Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**19660076 001**		**Seite 1 von 37** *Page 1 of 37*
Auftraggeber: *Client:*	**ATMEL NORWAY AS** **VESTRE ROSTEN 79** **7075 TILLER** **TRONDHEIM** **NORWAY – 7075**		
Gegenstand der Prüfung: *Test item:*	**SAMR21-XPRO**		
Bezeichnung: *Identification:*	**A09-2127**	**Serien-Nr.:** *Serial No.*	**Engineering Sample**
Wareneingangs-Nr.: *Receipt No.:*	**1803032243**	**Eingangsdatum:** *Date of receipt:*	**28.02.2014**
Prüfort: *Testing location:*	**Refer Page 4 of 37 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:*

12.03.2014	Saibaba Siddapur Engineer	Saibaba
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

kontrolliert / *reviewed by:*

14.03.2014	Raghavendra Kulkarni Sr.Manager	Kulkarni
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges /*Other Aspects:*	**FCC ID:VW4A092127**

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(e)	Power Spectral Density	Pass
FCC 15.247(a) (2)	6dB Bandwidth	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

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	01.11.2014
Broadband Horn Antenna	Frankonia	HAX-18	HAX18-802	10.10.2014
Emission Horn Antenna	ETS Lindgren	116706	00107323	01.11.2014
Active Loop Antenna	Frankonia	LAX-10	LAX-10-800	01.11.2014
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 Atmel® SAM R21 Xplained Pro evaluation kit is a hardware platform to evaluate the ATSAMR21G18A microcontroller. ATSAMR21G18A has bidirectional 100 ohm differential antenna pins, which are fed through a balun to create a single 50 ohm unbalanced output/input. It has a passive analog RF switch connected to the unbalanced output of the balun. It has two antennas; one is the chip antenna and the SMA connector for external antennas. 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.

Ratings and System Details

Operating Frequency	2400MHz – 2483.5MHz
No. of channels	16
Channel Spacing	5MHz
Modulation	O-QPSK
Transmitted Power	4.07dBm
Data Rate	250kbps
Antenna Type	Refer Page 7 of 37
Number of antenna	Refer Page 7 of 37
Antenna Gain	Refer Page 7 of 37
Supply Voltage	5 V DC (from USB Port)
Dimensions	60mm x 60mm x 1.6mm
Environmental	-40 to +85 degrees C range

Test Conditions:

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

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

Test software (Atmel Studio 6.1) 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

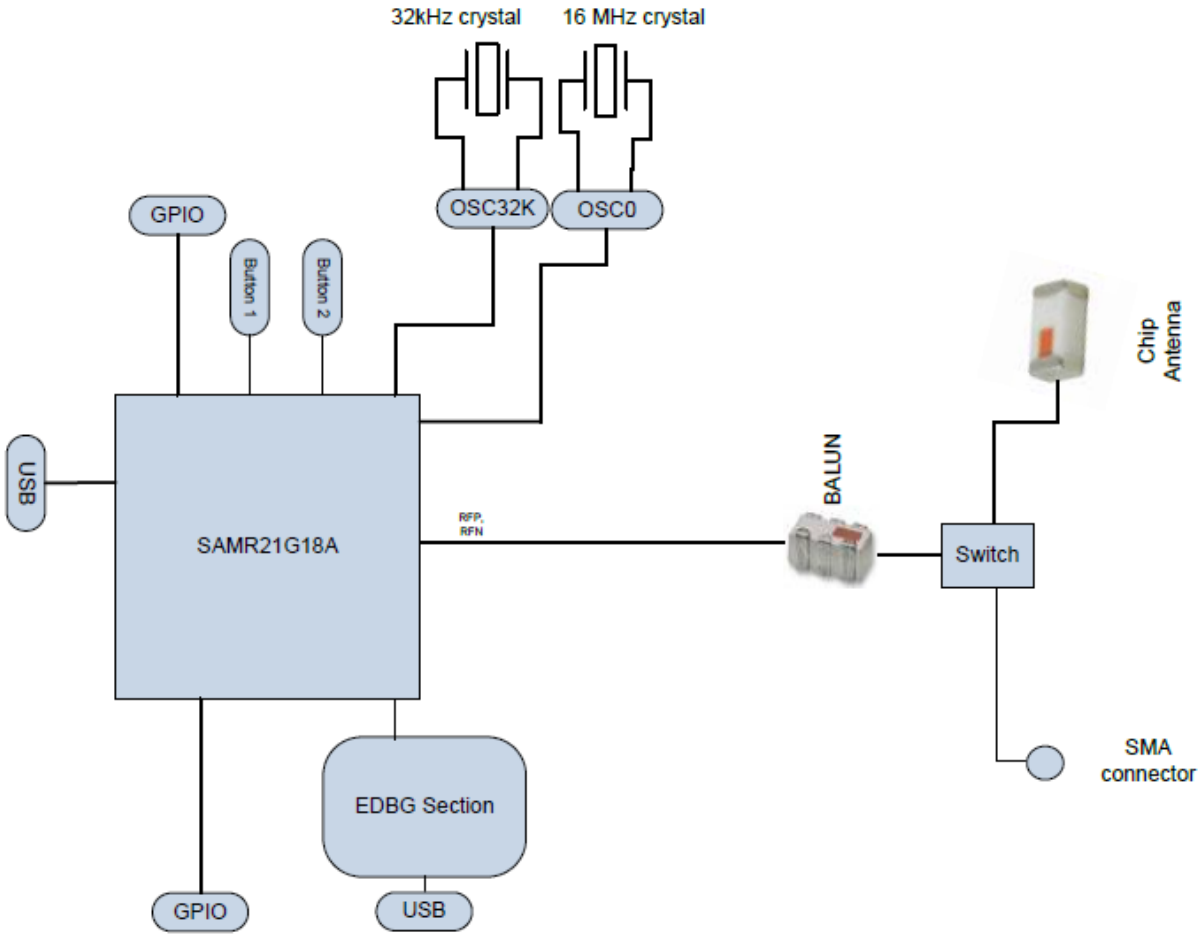
Note: Conducted Parameter, Radiated Spurious Emission and Restricted Bands of Operation testing carried out with Transmitter power Register values used for Ceramic antenna port and external antenna port are listed as below

Antenna	Channel	TX Power Register value
Ceramic Antenna	Low (2405)	0
	Mid(2440)	0
	High (2480)	13
External Antenna	Low (2405)	0
	Mid(2440)	0
	High (2480)	9

Antenna Used

Make	Model/Part #	Antenna Gain (dBi)	Type of Antenna
Johanson Technology	2450AT18D0100	1.5dBi	Ceramic Antenna
Tekfun Co., Ltd	M01-SS2	0dBi	External Antenna

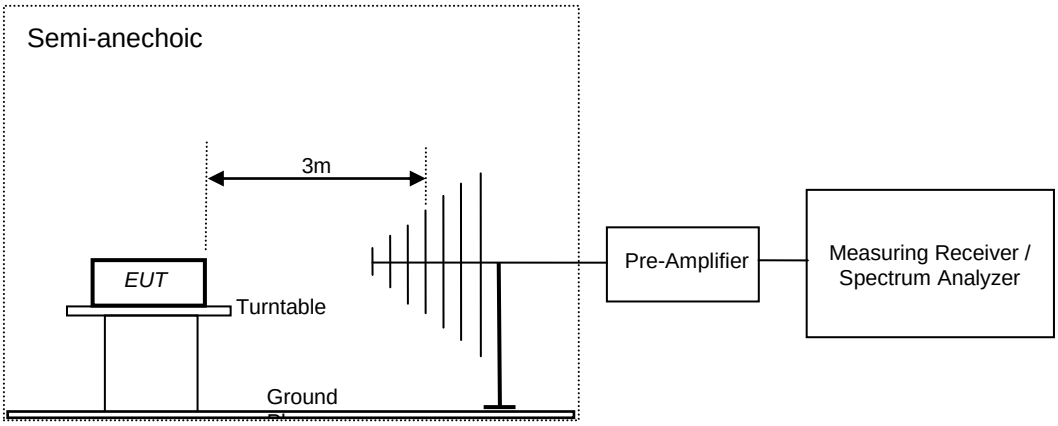
Block Diagram



Test Methodology

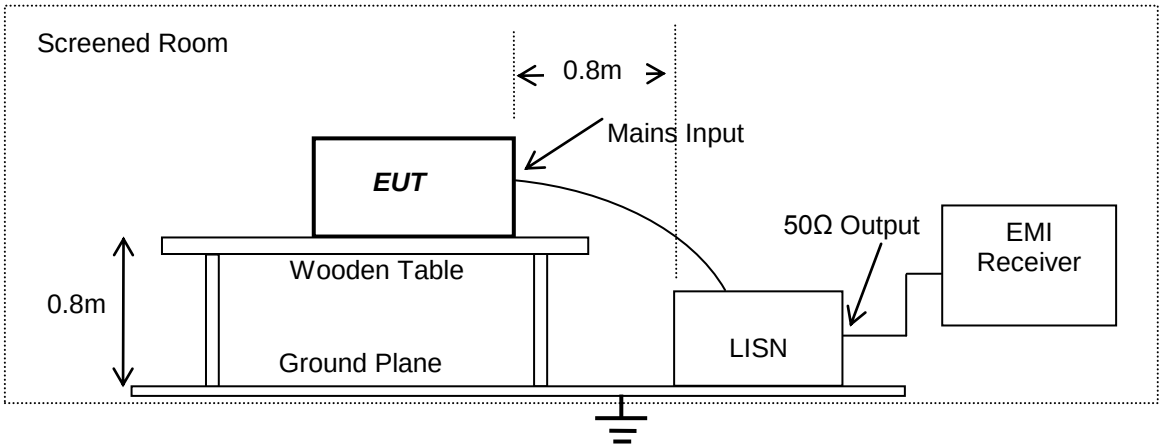
Radiated Emission Test

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.



Conducted Emission Test on A.C. mains line

The equipment under test (EUT) was placed on a wooden table 80cm above the ground plane, the LISN was place 80cm away from the EUT. The test was performed in accordance with ANSI C63.4: 2003, with the following: an initial measurement was performed in peak and average detection mode on the live and neutral lines. The pre-scan was performed by peak detection on both live and neutral conductors. Any emissions recorded within 20dB of the relevant limit line were re-measured using quasi-peak and average detections, the 6 worst cases was recorded in the table of results.

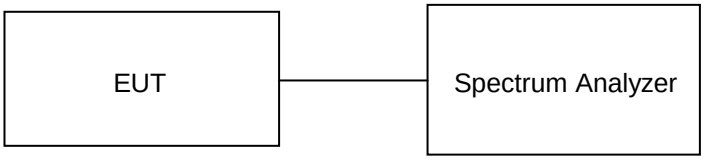


Test Results

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).

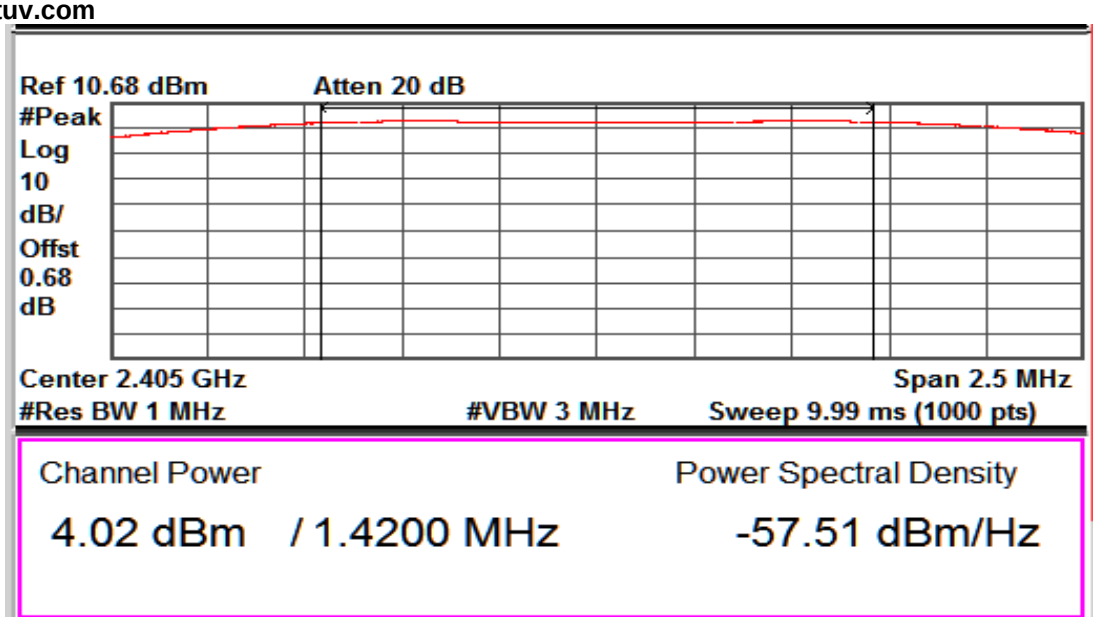
Test Method:



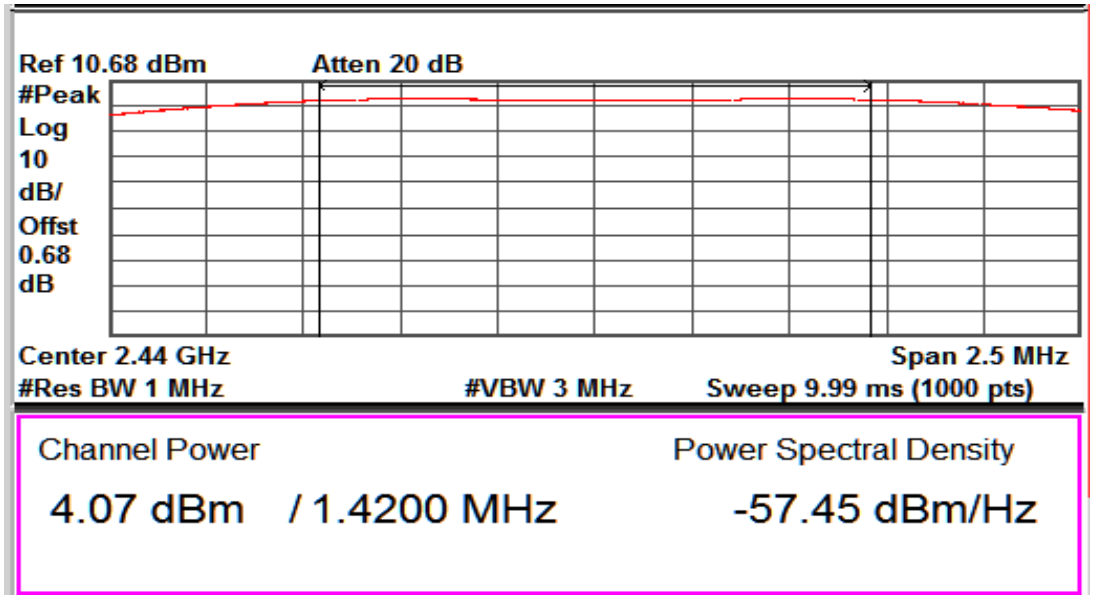
Note: cable (0.68dB) offset already part of measurement offset in spectrum analyzer.

