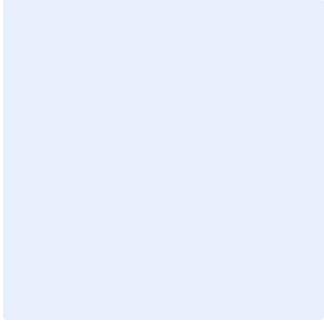


Prüfbericht-Nr.: <i>Test report no.:</i>	IN24J4N4 001	Auftrags-Nr.: <i>Order no.:</i>	146979398 0010	Seite 1 von 52 Page 1 of 52
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2503323	Auftragsdatum: <i>Order date:</i>	2024-10-29	
Auftraggeber: <i>Client:</i>	Building robotics Inc 46897 Bayside Parkway #200 Fremont CA 94538, USA			
Prüfgegenstand: <i>Test item:</i>	Sensor SU-6S			
Bezeichnung <i>Identification</i>	SU-6S-8W-HRW, SU-6S-8W-LRW, SU-6S-8W-H, SU-6S-2W-HRW, SU-6S-2W-LRW, SU-6S-2W-H	Serien -Nr.: <i>Serial no.:</i>	TTSR02243300036 TTSL02243800045 TTSH02243900022 TTRR02243500014 TTRL02243800013 TTRH02243800023	
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>	2024-11-05			
Prüfmuster-Nr.: <i>Test sample no:</i>	A003856262-006 A003856262-007			
Prüfzeitraum: <i>Testing period:</i>	2024-11-07 - 2024-12-02			
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 Phase 1, Bangalore-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>	2024-12-13	Ausstellatum: <i>Issue date:</i>	2024-12-17	
Stellung / Position:	Likhithesh M D Senior Engineer	Stellung / Position:	Madhu K.N Assistant Manager	
Sonstiges / Other:	FCC ID: AQQ-SU6S IC : 10138A-SU6S HVIN : SU-6S-8W-HRW, SU-6S-8W-LRW, SU-6S-8W-H, SU-6S-2W-HRW, SU-6S-2W-LRW, SU-6S-2W-H			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* 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. <i>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.</i>				

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- | | |
|---|---|
| 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> |
| 2 | <p>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.</p> <p><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></p> |
| 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 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.</p> <p><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></p> |

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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

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REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
IN24J4N4 001	01	Initial issue of report	2024-12-17

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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

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2 TEST SITES

2.1 Testing Facilities

- | | |
|---|--|
| <p>1. TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
ElectronicCityPhase1
Bangalore – 560 100,
India
Radiated Measurement site type:
Fully anechoic chamber (used for above 1 GHz
measurements)</p> | <p>2. TUV Rheinland (India) Pvt.Ltd.,
108, Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100.
India
Radiated Measurement site type:
Semi anechoic chamber (used for below 1 GHz
measurements)</p> |
|---|--|

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	101733	1.72 SP5	26.01.2025	Yearly	Radiated Spurious Emission
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	-	03.06.2025	Yearly	
Log Periodic Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-324	-	31.05.2025	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120D	01944	-	12.11.2025	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	15.01.2025	Yearly	
EMI Test Receiver	Rohde & Schwarz	ESW44	101773	1.72.SP1	10.05.2025	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	-	08.03.2025	Yearly	
Signal Analyzer	Rohde & Schwarz	FSV7	101133	3.48 SP3	09.02.2025	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

Sensor SU-6S family consists of the High Bay and Ruggedized Sensors 8 wire and 2 wire interfaces. Both 8-wire and 2-wire, is a complete sensing and lighting control node powered from its attached light fixture. Sensor information combined with a configurable behaviour profile makes the High Bay sensor an integral component of an intelligent lighting control and sensing solution. 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.

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
Maximum Measured Power (e.i.r.p)		4.49dBm @ 2405MHz	3.23dBm @2402MHz
Modulation		IEEE 802.15.4: OQPSK	BLE:GFSK
Number of antennas		1	1
Antenna Gain & Type		0dBi & Wire antenna (internal)	
Supply Voltage to Product		9.5 to 22.5 VDC [SU-6S-2W] & 12 to 30 VDC [SU-6S-8W]	
Environmental conditions	Ruggedized Storage	0° to 60° C	
	Ruggedized Operating	-31° to 185° F / -35° to 85° C	
	High Bay Storage	0° to 60° C	
	High Bay Operating	32° to 122° F / 0° to 50° C	
EUT Dimension	Ruggedized	90.0 mm (Diameter) * 29.5 mm (Height)	
	High Bay	90.0 mm (Length) * 90.0 mm(Width)	

***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-6S-8W** and **SU-6S-2W** product, all models are electrically identical. As a result, we evaluated the **SU-6S-8W-HRW**, 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): SU-6S-8W-HRW, SU-6S-8W-LRW, SU-6S-8W-H, SU-6S-2W-HRW, SU-6S-2W-LRW, SU-6S-2W-H

Software version : ETS_V2.3

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

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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

1. TUV Sample Identification number: A003856262-006 – Radiated test Sample
A003856262-007 – Conducted test Sample

5 OPERATIONAL DESCRIPTION

The sensor operates by detecting motion and providing corresponding LED status indicators. When powered, the sensor's LED will display different colors and patterns to indicate its status, such as blinking green for successful power-up and motion detection, blinking red for wiring issues, and solid red for a faulty sensor. Installation involves de-energizing the luminaire, mounting the sensor using the provided components, and connecting it to the control unit via an RJ45 coupler. The sensor's performance and status can be monitored through its LED indicators, ensuring proper functionality and ease of maintenance.

6 TEST METHODOLOGY

6.1 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.

6.1.1 Test Setup Configuration

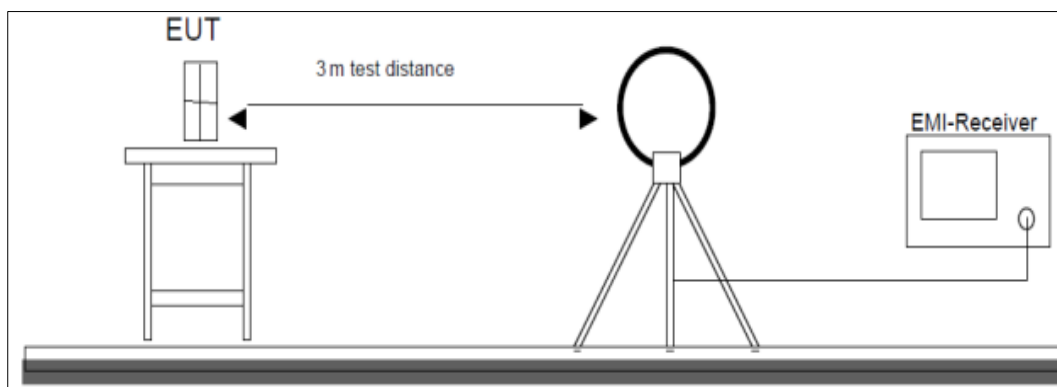


Figure 1: Frequency Range 9 kHz- 30 MHz

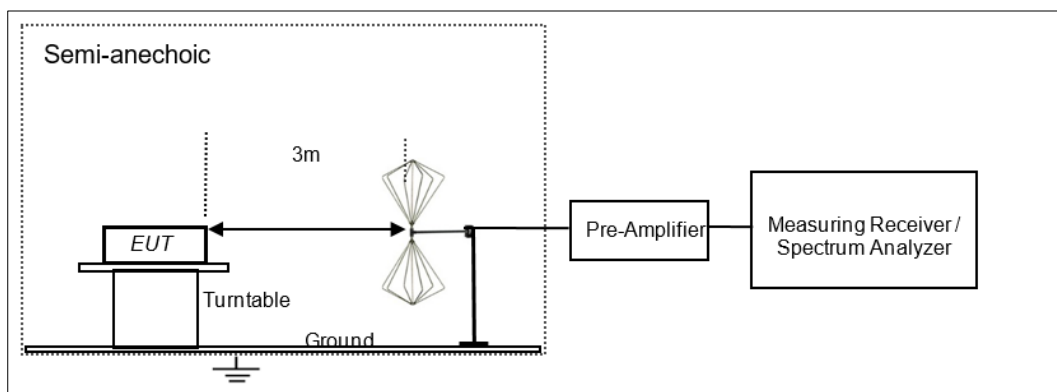


Figure 2: Frequency Range 30 MHz – 200 MHz

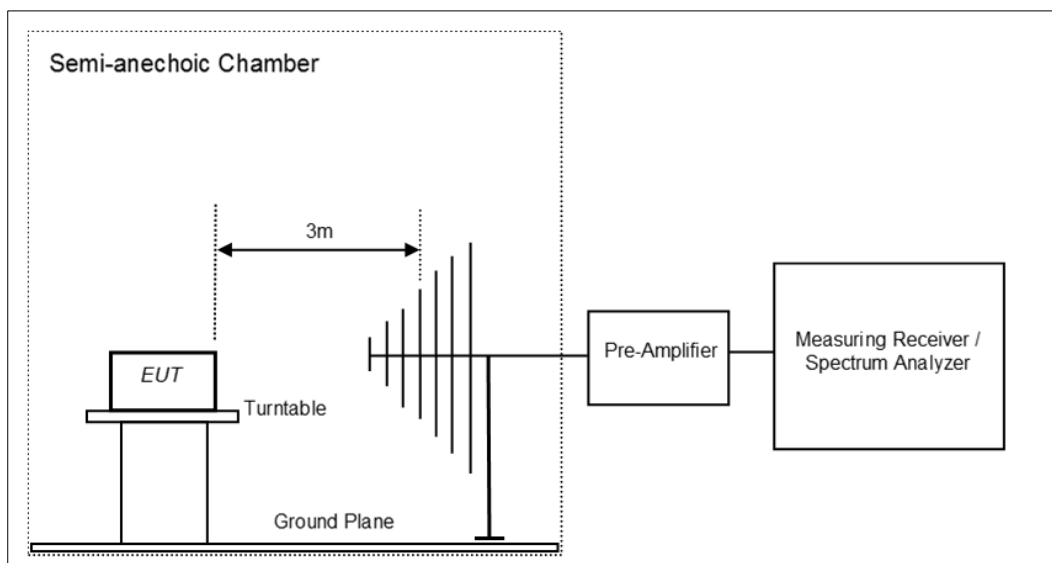


Figure 3: Frequency Range 200 MHz - 1GHz

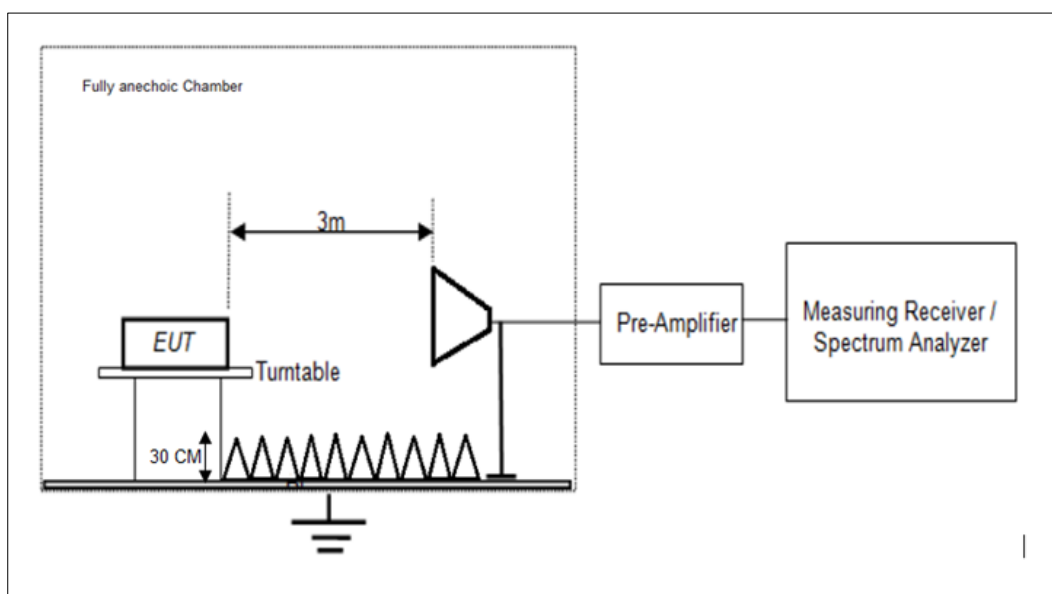


Figure 4: Frequency Range above 1 GHz

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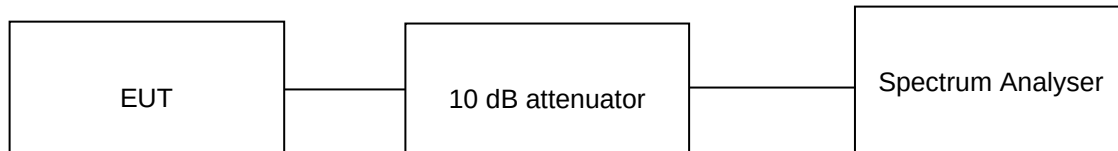
7 TEST RESULTS FOR IEEE 802.15.4

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: 16V DC/1Amps Current

Relative humidity: 65%

KDB Guidelines applied:

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

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Test results:

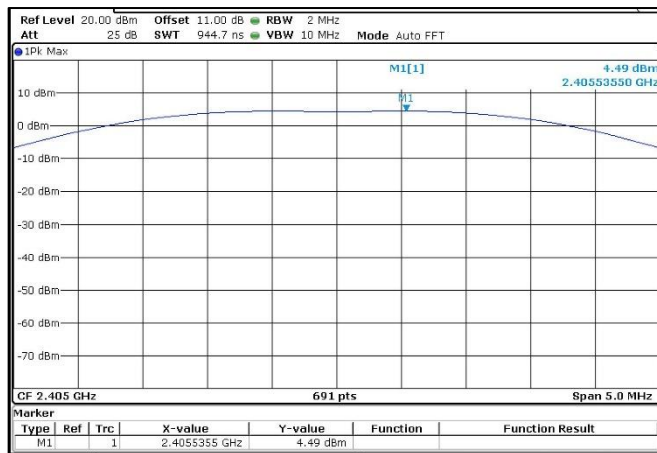
Note:

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 (0.4dB).
3. 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.

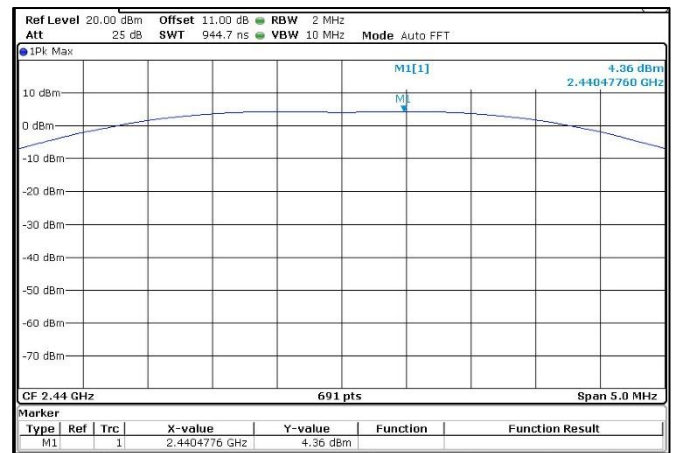
SU-6S-8W-HRW:

Data Rate (Mbps)	Channel Frequency (MHz)	Measured Power (dBm)	E.I.R.P (dBm)	Power Limit (dBm)	Limit (e.i.r.p)
1	2405	4.49	4.49	30	36
	2440	4.36	4.36	30	36
	2480	-4.74	-4.74	30	36

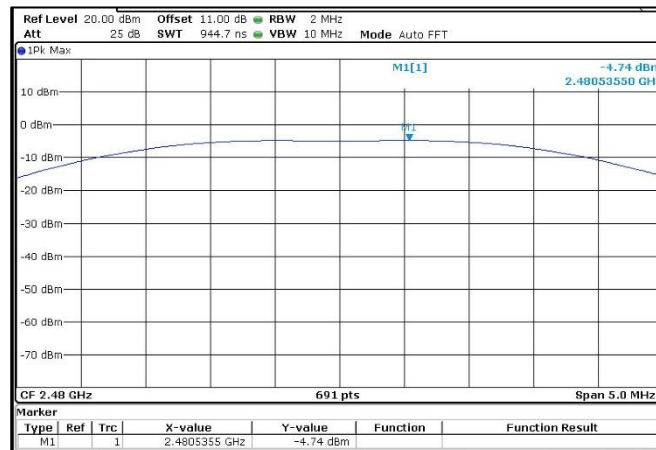
Test Plots:



Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

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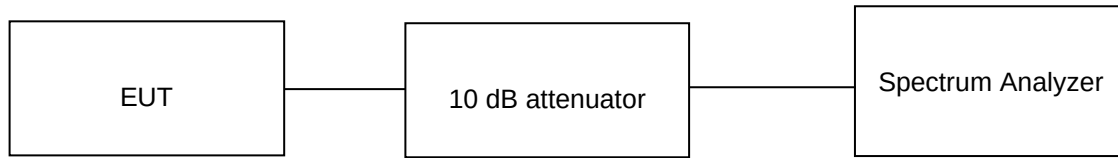
7.2 DTS Bandwidth & 99% Bandwidth

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: 16V DC/1Amps Current

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 0 dBi.

