

FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

Tablet with cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA /CDMA 1xRTT /1x Advanced/EV-DO Rev 0, A, B/LTE/IEEE 802.11a/b/g/n (MIMO 2x2) and Bluetooth Radio

MODEL: A1475

FCC ID: BCGA1475 IC: 579C-A1475

REPORT NUMBER: 13U15555-9

ISSUE DATE: SEPTEMBER 17, 2013

Prepared for

APPLE, INC. 1 INFINITE LOOP CUPERTINO, CA 95014, U.S.A.

Prepared by UL VERIFICATION SERVICES INC. 47173 BENICIA STREET FREMONT, CA 94538, U.S.A. TEL: (510) 771-1000 FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
	09/17/13	Initial Issue	T. Chan

Page 2 of 272

TABLE OF CONTENTS

1.	ATTES	TATION OF TEST RESULTS	5
2.	TEST N	ETHODOLOGY	6
3.	FACILI	TIES AND ACCREDITATION	6
4.	CALIBR	ATION AND UNCERTAINTY	6
4	.1. ME	ASURING INSTRUMENT CALIBRATION	6
4	.2. SA	MPLE CALCULATION	6
4	.3. ME	ASUREMENT UNCERTAINTY	7
5.	EQUIP	IENT UNDER TEST	7
5	5.1. DE	SCRIPTION OF EUT	7
5	5.2. MA	XIMUM OUTPUT POWER	7
5	5.3. DE	SCRIPTION OF AVAILABLE ANTENNAS	8
5	5.4. SO	FTWARE AND FIRMWARE	8
5	5.5. WC	ORST-CASE CONFIGURATION AND MODE	9
5	5.6. DE	SCRIPTION OF TEST SETUP	10
6.	TEST A	ND MEASUREMENT EQUIPMENT	13
7.		E, DUTY CYCLE AND MEASUREMENT METHODS	
7	7.1. ON	TIME AND DUTY CYCLE RESULTS	14
7	7.1. ON 7.2. ME	TIME AND DUTY CYCLE RESULTS	14 14
7 7 8.	7.1. ON 7.2. ME ANTEN	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS	14 14 19
7 7 8.	2.1. ON 2.2. ME ANTEN 8.1. 802	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND	14 14 19 19
7 7 8.	7.1. ON 7.2. ME ANTEN	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS	14 14 19 19 19
7 7 8.	7.1. ON 7.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND 6 dB BANDWIDTH 99% BANDWIDTH AVERAGE POWER	14 14 19 19 23 27
7 7 8.	2.1. ON 2.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3. 8.1.4.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND 6 dB BANDWIDTH 99% BANDWIDTH AVERAGE POWER OUTPUT POWER	14 14 19 19 19 23 27 28
7 7 8.	7.1. ON 7.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND 6 dB BANDWIDTH 99% BANDWIDTH AVERAGE POWER	14 14 19 19 23 27 28 33
7 7 8. 8	2.1. ON 2.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3. 8.1.3. 8.1.4. 8.1.5. 8.1.6.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND 6 dB BANDWIDTH	14 19 19 19 23 27 28 37
7 7 8. 8	2.1. ON 2.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3. 8.1.3. 8.1.4. 8.1.5. 8.1.6.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND 6 dB BANDWIDTH 99% BANDWIDTH AVERAGE POWER OUTPUT POWER PSD	14 14 19 19 23 28 33 37 44
7 7 8. 8	2.1. ON 2.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3. 8.1.4. 8.1.5. 8.1.6. 8.2. 802 8.2.1. 8.2.2.	TIME AND DUTY CYCLE RESULTS	14 19 19 19 23 27 28 37 37 44 44 48
7 7 8. 8	2.1. ON 2.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3. 8.1.4. 8.1.4. 8.1.5. 8.1.6. 8.2. 802 8.2.1. 8.2.2. 8.2.3.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND 6 dB BANDWIDTH	14 19 19 23 27 28 33 37 44 44 48 52
7 7 8. 8	2.1. ON 2.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3. 8.1.4. 8.1.4. 8.1.5. 8.1.6. 8.2. 802 8.2.1. 8.2.2. 8.2.3. 8.2.4.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS	14 19 19 27 28 33 37 44 44 48 52 53
7 7 8. 8	2.1. ON 2.2. ME ANTEN 8.1. 802 8.1.1. 8.1.2. 8.1.3. 8.1.4. 8.1.4. 8.1.5. 8.1.6. 8.2. 802 8.2.1. 8.2.2. 8.2.3.	TIME AND DUTY CYCLE RESULTS ASUREMENT METHODS NA PORT TEST RESULTS 2.11b MODE IN THE 2.4 GHz BAND 6 dB BANDWIDTH	14 19 19 23 27 28 33 37 44 44 44 48 52 53 58
7 7 8. 8	C.1. ON ANTEN ANTEN 8.1. 802 8.1.1. 802 8.1.2. 81.2. 8.1.3. 8.1.4. 8.1.4. 8.1.5. 8.1.6. 8.2.1. 8.2.1. 8.2.2. 8.2.3. 8.2.4. 8.2.5. 8.2.6.	TIME AND DUTY CYCLE RESULTS	14 19 19 23 27 28 33 37 44 44 44 48 52 53 58 62 69
7 7 8. 8	C.1. ON ANTEN 8.1. 802 8.1.1. 802 8.1.2. 802 8.1.3. 8.1.4. 8.1.5. 8.1.6. 8.2.1. 8.2.1. 8.2.2. 8.2.3. 8.2.4. 8.2.5. 8.2.6. 8.3.1.	TIME AND DUTY CYCLE RESULTS	14 14 19 19 23 27 28 27 28 37 44 44 48 52 53 62 69 69 69
7 7 8. 8	C.1. ON Z.2. ME ANTEN 8.1.2. 8.1.3. 8.1.2. 8.1.4. 8.1.5. 8.1.6. 8.2.1. 8.2.1. 8.2.2. 8.2.3. 8.2.4. 8.2.5. 8.2.6. 8.3.1. 8.3.1.	TIME AND DUTY CYCLE RESULTS	14 14 19 19 27 28 33 37 44 44 48 52 53 53 58 62 69 69 75
7 7 8. 8	C.1. ON ANTEN 8.1. 802 8.1.1. 802 8.1.2. 802 8.1.3. 8.1.4. 8.1.5. 8.1.6. 8.2.1. 8.2.1. 8.2.2. 8.2.3. 8.2.4. 8.2.5. 8.2.6. 8.3.1.	TIME AND DUTY CYCLE RESULTS	14 14 19 19 23 27 28 33 37 44 44 48 52 53 58 62 69 69 75 81

47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888 This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

REPORT NO: 13U15555-9 DATE: SEPTEMBE FCC ID: BCGA1475 IC: 57	R 17, 2013 9C-A1475
FCC ID: BCGA1475 IC: 57 8.3.4. OUTPUT POWER	
8.3.5. PSD	
8.3.6. OUT-OF-BAND EMISSIONS	
8.4. 802.11a MODE IN THE 5.8 GHz BAND	
8.4.1. 6 dB BANDWIDTH	
8.4.2. 99% BANDWIDTH	
8.4.3. AVERAGE POWER	
8.4.4. OUTPUT POWER	
8.4.6. OUT-OF-BAND EMISSIONS	
8.5. 802.11n HT20 2TX CDD MODE IN THE 5.8 GHz BAND	
8.5.1. 6 dB BANDWIDTH	
8.5.2. 99% BANDWIDTH	130
8.5.3. AVERAGE POWER	
8.5.4. OUTPUT POWER	
8.5.5. PSD	
8.5.6. OUT-OF-BAND EMISSIONS	
8.6. 802.11n HT40 SISO MODE IN THE 5.8 GHz BAND	
8.6.1. 6 dB BANDWIDTH	
8.6.2. 99% BANDWIDTH	
8.6.3. AVERAGE POWER 8.6.4. OUTPUT POWER	
8.6.5. PSD	
8.6.6. OUT-OF-BAND EMISSIONS	
8.7. 802.11n HT40 2TX CDD MODE IN THE 5.8 GHz BAND	167
8.7.1. 6 dB BANDWIDTH	
8.7.2. 99% BANDWIDTH	170
8.7.3. AVERAGE POWER	-
8.7.4. OUTPUT POWER	
8.7.5. PSD	
8.7.6. OUT-OF-BAND EMISSIONS	181
9. RADIATED TEST RESULTS	188
9.1. LIMITS AND PROCEDURE	188
9.2. TRANSMITTER ABOVE 1 GHz	
9.2.1. TX ABOVE 1 GHz 802.11b MODE IN THE 2.4 GHz BAND	
9.2.2. TX ABOVE 1 GHz 802.11g MODE IN THE 2.4 GHz BAND	
9.2.3. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 2.4 GHz BAND	-
9.2.4. TX ABOVE 1 GHz 802.11a MODE IN THE 5.8 GHz BAND	
9.2.5. TX ABOVE 1 GHz 802.11n HT20 2TX CDD MODE IN THE 5.8 GHz BAN	
9.2.6. TX ABOVE 1 GHz 802.11n HT40 1TX MODE IN THE 5.8 GHz BAND 9.2.7. TX ABOVE 1 GHz 802.11n HT40 2TX CDD MODE IN THE 5.8 GHz BAN	
9.3. WORST-CASE ABOVE 18 GHz	
9.4. WORST-CASE BELOW 1 GHz	260
10. AC POWER LINE CONDUCTED EMISSIONS	264
11. SETUP PHOTOS	269

Page 4 of 272

Pass

1. ATTESTATION OF TEST RESULTS

INDUSTRY CANADA RSS-GEN Issue 3

COMPANY NAME: APPLE, INC. 1 INFINITE LOOP CUPERTINO, CA 95014, U.S.A.					
EUT DESCRIPTION:	Tablet with cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC- HSDPA/CDMA1xRTT/1x Advanced/EV-DO Rev 0, A, B/LTE/IEE 802.11a/b/g/n (MIMO 2x2) and Bluetooth radio				
MODEL:	A1475				
SERIAL NUMBER:	SERIAL NUMBER: DLXL106FFMNK (Conducted); DLXL104WFMNF (Radiated)				
DATE TESTED:	DATE TESTED: JULY 19 - SEPTEMBER 10, 2013				
	APPLICABLE STANDARDS				
STANDARD TEST RESULTS					
CFR 47 P	art 15 Subpart C	Pass			
INDUSTRY CANADA	A RSS-210 Issue 8 Annex 8	Pass			

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL Verification Services Inc. By:

Tested By:

Thu Chan WiSE Operations Manager UL Verification Services Inc.

Oliver Su WiSE Engineer UL Verification Services Inc.

Page 5 of 272

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2009, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
Chamber A	Chamber D
Chamber B	🛛 Chamber E
Chamber C	Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://www.ccsemc.com</u>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

Page 6 of 272

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Tablet with cellular GSM/GPRS/EGPRS/WCDMA/HSPA+/DC-HSDPA/CDMA1xRTT/1x Advanced/EV-DO Rev 0, A, B/LTE/IEEE 802.11a/b/g/n (MIMO 2x2) and Bluetooth radio

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted peak output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11b	18.36	68.55
2413 - 2472	802.11g	23.45	221.31
2414 - 2472	802.11n HT20 CDD 2TX	27.03	504.66
5745 - 5825	802.11a	23.60	229.09
5745 - 5825	802.11n HT20 CDD 2TX	25.72	373.25
5755 - 5795	802.11n HT40 SISO	23.52	224.91
5755 - 5795	802.11n HT40 CDD 2TX	25.88	387.26

Page 7 of 272

List of test reduction and modes covering other modes:

Frequency Range (MHz)			
2.4 GHz band			
2412 - 2472	802.11g 2TX CDD	802.11n HT20 CDD 2TX	
2412 - 2472	802.11n SISO	802.11g SISO	
2412 - 2472	802.11n HT20 2TX STBC	802.11n HT20 CDD 2TX	
2412 - 2472	802.11n HT20 2TX SDM	802.11n HT20 CDD 2TX	
5.8 GHz band			
5745 - 5825	802.11a 2TX CDD	802.11n HT20 CDD 2TX	
5745 - 5825	802.11n SISO	802.11a SISO	
5745 - 5825	802.11n HT20 2TX STBC	802.11n HT20 CDD 2TX	
5745 - 5825	802.11n HT20 2TX SDM	802.11n HT20 CDD 2TX	
5745 - 5825	802.11n HT40 2TX STBC	802.11n HT40 CDD 2TX	
5745 - 5825	802.11n HT40 2TX SDM	802.11n HT40 CDD 2TX	

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band	Antenna Gain (dBi)		Uncorrelated Gain	
(GHz)	Tx1	Tx2	(dBi)	
2.4	0.50	1.99	1.31	
5.8	4.21	3.92	4.07	

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Broadcom WL Tool Version 6.25.86.

5.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated in three orthogonal orientations X, Y, Z, with AC Adapter and Headset, it was determined that X orientation without AC Adapter and Headset was the worst-case orientation for 2.4GHz band, and Z orientation was the worst-case orientation for 5.8 GHz band; therefore, all final radiated testing was performed with the EUT in X orientation for 2.4GHz band, and Z orientation for 5.8 GHz band.

Worst-case data rates as provided by the client were:

802.11b mode: 1 Mbps 802.11g mode: 6 Mbps 802.11a mode: 6 Mbps 802.11n HT20mode: MCS0 802.11n HT40mode: MCS0

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was including headset, AC charger and the mode and channel with the highest output power.

For all modes with single chain, chain 0 was selected per the software provided by the client. Based on the client a preliminary investigation was performed on the two chains and chain 0 was found to be worst-case for the antenna port. The radiated emissions test was based on the port with the higher antenna gain.

Page 9 of 272

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List							
Description Manufacturer Model Serial Num				FCC ID			
AC /DC adapter	Apple	A1401	60812	DoC			
Earphone	Apple	NA	NA	NA			

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
CablePort# of identicalConnectorCable TypeCableRemarksNoportsTypeLength (m)				Remarks		
_		• • • •	71		- 0- 1 /	
1	Antenna	1	SMA	Un-Shielded	0.1m	To Spectrum Analyzer

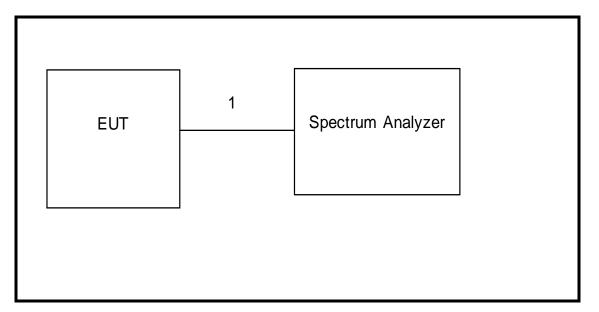
I/O CABLES (RADIATED TEST)

I/O Cable List							
Cable Port # of identical Connector Cable Type Cable Remarks					Remarks		
No		ports	Туре		Length (m)		
1	Audio	1	Jack	Un-Shielded	0.5m	NA	

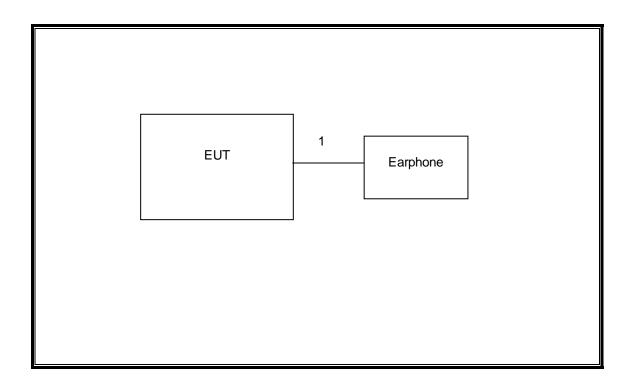
I/O CABLES (AC POWER CONDUCTED TEST)

	I/O Cable List										
Cable	Port	# of identical	Connector	Cable	Remarks						
No		ports	Туре		Length (m)						
1	AC	1	US115	Un-Shielded	2m	NA					
2	DC	1	USB	Un-Shielded	2m	NA					
3	Audio	1	Jack	Un-Shielded	0.5m	NA					

Page 10 of 272

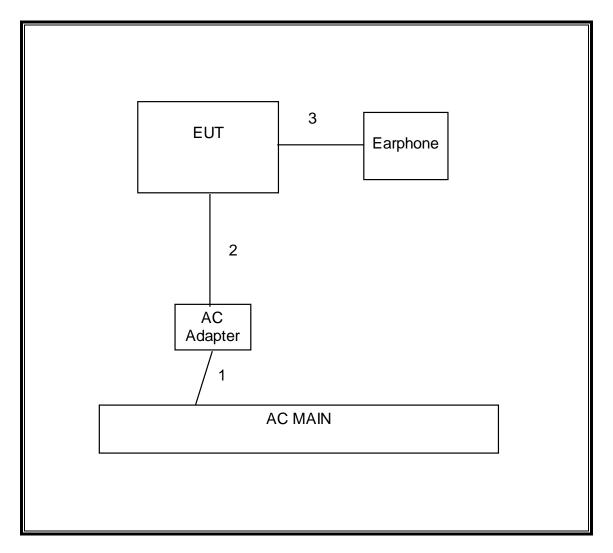


SETUP DIAGRAM FOR RADIATED TESTS



Page 11 of 272

SETUP DIAGRAM FOR BELOW 1GHZ & AC POWER CONDUCTED TESTS



Page 12 of 272

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

	Test Equipment	List		
Description	Manufacturer	Model	Asset	Cal Due
Horn Antenna 1-18GHz	ETS Lindgren	3117	F00131	02/19/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/14
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	05/06/14
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00027	03/07/14
Peak / Average Power Sensor	Agilent / HP	E9323A	F00163	04/03/14
P-Series single channel Power Meter	Agilent / HP	N1911A	F00164	04/03/14
Spectrum Analyzer, 3Hz-44GHz	Agilent	N9030A	F00127	02/22/14
Spectrum Analyzer, 3Hz-44GHz	Agilent	E4446A	C01012	10/21/13
PreApmplifier, 1-26.5GHz	Agilent	8449B	C01052	10/22/13
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	F00194	05/14/14
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/15/14
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/20/14

Page 13 of 272

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

<u>LIMITS</u>

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

7.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time	Period	Duty Cycle	Duty	Duty Cycle	1/T
	В		х	Cycle	Correction Factor	Minimum VBW
	(msec)	(msec)	(linear)	(%)	(dB)	(kHz)
2.4 GHz						
802.11b	12.41	12.46	0.996	99.6%	0.00	0.010
802.11g	2.050	2.080	0.986	98.6%	0.00	0.010
802.11n HT20	1.91	1.94	0.986	98.6%	0.00	0.010
5.8 GHz						-
802.11a	2.06	2.09	0.985	98.5%	0.00	0.010
802.11n HT20 CDD	1.91	1.93	0.988	98.8%	0.00	0.010
802.11n HT40 SISO	0.93	0.94	0.987	98.7%	0.00	0.010
802.11n HT40 CDD	0.93	0.95	0.983	98.3%	0.00	0.010

7.2. MEASUREMENT METHODS

<u>6 dB BW</u>: KDB 558074 D01.

