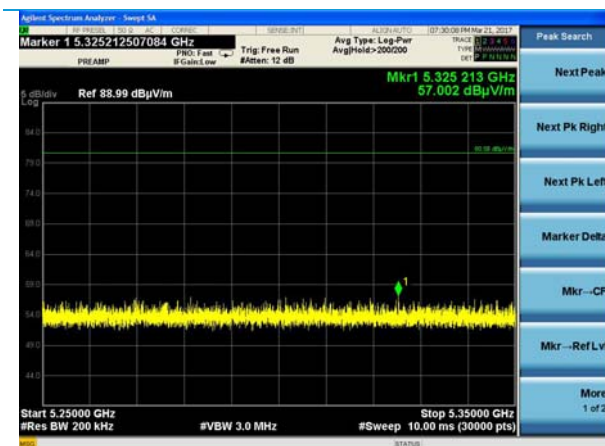
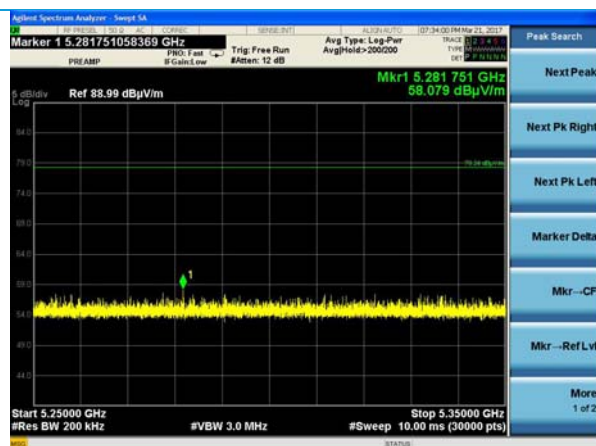


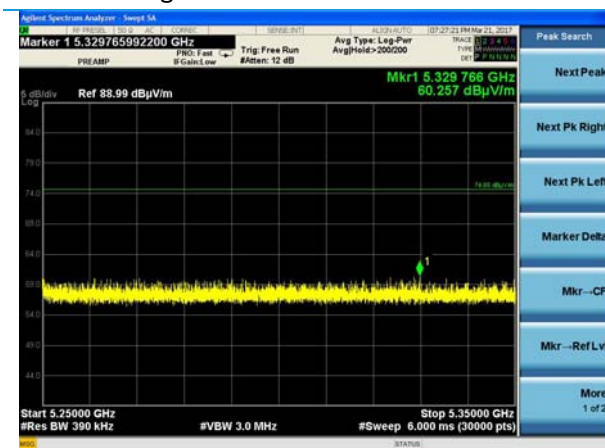
Plots – U-NII-1 ISED Upper Band-Edge



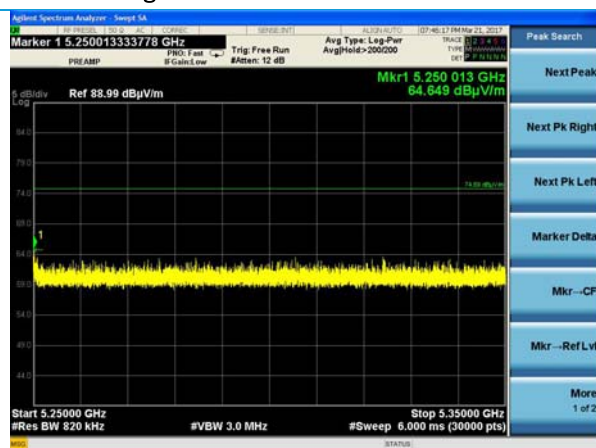
High Channel – 802.11a HT-20



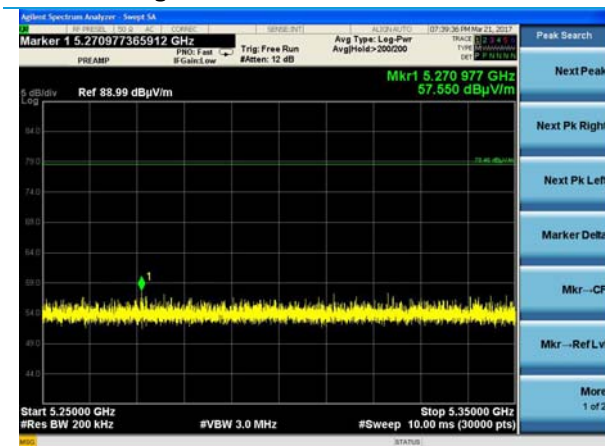
High Channel – 802.11ac HT-20



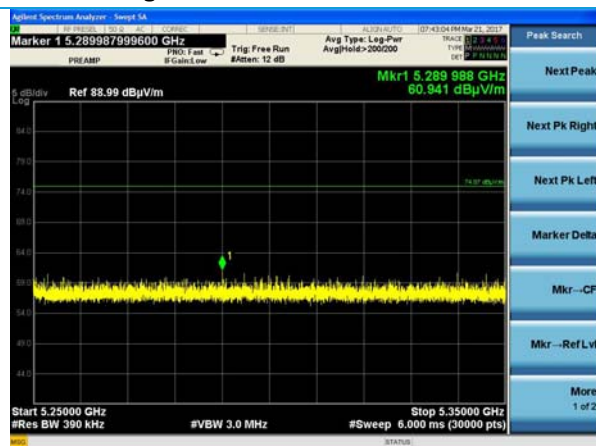
High Channel – 802.11ac HT-40



High Channel – 802.11ac HT-80



High Channel – 802.11n HT-20



High Channel – 802.11n HT-40

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

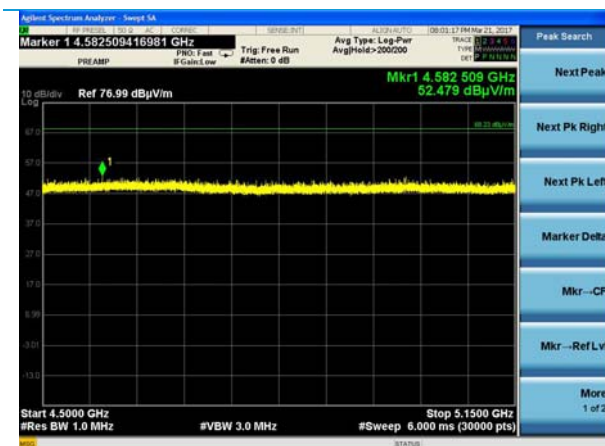
Job: C-2602

Name: Sterling-LWB5

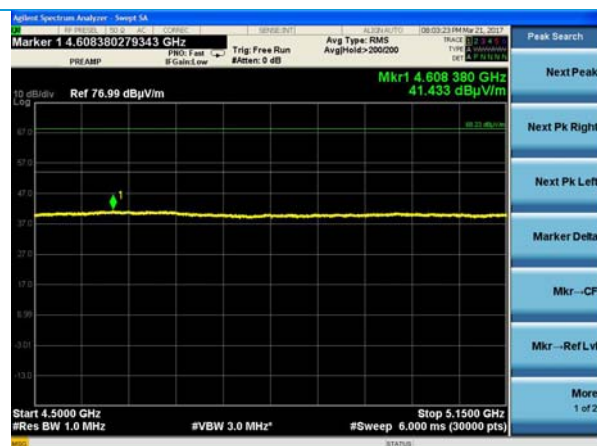
Model: Sterling-LWB5

Serial: 00008, 00035

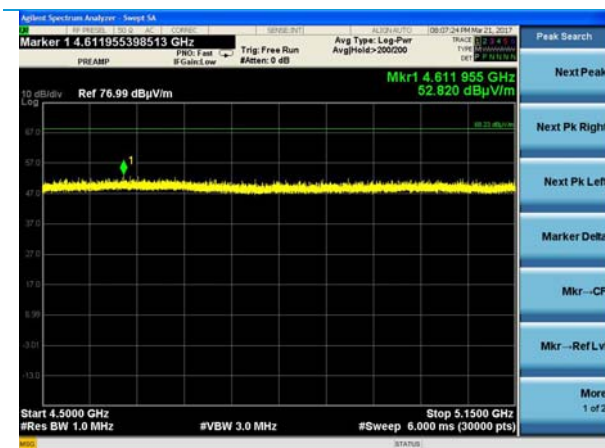
Plots – U-NII-2A Restricted-Band Lower Band-Edge



