TEST REPORT

Report Number: 100691933ATL-001

April 27, 2012

Product Designation: RF4CE

Standard: FCC 15.249 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.
RSS-210, Issue 7, 2007

Tested by:
Intertek Testing Services NA Inc.
1950 Evergreen Blvd., Suite 100
Duluth, GA 30096

Client:
CISCO
5030 Sugarloaf Parkway
Lawrenceville, GA 30044
Contact: Bob Lyall
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lyallr@cisco.com

Tests performed by:

Jeremy O. Pickens
Senior Staff Engineer

Report reviewed by:

Troy J. Ihle
EMC Project Engineer

1.0 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatum text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

2.0 Test Summary

Section	Test Full Name	Test Date	Result
4.0	System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)		
5.0	Overview of EUT (Low Power Transmitters) (FCC 15C - EUT Overview)		
6.0	Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)	03/30/2012	PASS
7.0	Occupied Bandwidth (FCC Part 2.1049)	03/30/2012	PASS
8.0	15.249(b): Requirements for fixed, point-to-point operation (FCC 15C - 15.249(b))		
9.0	Additional provisions to the general radiated emission limitations. (FCC 15C - 15.215)		
NA	Conducted emissions on AC power lines (Conducted Emissions) was waived due to the modeul does not connect to the AC mains.		

3.0 Description of Equipment Under Test

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Radio Module	CISCO	RF4CE	NA

EUT receive date:	March 29, 2012
EUT receive condition:	Good

Description of EUT provided by Client:
The RF4CE is a 2.4GHz Zigbee radio module for use in cable set top boxes for remote control.

Description of EUT exercising:
During testing, the device was configured in standby mode, low channel, mid channel, and high channel for testing to FCC Part 15. The module was powered through a ribbon cable from a remotely-located set top box.

4.0 System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)

Method:

Record the details of EUTcabling, document the support equipment, and show the interconnections in a block diagram.

Data:

EUT Cabling						
					Connection	
ID	Description	Length	Shielding	Ferrites	From	To
A	Ribbon Cable	3m	None	None	Module	STB

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Set Top Box (STB)	CISCO	9KG8	NA

5.0 Overview of EUT (Low Power Transmitters) (FCC 15C - EUT Overview)

Method:

Complete the overview spreadsheet.

Related Submittal(s) Grants: This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.

Data:

Applicant	CISCO Systems, Inc.
	170 West Tasman Drive
	San Jose, CA 95134
Trade Name & Model No.	Zigbee Module / RF4CE
FCC Identifier	LDK9KG80001
Frequency Range (MHz)	2425-2475
Antenna Type (15.203)	PCB
Manufacturer name & address	CISCO Systems, Inc.
	5030 Sugarloaf Parkway
	Lawrenceville, GA 30044

Related Submittals and Grants:	This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.
Additions, deviations and exclusions from standards	NA

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Method:

Measurements shall be performed with a quasi-peak detector instrument that meets the requirements of Section One of CISPR 16.

Bandwidths:
30 MHz to 1000 MHz: 120 kHz RBW and 1 MHz VBW
Above 1000 MHz: 1 MHz RBW and 3 MHz VBW

Detectors:
Equal to or less than 1000 MHz: CISPR quasi-peak detector (alternative: peak detector)
Above 1000 MHz: Average detector (applies to average limit)
Above 1000 MHz: Peak detector (applies to peak limit)

Limits:
Equal to or less than 1000 MHz, the limits are specified as quasi-peak. If a peak detector is used, the limit does not change.
Above 1000 MHz, the limits are specified as average. The peak limit is 20 dB above the average limit. Both peak and average measurements are required to be reported.

Frequency range of radiated measurements
For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

Measurement antenna requirements:
Below 30 MHz - Loop antenna
30 to 1000 MHz - Biconical, Log Periodic, or equivalent
Above 1000 MHz - Horn or equivalent

Measurements of the radiated field are made with the antenna located at a distance of 3 or 10 meters from the EUT. The limit applied to the measurement shall be appropriate for the test distance. The test distance shall be indicated in the results section.

The EUT shall be arranged and connected with cables terminated in accordance with the product specification.

Exploratory tests should be carried out while varying the cable positions to determine the maximum or near-maximum emission level. During manipulation, cables shall not be placed under or on top of the system test components unless such placement is required by the inherent equipment design.

The antenna shall be adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth shall be varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) shall be varied during the measurements to find the maximum field-strength readings.

If the EUT is handheld, it shall be oriented in each of its othogonal axes.

If the EUT is intended for tabletop use, it shall be placed on a table whose top is 0.8m above the ground plane. The table shall be constructed of non-conductive materials. Its dimensions are at least 1m by 1.5m, but may be extended for larger EUT.

If EUT is floor standing, the EUT was placed on a horizontal metal ground plane and isolated from the ground plane by up to 12 mm of insulating material.

Equipment setup for radiated disturbance tests shall follow the guidelines of ANSI C63.4:2003.

TEST SITE
The test site for radiated emissions is located at 1950 Evergreen Blvd, Suite 100, Duluth, Georgia 30096.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	211386	10/25/2011	10/25/2012

