TEST REPORT

of the accredited test laboratory

TÜV Nr.:M/FG-16/121

Applicant:	BETSO ELECTRONICS s.r.o. Elisky Premyslovny 1335 156 00, Prague 5, Czech Republic		
Tested Product:	FHSS radio module Model: 'RFM1'		
FCC-ID:	2AJWB-RFM1		
IC-ID:	21968-RFM1		
Manufacturer:	See applicant		
Output power / field strength:	8,73 mW conducted	**power supply:**	+3,0 to +5,5 VDC
Frequency range:	903 - 927 MHz	**Channel separation:**	480 kHz
Standard:	FCC: 47 CFR Part 15 (October 1, 2015 edition) RSS-247 Issue 1, May 2015; including modifications and clarifications in CB Notice 2015-07		

TUV Austria Services GmbH
Test laboratory for EMC

Supervisor of EMC-laboratory: Ing. Wilhelm Seier

Rundsiegel

checked by: Ing. Michael Emminger

09.11.2016

Copy Nbr.: Ø1

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

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Testing Body for Communication Technology/ EMC

TÜV ®

LIST OF MEASUREMENTS

The complete list of measurements called for in 47 CFR 15 and RSS-247 is given below.

TEST OBJECT DATA

General EUT Description

This is a frequency hopping radio module.

2.1033 (c) Technical description

2.1033 (4) Type of emission: 46K6F1D – Channel spacing 480 kHz.

2.1033 (5) Frequency range: 903,24 to 926,78 MHz (channel center frequencies). 50 channels.

2.1033 (6) Power range and Controls: The maximum peak output power is 8,73 mW and there is no power regulation.

2.1033 (7) Maximum output power rating: 8,73 mW conducted.

2.1033 (8) DC Voltage and Current: 3,0 to 5,5V DC
maximum current consumption: 18 mA

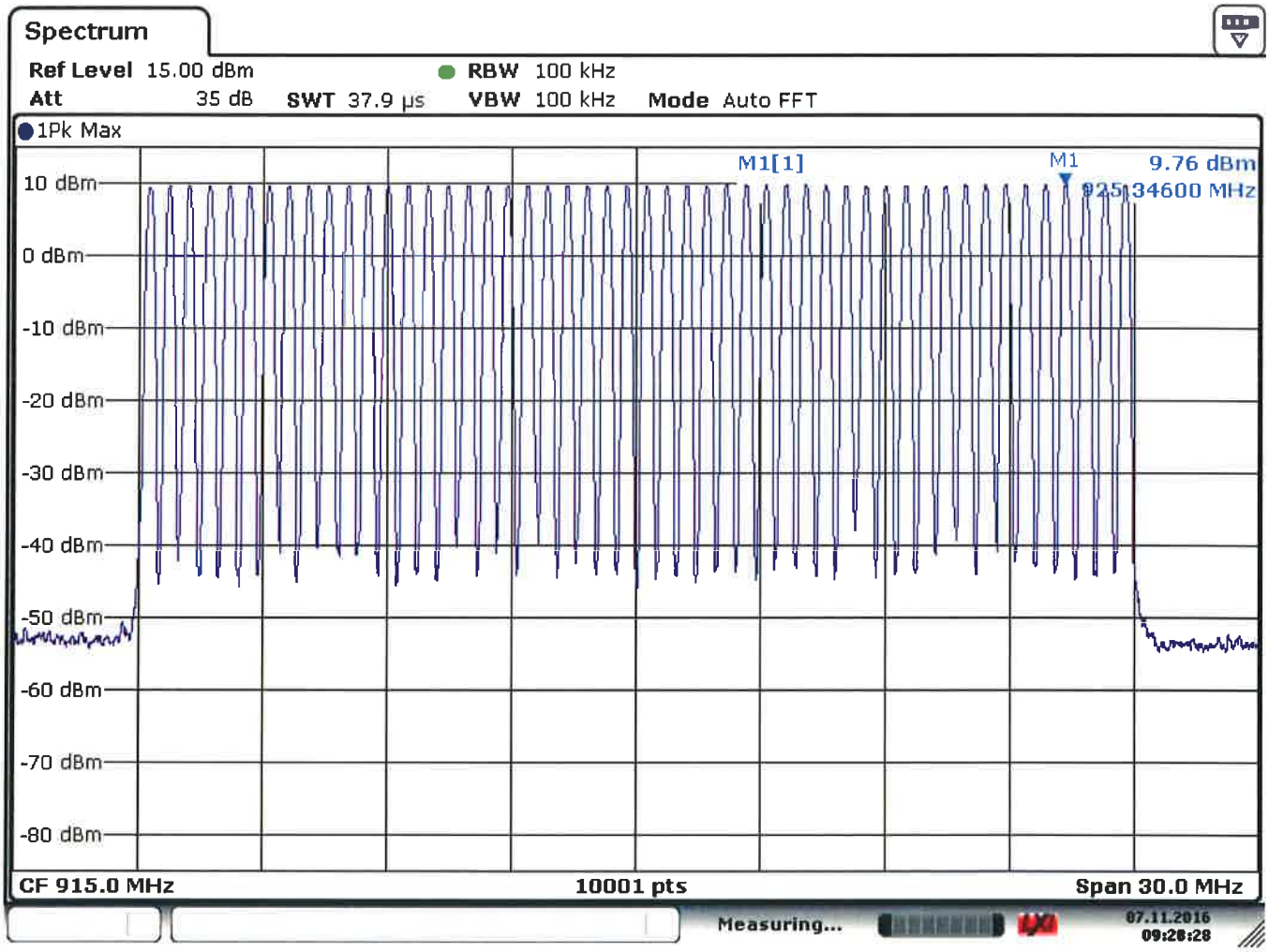
RSS-135 This standard does not apply to:
1.1.(a) a receiver that scans radio frequencies for the purpose of enabling its associated transmitter to avoid transmitting in an occupied frequency but which does not have the capability of decoding the message (e.g. converting it to audio voice) contained in the radio signal

Tests were performed 7th October 2016.

Number of channels and channel spacing **§ 15.247 (a) (1)**
5.1 (2) (4)

Conducted Measurement

Rated output power: 8,73 mW



Date: 7.NOV.2016 09:28:29

There are 50 Channels used, starting at 903,24 till 926,78 each spaced by 480 kHz 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.

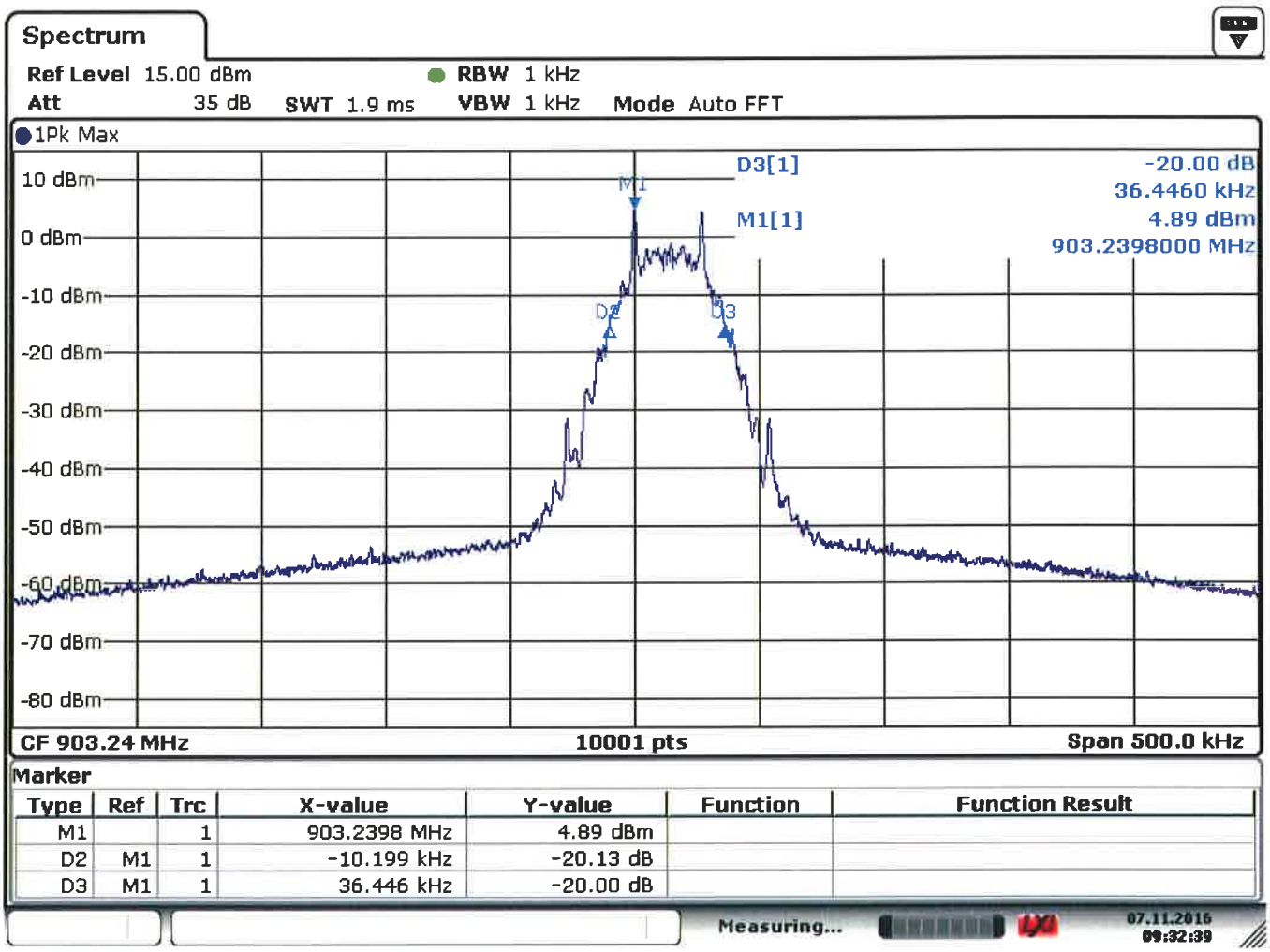
Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

20dB Bandwidth **§ 15.247 (a) (1)**
5.1 (2)

Conducted Measurement

Rated output power: 8,73 mW 903,24 MHz



Date: 7.NOV.2016 09:32:40

20dB Bandwidth: 46,645 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.

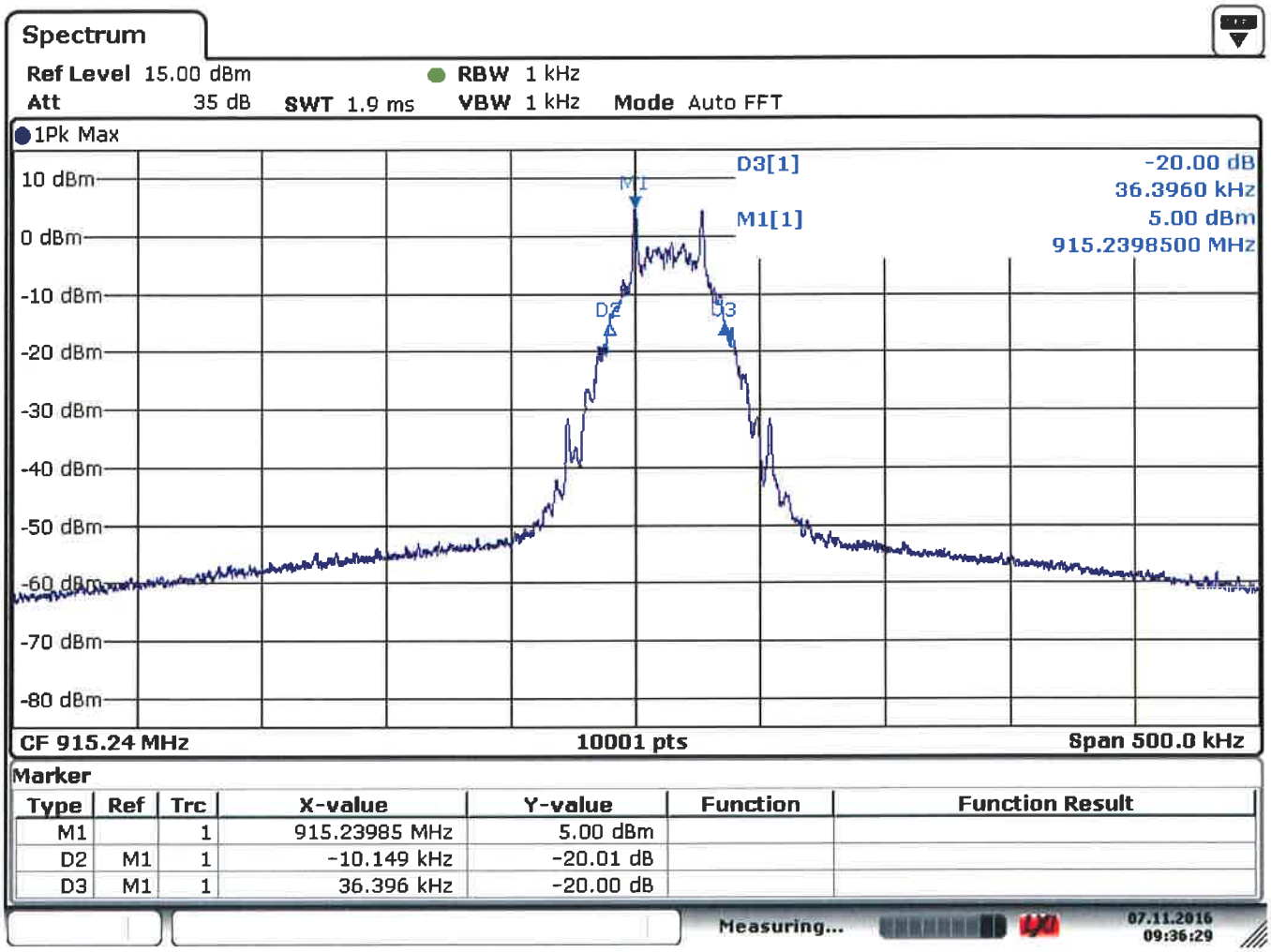
Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

20dB Bandwidth **§ 15.247 (a) (1)**
5.1 (2)

Conducted Measurement

Rated output power: 8,73 mW 915,24 MHz



Date: 7.NOV.2016 09:36:29

20dB Bandwidth: 46,545 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.

