



Produkte
Products

Prüfbericht - Nr.:		19660026 001		Seite 1 von 28	
<i>Test Report No.:</i>		<i>Page 1 of 28</i>			
Auftraggeber: <i>Client:</i>		ATMEL NORWAY AS VESTRE ROSTEN 79 7075 TILLER TRONDHEIM NORWAY - 7075			
Gegenstand der Prüfung: <i>Test item:</i>		ZigBit ATxmega256A3U + RF233			
Bezeichnung: <i>Identification:</i>		ATZB-X0-256-3-0-C	Serien-Nr.: <i>Serial No.</i>	Engineering Sample	
Wareneingangs-Nr.: <i>Receipt No.:</i>		1803001641	Eingangsdatum: <i>Date of receipt:</i>	10.09.2013	
Prüfort: <i>Testing location:</i>		Refer Page 4 of 28 for test facilities			
Prüfgrundlage: <i>Test specification:</i>		FCC Part 15, Subpart C			
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:		
17.09.2013	Saibaba Siddapur Engineer		20.09.2013	Raghavendra Kulkarni Sr. Manager	
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other Aspects: FCC ID : VW4A091731					
Abkürzungen:		P(ass) = entspricht Prüfgrundlage	Abbreviations:		P(ass) = passed
F(ail) = entspricht nicht Prüfgrundlage					F(ail) = failed
N/A = nicht anwendbar					N/A = not applicable
N/T = nicht getestet					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>					

Test Result Summary

Clause	Test Item	Result
FCC 15.247(b) (3)	Maximum Conducted Peak Output Power	Pass
FCC 15.247(a) (2)	6dB Bandwidth	Pass
FCC 15.247(e)	Power Spectral Density	Pass
FCC 15.247(d)	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

Content

List of Type and Measurement Instruments	4
General Product Information	5
Product Function and Intended Use	5
Ratings and System Details.....	5
Test Set-up and Operation Mode.....	6
Principle of Configuration Selection	6
Test Operation and Test Software	6
Special Accessories and Auxiliary Equipment	6
Countermeasures to achieve EMC Compliance	6
Test Methodology	8
Radiated Emission Test	8
Test Results	9
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)19
Spurious Radiated Emissions and	
Restricted Bands of Operation	Section 15.209 and 15.205 23
Conducted Emission Test on A.C. Power Line	Section 15.207.....26
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 Diagrams	
Appendix 8: Bill of Material	
Appendix 9: User Manual	
Appendix 10: Maximum Permissible Exposure Calculation	

List of Type and Measurement Instruments

Equipment	Manufacturer	Model	S/N	Calibration Due Date
EMI Test Receiver	Rohde & Schwarz	ESU 40	100288	04.10.2013
Hybrid Log Periodic antenna	ETS Lindgren	3142D	00081354	01.11.2013
Broadband Horn Antenna	Frankonia	HAX-18	HAX18-802	10.10.2013
Emission Horn Antenna	ETS Lindgren	116706	00107323	01.11.2013
Active Loop Antenna	Frankonia	LAX-10	LAX-10-800	01.11.2013
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	22.03.2014

Testing Facilities:

- 1) TUV Rheinland (India) Private Limited
No. 108, West Wing
Electronic city Phase I
Bangalore – 560100

www.tuv.com

General Product Information

Product Function and Intended Use

The ZigBit ATxmega256A3U + RF233 is a ZigBit module with the Atmel ATxmega256A3U microcontroller and AT86RF233 radio transceiver. The AT86RF233 radio transceiver supports the worldwide accessible 2.4GHz ISM band. The system is designed for standard-based applications such as ZigBee/IEEE 802.15.4, ZigBee RF4CE, and 6LoWPAN, as well as high data rate ISM applications. The MS147 connector allows conducting RF performance measurements.

Ratings and System Details

Operating Frequency	2400MHz – 2483.5MHz
No. of channels	16
Channel Spacing	5MHz
Modulation	DSSS (O-QPSK)
Transmitted Power	4.34dBm
Data Rate	250 kbps
Antenna Type	Refer Page 6 of 28
Number of antenna	One
Antenna Gain	Refer Page 6 of 28
Supply Voltage	3.3VDC
Dimensions	33 mm x 20 mm x 0.7mm
Environmental	-20 to +85 degrees C range

Test Conditions:

Voltage: Voltage: 5 V DC (from USB Port)

Environmental conditions:

Temperature: +23 °C **RH:** 62%

www.tuv.com

Test Set-up and Operation Mode

Principle of Configuration Selection

Transmission was enabled with 100% duty cycle on low, mid and high channel.

Test Operation and Test Software

Test software was used to enable the transmission with 100% duty cycle and channels 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	Channel No.	Frequency (MHz)
2400-2483.5 MHz	11	2405
	12	2410
	13	2415
	14	2420
	15	2425
	16	2430
	17	2435
	18	2440
	19	2445
	20	2450
	21	2455
	22	2460
	23	2465
	24	2470
	25	2475
	26	2480

Note: Peak Power Testing carried with different register value for different channel as listed below

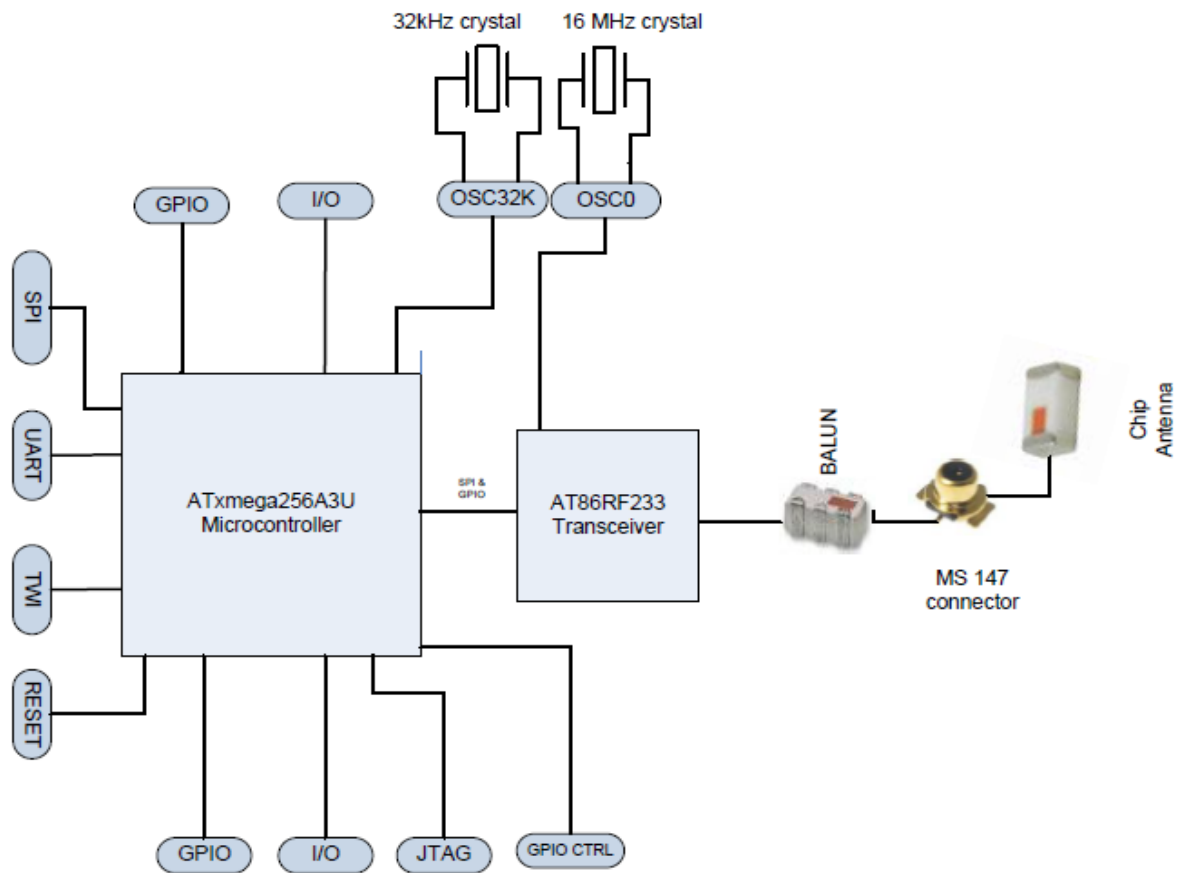
Channel	Register Value
Low	0x0
Mid	0x0
High	0x3