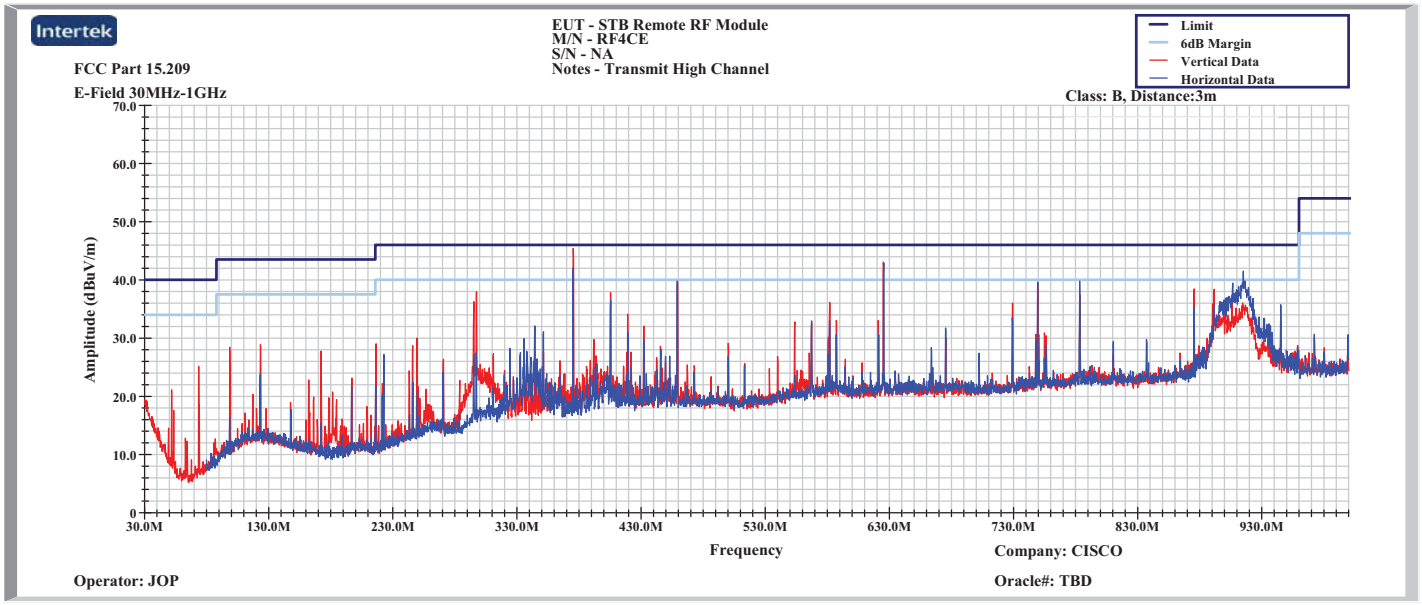
6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Antenna, Horn, <18 GHz	EMCO	3115	213061	05/07/2010	05/07/2012
Antenna, Horn, 18-40 GHz	EMCO	3116	213023	07/06/2011	07/06/2012
Cable E403, 40 GHz, 2.9, 9"	Megaphase	TM40 K1K1 9	E403	07/07/2011	07/07/2012
Cable MP3, 18 GHz, N, 10m	Megaphase	G919-NKNK-394	MP3	05/12/2011	05/12/2012
Cable, 7 meters, 1-18GHz	Storm Products Co.	PR90-195-7MTR	ST-3	09/07/2011	09/07/2012
Cable, N-N 3 meters, 18GHz	Megaphase	TM18 NKNK 118	E203	05/12/2011	05/12/2012
Cable, N-N, 3 meters, 18GHz	Megaphase	TM18-NKNK-118	E204	05/12/2011	05/12/2012
EMI Receiver	Hewlett Packard	8546A	213109	12/29/2011	12/29/2012
EMI Receiver, Preselector section	Hewlett Packard	85460A	213108	12/29/2011	12/29/2012
Excel spreadsheet for radiated emissions	Software	Excel - RE Worksh	SW004	12/08/2011	12/08/2012
Preamplifier, 10 MHz to 2000 MHz, 30 dB gain	Mini-Circuits	ZKL-2	200069	02/23/2012	02/23/2013
Preamplifier, 18-40GHz, 29 dB Gain	Miteq	JS41800400-30-5P	200080	07/06/2011	07/06/2012
Preamplifier, 18-40GHz, 29 dB Gain	Miteq	JS41800400-30-5P	200106	07/06/2011	07/06/2012
Spectrum Analyzer	Agilent	E7405A	AGL001	05/13/2011	05/13/2012
Tile - software profile for radiated and conducted emissions testing.	Software	Tile - Emissions	SW006	12/08/2011	12/08/2012

Results: The sample tested was found to Comply.

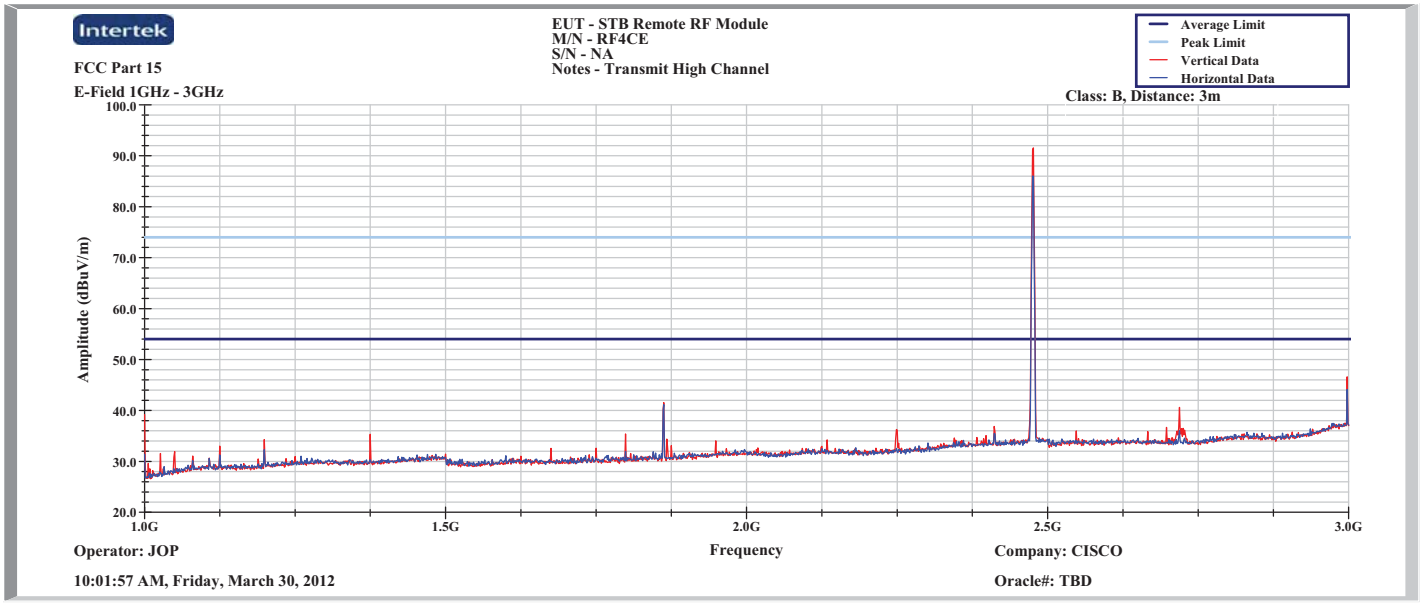
Plot:



Peak Plot - 30-1000MHz (Tx High Channel)

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

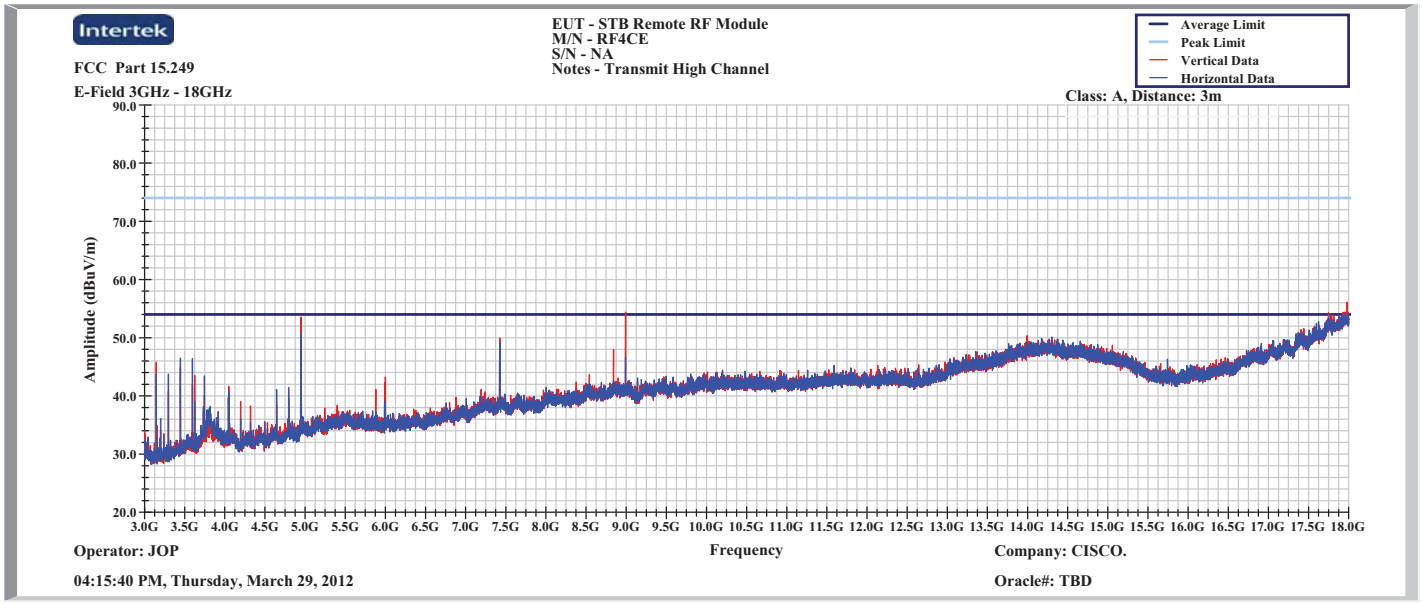
Plot:



Peak Plot - 1-3GHz (Tx High Channel)

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

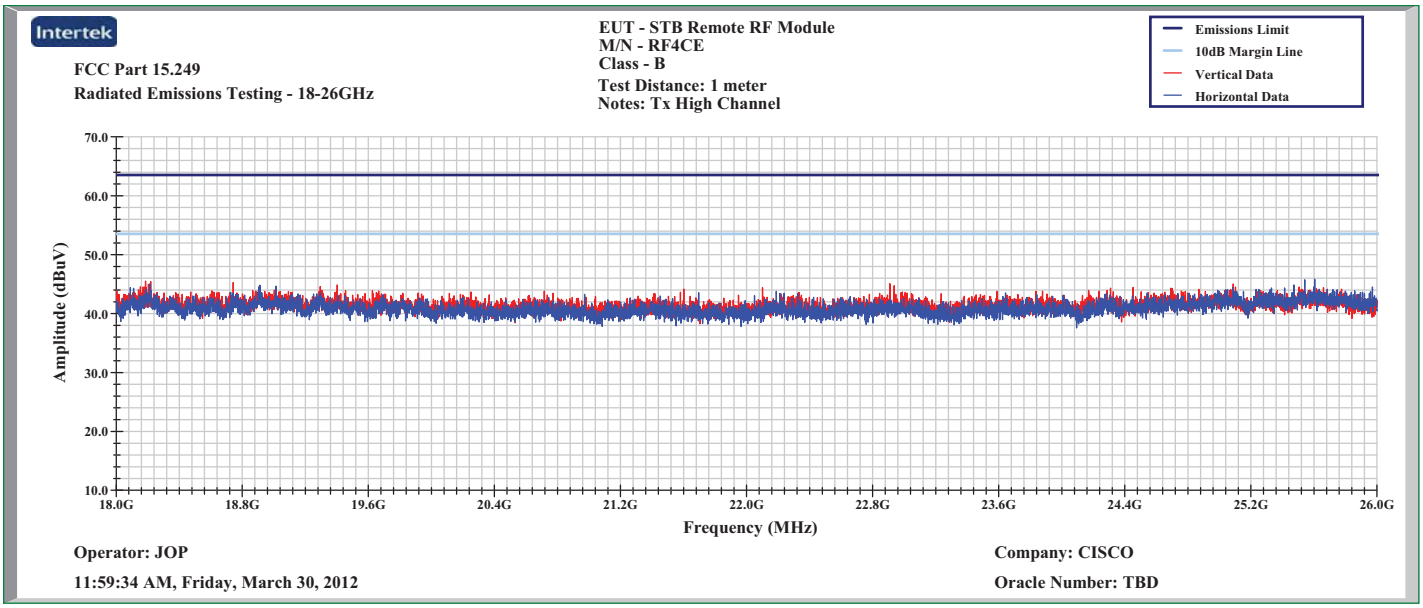
Plot:



Peak Plot - 3-18GHz (Tx High Channel)

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

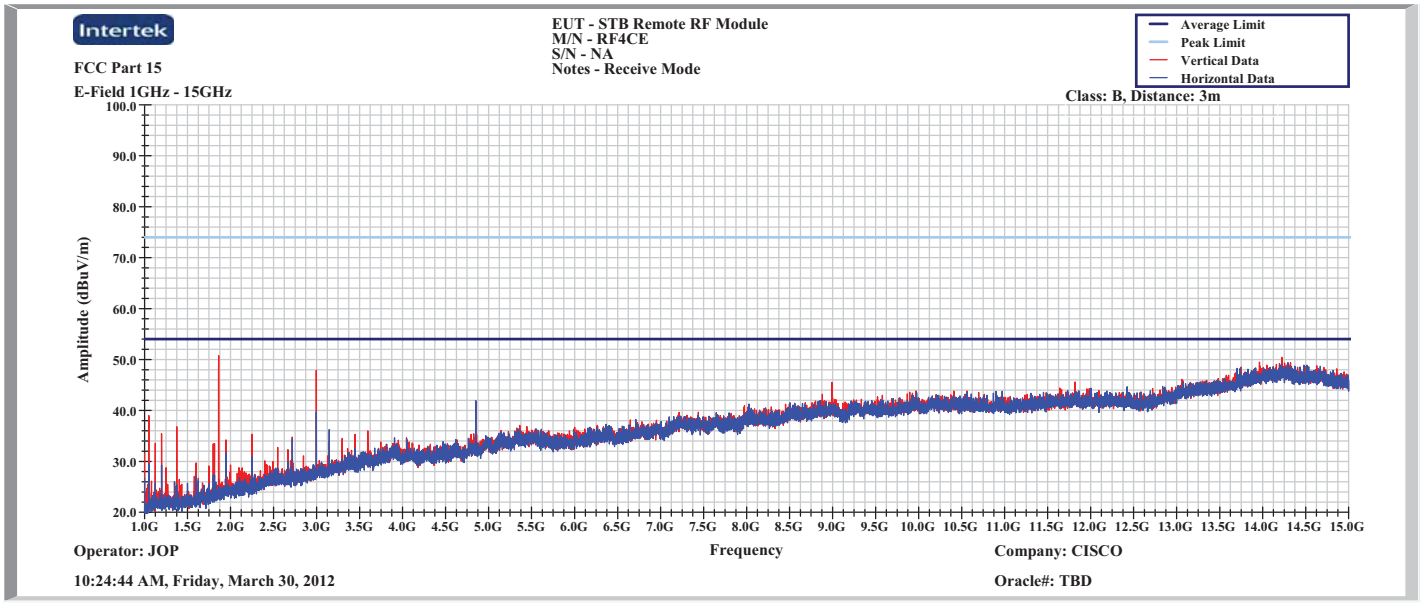
Plot:



Peak Plot - 18-26GHz (Tx High Channel)

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

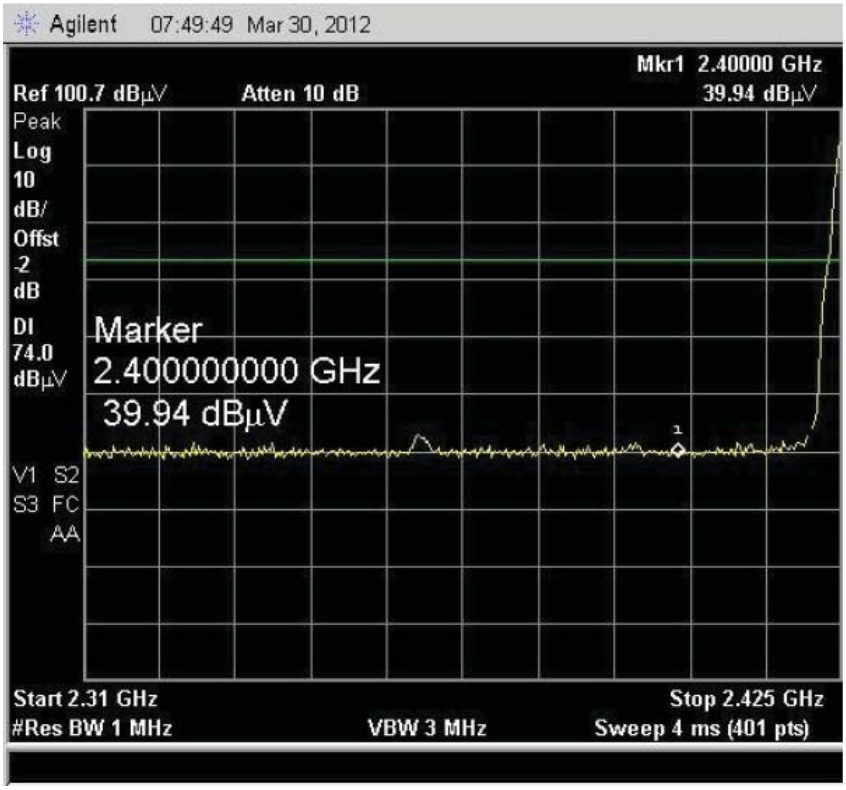
Plot:



Peak Plot - 1-15GHz (Rx Mode)

