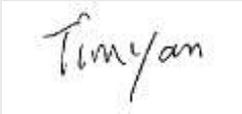


Test report No: 4394267.50

## TEST REPORT

### Radio Spectrum Matters (RF)

Identification of item tested	Bluetooth Low Energy Module
Trademark	Panasonic
Model and /or type reference /PMN	PAN1780
FCC/IC ID	FCC ID: T7V1780; IC: 216Q-1780
HVIN	ENW89854A1KF
FVIN	Casambi FW 36.x
Features	3,3 Vdc
Applicant's name / address	Panasonic Industrial Devices Europe GmbH Zeppelinstrasse 19 21337 Lüneburg / GERMANY
Test method requested, standard	FCC CFR Title 47 Part15 Subpart C Section 15.247; KDB558074 D01v05r02; RSS-Gen Issue 5; RSS-247 Issue 2
Verdict Summary	COMPLIANCE
Tested by (name & signature)	Harry Deng 
Approved by (name & signature)	Tim Yan 
Date of issue	2022-11-22
Report template No	TRF_EMG 2017-06- FCC_Part15C_247

## INDEX

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	page
General conditions .....	3
Uncertainty .....	3
Environmental conditions .....	3
Possible test case verdicts .....	3
Definition of symbols used in this test report .....	4
Abbreviations .....	4
Document History .....	4
Remarks and Comments .....	4
1 General Information .....	5
1.1 General Description of the Item(s) .....	5
1.2 Test data .....	6
1.3 The environment(s) in which the EUT is intended to be used .....	6
1.4 Channel List .....	6
2 Description of Test Setup .....	7
2.1 Operating mode(s) used for tests .....	7
2.2 Support / Auxiliary equipment / unit / software for the EUT .....	7
2.3 Test Configuration / Block diagram used for tests .....	7
3 Verdict summary section .....	8
3.1 Standards .....	8
3.2 Deviation(s) from the Standard(s) / Test Specification(s) .....	8
3.3 Overview of results .....	8
3.4 Measurement procedure .....	10
4 Transmitter Test Results .....	11
4.1 Emissions in non-restricted frequency bands .....	11
4.2 Emissions in restricted frequency bands .....	20
4.3 Band Edge .....	27
4.4 Duty cycle .....	30
4.5 DTS Bandwidth .....	32
4.6 Fundamental emission output power .....	35
4.7 Power Density .....	37
5 Identification of the Equipment Under Test .....	40
Annex 1 – Measurement Uncertainty .....	41
Annex 2 - Used Equipment .....	42
Annex 3 - Test Photos .....	43

## GENERAL CONDITIONS

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.
5. This report will not be used for social proof function in China market.

## UNCERTAINTY

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For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in EN 55016-4-2 (CISPR 16-4-2), EN/IEC 61000-4 series or a product standard, the measurement instrumentation uncertainty has been calculated and applied in accordance with these standards.

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

## ENVIRONMENTAL CONDITIONS

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The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%
Atmospheric pressure	86 kPa – 106 kPa

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

## POSSIBLE TEST CASE VERDICTS

---

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not measured	N/M

## DEFINITION OF SYMBOLS USED IN THIS TEST REPORT

<input checked="" type="checkbox"/> Indicates that the listed condition, standard or equipment is applicable for this report/test/EUT.			
<input type="checkbox"/> Indicates that the listed condition, standard or equipment is not applicable for this report/test/EUT.			
Decimal separator used in this report	<input checked="" type="checkbox"/>	Comma (,)	<input type="checkbox"/> Point (.)

## ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT	: Equipment Under Test
QP	: Quasi-Peak
CAV	: CISPR Average
AV	: Average
CDN	: Coupling Decoupling Network
SAC	: Semi-Anechoic Chamber
OATS	: Open Area Test Site
BW	: Bandwidth
AM	: Amplitude Modulation
PM	: Pulse Modulation
HCP	: Horizontal Coupling Plane
VCP	: Vertical Coupling Plane
$U_N$	: Nominal voltage
$T_x$	: Transmitter
$R_x$	: Receiver
N/A	: Not Applicable
N/M	: Not Measured

## DOCUMENT HISTORY

Report nr.	Date	Description
4394267.50	2022-11-22	First release.

## REMARKS AND COMMENTS

The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).

This report is a certified BLE module updated for a C2PC application of FCC ID: T7V1780 and a C3PC application of IC: 216Q-1780. In this update, a Proprietary mode for the 2Mbps was added. After technical review, model PAN1780 (with Proprietary 2Mbps mode) was chosen for full test except for conducted emission test for compliance verification.

# 1 GENERAL INFORMATION

## 1.1 General Description of the Item(s)

Description of the item .....	Bluetooth Low Energy Module
Trademark.....	Panasonic
Model / Type number .....	PAN1780
FCC/IC ID .....	FCC ID: T7V1780; IC: 216Q-1780
Ratings.....	3,3 Vdc
Manufacturer/Factory.....	Panasonic Industrial Devices Europe GmbH Zeppelinstrasse 19 21337 Lüneburg / GERMANY

Operating frequency range(s) – Tx.:	2402-2480 MHz
Operating frequency range(s) – Rx :	2402-2480 MHz
Type of Modulation .....	GFSK
PHYs.....	LE 1M, LE 2M, LE Coded PHY supported (S=2), LE Coded PHY supported (S=8)
Data Rate.....	1 Mbps, 2 Mbps, 2 Mbps (proprietary), 125 kbps, 500 kbps
Antenna type.....	Integral Antenna
Antenna gain.....	1 dBi
Number of channel .....	40
Operating Temperature Range.....	-40 - 85 °C

Rated power supply .....	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input type="checkbox"/>	AC: 120 V, 60 Hz	<input type="checkbox"/>				
	<input checked="" type="checkbox"/>	DC: 3,3 V					
Mounting position.....	<input type="checkbox"/>	Battery: 3 V					
	<input type="checkbox"/>	Table top equipment					
	<input type="checkbox"/>	Wall/Ceiling mounted equipment					
	<input type="checkbox"/>	Floor standing equipment					
	<input type="checkbox"/>	Hand-held equipment					
	<input type="checkbox"/>	Other:					

Intended use of the Equipment Under Test (EUT)
The apparatus as supplied for the test is Bluetooth Low Energy Module which intended for residential use, the product contains electronic control circuitry.

Copy of marking plate:
No provide.

## 1.2 Test data

Test Location	DEKRA Testing and Certification (Shanghai) Ltd. Guangzhou Branch Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China FCC Designation Number: CN1324; ISED CAB identifier: CN0130
Date of receipt of test item	2022-09-15
Date (s) of performance of tests	2022-09-15 to 2022-09-28

## 1.3 The environment(s) in which the EUT is intended to be used

The equipment under test (EUT) is intended to be used in the following environment(s):

<input checked="" type="checkbox"/>	Residential (domestic) environment.
<input checked="" type="checkbox"/>	Commercial and light-industrial environment.
<input type="checkbox"/>	Industrial environment.

## 1.4 Channel List

Bluetooth Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
37	2402 MHz	00	2404 MHz	01	2406 MHz	02	2408 MHz
03	2410 MHz	04	2412 MHz	05	2414 MHz	06	2416 MHz
07	2418 MHz	08	2420 MHz	09	2422 MHz	10	2424 MHz
38	2426 MHz	11	2428 MHz	12	2430 MHz	13	2432 MHz
14	2434 MHz	15	2436 MHz	16	2438 MHz	17	2440 MHz
18	2442 MHz	19	2444 MHz	20	2446 MHz	21	2448 MHz
22	2450 MHz	23	2452 MHz	24	2454 MHz	25	2456 MHz
26	2458 MHz	27	2460 MHz	28	2462 MHz	29	2464 MHz
30	2466 MHz	31	2468 MHz	32	2470 MHz	33	2472 MHz
34	2474 MHz	35	2476 MHz	36	2478 MHz	39	2480 MHz

## 2 DESCRIPTION OF TEST SETUP

### 2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

Operating mode	Operating mode description	Used for methos	
		Conducted	Radiated
1	Transmitting at proprietary 2 Mbps	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2		<input type="checkbox"/>	<input type="checkbox"/>
3		<input type="checkbox"/>	<input type="checkbox"/>
4		<input type="checkbox"/>	<input type="checkbox"/>
Supplemental information: ---			

### 2.2 Support / Auxiliary equipment / unit / software for the EUT

The EUT has been tested with the following auxiliary equipment / unit / software:

Auxiliary equipment / unit / software	Type / Version	Manufacturer	Supplied by
---	---	---	---
Supplemental information: ---			

### 2.3 Test Configuration / Block diagram used for tests

Refer to Annex 3.

### 3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

#### 3.1 Standards

Standard	Year	Description
FCC CFR Title 47 Part 15 Subpart C Section 15.247	2022	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.
KDB 558074 D01 v05r02	2019	Guidance for performing compliance measurements on Digital Transmission System (DTS) operating under section 15.247
RSS-Gen Issue 5 Amendment 1	2019	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2	2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

#### 3.2 Deviation(s) from the Standard(s) / Test Specification(s)

The following deviation(s) was / were made from the published requirements of the listed standards: N/A.

#### 3.3 Overview of results

FCC measurement			
Requirement – Test case	Basic standard(s)	Verdict	Remark
AC Power Line Conducted Emission	FCC 15.207	N/T	---
Emissions in non-restricted frequency bands	FCC 15.247(d), FCC 15.209	PASS	---
Emissions in restricted frequency bands	FCC 15.247(b)(3)	PASS	---
Duty cycle	ANSI C63.10:2013	PASS	---
Band Edge	FCC 15.247(d)	PASS	---
Fundamental emission output power	FCC 15.247(d), FCC 15.209	PASS	---
DTS Bandwidth	FCC 15.247(a)(2)	PASS	---
Power Spectral Density	FCC 15.247(e)	PASS	---
Antenna Requirement	FCC 15.203	PASS	---
Supplementary information: ---			

<b>ISED measurement</b>			
<b>Requirement – Test case</b>	<b>Basic standard(s)</b>	<b>Verdict</b>	<b>Remark</b>
AC Power Line Conducted Emission	RSS-Gen Issue 5 Section 8.8	N/T	---
Emissions in restricted frequency bands	RSS-Gen Issue 5 Section 8.9	PASS	---
Emissions in non-restricted frequency bands	RSS-247 Issue 2 Section 5.5	PASS	---
Duty cycle	ANSI C63.10:2013	PASS	---
Band Edge	RSS-Gen Issue 5 Section 8.10	PASS	---
Fundamental emission output power	RSS-247 Issue 2 Section 5.4(d)	PASS	---
DTS Bandwidth	RSS-Gen Issue 5 Section 6.7	PASS	---
Power Spectral Density	RSS-247 Issue 2 Section 5.2(b)	PASS	---
Antenna Requirement	RSS-Gen Issue 5 Section 6.8	PASS	---
<u>Supplementary information:</u> ---			

The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to calculate the uncertainty associated with the measurement result.

### 3.4 Measurement procedure

The EUT was controlled by APP which provided by manufacturer which connected to phone through the wireless. After connected, run the software "Utility" supplied by manufacturer to control the EUT work in required test mode as below table.

