EMI – TEST REPORT

- FCC Part 15.517, RSS-220 -

Type / Model Name	:	KINEXON Mesh Tag / T07001
Product Description	:	Tracking-Tag for an UWB localization system
Applicant	:	Kinexon Inc.
Address	:	200 S Wacker Drive, Suite 3100
		CHICAGO, IL 60606, USA
Manufacturer	:	Kinexon GmbH
Address	:	Schellingstraße 35
		80799 MÜNCHEN, GERMANY

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

Test Report No. : 80183169-06 Rev2	26. April 2024 Date of issue

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

FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

Contents

1 TEST STANDARDS 3

2 EQUIPMENT UNDER TEST 4

2.1 Information provided by the Client 4
2.2 Sampling 4
2.3 Photo documentation of the EUT – Detailed photos see ATTACHMENT A 4
2.4 Equipment type 4
2.5 Short description of the equipment under test (EUT) 4
2.6 Variants of the EUT 4
2.7 Operation frequency and channel plan 5
2.8 Transmit operating modes 5
2.9 Antenna 5
2.10 Power supply system utilised 5
2.11 Peripheral devices and interface cables 5
2.12 Determination of worst case conditions for final measurement 6

3 TEST RESULT SUMMARY 7

3.1 Revision history of test report 7
3.2 Final assessment 8

4 TEST ENVIRONMENT 9

4.1 Address of the test laboratory 9
4.2 Environmental conditions 9
4.3 Statement of the measurement uncertainty 9
4.4 Conformity Decision Rule 10
4.5 Measurement protocol for FCC and ISED 10

5 TEST CONDITIONS AND RESULTS 13

5.1 UWB Bandwidth 13
5.2 Radiated Emissions 9 kHz to 40 GHz 17
5.3 Radiated Emissions at 1164-1240 MHz and 1559-1610 MHz 25
5.4 Peak Power radiated 31

6 USED TEST EQUIPMENT AND ACCESSORIES 33

ATTACHMENT A as separate supplements

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (September 2021)

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.207	Conducted limits
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements

FCC Rules and Regulations Part 15, Subpart F – Ultra Wideband Operation (October 2021)

Part 15, Subpart F, Section 15.517	Technical requirements for indoor UWB systems
Part 15, Subpart F, Section 15.521	Technical requirements applicable to all UWB devices

Industry Canada – Radio equipment standards

RSS-Gen, Issue 5 + A1 + A2, March 2019	General Requirements for Compliance of Radio Apparatus
RSS-220, Issue 1 + A1, July 2018	Devices Using Ultra-Wideband (UWB) Technology

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 393764 D01 v02r01 (April 25, 2022)	Ultra-Wideband (UWB) Devices – Frequently Asked Questions

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 his/her instructions.

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

2.4 Equipment type

UWB Device for Indoor Use

2.5 Short description of the equipment under test (EUT)

The KINEXON Mesh system is a sophisticated real-time location system (RTLS) designed to provide precise tracking and asset management solutions. Tags are small devices equipped with UWB, BLE, and accelerometer functionalities. Devices affixed to assets that emit UWB beacons.

Number of tested samples:	1
Serial number:	pre-production sample #1 (cont. Tx on ch3) pre-production sample #10 (cont. Tx on ch5)
Firmware version:	V0.1.0

2.6 Variants of the EUT

According to the manufacturer, two different accelerometers as 1:1 replacement can be used in the EUT. For details, please refer to the user manual.

KNX-no.	Description	Comment
KNX-T7.1-1.1-1	Mesh Tag with accelerometer WSEN-ITDS	1:1 replacement for LIS2DE12, other supplier
KNX-T7.1-2.1-1	Mesh Tag with accelerometer LIS2DE12	1:1 replacement for WSEN-ITDS, other supplier

2.7 Operation frequency and channel plan

The operating frequency band is 3100 MHz to 10600 MHz.

Channel plan FCC:

Channel number	f_c (MHz)
Channel 3	4492.8
Channel 5	6489.6

Channel plan IC

Channel number	f_c (MHz)
Channel 5	6489.6

2.8 Transmit operating modes

Modulation: variable pulse position modulation (PPM) in combination with binary phase shift keying (BPSK).
Data rate: 6.8 Mbit/s

2.9 Antenna

The following antennas shall be used with the EUT:

Number	Characteristic	Model number	Plug	f-range (GHz)	Gain (dBi)
1	Omni	PCB antenna WB001	None	3.5 – 7.0	4.0 at 4.0 GHz 3.7 at 6.5 GHz

2.10 Power supply system utilised

Power supply voltage, V_{nom} : 3.0 V DC

2.11 Peripheral devices and interface cables

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

- --- Model : ---

2.12 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes with horizontal and vertical antenna positions to determine the worst case condition.

X

Y

Z

2.12.1 Test jig

No test jig is used.

2.12.2 Test software

The test modes of the EUTs are provided by the manufacturer.

3 TEST RESULT SUMMARY

FCC Rule Part	RSS Rule Part	Description	Result
15.207(a) 15.521(j)	RSS-Gen, 8.8	AC power line conducted emissions	not applicable *1
15.517(b) 15.521(e)	RSS-220, 2, 5.1(a)	UWB Bandwidth	passed
---	RSS-Gen, 6.6	99 % Bandwidth	passed
15.209(a) 15.517(c) 15.521(c)(d)(h)	RSS-Gen, 8.9 RSS-220, 3.4, 5.2.1(c), 5.2.1(d)	Radiated Emissions 9 kHz to 40 GHz	passed
15.517(d)	RSS-220, 5.2.1(e)	Radiated Emissions at 1164-1240 MHz and 1559-1610 MHz	passed
15.517(e) 15.521(g)	RSS-220, 5.2.1(g)	Peak Power radiated	passed
15.203 15.521(b)	---	Antenna requirement	not applicable *2
15.204 15.521(b)	---	External radio frequency power amplifiers and antenna modifications	not applicable *2
15.521(a)(f)(i)	---	Technical requirements applicable to all UWB devices	not applicable *3

*1 Not applicable, the EUT can not be connected to the public utility (AC) power line.

*2 According to the applicant, the EUT has an internal PCB antenna. No other antennas can be connected to the EUT. Therefor, the requirements are regarded as fulfilled.
The EUT uses a unique coupling for its external antenna (reverse polarity xyz connector) and no standard aerial socket. Therefor, the requirements are regarded as fulfilled.

*3 According to the applicant, the EUT will be used indoor only. The EUT is no imaging system. For details refer to the user manual.

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80183169-06	0	15 December 2023	Initial test report
80183169-06	1	18 March 2024	Clause 2.6: Clarification of variants. Clause 4.5.2.2.4: height of EUT corrected to 1.5 m.
80183169-06	2	26 April 2024	Clause 5: OBW99% measurements data updated

The test report with the highest revision number replaces the previous test reports.

3.2 Final assessment

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

Date of receipt of test sample	:	acc. to storage records
Testing commenced on	:	19 September 2023
Testing concluded on	:	29 November 2023

Checked by:

Klaus Gegenfurtner
I confirm the correctness and integrity of this document
2024.04.26 09:46:33 +02'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

I am the author of this document
2024.04.26 09:26:01 +02'00'

Franz-Xaver Schrettenbrunner
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 on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. 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%	± 3.29 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%	± 3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 3.71 dB
Radiated Spurious Emissions	1000 MHz to 10000 MHz	95%	± 2.34 dB
Peak conducted output power	902 MHz to 928 MHz	95%	± 0.35 dB
Conducted Spurious Emissions	9 kHz to 10000 MHz	95%	± 2.15 dB

4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule (w = 0).
Details can be found in the procedure CSA_B_V50_29.

4.5 Measurement protocol for FCC and ISED

4.5.1 General information

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

FCC: DE 0011
ISED: DE0009

4.5.2 General Standard information

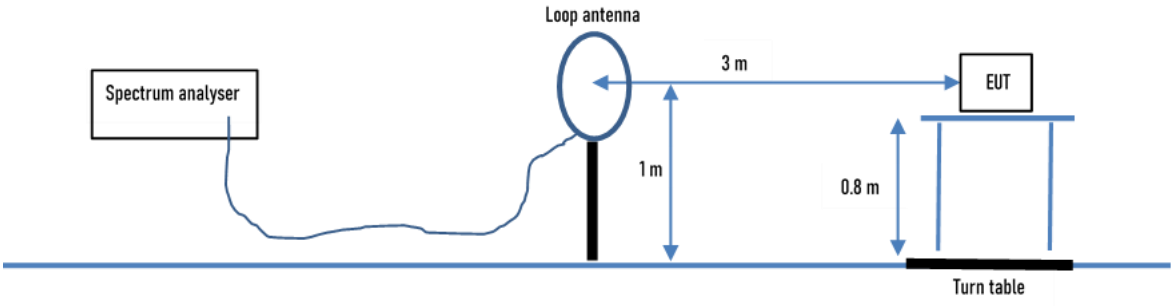
The test methods used comply with ANSI C63.10 - "Testing Unlicensed Wireless Devices".

4.5.2.1 Justification

The equipment under test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

4.5.2.2 Radiated emission

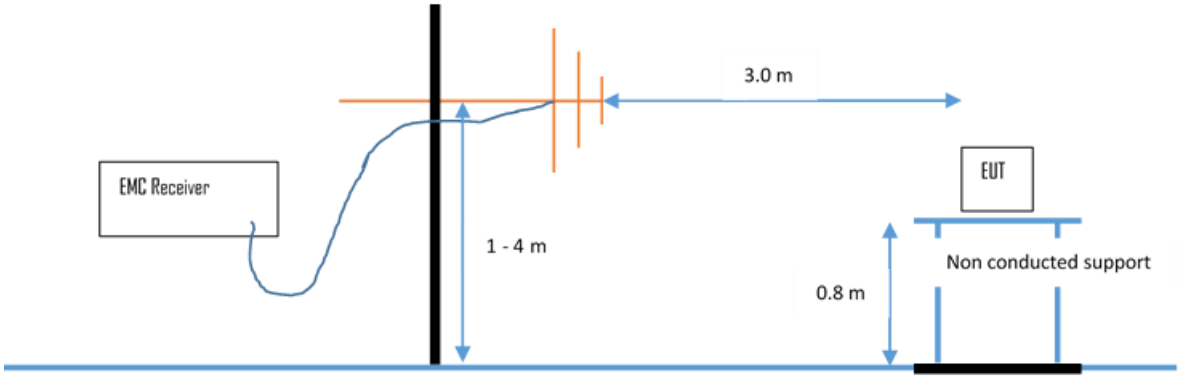
4.5.2.2.1 OATS1 test site (9 kHz - 30 MHz):
Test setup according ANSI C63.10



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.

4.5.2.2.2 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 dBµV/m is calculated by taking the reading from the EMI receiver (Level dBµV) 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.

