



RF - TEST REPORT

- FCC Part 15.247, RSS-247 -

Type / Model Name : SunSense Pro

Product Description : UV measuring device with BLE

Applicant : SunSense as

Address : Radyrvegen 16

4737 Hornnes, NORWAY

Manufacturer : SunSense as

Address : Radyrvegen 16

4737 Hornnes, NORWAY

Test Result according to the standards
listed in clause 1 test standards:

POSITIVE

Test Report No. : **80079239-01 Rev_1**

07. July 2022

Date of issue



Deutsche
Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (September 2020)

Part 15, Subpart A, Section 15.31

Measurement standards

Part 15, Subpart A, Section 15.33

Frequency range of radiated measurements

Part 15, Subpart A, Section 15.35

Measurement detector functions and bandwidths

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September 2020)

Part 15, Subpart C, Section 15.203

Antenna requirement

Part 15, Subpart C, Section 15.204
modifications

External radio frequency power amplifiers and antenna

Part 15, Subpart C, Section 15.205

Restricted bands of operation

Part 15, Subpart C, Section 15.207

Conducted limits

Part 15, Subpart C, Section 15.209

Radiated emission limits, general requirements

Part 15, Subpart C, Section 15.247

Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz

ANSI C63.10: 2013

Testing Unlicensed Wireless Devices

ETSI TR 100 028 V1.3.1: 2001-03.

Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

KDB 558074 D01 v05r02

Guidance for compliance measurements on DTS; FHSS and hybrid system devices operating under Section 15.247 of the FCC rules, April 2, 2019.

2 EQUIPMENT UNDER TEST

2.1 Information provided by the Client

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

2.2 Sampling

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according to his/her instructions.

2.3 General remarks

2.4 Photo documentation of the EUT – Detailed photos see ATTACHMENT A

2.5 Equipment type

BLE device

2.6 Short description of the equipment under test (EUT)

The EUT is a Bluetooth 5.0 Low Energy system.

The EUT is compatible with the standard 802.15.1. It supports the 2.4 GHz frequency band.

Number of tested samples:	1 radiated	1 conducted
Serial number:	5	4

2.7 Variants of the EUT

There are no variants.

2.8 Operation frequency and channel plan

The operating frequency is 2400 MHz to 2483.5 MHz.

Channel plan:

Channel	Frequency	Channel	Frequency
37	2402	18	2442
0	2404	19	2444
1	2406	20	2446
2	2408	21	2448
3	2410	22	2450
4	2412	23	2452
5	2414	24	2454
6	2416	25	2456
7	2418	26	2458
8	2420	27	2460
9	2422	28	2462
10	2424	29	2464
38	2426	30	2466
11	2428	31	2468
12	2430	32	2470
13	2432	33	2472
14	2434	34	2474
15	2436	35	2476
16	2438	36	2478
17	2440	39	2480

Note: the marked frequencies are determined for final testing.

2.9 Transmit operating modes

The EUT uses GFSK modulation and may provide following data rates:

- 1000 kbps

(kbps = kilobits per second)

2.10 Antenna

The following antennas shall be used with the EUT:

The EUT has only an integrated SMD antenna, no temporary connector and no external antenna to be connected.

2.11 Power supply system utilised

Power supply voltage : 3 V_{DC}

2.12 Peripheral devices and interface cables

The following peripheral devices and interface cables are connected during the measurements:

- Serial to USB converter Model : DSD TECH
- Laptop Model : _____
- _____ Model : _____

2.13 Determination of worst-case conditions for final measurement

Measurements are made in all three orthogonal axes and the settings of the EUT are changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position.

The tests are carried out in the following frequency band:

2400 MHz – 2483.5 MHz

For the final test the following channels and test modes are selected:

Wireless system	Available channel	Tested channels	Power setting	Modulation	Modulation type	Data rate
802.15.1	0 - 39	37, 17, 39	default	DSSS	GFSK	1000 kbps

2.13.1 Test jig

No test jig is used.

2.13.2 Test software

The test software for the EUT provides the special test mode RX and the TX continuous mode, modulated. The EUT was set with test modulation to transmit data during the tests with a maximum duty cycle (100%) from an internal packet generator.

3 TEST RESULT SUMMARY

BLE device using digital modulation and operates in the 2400 MHz – 2483.5 MHz:

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a)	RSS-Gen, 8.8	AC power line conducted emissions	not applicable
15.247(a)(2)	RSS-247, 6.2.4(1)	-6 dB EBW	passed
15.247(b)(3)	RSS-247, 6.2.4(1)	Maximum peak conducted output power	passed
15.247(b)(4)	-	Defacto limit	passed
15.247(d)	RSS-247, 6.2.4(2)	Out-of-band emission, radiated	passed
15.247(d)	RSS-Gen, 8.9	Emissions in restricted bands	passed
15.247(e)	RSS-247, 6.2.4(1)	PSD	passed
15.203	RSS-Gen, 6.6	Antenna requirement	passed
-	RSS-Gen, 6.11	Transmitter frequency stability	passed
-	RSS-Gen, 6.6	99 % Bandwidth	passed

The mentioned new RSS Rule Parts in the above table are related to:

RSS-Gen, Issue 5 + Amendment 1, March 2019

RSS-247, Issue 2, February 2017

AC power line conducted emissions is not applicable because the device is battery powered.

3.1 Final assessment

The equipment under test fulfills the requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 30 April 2021

Testing concluded on : 06 July 2022

Checked by:

Tested by:

Klaus Gegenfurtner
Teamleader Radio

Lukas Scheuermann
Radio Team

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

**CSA Group Bayern GmbH
Ohmstrasse 1-4
94342 STRASSKIRCHEN
GERMANY**

4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15 - 35 °C

Humidity: 30 - 60 %

Atmospheric pressure: 86 - 106 kPa

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor $k = 2$. The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 / 2011 + A1 / 2014 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, CSA Group Bayern GmbH, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	$\pm 3.29 \text{ dB}$
20 dB Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
99% Occupied Bandwidth	Center frequency of EUT	95%	$\pm 2.5 \times 10^{-7}$
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	$\pm 3.53 \text{ dB}$
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	$\pm 3.71 \text{ dB}$
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	$\pm 2.34 \text{ dB}$
Peak conducted output power	902 MHz to 928 MHz	95%	$\pm 0.35 \text{ dB}$
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	$\pm 2.15 \text{ dB}$

4.1 Conformity Decision Rule

The conformity decision rule is based on the ILAC G8 published at the time of reporting.

4.2 Measurement protocol for FCC and ISCED

4.2.1 General information

CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

FCC: DE 0011

ISED: DE0009

4.2.2 General Standard information

The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices".

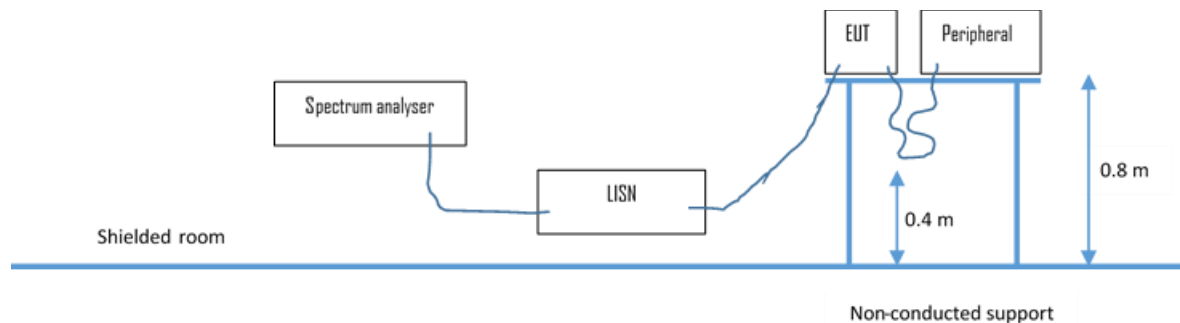
4.2.2.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions.

4.2.3 Details of test procedures

4.2.3.1 Conducted emission

Test setup according ANSI C63.10



The final level, expressed in dB μ V, is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between dB μ V and μ V, the following conversions apply:

$$\text{dB}\mu\text{V} = 20(\log \mu\text{V})$$

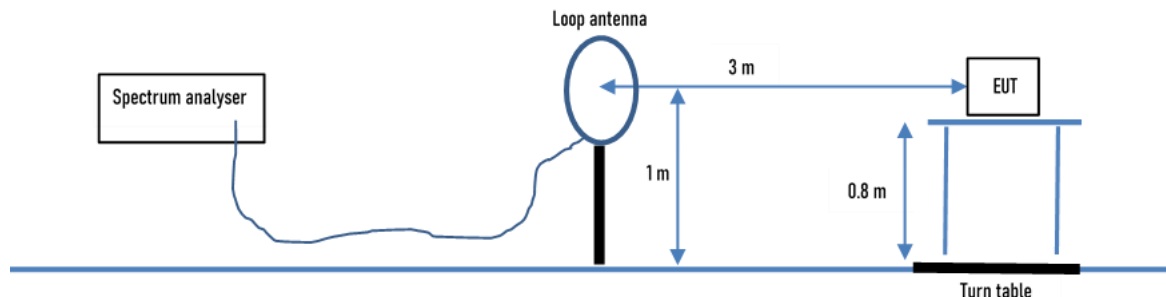
$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with 50 Ω / 50 μ H (CISPR 16) characteristics. The receiver is protected by means of an impedance matched pulse limiter connected directly to the RF input. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission is re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

4.2.3.2 Radiated emission

4.2.3.2.1 OATS1 test site (9 kHz - 30 MHz):

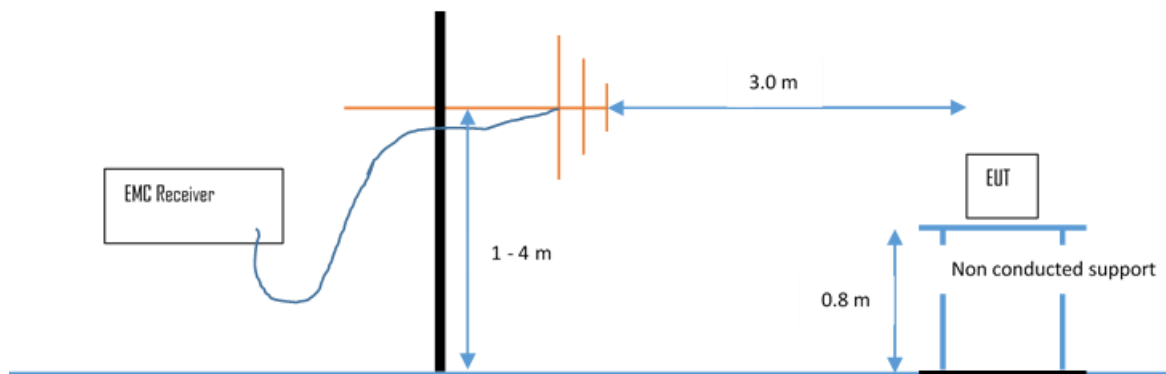
Test setup according ANSI C63.10



Emissions from the EUT are measured in the frequency range of 9 MHz to 30 MHz using a tuned receiver and a calibrated loop antenna. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. The antenna is positioned 3, 10 or 30 metres horizontally from the EUT and is repeated vertically. To locate maximum emissions from the test sample the antenna is varied along the site axis and the EUT is rotated 360 degrees.