Mode	Frequency (MHz)
BLE	2402
	2440
	2480

## 4 TRANSMITTER TEST RESULTS

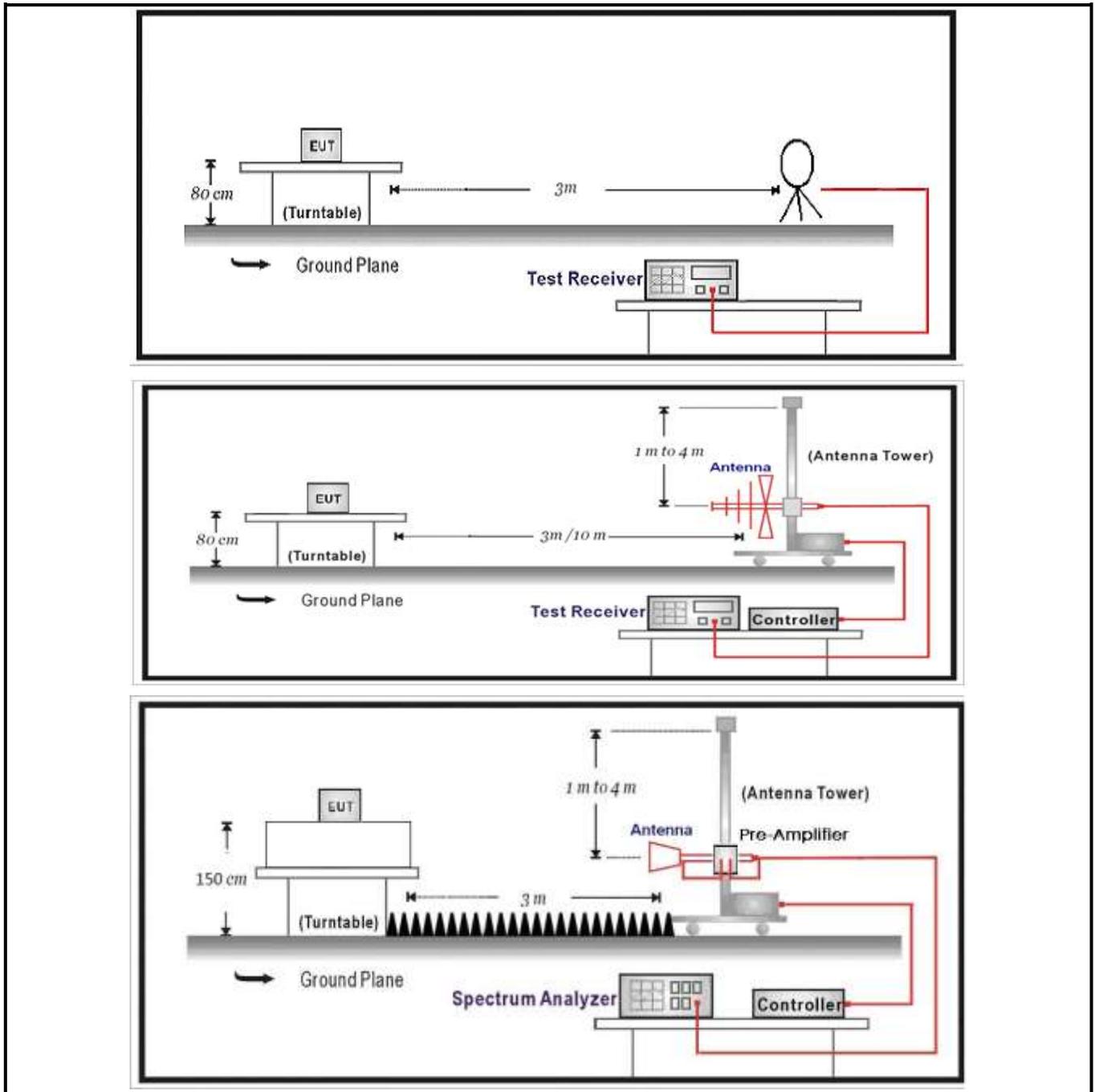
<b>4.1 Emissions in non-restricted frequency bands</b>	<b>VERDICT: PASS</b>
--	----------------------

Emissions Limit 15.209(a)			
Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 – 13.8	300 <sub>(Note 1)</sub>
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30 <sub>(Note 1)</sub>
1.705 - 30	30	29.5	30 <sub>(Note 1)</sub>
30 - 88	100	40	3 <sub>(Note 2)</sub>
88 - 216	150	43.5	3 <sub>(Note 2)</sub>
216 - 960	200	46	3 <sub>(Note 2)</sub>
Above 960	500	54	3 <sub>(Note 2)</sub>

Note 1: At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

### Test Configuration



### Performed measurements

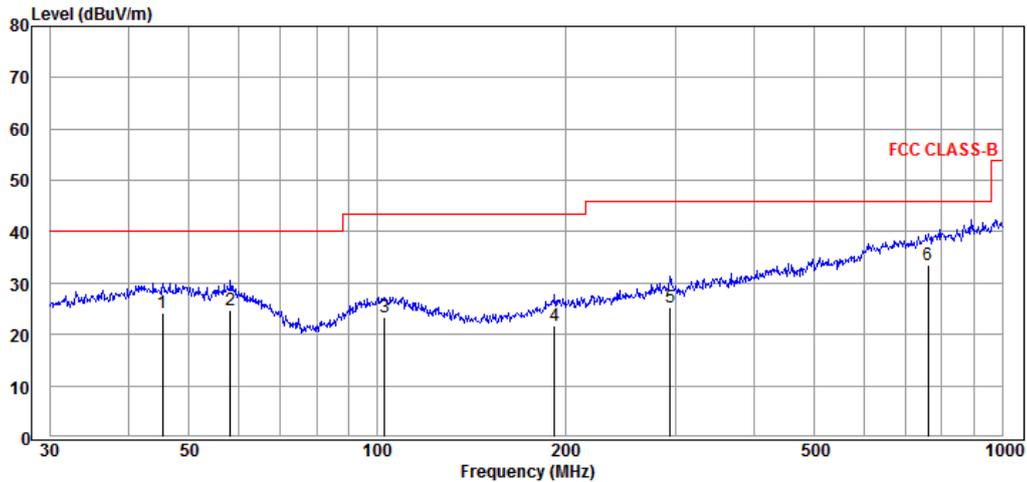
Port under test	Enclosure port	
Test method applied	<input type="checkbox"/>	Conducted measurement
	<input checked="" type="checkbox"/>	Radiated measurement
Test setup	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1	
Remark	The test frequency range, 9kHz~30MHz, 18GHz~26GHz, both of the worst case are at least 20dB below the limits, therefore no data appear in the report. Three orientations of tests were checked, and the horizontal orientation has the worst result.	

## Results of 30 – 1000 MHz

Model	PAN1780
Operation Mode	Mode 1 @2402MHz (worst case)
Test voltage	3,3 Vdc

### Results

#### Horizontal



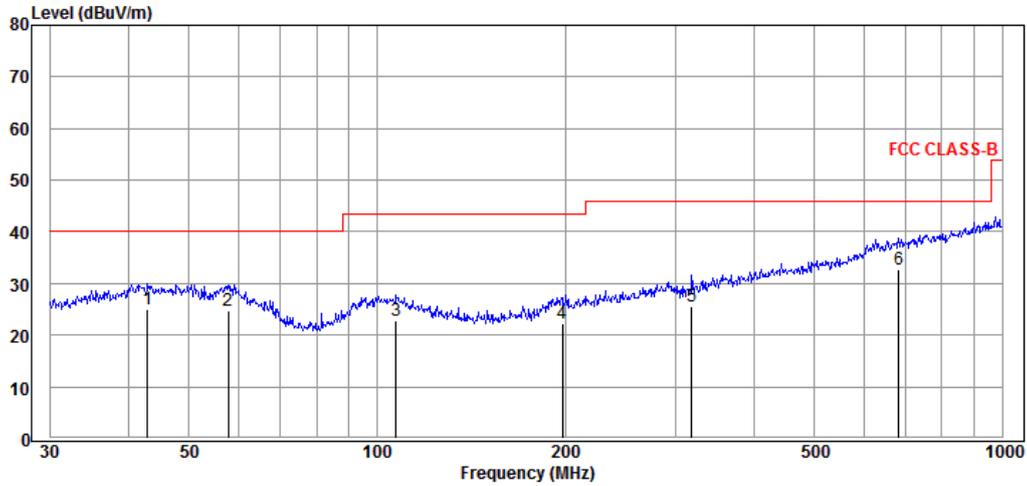
Freq (MHz)	Reading (dBuV)	C.F (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin=limit-result (dB)
45,38	8,39	15,67	24,06	40,00	15,94
58,20	8,46	16,15	24,61	40,00	15,39
102,72	9,26	13,98	23,24	43,50	20,26
192,42	8,11	13,53	21,64	43,50	21,86
294,11	9,59	15,71	25,30	46,00	20,70
760,70	8,82	24,74	33,56	46,00	12,44

Remarks:

- 1) C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
- 2) Result = Reading + C.F (Correction Factor)

No other significant emissions were measured at the frequency range of interest employing the QP detectors.

## Vertical



Freq (MHz)	Reading (dBuV)	C.F (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin=limit-result (dB)
42,90	8,90	16,07	24,97	40,00	15,03
57,80	8,46	16,23	24,69	40,00	15,31
107,13	8,91	13,94	22,85	43,50	20,65
197,89	9,10	13,16	22,26	43,50	21,24
318,82	9,46	16,24	25,70	46,00	20,30
682,35	9,25	23,44	32,69	46,00	13,31

Remarks:

- 1) C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
- 2) Result = Reading + C.F (Correction Factor)

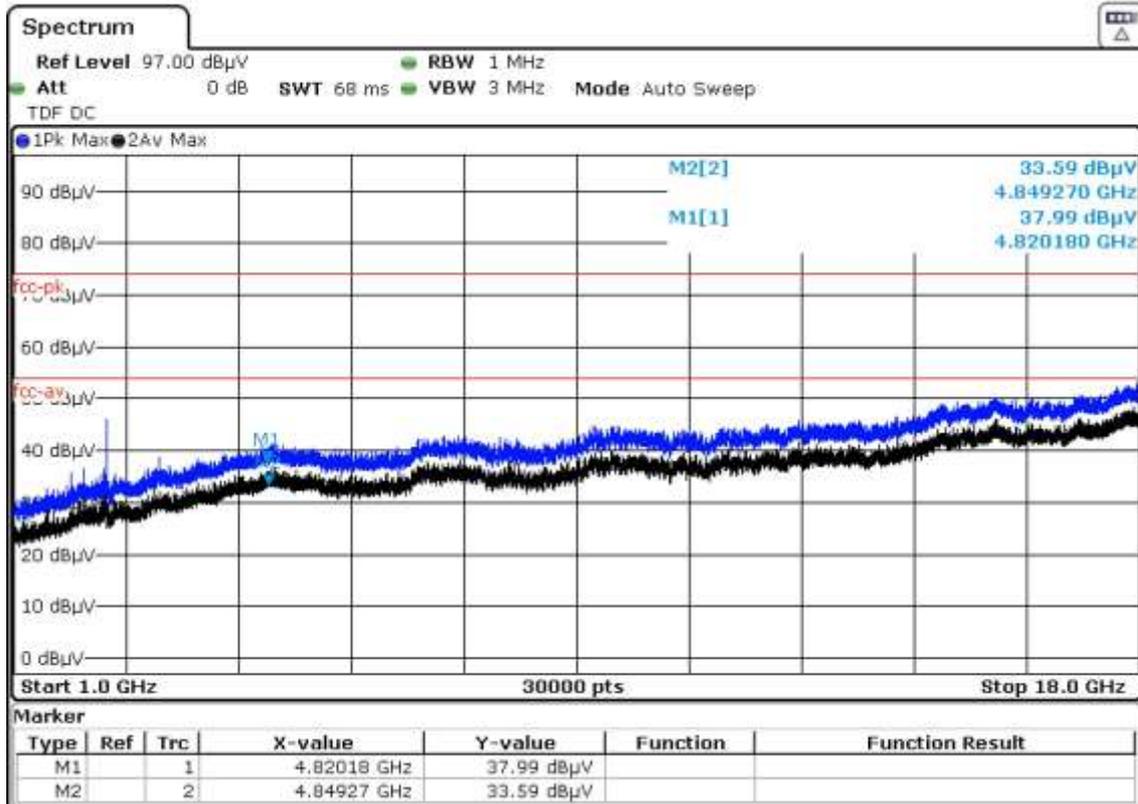
No other significant emissions were measured at the frequency range of interest employing the QP detectors.

