

Prüfbericht-Nr.: Test report no.:	IN25YLOB 001	Auftrags-Nr.: Order no.:	147004419 010	Seite 1 von 79 Page 1 of 79
Kunden-Referenz-Nr.: Client reference no.:	2532520	Auftragsdatum: Order date:	2024-12-23	
Auftraggeber: Client:	Cooper Lighting LLC, 1121 Highway 74 South, Peachtree City, GA, 30269, USA			
Prüfgegenstand: Test item:	Industrial HB2 Sensor			
Bezeichnung / Typ-Nr.: Identification / Type no.:	WLS4-HB2			
Auftrags-Inhalt: Order content:	Testing and issue of Test Report with Grant Certificate			
Prüfgrundlage: Test specification:	FCC Part15 SubpartC 15.247; 15.205; 15.207; 15.209 RSS Gen Issue 5; RSS 247 Issue 3			
Wareneingangsdatum: Date of sample receipt:	2025-02-10			
Prüfmuster-Nr.: Test sample no.:	A003922119-011 & A003922119-012			
Prüfzeitraum: Testing period:	2025-02-10 - 2025-02-12			
Ort der Prüfung: Place of testing:	Wireless laboratory, Bangalore			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (India) Pvt.Ltd., 27/B, 2nd Cross, Electronic City Phase1 Bangalore -560 100, India FCC Test site registration number: 496599 ISED Test site registration number: 27711			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:			genehmigt von: authorized by:	
Datum: Date: 2025-10-27	Signed by: Naveen Kumar Muthyalapati Venkata		Ausstellungsdatum: Issue date: 2025-10-27	Signed by: Madhu Nagaraju
Stellung / Position:	M.V.Naveen Kumar Senior Engineer		Stellung / Position:	Madhu K.N Assistant Manager
Sonstiges / Other:	FCC ID: 2AKCY-42296621971 IC : 4706A-42296621971 HVIN : 442296621971			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet			
* Legend:	P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested			
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the above mentioned test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Prüfbericht - Nr.:

IN25YLOB 001

Seite 2 von 79

Test Report No.:

Page 2 of 79

- | | |
|---|--|
| 1 | <p>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.</p> <p>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i></p> |
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| 3 | <p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben.</p> <p>Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i></p> <p><i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p> |
| 4 | <p>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2023, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</p> <p><i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2023, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i></p> |

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 3 von 79
Page 3 of 79

Test Summary

Test Item	FCC	ISED	Result
Maximum conducted (Peak) output power	15.247 (b)(3)	RSS 247 Issue 3 Section 5.4(d)	Pass
Maximum Power Spectral Density	FCC 15.247(e)	RSS 247 Issue 3 Section 5.2(b)	Pass
DTS Bandwidth & 99% Bandwidth	FCC 15.247(a)(2)	RSS 247 Issue 3 Section 5.2(a) RSS Gen Issue 5 Section 6.7	Pass
Emissions in non-restricted frequency bands	15.247 (d)	RSS 247 Issue 3 Section 5.5	Pass
Spurious Radiated Emissions and Restricted Bands of Operation	15.247 (d) / FCC 15.209 / FCC 15.205	RSS-Gen Issue 5, Section 8.9 /8.10	Pass
AC Power lines Conducted emission	FCC 15.207	RSS Gen Issue 5 Section 8.8	Pass
Antenna Requirement	FCC 15.203	RSS Gen Issue 5 Section 6.8	Complied

Product Category: Electronics Testing

Test Discipline: EMC Test Facility

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 4 von 79
Page 4 of 79

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
IN25YLOB 001	01	Initial issue of report	2025-10-27

Table of Contents

1 GENERAL REMARKS	6
1.1 Attachments	6
2 TEST SITES	7
2.1 Testing Facilities	7
2.2 List of Test and Measurement Instruments.....	7
3 GENERAL PRODUCT INFORMATION	8
3.1 Product Function and Intended Use	8
3.2 Ratings and System Details of Equipment under Test	8
3.3 Measurement Uncertainty:	9
4 TEST SET-UP AND OPERATION MODE	10
4.1 Principle of Configuration Selection	10
4.2 Test Operation and Test Software	10
4.3 Special Accessories and Auxiliary Equipment	10
4.4 Countermeasures to achieve EMC Compliance	10
4.5 List of frequencies	10
4.6 TUV Sample Identification.....	12
5 Operational Description	13
6 TEST METHODOLOGY	14
6.1 AC Power lines Conducted emission	14
6.1.1 Test Setup Configuration.....	14
6.2 Radiated Emission Test	15
6.2.1 Test Setup Configuration.....	15
7 TEST RESULTS FOR 802.15.4.....	17
7.1 Maximum Peak Conducted Output Power	17
7.2 DTS Bandwidth & 99% Bandwidth.....	19
7.3 Power Spectral Density	22
7.4 Emissions in non-restricted frequency bands and Conducted Spurious Emission.....	24
7.4.1 Band edge	25
7.4.2 Out-Of-Band Emissions.....	27
7.5 Spurious Radiated Emissions & Restricted Bands of Operation	29
8 TEST RESULTS FOR BLUETOOTH LOW ENERGY	40
8.1 Maximum Peak Conducted Output Power	40
8.2 DTS Bandwidth & 99% Bandwidth.....	43
8.3 Maximum Power Spectral Density	47
8.4 Emissions in non-restricted frequency bands and Conducted Spurious Emission.....	50
8.4.1 Band edge	51
8.4.2 Out-Of-Band Emissions.....	53
8.5 Spurious Radiated Emissions & Restricted Bands of Operation	59
9 AC Power lines Conducted Emission	76
10 LIST OF TABLES.....	79
11 List of Figures	79
12 Power levels used.....	79

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 6 von 79
Page 6 of 79

1 GENERAL REMARKS

1.1 Attachments

All attachments are part of this test report and are issued in separate document

1. Test Setup photos
2. EUT External Photos
3. EUT Internal Photos
4. FCC Label and Label Location
5. Block Diagram
6. Specification of EUT
7. Schematic Diagrams
8. Bill of Material
9. User Manual
10. Maximum Permissible Exposure Information

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 7 von 79
Page 7 of 79

2 TEST SITES

2.1 Testing Facilities

1. TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
ElectronicCityPhase1
Bangalore – 560 100,
India
2. TUV Rheinland (India) Pvt.Ltd.,
108, Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100,
India

2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

Equipment	Manufacturer	Model Name	Serial Number	Firmware Versions	Calibration Due Date	Periodicity	Test Facility
EMI Receiver	Rohde & Schwarz	ESW 44	103384	3.20SP2	24.06.2026	Yearly	Radiated Spurious Emission
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	16.04.2026	Yearly	
Balun & Biconical Antenna	Schwarzbeck mess-elektronik	BBA 9106+VHBB 9124	9124-1117	-	27.05.2026	Yearly	
Log-Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP 9111B	9111B-324	-	26.05.2026	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120D	01944	-	12.11.2025	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	14.02.2026	Yearly	
EMI Test Receiver	Rohde & Schwarz	ESW44	101773	1.72.SP1	26.01.2026	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
Spectrum Analyzer	Agilent	E4407B	ESA-E	A.14.07	16.01.2026	Yearly	Conducted Test Parameters
10dB Attenuator	H+S Electronics Pvt. Ltd	6810.17. A	770041	-	15.10.2025	Yearly	
Signal Analyzer	Rohde & Schwarz	FSV7	101133	3.48 SP3	13.02.2026	Yearly	
Signal Analyser	Anritsu Corporation	MS2830A	6261983 953	-	07-11-2025	Yearly	
EMI Receiver	Rohde & Schwarz	ESR7	101133	3.48 SP3	20.05.2026	Yearly	Conducted AC Power line Test
Two Line LISN	Scientific	SMLIN63-2	161101	-	06.03.2026	Yearly	
Pulse limiter [0 - 30 MHz]	Rohde & Schwarz	ESH3-Z2	100811	-	26.06.2026	Yearly	

Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in FAC	EMC 32	10.60.20
2	Radiated spurious emission measurement in 10mtr SAC	BAT EMC	3.20.0.17

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

Industrial HB2 Sensor will used with highbay lighting fixture. It provides wireless connectivity via BLE/Zigbee with Wavelinx system to the fixture. Sensor incorporated with daylight sensor and PIR sensor to support run time light dimming and occupancy detection respectively.

3.2 Ratings and System Details of Equipment under Test

Table 3: Ratings and System Details as declared by Client*

Radio Protocol		IEEE 802.15.4	BLE
Operating Frequency Range		2405 MHz – 2480 MHz	2402MHz to 2480MHz
No. of Channels		16 (Refer Table 4)	40 (Refer Table 5)
Channel Spacing		5MHz	2MHz
Transmitted Power level (dBm)		Refer Clause 12	
Maximum Measured Power (e.i.r.p)		12.70 dBm @ 2405MHz	13.57dBm @ 2402MHz
Modulation		IEEE 802.15.4: OQPSK	BLE:GFSK
Number of antennas		1	1
Antenna Type & Make		SMD Chip Antenna & KYOCERA AVX Antennas make 1001013	
Antenna Gain		2.6dBi	
Supply Voltage to Product		12VDC Supply from Driver Driver Power Option 1:120VAC Driver Power Option 2: 277VAC	
Environmental conditions	Storage	-40° C to 70° C (-40°F to 158°F)	
	Operating	-30°C to 55°C (-22F to 131F)	
EUT Dimension	LXWXH	85.67mm X 85.67mm X 60.74 mm	

***Disclaimer:** The information/data is supplied by the client and the same is considered to arrive at the final value. Any changes made apart from the specified specification, can directly impact on the tests results. Refer the products user manual for more details.

3.3 Measurement Uncertainty:

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$

Table 4: Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	± 0.67 dB
Power Spectral Density, conducted	± 0.85 dB
Unwanted Emissions, conducted	± 2.58 dB
All emissions, radiated	± 3.67 dB

4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

Transmission was enabled with highest possible duty cycle transmission on low, mid and high channel.

4.2 Test Operation and Test Software

Hardware Version Identification number (HVIN): 442296621971

Software version: railtest_mg24_1536k_version_1.1

EUT Hardware Name & Number: Wavelinx Industrial HB2 Sensor & WLS4-HB2

4.3 Special Accessories and Auxiliary Equipment

- None

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 List of frequencies

Frequency Band (MHz)	Channel Number	Channel Frequency (MHz)
2405 – 2480	00	2405
	01	2410
	02	2415
	03	2420
	04	2425
	05	2430
	06	2435
	07	2440
	08	2445
	09	2450
	10	2455
	11	2460
	12	2465
	13	2470
	14	2475
	15	2480

Table 5: List of IEEE 802.15.4 Center frequencies

Channel used for IEEE 802.15.4 testing.

Channel low: 2405MHz

Channel mid: 2440MHz

Channel mid: 2475MHz

Channel high: 2480MHz

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 11 von 79

Page 11 of 79

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
2402 – 2480	0	2402
	1	2404
	2	2406
	3	2408
	:	:
	11	2424
	12	2426
	:	:
	19	2440
	20	2442
	:	:
	:	:
	:	:
	:	:
	36	2474
	37	2476
	38	2478
	39	2480

Table 6: List of BLE Centre frequencies

Channel used for BLE testing.

Channel low: 2402MHz

Channel mid: 2440MHz

Channel mid: 2478MHz

Channel high: 2480MHz

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 12 von 79

Page 12 of 79

Channel used for BLE testing.

Channel low: 2402MHz

Channel mid: 2440MHz

Channel high : 2480MHz

4.6 TUV Sample Identification

1. TUV Sample Identification number: A003922119-011– Radiated test Sample
A003922119-012– Conducted test Sample

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 13 von 79

Page 13 of 79

5 Operational Description

Industrial HB2 Sensor will be part of WLX lite or WLX pro network. Which provides wireless communication over BLE or Zigbee to configure light fixture with different dimming level and other settings related to PIR configuration and daylight sensor configuration. on board PIR sensor detect occupancy and turn on light fixture and turn off once the vacancy is detected while daylight sensor ensures the lux value maintained as per setting.

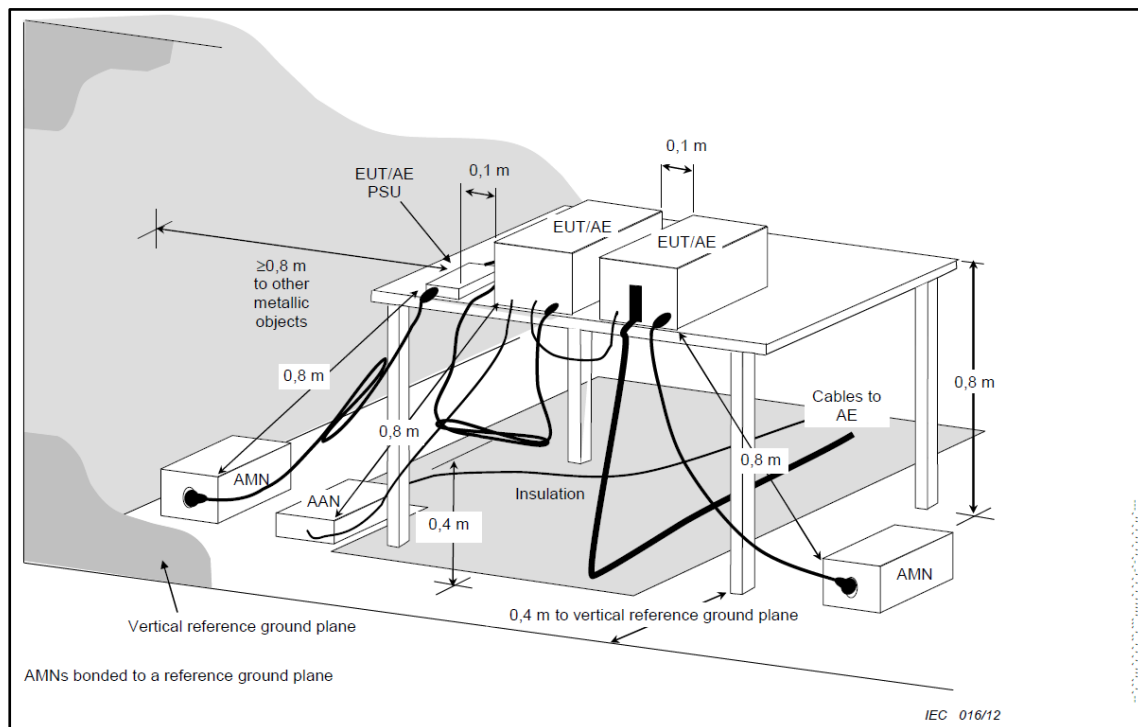
6 TEST METHODOLOGY

6.1 AC Power lines Conducted emission

Measured levels of ac powerline conducted emission across the 50Ω LISN port (to which the EUT is connected). All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer.

The device is placed on the test table, raised 80cm above the reference ground plane. The vertical conducting plane is located 40cm to the rear of the device. AC Conducted emission measurement is made over frequency range from 150 kHz to 30MHz, this measurement was performed an AC adaptor 110V AC 60Hz supply

6.1.1 Test Setup Configuration



6.2 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2020. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable for below 1 GHz & 1.5 m height for above 1 GHz measurement, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000 MHz was performed by horn antenna, the measurement below 30 MHz was performed by loop antenna, Measurement from 30 MHz to 200 MHz was performed by Balloon and Biconical Antenna, and measurement from 200 MHz to 1 GHz was performed by Log-Periodic Antenna.

The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded

6.2.1 Test Setup Configuration

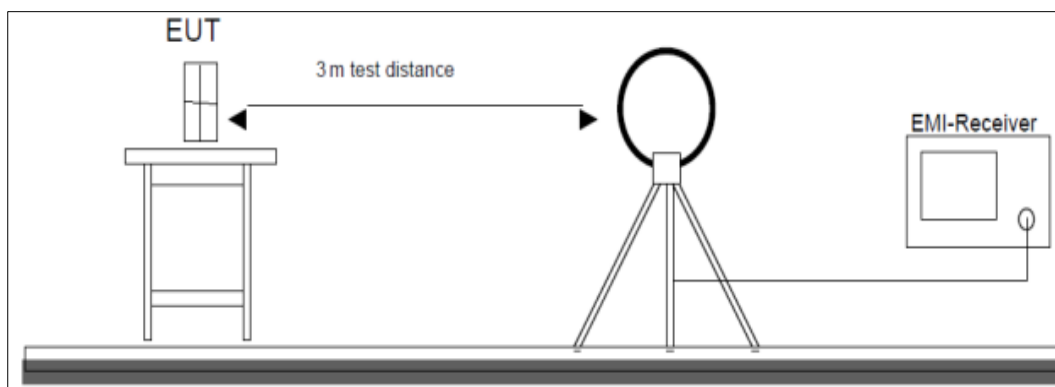


Figure 1: Frequency Range 9 kHz- 30 MHz

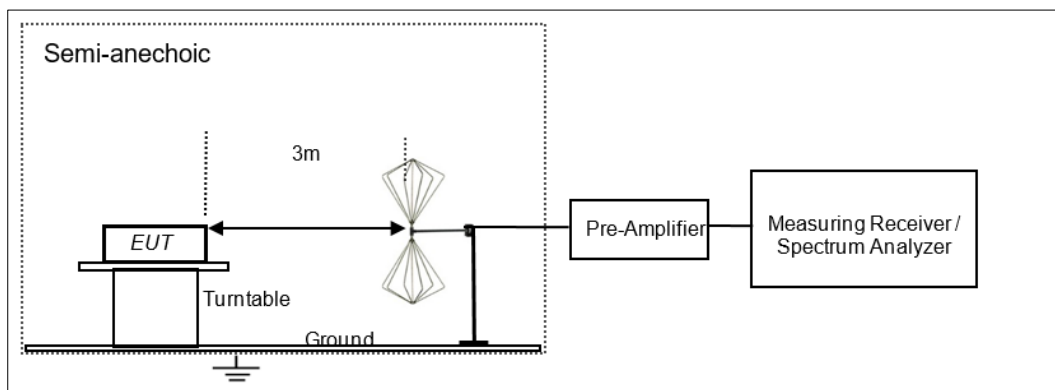


Figure 2: Frequency Range 30 MHz – 200 MHz

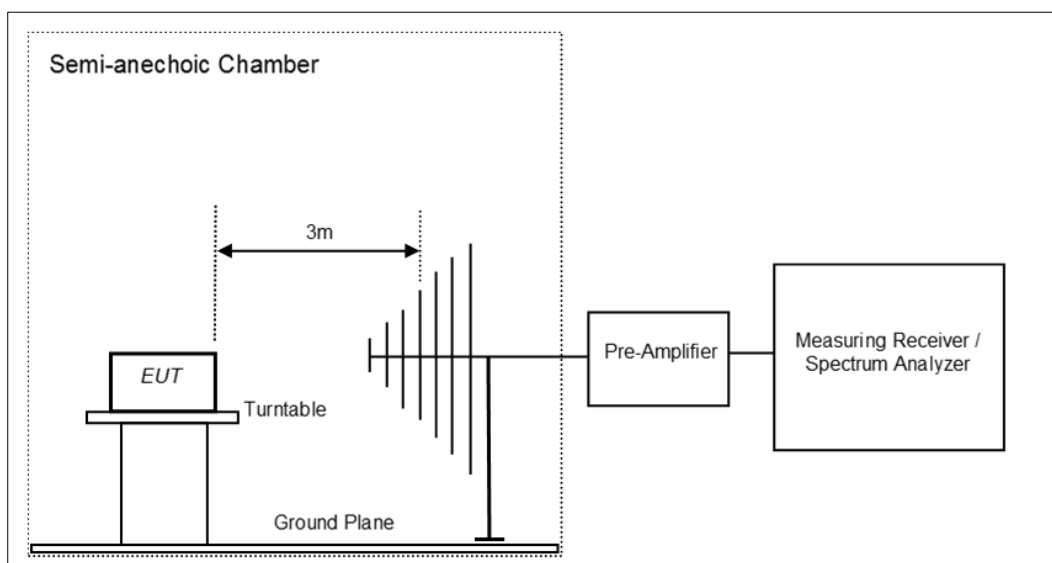


Figure 3: Frequency Range 200 MHz - 1GHz

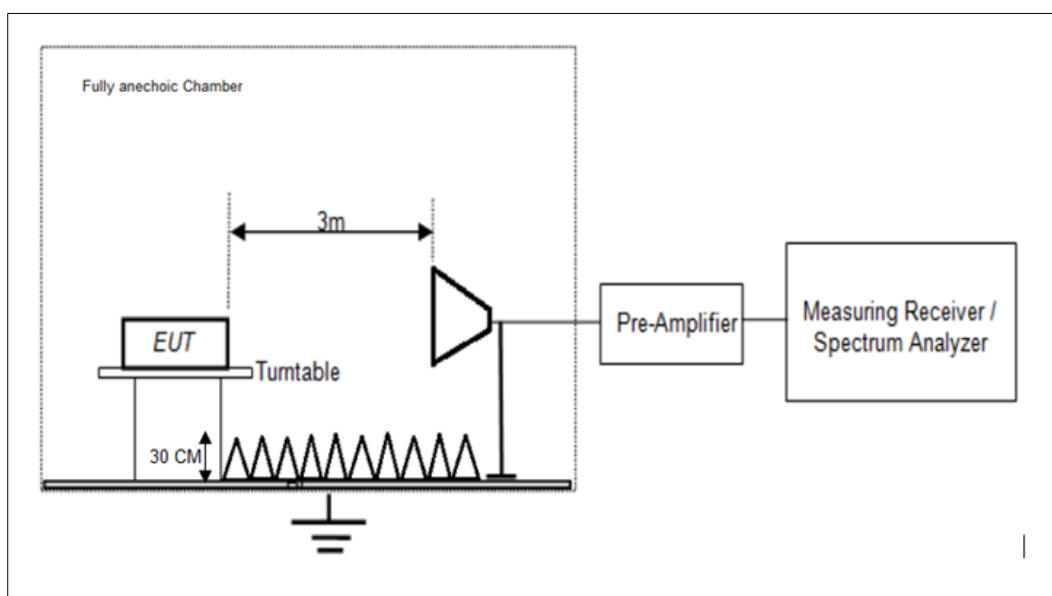


Figure 4: Frequency Range above 1 GHz

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 17 von 79
Page 17 of 79

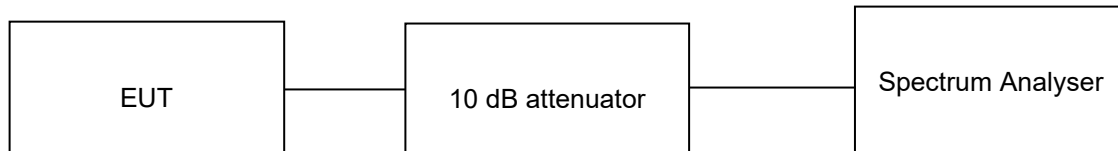
7 TEST RESULTS FOR 802.15.4

7.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3) / RSS 247 Issue 3, Section 5.4 (d)
Test Method	Subclause 11.9.1.1 of ANSI C63.10-2020
Measurement Bandwidth	2MHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power ≤ 1 W (30 dBm) & e.i.r.p ≤ 6 W(36dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.3.1 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 18 von 79

Page 18 of 79

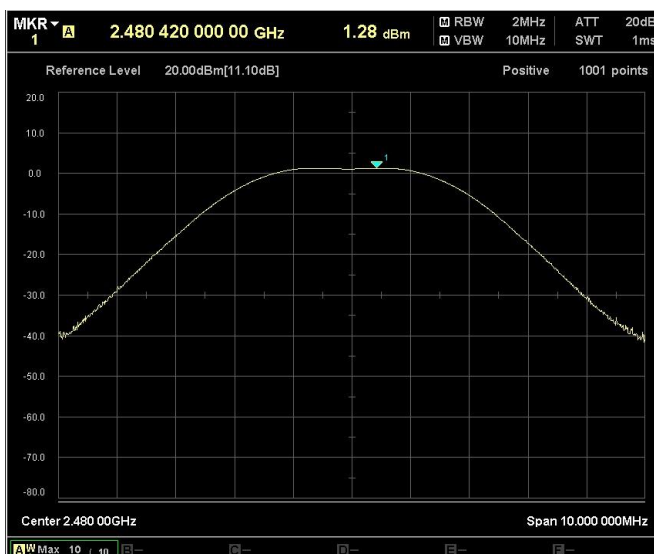
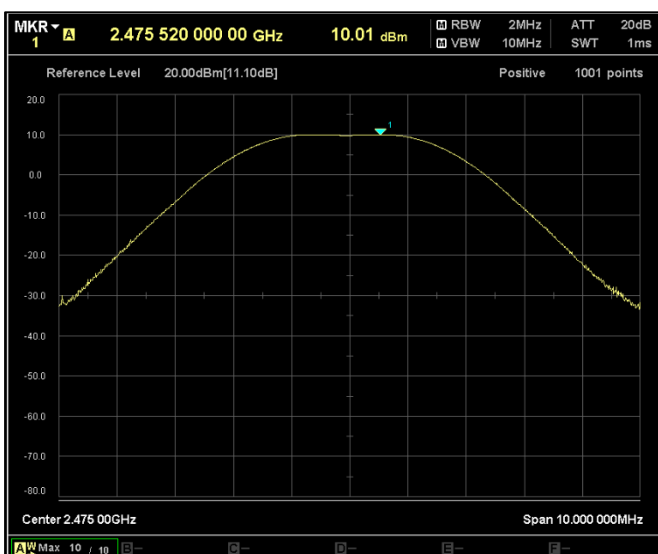
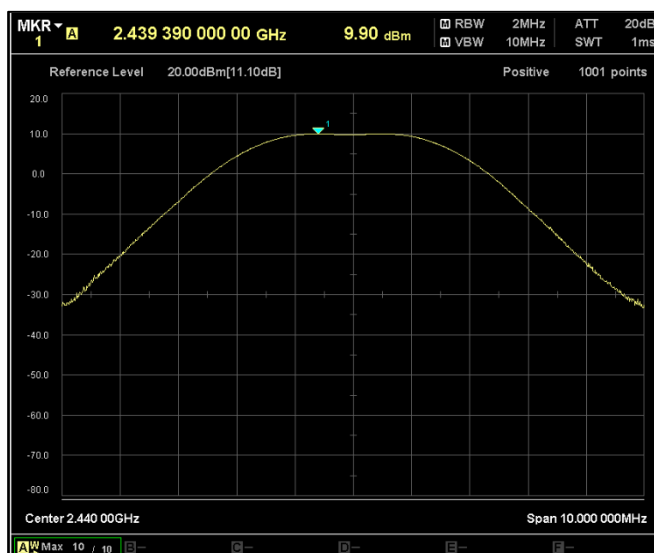
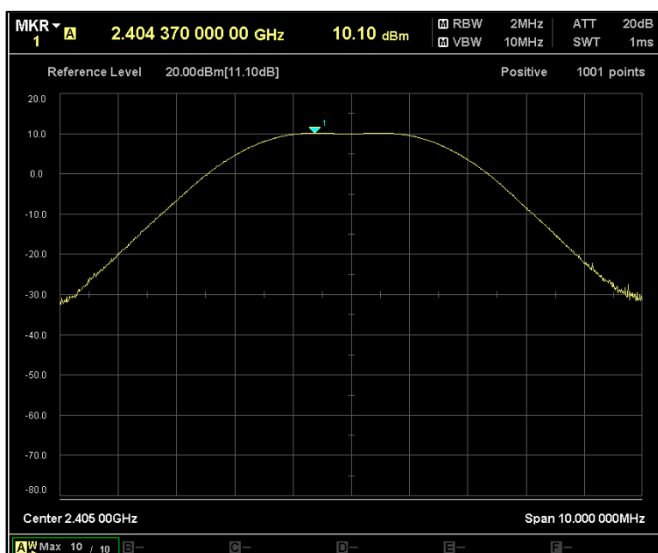
Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB) + U. FL Cable loss (0.5dB).
3. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 2.60 dBi.

Data Rate (kbps)	Channel Frequency (MHz)	Measured Power (dBm)	E.I.R.P (dBm)	Power Limit (dBm)	Limit (e.i.r.p)
250	2405.00	10.10	12.70	30.00	36.00
	2440.00	9.90	12.50	30.00	36.00
	2475.00	10.01	12.61	30.00	36.00
	2480.00	1.28	3.88	30.00	36.00

Test Plots:



Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 19 von 79
Page 19 of 79

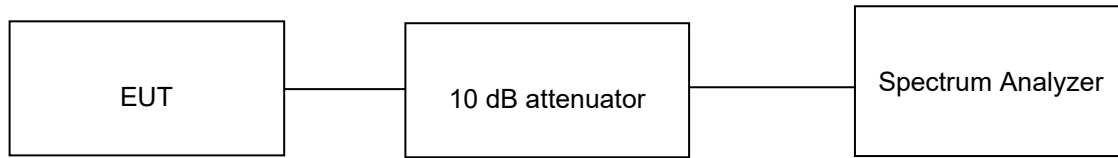
7.2 DTS Bandwidth & 99% Bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (2) / RSS 247 Issue 3, Section 5.2 (a)
Test Method	Subclause 11.8.1 & 6.9.3 of ANSI C63.10-2020 Subclause 6.9.3 of ANSI C63.10a-2024
Measurement Bandwidth	100 kHz for x dB bandwidth 1 to 5% of OCB for 99% bandwidth
Detector	Peak
Port of testing	Antenna port
Requirement	Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.2 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence directional gain of the single antenna is 2.60 dBi.

