

TEST REPORT

of the accredited test laboratory

TÜV Nr.:INE-AT/FG-19/195

Applicant: StreamUnlimited Engineering GmbH
High Tech Campus Vienna
Gutheil-Schoder-Gasse 10
A-1100 Vienna

Tested Product: STREAM1955 Bluetooth / BLE / WIFI streaming module
Test report for Bluetooth part only

FCC-ID: 2AJYB-S1955

IC-ID: 20504-S1955

Manufacturer: See applicant

Output power / 4,57 mW **power supply:** 12 VDC
field strength: conducted

Frequency range: 2402 - 2480 MHz **Channel separation:** 1 MHz

Standard: FCC: 47 CFR Part 15 (October 1, 2018 edition)
RSS-247 Issue 2, February 2017

Testing Laboratory,
Inspection Body,
Certification Body,
Calibration Laboratory,
Verifizierungsstelle**Notified Body 0408
IC 2932K-1****Non-executive
Board of Directors:**
KR DI Johann
Marihart**Management:**
DI Dr. Stefan Haas
Mag. Christoph
Wenninger**Registered Office:**
Deutschstrasse 10
1230 Vienna/Austria**Branch Offices:**
www.tuv.at/standorte**Company Register
Court / - Number:**
Vienna / FN 288476 f**Bank Details:**
IBAN
AT131200052949001066
BIC BKAUATWWIBAN
AT153100000104093282
BIC RZBAATWWVAT ATU63240488
DVR 3002476**TUV Austria Services GmbH**
Test laboratory for EMC

Supervisor of EMC-laboratory:

Ing. Wilhelm Seier



02.12.2019

checked by:

Ing. Michael Emminger

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The results of this test report only refer to the provided equipment.

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1. Applicant

Company: StreamUnlimited Engineering GmbH

Department: Director Systems

Address: High Tech Campus Vienna
Gutheil-Schoder-Gasse 10
A-1100 Vienna

Contact person: Mr. DI Christoph Apel

EUT received on: 20.05.2019

Tests were performed on: 27.05. till 17.09.2019

2. Description of EUT

EUT: Bluetooth / BLE / WIFI module "STREAM1955"

Serial Number: Prototype mounted on evaluation board

Manufacturer: StreamUnlimited Engineering GmbH
High Tech Campus Vienna
Gutheil-Schoder-Gasse 10
A-1100 Vienna

Description: StreamUnlimited Engineering GmbH provided the following configuration for the measurements:

Prototype mounted on evaluation board with direct connection for conducted measurements and with antenna type of highest gain for radiated measurements

Operating mode: The measurements were carried out at the following running states:
test-firmware running, transmitting continuously

Technical data EUT: Rated voltage: 5VDC
Rated current: 450mA
Rated frequency: DC

Mains voltage during the tests: 5VDC

Climatic conditions in the emc laboratory: Relative humidity: 39%
Temperature: 23°C

3. Standards / Final result

Name	Title	Deviation	Result
Title 47 CFR Part 15 October 1 st 2018 edition	RADIO FREQUENCY DEVICES	none	OK
RSS-247 Issue 2, February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	none	OK
Result: Opinions and interpretation of testing laboratory OK: EUT passed NOK: EUT failed			

4. TEST RESULTS

4.1. TEST OBJECT DATA

General EUT Description

This Bluetooth / BLE / WIFI module is using either 2.4 GHz frequencies or 5 GHz (WIFI only). This test report is only for the Bluetooth part. See additional test reports:

INE-AT/FG-19/196 for BLE

INE-AT/FG-19/197 for 2,4 GHz WIFI and

INE-AT/FG-19/198 for 5 GHz WIFI measurement results including photodocumentation.

2.1033 (c) Technical description

2.1033 (4) Type of emission: Basic datarate: 976KF1D – Channel spacing 1 MHz
Enhanced datarate: 1M40F1D – Channel spacing 1 MHz > 2/3 of channel
bandwidth - > maximum power should be 125 mW.

2.1033 (5) Frequency range: 2402 to 2480 MHz (channel center frequencies).

2.1033 (6) Power range and Controls: The maximum peak output power is 4,57 mW and there is no power regulation.

2.1033 (7) Maximum output power rating: 4,57 mW conducted.

2.1033 (8) DC Voltage and Current: 5V DC
maximum current consumption: 450 mA

RSS-135 This standard does not apply to:

- 1.1.(a) a receiver that scans radio frequencies for the purpose of enabling its associated transmitter to avoid transmitting in an occupied frequency but which does not have the capability of decoding the message (e.g. converting it to audio voice) contained in the radio signal

Antennas used for all radiated measurements: MOLEX '1461531100'

Worst case Spurious Emissions: 45,6 dBµV/m Average at 4 GHz.

Tests were performed May 27th till September 17th 2019.

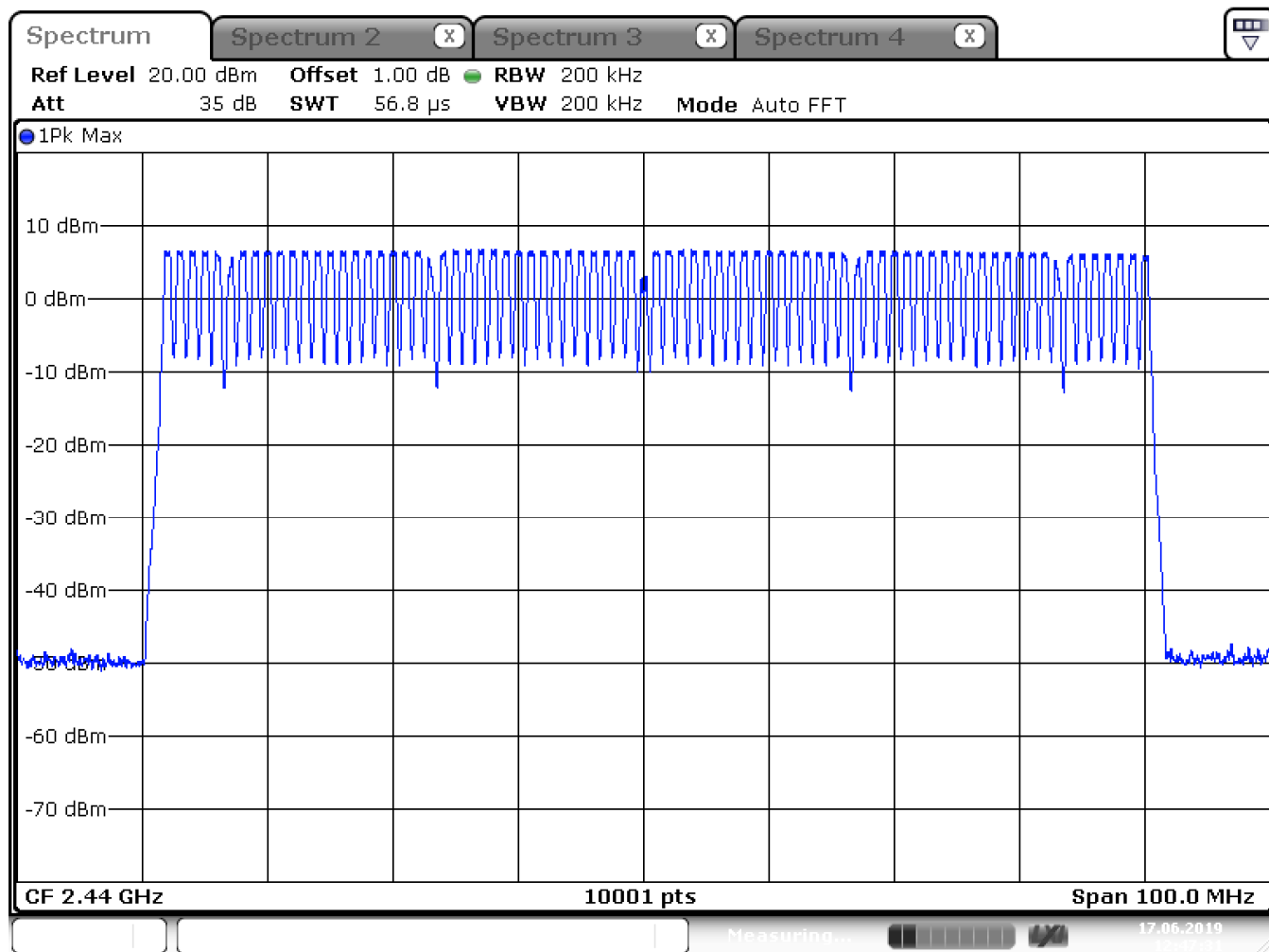
4.2. Number of channels and channel spacing

§ 15.247 (a) (1)
5.1 (2) (4)

Mode: Bluetooth

Conducted Measurement

Rated output power: 4,57 mW



Date: 17.JUN.2019 12:47:31

There are 79 Channels used, starting at 2402 till 2480 each spaced by 1 MHz channel spacing.

LIMIT SUBCLAUSE 15.247(a) (1) – 5.1(4)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

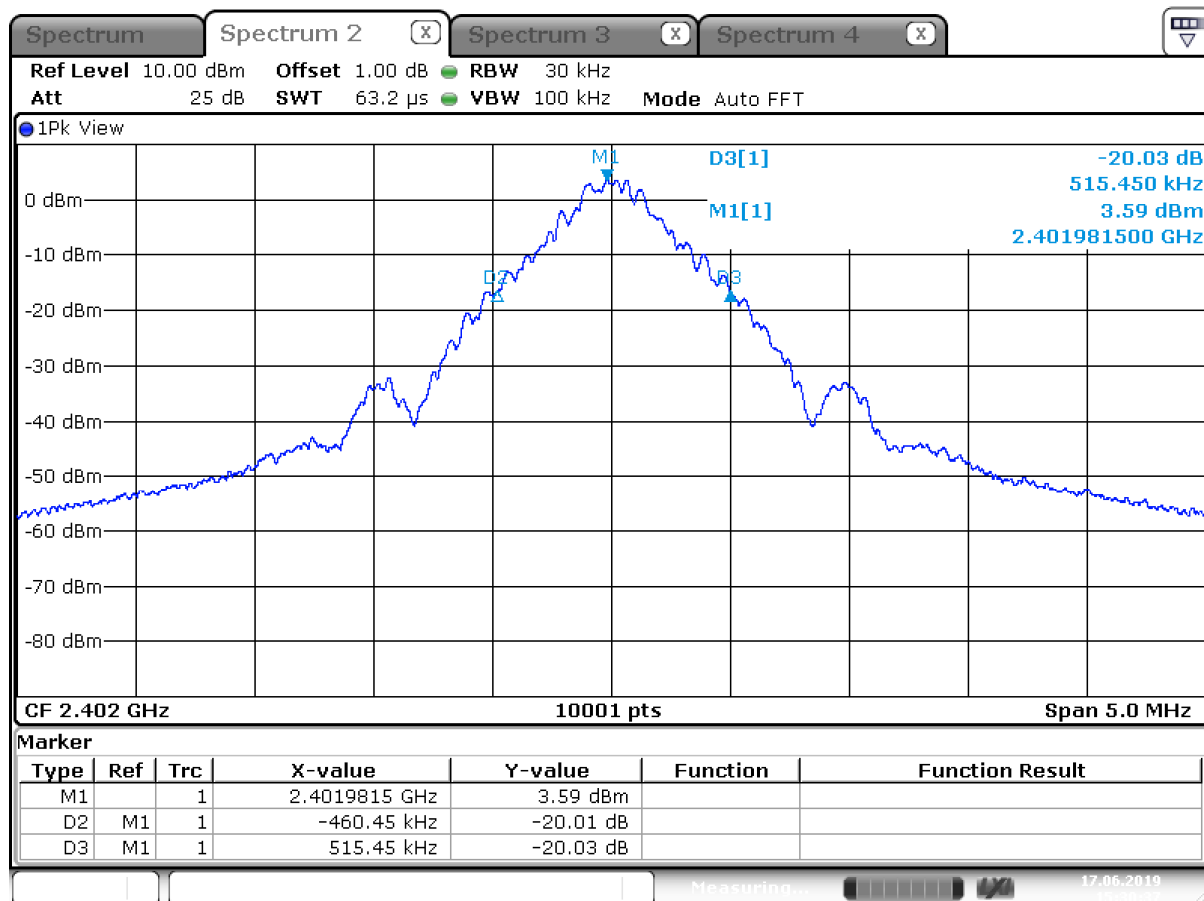
Test Equipment used: EMV-205

4.3. 20dB Bandwidth

§ 15.247 (a) (1)
5.1 (2)

Conducted Measurement - Mode: Bluetooth BDR

Rated output power: 4,57 mW 2402 MHz



Date: 17.JUN.2019 15:30:38

20dB Bandwidth: 975,9 kHz

LIMIT SUBCLAUSE 15.247(a) (1) – 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

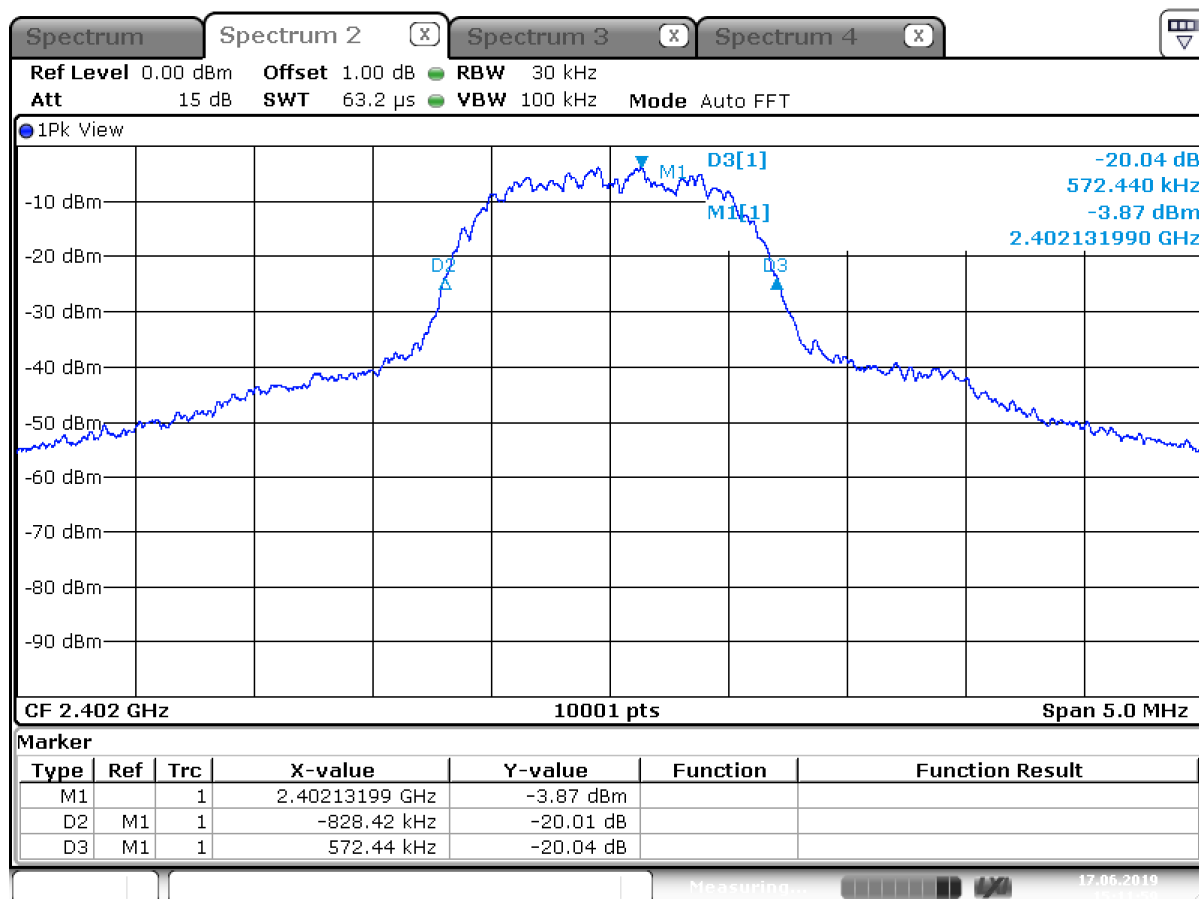
Test Equipment used: EMV-205

20dB Bandwidth

§ 15.247 (a) (1)
5.1 (2)

Conducted Measurement - Mode: Bluetooth EDR

Rated output power: 4,57 mW 2402 MHz



Date: 17.JUN.2019 15:12:00

20dB Bandwidth: 1401 kHz

LIMIT SUBCLAUSE 15.247(a) (1) – 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

