

Section 8
Test name
Specification

Testing data
FCC 15.407(b) and RSS-247 6.2.1.2 Undesirable (unwanted) emissions
FCC Part 15 Subpart E and RSS-247, Issue 2

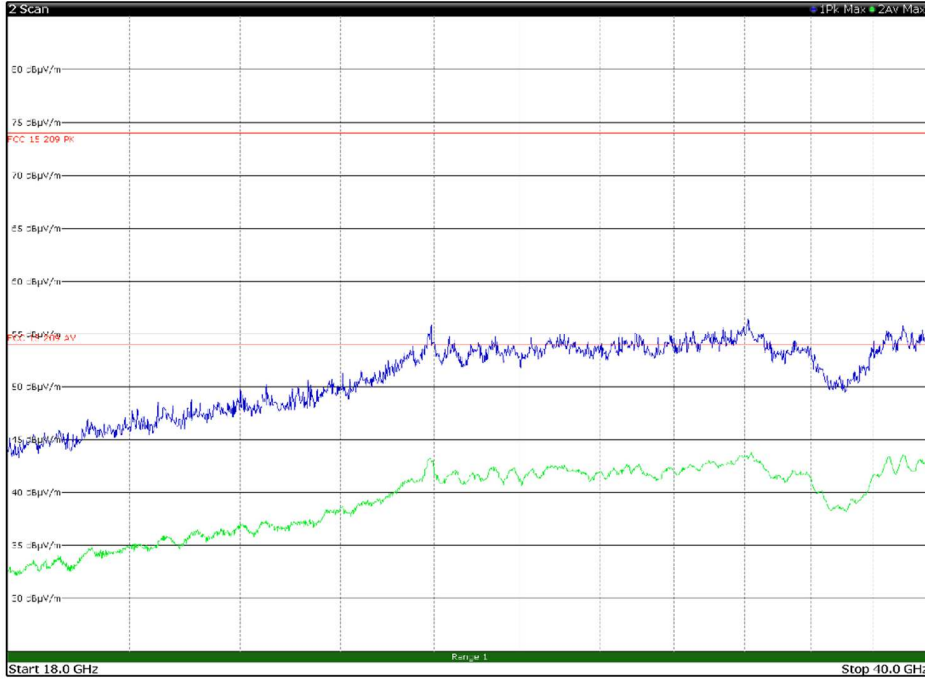


Figure 8.4-71: Radiated spurious emissions 18 to 40 GHz, high channel with antenna in horizontal polarization

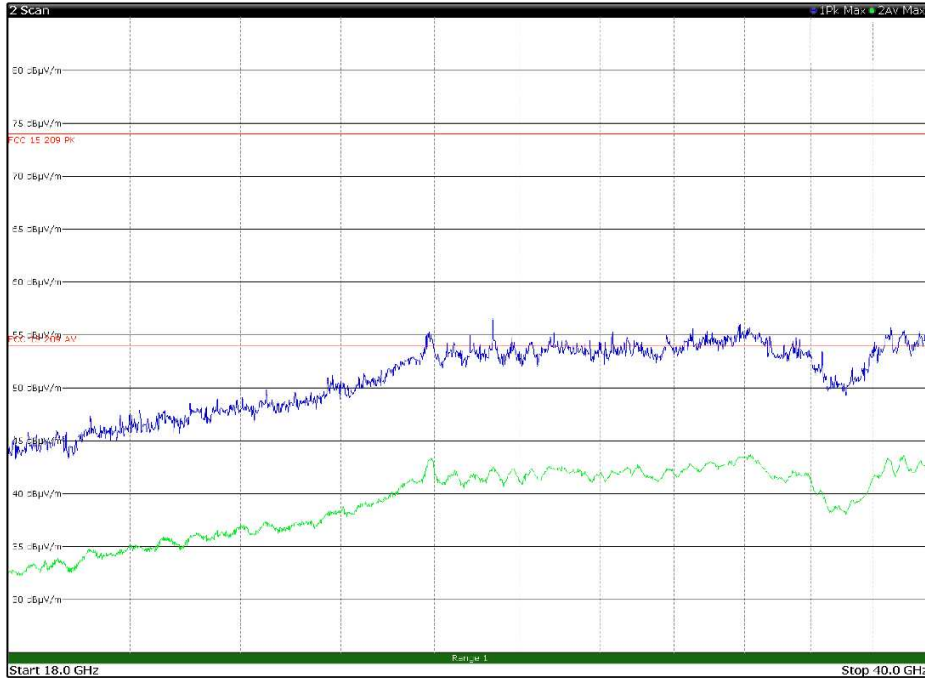


Figure 8.4-72: Radiated spurious emissions 18 to 40 GHz, high channel with antenna in vertical polarization

8.4.1 Test data for DYGATE-10-12-GS04 Antenna configuration 2

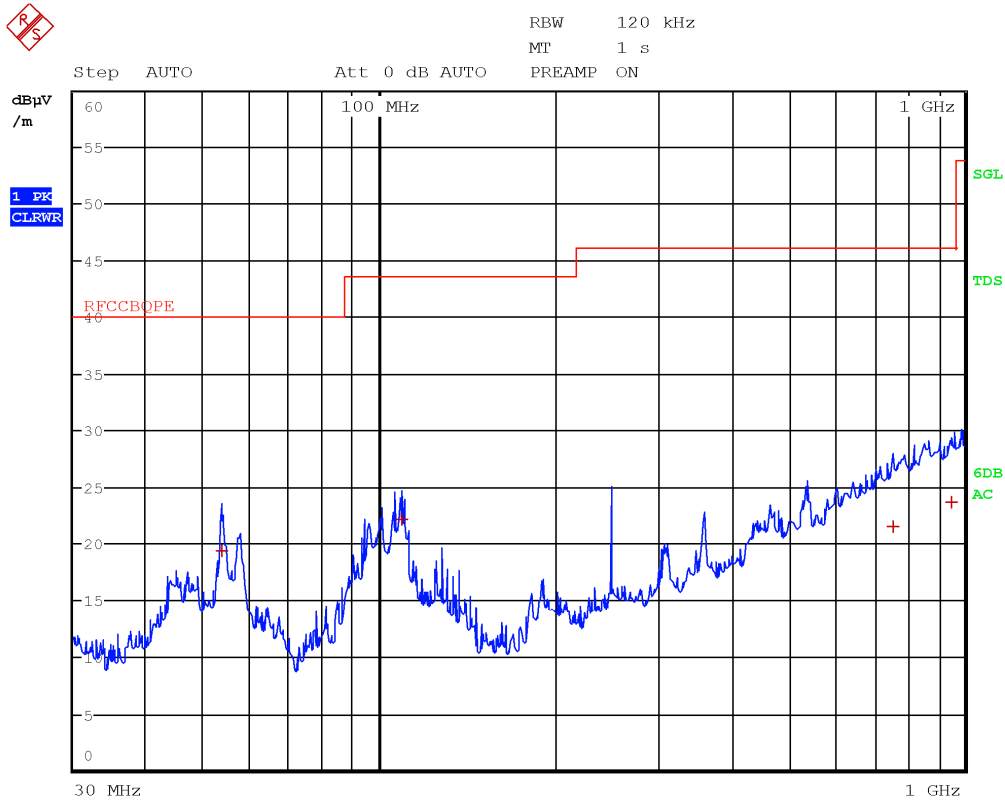


Figure 8.4-73: Radiated spurious emissions 30 to 1000 MHz, Low channel with antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
53.8400	19.4	40.0	-20.6	QP
109.0400	22.2	43.5	-21.3	QP
755.0000	21.5	46.0	-24.5	QP
949.3200	23.7	46.0	-22.3	QP

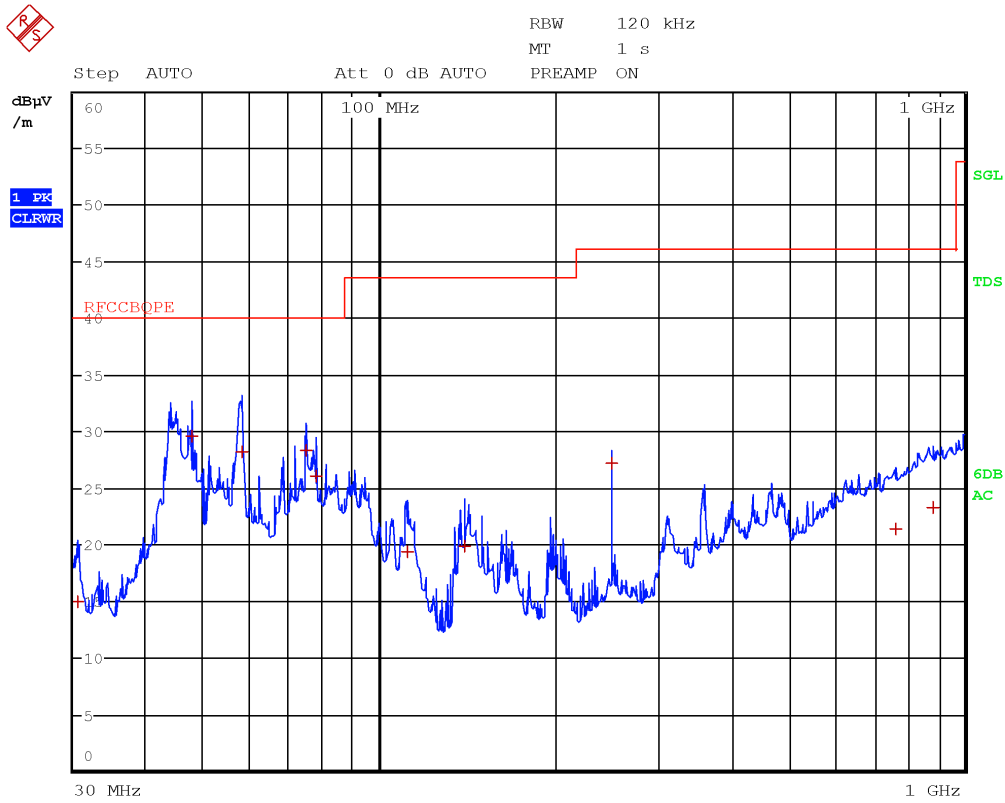


Figure 8.4-74: Radiated spurious emissions 30 to 1000 MHz, Low channel with antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.4800	15.0	40.0	-25.0	QP
47.8000	29.6	40.0	-10.4	QP
58.2000	28.2	40.0	-11.8	QP
74.8000	28.4	40.0	-11.6	QP
77.9200	26.1	40.0	-13.9	QP
111.5200	19.5	43.5	-24.0	QP
140.1200	19.9	43.5	-23.6	QP
250.0000	27.2	46.0	-18.8	QP
763.5200	21.4	46.0	-24.6	QP
884.6800	23.3	46.0	-22.7	QP

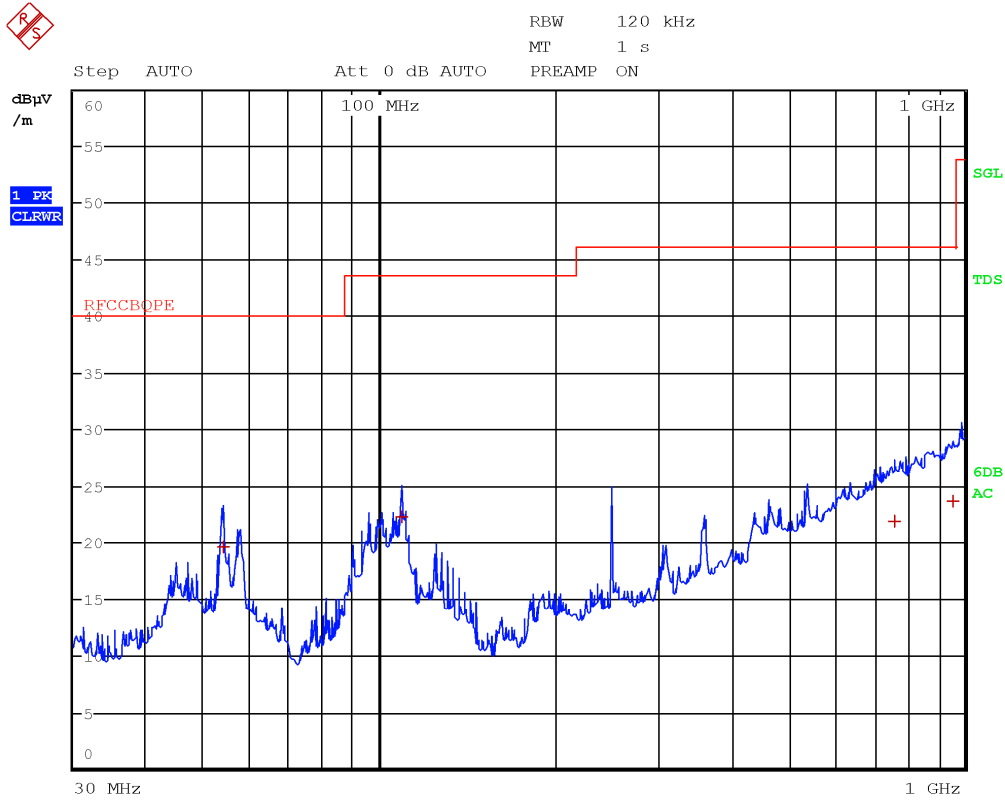


Figure 8.4-75: Radiated spurious emissions 30 to 1000 MHz, mid channel with antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
53.9600	19.6	40.0	-20.4	QP
109.0400	22.2	43.5	-21.3	QP
759.7600	21.9	46.0	-24.1	QP
955.2400	23.7	46.0	-22.3	QP

