EMI – TEST REPORT

- FCC Part 15.209-

Type / Model Name	:	KNX-A1.8
Product Description	:	UWB Anchor
Applicant	:	Kinexon Sports & Media Inc.
Address	:	22 west 38th
		New York, NY 10018
Manufacturer	:	Kinexon GmbH
Address	:	Schellingstraße 35
		80799 München

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

Test Report No. : T44481-00-08KS	27. November 2018 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-01
D-PL-12030-01-02

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 15, Subpart A - General (October 2018)

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 (October 2018)

Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
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

2 EQUIPMENT UNDER TEST

2.1 Photo documentation of the EUT – Detailed photos see ATTACHMENT B

2.2 Equipment type

UWB device

2.3 Short description of the equipment under test (EUT)

The technology is used in sports as well as industrial environments.
Kinexon Anchors communicate with each other and nearby Tags to obtain information on the Tag positions.

The EUT includes three radio technologies: UWB, WLAN 802.11 a/ac/b/g/n and Bluetooth low energy. The EUT has two identical UWB modules.

Number of tested samples:	1
Serial number:	pre-production sample
Firmware version:	4.15.0

EUT configuration:
(The CDF filled by the applicant can be viewed at the test laboratory.)

2.4 Variants of the EUT

None.

2.5 Operation frequency and channel plan

UWB:

The operating frequency band is 3100 MHz to 10600 MHz.

Channel plan:

Channel 1: 3494.4 MHz

Channel 2: 3993.6 MHz

Channel 3: 4492.8 MHz

Channel 5: 6489.6 MHz

Bluetooth:

The operating frequency band is 2400 MHz to 2483.5 MHz.

WLAN:

WLAN is working in the frequency range 2400 MHz to 2483.5 MHz and 5150 MHz to 5850 MHz

2.6 Peripheral devices and interface cables

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

- Laptop Model : Fujitsu E780
- Computer Model : Intel NUC Kit NUC6i5SYH
- Network switch Model : Netgear ProSafe GS105

2.7 Determination of worst case conditions for final measurement

Measurements are made in all three orthogonal axes of the EUT to locate at which position the EUT produces the maximum of the emissions.

3 TEST RESULT SUMMARY

FCC Rule Part	Description	Result
15.209(a) partly	Radiated Emissions 1 GHz to 40 GHz	passed

3.1 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 : 24 August 2018

Testing concluded on : 08 October 2018

Checked by:

Klaus Gegenfurtner
I confirm the correctness and integrity of this document.
2018.11.27 16:21:59 +01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Kathrin Schiebl
I am the author of this document
2018.11.27 16:17:26 +01'00'

Kathrin Schiebl
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 / 11.2003 „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 power line conducted emissions	0.15 MHz to 30 MHz	95%	± 3.29 dB
EBW and OBW	2400 MHz to 30000 MHz	95%	± 2.5 x 10^{-7}
Output power ERP, radiated	1000 MHz to 7000 MHz	95%	± 2.71 dB
Field strength of the fundamental	1000 MHz to 7000 MHz	95%	± 2.71 dB
Power spectral density	2400 MHz to 3000 MHz	95%	± 0.62 dB
Spurious Emissions, conducted	9 kHz to 10000 MHz	95%	± 2.15 dB
Spurious Emissions, conducted	10000 MHz to 40000 MHz	95%	± 3.47 dB
Spurious Emissions, radiated	9 kHz to 30 MHz	95%	± 3.53 dB
Spurious Emissions, radiated	30 MHz to 1000 MHz	95%	± 4.44 dB
Spurious Emissions, radiated	1000 MHz to 30000 MHz	95%	± 2.34 dB
Spurious Emissions, radiated	30000 MHz to 40000 MHz	95%	± 5.13 dB

4.4 Measurement protocol for FCC and ISED

4.4.1 General information

The Open Area test site is a listed Open Site under the Canadian Test-Sites File-No:

IC 3009A-1

The Anechoic chamber is a listed test site under the Canadian Test-Sites File-No:

IC 3009A-2

4.4.2 General Standard information

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

4.4.2.1 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.

4.4.2.2 Radiated emission (electrical field 30 MHz - 1 GHz)

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. The setup of the equipment under test is established in accordance with ANSI C63.10.The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so that they are at least 40 centimetres from 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 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	Level	+	Factor	=	Level	-	Limit	=	Delta
(MHz)	(dBµV)		(dB)		(dBµV/m)		(dBµV/m)		(dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

4.4.2.3 Radiated emission (electrical field 1 GHz - 40 GHz)

Radiated emissions from the EUT are measured in the frequency range 1 GHz up to the maximum frequency 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 1.0 X 1.5 metre non-conducting table, 1.5 metre above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is following set out in ANSI C63.10. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimetres from 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. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyzer set to max peak detector function and a resolution 1 MHz and video bandwidth 3 MHz for peak measurement. The conditions determined as worst case will then be used for the final measurements. When the EUT is larger than the beam width of the measuring antenna it will be moved over the surface for the four sides of the equipment. Where appropriate, the test distance may be reduced in order to detect emissions under better uncertainty and are calculated at the specified test distance.