4.2.3.2.2 OATS1 test site (30 MHz - 1 GHz):

Test setup according ANSI C63.10.



Spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarised antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 m non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screened room located outside the test area. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres and the EUT is rotated 360 degrees. The final level in dB μ V/m is calculated by taking the reading from the EMI receiver (Level dB μ V) and adding the correction factors and cable loss factor (dB). The FCC limit is subtracted from this result in order to provide the limit margin listed in the measurement protocol.

The resolution bandwidth setting:

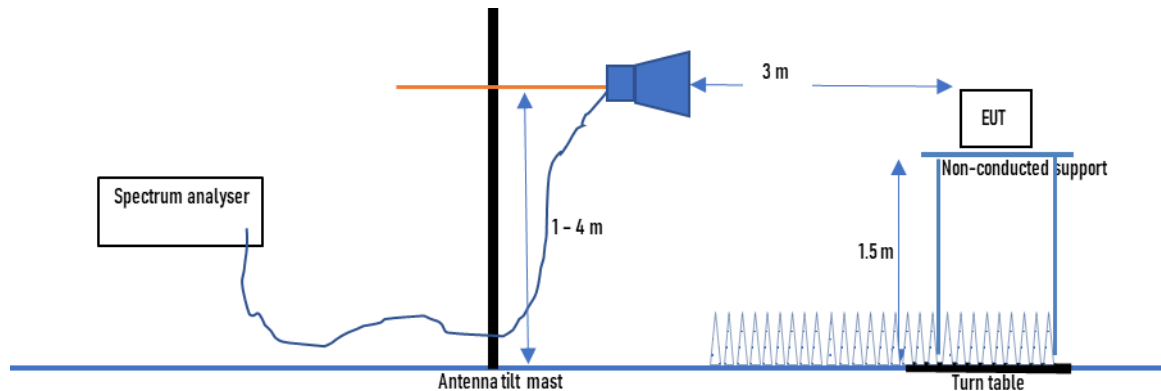
30 MHz – 1000 MHz: RBW: 120 kHz

Example:

Frequency (MHz)	Level (dB μ V)	+	Factor (dB)	=	Level (dB μ V/m)	-	Limit (dB μ V/m)	=	Delta (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

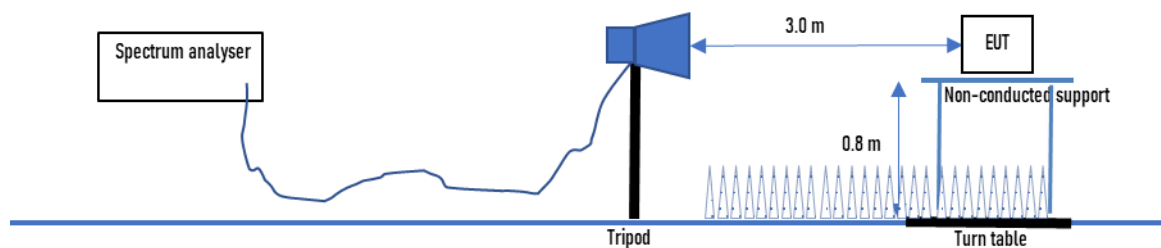
4.2.3.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

Test setup according ANSI C63.10.



Radiated emissions from the EUT are measured in the frequency range 1 GHz up to 18 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 1.5 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the centre, forming a bundle 30 cm to 40 cm long. Measurements are made in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements.

4.2.3.2.4 Anechoic chamber 1 (18 GHz – 40 GHz)



Emissions from the EUT are measured in the frequency range 18 GHz up to 40 GHz as specified in 47 CFR Part 15, Subpart A, Section 15.33, using a spectrum analyser and appropriate linearly polarized antennas. Table top equipment is placed on a non-conducting table, 0.8 metre above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). Any controlling device is positioned such that it does not significantly influence the measurement results. Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the centre, forming a bundle 30 cm to 40 cm long. Measurements are made in three orientations of the EUT and the horizontal and vertical polarization planes of measurement antenna in a fully anechoic room. The measurement antenna is adjusted and the EUT orientated to permit the measurement of the maximum emission from the EUT. The conditions determined as worst-case will then be used for the final measurements. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty. The limit is adopted.

5 TEST CONDITIONS AND RESULTS

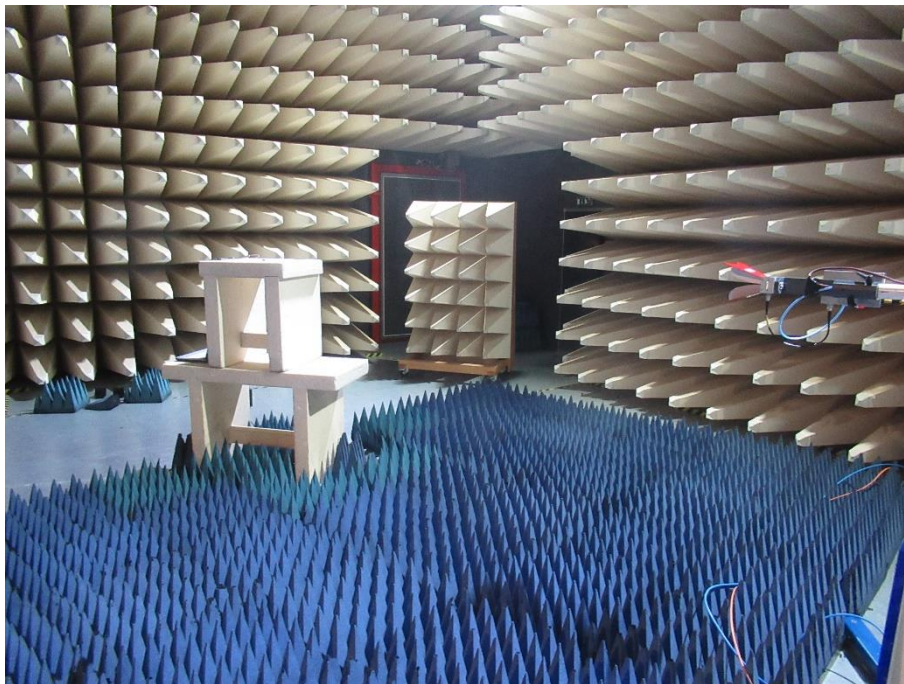
5.1 Emission bandwidth and Occupied bandwidth

For test instruments and accessories used see section 6 Part **CPR 3**.

5.1.1 Description of the test location

Test location: Anechoic chamber 1

5.1.2 Photo documentation of the test set-up



5.1.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(2):

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.1.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyser.

Spectrum analyser settings of 99% OBW:

RBW: 10 kHz, VBW: 30 kHz, Detector: Max peak, Span: 2 MHz;

Spectrum analyser settings of EBW:

RBW: 100 kHz, VBW: 300 kHz, Detector: Max peak, Span: 2 MHz;

5.1.5 Test result

Emission bandwidth EBW-6dB:

Channel	Centre frequency (MHz)	6 dB bandwidth (kHz)	Minimum limit (kHz)
37	2402	717	500
17	2440	723	500
39	2480	725	500

Occupied bandwidth 99%:

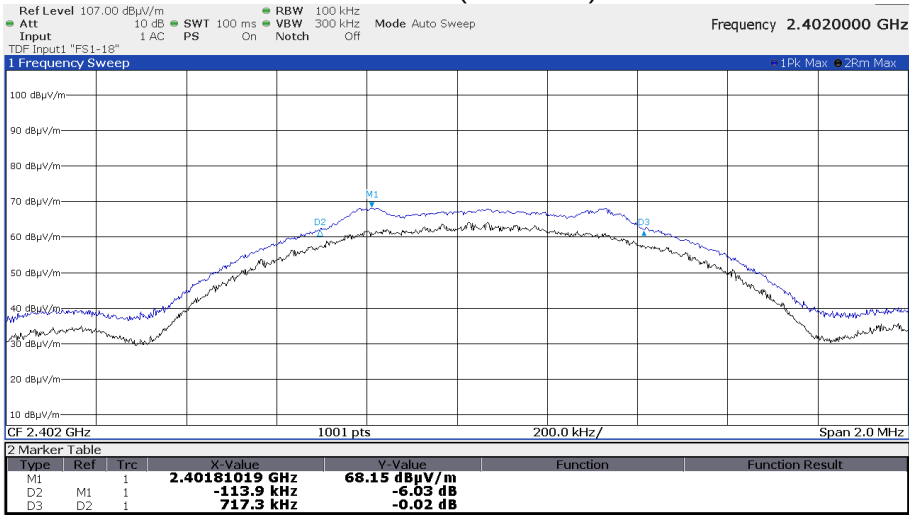
Channel	Centre frequency (MHz)	99 % bandwidth (kHz)
37	2402	1074
17	2440	1060
39	2480	1075

The requirements are **FULFILLED**.

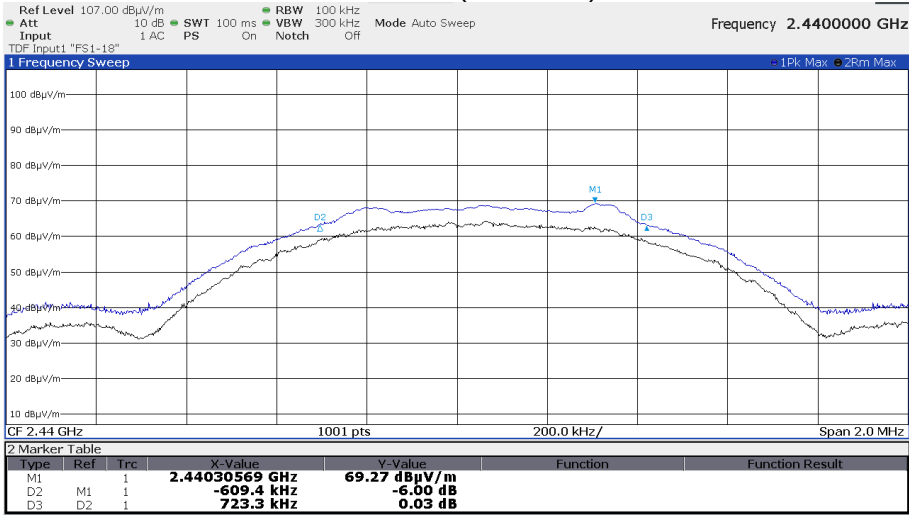
Remarks: For detailed test result please see the following test protocols