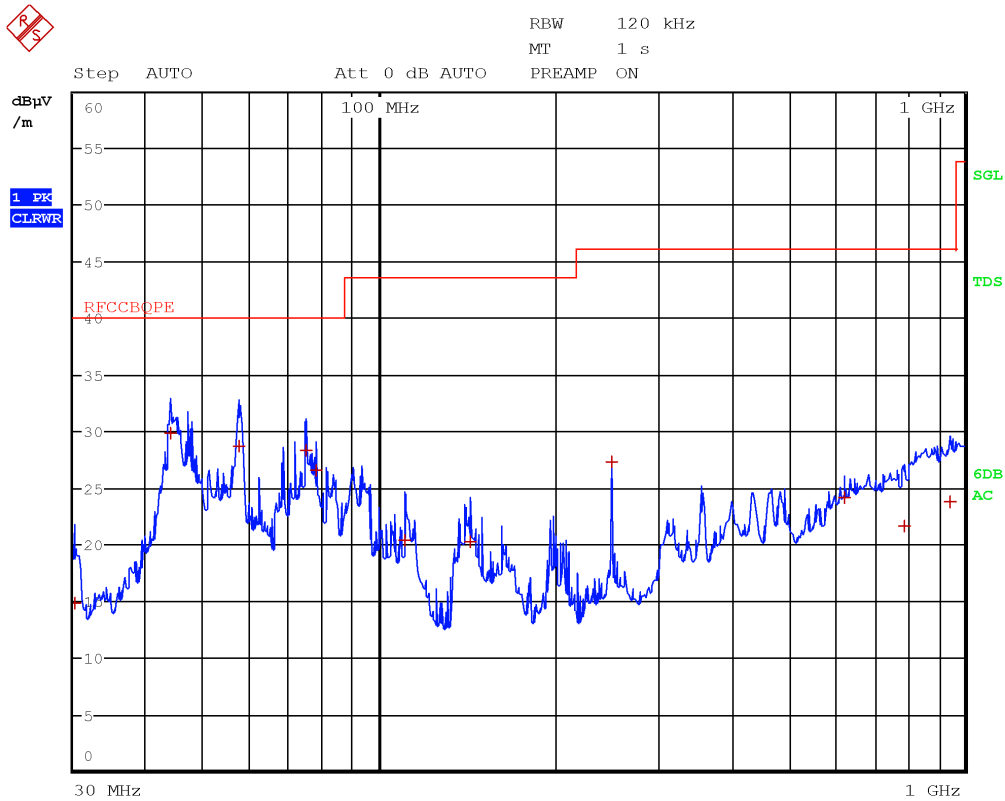


Figure 8.4-76: Radiated spurious emissions 30 to 1000 MHz, mid channel with antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.2000	14.8	40.0	-25.2	QP
43.8000	29.8	40.0	-10.2	QP
57.5600	28.7	40.0	-11.3	QP
74.8000	28.4	40.0	-11.6	QP
77.8800	26.6	40.0	-13.4	QP
110.7600	20.4	43.5	-23.1	QP
143.2800	20.3	43.5	-23.2	QP
250.0000	27.4	46.0	-18.6	QP
624.9600	24.2	46.0	-21.8	QP
789.4800	21.7	46.0	-24.3	QP
947.3200	23.9	46.0	-22.1	QP

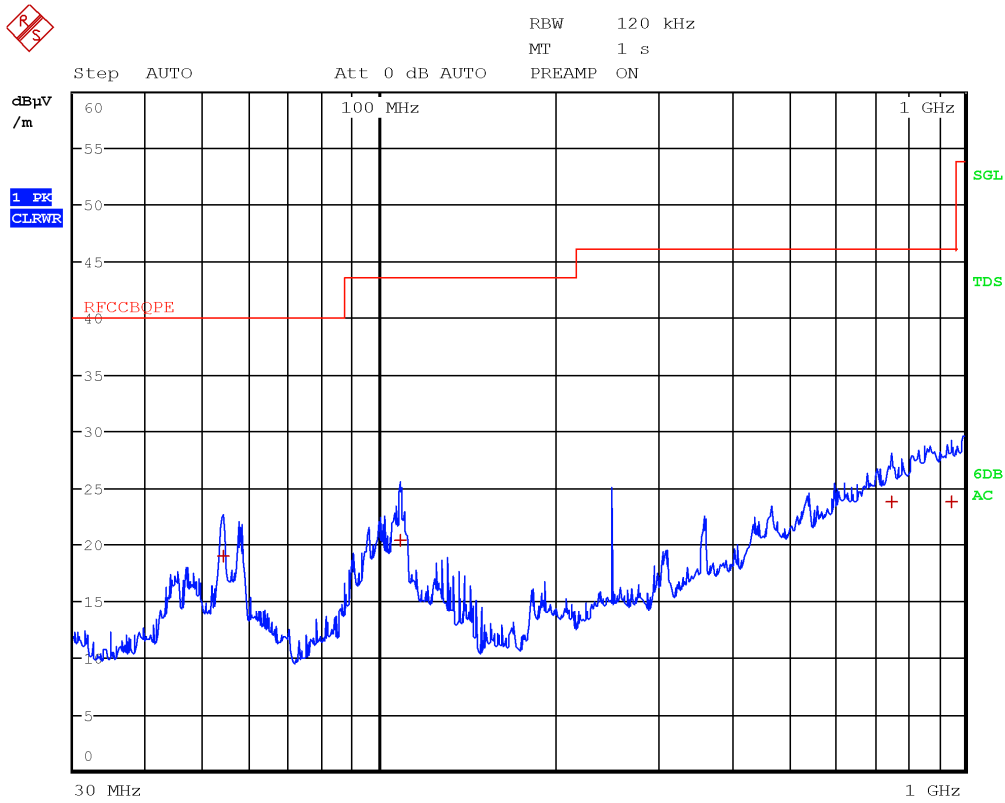


Figure 8.4-77: Radiated spurious emissions 30 to 1000 MHz, high channel with antenna in horizontal polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
54.1200	19.0	40.0	-21.0	QP
108.8400	20.4	43.5	-23.1	QP
749.9600	23.8	46.0	-22.2	QP
948.6400	23.8	46.0	-22.2	QP

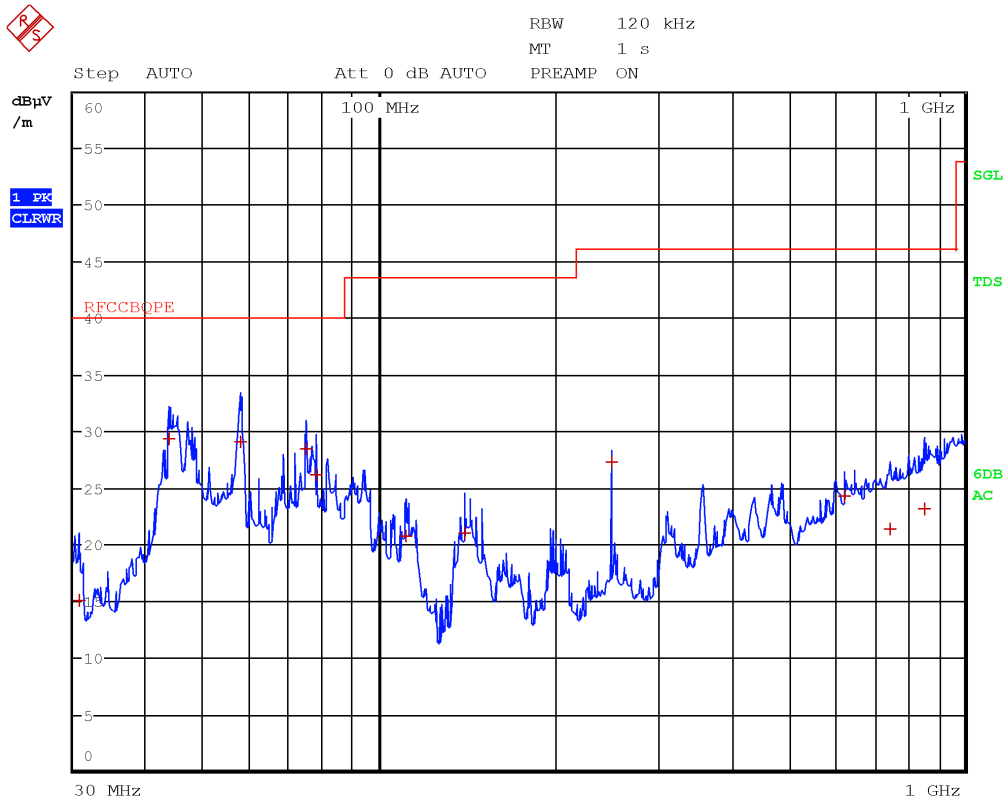


Figure 8.4-78: Radiated spurious emissions 30 to 1000 MHz, high channel with antenna in vertical polarization

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
30.5600	15.1	40.0	-24.9	QP
43.7600	29.3	40.0	-10.7	QP
57.9200	29.1	40.0	-10.9	QP
74.8000	28.4	40.0	-11.6	QP
77.8400	26.2	40.0	-13.8	QP
110.8000	20.8	43.5	-22.7	QP
140.1600	21.1	43.5	-22.4	QP
250.0000	27.4	46.0	-18.6	QP
624.9600	24.3	46.0	-21.7	QP
746.8400	21.4	46.0	-24.6	QP
853.6000	23.2	46.0	-22.8	QP

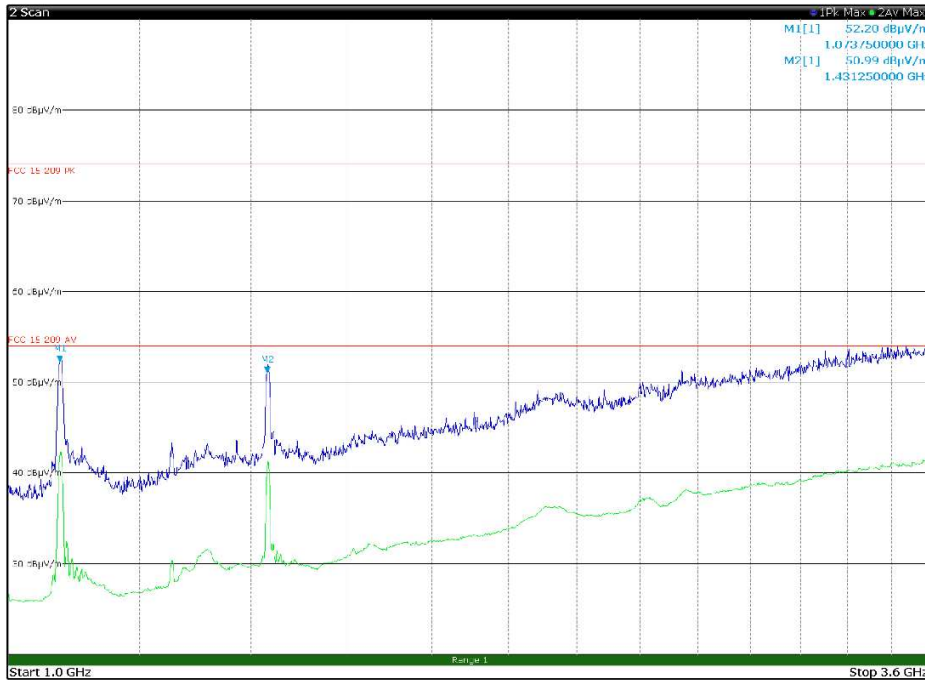


Figure 8.4-79: Radiated spurious emissions 1 to 3.6 GHz, Low channel with antenna in horizontal polarization

