

TEST REPORT

of the accredited test laboratory

TÜV Nr.: 2023-IN-AT-TICL-E-EX-0-000018-FG-034

Applicant: SES-imagotag GmbH
Kalsdorfer Strasse 12
A – 8072 Fernitz-Mellach

Tested Product: Electronic shelf labelling system

Product Name: VUSION 2.1 WP

Model: EWB1-0210-A

FCC ID: 2ACQM-EWB1-0210-A

IC ID: 12154A-EWB10210A

Manufacturer: SES-imagotag GmbH
Kalsdorfer Strasse 12
A – 8072 Fernitz-Mellach

Output power 0,68 mW eirp **power supply:** 3 VDC via Battery

Frequency range: 2402 - 2480 MHz **Channel separation:** 2 MHz

Accredited Standards: FCC: 47 CFR Part 15 (eCFR 21.11.2023)
RSS-102 Issue 5, March 2015 + Amd. 1 02.02.2021
RSS-247 Issue 3, August 2023
ANSI C63.10-2013

TÜV AUSTRIA GMBH
Test laboratory for EMC



Ing. Andreas Malek
examined by / Testing
Laboratory
TÜV AUSTRIA GMBH



22.11.2023



Ing. Michael Emminger
approved by / Testing
Laboratory
TÜV AUSTRIA GMBH



Testing Laboratory,
Inspection Body,
Certification Body,
Calibration Laboratory,
Verifizierungsstelle

Notified Body 0408

**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 BKAUATWW

VAT ATU63240488
DVR 3002476

A publication of this test report is only permitted literally.
Copying or reproduction of partial sections needs a written permission of
TÜV AUSTRIA GMBH.

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

Contents

	Designation	PAGE
1.	Applicant	3
2.	Description of EUT	4
3.	Standards / Final result	5
4.	Test results	
	List of measurements according to 47 CFR 15 and RSS-247	
4.1	Test object data	6
4.2	Number of channels and channel spacing	7
4.3	6 dB Bandwidth	8 – 10
4.4	99% dB Bandwidth	11 – 13
4.5	Maximum Peak RF Power Output	14
4.6	Power Spectral Density	15 – 17
4.7	Emissions in restricted bands	18 – 22
4.8	RF Exposure	23 – 26
Appendix	Designation	PAGES
1	Test equipment used	5
2	Photodocumentation	11

1. Applicant

Company: SES-imagotag GmbH

Department: Product & Project Manager

Address: A – 8072 Fernitz-Mellach; Kalsdorfer Strasse 12

Contact person: Mrs. Bernarda Minov Petkov

EUT received on: 21.11.2023

Tests were performed on: 21.11. till 22.11.2023

2. Description of EUT

EUT: Electronic shelf labelling system

Product Name: VUSION 2.1 WP

Model: EWB1-0210-A

Serial Number: prototype

Manufacturer: SES-imagotag GmbH

Description: SES-imagotag GmbH provided the following configuration for the measurements:

Prototype with special firmware for continuous transmission

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

Technical data EUT: Rated voltage: 3VDC
Rated frequency: DC
Mains voltage during the tests: 3VDC

Climatic conditions in the emc laboratory: Relative humidity: 33%
Temperature: 23°C

3. Standards / Final result

Name	Title	Deviation	Result
FCC: 47 CFR Part 15 (eCFR 21.11.2023)	RADIO FREQUENCY DEVICES	none	OK
RSS-247 Issue 3, August 2023	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	none	OK
RSS-102 Issue 5, March 2015 + Amd. 1 02.02.2021	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)	none	OK
ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	none	OK
<p>Result: Opinions and interpretation of testing laboratory OK: EUT passed NOK: EUT failed</p>			

4. TEST RESULTS

4.1. TEST OBJECT DATA

General EUT Description

2.1033 (c) Technical description

2.1033 (4) Type of emission: 1M04F1D – Channel spacing 2 MHz

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 0,68 mW and there is no power regulation.

2.1033 (7) Maximum output power rating: 0,68 mW.

2.1033 (8) DC Voltage and Current: 3V DC

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

Worst case Spurious Emissions: 32,79 dB μ V/m Average at 4880,0 MHz.

Tests were performed July 21st till July 22nd 2023.

4.2. Number of channels and channel spacing

§ 2.1033

Conducted Measurement

Rated output power: 0,68 mW

There are 40 Channels used, starting at 2402 till 2480 MHz each separated by 2 MHz channel spacing.

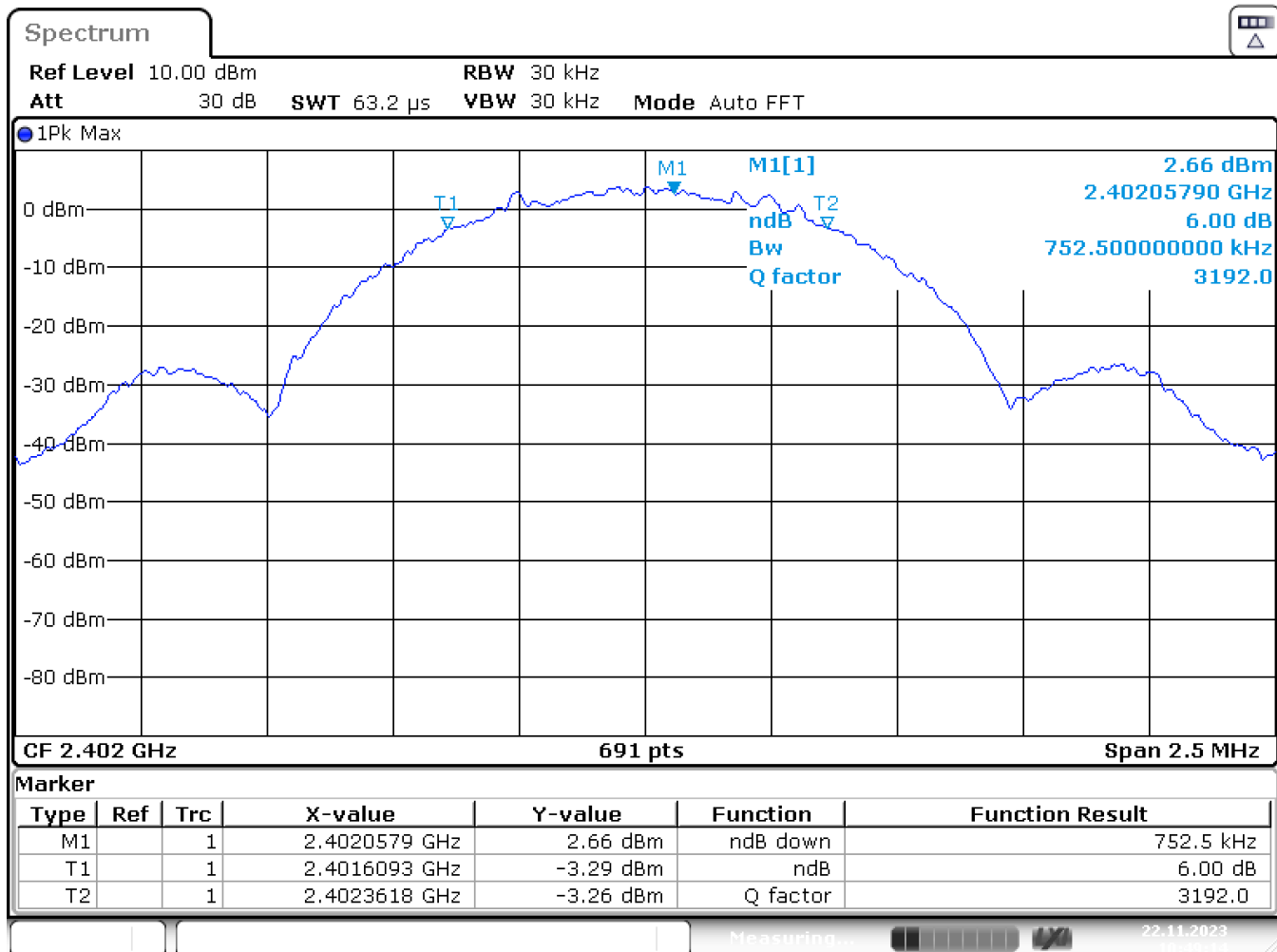
Test Equipment used: N/A

4.3. 6 dB Bandwidth

§ 15.247(a)(2)
 5.2.a

Conducted Measurement

Rated output power: 0,68 mW Channel 0 (2402 MHz center frequency)



Date: 22.NOV.2023 10:49:15

6dB Bandwidth: 752,5 kHz

LIMIT SUBCLAUSE 15.247(e) – 5.2.a)

Under normal test conditons	6 dB Bandwidth at least 500 kHz
-----------------------------	---------------------------------

