

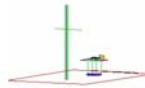


PCTEST ENGINEERING LABORATORY, INC.

7185 Oakland Mills Road, Columbia, MD 21046 USA

Tel. 410.290.6652 / Fax 410.290.6654

<http://www.pctestlab.com>



MEASUREMENT REPORT FCC PART 15.247 2400MHz DMSS

Applicant Name:

Japan Remote Control Co., Ltd.
2-12, 2 Chome, Eiwa
Higashi Osaka
Osaka 577-0809,
Japan

Date of Testing:

11/30/2015 - 2/11/2016

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

0Y1512282276.AXG

FCC ID: AXG-RF2TPA

APPLICANT: Japan Remote Control Co., Ltd.

Application Type: Certification

Model(s): XG6, XG8, XG14, XG14E, C.O.L.T, MERCURY

EUT Type: Telemetry Radio Control System

Max. RF Output Power: 123.794 mW (20.93 dBm) Peak Conducted

Frequency Range: 2404 – 2479 MHz

FCC Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)

FCC Rule Part(s): Part 15 Subpart C (15.247)

Test Procedure(s): ANSI C63.10-2013

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Randy Ortanez
President

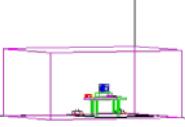
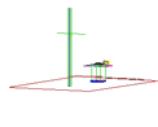


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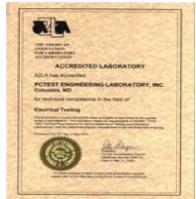
FCC Part 15.247

§ 2.1033 General Information

APPLICANT: Japan Remote Control Co., Ltd.
APPLICANT ADDRESS: 2-12, 2 Chome, Eiwa
 Higashi Osaka, Osaka 577-0809,
TEST SITE: PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS: 7185 Oakland Mills Road, Columbia, MD 21046 USA
FCC RULE PART(S): Part 15 Subpart C (15.247)
BASE MODEL: XG6
FCC ID: AXG-RF2TPA
FCC CLASSIFICATION: FCC Part 15 Spread Spectrum Transmitter (DSS)
Test Device Serial No.: 600301, S404178, Production Pre-Production Engineering
 S402845, 12130192, Production Pre-Production Engineering
Method/System: Frequency Hopping Spread Spectrum (FHSS)
DATE(S) OF TEST: 11/30/2015 - 2/11/2016
TEST REPORT S/N: 0Y1512282276.AXG

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Innovation, Science and Economic Development Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Innovation, Science and Economic Development Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Innovation, Science and Economic Development Canada Standards (RSS).
- PCTEST facility is an ISED registered (2451B-1) test laboratory with the site description on file at Innovation, Science and Economic Development Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EVDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada Certification and Engineering Bureau.

1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Interntl (BWI) airport, the city of Baltimore and the Washington, DC area. (See *Figure 1-1*.)

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

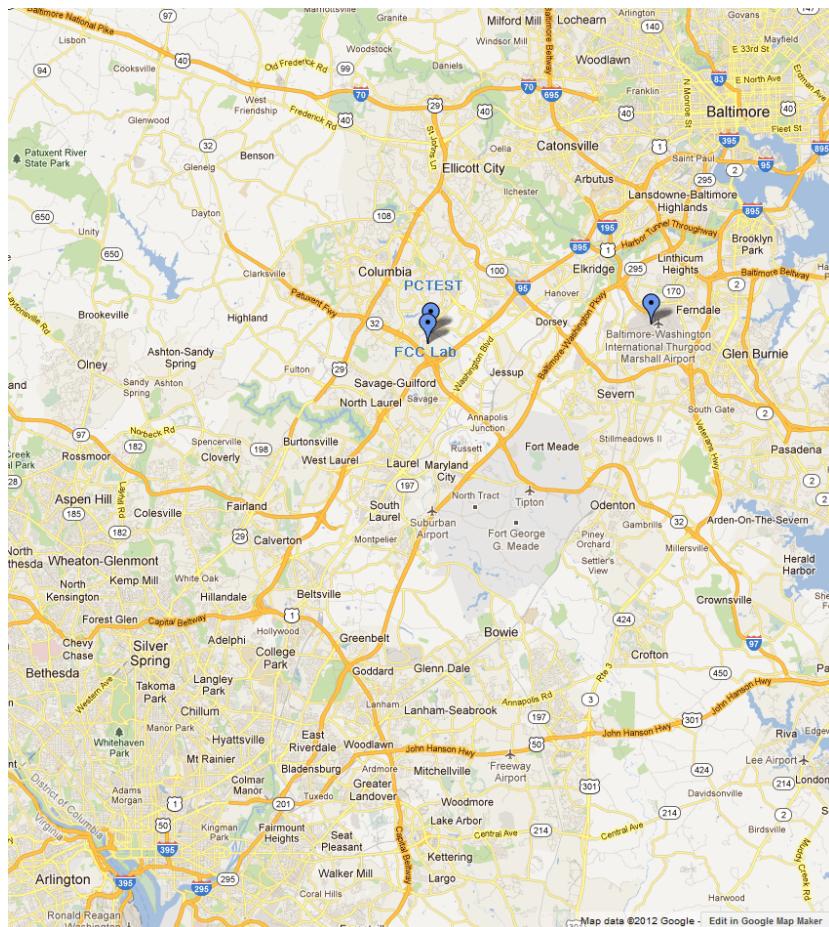


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Japan Remote Control Telemetry Radio Control System FCC ID: AXG-RF2TPA**. The test data contained in this report pertains only to the emissions due to the EUT's 2.4GHz transmitter.

- For this module, we confirm the following:
 - A) The hopping sequence is pseudorandom
 - B) All channels are used equally on average
 - C) The receiver input bandwidth equals the transmit bandwidth
 - D) The receiver hops in sequence with the transmit signal
- 15.247(g): The system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): The system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

2.2 Device Capabilities

This device contains the following capabilities:

2.4 GHz Frequency Hopper

2.3 Test Configuration

The Japan Remote Control Telemetry Radio Control System FCC ID: AXG-RF2TPA was tested per the guidance of ANSI C63.10-2013. The EUT was configured for continuous transmission in single channel operation for testing purposes only. ANSI C63.10-2013 was also used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, and 7.8 for antenna port conducted emissions test setups.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the **Japan Remote Control Telemetry Radio Control System FCC ID: AXG-RF2TPA**.

Deviation from measurement procedure.....None

3.2 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, a 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm. For measurements above 1GHz, a high density expanded polystyrene block is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

3.3 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of the Japan Remote Control Telemetry Radio Control System uses a unique coupling to the module.

Conclusion:

The Japan Remote Control Telemetry Radio Control System FCC ID: AXG-RF2TPA unit complies with the requirement of §15.203.

Ch.	Frequency (MHz)
1	2404
:	:
13	2440
:	:
26	2479

Table 4-1. Frequency/ Channel Operations

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013 and ETSI TR 100 028-2001. All measurement uncertainty values are shown with a coverage factor of $k = 1.96$ to indicate a 95% level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (\pm dB)
Conducted Bench Top Measurements	1.13
Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	4/28/2015	Annual	4/28/2016	RE1
-	WL25-1	Conducted Cable Set (25GHz)	4/8/2015	Annual	4/8/2016	WL25-1
Agilent	8447D	Broadband Amplifier	6/12/2015	Annual	6/12/2016	1937A03348
Agilent	N9030A	PXA Signal Analyzer (44GHz)	3/17/2015	Annual	3/17/2016	MY52350166
Agilent	E4448A	PSA (3Hz-50GHz) Spectrum Analyzer	3/19/2015	Annual	3/19/2016	US42510244
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Agilent	N9038A	MXE EMI Receiver	3/24/2015	Annual	3/24/2016	MY51210133
Anritsu	MA2411B	Pulse Sensor	4/8/2014	Biennial	4/8/2016	846215
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	941001
Emco	6502	Active Loop Antenna (10k - 30 MHz)	6/24/2014	Biennial	6/24/2016	267
Emco	3115	Horn Antenna (1-18GHz)	1/30/2014	Biennial	3/30/2016	9704-5182
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	11/11/2014	Biennial	11/11/2016	114451
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/8/2014	Biennial	4/8/2016	125518
ETS Lindgren	3160-09	18-26.5 GHz Standard Gain Horn	6/17/2014	Biennial	6/17/2016	135427
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	4/20/2015	Annual	4/20/2016	251425001
K & L	11SH10-3075/U18000	High Pass Filter	7/18/2015	Annual	7/18/2016	11SH10-3075/U18000-2
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	4/28/2015	Annual	4/28/2016	NMLC-1
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	6/2/2015	Annual	6/2/2016	103200
Rohde & Schwarz	TS-PR18	Pre-Amplifier	3/5/2015	Annual	3/5/2016	101622
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	3/27/2015	Annual	3/27/2016	100342
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	3/5/2015	Annual	3/5/2016	100071
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	3/3/2015	Annual	3/3/2016	100040
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	1/28/2014	Biennial	3/28/2016	A051107
VWR	62344-734	Thermometer with Clock	2/20/2014	Biennial	2/20/2016	140140420

Table 6-1. Annual Test Equipment Calibration Schedule

Note:

1. All test equipment was used within its calibration cycle for the stated test dates.

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7.0 TEST RESULTS

7.1 Summary

Company Name: Japan Remote Control Co., Ltd.
 FCC ID: AXG-RF2TPA
 Method/System: Frequency Hopping Spread Spectrum (FHSS)
 Number of Channels: 79

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (Tx)					
15.247(a)(1)	20dB Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
15.247(b)(1)	Peak Transmitter Output Power	< 125 mW		PASS	Section 7.3
15.247(a)(1)	Channel Separation	> 2/3 of 20 dB BW for systems with Output Power < 125mW		PASS	Section 7.5
15.247(a)(1)(iii)	Number of Channels	> 15 Channels		PASS	Section 7.7
15.247(a)(1)(iii)	Time of Occupancy	< 0.4 sec in 10.4 sec period		PASS	Section 7.6
15.247(d)	Band Edge / Out-of-Band Emissions	Conducted > 20dBc		PASS	Section 7.4, Section 7.8
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	RADIATED	PASS	Section 7.9, Section 7.10, Section 7.11

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
- 4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "BT Auto," Version 2.9.
- 5) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "Chamber Automation," Version 1.1.2.

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7.2 20dB Bandwidth Measurement

§15.247 (a.1.iii)

Test Overview and Limit

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

Test Procedure Used

ANSI C63.10-2013 – Section 6.9.2

Test Settings

1. The signal analyzers' automatic bandwidth measurement capability of the spectrum analyzer was used to perform the 20dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 20. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% OBW
3. VBW \geq 3 x RBW
4. Reference level set to keep signal from exceeding maximum input mixer level for linear operation.
5. Detector = Peak
6. Trace mode = max hold
7. Sweep = auto couple
8. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

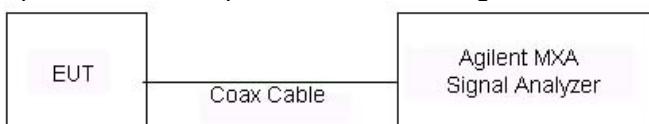


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None

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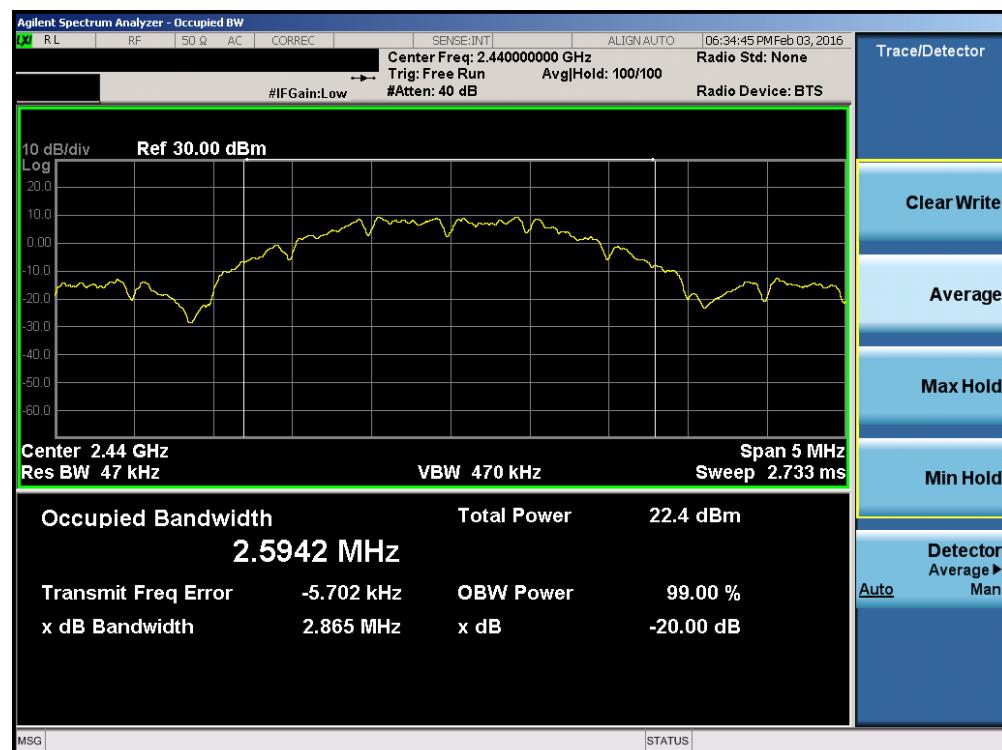
Frequency [MHz]	Channel No.	20dB Bandwidth Test Results	
		Measured Bandwidth [MHz]	Pass/Fail
2404	1	2.833	Pass
2441	13	2.865	Pass
2479	26	2.851	Pass

Table 7-2. Conducted 20dB Bandwidth Measurements



Plot 7-1. 20dB Bandwidth Plot (2400 MHz Band, Ch. 1)

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Plot 7-2. 20dB Bandwidth Plot (2400 MHz Band, Ch. 13)



Plot 7-3. 20dB Bandwidth Plot (2400 MHz Band, Ch. 26)

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7.3 Output Power Measurement

§15.247 (b.1)

Test Overview and Limits

Measurement is made while the EUT is operating in non-hopping transmission mode. The powers shown below were measured using a spectrum analyzer. Average power measurements were made using trace averaging over 100 traces with an RMS detector.