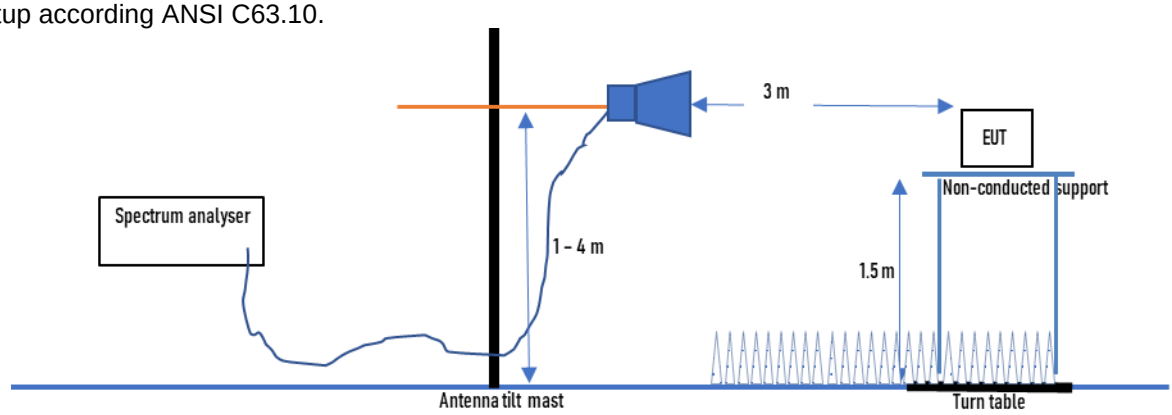
The resolution bandwidth setting:
30 MHz – 1000 MHz: RBW: 120 kHz

Example:

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

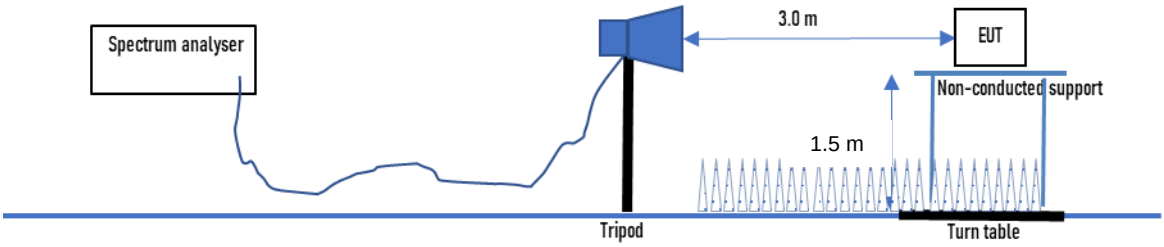
4.5.2.2.3 Anechoic chamber 1 (1000 MHz – 18000 MHz)

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 center, forming a bundle 30 cm to 40 cm long. Measurements are made in 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.

4.5.2.2.4 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 center, forming a bundle 30 cm to 40 cm long. Measurements are made in 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 are adopted.

5 TEST CONDITIONS AND RESULTS

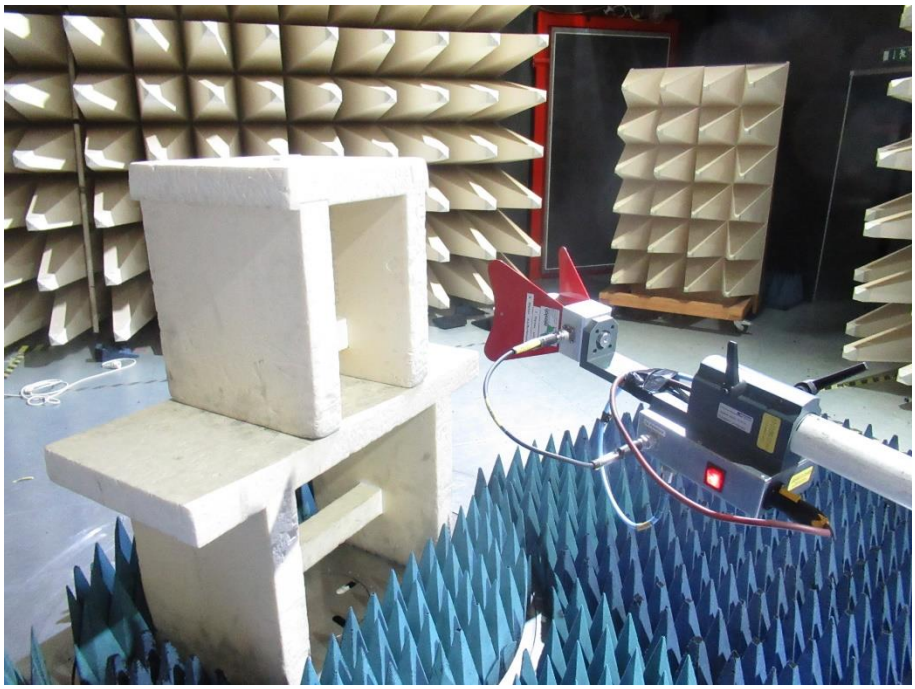
5.1 UWB Bandwidth

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 15.517(b):
The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

According to FCC Part 15, Section 15.503(d):
Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

5.1.4 Description of Measurement

The bandwidth is measured following the procedure set out in ANSI C63-10, Item 10.1. The measurement was performed radiated at a distance of 3 m. The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -10 dB. The EUT is set in TX continuous mode while measuring.

Spectrum analyser settings:

EBW:	RBW: 1 MHz,	VBW: 3 MHz,	Detector: Peak
OBW:	RBW: 10 MHz,	VBW: 28 MHz,	Detector: Peak

5.1.5 Test result

channel	lowest frequency f_L (MHz)	highest frequency f_H (MHz)	permitted frequency range (GHz)	UWB bandwidth (MHz)	required UWB bandwidth (MHz)	OBW 99%	result
3	4228.24	4806.35	3.1 – 10.6	578.11	> 500	679.74	passed
5	6145.38	6834.33	3.1 – 10.6	688.66	> 500	818.78	passed

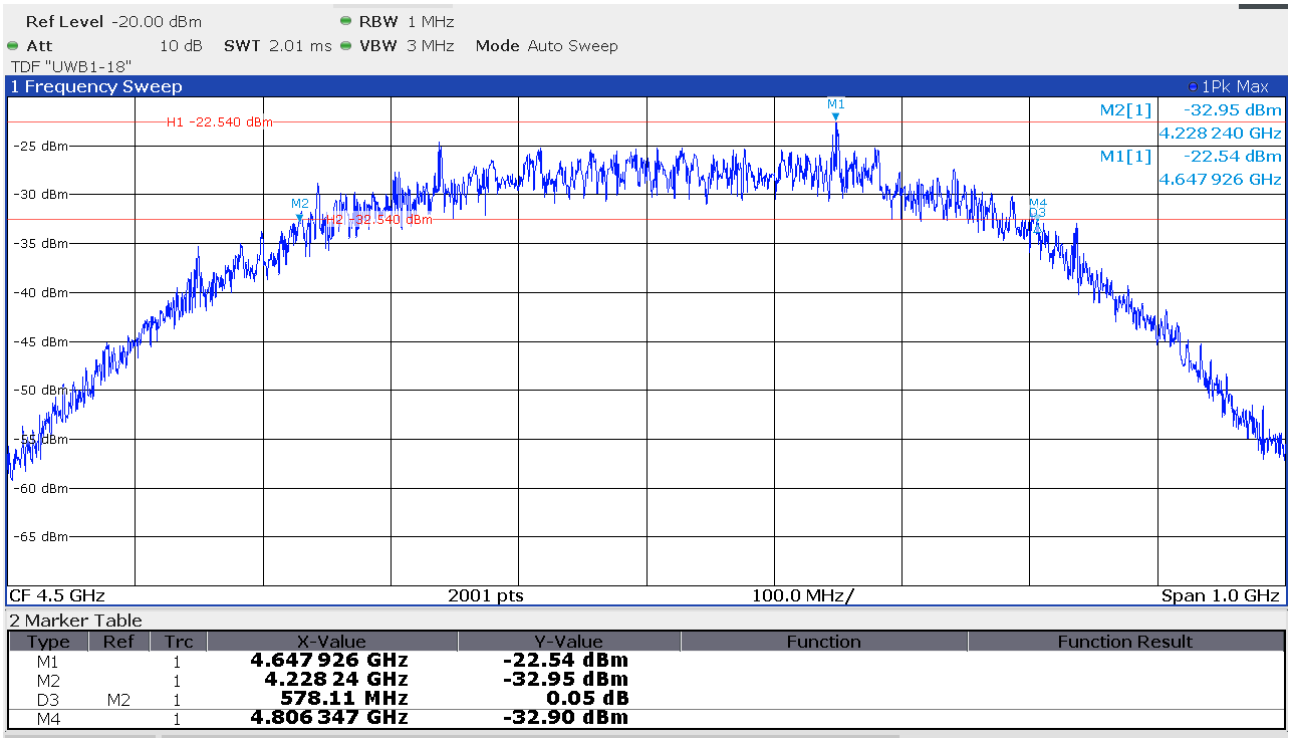
The requirements are **FULFILLED.**

Remarks: For detailed test results please refer to following test protocols.

FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

5.1.6 Test protocols EBW

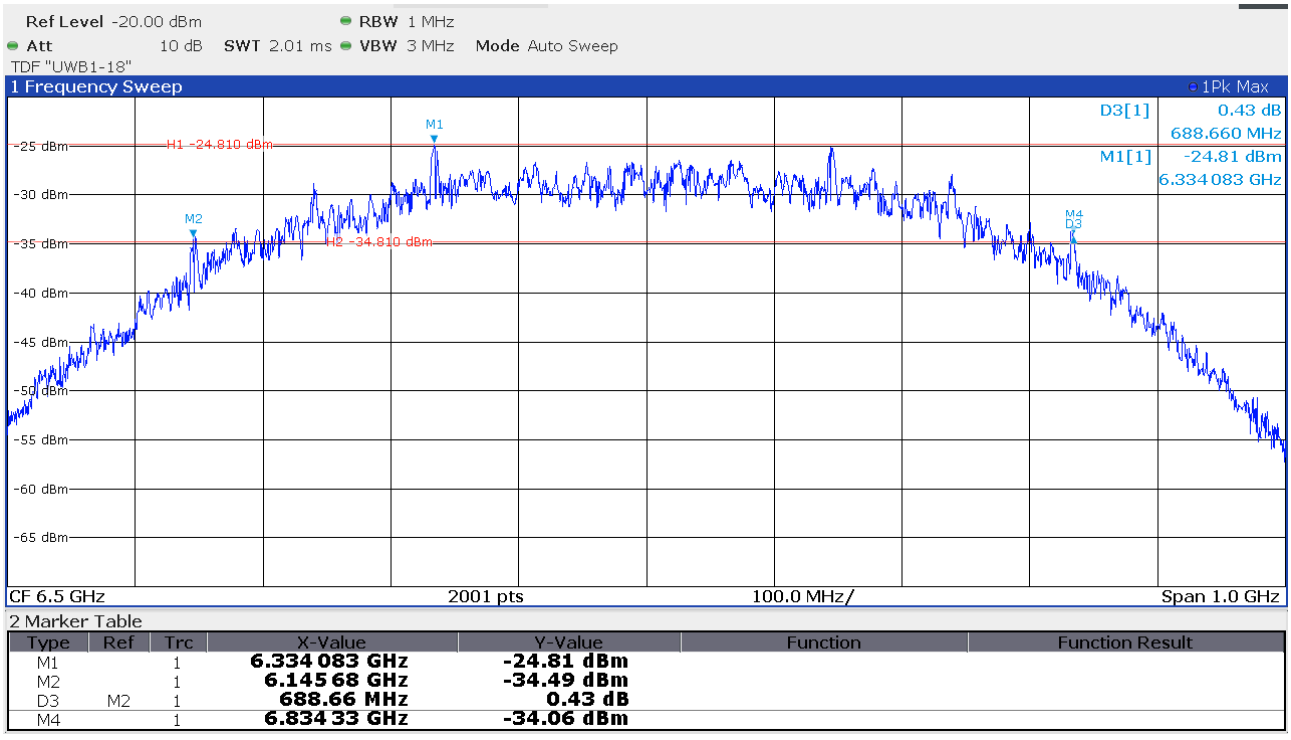
Channel 3



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	4.647 926 GHz	-22.54 dBm		
M2		1	4.228 24 GHz	-32.95 dBm		
D3	M2	1	578.11 MHz	0.05 dB		
M4		1	4.806 347 GHz	-32.90 dBm		