Data Rate (kbps)	Channel Frequency (MHz)	99% Occupied bandwidth (MHz)	6dB BW (MHz)	Limit (MHz)
250	2405	2.26	1.65	0.5
	2440	2.26	1.65	0.5
	2475	2.27	1.64	0.5
	2480	2.28	1.67	0.5

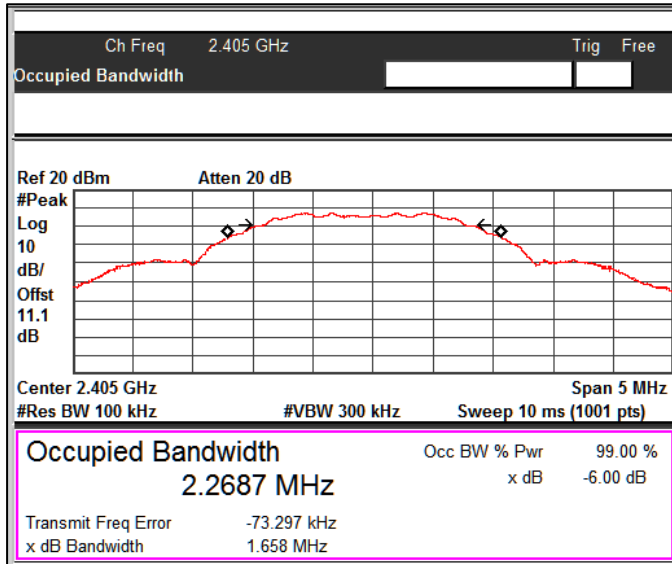
Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

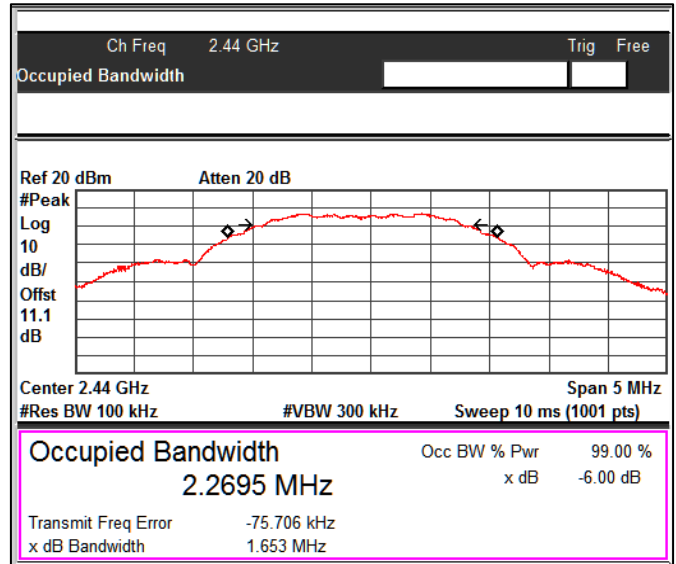
Seite 20 von 79
Page 20 of 79

Test Plots:

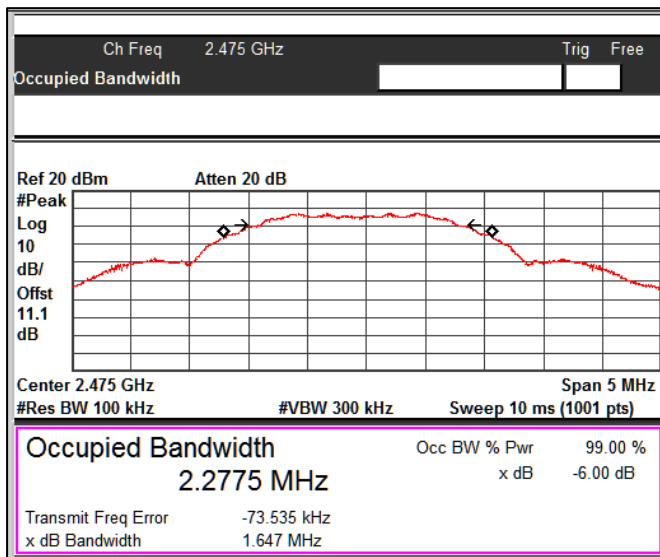
6dB DTS Plots



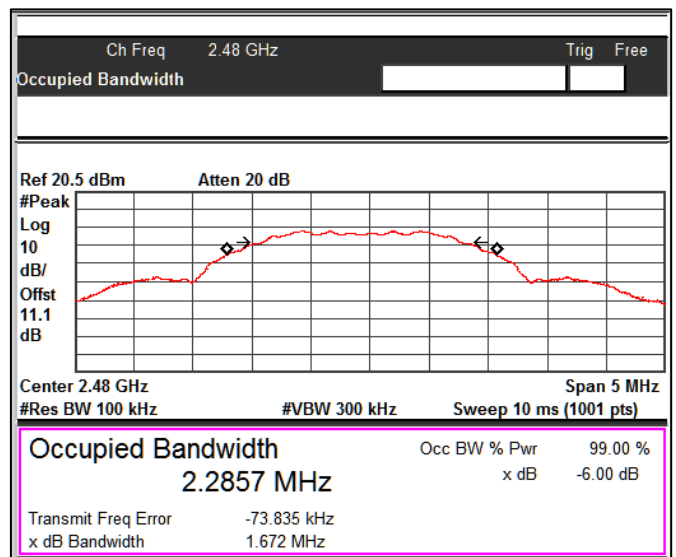
Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2475MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:

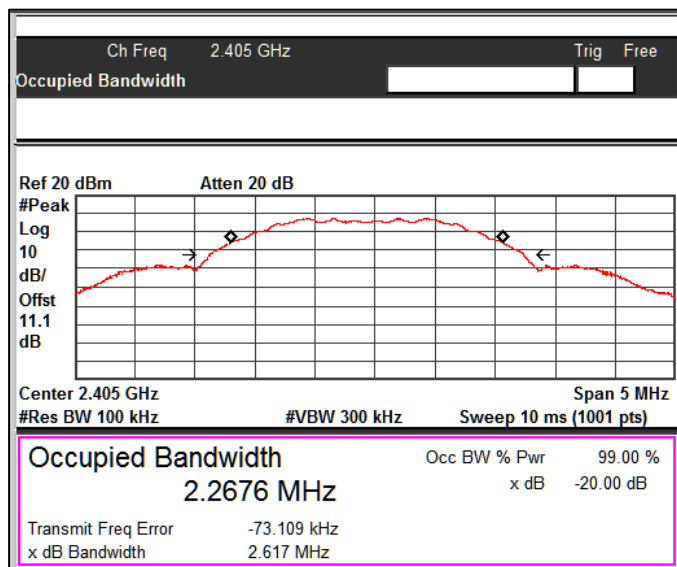
Test Report No.:

IN25YLOB 001

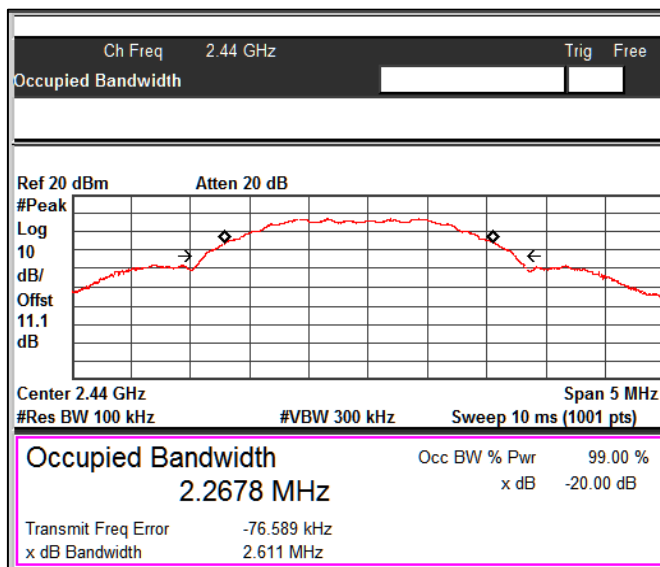
Seite 21 von 79

Page 21 of 79

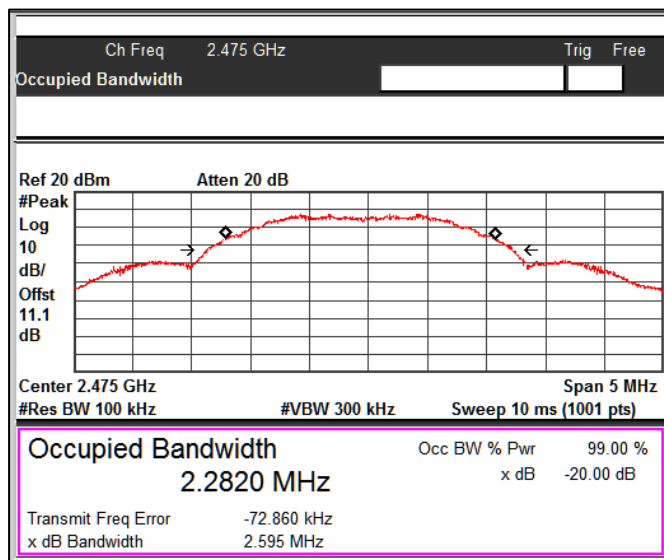
99% OBW plots



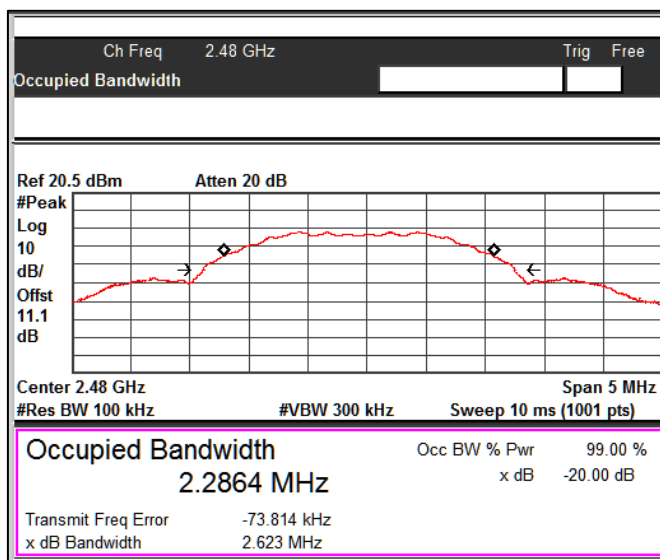
Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2475MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 22 von 79
Page 22 of 79

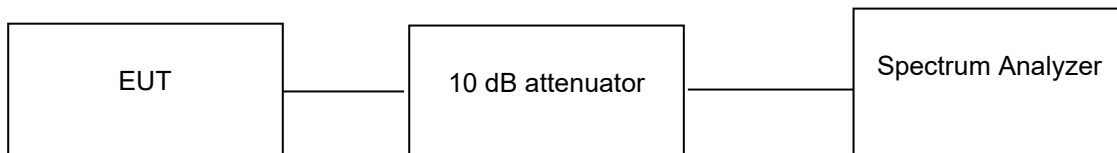
7.3 Power Spectral Density

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (e) / RSS 247 Issue 3, Section 5.2 (b)
Test Method	Subclause 11.10.2 of ANSI C63.10-2020
Measurement Bandwidth	3 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	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 Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 ° Voltage: 12VDC Supply from Driver Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.4 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report.

Data Rate (kbps)	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	PSD Limit (dBm/kHz)
250	2405	-4.15	8.00
	2440	-4.56	8.00
	2475	-4.52	8.00
	2480	-13.27	8.00

Prüfbericht - Nr.:

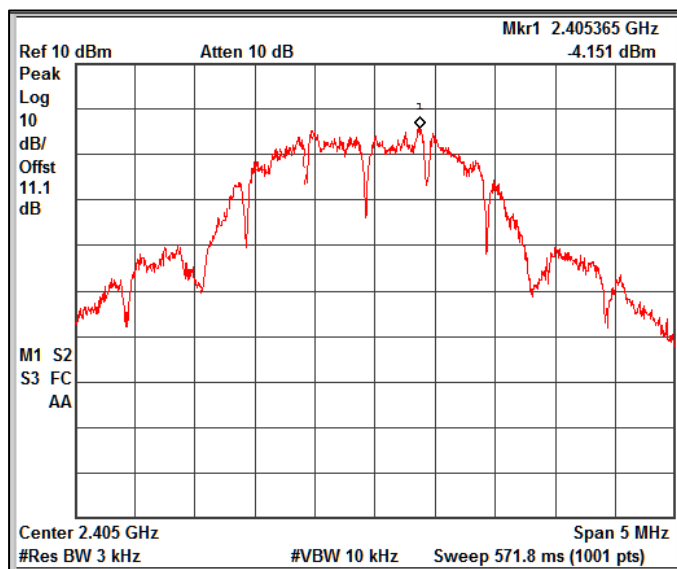
Test Report No.:

IN25YLOB 001

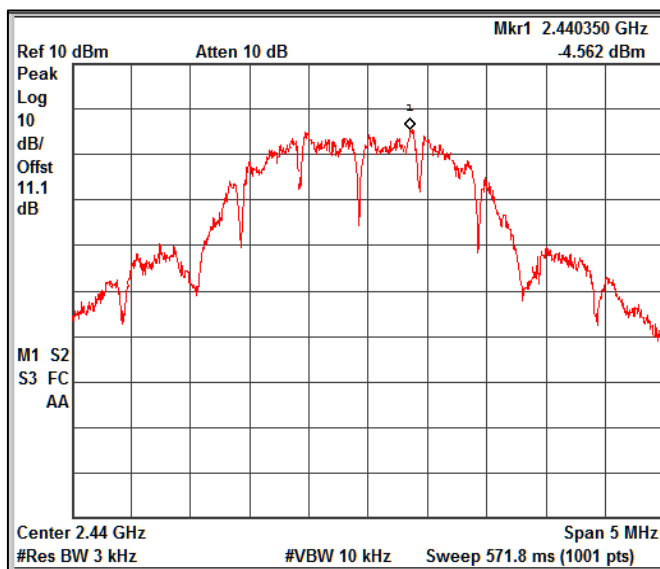
Seite 23 von 79

Page 23 of 79

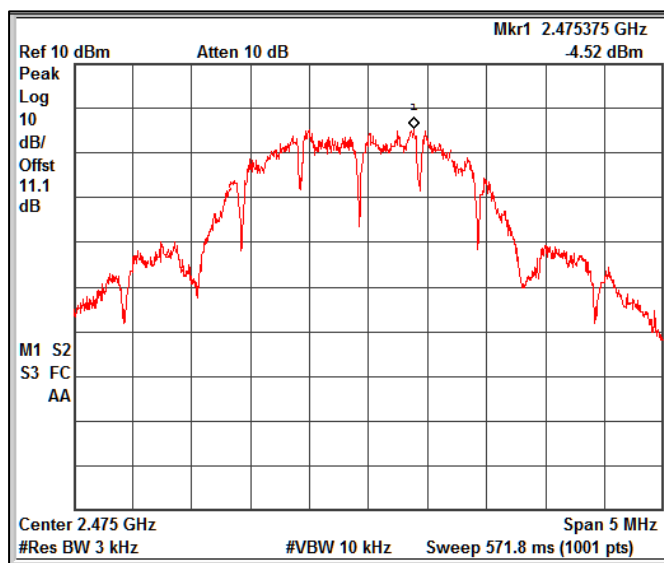
Test Plots:



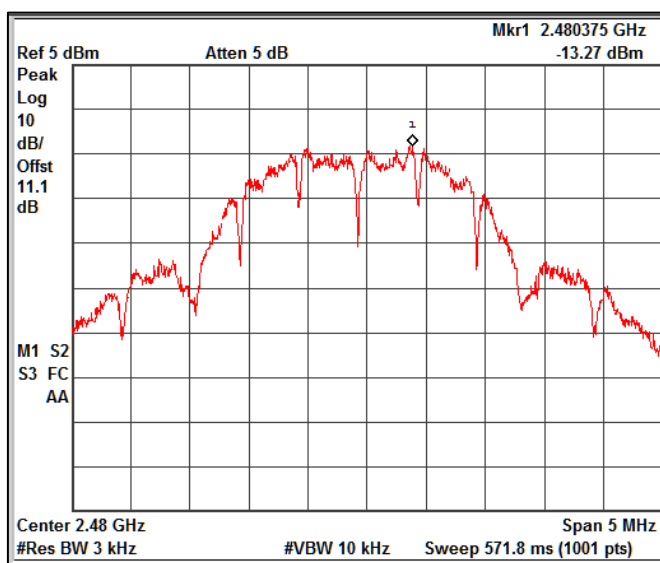
Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2475MHz



Channel Frequency 2480MHz

7.4 Emissions in non-restricted frequency bands and Conducted Spurious Emission

Result

Pass

Test Specification

FCC part 15 Subpart C 15.247 (d) / RSS 247 Issue 3, Section 5.5

Test Method

Subclause 11.11.3 of ANSI C63.10-2020

Measurement Bandwidth

100 kHz

Detector

Peak

Port of testing

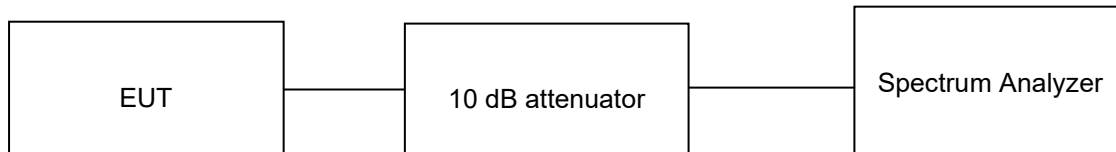
Antenna port

Requirement

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 db.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.5 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 25 von 79

Page 25 of 79

Test results:

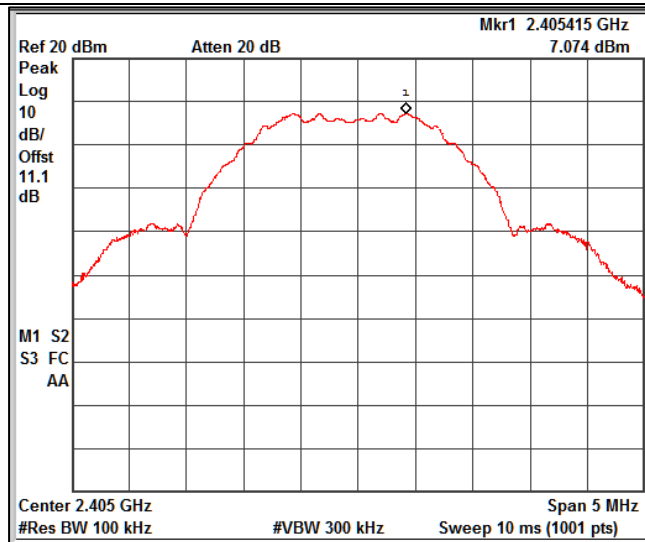
Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 2.60dBi.

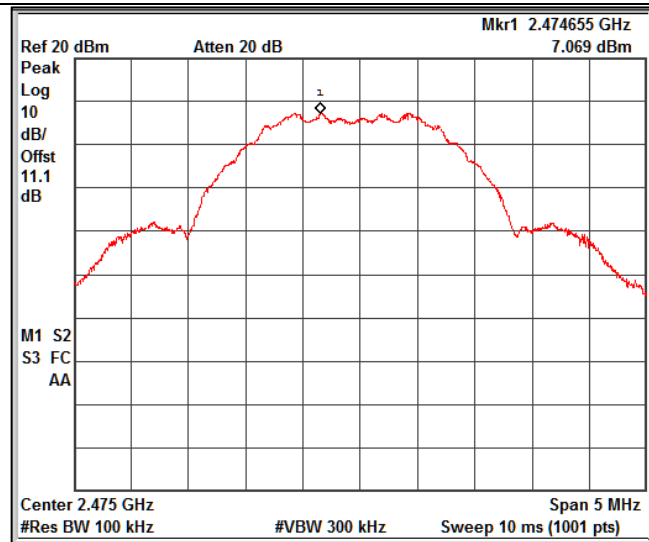
7.4.1 Band edge

Channel Frequency (MHz)	Band edge frequency (MHz)	Value at band edge (A) (dBm)	Reference value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2405.00	2400.00	-45.63	7.07	-52.70	-20.00
2475.00	2483.50	-49.08	7.06	-56.14	-20.00
2480.00	2483.50	-49.12	-1.75	-47.37	-20.00

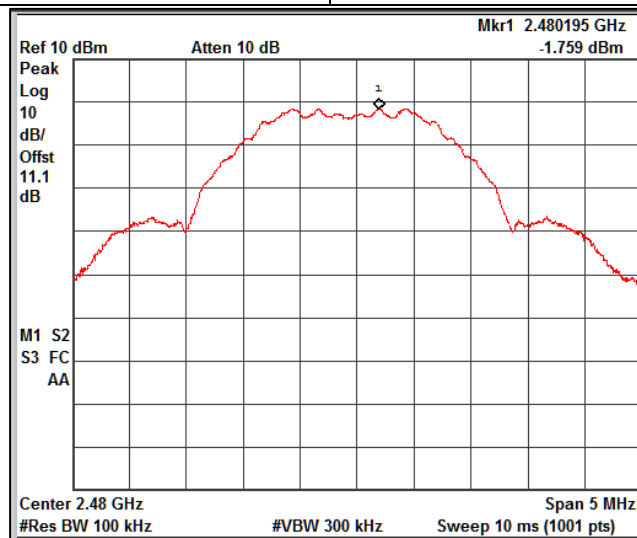
Reference Plots:



Channel Frequency 2405MHz



Channel Frequency 2475MHz



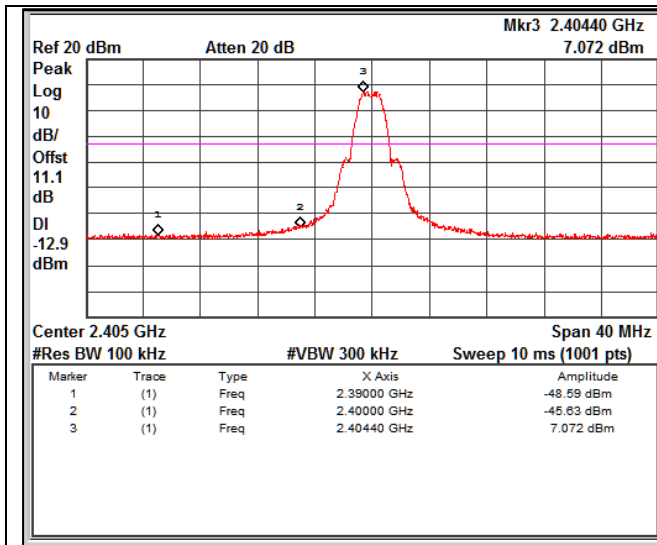
Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

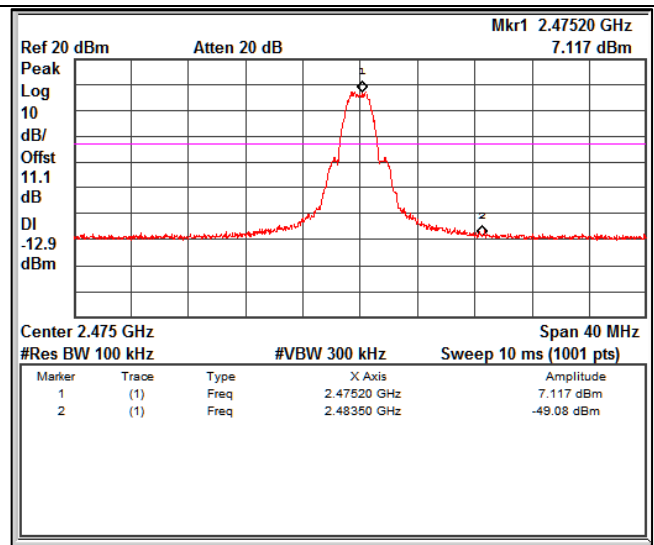
IN25YLOB 001

Seite 26 von 79
Page 26 of 79

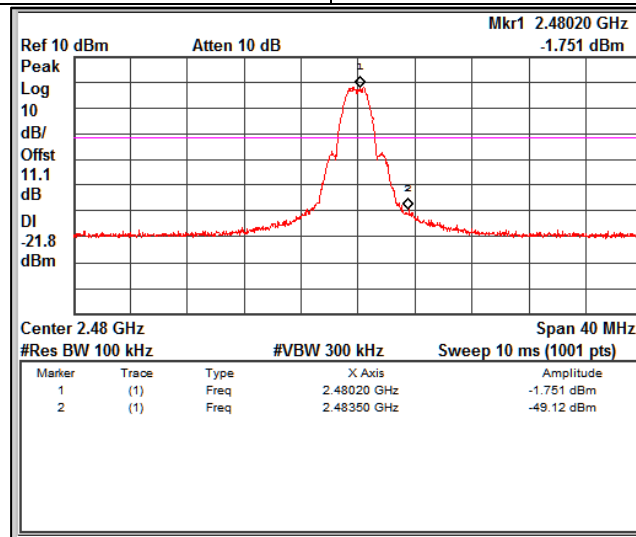
Bandedge Plots:



Channel Frequency 2405MHz

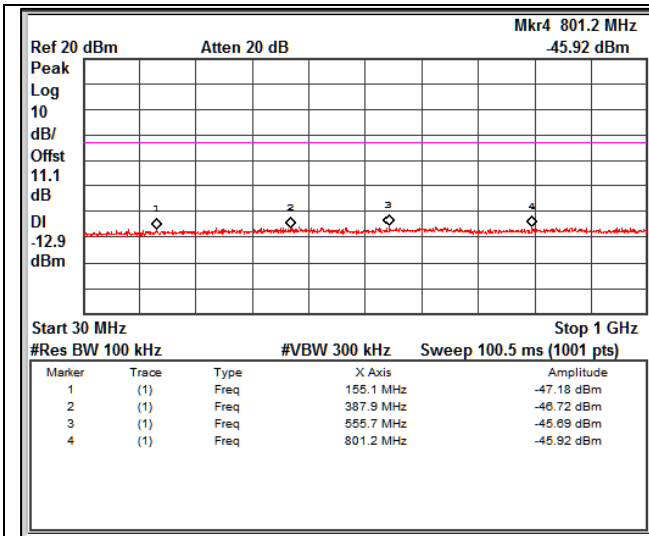


Channel Frequency 2475MHz

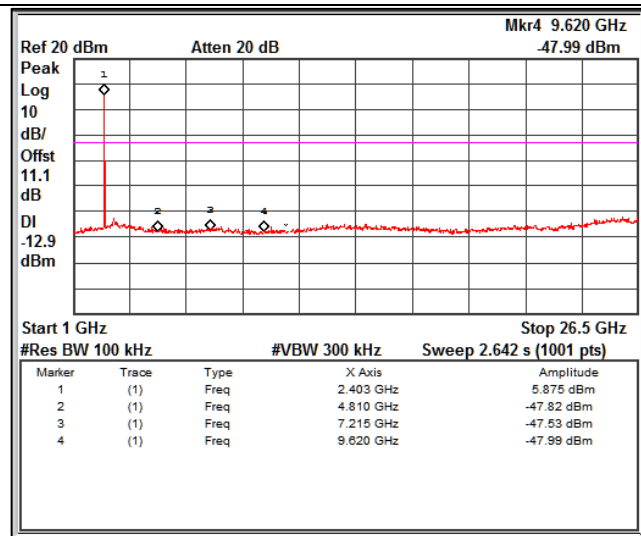


Channel Frequency 2480MHz

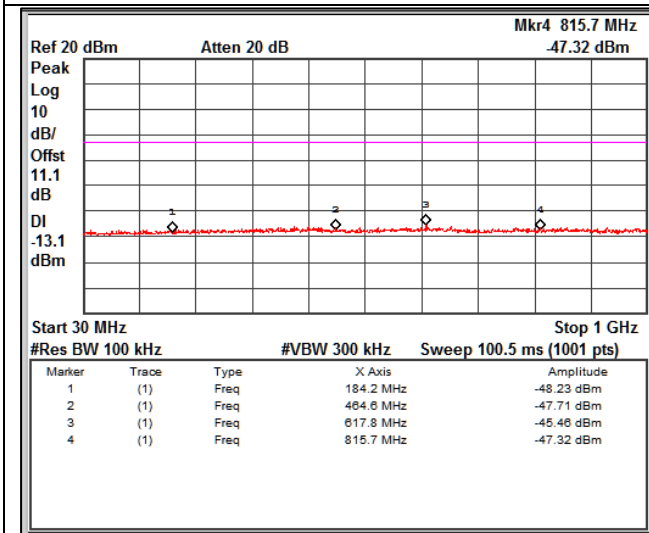
7.4.2 Out-Of-Band Emissions



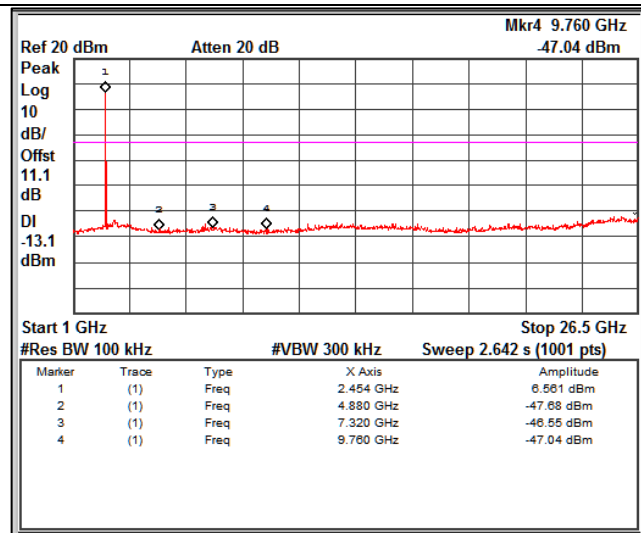
Channel Frequency: 2405MHz Frequency Range 30MHz – 1GHz



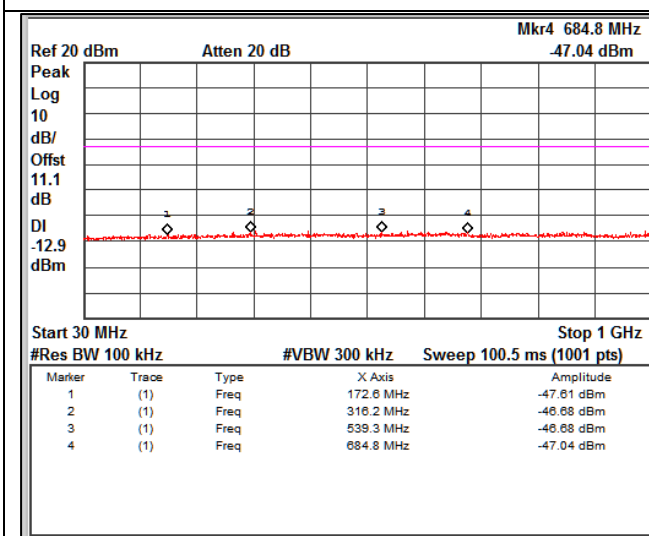
Channel Frequency: 2405MHz Frequency Range 1GHz – 26.5GHz



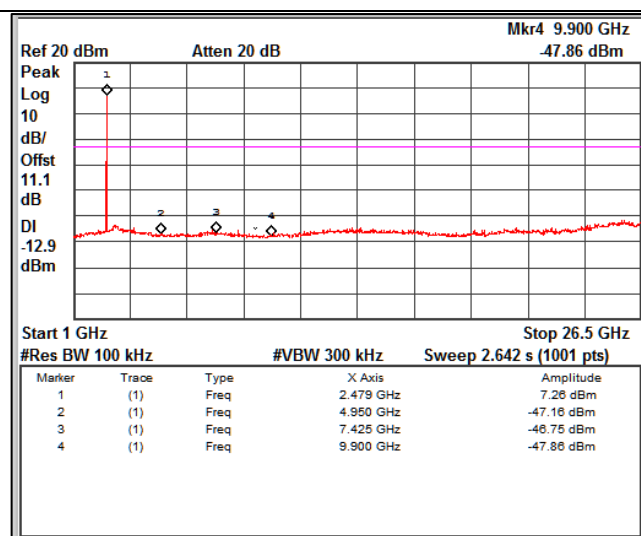
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2440MHz Frequency Range 1GHz – 26.5GHz



Channel Frequency: 2475MHz Frequency Range 30MHz – 1GHz

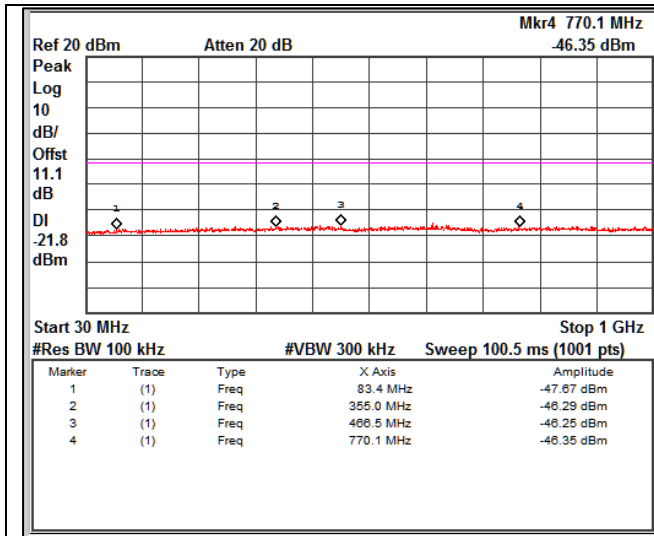


Channel Frequency: 2475MHz Frequency Range 1GHz – 26.5GHz

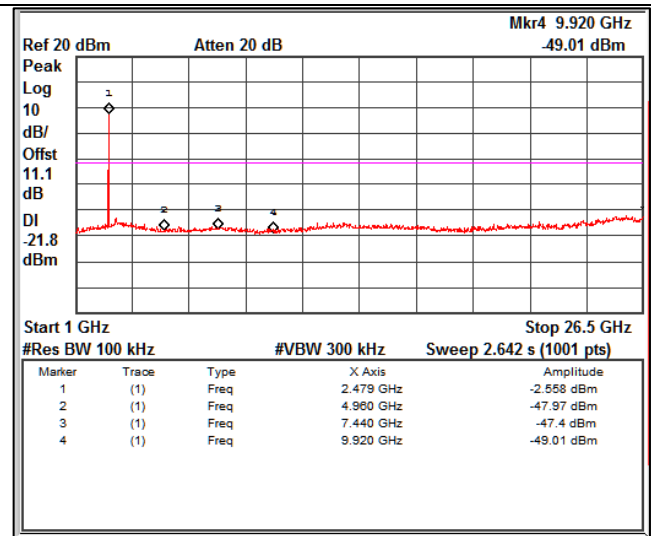
Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 28 von 79
Page 28 of 79



Channel Frequency: 2480MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2480MHz Frequency Range 1GHz – 26.5GHz

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 29 von 79
Page 29 of 79

7.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205) /IC RSS-GEN, Section 8.9 and 8.10
Test Method	ANSI C63.10-2020
Measurement Location	Semi Anechoic Chamber 9kHz - 1 GHz Fully Anechoic Chamber 1 GHz - 40GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz 1 MHz for Frequency range >1GHz
Detector	Refer remarks below
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 7: Transmitter limits for Radiated emission

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300-meter, 30 meter and 30-meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

Test results

Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details.

