Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**19660024 001**	**Seite 1 von 28** *Page 1 of 28*

Auftraggeber: *Client:*	**ATMEL NORWAY AS** **VESTRE ROSTEN 79** **7075 TILLER** **TRONDHEIM** **NORWAY - 7075**		
Gegenstand der Prüfung: *Test item:*	**ZigBit ATmega256RFR2**		
Bezeichnung: *Identification:*	**ATZB-S1-256-3-0-C**	**Serien-Nr.:** *Serial No.*	**Engineering Sample**
Wareneingangs-Nr.: *Receipt No.:*	**1803001640**	**Eingangsdatum:** *Date of receipt:*	**10.09.2013**
Prüfort: *Testing location:*	**Refer Page 4 of 28 for test facilities**		
Prüfgrundlage: *Test specification:*	**FCC Part 15, Subpart C**		
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 **FCC Registration No.: 176555; IC Assigned Code: 3466E**		

geprüft / *tested by:*

16.09.2013	Saibaba Siddapur Engineer	Saibaba
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

kontrolliert / *reviewed by:*

18.09.2013	Raghavendra Kulkarni Sr.Manager	Kulkarni
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges /*Other Aspects:* **FCC ID : VW4A091732**

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***

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

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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	04.10.2013
BiConiLog Antenna	ETS Lindgren	3142D	00081354	01.11.2013
Horn Antenna	Frankonia	HAX-18	HAX18-802	10.10.2013
Double-Ridged Waveguide 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

General Product Information

Product Function and Intended Use

The ZigBit ATmega256RFR2 is a ZigBit module of 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 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	4.74 dBm (Conducted)
Data Rate	250 kbps
Number of Antenna	1
Antenna Type	Refer page 6 of 28
Antenna Gain	Refer page 6 of 28
Supply Voltage to Module	3.3VDC
Dimensions	30 mm x 20 mm x 0.7mm
Environmental	-20 to +85 degrees C range

Test Conditions:

Voltage: 5 V DC from USB

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 on low, mid and high channel.

Test Operation and Test Software

Hyper terminal in the computer was used to enable the transmission with 100% duty cycle and to change the 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

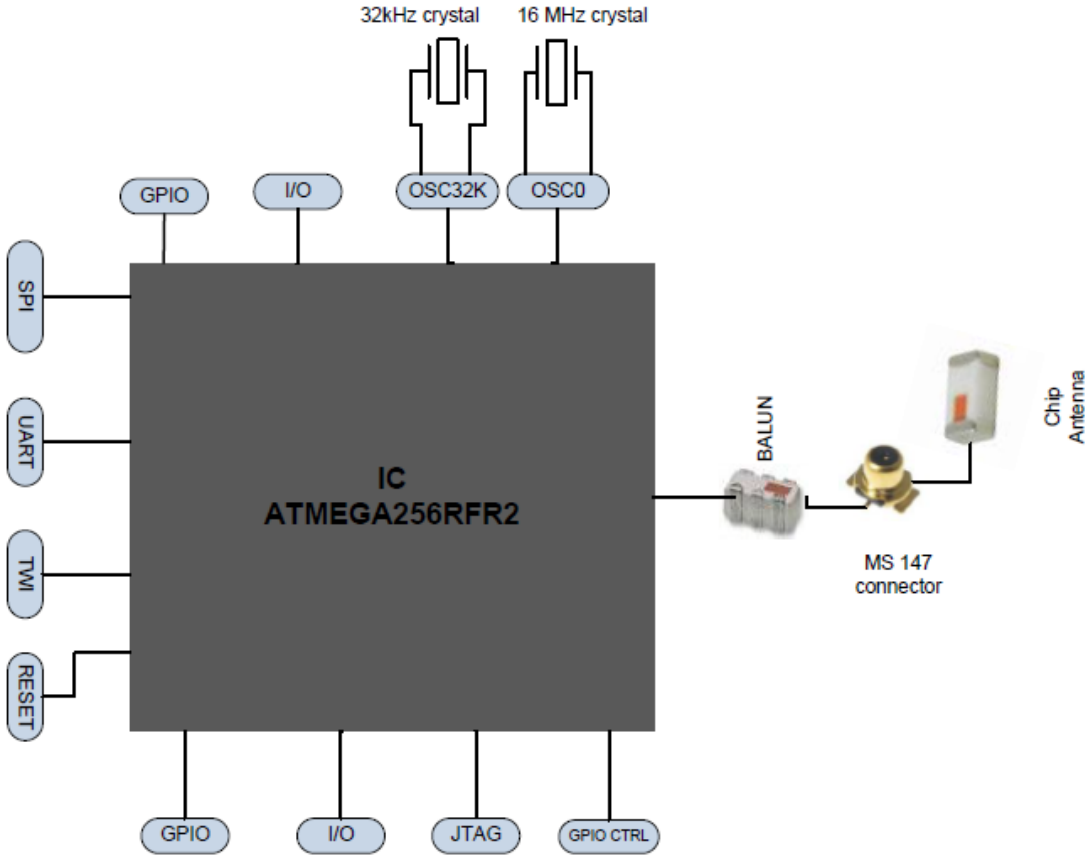
Table of frequencies

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

Antenna Used

Make	Model/Part #	Antenna Gain (dBi)	Type of Antenna
Johanson Technology	2450AT18D0100	1dBi	Ceramic Antenna

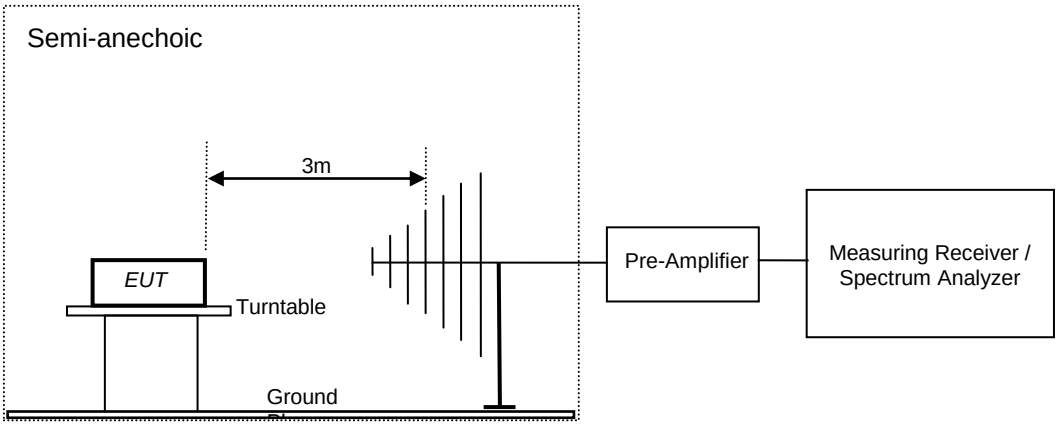
Block Diagram



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.

