

Test Report

of the accredited Testing Laboratory
0274 – TÜV AUSTRIA GMBH – Location Vienna - EMC Radio
ISED Laboratory Company Number: 2932K, CAB identifier: AT0001

Order Confirmation Number: 2024-AT-TC-EE-ET-EX-0-000005
About

the Radio - test listed below

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

Test object: Electronic shelf labelling system
Product Marketing Name: E300 2.6
Model: EDB2-0260-A
FCC-ID: 2ACQM-EDB2-0260-A
IC-ID: 12154A-EDB20260A

Serial number: Prototype

Accredited regulation: FCC: 47 CFR Part 15 (eCFR 05.11.2024)
RSS-247 Issue 3, August 2023
RSS-102 Issue 6, Dember 2023
ANSI C63.10-2020

Andreas Malek

Michael Emminger



Examined by / Testing Laboratory
TÜV AUSTRIA GMBH

Approved by / Testing Laboratory
TÜV AUSTRIA GMBH

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

Issued on 08.01.2025 in Vienna / TIC

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1. Applicant

Company: VusionGroup GmbH

Department: Product & Project Manager

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

Contact person: Mrs. Tamara Risek Gmajnic

EUT received on: 05.11.2024

Tests were performed on: 05.11.2024 to 17.12.2024

2. Description of EUT

EUT: Electronic shelf labelling system

Product Name: E300 2.6

Model: EDB2-0260-A

Serial Number: Prototype

Manufacturer: VusionGroup GmbH

Description: VusionGroup 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: 38%
Temperature: 23°C

3. Standards / Final result

Name	Title	Deviation	Result
FCC: 47 CFR Part 15 (eCFR 05.11.2024)	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 6, December 2023	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)	none	OK
ANSI C63.10-2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless 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

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 3,39 mW and there is no power regulation.

2.1033 (7) Maximum output power rating: 3,39 mW eirp.

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: 44,20dBμV/m Average @ 4805,0 MHz

Tests were performed November 5th till December 17th 2024.

4.2. Number of channels and channel spacing

§ 2.1033

Conducted Measurement

Rated output power: 3,39 mW

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

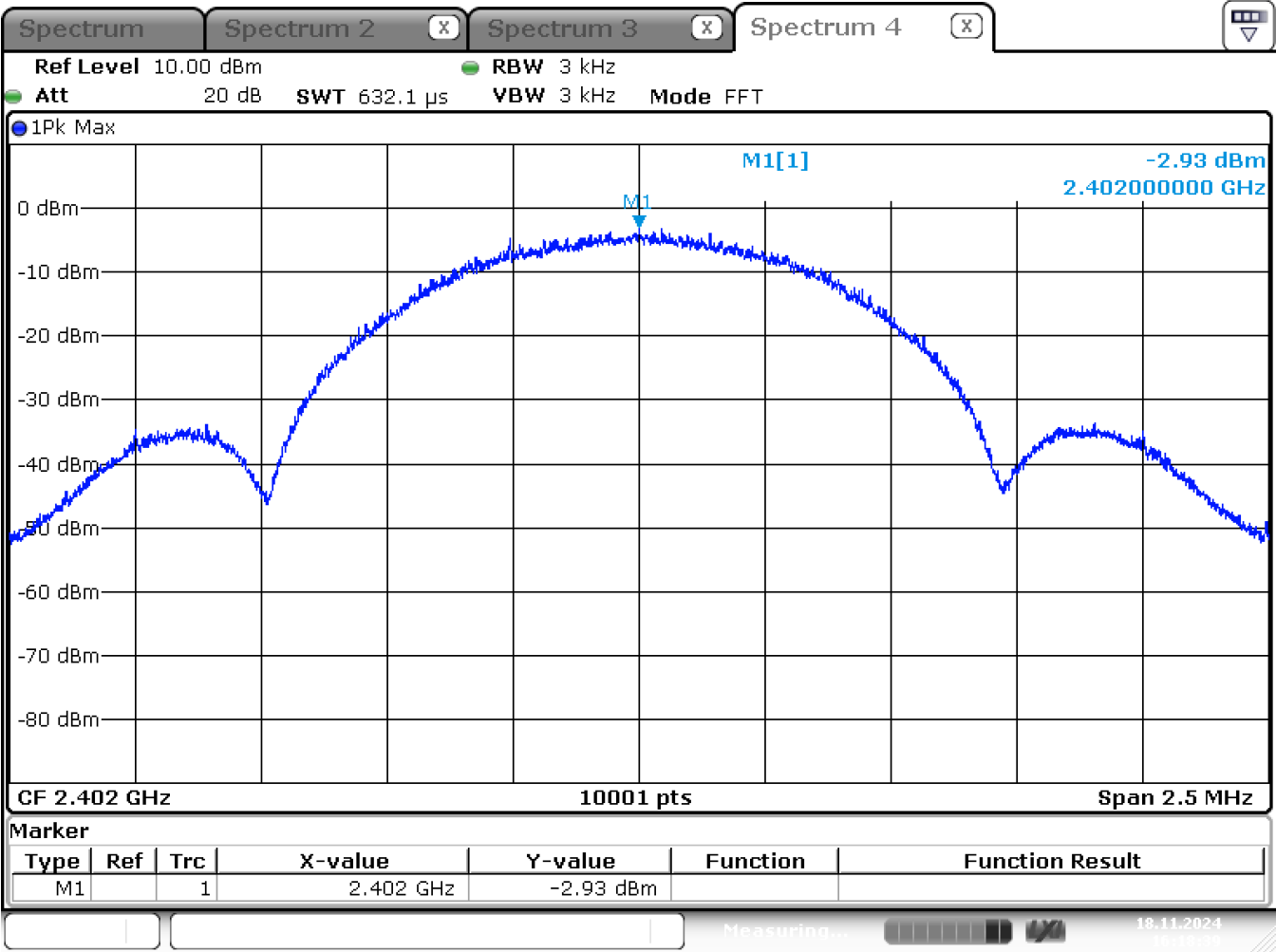
Test Equipment used: N/A

4.3. 6 dB Bandwidth

§ 15.247(a)(2)
5.2.a)

Conducted Measurement

Rated output power: 3,39 mW Channel 0 (2402 MHz center frequency)



Date: 18.NOV.2024 16:18:39

6dB Bandwidth: 681,2 kHz

LIMIT SUBCLAUSE 15.247(e) – 5.2.a)

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

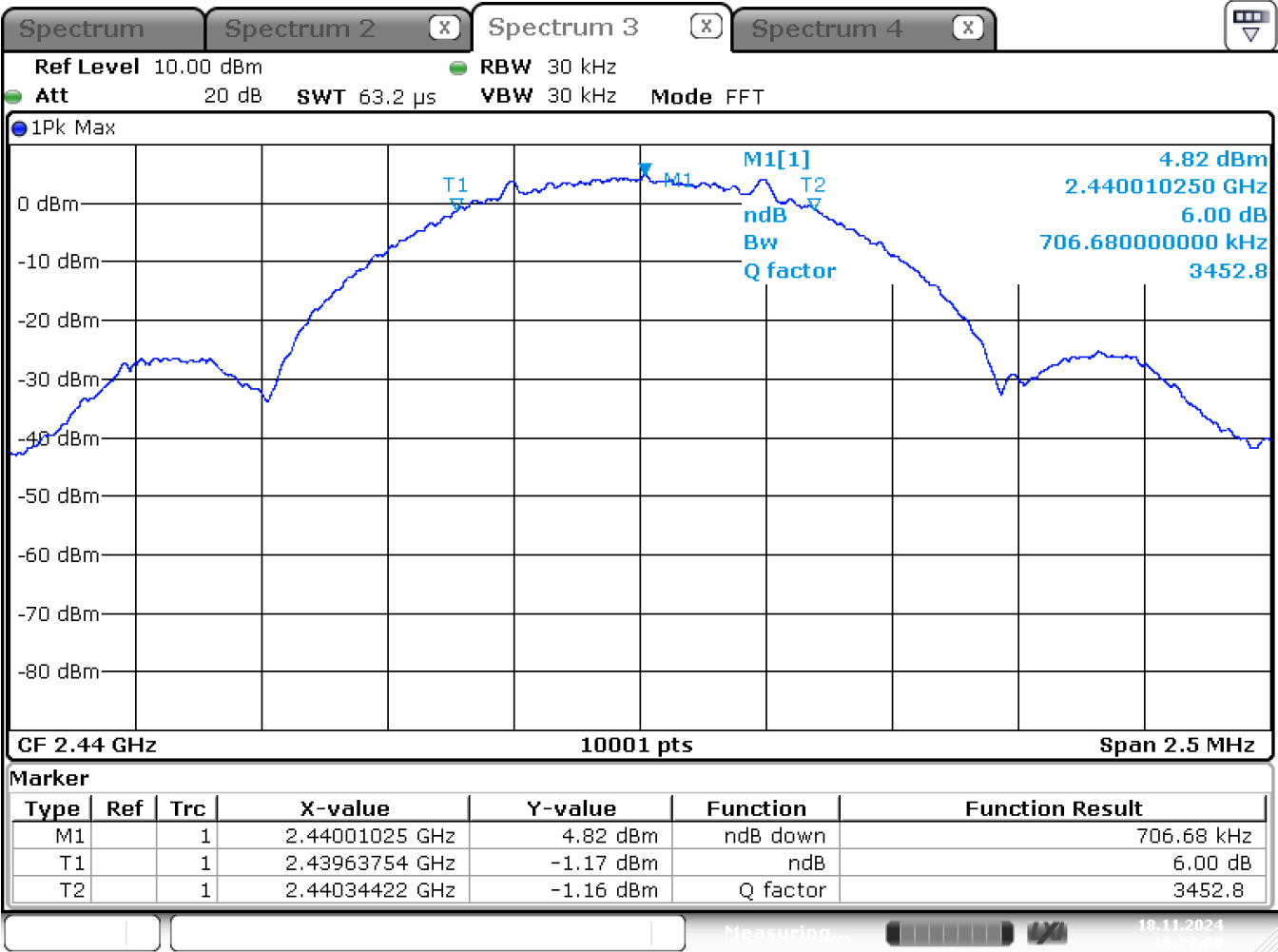
Test Equipment used: EMV-205;

6 dB Bandwidth

§ 15.247(a)(2)
5.2.a)

Conducted Measurement

Rated output power: 3,39 mW Channel 19 (2440 MHz center frequency)



Date: 18.NOV.2024 16:22:08

6dB Bandwidth: 706,7 kHz

LIMIT SUBCLAUSE 15.247(e) – 5.2.a)

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

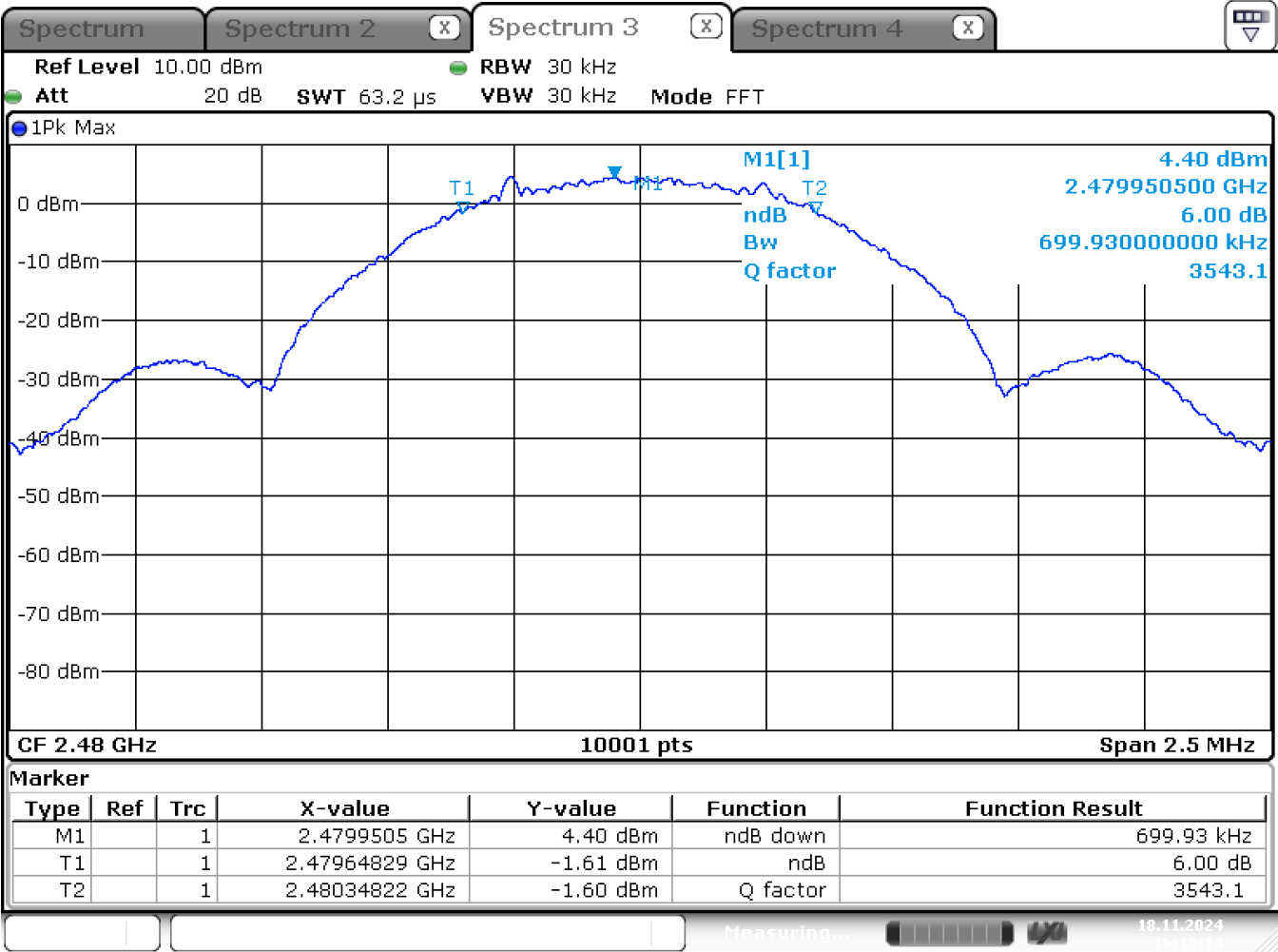
Test Equipment used: EMV-205;