Output Power: KDB 558074 D01.

Power Spectral Density: KDB 558074 D01.

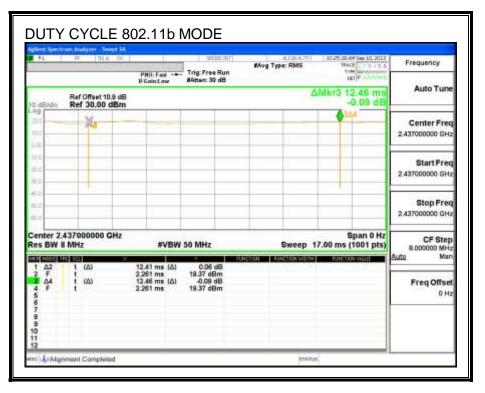
Out-of-band emissions in non-restricted bands: KDB 558074 D01.

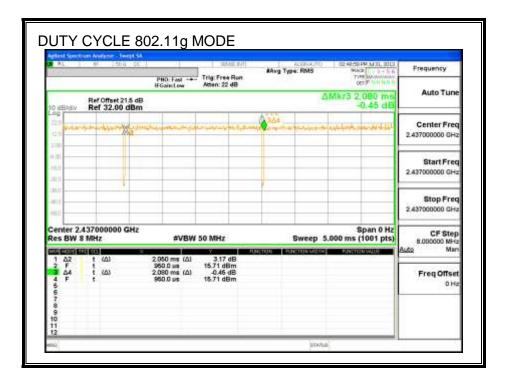
Out-of-band emissions in restricted bands: KDB 558074 D01.

Page 14 of 272

7.2.1. DUTY CYCLE PLOTS

2.4 GHz Band

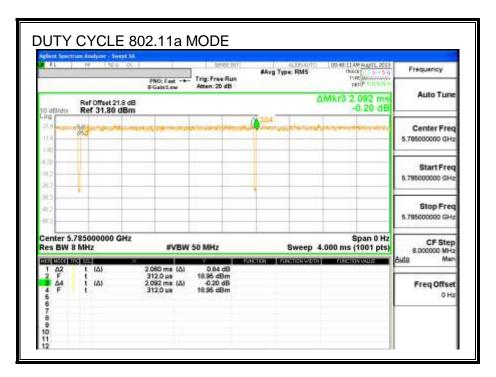




Page 15 of 272

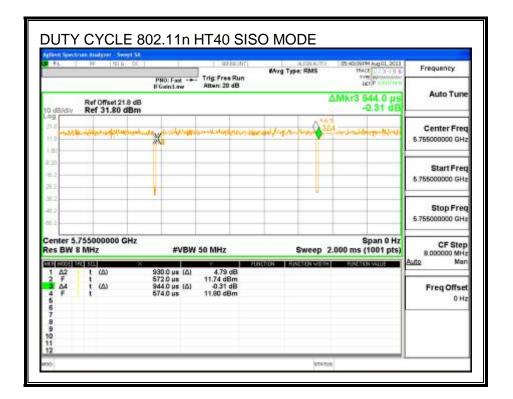
AL .		1994	PHD: For IFGainst o		Trig: Free Run Attan: 22 dB	#Avg Type	RMS	SACE THE WAY	450	Frequency
0 dBldby		Offset 21.5 (32.00 dB	:0	W.			۵	Mkr3 1.936 -0.12		Auto Tune
99			All and a second		va servit som som	- Angeler		304		
			MOLLENS	W.			-			Center Freq 2.437000000 GHz
100	-									Start Freq
00										2.437000000 GHz
12	_					-			F	
80										Stop Freq 2.437000000 GHz
enter 2.		00000 GH		/BW	50 MHz		Sweep 4	Span (000 ms (1001		CF Step 8.00000 MHz
				-	291 dB	sactors - Fin	NO CENTRAL	ALSO DO DO	-	ute Man
1 42 2 F 3 44 4 F 6		ώ) (Δ)	1.906 ms 1.526 ms 1.936 ms 1.528 ms	17.1	2.91 db 18.85 dBm -0.12 dB 18.55 dBm				ſ	Freq Offset 0 Ha
6 7 8 9 0										

5.8GHz Band



Page 16 of 272

RL.	14 12	FLA: SC]	PND: Fast -	a	Run	#Avg Type:	RMS	THE WOMAN DCT P INTER	Frequency
vibidiv	Ref Offse Ref 31.8		In GIRECTION				A	Vikr1 1.908 m 1.03 d	
	x	None and the second second	X		4 Autoritan		-	262 	Center Free 5.78500000 GH
120 11.2									Start Free 5.78500000 GH
12 12 12									Stop Free 5.78500000 GH
es BW I	78500000 8 MHz	0 GHz	#VB	W 50 MHz		and the second second second	Contraction of the local division of the loc	Span 0 H 000 ms (1001 pt	
4 F 5 6 7 8 9 11 12 14 14 15 15 10 11 12 10 10 10 10 10 10 10 10 10 10	t (Δ) t t (Δ) t	18	1.908 ms (∆ 1.460 ms 1.932 ms (∆ 1.486 ms	19.00 dB	m B	IN AUNC		RINE TRON VALUE	Freq Offse 0 H



Page 17 of 272

RL I	H.	1419	PNO	Fast -+-	Trig Free Run	Mvg Type: RMS	09-22-49 AM Aug(2, 2012) 18A02 2 - 1 - 5 - 5 1146 Wommann 061 P	Frequency
o dB/div		Offset 21.8 31.80 dB	dB	nLaw	Atten 20 dB		10.17 dB	Auto Tune
og It i ukrus	-m-th-de	up editate	-5/5/6/6	minu	y and in producing (AP.		han (1304 - julinus	Center Free 5.75500000 GH:
120								Start Free 5.75500000 GH
12							1	Stop Free 5.75500000 GH
enter 5. es BW 8	8 MHz	00000 GH	łz	#VBW	50 MHz	Sweep 2	Span 0 Hz .000 ms (1001 pts)	CF Step 8 000000 MH Auto Mar
1 Δ2 2 F Δ4 4 F 5 6 7 8 9 0 1 2	1	لم) ا	796.	Dus (A)	3.14 dB 11.63 dBm 4.17 dB 11.63 dBm			Freq Offse 0 H

Page 18 of 272

8. ANTENNA PORT TEST RESULTS

8.1. 802.11b MODE IN THE 2.4 GHz BAND

8.1.1. 6 dB BANDWIDTH

<u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

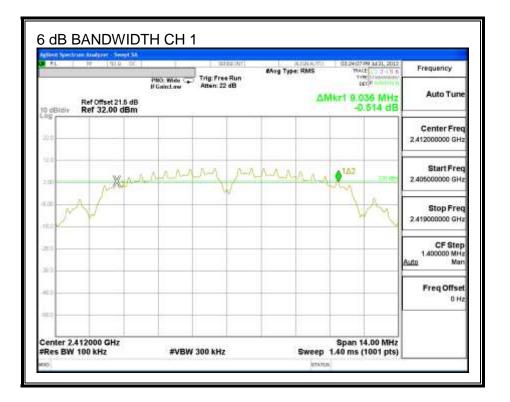
TEST PROCEDURE

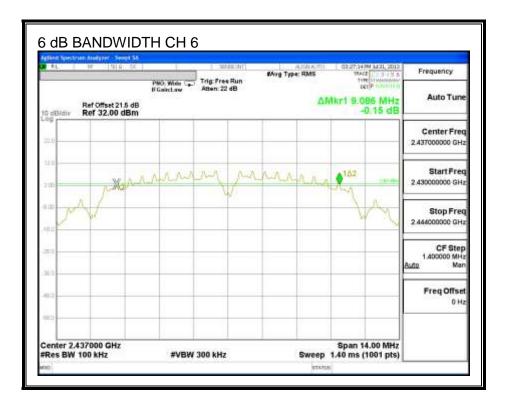
KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

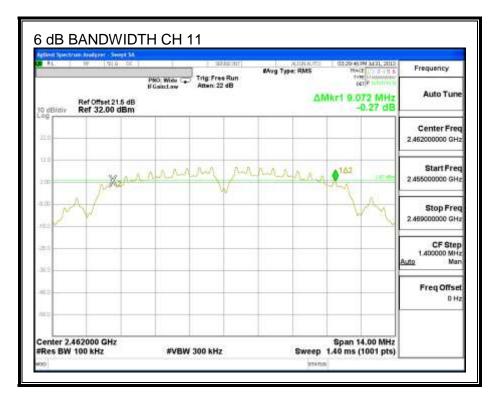
Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
1	2412	9.036	0.5
6	2437	9.086	0.5
11	2462	9.072	0.5
12	2467	9.067	0.5
13	2472	9.088	0.5

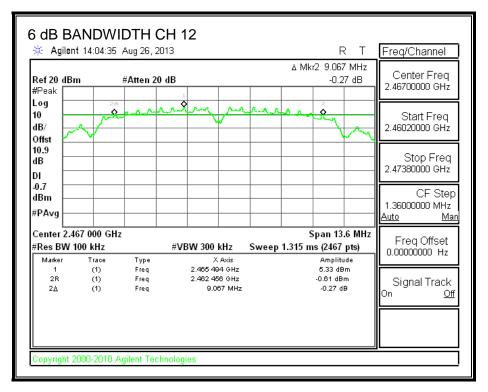
Page 19 of 272





Page 20 of 272





Page 21 of 272

e Agilen	t 15:23:06	Aug 26, 2	2013					R		Freq/Channel
ef20dBr ⊃eak	n	#Atten 2	0 dB		1	1	∆ Mk	r2 9.088 -0.2	3 MHz 1 dB	Center Freq 2.47200000 GHz
og) B/	2R	<u>r-n-</u>	~~~		m	min	<u></u>	2 X	\sim	Start Freq 2.46515000 GHz
3										Stop Freq 2.47885000 GHz
.2 3m PAvg										CF Ste 1.37000000 MHz Auto Mi
enter 2.4 Res BW 1	72 000 GHz 100 kHz		#VE	3W 300	kHz	Swee		Span 13. ms (601		Freq Offset 0.00000000 Hz
Marker 1 2R 2 <u>A</u>	Trace (1) (1) (1)	Type Freq Freq Freq		2.471 49 2.467 43				Amplitu 5.77 dB -0.67 dBı -0.21 dl	m m	Signal Track

Page 22 of 272

8.1.2. 99% BANDWIDTH

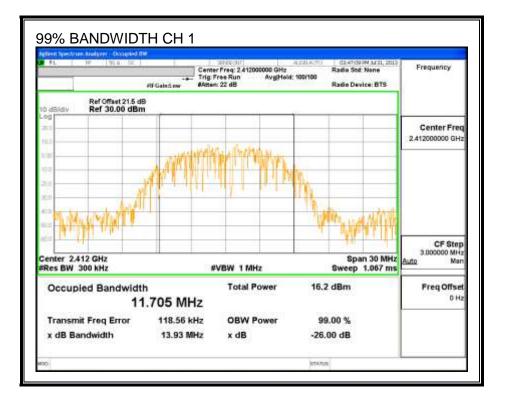
LIMITS

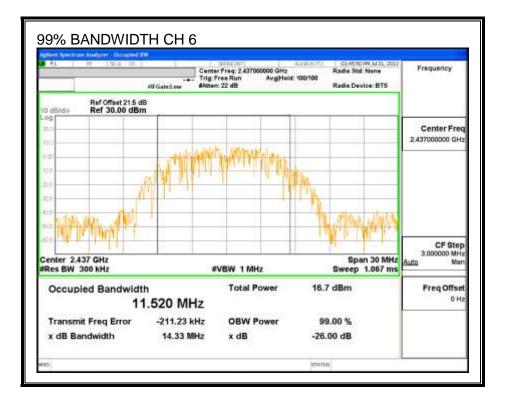
None; for reporting purposes only.

<u>RESULTS</u>

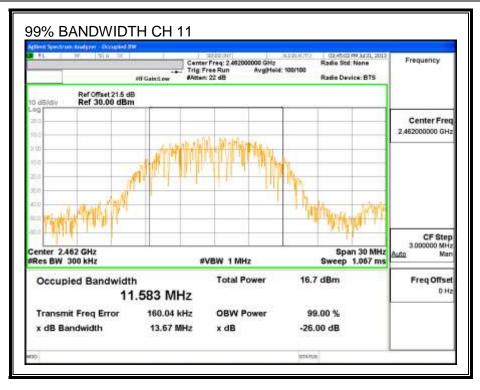
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
1	2412	11.7050
6	2437	11.5200
11	2462	11.5830
12	2467	11.4124
13	2472	11.4385

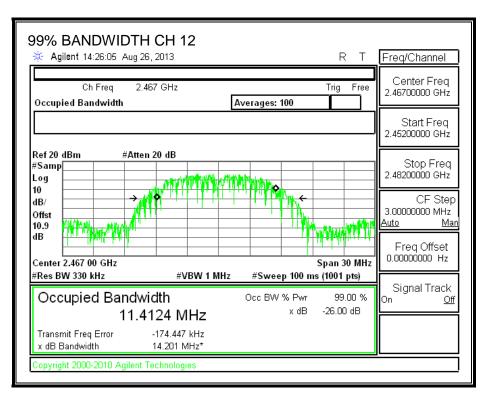
Page 23 of 272





Page 24 of 272





Page 25 of 272

99% BANDWIDTH CH 13	RТ	Freq/Channel
Ch Freq 2.472 GHz Occupied Bandwidth Averages: 100	Trig Free	Center Freq 2.47200000 GHz
		Start Freq 2.45700000 GHz
Ref 20 dBm #Atten 20 dB #Samp Log 10		Stop Freq 2.48700000 GHz
ID dB/ Offst 10.9 44 https://doi.org/10.1010/001000000000000000000000000000		CF Step 3.0000000 MHz <u>Auto Man</u>
Center 2.472 00 GHz	Span 30 MHz p 1 ms (601 pts)	Freq Offset 0.00000000 Hz
Occupied Bandwidth Occ BW % P	• • • •	Signal Track On <u>Off</u>
Transmit Freq Error -138.215 kHz x dB Bandwidth 14.168 MHz*		
Copyright 2000-2010 Agilent Technologies		

Page 26 of 272

8.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
1	2412	15.94
6	2437	15.98
11	2462	15.95
12	2467	15.11
13	2472	13.91

Page 27 of 272

8.1.4. OUTPUT POWER

<u>LIMITS</u>

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 28 of 272

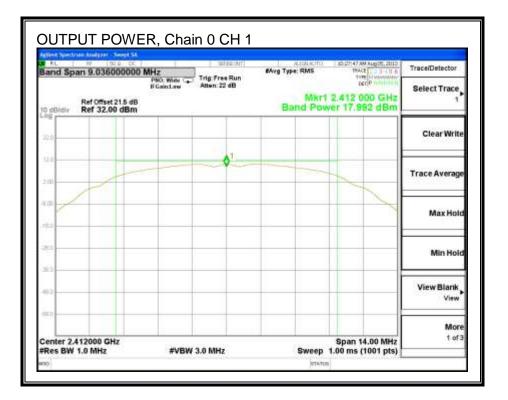
Limits

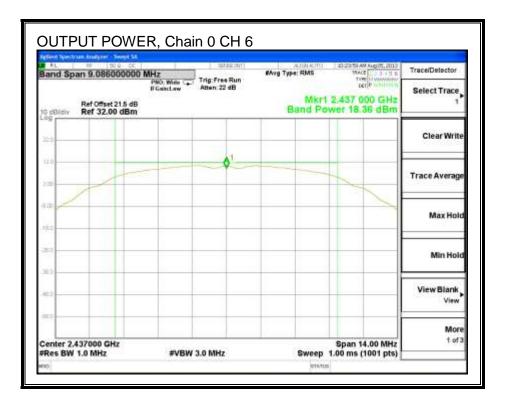
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
1	2412	1.99	30.00	30	36	30.00
6	2437	1.99	30.00	30	36	30.00
11	2462	1.99	30.00	30	36	30.00
12	2467	1.99	30.00	30	36	30.00
13	2472	1.99	30.00	30	36	30.00

Results

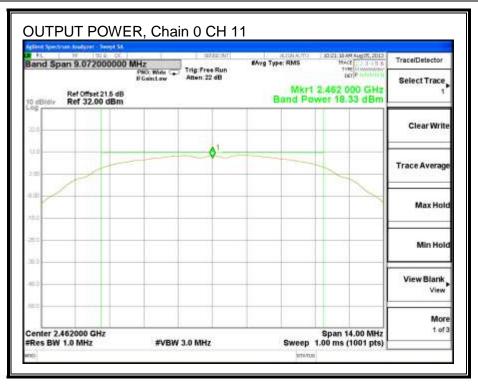
Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
1	2412	17.992	17.99	30.00	-12.01
6	2437	18.360	18.36	30.00	-11.64
11	2462	18.330	18.33	30.00	-11.67
12	2467	18.180	18.18	30.00	-11.82
13	2472	17.280	17.28	30.00	-12.72

