



Test report

according to ISO/IEC 17025:2017

FCC

(Federal Communications Commission)

Test Firm Registration Number: 768032

Designation Number DE0022

ISED

(Innovation, Science and Economic Development)

CAB identifier: DE0012

ISED#: 6155A

BLE; FHSS

Electromagnetic compatibility

Intentional Radiators



Deutsche
Akkreditierungsstelle
D-PL-17379-01-01
D-PL-17379-01-02
D-PL-17379-01-03

 **TESTED
IN GERMANY**

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Test report no.: **22/09-0001 E**

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Location of test facility:



**STC Germany GmbH
Ohmstrasse 1
84160 Frontenhausen
Germany**

1. Client information

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Address: Carl-Zeiss-Straße 22
D-73447 Oberkochen
Germany
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Telephone: +49 (0) 7364 20 87060
Fax: -/-
E-mail: andreas2.wolf@zeiss.com

2. Equipment under test (EUT)

2.1 Identification of the EUT

Equipment: Wärmebildkamera / Thermal Imaging Monocular
Model: DTI 6
Types: DTI 6/20, DTI 6/40
Brand name: Zeiss
Serial no.: Sample 1: 5272768 Sample 02: 5272777
Sample 3: NVDEM085
Manufacturer: Carl Zeiss AG

Country of origin: Germany
Power rating: 7.2 V DC
Highest frequency generated or used in the device or on which the device operates or tunes (MHz): 2.48 GHz
Date Sample Received: 05.09.2022
Tests were performed: 05.09.2022 – 03.11.2022

2.2 Additional information about the EUT:

The EUT is a host devices were a modular approved module is integrated.
The EUT can also operate at 2.4 GHz in BLE mode simultaneously to the 2.4 GHz Wifi-function.
The 2.4 GHz WLAN mode is not documented in this Report.

To duplicate parts of this test report needs the written confirmation of the test laboratory.

The test results relate only to the above mentioned test sample(s).

3. Description of the Equipment under test and test conditions

Power:	Adaptor: RWD018G In: 100..240 V 50/60 Hz 0,6 A max Out: 5 V 3 A (15 W), 9 V 2 A(18 W), 12 V 1,5 A (18 W) Li-ion Battery: 21NR 19/66 Voltage: 7.2 V, Capacity: 3.2 Ah, Energy: 23.04 Wh Battery Charger Model: DD-PS2 In 5 V 3 A, 9V 3 A, 12 V 2.5 A, 15 V 2 A Out: 8.4 V 3 A	
Cables:	USB (PC/Charger) 94.5 cm	
Approx. Size (l x w x h):	(227 x 70 x 73) mm	
Test conditions:	The "Wärmebildkamera / Thermal Imaging Monocular" Model: DTI 6 (= equipment under test – EUT) had been tested with different type of connection as well as controlled by test software. 1) WLAN 2) BLE < EUT Typer DTI 6/20 and DTI 6/40 are electrically identical and just differ by objective lens diameter. The tested configuration represents (based on the product specification) with the tested operation modes the worst case.	
RF Module Model Number:	Laird Sterling LWB-Module, Part-Number. 450-0152	
RF Module FCC ID:	2AMSP-DTI6	
RF Module IC:	22938-DTI6	
Type of modulation (ITU designation):	-/-	
Operating temperature range:	-/-	
Operating voltage range:	-/-	
Frequency range:	2400 MHz ... 2483.5MHz	
Transmission protocol	WLAN	BLE
Specification	802.11/b/g/n	BLE 4.2
Number of channels:	11	3
Channel separation:	5 MHz	2 MHz
Output power (effective radiated power):	radiated: 8.21 dBm conducted: -/-	radiated: 5.02 dBm conducted: -/-
Environmental conditions during tests:	Ambient temperature: 22 °C Relative humidity 60 % Atmospheric pressure 966 mbar	
Antenna specification:	Model: Ceramic chip antenna 2450AT18D0100 Gain: 1.5 dBi Type: <input type="checkbox"/> External (with accessible antenna socket) <input checked="" type="checkbox"/> Internal (integrated)	
Test standard:	e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C § 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz. RSS-247 issue 02 February 2017 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices	

Channel List

2.4 GHz Band

Frequency Allocation for BLE			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
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
2 MHz bandwidth systems, use Channel 0 – Channel 39			

4. Performed measurements and results

The complete list of measurements required in e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 is given below.

Standard:	Standard:	Test Method:		Test requirements:			
				applicable:		fulfilled:	
				yes	no	yes	no
§ 15.203	RSS-Gen issue 5	ANSI 63.10 Section 14	Antenna requirement	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§ 15.207	RSS-Gen issue 5	ANSI 63.10 Section 6.2	AC Mains Conducted Emissions	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§ 15.209	RSS-Gen issue 5	ANSI 63.10 Section 6.3 - 6.6	Radiated Emissions Out-of-Band Emission	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§ 15.247	RSS-247 issue 2	ANSI 63.10 Section 11.8.1	6 dB DTS Bandwidth	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§ 15.247	RSS-247 issue 2	ANSI 63.10 Section 11.9.2	Output Power of Fundamental Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
§ 15.247	RSS-247 issue 2	ANSI 63.10 Section 11.10.3	Maximum Power Spectral Density	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§ 15.247	RSS-247 issue 2	ANSI 63.10 Section 11.13.2	Band Edges Measurement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
-/-	RSS-Gen issue 5	ANSI 63.10 Section 6.9.3	99% Power Bandwidth	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All required / applicable tests according to the following standards were performed under Ref-No. 22/09-0001.

- e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 with test Method according to ANSI C63.10-2013

-RSS-247 issue 02 February 2017 Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

- e-CFR data is current as of November 25, 2022

Remark: -/-

5. Antenna requirement

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.203 Antenna requirement

-RSS-Gen issue 05 section 6.8

Requirements:

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 so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Measurement

No measurement/statement required

Result

-/-

6. AC Mains conducted emissions

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.207 Conducted limits
-RSS-Gen issue 05 section 7.2

Test site

Measurements of conducted emission from EUT was made in the shielded chamber (DC - 10GHz) located in the test facility.

Test equipment and test set up

Test equipment used for conducted measurements on Mains as given in clause Test equipment of this report.

Test setup used for conducted measurements on Mains as given in clause Test setups of this report.

Detector function selection and bandwidth

In conducted emissions measurement CISPR quasi-peak- and average-detector were used.
The bandwidth of the detector of instrument is 10 kHz over the frequency range of 150 kHz to 30 MHz.

Frequency range to be scanned

For conducted emission measurements, the spectrum in the range of 150 kHz to 30 MHz was investigated.

Test conditions and configuration of EUT

The EUT was configured and operated with conditions as mentioned under "Test conditions" in clause 3 above.

All modes are investigated by operating the EUT in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement. For each mode of operation and for each ac power current-carrying conductor, cable manipulation are performed within the range of likely configurations. The highest values measured are shown in the table below. The corresponding configuration is shown in the "Photo(s) of test setup".

The EUT was placed on a 80 cm high non metallic table. Measurements were performed on the AC terminals of the Host AC-Adaptor, on neutral (N)- and live (L1)-wire had been performed.

Requirements

Frequency Range [MHz]	Quasi-Peak Limits [dB μ V]	Average Limits [dB μ V]
0.15 - 0.5	66 to 56 ^{Note 1}	56 to 46 ^{Note 1}
0.5 - 5.0	56	46
5.0 - 30.0	60	50
Note 1: The level decreases linearly with the logarithm of the frequency		

Measurement

Not applicable as device is battery-operated only.

Result

-/-

Remarks:

Composition of the measurement value:

$$\mathbf{M_{Value} = M_{Rec} + C_{Loss} + LISN_{cor}}$$

M_{Value} = Measurement Value

M_{Rec} = Reading value of test receiver

C_{Loss} = Cable loss between Receiver and LISN

$LISN_{cor}$ = LISN correction factor.

Sample calculation:

$$40.8 \text{ dB}\mu\text{V} = 40.1 \text{ dB}\mu\text{V} + 0.3 \text{ dB} + 0.4 \text{ dB}$$

7. Radiated emission measurements

Test site

Measurement of radiated emissions from EUT was made in the semi-anechoic chamber SAC3 (DC to 26 GHz) located in the test facility.

Test equipment and test set up

Test equipment used for radiated measurements as given in clause Test equipment of this report.
Test setup used for radiated measurements as given in clause Test setups of this report.

Detector function selection and bandwidth

In radiated emissions measurement, an EMI test receiver that have CISPR detectors was used.

Frequency range	Resolution Bandwidth
9KHz – 150kHz (Quasi Peak & Average* Detector)	200Hz
150KHz – 30MHz (Quasi Peak & Average* Detector)	9kHz
30MHz – 1GHz (Quasi Peak Detector)	120kHz
Above 1GHz (Peak & Average Detector)	1MHz

*Average Detector only in specify frequency range.

Antennas

Measurements were made using a calibrated loop antenna in the range 9 kHz – 30 MHz, as well as a calibrated bilog antenna in the range of 30 to 1000 MHz to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization.

The horizontal distance between the receiving antenna and the EUT was 3 meters.

In the range of 1 GHz to 26 GHz measurements were made using a calibrated horn antenna to determine the emission characteristics of the EUT. Measurements were also made for both horizontal and vertical polarization. The horizontal distance between the receiving antenna and the EUT was 3 meters.

Frequency range to be scanned

For radiated emissions measurements, the spectrum in the range of 9kHz MHz to 26GHz was investigated as the highest frequency generated in the EUT is 2.462 GHz.

Test conditions and configuration of EUT

The EUT was configured and operated with conditions as mentioned under “Test conditions” in clause 3 above.

During test the EUT was operated as specified in the user manual of the EUT. For frequencies below 1000 MHz the EUT was placed on a 80 cm and for frequencies above 1000 MHz the RF Transmitter modul was placed on a 150 cm high non metallic table placed on the turntable. The EUT was rotated and the antenna height was varied between 1 m to 4 m to find the maximum RF energy generated from EUT. The procedure according to ANSI C63.10:2013 is used and all modes are investigated by operating the EUT in a range of typical modes of operation, with typical cable positions, and with a typical system equipment configuration and arrangement. For each mode of operation, cable manipulation are performed within the range of likely configurations. The highest values measured are shown in the table below.

Remarks:

-Correction factor included antenna factor and cable attenuation.

-In the frequency range 1 GHz – 7 GHz the Band Reject Filter 2,4 GHz (ID11243) was used to attenuate the fundamental emission.

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits
 -RSS-Gen issue 05 section 8.9

Requirements

acc. e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits

Frequency MHz	Limits [μV/m] Quasi-peak	Limits [dBμV/m] Quasi-peak	Limits [μV/m] Average	Limits [dBμV/m] Average	Test distance [m]
0.009 – 0.090	-/-	-/-	2400/F (kHz)	48.5 – 28.5	300
0.090 - 0.110	2400/F (kHz)	28.5 – 26.8	-/-	-/-	300
0.110 – 0.490	-/-	-/-	2400/F (kHz)	26.8 – 13.8	300
0.490 - 1.705	24000/F (kHz)	33.8 – 23.0	-/-	-/-	30
1.705 - 30.0	30	29.5	-/-	-/-	30

acc. RSS-Gen issue 05 section 8.9

Frequency MHz	Limits [μA/m] Quasi-peak	Limits [dBμA/m] Quasi-peak	Limits [μA/m] Average	Limits [dBμA/m] Average	Test distance [m]
0.009 – 0.090	-/-	-/-	6.37/F (kHz)	-3 – -23.0	300
0.090 - 0.110	6.37/F (kHz)	-23.0 – -24.7	-/-	-/-	300
0.110 – 0.490	-/-	-/-	6.37/F (kHz)	-24.7 – -37.7	300
0.490 - 1.705	63.7/F (kHz)	-17.7 – -28.5	-/-	-/-	30
1.705 - 30.0	0.08	-22	-/-	-/-	30

acc. e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C, § 15.209 Radiated emission limits
 and RSS-Gen issue 05 section 8.9

Frequency MHz	Limits [μV/m] Quasi-peak	Limits [dBμV/m] Quasi-peak	Limits [μV/m] Average	Limits [dBμV/m] Average	Test distance [m]
30 - 88	100	40	-/-	-/-	3
88 - 216	150	43.5	-/-	-/-	3
216 - 960	200	46	-/-	-/-	3
960 - 1000	500	54	-/-	-/-	3
Above 1000	-/-	-/-	500	54	3

Result

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Out of Band Emission**.

Measurement

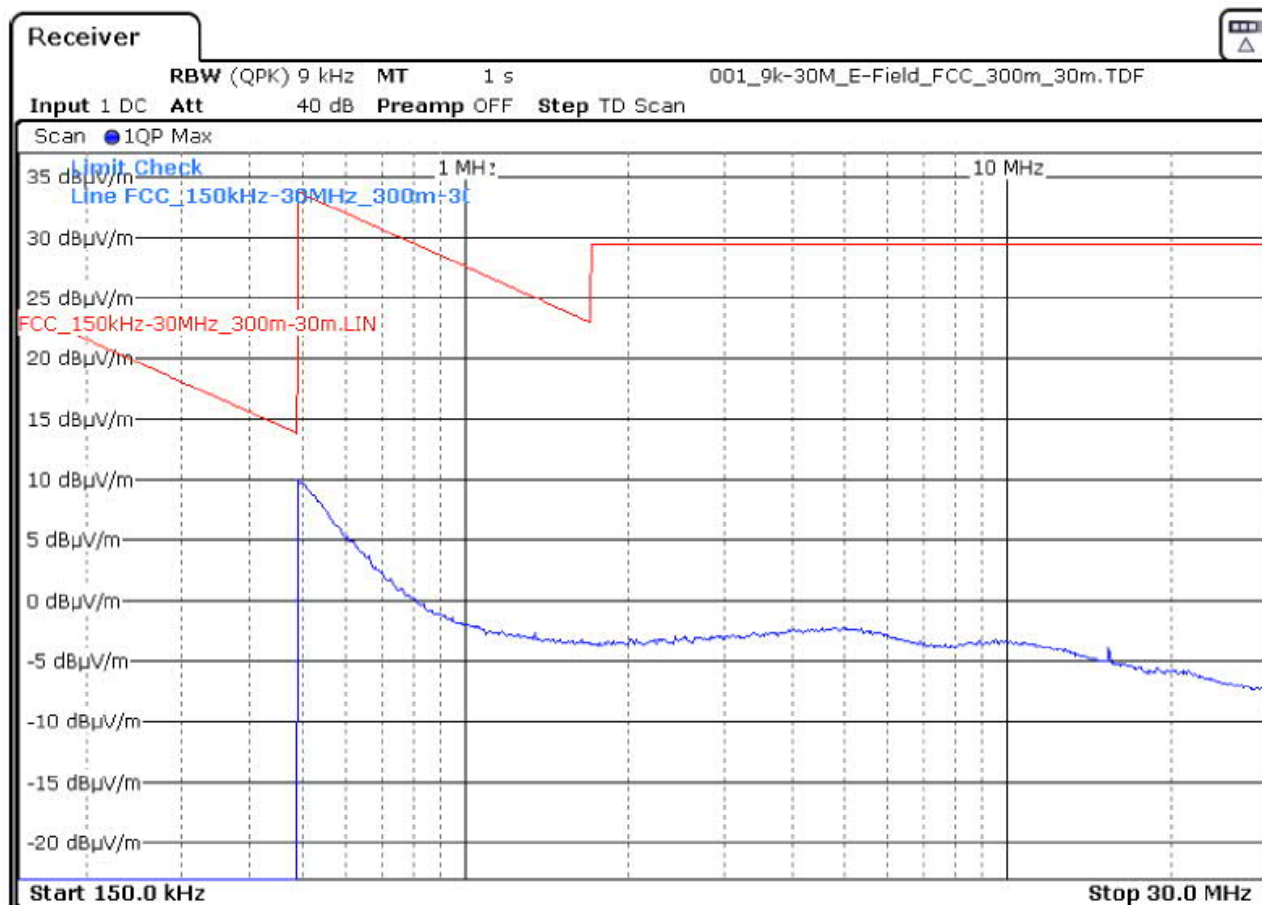
The measurements were performed on: 25.07.2022

[illegible]

Ref.-No.: 22/09-0001

Operation mode: TX BLE; CH.20 (2442MHz)

Position X (150kHz – 30MHz)

[illegible]

Operation mode: TX BLE; CH.20 (2442MHz)

Receiver

RBW (QPK) 200 Hz MT 1 s 001_9k-30M_E-Field_FCC_300m_30m.TDF

Input 1 DC Att 40 dB Preamp OFF Step TD Scan

Scan 1 QP Max

Unit Check

10 kHz

50 dBμV/m

40 dBμV/m

30 dBμV/m

20 dBμV/m

10 dBμV/m

0 dBμV/m

-10 dBμV/m

-20 dBμV/m

-30 dBμV/m

-40 dBμV/m

100 kHz

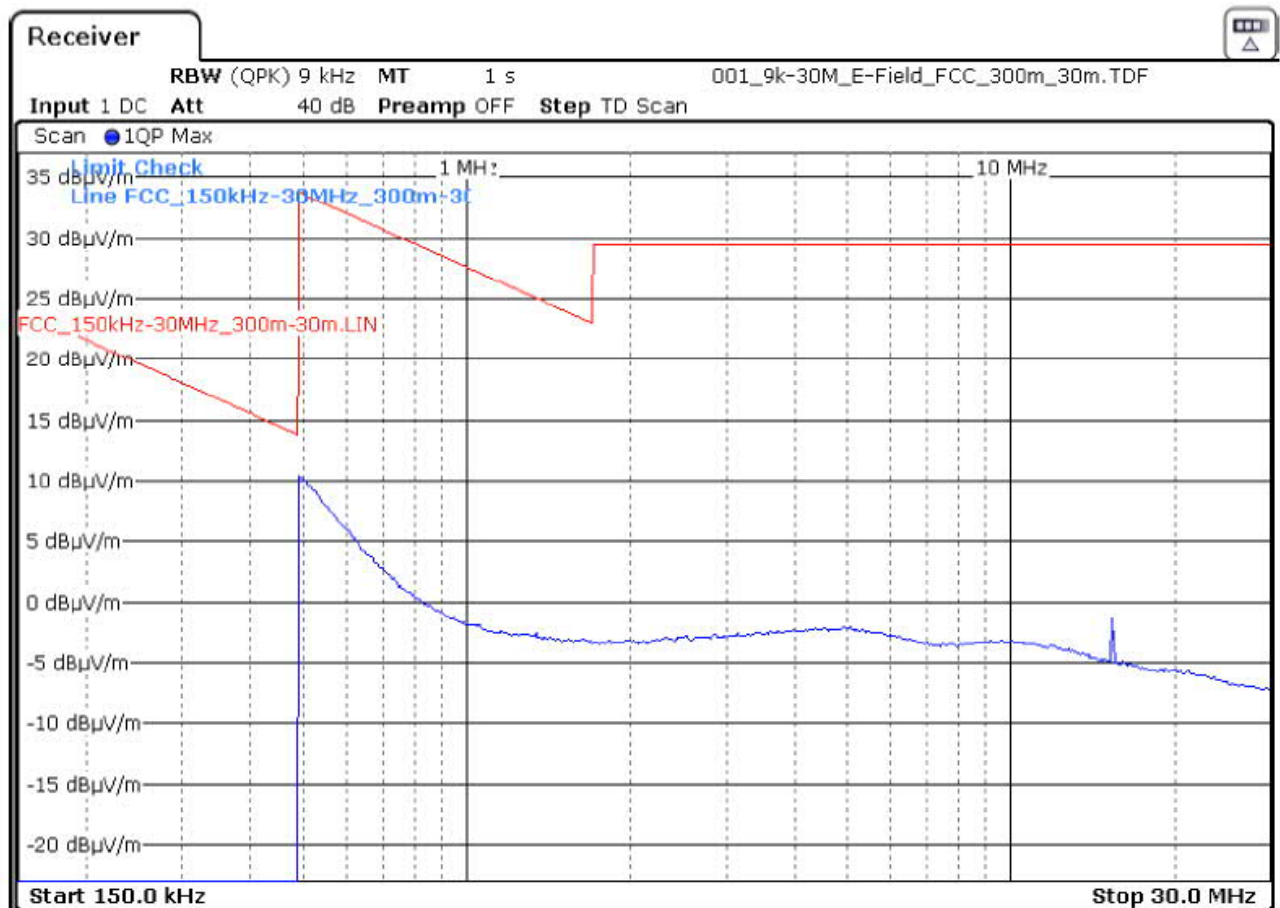
Start 9.0 kHz Stop 150.0 kHz

[illegible]

Ref.-No.: 22/09-0001

Operation mode: TX BLE; CH.20 (2442MHz)

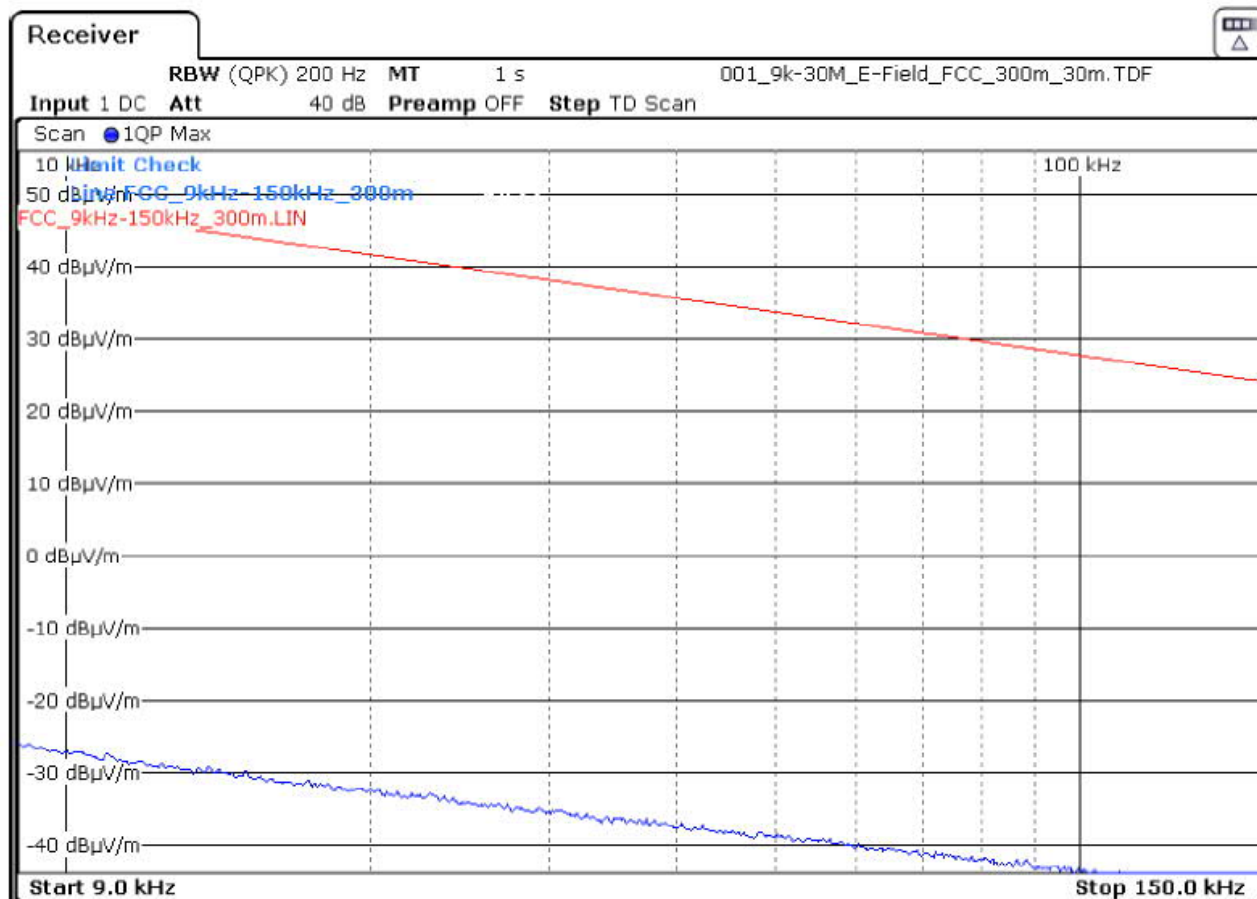
Position Y (150kHz – 30MHz)