SU-6S-8W-HRW:

Data Rate (Mbps)	Channel Frequency (MHz)	99% Occupied bandwidth (MHz)	6dB BW (MHz)	Limit (kHz)
1Mbps	2405	2.23	1.24	0.5
	2440	2.25	1.34	0.5
	2480	2.25	1.57	0.5

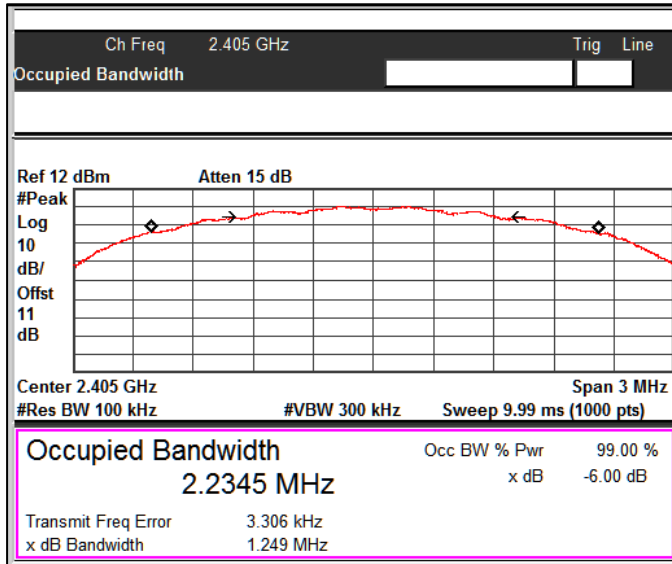
Prüfbericht - Nr.:
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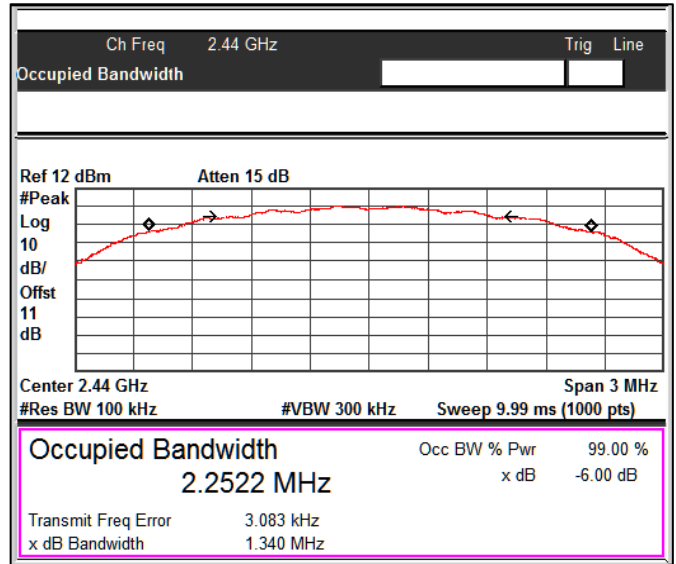
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Test Plots:

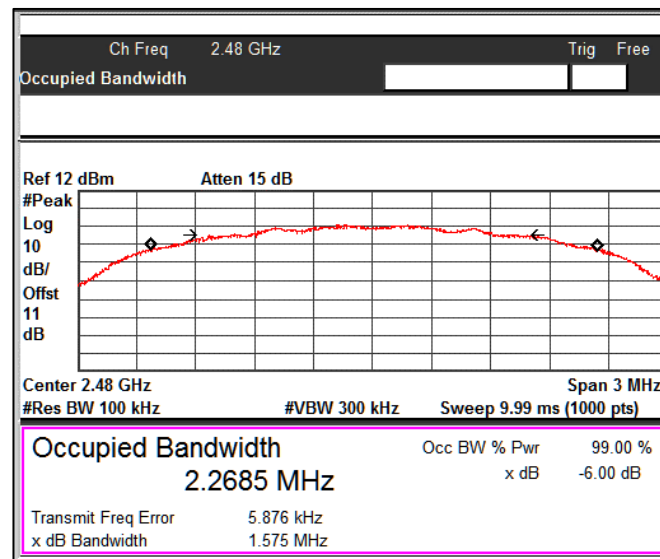
6dB DTS Plots



Channel Frequency 2405MHz



Channel Frequency 2440MHz



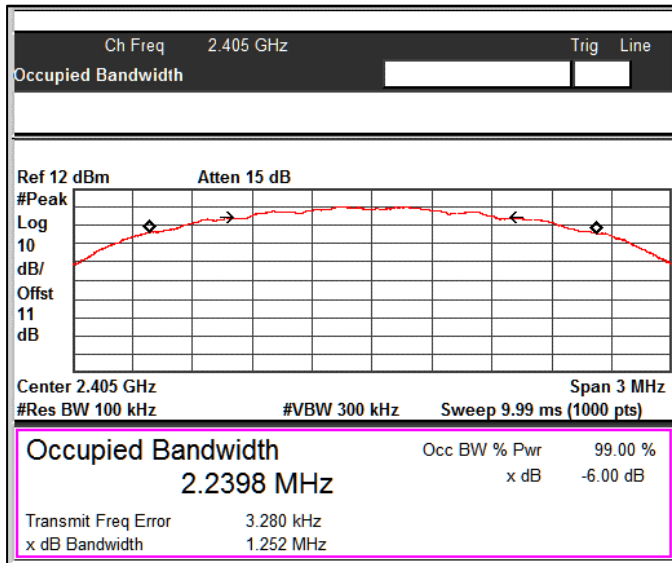
Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

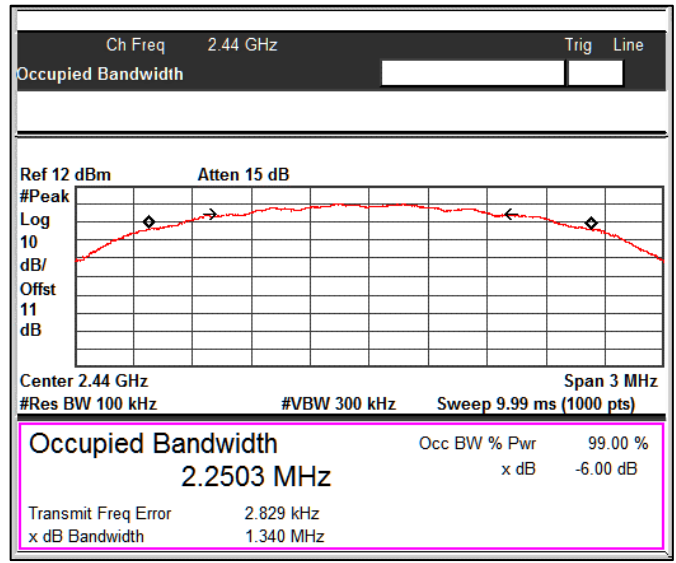
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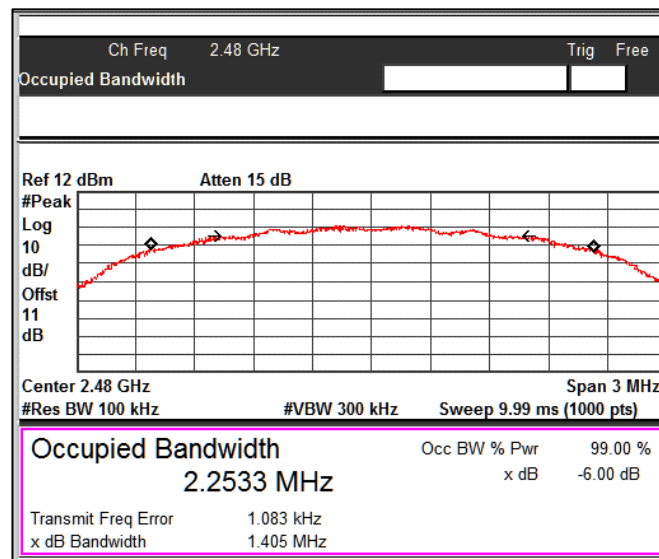
99% OBW plots



Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

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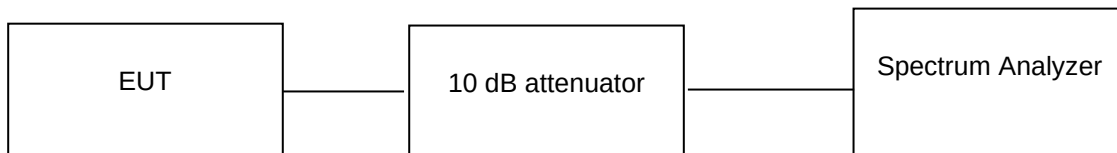
7.3 Power Spectral Density

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: 16V DC/1Amps Current 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.

SU-6S-8W-HRW:

Data Rate (Mbps)	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	PSD Limit (dBm/kHz)
1Mbps	2405	-8.39	8.00
	2440	-8.62	8.00
	2480	-17.64	8.00

Prüfbericht - Nr.:

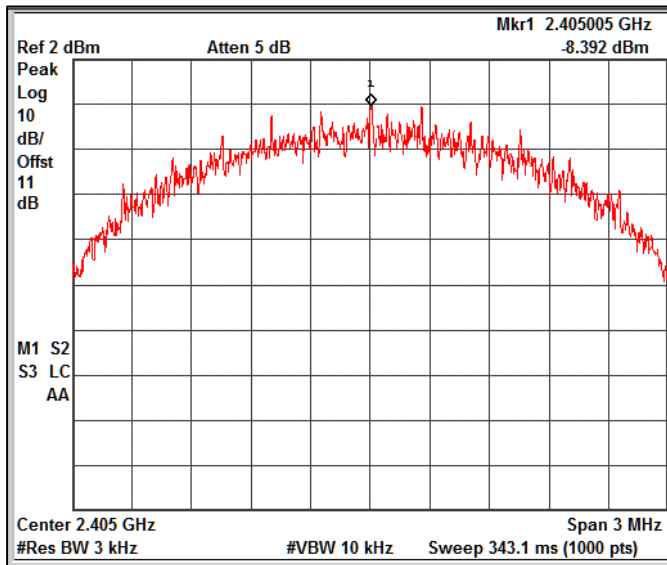
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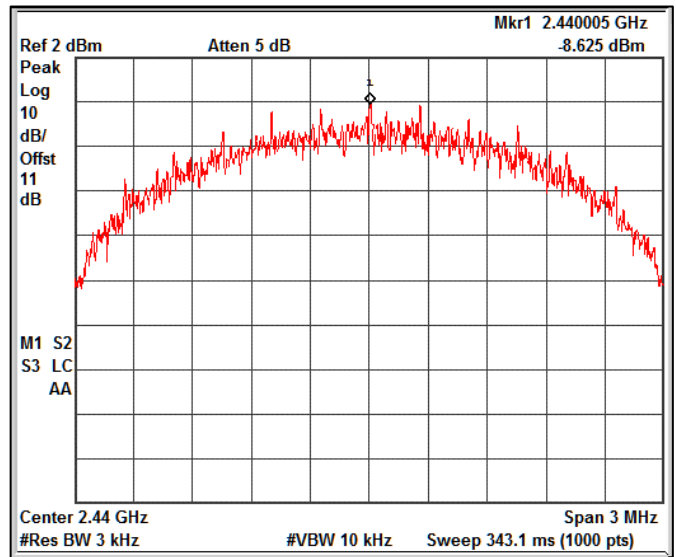
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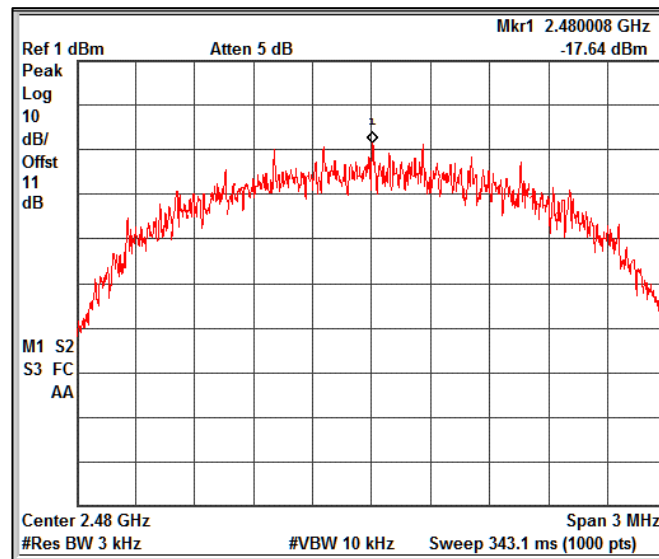
Test Plots:



Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

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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

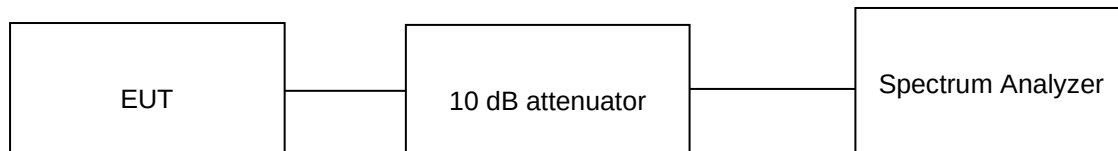
Antenna port

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: 16V DC/1Amps Current

Relative humidity: 65%

KDB Guidelines applied:

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

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Test results:

Note:

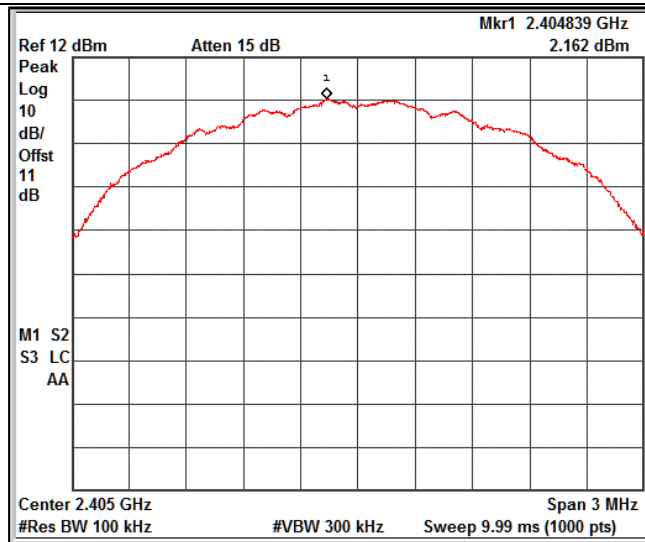
1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 0dBi.