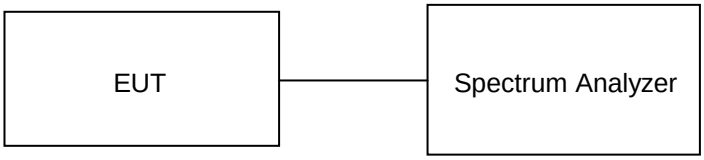


Test Results

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).

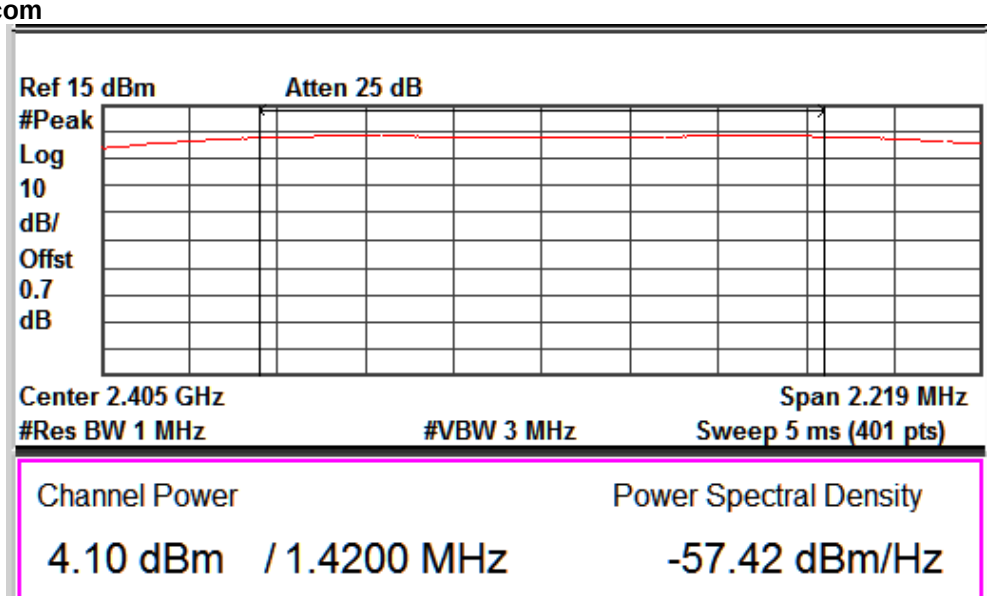
Test Method:



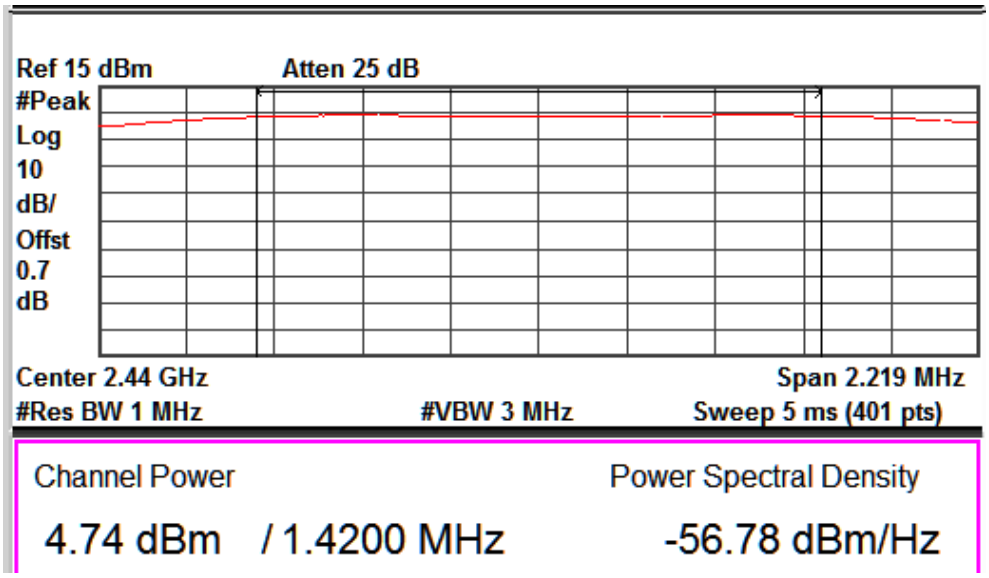
Cable Loss: 0.7dB (Included in the test results)

Test Result:

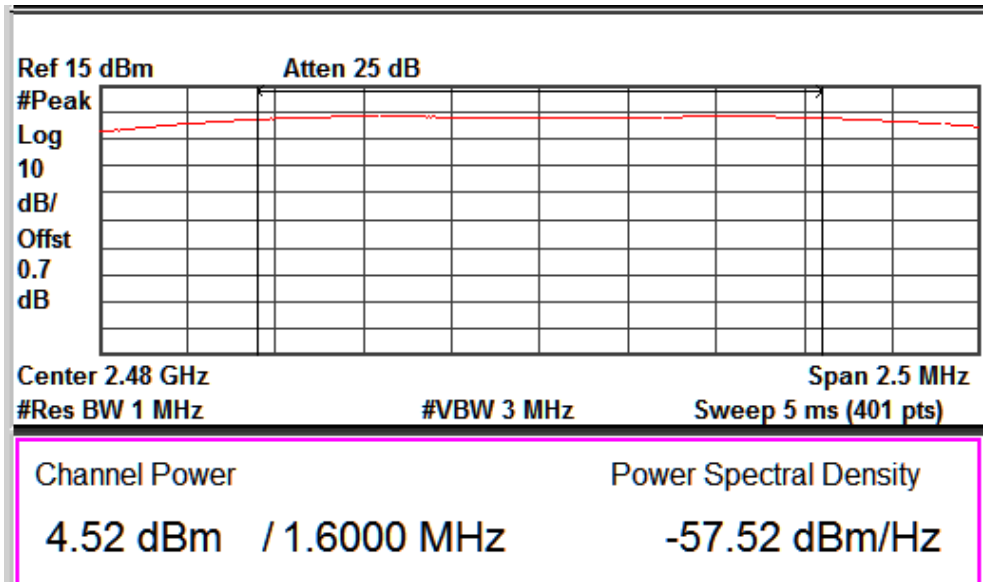
Frequency (MHz)	Total Output power (dBm)	Limit (dBm)	Margin (dB)
2405	4.10	30.00	-25.90
2440	4.74	30.00	-25.26
2480	4.52	30.00	-25.48



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

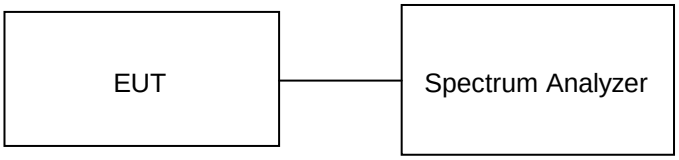


Channel Frequency: 2480 MHz

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.