[illegible]

Ref.-No.: 22/09-0001

Operation mode: TX BLE; CH.20 (2442MHz)

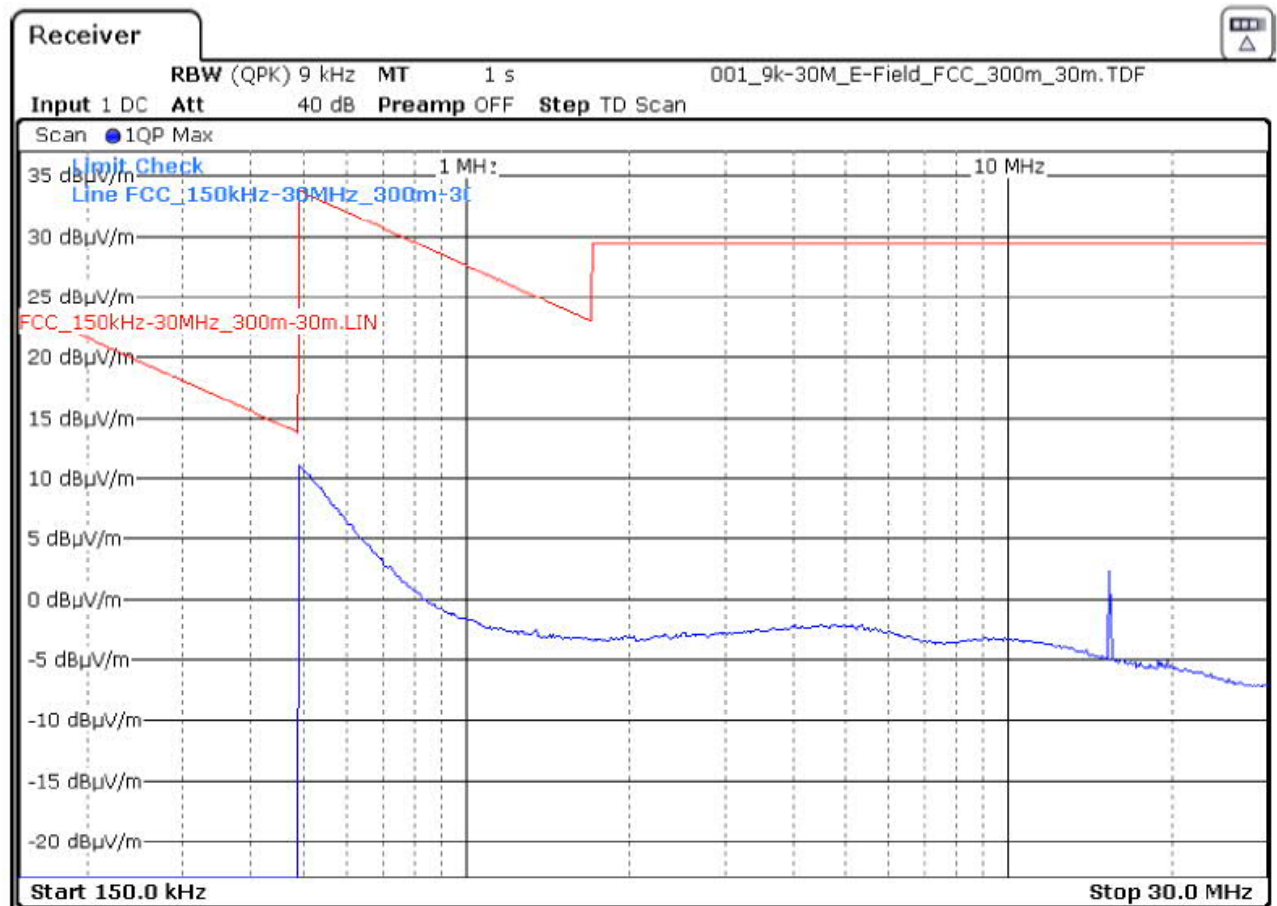
Position Z (9kHz - 150kHz)

[illegible]

Ref.-No.: 22/09-0001

Operation mode: TX BLE; CH.20 (2442MHz)

Position Z (150kHz – 30MHz)

[illegible]

Ref.-No.: 22/09-0001

Product: Camera

Sample: 01

Date: 07.09.2022

Operator: BI

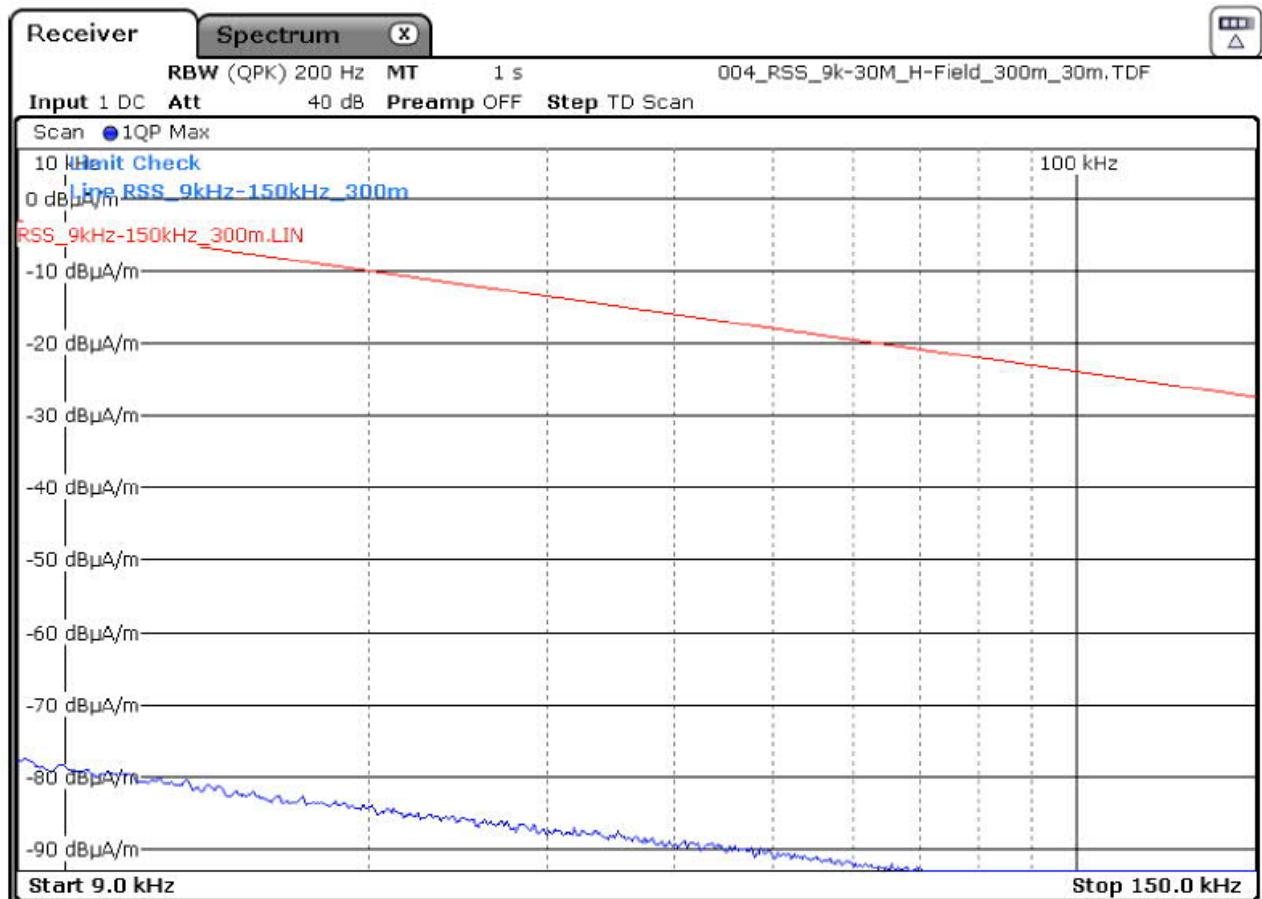
Remarks:

pass fail

Result: ☒ ☐

Operation mode: TX BLE; CH.20 (2442MHz)

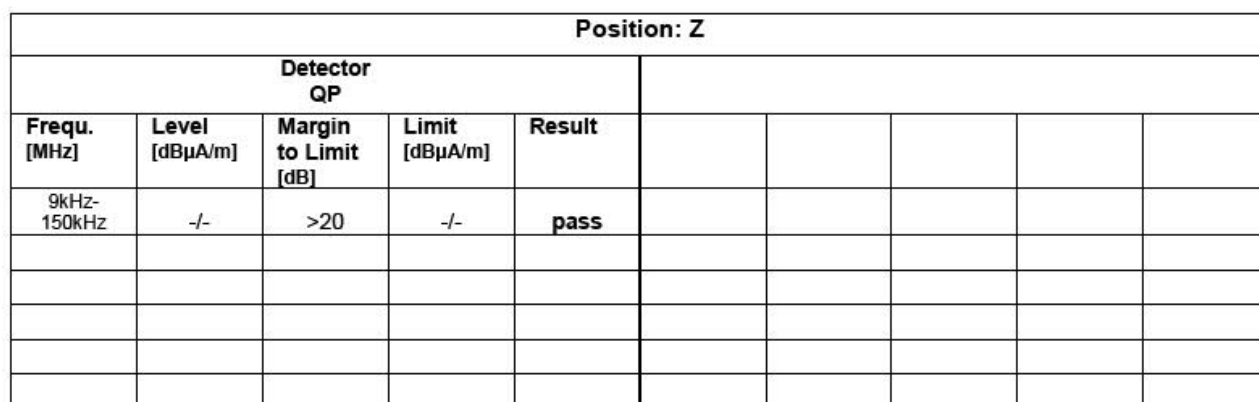
Position X (9kHz - 150kHz)



[illegible]

[illegible]

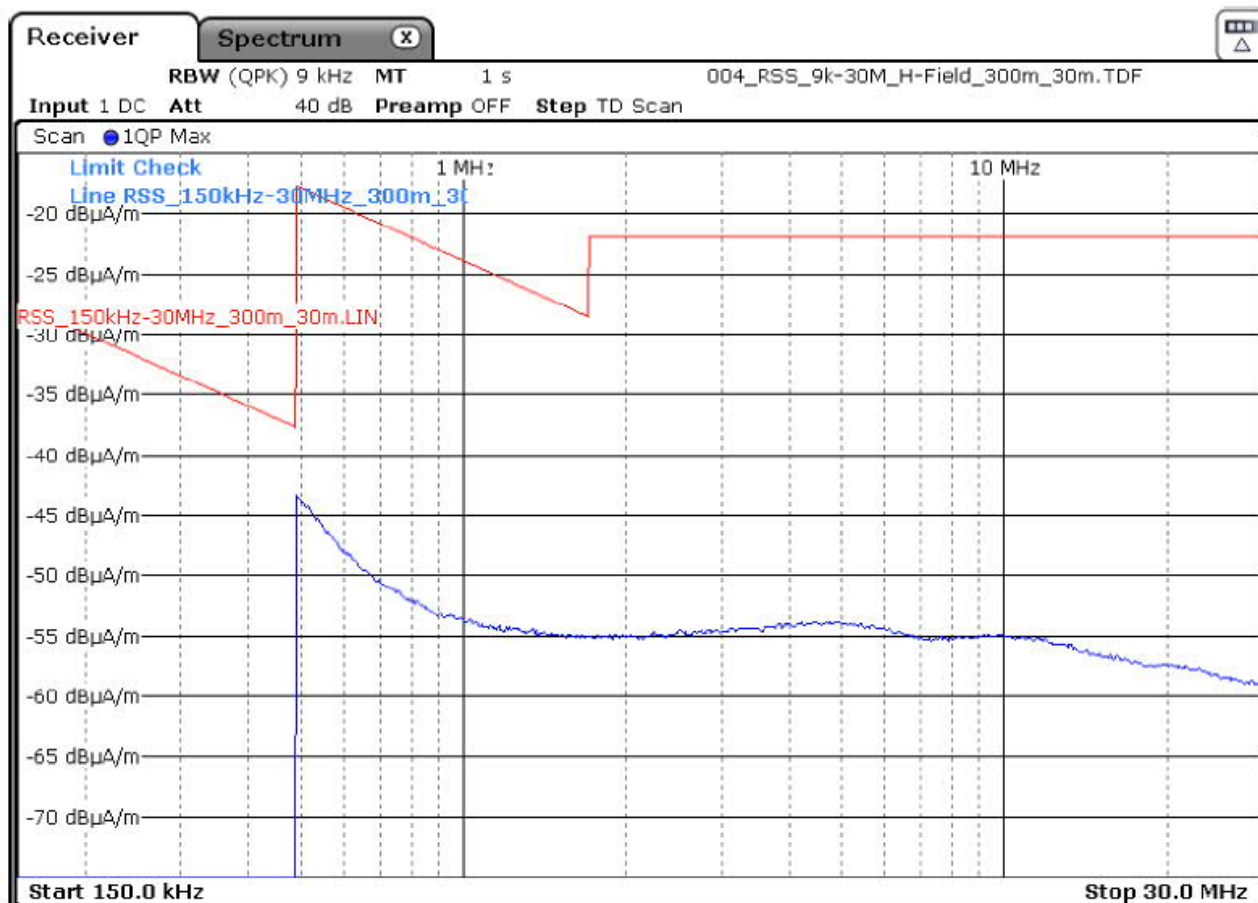
Position Z (9kHz - 150kHz)



Ref.-No.: 22/09-0001

Operation mode: TX BLE; CH.20 (2442MHz)

Position Z (150kHz – 30MHz)

[illegible]

Ref.-No.: 22/09-0001

Product: Camera

Sample: 01

Date: 07.09.2022

Operator: BI

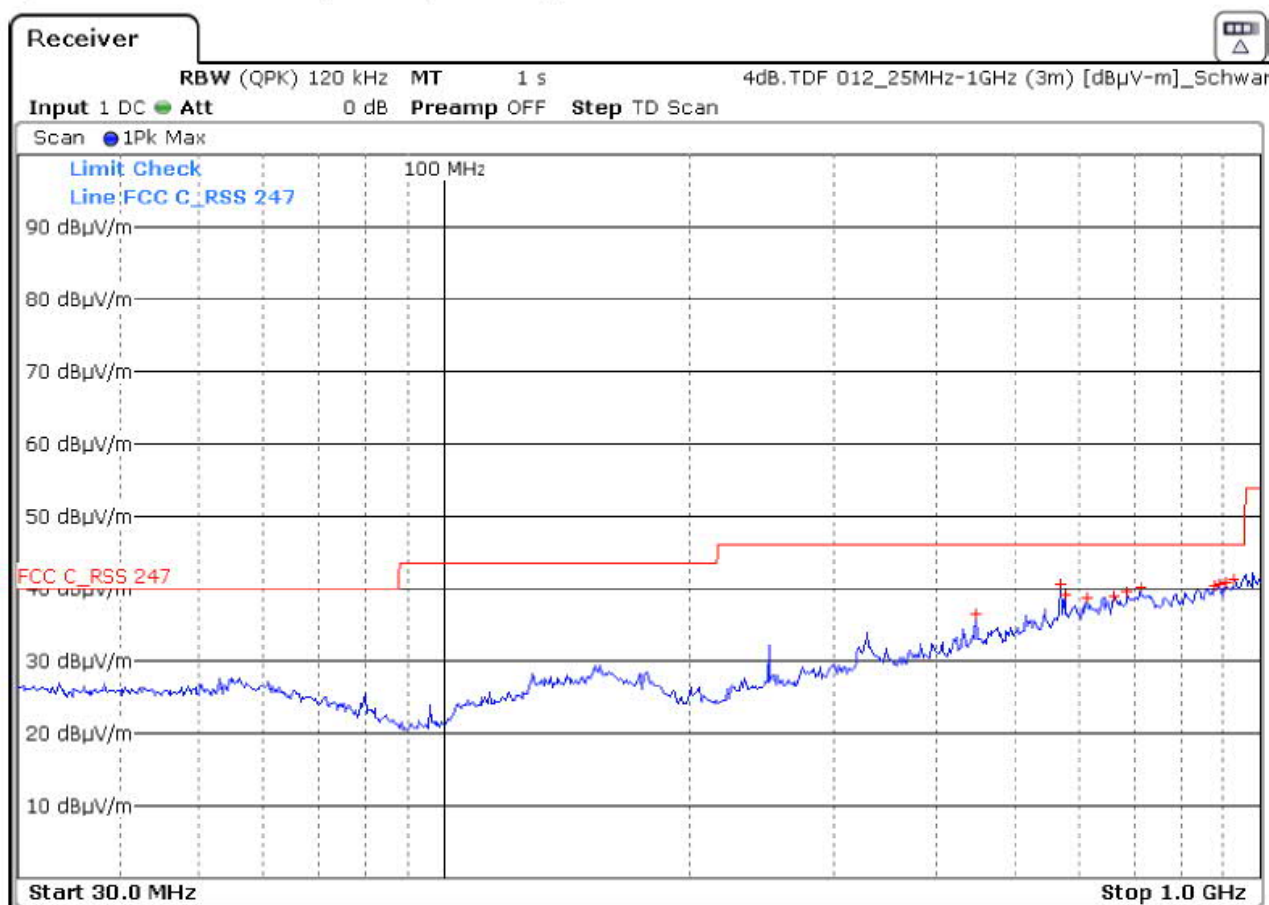
Remarks:

pass fail

Result: ☒ ☐

Final Measurement

Operation mode: TX BLE; CH.20 (2442MHz)

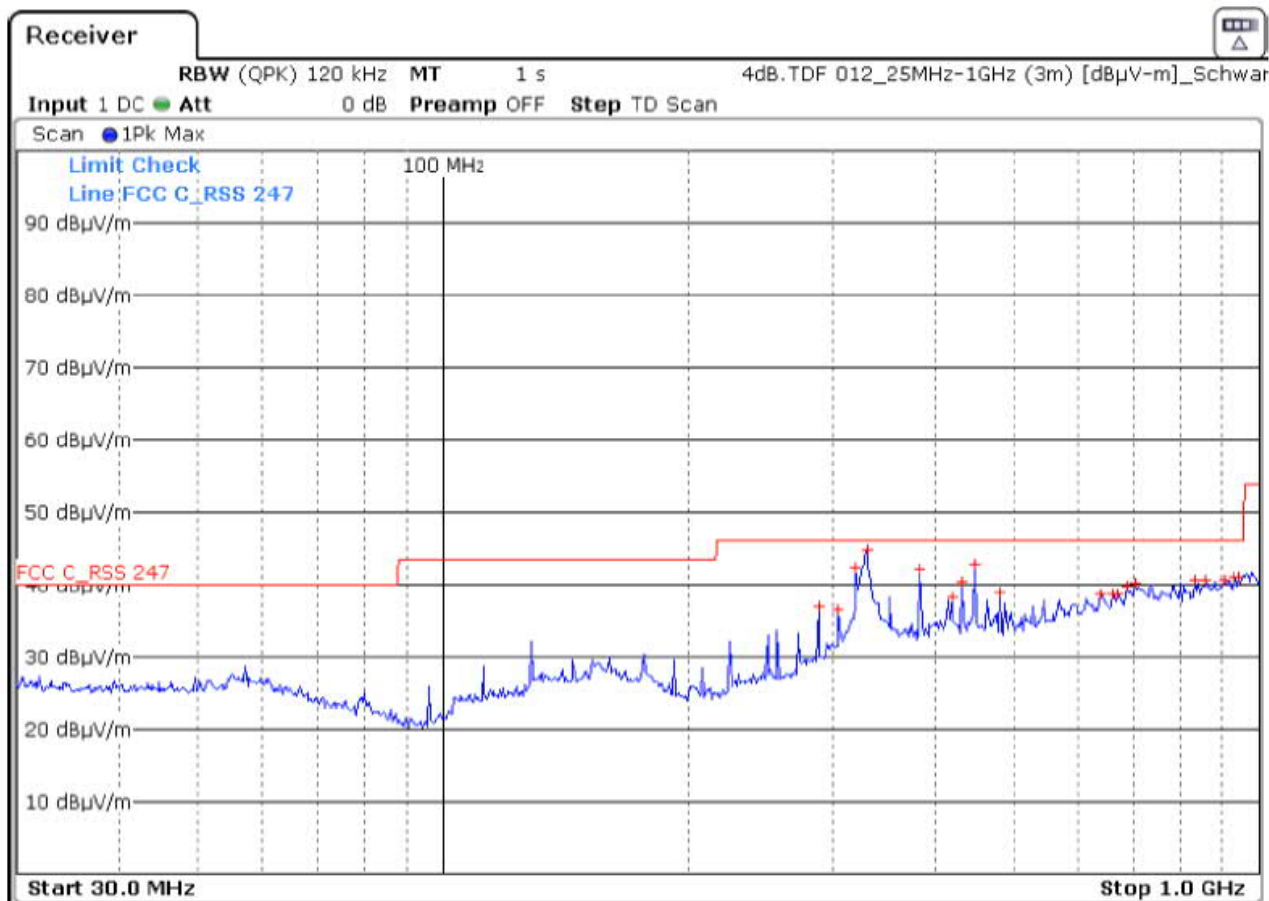


Polarisation: V

Scan Detector Peak					Final Detector Quasi Peak				
Frequ. [MHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [MHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
929,13	41,40	-4,60	46,00	pass					
905,49	40,87	-5,13	46,00	pass					
890,52	40,70	-5,30	46,00	pass					
568,17	40,59	-5,41	46,00	pass					
880,98	40,42	-5,58	46,00	pass					
712,77	40,14	-5,86	46,00	pass					
*Retest with Quasi Peak					Retest with Quasi Peak Detector not required				

Ref.-No.: 22/09-0001

Operation mode: TX BLE; CH.20 (2442MHz)

