ONE WORLD ○ OUR APPROVAL

Wireless test report – 395016-9TRFWL

Applicant:

Eurotech SpA

Product name:

MRG1014

Model:

REGATE-10-14-35

Model variant:

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FCC ID:

UKMMRG1014

IC Registration number:

21442-MRG1014

Specifications:

- FCC 47 CFR Part 15 Subpart E, §15.407

  Unlicensed National Information Infrastructure Devises

- RSS-247, Issue 2, Section 6, Feb 2017

  Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Date of issue: June 23, 2020

Tested by
(name, function and signature) P. Barbieri (project handler) Signature:

Reviewed by
(name, function and signature) D. Guarnone (verifier) Signature:

Test location

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

Limits of responsibility

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

Copyright notification

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Eurotech SpA
Address	Via Fratelli Solari 3/a 33020 Amaro, UD, Italy

1.2 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407 RSS-247, Issue 2, February 2017 RSS-Gen, Issue 5, March 2019, Amendment 1	Unlicensed National Information Infrastructure Devises Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

789033 D02 General UNII Test Procedures New Rules v02r01 (Dec 14, 2017)	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

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

See “Summary of test results” for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Date of issue	Details of changes made to test report
395016-9TRFWL	June 23, 2020	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.31(e)	Variation of power source	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 uses a unique coupling to the intentional radiator.

2.2 FCC Part 15 Subpart E, test results

Part	Test description	Verdict
§15.403(i)	Emission bandwidth	Not tested
§15.407(a)(1)	Power and density limits within 5.15–5.25 GHz band	Pass
§15.407(a)(2)	Power and density limits within 5.25–5.35 GHz and 5.47–5.725 GHz bands	Pass
§15.407(a)(3)	Power and density limits within 5.725–5.85 GHz band	Pass
§15.407(b)(1)	Undesirable emission limits for 5.15–5.25 GHz band	Pass
§15.407(b)(2)	Undesirable emission limits for 5.25–5.35 GHz band	Pass
§15.407(b)(3)	Undesirable emission limits for 5.47–5.725 GHz bands	Pass
§15.407(b)(4)	Undesirable emission limits for 5.725–5.85 GHz band	Pass
§15.407(b)(6)	Conducted limits for U-NII devices using an AC power line	Pass
§15.407(e)	Minimum 6 dB bandwidth of U-NII devices within the 5.725-5.85 GHz band	Not tested
§15.407(g)	Frequency stability	Not tested
§15.407(h)(1)[1]	Transmit power control (TPC)	Not tested
§15.407(h)(2)[1]	Dynamic Frequency Selection (DFS)	Not tested

Note: [1]DFS and TPC requirements are only applicable to 5.25–5.35 GHz and 5.47–5.725 GHz bands

2.3 IC RSS-Gen, Issue 5, March 2019, Amendment 1, test results

Part	Test description	Verdict
6.6	Occupied Bandwidth	Not tested
7.1.2[1]	Receiver radiated emission limits	Not applicable
7.1.3[1]	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Pass
8.11[2]	Frequency stability	Not tested

Notes: [1]According to sections 5.2 and 5.3 of RSS-Gen, Issue 5: if EUT does not have a stand-alone receiver neither scanner receiver, then it exempt from receiver requirements.

[2]According to section 8.11 of RSS-Gen, Issue 5: if the frequency stability of the licence-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required

2.4 IC RSS-247, Issue 1, test results

Section	Test description	Verdict
6.1[1]	Types of Modulation	Pass
6.2.1.1	Power limits for 5150–5250 MHz band	Pass
6.2.2.1	Power limits for 5250–5350 MHz band	Pass
6.2.3.1	Power limits for 5470–5600 MHz and 5650–5725 MHz bands	Pass
6.2.4.1	Power limits for 5725–5850 MHz band	Pass
6.2.4.1	Minimum 6 dB bandwidth	Not tested
6.2.1.2	Unwanted emission limits for 5150–5250 MHz band	Pass
6.2.2.2	Unwanted emission limits for 5250–5350 MHz band	Pass
6.2.2.2	TPC requirements for devices with a maximum e.i.r.p. greater than 500 mW	Not tested
6.2.2.3	e.i.r.p. at different elevations restrictions for 5250–5350 MHz band	Not tested
6.2.3.2	Unwanted emission limits for 5470–5600 MHz and 5650–5725 MHz bands	Pass
6.2.4.2	Unwanted emission limits for 5725–5850 MHz band	Pass
6.3	Dynamic Frequency Selection (DFS) for devices operating in the bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz	Not tested

Notes: [1] The EUT employs digital modulation: 802.11a/n

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	April 23, 2020
Nemko sample ID number	395016-1/1

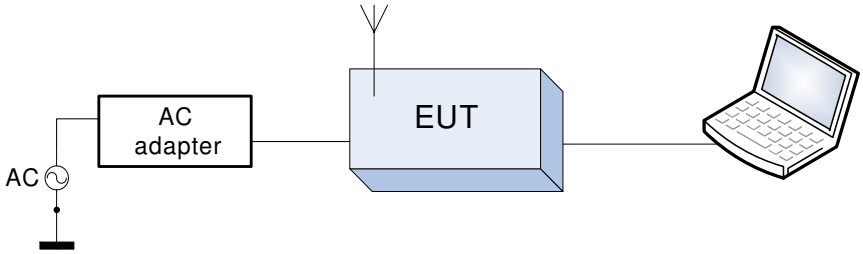
3.2 EUT information

Product name	MRG1014
Model	Regate-10-14-35
Model variant	--
Serial number	395016-1/1 (Number assigned by Nemko Spa)

3.3 Technical information

RSS number and Issue number	RSS-247 Issue 2, Section 6, February 2017
Frequency band	5150–5725 MHz
Frequency Min (MHz)	5180 (20 MHz channel)
Frequency Max (MHz)	5700 (20 MHz channel)
RF power Max (W), Conducted	0.02291 (13.6 dBm for 20 MHz channel)
Measured BW (MHz) (26 dB)	21.2
Measured BW (MHz) (99%)	16.4
Type of modulation	802.11a/n
Emission classification (F1D, G1D, D1D)	16M4W7D
Transmitter spurious, dBµV/m @3 m	51.1
Equipment class	NII - Unlicensed National Information Infrastructure TX
Power requirements	24 $V_{DC,}$ via 120 V_{AC} adapter or battery
Antenna information	The EUT uses a unique antenna coupling. The following antennas are provided with the EUT. Product Type — Manufacturer — Model Wi-Fi/BT antenna — Linx Technologies — ANT-DB1-RAF-RPS GNSS antenna — 2J-ANTENNA — 2J4301MPGF Cellular antenna — 2J-ANTENNA — 2JW0124

3.4 EUT setup diagram



3.5 Product description and theory of operation

The ReliaGATE 10-14 is a Multi-service IoT Gateway that has been designed to deliver LTE and 2G/3G connectivity to industrial and lightly rugged applications. Based on the NXP i.MX 8M Mini Cortex-A53 quad core processor, with up to 4GB of RAM, up to 64GB of eMMC and a user-accessible microSD slot, the ReliaGATE 10-14 is a low power gateway suitable for demanding use cases: it supports a 9 to 30V power supply with transient protection, Display Port video output, two protected and isolated RS-232/422/RS-485 serial ports, two noise and surge protected USB ports, six optoisolated digital and two isolated analog interfaces. The ReliaGATE 10-14 features a wide range of connectivity capabilities: it integrates a carrier certified LTE Cat 1 cellular modem with dual SIM support, Wi-Fi, Bluetooth 4.2/BLE, and two Gigabit Ethernet ports; an optional internal GNSS provides precise geolocation capabilities. Expansion options allow adding extra features with side modules, such as the LoRa LPWAN Gateway unit, or the DAQ unit that provides analog input and more DI/O ports. The EUT is equipped with two Telit radio module model WE866C3-P for WIFI/BT and model LE910C1-NF for 3G/LTE and GNSS.

3.6 EUT sub assemblies

Table 3.6-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
ReliaGATE 10-14	Eurotech	REGATE-10-14-35	395016-1/1
AC adapter	Sunny	SYS1541-2424	None

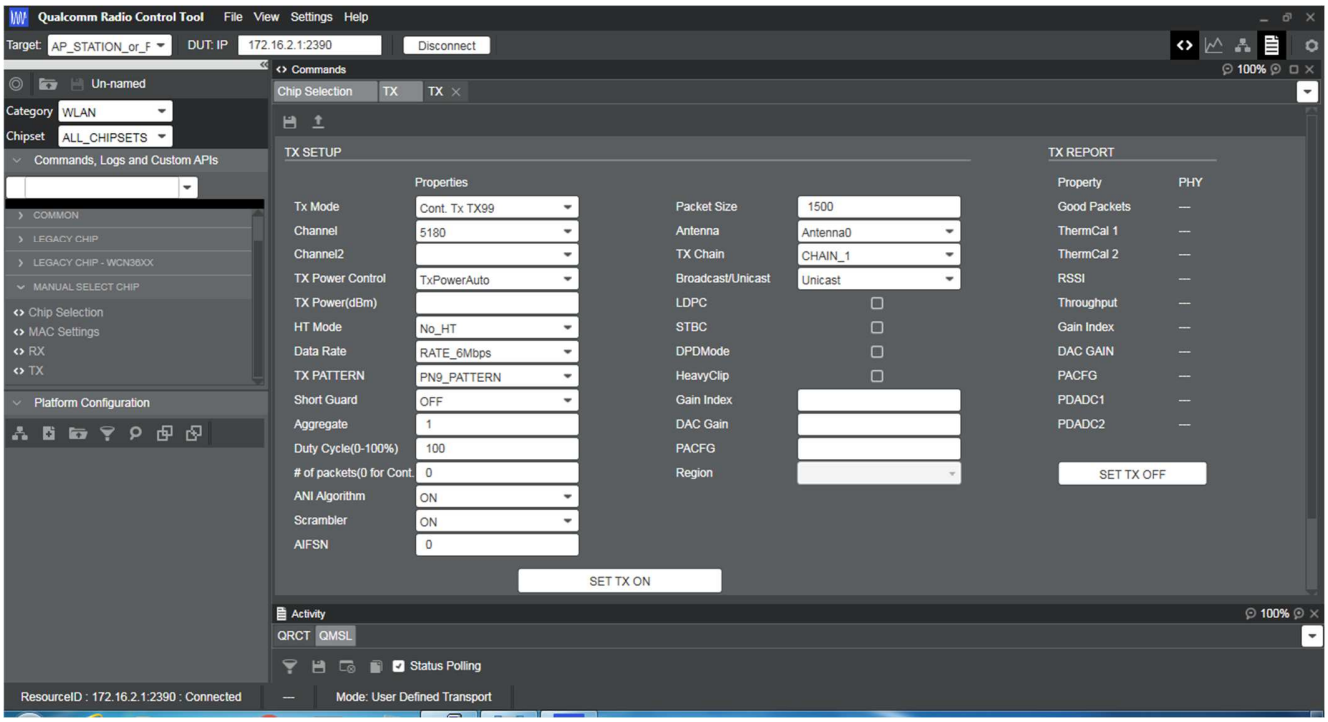
Section 3: Equipment under test (EUT) details

EUT exercise details

EUT was set to continuously transmit mode during tests, by test software provided by client.
The EUT runs a Linux operating system which allows for the testing to be performed using engineering test tools and scripts. Communication with the EUT is via a serial console or Ethernet connection which provides a Linux command line interface for execution of the test tools/scripts. These tools/scripts configure the radio modules to enable continuous transmission with the ability to adjust modulation, frequency and output power as required.

Linux operating system version: 4.19.35-imx_4.19.35_1.0.0+ge4452f4

The following software installed on the PC has been used to force the EUT in TX mode (Qualcomm Radio Control Tool version 4.0.00125):



Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

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

4.2 Technical judgment

The EUT has three WIFI standard and three channel bandwidths; 802.11a 6 Mb/s with 20 MHz bandwidth standard is chosen to be the representative worst-case.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

In the laboratory, the following ambient conditions are respected for each test reported below:

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

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model no.	Asset no.	Cal date	Next cal.
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305	2019-01	2021-01
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	2019-01	2021-01
Barometer	Castle	GPB 3300	072015	2019-12	2020-12

5.2 Power supply range

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

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

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

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

Hereafter Nemko's measurement uncertainties are reported:

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

EUT	Type	Test	Range	Measurement Uncertainty	Notes
Receiver	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)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	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)

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 (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESU8	100202	2020-01	2021-01
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESW44	101620	2019-08	2020-08
Trilog Antenna (30 MHz ÷ 7 GHz)	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-123	2018-07	2021-07
Preamplifier (1 ÷ 18 GHz)	Schwarzbeck	BBV 9718	9718-137	2019-09	2020-09
Horn antenna (18 ÷ 40 GHz)	A.H. System	SAS-574	558	2020-01	2023-01
Preamplifier (18 ÷ 40 GHz)	Miteq	JS44-18004000-35-8P-R	1.627	2019-09	2020-09
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
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2019-09	2021-09
Shielded room	Siemens	10m control room	1947	NCR	NCR
LISN three phase (9 kHz ÷30 MHz)	Rohde & Schwarz	ESH2-Z5	872 460/041	2019-09	2020-09
Shielded room	Siemens	Conducted emission test room	1862	NCR	NCR

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

Section 8. Testing data

8.1 FCC 15.407(a) and RSS-247 6.2 output power

8.1.1 Definitions and limits

FCC:

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30 dBm). In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

ISED:
Frequency band 5150-5250 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW. For other devices, the maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

Frequency band 5250-5350 MHz

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or 1.76 + 10 log10B, dBm, whichever is less. Devices shall implement TPC in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.
Devices, other than devices installed in vehicles, shall comply with the following:

a) The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band;
b) The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Frequency bands 5470-5600 MHz and 5650-5725 MHz

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band. The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

8.1.2 Test summary

Test start date:	June 12, 2020

8.1.3 Observations, settings and special notes

EUT was configured to continuous transmit mode during tests.

EIRP was calculated as following: EIRP = output power + antenna gain

8.1.4 Test data

Table 8.1-1: *FCC Output power measurements results*

Modulation	Frequency, MHz	26 dB bandwidth, MHz	Output power, dBm	Power limit, dBm	Margin, dB
802.11a	5180	20.6	13.6	30.0	-16.4
	5200	20.8	13.3	30.0	-16.7
	5240	21.2	12.9	30.0	-17.1
	5260	20.8	13.6	24.0	-10.4
	5300	20.2	13.0	24.0	-11.0
	5320	20.4	12.9	24.0	-11.1
	5500	20.6	13.1	24.0	-10.9
	5600	20.4	13.2	24.0	-10.8
	5700	21.2	12.9	24.0	-11.1

Table 8.1-2: *ISED e.i.r.p measurements results*

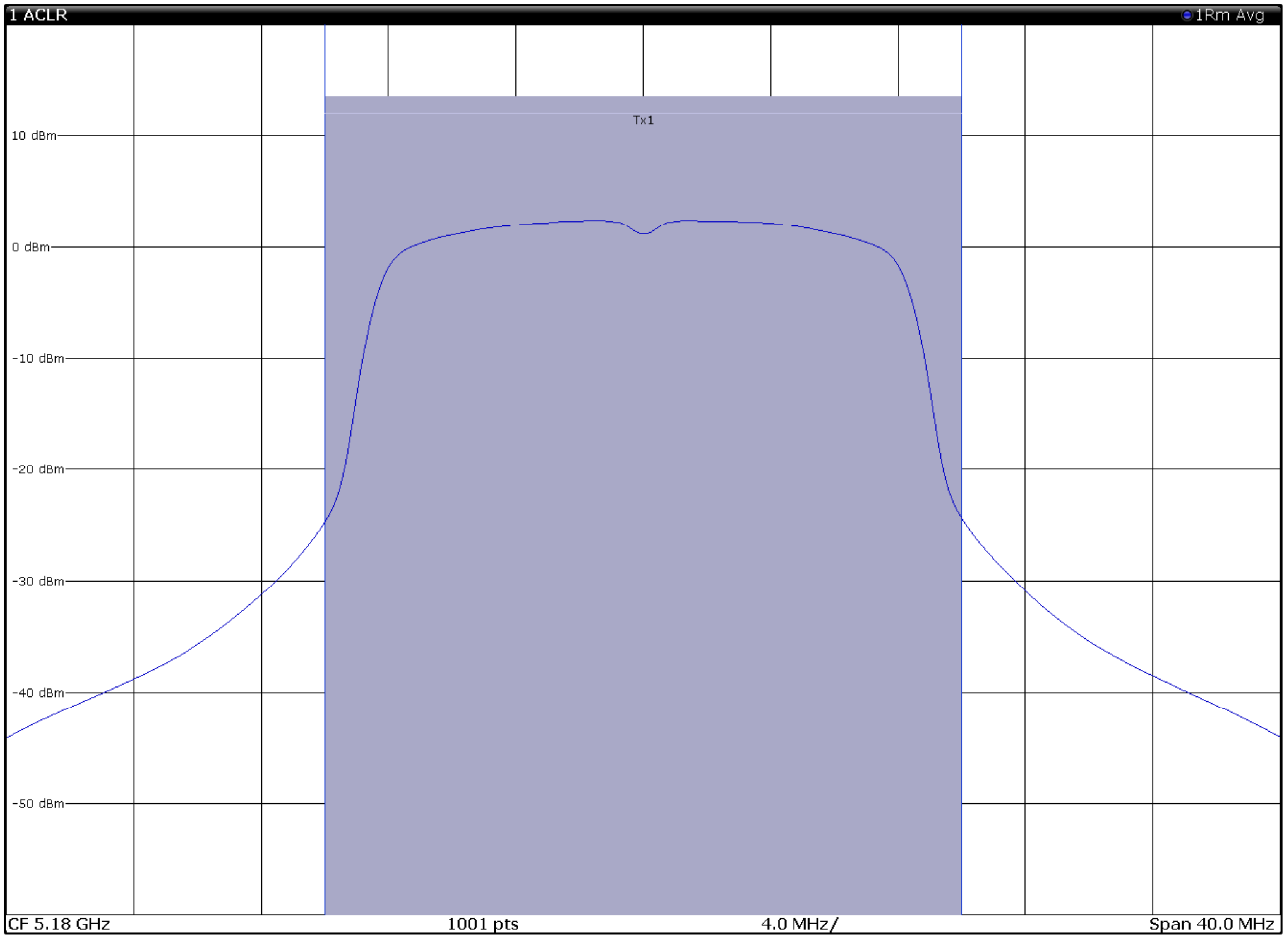
Modulation	Frequency, MHz	99% emission bandwidth, MHz	Output power, dBm	Output power limit, dBm	Antenna Gain, dBi	EIRP, dBm	EIRP limit, dBm	Margin, dB
802.11a	5180	16.4	13.6	--	4.6	18.2	22.0	-3.8
	5200	16.4	13.3	--	4.6	17.9	22.0	-4.1
	5240	16.4	12.9	--	4.6	17.5	22.0	-4.5
	5260	16.4	13.6	23	4.6	18.2	29.0	-10.8
	5300	16.2	13.0	23	4.6	17.6	29.0	-11.4
	5320	16.2	12.9	23	4.6	17.5	29.0	-11.5
	5500	16.4	13.1	23	4.6	17.7	29.0	-11.3
	5600	16.4	13.2	23	4.6	17.8	29.0	-11.2
	5700	16.2	12.9	23	4.6	17.5	29.0	-11.5

Output power = 11 + 10 x $\log_{10}$ (99% emission bandwidth) = 11 + 10 x $\log_{10}$ (16.2) = 23 dBm
EIRP limit = 10 + 10 x $\log_{10}$ (99% emission bandwidth) = 10 + 10 × $\log_{10}$ (16.2) = 22 dBm
EIRP limit = 17 + 10 x $\log_{10}$ (99% emission bandwidth) = 17 + 10 × $\log_{10}$ (16.2) = 29 dBm

Table 8.1-3: *ISED e.i.r.p measurements results for OEM devices installed in vehicles*

Modulation	Frequency, MHz	99% emission bandwidth, MHz	Output power, dBm	Output power limit, dBm	Antenna Gain, dBi	EIRP, dBm	EIRP limit, dBm	Margin, dB
802.11a	5180	16.4	8.6	--	4.6	13.2	13.8	-0.6
	5200	16.4	8.3	--	4.6	12.9	13.8	-0.9
	5240	16.4	7.9	--	4.6	12.5	13.8	-1.3
	5260	16.4	8.6	--	4.6	13.2	13.8	-0.6
	5300	16.2	8.0	--	4.6	12.6	13.8	-1.2
	5320	16.2	7.9	--	4.6	12.5	13.8	-1.3

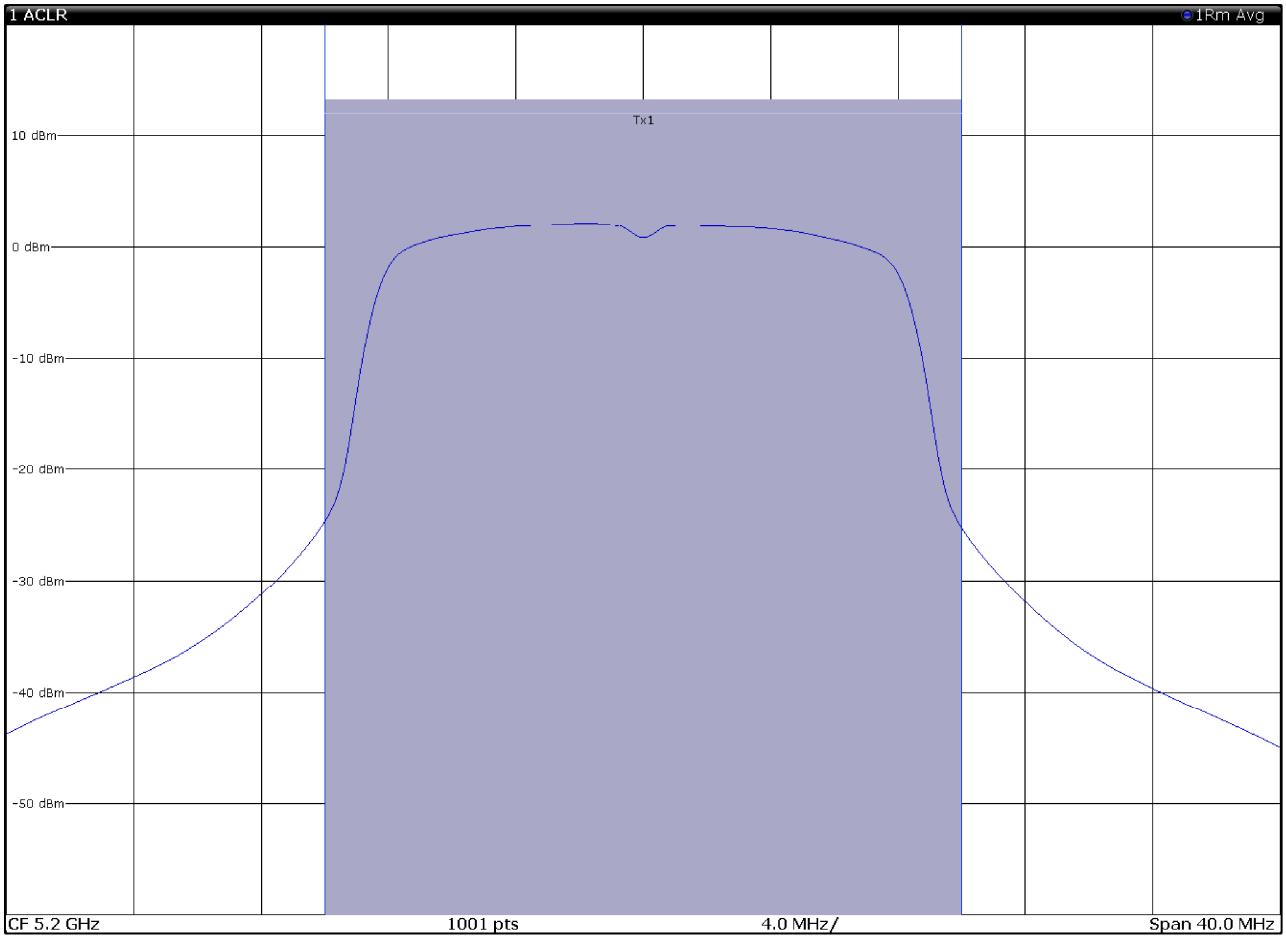
EIRP limit = 1.7 + 10 x $\log_{10}$ (99% emission bandwidth) = 1.7 + 10 × $\log_{10}$ (16.2) = 13.8 dBm
NB: For vehicular use, the EUT power is reduced by 5 dB.



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**13.55 dBm**
Tx Total			**13.55 dBm**

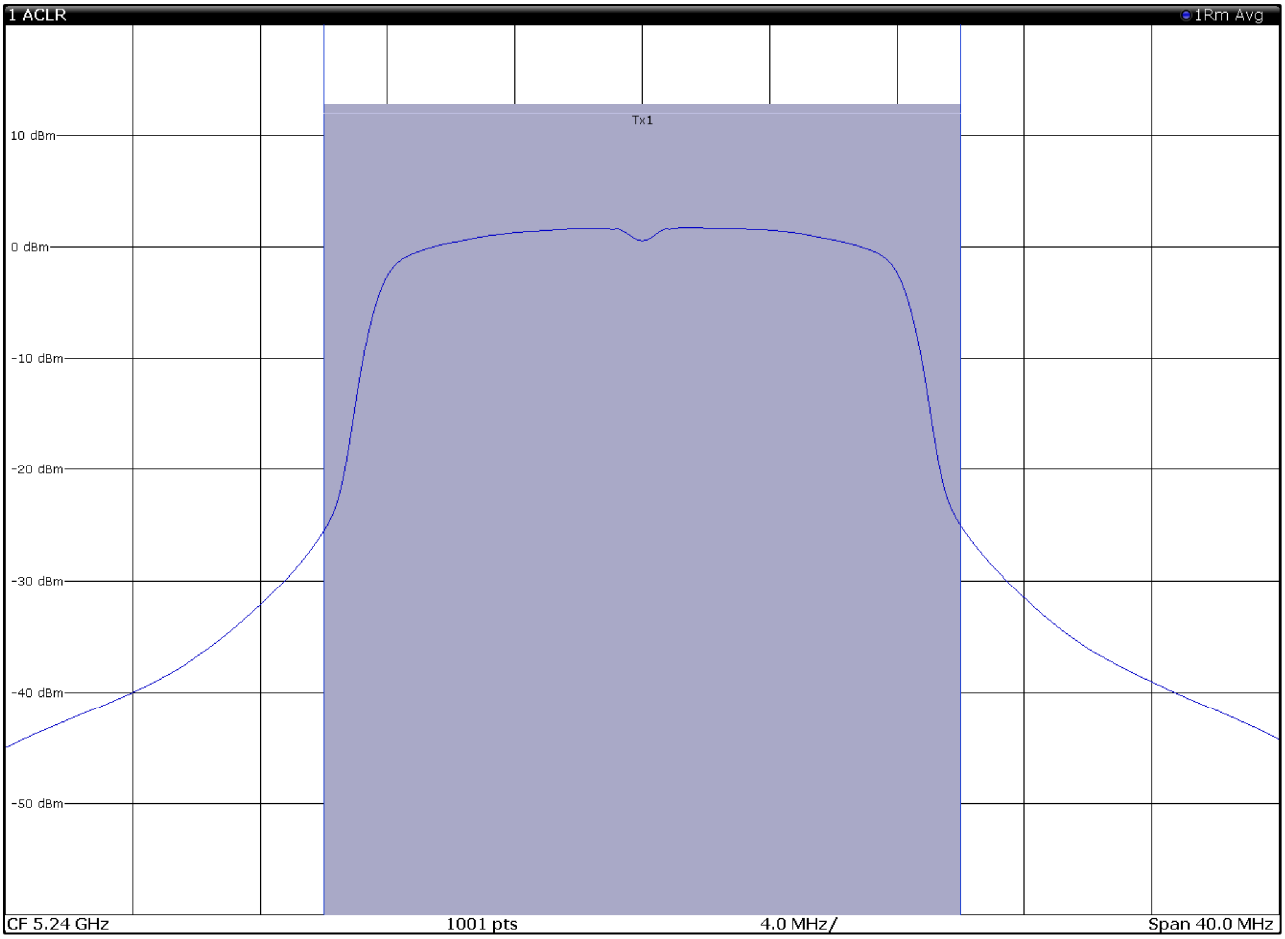
Figure 8.1-1: *FCC Output power on 802.11a – 5180 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**13.24 dBm**
Tx Total			**13.24 dBm**

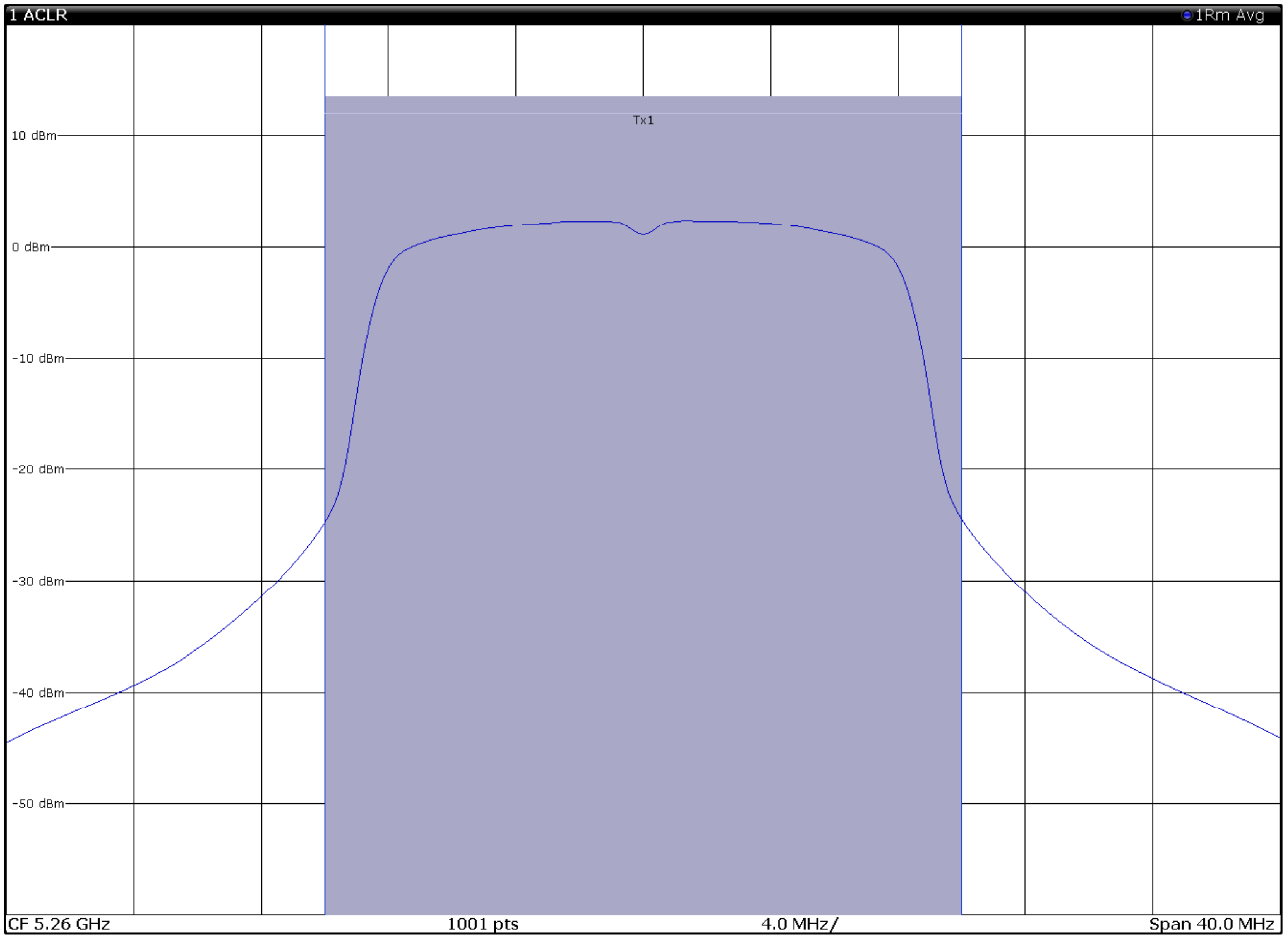
Figure 8.1-2: *FCC Output power on 802.11a – 5200 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**12.88 dBm**
Tx Total			**12.88 dBm**

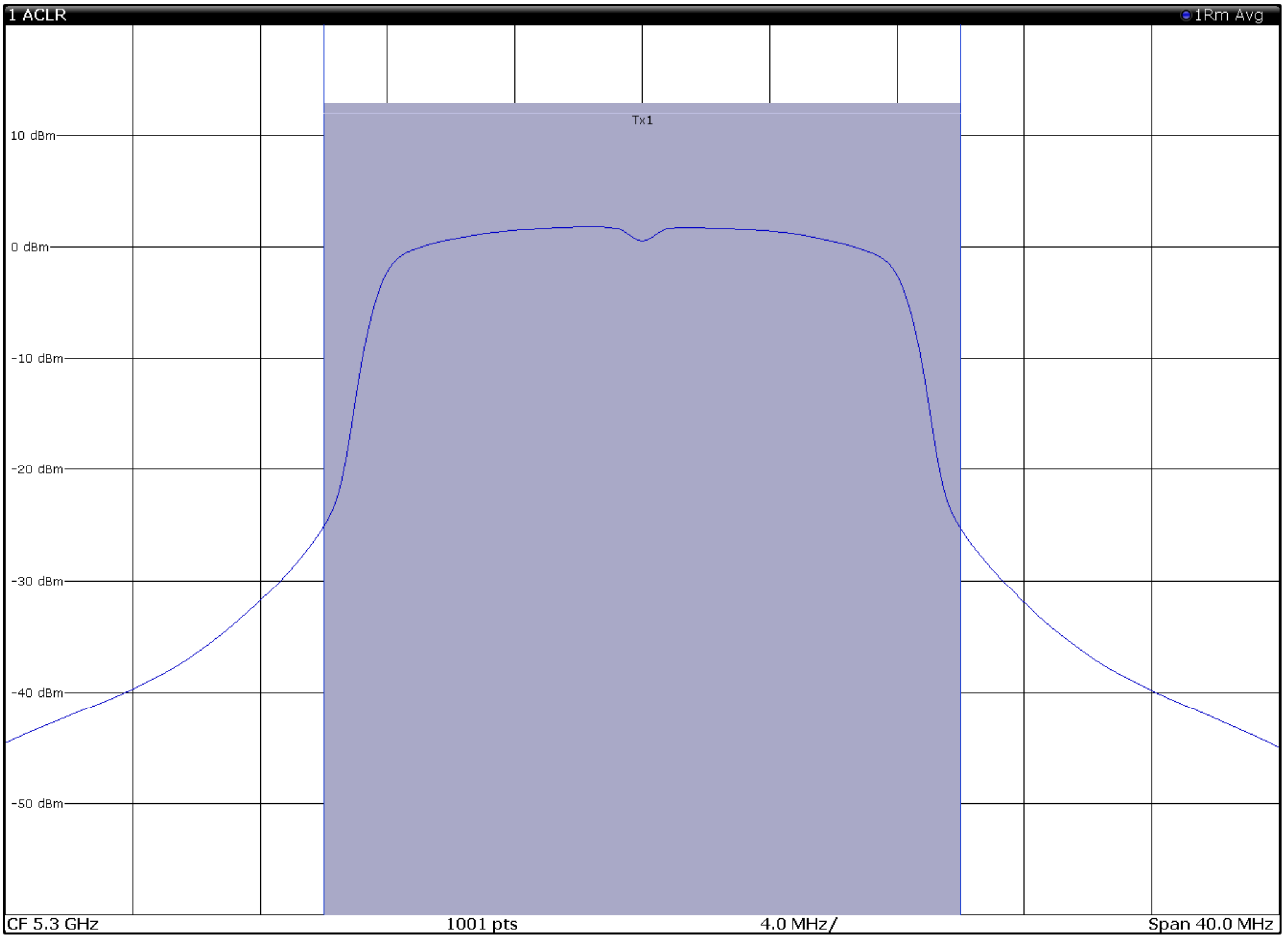
Figure 8.1-3: *FCC Output power on 802.11a – 5240 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**13.54 dBm**
Tx Total			**13.54 dBm**