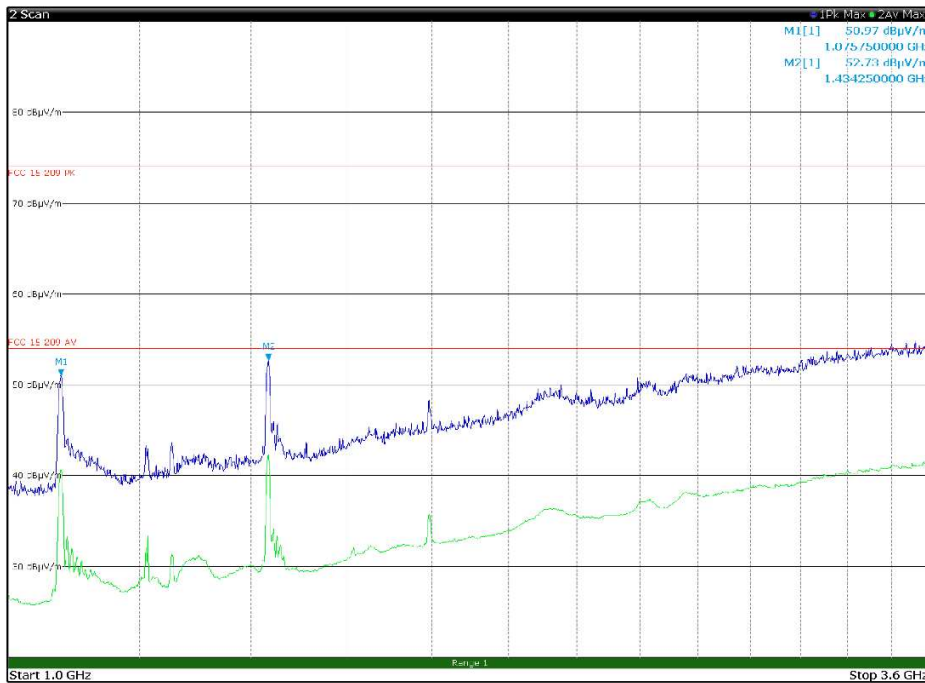


Figure 8.4-80: Radiated spurious emissions 1 to 3.6 GHz, Low channel with antenna in vertical polarization

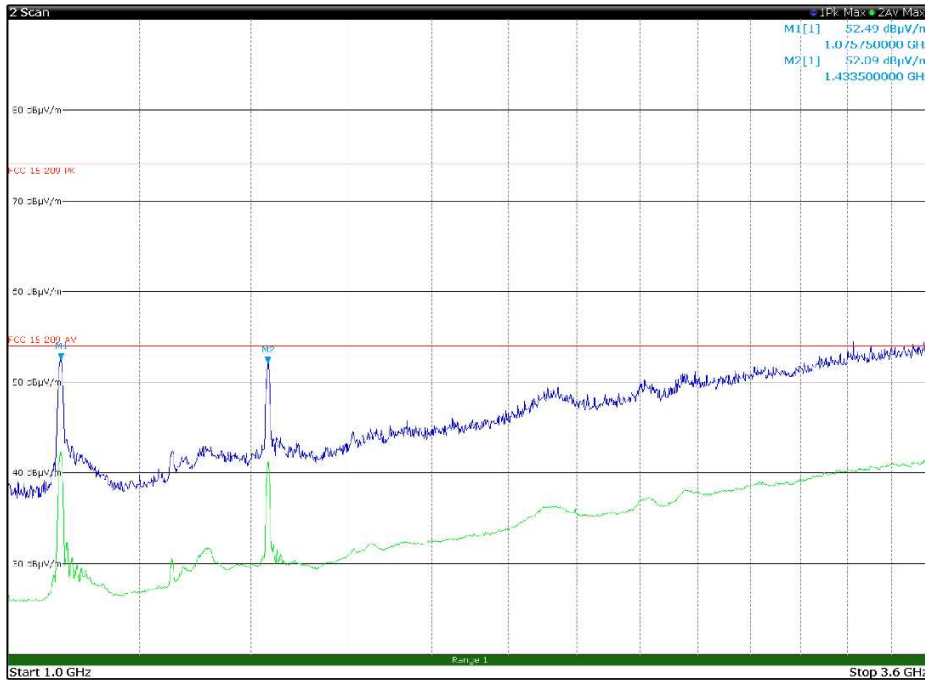


Figure 8.4-81: Radiated spurious emissions 1 to 3.6GHz, mid channel with antenna in horizontal polarization

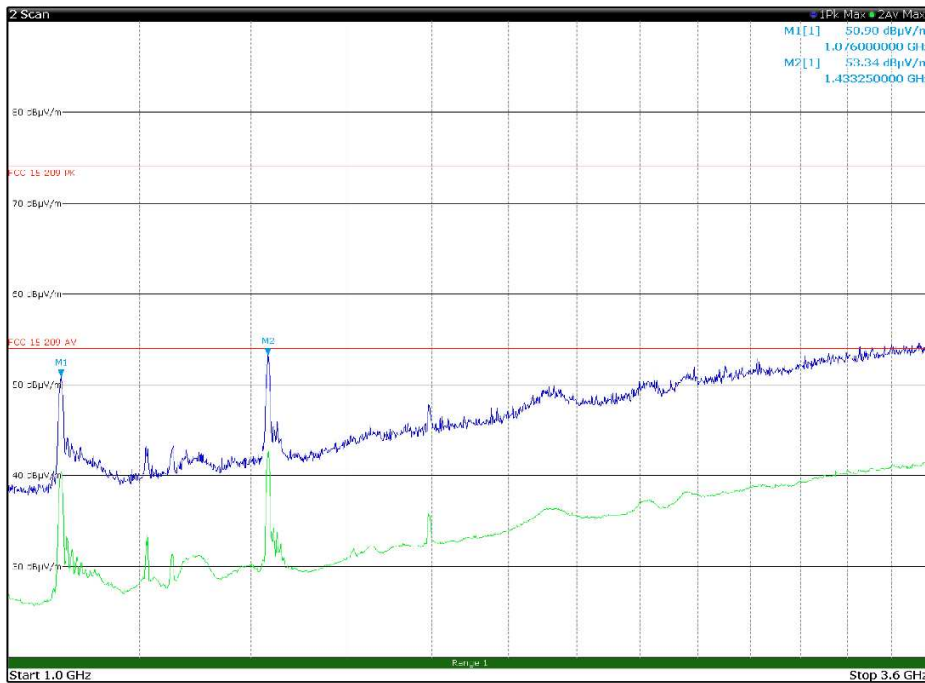


Figure 8.4-82: Radiated spurious emissions 1 to 3.6GHz, mid channel with antenna in vertical polarization

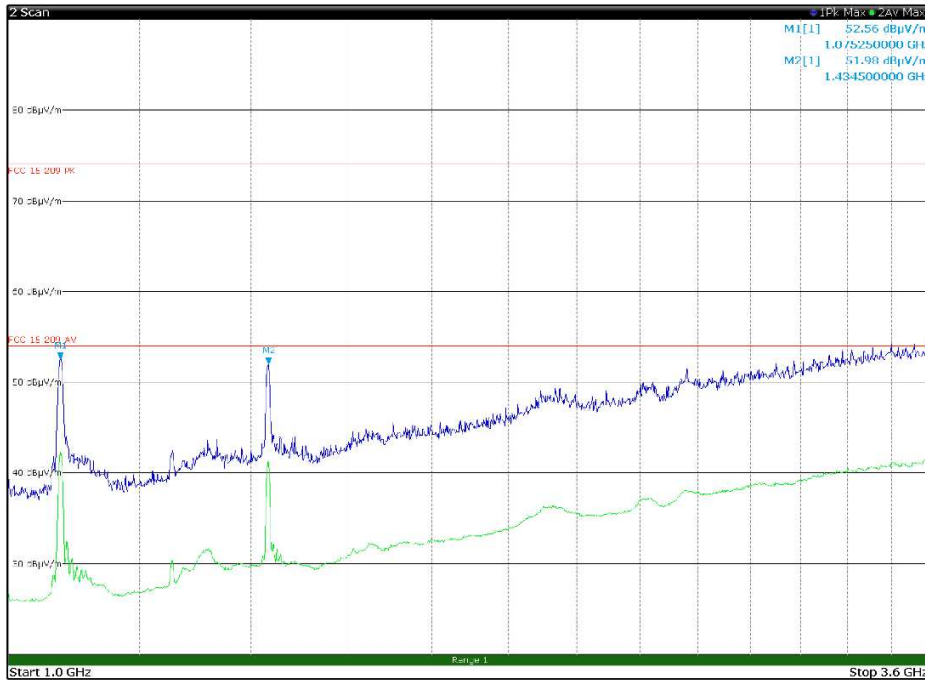


Figure 8.4-83: Radiated spurious emissions 1 to 3.6GHz, high channel with antenna in horizontal polarization

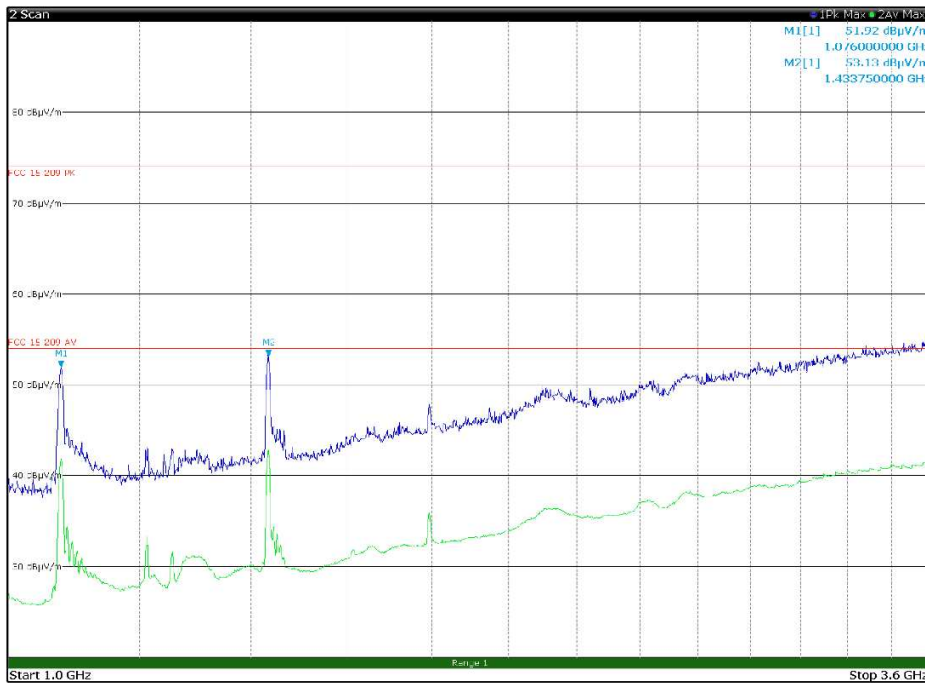


Figure 8.4-84: Radiated spurious emissions 1 to 3.6GHz,, high channel with antenna in vertical polarization