The maximum permissible output power is 1 Watt.

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.5

Test Settings

Peak Power Measurement

1. Span = approximately 5x 20dB bandwidth, centered on hopping channel
2. RBW > 20dB bandwidth of emission being measured
3. VBW \geq RBW
4. Sweep = auto
5. Detector = peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

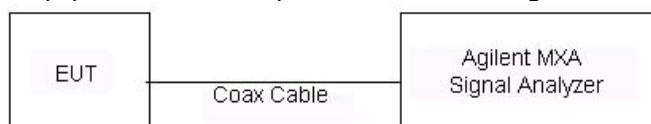


Figure 7-2. Test Instrument & Measurement Setup

Note

The test procedure in Section 7.8.5 of ANSI C63.10-2013 was followed for power measurements of the EUT even though it was configured for continuous transmission in single channel operation mode.

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Final results were obtained using calibrated attenuators and cables. The following formula was used:

$$\text{Output Power (dBm)} = \text{Raw Analyzer Level (dBm)} + \text{Cable Loss (dB)}$$

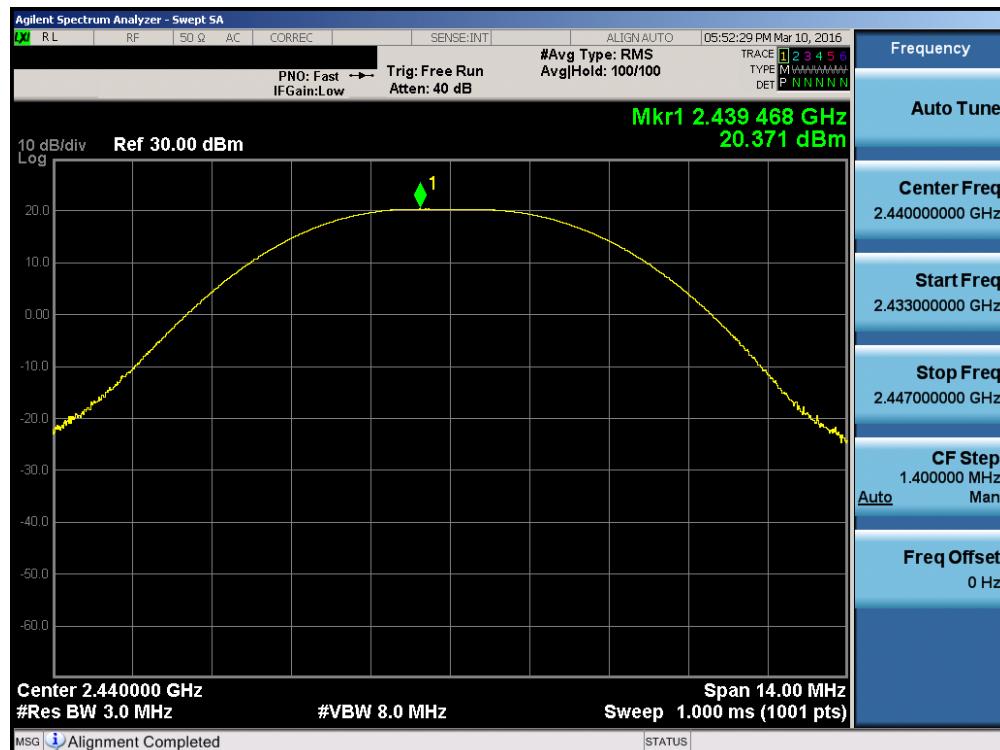
Frequency [MHz]	Peak Conducted Power		Avg Conducted Power	
	[dBm]	[mW]	[dBm]	[mW]
2404	20.93	123.794	20.26	106.072
2440	20.37	108.893	19.80	95.389
2479	13.26	21.184	12.56	18.022

Table 7-3. Conducted Output Power Measurements

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 15 of 48



Plot 7-4. Peak Conducted Power (2400MHz Band – Ch. 1)



Plot 7-5. Peak Conducted Power (2400MHz Band – Ch. 13)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 16 of 48

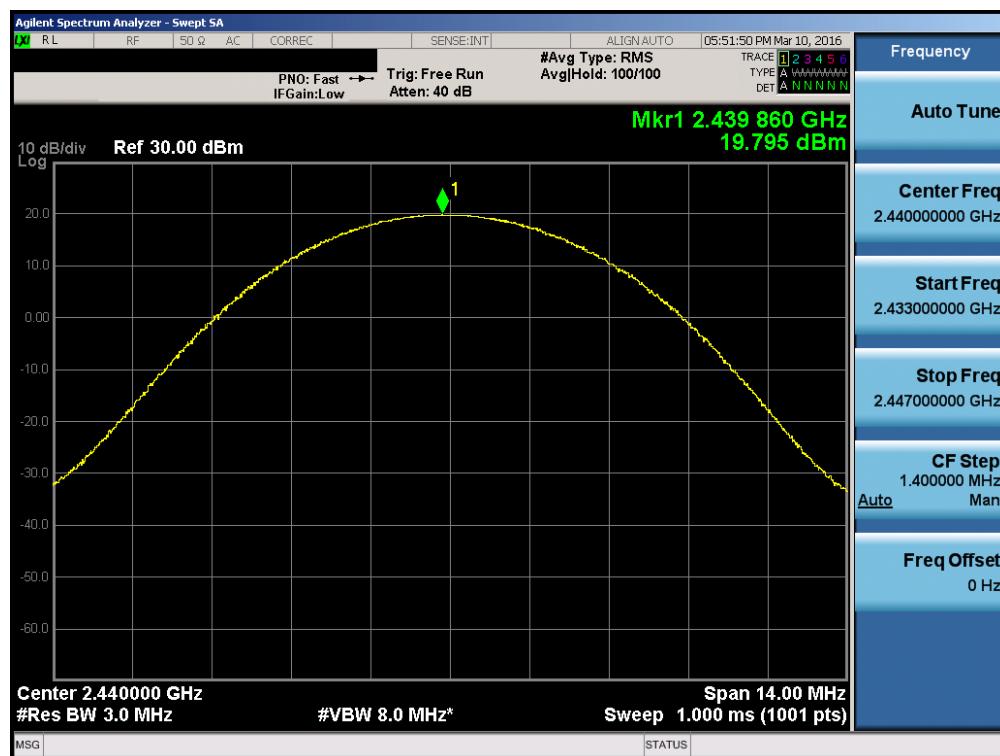


Plot 7-6. Peak Conducted Power (2400MHz Band – Ch. 26)

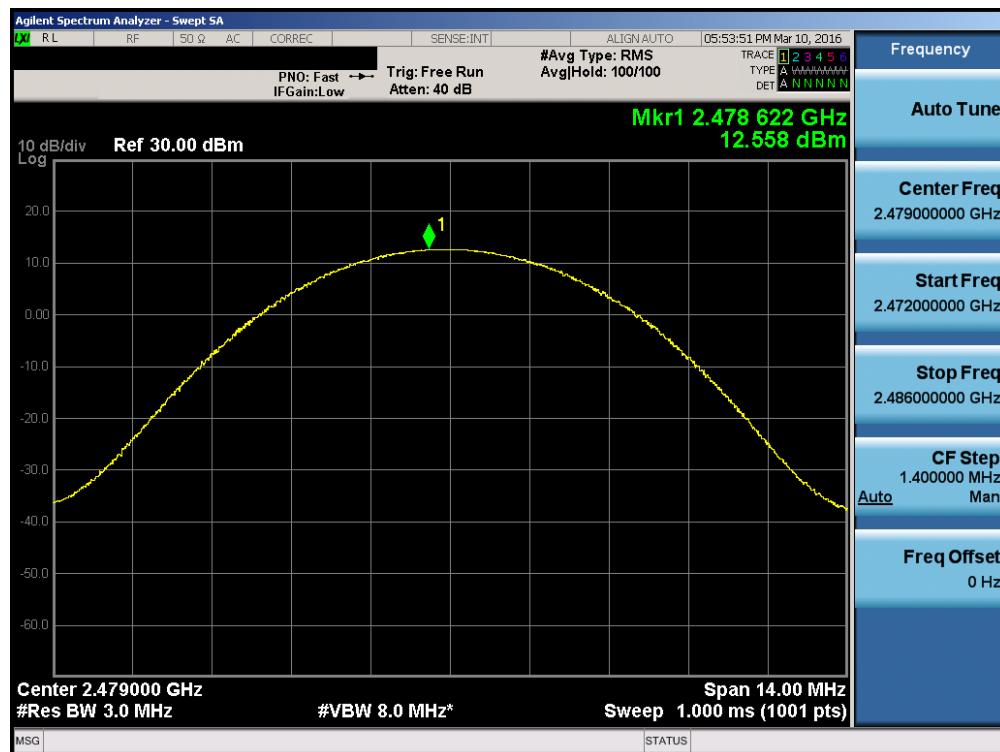


Plot 7-7. Average Conducted Power (2400MHz Band – Ch. 1)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 17 of 48



Plot 7-8. Average Conducted Power (2400MHz Band – Ch. 13)



Plot 7-9. Average Conducted Power (2400MHz Band – Ch. 26)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 18 of 48

7.4 Band Edge Compliance

§15.247 (d)

Test Overview and Limits

EUT operates in hopping and non-hopping transmission mode. Measurement is taken at the highest point located outside of the emission bandwidth. ***The maximum permissible out-of-band emission level is 20 dBc.***

Test Procedure Used

ANSI C63.10-2013 – Section 6.10.4

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100kHz
4. VBW = 300kHz
5. Detector = Peak
6. Number of sweep points $\geq 2 \times \text{Span}/\text{RBW}$
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

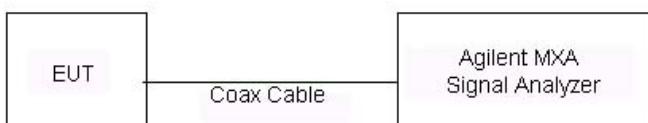
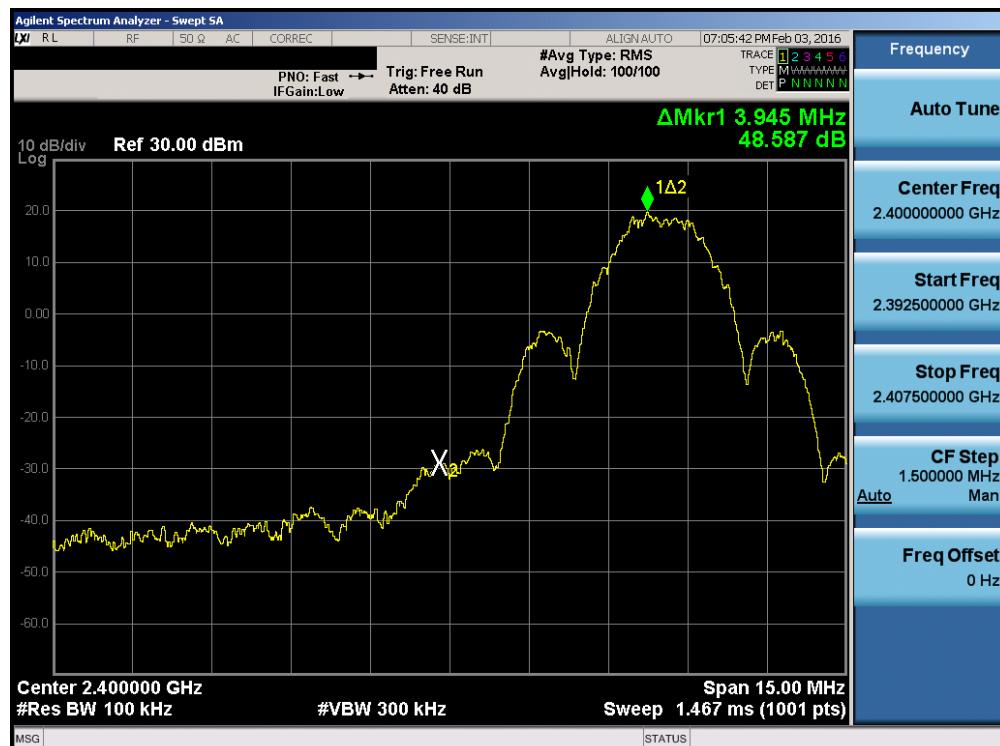