### Results of 1 – 18 GHz

Model	PAN1780
Operation Mode	Mode 1 @2402 MHz
Test voltage	3,3 Vdc

### Results

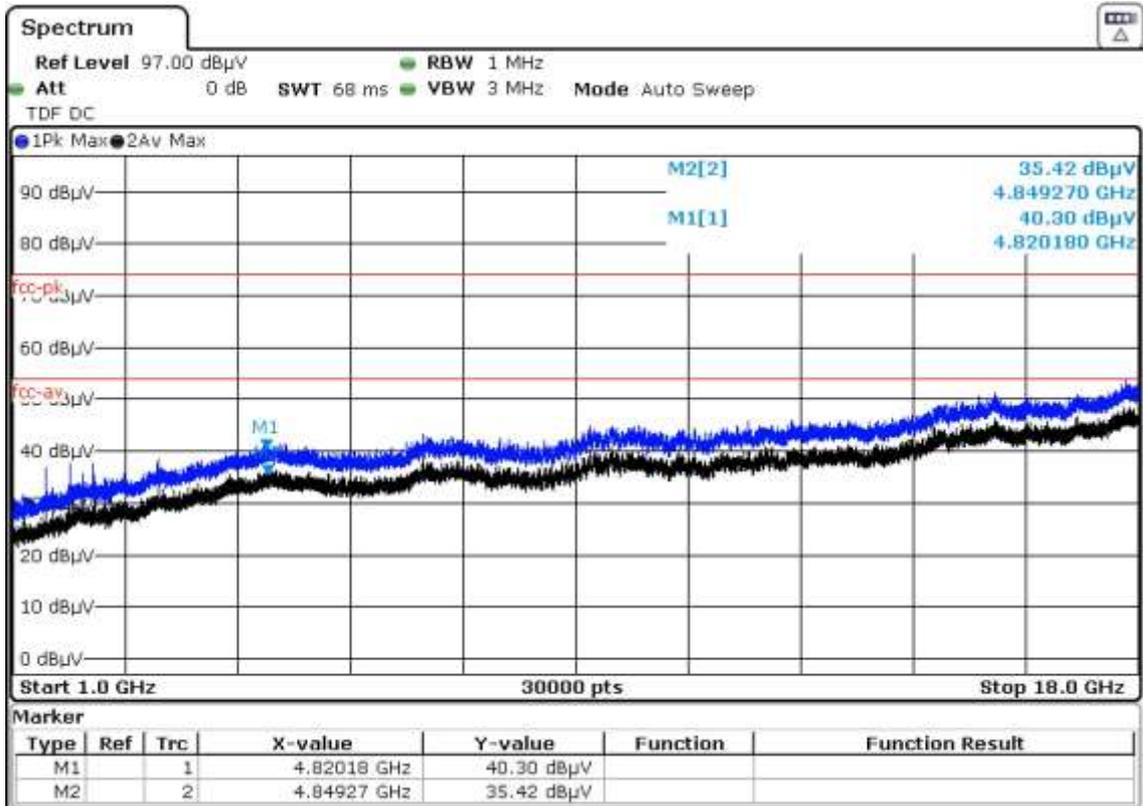
#### Horizontal



Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

**Vertical**



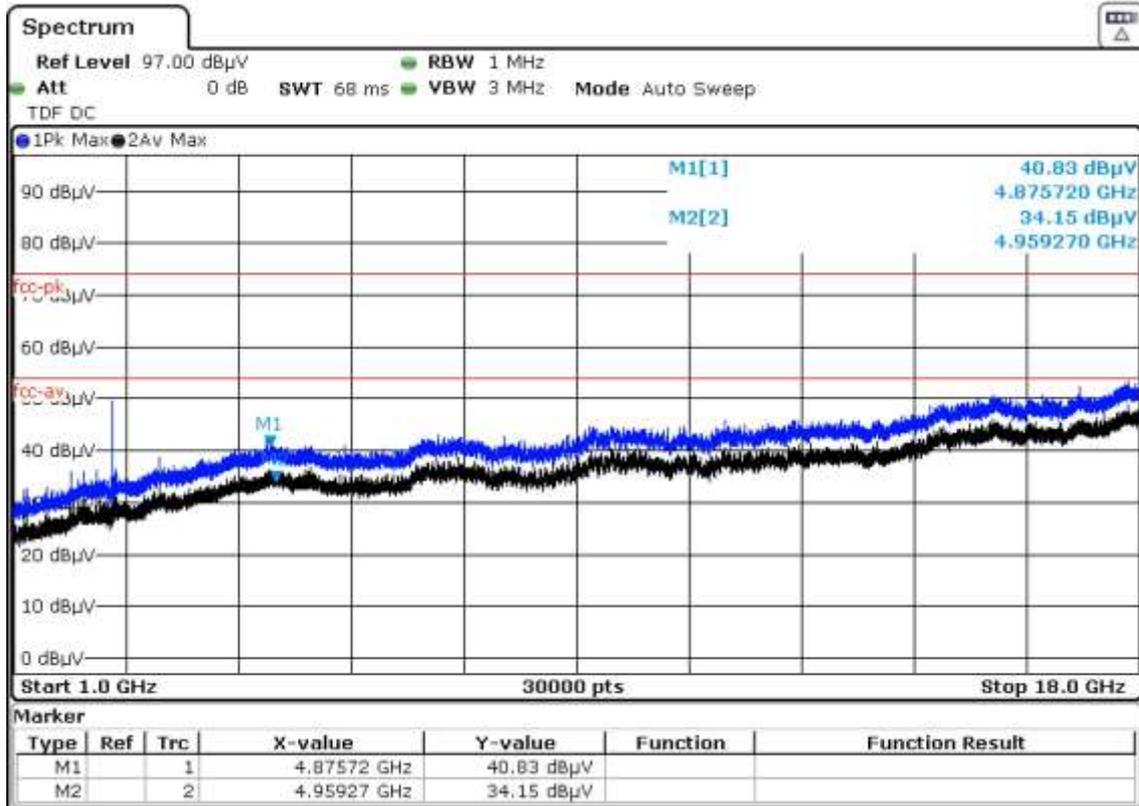
Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

Model	PAN1780
Operation Mode	Mode 1 @2480 MHz
Test voltage	3,3 Vdc

## Results

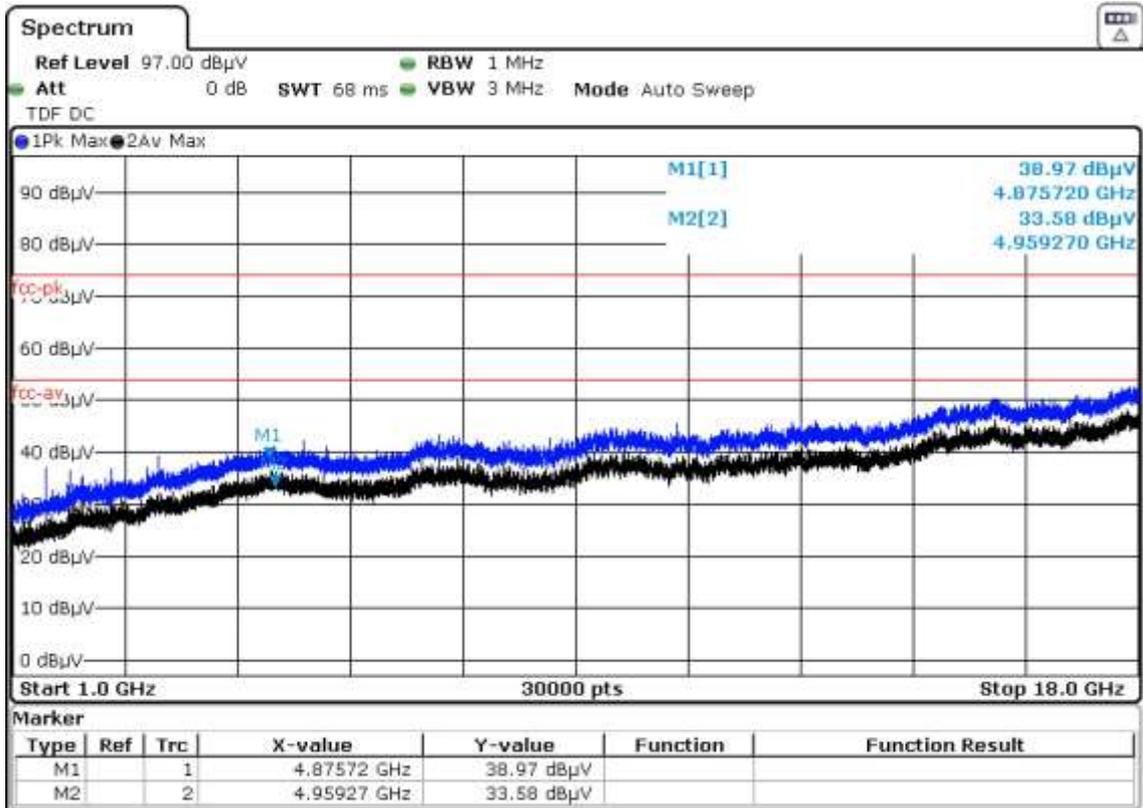
### Horizontal



Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

**Vertical**



Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

<b>4.2 Emissions in restricted frequency bands</b>	<b>VERDICT: PASS</b>
--	----------------------