Test results for frequency range 9 kHz – 30MHz

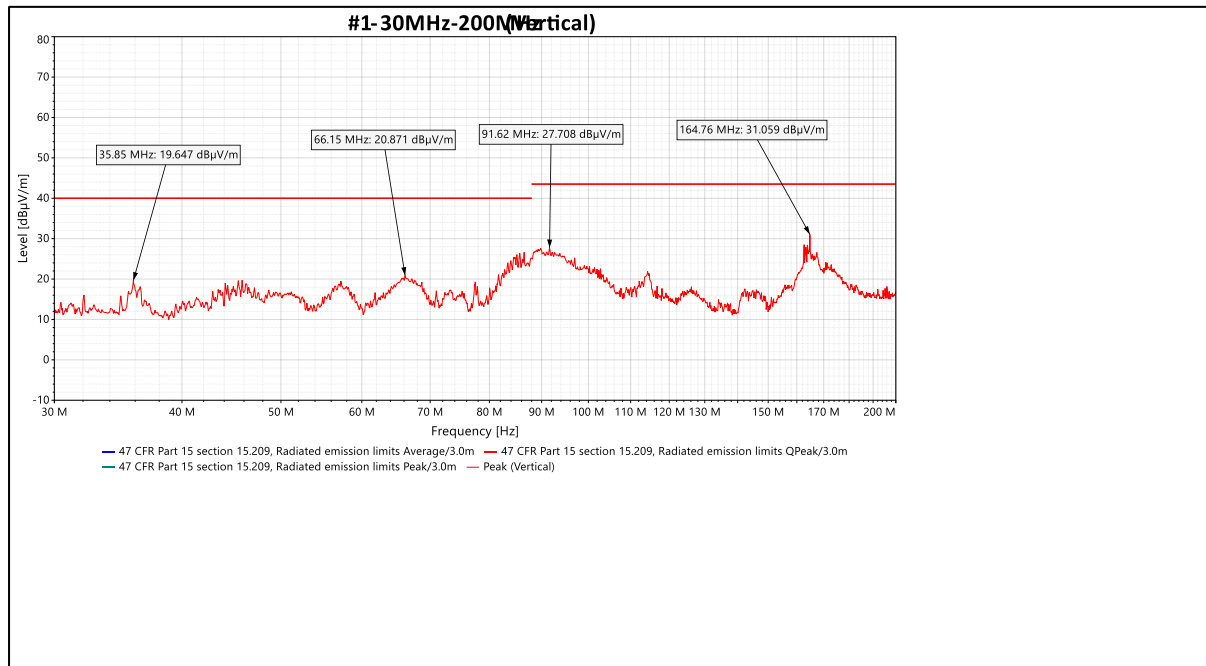
No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported.

Table 8: Test results for frequency range 30MHz – 200MHz

IEEE 802.15.4:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	35.85	19.64	40.00	-20.36
	66.15	20.87	40.00	-19.13
	91.62	27.70	43.50	-15.80
	164.76	31.05	43.50	-12.45
Horizontal	50.76	15.24	40.00	-24.76
	73.05	17.16	40.00	-22.84
	86.97	20.81	40.00	-19.19
	165.51	16.30	43.50	-27.20

Frequency Range: 30MHz -200MHz_Vertical Polarization



Frequency Range: 30MHz -200MHz_Horizontal Polarization

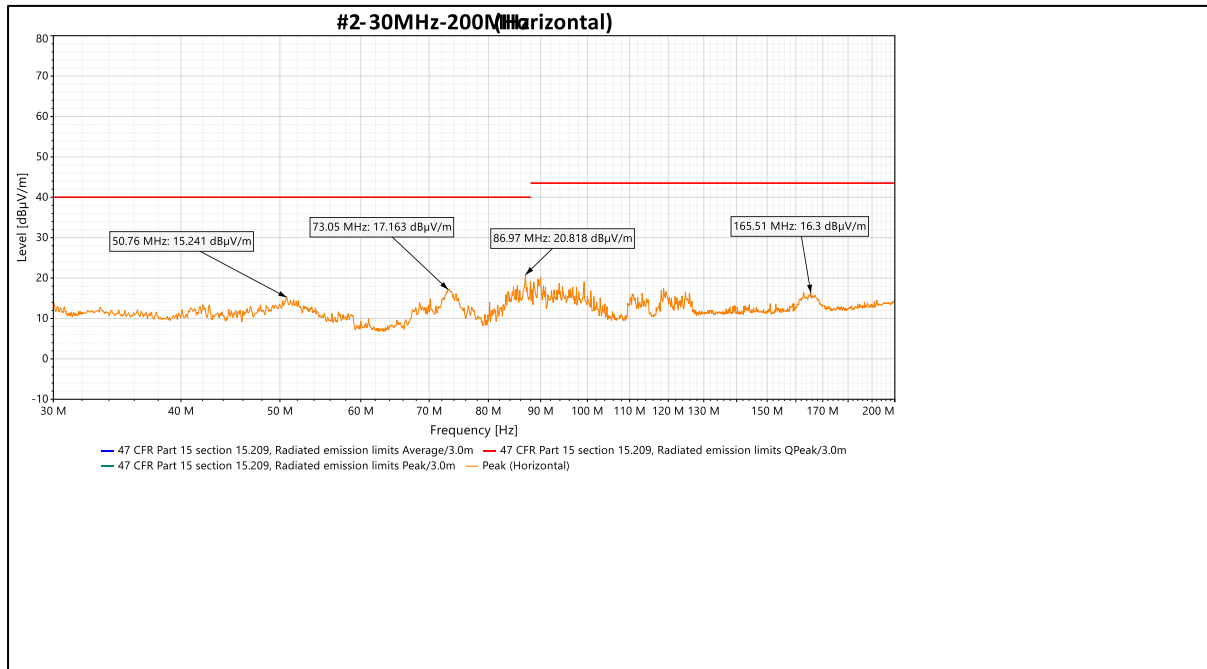


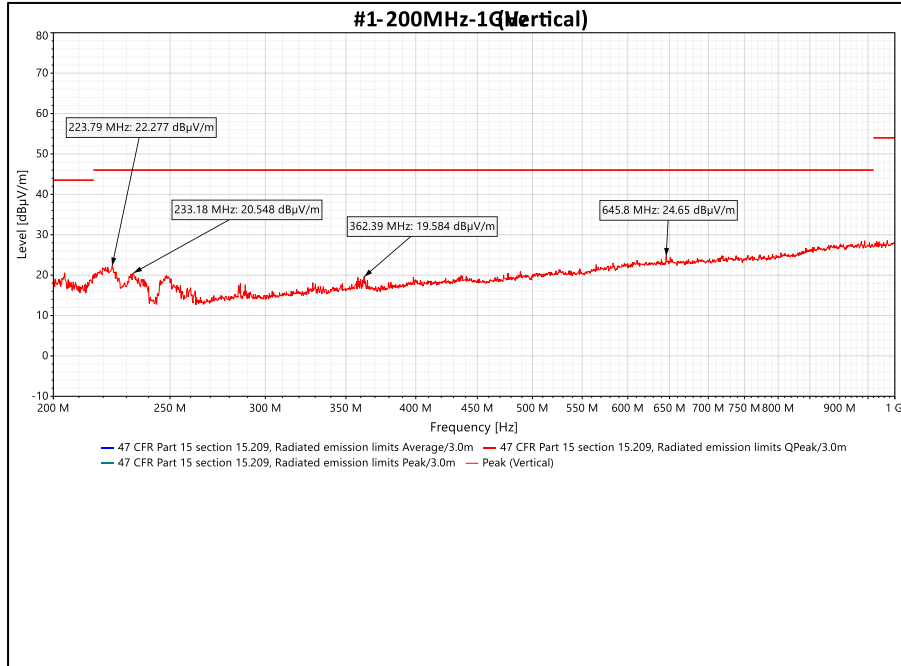
Table 9: Test results for frequency range 200MHz – 1GHz

IEEE 802.15.4:

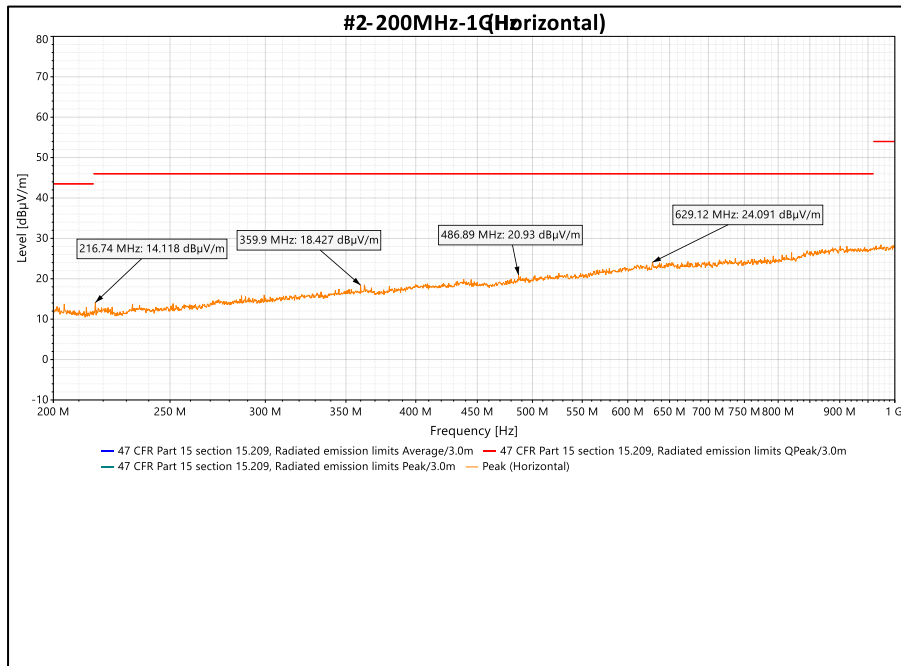
Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	223.79	22.27	46.00	-23.73
	233.18	20.54	46.00	-25.46
	362.39	19.58	46.00	-26.42
	645.80	24.65	46.00	-21.35
	216.74	14.11	43.50	-29.39
Horizontal	359.90	18.42	46.00	-27.58
	486.89	20.93	46.00	-25.07
	629.19	24.09	46.00	-21.91
	223.79	22.27	46.00	-23.73

IEEE 802.15.4 Plots:

Frequency Range: 200MHz – 1GHz_Vertical Polarization



Frequency Range: 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 33 von 79
Page 33 of 79

**Table 10: Test results for the frequencies above 1GHz:
IEEE 802.15.4:**

Data Rate: 250kbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2405	2405(Pk)	Vertical	105.64	-	-
	2405(Av)		101.79	-	-
	2390(Pk)		45.18	74.00*	-28.82
	2390(Av)		34.52	54.00*	-19.48
	4810(Pk)		48.52	74.00	-25.48
	4810(Av)		38.67	54.00	-15.33
	7215(Pk)		51.08	74.00	-22.92
	7215(Av)		39.41	54.00	-14.59
	2405(Pk)	Horizontal	102.69	-	-
	2405(Av)		98.86	-	-
	2390(Pk)		42.14	74.00*	-31.86
	2390(Av)		31.66	54.00*	-22.34
	4810(Pk)		45.13	74.00	-28.87
	4810(Av)		34.16	54.00	-19.84
	7215(Pk)		46.44	74.00	-27.56
	7215(Av)		36.29	54.00	-17.71
2440	2440(Pk)	Vertical	102.64	-	-
	2440(Av)		98.83	-	-
	4880(Pk)		49.50	74.00	-24.50
	4880(Av)		41.22	54.00	-12.78
	7320(Pk)		52.39	74.00	-21.61
	7320(Av)		42.21	54.00	-11.79
	2440(Pk)	Horizontal	104.09	-	-
	2440(Av)		100.31	-	-
	4880(Pk)		44.26	74.00	-29.74
	4880(Av)		33.10	54.00	-20.90
	7320(Pk)		50.11	74.00	-23.89
	7320(Av)		38.36	54.00	-15.64
2475	2475(Pk)	Vertical	101.91	-	-
	2475(Av)		98.15	-	-
	2483.5(Pk)		45.27	74.00*	-28.73
	2483.5(Av)		33.25	54.00*	-20.75
	4950(Pk)		49.39	74.00	-24.61
	4950(Av)		40.87	54.00	-13.13
	7425(Pk)		53.19	74.00	-20.81
	7425(Av)		43.39	54.00	-10.61
	2475(Pk)	Horizontal	103.61	-	-
	2475(Av)		99.78	-	-
	2483.5(Pk)		47.90	74.00*	-26.10
	2483.5(Av)		35.37	54.00*	-18.63
	4950(Pk)		43.44	74.00	-30.56
	4950(Av)		33.16	54.00	-20.84
	7425(Pk)		50.29	74.00	-23.71
	7425(Av)		38.58	54.00	-15.42

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 34 von 79
Page 34 of 79

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2480	2480(Pk)	Vertical	92.43	-	-
	2480(Av)		88.63	-	-
	2483.5(Pk)		49.30	74.00*	-24.70
	2483.5(Av)		36.95	54.00*	-17.05
	4960(Pk)		44.83	74.00	-29.17
	4960(Av)		33.96	54.00	-20.04
	7440(Pk)		47.48	74.00	-26.52
	7440(Av)		34.67	54.00	-19.33
	2480(Pk)	Horizontal	94.57	-	-
	2480(Av)		90.72	-	-
	2483.5(Pk)		51.65	74.00*	-22.35
	2483.5(Av)		39.10	54.00*	-14.90
	4960(Pk)		42.64	74.00	-31.36
	4960(Av)		30.79	54.00	-23.21
	7440(Pk)		48.12	74.00	-25.88
	7440(Av)		34.61	54.00	-19.39

_ → Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

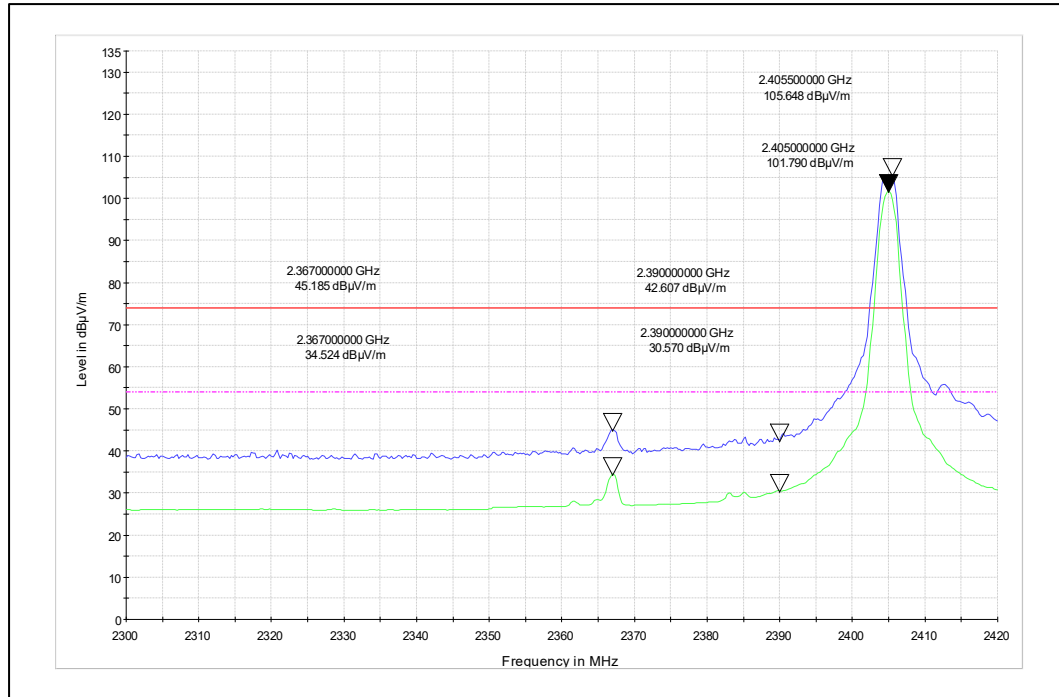
Av: Average Detect

Test Plots:

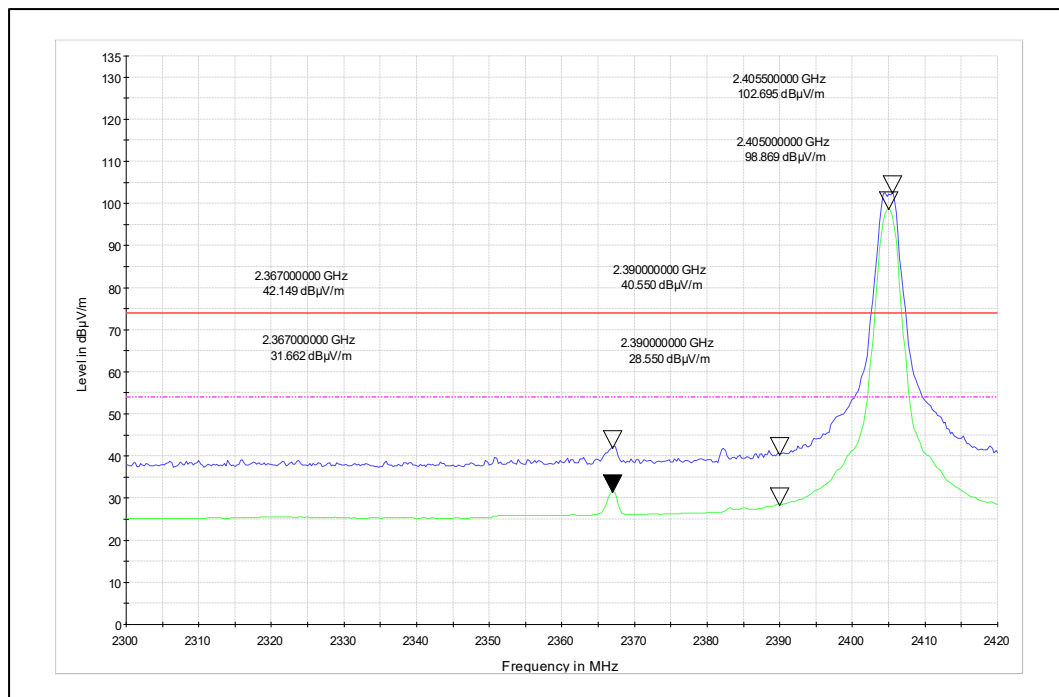
IEEE 802.15.4: Plots:

Data Rate: 250kbps

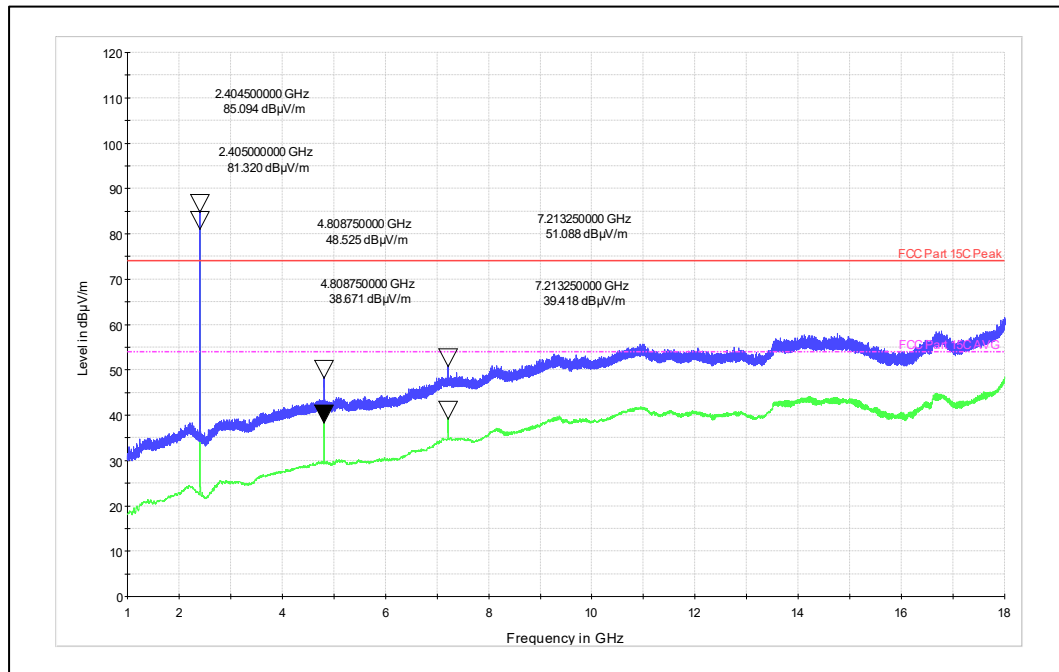
Channel Frequency 2405MHz_Vertical Polarization



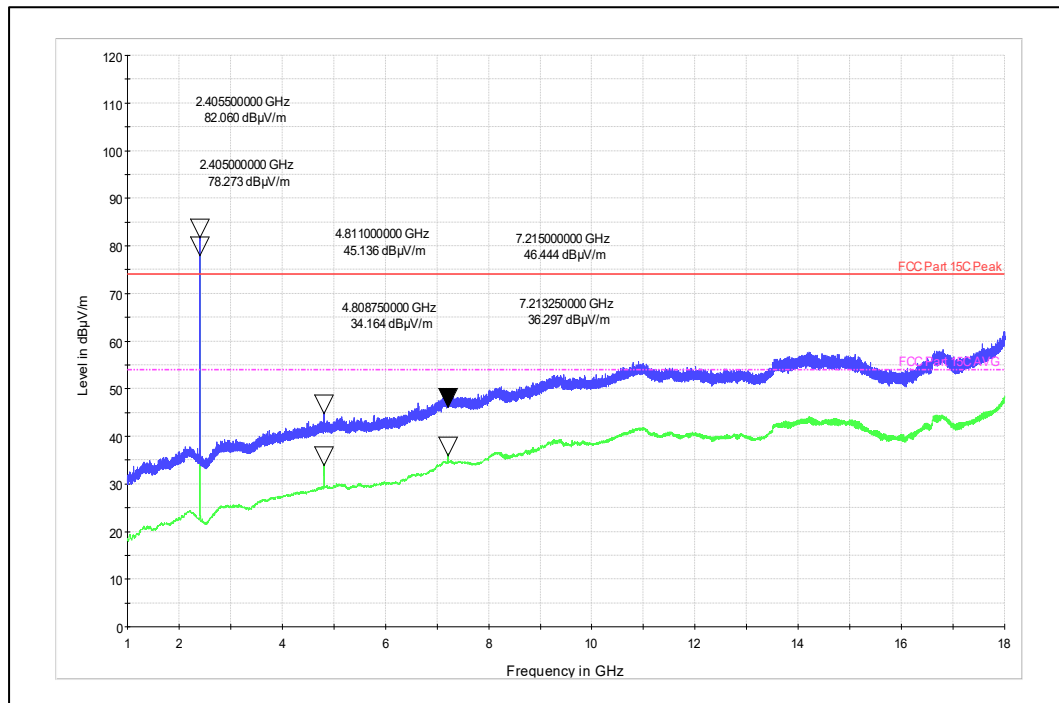
Channel Frequency 2405MHz_Horizontal Polarization



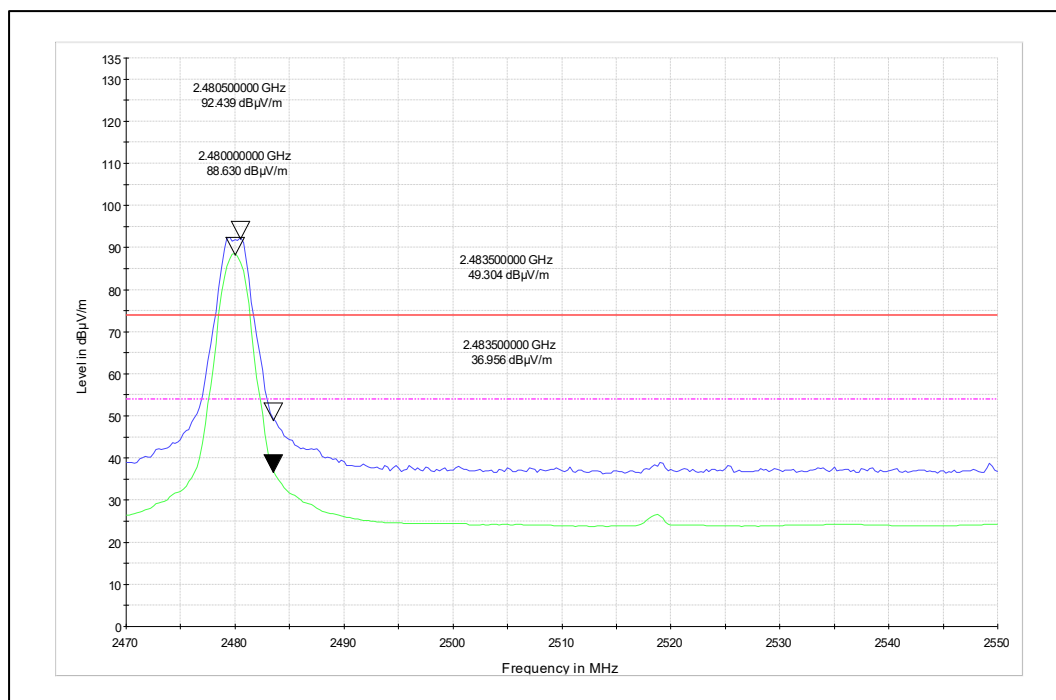
Frequency Range: 1GHz – 18GHz_Vertical Polarization



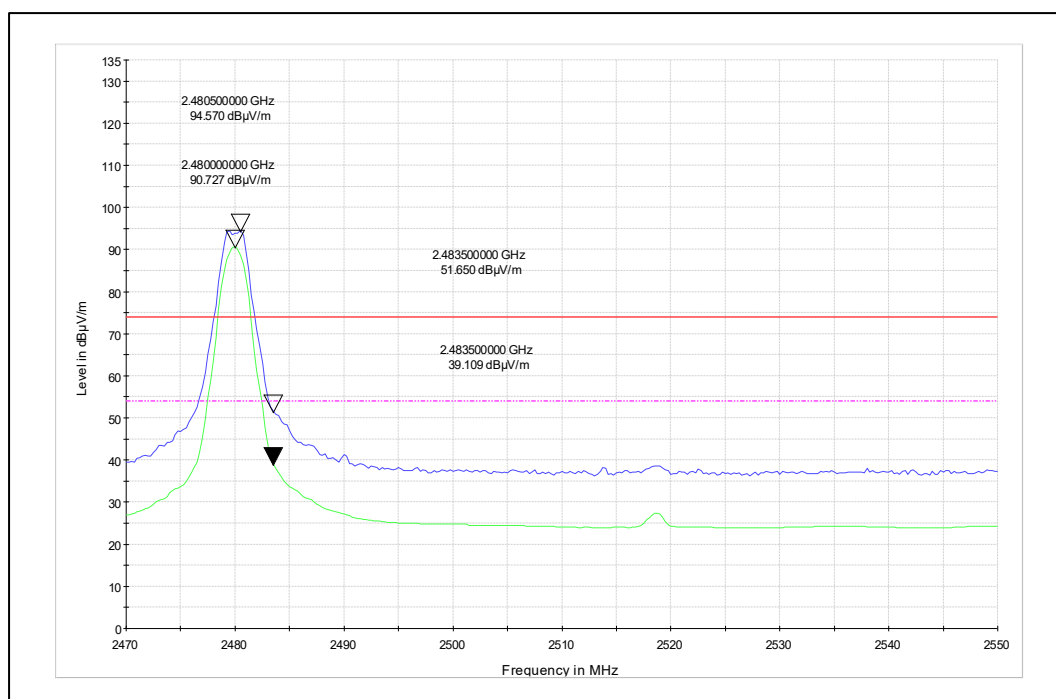
Frequency Range: 1GHz – 18GHz_Horizontal Polarization