SU-6S-8W-HRW:

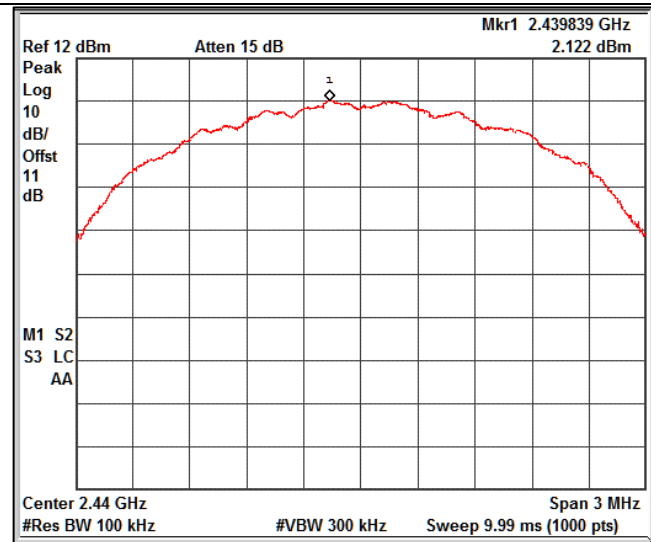
7.4.1 Band edge

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	2390.00	-52.81	2.16	-54.97	-20
2480.00	2483.50	-51.71	-6.87	-44.84	-20

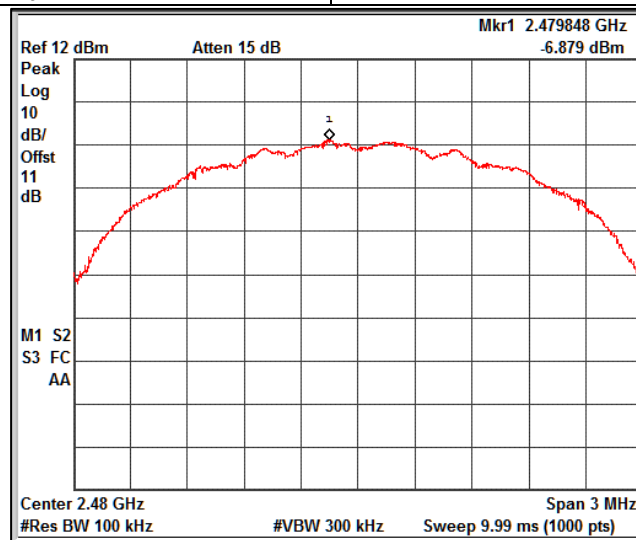
Reference Plots:



Channel Frequency 2405MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

Prüfbericht - Nr.:

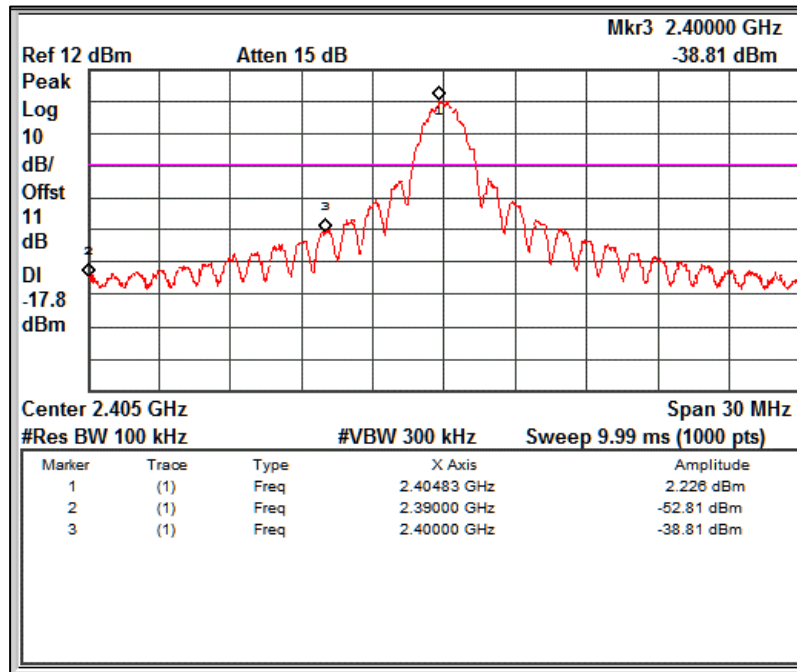
Test Report No.:

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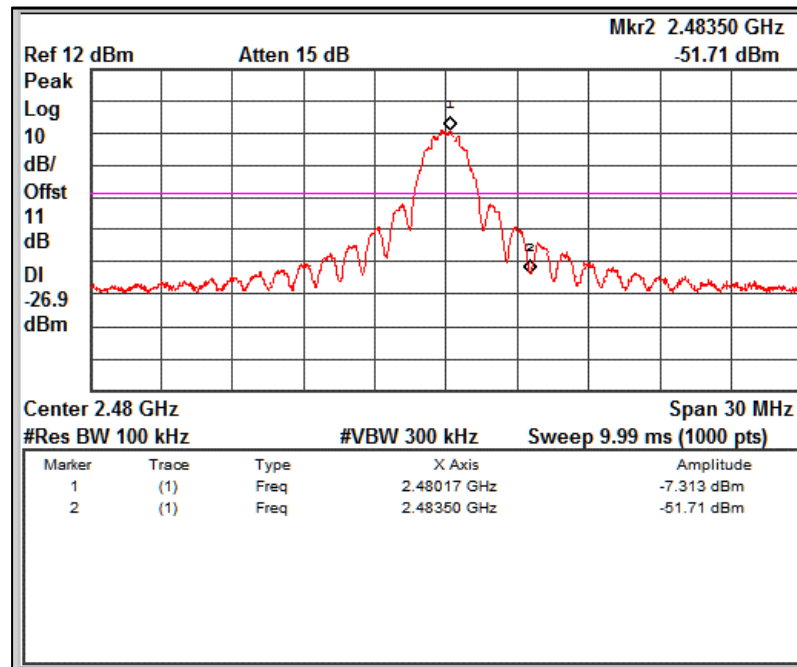
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Bandedge Plots:



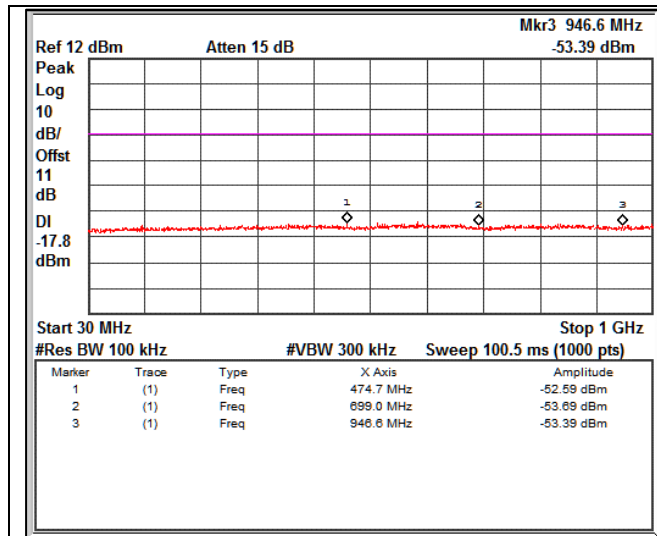
Channel Frequency:2405MHz



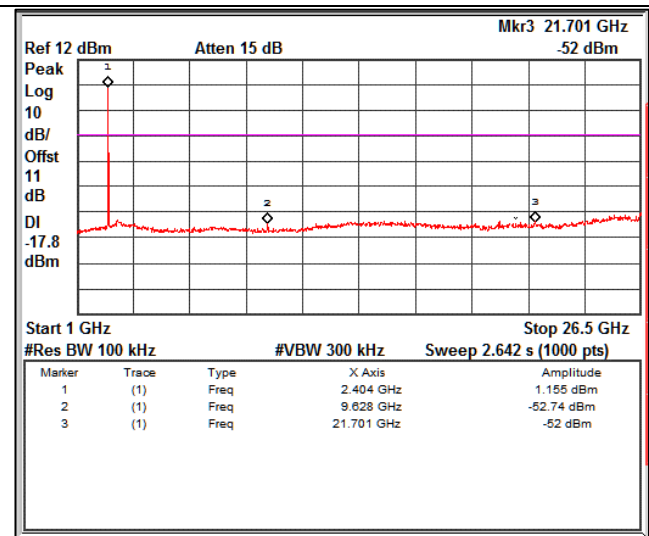
Channel Frequency:2480MHz

7.4.2 Out-Of-Band Emissions

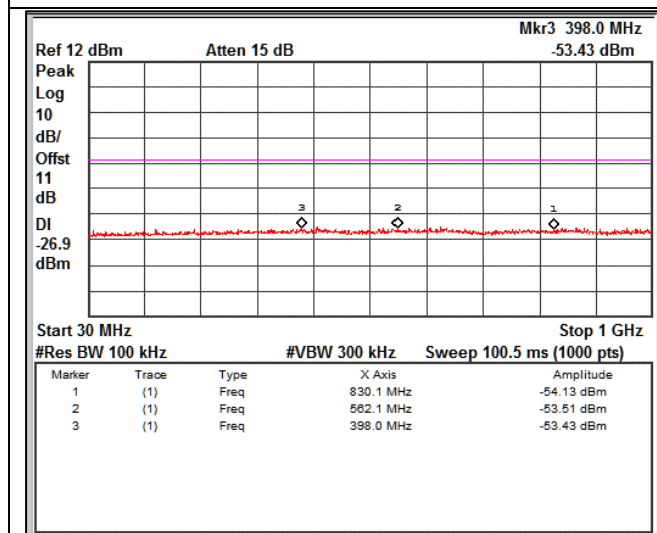
SU-6S-8W-HRW



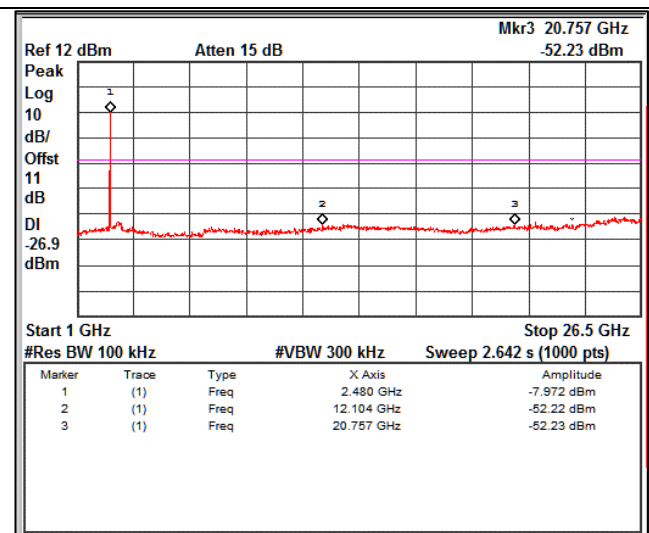
Channel Frequency: 2405MHz Frequency Range 30MHz – 1GHz



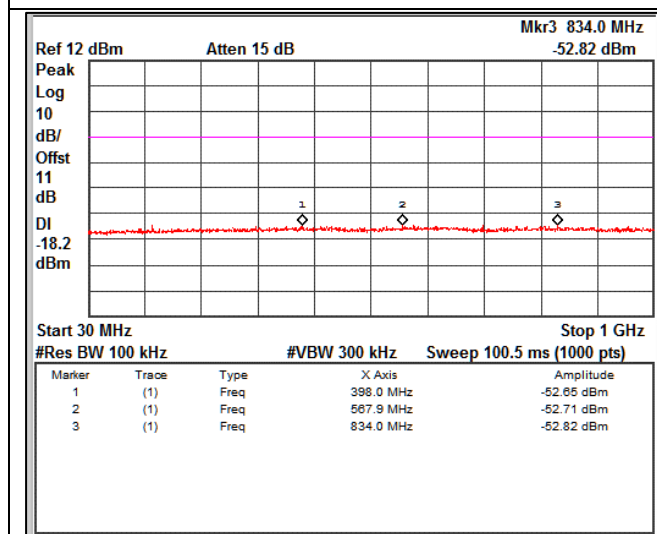
Channel Frequency: 2405MHz Frequency Range 1GHz – 26.5GHz



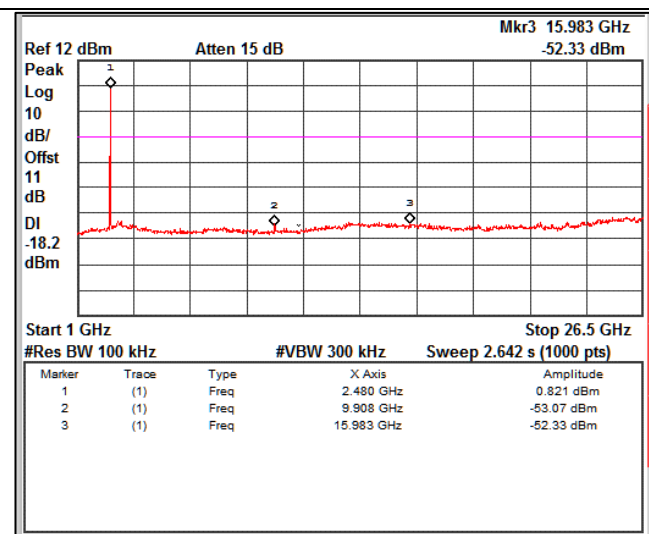
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



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



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



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

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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: 16V DC/1Amps Current

Relative humidity: 65%

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Test results of SU-6S-8W-HRW:

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.

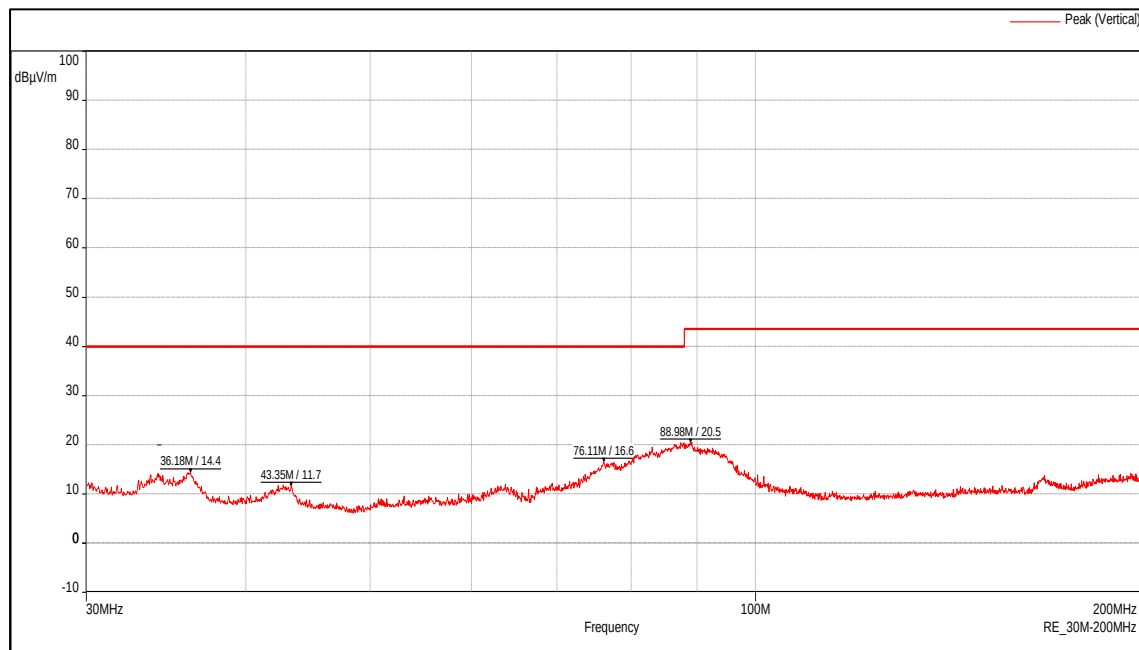
Test results of SU-6S-8W-HRW:

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	36.18	14.40	40.00	-25.60
	43.35	11.70	40.00	-28.30
	76.10	16.60	40.00	-23.40
	88.98	20.50	43.50	-23.00
Horizontal	43.02	9.74	40.00	-30.26
	56.13	8.55	40.00	-31.45
	87.24	9.65	40.00	-30.35
	134.88	10.80	43.50	-32.70

Frequency Range: 30MHz -200MHz_Vertical Polarization



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Frequency Range: 30MHz -200MHz_Horizontal Polarization

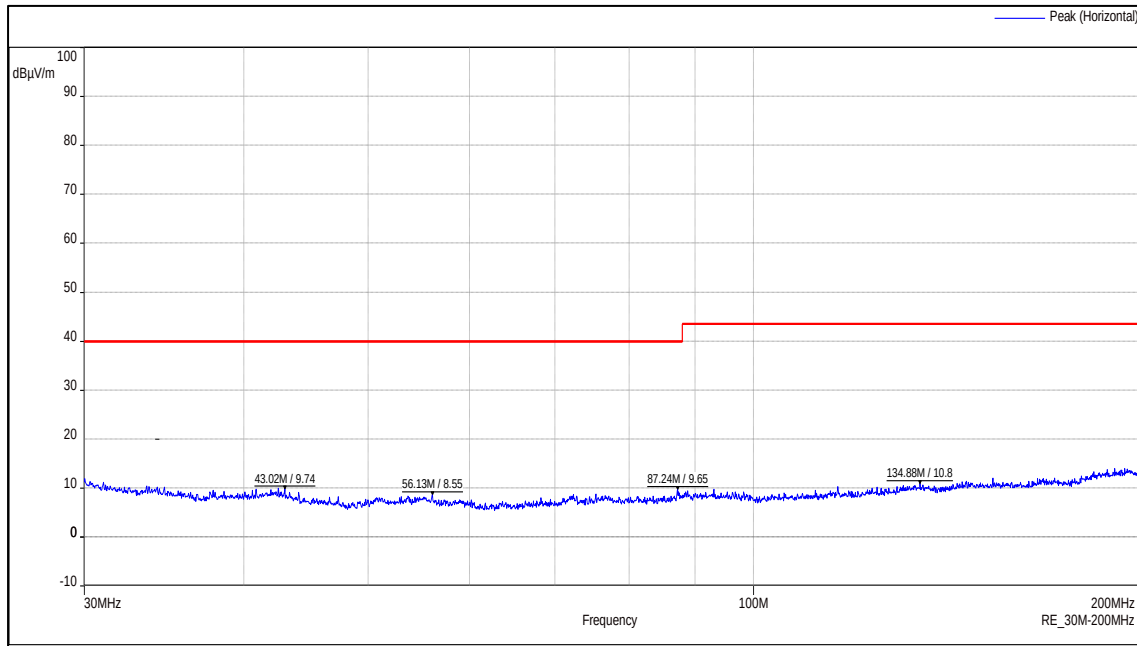


Table 8: Test results for frequency range 200MHz – 1GHz

IEEE 802.15.4:

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	235.10	13.50	46.00	-32.50
	266.42	16.80	46.00	-29.20
	343.85	17.40	46.00	-28.60
	486.38	18.50	46.00	-27.50
	943.97	24.20	46.00	-21.80
Horizontal	211.34	11.50	43.50	-32.00
	347.33	17.80	46.00	-28.20
	597.17	19.80	46.00	-26.20
	857.57	22.50	46.00	-23.50

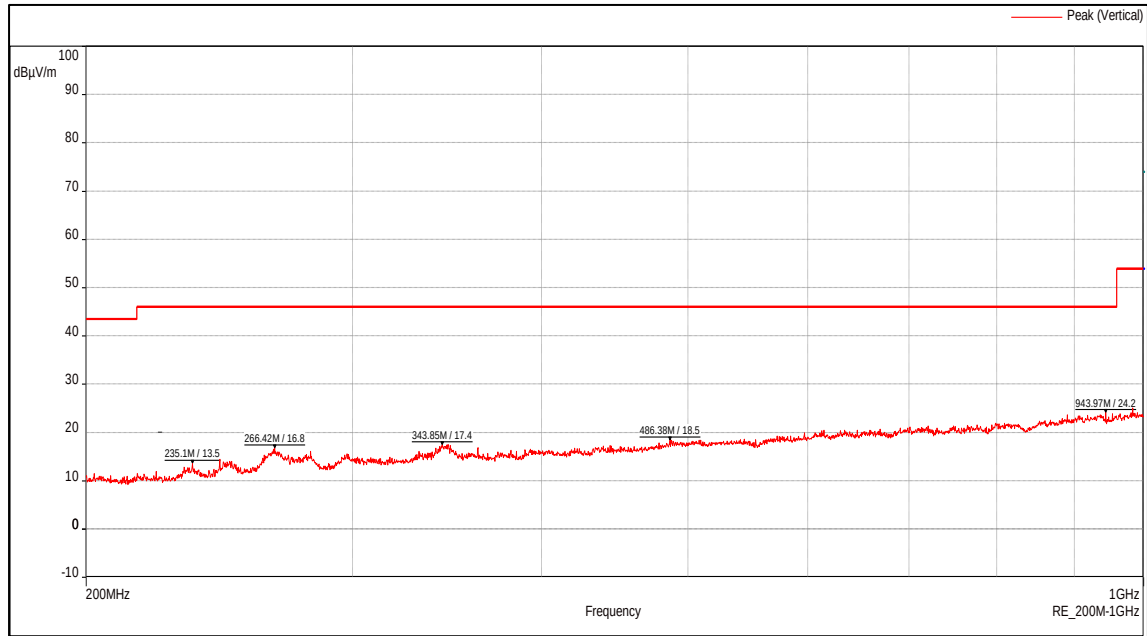
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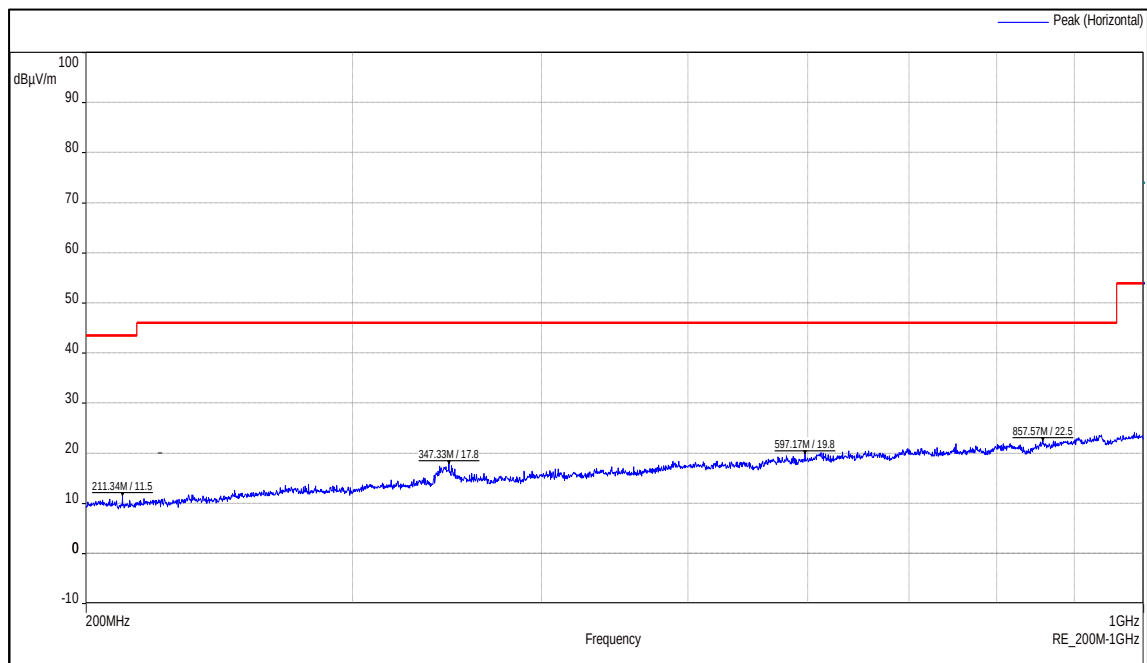
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IEEE 802.15.4 Plots:

Frequency Range: 200MHz – 1GHz_Vertical Polarization



Frequency Range: 200MHz – 1GHz_Horizontal Polarization



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**Table 9: Test results for the frequencies above 1GHz:
SU-6S-8W-HRW 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	100.31	-	-
	2405(Av)		97.64	-	-
	2390(Pk)		45.16	74.00*	-28.84
	2390(Av)		37.61	54.00*	-16.39
	4810(Pk)		44.60	74.00	-29.40
	4810(Av)		34.23	54.00	-19.77
	7215(Pk)		47.88	74.00	-26.12
	7215(Av)		35.45	54.00	-18.55
	2405(Pk)	Horizontal	96.94	-	-
	2405(Av)		94.26	-	-
	2390(Pk)		43.13	74.00*	-30.87
	2390(Av)		34.21	54.00*	-19.79
	4810(Pk)		41.78	74.00	-32.22
	4810(Av)		29.35	54.00	-24.65
	7215(Pk)		47.63	74.00	-26.37
	7215(Av)		35.41	54.00	-18.59
2440	2440(Pk)	Vertical	101.07	-	-
	2440(Av)		98.41	-	-
	4880(Pk)		45.50	74.00	-28.50
	4880(Av)		34.42	54.00	-19.58
	7320(Pk)		47.20	74.00	-26.80
	7320(Av)		35.84	54.00	-18.16
	2440(Pk)	Horizontal	96.09	-	-
	2440(Av)		93.46	-	-
	4880(Pk)		41.34	74.00	-32.66
	4880(Av)		29.50	54.00	-24.50
	7320(Pk)		47.41	74.00	-26.59
	7320(Av)		35.83	54.00	-18.17
2480	2480(Pk)	Vertical	92.96	-	-
	2480(Av)		90.10	-	-
	2483.5(Pk)		61.38	74.00*	-12.62
	2483.5(Av)		52.86	54.00*	-1.14
	4960(Pk)		42.13	74.00	-31.87
	4960(Av)		32.64	54.00	-21.36
	7440(Pk)		47.31	74.00	-26.69
	7440(Av)		35.84	54.00	-18.16
	2480(Pk)	Horizontal	86.60	-	-
	2480(Av)		83.73	-	-
	2483.5(Pk)		55.19	74.00*	-18.81
	2483.5(Av)		46.40	54.00*	-7.60
	4960(Pk)		41.60	74.00	-32.40
	4960(Av)		30.45	54.00	-23.55
	7440(Pk)		47.47	74.00	-26.53
	7440(Av)		35.88	54.00	-18.12

→ Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

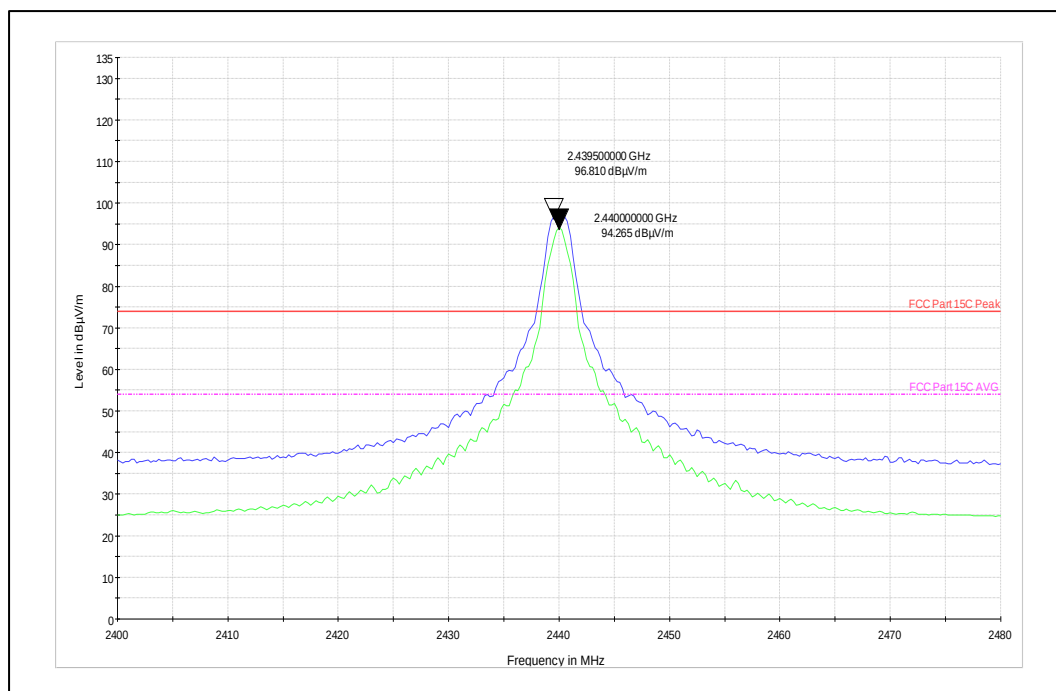
Av: Average Detect

Worst Case Test Plots:

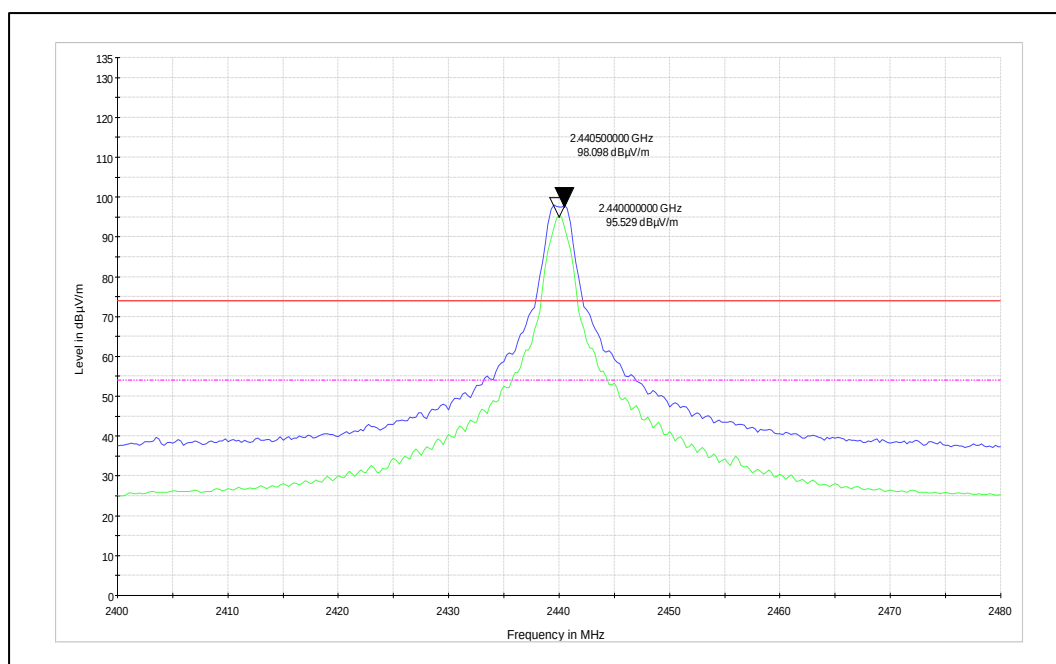
SU-6S-8W-HRW IEEE 802.15.4: Plots:

Data Rate: 1 Mbps

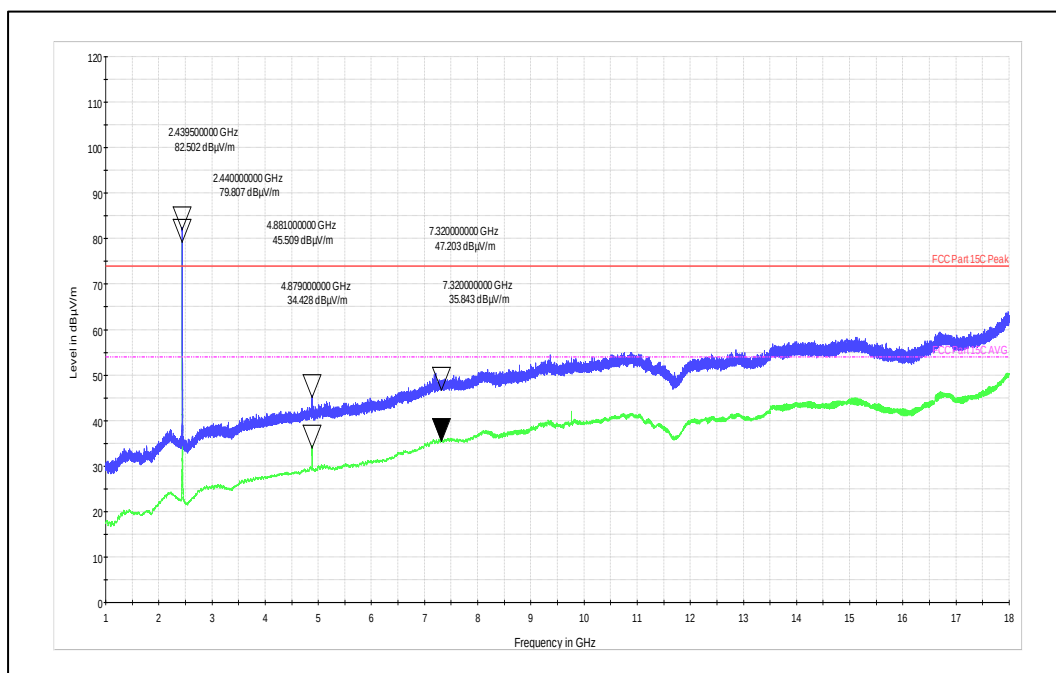
Channel Frequency 2440MHz_Vertical Polarization



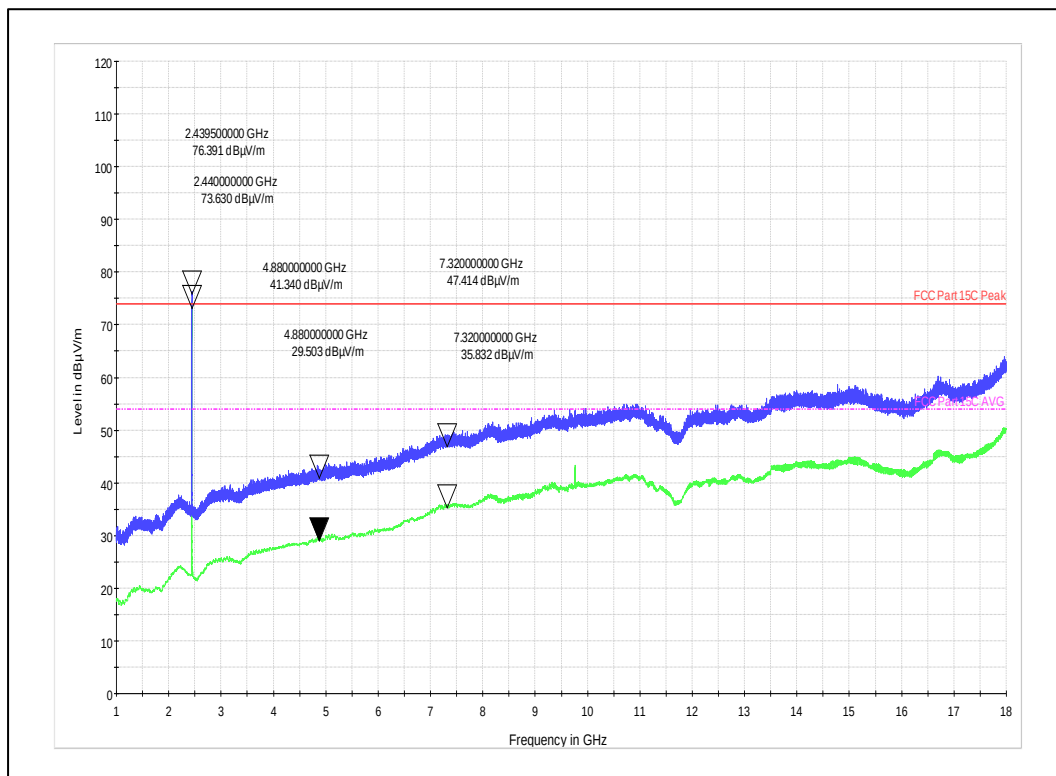
Channel Frequency 2440MHz_Horizontal Polarization