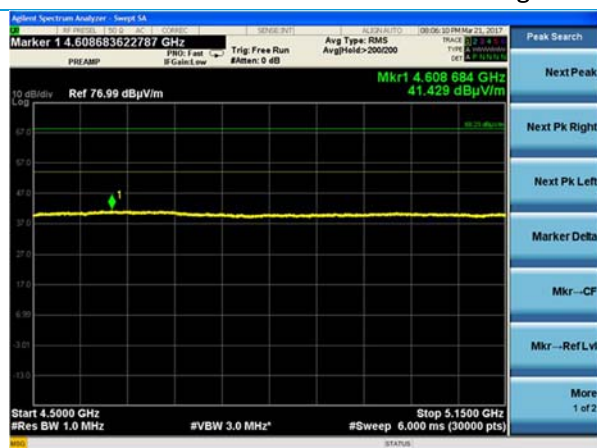
Low Channel – 802.11a HT-20 – Peak



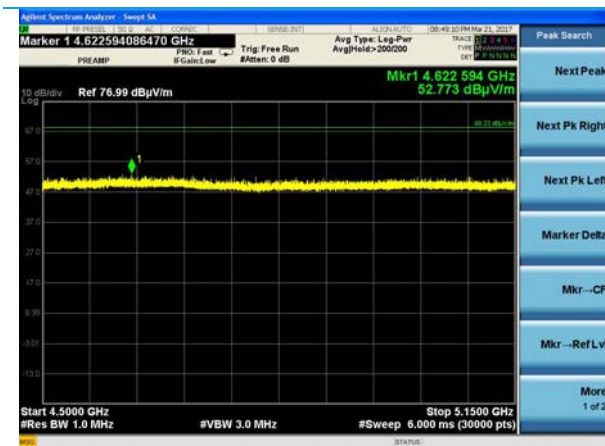
Low Channel – 802.11a HT-20 – Average



Low Channel – 802.11ac HT-20 – Peak



Low Channel – 802.11ac HT-20 – Average



Low Channel – 802.11ac HT-40 – Peak



Low Channel – 802.1ac HT-40 - Average

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

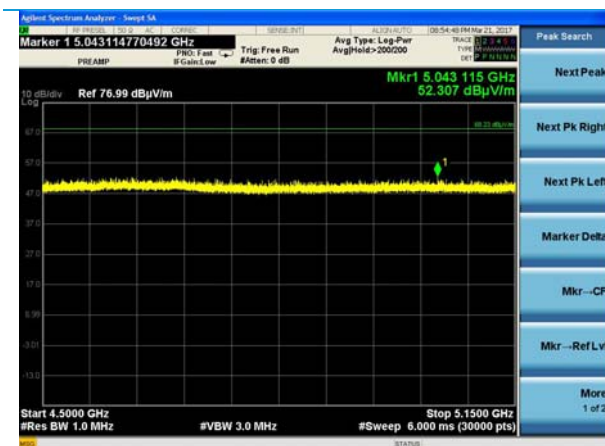
Page 126 of 149

Name: Sterling-LWB5

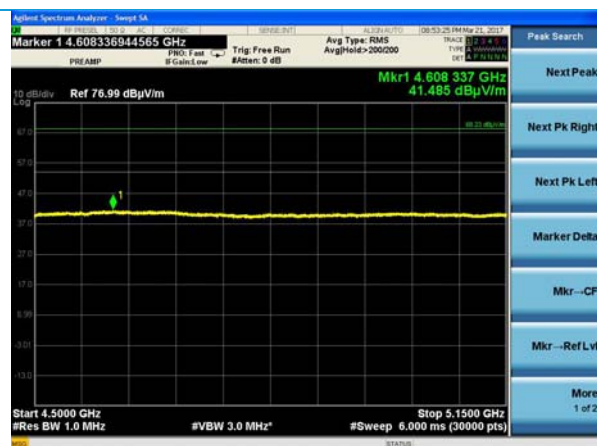
Model: Sterling-LWB5

Serial: 00008, 00035

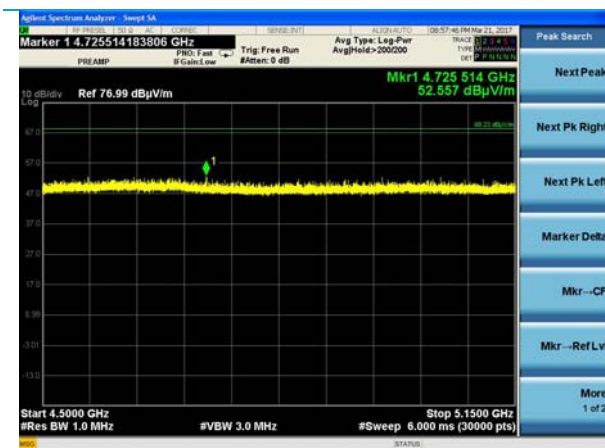
Plots – U-NII-2A Restricted-Band Lower Band-Edge, continued



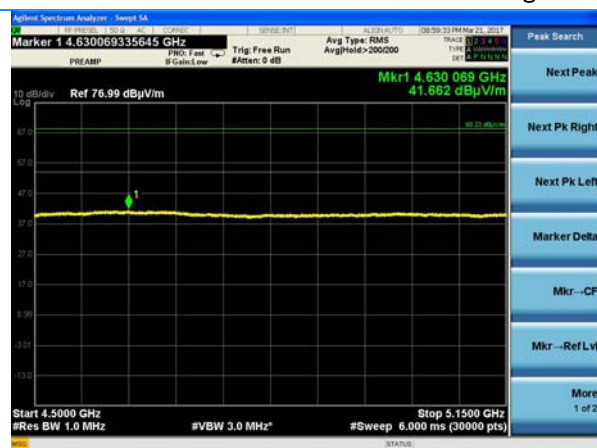
Low Channel – 802.11ac HT-80 – Peak



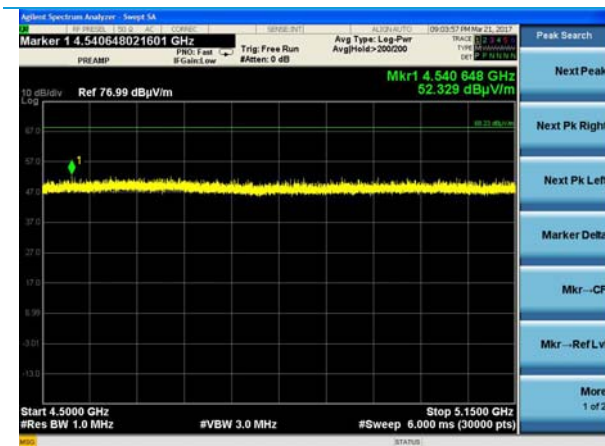
Low Channel – 802.11ac HT-80 – Average



Low Channel – 802.11n HT-20 – Peak



Low Channel – 802.11n HT-20 – Average



Low Channel – 802.11ac HT-40 – Peak



Low Channel – 802.1n HT-40 - Average

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Report: TR 316356 C (U-NII)

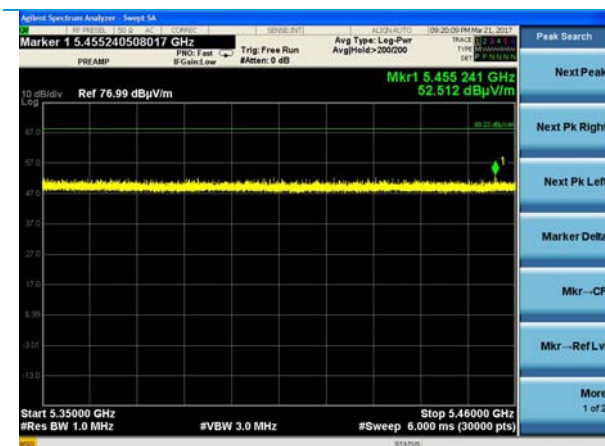
Job: C-2602

Name: Sterling-LWB5

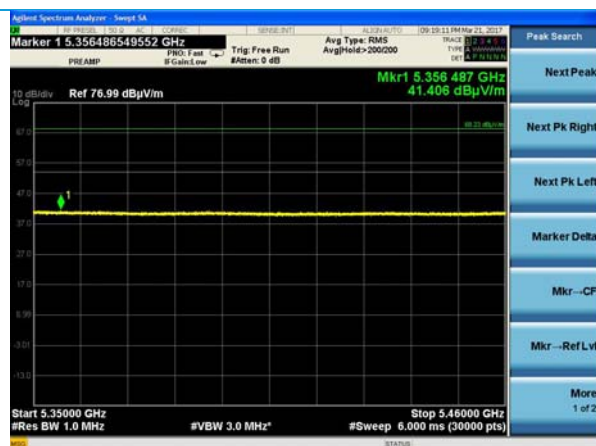
Model: Sterling-LWB5

Serial: 00008, 00035

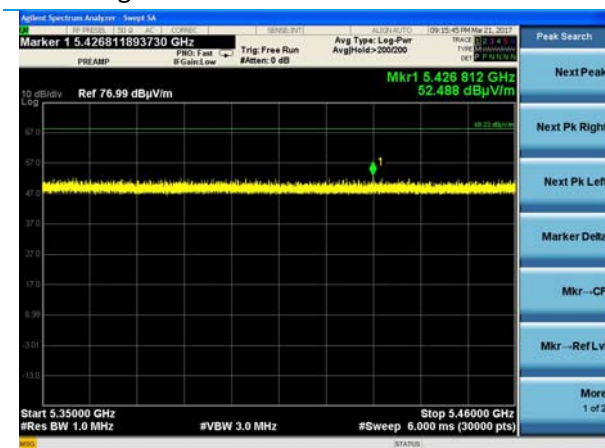
Plots – U-NII-2A Restricted-Band Upper Band-Edge