Test Result:

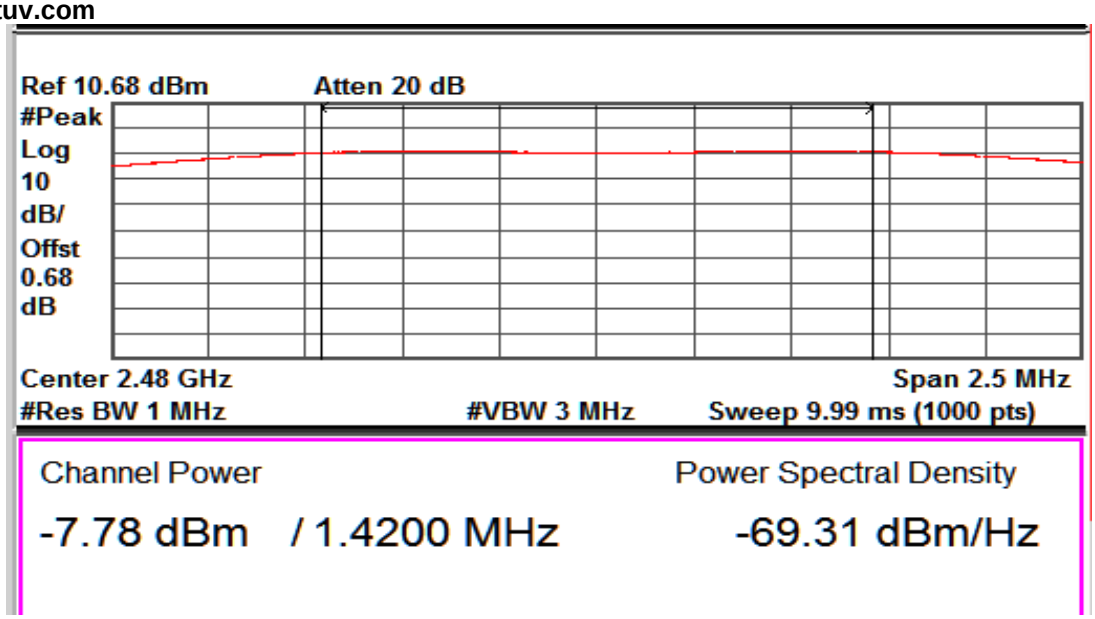
Antenna Port	Frequency (MHz)	Total Output power (dBm)	Limit (dBm)	Margin (dB)
Ceramic Antenna Port	2405	4.02	30	-25.98
	2440	4.07	30	-25.93
	2480	-7.78	30	-37.78
External Antenna Port	2405	3.17	30	-26.83
	2440	2.67	30	-27.33
	2480	-2.23	30	-32.23



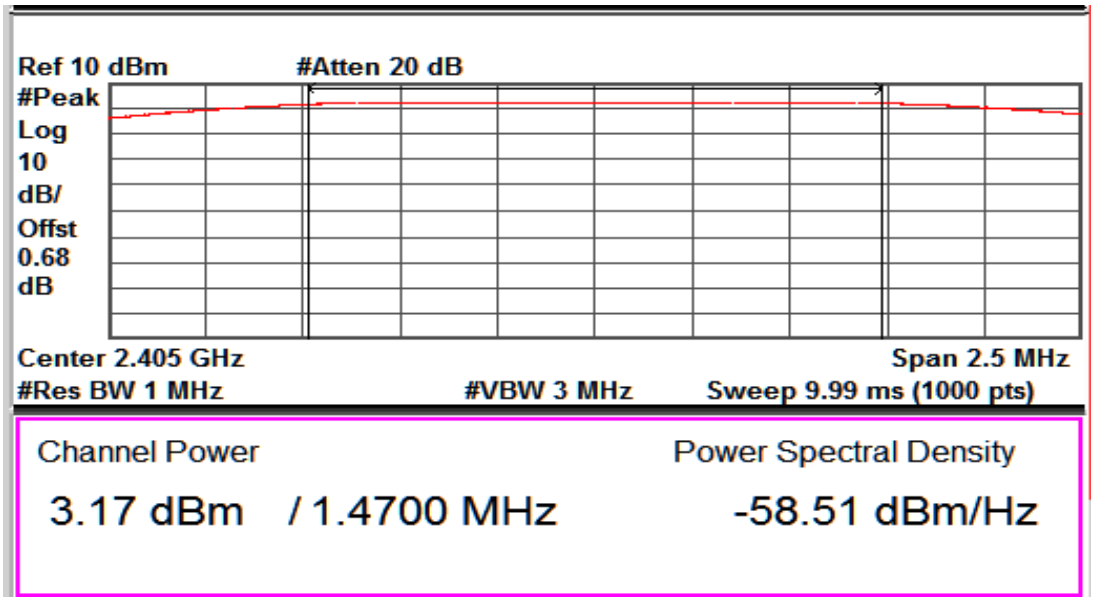
Channel Frequency: 2405 MHz



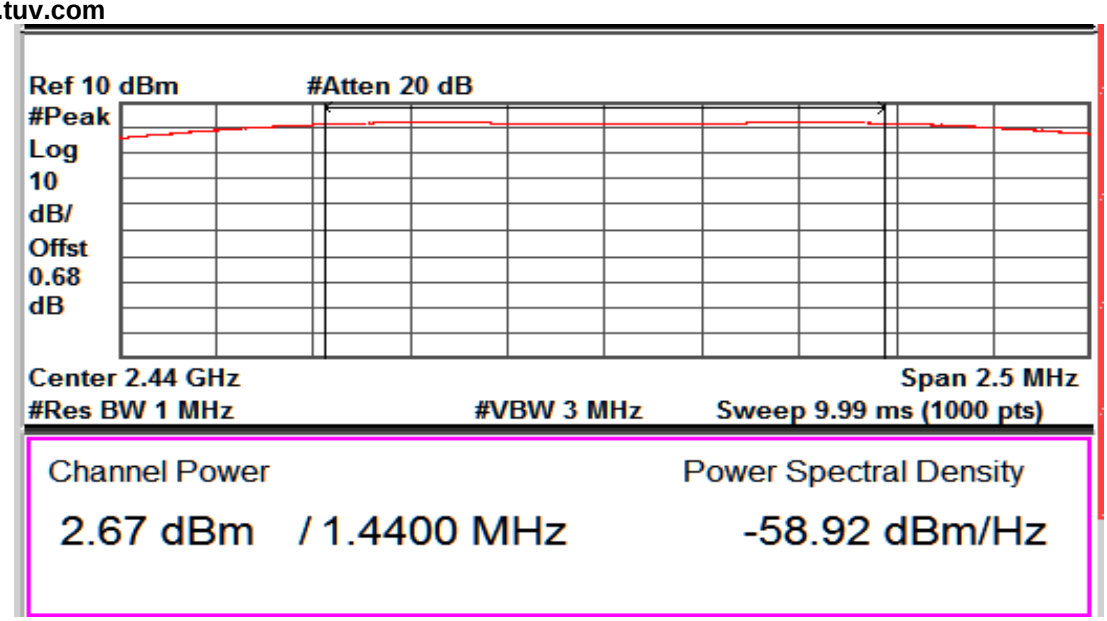
Channel Frequency: 2440 MHz



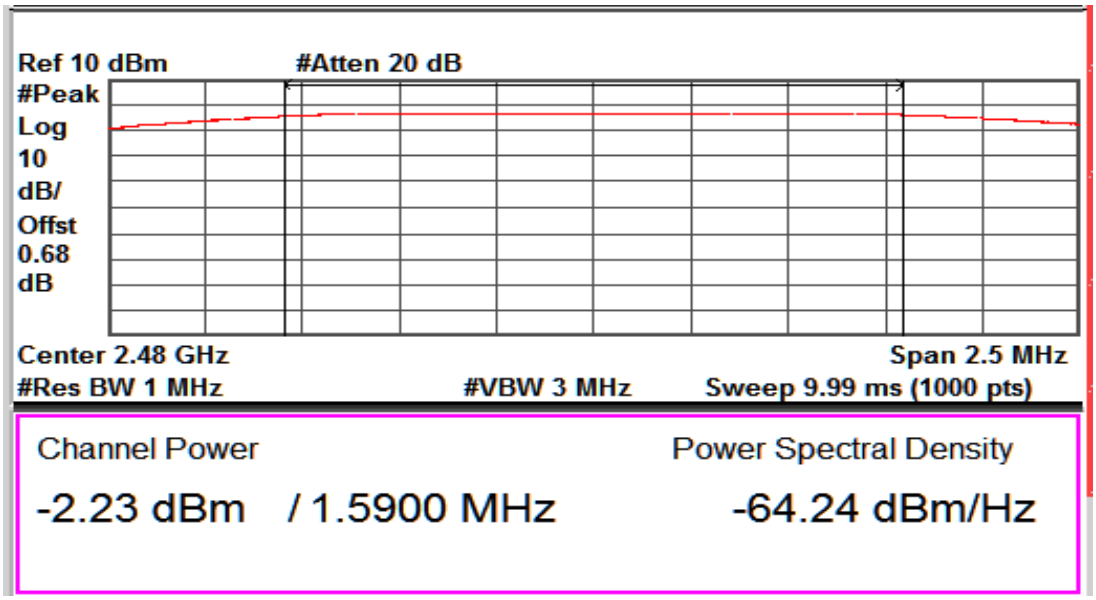
Channel Frequency: 2480 MHz



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

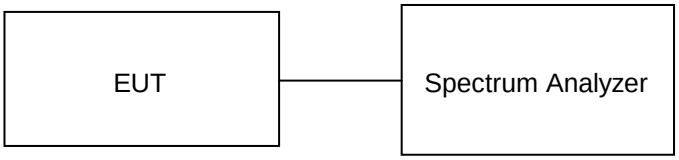


Channel Frequency: 2480 MHz

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.

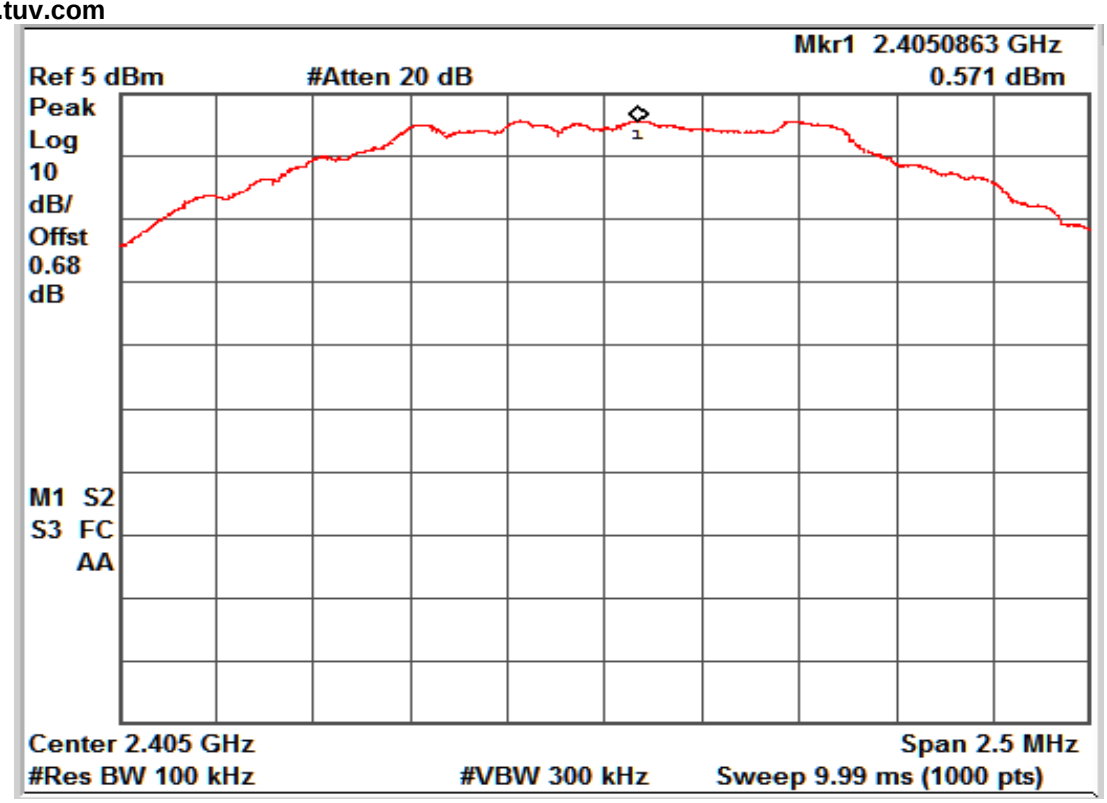
Test Method:



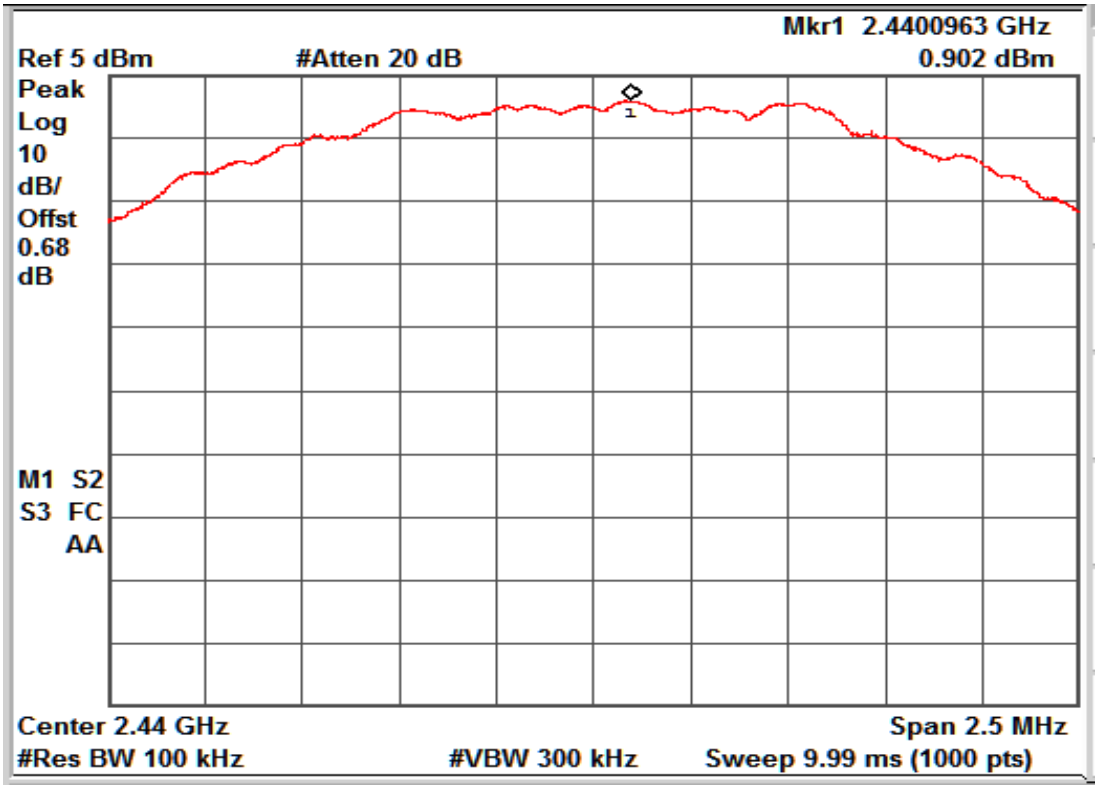
Note: cable (0.68dB) offset already part of measurement offset in spectrum analyzer.

Test Result:

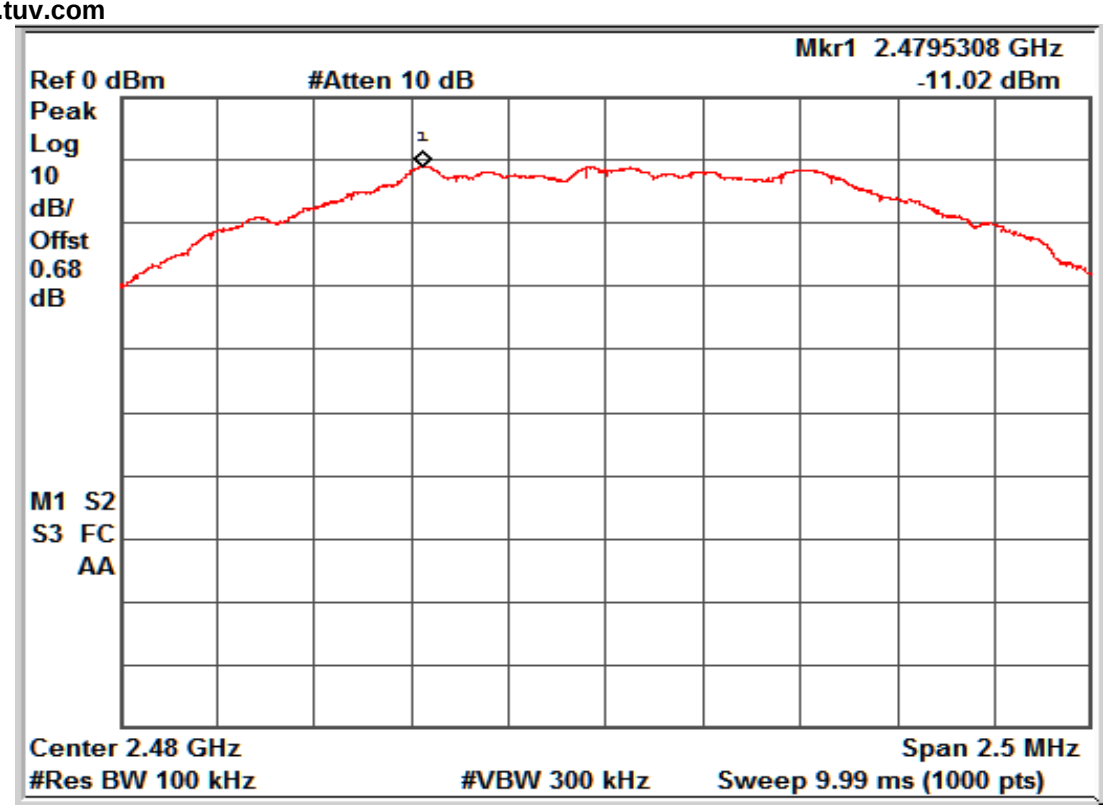
Antenna Port	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Ceramic Antenna Port	2405	0.57	8	-7.43
	2440	0.90	8	-7.10
	2480	-11.02	8	-19.02
External Antenna Port	2405	-0.10	8	-8.10
	2440	0.54	8	-7.46
	2480	-4.50	8	-12.50



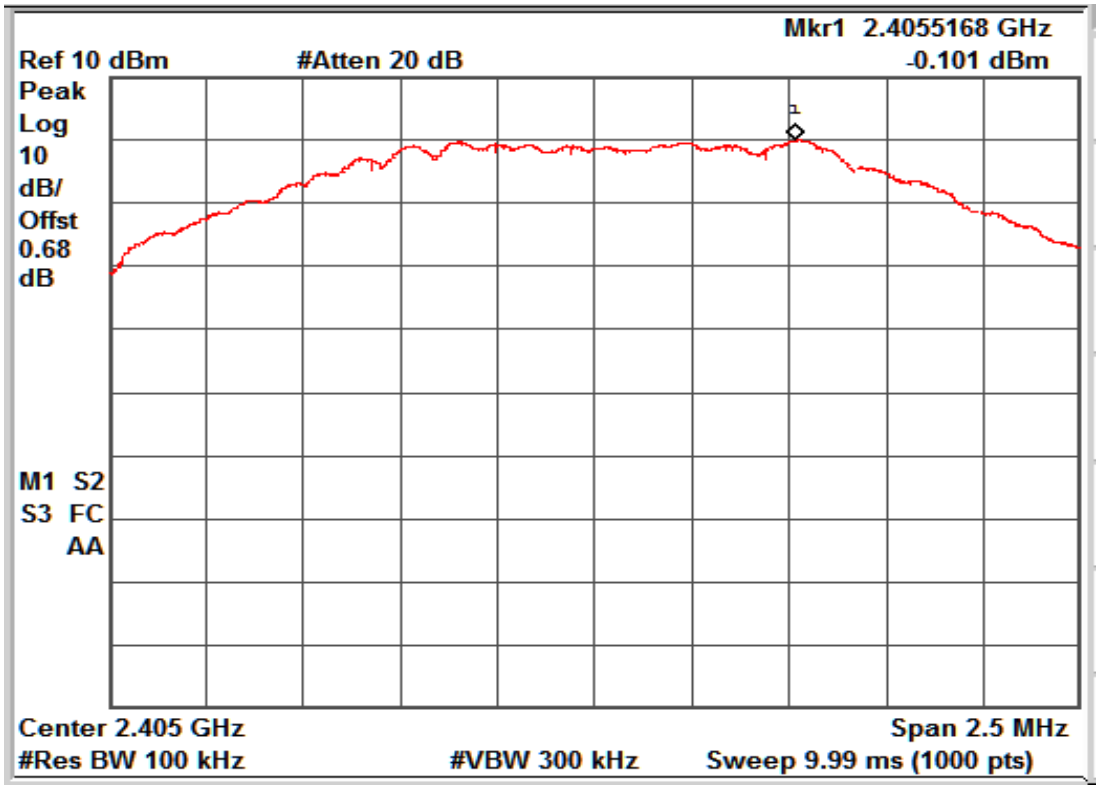
Channel Frequency: 2405 MHz



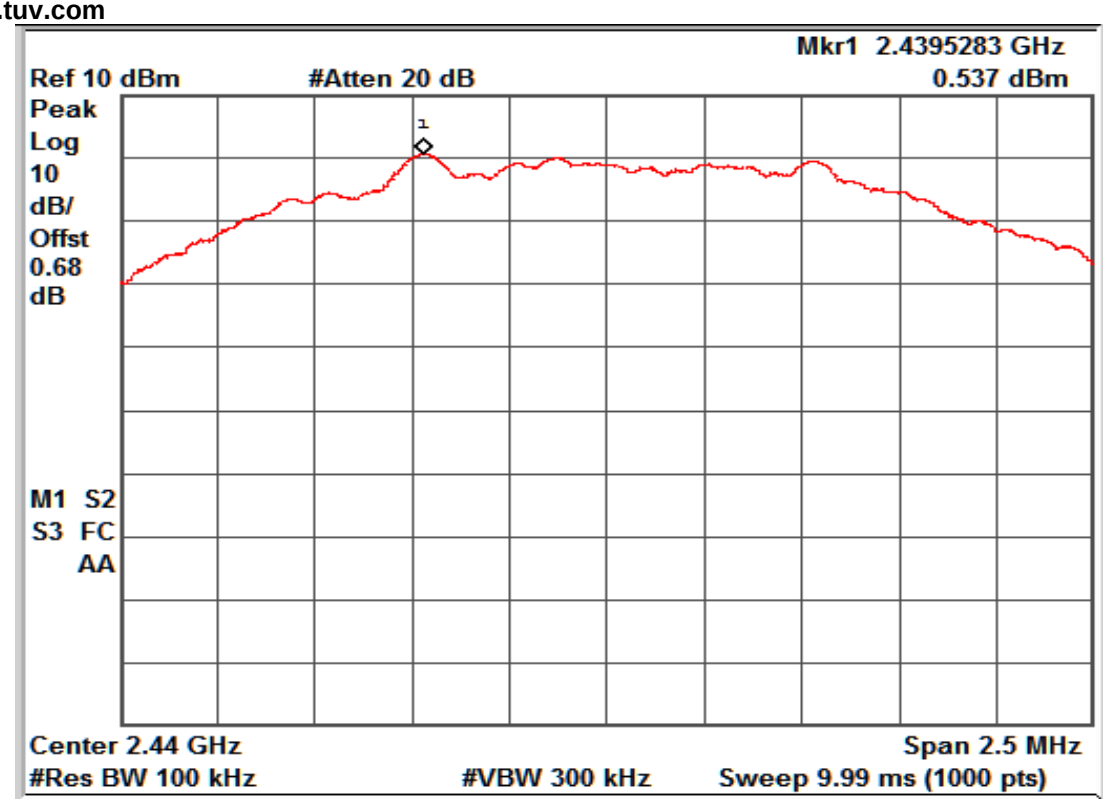
Channel Frequency: 2440 MHz



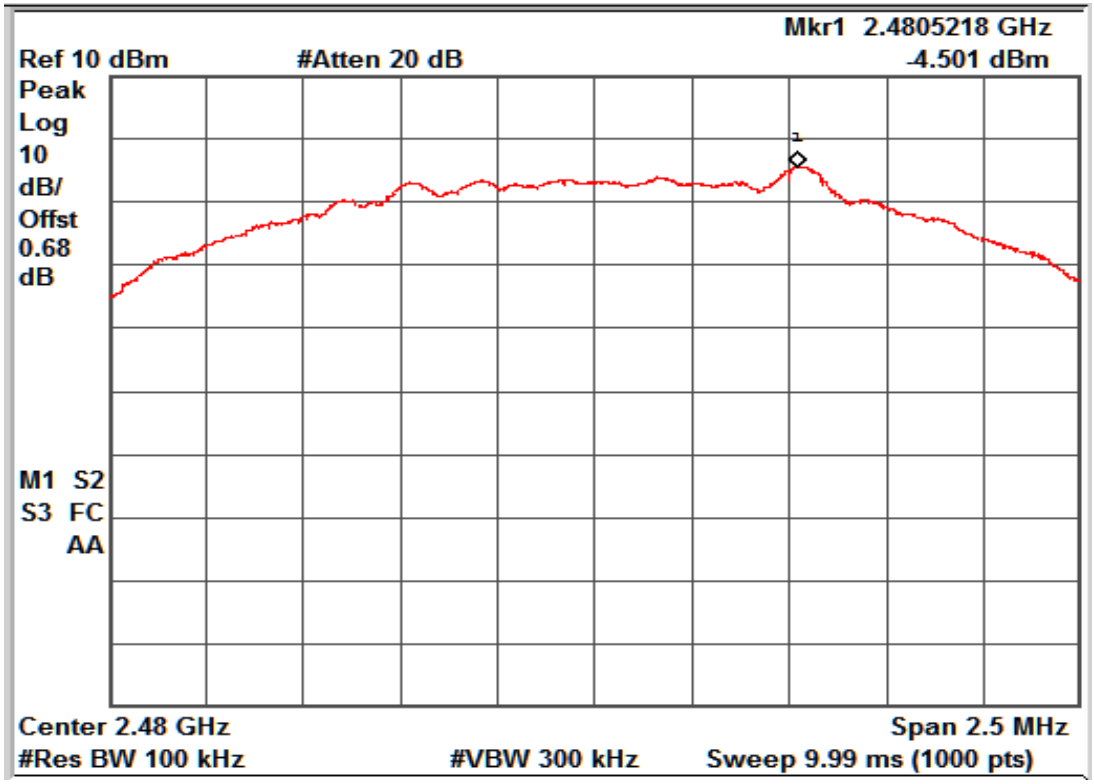
Channel Frequency: 2480 MHz



Channel Frequency: 2405 MHz



Channel Frequency: 2440 MHz

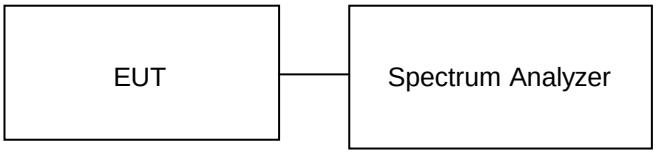


Channel Frequency: 2480 MHz

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.