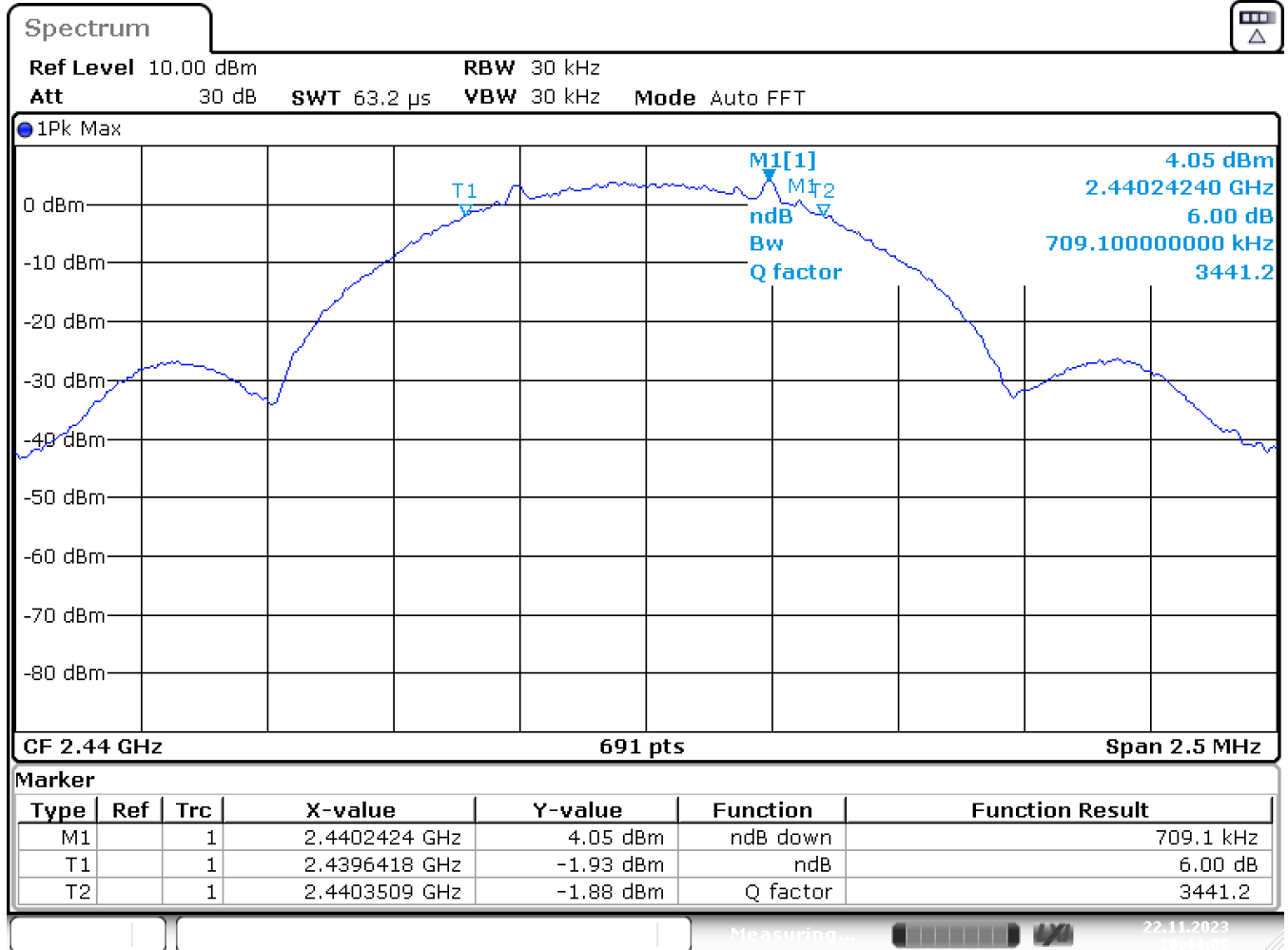
Test Equipment used: EMV-205;

6 dB Bandwidth

§ 15.247(a)(2)
 5.2.a

Conducted Measurement

Rated output power: 0,68 mW Channel 19 (2440 MHz center frequency)



Date: 22.NOV.2023 10:44:09

6dB Bandwidth: 709,1 kHz

LIMIT SUBCLAUSE 15.247(e) – 5.2.a)

Under normal test conditons	6 dB Bandwidth at least 500 kHz
-----------------------------	---------------------------------

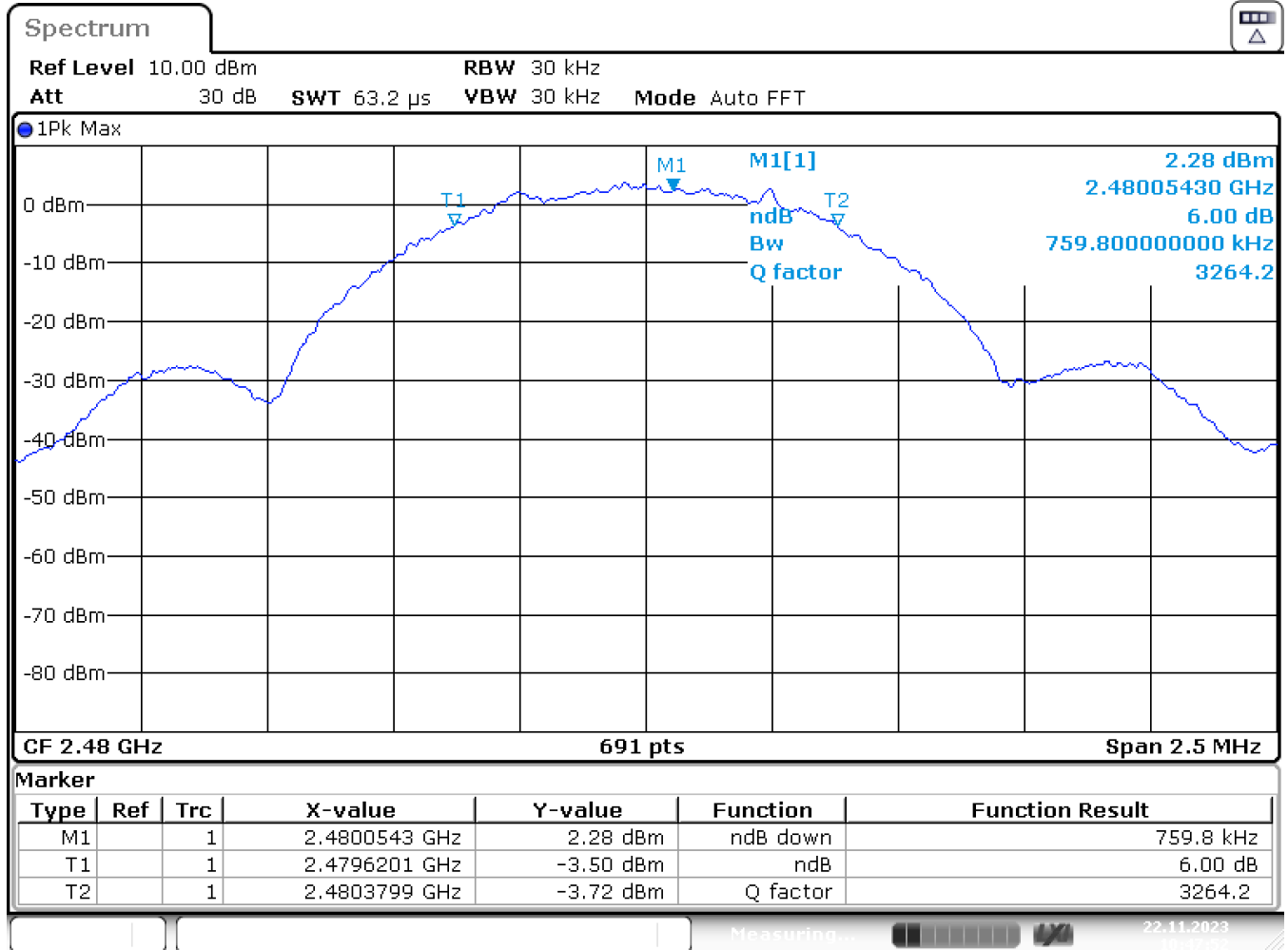
Test Equipment used: EMV-205;

6 dB Bandwidth

**§ 15.247(a)(2)
 5.2.a**

Conducted Measurement

Rated output power: 0,68 mW Channel 39 (2480 MHz center frequency)



Date: 22.NOV.2023 10:47:52

6dB Bandwidth: 759,8 kHz

LIMIT SUBCLAUSE 15.247(e) – 5.2.a)

Under normal test conditons	6 dB Bandwidth at least 500 kHz
-----------------------------	---------------------------------

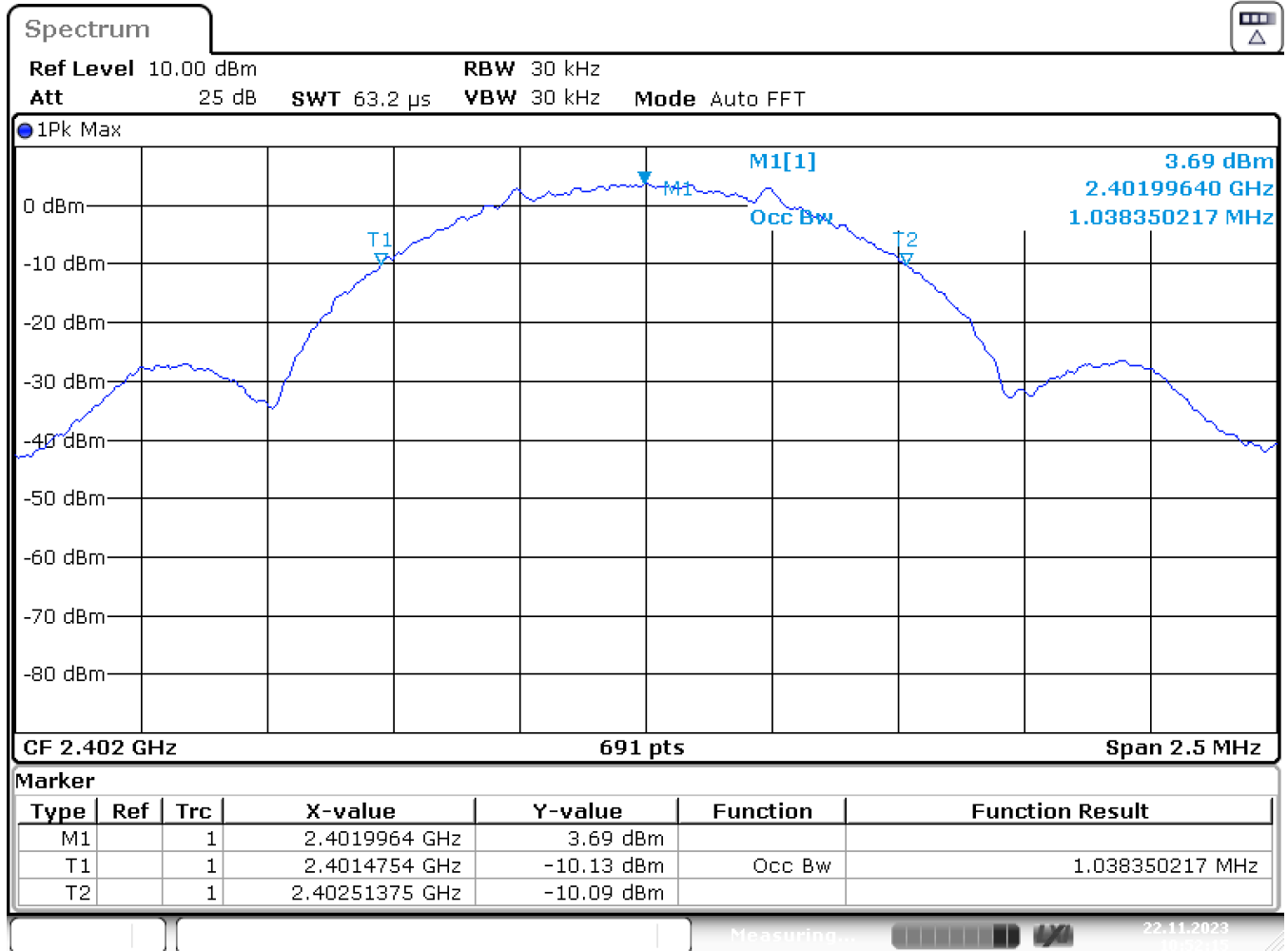
Test Equipment used: EMV-205;