5.1.6 Test protocols EBW

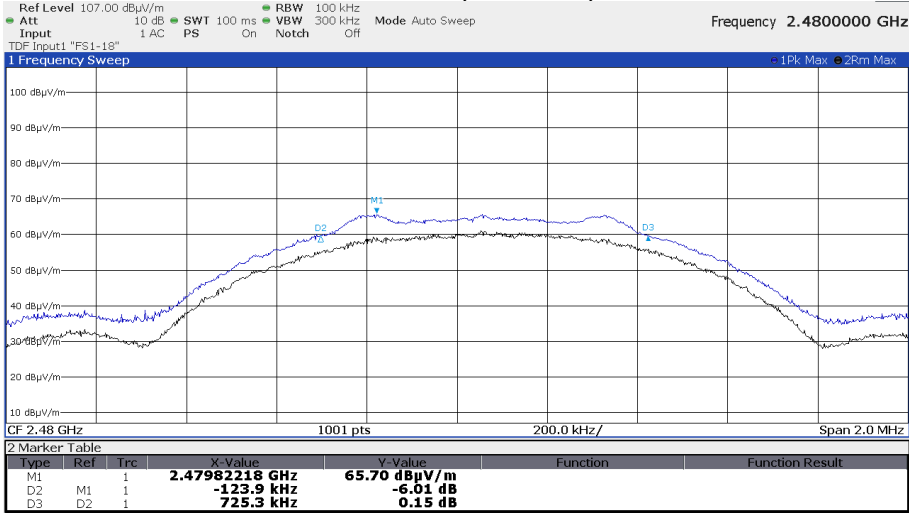
Channel 37 (2402 MHz)



Channel 17 (2440 MHz)

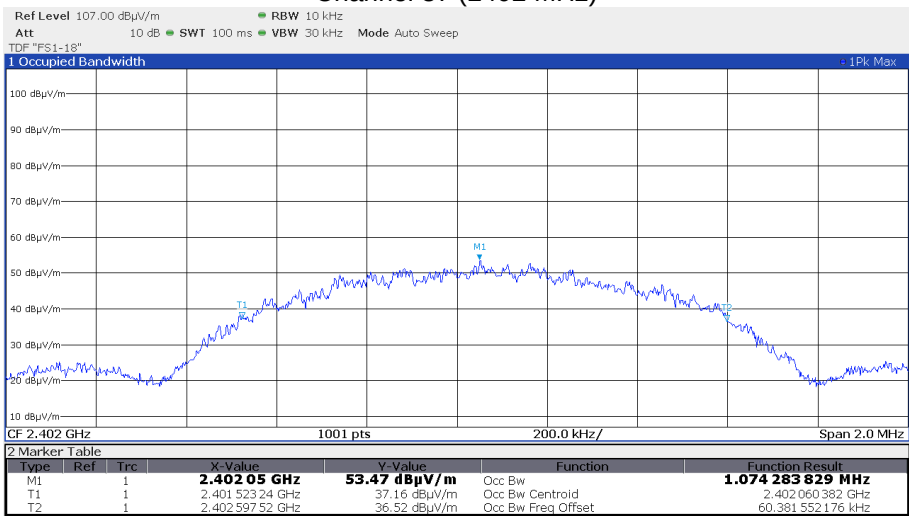


Channel 39 (2480 MHz)

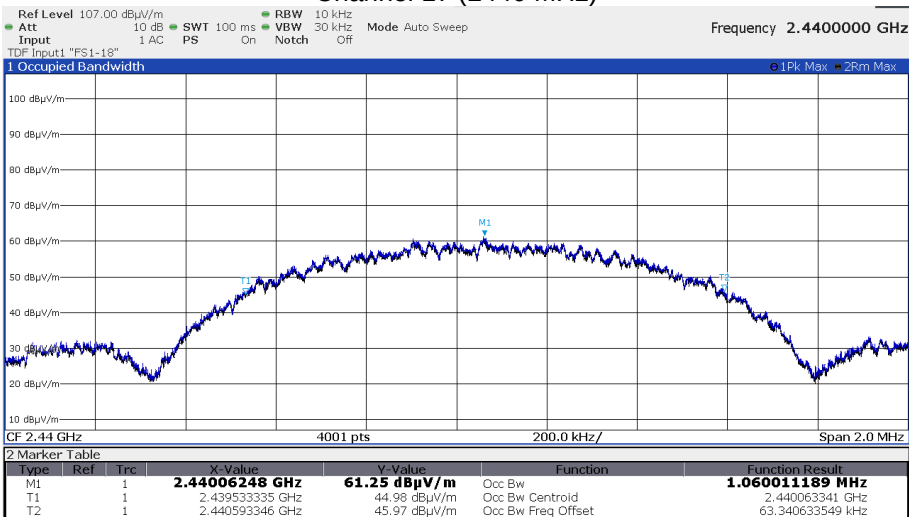


5.1.7 Test protocols OBW

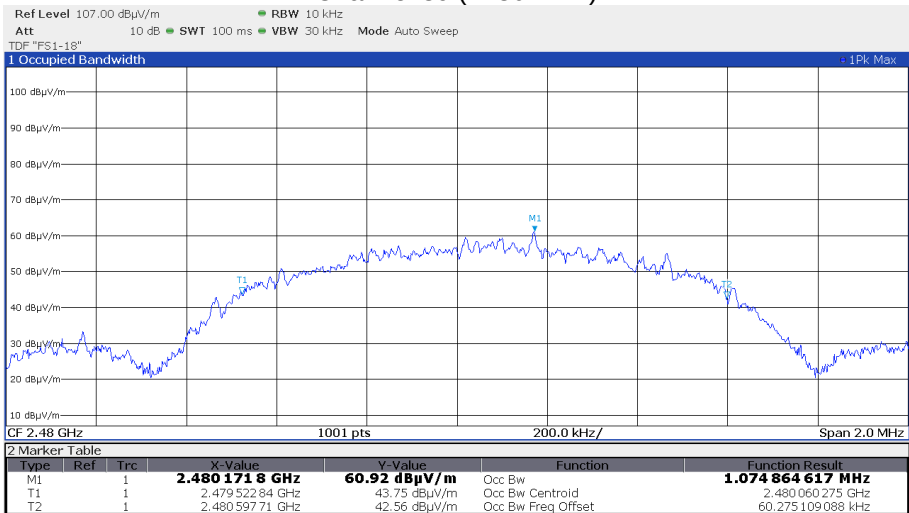
Channel 37 (2402 MHz)



Channel 17 (2440 MHz)



Channel 39 (2480 MHz)



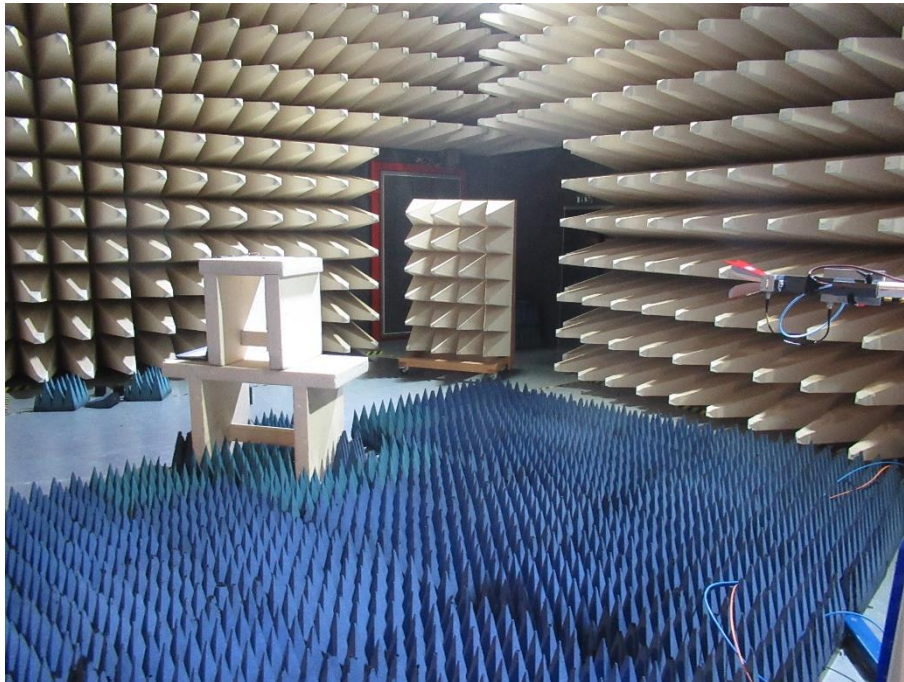
5.2 Maximum peak radiated output power

For test instruments and accessories used see section 6 Part **CPR 3, CPC 3**.

5.2.1 Description of the test location

Test location: Anechoic chamber 1

5.2.2 Photo documentation of the test set-up



5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

5.2.4 Description of Measurement

The maximum peak radiated output power is measured using a spectrum analyser following the procedure set out in ANSI C63.10, item 11.9.2.2. The EUT is set in TX continuous mode while measuring. The radiated measurement was performed in terms of fieldstrength. Therefore, the formula set out in ANSI C63.10, item 9.5 (Equation 22) is changed into the following term:

$$E = \text{EIRP} - (20 \cdot \log_{10}(3)) + 104.7$$

5.2.5 Test result

802.15.1, 1000 kbps, TX		Test results radiated			
		Fieldstrength E (dBμV/m)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
Lowest frequency: CH37					
T_{nom}	V_{nom}	59.5	-35.7	36.0	-71.7
Middle frequency: CH17					
T_{nom}	V_{nom}	65.5	-29.8	36.0	-65.8
Highest frequency: CH39					
T_{nom}	V_{nom}	66.4	-28.9	36.0	-64.9

802.15.1, 1000 kbps, TX		Test results conducted		
		P (dBm)	Limit (dBm)	Margin (dB)
Lowest frequency: CH37				
T_{nom}	V_{nom}	-1.7	30.0	-31.7
Middle frequency: CH17				
T_{nom}	V_{nom}	-2.0	30.0	-32.0
Highest frequency: CH39				
T_{nom}	V_{nom}	-2.3	30.0	-32.3

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak Power Limit conducted	
	(dBm)	(W)
902-928	30	1.0
2400-2483.5	30	1.0
5725-5850	30	1.0

Frequency (MHz)	Peak Power Limit radiated	
	(dBm)	(W)
902-928	36	4.0
2400-2483.5	36	4.0
5725-5850	36	4.0

The requirements are **FULFILLED**.

Remarks: N/A

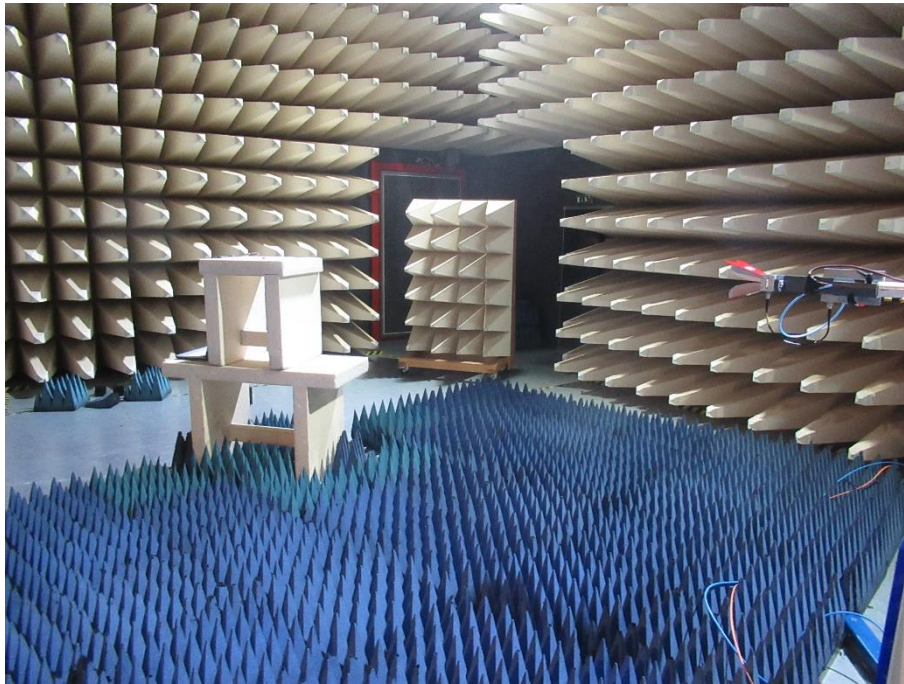
5.3 Power spectral density

For test instruments and accessories used see section 6 Part **CPR 3, CPC 3**.