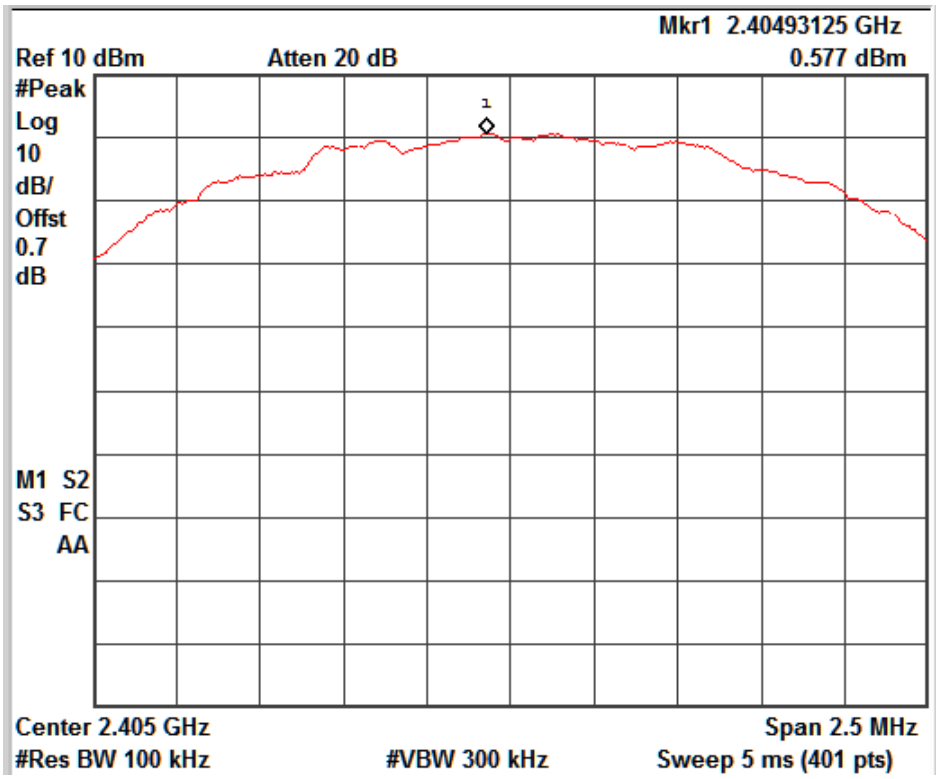
Test Method:



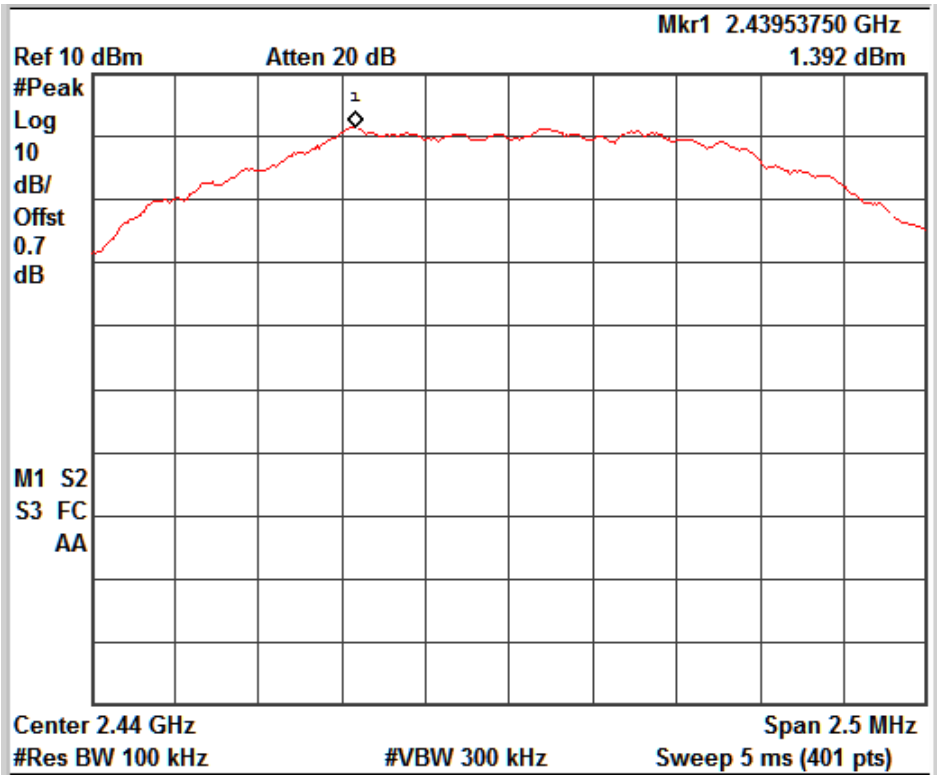
Cable Loss: 0.7dB (Included in the test results)

Test Result:

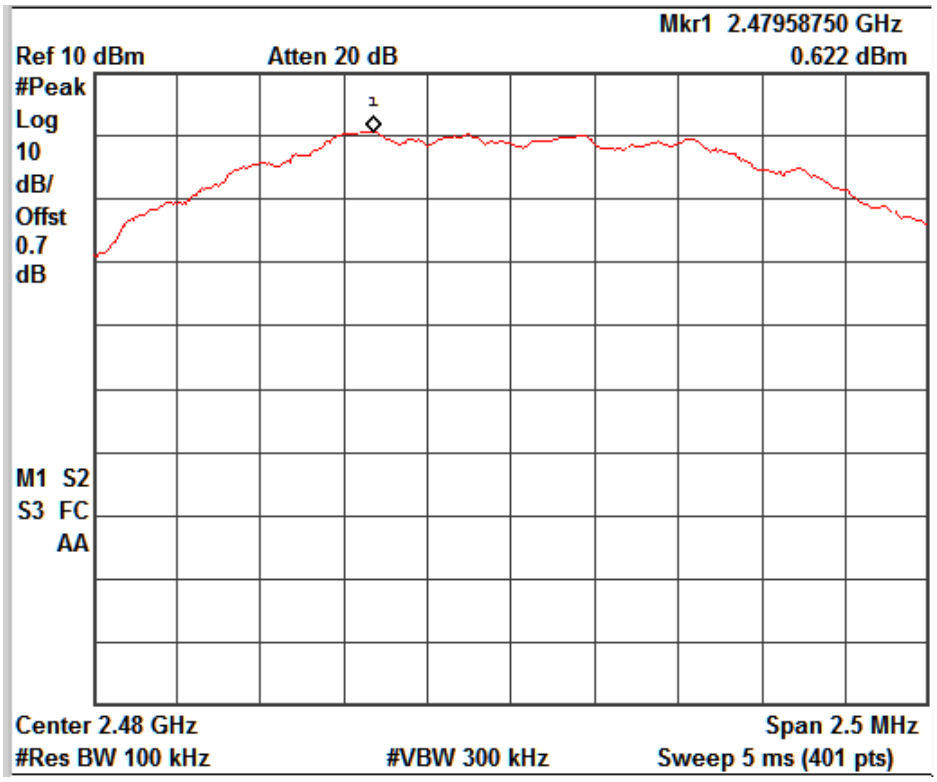
Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin(dB)
2405	0.58	8.00	-7.42
2440	1.39	8.00	-6.61
2480	0.62	8.00	-7.38