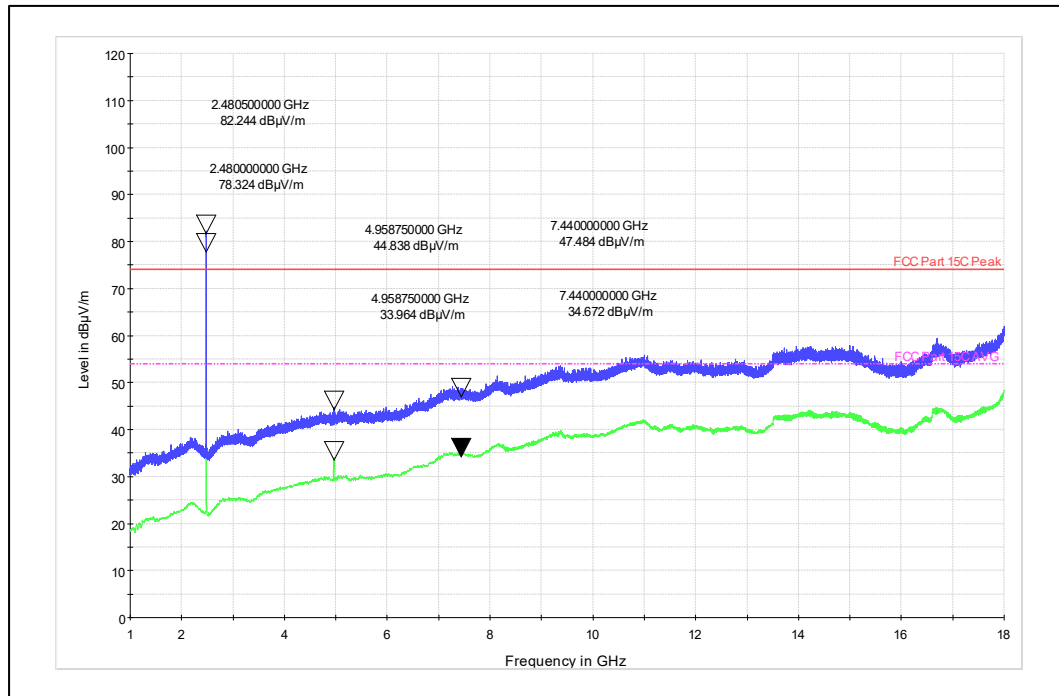
Channel Frequency 2480MHz_Vertical Polarization



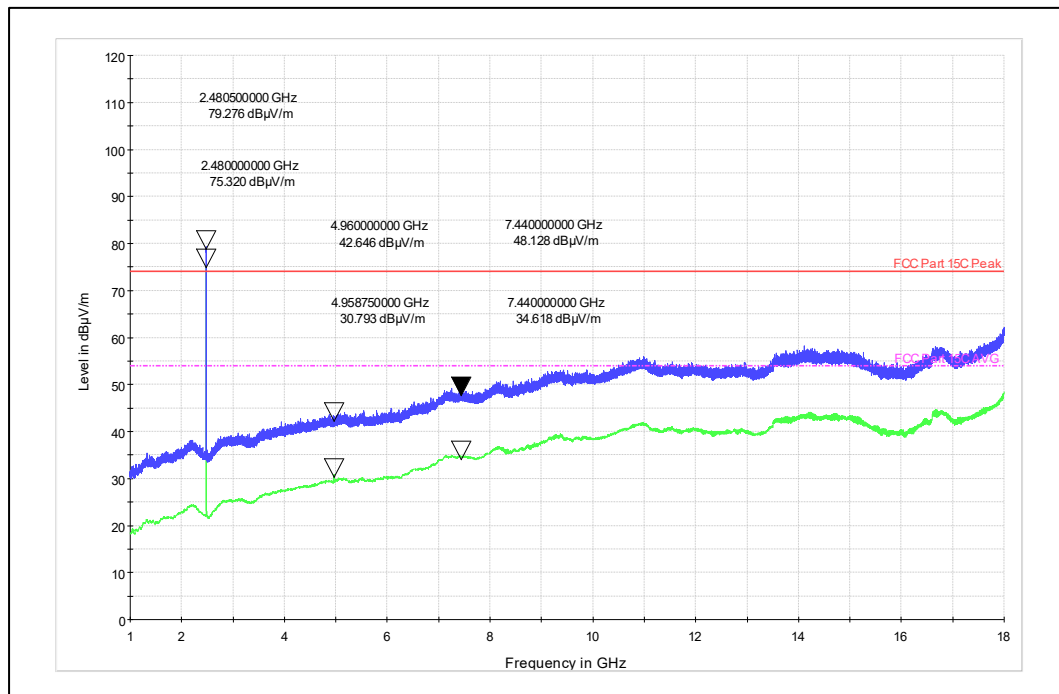
Channel Frequency 2480MHz_Horizontal Polarization



Frequency Range: 1GHz – 18GHz_Vertical Polarization



Frequency Range: 1GHz – 18GHz_Horizontal Polarization



Prüfbericht - Nr.:

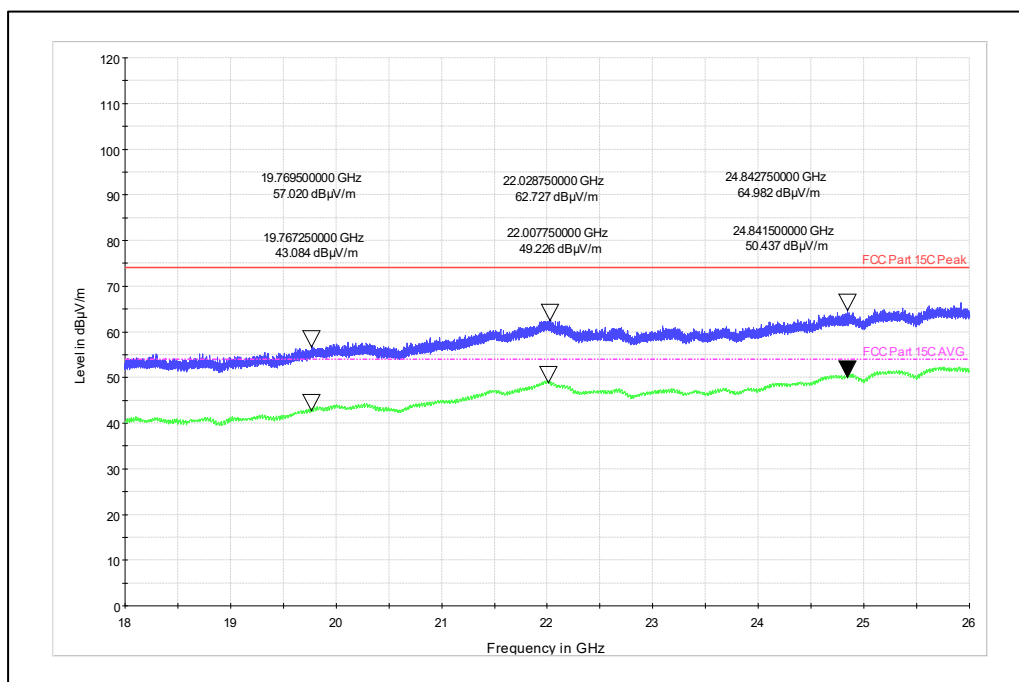
Test Report No.:

IN25YLOB 001

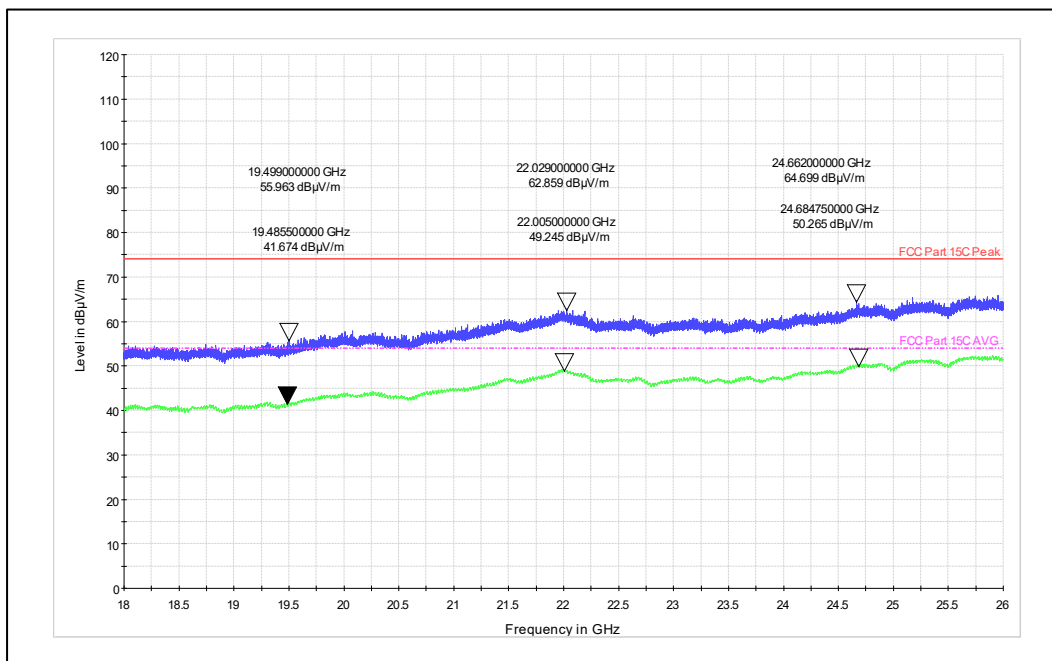
Seite 39 von 79

Page 39 of 79

Frequency range: 18GHz to 26GHz_Vertical Polarization



Frequency range: 18GHz to 26GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 40 von 79
Page 40 of 79

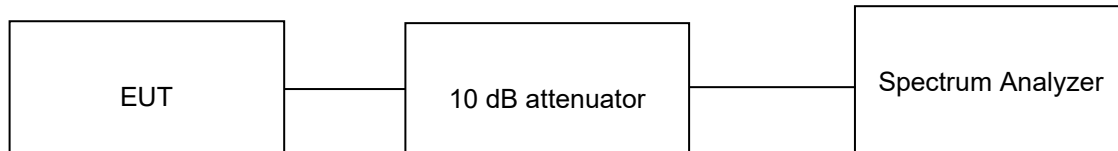
8 TEST RESULTS FOR BLUETOOTH LOW ENERGY

8.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3) / RSS 247 Issue 3, Section 5.4 (d)
Test Method	Subclause 11.9.1.1 of ANSI C63.10-2020
Measurement Bandwidth	1MHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power ≤ 1 W (30 dBm) & e.i.r.p ≤ 4 W (36 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.3.1 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 41 von 79

Page 41 of 79

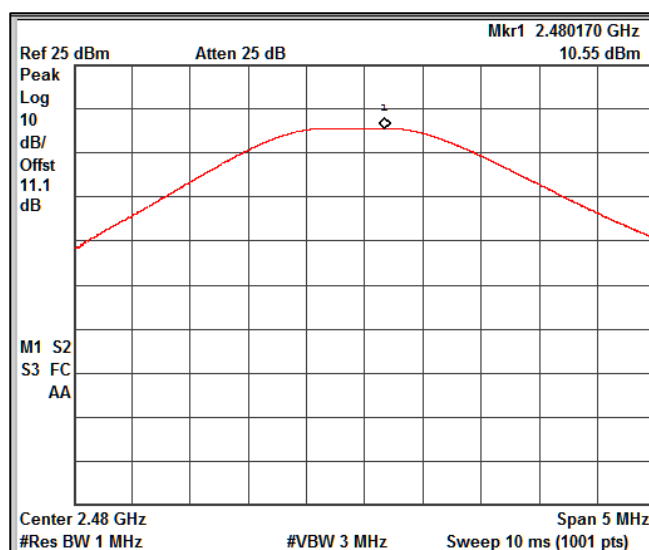
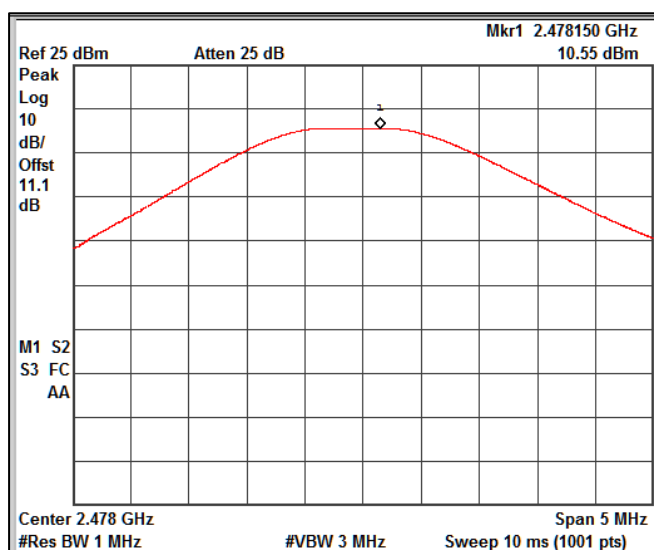
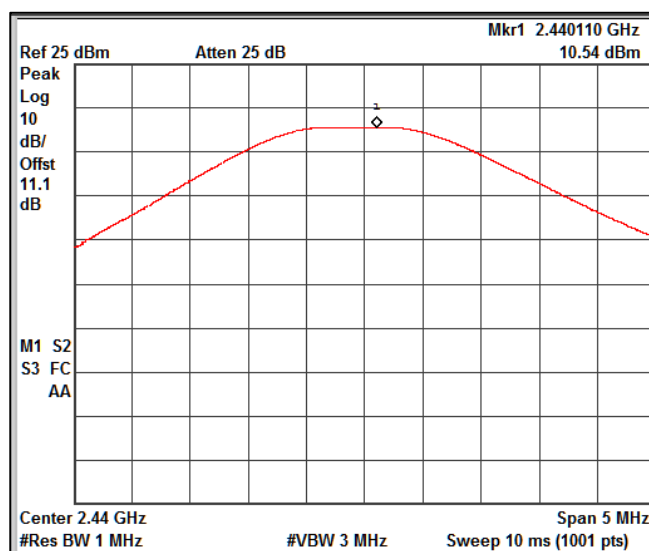
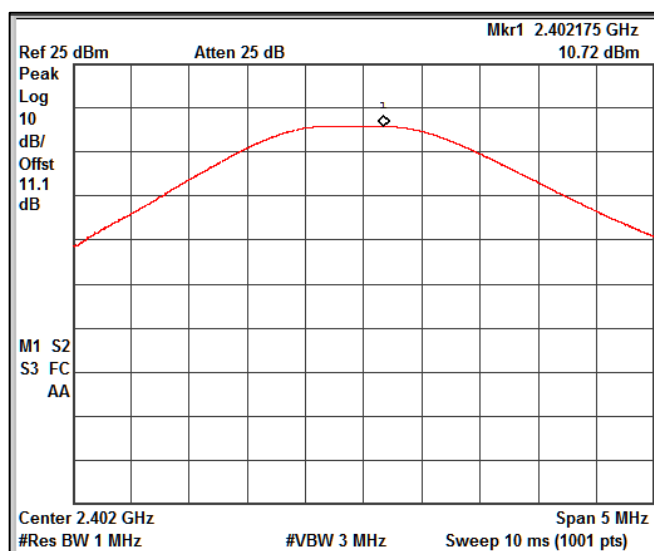
Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB) + U.FL Cable loss (0.5)
3. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 2.60 dBi.

Data Rate (Mbps)	Channel Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	Maximum (e.i.r.p)	Power Limit (dBm)	Limit (e.i.r.p)
1	2402.00	10.72	13.32	30.00	36.00
	2440.00	10.54	13.14	30.00	36.00
	2478.00	10.55	13.15	30.00	36.00
	2480.00	10.55	13.15	30.00	36.00

Test Plots:



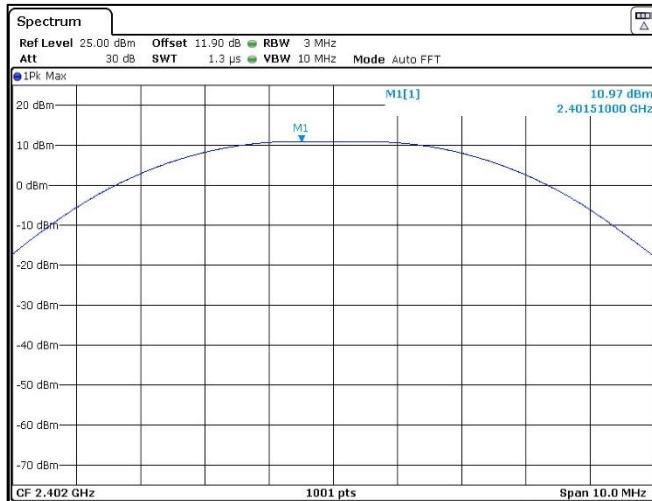
Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

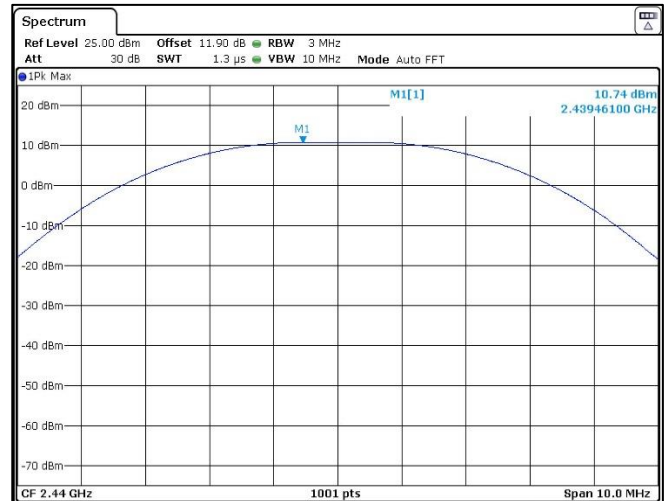
Seite 42 von 79
Page 42 of 79

Data Rate (Mbps)	Channel Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	Maximum (e.i.r.p)	Power Limit (dBm)	Limit (e.i.r.p)
2	2402.00	10.97	13.57	30.00	36.00
	2440.00	10.74	13.34	30.00	36.00
	2478.00	10.48	13.08	30.00	36.00
	2480.00	10.49	13.09	30.00	36.00

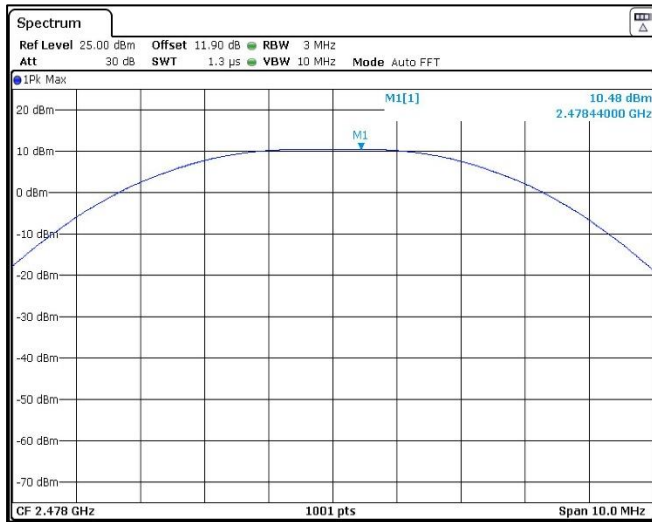
Test Plots:



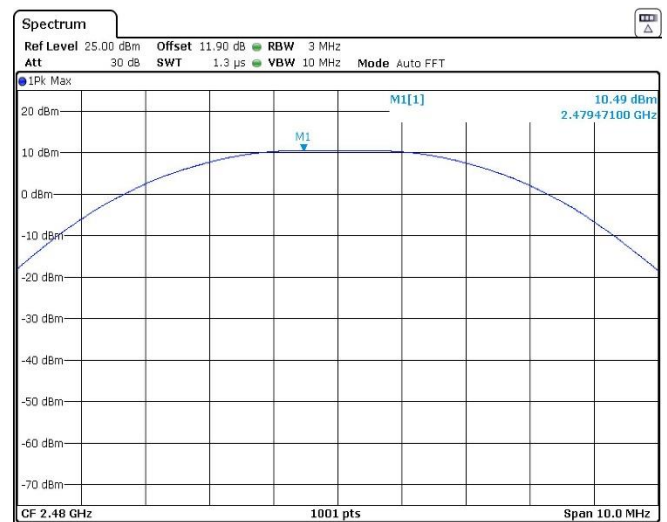
Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2478MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 43 von 79
Page 43 of 79

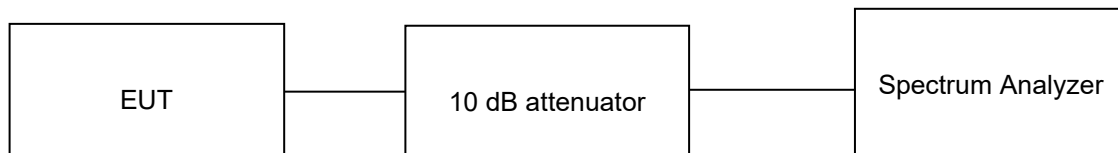
8.2 DTS Bandwidth & 99% Bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (2) / RSS 247 Issue 3, Section 5.2 (a)
Test Method	Subclause 11.8.1 & 6.9.3 of ANSI C63.10-2020 Subclause 6.9.3 of ANSI C63.10a-2024
Measurement Bandwidth	100 kHz for x dB bandwidth 1 to 5% of OCB for 99% bandwidth
Detector	Peak
Port of testing	Antenna port
Requirement	The minimum 6 dB bandwidth shall be at least 500 kHz

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.2 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 44 von 79

Page 44 of 79

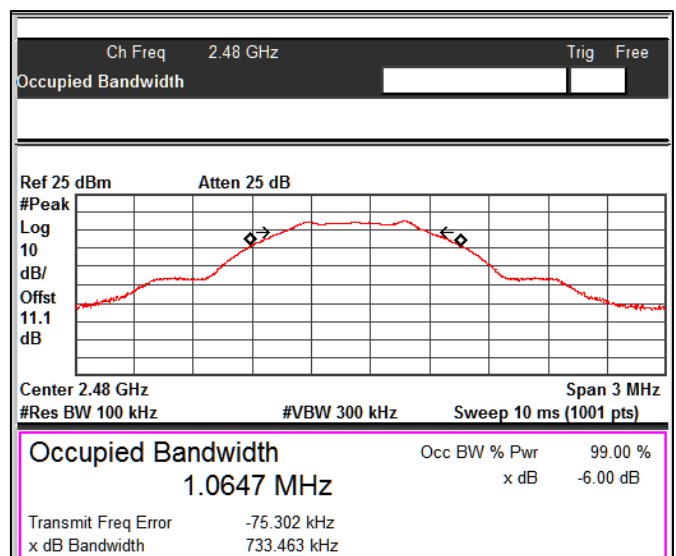
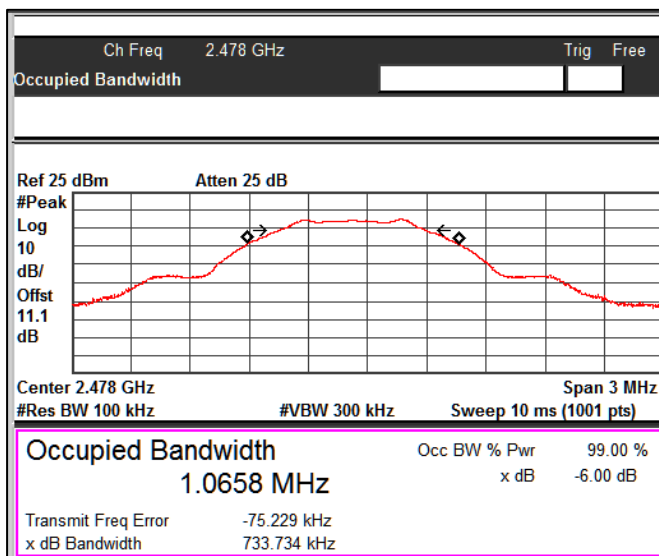
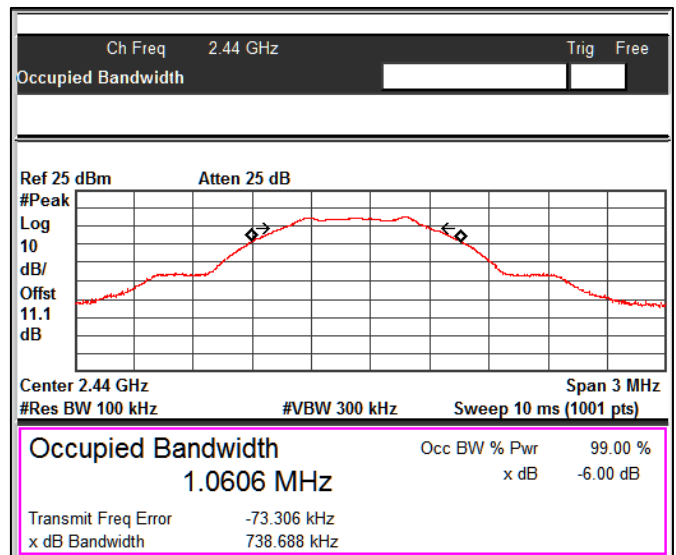
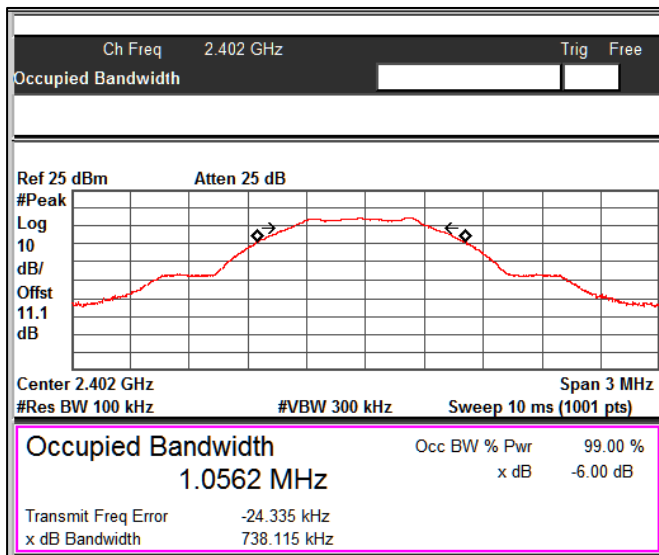
Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report.

Data Rate (Mbps)	Channel Frequency (MHz)	99% Occupied bandwidth (MHz)	6dB BW (MHz)	Limit (kHz)
1Mbps	2402	1.03	0.73	0.5
	2440	1.03	0.73	0.5
	2478	1.03	0.73	0.5
	2480	1.03	0.73	0.5

Test Plots:

6dB DTS Plots



Prüfbericht - Nr.:

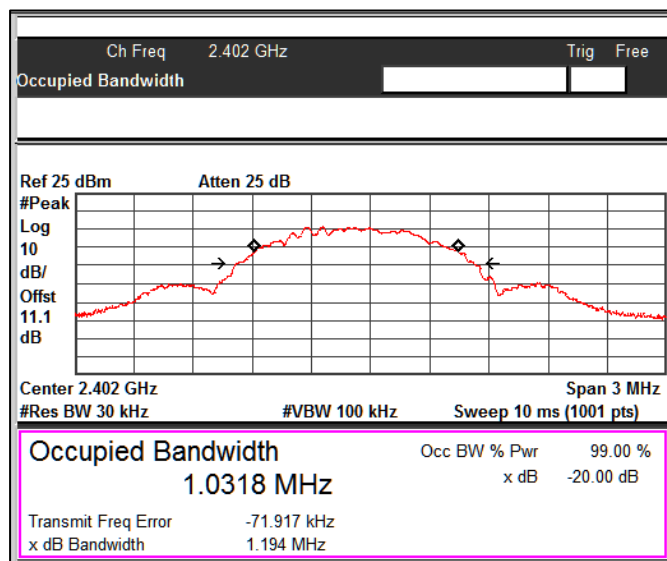
Test Report No.:

IN25YLOB 001

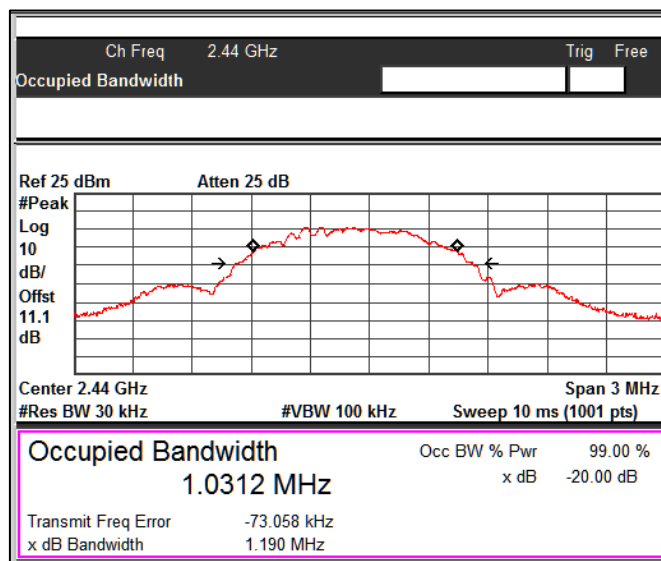
Seite 45 von 79

Page 45 of 79

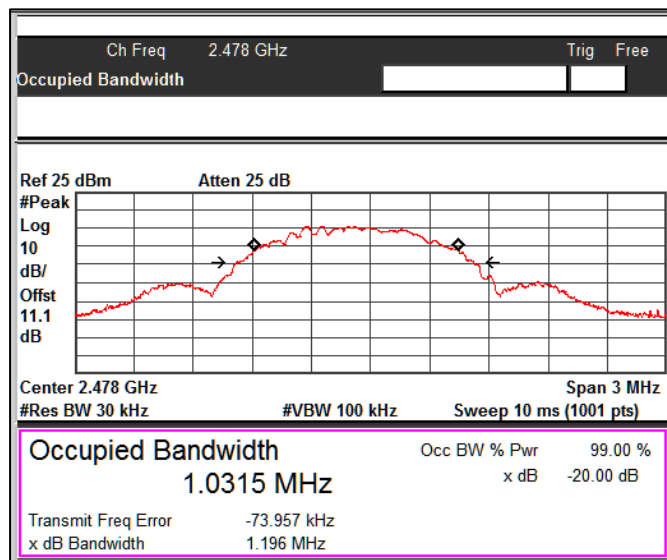
99% OBW plots



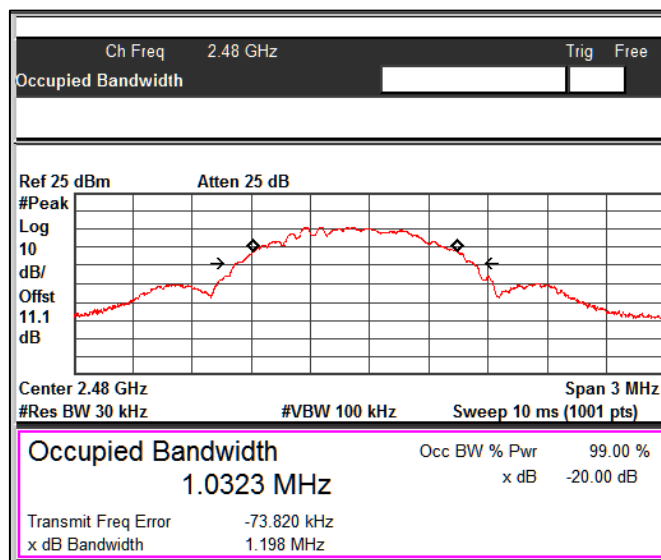
Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2478MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