Figure 7-3. Test Instrument & Measurement Setup

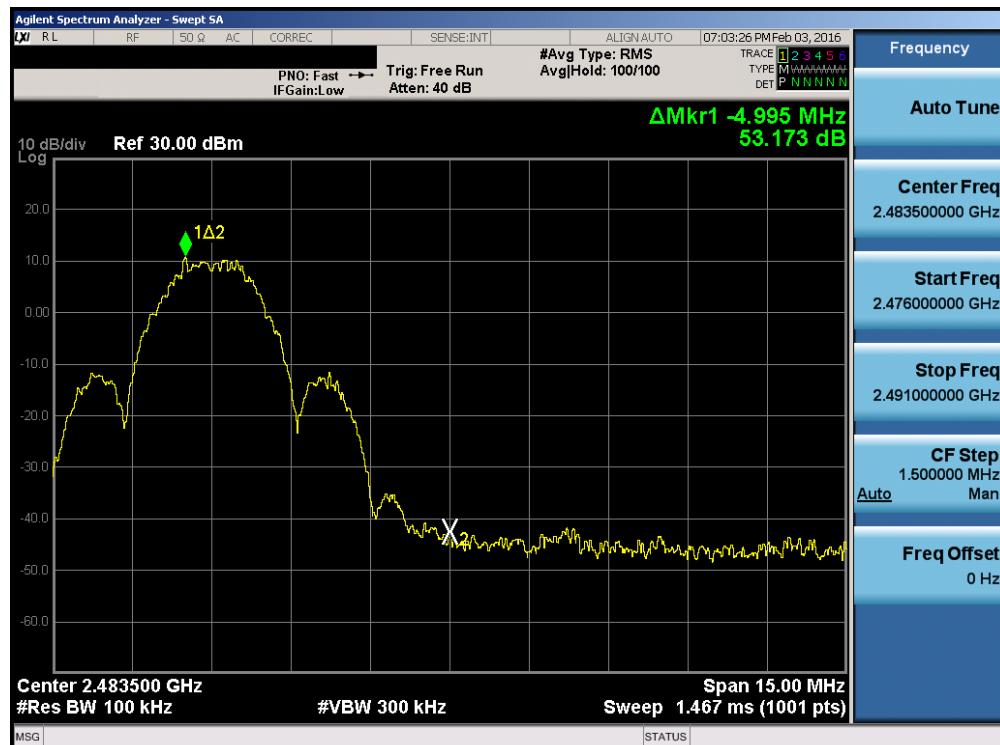
Test Notes

Out of band conducted spurious emissions at the band edge were investigated in hopping and non-hopping modes. Band edge emissions were also investigated with the EUT transmitting in hopping and non-hopping modes. Plots of the worst case single channel and hopping mode emissions are shown below.

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Plot 7-10. Band Edge Plot (2400 MHz Band with Hopping Disabled, Ch. 1)



Plot 7-11. Band Edge Plot (2400 MHz Band with Hopping Disabled, Ch. 26)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Plot 7-12. Band Edge Plot (2400 MHz Band with Hopping Enabled)



Plot 7-13. Band Edge Plot (2400 MHz Band with Hopping Enabled)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 21 of 48

7.5 Carrier Frequency Separation

§15.247 (a.1)

Test Overview and Limit

Measurement is made with EUT operating in hopping mode. ***The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.2

Test Settings

1. Span = Wide enough to capture peaks of two adjacent channels
2. RBW = 30% of channel spacing. Adjust as necessary to best identify center of each individual channel
3. VBW \geq RBW
4. Sweep = Auto
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize.
8. Marker-delta function used to determine separation between peaks of the adjacent channels

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

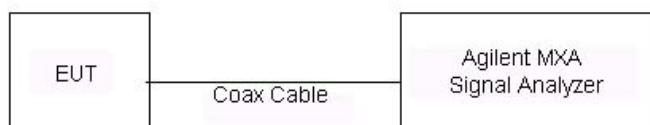


Figure 7-4. Test Instrument & Measurement Setup

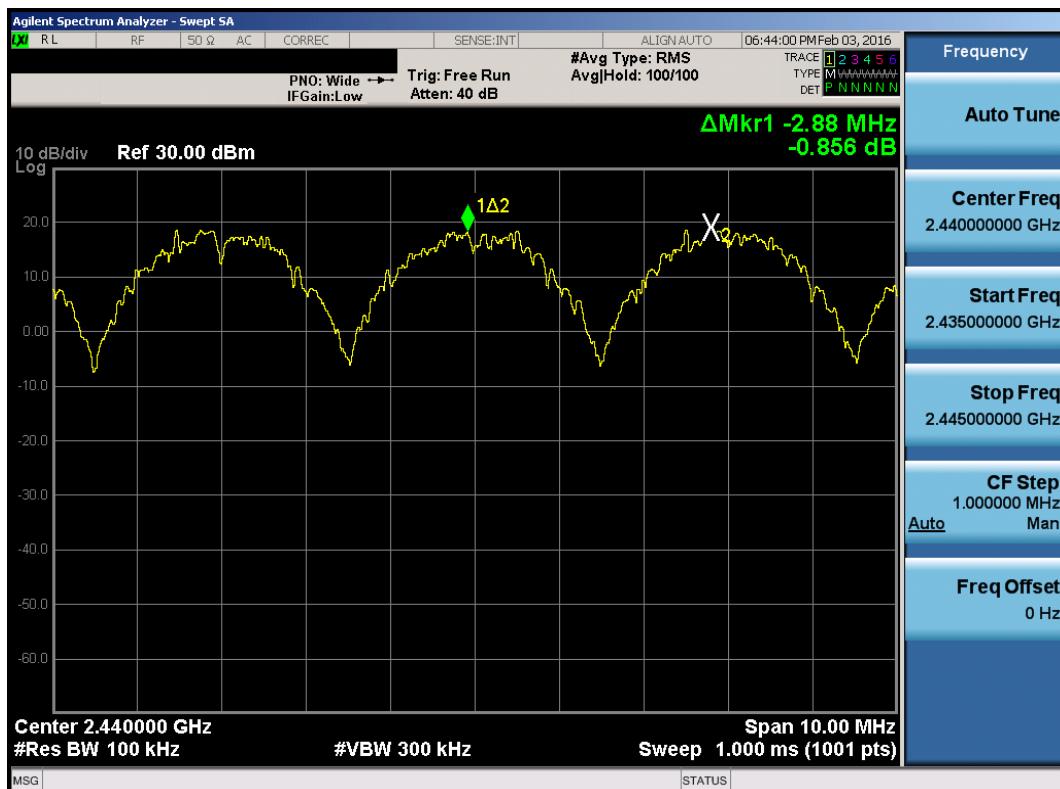
Test Notes

The EUT complies with the minimum channel separation requirement when it is operating in standard hopping mode.

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Frequency [MHz]	Channel No.	Min. Channel Separation [MHz]
2404	1	1.889
2440	13	1.910
2479	26	1.901

Table 7-4. Minimum Channel Separation



Plot 7-14. Channel Spacing Plot (2400 MHz Band)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 23 of 48

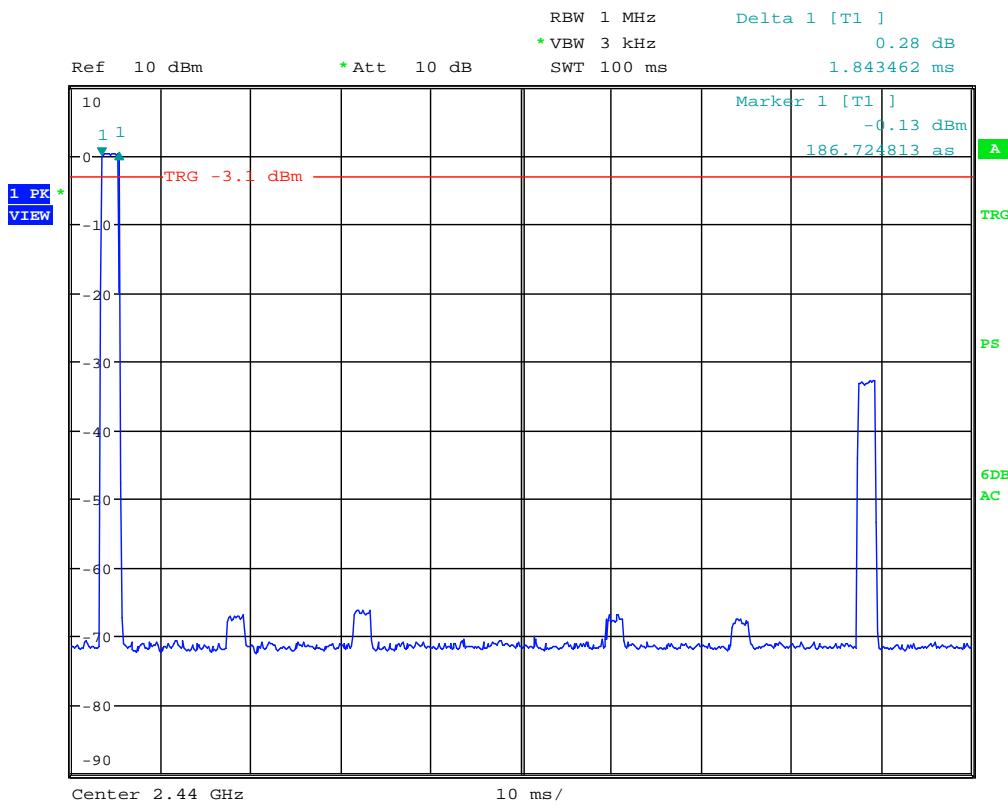
7.6 Time of Occupancy

§15.247 (a.1.iii)

Test Overview and Limit

Measurement is made while EUT is operating in hopping mode with the spectrum analyzer set to zero span. **The maximum permissible time of occupancy is 400 ms within a period of 400ms multiplied by the number of hopping channels employed.**

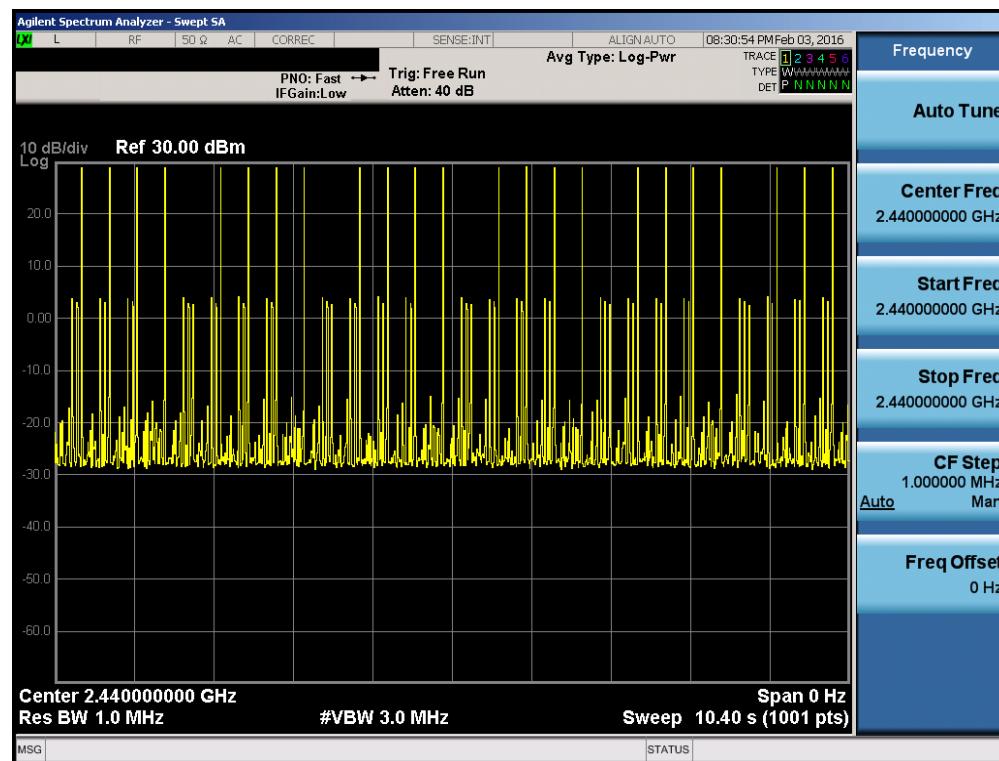
The pulse width for this device was measured on a spectrum analyzer and found to be 1.84 ms, as shown in Plot 7-15 below. After determining the pulse width, the analyzer was set to capture 10.4 seconds worth of data to determine the maximum number of times that one particular channel is transmitting. As shown in Plot 7-16 on the following page, the maximum occurrence of a channel is 23 times within a 10.4 second window.



Date: 10.DEC.2015 22:32:41

Plot 7-15. Time of Occupancy Plot (2400 MHz Band)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Plot 7-16. Dwell Time

Time of Occupancy Calculation

Based on the previous two plots, the time of occupancy can be determined as follows:

- Pulse Width = 1.84 ms (See Plot 7-15)
- 400ms x 26 hopping channels = 10.4 sec (Time of Occupancy Limit)
- Number of times that one particular channel appears in a 10.4 second period = 23 (See Plot 7-16)
- Time of Occupancy = 1.84 ms/pulse x 23 pulses/10.4 sec = 42.32ms/10.4 sec

Note:

Since the EUT was operating in hopping mode, there are several pulses shown in plots 7-15 and 7-16 due to operation on adjacent channels. Only the twenty-three pulses with the highest amplitude are used in the "time of occupancy" calculation because they are from the channel on which the analyzer was tuned.