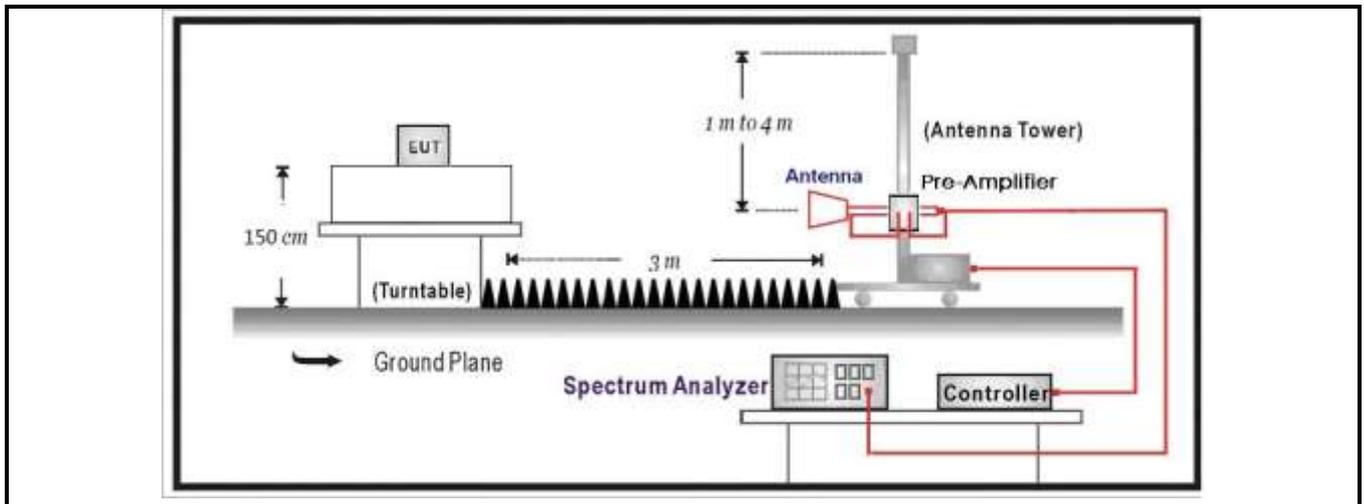
Restricted Bands of operation of FCC			
Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.81425 – 8.81475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	
13.36 – 13.41			
Restricted Bands of operation for IC			
0.090 - 0.110	13.36 - 13.41	960 - 1427	9.0 - 9.2
0.495 - 0.505	16.42 - 16.423	1435 - 1626.5	9.3 - 9.5
2.1735 - 2.1905	16.69475 - 16.69525	1645.5 - 1646.5	10.6 - 12.7
3.020 - 3.026	16.80425 - 16.80475	1660 - 1710	13.25 - 13.4
4.125 - 4.128	25.5 - 25.67	1718.8 - 1722.2	14.47 - 14.5
4.17725 - 4.17775	37.5 - 38.25	2200 - 2300	15.35 - 16.2
4.20725 - 4.20775	73 - 74.6	2310 - 2390	17.7 - 21.4
5.677 - 5.683	74.8 - 75.2	2483.5 - 2500	22.01 - 23.12
6.215 - 6.218	108 - 138	2655 - 2900	23.6 - 24.0
6.26775 - 6.26825	149.9 - 150.05	3260 - 3267	31.2 - 31.8
6.31175 - 6.31225	156.52475 - 156.52525	3332 - 3339	36.43 - 36.5
8.291 - 8.294	156.7 - 156.9	3345.8 - 3358	Above 38.6
8.362 - 8.366	162.0125 - 167.17	3500 - 4400	
8.37625 - 8.38675	167.72 - 173.2	4500 - 5150	
8.41425 - 8.41475	240 - 285	5350 - 5460	
12.29 - 12.293	322 - 335.4	7250 - 7750	
12.51975 - 12.52025	399.9 - 410	8025 - 8500	
12.57675 - 12.57725	608 - 614	--	

Restricted Band Emissions Limit			
Frequency (MHz)	Field strength ( $\mu\text{V}/\text{m}$ )	Field strength ( $\text{dB}\mu\text{V}/\text{m}$ )	Measurement distance (m)
0.009 - 0.49	2400/F(kHz)	48.5 – 13.8	300 <sup>(Note 1)</sup>
0.49 - 1.705	24000/F(kHz)	33.8 - 23	30 <sup>(Note 1)</sup>
1.705 - 30	30	29.5	30 <sup>(Note 1)</sup>
30 - 88	100	40	3 <sup>(Note 2)</sup>
88 - 216	150	43.5	3 <sup>(Note 2)</sup>
216 - 960	200	46	3 <sup>(Note 2)</sup>
Above 960	500	54	3 <sup>(Note 2)</sup>

Note 1: At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

### Test Configuration



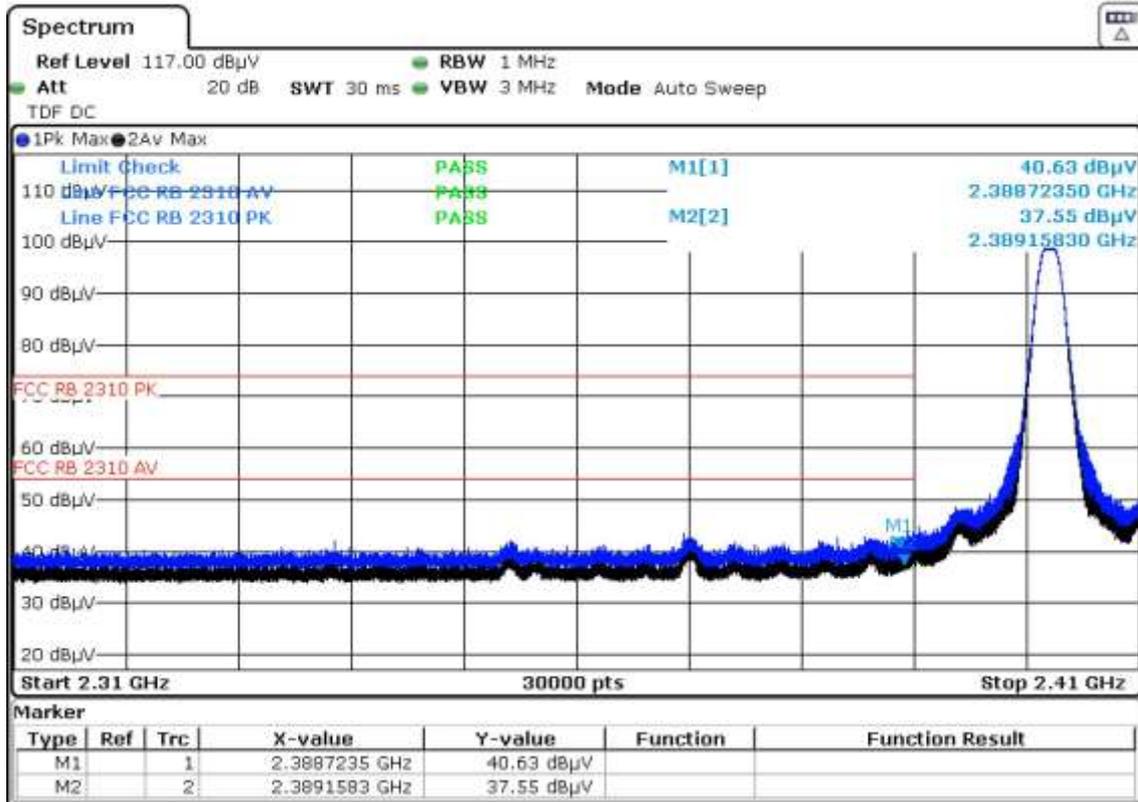
### Performed measurements

Port under test	Enclosure port	
Test method applied	<input type="checkbox"/>	Conducted measurement
	<input checked="" type="checkbox"/>	Radiated measurement
Test setup	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1	
Remark	---	

Model	PAN1780
Operation Mode	Mode 1 @2402 MHz
Test voltage	3,3 Vdc

## Results

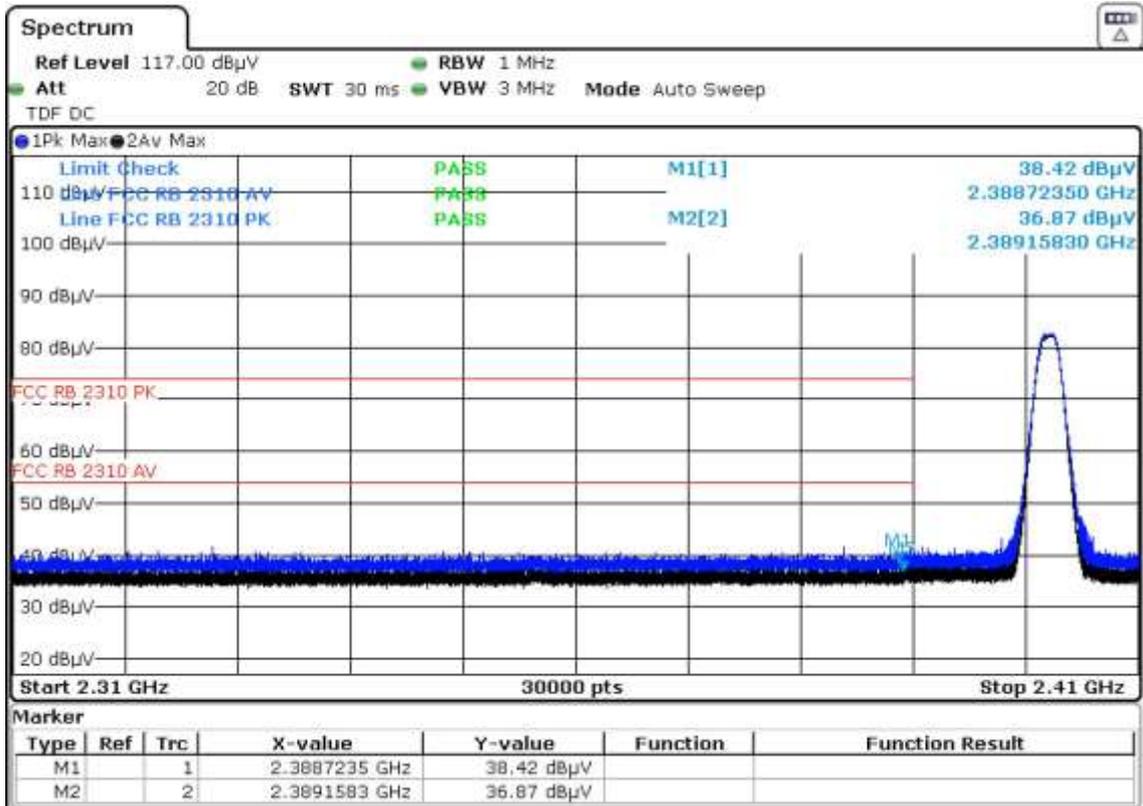
### Horizontal



Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

**Vertical**



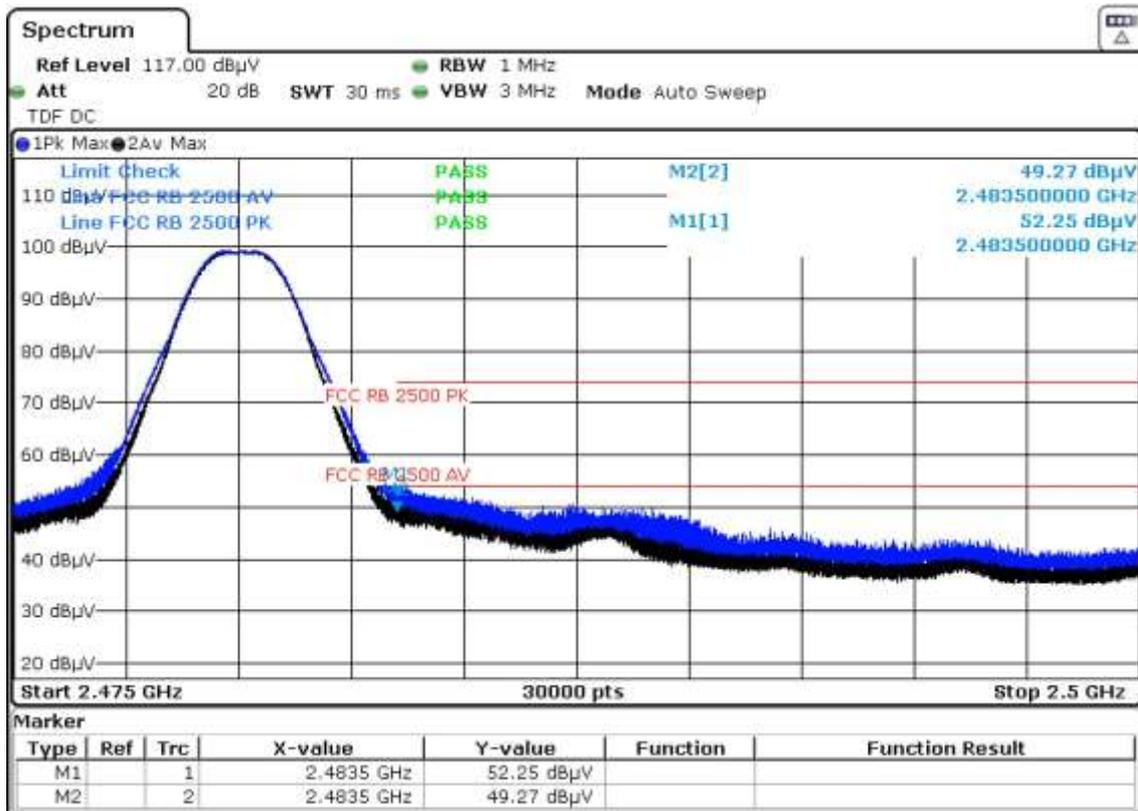
Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

