RF TEST REPORT

SIEMIC
GLOBAL TESTING & CERTIFICATIONS
YOUR CHOICE FOR- TCB FCB CB NB CAB RCB

Report No.: RF_SL16022201-UBN-001_FCC IC Rev 1.0
Supersede Report No.: RF_SL16022201-UBN-001_FCC IC

Applicant	Ubiquiti Network, Inc.
Product Name	Point to Point Device
Model No.	AF4X
Test Standard	47 CFR Part 90 Subpart Y RSS-111, Sep, 2014, Issue 5
Test Procedure	47 CFR Part 90 Subpart Y RSS-Gen, Nov 2014, Issue 4
FCC ID	SWX-AF4X
IC ID	6545A-AF4X
Date of test	03/07/2016 - 03/16/2016
Issue Date	04/04/2016
Test Result	Pass Fail
Equipment complied with the specification	[x]
Equipment did not comply with the specification	[ ]

Gary Chou	Chen Ge
Test Engineer	Engineer Reviewer

This test report may be reproduced in full only
Test result presented in this test report is applicable to the tested sample only

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA
A2LA ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	COM, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
RF_SL16022201-UBN-001_FCC IC	-	Original	03/18/2016
RF_SL16022201-UBN-001_FCC IC Rev 1.0	Rev 1.0	Updated per TCB reviewer	04/04/2016

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Ubiquiti Network, Inc.
Product: Point to Point Device
Model: AF4X

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	Ubiquiti Networks, Inc.
Applicant Address	2580 Orchard Parkway, San Jose, CA 95131
Manufacturer Name	Ubiquiti Networks, Inc.
Manufacturer Address	2580 Orchard Parkway, San Jose, CA 95131

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	Point to Point Device
Model No.	AF4X
Trade Name	Ubiquiti
Serial No.	1605PO418D6E3B950
Input Power via PoE	24VDC
PoE Adapter Manu/Model	GP-H240-100G-4
Power Adapter SN	N/A-0000414
Hardware version	N/A
Software version	5.0
Date of EUT received	03/07/2016
Equipment Class/ Category	TNB
Highest Clock Frequency	N/A
Port/Connectors	RJ45

6.2 Radio Description

Spec for Radio -

Radio Type	
Operating Frequency	4940MHz – 4990MHz
Modulation	OFDM, 16-QAM, 64-QAM, 256-QAM
Channel Bandwidth	5MHz, 10MHz, 20MHz
Antenna Gain	26dBi
Antenna Type	External antenna
Antenna Connector Type	SMA-type

6.3 EUT test modes/configuration Description

Test Mode		Note
Test_mode_1	Continuous Transmit	-
Test_mode_2	-	-
Remark:		

Note: Different data rate have been verified, the results shows the worst case only.

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	T530	-	Lenovo	-
2	PoE Adapter	GP-H240-100G-4	-	Ubiquiti	-

7.2 Test Software Description

Test Item	Software	Description
RF Tests	Telnet	Set the EUT to different channels and modulations

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Occupied Bandwidth & Emissions Mask	FCC IC	§90 Subpart Y RSS-111	FCC §2.1049 FCC §90.210 RSS-Gen	☒ Pass ☐ N/A
Peak Output Power	FCC IC	§90 Subpart Y RSS-111	FCC §2.1046 FCC §90.1215(a) RSS-Gen	☒ Pass ☐ N/A
Power Spectral Density	FCC IC	§90 Subpart Y RSS-111	FCC §2.1046 FCC §90.1215(a) RSS-Gen	☒ Pass ☐ N/A
Peak Excursion	FCC IC	§90 Subpart Y RSS-111	FCC §90.1215 RSS-Gen	☒ Pass ☐ N/A
Conducted Spurious Emissions at the Antenna Terminals	FCC IC	§90 Subpart Y RSS-111	FCC §2.1051 FCC §90.210 RSS-Gen	☒ Pass ☐ N/A
Radiated Spurious Emissions	FCC IC	§90 Subpart Y RSS-111	FCC §2.1053 FCC §90.210 TIA-603-D RSS-Gen	☒ Pass ☐ N/A
Frequency Stability	FCC IC	§90 Subpart Y RSS-111	FCC §2.1055 FCC §90.213 RSS-Gen	☒ Pass ☐ N/A
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.			

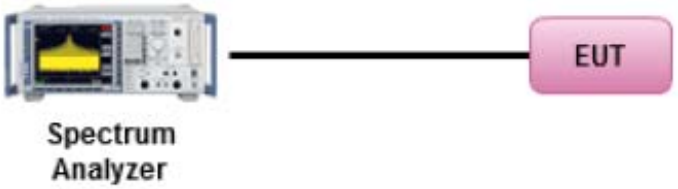
9 Measurement Uncertainty

Emissions			
Test Item	Frequency Range	Description	Uncertainty
Radiated Spurious Emissions	30MHz – 1GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
Radiated Spurious Emissions	1GHz – 40GHz	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+4.3dB/-4.1dB

10 Measurements, Examination and Derived Results

10.1 Occupied Bandwidth & Emissions Mask

Requirement(s):

<table>
<tr><td>Spec</td><td>Requirement</td><td>Applicable</td></tr>
<tr><td>FCC §2.1049
FCC §90.210
RSS-111</td><td>For low power transmitters (20 dBm or less) and high power transmitters (greater than 20 dBm operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:
<table>
<tr><td rowspan="2">Frequency Offset f_d</td><td colspan="2">Minimum Attenuation</td></tr>
<tr><td>Low Power Transmitter</td><td>High Power Transmitter</td></tr>
<tr><td>$0 < f_d \leq 45$</td><td>0</td><td>0</td></tr>
<tr><td>$45 < f_d \leq 50$</td><td>$219 \log(f_d/45)$</td><td>$568 \log(f_d/45)$</td></tr>
<tr><td>$50 < f_d \leq 55$</td><td>$10 + 242 \log(f_d/50)$</td><td>$26 + 145 \log(f_d/50)$</td></tr>
<tr><td>$55 < f_d \leq 100$</td><td>$20 + 31 \log(f_d/55)$</td><td>$32 + 31 \log(f_d/55)$</td></tr>
<tr><td>$100 < f_d \leq 150$</td><td>$28 + 68 \log(f_d/100)$</td><td>$40 + 57 \log(f_d/100)$</td></tr>
<tr><td>$f_d > 150$</td><td>40</td><td>50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.</td></tr>
</table>
f_d is the percentage of the equipment's channel bandwidth.</td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Procedure</td><td colspan="2">The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz.</td></tr>
<tr><td>Remark</td><td colspan="2">-</td></tr>
<tr><td>Environmental conditions</td><td>Temperature (°C)
Humidity (%)
Atmospheric (mbar)</td><td>21 °C
38%
1019 mbar</td></tr>
<tr><td>Test Date</td><td colspan="2">03/07/2016 – 03/11/2016</td></tr>
<tr><td>Result</td><td colspan="2">☒ Pass ☐ Fail</td></tr>
</table>

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

Test was done by *Chen Ge* at *RF test site*.

5MHz:

Frequency (MHz)	Channel	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
4942.5	Low	4.74	5.31
4965	Middle	4.73	5.32
4987.5	High	4.75	5.34

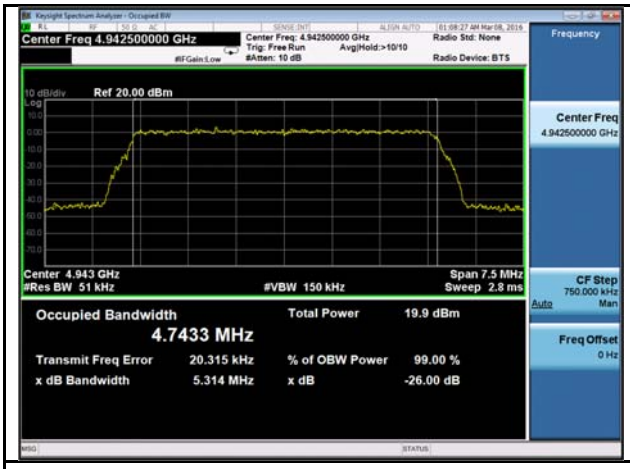
10MHz:

Frequency (MHz)	Channel	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
4945	Low	9.35	10.43
4965	Middle	9.34	10.40
4985	High	9.35	10.45

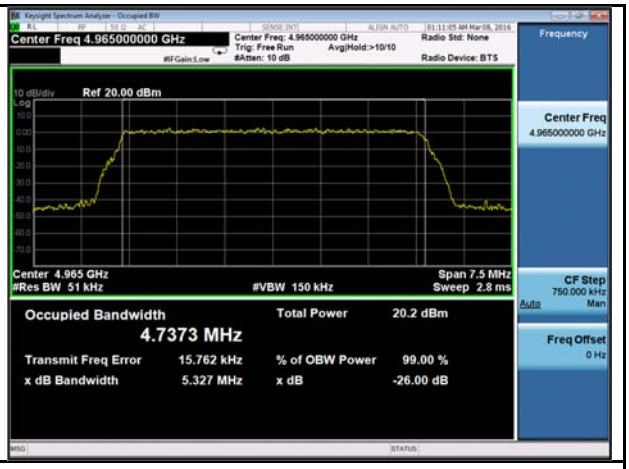
20MHz:

Frequency (MHz)	Channel	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
4950	Low	18.78	21.08
4965	Middle	18.79	21.17
4980	High	18.76	21.21

