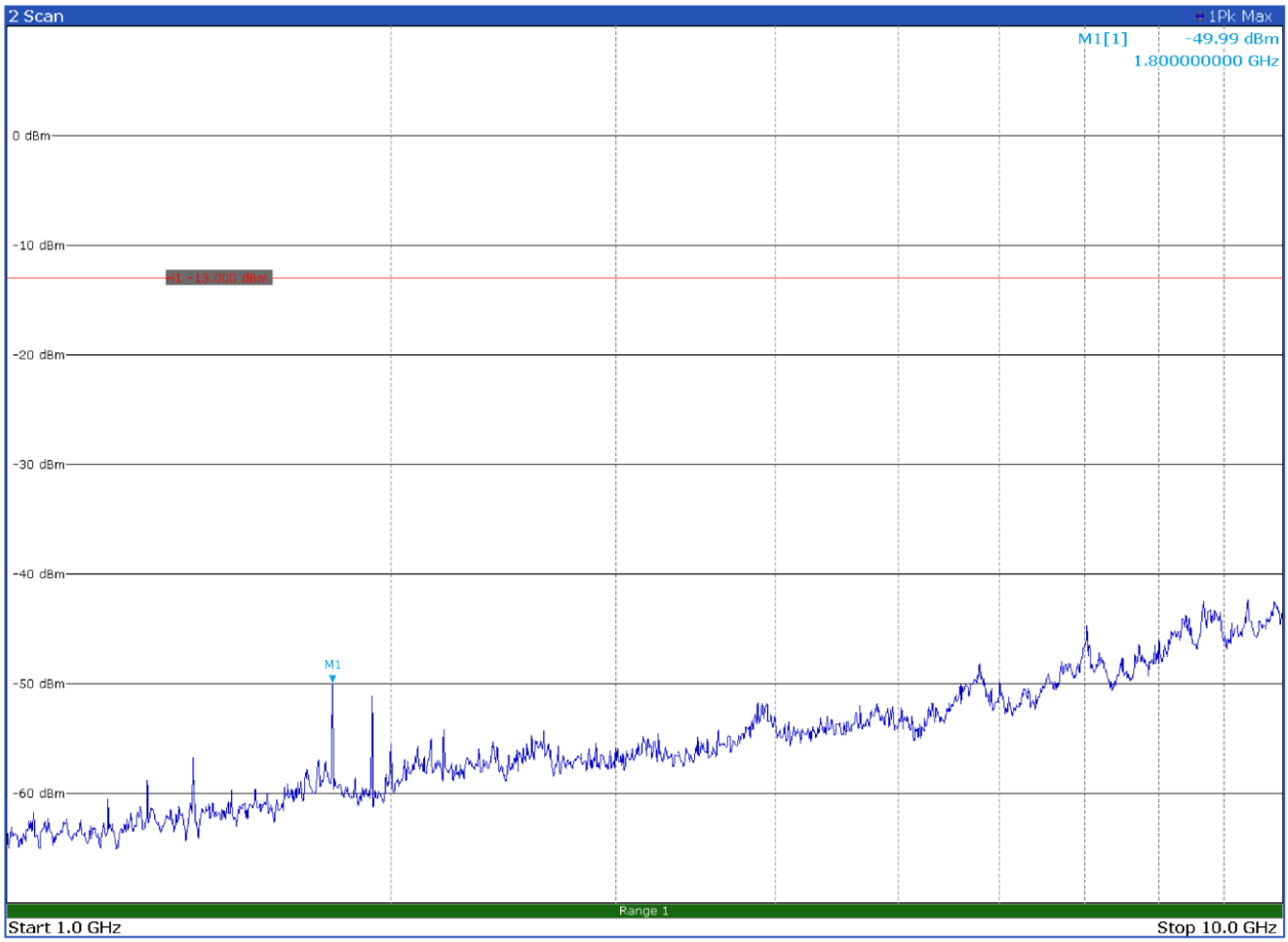


Figure 8.7-12: *Radiated spurious emissions from 1 GHz to 10 GHz, high channel with antenna in vertical polarization*

8.8 Frequency stability measurements

8.8.1 References, definitions and limits

FCC § 27.54

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

RSS-131, Clause 5.2.4

Industrial zone enhancers shall comply with the frequency stability given in the RSS that applies to the equipment with which the zone enhancer is to be used. In cases where the frequency stability limit is not given in the applicable RSS, the equipment shall comply with a frequency stability of ± 1.5 ppm. For zone enhancers with no input signal processing capability, the frequency stability measurement in this section is not required.