Model	PAN1780
Operation Mode	Mode 1 @2480 MHz
Test voltage	3,3 Vdc

## Results

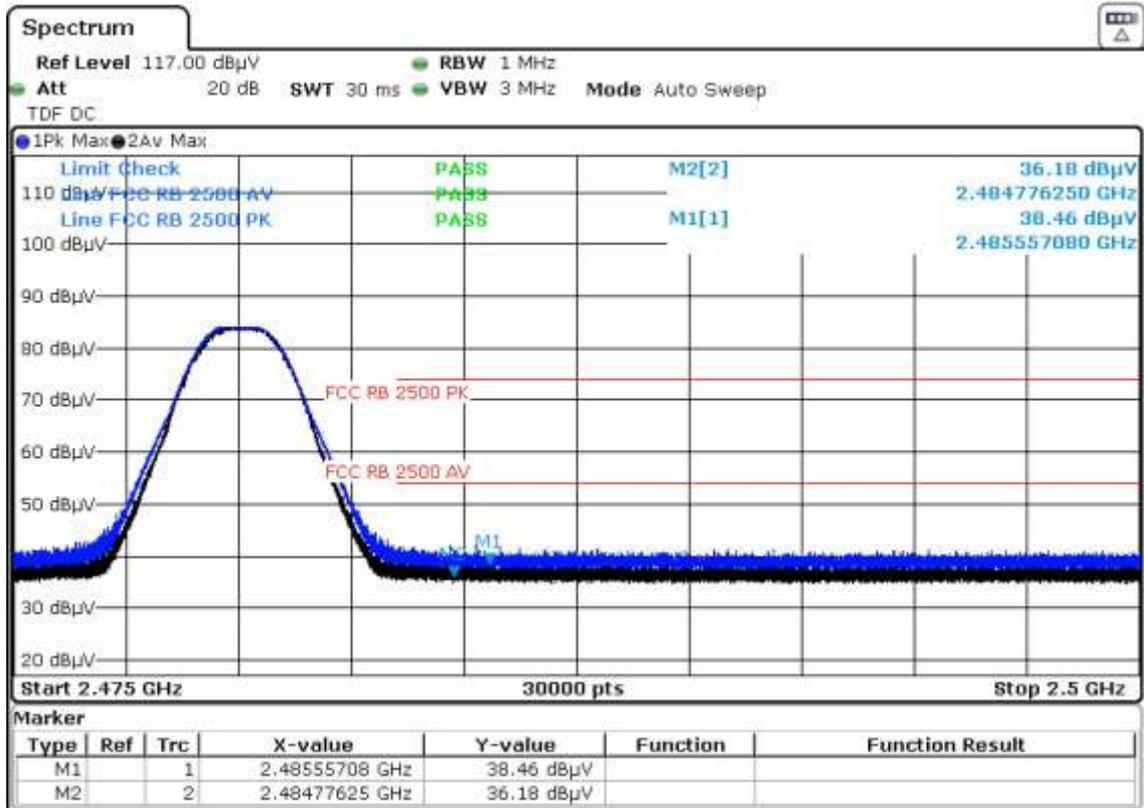
### Horizontal



Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

**Vertical**



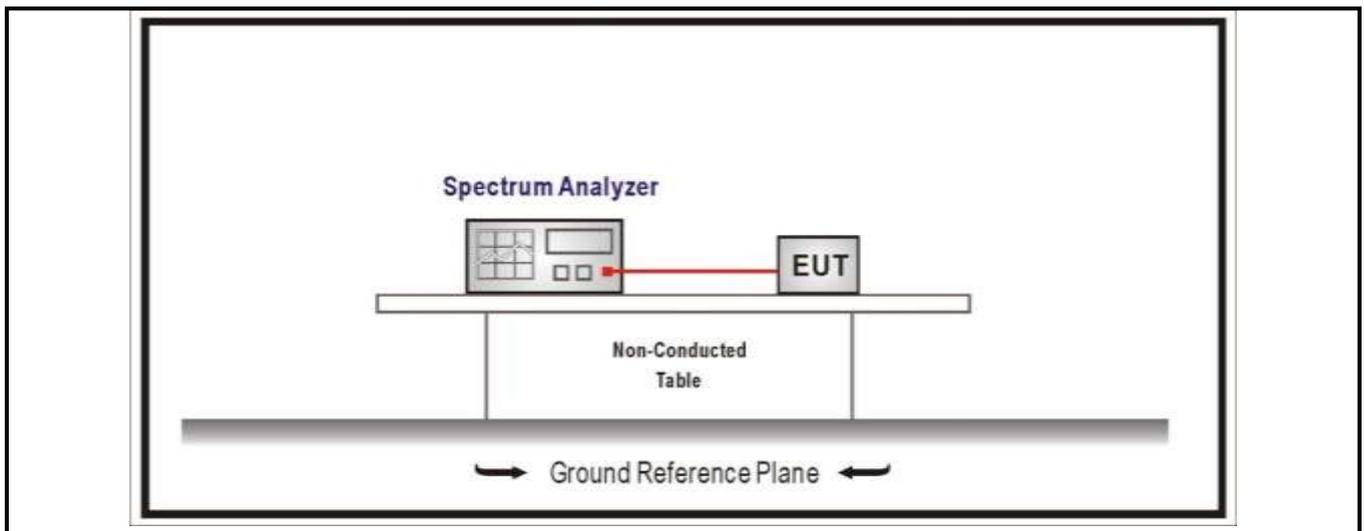
Remarks: Y-Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

No other significant emissions were measured at the frequency range of interest employing the PK and AV detectors.

<b>4.3 Band Edge</b>	<b>VERDICT: PASS</b>
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<b>Standard</b>	FCC Part 15 Subpart C Paragraph 15.247(d)	
RF Output power (Detection methods)	Limit(dB)	
RF Output power(Average detector)	30dBc(Note1)	
RF Output power(PK detector)	20dBc(Note2)	
<p>Note 1: If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD by level in 100 kHz (i.e., 30 dBc).</p> <p>Note 2: If the maximum peak conducted output power procedure was used, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD by level in 100 kHz (i.e., 20 dBc).</p>		

**Test Configuration**

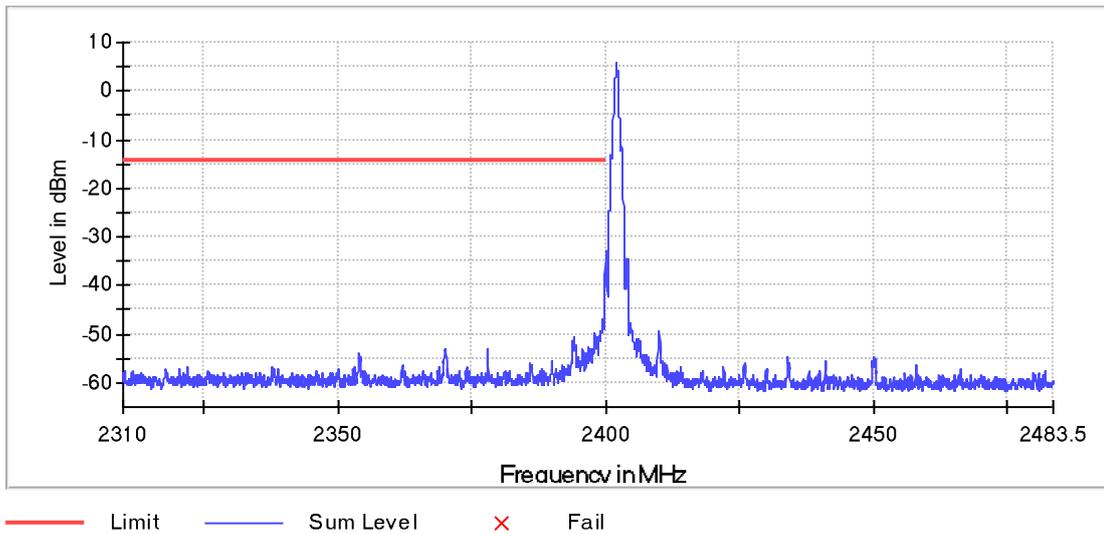


**Performed measurements**

Port under test	Antenna port	
Test method applied	<input checked="" type="checkbox"/> Conducted measurement	
	<input type="checkbox"/> Radiated measurement	
Test setup	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1	
Remark	---	

## Results of mode 1 @2402 MHz

Band Edge



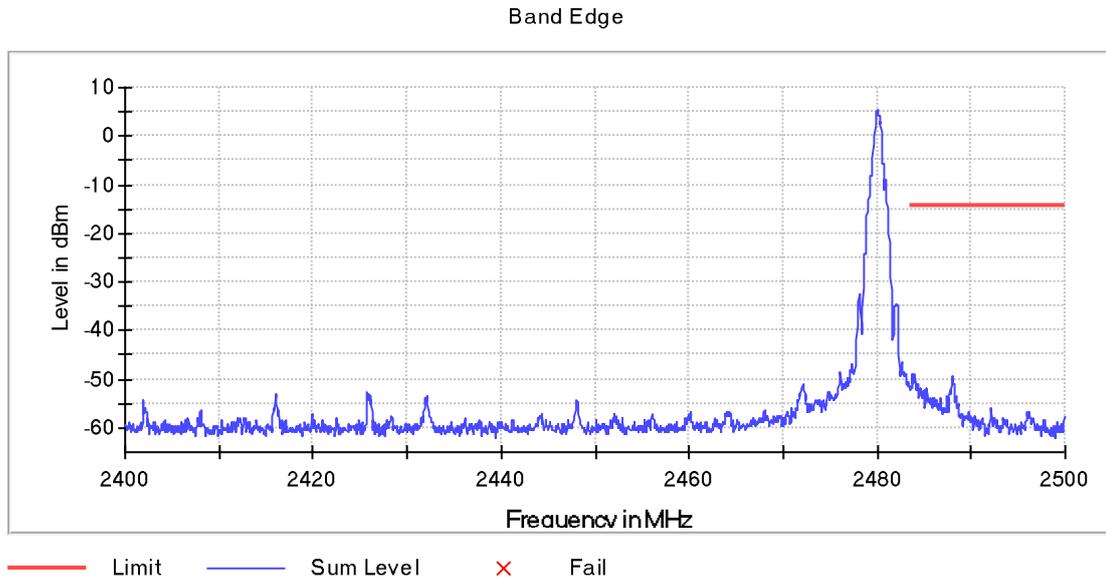
### Inband Peak

Frequency (MHz)	Level (dBm)
2402.0000	5.8

### Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-34.4	20.1	-14.2	PASS
2399.925000	-38.0	23.8	-14.2	PASS
2399.875000	-38.9	24.7	-14.2	PASS
2399.825000	-40.9	26.7	-14.2	PASS
2399.775000	-43.9	29.6	-14.2	PASS
2399.525000	-46.9	32.7	-14.2	PASS
2399.475000	-47.0	32.8	-14.2	PASS
2399.425000	-47.3	33.1	-14.2	PASS
2399.575000	-47.5	33.3	-14.2	PASS
2399.725000	-47.8	33.6	-14.2	PASS
2399.325000	-48.1	33.8	-14.2	PASS
2399.625000	-48.5	34.3	-14.2	PASS
2399.375000	-48.5	34.3	-14.2	PASS
2399.675000	-49.0	34.8	-14.2	PASS
2399.125000	-49.4	35.2	-14.2	PASS