5.3.1 Description of the test location

Test location: Anechoic chamber 1

5.3.2 Photo documentation of the test set-up



5.3.3 Applicable standard

According to FCC Part 15, Section 15.247(e):

For digitally modulated systems, the power spectral density radiated from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the radiated output power shall be used to determine the power spectral density.

5.3.4 Description of Measurement

The measurement is performed using the procedure set out in 11.10 of ANSI C63.10. The power measurement was done as peak power measurement. Therefore, the PKPSD is measured. The max peak was located and with the spectrum analyser and a marker set to peak.

Spectrum analyser settings:

RBW: 3 kHz, VBW: 10 kHz, Detector: Peak, Sweep time: Auto

5.3.5 Test result

802.15.1, 1000 kbps, 1 TX		Test results radiated			
		PD [Pmax] (dB(μV/m)/3kHz)	PD [Pmax] (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Lowest frequency: 2402 MHz					
T_{nom}	V_{nom}	45.4	-49.8	14.0	-63.8
Middle frequency: 2440 MHz					
T_{nom}	V_{nom}	53.0	-42.2	14.0	-56.2
Highest frequency: 2480 MHz					
T_{nom}	V_{nom}	52.3	-42.9	14.0	-56.9

802.15.1, 1000 kbps, 1 TX		Test results conducted		
		PD [Pmax] (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Lowest frequency: 2402 MHz				
T_{nom}	V_{nom}	-14.9	8.0	-22.9
Middle frequency: 2440 MHz				
T_{nom}	V_{nom}	-15.9	8.0	-23.9
Highest frequency: 2480 MHz				
T_{nom}	V_{nom}	-14.7	8.0	-22.7

Power spectral density limit according to FCC Part 15, Section 15.247(e):

Frequency (MHz)	Power spectral density limit radiated
	(dBm/3 kHz)
2400 - 2483.5	14

Frequency (MHz)	Power spectral density limit conducted
	(dBm/3 kHz)
2400 - 2483.5	8

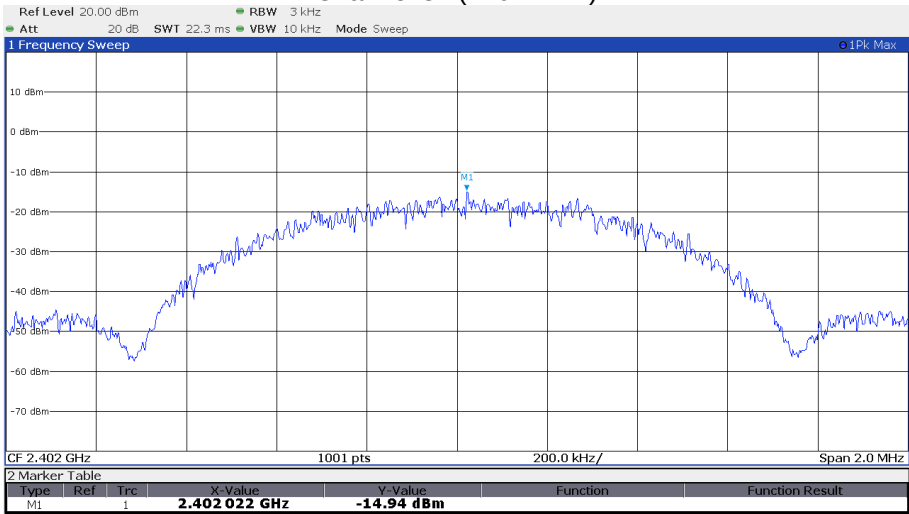
The requirements are **FULFILLED**.

Remarks: For detailed test result please see the following test protocols

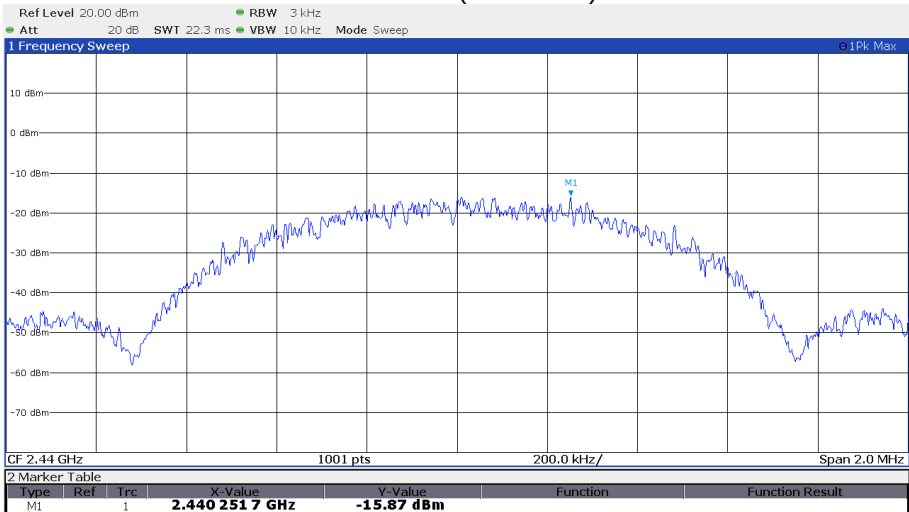
5.3.6 Test protocols

Conducted:

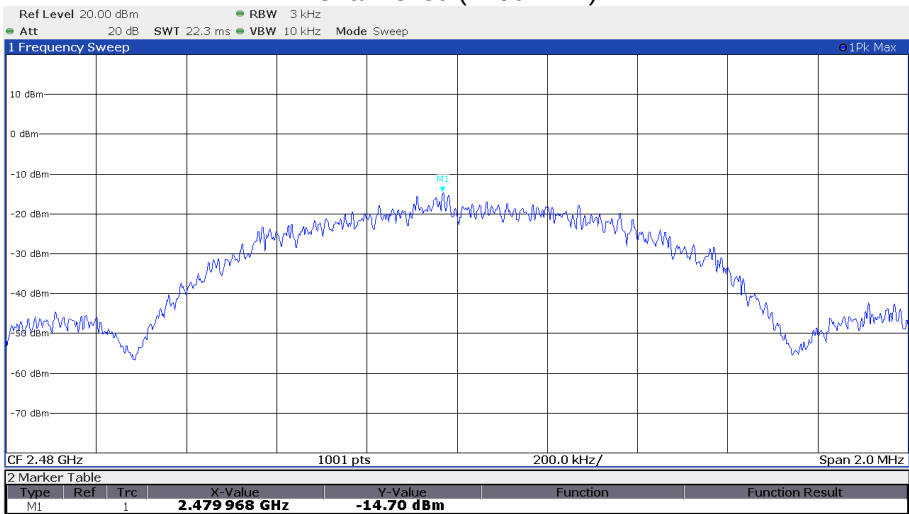
Channel 37 (2402 MHz)



Channel 17 (2440 MHz)

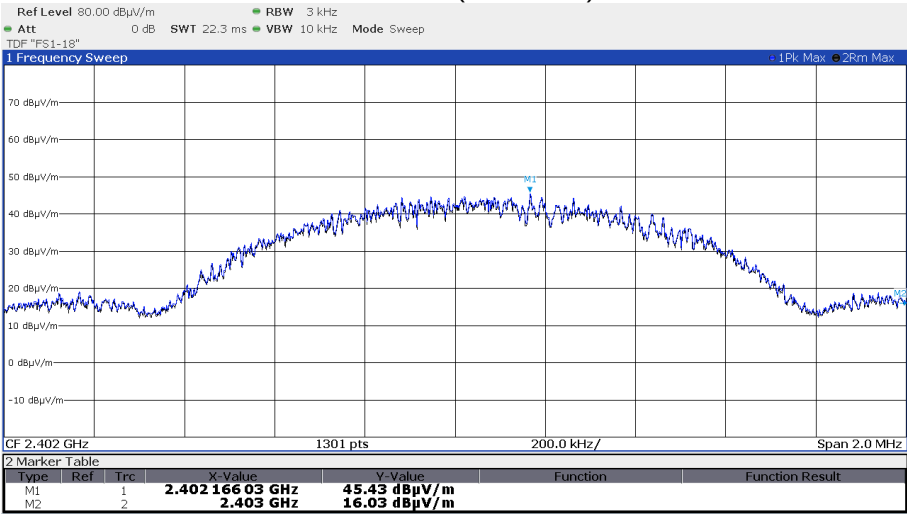


Channel 39 (2480 MHz)

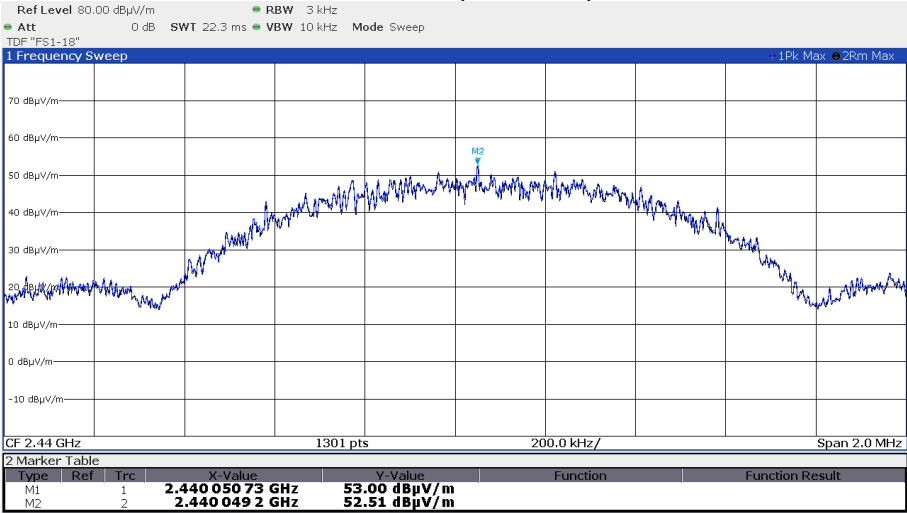


Radiated:

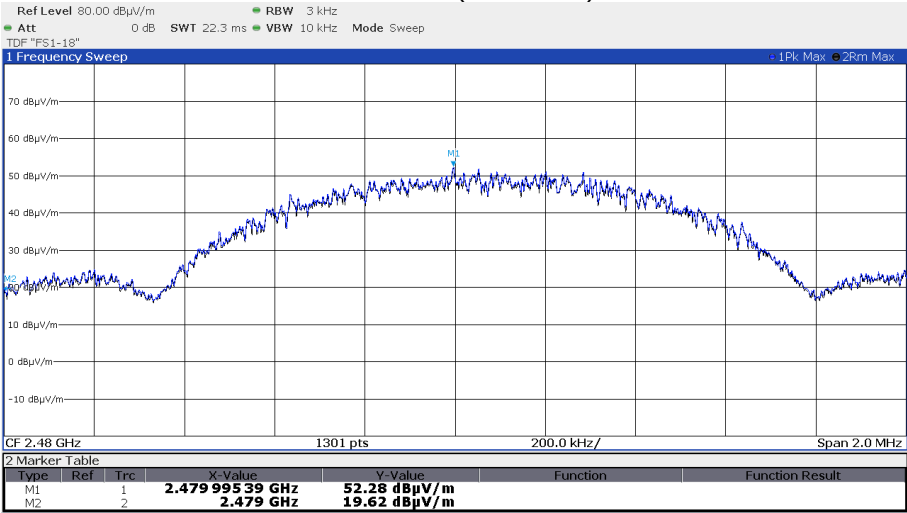
Channel 37 (2402 MHz)



Channel 17 (2440 MHz)



Channel 39 (2480 MHz)



5.4 Radiated emissions in restricted bands

For test instruments and accessories used see section 6 Part **SER 2, SER 3**.

