



Prüfbericht-Nr.: <i>Test report no.:</i>	IN24LVFZ 001	Auftrags-Nr.: <i>Order no.:</i>	146898590 0010	Seite 1 von 69 Page 1 of 69
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2503323	Auftragsdatum: <i>Order date:</i>	2024-03-26	
Auftraggeber: <i>Client:</i>	Building robotics Inc 3979 Freedom Circle Suite 210, Santa Clara, California United states of America - 95054			
Prüfgegenstand: <i>Test item:</i>	SU-6E-2W SU6E-2W-LR RM6E-2W RM6E-2W-LR SU-6E-8W SU-6E-8W-LR RM-6E-8W RM-6E-8W-LR			
Bezeichnung <i>Identification</i>	SU-6E-2W SU6E-2W-LR RM6E-2W RM6E-2W-LR SU-6E-8W SU-6E-8W- LR RM-6E-8W RM-6E-8W-LR	Serien -Nr.: <i>Serial no.:</i>	TKUU022313 00001,00052 TR2U022343 00030,00020 TR8U022351 00066,00031 TT8U022351 00061,00046	
Auftrags-Inhalt: <i>Order content:</i>	Testing and issue of Test Report with Grant Certificate			
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C 15.247, 15.207, 15.205 & 15.209 RSS 247 Issue 3 and RSS GEN Issue 5			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2024-04-01			
Prüfmuster-Nr.: <i>Test sample no:</i>	A003483802-004 A003483802-005			
Prüfzeitraum: <i>Testing period:</i>	2024-06-13 - 2024-06-14			
Ort der Prüfung: <i>Place of testing:</i>	Wireless laboratory, Bangalore			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. 27/B,2nd cross road, Electronic city Phase1, Banglore-560100, India FCC Test Site Registration No: 496599 IC Test Site Registration No: 27711			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>		genehmigt von: <i>authorized by:</i>		
Datum: <i>Date:</i>	2024-09-02	Ausstellatum: <i>Issue date:</i>	2024-09-04	
Stellung / Position:	Likhithesh M D Senior Engineer	Stellung / Position:	Madhu K.N Assistant Manager	
Sonstiges / Other:	FCC ID: AQQ-SU6E IC : 10138A-SU6E HVIN: 01-03335-03, SU-6E-2W-LR, RM-6E-2W, RM-6E-2W-LR, SU-6E-8W SU-6E-8W-LR, RM-6E-8W, RM-6E-8W-LR			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
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. This test report only relates to the a. m. 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.				

Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 2 von 69

Page 2 of 69

1	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. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <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>
2	Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. <i>As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged.</i>
3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, 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. <i>The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, 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.</i>

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 3 von 69
Page 3 of 69

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	FCC 15.247(a)(2)	RSS 247 Issue 3, Section 5.2 (a)	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
Conducted Spurious Emission on AC Power lines	FCC 15.207	RSS-Gen Issue 5, Section 8.8	Pass

Product Category: Electronics Testing

Test Discipline: EMC Test Facility

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 4 von 69
Page 4 of 69

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
IN23KSXW 001	01	Initial issue of report	2023-12-05
IN2362JI 001	02	SU6E-2W-LR, RM6E-2W, RM6E-2W-LR	2024-01-11
IN24LVFZ 001	03	SU-6E-8W, SU-6E-8W-LR, RM-6E-8W, RM-6E-8W-LR	2024-09-04

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.....	9
3.1	Product Function and Intended Use.....	9
3.2	Ratings and System Details of Equipment under Test	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	Simultaneous Transmission	10
4.5	Countermeasures to achieve EMC Compliance	10
4.6	List of frequencies	10
4.7	TUV Sample Identification.....	11
5	OPERATIONAL DESCRIPTION.....	12
6	TEST METHODOLOGY	13
6.1	Conducted Spurious Emission AC Power line Test.....	13
6.2	Radiated Emission Test	14
7	TEST RESULTS FOR IEEE 802.15.4	16
7.1	Maximum Peak Conducted Output Power	16
7.2	DTS Bandwidth & 99% Bandwidth.....	18
7.3	Power Spectral Density	21
7.4	Emissions in non-restricted frequency bands and Conducted Spurious Emission.....	23
7.5	Spurious Radiated Emissions & Restricted Bands of Operation	27
8	TEST RESULTS FOR BLUETOOTH LOW ENERGY	41
8.1	Maximum Peak Conducted Output Power	41
8.2	DTS Bandwidth & 99% Bandwidth	43
8.3	Maximum Power Spectral Density	46
8.4	Emissions in non-restricted frequency bands and Conducted Spurious Emission.....	48
8.5	Spurious Radiated Emissions & Restricted Bands of Operation	52
9	Conducted spurious emission Test on AC Power lines.....	66
10	LIST OF TABLES	69
11	List of Figures.....	69
12	Power level used for Testing	69

Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 6 von 69

Page 6 of 69

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.:

IN24LVFZ 001

Seite 7 von 69
Page 7 of 69

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

Radiated Measurement site type:
Fully anechoic chamber (used for above 1 GHz
measurements)

Radiated Measurement site type:
Semi anechoic chamber (used for below 1 GHz
measurements)

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
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	23.03.2025	Yearly	
Balun & Biconical Antenna	Schwarzbeck Mess-Elektronik	BBA 9106+VHBB 9124	9124-1117	-	06.03.2025	Yearly	
Log Periodic Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-324	-	31.05.2025	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-01944	-	28.10.2024	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	15.01.2025	Yearly	
EMI Test Receiver	Rohde & Schwarz	ESW44	101773	1.72.SP1	26.01.2025	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	Conducted Test Parameters
Spectrum Analyzer	Agilent	E4407B	ESA-E	A.14.07	04-01-2025	Yearly	
10dB Attenuator	H+S Electronics Pvt. Ltd	6810.17. A	770041	-	03.08.2025	Yearly	
Signal Analyzer	Rohde & Schwarz	FSV7	101644	3.48 SP3	09.02.2025	Yearly	
Line Impedance Stabilization Network	Rohde & Schwarz	ENV 216	101434	-	15.04.2025	Yearly	
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100811	-	08.07.2025	Yearly	Conducted AC Power line Test

Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 8 von 69

Page 8 of 69

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

The Micro Sensor is our sixth-generation 2-wire sensor, delivering all the functionality of our other sensors in a minimally sized package. This version supports direct connection to 2-wire compatible DALI drivers. Integrated sensors capture data that is both processed locally and transmitted over the Enlighted network, enabling a full suite of applications. In addition, the sensor supports Bluetooth® Low Energy communication with tags and other BLE beacon devices.

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
Transmitting Power Level		Refer clause 12	8dBm Transmitted power level
Maximum Measured Power (e.i.r.p)		6.85 dBm at 2405MHz SU-6E-2W	9.64 dBm at 2440MHz SU-6E-2W
Modulation		IEEE 802.15.4: OQPSK	BLE:GFSK
Number of antennas		1	
Antenna Gain & Type		0dBi & Wire antenna (internal)	
Supply Voltage to Product		(9.5 – 22.5VDC) for SU-6E-2W	
Environmental conditions	Storage	0° to 60°	
	Operating	32° to 122° F / 0° to 50° C	
EUT Dimension		30 X 25 X 13 mm(Height X Outer diameter X Inner diameter)	

***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.

Note:

There are various models of the **SU-6E-2W** product, all models are electrically identical. As a result, we evaluated the **SU-6E-2W**, a higher version of the product, and presented the worst-case test results.

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): 01-03335-03
Software version : ETS V_1.8

4.3 Special Accessories and Auxiliary Equipment

Test laptop (Tera Term VT ver 4.106),
USB Cable & TTL to USB Converter

4.4 Simultaneous Transmission

- None

4.5 Countermeasures to achieve EMC Compliance

- None

4.6 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 4: List of IEEE 802.15.4 Center frequencies

Channel used for IEEE 802.15.4 testing.

Channel low: 2405MHz

Channel mid: 2440MHz

Channel high : 2480MHz

Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 11 von 69

Page 11 of 69

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 5: List of BLE Centre frequencies

Channel used for BLE testing.

Channel low: 2402MHz

Channel mid: 2440MHz

Channel high : 2480MHz

4.7 TUV Sample Identification

- TUV Sample Identification number: A003483802-004 – Radiated test Sample
A003483802-005 – Conducted test Sample

5 OPERATIONAL DESCRIPTION

The Micro Sensor SU-6E-2W is powered through DALI PSU, is a complete sensing and lighting control node powered from its attached light fixture. Integrated sensors capture data that is both processed locally and transmitted over the network, enabling a full suite of applications. With integrated wireless communications for data transmission and remote configuration as well as autonomous fixture-level control, this sensor brings advanced lighting automation to a whole new level.

In addition, the sensor supports Bluetooth Low Energy communication with tags and other BLE devices. An embedded BLE radio allows the sensor to receive and transmit beacons as well as support communication with lighting control devices and other sensor.

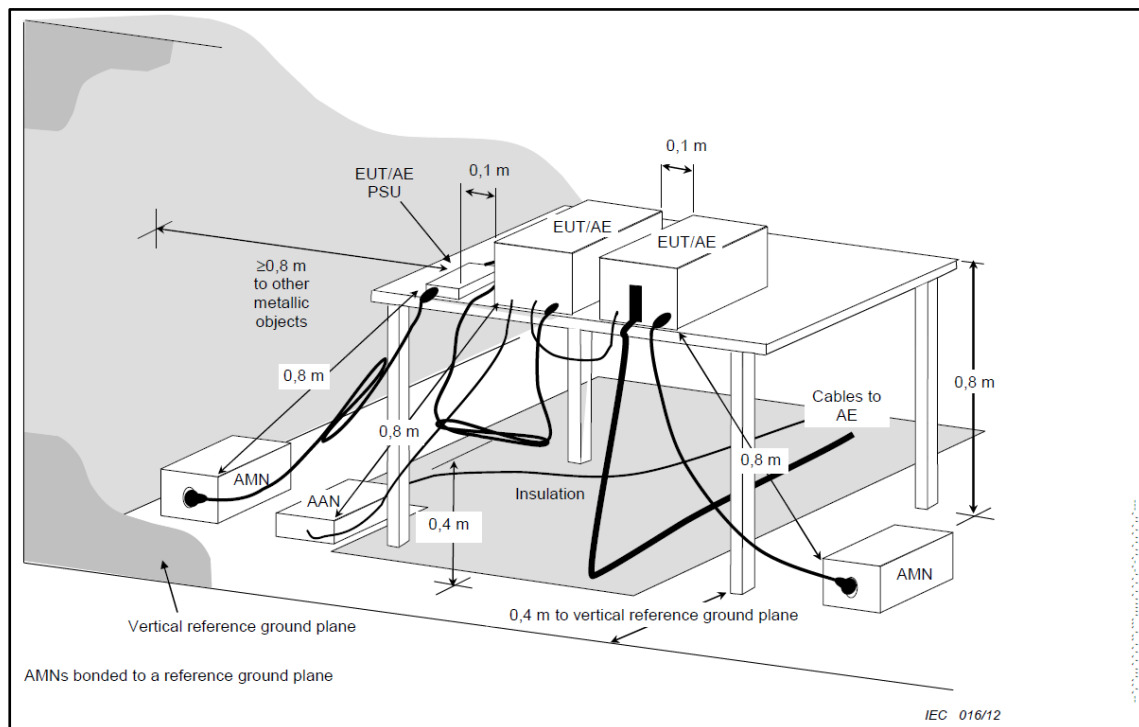
6 TEST METHODOLOGY

6.1 Conducted Spurious Emission AC Power line Test.

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 C63.10-2013. 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

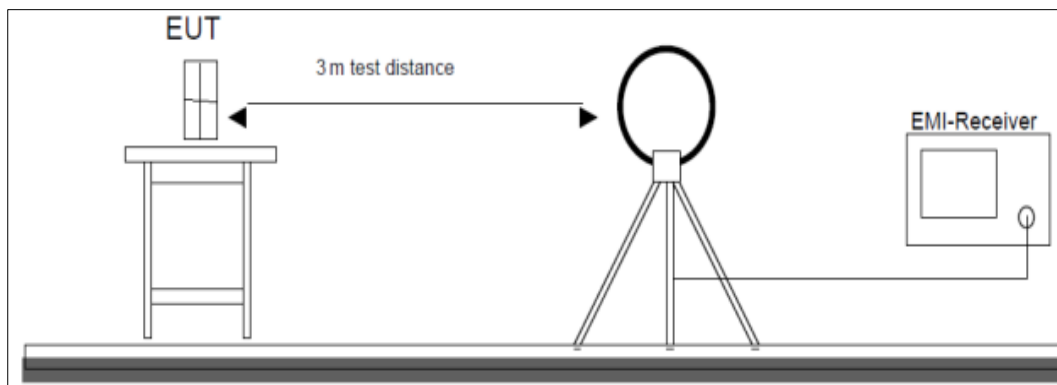


Figure 1: Frequency Range 9 kHz- 30 MHz

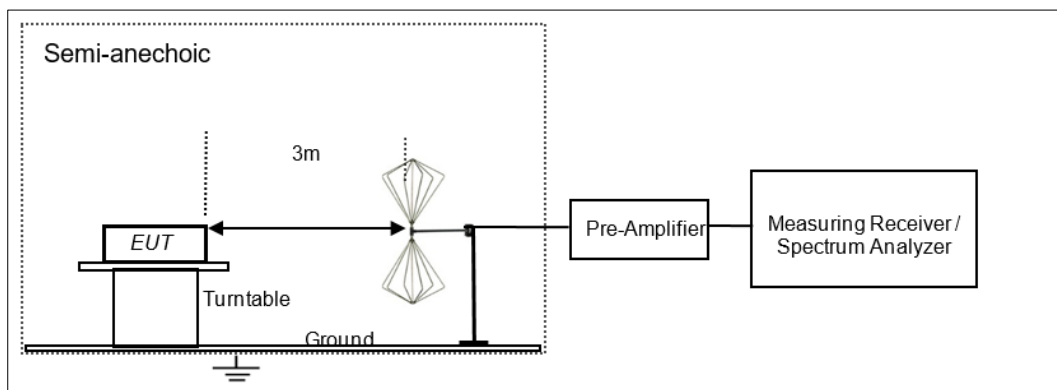


Figure 2: Frequency Range 30 MHz – 200 MHz

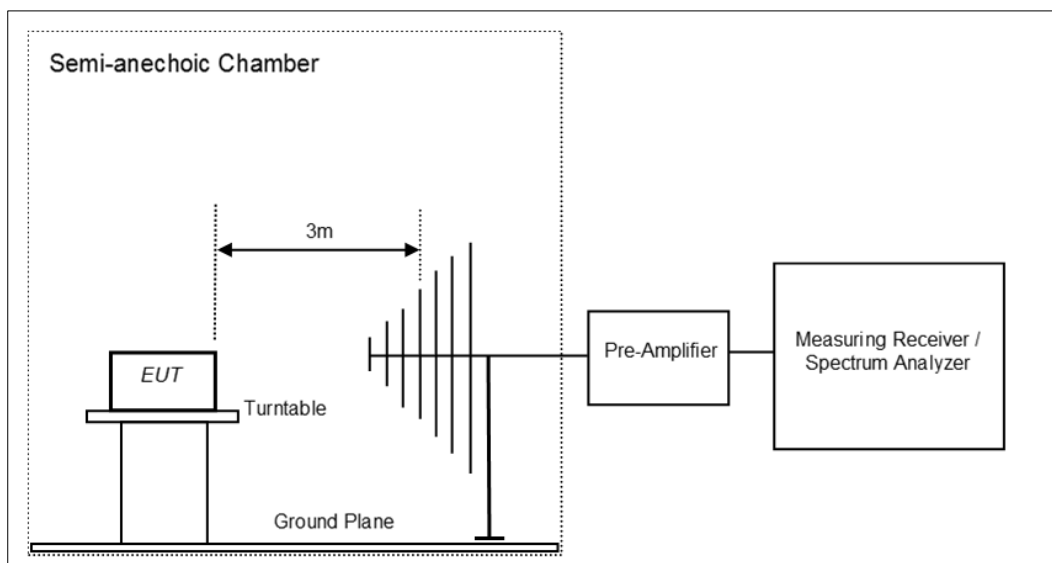


Figure 3: Frequency Range 200 MHz - 1GHz

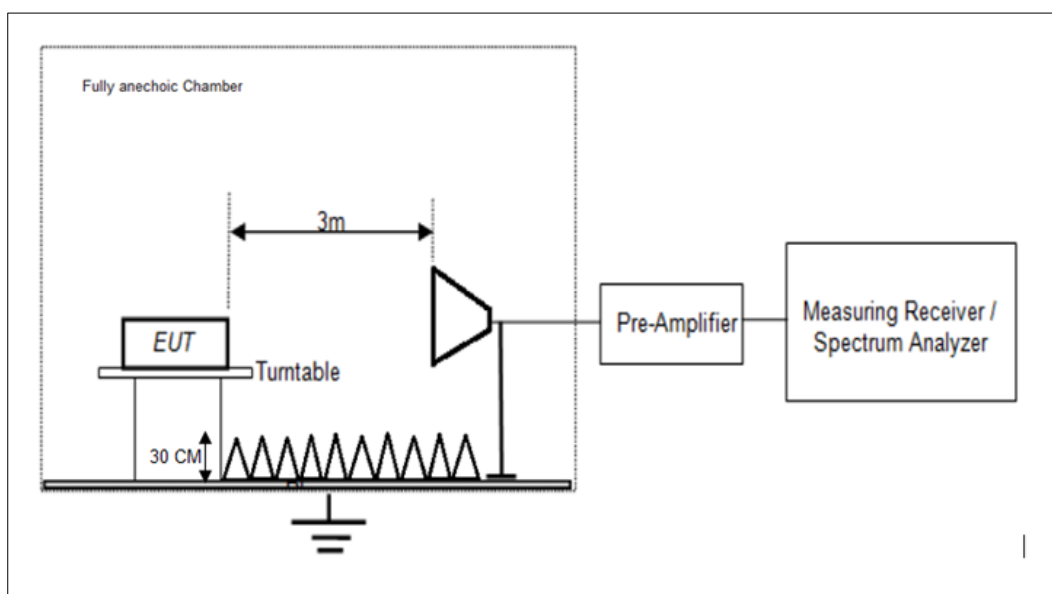


Figure 4: Frequency Range above 1 GHz

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 16 von 69
Page 16 of 69

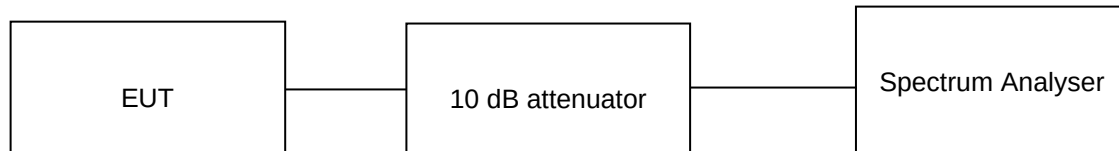
7 TEST RESULTS FOR IEEE 802.15.4

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
Measurement Bandwidth	1MHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power $\leq$ 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °

Voltage: 24V DC through DC supply

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.:

IN24LVFZ 001

Seite 17 von 69

Page 17 of 69

Test results:

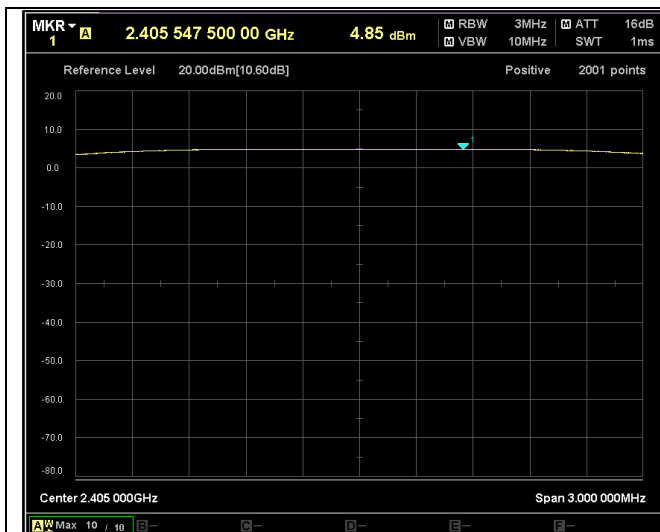
Note:

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)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is -1.0 dBi.

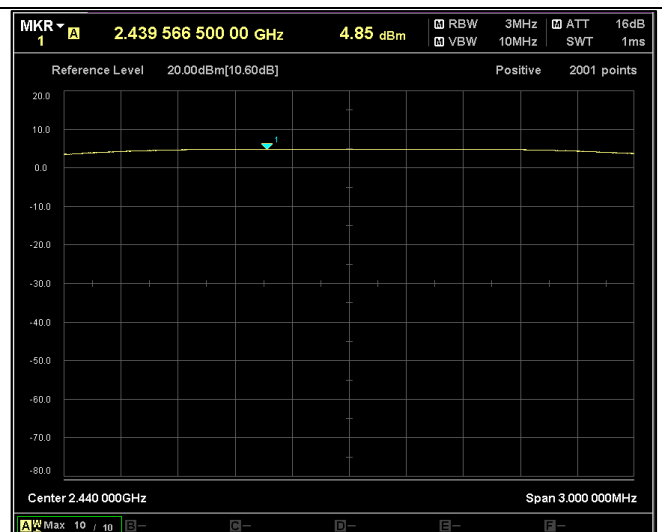
SU-6E-2W:

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	2405	4.85	3.85	30	36
	2440	4.85	4.85	30	36
	2480	1.57	1.57	30	36

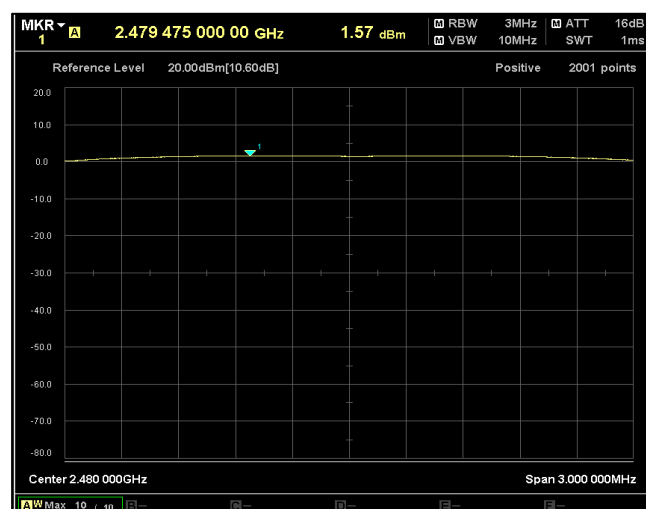
Test Plots:



Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 18 von 69
Page 18 of 69

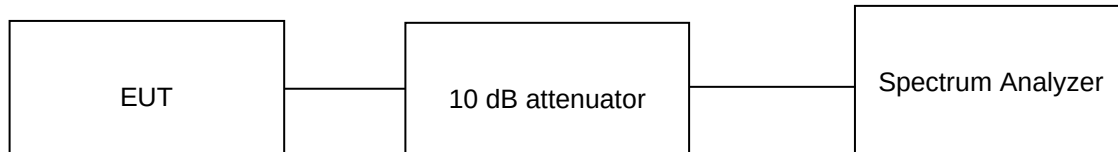
7.2 DTS Bandwidth & 99% Bandwidth

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
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: 9.5-22.5V DC/180 mW

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.:

IN24LVFZ 001

Seite 19 von 69
Page 19 of 69

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 0 dBi.