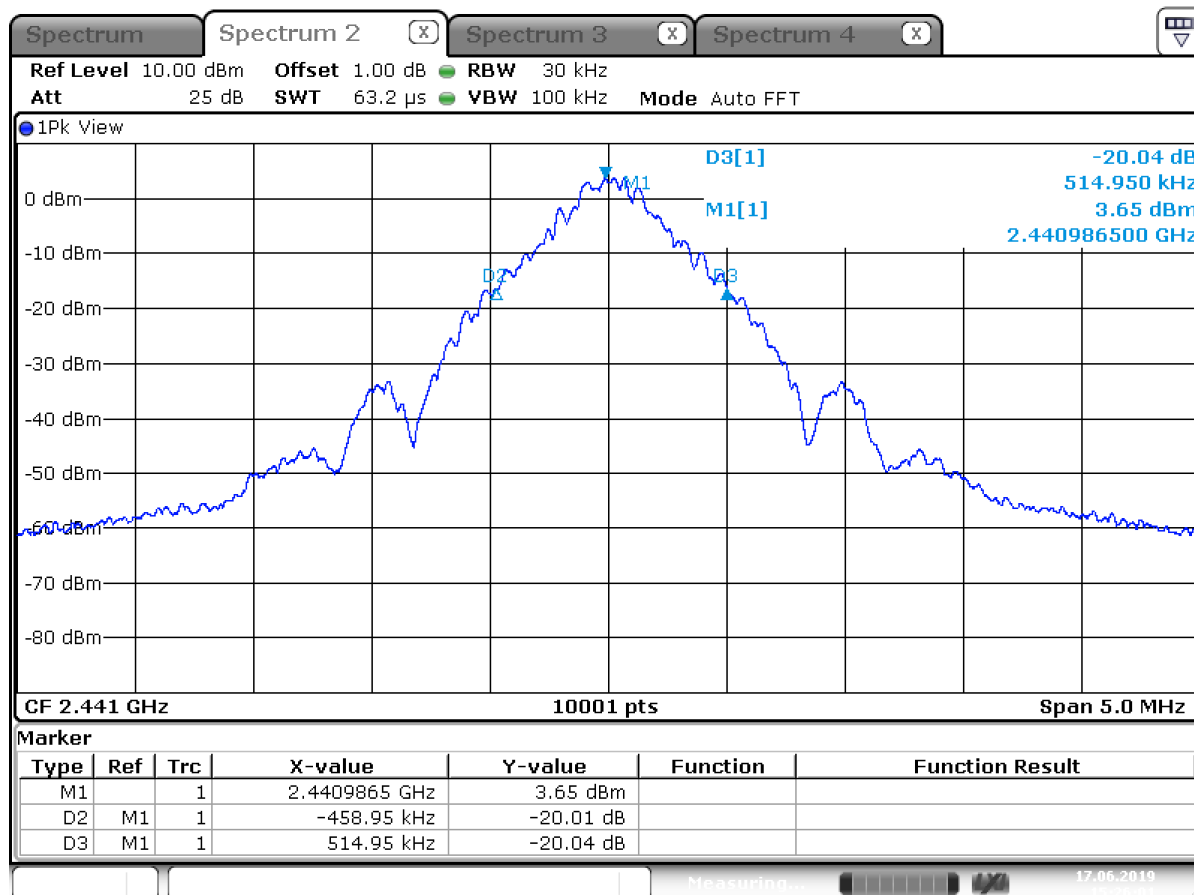
Test Equipment used: EMV-205

20dB Bandwidth

§ 15.247 (a) (1)
5.1 (2)

Conducted Measurement - Mode: Bluetooth BDR

Rated output power: 4,57 mW 2441 MHz



Date: 17.JUN.2019 15:26:01

20dB Bandwidth: 973,9 kHz

LIMIT SUBCLAUSE 15.247(a) (1) – 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

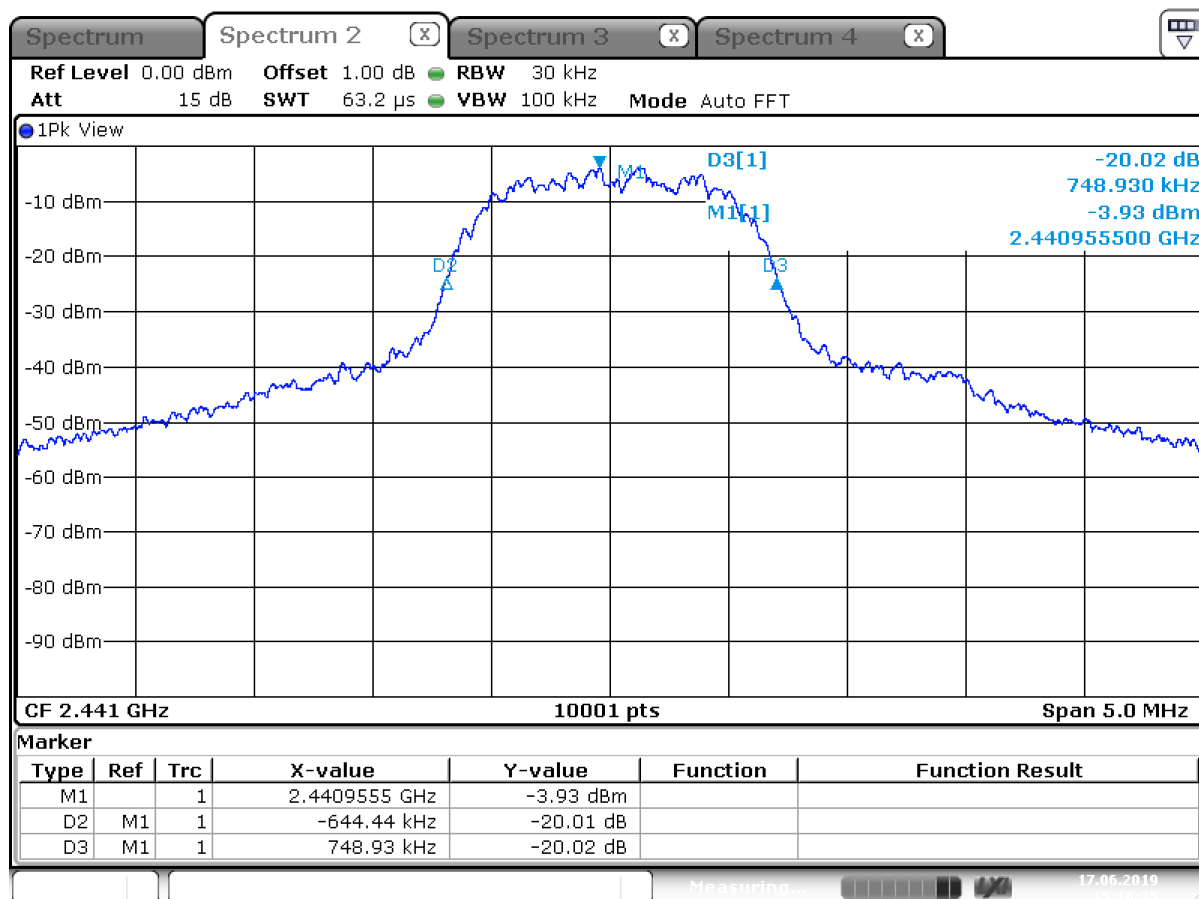
Test Equipment used: EMV-205

20dB Bandwidth

§ 15.247 (a) (1)
5.1 (2)

Conducted Measurement - Mode: Bluetooth EDR

Rated output power: 4,57 mW 2441 MHz



Date: 17.JUN.2019 15:16:35

20dB Bandwidth: 1394 kHz

LIMIT SUBCLAUSE 15.247(a) (1) – 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

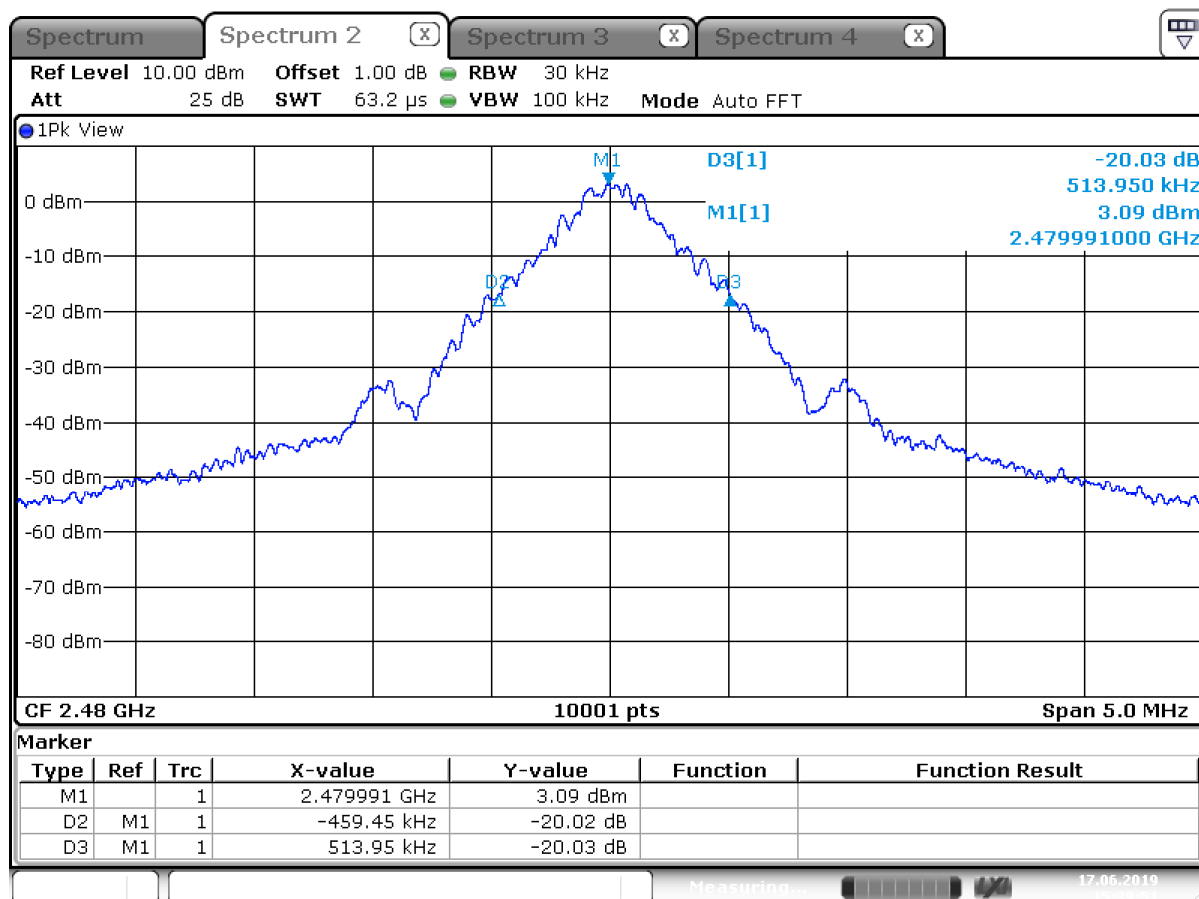
Test Equipment used: EMV-205

20dB Bandwidth

§ 15.247 (a) (1)
5.1 (2)

Conducted Measurement - Mode: Bluetooth BDR

Rated output power: 4,57 mW 2480 MHz



Date: 17.JUN.2019 15:39:51

20dB Bandwidth: 973,4 kHz

LIMIT SUBCLAUSE 15.247(a) (1) – 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

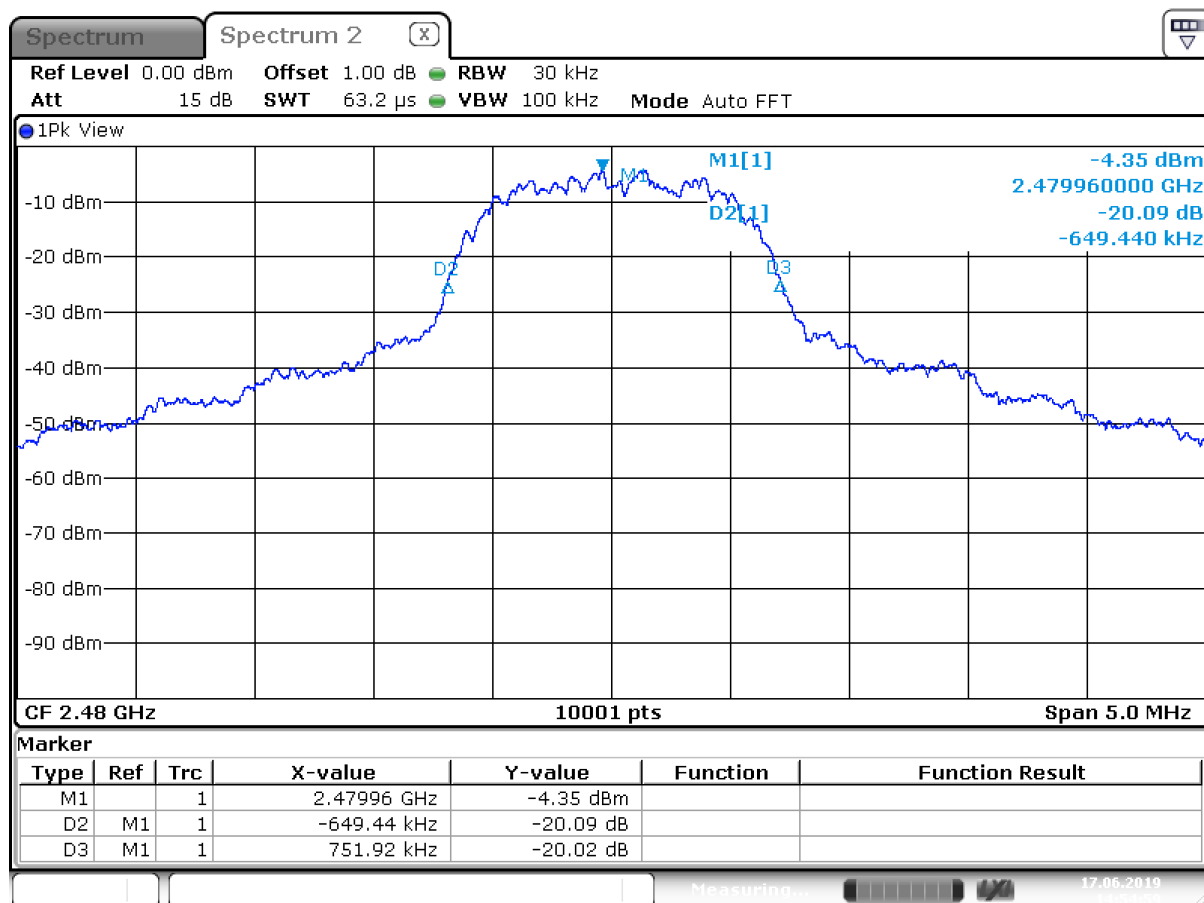
Test Equipment used: EMV-205

20dB Bandwidth

§ 15.247 (a) (1)
5.1 (2)

Conducted Measurement - Mode: Bluetooth EDR

Rated output power: 4,57 mW 2480 MHz



Date: 17.JUN.2019 14:54:59

20dB Bandwidth: 1402 kHz

LIMIT SUBCLAUSE 15.247(a) (1) – 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test Equipment used: EMV-205

4.4. Maximum Peak RF Power Output (EIRP)

§ 15.247(b)(1)
5.4(2)

Conducted Measurement – Mode: Bluetooth BDR

Rated output power: 4,57 mW

Test conditions		Transmitter power (mW)		
		2402 MHz	2441 MHz	2480 MHz
T _{nom} (23) °C	V _{nom} (5) V	4,57	4,57	4,07
Maximum deviation from rated output power under normal test conditions (dB)		0	0	-0,5
Measurement uncertainty		± 0,75 dB		

LIMIT SUBCLAUSE 15.247(b)(1) – 5.4(2)

Under normal test conditons	1W conducted (4W eirp)
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Maximum Antenna Gain: 6dBi, eirp can be calculated by multiplying conducted value with factor 4.

Test Equipment used: EMV-205

Maximum Peak RF Power Output (EIRP)

**§ 15.247(b)(1)
5.4(2)**

Conducted Measurement – Mode: Bluetooth EDR

Rated output power: 4,57 mW

Test conditions		Transmitter power (mW)		
		2402 MHz	2441 MHz	2480 MHz
T _{nom} (23) °C	V _{nom} (5) V	1,74	1,70	1,48
Maximum deviation from rated output power under normal test conditions (dB)		-4,2	-4,3	-4,9
Measurement uncertainty		± 0,75 dB		

LIMIT SUBCLAUSE 15.247(b)(1) – 5.4(2)

Under normal test conditons	1W conducted (4W eirp)
-----------------------------	------------------------

Maximum Antenna Gain: 6dBi, eirp can be calculated by multiplying conducted value with factor 4.

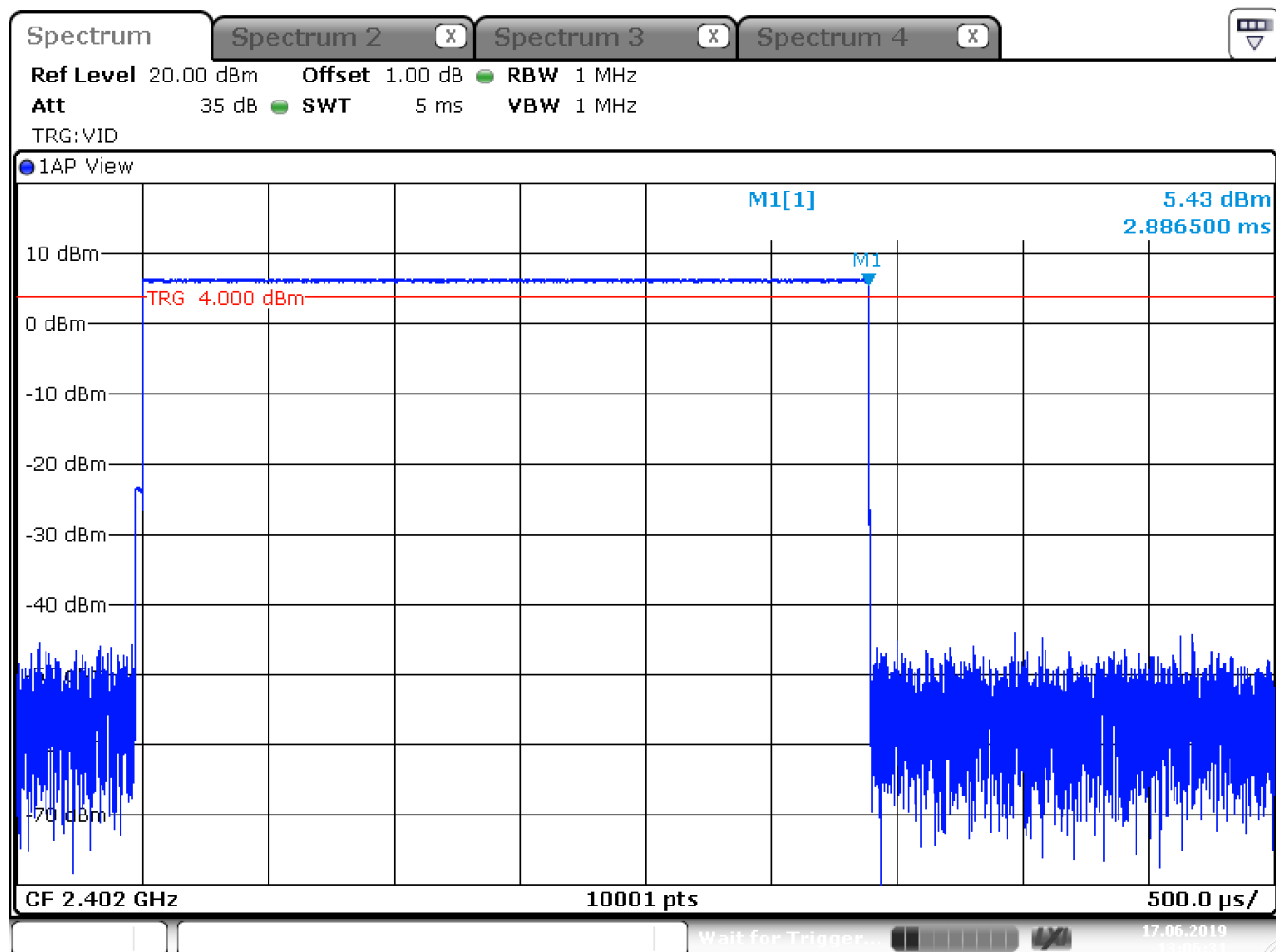
Test Equipment used: EMV-205

4.5. Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth BDR

Rated output power: 4,57 mW 2402 MHz



Date: 17.JUN.2019 13:06:31

The dwell time is constant 2,9 ms.