Antenna Used

Make	Model/Part #	Antenna Gain (dBi)	Type of Antenna
Johanson Technology	2450AT18D0100	0dBi	Ceramic Antenna

www.tuv.com

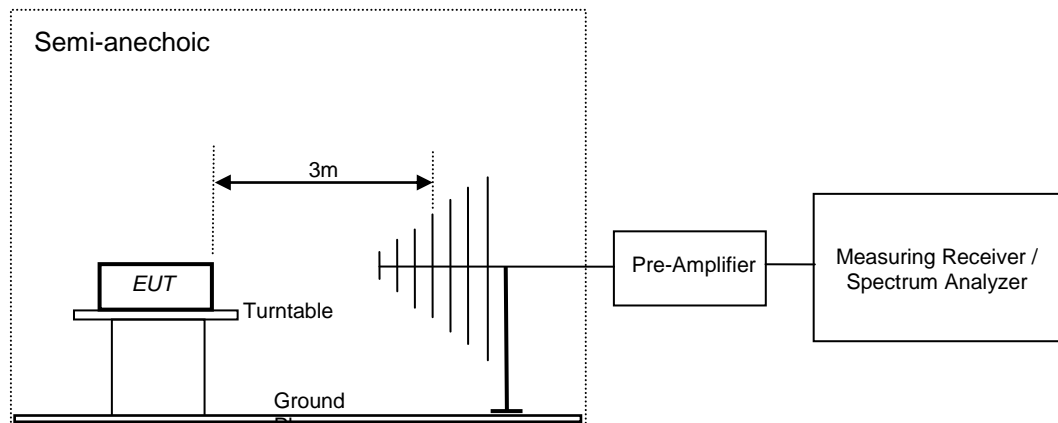
Block Diagram



Test Methodology

Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.4-2003. 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.



www.tuv.com

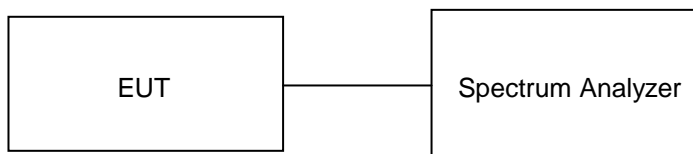
Test Results

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:

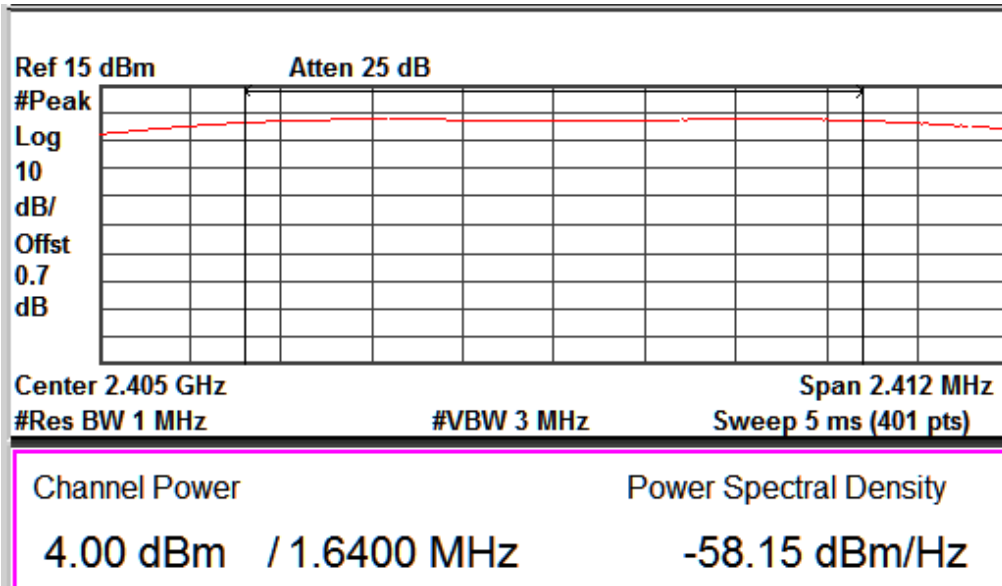


Cable Loss: 0.7dB (Included in the test results)

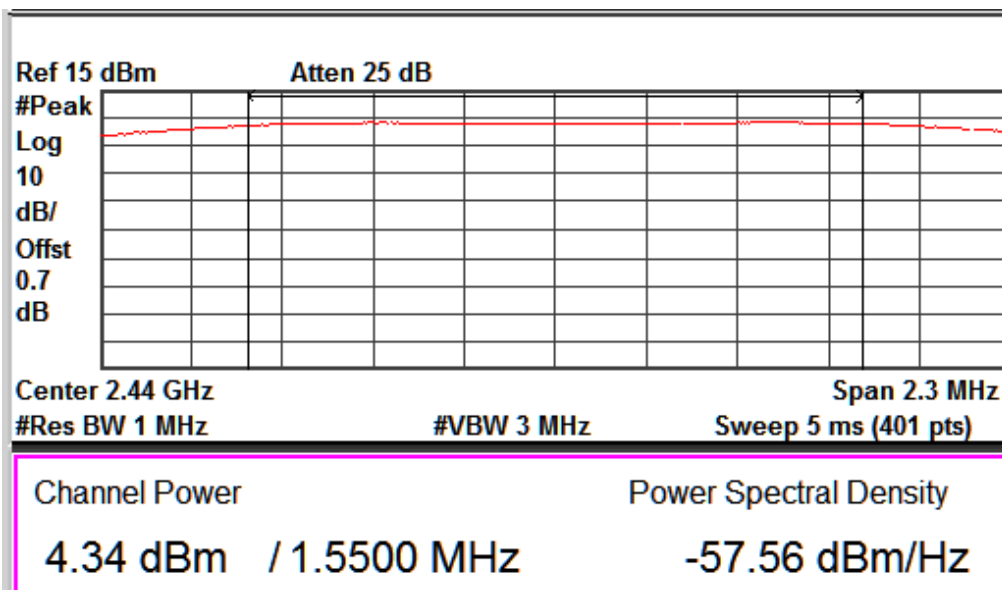
Test Result:

Frequency (MHz)	Total Output power (dBm)	Limit (dBm)	Margin (dB)
2405	4.00	30.00	-26.00
2440	4.34	30.00	-25.46
2480	3.24	30.00	-26.76

www.tuv.com

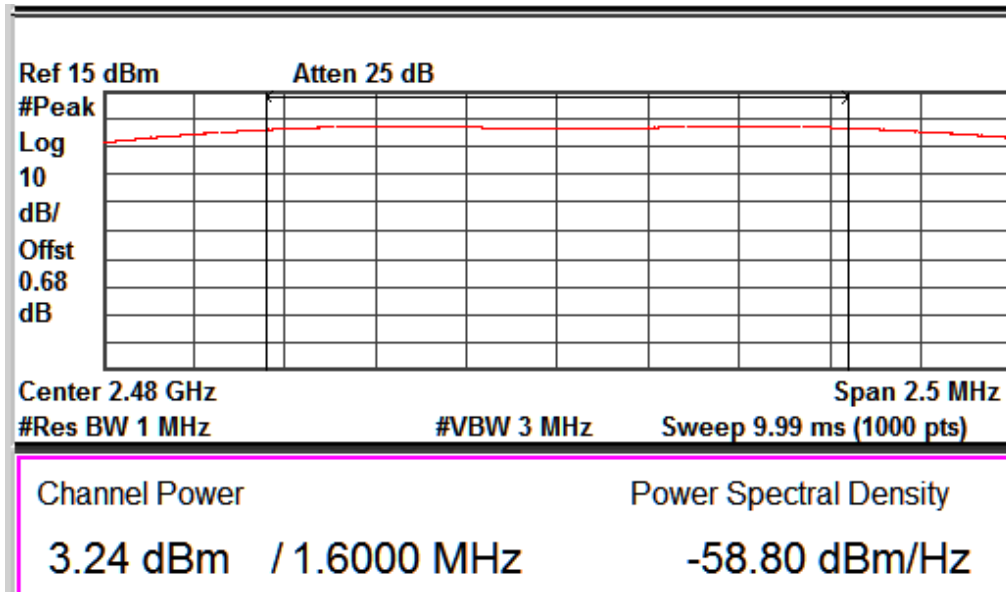


Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

www.tuv.com



Channel Frequency: 2480 MHz

www.tuv.com

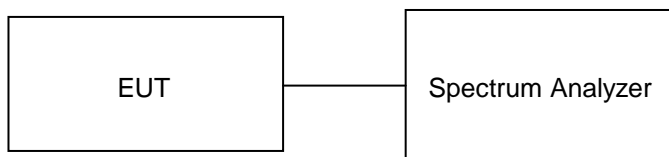
**Power Spectral Density
Result**

**Section 15.247(e)
Pass**

Test Specification FCC Part 15 Subpart C
Detector Function Peak

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:

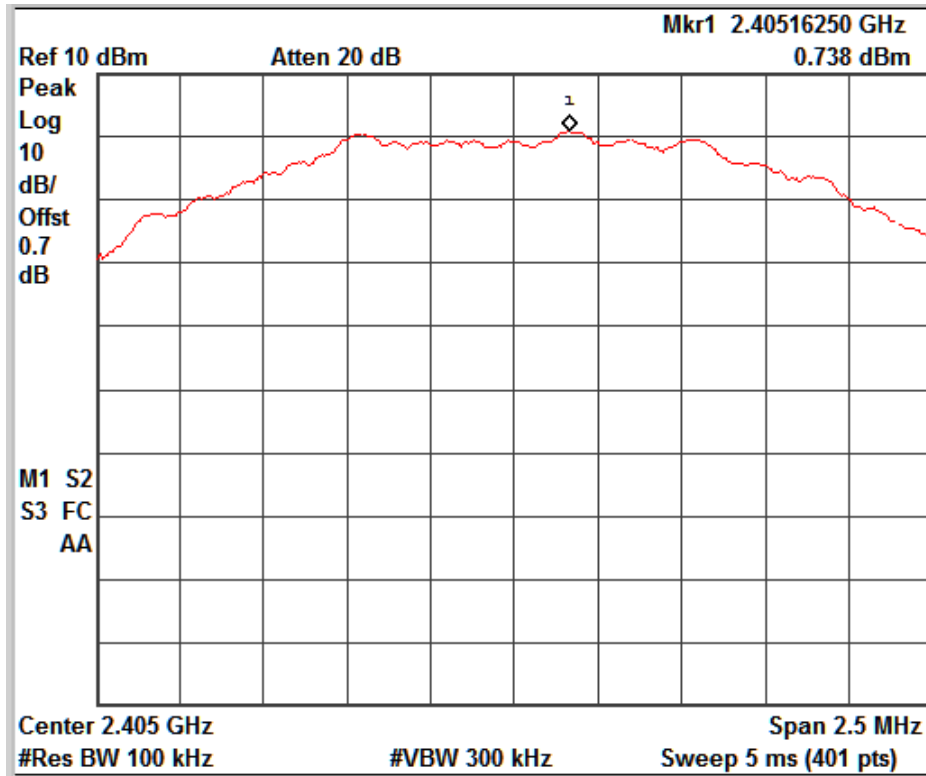


Cable Loss: 0.7dB (Included in the test results)

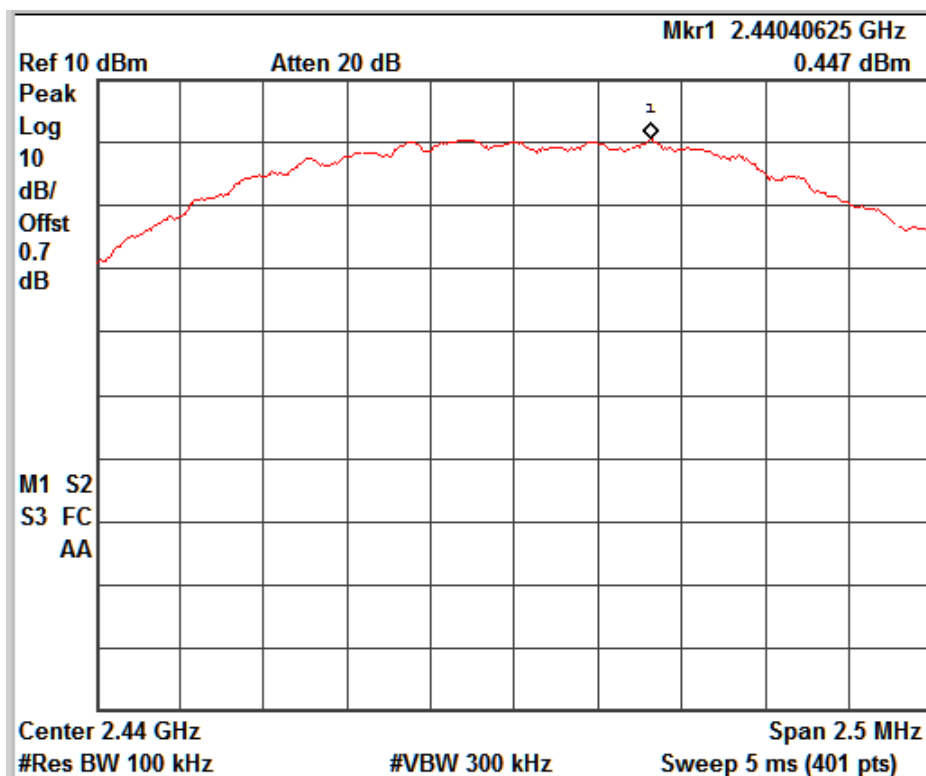
Test Result:

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin(dB)
2405	0.74	8.00	-7.26
2440	0.45	8.00	-7.55
2480	0.96	8.00	-7.04

www.tuv.com

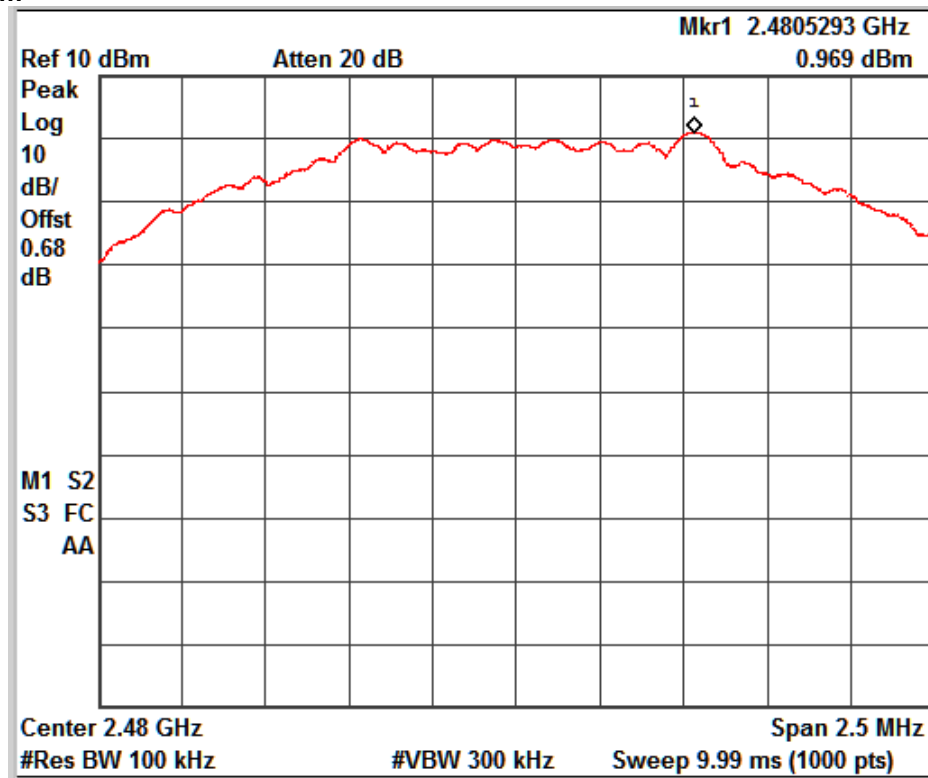


Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

www.tuv.com



Channel Frequency: 2480 MHz

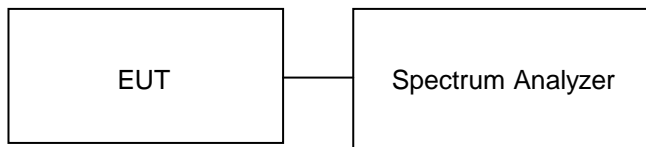
www.tuv.com

**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.

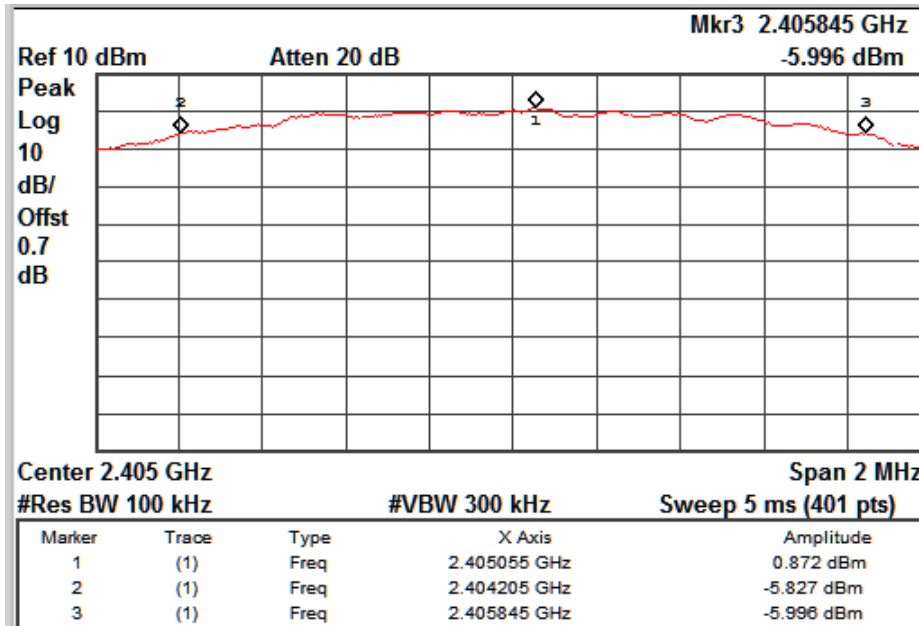
Test Method:



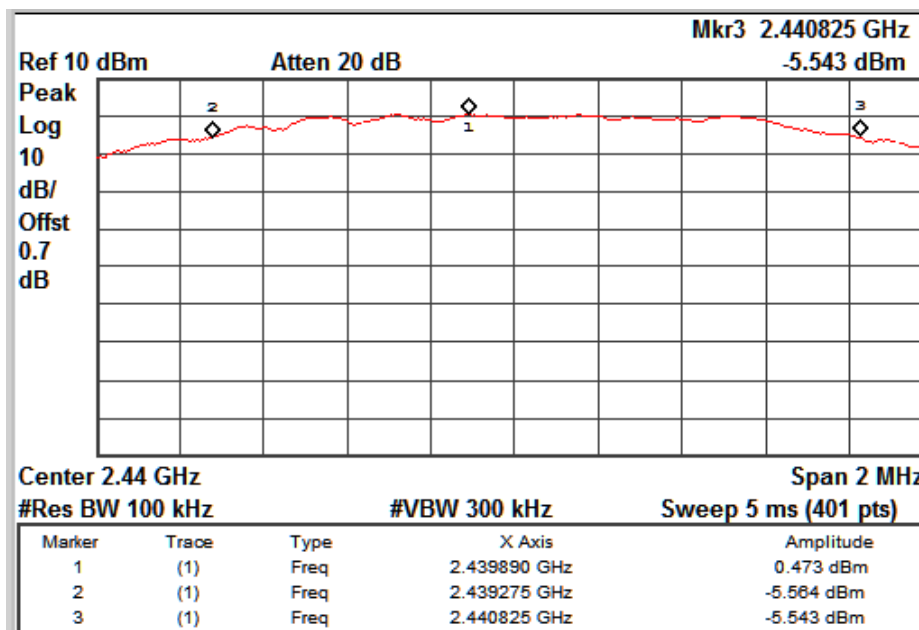
Cable Loss: 0.7dB (Included in the test results)

Test Result:

Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	OBW (MHz)
2405	2404.21	2405.85	1.64	2.35
2440	2439.28	2440.83	1.55	2.38
2480	2479.3	2480.81	1.51	2.38