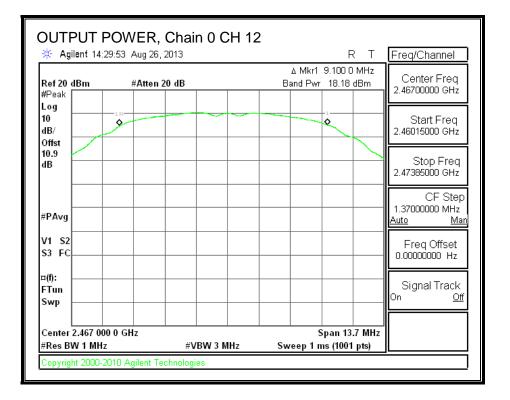
Page 29 of 272



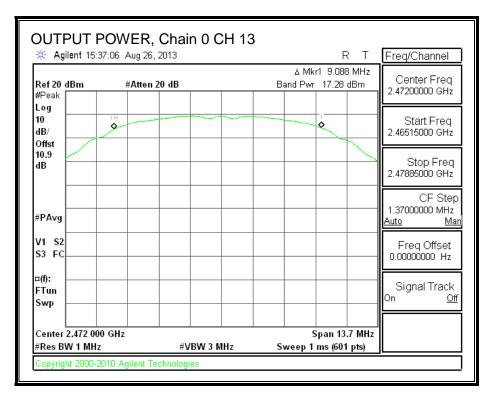


Page 30 of 272





Page 31 of 272



Page 32 of 272

8.1.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

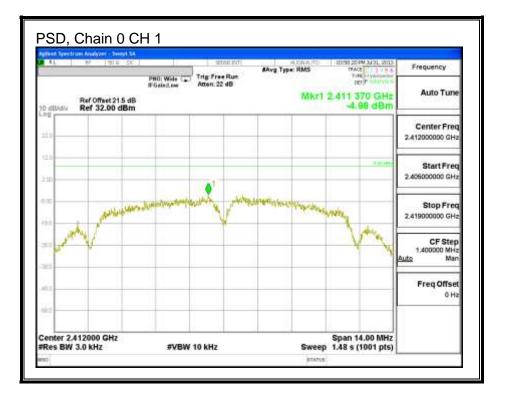
RESULTS

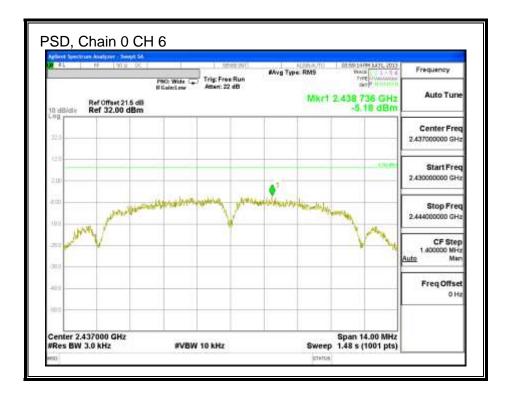
PSD Results

Channel	Frequency	Chain 0	Limit	Margin
		Meas		
	(MHz)	(dBm)	(dBm)	(dB)
1	2412	-4.98	8.0	-13.0
6	2437	-5.18	8.0	-13.2
11	2462	-4.88	8.0	-12.9
12	2467	-7.02	8.0	-15.0
13	2472	-8.22	8.0	-16.2

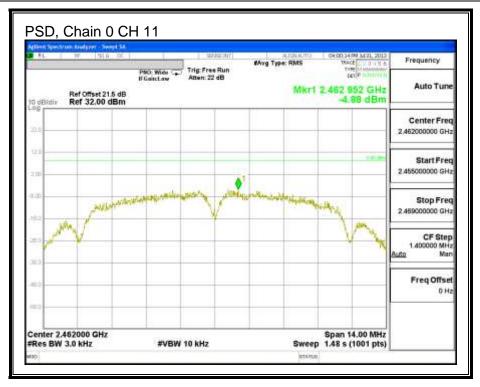
Page 33 of 272

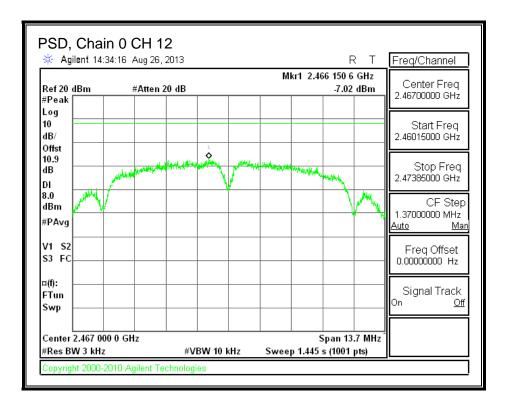
PSD, Chain 0



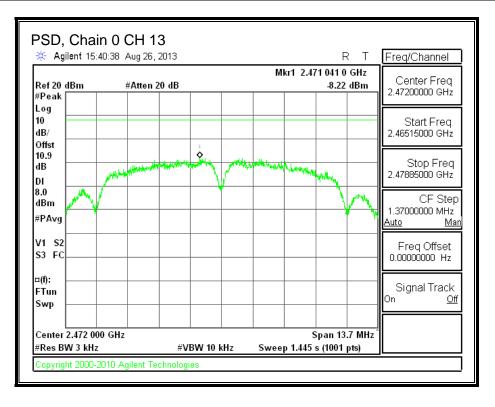


Page 34 of 272





Page 35 of 272



Page 36 of 272

8.1.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

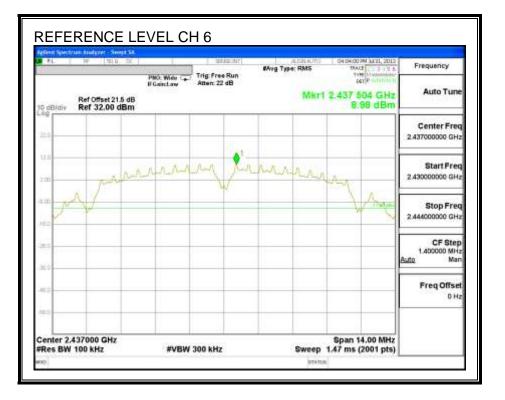
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

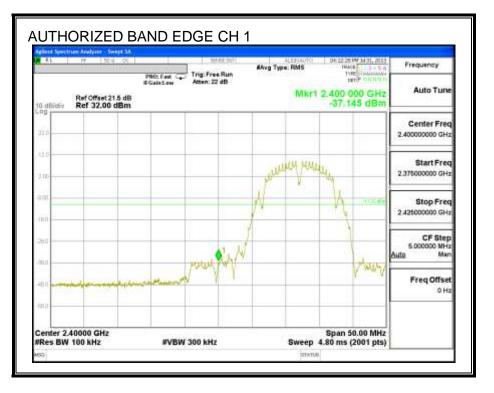
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

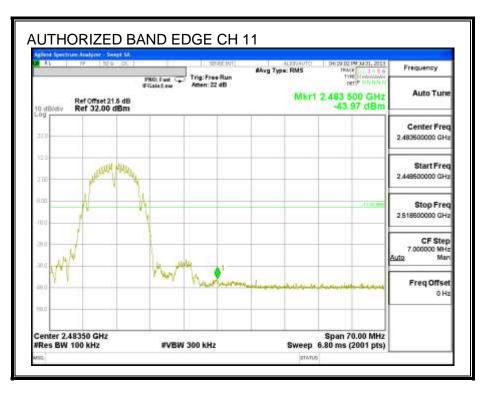
Page 37 of 272

IN-BAND REFERENCE LEVEL

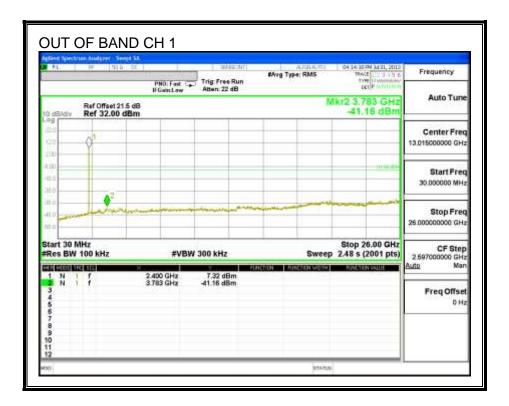


LOW CHANNEL BANDEDGE



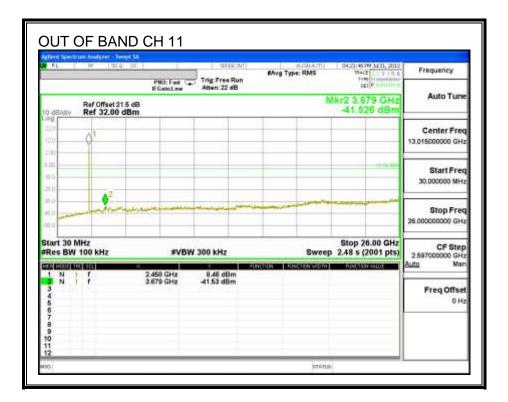


OUT-OF-BAND EMISSIONS

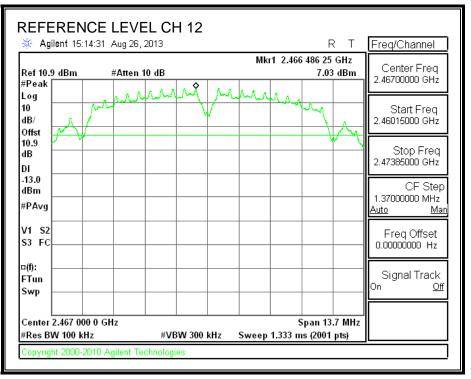


Page 39 of 272

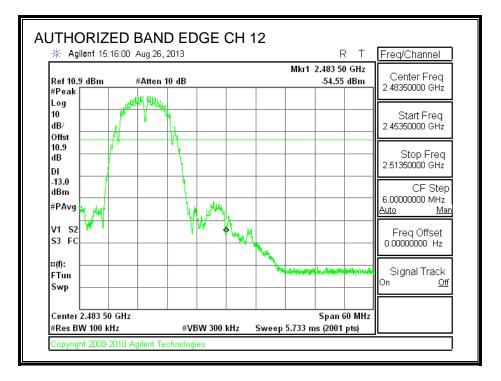
RL.	14	1741 - Sec. 19			atter a		g Type: RMS	0.0		M MIT, 2012	Frequency
			PNO: IF Gain	Fast Ca	Atten: 22 dB	e - 200	7 08 C CD D		119	P In the form	00000000
vibiBb 01		ffset 21.5 32.00 dE						Mkr		45 GHz i5 dBm	Auto Tune
00											Center Free
120	•										13,015000000 GH
2.00		-				_	_	-			Start Free
38.0											30.000000 MH
9.00		Sun		waren	mannin		- tala and the	-		-	Stop Free
40.0		1000	Sum-Su								26.00000000 GH
Start 30 #Res BW		Hz		#VBV	V 300 kHz	-	Swe			5.00 GHz 2001 pts)	CF Step 2 597000000 GH
		-	2.445 0	Hz	7.55 dBm	MARCON	ANALON		HISTORY		Auto Mar
2 N 3 4 5 6	1 1		3.796 G	Hz	-41.94 dBm						Freq Offse 0 H
7 8 9											
11 12											



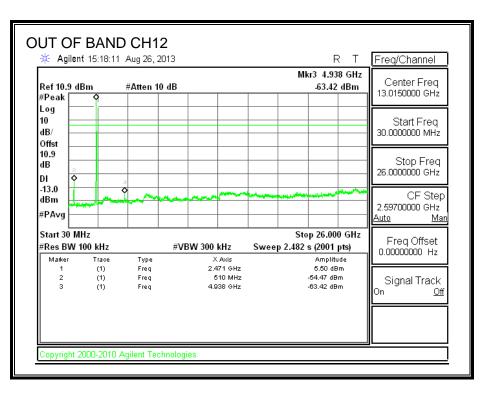
Page 40 of 272



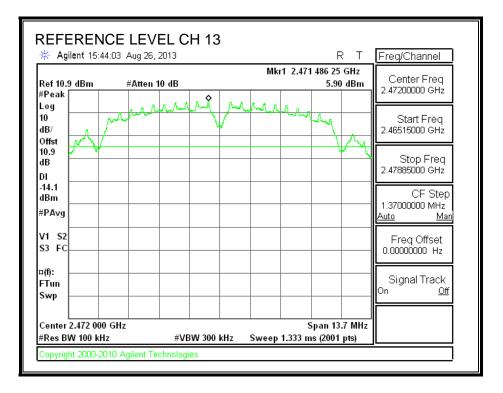
HIGH CHANNEL BANDEDGE



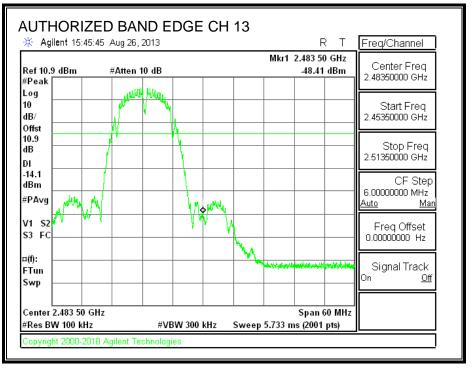
Page 41 of 272



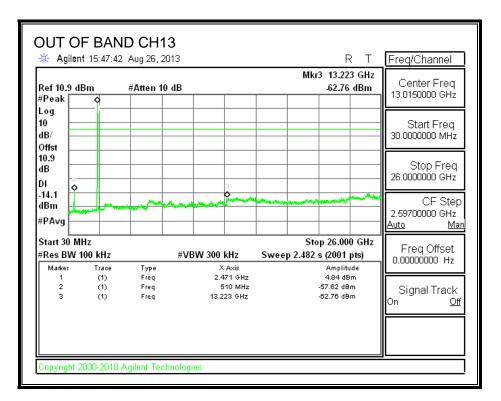
CH13 (REFERENCE LEVEL)



Page 42 of 272



OUT-OF-BAND EMISSIONS



Page 43 of 272

8.2. 802.11g MODE IN THE 2.4 GHz BAND

8.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

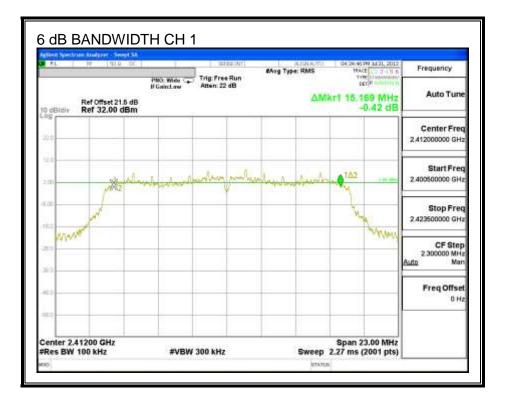
TEST PROCEDURE

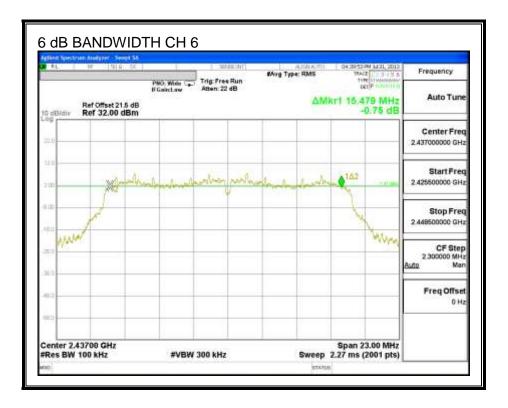
KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

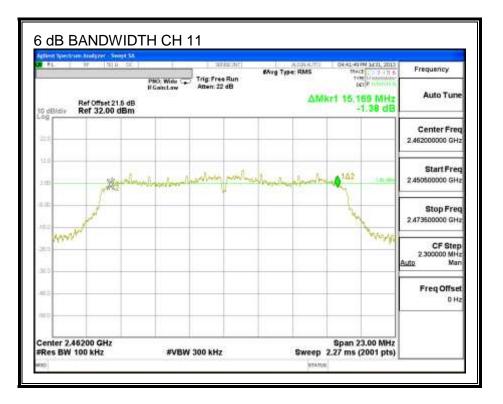
Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
1	2412	15.169	0.5
6	2437	15.479	0.5
11	2462	15.169	0.5
12	2467	15.528	0.5
13	2472	15.552	0.5

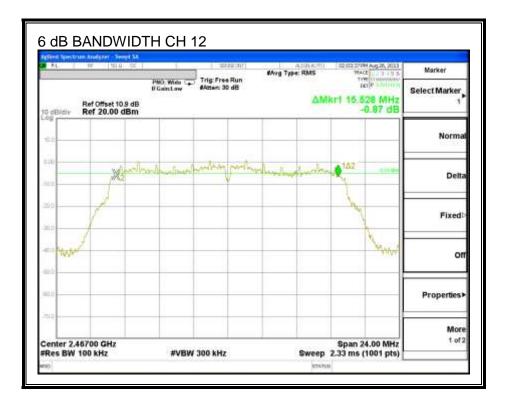
Page 44 of 272



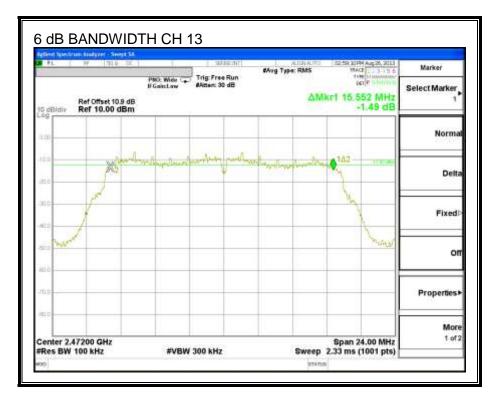


Page 45 of 272





Page 46 of 272



Page 47 of 272

8.2.2. 99% BANDWIDTH

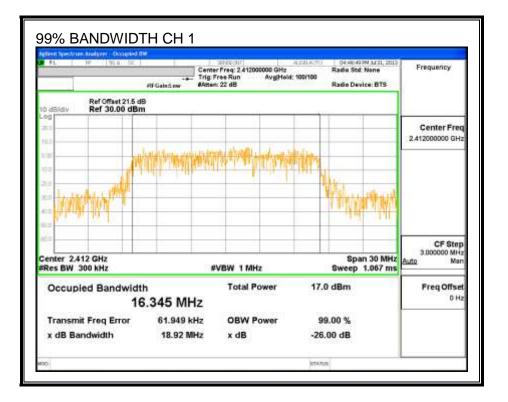
LIMITS

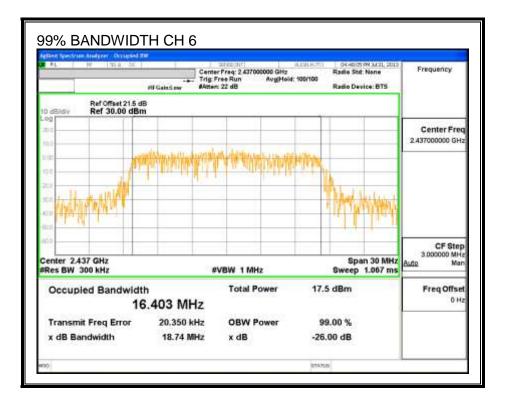
None; for reporting purposes only.