## Results of mode 1 @2480 MHz



### Inband Peak

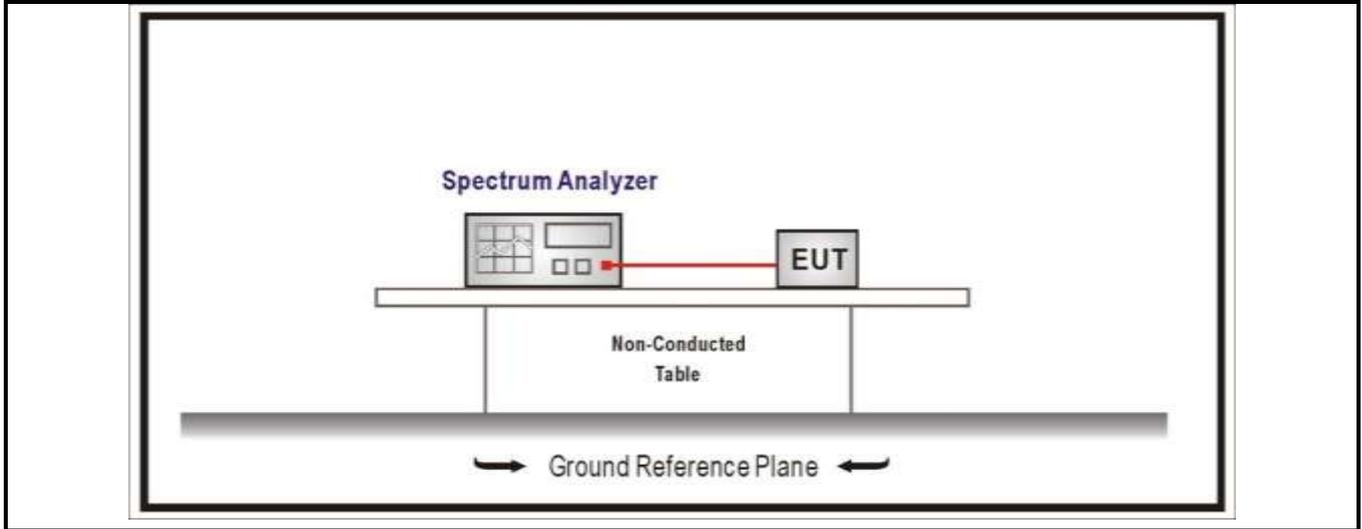
Frequency (MHz)	Level (dBm)
2480.0000	5.7

### Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.975000	-48.7	34.4	-14.3	PASS
2484.025000	-48.8	34.4	-14.3	PASS
2483.725000	-48.8	34.5	-14.3	PASS
2483.675000	-49.2	34.8	-14.3	PASS
2488.025000	-49.5	35.1	-14.3	PASS
2487.975000	-49.6	35.2	-14.3	PASS
2483.775000	-49.7	35.4	-14.3	PASS
2483.925000	-50.3	36.0	-14.3	PASS
2483.875000	-50.7	36.4	-14.3	PASS
2484.275000	-50.8	36.5	-14.3	PASS
2484.175000	-50.9	36.5	-14.3	PASS
2483.825000	-50.9	36.6	-14.3	PASS
2488.075000	-51.0	36.6	-14.3	PASS
2484.325000	-51.0	36.6	-14.3	PASS
2488.125000	-51.1	36.7	-14.3	PASS

<b>4.4 Duty cycle</b>	<b>VERDICT: PASS</b>
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**Test Configuration**



**Performed measurements**

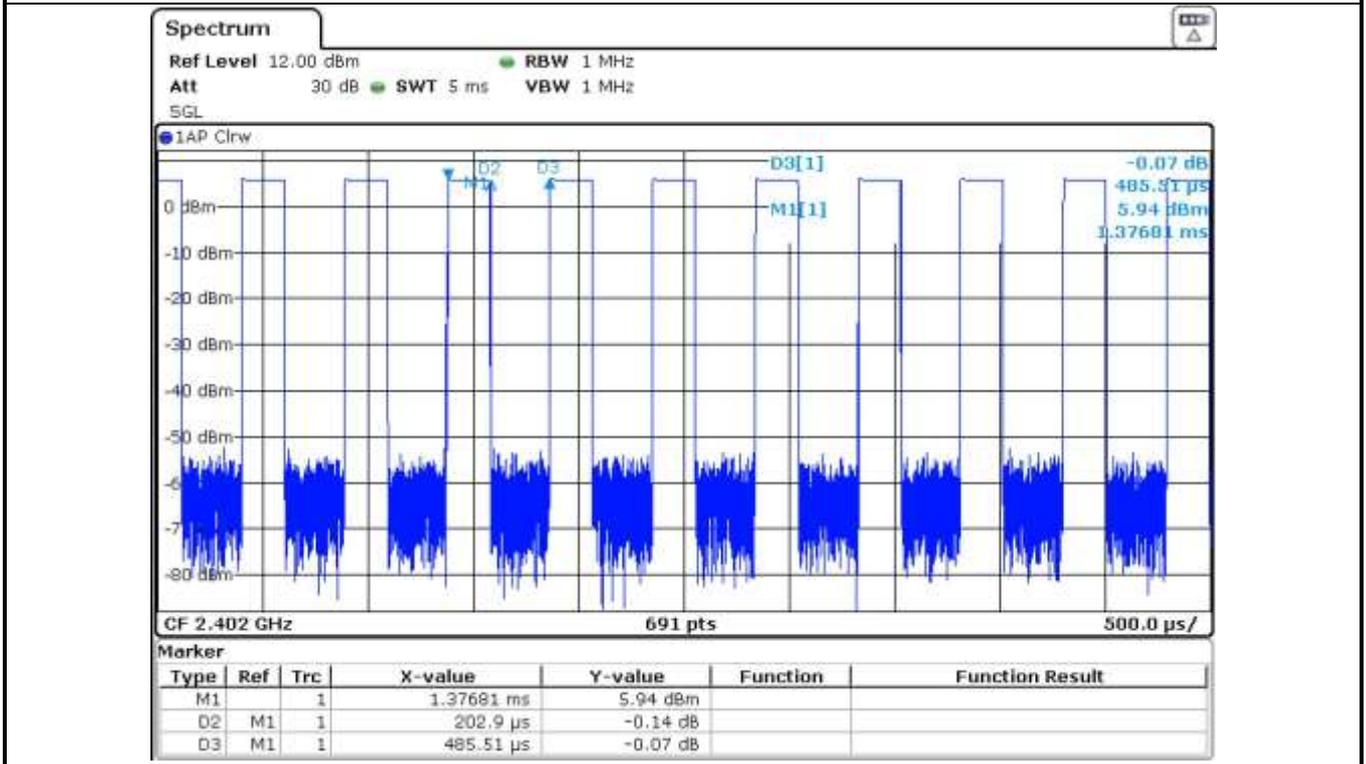
Port under test	Antenna port	
Test method applied	<input checked="" type="checkbox"/>	Conducted measurement
	<input type="checkbox"/>	Radiated measurement
Test setup	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1, Mode 2	
Remark	---	

**Results**

Test Mode	Tx On (us)	Tx On + Tx Off (us)	Duty Cycle
Mode 1	202,9	485,5	42%

Note 1: T means the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control Level for the tested mode of operation.

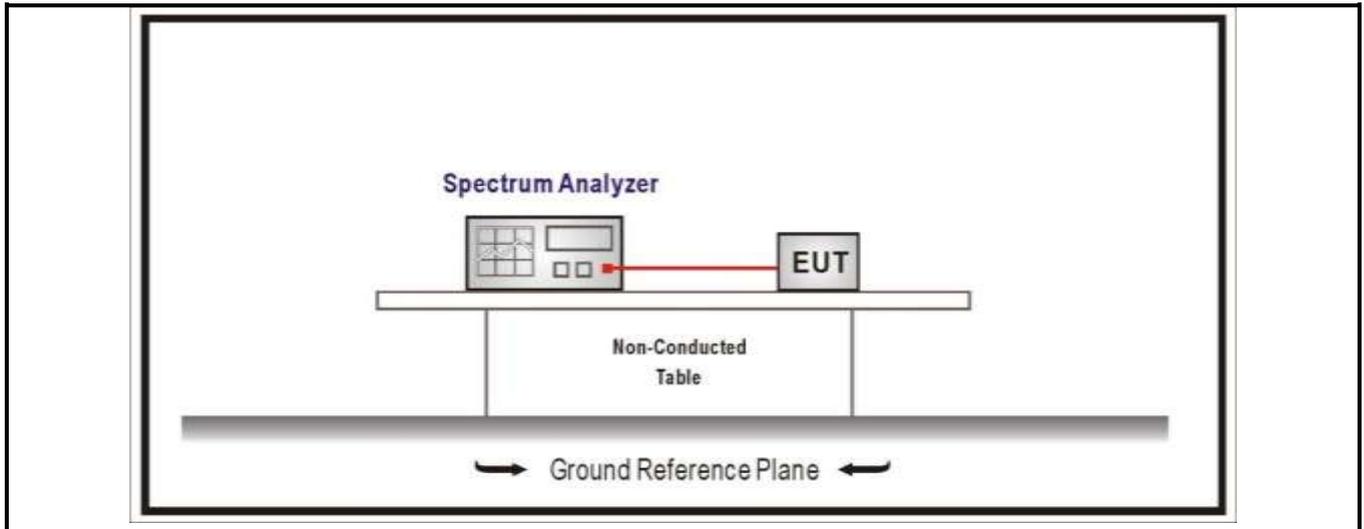
Note 2: According to KDB 558074, when test for Radiated Emission Band Edge and Radiated Emission, for average detector set: VBW ≥ 1/T will be used.



<b>4.5 DTS Bandwidth</b>	<b>VERDICT: PASS</b>
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<b>Standard</b>	FCC Part 15 Subpart C Paragraph 15.247 (a)(2)
Systems using digital modulation techniques operate in the 2400-2483.5 MHz .The minimum 6 dB bandwidth shall be at by least 500 kHz	

**Test Configuration**



**Performed measurements**

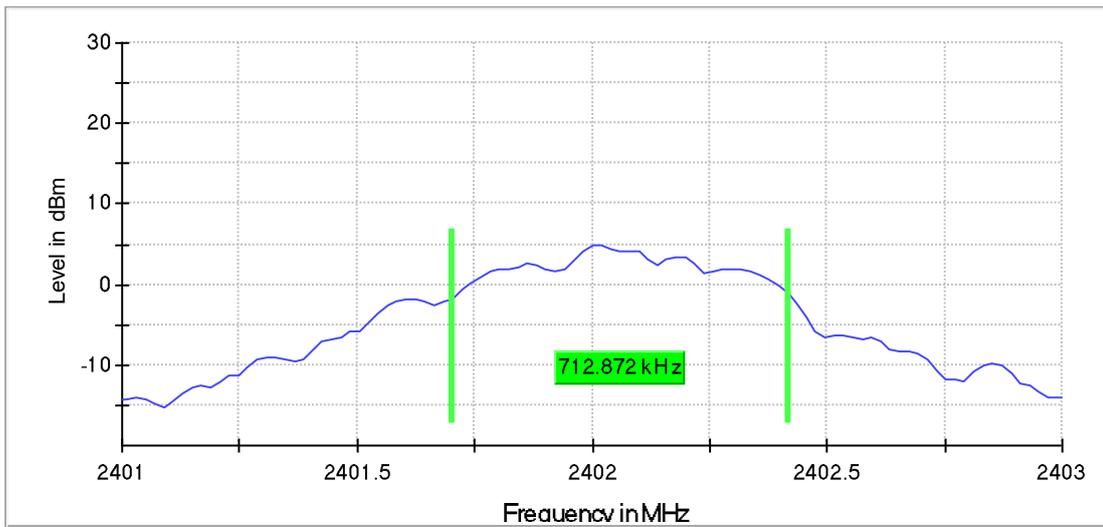
Port under test	Antenna port	
Test method applied	<input checked="" type="checkbox"/>	Conducted measurement
	<input type="checkbox"/>	Radiated measurement
Test setup	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1	
Remark	---	