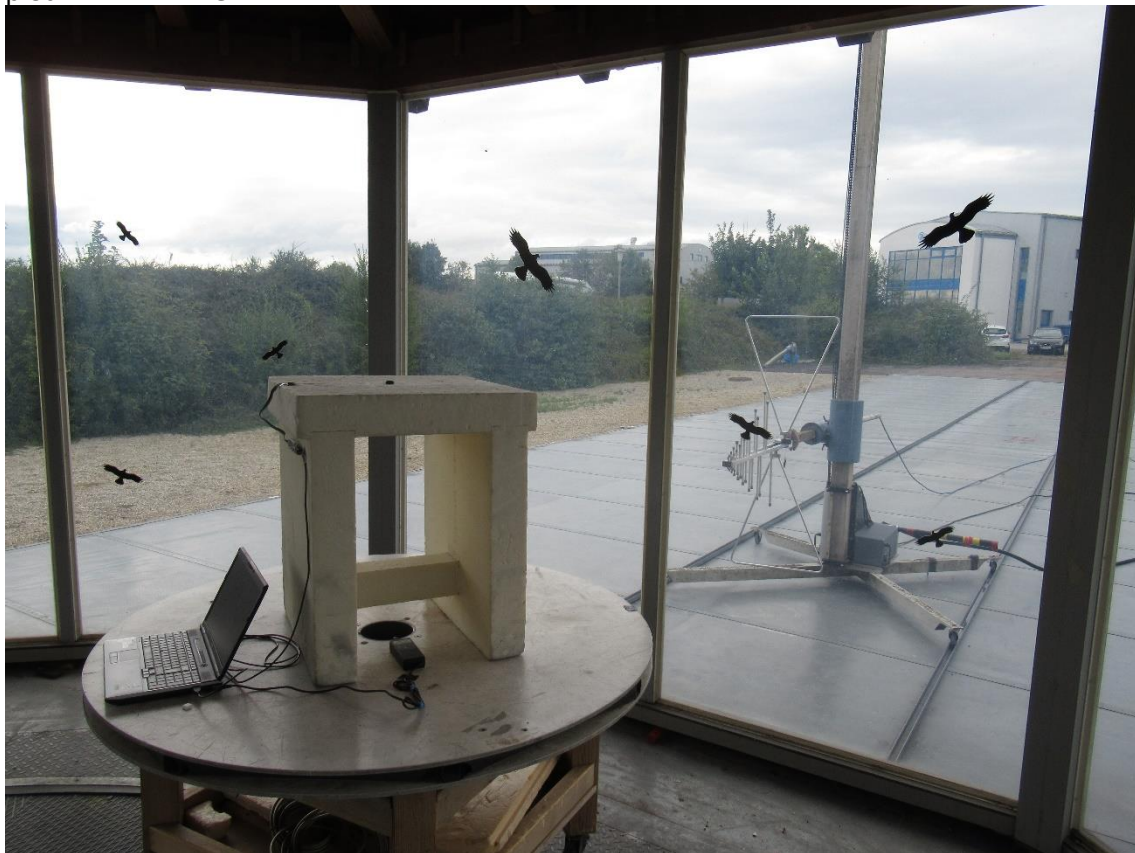
5.4.1 Description of the test location

Test location: OATS 1
Test location: Anechoic chamber 1

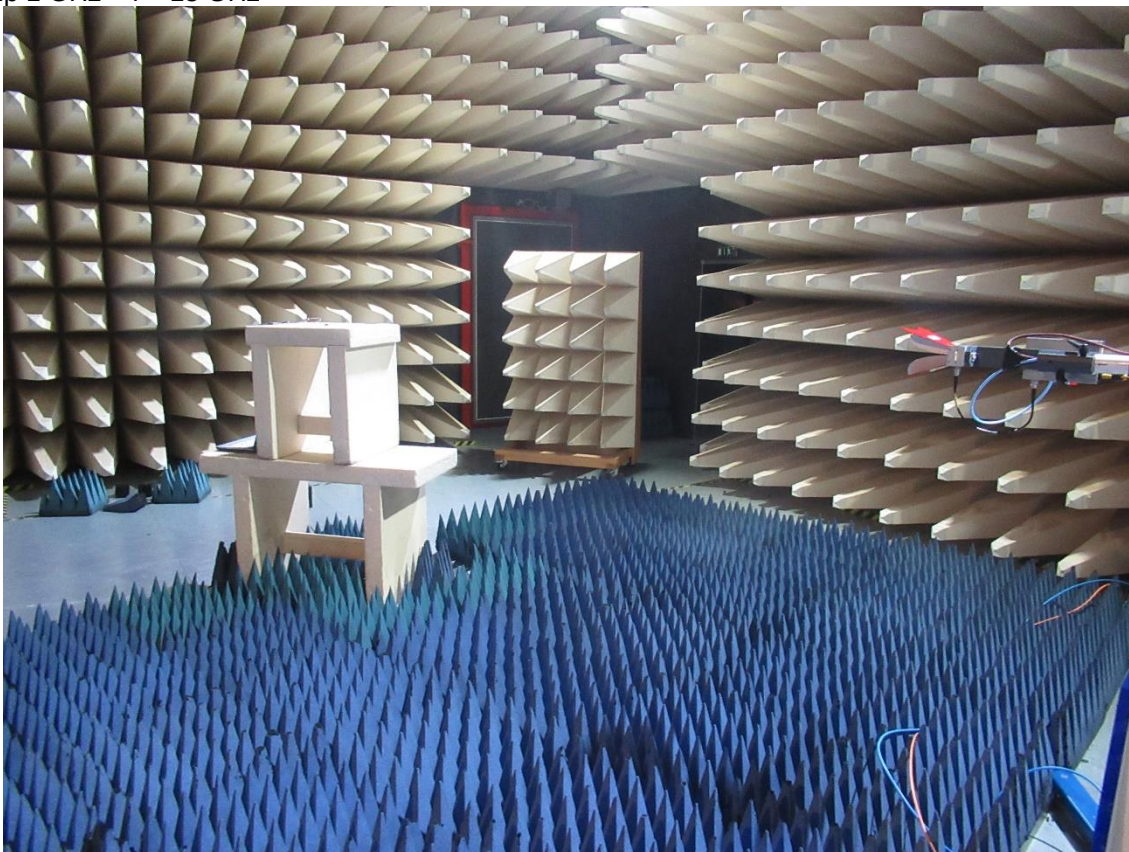
Test distance: 3 m

5.4.2 Photo documentation of the test set-up

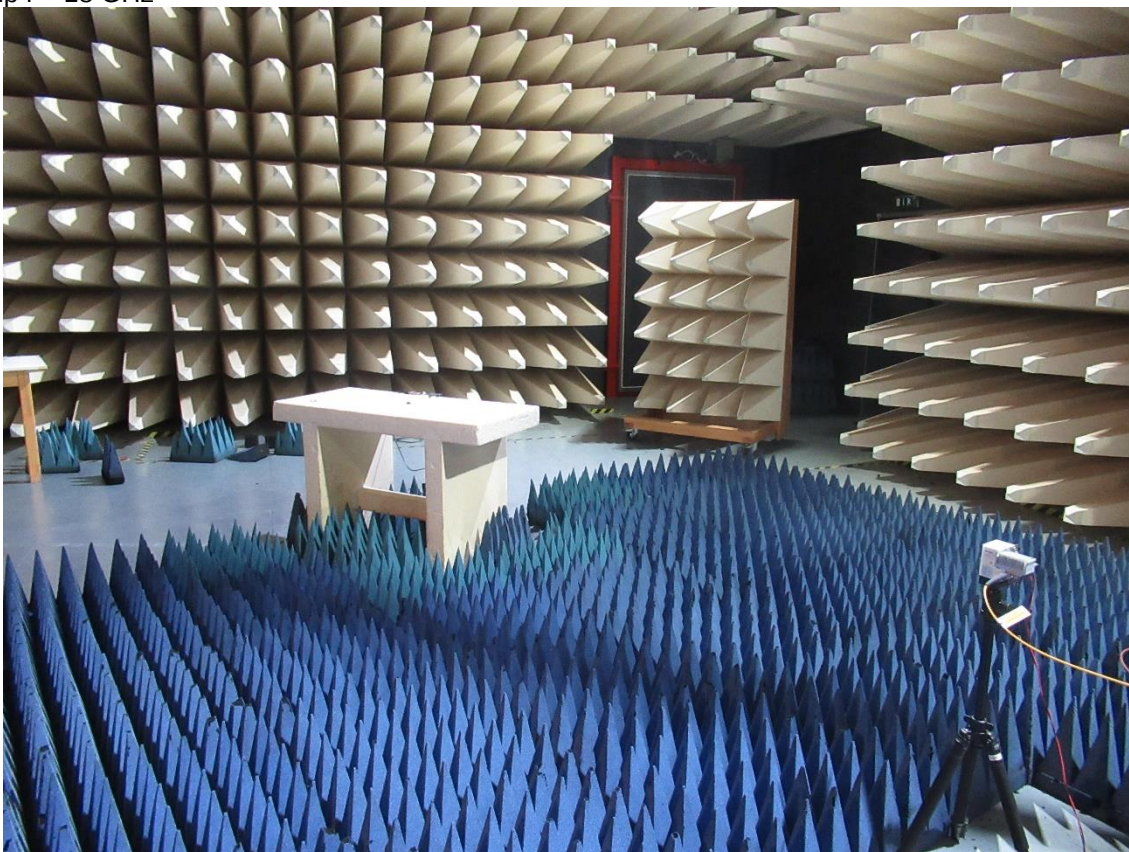
Test Setup 30 MHz < f < 1 GHz:



Test Setup $1\text{ GHz} < f < 18\text{ GHz}$



Test Setup $f > 18\text{ GHz}$



According to FCC Part 15, Section 15.205(a):

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a).