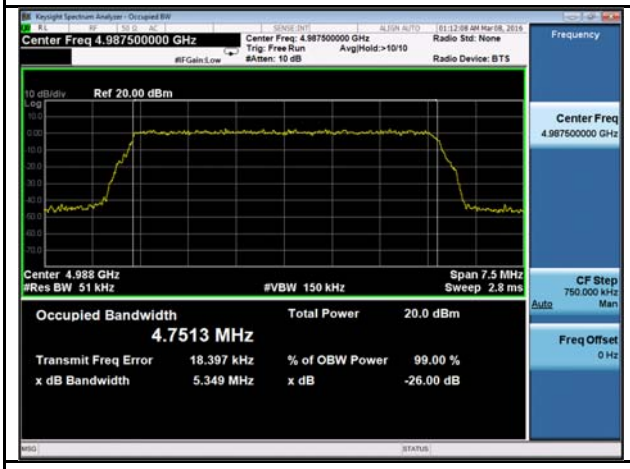
Occupied Bandwidth Test Plots



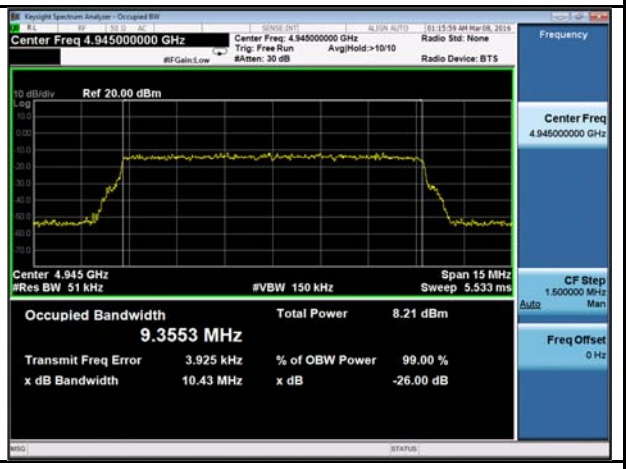
5MHz - Low CH 4942.5MHz



5MHz - Middle CH 4965MHz

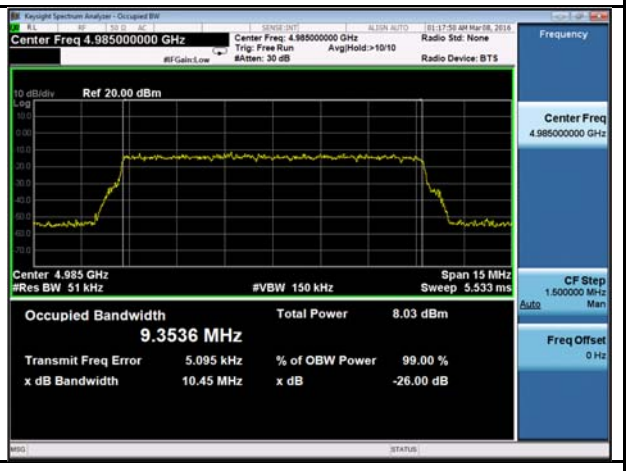


5MHz - High CH 4987.5MHz



10MHz - Low CH 4945MHz

10MHz - Middle CH 4965MHz



10MHz - High CH 4985MHz

20MHz - Low CH 4950MHz

20MHz - Middle CH 4965MHz

20MHz - High CH 4980MHz

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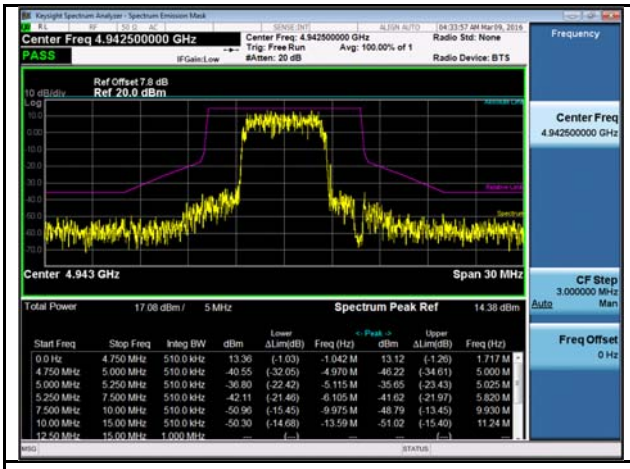
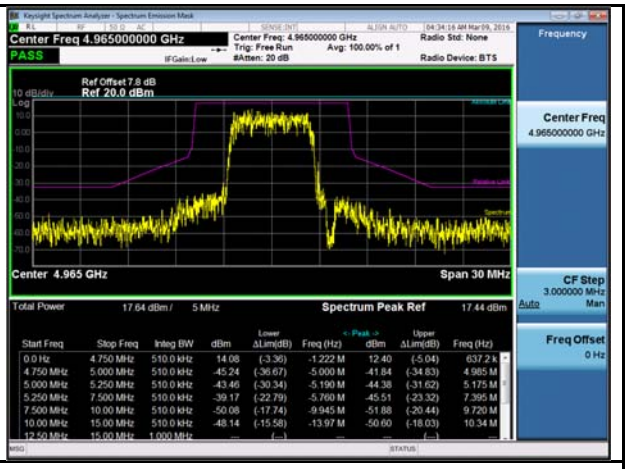
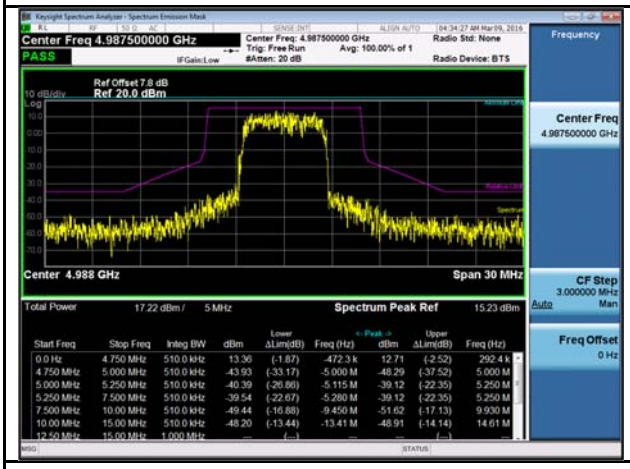
Emission Mask Test Plots



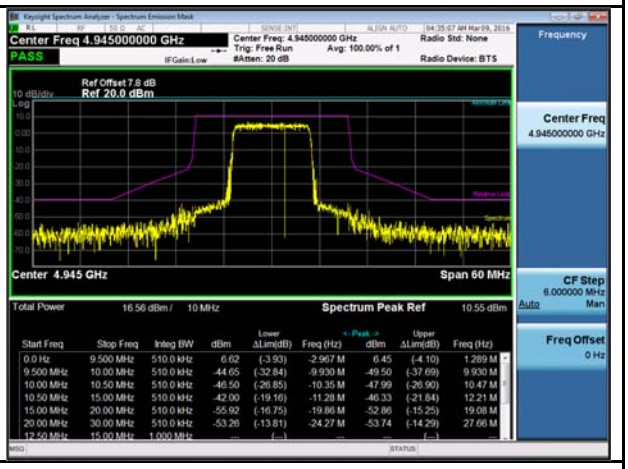
5MHz - Low CH 4942.5MHz



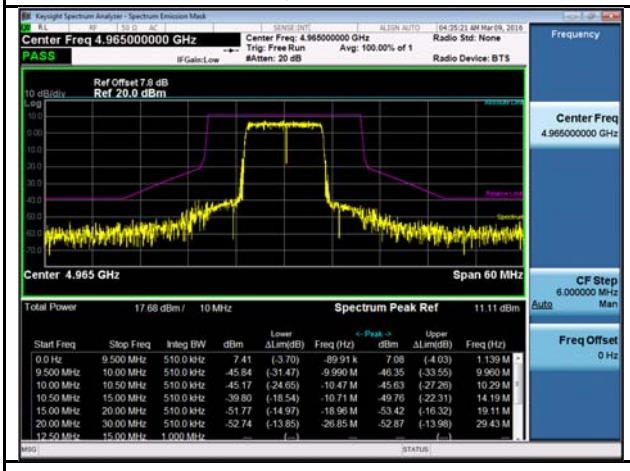
5MHz - Middle CH 4965MHz



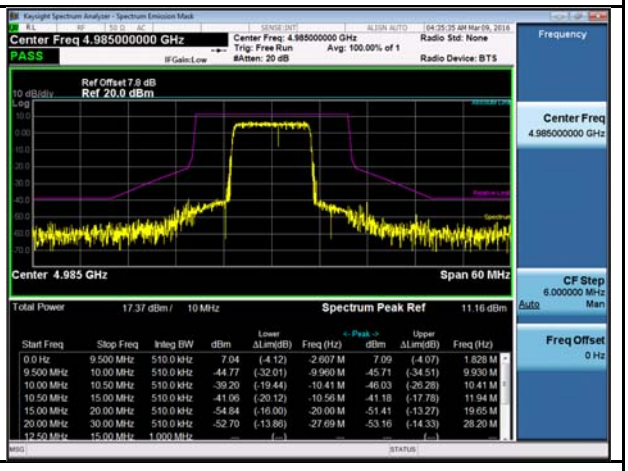
5MHz - High CH 4987.5MHz



10MHz - Low CH 4945MHz

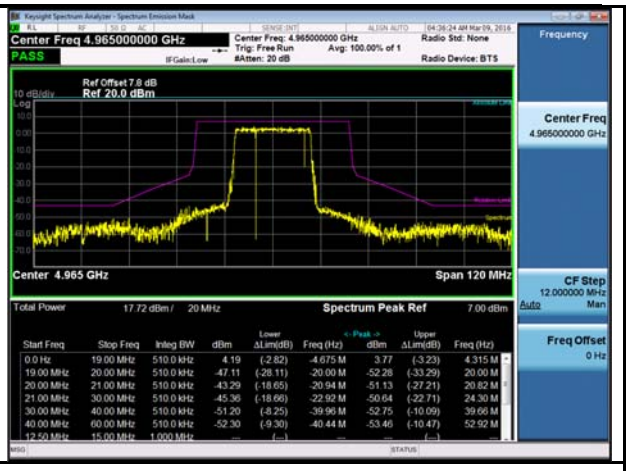


10MHz - Middle CH 4965MHz



10MHz - High CH 4985MHz

20MHz - Low CH 4950MHz



20MHz - Middle CH 4965MHz

20MHz - High CH 4980MHz

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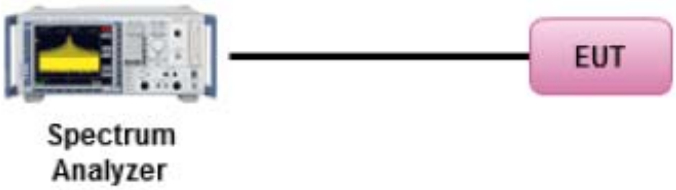
10.2 Output Power

Requirement(s):

<table>
<tr><td>Spec</td><td>Requirement</td><td>Applicable</td></tr>
<tr><td>FCC §2.1046
FCC §90.1215(a)
RSS-111</td><td>Per FCC §90.1215, the transmitting power of stations operating in the 4940-4990 MHz band must not exceed the maximum limits in this section.
The maximum conducted output power should not exceed:
<table>
<tr><th>Channel bandwidth (MHz)</th><th>Low power maximum conducted output power (dBm)</th><th>High power maximum conducted output power (dBm)</th></tr>
<tr><td>1</td><td>7</td><td>20</td></tr>
<tr><td>5</td><td>14</td><td>27</td></tr>
<tr><td>10</td><td>17</td><td>30</td></tr>
<tr><td>15</td><td>18.8</td><td>31.8</td></tr>
<tr><td>20</td><td>20</td><td>33</td></tr>
</table>
However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.</td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Procedure</td><td colspan="2">The maximum conducted output power is measured as a conducted emission over any interval of continuous transmission using instrumentation calibrated in terms of an RMS-equivalent voltage. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true maximum conducted output power measurement.</td></tr>
<tr><td>Environmental conditions</td><td>Temperature (°C)
Humidity (%)
Atmospheric (mbar)</td><td>23 °C
40%
1019 mbar</td></tr>
<tr><td>Test Date</td><td colspan="2">03/07/2016 – 03/11/2016</td></tr>
<tr><td>Remark</td><td colspan="2">The two antennas are cross-polarized, so the directional gain = 26dBi.</td></tr>
<tr><td>Result</td><td colspan="2">☒ Pass ☐ Fail</td></tr>
</table>

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Chen Ge* at *RF test site*.

Maximum Output Power measurement results

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain0	Chain1	Combined Power		
Output power	5M	4942.5	Low	22.08	22.32	25.21	27	Pass
		4965	Mid	20.86	22.44	24.73	27	Pass
		4987.5	High	21.10	22.32	24.76	27	Pass
	10M	4945	Low	25.99	25.84	28.93	30	Pass
		4965	Mid	26.17	25.89	29.04	30	Pass
		4985	High	26.26	26.02	29.15	30	Pass
	20M	4950	Low	26.11	25.85	28.99	33	Pass
		4965	Mid	26.22	25.95	29.10	33	Pass
		4980	High	26.32	26.11	29.23	33	Pass
Note	N/A							