SU-6E-2W:

Data Rate (Mbps)	Channel Frequency (MHz)	99% Occupied bandwidth (MHz)	6dB BW (MHz)	Limit (kHz)
1Mbps	2405	2.24	1.34	0.5
	2440	2.26	1.41	0.5
	2480	2.29	1.47	0.5

Test Plots:

6dB DTS Plots

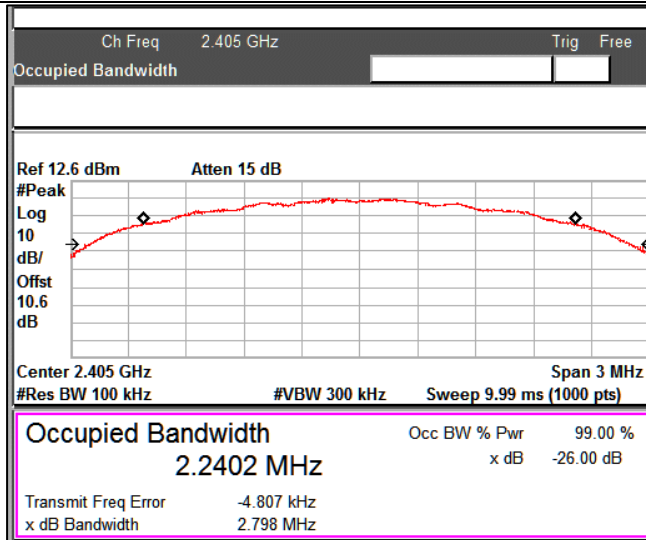


Prüfbericht - Nr.:
Test Report No.:

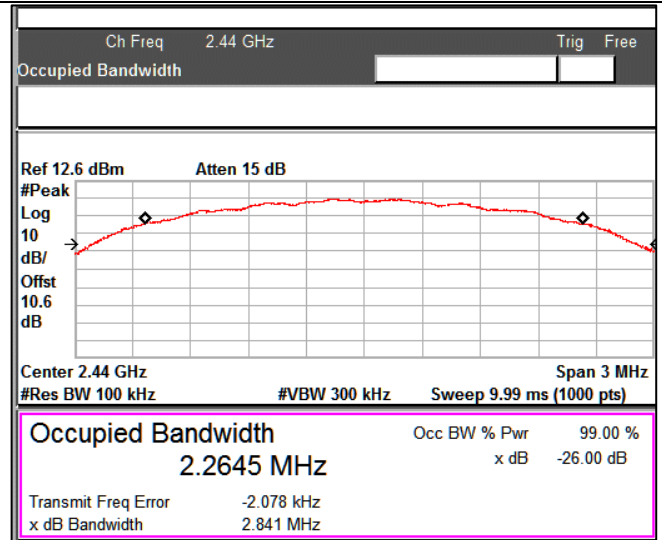
IN24LVFZ 001

Seite 20 von 69
Page 20 of 69

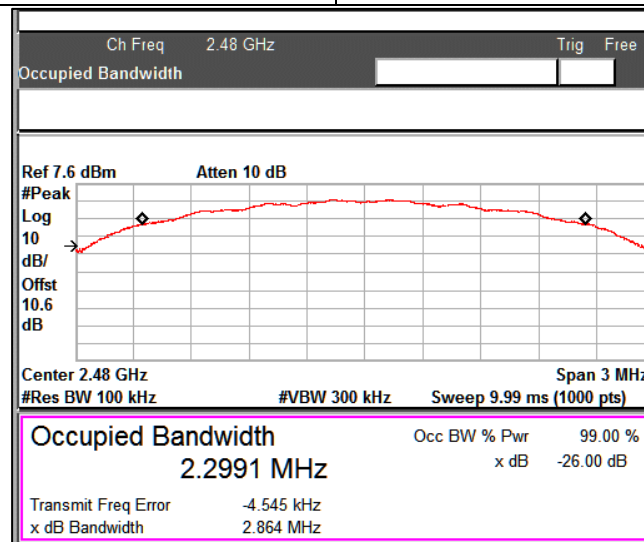
99% OBW plots



Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 21 von 69
Page 21 of 69

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

Measurement Bandwidth

3 kHz

Detector

Peak

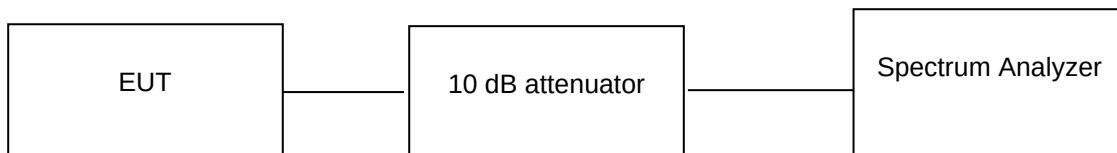
Port of testing

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: 9.5-22.5V DC/180 mW

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.:

IN24LVFZ 001

Seite 22 von 69
Page 22 of 69

Test results:

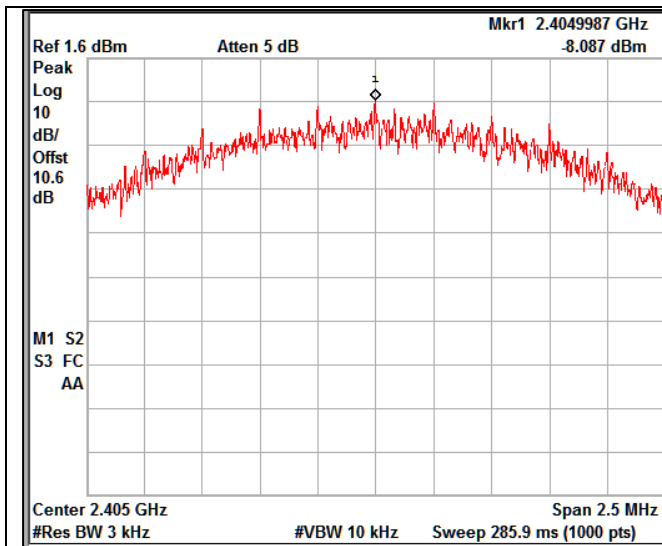
Note:

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

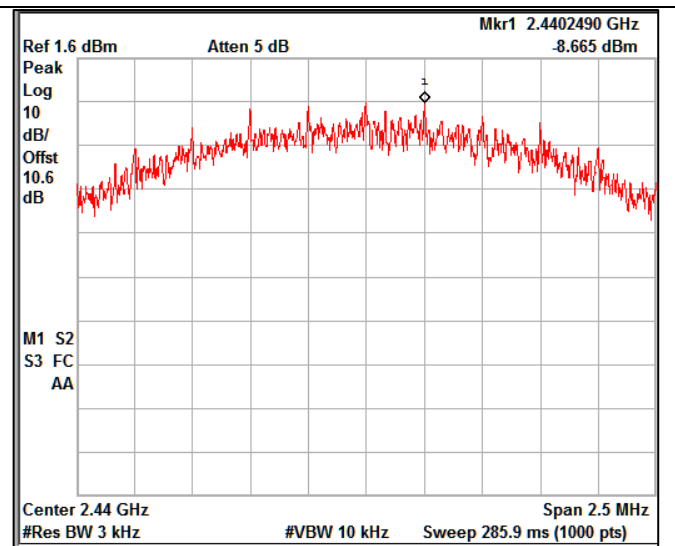
SU-6E-2W:

Data Rate (Mbps)	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	PSD Limit (dBm/kHz)
1Mbps	2405	-8.08	8.00
	2440	-8.66	8.00
	2480	-10.97	8.00

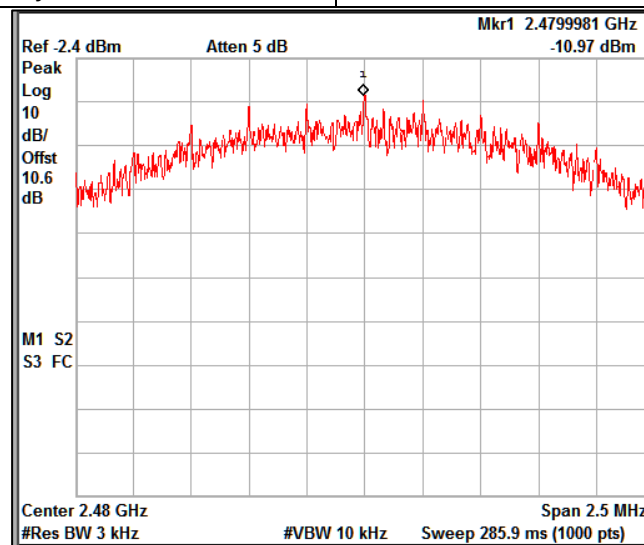
Test Plots:



Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 23 von 69
Page 23 of 69

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

Measurement Bandwidth

100 kHz

Detector

Peak

Port of testing

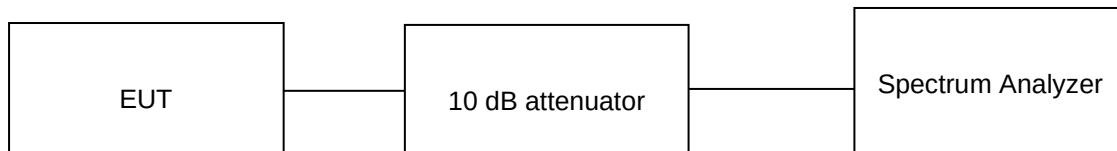
Antenna port

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: 9.5-22.5V DC/180 mW

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.:

IN24LVFZ 001

Seite 24 von 69

Page 24 of 69

Test results:

Note:

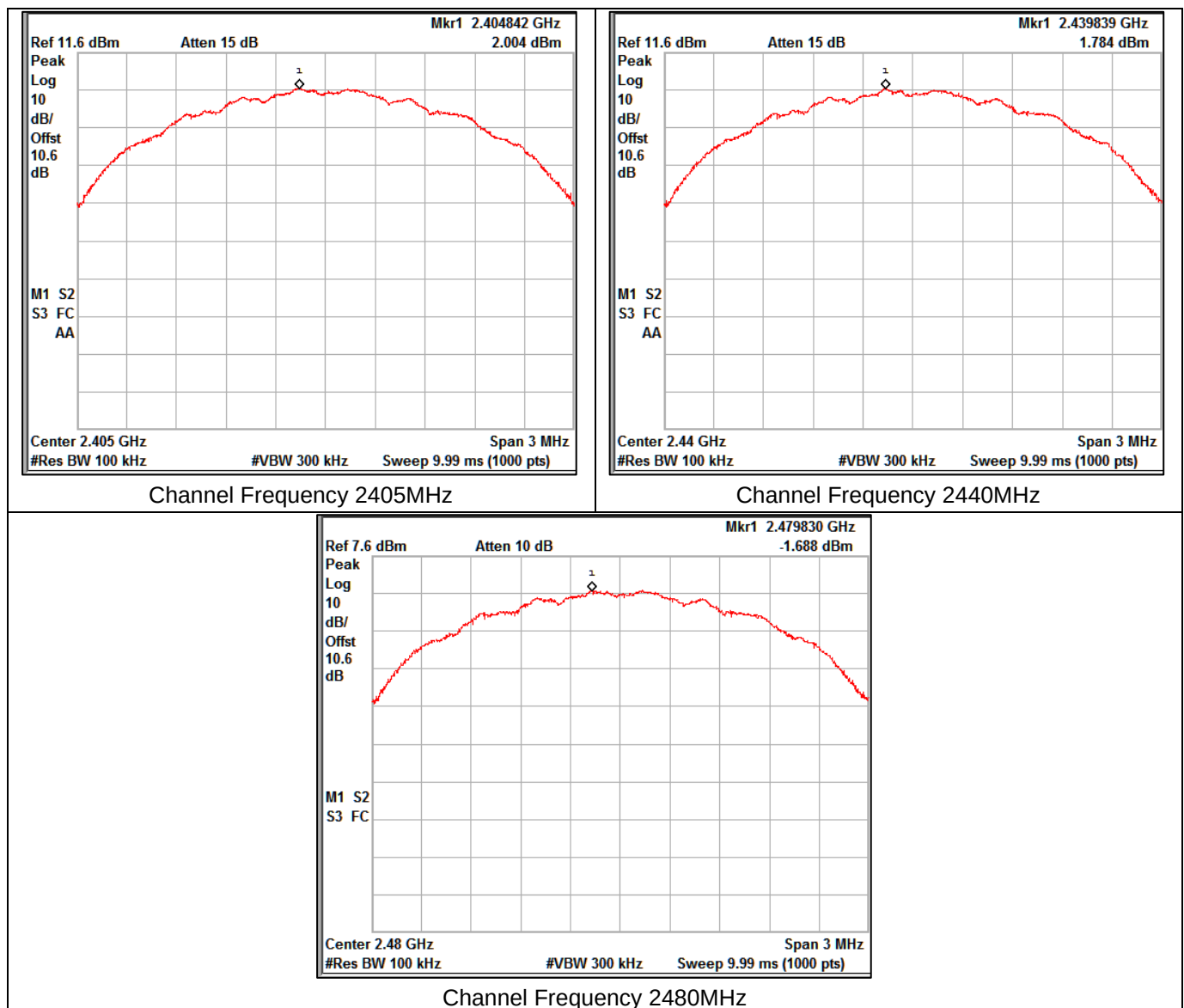
1. All the losses are included during measurement and final values are mentioned in the test report
2. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 0dBi.

SU-6E-2W:

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	-38.83	2.00	-40.83	-20
2480.00	2483.50	-46.75	-1.68	-45.07	-20

Reference Plots:

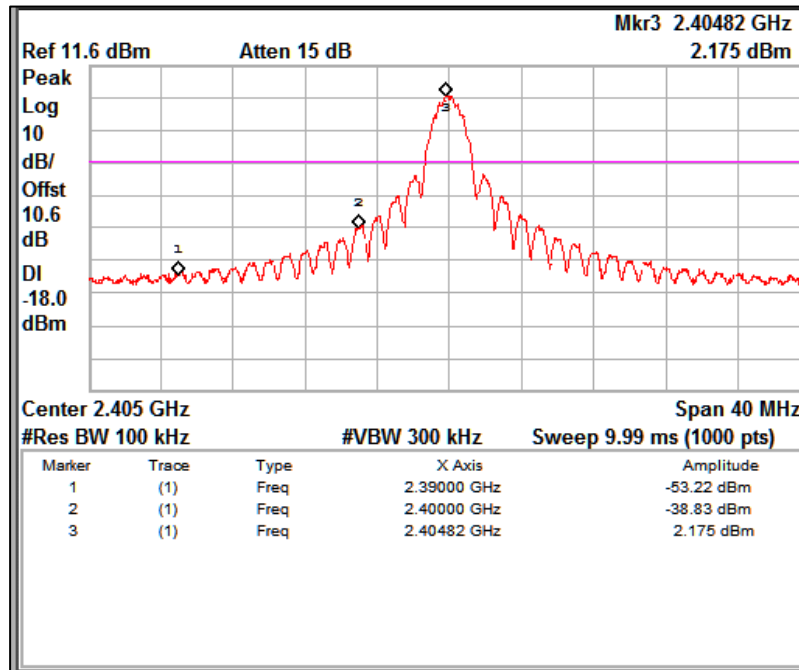


Prüfbericht - Nr.:
Test Report No.:

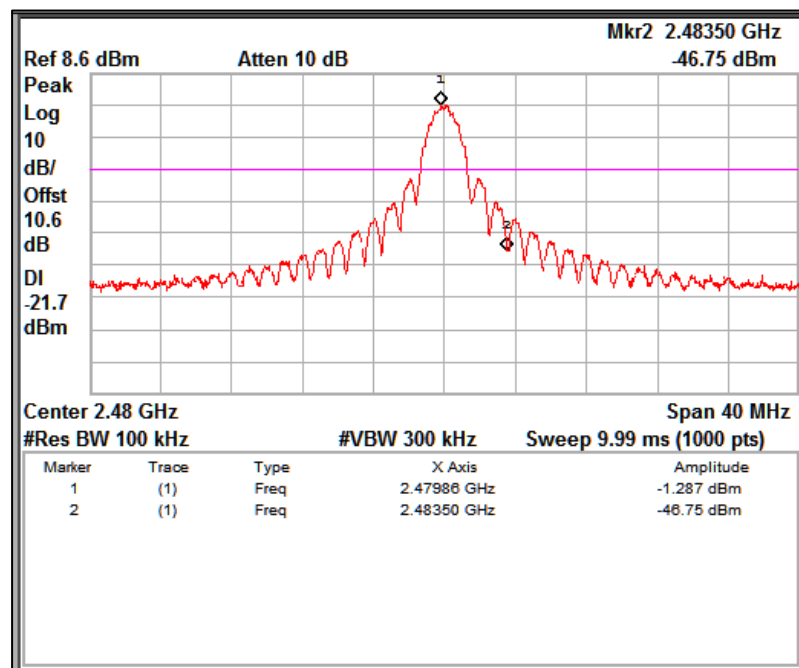
IN24LVFZ 001

Seite 25 von 69
Page 25 of 69

Bandedge Plots:



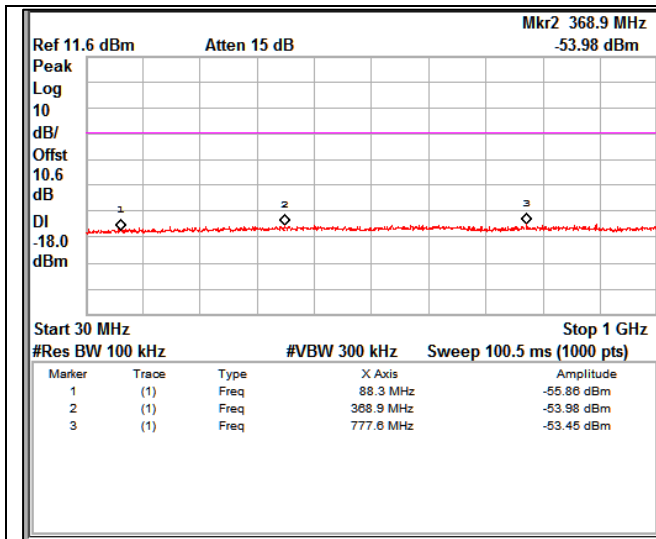
Channel Frequency:2405MHz



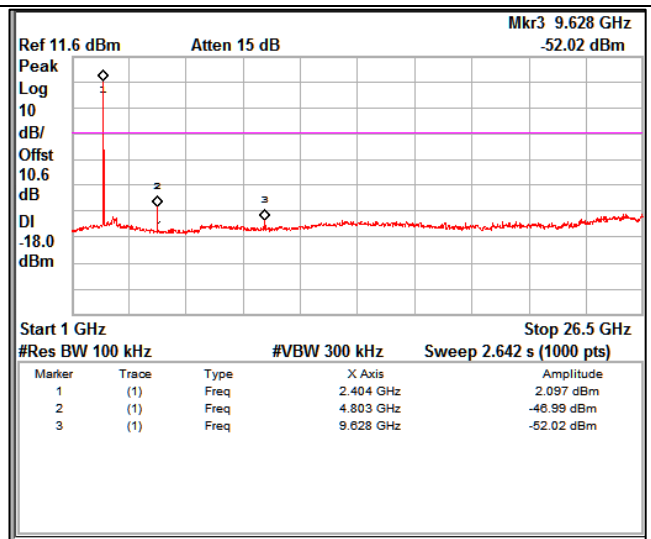
Channel Frequency:2480MHz

7.4.2 Out-Of-Band Emissions

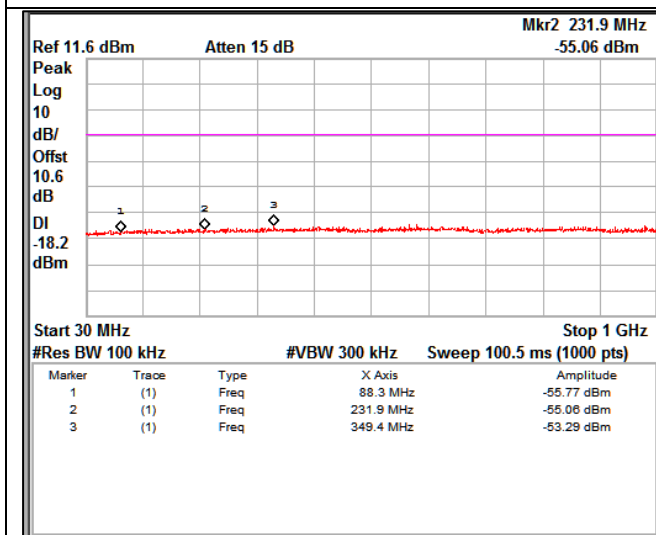
SU-6E-2W



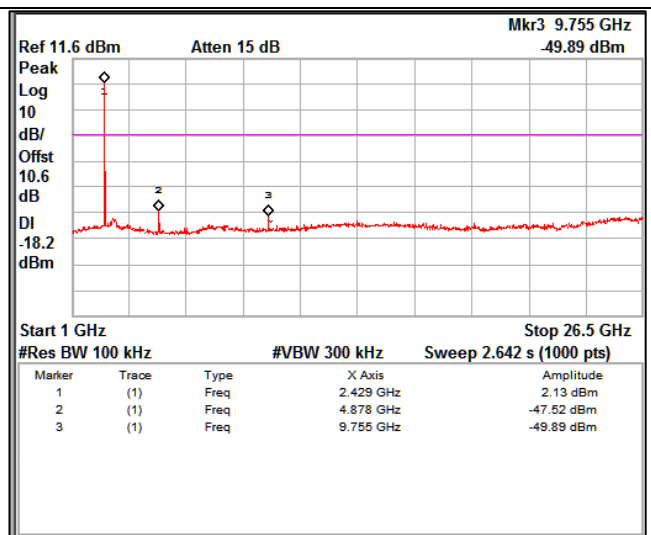
Channel Frequency: 2405MHz Frequency Range 30MHz – 1GHz



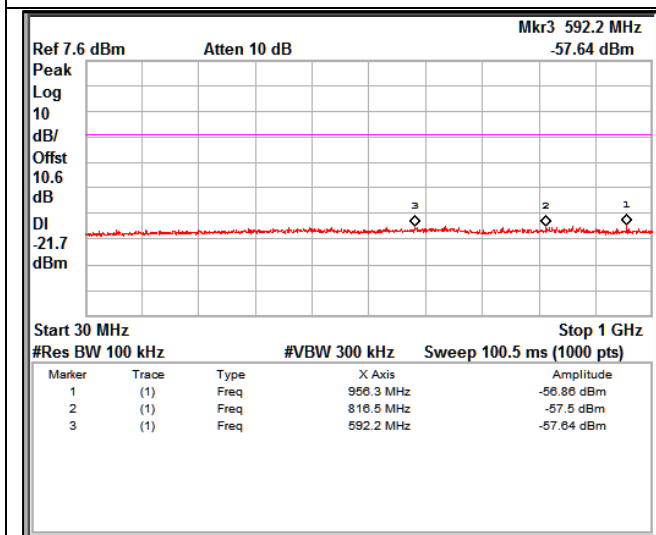
Channel Frequency: 2405MHz Frequency Range 1GHz – 26.5GHz



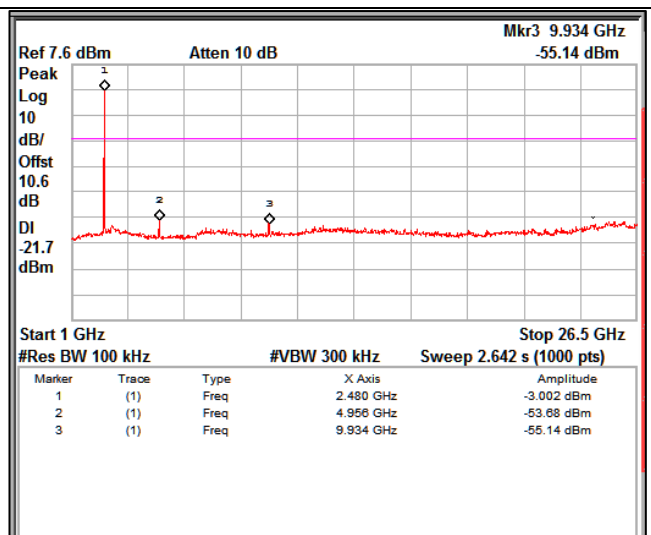
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



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



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



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

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 27 von 69
Page 27 of 69

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
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 6: 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: Microsensor SU-6E-2W & 9.5 – 22.5VDC/180 mW Relative humidity: 65%

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 28 von 69
Page 28 of 69

Test results of SU-6E-2W :

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.