5.4.3 Description of Measurement

The restricted bands are measured radiated. The span of the spectrum analyser is set wide enough to capture the restricted band and measure the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The restricted bands are measured falling emissions into it and the nearest restricted band are checked for emissions also the restricted band for the harmonics of the carrier.

Test receiver settings for SER2:

RBW: 120 MHz, Detector: Quasi peak, Mes. Time: 1 s,

Spectrum analyser settings for SER3:

RBW: 1 MHz, VBW: 3 MHz, Detector: Max. peak, Trace: Max. hold, Sweep: Auto

5.4.4 Test result

Min. limit margin -19.3 dB

30 MHz < f < 1000 MHz

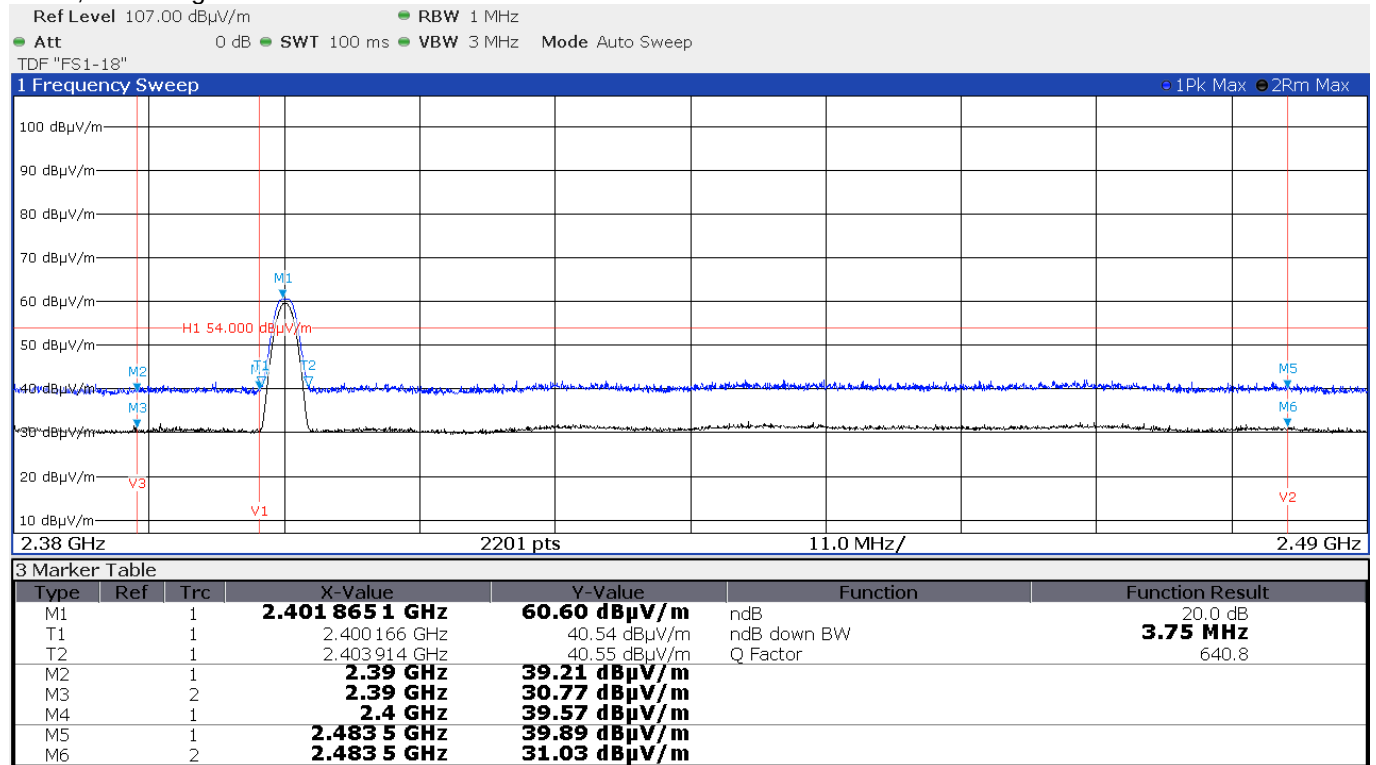
Frequency (MHz)	Reading Vert. (dBµV)	Reading Hor. (dBµV)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dBµV/m)	Level Hor. (dBµV/m)	Limit (dBµV/m)	Dlimit (dB)
40.00	9.0	-1.5	17.0	18.0	26.0	16.5	40.0	-14.0
130.00	3.1	0.8	18.3	17.6	21.4	18.4	43.5	-22.1
300.00	1.7	4.5	20.2	20.7	21.9	25.2	46.0	-20.8
650.00	-2.5	-2.4	28.9	29.4	26.4	27.0	46.0	-19.0
884.00	-0.9	-0.7	32.6	33.0	31.7	32.3	46.0	-13.7
920.00	-0.5	-0.6	33.1	33.5	32.6	32.9	46.0	-13.1

Note: Due to the small dimension of the EUT (2.4 cm) no measurements below 30 MHz were done.

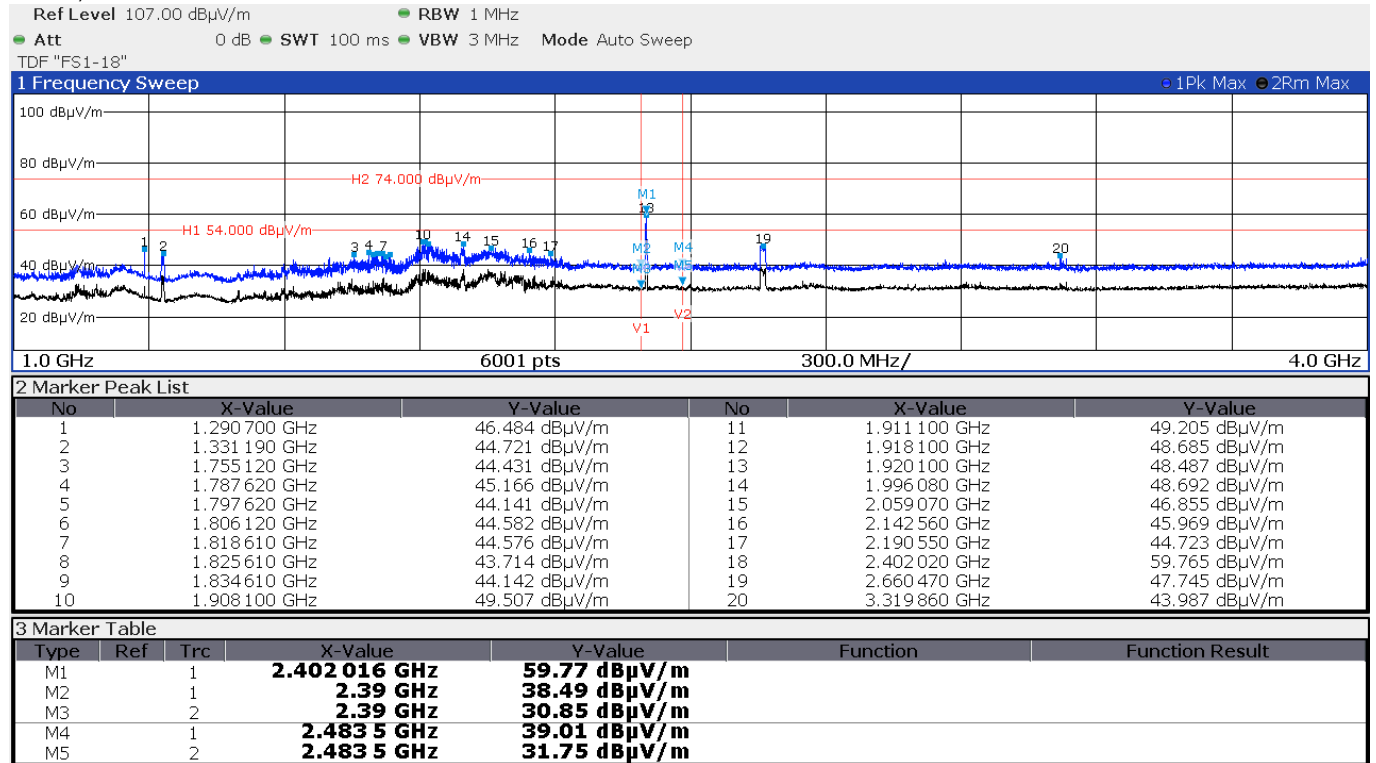
No emissions could be identified in the frequency span 30 MHz to 1000 MHz. Stated values are noise values from the OATS1.

f > 1000 MHz

CH37, Band edge

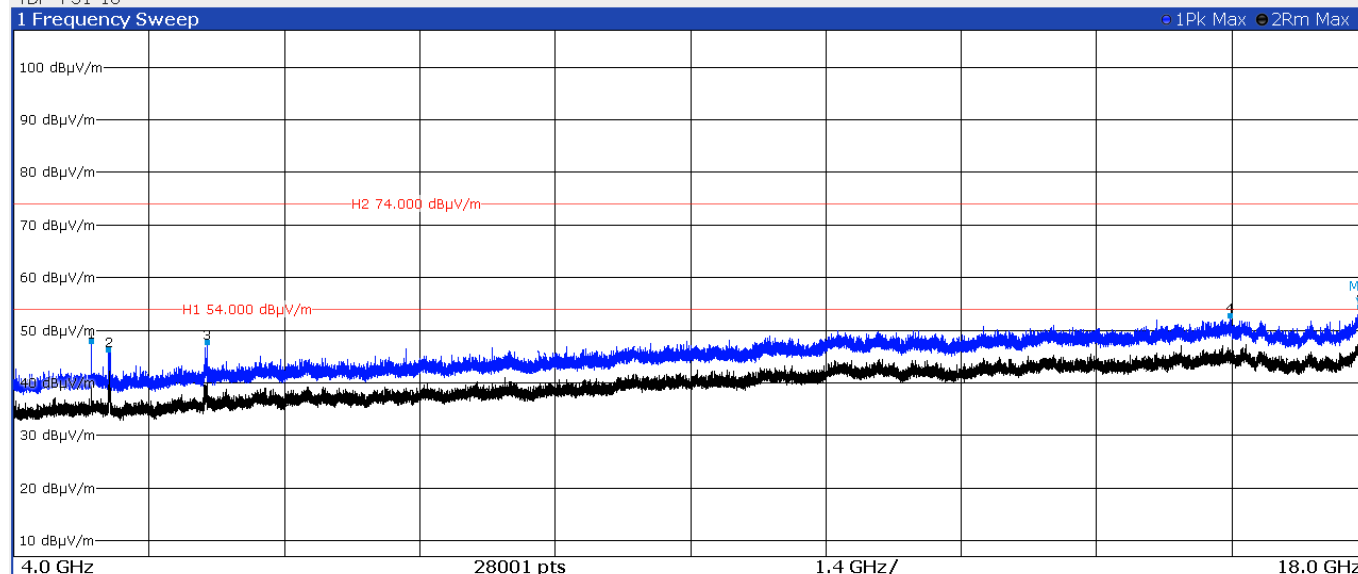


CH37, 1 GHz – 4 GHz



CH37, 4 GHz – 18 GHz

Ref Level 107.00 dBμV/m
 Att 10 dB RBW 1 MHz
 TDF "FS1-18"