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

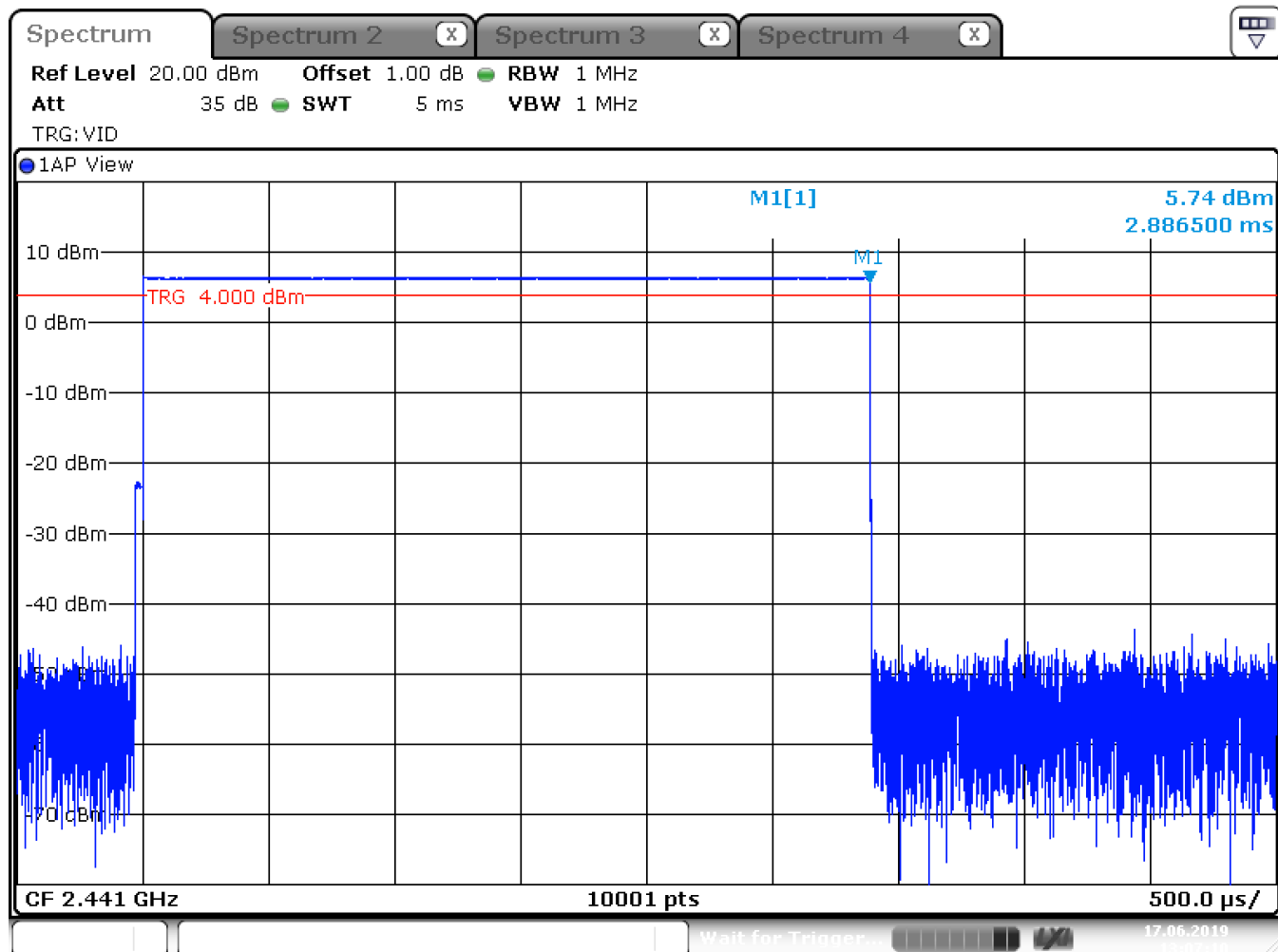
Test Equipment used: EMV-205

Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth BDR

Rated output power: 4,57 mW 2441 MHz



Date: 17.JUN.2019 13:07:10

The dwell time is constant 2,9 ms.

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

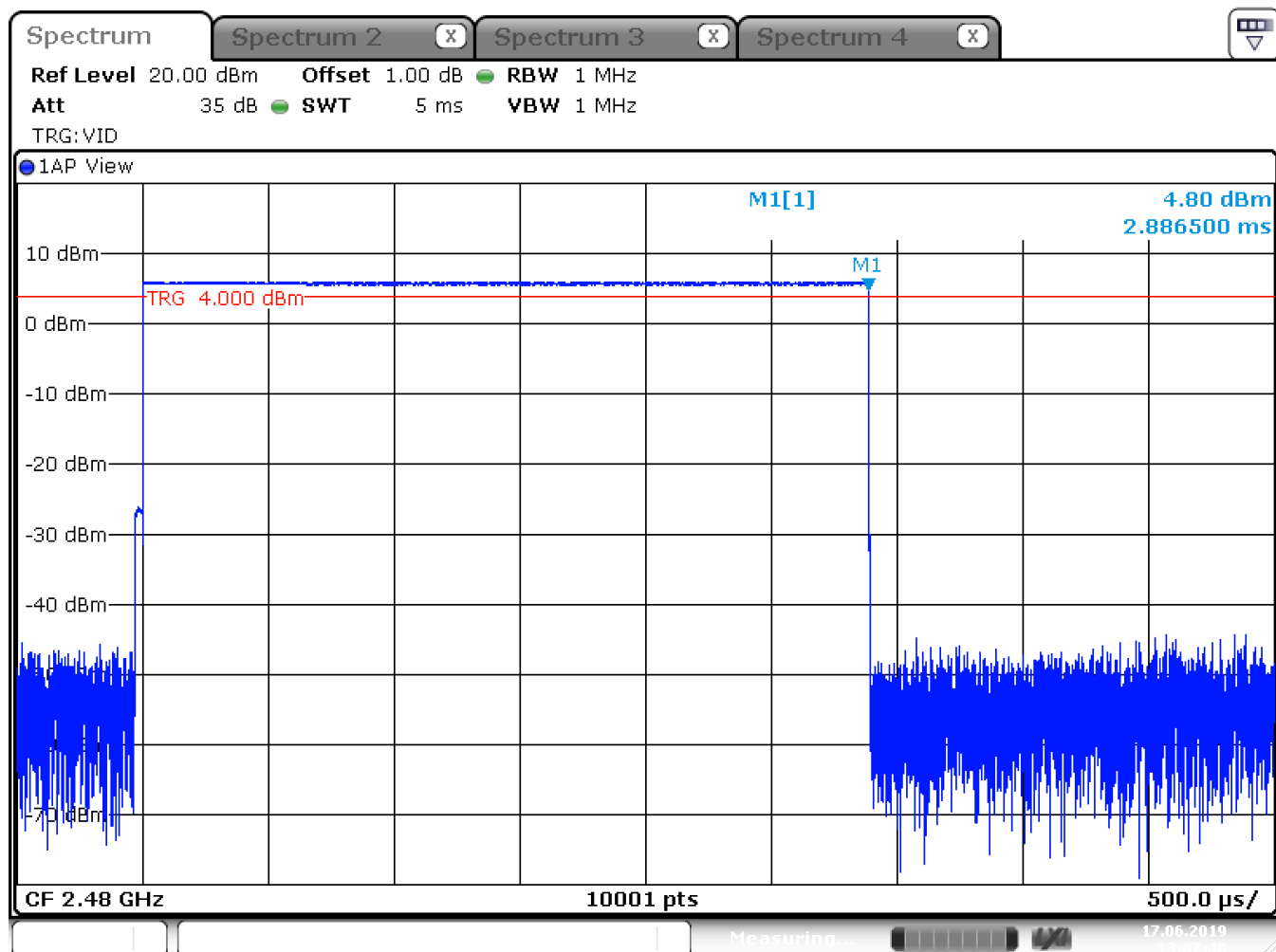
Test Equipment used: EMV-205

Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth BDR

Rated output power: 4,57 mW 2480 MHz



Date: 17.JUN.2019 13:07:41

The dwell time is constant 2,9 ms.

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Equipment used: EMV-205

Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth BDR

Rated output power: 4,57 mW

	Channel 0 (2402 MHz)	Channel 39 (2441 MHz)	Channel 78 (2480 MHz)
Observed time period	79 times 0,4 Seconds = 31,6 seconds		
Time of each individual transmission	2,9 ms	2,9 ms	2,9 ms
Observed number of transmissions	118	122	110
Average time of occupancy	0,3422 seconds	0,3538 seconds	0,319 seconds

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

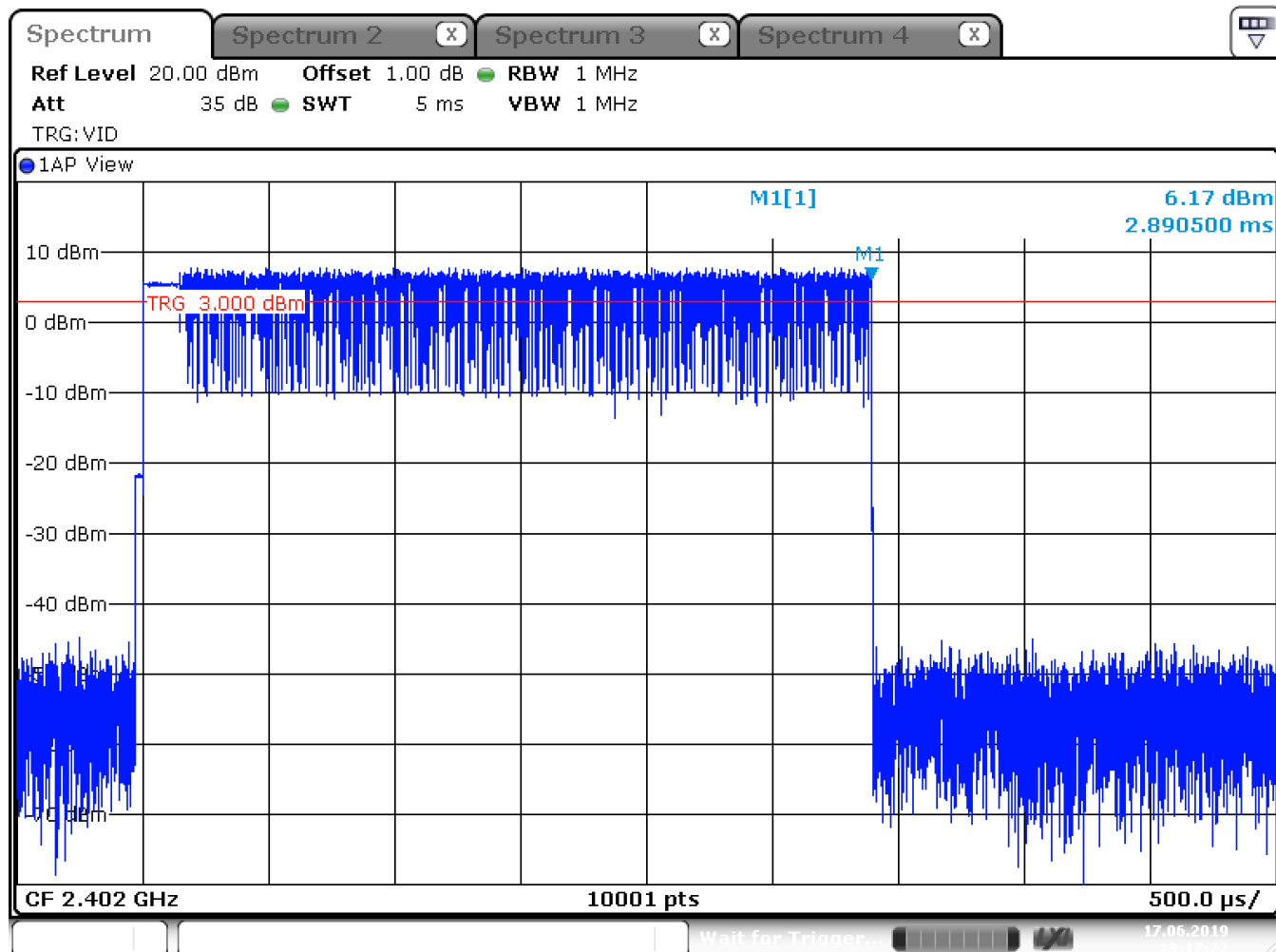
Test Equipment used: EMV-205

Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth EDR

Rated output power: 4,57 mW 2402 MHz



Date: 17.JUN.2019 13:17:27

The dwell time is constant 2,9 ms.

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

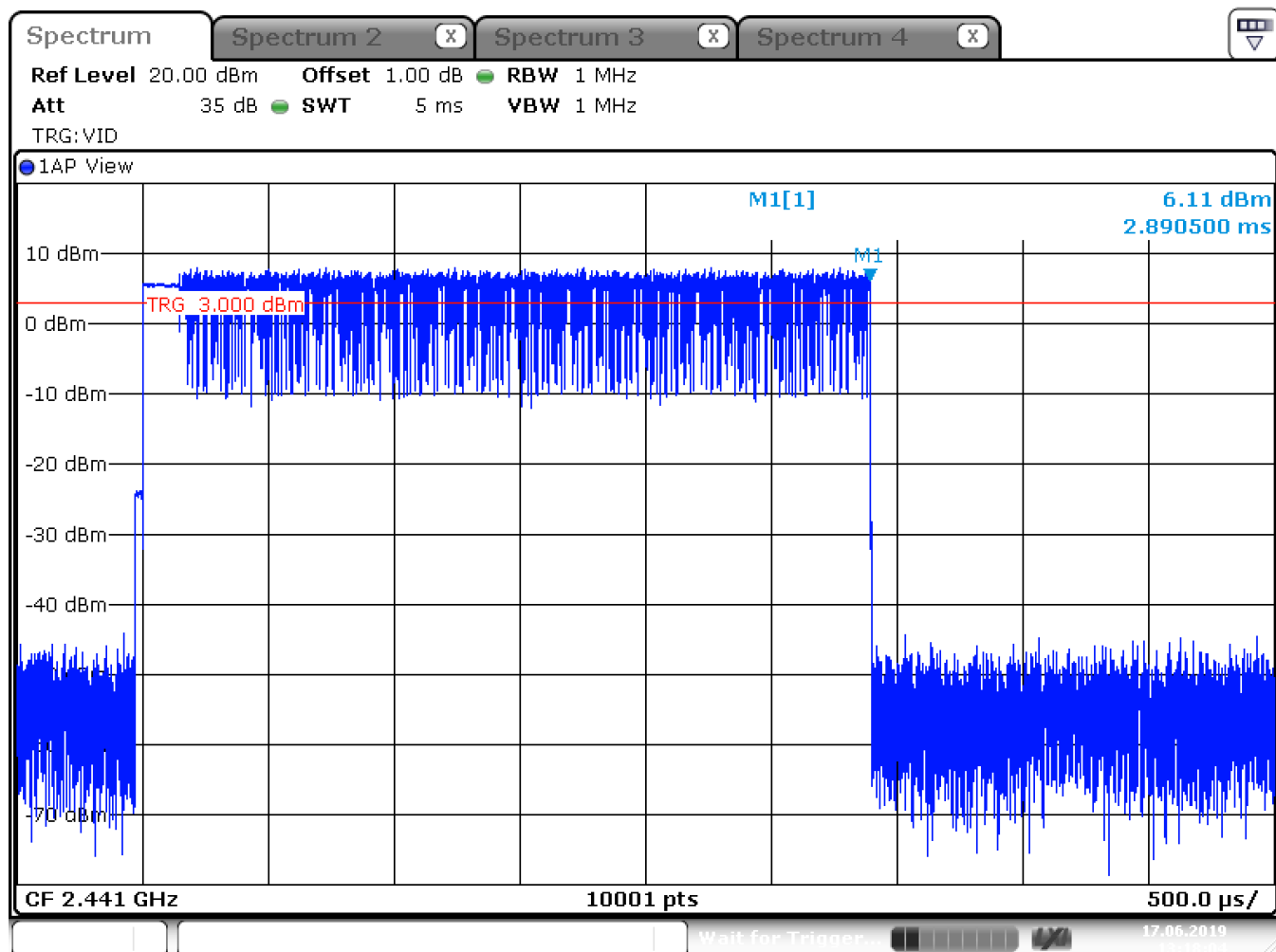
Test Equipment used: EMV-205

Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth EDR

Rated output power: 4,57 mW 2441 MHz



Date: 17.JUN.2019 13:18:04

The dwell time is constant 2,9 ms.