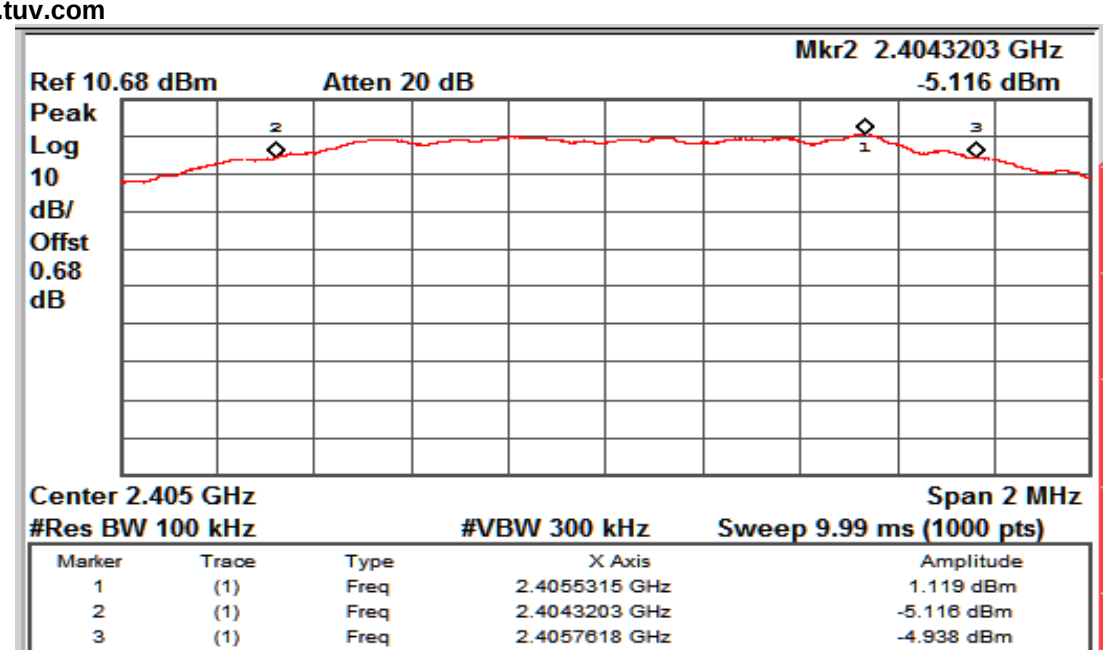
Test Method:



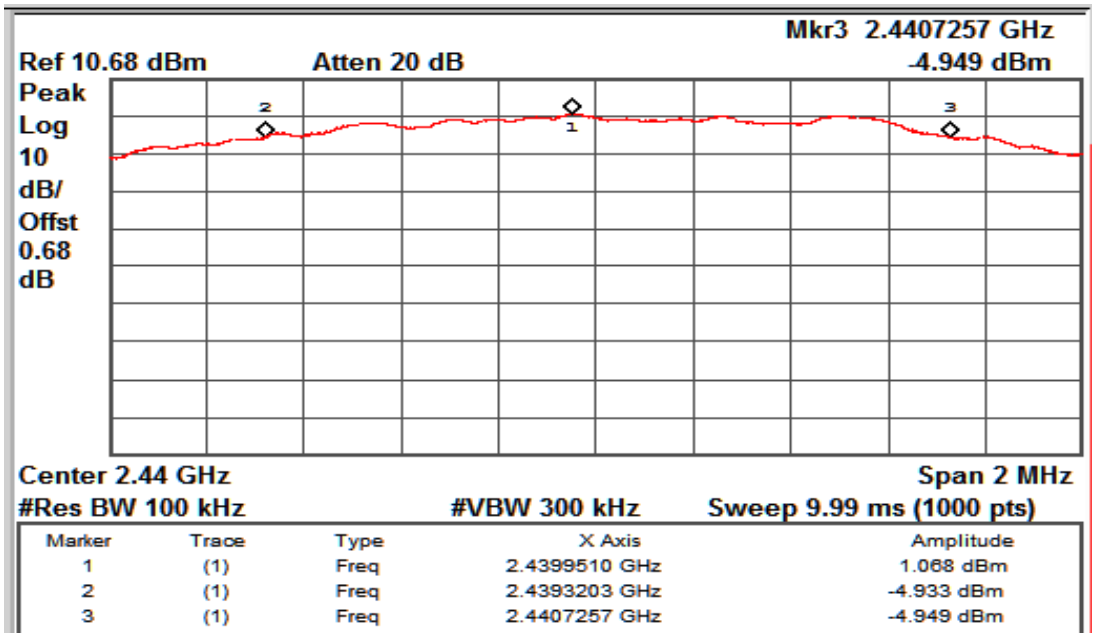
Note: cable (0.68dB) offset already part of measurement offset in spectrum analyzer.

Test Result:

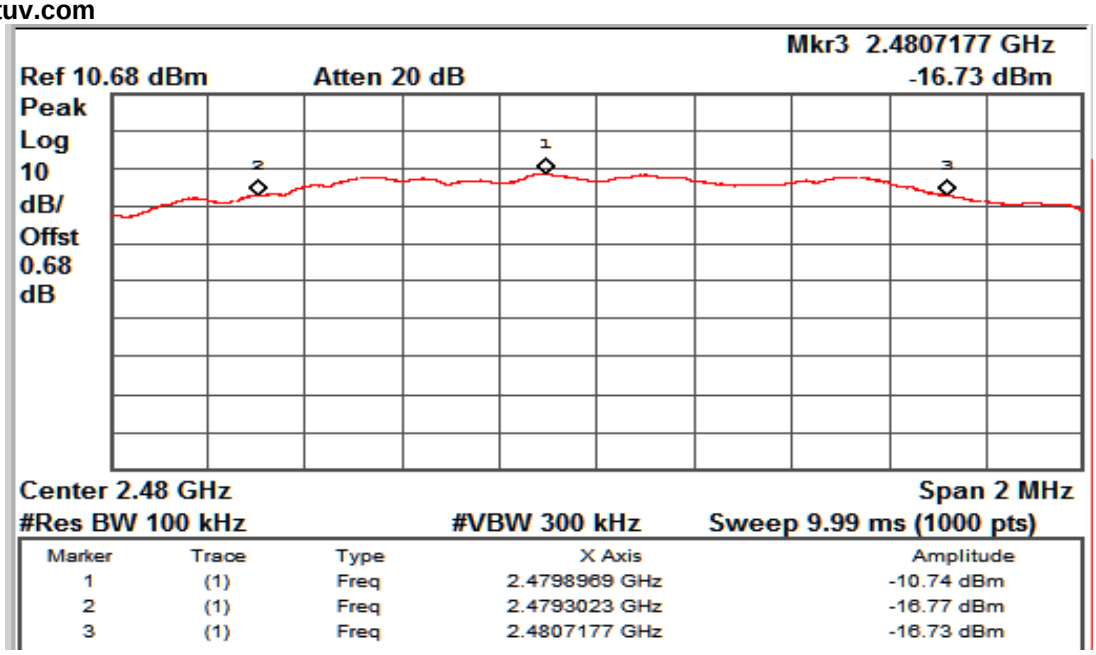
Antenna Port	Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	6 dB Bandwidth (MHz)	OBW (MHz)
Ceramic Antenna Port	2405	2404.32	2405.76	1.44	2.28
	2440	2439.32	2440.72	1.40	2.32
	2480	2479.3	2480.71	1.41	2.35
External Antenna Port	2405	2404.32	2405.79	1.47	2.28
	2440	2439.32	2440.76	1.44	2.33
	2480	2479.22	2480.81	1.59	2.37