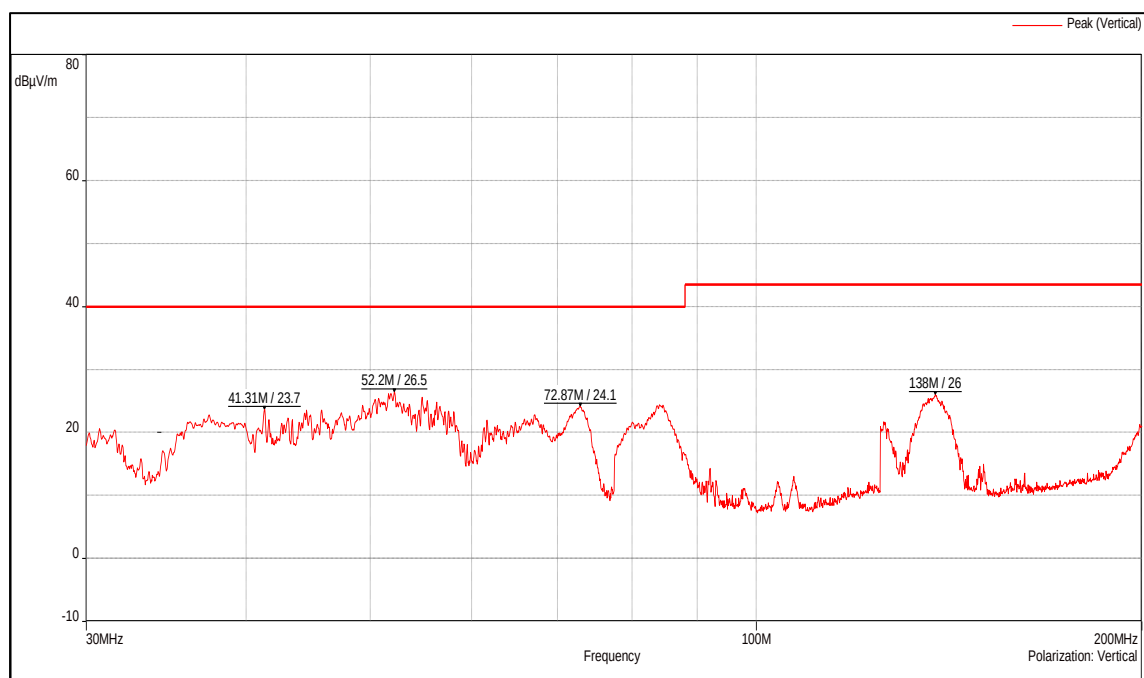
Test results of SU-6E-2W:

Table 7: 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	41.31	23.70	40.00	-16.30
	52.20	26.50	40.00	-13.50
	72.87	24.10	40.00	-15.90
	138.00	26.00	43.50	-17.50
Horizontal	47.07	29.00	40.00	-11.00
	52.02	29.00	40.00	-11.00
	73.89	25.10	40.00	-14.90
	143.01	21.60	43.50	-21.90

Frequency Range: 30MHz -200MHz_Vertical Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 29 von 69
Page 29 of 69

Frequency Range: 30MHz -200MHz_Horizontal Polarization

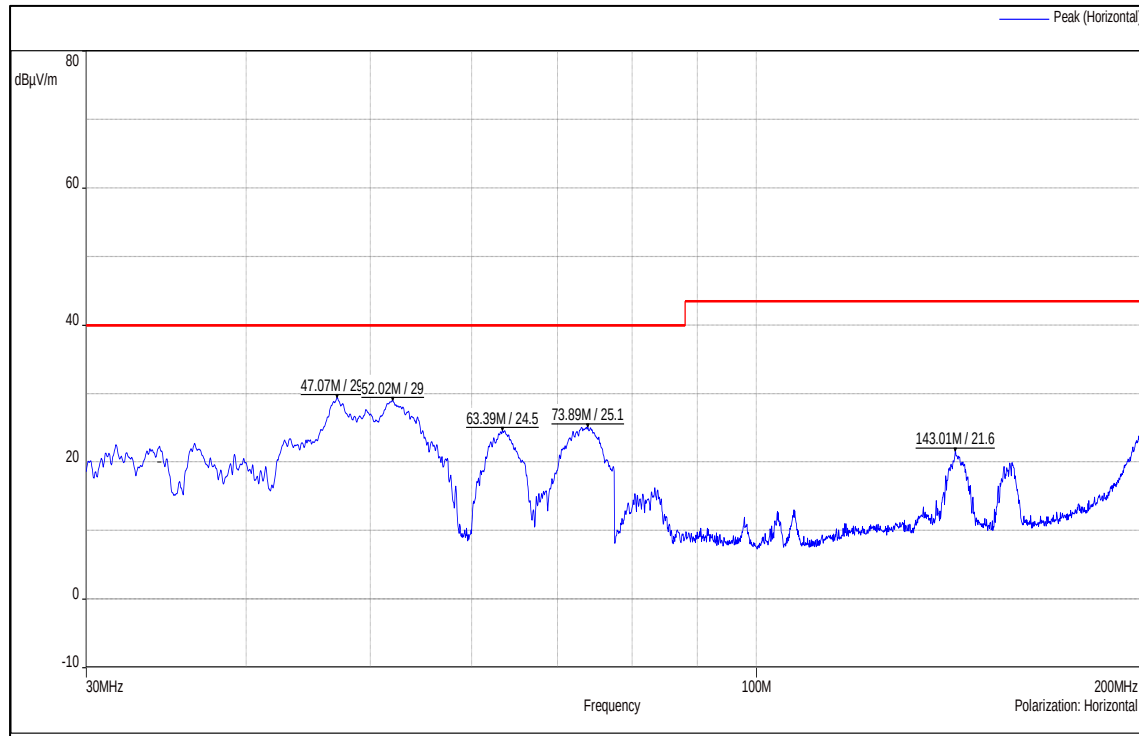


Table 8: Test results for frequency range 200MHz – 1GHz

IEEE 802.15.4:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	204.59	34.90	43.50	-8.60
	265.70	32.20	46.00	-13.80
	342.65	33.60	46.00	-12.40
	449.21	36.00	46.00	-10.00
	545.21	30.40	46.00	-15.60
Horizontal	342.17	37.00	46.00	-9.00
	449.15	34.40	46.00	-11.60
	546.92	28.60	46.00	-17.40
	698.48	32.50	46.00	-13.50

Prüfbericht - Nr.:

Test Report No.:

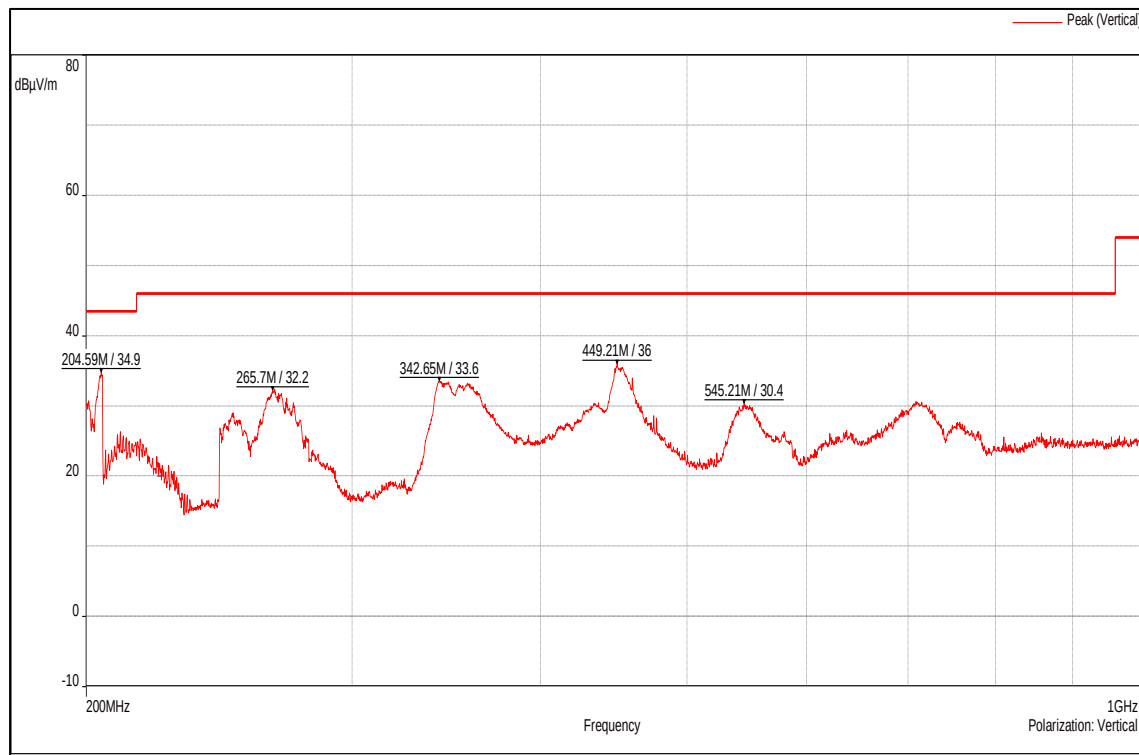
IN24LVFZ 001

Seite 30 von 69

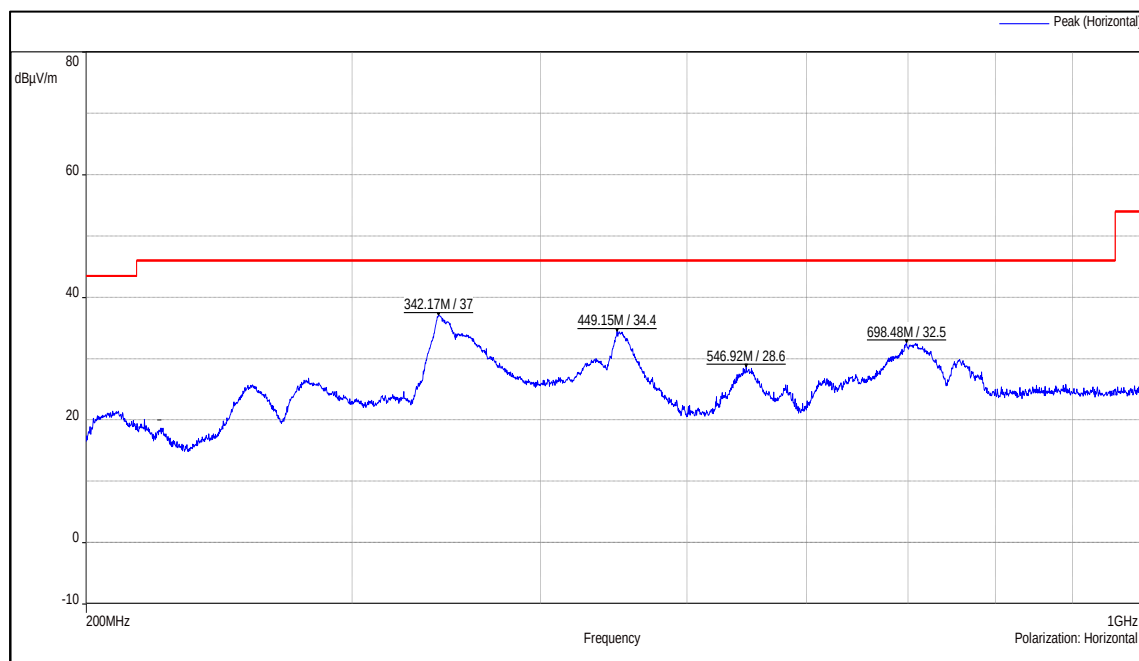
Page 30 of 69

IEEE 802.15.4 Plots:

Frequency Range: 200MHz – 1GHz_Vertical Polarization



Frequency Range: 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 31 von 69
Page 31 of 69

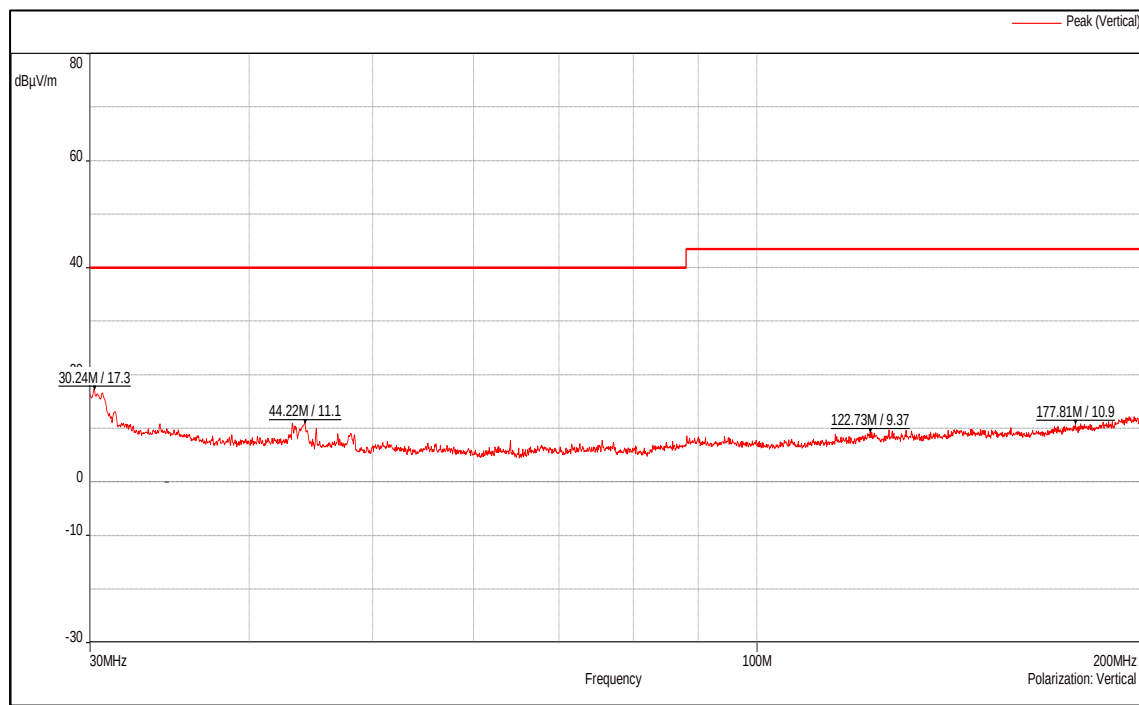
Test results of SU-6E-8W:

Table 9: 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	30.24	17.30	40.00	-22.70
	44.22	11.10	40.00	-28.90
	122.73	9.37	43.50	-34.13
	177.81	10.90	43.50	-32.60
Horizontal	30.03	18.90	40.00	-21.10
	47.01	11.00	40.00	-29.00
	73.77	7.04	40.00	-32.96
	132.63	12.40	43.50	-31.10

Frequency Range: 30MHz -200MHz_Vertical Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 32 von 69
Page 32 of 69

Frequency Range: 30MHz -200MHz_Horizontal Polarization

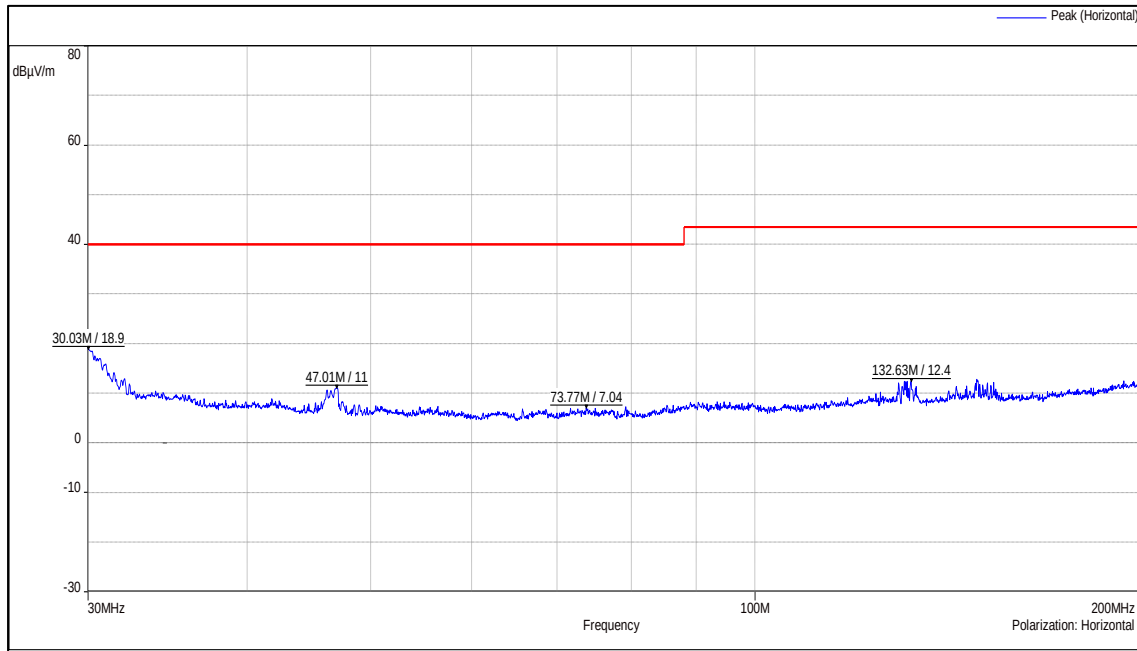


Table 10: Test results for frequency range 200MHz – 1GHz

IEEE 802.15.4:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	221.03	15.40	46.00	-30.60
	292.43	18.70	46.00	-27.30
	368.48	17.40	46.00	-28.60
	750.56	22.30	46.00	-23.70
Horizontal	221.30	15.30	46.00	-30.70
	297.65	23.30	46.00	-22.70
	478.97	22.00	46.00	-24.00
	768.92	20.70	46.00	-25.30

Prüfbericht - Nr.:

Test Report No.:

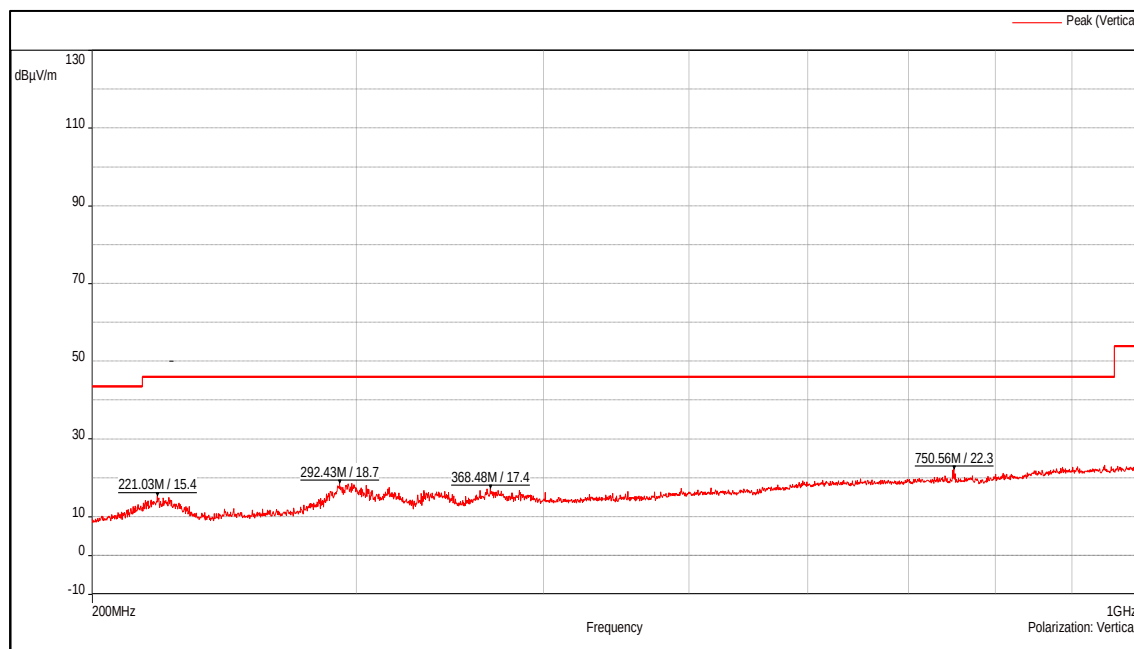
IN24LVFZ 001

Seite 33 von 69

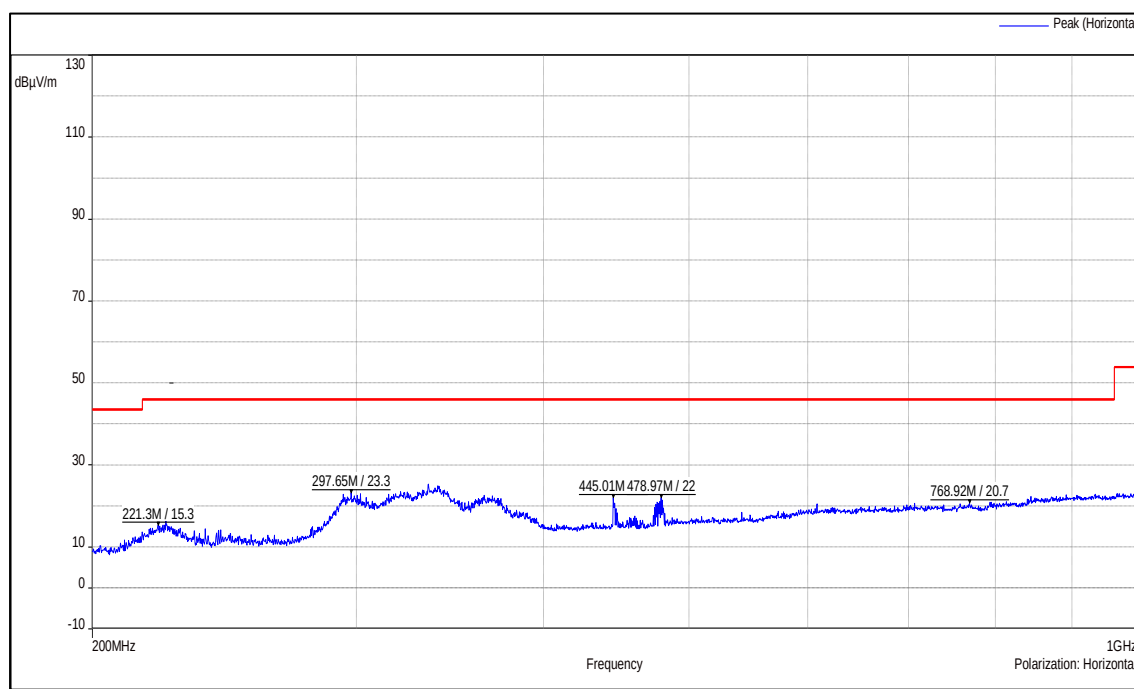
Page 33 of 69

IEEE 802.15.4 Plots:

Frequency Range: 200MHz – 1GHz_Vertical Polarization



Frequency Range: 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 34 von 69

Page 34 of 69

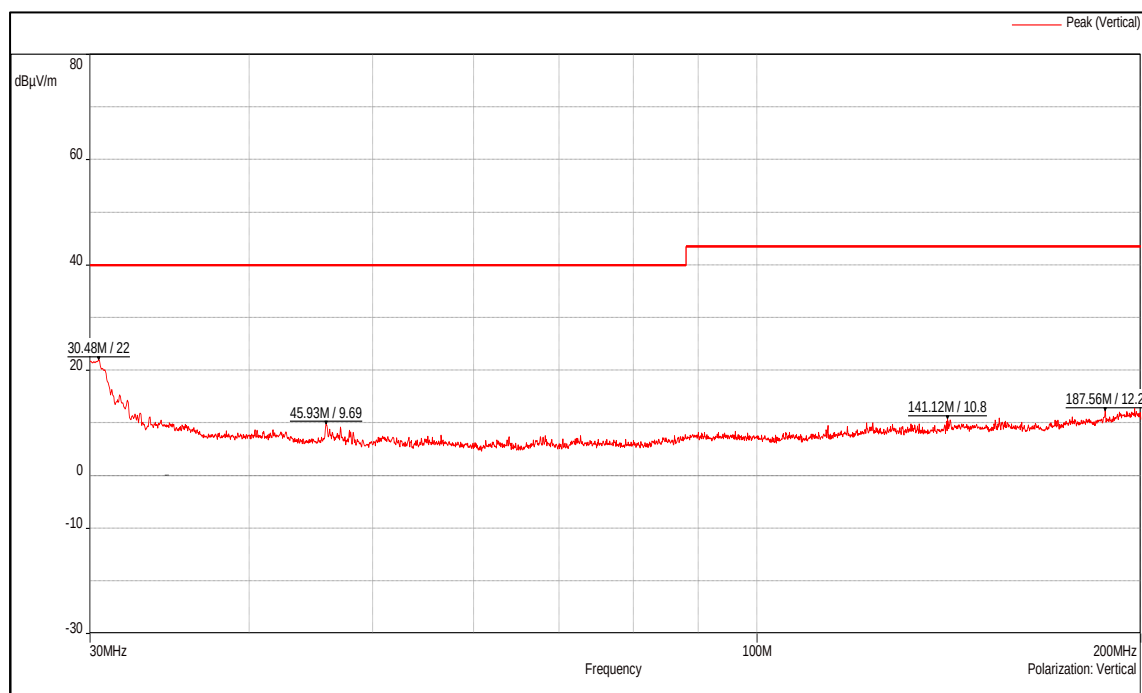
Test results of RM-6E-8W-LR:

Table 11: 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	30.48	22.00	40.00	-18.00
	45.93	9.69	40.00	-30.31
	141.12	10.80	43.50	-32.70
	187.56	12.20	43.50	-31.30
Horizontal	30.12	18.70	40.00	-21.30
	47.52	10.50	40.00	-29.50
	92.34	14.30	43.50	-29.20
	112.59	13.10	43.50	-30.40
	166.98	16.20	43.50	-27.30

Frequency Range: 30MHz -200MHz_Vertical Polarization



Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 35 von 69

Page 35 of 69

Frequency Range: 30MHz -200MHz_Horizontal Polarization

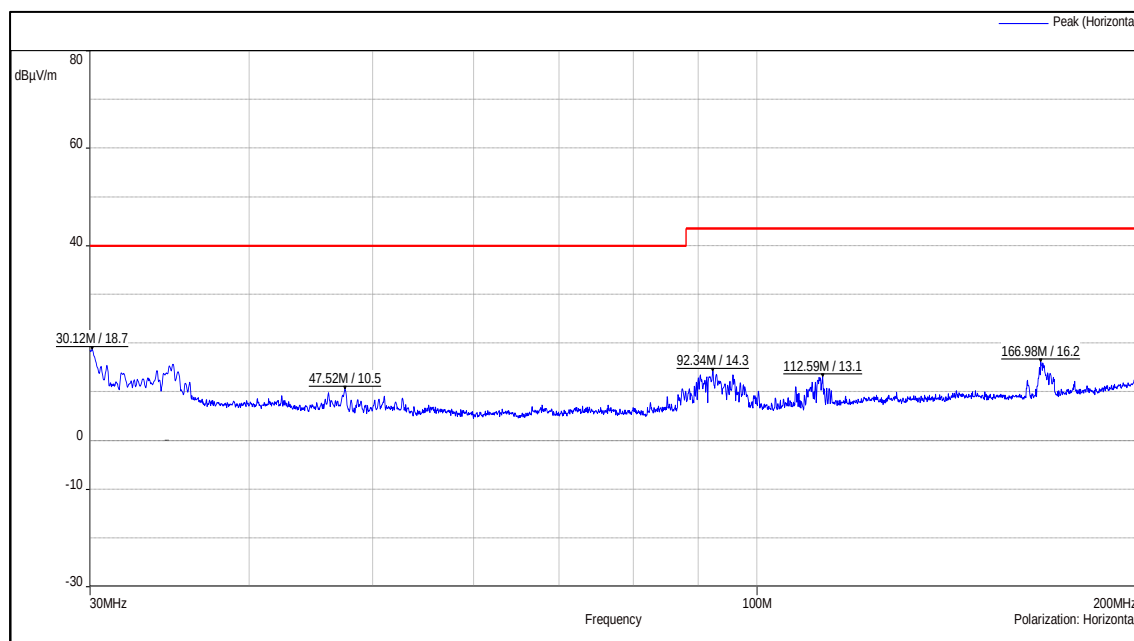


Table 12: Test results for frequency range 200MHz – 1GHz

IEEE 802.15.4:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	203.66	25.10	43.50	-18.40
	346.61	31.00	46.00	-15.00
	619.10	21.00	46.00	-25.00
Horizontal	212.60	19.70	46.00	-26.30
	303.71	25.60	46.00	-20.40
	445.49	23.20	46.00	-22.80

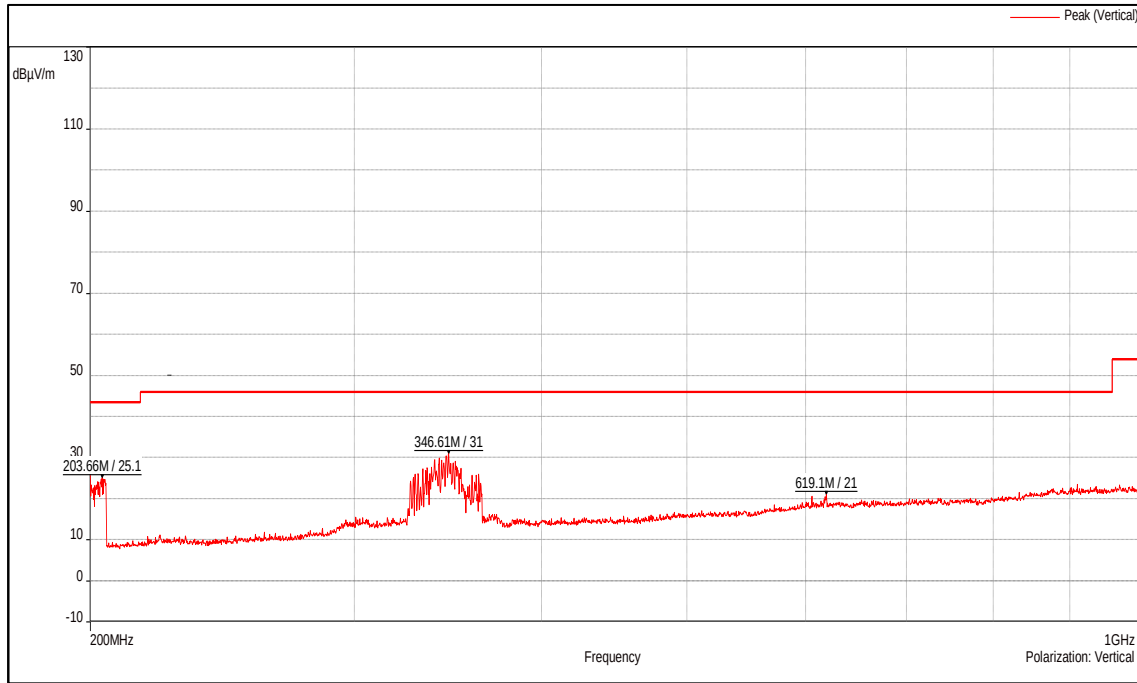
Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

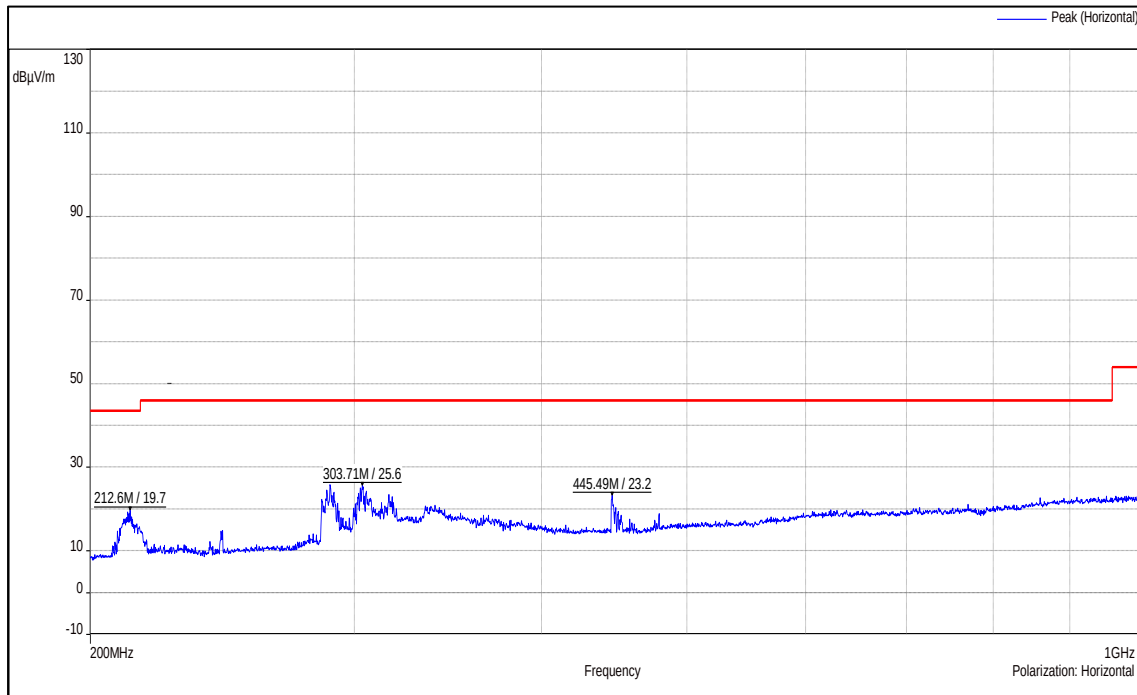
Seite 36 von 69
Page 36 of 69

IEEE 802.15.4 Plots:

Frequency Range: 200MHz – 1GHz_Vertical Polarization



Frequency Range: 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 37 von 69
Page 37 of 69

Table 13: Test results for the frequencies above 1GHz:

SU-6E-2W IEEE 802.15.4:

Data Rate: 1 Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2405	2405(Pk)	Vertical	94.02	-	-
	2405(Av)		91.50	-	-
	2390(Pk)		41.76	74.00*	-32.24
	2390(Av)		31.65	54.00*	-22.35
	4810(Pk)		45.90	74.00	-28.10
	4810(Av)		35.70	54.00	-18.30
	7215(Pk)		46.50	74.00	-27.50
	7215(Av)		34.71	54.00	-19.29
	2405(Pk)	Horizontal	93.52	-	-
	2405(Av)		90.99	-	-
	2390(Pk)		42.05	74.00*	-31.95
	2390(Av)		32.00	54.00*	-22.00
	4810(Pk)		42.77	74.00	-31.23
	4810(Av)		31.06	54.00	-22.94
	7215(Pk)		47.41	74.00	-26.59
	7215(Av)		34.66	54.00	-19.34
2440	2440(Pk)	Vertical	94.08	-	-
	2440(Av)		91.49	-	-
	4880(Pk)		44.72	74.00	-29.28
	4880(Av)		34.31	54.00	-19.69
	7320(Pk)		46.55	74.00	-27.45
	7320(Av)		35.02	54.00	-18.98
	2440(Pk)	Horizontal	94.11	-	-
	2440(Av)		91.52	-	-
	4880(Pk)		43.97	74.00	-30.03
	4880(Av)		31.40	54.00	-22.60
	7320(Pk)		47.19	74.00	-26.81
	7320(Av)		34.73	54.00	-19.27
2480	2480(Pk)	Vertical	90.23	-	-
	2480(Av)		87.14	-	-
	2483.5(Pk)		60.56	74.00*	-13.44
	2483.5(Av)		50.42	54.00*	-3.58
	4960(Pk)		44.06	74.00	-29.94
	4960(Av)		32.95	54.00	-21.05
	7440(Pk)		47.48	74.00	-26.52
	7440(Av)		34.88	54.00	-19.12
	2480(Pk)	Horizontal	90.84	-	-
	2480(Av)		87.77	-	-
	2483.5(Pk)		60.80	74.00*	-13.20
	2483.5(Av)		51.15	54.00*	-2.85
	4960(Pk)		41.54	74.00	-32.46
	4960(Av)		30.18	54.00	-23.82
	7440(Pk)		47.14	74.00	-26.86
	7440(Av)		34.79	54.00	-19.21

_ → Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

Av: Average Detect

Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 38 von 69

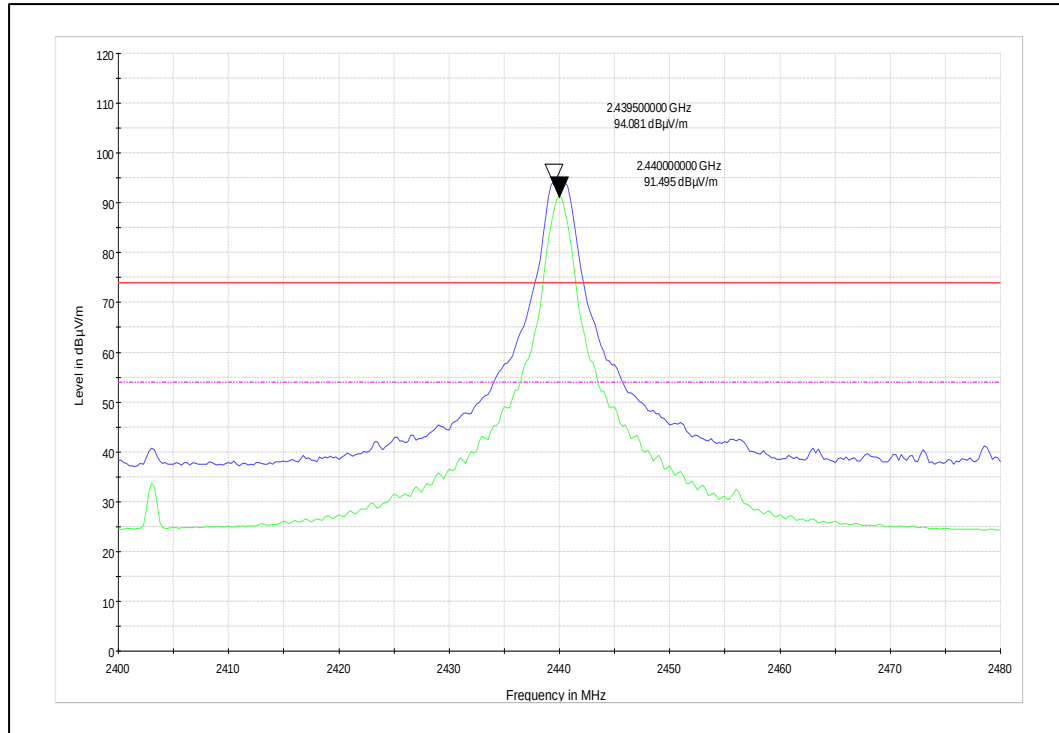
Page 38 of 69

Worst Case Test Plots:

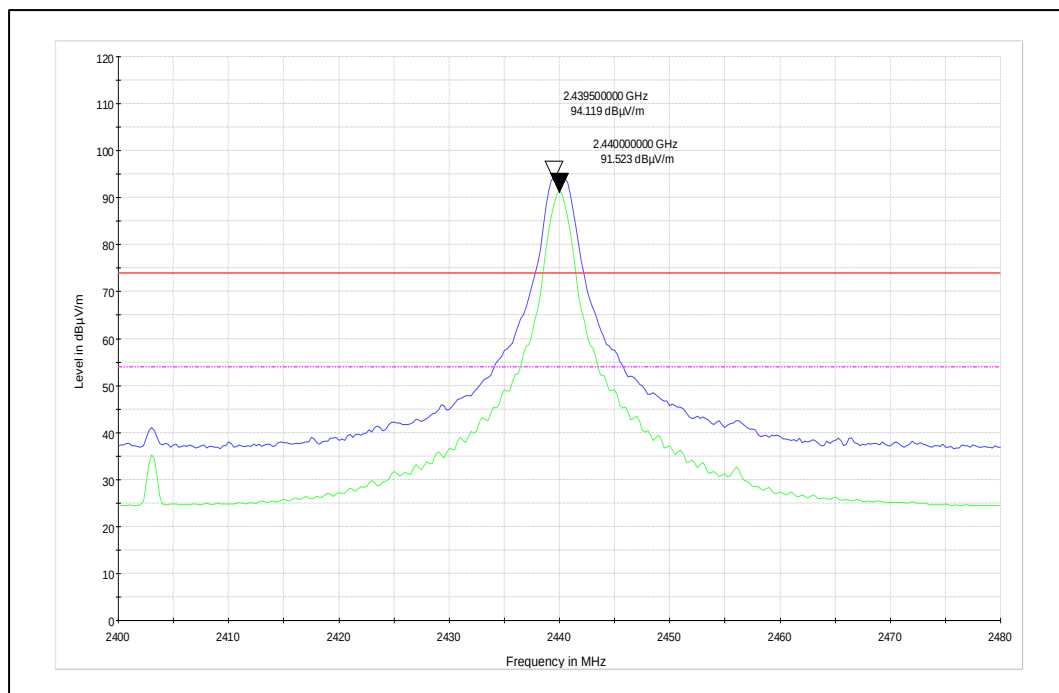
SU-6E 2W IEEE 802.15.4: Plots:

Data Rate: 1 Mbps

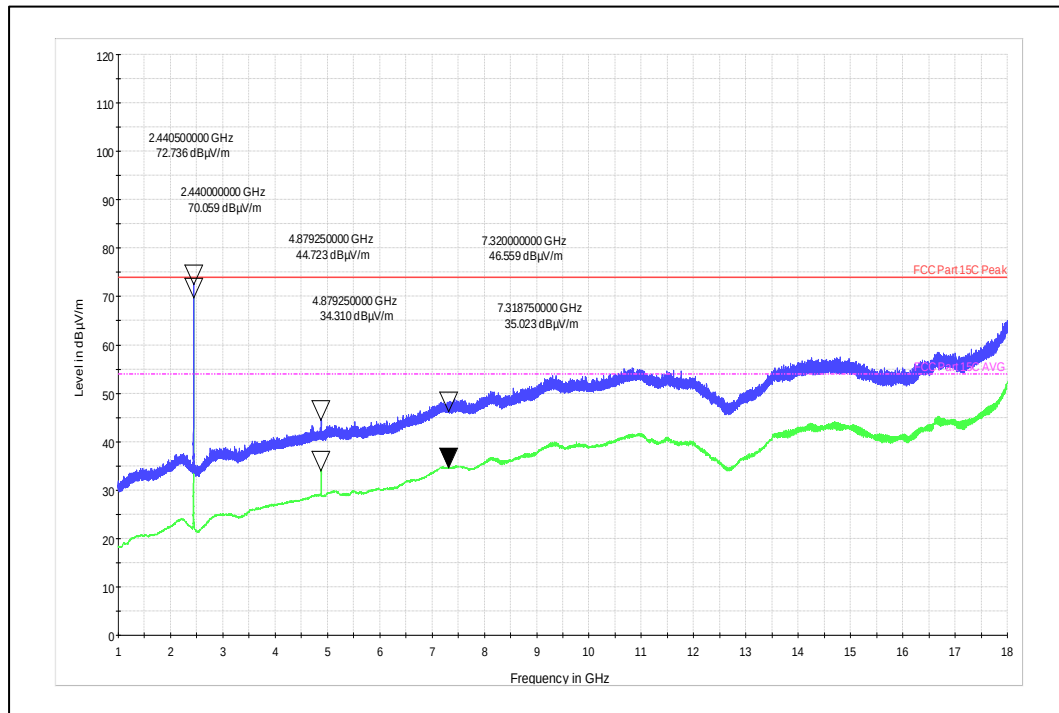
Channel Frequency 2440MHz_Vertical Polarization



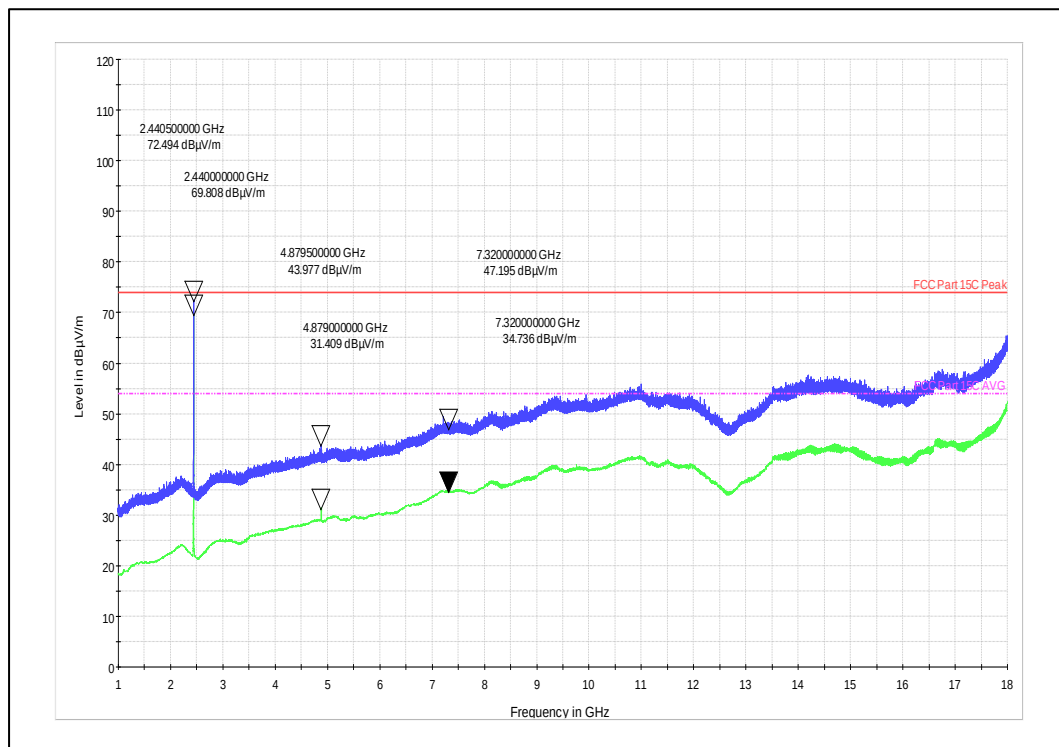
Channel Frequency 2440MHz_Horizontal Polarization



