

Produkte
Products

Prüfbericht - Nr.: 01200041 001		Seite 1 von 27	
<i>Test Report No.:</i>		<i>Page 1 of 27</i>	
Auftraggeber: <i>Client:</i>		Melange Systems Pvt. Ltd. No 4/1, 7th cross Kumara Park West Bangalore-560020, INDIA	
Gegenstand der Prüfung: <i>Test item:</i>		Tarang-P20	
Bezeichnung: <i>Identification:</i>	Tarang-P20	Serien-Nr.: <i>Serial No.</i>	Engineering Sample
Wareneingangs-Nr.: <i>Receipt No.:</i>	1403019840	Eingangsdatum: <i>Date of receipt:</i>	25.05.2012
Prüfort: <i>Testing location:</i>		Refer Page 4 of 27 for test facilities	
Prüfgrundlage: <i>Test specification:</i>		FCC Part 15, Subpart C ANSI C63.4-2003	
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	
geprüft / tested by:		kontrolliert / reviewed by:	
28.05.2012	Saibaba Siddapur Test Engineer	31.05.2012	Raghavendra Kulkarni Manager
			
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
Sonstiges / Other Aspects:		FCC ID : N3Y-TARANG-P20	
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>			

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

Content

List of Type and Measurement Instruments	4
General Product Information	5
Product Function and Intended Use	5
Ratings and System Details	5
Operation Descriptions	6
Test Set-up and Operation Mode	7
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	8
Radiated Emission Test	8
Test Results	9
Maximum Conducted Peak Output Power	Section 15.247(b) (3)
Power Spectral Density	Section 15.247(e)
6 dB Bandwidth	Section 15.247(a)(2)
Band-edge Compliance	Section 15.247(d)
Spurious Radiated Emissions and	
Restricted Bands of Operation	Section 15.209 and 15.205
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

TÜV Rheinland (India) Pvt. Ltd, Bangalore

List of Test and Measurement Instruments

Equipment	Manufacturer	Model	S/N	Calibration Due Date
EMI Test Receiver	Rohde &Schwarz	ESU 40	100288	21.07.2012
EMI Test Receiver	Rohde &Schwarz	ESCI	100661	17.03.2013
Hybrid Log Periodic antenna	ETS Lindgren	3142D	00081354	26.07.2013
Broadband Horn Antenna	Frankonia	HAX-18	HAX18-802	23.03.2013
Double-Ridged Waveguide Horn Antenna	ETS Lindgren	116794	00133356	01-09-2013
Emission Horn Antenna	ETS Lindgren	116706	00107323	24-08-2013
Active Loop Antenna	Frankonia	LAX-10	LAX-10-800	11-04-2013
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	17.03.2013

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 product is a radio module based on Zigbee hardware that can be used for wireless data communication. The module requires a host board to drive its I/O pins and provide power for its operation. The host board may provide level translation function to establish a serial or USB connection. The device uses 2.4 -2.4835 GHz ISM band for wireless operation. Typical applications include industrial automation, wireless networking and AMR.

Ratings and System Details

Operating Frequency	2400MHz – 2483.5MHz
No. of channels	15
Channel Spacing	5MHz
Modulation	DSSS
Transmitted Power	22.11 dBm
Data Rate	250 kbps
Antenna Type	Wire Antenna
Number of antenna	1
Antenna Gain	0dBi
Supply Voltage	3.3V – 3.6V
Dimensions	26mm x 37.3 mm x 9.1 mm (excluding antenna height for wire antenna)
Environmental	Operating : -40 deg C to 85 deg C.

Test Conditions:

Voltage: 5V through USB

Environmental conditions:

Temperature: +23 °C **RH:** 62%

www.tuv.com

Operation Descriptions

The device operates from a 3VDC source provided on the host board. It is a low power wireless device with Air data rate of 256 kbps. The device has serial ports to support serial data communication. In addition, the device has got several I/O ports/ADC pin outs. The module uses a SIP (System in Package) that combines a microcontroller and wireless transceiver on to one package. The module can be put into sleep mode through hardware or software control.

www.tuv.com

Test Set-up and Operation Mode

Principle of Configuration Selection

Emission: The test was performed under continuous transmission to obtain the maximum emissions.

Test Operation and Test Software

Continuous transmission was enabled through test software and Channel / data rate selection was done with the software

Special Accessories and Auxiliary Equipment

- None

Countermeasures to achieve EMC Compliance

- None

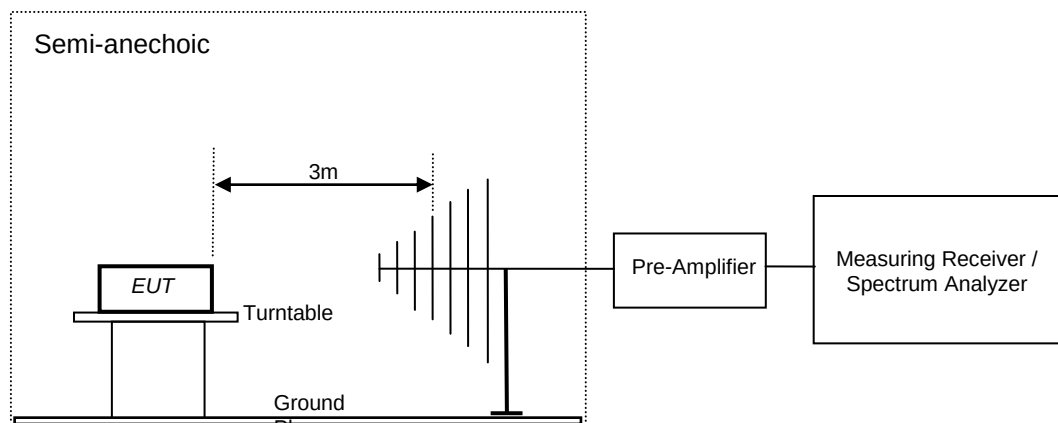
Table of carrier frequencies

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	2475

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)

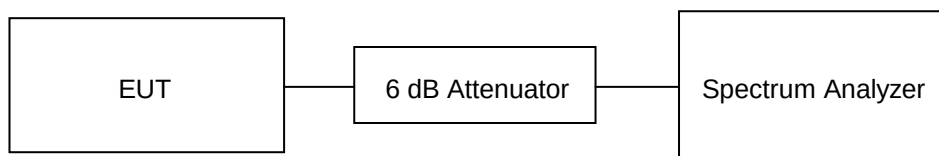
Result

Pass

Test Specification
Measurement Bandwidth (RBW)
Requirement

FCC Part 15 Subpart C
1 MHz
<1 watt (30dBm) for Digital Transmission System.

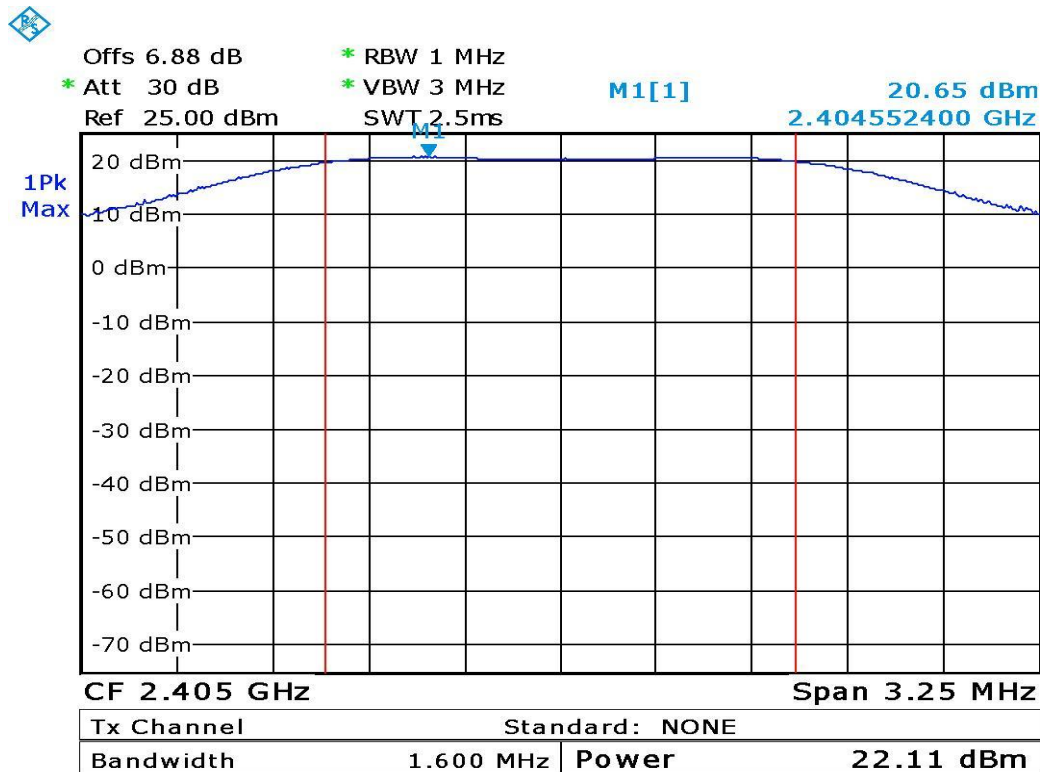
Test Method:



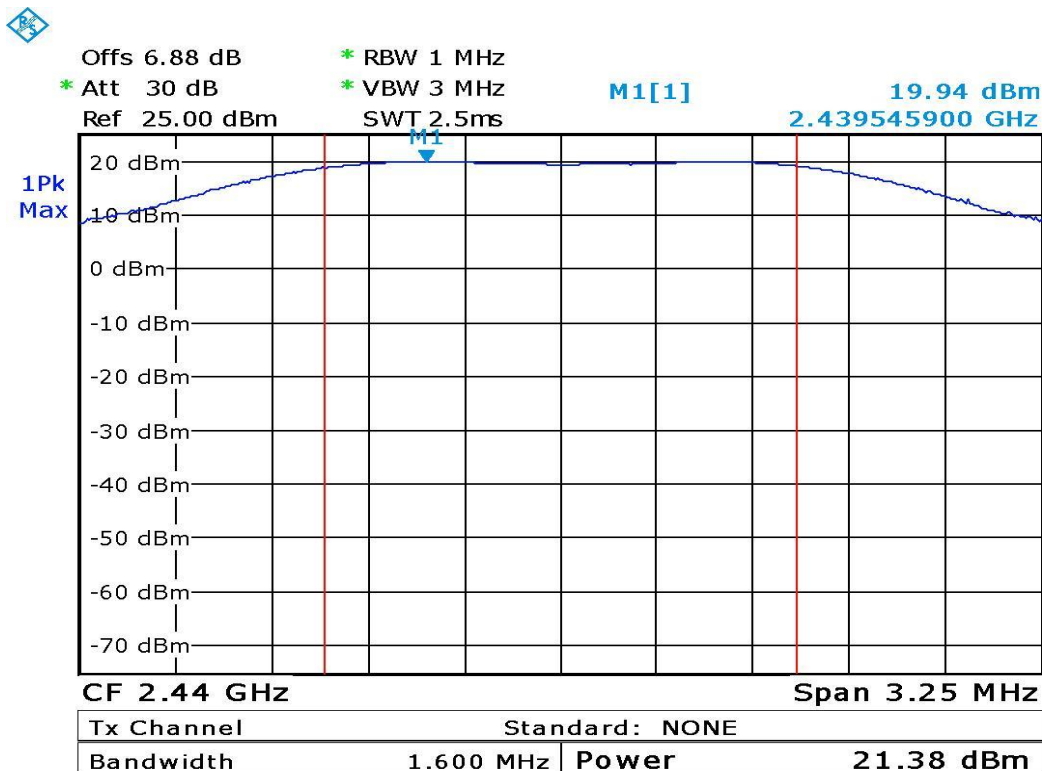
Test Result:

Cable Loss: 0.88 dB

Frequency (MHz)	Total Output power (dBm)	Limit (dBm)
2405	22.11	30.00
2440	21.38	30.00
2475	21.02	30.00