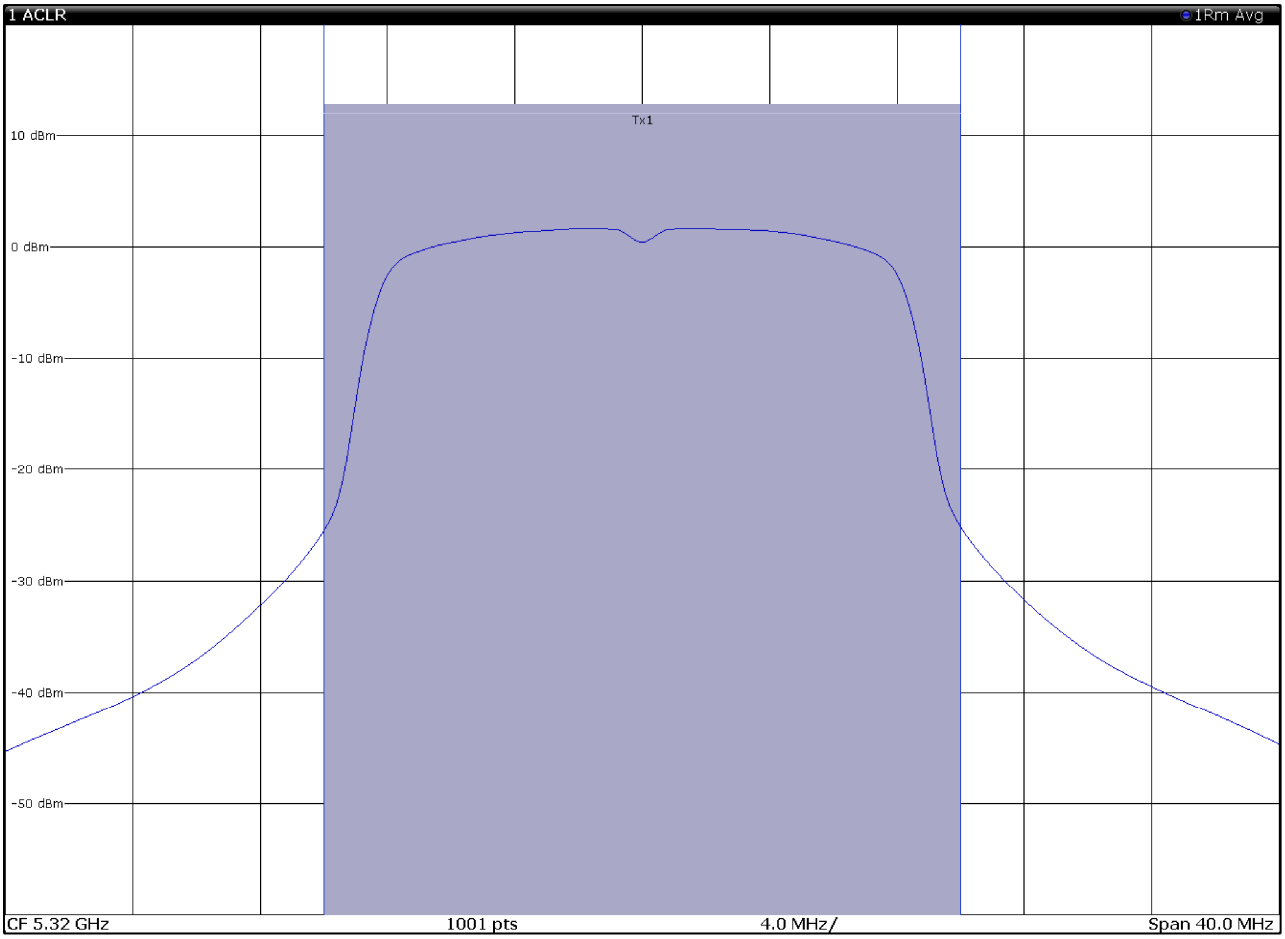
Figure 8.1-4: *FCC Output power on 802.11a – 5260 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**12.94 dBm**
Tx Total			**12.94 dBm**

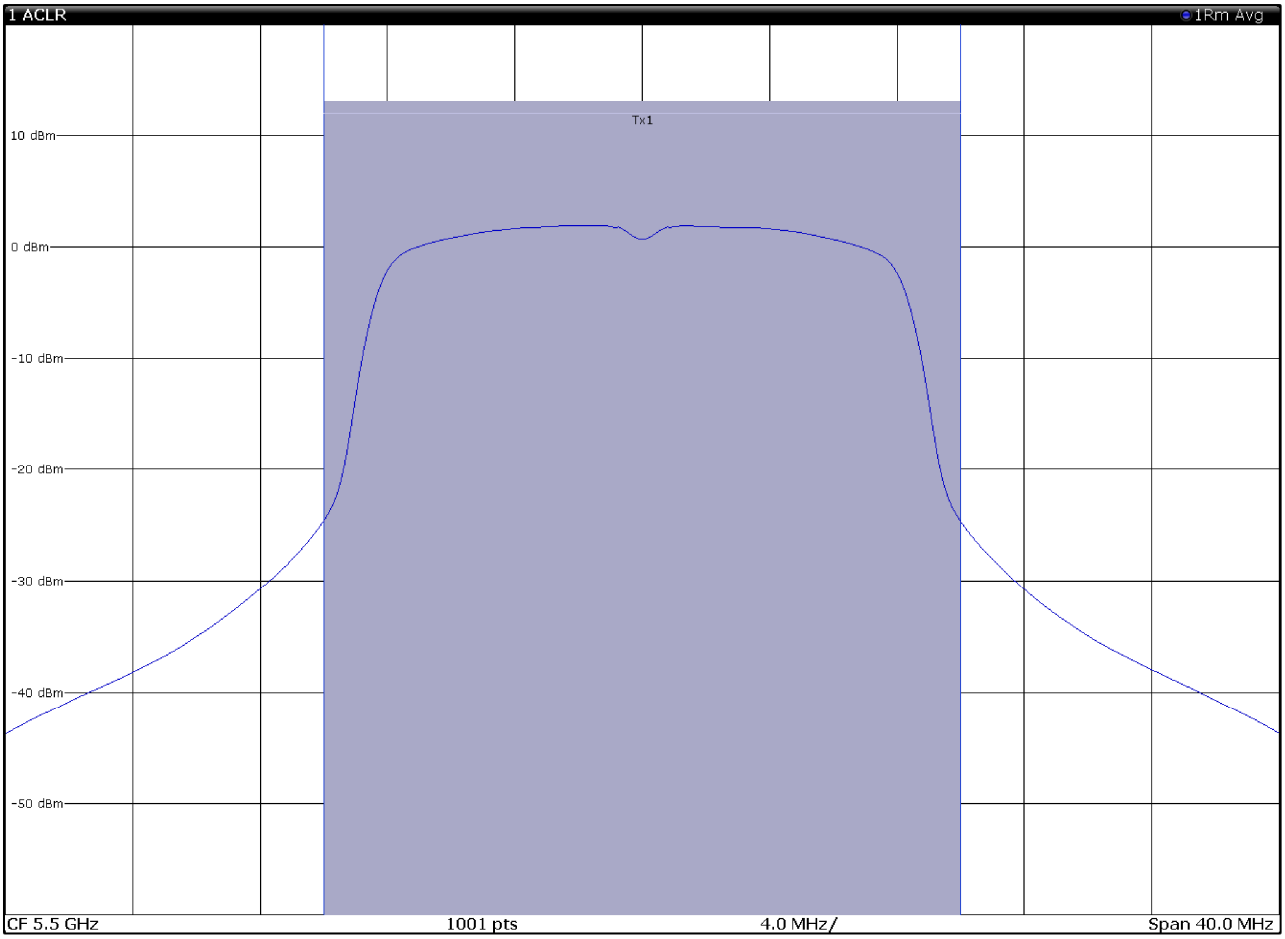
Figure 8.1-5: *FCC Output power on 802.11a – 5300 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**12.82 dBm**
Tx Total			**12.82 dBm**

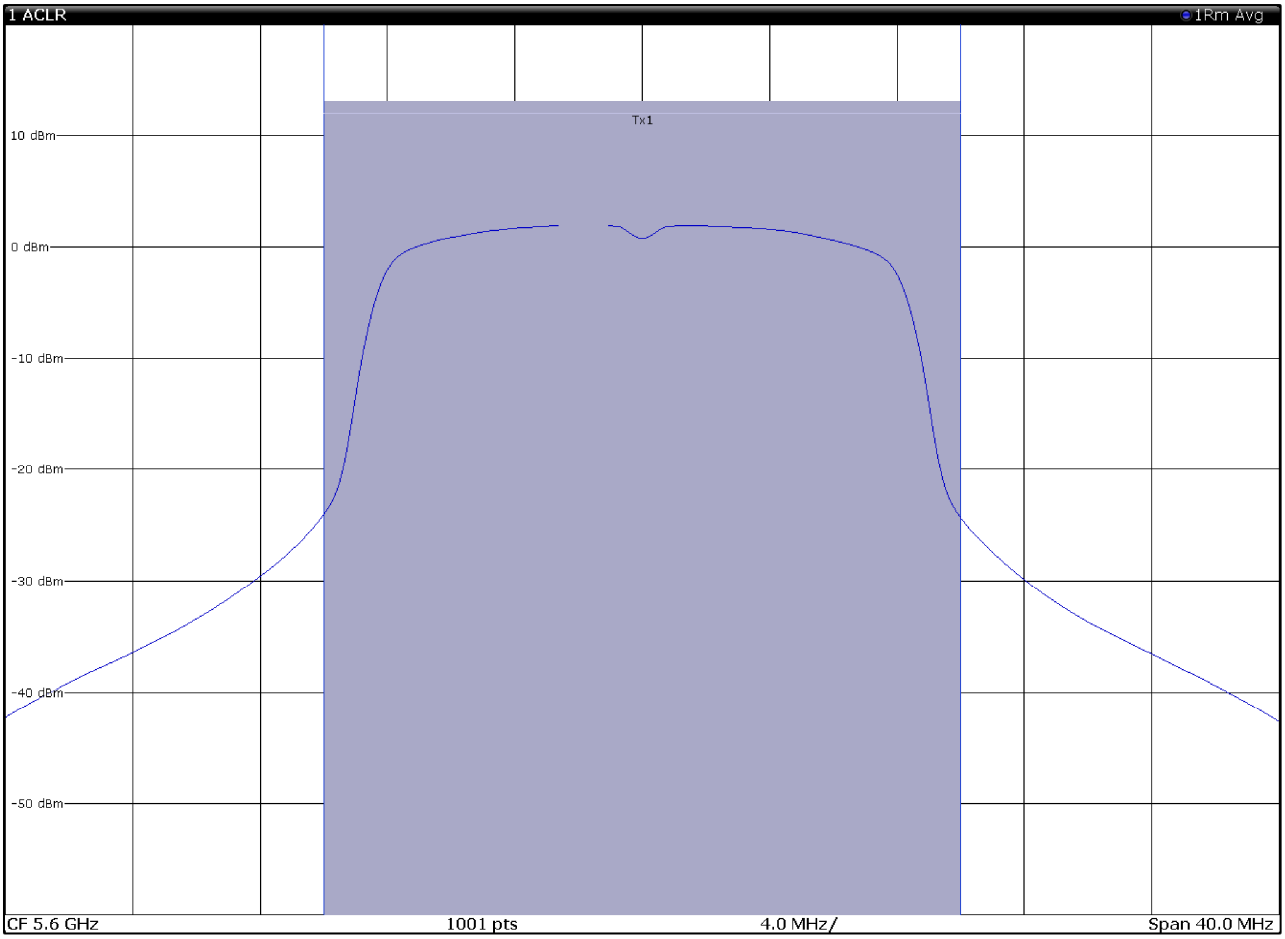
Figure 8.1-6: *FCC Output power on 802.11a – 5320 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**13.09 dBm**
Tx Total			**13.09 dBm**

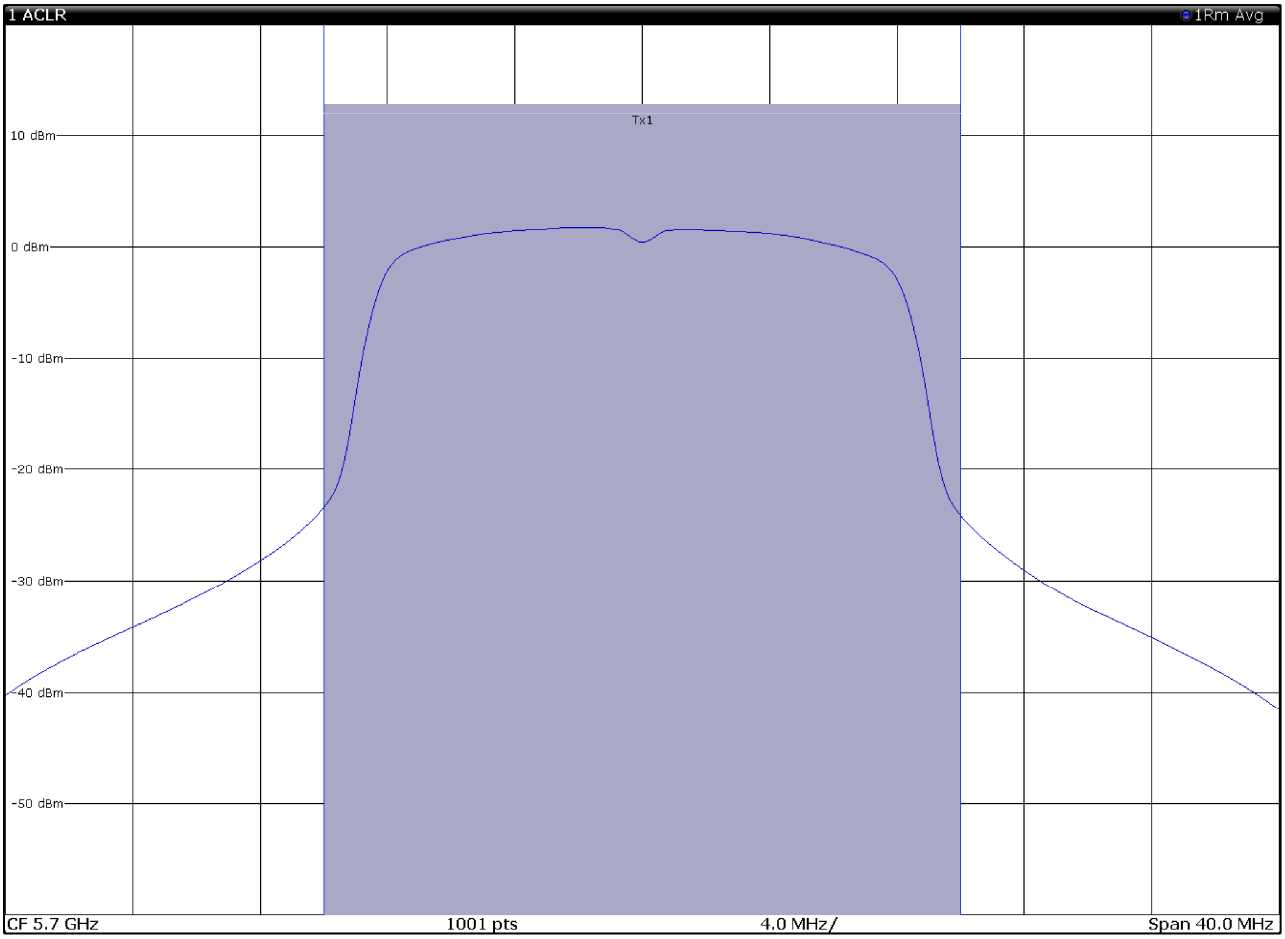
Figure 8.1-7: *FCC Output power on 802.11a – 5500 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**13.11 dBm**
Tx Total			**13.11 dBm**

Figure 8.1-8: *FCC Output power on 802.11a – 5600 channel*



2 Result Summary — WLAN 802.11a

Channel	Bandwidth	Offset	Power
Tx1 (Ref)	20.000 MHz		**12.81 dBm**
Tx Total			**12.81 dBm**

Figure 8.1-9: *FCC Output power on 802.11a – 5700 channel*

8.2 FCC 15.407(b) Undesirable (unwanted) emissions

8.2.1 Definitions and limits

FCC:
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.
(7) The provisions of §15.205 apply to intentional radiators operating under this section.
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

ISED:
Frequency band 5150-5250 MHz

For transmitters with operating frequencies in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz. The 26 dB bandwidth may fall into the 5250-5350 MHz band; however, if the occupied bandwidth also falls within the 5250-5350 MHz band, the transmission is considered as intentional and the devices shall comply with all requirements in the band 5250-5350 MHz including implementing dynamic frequency selection (DFS) and TPC, on the portion of the emission that resides in the 5250-5350 MHz band.

Frequency band 5250-5350 MHz

Devices shall comply with the following:
a) All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p.; or
b) All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device, except devices installed in vehicles, shall be labelled or include in the user manual the following text “for indoor use only.”

Frequency bands 5470-5600 MHz and 5650-5725 MHz

Emissions outside the band 5470-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p. at 5850 MHz instead of 5725 MHz.

RSS-Gen 8.10 Emissions falling within restricted frequency bands
Restricted bands, identified in Table 8.2-2, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:
(a) fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of below;
(b) unwanted emissions falling into restricted bands of below shall comply with the limits specified in RSS-Gen;
(c) unwanted emissions not falling within restricted frequency bands shall either comply with the limits specified in the applicable RSS, or with those specified in RSS-Gen.

Table 8.2-1: *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 *(F in kHz)*	67.6 – 20 × log₁₀(F) *(F in kHz)*	300
0.490–1.705	24000/F *(F in kHz)*	87.6 – 20 × log₁₀(F) *(F in kHz)*	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

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

Table 8.2-2: *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 8.2-2 and above 38.6 GHz are designated for low-power license-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.2-3: *FCC restricted frequency bands*

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

8.2.2 Test summary

Test start date:	June 10, 2020

8.2.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 40 GHz while the EUT was continuously transmitting.
Radiated measurements were performed at a distance of 3 m.

Spectrum analyser for peak conducted measurements within restricted bands below 1 GHz:

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

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

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

Spectrum analyser for average conducted measurements within restricted bands above 1 GHz for frequencies where peak results were above the average limit:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	RMS
Trace mode:	Power average
Number of averaging traces:	100

Spectrum analyser for peak conducted measurements outside restricted bands:

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

Spectrum analyzer 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 analyzer 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

8.2.4 Test data

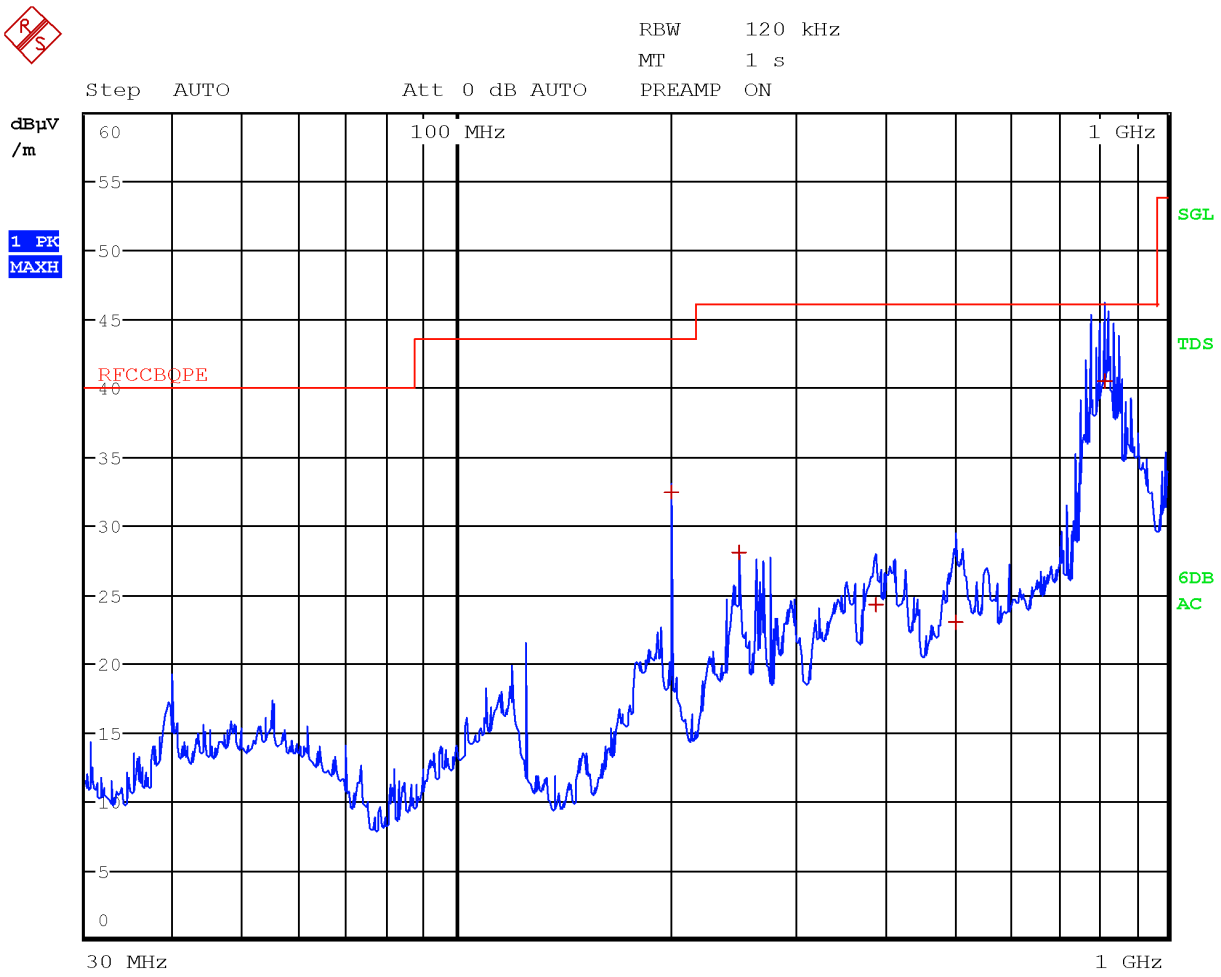


Figure 8.2-1: *Radiated spurious emissions 30 to 1000 MHz, 5200 channel with antenna in horizontal polarization*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
200.0000	32.5	43.5	-11.0	QP
250.0000	28.1	46.0	-17.9	QP
389.8400	24.3	46.0	-21.7	QP
503.4000	23.0	46.0	-23.0	QP
816.0000	40.6	46.0	-5.4	QP

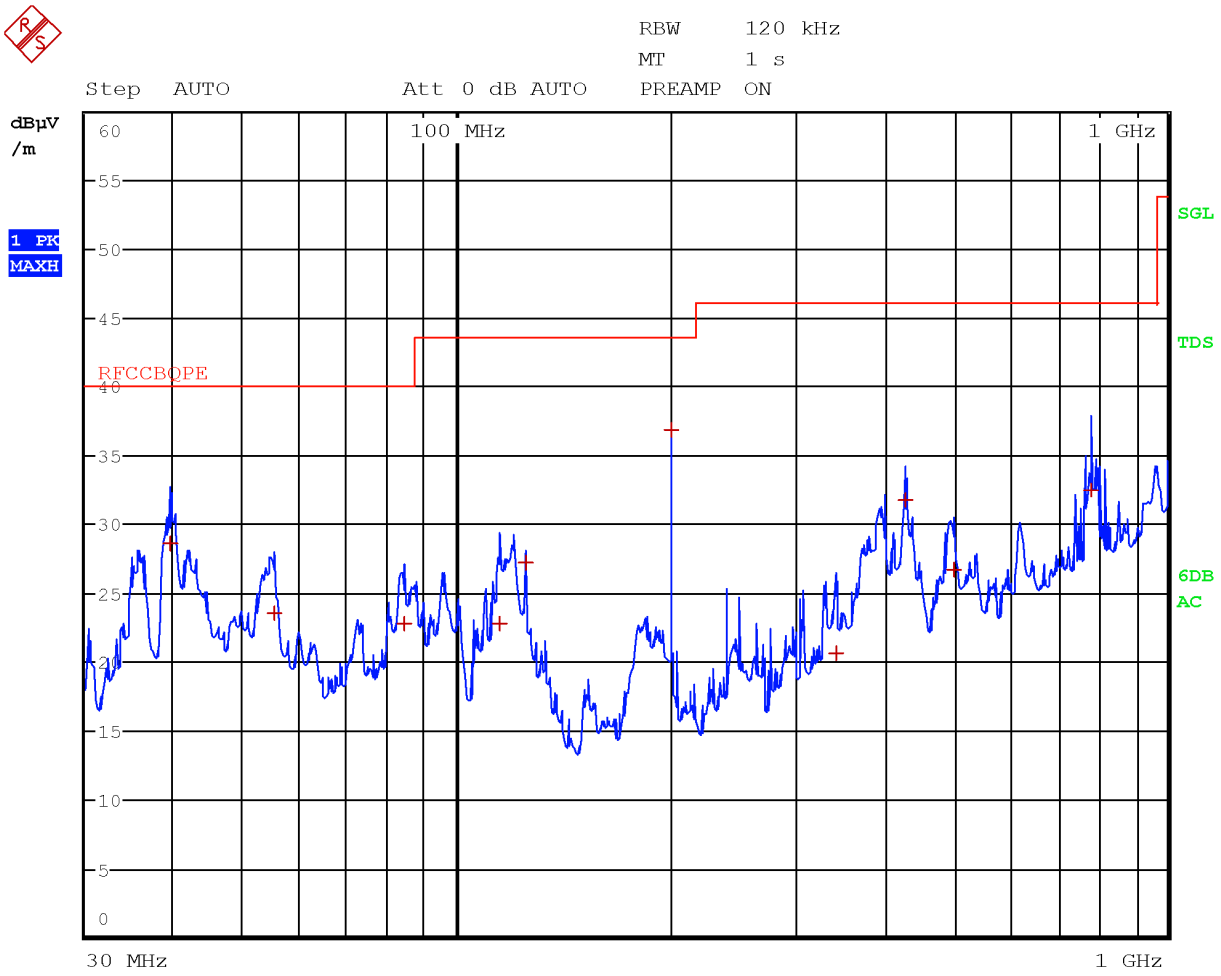


Figure 8.2-2: *Radiated spurious emissions 30 to 1000 MHz, 5200 channel with antenna in vertical polarization*

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
39.5200	28.6	40.0	-11.4	QP
55.2400	23.5	40.0	-16.5	QP
84.1200	22.8	40.0	-17.2	QP
114.5600	22.8	43.5	-20.7	QP
125.0000	27.2	43.5	-16.3	QP
200.0000	36.9	43.5	-6.6	QP
342.5200	20.6	46.0	-25.4	QP
427.8800	31.7	46.0	-14.3	QP
501.1600	26.7	46.0	-19.3	QP
780.0400	32.5	46.0	-13.5	QP

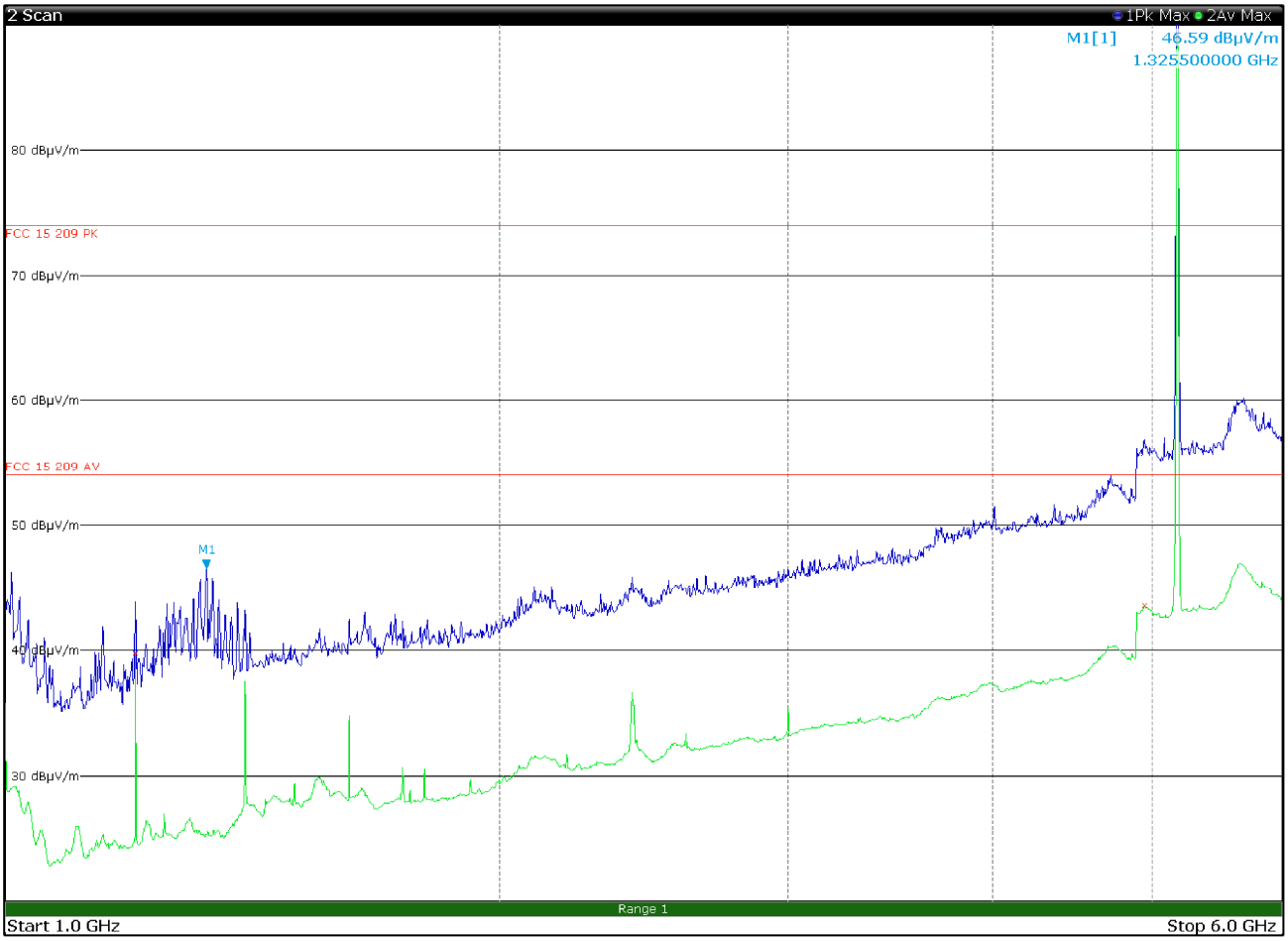


Figure 8.2-3: *Radiated spurious emissions 1 to 6 GHz, 5180 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1200.0000	39.8	54.0	-14.2	Av
4945.2500	43.6	54.0	-10.4	Av

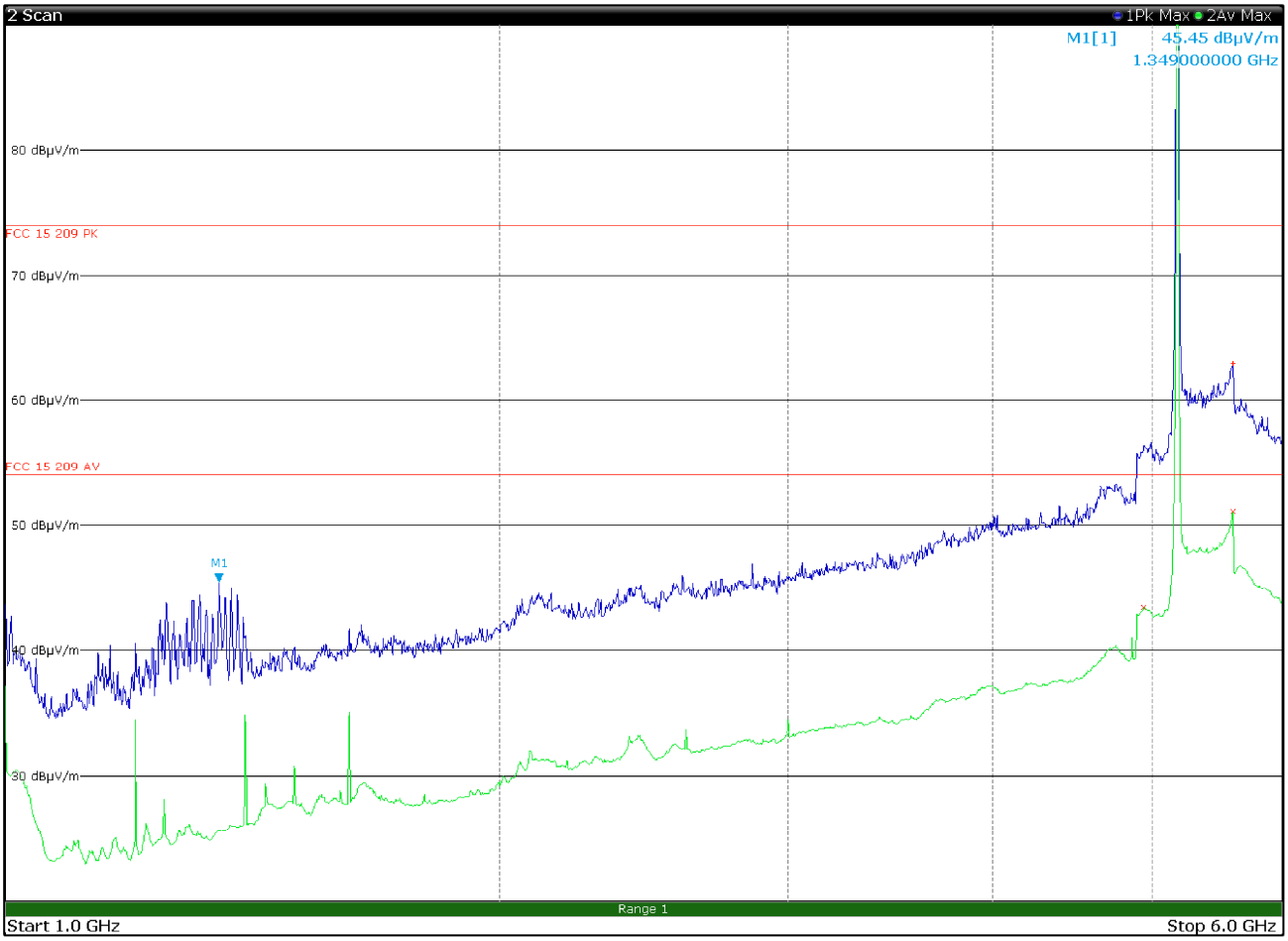


Figure 8.2-4: *Radiated spurious emissions 1 to 6 GHz, 5180 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
4943.0000	43.5	54.0	-10.5	Av
5599.0000	51.1	54.0	-2.9	Av
5601.2500	62.9	74.0	-11.1	Pk

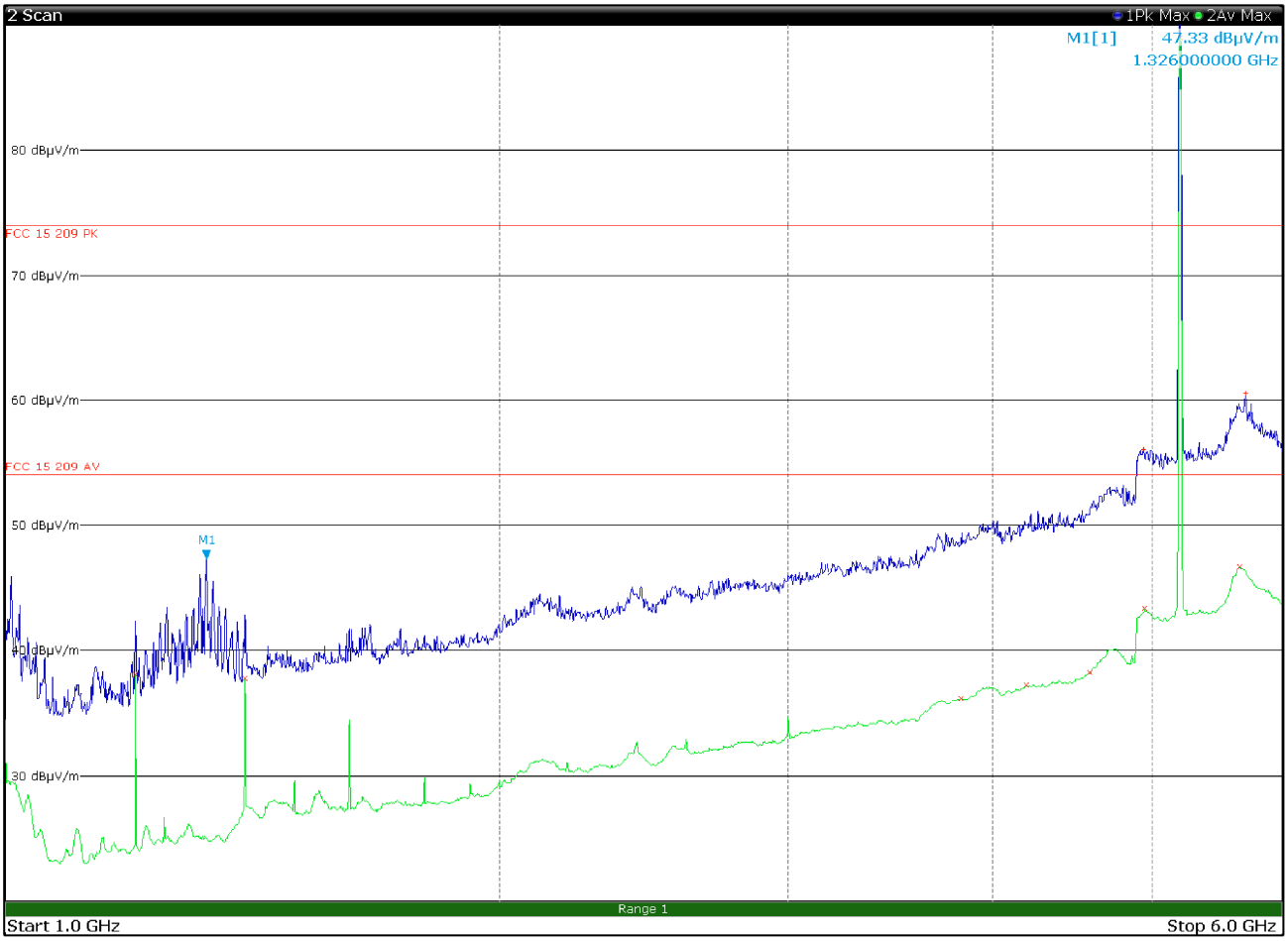


Figure 8.2-5: *Radiated spurious emissions 1 to 6 GHz, 5200 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1200.0000	38.2	54.0	-15.8	Av
1400.0000	37.9	54.0	-16.1	Av
3822.5000	36.2	54.0	-17.8	Av
4192.7500	37.3	54.0	-16.7	Av
4582.0000	38.3	54.0	-15.7	Av
4938.5000	56.1	74.0	-17.9	Pk
4948.7500	43.4	54.0	-10.6	Av
5651.2500	46.7	54.0	-7.3	Av
5701.5000	60.6	74.0	-13.4	Pk