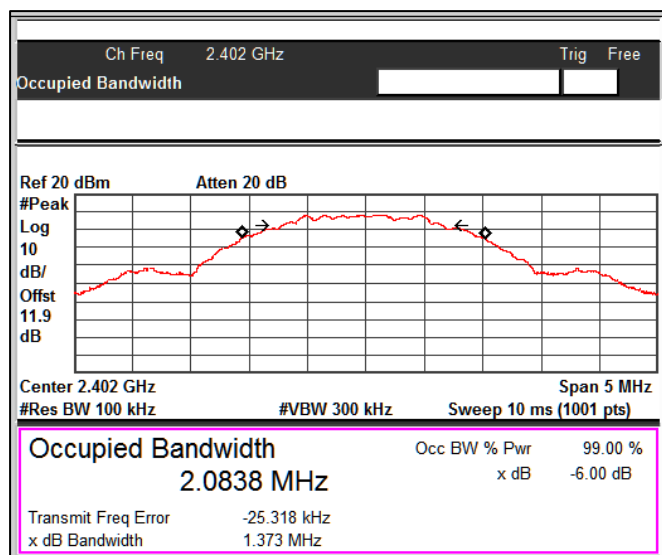
Seite 46 von 79

Page 46 of 79

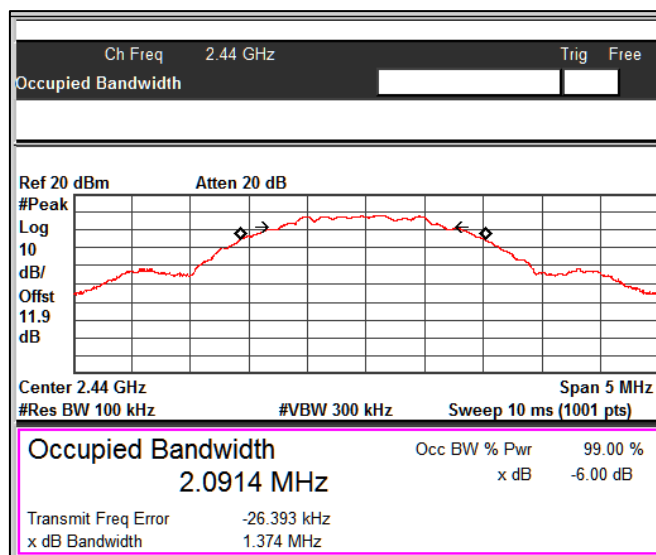
Data Rate (Mbps)	Channel Frequency (MHz)	99% Occupied bandwidth (MHz)	6dB BW (MHz)	Limit (kHz)
2Mbps	2402	2.08	1.37	0.5
	2440	2.09	1.37	0.5
	2478	2.10	1.37	0.5
	2480	2.09	1.37	0.5

Test Plots:

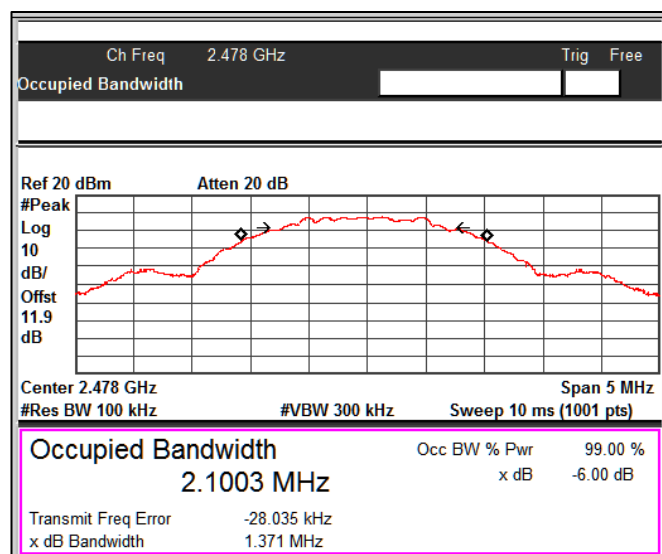
6dB DTS & 99% Plots



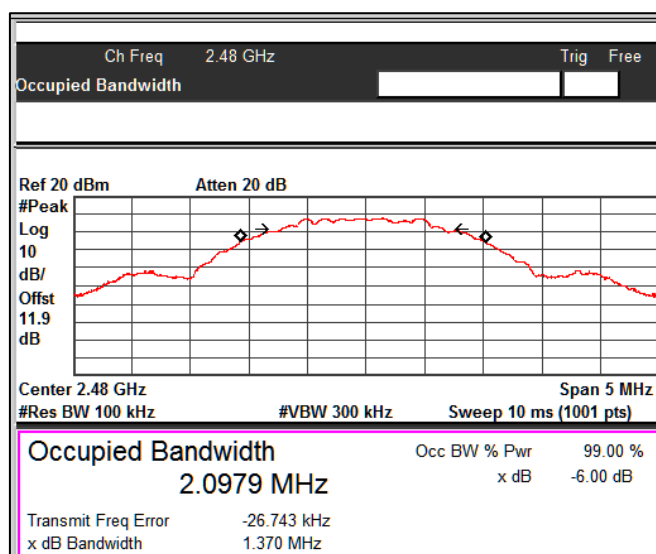
Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2478MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 47 von 79
Page 47 of 79

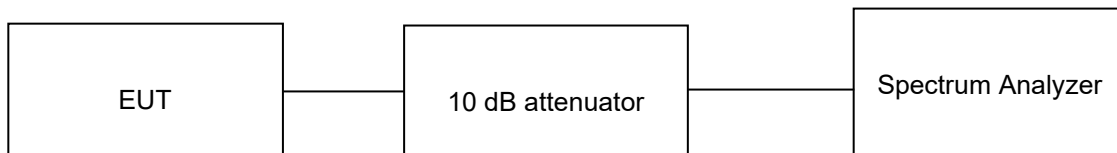
8.3 Maximum Power Spectral Density

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (e) / RSS 247 Issue 3, Section 5.2 (b)
Test Method	Subclause 11.10.2 of ANSI C63.10-2020
Measurement Bandwidth	3 kHz
Detector	Peak detector
Port of testing	Antenna port
Requirement	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.4 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 48 von 79

Page 48 of 79

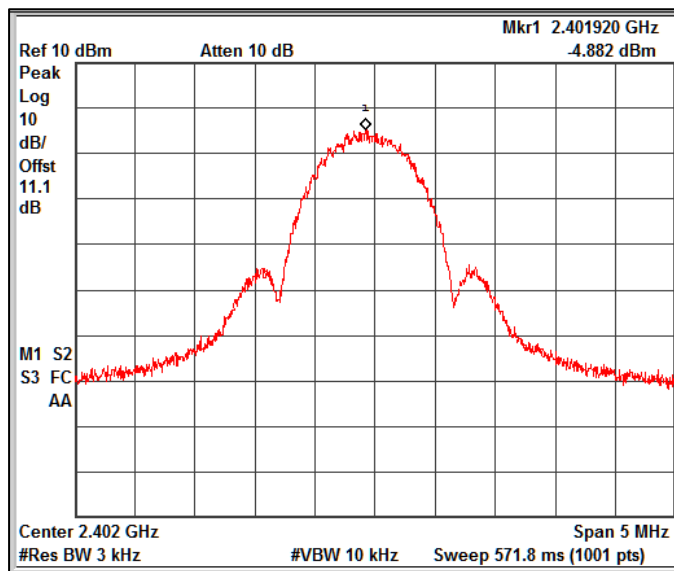
Test results:

Note:

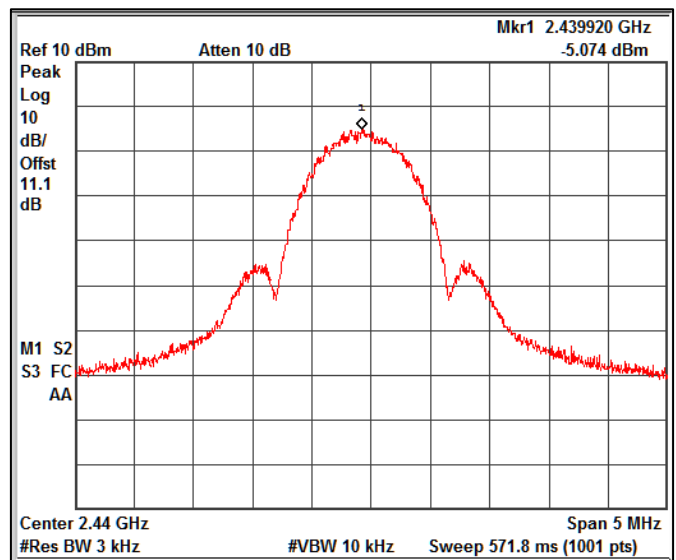
1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Peak PSD (dBm) = Measured Peak PSD (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB)+ U.FL Cable loss (0.5dB).

Data Rate (Mbps)	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	PSD Limit (dBm/kHz)
1Mbps	2402	-4.88	8.00
	2440	-5.07	8.00
	2748	-4.99	8.00
	2480	-4.97	8.00

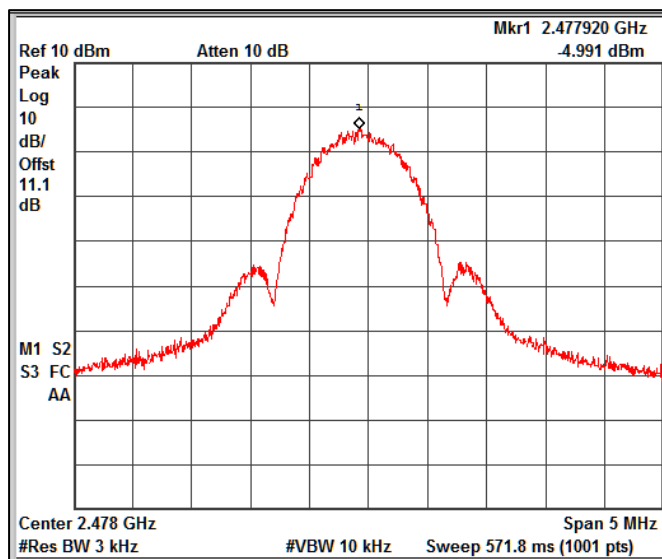
Test Plots:



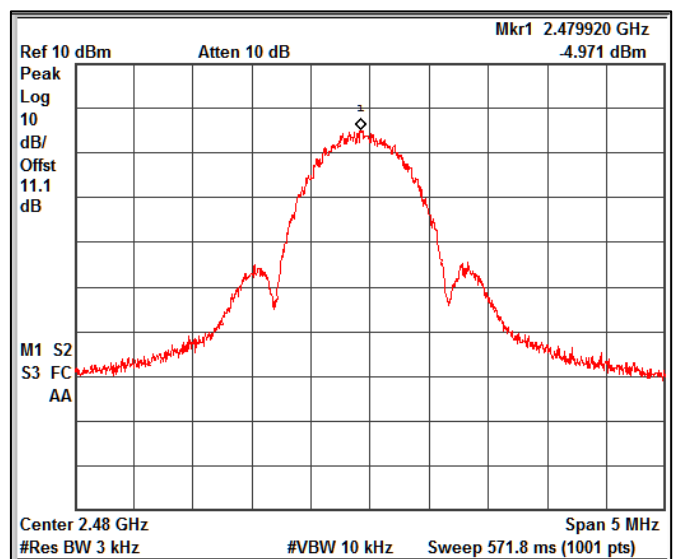
Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2478MHz



Channel Frequency 2480MHz

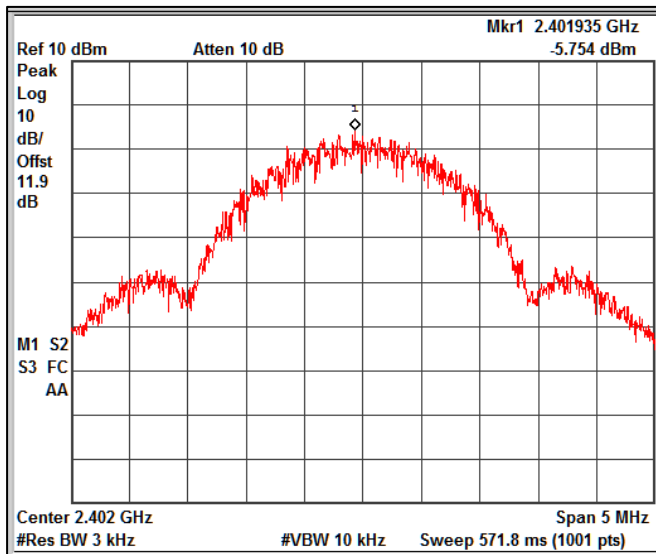
Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

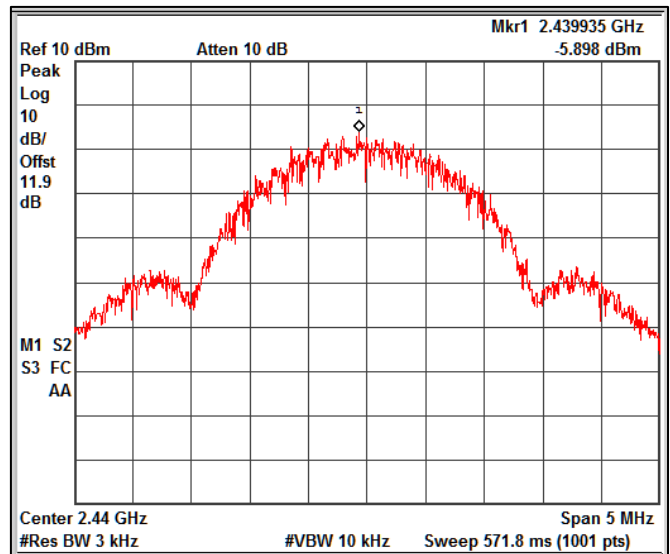
Seite 49 von 79
Page 49 of 79

Data Rate (Mbps)	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	PSD Limit (dBm/kHz)
2Mbps	2402	-5.75	8.00
	2440	-5.89	8.00
	2748	-6.15	8.00
	2480	-6.16	8.00

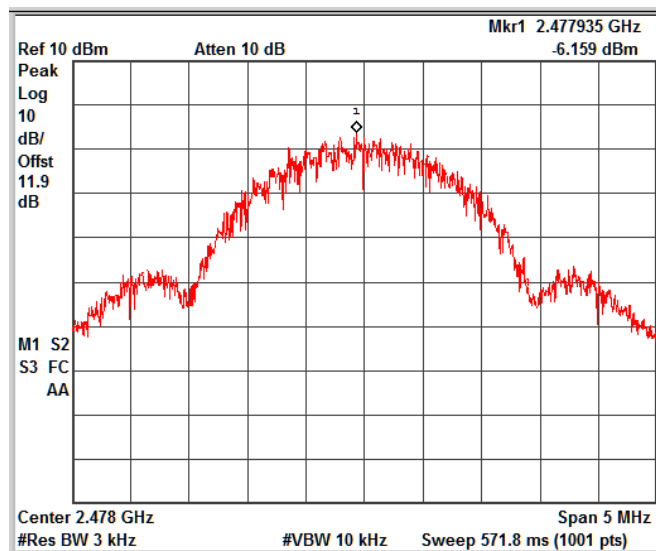
Test Plots:



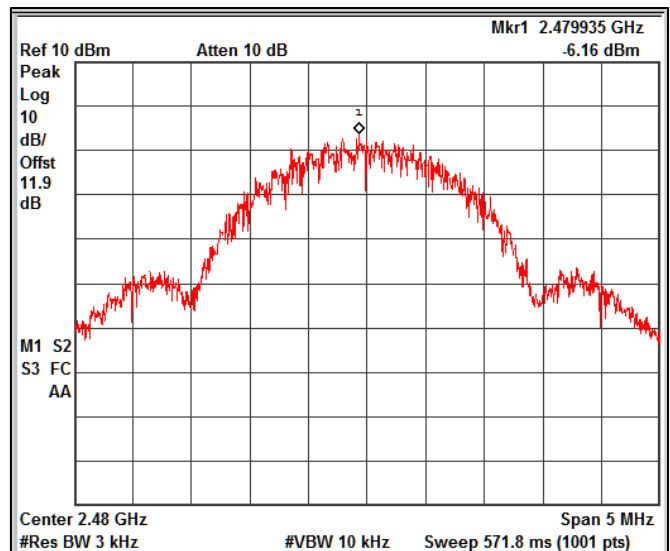
Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2478MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 50 von 79
Page 50 of 79

8.4 Emissions in non-restricted frequency bands and Conducted Spurious Emission

Result

Pass

Test Specification

FCC part 15 Subpart C 15.247 (d) /
RSS 247 Issue 3, Section 5.5

Test Method

Subclause 11.11 of ANSI C63.10-2020

Measurement Bandwidth

100 kHz

Detector

Peak

Port of testing

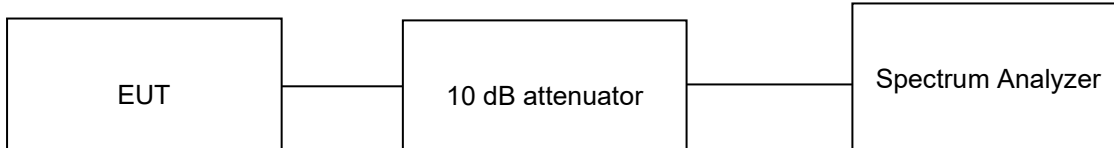
Antenna port

Requirement

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.5 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 51 von 79

Page 51 of 79

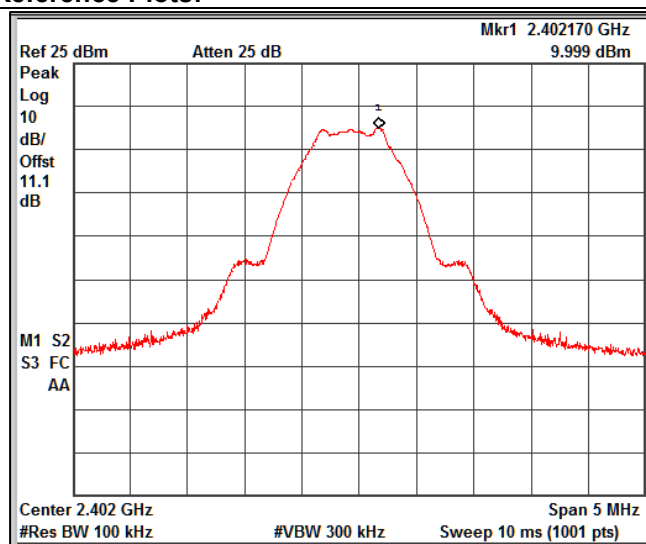
Test results:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Final Value (dBm) = Measured Value (dBm) + Attenuator factor (10dB) + Cable loss (1.10dB)
3. This product does not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 2.60 dBi

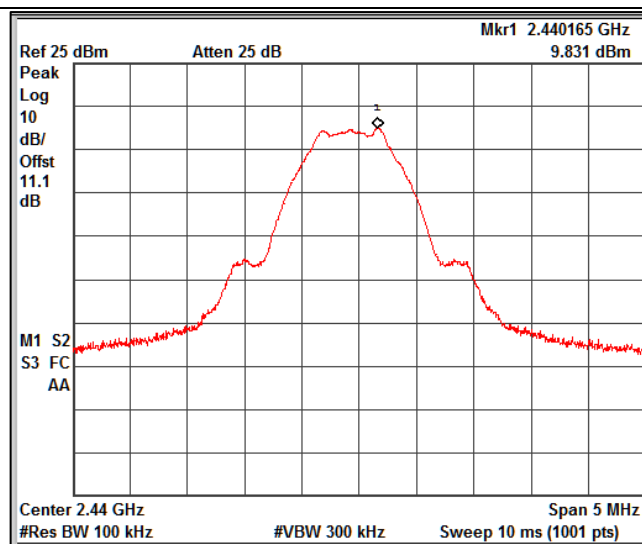
8.4.1 Band edge

Data Rate	Channel Frequency (MHz)	Band edge frequency (MHz)	Value at band edge (A) (dBm)	Reference value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
1Mbps	2402.00	2400.00	-40.21	9.99	-50.20	-20.00
	2478.00	2483.50	-44.53	9.83	-54.36	-20.00
	2480.00	2483.50	-42.02	9.83	-51.85	-20.00
2Mbps	2402.00	2400.00	-22.70	8.09	-30.79	-20.00
	2478.00	2483.50	-45.13	7.55	-52.68	-20.00
	2480.00	2483.50	-42.69	7.58	-50.27	-20.00

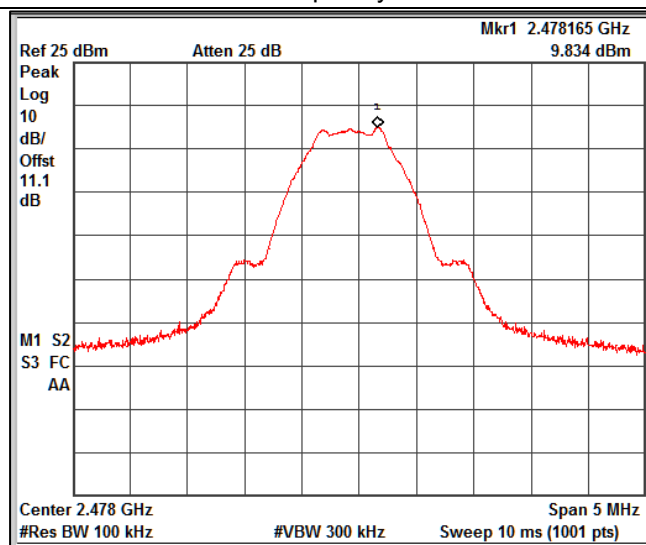
Reference Plots:



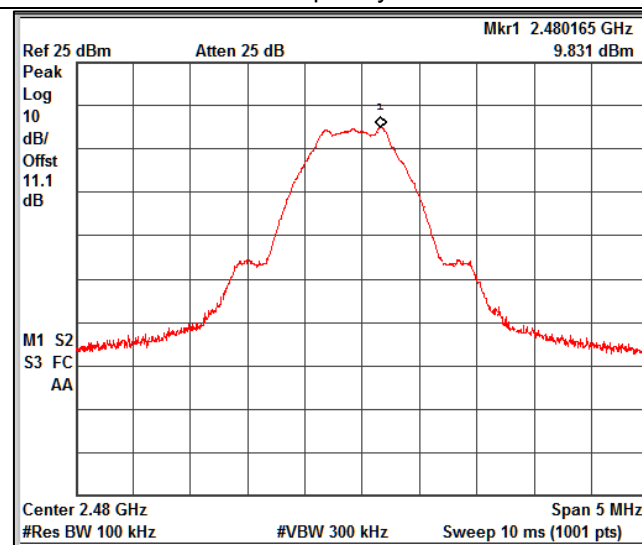
Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2478MHz



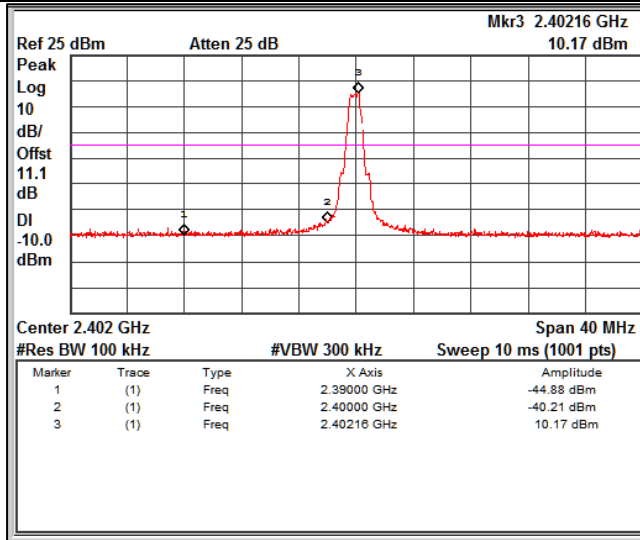
Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

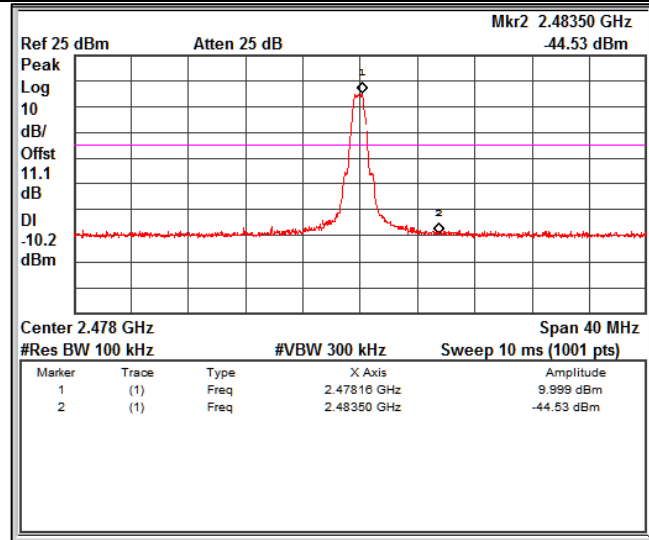
IN25YLOB 001

Seite 52 von 79
Page 52 of 79

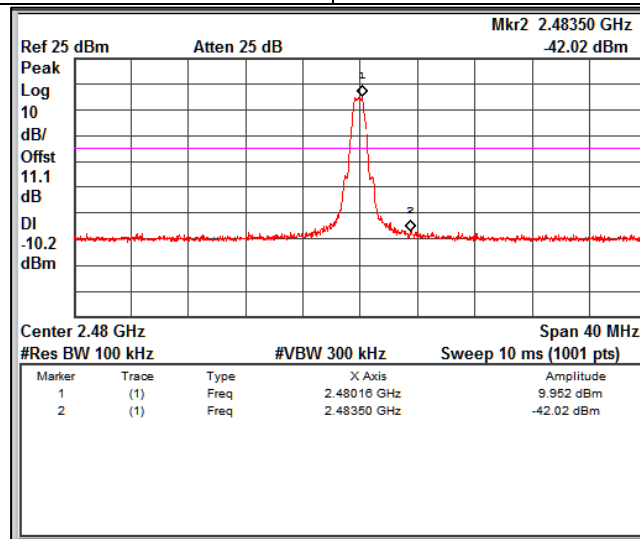
Bandedge Plots:



Channel Frequency 2402MHz

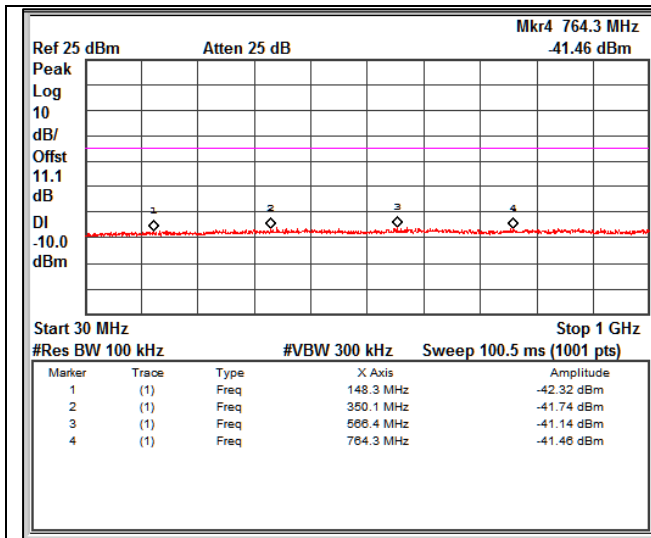


Channel Frequency 2478MHz

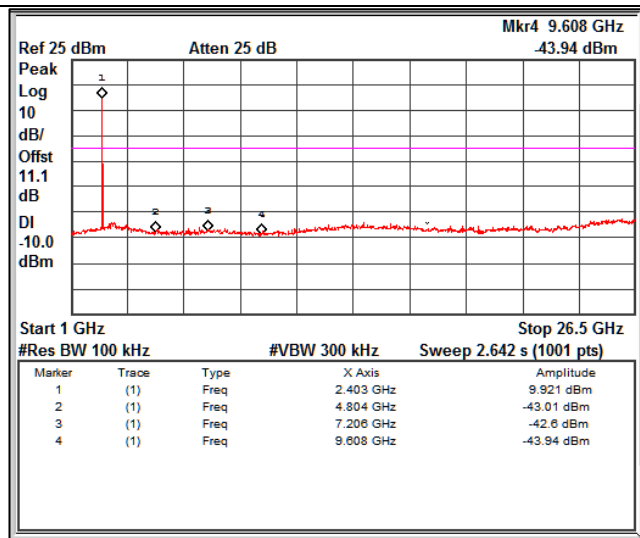


Channel Frequency 2480MHz

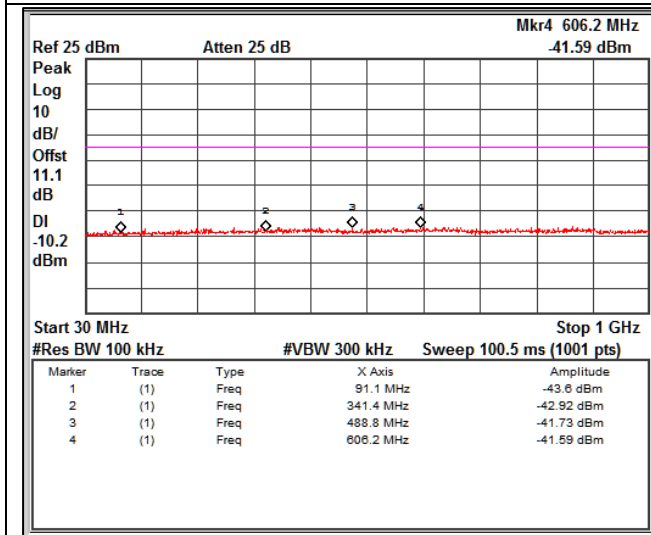
8.4.2 Out-Of-Band Emissions



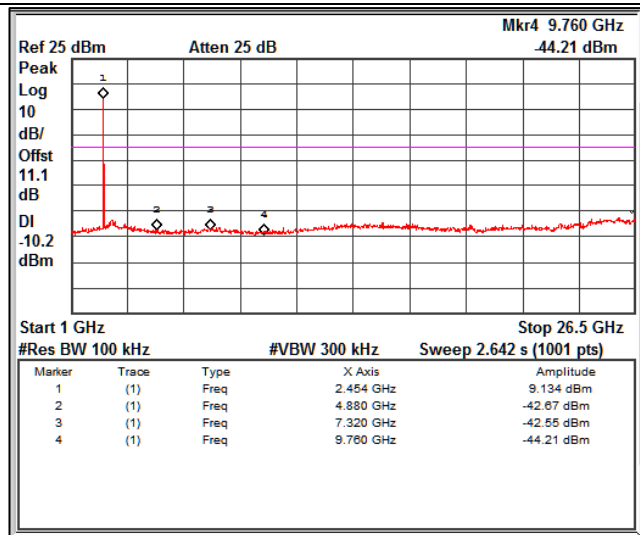
Channel Frequency: 2402MHz Frequency Range 30MHz – 1GHz