<u>RESULTS</u>

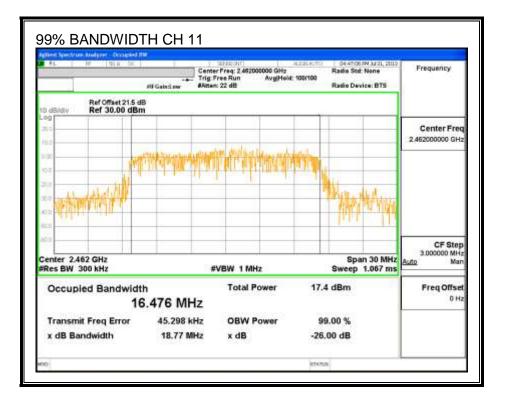
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
1	2412	16.3450
6	2437	16.4030
11	2462	16.4760
12	2467	16.1980
13	2472	16.3330

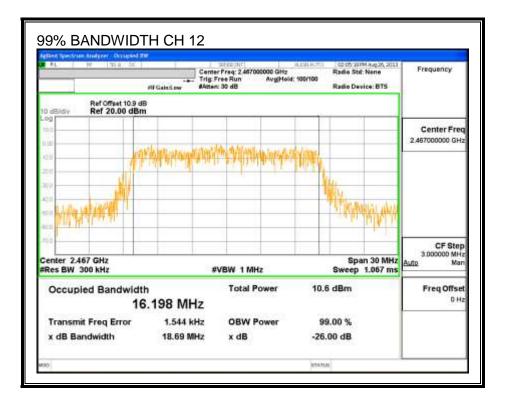
Page 48 of 272





Page 49 of 272





Page 50 of 272

KL.	W 314 54	- 11 - 11 - <u>1</u>	Center Freq: 2,472000000 C Trig: Free Run Avg Matem: 30 dB		2/25
0 dB/div	Ref Offset 10.9 Ref 20.00 dB			- 11 - 200 D.J 200	
0.00					Center Free 2.472000000 GHz
100 200 300		NY ALARA	1. Walter March	AL AND AL	
	Mar M			The second	Numbe
Center 2.4			#VBW 1 MHz		CF Step 3.00000 MHz 1.067 ms
	ed Bandwid	ith 6.333 MH:	Total Power	- no second second	Freq Offset
Transmi x dB Ba	t Freq Error ndwidth	-24.399 kH 18.50 MH			

Page 51 of 272

8.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
	. ,	,
1	2412	15.70
6	2437	15.80
11	2462	14.90
12	2467	10.50
13	2472	3.00

Page 52 of 272

8.2.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 53 of 272

RESULTS

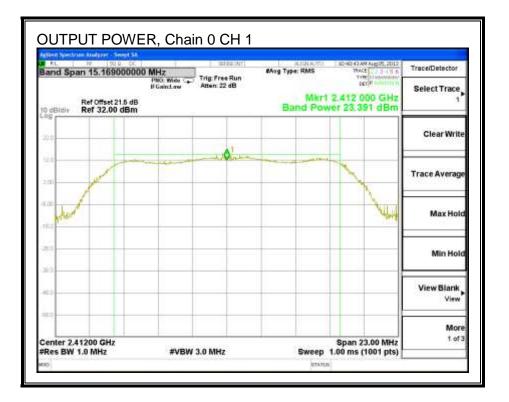
Limits

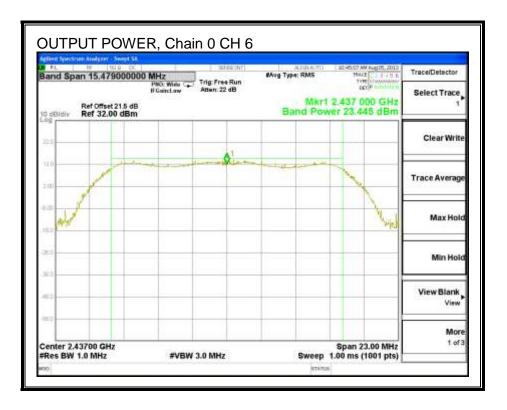
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
1	2412	1.99	30.00	30	36	30.00
6	2437	1.99	30.00	30	36	30.00
11	2462	1.99	30.00	30	36	30.00
12	2467	1.99	30.00	30	36	30.00
13	2472	1.99	30.00	30	36	30.00

Results

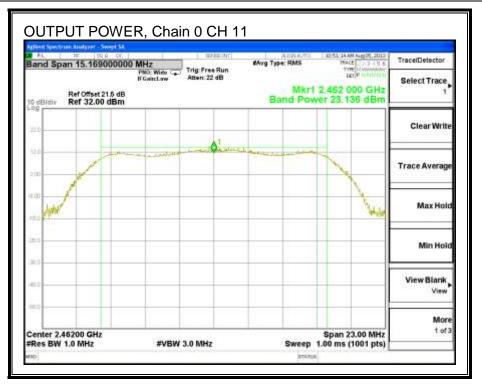
Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
1	2412	23.391	23.39	30.00	-6.61
6	2437	23.445	23.45	30.00	-6.56
11	2462	23.136	23.14	30.00	-6.86
12	2467	19.015	19.02	30.00	-10.99
13	2472	11.500	11.50	30.00	-18.50

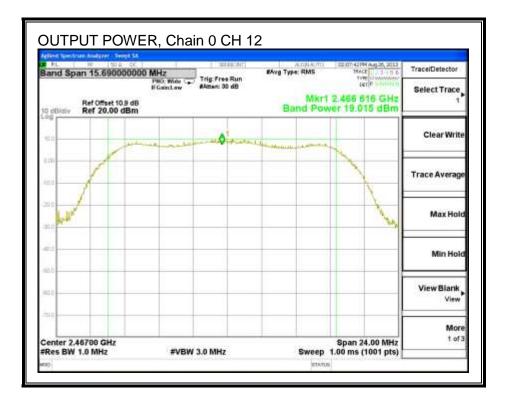
Page 54 of 272



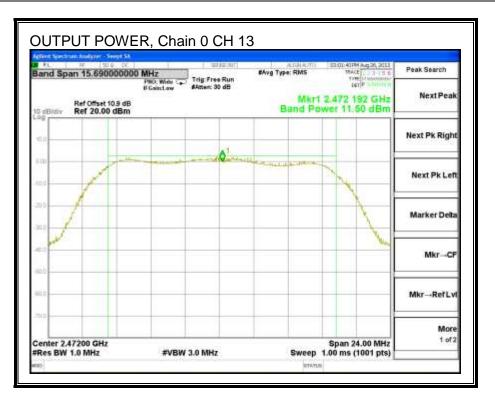


Page 55 of 272





Page 56 of 272



Page 57 of 272

8.2.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

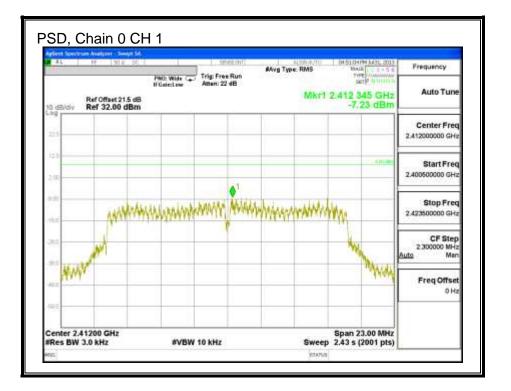
<u>RESULTS</u>

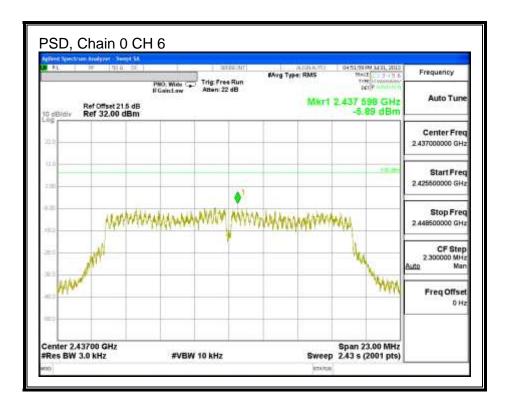
PSD Results

Channel	Frequency	Chain 0	Limit	Margin
		Meas		
	(MHz)	(dBm)	(dBm)	(dB)
1	2412	-7.23	8.0	-15.2
6	2437	-5.89	8.0	-13.9
11	2462	-6.43	8.0	-14.4
12	2467	-12.89	8.0	-20.9
13	2472	-20.02	8.0	-28.0

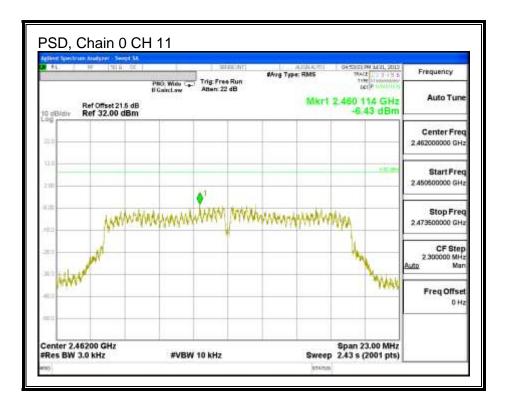
Page 58 of 272

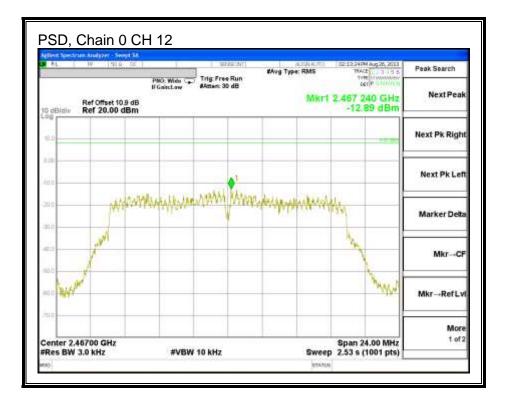
PSD, Chain 0



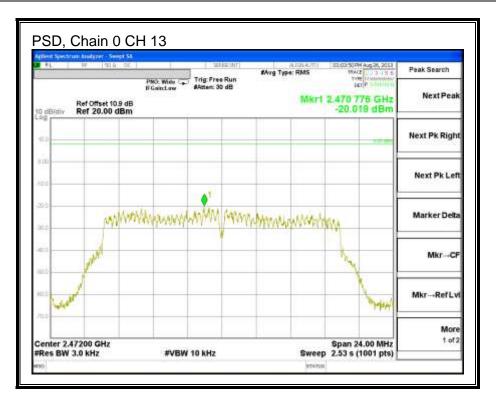


Page 59 of 272





Page 60 of 272



Page 61 of 272

8.2.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

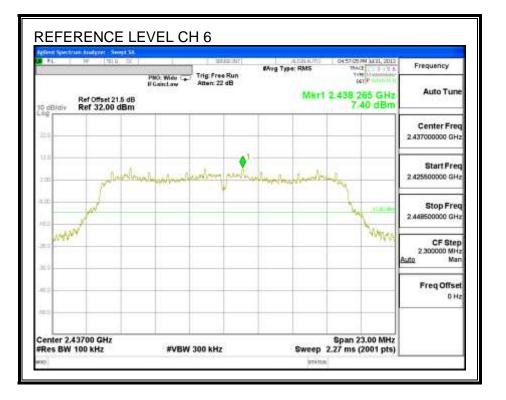
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

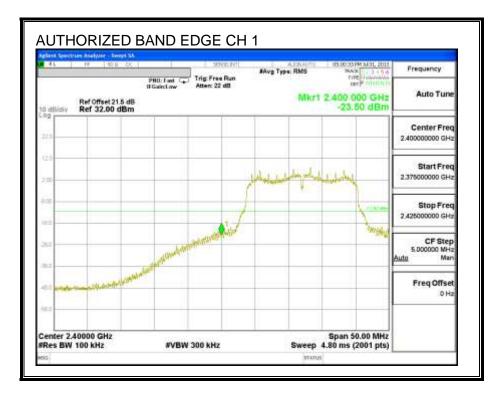
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

Page 62 of 272

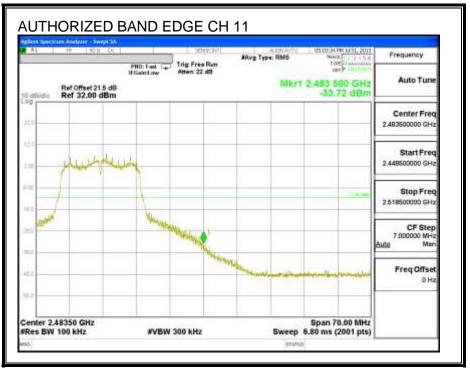
IN-BAND REFERENCE LEVEL



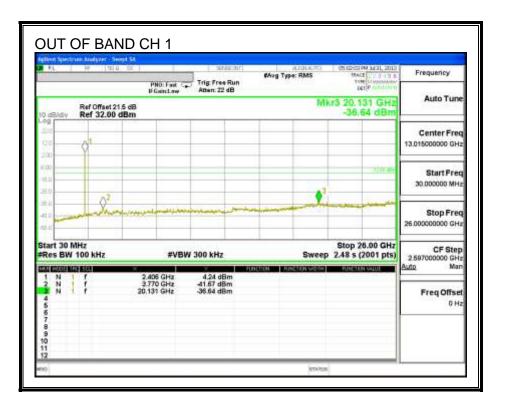
LOW CHANNEL BANDEDGE



Page 63 of 272

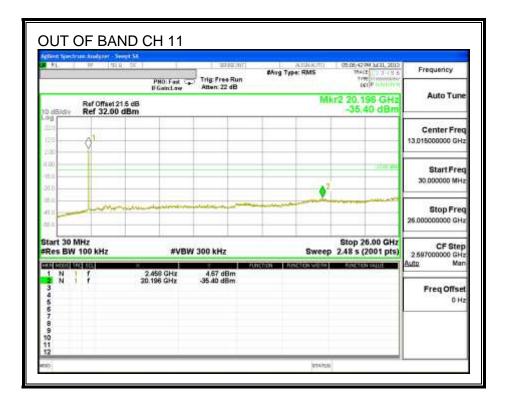


OUT-OF-BAND EMISSIONS

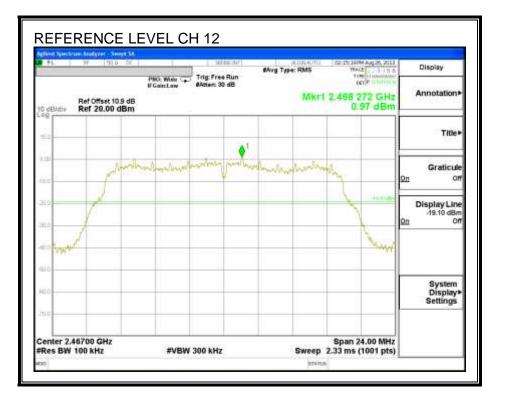


Page 64 of 272

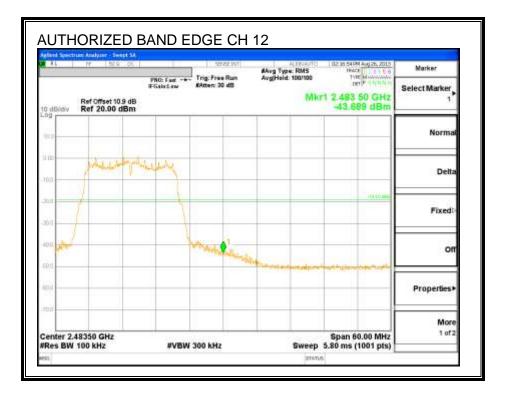
Frequency	NGE 127-155	784	Type: RMS		and a		9.55	17 19	1	AL.
	DET P IN PRIMA	1	0.000 213 224	1589	Trig: Free Run Atten: 22 dB	PND: Fast G				_
Auto Tune	029 GHz 274 dBm							Ref Offset: Ref 32.00	diγ	0 de
Center Free 13.01500000 GH								Q1		99 0 00 -
Start Free 30.000000 MH	(itan ini									200 - 100 - 110 -
Stop Fre 26.00000000 GH				*****			A.,,	- And	-	0.0 11 D
CF Ster 2.597000000 GH	26.00 GHz (2001 pts)		Sweet		300 kHz	#VBI		z 00 kHz	30 M BW 1	
Auto Mar Freq Offse 0 H	TERS VALUE	HINCT	AUNCLER WEDTH	HARTIGH	5.49 dBm -42.27 dBm	432 GHz 029 GHz	2/ 4/	f f		1



Page 65 of 272



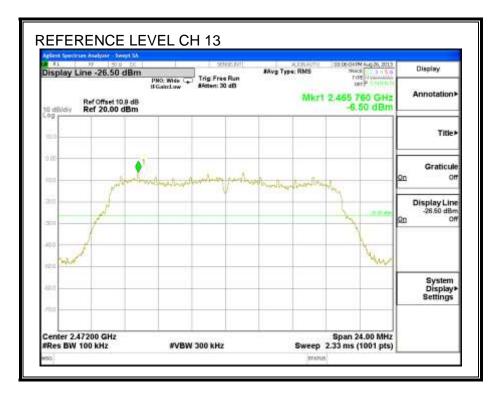
HIGH CHANNEL BANDEDGE



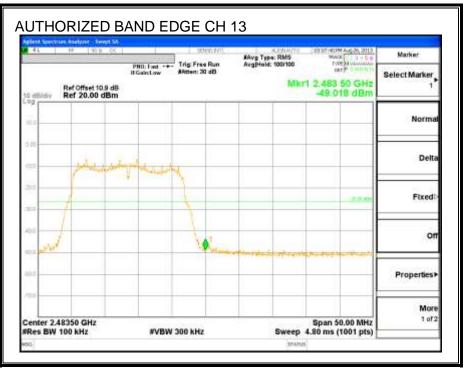
Page 66 of 272

Marker	2 31 250M Aug 25, 2015 TRACE	RMS	#Avg Typ	38562 [10]			99. OL	11 11	-	41
Select Marker	Det P 1 N Is is n	35555	50.9%-335	: Free Run en: 30 dtl		FRO: Fast FGaind ow				
2	25.610 GHz -38.30 dBm	Mk					t 10.9 dB 10 dBm	Ref Offse Ref 20.0		CB P
Norma										
		_		_	-	_	-			10
Delta		- Q								10 10
Fixed							-	And the	-	
on	Stop 26.00 GHz .48 s (1001 pts)	Sweep		kHz	VBW 3	#VE		iz 00 kHz	80 MH BW 1	
	PUNCTION WALKE	nowwpm+1	NCTION PLA	75 dBm 30 dBm		0.403 GHz 5.610 GHz		911. 1 1	1	
Properties*										5
More 1 of 2										890