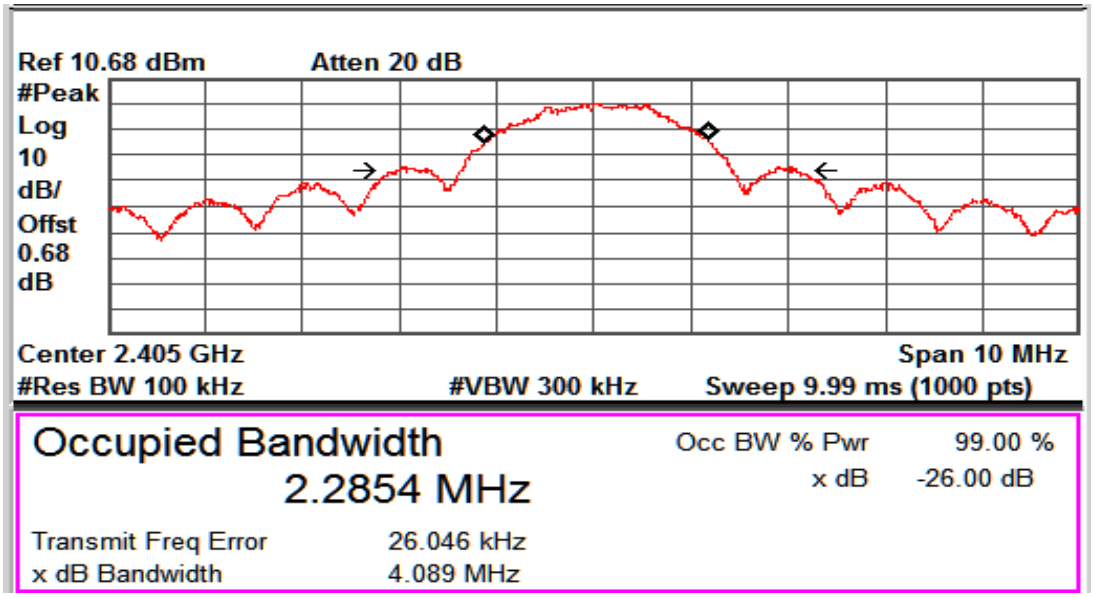
Channel frequency: 2405 MHz



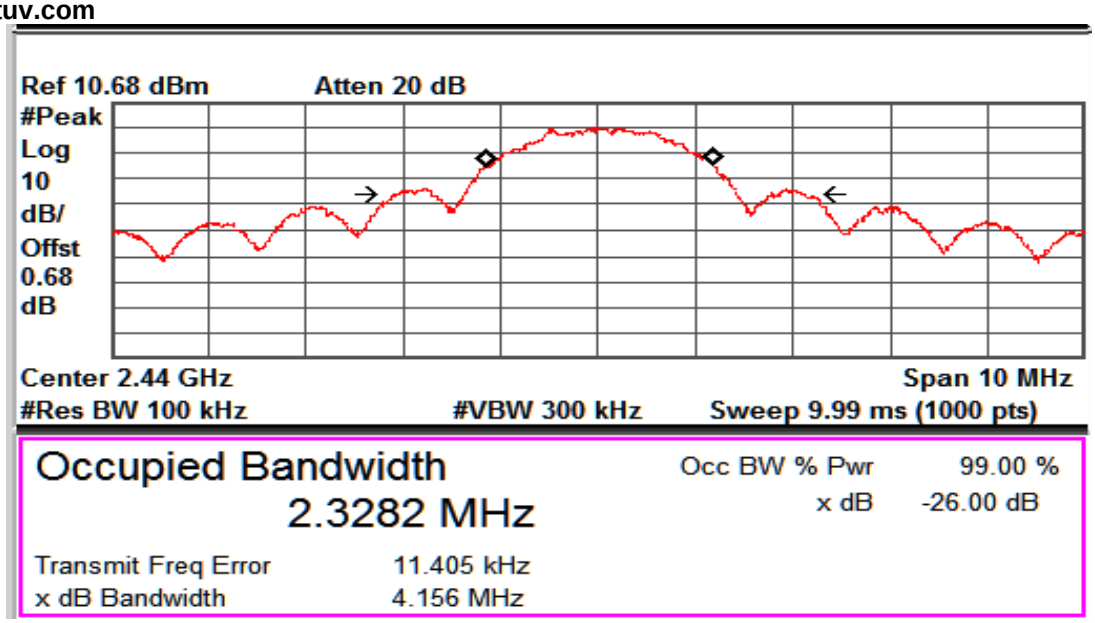
Channel frequency: 2440 MHz



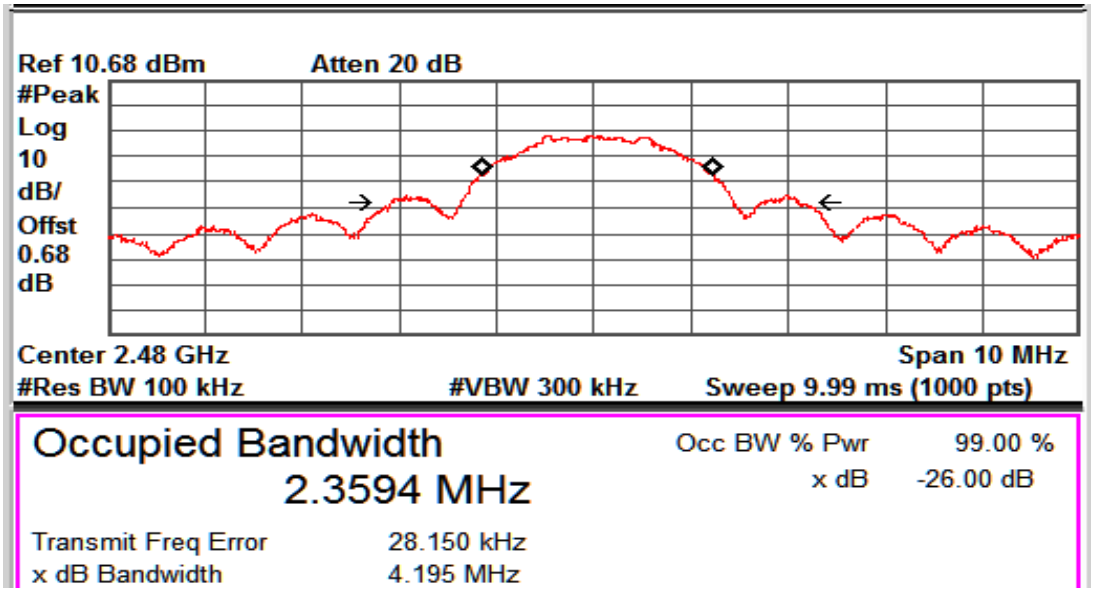
Channel frequency: 2480 MHz



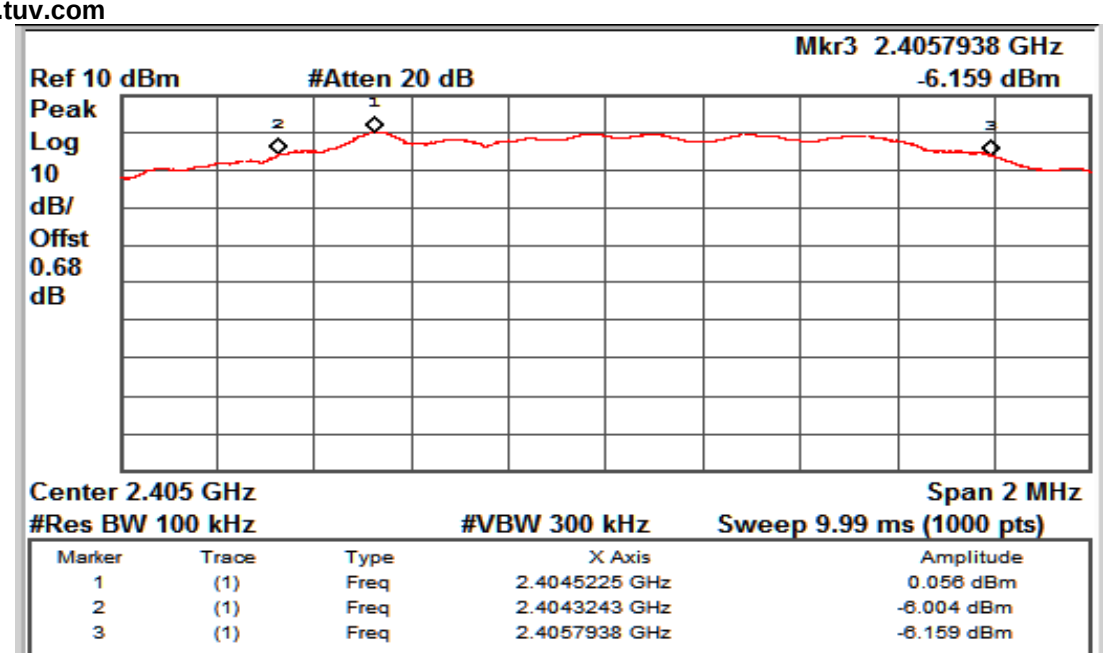
OBW Channel frequency: 2405 MHz



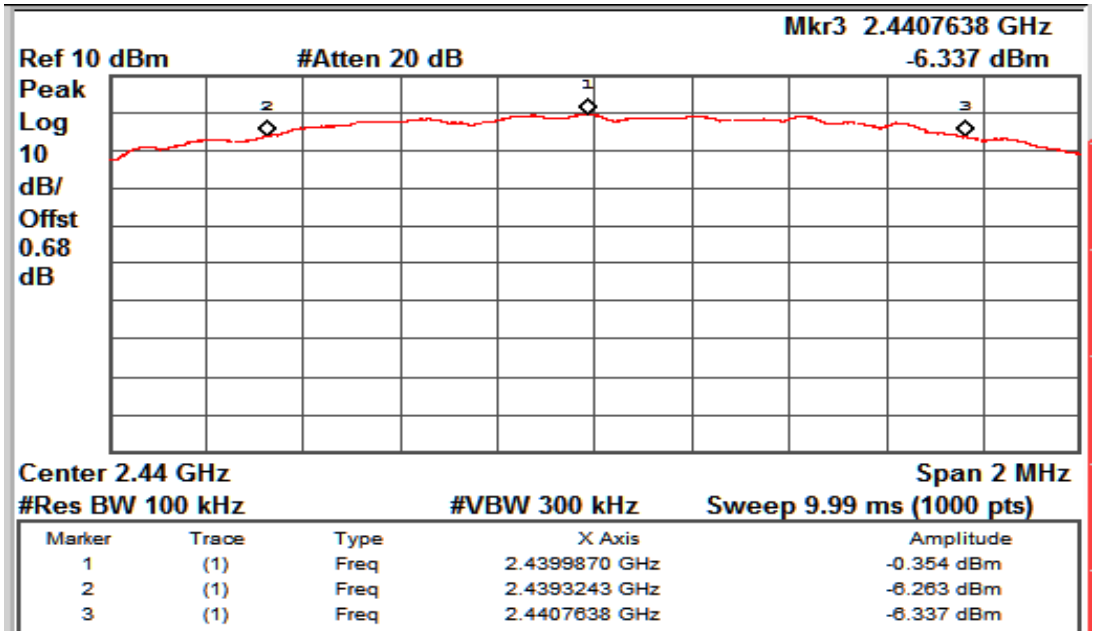
OBW Channel frequency: 2440 MHz



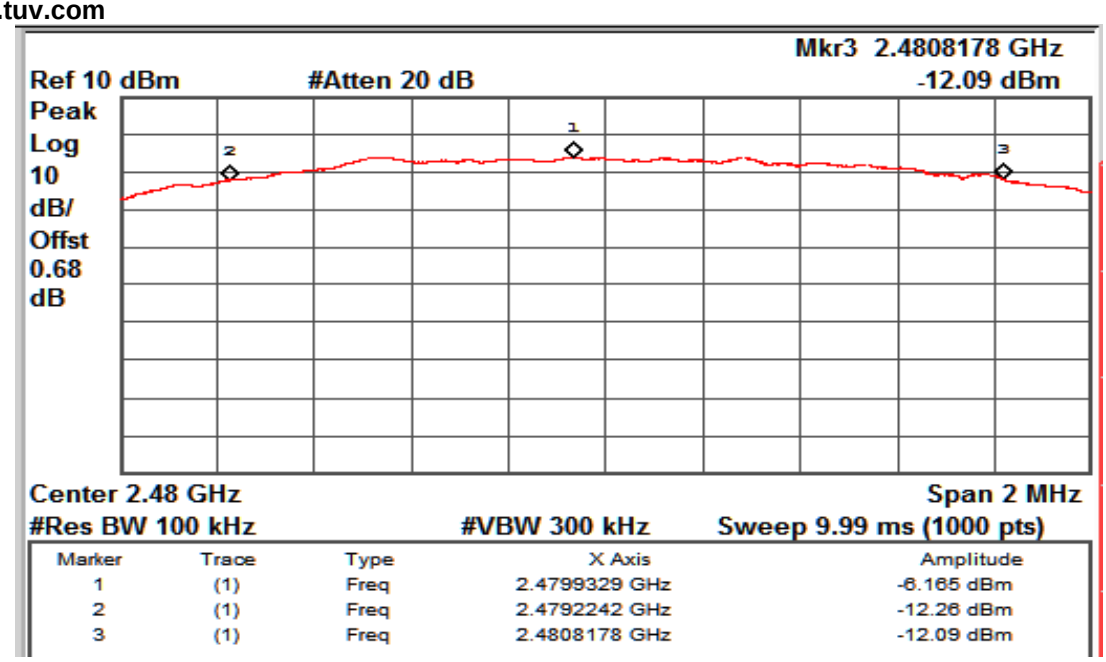
OBW Channel frequency: 2480 MHz



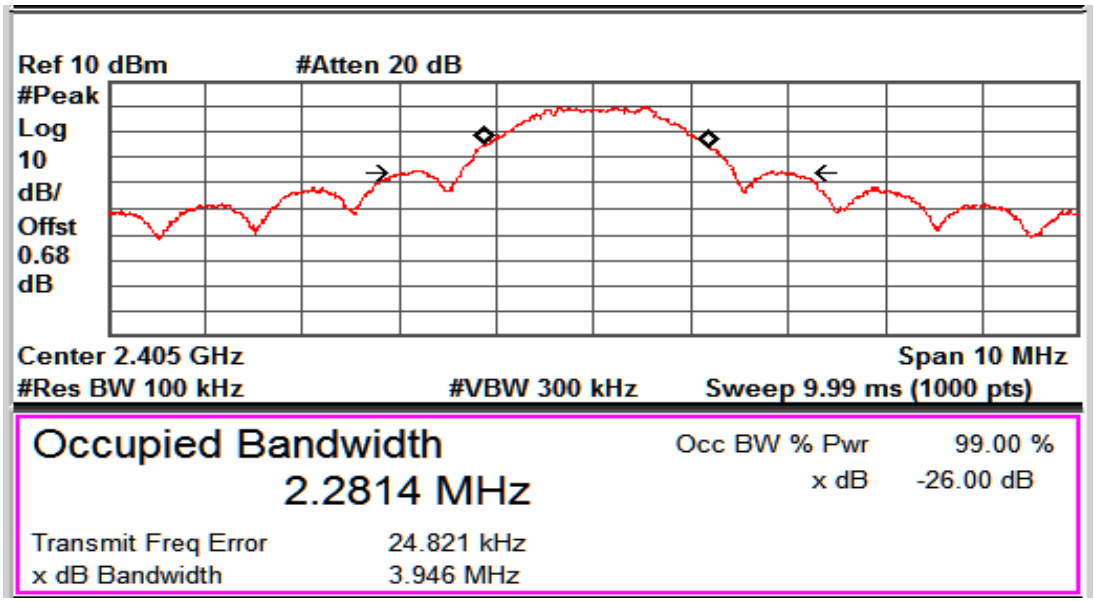
Channel frequency: 2405 MHz



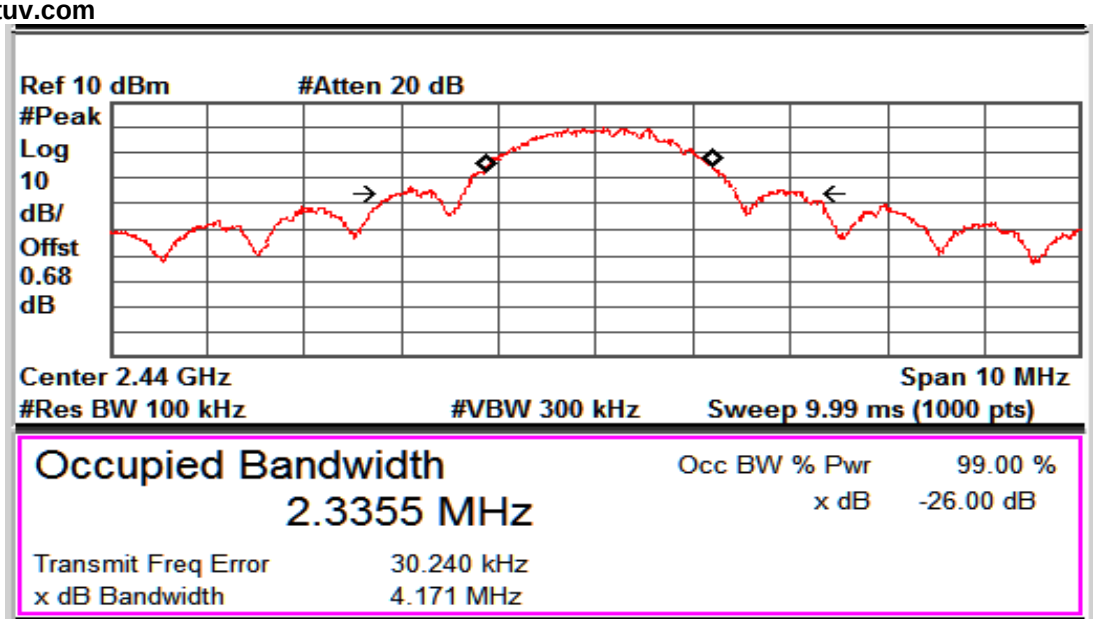
Channel frequency: 2440 MHz



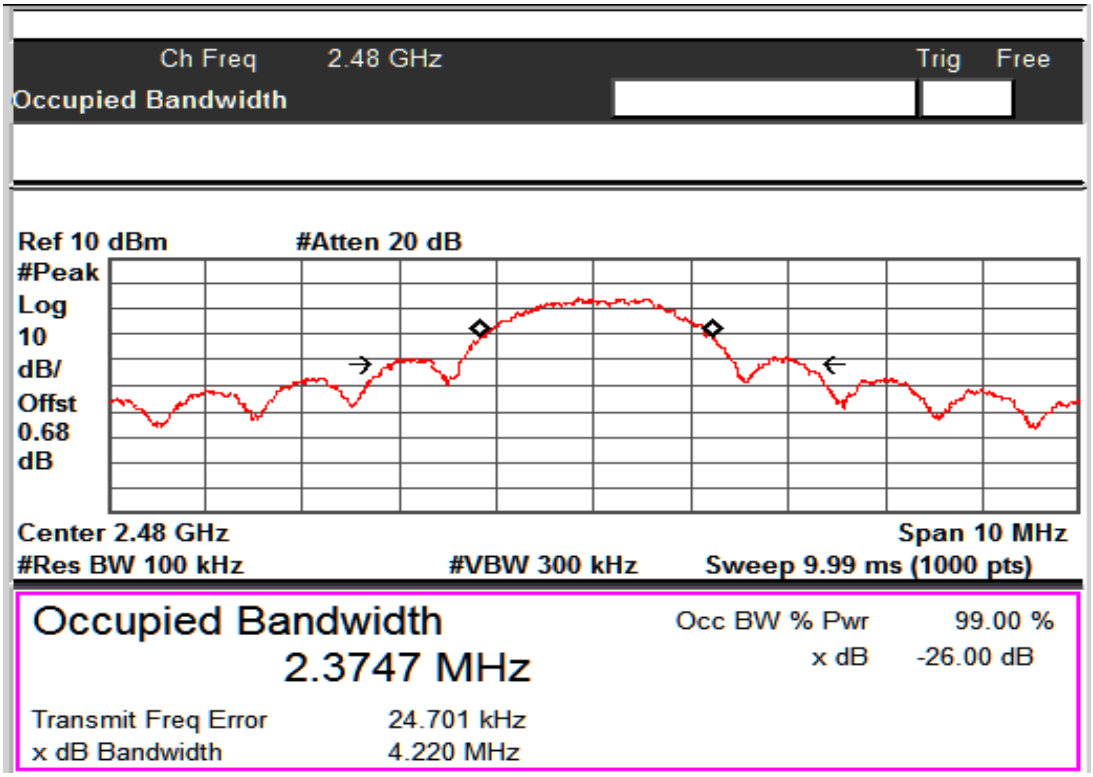
Channel frequency: 2480 MHz



OBW Channel frequency: 2405 MHz



OBW Channel frequency: 2440 MHz

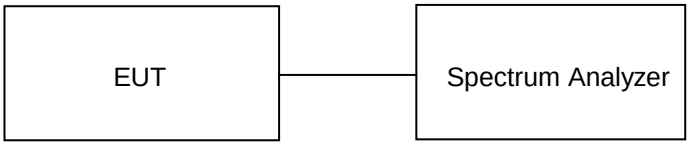


OBW Channel frequency: 2480 MHz

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:

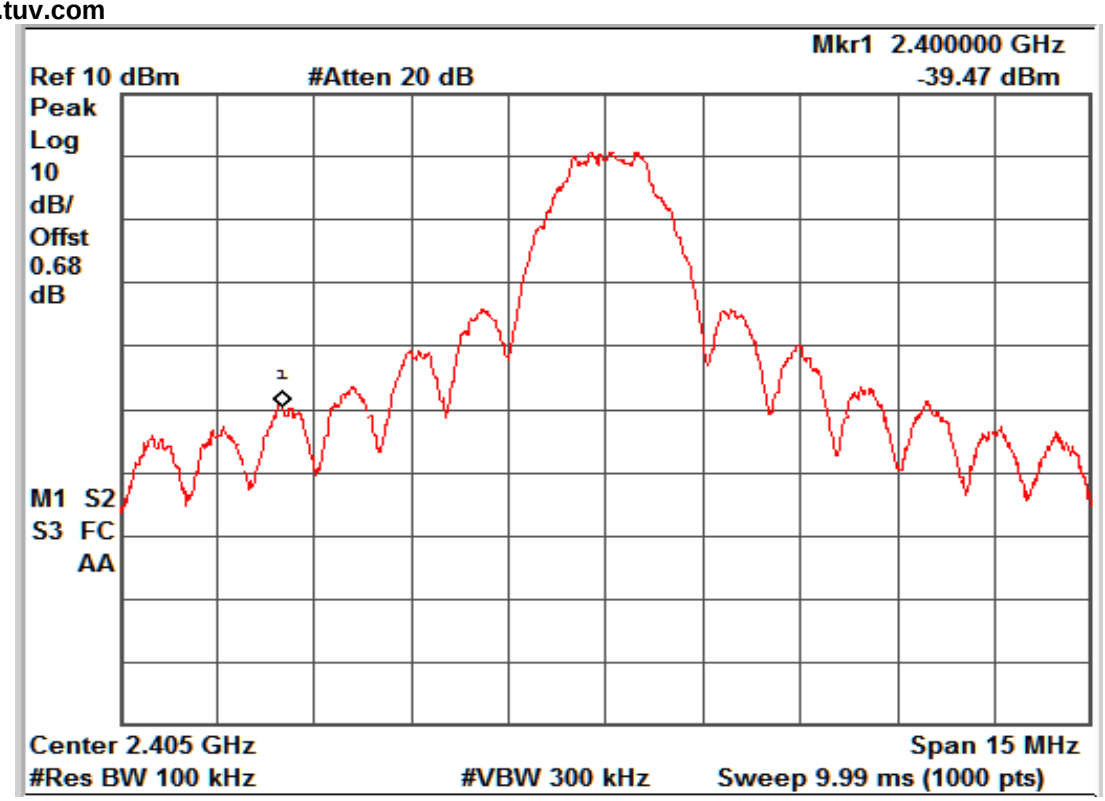


Note: cable (0.68dB) offset already part of measurement offset in spectrum analyzer.

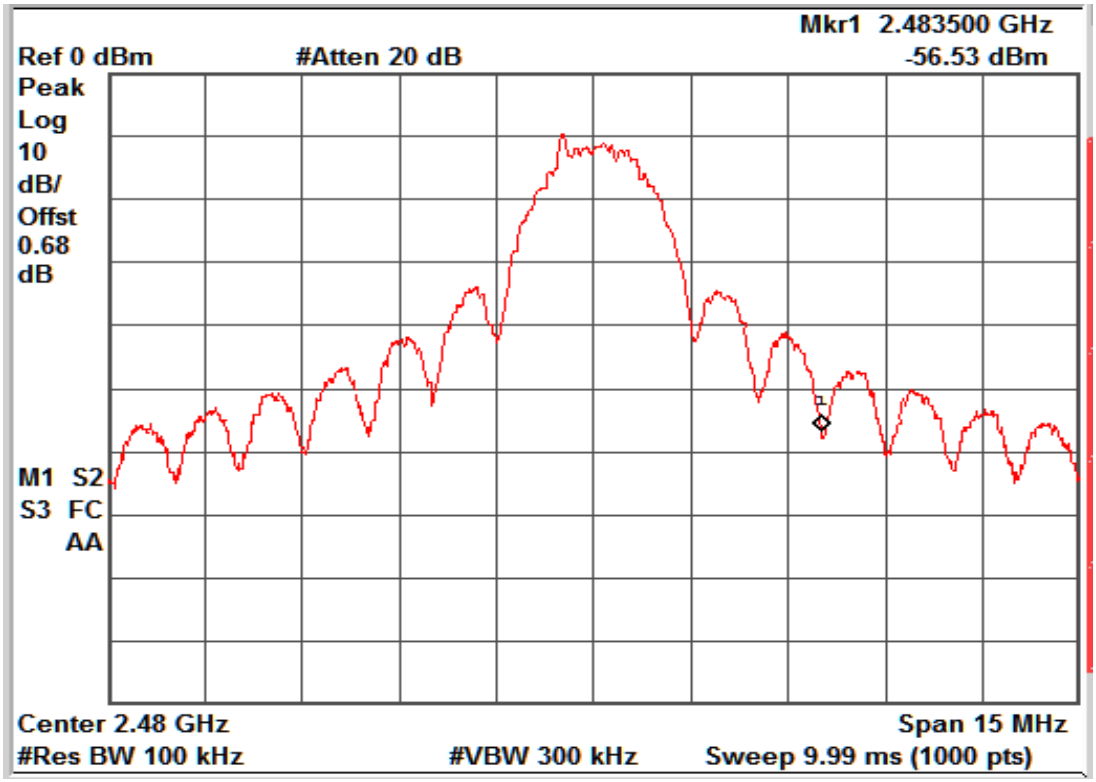
Test Result:

Antenna port	Channel Frequency (MHz)	Value at Band Edge				Limit (dBc)
		Band Edge Frequency (MHz)	Measured PSD Level*	Band Edge Value (dBm)	Value (dBc)	
Ceramic Antenna Port	2405	2400.00	00.57	-39.47	40.04	20.00
	2480	2483.50	-11.02	-56.53	45.51	20.00
External Antenna Port	2405	2400.00	-00.10	-39.83	39.73	20.00
	2480	2483.50	-4.50	-50.76	46.26	20.00

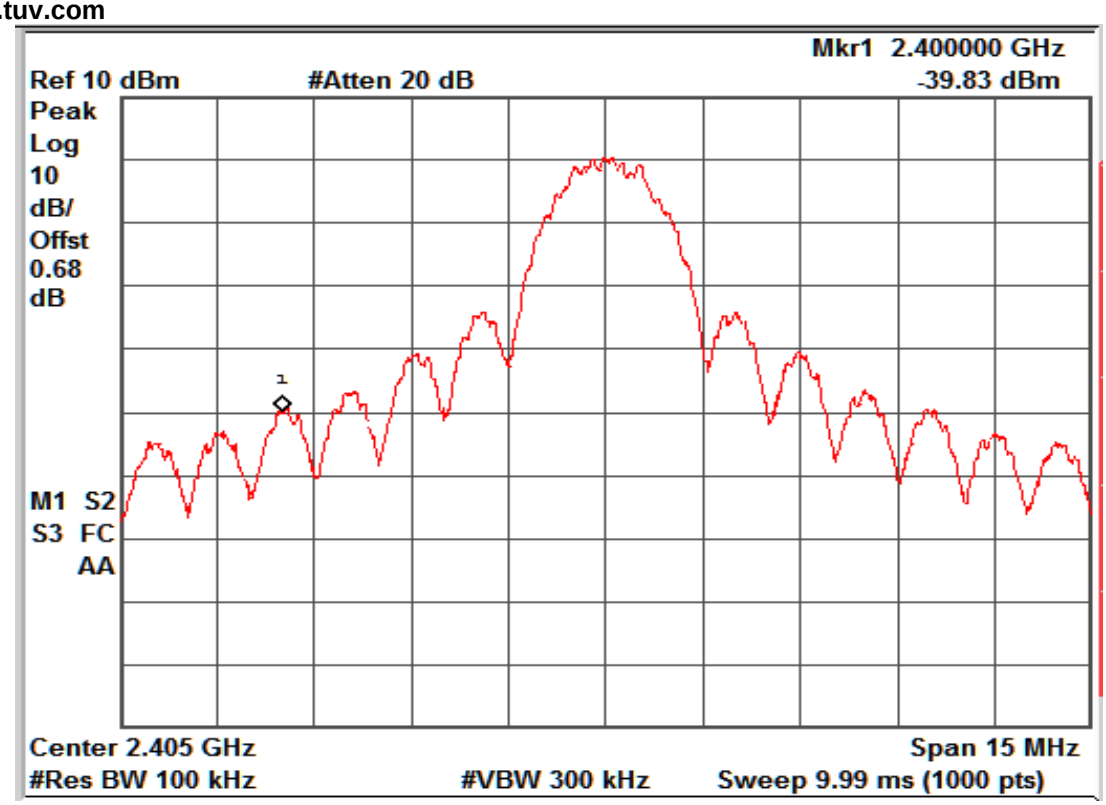
Note: The reference values are taken from the plots reported under the Power spectral Density Section 15.247(e).