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7.7 Number of Hopping Channels

§15.247 (a.1.iii)

Test Overview and Limit

Measurement is made while EUT is operating in hopping mode. ***This frequency hopping system must employ a minimum of 15 hopping channels.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.3

Test Settings

1. Span = frequency of band of operation (divided into two plots)
2. RBW < 30% of channel spacing or 20dB bandwidth, whichever is smaller.
3. VBW \geq RBW
4. Sweep = auto
5. Detector = peak
6. Trace mode = max hold
7. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

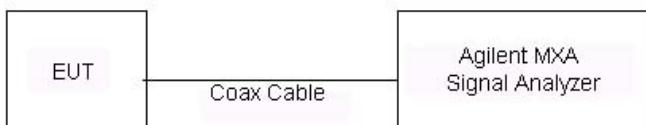
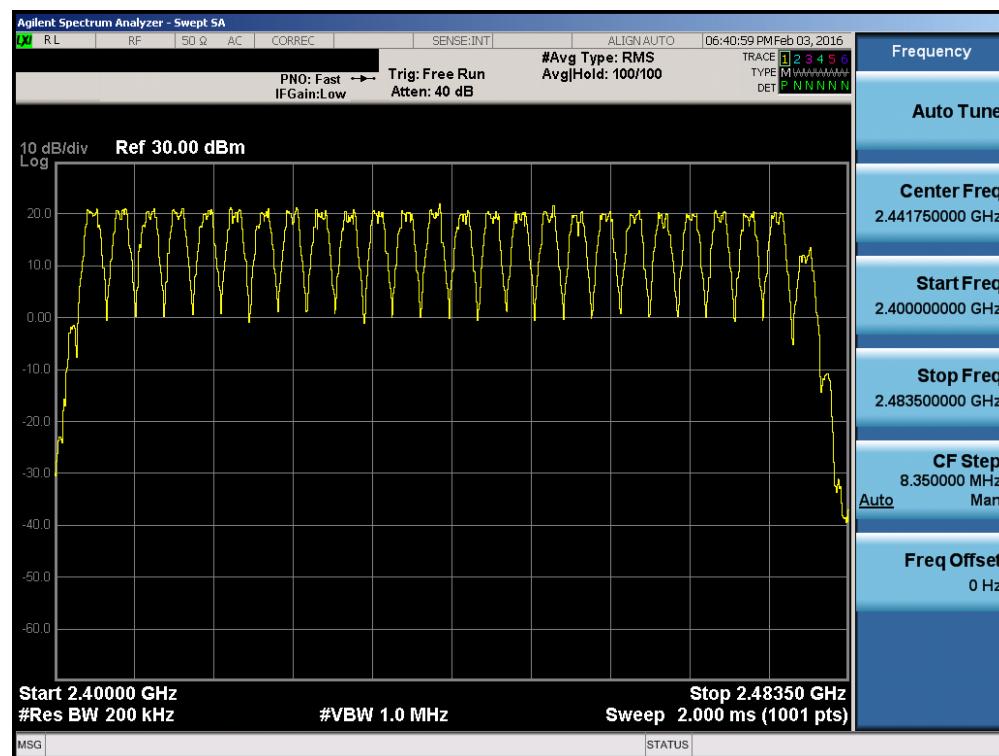


Figure 7-5. Test Instrument & Measurement Setup

Test Notes

None.

FCC ID: AXG-RF2TPA	 PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	 IMPROPO	Reviewed by: Quality Manager
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Plot 7-17. 2400MHz Spectrum Channel Hopping Plot (2400 MHz Band)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	Reviewed by: Quality Manager
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7.8 Conducted Spurious Emissions

§15.247 (d)

Test Overview and Limit

Conducted out-of-band spurious emissions were investigated from 30MHz up to 25GHz to include the 10th harmonic of the fundamental transmit frequency. ***The maximum permissible out-of-band emission level is 20 dBc.***

Test Procedure Used

ANSI C63.10-2013 – Section 7.8.8

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 25GHz (separated into two plots per channel)
2. RBW = 1MHz* (See note below)
3. VBW = 3MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

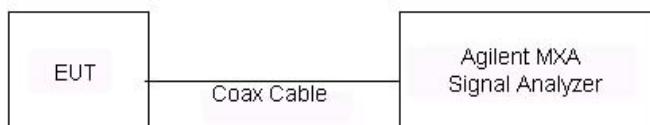
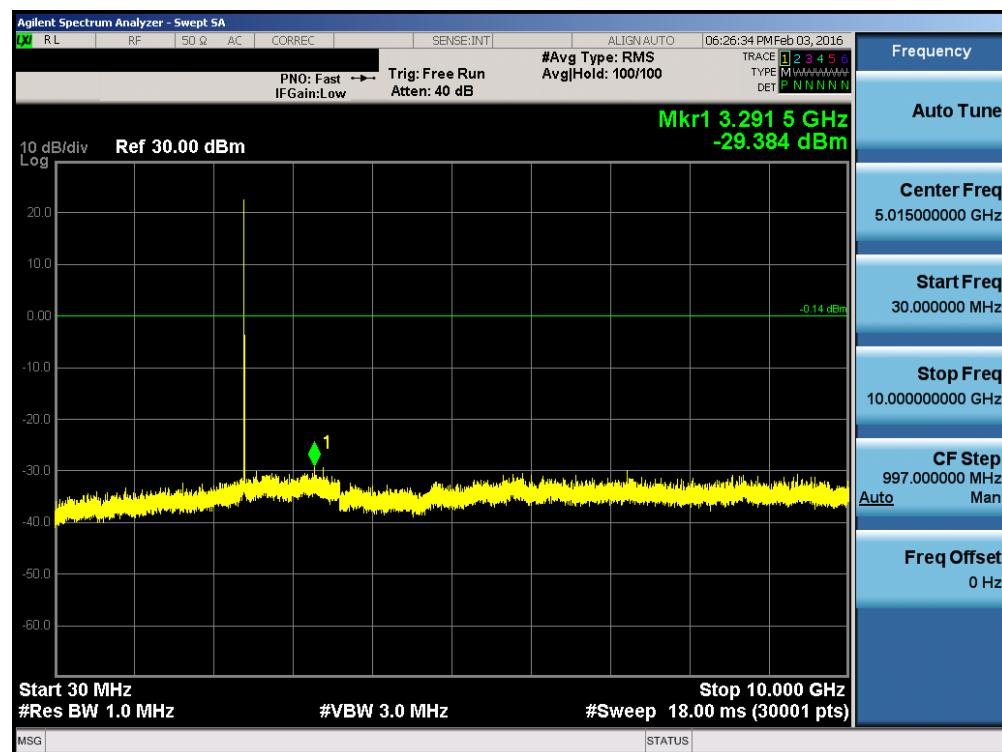


Figure 7-6. Test Instrument & Measurement Setup

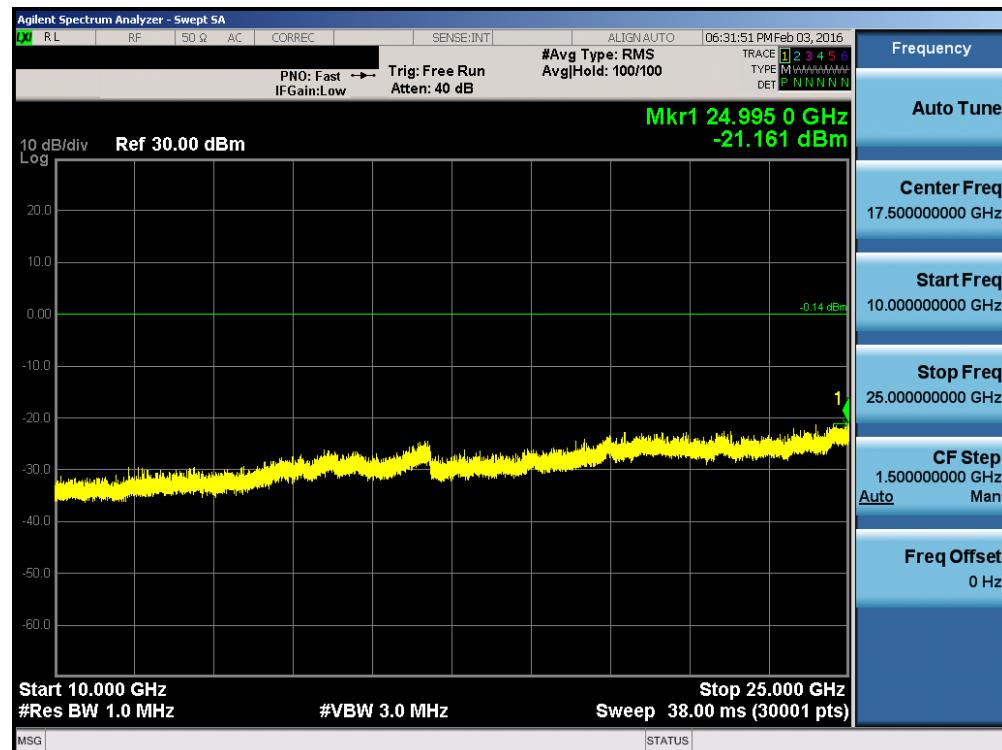
Test Notes

The display line shown in the following plots is the limit at 20dB below the fundamental emission level measured in a 100kHz bandwidth. However, the traces in the following plots are measured with a 1MHz RBW to reduce test time, so the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1MHz bandwidth.

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 28 of 48

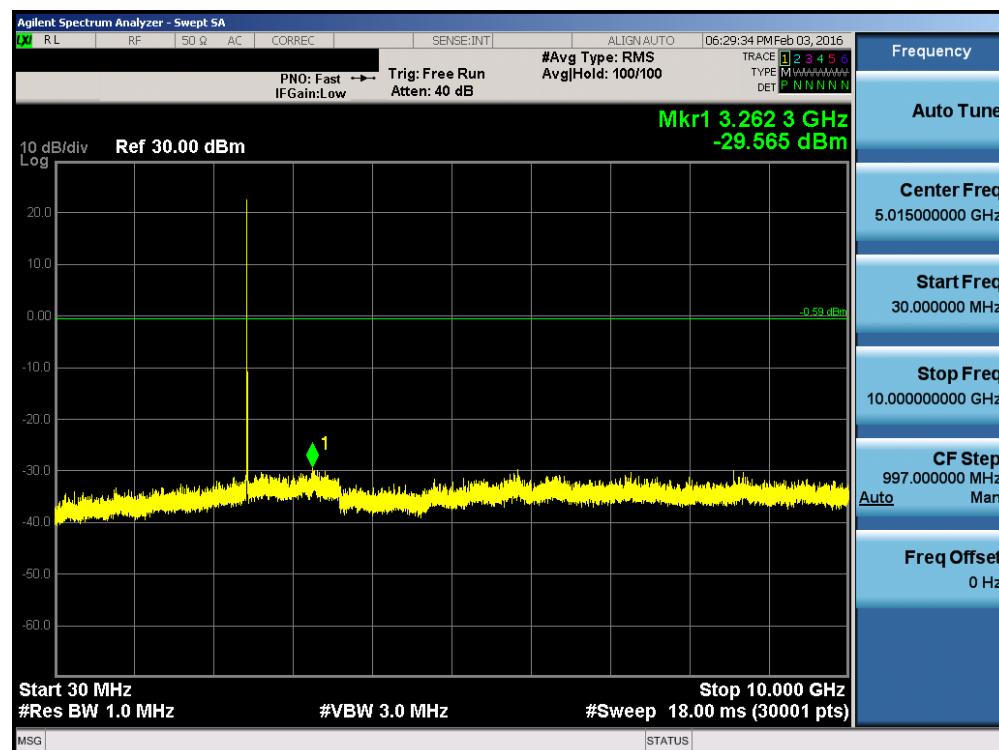


Plot 7-18. Conducted Spurious Plot (2400 MHz Band, Ch. 1)