4.4. 99% Bandwidth

RSS 247

Conducted Measurement

Rated output power: 0,68 mW Channel 0 (2402 MHz center frequency)



Date: 22.NOV.2023 10:52:15

99% Bandwidth: 1038,4 kHz

LIMIT RSS 247

None; for IC reporting purposes only

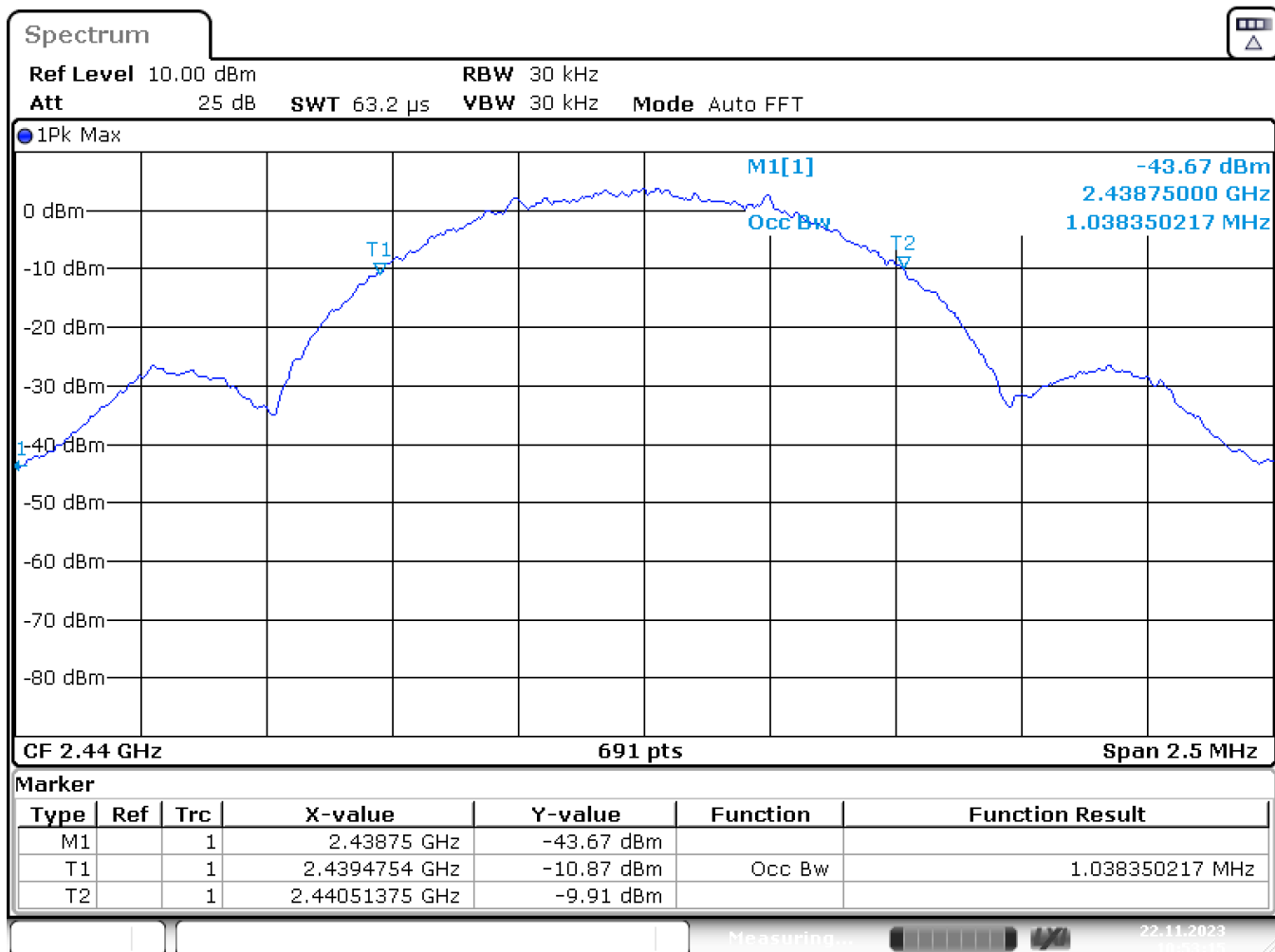
Test Equipment used: EMV-205;

99% Bandwidth

RSS 247

Conducted Measurement

Rated output power: 0,68 mW Channel 19 (2440 MHz center frequency)



Date: 22.NOV.2023 10:53:14

99% Bandwidth: 1038,4 kHz

LIMIT RSS 247

None; for IC reporting purposes only

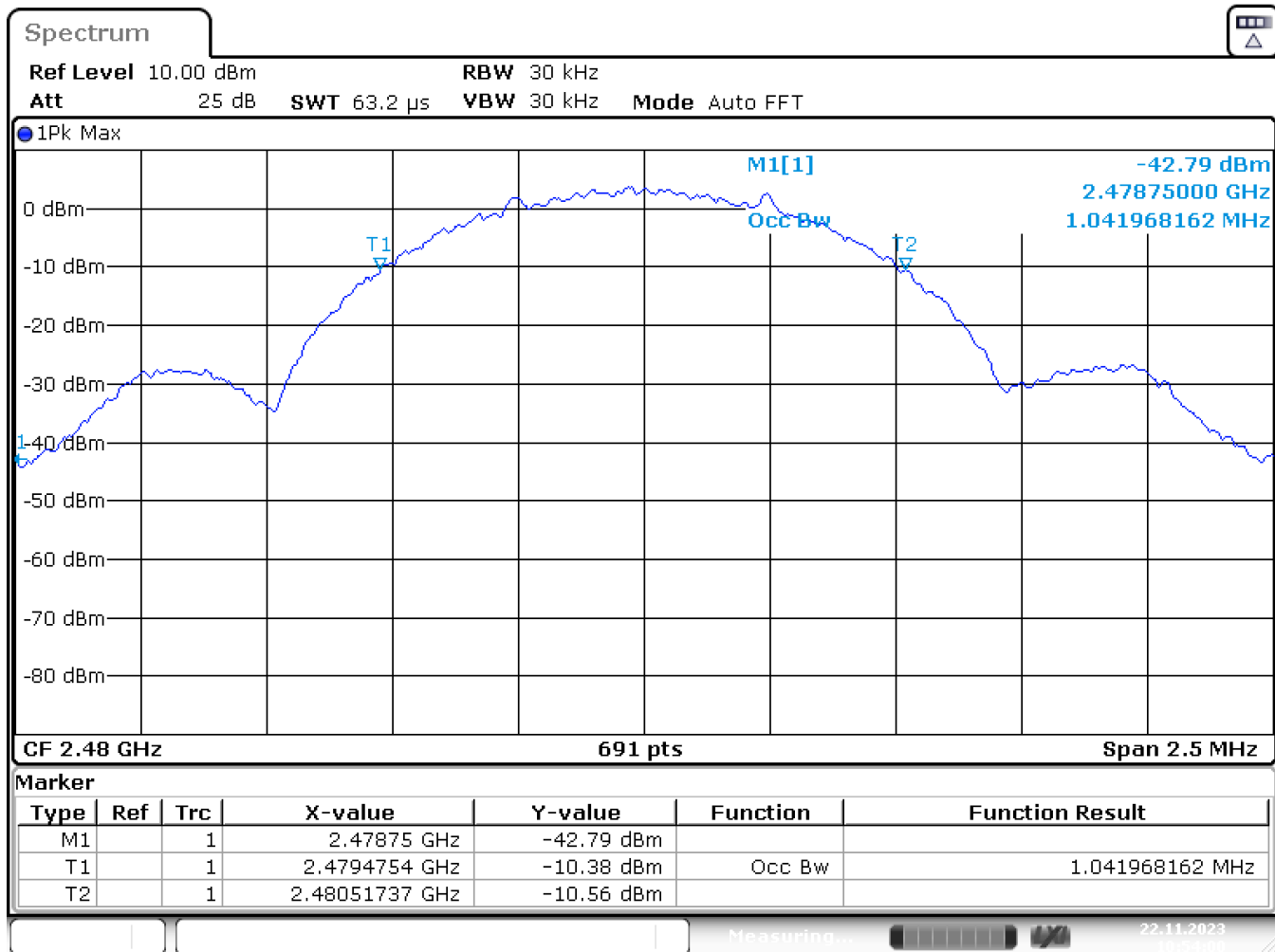
Test Equipment used:EMV-205;

99% Bandwidth

RSS 247

Conducted Measurement

Rated output power: 0,68 mW Channel 39 (2480 MHz center frequency)



Date: 22.NOV.2023 10:54:00

99% Bandwidth: 1042,0 kHz

LIMIT RSS 247

None; for IC reporting purposes only

Test Equipment used: EMV-205;

4.5. Maximum Peak RF Power Output

§ 15.247(b)(3)
 5.4.d

Conducted Measurement

Rated output power: 0,68 mW

Test conditions		Transmitter power (mW)		
		2402 MHz	2440 MHz	2480 MHz
T _{nom} (23)°C	V _{nom} (3) V	4,25	4,10	3,95
Measurement uncertainty		± 0,75 dB		

Radiated Measurement

Rated output power: 0,68 mW

Test conditions		Transmitter power (mW) EIRP		
		2402 MHz	2440 MHz	2480 MHz
T _{nom} (23)°C	V _{nom} (3) V	0,55	0,67	0,68
Measurement uncertainty		± 2 dB		

Maximum Gain derived from EIRP and conducted measurement:		Maximum Gain (dBi)		
Test condition		2402 MHz	2440 MHz	2480 MHz
T _{nom} 23 °C	V _{nom} (3)V	-8,86	-7,87	-7,64