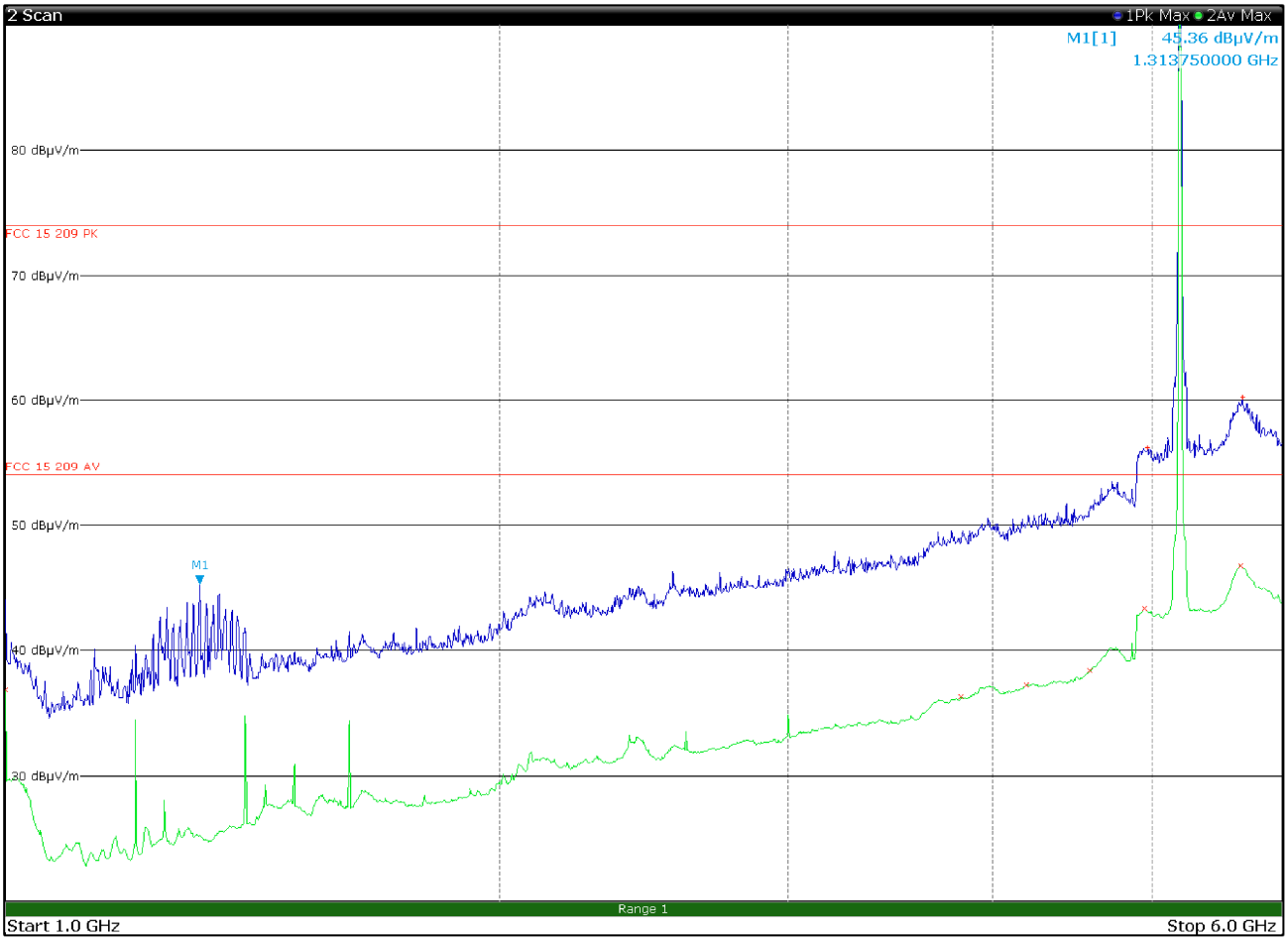


Figure 8.2-6: *Radiated spurious emissions 1 to 6 GHz, 5200 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	36.9	54.0	-17.1	Av
3823.5000	36.4	54.0	-17.6	Av
4192.5000	37.3	54.0	-16.7	Av
4580.2500	38.5	54.0	-15.5	Av
4945.5000	43.4	54.0	-10.6	Av
4970.0000	56.2	74.0	-17.8	Pk
5660.2500	46.8	54.0	-7.2	Av
5676.5000	60.3	74.0	-13.7	Pk

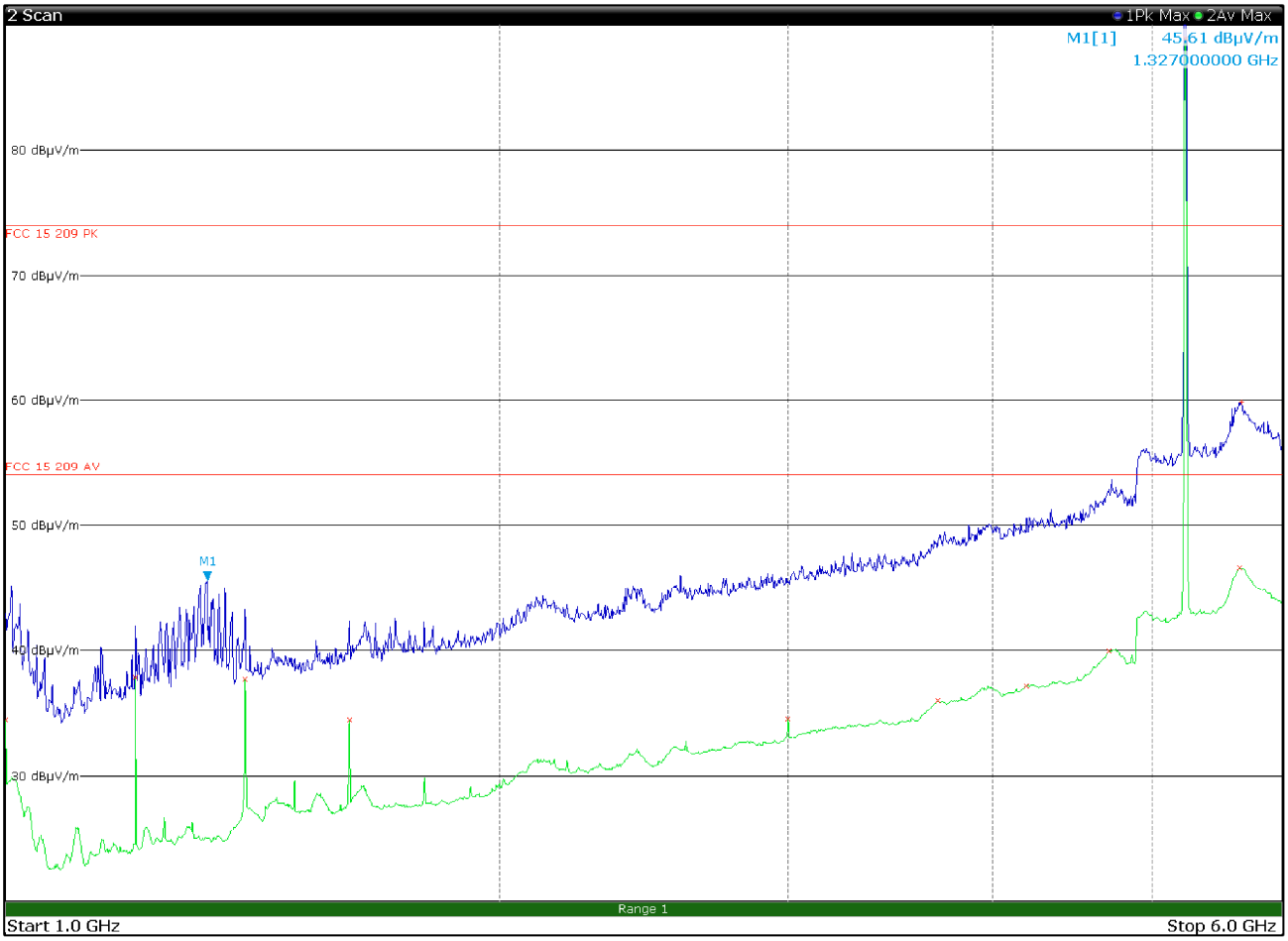


Figure 8.2-7: *Radiated spurious emissions 1 to 6 GHz, 5240 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	34.5	54.0	-19.5	Av
1200.0000	37.9	54.0	-16.1	Av
1400.0000	37.8	54.0	-16.2	Av
1620.0000	34.5	54.0	-19.5	Av
3000.2500	34.5	54.0	-19.5	Av
3701.5000	36.1	54.0	-17.9	Av
4192.0000	37.2	54.0	-16.8	Av
4703.5000	40.0	54.0	-14.0	Av
5651.5000	46.7	54.0	-7.3	Av
5667.5000	59.9	74.0	-14.1	Pk

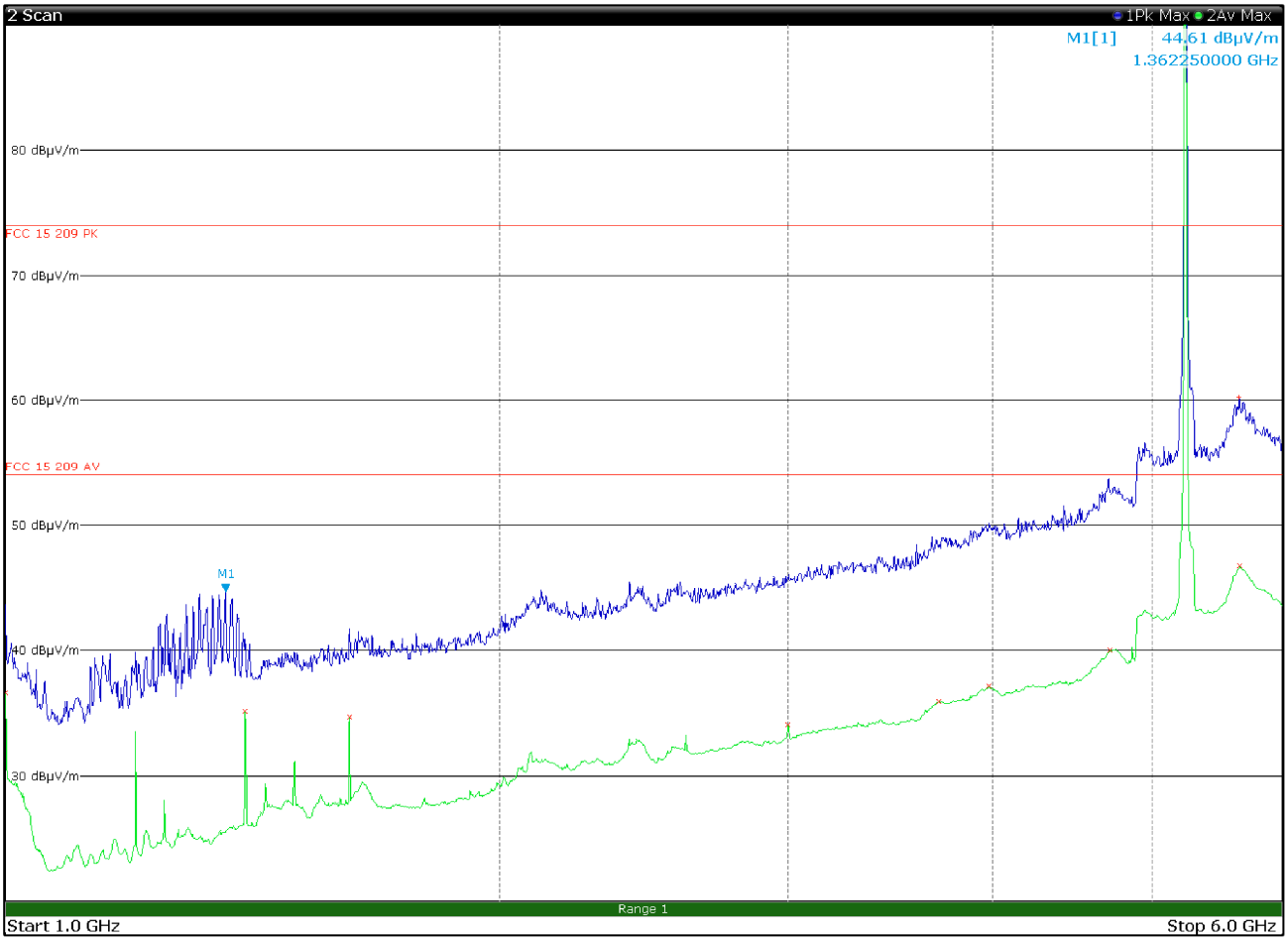


Figure 8.2-8: *Radiated spurious emissions 1 to 6 GHz, 5240 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	36.7	54.0	-17.3	Av
1400.0000	35.2	54.0	-18.8	Av
1620.0000	34.7	54.0	-19.3	Av
3000.2500	34.1	54.0	-19.9	Av
3707.5000	36.0	54.0	-18.0	Av
3976.0000	37.2	54.0	-16.8	Av
4715.2500	40.1	54.0	-13.9	Av
5648.7500	60.3	74.0	-13.7	Pk
5655.2500	46.9	54.0	-7.1	Av

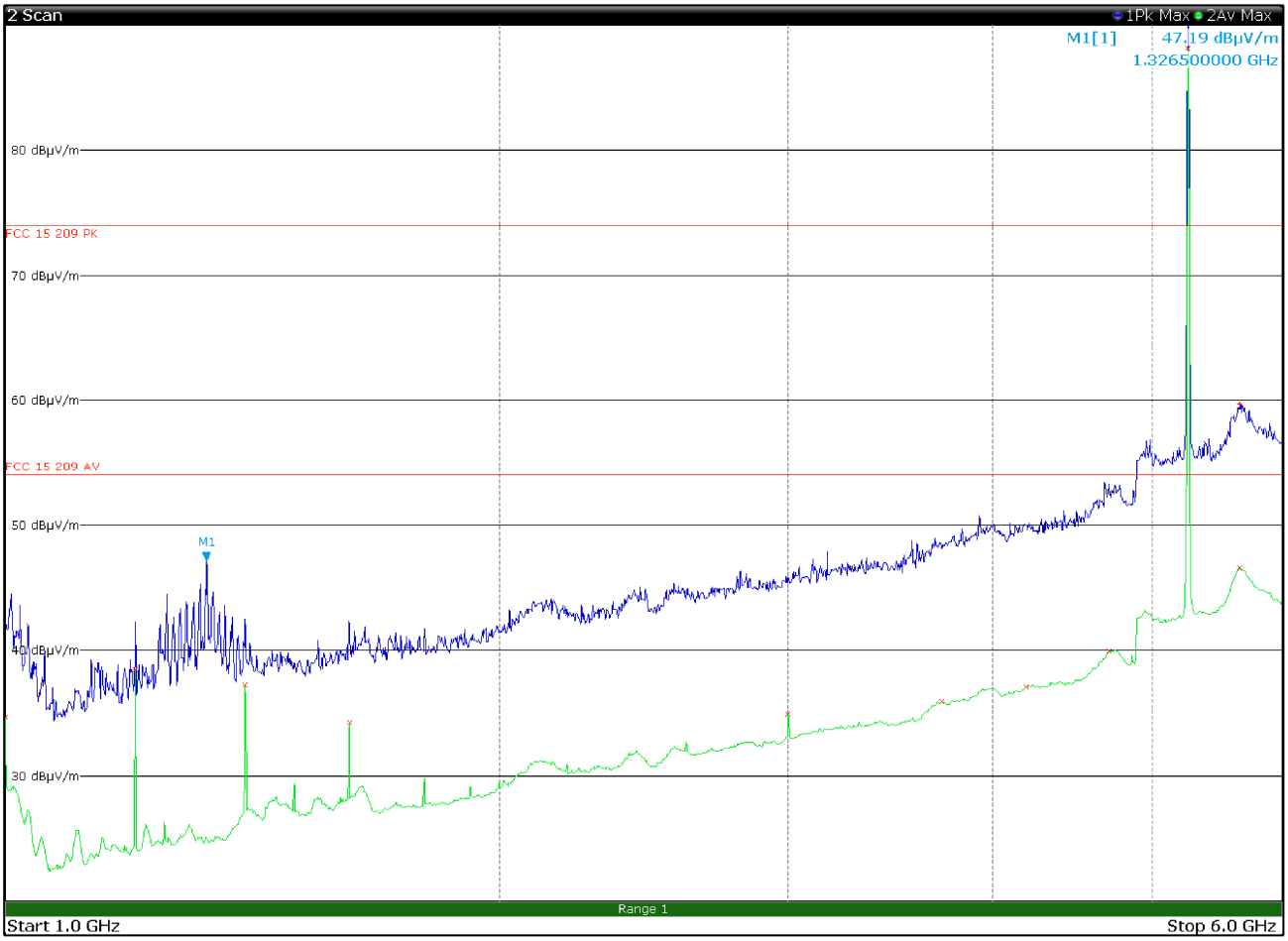


Figure 8.2-9: *Radiated spurious emissions 1 to 6 GHz, 5260 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	34.7	54.0	-19.3	Av
1200.0000	38.6	54.0	-15.4	Av
1400.0000	37.3	54.0	-16.7	Av
1620.0000	34.2	54.0	-19.8	Av
3000.2500	34.9	54.0	-19.1	Av
3719.2500	36.0	54.0	-18.0	Av
4189.7500	37.2	54.0	-16.8	Av
4706.0000	40.0	54.0	-14.0	Av
5651.0000	46.6	54.0	-7.4	Av
5656.5000	59.8	74.0	-14.2	Pk

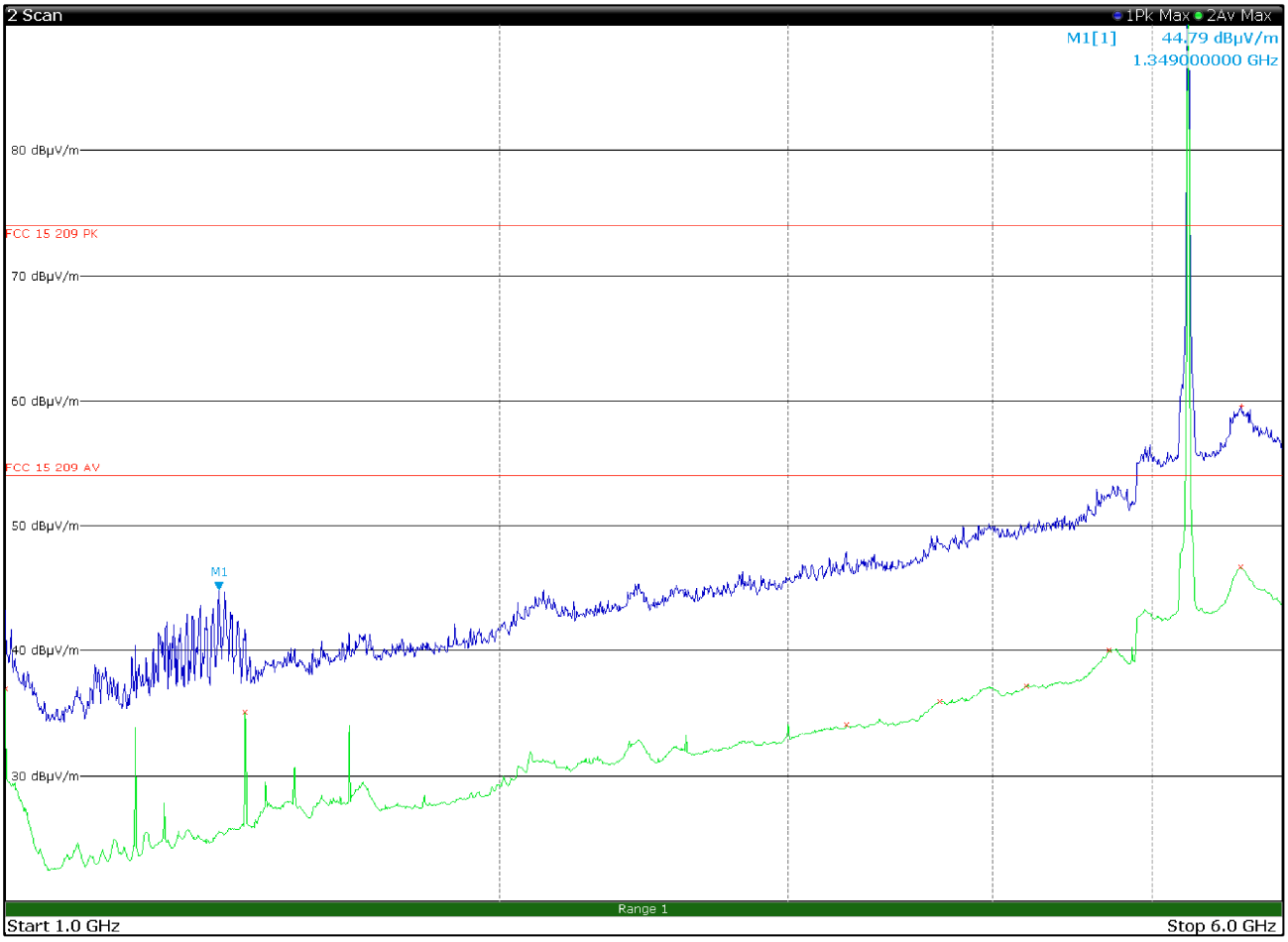


Figure 8.2-10: *Radiated spurious emissions 1 to 6 GHz, 5260 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	37.0	54.0	-17.0	Av
1400.0000	35.1	54.0	-18.9	Av
3257.5000	34.1	54.0	-19.9	Av
3710.2500	36.0	54.0	-18.0	Av
4191.5000	37.2	54.0	-16.8	Av
4707.7500	40.1	54.0	-13.9	Av
5659.2500	46.8	54.0	-7.2	Av
5667.0000	59.7	74.0	-14.3	Pk

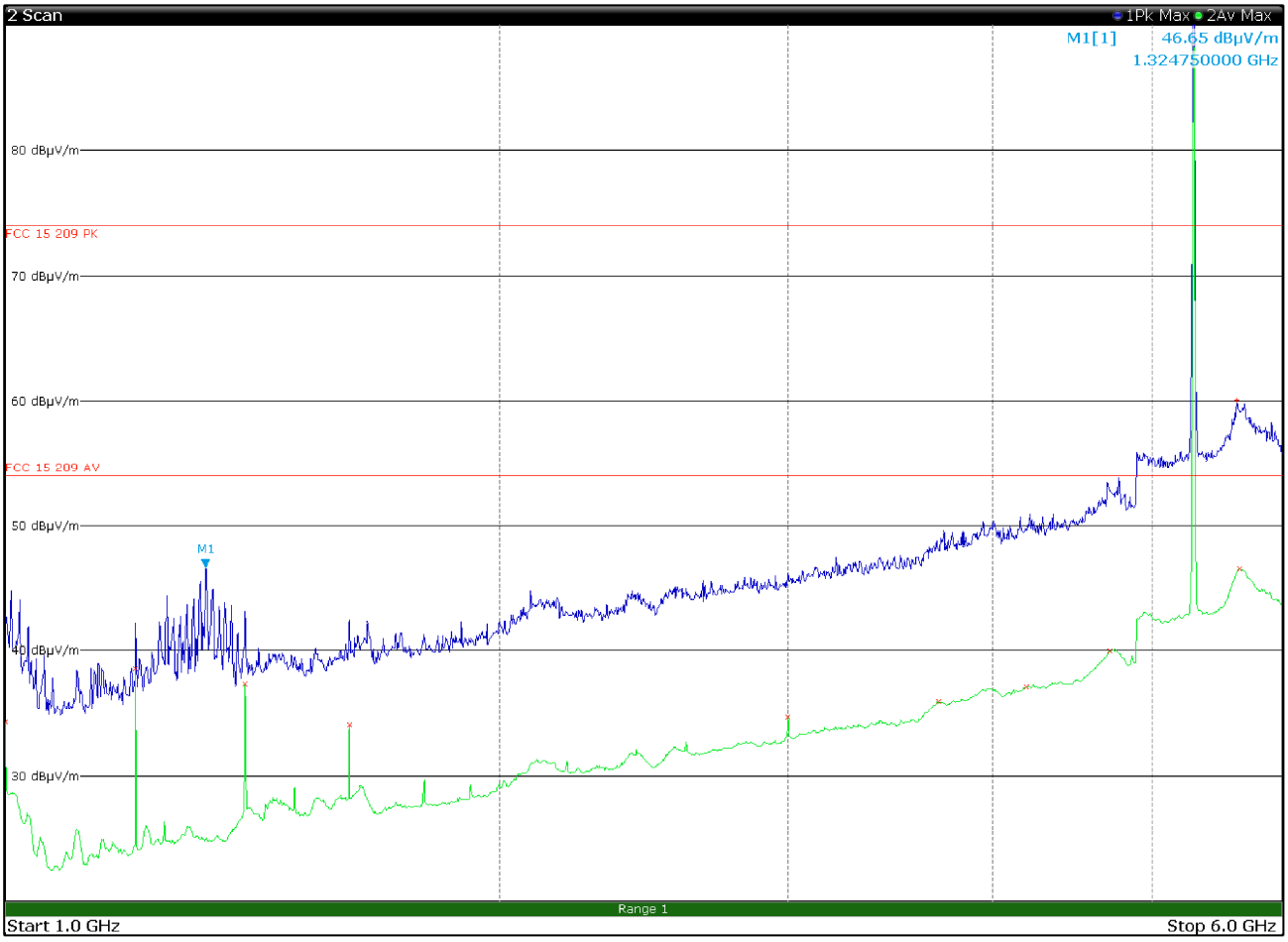


Figure 8.2-11: *Radiated spurious emissions 1 to 6 GHz, 5300 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	34.3	54.0	-19.7	Av
1200.0000	38.6	54.0	-15.4	Av
1400.0000	37.4	54.0	-16.6	Av
1620.0000	34.1	54.0	-19.9	Av
3000.2500	34.7	54.0	-19.3	Av
3707.2500	36.0	54.0	-18.0	Av
4189.2500	37.1	54.0	-16.9	Av
4714.2500	40.0	54.0	-14.0	Av
5631.2500	60.1	74.0	-13.9	Pk
5652.0000	46.6	54.0	-7.4	Av

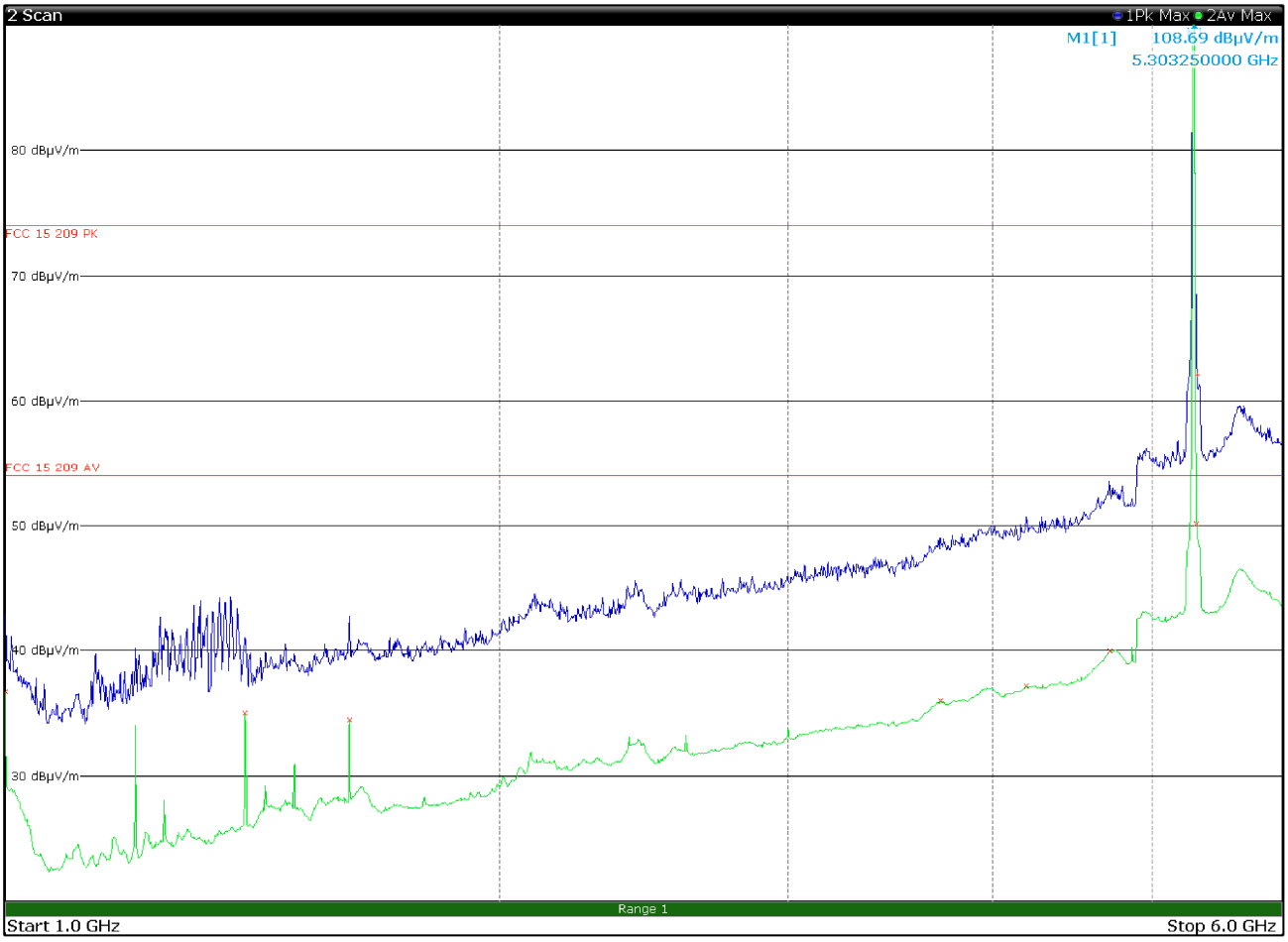


Figure 8.2-12: *Radiated spurious emissions 1 to 6 GHz, 5300 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	36.8	54.0	-17.2	Av
1400.0000	35.0	54.0	-19.0	Av
1620.0000	34.5	54.0	-19.5	Av
3717.0000	36.1	54.0	-17.9	Av
4191.5000	37.3	54.0	-16.7	Av
4713.5000	40.0	54.0	-14.0	Av

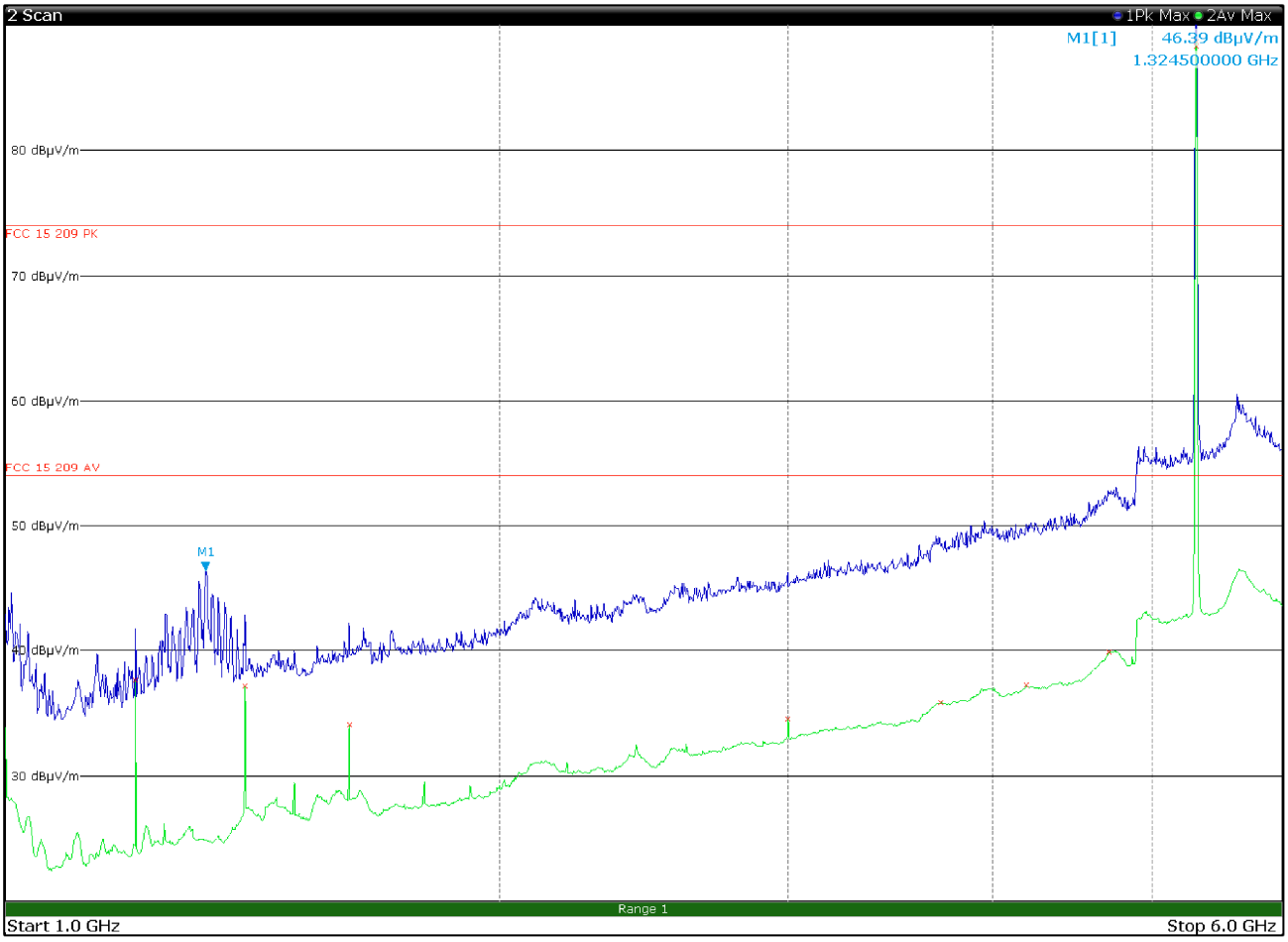


Figure 8.2-13: *Radiated spurious emissions 1 to 6 GHz, 5320 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1200.0000	37.7	54.0	-16.3	Av
1400.0000	37.2	54.0	-16.8	Av
1620.0000	34.1	54.0	-19.9	Av
3000.2500	34.6	54.0	-19.4	Av
3718.7500	35.9	54.0	-18.1	Av
4190.7500	37.3	54.0	-16.7	Av
4704.7500	40.0	54.0	-14.0	Av

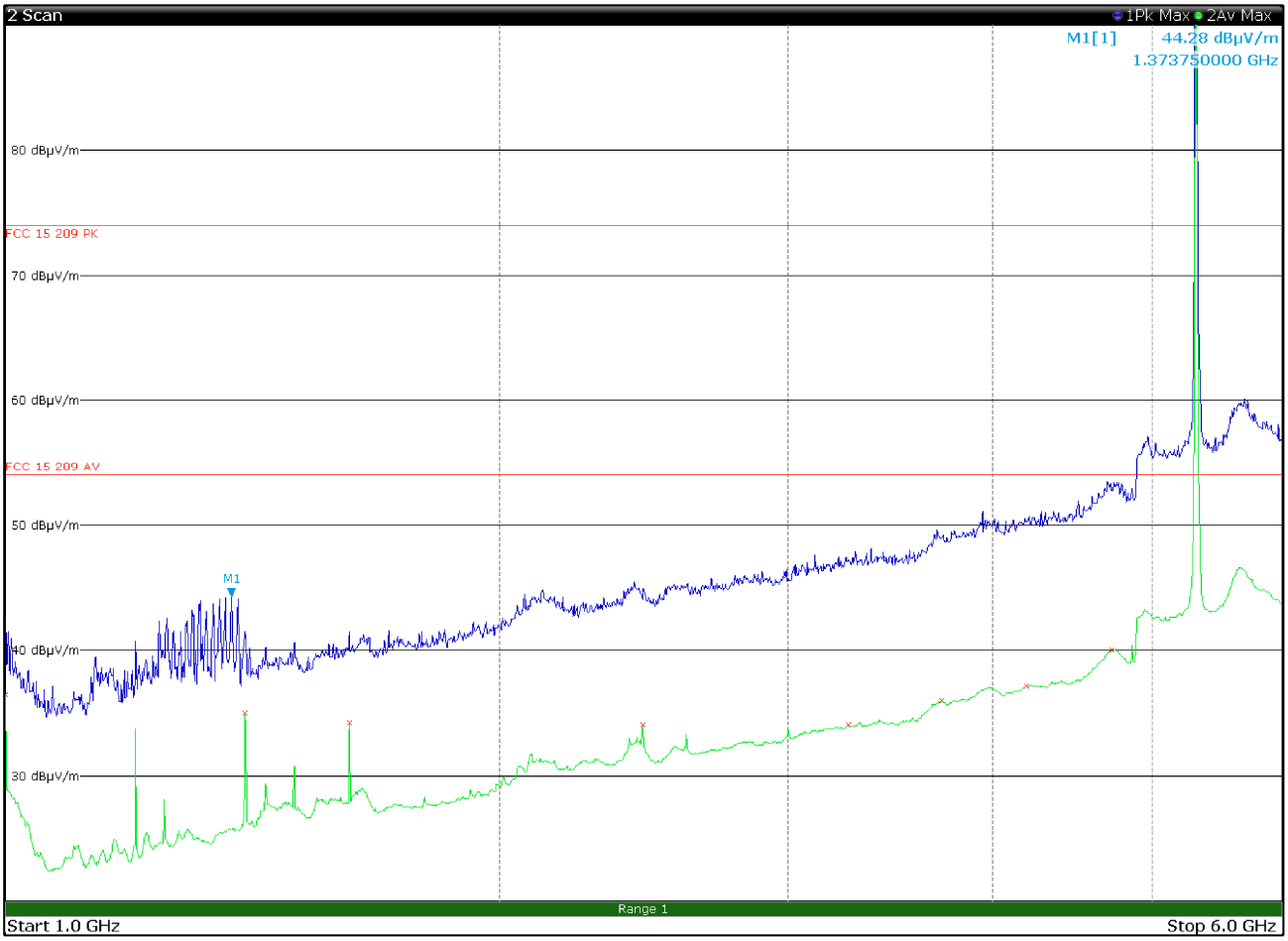


Figure 8.2-14: *Radiated spurious emissions 1 to 6 GHz, 5320 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	36.6	54.0	-17.4	Av
1400.0000	35.0	54.0	-19.0	Av
1620.0000	34.2	54.0	-19.8	Av
2445.2500	34.1	54.0	-19.9	Av
3263.2500	34.1	54.0	-19.9	Av
3720.5000	36.1	54.0	-17.9	Av
4190.5000	37.2	54.0	-16.8	Av
4723.2500	40.1	54.0	-13.9	Av