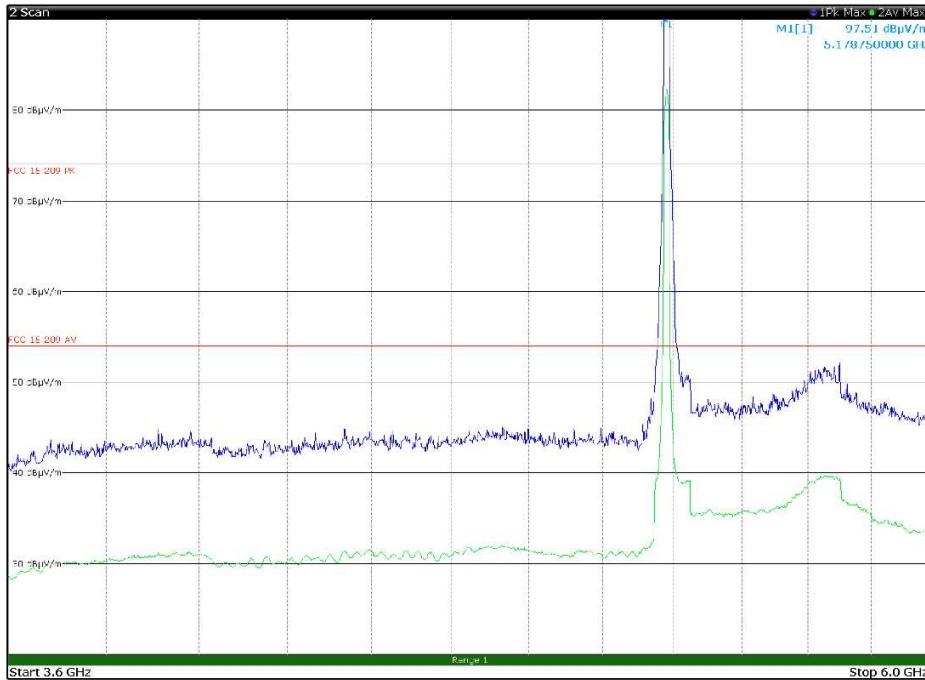


Figure 8.4-85: Radiated spurious emissions 3.6 to 6 GHz, Low channel with antenna in horizontal polarization

Limit exceeded by the carrier

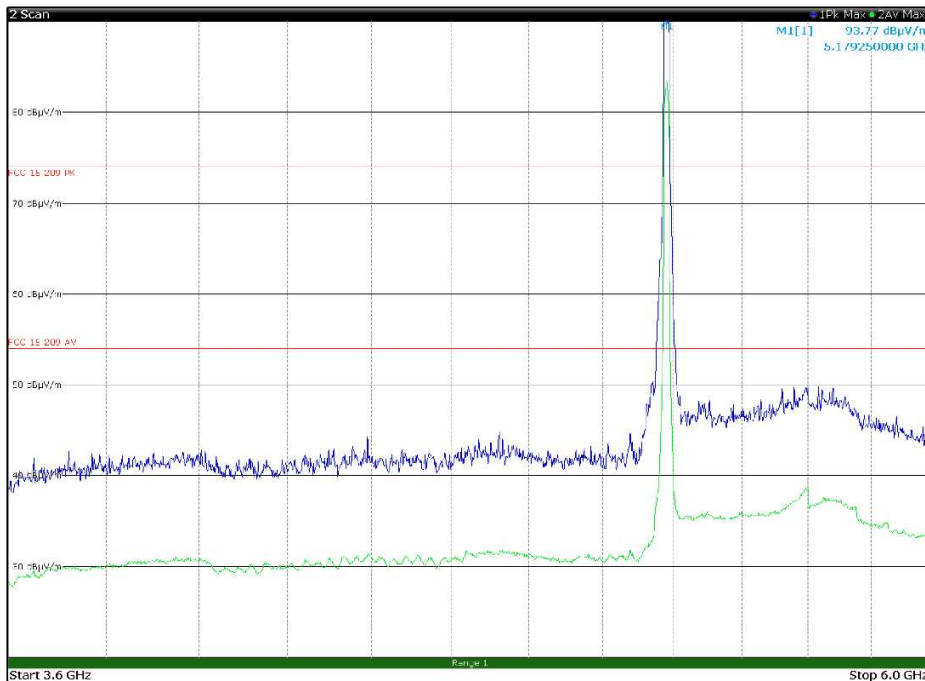


Figure 8.4-86: Radiated spurious emissions 3.6 to 6 GHz, Low channel with antenna in vertical polarization

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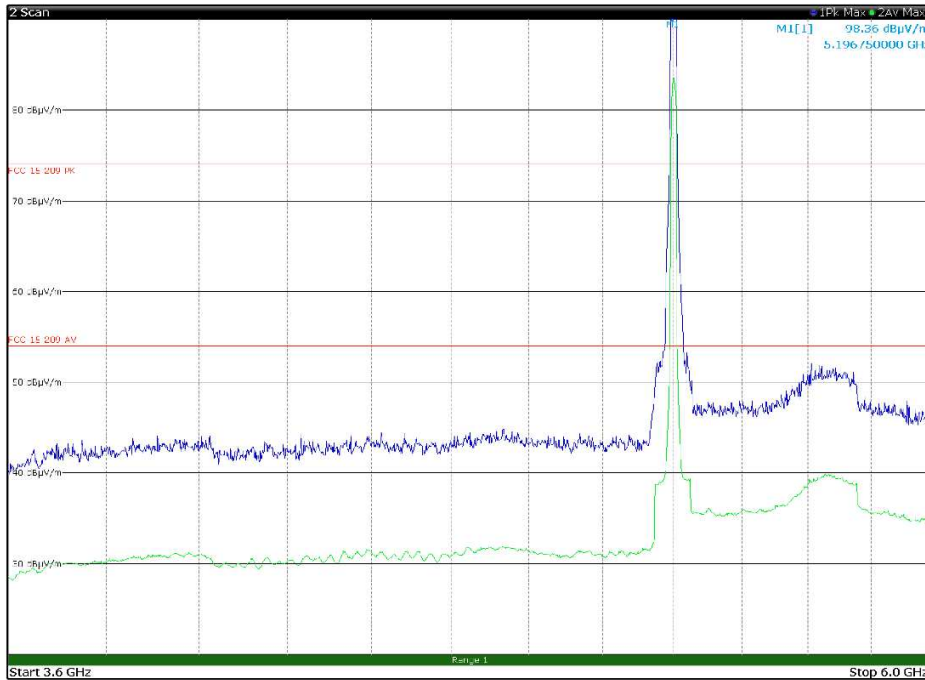


Figure 8.4-87: Radiated spurious emissions 3.6 to 6 GHz, mid channel with antenna in horizontal polarization

Limit exceeded by the carrier

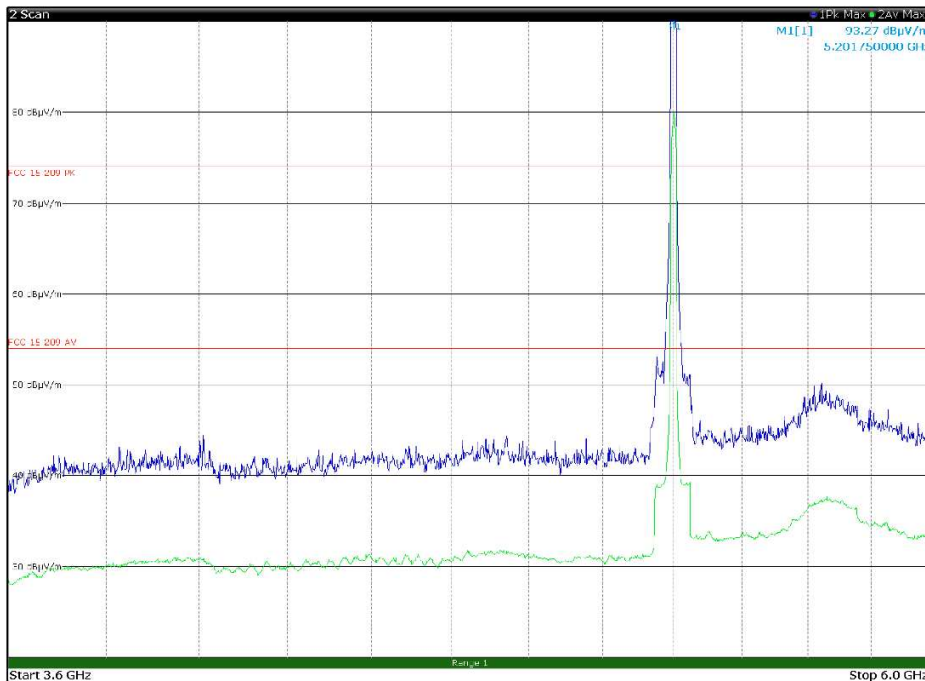


Figure 8.4-88: Radiated spurious emissions 3.6 to 6 GHz, mid channel with antenna in vertical polarization

Limit exceeded by the carrier

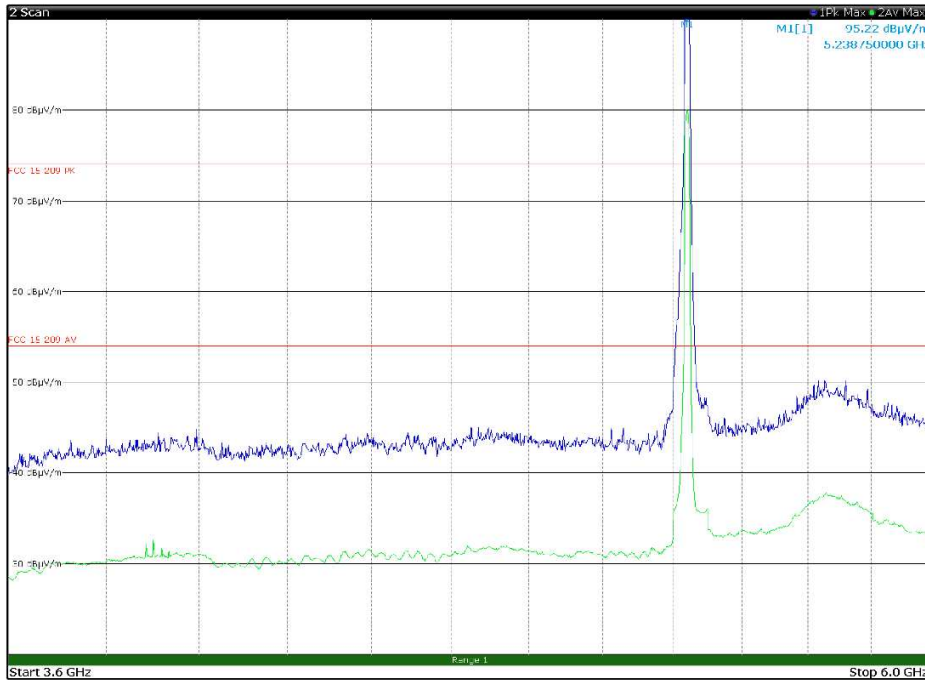


Figure 8.4-89: Radiated spurious emissions 3.6 to 6 GHz, high channel with antenna in horizontal polarization

Limit exceeded by the carrier

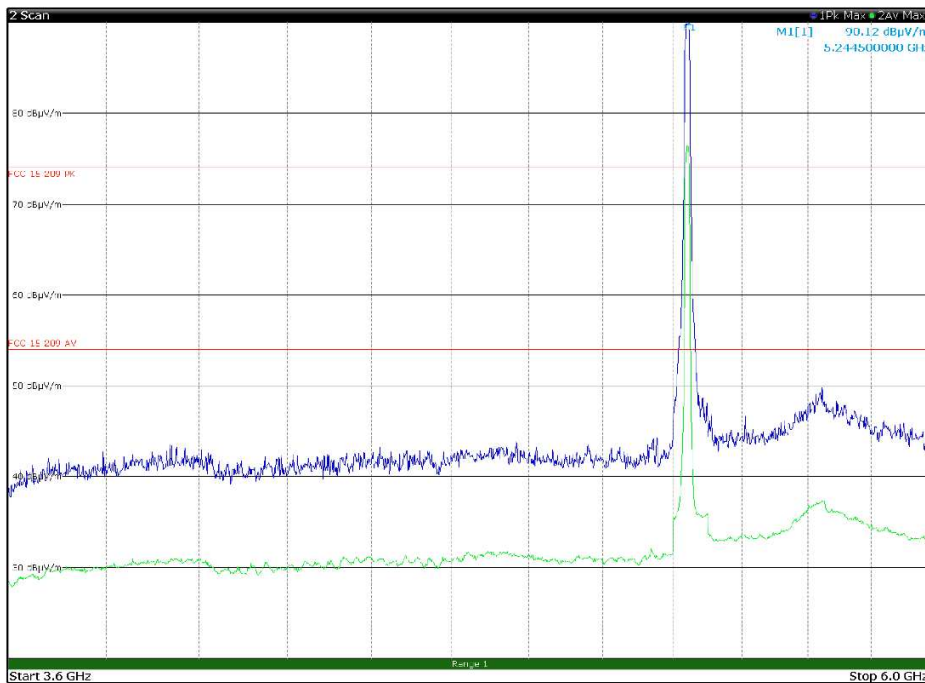


Figure 8.4-90: Radiated spurious emissions 3.6 to 6 GHz, high channel with antenna in vertical polarization