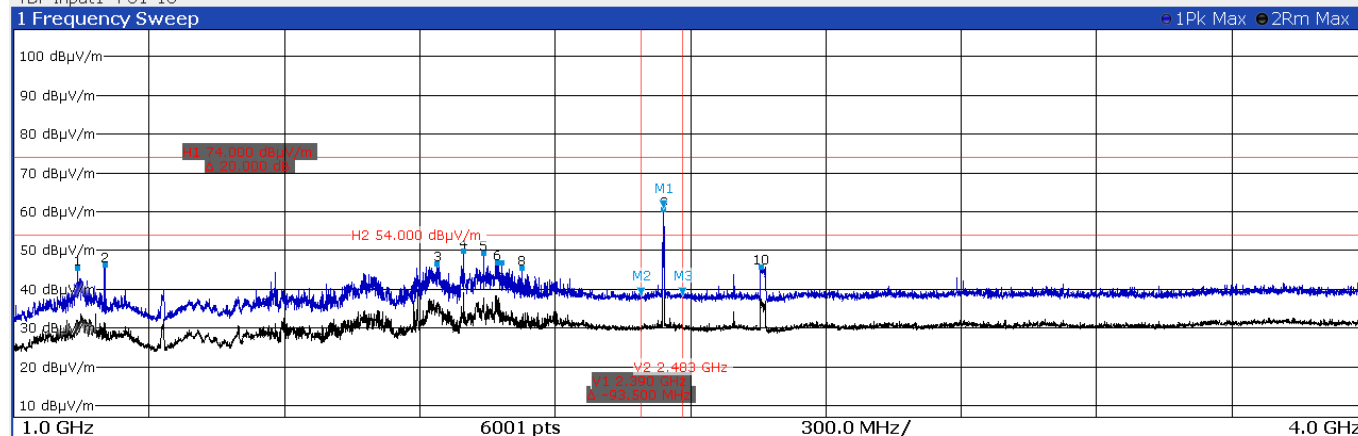


No	X-Value	Y-Value	No	X-Value	Y-Value
1	4.804220 GHz	47.809 dBμV/m	4	16.576300 GHz	52.667 dBμV/m
2	4.984210 GHz	46.177 dBμV/m	5	17.928250 GHz	54.296 dBμV/m
3	5.997680 GHz	47.681 dBμV/m			

CH17, 1 GHz – 4 GHz

Ref Level 107.00 dBμV/m
 Att 10 dB RBW 1 MHz
 Input 1 AC PS On Notch Off
 TDF Input1 "FS1-18"

Frequency 2.500000 GHz



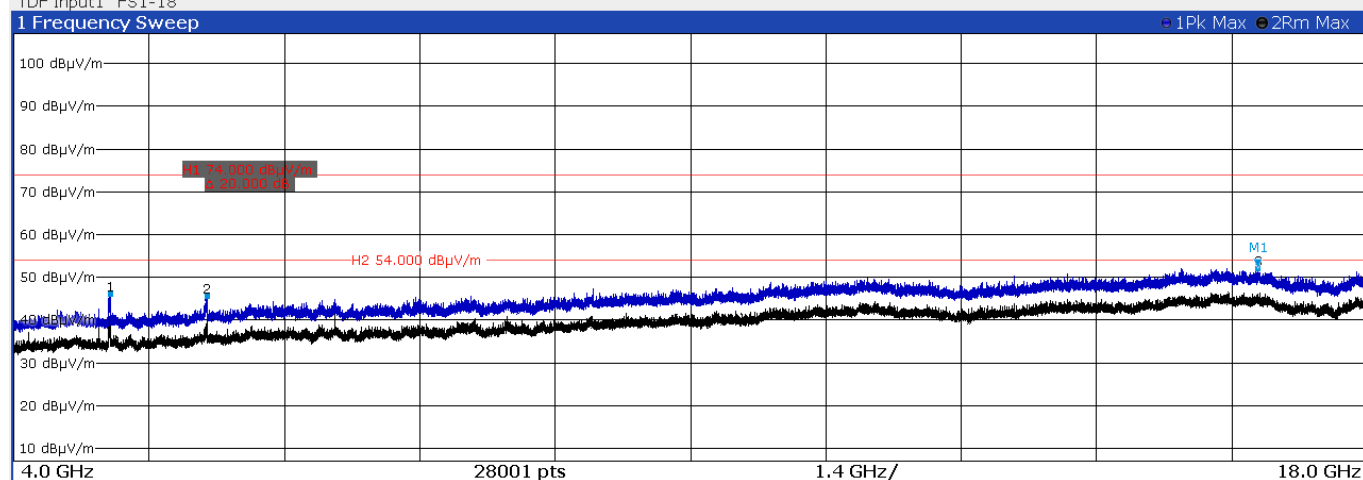
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1	1		2.44001 GHz	60.65 dBμV/m		
M2	1		2.39 GHz	37.96 dBμV/m		
M3	1		2.4835 GHz	38.09 dBμV/m		

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.142230 GHz	45.394 dBμV/m	6	2.072070 GHz	46.954 dBμV/m
2	1.201720 GHz	46.318 dBμV/m	7	2.081570 GHz	46.780 dBμV/m
3	1.938090 GHz	46.609 dBμV/m	8	2.125560 GHz	45.455 dBμV/m
4	1.996580 GHz	49.986 dBμV/m	9	2.440010 GHz	60.648 dBμV/m
5	2.041080 GHz	49.356 dBμV/m	10	2.657470 GHz	45.803 dBμV/m

CH17, 4 GHz – 18 GHz

Ref Level 107.00 dB μ V/m
Att 10 dB SWT 100 ms RBW 1 MHz
Input 1 AC PS On VBW 3 MHz Mode Auto Sweep
TDF Input1 "FS1-18"

Frequency 11.0000000 GHz



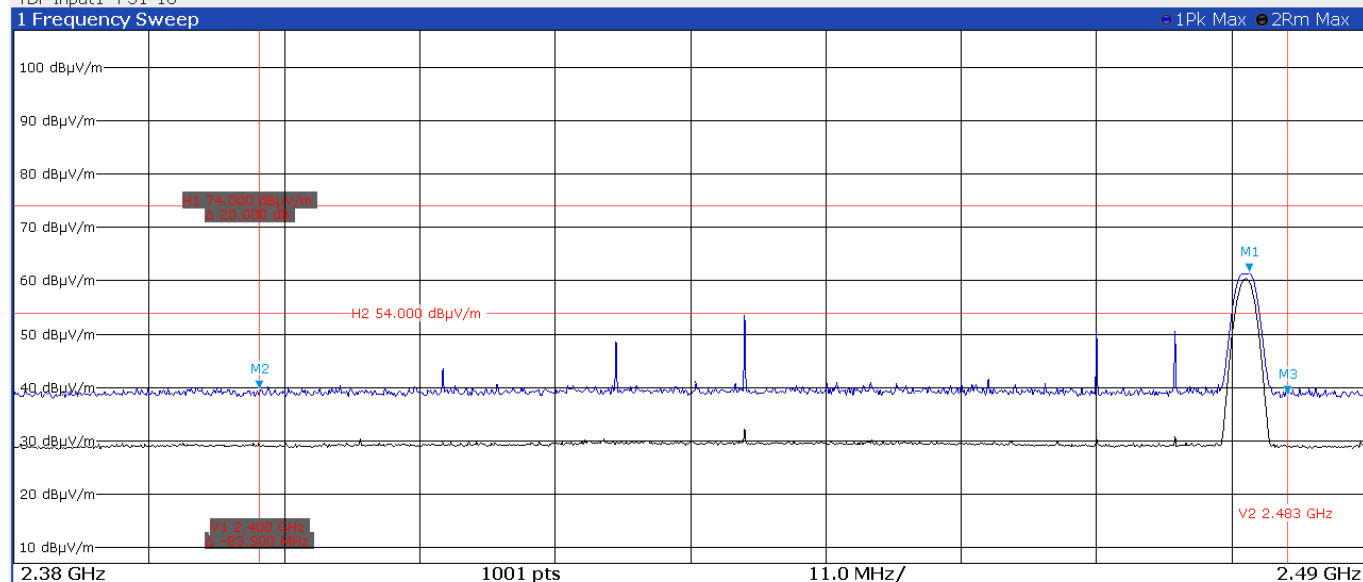
2 Marker Table						
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	16.86729 GHz	52.11 dB μ V/m		

3 Marker Peak List						
No	X-Value	Y-Value	No	X-Value	Y-Value	
1	4.995710 GHz	46.107 dB μ V/m	3	16.867290 GHz	52.106 dB μ V/m	
2	5.999680 GHz	45.562 dB μ V/m				

CH39, Band edge

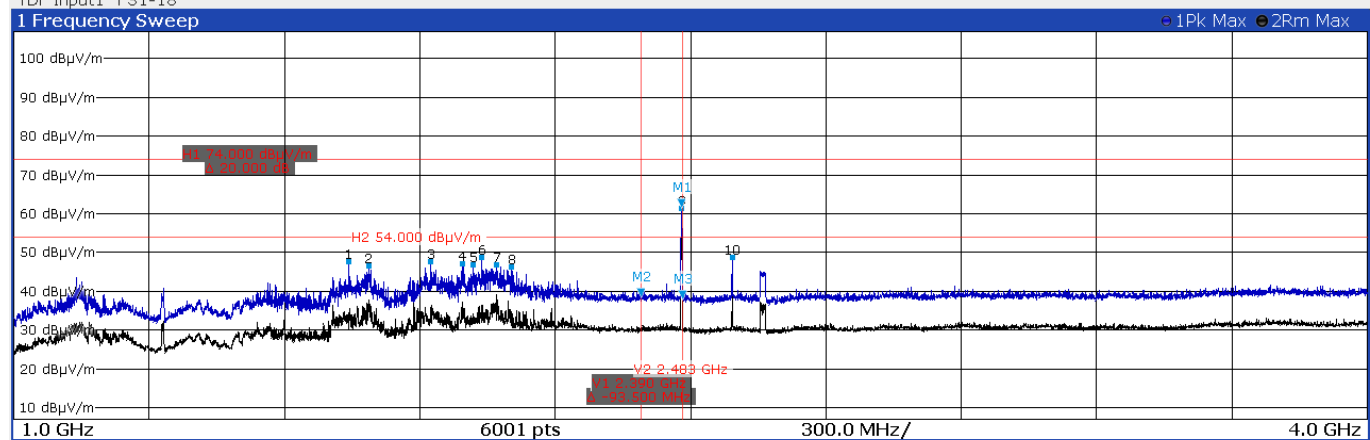
Ref Level 107.00 dB μ V/m
Att 10 dB SWT 100 ms RBW 1 MHz
Input 1 AC PS On VBW 3 MHz Mode Auto Sweep
TDF Input1 "FS1-18"