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

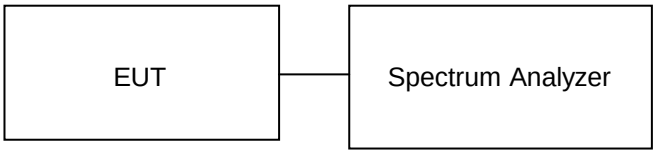


Channel Frequency: 2480 MHz

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.

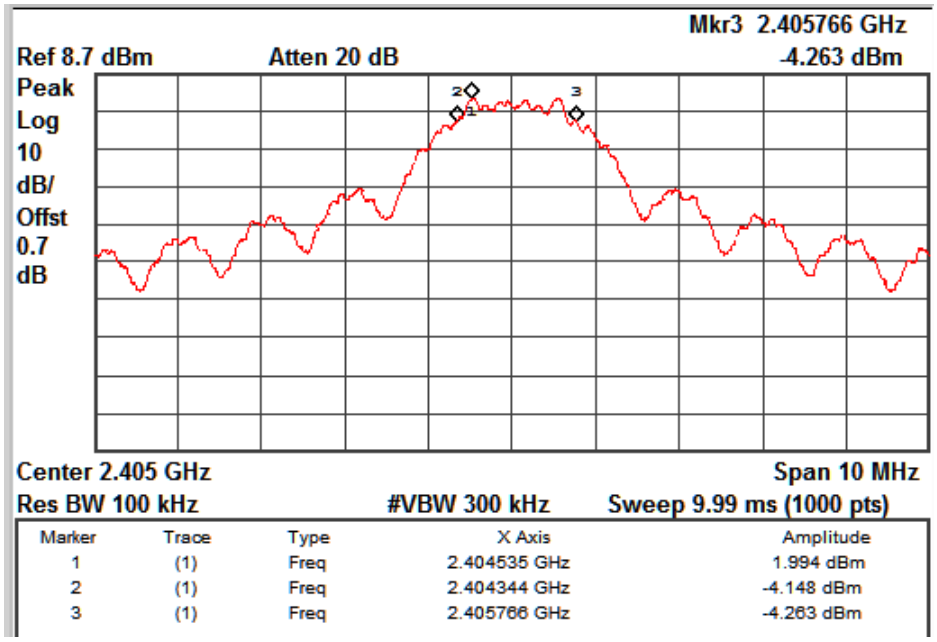
Test Method:



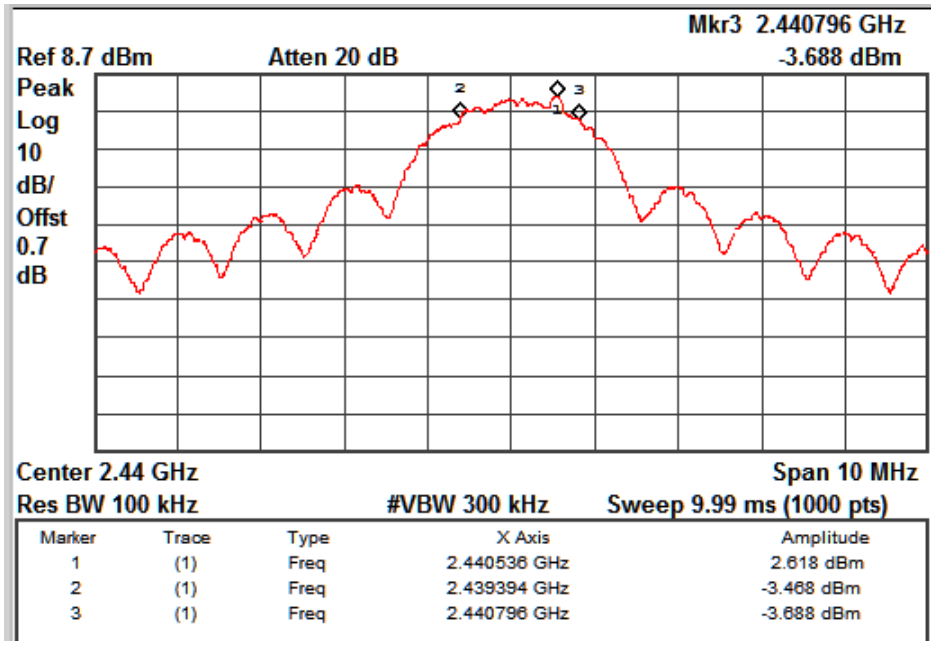
Cable Loss: 0.7dB (Included in the test results)

Test Result:

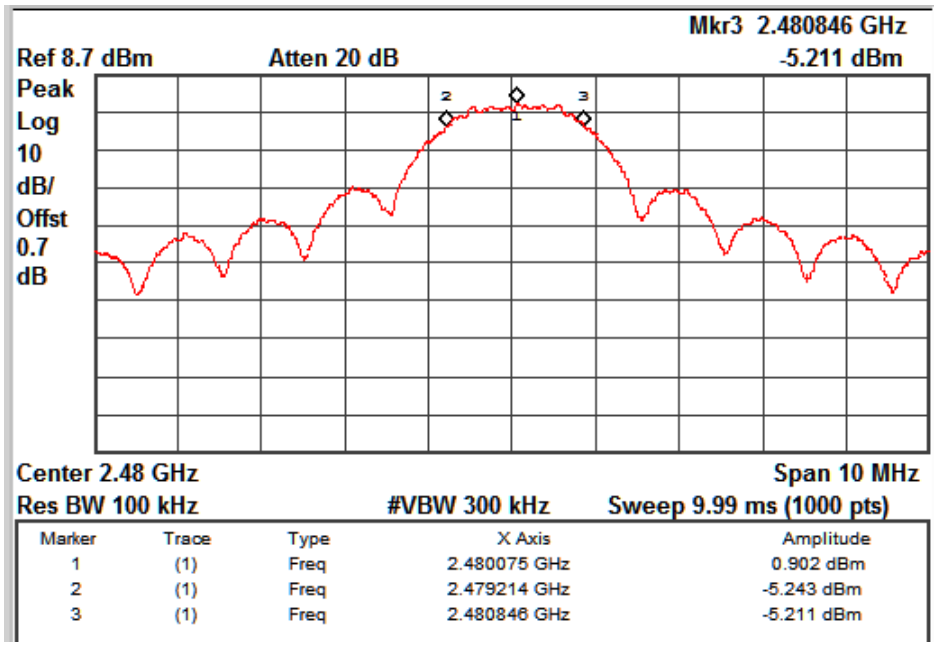
Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	OBW (MHz)
2405	2404.34	2405.77	1.42	2.32
2440	2439.39	2440.80	1.40	2.37
2480	2479.21	2480.85	1.63	2.42