High Channel – 802.11a HT-20 – Peak



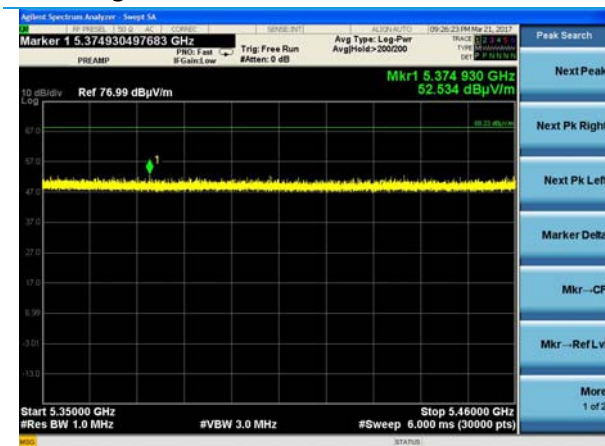
High Channel – 802.11a HT-20 – Average



High Channel – 802.11ac HT-20 – Peak



High Channel – 802.11ac HT-20 – Average



High Channel – 802.11ac HT-40 – Peak



High Channel – 802.1ac HT-40 - Average

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

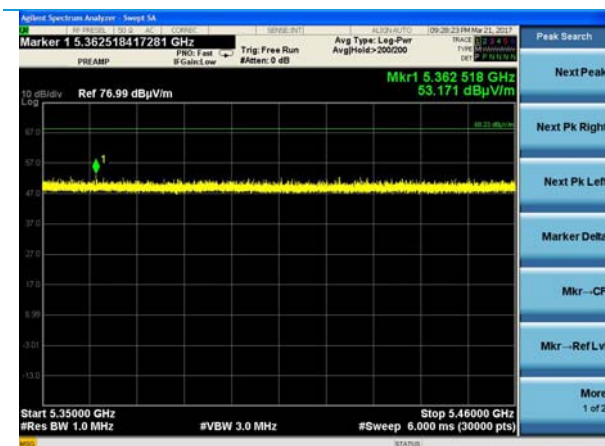
Page 128 of 149

Name: Sterling-LWB5

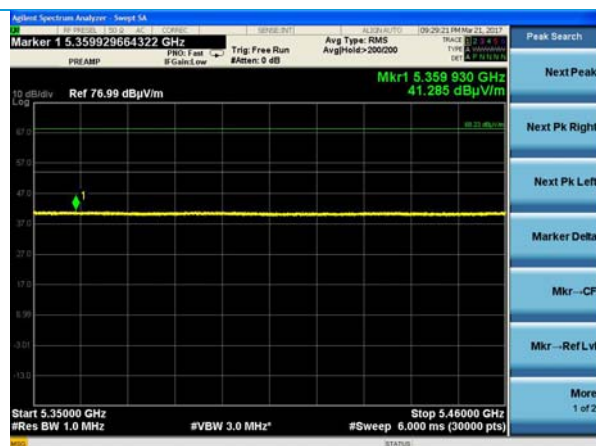
Model: Sterling-LWB5

Serial: 00008, 00035

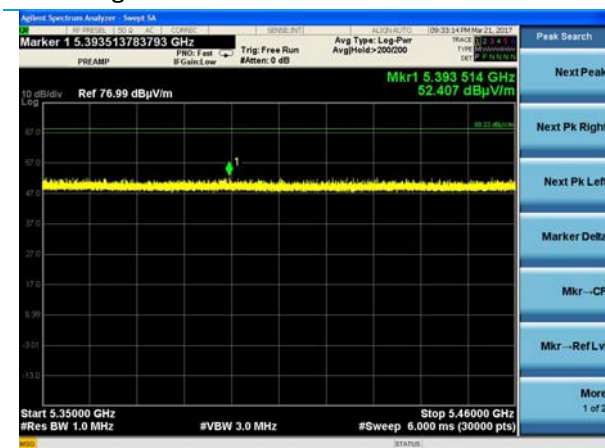
Plots – U-NII-2A Restricted-Band Upper Band-Edge, continued



High Channel – 802.11ac HT-80 – Peak



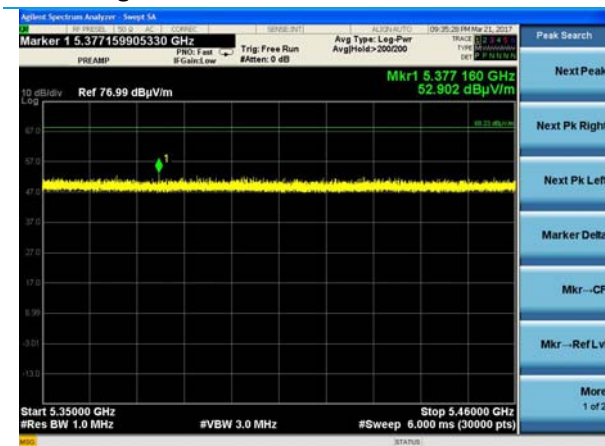
High Channel – 802.11ac HT-80 – Average



High Channel – 802.11n HT-20 – Peak



High Channel – 802.11n HT-20 – Average



High Channel – 802.11ac HT-40 – Peak



High Channel – 802.1n HT-40 - Average

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

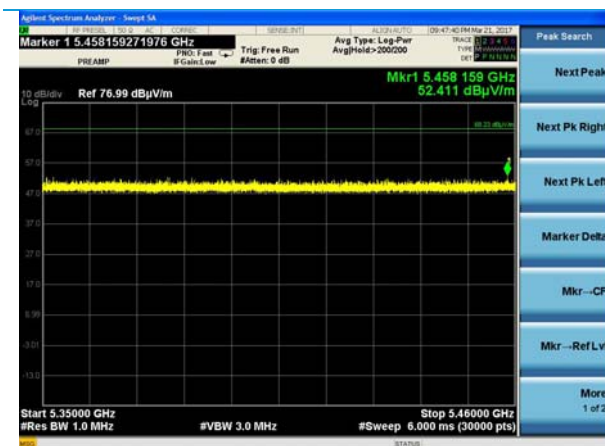
Page 129 of 149

Name: Sterling-LWB5

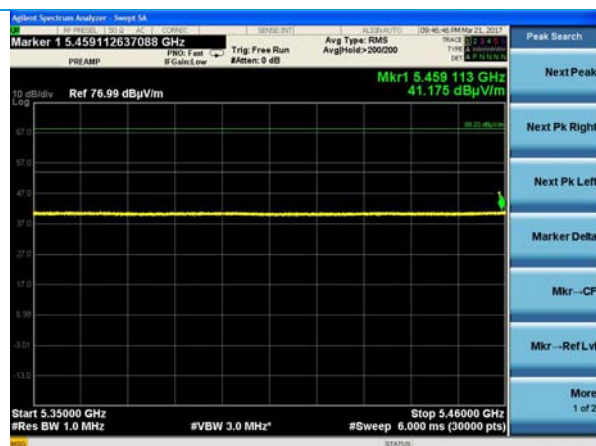
Model: Sterling-LWB5

Serial: 00008, 00035

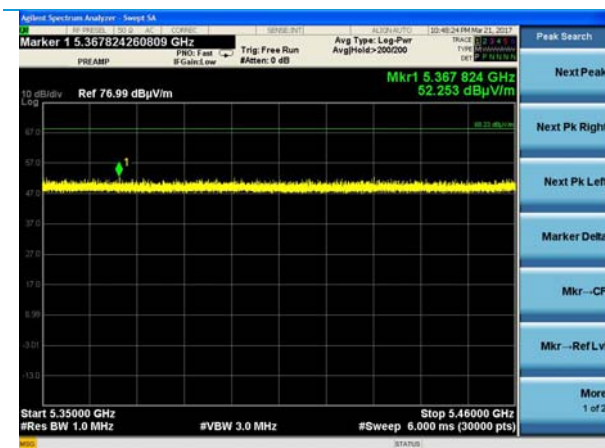
Plots – U-NII-2C Restricted-Band Lower Band-Edge