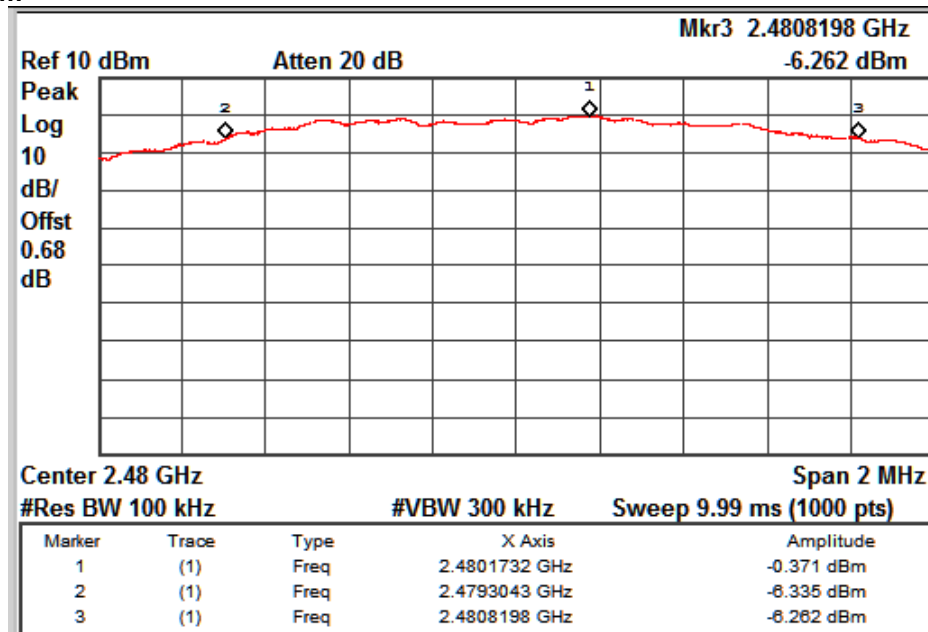


Channel frequency: 2405 MHz

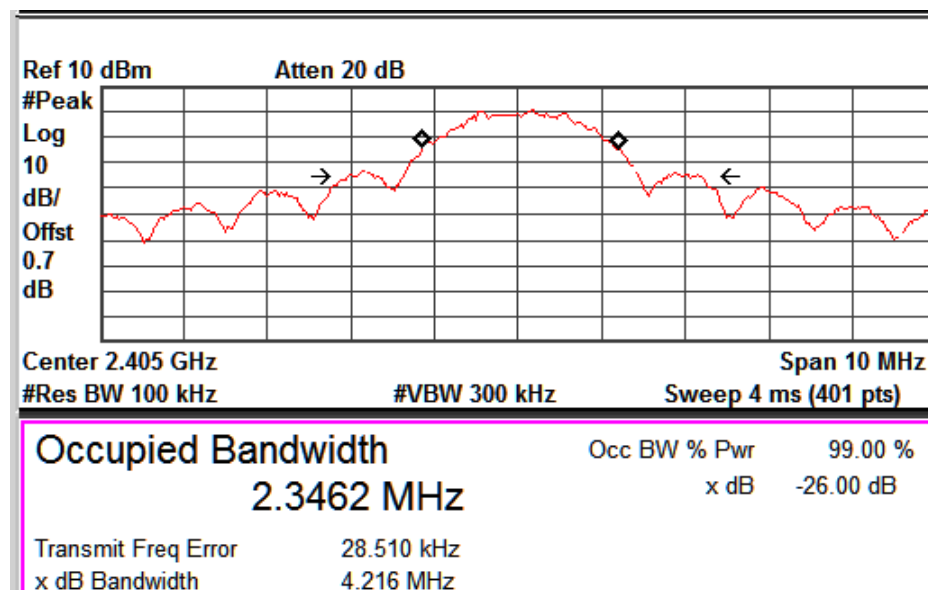


Channel frequency: 2440 MHz

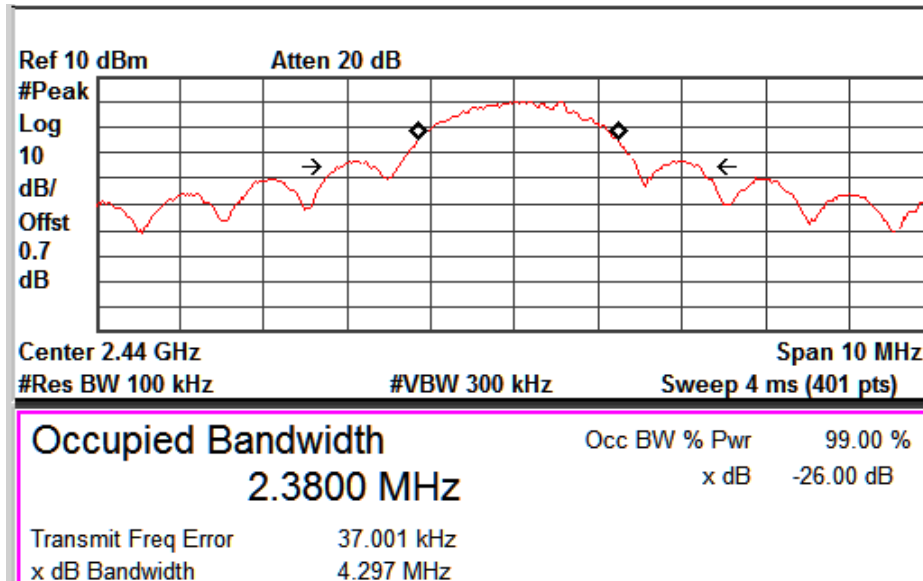
www.tuv.com



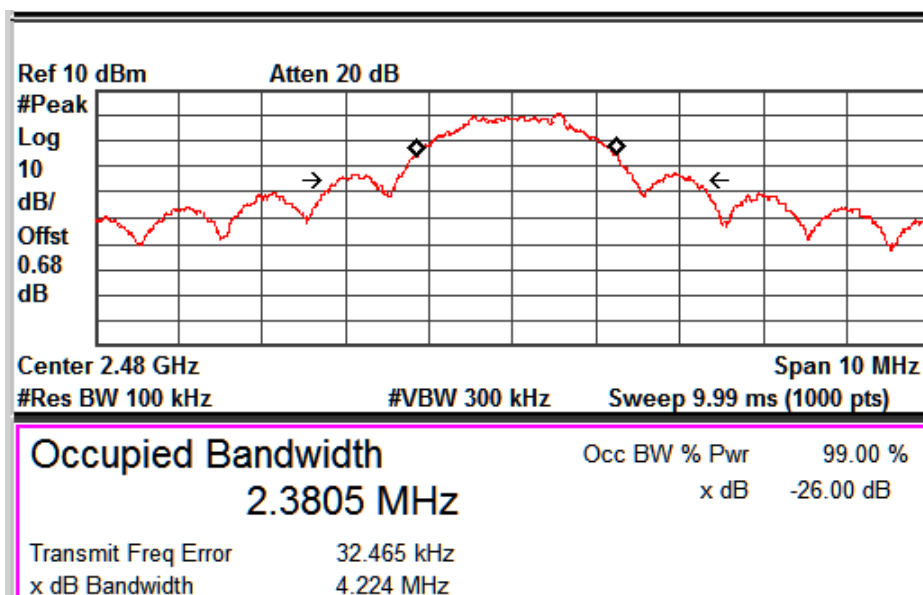
Channel frequency: 2480 MHz



OBW Channel frequency: 2405 MHz



OBW Channel frequency: 2440 MHz



OBW Channel frequency: 2480 MHz

www.tuv.com

**Band-edge Compliance
Result**

**Section 15.247(d)
Pass**

Test Specification

FCC Part 15 Subpart C

Detector Function

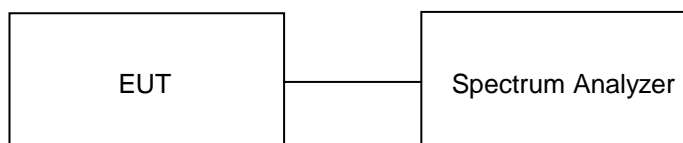
Peak

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:

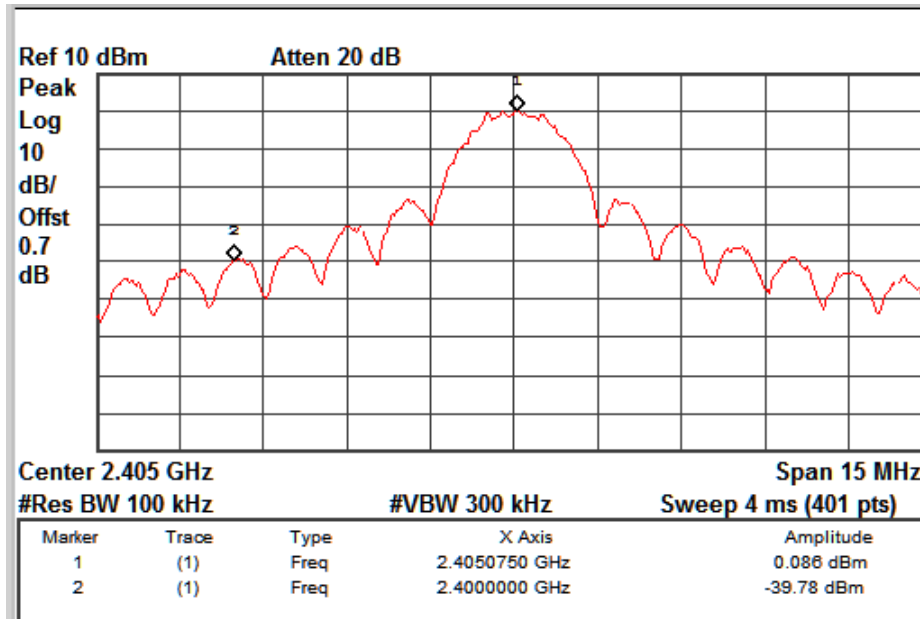


Cable Loss: 0.7dB (Included in the test results)

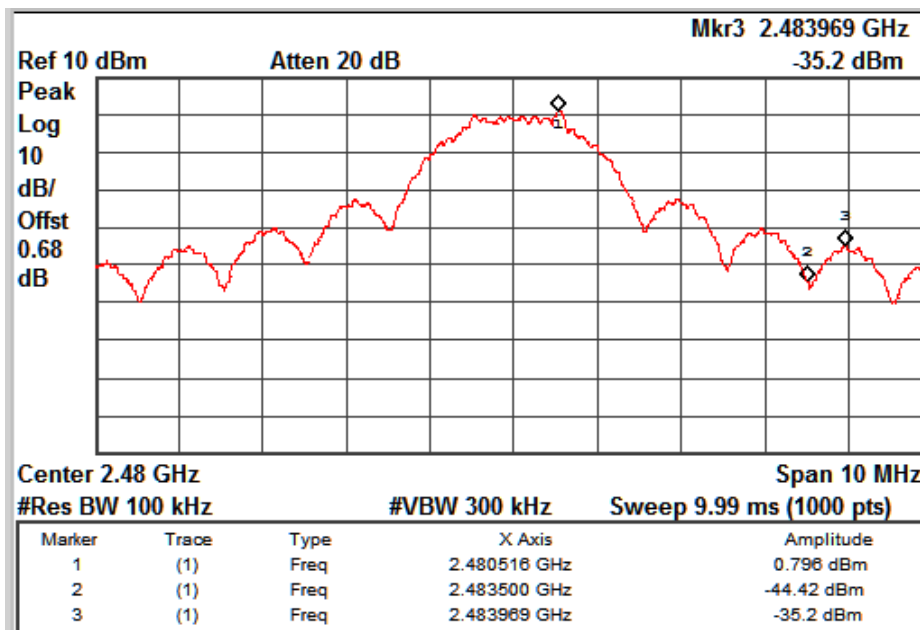
Test Result:

Channel Frequency (MHz)	Value at Band Edge				Limit (dB)
	Band Edge Frequency (MHz)	Measured PSD Level*	Band Edge Value (dBm)	Value (dBc)	
2405	2400.00	0.74	-39.78	-40.52	-20.00
2480	2483.50	0.96	-44.53	-45.38	-20.00