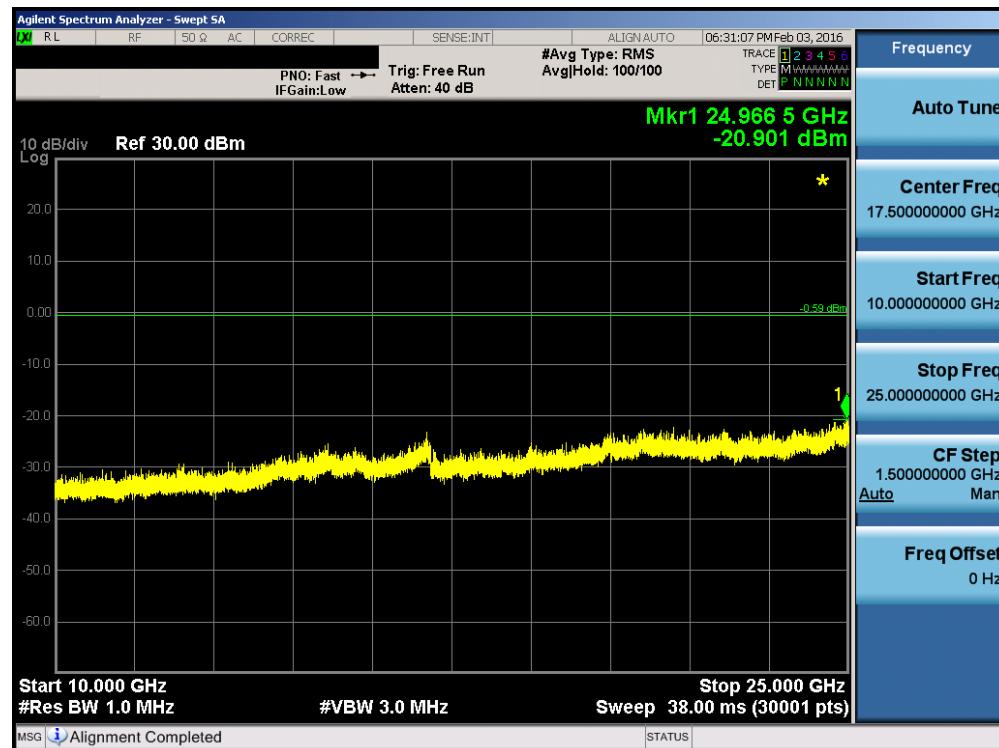


Plot 7-19. Conducted Spurious Plot (2400 MHz Band, Ch. 1)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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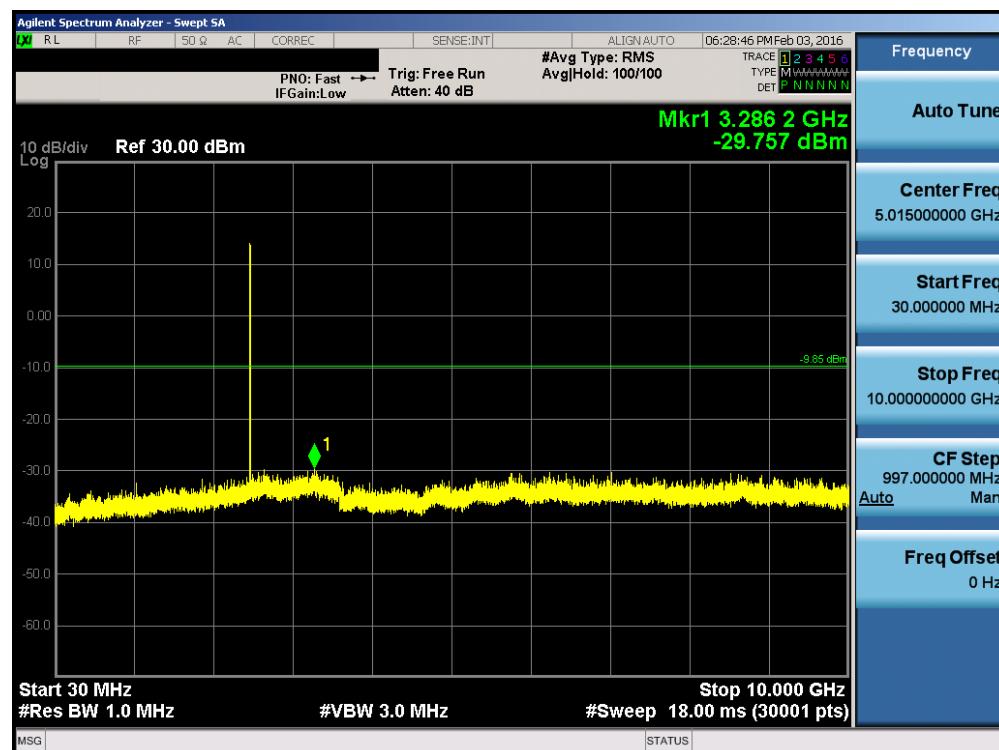


Plot 7-20. Conducted Spurious Plot (2400 MHz Band, Ch. 13)

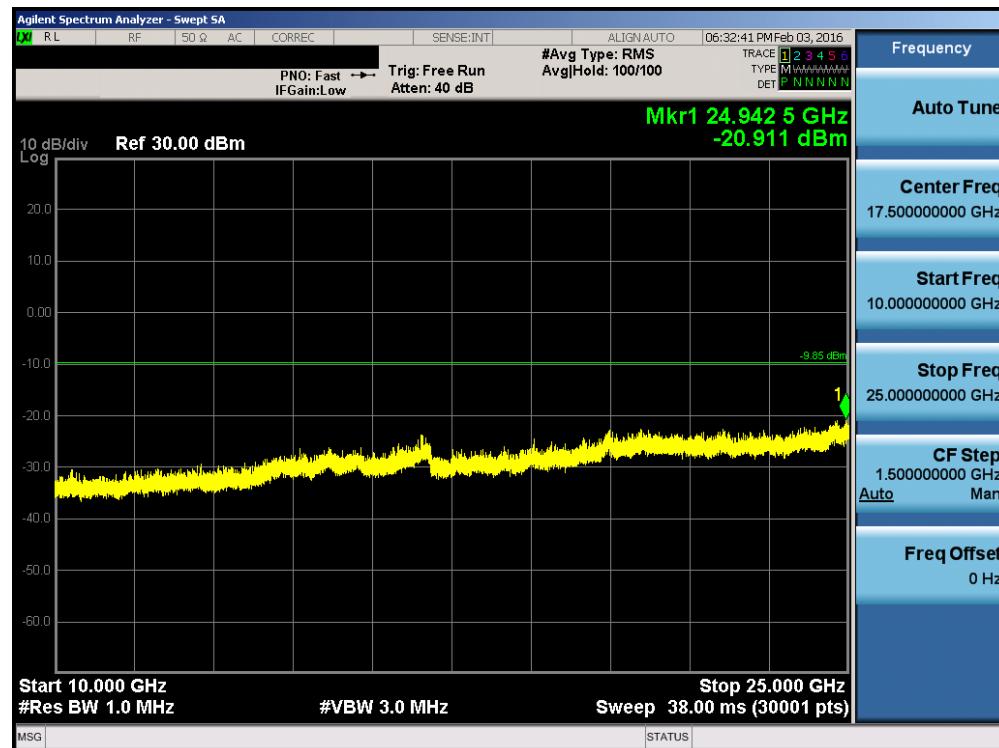


Plot 7-21. Conducted Spurious Plot (2400 MHz Band, Ch. 13)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	Reviewed by: Quality Manager
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Plot 7-22. Conducted Spurious Plot (2400 MHz Band, Ch. 26)



Plot 7-23. Conducted Spurious Plot (2400 MHz Band, Ch. 26)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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7.9 Radiated Spurious Emission Measurements – Above 1GHz

§15.205 §15.209 §15.247 (d)

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at maximum power and at the appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 7-5 per Section 15.209.

Frequency	Field Strength [μ V/m]	Measured Distance [Meters]
Above 960.0 MHz	500	3

Table 7-5. Radiated Limits

Test Procedure Used

ANSI C63.10-2013 – Section 6.6.4.3

Test Settings

Average Field Strength Measurements per Section 4.1.4.2.3 of ANSI C63.10-2013

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 1kHz
4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
5. Detector = peak
6. Sweep time = auto
7. Trace mode = max hold
8. Trace was allowed to stabilize

Peak Field Strength Measurements per Section 4.1.4.2.2 of ANSI C63.10-2013

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW is set depending on measurement frequency, as specified in Table 7-6 below
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

FCC ID: AXG-RF2TPA	 PCTEST Engineering Laboratory, Inc.	FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	IMPROPO	Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 32 of 48

Frequency	RBW
9 – 150kHz	200 – 300Hz
0.15 – 30MHz	9 – 10kHz
30 – 1000MHz	100 – 120kHz
> 1000MHz	1MHz

Table 7-6. RBW as a Function of Frequency

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

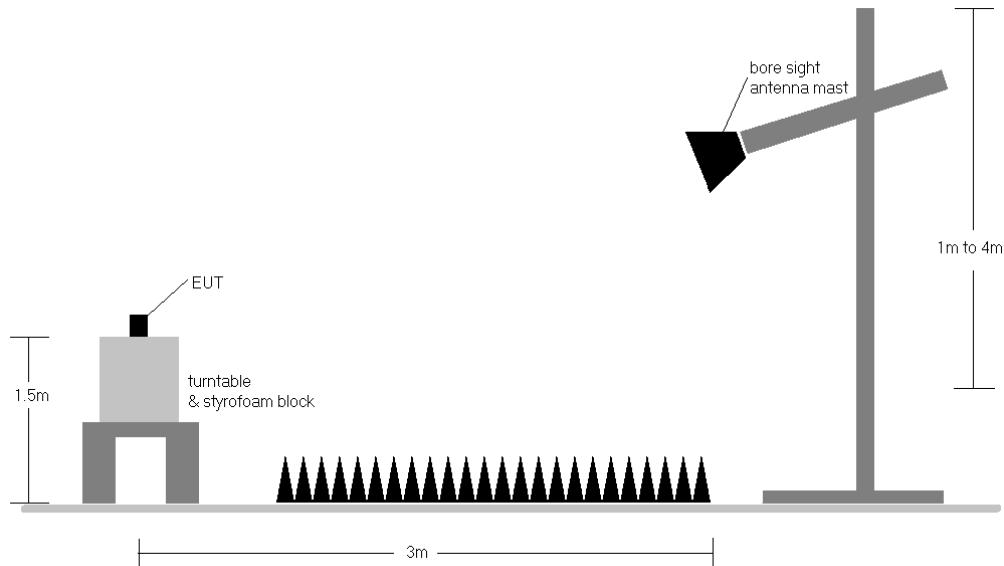


Figure 7-7. Radiated Test Setup >1GHz

Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-5.
2. No significant radiated emissions were found in the 2310 - 2390MHz restricted band.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
6. The duty cycle correction factor was not applied to noise floor measurements.
7. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section.
8. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

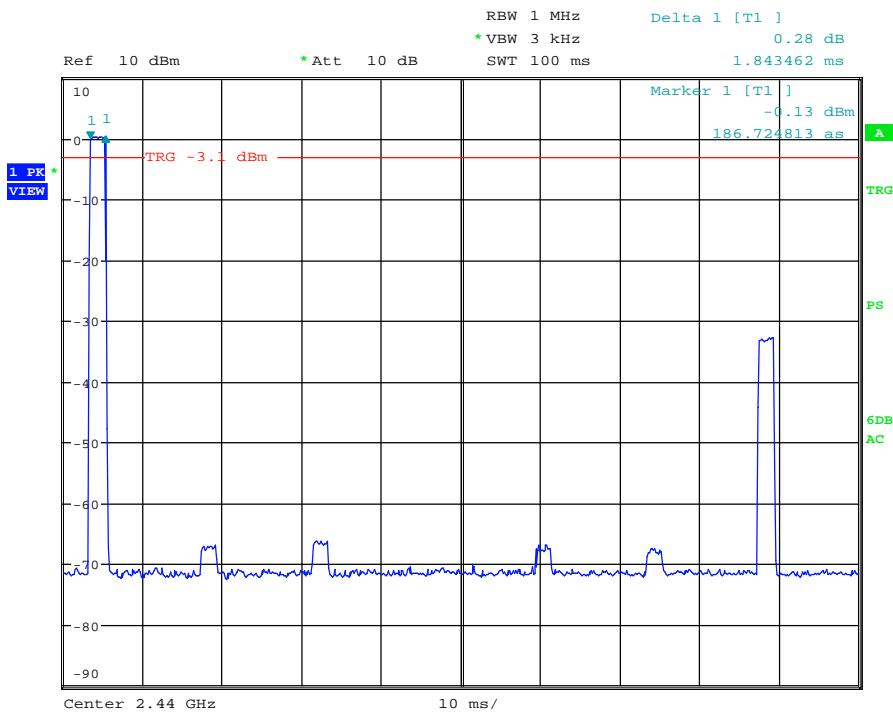
FCC ID: AXG-RF2TPA	 PCTEST Engineering Laboratory, Inc.	FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	JM PROPO	Reviewed by: Quality Manager
Test Report S/N: 0Y1512282276.AXG	Test Dates: 11/30/2015 - 2/11/2016, 3/10/2016	EUT Type: Telemetry Radio Control System		Page 33 of 48

Sample Calculation

- Field Strength Level $[\text{dB}_{\mu\text{V/m}}]$ = Analyzer Level $[\text{dBm}] + 107 + \text{AFCL } [\text{dB/m}] + \text{Duty Cycle Correction } [\text{dB}]$
- AFCL $[\text{dB/m}]$ = Antenna Factor $[\text{dB/m}] + \text{Cable Loss } [\text{dB}]$
- Margin $[\text{dB}]$ = Field Strength Level $[\text{dB}_{\mu\text{V/m}}] - \text{Limit } [\text{dB}_{\mu\text{V/m}}]$

Duty Cycle Correction Factor Calculation

- Worst case dwell time = 1.843 ms
- Duty cycle correction factor = $20\log_{10}(1.843\text{ms}/100\text{ms}) = -34.7 \text{ dB}$