6 dB Bandwidth

§ 15.247(a)(2)
5.2.a)

Conducted Measurement

Rated output power: 3,39 mW Channel 39 (2480 MHz center frequency)



Date: 18.NOV.2024 16:16:14

6dB Bandwidth: 699,9 kHz

LIMIT SUBCLAUSE 15.247(e) – 5.2.a)

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

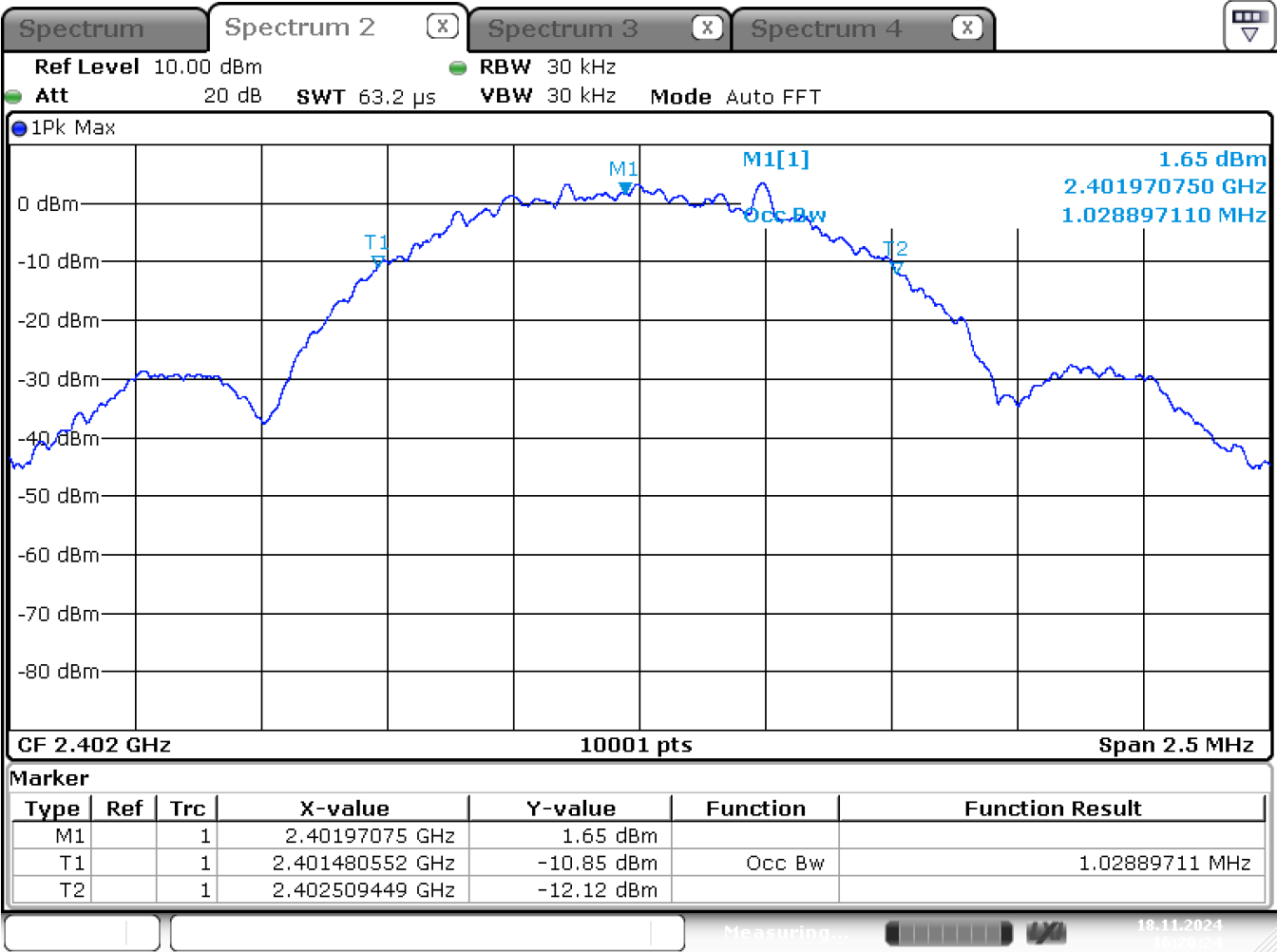
Test Equipment used: EMV-205;

4.4. 99% Bandwidth

RSS 247

Conducted Measurement

Rated output power: 3,39 mW Channel 0 (2402 MHz center frequency)



Date: 18.NOV.2024 16:20:25

99% Bandwidth: 1028,9 kHz

LIMIT RSS 247

None; for IC reporting purposes only

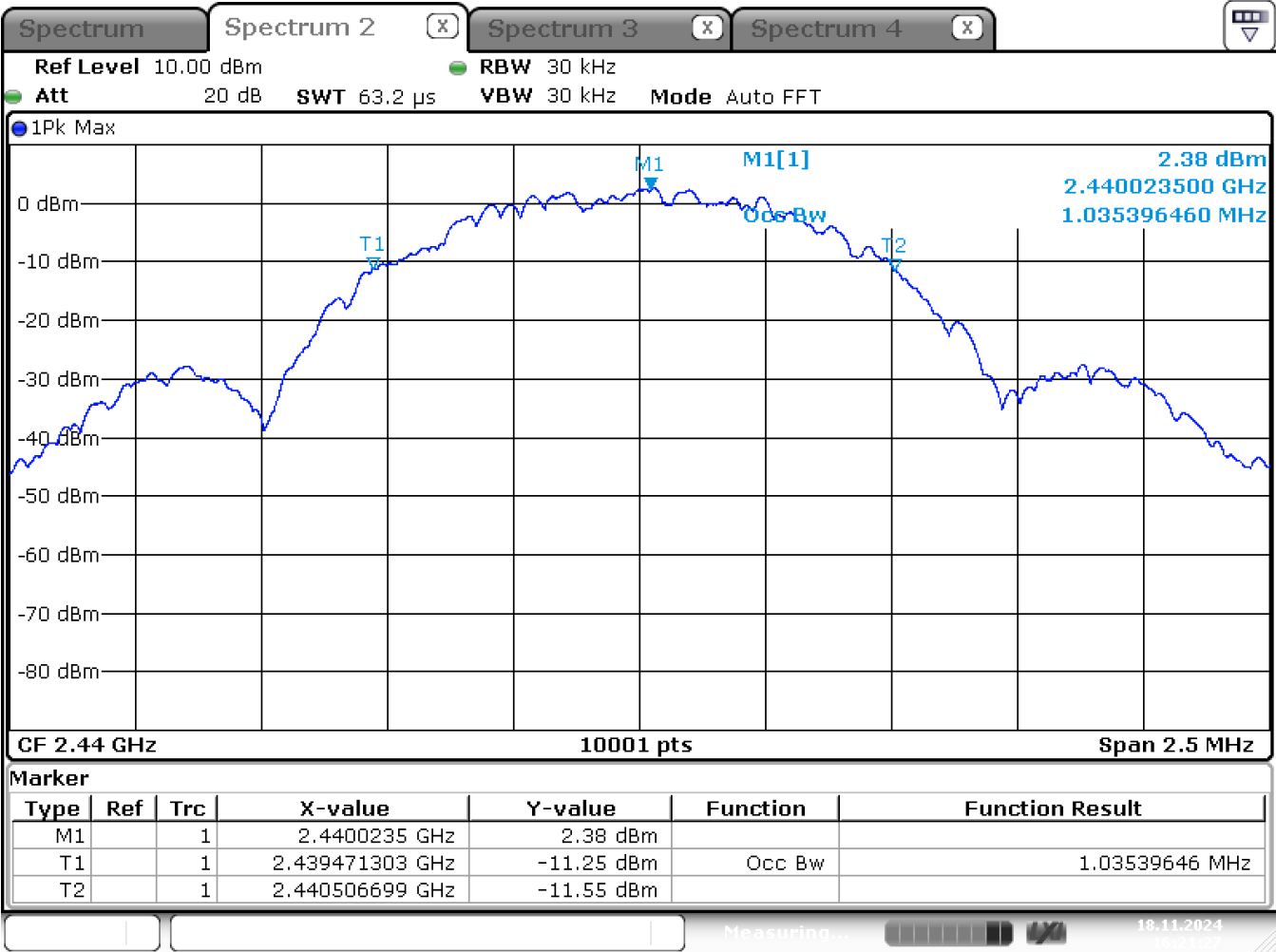
Test Equipment used: EMV-205;

99% Bandwidth

RSS 247

Conducted Measurement

Rated output power: 3,39 mW Channel 19 (2440 MHz center frequency)



Date: 18.NOV.2024 16:21:27

99% Bandwidth: 1035,4 kHz

LIMIT RSS 247

None; for IC reporting purposes only

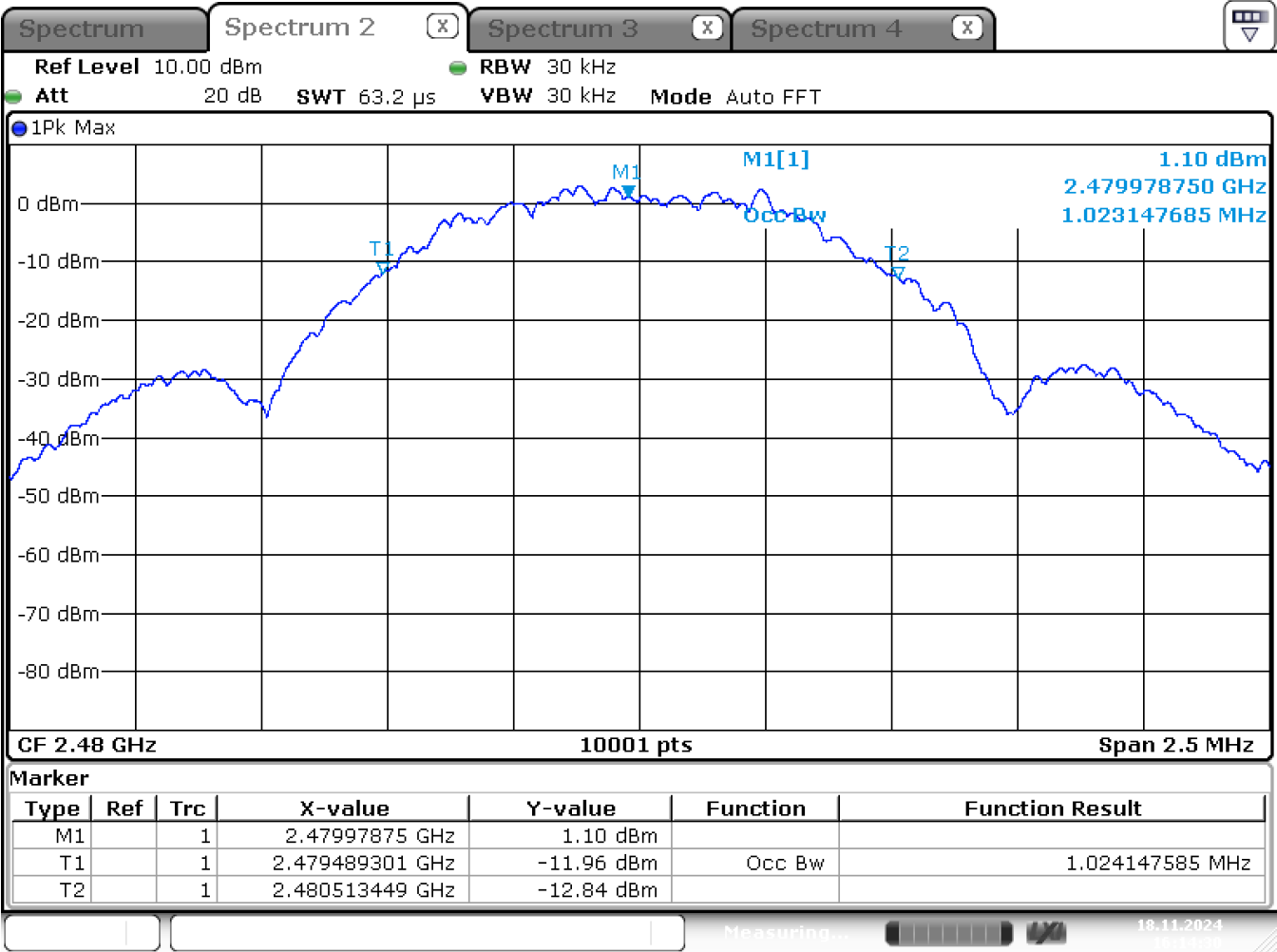
Test Equipment used: EMV-205;

99% Bandwidth

RSS 247

Conducted Measurement

Rated output power: 3,39 mW Channel 39 (2480 MHz center frequency)



Date: 18.NOV.2024 16:14:30

99% Bandwidth: 1023,1 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)
5.4.4

Conducted Measurement

Rated output power: 3,39 mW

Test conditions		Transmitter power (mW)		
		2402 MHz	2440 MHz	2480 MHz
T _{nom} (23)°C	V _{nom} (3) V	4.84	4.73	4.60
Measurement uncertainty		± 0,75 dB		

Radiated Measurement

Rated output power: 3,39 mW

Test conditions		Transmitter power (mW) EIRP		
		2402 MHz	2440 MHz	2480 MHz
T _{nom} (23)°C	V _{nom} (3) V	3,39	2,75	2,88
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	-1,55	-2,35	-2,03