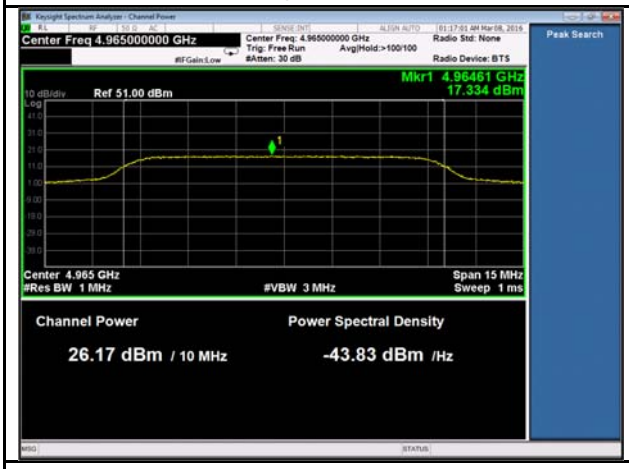
Output Power Test Plots
Chain 0

5MHz - Low CH 4942.5MHz

5MHz - Middle CH 4965MHz

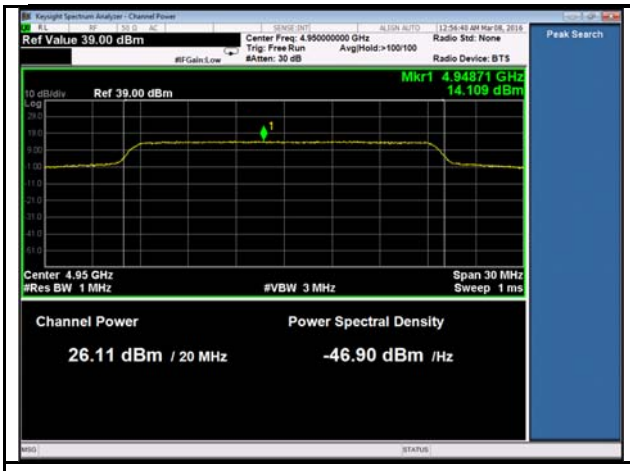
5MHz - High CH 4987.5MHz

10MHz - Low CH 4945MHz

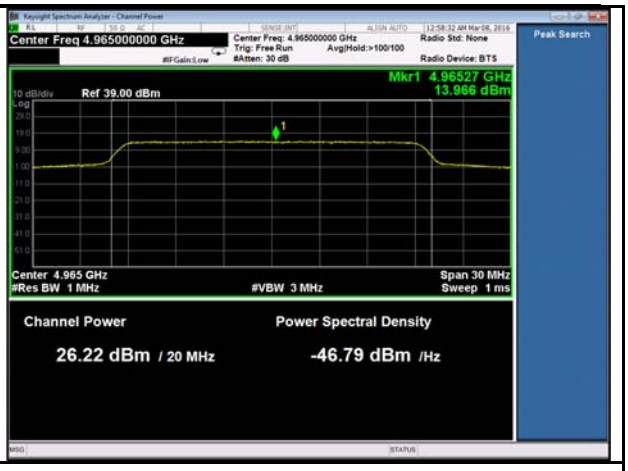


10MHz - Middle CH 4965MHz

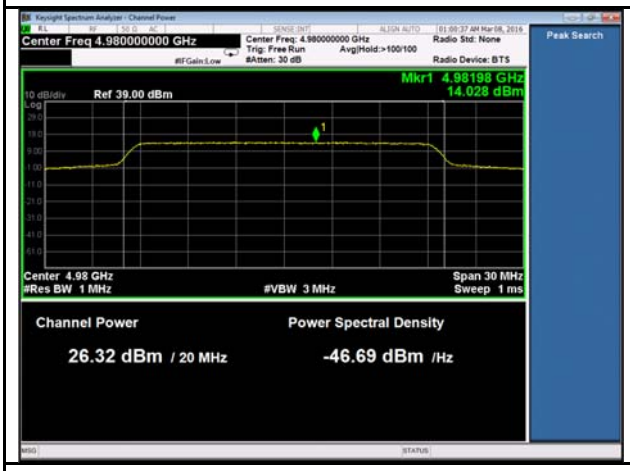
10MHz - High CH 4985MHz



20MHz - Low CH 4950MHz



20MHz - Middle CH 4965MHz



20MHz - High CH 4980MHz

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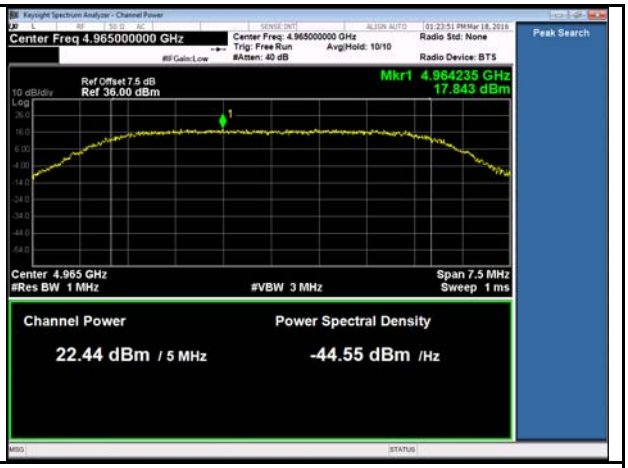
Chain 1

5MHz - Low CH 4942.5MHz

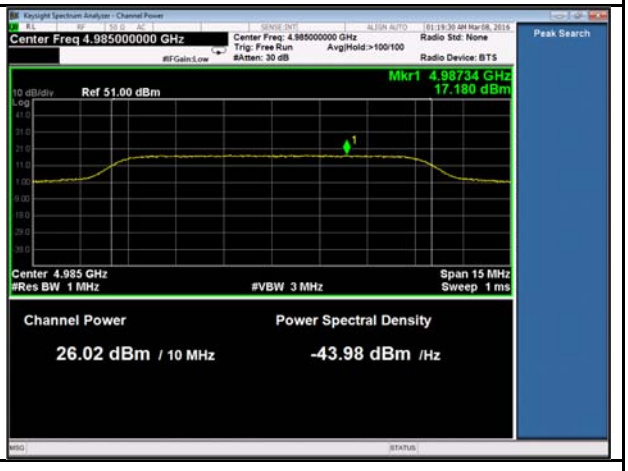


5MHz - Middle CH 4965MHz

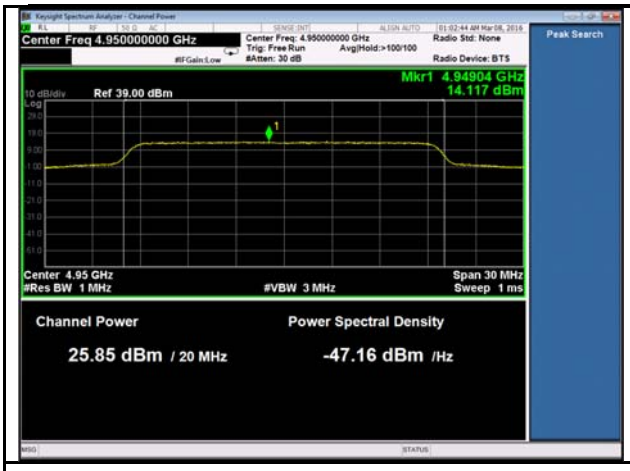
5MHz - High CH 4987.5MHz

10MHz - Low CH 4945MHz

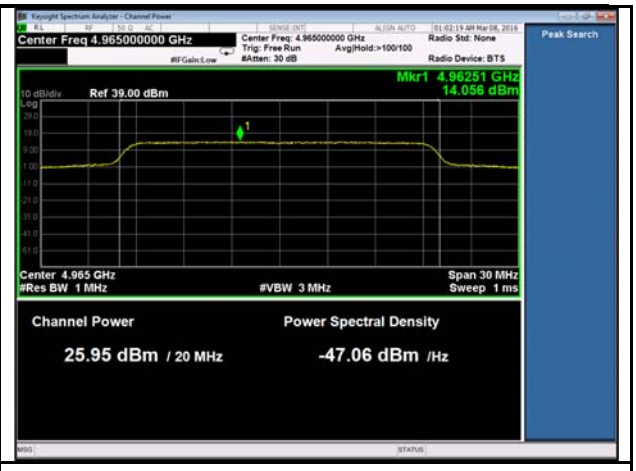
10MHz - Middle CH 4965MHz



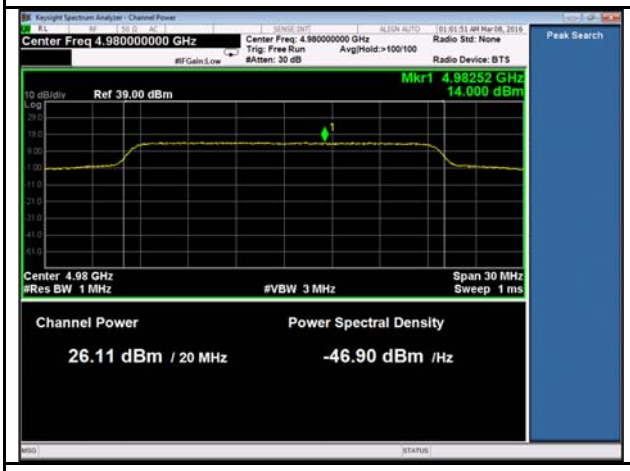
10MHz - High CH 4985MHz



20MHz - Low CH 4950MHz



20MHz - Middle CH 4965MHz



20MHz - High CH 4980MHz

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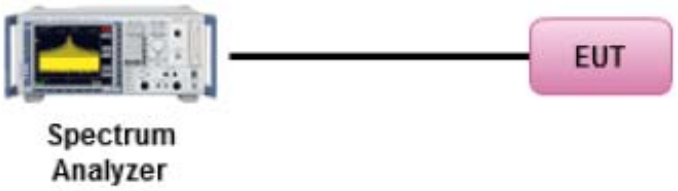
10.3 Power Spectral Density

Requirement(s):

Spec	Requirement	Applicable
FCC §2.1046 FCC §90.1215 RSS-111	High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point and point-to-multipoint operations (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the maximum conducted output power or spectral density. Corresponding reduction in the maximum conducted output power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.	☒
Test Setup		
Test Procedure	The peak power spectral density is measured as conducted emission by direct connection of a calibrated test instrument to the equipment under test. Measurements are made over a bandwidth of one MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth.	
Environmental conditions	Temperature (°C) Humidity (%) Atmospheric (mbar)	23 °C 40% 1019 mbar
Test Date	03/07/2016 – 03/11/2016	
Remark	The two antennas are cross-polarized, so the directional gain = 26dBi.	
Result	☒ Pass ☐ Fail	

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Chen Ge* at *RF test site*.

Power Spectral Density measurement results

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm/MHz)			Limit (dBm/MHz)	Result
				Chain0	Chain1	Combined Power		
Output power	5M	4942.5	Low	17.60	17.61	20.62	21	Pass
		4965	Mid	16.65	17.84	20.30	21	Pass
		4987.5	High	17.06	17.76	20.43	21	Pass
	10M	4945	Low	16.97	16.65	19.82	21	Pass
		4965	Mid	17.33	16.98	20.17	21	Pass
		4985	High	17.29	17.18	20.25	21	Pass
	20M	4950	Low	14.10	14.11	17.12	21	Pass
		4965	Mid	13.96	14.05	17.02	21	Pass
		4980	High	14.02	14.00	17.02	21	Pass
'Note	N/A							

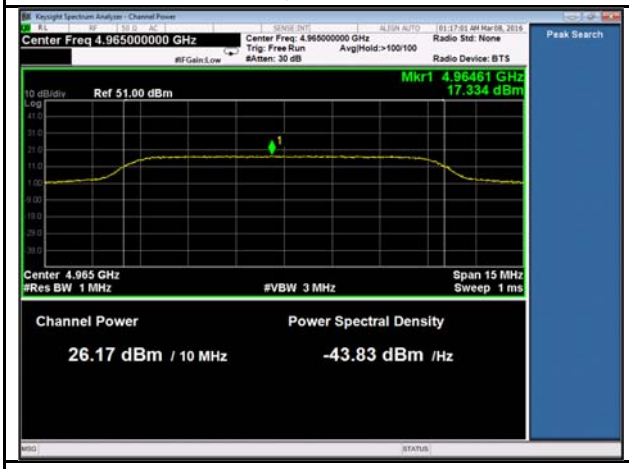
Power Spectral Density Test Plots
Chain 0