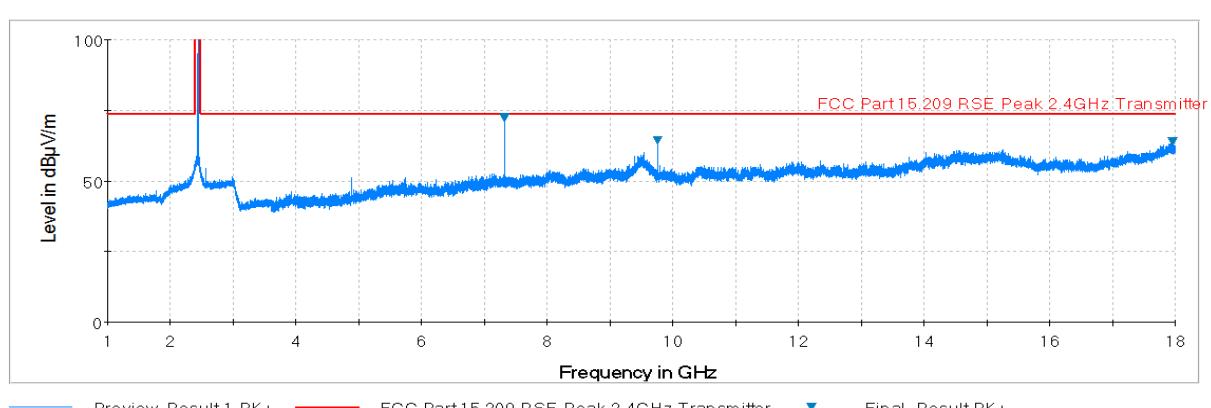
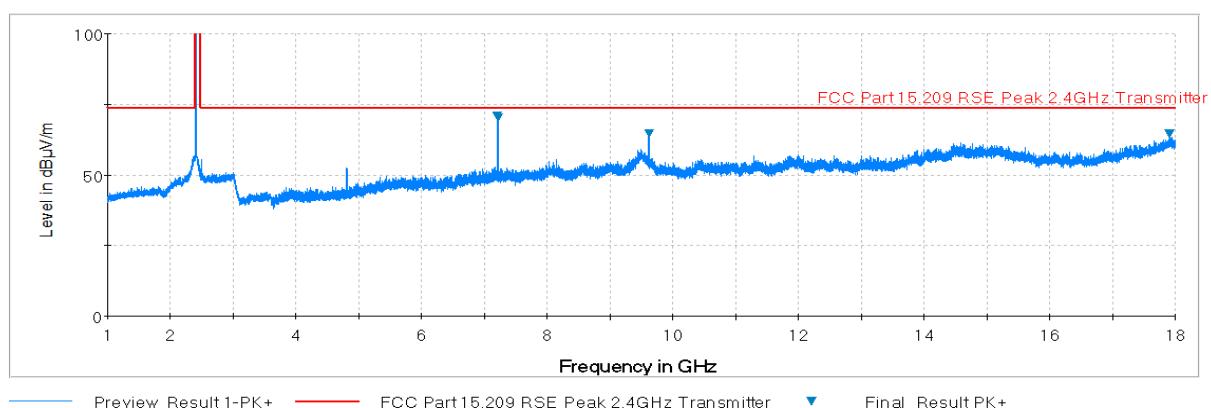
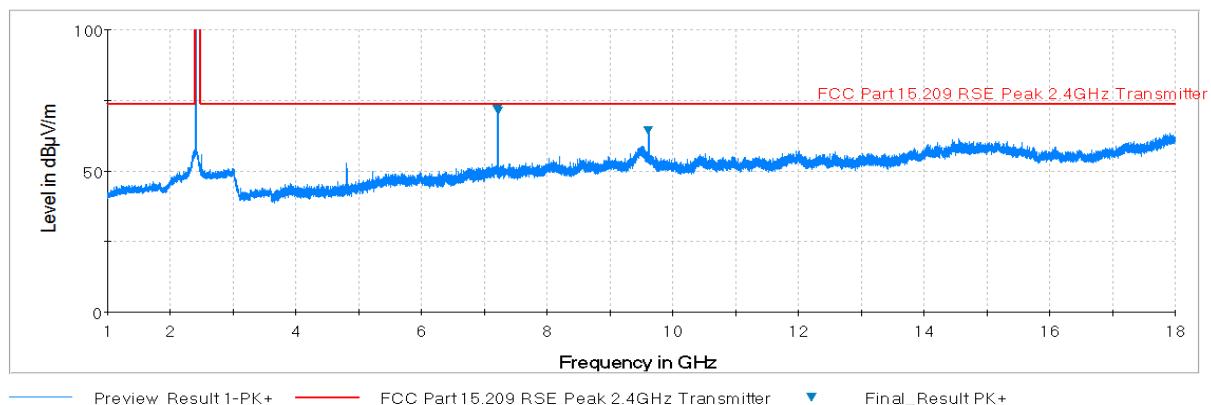
Date: 10.DEC.2015 22:32:41

Plot 7-24. Dwell Time

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d)



FCC ID: AXG-RF2TPA



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(CERTIFICATION)



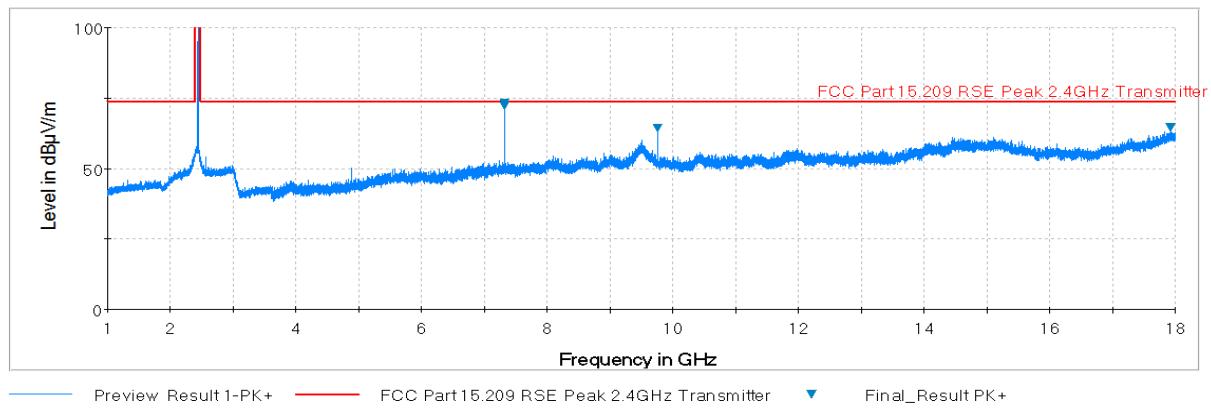
Reviewed by:
Quality Manager

Test Report S/N:
0Y1512282276.AXG

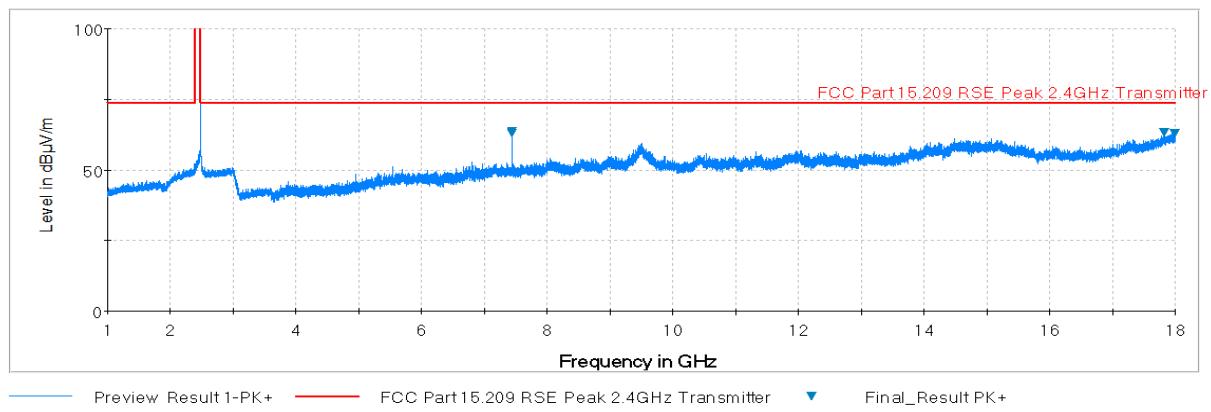
Test Dates:
11/30/2015 - 2/11/2016, 3/10/2016

EUT Type:
Telemetry Radio Control System

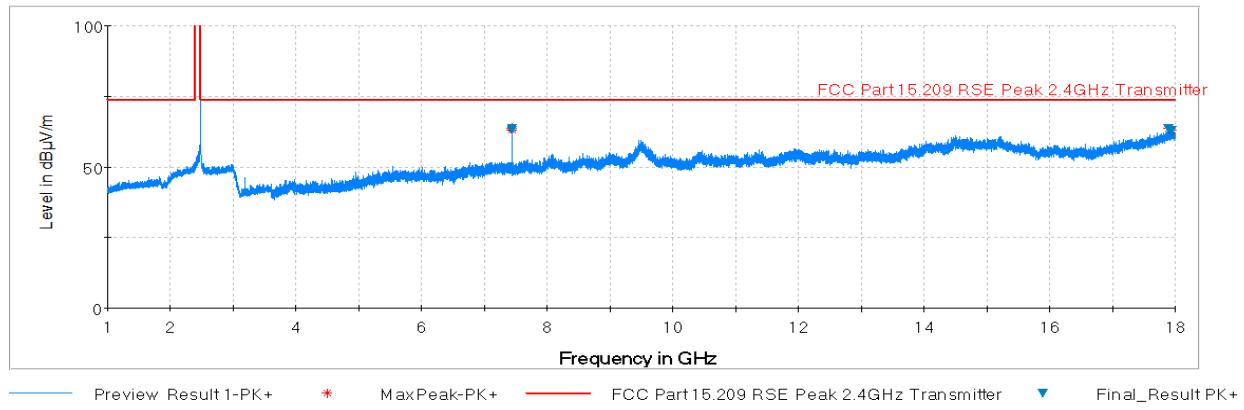
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Plot 7-28. Radiated Spurious Plot above 1GHz (2400MHz Band – Ch. 13, Ant. Pol. V)



Plot 7-29. Radiated Spurious Plot above 1GHz (2400MHz Band – Ch. 26, Ant. Pol. H)