Low Channel – 802.11a HT-20 – Peak



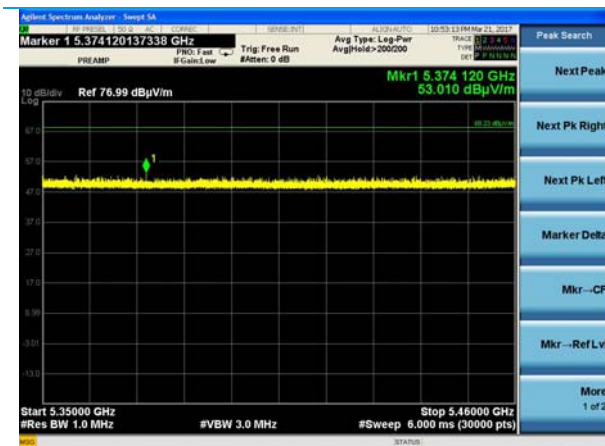
Low Channel – 802.11a HT-20 – Average



Low Channel – 802.11ac HT-20 – Peak



Low Channel – 802.11ac HT-20 – Average



Low Channel – 802.11ac HT-40 – Peak



Low Channel – 802.11ac HT-40 - Average

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

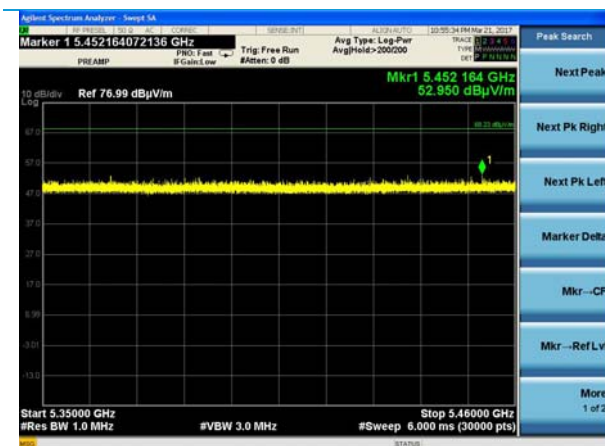
Page 130 of 149

Name: Sterling-LWB5

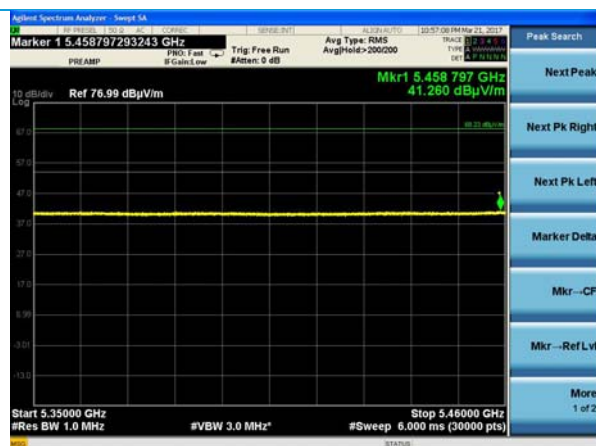
Model: Sterling-LWB5

Serial: 00008, 00035

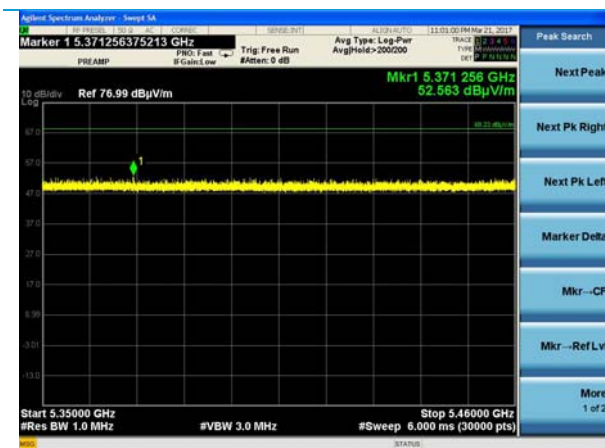
Plots – U-NII-2C Restricted-Band Lower Band-Edge, continued