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

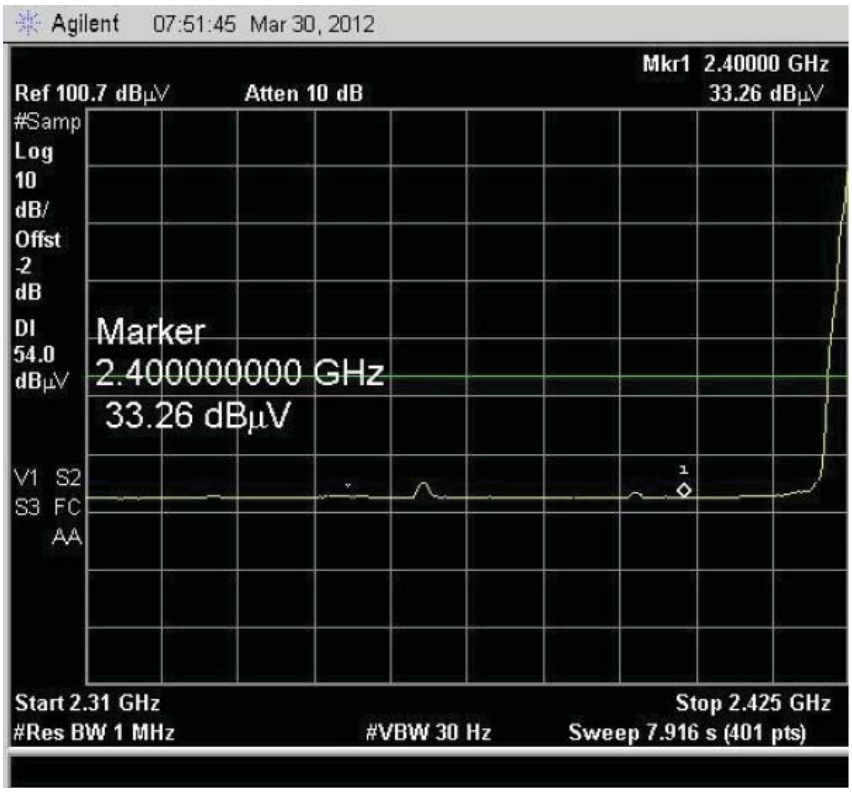
Plot:



Band Edge - Low - Peak

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

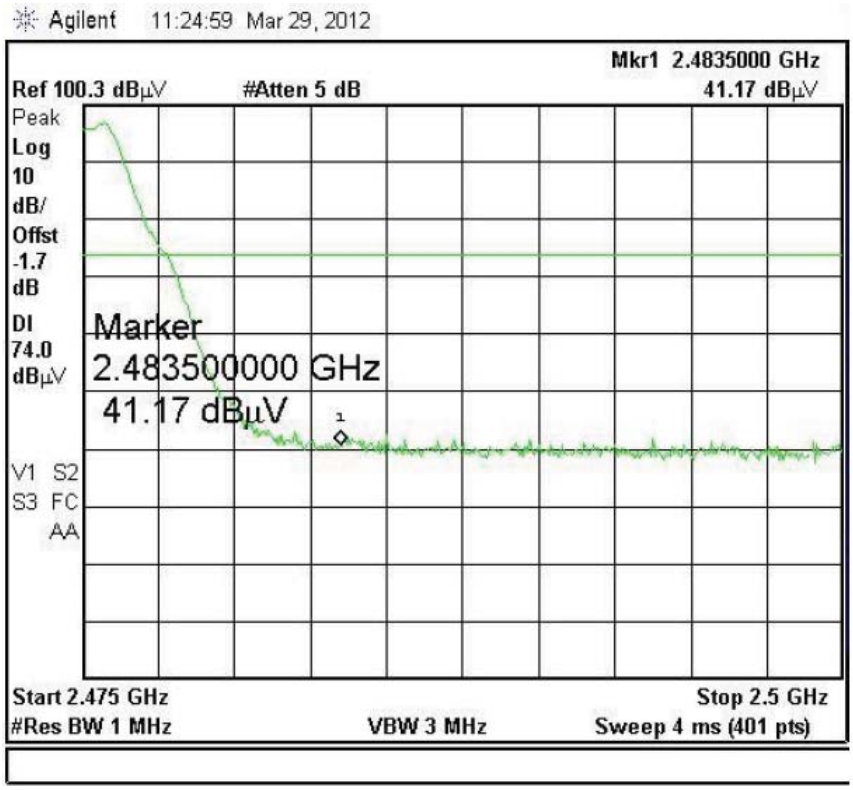
Plot:



Band Edge - Low - AVG

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

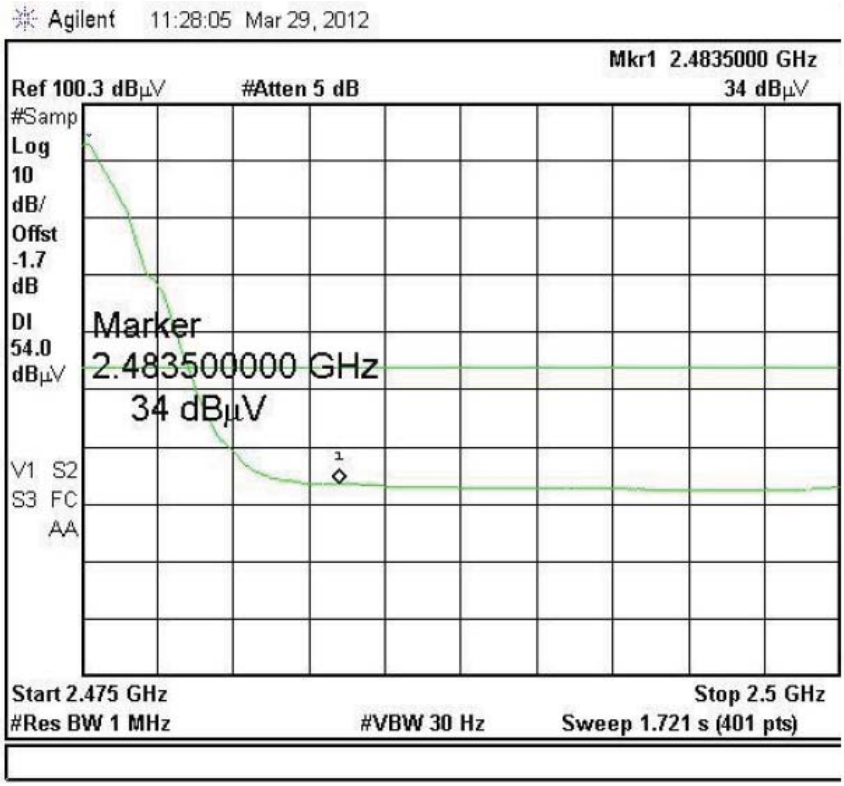
Plot:



Band Edge - High - Peak

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Plot:



Band Edge - High - AVG

Data:

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Date: 3/30/2012 **Test Distance (m):** 3
Frequency Range (MHz): 30-1000 **Limit:** FCC15 Class B-3m
Input power: DC from STB **Modifications for compliance (y/n):** n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
Emissions from STB - Wrapped support in aluminum foil									
h	375.000	53.5	15.6	4.1	37.2	36.0	46.0	-10.0	QP/120k/300k
v	375.000	57.0	15.6	4.1	37.2	39.5	46.0	-6.5	QP/120k/300k
h	625.000	50.1	19.4	5.3	36.8	38.0	46.0	-8.0	QP/120k/300k
v	906.130	53.1	21.7	6.4	36.3	44.8	46.0	-1.2	QP/120k/300k
h	783.000	40.7	20.2	6.0	36.6	30.3	46.0	-15.7	QP/120k/300k
h	912.750	40.9	20.7	6.4	36.2	31.8	46.0	-14.2	QP/120k/300k
v	906.130	45.7	21.7	6.4	36.3	37.4	46.0	-8.6	QP/120k/300k
Calculations		G=C+D+E-F		I=G-H					

Test Data - 30-1000MHz (Tx High Channel)

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Data:

Date: 3/30/2012 **Test Distance (m):** 3
Frequency Range (MHz): 1000-26000 **Limit:** FCC15 Class B-3m
Input power: DC from STB **Modifications for compliance (y/n):** n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
Low Channel (2425MHz)									
v	2425.175	99.3	28.5	2.2	32.7	97.3	114.0	-16.7	PK/1M/3M
v	2425.175	91.3	28.5	2.2	32.7	89.3	94.0	-4.7	AVG/1M/3M
h	2425.175	99.2	28.5	2.2	32.7	97.2	114.0	-16.8	PK/1M/3M
h	2425.175	91.5	28.5	2.2	32.7	89.5	94.0	-4.5	AVG/1M/3M
v	4849.360	57.0	32.8	4.0	33.1	60.7	74.0	-13.3	PK/1M/3M
v	4849.360	48.8	32.8	4.0	33.1	52.5	54.0	-1.5	AVG/1M/3M
h	4849.360	56.9	32.8	4.0	33.1	60.6	74.0	-13.4	PK/1M/3M
h	4849.360	48.7	32.8	4.0	33.1	52.4	54.0	-1.6	AVG/1M/3M
v	7274.025	57.3	36.4	5.2	31.8	67.1	74.0	-6.9	PK/1M/3M
v	7274.025	41.0	36.4	5.2	31.8	50.8	54.0	-3.2	AVG/1M/3M
h	7274.025	45.7	36.2	5.2	31.8	55.3	74.0	-18.7	PK/1M/3M
h	7274.025	35.5	36.2	5.2	31.8	45.1	54.0	-8.9	AVG/1M/3M
Calculations		G=C+D+E-F		I=G-H					

Test Data - Tx Low Channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Data:

Date: 3/30/2012 **Test Distance (m):** 3
Frequency Range (MHz): 1000-26000 **Limit:** FCC15 Class B-3m
Input power: DC from STB **Modifications for compliance (y/n):** n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
Mid-Channel (2450 MHz)									
v	2450.630	98.0	28.6	2.2	32.7	96.2	114.0	-17.8	PK/1M/3M
v	2450.630	93.4	28.6	2.2	32.7	91.6	94.0	-2.4	AVG/1M/3M
h	2450.630	98.9	28.5	2.2	32.7	97.0	114.0	-17.0	PK/1M/3M
h	2450.630	94.3	28.5	2.2	32.7	92.4	94.0	-1.6	AVG/1M/3M
v	4901.268	57.6	33.0	4.0	33.0	61.6	74.0	-12.4	PK/1M/3M
v	4901.268	49.5	33.0	4.0	33.0	53.5	54.0	-0.5	AVG/1M/3M
h	4901.268	54.3	32.9	4.0	33.0	58.1	74.0	-15.9	PK/1M/3M
h	4901.268	45.9	32.9	4.0	33.0	49.7	54.0	-4.3	AVG/1M/3M
v	7351.942	44.5	36.5	5.3	31.9	54.4	74.0	-19.6	PK/1M/3M
v	7351.942	36.3	36.5	5.3	31.9	46.2	54.0	-7.8	AVG/1M/3M
h	7351.942	46.5	36.5	5.3	31.9	56.4	74.0	-17.6	PK/1M/3M
h	7351.942	38.2	36.5	5.3	31.9	48.1	54.0	-5.9	AVG/1M/3M
Calculations		G=C+D+E-F		I=G-H					

Test Data - Tx Mid Channel

6.0 Radiated emissions (E-field) for low power intentional radiators. (Radiated Emissions LPD)

Data:

Date: 3/30/2012 **Test Distance (m):** 3
Frequency Range (MHz): 1000-26000 **Limit:** FCC15 Class B-3m
Input power: DC from STB **Modifications for compliance (y/n):** n

A	B	C	D	E	F	G	H	I	J
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**	**Detectors / Bandwidths Det/RBW/VBW**
High-Channel (2475 MHz)									
v	2475.638	99.0	28.6	2.3	32.6	97.3	114.0	-16.7	PK/1M/3M
v	2475.638	94.0	28.6	2.3	32.6	92.3	94.0	-1.7	AVG/1M/3M
h	2475.638	97.1	28.6	2.3	32.6	95.4	114.0	-18.6	PK/1M/3M
h	2475.638	88.9	28.6	2.3	32.6	87.2	94.0	-6.8	AVG/1M/3M
v	4951.388	55.3	33.2	4.0	33.0	59.6	74.0	-14.4	PK/1M/3M
v	4951.388	48.3	33.2	4.0	33.0	52.6	54.0	-1.4	AVG/1M/3M
h	4951.388	53.7	33.1	4.0	33.0	57.8	74.0	-16.2	PK/1M/3M
h	4951.388	45.8	33.1	4.0	33.0	49.9	54.0	-4.1	AVG/1M/3M
v	7426.963	47.4	36.5	5.3	31.9	57.3	74.0	-16.7	PK/1M/3M
v	7426.963	37.3	36.5	5.3	31.9	47.2	54.0	-6.8	AVG/1M/3M
h	7426.963	46.3	36.5	5.3	31.9	56.3	74.0	-17.7	PK/1M/3M
h	7426.963	37.0	36.5	5.3	31.9	47.0	54.0	-7.0	AVG/1M/3M
v	8991.000	30.3	37.7	6.4	31.7	42.7	54.0	-11.3	AVG/1M/3M
Calculations		G=C+D+E-F		I=G-H					

Test Data - Tx High Channel

7.0 Occupied Bandwidth (FCC Part 2.1049)

Method:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Connect the antenna port of the EUT to a spectrum analyzer using a calibrated coaxial cable and attenuator. Set the EUT to transmit at its highest power setting. The 99% bandwidth function of the analyzer was used to automatically generate the occupied bandwidth plots. Repeat for low, mid, and high channels of each band of the EUT.