Channel 5



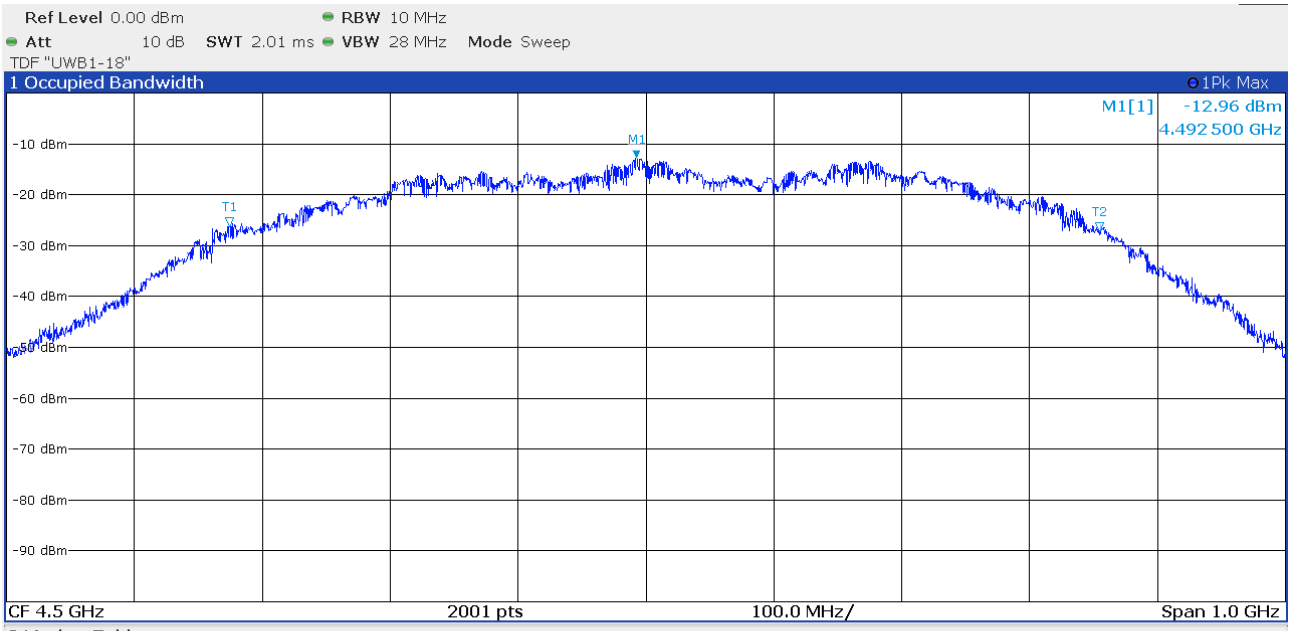
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	6.334 083 GHz	-24.81 dBm		
M2		1	6.145 68 GHz	-34.49 dBm		
D3	M2	1	688.66 MHz	0.43 dB		
M4		1	6.834 33 GHz	-34.06 dBm		

FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

5.1.7 Test protocols EBW

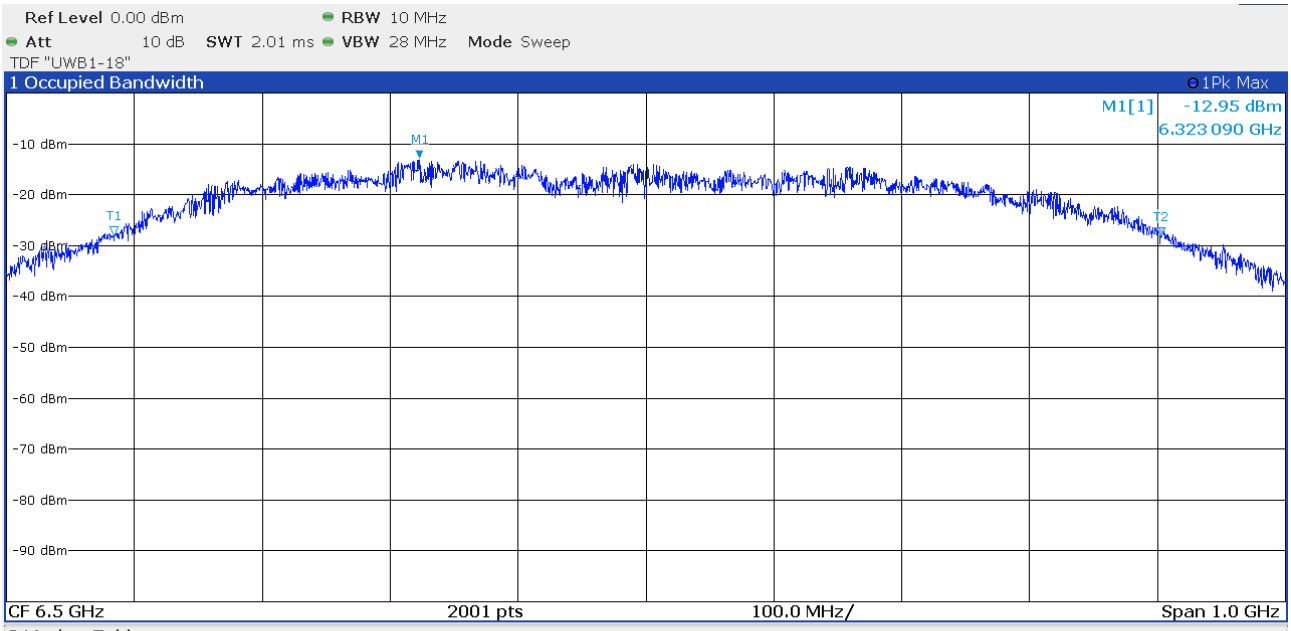
Channel 3



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**4.492 5 GHz**	**-12.96 dBm**	Occ Bw	**679.737 626 376 MHz**
T1		1	4.174 564 GHz	-26.30 dBm	Occ Bw Centroid	4.514 432 918 GHz
T2		1	4.854 302 GHz	-27.25 dBm	Occ Bw Freq Offset	14.432 918 151 MHz

Channel 5



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**6.323 09 GHz**	**-12.95 dBm**	Occ Bw	**818.783 752 005 MHz**
T1		1	6.083 932 GHz	-28.07 dBm	Occ Bw Centroid	6.493 323 794 GHz
T2		1	6.902 716 GHz	-28.27 dBm	Occ Bw Freq Offset	-6.676 206 409 MHz

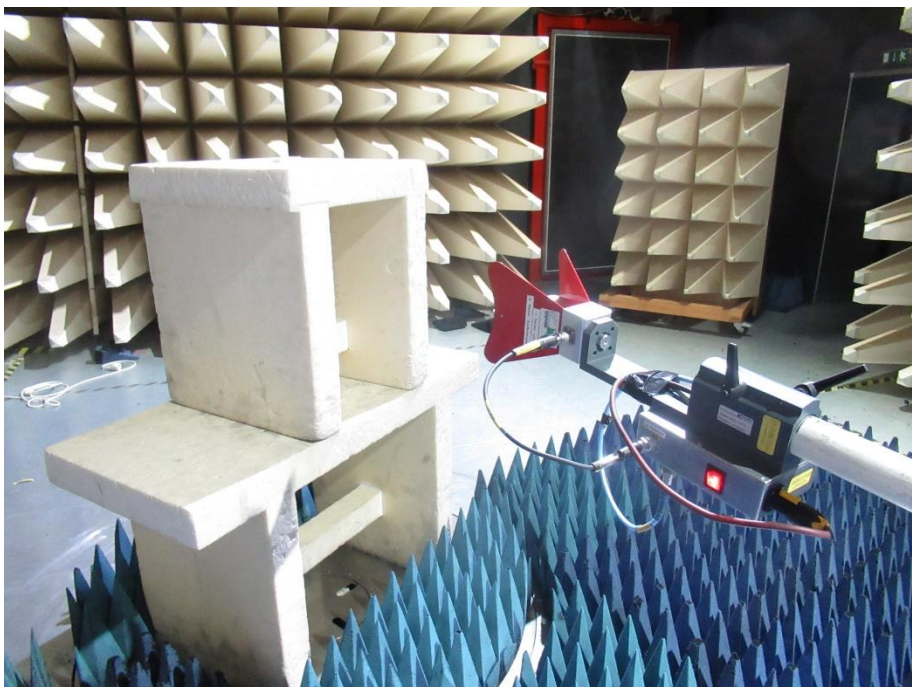
5.2 Radiated Emissions 9 kHz to 40 GHz

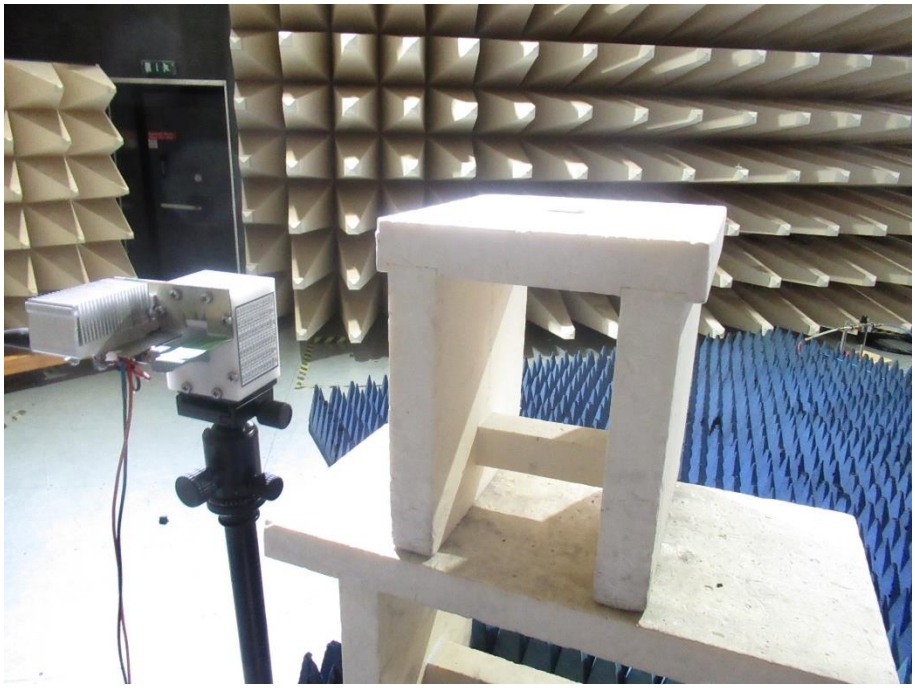
For test instruments and accessories used see section 6 Part **SER 2** and **SER 3**.