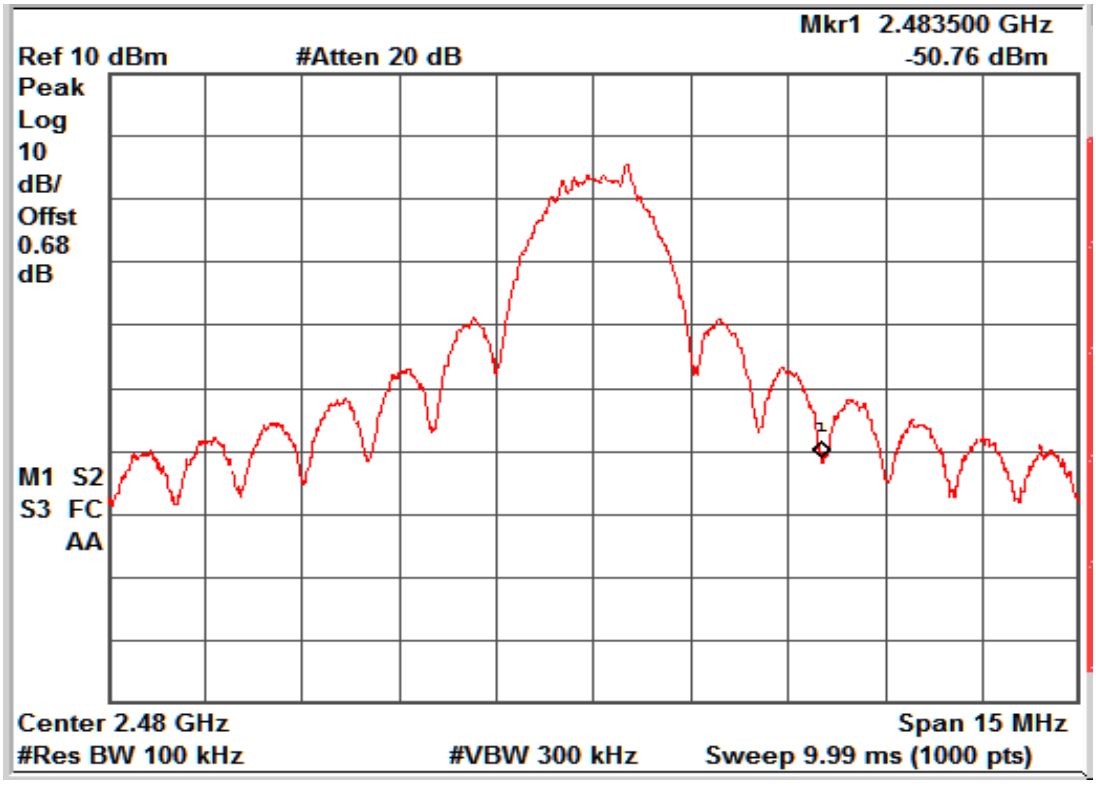
Channel frequency: 2405 MHz



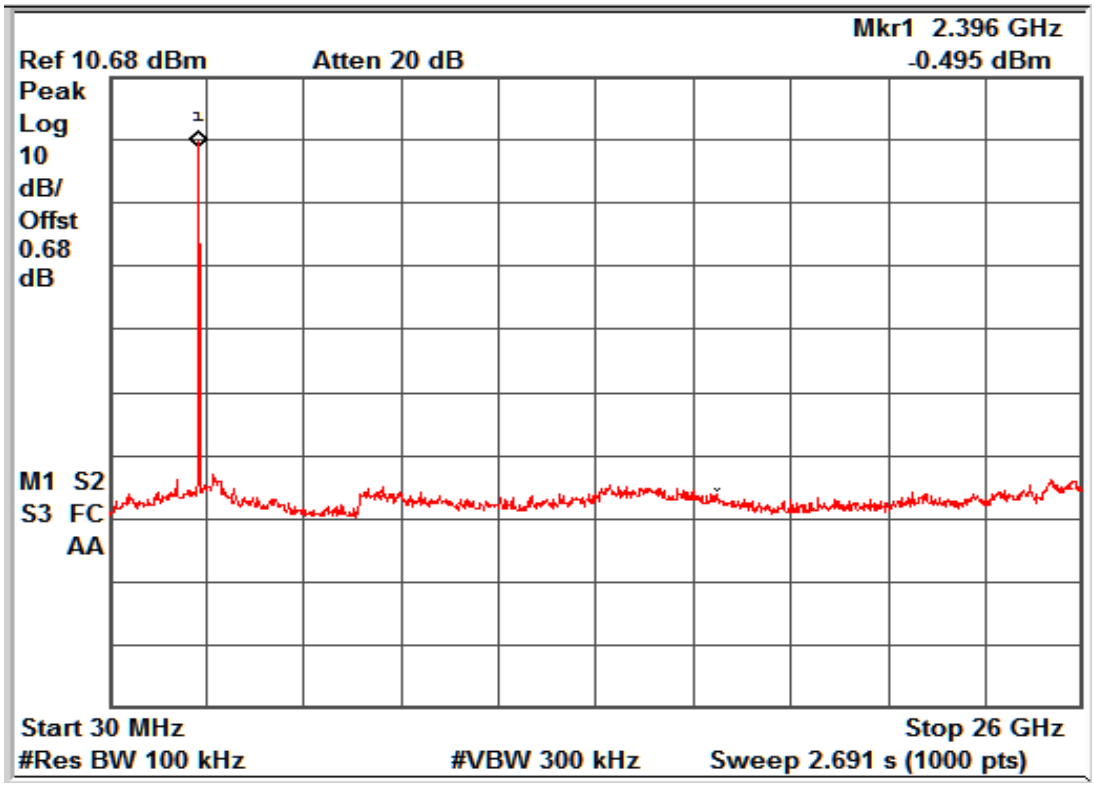
Channel frequency: 2480 MHz



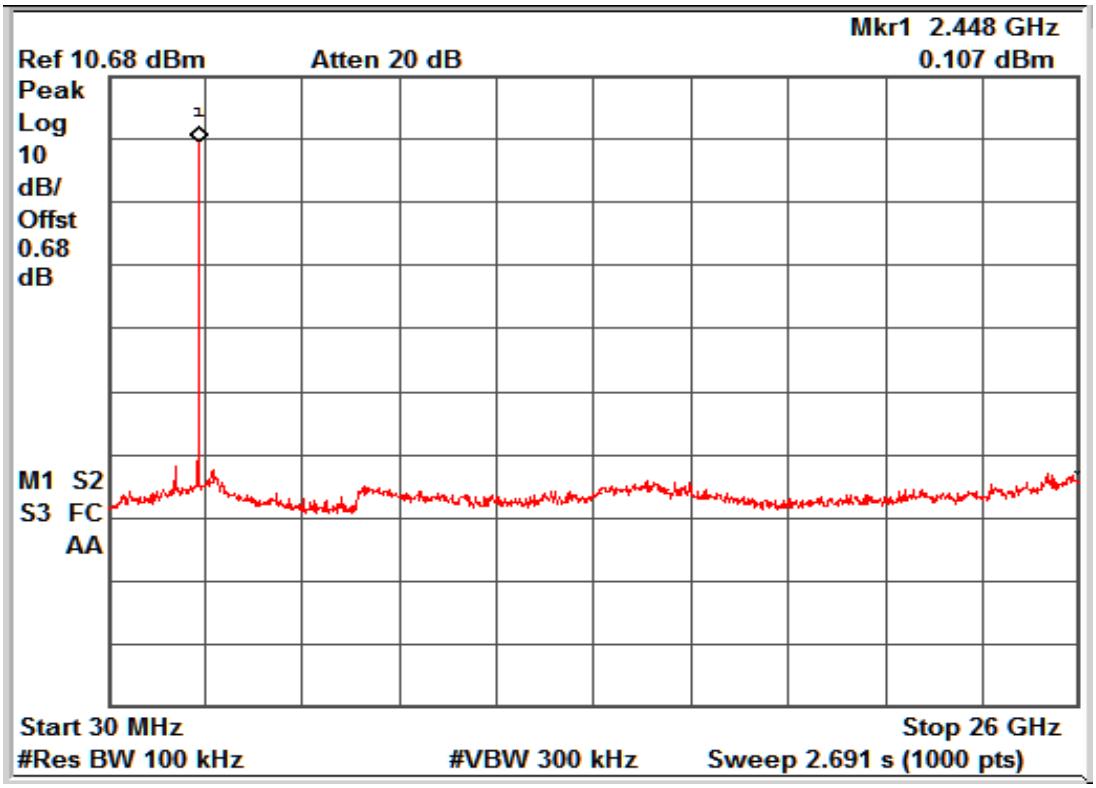
Channel frequency: 2405 MHz



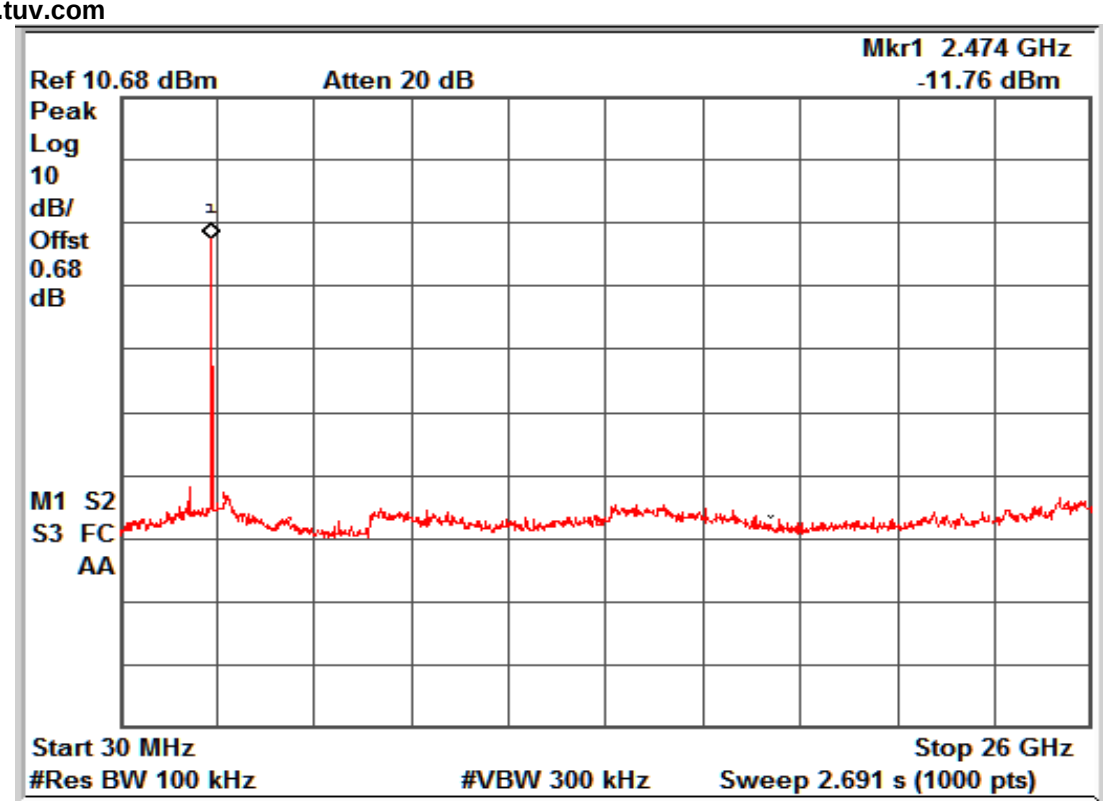
Channel frequency: 2480 MHz



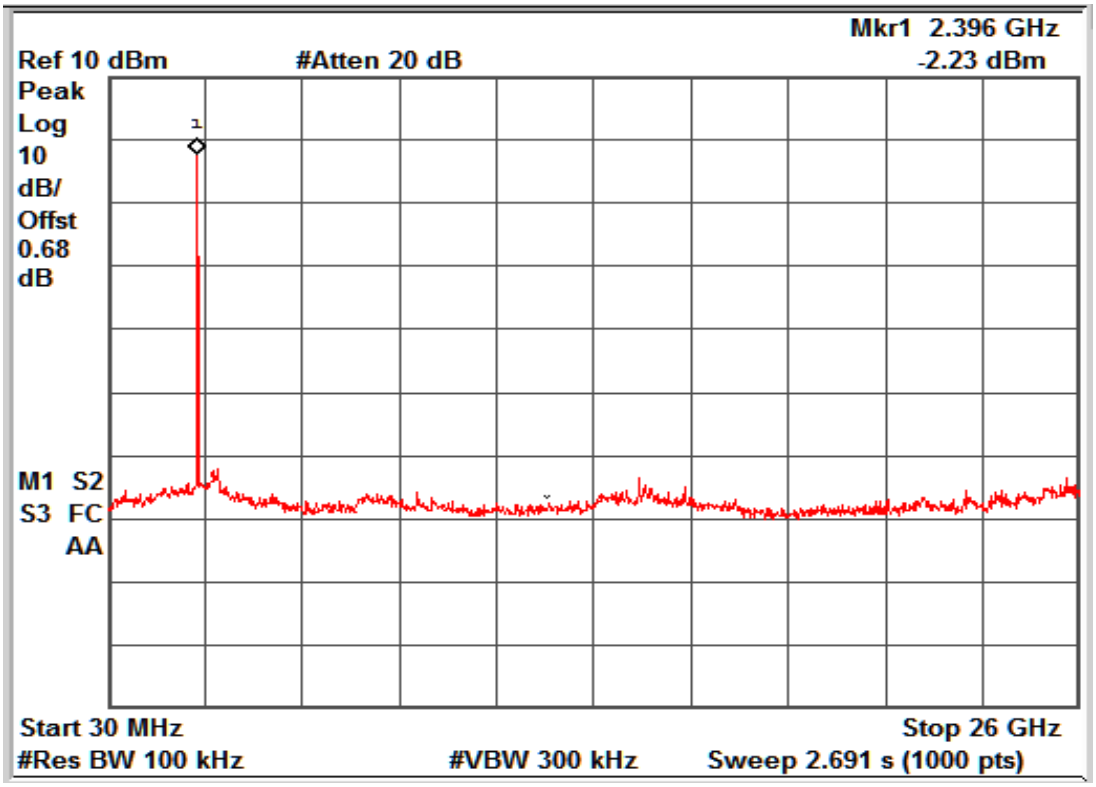
Channel frequency: 2405 MHz



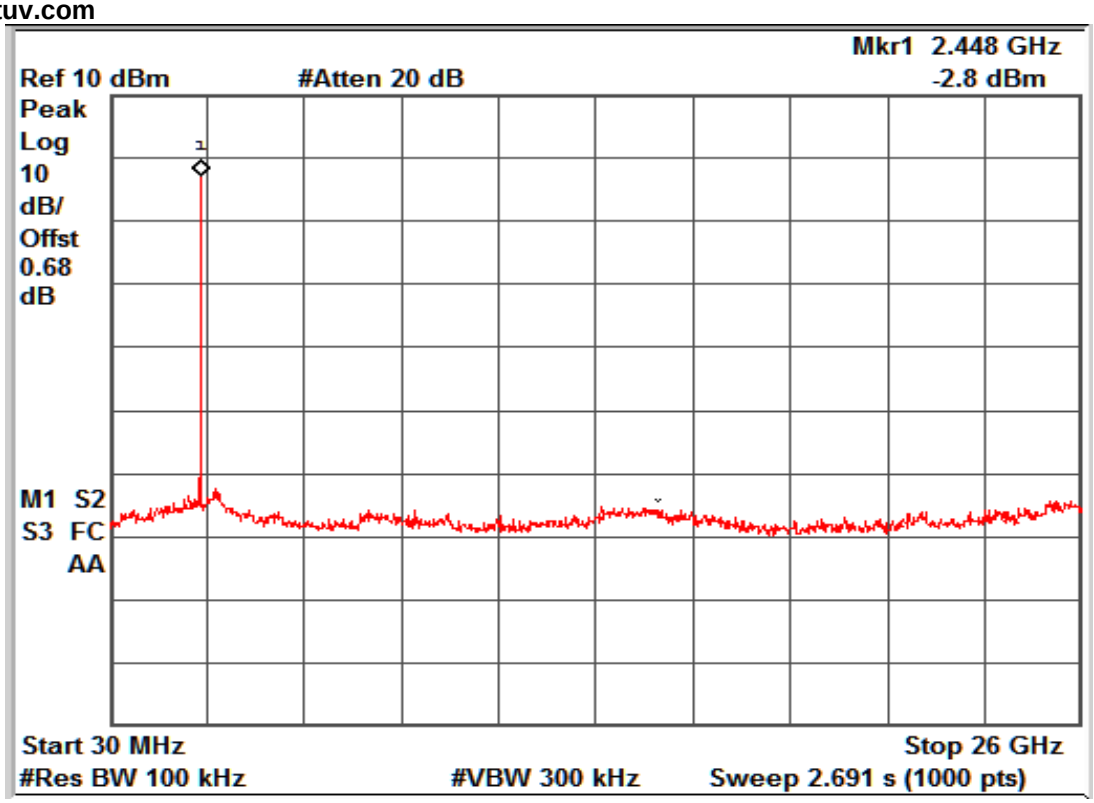
Channel frequency: 2440 MHz



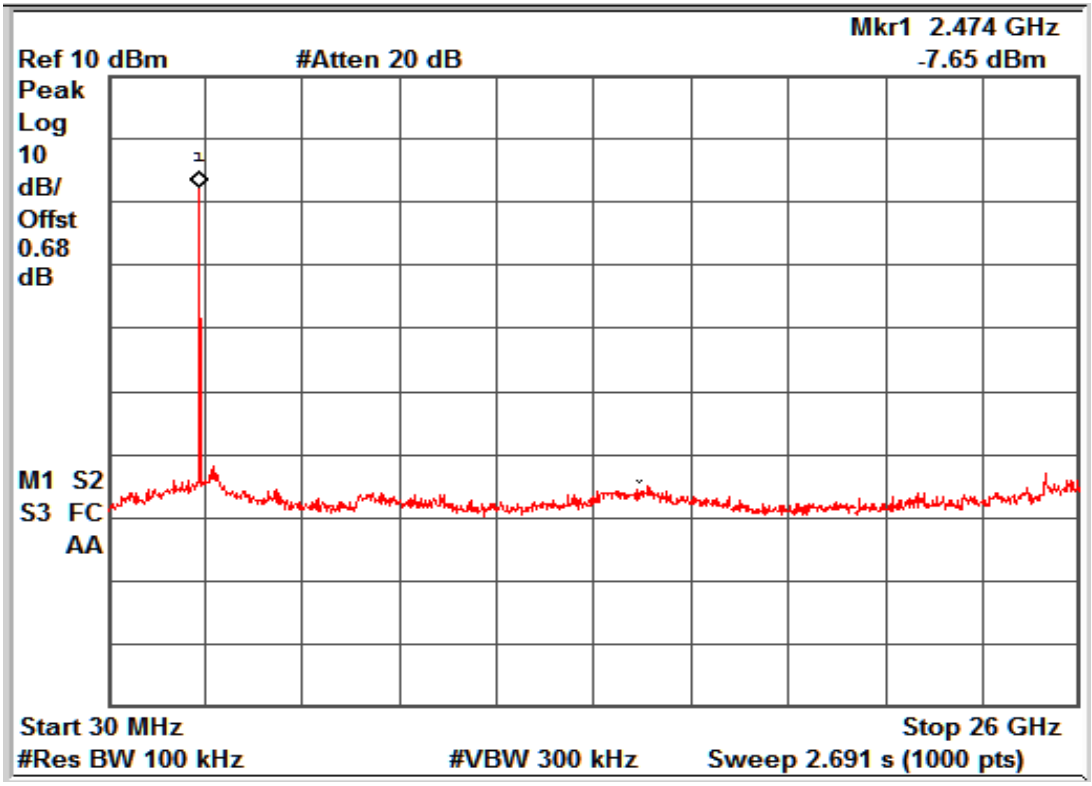
Channel frequency: 2480 MHz



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:

Worst case emissions observed are listed below.

Antenna Polarization	Frequency of Emission (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	239.61	38.02	46.00	-07.98
Horizontal	234.96	33.55	46.00	-12.45

Emission above 1 GHz:

Antenna Port	Channel	Polarization	Frequency (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Ceramic Antenna Port	2405MHz	Vertical	2388.8(Pk)	42.34	74	-31.66
			2390(Av)	32.51	54	-21.49
			2405(Pk)	93.41	*	*
			2405(Av)	90.54	-	-
			4810(Pk)	50.65	74	-23.35
			4810(Av)	38.91	54	-15.09
		Horizontal	2389.5(Pk)	47.09	74	-26.91
			2390(Av)	39.28	54	-14.72
			2405(Pk)	101.21	*	*
			2405(Av)	98.36	-	-
			4810(Pk)	51.53	74	-22.47
			4810(Av)	41.22	54	-12.78
	2440MHz	Vertical	2440(Pk)	96.29	*	*
			2440(Av)	93.55	-	-
			4880(Pk)	50.17	74	-23.83
			4880(Av)	37.81	54	-16.19
		Horizontal	2440(Pk)	103.52	*	*
			2440(Av)	100.65	-	-
			4880(Pk)	50.98	74	-23.02
			4880(Av)	39.83	54	-14.17
	2475MHz	Vertical	2475(Pk)	96.12	*	*
			2475(Av)	93.01	-	-
			2483.5(Pk)	49.78	74	-24.22
			2483.5(Av)	40.82	54	-13.18
			4950(Pk)	50.23	74	-23.77
			49500(Av)	38.74	54	-15.26
		Horizontal	2475(Pk)	103.92	*	*
			2475(Av)	100.83	-	-
			2483.5(Pk)	56.6	74	-17.4
			2483.5(Av)	48.17	54	-5.83
			4950(Pk)	50.83	74	-23.17
			49500(Av)	39.85	54	-14.15
	2408MHz	Vertical	2480(Pk)	83.21	*	*
			2480(Av)	80.05	-	-
			2483.5(Pk)	52.3	74	-21.7
			2483.5(Av)	43.16	54	-10.84
		Horizontal	2480(Pk)	92.14	*	*
			2480(Av)	89.09	-	-
			2483.5(Pk)	61.34	74	-12.66
			2483.5(Av)	53.13	54	-0.87

Antenna Port	Channel Frequency	Polarization	Frequency (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