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

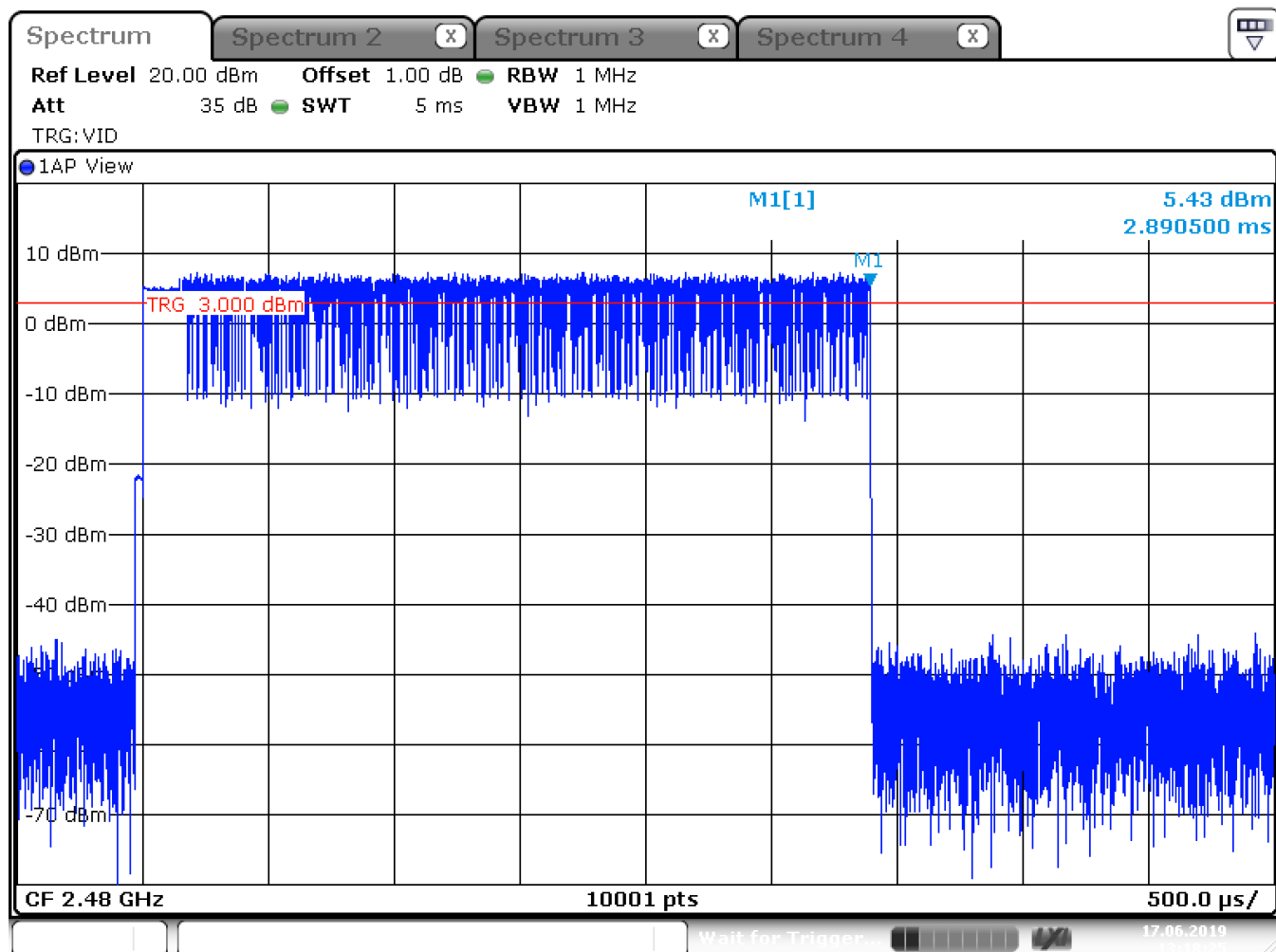
Test Equipment used: EMV-205

Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth EDR

Rated output power: 4,57 mW 2480 MHz



Date: 17.JUN.2019 13:18:25

The dwell time is constant 2,9 ms.

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Equipment used: EMV-205

Average Time of Occupancy

§ 15.247(a)(1)(iii)
5.1(4)

Conducted Measurement - Mode: Bluetooth EDR

Rated output power: 4,57 mW

	Channel 0 (2402 MHz)	Channel 39 (2441 MHz)	Channel 78 (2480 MHz)
Observed time period	79 times 0,4 Seconds = 31,6 seconds		
Time of each individual transmission	2,9 ms	2,9 ms	2,9 ms
Observed number of transmissions	112	107	107
Average time of occupancy	0,3248 seconds	0,3103 seconds	0,3103 seconds

LIMIT SUBCLAUSE 15.247(a)(1)(iii) – 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

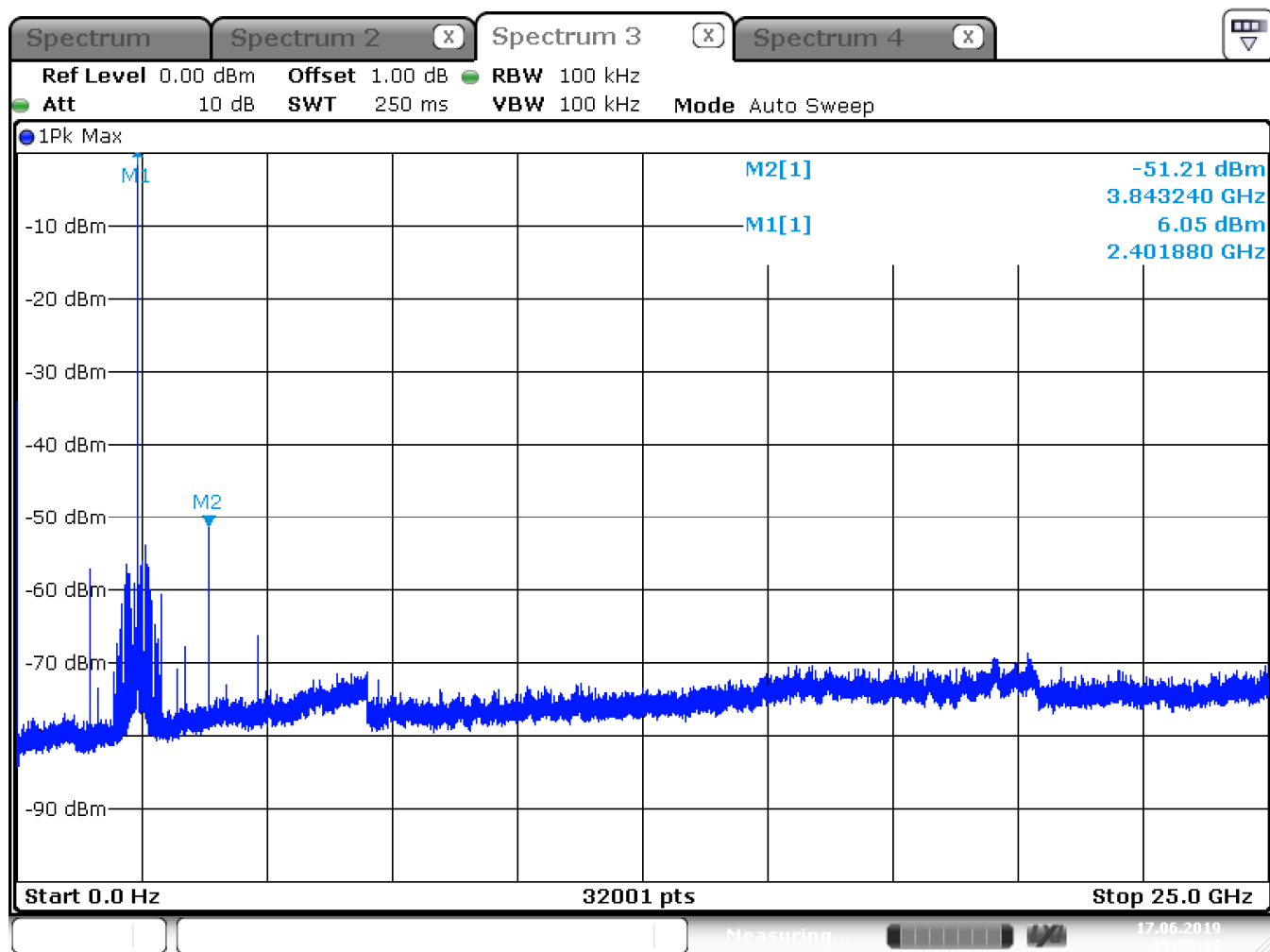
Test Equipment used: EMV-205

4.6. Out-of-band Emission

§ 15.247(d)
5.5

Measurement conducted with Peak-Detector:

Mode: Bluetooth BDR – Channel 0 – 2402 MHz



Date: 17.JUN.2019 15:35:19

LIMIT

SUBCLAUSE 15.247(d) – 5.5

In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.

At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

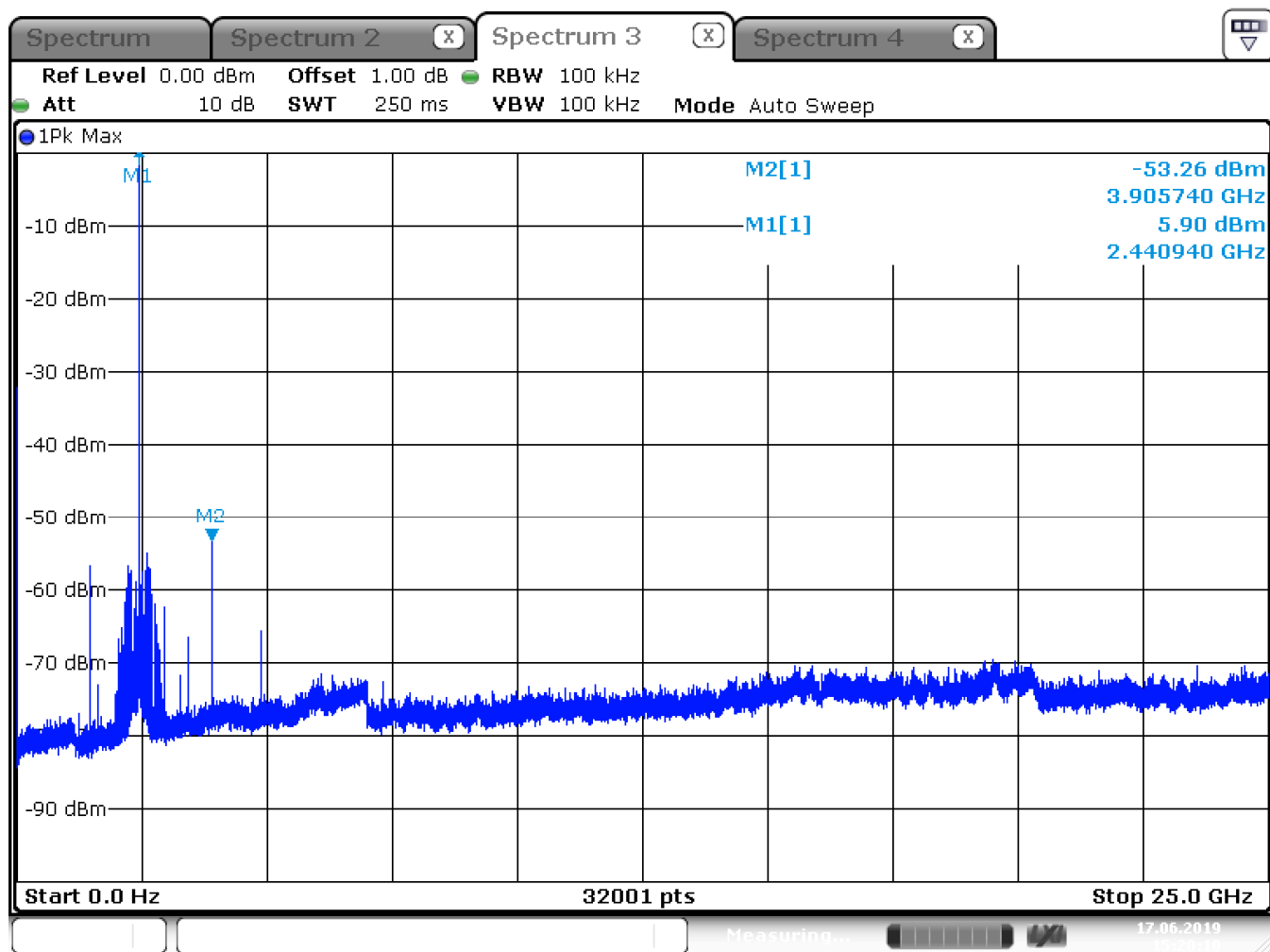
Test Equipment used: EMV-205

Out-of-band Emission

§ 15.247(d)
5.5

Measurement conducted with Peak-Detector:

Mode: Bluetooth BDR – Channel 39 – 2441 MHz



Date: 17.JUN.2019 15:20:11

LIMIT

SUBCLAUSE 15.247(d) – 5.5

In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.

At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

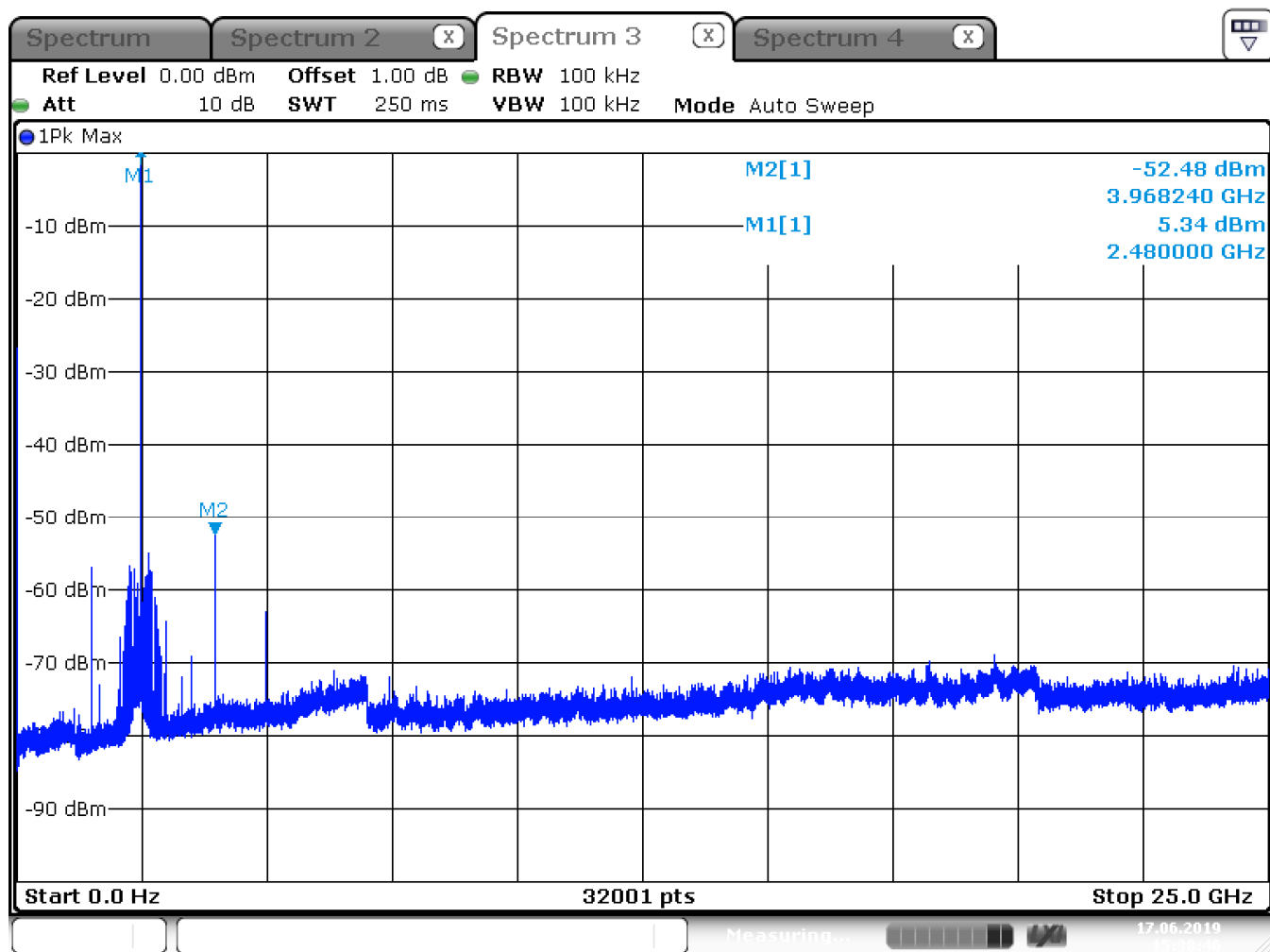
Test Equipment used: EMV-205

Out-of-band Emission

§ 15.247(d)
5.5

Measurement conducted with Peak-Detector:

Mode: Bluetooth BDR – Channel 78 – 2480 MHz



Date: 17.JUN.2019 15:38:47

LIMIT

SUBCLAUSE 15.247(d) – 5.5

In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.