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

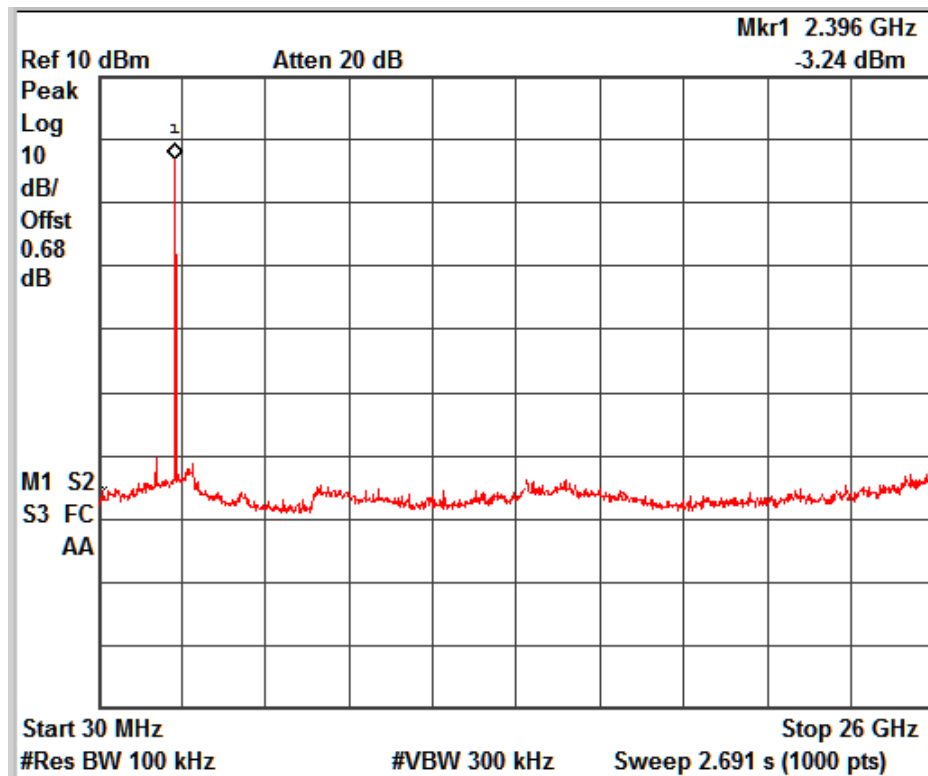


Channel frequency: 2405 MHz

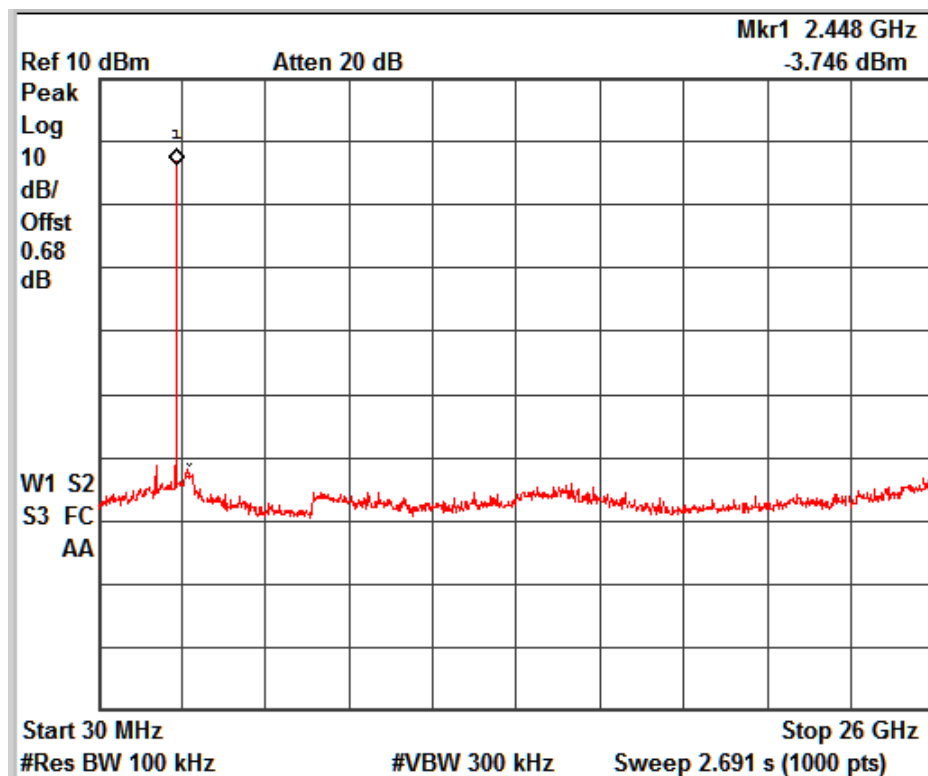


Channel frequency: 2480 MHz

www.tuv.com
Conducted Spurious Emission

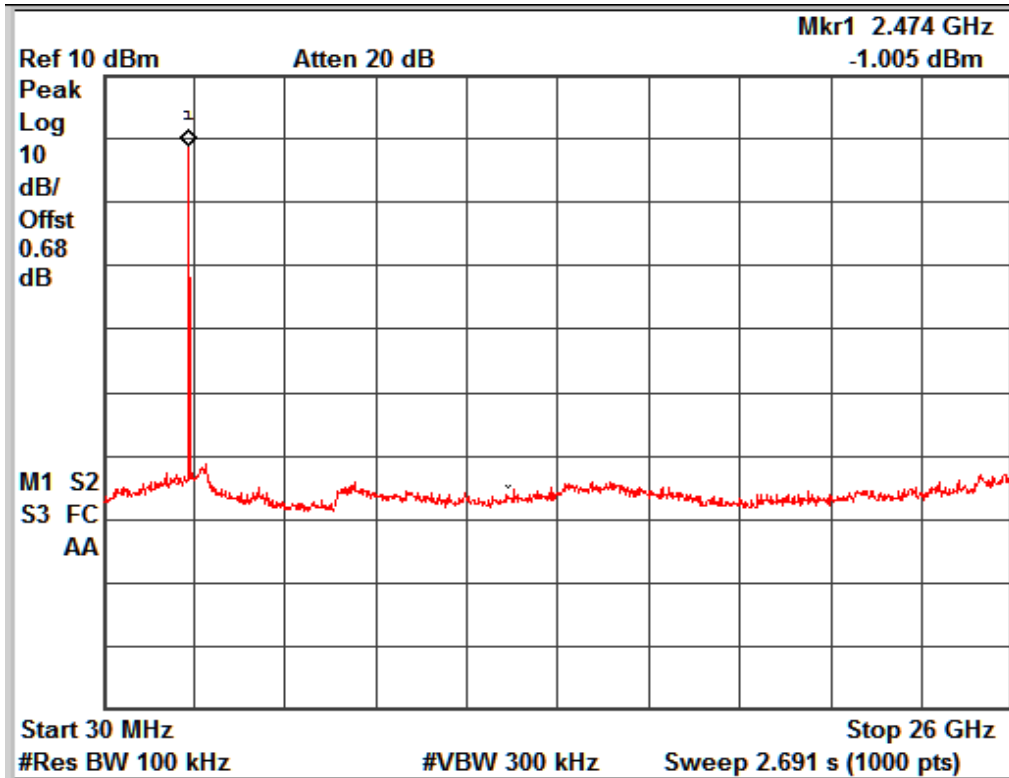


Channel frequency: 2405 MHz



Channel frequency: 2440 MHz

www.tuv.com



Channel frequency: 2480 MHz

www.tuv.com

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

**Section 15.209 and 15.205
Pass**

Test Specification	FCC Part 15 Subpart C
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 ($\text{dB}\mu\text{V/m}$)	Distance of Measurement (m)
0.009 – 0.490	$2400/F(\text{kHz})$	48.50 – 13.80	300*
0.490 – 1.705	$24000/F(\text{kHz})$	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.

www.tuv.com

Test result:

Worst case emissions observed are listed below.

Antenna Polarization	Frequency of Emission (MHz)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Vertical	97.6	29.37	43.5	-14.13
	241.072	34.51	46	-11.49
Horizontal	170.94	26.26	43.5	-17.24
	241.072	30.15	46	-15.85

www.tuv.com

Emission above 1 GHz:

Fundamental Frequency (MHz)	Antenna Polarization	Frequency of Emission (MHz)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2405	V	2390(Pk)	43.96	74	-30.04
		2390(Av)	29.59	54	-24.41
		2405(Pk)	91.89	*	-
		2405(Av)	89.12	*	-
		4810(Pk)	50.36	74	-23.64
		4810(Av)	38.46	54	-15.54
	H	2390(Pk)	43.93	74	-30.07
		2390(Av)	34.50	54	-19.50
		2405(Pk)	99.17	*	-
		2405(Av)	95.35	*	-
		4810(Pk)	54.43	74	-19.57
		4810(Av)	44.63	54	-09.37
2440	V	2440(Pk)	91.40	*	-
		2440(Av)	87.74	*	-
		4880(Pk)	50.40	74	-23.60
		4880(Av)	37.35	54	-16.65
	H	2440(Pk)	98.33	*	-
		2440(Av)	95.65	*	-
		4880(Pk)	52.96	74	-21.04
		4880(Av)	43.26	54	-10.74
2480	V	2480(Pk)	88.98	*	-
		2480(Av)	86.13	*	-
		2483.5(Pk)	54.92	74	-19.08
		2483.5(Av)	47.71	54	-06.29
		4960(Pk)	50.41	74	-23.59
		4960(Av)	38.17	54	-15.83
	H	2480(Pk)	93.81	*	-
		2480(Av)	90.85	*	-
		2483.5(Pk)	61.65	74	-12.35
		2483.5(Av)	53.43	54	-00.57
		4960(Pk)	52.87	74	-21.13
		4960(Av)	42.56	54	-11.44

* - --> Fundamental Frequency
 Pk--> Peak Detector
 Av--> Average Detector

Note: Emission measurement from 1GHz to 26GHz was done by rotating the EUT, and changing the antenna in both height and polarization, to maximize the measured emission. The emission was kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT was measured.