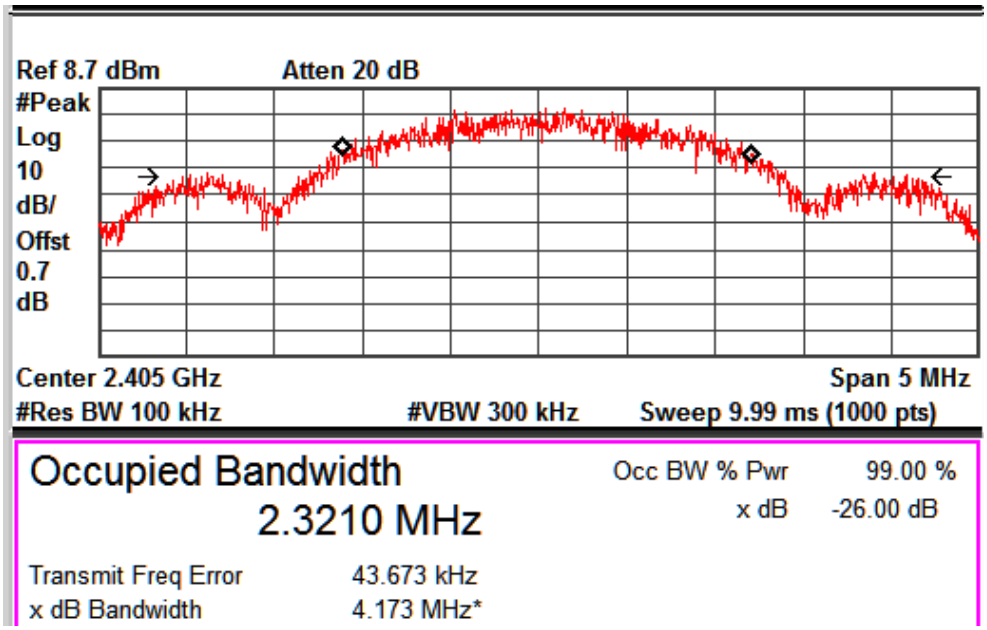
Channel frequency: 2405 MHz



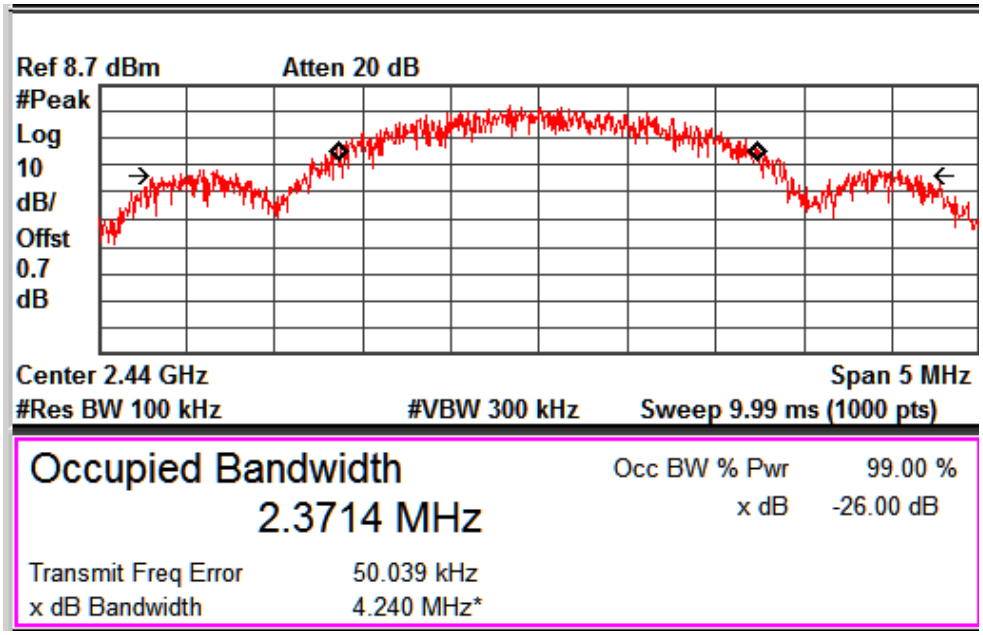
Channel frequency: 2440 MHz



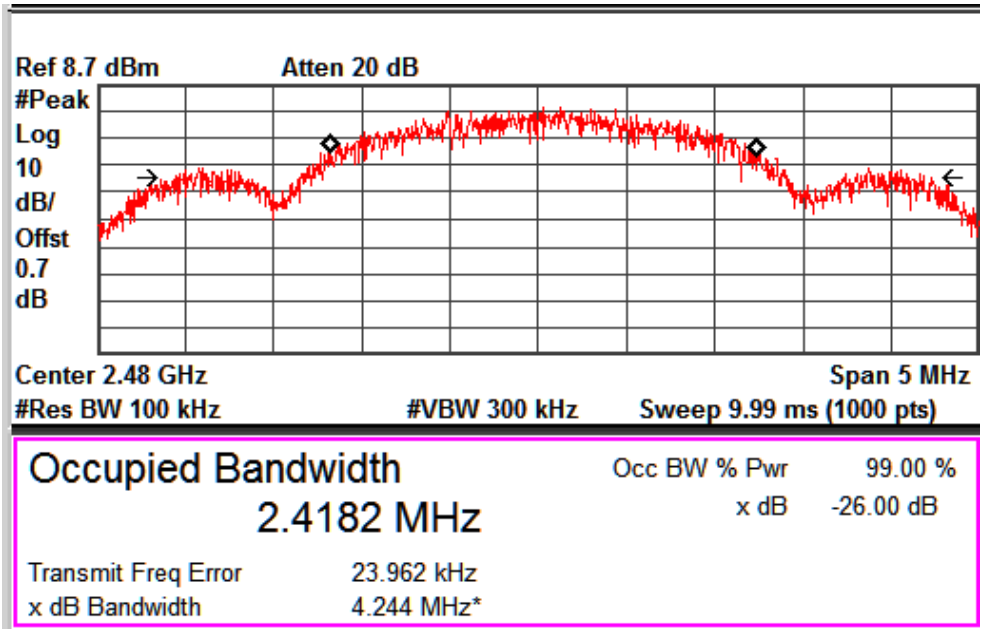
Channel frequency: 2480 MHz



OBW Channel frequency: 2405 MHz



OBW Channel frequency: 2440 MHz

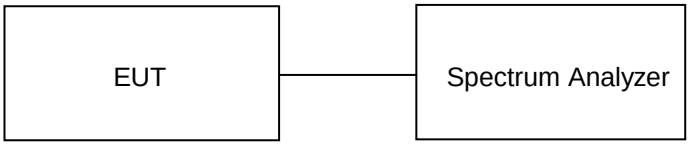


OBW Channel frequency: 2480 MHz

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:

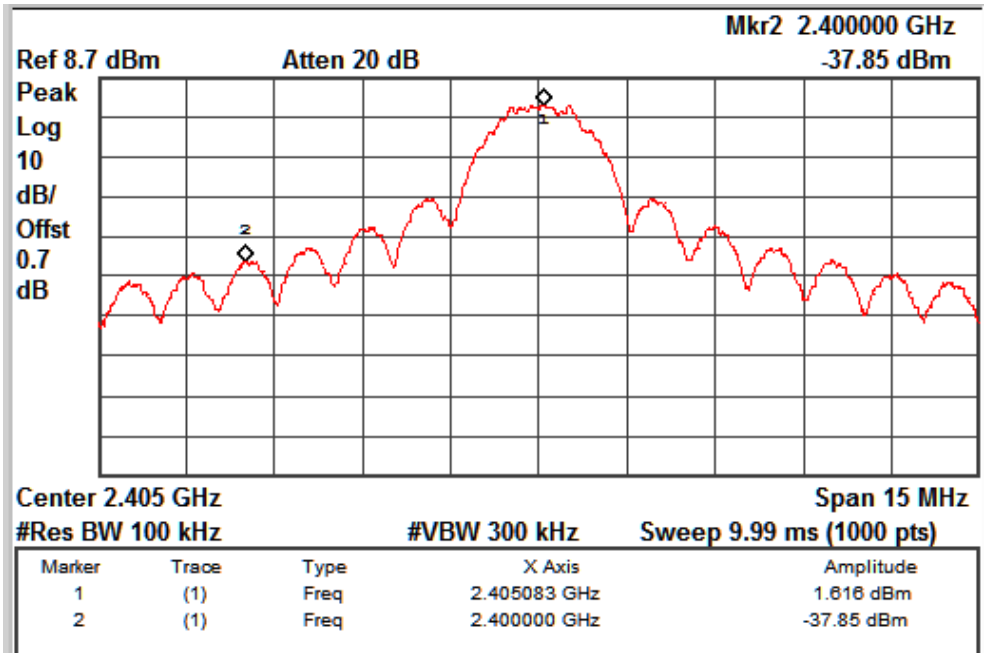


Cable Loss: 0.7dB (Included in the test results)

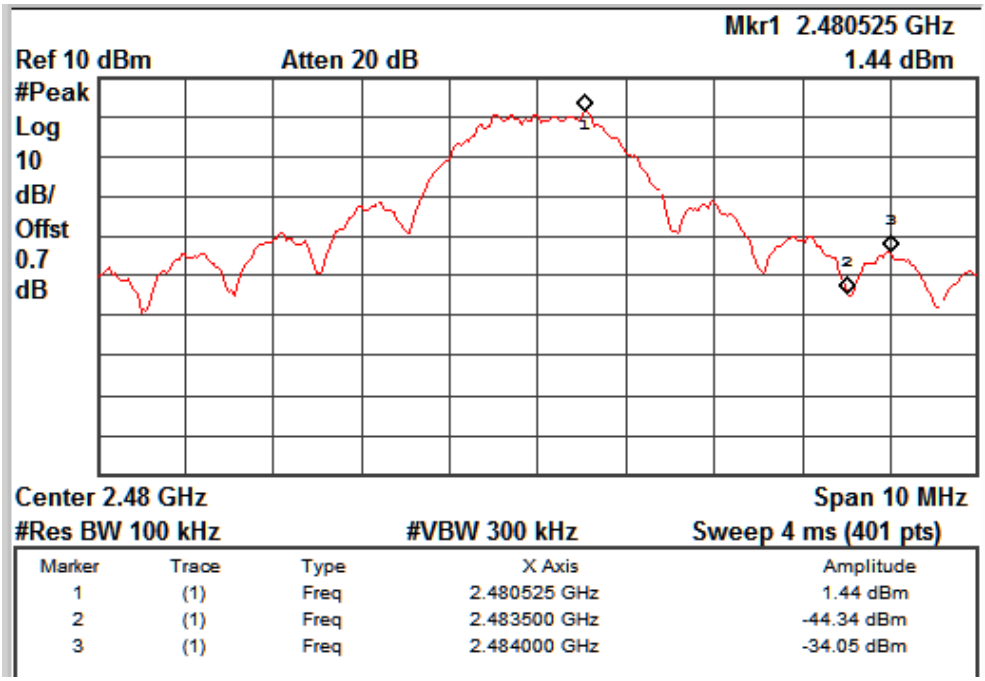
Test Result:

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	0.58	-37.85	-38.43	-20.00
2480	2483.50	0.62	-44.34	-44.96	-20.00