5MHz - Low CH 4942.5MHz

5MHz - Middle CH 4965MHz

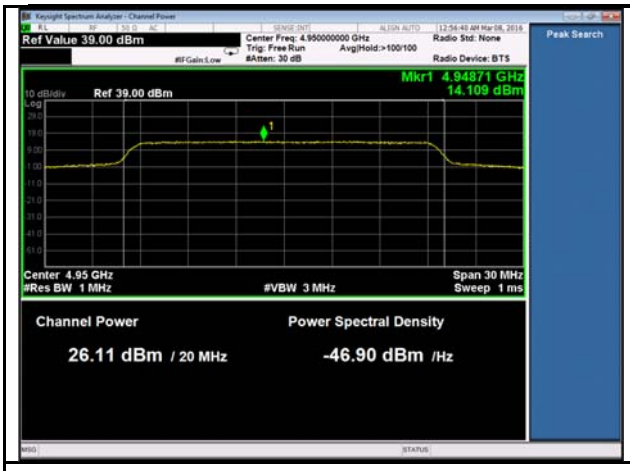
5MHz - High CH 4987.5MHz

10MHz - Low CH 4945MHz

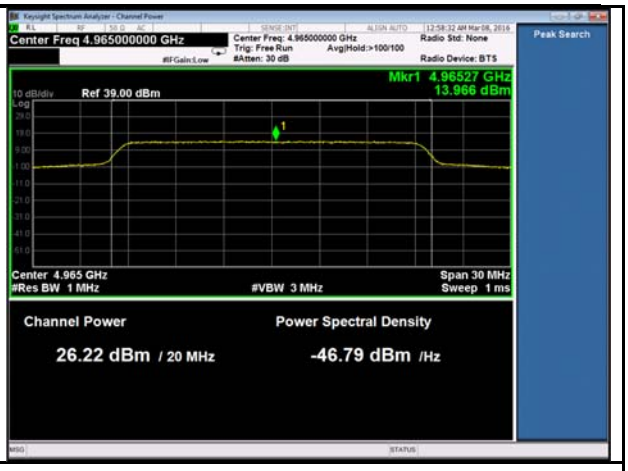


10MHz - Middle CH 4965MHz

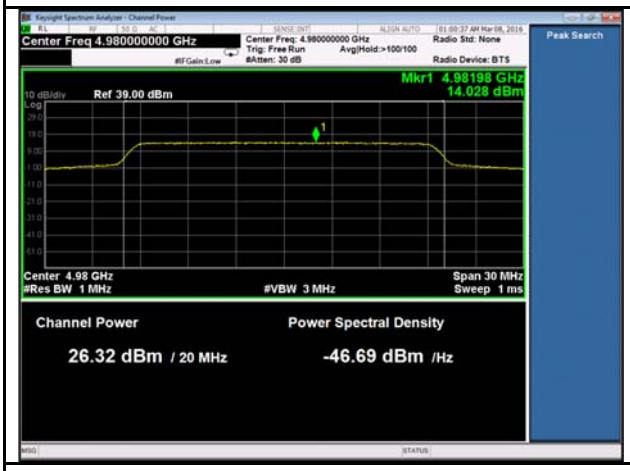
10MHz - High CH 4985MHz



20MHz - Low CH 4950MHz



20MHz - Middle CH 4965MHz



20MHz - High CH 4980MHz

-

Chain 1

5MHz - Low CH 4942.5MHz

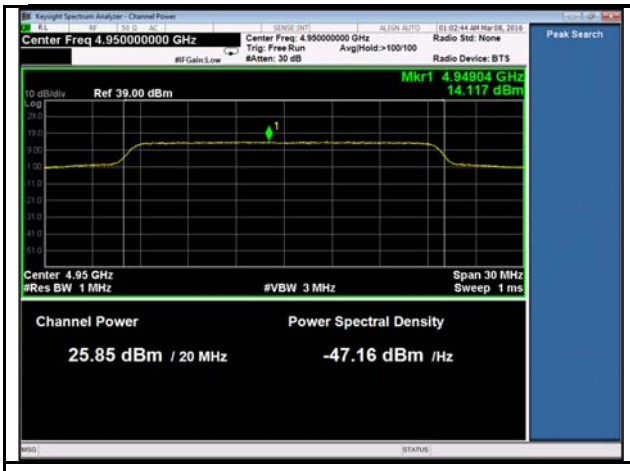
5MHz - Middle CH 4965MHz

5MHz - High CH 4987.5MHz

10MHz - Low CH 4945MHz

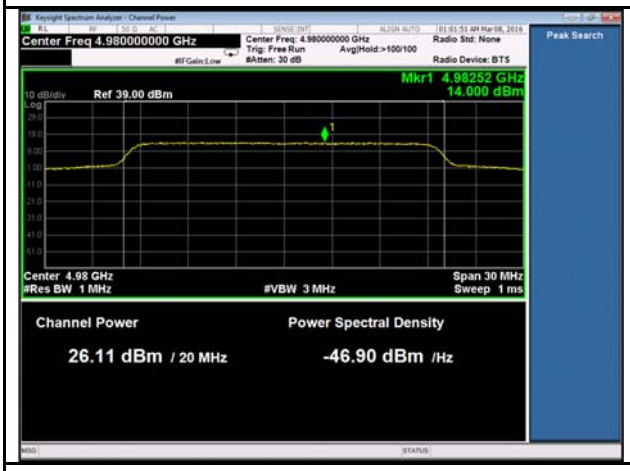
10MHz - Middle CH 4965MHz

10MHz - High CH 4985MHz



20MHz - Low CH 4950MHz

20MHz - Middle CH 4965MHz

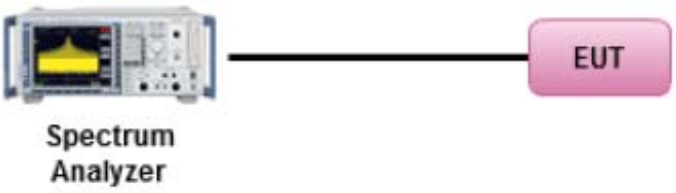


20MHz - High CH 4980MHz

-

10.4 Peak Excursion

Requirement(s):

Spec	Requirement	Applicable
FCC §90.1215 RSS-111	The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.	☒
Test Setup		
Test Procedure	The EUT was set to transmit continuously; The following setting were set on the spectrum analyzer: Trace 1: - RBW = 1MHz - VBW = 3 x RBW - Span = 40MHz - Detector = Peak - Trace = Maxhold Trace 2: - RBW = 1MHz - VBW = 3 x RBW - Span = 40MHz - Detector = Average (RMS) - Trace = 100 Trace average	
Environmental conditions	Temperature (°C) Humidity (%) Atmospheric (mbar)	22 °C 42% 1019 mbar
Test Date	03/07/2016 – 03/11/2016	
Remark	-	
Result	☒ Pass ☐ Fail	

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Chen Ge* at *RF test site*.

Peak Excursion Measurement Results (25dBi Antenna Gain)
5MHz:

Frequency (MHz)	Channel	Peak Excursion (dB)	Limit (dB)
4950	Low	7.36	13
4965	Middle	7.58	13
4980	High	7.43	13

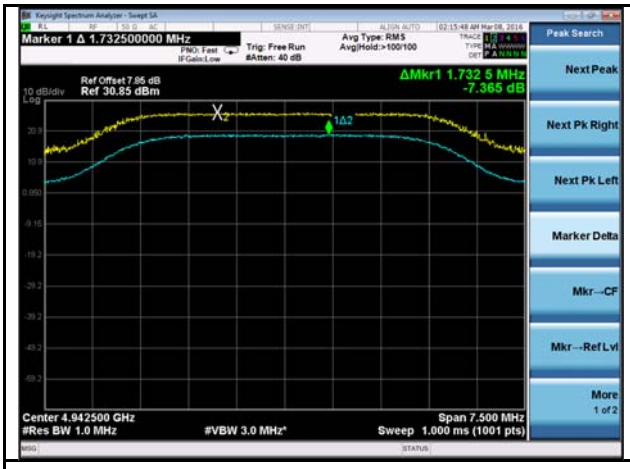
10MHz:

Frequency (MHz)	Channel	Peak Excursion (dB)	Limit (dB)
4950	Low	9.29	13
4965	Middle	9.28	13
4980	High	9.40	13

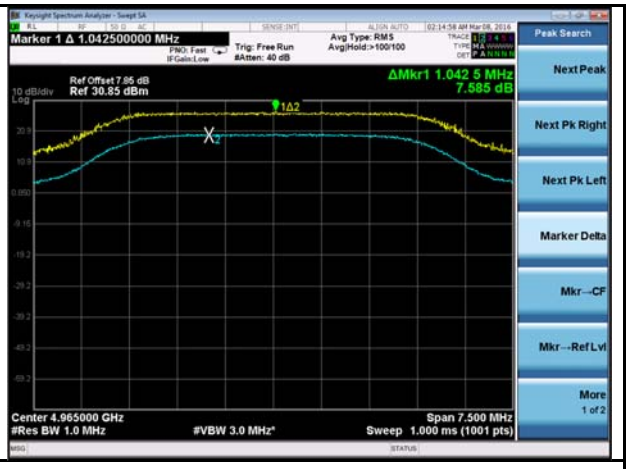
20MHz:

Frequency (MHz)	Channel	Peak Excursion (dB)	Limit (dB)
4950	Low	10.17	13
4965	Middle	10.03	13
4980	High	9.51	13

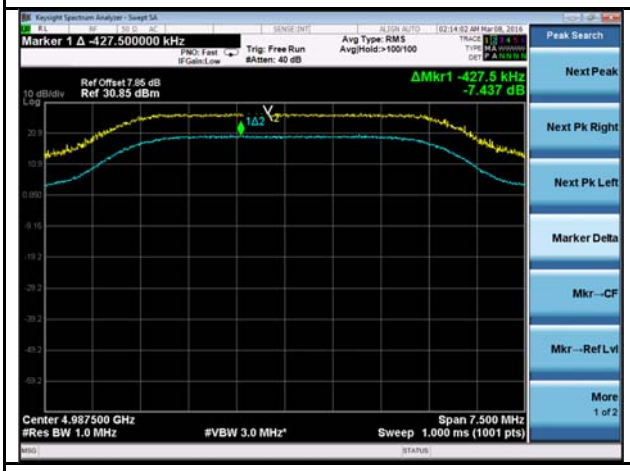
Peak Excursion Test Plots



5MHz - Low CH 4942.5MHz

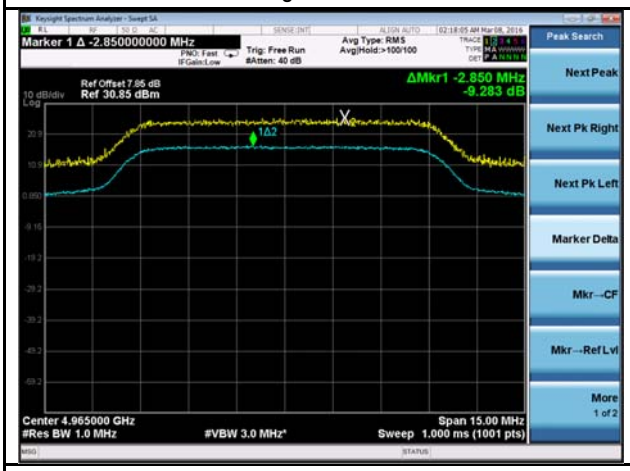


5MHz - Middle CH 4965MHz



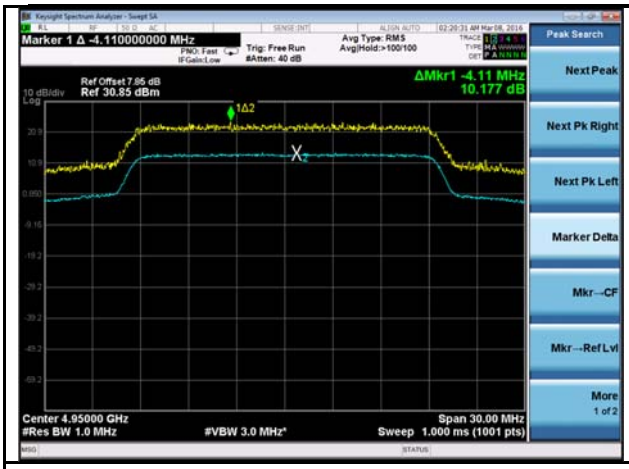
5MHz - High CH 4987.5MHz

10MHz - Low CH 4945MHz



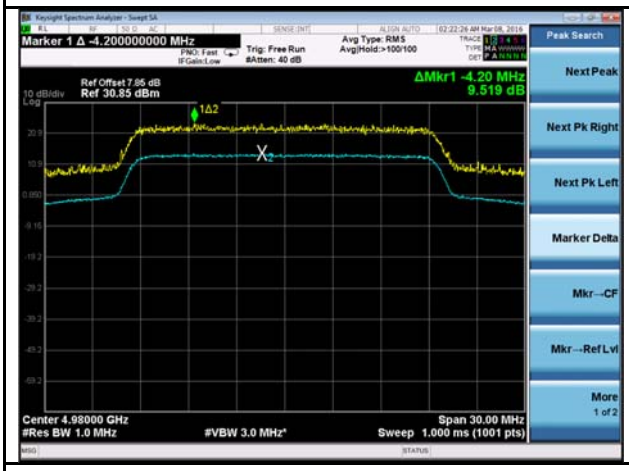
10MHz - Middle CH 4965MHz

10MHz - High CH 4985MHz



20MHz - Low CH 4950MHz

20MHz - Middle CH 4965MHz

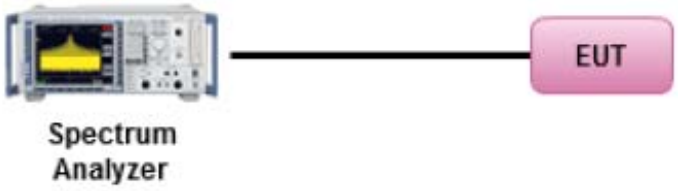


20MHz - High CH 4980MHz

-

10.5 Transmitter Conducted Unwanted Emissions

Requirement(s):

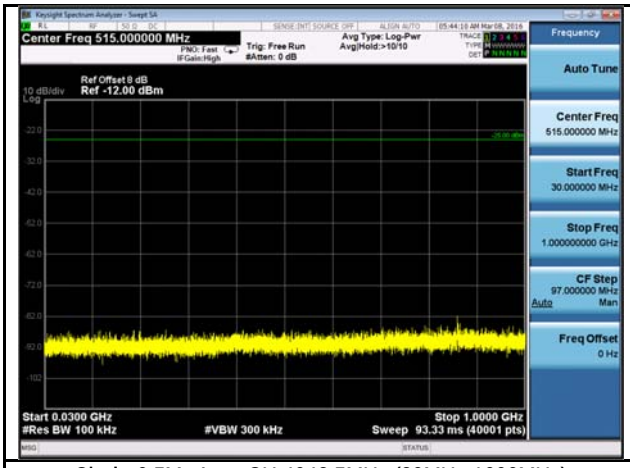
<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>FCC §2.1051
FCC §90.210
RSS-111</td><td>For low power transmitters (20 dBm or less) and high power transmitters (greater than 20 dBm operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:
<table>
<tr><th rowspan="2">Frequency Offset f_d</th><th colspan="2">Minimum Attenuation</th></tr>
<tr><th>Low Power Transmitter</th><th>High Power Transmitter</th></tr>
<tr><td>$0 < f_d \leq 45$</td><td>0</td><td>0</td></tr>
<tr><td>$45 < f_d \leq 50$</td><td>$219 \log(f_d/45)$</td><td>$568 \log(f_d/45)$</td></tr>
<tr><td>$50 < f_d \leq 55$</td><td>$10 + 242 \log(f_d/50)$</td><td>$26 + 145 \log(f_d/50)$</td></tr>
<tr><td>$55 < f_d \leq 100$</td><td>$20 + 31 \log(f_d/55)$</td><td>$32 + 31 \log(f_d/55)$</td></tr>
<tr><td>$100 < f_d \leq 150$</td><td>$28 + 68 \log(f_d/100)$</td><td>$40 + 57 \log(f_d/100)$</td></tr>
<tr><td>$f_d > 150$</td><td>40</td><td>50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.</td></tr>
</table>
f_d is the percentage of the equipment's channel bandwidth..</td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Procedure</td><td colspan="2">- The EUT was set to transmit in a modulated transmit mode.
- The RF output of the EUT was connected to a spectrum analyzer using appropriate attenuations.
- Conducted spurious emissions were measured up to 40GHz.
- Sufficient scans were taken to shown any out of band emissions.</td></tr>
<tr><td>Environmental conditions</td><td>Temperature (°C)
Humidity (%)
Atmospheric (mbar)</td><td>21 °C
38%
1020 mbar</td></tr>
<tr><td>Test Date</td><td colspan="2">03/07/2016 – 03/11/2016</td></tr>
<tr><td>Remark</td><td colspan="2">N/A</td></tr>
<tr><td>Result</td><td colspan="2">☒ Pass ☐ Fail</td></tr>
</table>

Test Data ☐ Yes ☒ N/A

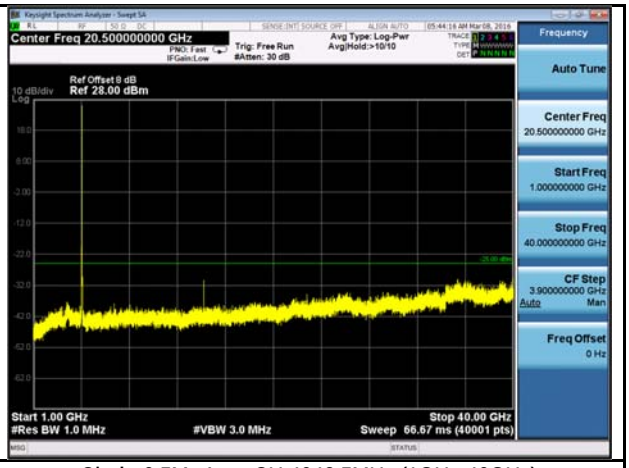
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Chen Ge* at *RF test site*.

