

Produkte
Products

Prüfbericht - Nr.: 19660174 001		Seite 1 von 26	
<i>Test Report No.:</i>		<i>Page 1 of 26</i>	
Auftraggeber: <i>Client:</i>	Cypress Semiconductor 198 Champion Court San Jose, CA 95134 USA Tel: (408) 943 2600		
Gegenstand der Prüfung: <i>Test item:</i>	EZ-BLE PROc Module		
Bezeichnung: <i>Identification:</i>	CYBLE-022001-00	Serien-Nr.: <i>Serial No.</i>	Engineering Sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	1803073245	Eingangsdatum: <i>Date of receipt:</i>	07.04.2015
Prüfört: <i>Testing location:</i>	Refer Page 4 of 26 for test facilities		
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15, Subpart C ANSI C63.10-2009		
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test items passed the test specification(s).</i>		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. 82/A, 3rd Main, West Wing, Electronic City Phase 1 Hosur Road, Bangalore – 560 100. India FCC Registration No.: 176555; IC Assigned Code: 3466E		
geprüft / tested by:		kontrolliert / reviewed by:	
10.04.2015	Shrikanth S Naik Engineer	13.04.2015	Raghavendra Kulkarni Sr. Manager
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
Sonstiges / Other Aspects: FCC ID : WAP2001			
Abkürzungen:	P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet	Abbreviations:	P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report 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 safety mark on this or similar products.</i>			

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Test Result Summary

Clause	Test Item	Result
FCC 15.247(b) (3)	Maximum Conducted Peak Output Power	Pass
FCC 15.247(a) (2)	DTS (6dB) Bandwidth	Pass
FCC 15.247(e)	Power Spectral Density	Pass
FCC 15.247(d)	Emission in the non-restricted frequency bands (Band-edge compliance)	Pass
FCC 15.209 / FCC 15.205	Spurious Radiated Emissions and Restricted Bands of Operation	Pass
FCC 15.207	Conducted Emissions on A.C Power lines	Pass

Note: Conducted measurements are done according to the procedure given in KDB No. **558074**
D01 DTS Meas Guidance v03r02

Content

List of Test and Measurement Instruments	4
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General Product Information

Product Function and Intended Use	5
Ratings and System Details.....	5

Test Set-up and Operation Mode

Principle of Configuration Selection	7
Test Operation and Test Software	7
Special Accessories and Auxiliary Equipment	7
Countermeasures to achieve EMC Compliance	7

Test Methodology

Radiated Emission Test	8
Conducted Emission Test on A.C. mains line	8

Test Results

Maximum Conducted Peak Output Power	Section 15.247(b) (3)	9
Power Spectral Density	Section 15.247(e)	12
6 dB Bandwidth	Section 15.247(a) (2).....	15
Band-edge Compliance	Section 15.247(d)	17
Spurious Radiated Emissions and Restricted Bands of Operation	Section 15.209 and 15.205	21
Conducted Emission Test on A.C. Power Line	Section 15.207.....	24

Appendix 1: Test Setup Photo

Appendix 2: EUT External Photo

Appendix 3: EUT Internal Photo

Appendix 4: FCC Label and Label Location

Appendix 5: Block Diagram

Appendix 6: Specification of EUT

Appendix 7: Schematic Diagram

Appendix 8: Bill of Material

Appendix 9: User Manual

Appendix 10: Maximum Permissible Exposure Calculation

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List of Test and Measurement Instruments

Testing Facilities

- 1) TÜV Rheinland (India) Pvt. Ltd.
82/A, 3rd Main, West Wing, Electronic City,
West Phase, Hosur Road
Bangalore – 560 100.

Equipment	Manufacturer	Model Name	Serial Number	Calibration Due Date	Periodicity	Used for Test Items
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	27.03.2016	Yearly	Antenna port conducted measurements

- 2) TUV Rheinland (India) Private Limited
108 , Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100.

Equipment	Manufacturer	Model Name	Serial Number	Calibration Due Date	Periodicity	Used for Test Items
EMI Test Receiver	Rohde & Schwarz	ESU 40	100288	20.06.2015	Yearly	Spurious Radiated Emissions
Broadband Antenna	Frankonia	ALX-4000	ALX-4000-806	22.06.2015	Yearly	
Active Loop Antenna	Frankonia	LAX-10	LAX-10-800	22.06.2015	Yearly	
Horn Antenna	Frankonia	HAX-18	HAX18-802	22.06.2015	Yearly	
Double-Ridged Waveguide Horn Antenna	ETS	116706	00107323	22.06.2015	Yearly	
Anechoic Chamber	Frankonia	-	-	-	-	Conducted Emission on AC power lines
LISN	Rohde & Schwarz	ENV216	100022	12.09.2015	Yearly	
EMI Receiver	Rohde & Schwarz	ESR7	101133	19.11.2015	Yearly	

Product Function and Intended Use

The EZ_BLE PProC module comes with a 32 bit, ARM Cortex-M0 microcontroller with a variety of analog and digital peripherals, a BLE radio and link layer along with all the associated circuitry and built-in Antenna. The module enables customers to develop a quick turnaround Bluetooth Low Energy solution for their products.

Ratings and System Details

Operating Frequency	2400 – 2483.5MHz
No. of channel	40
Channel Spacing	2 MHz
Modulation	GFSK
Transmit Power (ERP)	2.16 dBm / 1.64437mW
Data Rate	1 Mbps
Antenna Type	Chip antenna
Number of antenna	One
Antenna Gain	0.5dBi
Supply Voltage	1.9 V to 5.5V (3.3V nominal from test jig)
Dimension	10 mm x 10 mm
Environmental	Operating: -40 °C to +85 °C

Test Conditions:

Voltage: 5VDC from USB.

Environmental conditions:

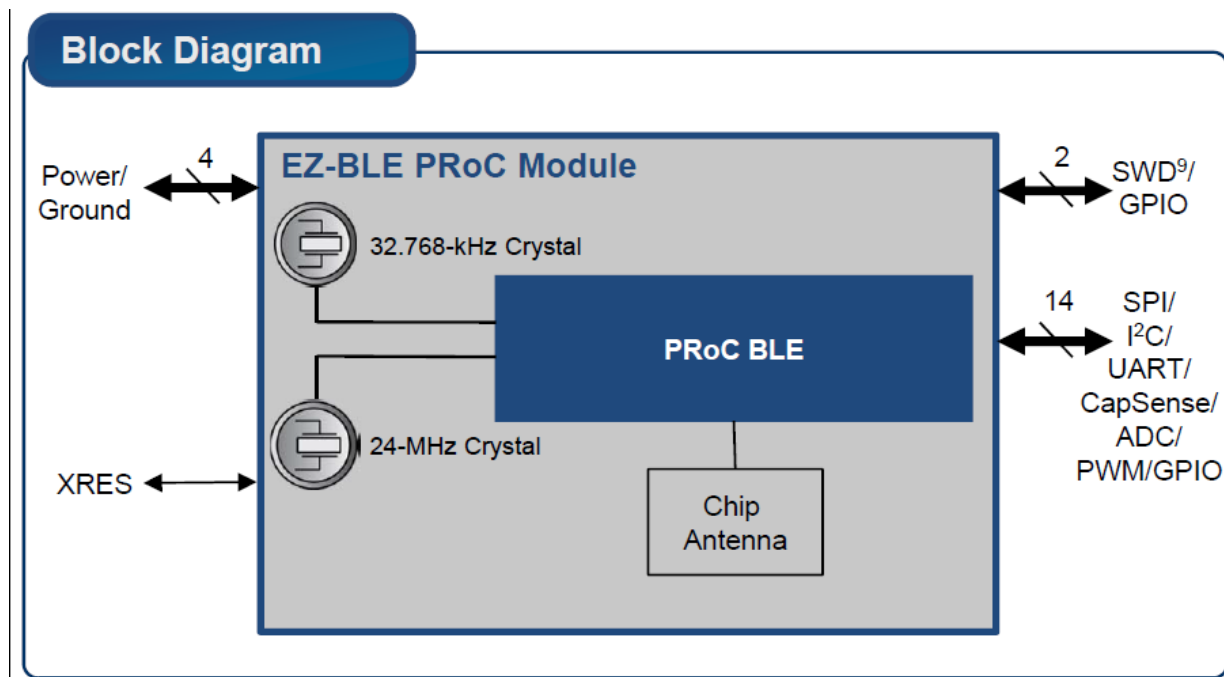
Temperature: +23 °C **RH:** 62%

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Operational Description

For testing purpose, the EZ-BLE module is supplied power through a test jig which also has LEDs and a button to change the test modes. Upon power up the module is in idle mode, pressing the button each time takes the user through all the test modes. The first three modes have receiver ON at low mid and high channels. The next three modes have packet transmission as at low mid and high channels.

Block Diagram



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Test Set-up and Operation Mode

Principle of Configuration Selection

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

Test Operation and Test Software

A button on the base board was used to enable the transmission at maximum defined power level and to select channels low, mid and high in 2.4 GHz band on the EUT for the tests in this report.

Special Accessories and Auxiliary Equipment

- None

Countermeasures to achieve EMC Compliance

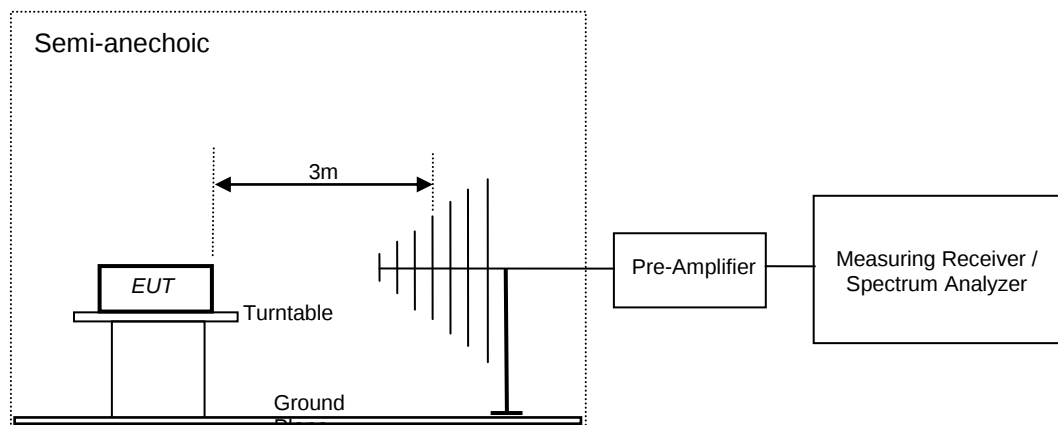
- None

Table of frequencies

Frequency Band (MHz)	Frequency (MHz)
2400 – 2483.5	2402
	2404
	2406
	;
	:
	:
	2440
	2442
	2444
	;
	:
	:
	2478
	2480

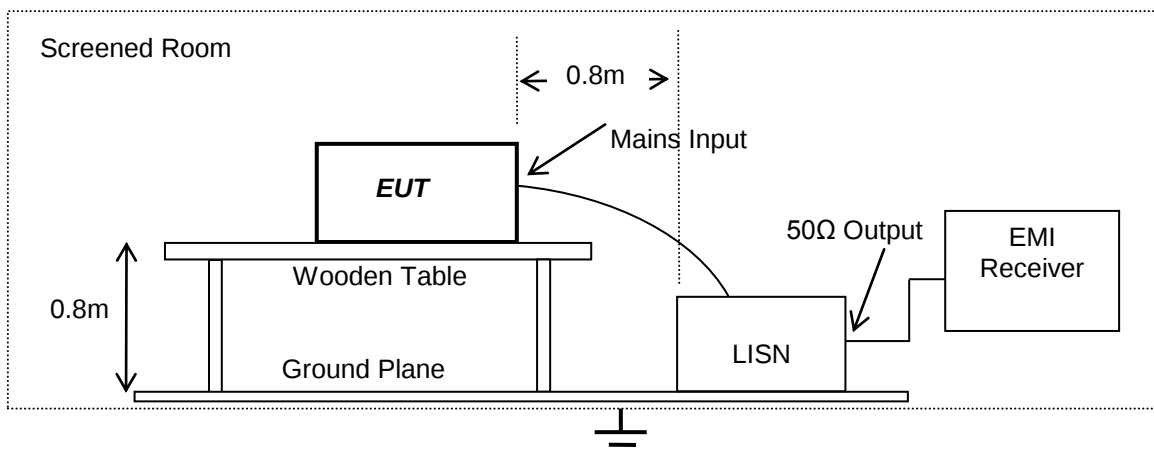
Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2009. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable, 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 1m and 4m, 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 1000MHz was performed by horn antenna. The measurement below 30MHz was performed by loop antenna. The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded.



Conducted Emission Test on A.C. mains line

The equipment under test (EUT) was placed on a wooden table 80cm above the ground plane, the LISN was placed 80cm away from the EUT. The test was performed in accordance with ANSI C63.10: 2009, with the following: an initial measurement was performed in peak and average detection mode on the live and neutral lines. The pre-scan was performed by peak detection on both live and neutral conductors. Any emissions recorded within 20dB of the relevant limit line were re-measured using quasi-peak and average detections, the 6 worst cases were recorded in the table of results.



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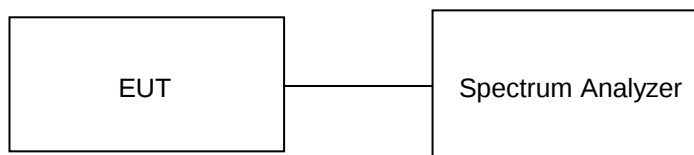
Test Results

Maximum Conducted Peak Output Power Result

Section 15.247(b) (3)
Pass

Test Specification	FCC Part 15 Subpart C
Measurement Bandwidth (RBW)	1 MHz
Detector	Peak
Requirement	<1 watt (30dBm).

