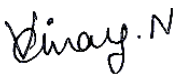



Produkte
Products

Prüfbericht - Nr.: 19660058 001		Seite 1 von 26			
<i>Test Report No.:</i>		<i>Page 1 of 26</i>			
Auftraggeber: <i>Client:</i>	The Kroger Co. 11450 Grooms Rd. Blue Ash, OH 45242 United States				
Gegenstand der Prüfung: <i>Test item:</i>	CC2533 ZigBee Module				
Bezeichnung: <i>Identification:</i>	SRMANM	Serien-Nr.: <i>Serial No.</i>	Engineering Sample		
Wareneingangs-Nr.: <i>Receipt No.:</i>	1803022504	Eingangsdatum: <i>Date of receipt:</i>	21.11.2013		
Prüfart: <i>Testing location:</i>	Refer Page 4 of 26 for test facilities				
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15, Subpart C ANSI C63.4-2003				
Prüfresultat: <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				
geprüft / tested by:		kontrolliert / reviewed by:			
06.01.2014	Vinay N Test Engineer		08.01.2014	Raghavendra Kulkarni Senior 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 : PBR-SZMDLMA1			
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	Spurious Radiated Emissions	Pass
FCC 15.205	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	7
Radiated Emission Test	7
Test Results.....	8
Maximum Conducted Peak Output Power Section 15.247(b) (3).....	8
Power Spectral Density Section 15.247(e)	11
6 dB Bandwidth Section 15.247(a)(2).....	14
Band-edge Compliance Section 15.247(d).....	18
Spurious Radiated Emissions and Restricted Bands of Operation Section 15.209 and 15.205	22
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 Diagrams	
Appendix 8: Bill of Material	
Appendix 9: User Manual	
Appendix 10: Maximum Permissible Exposure Calculation	

www.tuv.com

List of Type and Measurement Instruments

TÜV Rheinland (India) Pvt. Ltd, Bangalore

Equipment	Manufacturer	Model	S/N	Calibration Due Date
EMI Test Receiver	Rohde &Schwarz	ESU 40	100288	04.10.2014
Hybrid Log Periodic antenna	ETS Lindgren	3142D	00081354	26.07.2014
Broadband Horn Antenna	Frankonia	HAX-18	HAX18-802	23.03.2014
Double-Ridged Waveguide Horn Antenna	ETS Lindgren	116794	00133356	01.09.2014
Emission Horn Antenna	ETS Lindgren	116706	00107323	24.08.2014
Active Loop Antenna	Frankonia	LAX-10	LAX-10-800	11.04.2014
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	21.03.2014

Testing Facilities:

- 1) TÜV 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 SRMANM Module is designed to be used for Zigbee Wireless network applications. The Module is 2.4GHz ZigBee/802.15.4 Wireless device to be used with Host device to create low power wireless network. The Module has RF Front end SoC to boost the RF Power level for range extension. The module will be soldered on Host Board and will be powered through Host Board power system. The module will transmit/receive data over the air. The module will communicate with Host CPU through SPI/UART interface and I/O pins.

Ratings and System Details

Operating Frequency	2400MHz – 2483.5MHz
No. of channels	16
Channel Spacing	5MHz
Modulation	DSSS
Transmitted Power	0.37dBm
Data Rate	250 kbps
Antenna Type	PCB Inverted F Antenna
Number of antenna	1
Antenna Gain	2dBi
Supply Voltage	2.7V – 3.6V
Dimensions	Height: 21.72mm Width: 20.96mm
Environmental	Temp: : -30 °C - +75 °C Humidity: 20-80% RHG

Test Conditions:

Voltage: 3.3 V DC

Environmental conditions:

Temperature: +23 °C **RH:** 62%

www.tuv.com

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

Test software was used to enable the transmission with highest possible 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 carrier 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	2480	

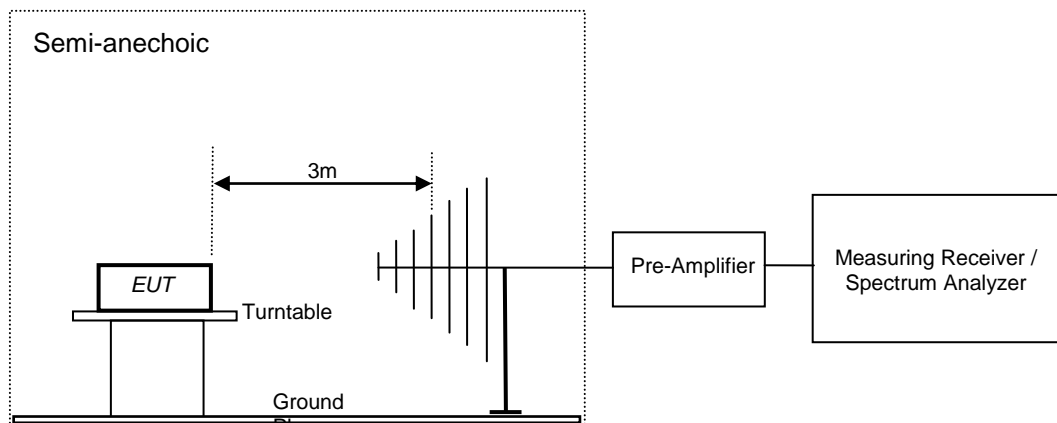
www.tuv.com

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

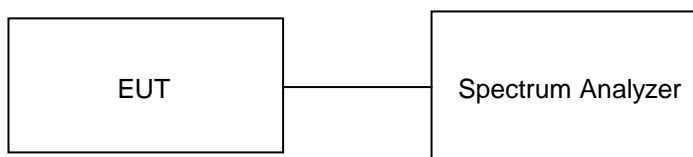
Section 15.247(b) (3)

Result

Pass

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

Test Method:

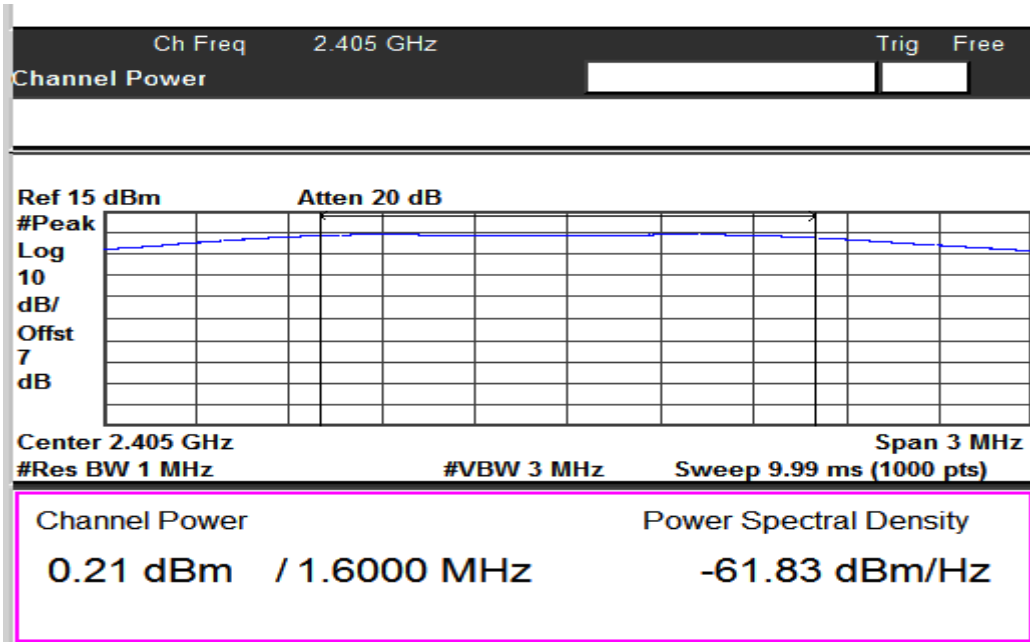


Test Result:

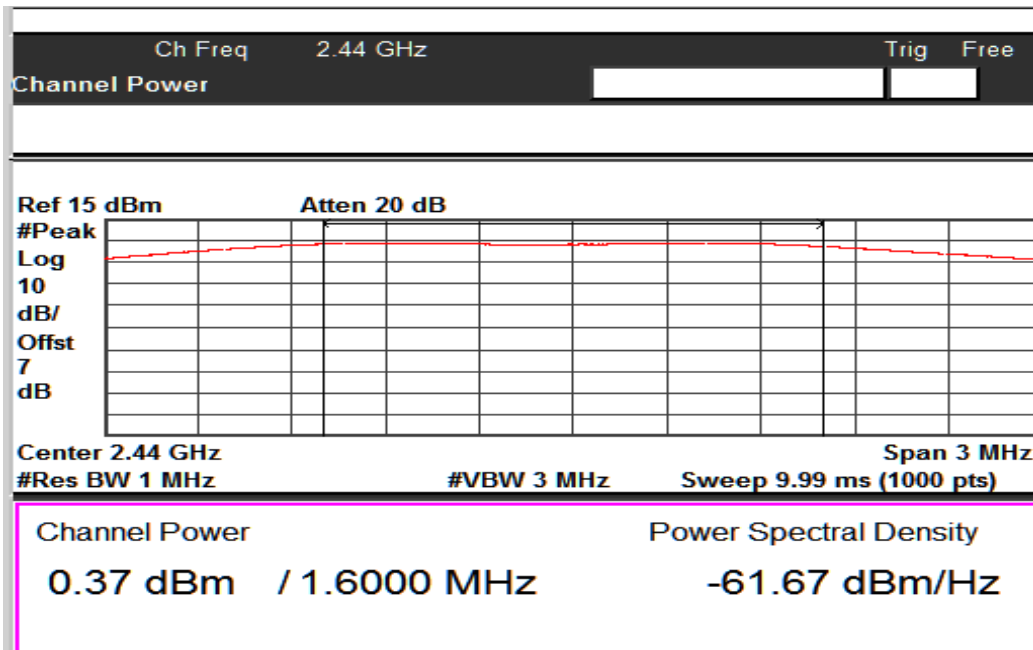
Attenuator: 6dB
Cable Loss: 1.00 dB

Frequency (MHz)	Total Output power (dBm)	Limit (dBm)
2405	0.21	30.00
2440	0.37	30.00
2480	-0.27	30.00

www.tuv.com

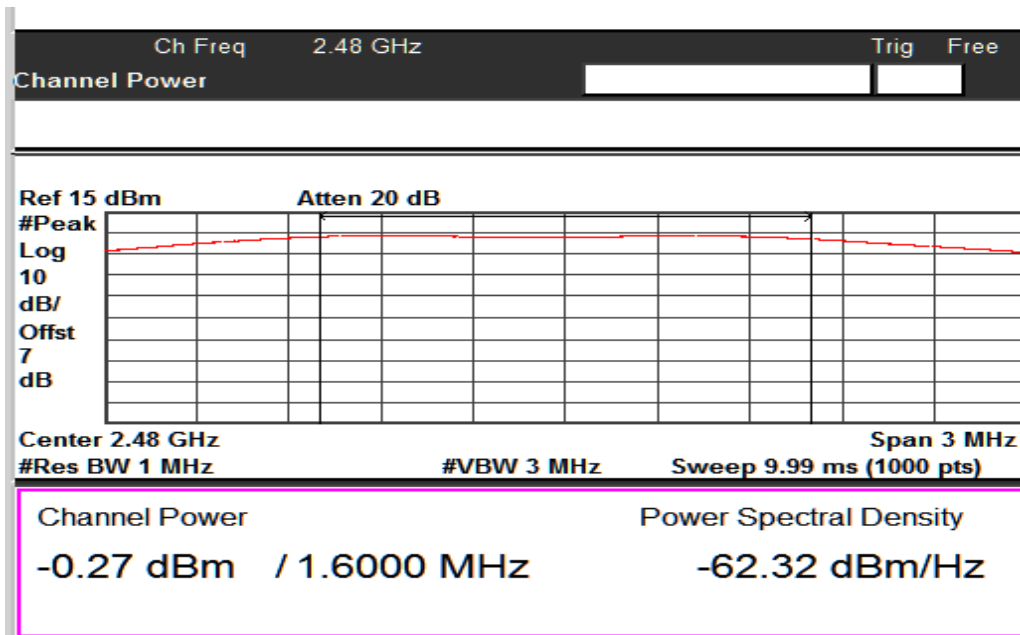


Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

www.tuv.com



Channel Frequency: 2480 MHz

www.tuv.com

Power Spectral Density

Section 15.247(e)

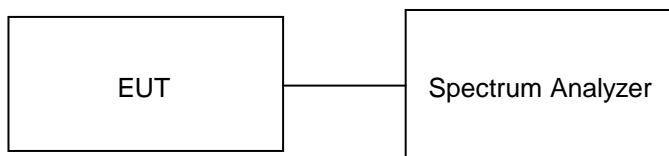
Result

Pass

Test Specification FCC Part 15 Section 15.247 (e)
 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 in any 3 kHz band during any time interval of continuous transmission.