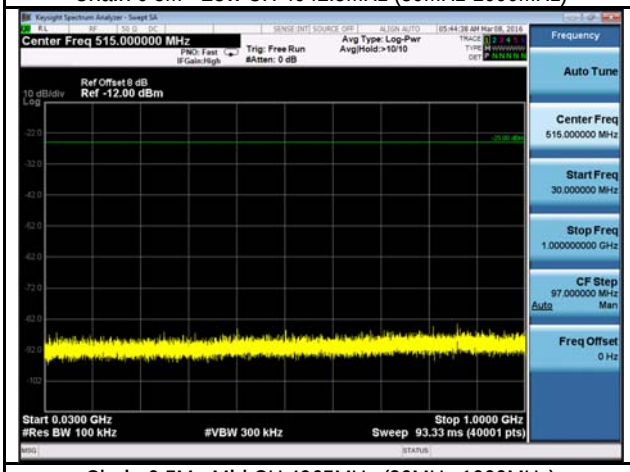
Conducted Spurious Emissions Test Plots
Chain 0



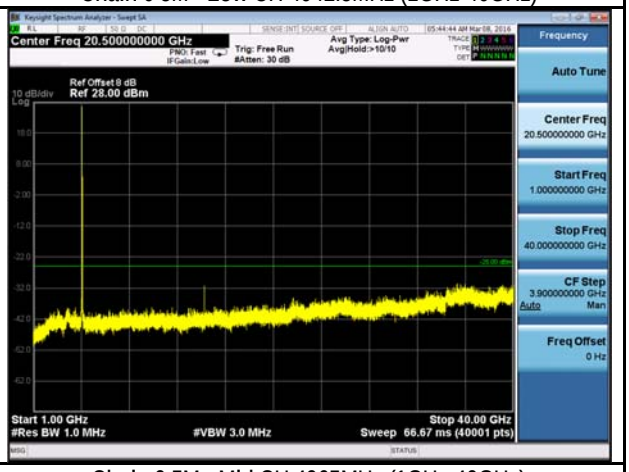
Chain 0 5M - Low CH 4942.5MHz (30MHz-1000MHz)



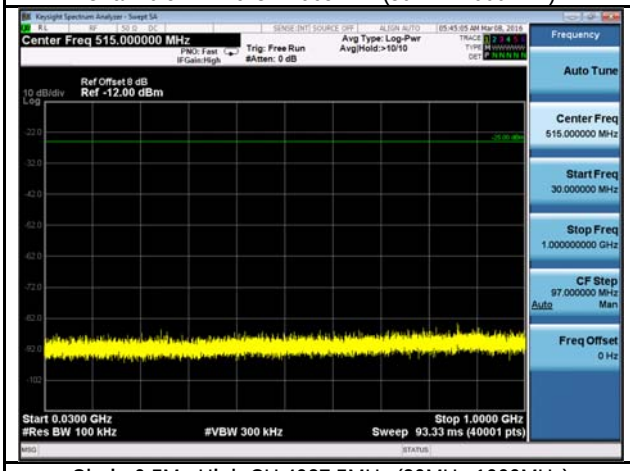
Chain 0 5M - Low CH 4942.5MHz (1GHz-40GHz)



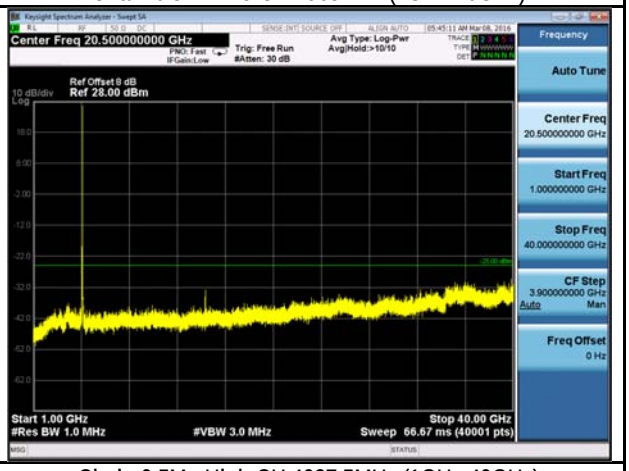
Chain 0 5M - Mid CH 4965MHz (30MHz-1000MHz)



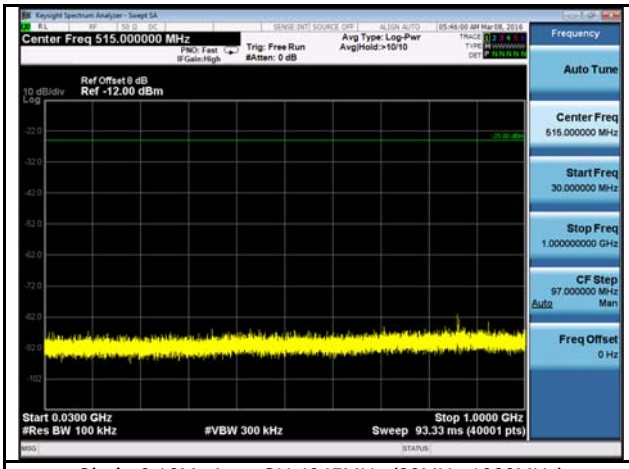
Chain 0 5M - Mid CH 4965MHz (1GHz-40GHz)



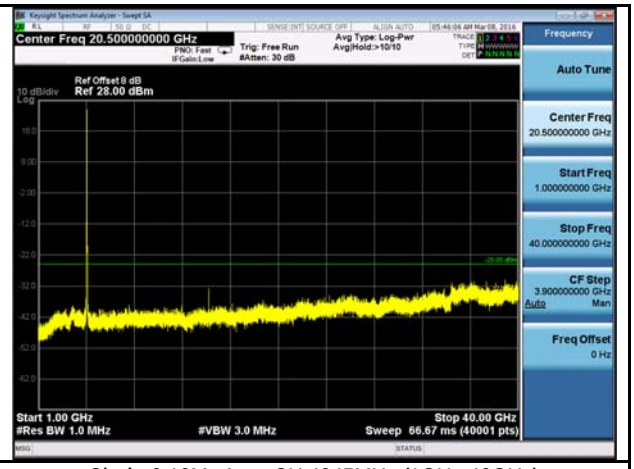
Chain 0 5M - High CH 4987.5MHz (30MHz-1000MHz)



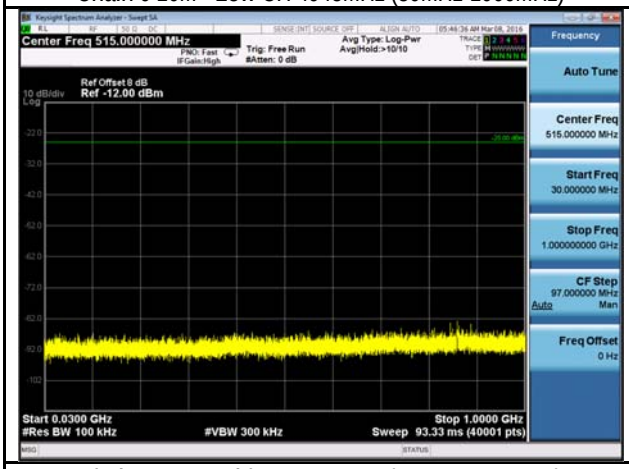
Chain 0 5M - High CH 4987.5MHz (1GHz-40GHz)



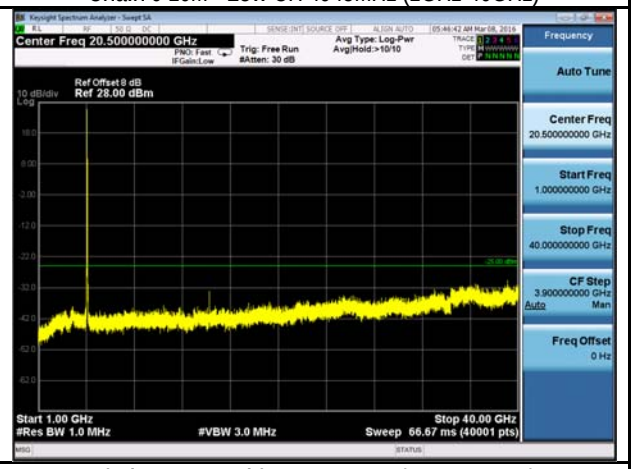
Chain 0 10M - Low CH 4945MHz (30MHz-1000MHz)



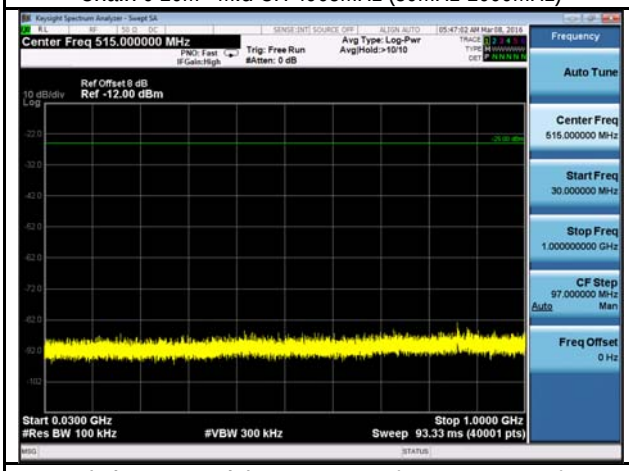
Chain 0 10M - Low CH 4945MHz (1GHz-40GHz)



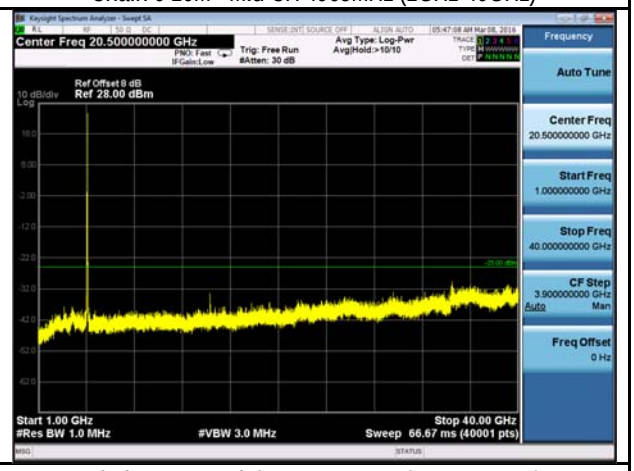
Chain 0 10M - Mid CH 4965MHz (30MHz-1000MHz)



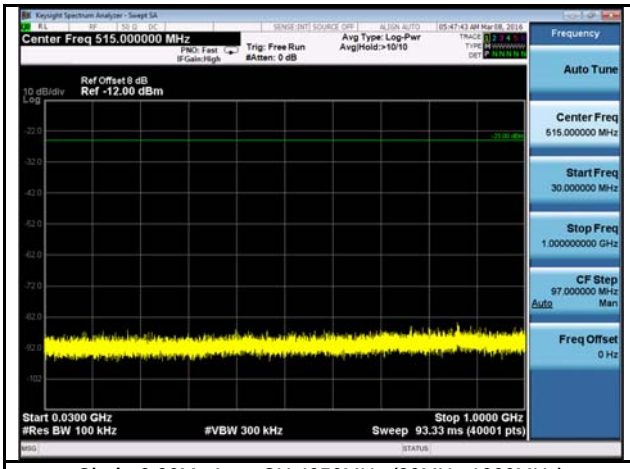
Chain 0 10M - Mid CH 4965MHz (1GHz-40GHz)