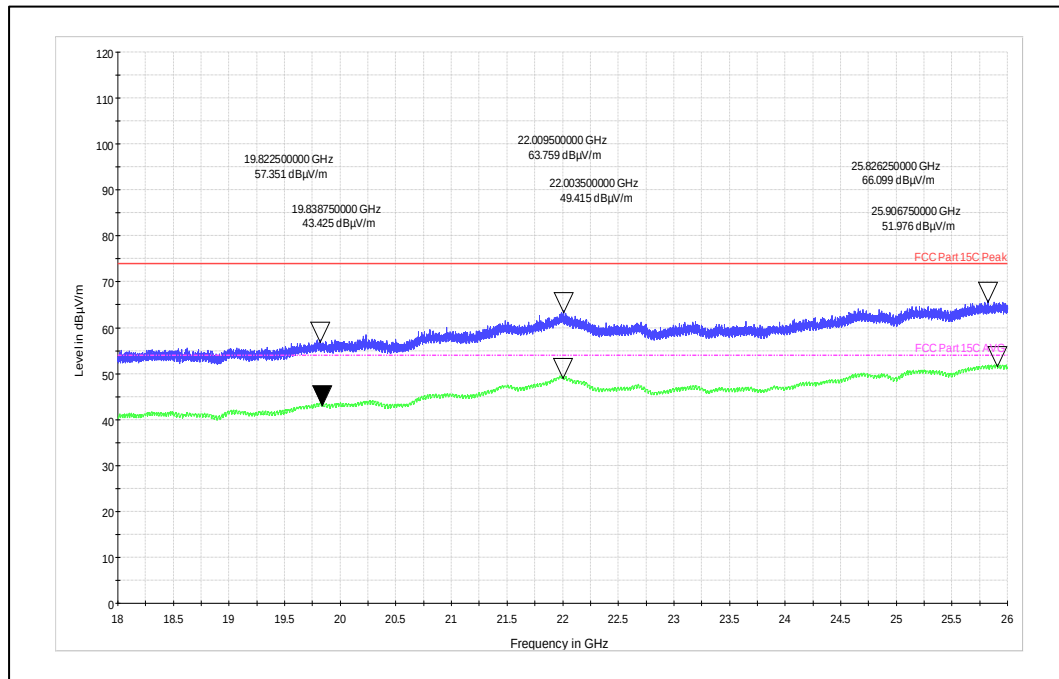
Frequency Range: 1GHz – 18GHz_Vertical Polarization



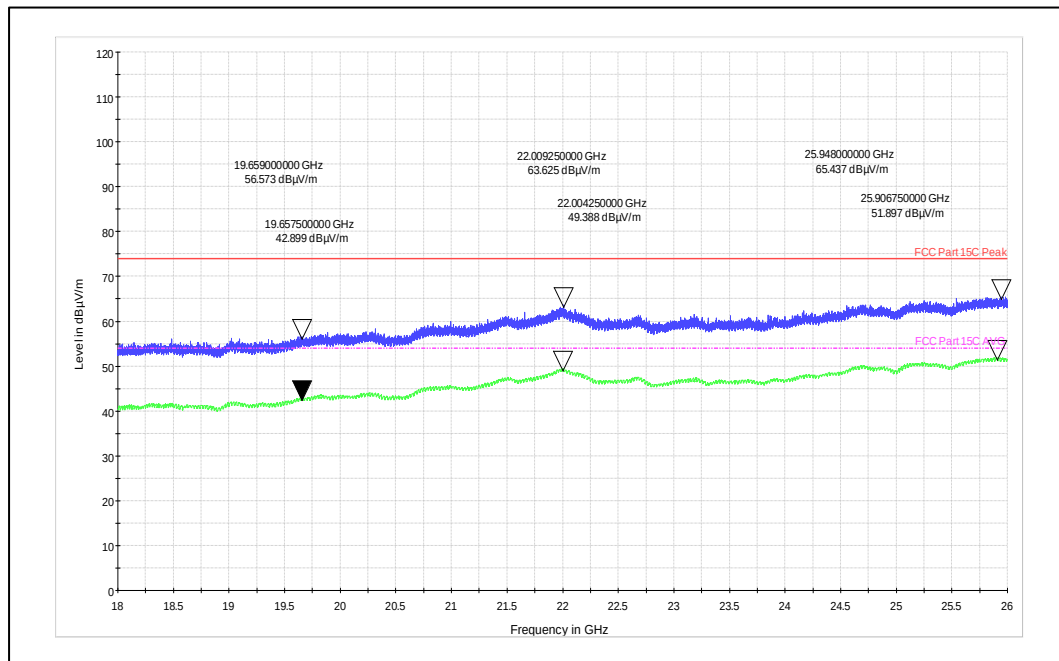
Frequency Range: 1GHz – 18GHz_Horizontal Polarization



Frequency range: 18GHz to 26GHz_Vertical Polarization



Frequency range: 18GHz to 26GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 41 von 69
Page 41 of 69

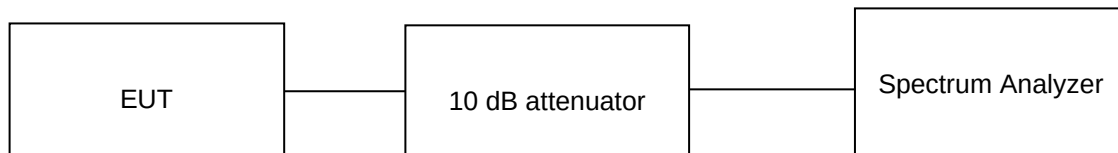
8 TEST RESULTS FOR BLUETOOTH LOW ENERGY

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
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: 9.5-22.5V DC/180 mW

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.:

IN24LVFZ 001

Seite 42 von 69

Page 42 of 69

Test results:

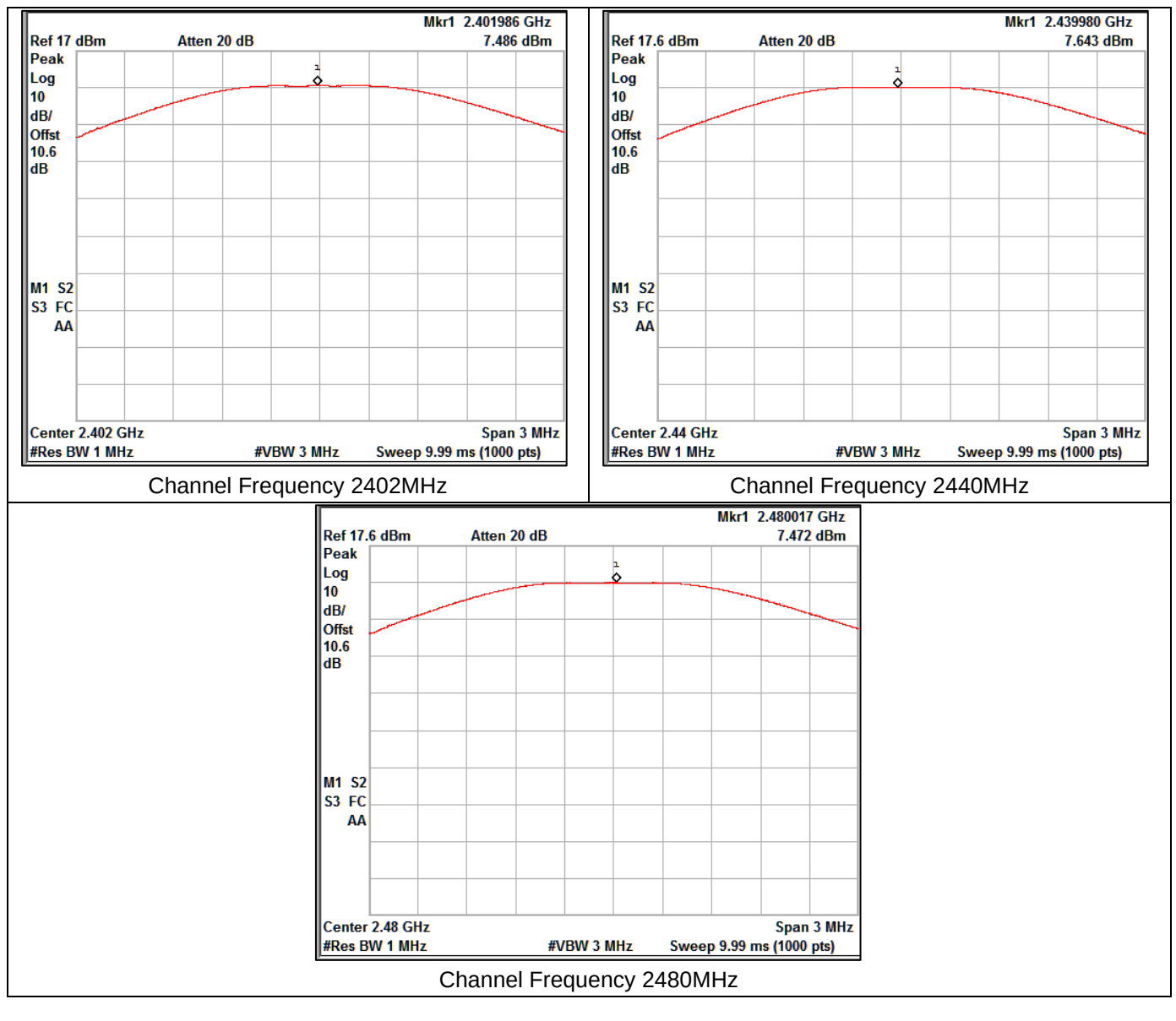
Note:

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)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 0 dBi.

SU-6E 2W:

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	7.48	7.48	30	36
	2440	7.64	7.64	30	36
	2480	7.47	7.47	30	36

Test Plots:



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 43 von 69
Page 43 of 69

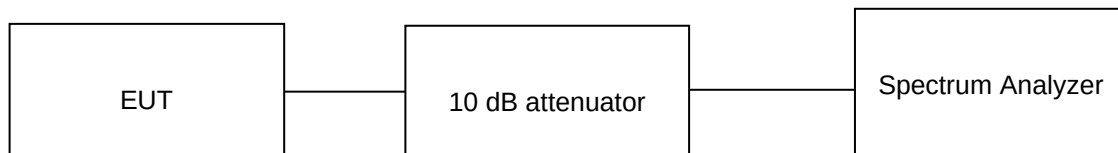
8.2 DTS Bandwidth & 99% Bandwidth

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 of ANSI C63.10
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: 9.5-22.5V DC/180 mW

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.:

IN24LVFZ 001

Seite 44 von 69
Page 44 of 69

Test results:

Note:

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

SU-6E-2W:

Data Rate (Mbps)	Channel Frequency (MHz)	99% Occupied bandwidth (MHz)	6dB BW (MHz)	Limit (kHz)
1Mbps	2402	1.04	0.729	0.5
	2440	1.04	0.740	0.5
	2480	1.05	0.738	0.5

Test Plots:

6dB DTS Plots

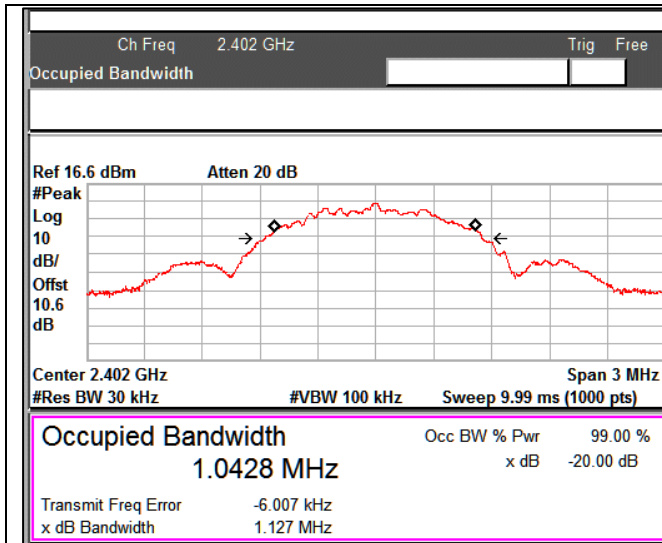


Prüfbericht - Nr.:
Test Report No.:

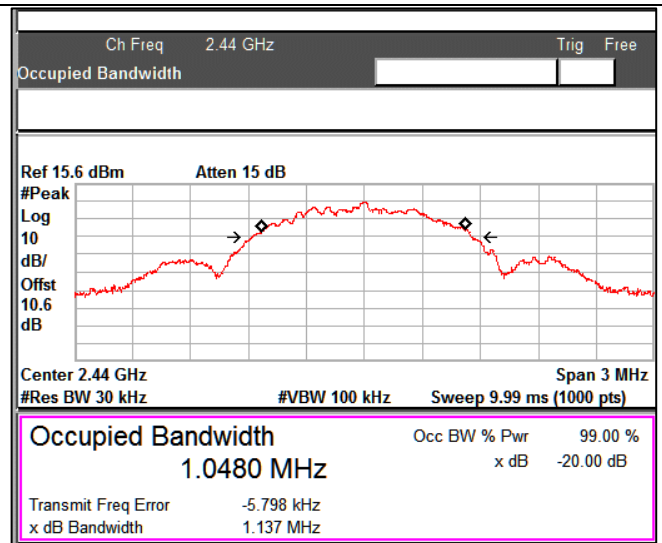
IN24LVFZ 001

Seite 45 von 69
Page 45 of 69

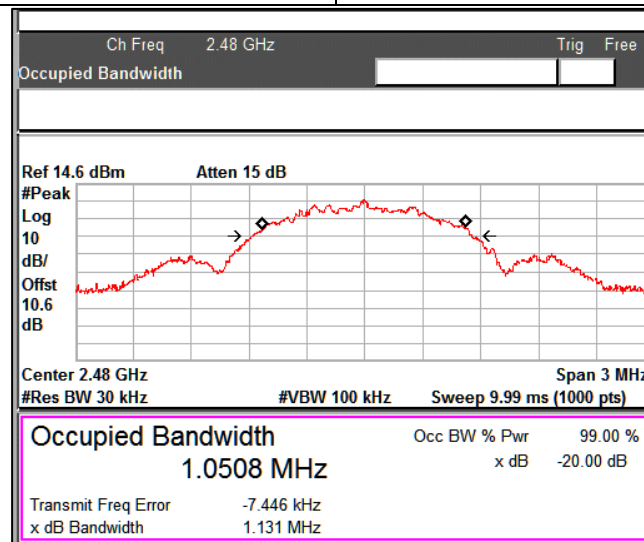
99% OBW plots



Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 46 von 69
Page 46 of 69

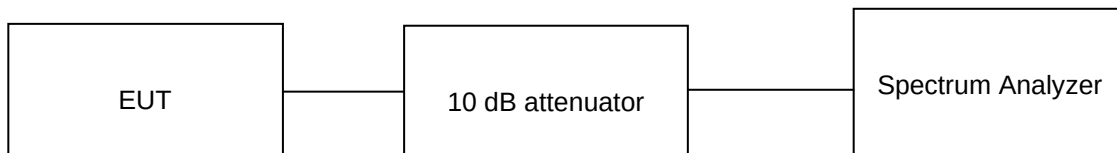
8.3 Maximum Power Spectral Density

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
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: 9.5-22.5V DC/180 mW

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.:

IN24LVFZ 001

Seite 47 von 69

Page 47 of 69

Test results:

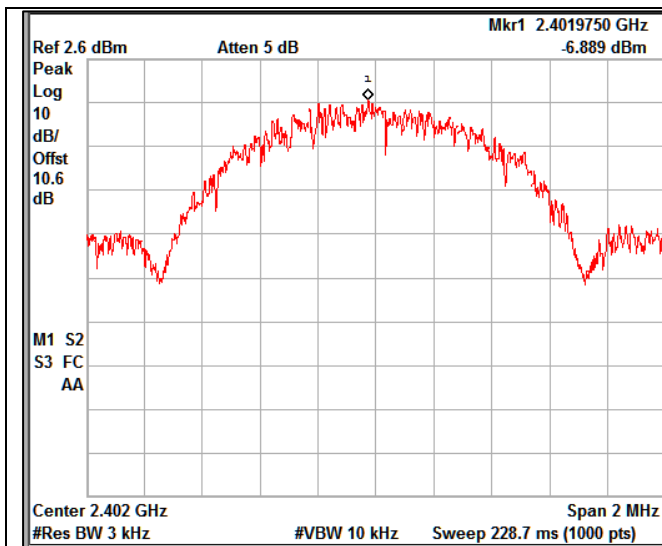
Note:

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)

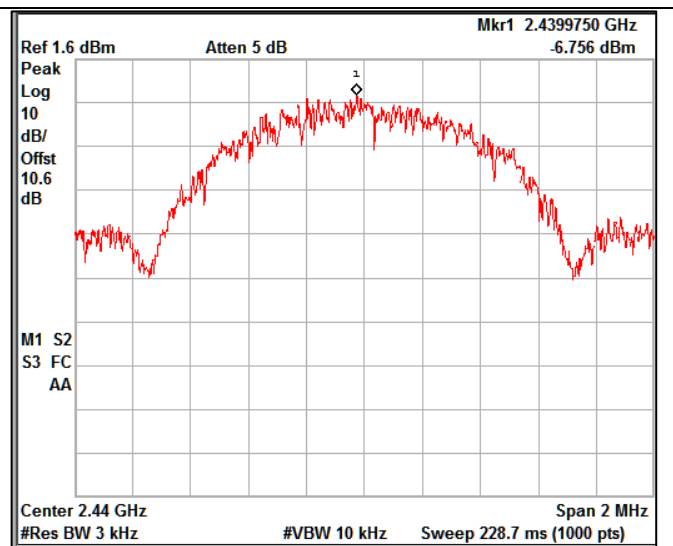
SU-6E-2W:

Data Rate (Mbps)	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	PSD Limit (dBm/kHz)
1Mbps	2402	-6.88	8.00
	2440	-6.75	8.00
	2480	-7.11	8.00

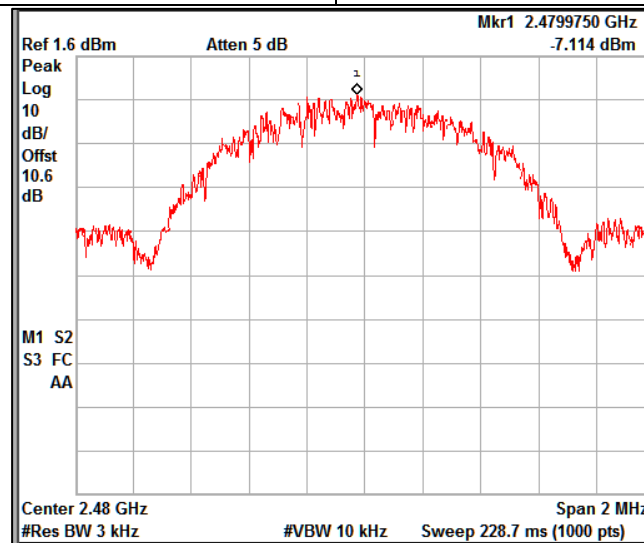
Test Plots:



Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 48 von 69
Page 48 of 69

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

Measurement Bandwidth

100 kHz

Detector

Peak

Port of testing

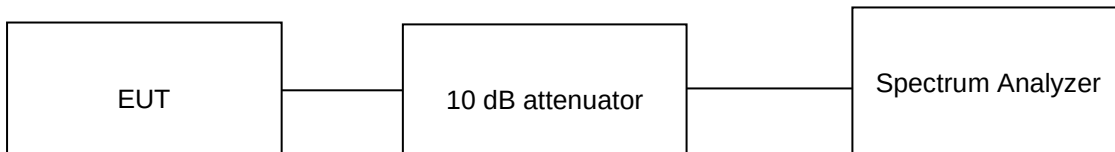
Antenna port

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: 9.5-22.5V DC/180 mW

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.:

IN24LVFZ 001

Seite 49 von 69
Page 49 of 69

Test results: Note:

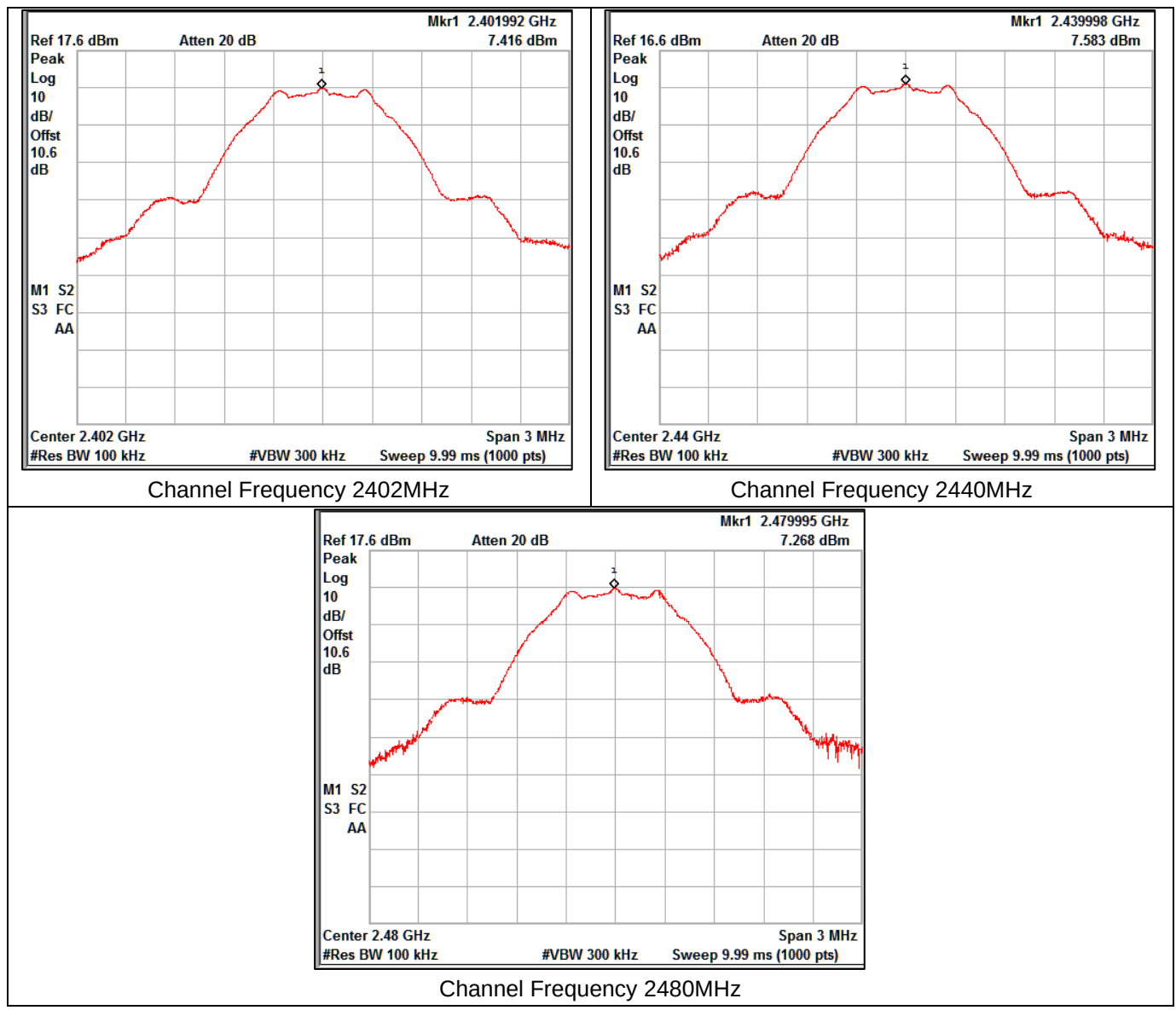
1. All the losses are included during measurement and final values are mentioned in the test report.
2. Final Value (dBm) = Measured Value (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 0 dBi

SU-6E 2W:

8.4.1 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)
2402.00	2400.00	-42.12	7.41	-49.53	-20
2480.00	2483.50	-50.34	7.26	-57.60	-20

Reference Plots:

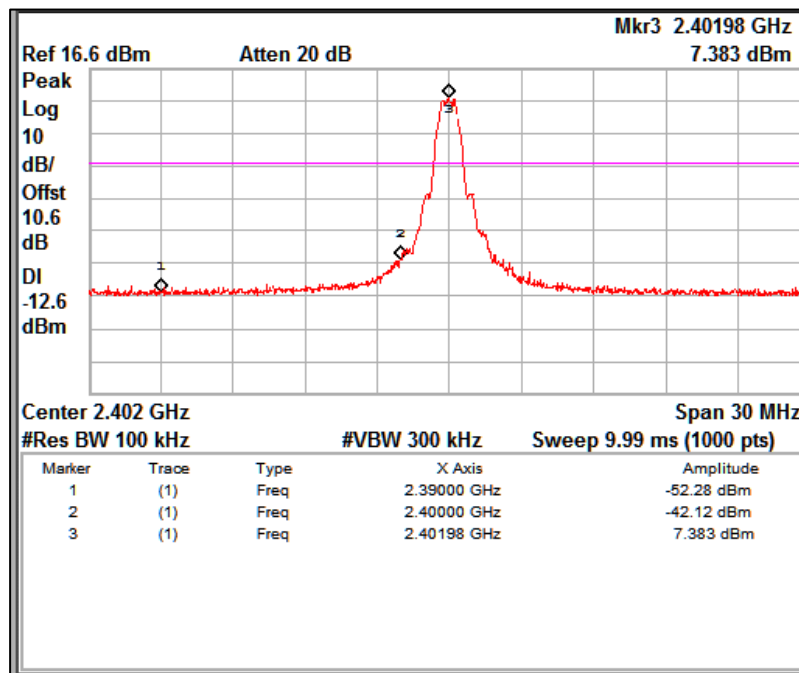


Prüfbericht - Nr.:
Test Report No.:

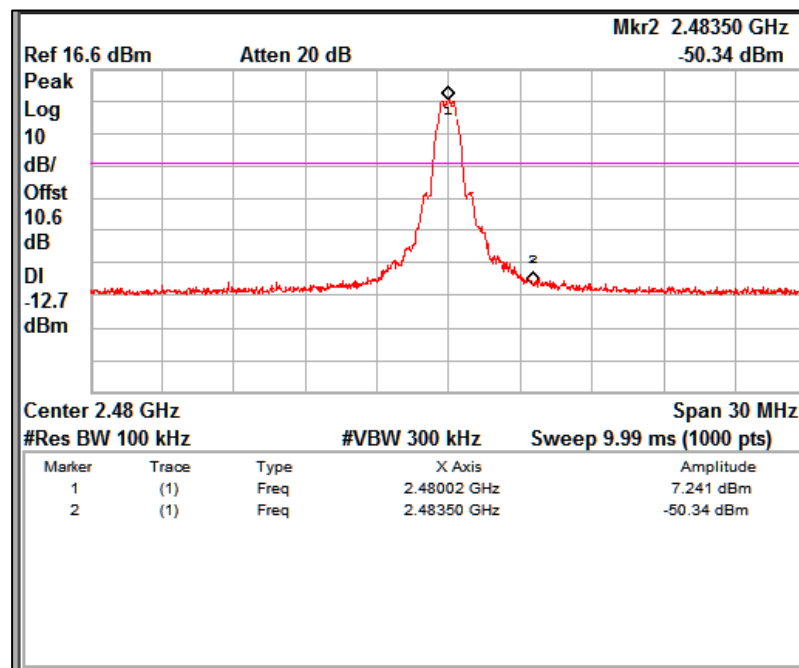
IN24LVFZ 001

Seite 50 von 69
Page 50 of 69

Bandedge Plots:



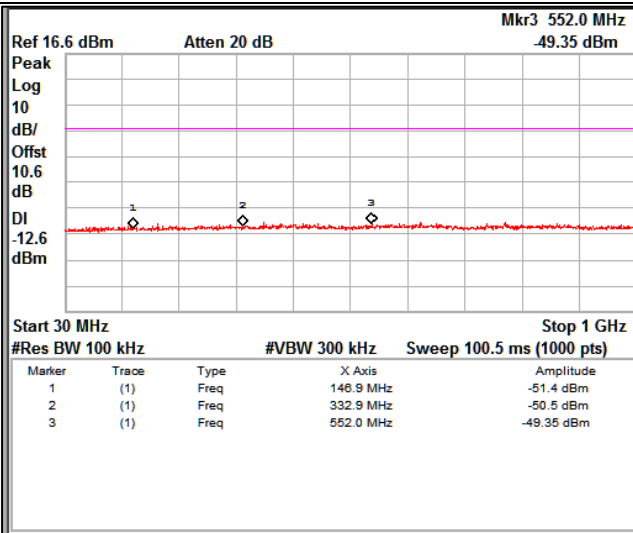
Channel Frequency:2402MHz



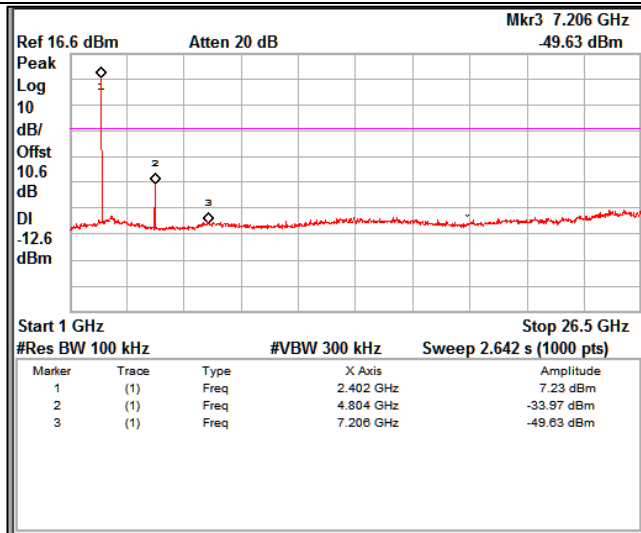
Channel Frequency:2480MHz

8.4.2 Out-Of-Band Emissions

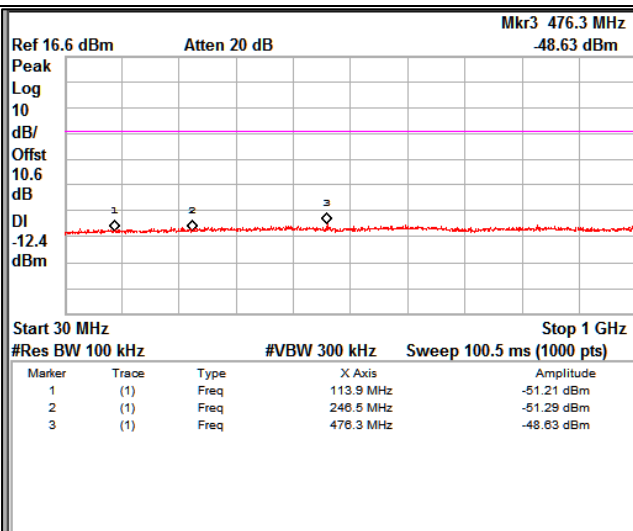
SU-6E 2W:



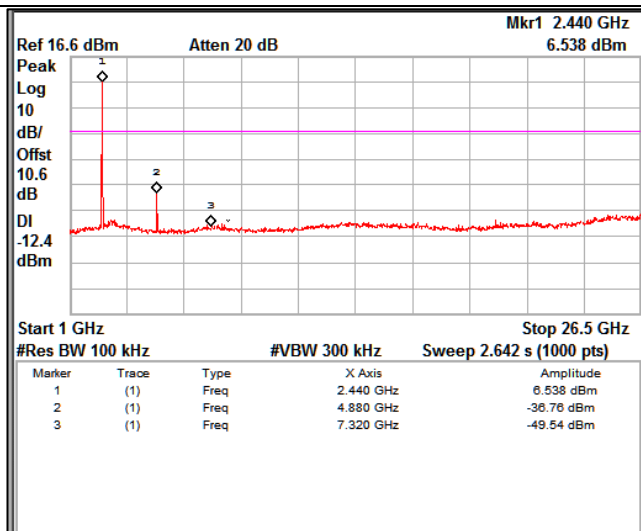
Channel Frequency: 2402MHz Frequency Range 30MHz – 1GHz



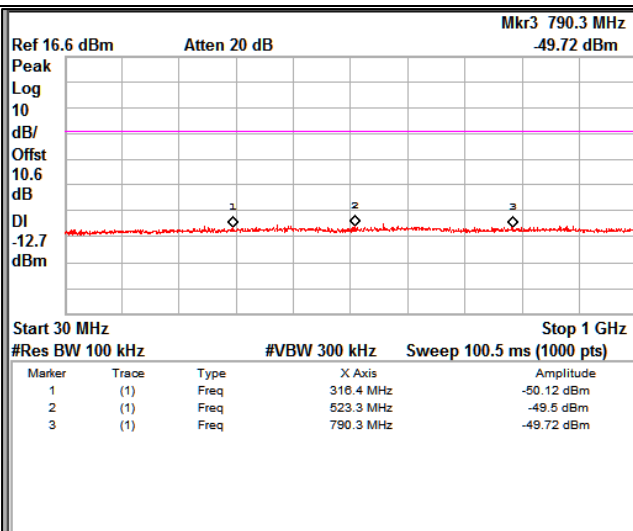
Channel Frequency: 2402MHz Frequency Range 1GHz – 26.5GHz



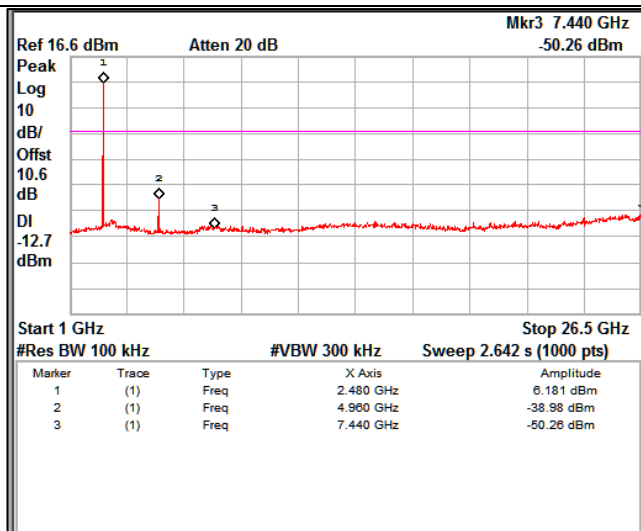
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



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



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



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

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 52 von 69
Page 52 of 69

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
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 14: 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: Microsensor SU-6E-2W & 9.5 – 22.5VDC/180 mW Relative humidity: 65%

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 53 von 69
Page 53 of 69

Test results of SU-6E-2W:

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

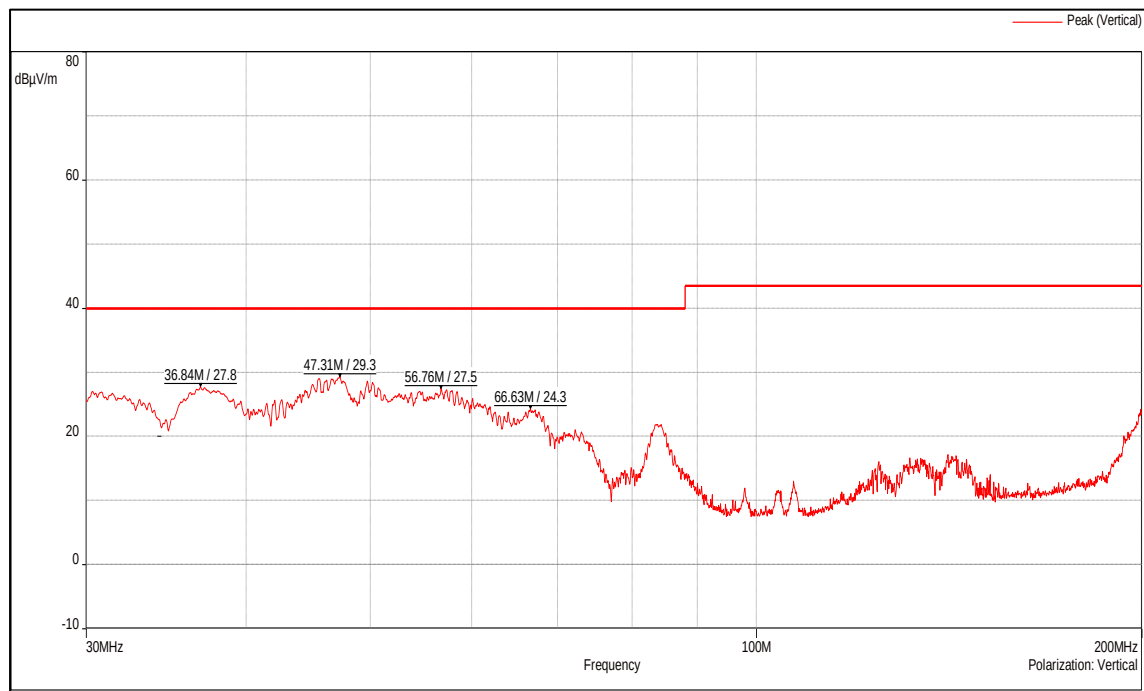
Test results for frequency range 9 kHz – 30MHz

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 15: Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	36.84	27.80	40	-12.20
	47.31	29.30	40	-10.70
	56.76	27.50	40	-12.50
	66.63	24.30	40	-15.70
Horizontal	51.66	24.40	40	-15.60
	67.17	19.30	40	-20.70
	83.49	22.60	40	-17.40
	95.07	23.30	43.5	-20.20

Frequency Range 30MHz – 200MHz _ Vertical Polarization



Prüfbericht - Nr.:

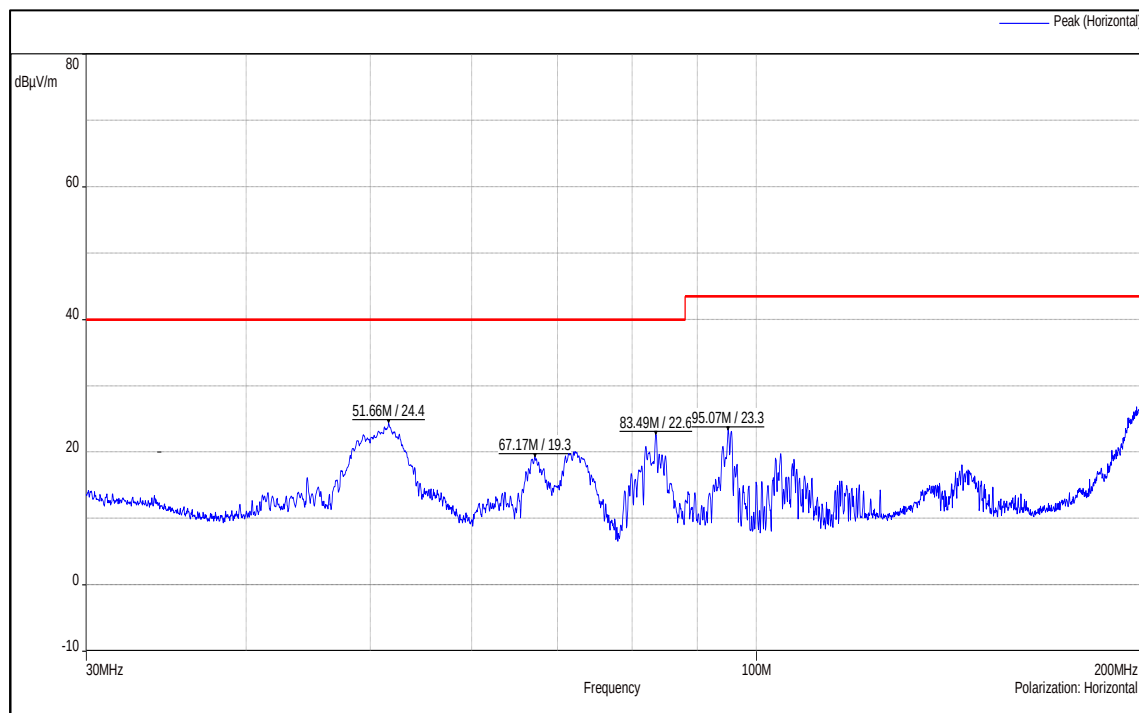
Test Report No.:

IN24LVFZ 001

Seite 54 von 69

Page 54 of 69

Frequency Range 30MHz – 200MHz _Horizontal Polarization



Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	268.58	29.40	46	-16.60
	342.35	38.50	46	-7.50
	452.93	38.70	46	-7.30
	545.84	34.60	46	-11.40
Horizontal	256.91	32.20	46	-13.80
	342.29	41.90	46	-4.10
	454.67	38.50	46	-7.50
	546.77	33.10	46	-12.90

Prüfbericht - Nr.:

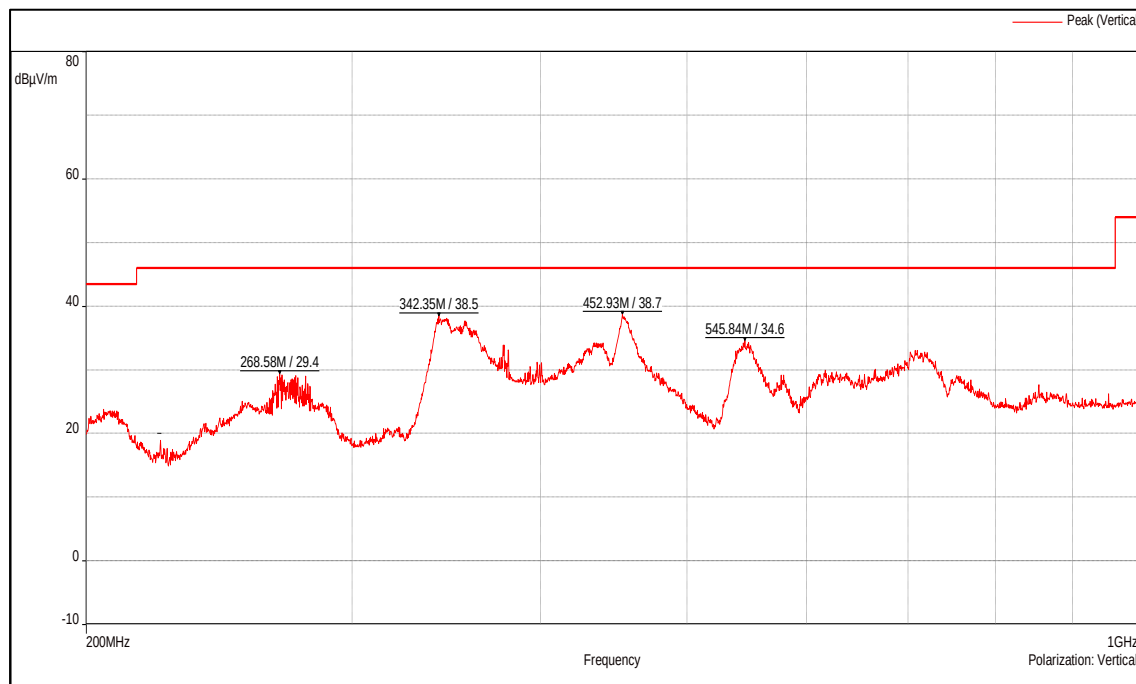
Test Report No.:

IN24LVFZ 001

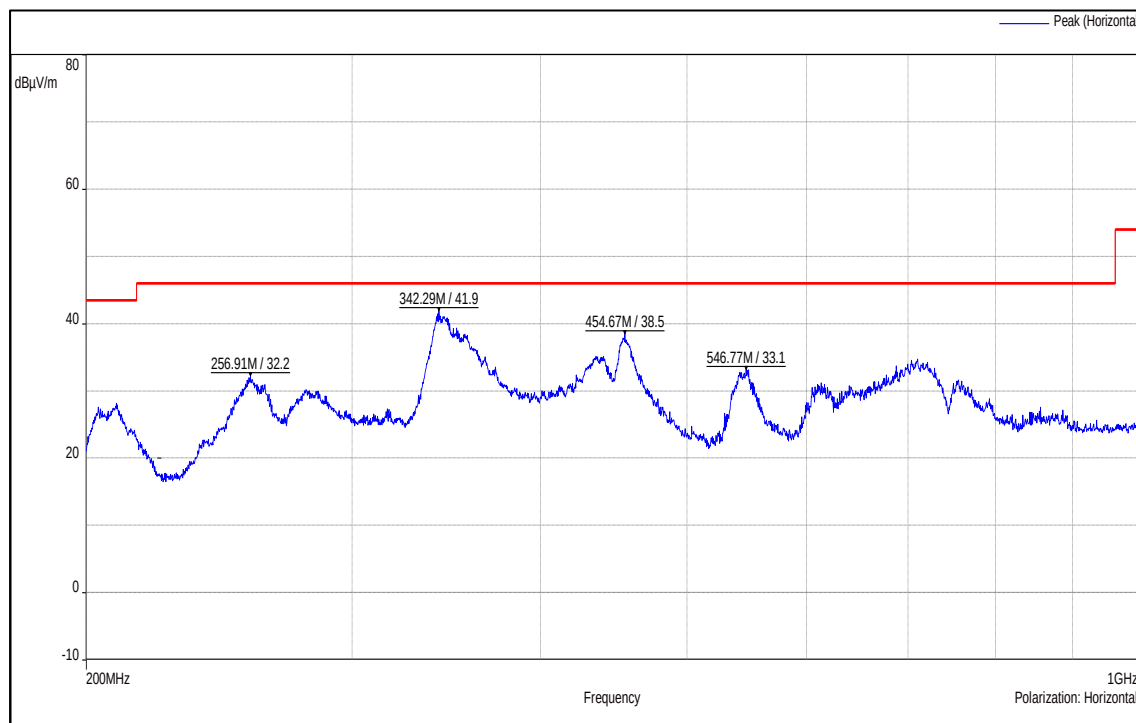
Seite 55 von 69

Page 55 of 69

Frequency Range 200MHz – 1GHz_Vertical Polarization



Frequency Range 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 56 von 69
Page 56 of 69

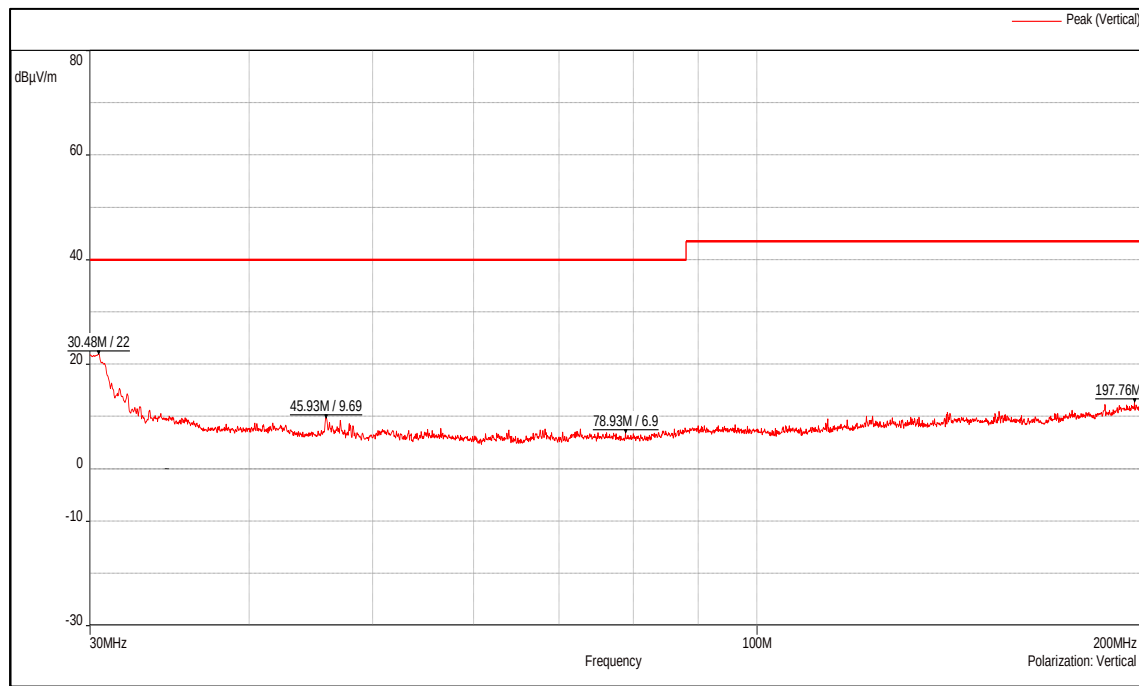
Test results of SU-6E-8W-LR:

Table 16: Test results for frequency range 30MHz – 200MHz

BLE:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	30.48	22.00	40.00	-18.00
	45.93	9.69	40.00	-30.31
	78.93	6.90	40.00	-33.10
Horizontal	34.86	15.60	40.00	-24.40
	47.52	10.50	40.00	-29.50
	92.34	14.30	43.50	-29.20
	112.59	13.10	43.50	-30.40
	166.98	16.20	43.50	-27.30

Frequency Range: 30MHz -200MHz_Vertical Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 57 von 69
Page 57 of 69

Frequency Range: 30MHz -200MHz_Horizontal Polarization

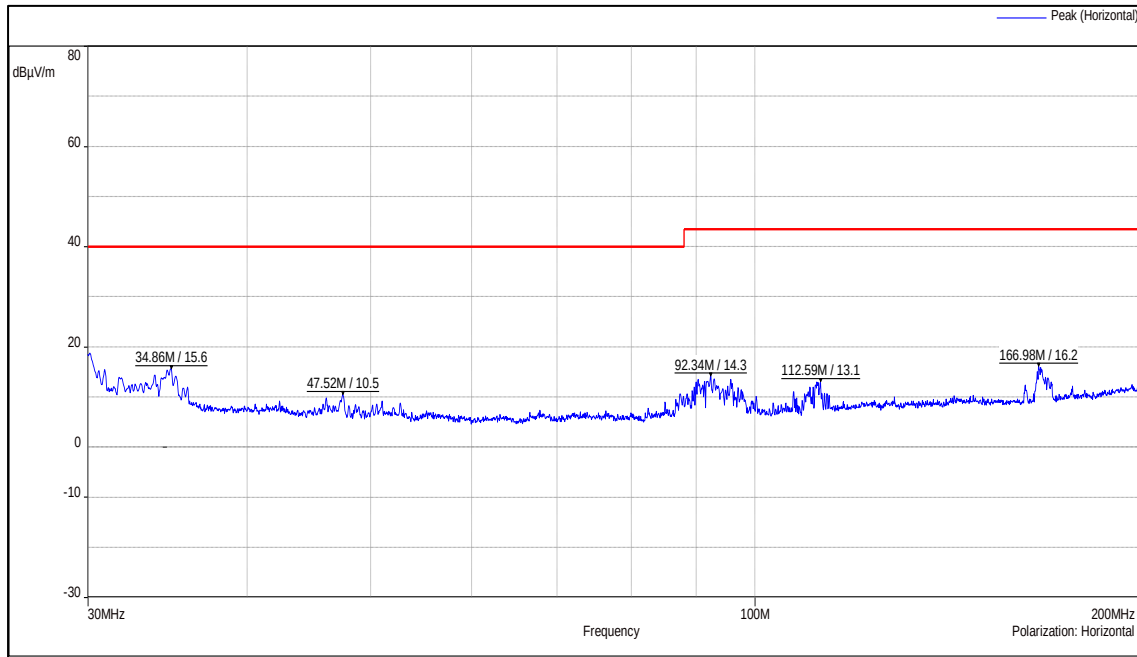


Table 17: Test results for frequency range 200MHz – 1GHz

BLE:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	228.65	14.40	46.00	-31.60
	384.29	27.40	46.00	-18.60
	633.26	20.10	46.00	-25.90
Horizontal	226.01	15.60	46.00	-30.40
	339.98	23.10	46.00	-22.90
	708.29	26.30	46.00	-19.70

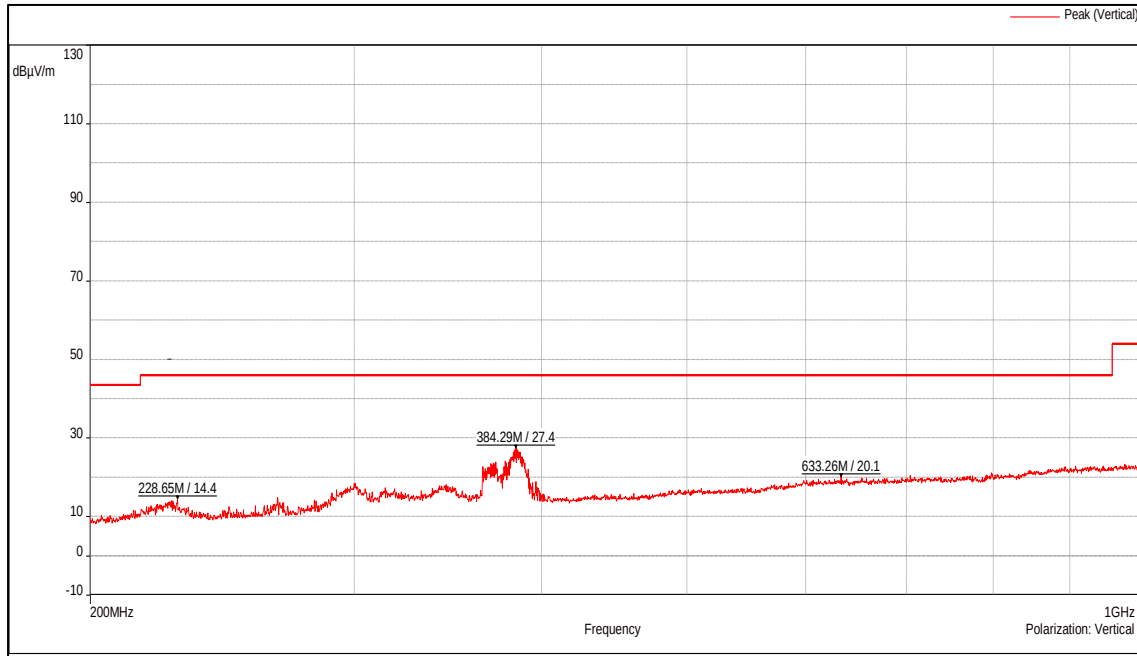
Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

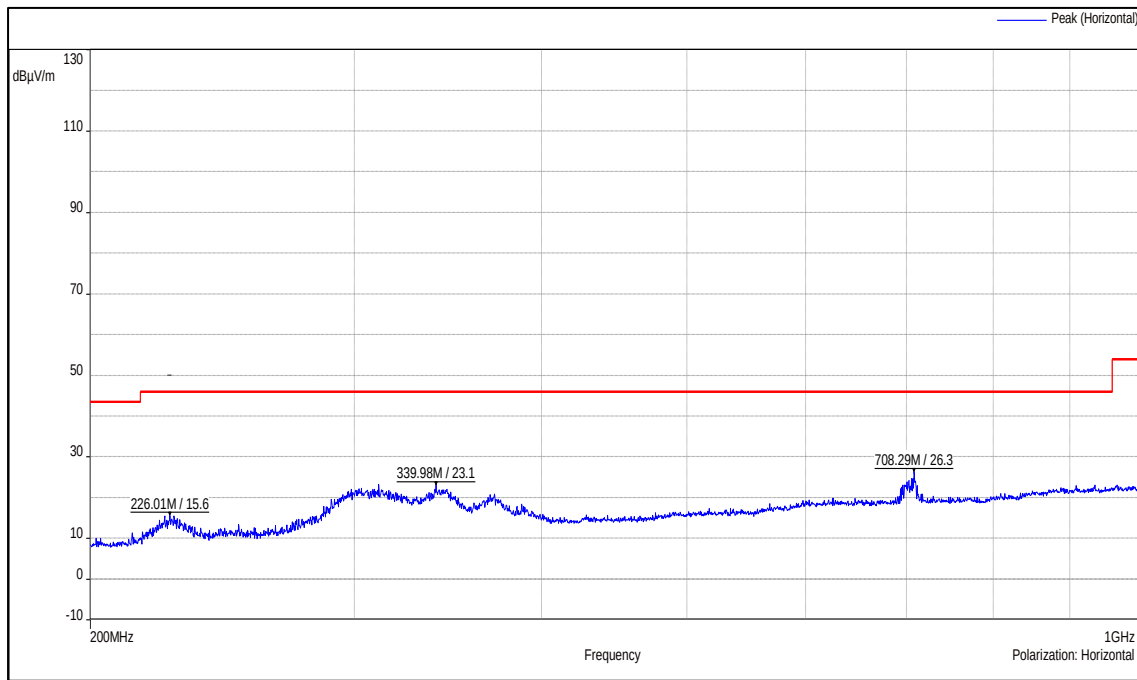
Seite 58 von 69
Page 58 of 69

BLE Plots:

Frequency Range: 200MHz – 1GHz_Vertical Polarization



Frequency Range: 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 59 von 69
Page 59 of 69

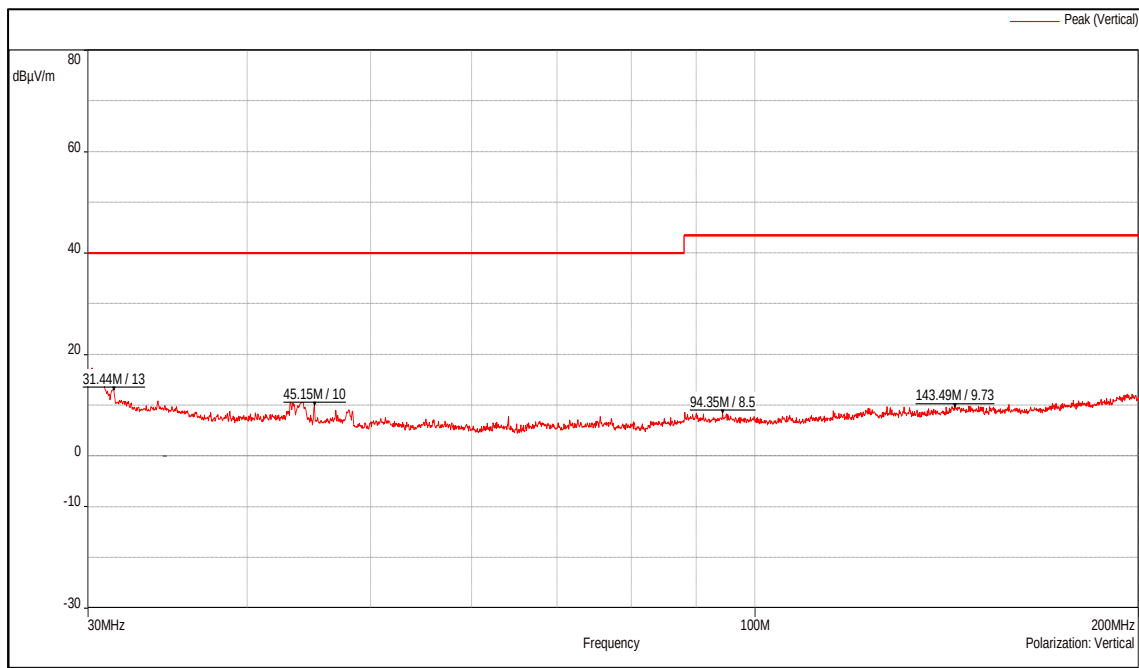
Test results of RM-6E-8W:

Table 18: Test results for frequency range 30MHz – 200MHz

BLE:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	31.44	13.00	40.00	-27.00
	45.15	10.00	40.00	-30.00
	94.35	8.50	43.50	-35.00
	143.49	9.73	43.50	-33.77
Horizontal	30.99	15.80	40.00	-24.20
	47.07	11.00	40.00	-29.00
	129.69	12.10	43.50	-31.40
	153.99	12.10	43.50	-31.40

Frequency Range: 30MHz -200MHz_Vertical Polarization



Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

Seite 60 von 69
Page 60 of 69

Frequency Range: 30MHz -200MHz_Horizontal Polarization

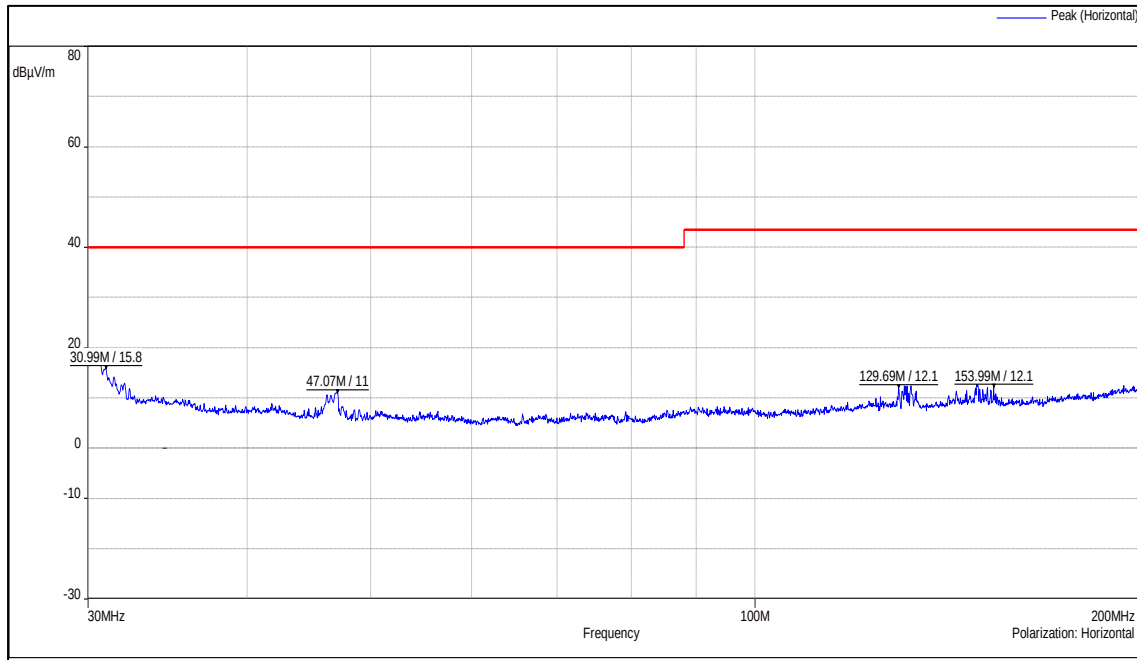


Table 19: Test results for frequency range 200MHz – 1GHz

BLE:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	205.01	28.30	43.50	-15.20
	290.15	25.50	46.00	-20.50
	444.71	16.10	46.00	-29.90
Horizontal	263.33	13.50	46.00	-32.50
	341.18	21.00	46.00	-25.00
	532.46	17.70	46.00	-28.30

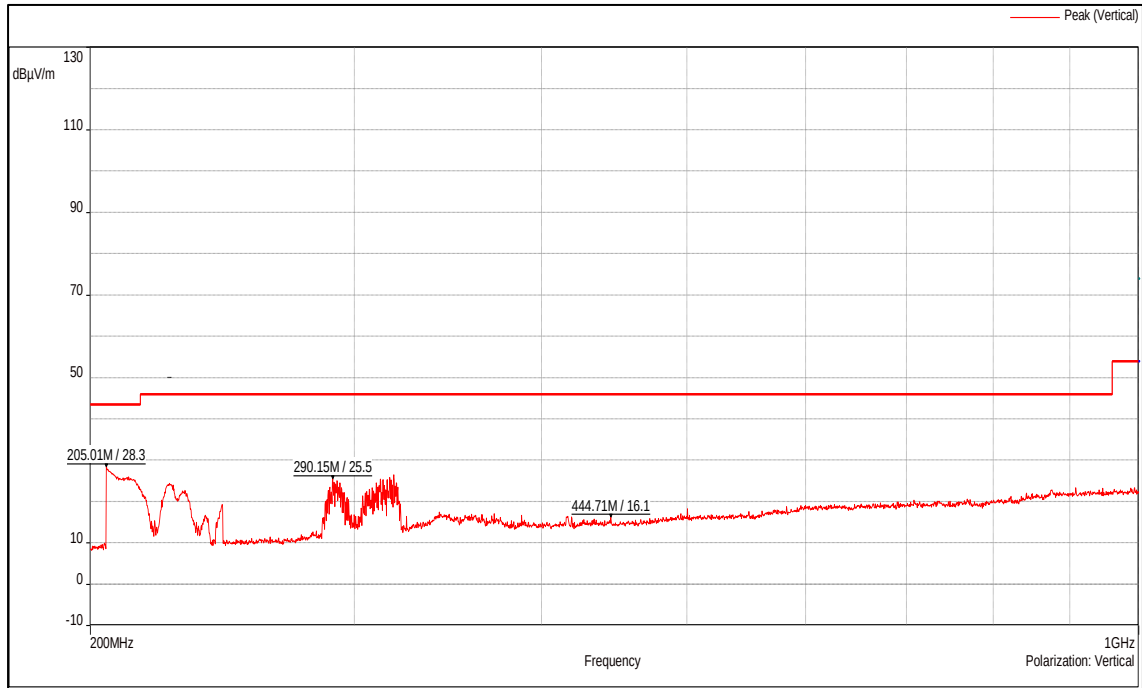
Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

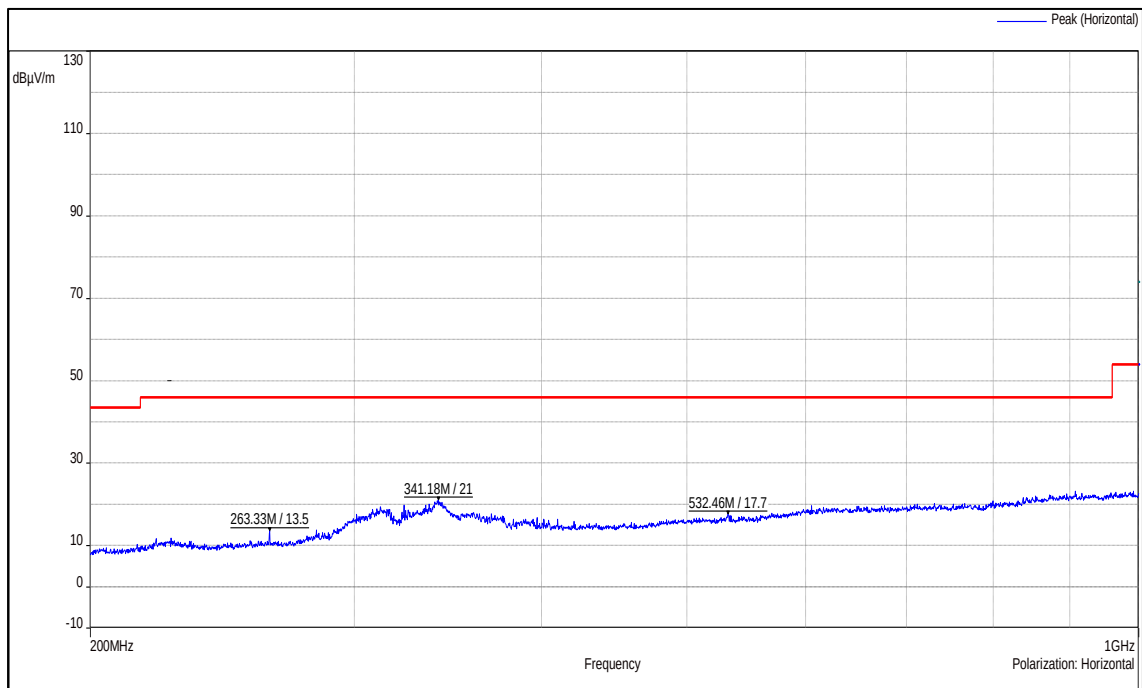
Seite 61 von 69
Page 61 of 69

BLE Plots:

Frequency Range: 200MHz – 1GHz_Vertical Polarization



Frequency Range: 200MHz – 1GHz_Horizontal Polarization



Prüfbericht - Nr.:

Test Report No.:

IN24LVFZ 001

Seite 62 von 69

Page 62 of 69

Table 20: Test results for the frequencies above 1GHz:

SU-6E-2W BLE:

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2402(Pk)	Vertical	89.35	-	-
	2402(Av)		86.53	-	-
	2390(Pk)		41.37	74.00*	-32.63
	2390(Av)		24.91	54.00*	-29.09
	4804(Pk)		47.11	74.00	-26.89
	4804(Av)		38.32	54.00	-15.68
	7206(Pk)		47.33	74.00	-26.67
	7206(Av)		36.12	54.00	-17.88
	2402(Pk)	Horizontal	93.77	-	-
	2402(Av)		90.94	-	-
	2390(Pk)		40.20	74.00*	-33.80
	2390(Av)		26.31	54.00*	-27.69
	4804(Pk)		47.30	74.00	-26.70
	4804(Av)		37.97	54.00	-16.03
	7206(Pk)		50.00	74.00	-24.00
	7206(Av)		38.17	54.00	-15.83
2440	2440(Pk)	Vertical	88.90	-	-
	2440(Av)		86.09	-	-
	4880(Pk)		47.29	74.00	-26.71
	4880(Av)		38.98	54.00	-15.02
	7320(Pk)		51.20	74.00	-22.80
	7320(Av)		39.71	54.00	-14.29
	2440(Pk)	Horizontal	92.93	-	-
	2440(Av)		90.11	-	-
	4880(Pk)		48.07	74.00	-25.93
	4880(Av)		39.75	54.00	-14.25
	7320(Pk)		47.82	74.00	-26.18
	7320(Av)		36.58	54.00	-17.42
2480	2480(Pk)	Vertical	88.98	-	-
	2480(Av)		86.17	-	-
	2483.5(Pk)		40.46	74.00*	-33.54
	2483.5(Av)		27.72	54.00*	-26.28
	4960(Pk)		46.99	74.00	-27.01
	4960(Av)		37.68	54.00	-16.32
	7440(Pk)		48.09	74.00	-25.91
	7440(Av)		36.23	54.00	-17.77
	2480(Pk)	Horizontal	92.20	-	-
	2480(Av)		89.40	-	-
	2483.5(Pk)		42.90	74.00*	-31.10
	2483.5(Av)		29.78	54.00*	-24.22
	4960(Pk)		47.60	74.00	-26.40
	4960(Av)		38.02	54.00	-15.98
	7440(Pk)		52.39	74.00	-21.61
	7440(Av)		41.71	54.00	-12.29

→ Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

Av: Average Detect

Prüfbericht - Nr.:
Test Report No.:

IN24LVFZ 001

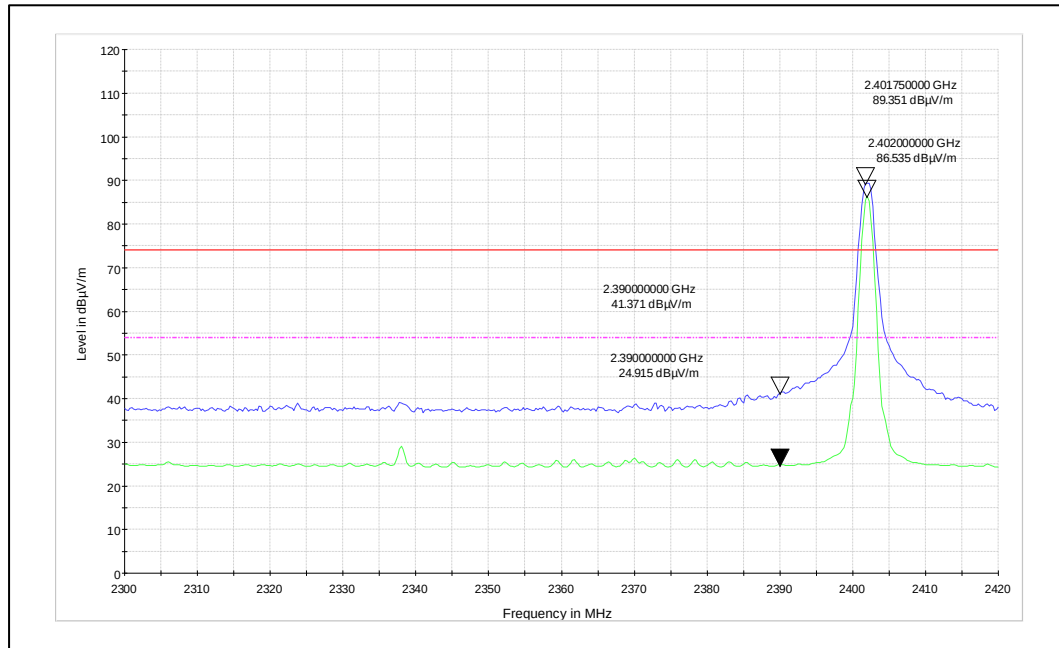
Seite 63 von 69
Page 63 of 69

Worst Case Test Plots:

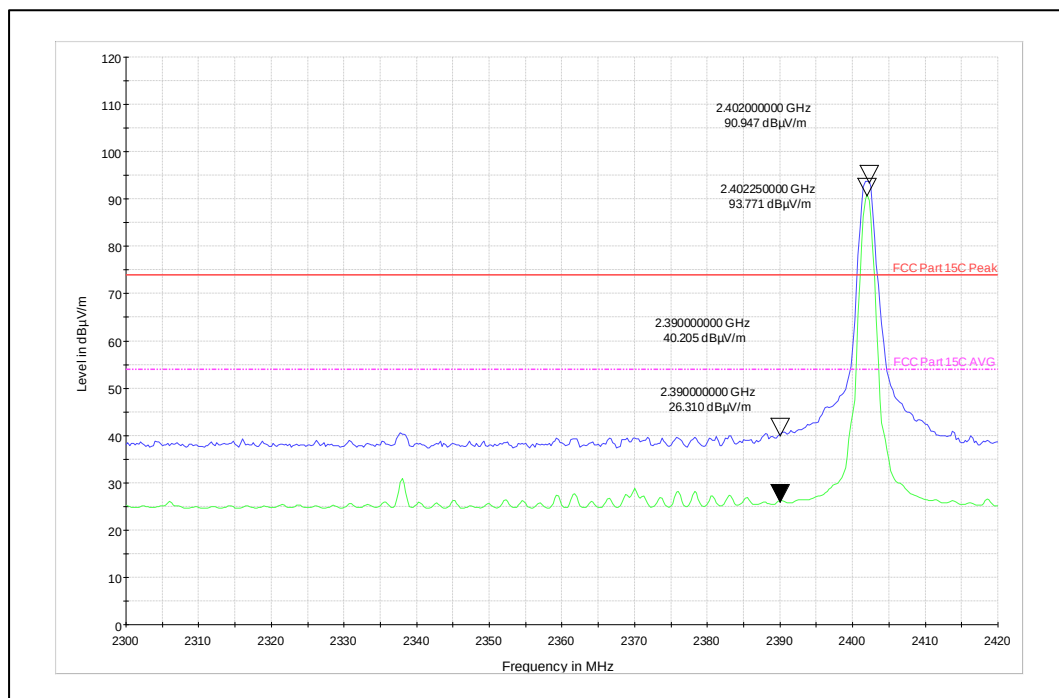
SU-6E 2W BLE: Plots:

Data Rate: 1 Mbps

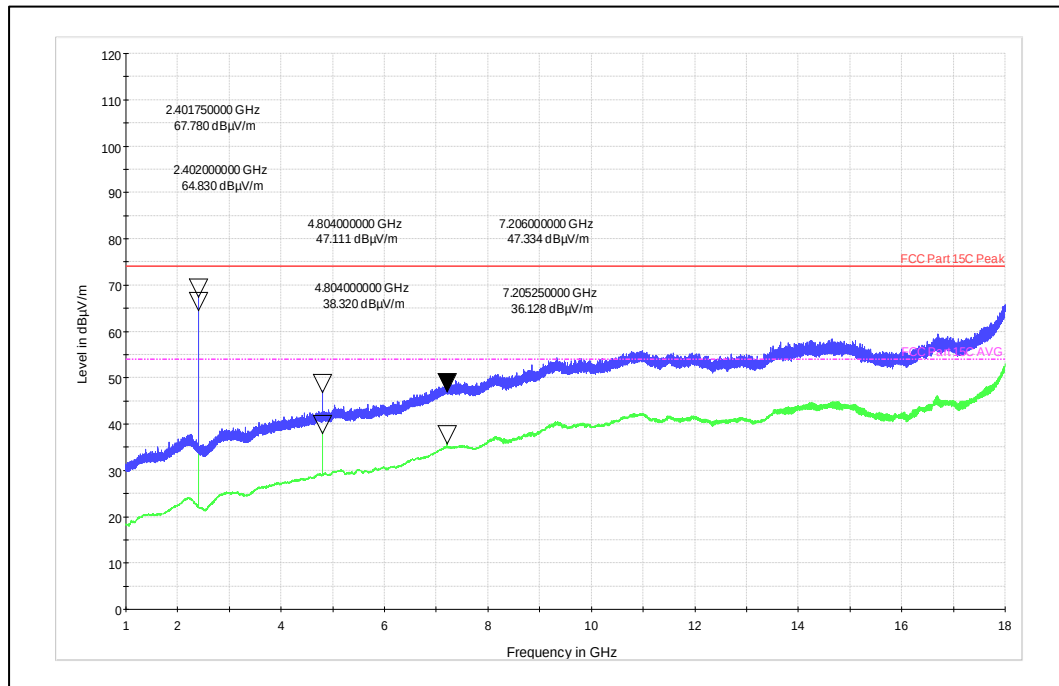
Channel Frequency: 2440MHz_Vertical Polarization



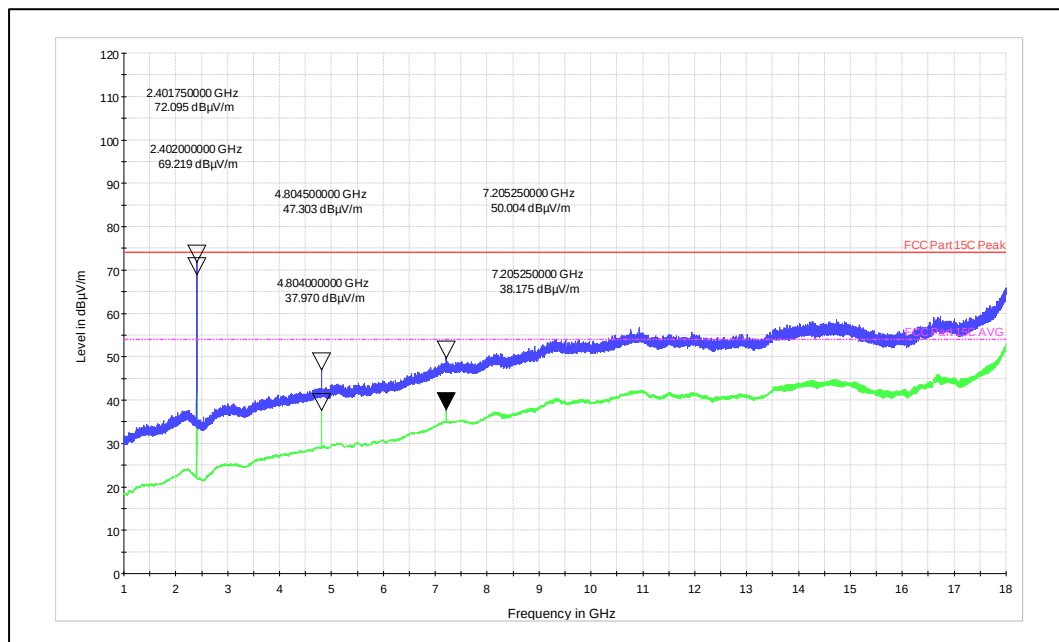
Channel Frequency: 2440MHz_Horizontal Polarization



Frequency Range: 1GHz – 18GHz_Vertical Polarization



Frequency Range: 1GHz – 18GHz_Horizontal Polarization

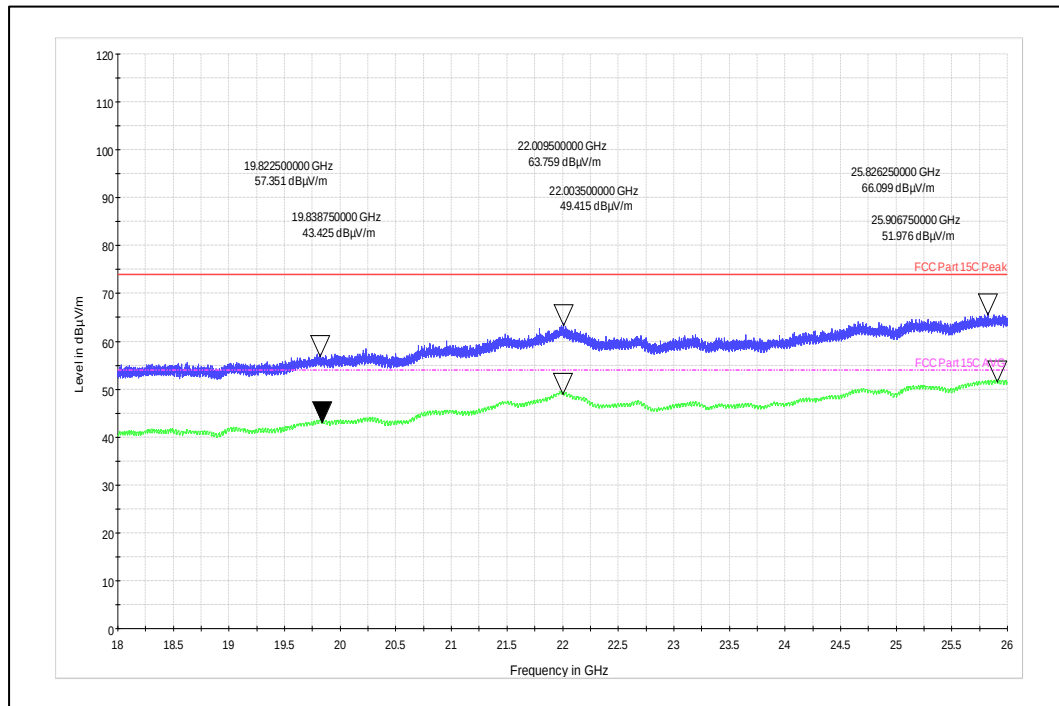


Prüfbericht - Nr.:
Test Report No.:

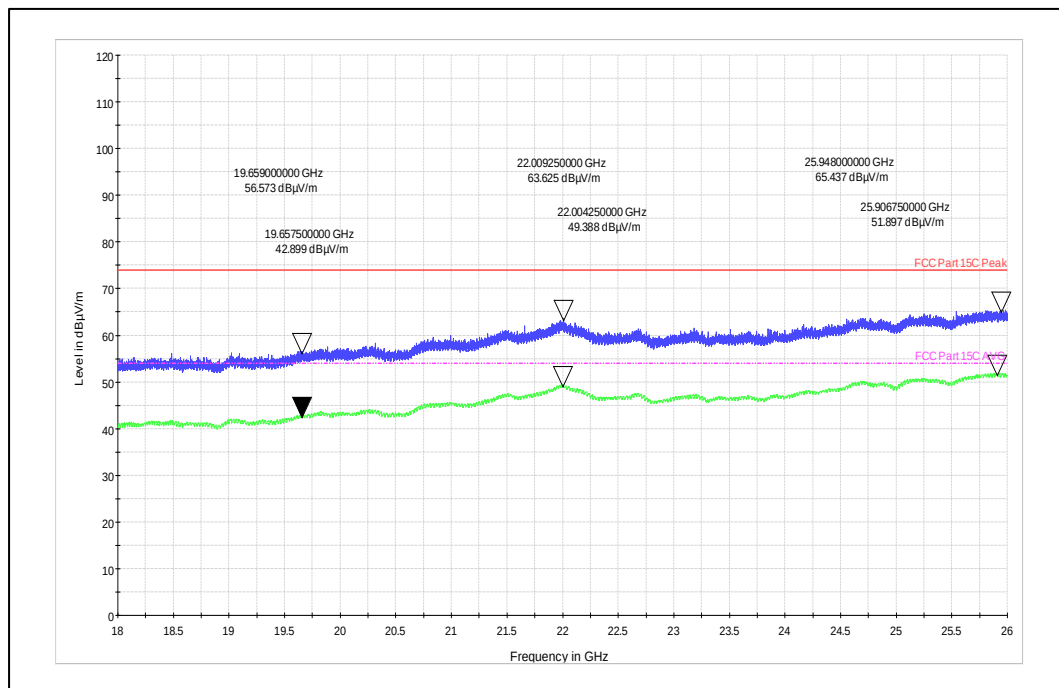
IN24LVFZ 001

Seite 65 von 69
Page 65 of 69

Frequency Range: 18GHz – 26GHz_Vertical Polarization



Frequency Range: 18GHz – 26GHz_Horizontal Polarization



9 Conducted spurious emission Test on AC Power lines

Result

Pass

Test Specification : FCC Part 15 Section 15.207 / RSS Gen Issue 5 Section 8.8
 Test Method : ANSI C 63.10-2013
 Testing Location : Screened room
 Measurement Bandwidth : 9kHz
 Frequency Range : 150kHz – 30MHz
 Supply Voltage : 110VAC,60Hz
 Test Method : Refer TEST METHODOLOGY

Table 21: Limits for Conducted power line emission

Frequency of emission (MHz)	QP Limit (dBμV)	AV Limit (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:

Temperature (Norm) = +24 °C Voltage = 110V AC (Through AC to DC Adapter) Relative humidity: 64%

Prüfbericht - Nr.:

Test Report No.:

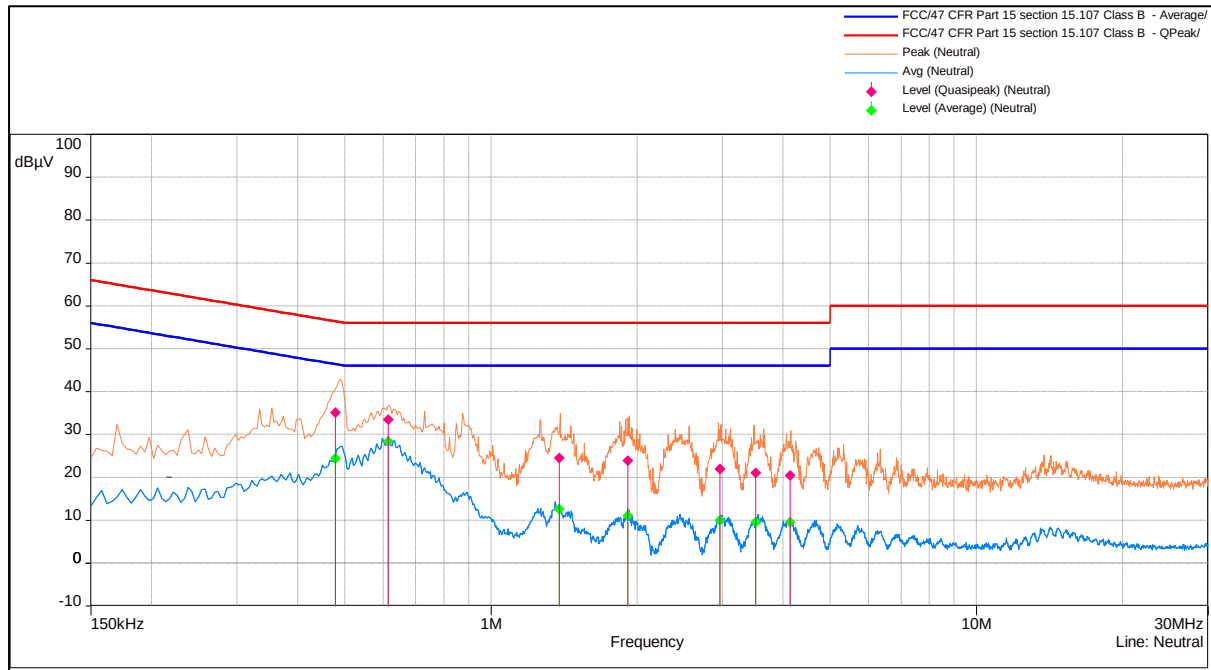
IN24LVFZ 001

Seite 67 von 69

Page 67 of 69

Test results:

110VAC-60Hz- Neutral

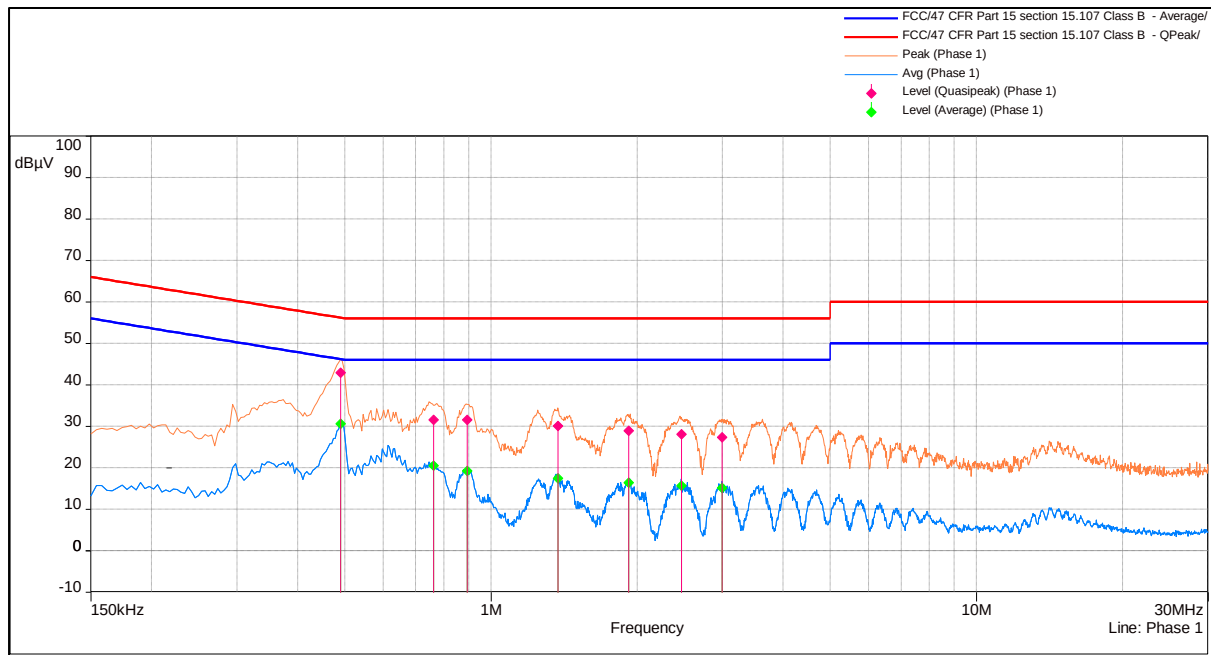


Neutral Graph

Quasipeak						
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	RBW	Comments
0.4774	35.1	56.37	-21.28	Neutral	9k	Pass
0.61215	33.46	56	-22.54	Neutral	9k	Pass
1.3801	24.55	56	-31.45	Neutral	9k	Pass
1.9129	23.9	56	-32.1	Neutral	9k	Pass
2.9573	21.95	56	-34.05	Neutral	9k	Pass
3.50535	21.08	56	-34.92	Neutral	9k	Pass
4.1298	20.51	56	-35.49	Neutral	9k	Pass

Average						
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	RBW	Comments
0.61215	28.39	46	-17.61	Neutral	9k	Pass
0.4774	24.48	46.37	-21.9	Neutral	9k	Pass
1.3801	12.6	46	-33.4	Neutral	9k	Pass
1.9129	11.08	46	-34.92	Neutral	9k	Pass
2.9573	9.95	46	-36.05	Neutral	9k	Pass
4.1298	9.61	46	-36.39	Neutral	9k	Pass
3.50535	9.6	46	-36.4	Neutral	9k	Pass

110VAC-60Hz-Line:



Line Graph

Quasipeak						
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	RBW	Comments
0.49085	42.96	56.17	-13.21	Phase 1	9k	Pass
0.8945	31.64	56	-24.36	Phase 1	9k	Pass
0.7631	31.59	56	-24.41	Phase 1	9k	Pass
1.37535	30.07	56	-25.93	Phase 1	9k	Pass
1.92045	28.98	56	-27.02	Phase 1	9k	Pass
2.4671	28.07	56	-27.93	Phase 1	9k	Pass
2.9936	27.4	56	-28.6	Phase 1	9k	Pass

Average						
Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	RBW	Comments
0.49085	30.63	46.17	-15.54	Phase 1	9k	Pass
0.7631	20.55	46	-25.45	Phase 1	9k	Pass
0.8945	19.25	46	-26.75	Phase 1	9k	Pass
1.37535	17.47	46	-28.53	Phase 1	9k	Pass
1.92045	16.44	46	-29.56	Phase 1	9k	Pass
2.4671	15.66	46	-30.34	Phase 1	9k	Pass
2.9936	15.14	46	-30.86	Phase 1	9k	Pass

10 LIST OF TABLES

Table 1: List of test and measurement instruments	7
Table 2: Instrument application Software versions	8
Table 3: Ratings and System Details as declared by Client*	9
Table 4: List of IEEE 802.15.4 Center frequencies	10
Table 5: List of BLE Centre frequencies	11
Table 6: Transmitter limits for Radiated emission	27
Table 7: Test results for frequency range 30MHz – 200MHz	28
Table 8: Test results for frequency range 200MHz – 1GHz	29
Table 9: Test results for frequency range 30MHz – 200MHz	31
Table 10: Test results for frequency range 200MHz – 1GHz	32
Table 11: Test results for frequency range 30MHz – 200MHz	34
Table 12: Test results for frequency range 200MHz – 1GHz	35
Table 13: Test results for the frequencies above 1GHz:	37
Table 14: Transmitter limits for Radiated emission	52
Table 15: Test results for frequency range 30MHz – 200MHz	53
Table 16: Test results for frequency range 30MHz – 200MHz	56
Table 17: Test results for frequency range 200MHz – 1GHz	57
Table 18: Test results for frequency range 30MHz – 200MHz	59
Table 19: Test results for frequency range 200MHz – 1GHz	60
Table 20: Test results for the frequencies above 1GHz:	62
Table 21: Limits for Conducted power line emission	66

11 List of Figures

Figure 1: Frequency Range 9 kHz- 30 MHz	14
Figure 2: Frequency Range 30 MHz – 200 MHz	14
Figure 3: Frequency Range 200 MHz - 1GHz	15
Figure 4: Frequency Range above 1 GHz	15

12 Power level used for Testing

Power Settings for IEEE 802.15.4

Model Numbers	Data rate (Mbps)	Channels Frequency (MHz)	Power level (dBm)
SU-6E-2W	1	2405	4
		2440	4
		2480	1

Power Settings for BLE

Model Numbers	Data rate (Mbps)	Channels Frequency (MHz)	Power level (dBm)
SU-6E-2W	1	2402	8
		2440	8
		2480	8

End of test report