Low Channel – 802.11ac HT-80 – Peak



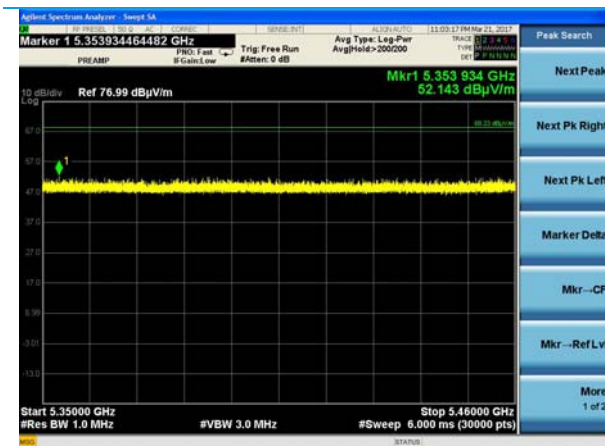
Low Channel – 802.11ac HT-80 - Average



Low Channel – 802.11n HT-20 – Peak



Low Channel – 802.11n HT-20 - Average

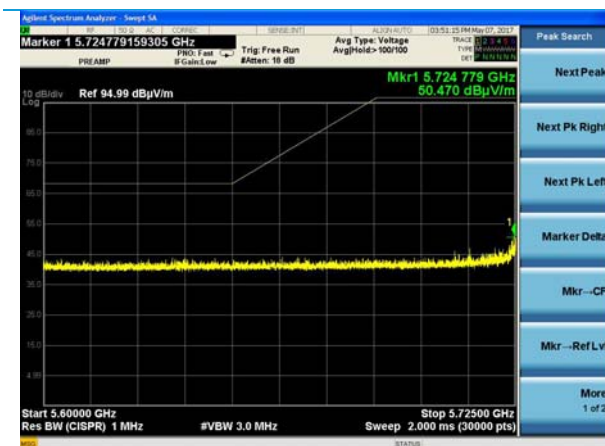


Low Channel – 802.11n HT-40 – Peak

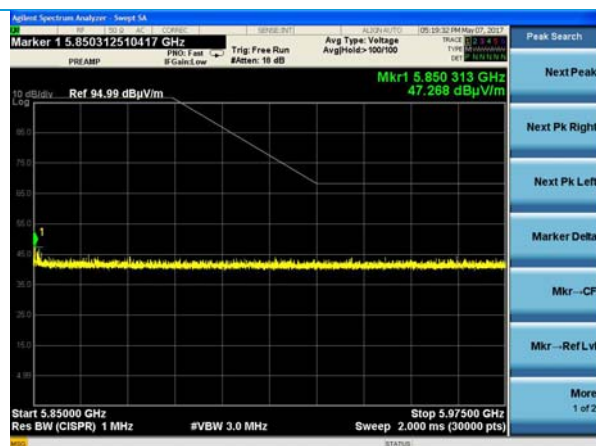


Low Channel – 802.11n HT-40 - Average

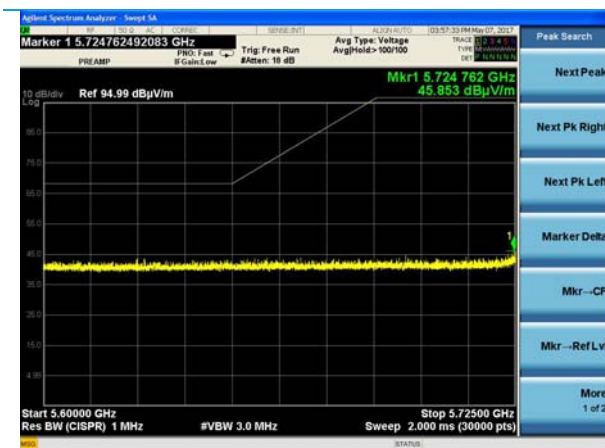
Plots – U-NII-3 Band-Edge Mask



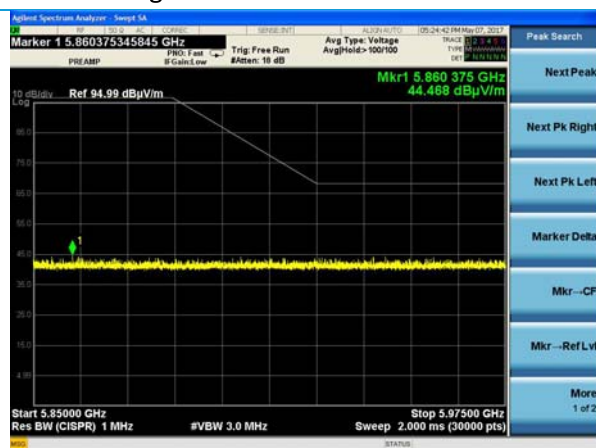
Low Channel – 802.11a HT-20



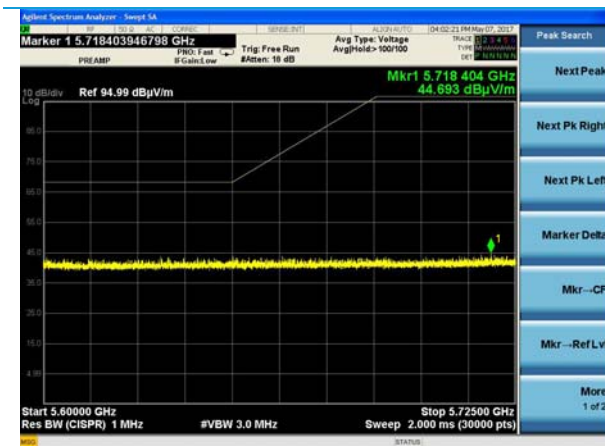
High Channel – 802.11a HT-20



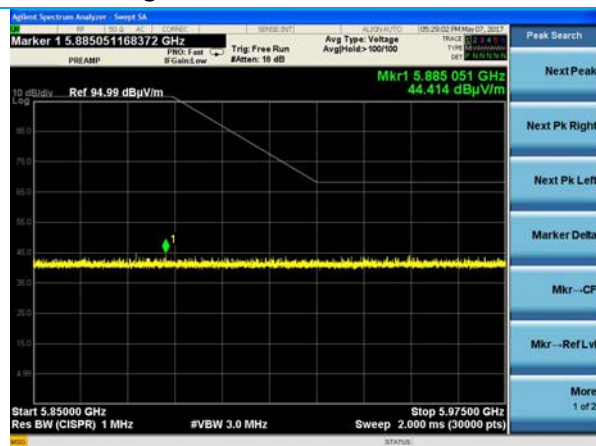
Low Channel – 802.11ac HT-20



High Channel – 802.11ac HT-20



Low Channel – 802.11ac HT-40



High Channel – 802.11ac HT-40

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

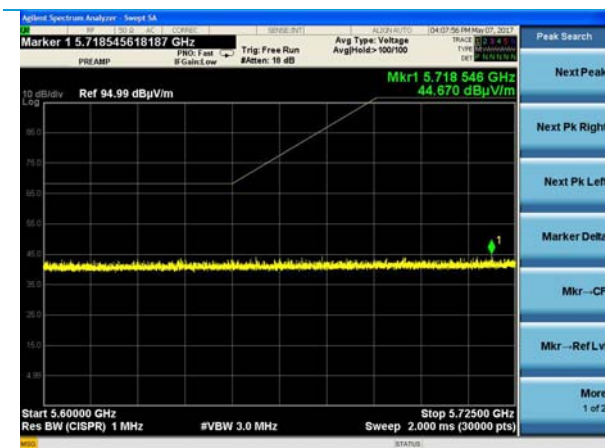
Page 132 of 149

Name: Sterling-LWB5

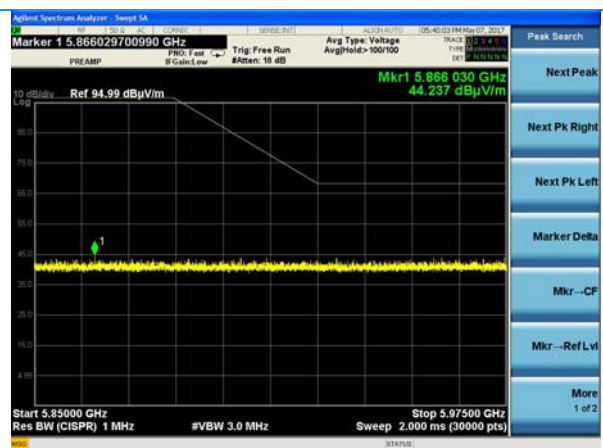
Model: Sterling-LWB5

Serial: 00008, 00035

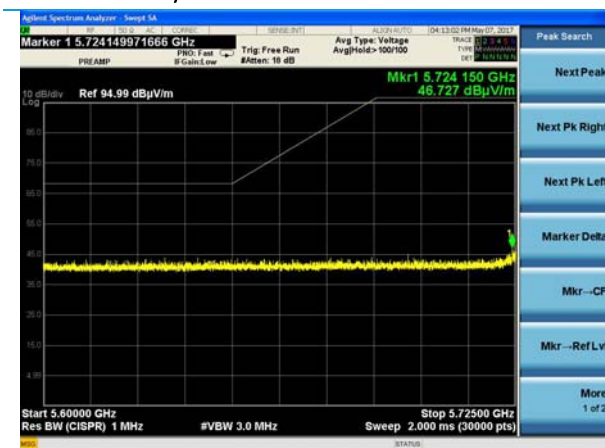
Plots – U-NII-3 Band-Edge Mask, continued



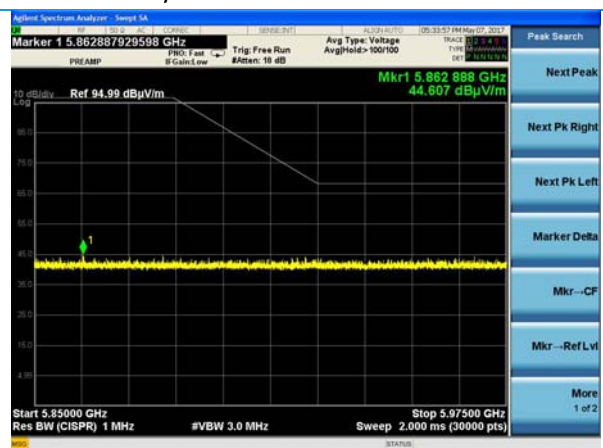
Only Channel – 802.11ac HT-80



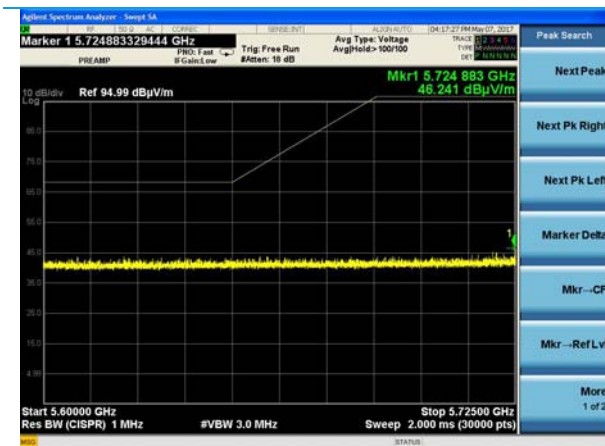
Only Channel – 802.11ac HT-80



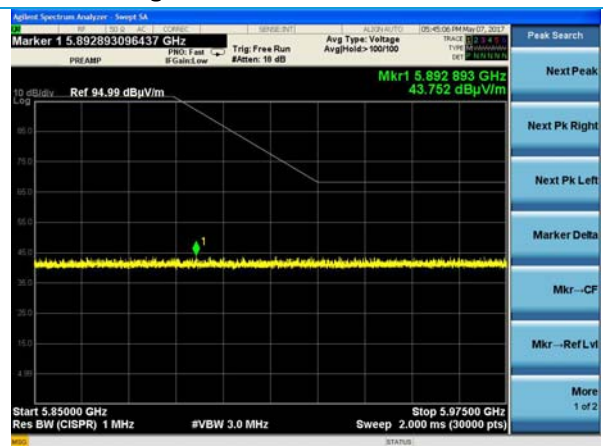
Low Channel – 802.11n HT-20



High Channel – 802.11n HT-20



Low Channel – 802.11n HT-40



High Channel – 802.11n HT-40

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

Page 133 of 149

Name: Sterling-LWB5

Model: Sterling-LWB5

Serial: 00008, 00035

5.2.2 Radiated – Spurious & Harmonic Emissions

Operator	Kimberly Bay
QA	Shane Dock
Test Date	U-NII-1: March 20-21, 25, 2017; U-NII-2A: March 25, 2017 U-NII-2C: March 25, 2017; U-NII-3: March 7, 23-24, 2017
Location	3-meter Semi-Anechoic Chamber
Temp. / R.H.	21°C / 28%-34% RH
Requirement	FCC 15.407 (b)(1-8) RSS 247 Issue 2 Sections 6.2.1.2, 6.2.2.2, 6.2.3.2, 6.2.4.2
Method	KDB 789033 D02 v01r04 Section II.G.1,3,5 (max), 6 (average)