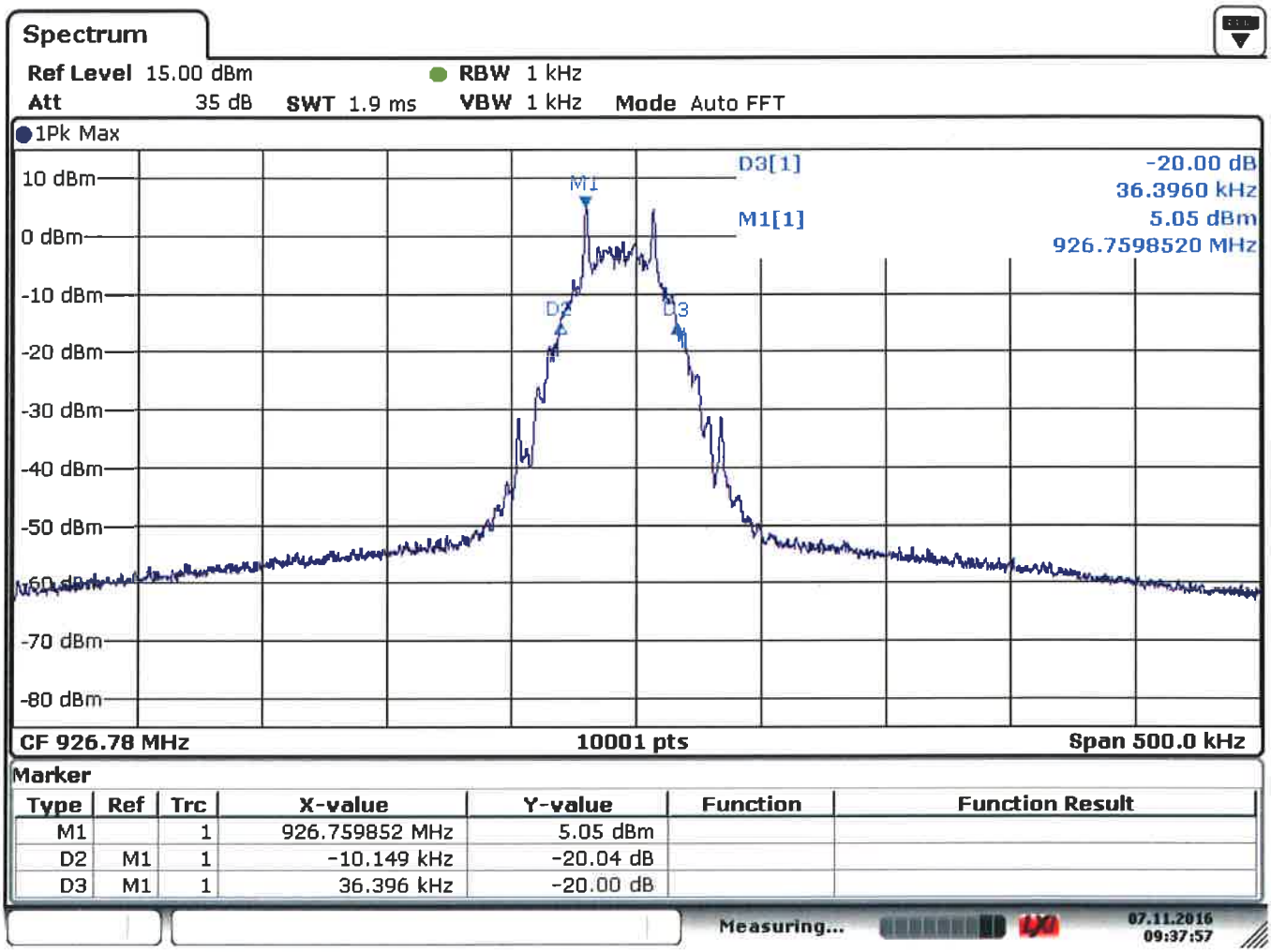
Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

20dB Bandwidth **§ 15.247 (a) (1)**
5.1 (2)

Conducted Measurement

Rated output power: 8,73 mW 926,78 MHz



Date: 7.NOV.2016 09:37:58

20dB Bandwidth: 46,545 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

Maximum Peak RF Power Output (EIRP) **§ 15.247(b)(1)**
5.4(2)

Conducted /radiated Measurement

Rated output power: 8,73 mW

Test conditions	Transmitter power (mW)		
	2402 MHz	2441 MHz	2480 MHz
Conducted	8,00	8,45	8,73
Radiated – Antenna: ANT-916-CHP	2,34	2,00	1,62
Radiated – Antenna: ANT-868-PW-LP	3,02	2,88	2,63
Radiated – Antenna: ANT-868-CW-RH	2,40	1,91	1,45
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-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-112; EMV-200; EMV-205

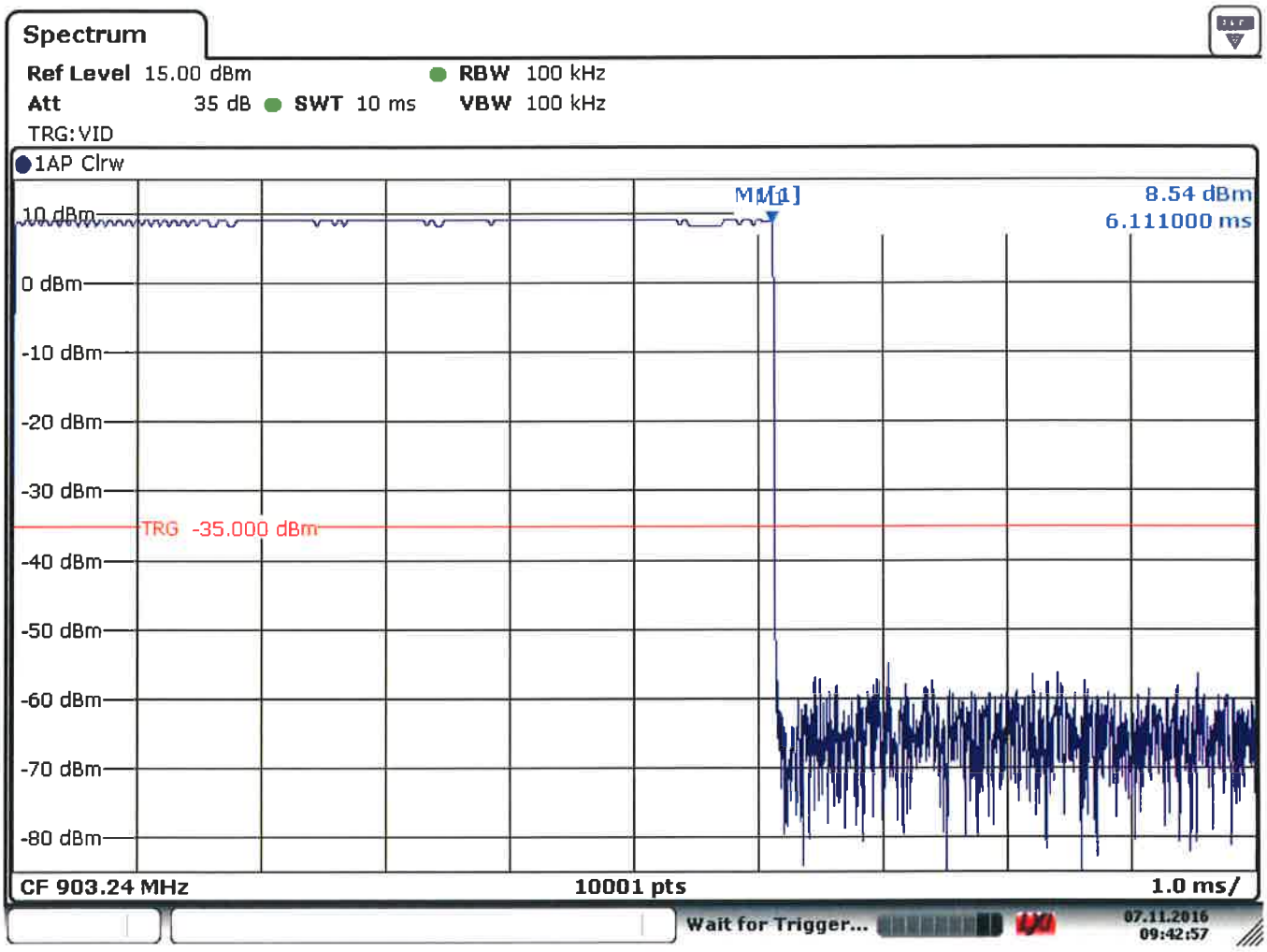
Note: The module does not have integrated antenna. For testing the module was mounted on an evaluation board, that was constructed to support the different antennas and RP-SMA connector for conducted measurements.

Radiated emission measurements were made with the setup giving the highest EIRP in the measurement above.

Average Time of Occupancy **§ 15.247(a)(1)(iii)**
5.1(4)

Conducted Measurement

Rated output power: 8,73 mW 903,24 MHz



Date: 7.NOV.2016 09:42:57

The dwell time is constant 6,111 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.

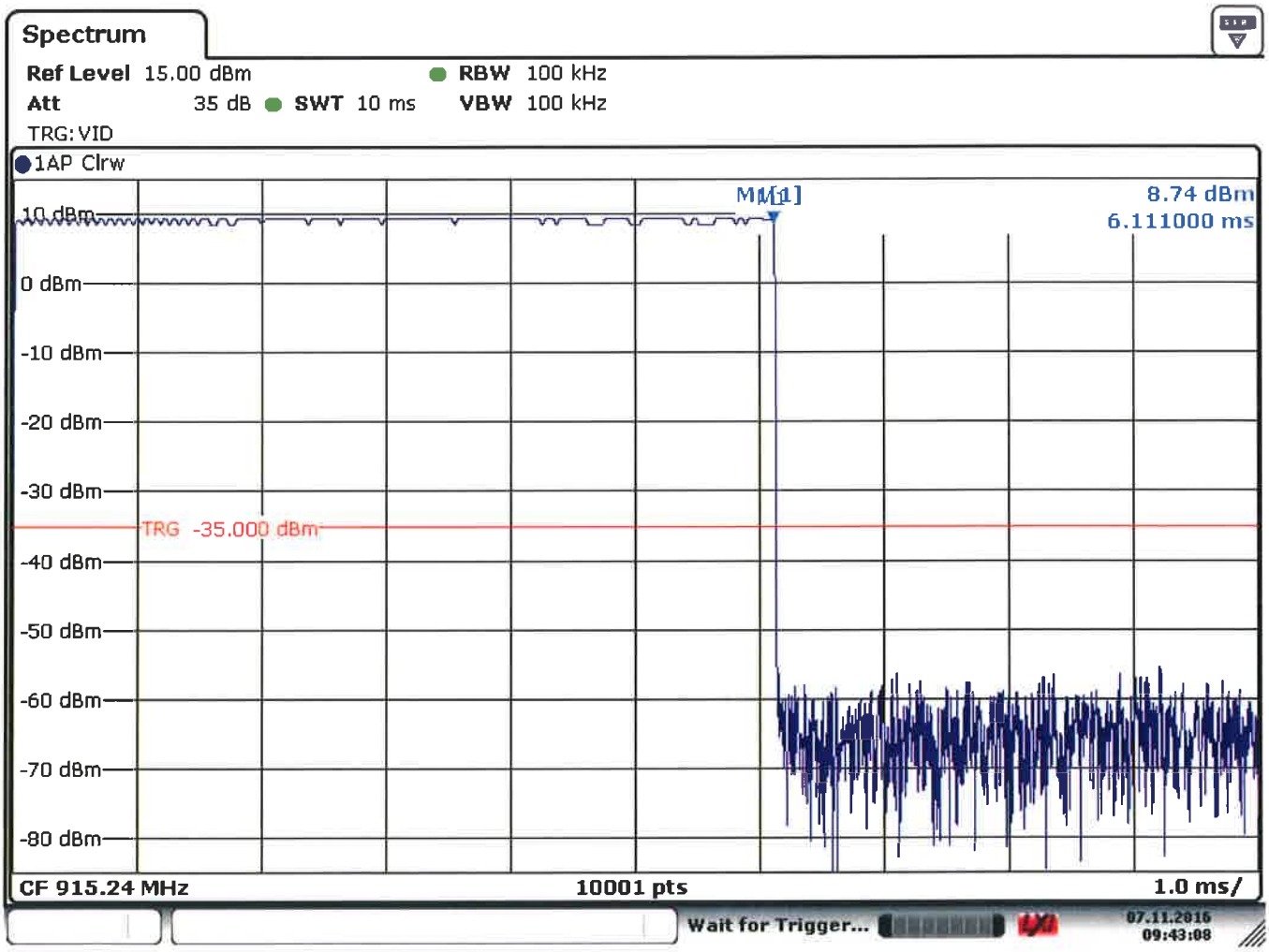
Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

Average Time of Occupancy **§ 15.247(a)(1)(iii)**
5.1(4)

Conducted Measurement

Rated output power: 8,73 mW 915,24 MHz



Date: 7.NOV.2016 09:43:09

The dwell time is constant 6,111 ms.

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

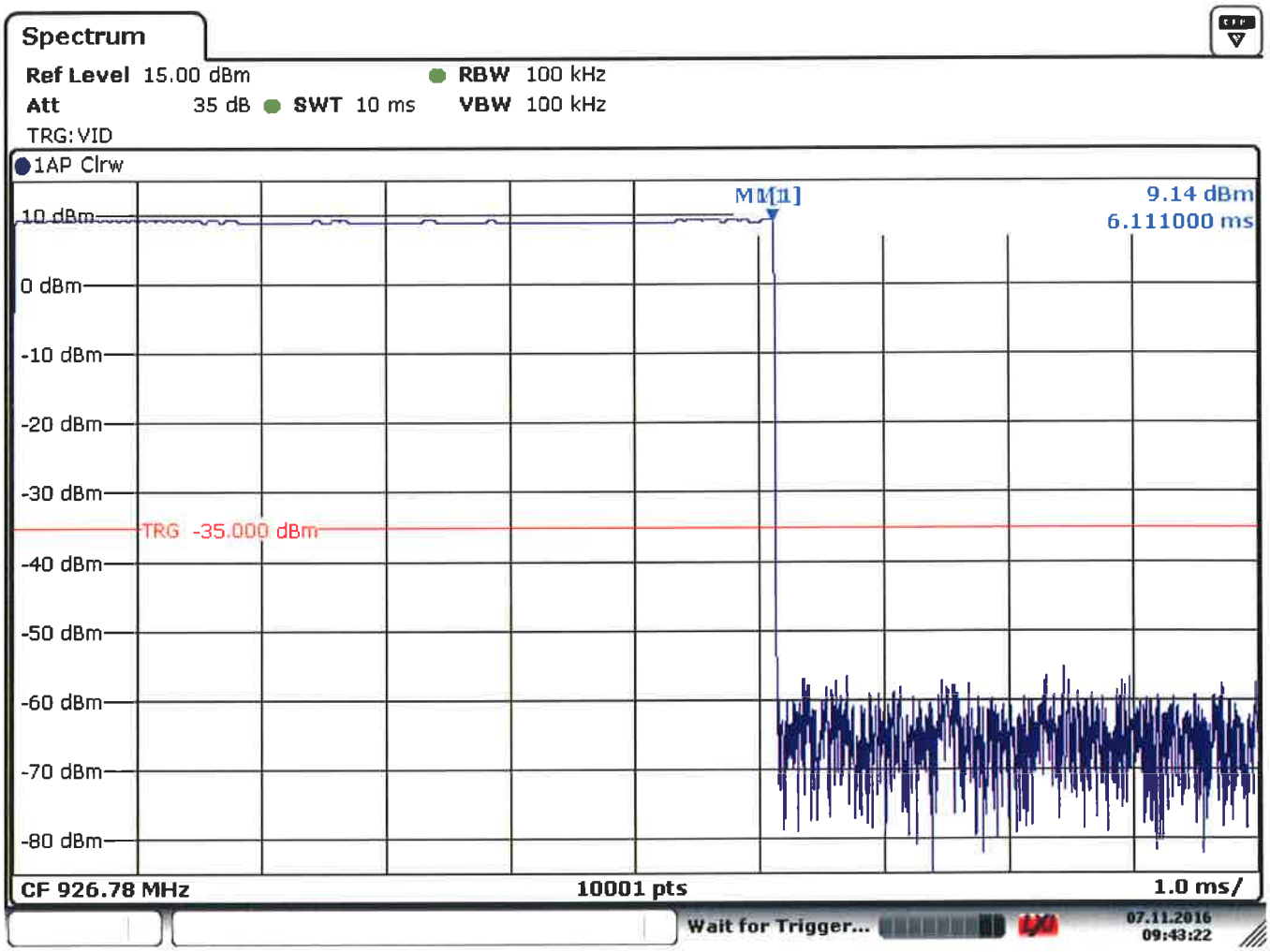
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Equipment used: EMV-205

Average Time of Occupancy **§ 15.247(a)(1)(iii)**
5.1(4)

Conducted Measurement

Rated output power: 8,73 mW 926,78 MHz



Date: 7.NOV.2016 09:43:22

The dwell time is constant 6,111 ms.