Test Method:

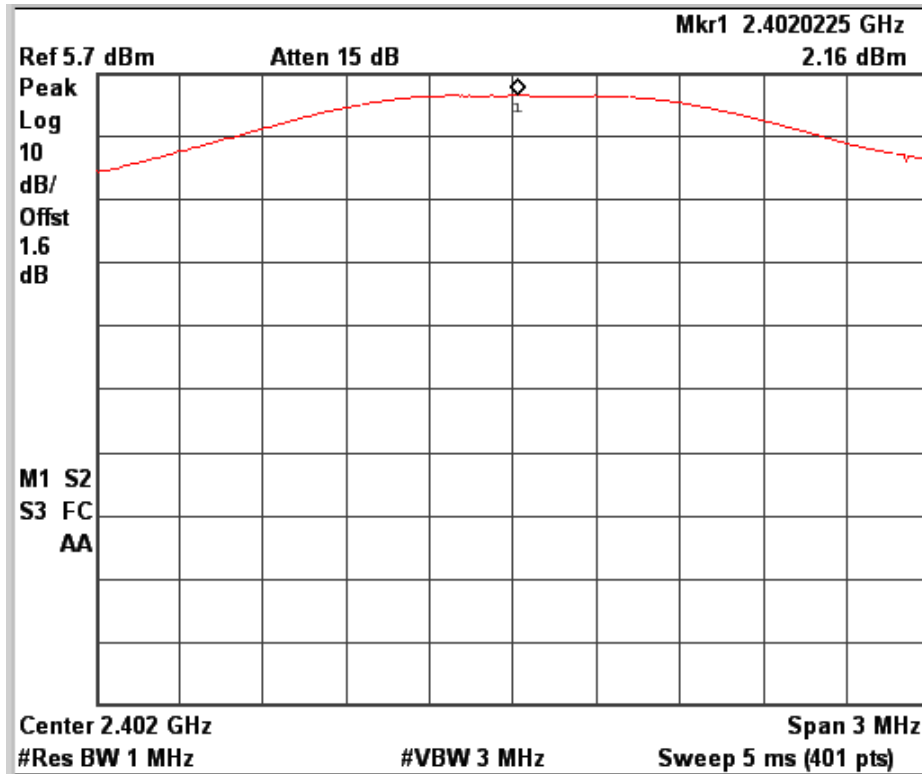


Cable Loss: 1.6dB (Included in the test results)

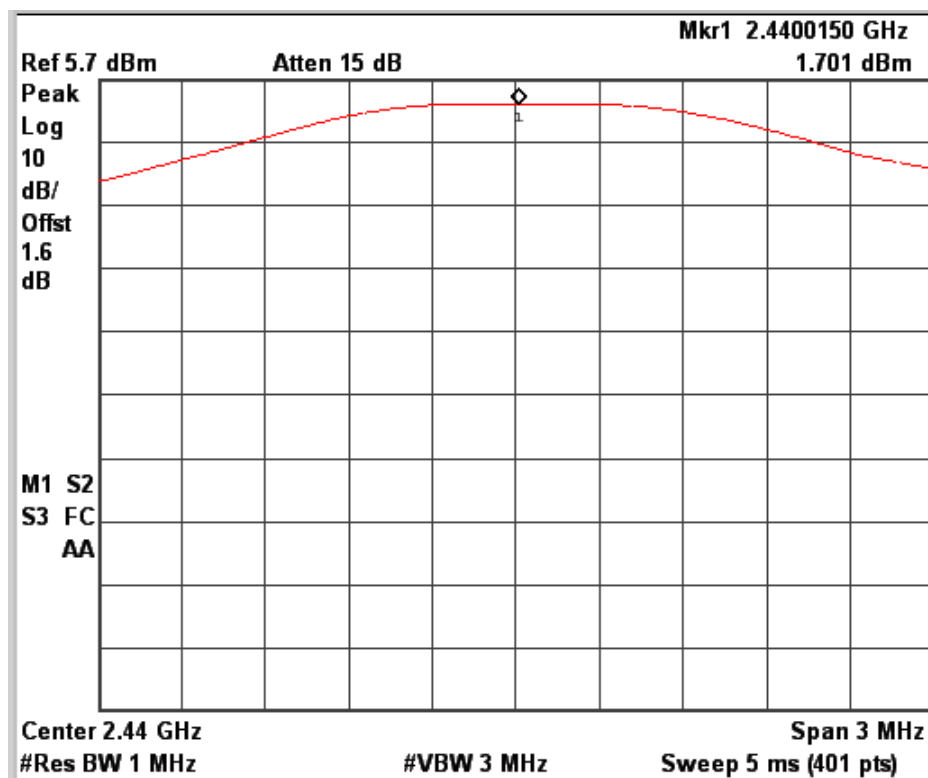
Test Result:

Frequency (MHz)	Total Output power (dBm)	Limit (dBm)
2402	2.16	30.00
2440	1.70	30.00
2480	1.53	30.00

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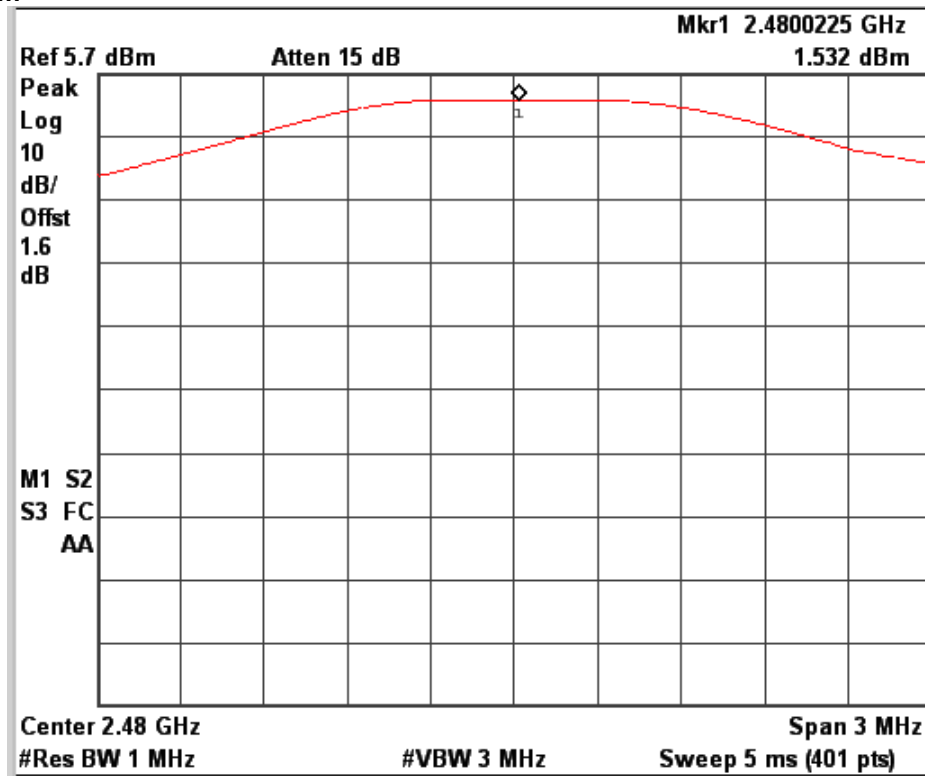


Channel Frequency: 2402 MHz



Channel Frequency: 2440 MHz

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Channel Frequency: 2480 MHz

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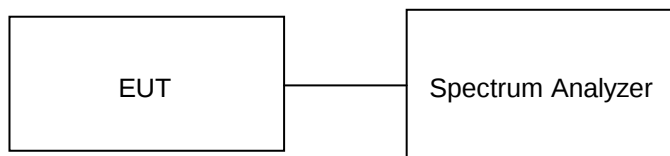
**Power Spectral Density
Result**

**Section 15.247(e)
Pass**

Test Specification
Detector Function
Requirement

FCC Part 15 Subpart C
Peak
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:

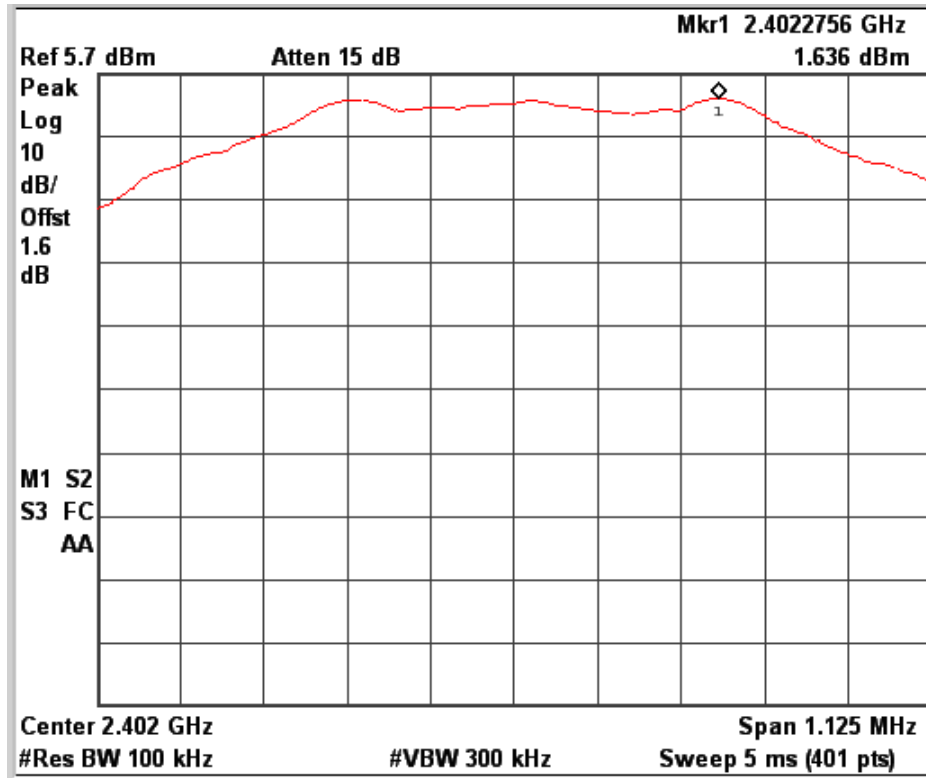


Cable Loss: 1.6 dB (Included in the test results)

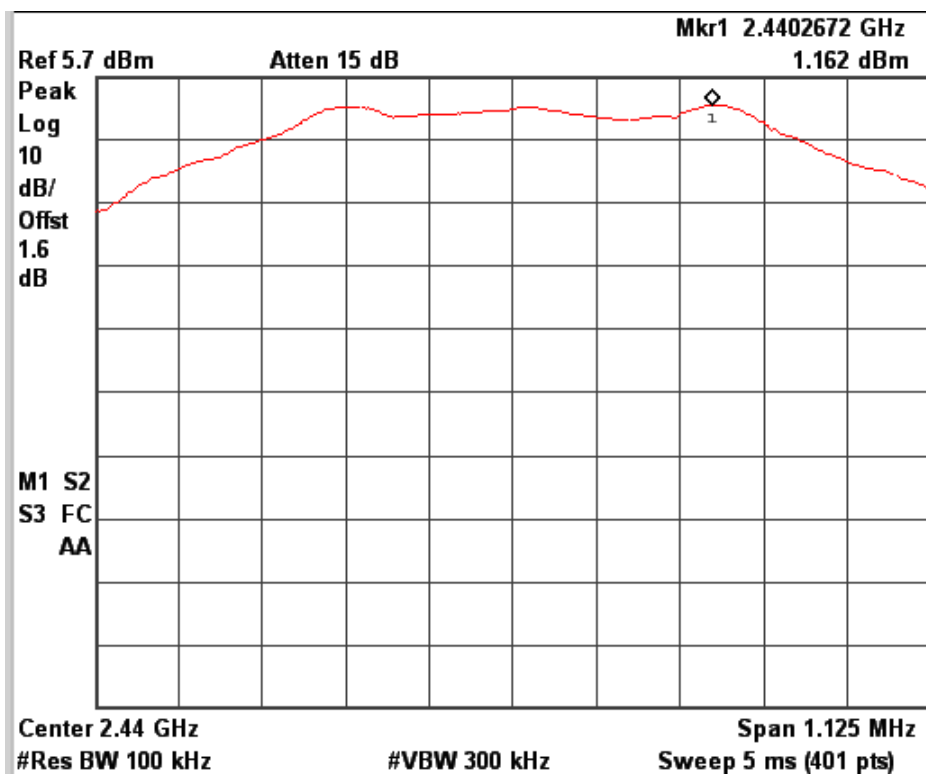
Test Result:

Frequency (MHz)	Total PSD (dBm)	Limit (dBm)
2402	1.64	8
2440	1.16	8
2480	1.00	8

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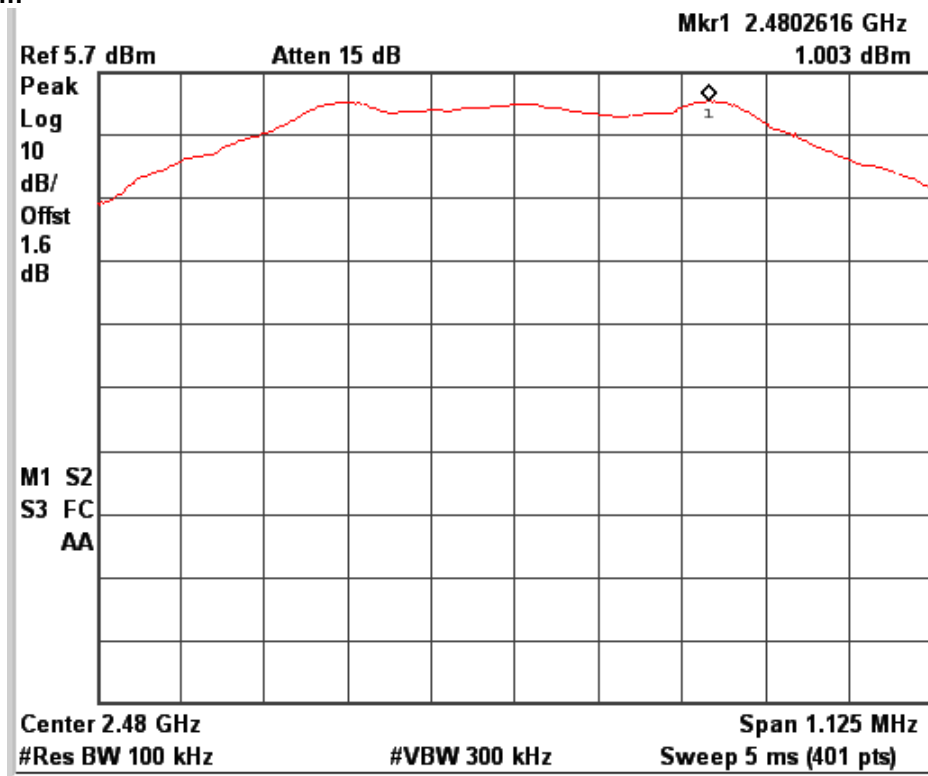


Channel Frequency: 2402 MHz



Channel Frequency: 2440 MHz

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Channel Frequency: 2480 MHz

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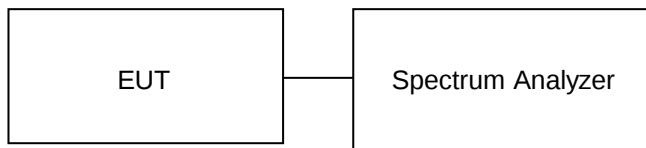
6 dB Bandwidth Result

Section 15.247(a) (2)
Pass

Test Specification
Requirement

FCC Part 15 Subpart C
The minimum 6 dB bandwidth shall be at least 500 kHz.