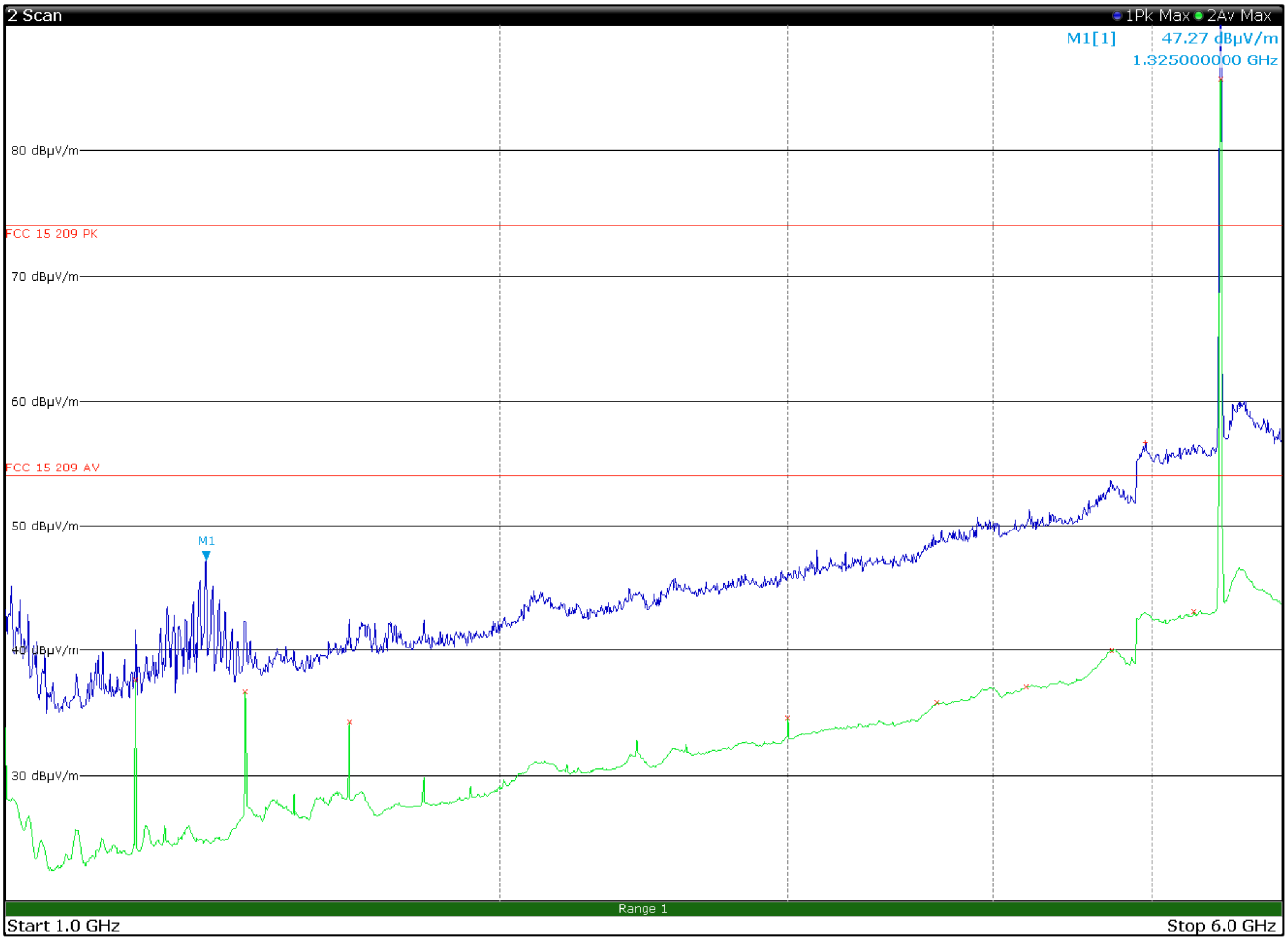


Figure 8.2-15: *Radiated spurious emissions 1 to 6 GHz, 5500 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1200.0000	37.7	54.0	-16.3	Av
1400.0000	36.8	54.0	-17.2	Av
1620.0000	34.3	54.0	-19.7	Av
3000.0000	34.6	54.0	-19.4	Av
3697.7500	35.9	54.0	-18.1	Av
4192.2500	37.2	54.0	-16.8	Av
4723.0000	40.0	54.0	-14.0	Av
4957.0000	56.8	74.0	-17.2	Pk
5298.7500	43.1	54.0	-10.9	Av

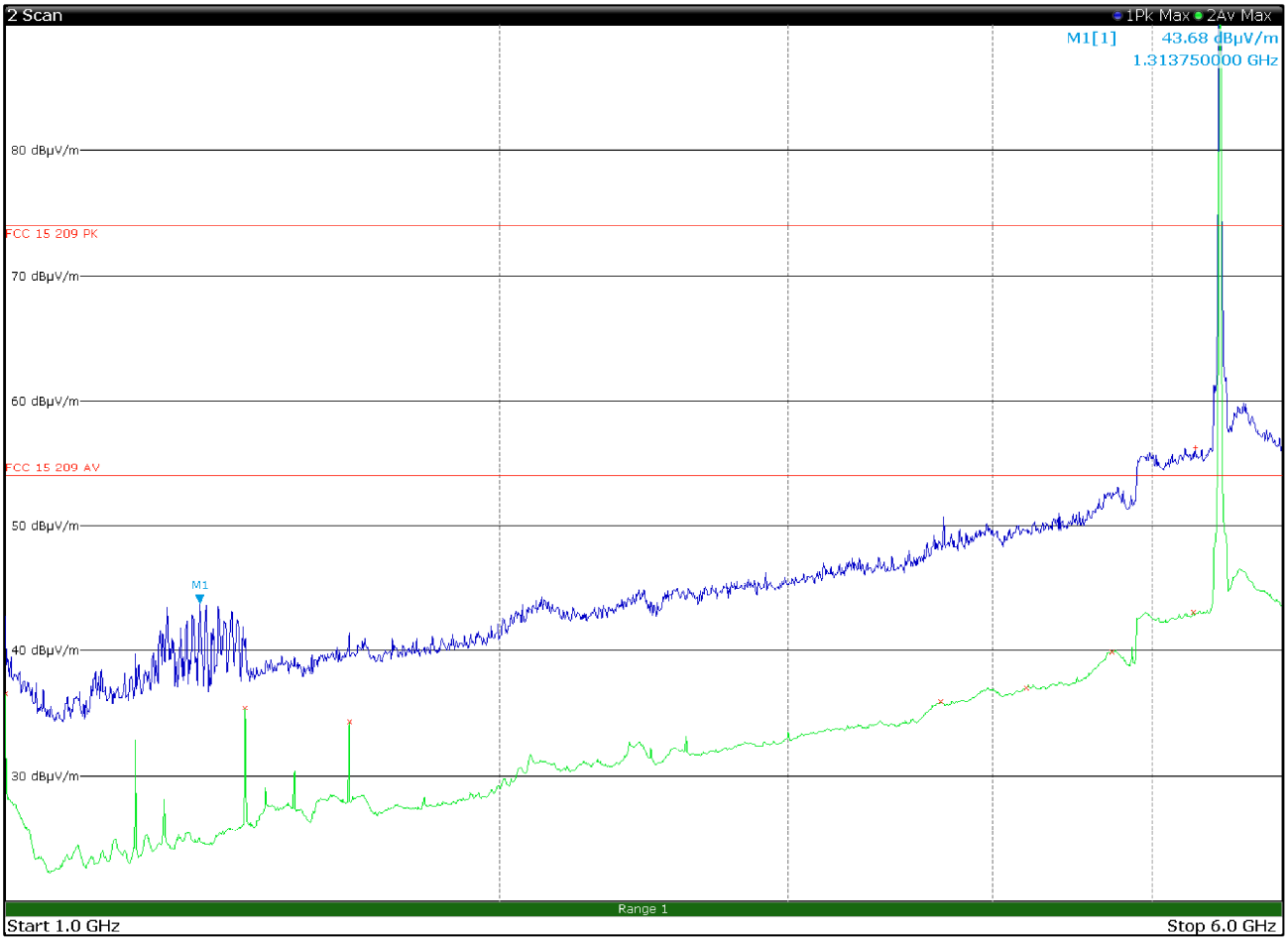


Figure 8.2-16: *Radiated spurious emissions 1 to 6 GHz, 5500 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	36.6	54.0	-17.4	Av
1400.0000	35.5	54.0	-18.5	Av
1620.0000	34.3	54.0	-19.7	Av
3718.0000	36.0	54.0	-18.0	Av
4191.2500	37.1	54.0	-16.9	Av
4723.0000	40.0	54.0	-14.0	Av
5299.0000	43.1	54.0	-10.9	Av
5314.0000	56.3	74.0	-17.7	Pk

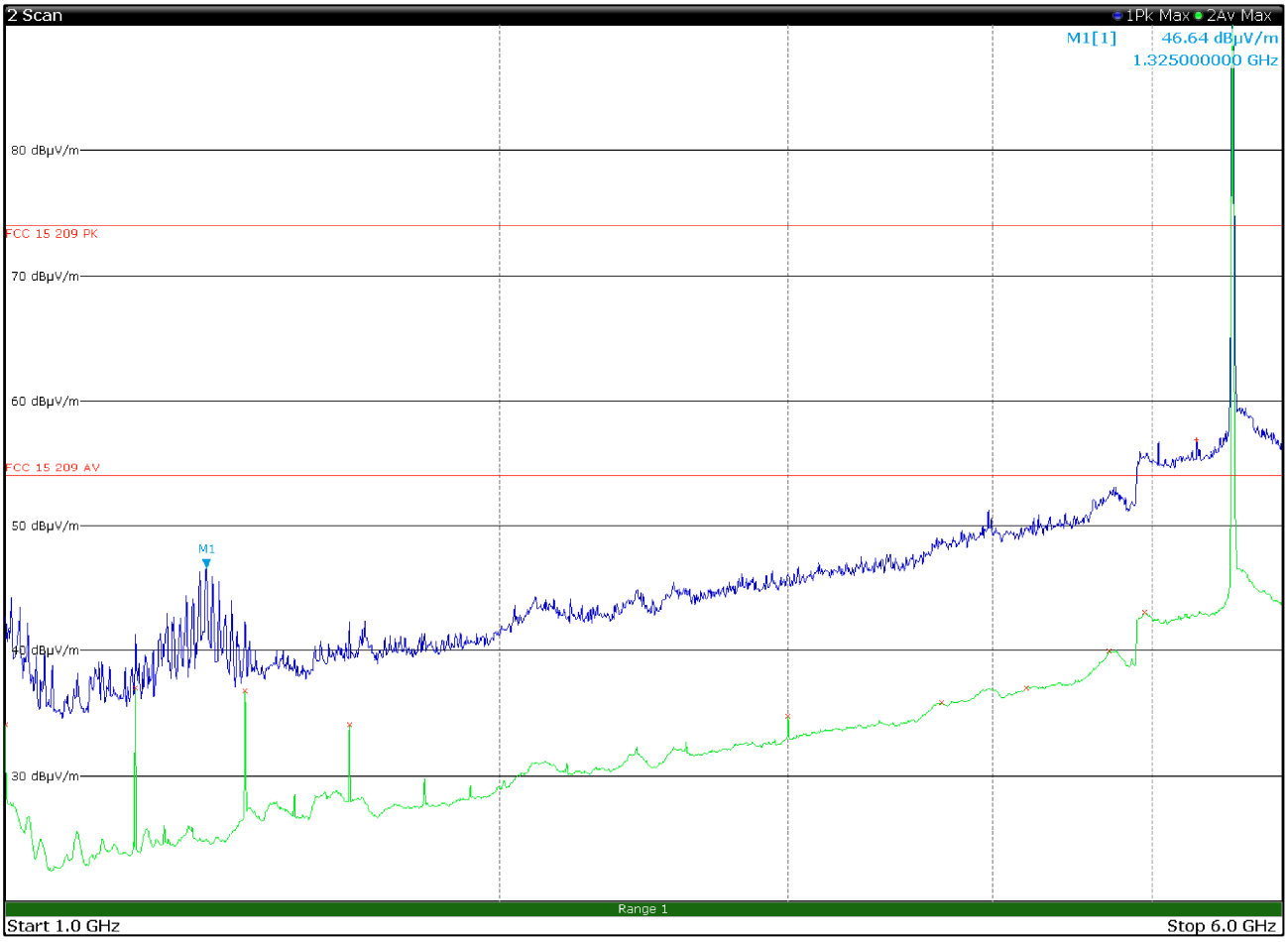


Figure 8.2-17: *Radiated spurious emissions 1 to 6 GHz, 5600 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	34.1	54.0	-19.9	Av
1200.0000	37.1	54.0	-16.9	Av
1400.0000	36.9	54.0	-17.1	Av
1620.0000	34.1	54.0	-19.9	Av
3000.2500	34.8	54.0	-19.2	Av
3720.5000	35.9	54.0	-18.1	Av
4189.0000	37.1	54.0	-16.9	Av
4709.0000	40.0	54.0	-14.0	Av
4945.0000	43.1	54.0	-10.9	Av
5323.0000	56.9	74.0	-17.1	Pk

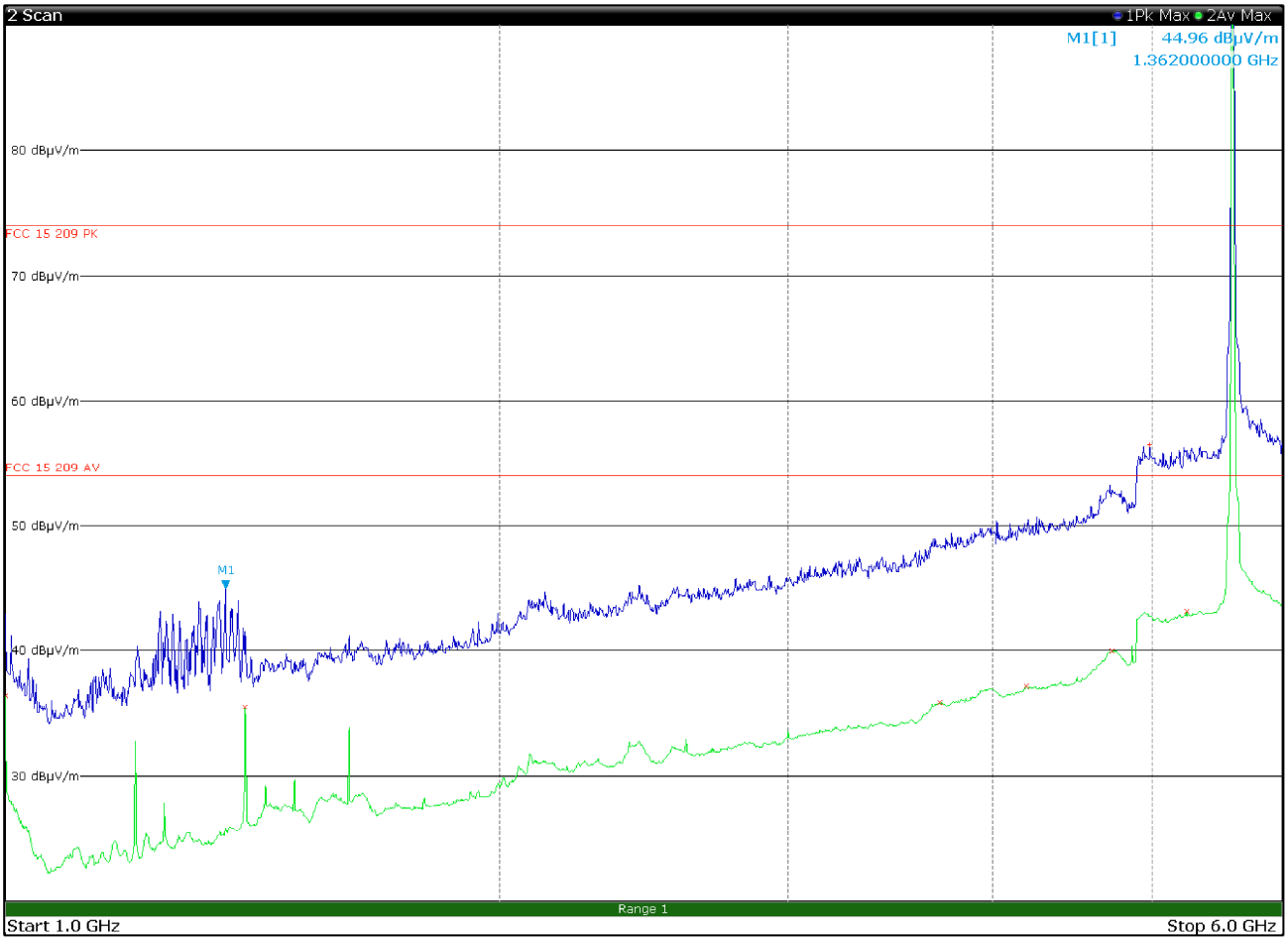


Figure 8.2-18: *Radiated spurious emissions 1 to 6 GHz, 5600 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	36.5	54.0	-17.5	Av
1400.0000	35.6	54.0	-18.4	Av
3709.2500	35.9	54.0	-18.1	Av
4190.5000	37.2	54.0	-16.8	Av
4723.0000	40.0	54.0	-14.0	Av
4981.5000	56.6	74.0	-17.4	Pk
5248.0000	43.1	54.0	-10.9	Av

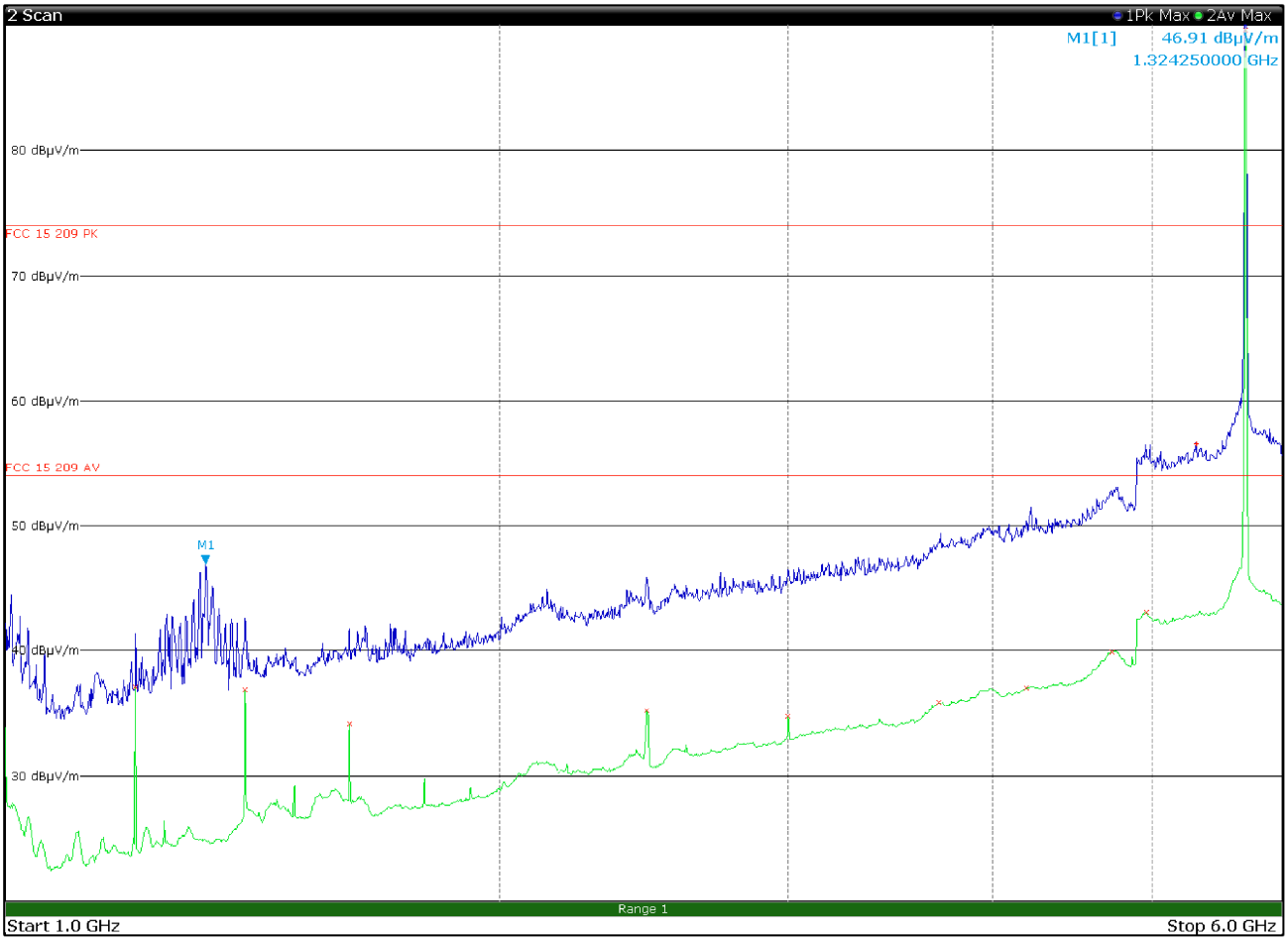


Figure 8.2-19: *Radiated spurious emissions 1 to 6 GHz, 5700 channel with antenna in horizontal polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1200.0000	37.1	54.0	-16.9	Av
1400.0000	36.9	54.0	-17.1	Av
1620.0000	34.2	54.0	-19.8	Av
2459.2500	35.3	54.0	-18.7	Av
3000.2500	34.8	54.0	-19.2	Av
3705.0000	35.9	54.0	-18.1	Av
4191.0000	37.1	54.0	-16.9	Av
4724.0000	40.0	54.0	-14.0	Av
4960.7500	43.1	54.0	-10.9	Av
5317.7500	56.6	74.0	-17.4	Pk

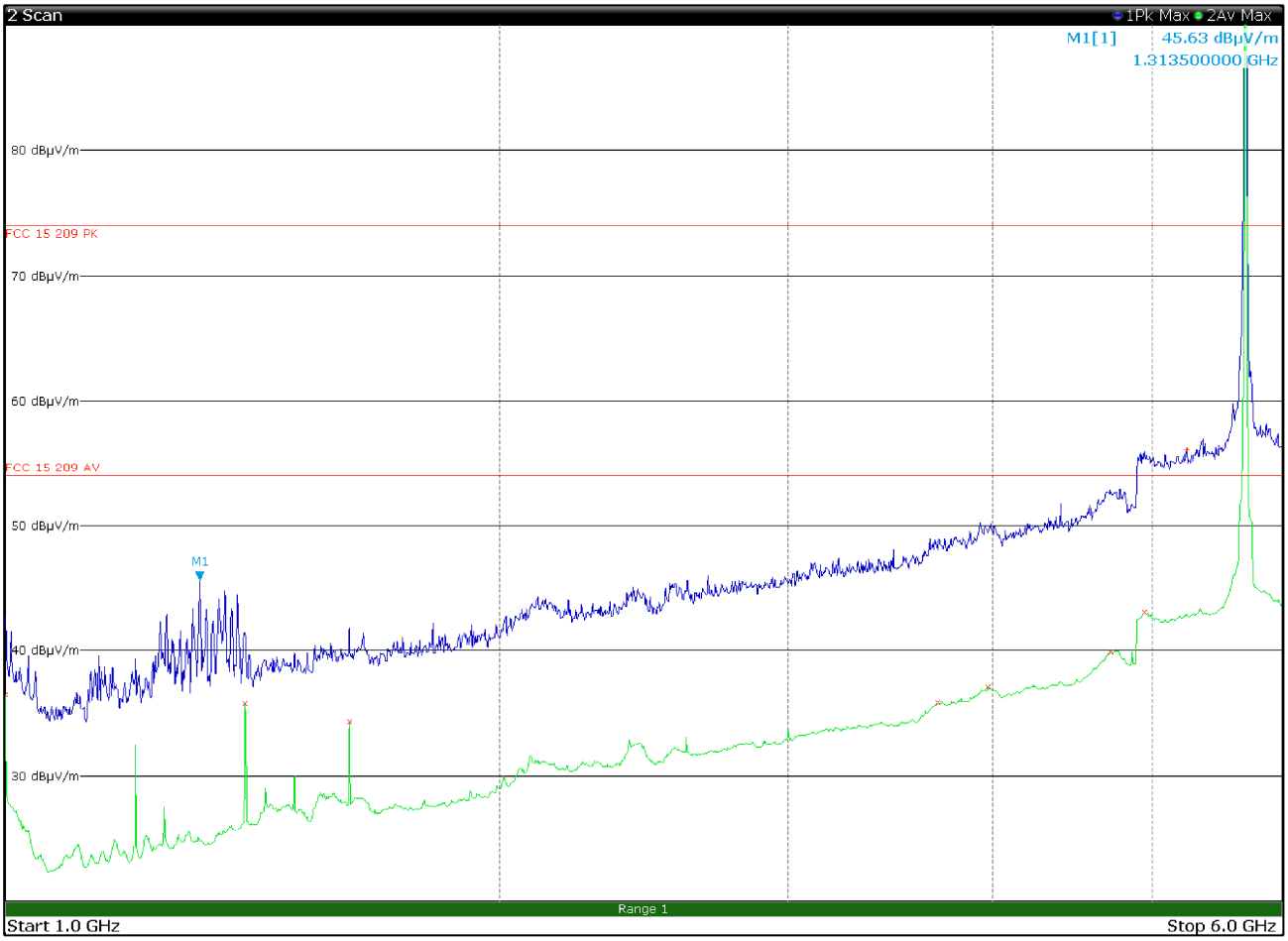


Figure 8.2-20: *Radiated spurious emissions 1 to 6 GHz, 5700 channel with antenna in vertical polarization*

Limit exceeded by the carrier

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1000.0000	36.5	54.0	-17.5	Av
1400.0000	35.9	54.0	-18.1	Av
1620.0000	34.3	54.0	-19.7	Av
3703.0000	35.9	54.0	-18.1	Av
3973.0000	37.1	54.0	-16.9	Av
4716.7500	39.9	54.0	-14.1	Av
4944.7500	43.1	54.0	-10.9	Av
5248.5000	56.2	74.0	-17.8	Pk

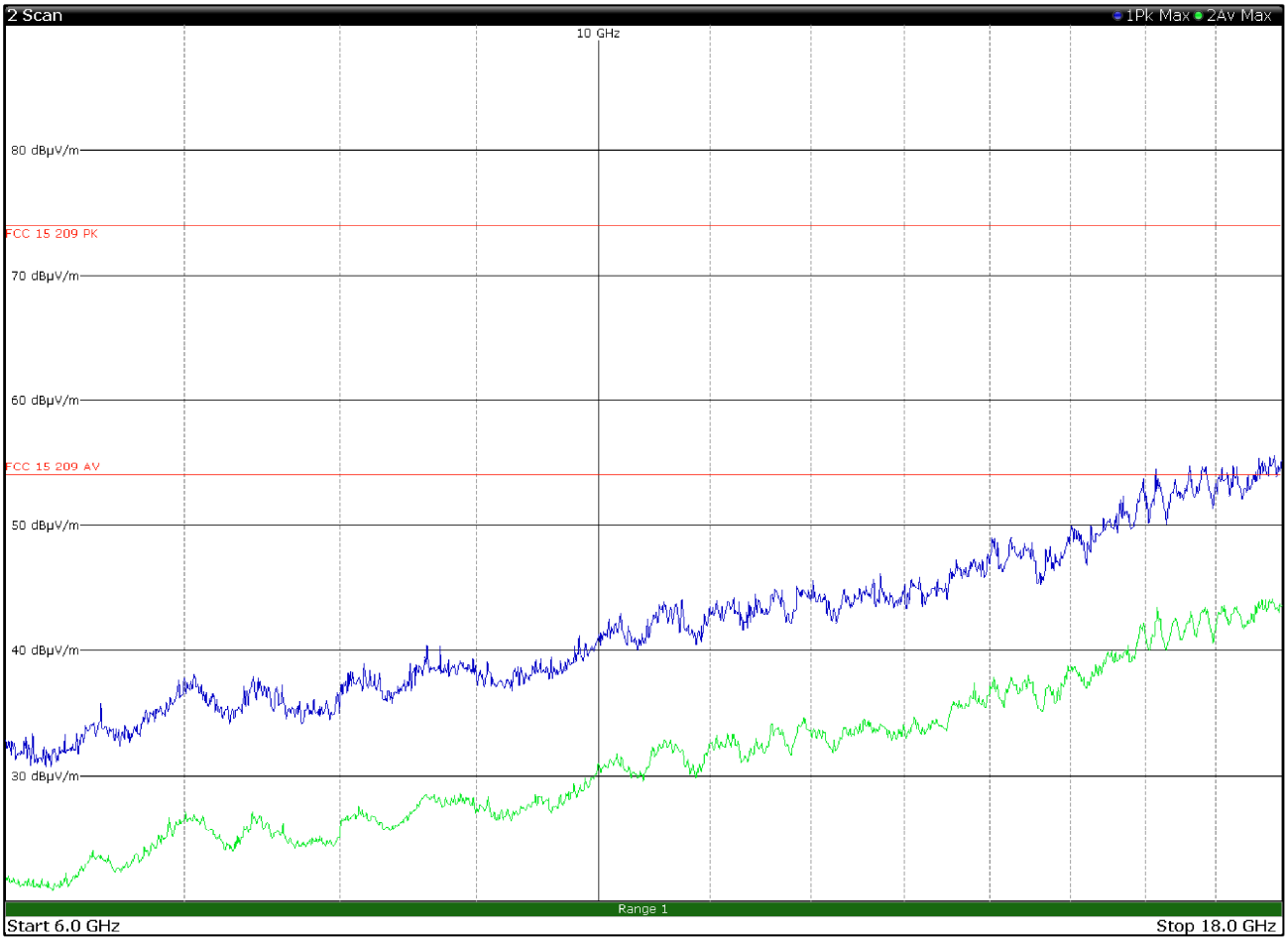


Figure 8.2-21: *Radiated spurious emissions 6 to 18 GHz, 5180 channel with antenna in horizontal polarization*

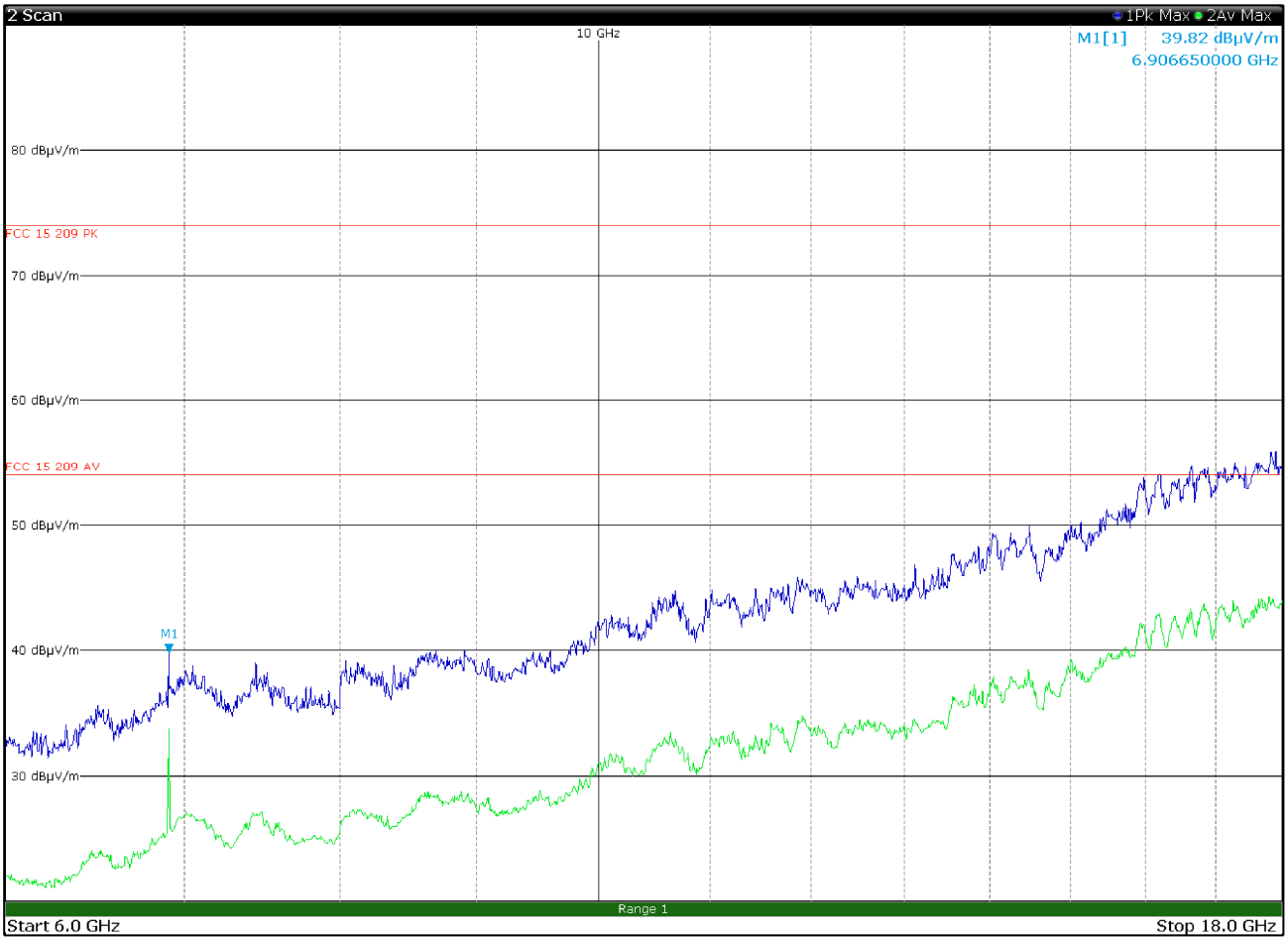


Figure 8.2-22: *Radiated spurious emissions 6 to 18 GHz, 5180 channel with antenna in vertical polarization*

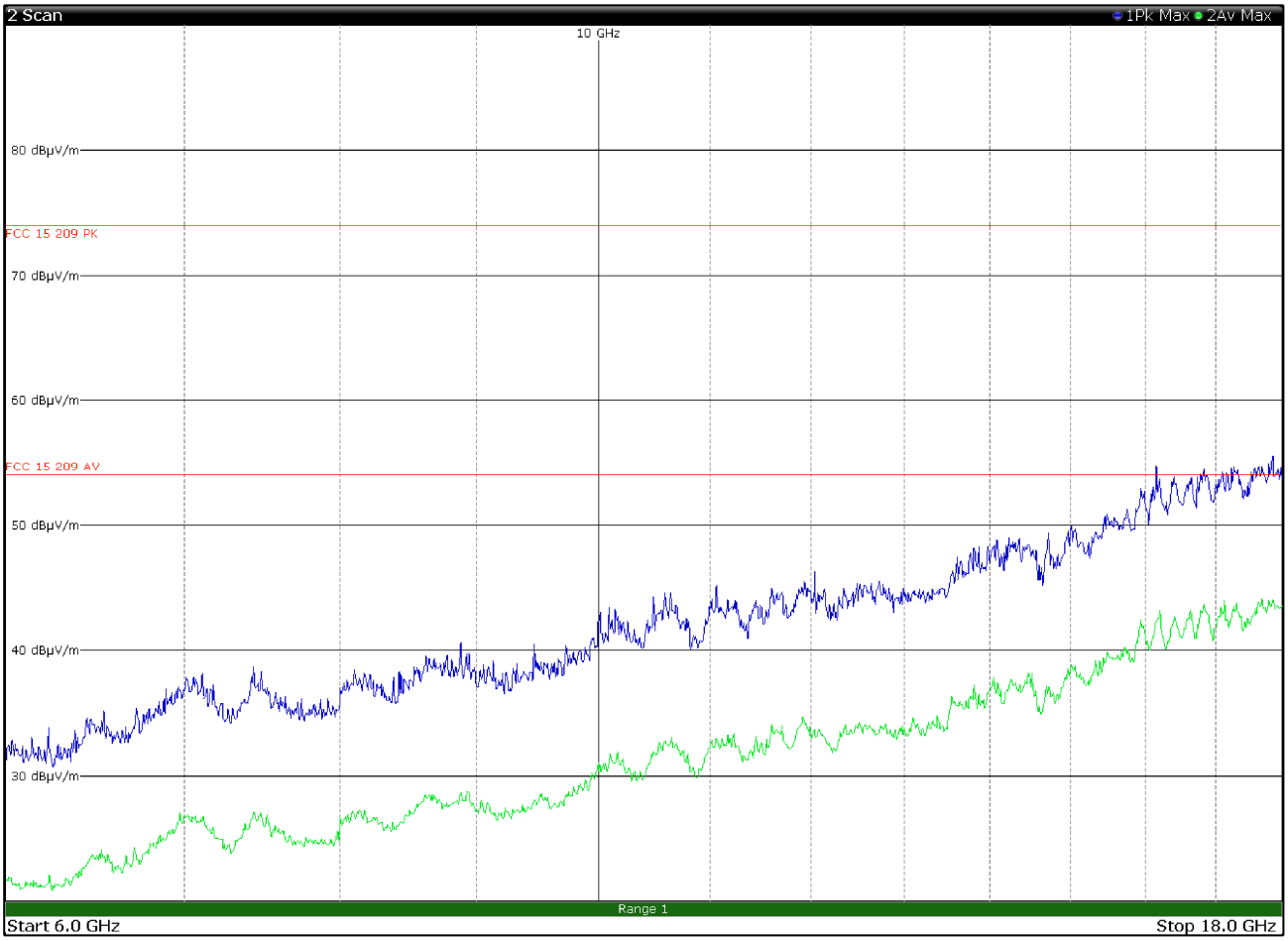


Figure 8.2-23: *Radiated spurious emissions 6 to 18 GHz, 5200 channel with antenna in horizontal polarization*