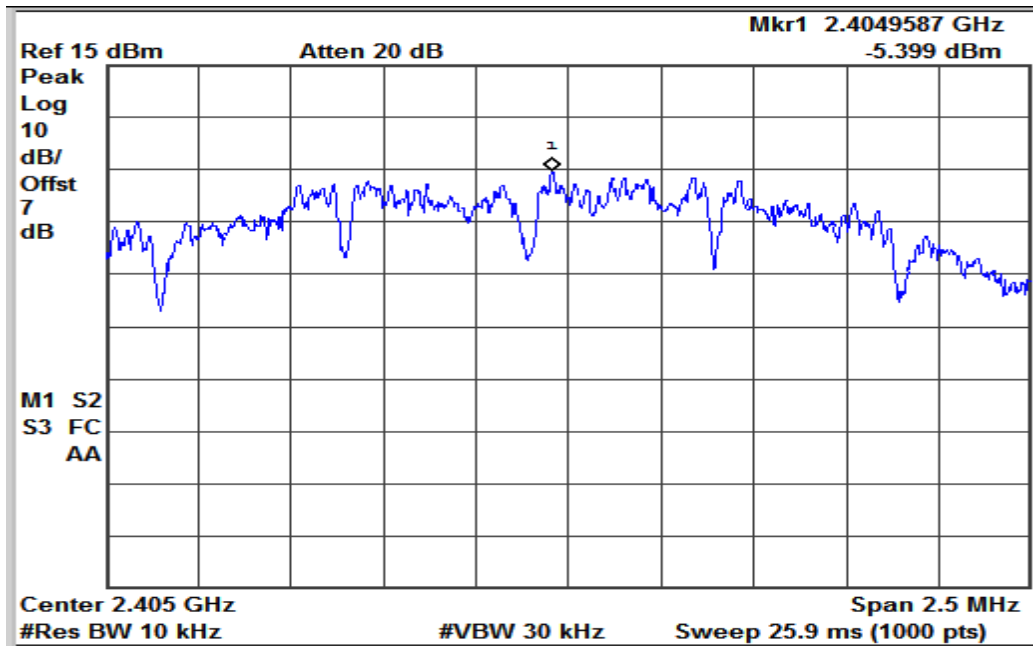
Test Method:



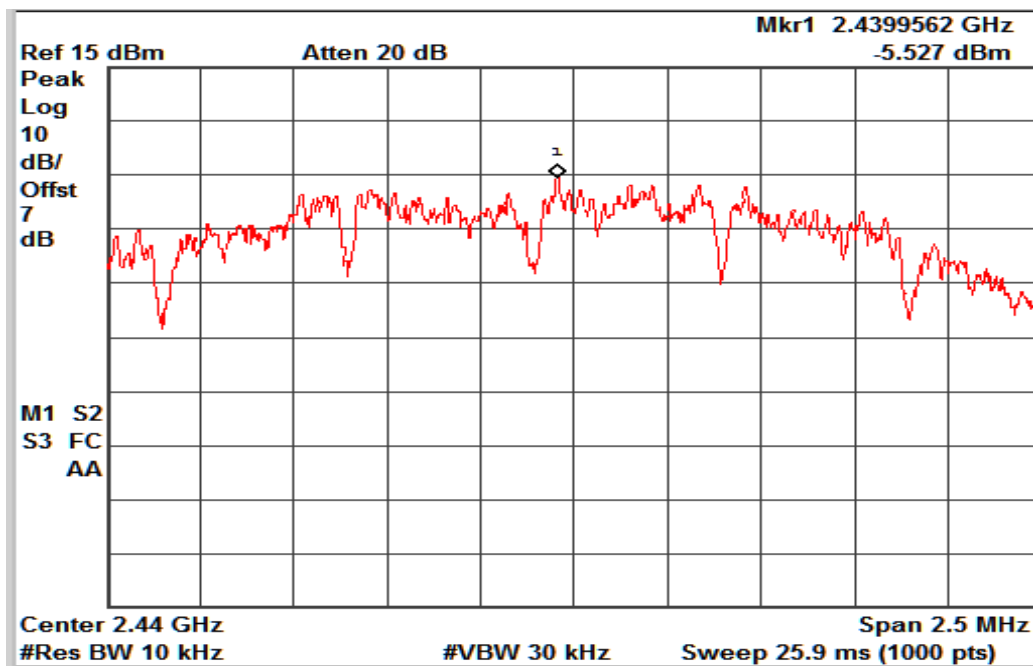
Test Result:

Attenuator: 6dB
Cable Loss: 1.00 dB

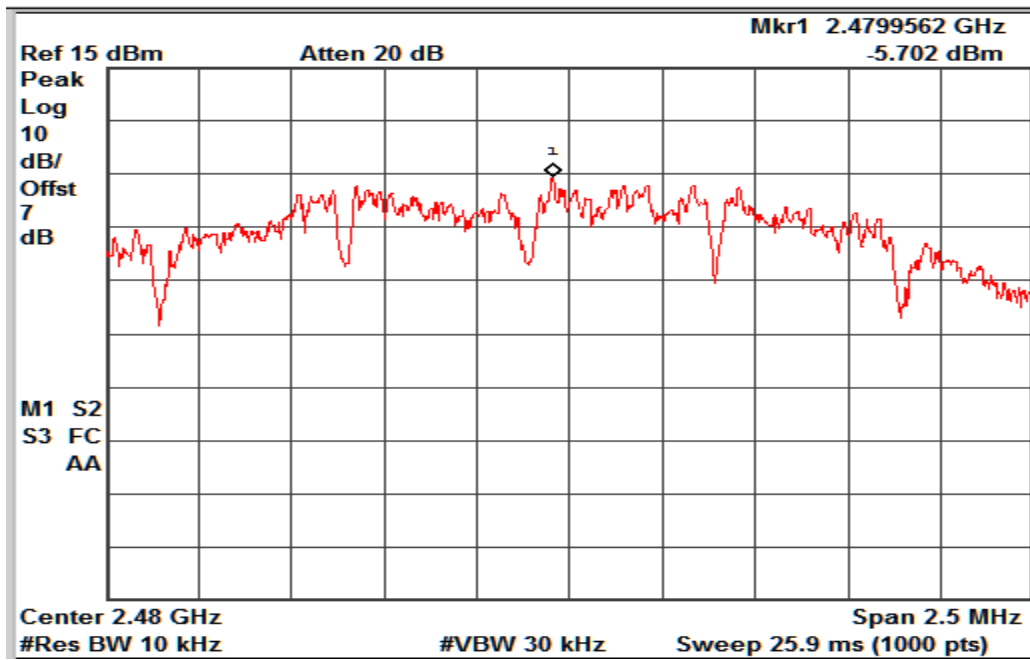
Frequency (MHz)	Total PSD (dBm)	Limit (dBm)
2405	-5.399	8.00
2440	-5.527	8.00
2480	-5.702	8.00



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz



Channel Frequency: 2480 MHz

www.tuv.com

6 dB Bandwidth

Section 15.247(a)(2)

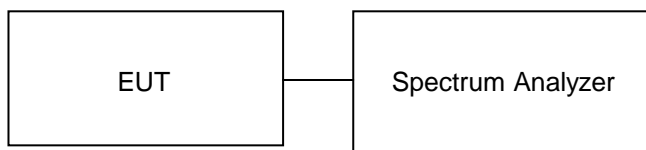
Result

Pass

Test Specification Requirement

FCC Part 15 Section 15.247 (a) (2)
The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Method:

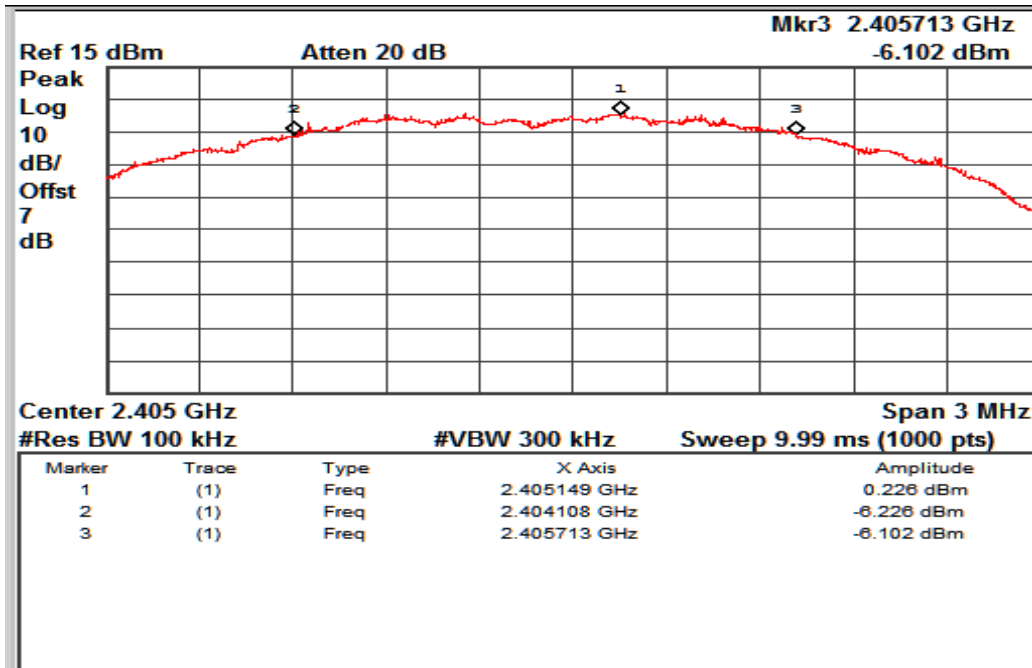


Test Result:

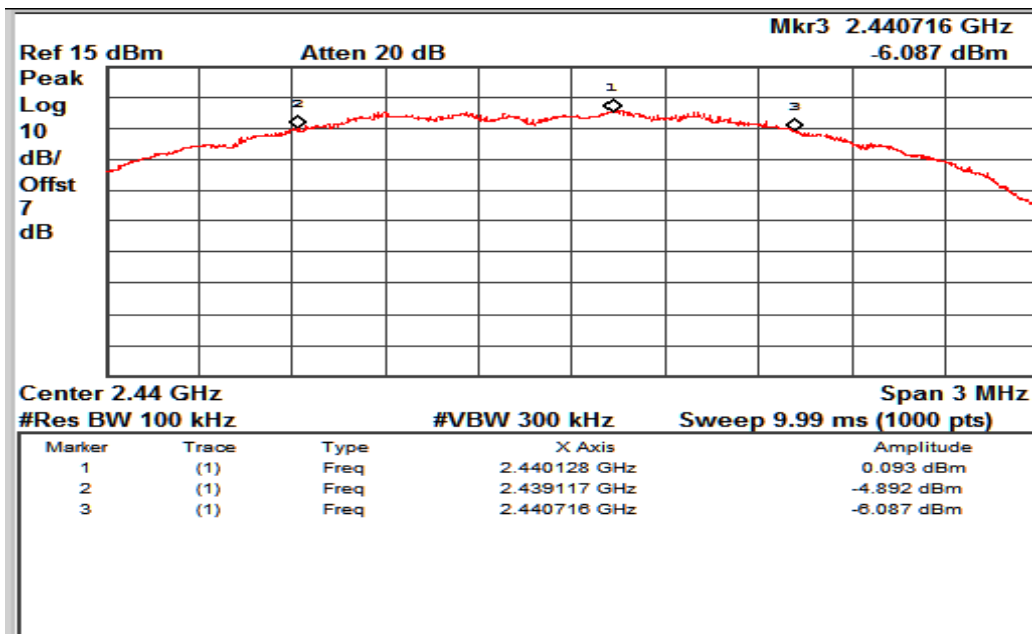
Attenuator: 6dB

Cable Loss: 1.00 dB

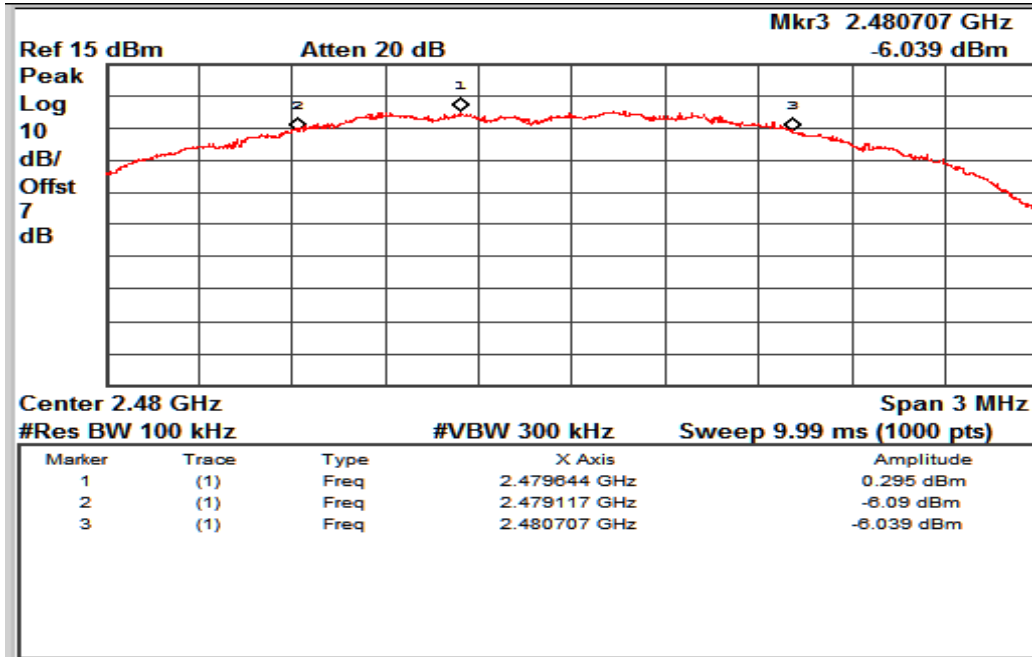
Carrier Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	OBW (MHz)
2405	2404.10	2405.71	1.61	2.60
2440	2439.11	2440.71	1.60	2.59
2480	2479.11	2480.70	1.59	2.59