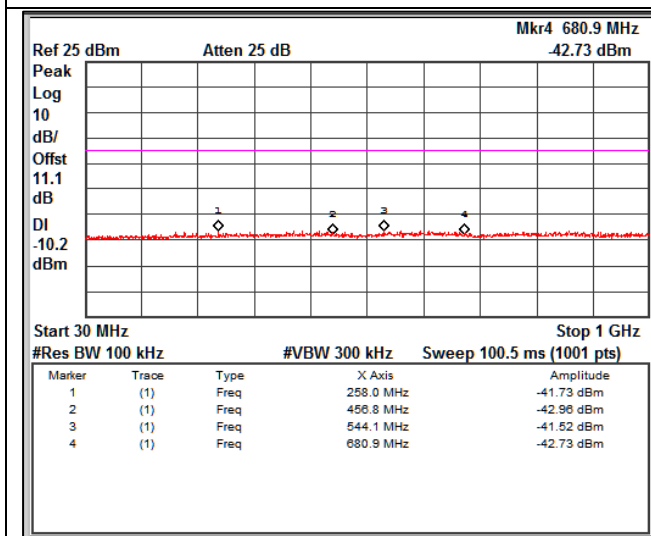
Channel Frequency: 2402MHz Frequency Range 1GHz – 26.5GHz



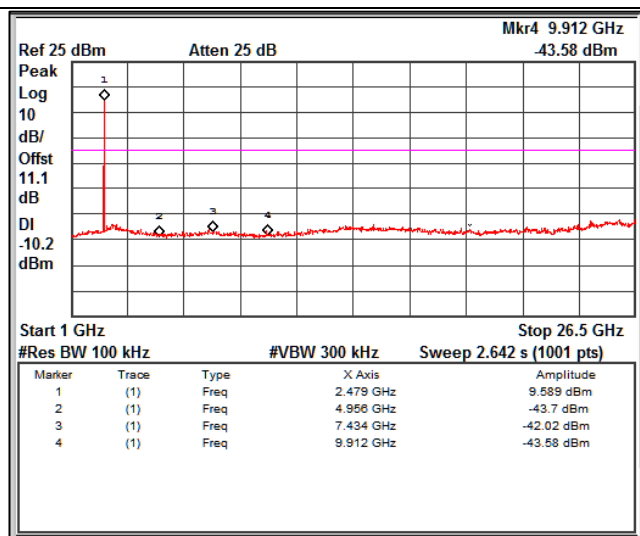
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2440MHz Frequency Range 1GHz – 26.5GHz



Channel Frequency: 2478MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2478MHz Frequency Range 1GHz – 26.5GHz

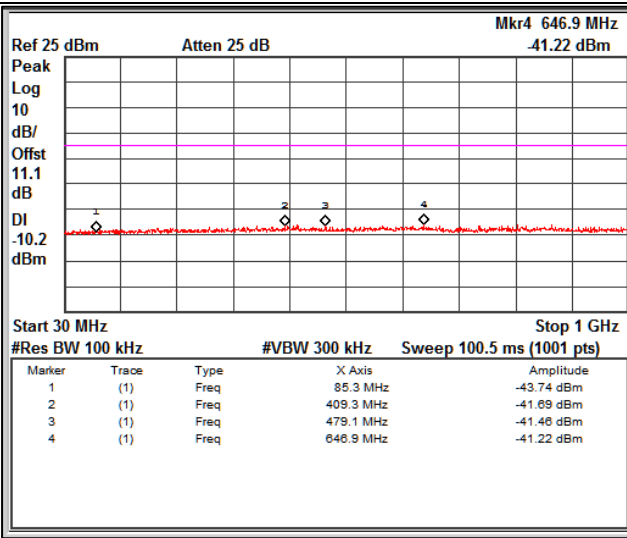
Prüfbericht - Nr.:

Test Report No.:

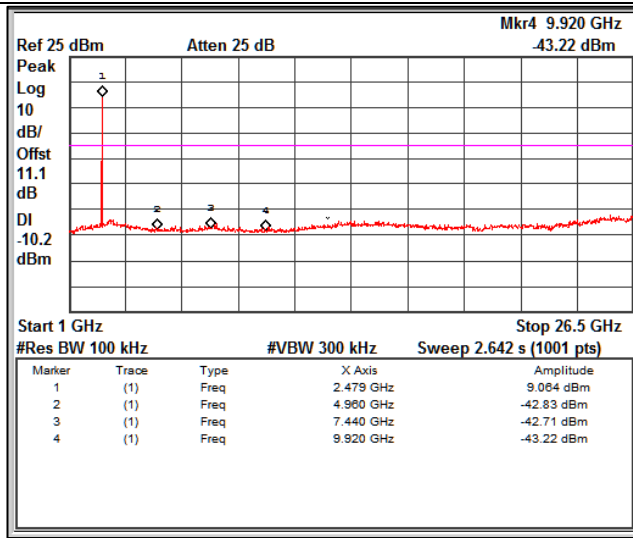
IN25YLOB 001

Seite 54 von 79

Page 54 of 79



Channel Frequency: 2480MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2480MHz Frequency Range 1GHz – 26.5GHz

Prüfbericht - Nr.:

Test Report No.:

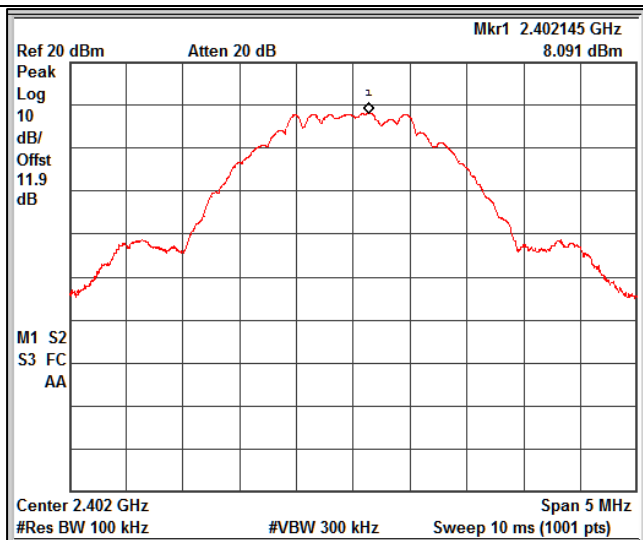
IN25YLOB 001

Seite 55 von 79

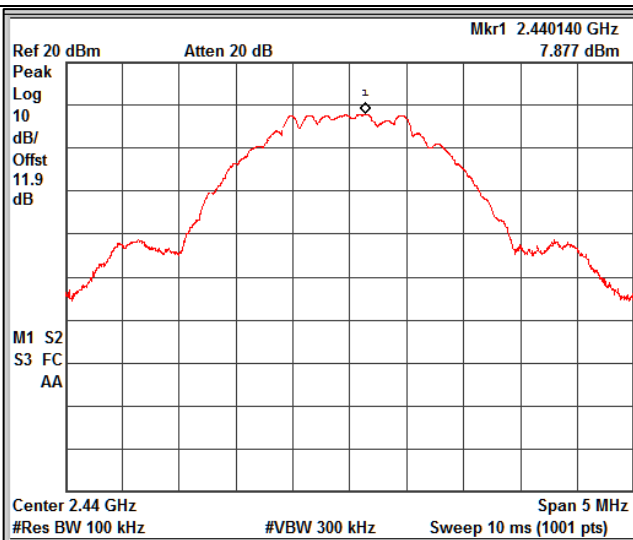
Page 55 of 79

Data Rate: 2Mbps

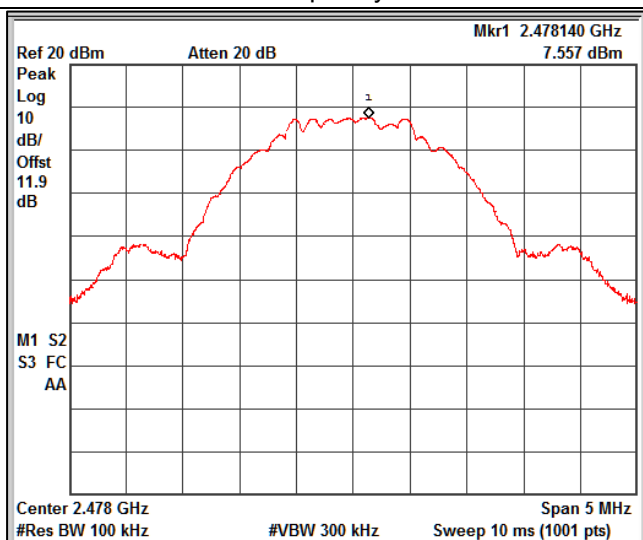
Reference Plots:



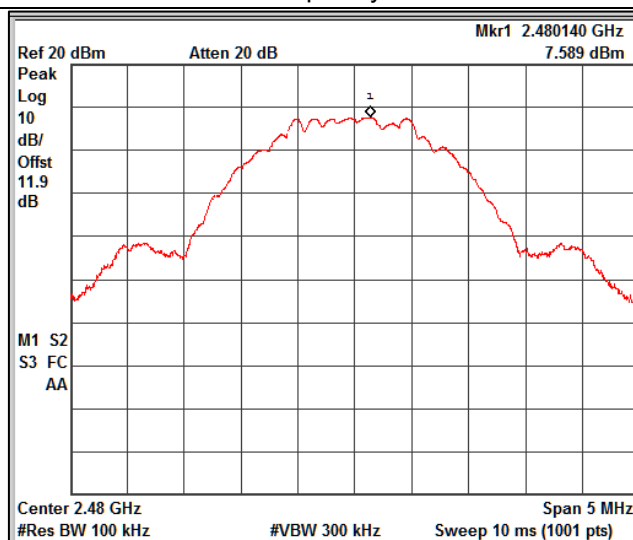
Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2478MHz



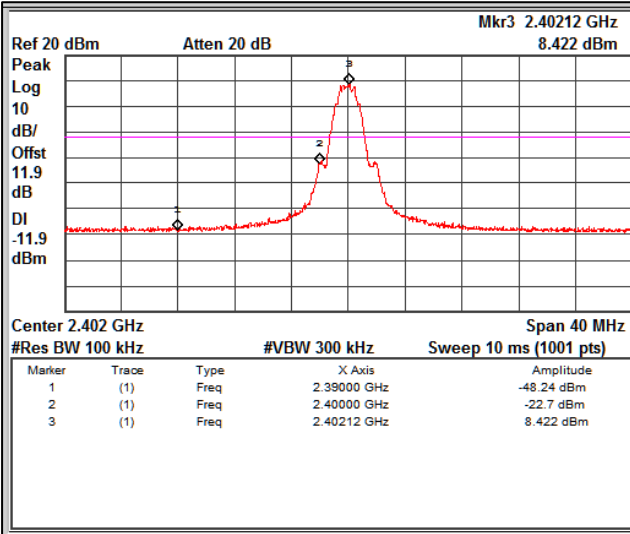
Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

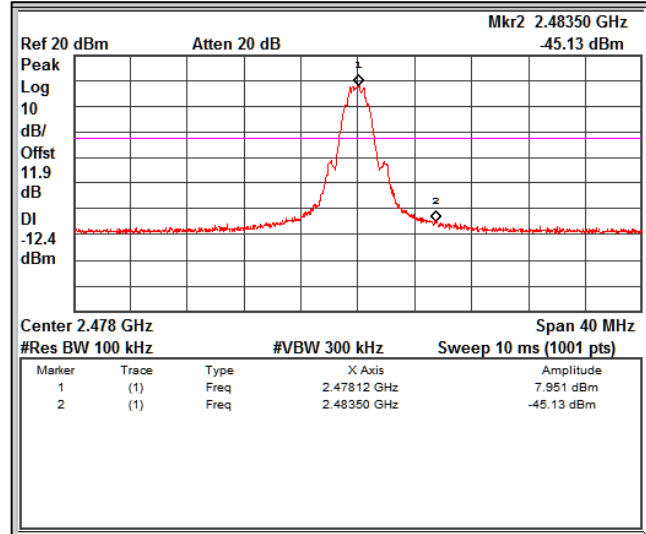
IN25YLOB 001

Seite 56 von 79
Page 56 of 79

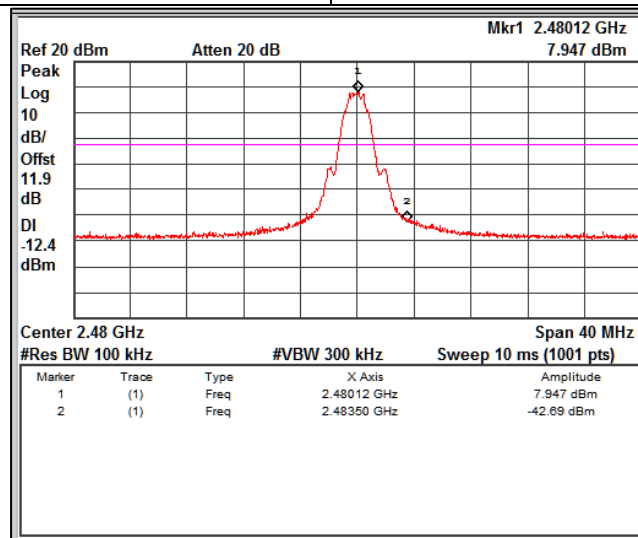
Bandedge Plots:



Channel Frequency 2402MHz



Channel Frequency 2478MHz



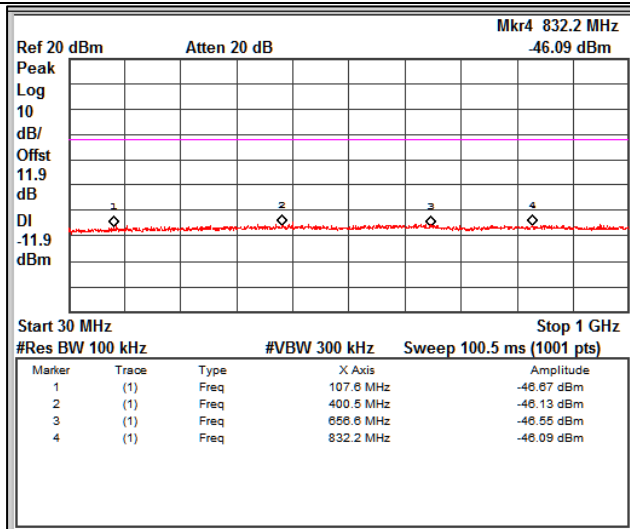
Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

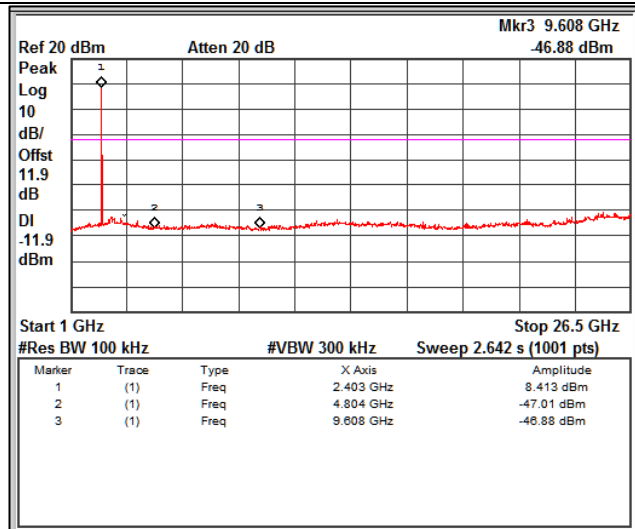
IN25YLOB 001

Seite 57 von 79
Page 57 of 79

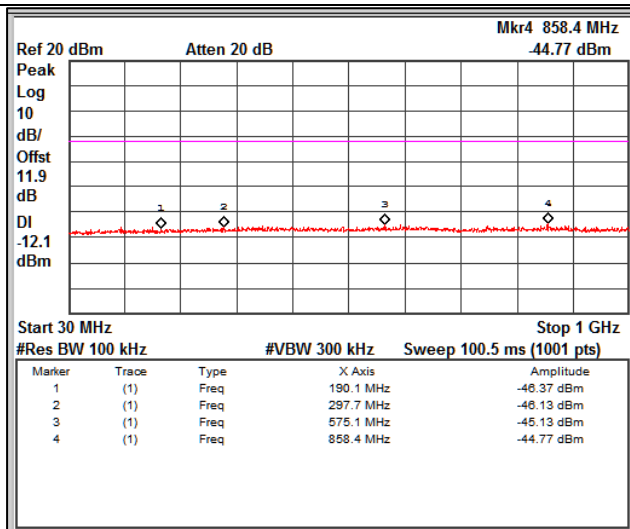
Out-Of-Band Emissions



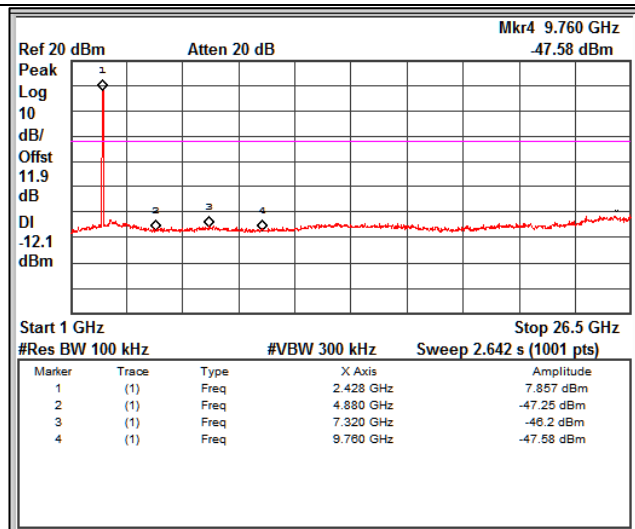
Channel Frequency: 2402MHz Frequency Range 30MHz – 1GHz



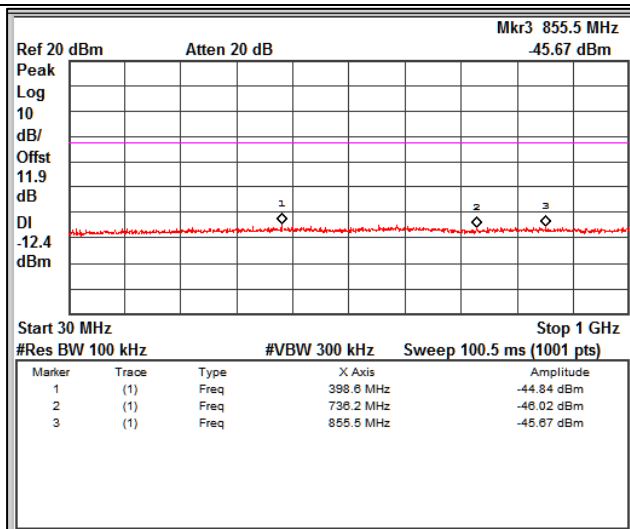
Channel Frequency: 2402MHz Frequency Range 1GHz – 26.5GHz



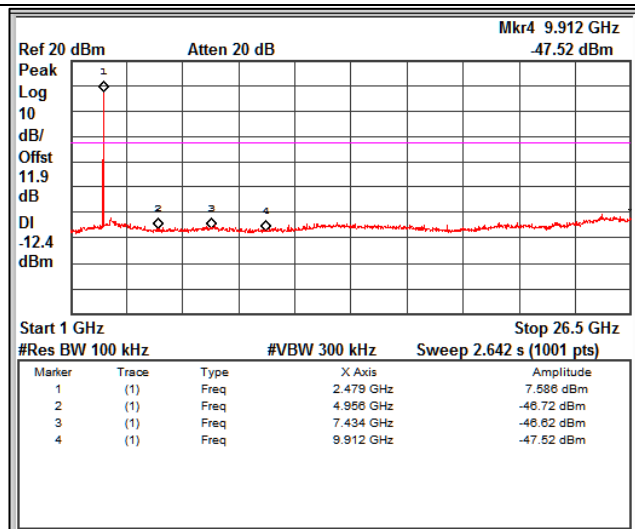
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2440MHz Frequency Range 1GHz – 26.5GHz



Channel Frequency: 2478MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2478MHz Frequency Range 1GHz – 26.5GHz

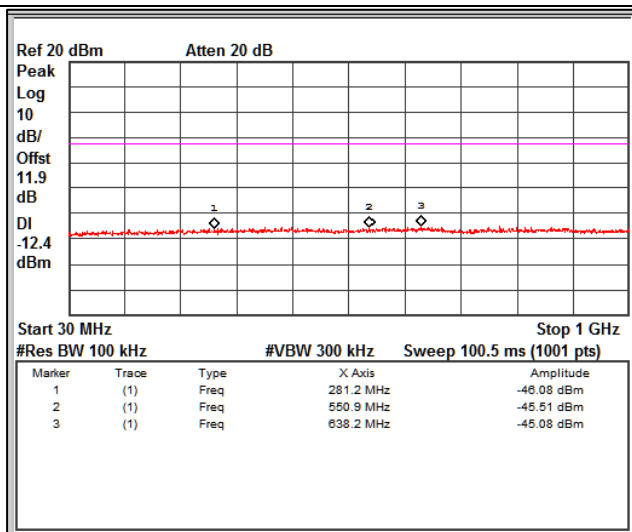
Prüfbericht - Nr.:

Test Report No.:

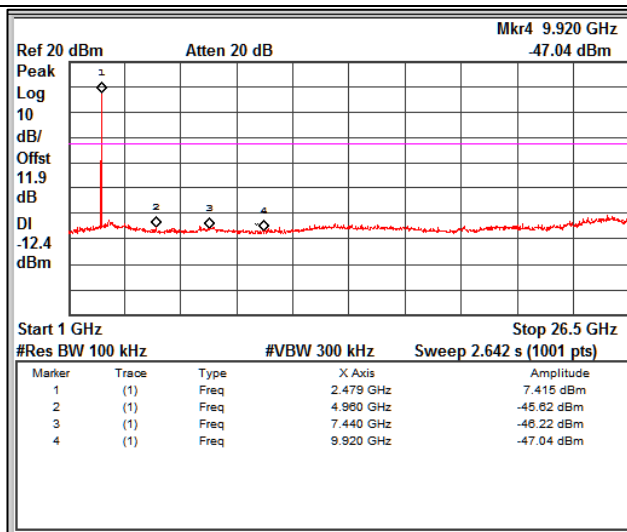
IN25YLOB 001

Seite 58 von 79

Page 58 of 79



Channel Frequency: 2480MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2480MHz Frequency Range 1GHz – 26.5GHz

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 59 von 79
Page 59 of 79

8.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result **Pass**

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205) / IC RSS-GEN, Section 8.9 and 8.10
Test Method	ANSI C63.10-2020
Measurement Location	Semi Anechoic Chamber 30MHz - 1 GHz Fully Anechoic Chamber 1 GHz - 40GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz 1 MHz for Frequency range >1GHz
Detector	Refer remarks below
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 11: Transmitter limits for Radiated emission

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300-meter, 30 meter and 30-meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 12VDC Supply from Driver

Relative humidity: 65%

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 60 von 79
Page 60 of 79

Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details.

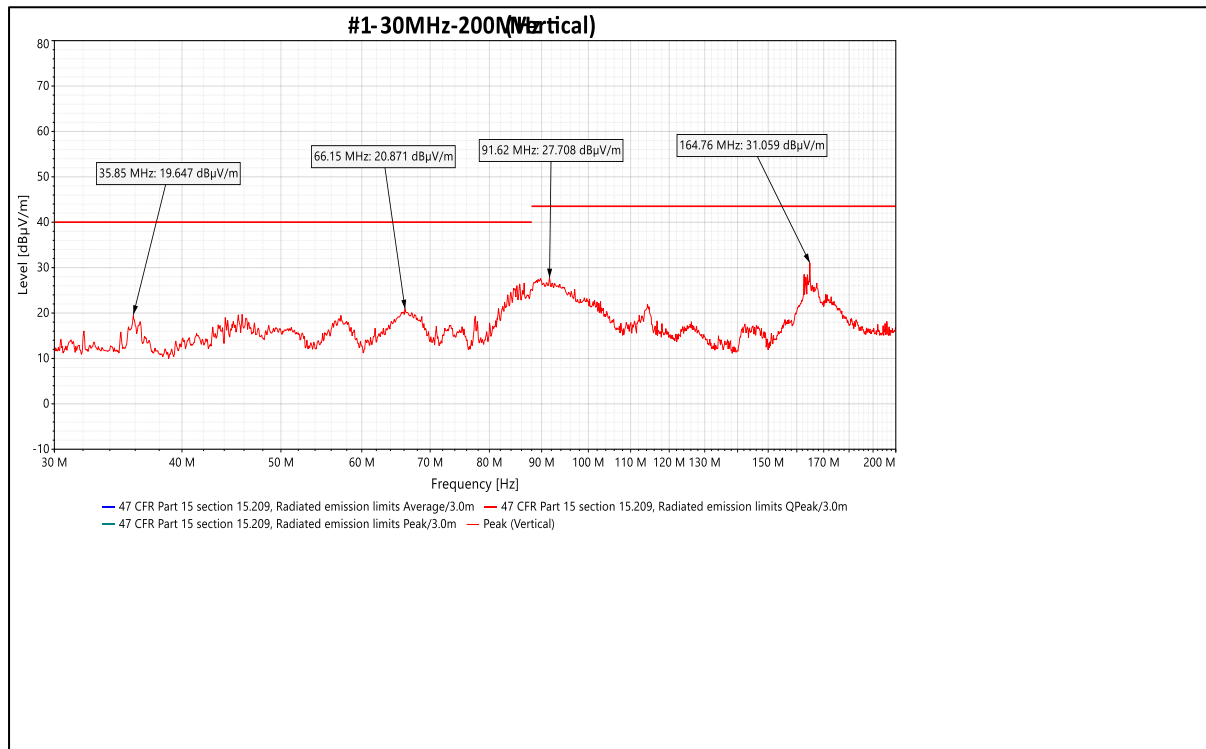
Test results for frequency range 9 kHz – 30MHz

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported.

Table 12: Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	35.85	19.64	40.00	-20.36
	66.15	20.87	40.00	-19.13
	91.62	27.70	43.50	-15.80
	164.76	31.05	43.50	-12.45
Horizontal	50.76	15.24	40.00	-24.76
	73.05	17.16	40.00	-22.84
	86.97	20.81	40.00	-19.19
	165.51	16.30	43.50	-27.20

Frequency Range 30MHz – 200MHz _Vertical Polarization



Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 61 von 79
Page 61 of 79

Frequency Range 30MHz – 200MHz _Horizontal Polarization

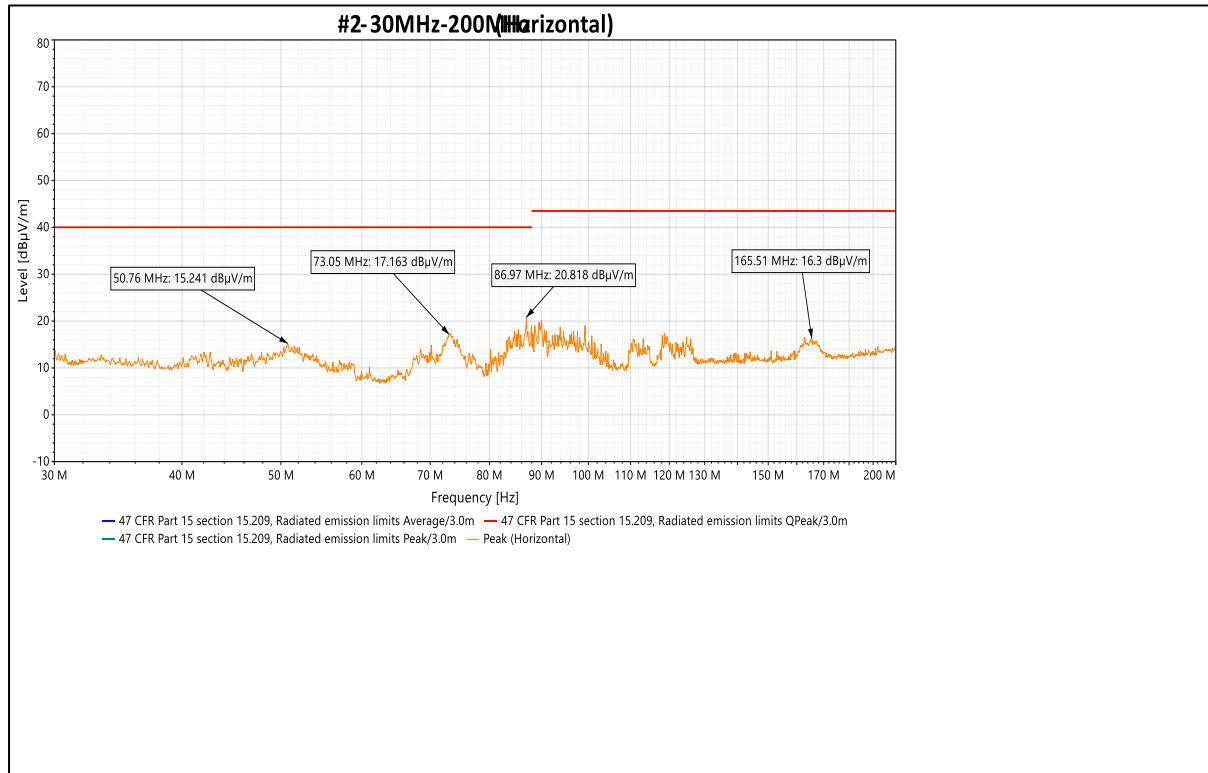
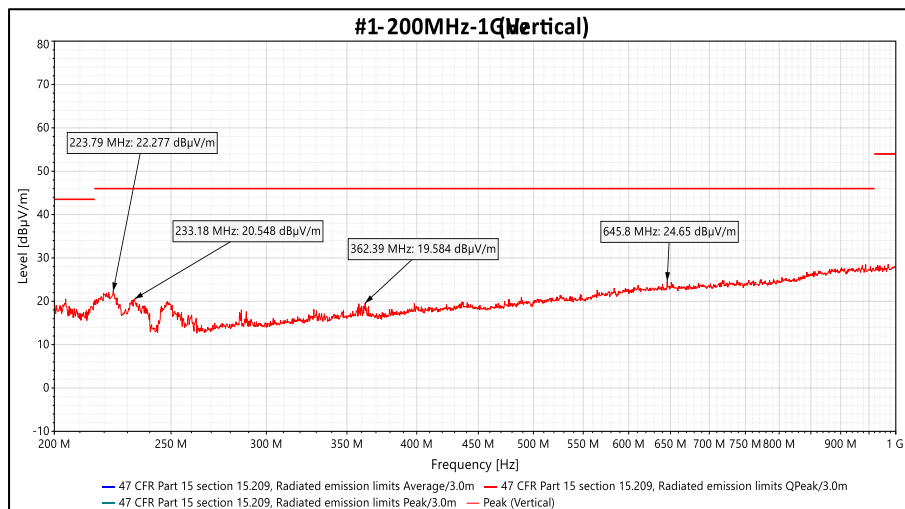