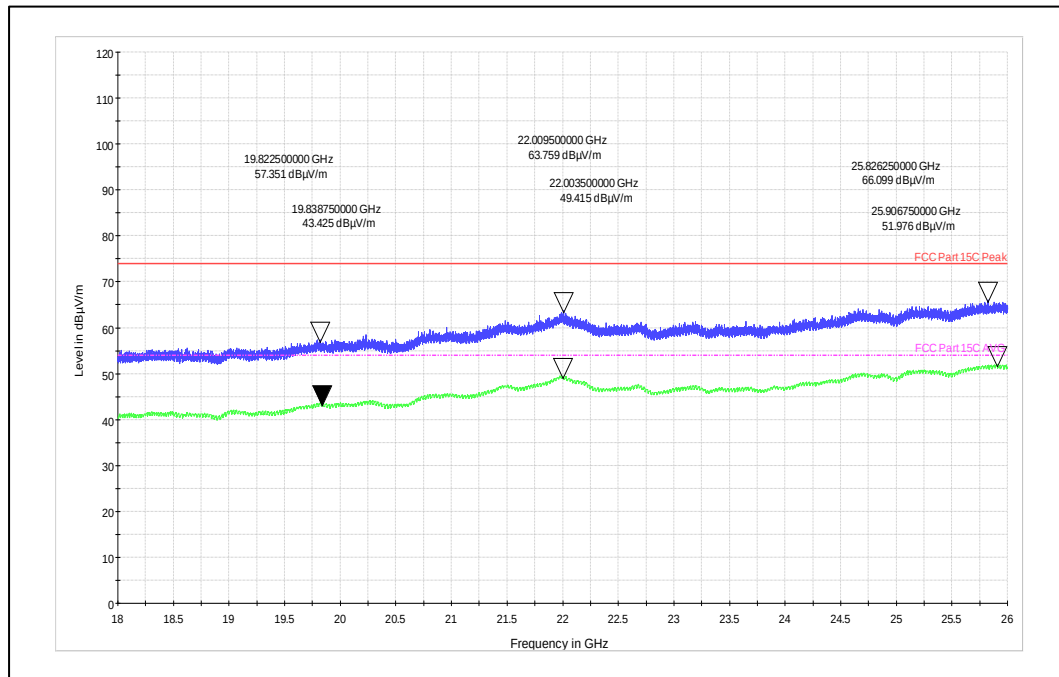
Frequency Range: 1GHz – 18GHz_Vertical Polarization



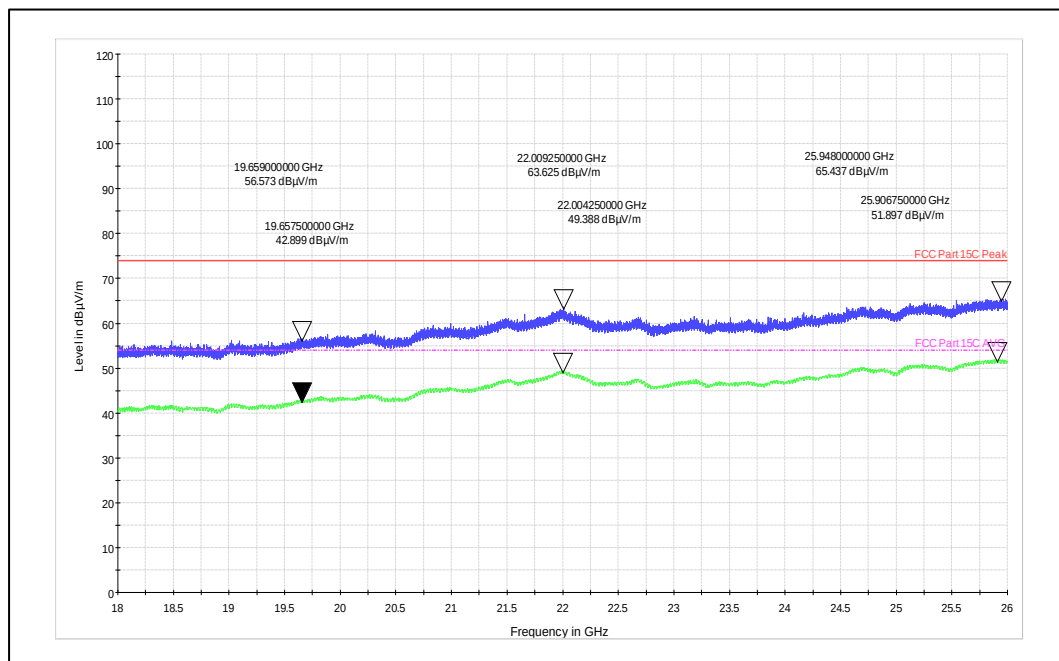
Frequency Range: 1GHz – 18GHz_Horizontal Polarization



Frequency range: 18GHz to 26GHz_Vertical Polarization



Frequency range: 18GHz to 26GHz_Horizontal Polarization



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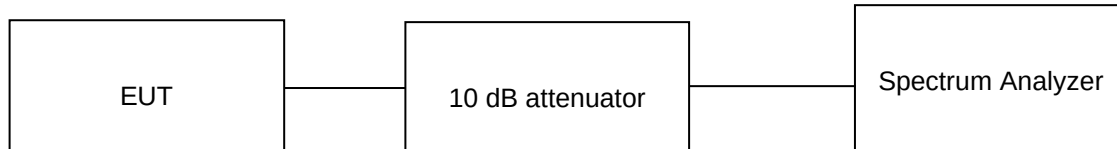
8 TEST RESULTS FOR BLUETOOTH LOW ENERGY

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: 16V DC/1Amps Current

Relative humidity: 65%

KDB Guidelines applied:

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

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Test results:

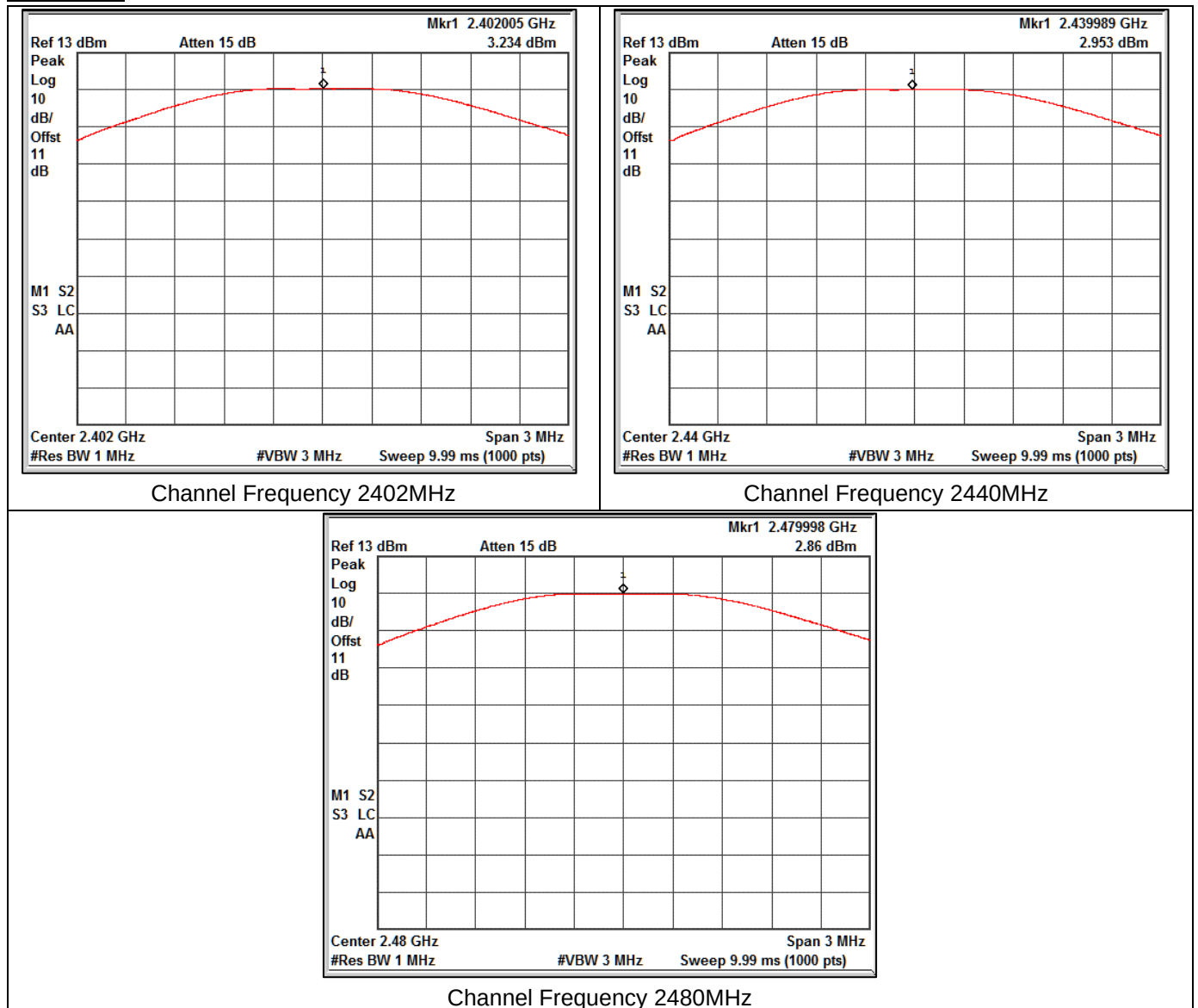
Note:

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 (0.4)
3. 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-6S-8W-HRW:

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	3.23	3.23	30	36
	2440	2.95	2.95	30	36
	2480	2.86	2.86	30	36

Test Plots:



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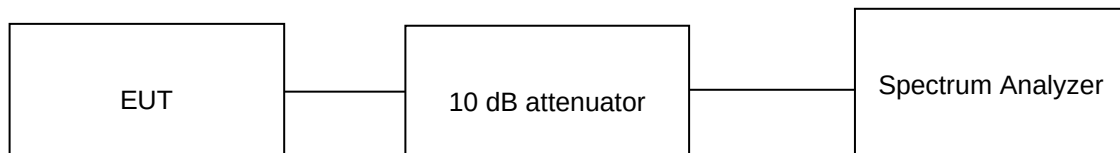
8.2 DTS Bandwidth & 99% Bandwidth

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: 16V DC/1Amps Current

Relative humidity: 65%

KDB Guidelines applied:

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

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Test results:

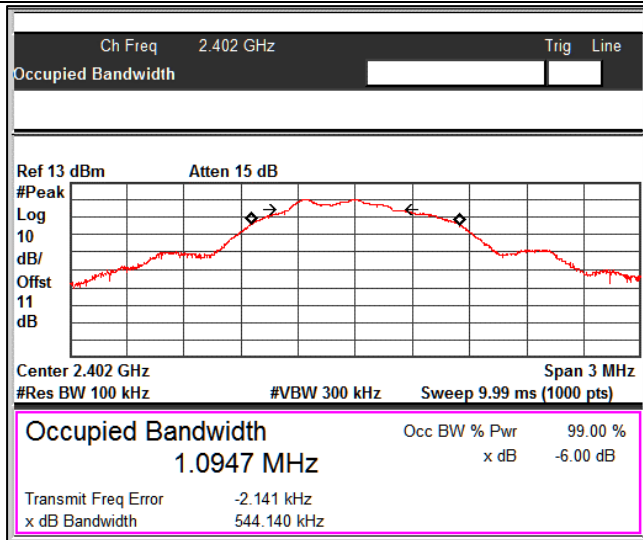
Note: All the losses are included during measurement and final values are mentioned in the test report.

SU-6S-8W- HRW:

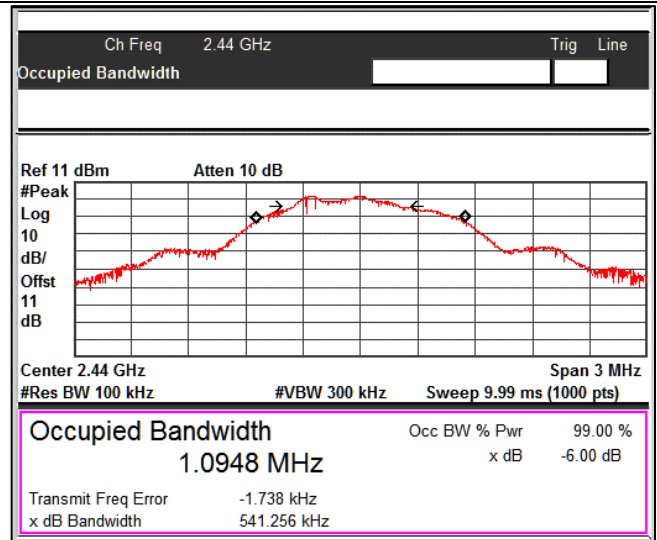
Data Rate (Mbps)	Channel Frequency (MHz)	99% Occupied bandwidth (MHz)	6dB BW (MHz)	Limit (kHz)
1Mbps	2402	1.033	0.544	0.5
	2440	1.037	0.541	0.5
	2480	1.034	0.540	0.5

Test Plots:

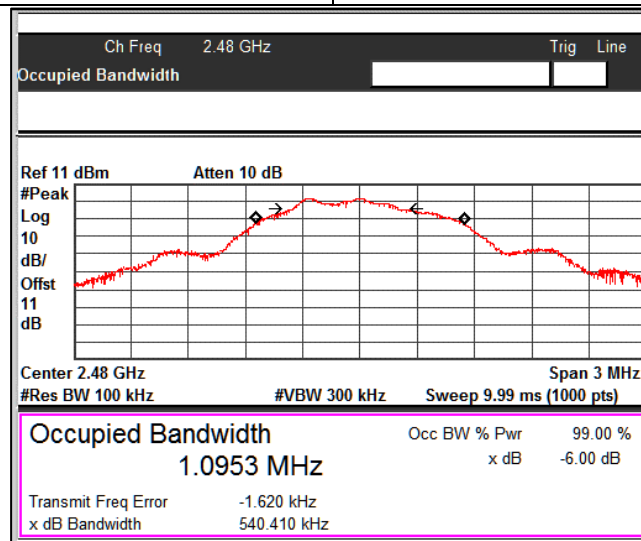
6dB DTS Plots



Channel Frequency 2402MHz



Channel Frequency 2440MHz



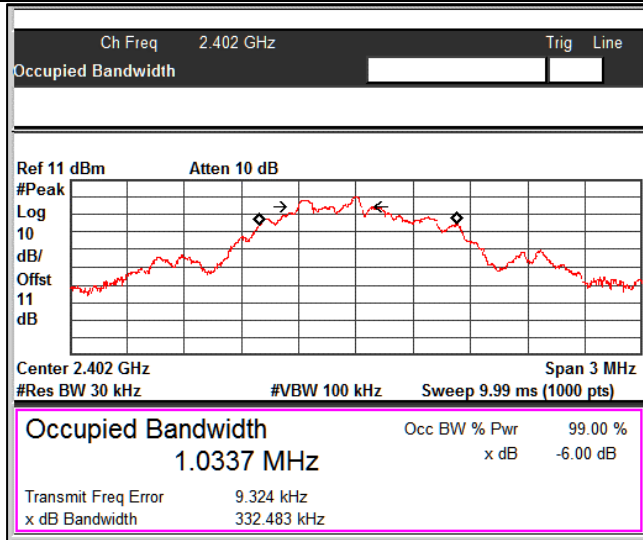
Channel Frequency 2480MHz

Prüfbericht - Nr.:
Test Report No.:

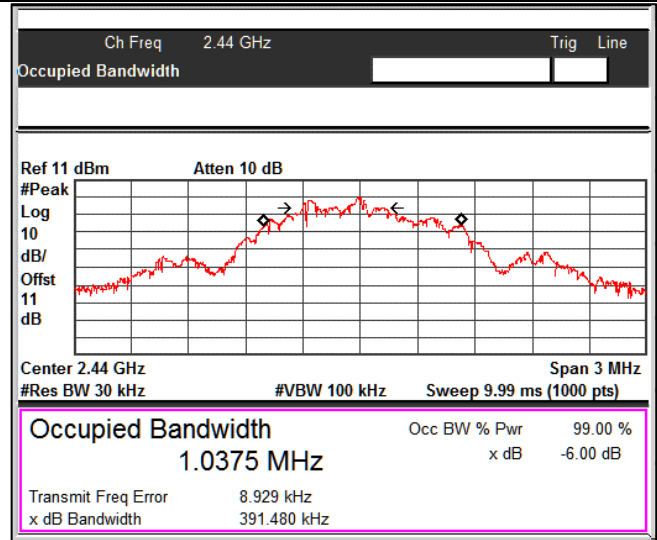
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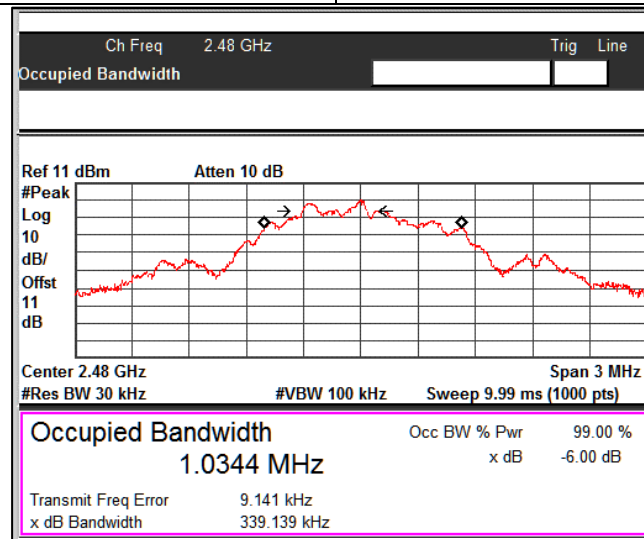
99% OBW plots



Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

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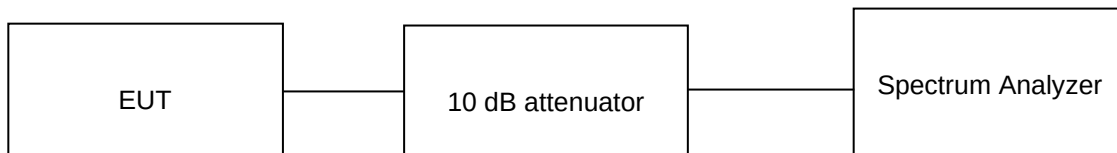
8.3 Maximum Power Spectral Density

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: 16V DC/1Amps Current

Relative humidity: 65%

KDB Guidelines applied:

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

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Test results:

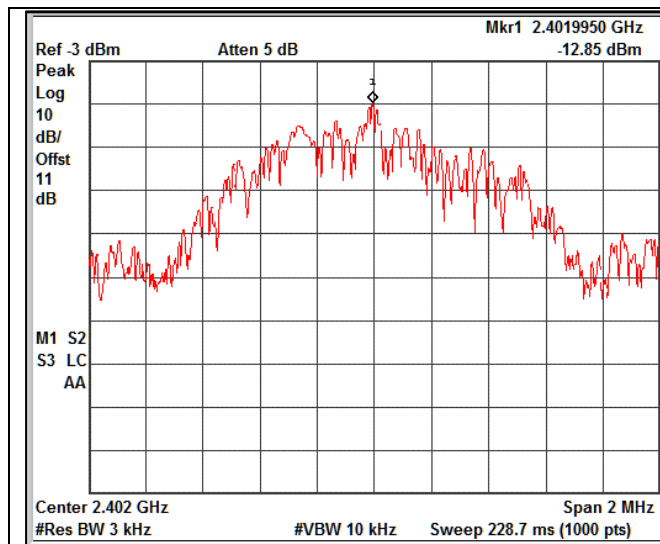
Note:

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 (0.4dB).

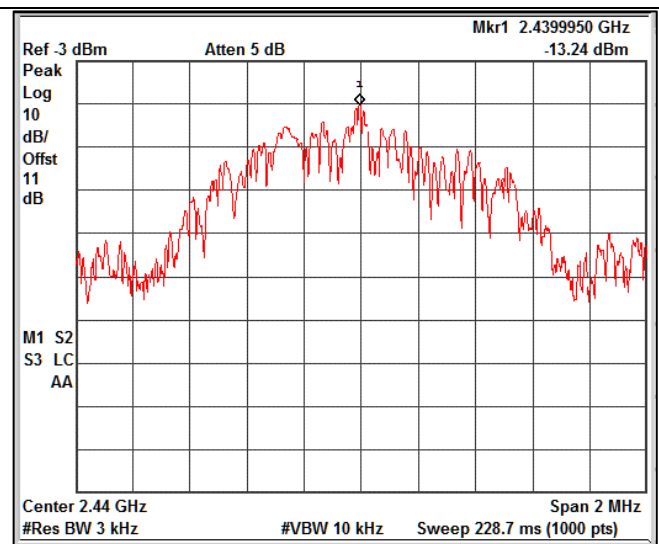
SU-6S- 8W-HRW:

Data Rate (Mbps)	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	PSD Limit (dBm/kHz)
1Mbps	2402	-12.85	8.00
	2440	-13.24	8.00
	2480	-13.41	8.00

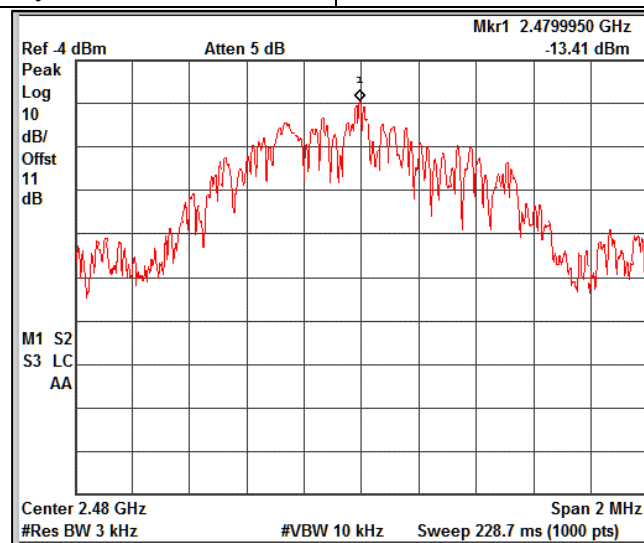
Test Plots:



Channel Frequency 2402MHz



Channel Frequency 2440MHz



Channel Frequency 2480MHz

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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

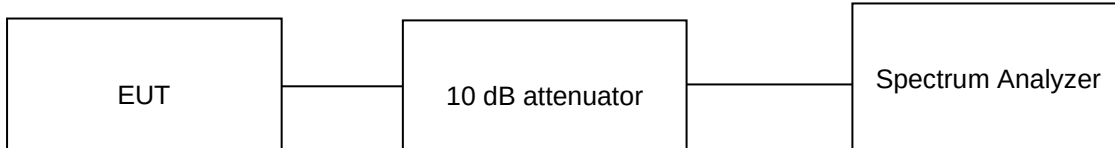
Antenna port

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: 16V DC/1Amps Current

Relative humidity: 65%

KDB Guidelines applied:

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

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Test results: Note:

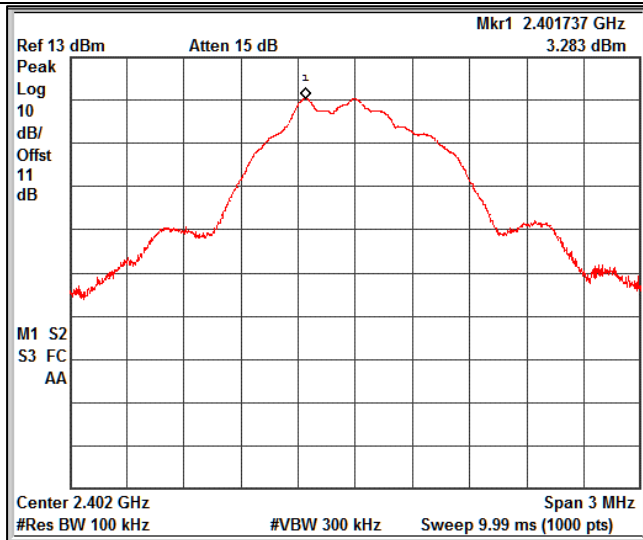
1. All the losses are included during measurement and final values are mentioned in the test report.
2. Final Value (dBm) = Measured Value (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB)
3. This product does not support additional beamforming gain / directional gain, it uses signal antenna and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

SU-6E- 8W-HRW:

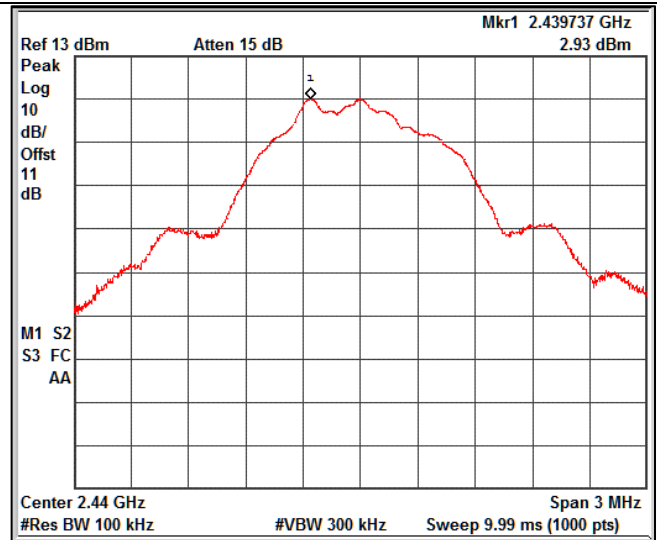
8.4.1 Band edge

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	2390.00	-54.70	3.28	-57.98	-20
2480.00	2483.50	-54.64	2.87	-57.51	-20

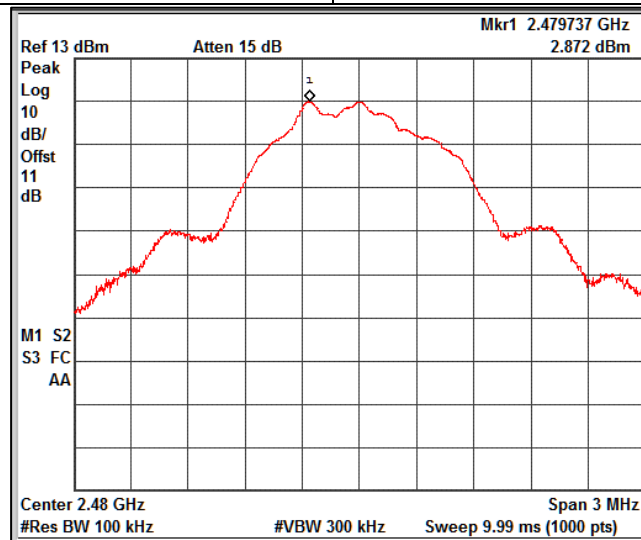
Reference Plots:



Channel Frequency 2402MHz



Channel Frequency 2440MHz



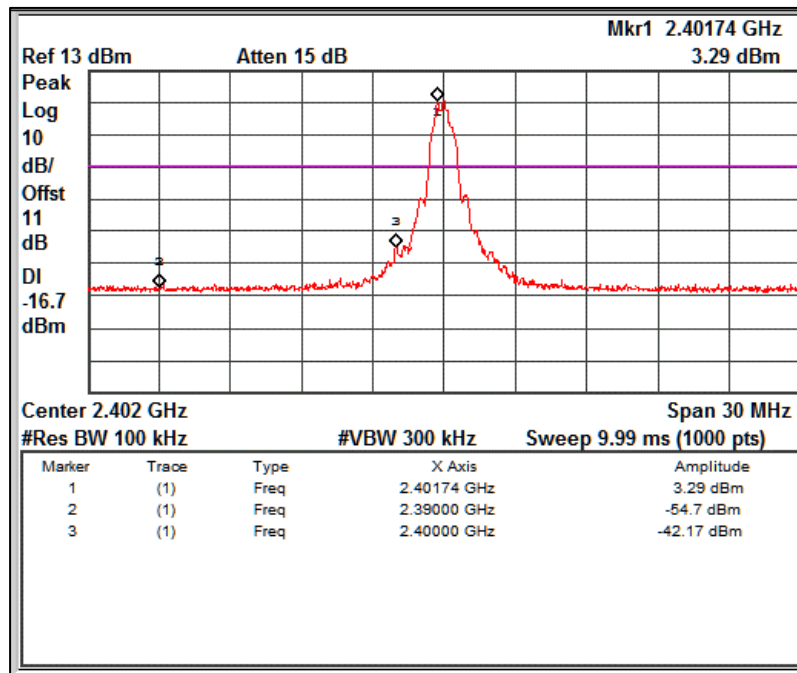
Channel Frequency 2480MHz

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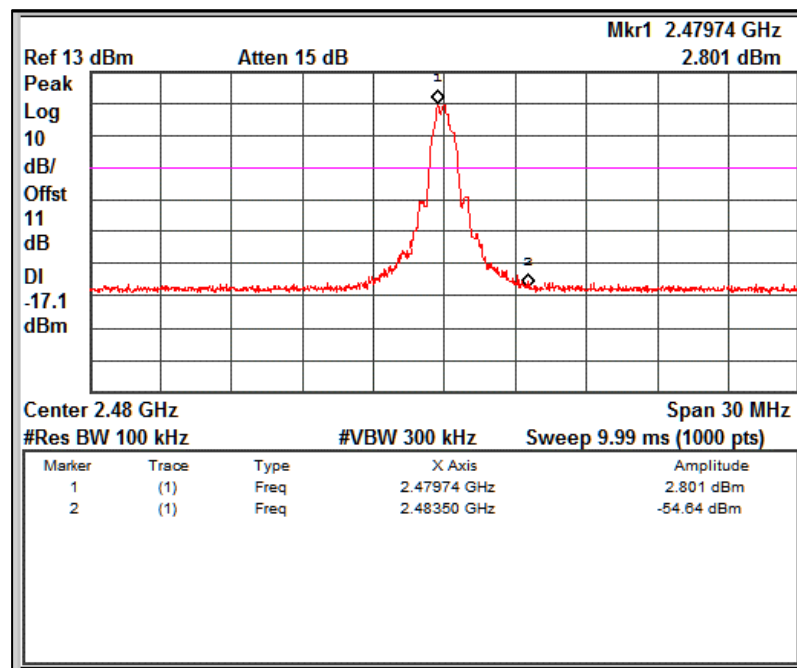
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Bandedge Plots:



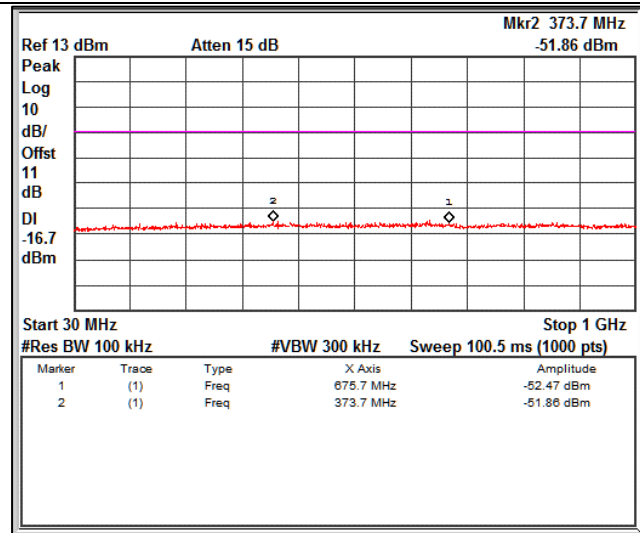
Channel Frequency:2402MHz



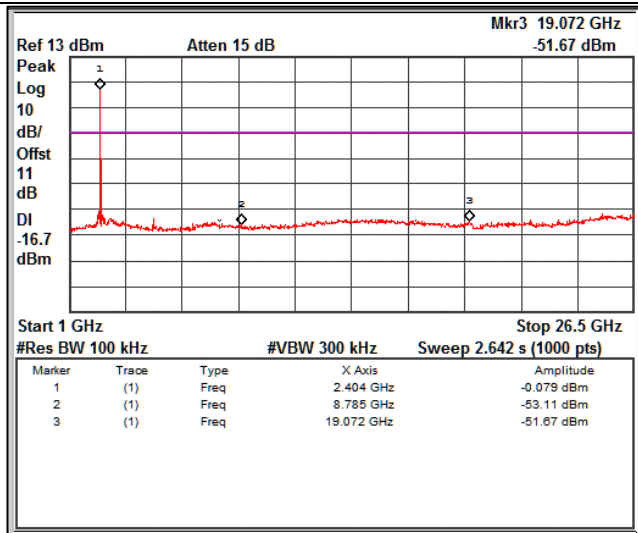
Channel Frequency:2480MHz

8.4.2 Out-Of-Band Emissions

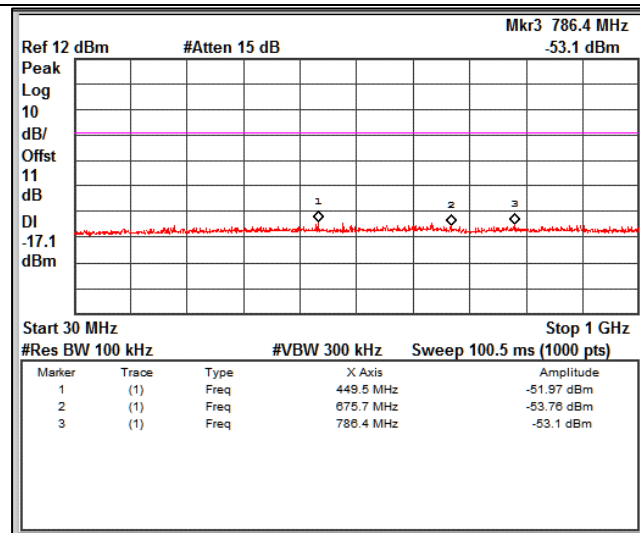
SU-6S 8W-HRW:



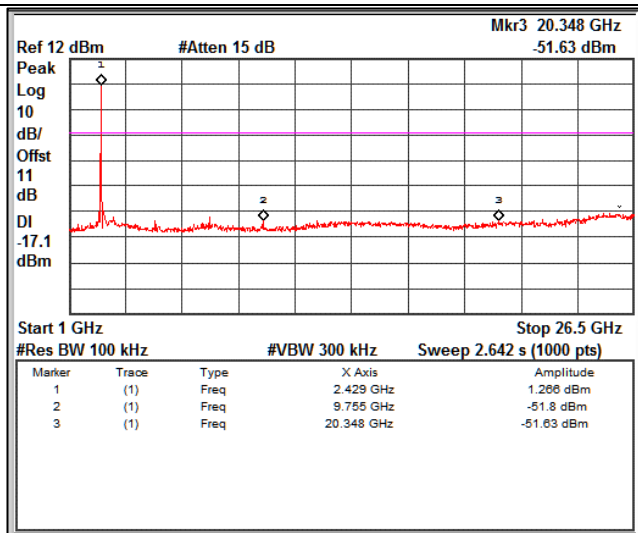
Channel Frequency: 2402MHz Frequency Range 30MHz – 1GHz



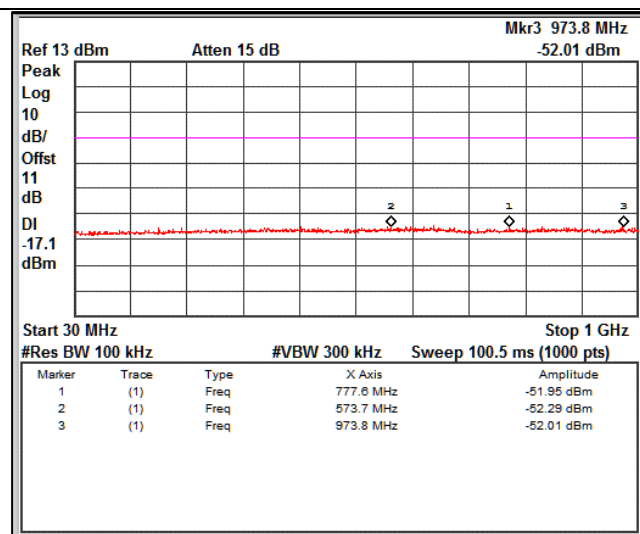
Channel Frequency: 2402MHz Frequency Range 1GHz – 26.5GHz



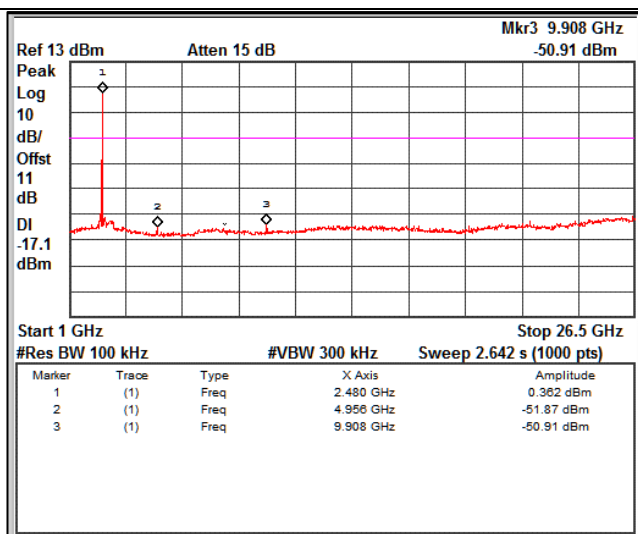
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



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



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



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

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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 10: 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: 16V DC/1Amps Current

Relative humidity: 65%

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Test results of SU-6S-8W-HRW:

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

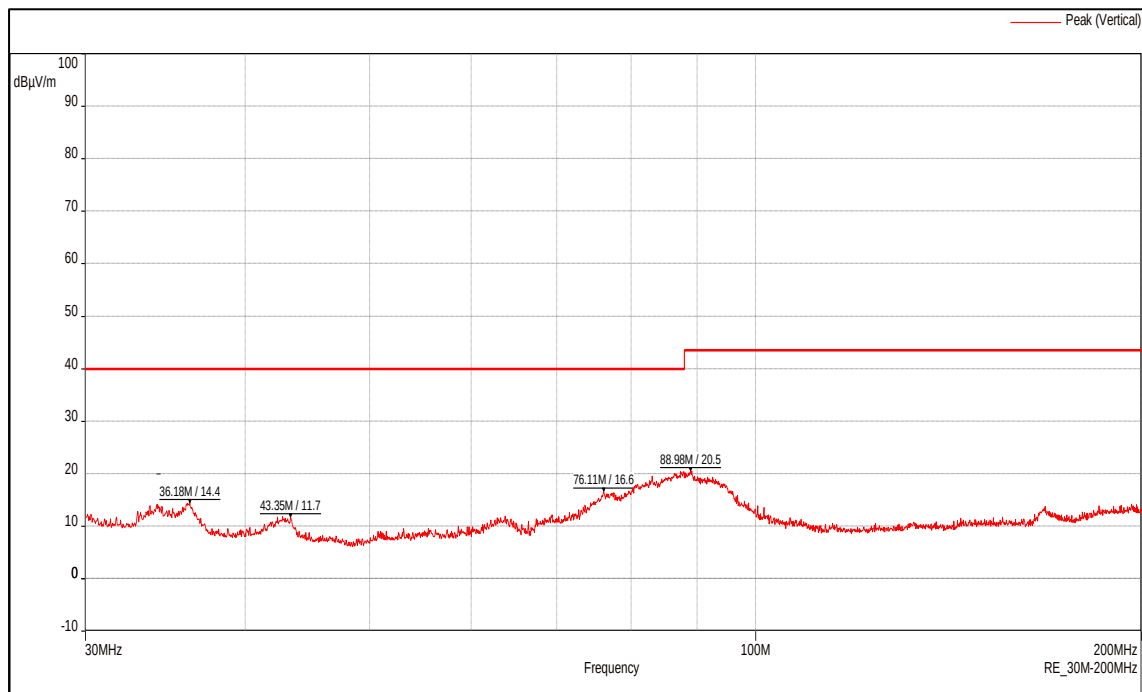
Test results for frequency range 9 kHz – 30MHz

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

Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	36.18	14.40	40.00	-25.60
	43.35	11.70	40.00	-28.30
	76.11	16.60	40.00	-23.40
	88.98	20.50	43.50	-23.00
Horizontal	43.02	9.74	40.00	-30.26
	56.13	8.55	40.00	-31.45
	87.24	9.65	40.00	-30.35
	134.88	10.80	43.50	-32.70

Frequency Range 30MHz – 200MHz _Vertical Polarization



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Frequency Range 30MHz – 200MHz _Horizontal Polarization

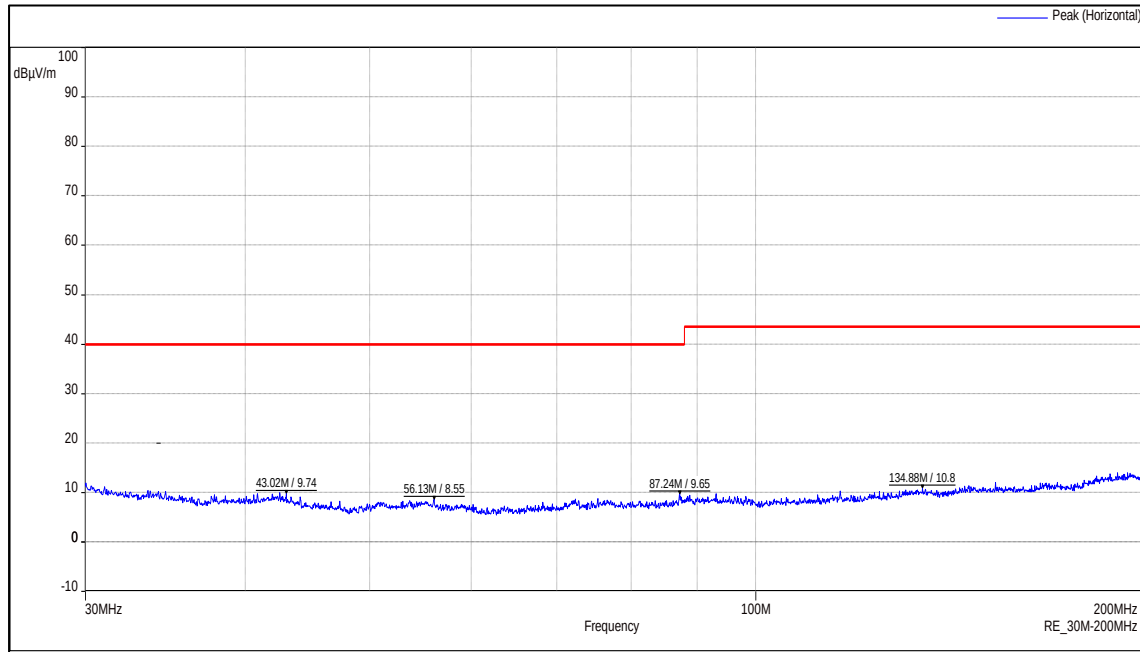


Table 12: Test results for frequency range 200MHz – 1GHz

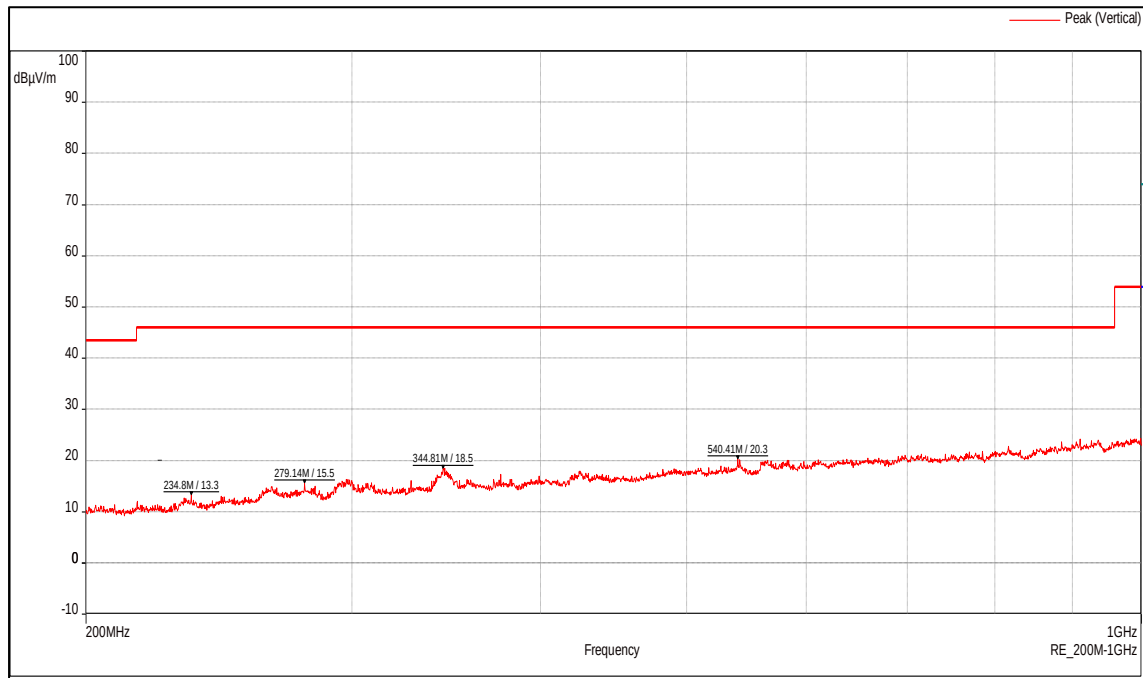
Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	234.80	13.30	46.00	-32.70
	279.14	15.50	46.00	-30.50
	344.81	18.50	46.00	-27.50
	540.41	20.30	46.00	-25.70
Horizontal	345.38	17.10	46.00	-28.90
	542.33	19.30	46.00	-26.70
	698.78	21.10	46.00	-24.90
	906.80	23.60	46.00	-22.40

Prüfbericht - Nr.:
Test Report No.:

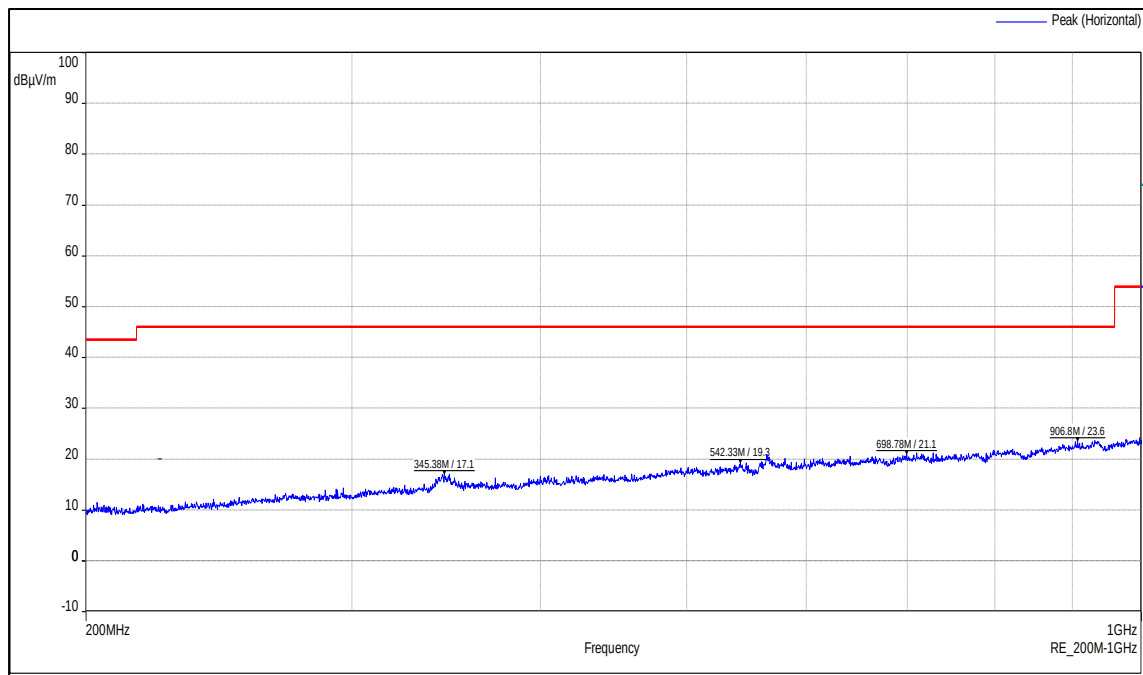
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Frequency Range 200MHz – 1GHz_Vertical Polarization



Frequency Range 200MHz – 1GHz_Horizontal Polarization



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

SU-6S-8W-HRW BLE:

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2402(Pk)	Vertical	103.37	-	-
	2402(Av)		100.57	-	-
	2390(Pk)		47.67	74.00*	-26.33
	2390(Av)		33.12	54.00*	-20.88
	4804(Pk)		50.01	74.00	-23.99
	4804(Av)		42.09	54.00	-11.91
	7206(Pk)		57.33	74.00	-16.67
	7206(Av)		48.27	54.00	-5.73
	2402(Pk)	Horizontal	90.82	-	-
	2402(Av)		87.91	-	-
	2390(Pk)		43.02	74.00*	-30.98
	2390(Av)		25.72	54.00*	-28.28
	4804(Pk)		46.07	74.00	-27.93
	4804(Av)		35.75	54.00	-18.25
	7206(Pk)		57.02	74.00	-16.98
	7206(Av)		47.52	54.00	-6.48
2440	2440(Pk)	Vertical	103.29	-	-
	2440(Av)		100.48	-	-
	4880(Pk)		49.47	74.00	-24.53
	4880(Av)		41.75	54.00	-12.25
	7320(Pk)		58.76	74.00	-15.24
	7320(Av)		49.38	54.00	-4.62
	2440(Pk)	Horizontal	89.38	-	-
	2440(Av)		86.56	-	-
	4880(Pk)		56.23	74.00	-17.77
	4880(Av)		46.39	54.00	-7.61
	7320(Pk)		56.38	74.00	-17.62
	7320(Av)		44.82	54.00	-9.18
2480	2480(Pk)	Vertical	101.92	-	-
	2480(Av)		99.10	-	-
	2483.5(Pk)		57.56	74.00*	-16.44
	2483.5(Av)		36.46	54.00*	-17.54
	4960(Pk)		45.31	74.00	-28.69
	4960(Av)		34.66	54.00	-19.34
	7440(Pk)		46.54	74.00	-27.46
	7440(Av)		46.18	54.00	-7.82
	2480(Pk)	Horizontal	89.39	-	-
	2480(Av)		86.56	-	-
	2483.5(Pk)		45.04	74.00*	-28.96
	2483.5(Av)		27.10	54.00*	-26.90
	4960(Pk)		44.22	74.00	-29.78
	4960(Av)		32.95	54.00	-21.05
	7440(Pk)		55.31	74.00	-18.69
	7440(Av)		45.53	54.00	-8.47

→ Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector.