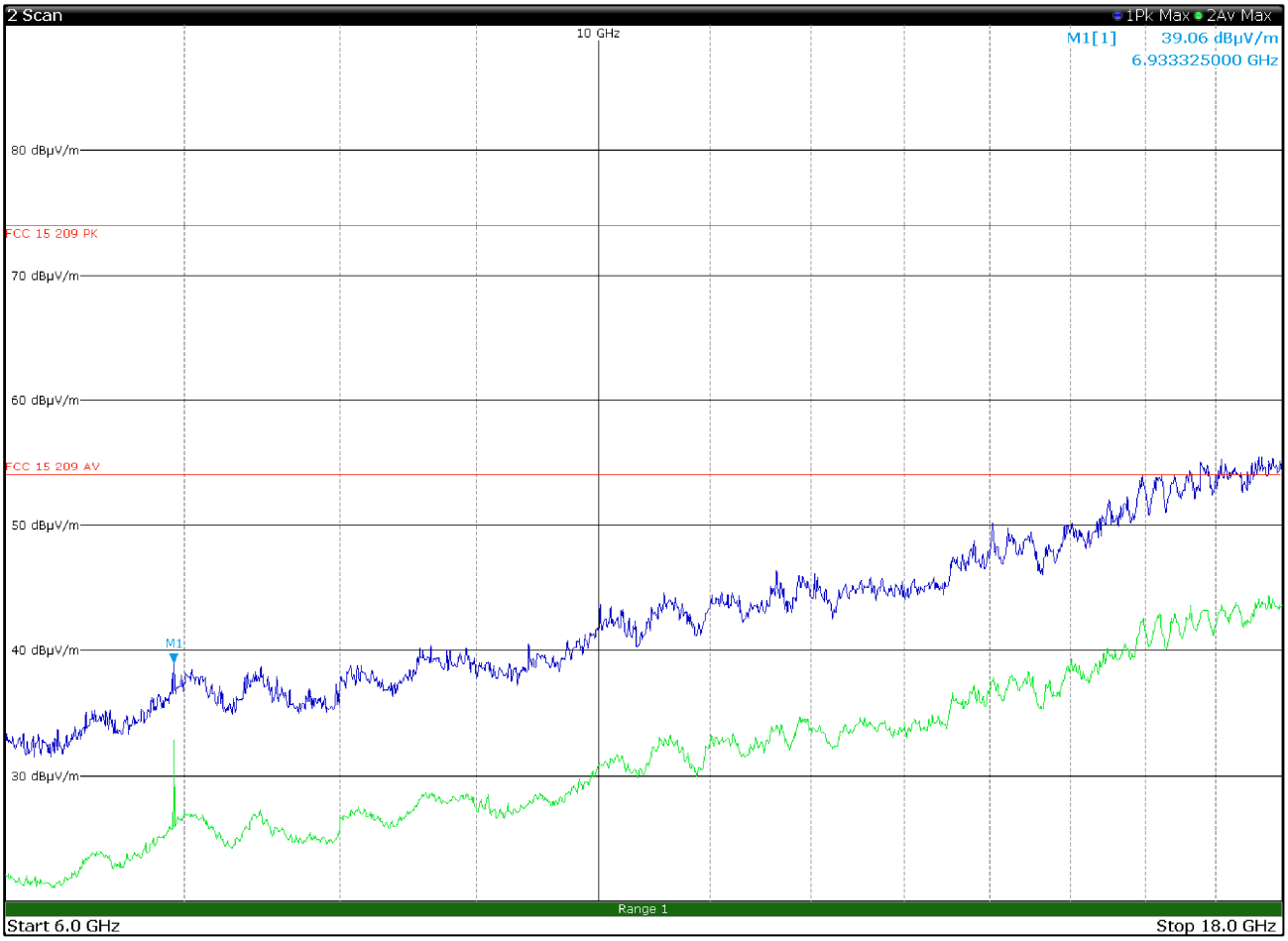


Figure 8.2-24: *Radiated spurious emissions 6 to 18 GHz, 5200 channel with antenna in vertical polarization*

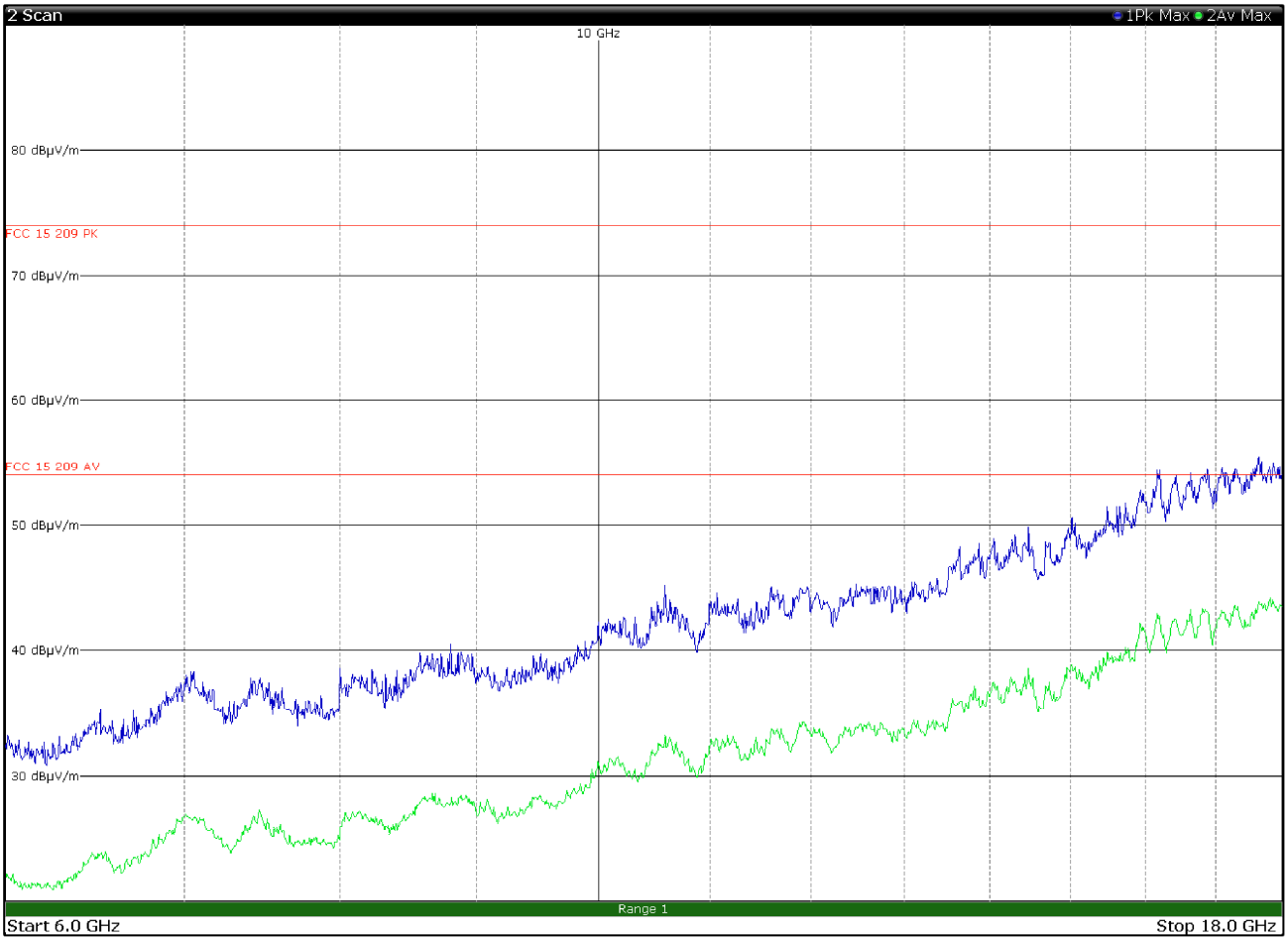


Figure 8.2-25: *Radiated spurious emissions 6 to 18 GHz, 5240 channel with antenna in horizontal polarization*

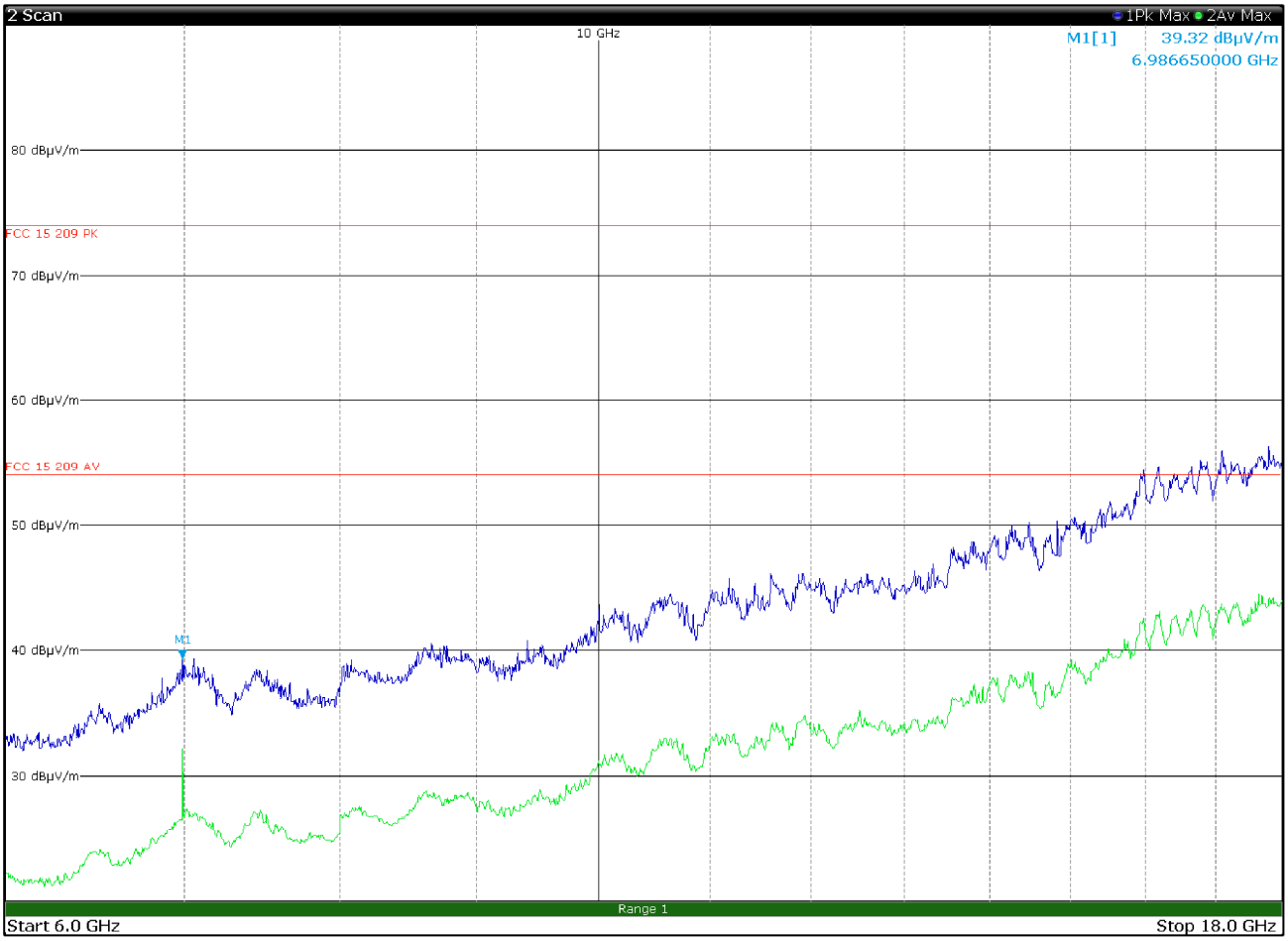


Figure 8.2-26: *Radiated spurious emissions 6 to 18 GHz, 5240 channel with antenna in vertical polarization*

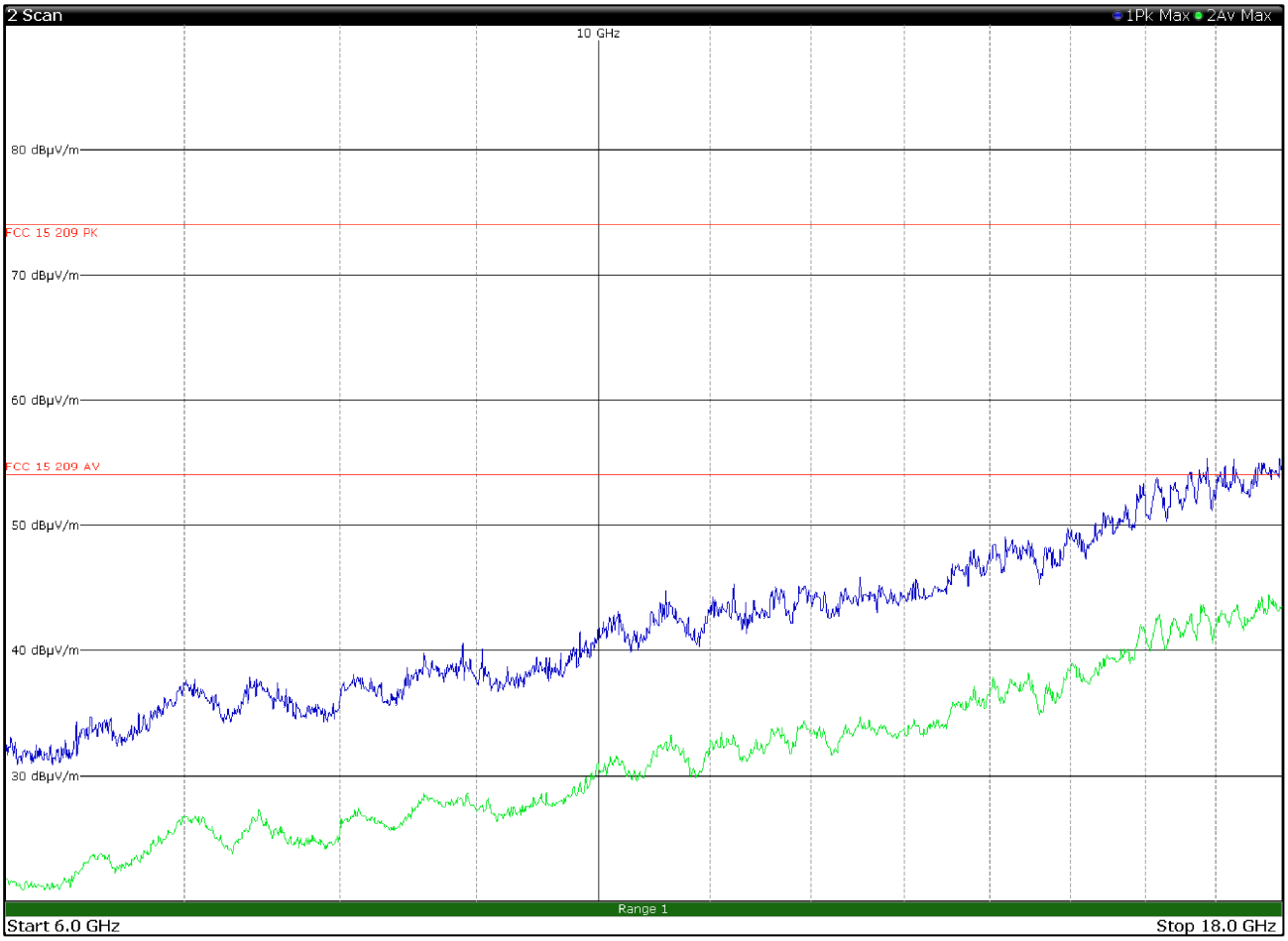


Figure 8.2-27: *Radiated spurious emissions 6 to 18 GHz, 5260 channel with antenna in horizontal polarization*

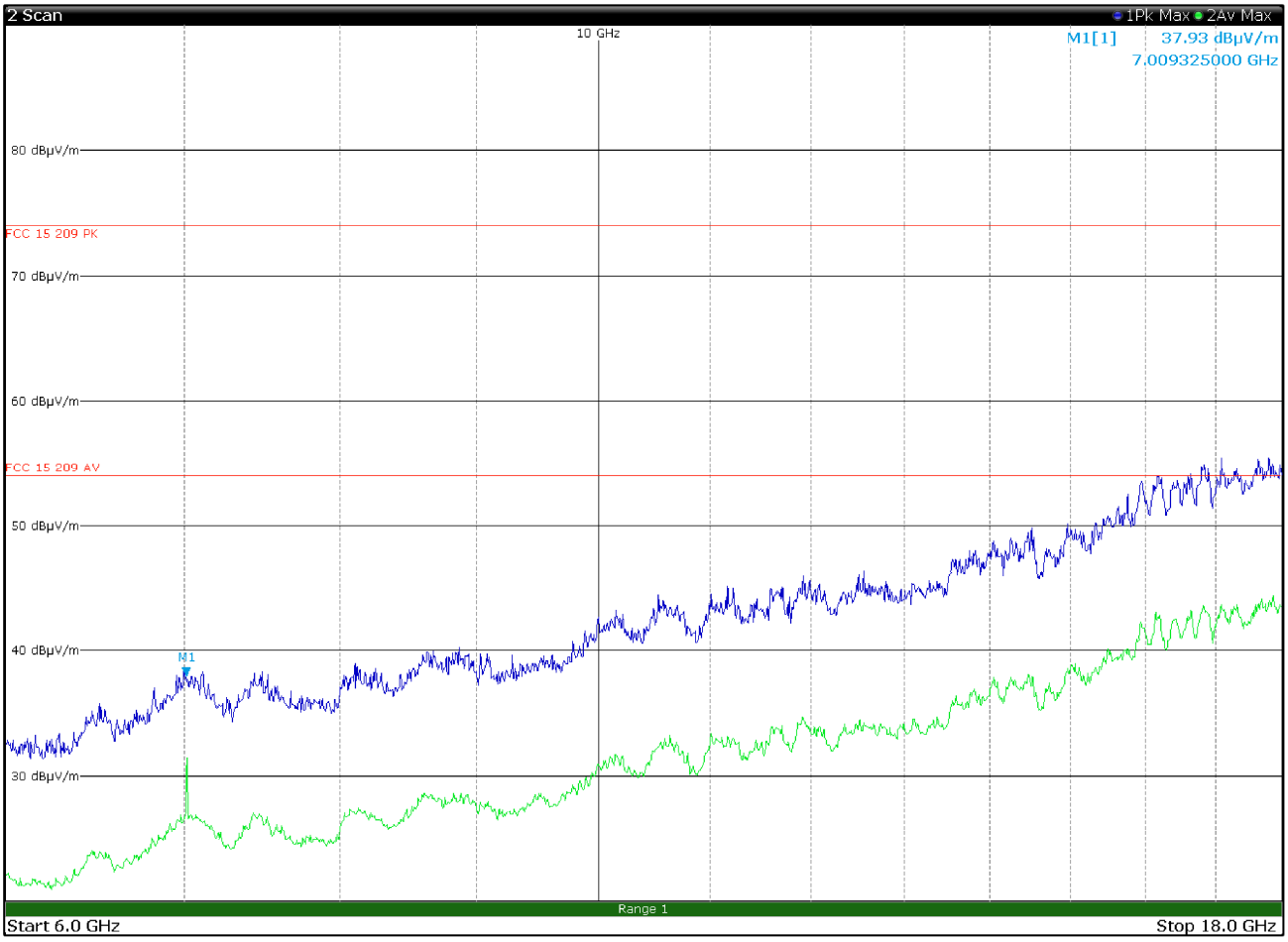


Figure 8.2-28: *Radiated spurious emissions 6 to 18 GHz, 5260 channel with antenna in vertical polarization*

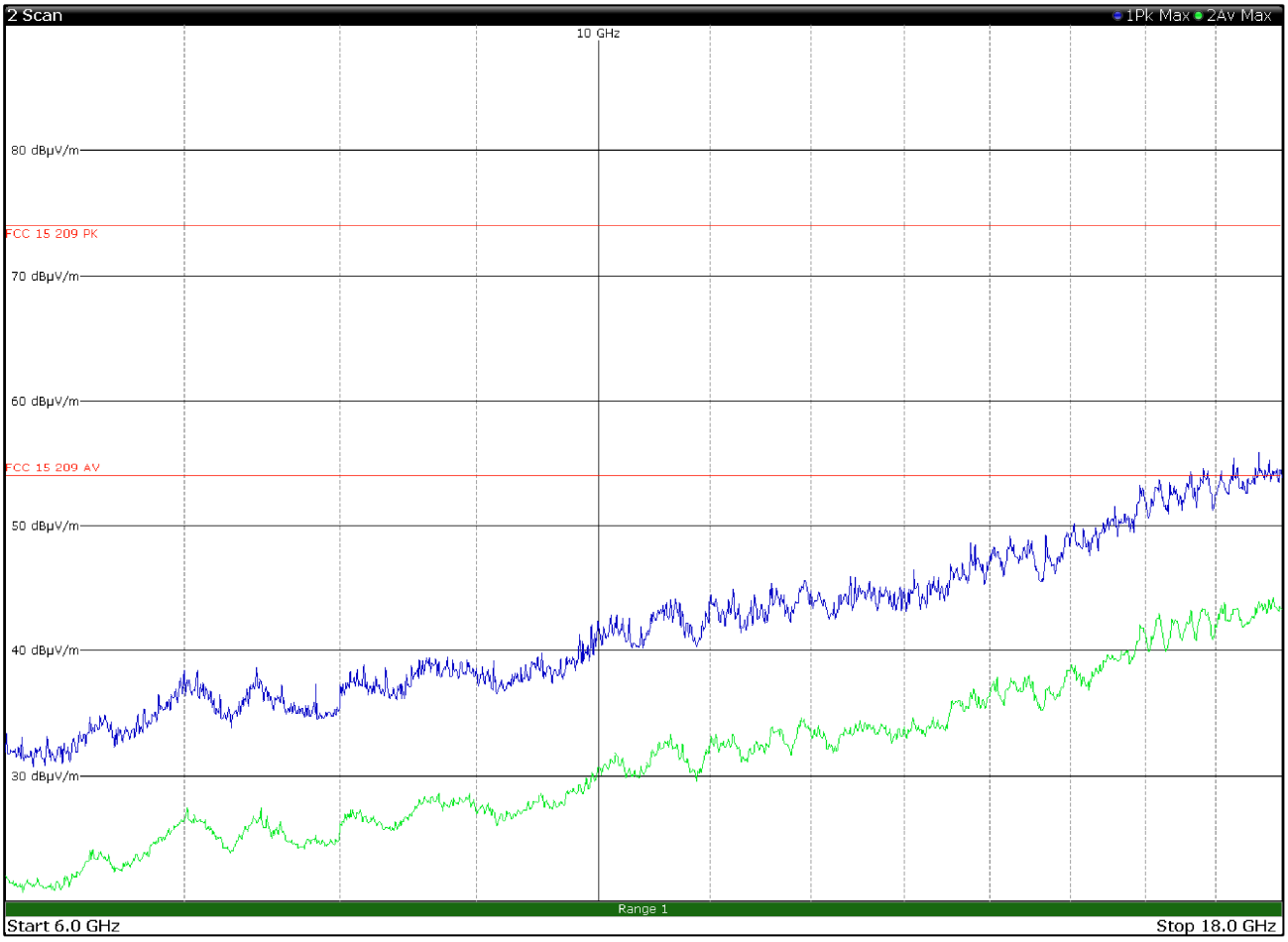


Figure 8.2-29: *Radiated spurious emissions 6 to 18 GHz, 5300 channel with antenna in horizontal polarization*

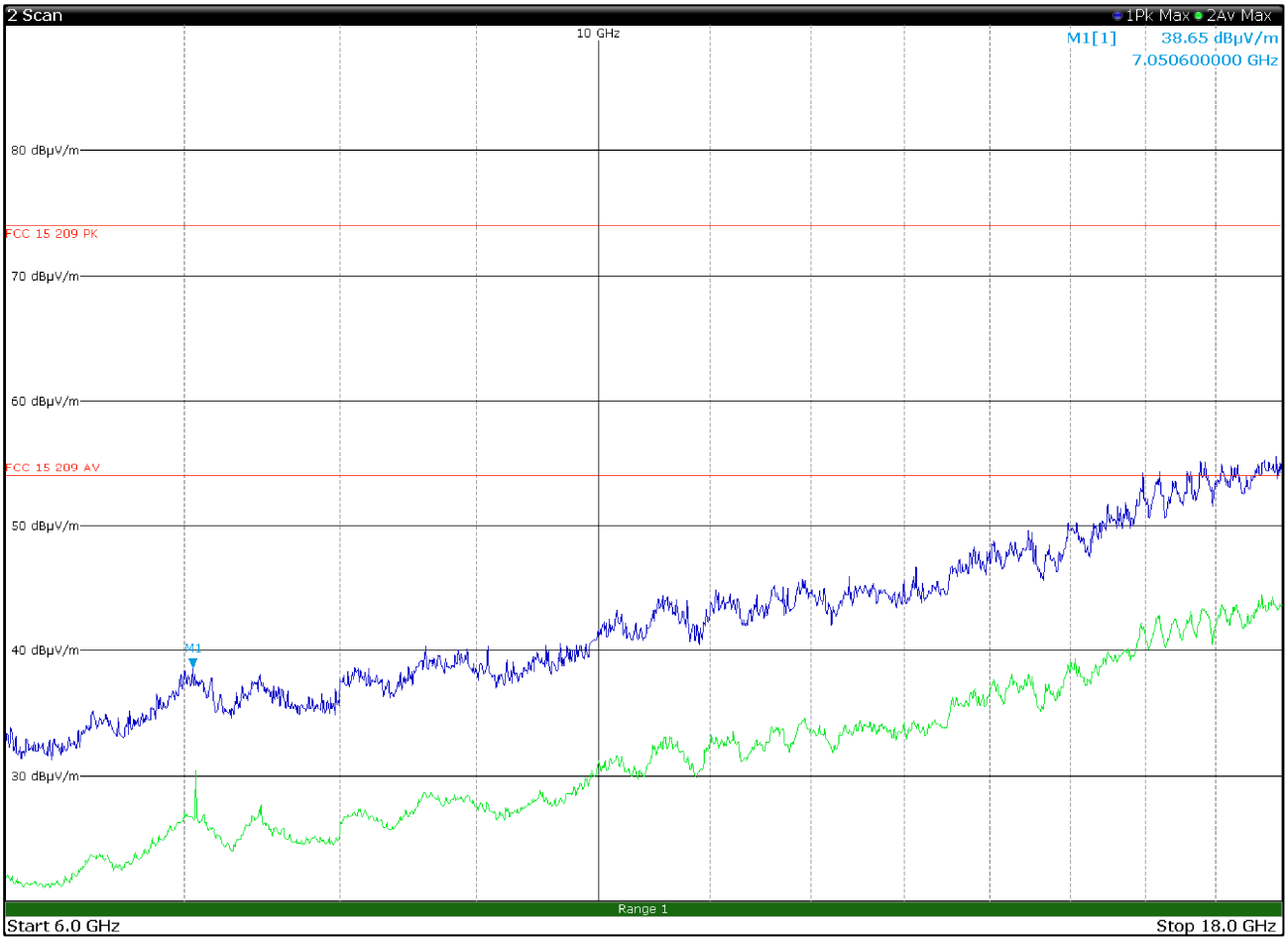


Figure 8.2-30: *Radiated spurious emissions 6 to 18 GHz, 5300 channel with antenna in vertical polarization*

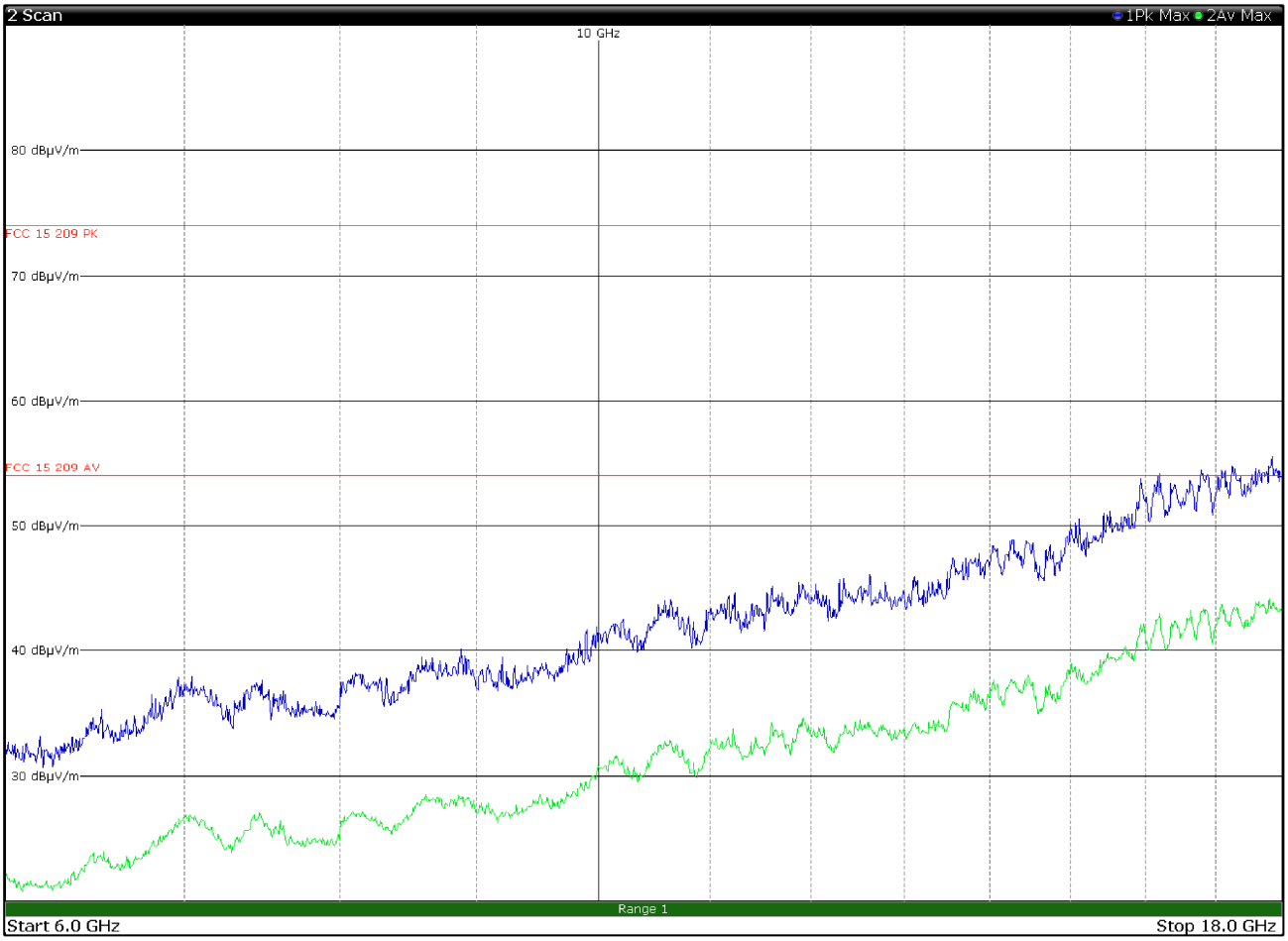


Figure 8.2-31: *Radiated spurious emissions 6 to 18 GHz, 5320 channel with antenna in horizontal polarization*

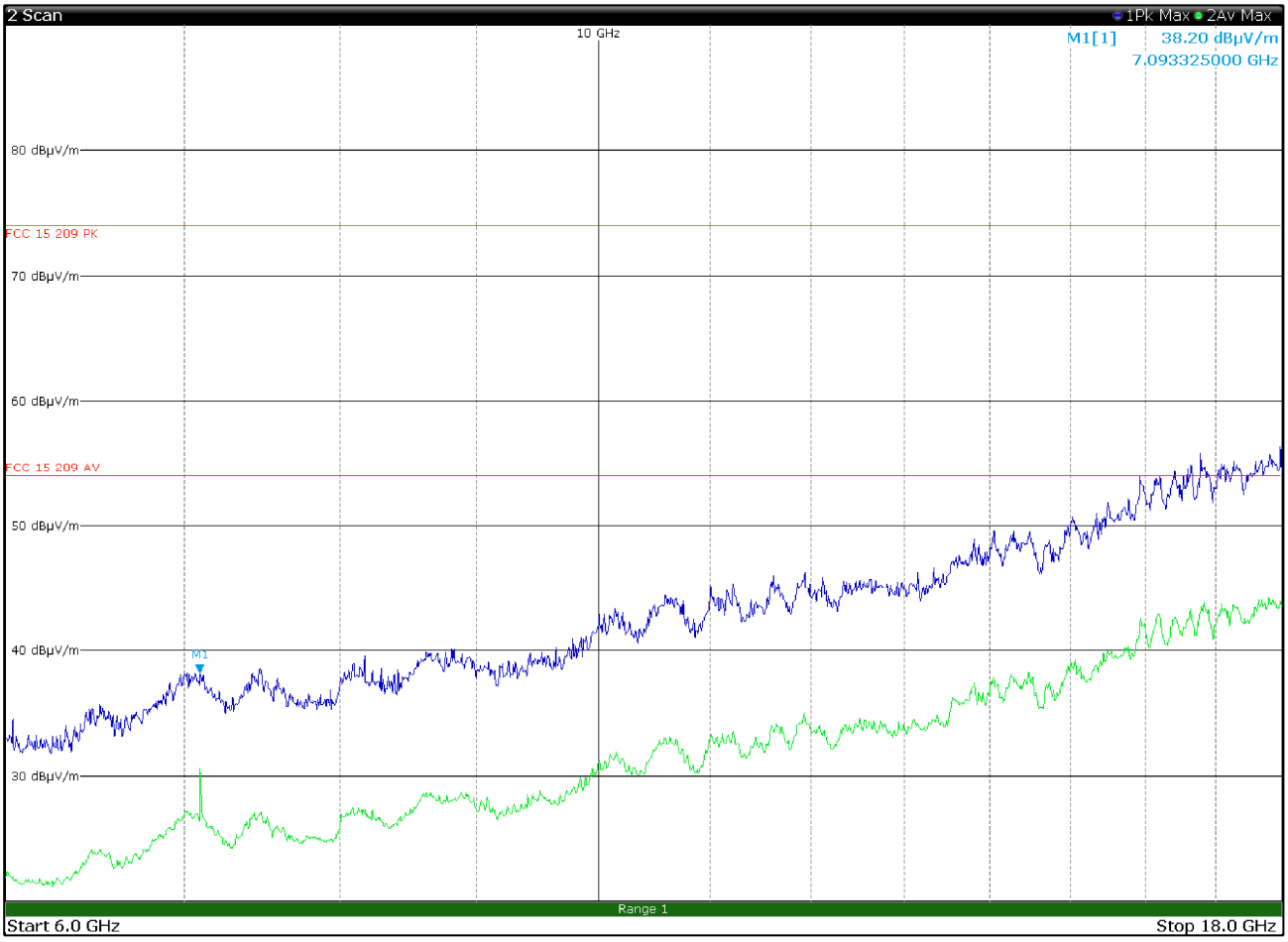


Figure 8.2-32: *Radiated spurious emissions 6 to 18 GHz, 5320 channel with antenna in vertical polarization*

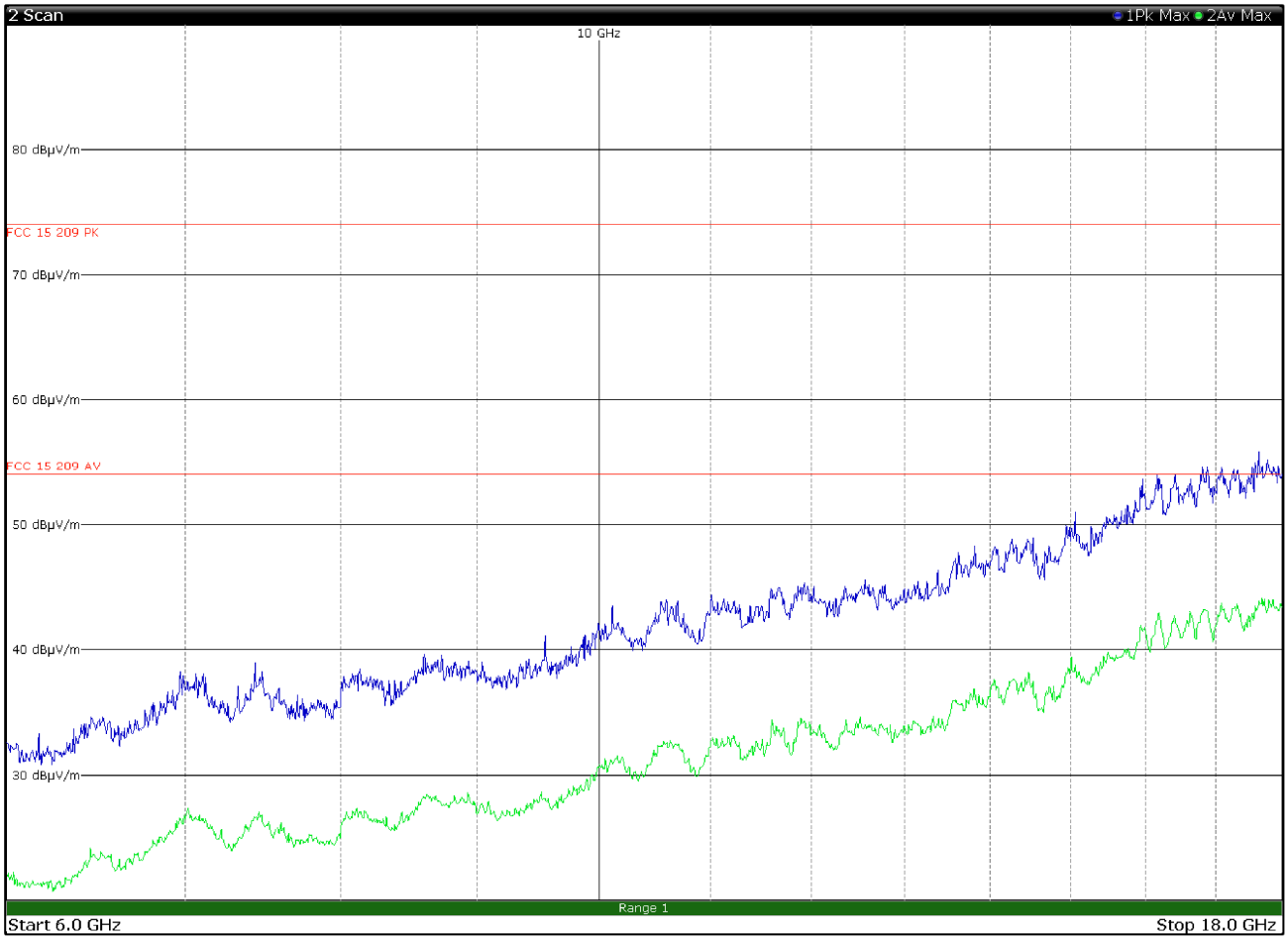


Figure 8.2-33: *Radiated spurious emissions 6 to 18 GHz, 5500 channel with antenna in horizontal polarization*