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

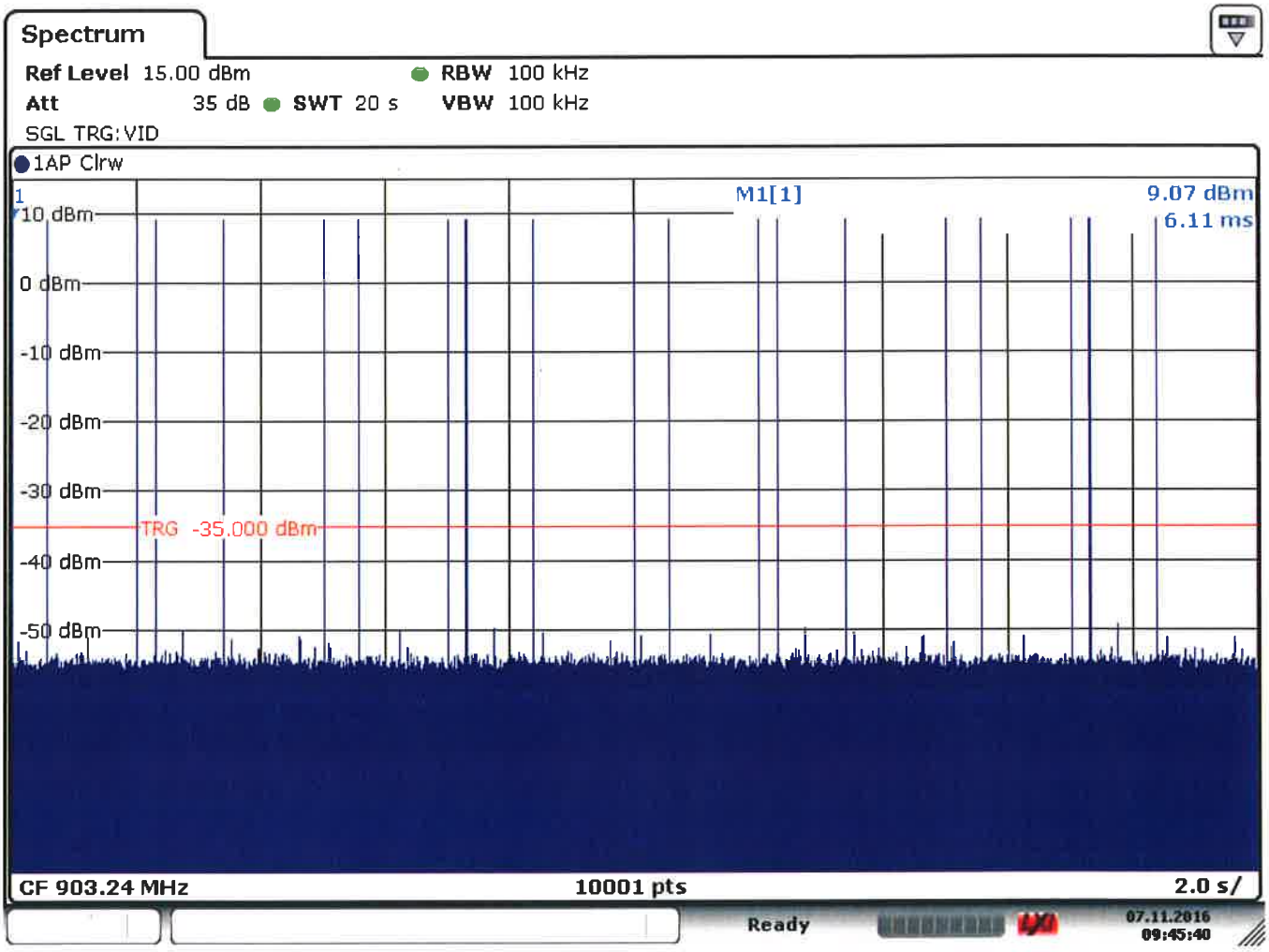
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Equipment used: EMV-205

Average Time of Occupancy **§ 15.247(a)(1)(iii)**
5.1(4)

Conducted Measurement

Rated output power: 8,73 mW 903,24 MHz



Date: 7.NOV.2016 09:45:41

20 transmissions were counted in a 20 seconds period. Each transmission has a dwell time of 6,111ms, resulting in an average occupancy of 122,22 ms which is far below 0,4 seconds.

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

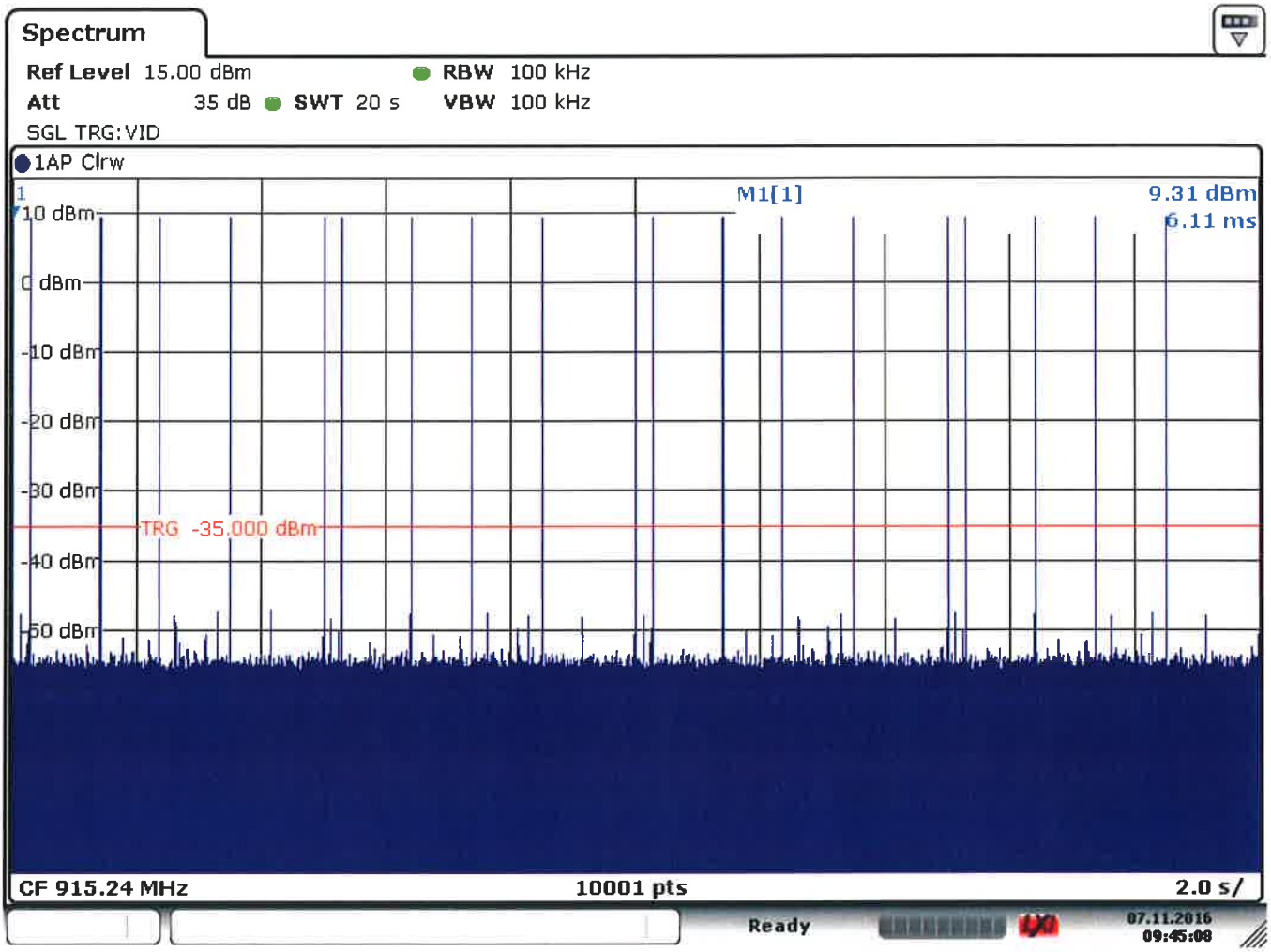
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20 seconds period.

Test Equipment used: EMV-205

Average Time of Occupancy **§ 15.247(a)(1)(iii)**
5.1(4)

Conducted Measurement

Rated output power: 8,73 mW 915,24 MHz



Date: 7.NOV.2016 09:45:09

20 transmissions were counted in a 20 seconds period. Each transmission has a dwell time of 6,111ms, resulting in an average occupancy of 122,22 ms which is far below 0,4 seconds.

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

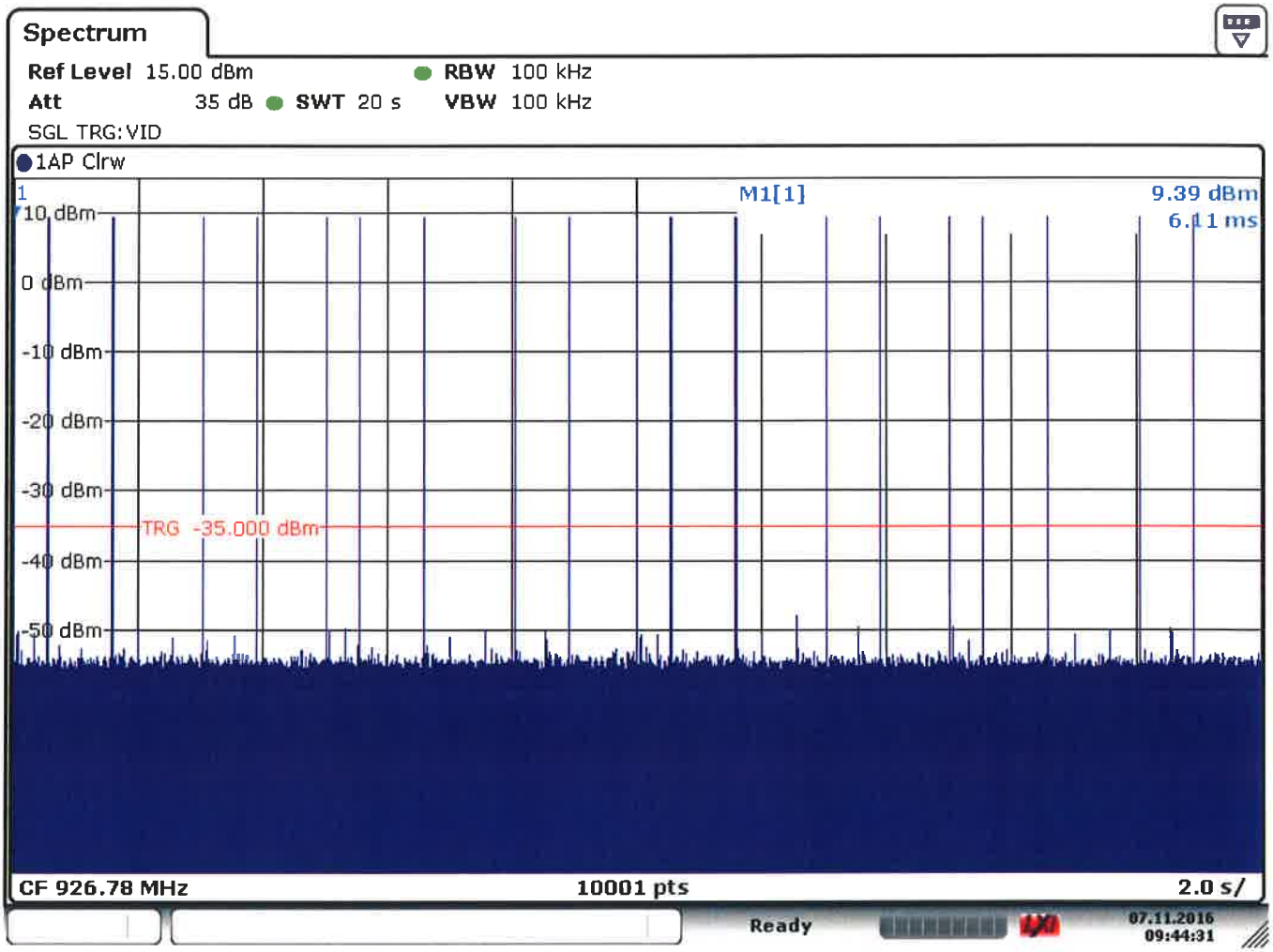
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20 seconds period.

Test Equipment used: EMV-205

Average Time of Occupancy **§ 15.247(a)(1)(iii)**
5.1(4)

Conducted Measurement

Rated output power: 8,73 mW 926,78 MHz



Date: 7.NOV.2016 09:44:32

20 transmissions were counted in a 20 seconds period. Each transmission has a dwell time of 6,111ms, resulting in an average occupancy of 122,22 ms which is far below 0,4 seconds.

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

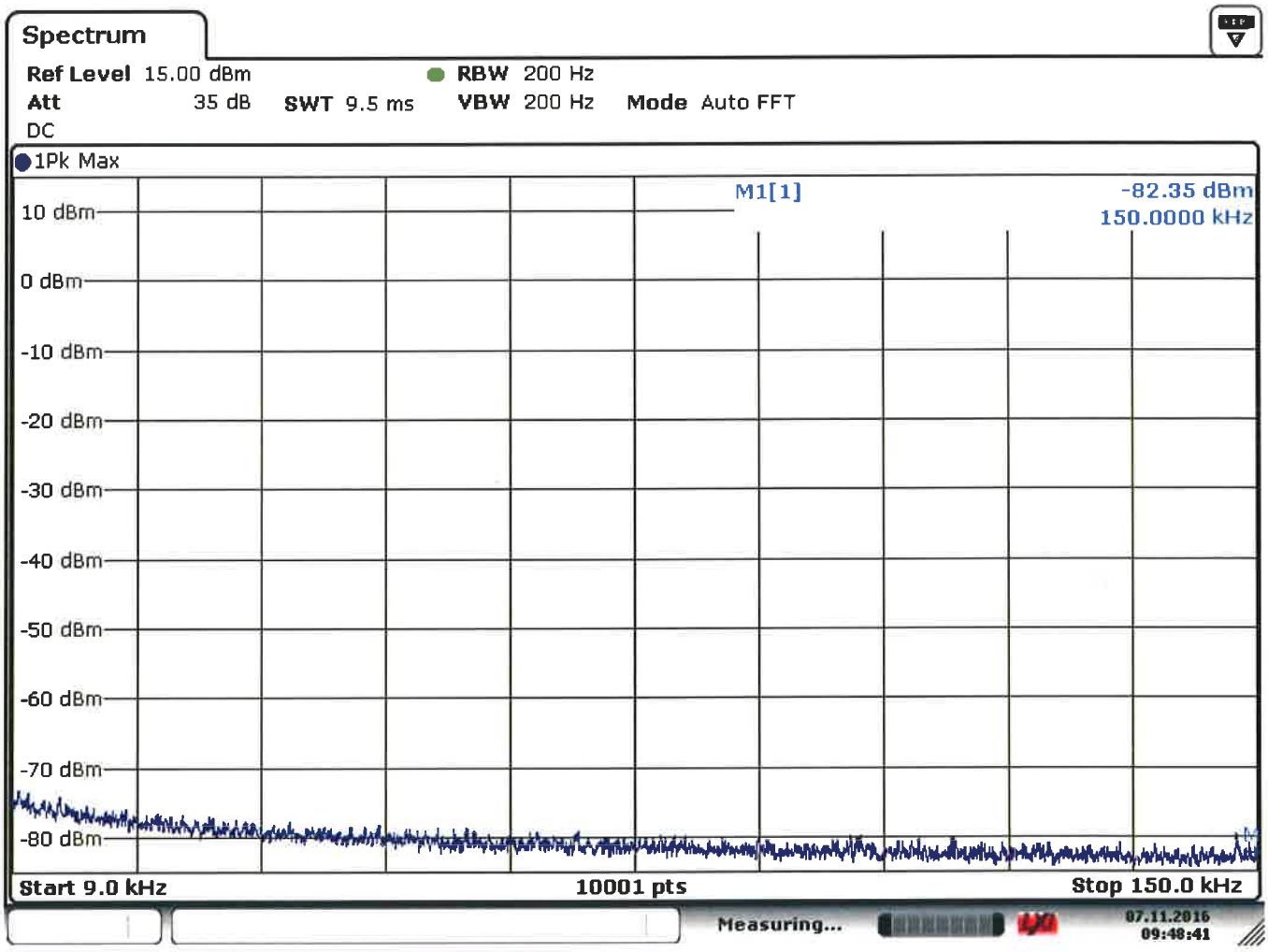
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20 seconds period.

Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

Out-of-band Emission **§ 15.247(d)**
5.5

Measurement conducted: 903,24 MHz – frequency range 9 kHz to 150 kHz (reduced measurement bandwidth)



Date: 7.NOV.2016 09:48:41

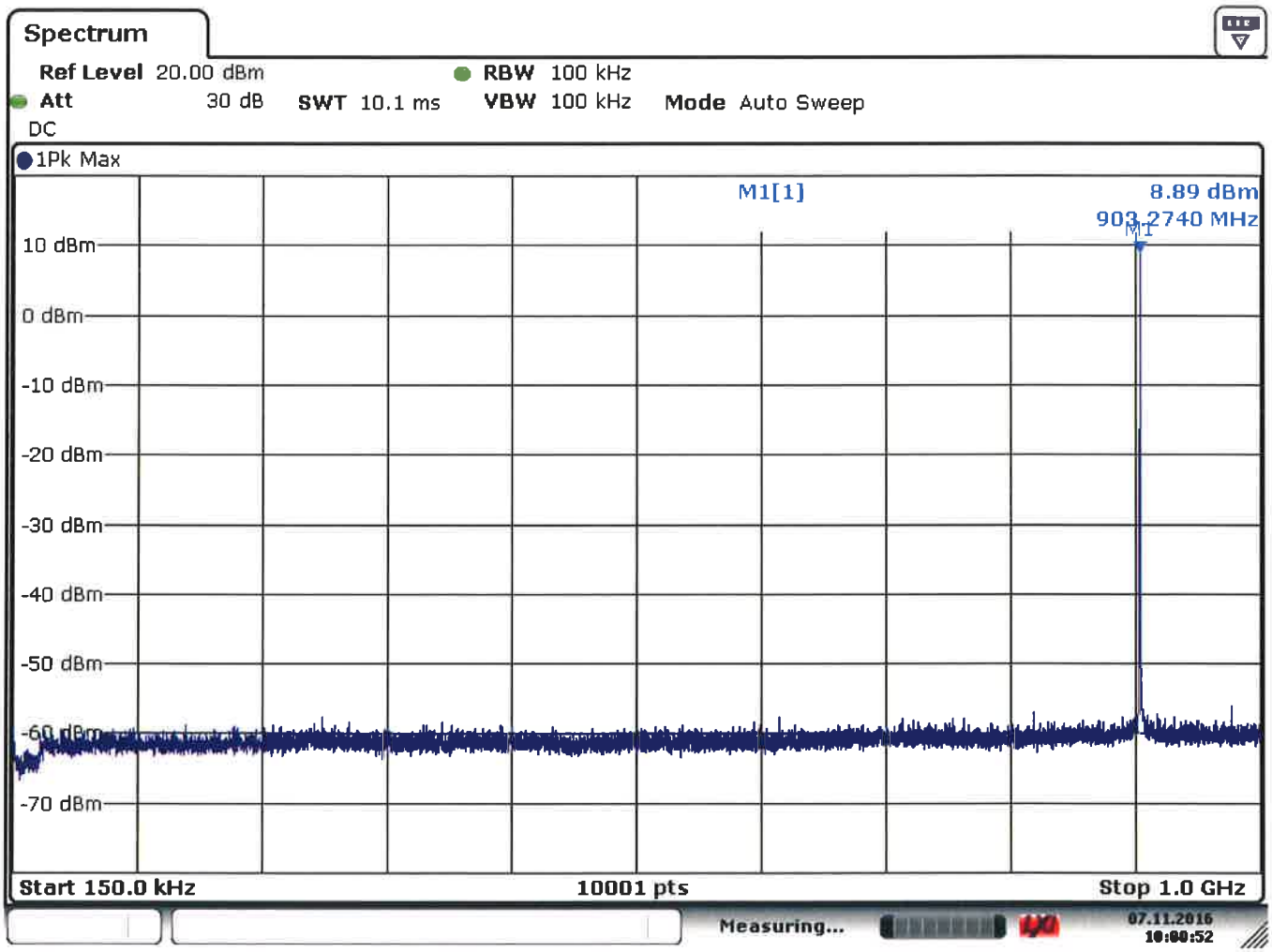
LIMIT **SUBCLAUSE 15.247(d) – 5.5**

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: 903,24 MHz – frequency range 150 kHz to 1 GHz



Date: 7.NOV.2016 10:00:52

LIMIT **SUBCLAUSE 15.247(d) – 5.5**

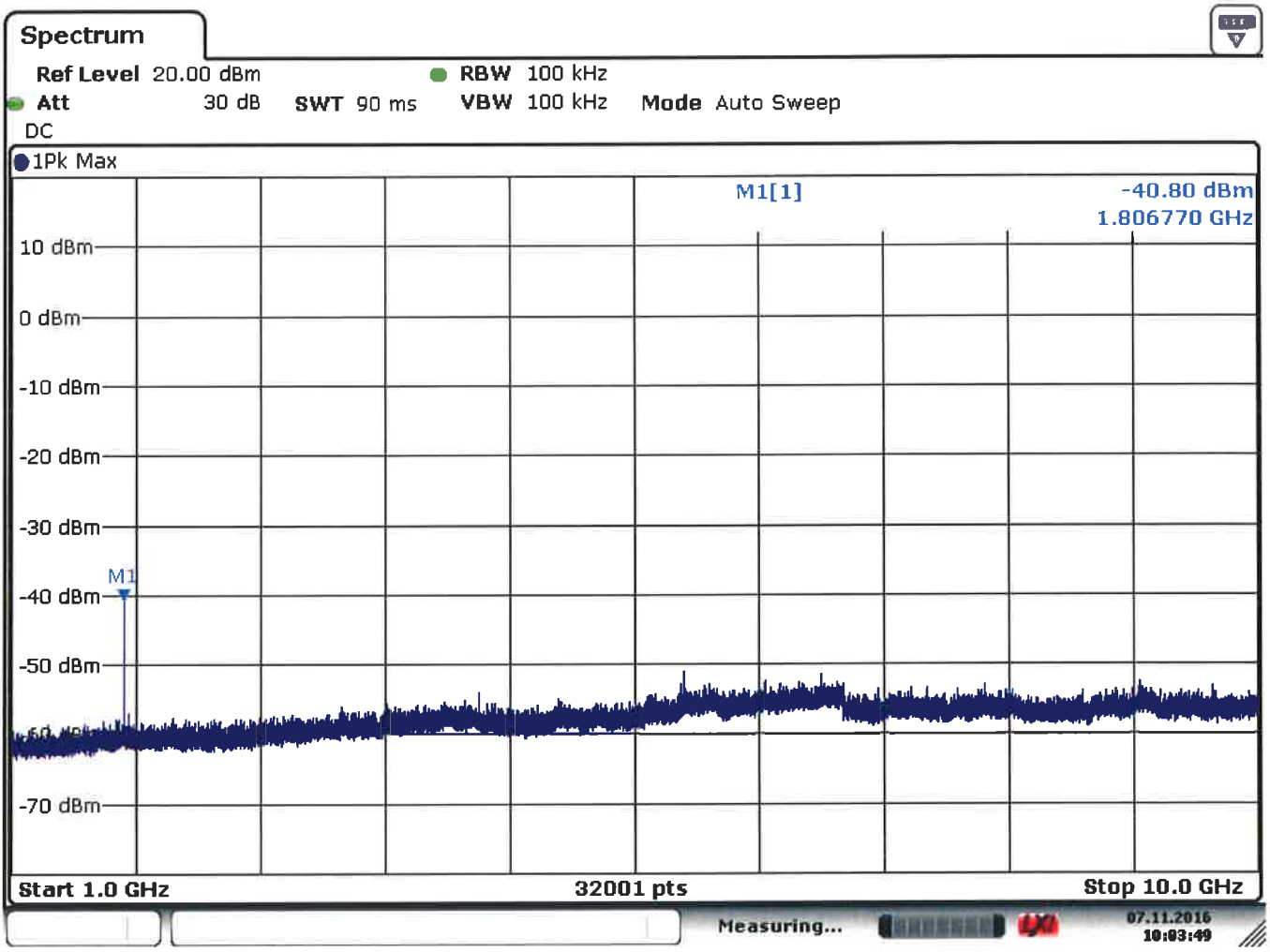
In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.	At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

Out-of-band Emission **§ 15.247(d)**
5.5

Measurement conducted: 903,24 MHz – frequency range 1 GHz to 10 GHz



Date: 7.NOV.2016 10:03:49

LIMIT **SUBCLAUSE 15.247(d) – 5.5**

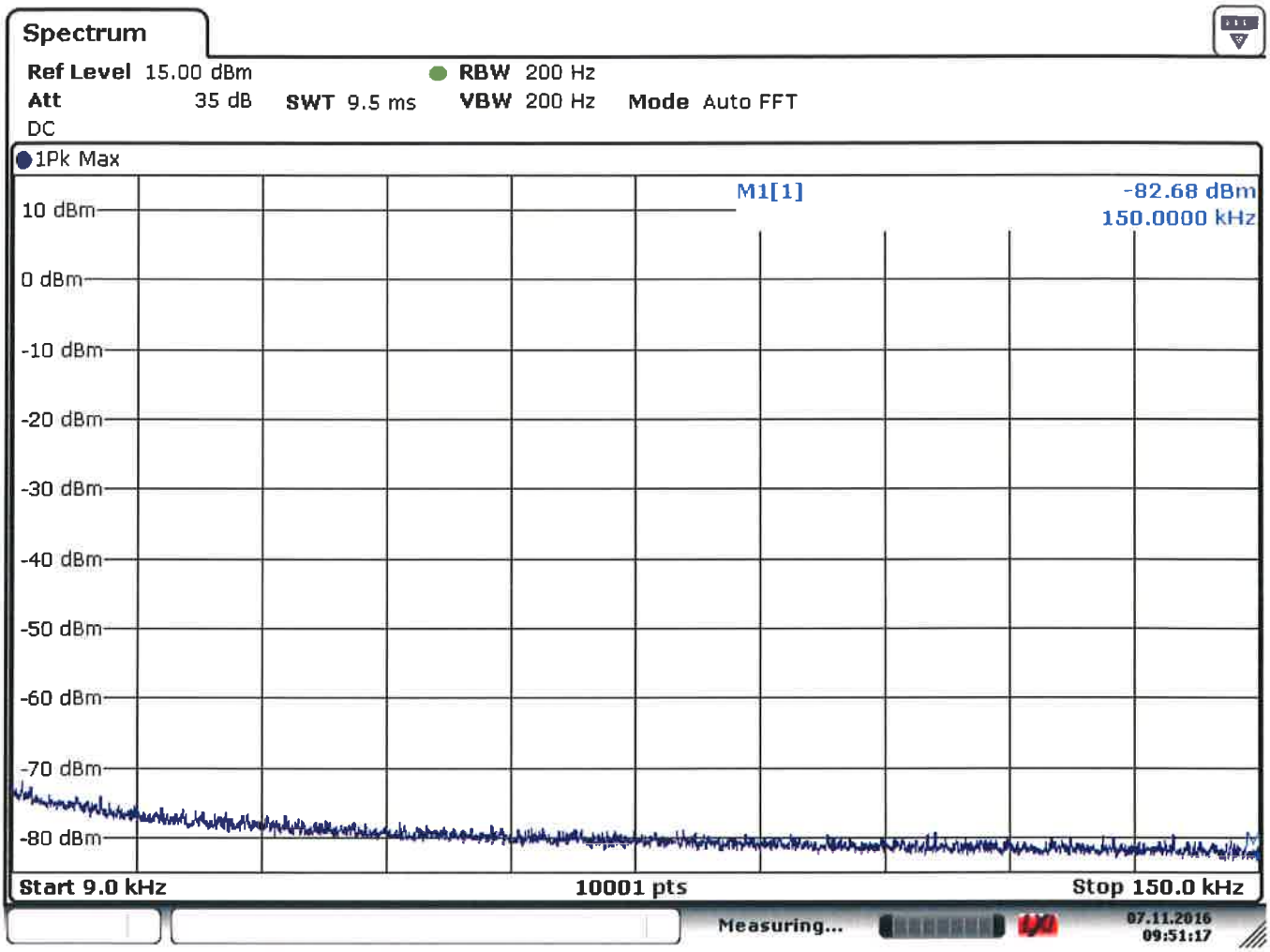
In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.	At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

Out-of-band Emission **§ 15.247(d)**
5.5

Measurement conducted: 915,24 MHz – frequency range 9 kHz to 150 kHz (reduced measurement bandwidth)



Date: 7.NOV.2016 09:51:17

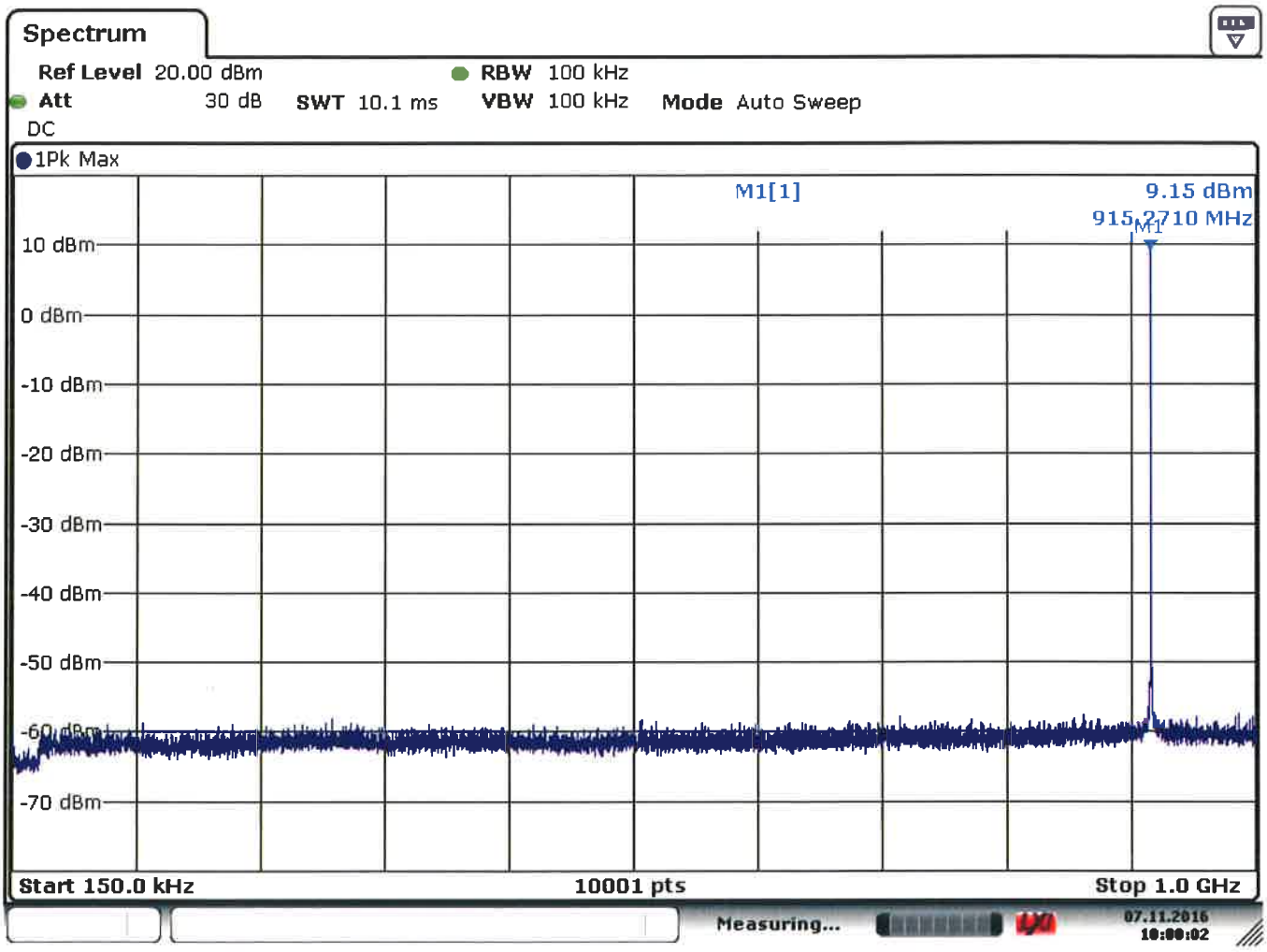
LIMIT **SUBCLAUSE 15.247(d) – 5.5**

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: 915,24 MHz – frequency range 150 kHz to 1 GHz