Limits:

U-NII Band	Frequency Range	FCC Limit (@ 3m)	ISED Limit (@ 3m)
All	30-88 MHz	Quasi-peak 40 dBμV/m	Quasi-peak 40 dBμV/m
All	88-216 MHz	Quasi-peak 43.5 dBμV/m	Quasi-peak 43.5 dBμV/m
All	216-960 MHz	Quasi-peak 46 dBμV/m	Quasi-peak 46 dBμV/m
All	960-1000 MHz	Peak 74 dBμV/m Average 54 dBμV/m	Peak 74 dBμV/m Average 54 dBμV/m
U-NII-1	1-40 GHz	Emissions outside of 5150-5350 MHz ≤ 68.23 dBμV/m	Emissions outside of 5150-5350 MHz ≤ 68.23 dBμV/m
U-NII-2A	1-40 GHz	Emissions outside of 5150-5350 MHz ≤ 68.23 dBμV/m	1) Emissions outside of 5250-5350 MHz ≤ 68.23 dBμV/m OR 2) Emissions outside of 5150-5350 MHz ≤ 68.23 dBμV/m AND PSD must comply with ISED U- NII-1 PSD limit
U-NII-2C	1-40 GHz	Emissions outside of 5470-5725 MHz ≤ 68.23 dBμV/m	1) Emissions outside of 5470-5600 MHz AND 5650-5725 MHz ≤ 68.23 dBμV/m 2) Devices w/ BW overlapping the band edge of 5725 MHz can meet the emission limit of 68.23 dBμV/m at 5850 MHz instead of 5725 MHz
U-NII-3	1-40 GHz	Unwanted emissions must comply with the following: 122.23 dBμV/m at frequencies from the band edges decreasing linearly to 110.83 dBμV/m at 5 MHz above or below the band edges; 110.83 dBμV/m at 5 MHz above or below the band edges decreasing linearly to 105.23 dBμV/m at 25 MHz above or below the band edges; 105.23 dBμV/m at 25 MHz above or below the band edges decreasing linearly to 68.23 dBμV/m above or below the band edges; and 68.23 dBμV/m at frequencies more than 75 MHz above or below the band edges.	

Test Parameters

Frequency	30-40000 MHz
Distance	3 meters
Test Chamber	Above 1 GHz: Absorbers on floor and tilt gear added to antenna assembly to maintain cone of radiation.
EUT	802.11ac HT-20: 5180, 5200, 5220 (ISED only), 5240 (FCC only)MHz (U-NII-1) 5260, 5300, 5320 MHz (U-NII-2A) 5500, 5580, 5720 MHz (U-NII-2C) 5745, 5785, 5825 MHz (U-NII-3)
EUT	6 Mbps, maximum power setting
Note	Data rate of highest Pout was used for this test
Note	Measurements performed with EUT antenna port terminated
Example Calculation	Raw Data + Antenna Factor + Cable Factor = Reported Data 19.77 dBμV + 12.5 dB/m + 0.93 dB = 38.8 dBμV/m

Instrumentation



Date : 6-Feb-2017			Type Test : Radiated Emissions - U-NII			Job # : C-2602		
Prepared By: Kim			Customer : LSR			Quote #: 316356		
No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960158	Double Ridge Horn Antenna	ETS Lindgren	3117	109300	10/13/2016	10/13/2017	Active Calibration
3	EE 960159	Low Noise Amplifier	Mini-Circuits	ZVA-213K-S+	40201429	10/13/2016	10/13/2017	Active Calibration
4	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	7/22/2016	7/22/2017	Active Calibration
5	EE 960160	Low Noise Amplifier	Mini-Circuits	ZVA-213K-S+	977711030	7/22/2016	7/22/2017	Active Calibration
6	AA 960174	Small Horn Antenna	ETS Lindgren	3116C-PA	00206880	4/23/2016	4/23/2017	Active Calibration
7	AA 960161	Highpass Filter 5 GHz	K&L Microwave	11SH10-8000	2	2/17/2016	4/5/2017	Active Calibration

Company: LSR a Laird Business	Page 136 of 149	Name: Sterling-LWB5
Report: TR 316356 C (U-NII)		Model: Sterling-LWB5
Job: C-2602		Serial: 00008, 00035

Table – U-NII Spurious Emissions

Frequency (MHz)	Peak Reading (dBμV/m)	Average Reading (dBμV/m)	FCC 15.407/ RSS 247 EIRP Limit (dBμV/m) @3m	FCC 15.407/ RSS 247 Margin (dB)	FCC 15.209 Average Limit (dBμV/m) @3m	FCC 15.209 Average Margin (dB)	Height (m)	Azimuth (degrees)	EUT Orientation	Antenna Polarization	Band/ Channel
3453	46.4	42.9	68.2	21.8	54	11.1	1.0	0	Side	H	U-NII-1/ 36
3829	44.6	39.6	68.2	23.6	54	14.4	1.1	304	Side	H	U-NII-3/ 149
3830	44.9	40.6	68.2	23.3	54	13.4	1.1	126	Side	V	U-NII-3/ 149

Table – U-NII-1 Harmonic Emissions – FCC 15.407/RSS 247 Limits

Fund. Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	FCC 15.407/ RSS 247 Limit (dBμV/m) @3m	FCC 15.407/ RSS 247 Margin (dB)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5180	3	15540	65.4	68.2	2.8	1.8	35	H	Side
5200	3	15600	64.1	68.2	4.1	1.8	23	H	Side
5220	3	15660	63.4	68.2	4.8	1.7	20	H	Side
5240	3	15720	62.6	68.2	5.6	1.9	14	H	Side

Table – U-NII-1 Harmonic Emissions – FCC 15.209 Limits

Fund. Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	Average Reading (dBμV/m)	FCC 15.209 Peak/Average Limit (dBμV/m)	Peak Margin (dBm)	Average Margin (dBm)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5180	3	15540	65.4	53.2	74/54	8.6	0.8	1.8	35	H	Side
5200	3	15600	64.1	51.8	74/54	9.9	2.2	1.8	23	H	Side
5220	3	15660	63.4	50.9	74/54	10.6	3.1	1.7	20	H	Side
5240	3	15720	62.6	50.1	74/54	11.4	3.9	1.9	14	H	Side

Table – U-NII-2A Harmonic Emissions – FCC 15.407/RSS 247 Limits

Fundamental Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	FCC 15.407/ RSS 247 Limit (dBμV/m) @3m	FCC 15.407/ RSS 247 Margin (dB)	Average Margin (dBm)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5260	3	15780	61.0	68.2	7.2	5.2	1.0	11.5	H	Side
5300	3	15900	58.1	68.2	10.1	9.7	1.0	0.0	H	Side
5320	3	15960	55.2	68.2	13.0	11.2	2.2	8.0	H	Side

Table – U-NII-2A Harmonic Emissions – FCC 15.209 Limits

Fundamental Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	Average Reading (dBμV/m)	FCC 15.209 Peak/Average Limit (dBμV/m)	Peak Margin (dBm)	Average Margin (dBm)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5260	3	15780	61.0	48.8	74/54	13	5.2	1.0	11.5	H	Side
5300	3	15900	58.1	44.3	74/54	15.9	9.7	1.0	0.0	H	Side
5320	3	15960	55.2	42.8	74/54	18.8	11.2	2.2	8.0	H	Side

Table – U-NII-2C Harmonic Emissions – FCC 15.407/RSS 247 Limits

Fundamental Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	FCC 15.407/ RSS 247 Limit (dBμV/m) @3m	FCC 15.407/ RSS 247 Margin (dB)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5500	3	11000	52.8	68.2	15.4	1.2	8.5	H	Side
5580	3	11160	53.4	68.2	14.8	1.3	0.0	H	Side
5700	3	11400	54.3	68.2	13.9	1.1	0.0	H	Side

Table – U-NII-2C Harmonic Emissions – FCC 15.209 Limits

Fundamental Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	Average Reading (dBμV/m)	FCC 15.209 Peak/Average Limit (dBμV/m)	Peak Margin (dBm)	Average Margin (dBm)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5500	3	11000	52.8	40.4	74/54	21.2	13.6	1.2	8.5	H	Side
5580	3	11160	53.4	42.0	74/54	20.6	12.0	1.3	0.0	H	Side
5700	3	11400	54.3	42.5	74/54	19.7	11.5	1.1	0.0	H	Side