At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

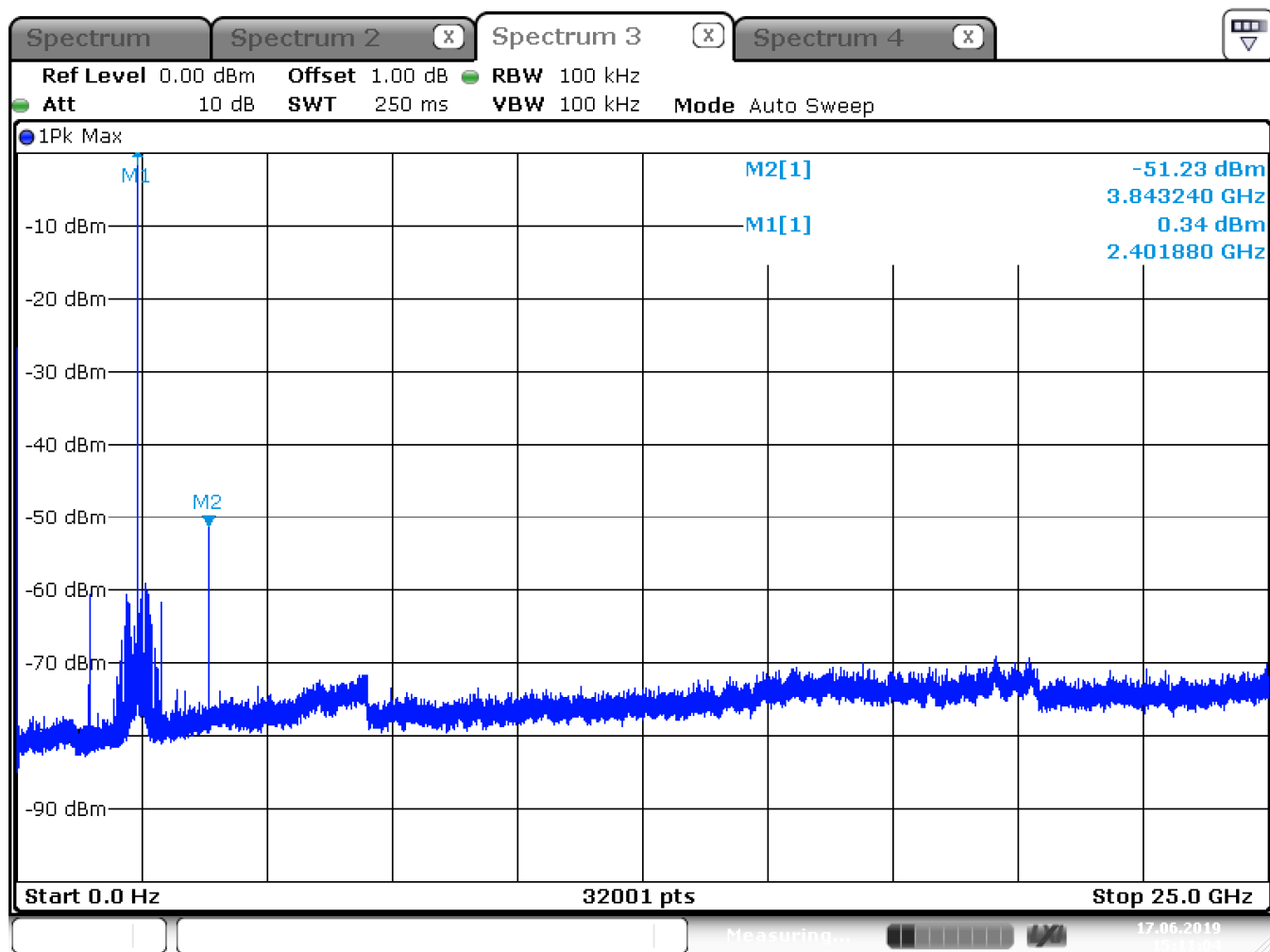
Test Equipment used: EMV-205

Out-of-band Emission

§ 15.247(d)
5.5

Measurement conducted with Peak-Detector:

Mode: Bluetooth EDR – Channel 0 – 2402 MHz



Date: 17.JUN.2019 15:11:05

LIMIT

SUBCLAUSE 15.247(d) – 5.5

In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.

At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

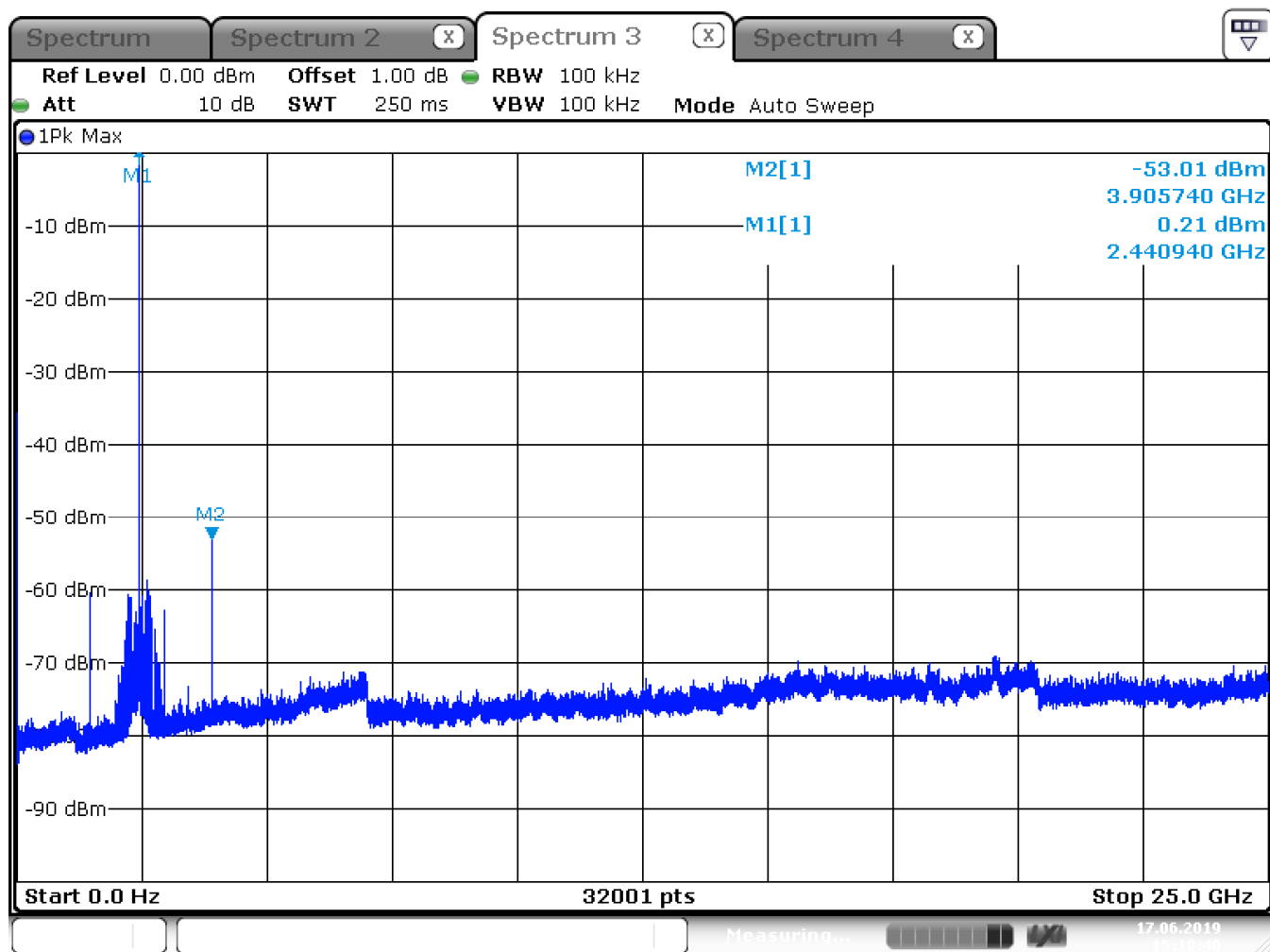
Test Equipment used: EMV-205

Out-of-band Emission

§ 15.247(d)
5.5

Measurement conducted with Peak-Detector:

Mode: Bluetooth EDR – Channel 39 – 2441 MHz



Date: 17.JUN.2019 15:18:40

LIMIT

SUBCLAUSE 15.247(d) – 5.5

In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.

At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

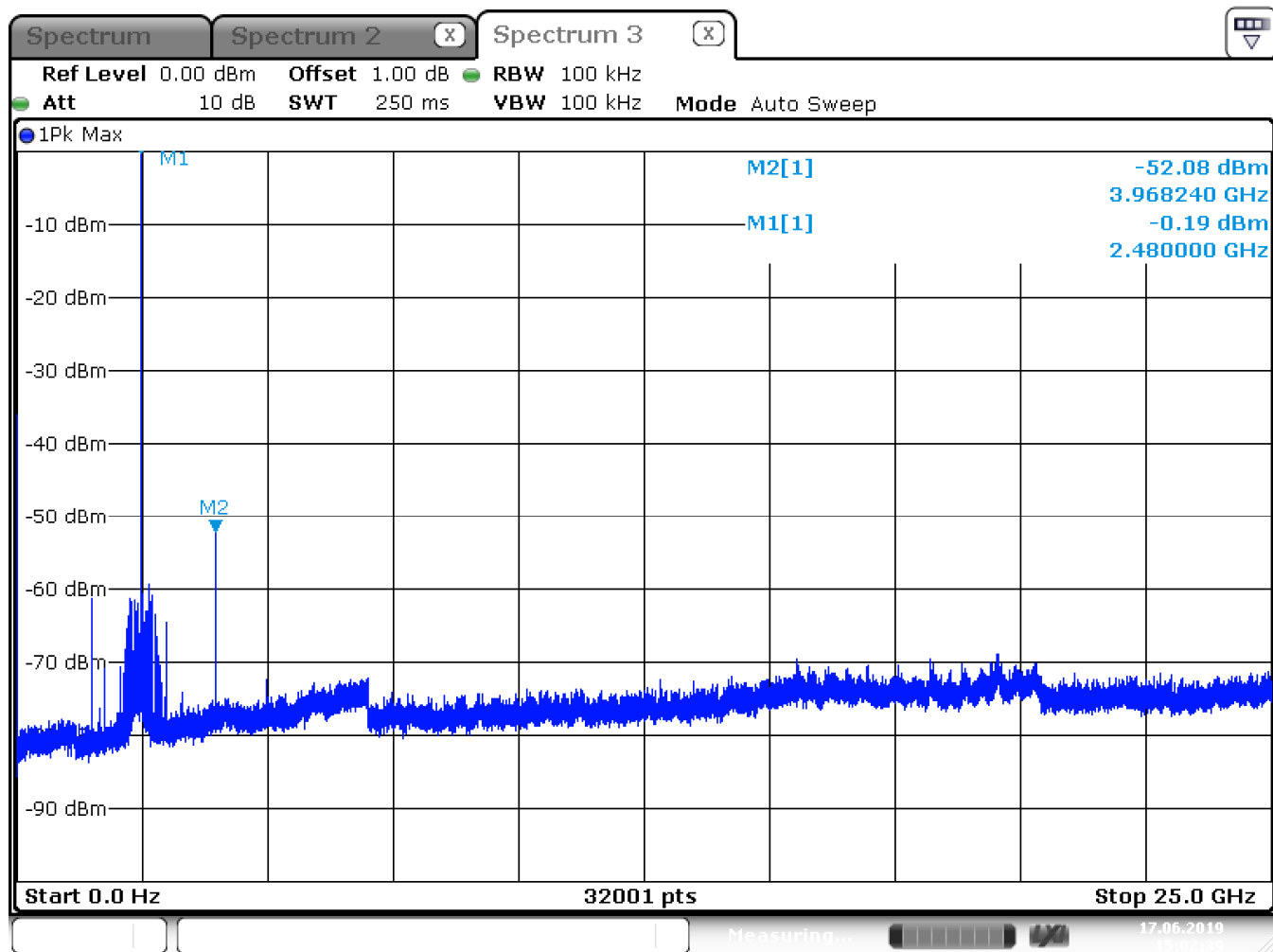
Test Equipment used: EMV-205

Out-of-band Emission

§ 15.247(d)
5.5

Measurement conducted with Peak-Detector:

Mode: Bluetooth EDR – Channel 78 – 2480 MHz



Date: 17.JUN.2019 15:02:40

LIMIT

SUBCLAUSE 15.247(d) – 5.5

In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.

At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

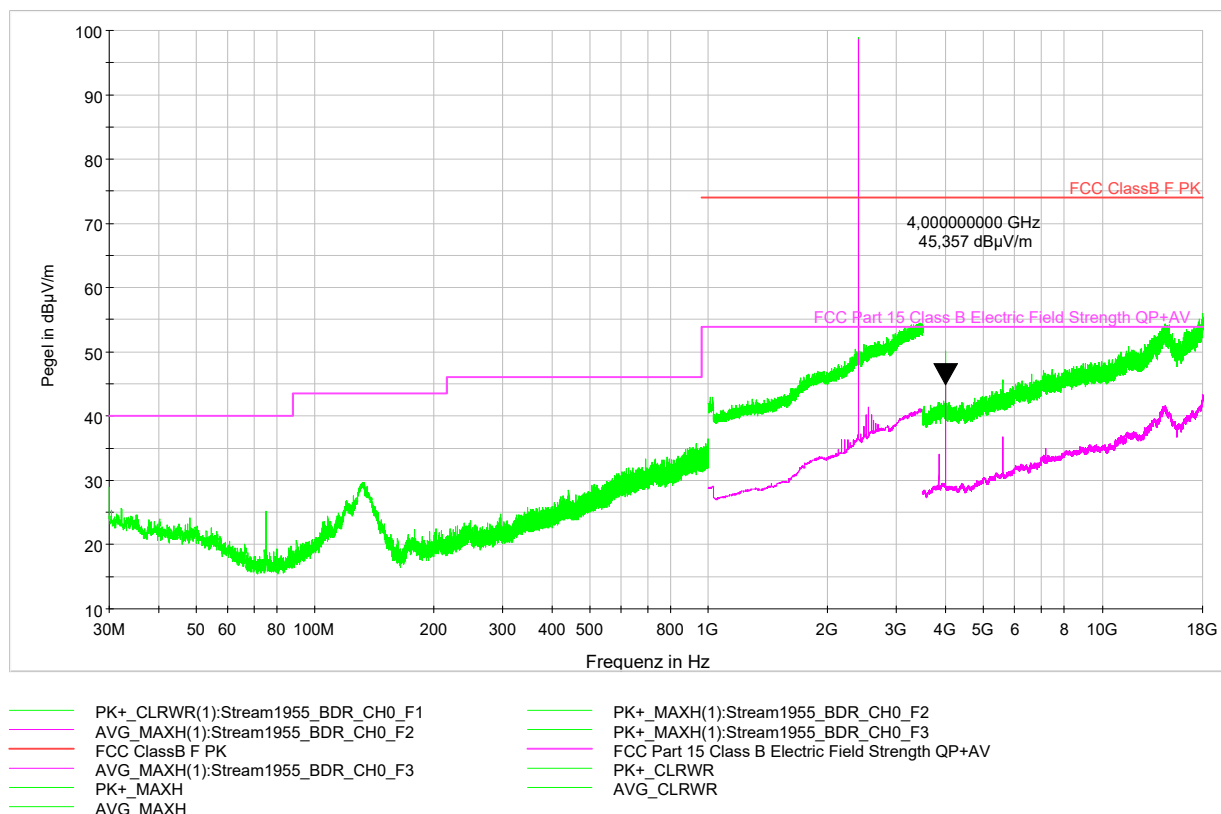
Test Equipment used: EMV-205

4.7. Emissions in restricted bands Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement radiated with Peak-Detector (green line) and Average detector (magenta line):

Mode: Bluetooth BDR – Channel 0 – 2402 MHz



Worst case emission: Average @ 4000,0 MHz: 45,4 dBµV/m

Remark: Although the measurement above ends at 18 GHz, all measurements were performed up to the tenth harmonics of the transmitter frequency.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

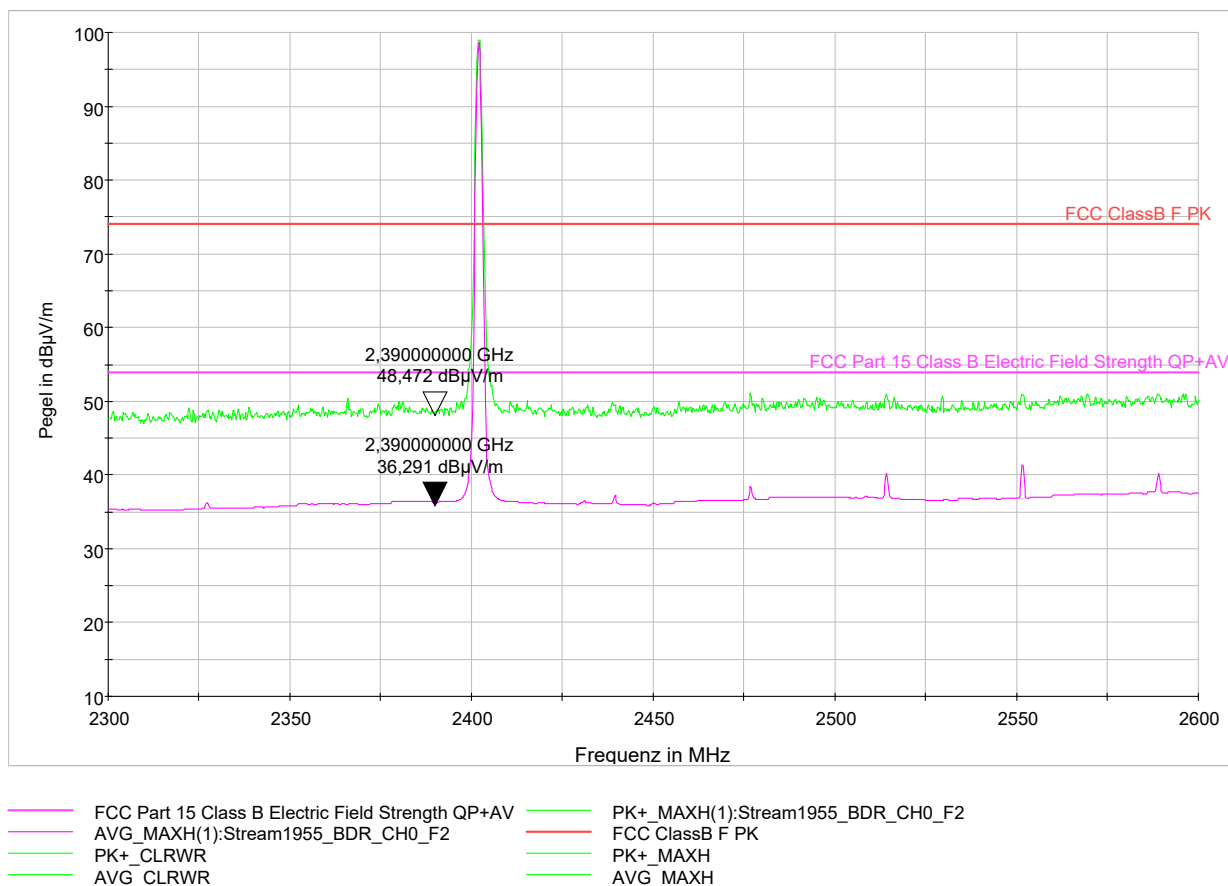
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200; EMV-205; NT-122; NT-126; NT-416

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement with Peak-Detector (green line) and Average detector (magenta line): Band Edge requirement

Setup: Bluetooth BDR – CH 0: 2402 MHz



LIMIT

SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Band edges of the nearest restricted bands: 2390 MHz and 2483,5 MHz.