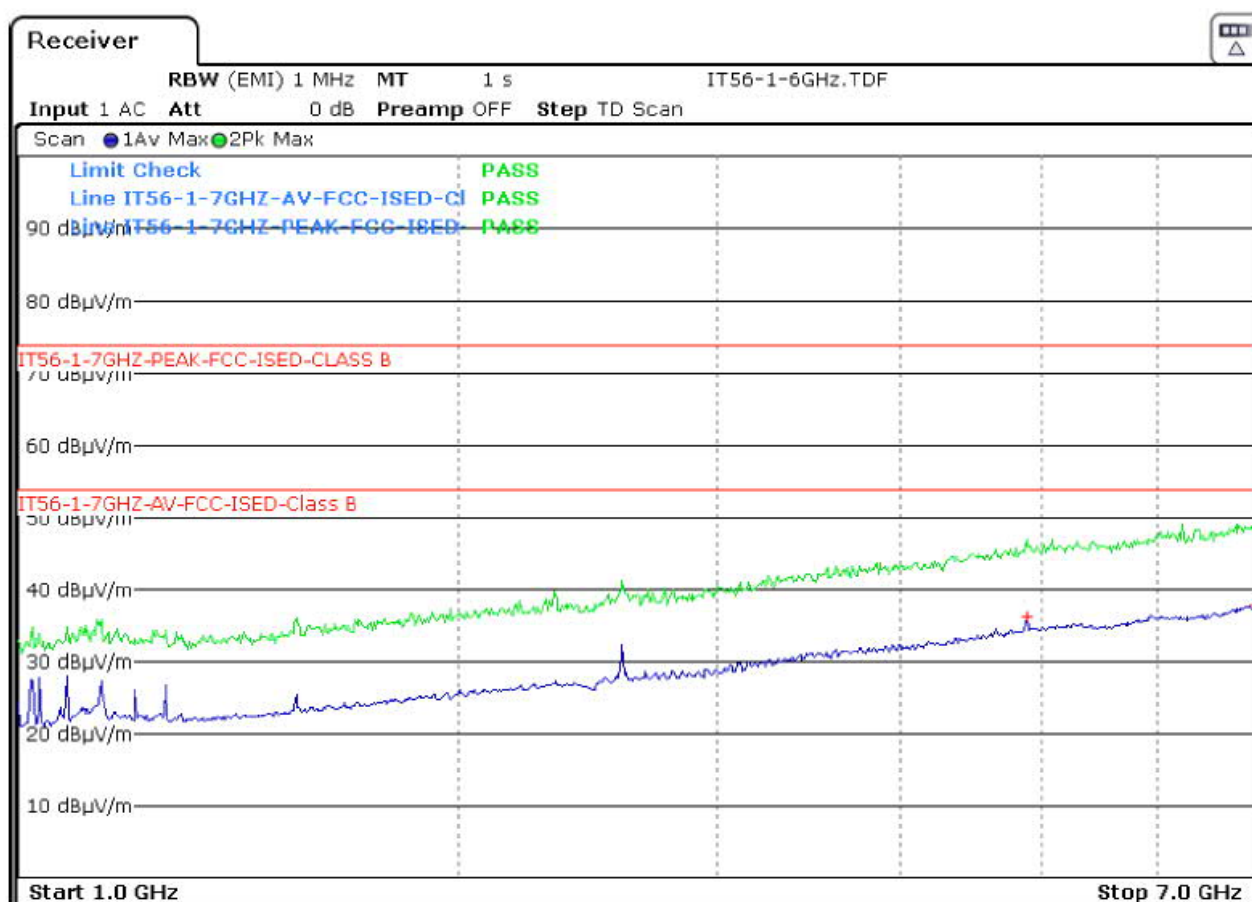


Polarisation: H									
Scan Detector Peak					Final Detector Quasi Peak				
Frequ. [MHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [MHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
330,72	44,72	-1,28	46,00	pass					
447,99	42,88	-3,12	46,00	pass					
319,98	42,41	-3,59	46,00	pass					
384,00	42,18	-3,82	46,00	pass					
931,08	41,07	-4,93	46,00	pass					
943,71	41,01	-4,99	46,00	pass					
*Retest with Quasi Peak					Retest with Quasi Peak Detector not required				

Testdistance Antenna/EUT: 3m

Remarks: BRF (2.4GHz/11243) connected (1-7GHz)

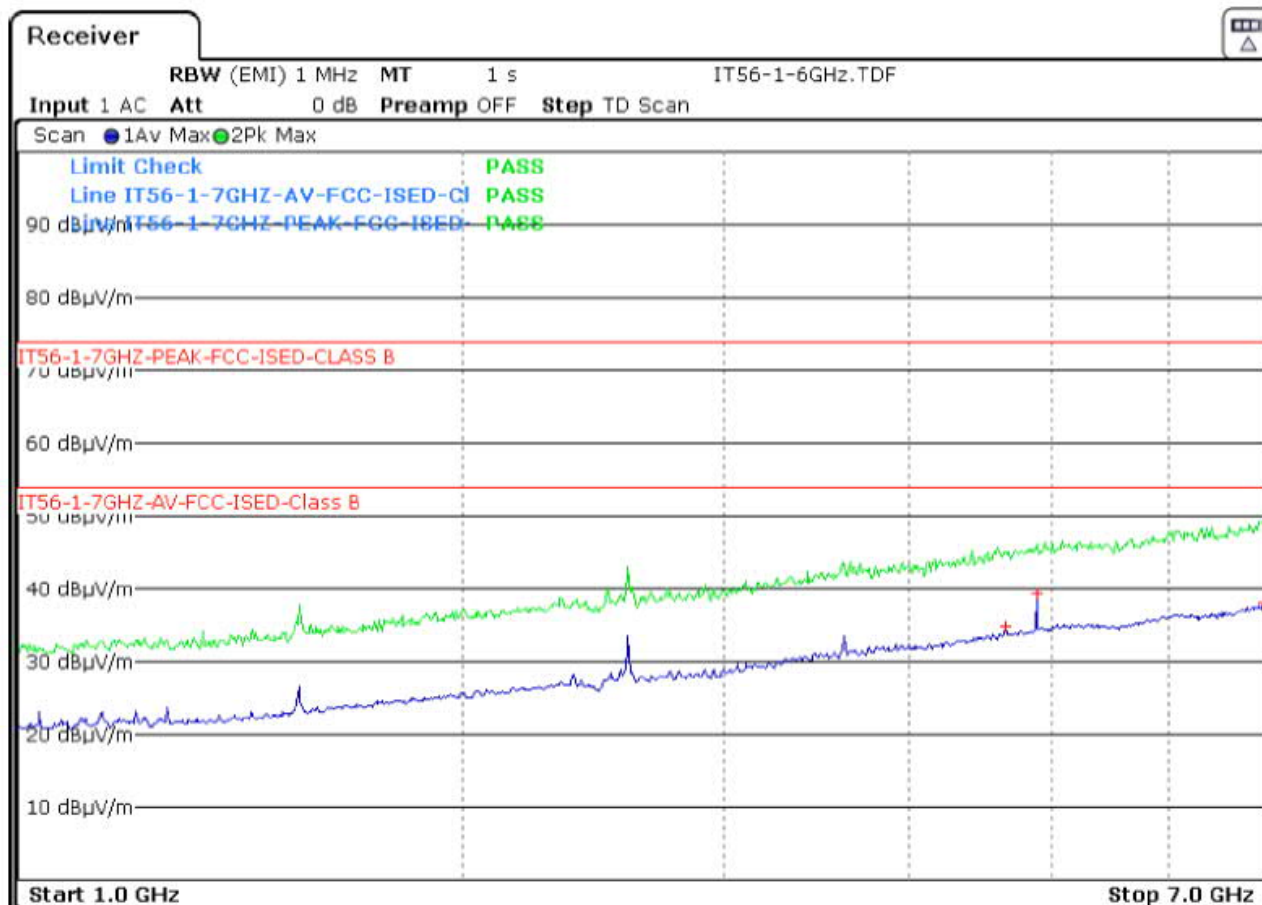
Result: ☒ ☐



Polarisation: V									
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
6,9905	37,89	-16,11	54,00	pass	1 - 7	--/--	>10	74,00	pass
4,8838	36,28	-17,72	54,00	pass					

acc. FCC Subpart C; § 15.247 / acc. RSS-247

Operation mode: TX BLE; CH.20 (2442MHz)

[illegible]

Ref.-No.: 22/09-0001

Product: Camera

Sample: 01

Date: 21.07.2022

Operator: BI

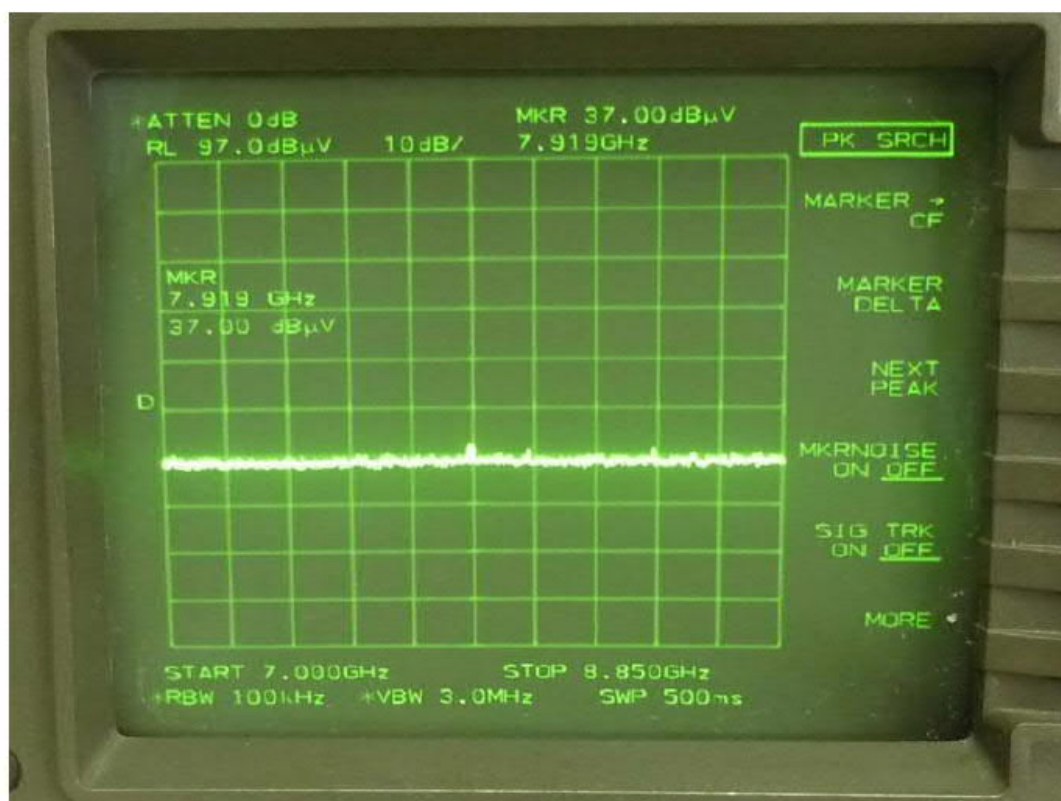
Remarks:

pass fail

Result: ☒ ☐

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 7GHz - 8,85GHz used; RBW 100 kHz; No significant emission found

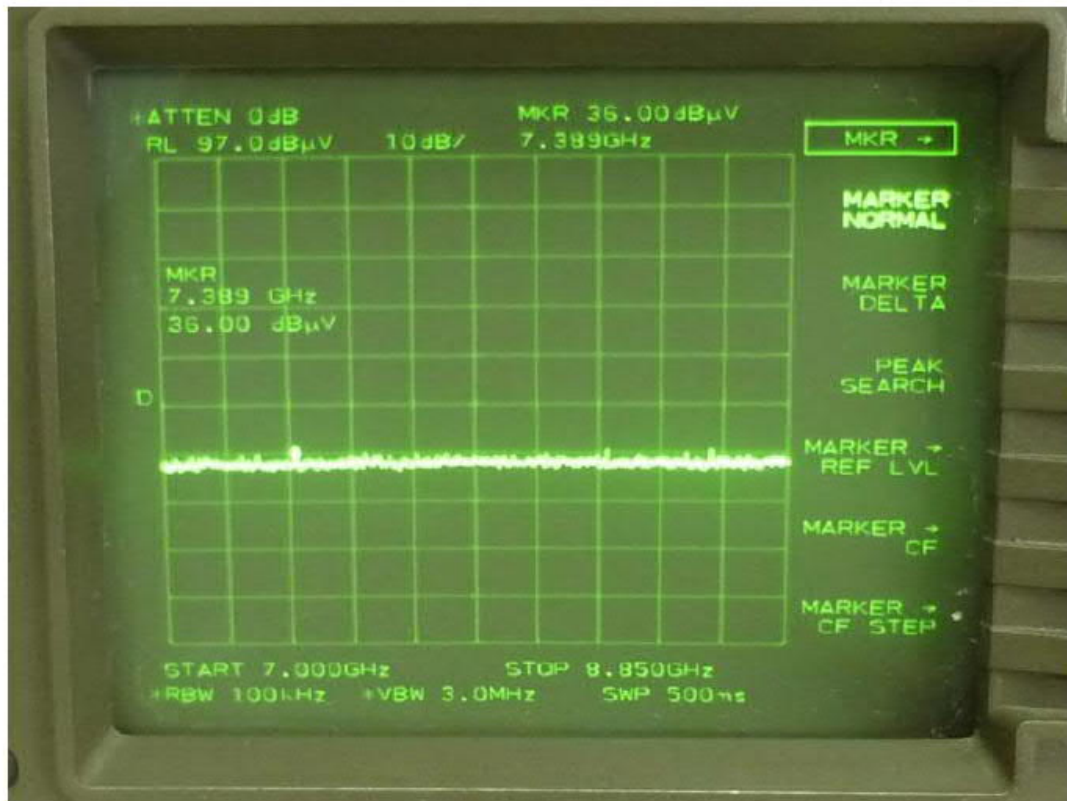


Polarisation: V				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
7 – 8,85	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 7GHz - 8,85GHz used; RBW 100 kHz; No significant emission found

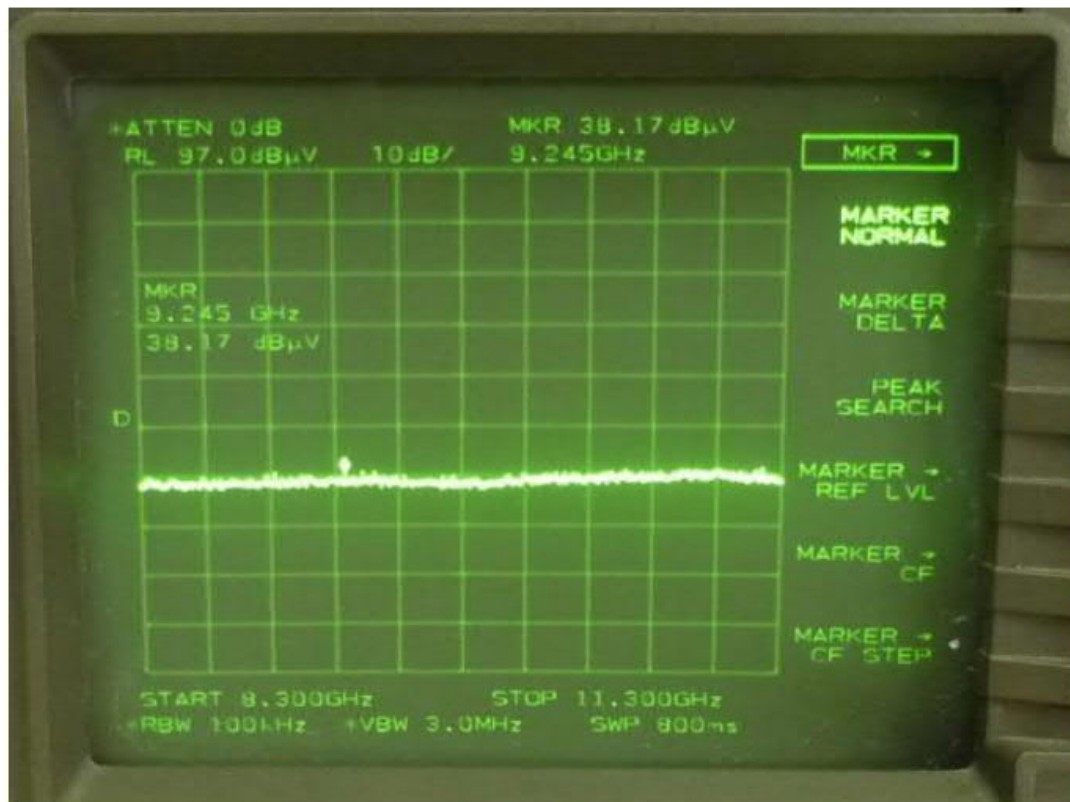


Polarisation: H				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
7 – 8,85	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 8,3GHz -11,3GHz used; RBW 100 kHz; No significant emission found

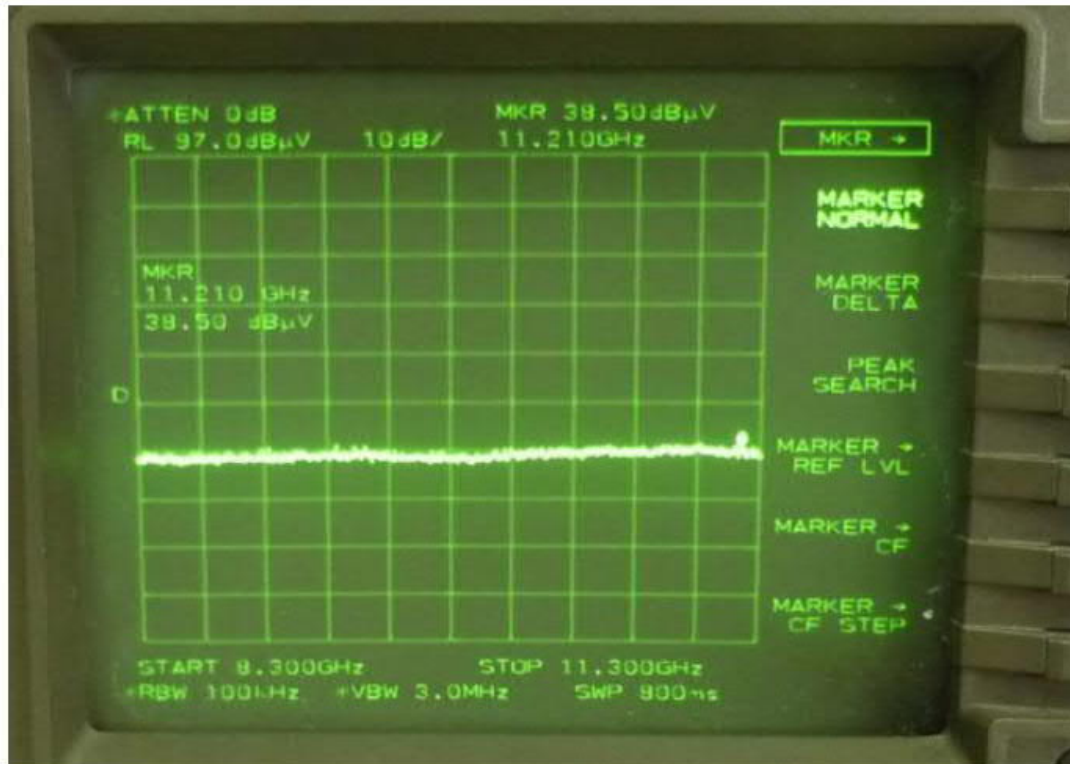


Polarisation: V				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
8,3 – 11,3	—/—	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 8,3GHz -11,3GHz used; RBW 100 kHz; No significant emission found

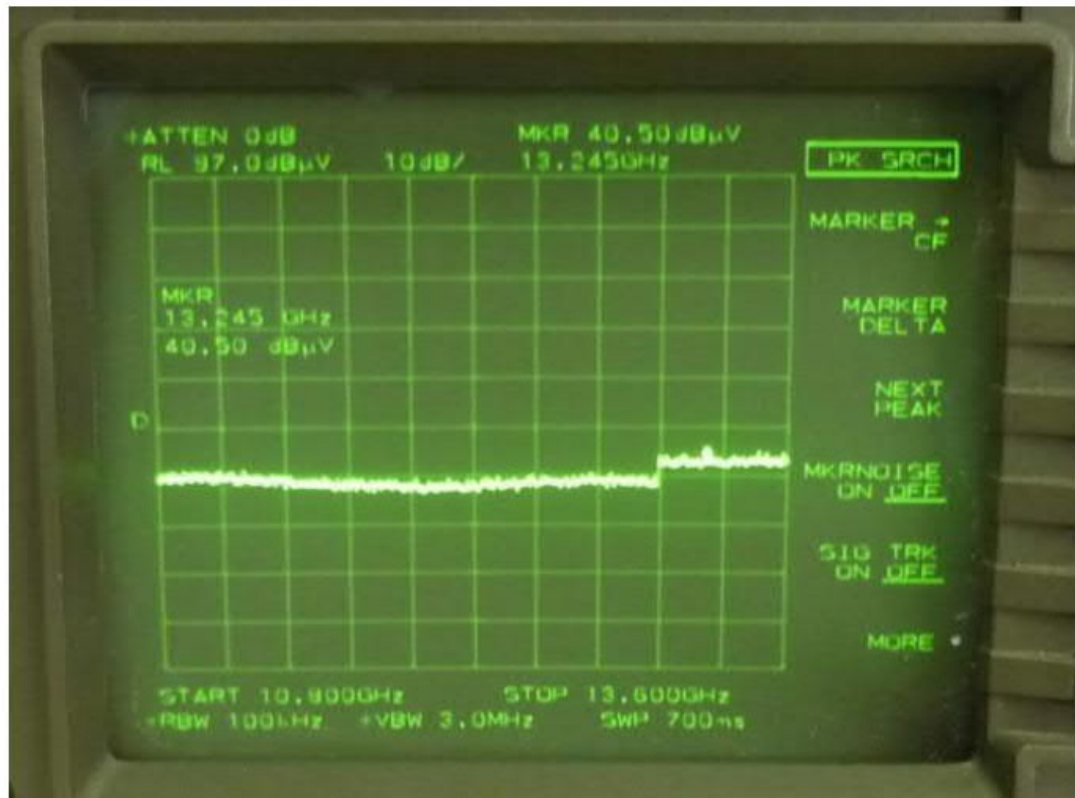


Polarisation: H				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
8,3 – 11,3	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 10,8GHz -13,6GHz used; RBW 100 kHz; No significant emission found

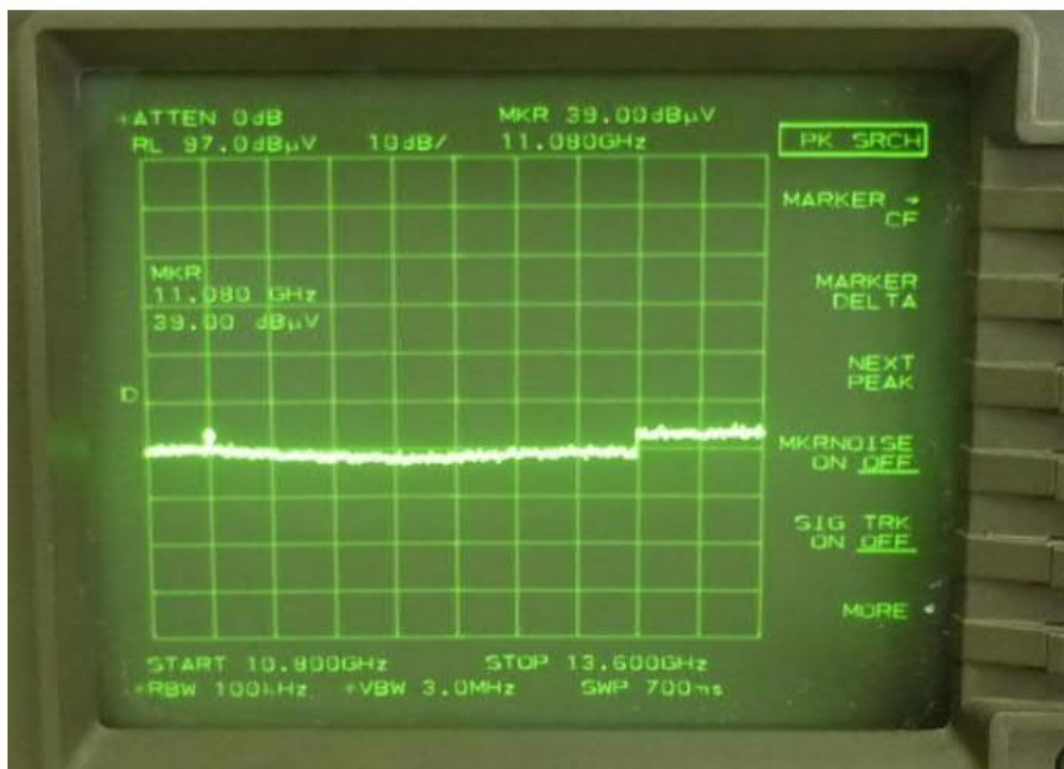


Polarisation: V				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
10,8 – 13,6	—/—	>10	74,00	pass