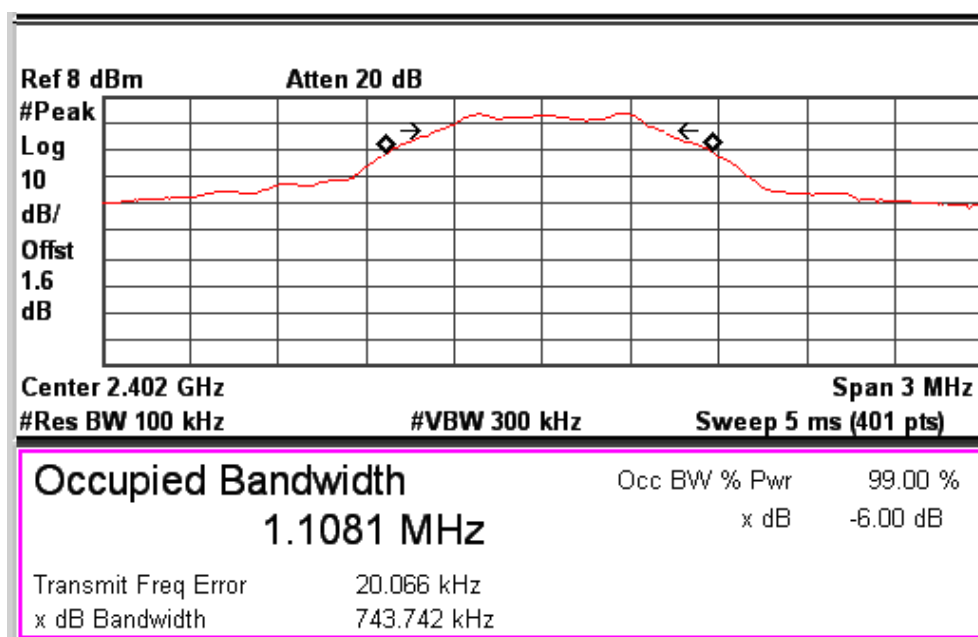
Test Method:



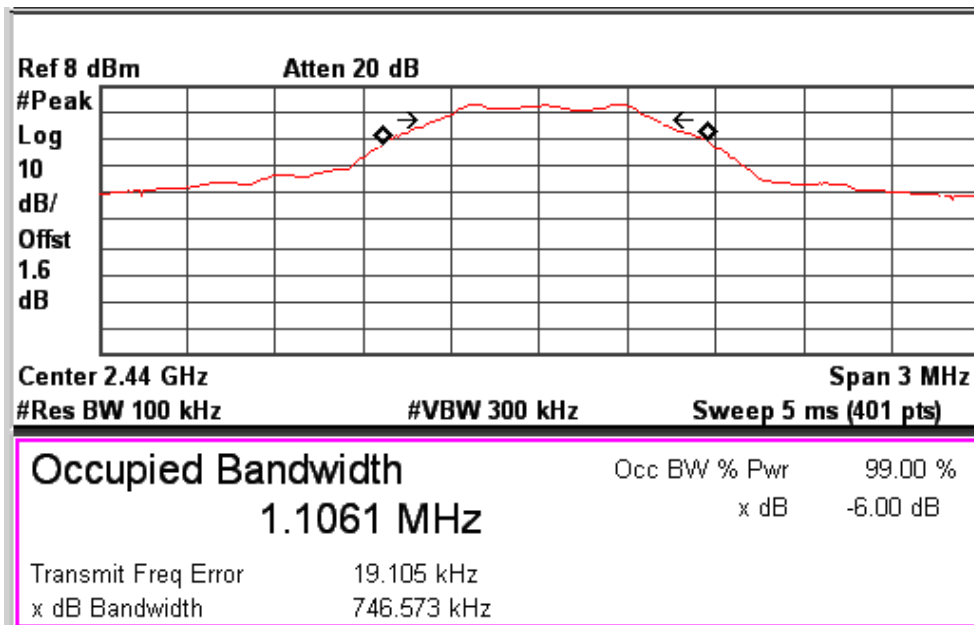
Cable Loss: 1.6dB (Included in the test results)

Test Result:

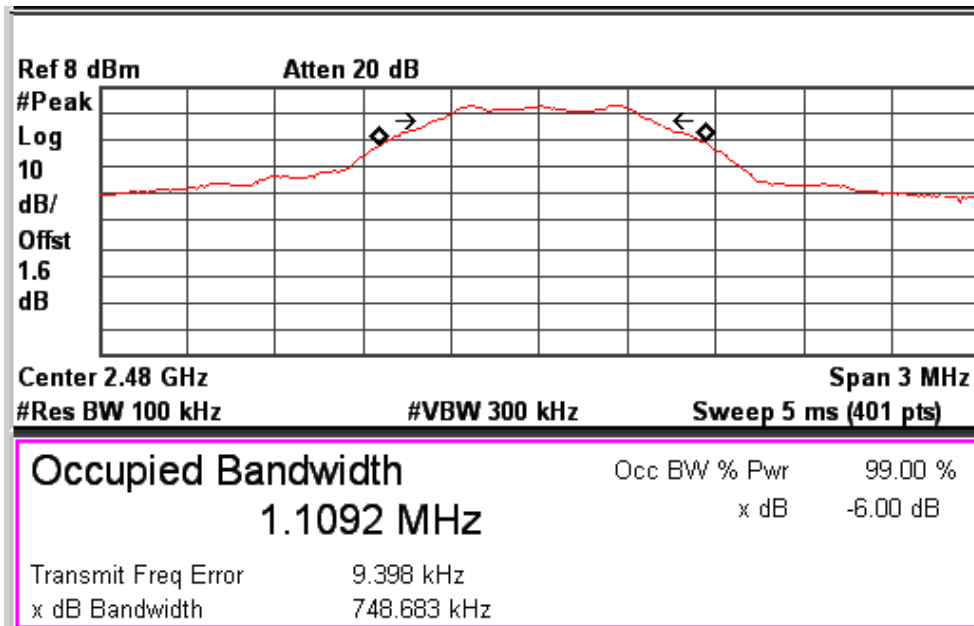
Frequency (MHz)	6 dB Bandwidth (kHz)	OBW (MHz)
2402	743.74	1.108
2440	746.57	1.106
2480	748.68	1.109



6dB BW and OBW: Channel frequency: 2402 MHz



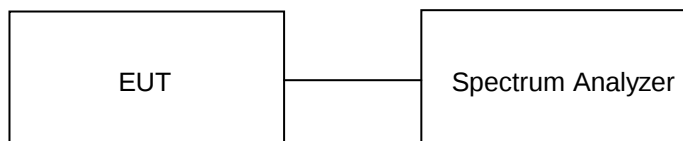
6dB BW and OBW: Channel frequency: 2440 MHz



6dB BW and OBW: Channel frequency: 2480 MHz

Emission in the non-restricted frequency bands
Result
Section 15.247(d)
Pass

Test Specification	FCC Part 15 Subpart C
Detector Function	Peak
Requirement	If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to 15.247(b)(3) requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level. If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to 15.247(b)(3) requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

Test Method:


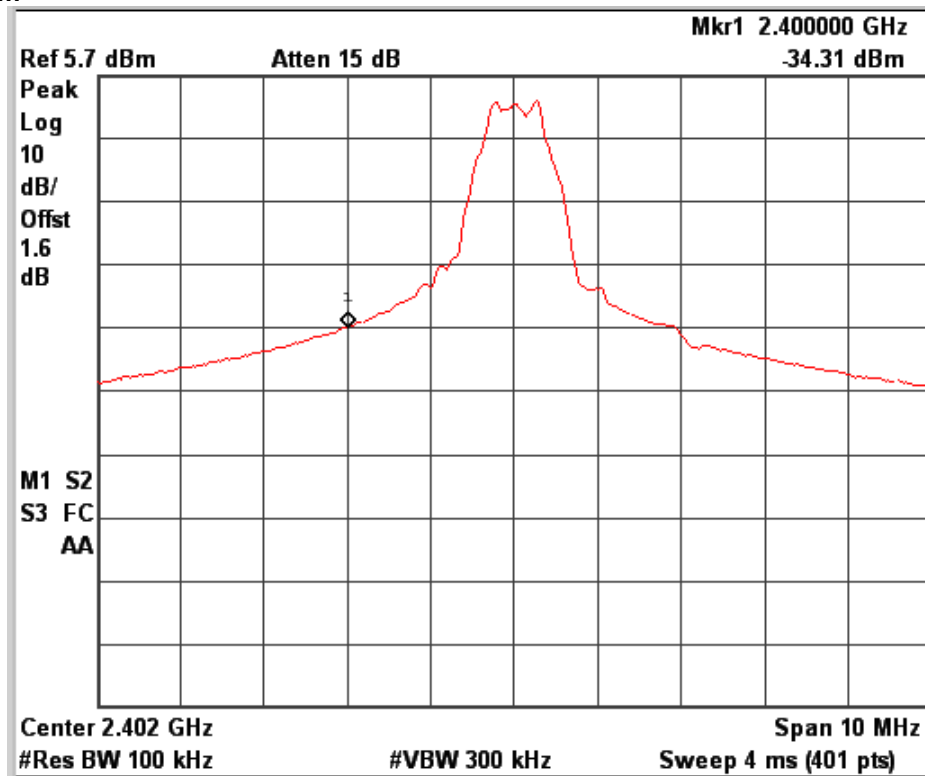
Cable Loss: 1.6dB (Included in the test results)

Test Result:

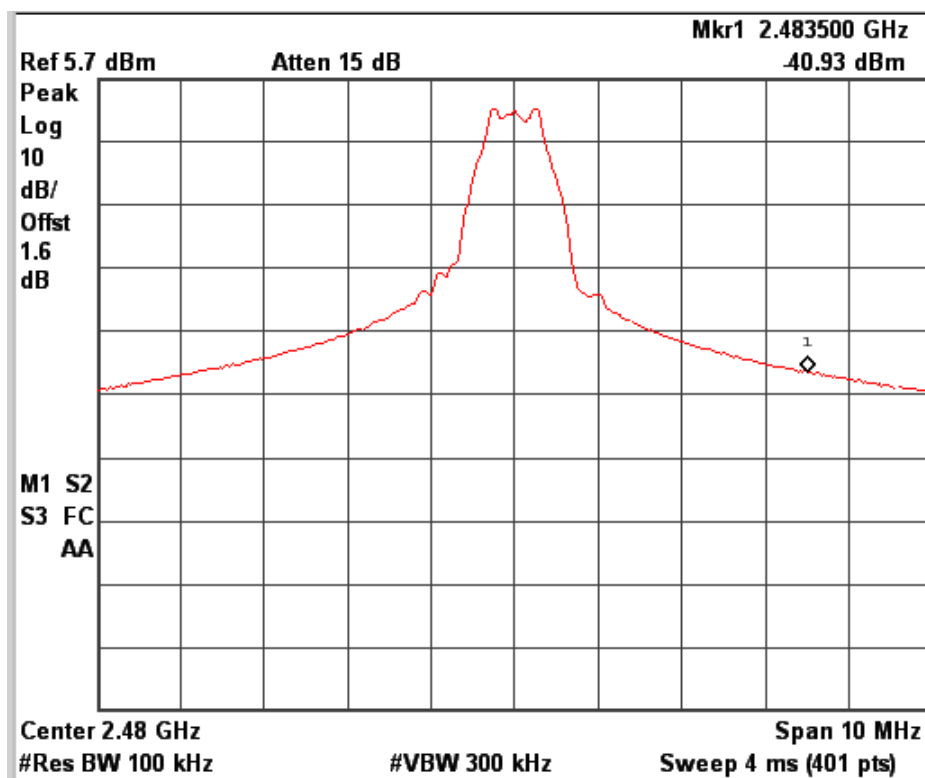
Channel Frequency (MHz)	Value at Band Edge				Limit (dB)
	Band Edge Frequency (MHz)	Reference PSD Level 'A' in (dBm)	Band Edge Value 'B' in (dBm)	Difference A-B (dB)	
2402	2400	1.64	-34.31	35.95	>20.00
2480	2483.5	1.00	-40.93	41.93	>20.00

Note: The reference PSD values are taken from the plots reported under the Power spectral Density Section 15.247(e).

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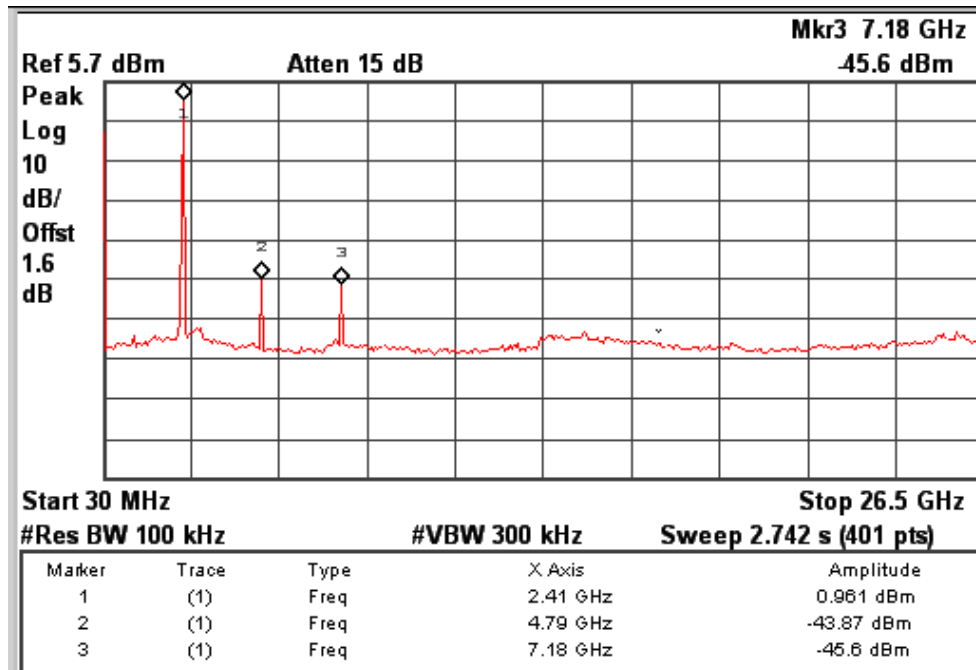
Channel frequency: 2402 MHz