Table – U-NII-3 Harmonic Emissions – FCC 15.407/RSS 247 Limits

Fundamental Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	FCC 15.407/ RSS 247 Limit (dBμV/m) @3m	FCC 15.407/ RSS 247 Margin (dB)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5745	2	11490	54.8	68.2	13.4	1.0	0	H	Side
5785	2	11570	56.2	68.2	12.0	1.2	0	H	Side
5785	3	17355	58.6	68.2	9.6	1.0	37	H	Side
5825	2	11650	57.1	68.2	11.1	1.3	0	H	Side

Table – U-NII-3 Harmonic Emissions – FCC 15.209 Limits

Fundamental Frequency (MHz)	Harmonic	Harmonic Frequency (MHz)	Peak Reading (dBμV/m)	Average Reading (dBμV/m)	FCC 15.209 Peak/Average Limit (dBμV/m)	Peak Margin (dBm)	Average Margin (dBm)	Height (m)	Azimuth (degrees)	Antenna Polarization	EUT Orientation
5745	2	11490	54.8	43.4	74/54	19.2	10.6	1	0	H	Side
5785	2	11570	56.2	44.5	74/54	17.8	9.5	1.2	0	H	Side
5785	3	17355	58.6	45.6	74/54	15.4	8.4	1.03	37	H	Side
5825	2	11650	57.1	45.5	74/54	16.9	8.5	1.3	0	H	Side

Plots – U-NII-1 Harmonic Emissions



Low Channel – Peak



Low Channel - Average



Mid Channel - Peak



Mid Channel - Average



High Channel – Peak



High Channel - Average

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

Name: Sterling-LWB5

Model: Sterling-LWB5

Serial: 00008, 00035

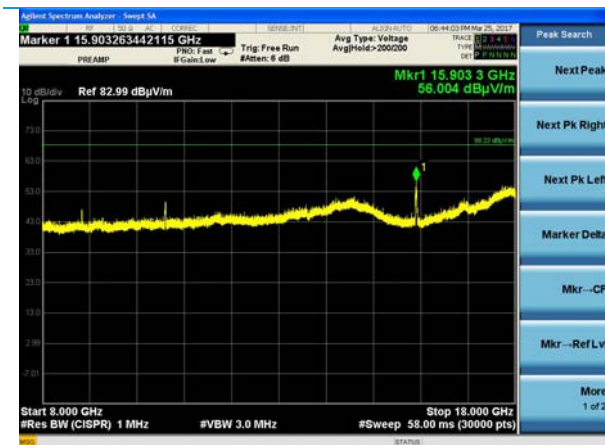
Plots – U-NII-2A Harmonic Emissions



Low Channel - Peak



Low Channel – Average



Mid Channel - Peak



Mid Channel – Average



High Channel - Peak



High Channel - Average

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

Page 141 of 149

Name: Sterling-LWB5

Model: Sterling-LWB5

Serial: 00008, 00035

Plots – U-NII-2C Harmonic Emissions



Low Channel – Peak



Low Channel – Average



Mid Channel – Peak



Mid Channel - Average



High Channel – Peak



High Channel - Peak

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

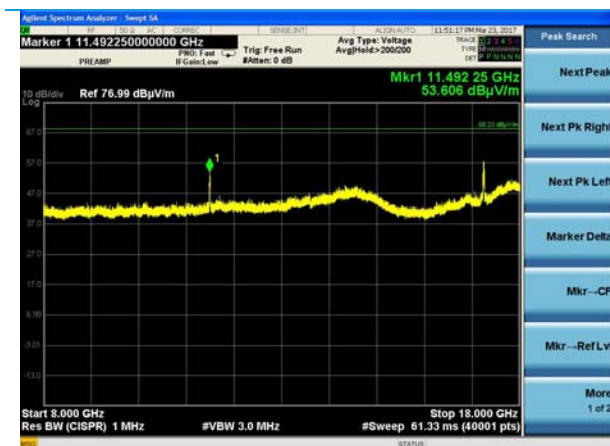
Job: C-2602

Name: Sterling-LWB5

Model: Sterling-LWB5

Serial: 00008, 00035

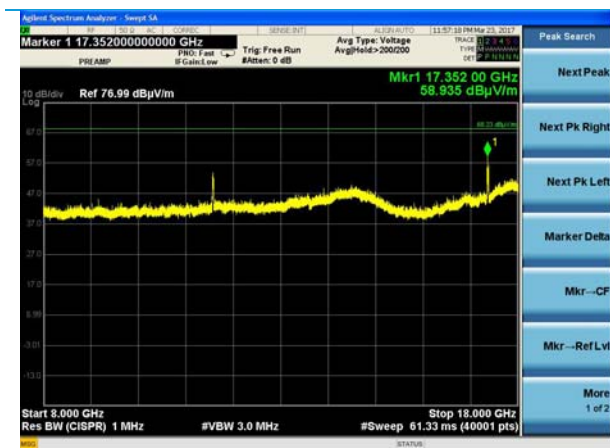
Plots – U-NII-3 Harmonic Emissions



Low Channel – Peak



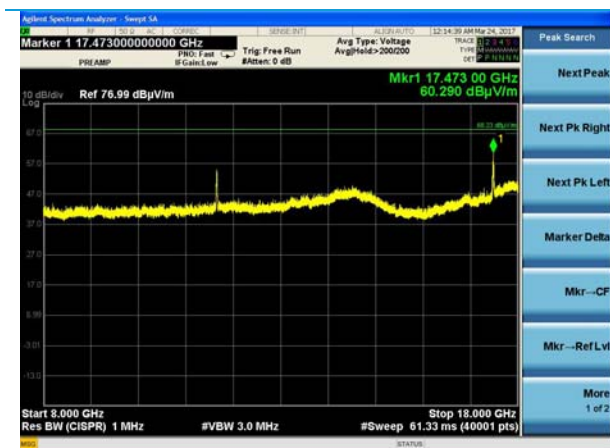
Low Channel - Average



Mid Channel – Peak



Mid Channel - Average



High Channel – Peak



High Channel - Average

Company: LSR a Laird Business

Report: TR 316356 C (U-NII)

Job: C-2602

Page 143 of 149

Name: Sterling-LWB5

Model: Sterling-LWB5

Serial: 00008, 00035

Plots – U-NII Spurious Emissions

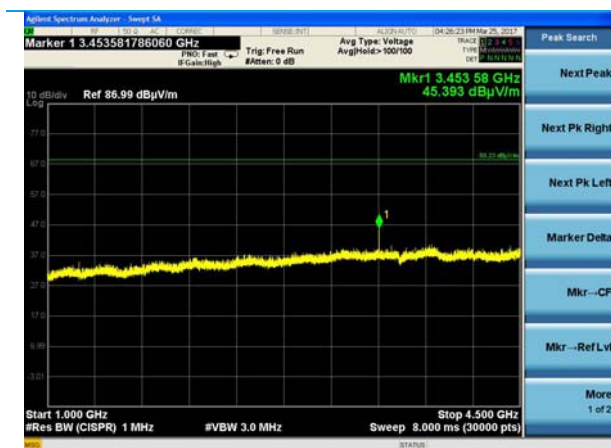
Plots show worst case (highest) emissions in the respective frequency range over all U-NII bands, unless otherwise noted.