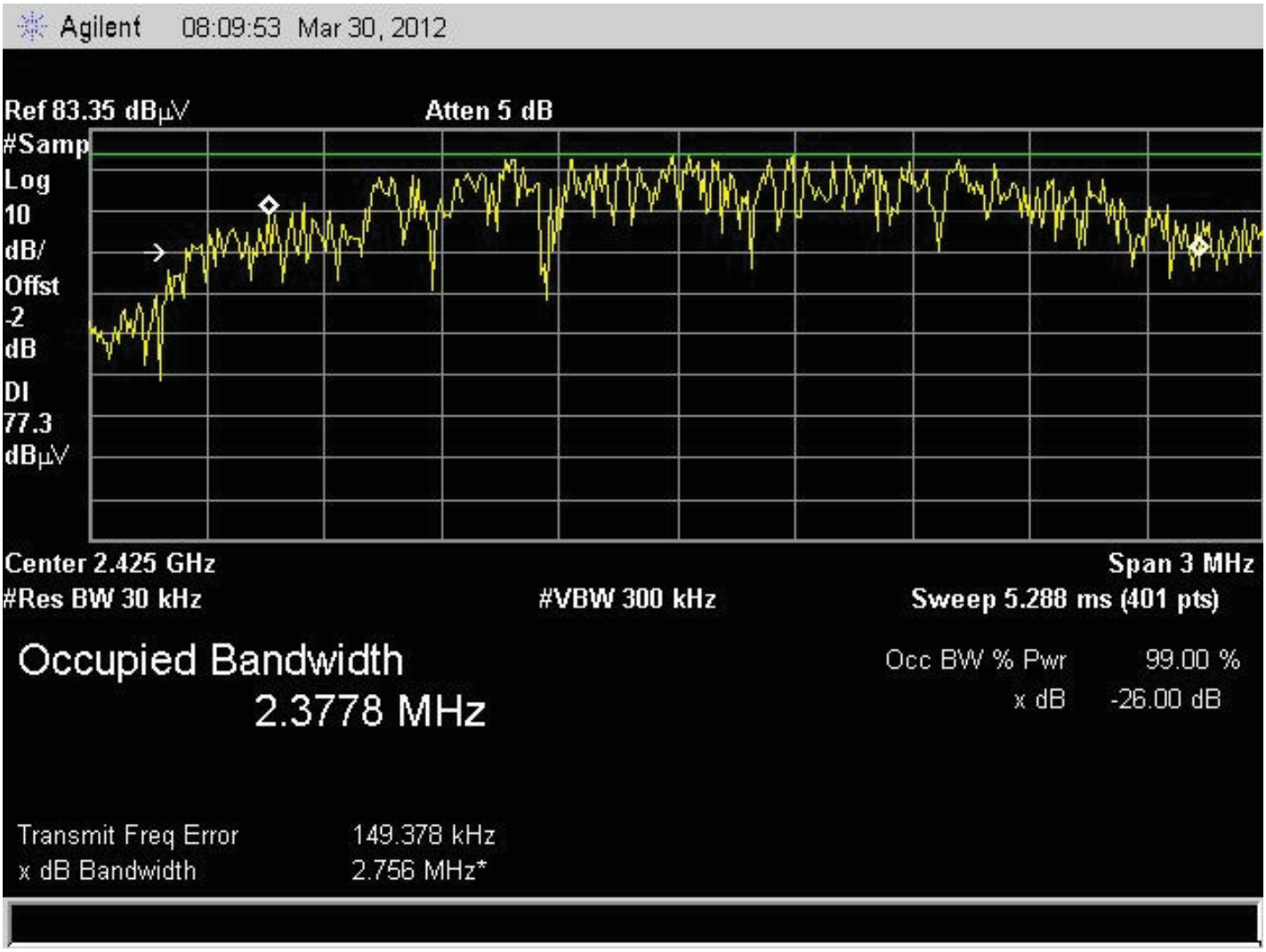
For amplifiers, the output bandwidth shall be less than or equal to the input bandwidth.

Test Equipment Used:

Description:	Manufacturer:	Model:	Asset Number:	Cal Date:	Cal Due:
Spectrum Analyzer	Agilent	E7405A	AGL001	05/13/2011	05/13/2012

Results: The sample tested was found to Comply.