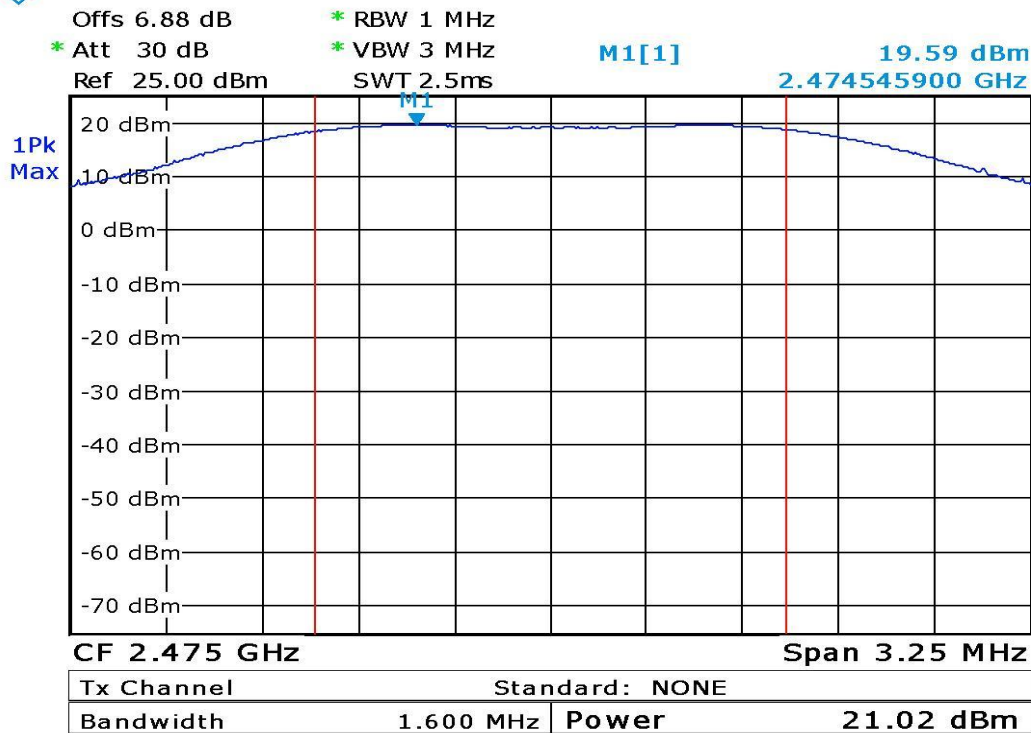


Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

www.tuv.com



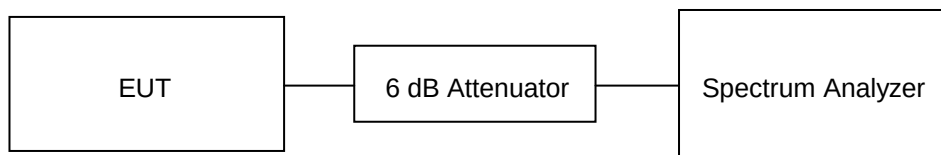
Channel Frequency: 2475 MHz

Power Spectral Density**Section 15.247(e)****Result****Pass**

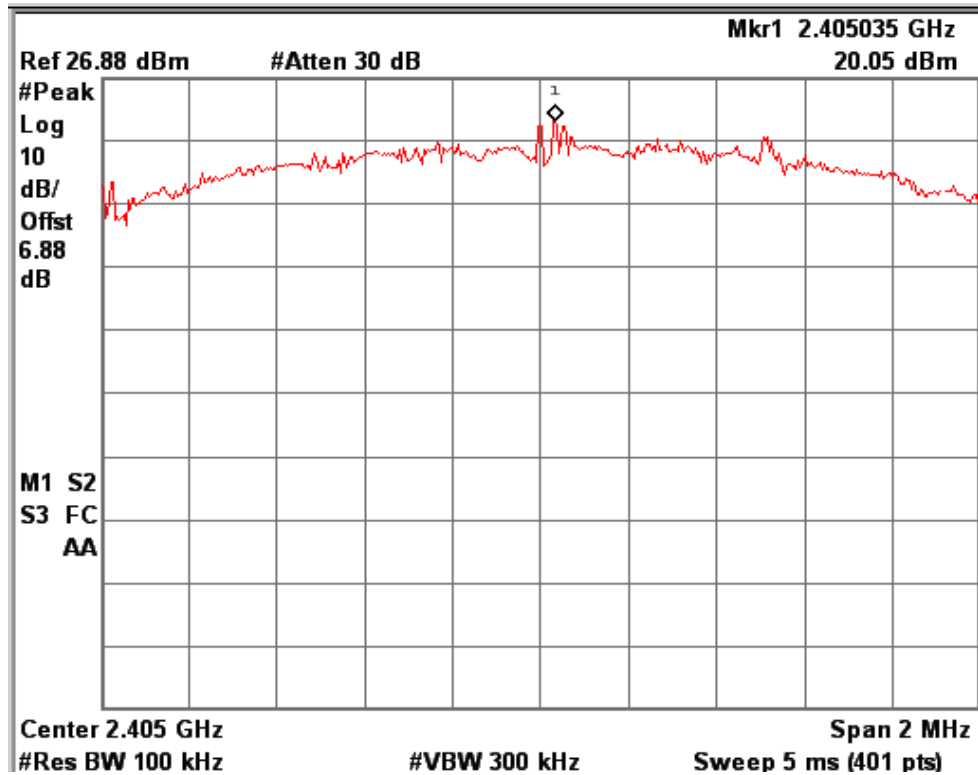
Test Specification
Detector Function
Requirement

FCC Part 15 Section 15.247 (e)
Peak

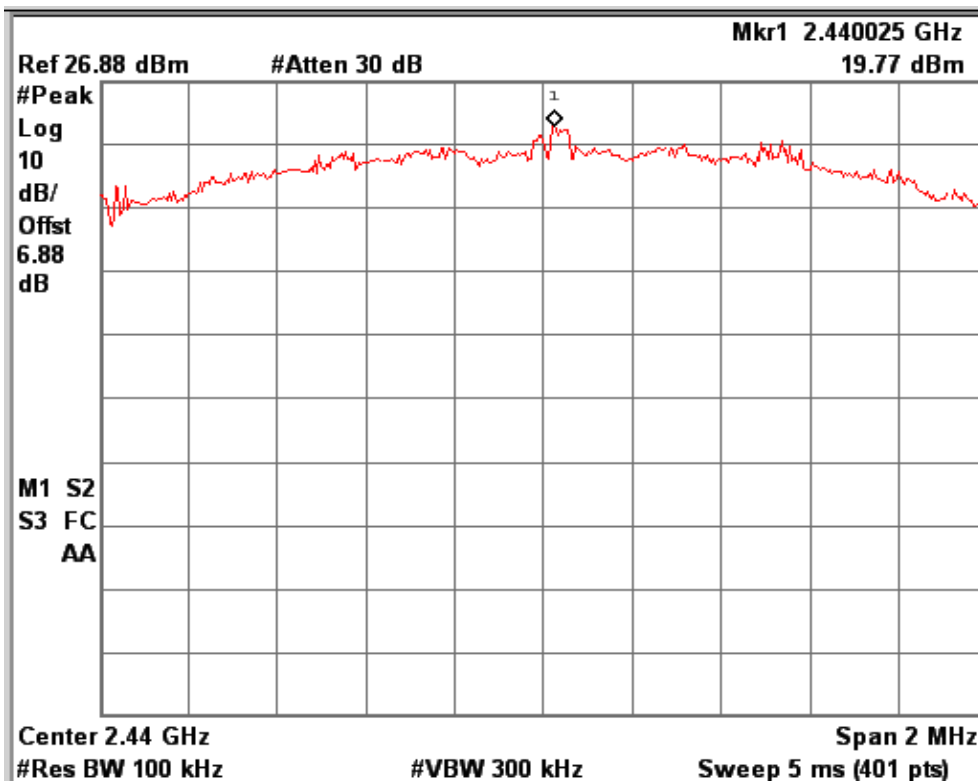
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Method:**Test Result:****Cable Loss:** 0.88 dB

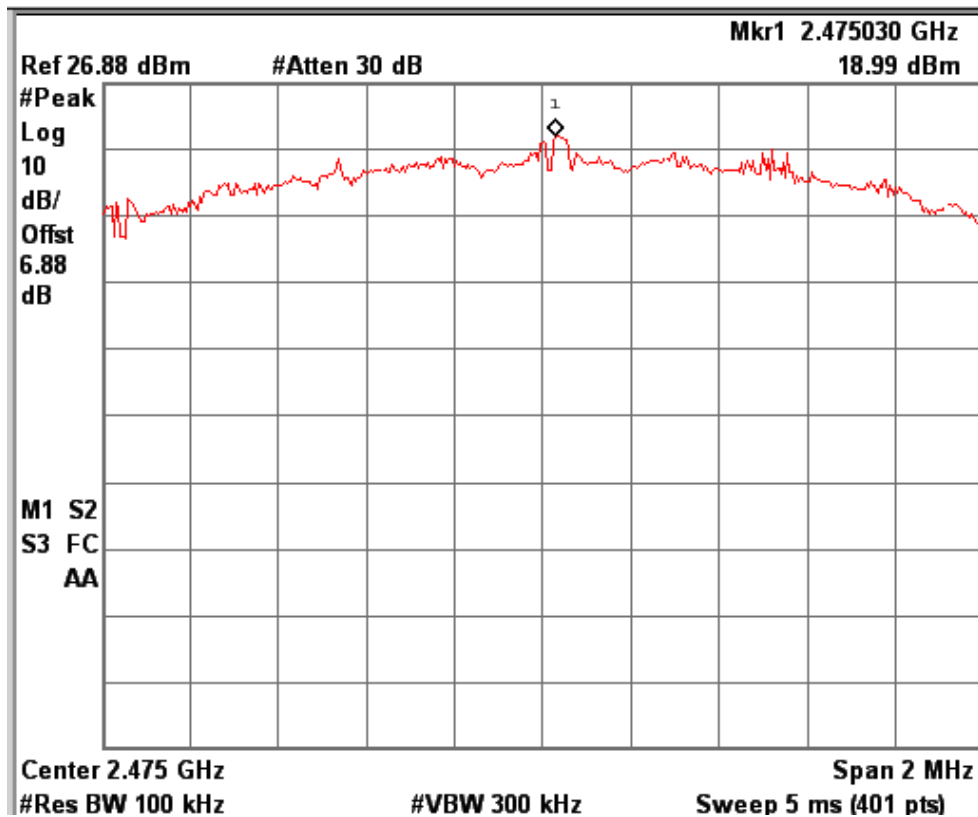
Frequency (MHz)	PSD (dBm)	BWCF (dB)	Total PSD (dBm)	Limit (dBm)
2405	20.05	-15.23	4.82	8.00
2440	19.77	-15.23	4.54	8.00
2475	18.99	-15.23	3.76	8.00



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz



Channel Frequency: 2475 MHz

www.tuv.com

6 dB Bandwidth

Section 15.247(a)(2)