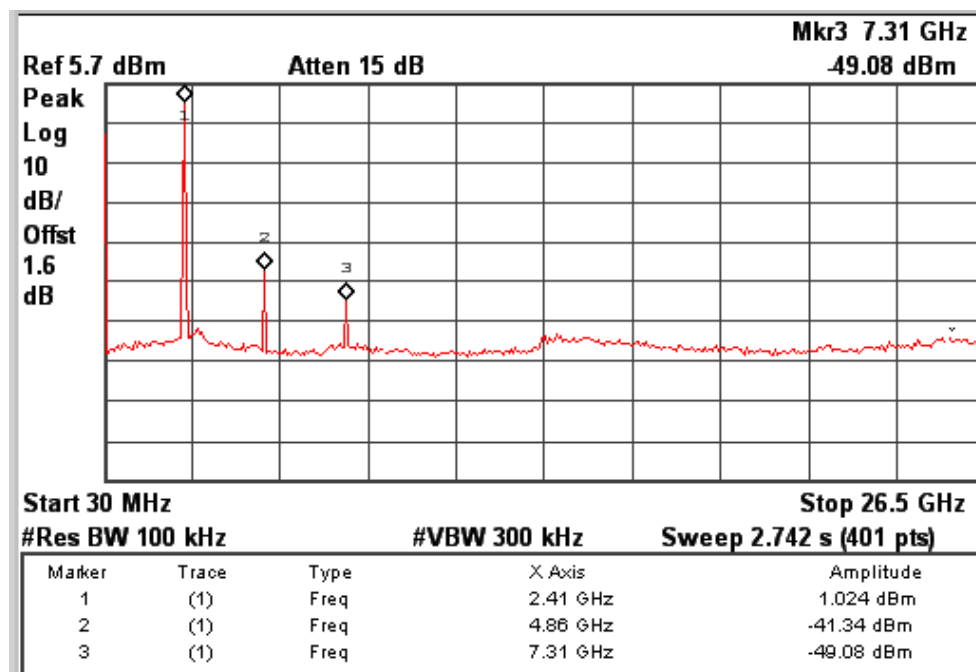
Channel frequency: 2480 MHz

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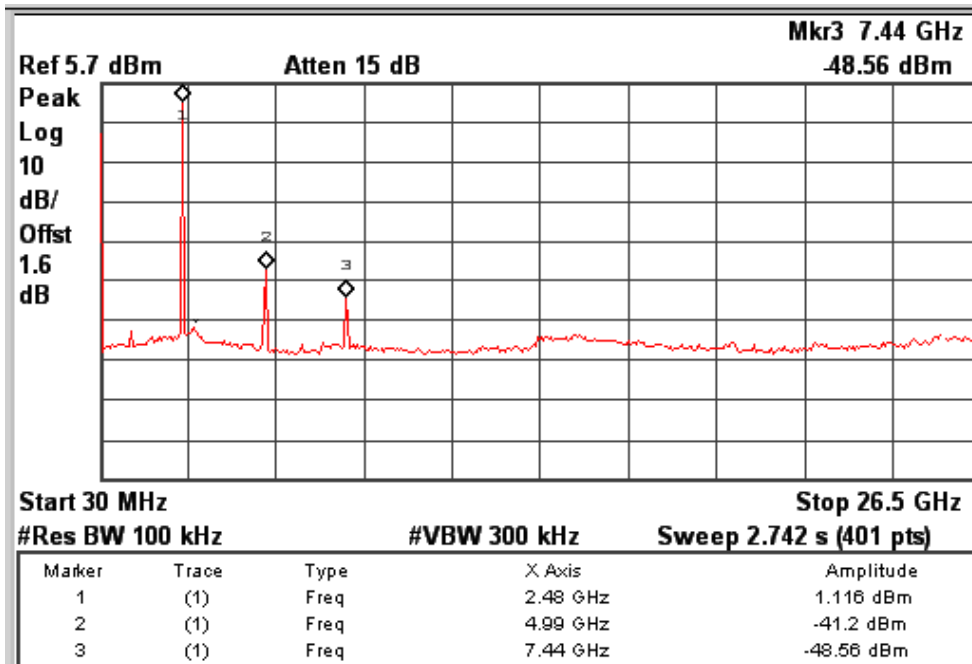
Conducted Spurious Emission



Channel frequency: 2402 MHz



Channel frequency: 2440 MHz



Channel frequency: 2480 MHz

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**Spurious Radiated Emissions and
Restricted Bands of Operation**

Section 15.209 and 15.205

Result

Pass

Test Specification	FCC Part 15 Subpart C
Test Method	ANSI C63.10-2009
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3m
Detection	QP for frequency below 1GHz, Peak and Average for frequency above 1GHz
Requirement	As per the limits mentioned in the bellow table

Limit for Radiated Emission of Section 15.209:

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Field strength (dB $\mu\text{V/m}$)	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 88, 50 – 53.80, 53.80 – 43.00 and 49.5dB $\mu\text{V/m}$ 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.

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Test results:

For frequency range 9 KHz to 1 GHz

Antenna Polarization	Frequency (MHz)	Field Strength Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	96.73	32.33	43.5	-11.17
	129.61	28.75	43.5	-14.75
	143.1	26.01	43.5	-17.49
Horizontal	310.23	29.47	46	-16.53

Frequencies above 1GHz

Fundamental Frequency (MHz)	Antenna Polarization	Frequency of Emission (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	V	2390 (Pk)	51.97	74	-22.03
		2390 (Av)	28.06	54	-25.94
		2402 (Pk)	88.80	*	-
		2402 (Av)	85.19	*	-
		4804 (Pk)	50.46	74	-23.54
		4804 (Av)	37.67	54	-16.33
	H	2390 (Pk)	51.46	74	-22.54
		2390 (Av)	27.89	54	-26.11
		2402 (Pk)	91.75	*	-
		2402 (Av)	87.46	*	-
		4804 (Pk)	50.42	74	-23.58
		4804 (Av)	37.97	54	-16.03
2440	V	2440 (Pk)	88.45	*	-
		2440 (Av)	84.75	*	-
		4880 (Pk)	50.54	74	-23.46
		4880 (Av)	38.14	54	-15.86
	H	2440 (Pk)	88.19	*	-
		2440 (Av)	84.83	*	-
		4880 (Pk)	51.15	74	-22.85
		4880 (Av)	39.05	54	-14.95
2480	V	2480 (Pk)	86.93	*	-
		2480 (Av)	83.37	*	-
		2483.5 (Pk)	60.61	74	-13.39
		2483.5 (Av)	28.53	54	-25.47
		4960 (Pk)	51.31	74	-22.69
		4960 (Av)	38.25	54	-15.75

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	H	2480 (Pk)	90.18	*	-
		2480 (Av)	85.55	*	-
		2483.5 (Pk)	63.11	74	-10.89
		2483.5 (Av)	29.04	54	-24.96
		4960 (Pk)	51.19	74	-22.81
		4960 (Av)	39.05	54	-14.95

Pk -> Peak Detector

Av -> Average Detector

*- -> Fundamental frequency

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**Conducted Emission Test on A.C. Power Line
Result**

**Section 15.207
Pass**

Test Specification : FCC Part 15 Section 15.207
Test Method : ANSI C63.10-2009
Testing Location : Screened room
Measurement Bandwidth : 9kHz
Frequency Range : 150kHz – 30MHz
Supply Voltage : 120VAC, 60Hz