Limit exceeded by the carrier

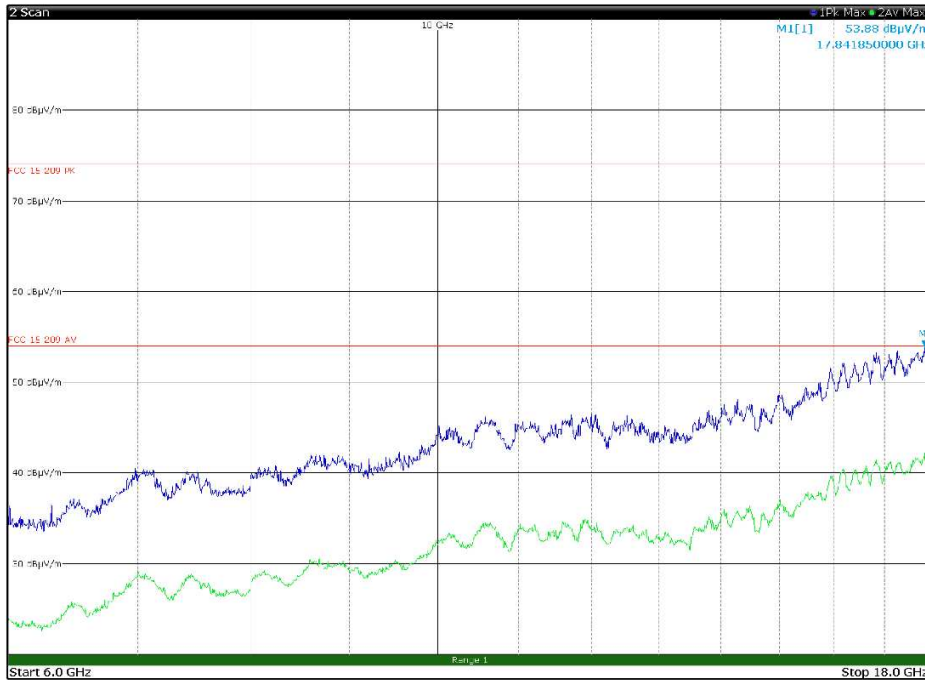


Figure 8.4-91: Radiated spurious emissions 6 to 18 GHz, Low channel with antenna in horizontal polarization

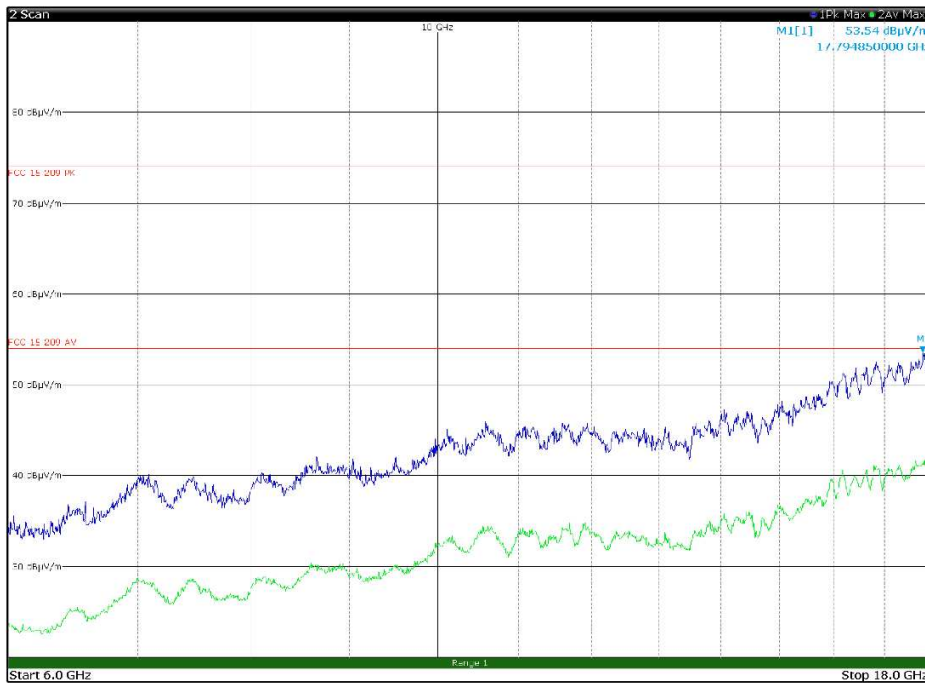


Figure 8.4-92: Radiated spurious emissions 6 to 18 GHz, Low channel with antenna in vertical polarization

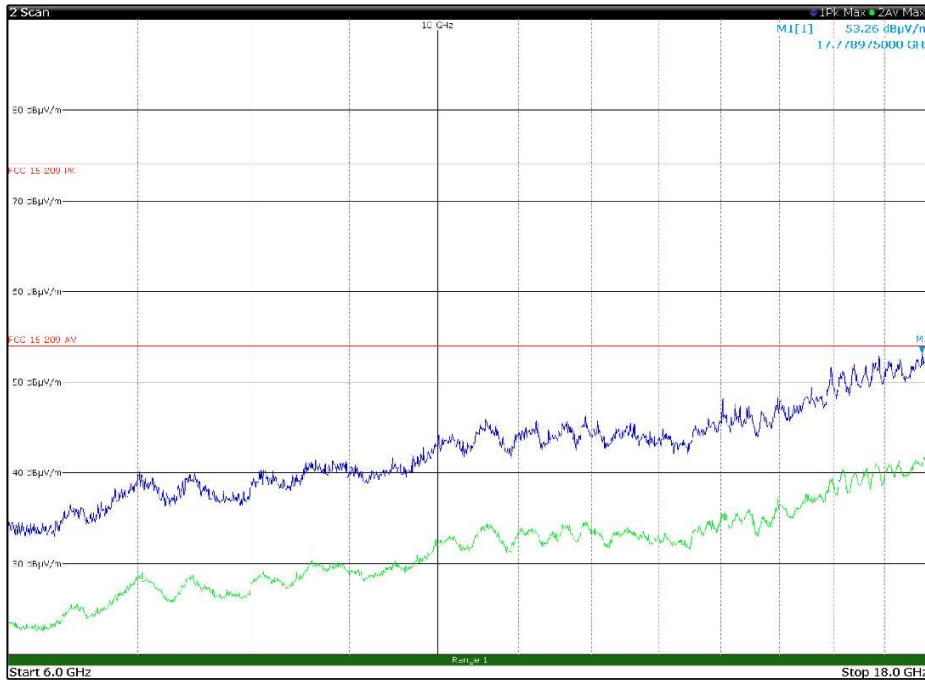


Figure 8.4-93: Radiated spurious emissions 6 to 18 GHz, mid channel with antenna in horizontal polarization

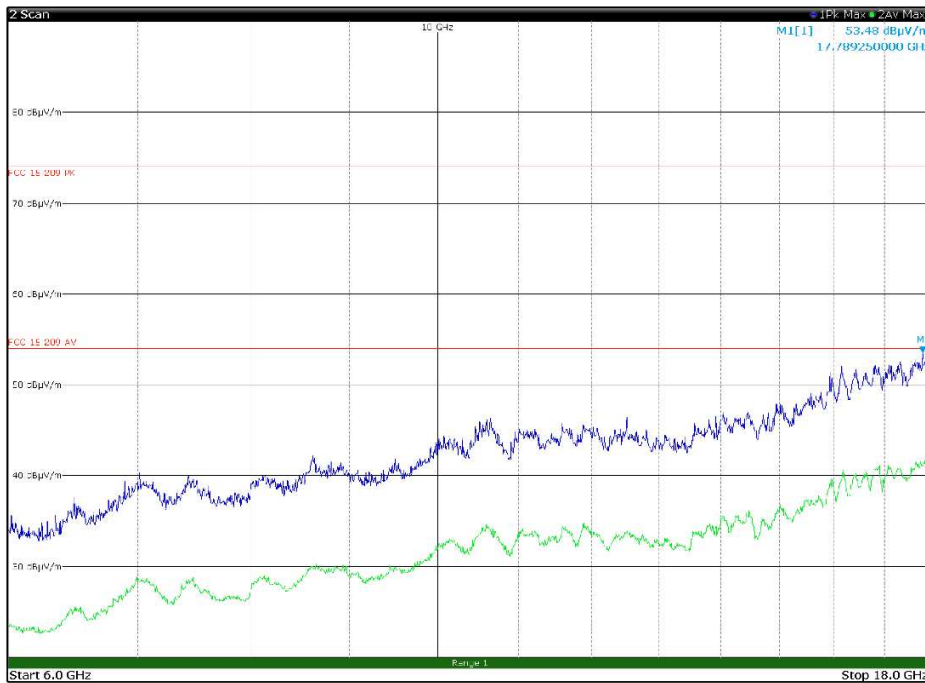


Figure 8.4-94: Radiated spurious emissions 6 to 18 GHz, mid channel with antenna in vertical polarization

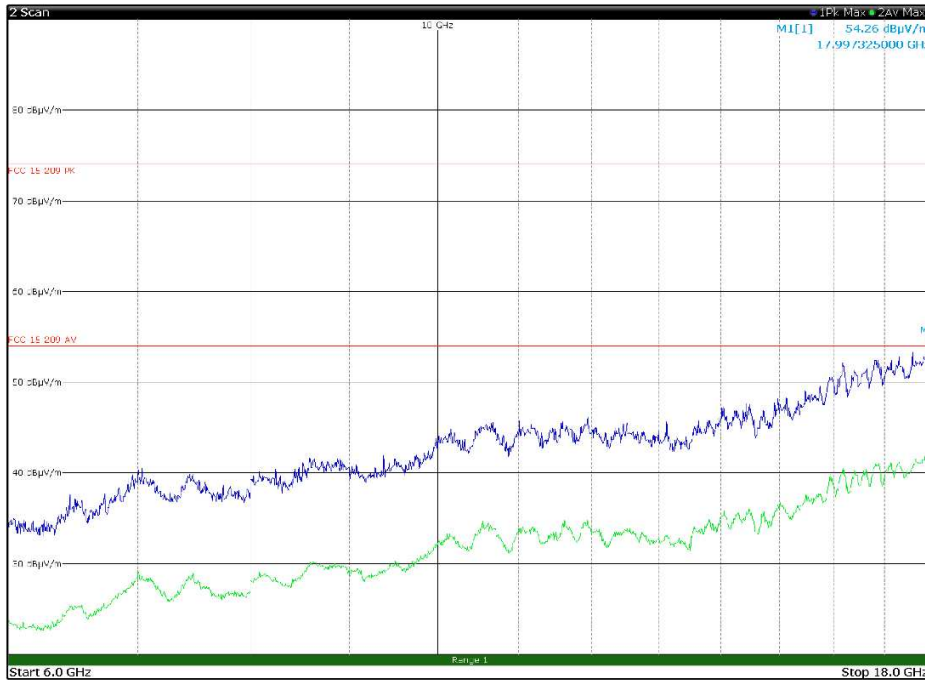


Figure 8.4-95: Radiated spurious emissions 6 to 18 GHz, high channel with antenna in horizontal polarization

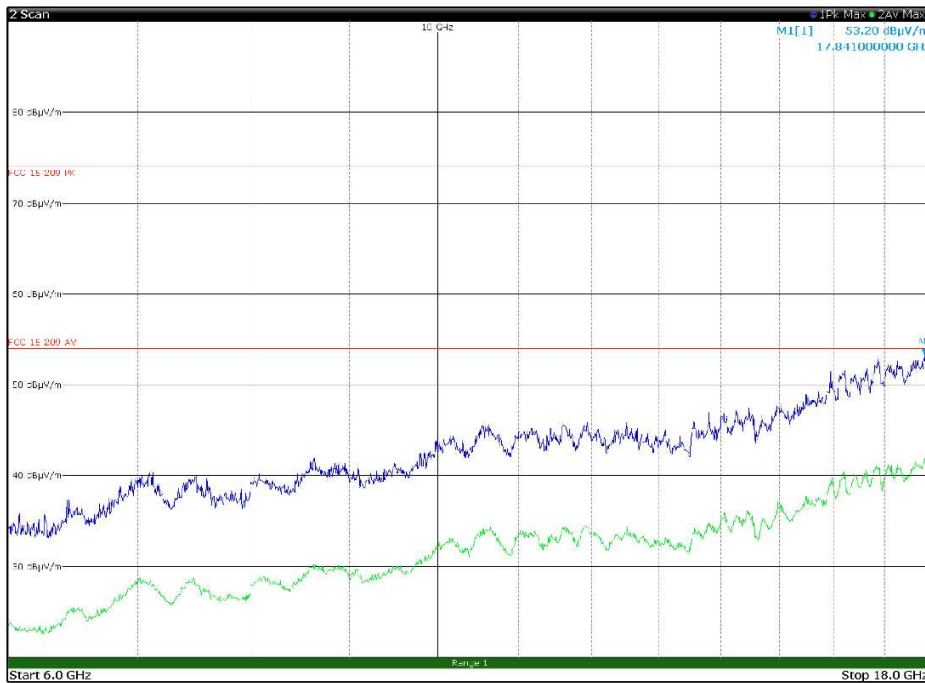


Figure 8.4-96: Radiated spurious emissions 6 to 18 GHz, high channel with antenna in vertical polarization