LIMIT SUBCLAUSE 15.247(b)(3) – 5.4.4

Under normal test conditons	1W conducted (4W eirp)
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Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-139; NT-207/1;

Grundvorlage / Basic Template: FM-TAGMBH-KBS-0100b_Grundvorlage Prüfbericht akkreditiert-EN, Rev. 04

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FG-0100a

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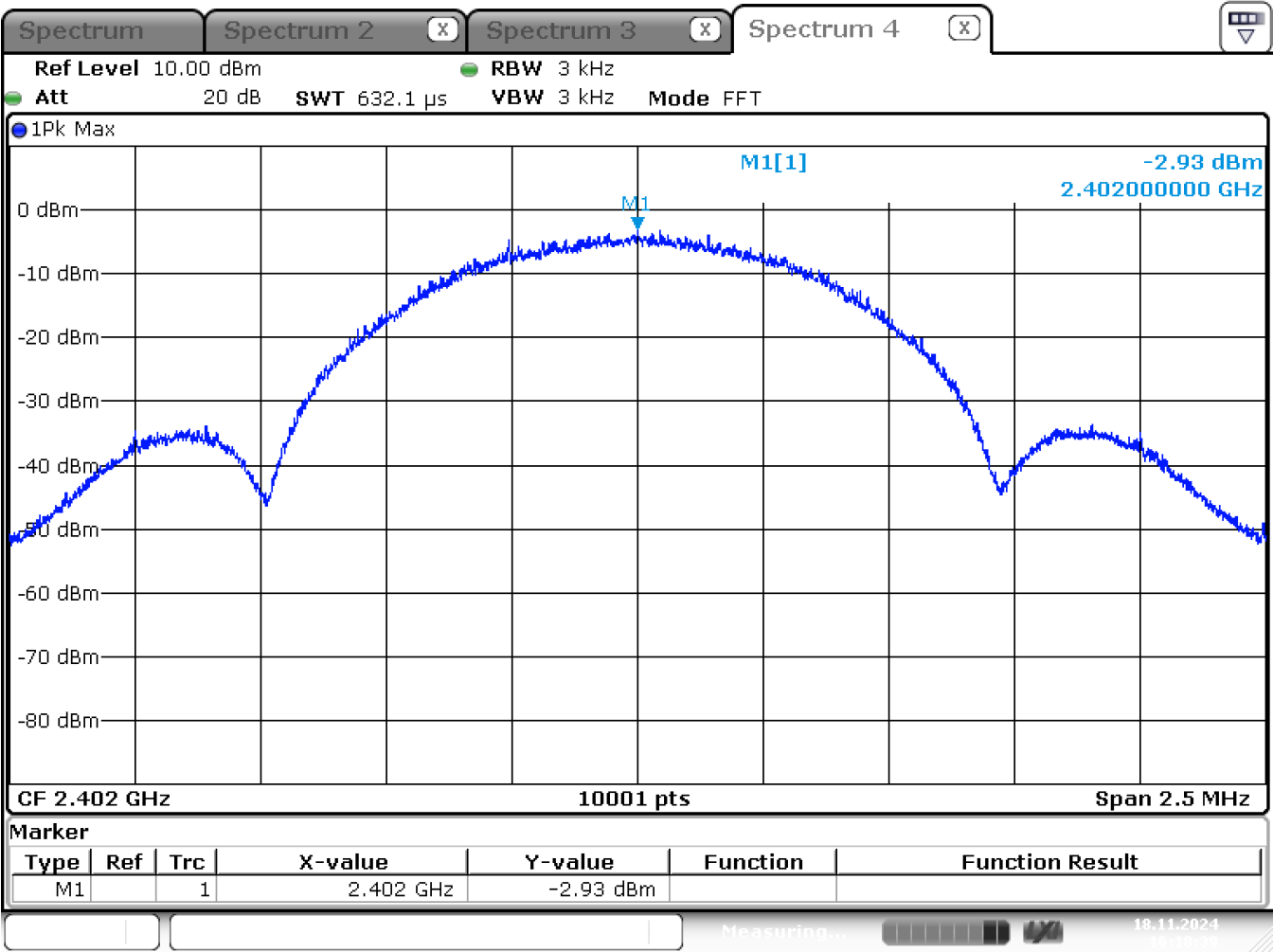


4.6. Power spectral density (radiated)

§ 15.247(e)
5.2.2

Conducted Measurement

Rated output power: 3,39 mW Channel 0 (2402 MHz center frequency)



Date: 18.NOV.2024 16:18:39

Power Spectral density: -2,93 dBm @ 2402,00 MHz

LIMIT SUBCLAUSE 15.247(e) – 5.2 b)

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

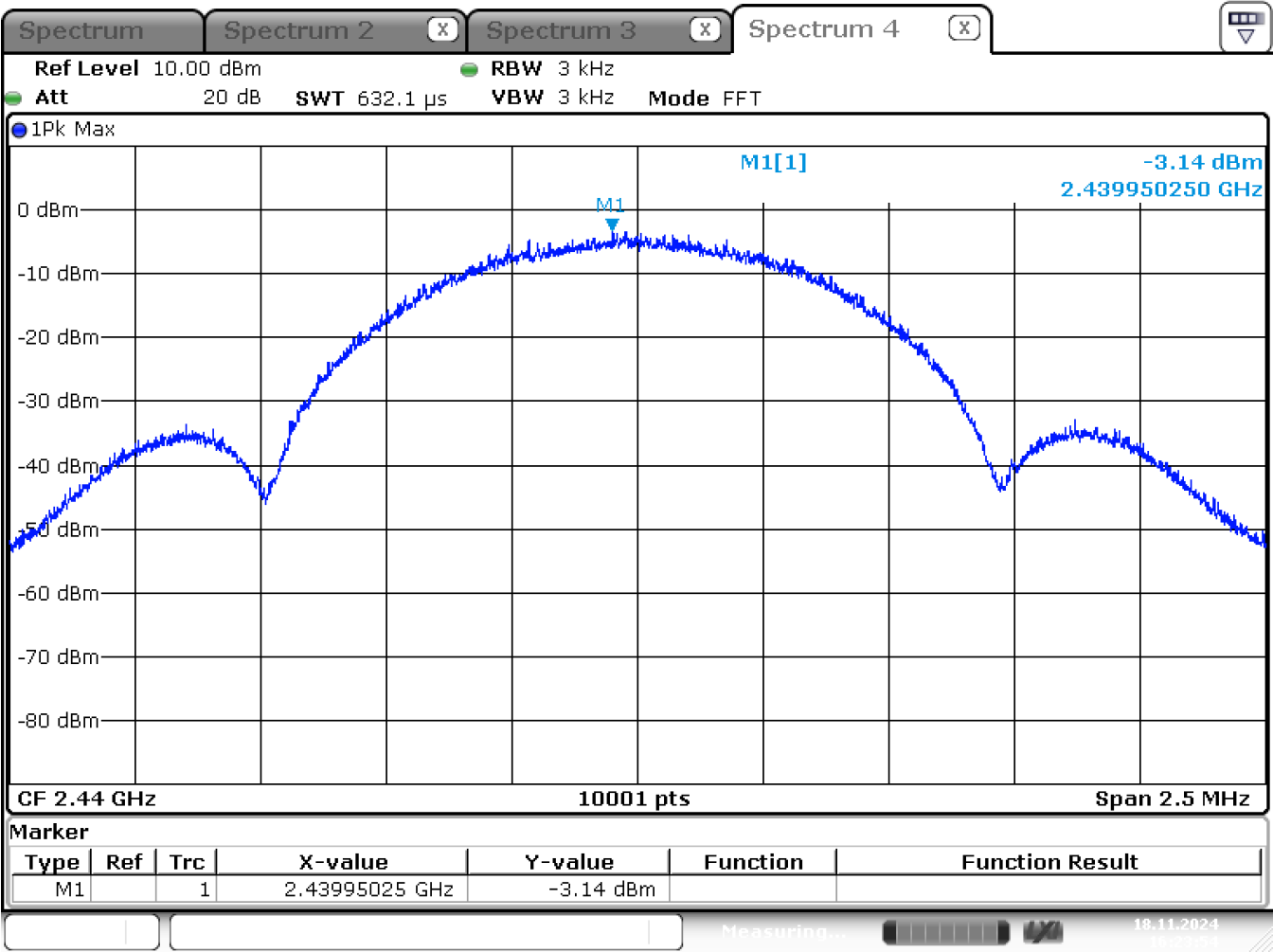
Test Equipment used: EMV-205;

Power spectral density (radiated)

§ 15.247(e)
5.2 b)

Conducted Measurement

Rated output power: 3,39 mW Channel 19 (2440 MHz center frequency)



Date: 18.NOV.2024 16:23:54

Power Spectral density: -3,14 dBm @ 2439,95 MHz

LIMIT SUBCLAUSE 15.247(e) – 5.2 b)

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

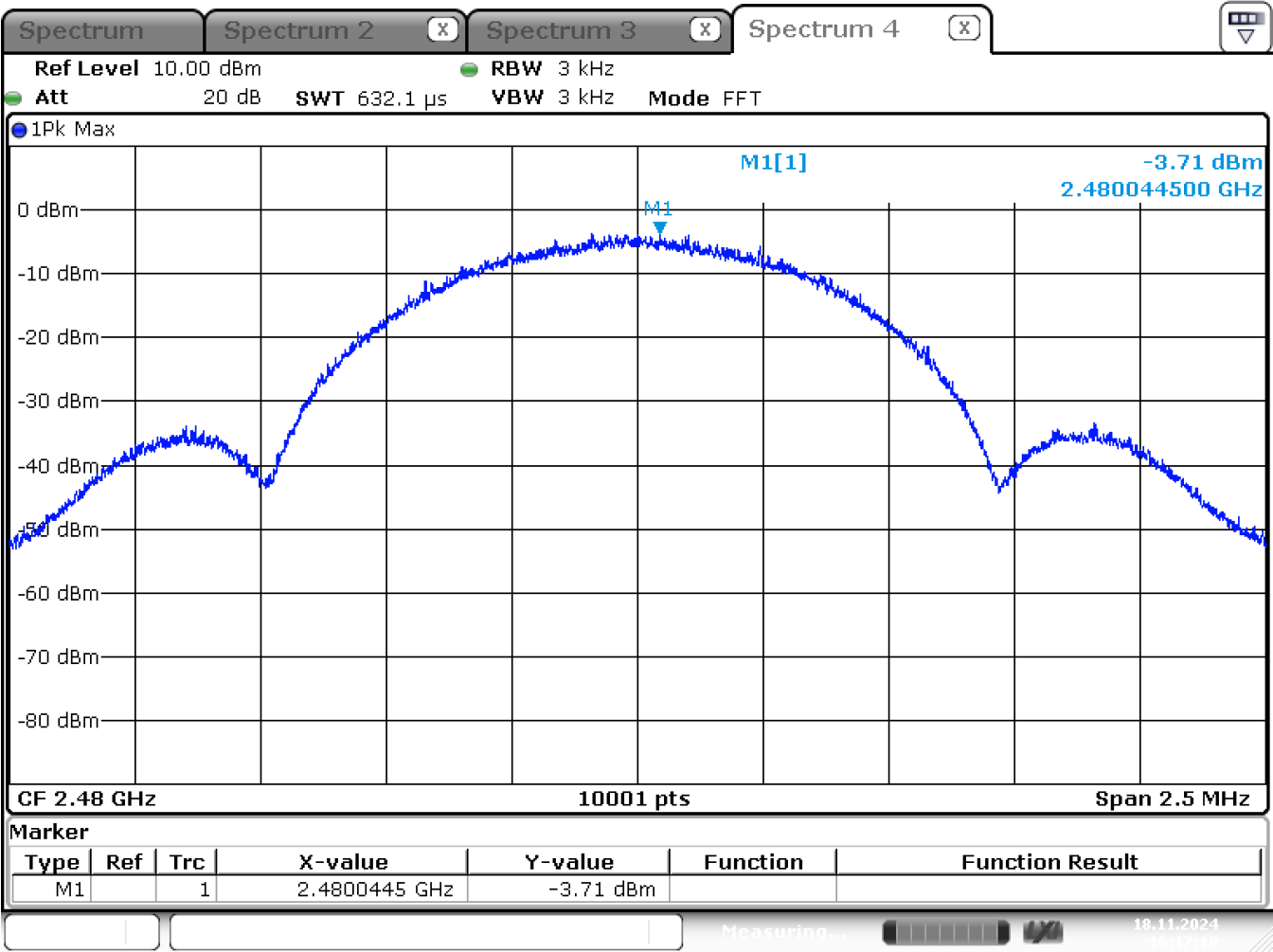
Test Equipment used: EMV-205;

Power spectral density (radiated)

§ 15.247(e)
5.2 b)

Conducted Measurement

Rated output power: 3,39 mW Channel 39 (2480 MHz center frequency)



Date: 18.NOV.2024 16:17:18

Power Spectral density: -3,71 dBm @ 2480,04 MHz

LIMIT SUBCLAUSE 15.247(e) – 5.2 b)

Under normal test conditons	+8dBm in any 3 kHz band
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Test Equipment used: EMV-205;

4.7. Emissions in restricted bands

Emissions falling within restricted frequency bands

§ 15.209(a)
RSS-Gen

Measuring apparatus parameters 9 kHz to 150 kHz

Parameter	Preview measurement	Final measurement	Parameter	Preview measurement	Final measurement
Start frequency	9 kHz	9 kHz	Detector	Max Peak	Quasi Peak
Stop frequency	150 kHz	150 kHz	Measuring time	10 ms	1 s
Stepsize	50 Hz	50 Hz	RF-attenuation	0dB	0dB
IF- Bandwidth	200 Hz	200 Hz	Preamplifier	20 dB	20 dB