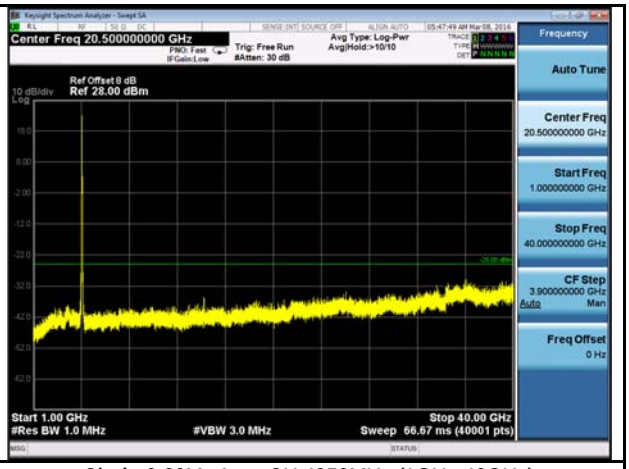
Chain 0 10M - High CH 4985MHz (30MHz-1000MHz)



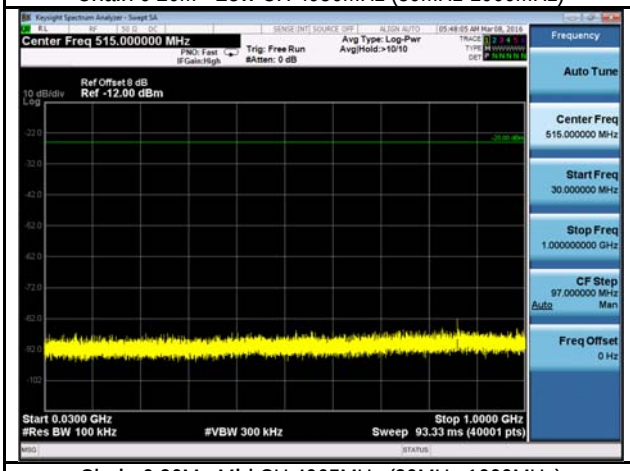
Chain 0 10M - High CH 4985MHz (1GHz-40GHz)



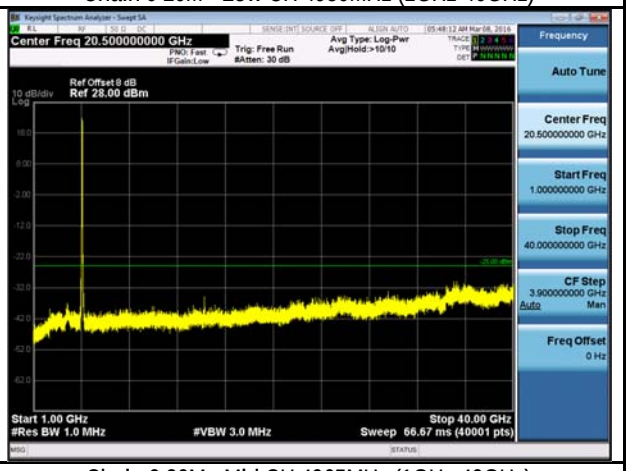
Chain 0 20M - Low CH 4950MHz (30MHz-1000MHz)



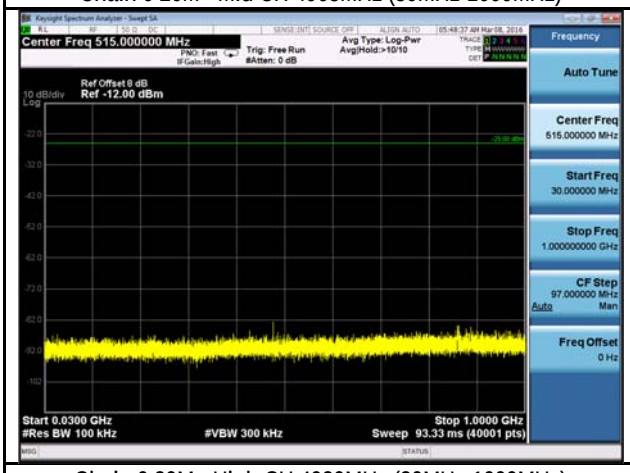
Chain 0 20M - Low CH 4950MHz (1GHz-40GHz)



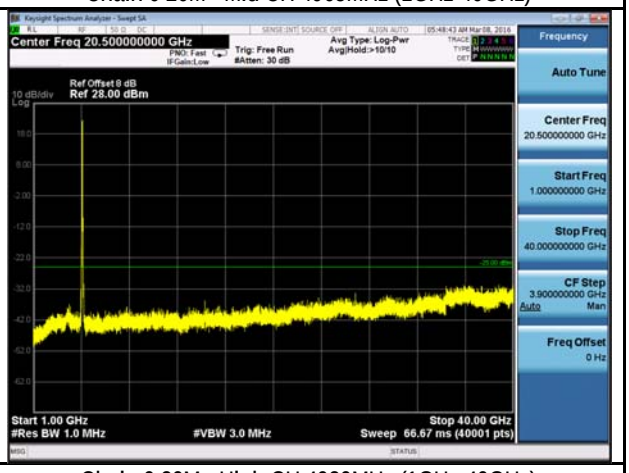
Chain 0 20M - Mid CH 4965MHz (30MHz-1000MHz)



Chain 0 20M - Mid CH 4965MHz (1GHz-40GHz)

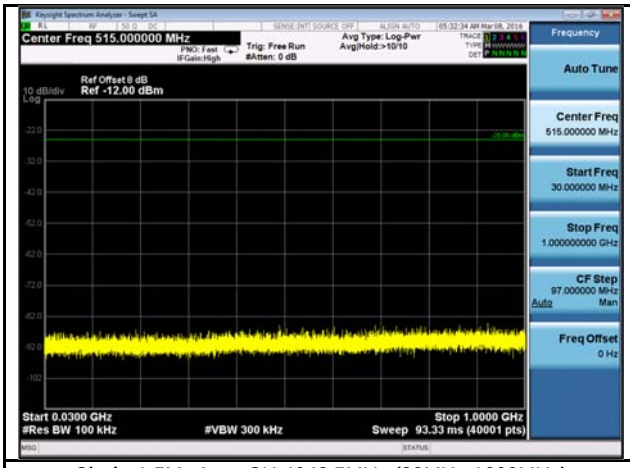


Chain 0 20M - High CH 4980MHz (30MHz-1000MHz)

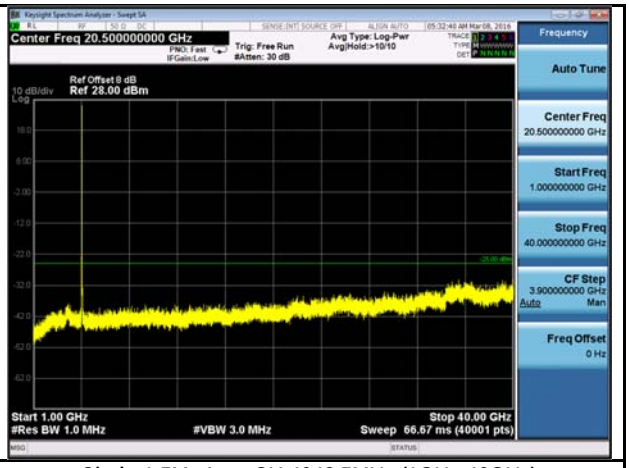


Chain 0 20M - High CH 4980MHz (1GHz-40GHz)

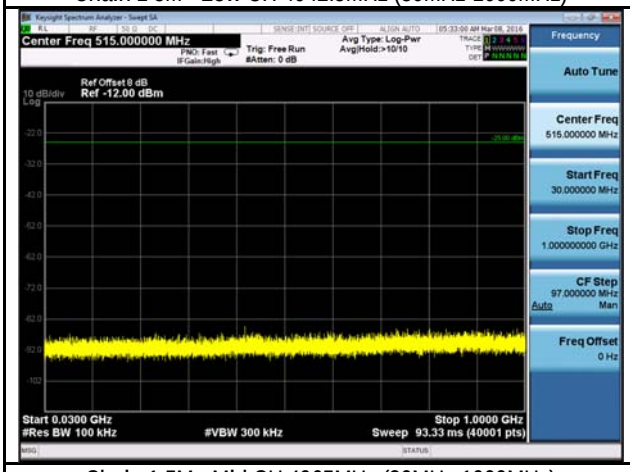
Conducted Spurious Emissions Test Plots
Chain 1



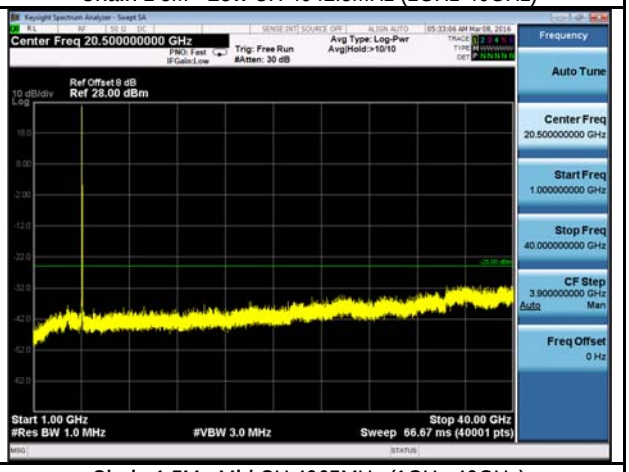
Chain 1 5M - Low CH 4942.5MHz (30MHz-1000MHz)



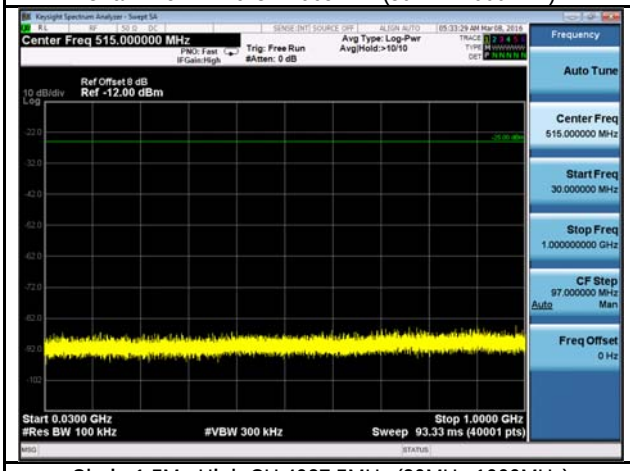
Chain 1 5M - Low CH 4942.5MHz (1GHz-40GHz)



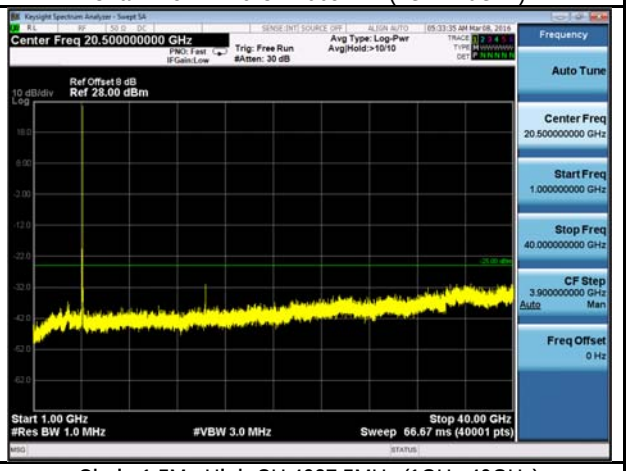
Chain 1 5M - Mid CH 4965MHz (30MHz-1000MHz)



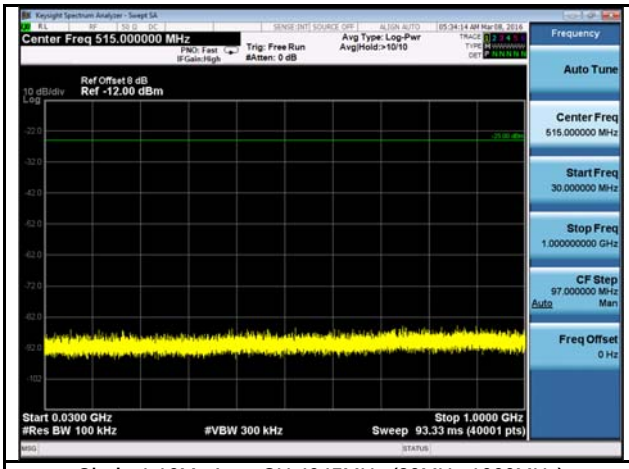
Chain 1 5M - Mid CH 4965MHz (1GHz-40GHz)



