Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**01200121 001**	**Seite 1 von 27** *Page 1 of 27*

Auftraggeber: *Client:*	**ATMEL NORWAY AS** **VESTRE ROSTEN 79** **7075 TILLER** **TRONDHEIM** **NORWAY - 7075**		
Gegenstand der Prüfung: *Test item:*	**RCB256RFR2 Module**		
Bezeichnung: *Identification:*	**RCB256RFR2**	**Serien-Nr.:** *Serial No.*	**Engineering Sample**
Wareneingangs-Nr.: *Receipt No.:*	**1403021819**	**Eingangsdatum:** *Date of receipt:*	**04.10.2012**
Prüfort: *Testing location:*	**Refer Page 4 of 27 for test facilities**		
Prüfgrundlage: *Test specification:*	**FCC Part 15, Subpart C** **ANSI C63.4-2003**		
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test items passed the test specification(s).*		
Prüflaboratorium: *Testing Laboratory:*	**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:*		
18.10.2012	Saibaba Siddapur Test Engineer		22.10.2012	Raghavendra Kulkarni Manager	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges /*Other Aspects:* **FCC ID : VW4A091786**

Abkürzungen:				***Abbreviations:***			
P(ass)	=	***entspricht Prüfgrundlage***		***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***

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

Content

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	21.07.2013
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) TUV Rheinland (India) Private Limited
No. 108, West Wing
Electronic city Phase I
Bangalore – 560100

General Product Information

Product Function and Intended Use

The RCB256RFR2 is a reference design for the Atmel ATmega256RFR2 single-chip microcontroller and radio transceiver. The IC integrates a powerful, 8-bit AVR® RISC microcontroller, an IEEE 802.15.4-compliant transceiver, and additional peripheral features. The built-in radio transceiver supports the worldwide accessible 2.4GHz ISM band.

The system is designed to demonstrate standard-based applications such as ZigBee/IEEE 802.15.4, ZigBee RF4CE, and 6LoWPAN, as well as high data rate ISM applications. The SMA antenna connector allows either operation with the antenna provided with the RCB or 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	5.07 dBm
Data Rate	250 kbps
Antenna Type	External Antenna
Number of antenna	1
Antenna Gain	0 dBi
Supply Voltage	1.8V DC – 3.6V DC
Dimensions	Length: 52mm Width: 45mm
Environmental	-25 to +85 degrees C; Storage: -45 to +125 degrees C

Test Conditions:

Voltage: 3.3 V DC

Environmental conditions:

Temperature: +23 º C **RH:** 62%

Test Set-up and Operation Mode

Principle of Configuration Selection
Transmission was enabled with 100% duty cycle duty 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

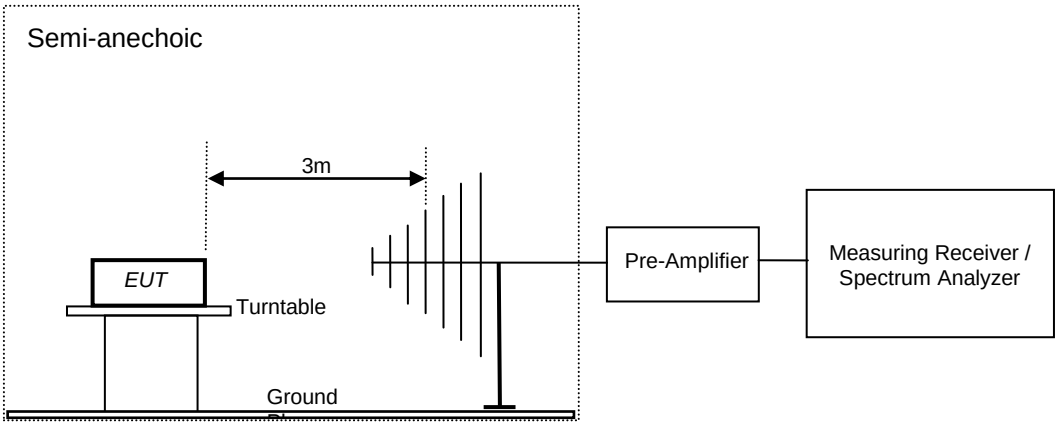
Table of carrier frequencies

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
	26	2480

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.

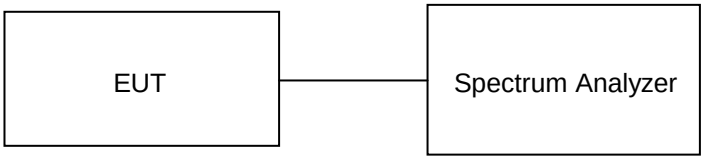


Test Results

Maximum Conducted Peak Output Power **Section 15.247(b) (3)**
Result **Pass**

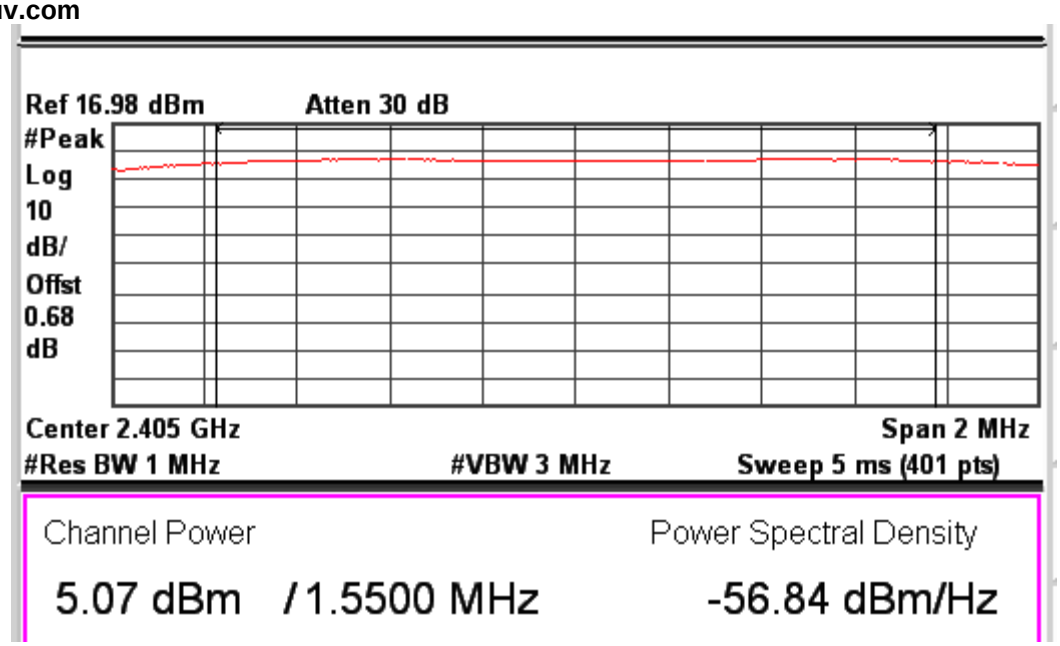
Test Specification	FCC Part 15 Subpart C
Measurement Bandwidth (RBW)	1 MHz
Detector	Peak
Requirement	<1 watt (30dBm).