Av: Average Detect

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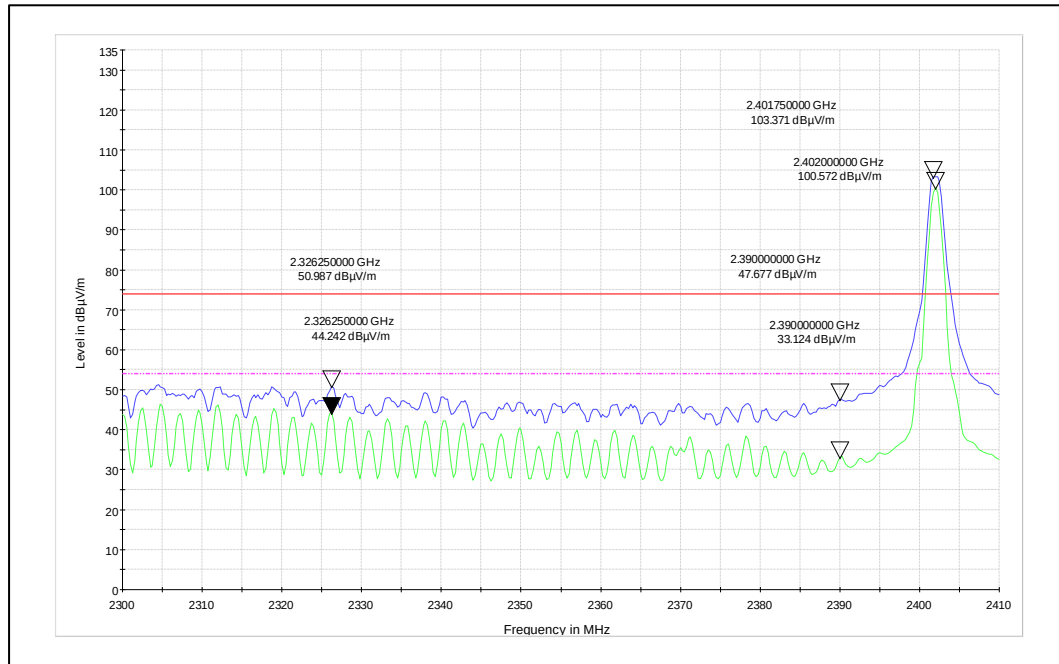
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Worst Case Test Plots:

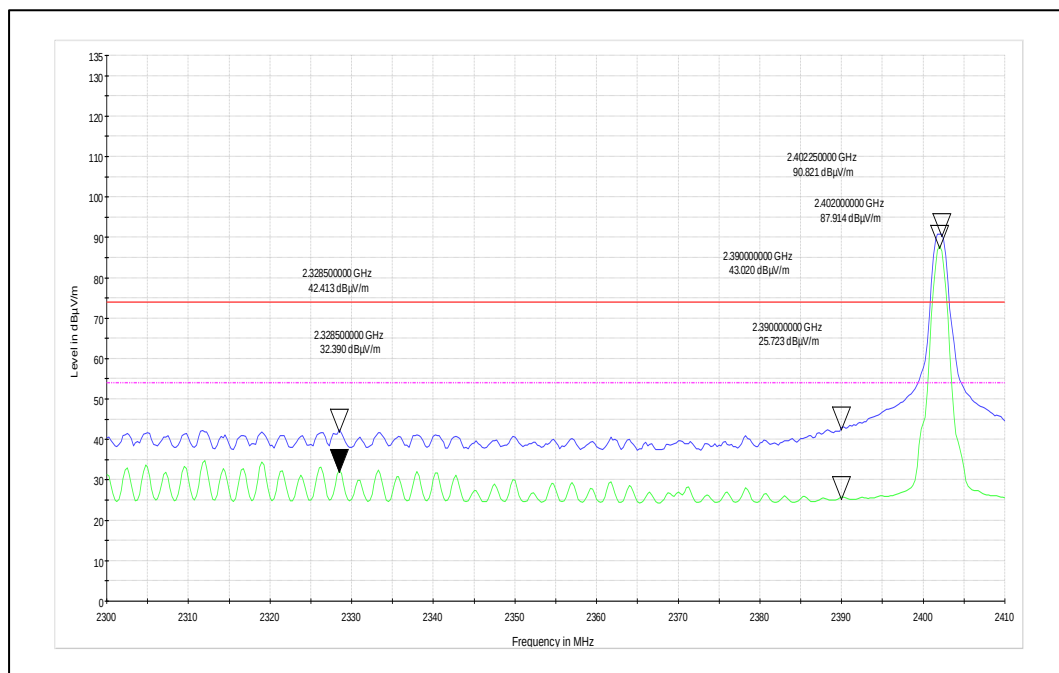
SU- 28W BLE: Plots:

Data Rate: 1 Mbps

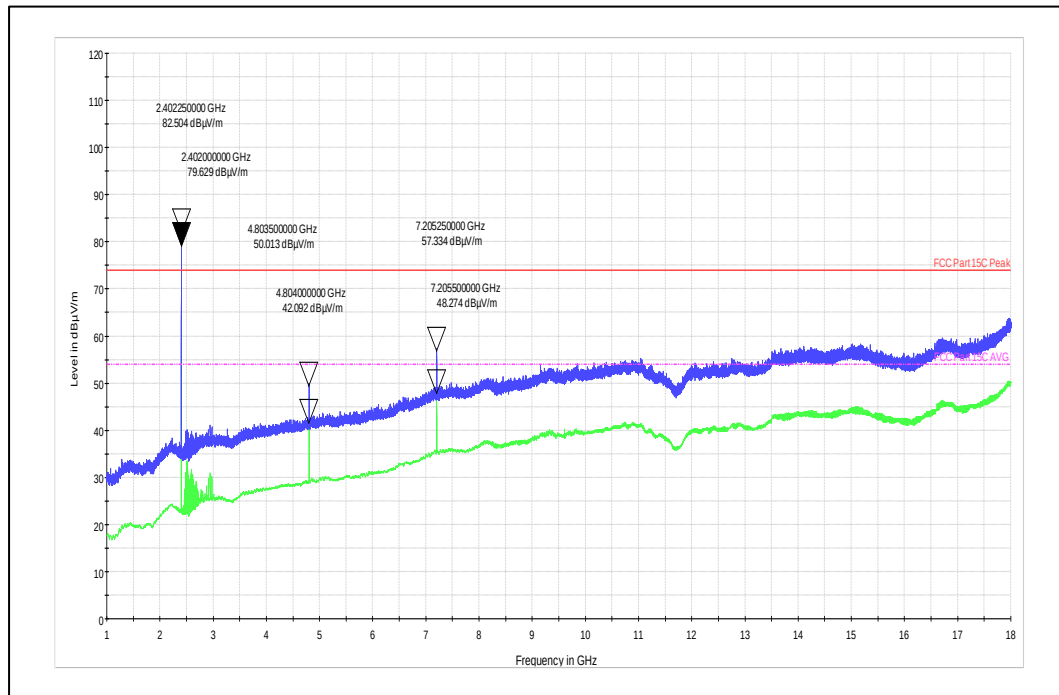
Channel Frequency: 2402MHz_Vertical Polarization



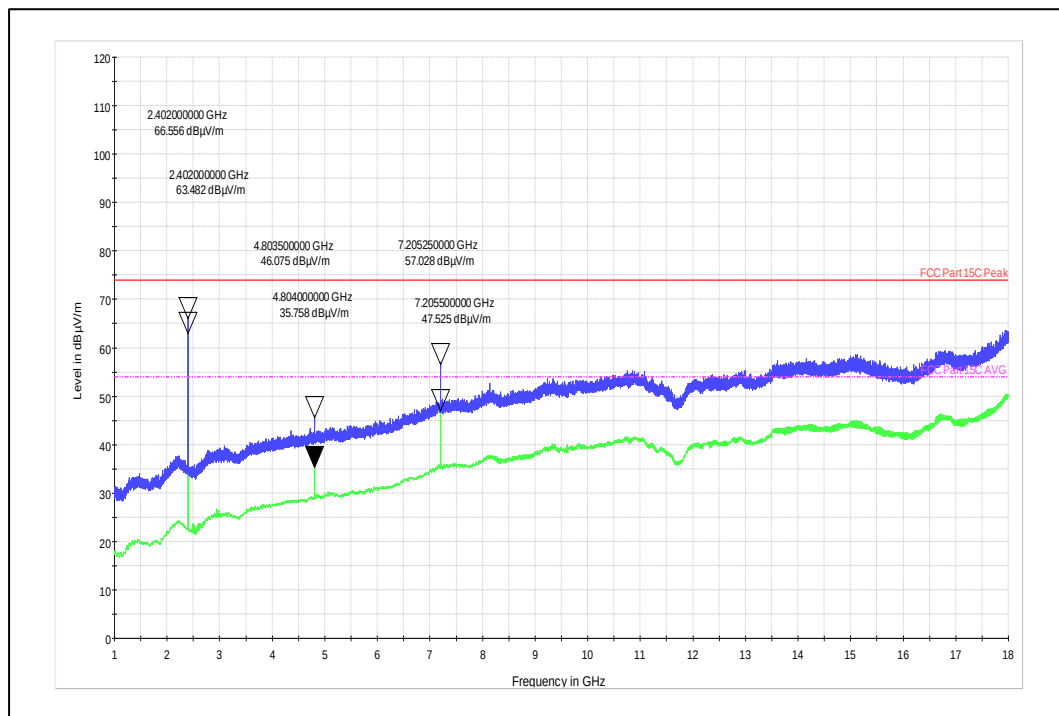
Channel Frequency: 2440MHz_Horizontal Polarization



Frequency Range: 1GHz – 18GHz_Vertical Polarization



Frequency Range: 1GHz – 18GHz_Horizontal Polarization

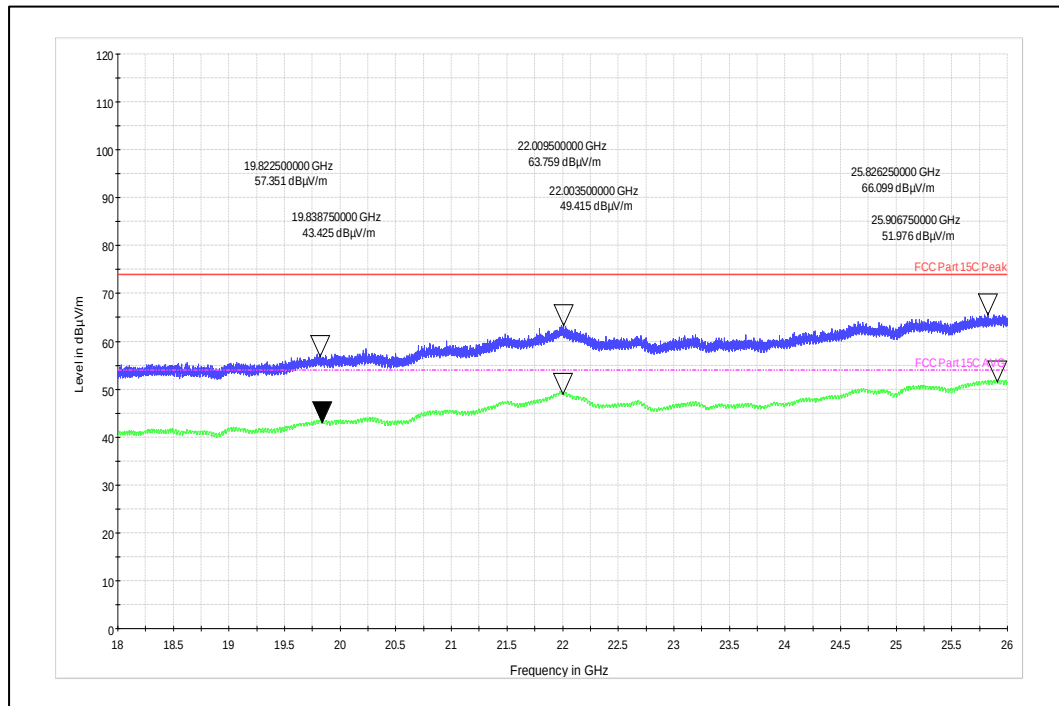


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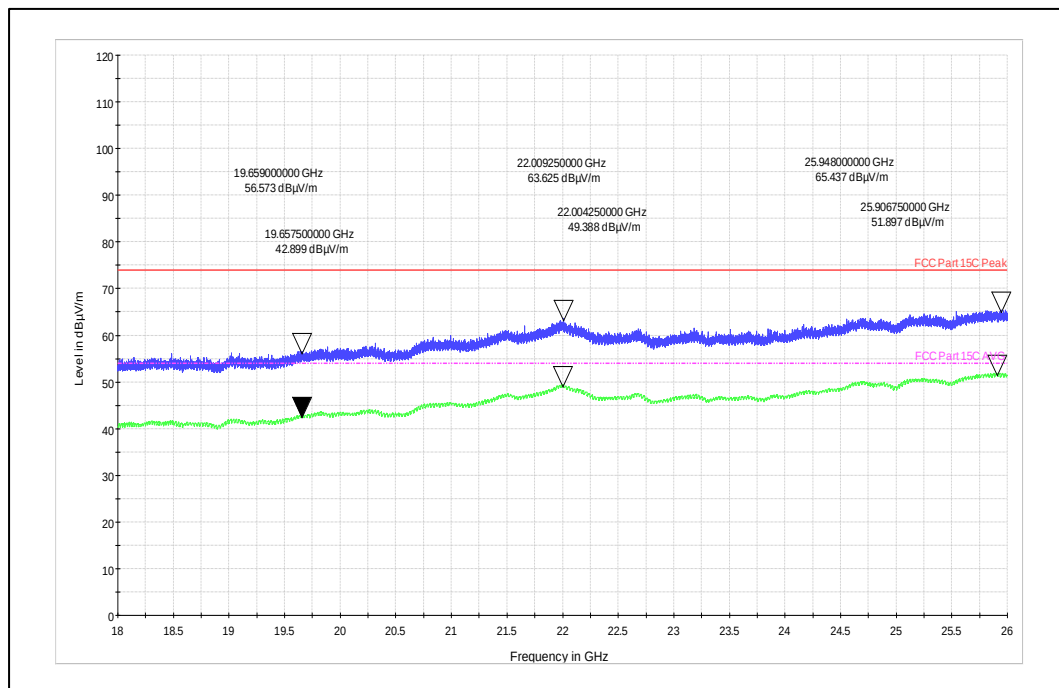
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Frequency Range: 18GHz – 26GHz_Vertical Polarization



Frequency Range: 18GHz – 26GHz_Horizontal Polarization



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11 Power level used for Testing

Power Settings for IEEE 802.15.4

Model Numbers	Data rate (Mbps)	Channels Frequency (MHz)	Power level (dBm)
SU-6S-8W-HRW	1	2405	4
		2440	4
		2480	-6

Power Settings for BLE

Model Numbers	Data rate (Mbps)	Channels Frequency (MHz)	Power level (dBm)
SU-6S-8W-HRW	1	2402	3
		2440	3
		2480	3

End of test report