Measuring apparatus parameters 150 kHz to 30 MHz

Parameter	Preview measurement	Final measurement	Parameter	Preview measurement	Final measurement
Start frequency	150 kHz	150 kHz	Detector	Max Peak	Quasi Peak
Stop frequency	30 MHz	30 MHz	Measuring time	10 ms	1 s
Stepsize	2.25 kHz	2.25 kHz	RF-attenuation	0dB	0dB
IF- Bandwidth	9 kHz	9 kHz	Preamplifier	20 dB	20 dB

Measuring apparatus parameters 30 MHz to 1000 MHz

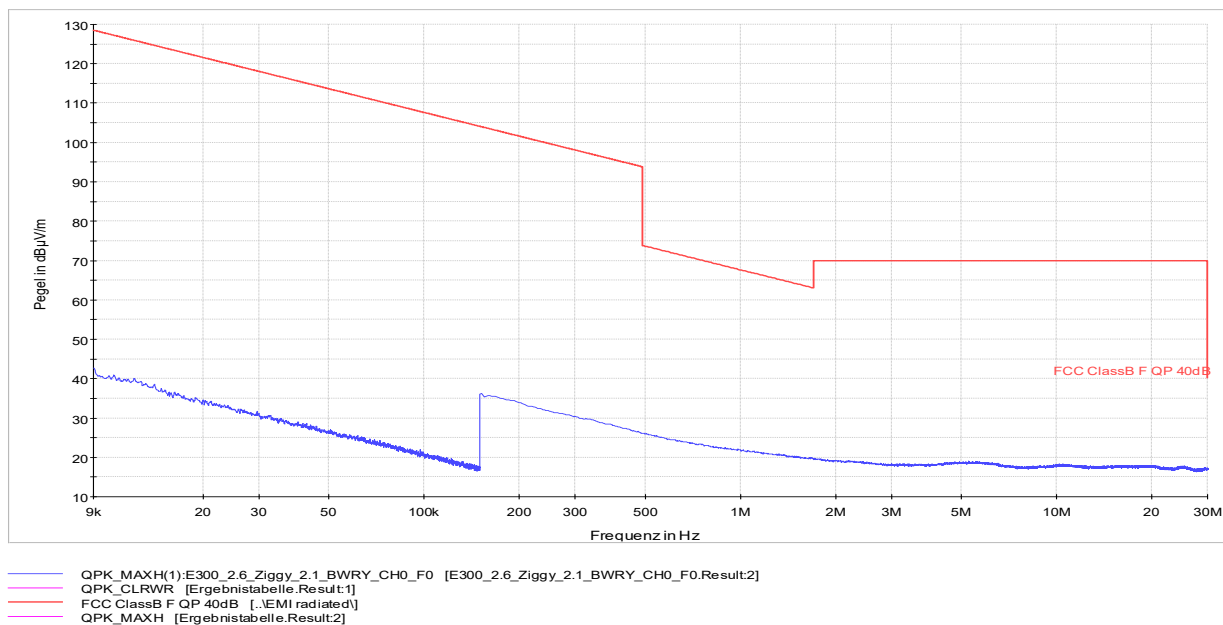
Parameter	Preview measurement	Final measurement	Parameter	Preview measurement	Final measurement
Start frequency	30 MHz	30 MHz	Detector	Max Peak	Quasi Peak
Stop frequency	1000 MHz	1000 MHz	Measuring time	10 ms	1 s
Stepsize	30 kHz	30 kHz	RF-attenuation	0dB	0dB
IF- Bandwidth	120 kHz	120 kHz	Preamplifier	20 dB	20 dB

Measuring apparatus parameters 1 GHz to 25 GHz

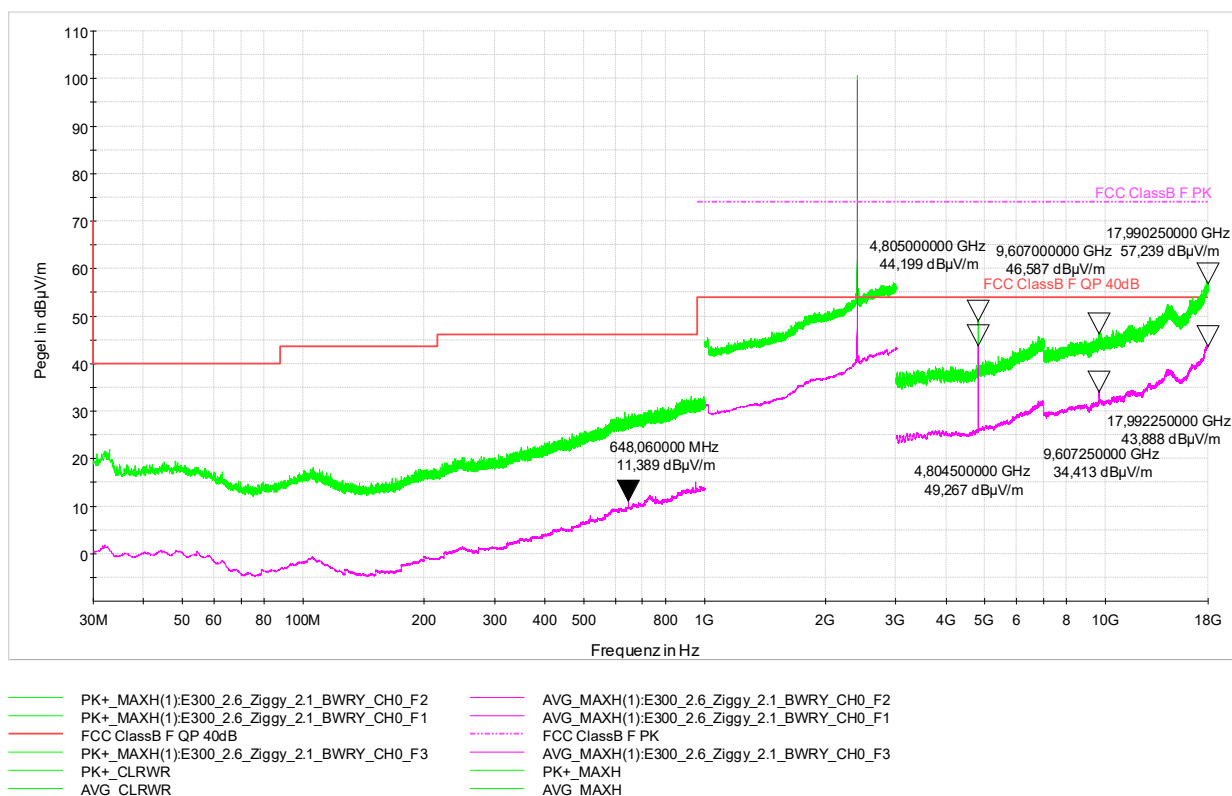
Parameter	Preview measurement	Final measurement	Parameter	Preview measurement	Final measurement
Start frequency	1 GHz	1 GHz	Detector	Max Peak / Average	Max Peak / Average
Stop frequency	25 GHz	25 GHz	Measuring time	100 ms	100 ms
Stepsize	250 kHz	250 kHz	RF-attenuation	0dB	0dB
IF- Bandwidth	1 MHz	1 MHz	Preamplifier	20 dB	20 dB

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

Setup: CH 0: 2402 MHz



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



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Worst case emission: Average @ 4805,0 MHz: 44,20dBµV/m

Frequency (MHz)	Value (dBµV/m)
4804,5	49,27 PK
4805,0	44,20 AVG
9607,0	46,59 PK
9607,3	34,41 AVG

The other values are noise.

Remark: Although the measurements were made up to the 10th harmonic (25 GHz) the frequency range above 18 GHz is not automatized, so no graphs are available. Nevertheless, no emissions above noise level were found in the frequency range above 18 GHz.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

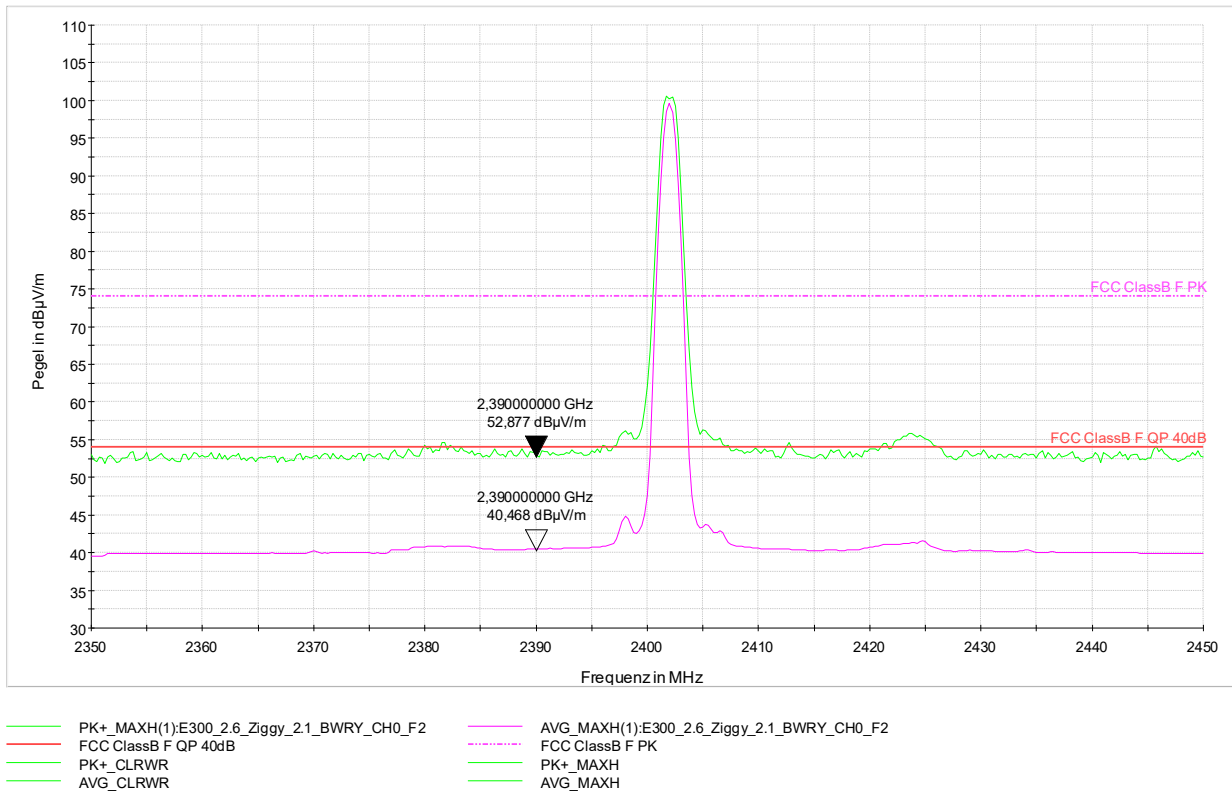
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200/1; NT-100; NT-110/1; NT-111/1; NT-126; NT-132; NT-207/1; NT-416;

Emissions in restricted bands § 15.209(a), § 15.212(c)
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



Frequency band (§ 15.247): 2400-2483.5 MHz

The 20 dB bandwidth of the emission on the lowest channel is fully contained within the frequency band.

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.

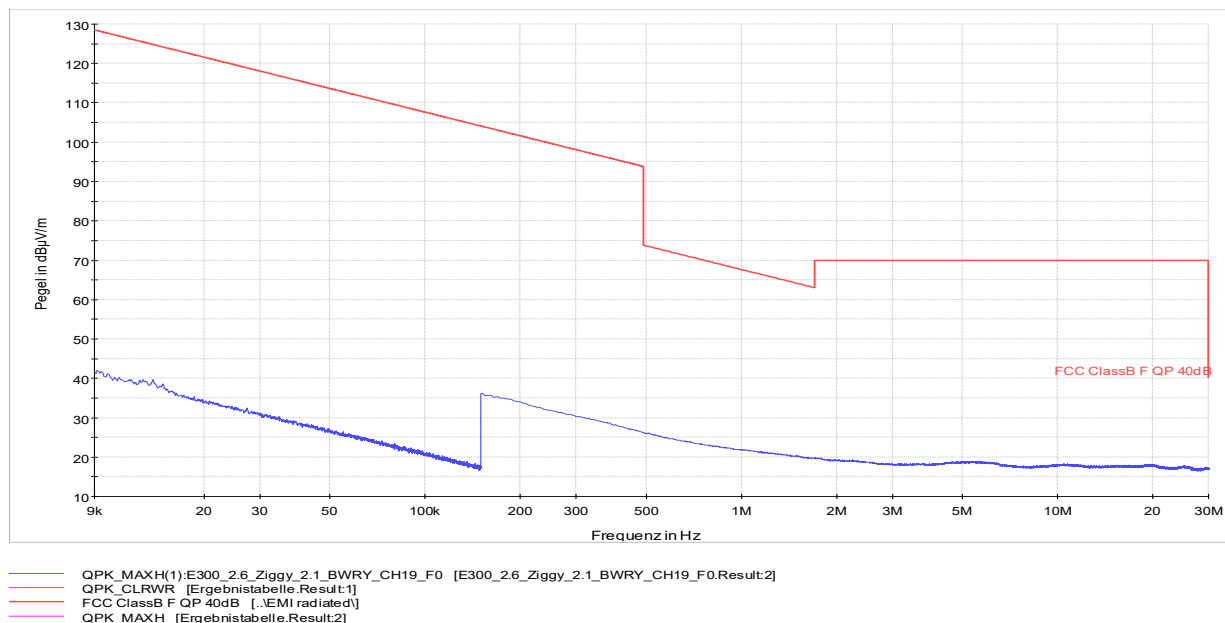
LIMIT SUBCLAUSE 15.212(c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