Ref.-No.: **22/09-0001**

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 10,8GHz -13,6GHz used; RBW 100 kHz; No significant emission found

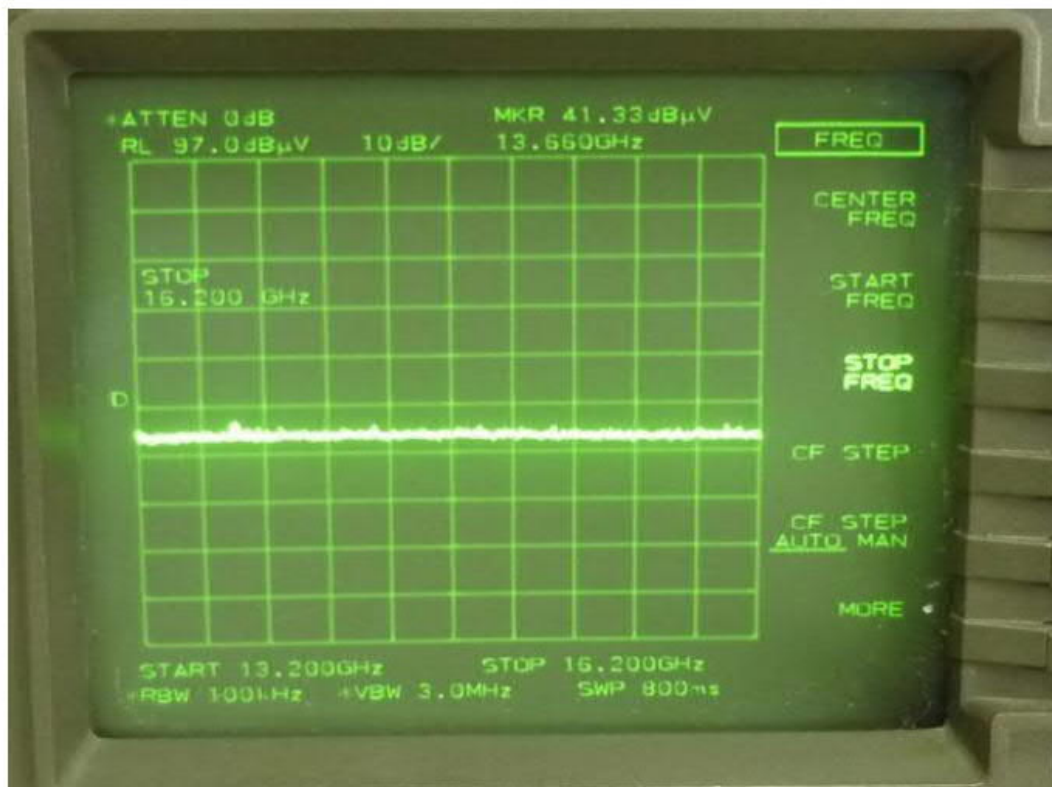


Polarisation: H				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
10,8 – 13,6	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 13,2GHz - 16,2GHz used; RBW 100kHz; No significant emission found

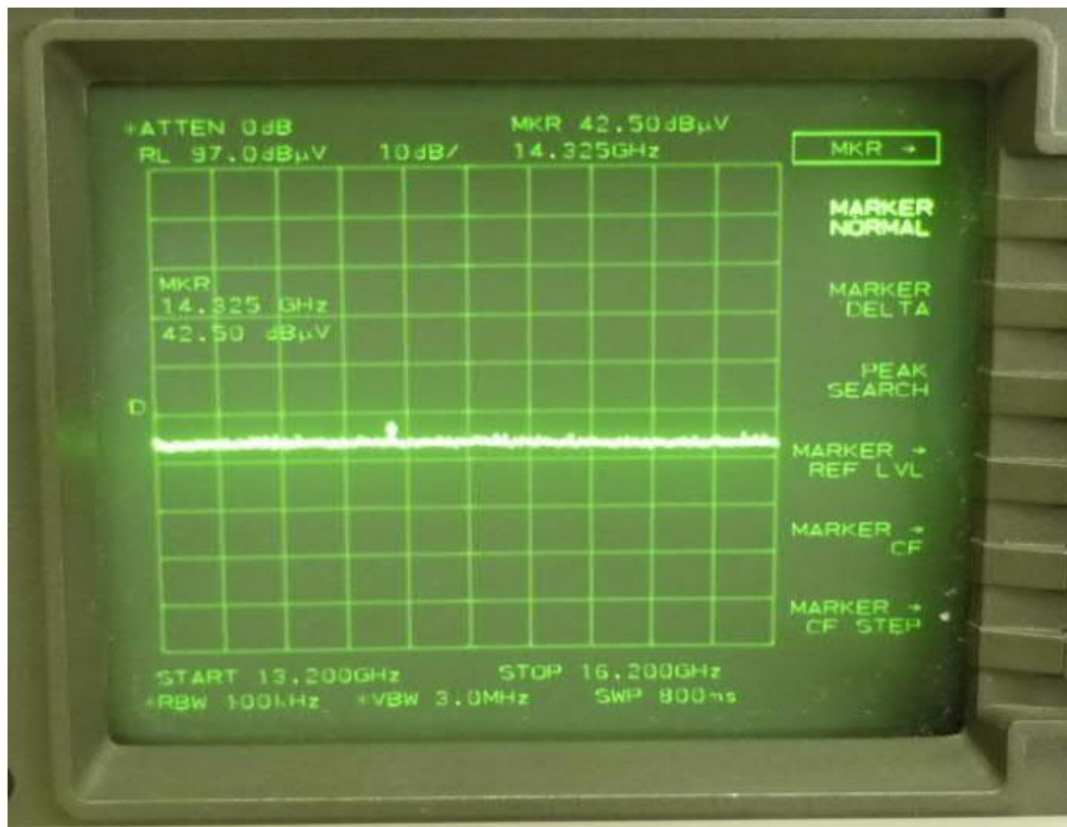


Polarisation: V				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
13,2 – 16,2	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 13,2GHz - 16,2GHz used; RBW 100kHz; No significant emission found

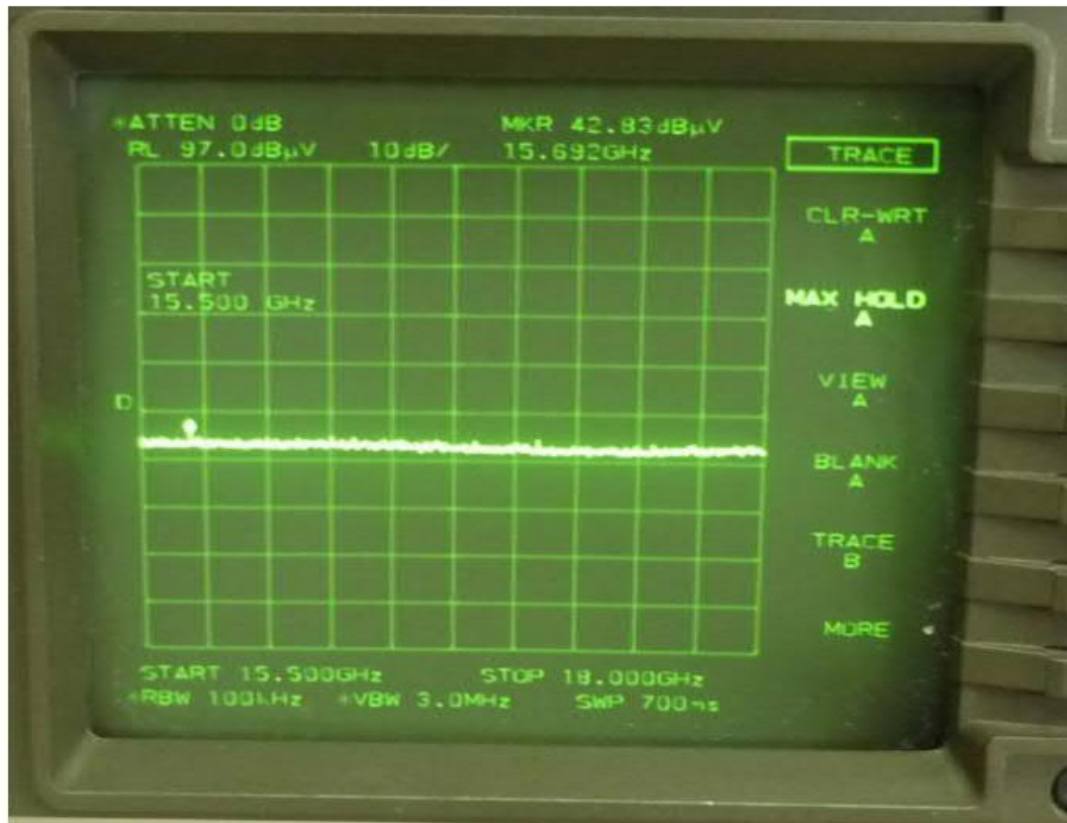


Polarisation: H				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
13,2 – 16,2	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 15,5GHz -18GHz used; RBW 100kHz; No significant emission found

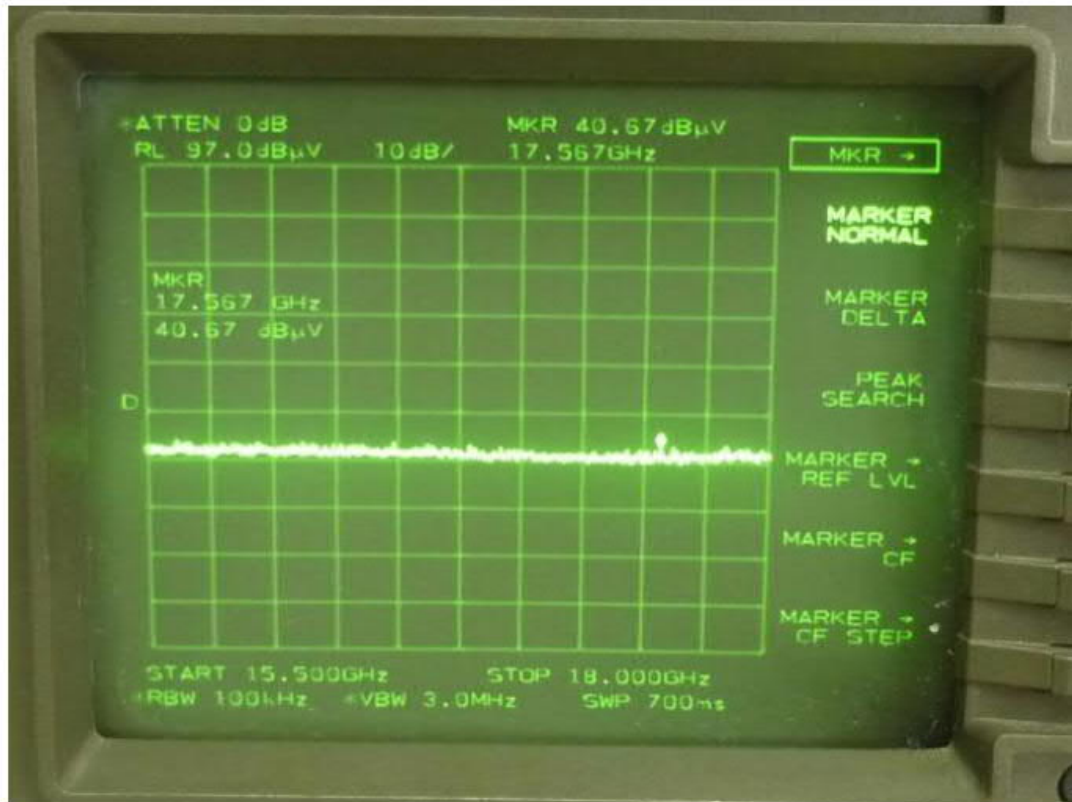


Polarisation: V				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
15,5 – 18	—/—	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

Bandpass 15,5GHz -18GHz used; RBW 100kHz; No significant emission found

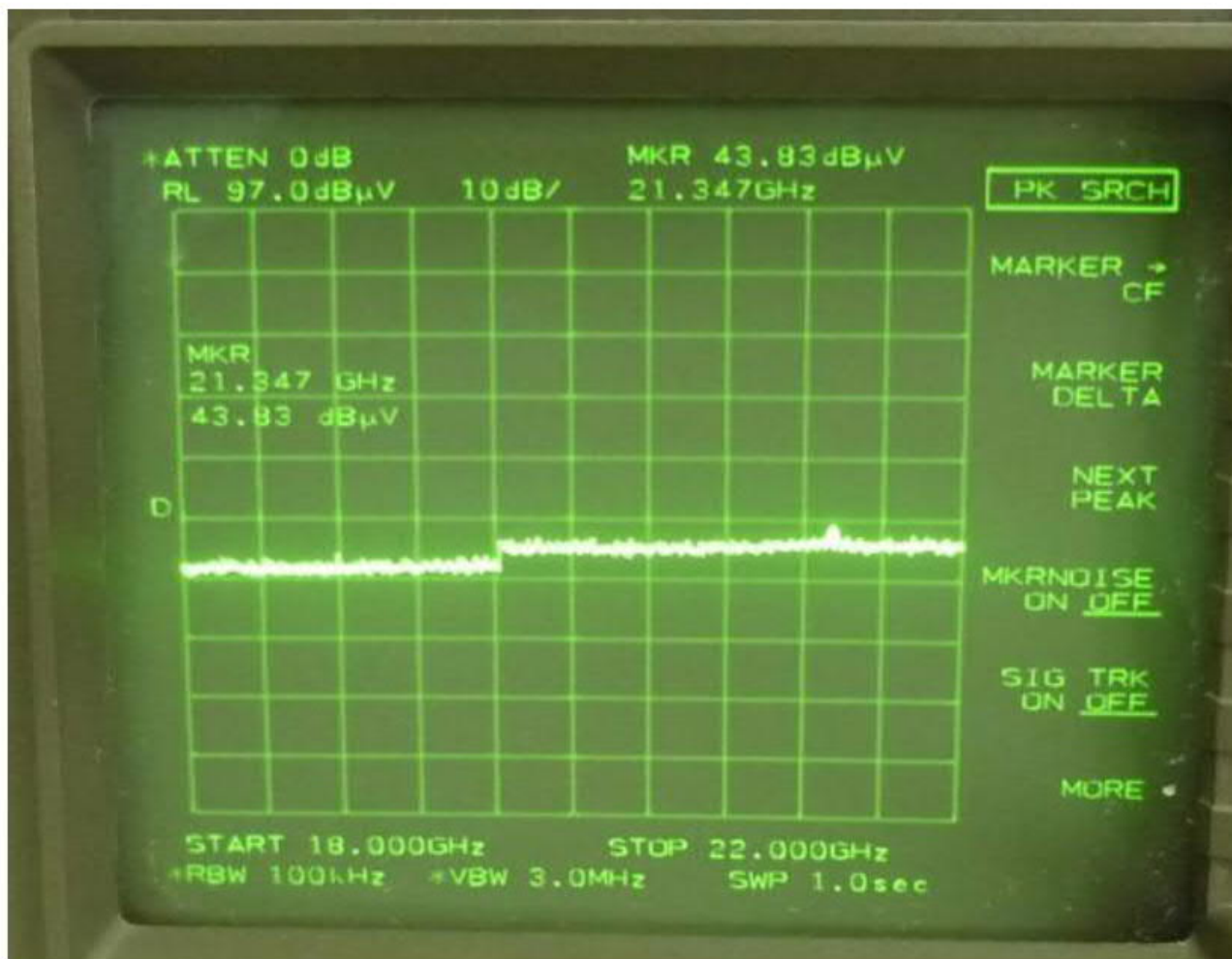


Polarisation: H				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
15,5 – 18	—/—	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

RBW 100 kHz; No significant emission found

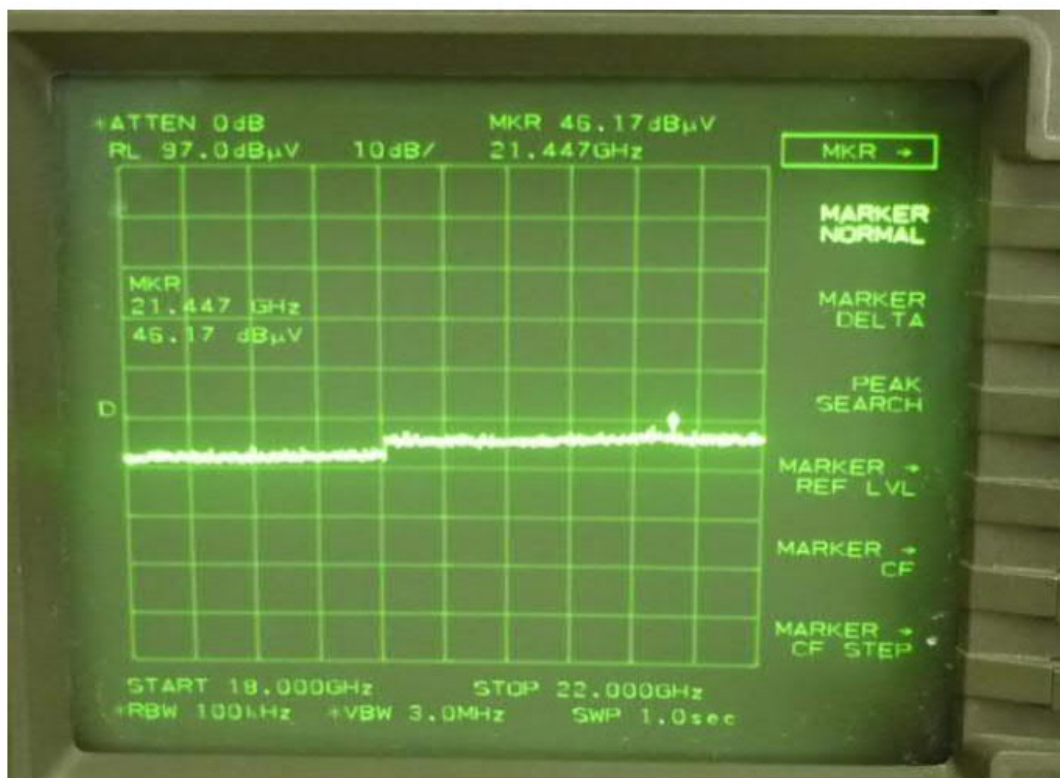


Polarisation: V				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
18 – 22	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

RBW 100 kHz; No significant emission found



Polarisation: H				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
18 – 22	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

RBW 100 kHz; No significant emission found



Polarisation: V				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
22 – 26,5	–/–	>10	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.20 (2442MHz)

RBW 100 kHz; No significant emission found



Polarisation: H				
Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
22 – 26,5	–/–	>10	74,00	pass

Result 9 kHz – 30 MHz

Remarks:

Composition of the measurement value (Freq.-range < 30 MHz):

$$M_{\text{Value}} = M_{\text{Rec}} + C_{\text{Loss}} + AF_{\text{Rec}}$$

M_{Value} = Measurement Value

M_{Rec} = Reading value of test receiver

C_{Loss} = Cable loss between Receiver and Antenna

AF_{Rec} = Antenna factor.

Sample calculation:

$$38.2 \text{ dB}\mu\text{V} = 18.3 \text{ dB}\mu\text{V} + 0.1 \text{ dB} + 19.8 \text{ dB}$$

Result 30 MHz – 1000 MHz

Remarks:

Composition of the measurement value (Freq.-range 30 MHz – 1000 MHz):

$$M_{\text{Value}} = M_{\text{Rec}} + C_{\text{Loss}} + AF_{\text{Rec}}$$

M_{Value} = Measurement Value

M_{Rec} = Reading value of test receiver

C_{Loss} = Cable loss between Receiver and Antenna

AF_{Rec} = Antenna factor.

Sample calculation:

$$38.7 \text{ dB}\mu\text{V} = 18.3 \text{ dB}\mu\text{V} + 0.6 \text{ dB} + 19.8 \text{ dB}$$

Result: Frequenz-range > 1 GHz

Remarks:

Composition of the measurement value (Freq.-range 1 GHz – 26 GHz):

$$M_{\text{Value}} = M_{\text{Rec}} + C_{\text{Loss}} + AF_{\text{Rec}} - G_{\text{Amp}}$$

M_{Value} = Measurement Value

M_{Rec} = Reading value of test receiver

C_{Loss} = Cable loss between Receiver and Antenna

AF_{Rec} = Antenna factor.

G_{Amp} = Gain Amplifier

Sample calculation:

$$39.7 \text{ dB}\mu\text{V} = 53.01 \text{ dB}\mu\text{V} + 0.9 \text{ dB} + 24.19 \text{ dB} - 38.4 \text{ dB}$$

8. Operation within the band 902-928 MHz, 2400-2483,5 MHz and 5725-5850 MHz

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247
-RSS-247 issue 2

8.1. 6 dB DTS Bandwidth Measurement

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (a) (2)
-RSS-247 issue 2 Section 5.2 (a)

Limit

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test equipment and test set up

Test equipment used for conducted measurements as given in clause Test equipment of this report.
Test setup used for conducted measurements as given in clause Test setups of this report.

Description

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Measurement

No measurement was performed

Result

-/-

8.2. Output Power of Fundamental Emissions

Maximum conducted/radiated Output Power

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (b) (3)
 -RSS-247 Issue 2 section 5.4 (d)

Limits for Peak Output Power of Fundamental (EIRP)

The maximum peak conducted/radiated output power of the intentional radiator shall not exceeded: 1 Watt
 As an alternative to the maximum peak conducted/radiated output power the average output power is measured to show compliance to the limit.

Test equipment and test set up

Test equipment used for conducted/radiated measurements as given in clause Test equipment of this report.
 Test setup used for conducted/radiated measurements as given in clause Test setups of this report.

The radio module was installed without any modification with the identical settings. The used antenna is model 2450AT18D0100. The radio module in the host "Zeiss Camera" has no connection for conducted measurements.

Description

For the conducted/radiated measurement, the RF output of the EUT was connected/radiated to the Analyzer.
 All the attenuation or cable loss will be added to the measured maximum output power.
 The results are recorded in Watt.

Radiated measurement data

The measurement was performed on: 07.09.2022

Maximum output power radiated measurement: Max. E.I.R.P.						
Channel	Frequency [MHz]	Output Power		Limit		Result
		[dBm]	[mW]	[dBm]	[mW]	
37	2402	4.77	3.00	30	1000	Pass
18	2442	5.02	3.18	30	1000	Pass
39	2480	3.60	2.29	30	1000	Pass

Result

From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements of **Output Power of Fundamental Emissions**.