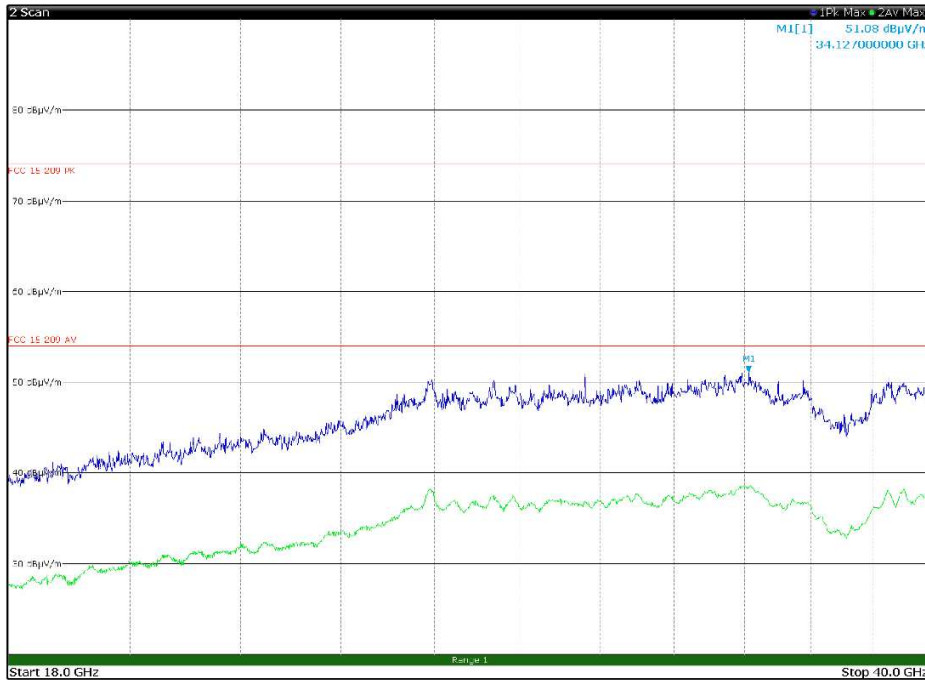


Figure 8.4-97: Radiated spurious emissions 18 to 40 GHz, Low channel with antenna in horizontal polarization

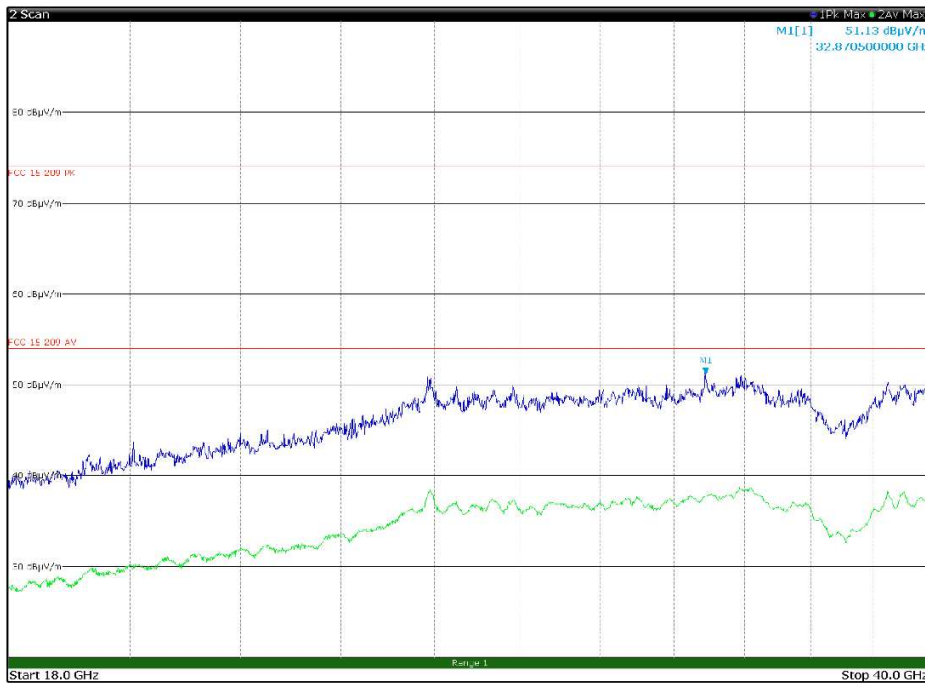


Figure 8.4-98: Radiated spurious emissions 18 to 40 GHz, Low channel with antenna in vertical polarization

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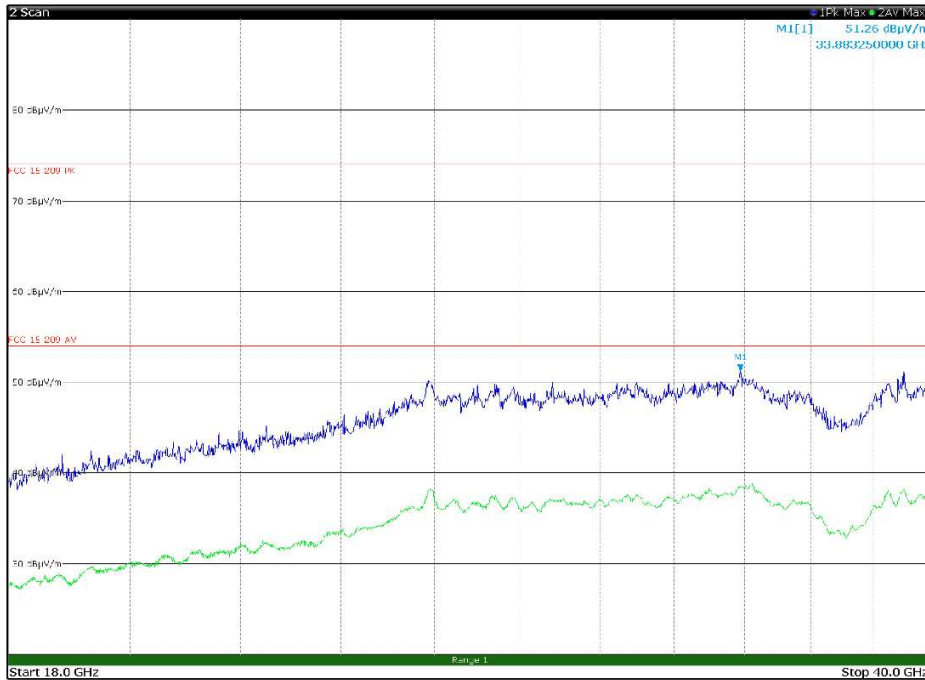


Figure 8.4-99: Radiated spurious emissions 18 to 40 GHz, mid channel with antenna in horizontal polarization

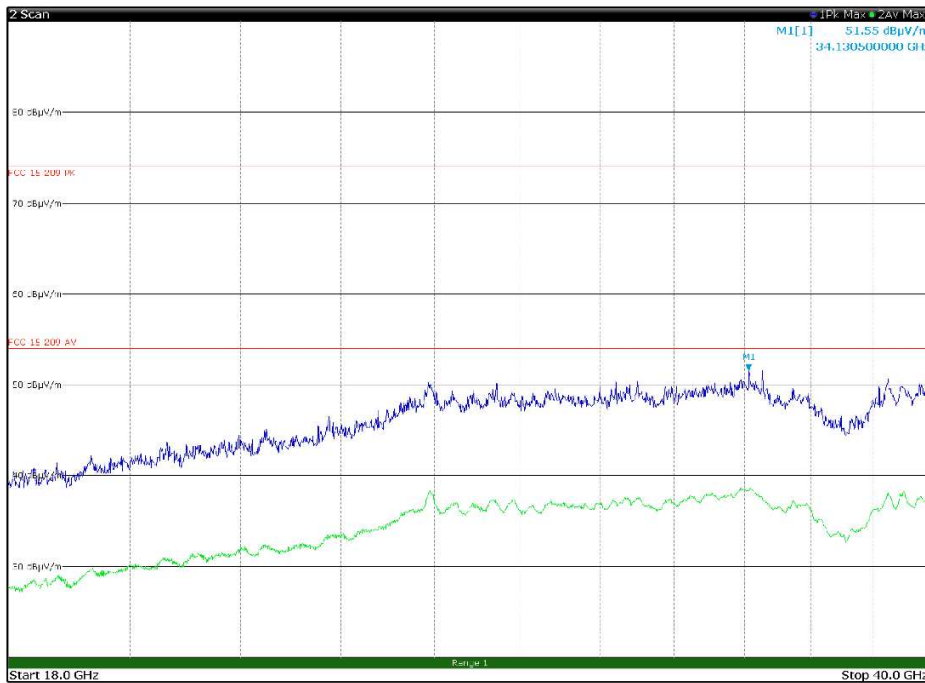


Figure 8.4-100: Radiated spurious emissions 18 to 40 GHz, mid channel with antenna in vertical polarization

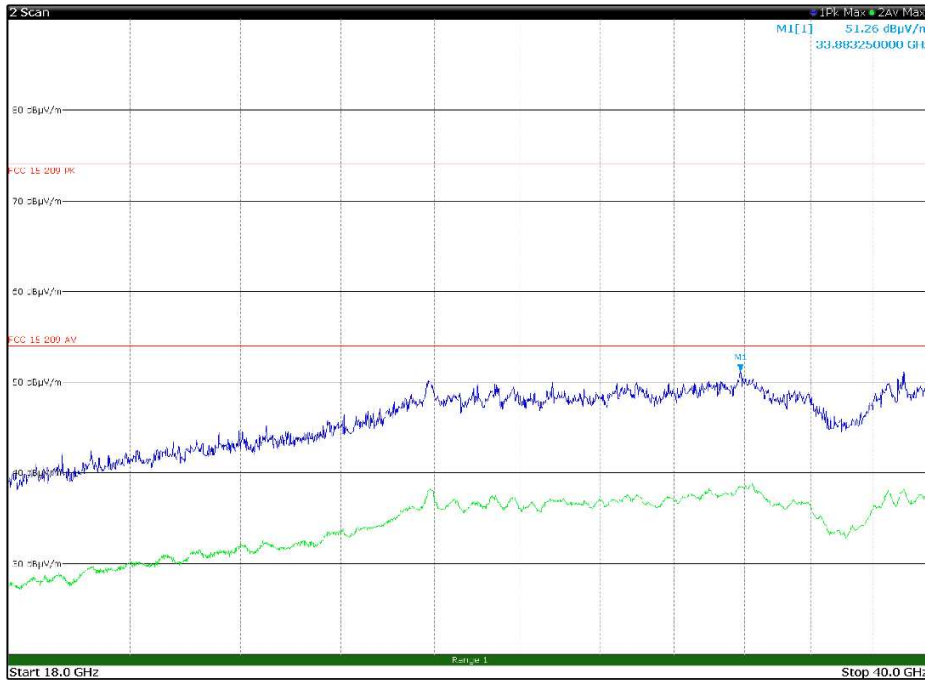


Figure 8.4-101: Radiated spurious emissions 18 to 40 GHz, high channel with antenna in horizontal polarization