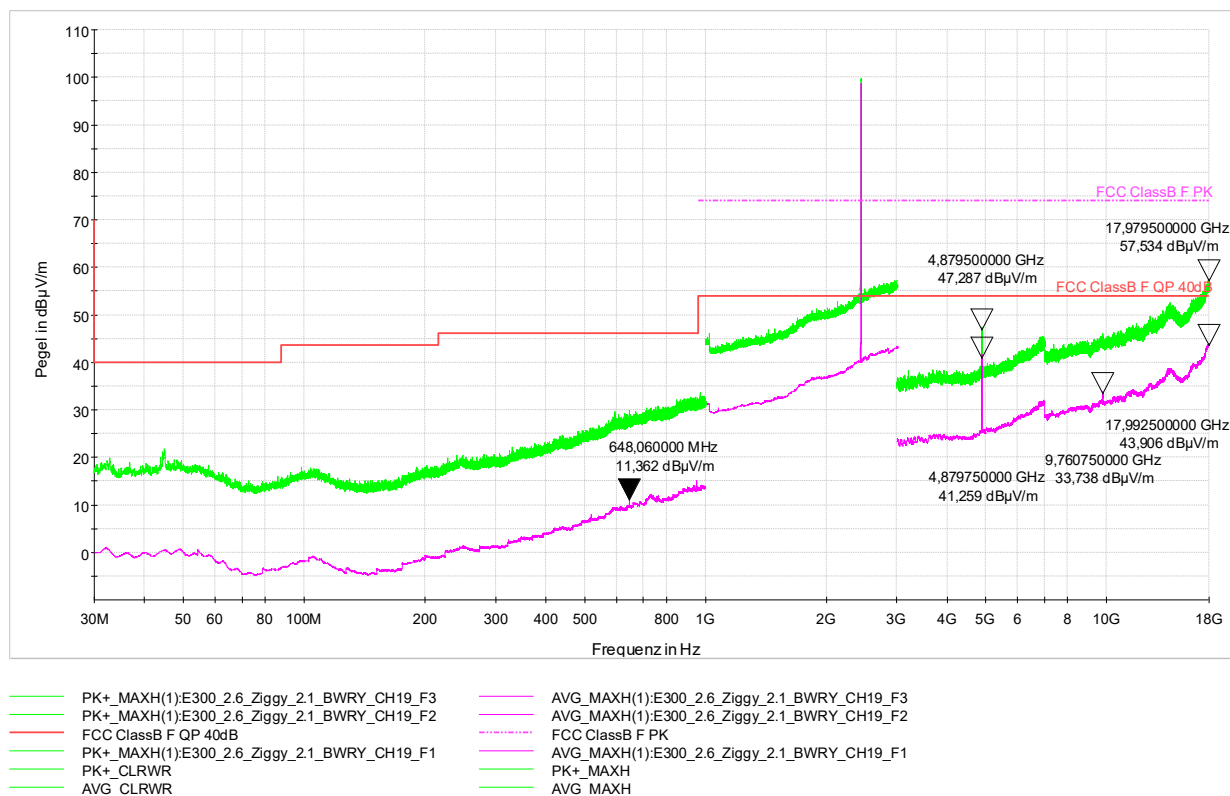
Test Equipment used: NT-100; NT-110/1; NT-111/1; NT-131/1; NT-139; NT-207/1;

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

Setup: CH 19: 2440 MHz



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



Grundvorlage / Basic Template: FM-TAGMBH-KBS-0100b_Grundvorlage Prüfbericht akkreditiert-EN, Rev. 04

FM-TAGMBH-EE-
FG-0100a**TÜV AUSTRIA GMBH**

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Worst case emission: Average @ 4879,8 MHz: 41,26 dBµV/m

Frequency (MHz)	Value (dBµV/m)
4879,5	47,29 PK
4879,8	41,26 AVG
9760,8	33,74 AVG

The other values are noise.

Remark: Although the measurements were made up to the 10th harmonic (25 GHz) the frequency range above 18 GHz is not automatized, so no graphs are available. Nevertheless, no emissions above noise level were found in the frequency range above 18 GHz.

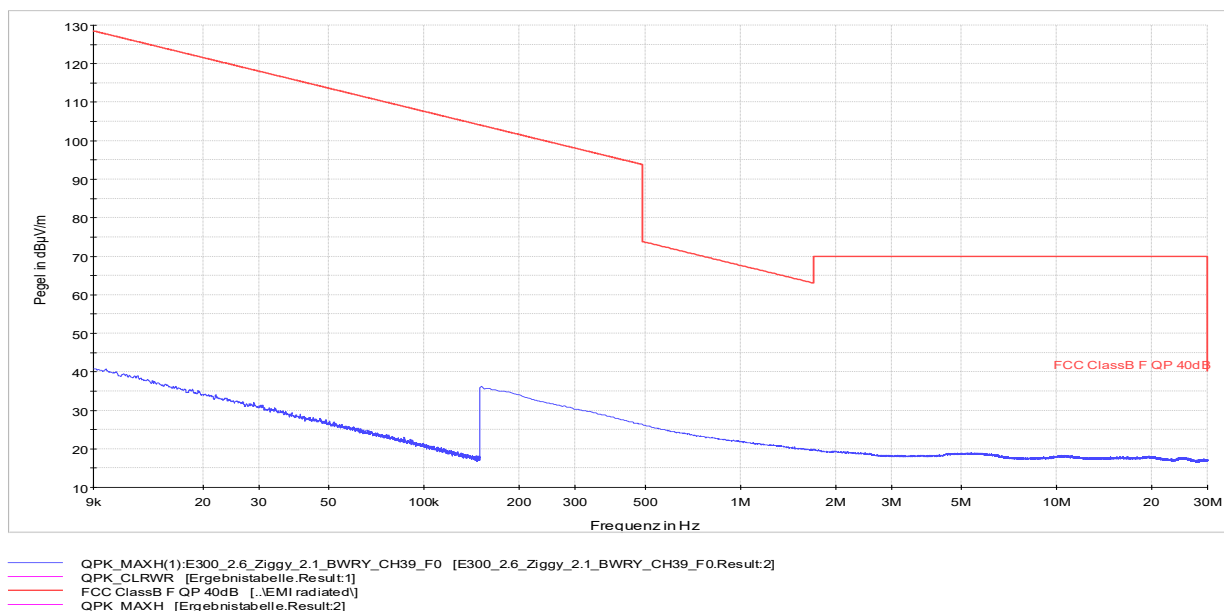
LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

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

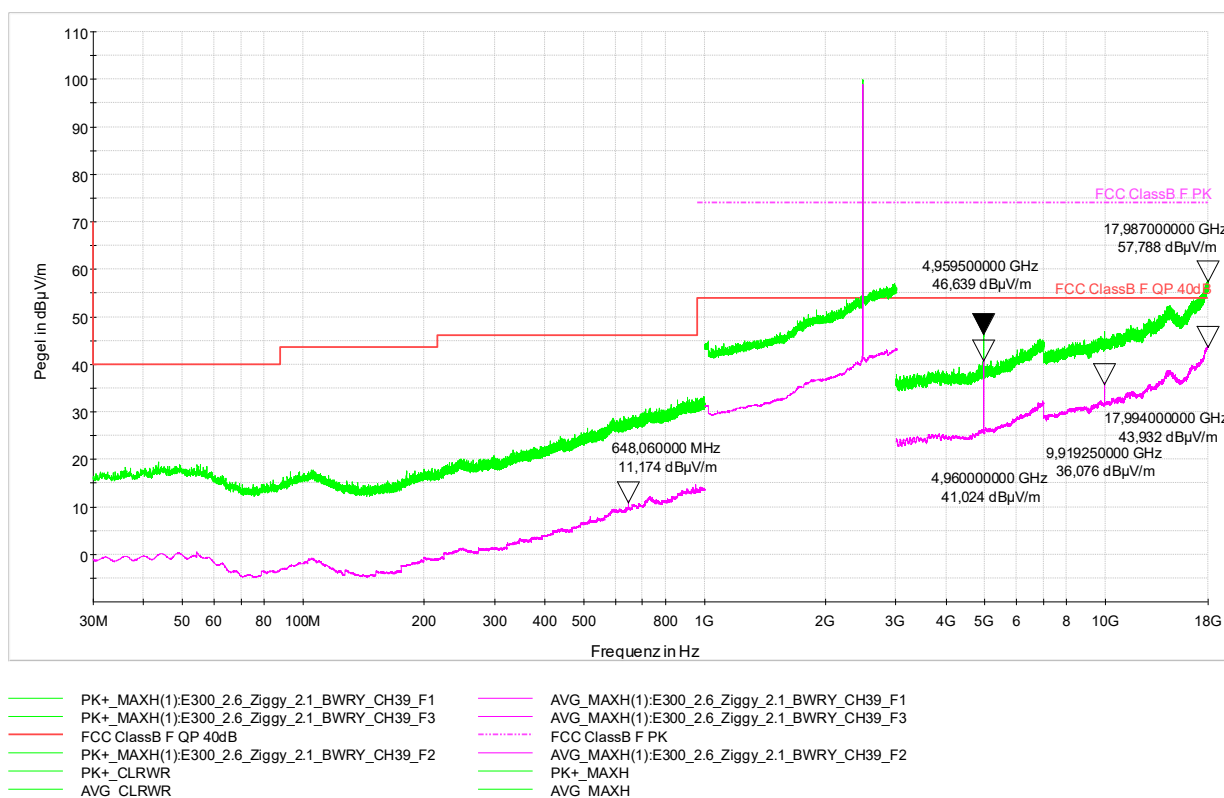
Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200/1; NT-100; NT-110/1; NT-111/1; NT-126; NT-132; NT-207/1; NT-416;

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

Setup: CH 39: 2480 MHz



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



Grundvorlage / Basic Template: FM-TAGMBH-KBS-0100b_Grundvorlage Prüfbericht akkreditiert-EN, Rev. 04

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Worst case emission: Average @ 4960,0 MHz: 41,02 dBµV/m

Frequency (MHz)	Value (dBµV/m)
4959,5	46,64 PK
4960,0	41,02 AVG
9919,3	36,08 AVG

The other values are noise.

Remark: Although the measurements were made up to the 10th harmonic (25 GHz) the frequency range above 18 GHz is not automatized, so no graphs are available. Nevertheless, no emissions above noise level were found in the frequency range above 18 GHz.

LIMIT SUBCLAUSE 15.209(a) – RSS-Gen

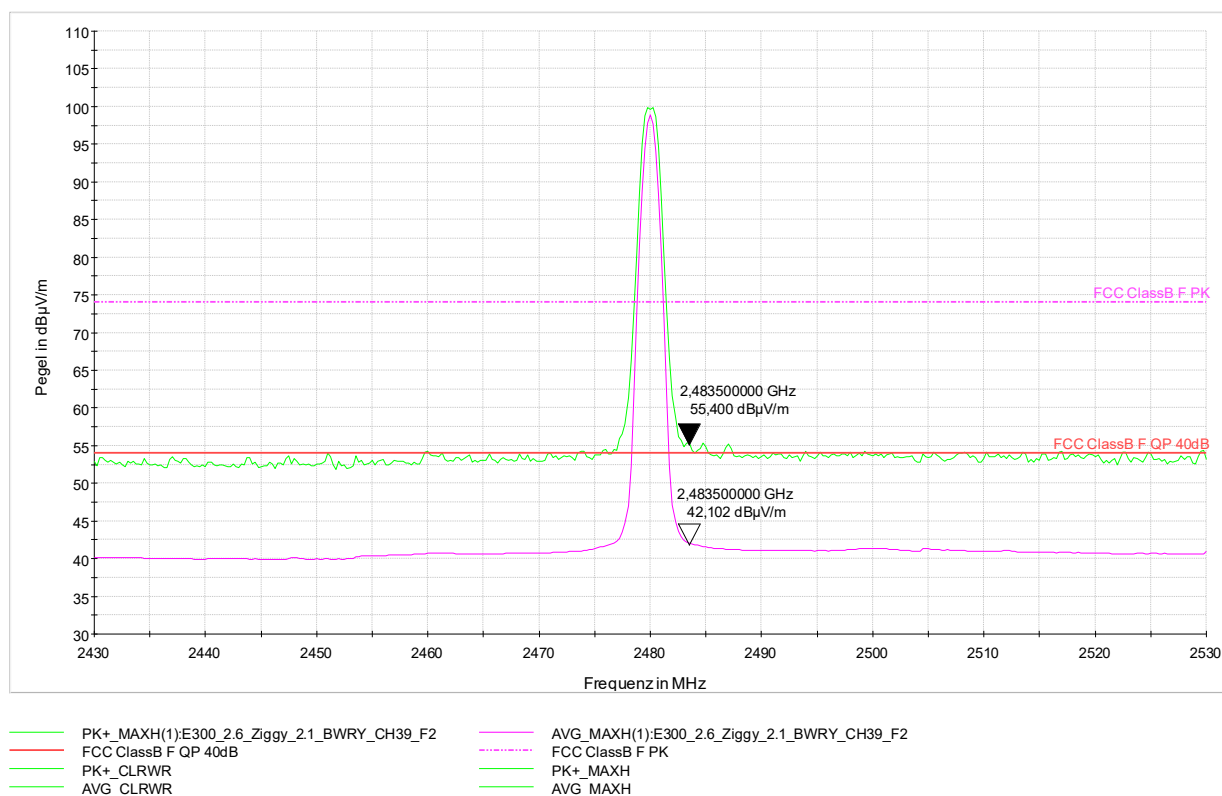
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

Test Equipment used: EMV-100; EMV-101; EMV-102; EMV-103; EMV-105; EMV-110; EMV-111; EMV-112; EMV-114; EMV-200/1; NT-100; NT-110/1; NT-111/1; NT-126; NT-132; NT-207/1; NT-416;

Emissions in restricted bands
Emissions falling within restricted frequency bands
§ 15.209(a), § 15.212(c)
RSS-Gen

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

Setup: CH 39: 2480 MHz



Frequency band (§ 15.247): 2400-2483.5 MHz

The 20 dB bandwidth of the emission on the lowest channel is fully contained within the frequency band.