5.2.1 Description of the test location

Test location: OATS 1
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 15.517(c):
The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.

According to FCC Part 15, Section 15.521(c):
Emissions from digital circuitry used to enable the operation of the UWB transmitter shall comply with the limits in § 15.209, rather than the limits specified in this subpart, provided it can be clearly demonstrated that those emissions from the UWB device are due solely to emissions from digital circuitry contained within the transmitter and that the emissions are not intended to be radiated from the transmitter's antenna. Emissions from associated digital devices, as defined in § 15.3(k), e.g., emissions from digital circuitry used to control additional functions or capabilities other than the UWB transmission, are subject to the limits contained in Subpart B of this part.

5.2.4 Description of Measurement

The maximum emission is measured following the procedure set out in ANSI C63-10, item 10.2. The EUT is set in TX continuous mode while measuring.

Analyser settings:

9 kHz – 150 kHz	RBW: 200 Hz			
150 kHz - 30 MHz	RBW: 9 kHz			
30 MHz – 960 MHz	RBW: 120 kHz	Detector: QP		
960 MHz – 40 GHz	RBW: 1 MHz	VBW: 3 MHz	Detector: RMS	Sweeptime: 1ms per MHz

for § 15.521(c) additionally:

960 MHz – 40 GHz	RBW: 1 MHz	VBW3: MHz	Detector: Peak/Av	Sweeptime: 100 ms

5.2.5 Test result

5.2.5.1 Measurement 9 kHz to 30 MHz

Note: Pre-measurements have shown, there are no detectable emissions in this frequency range. Emissions in this frequency range can be excluded because of the physical dimension of the EUT.

5.2.5.2 Measurement 30 MHz to 960 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)
150.00	3.5	3.9	19.5	18.9	23.0	22.8	43.5	-20.5
300.00	-3.5	1.2	20.2	20.8	16.7	22.0	46.0	-24.0
450.00	-8.3	-5.5	24.6	24.9	16.3	19.4	46.0	-26.6
600.00	-8.1	-4.4	28.3	28.6	20.2	24.2	46.0	-21.8
750.00	-8.0	-4.3	30.7	31.1	22.7	26.8	46.0	-19.2
900.00	-9.5	-9.3	32.9	33.4	23.4	24.1	46.0	-21.9

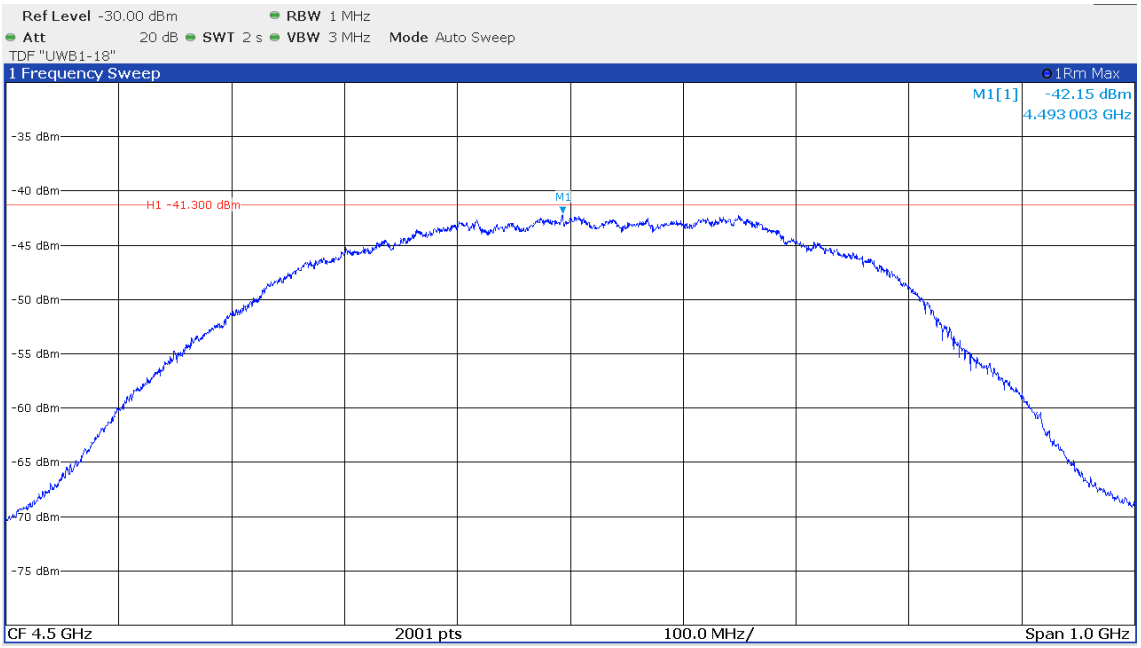
Note: Pre-scans show that no significant emissions occur in the frequency range from 30 MHz to 1000 MHz, independent on the operation mode of the EUT or channel. All recorded values represent the noise level of the test site.

5.2.5.3 Measurement 960 MHz to 40 GHz

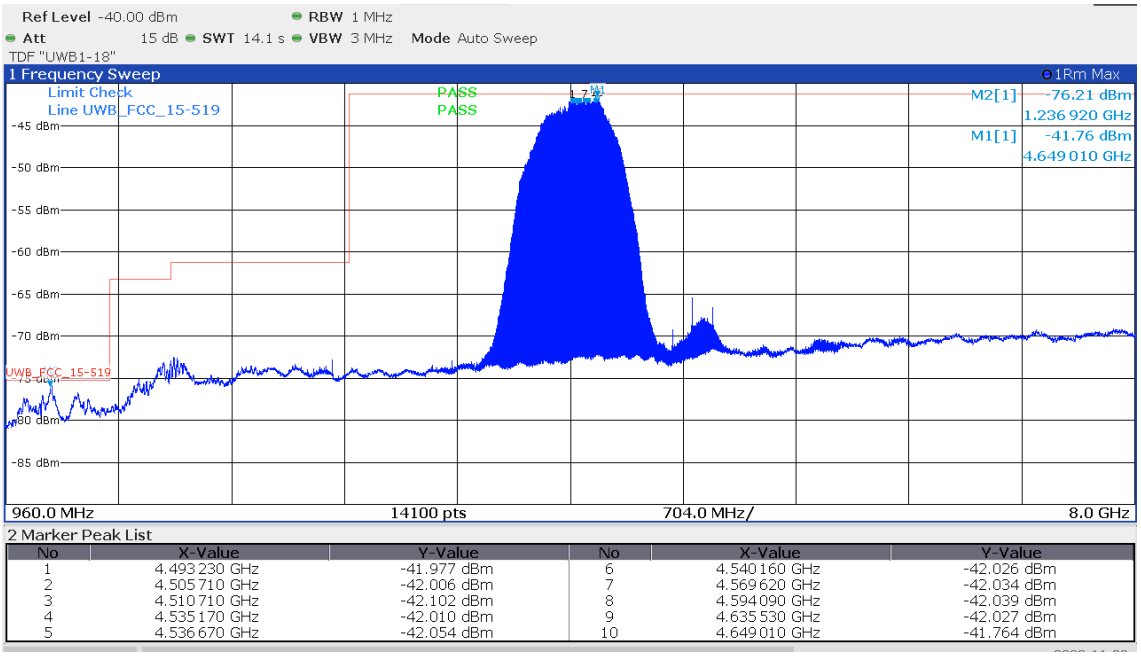
According to § 15.521(c), missions from digital circuitry used to enable the operation of the UWB transmitter shall comply with the limits in § 15.209. The average limit is given by 54 dBµV/m at 3 meter distance, which corresponds to an EIRP of -41.3 dBm according to ANSI C63.10 2013 clause 10.3.9.
As proven in the following measurements, no emissions outside the UWB transmission can be detected in the frequency range 960 MHz and 40 GHz and the highest emissions occurs by the UWB emission itself, which lies under the UWB limit of -41.3 dBm. Therefore, the requirements according to § 15.209 can be regarded as fulfilled.