LIMIT SUBCLAUSE 15.247(b)(3) – 5.4.4

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

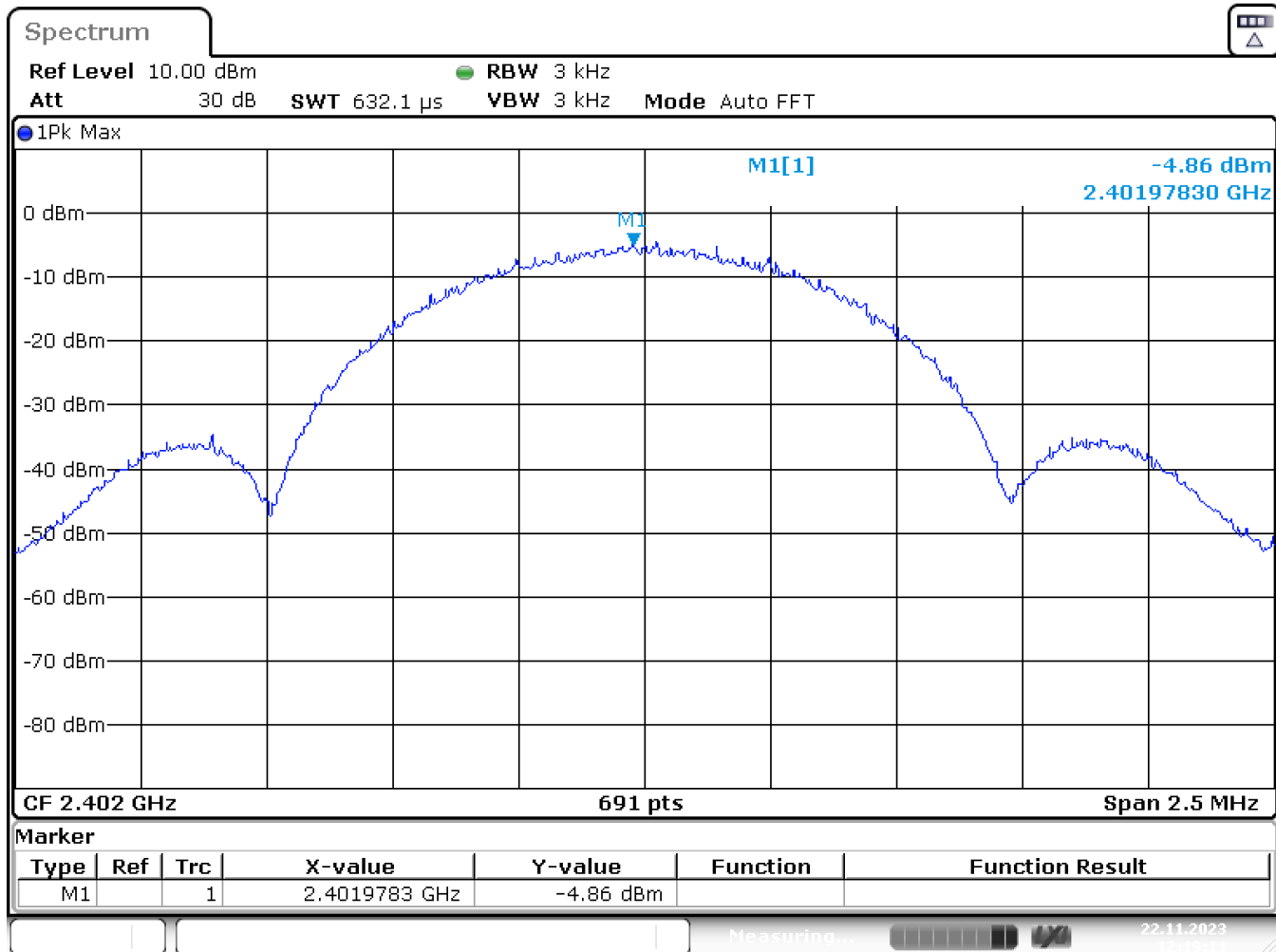
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-139; NT-207/1; EMV-205

4.6. Power spectral density

§ 15.247(e)
 5.2.b

Conducted Measurement

Rated output power: 1,94 mW Channel 0 (2402 MHz center frequency)



Date: 22.NOV.2023 12:19:11

Power Spectral density: -4,86 dBm @ 2402,00 MHz

LIMIT SUBCLAUSE 15.247(e) – 5.2 b)

Under normal test conditons	+8dBm in any 3 kHz band
-----------------------------	-------------------------

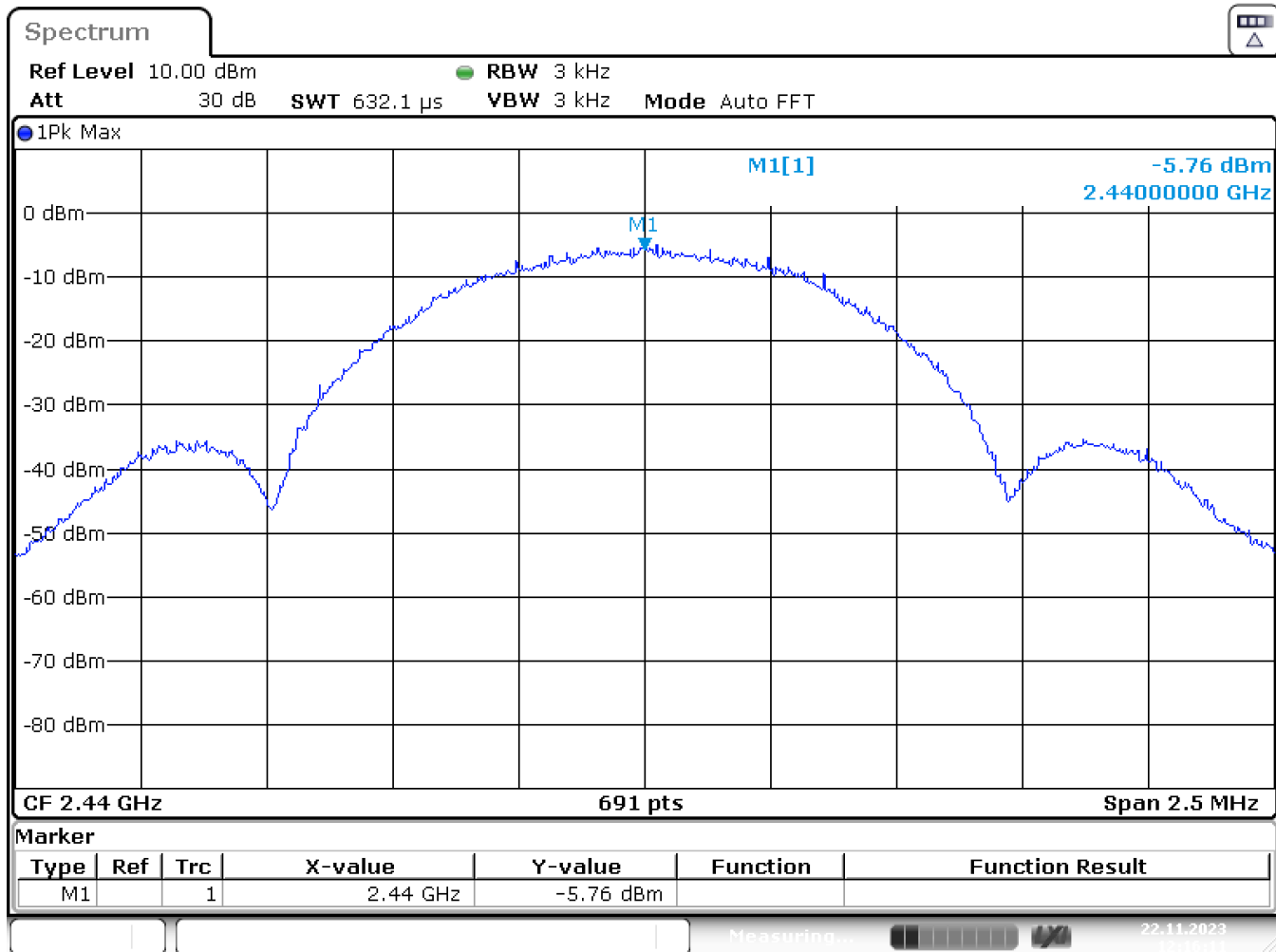
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-139; NT-207/1;

Power spectral density

**§ 15.247(e)
 5.2.b**

Conducted Measurement

Rated output power: 1,94 mW Channel 19 (2440 MHz center frequency)



Date: 22.NOV.2023 12:16:12

Power Spectral density: -5,76 dBm @ 2440,01 MHz

LIMIT SUBCLAUSE 15.247(e) – 5.2 b)

Under normal test conditons	+8dBm in any 3 kHz band
-----------------------------	-------------------------