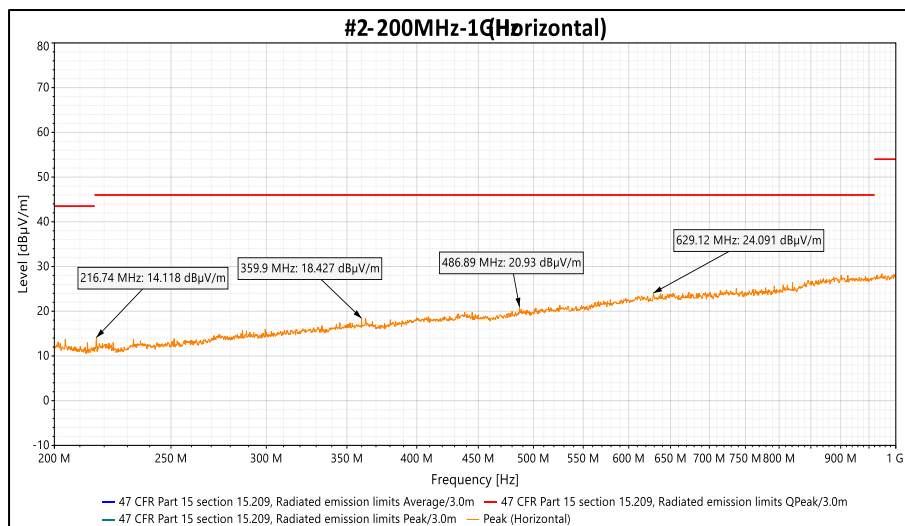
Table 13: Test results for frequency range 200MHz – 1GHz

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	223.79	22.27	46.00	-23.73
	233.18	20.54	46.00	-25.46
	362.39	19.58	46.00	-26.42
	645.80	24.65	46.00	-21.35
Horizontal	216.74	14.11	43.50	-29.39
	359.90	18.42	46.00	-27.58
	486.89	20.93	46.00	-25.07
	629.19	24.09	46.00	-21.91

Frequency Range 200MHz – 1GHz_Vertical Polarization



Frequency Range 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:

Test Report No.:

IN25YLOB 001

Seite 63 von 79

Page 63 of 79

Table 14: Test results for the frequencies above 1GHz:

BLE: Data Rate 1Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2402	2402(Pk)	Vertical	105.90	-	-
	2402(Av)		104.97	-	-
	2390(Pk)		44.34	74.00*	-26.33
	2390(Av)		25.51	54.00*	-20.88
	4804(Pk)		48.29	74.00	-23.99
	4804(Av)		41.64	54.00	-11.91
	7206(Pk)		50.63	74.00	-16.67
	7206(Av)		40.31	54.00	-5.73
	2402(Pk)	Horizontal	102.70	-	-
	2402(Av)		101.77	-	-
	2390(Pk)		41.80	74.00*	-30.98
	2390(Av)		32.23	54.00*	-28.28
	4804(Pk)		44.55	74.00	-27.93
	4804(Av)		35.78	54.00	-18.25
	7206(Pk)		49.24	74.00	-16.98
	7206(Av)		38.02	54.00	-6.48
2440	2440(Pk)	Vertical	105.60	-	-
	2440(Av)		104.46	-	-
	4880(Pk)		50.47	74.00	-24.53
	4880(Av)		44.33	54.00	-12.25
	7320(Pk)		52.89	74.00	-15.24
	7320(Av)		44.06	54.00	-4.62
	2440(Pk)	Horizontal	102.59	-	-
	2440(Av)		101.65	-	-
	4880(Pk)		44.19	74.00	-17.77
	4880(Av)		34.51	54.00	-7.61
	7320(Pk)		49.38	74.00	-17.62
	7320(Av)		39.41	54.00	-9.18
2478	2478(Pk)	Vertical	104.57	-	-
	2478(Av)		103.18	-	-
	2483.5(Pk)		51.49	74.00*	-16.44
	2483.5(Av)		37.67	54.00*	-17.54
	4956(Pk)		45.47	74.00	-28.69
	4956(Av)		36.70	54.00	-19.34
	7434(Pk)		53.06	74.00	-27.46
	7434(Av)		44.11	54.00	-7.82
	2478(Pk)	Horizontal	102.41	-	-
	2478(Av)		101.47	-	-
	2483.5(Pk)		49.86	74.00*	-28.96
	2483.5(Av)		36.39	54.00*	-26.90
	4956(Pk)		43.68	74.00	-29.78
	4956(Av)		33.61	54.00	-21.05
	7434(Pk)		50.33	74.00	-18.69
	7434(Av)		40.20	54.00	-8.47

→ Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

Av: Average Detect

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 64 von 79
Page 64 of 79

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2480	2480(Pk)	Vertical	104.46	-	-
	2480(Av)		103.36	-	-
	2483.5(Pk)		55.89	74.00*	-18.11
	2483.5(Av)		43.08	54.00*	-10.92
	4960(Pk)		47.49	74.00	-26.51
	4960(Av)		40.45	54.00	-13.55
	7440(Pk)		47.57	74.00	-26.43
	7440(Av)		36.23	54.00	-17.77
	2480(Pk)	Horizontal	102.34	-	-
	2480(Av)		101.42	-	-
	2483.5(Pk)		54.04	74.00*	-19.96
	2483.5(Av)		41.28	54.00*	-12.72
	4960(Pk)		42.90	74.00	-31.10
	4960(Av)		32.30	54.00	-21.70
	7440(Pk)		47.09	74.00	-26.91
	7440(Av)		35.12	54.00	-18.88

_ → Fundamental Frequency

* → Restricted Band edges

Pk: Peak Detector.

Av: Average Detect

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 65 von 79
Page 65 of 79

Data Rate 2Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2402(Pk)	Vertical	106.71	-	-
	2402(Av)		104.14	-	-
	2364(Pk)		45.65	74.00*	-28.35
	2363.75(Av)		35.90	54.00*	-18.10
	4804(Pk)		46.30	74.00	-27.70
	4804(Av)		34.94	54.00	-19.06
	7206(Pk)		52.02	74.00	-21.98
	7206(Av)		40.20	54.00	-13.80
	2402(Pk)	Horizontal	102.17	-	-
	2402(Av)		99.56	-	-
	2364(Pk)		42.60	74.00*	-31.40
	2363.75(Av)		32.10	54.00*	-21.90
	4804(Pk)		43.06	74.00	-30.94
	4804(Av)		30.71	54.00	-23.29
	7206(Pk)		47.92	74.00	-26.08
	7206(Av)		37.34	54.00	-16.66
2440	2440(Pk)	Vertical	105.78	-	-
	2440(Av)		103.23	-	-
	4880(Pk)		45.17	74.00	-28.83
	4880(Av)		33.74	54.00	-20.26
	7320(Pk)		52.83	74.00	-21.17
	7320(Av)		41.62	54.00	-12.38
	2440(Pk)	Horizontal	102.19	-	-
	2440(Av)		99.64	-	-
	4880(Pk)		41.91	74.00	-32.09
	4880(Av)		29.76	54.00	-24.24
	7320(Pk)		49.46	74.00	-24.54
	7320(Av)		37.50	54.00	-16.50
2478	2478(Pk)	Vertical	106.15	-	-
	2478(Av)		103.56	-	-
	2483.5(Pk)		56.24	74.00*	-17.76
	2483.5(Av)		44.19	54.00*	-9.81
	4956(Pk)		45.80	74.00	-28.20
	4956(Av)		35.40	54.00	-18.60
	7434(Pk)		53.07	74.00	-20.93
	7434(Av)		43.09	54.00	-10.91
	2478(Pk)	Horizontal	101.91	-	-
	2478(Av)		99.26	-	-
	2483.5(Pk)		51.50	74.00*	-22.50
	2483.5(Av)		39.51	54.00*	-14.49
	4956(Pk)		41.61	74.00	-32.39
	4956(Av)		29.93	54.00	-24.07
	7434(Pk)		49.42	74.00	-24.58
	7434(Av)		37.20	54.00	-16.80

_ → Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

Av: Average Detect

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 66 von 79
Page 66 of 79

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2480	2480(Pk)	Vertical	106.01	-	-
	2480(Av)		103.42	-	-
	2483.5(Pk)		62.29	74.00*	-11.71
	2483.5(Av)		49.63	54.00*	-4.37
	4960(Pk)		45.85	74.00	-28.15
	4960(Av)		35.01	54.00	-18.99
	7440(Pk)		52.42	74.00	-21.58
	7440(Av)		42.58	54.00	-11.42
	2480(Pk)	Horizontal	101.68	-	-
	2480(Av)		99.04	-	-
	2483.5(Pk)		57.56	74.00*	-16.44
	2483.5(Av)		45.01	54.00*	-8.99
	4960(Pk)		41.99	74.00	-32.01
	4960(Av)		30.11	54.00	-23.89
	7440(Pk)		47.79	74.00	-26.21
	7440(Av)		36.86	54.00	-17.14

_ → Fundamental Frequency

*→ Restricted Band edges

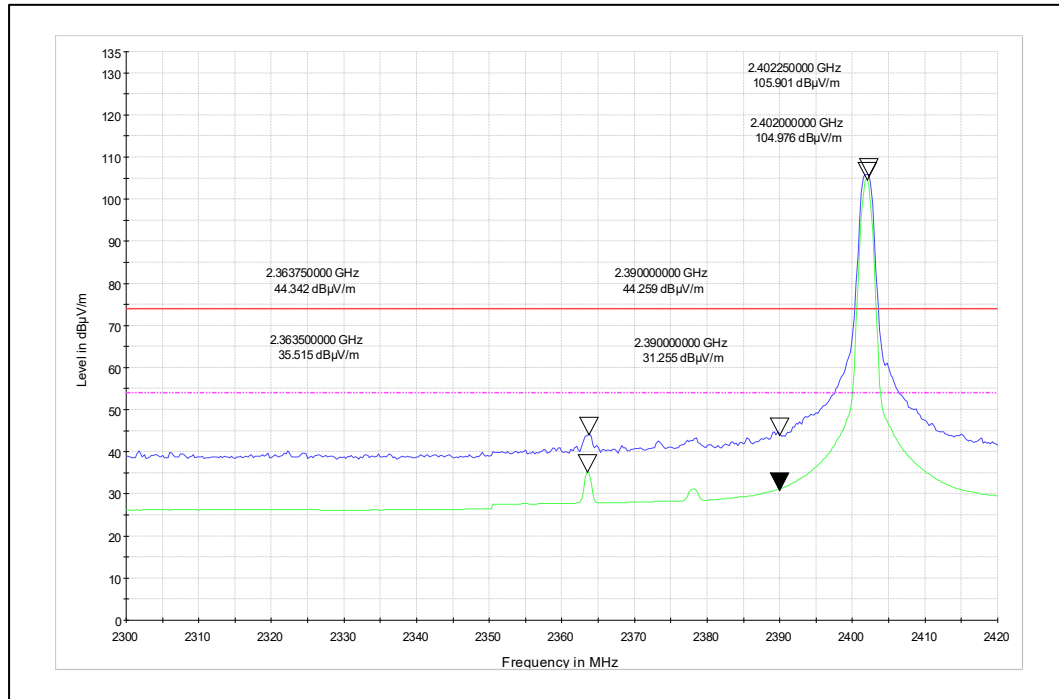
Pk: Peak Detector.

Av: Average Detect

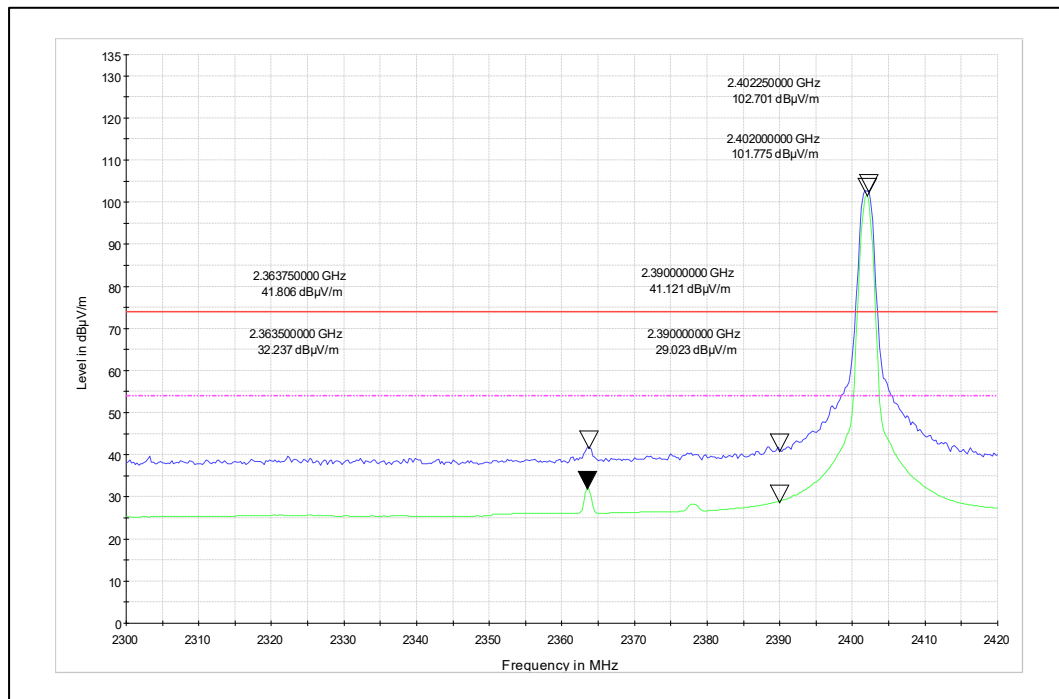
Test Plots:

Data Rate: 1 Mbps

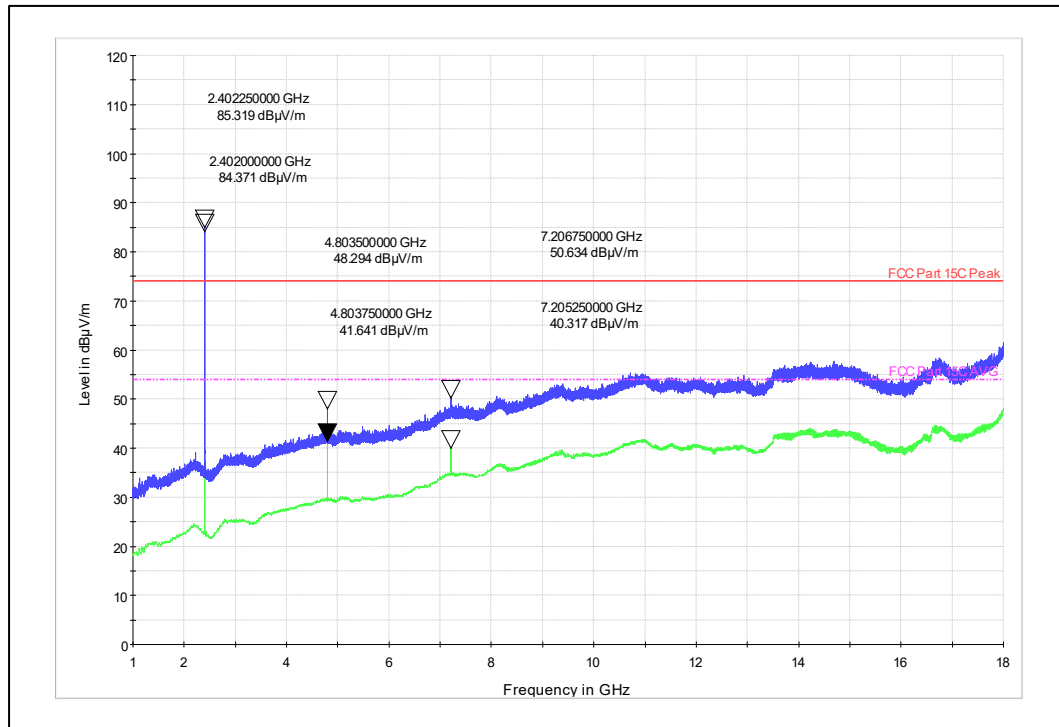
Channel Frequency: 2402MHz_Vertical Polarization



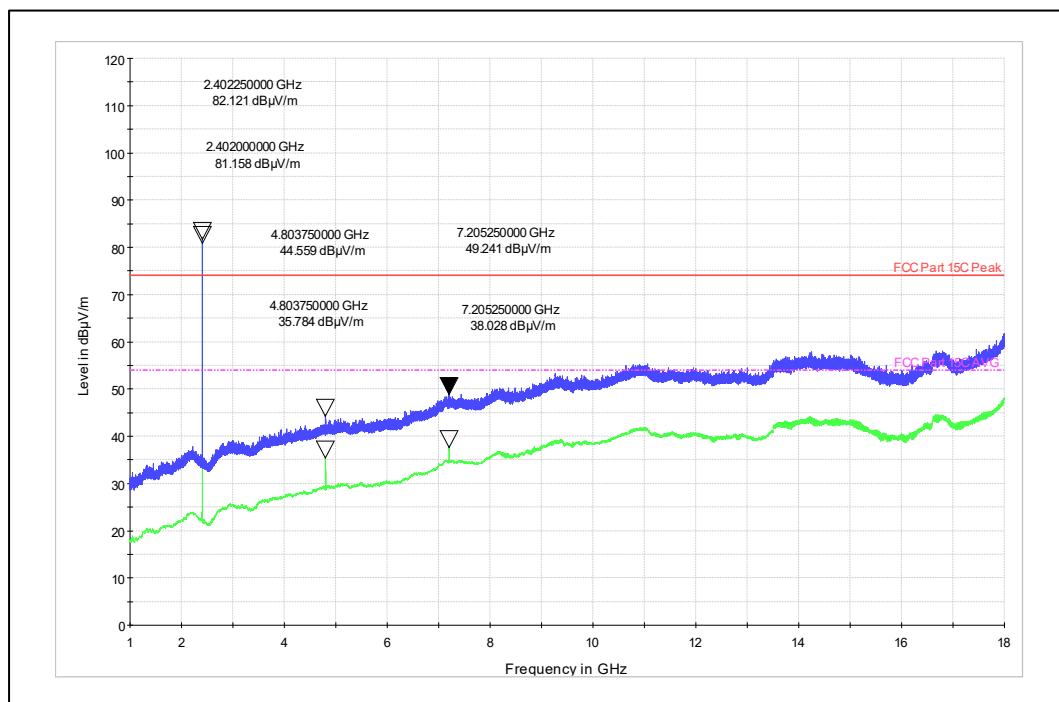
Channel Frequency: 2402MHz_Horizontal Polarization



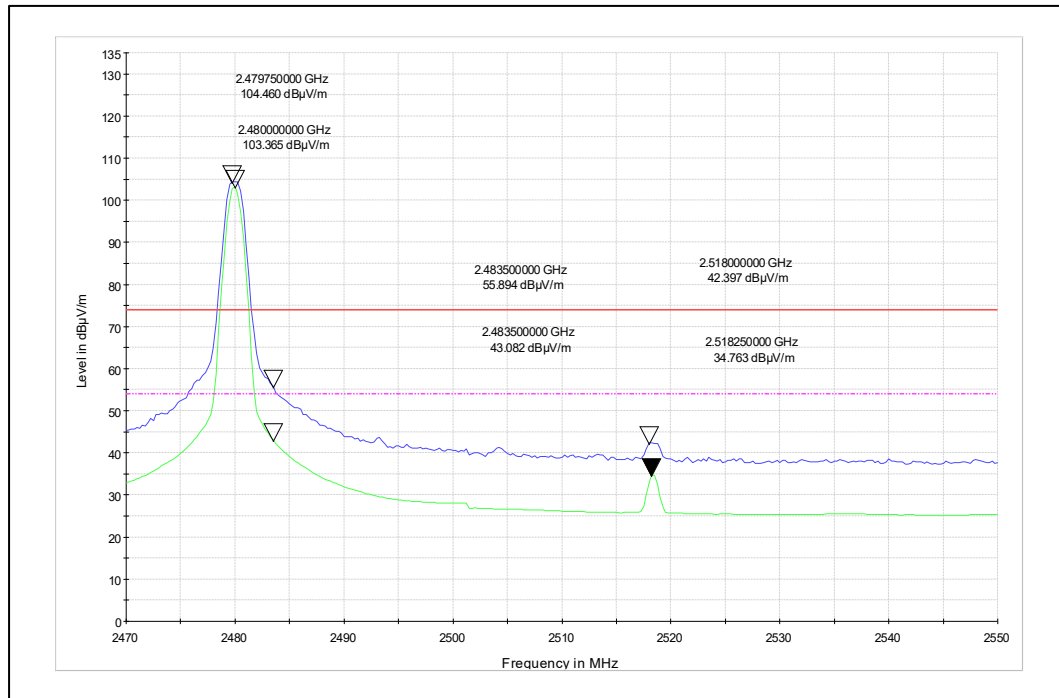
Frequency Range: 1GHz – 18GHz_Vertical Polarization



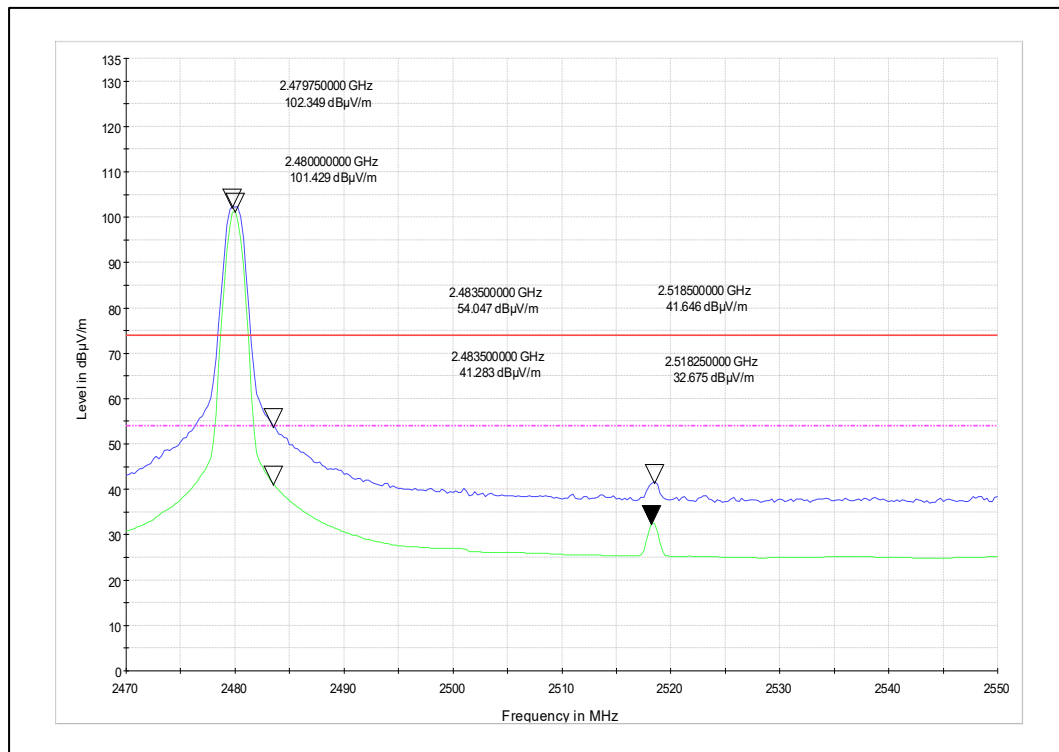
Frequency Range: 1GHz – 18GHz_Horizontal Polarization



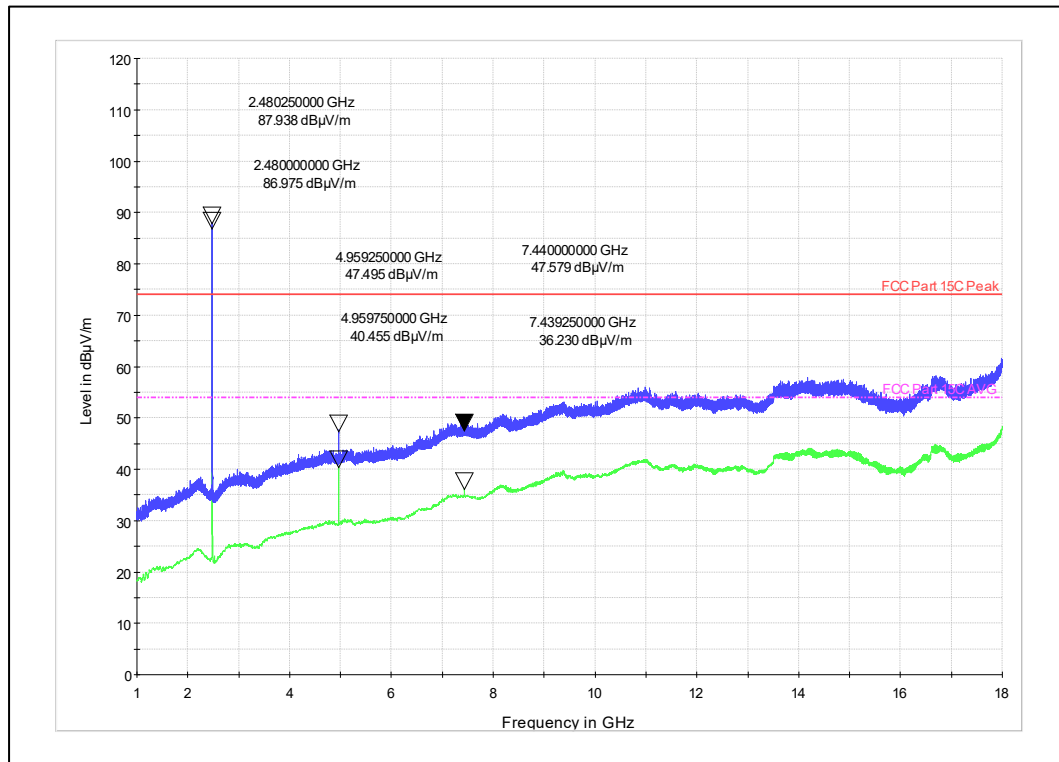
Channel Frequency: 2480MHz_Vertical Polarization



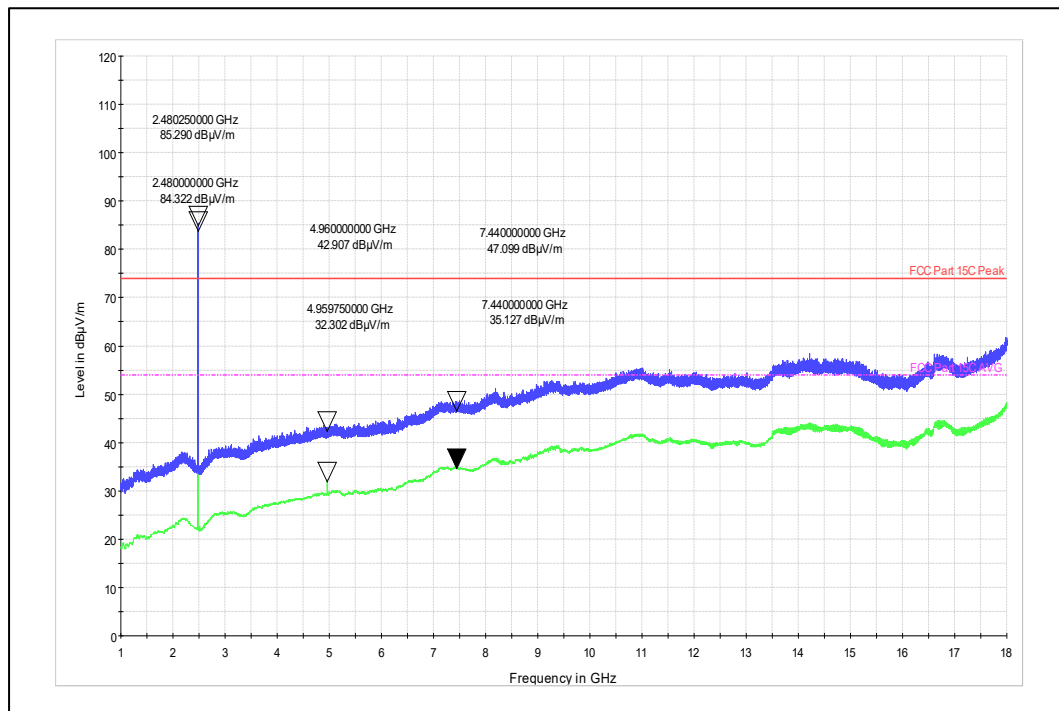
Channel Frequency: 2480MHz_Horizontal Polarization