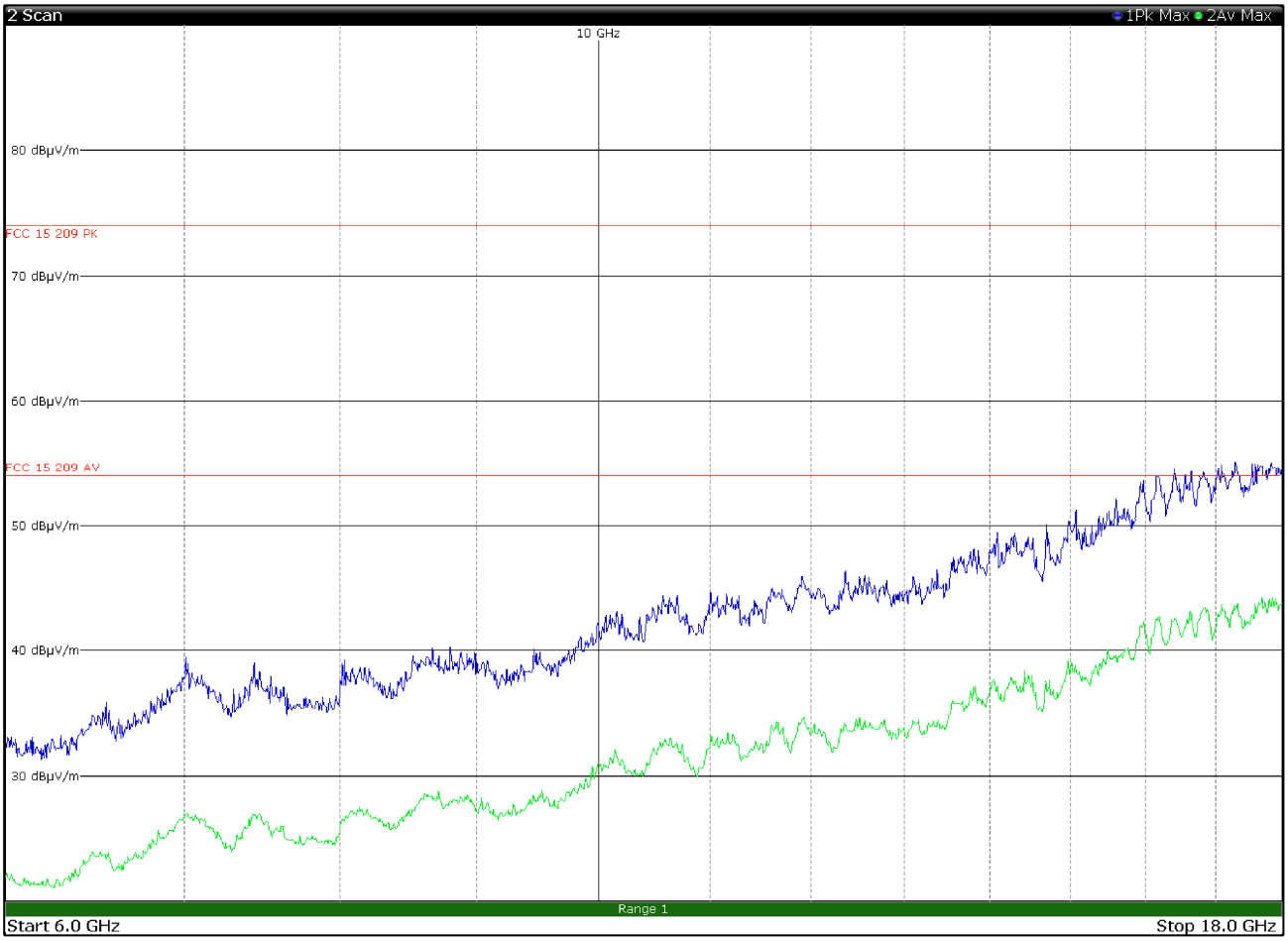


Figure 8.2-34: *Radiated spurious emissions 6 to 18 GHz, 5500 channel with antenna in vertical polarization*

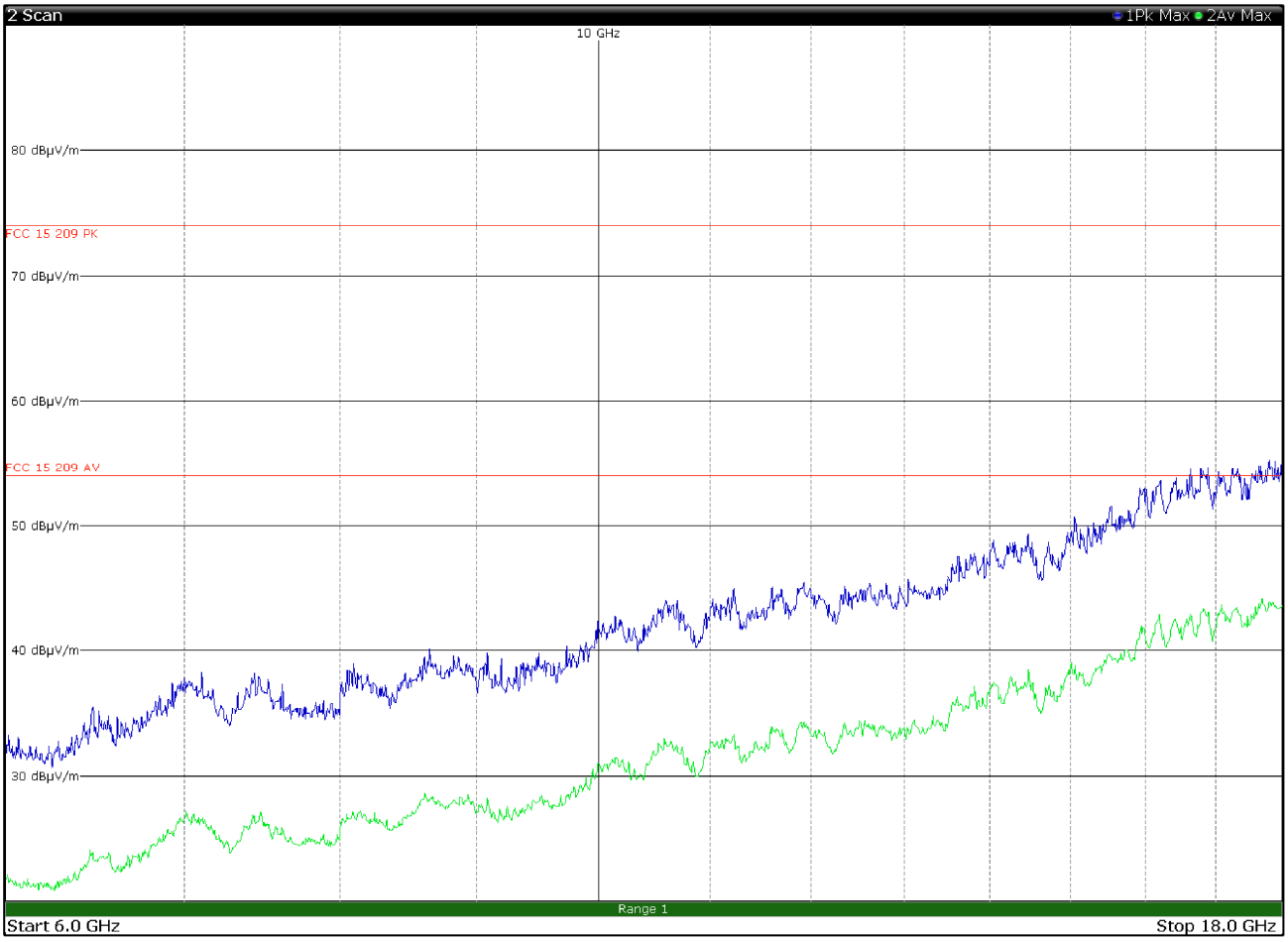


Figure 8.2-35: *Radiated spurious emissions 6 to 18 GHz, 5600 channel with antenna in horizontal polarization*

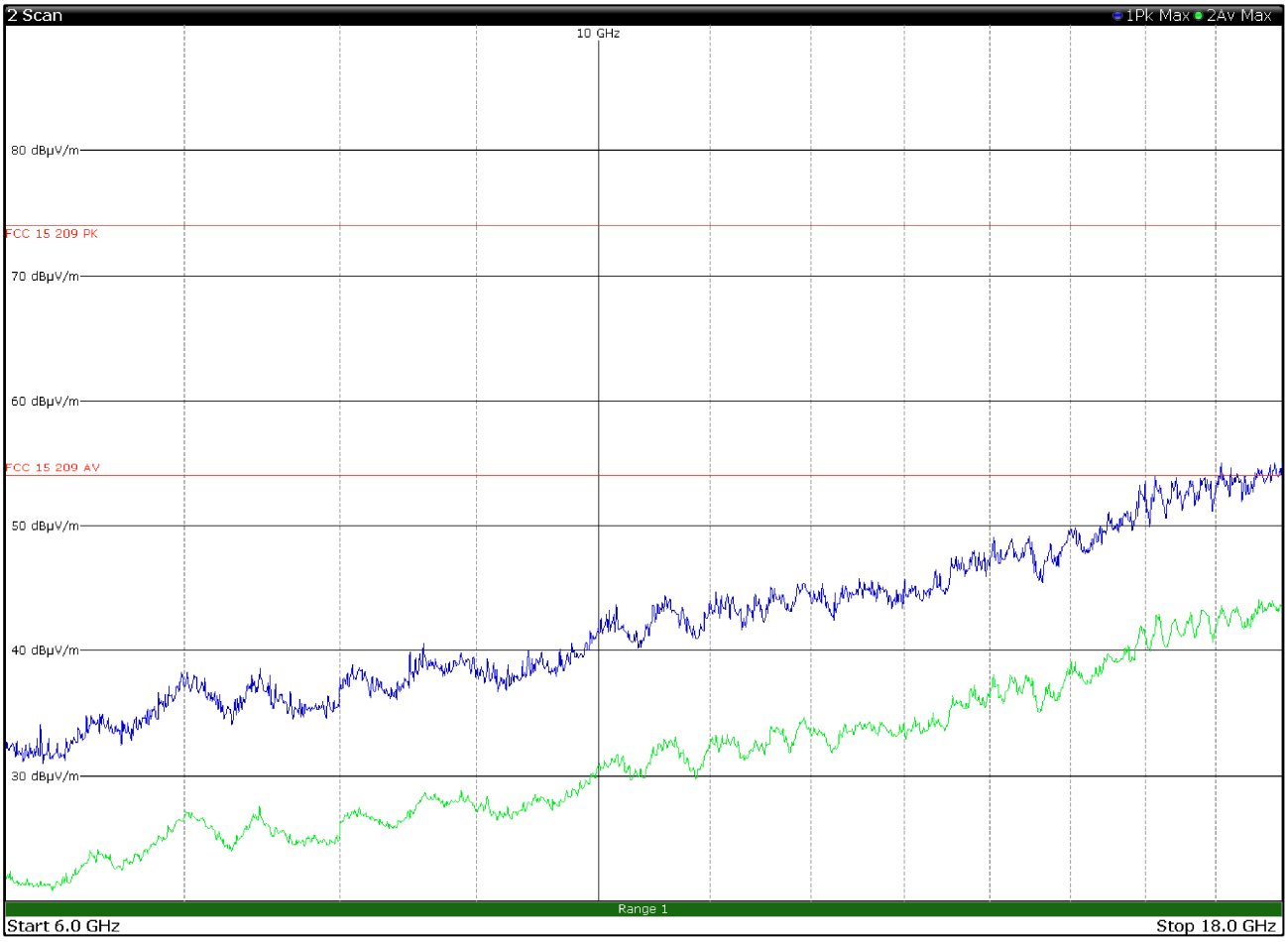


Figure 8.2-36: *Radiated spurious emissions 6 to 18 GHz, 5600 channel with antenna in vertical polarization*

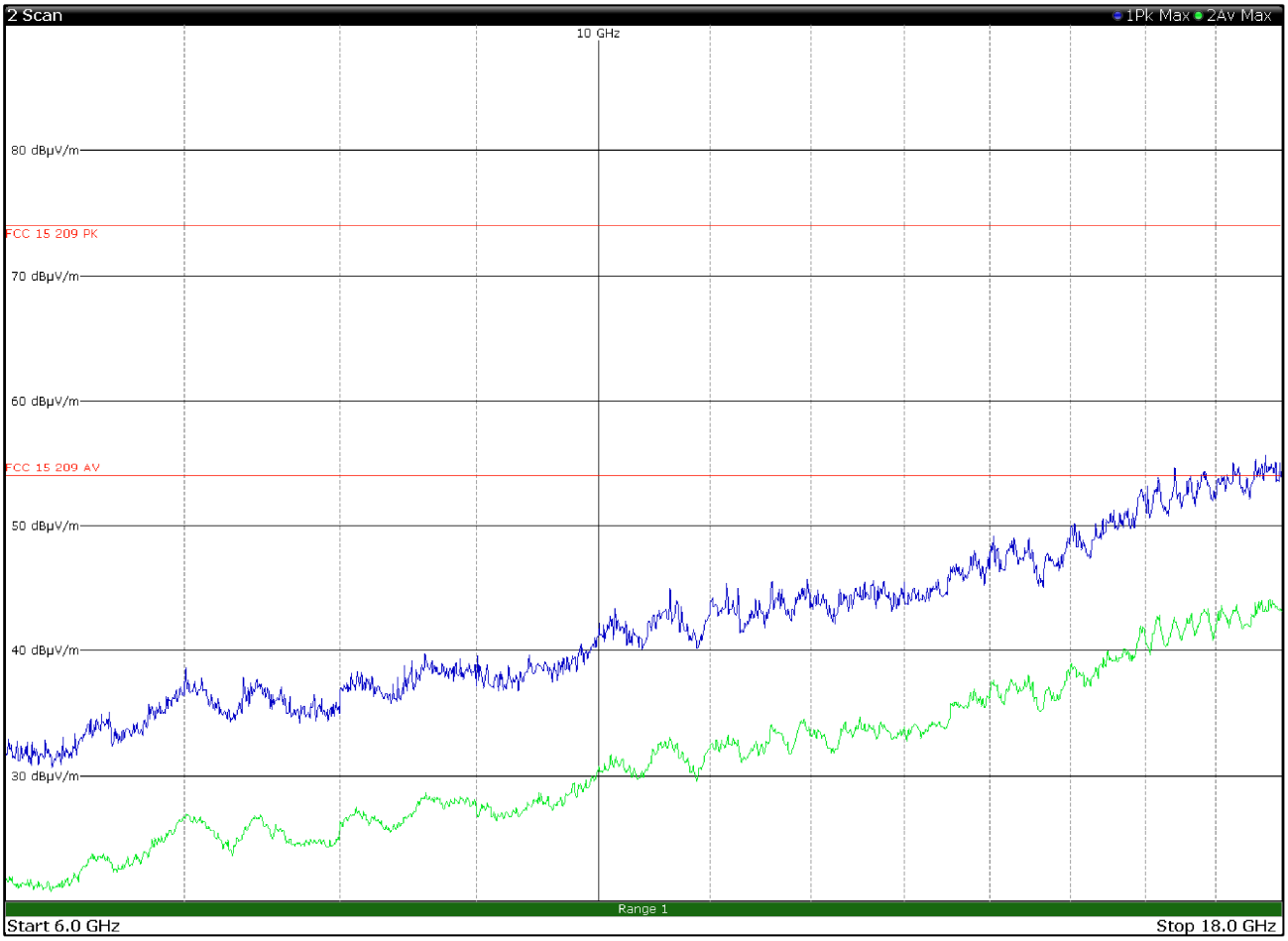


Figure 8.2-37: *Radiated spurious emissions 6 to 18 GHz, 5700 channel with antenna in horizontal polarization*

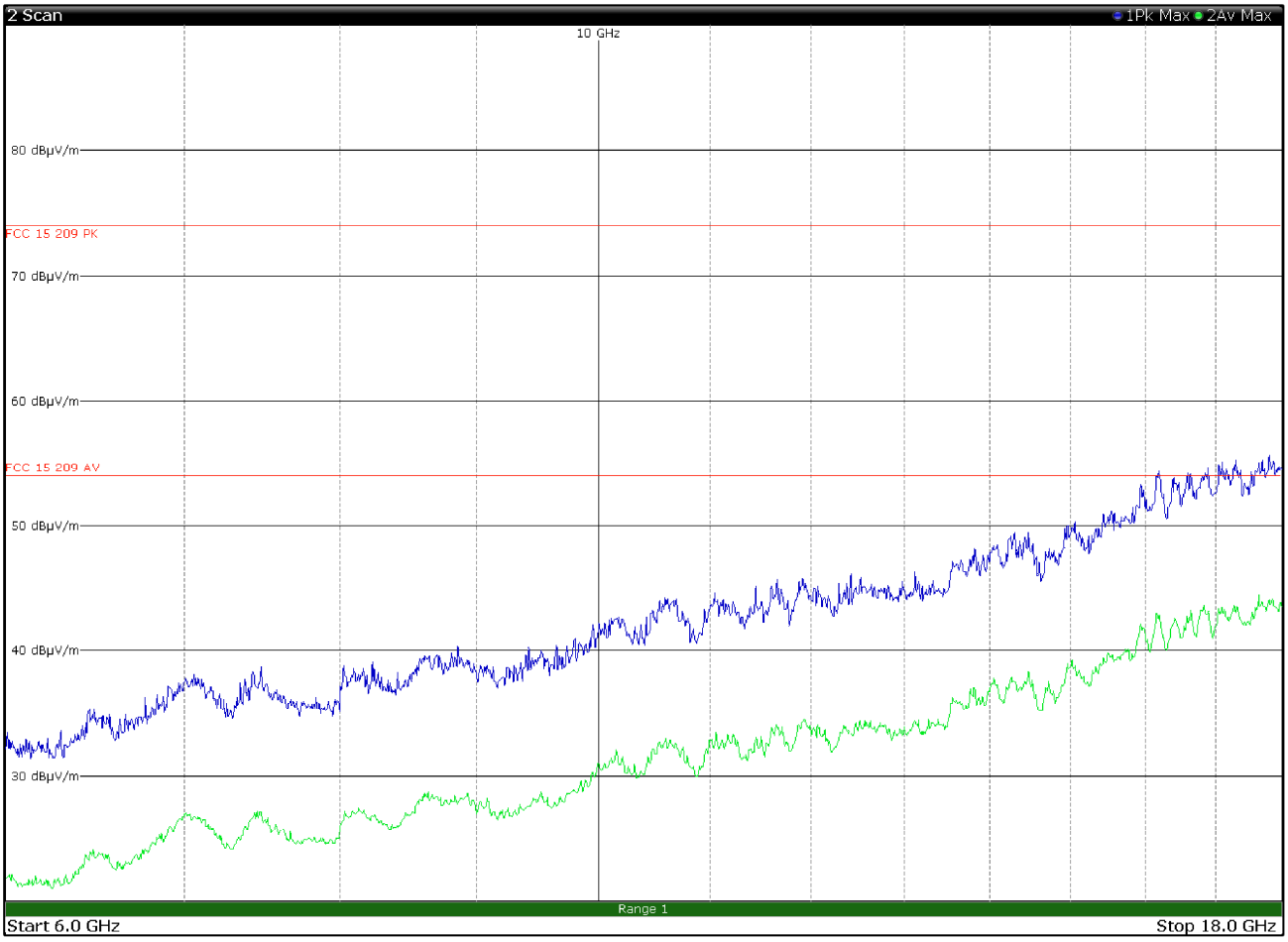


Figure 8.2-38: *Radiated spurious emissions 6 to 18 GHz, 5700 channel with antenna in vertical polarization*

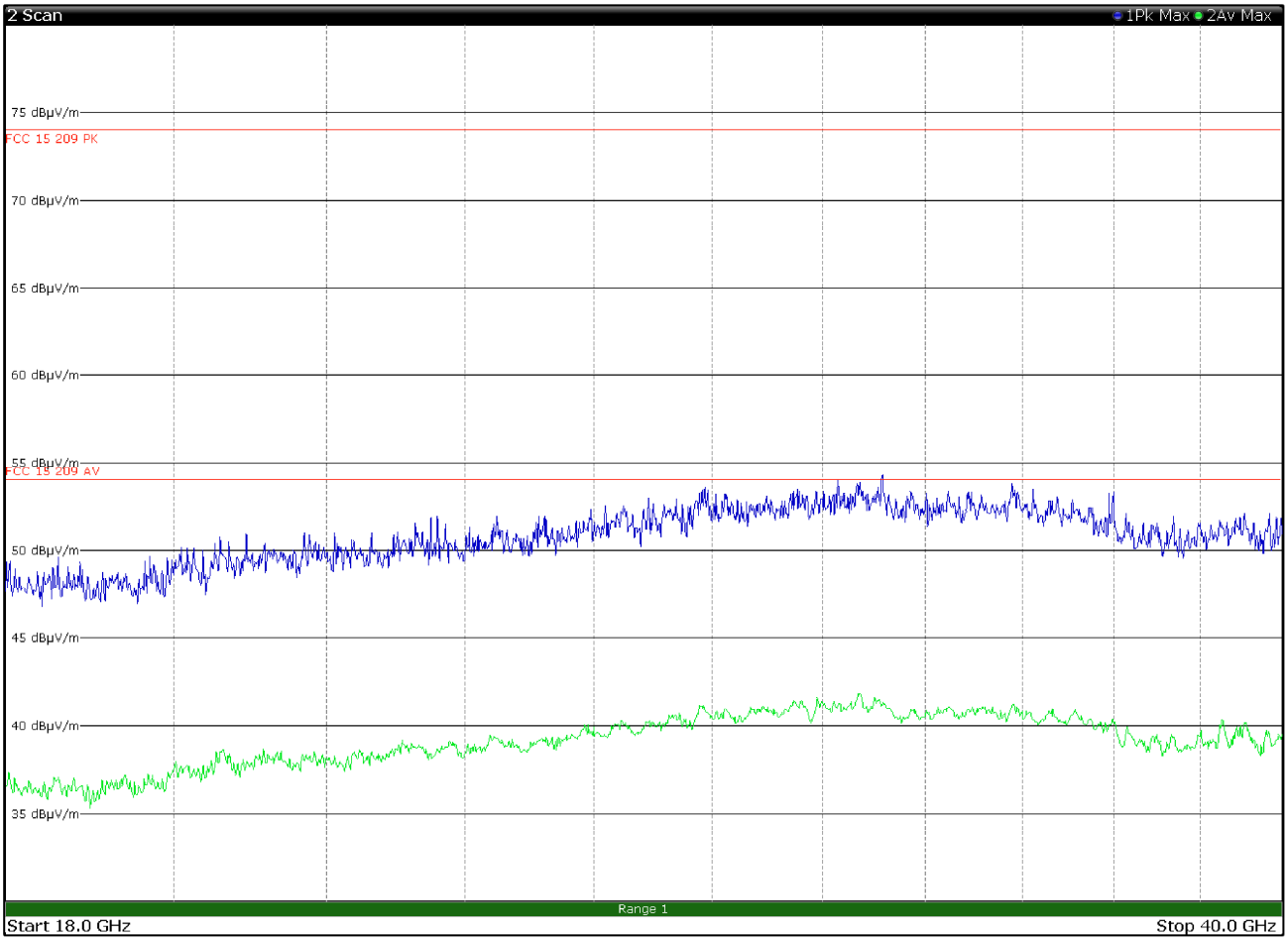


Figure 8.2-39: *Radiated spurious emissions 18 to 40 GHz, 5180 channel with antenna in horizontal polarization*

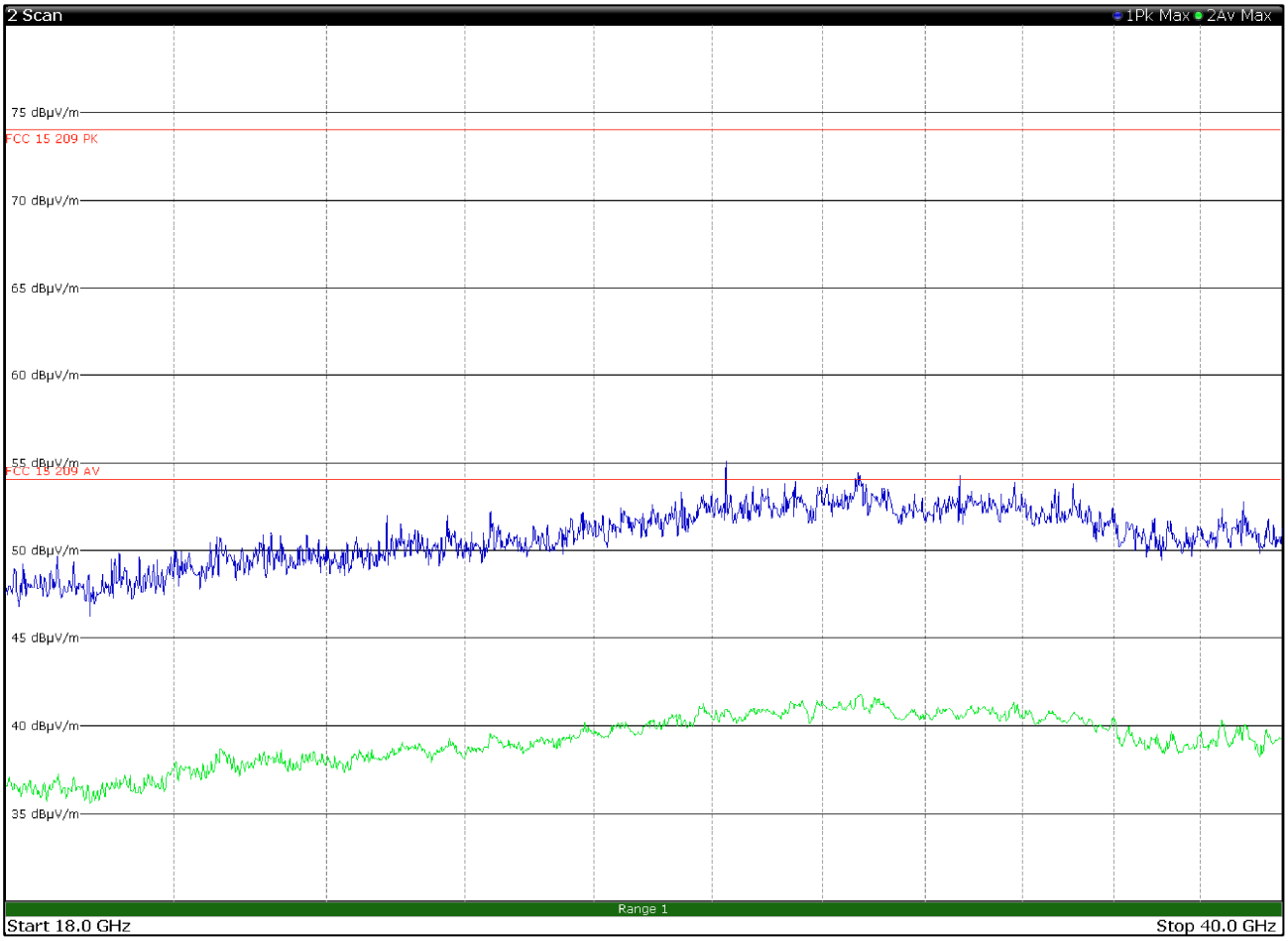


Figure 8.2-40: *Radiated spurious emissions 18 to 40 GHz, 5180 channel with antenna in vertical polarization*

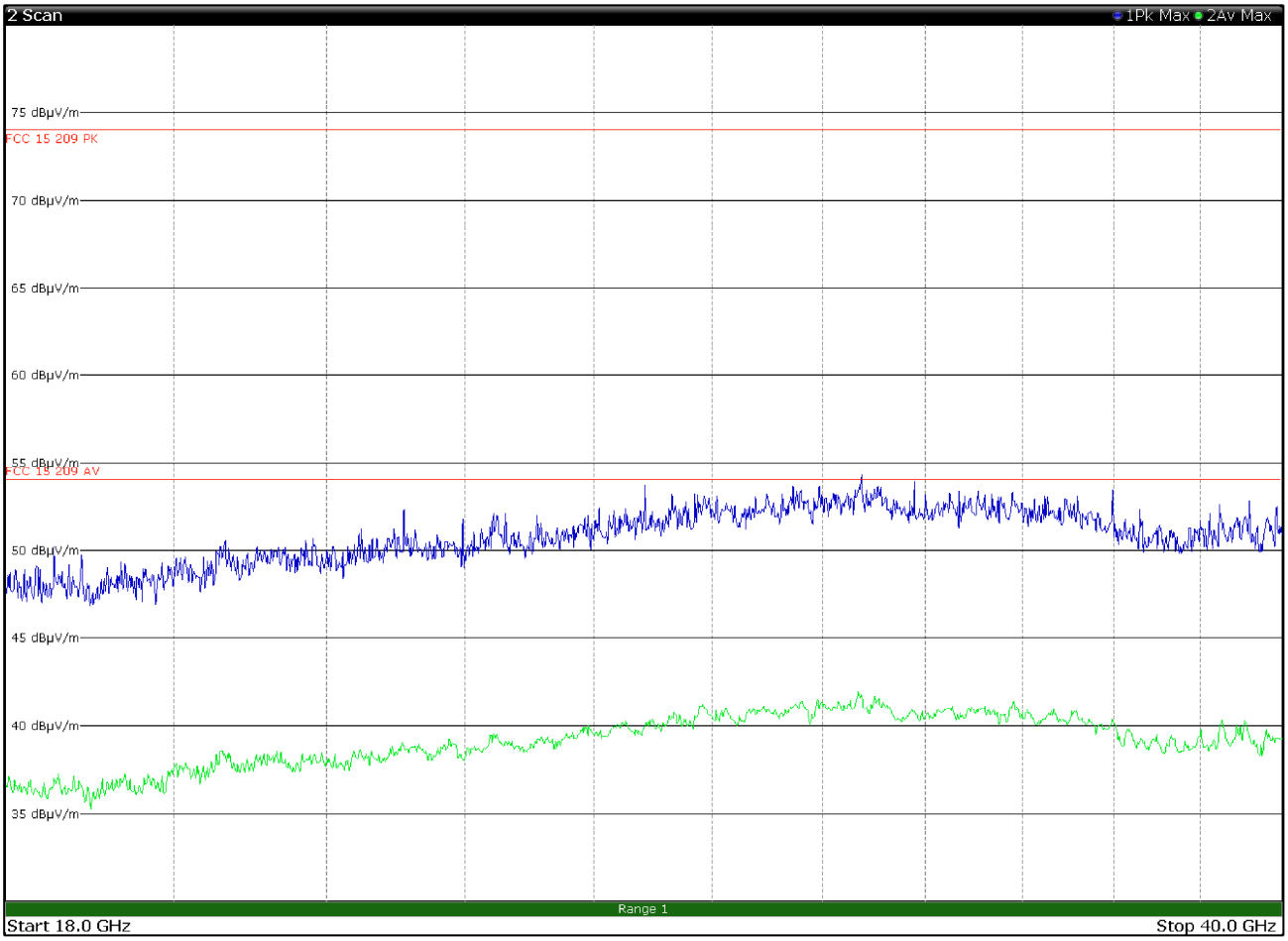


Figure 8.2-41: *Radiated spurious emissions 18 to 40 GHz, 5200 channel with antenna in horizontal polarization*

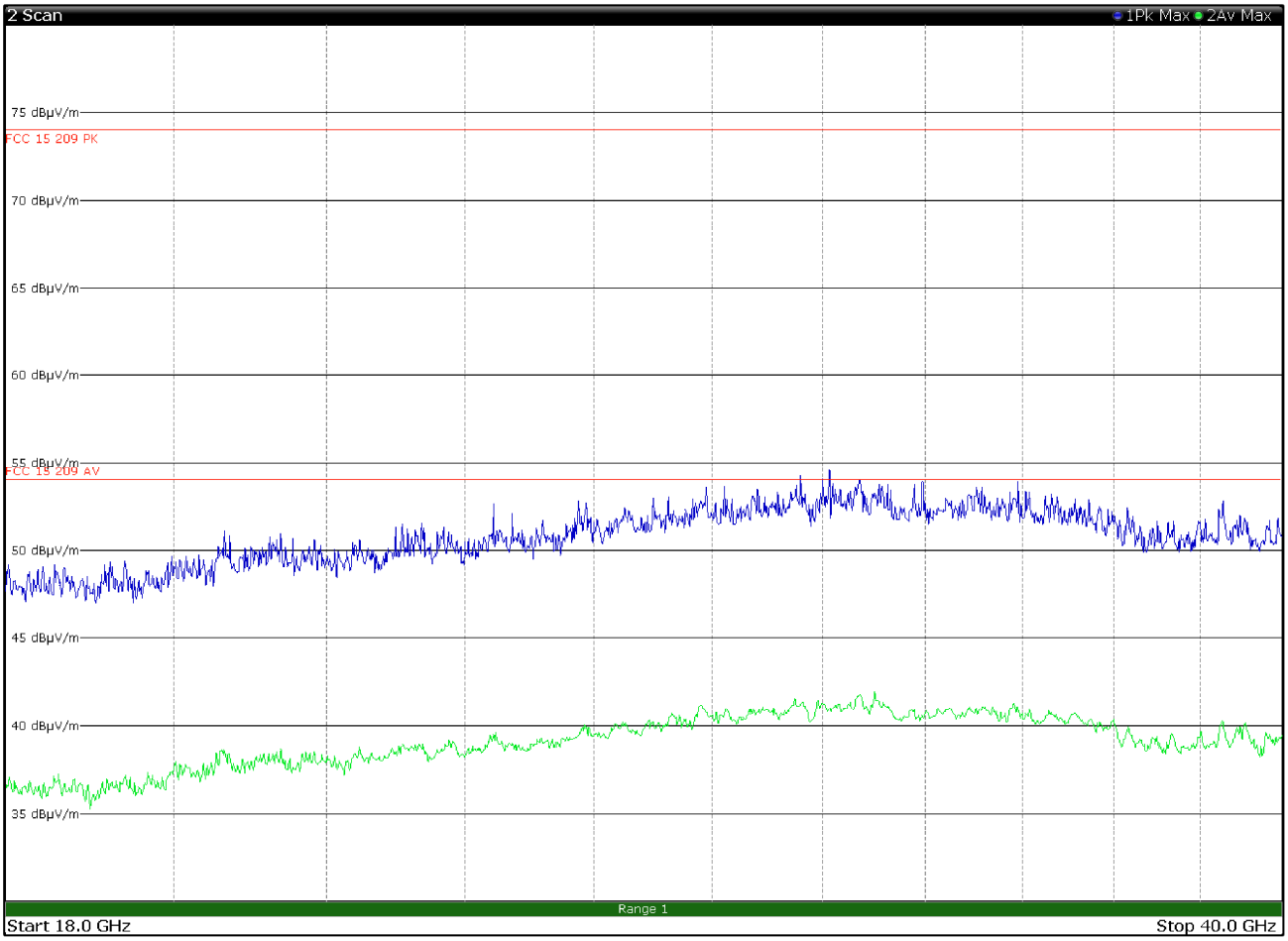


Figure 8.2-42: *Radiated spurious emissions 18 to 40 GHz, 5200 channel with antenna in vertical polarization*