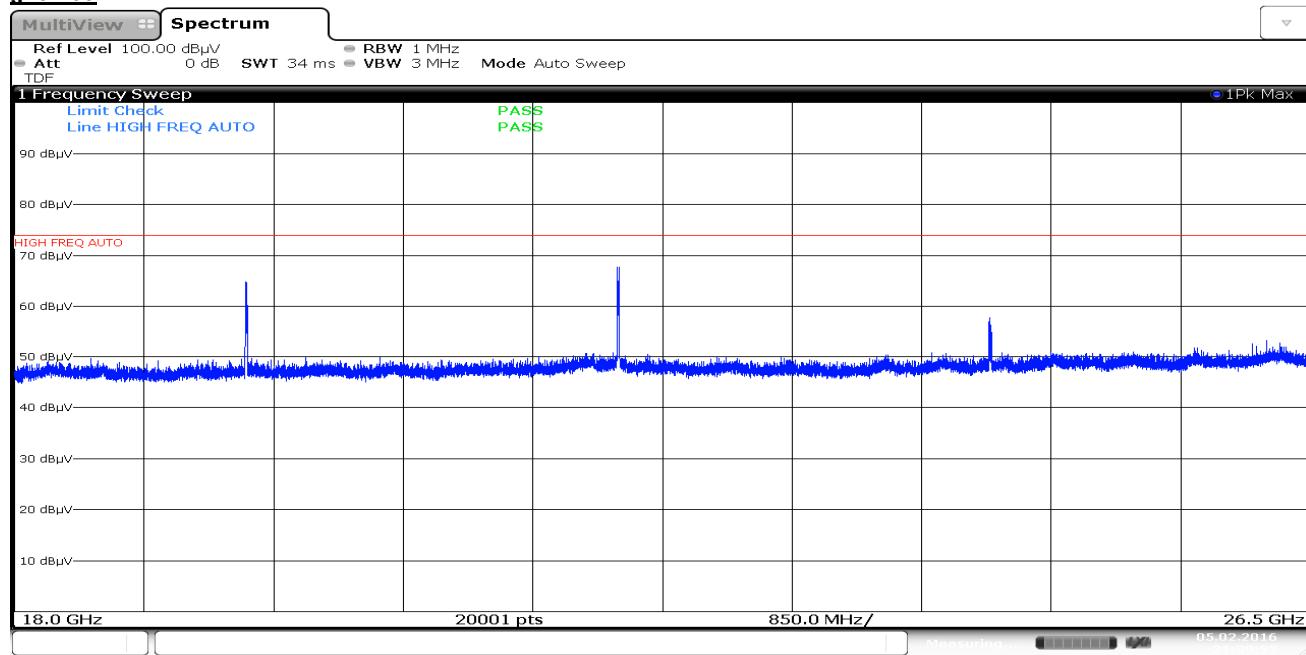


Plot 7-30. Radiated Spurious Plot above 1GHz (2400MHz Band – Ch. 26, Ant. Pol. V)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	Reviewed by: Quality Manager
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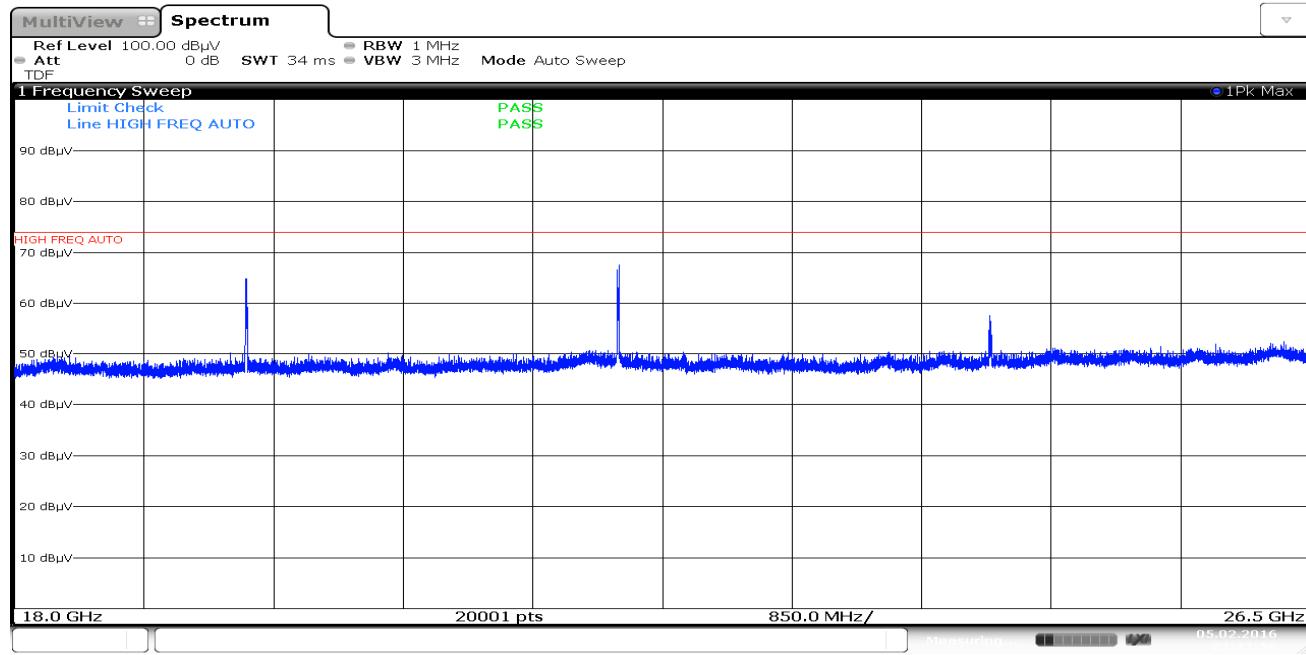
Radiated Spurious Emissions Measurements (Above 18GHz)

\$15.209



Date: 5.FEB.2016 21:39:52

Plot 7-31. Radiated Spurious Plot above 18GHz (Pol. H)



Date: 5.FEB.2016 21:41:56

Plot 7-32. Radiated Spurious Plot above 18GHz (Pol. V)

FCC ID: AXG-RF2TPA



FCC Pt. 15.247 2400MHz DMSS TEST REPORT
(CERTIFICATION)



Reviewed by:
Quality Manager

Test Report S/N:
0Y1512282276.AXG

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EUT Type:
Telemetry Radio Control System

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Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d)

Measurement Distance: 3 Meters
 Operating Frequency: 2404MHz
 Channel: 1

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [m]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB]	Duty Cycle Correction [dB]	Dist. Corr. Factor [dB]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
4808.00	Avg	H	1.46	148	-101.10	41.02	-34.70	0.00	12.22	53.98	-41.76
4808.00	Peak	H	1.46	148	-92.61	41.02	0.00	0.00	55.41	73.98	-18.57
12020.00	Avg	H	-	-	-111.21	51.25	0.00	0.00	47.05	53.98	-6.93
12020.00	Peak	H	-	-	-99.63	51.25	0.00	0.00	58.63	73.98	-15.35
19232.00	Avg	H	1.00	146	-99.12	44.32	-34.70	-9.54	7.95	53.98	-46.02
19232.00	Peak	H	1.00	146	-89.63	44.32	0.00	-9.54	52.15	73.98	-21.83

Table 7-7. Radiated Measurements

Measurement Distance: 3 Meters
 Operating Frequency: 2440MHz
 Channel: 13

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [m]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB]	Duty Cycle Correction [dB]	Dist. Corr. Factor [dB]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
4880.00	Avg	H	1.52	86	-99.26	40.72	-34.70	0.00	13.76	53.98	-40.22
4880.00	Peak	H	1.52	86	-90.98	40.72	0.00	0.00	56.74	73.98	-17.24
7320.00	Avg	H	1.10	266	-83.54	45.99	-34.70	0.00	34.75	53.98	-19.23
7320.00	Peak	H	1.10	266	-79.51	45.99	0.00	0.00	73.48	73.98	-0.50
12200.00	Avg	H	-	-	-111.33	50.05	0.00	0.00	45.72	53.98	-8.25
12200.00	Peak	H	-	-	-99.45	50.05	0.00	0.00	57.60	73.98	-16.37
19520.00	Avg	H	1.00	137	-98.12	44.32	-34.70	-9.54	8.95	53.98	-45.02
19520.00	Peak	H	1.00	137	-88.75	44.32	0.00	-9.54	53.03	73.98	-20.95

Table 7-8. Radiated Measurements

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Radiated Spurious Emission Measurements

§15.205 §15.209 §15.247 (d)

Measurement Distance: 3 Meters
 Operating Frequency: 2479MHz
 Channel: 26

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [m]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB]	Duty Cycle Correction [dB]	Dist. Corr. Factor [dB]	Field Strength [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
4958.00	Avg	H	1.52	94	-104.45	40.98	-34.70	0.00	8.83	53.98	-45.15
4958.00	Peak	H	1.52	94	-95.02	40.98	0.00	0.00	52.97	73.98	-21.01
7437.00	Avg	H	1.10	143	-90.04	46.77	-34.70	0.00	29.02	53.98	-24.96
7437.00	Peak	H	1.10	143	-82.64	46.77	0.00	0.00	71.12	73.98	-2.86
12395.00	Avg	H	-	-	-110.89	50.34	0.00	0.00	46.45	53.98	-7.53
12395.00	Peak	H	-	-	-98.47	50.34	0.00	0.00	58.87	73.98	-15.11
19832.00	Avg	H	-	-	-108.18	44.37	0.00	-9.54	33.65	53.98	-20.33
19832.00	Peak	H	-	-	-95.63	44.37	0.00	-9.54	46.20	73.98	-27.78
22311.00	Avg	H	-	-	-107.13	44.56	0.00	-9.54	34.89	53.98	-19.09
22311.00	Peak	H	-	-	-95.49	44.56	0.00	-9.54	46.53	73.98	-27.45

Table 7-9. Radiated Measurements

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	JM PROPO	Reviewed by: Quality Manager
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7.10 Radiated Restricted Band Edge Measurements

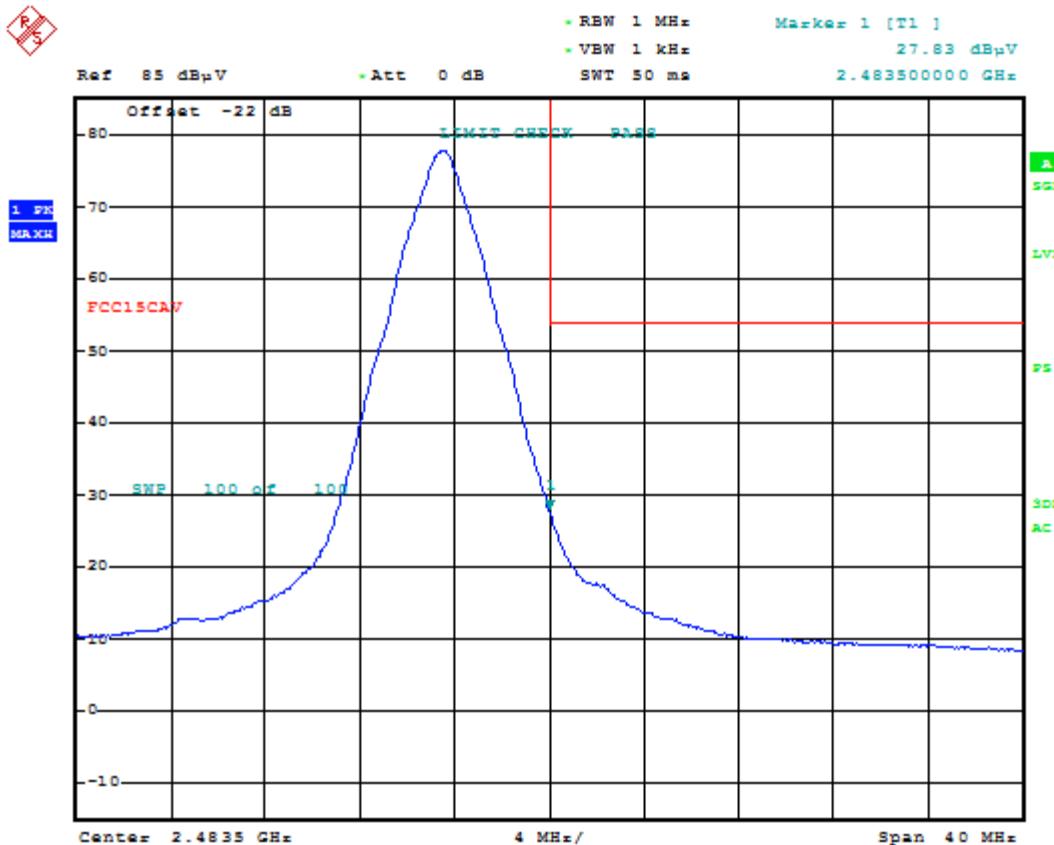
§15.205 §15.209 §15.247 (d)

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting. Two different amplitude offsets were used depending on whether peak or average measurements were measured. The average measurements use a duty cycle correction factor (DCCF).

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

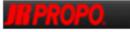
$$\text{Offset (dB)} = (\text{Antenna Factor} + \text{Cable Loss} + 10 \text{ dB Attenuator}) - \text{Preamplifier Gain} + \text{DCCF}$$

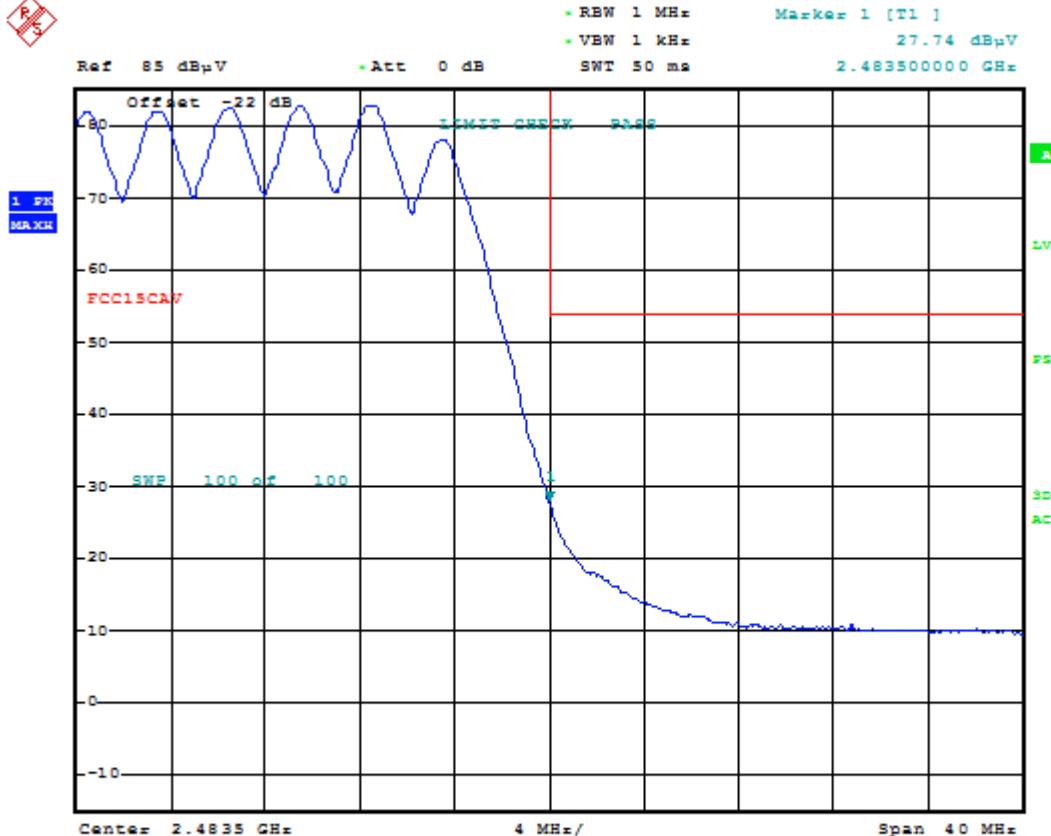
Measurement Distance: 3 Meters
 Operating Frequency: 2479MHz
 Channel: 26



Date: 5.FEB.2016 07:33:50

Plot 7-33. Radiated Restricted Upper Band Edge Measurement (Average)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Date: 5.FEB.2016 07:36:09

Plot 7-34. Radiated Restricted Upper Band Edge Measurement (Average, Hopping)