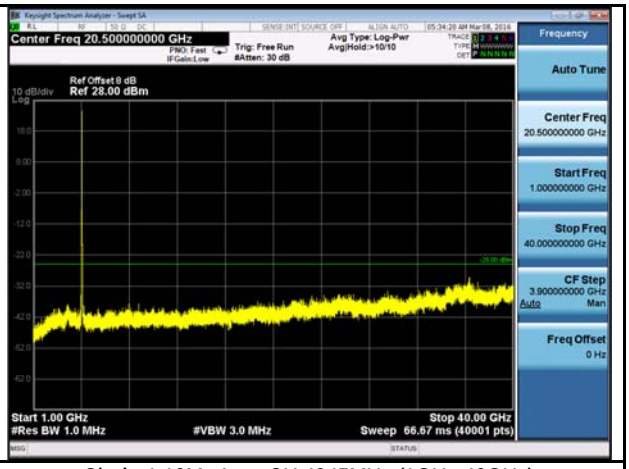
Chain 1 5M - High CH 4987.5MHz (30MHz-1000MHz)



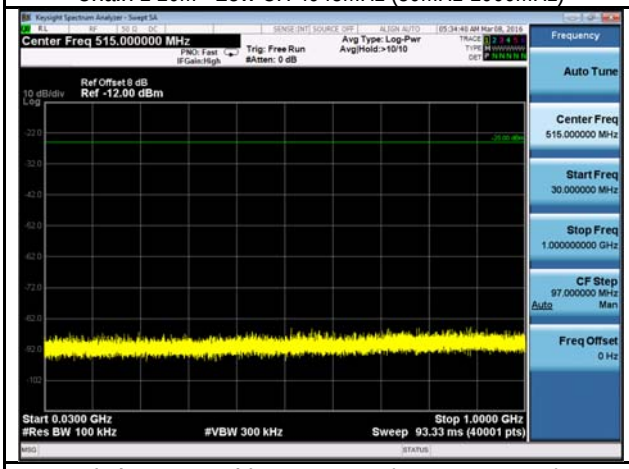
Chain 1 5M - High CH 4987.5MHz (1GHz-40GHz)



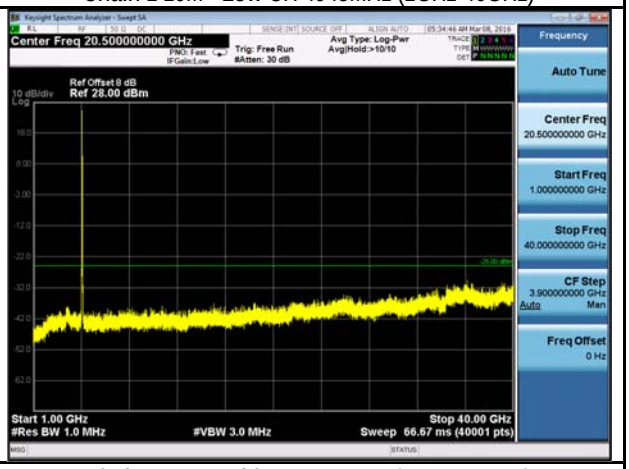
Chain 1 10M - Low CH 4945MHz (30MHz-1000MHz)



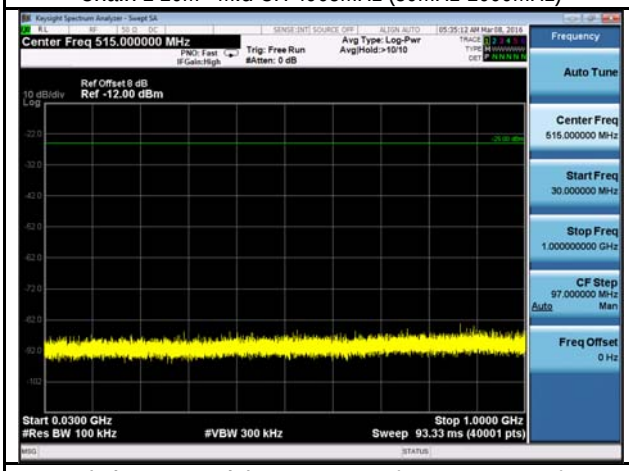
Chain 1 10M - Low CH 4945MHz (1GHz-40GHz)



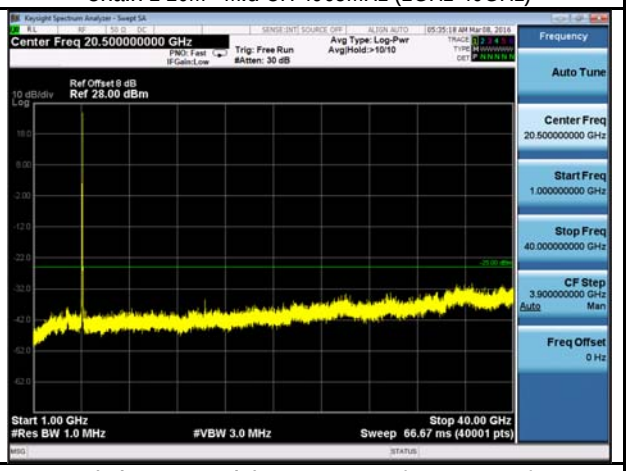
Chain 1 10M - Mid CH 4965MHz (30MHz-1000MHz)



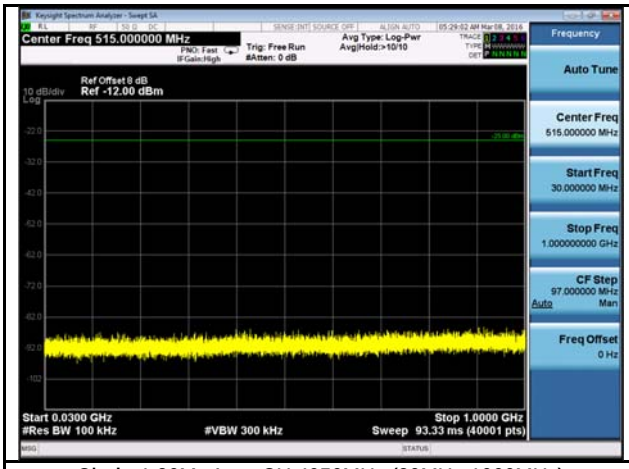
Chain 1 10M - Mid CH 4965MHz (1GHz-40GHz)



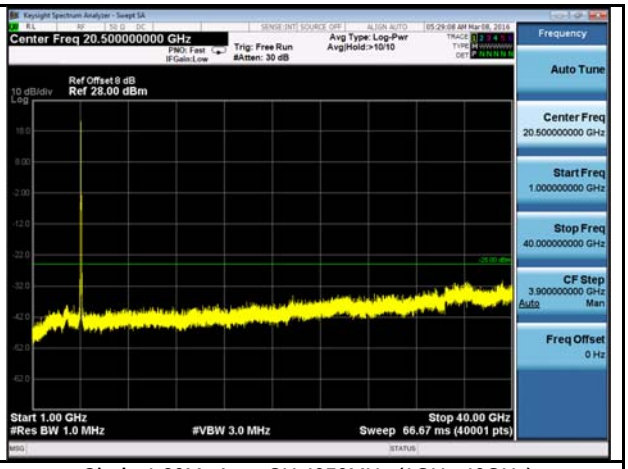
Chain 1 10M - High CH 4985MHz (30MHz-1000MHz)



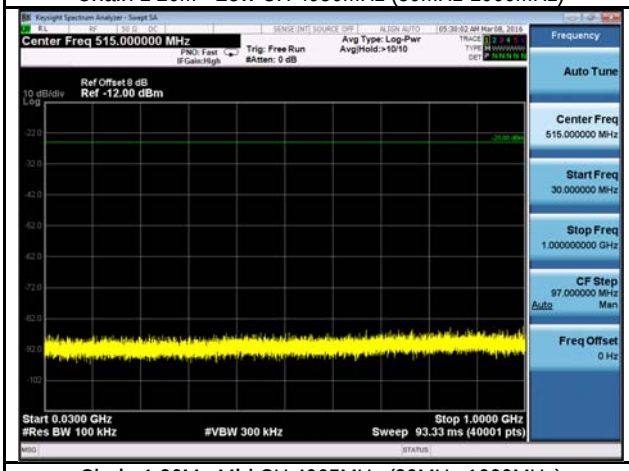
Chain 1 10M - High CH 4985MHz (1GHz-40GHz)



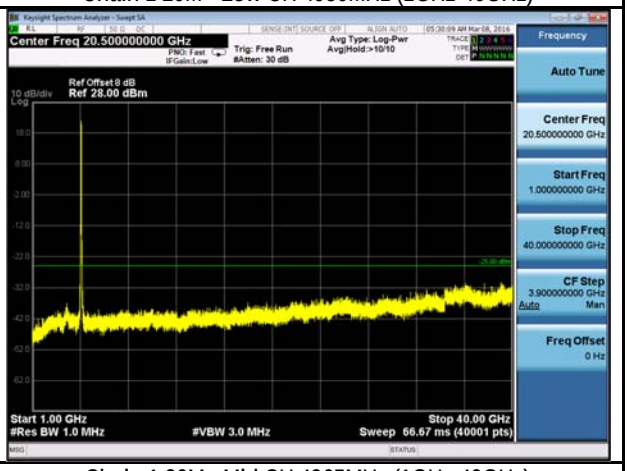
Chain 1 20M - Low CH 4950MHz (30MHz-1000MHz)



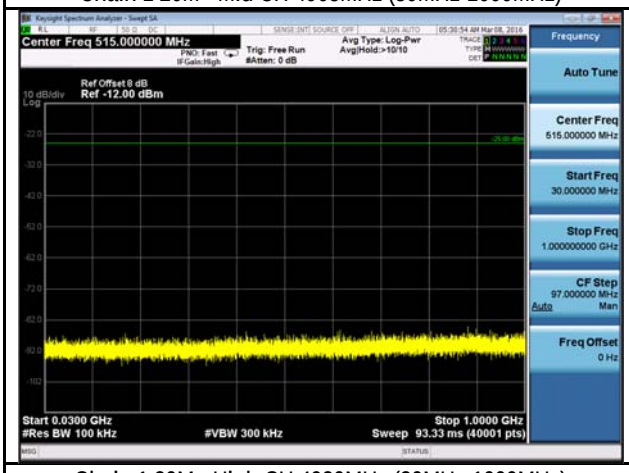
Chain 1 20M - Low CH 4950MHz (1GHz-40GHz)



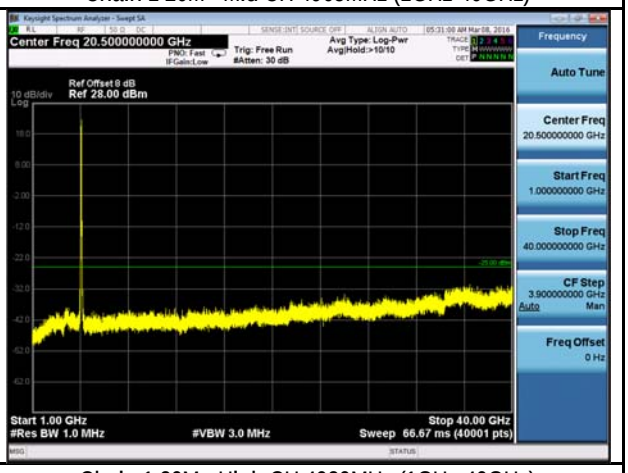
Chain 1 20M - Mid CH 4965MHz (30MHz-1000MHz)



Chain 1 20M - Mid CH 4965MHz (1GHz-40GHz)



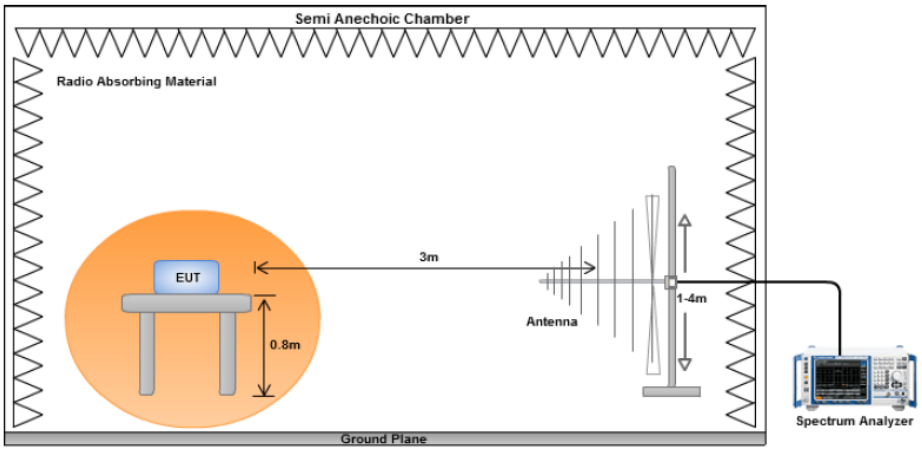
Chain 1 20M - High CH 4980MHz (30MHz-1000MHz)



Chain 1 20M - High CH 4980MHz (1GHz-40GHz)

10.6 Radiated Spurious Emissions

Requirement(s):

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>FCC §2.1053
FCC §90.210
RSS-111</td><td>For low power transmitters (20 dBm or less) and high power transmitters (greater than 20 dBm operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:
<table>
<tr><th rowspan="2">Frequency Offset
f_d</th><th colspan="2">Minimum Attenuation</th></tr>
<tr><th>Low Power Transmitter</th><th>High Power Transmitter</th></tr>
<tr><td>$0 < f_d \leq 45$</td><td>0</td><td>0</td></tr>
<tr><td>$45 < f_d \leq 50$</td><td>$219 \log(f_d/45)$</td><td>$568 \log(f_d/45)$</td></tr>
<tr><td>$50 < f_d \leq 55$</td><td>$10 + 242 \log(f_d/50)$</td><td>$26 + 145 \log(f_d/50)$</td></tr>
<tr><td>$55 < f_d \leq 100$</td><td>$20 + 31 \log(f_d/55)$</td><td>$32 + 31 \log(f_d/55)$</td></tr>
<tr><td>$100 < f_d \leq 150$</td><td>$28 + 68 \log(f_d/100)$</td><td>$40 + 57 \log(f_d/100)$</td></tr>
<tr><td>$f_d > 150$</td><td>40</td><td>50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation.</td></tr>
</table>
f_d is the percentage of the equipment's channel bandwidth..</td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Test Procedure</td><td colspan="2">1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. Measurement was made at a distance of 3 m.
3. The measuring antenna was set to 1.5 meter away from the ground plain.
4. Maximization of the emissions was carried out by rotating the EUT, and adjusting the antenna azimuth.
5. The test was done in both horizontal and vertical antenna polarizations.
6. The measurement shall be made with the transmitter set to the lowest operating frequency and with the transmitter set to the highest operating frequency</td></tr>
<tr><td>Remark</td><td colspan="2">EUT was tested with antenna port terminated by a 50Ohm load.</td></tr>
<tr><td>Result</td><td colspan="2">☒ Pass ☐ Fail</td></tr>
</table>

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by *Gary Chou* at *10m and 3m chamber*.