5 TEST CONDITIONS AND RESULTS

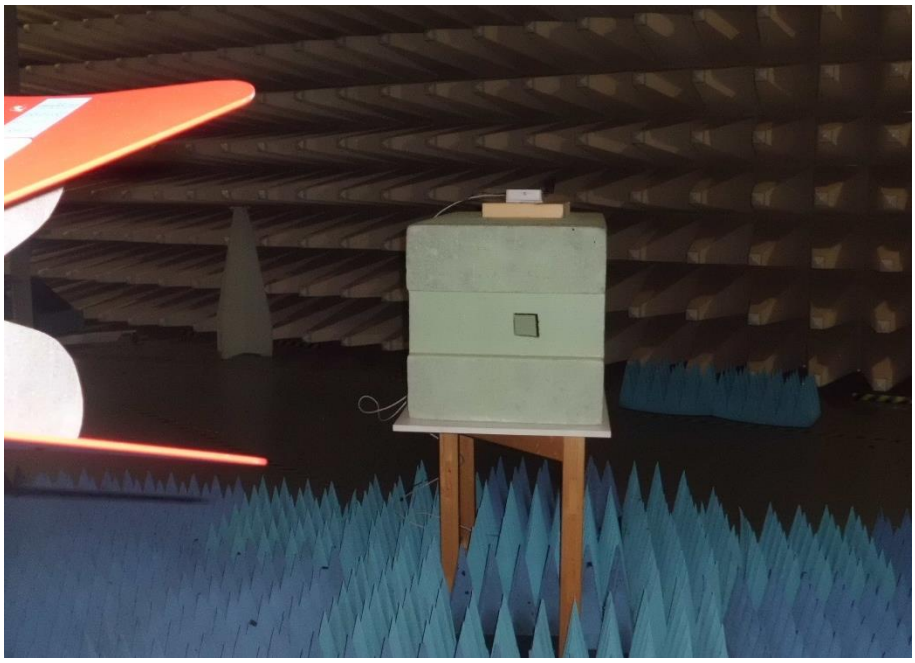
5.1 Radiated Emissions 1 GHz to 40 GHz

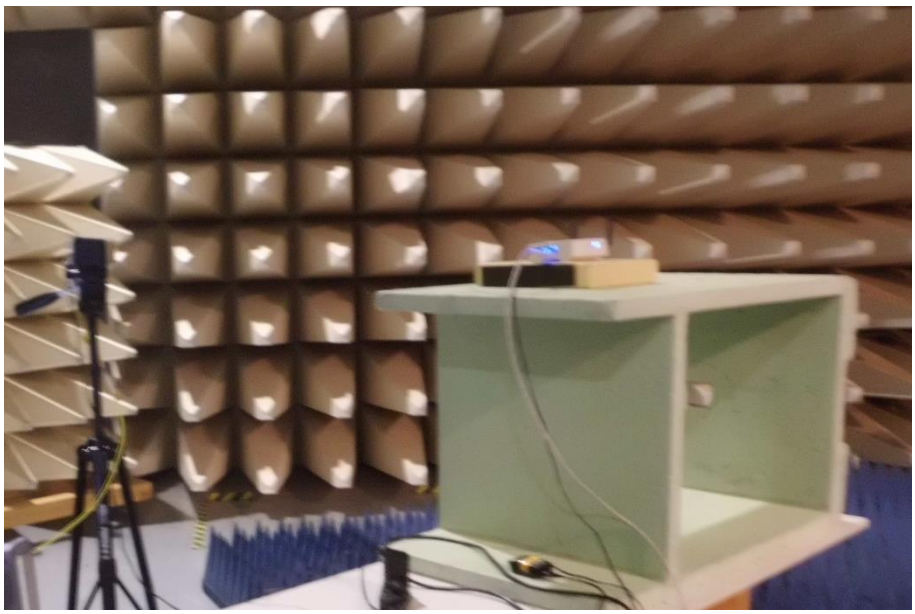
For test instruments and accessories used see section 6 Part **SER 3**.