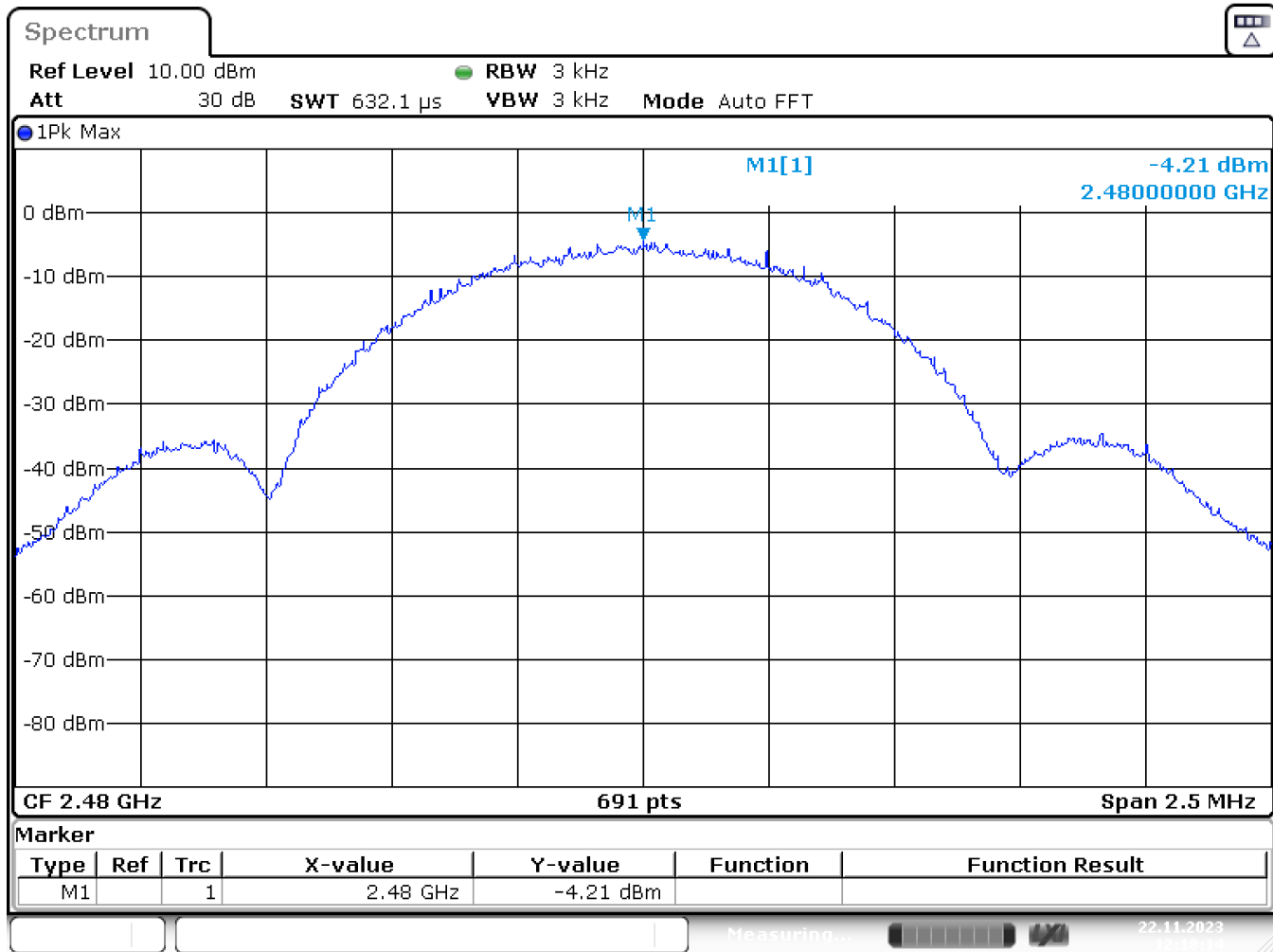
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-139; NT-207/1;

Power spectral density

**§ 15.247(e)
 5.2.b**

Conducted Measurement

Rated output power: 1,94 mW Channel 39 (2480 MHz center frequency)



Date: 22.NOV.2023 12:18:14

Power Spectral density: -4,21 dBm @ 2479,96 MHz

LIMIT SUBCLAUSE 15.247(e) – 5.2 b)

Under normal test conditons	+8dBm in any 3 kHz band
-----------------------------	-------------------------

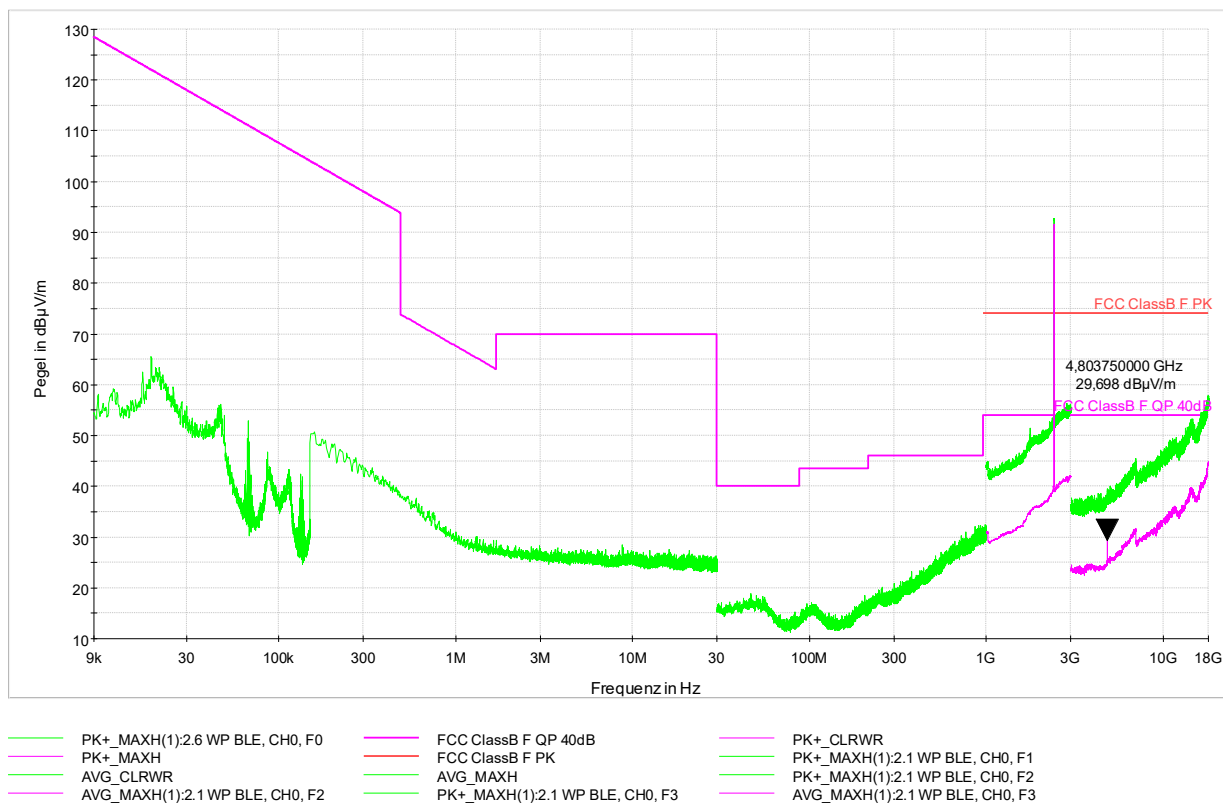
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-139; NT-207/1;

4.7. 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):

Setup: CH 0: 2402 MHz



Worst case emission: Average @ 4803,8 MHz: 29,70 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: NT-100; NT-110/1; NT-111/1; NT-132; NT-207/1;

Emissions in restricted bands § 15.209(a)
Emissions falling within restricted frequency bands RSS-Gen

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

Setup: 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.

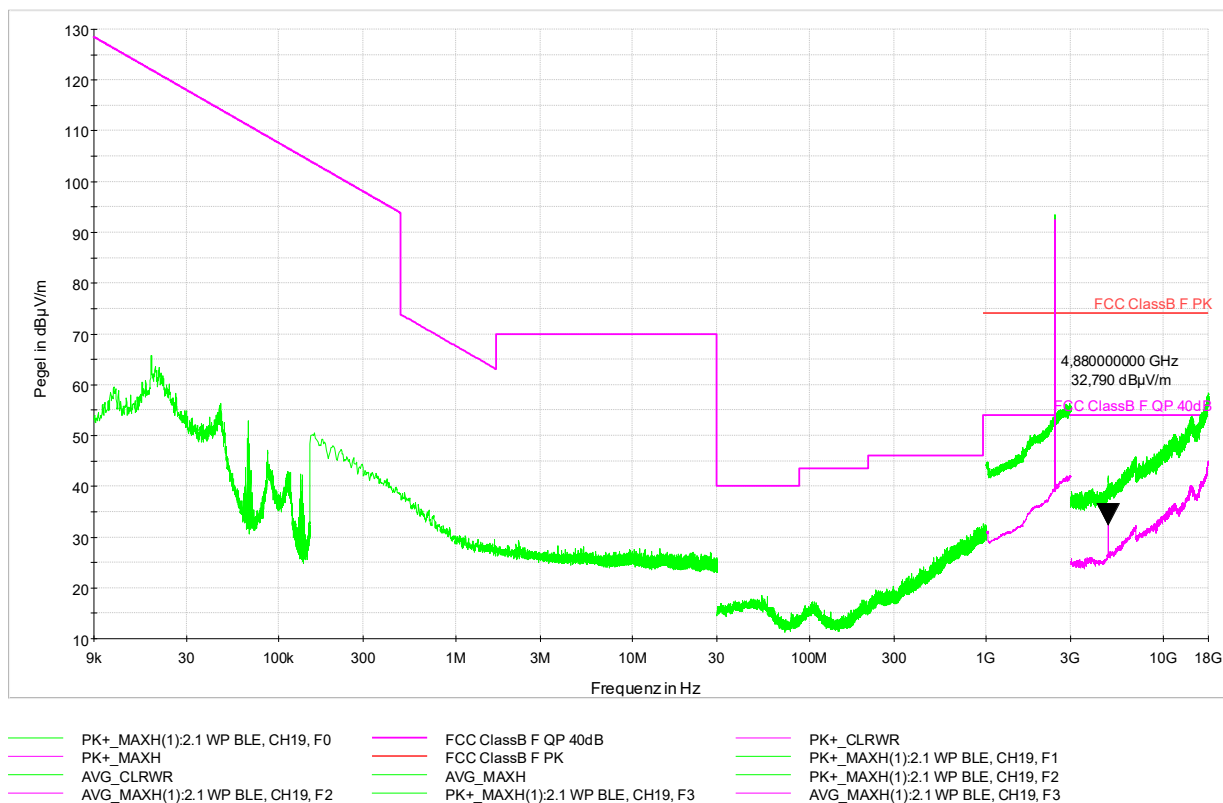
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-131/1; NT-139; NT-207/1;

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):

Setup: CH 19: 2440 MHz



Worst case emission: Average @ 4880,0 MHz: 32,79 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