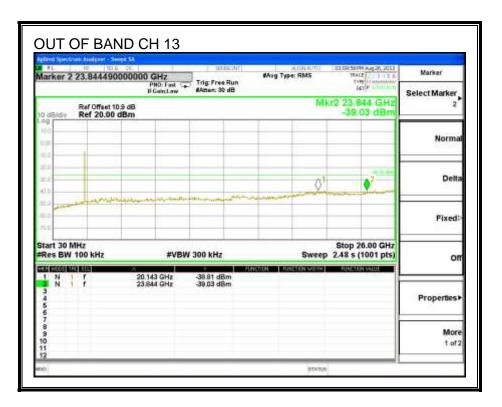
CH13 (REFERENCE LEVEL)



Page 67 of 272



OUT-OF-BAND EMISSIONS



Page 68 of 272

8.3. 802.11n HT20 MIMO 2TX CDD MODE IN THE 2.4 GHz BAND

8.3.1. 6 dB BANDWIDTH

<u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

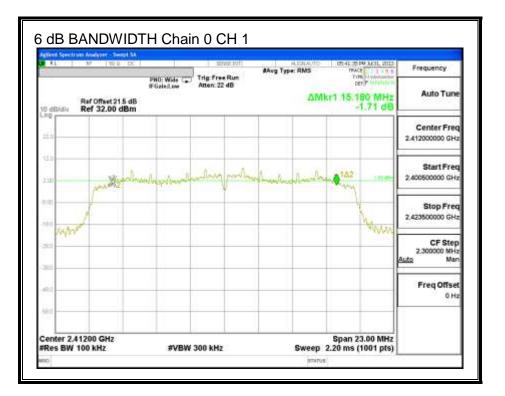
TEST PROCEDURE

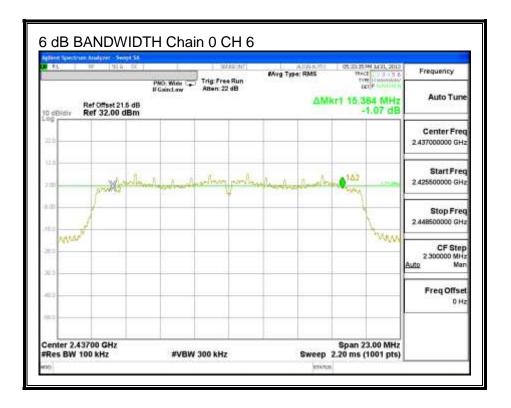
KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

Channel	hannel Frequency		6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(MHz)
1	2412	15.180	15.364	0.5
6	2437	15.364	15.962	0.5
11	2462	15.180	16.284	0.5
12	2467	16.525	16.650	0.5
13	2472	16.325	16.125	0.5

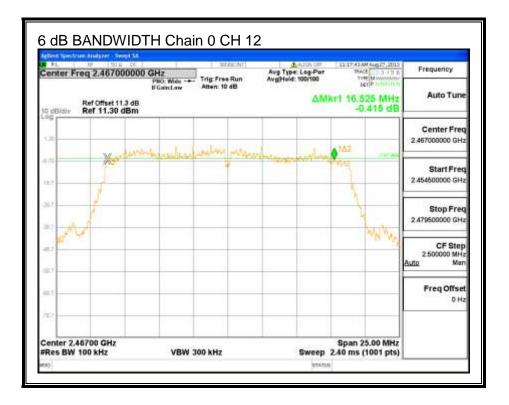
Page 69 of 272



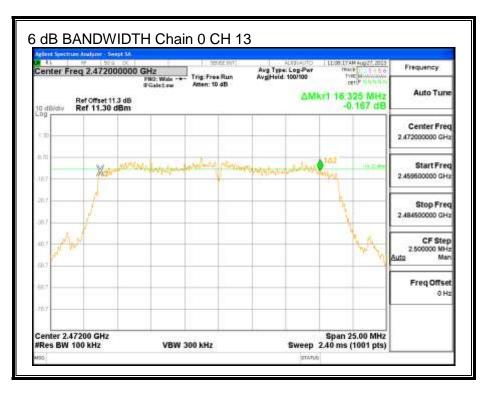


Page 70 of 272

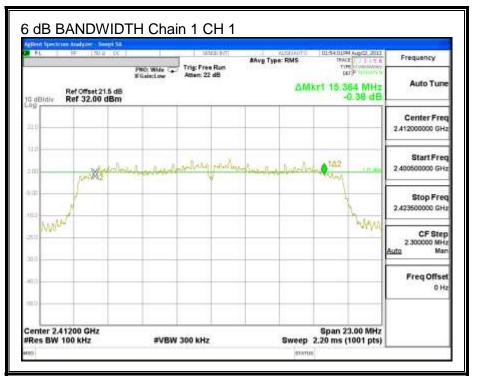




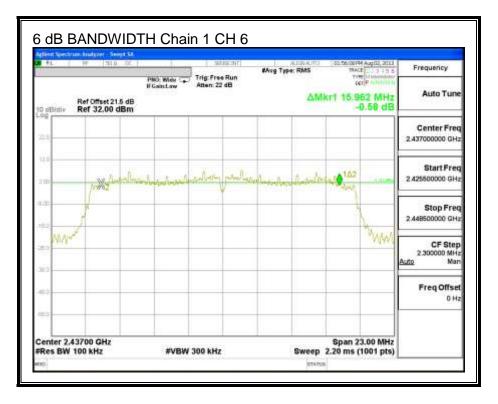
Page 71 of 272

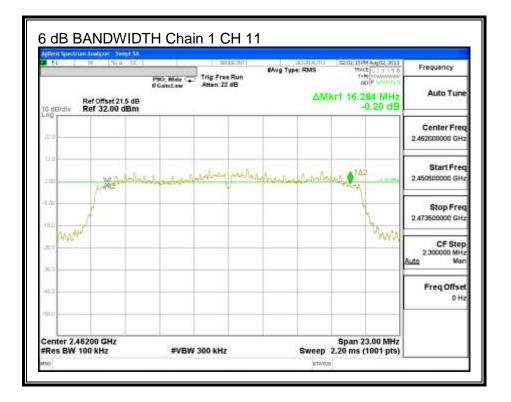


6 dB BANDWIDTH, Chain 1

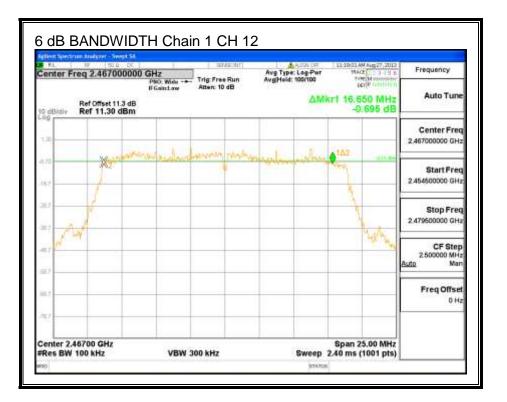


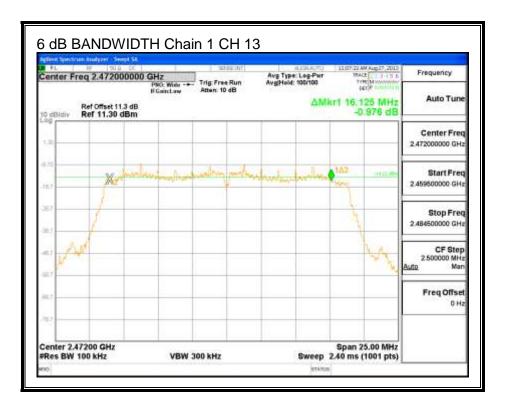
Page 72 of 272





Page 73 of 272





Page 74 of 272

8.3.2. 99% BANDWIDTH

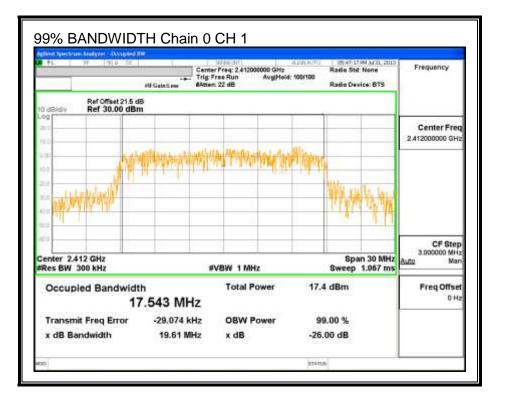
LIMITS

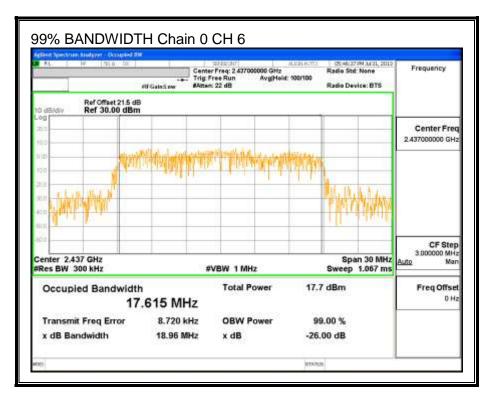
None; for reporting purposes only.

<u>RESULTS</u>

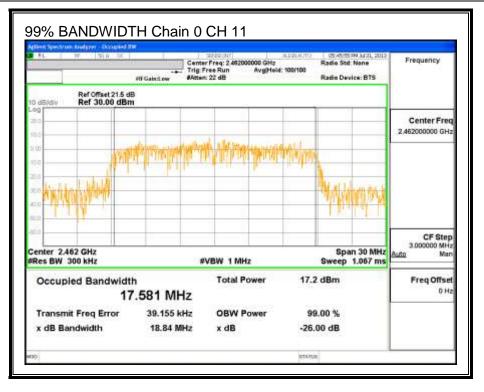
Channel	Frequency	99% BW	99% BW
		Chain 0	Chain 1
	(MHz)	(MHz)	(MHz)
1	2412	17.543	17.541
6	2437	17.615	17.574
11	2462	17.581	17.626
12	2467	17.510	17.605
13	2472	17.647	17.691

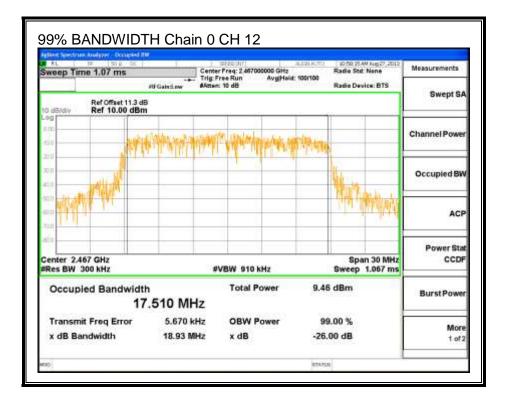
Page 75 of 272



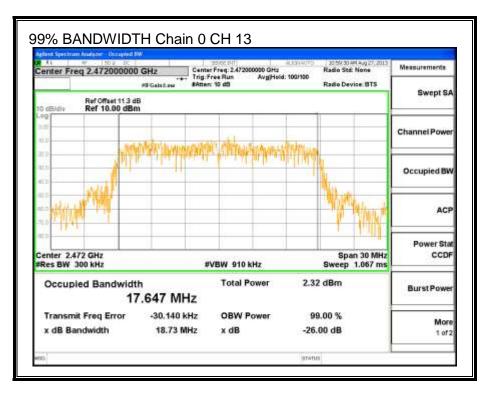


Page 76 of 272

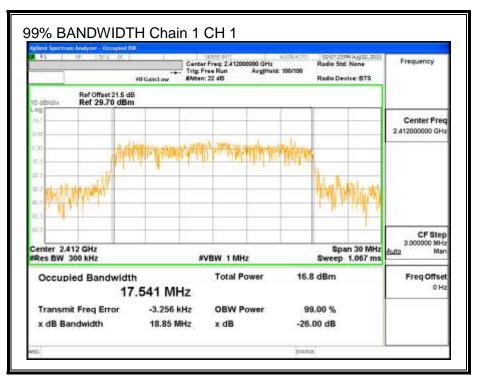




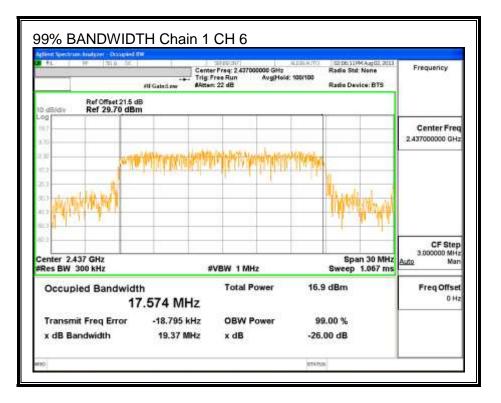
Page 77 of 272

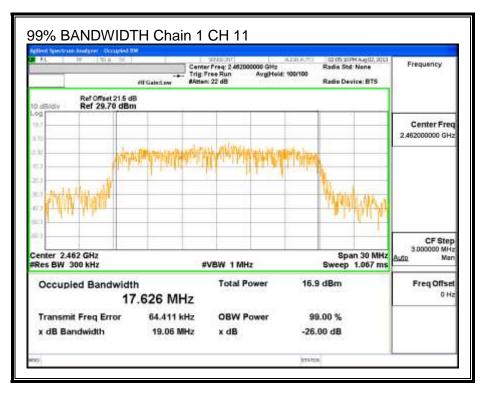


99% BANDWIDTH, Chain 1

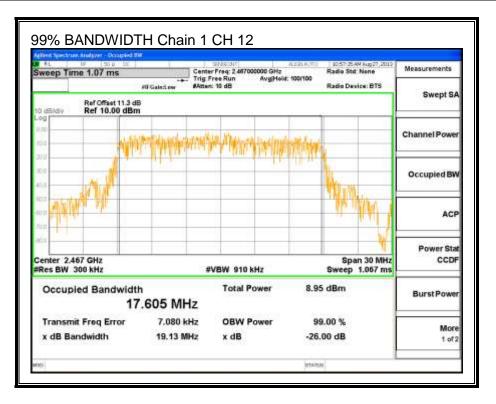


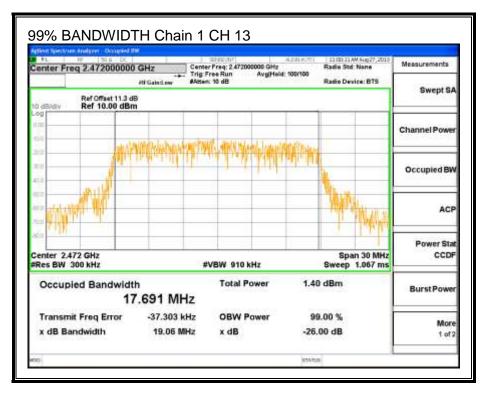
Page 78 of 272





Page 79 of 272





Page 80 of 272

8.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and 0.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Chain 0	Chain 1	Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(dBm)
1	2412	13.80	13.90	16.86
6	2437	16.00	15.90	18.96
11	2462	13.20	13.40	16.31
12	2467	8.90	9.00	11.96
13	2472	1.45	1.50	4.49

Page 81 of 272

8.3.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is unequal among the chains. The directional gain is:

Chain 0	Chain 1	Uncorrelated Chains
Antenna	Antenna	Directional
Gain	Gain	Gain
(dBi)	(dBi)	(dBi)
0.50	1.99	1.31

Page 82 of 272

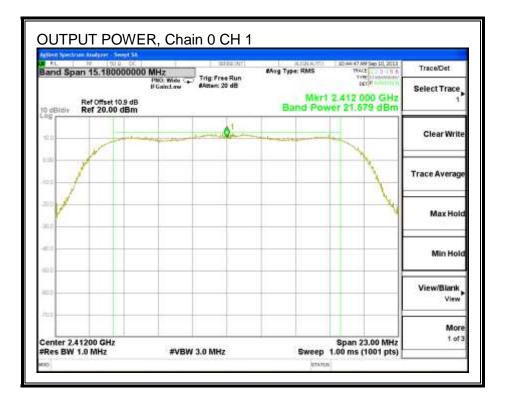
Limits

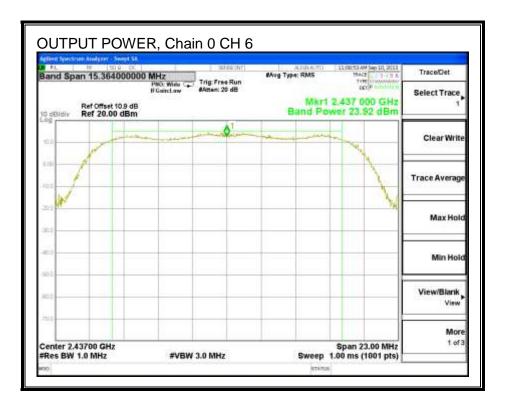
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
1	2412	1.31	30.00	30	36	30.00
6	2437	1.31	30.00	30	36	30.00
11	2462	1.31	30.00	30	36	30.00
12	2467	1.31	30.00	30	36	30.00
13	2472	1.31	30.00	30	36	30.00