External Antenna Port	2405MHz	Vertical	2390(Pk)	45.79	74	-28.21
			2390(Av)	35.55	54	-18.45
			2405(Pk)	97.63	*	*
			2405(Av)	94.7	-	-
			4810(Pk)	50.26	74	-23.74
			4810(Av)	38.13	54	-15.87
		Horizontal	2390(Pk)	42.85	74	-31.15
			2390(Av)	33.65	54	-20.35
			2405(Pk)	96.68	*	*
			2405(Av)	93.71	-	-
			4810(Pk)	50.83	74	-23.17
			4810(Av)	39.81	54	-14.19
	2440MHz	Vertical	2440(Pk)	97.34	*	-
			2440(Av)	94.48	*	-
			4880(Pk)	49.41	74	-24.59
			4880(Av)	37.64	54	-16.36
		Horizontal	2440(Pk)	96.46	*	*
			2440(Av)	93.69	-	-
			4880(Pk)	49.82	74	-24.18
			4880(Av)	38.65	54	-15.35
	2480MHz	Vertical	2480(Pk)	91.25	*	*
			2480(Av)	88.18	-	-
			2483.5(Pk)	60.07	74	-13.93
			2483.5(Av)	51.88	54	-2.12
			4960(Pk)	49.46	74	-24.54
			4960(Av)	37.61	54	-16.39
		Horizontal	2480(Pk)	93.03	*	*
			2480(Av)	89.9	-	-
			2483.5(Pk)	60.94	74	-13.06
			2483.5(Av)	52.77	54	-01.23
			4960(Pk)	50.86	74	-23.14
			4960(Av)	38.66	54	-15.34

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

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	:	120VAC,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

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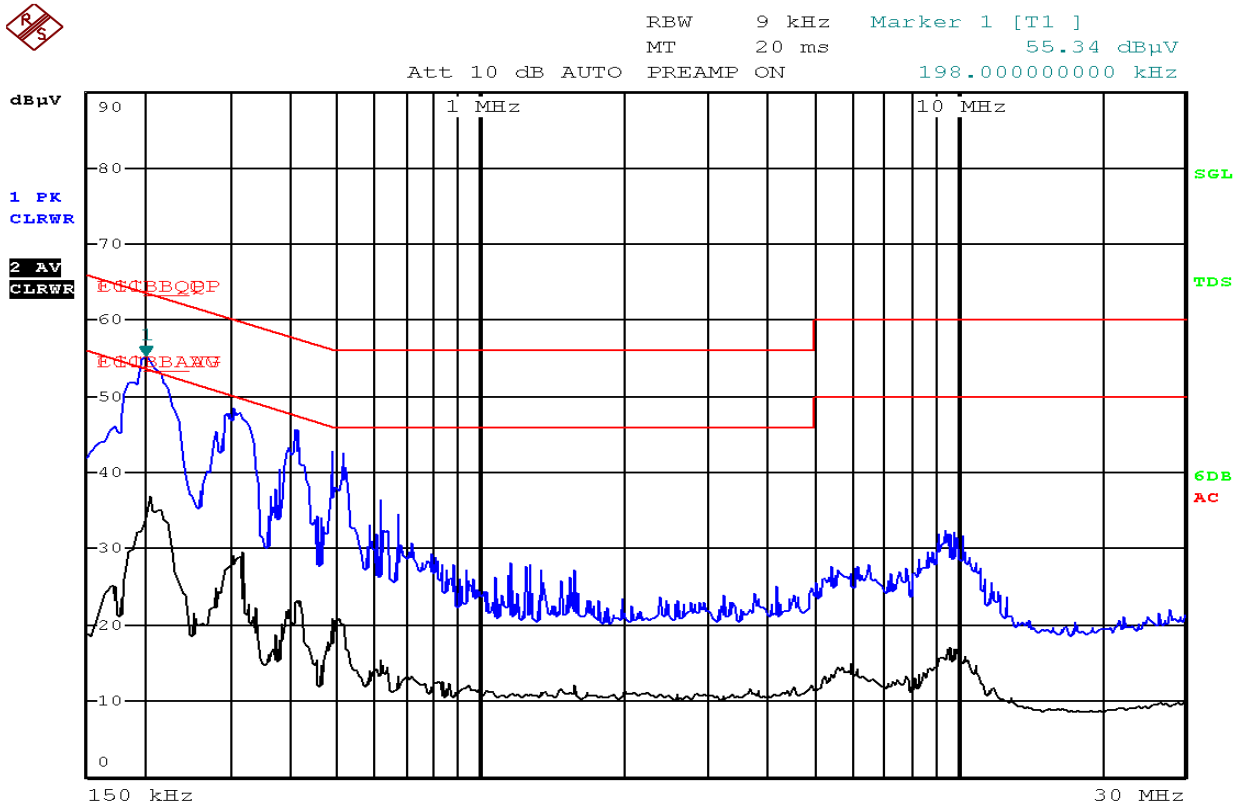
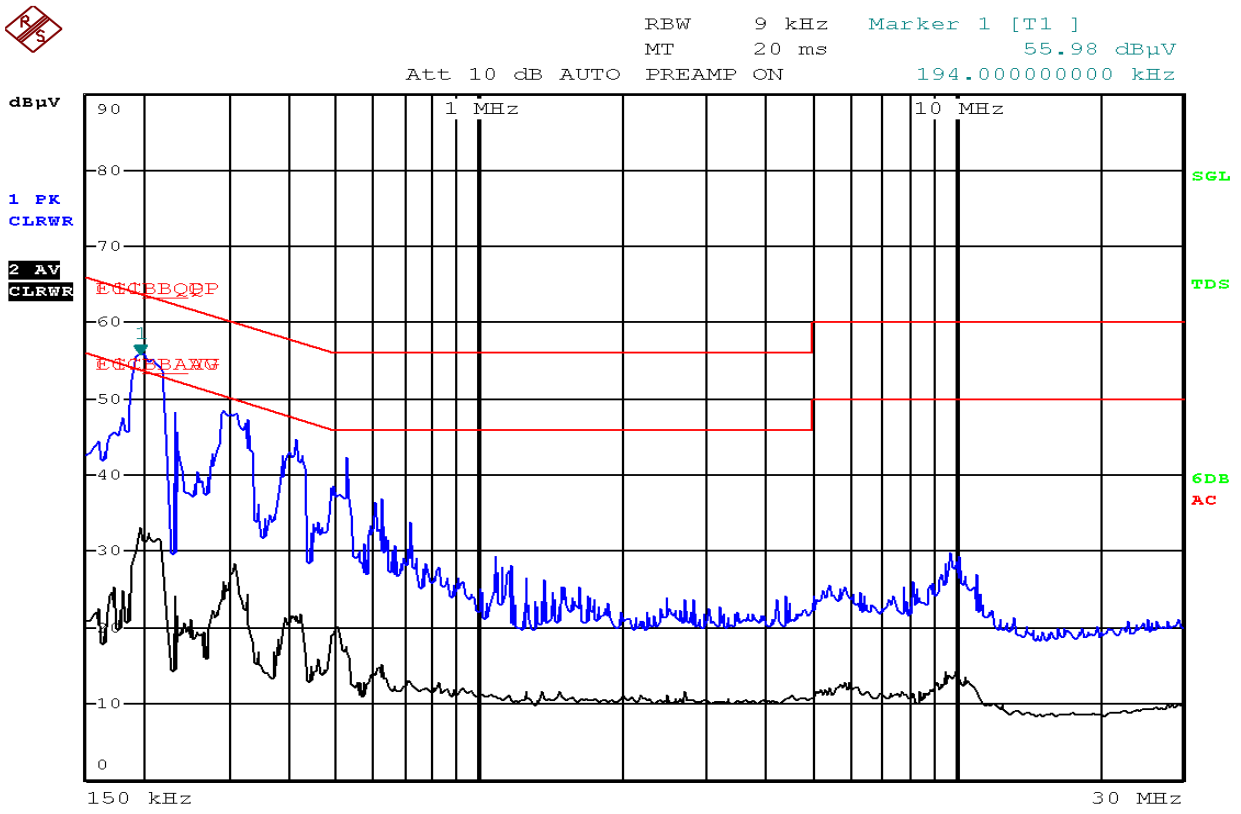
Test Result:



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	198 kHz	52.04 L1	-11.64
1 Quasi Peak	302 kHz	45.88 L1	-14.30
1 Quasi Peak	410 kHz	39.87 L1	-17.77
2 Average	202 kHz	35.72 L1	-17.80
1 Quasi Peak	490 kHz	35.19 L1	-20.96
2 Average	314 kHz	27.60 L1	-22.25
2 Average	410 kHz	22.64 L1	-25.00
2 Average	490 kHz	19.61 L1	-26.55
1 Quasi Peak	618 kHz	29.13 L1	-26.87
1 Quasi Peak	670 kHz	24.49 L1	-31.50
2 Average	9.69 MHz	14.69 L1	-35.30

Mode: Line



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	52.57 N	-11.29
1 Quasi Peak	290 kHz	45.42 N	-15.10
1 Quasi Peak	410 kHz	39.71 N	-17.93
1 Quasi Peak	230 kHz	43.36 N	-19.08
2 Average	194 kHz	31.81 N	-22.04
1 Quasi Peak	526 kHz	33.54 N	-22.45
2 Average	306 kHz	27.01 N	-23.06
1 Quasi Peak	622 kHz	29.43 N	-26.56
2 Average	506 kHz	19.10 N	-26.89
2 Average	398 kHz	20.68 N	-27.21
2 Average	230 kHz	22.99 N	-29.45

Mode: Neutral