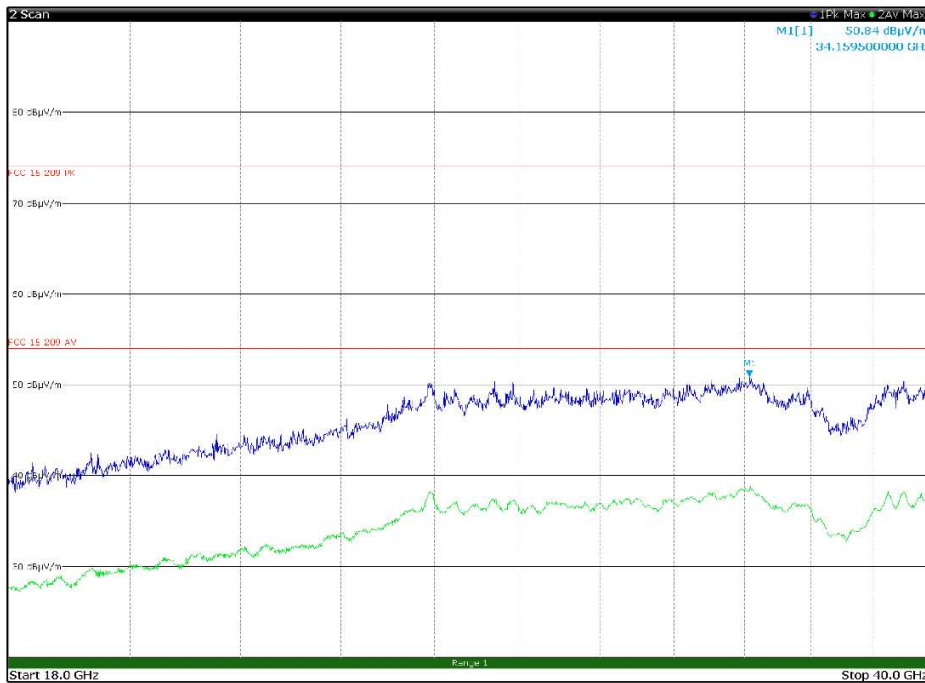


Figure 8.4-102: Radiated spurious emissions 18 to 40 GHz, high channel with antenna in vertical polarization



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

8.5.1 Definitions and limits

FCC §15.407(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 μ H/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 8.5-1: Conducted emissions limit

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

Note: * - The level decreases linearly with the logarithm of the frequency.

** - A linear average detector is required.

8.5.2 Test summary

Test start date: January 19, 2021

Section 8 Testing data
Test name FCC 15.407(b)(6) and RSS-Gen 8.8 AC power line conducted emissions limits
Specification FCC Part 15 Subpart E and RSS-Gen, Issue 4



8.5.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

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

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

Receiver settings for preview measurements:

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

Receiver settings for final measurements:

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

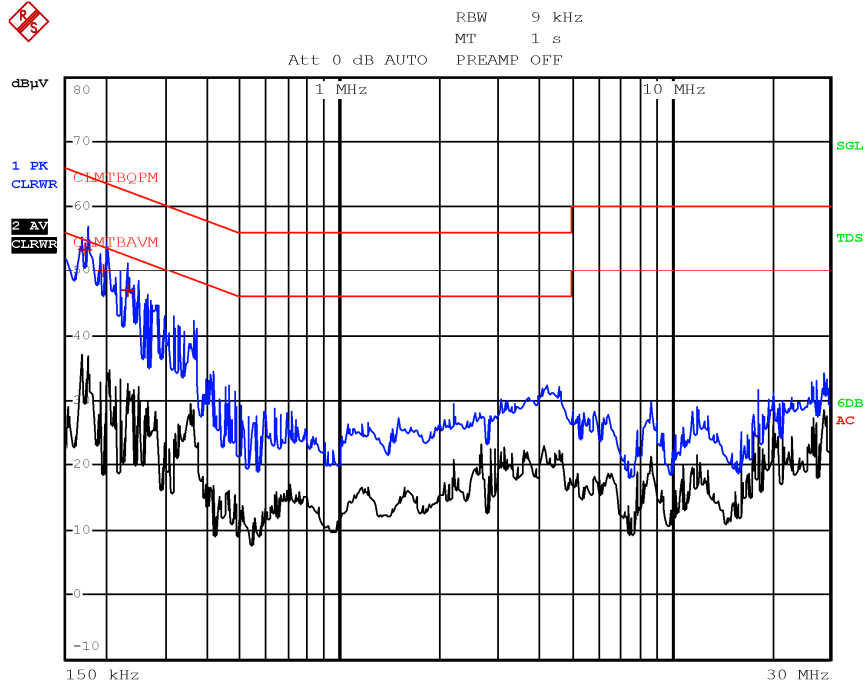
8.5.4 Equipment list

Table 8.5-2: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESU8	100202	2020-08	2021-08
LISN three phase (9 kHz ÷ 30 MHz)	Rohde & Schwarz	ESH2-Z5	872 460/041	2020-08	2021-08
Shielded room	Siemens	Conducted emission test room	1862	NCR	NCR

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

8.5.5 Test data

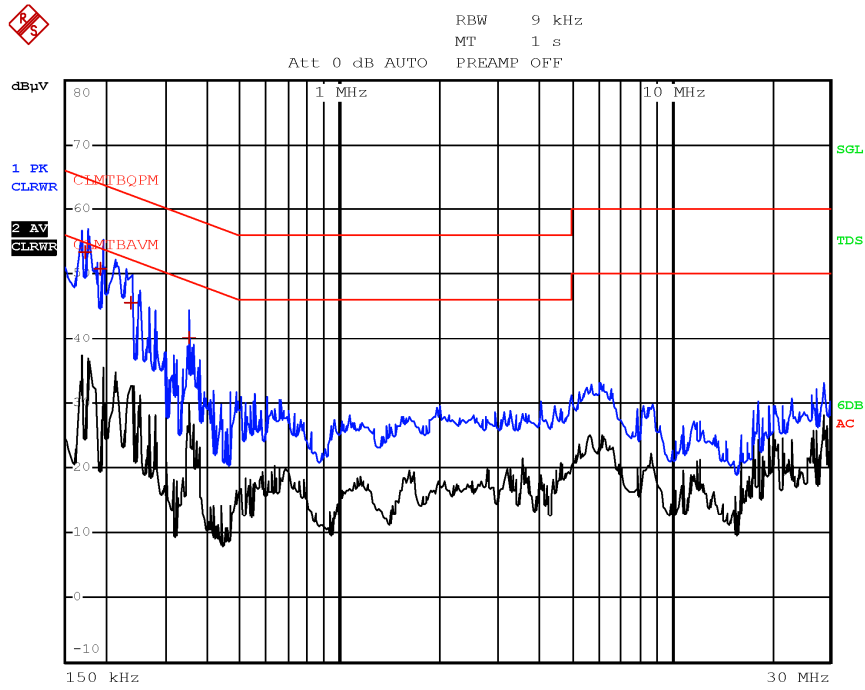


Plot 8.5-1: Conducted emissions on phase line

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1740	53.5	64.8	-11.3	QP
0.1980	50.1	63.7	-13.6	QP
0.2300	47.1	62.4	-15.4	QP

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 FCC 15.407(b)(6) and RSS-Gen 8.8 AC power line conducted emissions limits
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Plot 8.5-2: Conducted emissions on neutral line

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Detector
0.1740	53.5	64.8	-11.3	QP
0.1940	51.0	63.9	-12.9	QP
0.2380	45.6	62.2	-16.5	QP
0.3500	40.2	59.0	-18.8	QP

8.6 FCC 15.407(g) Frequency stability

8.6.1 Definitions and limits

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

8.6.2 Test summary

Test start date: January 19, 2021

8.6.3 Observations, settings and special notes

As per EUT's document provided by client, EUT's Operating Temperature is -40 °C to +70 °C(REGATE-10-12) and -40 °C to +85 °C (DYGATE-10-12), Nominal AC input voltage is 120 V.

Spectrum analyzer settings:

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

8.6.4 Equipment list

Table 8.6-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESW44	101620	2020-08	2021-08
Climatic chamber	Espec	ARS-1100	4100000067	2021-01	2022-01

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

8.6.5 Test data

Table 8.6-2: Frequency drift measurement

Test conditions Temperature, Voltage	Nominal frequency, GHz	Frequency, GHz	Drift, Hz
+85 °C, Nominal	5.2	5.2000889280	91105.1
+70 °C, Nominal	5.2	5.2000091900	11367.1
+23 °C, +15 %	5.2	5.1999978229	0
+23 °C, Nominal	5.2	5.1999978229	reference
+23 °C, -15 %	5.2	5.1999978229	0
-40 °C, Nominal	5.2	5.1999969610	-861.9

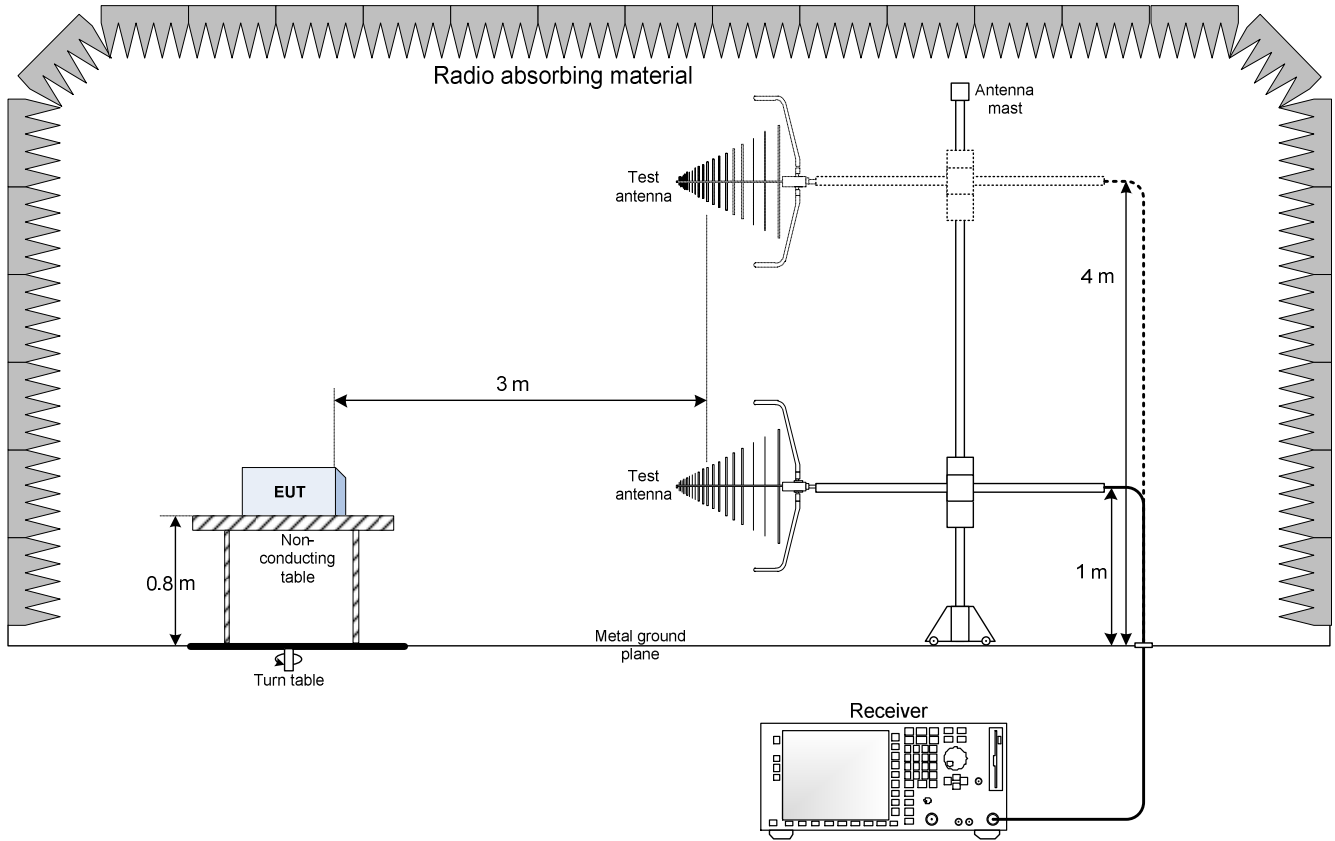
Minimum lower band edge margin is more than 1 kHz