5.1.1 Description of the test location

Test location: Anechoic chamber 1
Test distance: 3 m

5.1.2 Photo documentation of the test set-up





5.1.3 Applicable standard

According to FCC Part 15, Section 15.209

5.1.4 Analyser settings

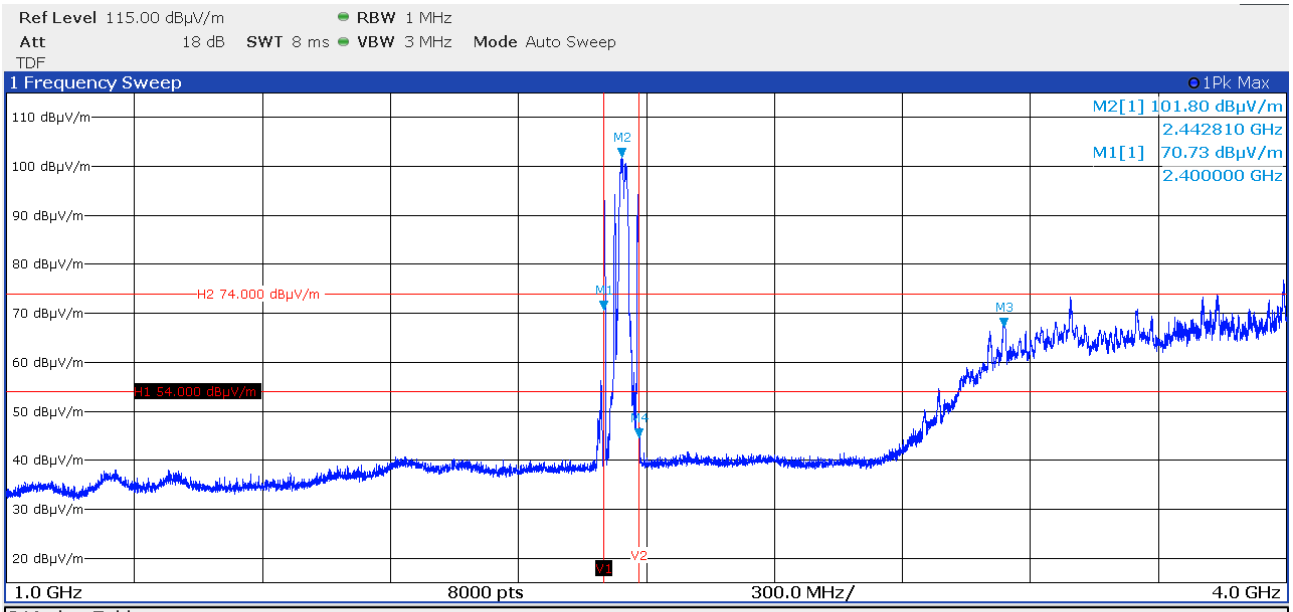
1 GHz – 40 GHz RBW: 1 MHz VBW: 3 MHz Detector: Peak / RMS

5.1.1 Test result

Measurement 1 GHz to 40 GHz:

BLE, WLAN channel 7, UWB ch 1 and UWB ch 2:

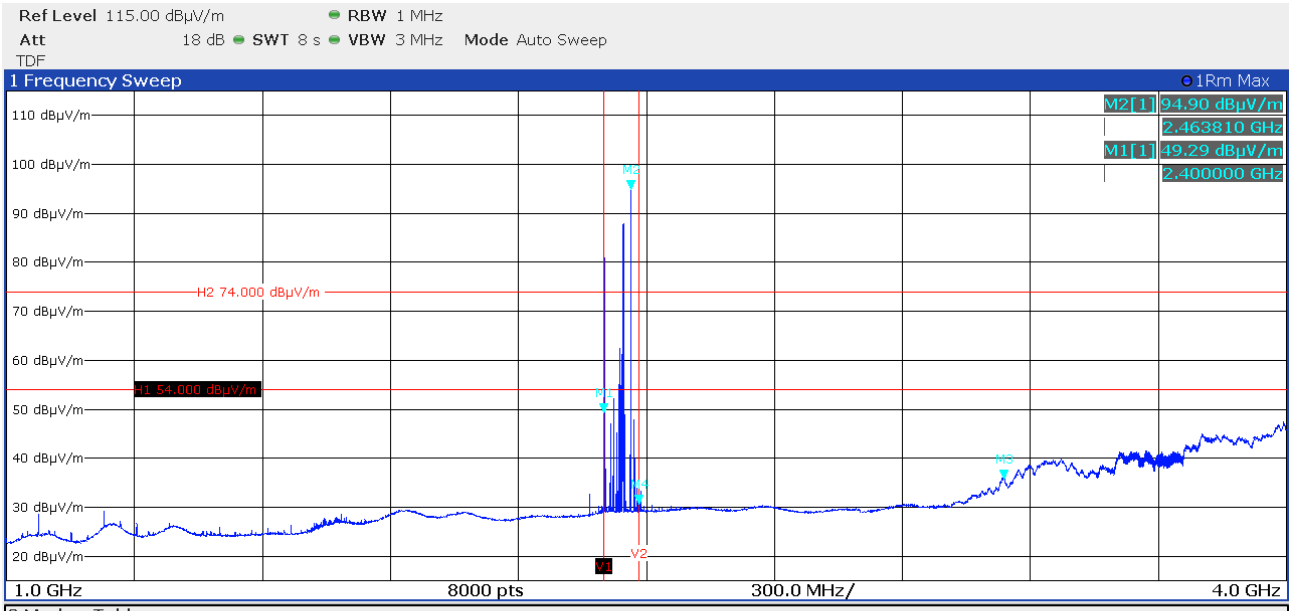
1 GHz to 4 GHz peak measurement



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.4 GHz	70.73 dBµV/m		
M2		1	2.44281 GHz	101.80 dBµV/m		
M3		1	3.33863 GHz	67.22 dBµV/m		
M4		1	2.4835 GHz	44.62 dBµV/m		

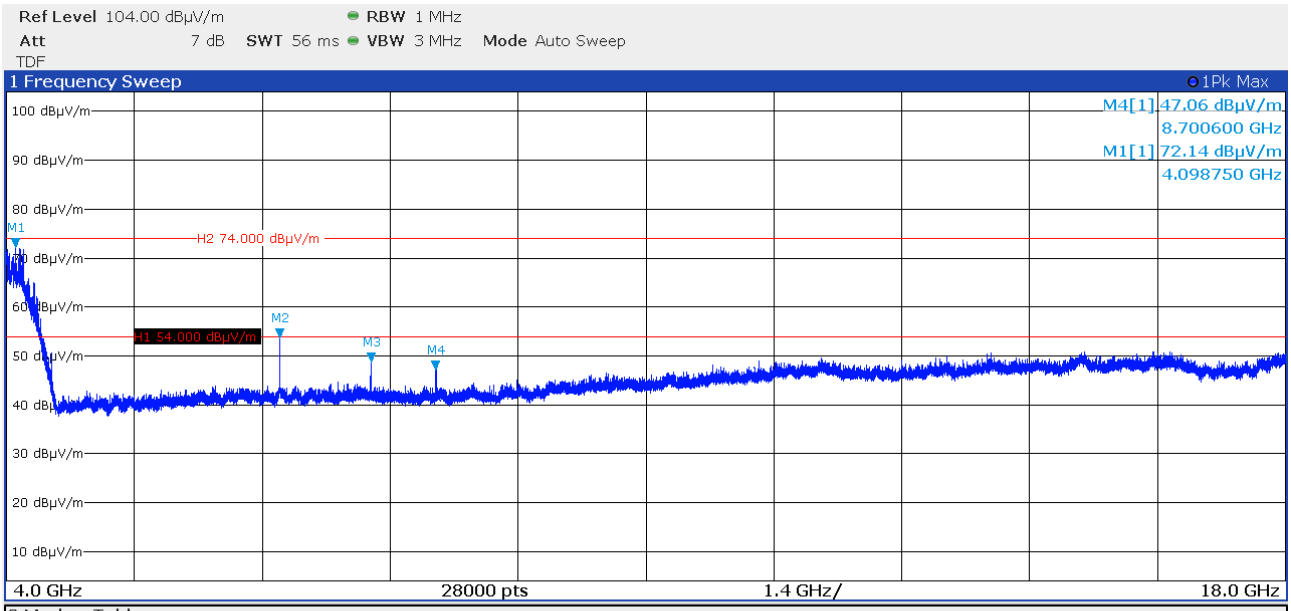
1 GHz to 4 GHz RMS measurement



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	2.4 GHz	49.29 dBµV/m		
M2		1	2.46381 GHz	94.90 dBµV/m		
M3		1	3.33863 GHz	35.80 dBµV/m		
M4		1	2.4835 GHz	30.56 dBµV/m		