Ref.-No.: 22/09-0001

Product: Camera

Sample: 01

Date: 07.09.2022

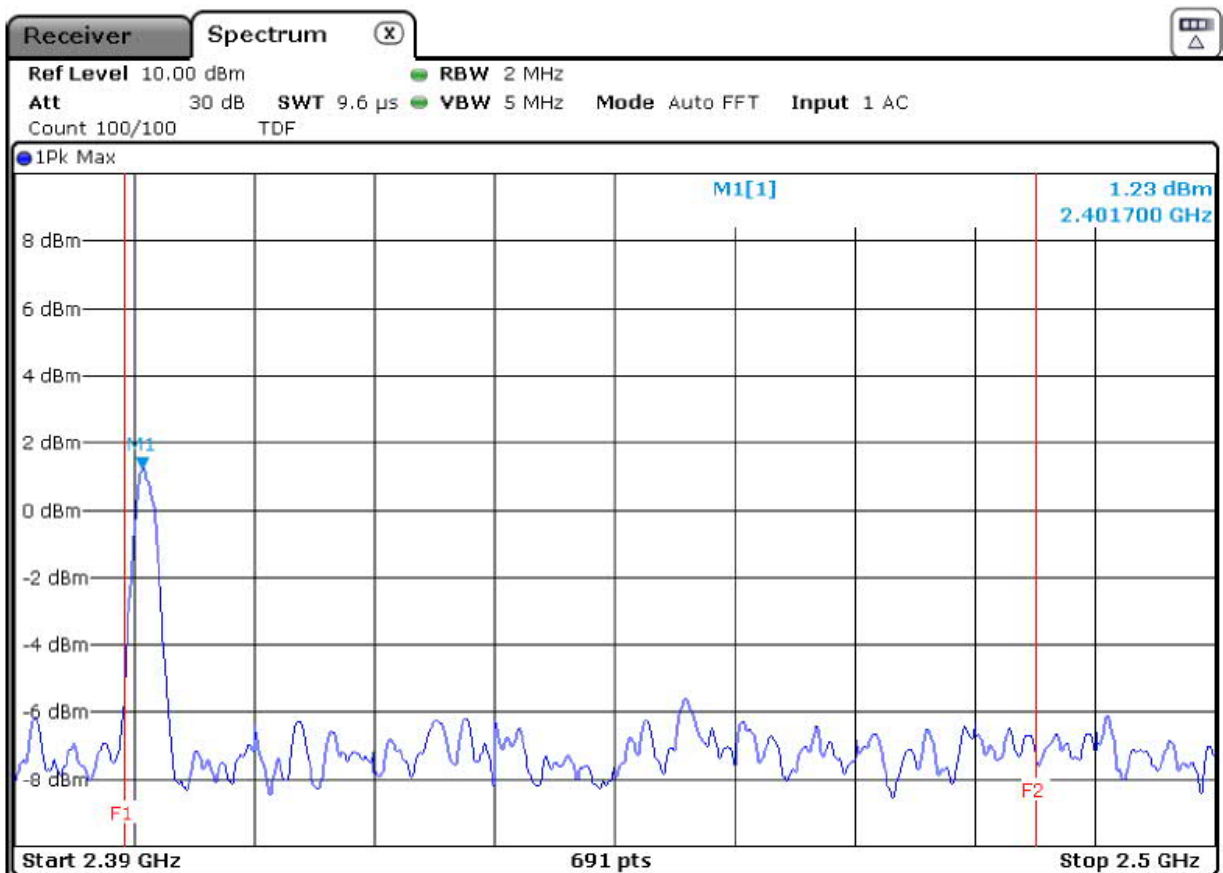
Operator: BI

Remarks:

pass fail

Result: ☒ ☐

Operating Mode: TX BLE; CH.0 (2402MHz)

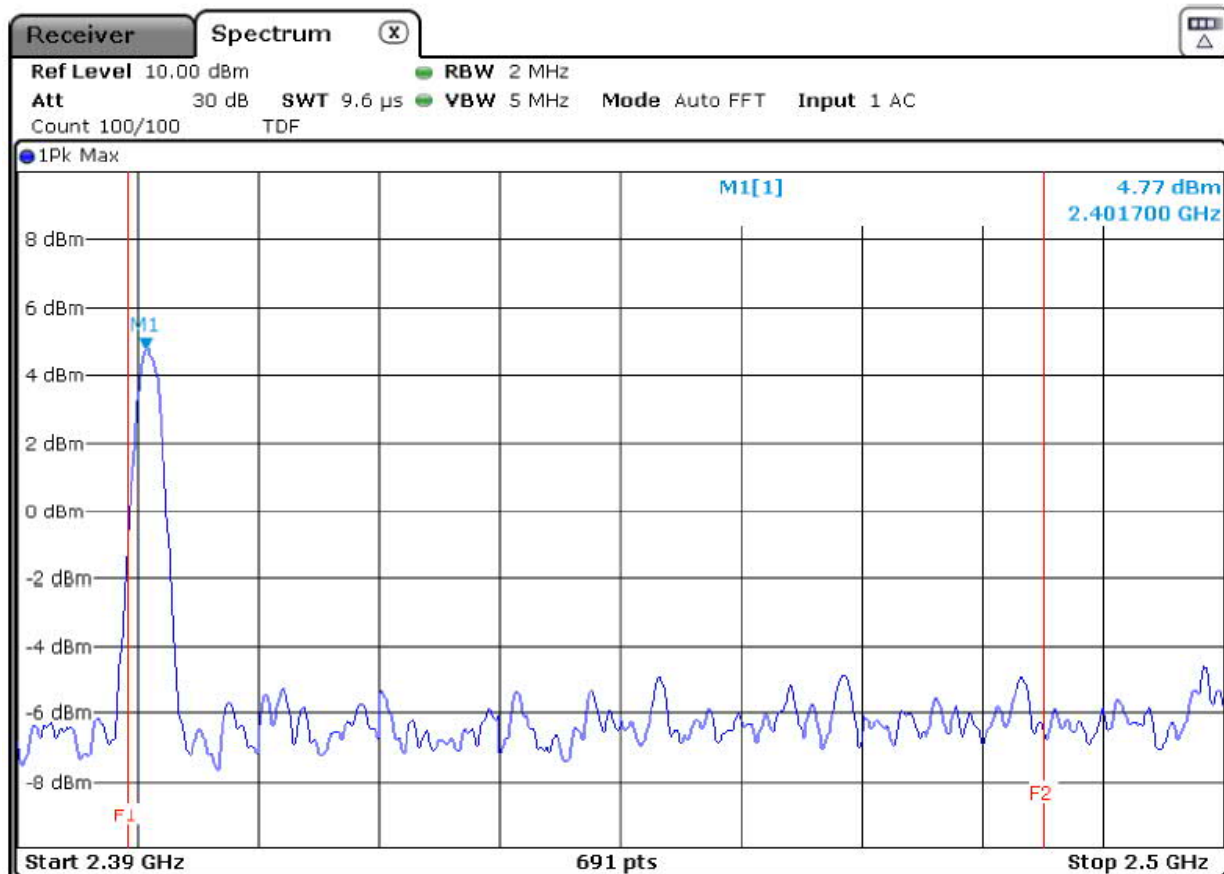


Position: X / Polarisation: V

Detector: Peak

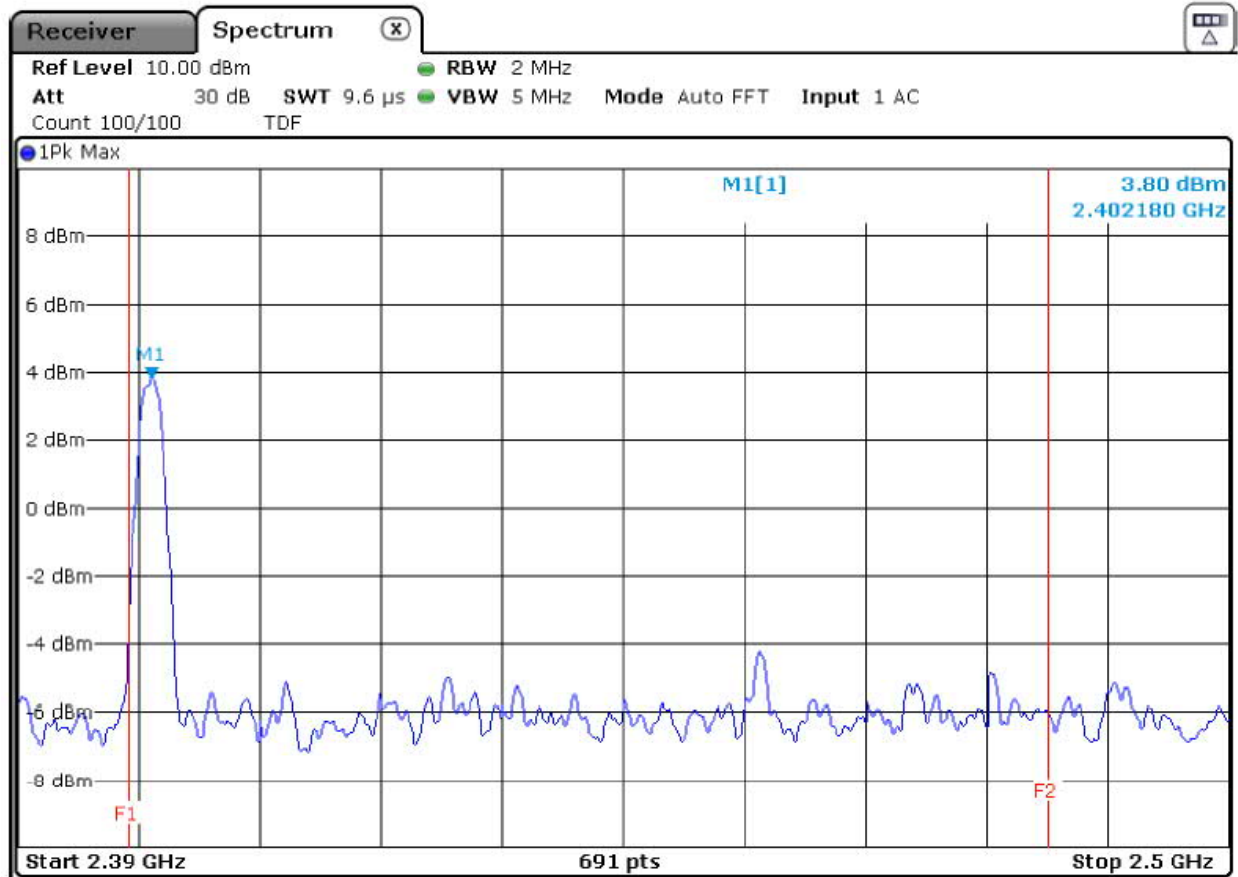
Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2402	1,23	-28,77	30,00	pass

Operating Mode: TX BLE; CH.0 (2402MHz)



Position: X / Polarisation: H				
Detector: Peak				
Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2402	4,77	-25,33	30,0	pass

Operating Mode: TX BLE; CH.0 (2402MHz)

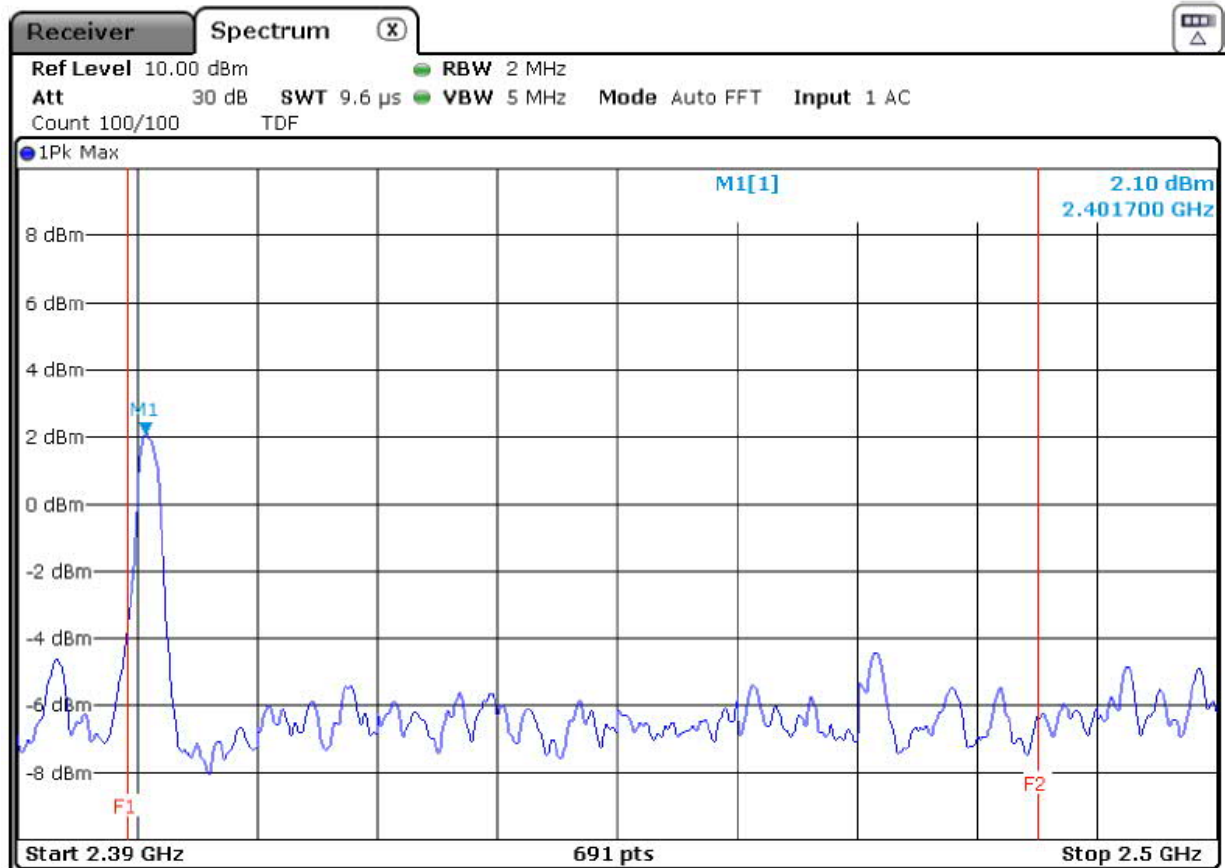


Position: Y / Polarisation: V

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2402	3,80	-26,2	30,00	pass

Operating Mode: TX BLE; CH.0 (2402MHz)

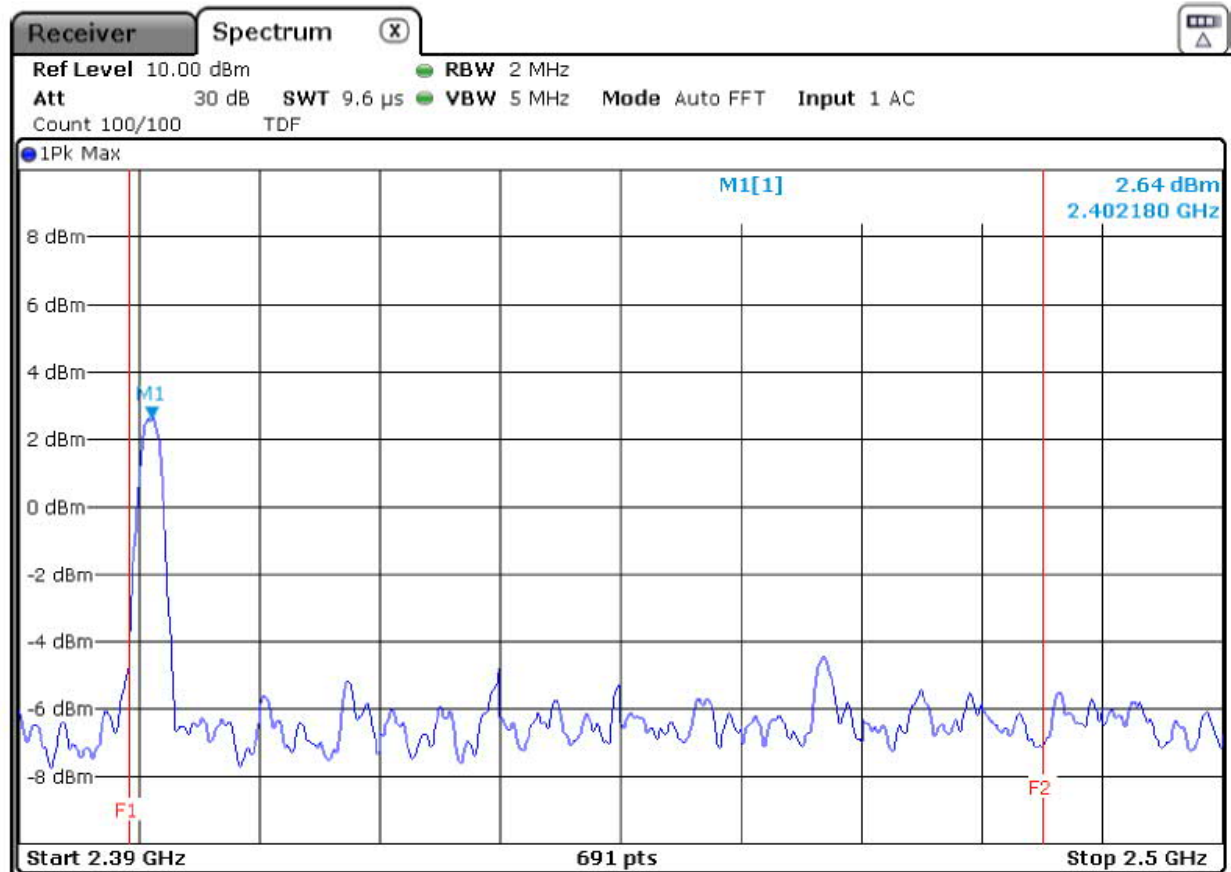


Position: Y / Polarisation: H

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2402	2,10	-27,90	30,00	pass

perating Mode: TX BLE; CH.0 (2402MHz)

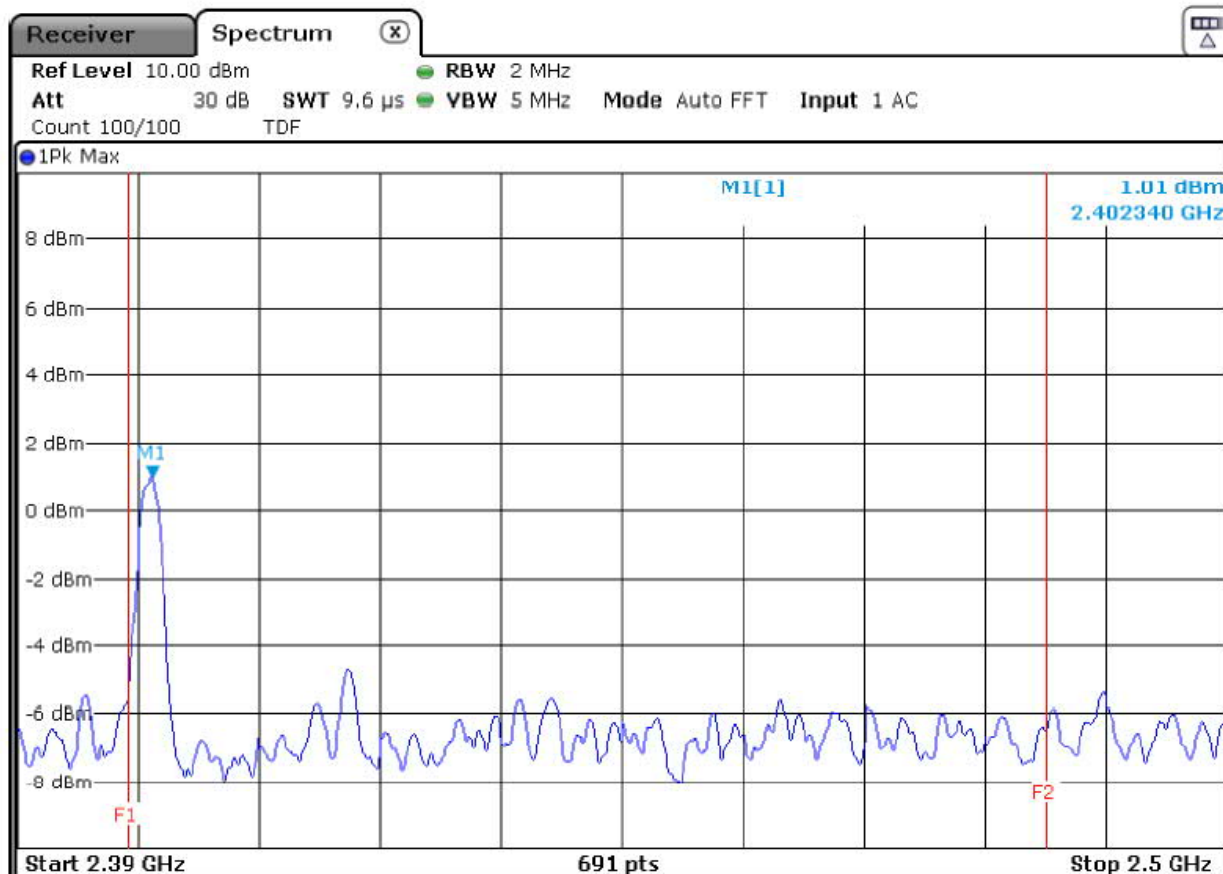


Position: Z / Polarisation: V

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2402	2,64	-27,36	30,00	pass

Operating Mode: TX BLE; CH.0 (2402MHz)



Position: Z / Polarisation: H

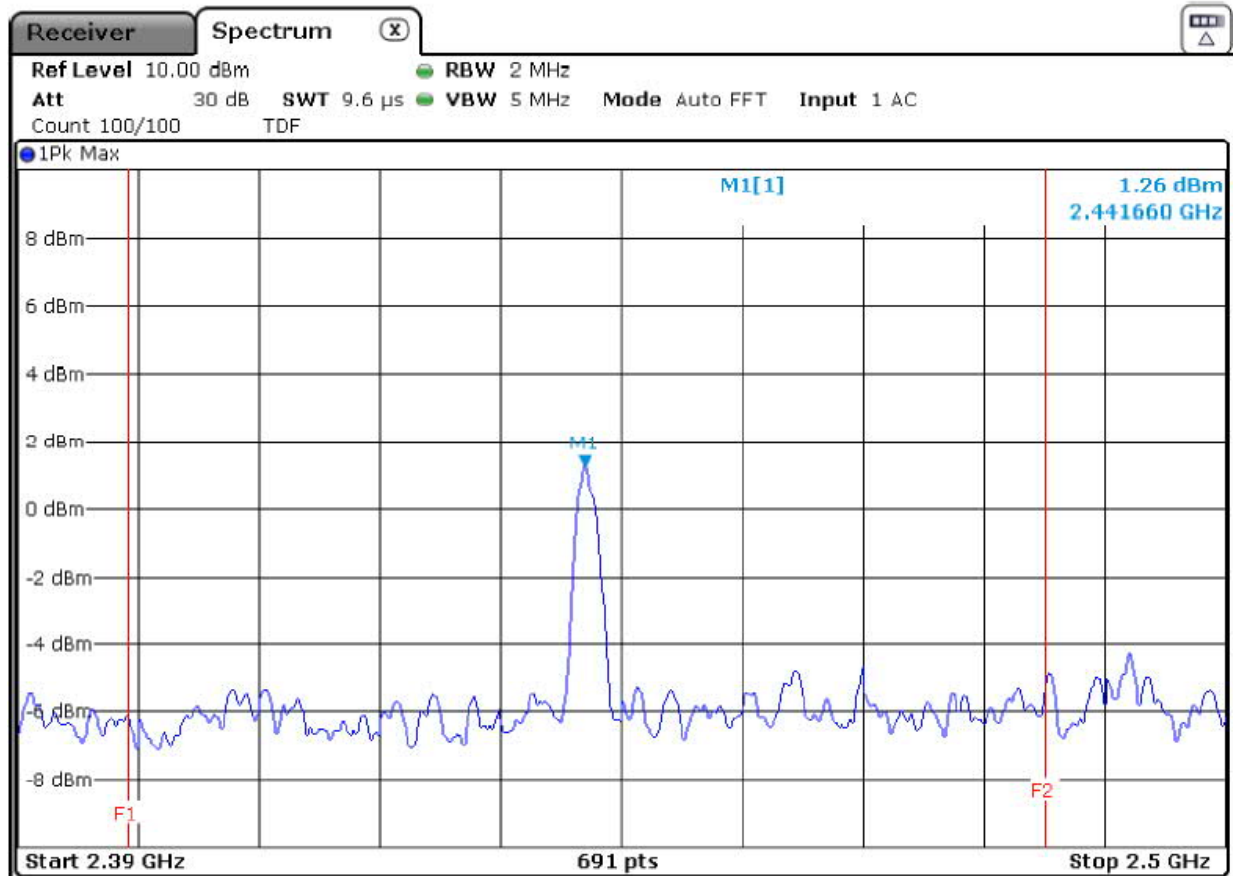
Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2402	1,01	-28,99	30,00	pass