Test Method:

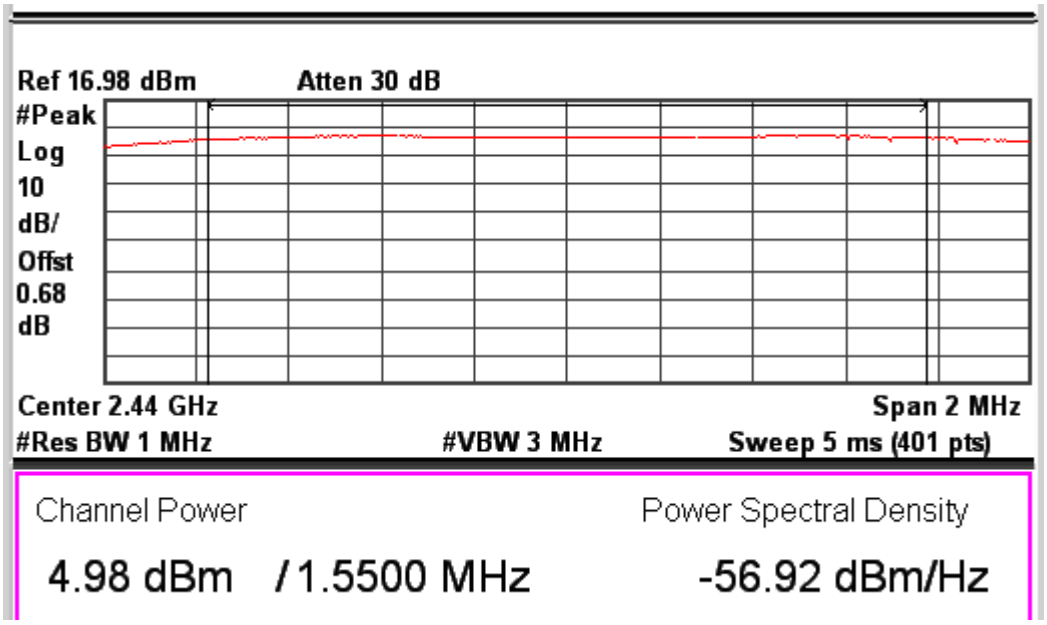


Test Result:

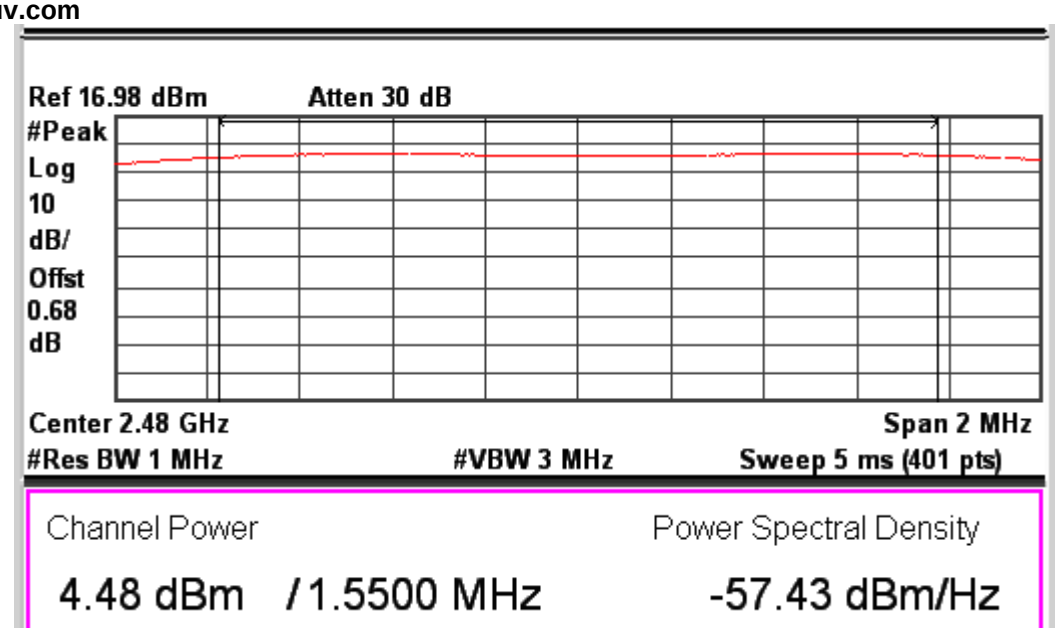
Frequency (MHz)	Total Output power (dBm)	Limit (dBm)
2405	5.07	30.00
2440	4.98	30.00
2480	4.48	30.00



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz



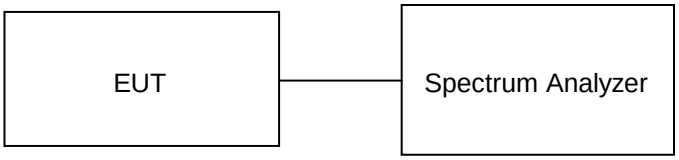
Channel Frequency: 2480 MHz

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

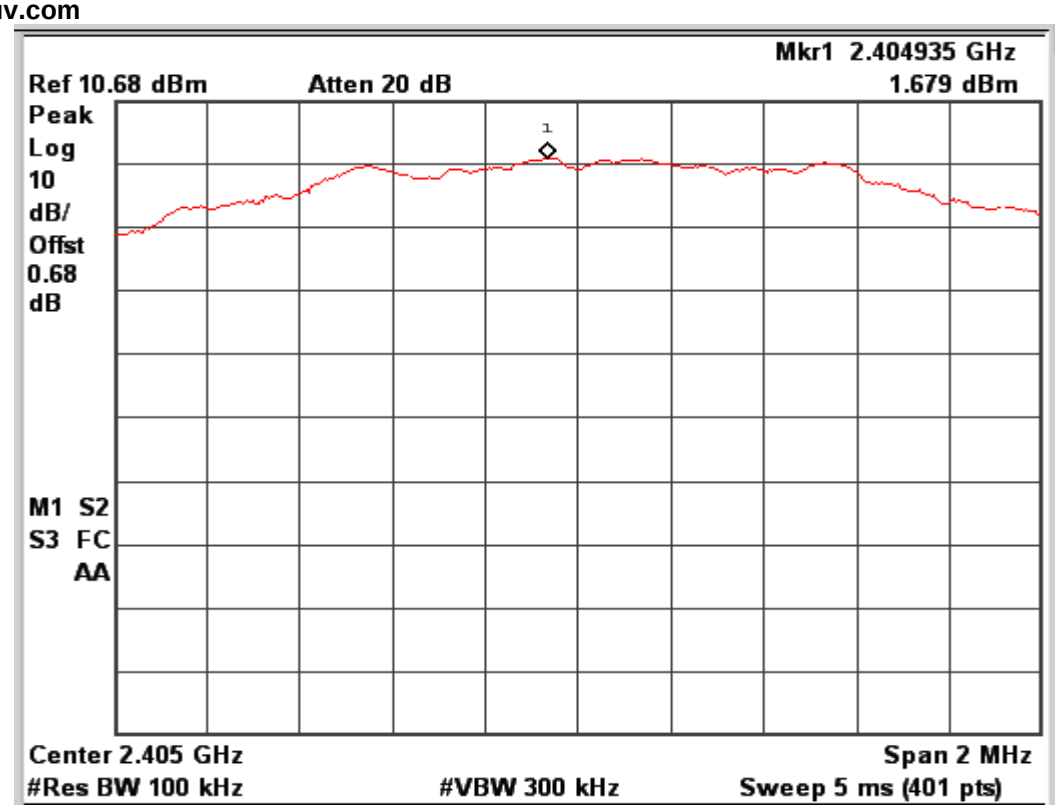


Test Result:

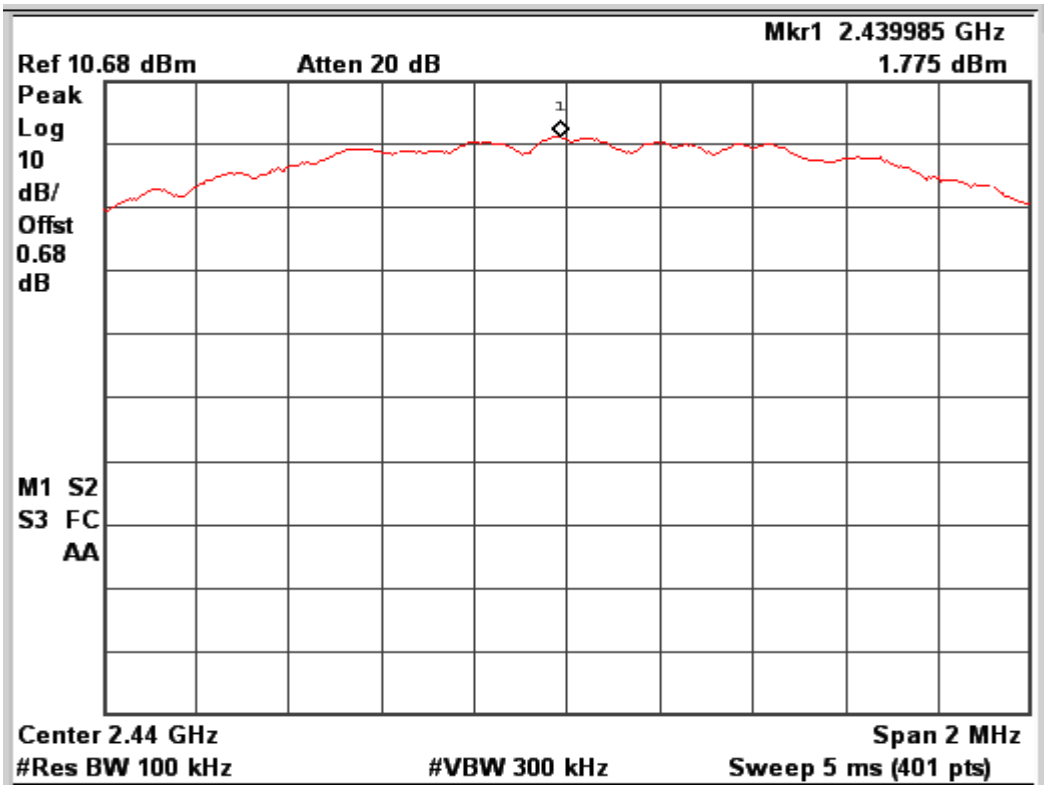
Cable Loss: 0.88 dB

Frequency (MHz)	Measured PSD (dBm)	BWCF* (dB)	Total PSD (dBm)	Limit(dBm)
2405	1.67	-15.23	-13.56	8.00
2440	1.77	-15.23	-13.46	8.00
2480	1.30	-15.23	-13.93	8.00

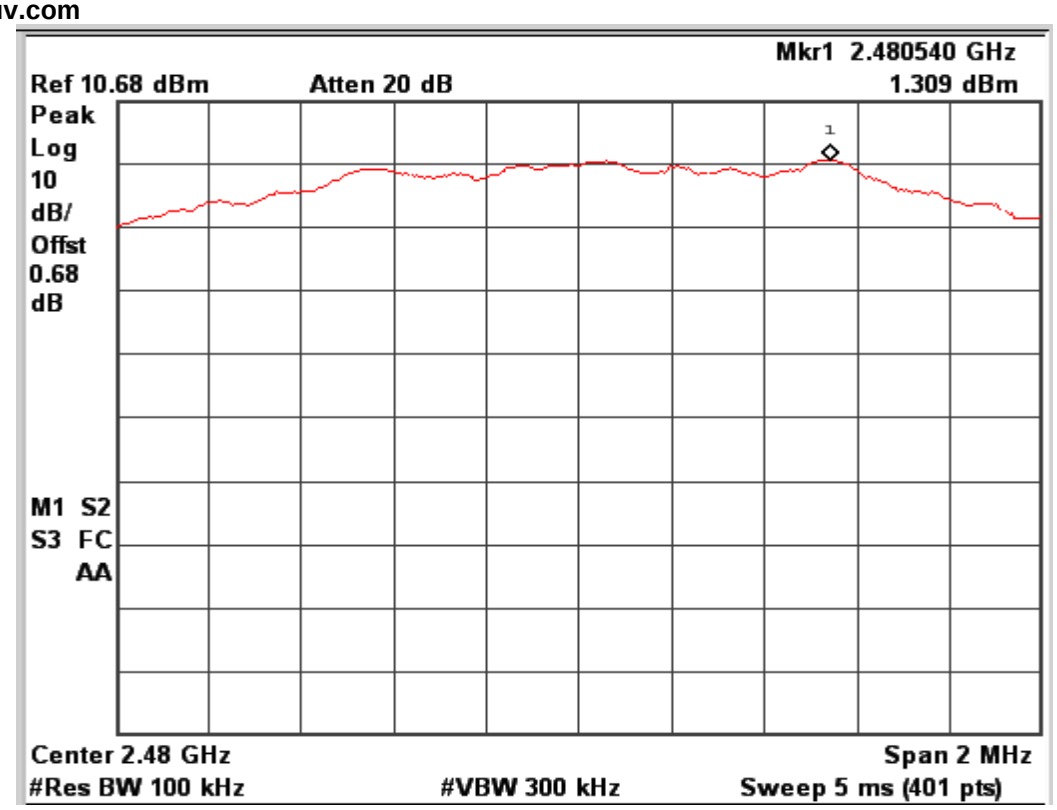
*** BWCF: Bandwidth Correction factor.**



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

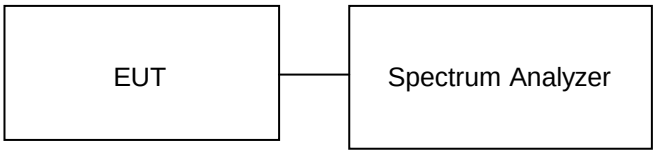


Channel Frequency: 2480 MHz

6 dB Bandwidth **Section 15.247(a) (2)**
Result **Pass**

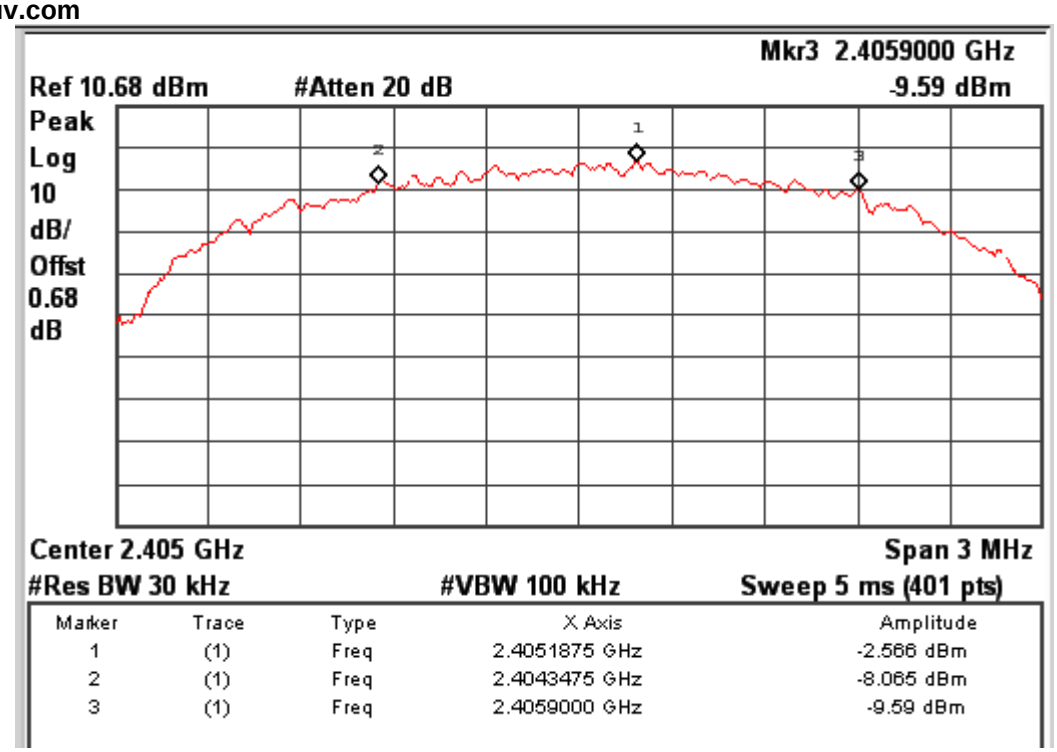
Test Specification FCC Part 15 Subpart C
Requirement The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Method:

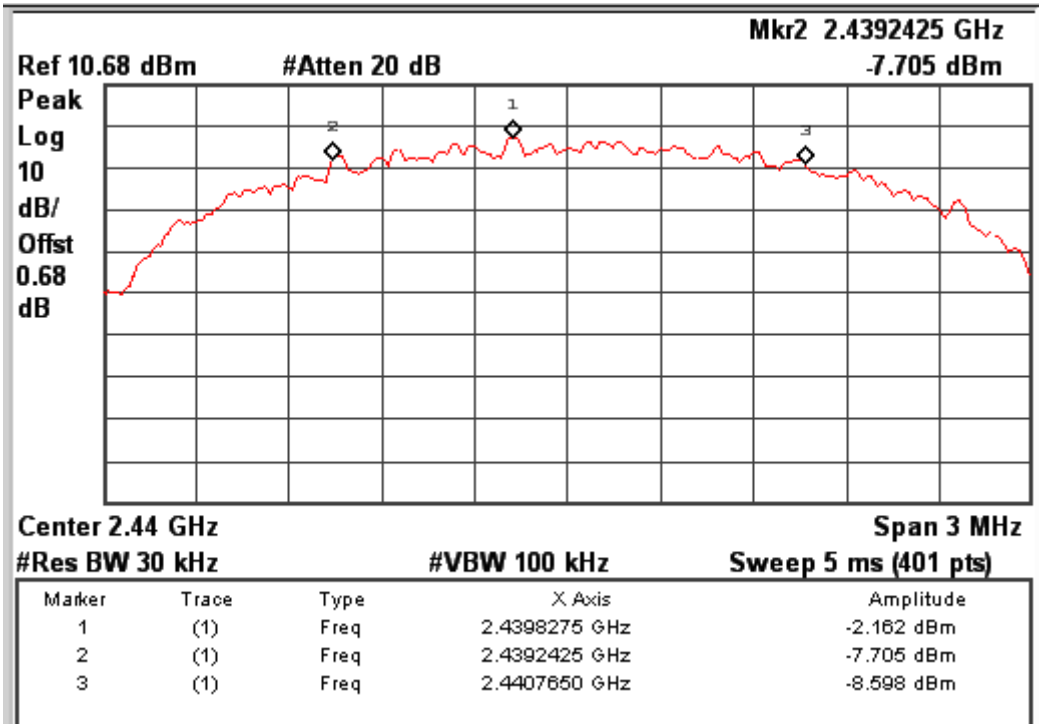


Test Result:

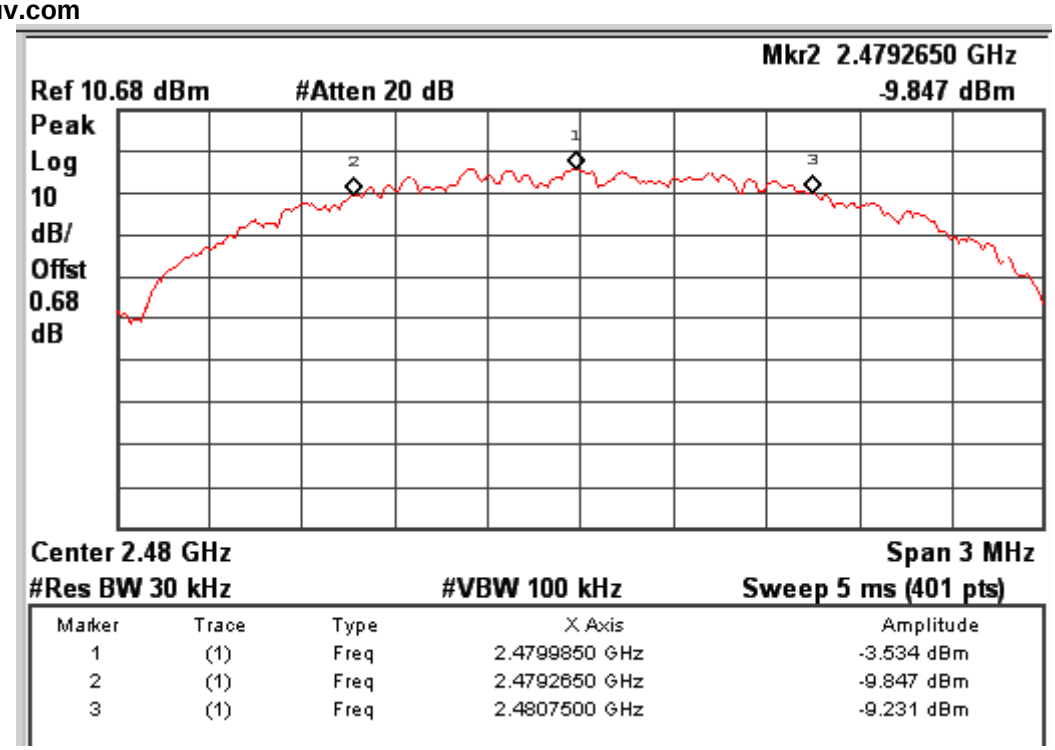
Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	OBW (MHz)
2405	2404.34	2405.90	1.56	2.36
2440	2439.24	2440.76	1.52	2.55
2480	2479.26	2480.75	1.49	2.55