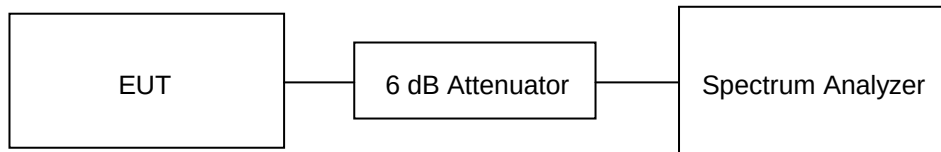
Result

Pass

Test Specification
Requirement

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

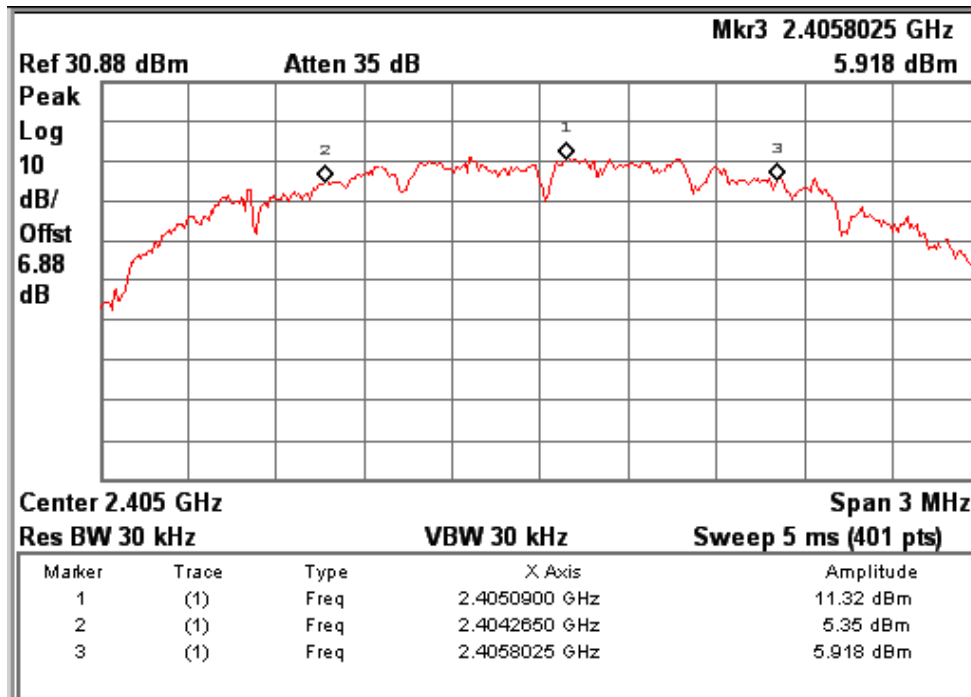
Test Method:



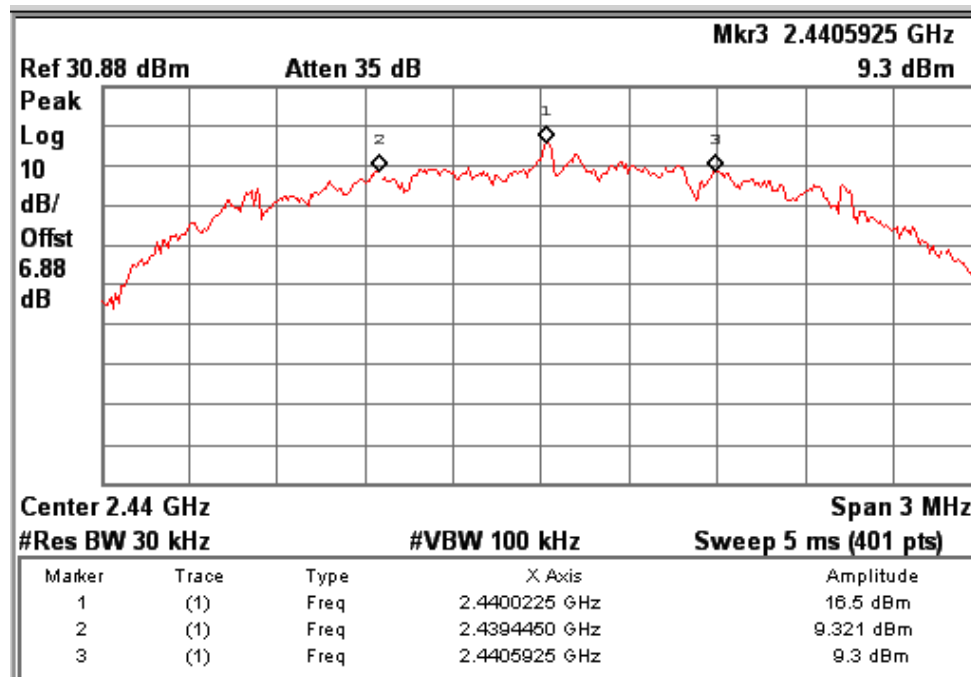
Test Result:

Cable Loss: 0.88 dB

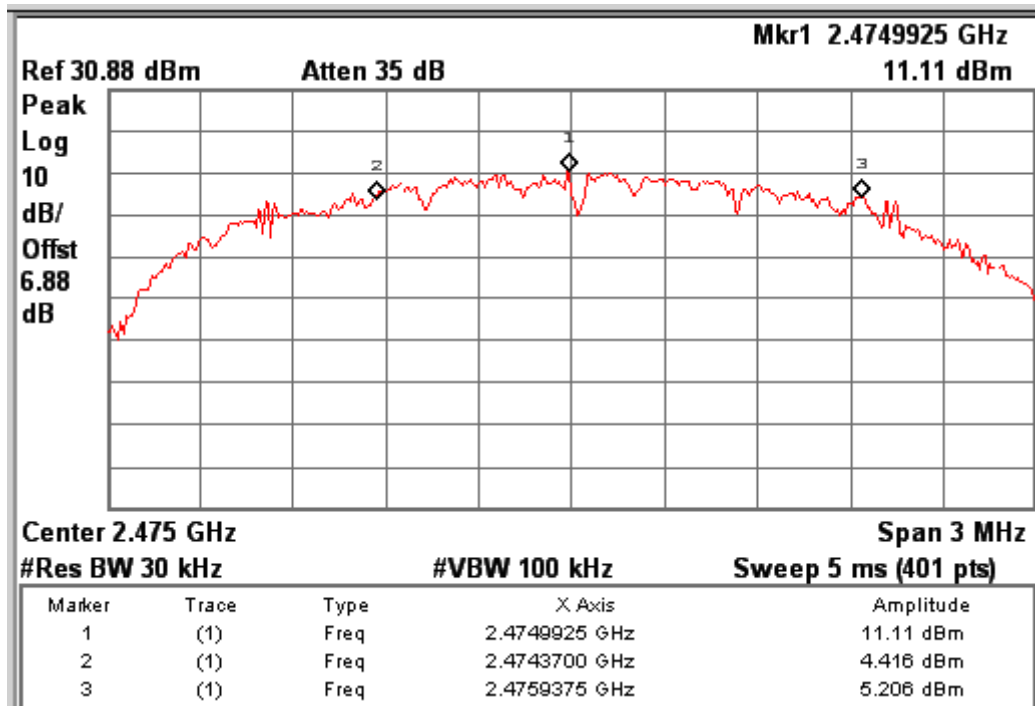
Carrier Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	OBW (MHz)	26dB Bandwidth (MHz)
2405	2404.26	2405.80	1.54	2.54	4.57
2440	2439.44	2440.59	1.15	2.44	4.53
2475	2474.37	2475.93	1.56	2.50	4.55