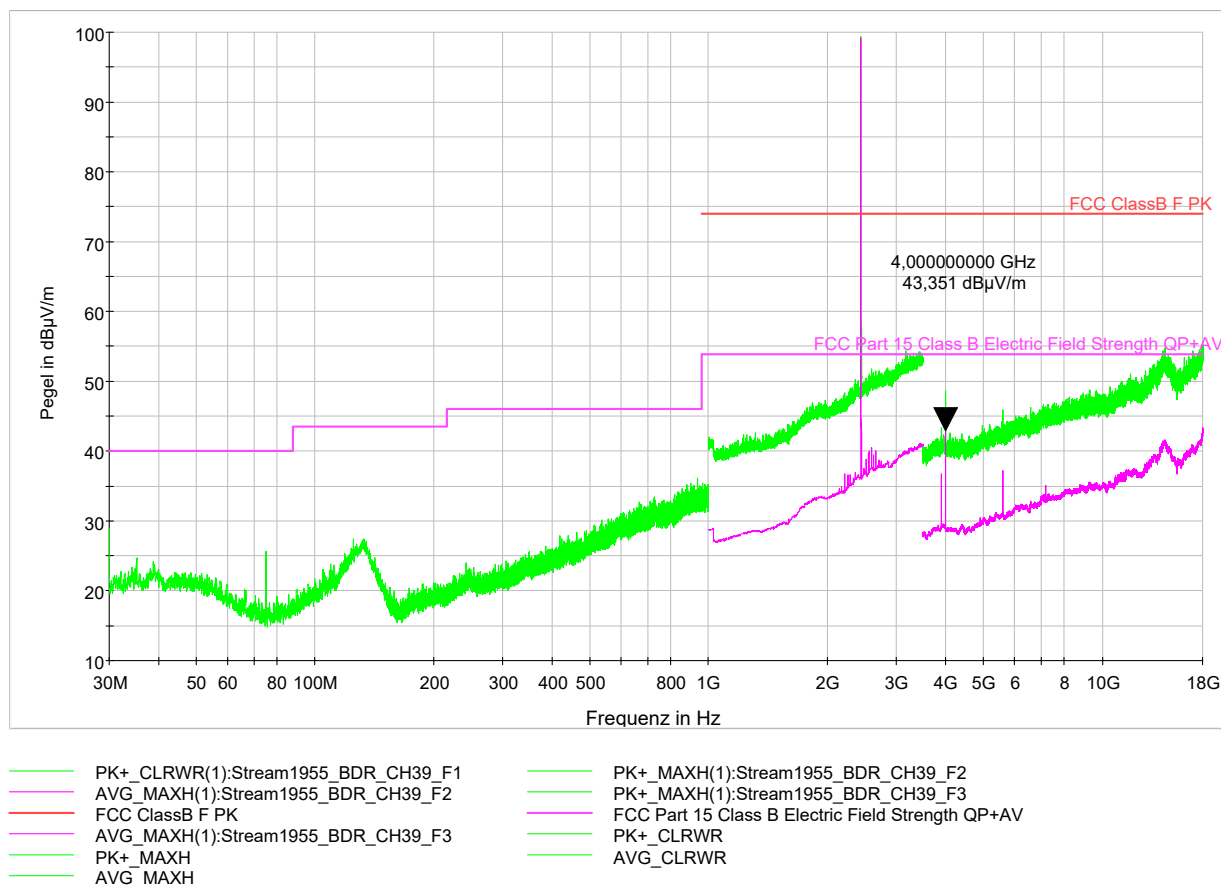
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-200

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement radiated with Peak-Detector (green line) and Average detector (magenta line):

Mode: Bluetooth BDR – Channel 39 – 2441 MHz



Worst case emission: Average @ 4000,0 MHz: 43,4 dBµV/m

Remark: Although the measurement above ends at 18 GHz, all measurements were performed up to the tenth harmonics of the transmitter frequency.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

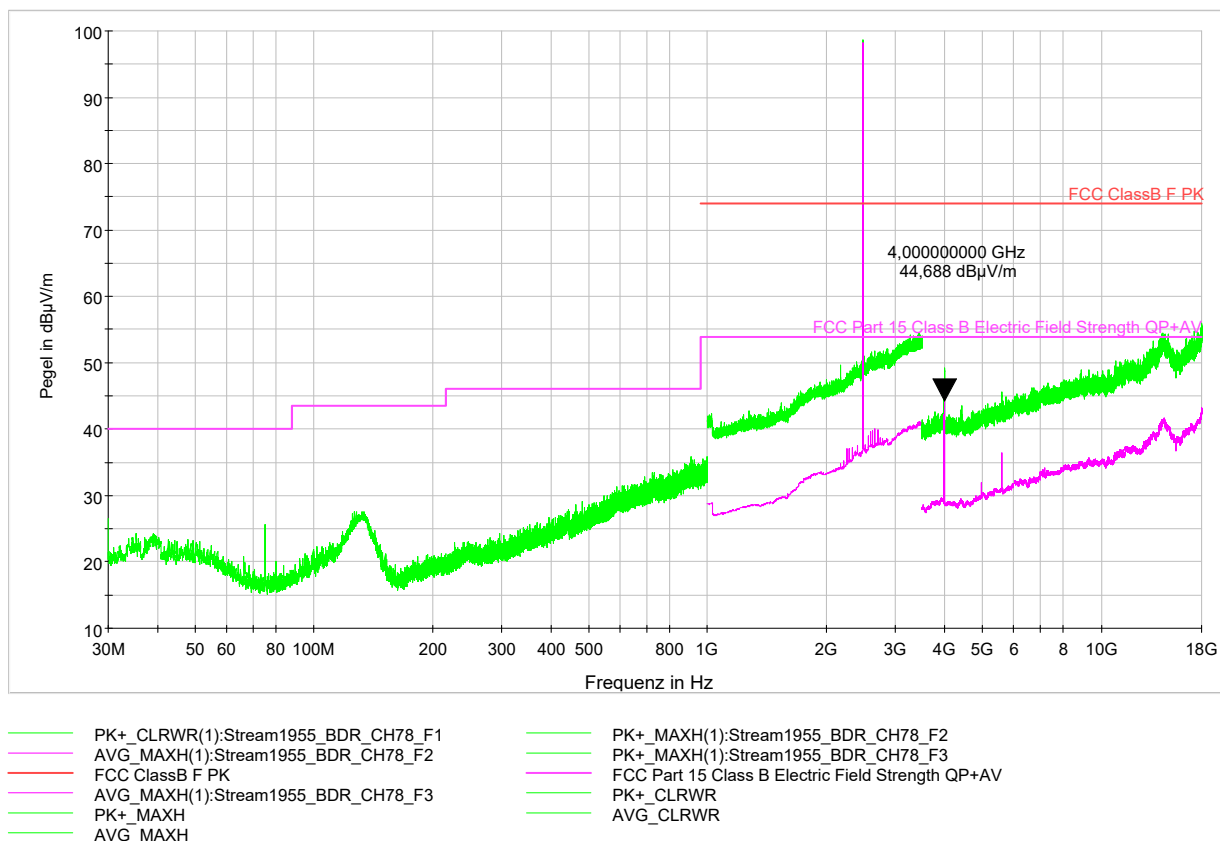
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200; EMV-205; NT-122; NT-126; NT-416

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement radiated with Peak-Detector (green line) and Average detector (magenta line):

Mode: Bluetooth BDR – Channel 78 – 2480 MHz



Worst case emission: Average @ 4000,0 MHz: 44,7 dBµV/m

Remark: Although the measurement above ends at 18 GHz, all measurements were performed up to the thenth harmonics of the transmitter frequency.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

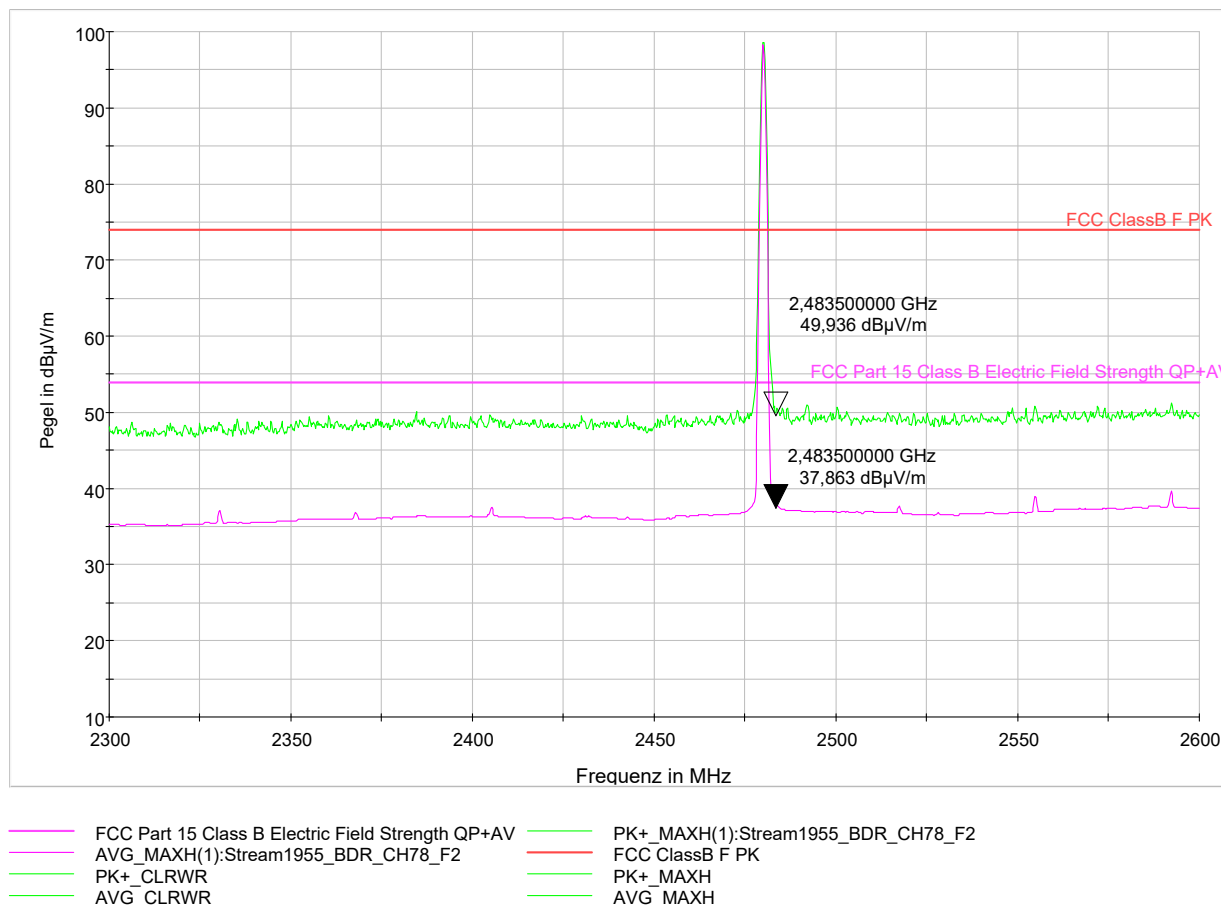
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200; EMV-205; NT-122; NT-126; NT-416

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement with Peak-Detector (green line) and Average detector (magenta line): Band Edge requirement

Setup: Bluetooth BDR – CH 78: 2480 MHz



LIMIT

SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Band edges of the nearest restricted bands: 2390 MHz and 2483,5 MHz.

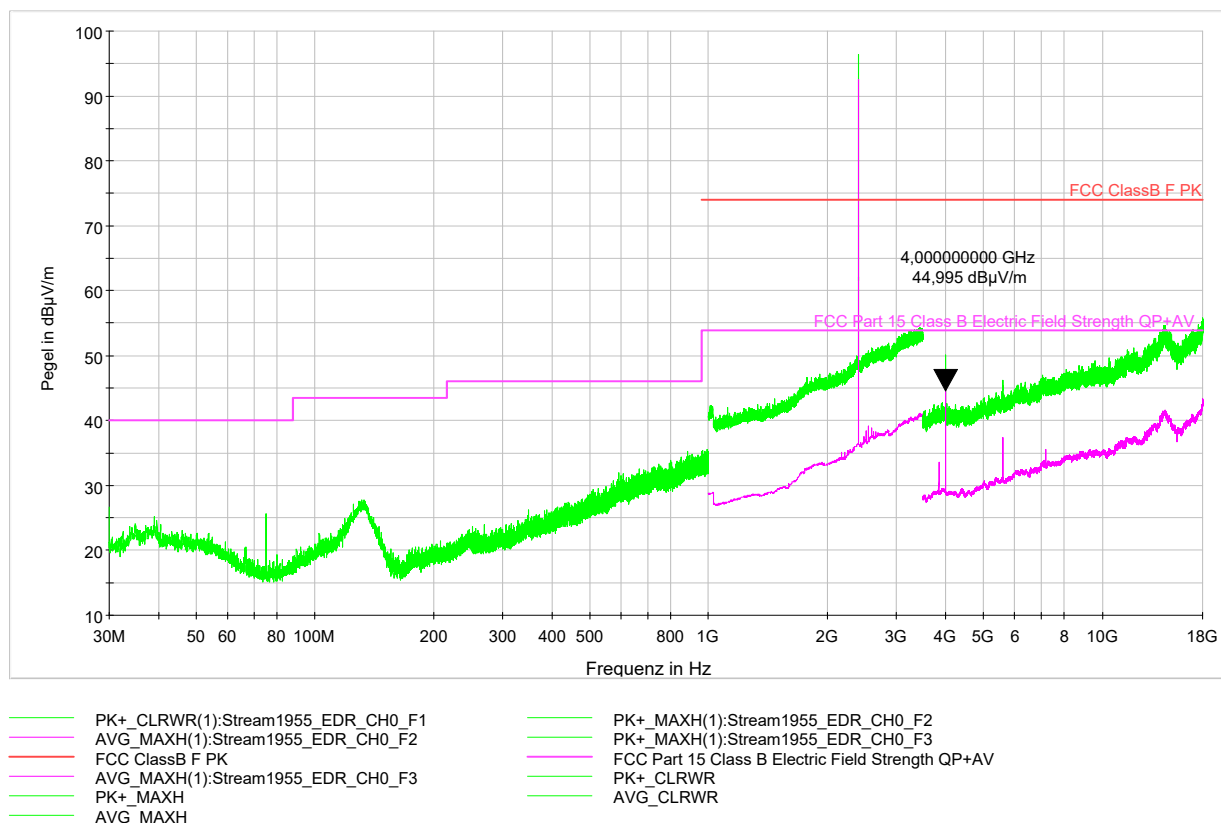
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-200

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement radiated with Peak-Detector (green line) and Average detector (magenta line):

Mode: Bluetooth EDR – Channel 0 – 2402 MHz



Worst case emission: Average @ 4000,0 MHz: 45,0 dBµV/m

Remark: Although the measurement above ends at 18 GHz, all measurements were performed up to the tenth harmonics of the transmitter frequency.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