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.

LIMIT SUBCLAUSE 15.212(c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

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	4,84	1	1,58	7,65	3,39	2,07	3,26
2440	4,73	1	1,58	7,48	2,75	1,68	2,65
2480	4,60	1	1,58	7,27	2,88	1,76	2,78

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

Grundvorlage / Basic Template: FM-TAGMBH-KBS-0100b_Grundvorlage Prüfbericht akkreditiert-EN, Rev. 04

FM-TAGMBH-EE-
FG-0100a

TÜV AUSTRIA GMBH

Revision: 00

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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	7,65	10,39	0,74	OK
2440	7,48	10,28	0,73	OK
2480	7,27	10,17	0,72	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 6

6.3 SAR exemption limits

Devices operating at or below the applicable output power levels (adjusted for tune-up tolerance) specified in table 11, based on the separation distance, are exempt from SAR evaluation. The separation distance, defined as the distance between the user and/or bystander and the antenna and/or radiating element of the device or the outer surface of the device, shall be less than or equal to 20 cm for these exemption limits to apply.

Table 11: Power limits for exemption from routine SAR evaluation based on the separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm (mW)	At separation distance of 10 mm (mW)	At separation distance of 15 mm (mW)	At separation distance of 20 mm (mW)	At separation distance of 25 mm (mW)
≤300	45	116	139	163	189
450	32	71	87	104	124
835	21	32	41	54	72
1900	6	10	18	33	57
2450	3	7	16	32	56
3500	2	6	15	29	50
5800	1	5	13	23	32

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm (mW)	At separation distance of 35 mm (mW)	At separation distance of 40 mm (mW)	At separation distance of 45 mm (mW)	At separation distance of ≥50 mm (mW)
≤300	216	246	280	319	362
450	147	175	208	248	296
835	96	129	172	228	298
1900	92	138	194	257	323
2450	89	128	170	209	245
3500	72	94	114	134	158
5800	41	54	74	102	128

The exemption limits in table 11 Table 11 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 50 mm from a flat phantom, which provides a SAR value of approximately 0.4 W/kg for 1 g of tissue.

For limb-worn devices where the 10 gram of tissue applies, the exemption limits for routine evaluation in table 11 are multiplied by a factor of 2.5.

For controlled-use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in table 11 Table 11 are multiplied by a factor of 5.

When the operating frequency of the device is between two frequencies located in table 11, linear interpolation shall be applied for the applicable separation distance. If the separation distance of the device is between two distances located in table 11, linear interpolation may be applied for the applicable frequency. Alternatively, the limit corresponding to the smaller distance may be employed. For example, in case of a 7 mm separation distance, either use the exception value for a 5 mm separation distance or interpolate between the limits corresponding to 5 mm and 10 mm separation distances.

For implanted medical devices, the exemption limit for routine SAR evaluation is set at an output power of 1 mW, regardless of frequency.

RSS-102 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	4,84	3,39	1	4,842	3,388	10	18.15	OK
2440	4,73	2,75	1	4,732	2,754	10	17.64	OK
2480	4,60	2,88	1	4,603	2,884	10	17.43	OK

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

**) Calculations are done for a minimum separation distance of 1 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

☐	Anechoic Chamber with 3m measurement distance	NT-100	☐	Ant. tripod for EN61000-4-3 Model TP1000A	NT-156
☐	Stripline according to ISO 11452-5	NT-108	☐	Power quality analyzer Fluke 1760 (complete set)	NT-160 - NT-173
☐	MA4000 - Antenna mast 1 - 4 m height	NT-110/1			
☐	DS - Turntable 0 - 400 ° Azimuth	NT-111/1	☐	ESCI - Test receiver 9 kHz - 7 GHz	NT-203/1
☐	CO3000 Controller Mast+Turntable	NT-112/1	☐	ESR – Test receiver 20 Hz – 26,5 GHz	NT-207/1
☐	HUF-Z3 - Log. Per. Antenna 200 - 1000 MHz	NT-121	☐	Digital Radio Tester CMW500	NT-208/1
☐	FMZB1513 - Loop Antenna 9 kHz - 30 MHz	NT-122/1	☐	Noise-gen., ITU-R 559-2 20 Hz – 20 kHz	NT-209
☐	HFH-Z6 - Rod Antenna 9 kHz - 30 MHz	NT-123	☐	CMTA - Radiocommunication analyzer ; 0,1 - 1000 MHz	NT-210
☐	Dipole Antenna VHA9103 30 - 300 MHz	NT-124/1a	☐	3271 - Spectrum analyzer 100 Hz - 26,5 GHz	NT-211
☐	Dipole Antenna UHA9105 300 - 1000 MHz	NT-124/1b	☐	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	☐	Radiocommunicationanalyzer SWR 1180 MD	NT-217
☐	AT-1080 - Log. Per. Antenna 80 - 1000 MHz	NT-128	☐	Mixer FS-Z60 40 GHz – 60 GHz	NT-218/1
☐	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-129	☐	Mixer FS-Z90 60 GHz – 90 GHz	NT-219/1
☐	HK-116 - bicon. Antenna 20 MHz - 300 MHz	NT-130	☐	GDS-2504 Digital scope	P-W/OS03
☐	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	☐	SRM-3006 Spectrumalyzer	NT-233/1a
☐	Horn Antenna 500 MHz - 6000 MHz	NT-133/1	☐	E-field probe SRM 75 MHz – 3 GHz	NT-234
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-134	☐	Field Meter NBM-500 incl. E- and H-Field probes	NT-240a-e
☐	Log. per. Antenna 800 MHz - 2500 MHz	NT-135	☐	Magnetometer HP-01	NT-241/1
☐	BiConiLog Antenna 26 MHz – 2000 MHz	NT-137	☐	EFA-3 H-field- / E-field probe	NT-243
☐	Conical Dipol Antenna PCD8250	NT-138	☐	EHP-50F H-field- / E-field probe	NT-243/1
☐	HF 906 - Horn Antenna 1 - 18 GHz (emission)	NT-139	☐	Field Meter EMR-200 100 kHz – 3 GHz	NT-244
☐	HZ-1 Antenna tripod	NT-150	☐	E-field probe 100 kHz – 3 GHz	NT-245
☐	BN 1500 Antenna tripod	NT-151	☐	H-field probe 300 kHz – 30 MHz	NT-246

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Test equipment used

☐ E-field probe 3 MHz – 18 GHz	NT-247	☐ Prana N-MT 500 - RF-Amplifier 80 - 1000 MHz / 500 W	NT-332/1
☐ H-field probe 27 MHz – 1 GHz	NT-248	☐ BBA150 RF-Amplifier 1 GHz - 6 GHz	NT-333/1
☐ ELT-400 1 Hz – 400 kHz	NT-249	☐ APA01 – RF-Amplifier 0,5 GHz – 2,5 GHz	NT-334
☐ MDS 21 - Absorbing clamp 30 - 1000 MHz	NT-250	☐ Preamplifier 1 GHz - 4 GHz	NT-335
☐ CDN EMCL-35 EM Injection clamp	NT-251/1	☐ Preamplifier for GPS MKU 152 A	NT-336
☐ FCC-203I-DCN Ferrite decoupling network	NT-252	☐ Preamplifier 1 GHz – 18 GHz	NT-337/1
☐ PR50 Current Probe	NT-253	☐ DC Block 10 MHz – 18 GHz Model 8048	NT-338
☐ i310s Current Probe	NT-254/1	☐ 2-97201 Electronic load	NT-341
☐ Fluke 87 V True RMS Multimeter	NT-260	☐ TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-344
☐ Model 2000 Digital Multimeter	NT-261	☐ TSX3510P - Power supply 0-30 V / 0 - 10 A	NT-345
☐ Fluke 87 V Digital Multimeter	NT-262/1	☐ VDS 200 Mobil-impuls-generator	NT-350
☐ ESH2-Z5-U1 Artificial mains network 4x25A	NT-300	☐ LD 200 Mobil-impuls-generator	NT-351
☐ ESH3-Z5-U1 Artificial mains network 2x10A	NT-301	☐ MPG 200 Mobil-Impuls-Generators	NT-352
☐ ESH3-Z6-U1 Artificial mains network 1x100A	NT-302	☐ EFT 200 Mobil-impuls-generator	NT-353
☐ ESH3-Z6-U1 Artificial mains network 1x100A	NT-302a	☐ AN 200 S1 Artificial Network	NT-354
☐ EZ10 T-Artificial Network	NT-305	☐ FP-EFT 32M 3 ph. Coupling filter (Burst)	NT-400/1
☐ SMA100A - Signal generator 9 kHz - 6 GHz	NT-310/1	☐ PHE 4500 - Mains impedance network	NT-401
☐ RefRad Reference generator	NT-312	☐ IP 6.2 Coupling filter for data lines (Surge)	NT-403
☐ SMP 02 Signal generator 10 MHz - 20 GHz	NT-313	☐ TK 9421 High Power Volt. Probe 150 kHz - 30 MHz	NT-409
☐ 40 MHz Arbitrary Generator TGA1241	NT-315	☐ ESH2-Z3 - Probe 9 kHz - 30 MHz	NT-410
☐ Artificial mains network NSLK 8127-PLC	NT-316	☐ CN-EFT1000 - Capacitive clamp (Burst)	NT-411/1
☐ PSURGE 4.1 Surge generator	NT-324	☐ Highpass-Filter 100 MHz – 3 GHz	NT-412
☐ IMU4000 Immunity test system	NT-325/1a-e	☐ Highpass-Filter 600 MHz – 4 GHz	NT-413
☐ VCS 500-M6 Surge-Generator	NT-326	☐ Highpass-Filter 1250 MHz – 4 GHz	NT-414
☐ Oscillatory Wave Simulator incl. Coupling networks	NT-328a+b+c	☐ Highpass-Filter 1800 MHz – 16 GHz	NT-415
☐ BTA-250 - RF-Amplifier 9 kHz - 220 MHz / 250 W	NT-330		

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Test equipment used

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

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Test equipment used

☐	Anechoic Chamber 3 m / 5 m measuring distance	EMV-100	☐	HF- Amplifier 9 kHz-225 MHz BBL200	EMV-300/1
☐	Turntabel 6 m diameter	EMV-101	☐	HF- Amplifier 80 -1000 MHz BBA150	EMV-301
☐	Antenna mast + controller	EMV-102+ EMV-103	☐	HF- Amplifier 0,8 - 6 GHz BBA150	EMV-302
☐	EMC Video/Audiosystem	EMV-104	☐	High Power Ant. 20-200 MHz HPBA-2510	EMV-303/1
☐	EMC Software EMC32 Version 11.7	EMV-105	☐	High Power Ant. 20-200 MHz S12018-21	EMV-303/2
☐	Hornantenna 1 – 18 GHz HF 907	EMV-110	☐	Log.per Antenna 80-2700 MHz STLP 9128 E special	EMV-304
☐	Antennapre.amp. 1 – 18 GHz BBV 9718 D	EMV-111/1	☐	Log.per Antenna 0,7 – 9 GHz STLP9149	EMV-305
☐	Trilog Antenna 30-3000 MHz VULB9163	EMV-112	☐	HF- Amplifier 9 kHz-250 MHz BBA150 (low noise)	EMV-306
☐	Monopol 9 kHz – 30 MHz VAMP 9243	EMV-113	☐	ISO11451-2 TLS 10 kHz – 30 MHz	EMV-307
☐	Antennapre.amp 18 – 40 GHz BBV 9721	EMV-114	☐	Load Dump Generator LD 200N	EMV-350
☐	Hornantenna 200 – 2000 MHz AH-220	EMV-115	☐	Ultra Compact Symulator UCS 200N100	EMV-351
☐	DC Artificial Network PVDC 8300	EMV-150	☐	Automotive Power fail module PFM 200N100.1	EMV-352
☐	AC Artificial Network NNLK 8121 RC	EMV-151	☐	Voltage Drop Symulator VDS 200Q100	EMV-353
☐	AC Artificial Network NNLK 140	EMV- 153a-d	☐	Arb. Generator AutoWave	EMV-354
☐	EMI Receiver ESW44	EMV-200/1	☐	Ultra Compact Symulator UCS 500N7	EMV-355
☐	Signalgenerator 9 kHz – 40 GHz N5173B	EMV-201	☐	Coupling decoupling network CNI 503B7 / 32 A	EMV-356
☐	GPS Frequency normal LBE-1420	EMV-202/1	☐	Coupling decoupling network CNI 503B7 / 63 A	EMV-357
☐	DC Power supply N5745A	EMV-203	☐	Telecom Surge Generator TSurge 7	EMV-358
☐	Spektrum Analyzator FSV40	EMV-205	☐	Coupling decoupling network CNI 508N2	EMV-359
☐	Thd Multimeter Model 2015	EMV-206	☐	Coupling decoupling network CNV 504N2.2	EMV-360
☐	Poweramplifier PAS15000	EMV- 207/abc	☐	Immunity generator NSG4060/NSG4060-1	EMV-361
☐	Inrush Current Source	EMV- 208/abc	☐	Coupling network CDND M316-2	EMV-362
☐	Arb.-generator Sycore	EMV-209	☐	Coupling network CT419-5	EMV-363
☐	Harmonics/Flicker analyzer ARS 16/3	EMV-210	☐	ESD Generator NSG 437	EMV-364
☐	Power Supply Regatron AC	EMV-214	☐	Pulse Limiter VTSD 9561-F BNC	EMV-405
☐	Power Supply Regatron DC	EMV-215	☐	Transient emission BSM200N40+BS200N100	EMV- 450+451
☐	Harmonics/Flicker analyser Zimmer	EMV-216	☐	Cap. Coupling Clamp HFK	EMV-455
☐	Flicker Impedanz Newtons4th 753	EMV-218	☐	Mag. Field System MS100N+MC26100+MC2630	EMV- 456-458
☐	Comemso	EMV-219			