**Conducted Emission Test on A.C. Power Line
Result****Section 15.207
Pass**

Test Specification : FCC Part 15 Section 15.207
Test Method : ANSI C63.4-2003
Testing Location : Screened room
Measurement Bandwidth : 9kHz
Frequency Range : 150kHz – 30MHz
Supply Voltage : 110VAC, 60Hz

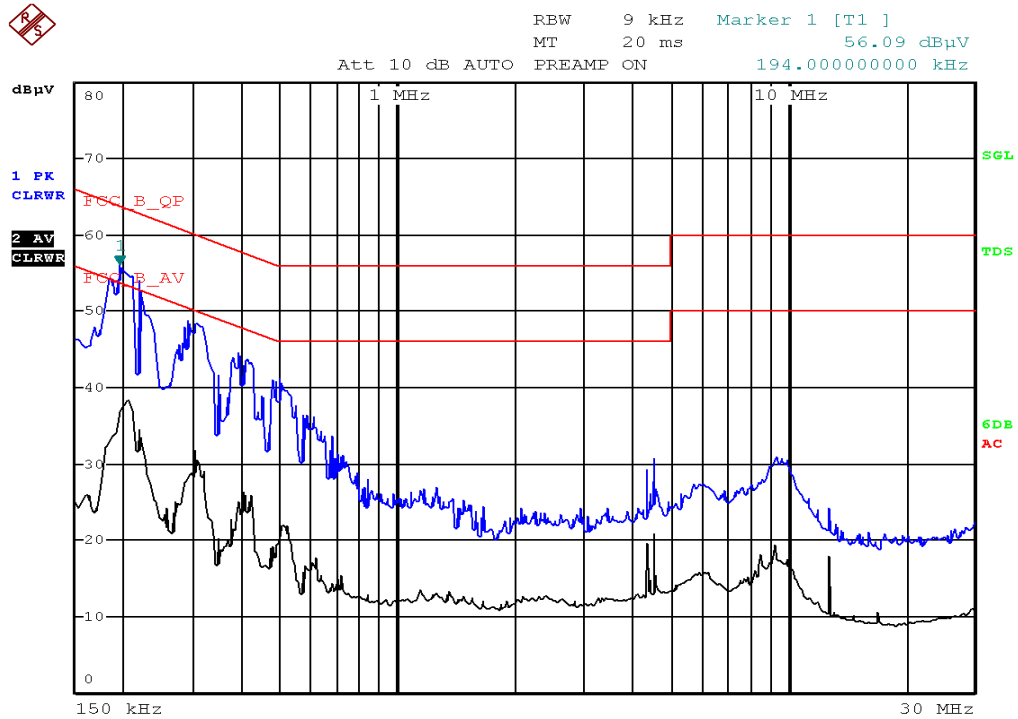
Limit of section 15.207

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

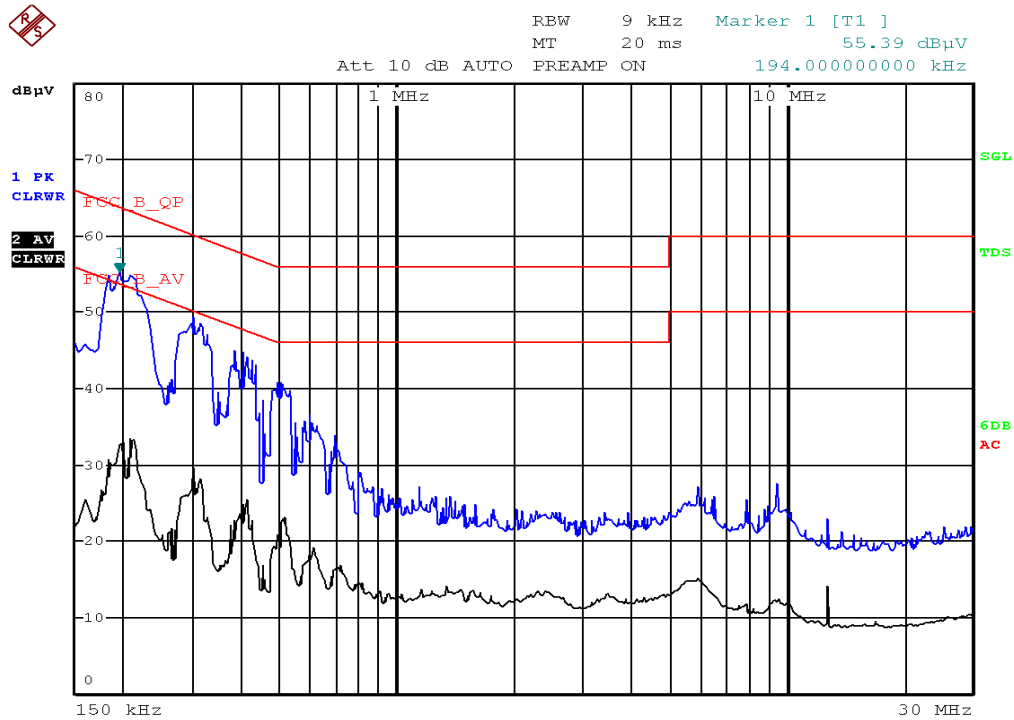
www.tuv.com

Test Result:



EDIT PEAK LIST (Final Measurement Results)				
Trace1:	FCC_B_QP			
Trace2:	FCC_B_AV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV		DELTA LIMIT dB
1 Quasi Peak	194 kHz	51.57 L1		-12.28
1 Quasi Peak	218 kHz	49.42 L1		-13.46
1 Quasi Peak	290 kHz	45.36 L1		-15.16
2 Average	202 kHz	37.37 L1		-16.14
1 Quasi Peak	390 kHz	40.49 L1		-17.56
1 Quasi Peak	498 kHz	36.82 L1		-19.20
2 Average	302 kHz	30.42 L1		-19.76
2 Average	402 kHz	26.15 L1		-21.65
1 Quasi Peak	586 kHz	31.57 L1		-24.42
2 Average	9.262 MHz	16.90 L1		-33.09
2 Average	4.534 MHz	12.36 L1		-33.63
2 Average	4.35 MHz	11.87 L1		-34.12
1 Quasi Peak	9.306 MHz	24.09 L1		-35.90
2 Average	12.682 MHz	13.02 L1		-36.97
1 Quasi Peak	4.534 MHz	18.20 L1		-37.79

Mode: Positive



EDIT PEAK LIST (Final Measurement Results)				
Trace1:	FCC_B_QP			
Trace2:	FCC_B_AV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dBμV		DELTA LIMIT dB
1 Quasi Peak	194 kHz	51.92	N	-11.94
1 Quasi Peak	298 kHz	45.61	N	-14.68
1 Quasi Peak	382 kHz	40.04	N	-18.19
1 Quasi Peak	506 kHz	36.43	N	-19.56
2 Average	206 kHz	31.76	N	-21.60
2 Average	298 kHz	28.21	N	-22.08
2 Average	410 kHz	25.21	N	-22.43
2 Average	514 kHz	22.09	N	-23.90
1 Quasi Peak	598 kHz	31.38	N	-24.61
1 Quasi Peak	450 kHz	30.92	N	-25.95
1 Quasi Peak	694 kHz	27.45	N	-28.54
1 Quasi Peak	9.45 MHz	17.40	N	-42.59

Mode: Negative