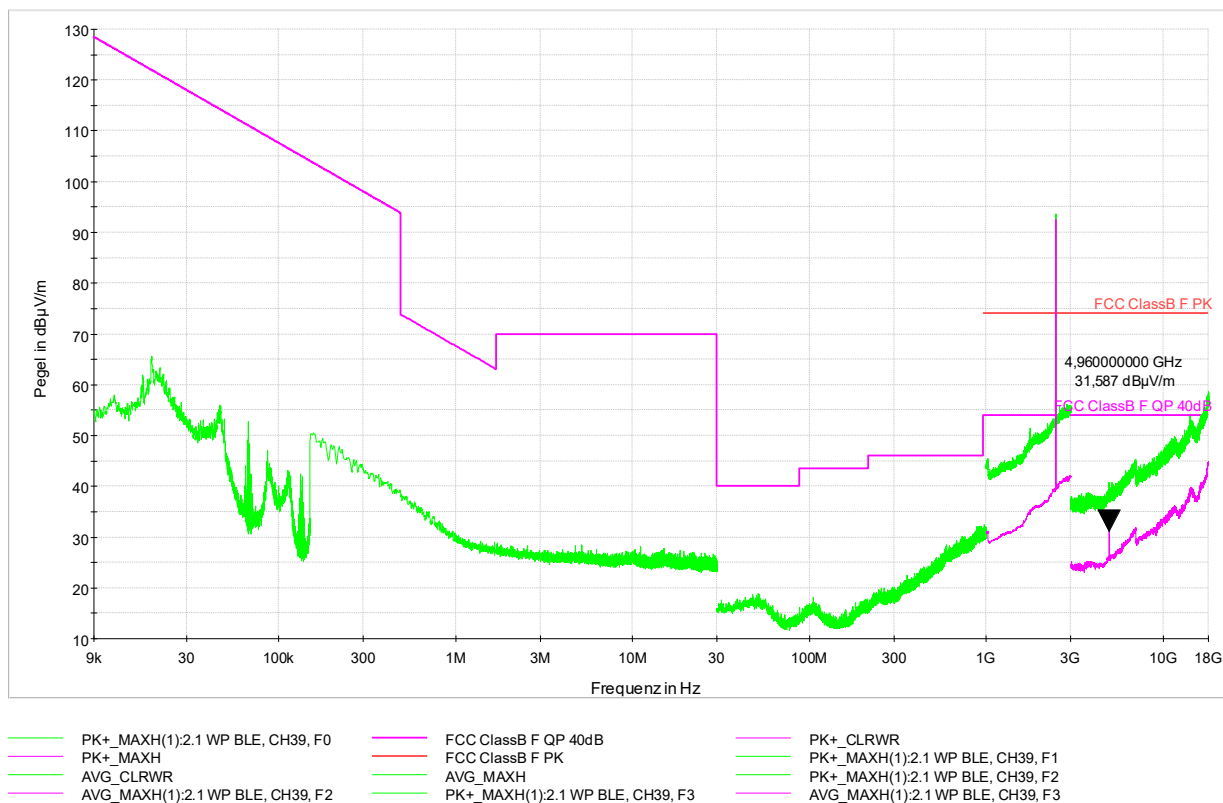
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-132; NT-207/1;

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):

Setup: CH 39: 2480 MHz



Worst case emission: Average @ 4960,0 MHz: 31,59 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

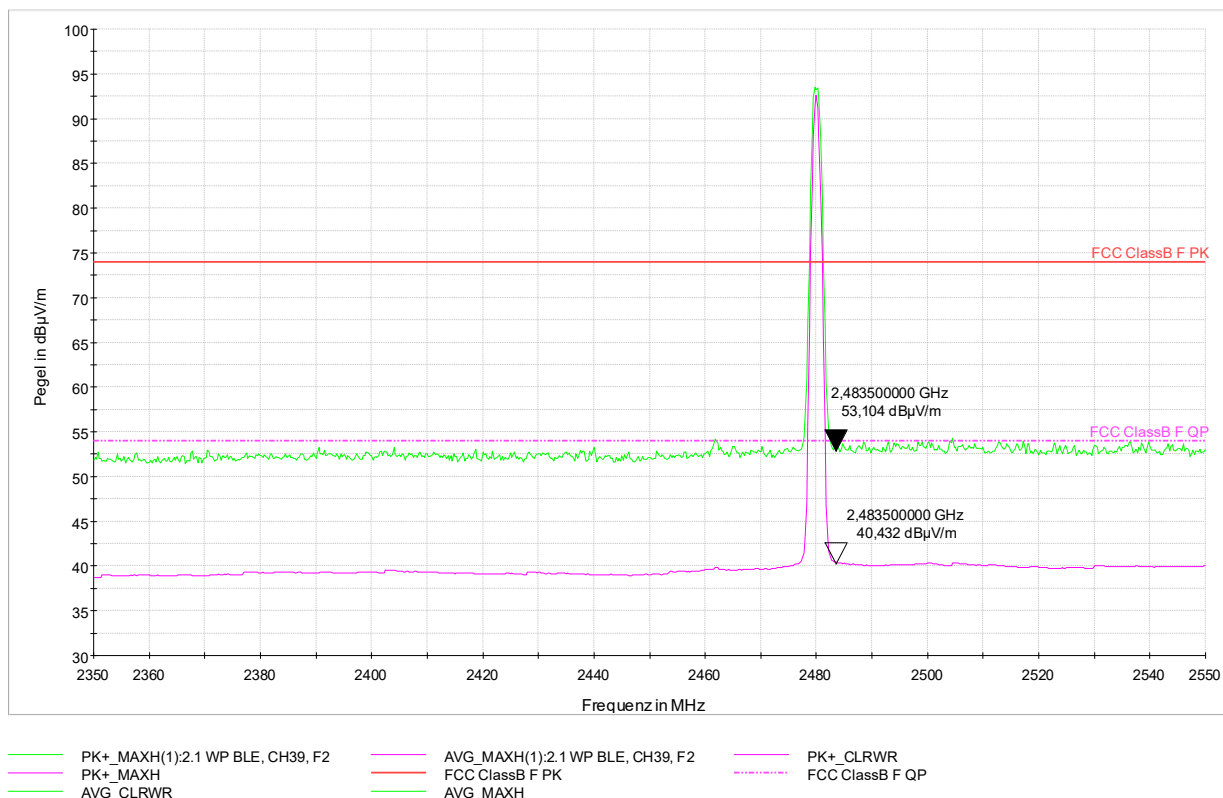
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-132; NT-207/1;

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: CH 39: 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: NT-100; NT-110/1; NT-111/1; NT-131/1; NT-139; NT-207/1;

4.8 RF Exposure

KDB 447498 D04
§1.1307(b)(3)(i)(B)

according to KDB 447498 D04 Interim General RF Exposure Guidance v01 "RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES".

The device has only one antenna and simultaneous transmission does not apply.
The evaluation followed the flowchart in Figure A.1.

Title 47 §1.1307(b)(3)(i)(B):

(3) Determination of exemption. (i) For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}}(d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Maximum conducted power and EIRP values are taken from Section 4.5.

Calculations are done for a minimum separation distance of 1 cm. This distance is derived from the device casing. It is conservative, as customers are not expected to touch or lean on electronic shelf labels for extended periods of time.

Production variance was declared by the manufacturer, see operational description.

f [MHz]	cond. P [mW]	duty cycle [1]	production variance [1]	max. time-averaged power [mW]	EIRP [mW]	ERP [mW]	ERP incl. prod. var. [mW]
2402	4,25	1	1,58	6,71	0,55	0,34	0,53
2440	4,10	1	1,58	6,48	0,67	0,41	0,65
2480	3,95	1	1,58	6,25	0,68	0,42	0,66

*) Duty cycle was not measured, factor 1 is a worst case assumption.

Title 47 §1.1307(b)(3)(i)(B) exemption calculation:

Frequency range (see 4.1 and 4.2)	max(max. time avg. P, ERP) [mW]	§1.1307(b)(3)(i)(B) limit (P_{th}) [mW]	P / P _{th} [1]	< 1
2402	6,71	10,39	0,65	OK
2440	6,48	10,28	0,63	OK
2480	6,25	10,17	0,61	OK

The available maximum time-averaged ERP is below P_{th} for separation distances of 1 cm and above.

The device is a *SAR exempt RF device* as per Title 47 §1.1307(b)(3)(i)(B).

RF Exposure

RSS-102, Issue 5

2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

RSS-102 2.5.1 Exemption calculation

Frequency (MHz)	cond. P (mW)	max. EIRP (mW)	Duty Cycle (1)	Avg. cond. P (mW)	Avg. EIRP (mW)	separation distance (mm)	Limit (mW)	
2402	4,25	0,55	1	4,25	0,55	5	10.65	OK
2440	4,10	0,67	1	4,10	0,67	5	10.14	OK
2480	3,95	0,68	1	3,95	0,68	5	9.86	OK

*) Duty cycle was not measured, factor 1 is a worst case assumption.

**) Calculations are done for a minimum separation distance of 0.5 cm and limb worn exposure. The distance is derived from the device casing. It is conservative, as customers are not expected to touch electronic shelf labels for extended periods of time.

The time-averaged output power is below the exemption limit for routine evaluation.