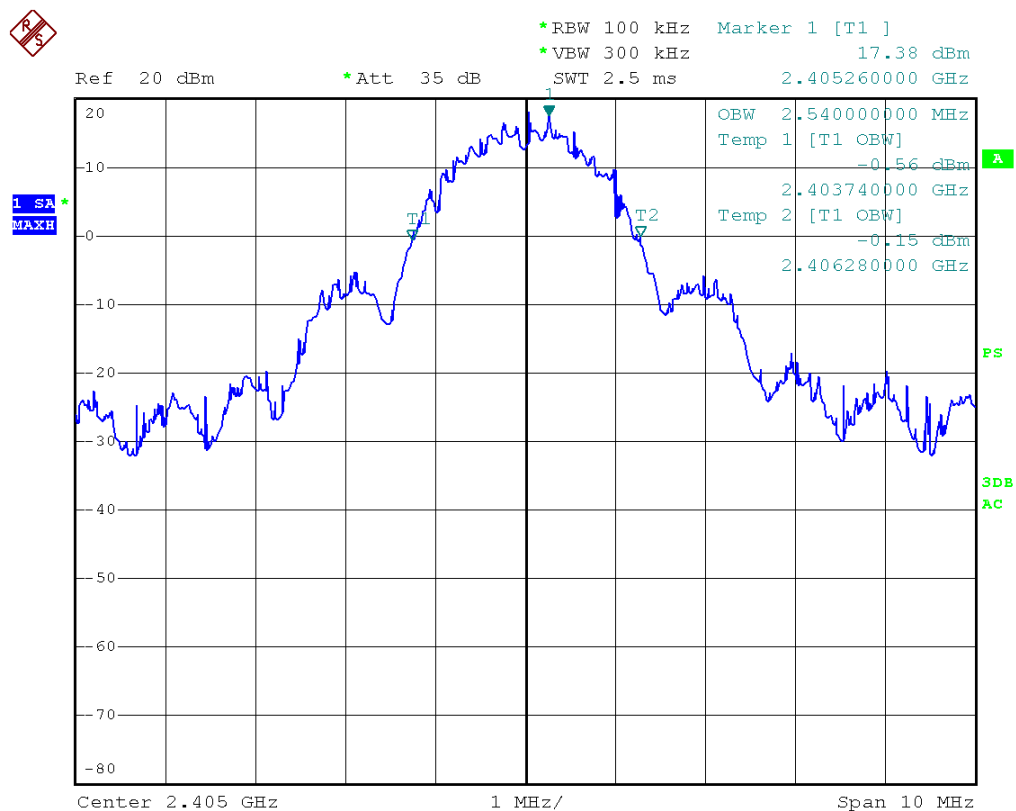
Channel frequency: 2405 MHz



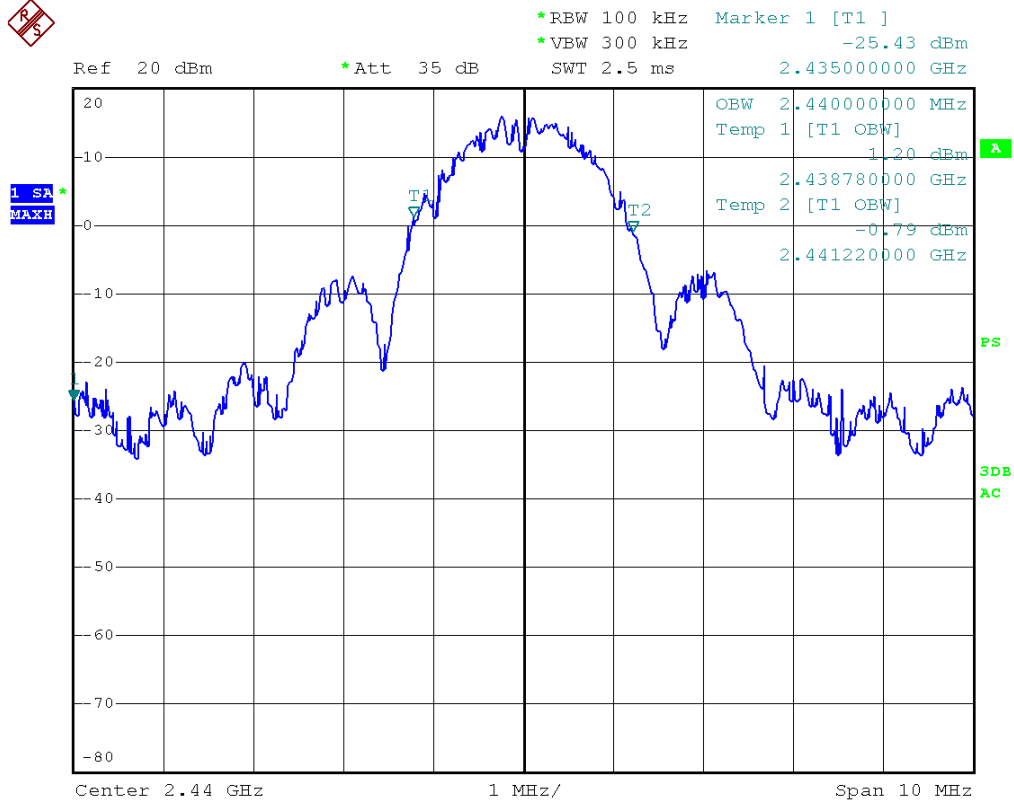
Channel frequency: 2440 MHz



Channel frequency: 2475 MHz



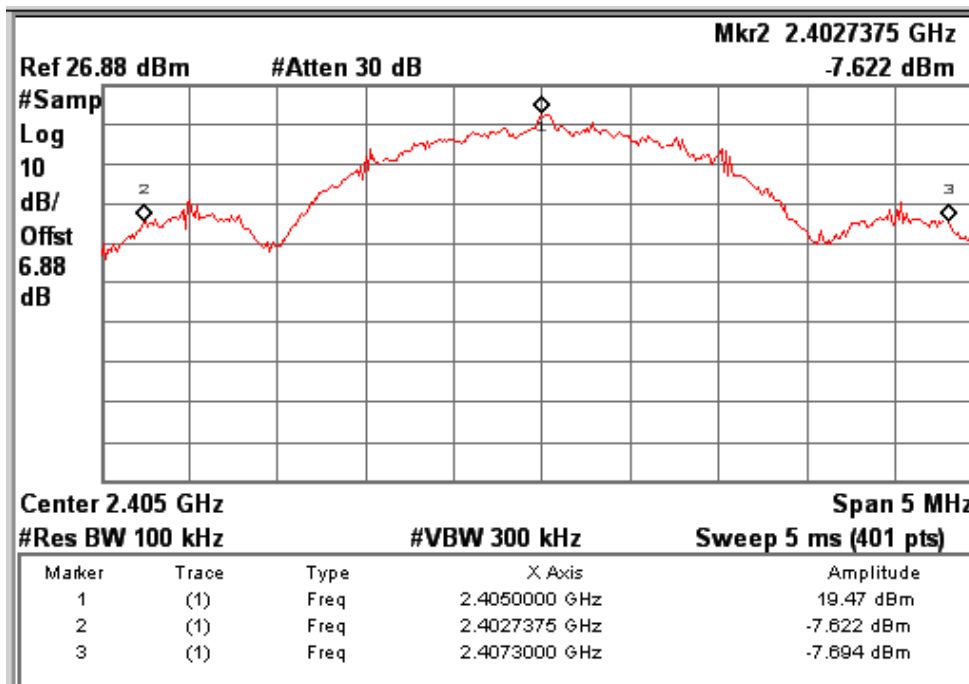
OBW Channel frequency: 2405 MHz



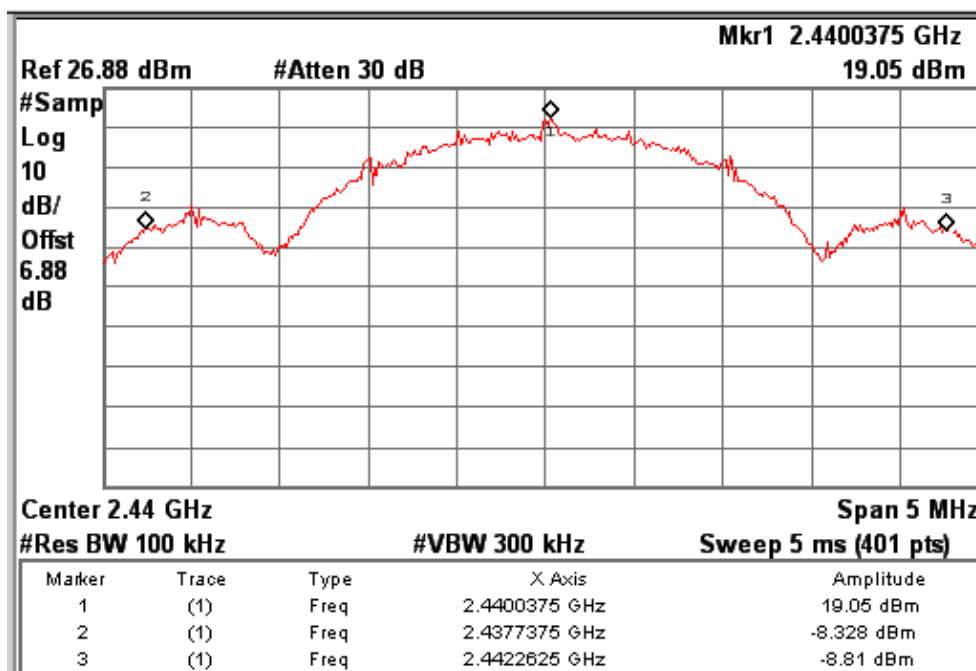
OBW Channel frequency: 2440 MHz



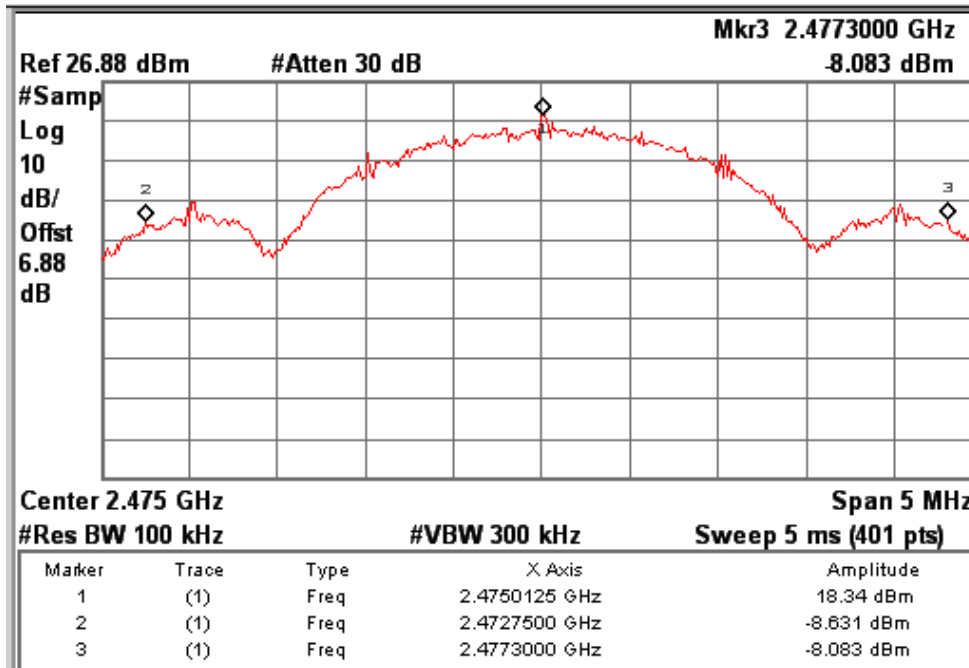
OBW Channel frequency: 2475 MHz



26 dB Bandwidth: Low Channel 2405 MHz



26 dB Bandwidth: Mid Channel 2440 MHz