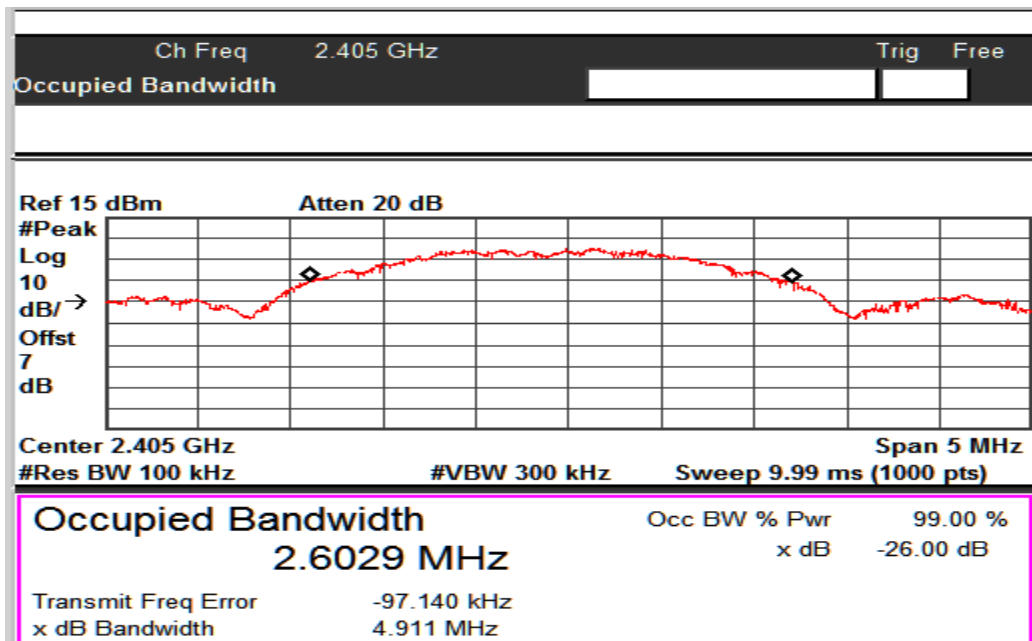
Channel frequency: 2405 MHz



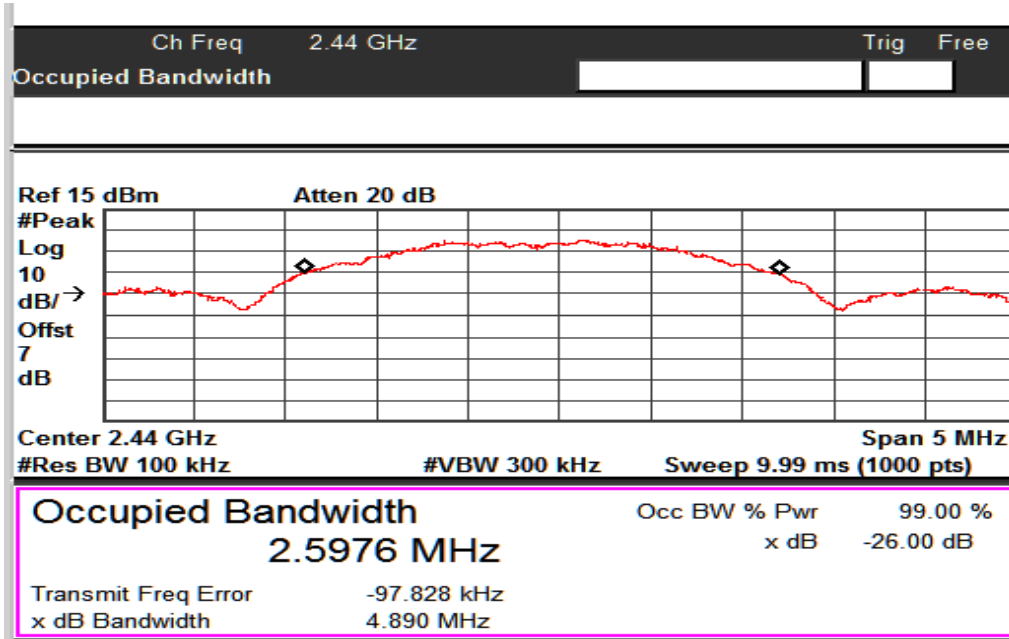
Channel frequency: 2440 MHz



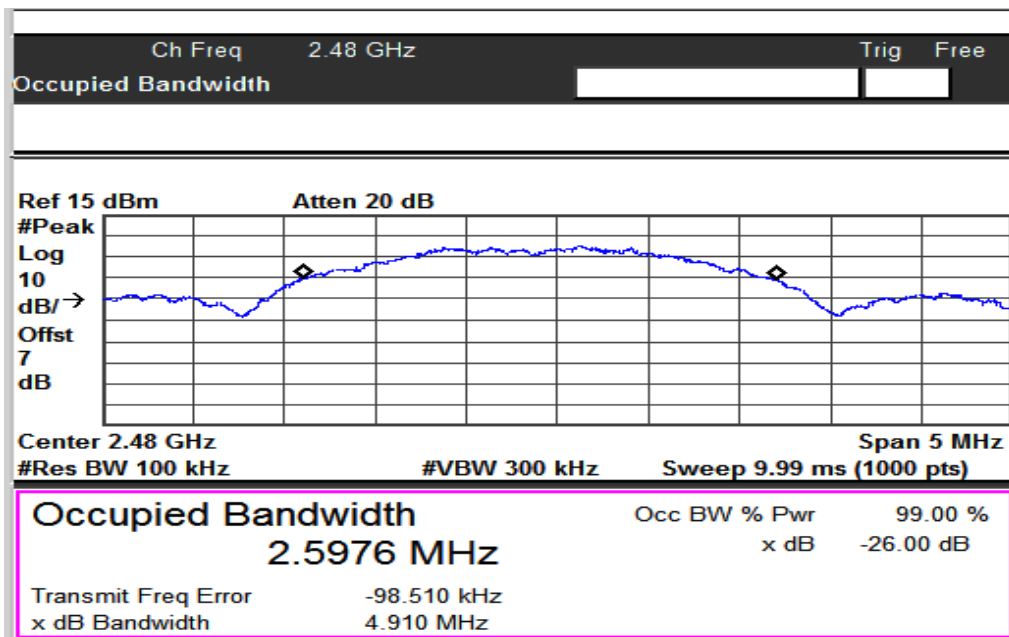
Channel frequency: 2480 MHz



OBW Channel frequency: 2405 MHz



OBW Channel frequency: 2440 MHz



OBW Channel frequency: 2480 MHz

www.tuv.com

Band-edge Compliance

Section 15.247(d)