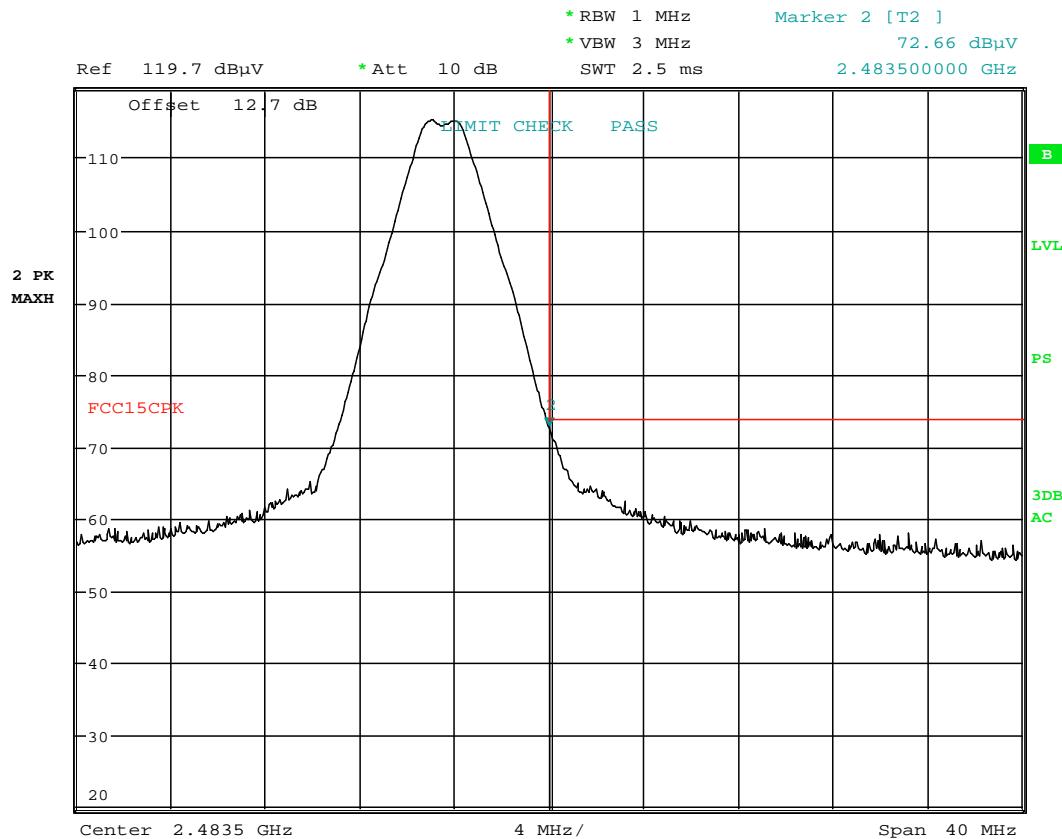
FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Radiated Restricted Band Edge Measurements

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The amplitude offset shown in the following plots for peak measurements was calculated using the formula:

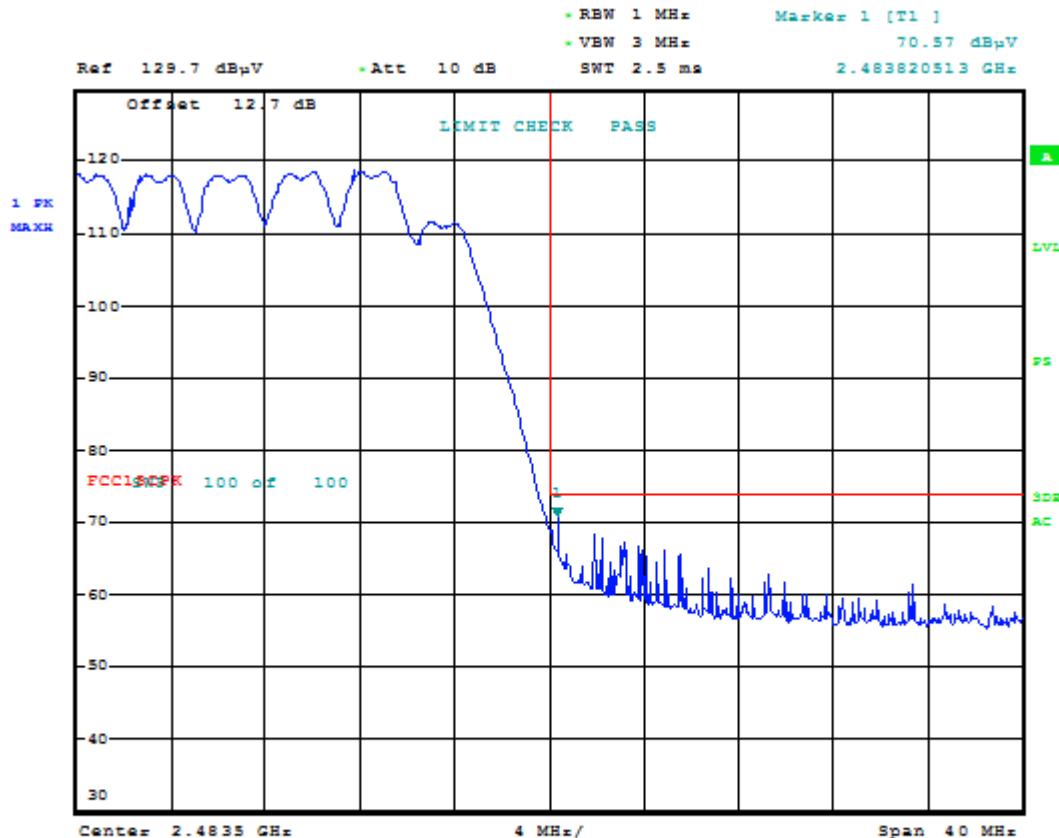
$$\text{Offset (dB)} = (\text{Antenna Factor} + \text{Cable Loss} + 10 \text{ dB Attenuator}) - \text{Preamplifier Gain}$$



Date: 5.FEB.2016 06:29:11

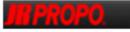
Plot 7-35. Radiated Restricted Upper Band Edge Measurement (Peak)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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Date: 5.FEB.2016 06:35:47

Plot 7-36. Radiated Restricted Upper Band Edge Measurement (Peak, Hopping)

FCC ID: AXG-RF2TPA		FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)		Reviewed by: Quality Manager
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7.11 Radiated Spurious Emissions Measurements – Below 1GHz

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Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 7-10 per Section 15.209.

Frequency	Field Strength [μ V/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-10. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

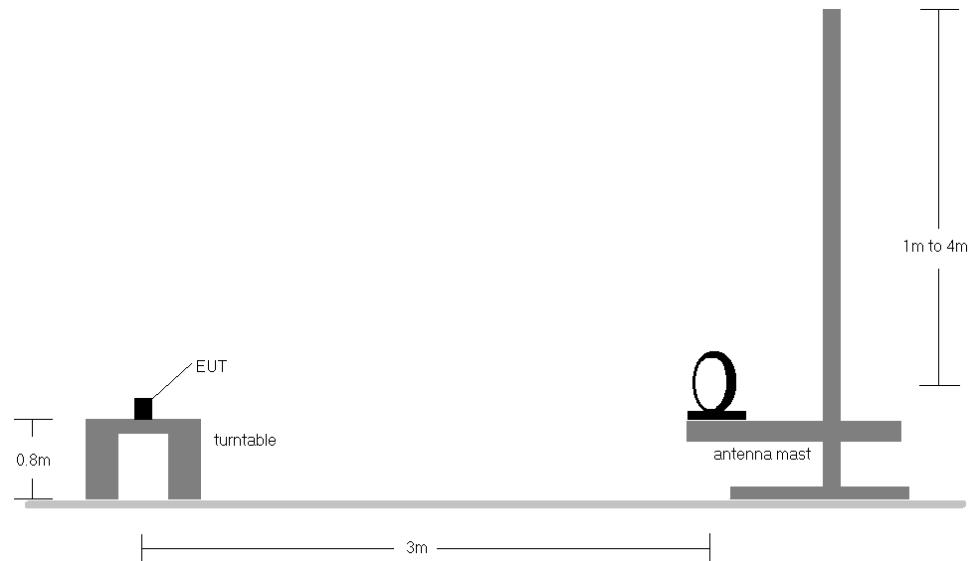


Figure 7-8. Radiated Test Setup <30MHz

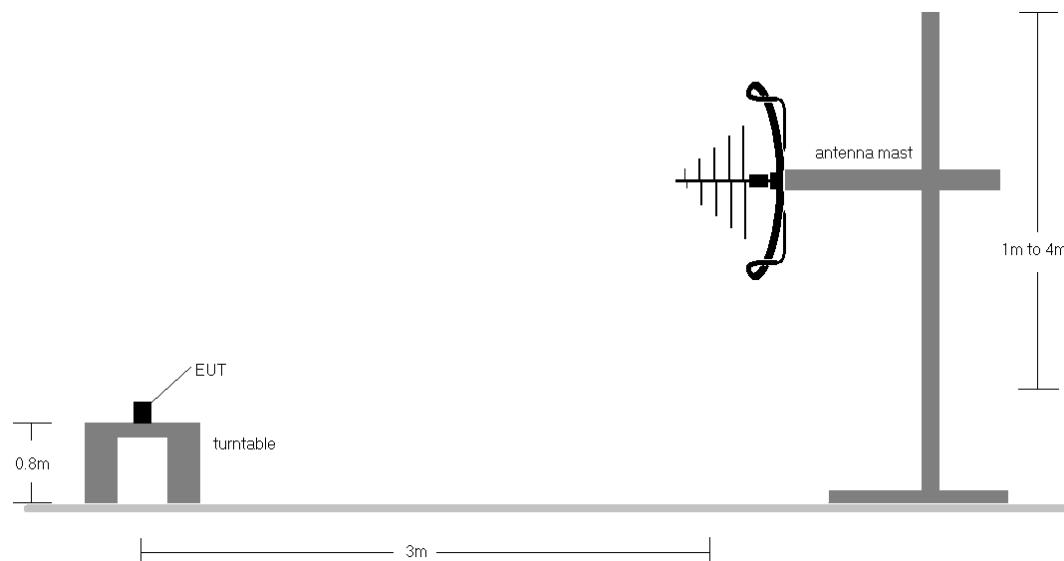


Figure 7-9. Radiated Test Setup <1000MHz

FCC ID: AXG-RF2TPA	 PCTEST Engineering Laboratory, Inc.	FCC Pt. 15.247 2400MHz DMSS TEST REPORT (CERTIFICATION)	JMPOPO	Reviewed by: Quality Manager
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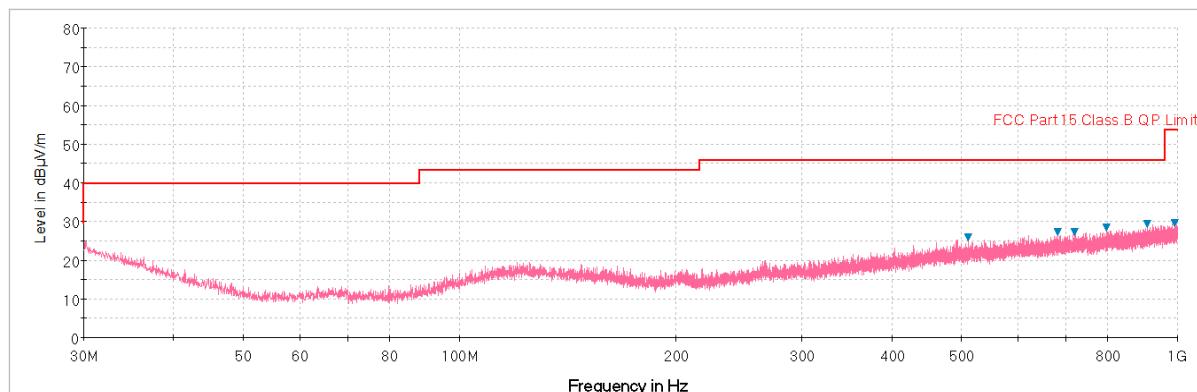
Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-10.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested with its standard battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
9. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

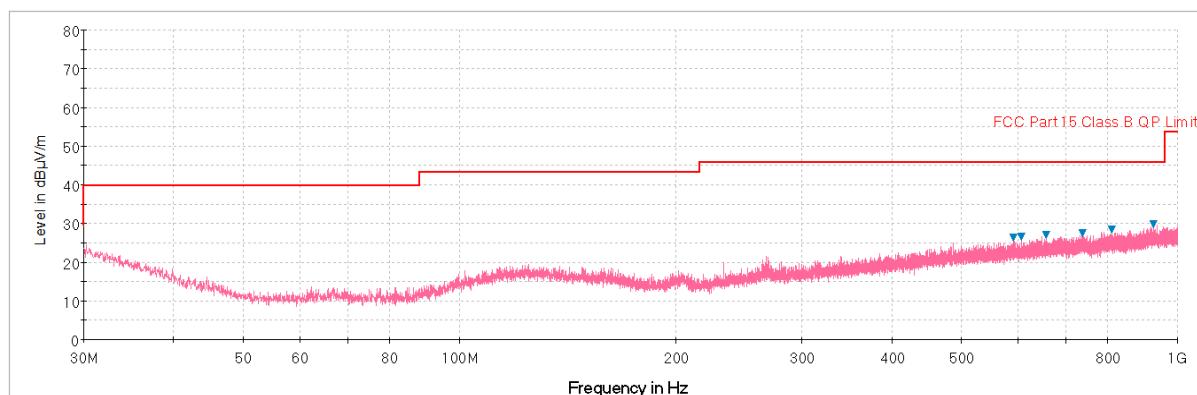
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Radiated Spurious Emissions Measurements (Below 1GHz)

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Plot 7-37. Radiated Spurious Plot below 1GHz (Pol. H)

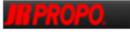


Plot 7-38. Radiated Spurious Plot below 1GHz (Pol. V)

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Japan Remote Control Telemetry Radio Control System FCC ID: AXG-RF2TPA** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules.

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