Frequency Range: 1GHz – 18GHz_Vertical Polarization

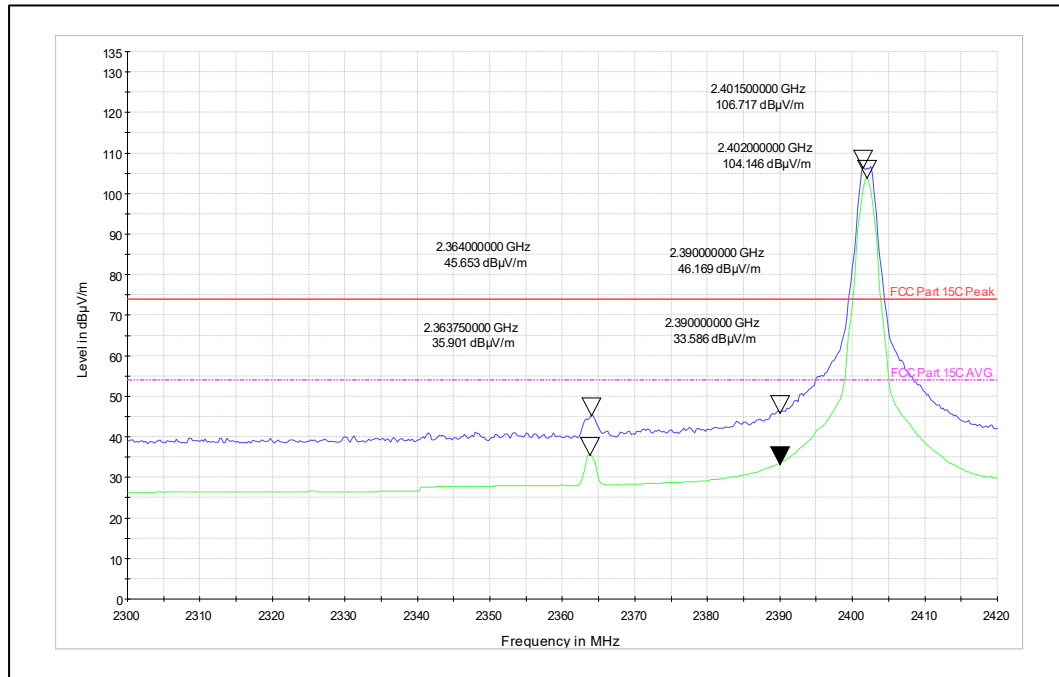


Frequency Range: 1GHz – 18GHz_Horizontal Polarization

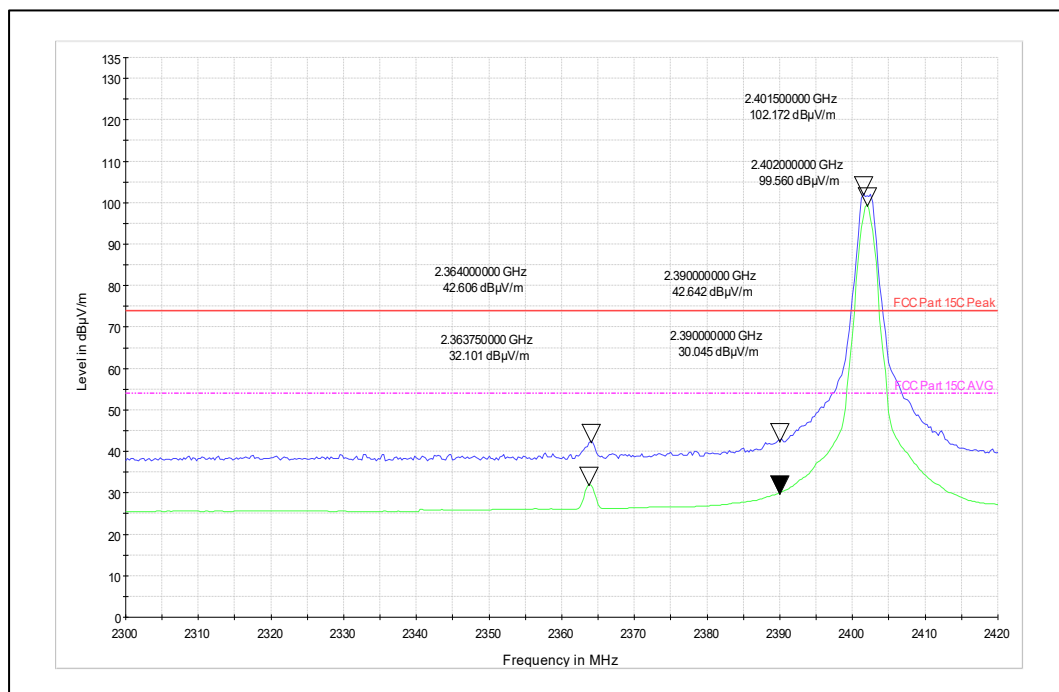


Data Rate: 2 Mbps

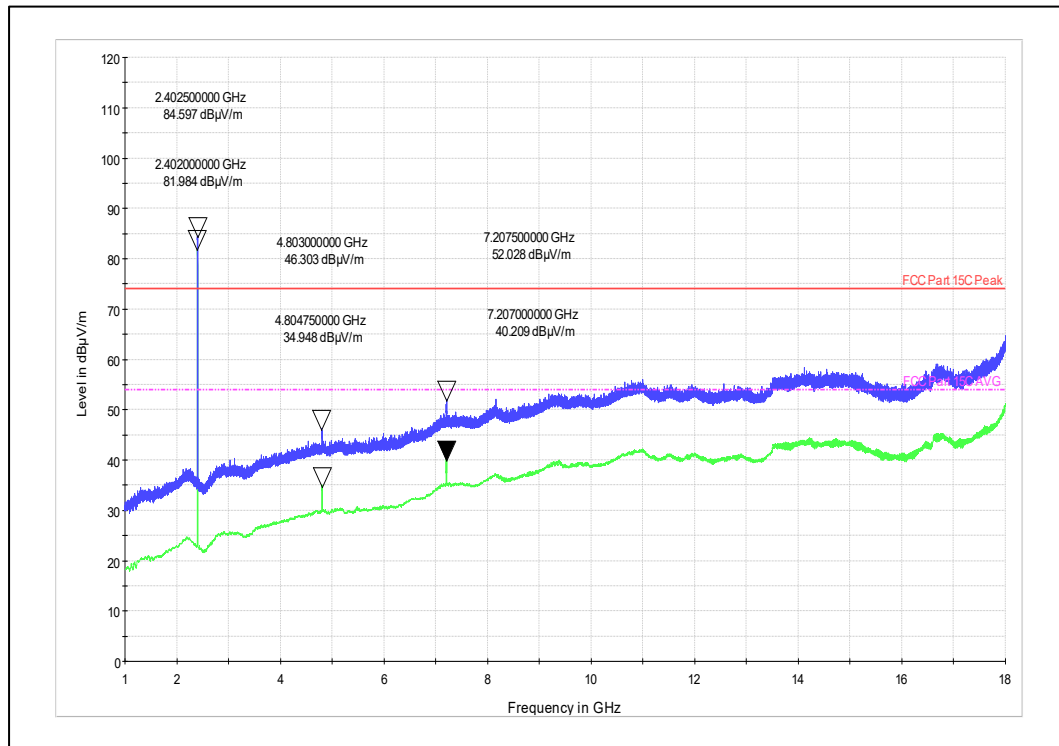
Channel Frequency: 2402MHz_Vertical Polarization



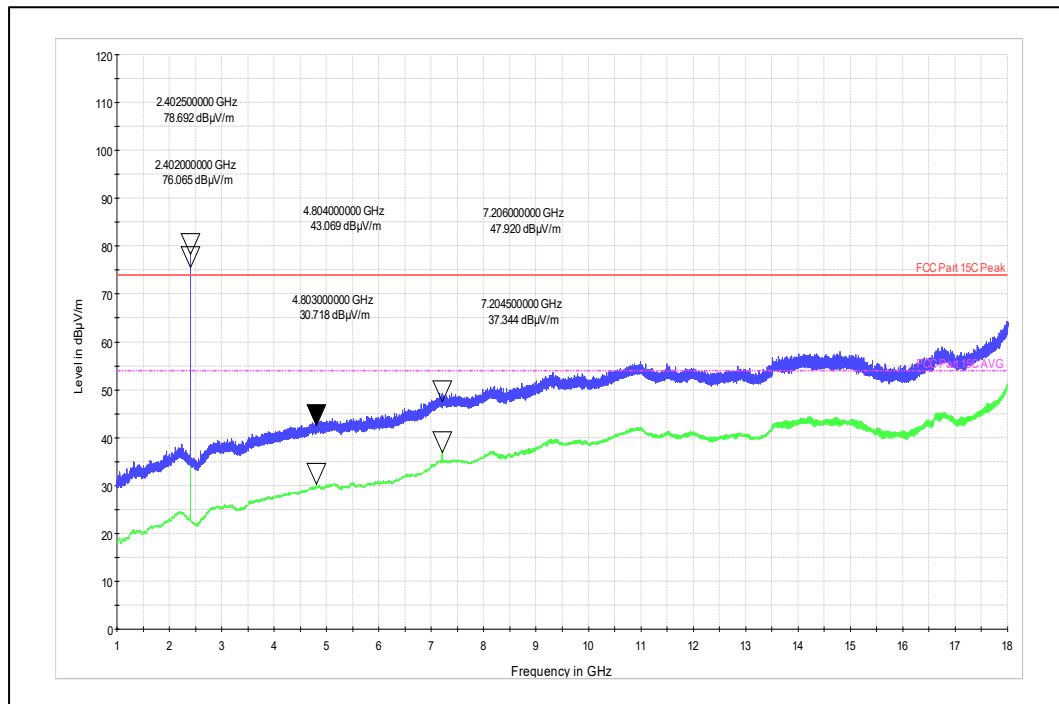
Channel Frequency: 2402MHz_Horizontal Polarization



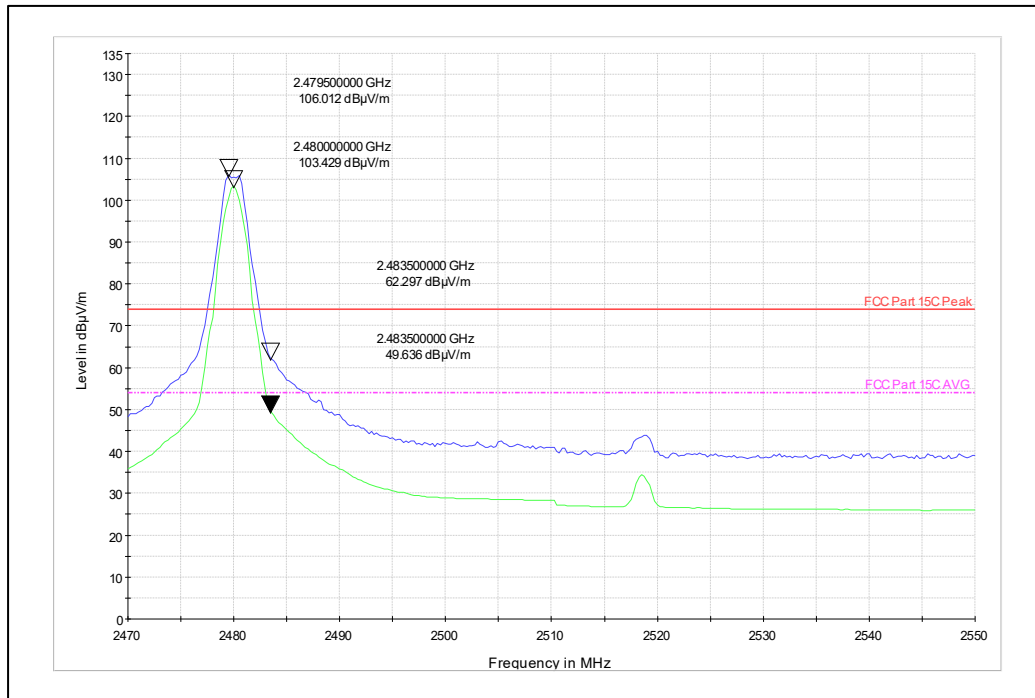
Frequency Range: 1GHz – 18GHz_Vertical Polarization



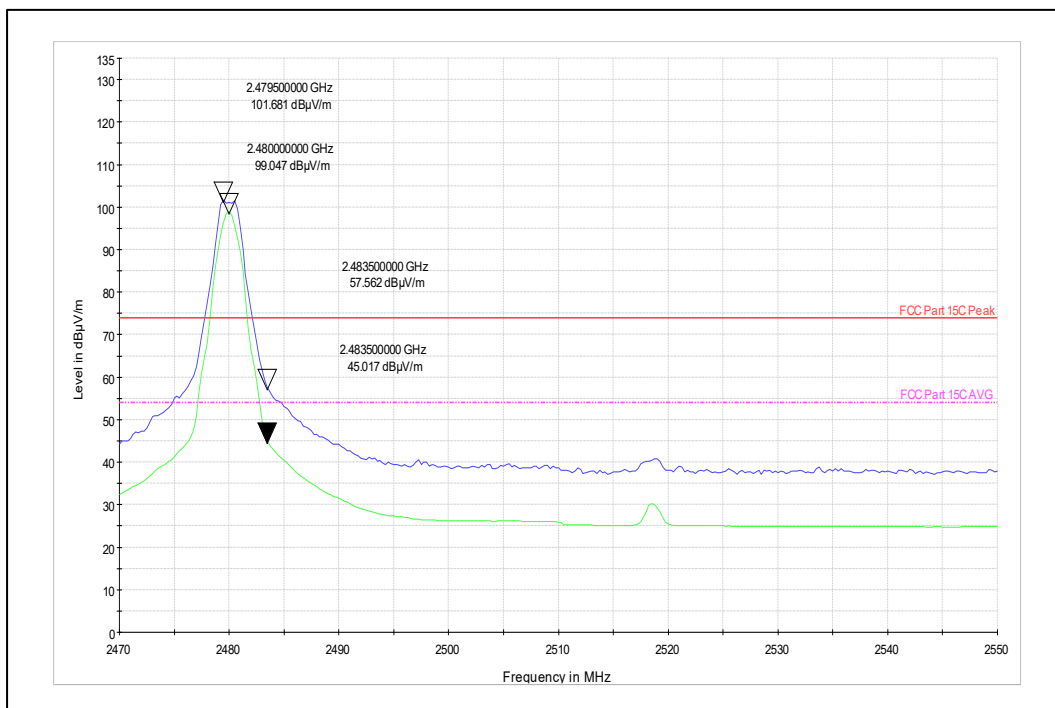
Frequency Range: 1GHz – 18GHz_Horizontal Polarization



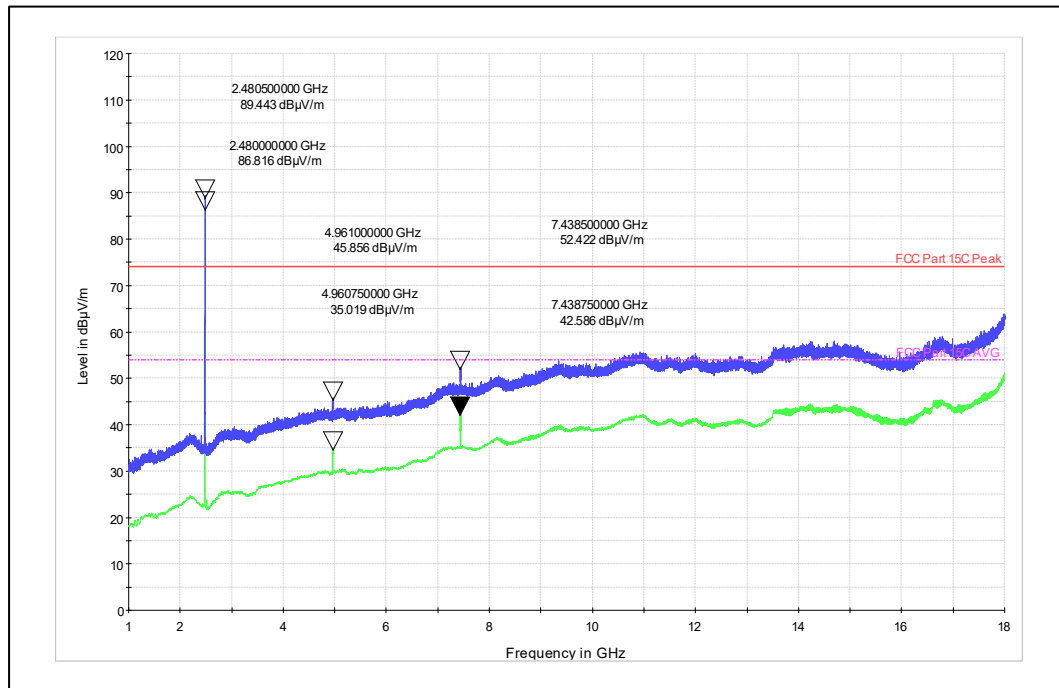
Channel Frequency: 2480MHz_Vertical Polarization



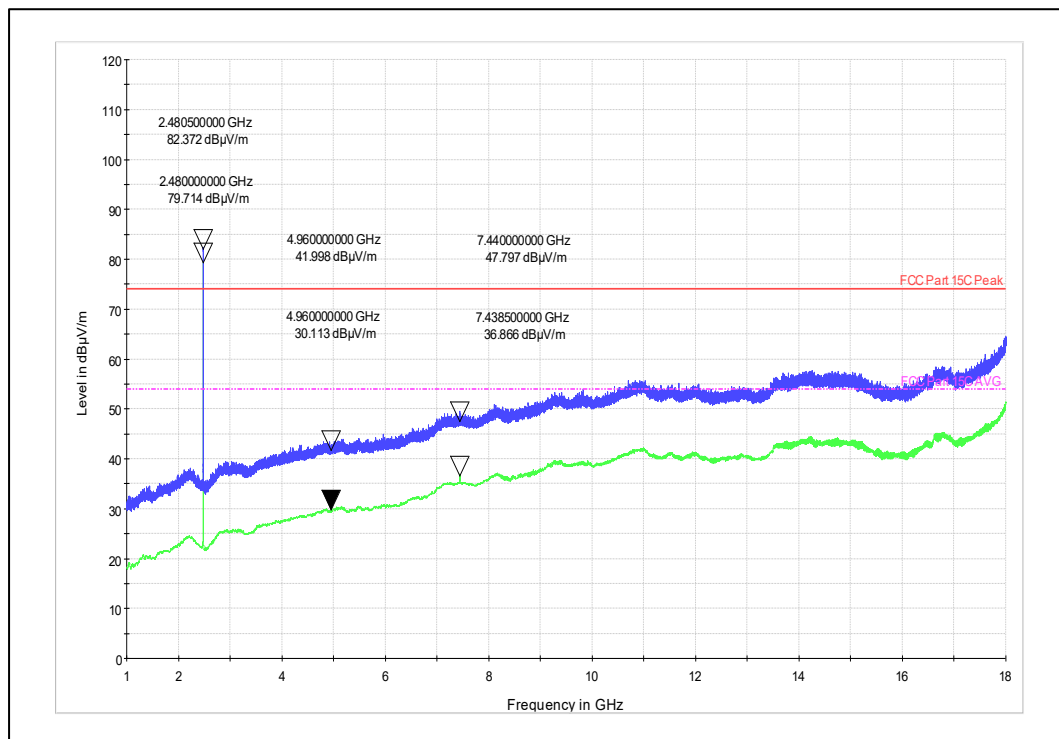
Channel Frequency: 2480MHz_Horizontal Polarization



Frequency Range: 1GHz – 18GHz_Vertical Polarization



Frequency Range: 1GHz – 18GHz_Horizontal Polarization



Prüfbericht - Nr.:

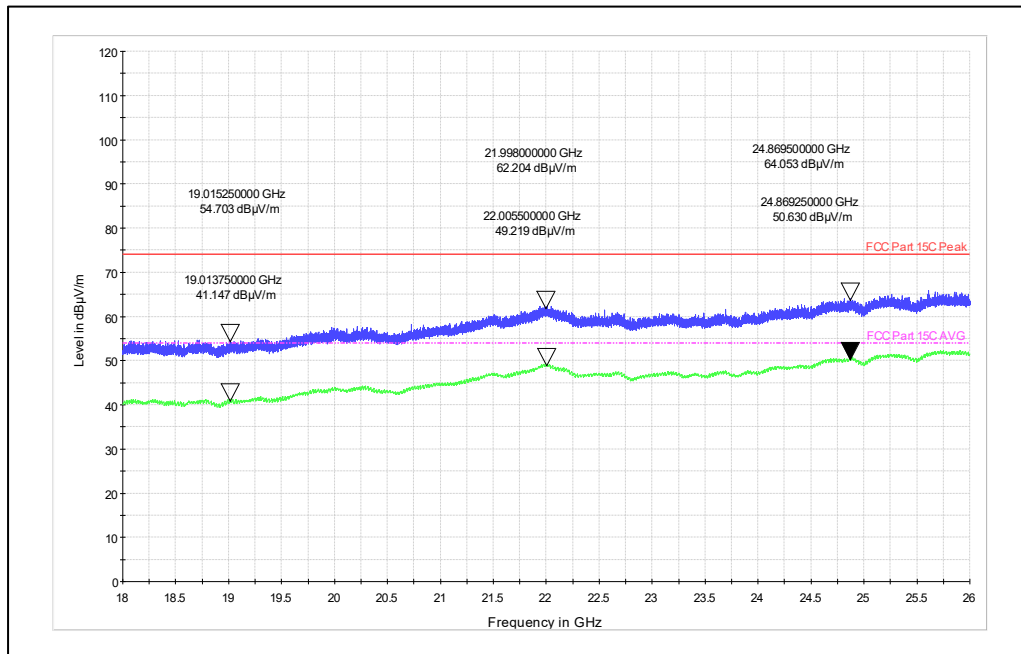
Test Report No.:

IN25YLOB 001

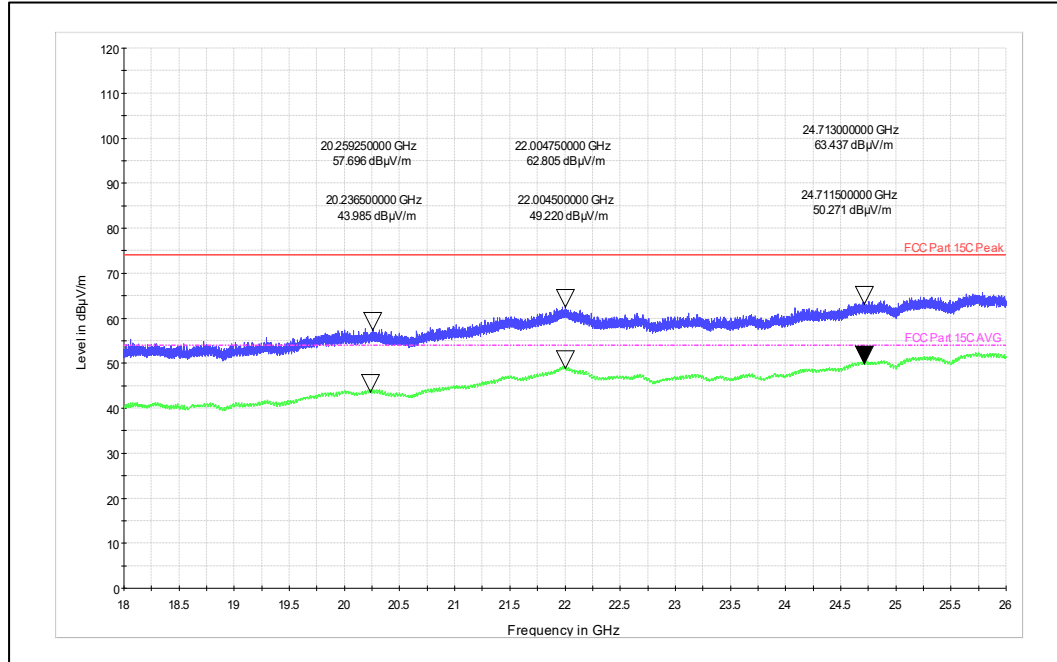
Seite 75 von 79

Page 75 of 79

Frequency range: 18GHz to 26GHz_Vertical Polarization



Frequency range: 18GHz to 26GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 76 von 79
Page 76 of 79

9 AC Power lines Conducted Emission

Result

Pass

Test Specification: FCC Part 15 Section 15.207
RSS Gen Issue 5, Section 8.8
Test Method: ANSI C 63.10-2020
ANSI C63.10-2020/Cor1-2023
Testing Location: Screened room
Measurement Bandwidth: 9kHz
Frequency Range: 150kHz – 30MHz
Supply Voltage: 110VAC,60Hz
Test Method: Refer TEST METHODOLOGY

Limits of section 15.207

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak (dBµV)	Average (dBµV)
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Test Conditions:

Normal Temperature = +24°C Voltage (V norm) = 110V AC through AC to DC Adapter Relative Humidity = 64%

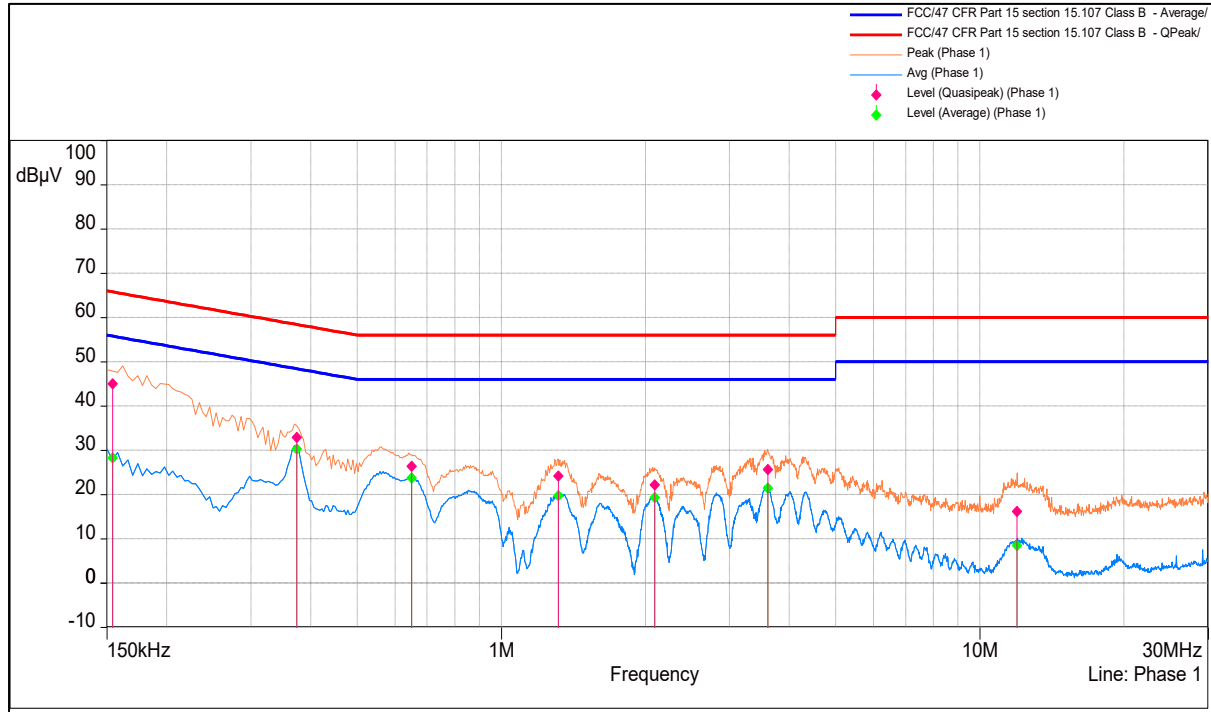
Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 77 von 79
Page 77 of 79

Test Result:

Power: 110V 60Hz_LINE



Quasipeak					
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Comments
0.1554	45.11	65.78	-20.67	Phase 1	Pass
0.37585	32.92	58.41	-25.49	Phase 1	Pass
0.651	26.45	56.00	-29.55	Phase 1	Pass
3.60465	25.64	56.00	-30.36	Phase 1	Pass
1.31355	24.2	56.00	-31.8	Phase 1	Pass
2.08885	22.24	56.00	-33.76	Phase 1	Pass
11.9553	16.21	60.00	-43.79	Phase 1	Pass

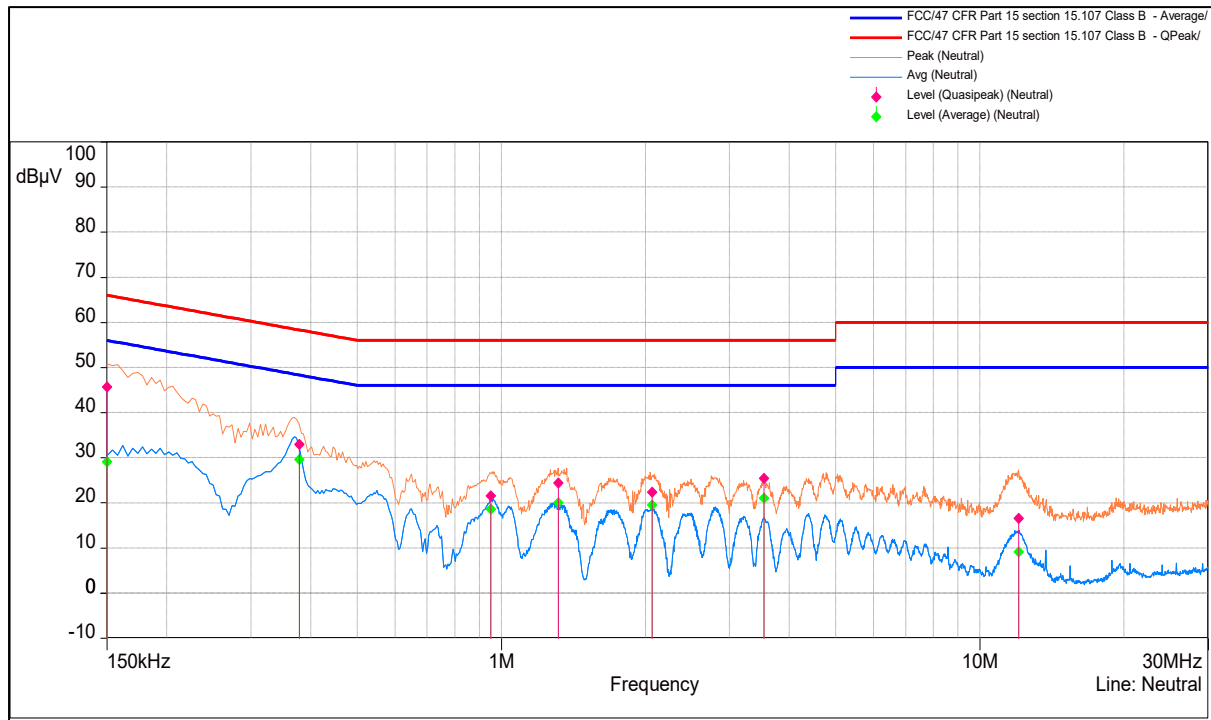
Average					
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Comments
0.37585	30.28	48.41	-18.13	Phase 1	Pass
0.651	23.82	46.00	-22.18	Phase 1	Pass
3.60465	21.53	46.00	-24.47	Phase 1	Pass
1.31355	19.82	46.00	-26.18	Phase 1	Pass
2.08885	19.34	46.00	-26.66	Phase 1	Pass
0.1554	28.36	55.78	-27.43	Phase 1	Pass
11.9553	8.49	50.00	-41.51	Phase 1	Pass

Prüfbericht - Nr.:
Test Report No.:

IN25YLOB 001

Seite 78 von 79
Page 78 of 79

Power: 110V 60Hz_ Neutral



Quasipeak					
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Comments
0.1554	45.11	65.78	-20.67	Phase 1	Pass
0.37585	32.92	58.41	-25.49	Phase 1	Pass
0.651	26.45	56.00	-29.55	Phase 1	Pass
3.60465	25.64	56.00	-30.36	Phase 1	Pass
1.31355	24.2	56.00	-31.8	Phase 1	Pass
2.08885	22.24	56.00	-33.76	Phase 1	Pass
11.9553	16.21	60.00	-43.79	Phase 1	Pass

Average					
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Comments
0.37585	30.28	48.41	-18.13	Phase 1	Pass
0.651	23.82	46.00	-22.18	Phase 1	Pass
3.60465	21.53	46.00	-24.47	Phase 1	Pass
1.31355	19.82	46.00	-26.18	Phase 1	Pass
2.08885	19.34	46.00	-26.66	Phase 1	Pass
0.1554	28.36	55.78	-27.43	Phase 1	Pass
11.9553	8.49	50.00	-41.51	Phase 1	Pass

10 LIST OF TABLES

Table 1: List of test and measurement instruments	7
Table 2: Instrument application Software versions	7
Table 3: Ratings and System Details as declared by Client*	8
Table 4: Measurement Uncertainty	9
Table 5: List of IEEE 802.15.4 Center frequencies	10
Table 6: List of BLE Centre frequencies	11
Table 7: Transmitter limits for Radiated emission	29
Table 8: Test results for frequency range 30MHz – 200MHz	30
Table 9: Test results for frequency range 200MHz – 1GHz	31
Table 10: Test results for the frequencies above 1GHz:	33
Table 11: Transmitter limits for Radiated emission	59
Table 12: Test results for frequency range 30MHz – 200MHz	60
Table 13: Test results for frequency range 200MHz – 1GHz	61
Table 14: Test results for the frequencies above 1GHz:	63

11 List of Figures

Figure 1: Frequency Range 9 kHz- 30 MHz	15
Figure 2: Frequency Range 30 MHz – 200 MHz	15
Figure 3: Frequency Range 200 MHz - 1GHz	16
Figure 4: Frequency Range above 1 GHz	16

12 Power levels used

Power Settings for IEEE 802.15.4

Data rate (kbps)	Channels Frequency (MHz)	Power level (dBm)
250	2405	12.70
	2440	12.70
	2478	12.70
	2480	0.00

Power Settings for BLE

Data rate (Mbps)	Channels Frequency (MHz)	Power level (dBm)
1 & 2	2402	12.70
	2440	12.70
	2478	12.70
	2480	12.70

End of test report