Radiated Emission Test Results (Below 1GHz)

Test specification	Radiated Spurious Emissions			
Environmental Conditions:	Temp (°C):	22	Result	PASS
	Humidity (%)	41		
	Atmospheric (mbar):	1021		
Mains Power:	120VAC/60Hz			
Tested by:	Gary Chou			
Test Date:	03/12/2016			
Remarks:	TX MODE 4965 MHZ 5MHz			

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
500	283	163	V	500	-62.24	0	0.29	-62.53	-25	-37.53
500	145	178	H	500	-64.24	0	0.29	-64.53	-25	-39.53
599	287	164	V	599	-63.87	0	0.31	-64.18	-25	-39.18
599	163	151	H	599	-64.22	0	0.31	-64.53	-25	-39.53
834	275	167	V	834	-66.04	0	0.33	-66.37	-25	-41.37
834	156	158	H	834	-66.9	0	0.33	-67.23	-25	-42.23

Test specification	Radiated Spurious Emissions			
Environmental Conditions:	Temp (°C):	23	Result	PASS
	Humidity (%)	43		
	Atmospheric (mPa):	1021		
Mains Power:	120VAC/60Hz			
Tested by:	Gary Chou			
Test Date:	03/12/2016			
Remarks:	TX MODE 4965MHz 20MHz			

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
599.1	242	163	V	599.1	-64.23	0	0.29	-64.52	-25	-39.52
599.1	146	183	H	599.1	-65.19	0	0.29	-65.48	-25	-40.48
615	253	149	V	615	-63.06	0	0.31	-63.37	-25	-38.37
615	106	186	H	615	-65.31	0	0.31	-65.62	-25	-40.62
720	248	132	V	720	-65.26	0	0.33	-65.59	-25	-40.59
720	165	153	H	720	-67.94	0	0.33	-68.27	-25	-43.27

Radiated Emission Test Results (1GHz-40GHz) – 5MHz

TX MODE 4942.5MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
5598.61	30	150	V	5598.61	-60.21	11.58	0.31	-48.94	-25	-23.94
5598.61	25	153	H	5598.61	-66.55	11.58	0.31	-55.28	-25	-30.28
9907.95	29	150	V	9907.95	-60.44	11.58	0.78	-49.64	-25	-24.64
9907.95	27	149	H	9907.95	-64.62	11.58	0.78	-53.82	-25	-28.82

TX MODE 4965MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
6433.79	30	150	V	6433.79	-61.25	12.19	0.31	-49.37	-25	-24.37
6433.79	25	153	H	6433.79	-68	12.19	0.31	-56.12	-25	-31.12
9338.46	29	150	V	9338.46	-58.97	11.5	0.78	-48.25	-25	-23.25
9338.46	27	149	H	9338.46	-62.85	11.5	0.78	-52.13	-25	-27.13

TX MODE 4987.5MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
6160.22	30	150	V	6160.22	-59.35	12.03	0.31	-47.63	-25	-22.63
6160.22	25	153	H	6160.22	-63.9	12.03	0.31	-52.18	-25	-27.18
10055.39	29	150	V	10055.39	-59.19	11.58	0.78	-48.39	-25	-23.39
10055.39	27	149	H	10055.39	-62.85	11.58	0.78	-52.05	-25	-27.05

Radiated Emission Test Results (1GHz-40GHz) – 10MHz

TX MODE 4945MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
3877.11	30	150	V	3877.11	-57.02	9.69	0.31	-47.64	-25	-22.64
3877.11	25	153	H	3877.11	-62.43	9.69	0.31	-53.05	-25	-28.05
9557.80	29	150	V	9557.80	-57.73	11.22	0.78	-47.29	-25	-22.29
9557.80	27	149	H	9557.80	-65.04	11.22	0.78	-54.6	-25	-29.60

TX MODE 4965MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
8104.74	30	150	V	8104.74	-61.33	12.27	0.31	-49.37	-25	-24.37
8104.74	25	153	H	8104.74	-67.49	12.27	0.31	-55.53	-25	-30.53
5613.71	29	150	V	5613.71	-59.04	11.58	0.78	-48.24	-25	-23.24
5613.71	27	149	H	5613.71	-64.96	11.58	0.78	-54.16	-25	-29.16

TX MODE 4985MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
3638.99	30	150	V	3638.99	-57.35	10.03	0.31	-47.63	-25	-22.63
3638.99	25	153	H	3638.99	-63.9	10.03	0.31	-54.18	-25	-29.18
8427.83	29	150	V	8427.83	-59.85	12.17	0.78	-48.46	-25	-23.46
8427.83	27	149	H	8427.83	-63.48	12.17	0.78	-52.09	-25	-27.09

Radiated Emission Test Results (1GHz-40GHz) – 20MHz

TX MODE 4950MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
3127.34	30	150	V	3127.34	-55.62	9.41	0.31	-46.52	-25	-21.52
3127.34	25	153	H	3127.34	-63.19	9.41	0.31	-54.09	-25	-29.09
6894.38	29	150	V	6894.38	-59.48	12.02	0.78	-48.24	-25	-23.24
6894.38	27	149	H	6894.38	-63.31	12.02	0.78	-52.07	-25	-27.07

TX MODE 4965MHz

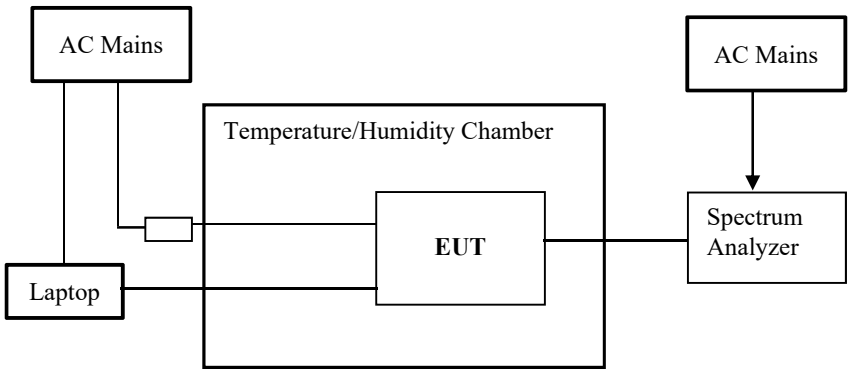
Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
5613.77	30	150	V	5613.77	-59.44	11.58	0.31	-48.17	-25	-23.17
5613.77	25	153	H	5613.77	-66.21	11.58	0.31	-54.94	-25	-29.94
8802.77	29	150	V	8802.77	-59.35	11.44	0.78	-48.69	-25	-23.69
8802.77	27	149	H	8802.77	-62.73	11.44	0.78	-52.07	-25	-27.07

TX MODE 4980MHz

Indicated		Test Antenna		Substituted						
Frequency (MHz)	Degree	Height (cm)	Polarity	Frequency (MHz)	Level (dBm)	Ant Gain (dBi)	Cable Loss (dB)	Absolute Level (dBm)	Limit (dBm)	Margin (dBm)
3638.99	30	150	V	3638.99	-57.35	10.03	0.31	-47.63	-25	-22.63
3638.99	25	153	H	3638.99	-63.9	10.03	0.31	-54.18	-25	-29.18
8427.83	29	150	V	8427.83	-59.85	12.17	0.78	-48.46	-25	-23.46
8427.83	27	149	H	8427.83	-63.48	12.17	0.78	-52.09	-25	-27.09

10.7 Frequency Stability

Requirement(s):

Spec	Requirement	Applicable
FCC §2.1055 FCC §90.213 RSS-111	The test shall be performed at normal and extreme test conditions. From -40°C to +55°C and vary the primary supply voltage from 85% to 115% of the nominal value.	☒
Test Setup		
Test Procedure	- The EUT was switched on and allowed to warm up to its normal operating condition. - The EUT output was connected to a spectrum analyser and the frequency stability was measured. - Measurements were taken after a thermal balance was obtained. - Normal and extreme test conditions were measured	
Test Data	03/08/2016	
Remark	-	
Result	☒ Pass ☐ Fail	

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by *Gary Chou* at *RF test site*.

Test Results

Temperature Vs Frequency Stability:

Temperature (°C)	Center Frequency (MHz)	Measured Frequency (MHz)	Deviation (ppm)
-40	4965	4965.012	2.42
-30	4965	4964.930	-14.10
-20	4965	4964.998	-0.40
-10	4965	4965.024	4.83
0	4965	4965.037	7.45
10	4965	4965.019	3.83
20	4965	4965.017	3.42
30	4965	4965.028	5.64
40	4965	4965.032	6.45
50	4965	4965.009	1.81
55	4965	4965.022	4.43

Voltage Vs Frequency Stability:

Voltage (AC)	Center Frequency (MHz)	Measured Frequency (MHz)	Deviation (ppm)
138	4965	4965.028	5.64
120	4965	4965.021	4.23
102	4965	4965.009	1.81

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
R & S Receiver	ESL6	100178	05/27/2015	1 Year	05/27/2016	☑
R & S Receiver	ESIB 40	100179	05/23/2015	1 Year	05/23/2016	☑
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	03/04/2016	1 Year	03/04/2017	☑
RF Preamplifier	LPA-6-30	11140711	02/10/2016	1 Year	02/10/2017	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2015	1 Year	08/12/2016	☑
Horn Antenna (1-18GHz)	3115	10SL0059	08/25/2015	1 Year	08/25/2016	☑
Horn Antenna (1-18GHz)	SAS-571	411	03/25/2015	1 Year	03/25/2016	☑
Horn Antenna (18-40GHz)	AH-840	101013	08/28/2015	1 Year	08/28/2016	☑
Horn Antenna (18-40GHz)	261B WR22	N/A	11/20/2015	2 Year	11/20/2017	☑
Tuned Dipole Antenna 30 - 1000 MHz (4pcs set)	AD-100	40133	10/02/2015	1 Year	10/02/2016	☑
3 Meters SAC	3M	N/A	08/08/2015	1 Year	08/08/2016	☑
10 Meters SAC	10M	N/A	09/05/2015	1 Year	09/05/2016	☑
RF Conducted Measurement						
Agilent Spectrum Analyzer	N9010A	10SL0219	08/20/2015	1 Year	08/20/2016	☑
Agilent Signal Generator	MXG N5182A	MY47071065	04/06/2015	1 Year	04/06/2016	☑
R & S Receiver	ESIB 40	100179	05/23/2015	1 Year	05/23/2016	☑
Splitter/Combiner (Mini-Circuit)	ZFSC-2-9G+	S F030000719	N/A	1 Year	N/A	☑
Splitter/Combiner (Mini-Circuit)	ZFSC-2-9G+	S F030000718	N/A	1 Year	N/A	☑
Test Equity Environment Chamber	1007H	61201	07/31/2015	1 Year	07/31/2016	☑
ETS-Lingren USB RF Power Sensor	7002-006	10SL0190	09/03/2015	1 Year	09/03/2016	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		Radio & Telecommunications Terminal Equipment: EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		(Phase II) OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		Radio: Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		Radio: A1. Terminal equipment for purpose of calling Telecom: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		EMI: KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI EMS: KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radio-communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2