26 dB Bandwidth: High Channel 2475 MHz

Band-edge Compliance

Section 15.247(d)

Result

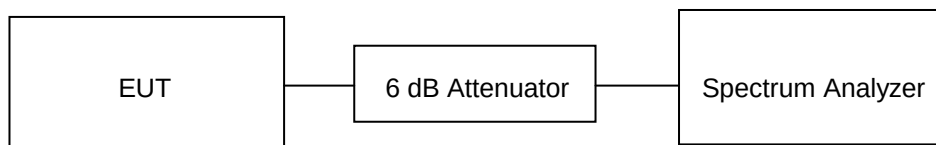
Pass

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:

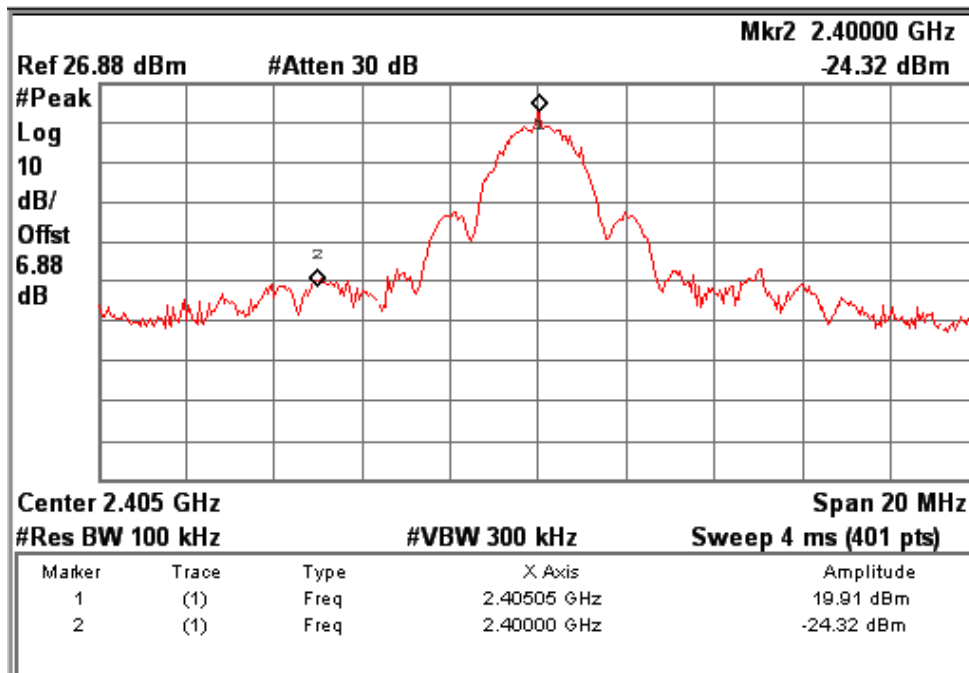


Test Result:

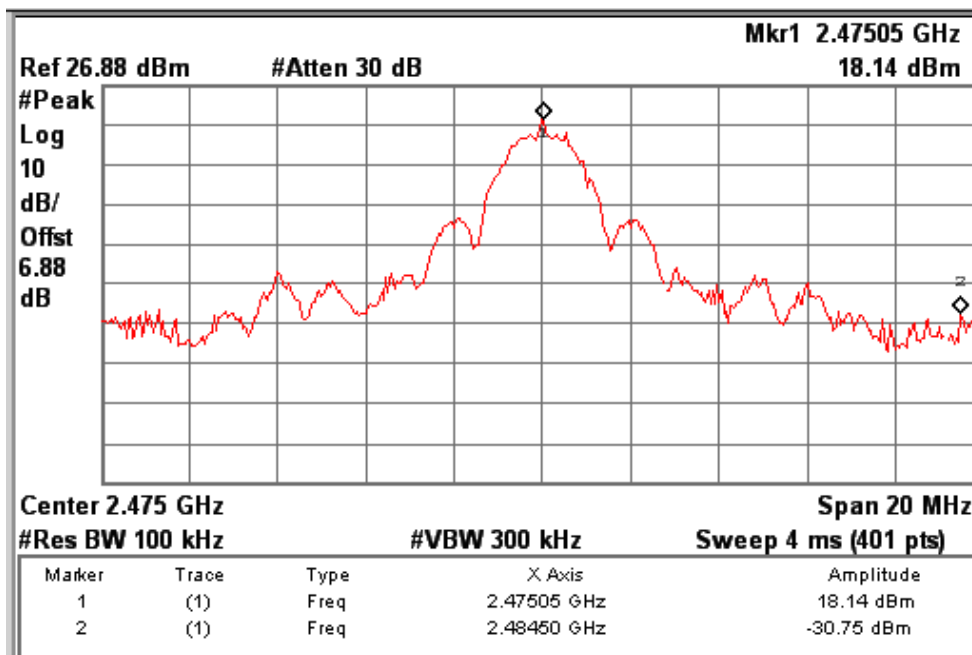
Cable Loss: 0.88 dB

Attenuator: 6 dB

Channel	Fundamental Frequency (MHz)	Value at Band Edge		Limit (dB)
		Frequency (MHz)	Value (dB)	
Low	2405	2400.00	-44.23	-20.00
High	2475	2483.50	-48.89	-20.00