Appendix 1

Test equipment used

<input type="checkbox"/>	Anechoic Chamber with 3m measurement distance	NT-100	<input type="checkbox"/>	Ant. tripod for EN61000-4-3 Model TP1000A	NT-156
<input type="checkbox"/>	Stripline according to ISO 11452-5	NT-108	<input type="checkbox"/>	Power quality analyzer Fluke 1760 (complete set)	NT-160 - NT-173
<input type="checkbox"/>	MA4000 - Antenna mast 1 - 4 m height	NT-110/1	<input type="checkbox"/>	Spectrumalyzer – FSP7 9 kHz – 7 GHz	NT-200
<input type="checkbox"/>	DS - Turntable 0 - 400 ° Azimuth	NT-111/1	<input type="checkbox"/>	ESCI - Test receiver 9 kHz - 7 GHz	NT-203/1
<input type="checkbox"/>	CO3000 Controller Mast+Turntable	NT-112/1	<input type="checkbox"/>	ESR – Test receiver 20 Hz – 26,5 GHz	NT-207/1
<input type="checkbox"/>	HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz	NT-121	<input type="checkbox"/>	Digital Radio Tester CMW500	NT-208/1
<input type="checkbox"/>	FMZB1513 - Loop Antenna 9 kHz - 30 MHz	NT-122/1	<input type="checkbox"/>	Noise-gen., ITU-R 559-2 20 Hz – 20 kHz	NT-209
<input type="checkbox"/>	HFH-Z6 - Rod Antenna 9 kHz - 30 MHz	NT-123	<input type="checkbox"/>	CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz	NT-210
<input type="checkbox"/>	Dipole Antenna VHA9103 30 - 300 MHz	NT-124/1a	<input type="checkbox"/>	3271 - Spectrum analyzer 100 Hz - 26,5 GHz	NT-211
<input type="checkbox"/>	Dipole Antenna UHA9105 300 - 1000 MHz	NT-124/1b	<input type="checkbox"/>	Digital Radio Tester Aeroflex 3920	NT-212/1
<input type="checkbox"/>	3115 - Horn Antenna 1 - 18 GHz (immunity)	NT-125	<input type="checkbox"/>	Mixer M28HW 26,5 GHz - 40 GHz	NT-214
<input type="checkbox"/>	3116 - Horn Antenna 18 - 40 GHz	NT-126	<input type="checkbox"/>	RubiSource T&M Timing reference	NT-216
<input type="checkbox"/>	SAS-200/543 - Bicon. Antenna 20 MHz - 300 MHz	NT-127	<input type="checkbox"/>	Radiocommunicationanalyzer SWR 1180 MD	NT-217
<input type="checkbox"/>	AT-1080 - Log. Per. Antenna 80 - 1000 MHz	NT-128	<input type="checkbox"/>	Mixer FS-Z60 40 GHz – 60 GHz	NT-218/1
<input type="checkbox"/>	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-129	<input type="checkbox"/>	Mixer FS-Z90 60 GHz – 90 GHz	NT-219/1
<input type="checkbox"/>	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-130	<input type="checkbox"/>	DSO9104 Digital scope	NT-220/1
<input type="checkbox"/>	3146 - Log. Per. Antenna 200 – 1000 MHz	NT-131	<input type="checkbox"/>	TPS 2014 Digital scope	NT-222
<input type="checkbox"/>	VULB 9163 Trilog Antenna 30 – 3000 MHz	NT-131/1	<input type="checkbox"/>	Artificial Ear according to IEC 60318	NT-224
<input type="checkbox"/>	Loop Antenna H-Field	NT-132	<input type="checkbox"/>	1 kHz Sound calibrator	NT-225
<input type="checkbox"/>	Horn Antenna 500 MHz - 2900 MHz	NT-133	<input type="checkbox"/>	SRM-3006 Spectrumalyzer	NT-233/1a
<input type="checkbox"/>	Horn Antenna 500 MHz - 6000 MHz	NT-133/1	<input type="checkbox"/>	E-field probe SRM 75 MHz – 3 GHz	NT-234
<input type="checkbox"/>	Log. per. Antenna 800 MHz - 2500 MHz	NT-134	<input type="checkbox"/>	Field Meter NBM-500 incl. E- and H-Field probes	NT-240a-e
<input type="checkbox"/>	Log. per. Antenna 800 MHz - 2500 MHz	NT-135	<input type="checkbox"/>	Magnetometer HP-01	NT-241/1
<input type="checkbox"/>	BiConiLog Antenna 26 MHz – 2000 MHz	NT-137	<input type="checkbox"/>	EFA-3 H-field- / E-field probe	NT-243
<input type="checkbox"/>	Conical Dipol Antenna PCD8250	NT-138	<input type="checkbox"/>	EHP-50F H-field- / E-field probe	NT-243/1
<input type="checkbox"/>	HF 906 - Horn Antenna 1 - 18 GHz (emission)	NT-139	<input type="checkbox"/>	Field Meter EMR-200 100 kHz – 3 GHz	NT-244
<input type="checkbox"/>	HZ-1 Antenna tripod	NT-150	<input type="checkbox"/>	E-field probe 100 kHz – 3 GHz	NT-245
<input type="checkbox"/>	BN 1500 Antenna tripod	NT-151	<input type="checkbox"/>	H-field probe 300 kHz – 30 MHz	NT-246

Division:
Industry & Energy

Test report number:
2023-IN-AT-TICL-E-EX-0-000018-FG-034

Page: 1 of 5

Date: 22.11.2023

Appendix 1 (continued)

Test equipment used

<input type="checkbox"/>	E-field probe 3 MHz – 18 GHz	NT-247	<input type="checkbox"/>	Prana N-MT 500 - RF-Amplifier 80 - 1000 MHz / 500 W	NT-332/1
<input type="checkbox"/>	H-field probe 27 MHz – 1 GHz	NT-248	<input type="checkbox"/>	BBA150 RF-Amplifier 1 GHz - 6 GHz	NT-333/1
<input type="checkbox"/>	ELT-400 1 Hz – 400 kHz	NT-249	<input type="checkbox"/>	APA01 – RF-Amplifier 0,5 GHz – 2,5 GHz	NT-334
<input type="checkbox"/>	MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250	<input type="checkbox"/>	Preamplifier 1 GHz - 4 GHz	NT-335
<input type="checkbox"/>	FCC-203I EM Injection clamp	NT-251	<input type="checkbox"/>	Preamplifier for GPS MKU 152 A	NT-336
<input type="checkbox"/>	FCC-203I-DCN Ferrite decoupling network	NT-252	<input type="checkbox"/>	Preamplifier 1 GHz – 18 GHz	NT-337/1
<input type="checkbox"/>	PR50 Current Probe	NT-253	<input type="checkbox"/>	DC Block 10 MHz – 18 GHz Model 8048	NT-338
<input type="checkbox"/>	i310s Current Probe	NT-254/1	<input type="checkbox"/>	2-97201 Electronic load	NT-341
<input type="checkbox"/>	Fluke 87 V True RMS Multimeter	NT-260	<input type="checkbox"/>	TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-344
<input type="checkbox"/>	Model 2000 Digital Multimeter	NT-261	<input type="checkbox"/>	TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-345
<input type="checkbox"/>	Fluke 87 V Digital Multimeter	NT-262/1	<input type="checkbox"/>	VDS 200 Mobil-impuls-generator	NT-350
<input type="checkbox"/>	ESH2-Z5-U1 Artificial mains network 4x25A	NT-300	<input type="checkbox"/>	LD 200 Mobil-impuls-generator	NT-351
<input type="checkbox"/>	ESH3-Z5-U1 Artificial mains network 2x10A	NT-301	<input type="checkbox"/>	MPG 200 Mobil-Impuls-Generators	NT-352
<input type="checkbox"/>	ESH3-Z6-U1 Artificial mains network 1x100A	NT-302	<input type="checkbox"/>	EFT 200 Mobil-impuls-generator	NT-353
<input type="checkbox"/>	ESH3-Z6-U1 Artificial mains network 1x100A	NT-302a	<input type="checkbox"/>	AN 200 S1 Artificial Network	NT-354
<input type="checkbox"/>	EZ10 T-Artificial Network	NT-305	<input type="checkbox"/>	FP-EFT 32M 3 ph. Coupling filter (Burst)	NT-400/1
<input type="checkbox"/>	SMG - Signal generator 0,1 - 1000 MHz	NT-310	<input type="checkbox"/>	PHE 4500 - Mains impedance network	NT-401
<input type="checkbox"/>	SMA100A - Signal generator 9 kHz - 6 GHz	NT-310/1	<input type="checkbox"/>	IP 6.2 Coupling filter for data lines (Surge)	NT-403
<input type="checkbox"/>	RefRad Reference generator	NT-312	<input type="checkbox"/>	TK 9421 High Power Volt. Probe 150 kHz - 30 MHz	NT-409
<input type="checkbox"/>	SMP 02 Signal generator 10 MHz - 20 GHz	NT-313	<input type="checkbox"/>	ESH2-Z3 - Probe 9 kHz - 30 MHz	NT-410
<input type="checkbox"/>	40 MHz Arbitrary Generator TGA1241	NT-315	<input type="checkbox"/>	CN-EFT1000 - Capacitive clamp (Burst)	NT-411/1
<input type="checkbox"/>	Artificial mains network NSLK 8127-PLC	NT-316	<input type="checkbox"/>	Highpass-Filter 100 MHz – 3 GHz	NT-412
<input type="checkbox"/>	PSURGE 4.1 Surge generator	NT-324	<input type="checkbox"/>	Highpass-Filter 600 MHz – 4 GHz	NT-413
<input type="checkbox"/>	IMU4000 Immunity test system	NT-325/1a-e	<input type="checkbox"/>	Highpass-Filter 1250 MHz – 4 GHz	NT-414
<input type="checkbox"/>	VCS 500-M6 Surge-Generator	NT-326	<input type="checkbox"/>	Highpass-Filter 1800 MHz – 16 GHz	NT-415
<input type="checkbox"/>	Oscillatory Wave Simulator incl. Coupling networks	NT-328a+b+c			
<input type="checkbox"/>	BTA-250 - RF-Amplifier 9 kHz - 220 MHz / 250 W	NT-330			