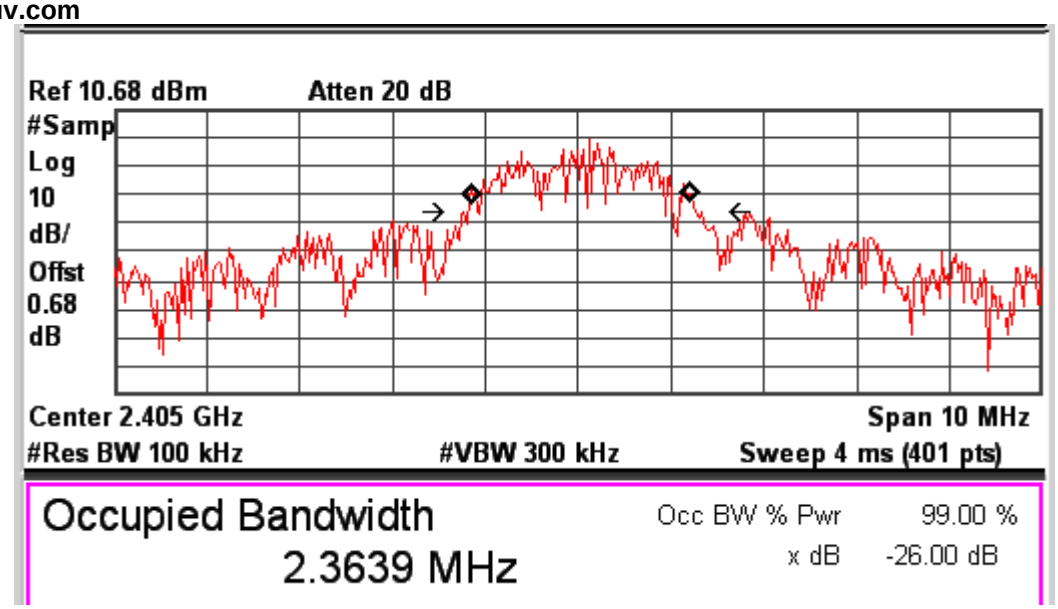
Channel frequency: 2405 MHz



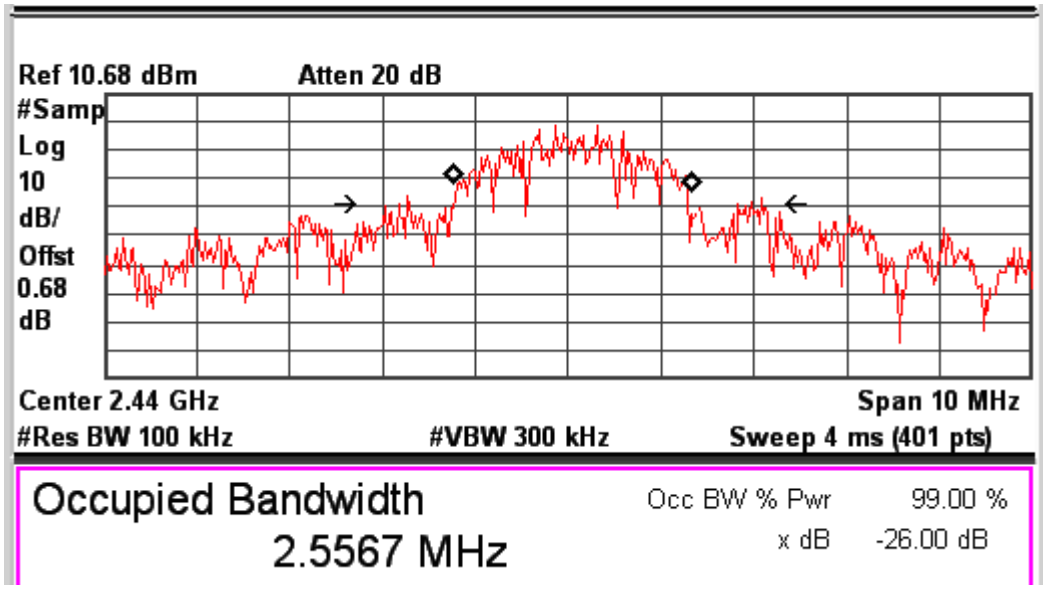
Channel frequency: 2440 MHz



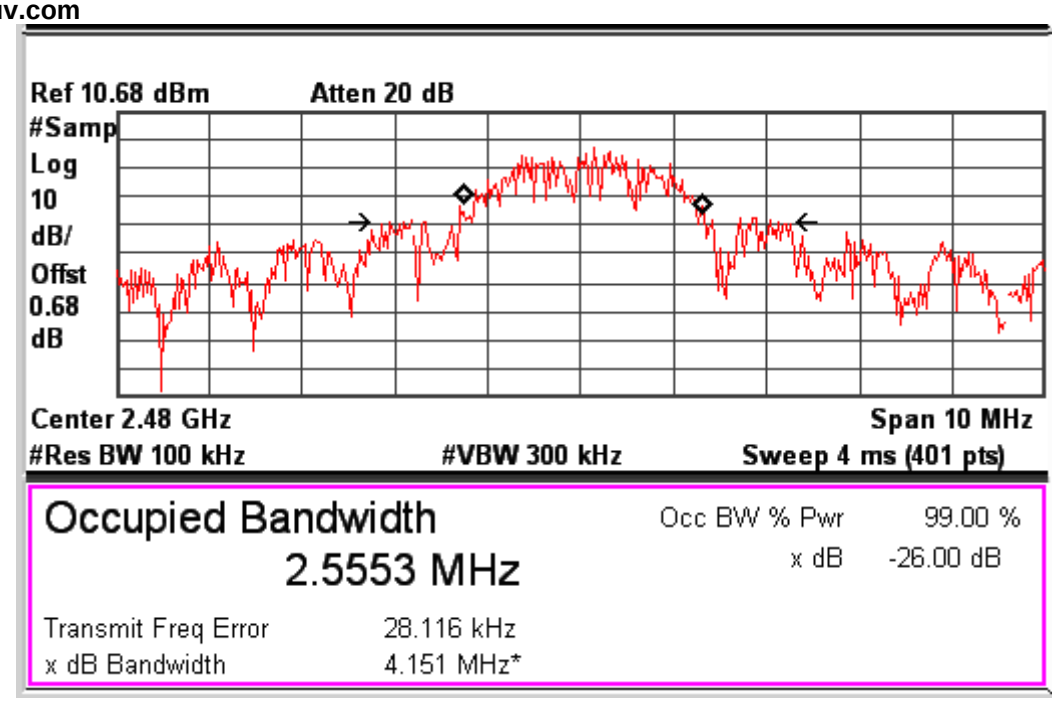
Channel frequency: 2480 MHz



OBW Channel frequency: 2405 MHz



OBW Channel frequency: 2440 MHz

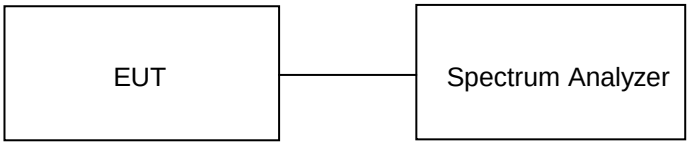


OBW Channel frequency: 2480 MHz

Band-edge Compliance **Section 15.247(d)**
Result **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.

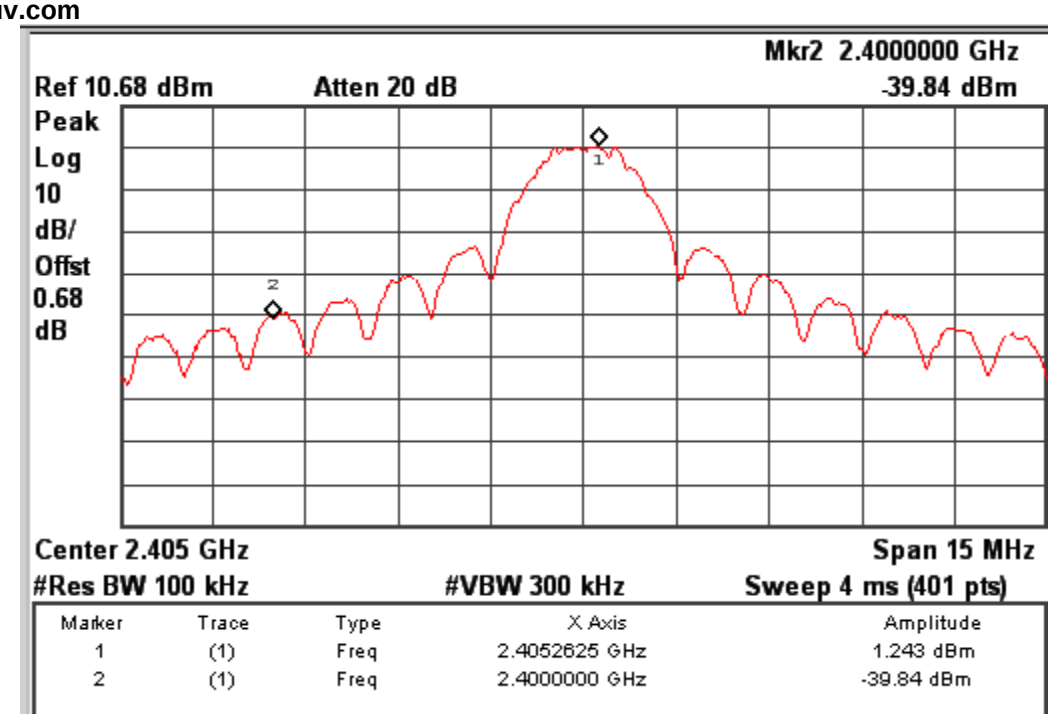
Test Method:



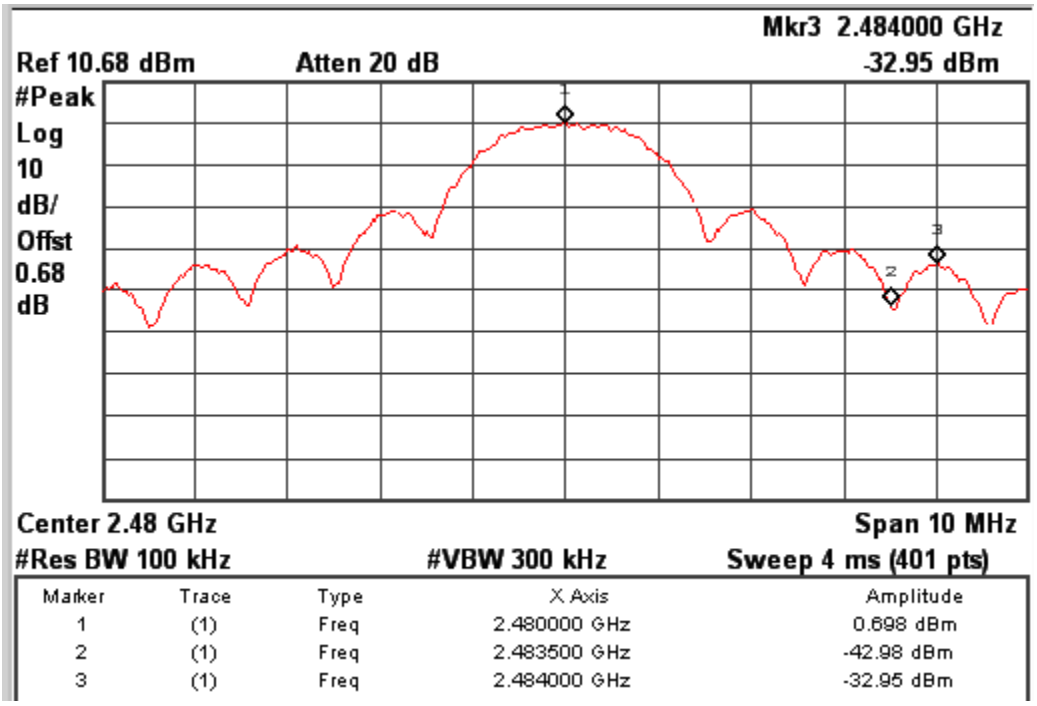
Test Result:

Frequency (MHz)	Value at Band Edge			Limit (dB)
	Frequency (MHz)	Measured PSD Level*	Value (dBc)	
2405	2400.00	1.67	-41.51	-20.00
2480	2483.50	1.30	-44.94	-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

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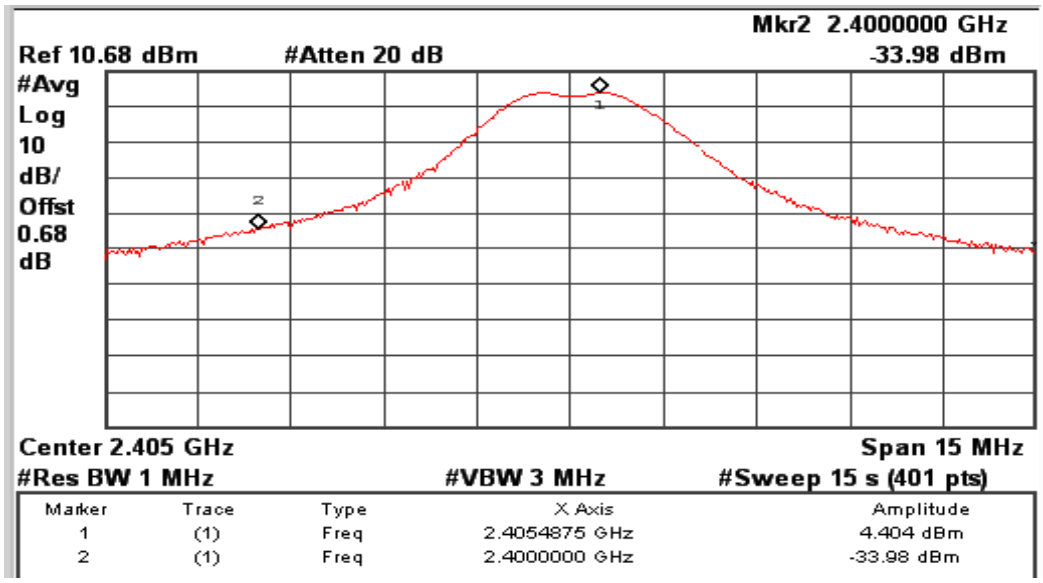
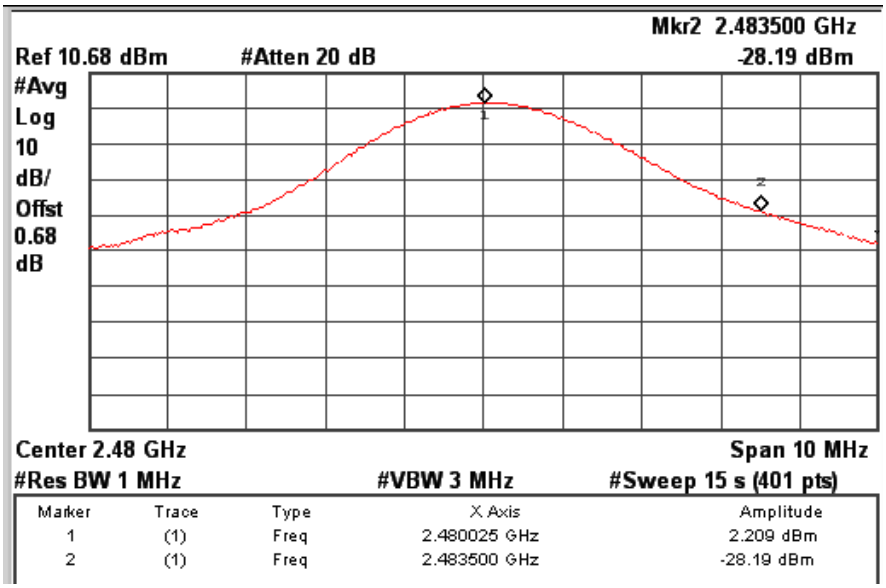
Channel Low



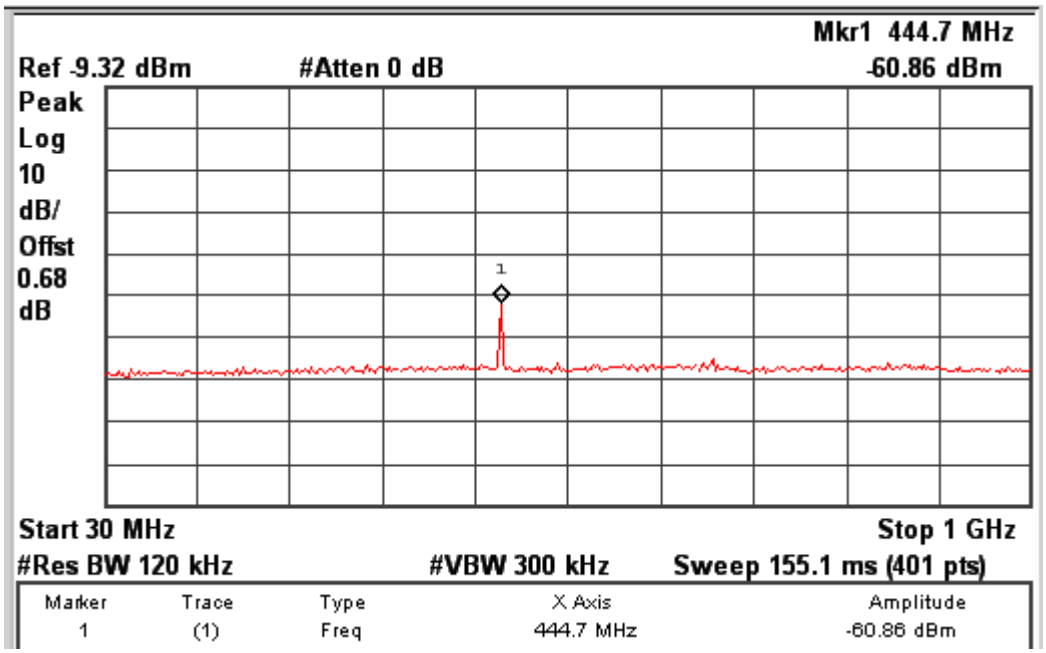
The band edge emission is 38.38 dBc between maximum power and the maximum emission at the band edge. The field strength of the channel low is 77.54dBµV/m (Average), so the maximum field strength in the restricted band is 39.16 dBµV/m which is under 54dBµV/m Limit.