Channel 3

Mean Power



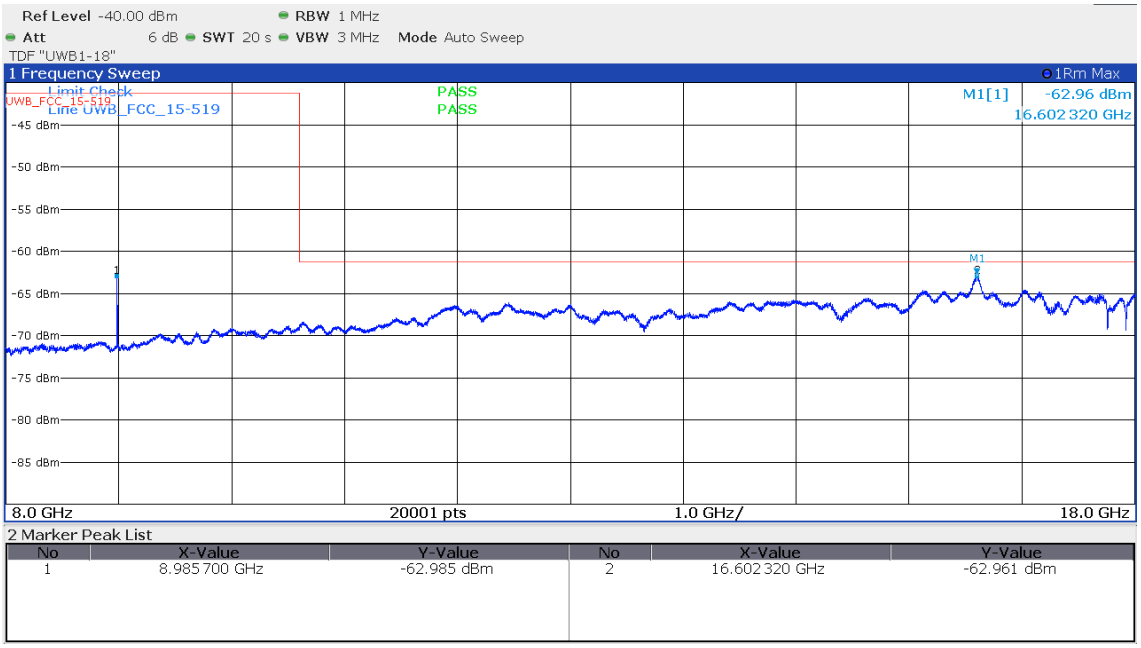
960 MHz to 18 GHz



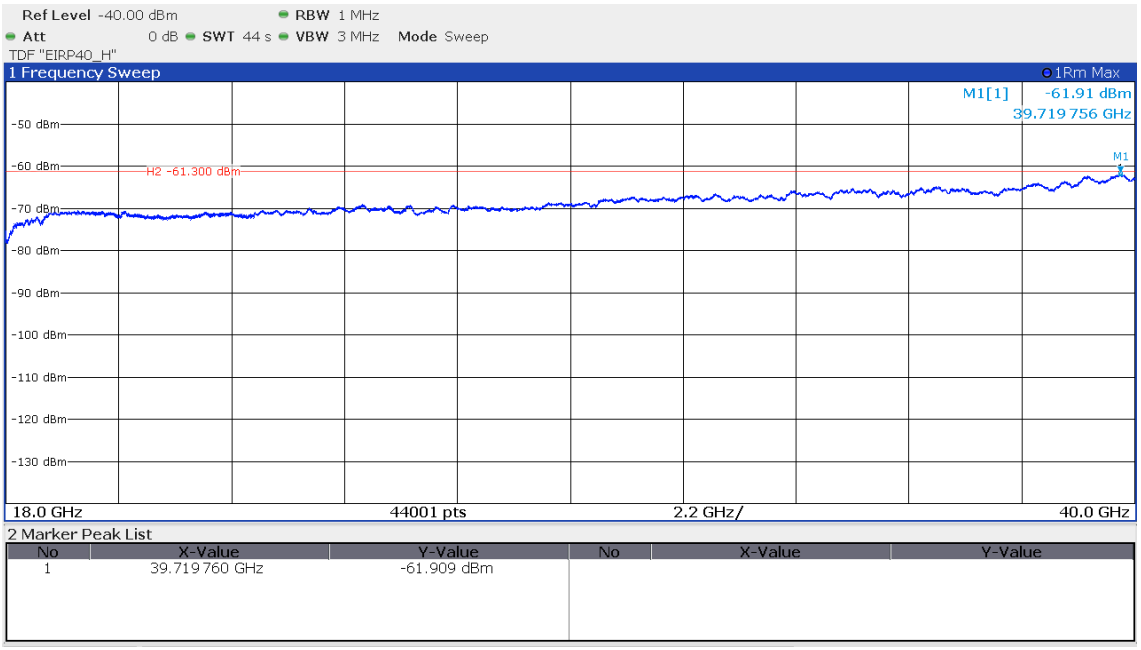
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	4.493 230 GHz	-41.977 dBm	6	4.540 160 GHz	-42.026 dBm
2	4.505 710 GHz	-42.006 dBm	7	4.569 620 GHz	-42.034 dBm
3	4.510 710 GHz	-42.102 dBm	8	4.594 090 GHz	-42.039 dBm
4	4.535 170 GHz	-42.010 dBm	9	4.635 530 GHz	-42.027 dBm
5	4.536 670 GHz	-42.054 dBm	10	4.649 010 GHz	-41.764 dBm

FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1



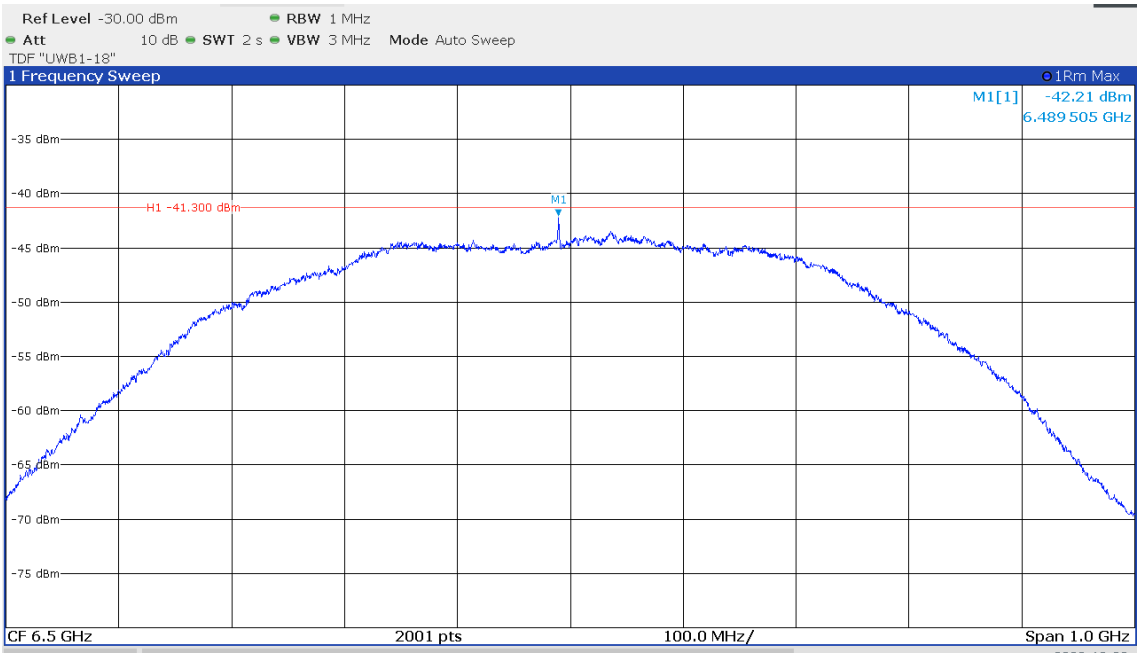
18 GHz to 40 GHz



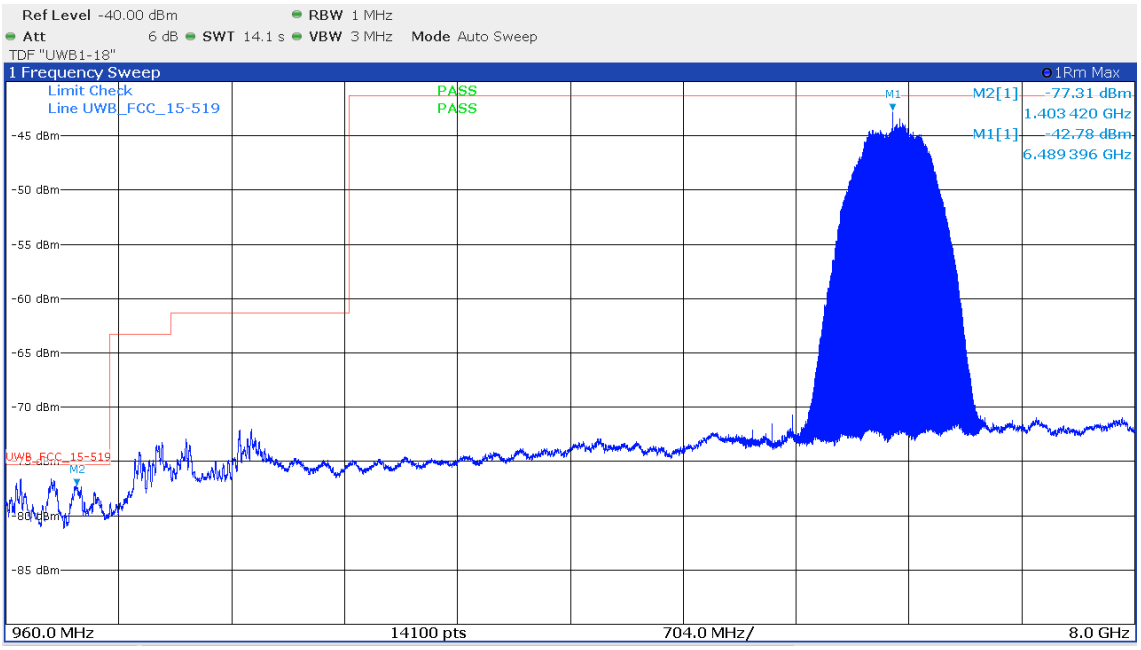
FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

Channel 5

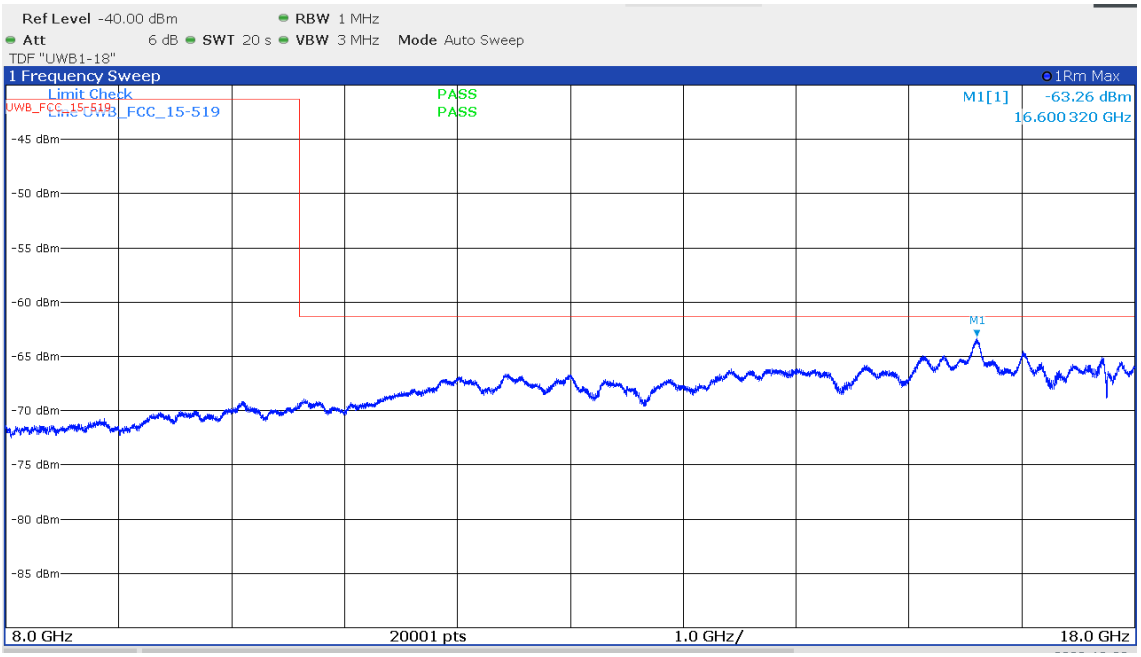
Mean Power



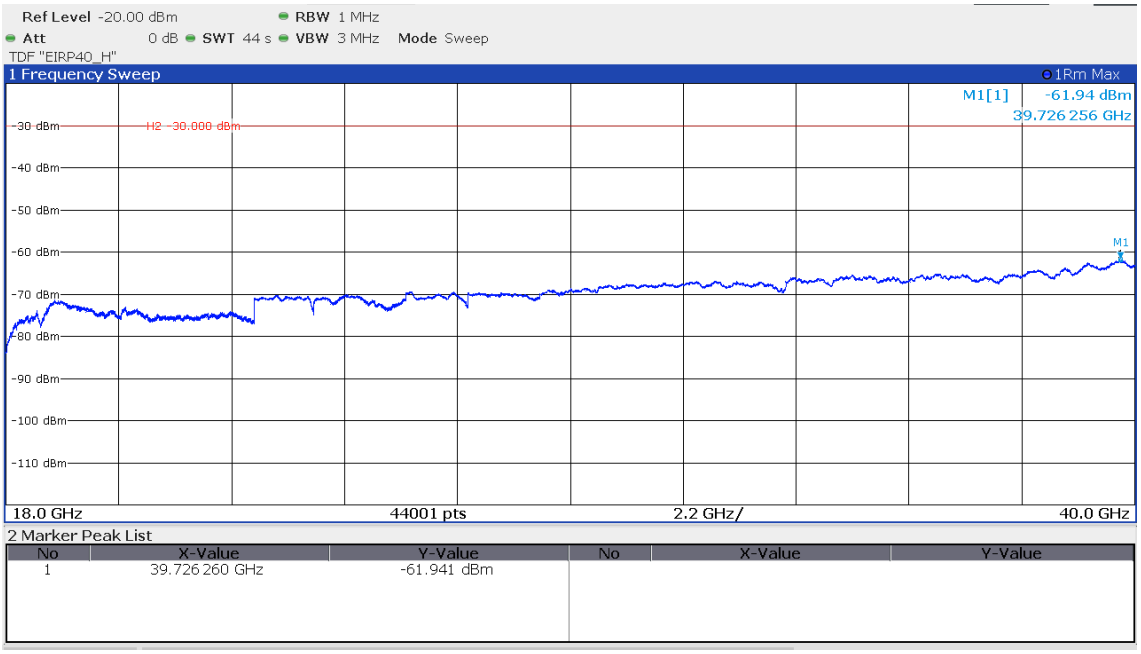
960 MHz to 18 GHz



FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1



18 GHz to 40 GHz



FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

Limits:

Limit according §15.209(a) in the frequency range 9 kHz 960 MHz:

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

Limit according §15.517(c) in the frequency range 960 MHz to 40 GHz:

Frequency in MHz	EIRP in dBm
960-1610	−75.3
1610-1990	−53.3
1990-3100	−51.3
3100-10600	−41.3
Above 10600	−51.3

Limit according RSS-220 5.2.1 (d) in the frequency range 960 MHz to 40 GHz:

Frequency in MHz	EIRP in dBm
960-1610	−75.3
1610-4750	−70.0
4750-10600	−41.3
Above 10600	−51.3

The requirements are **FULFILLED.**

Remarks: The tighter limit of -61.3 dBm of hand-held devices is shown in the plots.

All emissions for ch5 between 1610 MHz and 4750 MHz are under RSS-220 limit of -70.0 MHz.

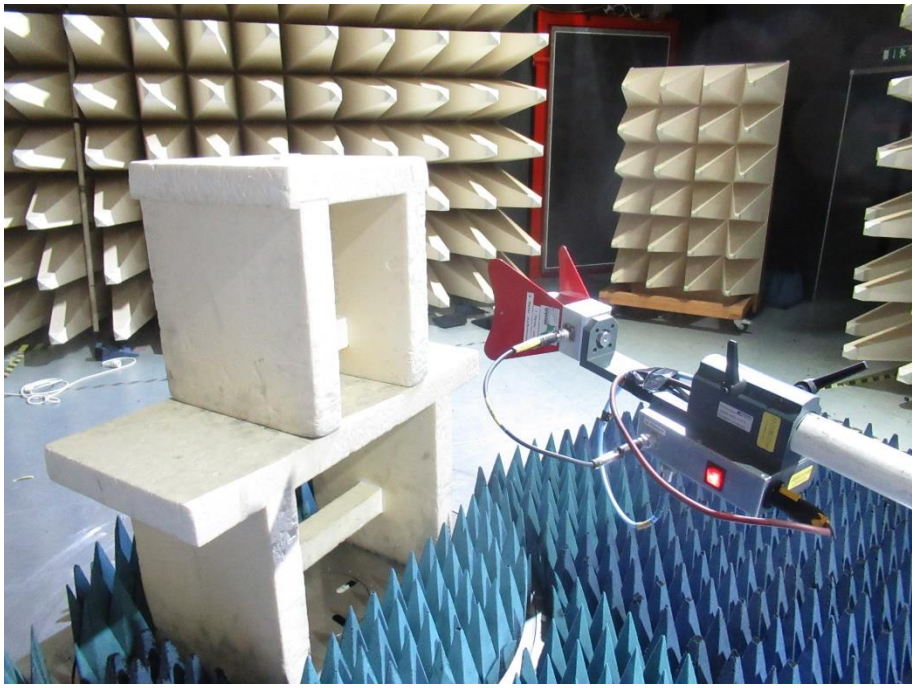
5.3 Radiated Emissions at 1164-1240 MHz and 1559-1610 MHz

For test instruments and accessories used see section 6 Part **SER 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 15.517(d):
In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz.

5.3.4 Description of Measurement

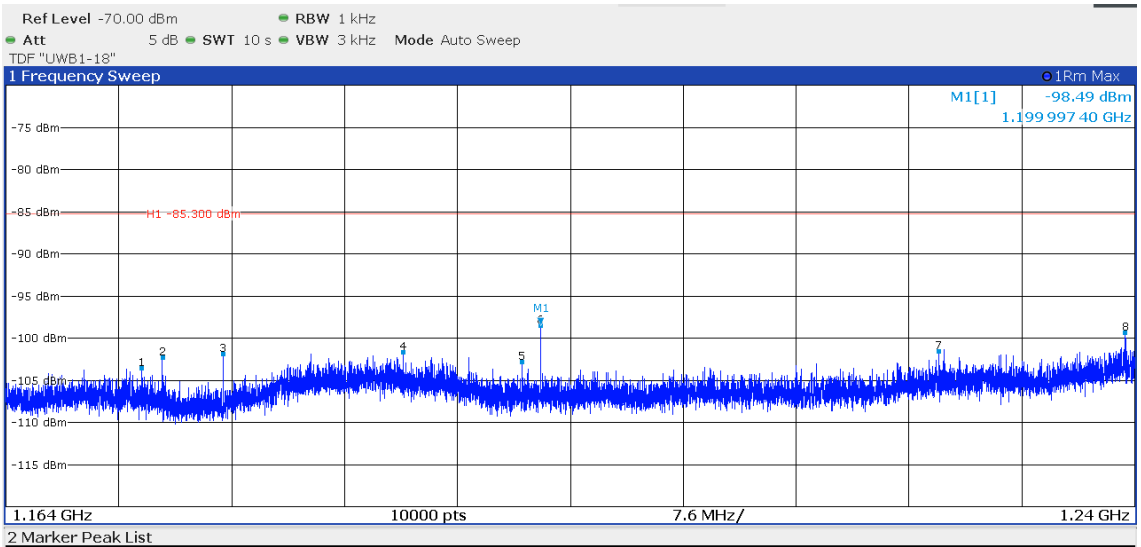
The spectral line is measured following the procedure set out in ANSI C63-10, item 10.3.10. The EUT is set in TX continuous mode while measuring.

Analyser settings:
RBW: 1 kHz, VBW: 3 kHz, Detector: RMS, Sweep time: 1 ms/1kHz,

5.3.5 Test result

Channel 3:

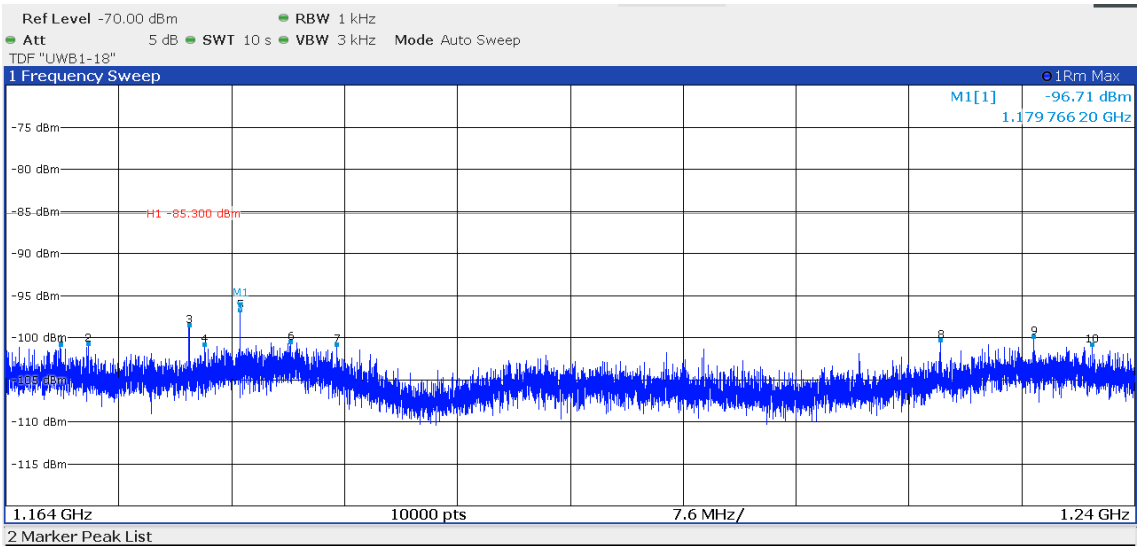
1164 MHz to 1240 MHz horizontal



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.173 147 GHz	-103.624 dBm	5	1.198 736 GHz	-102.884 dBm
2	1.174 537 GHz	-102.288 dBm	6	1.199 997 GHz	-98.486 dBm
3	1.178 611 GHz	-101.869 dBm	7	1.226 803 GHz	-101.598 dBm
4	1.190 771 GHz	-101.647 dBm	8	1.239 350 GHz	-99.401 dBm

1164 MHz to 1240 MHz vertical

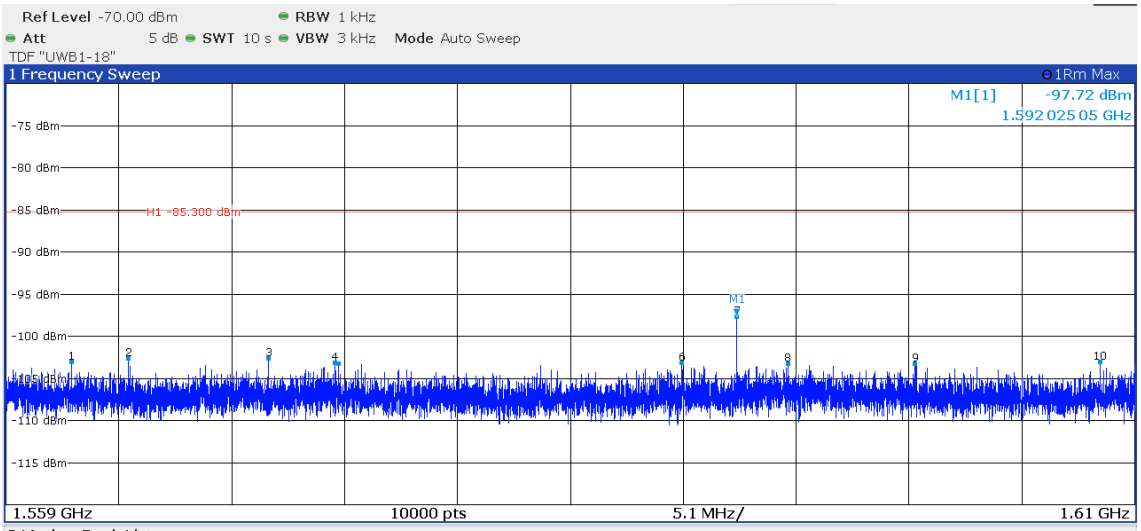


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.167 675 GHz	-100.872 dBm	6	1.183 186 GHz	-100.538 dBm
2	1.169 552 GHz	-100.772 dBm	7	1.186 272 GHz	-100.802 dBm
3	1.176 331 GHz	-98.489 dBm	8	1.226 932 GHz	-100.357 dBm
4	1.177 387 GHz	-100.824 dBm	9	1.233 194 GHz	-99.890 dBm
5	1.179 766 GHz	-96.707 dBm	10	1.237 139 GHz	-100.793 dBm

FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

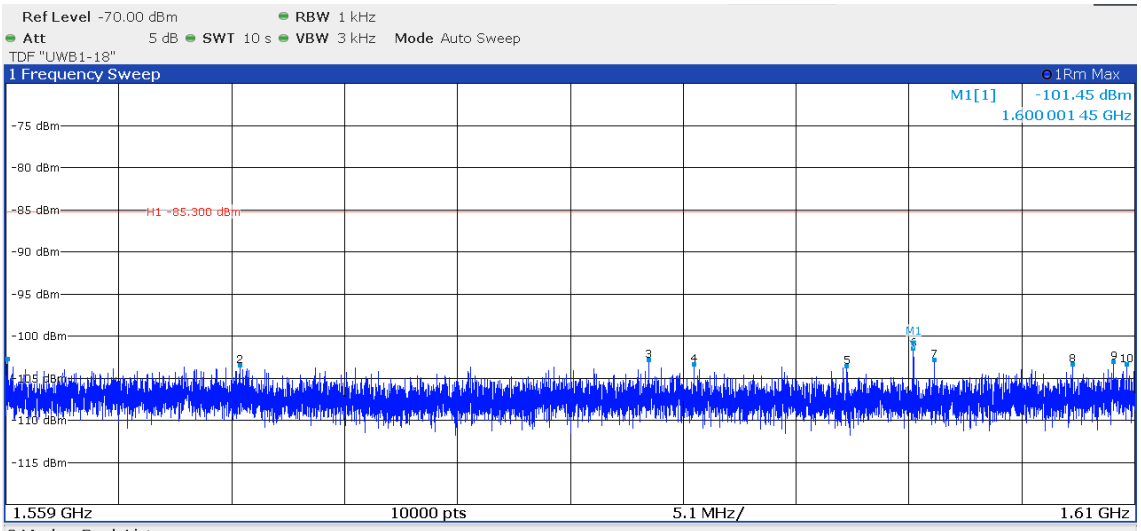
1559 MHz to 1610 MHz horizontal



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.561 981 GHz	-103.078 dBm	6	1.589 541 GHz	-103.191 dBm
2	1.564 541 GHz	-102.590 dBm	7	1.592 025 GHz	-97.724 dBm
3	1.570 875 GHz	-102.594 dBm	8	1.594 320 GHz	-103.279 dBm
4	1.573 849 GHz	-103.210 dBm	9	1.600 083 GHz	-103.254 dBm
5	1.574 027 GHz	-103.250 dBm	10	1.608 427 GHz	-103.014 dBm

1559 MHz to 1610 MHz vertical



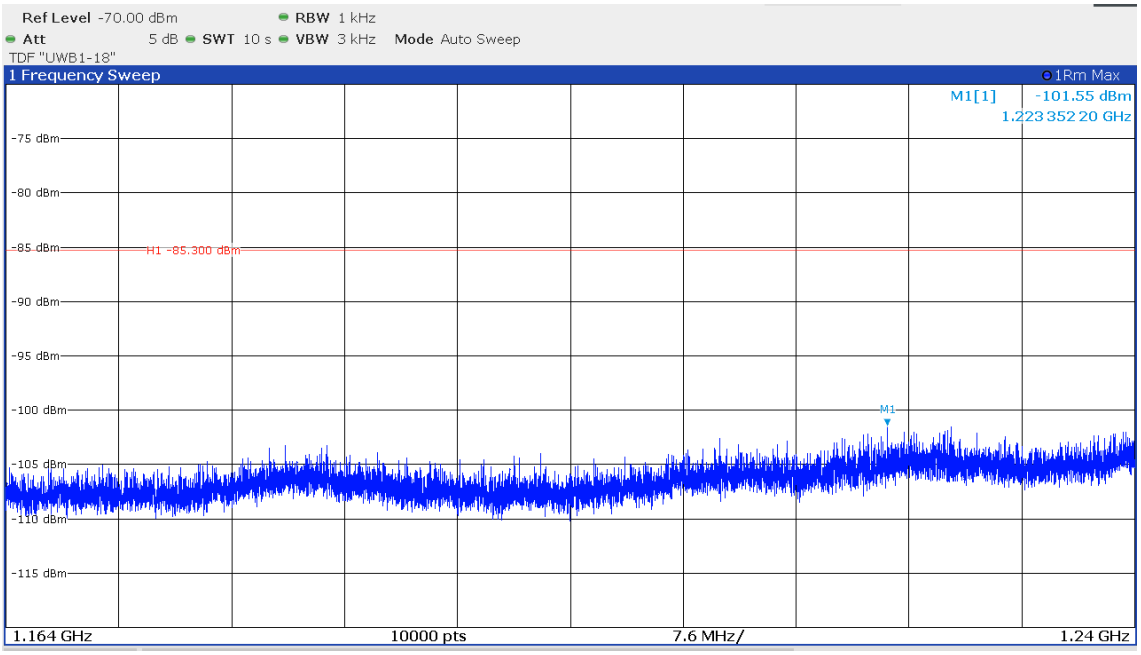
2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	1.559 064 GHz	-102.735 dBm	6	1.600 002 GHz	-101.449 dBm
2	1.569 565 GHz	-103.496 dBm	7	1.600 940 GHz	-102.882 dBm
3	1.588 037 GHz	-102.828 dBm	8	1.607 193 GHz	-103.398 dBm
4	1.590 082 GHz	-103.371 dBm	9	1.609 054 GHz	-103.035 dBm
5	1.596 998 GHz	-103.533 dBm	10	1.609 635 GHz	-103.367 dBm

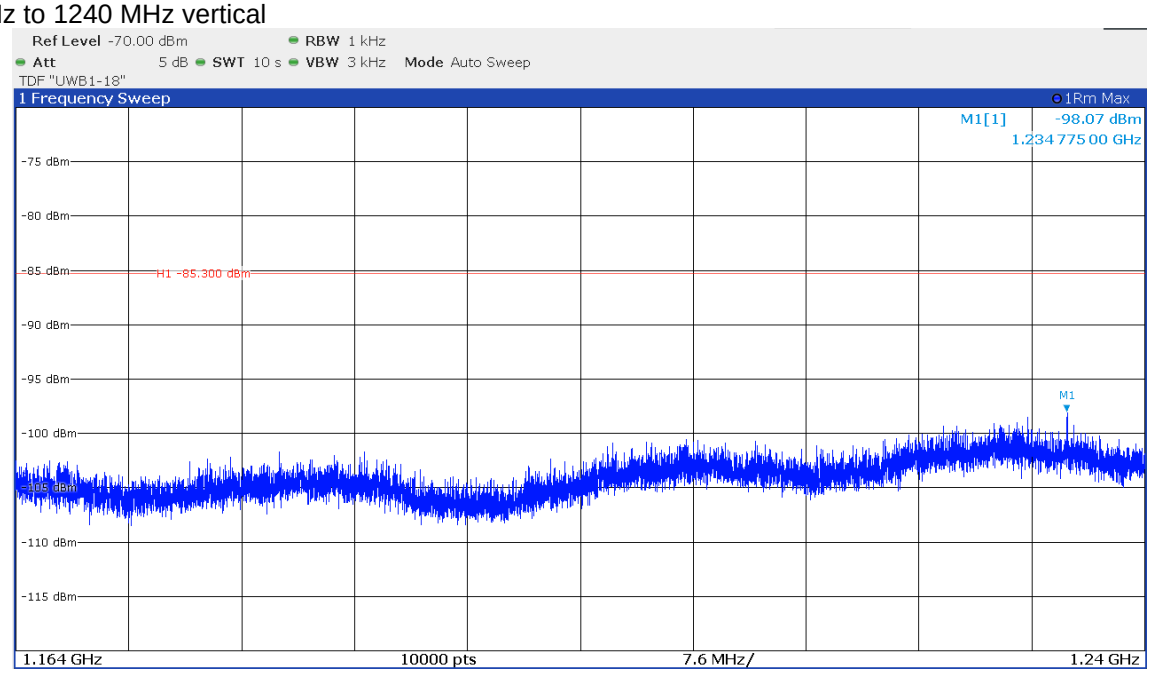
FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

Channel 5:

1164 MHz to 1240 MHz horizontal

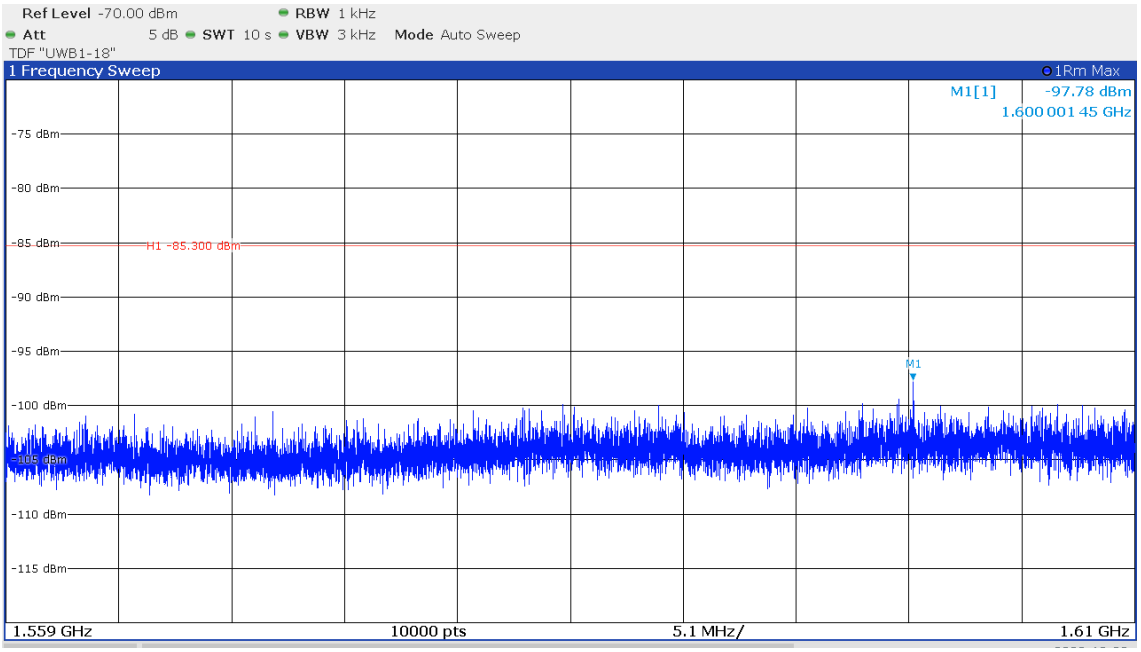


1164 MHz to 1240 MHz vertical

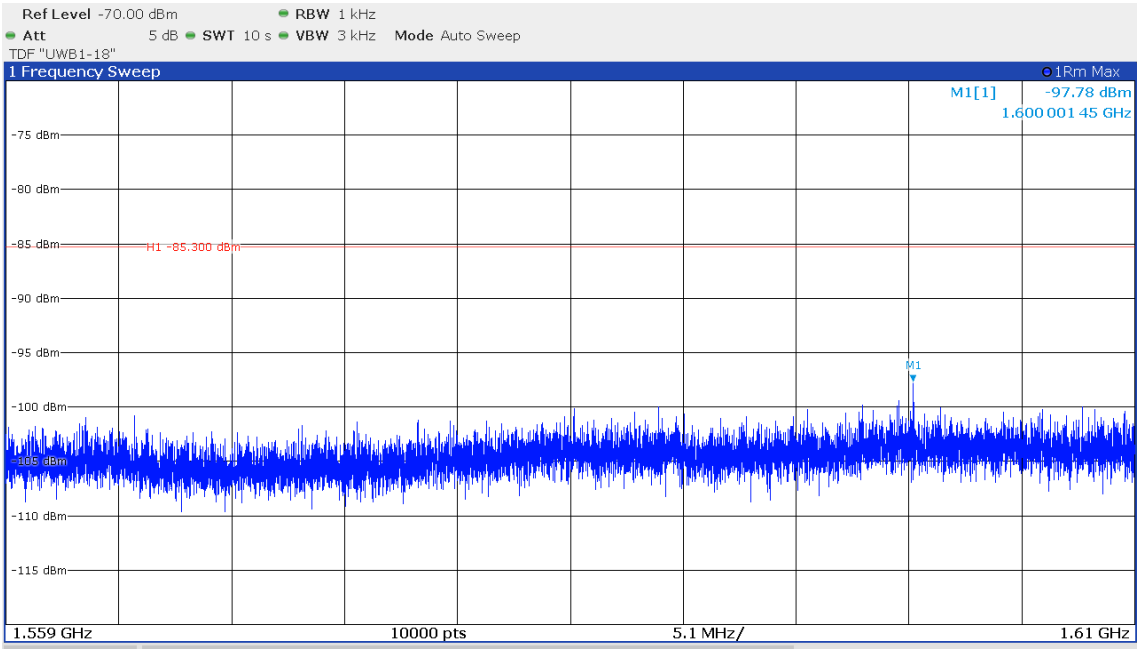


FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

1559 MHz to 1610 MHz horizontal



1559 MHz to 1610 MHz vertical



FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

Limit according §15.519(c) in the frequency

Frequency in MHz	EIRP in dBm
1164-1240	−85.3
1559-1610	−85.3

The requirements are **FULFILLED.**

Remarks: None.

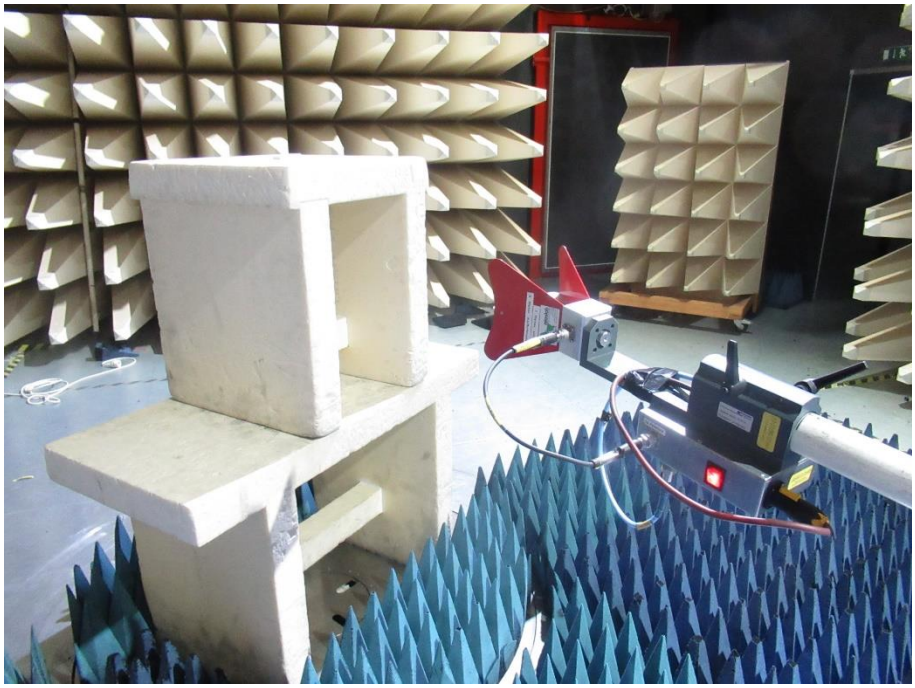
5.4 Peak Power radiated

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

5.4.1 Description of the test location

Test location: Anechoic chamber 1

5.4.2 Photo documentation of the test set-up



5.4.3 Applicable standard

According to FCC Part 15, Section 15.517(e):
There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

5.4.4 Description of Measurement

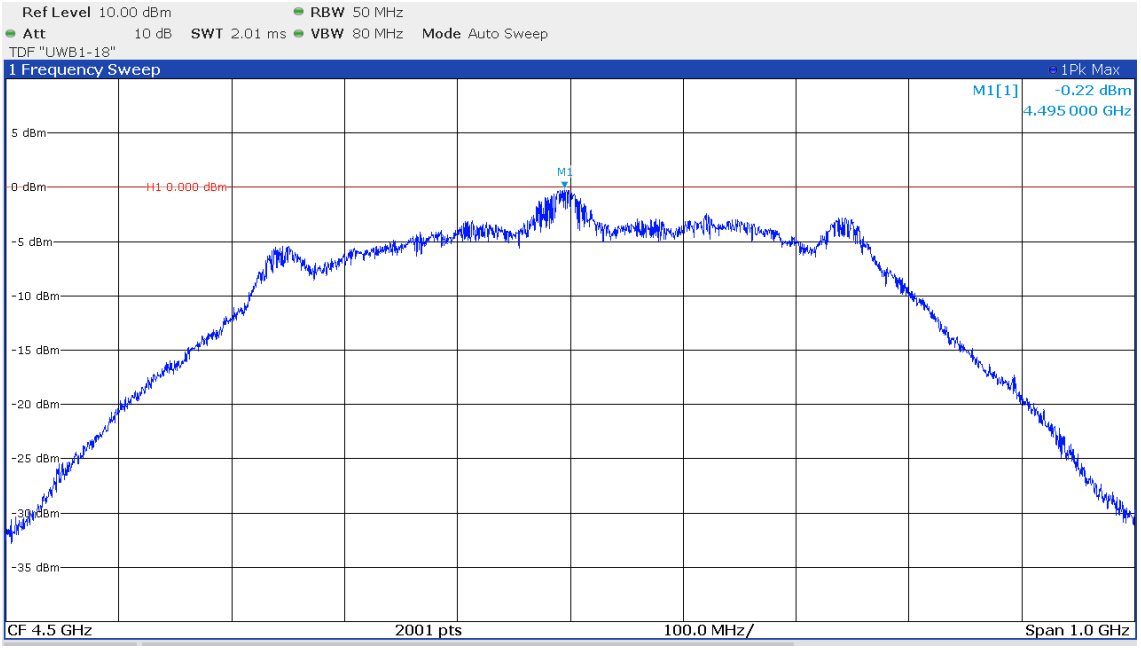
The peak power is measured following the procedure set out in ANSI C63-10, item 10.3.5. The EUT is set in TX continuous mode while measuring.

Analyser settings:
RBW: 50 MHz, VBW: 80 MHz, Detector: Peak, Trace Mode: Max hold

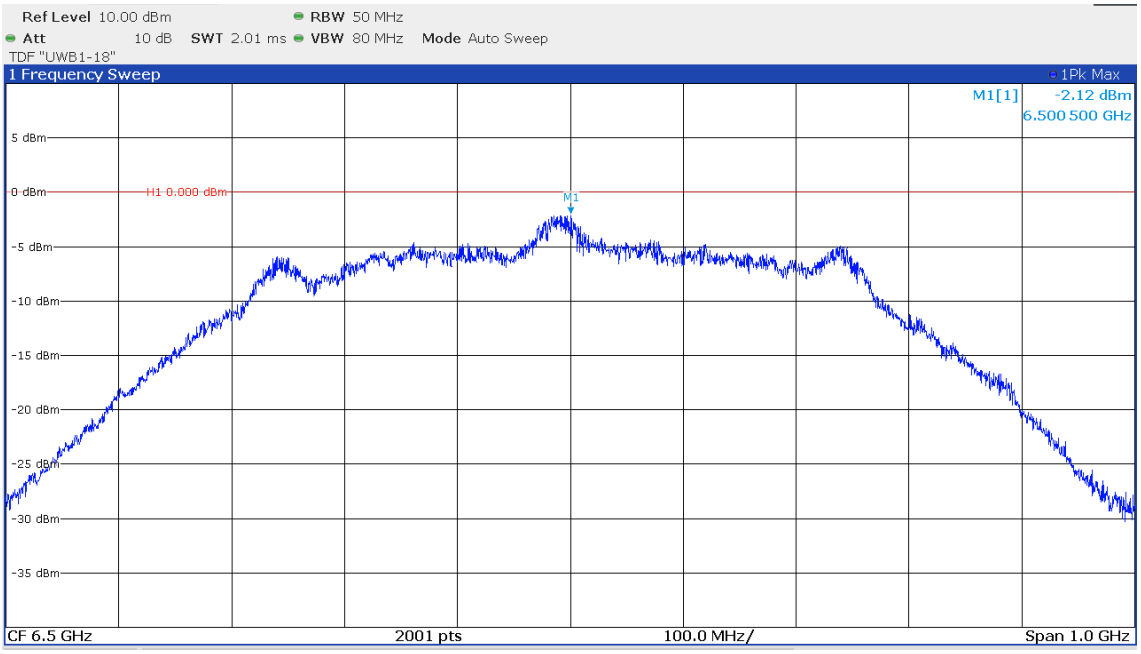
FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

5.4.5 Test result

Channel 3



Channel 5



Min. limit margin: -0.22 dB at 4495.0 MHz

The requirements are **FULFILLED.**

Remarks: None.

FCC ID: 2ALC5-KNX-TM1 IC: 25557-KNXTM1

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.
CPR 3	FSW43	02-02/11-21-001	22/05/2024	22/05/2023		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	12/07/2024	12/07/2023		
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	BAT-EMC 2022.0.23.0	02-02/68-13-001				
SER 2	ESVS 30	02-02/03-05-006	27/07/2024	27/07/2023		
	VULB 9168	02-02/24-05-005	20/04/2024	20/04/2023	03/05/2024	03/05/2023
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
	50F-003 N 3 dB	02-02/50-21-010				
SER 3	FSW43	02-02/11-21-001	22/05/2024	22/05/2023		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	LNA-40-18004000-33-5P	02-02/17-20-002				
	3117	02-02/24-05-009	12/07/2024	12/07/2023		
	BBHA 9170	02-02/24-05-013	21/03/2026	21/03/2023	21/03/2024	21/03/2023
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	KMS116-GL140SE-KMS116-	02-02/50-20-026				
	BAT-EMC 2022.0.23.0	02-02/68-13-001				