**Results**

Mode	CH.	Test Freq. (MHz)	6dB Occupied Bandwidth (kHz)	Limit (kHz)	Result
1	37	2402	712,87	>500	Pass
	39	2480	693,07	>500	Pass

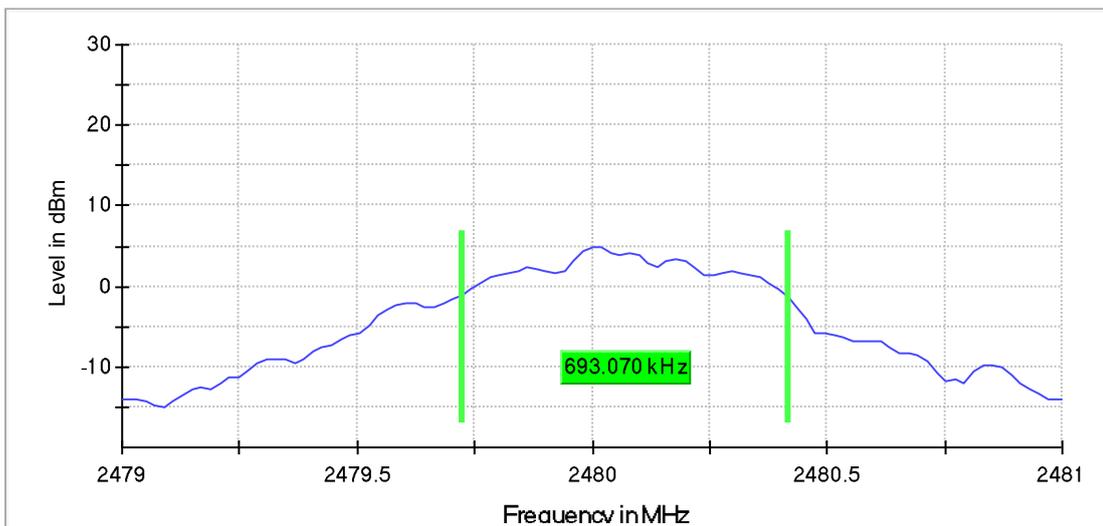
6dB Occupied Bandwidth  
 Mode 1 / CH37 (2402MHz)

6 dB Bandwidth



Mode 1 / CH39 (2480MHz)

6 dB Bandwidth

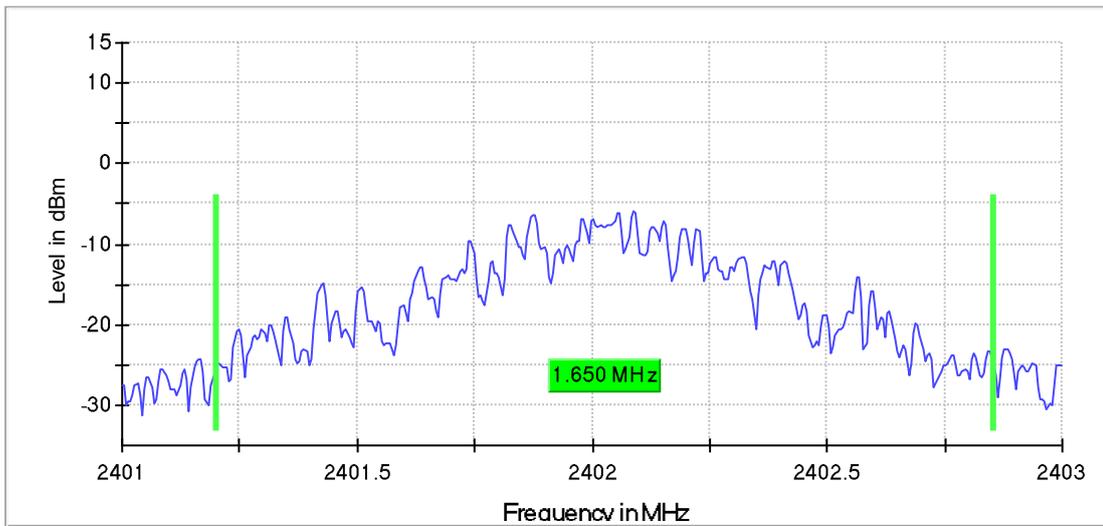


**Supplementary information:** RBW=100 kHz, VBW=300 kHz

Mode	CH.	Test Freq. (MHz)	99% Occupied Bandwidth (MHz)	Limit	Result
1	37	2402	1.65	Within frequency range	Pass
	39	2480	1.66	Within frequency range	Pass

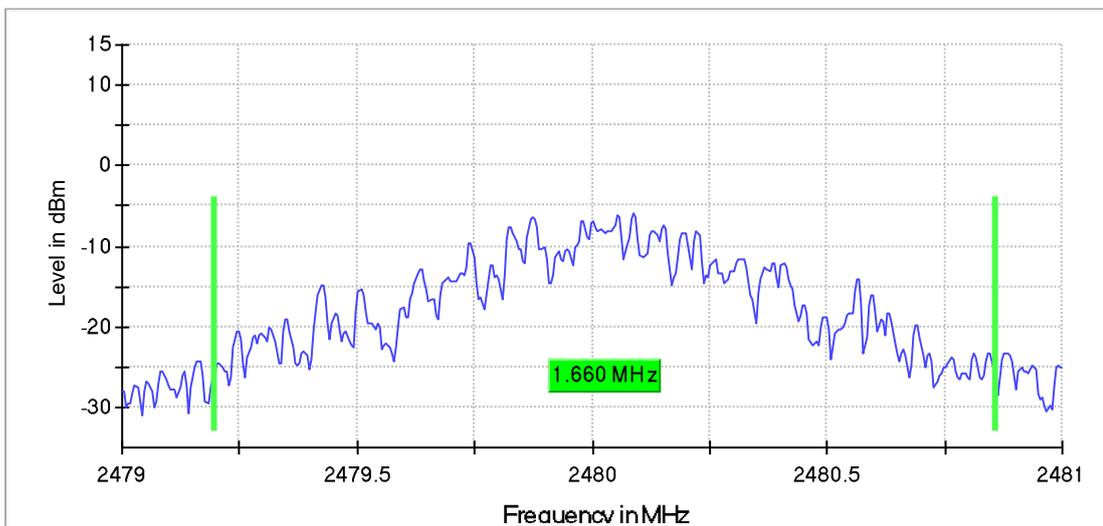
99% Occupied Bandwidth  
 Mode 1 / CH37 (2402 MHz)

99 % Bandwidth



Mode 1 / CH39 (2480 MHz)

99 % Bandwidth

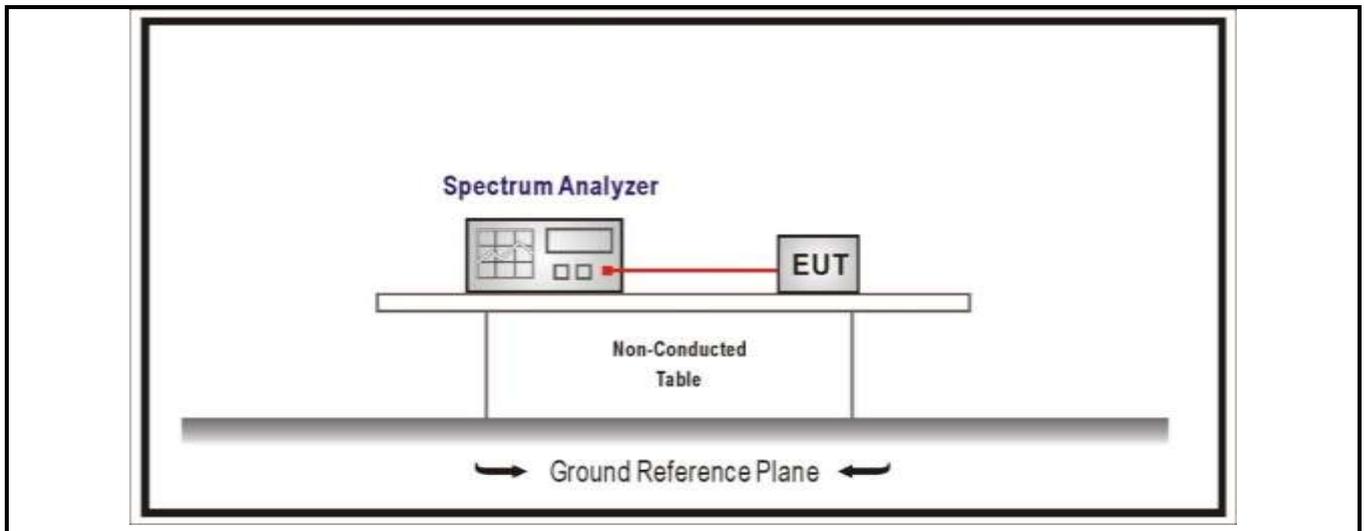


**Supplementary information:** RBW=30 kHz, VBW=100 kHz

<b>4.6 Fundamental emission output power</b>	<b>VERDICT: PASS</b>
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Standard	FCC Part 15 Subpart C Paragraph 15.247 (b)(3)	
<input checked="" type="checkbox"/>	GTX < 6dBi	$P_{out} \leq 30 \text{ dBm}$
<input type="checkbox"/>	GTX > 6dBi	
<input type="checkbox"/>	Non-Fix point-point	$P_{out} \leq 30 - (GTX - 6)$
<input type="checkbox"/>	Fix point-point	$P_{out} \leq 30 - [(GTX - 6)]/3$
<input type="checkbox"/>	Point-to-multipoint	$P_{out} \leq 30 - (GTX - 6)$
<input type="checkbox"/>	Overlap Beams	$P_{out} \leq 30 - [(GTX - 6)]/3$
<input type="checkbox"/>	Aggregate power transmitted simultaneously on all beams	$P_{out} \leq 30 - [(GTX - 6)]/3$
<input type="checkbox"/>	single LE directional beam	$P_{out} \leq 30 - [(GTX - 6)]/3 + 8 \text{ dB}$
Note 1 : GTX directional gain of transmitting antennas. Note 2 : Pout is maximum peak conducted output power .		