Result

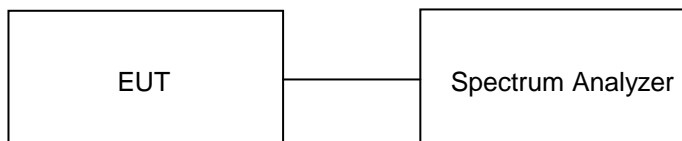
Pass

Test Specification
Detector Function
Requirement

FCC Part 15 Section 15.247(d)
Peak

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, and 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Method:

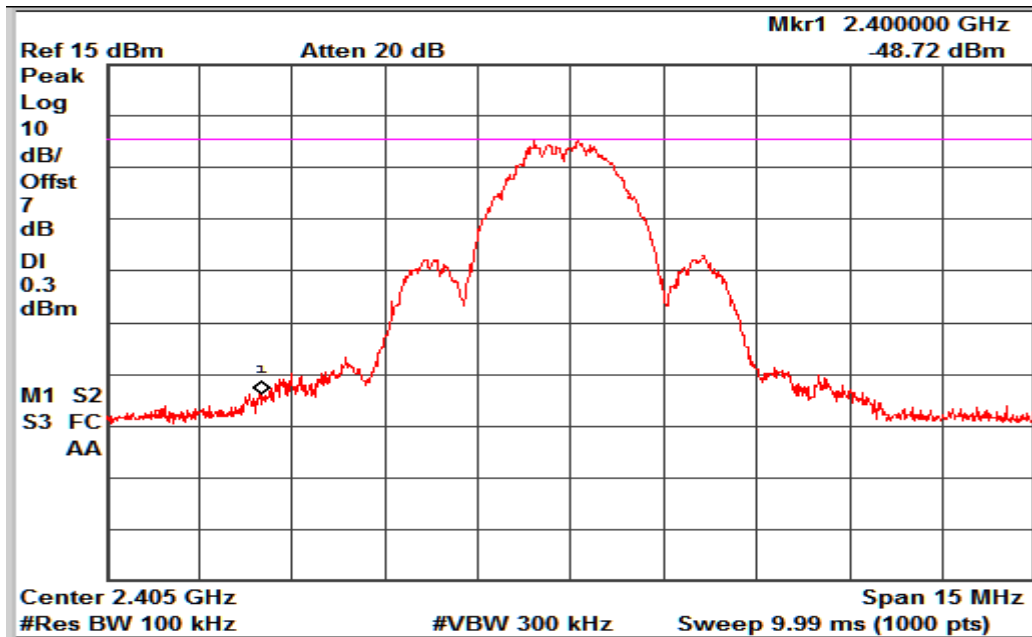


Test Result:

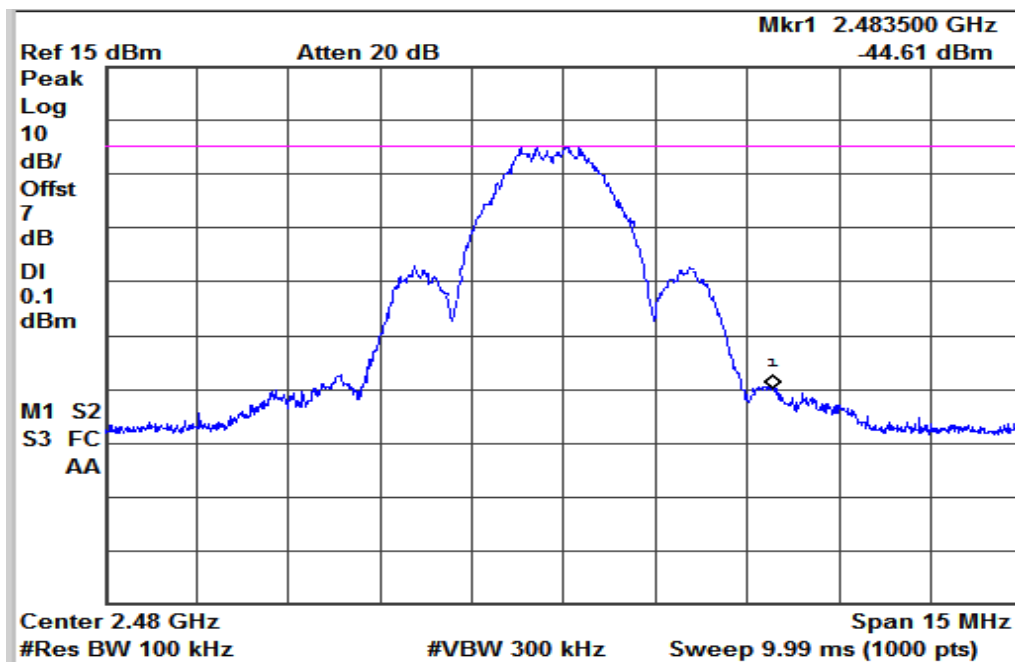
Attenuator: 6dB

Cable Loss: 1.00 dB

Channel	Fundamental Frequency (MHz)	Value at Band Edge		Limit (dBc)
		Frequency (MHz)	Value (dBc)	
Low	2405	2400.00	-48.72	-20.00
High	2480	2483.50	-44.61	-20.00