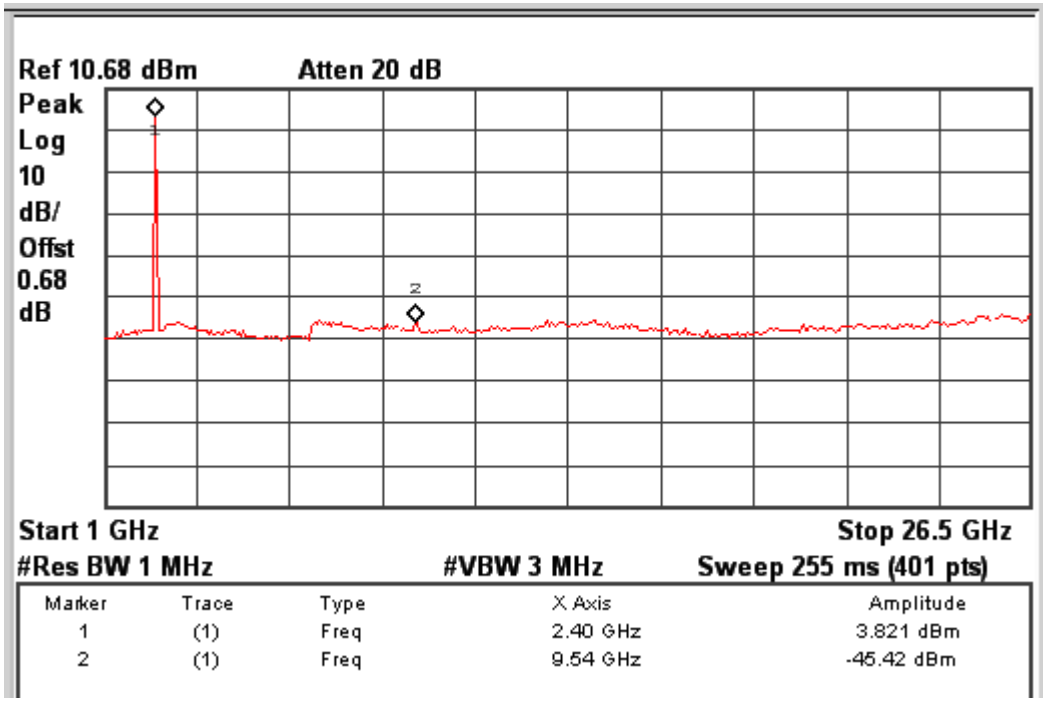
Channel High



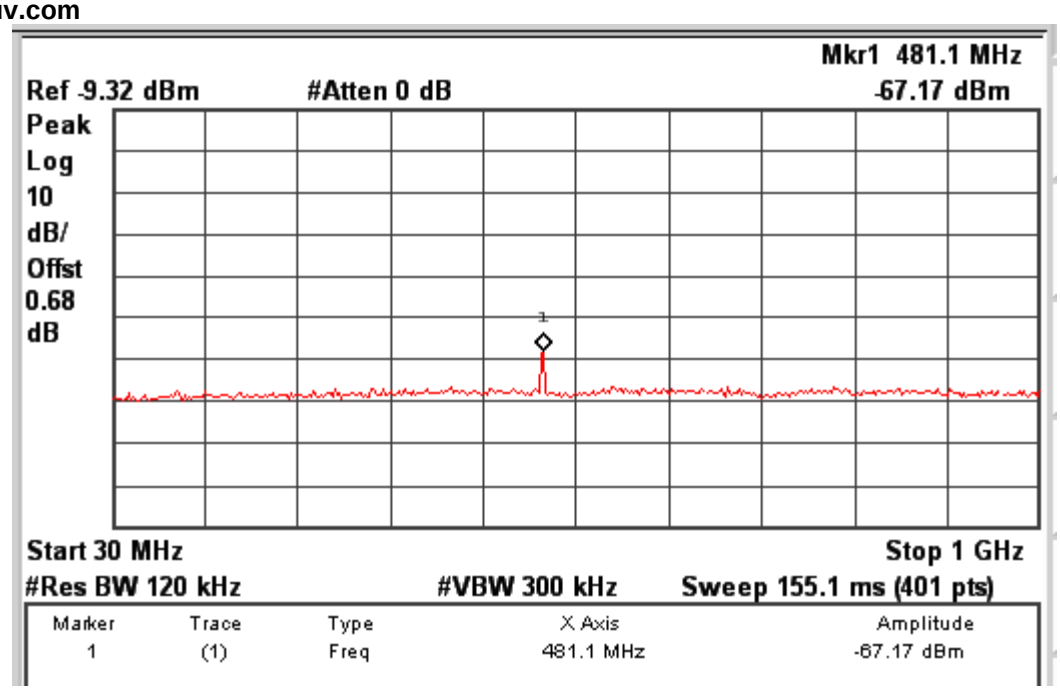
The band edge emission is 30.19 dBc between maximum power and the maximum emission at the band edge. The field strength of the channel low is 76.80dBµV/m (Average), so the maximum field strength in the restricted band is 46.41 dBµV/m which is under 54dBµV/m Limit.