Summary of the findings

Test conditions	Polarization of receiving antenna	Tested frequency [MHz]	Meas value [dBm]	Limit [dBm]	Result
Position: X	V	2402	1,23	30,00	pass
Position: X	H	2402	4,77	30,00	pass
Position: Y	V	2402	3,80	30,00	pass
Position: Y	H	2402	2,10	30,00	pass
Position: Z	V	2402	2,64	30,00	pass
Position: Z	H	2402	1,01	30,00	pass

Operating Mode: TX BLE; CH.20 (2442MHz)

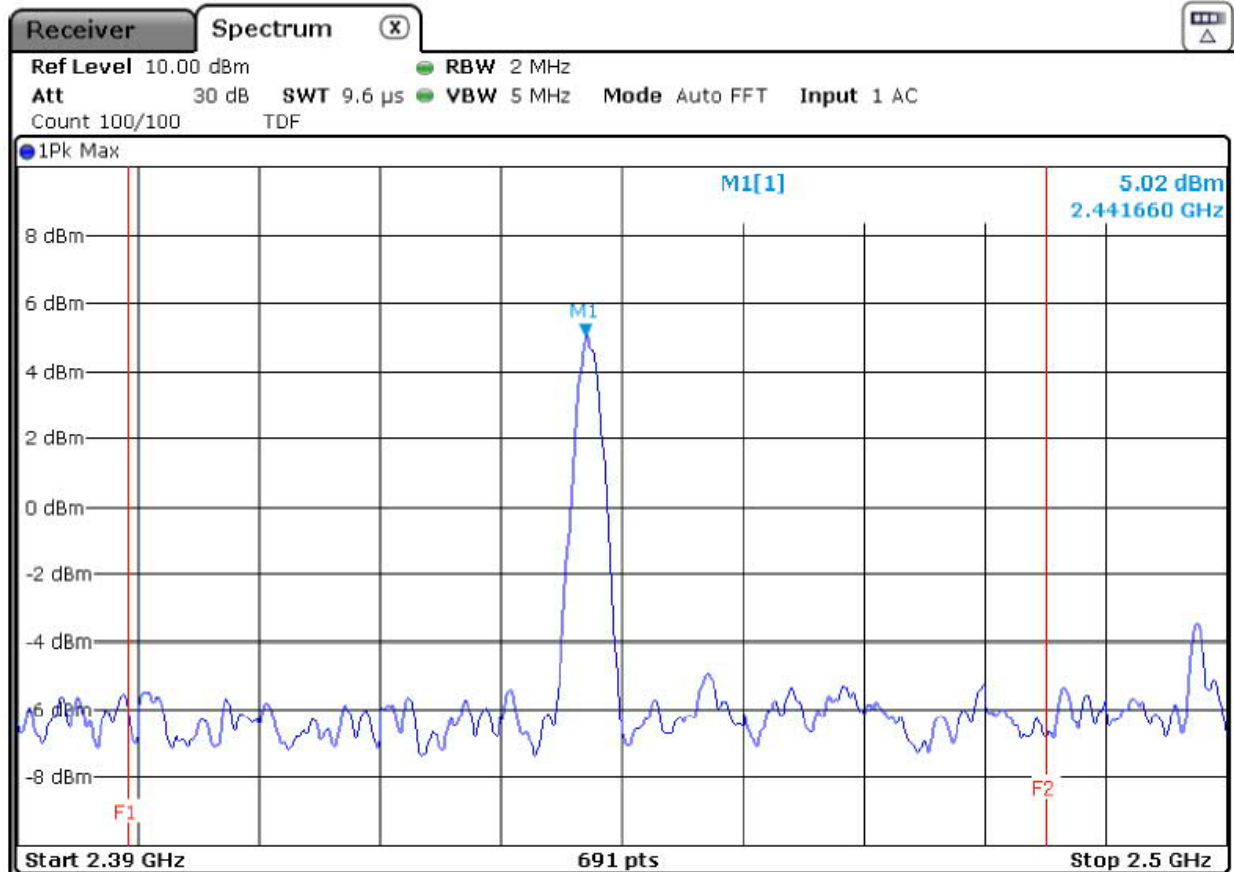


Position: X / Polarisation: V

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2442	1,26	-28,74	30,00	pass

Operating Mode: TX BLE; CH.20 (2442MHz)

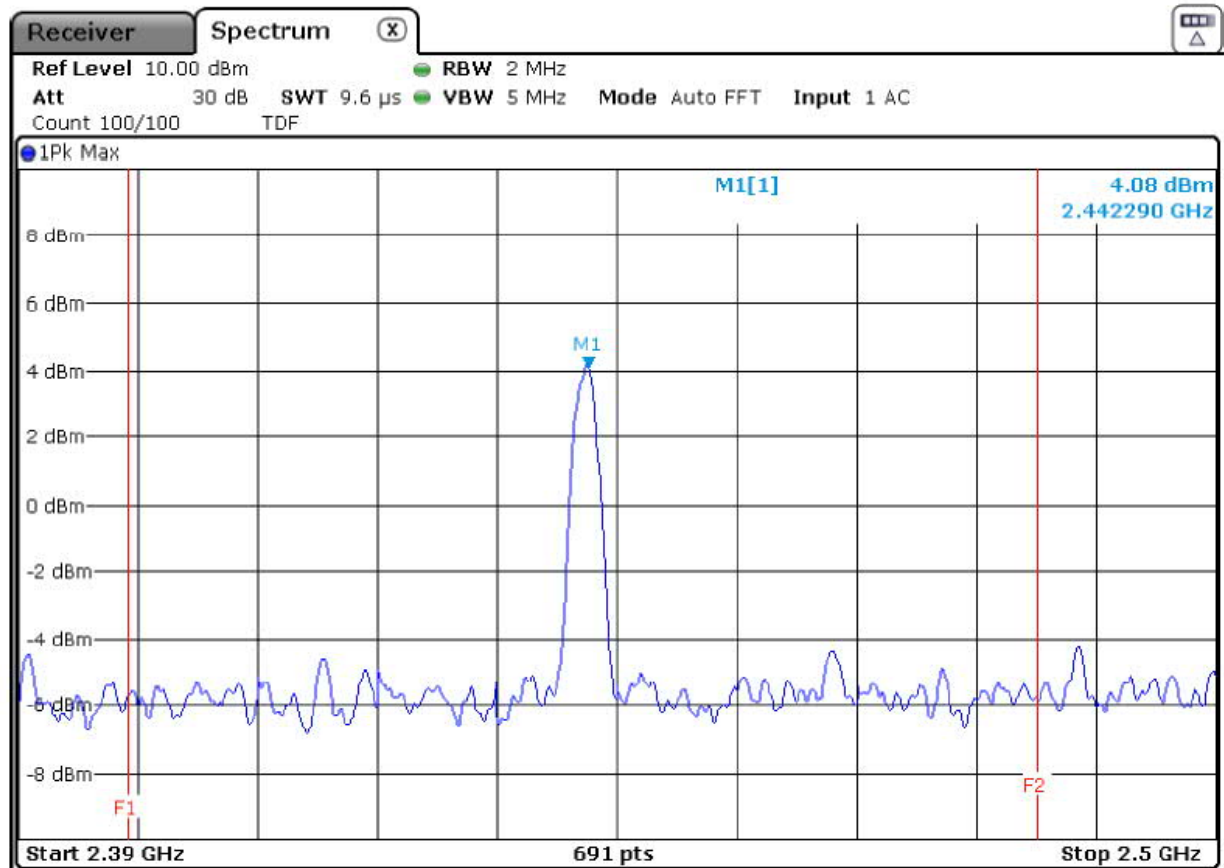


Position: X / Polarisation: H

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2442	5,02	24,98	30,00	pass

Operating Mode: TX BLE; CH.20 (2442MHz)

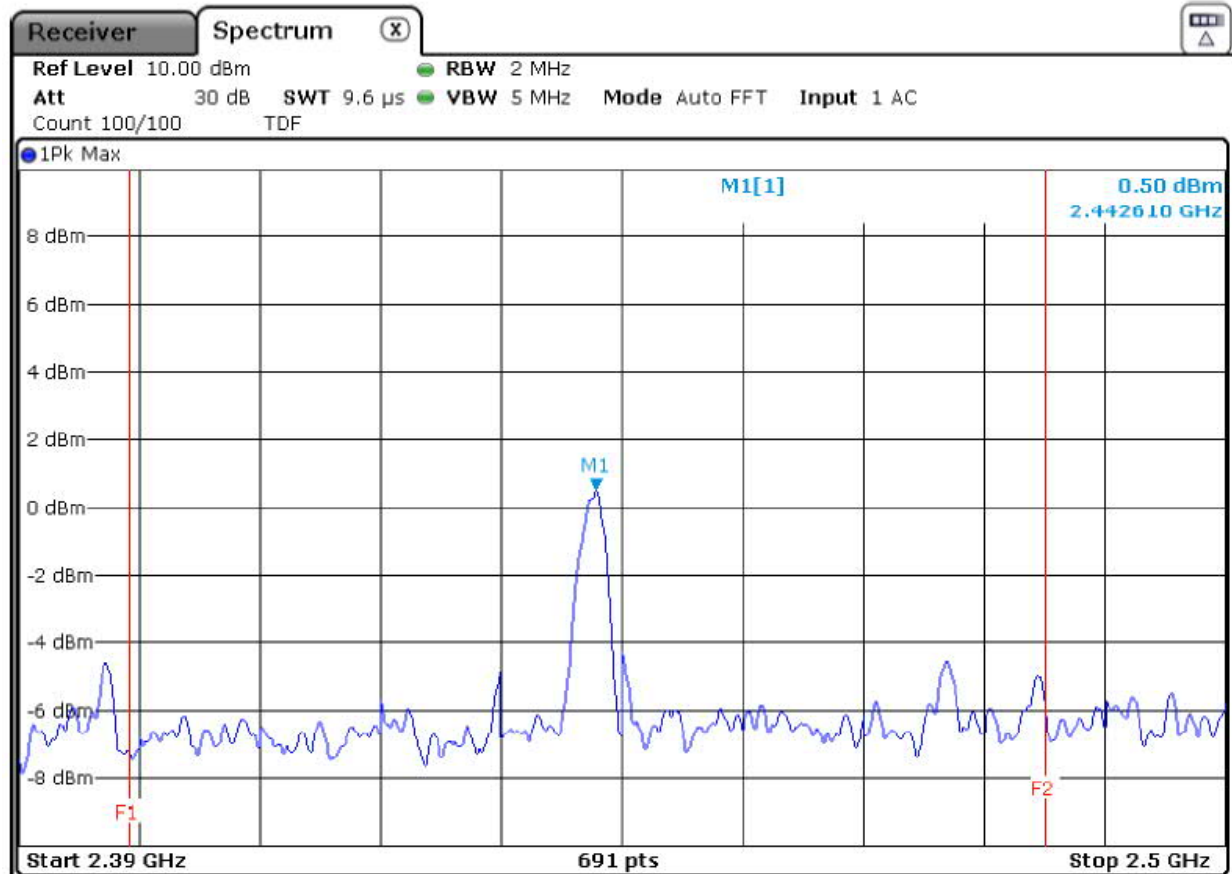


Position: Y / Polarisation: V

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2442	4,08	-25,92	30,00	pass

Operating Mode: TX BLE; CH. (2442MHz)

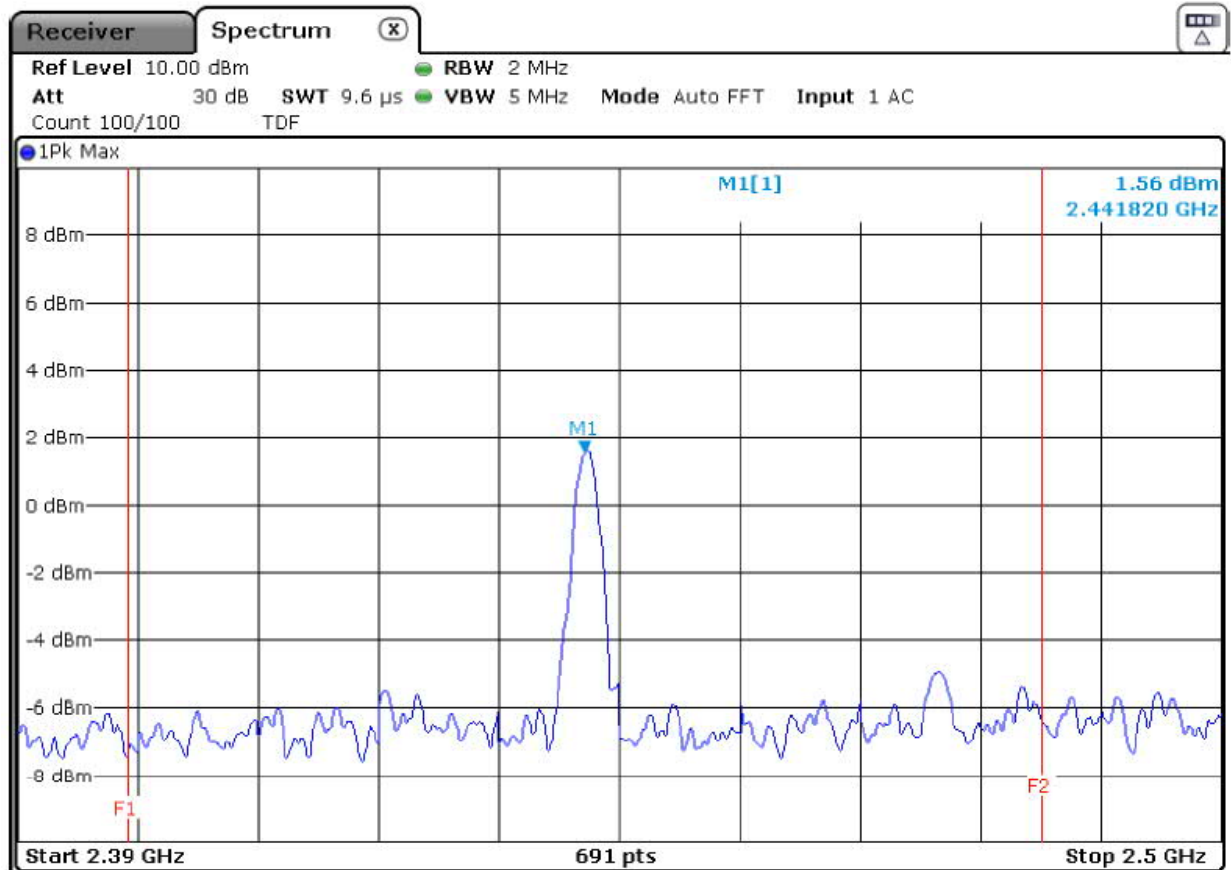


Position: Y / Polarisation: H

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2442	0,50	-29,50	30,00	pass

perating Mode: TX BLE; CH.20 (2442MHz)

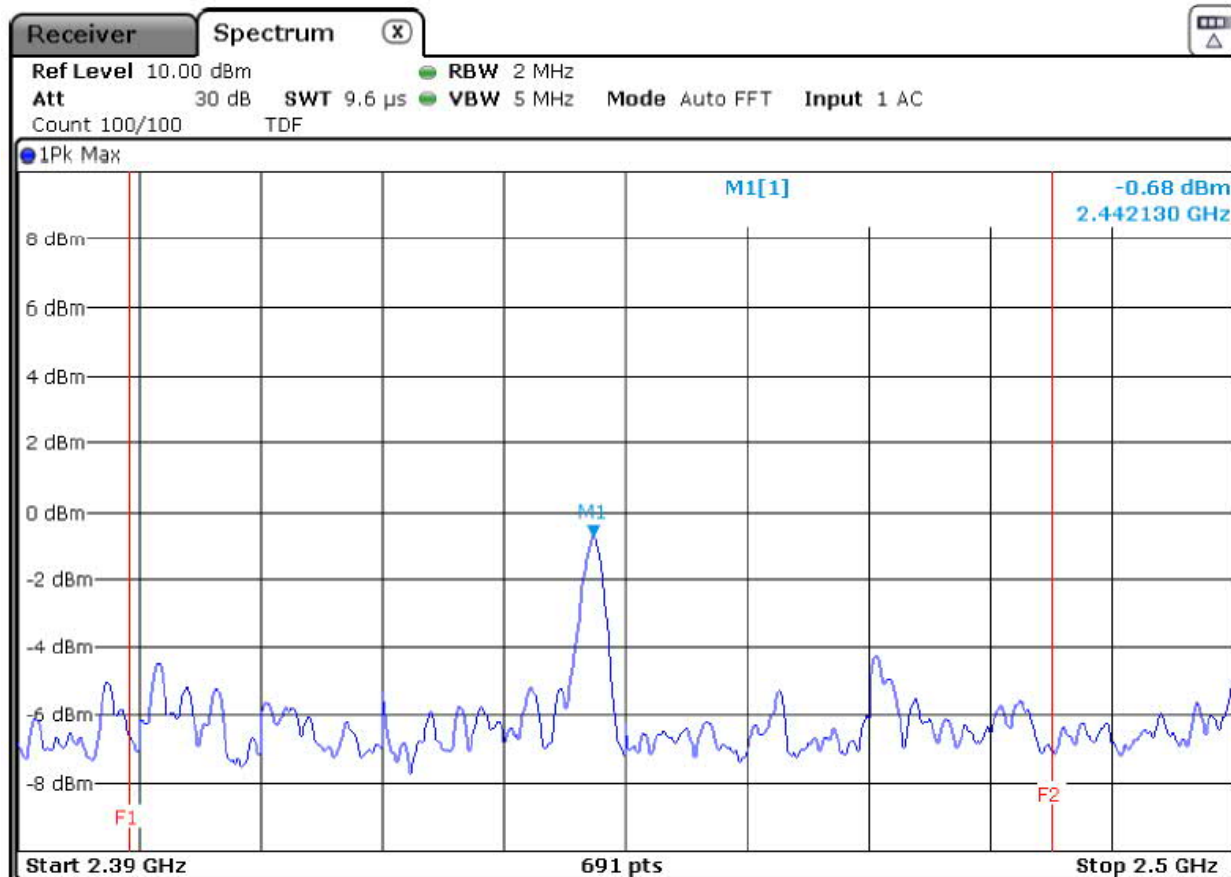


Position: Z / Polarisation: V

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2442	1,56	-28,44	30,00	pass

Operating Mode: TX BLE; CH.20 (2442MHz)



Position: Z / Polarisation: H

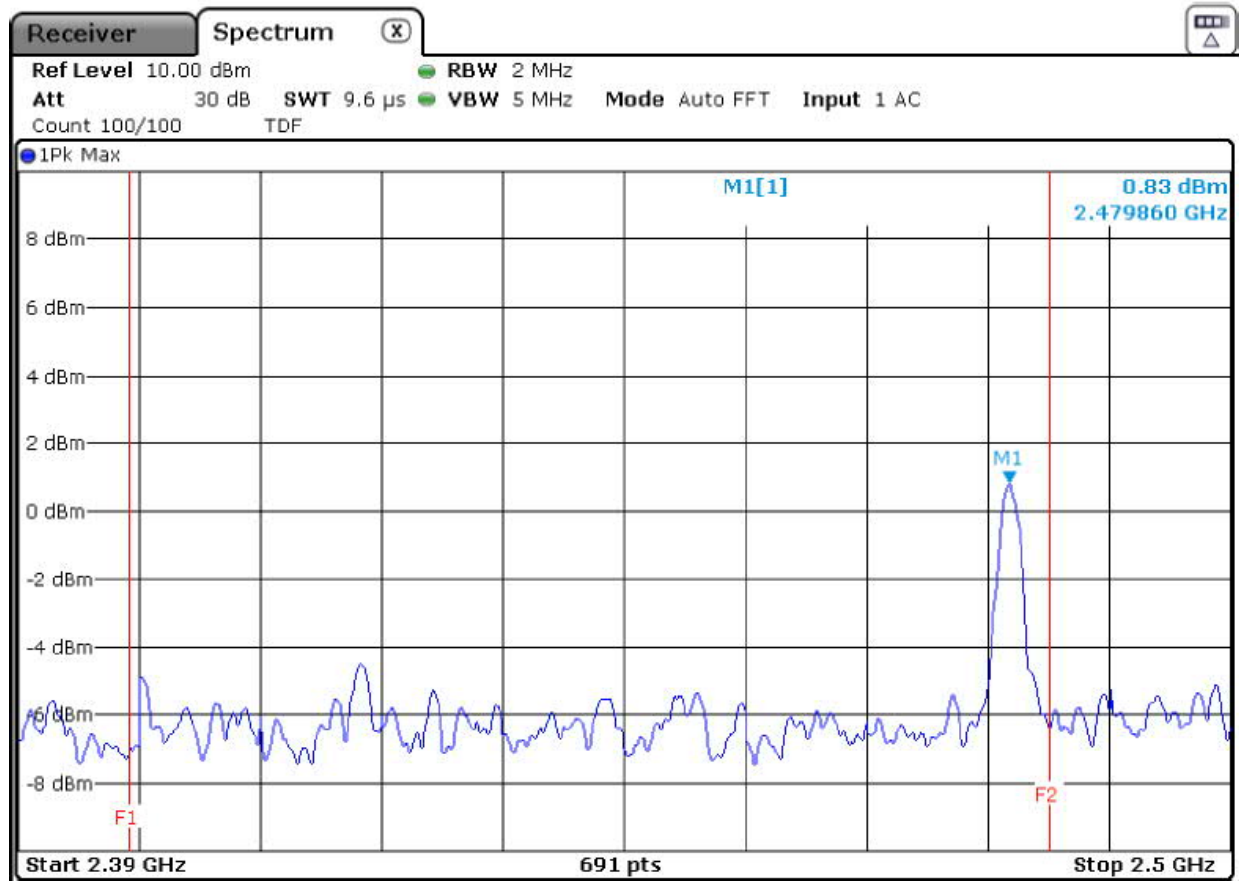
Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2442	-0,68	-30,68	30,00	pass