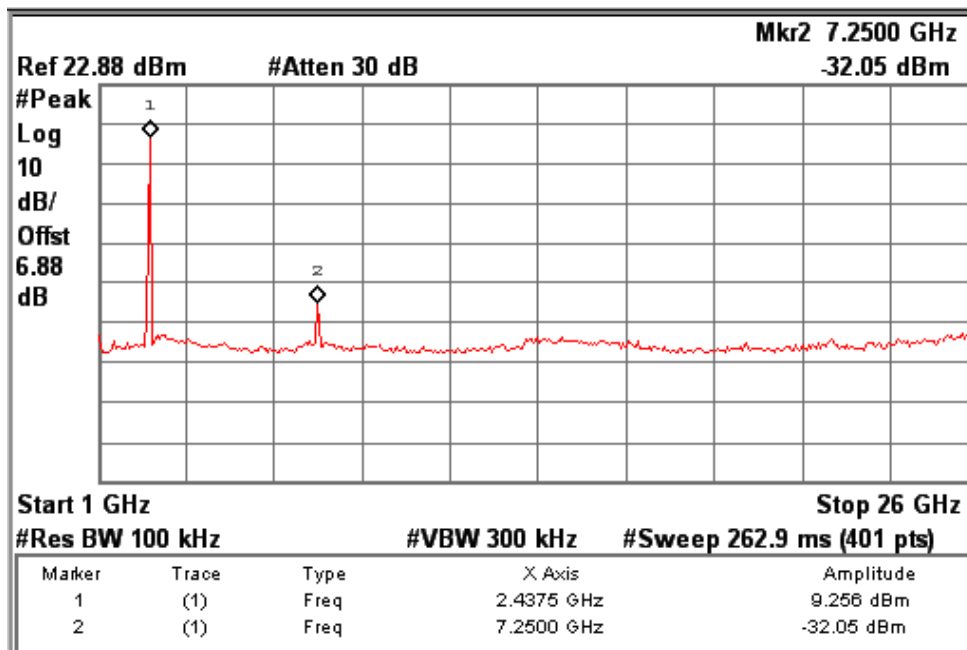
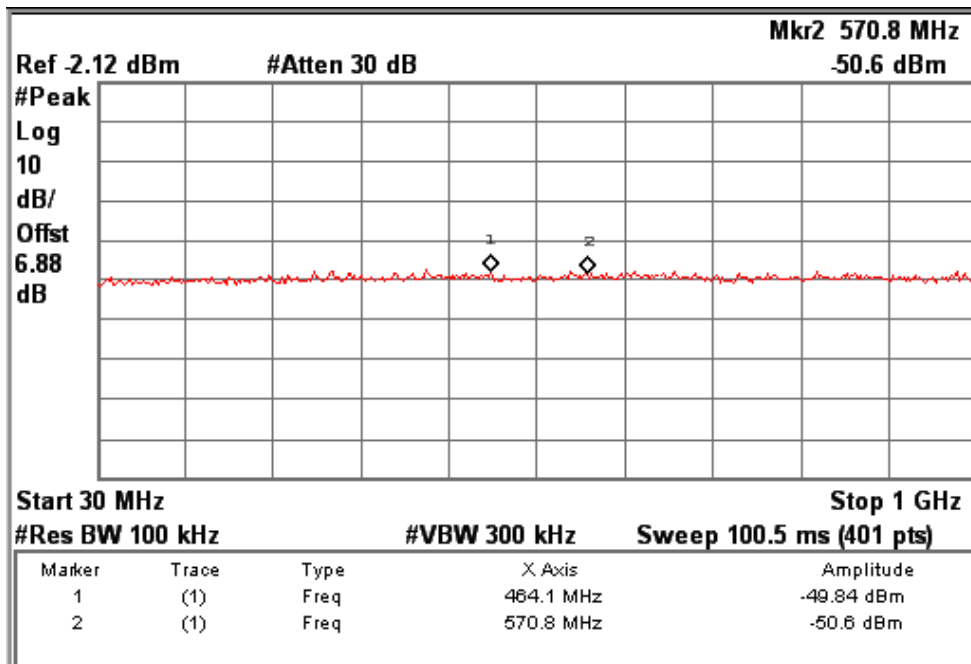


Channel frequency: 2405 MHz

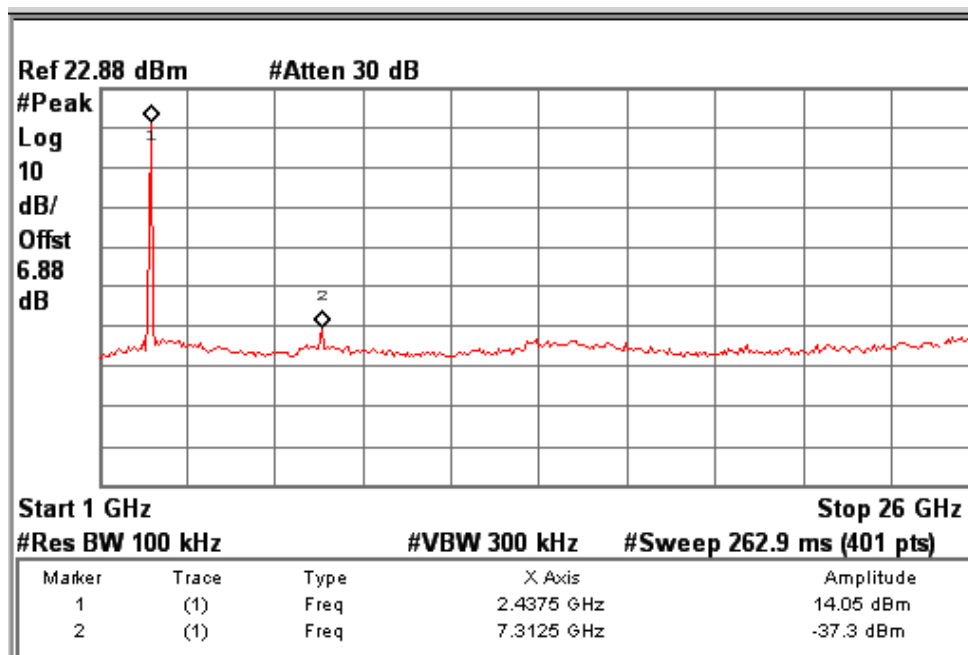
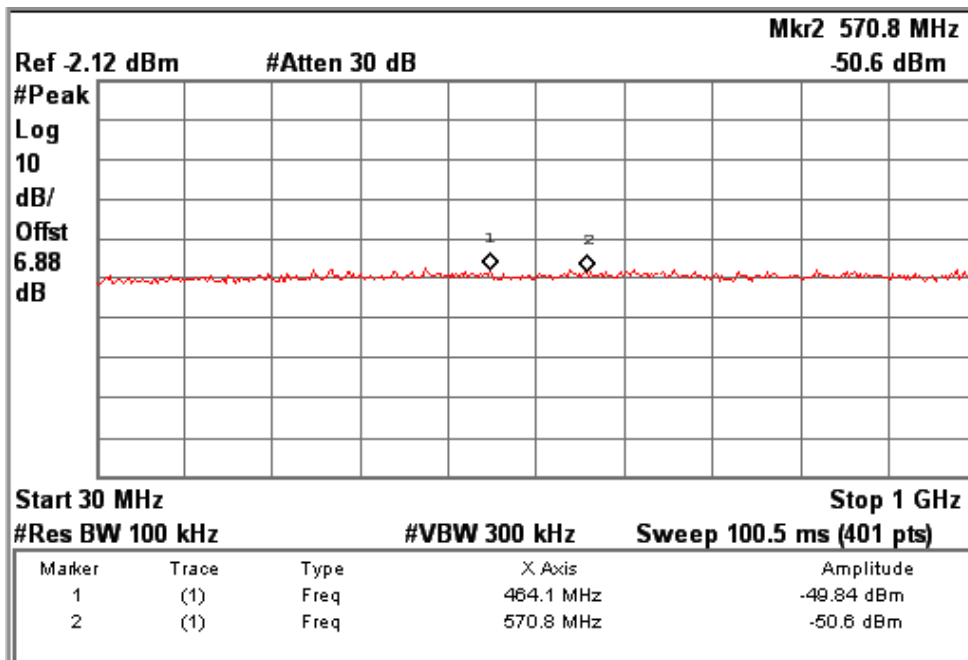