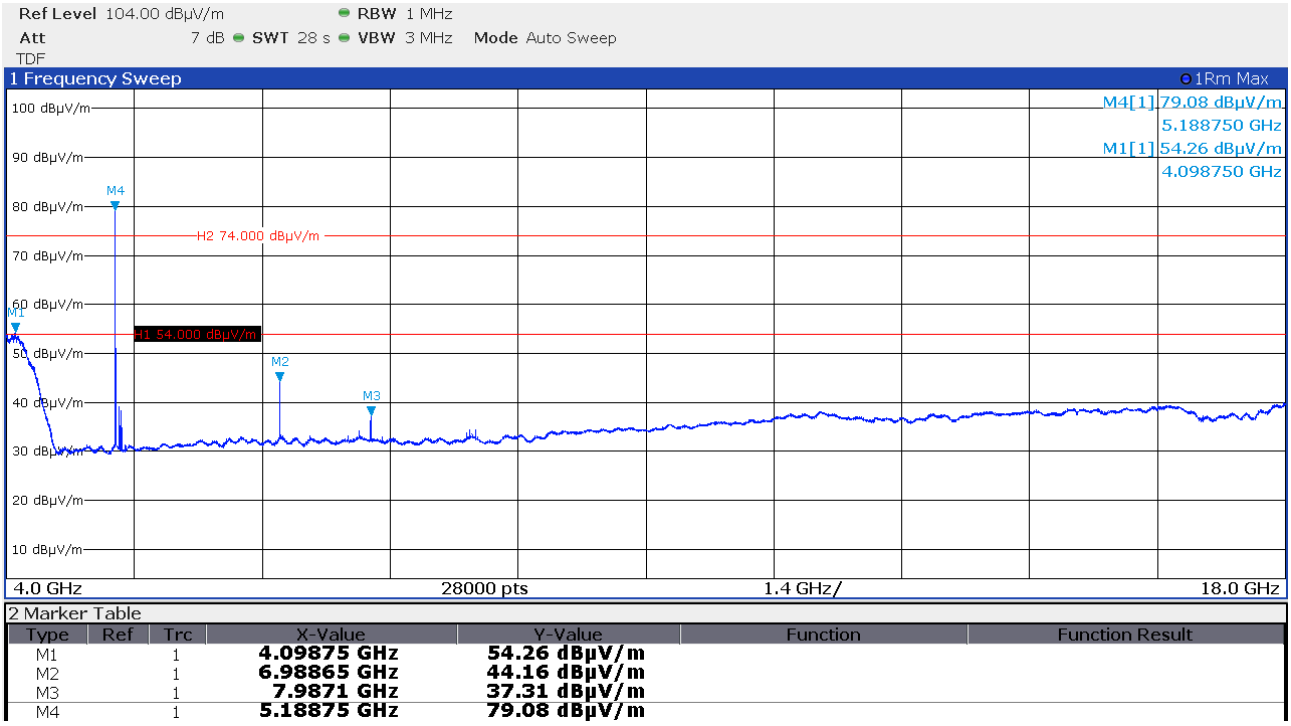
4 GHz to 18 GHz peak measurement



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	4.09875 GHz	72.14 dBµV/m		
M2		1	6.98865 GHz	53.68 dBµV/m		
M3		1	7.9871 GHz	48.78 dBµV/m		
M4		1	8.7006 GHz	47.06 dBµV/m		