Summary of the findings

Test conditions	Polarization of receiving antenna	Tested frequency [MHz]	Meas value [dBm]	Limit [dBm]	Result
Position: X	V	2442	1,26	30,00	pass
Position: X	H	2442	5,02	30,0	pass
Position: Y	V	2442	4,08	30,00	pass
Position: Y	H	2442	0,50	30,00	pass
Position: Z	V	2442	1,56	30,00	pass
Position: Z	H	2442	-0,68	30,00	pass

Operating Mode: TX BLE; CH.39 (2480 MHz)

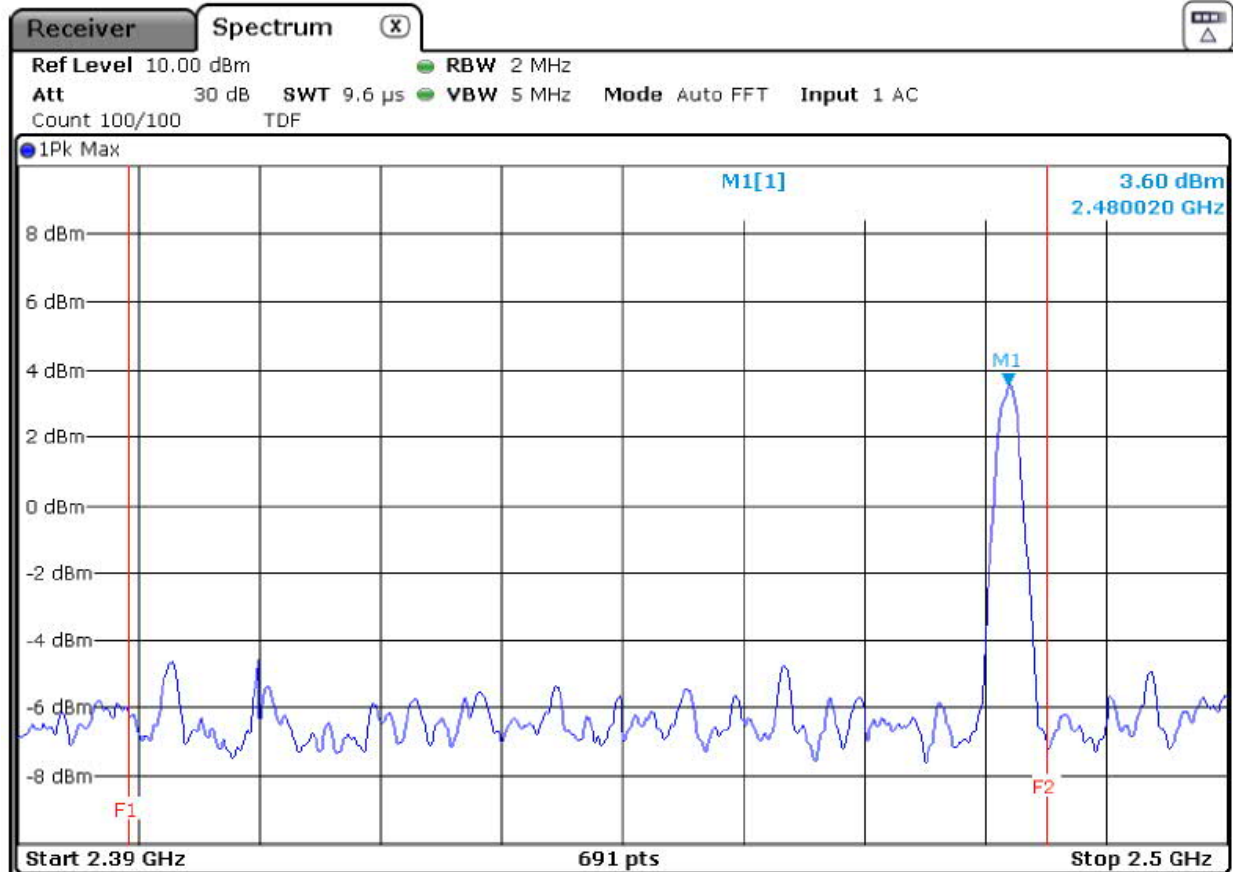


Position: X / Polarisation: V

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2480	0,83	-29,17	30,00	pass

Operating Mode: TX BLE; CH.39 (2480 MHz)

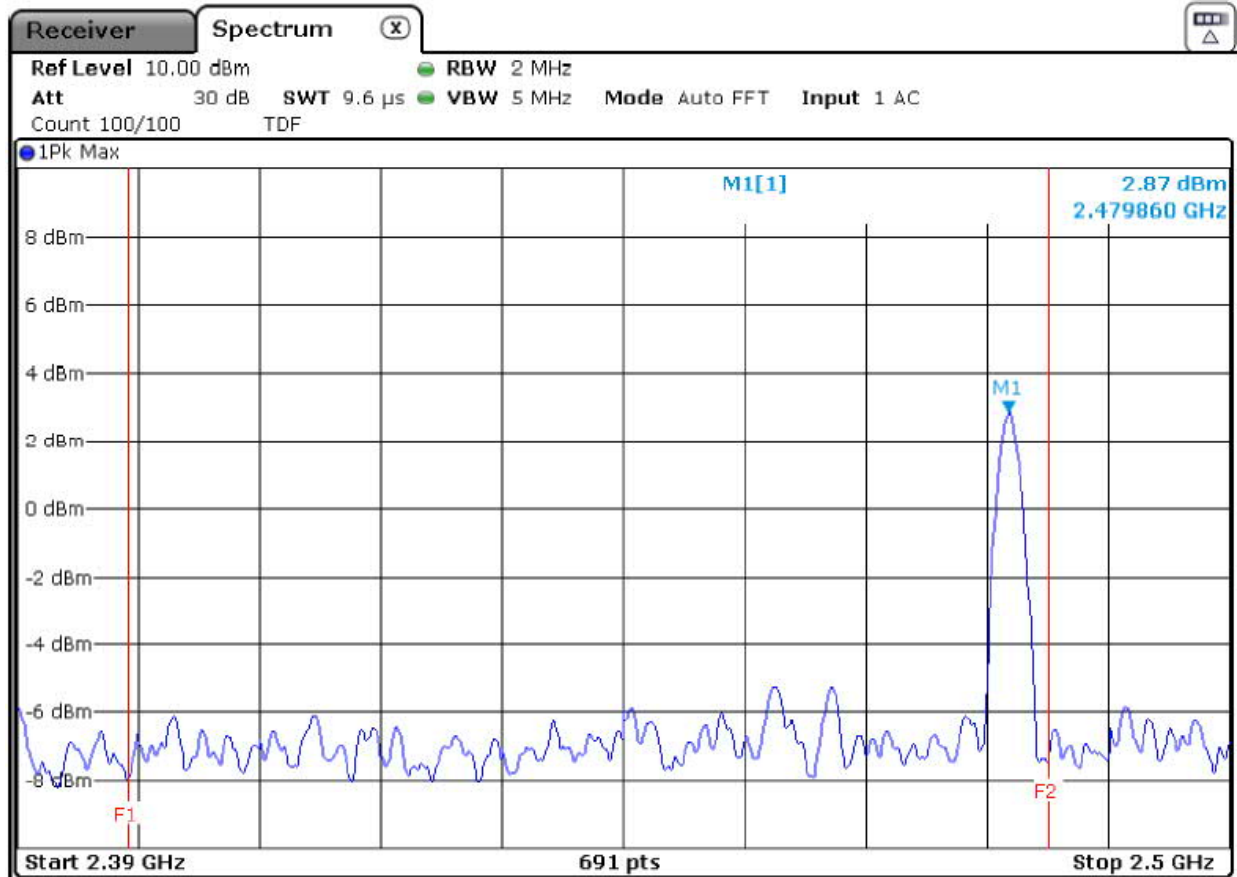


Position: X / Polarisation: H

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2480	3,60	-26,40	30,00	pass

Operating Mode: TX BLE; CH.39 (2480 MHz)

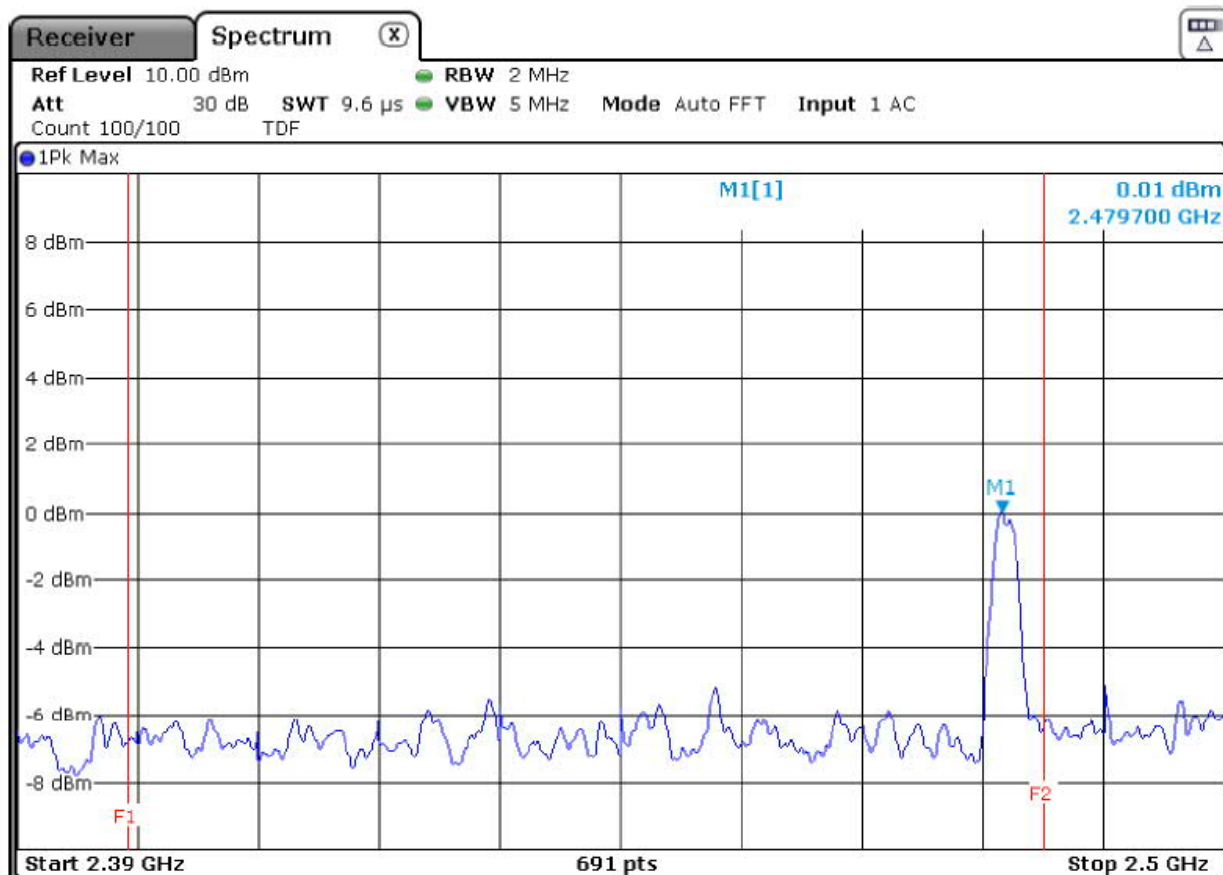


Position: Y / Polarisation: V

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2480	2,87	-27,13	30,00	pass

Operating Mode: TX BLE; CH.39 (2480 MHz)

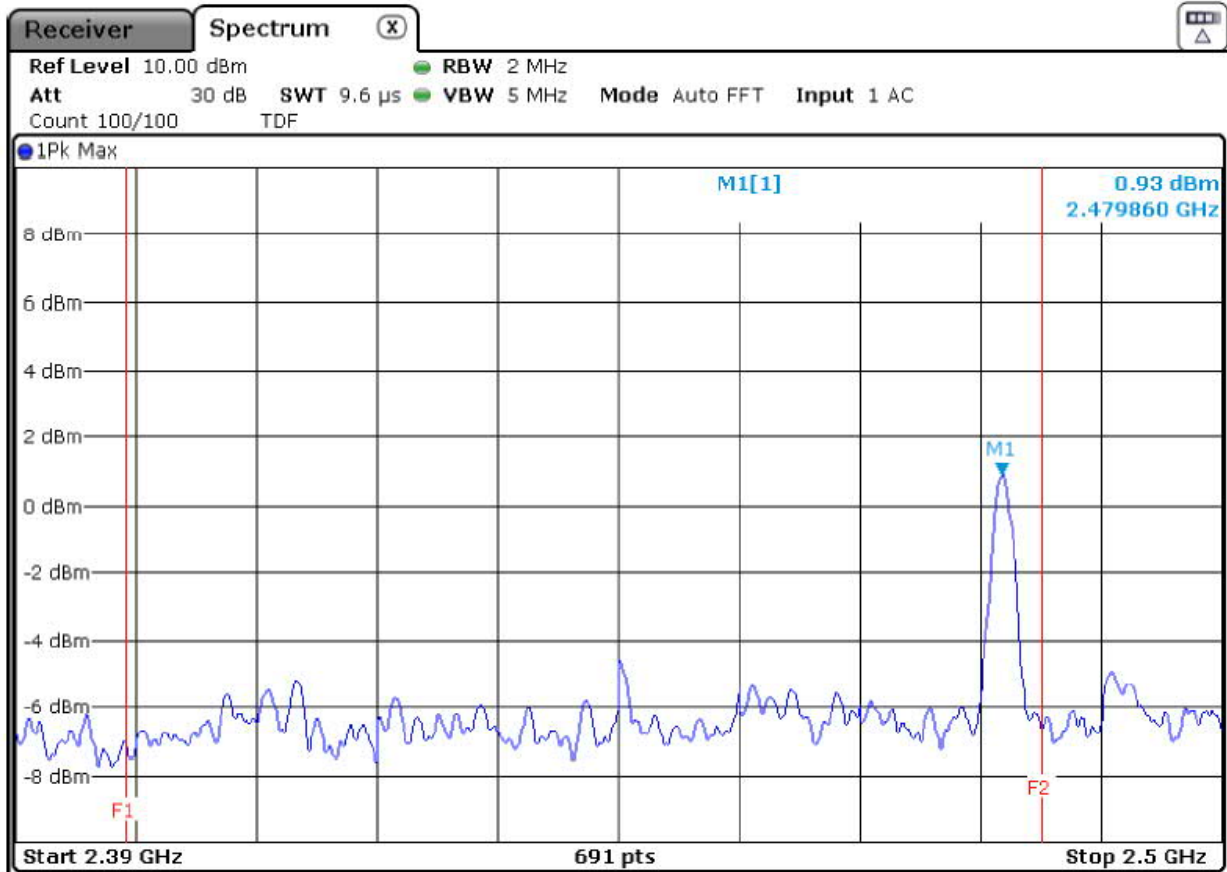


Position: Y / Polarisation: H

Detector: Peak

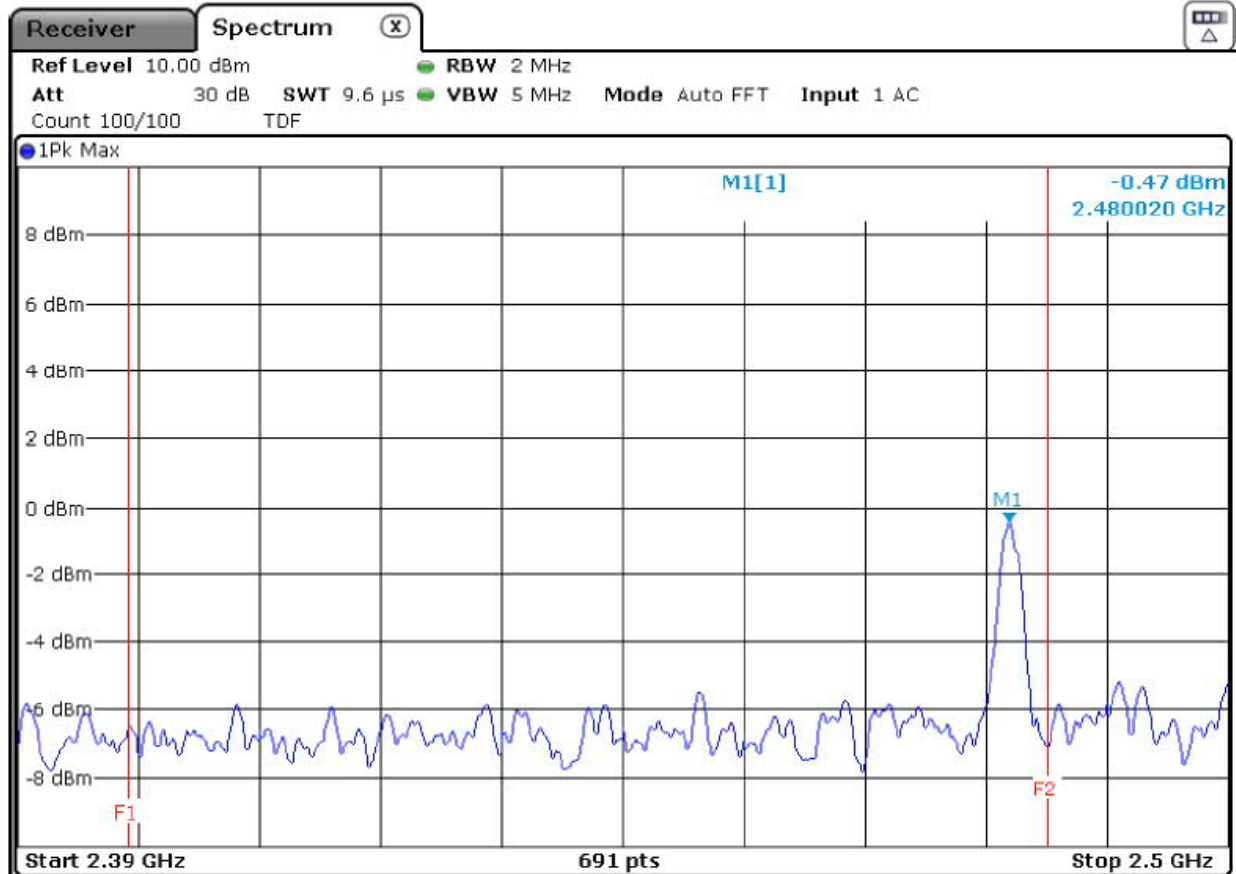
Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2480	0,01	-29,99	30,00	pass

perating Mode: TX BLE; CH.39 (2480 MHz)



Position: Z / Polarisation: V				
Detector: Peak				
Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2480	0,93	-29,07	30,00	pass

Operating Mode: TX BLE; CH.39 (2480 MHz)



Position: Z / Polarisation: H

Detector: Peak

Frequ. [MHz]	Level [dBm]	Margin to Limit [dB]	Limit [dBm]	Result
2480	-0,47	-30,47	30,00	pass

Summary of the findings

Test conditions	Polarization of receiving antenna	Tested frequency [MHz]	Meas value [dBm]	Limit [dBm]	Result
Position: X	V	2480	0,83	30,00	pass
Position: X	H	2480	3,60	30,00	pass
Position: Y	V	2480	2,87	30,00	pass
Position: Y	H	2480	0,01	30,00	pass
Position: Z	V	2480	0,93	30,00	pass
Position: Z	H	2480	-0,47	30,00	pass

8.3. Power Spectral Density

Applied standards

- e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (e)
- RSS-247 issue 2 Section 5.2 (b)

Limit

For digitally modulated systems, the power spectral density conducted 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.

Test equipment and test set up

Test equipment used for conducted measurements as given in clause Test equipment of this report.
Test setup used for conducted measurements as given in clause Test setups of this report.

Description

The maximum average conducted output power was used to determine compliance to the fundamental output power limit. So the maximum average conducted PSD level is measured with a power averaging (rms) detector.

Measurement

No measurement was performed

Result

-/-

8.4. Band-Edge Measurement

Applied standards

-e-CFR Title 47 Chapter I Subchapter A Part 15 Subpart C §15.247 (d)
 -RSS-247 issue 2 Section 5.5

Limit

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 30 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Attenuation below the general limits specified in § 15.209 and RSS-Gen Table 5 is not required. Emissions which fall in the restricted bands, as defined in §15.205 Restricted Bands of operation as well as in restricted bands of the RSS-Gen Issue 5 (see Section 8.10 Restricted Frequency Bands) and must also comply with the radiated emission limits specified in §15.209 Radiated emission limits as well as the limits specified in RSS-Gen Table 5.

Test equipment and test set up

Test equipment used for Band Edge measurements as given in clause Test equipment of this report.
 Test setup used for Band Edge measurements as given in clause Test setups of this report.

Description

For restricted Bands:

The Emission must comply with the radiated emission limits. Measured with Average and Peak detector.

For non restricted Bands:

The band edge is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

The measurements are initially carried out according to the requirements for restricted bands, as these requirements are more stringent. If the limit value is exceeded in a non-restricted band according to the restricted band specifications, the measurement is repeated again with requirements for non restricted bands in order to prove the conformity.

Note: It was not necessary to carry out a re-test for non restricted band requirements for the tested EUT.

Detector function selection and bandwidth

For the measurement, an EMI test receiver that have CISPR peak detector as well as average detector were used.

Band Edge for restricted Band

Frequency range:	Bandwidth	
See measurement graph	RBW:	1 MHz
	VBW:	3 MHz

Band Edge for non restricted Band

Frequency range:	Bandwidth	
See measurement graph	RBW:	100 kHz
	VBW:	300 kHz

Result

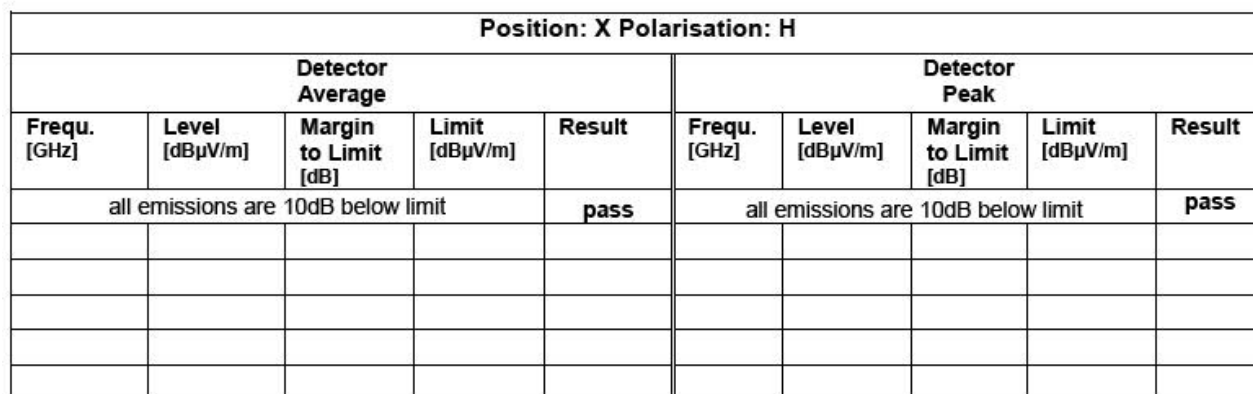
From the measurement data obtained, the tested sample was considered to have **COMPLIED** with the requirements for the **Band Edges**.