Date: 7.NOV.2016 10:00:02

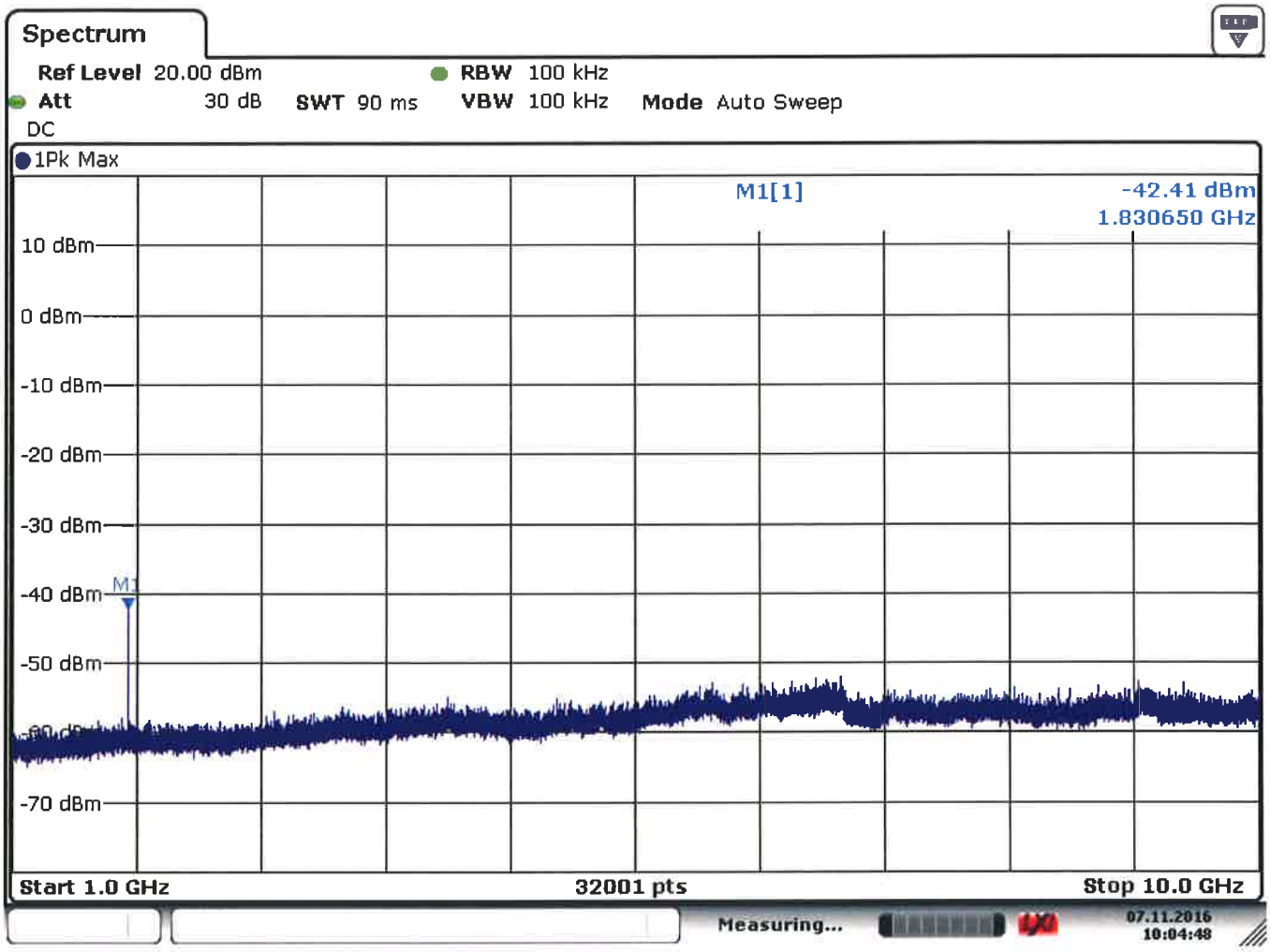
LIMIT **SUBCLAUSE 15.247(d) – 5.5**

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: 915,24 MHz – frequency range 1 GHz to 10 GHz



Date: 7.NOV.2016 10:04:49

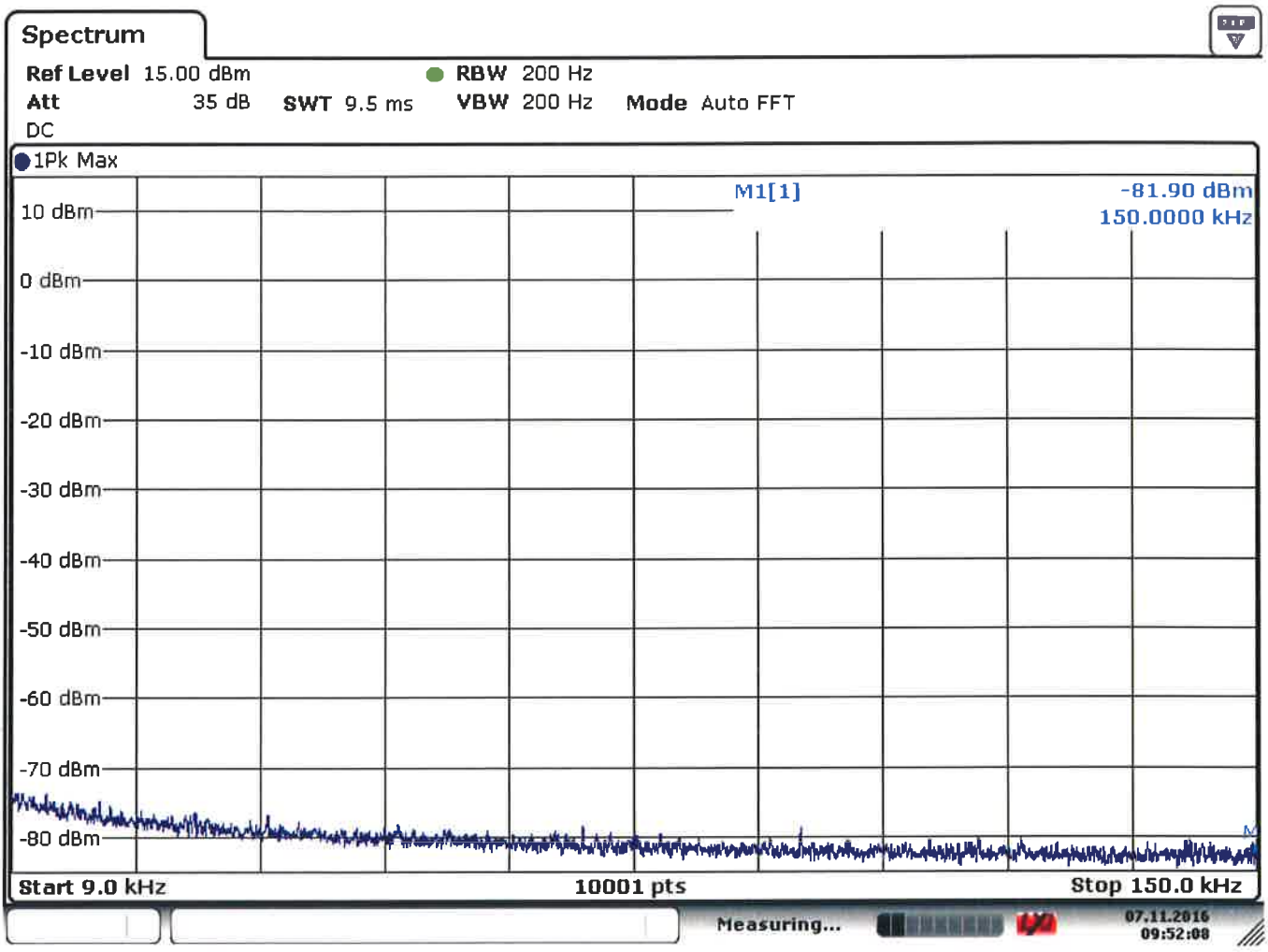
LIMIT **SUBCLAUSE 15.247(d) – 5.5**

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: 926,78 MHz – frequency range 9 kHz to 150 kHz (reduced measurement bandwidth)



Date: 7.NOV.2016 09:52:08

LIMIT **SUBCLAUSE 15.247(d) – 5.5**

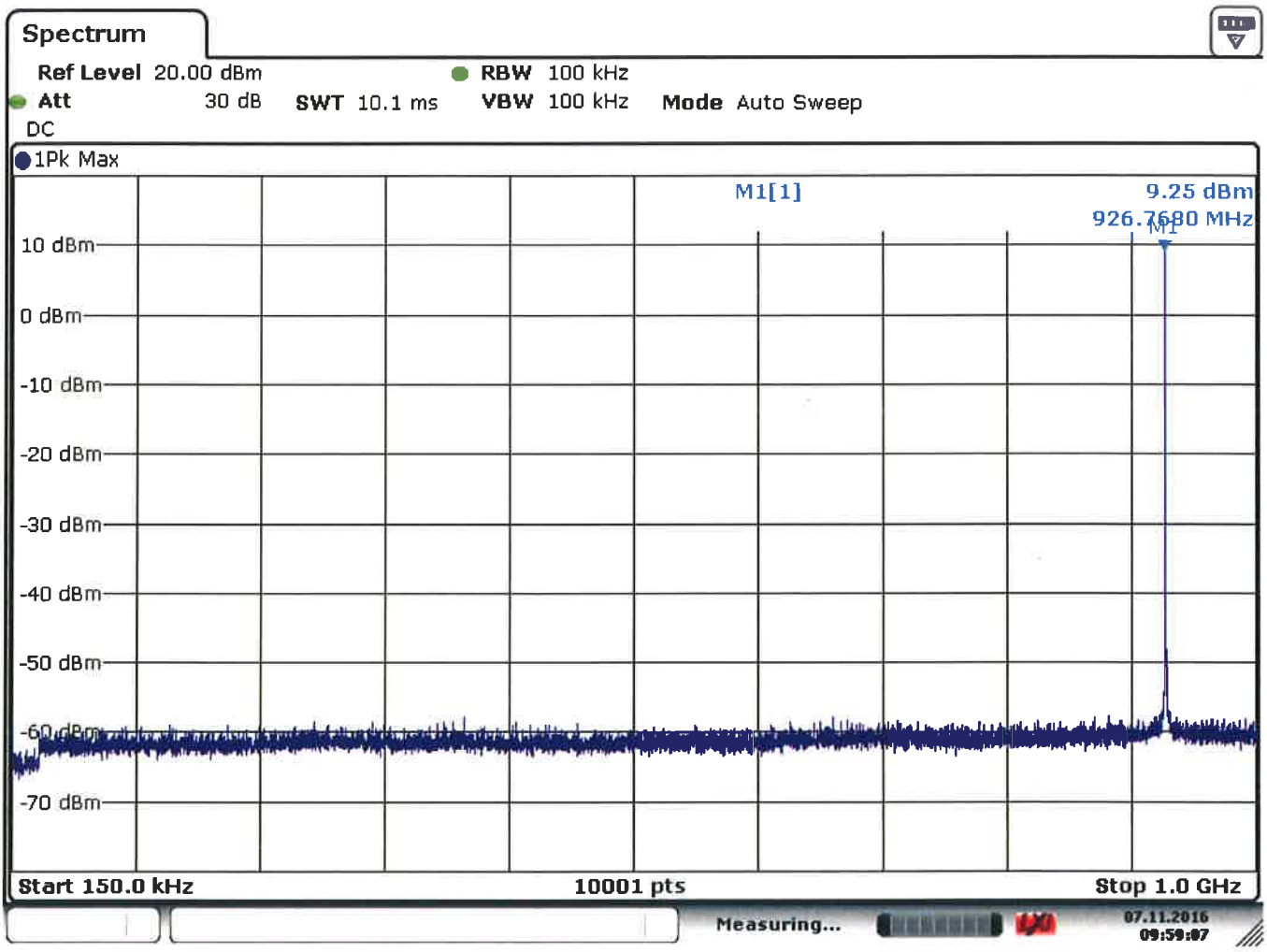
In any 100 kHz bandwidth outside the frequency band in which the radio device is operating.	At least 20dB below the power in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