Results

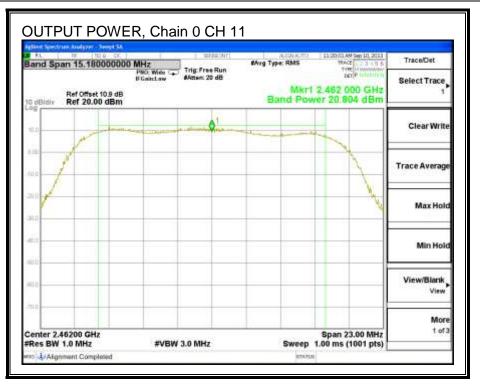
Channel	Frequency	Chain 0	Chain 1	Total	Power	Margin
		Meas	Meas	Corr'd	Limit	
		Power	Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
1	2412	21.58	22.48	25.07	30.00	-4.93
6	2437	23.92	24.12	27.03	30.00	-2.97
11	2462	20.80	22.11	24.52	30.00	-5.48
12	2467	16.63	17.82	20.28	30.00	-9.72
13	2472	8.98	9.82	12.43	30.00	-17.57

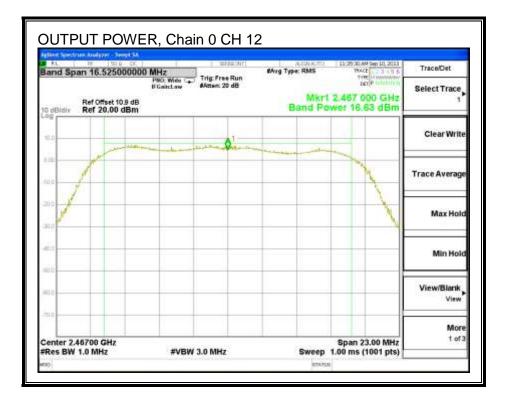
Page 83 of 272



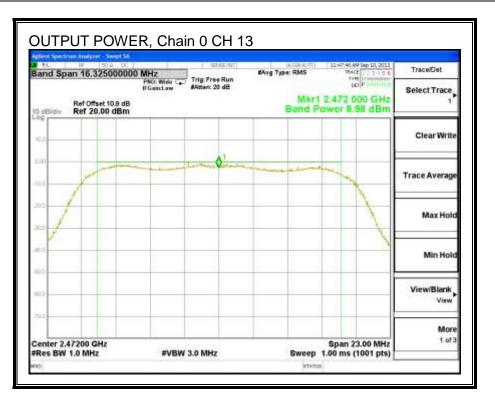


Page 84 of 272

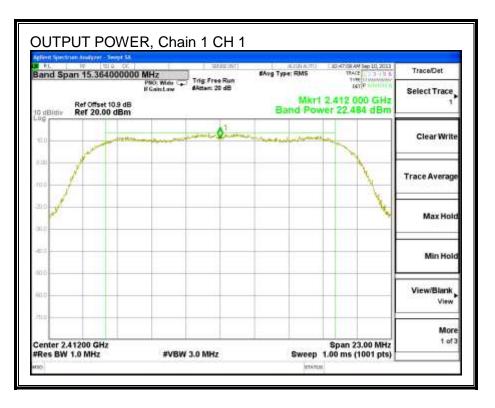




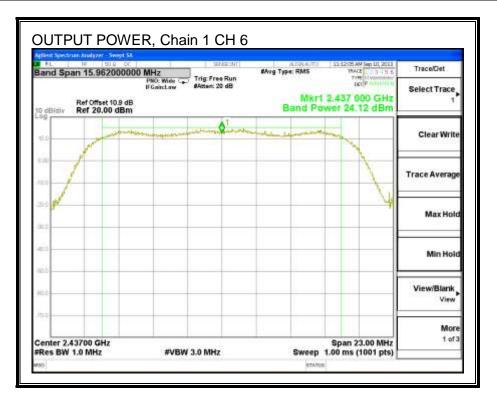
Page 85 of 272

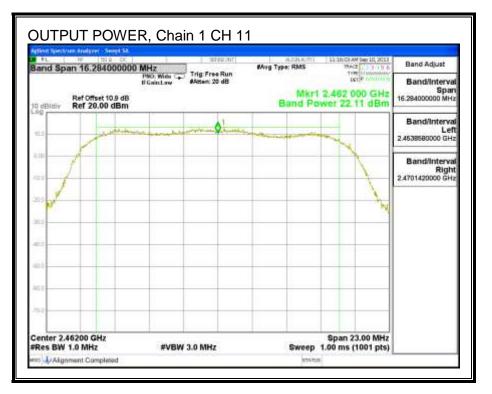


OUTPUT POWER, Chain 1

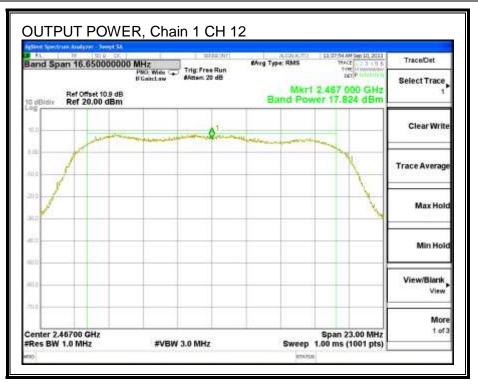


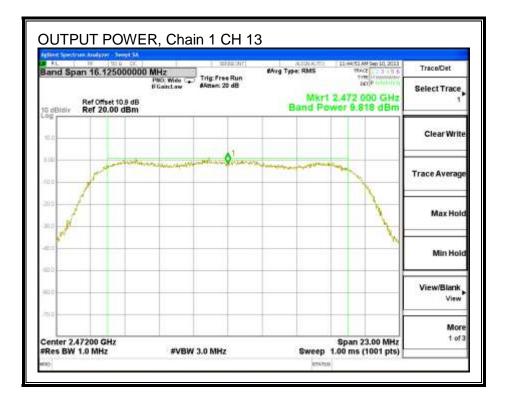
Page 86 of 272





Page 87 of 272





Page 88 of 272

8.3.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

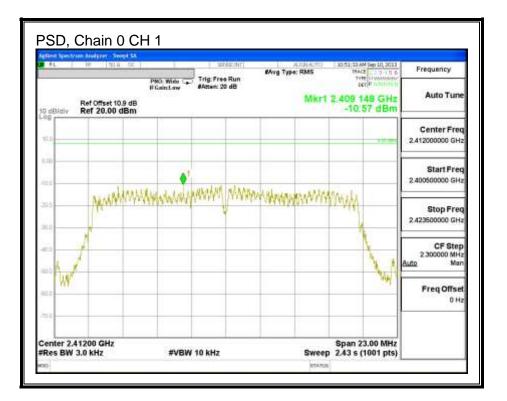
RESULTS

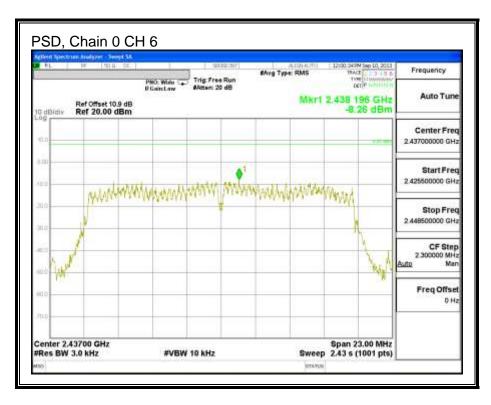
PSD Results

Channel	Frequency	Chain 0	Chain 1	Total	Limit	Margin
		Meas	Meas	PSD		
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
1	2412	-10.57	-9.32	-6.89	8.0	-14.9
6	2437	-8.26	-7.92	-5.08	8.0	-13.1
11	2462	-10.68	-10.10	-7.37	8.0	-15.4
12	2467	-14.49	-15.67	-12.03	8.0	-20.0
13	2472	-21.93	-22.61	-19.25	8.0	-27.2

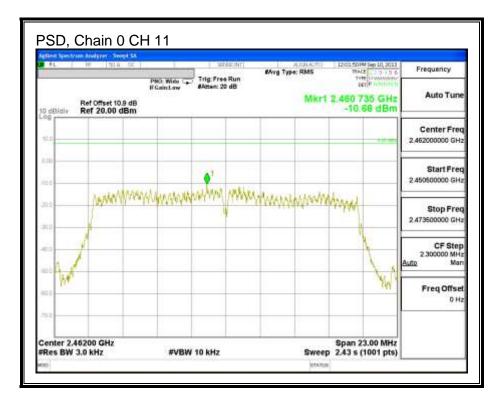
Page 89 of 272

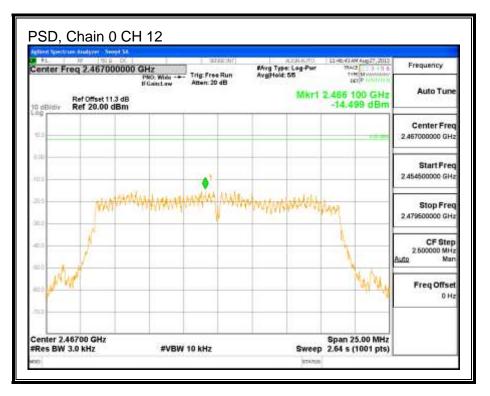
PSD, Chain 0



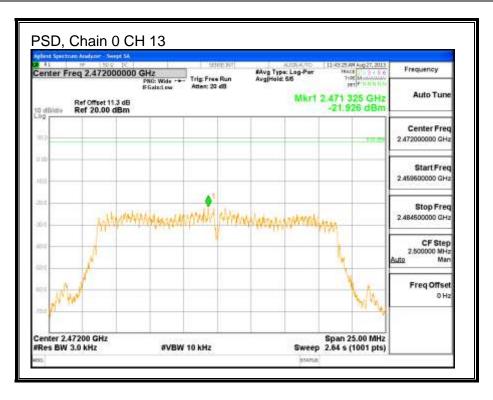


Page 90 of 272

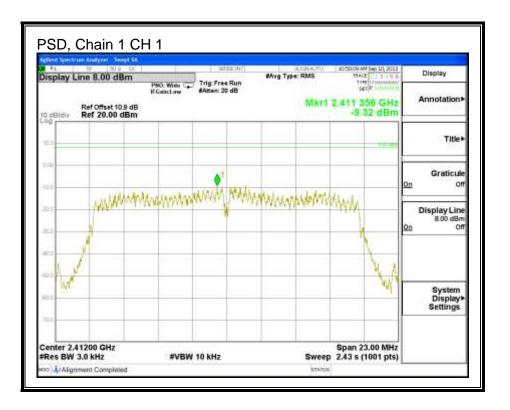




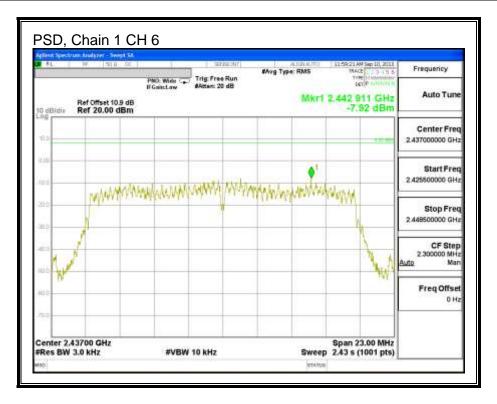
Page 91 of 272

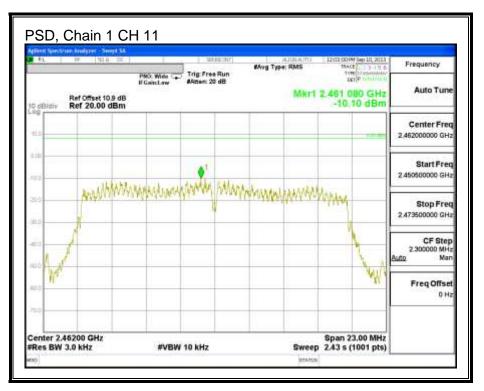


PSD, Chain 1

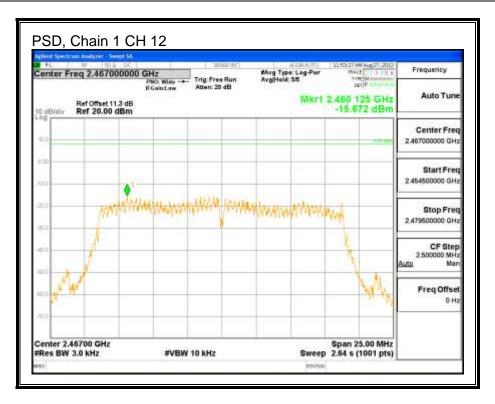


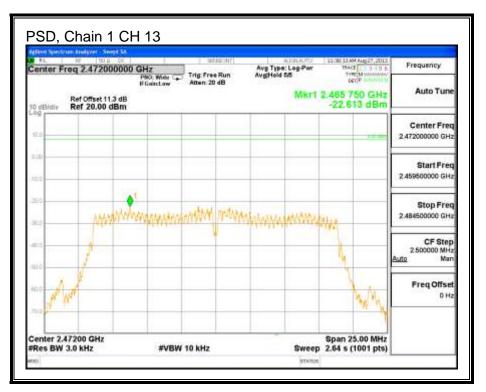
Page 92 of 272





Page 93 of 272





Page 94 of 272

8.3.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

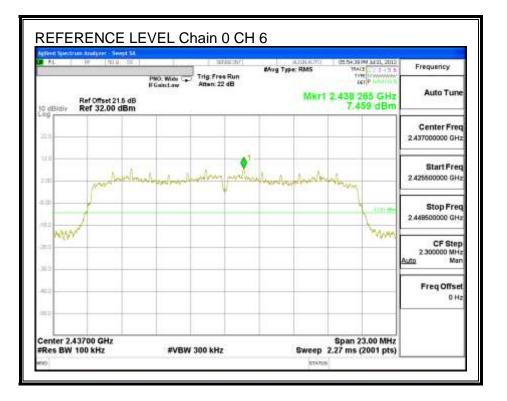
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

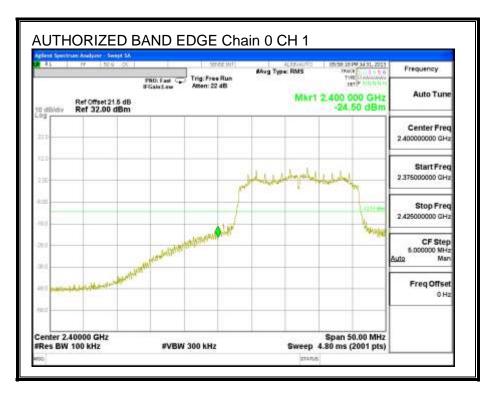
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

Page 95 of 272

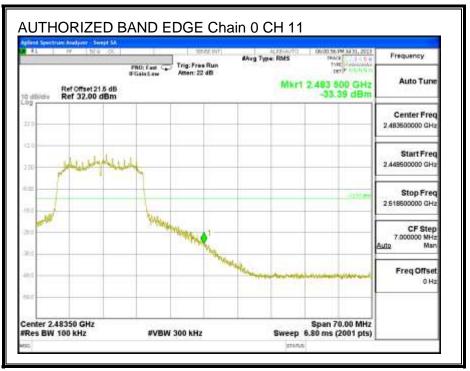
IN-BAND REFERENCE LEVEL, Chain 0



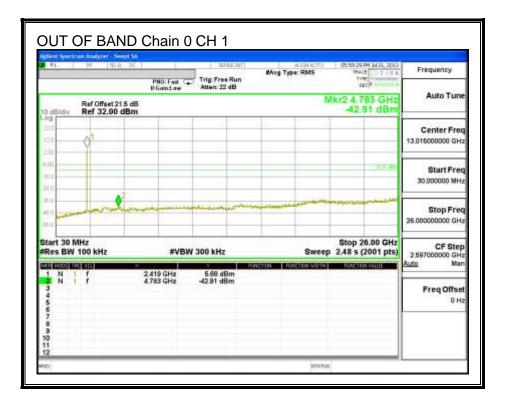
LOW CHANNEL BANDEDGE, Chain 0



Page 96 of 272

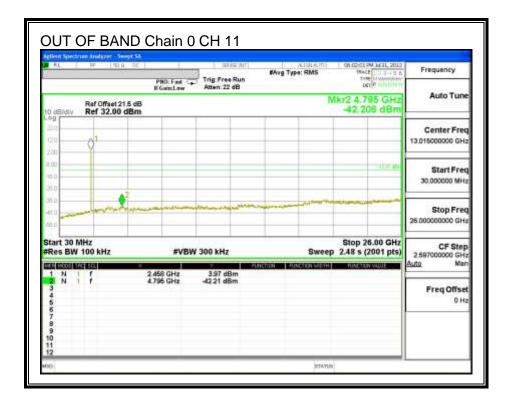


OUT-OF-BAND EMISSIONS, Chain 0

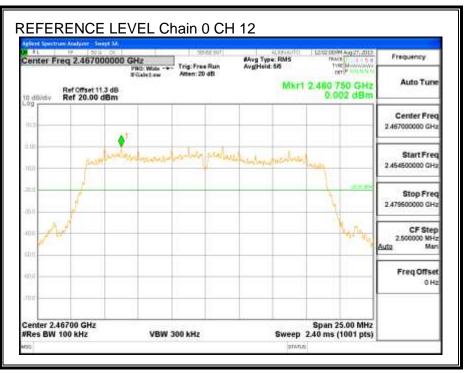


Page 97 of 272

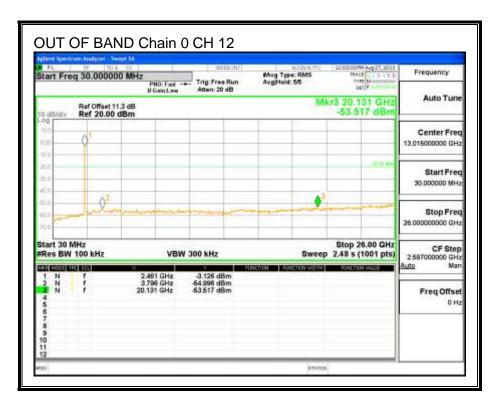
Frequency	RN 3431, 2013 CB 1 7 7 4 9 5 RE 34 Manual Manual	TRAC	e: RM\$	#Avg Ty	Free Run	τ,	90:Fast G	95	1 in the	1	
Auto Tune	09 GHZ	1kr2 3.8	N		22 dB	A	GaincLaw	1.5 dB	r Offset 2 f 32.00		5/dtv
Center Freq 13.015000000 GH:									1	<	
Start Free 30.000000 MH	- Home										_
Stop Free 25.00000000 GH;				****			ه از روبط معرفتري		at -	_	1
CF Step 2.59700000 GH Auto Mar	6.00 GHz 2001 pts)	2.48 5 (Sweep			N 30	#VBV			MHz V 100	s BV
Freq Offse					dBm idBm		32 GHz 29 GHz			1 1	22