RSS-130, Clause 4.5

For equipment that is capable of transmitting numerous channels simultaneously for different applications (e.g. LTE and narrowband – internet of things (IoT)), the occupied bandwidth shall be the bandwidth representing the sum of the occupied bandwidths of these channels.

The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each frequency block range when tested at the temperature and supply voltage variations specified in RSSGen

RSS-Gen, Clause 6.11

Transmitter frequency stability

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

When the measurement method of transmitter frequency stability is not stated in the applicable RSS or reference standards, the following conditions apply:

a. The reference temperature for radio transmitters is +20°C (+68°F).
b. A hand-held device that is only capable of operating using internal batteries shall be tested at the battery's nominal voltage, and again at the battery's operating end-point voltage, which shall be specified by the equipment manufacturer. For this test, either a battery or an external power supply can be used.
c. The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environmental test chamber, the unmodulated carrier frequency and frequency stability shall be measured under the conditions specified below for licensed and licence-exempt devices, unless specified otherwise in the applicable RSS. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement.

For licensed devices, the following measurement conditions apply:

a. at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage
b. at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

8.8.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	February 8, 2022

8.8.3 Observations, settings and special notes

Testing was performed per ANSI C63.26 Paragraphs 5.6.3, 5.6.4 and 5.6.5 methods.

8.8.4 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
EMI Receiver	Rohde & Schwarz	ESU8	100202
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397
Climatic Chamber	MSL	EC500DA	15022

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

8.8.5 Test data

Table 8.8-1: *Transmitter frequency stability results for antenna port 1*

Test conditions	Frequency, Hz	Drift, Hz	Drift, ppm	Limit ±ppm	Margin, ±ppm
+50 °C, Nominal	634489838.1	17.6	0.02774	1.5	1.47
+40 °C, Nominal	634489836.0	15.5	0.02443	1.5	1.48
+30 °C, Nominal	634489831.8	11.3	0.01781	1.5	1.48
+20 °C, -15% voltage	634489821.4	0.9	0.00142	1.5	1.50
+20 °C, Nominal	634489820.5	Reference	Reference	Reference	Reference
+20 °C, +15% voltage	634489818.6	-1.9	-0.00299	1.5	1.50
+10 °C, Nominal	634489802.0	-18.5	-0.02916	1.5	1.47
0 °C, Nominal	634489789.2	-31.3	-0.04933	1.5	1.45
−10 °C, Nominal	634489768.4	-52.1	-0.08211	1.5	1.42
−20 °C, Nominal	634489761.2	-59.3	-0.09346	1.5	1.41
−30 °C, Nominal	634489694.8	-125.7	-0.19811	1.5	1.30

Table 8.8-2: *Transmitter frequency stability results for antenna port 2*

Test conditions	Frequency, Hz	Drift, Hz	Drift, ppm	Limit ±ppm	Margin, ±ppm
+50 °C, Nominal	634489838.4	17.1	0.02695	1.5	1.47
+40 °C, Nominal	634489836.4	15.1	0.02380	1.5	1.48
+30 °C, Nominal	634489832.5	11.2	0.01765	1.5	1.48
+20 °C, -15% voltage	634489822.0	0.7	0.00110	1.5	1.50
+20 °C, Nominal	634489821.3	Reference	Reference	Reference	Reference
+20 °C, +15% voltage	634489819.2	-2.1	-0.00331	1.5	1.50
+10 °C, Nominal	634489802.4	-18.9	-0.02979	1.5	1.47
0 °C, Nominal	634489790.1	-31.2	-0.04917	1.5	1.45
−10 °C, Nominal	634489768.6	-52.7	-0.08306	1.5	1.42
−20 °C, Nominal	634489762.0	-59.3	-0.09346	1.5	1.41
−30 °C, Nominal	634489695.9	-125.4	-0.19764	1.5	1.30