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☐	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 10 dB / 250 Watt	EMV-469/2
☐	HV AMN NNHV 8123 800A	EMV-472
☐	HV AMN NNHV 8123 800A	EMV-473

Appendix 2 Photodocumentation

Division:
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Description: Front view

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Division:
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Description: Rear view

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Division:
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Description: Case opened

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Appendix 2 Photodocumentation

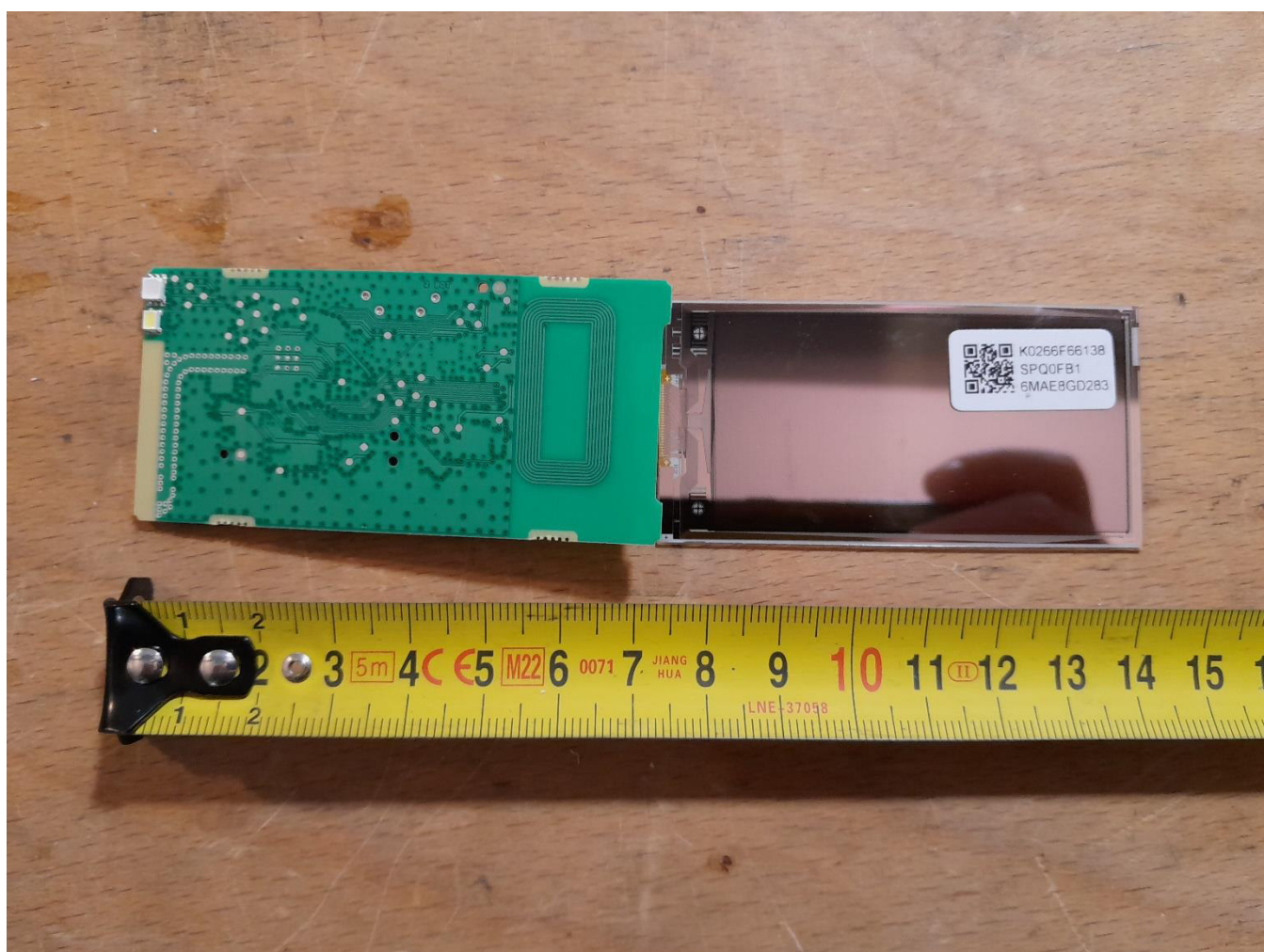
Division:
Industry & Energy

Description: Internal view #1

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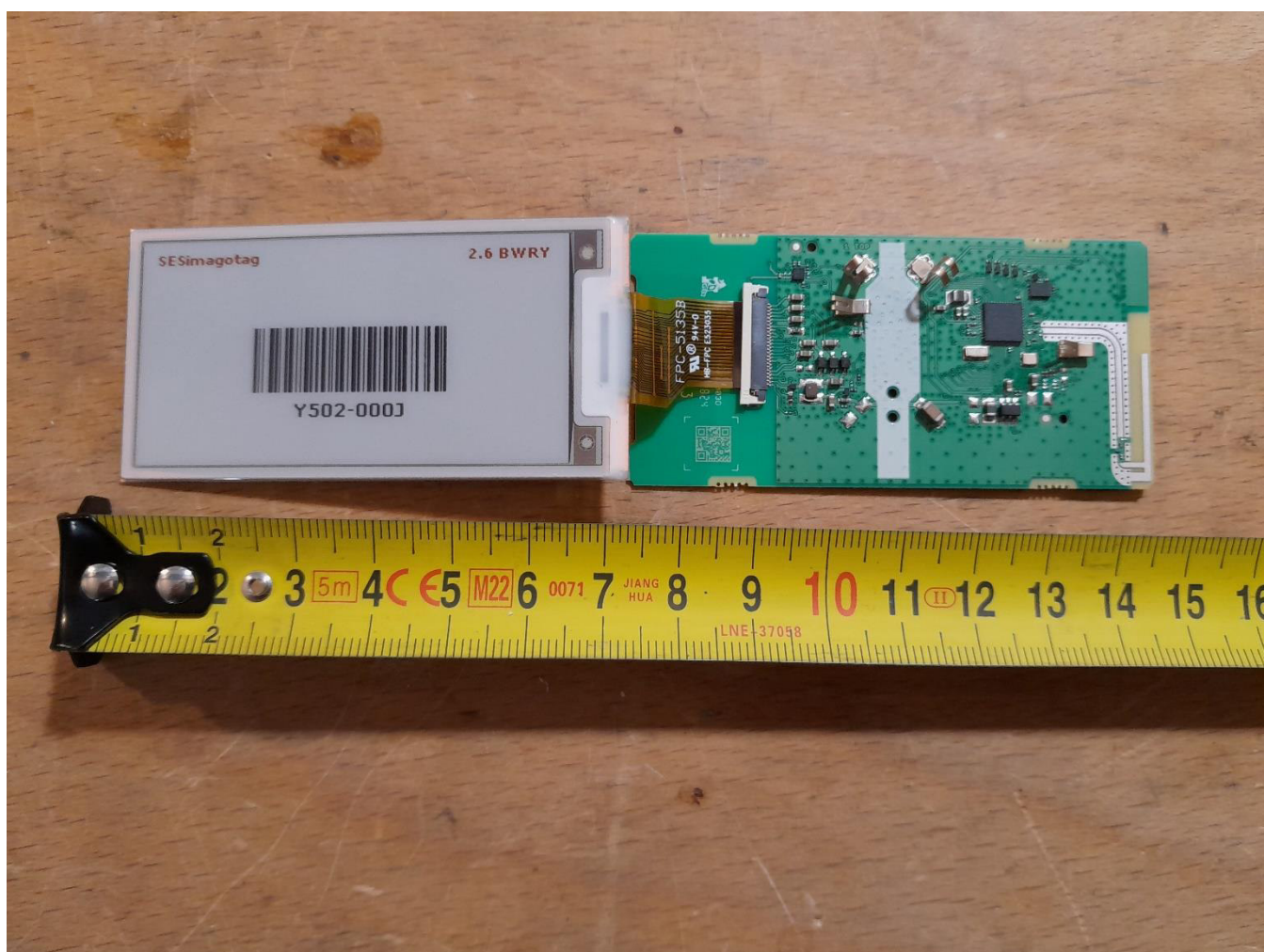
Division:
Industry & Energy

Description: Internal view #2

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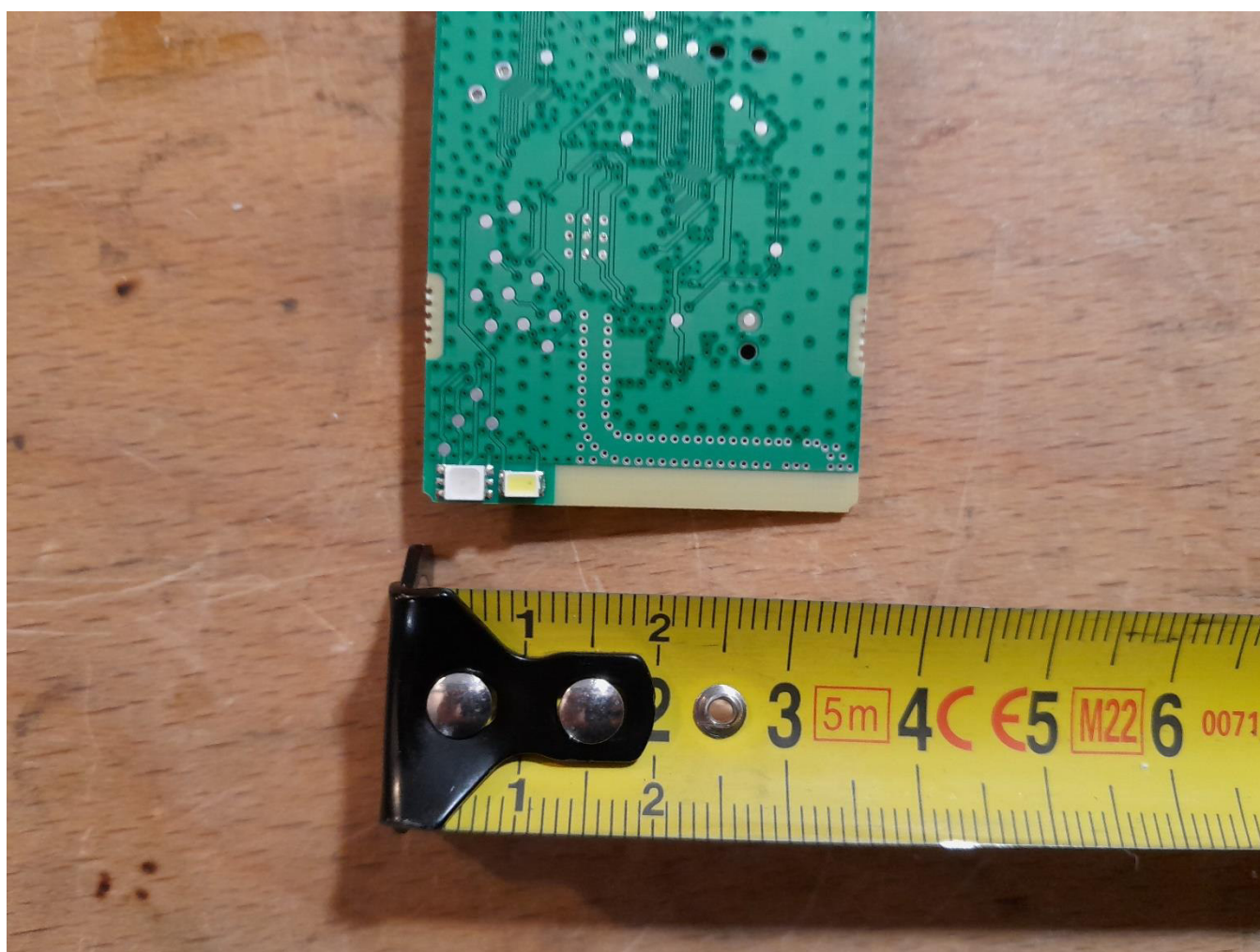
Description: Antenna detail #1