Division:
Industry & Energy

Test report number:
2023-IN-AT-TICL-E-EX-0-
000018-FG-034

Page: 2 of 5

Date: 22.11.2023

Appendix 1 (continued) Test equipment used

<input type="checkbox"/>	RF-Attenuator 10 dB DC – 18 GHz / 50 W	NT-417/1	<input type="checkbox"/>	SW 9605 - Current probe 150 kHz – 30 MHz	NT-465/1
<input type="checkbox"/>	RF-Attenuator 6 dB DC – 18 GHz / 50 W	NT-418	<input type="checkbox"/>	95242-1 – Current probe 1 MHz – 400 MHz	NT-468
<input type="checkbox"/>	RF-Attenuator 3 dB DC – 18 GHz / 50 W	NT-419	<input type="checkbox"/>	94106-1L-1 – Current probe 100 kHz – 450 MHz	NT-471
<input type="checkbox"/>	RF-Attenuator 20 dB DC - 1000 MHz / 25 W	NT-421	<input type="checkbox"/>	WHKX12-2700-3000-18000 3 GHz Highpass filter	NT-472
<input type="checkbox"/>	RF-Attenuator 30 dB DC - 1000 MHz / 1 W	NT-423	<input type="checkbox"/>	WHKX10-3870-4500-18000 4,5 GHz Highpass filter	NT-473
<input type="checkbox"/>	RF-Attenuator 30 dB	NT-424	<input type="checkbox"/>	CDN S9 USB3.0 Coupling decoupling network	NT-474
<input type="checkbox"/>	RF-Attenuator 6 dB DC - 1000 MHz / 1 W	NT-425	<input type="checkbox"/>	CDN S2 XLR3-1 Coupling decoupling network	NT-475
<input type="checkbox"/>	RF-Attenuator 6 dB DC - 1000 MHz / 1 W	NT-426	<input type="checkbox"/>	CDN S8 RJ45 Coupling decoupling network	NT-476
<input type="checkbox"/>	RF-Attenuator 6 dB	NT-428	<input type="checkbox"/>	GA 1240 Power amplifier according to EN 61000-4-16	NT-480
<input type="checkbox"/>	RF-Attenuator 0 dB - 81 dB	NT-429	<input type="checkbox"/>	Coupling networks according to EN 61000-4-16	NT-481 - NT-483
<input type="checkbox"/>	WRU 27 - Band blocking 27 MHz	NT-430	<input type="checkbox"/>	Van der Hoofden Test Head	NT-484
<input type="checkbox"/>	WHJ450C9 AA - High pass 450 MHz	NT-431	<input type="checkbox"/>	WRCJV12-5820-5850-5950-5980 5,9 GHz Band Reject Filter	NT-490
<input type="checkbox"/>	WHJ250C9 AA - High pass 250 MHz	NT-432	<input type="checkbox"/>	WHKX10-5670-6300-18000 6 GHz Highpass filter	NT-491
<input type="checkbox"/>	RF-Load 150 W	NT-433	<input type="checkbox"/>	WHK12-935-1000-7000 1 GHz Highpass filter	NT-492
<input type="checkbox"/>	Impedance transducer 1:4 ; 1:9 ; 1:16	NT-435	<input type="checkbox"/>	EMC Video/Audiosystem	NT-511/1
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 6 dB	NT-436	<input type="checkbox"/>	EMC32 Version 10.60.20 Test software	NT-520/1
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 6 dB	NT-437	<input type="checkbox"/>	SRM-TS Version 1.3 software for SRM-3000	NT-522
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 10 dB	NT-438	<input type="checkbox"/>	SRM-TS Version 1.3.1 software for SRM-3006	NT-522/1
<input type="checkbox"/>	RF-Attenuator DC – 18 GHz 20 dB	NT-439	<input type="checkbox"/>	Spitzenberger und Spies Test software V4.1	NT-525
<input type="checkbox"/>	I+P 7780 Directional coupler 100 - 2000 MHz	NT-440	<input type="checkbox"/>	Vertical coupling plane (ESD)	NT-531
<input type="checkbox"/>	ESH3-Z2 - Pulse limiter 9 kHz - 30 MHz	NT-441	<input type="checkbox"/>	Test cable #4 for EN 61000-4-6	NT-553
<input type="checkbox"/>	Power Divider 6 dB/1 W/50 Ohm	NT-443	<input type="checkbox"/>	Test cable #3 for conducted emission	NT-554
<input type="checkbox"/>	Directional coupler 0,1 MHz – 70 MHz	NT-444	<input type="checkbox"/>	Test cable #5+#6 ESD-cable (2x470k)	NT-555 + NT-556
<input type="checkbox"/>	Directional coupler 0,1 MHz – 70 MHz	NT-445	<input type="checkbox"/>	Test cable #8 Sucoflex 104EA	NT-559
<input type="checkbox"/>	Tube imitations according to EN 55015	NT-450	<input type="checkbox"/>	Test cable #9 (for outdoor measurements)	NT-580
<input type="checkbox"/>	FCC-801-M3-16A Coupling decoupling network	NT-458	<input type="checkbox"/>	Test cable #10 (for outdoor measurements)	NT-581
<input type="checkbox"/>	FCC-801-M2-50A Coupling decoupling network	NT-459	<input type="checkbox"/>	Test cable #13 Sucoflex 104PE	NT-584
<input type="checkbox"/>	FCC-801-M5-25 Coupling decoupling network	NT-460	<input type="checkbox"/>	Test cable #21 for SRM-3000	NT-592
<input type="checkbox"/>	FCC-801-T4 Coupling decoupling network	NT-463	<input type="checkbox"/>	Shield chamber	NT-600
<input type="checkbox"/>	FCC-801-C1 Coupling decoupling network	NT-464	<input type="checkbox"/>	Climatic chamber	M-1200

Division:
Industry & Energy

Test report number:
2023-IN-AT-TICL-E-EX-0-
000018-FG-034

Page: 3 of 5

Date: 22.11.2023

Appendix 1 (continued)

Test equipment used

<input type="checkbox"/>	Anechoic Chamber 3 m / 5 m measuring distance	EMV-100	<input type="checkbox"/>	HF- Amplifier 9 kHz-225 MHz BBL200	EMV-300/1
<input type="checkbox"/>	Turntabel 6 m diameter	EMV-101	<input type="checkbox"/>	HF- Amplifier 80 -1000 MHz BBA150	EMV-301
<input type="checkbox"/>	Antenna mast + controller	EMV-102+ EMV-103	<input type="checkbox"/>	HF- Amplifier 0,8 - 6 GHz BBA150	EMV-302
<input type="checkbox"/>	EMC Video/Audiosystem	EMV-104	<input type="checkbox"/>	High Power Ant. 20-200 MHz HPBA-2510	EMV-303/1
<input type="checkbox"/>	EMC Software EMC32 Version 10.60.20	EMV-105	<input type="checkbox"/>	High Power Ant. 20-200 MHz S12018-21	EMV-303/2
<input type="checkbox"/>	Hornantenna 1 – 18 GHz HF 907	EMV-110	<input type="checkbox"/>	Log.per Antenna 80-2700 MHz STLP 9128 E special	EMV-304
<input type="checkbox"/>	Antennapre.amp. 1 – 18 GHz BBV 9718 D	EMV-111/1	<input type="checkbox"/>	Log.per Antenna 0,7 – 9 GHz STLP9149	EMV-305
<input type="checkbox"/>	Trilog Antenna 30-3000 MHz VULB9163	EMV-112	<input type="checkbox"/>	HF- Amplifier 9 kHz-250 MHz BBA150 (low noise)	EMV-306
<input type="checkbox"/>	Monopol 9 kHz – 30 MHz VAMP 9243	EMV-113	<input type="checkbox"/>	ISO11451-2 TLS 10 kHz – 30 MHz	EMV-307
<input type="checkbox"/>	Antennapre.amp 18 – 40 GHz BBV 9721	EMV-114	<input type="checkbox"/>	Load Dump Generator LD 200N	EMV-350
<input type="checkbox"/>	Hornantenna 200 – 2000 MHz AH-220	EMV-115	<input type="checkbox"/>	Ultra Compact Symulator UCS 200N100	EMV-351
<input type="checkbox"/>	DC Artificial Network PVDC 8300	EMV-150	<input type="checkbox"/>	Automotive Power fail module PFM 200N100.1	EMV-352
<input type="checkbox"/>	AC Artificial Network NNLK 8121 RC	EMV-151	<input type="checkbox"/>	Voltage Drop Symulator VDS 200Q100	EMV-353
<input type="checkbox"/>	AC Artificial Network NNLK 140	EMV- 153a-d	<input type="checkbox"/>	Arb. Generator AutoWave	EMV-354
<input type="checkbox"/>	EMI Receiver ESW44	EMV-200/1	<input type="checkbox"/>	Ultra Compact Symulator UCS 500N7	EMV-355
<input type="checkbox"/>	Signalgenerator 9 kHz – 40 GHz N5173B	EMV-201	<input type="checkbox"/>	Coupling decoupling network CNI 503B7 / 32 A	EMV-356
<input type="checkbox"/>	GPS Frequency normal B-88	EMV-202	<input type="checkbox"/>	Coupling decoupling network CNI 503B7 / 63 A	EMV-357
<input type="checkbox"/>	DC Power supply N5745A	EMV-203	<input type="checkbox"/>	Telecom Surge Generator TSurge 7	EMV-358
<input type="checkbox"/>	Spektrum Analyzator FSV40	EMV-205	<input type="checkbox"/>	Coupling decoupling network CNI 508N2	EMV-359
<input type="checkbox"/>	Thd Multimeter Model 2015	EMV-206	<input type="checkbox"/>	Coupling decoupling network CNV 504N2.2	EMV-360
<input type="checkbox"/>	Poweramplifier PAS15000	EMV- 207/abc	<input type="checkbox"/>	Immunity generator NSG4060/NSG4060-1	EMV-361
<input type="checkbox"/>	Inrush Current Source	EMV- 208/abc	<input type="checkbox"/>	Coupling network CDND M316-2	EMV-362
<input type="checkbox"/>	Arb.-generator Sycore	EMV-209	<input type="checkbox"/>	Coupling network CT419-5	EMV-363
<input type="checkbox"/>	Harmonics/Flicker analyzer ARS 16/3	EMV-210	<input type="checkbox"/>	ESD Generator NSG 437	EMV-364
<input type="checkbox"/>	Power Supply Regatron AC	EMV-214	<input type="checkbox"/>	Pulse Limiter VTSD 9561-F BNC	EMV-405
<input type="checkbox"/>	Power Supply Regatron DC	EMV-215	<input type="checkbox"/>	Transient emission BSM200N40+BS200N100	EMV- 450+451
<input type="checkbox"/>	Harmonics/Flicker analyser Zimmer	EMV-216	<input type="checkbox"/>	Cap. Coupling Clamp HFK	EMV-455
<input type="checkbox"/>	Flicker Impedanz Newtons4th 753	EMV-218	<input type="checkbox"/>	Mag. Field System MS100N+MC26100+MC2630	EMV- 456-458
<input type="checkbox"/>	Comemso	EMV-219			

Division:
Industry & Energy

Test report number:
2023-IN-AT-TICL-E-EX-0-
000018-FG-034

Page: 4 of 5

Date: 22.11.2023

Appendix 1 (continued)

Test equipment used

<input type="checkbox"/>	Coupling network CDN M2-100A	EMV-459
<input type="checkbox"/>	Coupling network CDN M3-32A	EMV-460
<input type="checkbox"/>	Coupling network CDN M5-100A	EMV-461
<input type="checkbox"/>	Current Clamp CIP 9136A	EMV-462
<input type="checkbox"/>	DC Artificial Network HV-AN 150	EMV-464+465
<input type="checkbox"/>	Coupling Clamp EM 101	EMV-466
<input type="checkbox"/>	Decoupling Clamp FTC 101	EMV-467
<input type="checkbox"/>	Power attenuator 10 dB / 250 Watt	EMV-469/2
<input type="checkbox"/>	HV AMN NNHV 8123 800A	EMV-472
<input type="checkbox"/>	HV AMN NNHV 8123 800A	EMV-473

Division:
Industry & Energy

Test report number:
2023-IN-AT-TICL-E-EX-0-
000018-FG-034

Page: 5 of 5

Date: 22.11.2023