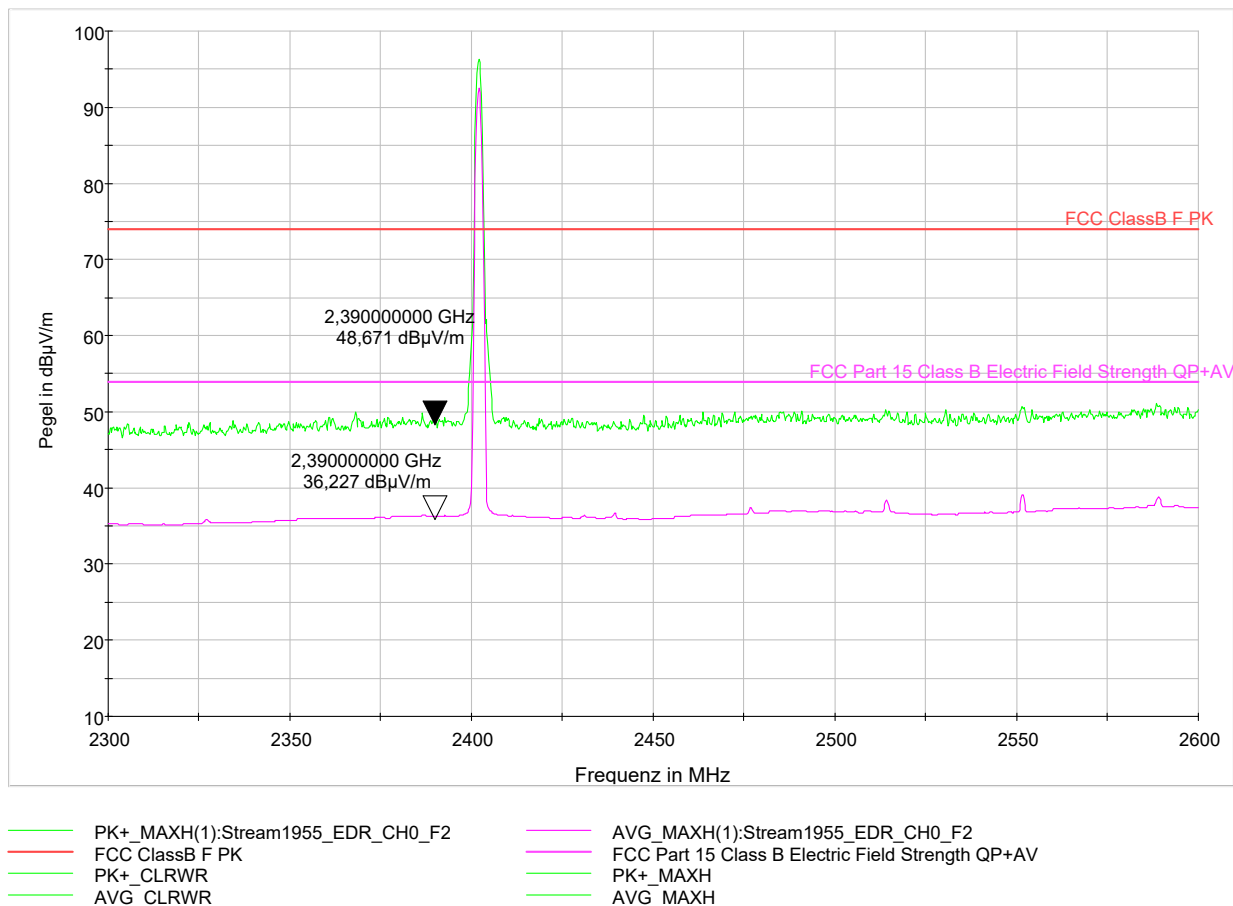
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200; EMV-205; NT-122; NT-126; NT-416

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement with Peak-Detector (green line) and Average detector (magenta line): Band Edge requirement

Setup: Bluetooth EDR – CH 0: 2402 MHz



LIMIT

SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Band edges of the nearest restricted bands: 2390 MHz and 2483,5 MHz.

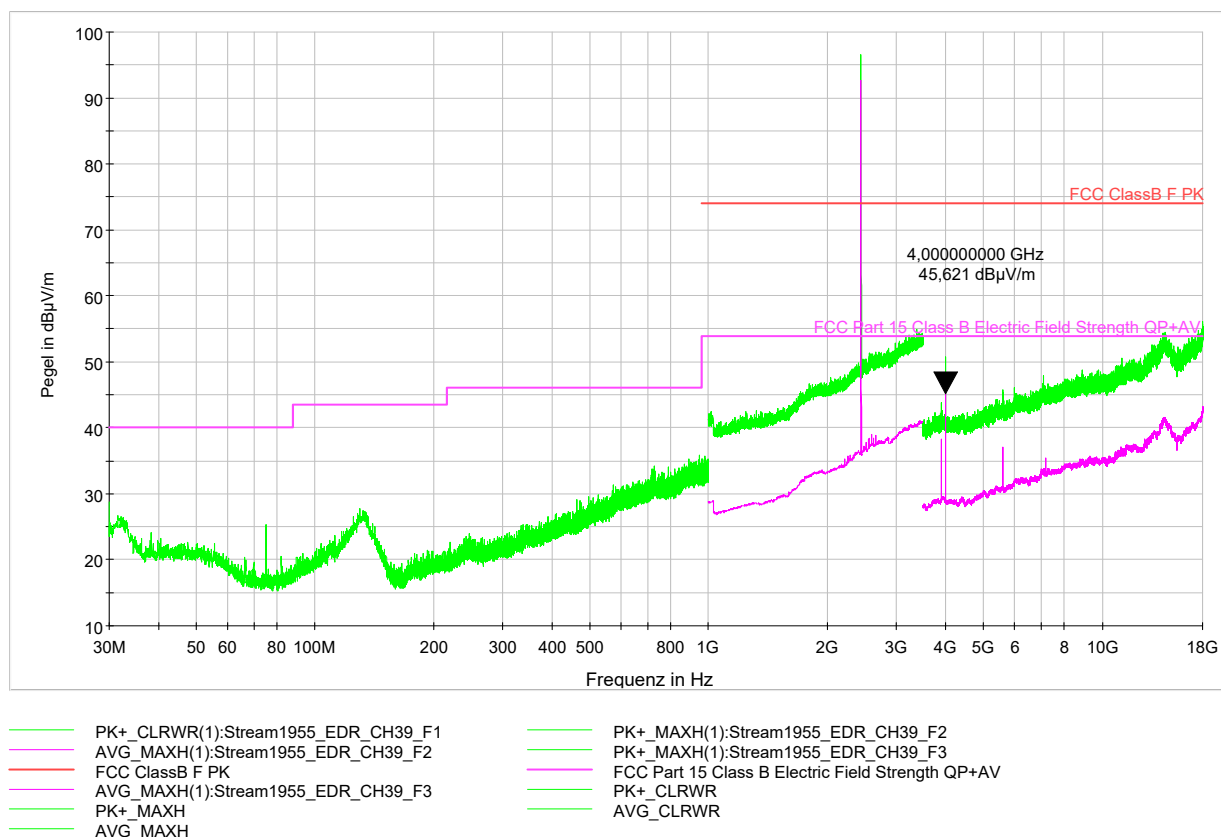
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-200

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement radiated with Peak-Detector (green line) and Average detector (magenta line):

Mode: Bluetooth EDR – Channel 39 – 2441 MHz



Worst case emission: Average @ 4000,0 MHz: 45,6 dBµV/m

Remark: Although the measurement above ends at 18 GHz, all measurements were performed up to the thenth harmonics of the transmitter frequency.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

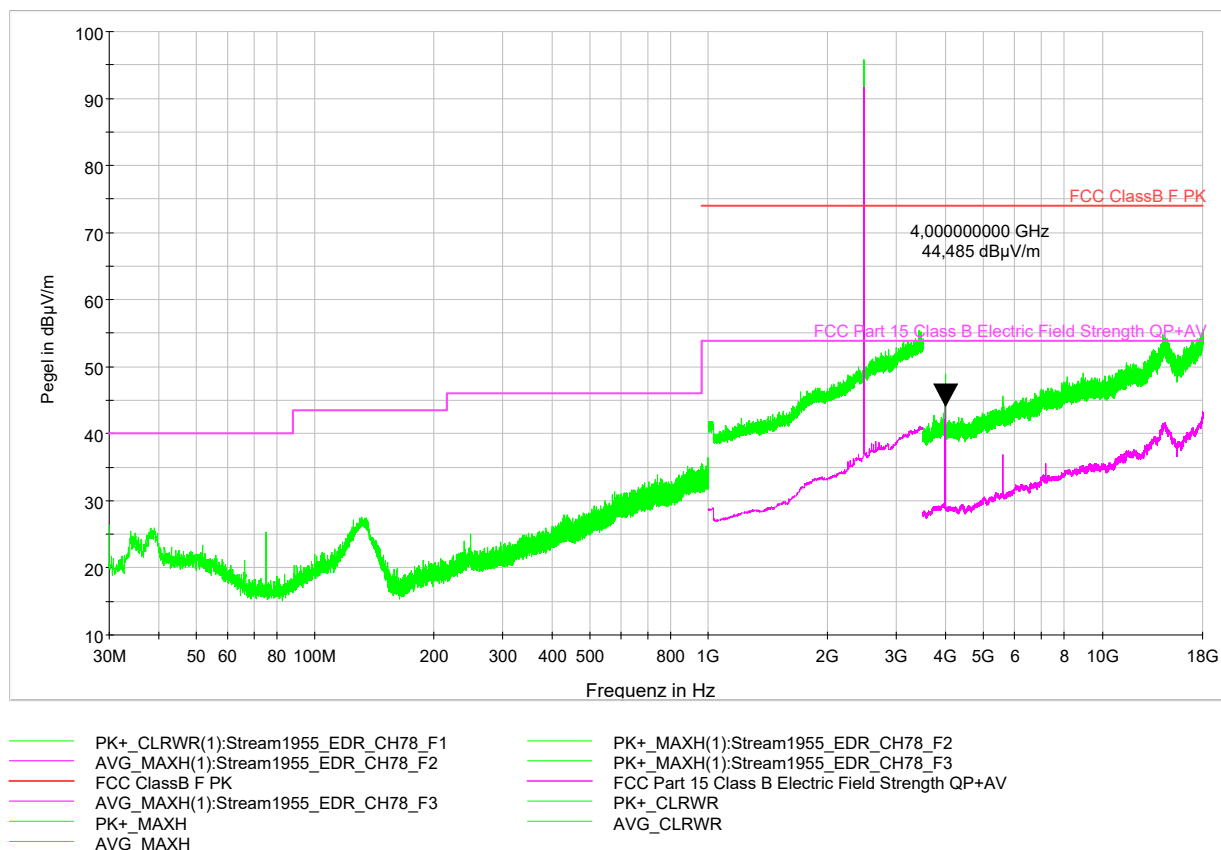
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200; EMV-205; NT-122; NT-126; NT-416

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement radiated with Peak-Detector (green line) and Average detector (magenta line):

Mode: Bluetooth EDR – Channel 78 – 2480 MHz



Worst case emission: Average @ 4000,0 MHz: 44,5 dBµV/m

Remark: Although the measurement above ends at 18 GHz, all measurements were performed up to the tenth harmonics of the transmitter frequency.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

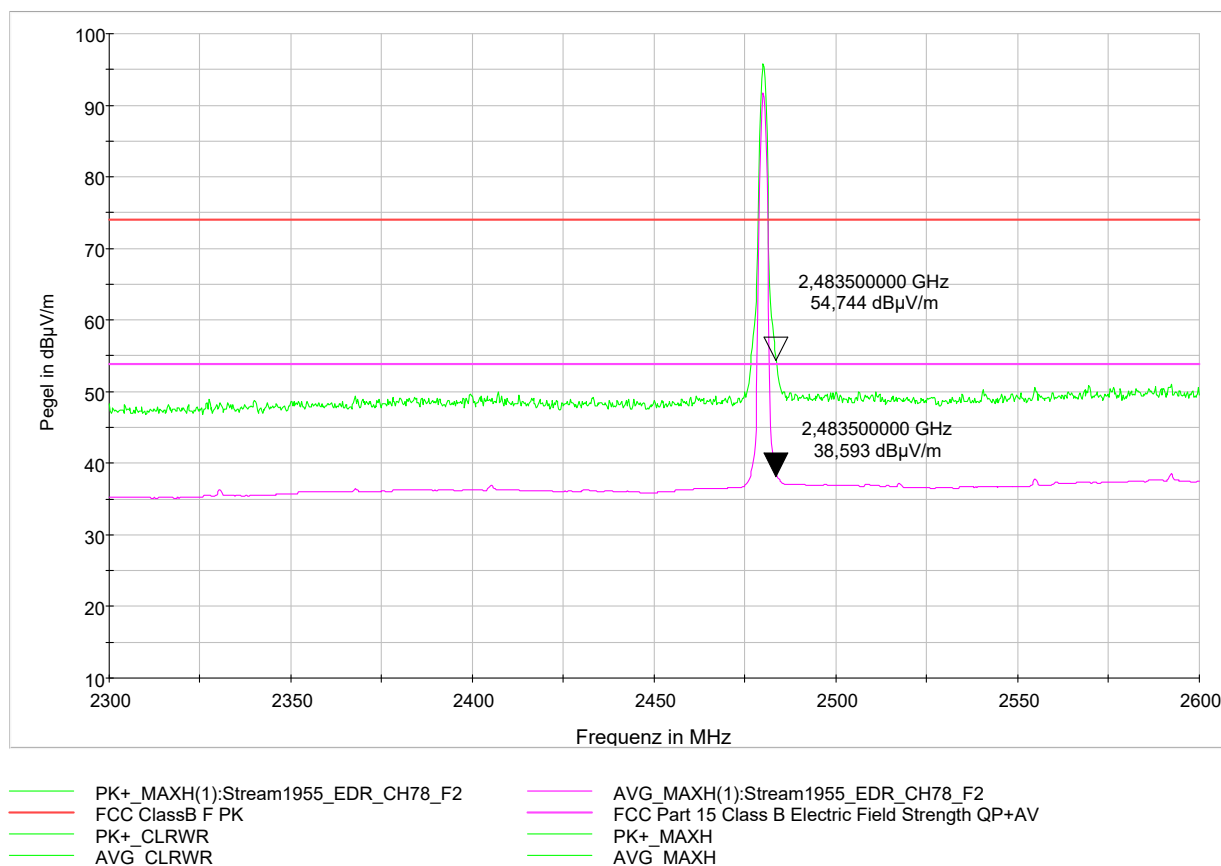
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200; EMV-205; NT-122; NT-126; NT-416

Emissions in restricted bands
Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measurement with Peak-Detector (green line) and Average detector (magenta line): Band Edge requirement

Setup: Bluetooth EDR – CH 78: 2480 MHz



LIMIT

SUBCLAUSE 15.209(a) – RSS-Gen

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Band edges of the nearest restricted bands: 2390 MHz and 2483,5 MHz.

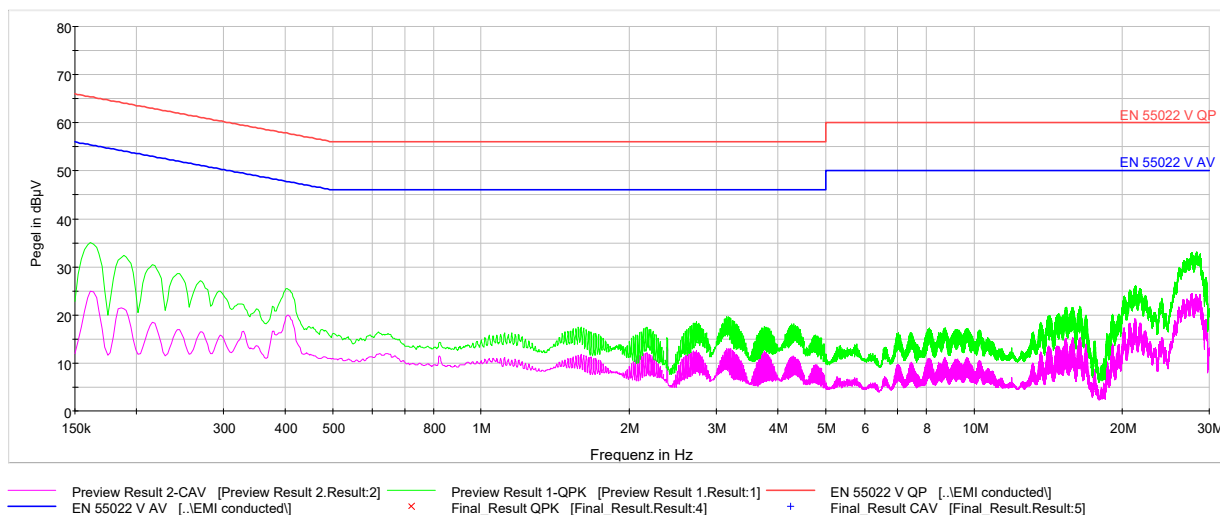
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-200

4.8. Conducted Limits

§ 15.207
RSS-Gen 8.8

Measurement with Peak-Detector (green line) and Average detector (magenta line):

Setup: Bluetooth BDR, Frequency hopping active



LIMIT

SUBCLAUSE 15.207(a) – RSS-Gen 8.8

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

*Decreases with the logarithm of the frequency.

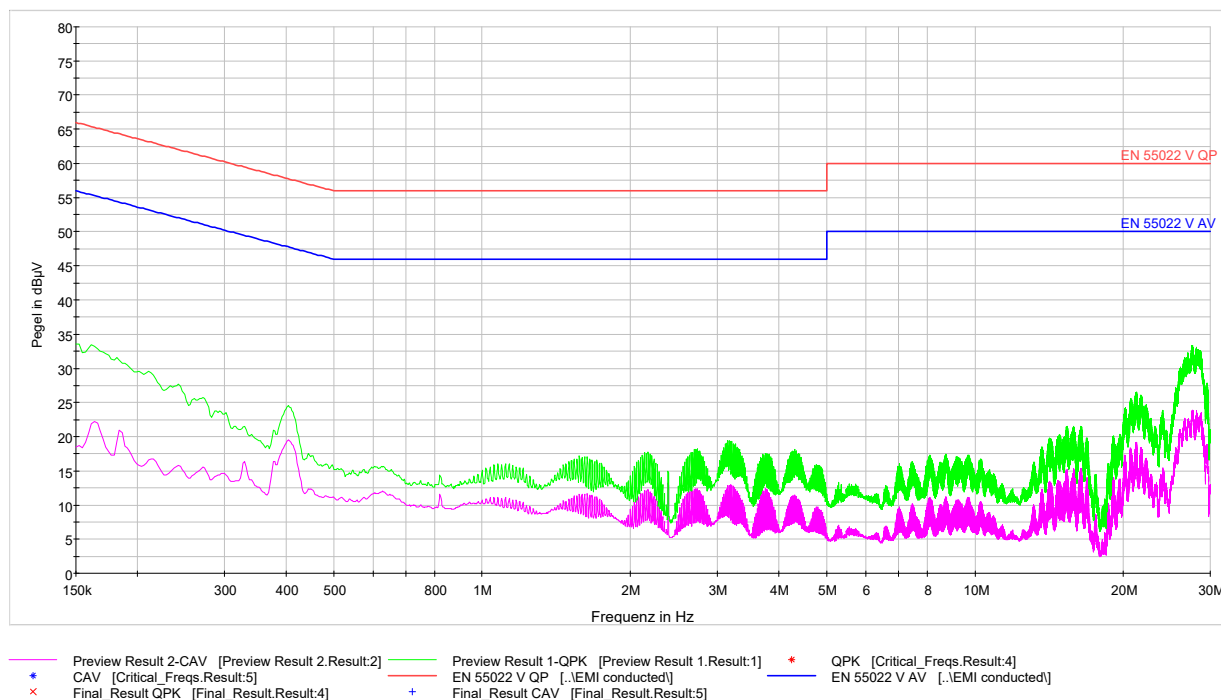
Test Equipment used: EMV-105; EMV-151; EMV-200; EMV-405

Conducted Limits

§ 15.207 RSS-Gen 8.8

Measurement with Peak-Detector (green line) and Average detector (magenta line):

Setup: Bluetooth EDR, Frequency hopping active



LIMIT

SUBCLAUSE 15.207(a) – RSS-Gen 8.8

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

*Decreases with the logarithm of the frequency.

Test Equipment used: EMV-105; EMV-151; EMV-200; EMV-405

4.9. Maximum permissible Exposure

§ 15.247(i)

This kind of radio equipment is categorically excluded from routine environmental evaluation.

Appendix 1

Test equipment used

Division:
Industry & Energy

Department: FG

Test report number:
INE-AT/FG-19/195

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Date: 02.12.2019

☐	Anechoic Chamber with 3m measurement distance	NT-100	☐	Power quality analyzer Fluke 1760 (complete set)	NT-160 - NT-173
☐	Stripline according to ISO 11452-5	NT-108	☐	Spectrum analyzer – FSP7 9 kHz – 7 GHz	NT-200
☐	MA4000 - Antenna mast 1 - 4 m height	NT-110/1	☐	ESCI - Test receiver 9 kHz - 7 GHz	NT-203/1
☐	DS - Turntable 0 - 400 ° Azimuth	NT-111/1	☐	ESI26 – Test receiver 20 Hz – 26,5 GHz	NT-207
☐	CO3000 Controller Mast+Turntable	NT-112/1	☐	Digital Radio Tester CMW500	NT-208/1
☐	HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz	NT-121	☐	Noise-gen., ITU-R 559-2 20 Hz – 20 kHz	NT-209
☐	FMZB1513 - Loop Antenna 9 kHz - 30 MHz	NT-122/1	☐	CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz	NT-210
☐	HFH-Z6 - Rod Antenna 9 kHz - 30 MHz	NT-123	☐	3271 - Spectrum analyzer 100 Hz - 26,5 GHz	NT-211
☐	3121C - Dipole Antenna 28 - 1000 MHz	NT-124	☐	Digital Radio Tester Aeroflex 3920	NT-212/1
☐	3115 - Horn Antenna 1 - 18 GHz (immunity)	NT-125	☐	Mixer M28HW 26,5 GHz - 40 GHz	NT-214
☐	3116 - Horn Antenna 18 - 40 GHz	NT-126	☐	RubiSource T&M Timing reference	NT-216
☐	SAS-200/543 - Bicon. Antenna 20 MHz - 300 MHz	NT-127	☐	Radiocommunication analyzer SWR 1180 MD	NT-217
☐	AT-1080 - Log. Per. Antenna 80 - 1000 MHz	NT-128	☐	Mixer M19HWD 40 GHz – 60 GHz	NT-218
☐	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-129	☐	Mixer M12HWD 60 GHz – 90 GHz	NT-219
☐	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-130	☐	DSO9104 Digital scope	NT-220/1
☐	3146 - Log. Per. Antenna 200 – 1000 MHz	NT-131	☐	TPS 2014 Digital scope	NT-222
☐	VULB 9163 Trilog Antenna 30 – 3000 MHz	NT-131/1	☐	Artificial Ear according to IEC 60318	NT-224
☐	Loop Antenna H-Field	NT-132	☐	1 kHz Sound calibrator	NT-225
☐	Horn Antenna 500 MHz - 2900 MHz	NT-133	☐	B10 - Harmonics and flicker analyzer	NT-232
☐	Horn Antenna 500 MHz - 6000 MHz	NT-133/1	☐	SRM-3006 Spectrum analyzer	NT-233/1a
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-134	☐	E-field probe SRM 75 MHz – 3 GHz	NT-234
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-135	☐	Field Meter NBM-500 incl. E- and H-Field probes	NT-240a-e
☐	BiConiLog Antenna 26 MHz – 2000 MHz	NT-137	☐	Hall-Teslameter ETM-1	NT-241
☐	Conical Dipol Antenna PCD8250	NT-138	☐	EFA-3 H-field- / E-field probe	NT-243
☐	HF 906 - Horn Antenna 1 - 18 GHz (emission)	NT-139	☐	EHP-50F H-field- / E-field probe	NT-243/1
☐	HZ-1 Antenna tripod	NT-150	☐	Field Meter EMR-200 100 kHz – 3 GHz	NT-244
☐	BN 1500 Antenna tripod	NT-151	☐	E-field probe 100 kHz – 3 GHz	NT-245
☐	Ant. tripod for EN61000-4-3 Model TP1000A	NT-156	☐	H-field probe 300 kHz – 30 MHz	NT-246

Appendix 1 (continued)

Test equipment used

Division:
Industry & Energy

Department: FG

Test report number:
INE-AT/FG-19/195

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☐ E-field probe 3 MHz – 18 GHz	NT-247	☐ T82-50 RF-Amplifier 2 GHz – 8 GHz	NT-331
☐ H-field probe 27 MHz – 1 GHz	NT-248	☐ 500W1000M7 - RF-Amplifier 80 - 1000 MHz / 500 W	NT-332
☐ ELT-400 1 Hz – 400 kHz	NT-249	☐ AS0102-65R - RF-Amplifier 1 GHz - 2 GHz	NT-333
☐ MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250	☐ APA01 – RF-Amplifier 0,5 GHz – 2,5 GHz	NT-334
☐ FCC-203I EM Injection clamp	NT-251	☐ Preamplifier 1 GHz - 4 GHz	NT-335
☐ FCC-203I-DCN Ferrite decoupling network	NT-252	☐ Preamplifier for GPS MKU 152 A	NT-336
☐ PR50 Current Probe	NT-253	☐ Preamplifier 100 MHz – 23 GHz	NT-337
☐ i310s Current Probe	NT-254/1	☐ DC Block 10 MHz – 18 GHz Model 8048	NT-338
☐ Fluke 87 V True RMS Multimeter	NT-260	☐ 2-97201 Electronic load	NT-341
☐ Model 2000 Digital Multimeter	NT-261	☐ TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-344
☐ Fluke 87 V Digital Multimeter	NT-262/1	☐ TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-345
☐ ESH2-Z5-U1 Artificial mains network 4x25A	NT-300	☐ VDS 200 Mobil-impuls-generator	NT-350
☐ ESH3-Z5-U1 Artificial mains network 2x10A	NT-301	☐ LD 200 Mobil-impuls-generator	NT-351
☐ ESH3-Z6-U1 Artificial mains network 1x100A	NT-302	☐ MPG 200 Mobil-Impuls-Generators	NT-352
☐ ESH3-Z6-U1 Artificial mains network 1x100A	NT-302a	☐ EFT 200 Mobil-impuls-generator	NT-353
☐ PHE 4500/B Power amplifier	NT-304	☐ AN 200 S1 Artificial Network	NT-354
☐ EZ10 T-Artificial Network	NT-305	☐ FP-EFT 32M 3 ph. Coupling filter (Burst)	NT-400/1
☐ SMG - Signal generator 0,1 - 1000 MHz	NT-310	☐ PHE 4500 - Mains impedance network	NT-401
☐ SMA100A - Signal generator 9 kHz - 6 GHz	NT-310/1	☐ IP 6.2 Coupling filter for data lines (Surge)	NT-403
☐ RefRad Reference generator	NT-312	☐ TK 9421 High Power Volt. Probe 150 kHz - 30 MHz	NT-409
☐ SMP 02 Signal generator 10 MHz - 20 GHz	NT-313	☐ ESH2-Z3 - Probe 9 kHz - 30 MHz	NT-410
☐ 40 MHz Arbitrary Generator TGA1241	NT-315	☐ IP 4 - Capacitive clamp (Burst)	NT-411
☐ Artificial mains network NSLK 8127-PLC	NT-316	☐ Highpass-Filter 100 MHz – 3 GHz	NT-412
☐		☐ Highpass-Filter 600 MHz – 4 GHz	NT-413
☐ PSURGE 4.1 Surge generator	NT-324	☐ Highpass-Filter 1250 MHz – 4 GHz	NT-414
☐ IMU4000 Immunity test system	NT-325/1	☐ Highpass-Filter 1800 MHz – 16 GHz	NT-415
☐ VCS 500-M6 Surge-Generator	NT-326		
☐ Oscillatory Wave Simulator incl. Coupling networks	NT-328a+b+c		
☐ BTA-250 - RF-Amplifier 9 kHz - 220 MHz / 250 W	NT-330		

Appendix 1 (continued)

Test equipment used

Division:
Industry & Energy

Department: FG

Test report number:
INE-AT/FG-19/195

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Date: 02.12.2019

☐	Highpass-Filter 3500 MHz – 18 GHz	NT-416	☐	FCC-801-AF10 Coupling decoupling network	NT-461
☐	RF-Attenuator 10 dB DC – 18 GHz / 50 W	NT-417	☐	FCC-801-S25 Coupling decoupling network	NT-462
☐	RF-Attenuator 6 dB DC – 18 GHz / 50 W	NT-418	☐	FCC-801-T4 Coupling decoupling network	NT-463
☐	RF-Attenuator 3 dB DC – 18 GHz / 50 W	NT-419	☐	FCC-801-C1 Coupling decoupling network	NT-464
☐	RF-Attenuator 20 dB DC - 1000 MHz / 25 W	NT-421	☐	SW 9605 - Current probe 150 kHz – 30 MHz	NT-465/1
☐	RF-Attenuator 30 dB DC - 1000 MHz / 1 W	NT-423	☐	95242-1 – Current probe 1 MHz – 400 MHz	NT-468
☐	RF-Attenuator 30 dB	NT-424	☐	94106-1L-1 – Current probe 100 kHz – 450 MHz	NT-471
☐	RF-Attenuator 6 dB DC - 1000 MHz / 1 W	NT-425	☐	GA 1240 Power amplifier according to EN 61000-4-16	NT-480
☐	RF-Attenuator 6 dB DC - 1000 MHz / 1 W	NT-426	☐	Coupling networks according to EN 61000-4-16	NT-481 - NT-483
☐	RF-Attenuator 6 dB	NT-428	☐	Van der Hoofden Test Head	NT-484
☐	RF-Attenuator 0 dB - 81 dB	NT-429	☐	EMC Video/Audiosystem	NT-511/1
☐	WRU 27 - Band blocking 27 MHz	NT-430	☐	ES-K1 Version 1.71 SP2 Test software	NT-520
☐	WHJ450C9 AA - High pass 450 MHz	NT-431	☐	EMC32 Version 10.50.40 Test software	NT-520/1
☐	WHJ250C9 AA - High pass 250 MHz	NT-432	☐	SRM-TS Version 1.3 software for SRM-3000	NT-522
☐	RF-Load 150 W	NT-433	☐	SRM-TS Version 1.3.1 software for SRM-3006	NT-522/1
☐	Impedance transducer 1:4 ; 1:9 ; 1:16	NT-435	☐	Spitzenberger und Spies Test software V4.1	NT-525
☐	RF-Attenuator DC – 18 GHz 6 dB	NT-436	☐	Noise power test apparatus according to EN 55014	NT-530
☐	RF-Attenuator DC – 18 GHz 6 dB	NT-437	☐	Vertical coupling plane (ESD)	NT-531
☐	RF-Attenuator DC – 18 GHz 10 dB	NT-438	☐	Test cable #4 for EN 61000-4-6	NT-553
☐	RF-Attenuator DC – 18 GHz 20 dB	NT-439	☐	Test cable #3 for conducted emission	NT-554
☐	I+P 7780 Directional coupler 100 - 2000 MHz	NT-440	☐	Test cable #5+#6 ESD-cable (2x470k)	NT-555 + NT-556
☐	ESH3-Z2 - Pulse limiter 9 kHz - 30 MHz	NT-441	☐	Test cable #8 Sucoflex 104EA	NT-559
☐	Power Divider 6 dB/1 W/50 Ohm	NT-443	☐	Test cable #9 (for outdoor measurements)	NT-580
☐	Directional coupler 0,1 MHz – 70 MHz	NT-444	☐	Test cable #10 (for outdoor measurements)	NT-581
☐	Directional coupler 0,1 MHz – 70 MHz	NT-445	☐	Test cable #13 Sucoflex 104PE	NT-584
☐	Tube imitations according to EN 55015	NT-450	☐	Test cable #21 for SRM-3000	NT-592
☐	FCC-801-M3-16A Coupling decoupling network	NT-458	☐	Shield chamber	NT-600
☐	FCC-801-M2-50A Coupling decoupling network	NT-459	☐	Climatic chamber	M-1200
☐	FCC-801-M5-25 Coupling decoupling network	NT-460			

Appendix 1 (continued)

Test equipment used

☐	Anechoic Chamber 3 m / 5 m measuring distance	EMV-100	☐	Log.per Antenna 0,7 – 9 GHz STLP9149	EMV-305
☐	Turntabel 6 m diameter	EMV-101	☐	HF- Amplifier 9 kHz-250 MHz BBA150 (low noise)	EMV-306
☐	Antenna mast + controller	EMV-102+ EMV-103	☐	ISO11451-2 TLS 10 kHz – 30 MHz	EMV-307
☐	EMC Video/Audiosystem	EMV-104	☐	Load Dump Generator LD 200N	EMV-350
☐	EMC Software EMC32 Version 10.50.40	EMV-105	☐	Ultra Compact Symulator UCS 200N100	EMV-351
☐	Hornantenna 1 – 18 GHz HF 907	EMV-110	☐	Automotive Power fail module PFM 200N100.1	EMV-352
☐	Antennapre.amp. 1 – 18 GHz ERZ-LNA0200-1800-30-2	EMV-111	☐	Voltage Drop Symulator VDS 200Q100	EMV-353
☐	Trilog Antenna 30-3000 MHz VULB9163	EMV-112	☐	Arb. Generator AutoWave	EMV-354
☐	Monopol 9 kHz – 30 MHz VAMP 9243	EMV-113	☐	Ultra Compact Symulator UCS 500N7	EMV-355
☐	Antennapre.amp 18 – 40 GHz BBV 9721	EMV-114	☐	Coupling decoupling network CNI 503B7 / 32 A	EMV-356
☐	Hornantenna 200 – 2000 MHz AH-220	EMV-115	☐	Coupling decoupling network CNI 503B7 / 63 A	EMV-357
☐	DC Artificial Network PVDC 8300	EMV-150	☐	Telecom Surge Generator TSurge 7	EMV-358
☐	AC Artificial Network NNLK 8121 RC	EMV-151	☐	Coupling decoupling network CNI 508N2	EMV-359
☐	EMI Receiver ESR26	EMV-200	☐	Coupling decoupling network CNV 504N2.2	EMV-360
☐	Signalgenerator 9 kHz – 40 GHz N5173B	EMV-201	☐	Immunity generator NSG4060/NSG4060-1	EMV-361
☐	GPS Frequency normal B-88	EMV-202	☐	Coupling network CDND M316-2	EMV-362
☐	DC Power supply N5745A	EMV-203	☐	Coupling network CT419-5	EMV-363
☐	Spektrum Analyzator FSV40	EMV-205	☐	ESD Generator NSG 437	EMV-364
☐	Thd Multimeter Model 2015	EMV-206	☐	Pulse Limiter VTSD 9561-F BNC	EMV-405
☐	Poweramplifier PAS15000	EMV- 207/abc	☐	Transient emission BSM200N40+BS200N100	EMV- 450+451
☐	Inrush Current Source	EMV- 208/abc	☐	Cap. Coupling Clamp HFK	EMV-455
☐	Arb.-generator Sycore	EMV-209	☐	Mag. Field System MS100N+MC26100+MC2630	EMV- 456-458
☐	Harmonics/Flicker analyzer ARS 16/3	EMV-210	☐	Coupling network CDN M2-100A	EMV-459
☐	HF- Amplifier 9 kHz-250 MHz BBA150	EMV-300	☐	Coupling network CDN M3-32A	EMV-460
☐	HF- Amplifier 80 -1000 MHz BBA150	EMV-301	☐	Coupling network CDN M5-100A	EMV-461
☐	HF- Amplifier 0,8 - 6 GHz BBA150	EMV-302	☐	Current Clamp CIP 9136A	EMV-462
☐	High Power Ant. 20-200 MHz HPBA-2510	EMV-303/1	☐	DC Artificial Network HV-AN 150	EMV- 464+465
☐	Log.per Antenna 80-2700 MHz STLP 9128 E special	EMV-304	☐	Coupling Clamp EM 101	EMV-466
			☐	Decoupling Clamp FTC 101	EMV-467
			☐	Power attenuator 10 dB / 250 Watt	EMV-469/2

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Industry & Energy

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