Division:
Industry & Energy

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Appendix 2

Photodocumentation

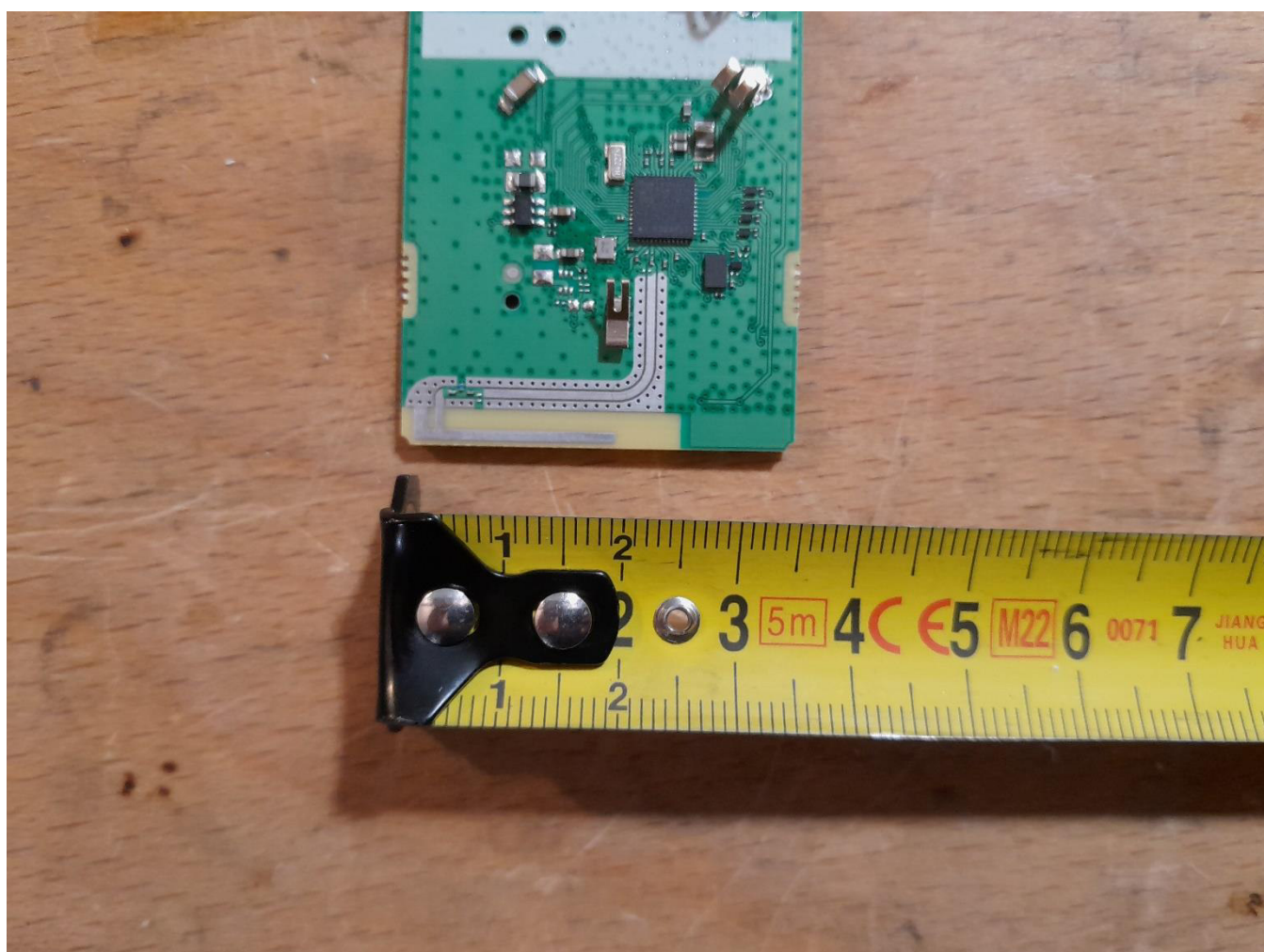
Division:
Industry & Energy

Description: Antenna detail #2
Inverted-F Antenna (IFA) fed by a coplanar waveguide

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Appendix 2

Photodocumentation

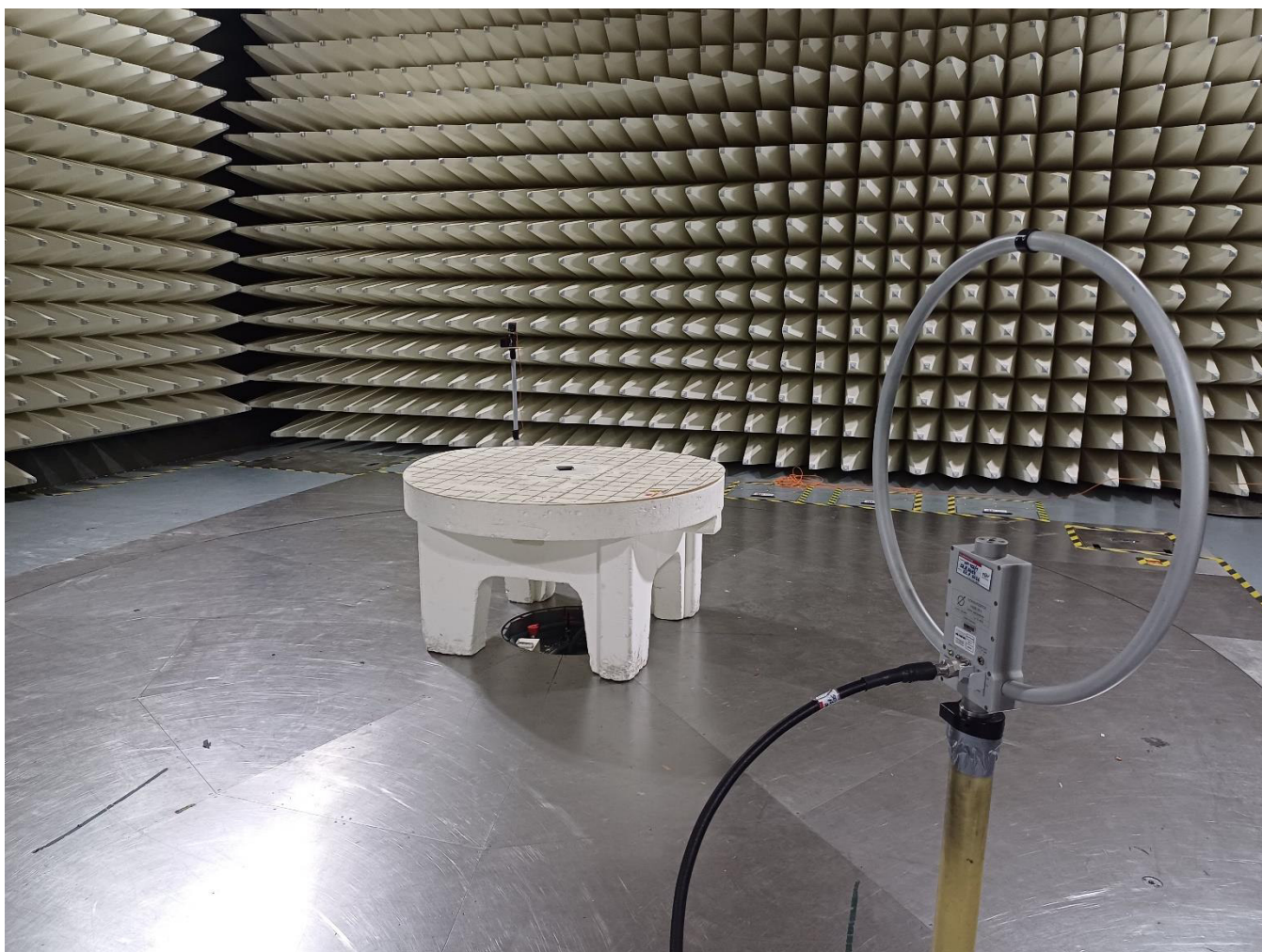
Division:
Industry & Energy

Description: Test setup emissions below 30 MHz

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Appendix 2 Photodocumentation

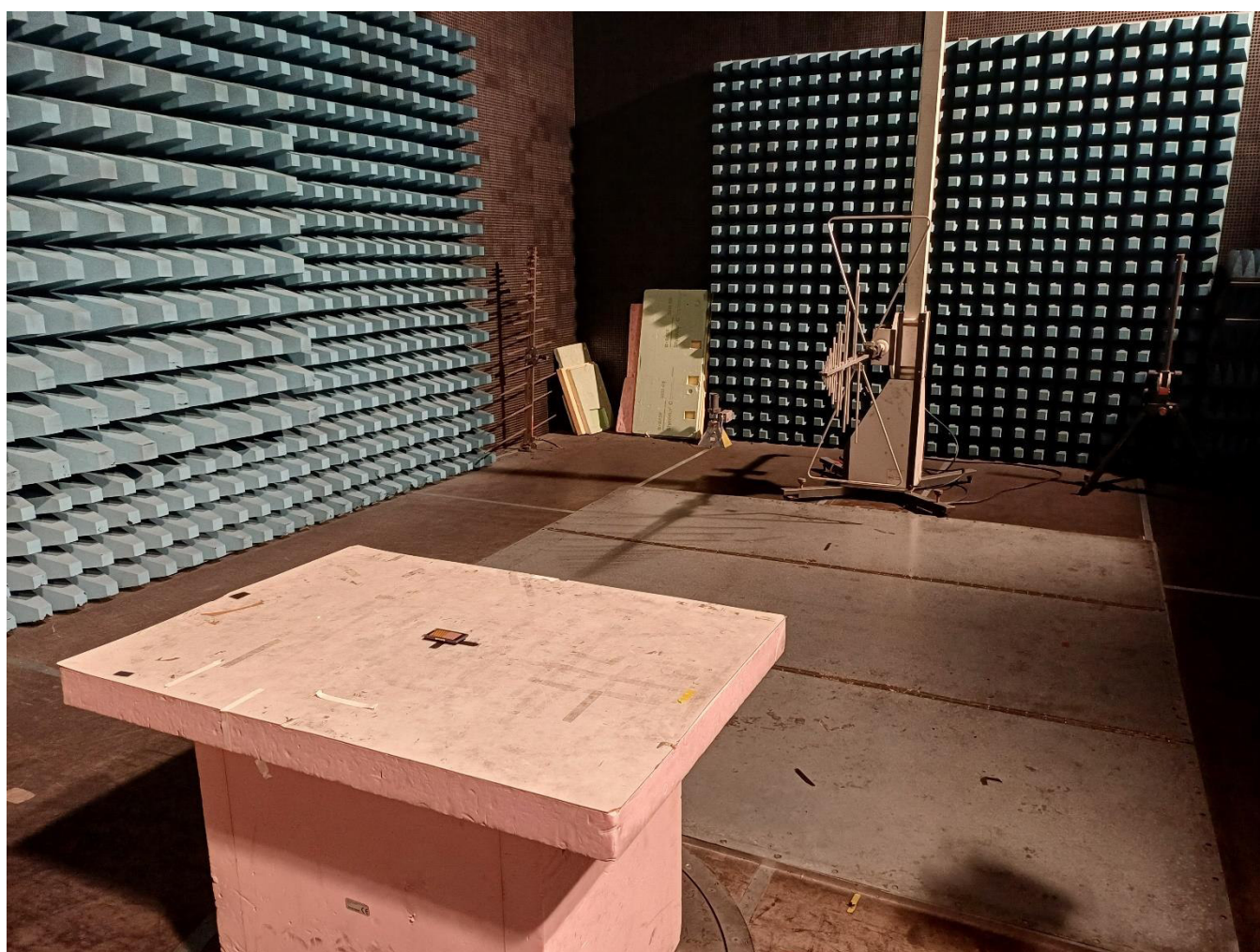
Division:
Industry & Energy

Description: Test setup emissions 30 MHz - 1 GHz

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Appendix 2 Photodocumentation

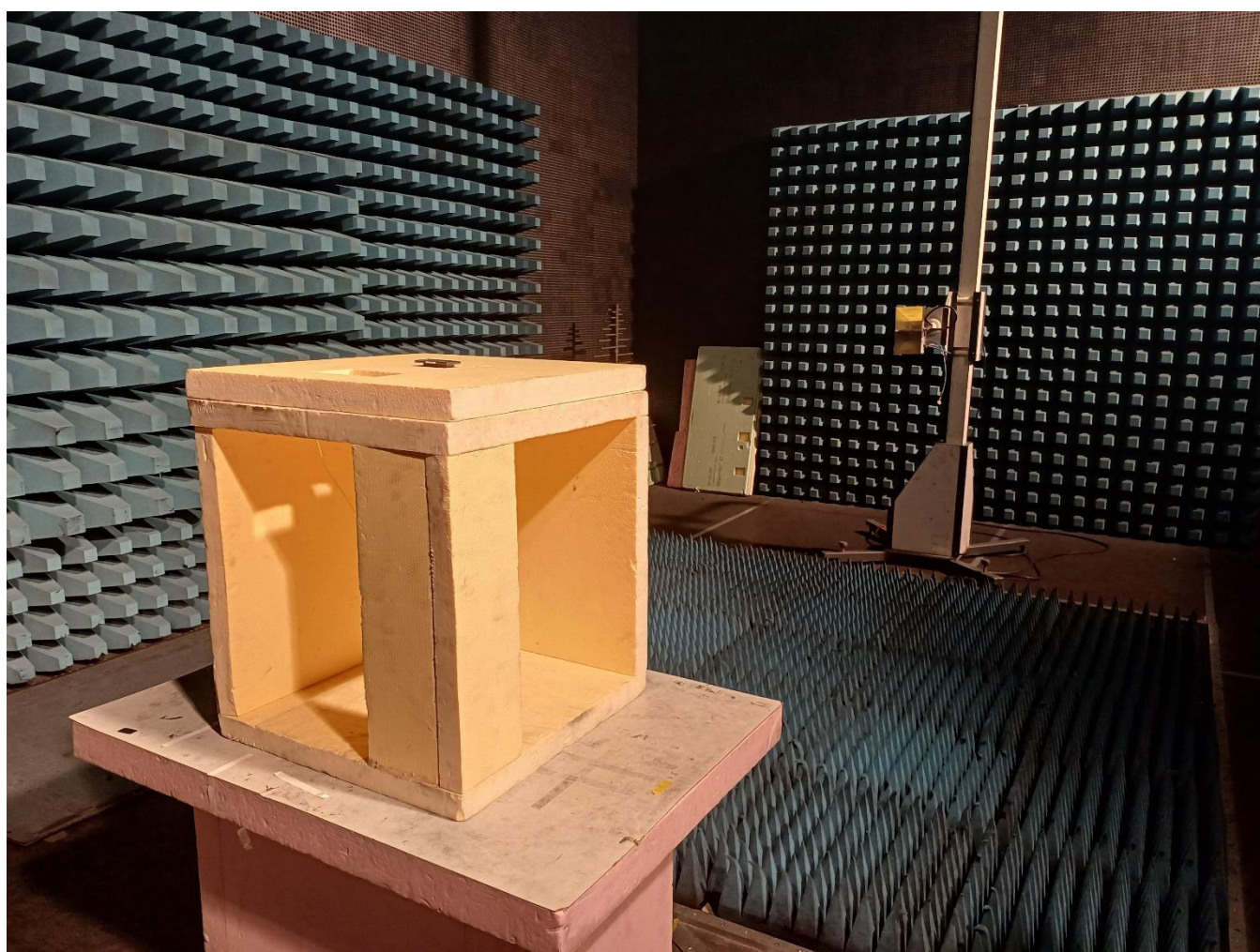
Division:
Industry & Energy

Description: Test setup emissions above 1 GHz

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--- END OF TEST REPORT ---