Test Equipment used: EMV-205

Ambient temperature: 22°C Relative humidity: 36%

Out-of-band Emission **§ 15.247(d)**
5.5

Measurement conducted: 926,78 MHz – frequency range 150 kHz to 1 GHz



Date: 7.NOV.2016 09:59:08

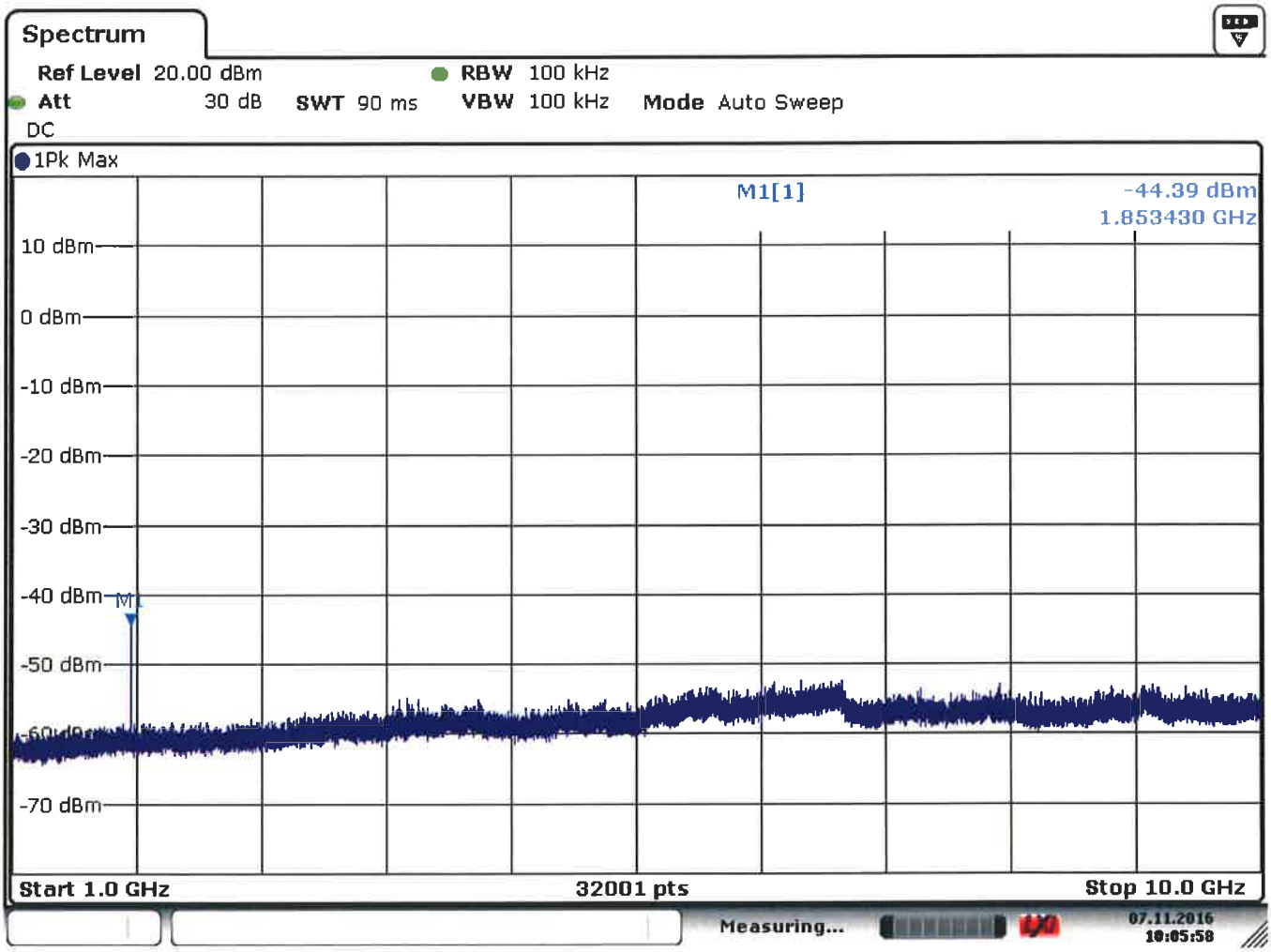
LIMIT **SUBCLAUSE 15.247(d) – 5.5**

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: 926,78 MHz – frequency range 1 GHz to 10 GHz



Date: 7.NOV.2016 10:05:59

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

Emissions in restricted bands **§ 15.209(a)**

LIMIT **SUBCLAUSE 15.209 – 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

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

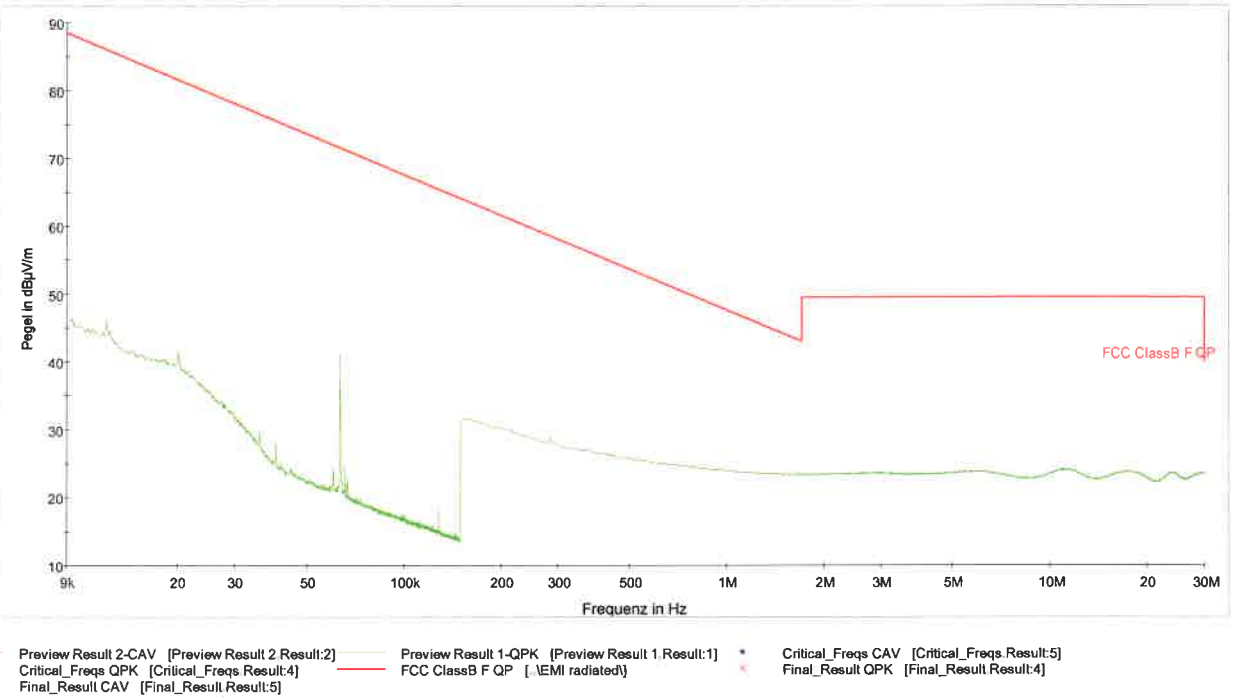
(e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

(f) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

Emissions in restricted bands **§ 15.209(a)**

Measurement with transmitter activated at 903,24 MHz



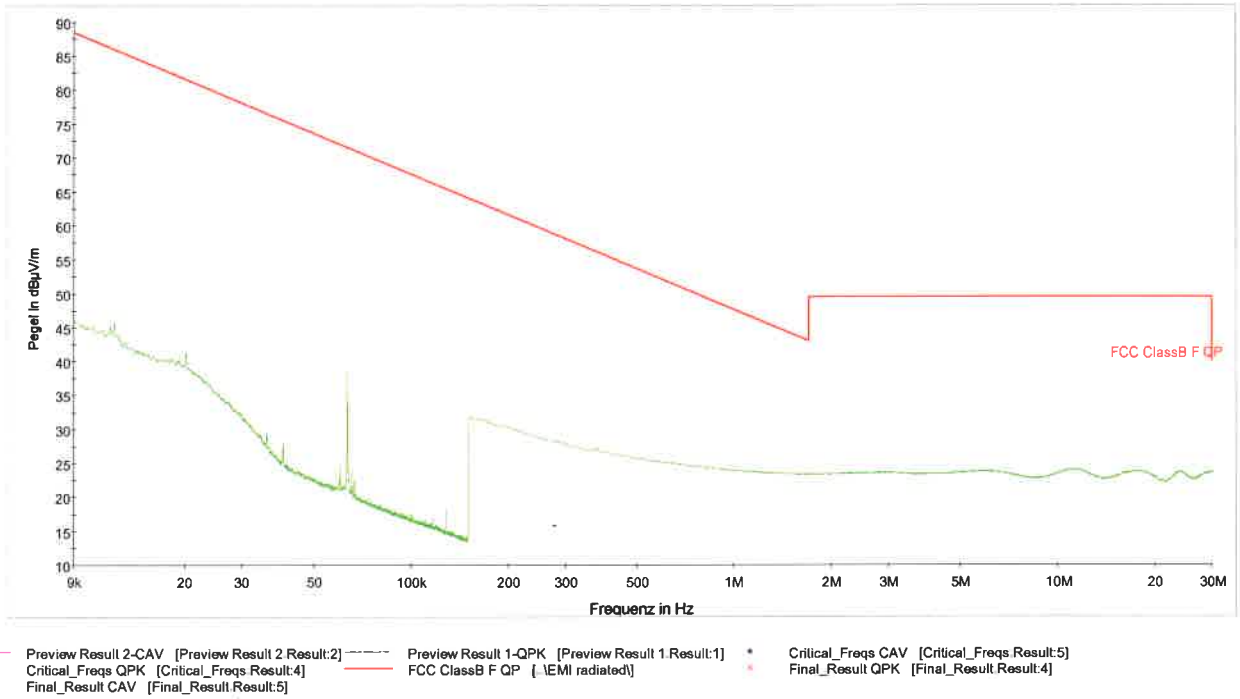
LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Emissions in restricted bands § 15.209(a)

Measurement with transmitter activated at 915,24 MHz



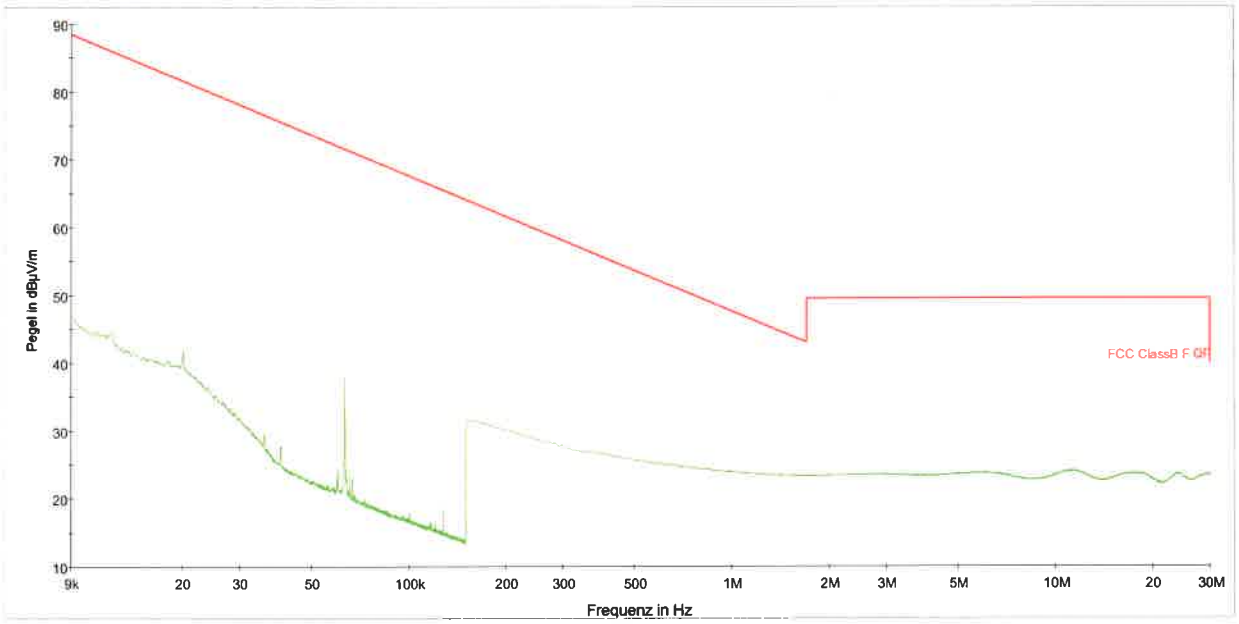
LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Emissions in restricted bands § 15.209(a)

Measurement with transmitter activated at 926,78 MHz



LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

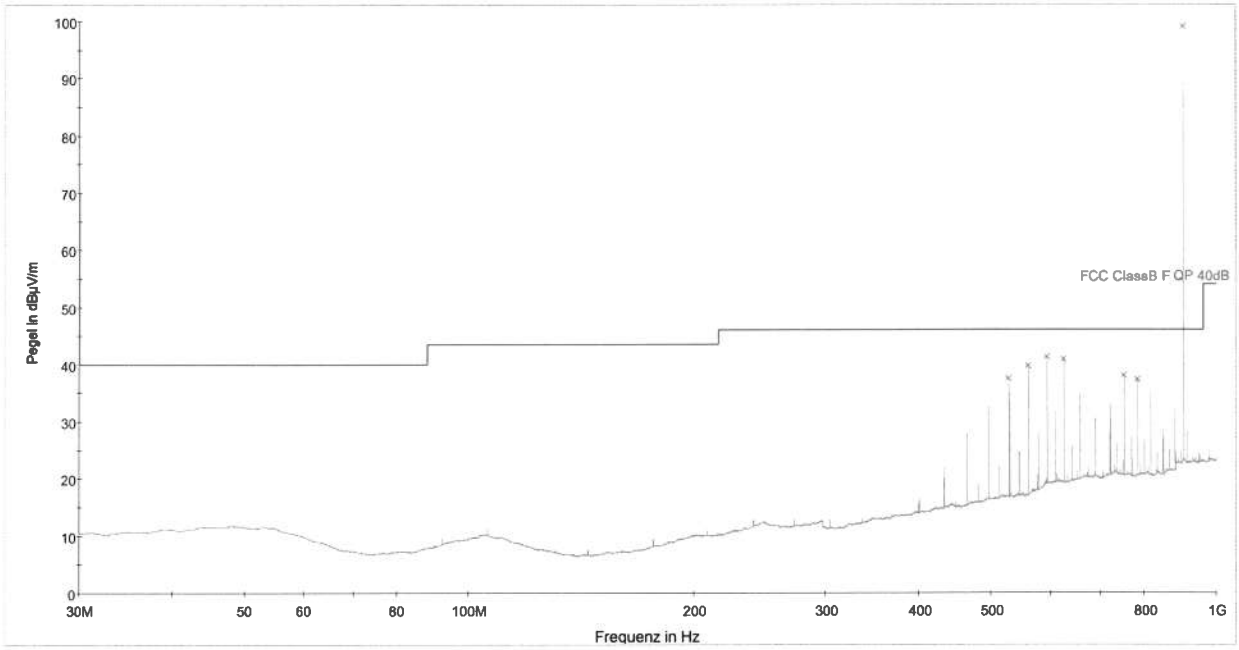
See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Ambient temperature: 22°C Relative humidity: 36%

Emissions in restricted bands **§ 15.209(a)**

Measurement with transmitter activated at 903,24 MHz



LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

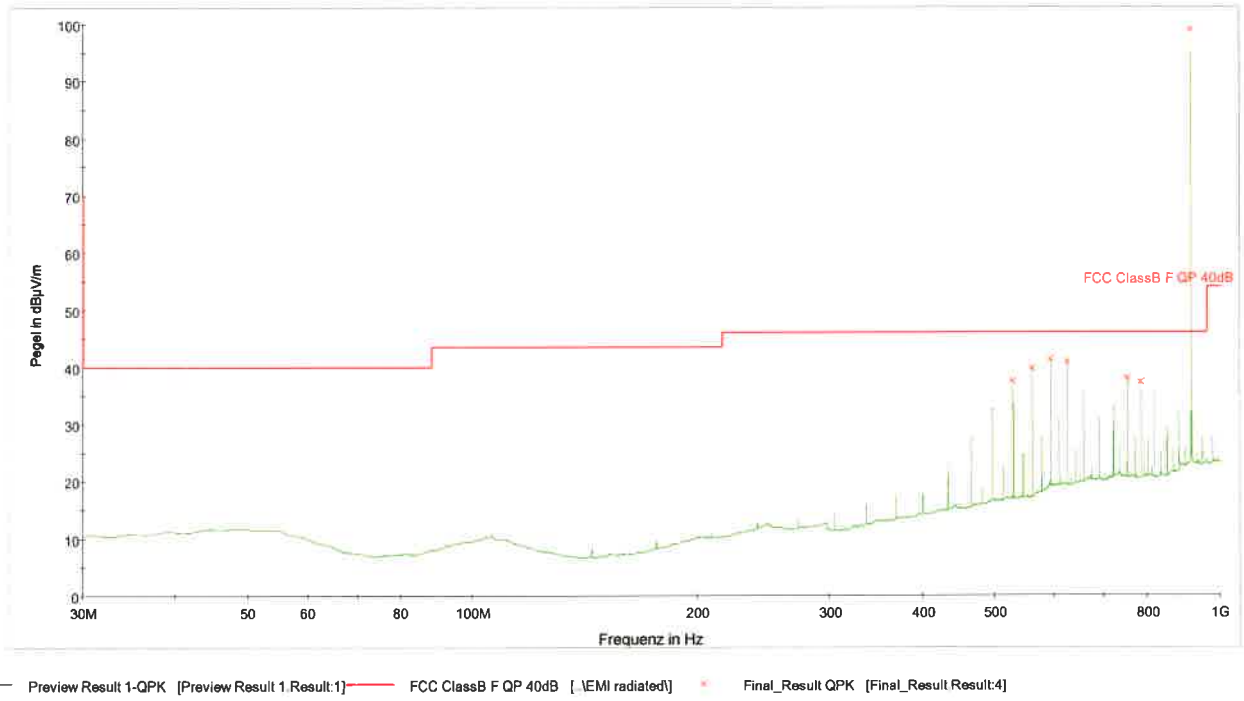
See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Ambient temperature: 22°C Relative humidity: 36%