Section 9 EUT photos

9.1 Set-up photos

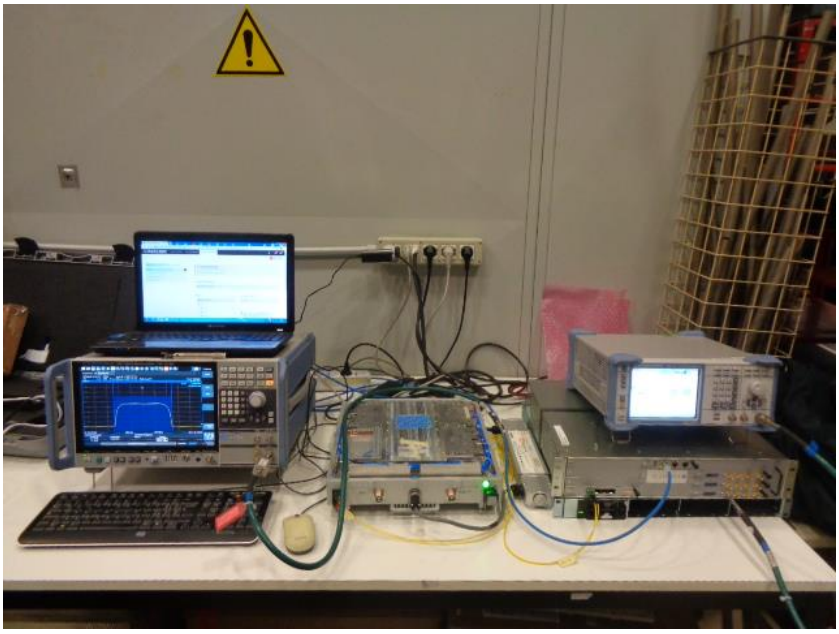


Figure 9.1-1: *Antenna port testing set-up*

Figure 9.1-2: *Antenna port testing set-up in climatic chamber*

Figure 9.1-3: *Radiated emissions set-up for frequencies below 1 GHz*

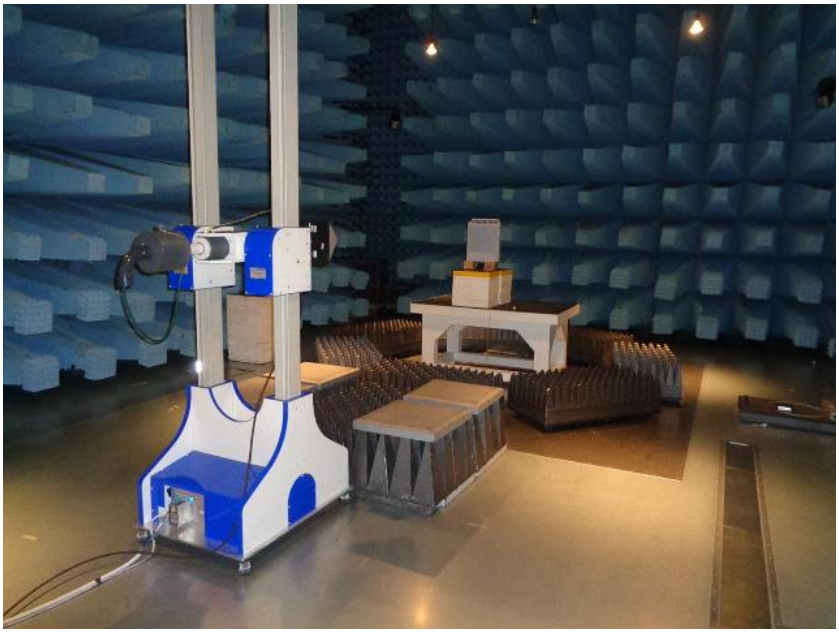


Figure 9.1-4: *Radiated emissions set-up for frequencies above 1 GHz*

9.2 External photos

Figure 9.2-1: *EUT photo*

End of the test report