Measurement

The Measurement was performed on: 07.09.2022

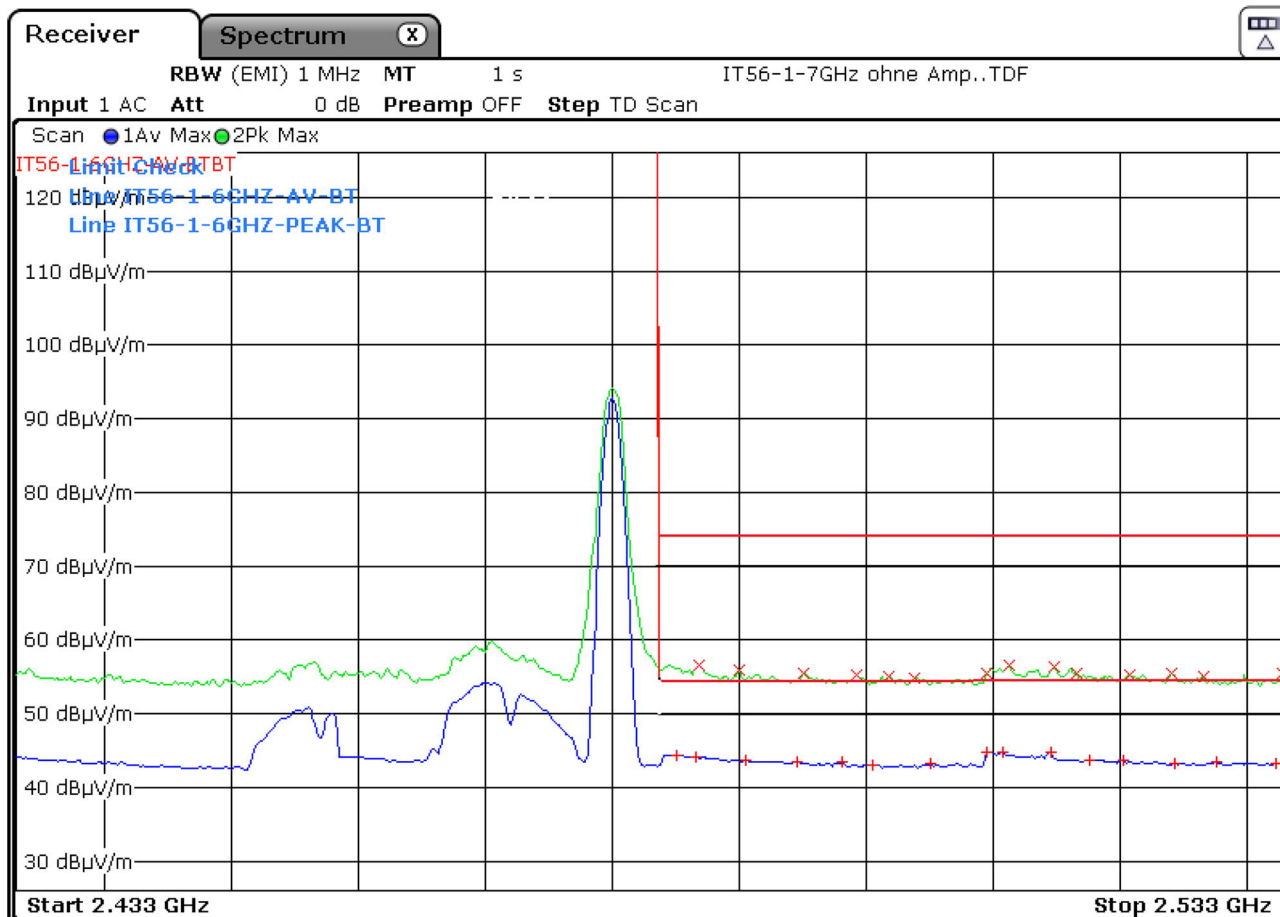
[illegible]

Operation mode: TX BLE CH.0 (2402MHz); Lowend



Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.39 (2480MHz); Highend

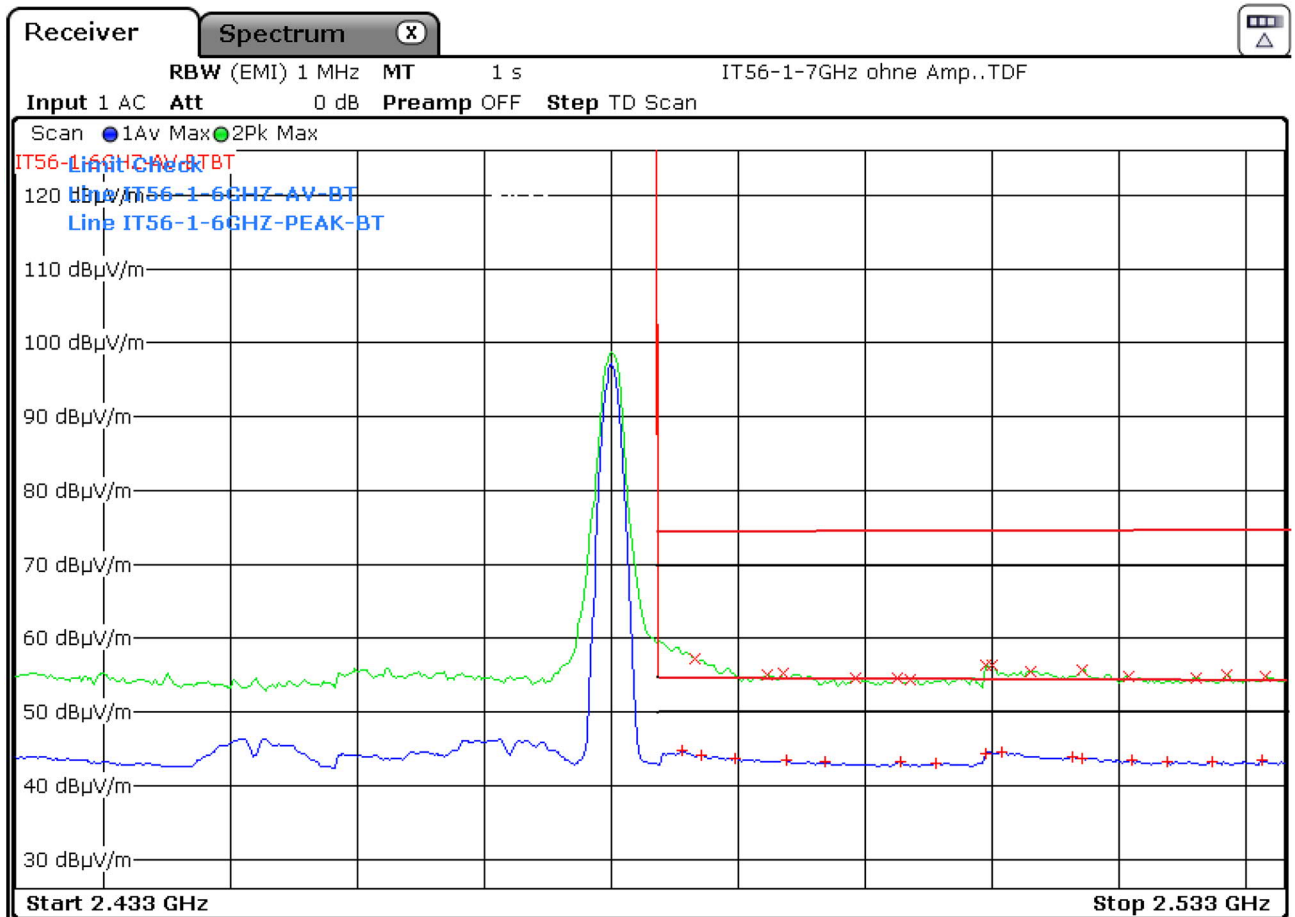


Position: X Polarisation: V

Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,4850	44,31	-9,69	54,00	pass	2,4868	56,48	-17,52	74,00	pass
2,4865	44,06	-9,94	54,00	pass	2,4900	55,70	-18,30	74,00	pass
2,4905	43,57	-10,43	54,00	pass	2,4950	55,42	-18,58	74,00	pass
2,4945	43,32	-10,68	54,00	pass	2,4993	55,16	-18,84	74,00	pass
2,4980	43,33	-10,67	54,00	pass	2,5018	54,86	-19,14	74,00	pass
2,5005	43,02	-10,98	54,00	pass	2,5038	54,66	-19,34	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.39 (2480MHz); Highend

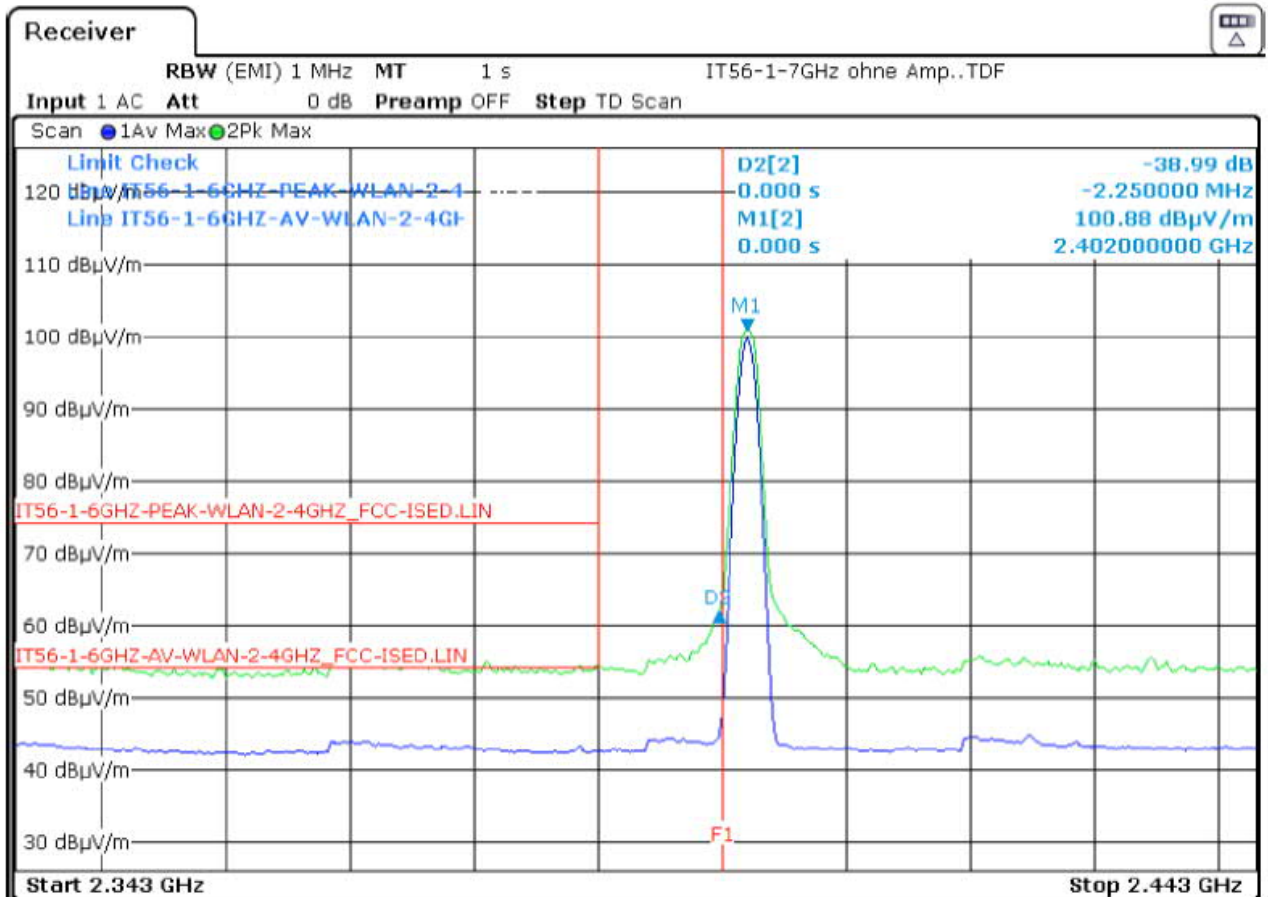


Position: X Polarisation: H

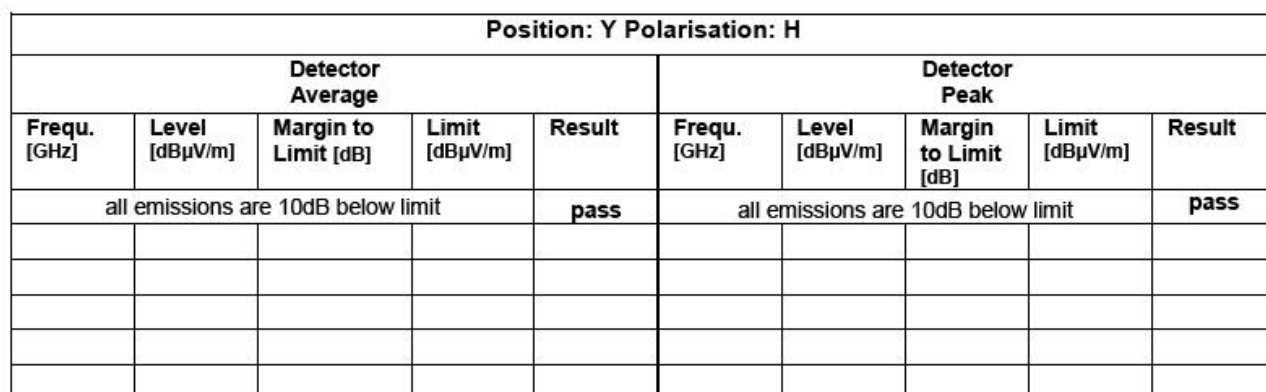
Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
2,4855	44,64	-9,36	54,00	pass	2,4865	57,14	-16,86	74,00	pass
2,4870	44,08	-9,92	54,00	pass	2,4923	54,98	-19,02	74,00	pass
2,4898	43,55	-10,45	54,00	pass	2,4935	55,09	-18,91	74,00	pass
2,4938	43,35	-10,65	54,00	pass	2,4993	54,43	-19,57	74,00	pass
2,4968	43,08	-10,92	54,00	pass	2,5025	54,55	-19,45	74,00	pass
2,5028	43,11	-10,89	54,00	pass	2,5035	54,36	-19,64	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.0 (2402MHz); Lowend

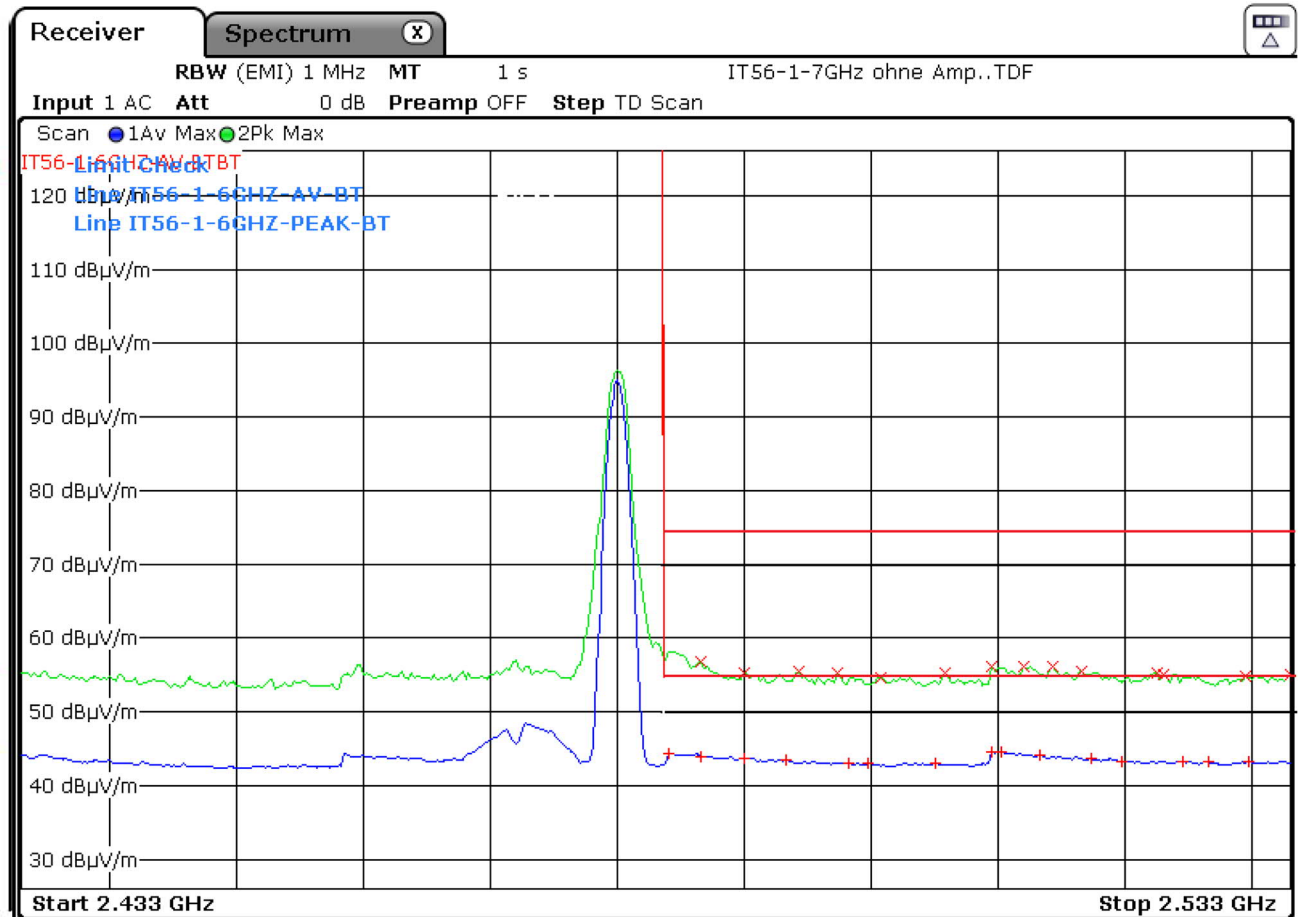
[illegible]

Operation mode: TX BLE CH.0 (2402MHz); Lowend



Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.39 (2480MHz); Highend

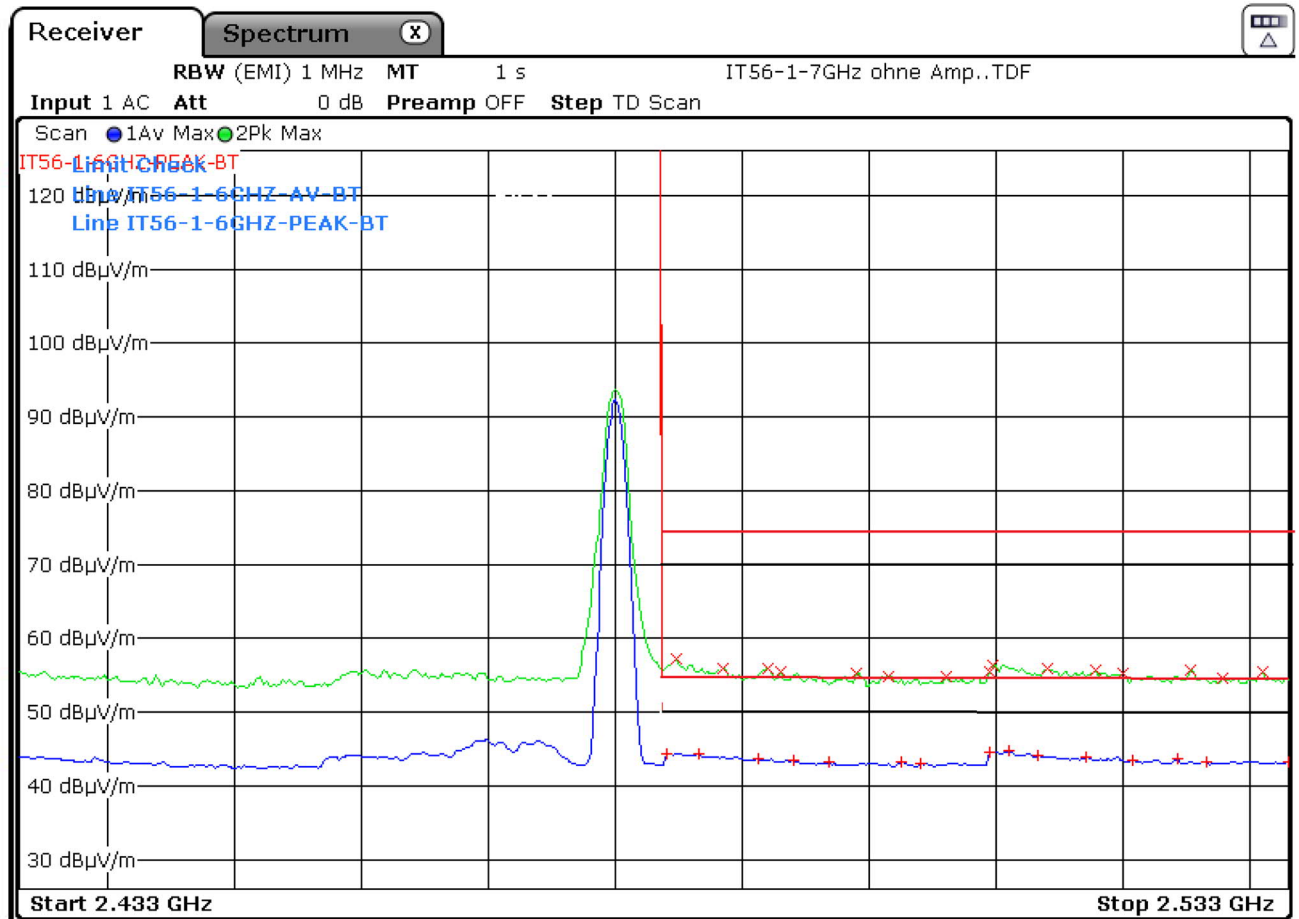


Position: Y Polarisation: V

Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result	Frequ. [GHz]	Level [dBµV/m]	Margin to Limit [dB]	Limit [dBµV/m]	Result
2,5103	44,51	-9,49	54,00	pass	2,4865	56,59	-17,41	74,00	pass
2,5095	44,40	-9,60	54,00	pass	2,5120	56,05	-17,95	74,00	pass
2,4840	44,30	-9,70	54,00	pass	2,5143	56,01	-17,99	74,00	pass
2,5133	44,03	-9,97	54,00	pass	2,5095	55,96	-18,04	74,00	pass
2,4865	43,87	-10,13	54,00	pass	2,5165	55,45	-18,55	74,00	pass
2,4900	43,68	-10,32	54,00	pass	2,4943	55,37	-18,63	74,00	pass

Ref.-No.: 22/09-0001

Operation mode: TX BLE CH.39 (2480MHz); Highend



Position: Y Polarisation: H

Detector Average					Detector Peak				
Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result	Frequ. [GHz]	Level [dBμV/m]	Margin to Limit [dB]	Limit [dBμV/m]	Result
2,5110	44,60	-9,40	54,00	pass	2,4848	57,06	-16,94	74,00	pass
2,5095	44,49	-9,51	54,00	pass	2,5098	56,19	-17,81	74,00	pass
2,4840	44,33	-9,67	54,00	pass	2,4885	55,89	-18,11	74,00	pass
2,4865	44,23	-9,77	54,00	pass	2,4920	55,81	-18,19	74,00	pass
2,5133	43,96	-10,04	54,00	pass	2,5140	55,73	-18,27	74,00	pass
2,5170	43,73	-10,27	54,00	pass	2,5253	55,59	-18,41	74,00	pass