**Test Configuration**



**Performed measurements**

Port under test	Antenna port	
Test method applied	<input checked="" type="checkbox"/>	Conducted measurement
	<input type="checkbox"/>	Radiated measurement
Test setup	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1	
Remark	---	

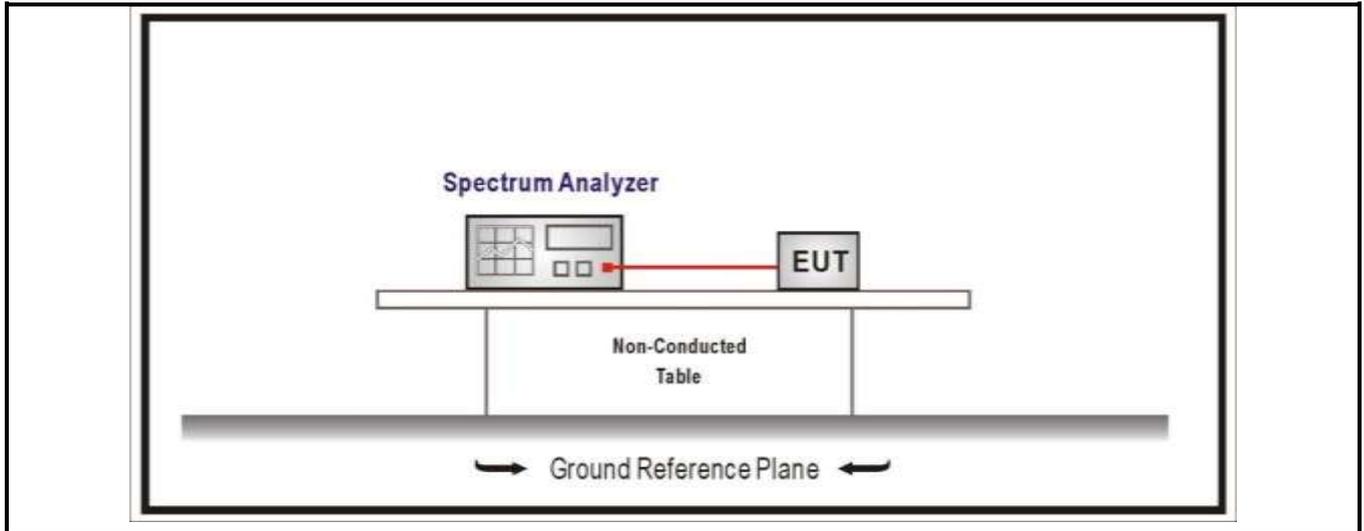
## Results

Mode	Channel	Test Frequency (MHz)	Conducted Power Output (dBm)	E.I.R.P (dBm)	Limit (dBm)	Result
Mode 1	37	2402	5,1	6,1	≤30	Pass
	17	2440	5,4	6,4	≤30	Pass
	39	2480	4,9	5,9	≤30	Pass

<b>4.7 Power Density</b>	<b>VERDICT: PASS</b>
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<b>Standard</b>	FCC Part 15 Subpart C Paragraph 15.247 (b)(3)
Power Spectral Density ≤ 8 dBm/3kHz	

**Test Configuration**



**Performed measurements**

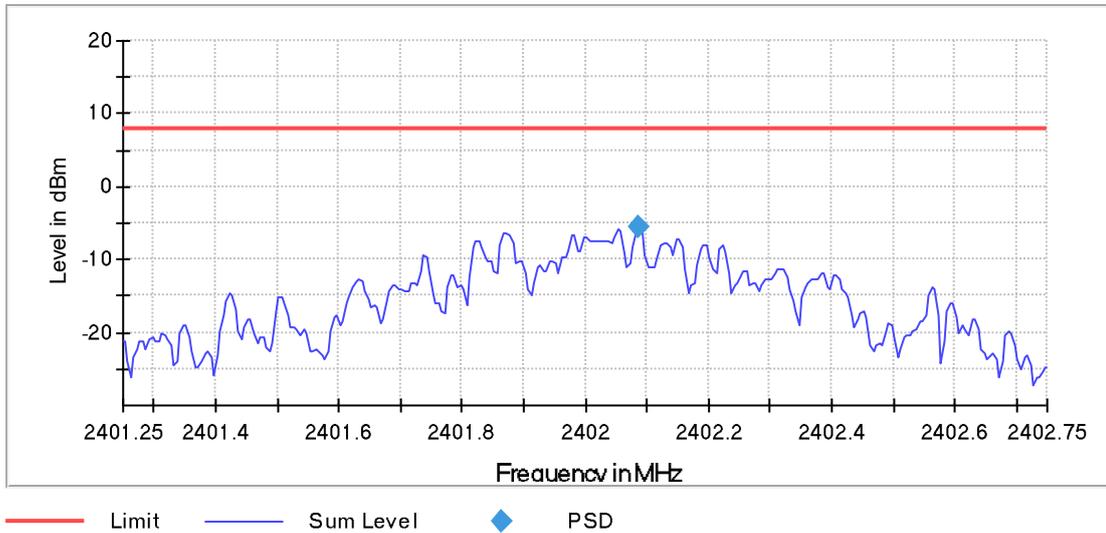
Port under test	Antenna port	
Test method applied	<input checked="" type="checkbox"/>	Conducted measurement
	<input type="checkbox"/>	Radiated measurement
Test setup	Refer to the Annex 3 for test setup photo(s).	
Operating mode(s) used	Mode 1	
Remark	RBW=10 kHz, VBW=30 kHz	

**Results**

Mode	Channel	Test Frequency (MHz)	Power Output (dBm)	Limit (dBm/3kHz)	Result
Mode 1	37	2402	-5,675	≤8	Pass
	17	2440	-5,344	≤8	Pass
	39	2480	-5,745	≤8	Pass

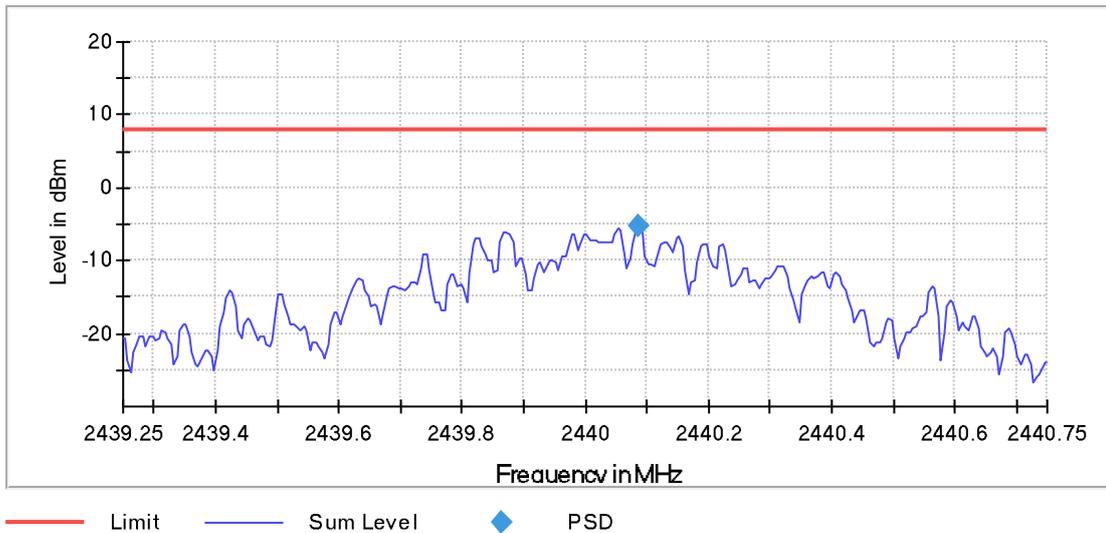
Test figure  
Channel 37

Peak Power Spectral Density



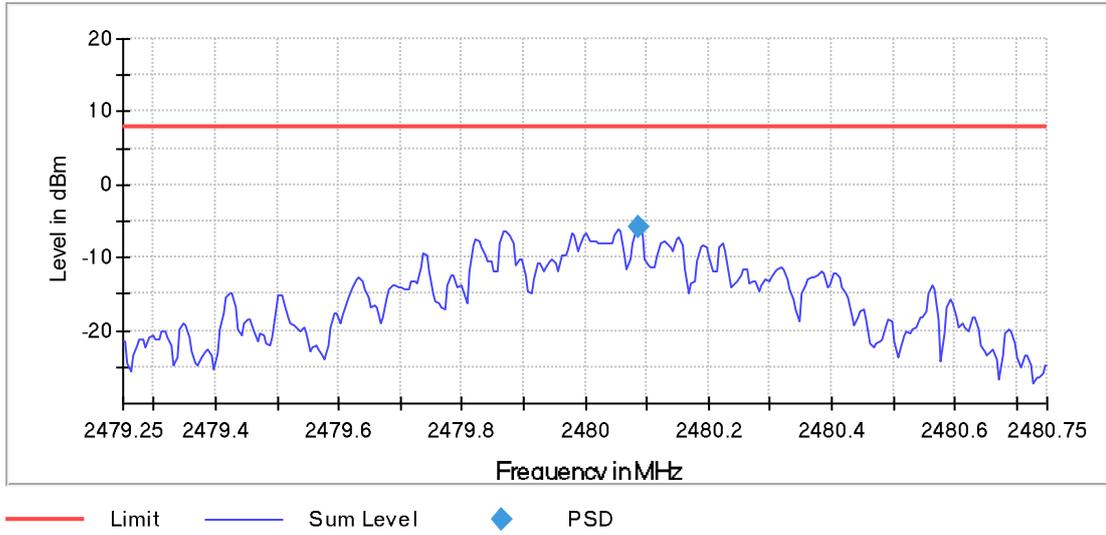
Channel 17

Peak Power Spectral Density



Channel 39

Peak Power Spectral Density



## 5 IDENTIFICATION OF THE EQUIPMENT UNDER TEST

The photographs show the tested device.

Refer to document 4394267\_Internal photos and 4394267\_External photos

## ANNEX 1 – MEASUREMENT UNCERTAINTY

Test Item	Uncertainty
Occupied Channel Bandwidth	$\pm 0,7\%$
RF Output power, conducted	$\pm 0,6\text{dB}$
Power Spectral Density, Conducted	$\pm 0,6\text{dB}$
Unwanted Emissions, Conducted	$\pm 0.7\text{dB}$
Spurious (30-1000MHz)	$\pm 4,4\text{dB}$
Spurious (1-12,75GHz)	$\pm 4,4\text{dB}$

## ANNEX 2 - USED EQUIPMENT

Emissions in non-restricted frequency bands/ Emissions in restricted frequency bands

Item	Instrumentation	Manufacturer	Model No.	Serial No.	DEKRA No.	Cal. Due date
1	EMI receiver	R&S	ESCI	101206	G/L858	2023/07/07
2	Antenna (30MHz-3GHz)	SCHWARZBECK	VULB9163	506	G/L864	2023/10/23
3	Chamber	ETS	/	/	G/L856	2024/06/10
4	Antenna (1GHz-18GHz)	R&S	HF907	102306	G/L1236	2023/02/23
5	Horn antenna preamplifier	Schwarzbeek	SCU-18	102234	G/L1236-1	2023/02/21
6	Spectrum analyzer	R&S	FSV	SN101012	G/L1235	2023/01/17
7	HF antenna (18 – 26.5 GHz)	ETS	3160-09	00164643	G/L1237	2023/01/16
8	High frequency antenna preamplifier (18 – 26.5 GHz)	Schwarzbeck	SCU-26	1879064	G/L1237-1	2023/01/10
9	Broadband horn antenna (15 – 40 GHz)	Schwarzbeck	BBHA9170	00908	GZ1901	2022/05/06
10	High frequency antenna preamplifier (18 – 26.5 GHz)	Schwarzbeck	SCU-26	1879064	G/L1237-1	2023/01/10
11	Annular magnetic field antenna	TESEQ	HLA6121	540045	GZ1905	2023/05/08
12	Radiated emission test system	AUDIX	E3	Version 6.130520		

Duty cycle/Band Edge/Fundamental emission output power/DTS Bandwidth/Power Spectral Density

Item	Instrumentation	Manufacturer	Model	Serial no.	DEKRA No.	Cal Due date
1	Spectrum analyzer	R&S	FSV	SN101012	G/L1235	2023/01/17
2	Chamber	ETS	/	/	G/L856	2024/06/10
3	OSP	R&S	OSP 150	101907	GZ1894	2023/04/27
4	Test software	R&S	EMC32	Version 11.30.00		

## ANNEX 3 - TEST PHOTOS

Refer to document 4394267\_Test setup.

--- END ---