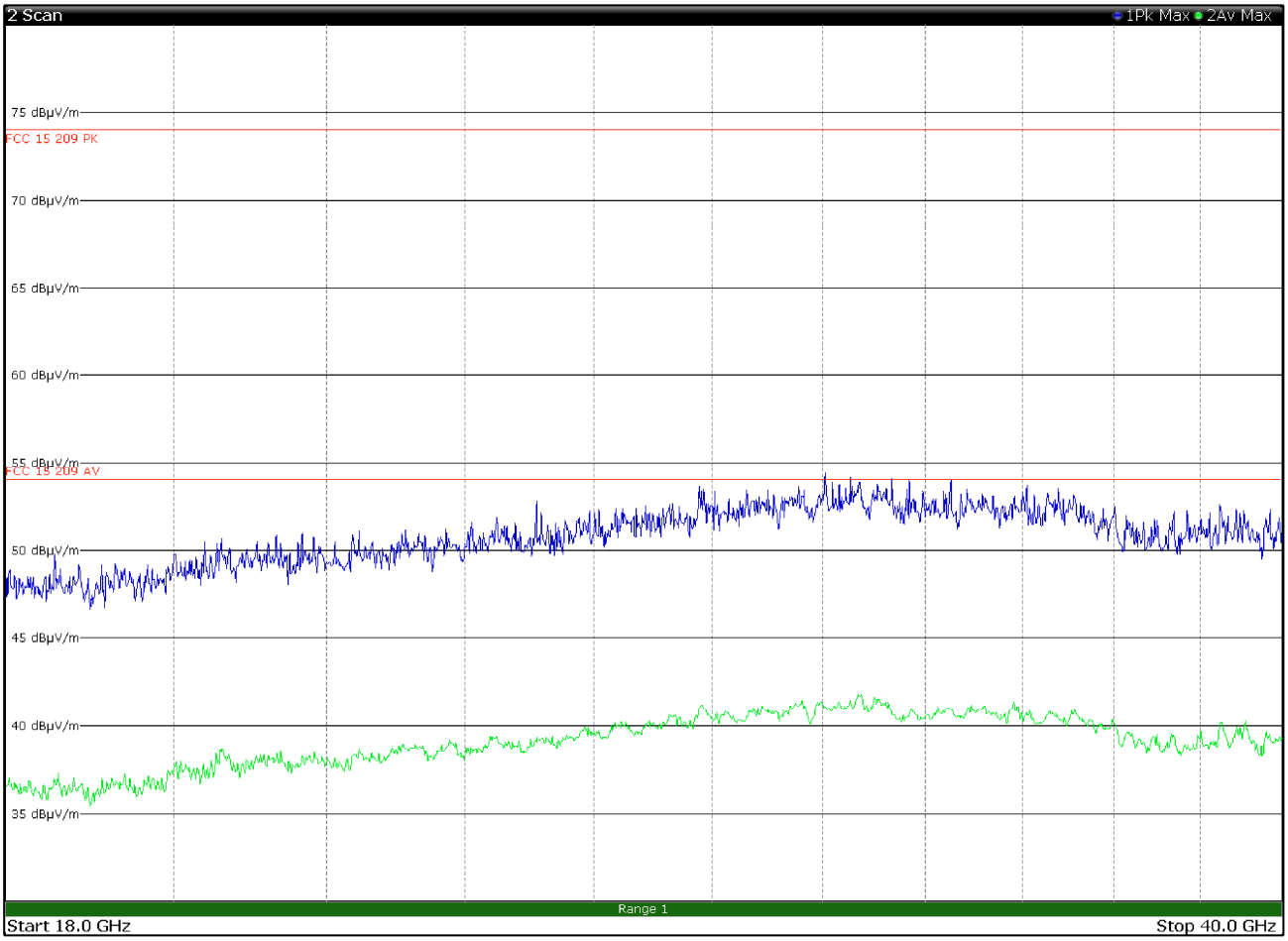


Figure 8.2-43: *Radiated spurious emissions 18 to 40 GHz, 5240 channel with antenna in horizontal polarization*

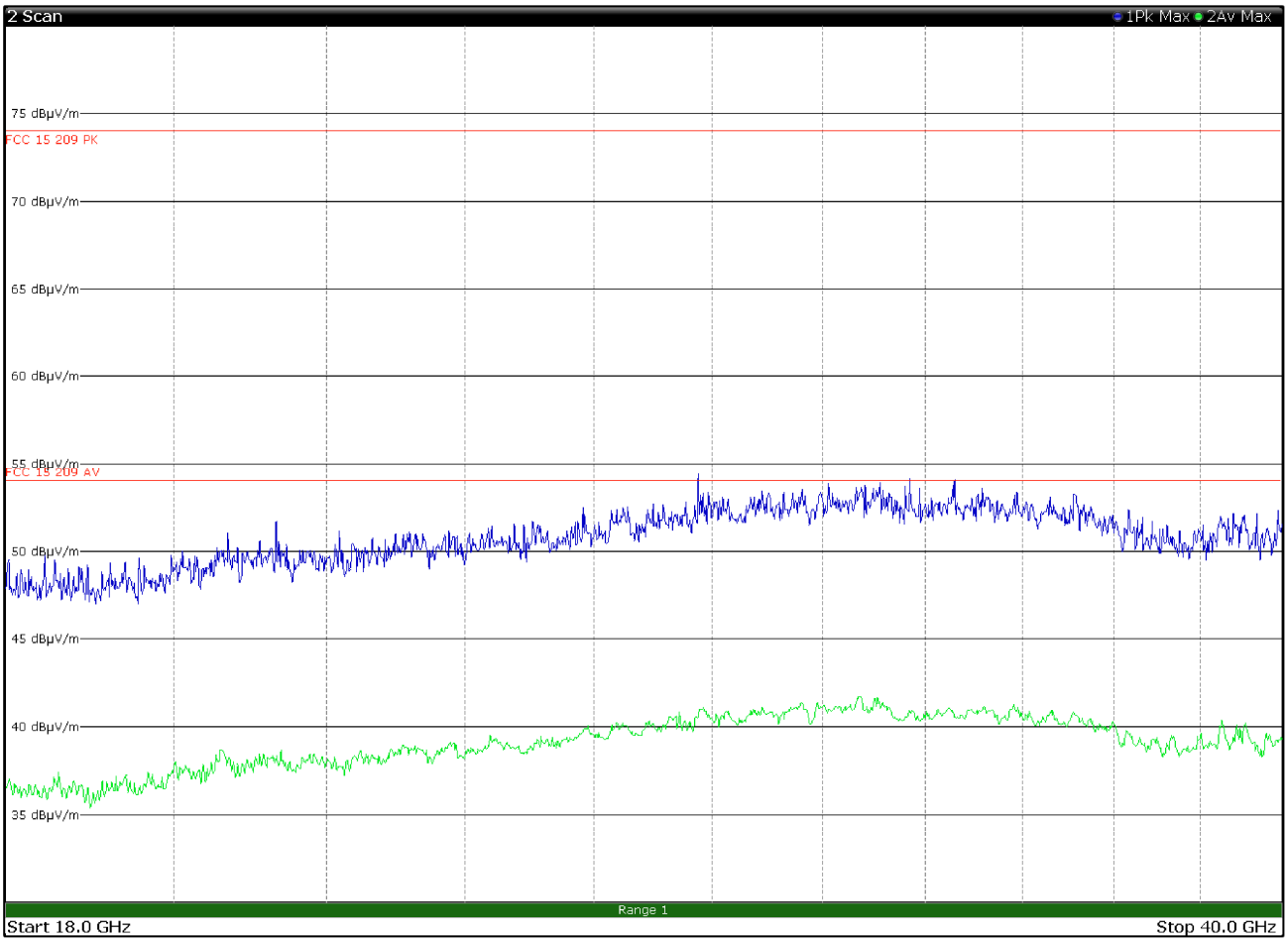


Figure 8.2-44: *Radiated spurious emissions 18 to 40 GHz, 5240 channel with antenna in vertical polarization*

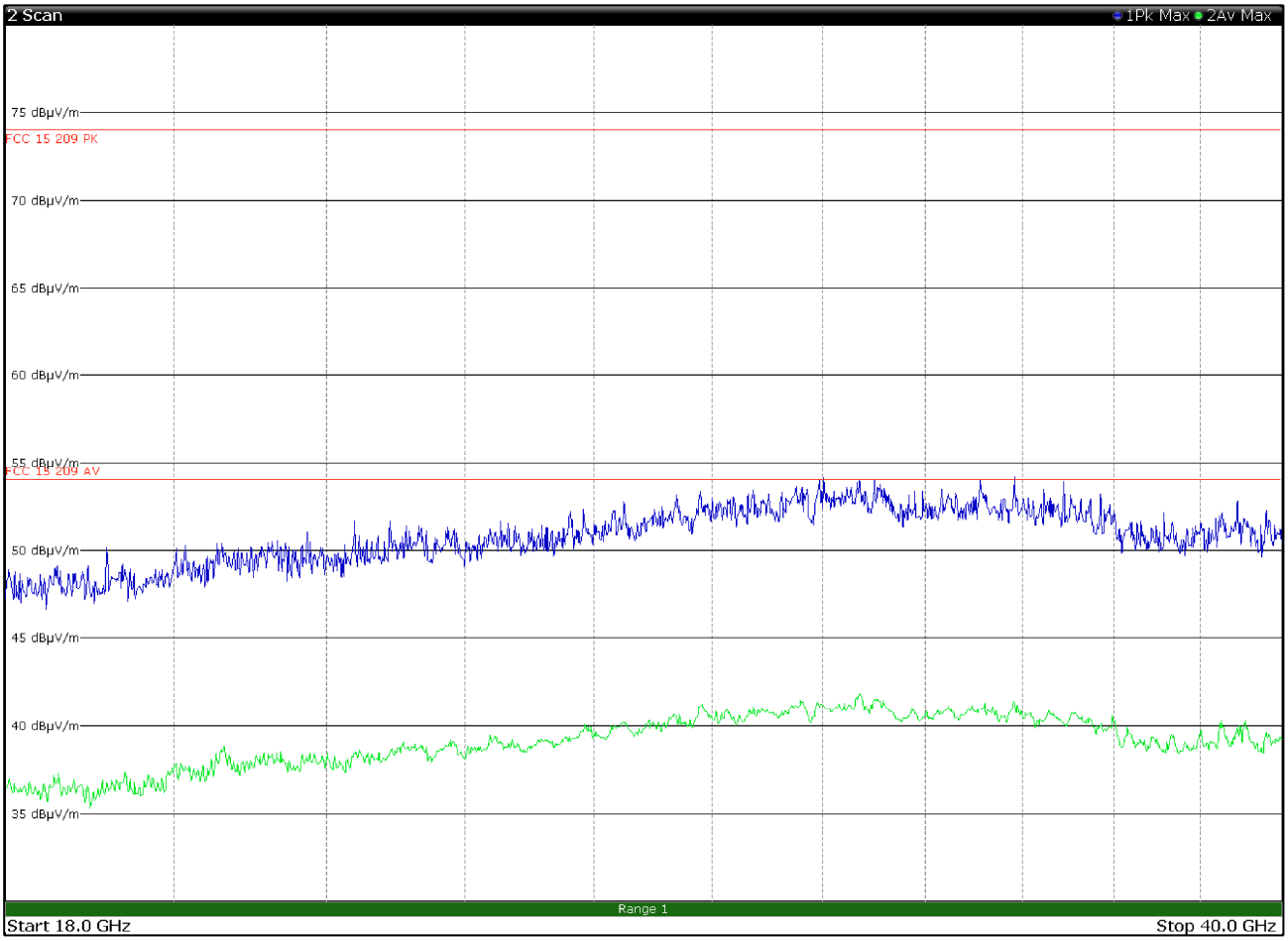


Figure 8.2-45: *Radiated spurious emissions 18 to 40 GHz, 5260 channel with antenna in horizontal polarization*

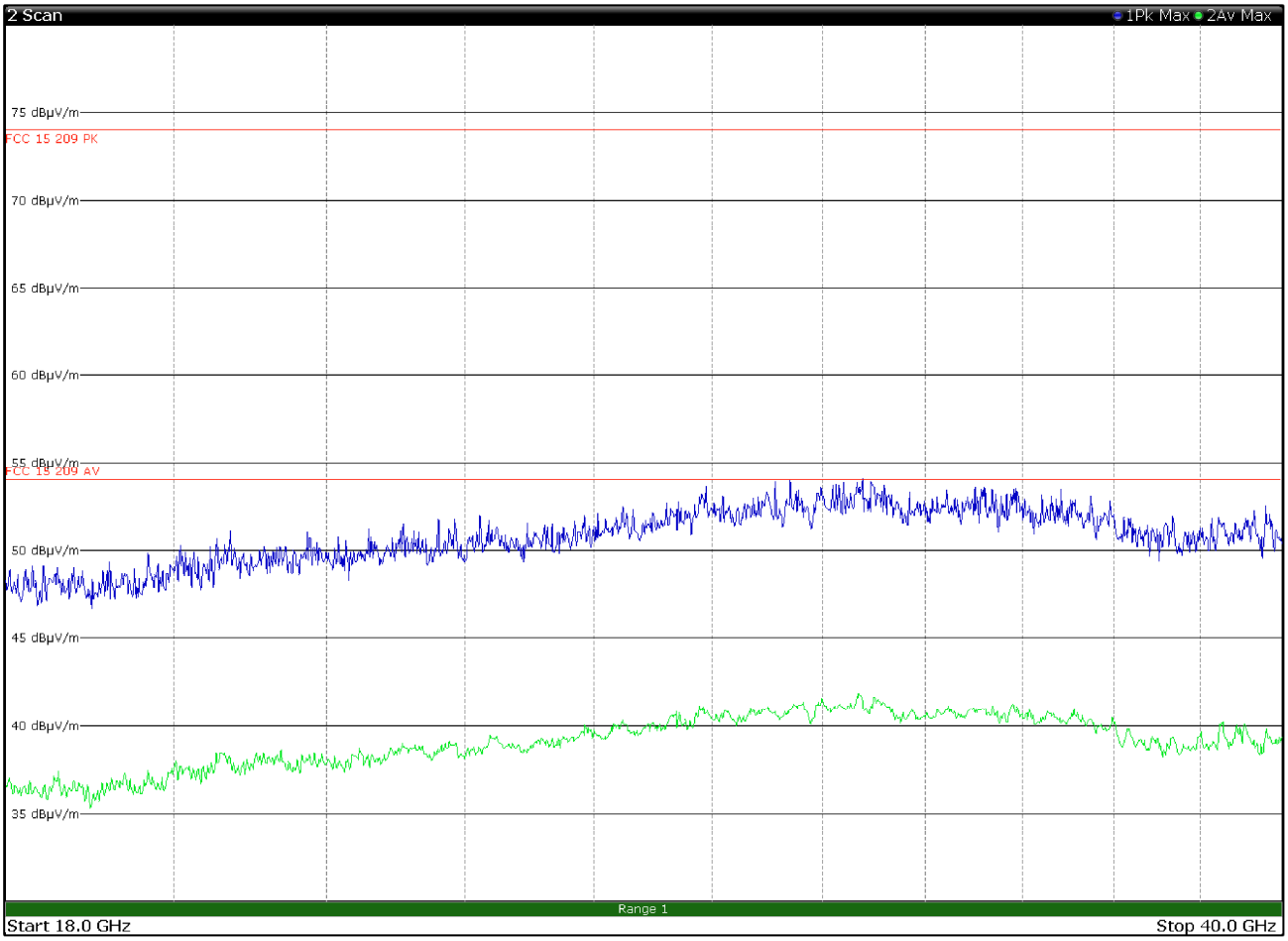


Figure 8.2-46: *Radiated spurious emissions 18 to 40 GHz, 5260 channel with antenna in vertical polarization*

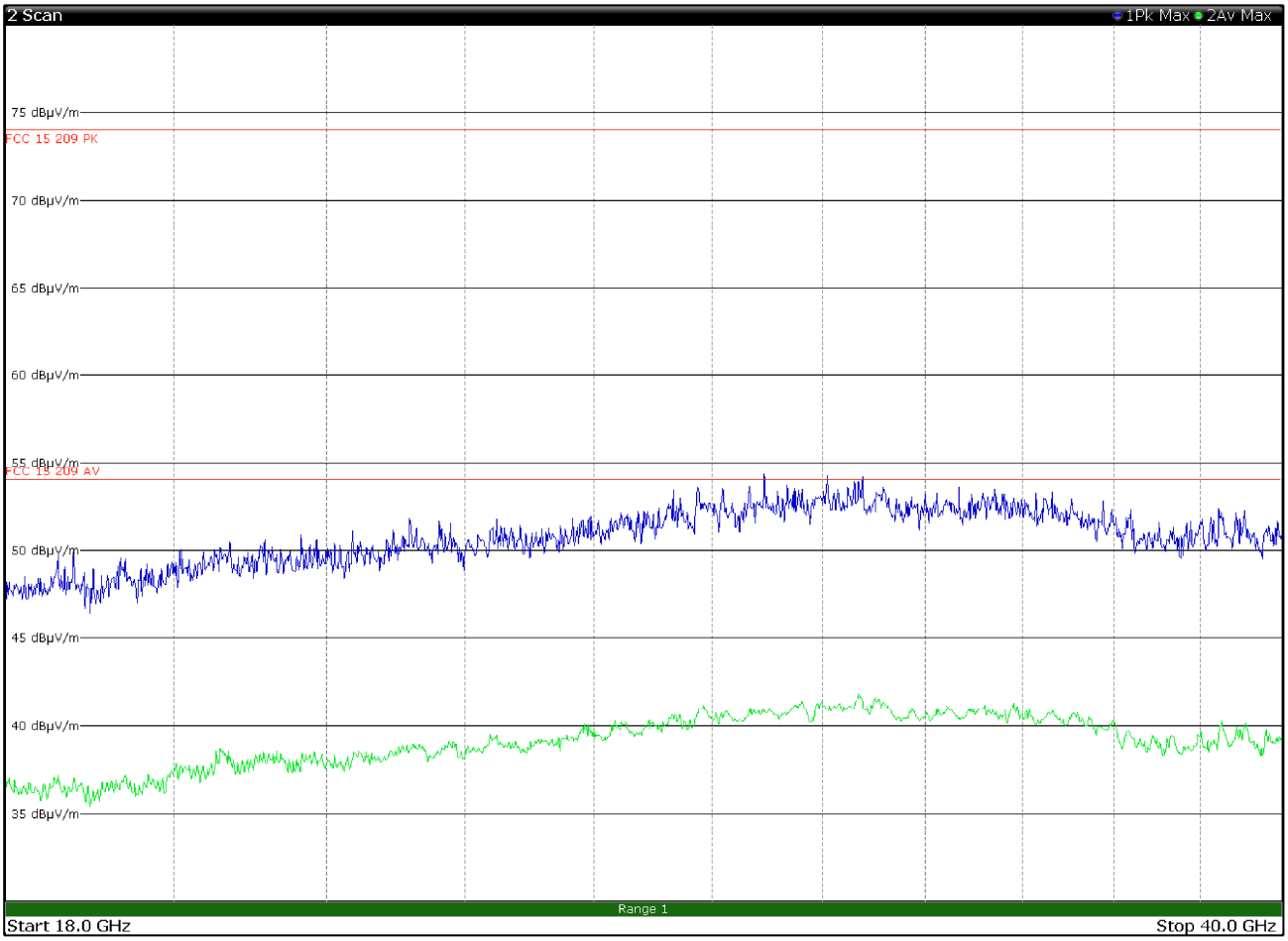


Figure 8.2-47: *Radiated spurious emissions 18 to 40 GHz, 5300 channel with antenna in horizontal polarization*

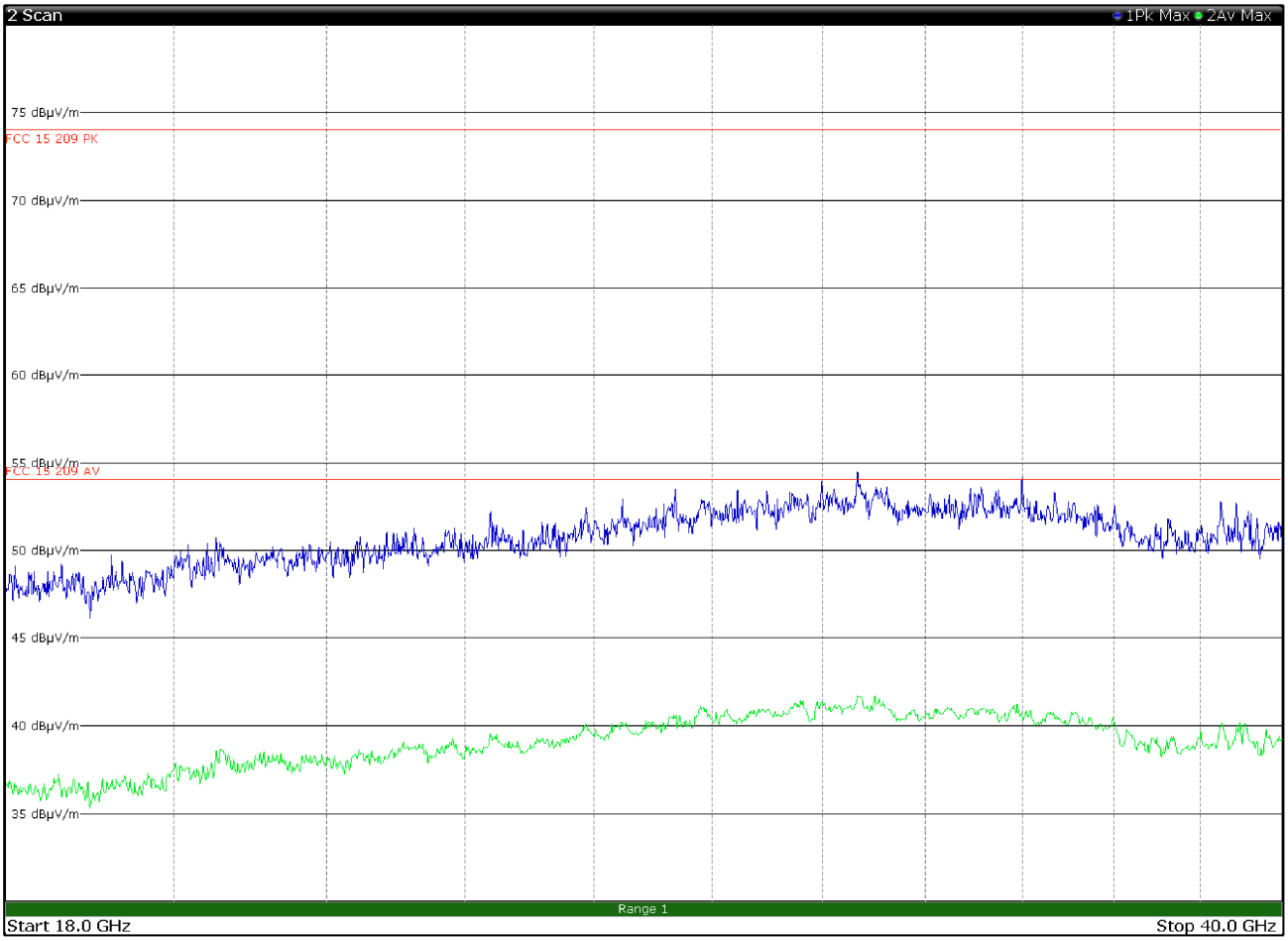


Figure 8.2-48: *Radiated spurious emissions 18 to 40 GHz, 5300 channel with antenna in vertical polarization*

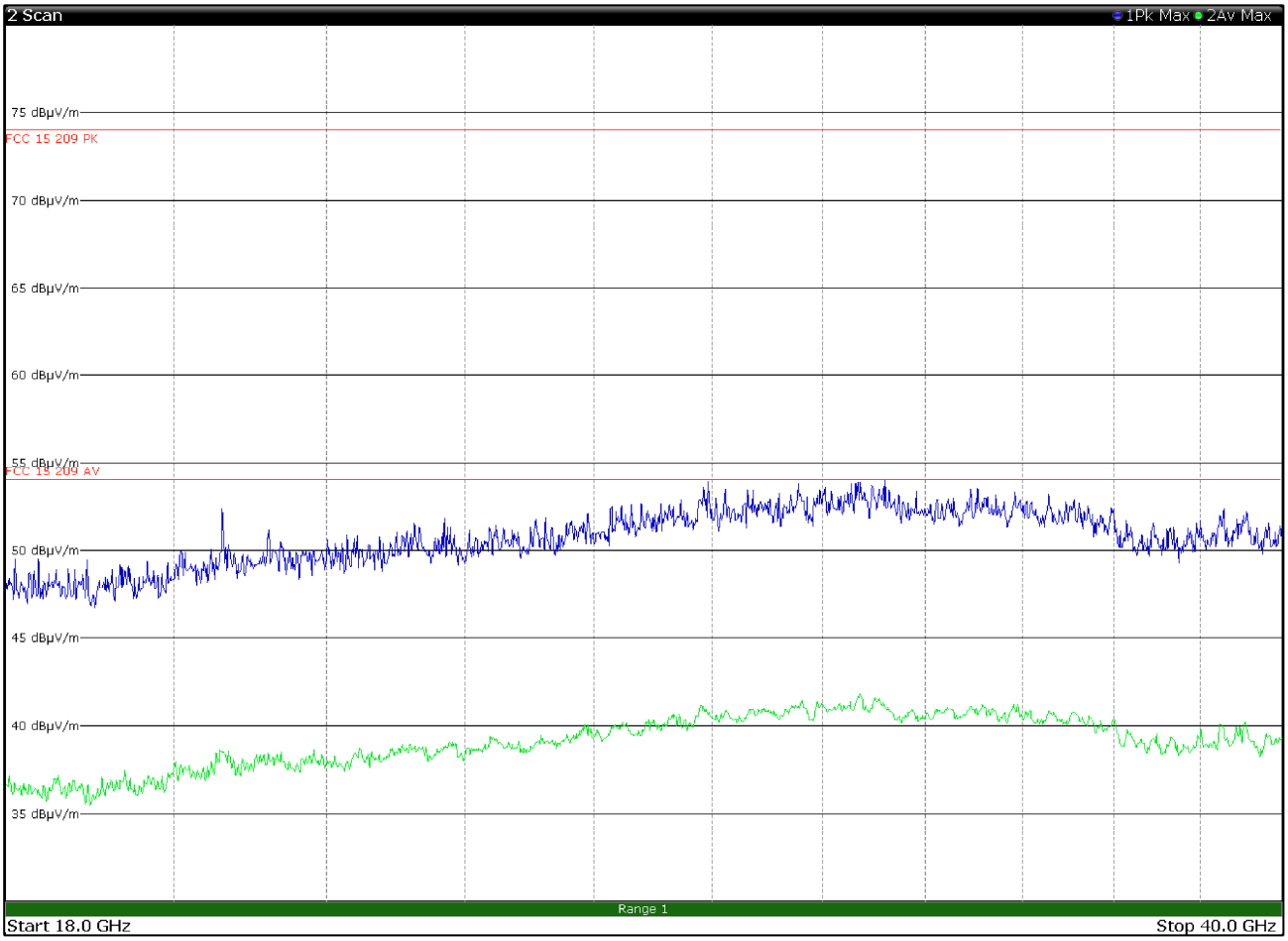


Figure 8.2-49: *Radiated spurious emissions 18 to 40 GHz, 5320 channel with antenna in horizontal polarization*

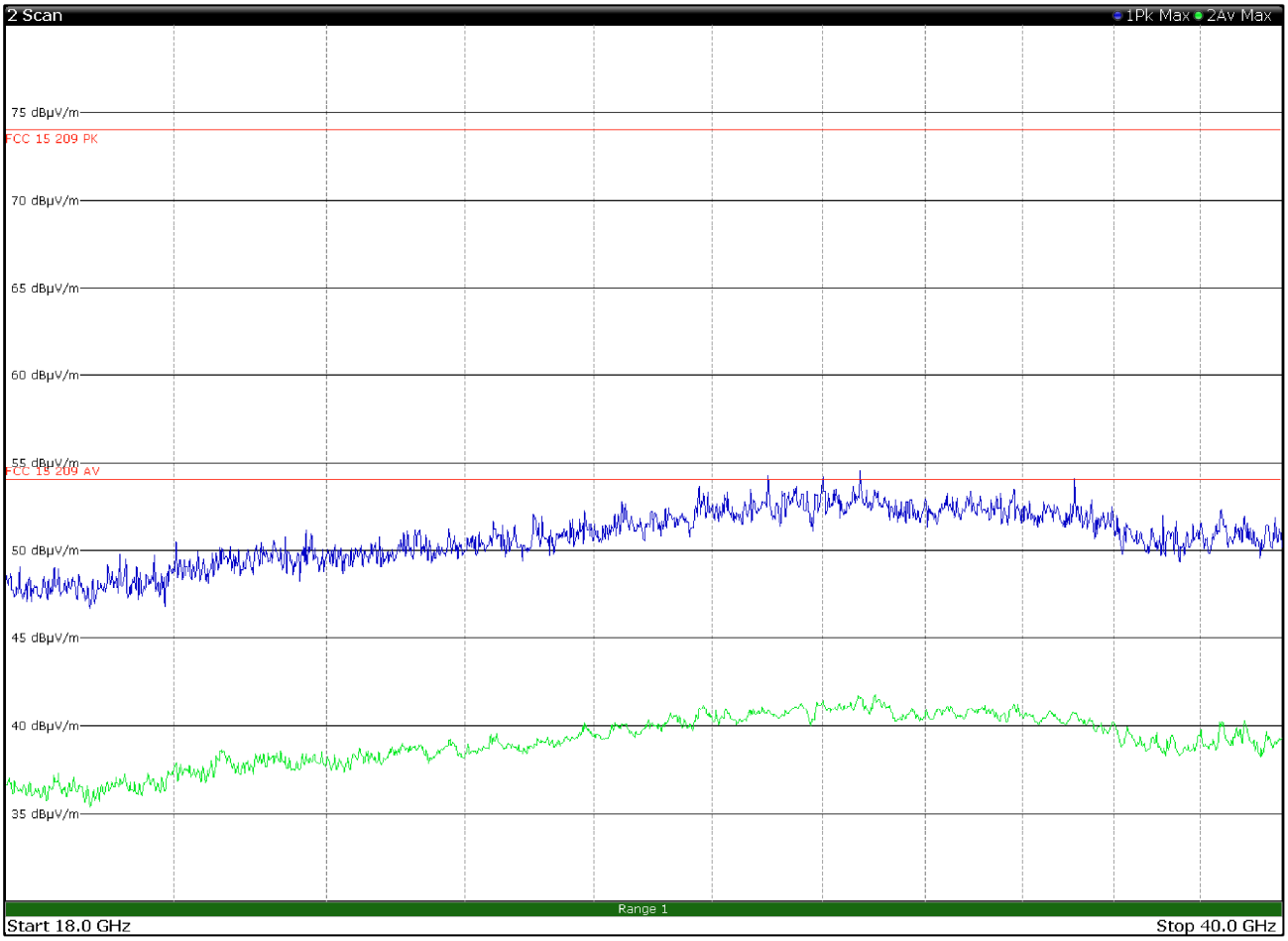


Figure 8.2-50: *Radiated spurious emissions 18 to 40 GHz, 5320 channel with antenna in vertical polarization*

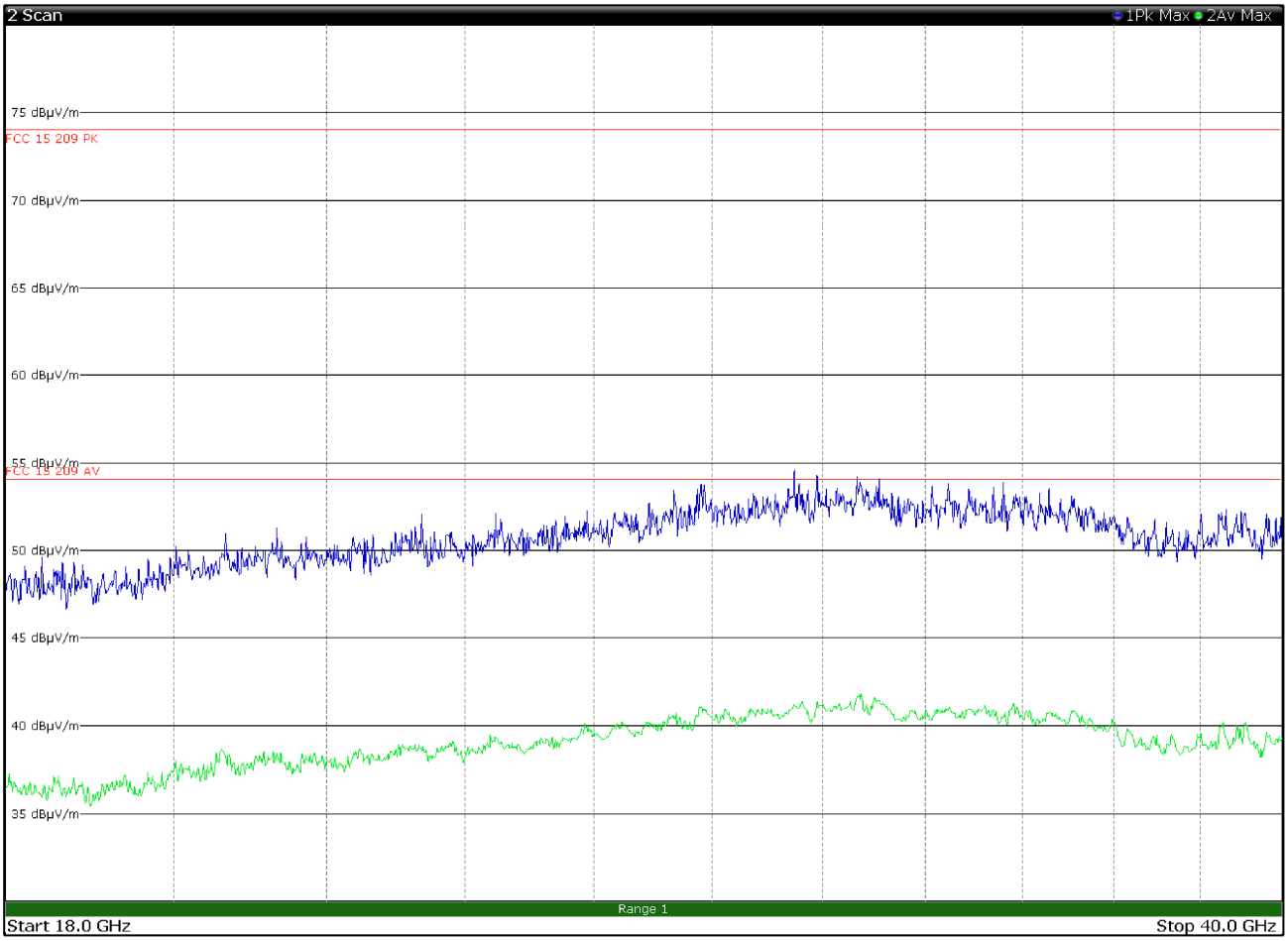


Figure 8.2-51: *Radiated spurious emissions 18 to 40 GHz, 5500 channel with antenna in horizontal polarization*

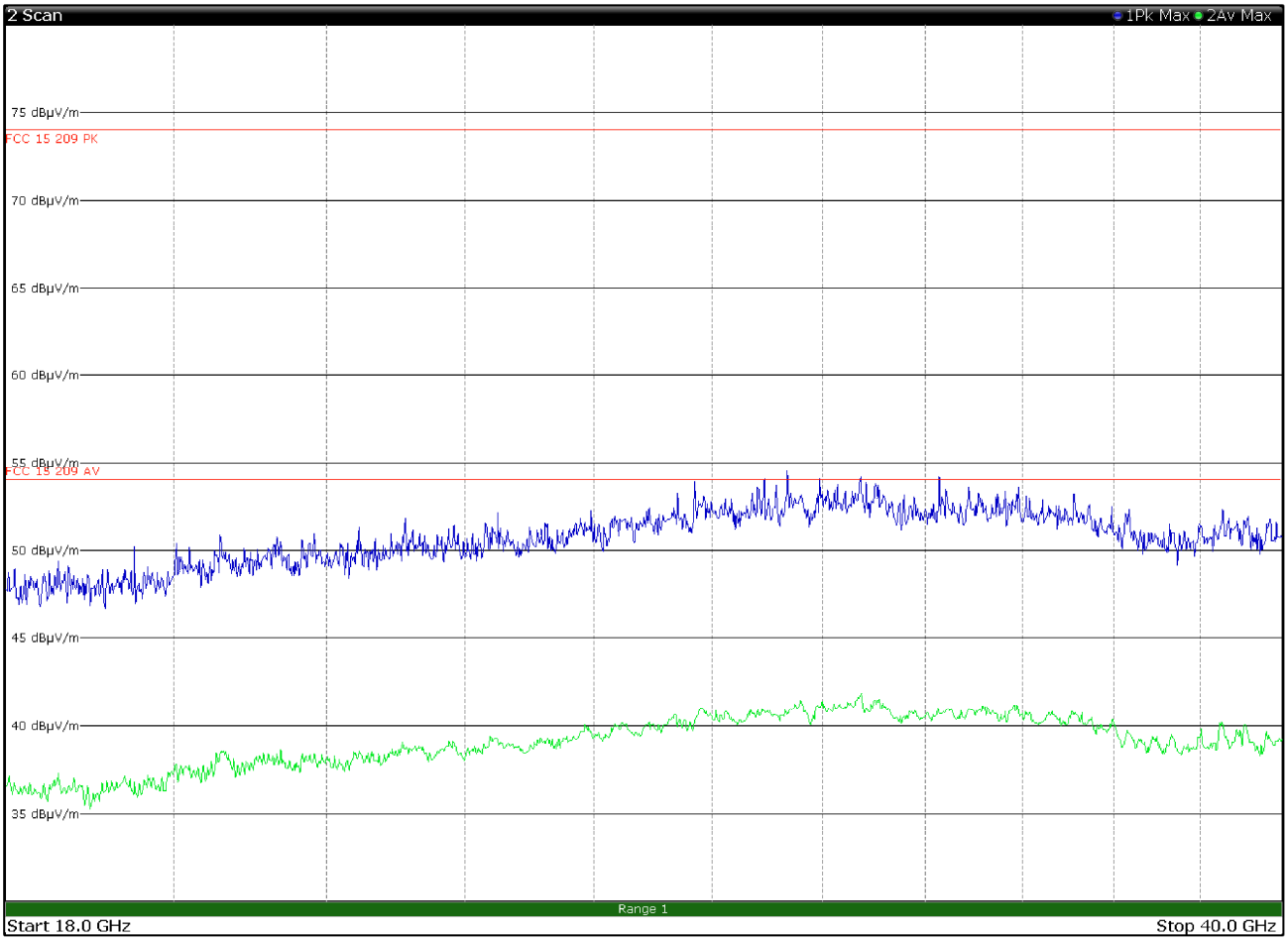


Figure 8.2-52: *Radiated spurious emissions 18 to 40 GHz, 5500 channel with antenna in vertical polarization*