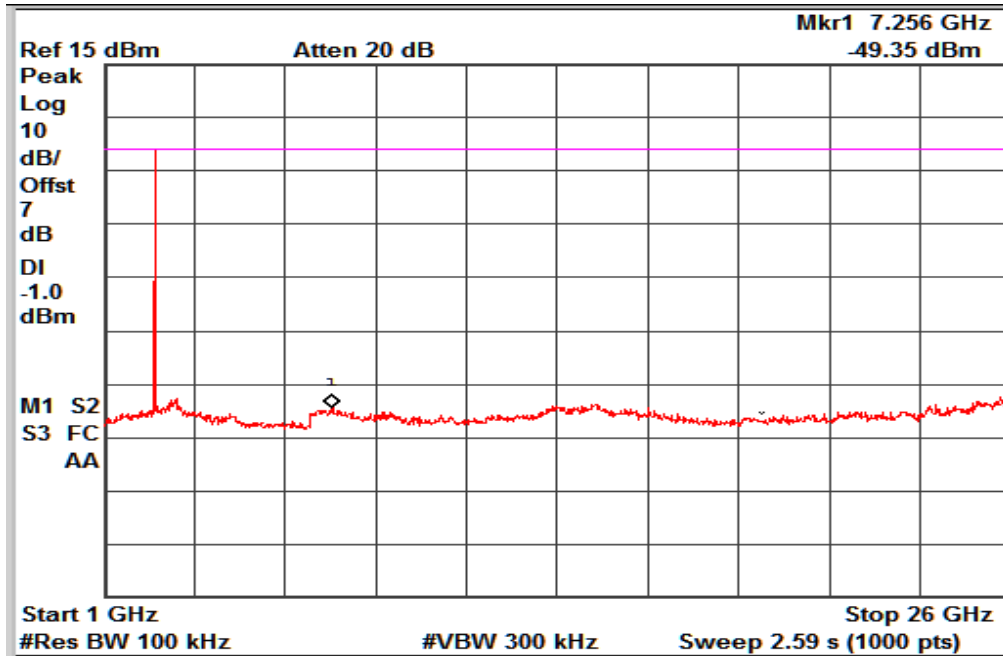
Channel frequency: 2405 MHz



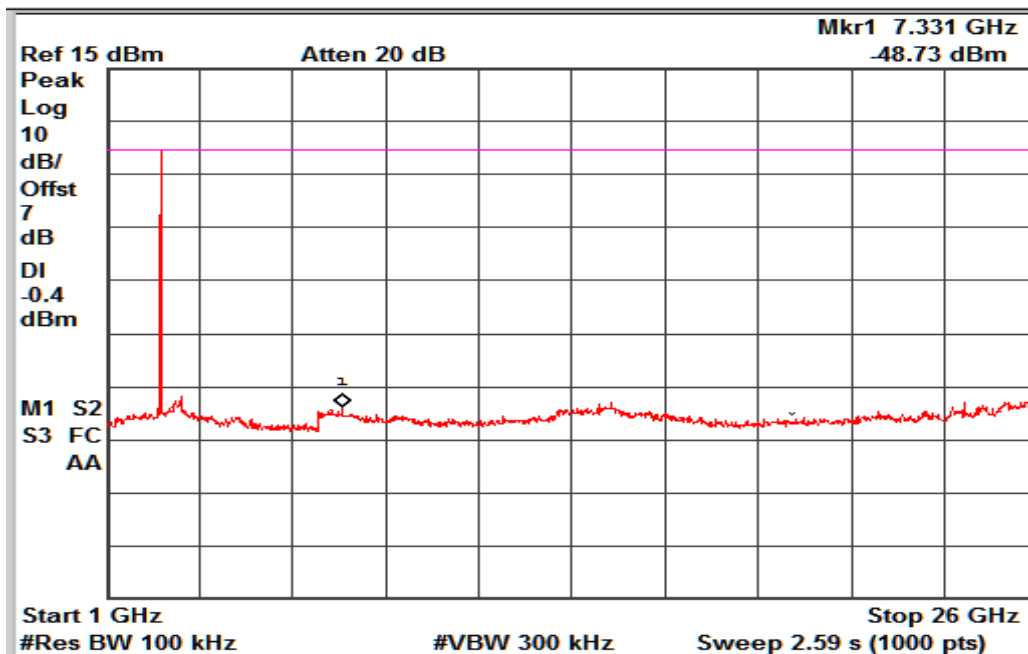
Channel frequency: 2480 MHz

www.tuv.com

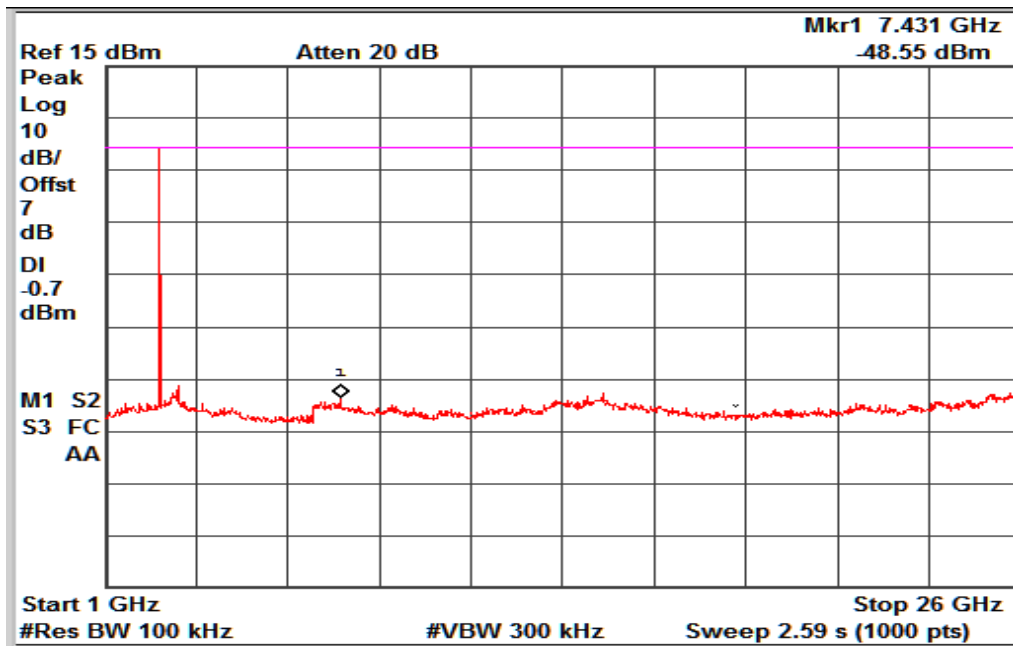
Conducted Spurious Emission



Channel frequency: 2405 MHz



Channel frequency: 2440 MHz



Channel frequency: 2480 MHz

www.tuv.com

Spurious Radiated Emissions and Restricted Bands of Operation

Section 15.209 and 15.205

Result

Pass

Test Specification	FCC Part 15 Section 15.209 &15.205
Test Method	ANSI C63.4-2003
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(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.

Test result:

There were no emissions found in the frequency range below 1GHz and hence they are not reported.

Fundamental Frequency (MHz)	Antenna Polarization	Spurious Emission (MHz)	Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2405	H	2404.4 (Pk)	81.65	*	-
		2404.8 (Av)	75.76	*	-
		2389.3 (Pk)	47.23	74	-26.77
		2390.0 (Av)	34.92	54	-19.08
		4810.25 (Pk)	46.65	74	-27.35
		4810.25 (Av)	35.64	54	-18.36
	V	2404.4 (Pk)	85.31	*	-
		2404.9 (Av)	79.91	*	-
		2388.5 (Pk)	47.61	74	-26.39
		2389.8 (Av)	35.03	54	-18.97
		4810.25 (Pk)	45.84	74	-28.16
		4810.25 (Av)	34.72	54	-19.28
2440	H	2440.3 (Pk)	85.62	*	-
		2440.3 (Av)	79.79	*	-
		4878.5 (Pk)	49.45	74	-24.55
		4880.2 (Av)	37.04	54	-16.96
	V	2440.3 (Pk)	87.05	*	-
		2440.0 (Av)	80.70	*	-
		4882.1 (Pk)	48.51	74	-25.49
2480	H	2480.4 (Pk)	81.68	*	-
		2479.9 (Av)	74.88	*	-
		2483.5 (Pk)	46.97	74	-27.03
		2483.5 (Av)	35.76	54	-18.24
		4960.0 (Pk)	49.93	74	-24.07
		4959.7 (Av)	38.37	54	-15.63
	V	2480.4 (Pk)	87.23	*	-
		2480.1 (Av)	81.35	*	-
		2483.5 (Pk)	48.76	74	-25.24
		2483.5 (Av)	37.09	54	-16.91
		4960.3 (Pk)	50.30	74	-23.70
4959.8 (Av)	39.03	54	-14.97		