Channel frequency: 2475 MHz

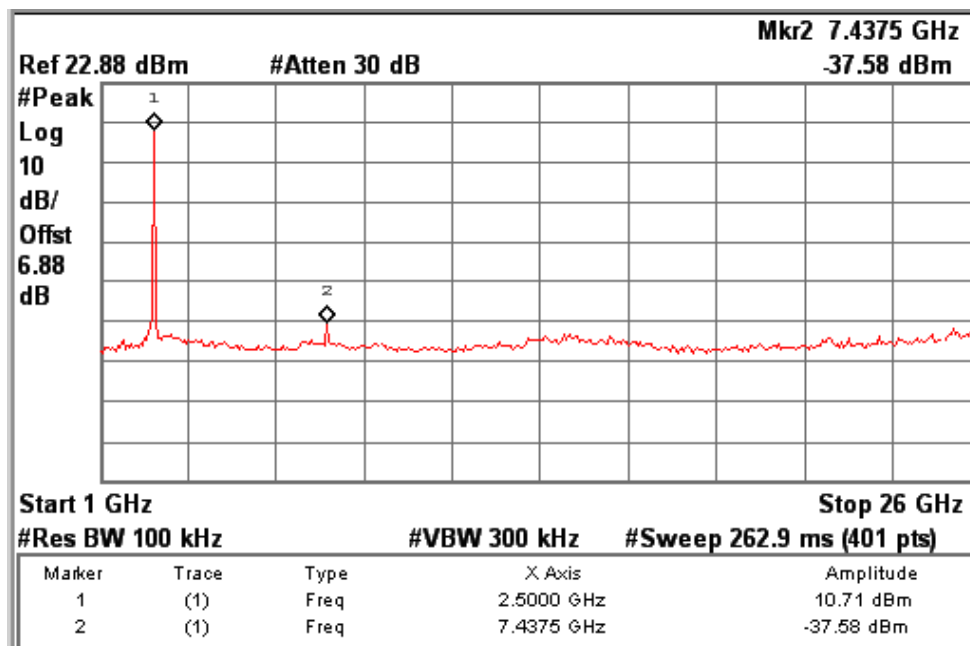
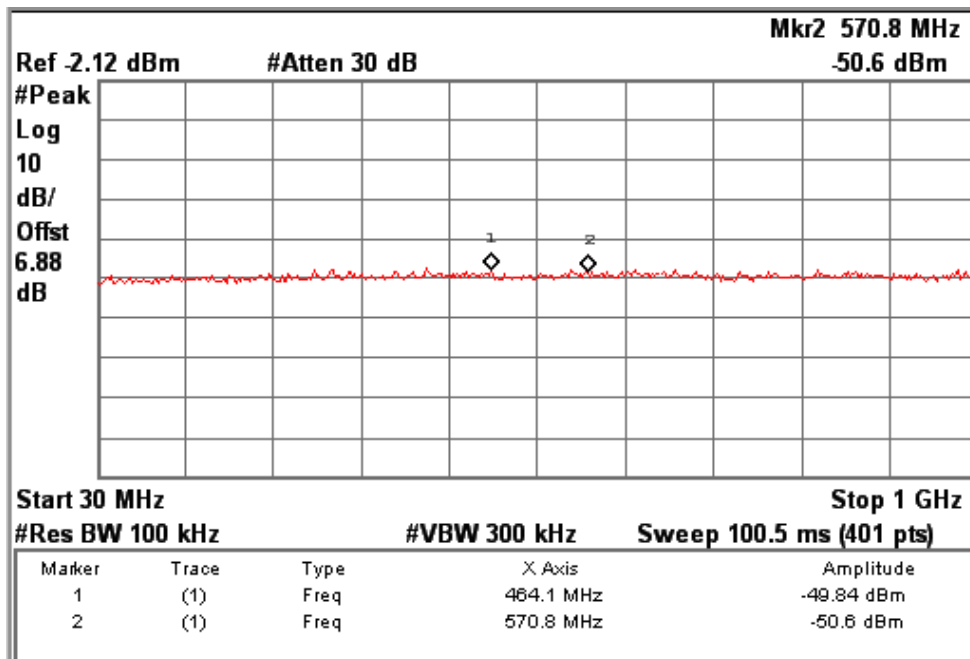
www.tuv.com
Conducted Spurious Emission



Channel frequency: 2405 MHz



Channel frequency: 2440 MHz



Channel frequency: 2475 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 below 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.

Note: The duty cycle observed during testing was 2.85%. Hence the average readings are extrapolated from the peak reading with the factor of -31dB.

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.

www.tuv.com

Test result:

Fundamental Frequency (MHz)	Antenna Polarization	Spurious Emission (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2405	H	335.99	34.10	46.00	-11.90
		2390.00 (P)	68.49	74.00	-05.51
		2390.00 (Av)	37.49	54.00	-16.51
		2405.00 (P)	108.08	*	-
		2405.00 (Av)	77.08	*	-
		4810.00 (P)	59.21	74.00	-14.79
		4810.00 (Av)	28.21	54.00	-25.79
	V	30.04	16.02	40.00	-23.98
		45.38	26.60	40.00	-13.40
		99.99	25.48	43.50	-18.02
		335.69	17.46	46.00	-28.54
		2390.00 (P)	73.02	74.00	-00.98
		2390.00 (Av)	42.02	54.00	-11.98
		2405.00 (P)	112.06	*	-
		2405.00 (Av)	81.06	*	-
		4810.00 (P)	61.93	74.00	-12.07
		4810.00 (Av)	30.93	54.00	-23.07
2440	H	335.99	34.10	46.00	-11.90
		2440.00 (P)	105.43	*	-
		2440.00 (Av)	74.43	*	-
		4880.00 (P)	59.30	74.00	-14.70
		4880.00 (Av)	28.30	54.00	-25.70
	V	30.24	16.02	40.00	-23.98
		45.18	26.60	40.00	-13.40
		99.99	25.48	43.50	-18.02
		334.61	19.46	46.00	-26.54
		2440.00 (P)	109.95	*	-
		2440.00 (Av)	78.95	*	-
		4880.00 (P)	61.39	74.00	-12.61
		4880.00 (Av)	30.39	54.00	-23.61
2475	H	335.99	34.10	46.00	-11.90
		2475.00 (P)	104.20	*	-
		2475.00 (Av)	73.20	*	-
		2483.50 (P)	67.90	74.00	-06.10
		2483.50 (Av)	36.90	54.00	-17.10
		4950.00 (P)	60.41	74.00	-13.59
		4950.00 (Av)	29.41	54.00	-24.59
	V	30.04	16.52	40.00	-23.48
		45.30	26.10	40.00	-13.90
		99.99	25.98	43.50	-17.52
		335.19	18.46	46.00	-27.54
		2475.00 (P)	110.56	*	-
		2475.00 (Av)	79.56	*	-
		2483.50 (P)	72.40	74.00	-01.60
		2483.50 (Av)	41.40	54.00	-12.60
		4950.00 (P)	62.91	74.00	-11.09
		4950.00 (Av)	31.91	54.00	-22.09

* - --> Fundamental Frequency

PK--> Peak Detector

Av--> Average Detector