30-200 MHz



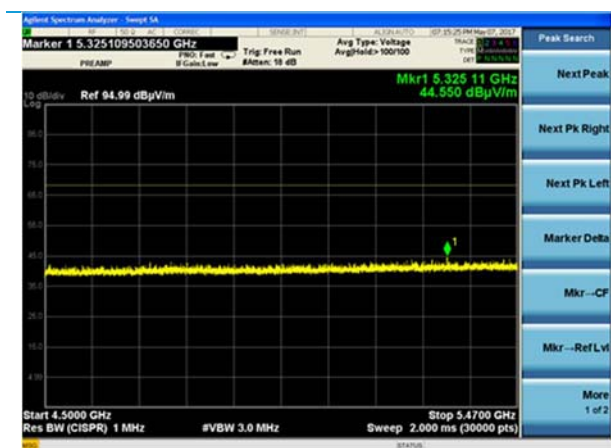
200-1000 MHz



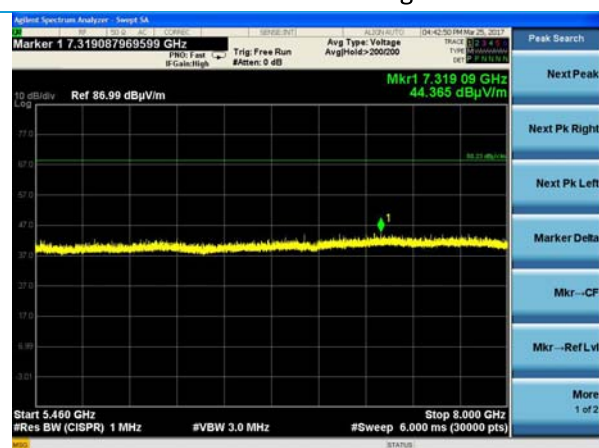
1-4.5 GHz – Peak



1-4.5 GHz – Average



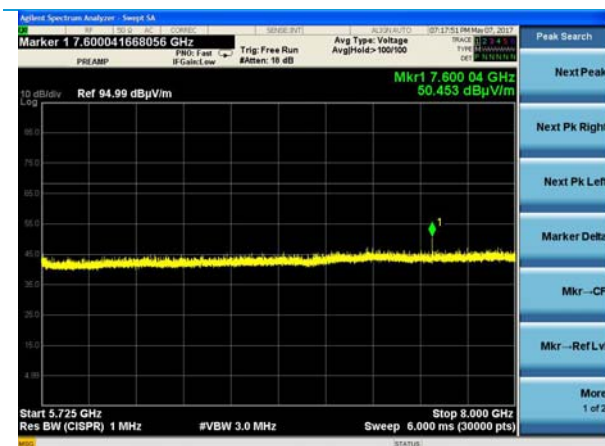
4.5-5.47 GHz – Peak (U-NII-2C/U-NII-3)



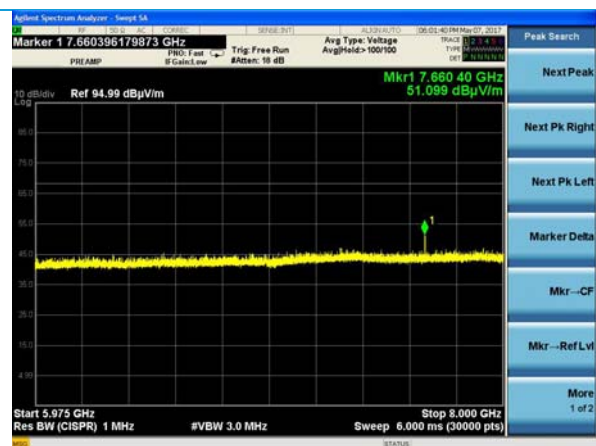
5.46-8 GHz – Peak (U-NII-1/U-NII-2A)

Plots – U-NII Spurious Emissions

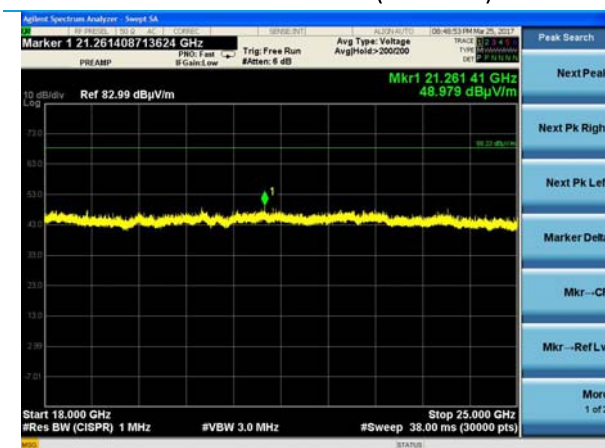
Plots show worst case (highest) emissions in the respective frequency range over all U-NII bands, unless otherwise noted.



5.725-8 GHz – Peak (U-NII-2C)



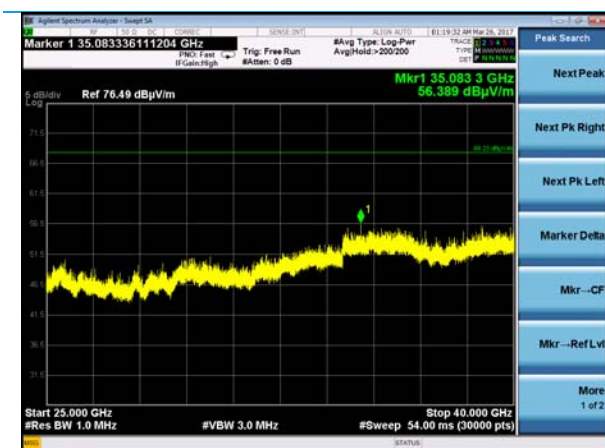
5.975-8 GHz – Peak (U-NII-3)



18-25 GHz – Peak



18-25 GHz – Average



25-40 GHz – Peak



25-40 GHz – Average

5.3 AC Mains Conducted Emissions

A line impedance stabilization network (LISN) or artificial mains network (AMN) allows the emissions of the power supply conductors to be measured while isolating the EUT from the supply mains.

Description of Measurement

The AMN, cable, and other necessary measurement system correction factors are loaded onto the EMI receiver when the measurements are performed. The data is gathered and reported as the corrected values.

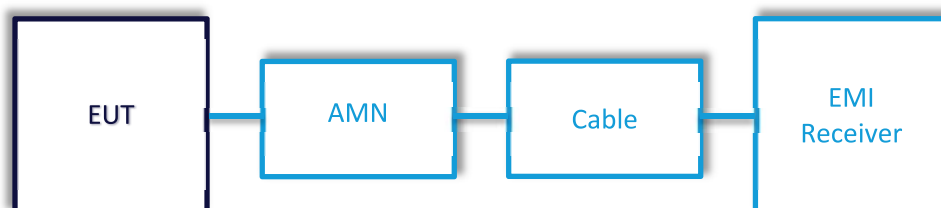
Maximum emissions are determined with a peak max hold trace then measurements at a selection of the highest points are made with quasi-peak and average detectors. Results are recorded and compared to limit for each line. (e.g. line and neutral)

Example Calculations

Measurement (dBμV) + Cable factor (dB) + Other (dB) = Corrected Reading (dBμV)

Margin (dB) = Limit (dBμV) - Corrected Reading (dBμV)

Block Diagram



5.3.1 AC Mains Conducted Emissions

Operator	Kimberly Bay
QA	Shane Dock
Test Date	April 4, 2017
Location	H+V Ground Plane
Temp. / R.H.	21°C / 43% R.H.
Requirement	FCC 15.407 (b)(6) / RSS-GEN Section 8.8
Method	ANSI C63.10 2013 Section 6.2

Limits:

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Parameters

Frequency	.150-30 MHz
Settings	RBW = 9 kHz, VBW = 90 kHz
EUT	5745 MHz, 80211a, 6 Mbps, maximum transmission power setting
Notes	No change of emissions between channels/data rates Off-the-shelf adapter used to provide 3.3VDC
Example Calculation	Raw Data + Correction Factor = Reported Data 20.75 dBμV + 0.78 dB = 21.53 dBμV

Instrumentation



Date: <u>4-Apr-2017</u>			Type Test: <u>Bluetooth Cond AC Emissions</u>			Job #: <u>C-2602</u>		
Prepared By: <u>Kim</u>			Customer: <u>LSR</u>			Quote #: <u>316356</u>		
No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960089	LISN	COM-POWER	LI-215A	191943	3/13/2017	3/13/2018	Active Calibration
2	EE 960088	MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	3/22/2017	3/22/2018	Active Calibration

Company: LSR a Laird Business	Page 147 of 149	Name: Sterling-LWB5
Report: TR 316356 C (U-NII)		Model: Sterling-LWB5
Job: C-2602		Serial: 00008, 00035

Table – Conducted AC Emissions Data

Frequency (MHz)	Line	Quasi-Peak			Average		
		Q-Peak Reading (dBμV)	Q-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	Average Reading (dBμV)	Average Limit (dBμV)	Average Margin (dB)
0.150	1	43.4	66.0	22.6	33.2	56.0	22.8
0.330	1	39.9	59.5	19.6	30.9	49.5	18.6
0.199	1	40.5	63.7	23.1	30.7	53.7	22.9
0.159	2	43.9	65.5	21.6	23.2	55.5	32.3
0.186	2	43.7	64.2	20.5	22.1	54.2	32.1
0.330	2	37.9	59.5	21.5	27.5	49.5	22.0

Plots – Conducted AC Emissions



6 REVISION HISTORY

Version	Date	Notes	Person
V0	5/1/2017	Initial Draft Release	KB
V1	5/9/2017	Final Release for TCB review	KB

END OF REPORT

Company: LSR a Laird Business	Page 149 of 149	Name: Sterling-LWB5
Report: TR 316356 C (U-NII)		Model: Sterling-LWB5
Job: C-2602		Serial: 00008, 00035