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

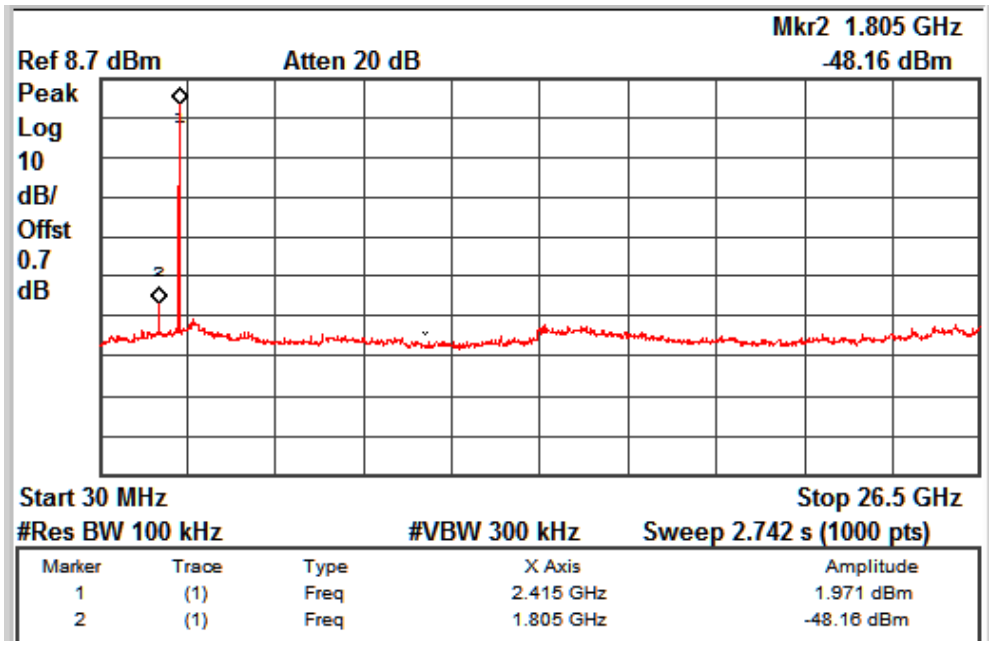


Channel frequency: 2405 MHz

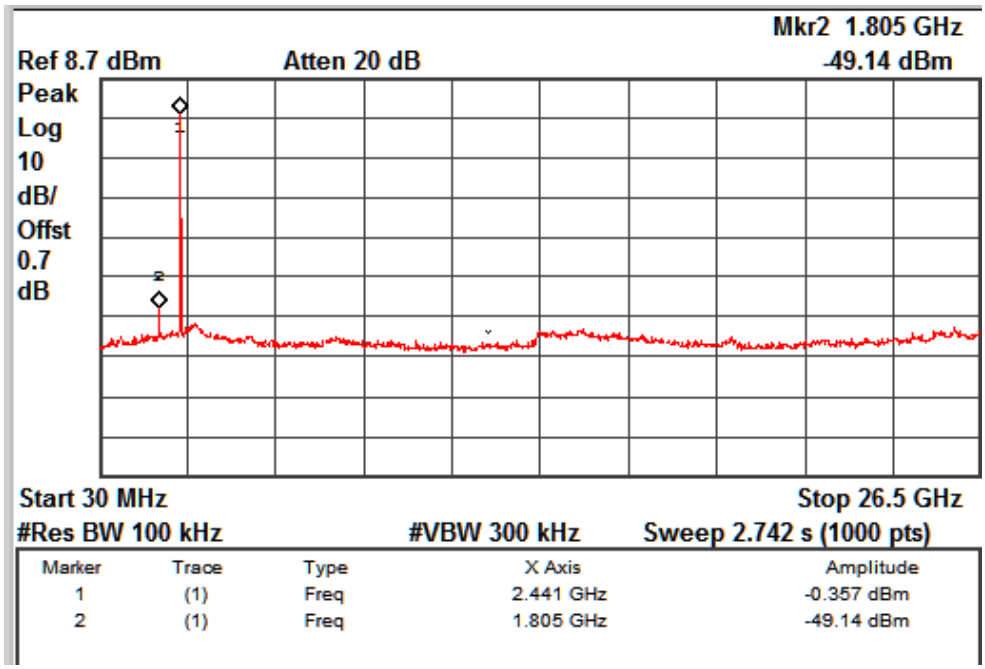


Channel frequency: 2480 MHz

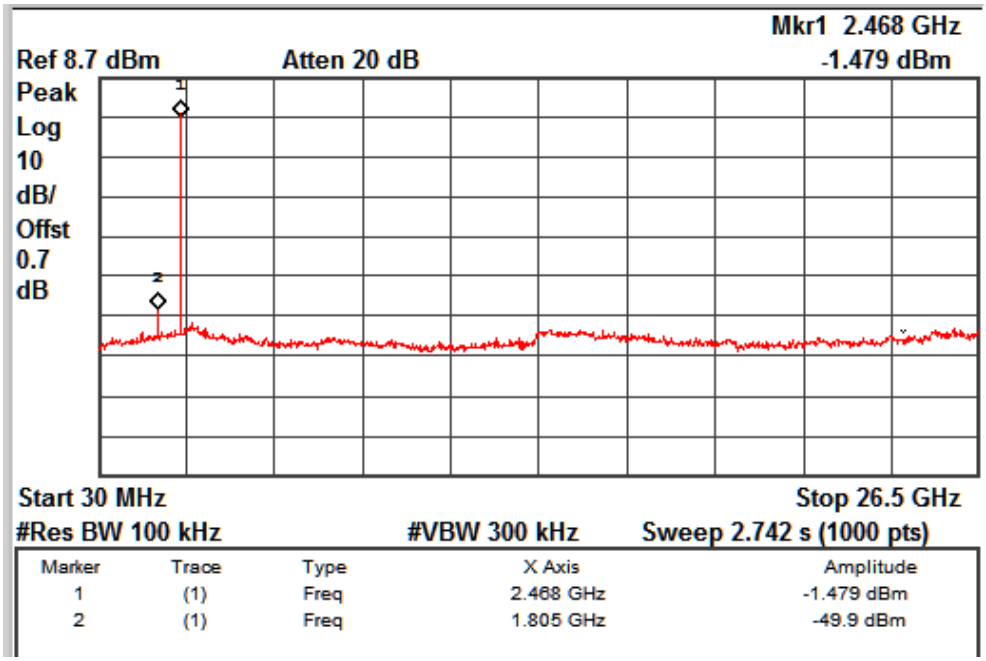
Conducted Spurious Emission



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
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.

Test result:

Emissions below 1 GHz:

Worst case emissions observed are listed below.

Antenna Polarization	Frequency of Emission (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	193.54	29.89	43.50	-13.61
	240.1	33.93	46.00	-12.07
Horizontal	238.84	28.58	46.00	-17.42

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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)	44.54	74	-29.46
		2390(Av)	28.97	54	-25.03
		2405(Pk)	93.74	*	-
		2405(Av)	91	*	-
		4810(Pk)	52.2	74	-21.8
		4810(Av)	41.55	54	-12.45
	H	2390(Pk)	42.7	74	-31.3
		2390(Av)	32.12	54	-21.88
		2405(Pk)	100.59	*	-
		2405(Av)	97.81	*	-
		4810(Pk)	53.83	74	-20.17
		4810(Av)	45.07	54	-8.93
2440	V	2440(Pk)	93.82	*	-
		2440(Av)	91.09	*	-
		4880(Pk)	51.41	74	-22.59
		4880(Av)	39.35	54	-14.65
	H	2440(Pk)	100.27	*	-
		2440(Av)	97.52	*	-
		4880(Pk)	52.09	74	-21.91
		4880(Av)	41.84	54	-12.16
2480	V	2480(Pk)	92.39	*	-
		2480(Av)	89.63	*	-
		2483.5(Pk)	48.57	74	-25.43
		2483.5(Av)	37.83	54	-16.17
		4960(Pk)	50.71	74	-23.29
		4960(Av)	38.84	54	-15.16
	H	2480(Pk)	100.26	*	-
		2480(Av)	97.4	*	-
		2483.5(Pk)	56.64	74	-17.36
		2483.5(Av)	45.63	54	-8.37
		4960(Pk)	50.86	74	-23.14
		4960(Av)	41.36	54	-12.64