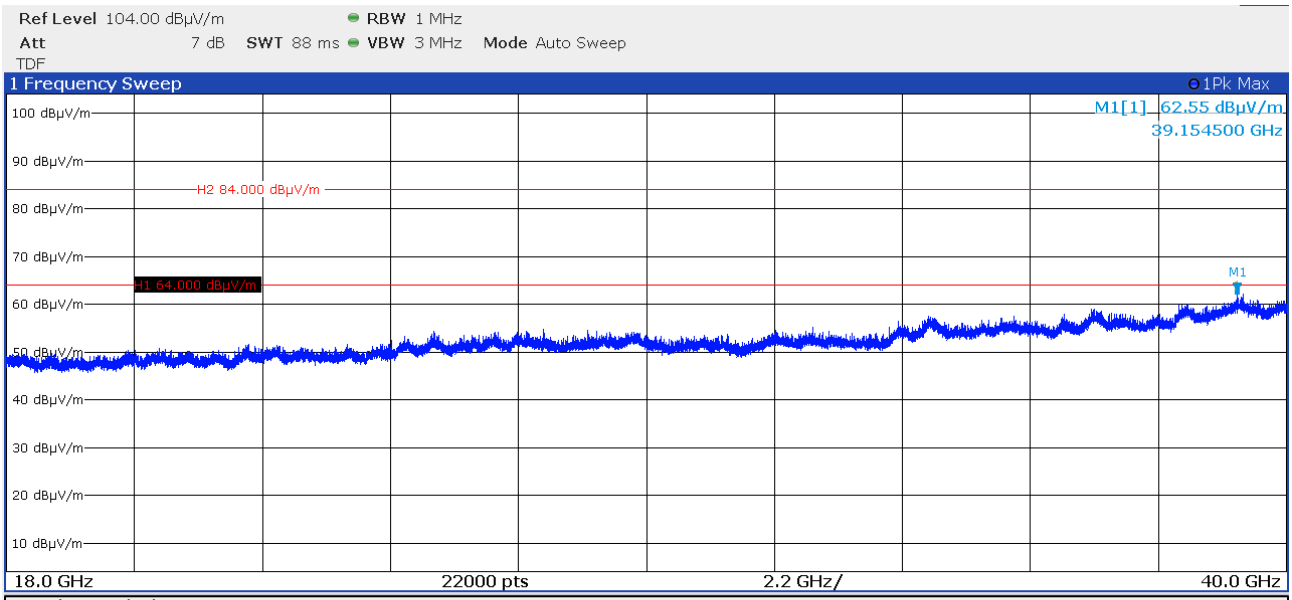
4 GHz to 18 GHz RMS measurement



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	4.09875 GHz	54.26 dBµV/m		
M2		1	6.98865 GHz	44.16 dBµV/m		
M3		1	7.9871 GHz	37.31 dBµV/m		
M4		1	5.18875 GHz	79.08 dBµV/m		

18 GHz to 40 GHz peak measurement

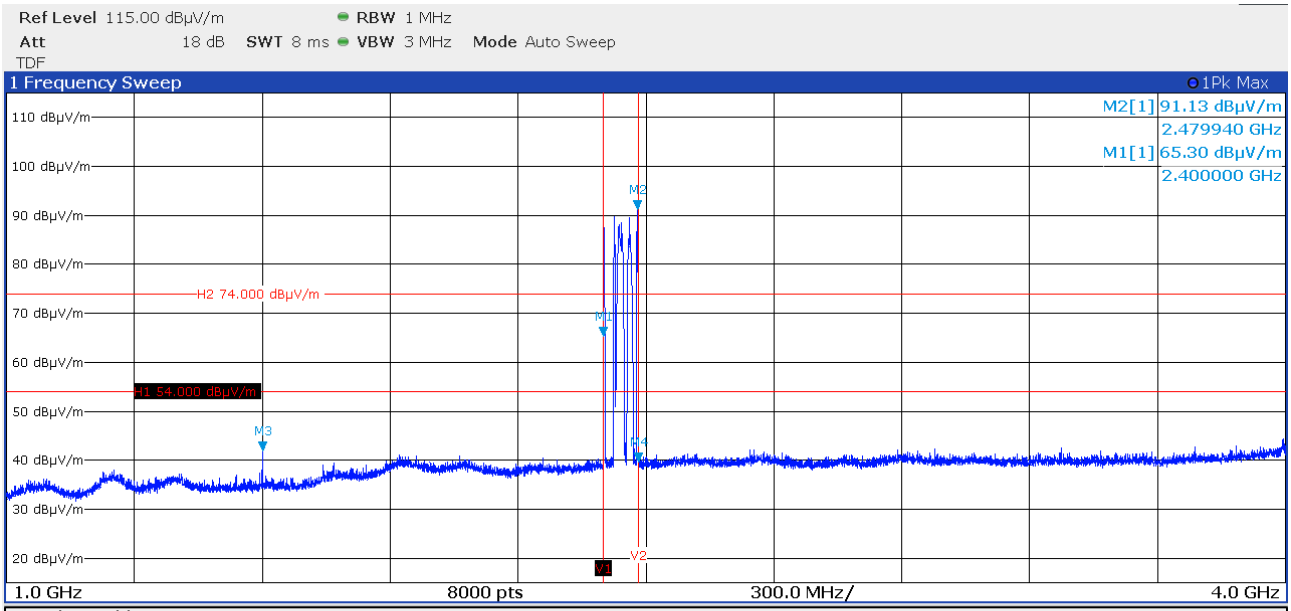


2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	39.154500 GHz	62.547 dBµV/m			

BLE, WLAN channel 36, UWB ch 3 and UWB ch 5:

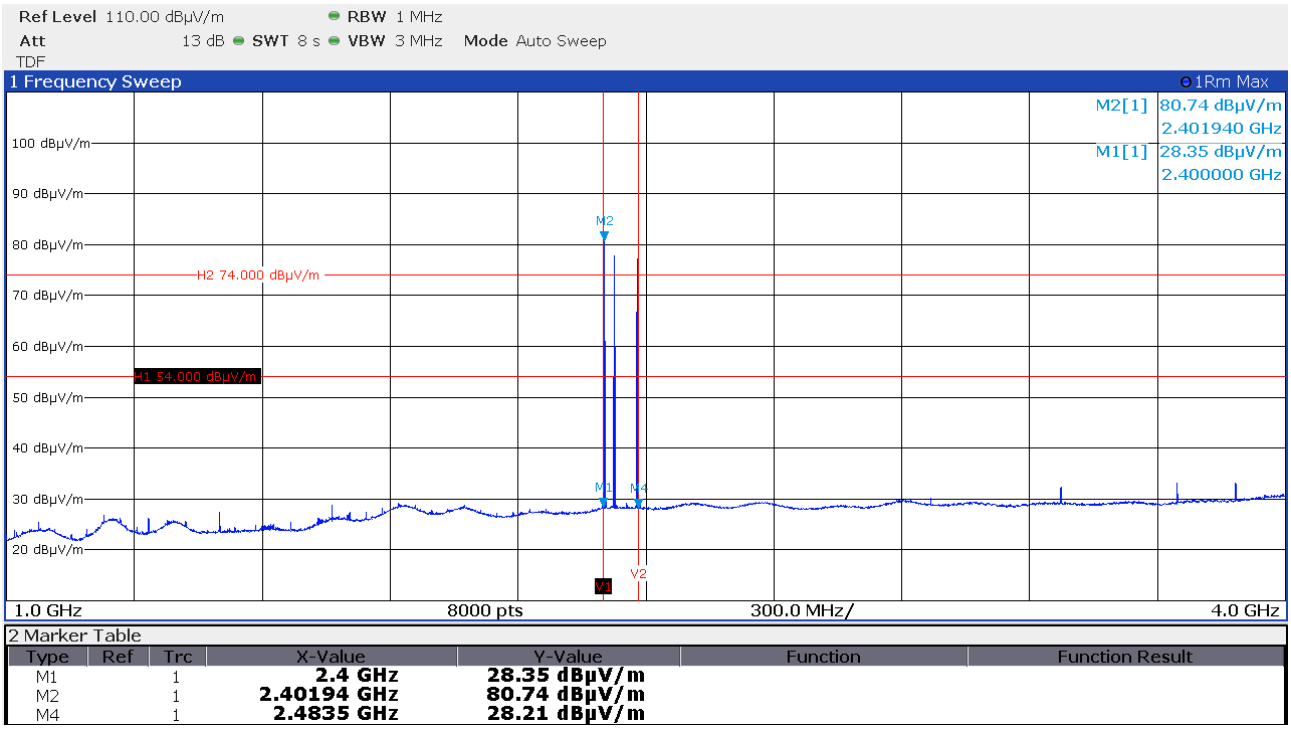
1 GHz to 4 GHz peak measurement



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.4 GHz**	**65.30 dBµV/m**		
M2		1	**2.47994 GHz**	**91.13 dBµV/m**		
M3		1	**1.60068 GHz**	**41.85 dBµV/m**		
M4		1	**2.4835 GHz**	**39.69 dBµV/m**		

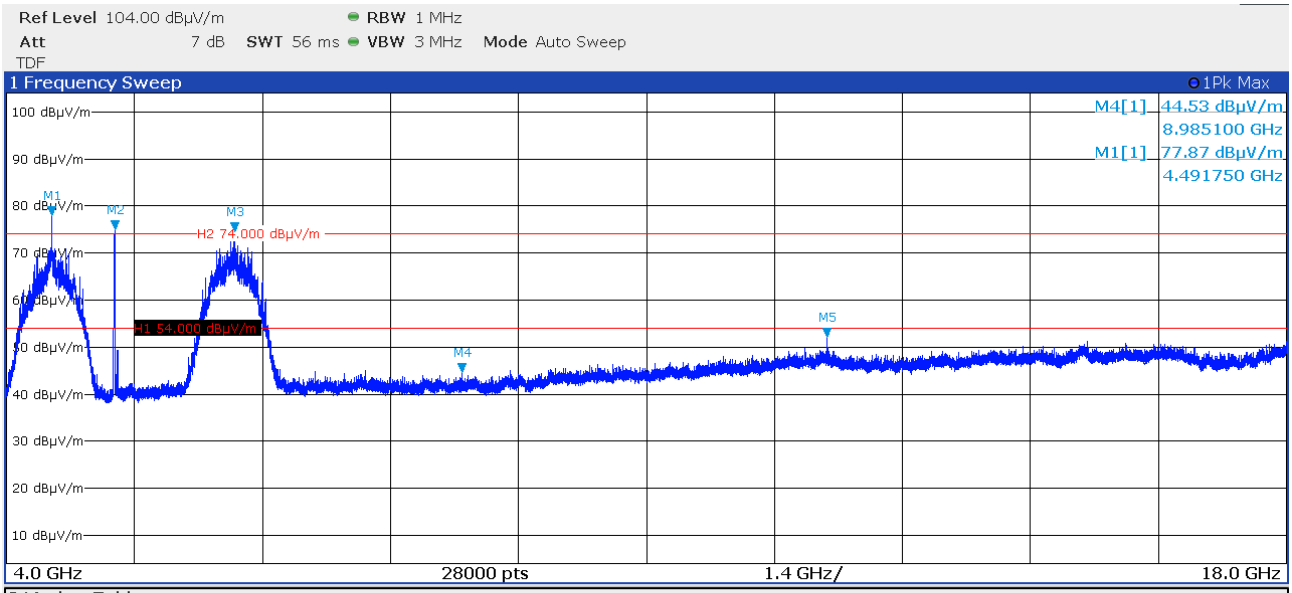
1 GHz to 4 GHz RMS measurement



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**2.4 GHz**	**28.35 dBµV/m**		
M2		1	**2.40194 GHz**	**80.74 dBµV/m**		
M4		1	**2.4835 GHz**	**28.21 dBµV/m**		