Minimum upper band edge margin is more than 100 kHz

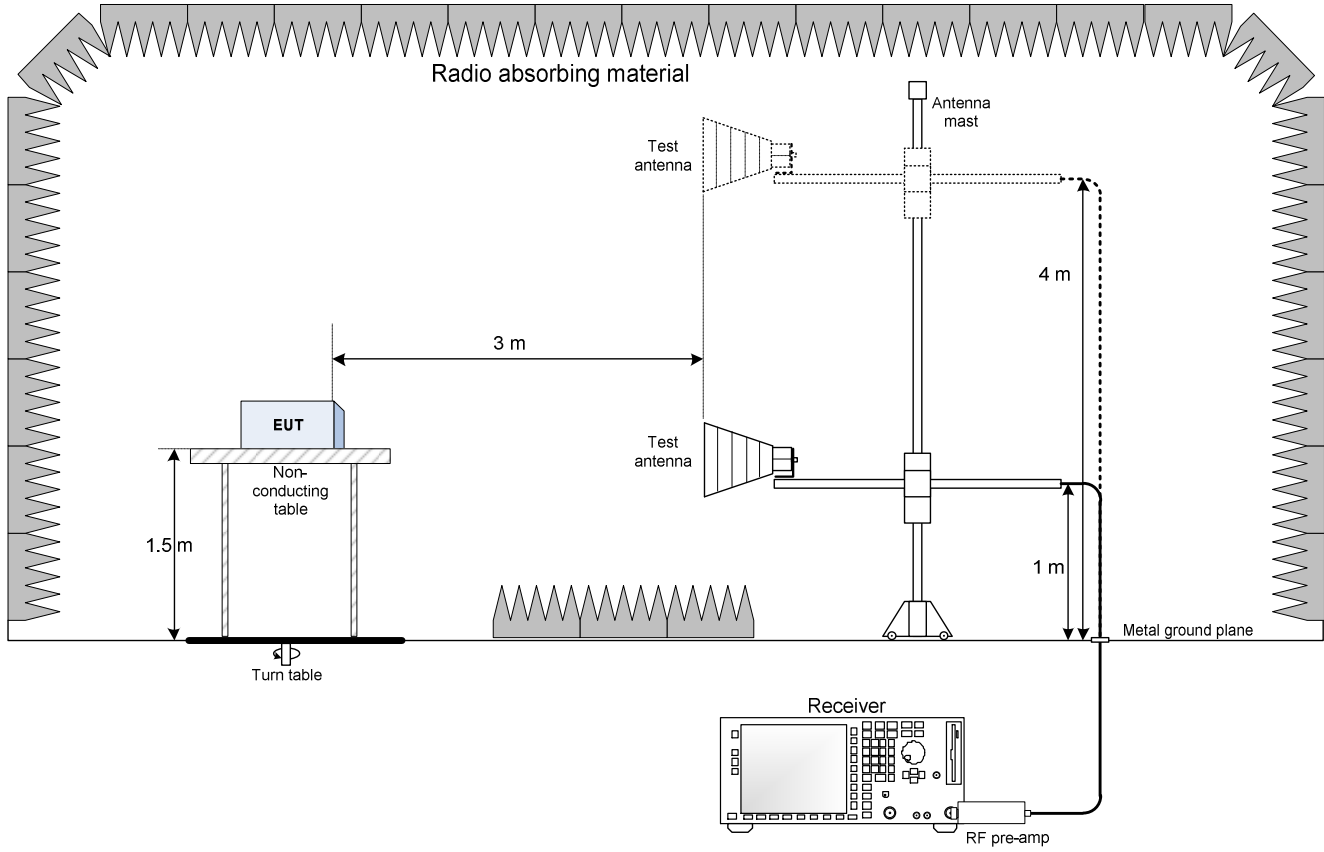
The frequency drifts in above table are within these minimum margins, the emissions are deemed to maintain within the band of operation.

Section 9. Block diagrams of test set-ups

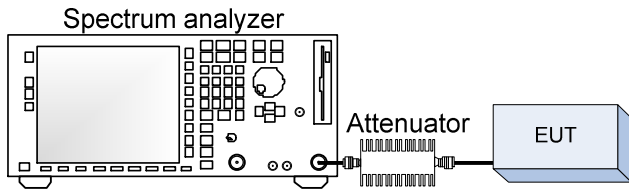
9.1 Radiated emissions set-up for frequencies below 1 GHz



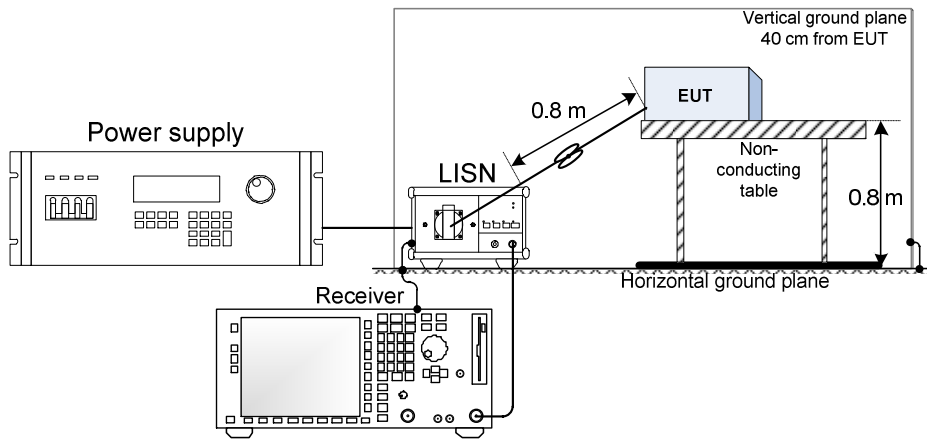
9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 Antenna port conducted measurements set-up

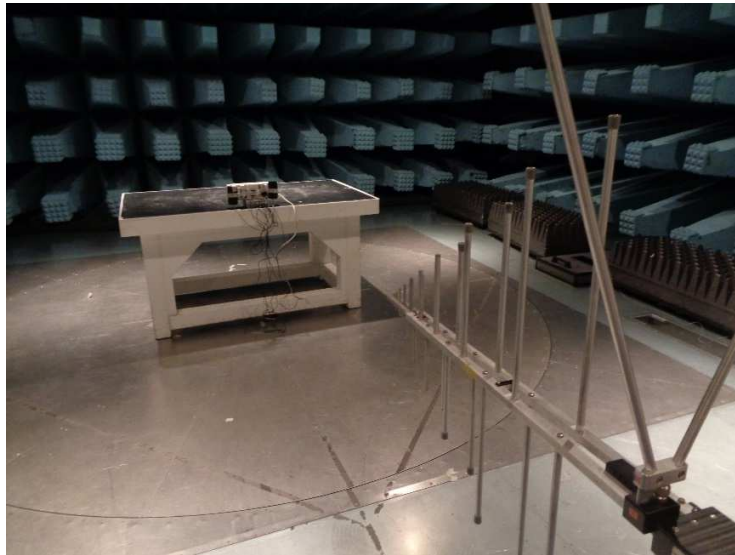


9.4 Power line Conducted emissions set-up



Section 10. Photos

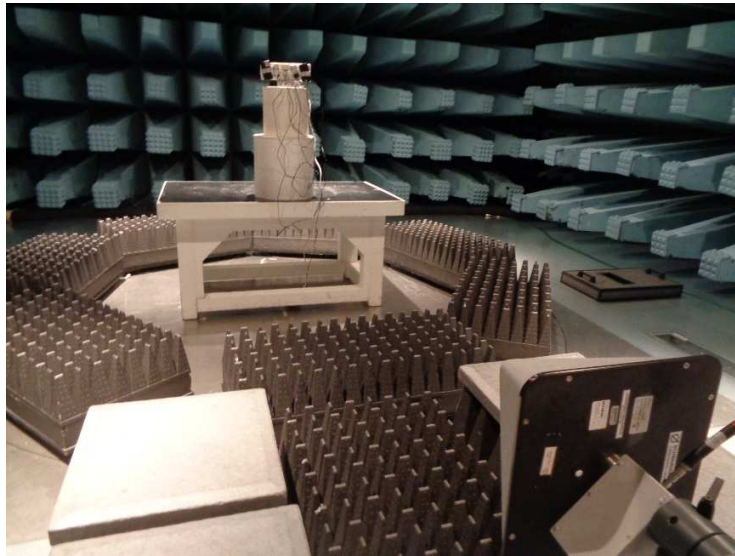
10.1 Photos of the test set-up



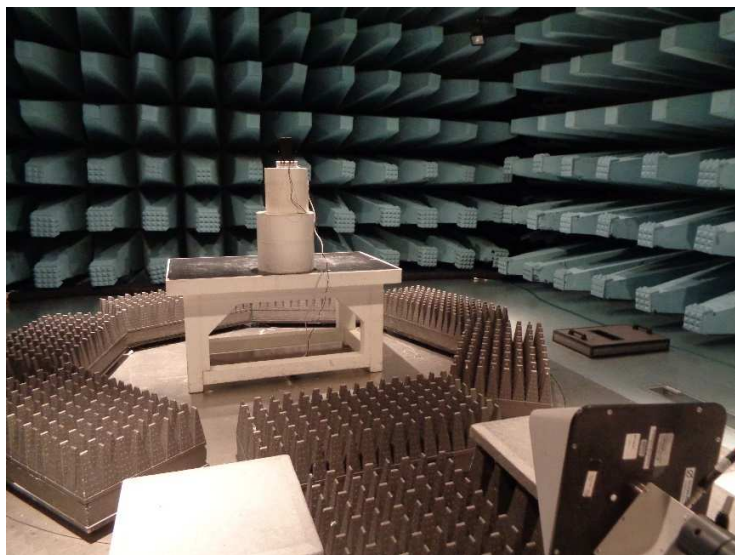
Radiated emission below 1 GHz – Antenna configuration 1



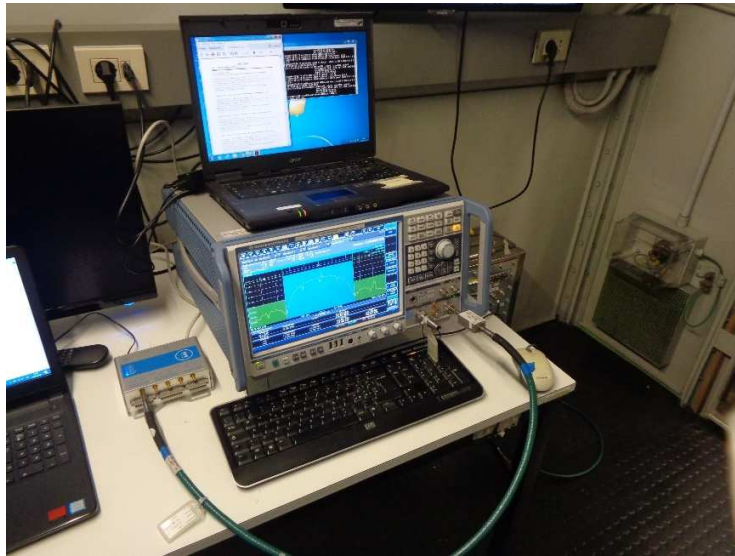
Radiated emission below 1 GHz – Antenna configuration 2



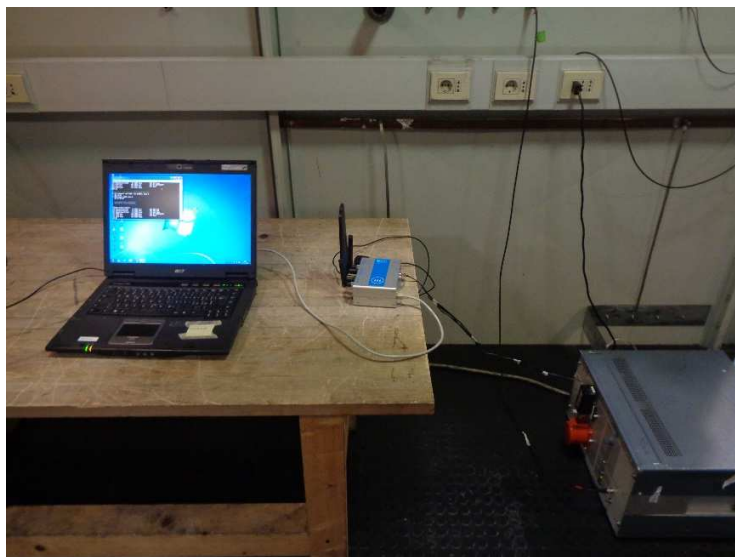
Radiated emission above 1 GHz - Configuration 1



Radiated emission above 1 GHz - Configuration 2



Conducted emission on the antenna port



Conducted emission on the AC Mains

10.2 Photos of the EUT

REGATE-10-12-GS04







DYGATE-10-12-GS04







(End of report)