Page 98 of 272

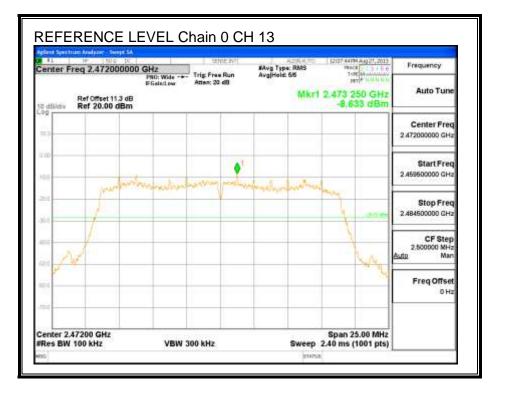


OUT-OF-BAND EMISSIONS, Chain 0

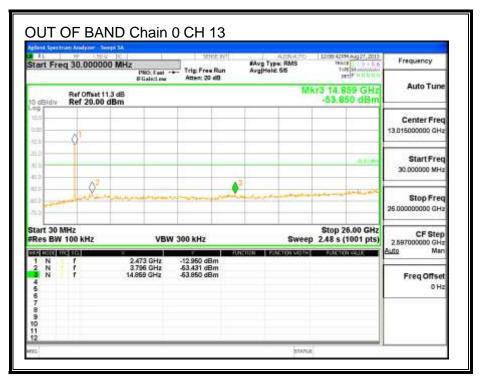


Page 99 of 272

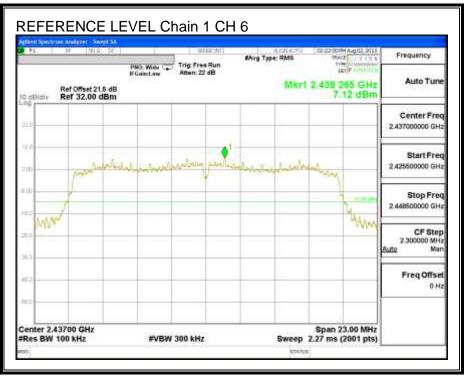
CH13 (REFERENCE LEVEL), Chain 0



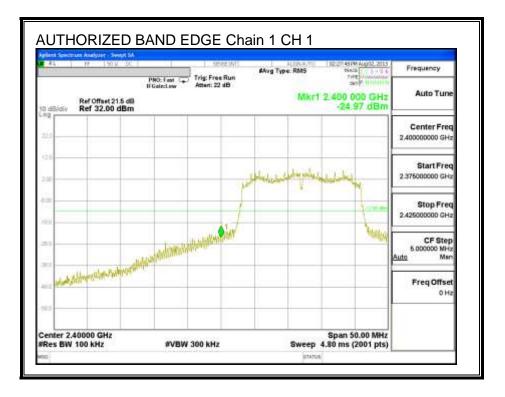
OUT-OF-BAND EMISSIONS, Chain 0



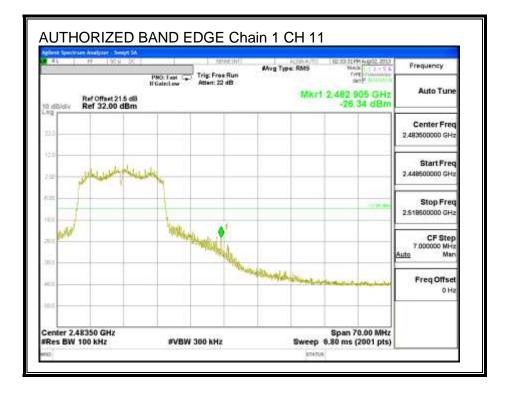
Page 100 of 272

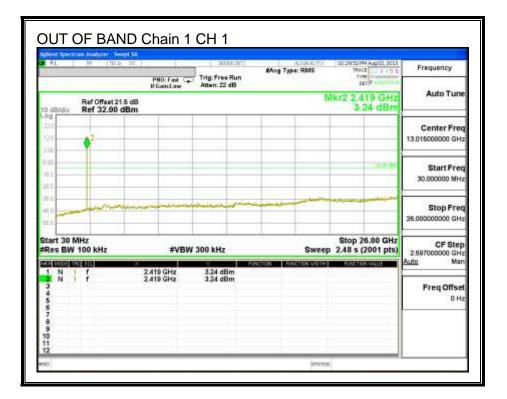


LOW CHANNEL BANDEDGE, Chain 1



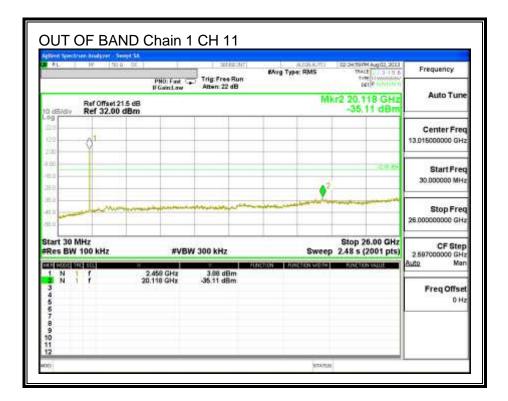
Page 101 of 272



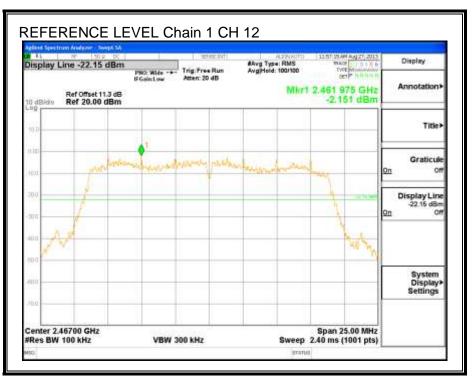


Page 102 of 272

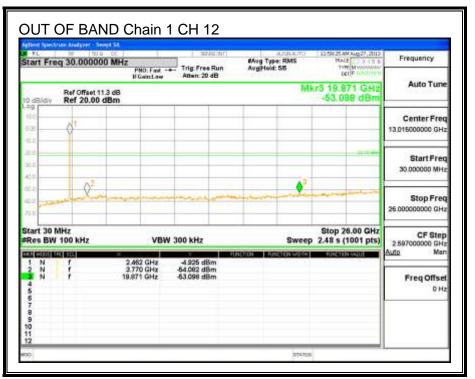
AL.	14 1416 S	PND: Fast C	Trig. Free Run Atten: 22 dB	Marg Type: RMS	TRACE 12 3 4 5 5 TRACE 12 3 4 5 5 TUTE IN MODIFIER	Frequency
VINES 01	Ref Offset 21.5 c Ref 32.00 dBr			1.00	Mkr2 3,744 GHz -43,13 dBm	Auto Tune
.09 .00 .00 .00	Q ¹					Center Free 13.01500000 GH:
1.00 10.0					(0.0. 8)	Start Free 30.000000 MH
10 0 11 D 10 0	- Anne		- marine marine	and the second		Stop Free 26.00000000 GH
tart 30 Mi Res BW 1	00 kHz	#VB	W 300 kHz	the second s	Stop 26.00 GHz p 2.48 s (2001 pts)	CF Step 2 59700000 GH Auto Mar
1 N 1 2 N 1 3 4 6 6 7 8 9 10 11		2.432 GHz 3.744 GHz	3,89 dBm -43.13 dBm	NETON ANETON VETH	PENCTRON VALUE	Freq Offse 0 H



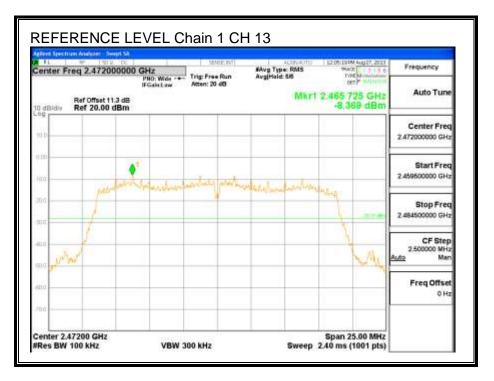
Page 103 of 272



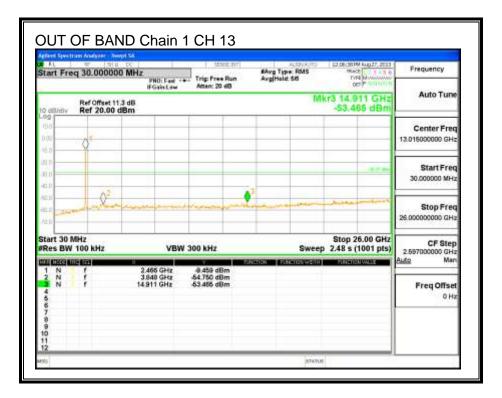
OUT-OF-BAND EMISSIONS, Chain 1



Page 104 of 272



OUT-OF-BAND EMISSIONS, Chain 1



Page 105 of 272

8.4. 802.11a MODE IN THE 5.8 GHz BAND

8.4.1. 6 dB BANDWIDTH

<u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

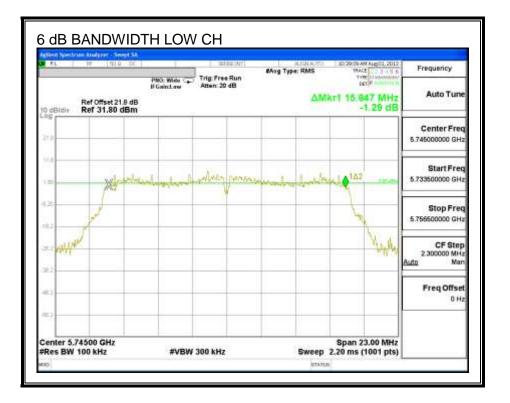
TEST PROCEDURE

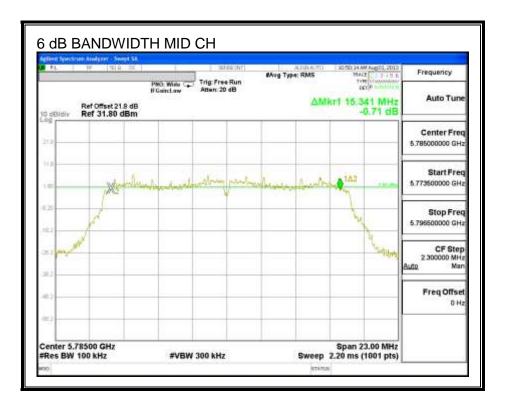
KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

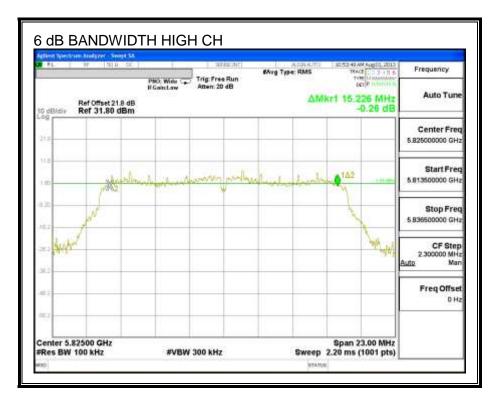
Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	5745	15.847	0.5
Mid	5785	15.341	0.5
High	5825	15.226	0.5

Page 106 of 272





Page 107 of 272



Page 108 of 272

8.4.2. 99% BANDWIDTH

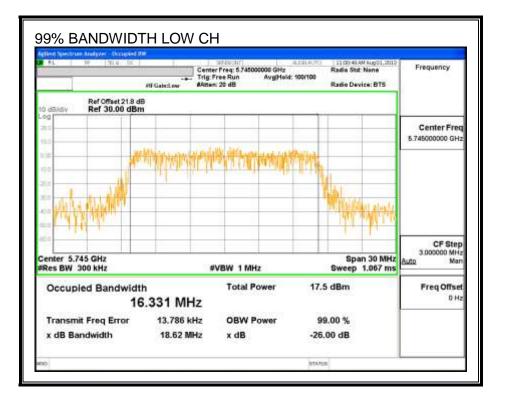
LIMITS

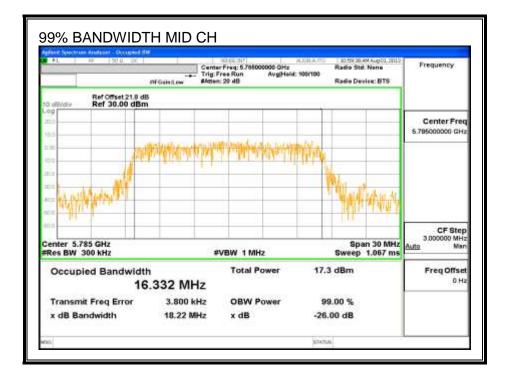
None; for reporting purposes only.

RESULTS

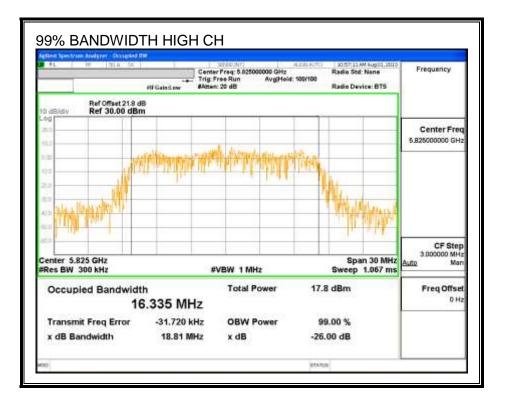
Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	5745	16.331
Mid	5785	16.332
High	5825	16.335

Page 109 of 272





Page 110 of 272



Page 111 of 272

8.4.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Power
	(MHz)	(dBm)
Low	5745	15.98
Mid	5785	15.95
High	5825	16.00

Page 112 of 272

8.4.4. OUTPUT POWER

LIMITS

FCC §15.247

IC RSS-210 A8.4

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Page 113 of 272

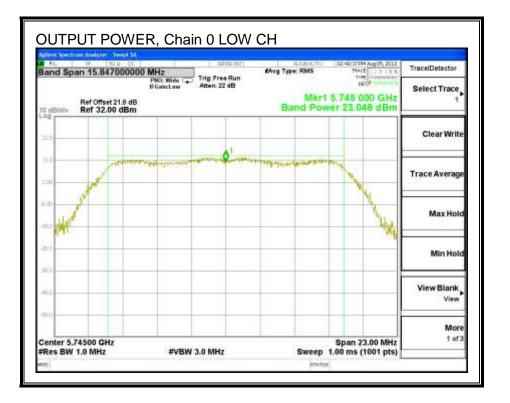
Limits

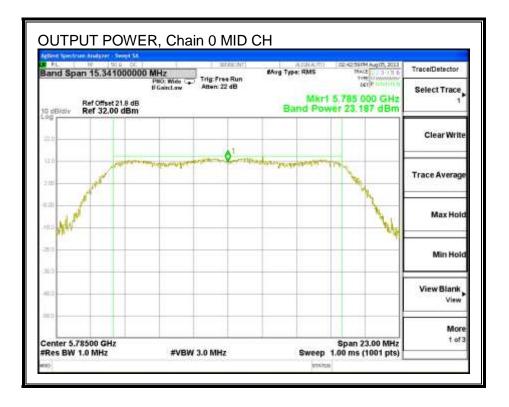
Channel	Frequency	Directional	FCC	IC	IC	Max
		Gain	Power	Power	EIRP	Power
			Limit	Limit	Limit	
	(MHz)	(dBi)	(dBm)	(dBm)	(dBm)	(dBm)
Low	5745	4.21	30.00	30	36	30.00
Mid	5785	4.21	30.00	30	36	30.00
High	5825	4.21	30.00	30	36	30.00

Results

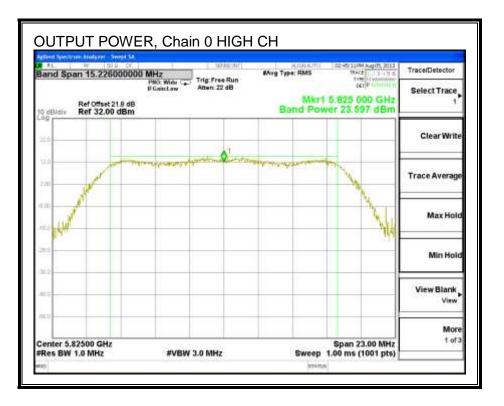
Channel	Frequency	Chain 0	Total	Power	Margin
		Meas	Corr'd	Limit	
		Power	Power		
	(MHz)	(dBm)	(dBm)	(dBm)	(dB)
Low	5745	23.048	23.05	30.00	-6.95
Mid	5785	23.187	23.19	30.00	-6.81
High	5825	23.597	23.60	30.00	-6.40

Page 114 of 272





Page 115 of 272



Page 116 of 272

8.4.5. PSD

LIMITS

FCC §15.247

IC RSS-210 A8.2

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

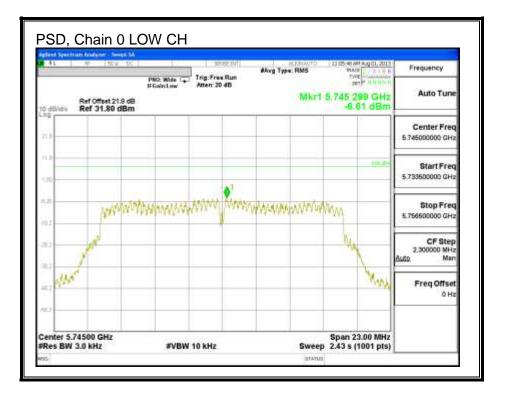
RESULTS

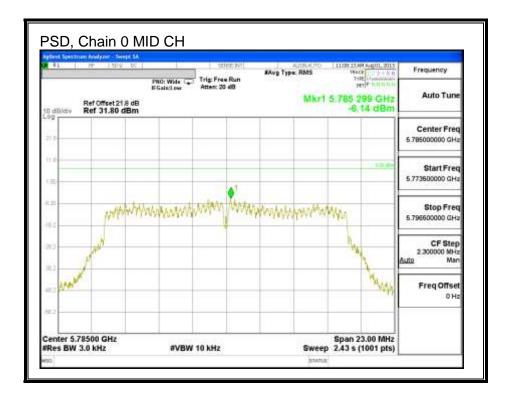
PSD Results

Channel	Frequency	Chain 0	Limit	Margin
		Meas		
	(MHz)	(dBm)	(dBm)	(dB)
Low	5745	-6.61	8.0	-14.6
Mid	5785	-6.14	8.0	-14.1
High	5825	-7.39	8.0	-15.4