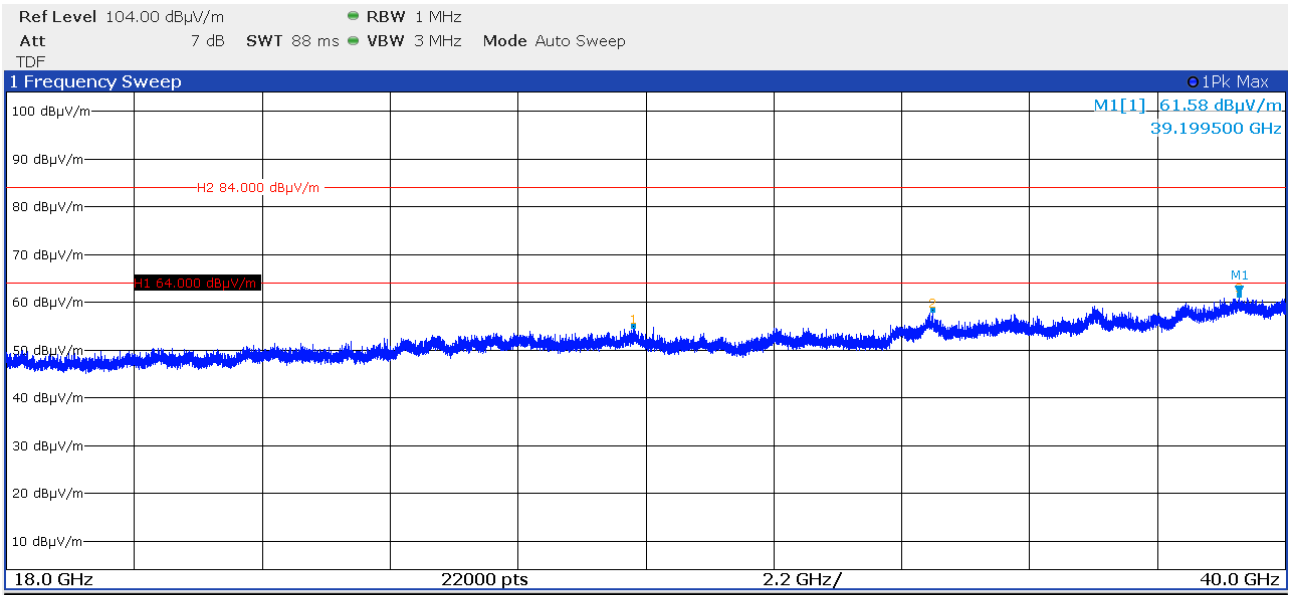
4 GHz to 18 GHz peak measurement



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	4.49175 GHz	77.87 dBµV/m		
M2		1	5.18275 GHz	75.01 dBµV/m		
M3		1	6.49215 GHz	74.57 dBµV/m		
M4		1	8.9851 GHz	44.53 dBµV/m		
M5		1	12.979 GHz	52.06 dBµV/m		

18 GHz to 40 GHz peak measurement



2 Marker Peak List

No	X-Value	Y-Value	No	X-Value	Y-Value
1	28.781500 GHz	54.845 dBµV/m	3	39.199500 GHz	61.576 dBµV/m
2	33.931500 GHz	58.329 dBµV/m			

Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions:

Frequency	Field strength of spurious emissions		Measurement distance
(MHz)	(µV/m)	dB(µV/m)	(metres)
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 requirements are **FULFILLED.**

Remarks: This test was performed with the sample 36158.

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.
SER 3	FSW43	02-02/11-15-001	19/03/2019	19/03/2018		
	JS4-18004000-30-5A	02-02/17-05-017				
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	08/05/2019	08/05/2018		
	BBHA 9170	02-02/24-05-014	12/06/2021	12/06/2018	12/06/2019	12/06/2018
	KMS102-1 m	02-02/50-11-014				
	KMS102-0.2 m	02-02/50-11-016				
	KMS102-0.2 m	02-02/50-11-020				
	18N-20	02-02/50-17-003				
	NMS111-GL200SC01-NMS11	02-02/50-17-012				
	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				