* - --> 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 **Section 15.207**
Result **Pass**

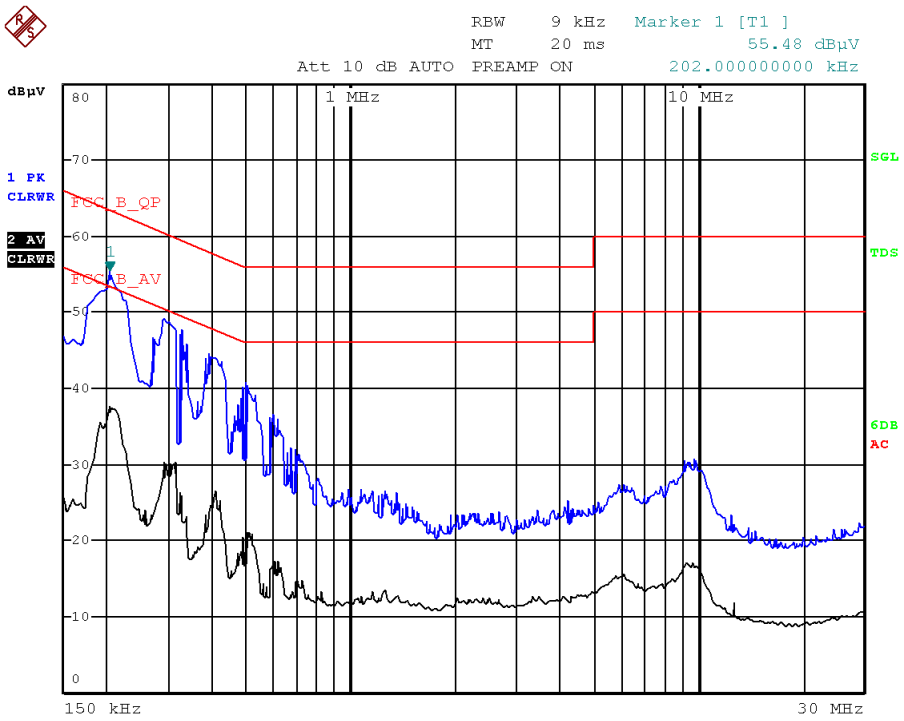
Test Specification	:	FCC Part 15 Section 15.207
Test Method	:	ANSI C63.4-2003
Testing Location	:	Screened room
Measurement Bandwidth	:	9kHz
Frequency Range	:	150kHz – 30MHz
Supply Voltage	:	110 Volt 60Hz AC

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

Test Result:

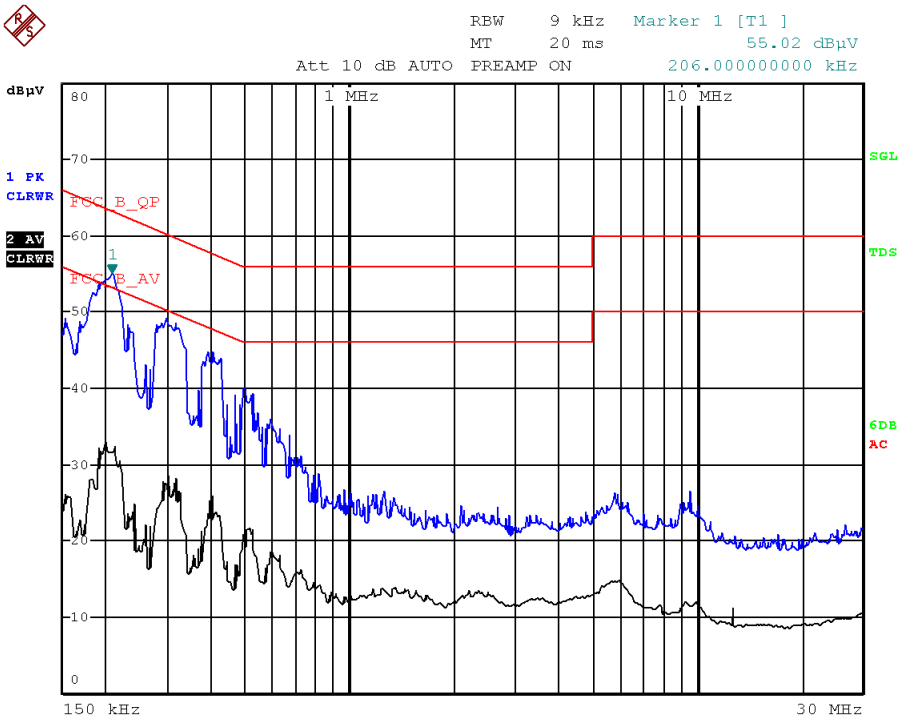


EDIT PEAK LIST (Final Measurement Results)

Trace1:	FCC_B_QP
Trace2:	FCC_B_AV
Trace3:	---

TRACE		FREQUENCY	LEVEL dBµV		DELTA LIMIT dB
1	Quasi Peak	202 kHz	50.80	L1	-12.72
1	Quasi Peak	290 kHz	44.57	L1	-15.94
2	Average	202 kHz	37.29	L1	-16.23
1	Quasi Peak	326 kHz	42.30	L1	-17.25
1	Quasi Peak	390 kHz	39.82	L1	-18.23
1	Quasi Peak	498 kHz	35.79	L1	-20.24
1	Quasi Peak	486 kHz	34.64	L1	-21.59
2	Average	290 kHz	28.80	L1	-21.71
2	Average	406 kHz	25.75	L1	-21.97
1	Quasi Peak	594 kHz	30.94	L1	-25.05
2	Average	498 kHz	19.97	L1	-26.05
2	Average	9.254 MHz	16.39	L1	-33.60
1	Quasi Peak	9.786 MHz	23.54	L1	-36.45

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	206 kHz	51.10 N	-12.25
1 Quasi Peak	294 kHz	45.01 N	-15.39
1 Quasi Peak	402 kHz	40.23 N	-17.58
1 Quasi Peak	494 kHz	35.46 N	-20.63
2 Average	198 kHz	31.51 N	-22.17
2 Average	298 kHz	27.43 N	-22.86
2 Average	402 kHz	24.72 N	-23.09
2 Average	514 kHz	21.84 N	-24.15
1 Quasi Peak	590 kHz	31.21 N	-24.78
1 Quasi Peak	466 kHz	30.40 N	-26.17

Mode: Negative