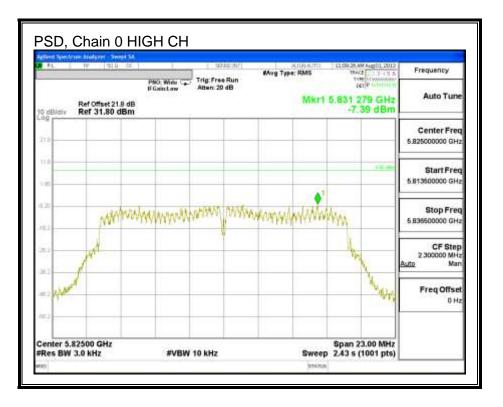
Page 117 of 272

PSD, Chain 0





Page 118 of 272



Page 119 of 272

8.4.6. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

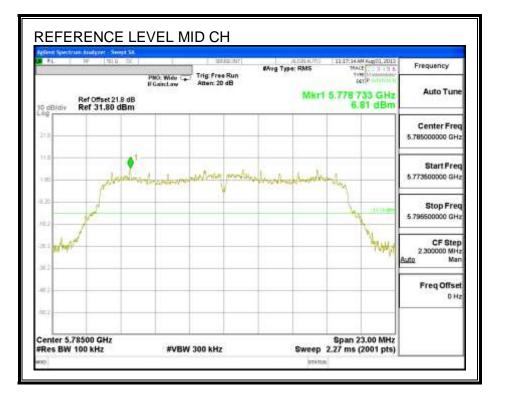
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

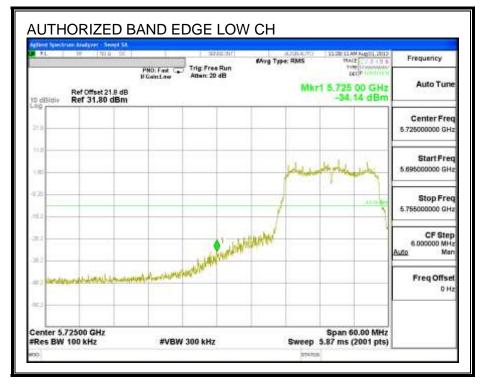
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the inband reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

Page 120 of 272

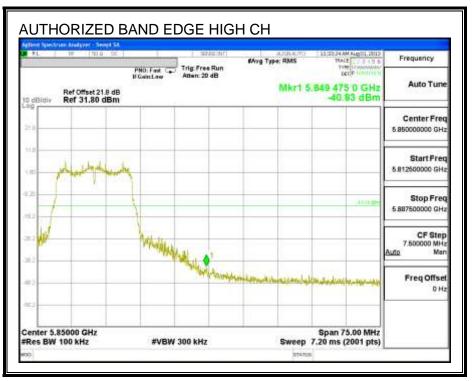
IN-BAND REFERENCE LEVEL



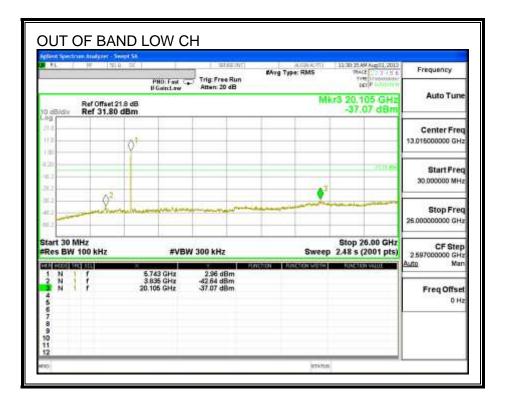
LOW CHANNEL BANDEDGE



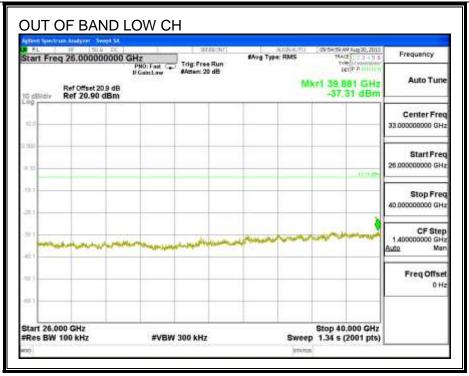
Page 121 of 272

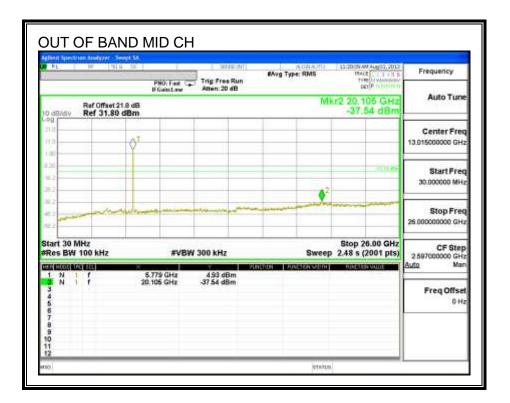


OUT-OF-BAND EMISSIONS



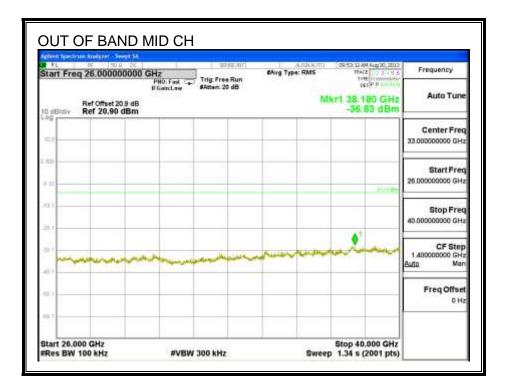
Page 122 of 272





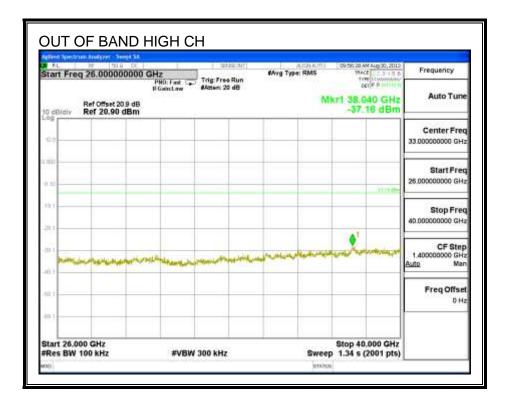
Page 123 of 272

AL I W	1419 SC	90: Fast C	Trig:Free Run Atten: 20 dB	Mayg Type: RMS	11.20009 AM ALGOD, 20 WACE 12.3.3.4.9 TVRE LI WARANA	5 Frequency
d dBldly Ref	Iffset 21.8 dB 31.80 dBm	Gaintaw	Aden 20 db		Mkr2 20.105 GH -37.54 dBr	Auto Tun
90 318 118 	٥́۲.					Center Free 13.015000000 GH
120 11.2 11.2 11.2				5	2	Start Free 30.000000 MH
82 82 82	mandament					Stop Free 26.00000000 GH
atart 30 MHz Res BW 100 k	Hz	#VBI	W 300 kHz		Stop 26.00 GH ep 2.48 s (2001 pts	2 59700000 GH
201 COOR 124 134 1 N 1 f 3 N 1 f 3 5 5 6 7 8 9 10 11 12	5.77 20.10	79 GHz 26 GHz	4.93 dBm -37.54 dBm	RICTION FUNCTION VIE	HINGTON VALUE	Freq Offse 0 H



Page 124 of 272

RL.	- Cours	Andyzer - See		PNO: Fast	Trig Free Run	Mvg Type	KINI KUTO K RMS	704	M Augul, 2012 CE 2 7 4 8 5 RE Divisionities	Frequency
0 darde		Ref Offset 21 Ref 31.80 d		If Gain:Low	Atten 20 dB		N	lkr3 3,6	87 GHz 56 dBm	Auto Tune
11.0 11.0 11.0			Q ¹							Center Free 13.015000000 GHz
120 1120									ames	Start Free 30.000000 MH
2	-	12 C					-			Stop Free 26.000000000 GH
tart 30 Res B		lz DO kHz		#VB	W 300 kHz		Sweep	Stop 2 2.48 s	26.00 GHz (2001 pts)	CF Step 2.597000000 GH
1 N 2 N 3 N 4 5	1			821 GHz 796 GHz 887 GHz	4.49 dBm -43.00 dBm -42.56 dBm	UNCTION AND	CTON WOTH	HINCH		Auto Mar Freq Offse 0 Hi
5 7 8 9 0 1										



Page 125 of 272

8.5. 802.11n HT20 2TX CDD MODE IN THE 5.8 GHz BAND

8.5.1. 6 dB BANDWIDTH

<u>LIMITS</u>

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

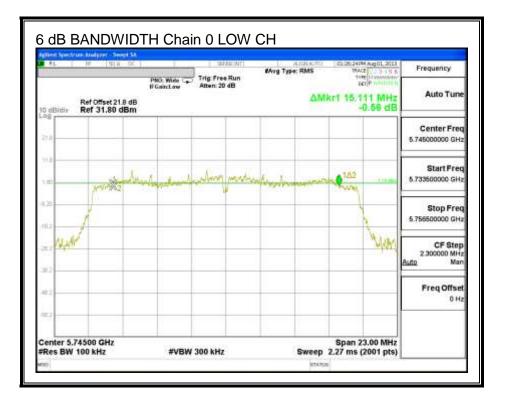
TEST PROCEDURE

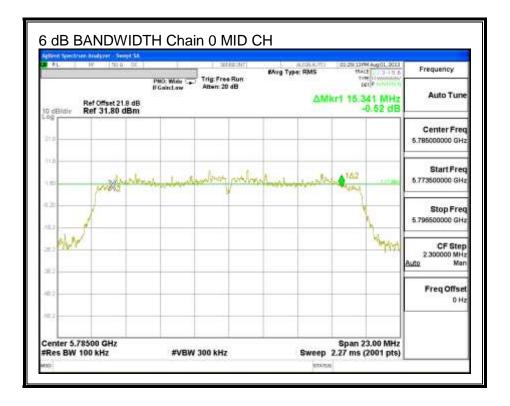
KDB 558074 D01 v01 "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247".

RESULTS

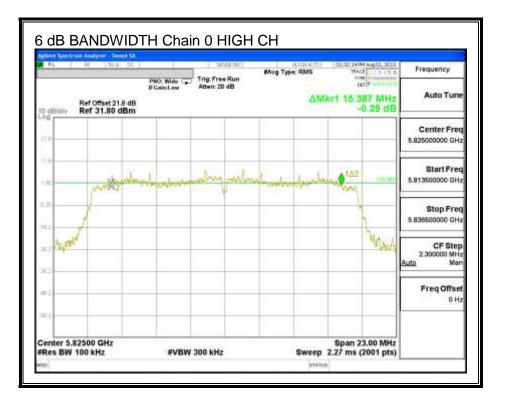
Channel	Frequency	6 dB BW	6 dB BW	Minimum
		Chain 0	Chain 1	Limit
	(MHz)	(MHz)	(MHz)	(MHz)
Low	5745	15.111	15.146	0.5
Mid	5785	15.341	15.134	0.5
High	5825	15.387	15.203	0.5

Page 126 of 272

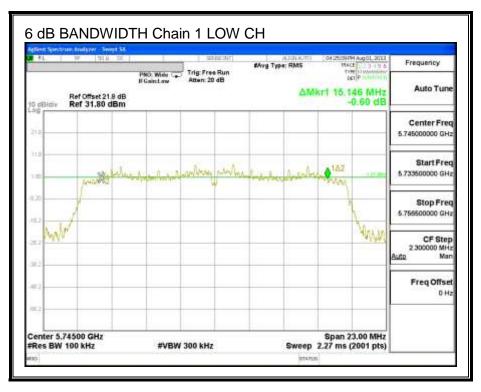




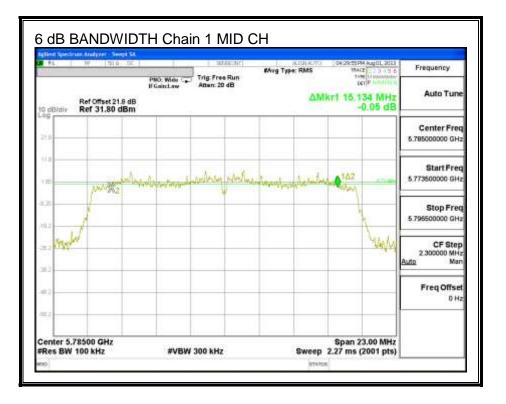
Page 127 of 272

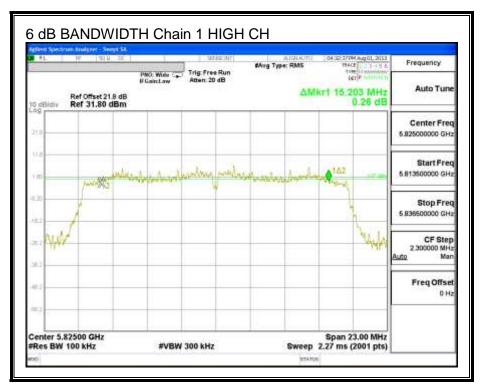


6 dB BANDWIDTH, Chain 1



Page 128 of 272





Page 129 of 272

8.5.2. 99% BANDWIDTH

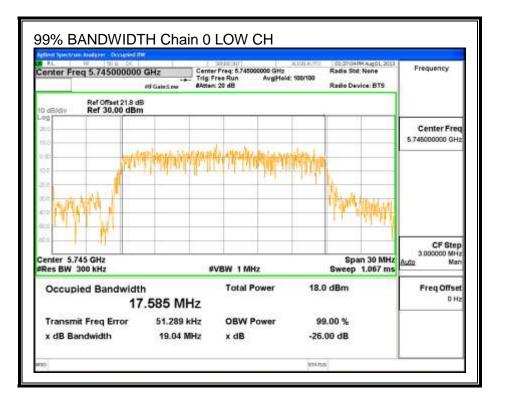
LIMITS

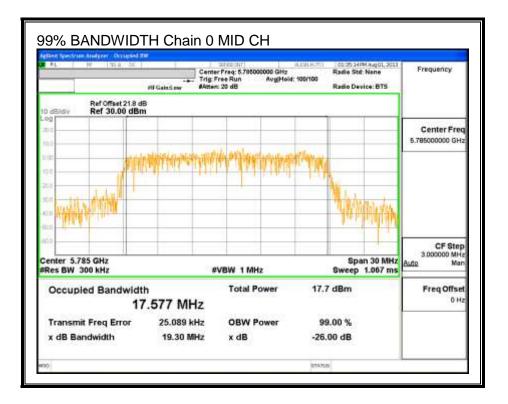
None; for reporting purposes only.

<u>RESULTS</u>

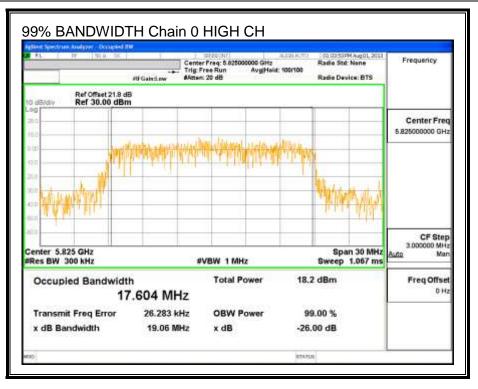
Channel	Frequency	99% BW	99% BW
			Chain 1
	(MHz)	(MHz)	(MHz)
Low	5745	17.585	17.560
Mid	5785	17.577	17.565
High	5825	17.604	17.558

Page 130 of 272

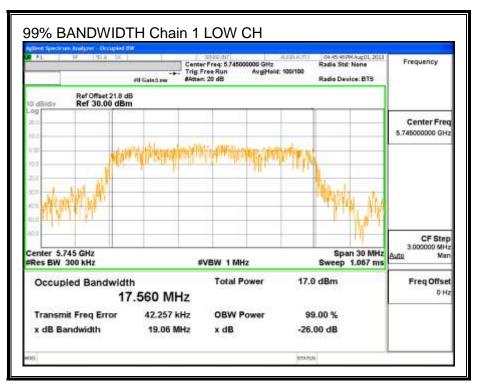




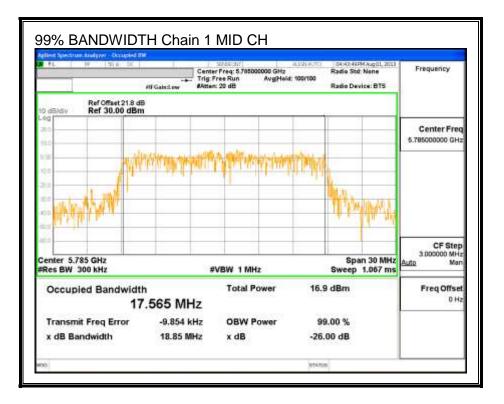
Page 131 of 272

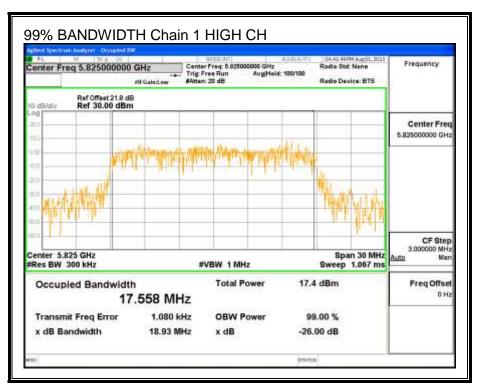


99% BANDWIDTH, Chain 1



Page 132 of 272





Page 133 of 272

8.5.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency	Chain 0	Chain 1	Total
		Power	Power	Power
	(MHz)	(dBm)	(dBm)	(dBm)
Low	5745	16.00	15.91	18.97
Mid	5785	16.00	15.95	18.99
High	5825	16.00	15.70	18.86

Page 134 of 272