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

www.tuv.com

Conducted Emission Test on a.c. Power Line

Section 15.207

Result

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 : 3.3V DC

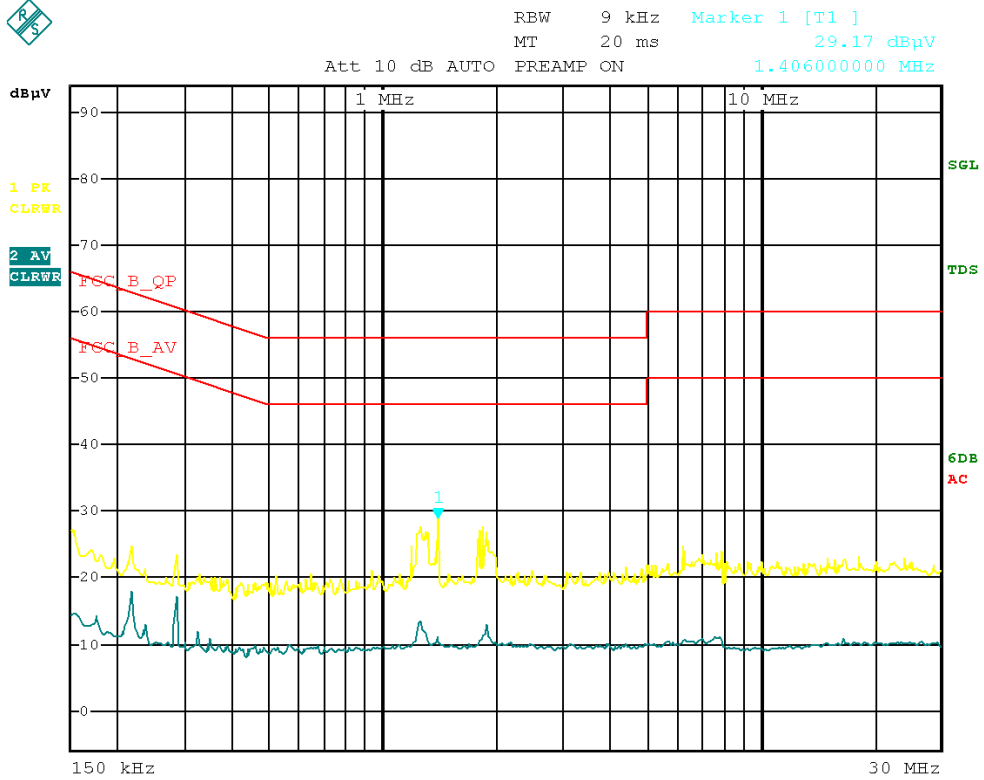
Limit of section 15.207

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

www.tuv.com

Test Result:
Mode: Positive



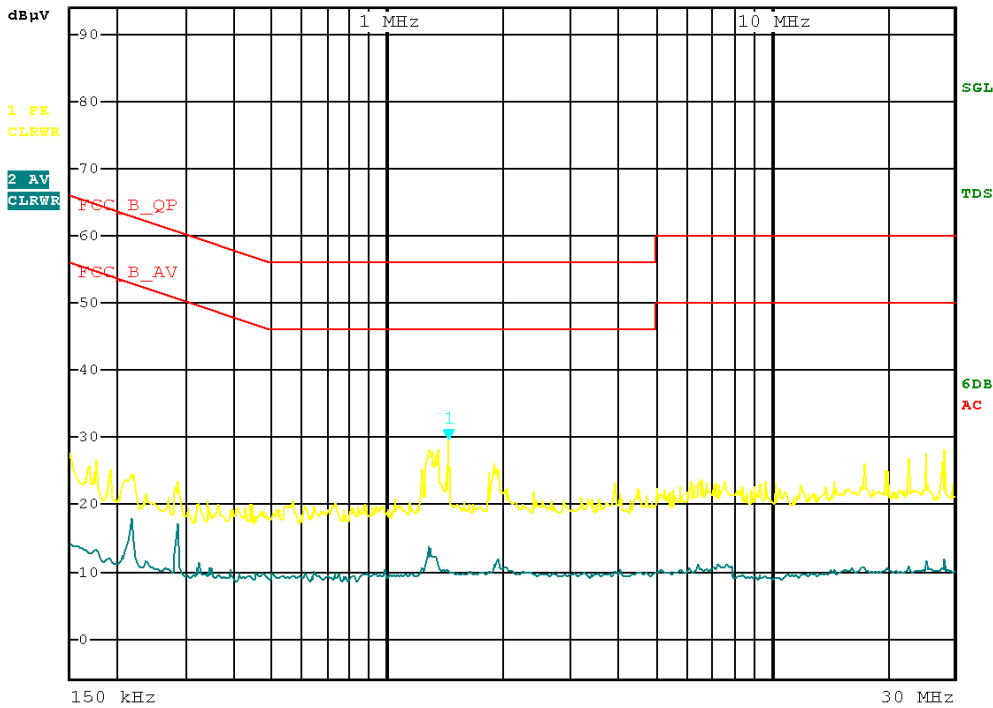
EDIT PEAK LIST (Final Measurement Results)				
TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
Trace1:	FCC_B_QP			
Trace2:	FCC_B_AV			
Trace3:	---			
1	Quasi Peak	1.406 MHz	26.48 L1	-29.51
2	Average	282 kHz	17.20 L1	-33.54
2	Average	214 kHz	18.45 L1	-34.59
2	Average	1.254 MHz	10.06 L1	-35.93
2	Average	1.882 MHz	9.87 L1	-36.12
1	Quasi Peak	282 kHz	20.32 L1	-40.43
1	Quasi Peak	214 kHz	21.78 L1	-41.26
1	Quasi Peak	1.85 MHz	14.39 L1	-41.60
1	Quasi Peak	150 kHz	22.92 L1	-43.07
1	Quasi Peak	6.278 MHz	14.90 L1	-45.09

www.tuv.com

Mode: Negative



RBW 9 kHz Marker 1 [T1]
 MT 20 ms 29.70 dBµV
 Att 10 dB AUTO PREAMP ON 1.450000000 MHz



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	1.362 MHz	23.39 N	-32.61	
2 Average	282 kHz	17.20 N	-33.55	
2 Average	1.294 MHz	11.18 N	-34.81	
2 Average	214 kHz	18.23 N	-34.81	
1 Quasi Peak	25.378 MHz	24.72 N	-35.27	
1 Quasi Peak	28.074 MHz	24.54 N	-35.45	
2 Average	1.938 MHz	10.27 N	-35.73	
1 Quasi Peak	1.45 MHz	19.14 N	-36.86	
1 Quasi Peak	1.894 MHz	17.41 N	-38.58	
1 Quasi Peak	150 kHz	23.05 N	-42.94	