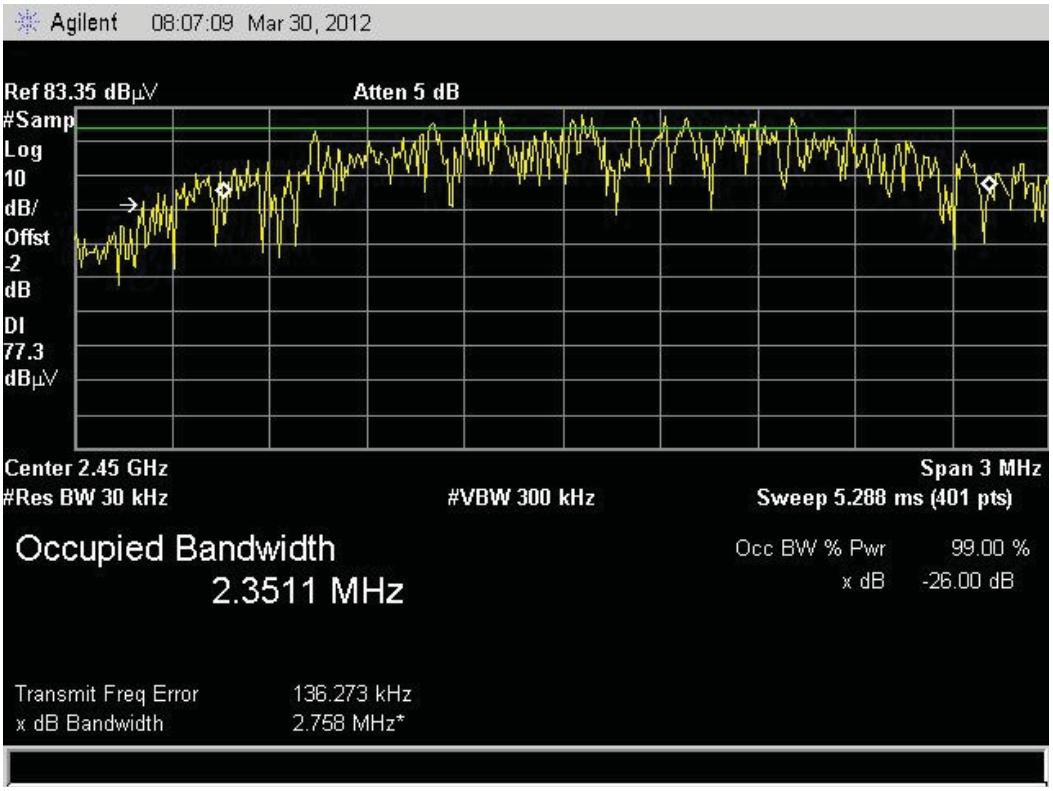
Photo:



Occupied BW Plot - Low Channel

7.0 Occupied Bandwidth (FCC Part 2.1049)

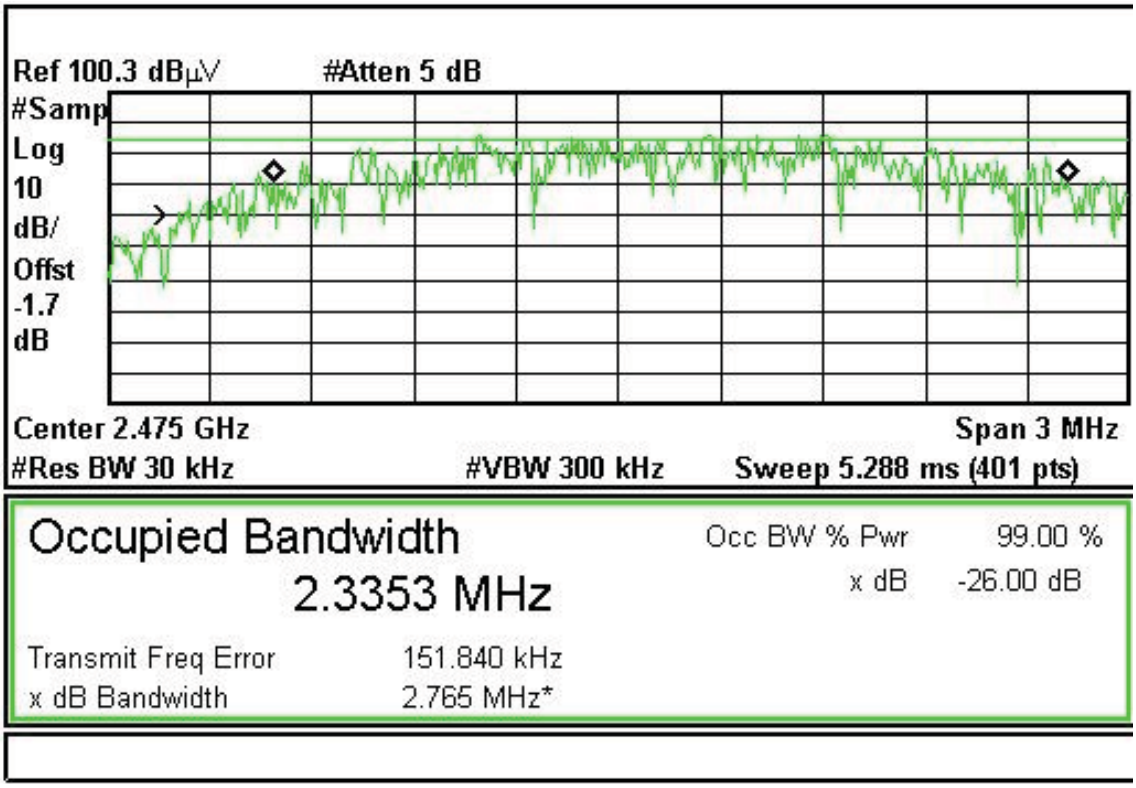
Plot:



Occupied BW Plot - Mid Channel

7.0 Occupied Bandwidth (FCC Part 2.1049)

Plot:



Occupied BW Plot - High Channel

Data:

7.0 Occupied Bandwidth (FCC Part 2.1049)

Mode	Frequency MHz	Resolution Bandwidth (1)	Video Bandwidth	Sweep time Seconds	Measured Bandwidth MHz
Low Channel	2425	30 kHz	300 kHz	5	2.3778
Mid Channel	2450	30 kHz	300 kHz	5	2.3511
High Channel	2475	30 kHz	300 kHz	5	2.3353

Note (1): Greater or equal to 1% of emission bandwidth.

8.0 15.249(b): Requirements for fixed, point-to-point operation (FCC 15C - 15.249(b))

Method:

(b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05–24.25 GHz band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(2) The frequency tolerance of the carrier signal shall be maintained within ±0.001% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

9.0 Additional provisions to the general radiated emission limitations. (FCC 15C - 15.215)

Method:

§ 15.215 Additional provisions to the general radiated emission limitations.
(a) The regulations in §§15.217 through 15.257 provide alternatives to the general radiated emission limits for intentional radiators operating in specified frequency bands. Unless otherwise stated, there are no restrictions as to the types of operation permitted under these sections.

(b) In most cases, unwanted emissions outside of the frequency bands shown in these alternative provisions must be attenuated to the emission limits shown in §15.209. In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission.

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.