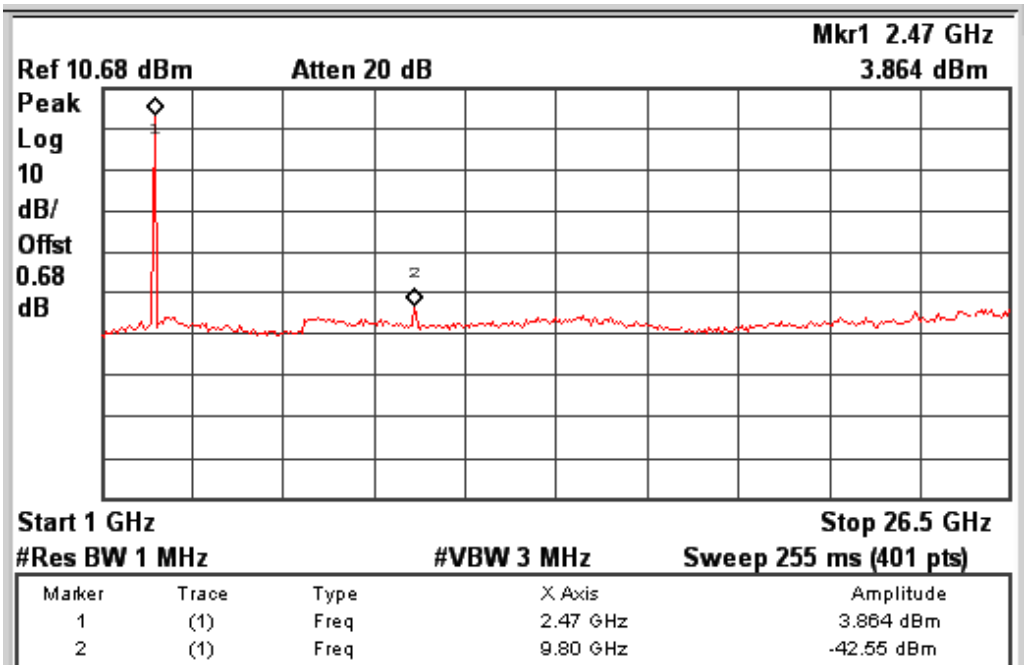
Conducted Spurious Emission



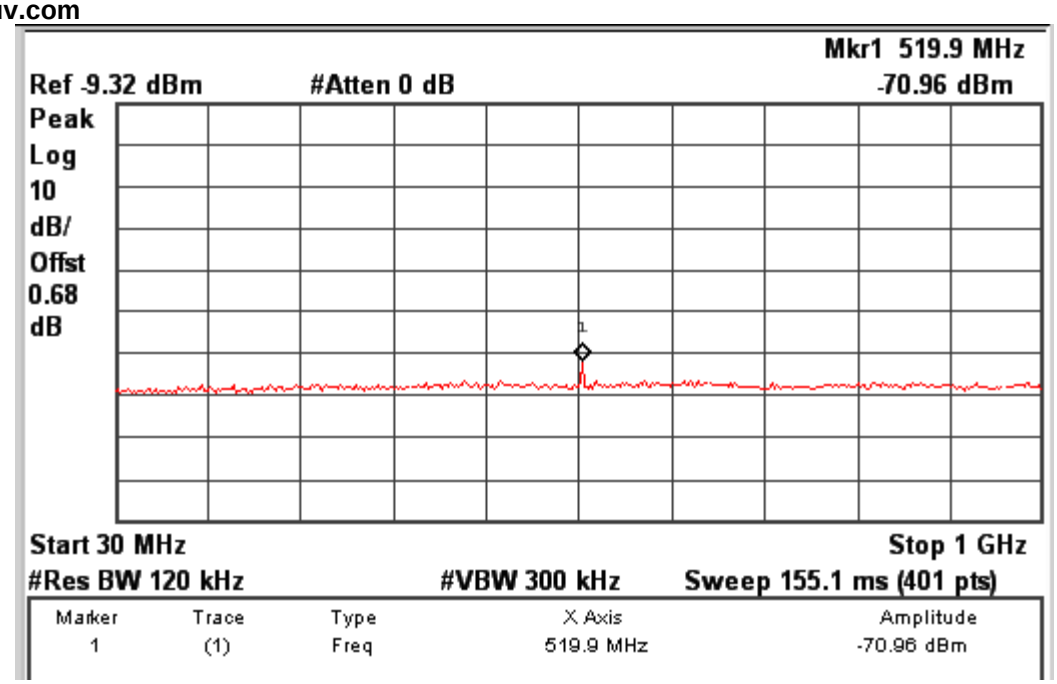


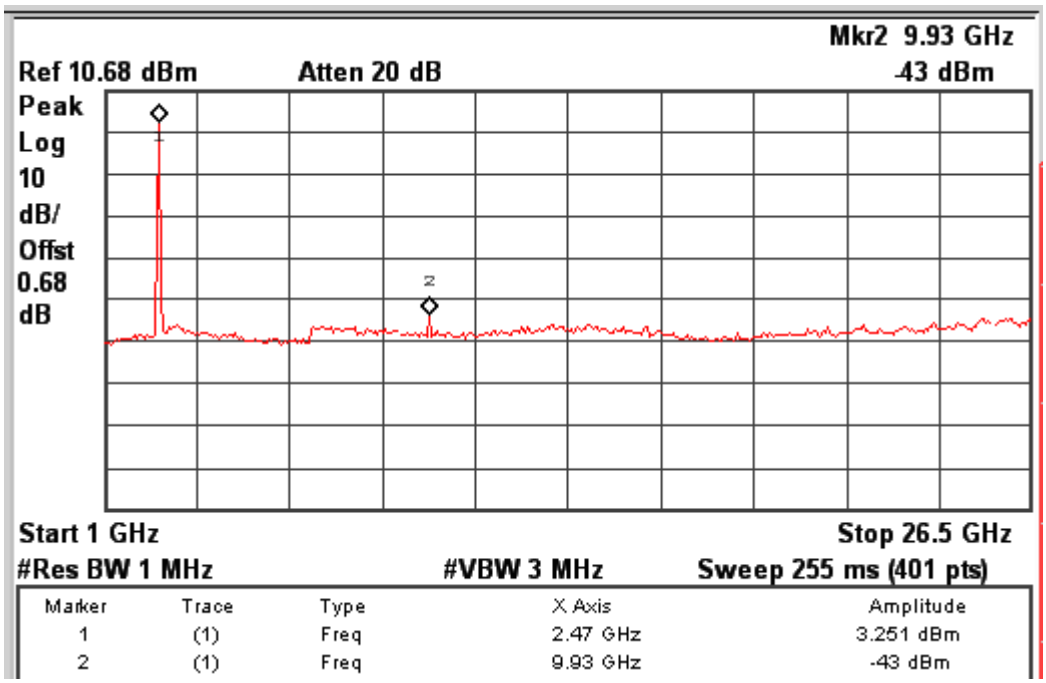
Channel frequency: 2405 MHz





Channel frequency: 2440 MHz





Channel frequency: 2480 MHz

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 C63.4-2003
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 (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 88, 50 – 53.80, 53.80 – 43.00 and 49.5dBµV/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 Radiated Emission Test carried out with 100% duty Cycle. And the Practical Duty Cycle is 8.2% so; the Peak readings were extrapolated to arrive at the average readings by using the following calculation.

Duty Cycle = 0.82/10.0 = 0.082
Duty Cycle Correction Factor = 20*log (duty cycle)
=20*log (0.082)
= -21.72

Average = Peak + (-21.72)

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 (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2405	V	2390.00(Pk)	45.61	74	-28.39
		2390.00(Av)	23.89	54	-30.11
		2404.50(Pk)	99.26	*	-
		2405.00(Av)	77.54	*	-
		4809.90(Pk)	49.36	74	-24.64
		4809.30(Av)	27.64	54	-26.36
	H	2390.00(Pk)	42.08	75	-31.92
		2388.20(Av)	20.36	54	-33.64
		2404.50(Pk)	95.75	*	-
		2405.00(Av)	74.03	*	-
		4809.80(Pk)	48.98	74	-25.02
		4809.50(Av)	27.26	54	-26.74
2440	V	2439.60(Pk)	100.88	*	-
		2439.99(Av)	79.16	*	-
		4879.90(Pk)	50.78	74	-23.22
		4881.20(Av)	29.06	54	-24.94
	H	2439.60(Pk)	94.81	*	-
		2440.00(Av)	73.09	*	-
		4879.60(Pk)	49.23	74	-24.77
		4878.90(Av)	27.51	54	-26.49
2480	V	2479.60(Pk)	98.52	*	-
		2480.10(Av)	76.80	*	-
		2483.50(Pk)	66.73	74	-07.27
		2483.50(Av)	45.01	54	-08.99
		4960.00(Pk)	50.20	74	-23.80
		4959.70(Av)	28.48	54	-25.52
	H	2479.50(Pk)	92.39	*	-
		2480.10(Av)	70.67	*	-
		2483.50(Pk)	60.68	74	-13.32
		2483.50(Av)	38.96	54	-15.04
		4960.90(Pk)	50.27	74	-23.73
		4960.50(Av)	28.55	54	-25.45

* - --> 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