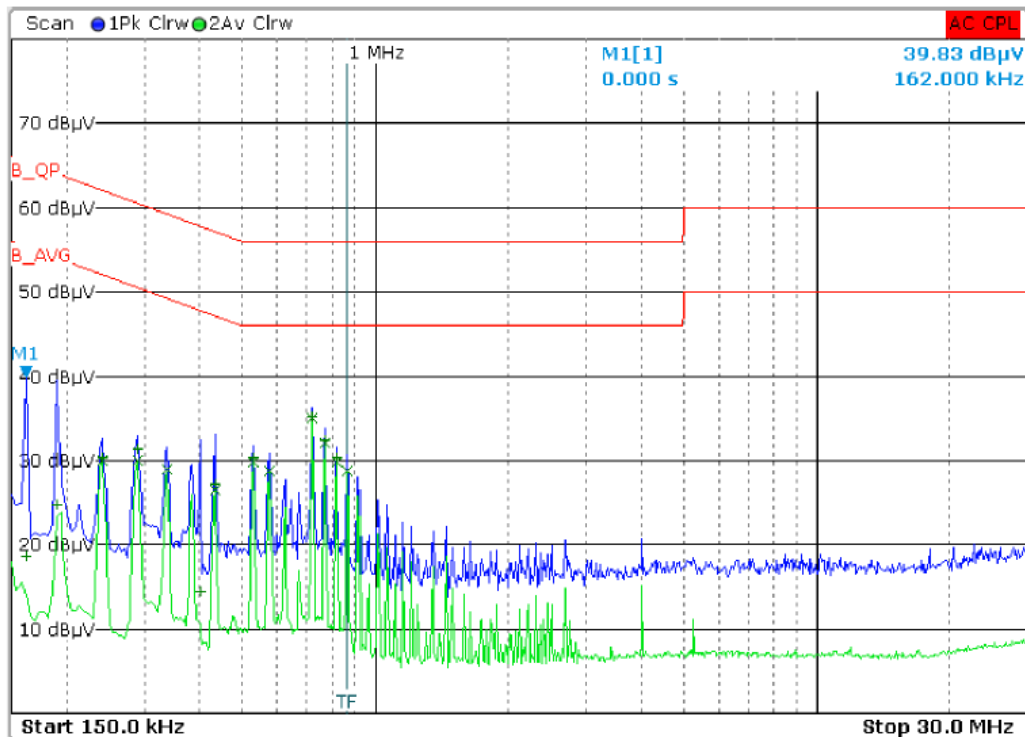
Limit of section 15.207

Frequency of Emission (MHz)	QP Limit (dB μ V)	AV Limit (dB μ V/m)
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency

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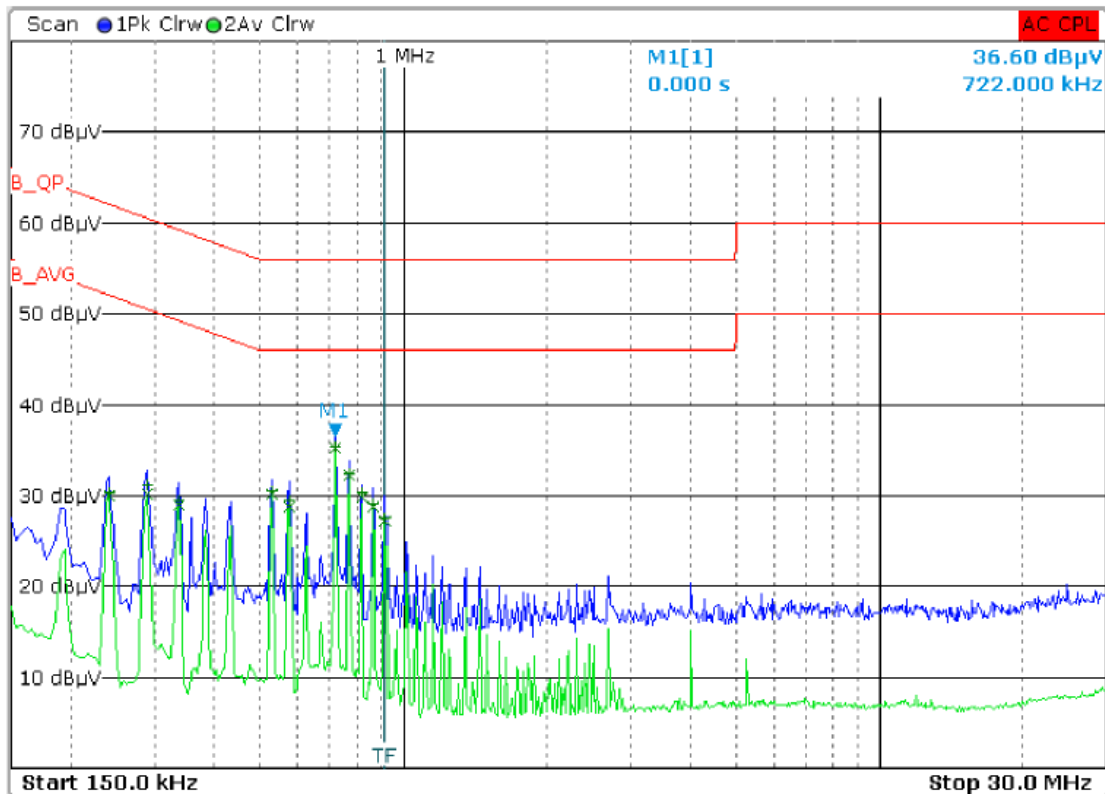
Test Results:



Trace	Frequency	Level (dBμV)	Phase	Detector	Delta Limit/dB
2	722.000000000 kHz	35.00		Average	-11.00
2	770.000000000 kHz	32.02		Average	-13.98
2	818.000000000 kHz	29.83		Average	-16.17
2	530.000000000 kHz	29.82		Average	-16.18
2	578.000000000 kHz	28.75		Average	-17.25
2	866.000000000 kHz	28.69		Average	-17.31
2	338.000000000 kHz	28.85		Average	-20.40
2	290.000000000 kHz	30.06		Average	-20.46
2	434.000000000 kHz	26.54		Average	-20.64
1	722.000000000 kHz	35.24		Quasi Peak	-20.76
2	242.000000000 kHz	30.00		Average	-22.03
1	770.000000000 kHz	32.36		Quasi Peak	-23.64
1	530.000000000 kHz	30.40		Quasi Peak	-25.60
1	818.000000000 kHz	30.30		Quasi Peak	-25.70
1	290.000000000 kHz	31.31		Quasi Peak	-29.21
1	434.000000000 kHz	27.15		Quasi Peak	-30.03
1	242.000000000 kHz	30.38		Quasi Peak	-31.65
1	190.000000000 kHz	24.67		Quasi Peak	-39.37
1	402.000000000 kHz	14.49		Quasi Peak	-43.32
1	162.000000000 kHz	18.69		Quasi Peak	-46.67

Mode: Line

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Trace	Frequency	Level (dBµV)	Phase	Detector	Delta Limit/dB
2	722.000000000 kHz	35.17		Average	-10.83
2	770.000000000 kHz	32.17		Average	-13.83
2	530.000000000 kHz	30.08		Average	-15.92
2	818.000000000 kHz	29.88		Average	-16.12
2	578.000000000 kHz	28.82		Average	-17.18
2	866.000000000 kHz	28.69		Average	-17.31
2	914.000000000 kHz	27.22		Average	-18.78
2	338.000000000 kHz	28.89		Average	-20.36
2	290.000000000 kHz	30.14		Average	-20.38
1	722.000000000 kHz	35.40		Quasi Peak	-20.60
2	242.000000000 kHz	29.99		Average	-22.04
1	770.000000000 kHz	32.48		Quasi Peak	-23.52
1	530.000000000 kHz	30.48		Quasi Peak	-25.52
1	818.000000000 kHz	30.35		Quasi Peak	-25.65
1	578.000000000 kHz	29.42		Quasi Peak	-26.58
1	866.000000000 kHz	29.11		Quasi Peak	-26.89
1	914.000000000 kHz	27.47		Quasi Peak	-28.53
1	290.000000000 kHz	31.26		Quasi Peak	-29.26
1	338.000000000 kHz	29.39		Quasi Peak	-29.86
1	242.000000000 kHz	30.40		Quasi Peak	-31.63

Mode: Neutral

END OF TEST REPORT