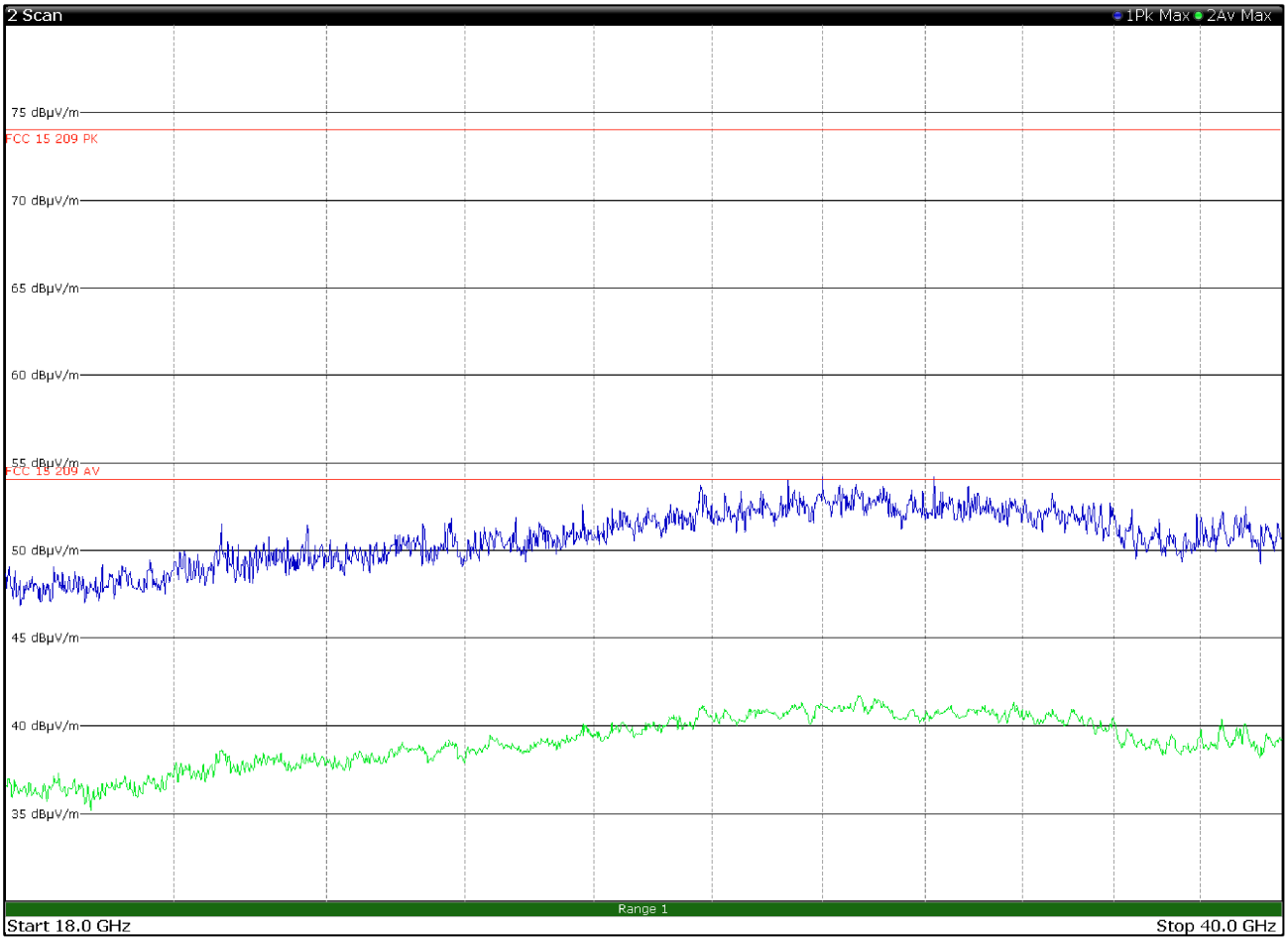


Figure 8.2-53: *Radiated spurious emissions 18 to 40 GHz, 5600 channel with antenna in horizontal polarization*

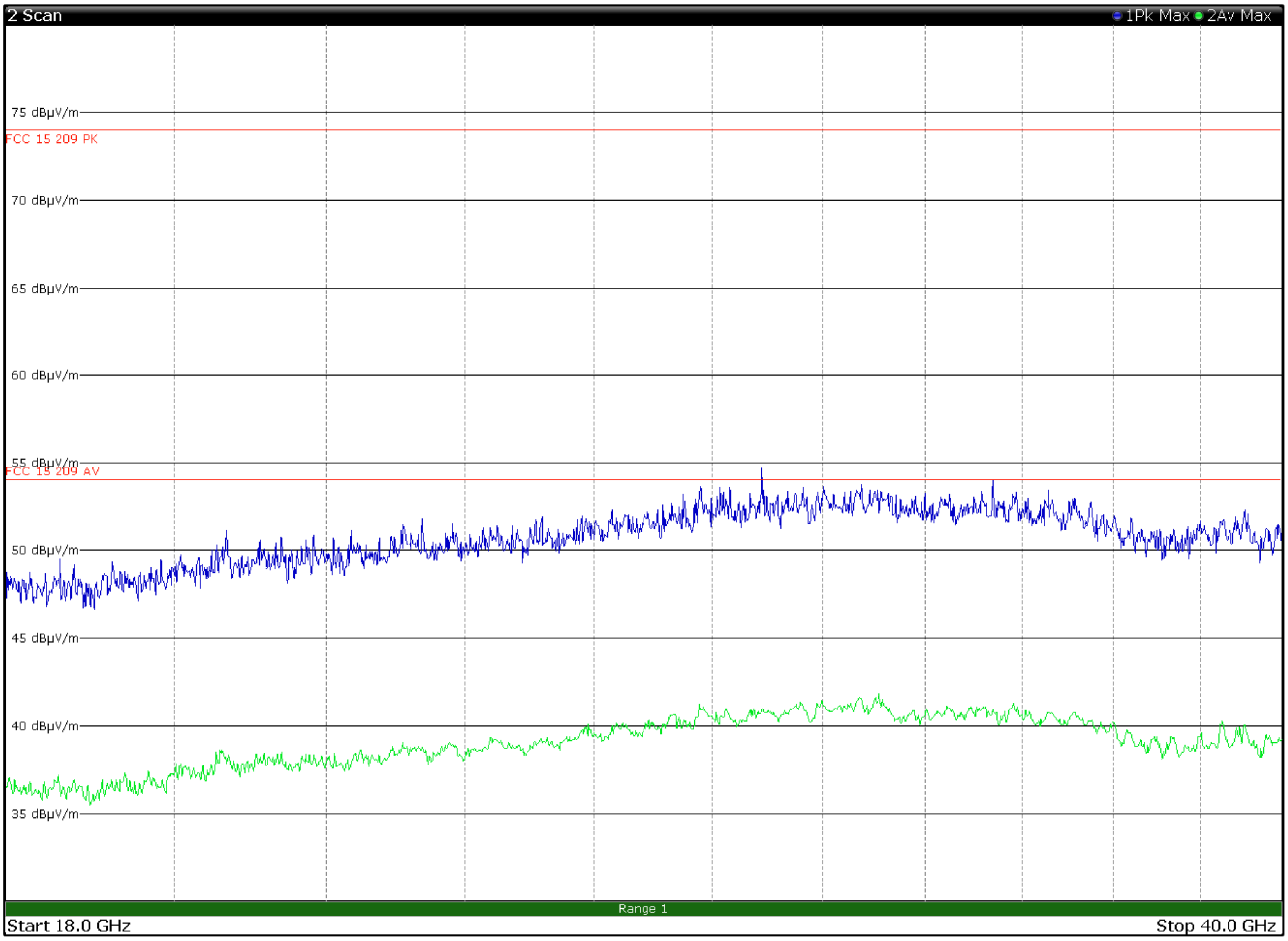


Figure 8.2-54: *Radiated spurious emissions 18 to 40 GHz, 5600 channel with antenna in vertical polarization*

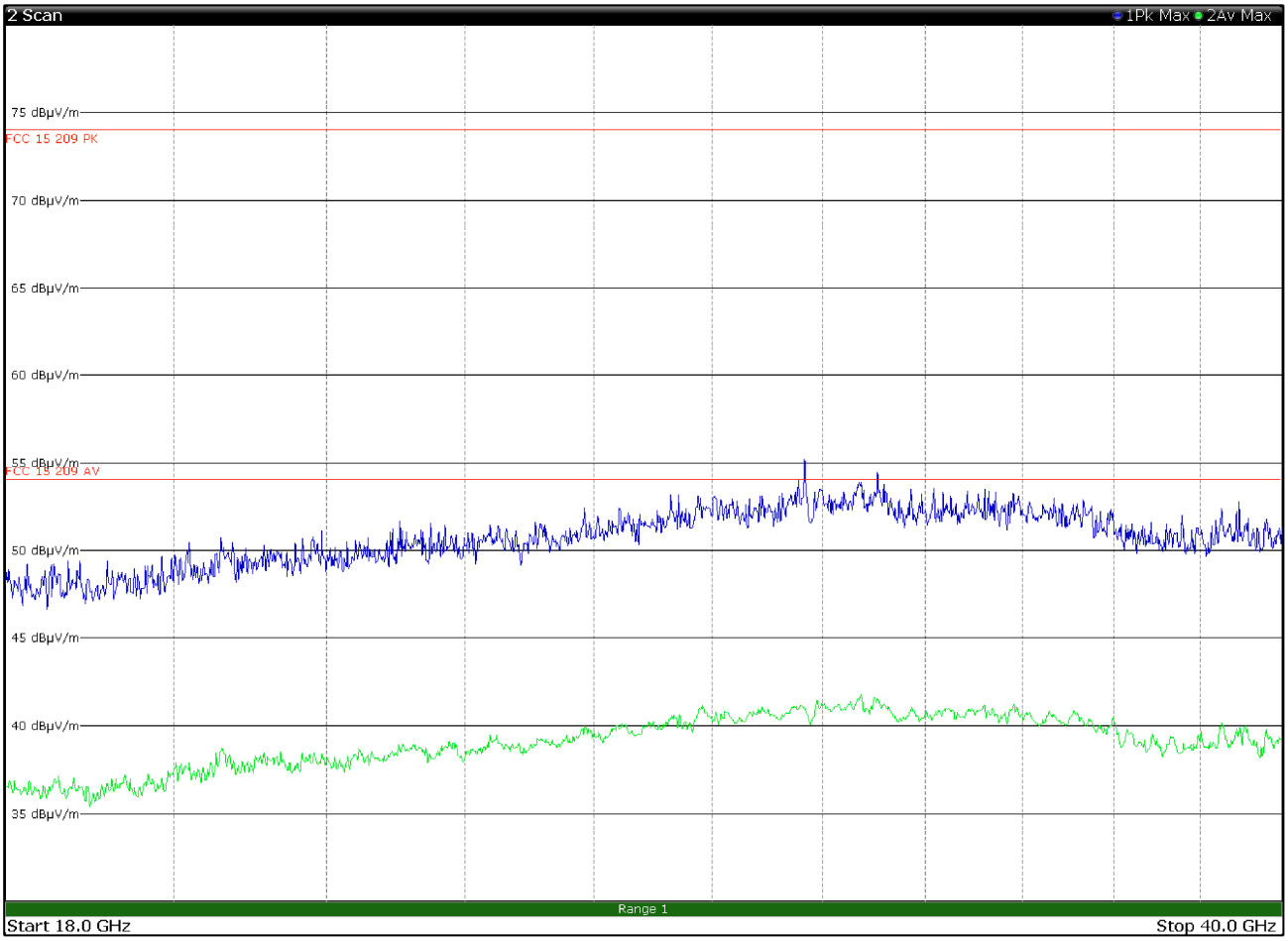


Figure 8.2-55: *Radiated spurious emissions 18 to 40 GHz, 5700 channel with antenna in horizontal polarization*

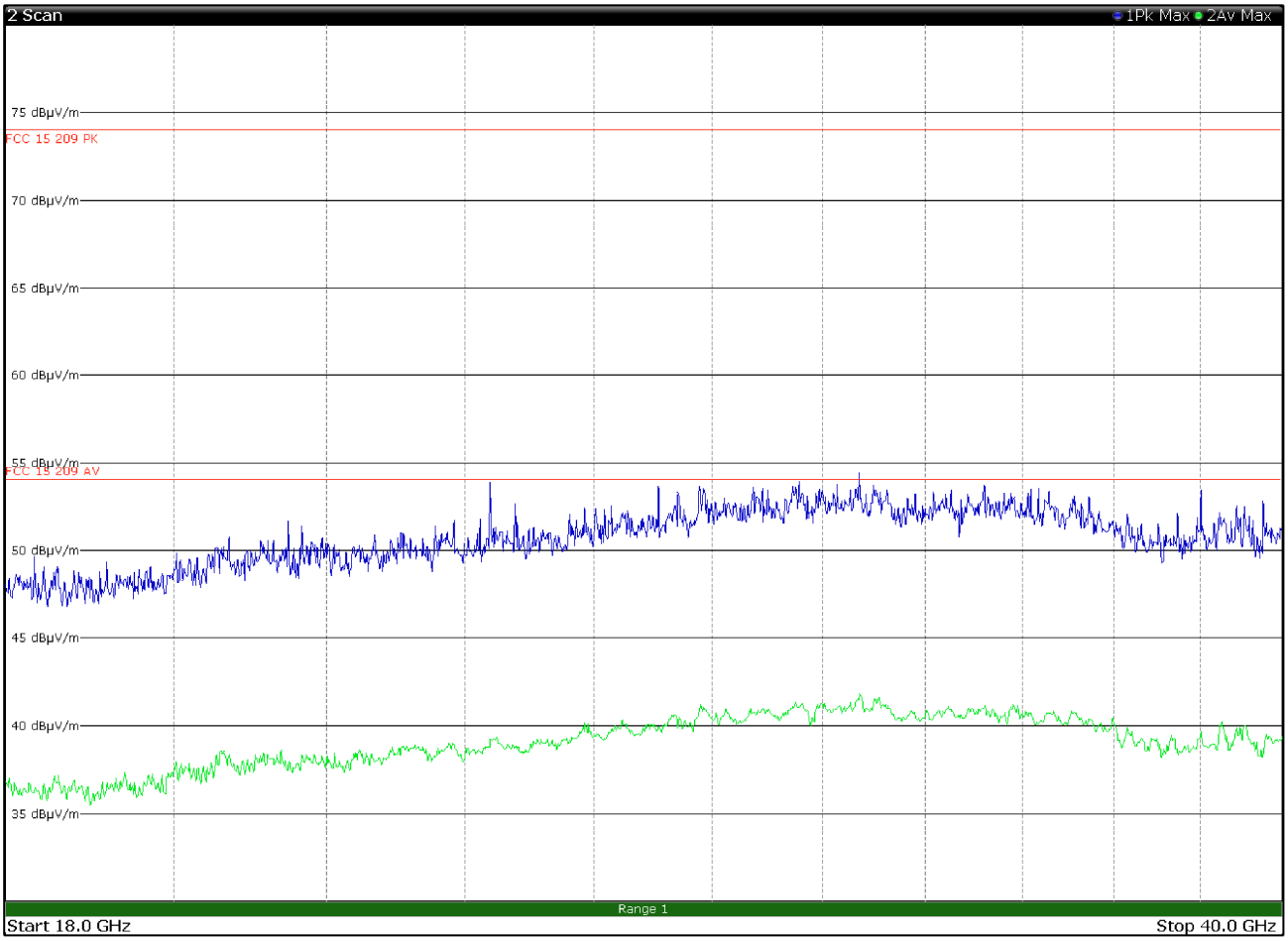


Figure 8.2-56: *Radiated spurious emissions 18 to 40 GHz, 5700 channel with antenna in vertical polarization*

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

8.3.1 Definitions and limits

FCC §15.407(6)(b):

Any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207

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

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

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

Table 8.3-1: *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.

8.3.2 Test summary

Test start date:	April 15, 2020

8.3.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

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

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

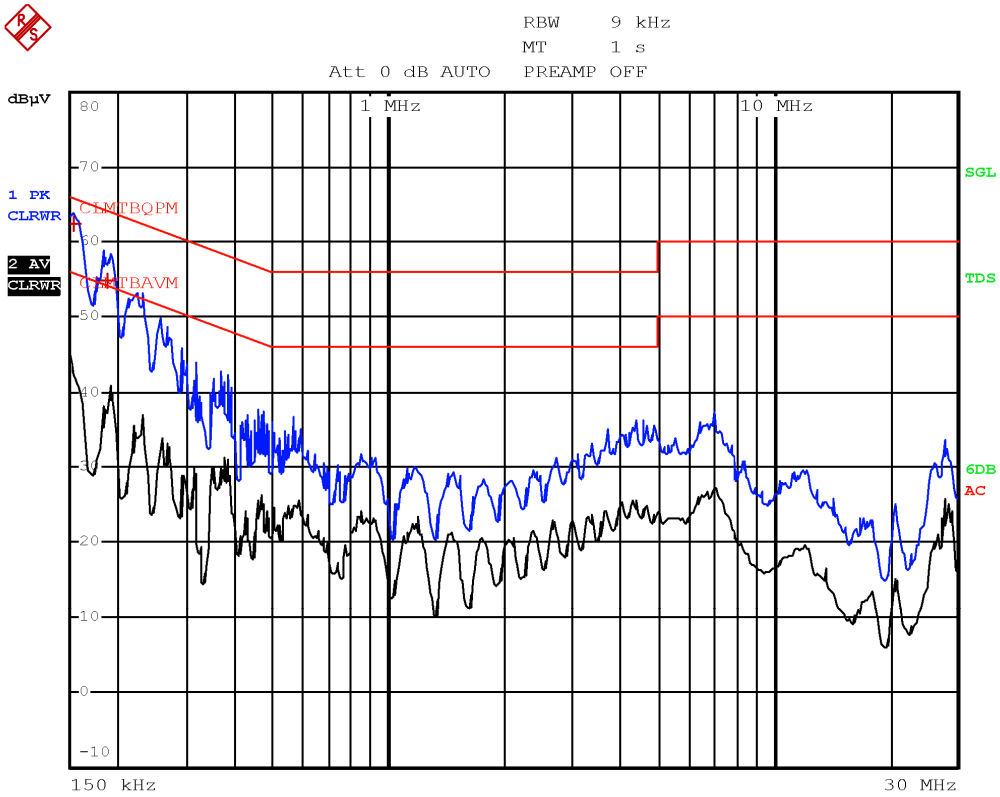
Receiver settings for preview measurements:

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

Receiver settings for final measurements:

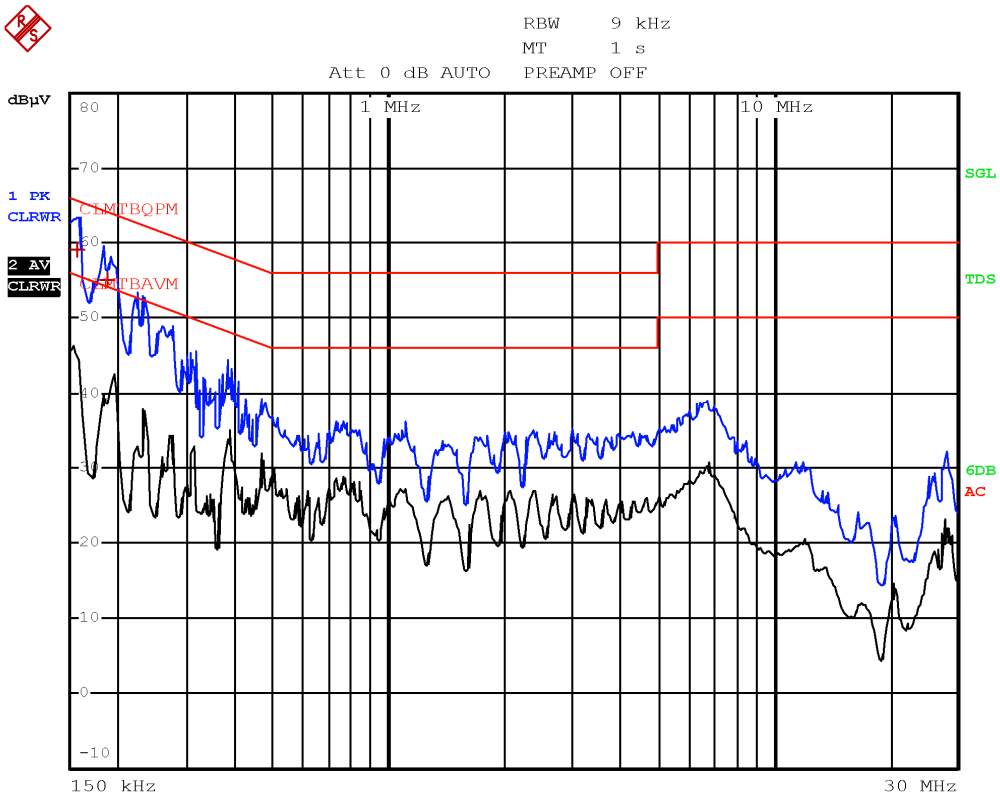
Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Quasi-Peak and Average
Trace mode	Max Hold
Measurement time	100 ms

8.3.4 Test data



Plot 8.3-1: *Conducted emissions on phase line*

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1540	62.0	65.8	-3.8	QP
0.1900	55.1	64.0	-8.9	QP

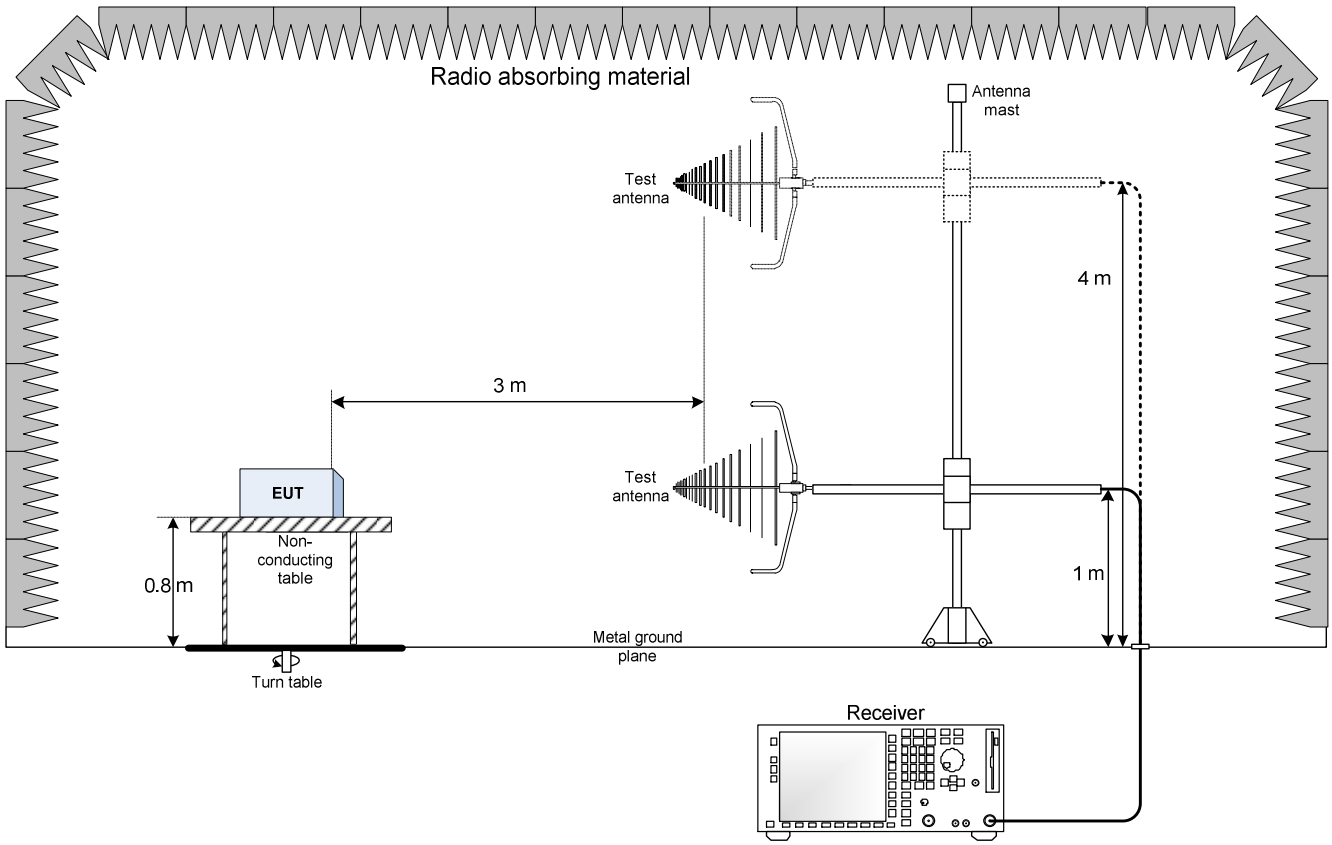


Plot 8.3-2: *Conducted emissions on neutral line*

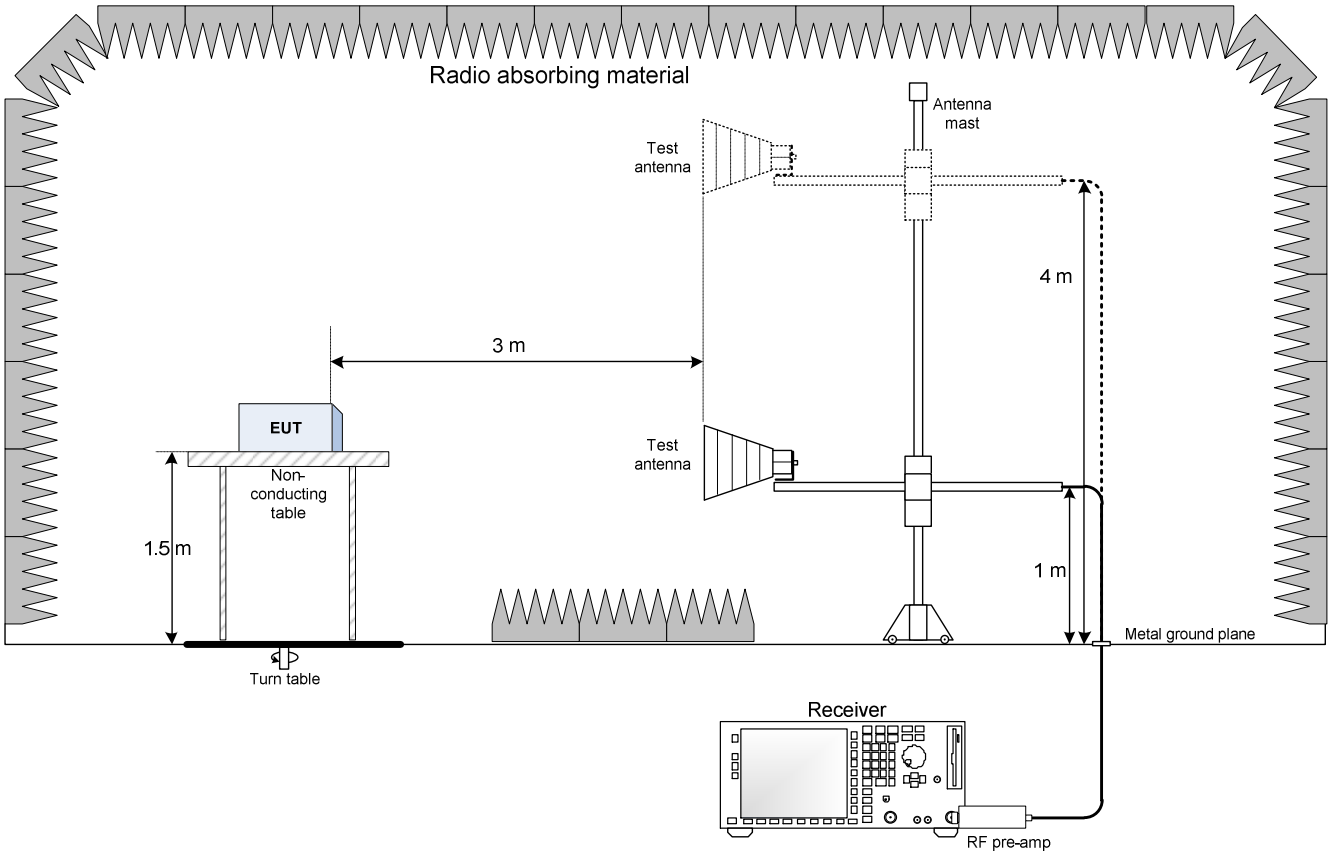
Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1580	59.0	65.6	-6.6	QP
0.1900	55.5	64.0	-8.5	QP

Section 9. Block diagrams of test set-ups

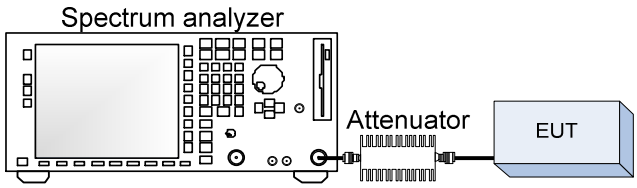
9.1 Radiated emissions set-up for frequencies below 1 GHz



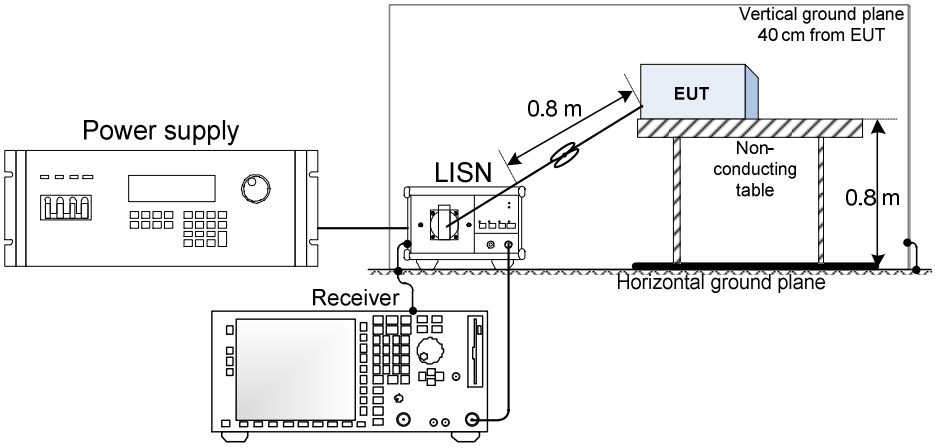
9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 Antenna port conducted measurements set-up

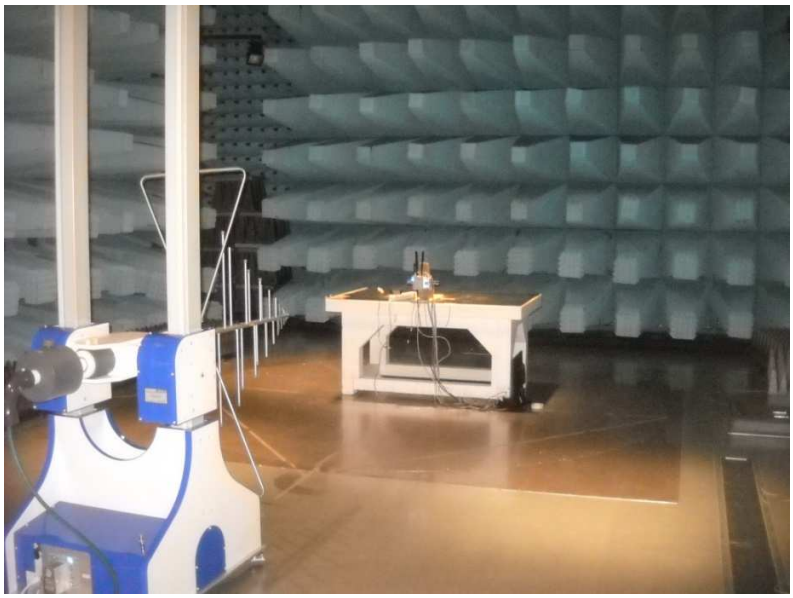


9.4 Power line Conducted emissions set-up



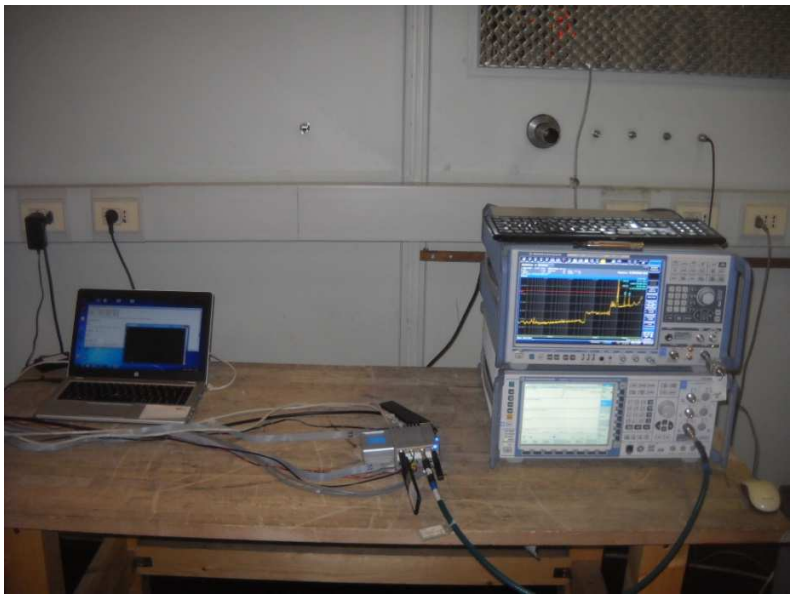
Section 10. Photos

10.1 Photos of the test set-up



Radiated emission below 1 GHz

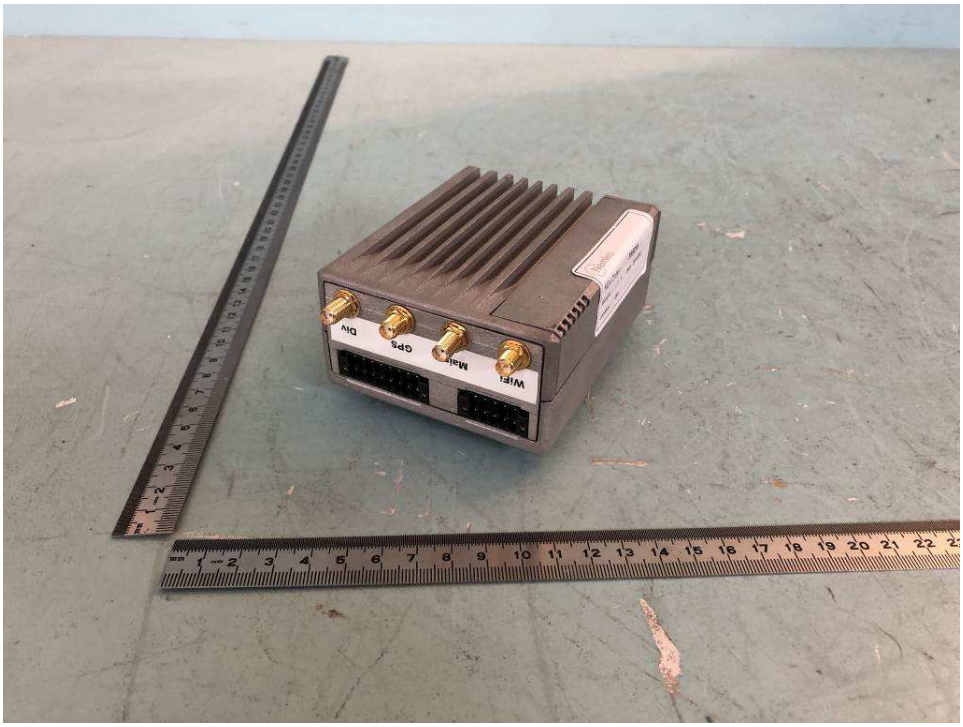
Radiated emission above 1 GHz

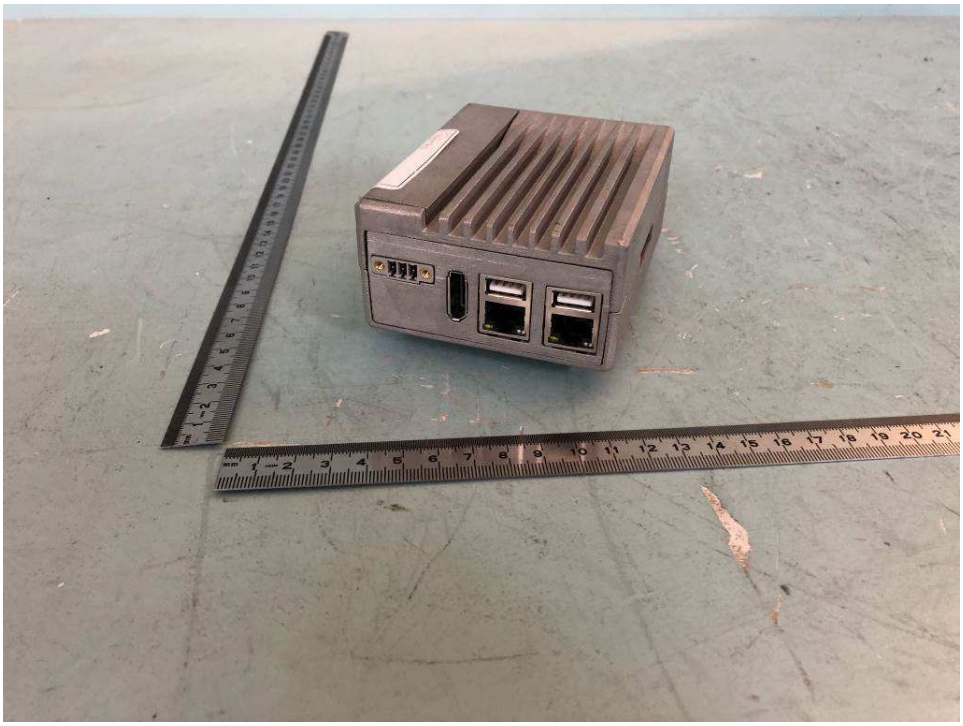


Conducted emission on the antenna port

Conducted emission on the AC Mains

10.2 Photos of the EUT





(End of report)