Frequency 2.4350000 GHz



2 Marker Table						
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.48038 GHz	61.46 dB μ V/m		
M2		1	2.4 GHz	39.48 dB μ V/m		
M3		1	2.4835 GHz	38.59 dB μ V/m		

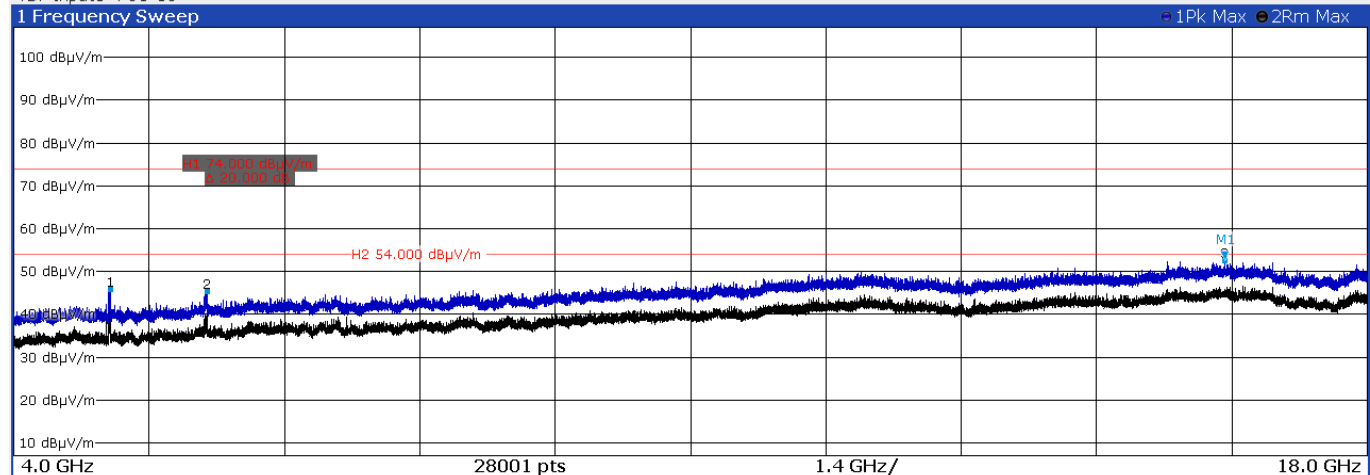
Ref Level 107.00 dBμV/m RBW 1 MHz
 Att 10 dB SWT 100 ms VBW 3 MHz Mode Auto Sweep
 Input 1 AC PS On Notch Off
 TDF Input1 "FS1-18" Frequency 2.500000 GHz



2 Marker Table						
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.480003 GHz	61.37 dBµV/m		
M2		1	2.39 GHz	38.43 dBµV/m		
M3		1	2.4835 GHz	37.83 dBµV/m		

3 Marker Peak List					
No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.742630 GHz	47.564 dBμV/m	6	2.037080 GHz	48.773 dBμV/m
2	1.786620 GHz	46.660 dBμV/m	7	2.070070 GHz	46.882 dBμV/m
3	1.924100 GHz	47.616 dBμV/m	8	2.104070 GHz	46.304 dBμV/m
4	1.993580 GHz	47.118 dBμV/m	9	2.480000 GHz	61.372 dBμV/m
5	2.018080 GHz	46.816 dBμV/m	10	2.592980 GHz	48.731 dBμV/m

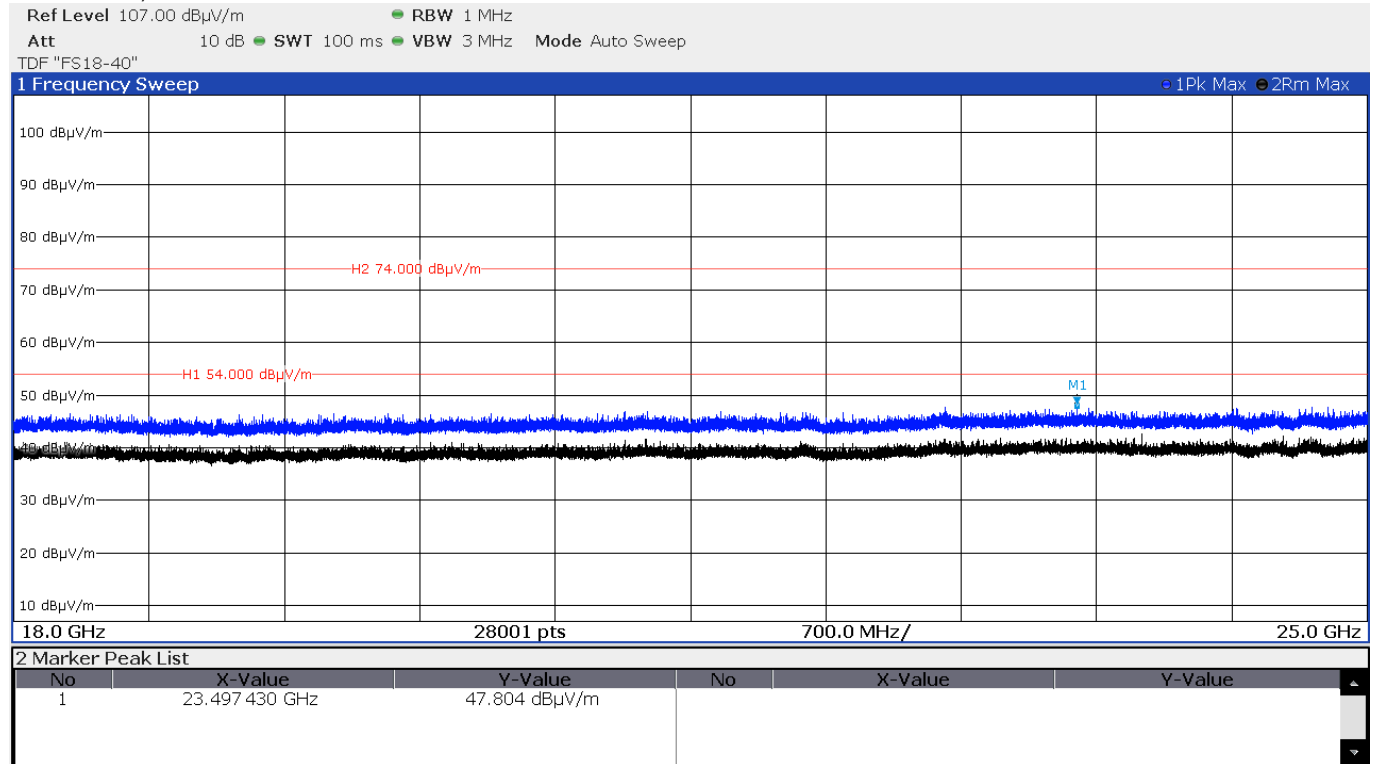
Ref Level 107.00 dBµV/m **RBW** 1 MHz
Att 10 dB **SWT** 100 ms **VBW** 3 MHz **Mode** Auto Sweep **Frequency** 11.000000 GHz
Input 1 AC **PS** On **Notch** Off
 TDF Input1 "FS1-18"



Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	16.524303 GHz	52.50 dBμV/m		

3 Marker Peak List					
No	X-Value	Y-Value	No	X-Value	Y-Value
1	4.998210 GHz	45.875 dBμV/m	3	16.524300 GHz	52.497 dBμV/m
2	5.998680 GHz	45.310 dBμV/m			

All channel, 18 GHz – 25 GHz



Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(µV/m)	dB(µV/m)	
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

RSS-Gen, Table 6 – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	12.57675 - 12.57725	399.9 - 410	7.250 - 7.750
0.495 - 0.505	13.36 - 13.41	608 - 614	8.025 – 8.500
2.1735 - 2.1905	16.42 - 16.423	960 - 1427	9.0 - 9.2
3.020 - 3.026	16.69475 - 16.69525	1435 - 1626.5	9.3 - 9.5
4.125 - 4.128	16.80425 - 16.80475	1645.5 - 1646.5	10.6 - 12.7
4.17725 - 4.17775	25.5 - 25.67	1660 - 1710	13.25 - 13.4
4.20725 - 4.20775	37.5 - 38.25	1718.8 - 1722.2	14.47 - 14.5
5.677 - 5.683	73 - 74.6	2200 - 2300	15.35 - 16.2
6.215 - 6.218	74.8 - 75.2	2310 - 2390	17.7 - 21.4
6.26775 - 6.26825	108 – 138	2483.5 - 2500	22.01 - 23.12
6.31175 - 6.31225	149.9 - 150.05	2655 - 2900	23.6 - 24.0
8.291 - 8.294	156.52475 - 156.52525	3260 – 3267	31.2 - 31.8
8.362 - 8.366	156.7 - 156.9	3332 - 3339	36.43 - 36.5
8.37625 - 8.38675	162.0125 - 167.17	3345.8 - 3358	Above 38.6
8.41425 - 8.41475	167.72 - 173.2	3500 - 4400	
12.29 - 12.293	240 – 285	4500 - 5150	
12.51975 - 12.52025	322 - 335.4	5350 - 5460	

The requirements are **FULFILLED**.

Remarks: The measurement was performed up to the 10th harmonic. Only the worst-case plots are listed.

5.5 Spurious emissions radiated

5.5.1 Applicable standard

According to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

The requirements are **FULFILLED**.

Remarks: All emissions comply the general limits of 5.4 in this test report. Therefore, spurious emissions
are not measured separately.

5.6 Antenna application

5.6.1 Applicable standard

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT has an integrated antenna. No other antenna can be used with the device.

The supplied antenna meets the requirements of part 15.203 and 15.204.

Remarks: N/A

5.7 Defacto EIRP-Limit

According to FCC Part 15C, Section 15.247(b)(4):

The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Defacto EIRP-Limit:

$$P_{out} = 30 - (G_x - 6);$$

The antenna is < 6 dBi gain, no Defacto limit applies.

The requirements are **FULFILLED**.

Remarks:

6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
CPC 3	FSW43	02-02/11-15-001	06/04/2022	06/04/2021		
CPR 3	AMF-6D-01002000-22-10P 3117 BAM 4.5-P NCD KK-SF106-2X11N-6,5M BAT-EMC 3.20.0.23	02-02/17-15-004 02-02/24-05-009 02-02/50-17-024 02-02/50-17-025 02-02/50-18-016 02-02/68-13-001	28/06/2021	28/06/2020		
SER 2	ESVS 30 VULB 9168 NW-2000-NB KK-EF393/U-16N-21N20 m KK-SD_7/8-2X21N-33,0M 50F-003 N 3 dB	02-02/03-05-006 02-02/24-05-005 02-02/50-05-113 02-02/50-12-018 02-02/50-15-028 02-02/50-21-010	09/07/2021 18/12/2021	09/07/2020 18/12/2020	07/07/2022	07/07/2021
SER 3	AMF-6D-01002000-22-10P 3117 BAM 4.5-P NCD KK-SF106-2X11N-6,5M BAT-EMC 3.20.0.23 ESW26	02-02/17-15-004 02-02/24-05-009 02-02/50-17-024 02-02/50-17-025 02-02/50-18-016 02-02/68-13-001 02-02/03-17-002	28/06/2023 10/02/2023	28/06/2022 10/02/2022		