Emissions in restricted bands **§ 15.209(a)**

Measurement with transmitter activated at 915,24 MHz



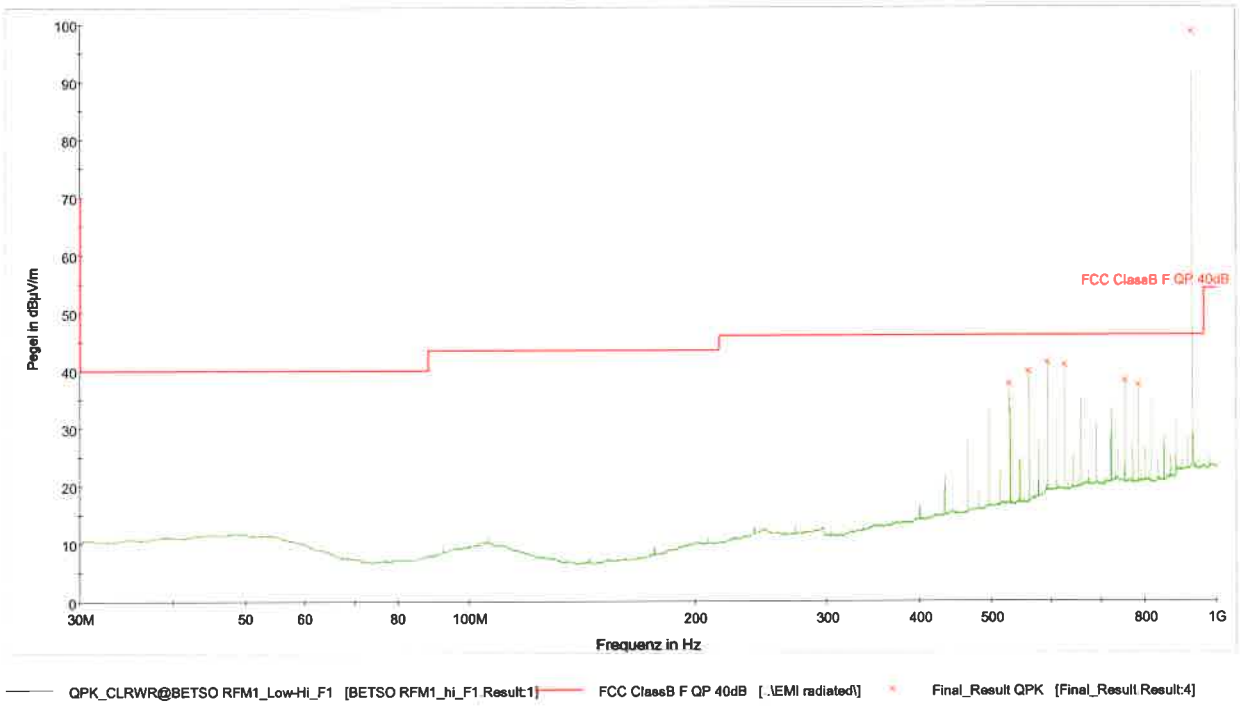
LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Emissions in restricted bands § 15.209(a)

Measurement with transmitter activated at 926,78 MHz



LIMIT SUBCLAUSE 15.209 – RSS-Gen

See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Emissions in restricted bands **§ 15.209(a)**

Measurement with QuasiPeak-Detector:

Measurement on lowest, middle and highest cannel

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB	Exceed-Mark	Height cm	Azimuth deg	Polarization
528,00	37,49	46,00	8,51		113	22	V
560,01	39,74	46,00	6,26		102	26	V
591,99	41,28	46,00	4,72		104	10	V
624,00	40,80	46,00	5,20		100	-4	V
752,01	38,07	46,00	7,93		100	-51	V
783,99	37,37	46,00	8,63		100	-118	V
903,24	99,06	N/A			138	-101	V
915,24	98,86	N/A			138	-101	V
926,78	98,46	N/A			138	-101	V

LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

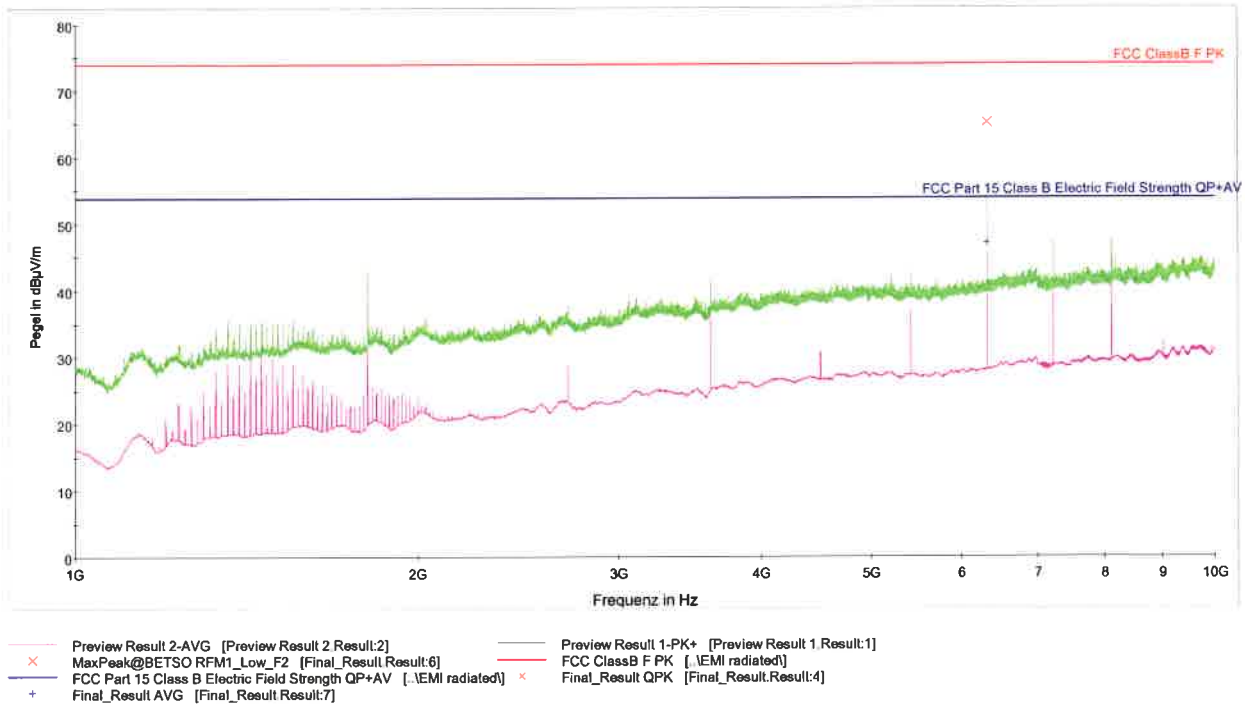
See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Ambient temperature: 22°C Relative humidity: 36%

Emissions in restricted bands § 15.209(a)

Measurement with transmitter activated at 903,24 MHz
Measurement with Peak-Detector (green line) and Average detector (magenta line):



LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

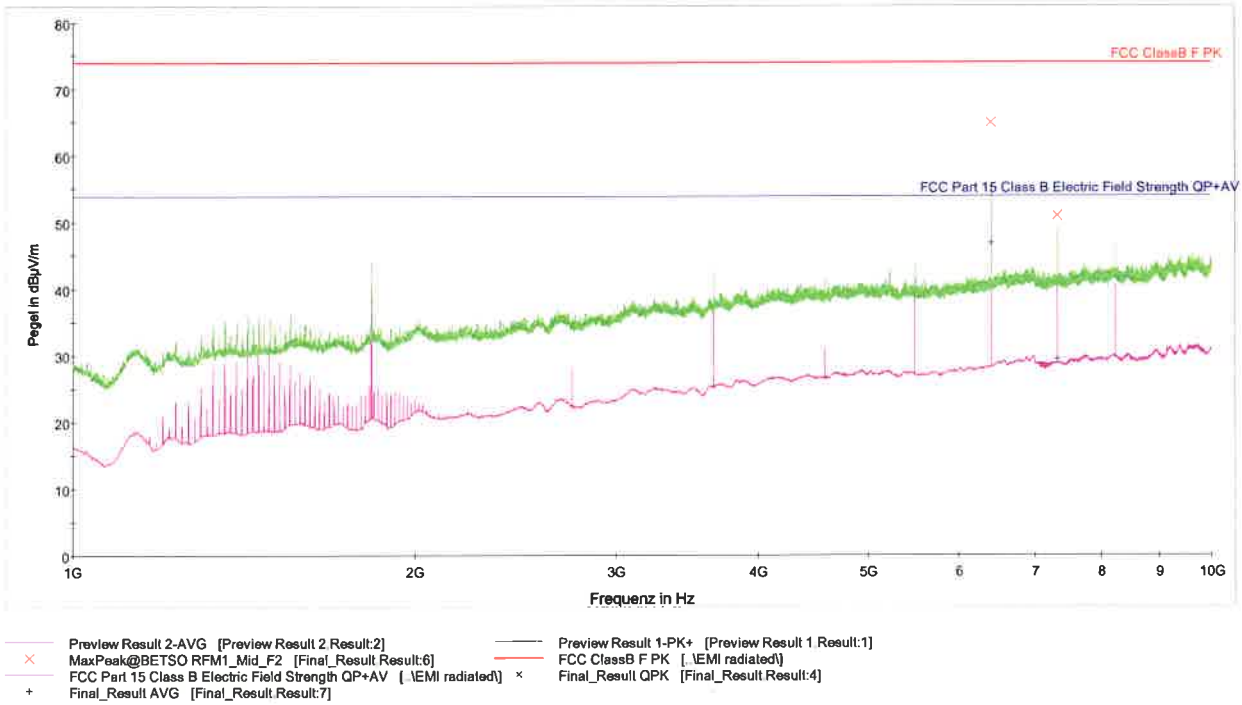
See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Ambient temperature: 22°C Relative humidity: 36%

Emissions in restricted bands **§ 15.209(a)**

Measurement with transmitter activated at 915,24 MHz
Measurement with Peak-Detector (green line) and Average detector (magenta line):



LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

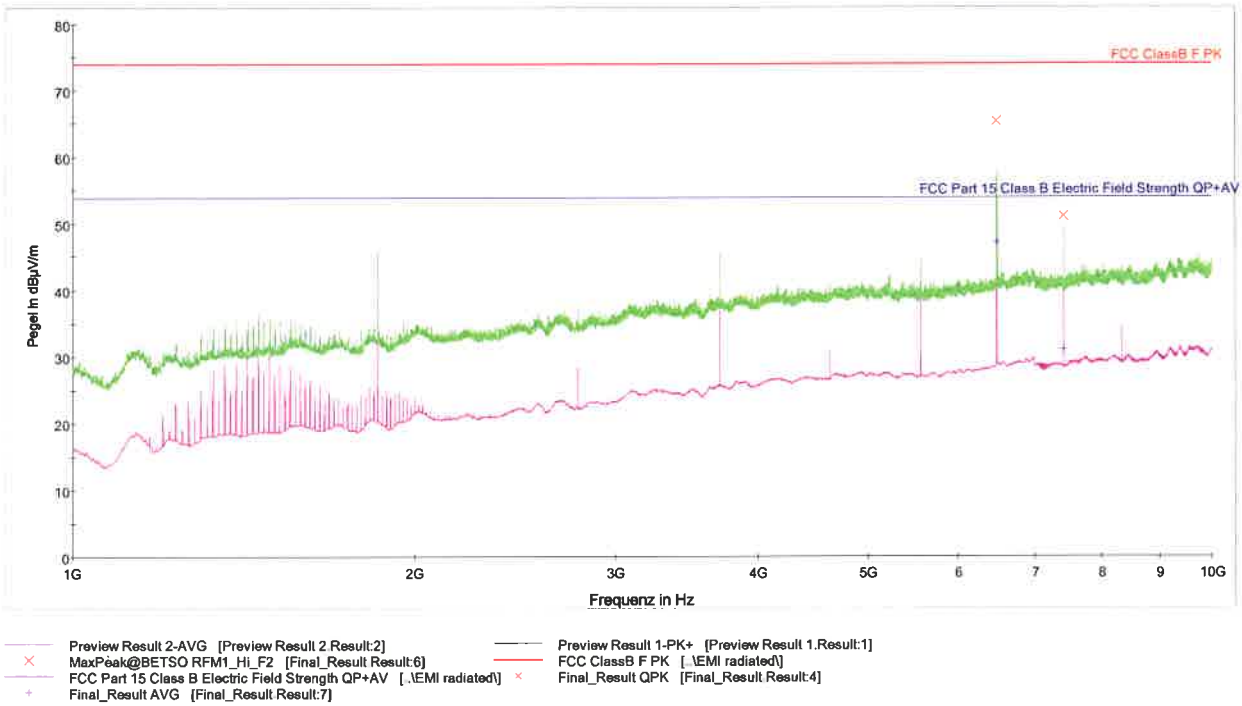
See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Ambient temperature: 22°C Relative humidity: 36%

Emissions in restricted bands **§ 15.209(a)**

Measurement with transmitter activated at 926,78 MHz
Measurement with Peak-Detector (green line) and Average detector (magenta line):



LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Emissions in restricted bands **§ 15.209(a)**

Measurement with Peak- and Average-Detector:

With one transmission of 6,111 ms and the worst case assumption that a maximum of 2 transmissions can occur in 100 ms, the Average value (measured with continuous transmission) was lowered by 18,25 dB (12,222/100).

Measurement with transmitter operating at 903,24 MHz

Frequency MHz	PK-Level dBµV/m	PK-Limit dBµV/m	AV-Level dBµV/m	AV-Limit dBµV/m	Margin dB	Exceed-Mark	Polarization
6322,75	65,21	74,00	46,96	54,00	7,04		H

Measurement with transmitter operating at 903,24 MHz

Frequency MHz	PK-Level dBµV/m	PK-Limit dBµV/m	AV-Level dBµV/m	AV-Limit dBµV/m	Margin dB	Exceed-Mark	Polarization
6406,75	64,98	74,00	46,73	54,00	7,27		H
7322,00	51,00	74,00	29,45	54,00	24,55		V

Measurement with transmitter operating at 903,24 MHz

Frequency MHz	PK-Level dBµV/m	PK-Limit dBµV/m	AV-Level dBµV/m	AV-Limit dBµV/m	Margin dB	Exceed-Mark	Polarization
6487,50	65,31	74,00	47,06	54,00	6,94		H
7414,25	51,19	74,00	30,94	54,00	23,06		V

LIMIT **SUBCLAUSE 15.209 – RSS-Gen**

See page 24

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-200; NT-414

Maximum permissible Exposure **§ 15.247(i)**

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

Appendix 1
Test equipment used

TÜV AUSTRIA

Division:
Industry & Energy

Department: FG

Test report number:
M/FG-16/121

Date: 09.11.2016

Checked by:

☐	Anechoic Chamber with 3m measurement distance	NT-100
☐	Stripline according to ISO 11452-5	NT-108
☐	MA4000 - Antenna mast 1 - 4 m height	NT-110/1
☐	DS - Turntable 0 - 400 ° Azimuth	NT-111/1
☐	CO3000 Controller Mast+Turntable	NT-112/1
☐	HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz	NT-121
☐	HFH-Z2 - Loop Antenna 9 kHz - 30 MHz	NT-122
☐	HFH-Z6 - Rod Antenna 9 kHz - 30 MHz	NT-123
☐	3121C - Dipole Antenna 28 - 1000 MHz	NT-124
☐	3115 - Horn Antenna 1 - 18 GHz (immunity)	NT-125
☐	3116 - Horn Antenna 18 - 40 GHz	NT-126
☐	SAS-200/543 - Bicon. Antenna 20 MHz - 300 MHz	NT-127
☐	AT-1080 - Log. Per. Antenna 80 - 1000 MHz	NT-128
☐	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-129
☐	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-130
☐	3146 - Log. Per. Antenna 200 – 1000 MHz	NT-131
☐	VULB 9163 Trilog Antenna 30 – 3000 MHz	NT-131/1
☐	Loop Antenna H-Field	NT-132
☐	Horn Antenna 500 MHz - 2900 MHz	NT-133
☐	Horn Antenna 500 MHz - 6000 MHz	NT-133/1
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-134
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-135
☐	BiConiLog Antenna 26 MHz – 2000 MHz	NT-137
☐	Conical Dipol Antenna PCD8250	NT-138
☐	HF 906 - Horn Antenna 1 - 18 GHz (emission)	NT-139
☐	HZ-1 Antenna tripod	NT-150
☐	BN 1500 Antenna tripod	NT-151
☐	Ant. tripod for EN61000-4-3 Model TP1000A	NT-156
☐	Power quality analyzer Fluke 1760 (complete set)	NT-160 - NT-173
☐	Spectrumanalyzer – FSP7 9 kHz – 7 GHz	NT-200
☐	ESCI - Test receiver 9 kHz - 7 GHz	NT-203/1
☐	ESI26 – Test receiver 20 Hz – 26,5 GHz	NT-207
☐	Digital Radio Tester CTS55	NT-208
☐	Noise-gen., ITU-R 559-2 20 Hz – 20 kHz	NT-209
☐	CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz	NT-210
☐	3271 - Spectrum analyzer 100 Hz - 26,5 GHz	NT-211
☐	Digital Radio Tester Aeroflex 3920	NT-212/1
☐	Mixer M28HW 26,5 GHz - 40 GHz	NT-214
☐	RubiSource T&M Timing reference	NT-216
☐	Radiocommunicationanalyzer SWR 1180 MD	NT-217
☐	Mixer M19HWD 40 GHz – 60 GHz	NT-218
☐	Mixer M12HWD 60 GHz – 90 GHz	NT-219
☐	DSO9104 Digital scope	NT-220/1
☐	TPS 2014 Digital scope	NT-222
☐	Artificial Ear according to IEC 60318	NT-224
☐	1 kHz Sound calibrator	NT-225
☐	B10 - Harmonics and flicker analyzer	NT-232
☐	SRM-3000 Spectrumanalyzer	NT-233
☐	SRM-3006 Spectrumanalyzer	NT-233/1a
☐	E-field probe SRM 75 MHz – 3 GHz	NT-234
☐	Field Meter NBM-500 incl. E- and H-Field probes	NT-240a-d
☐	Hall-Teslameter ETM-1	NT-241
☐	EFA-3 H-field- / E-field probe	NT-243
☐	Field Meter EMR-200 100 kHz – 3 GHz	NT-244
☐	E-field probe 100 kHz – 3 GHz	NT-245
☐	H-field probe 300 kHz – 30 MHz	NT-246

Appendix 1 (continued)
Test equipment used

TÜV AUSTRIA

☐	E-field probe 3 MHz – 18 GHz	NT-247
☐	H-field probe 27 MHz – 1 GHz	NT-248
☐	ELT-400 1 Hz – 400 kHz	NT-249
☐	MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250
☐	FCC-203I EM Injection clamp	NT-251
☐	FCC-203I-DCN Ferrite decoupling network	NT-252
☐	PR50 Current Probe	NT-253
☐	i310s Current Probe	NT-254/1
☐	Fluke 87 V True RMS Multimeter	NT-260
☐	Model 2000 Digital Multimeter	NT-261
☐	Fluke 87 V Digital Multimeter	NT-262/1
☐	ESH2-Z5-U1 Artificial mains network 4x25A	NT-300
☐	ESH3-Z5-U1 Artificial mains network 2x10A	NT-301
☐	ESH3-Z6-U1 Artificial mains network 1x100A	NT-302
☐	ESH3-Z6-U1 Artificial mains network 1x100A	NT-302a
☐	PHE 4500/B Power amplifier	NT-304
☐	EZ10 T-Artificial Network	NT-305
☐	SMG - Signal generator 0,1 - 1000 MHz	NT-310
☐	SMA100A - Signal generator 9 kHz - 6 GHz	NT-310/1
☐	RefRad Reference generator	NT-312
☐	SMP 02 Signal generator 10 MHz - 20 GHz	NT-313
☐	40 MHz Arbitrary Generator TGA1241	NT-315
☐	Artificial mains network NSLK 8127-PLC	NT-316
☐	PEFT - Burst generator up to 4 kV	NT-320
☐	ESD 30 System up to 25 kV	NT-321
☐	PSURGE 4.1 Surge generator	NT-324
☐	IMU4000 Immunity test system	NT-325/1
☐	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
☐	T82-50 RF-Amplifier 2 GHz – 8 GHz	NT-331
☐	500W1000M7 - RF-Amplifier 80 - 1000 MHz / 500 W	NT-332
☐	AS0102-65R - RF-Amplifier 1 GHz - 2 GHz	NT-333
☐	APA01 – RF-Amplifier 0,5 GHz – 2,5 GHz	NT-334
☐	Preamplifier 1 GHz - 4 GHz	NT-335
☐	Preamplifier for GPS MKU 152 A	NT-336
☐	Preamplifier 100 MHz – 23 GHz	NT-337
☐	DC Block 10 MHz – 18 GHz Model 8048	NT-338
☐	2-97201 Electronic load	NT-341
☐	TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-344
☐	TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-345
☐	VDS 200 Mobil-impuls-generator	NT-350
☐	LD 200 Mobil-impuls-generator	NT-351
☐	MPG 200 Mobil-Impuls-Generators	NT-352
☐	EFT 200 Mobil-impuls-generator	NT-353
☐	AN 200 S1 Artificial Network	NT-354
☐	FP-EFT 32M 3 ph. Coupling filter (Burst)	NT-400/1
☐	PHE 4500 - Mains impedance network	NT-401
☐	IP 6.2 Coupling filter for data lines (Surge)	NT-403
☐	TK 9421 High Power Volt. Probe 150 kHz - 30 MHz	NT-409
☐	ESH2-Z3 - Probe 9 kHz - 30 MHz	NT-410
☐	IP 4 - Capacitive clamp (Burst)	NT-411
☐	Highpass-Filter 100 MHz – 3 GHz	NT-412
☐	Highpass-Filter 600 MHz – 4 GHz	NT-413
☐	Highpass-Filter 1250 MHz – 4 GHz	NT-414
☐	Highpass-Filter 1800 MHz – 16 GHz	NT-415

Appendix 1 (continued)
Test equipment used

TÜV AUSTRIA

☐	Highpass-Filter 3500 MHz – 18 GHz	NT-416
☐	RF-Attenuator 10 dB DC – 18 GHz / 50 W	NT-417
☐	RF-Attenuator 6 dB DC – 18 GHz / 50 W	NT-418
☐	RF-Attenuator 3 dB DC – 18 GHz / 50 W	NT-419
☐	RF-Attenuator 20 dB DC - 1000 MHz / 25 W	NT-421
☐	RF-Attenuator 30 dB DC - 1000 MHz / 1 W	NT-423
☐	RF-Attenuator 30 dB	NT-424
☐	RF-Attenuator 6 dB DC - 1000 MHz / 1 W	NT-425
☐	RF-Attenuator 6 dB DC - 1000 MHz / 1 W	NT-426
☐	RF-Attenuator 6 dB	NT-428
☐	RF-Attenuator 0 dB - 81 dB	NT-429
☐	WRU 27 - Band blocking 27 MHz	NT-430
☐	WHJ450C9 AA - High pass 450 MHz	NT-431
☐	WHJ250C9 AA - High pass 250 MHz	NT-432
☐	RF-Load 150 W	NT-433
☐	Impedance transducer 1:4 ; 1:9 ; 1:16	NT-435
☐	RF-Attenuator DC – 18 GHz 6 dB	NT-436
☐	RF-Attenuator DC – 18 GHz 6 dB	NT-437
☐	RF-Attenuator DC – 18 GHz 10 dB	NT-438
☐	RF-Attenuator DC – 18 GHz 20 dB	NT-439
☐	I+P 7780 Directional coupler 100 - 2000 MHz	NT-440
☐	ESH3-Z2 - Pulse limiter 9 kHz - 30 MHz	NT-441
☐	Power Divider 6 dB/1 W/50 Ohm	NT-443
☐	Directional coupler 0,1 MHz – 70 MHz	NT-444
☐	Directional coupler 0,1 MHz – 70 MHz	NT-445
☐	Tube imitations according to EN 55015	NT-450
☐	FCC-801-M3-16A Coupling decoupling network	NT-458
☐	FCC-801-M2-50A Coupling decoupling network	NT-459
☐	FCC-801-M5-25 Coupling decoupling network	NT-460
☐	FCC-801-AF10 Coupling decoupling network	NT-461
☐	FCC-801-S25 Coupling decoupling network	NT-462
☐	FCC-801-T4 Coupling decoupling network	NT-463
☐	FCC-801-C1 Coupling decoupling network	NT-464
☐	SW 9605 - Current probe 150 kHz – 30 MHz	NT-465/1
☐	95242-1 – Current probe 1 MHz – 400 MHz	NT-468
☐	94106-1L-1 – Current probe 100 kHz – 450 MHz	NT-471
☐	GA 1240 Power amplifier according to EN 61000-4-16	NT-480
☐	Coupling networks according to EN 61000-4-16	NT-481 - NT-483
☐	Van der Hoofden Test Head	NT-484
☐	PC P4 3 GHz Test computer	NT-500
☐	PC P4 1700 MHz Notebook	NT-505
☐	Monitoring camera with Monitor	NT-511
☐	ES-K1 Version 1.71 SP2 Test software	NT-520
☐	EMC32 Version 10.01 Test software	NT-520/1
☐	SRM-TS Version 1.3 software for SRM-3000	NT-522
☐	SRM-TS Version 1.3.1 software for SRM-3006	NT-522/1
☐	Spitzenberger und Spies Test software V3.4	NT-525
☐	Noise power test apparatus according to EN 55014	NT-530
☐	Vertical coupling plane (ESD)	NT-531
☐	Test cable #4 for EN 61000-4-6	NT-553
☐	Test cable #3 for conducted emission	NT-554
☐	Test cable #5+#6 ESD-cable (2x470k)	NT-555 + NT-556
☐	Test cable #8 Sucoflex 104EA	NT-559
☐	Test cable #9 (for outdoor measurements)	NT-580
☐	Test cable #10 (for outdoor measurements)	NT-581
☐	Test cable #13 Sucoflex 104PE	NT-584
☐	Test cable #21 for SRM-3000	NT-592
☐	Shield chamber	NT-600
☐	Climatic chamber	M-1200

Appendix 1 (continued)
Test equipment used

TÜV AUSTRIA

☐	Anechoic Chamber 3 m / 5 m measuring distance	EMV-100
☐	Turntabel 6 m diameter	EMV-101
☐	Antenna mast 1 – 4 m	EMV-102
☐	Mast and Turntable controller FC-06	EMV-103
☐	EMC Video/Audiosystem	EMV-104
☐	EMC Software EMC32 Version 10.01	EMV-105
☐	Hornantenna 1 – 18 GHz HF 907	EMV-110
☐	Antennapre.amp. 1 – 18 GHz ERZ-LNA0200-1800-30-2	EMV-111
☐	Trilog Antenna 30-3000 MHz VULB9163	EMV-112
☐	Monopol 9 kHz – 30 MHz VAMP 9243	EMV-113
☐	Antennapre.amp 18 – 40 GHz BBV 9721	EMV-114
☐	DC Artificial Network PVDC 8300	EMV-150
☐	AC Artificial Network NNLK 8121 RC	EMV-151
☐	EMI Receiver ESR26	EMV-200
☐	Signalgenerator 9 kHz – 40 GHz N5173B	EMV-201
☐	GPS Frequency normal B-88	EMV-202
☐	DC Power supply N5745A	EMV-203
☐	DC Power supply N5745A	EMV-204
☐	Spektrum Analyzator FSV40	EMV-205
☐	Thd Multimeter Model 2015	EMV-206
☐	Poweramplifier PAS15000	EMV- 207/abc
☐	Inrush Current Source	EMV- 208/abc
☐	Arb.-generator Sycore	EMV-209
☐	Harmonics/Flicker analyzer ARS 16/3	EMV-210
☐	HF- Ampflifier 9 kHz-250 MHz BBA150	EMV-300
☐	HF- Amplifier 80 -1000 MHz BBA150	EMV-301
☐	HF- Amplifier 0,8 - 6 GHz BBA150	EMV-302
☐	High Power Ant. 20-200 MHz VHBD 9134	EMV-303
☐	Log.per Antenna 80-2700 MHz STLP 9128 E special	EMV-304
☐	Log.per Antenna 0,7 – 9 GHz STLP9149	EMV-305
☐	Load Dump Generator LD 200N	EMV-350
☐	Ultra Compact Symulator UCS 200N100	EMV-351
☐	Automotive Power fail module PFM 200N100.1	EMV-352
☐	Voltage Drop Symulator VDS 200Q100	EMV-353
☐	Arb. Generator AutoWave	EMV-354
☐	Ultra Compact Symulator UCS 500N7	EMV-355
☐	Coupling decoupling network CNI 503B7 / 32 A	EMV-356
☐	Coupling decoupling network CNI 503B7 / 63 A	EMV-357
☐	Telecom Surge Generator TSurge 7	EMV-358
☐	Coupling decoupling network CNI 508N2	EMV-359
☐	Coupling decoupling network CNV 504N2.2	EMV-360
☐	Immunity generator NSG4060/NSG4060-1	EMV-361
☐	Coupling network CDND M316-2	EMV-362
☐	Coupling network CT419-5	EMV-363
☐	ESD Generator NSG 437	EMV-364
☐	Pulse Limiter VTSD 9561-F BNC	EMV-405
☐	Transient emission BSM200N40+BS200N100	EMV- 450+451
☐	Cap. Coupling Clamp HFK	EMV-455
☐	Mag. Field System MS100N+MC26100+MC2630	EMV- 456-458
☐	Coupling network CDN M2-100A	EMV-459
☐	Coupling network CDN M3-32A	EMV-460
☐	Coupling network CDN M5-100A	EMV-461
☐	Current Clamp CIP 9136A	EMV-462
☐	DC Artificial Network HV-AN 150	EMV- 464+465
☐	Coupling Clamp EM 101	EMV-466
☐	Decoupling Clamp FTC 101	EMV-467
☐	Power attenuator DG 250 W 6 GHz 6 dB	EMV-469

Division:
Industry & Energy

Department: FG

Test report number:
M/FG-16/121

Date: 09.11.2016

Checked by: