

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

F1.7 Conducted Spurious Emissions - Far-out per CFR 47 2.1051

Specification Requirement 47 CFR §27.1509(b) - Emission Limits:

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

(b) For 900 MHz broadband operations in the 936.5-939.5 MHz band, by at least $50 + 10 \log (P)$ dB.

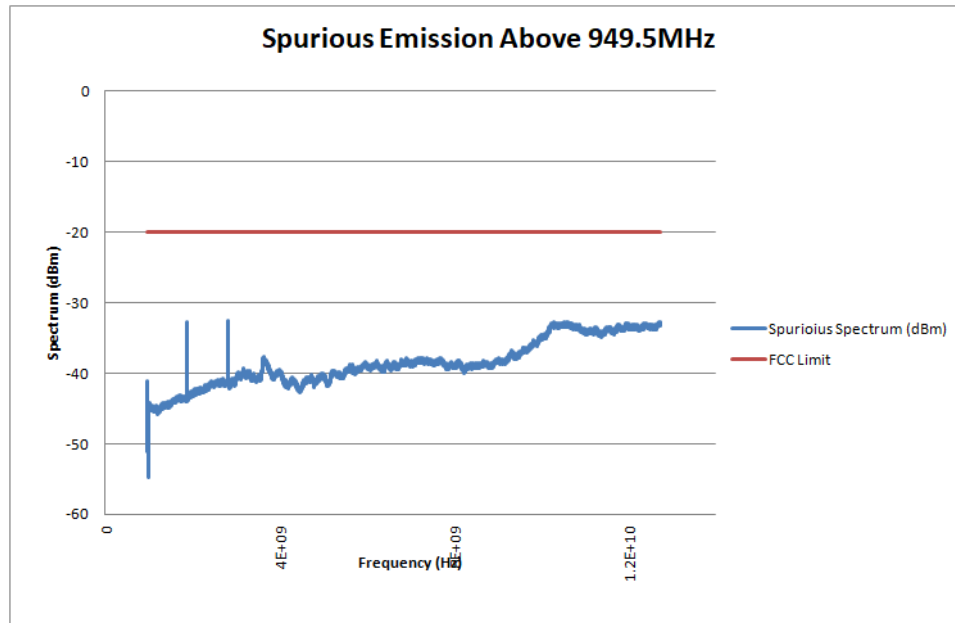
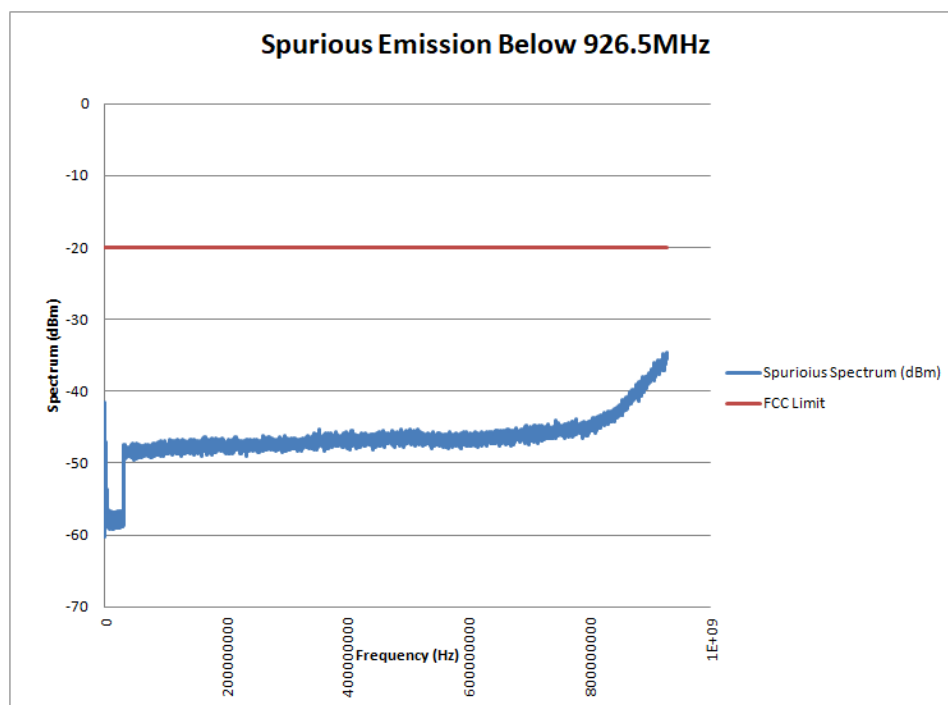
Measurement made with a PXA Signal Analyzer per ANSI C63.26. A lowpass filter was used for measurements below the carrier and a highpass filter was used for measurements above the carrier.

EXHIBIT	DESCRIPTION
F1-7.1	Conducted Spurious Emissions, Power Output 80 Watts, 3MHz BW, 938MHz Tx1
F1-7.2	Conducted Spurious Emissions, Power Output 80 Watts, 3MHz BW, 938MHz Tx2
F1-7.3	Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 937.2MHz Tx1
F1-7.4	Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 937.2MHz Tx2
F1-7.5	Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 938.8MHz Tx1
F1-7.6	Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 938.8MHz Tx2
F1-7.7	Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW, 937.2/938.8MHz Tx1
F1-7.8	Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW, 937.2/938.8MHz Tx2
F1-7.9	Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW + NB IoT, 937.3/938.8/938MHz Tx1
F1-7.10	Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW + NB IoT, 937.3/938.8/938MHz Tx2
F1-7.11	Conducted Spurious Emissions, Power Output 50 Watts, NB IoT, 936.7MHz Tx1
F1-7.12	Conducted Spurious Emissions, Power Output 50 Watts, NB IoT, 936.7MHz Tx2
F1-7.13	Conducted Spurious Emissions, Power Output 50 Watts, 2xNB IoT, 936.7/937MHz Tx1
F1-7.14	Conducted Spurious Emissions, Power Output 50 Watts, 2xNB IoT, 936.7/937MHz Tx2

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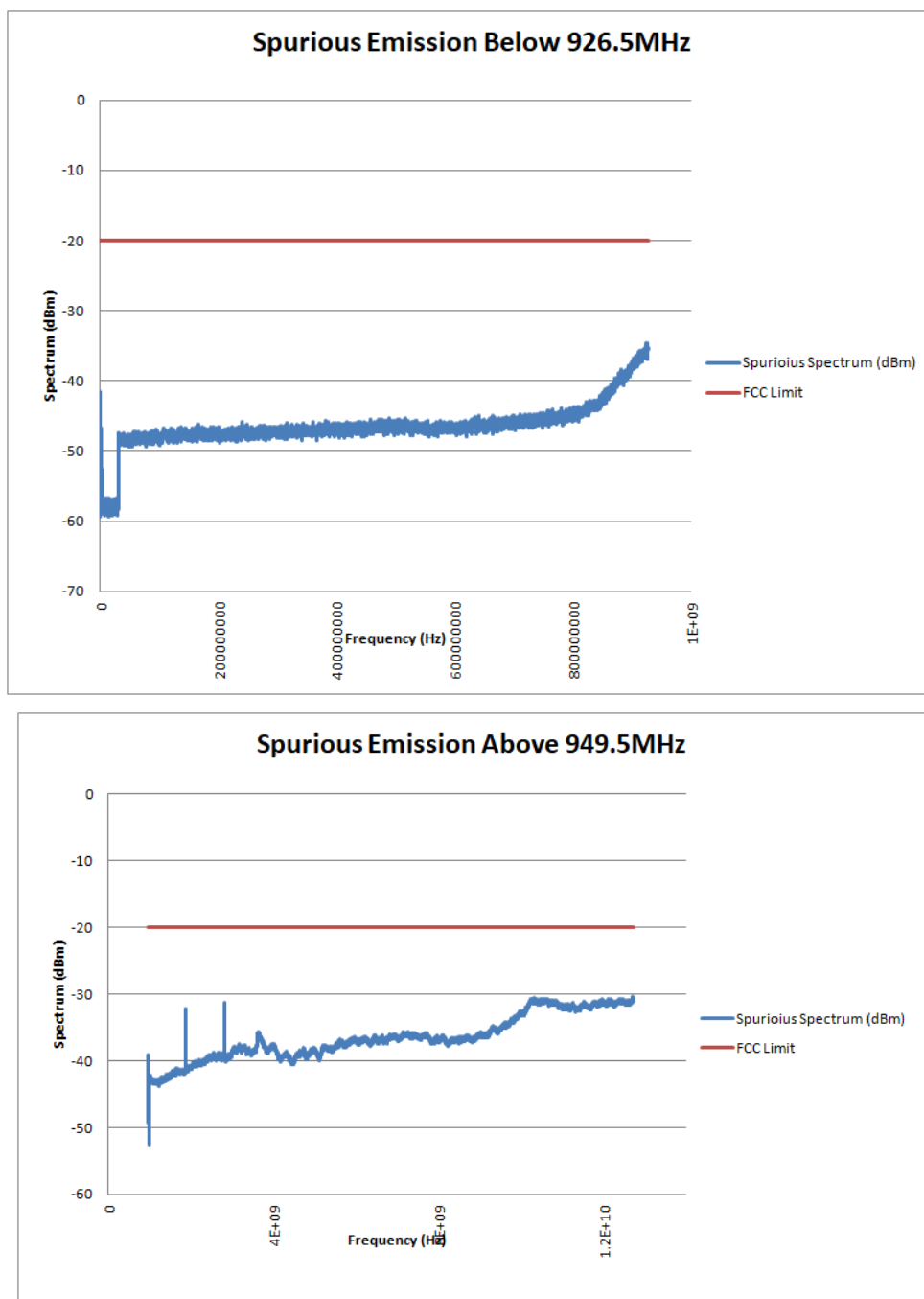
F1-7.15	Conducted Spurious Emissions, Power Output 50 Watts,3xNBloT, 936.7/937/937.3MHz Tx1
F1-7.16	Conducted Spurious Emissions, Power Output 50 Watts,3xNBloT, 936.7/937/937.3MHz Tx2
F1-7.17	Conducted Spurious Emissions, Power Output 50 Watts,4xNBloT, 936.7/937/937.3/937.6MHz Tx1
F1-7.18	Conducted Spurious Emissions, Power Output 50 Watts,4xNBloT, 936.7/937/937.3/937.6MHz Tx2
F1-7.19	Conducted Spurious Emissions, Power Output 50 Watts,NBloT, 939.3MHz Tx1
F1-7.20	Conducted Spurious Emissions, Power Output 50 Watts,NBloT, 939.3MHz Tx2
F1-7.21	Conducted Spurious Emissions, Power Output 50 Watts,2xNBloT, 939/939.3MHz Tx1
F1-7.22	Conducted Spurious Emissions, Power Output 50 Watts,2xNBloT, 939/939.3MHz Tx2
F1-7.23	Conducted Spurious Emissions, Power Output 50 Watts,3xNBloT, 938.7/939/939.3MHz Tx1
F1-7.24	Conducted Spurious Emissions, Power Output 50 Watts,3xNBloT, 938.7/939/939.3MHz Tx2
F1-7.25	Conducted Spurious Emissions, Power Output 50 Watts,4xNBloT, 938.4/938.7/939/939.3MHz Tx1
F1-7.26	Conducted Spurious Emissions, Power Output 50 Watts,4xNBloT, 938.4/938.7/939/939.3MHz Tx2
F1-7.27	Conducted Spurious Emissions, Power Output 80 Watts,1.4MHz BW + 4xNBloT, 937.2/938.4/938.7/939.0/939.3MHz Tx1
F1-7.28	Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW + 4xNBloT, 937.2/938.4/938.7/939.0/939.3MHz Tx2
F1-7.29	Conducted Spurious Emissions, Power Output 80 Watts,1.4MHz BW + 4xNBloT, 938.8/936.7/937.0/937.3/937.6MHz Tx1
F1-7.30	Conducted Spurious Emissions, Power Output 80 Watts,1.4MHz BW + 4xNBloT, 938.8/936.7/937.0/937.3/937.6MHz Tx2

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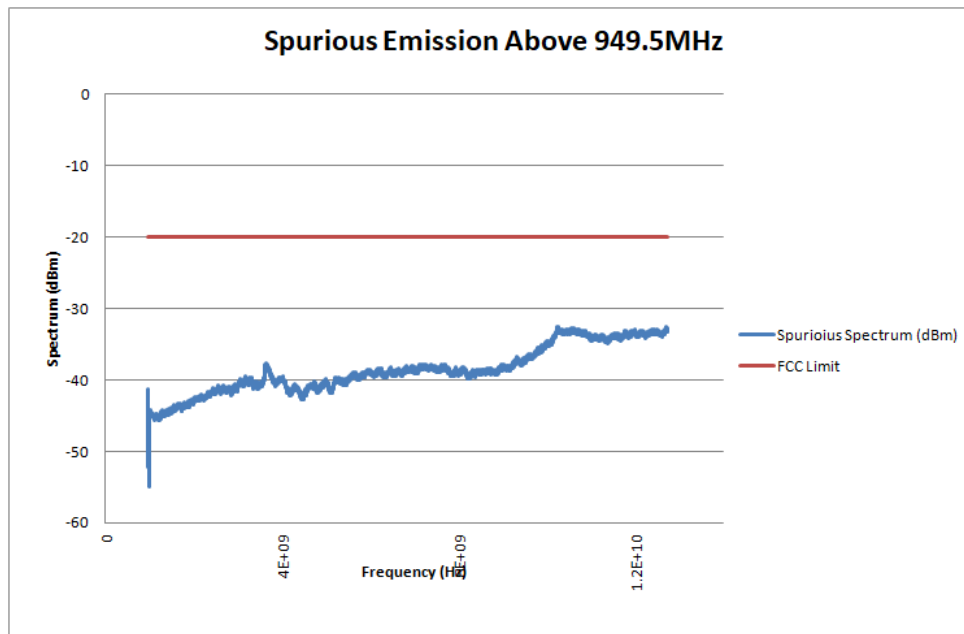
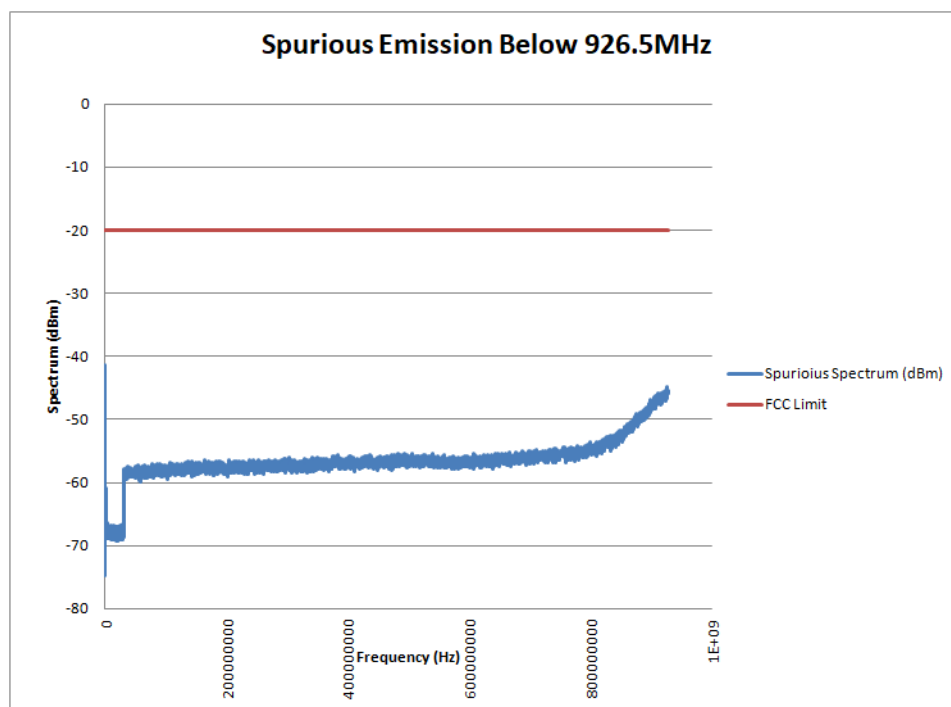
F1-7.1 Conducted Spurious Emissions, Power Output 80 Watts, 3MHz BW, 938MHz Tx1

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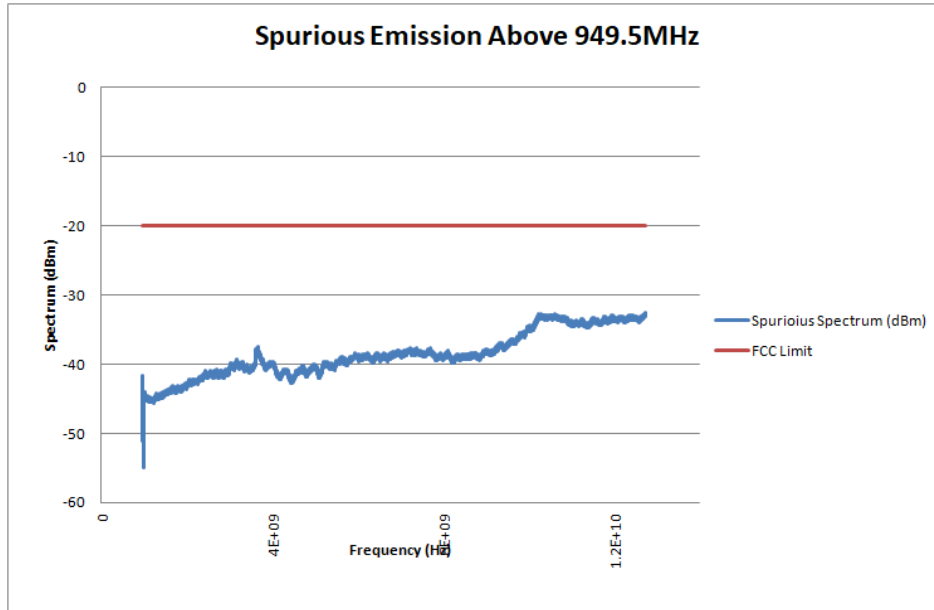
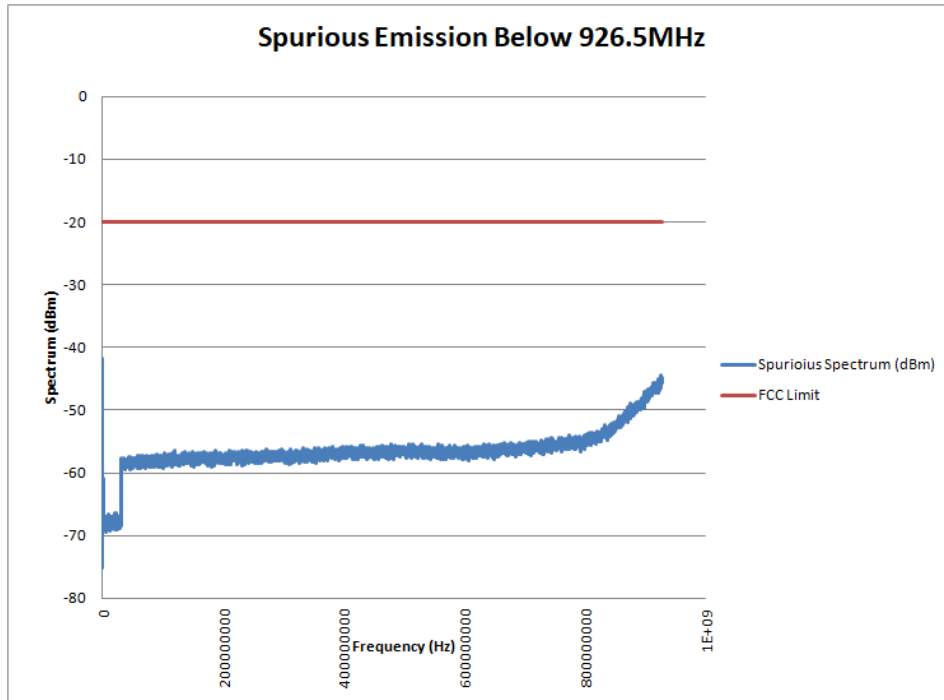
F1-7.2 Conducted Spurious Emissions, Power Output 80 Watts, 3MHz BW, 938MHz Tx2

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



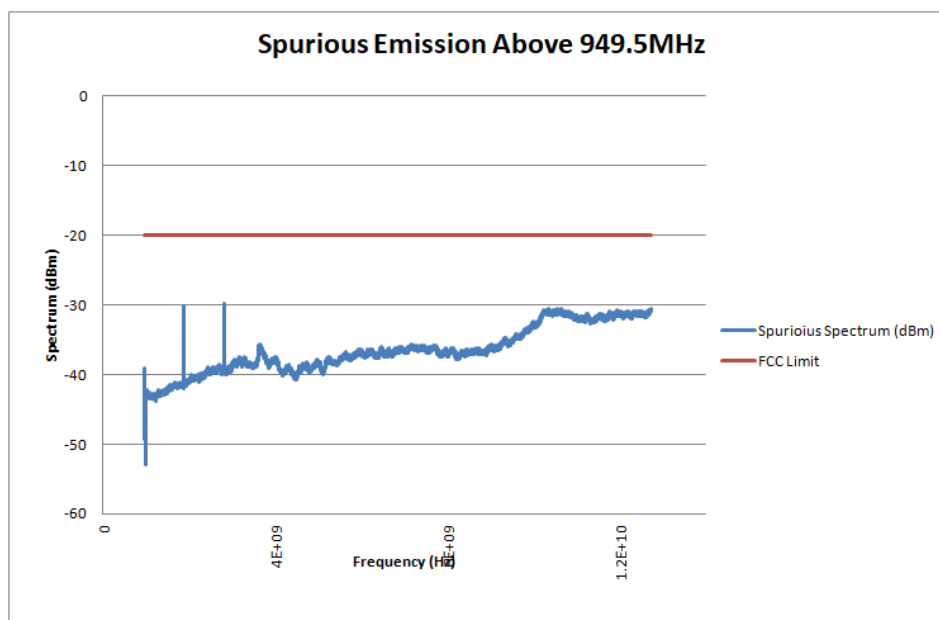
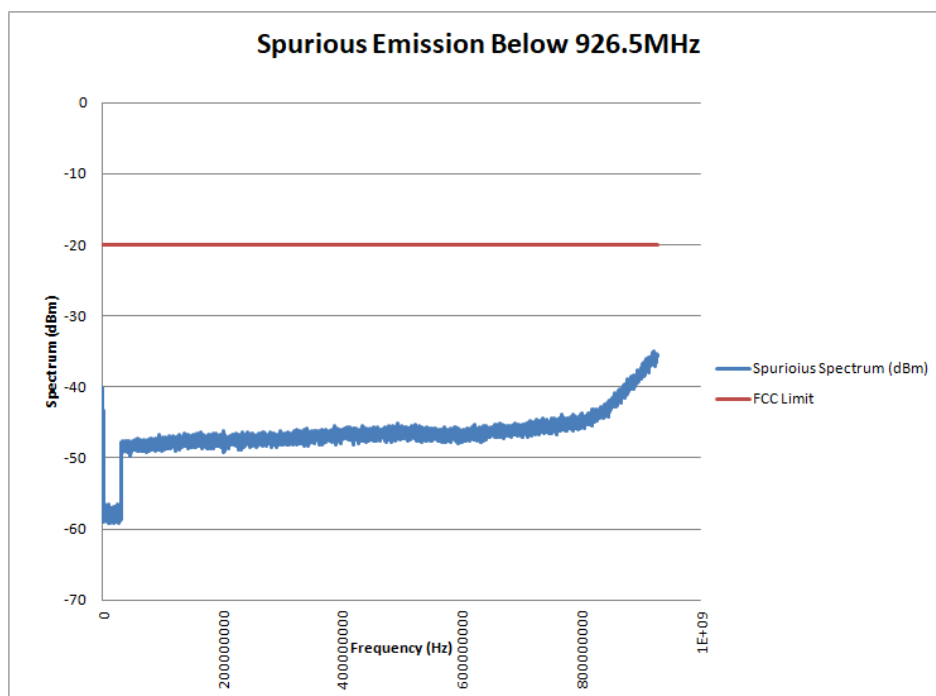
F1-7.3 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 937.2MHz Tx1

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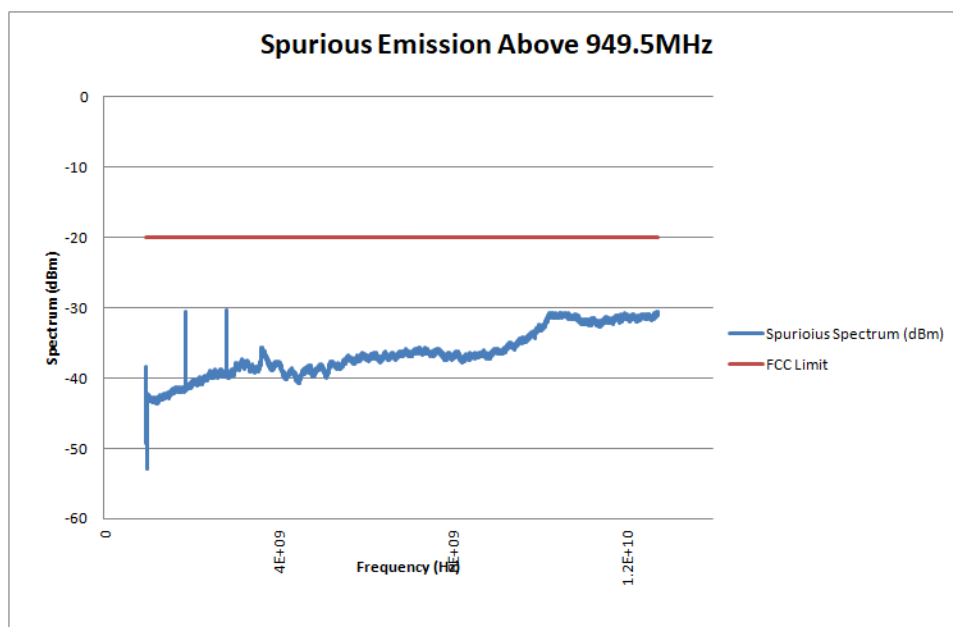
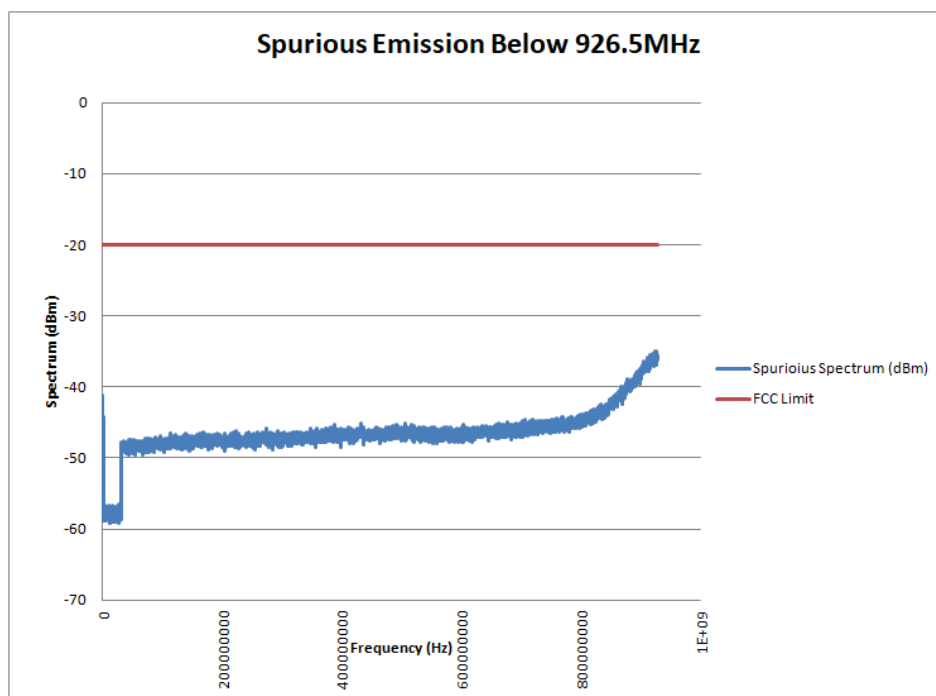
F1-7.4 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 937.2MHz Tx2

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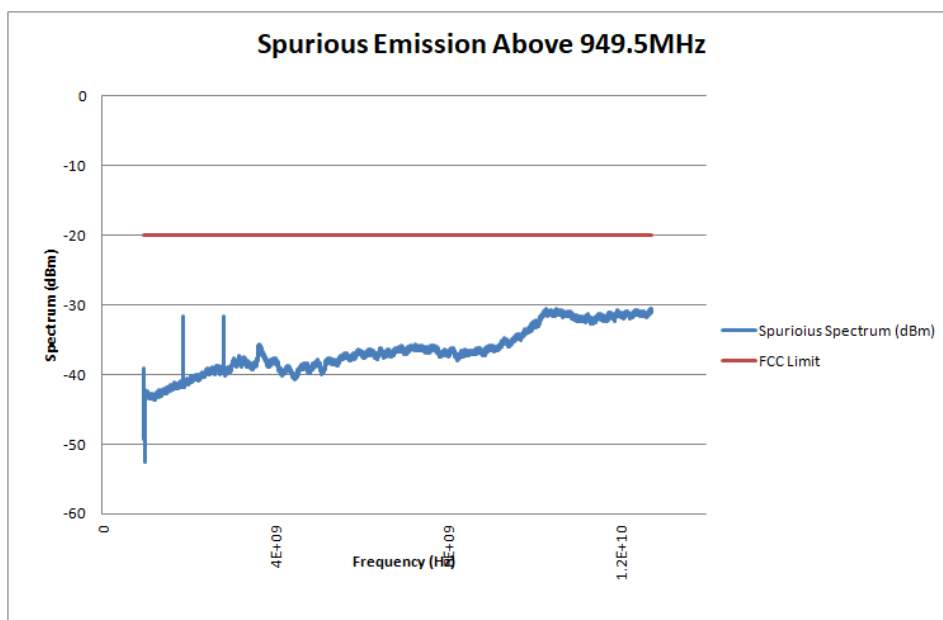
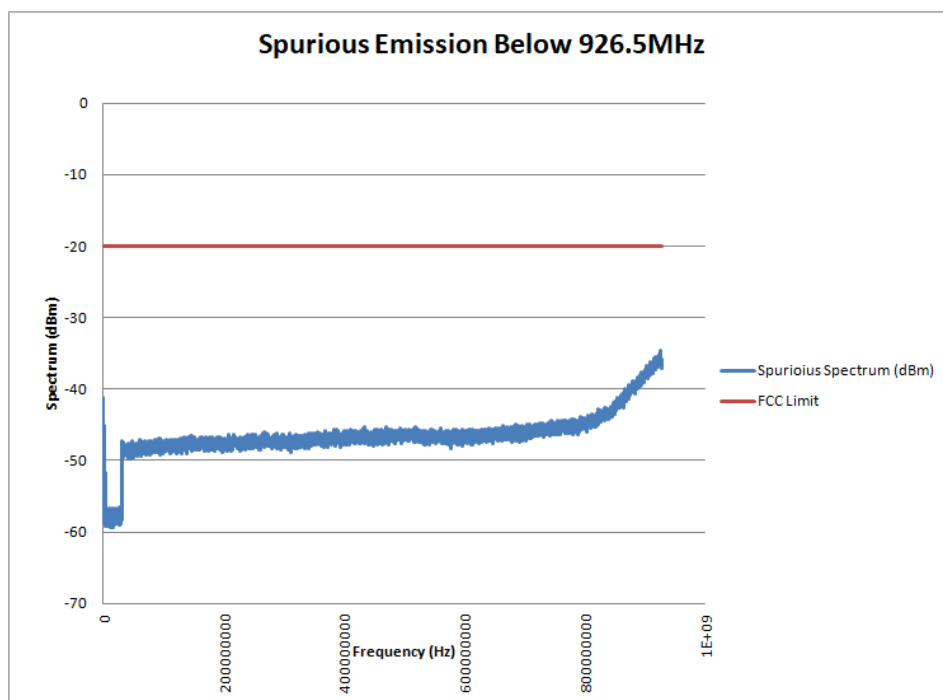
F1-7.5 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 938.7MHz Tx1

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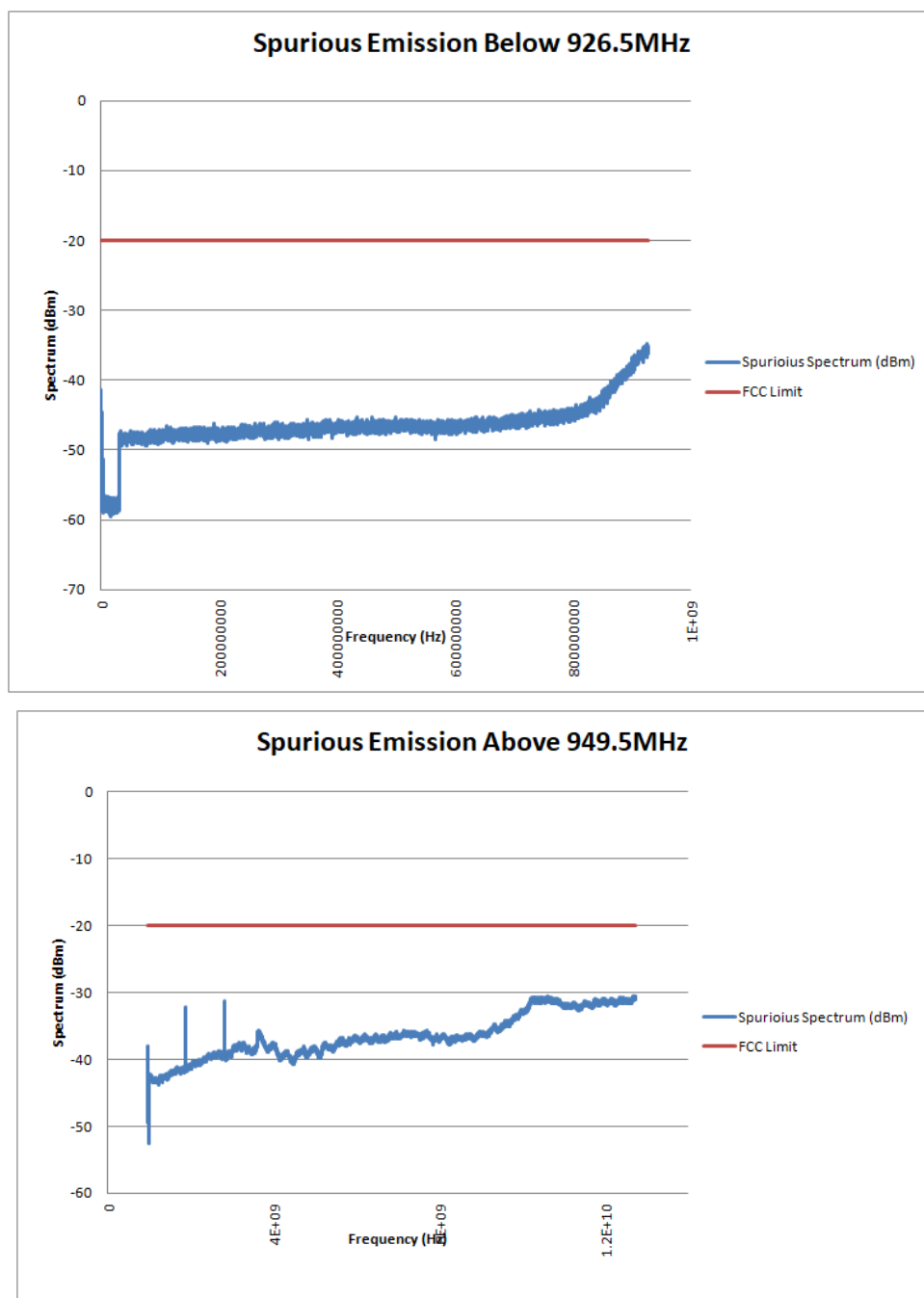
F1-7.6 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW, 938.7MHz Tx2

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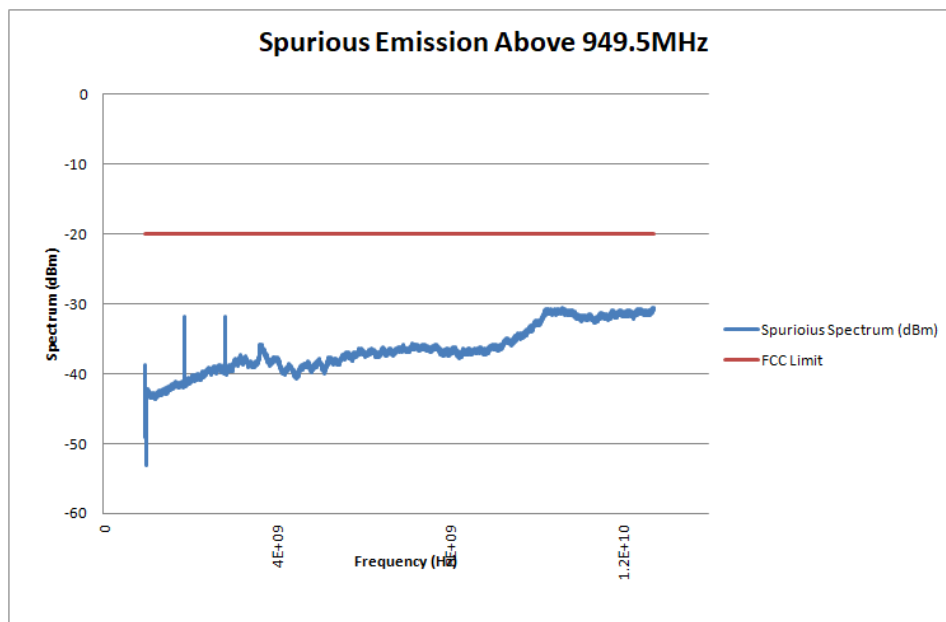
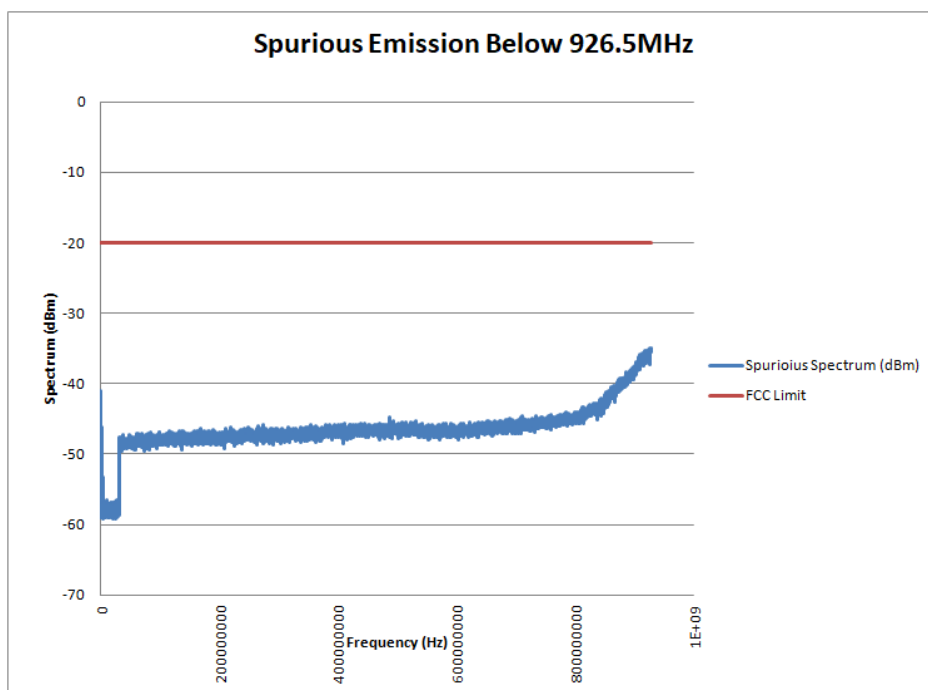
F1-7.7 Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW, 937.2/938.8MHz Tx1

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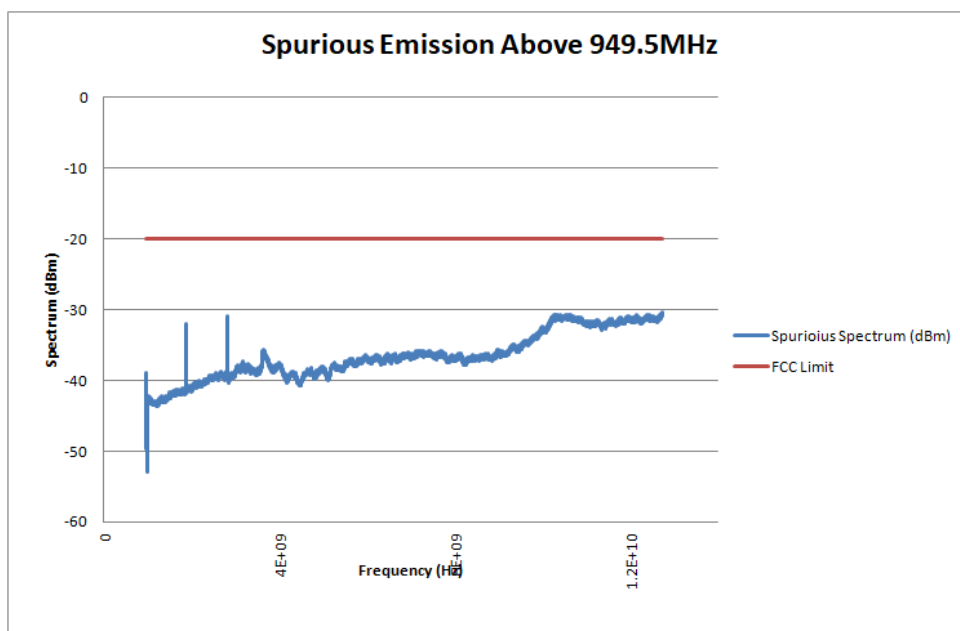
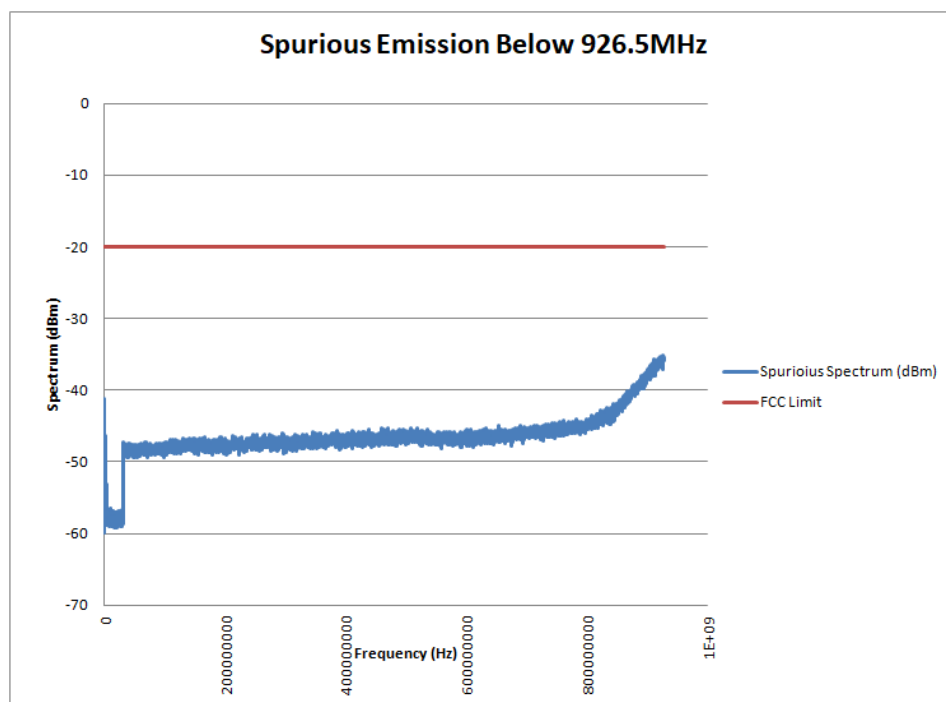
F1-7.8 Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW, 937.2/938.8MHz Tx2

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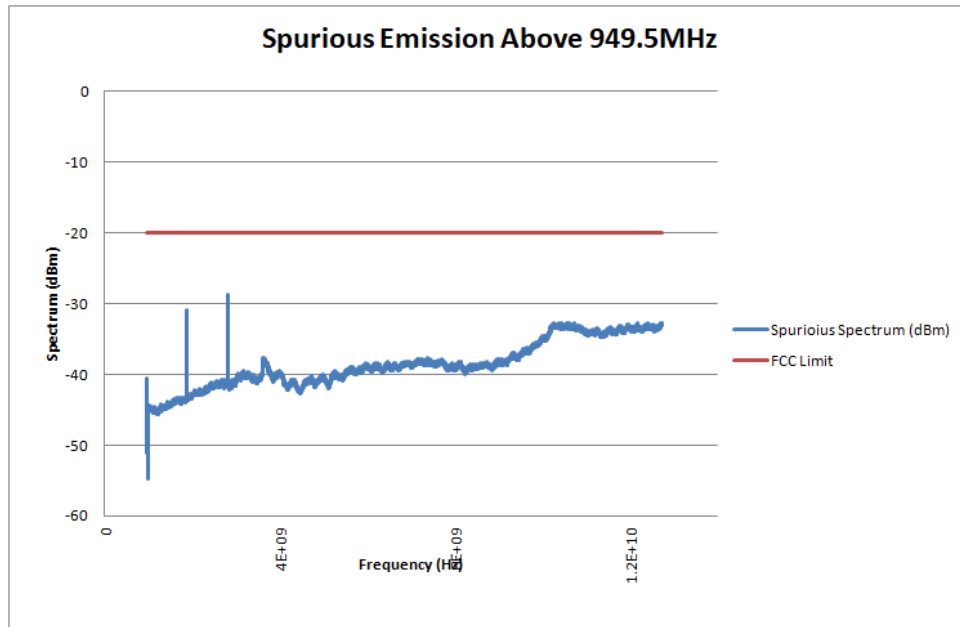
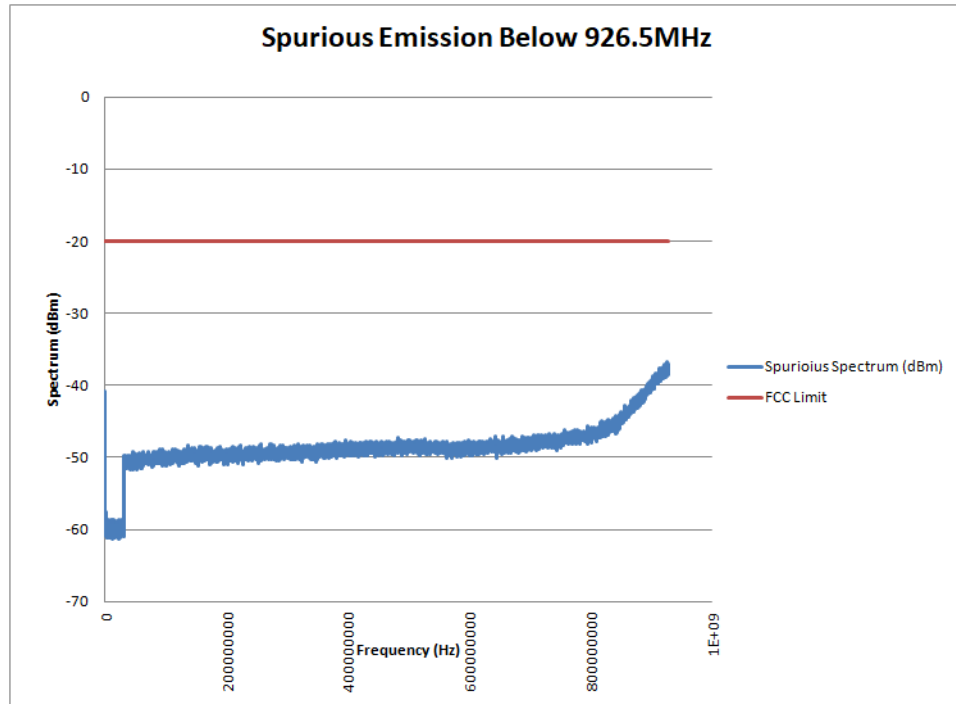
F1-7.9 Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW + NB IoT, 937.3/938.8/938MHz Tx1

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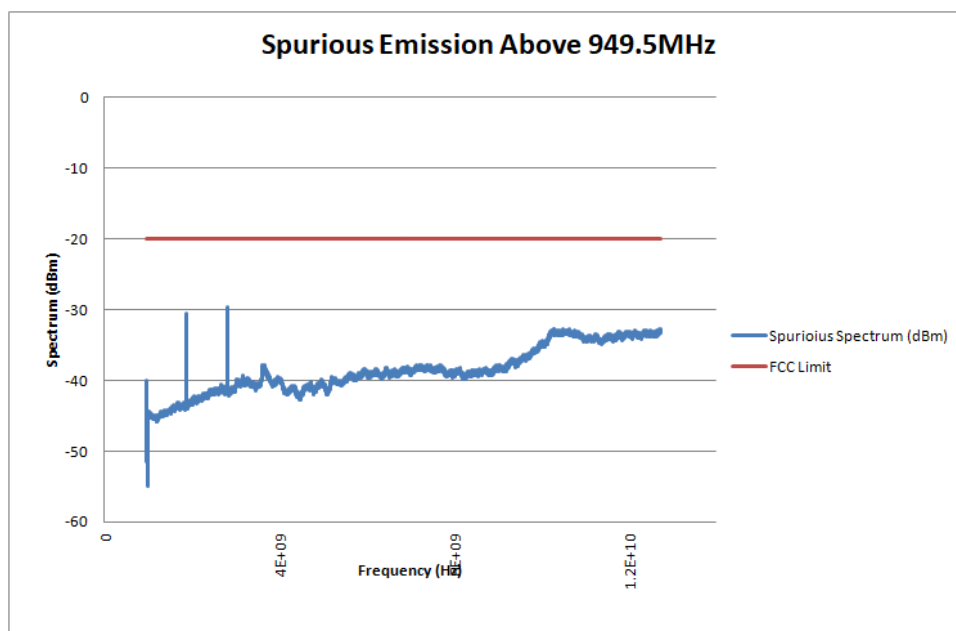
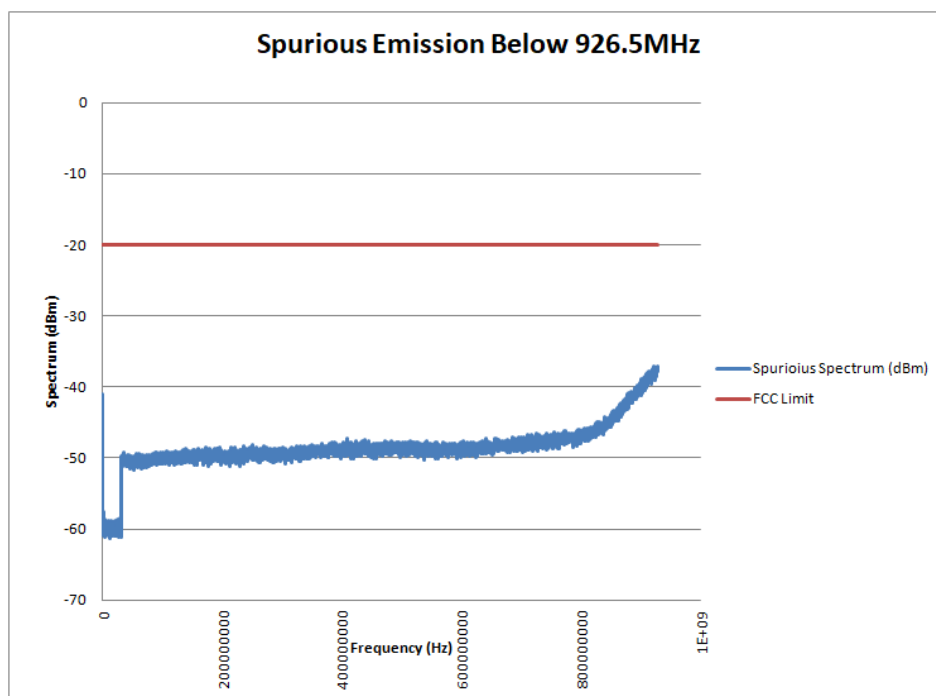
F1-7.10 Conducted Spurious Emissions, Power Output 80 Watts, 2x1.4MHz BW + NB IoT, 937.3/938.8/938MHz Tx2

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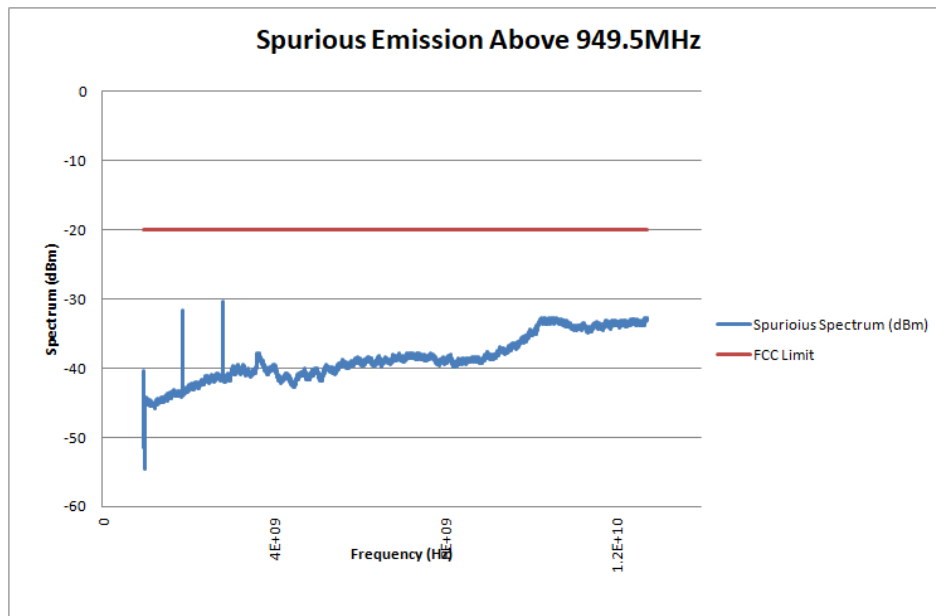
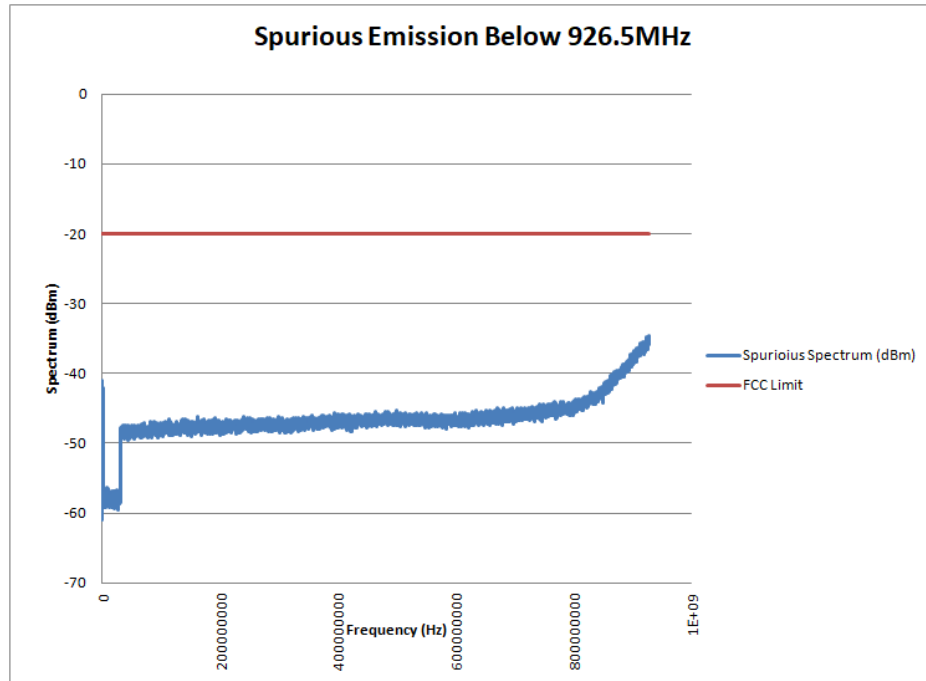
F1-7.11 Conducted Spurious Emissions, Power Output 50 Watts, NBIoT, 936.7MHz Tx1

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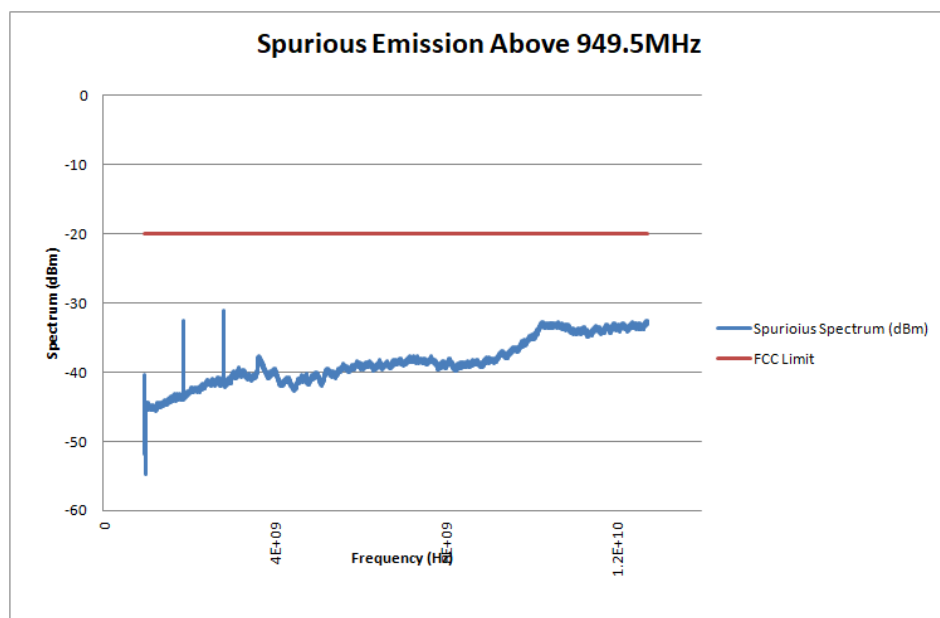
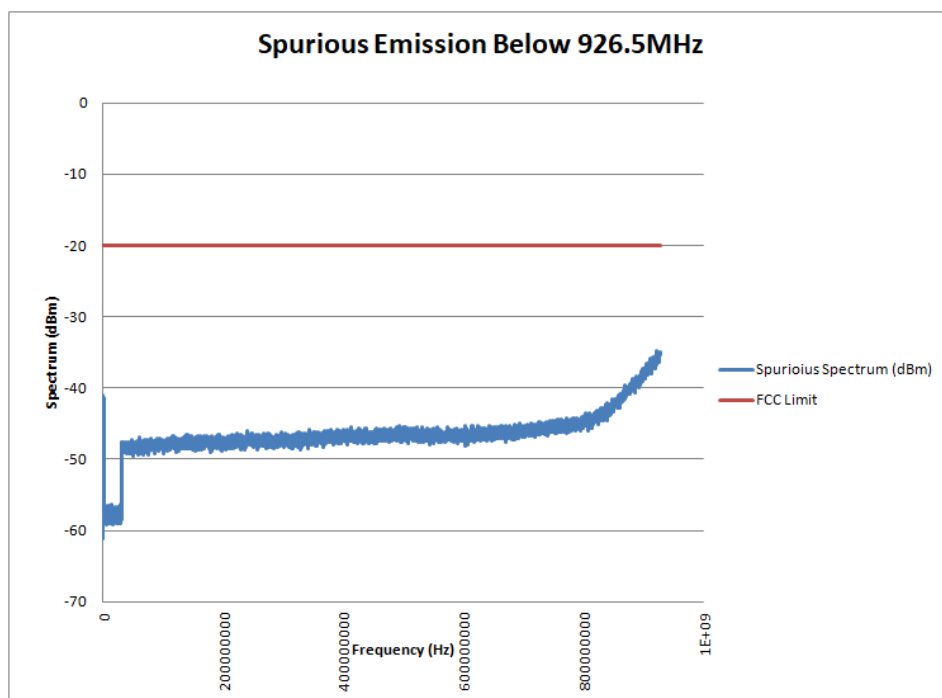
F1-7.12 Conducted Spurious Emissions, Power Output 50 Watts, NBIoT, 936.7MHz Tx2

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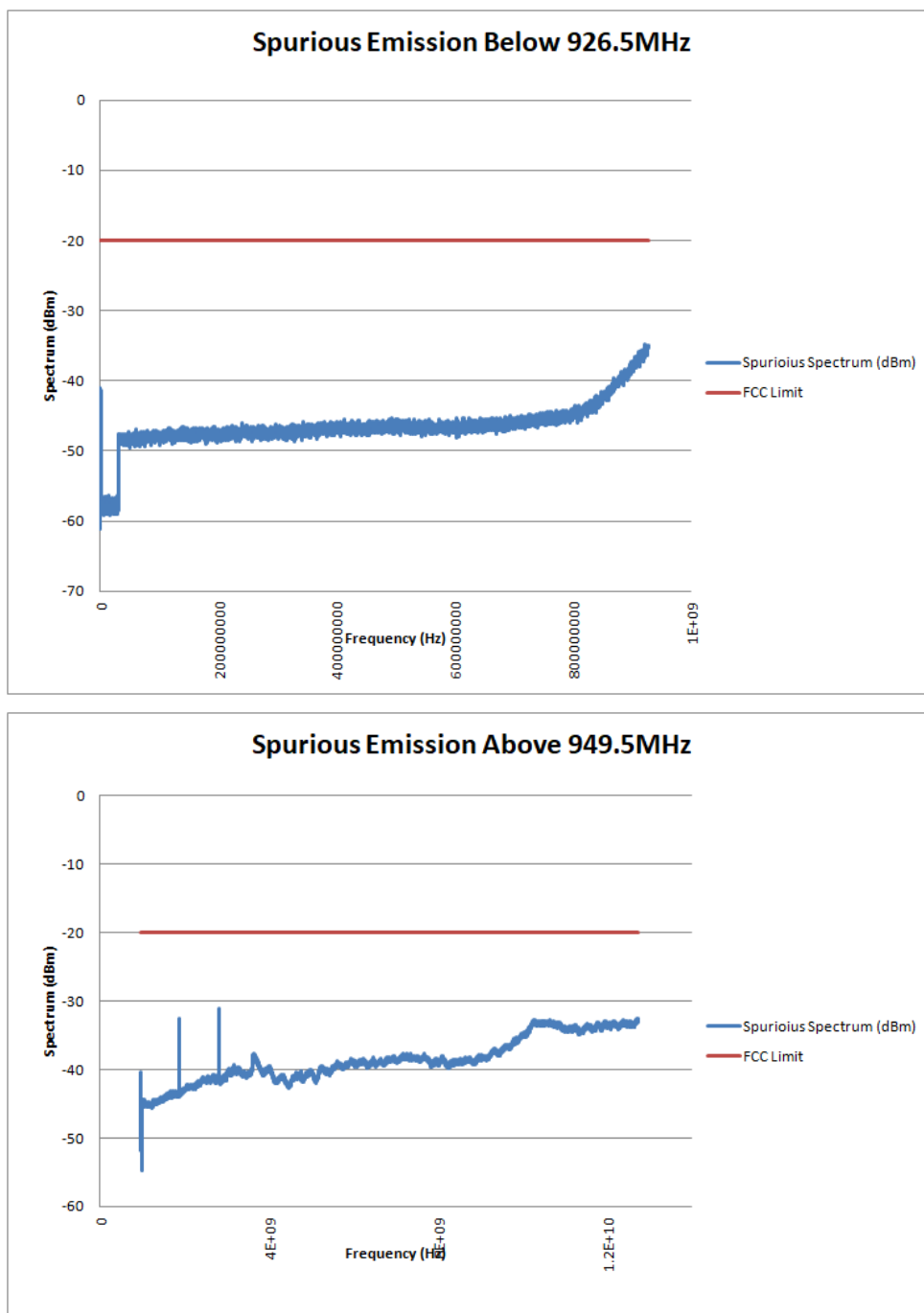
F1-7.13 Conducted Spurious Emissions, Power Output 50 Watts, 2xNB IoT, 936.7/937MHz Tx1

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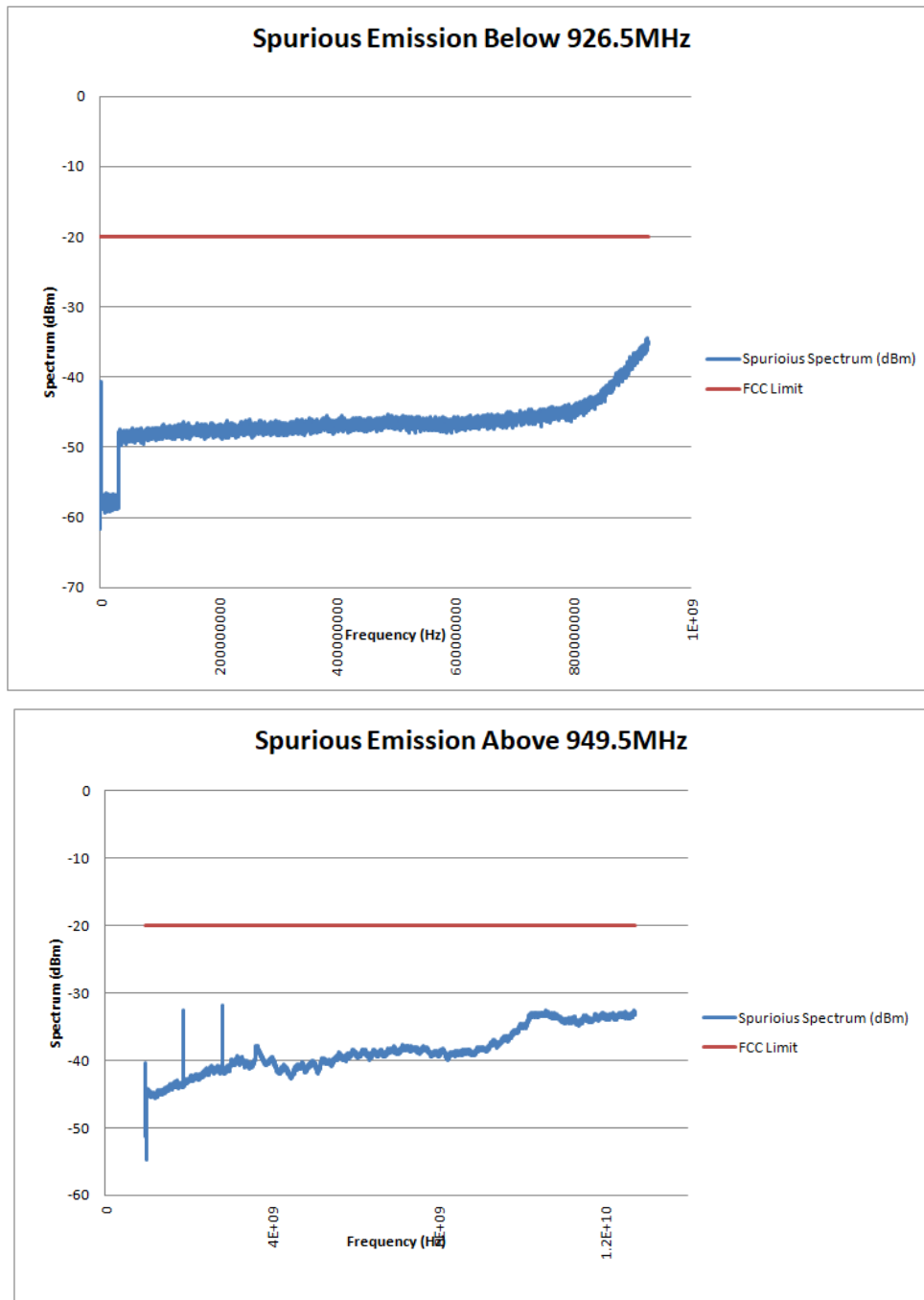
F1-7.14 Conducted Spurious Emissions, Power Output 50 Watts, 2xNB IoT, 936.7/937MHz Tx2

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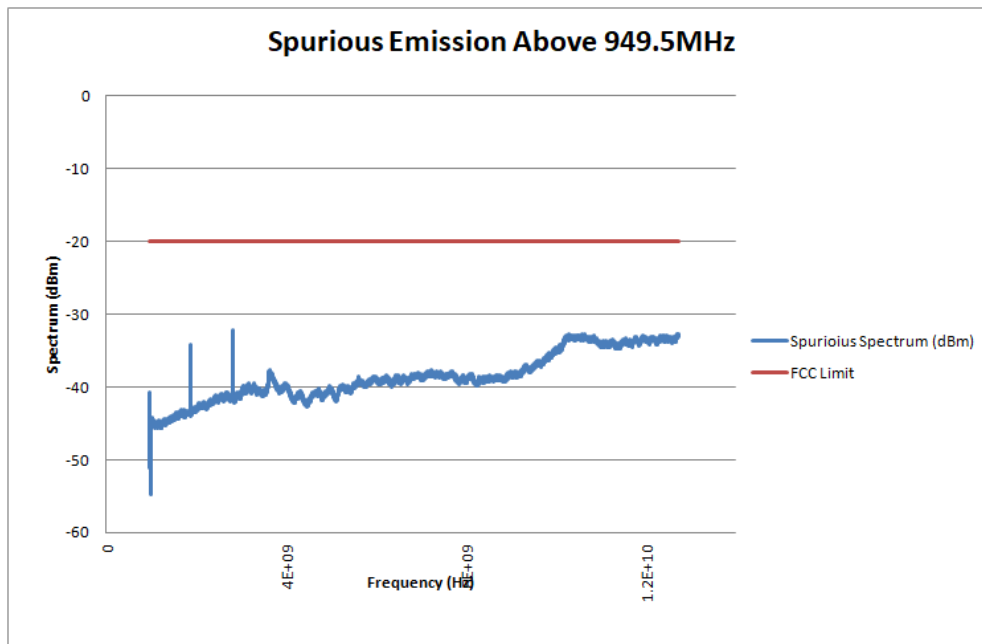
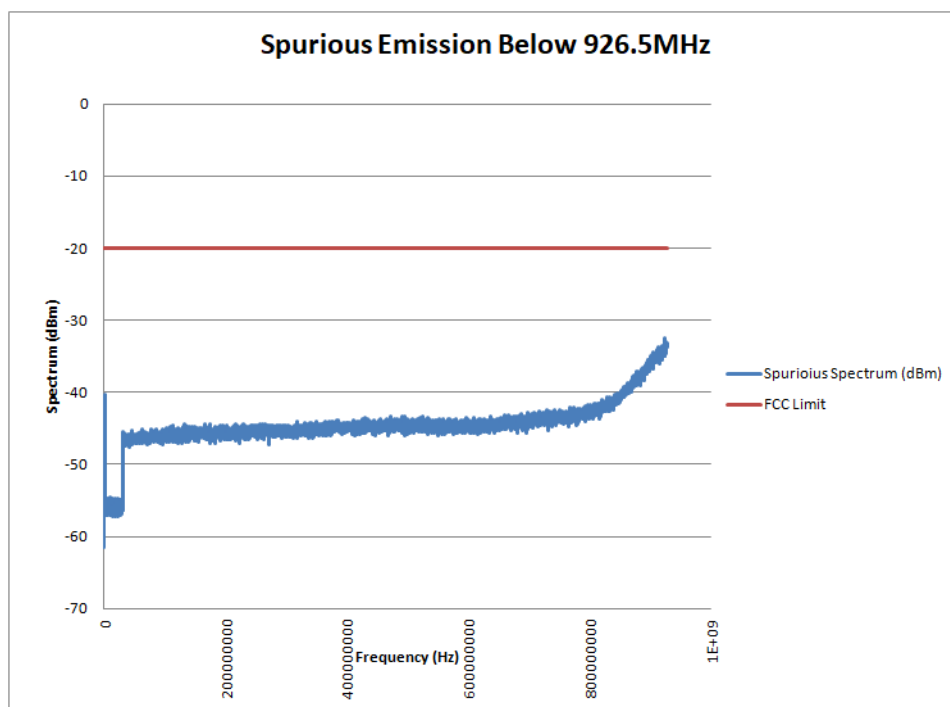
F1-7.15 Conducted Spurious Emissions, Power Output 50 Watts,3xNB IoT, 936.7/937/937.3MHz
Tx1

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



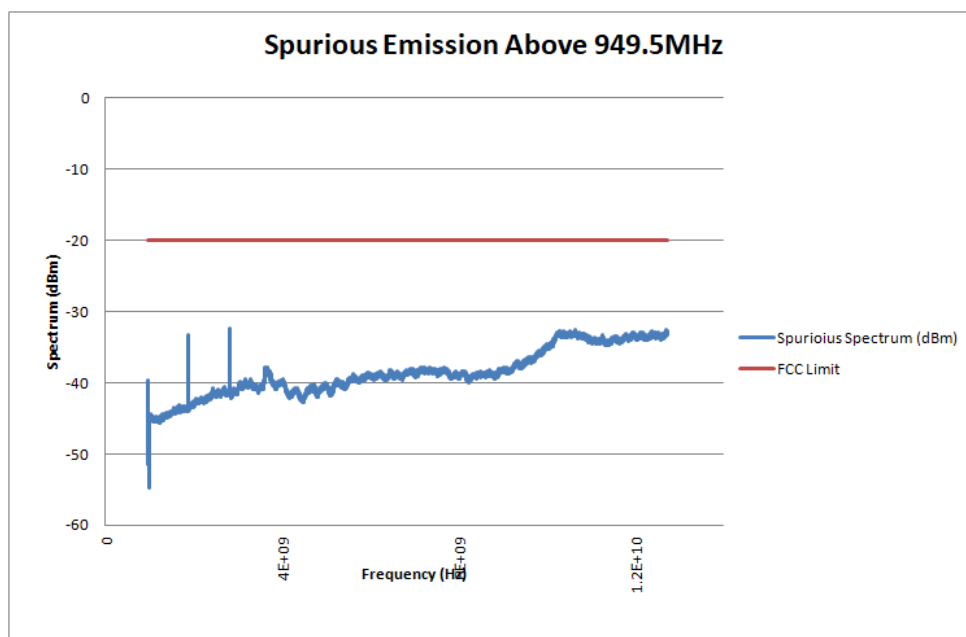
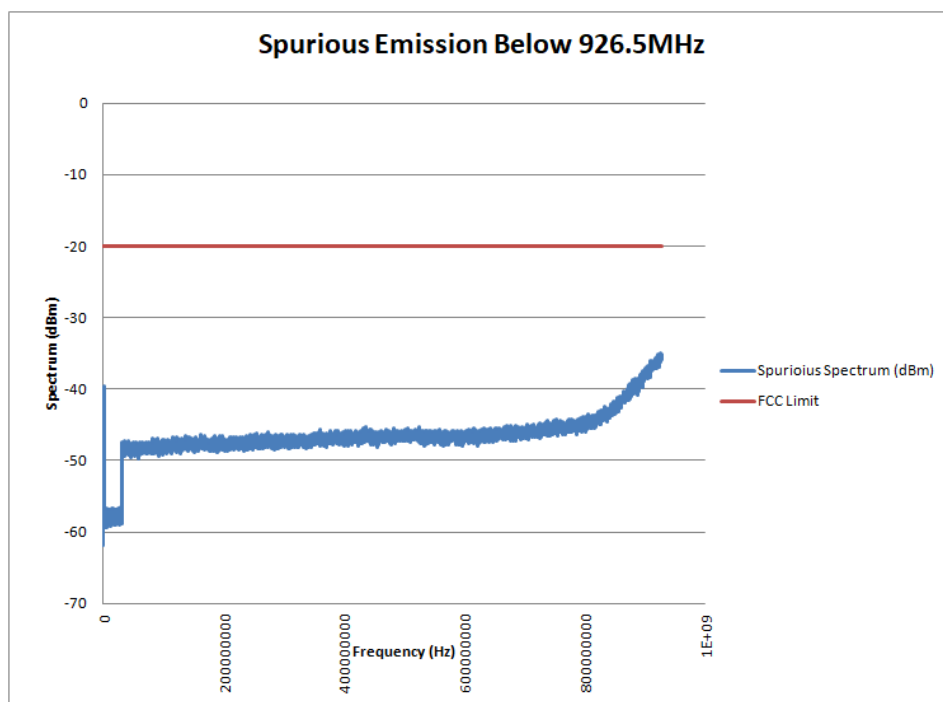
F1-7.16 Conducted Spurious Emissions, Power Output 50 Watts, 3xNB IoT, 936.7/937/937.3 MHz
Tx2

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



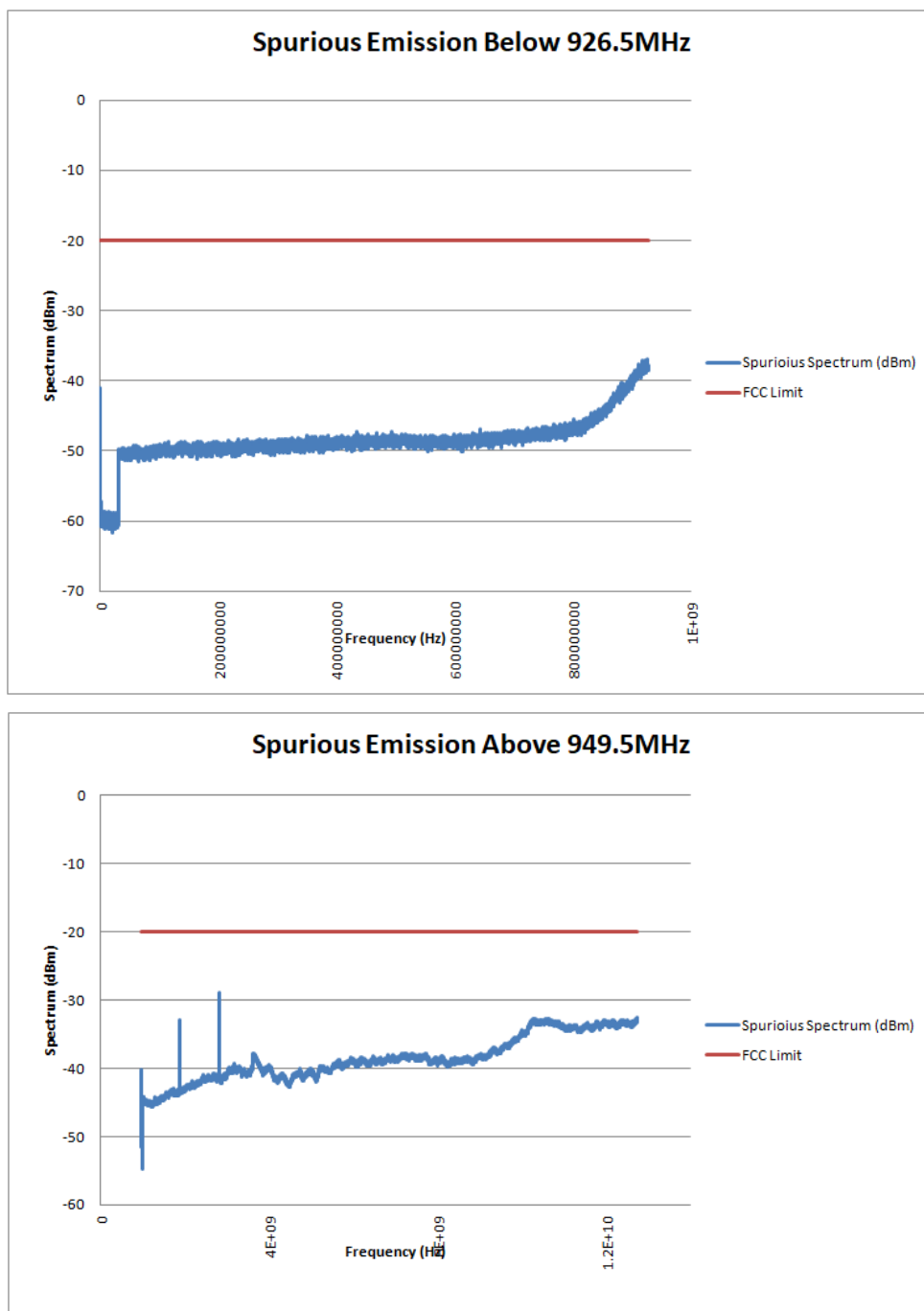
F1-7.17 Conducted Spurious Emissions, Power Output 50 Watts, 4xNB IoT,
936.7/937/937.3/937.6MHz Tx1

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



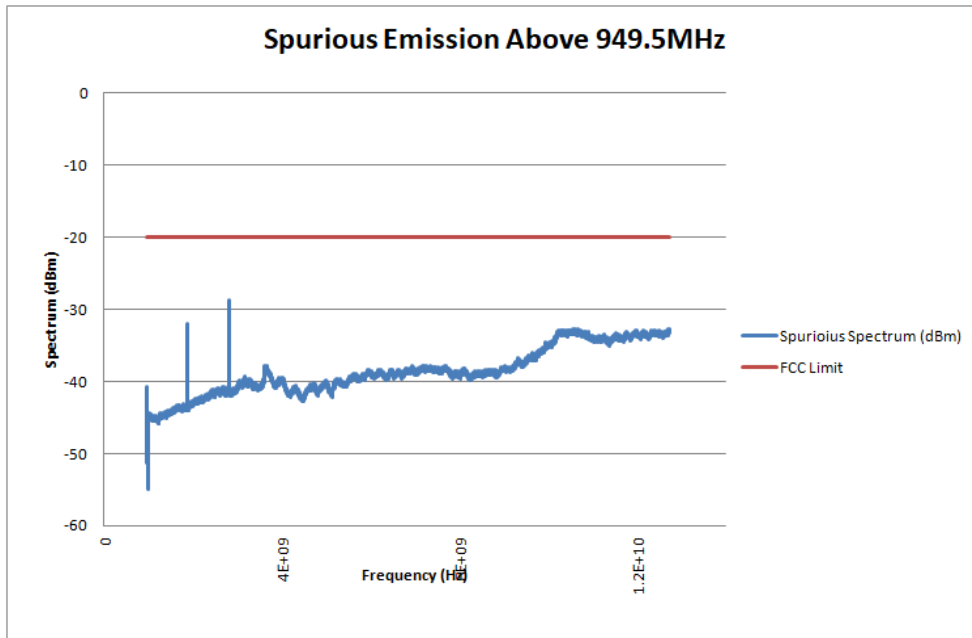
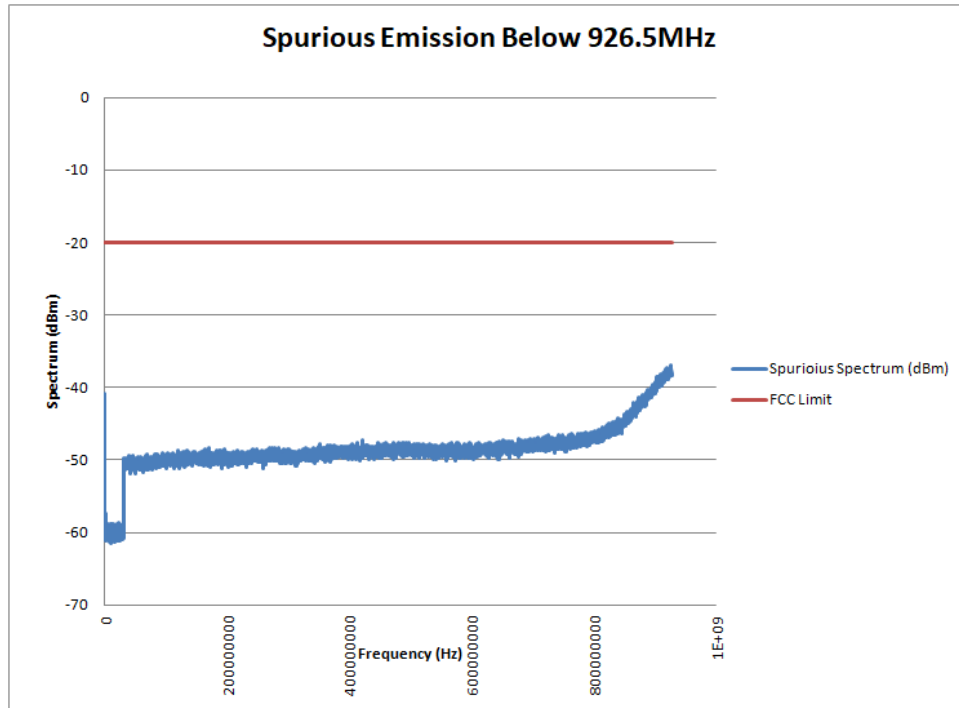
F1-7.18 Conducted Spurious Emissions, Power Output 50 Watts, 4xNB IoT, 936.7/937/937.3/937.6MHz Tx2

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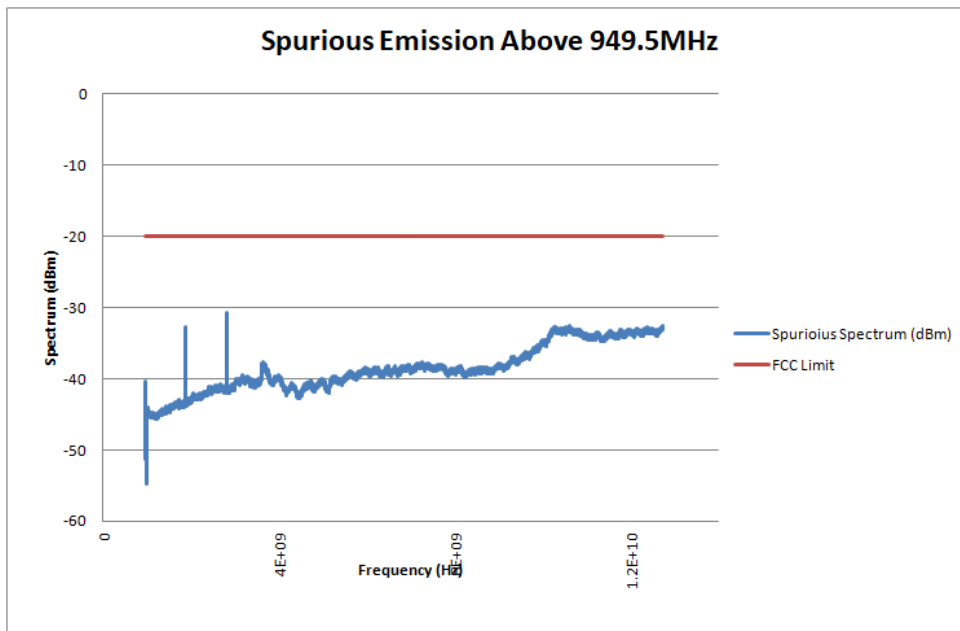
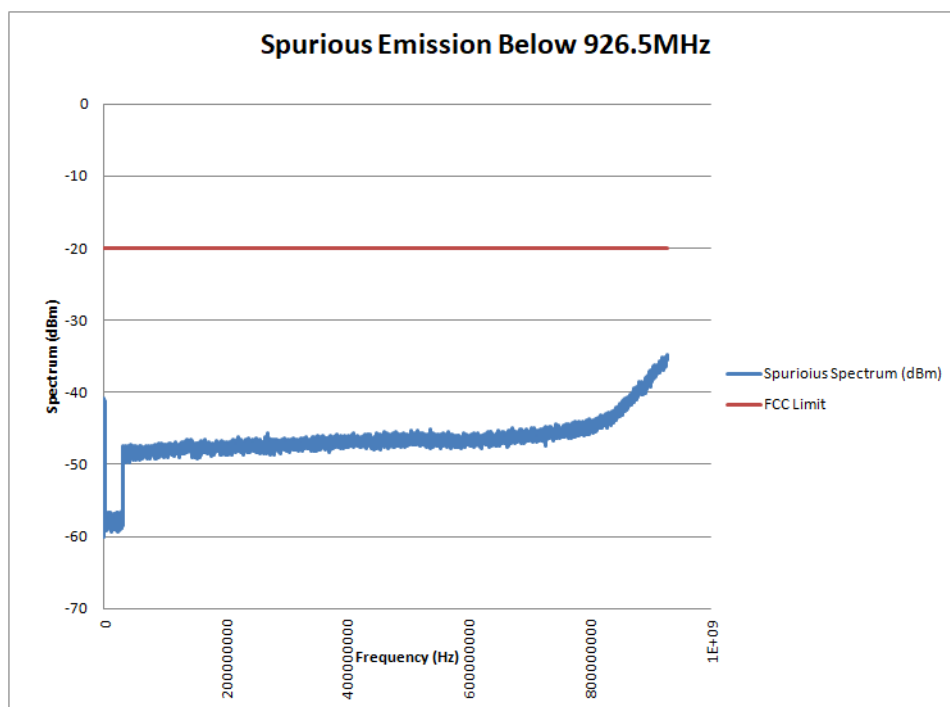
F1-7.19 Conducted Spurious Emissions, Power Output 50 Watts,NB IoT, 939.3MHz Tx1

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



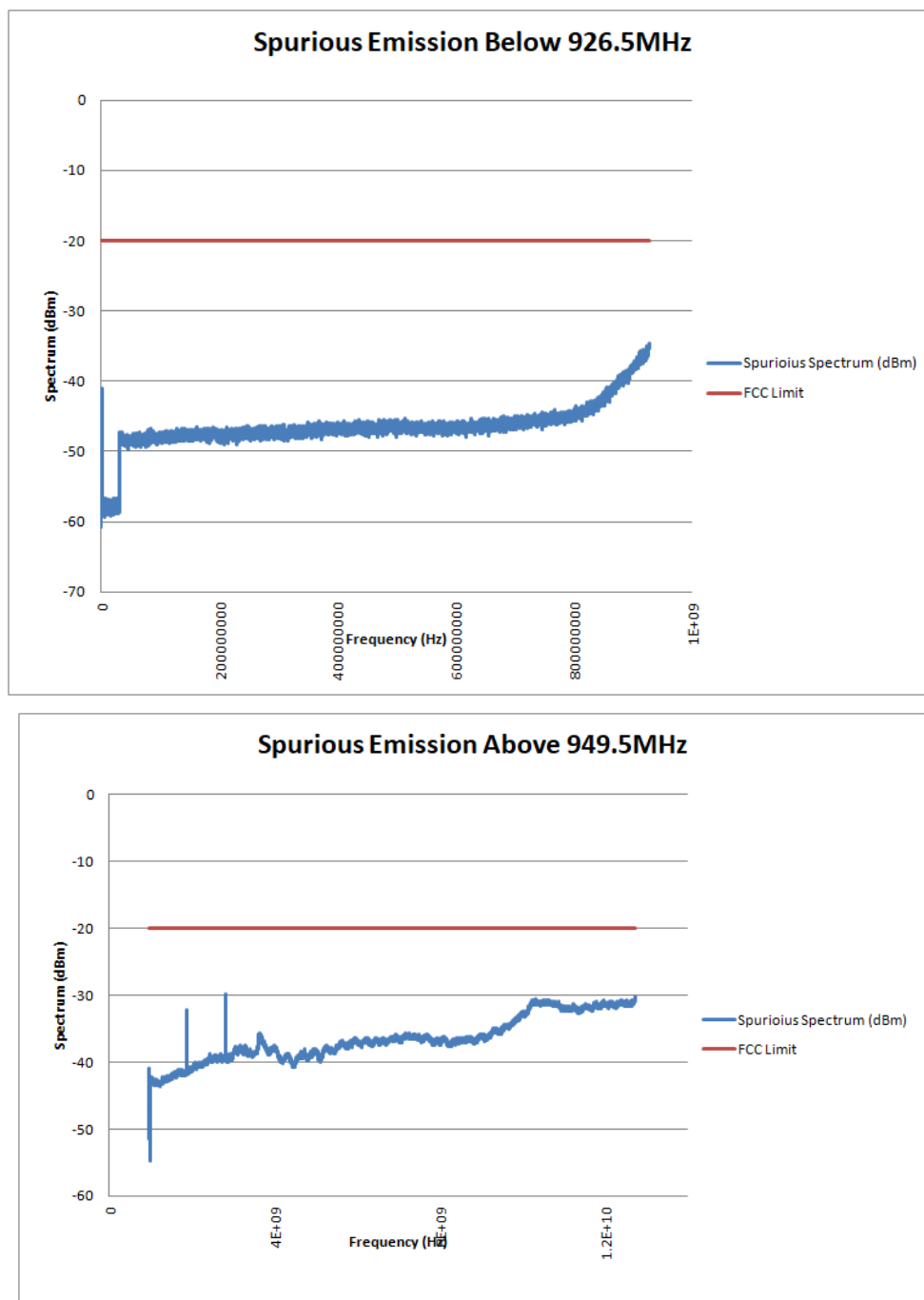
F1-7.20 Conducted Spurious Emissions, Power Output 50 Watts,NB IoT, 939.3MHz Tx2

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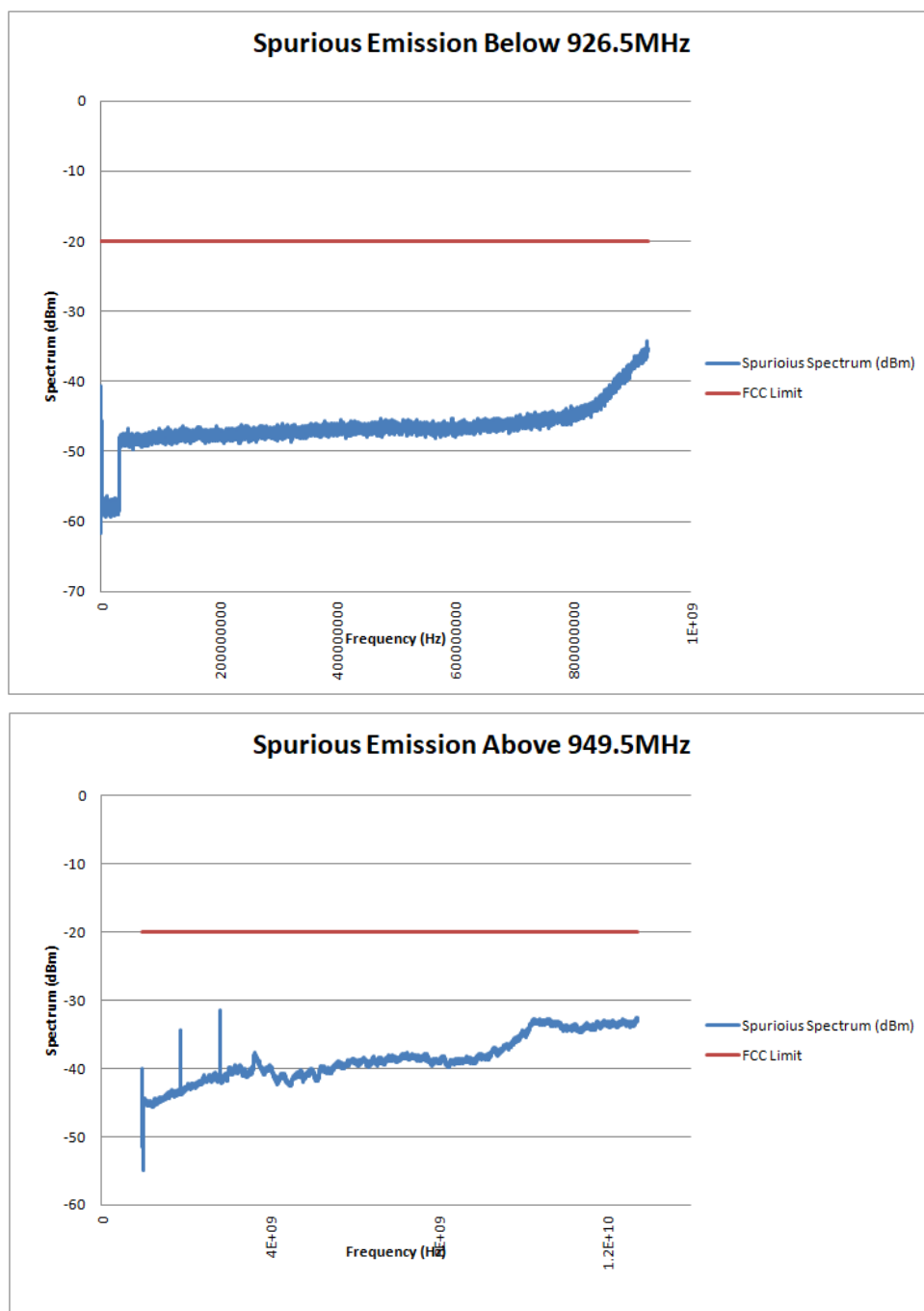
F1-7.21 Conducted Spurious Emissions, Power Output 50 Watts, 2xNB IoT, 939/939.3MHz Tx1

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



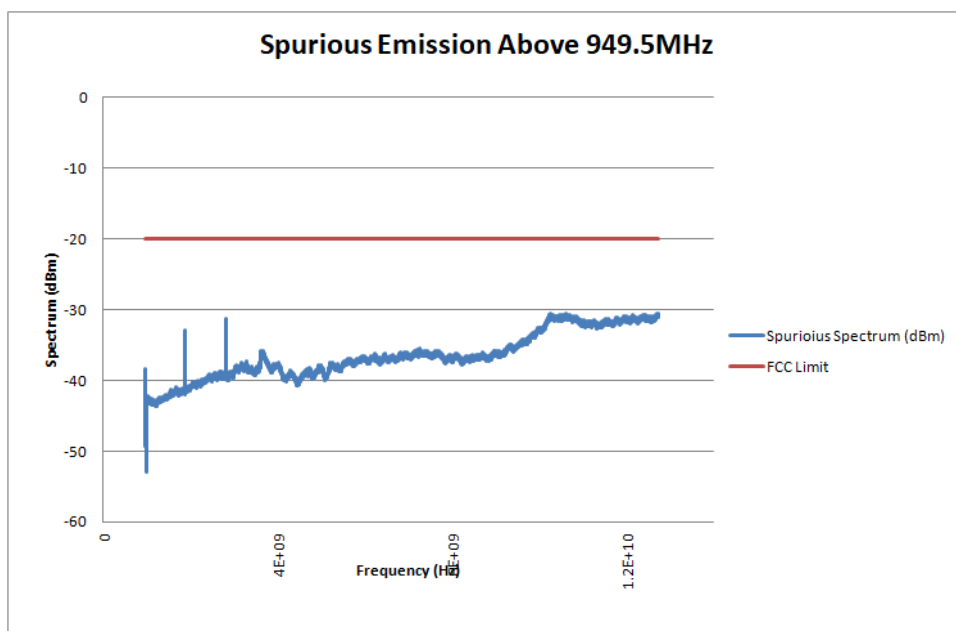
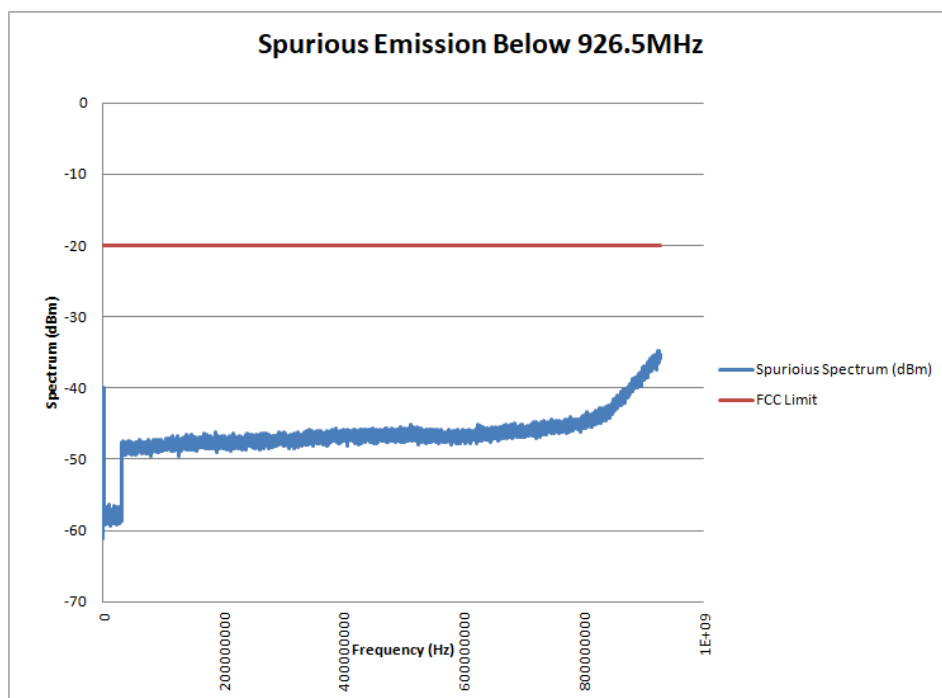
F1-7.22 Conducted Spurious Emissions, Power Output 50 Watts, 2xNB IoT, 939/939.3 MHz Tx2

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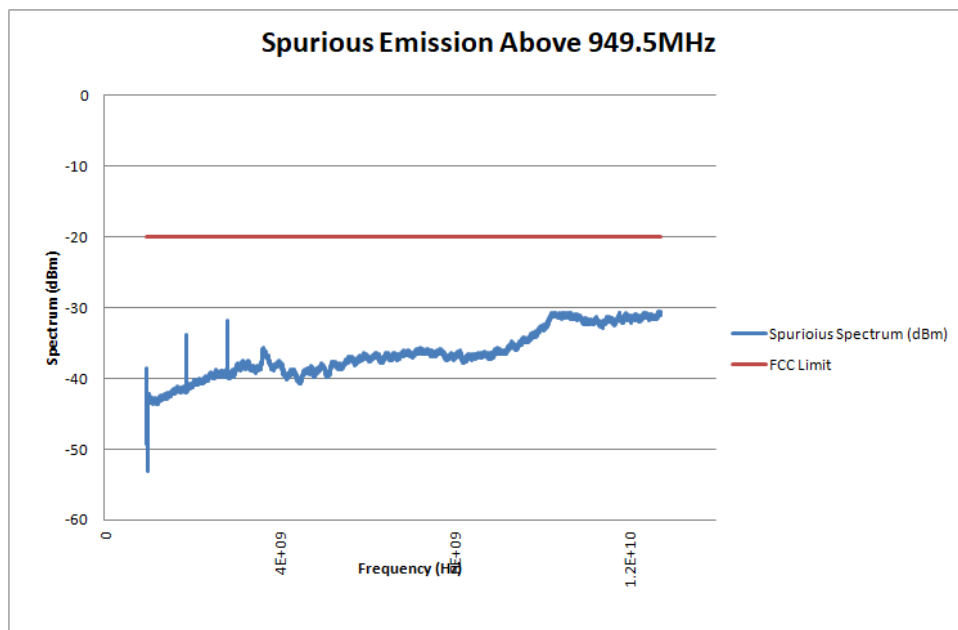
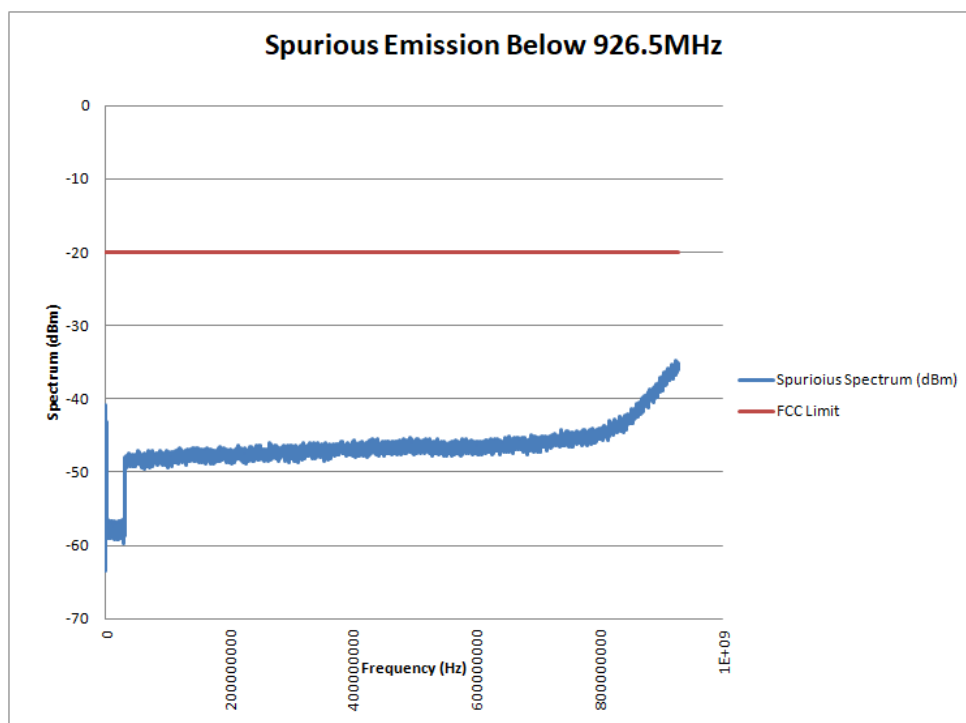
F1-7.23 Conducted Spurious Emissions, Power Output 50 Watts, 3xNB IoT, 938.7/939/939.3 MHz Tx1

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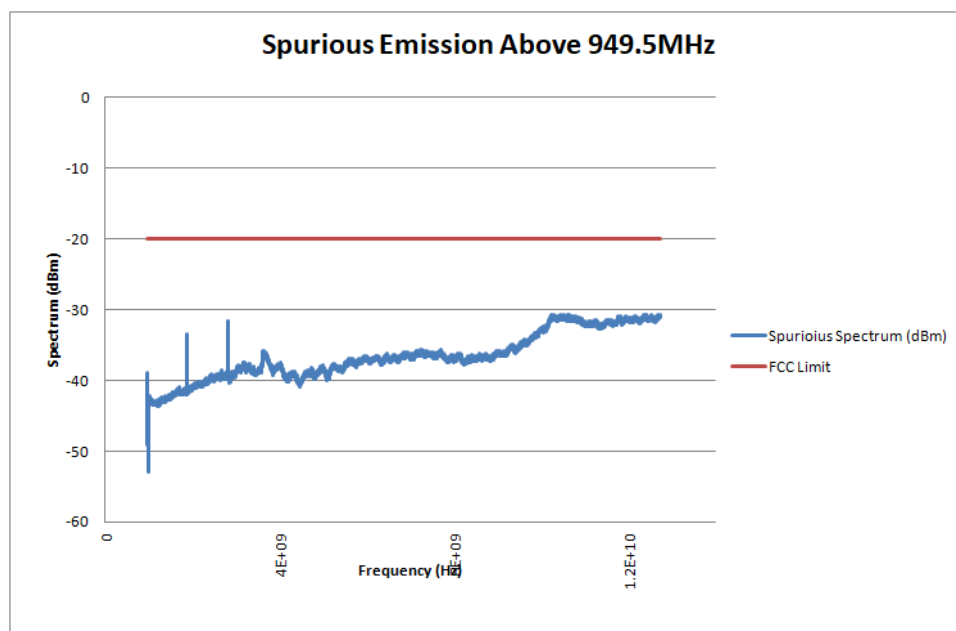
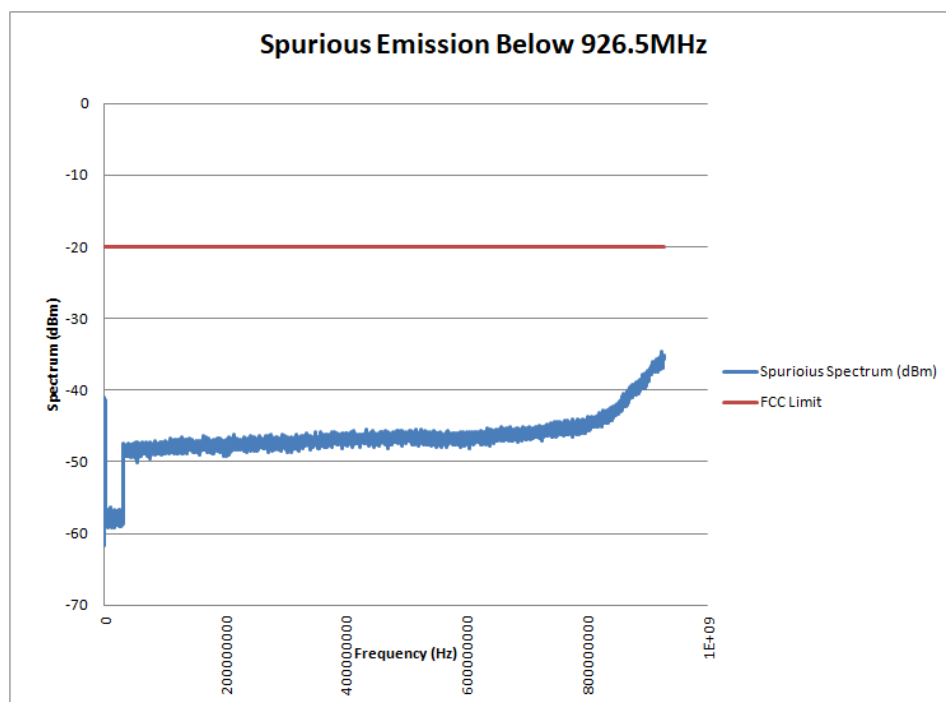
F1-7.24 Conducted Spurious Emissions, Power Output 50 Watts, 3xNB IoT, 938.7/939/939.3MHz Tx2

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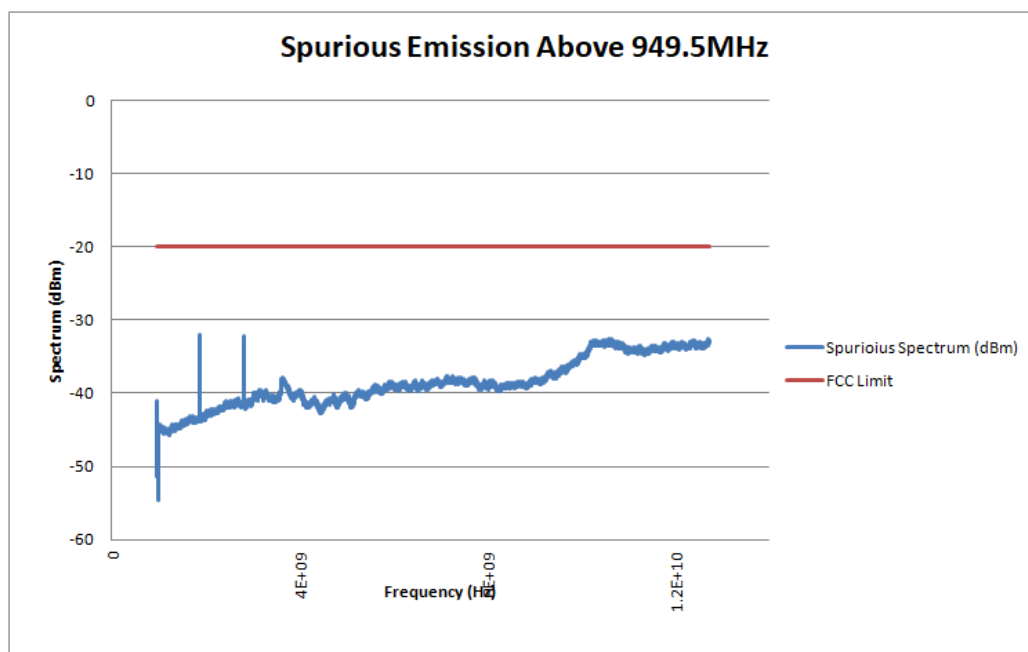
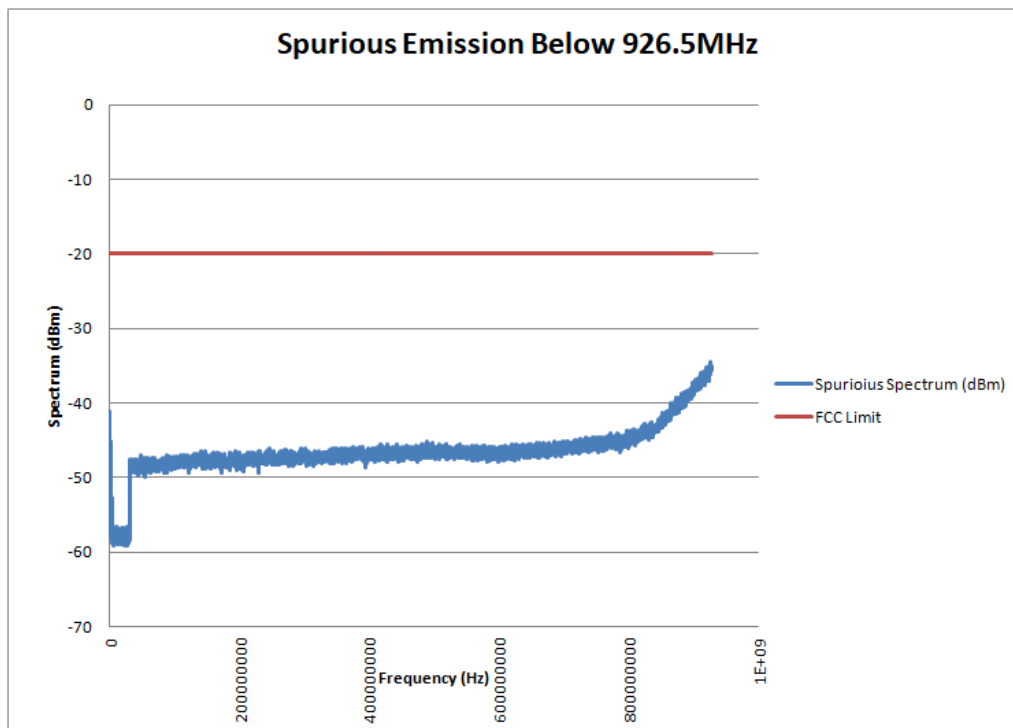
F1-7.25 Conducted Spurious Emissions, Power Output 50 Watts, 4xNB IoT, 938.4/938.7/939/939.3MHz Tx1

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



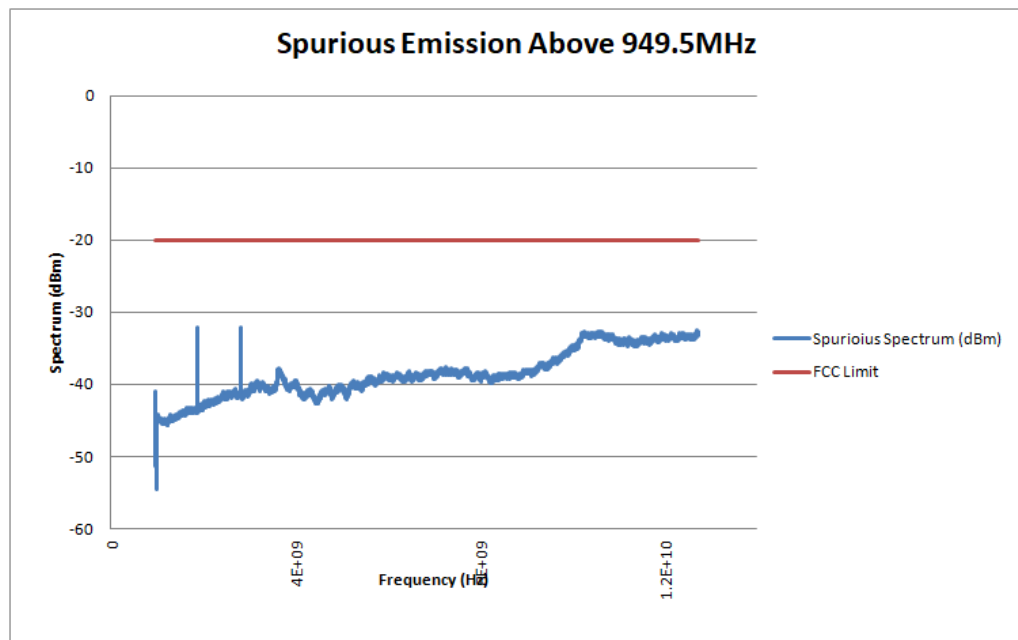
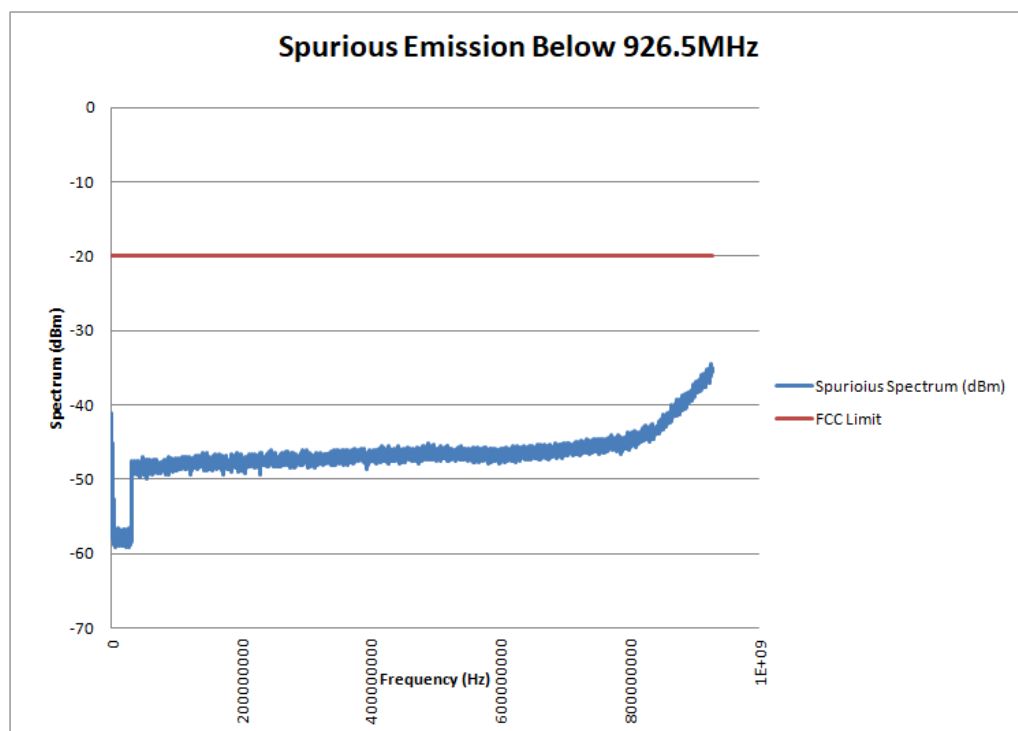
F1-7.26 Conducted Spurious Emissions, Power Output 50 Watts, 4xNB IoT, 938.4/938.7/939/939.3MHz Tx2

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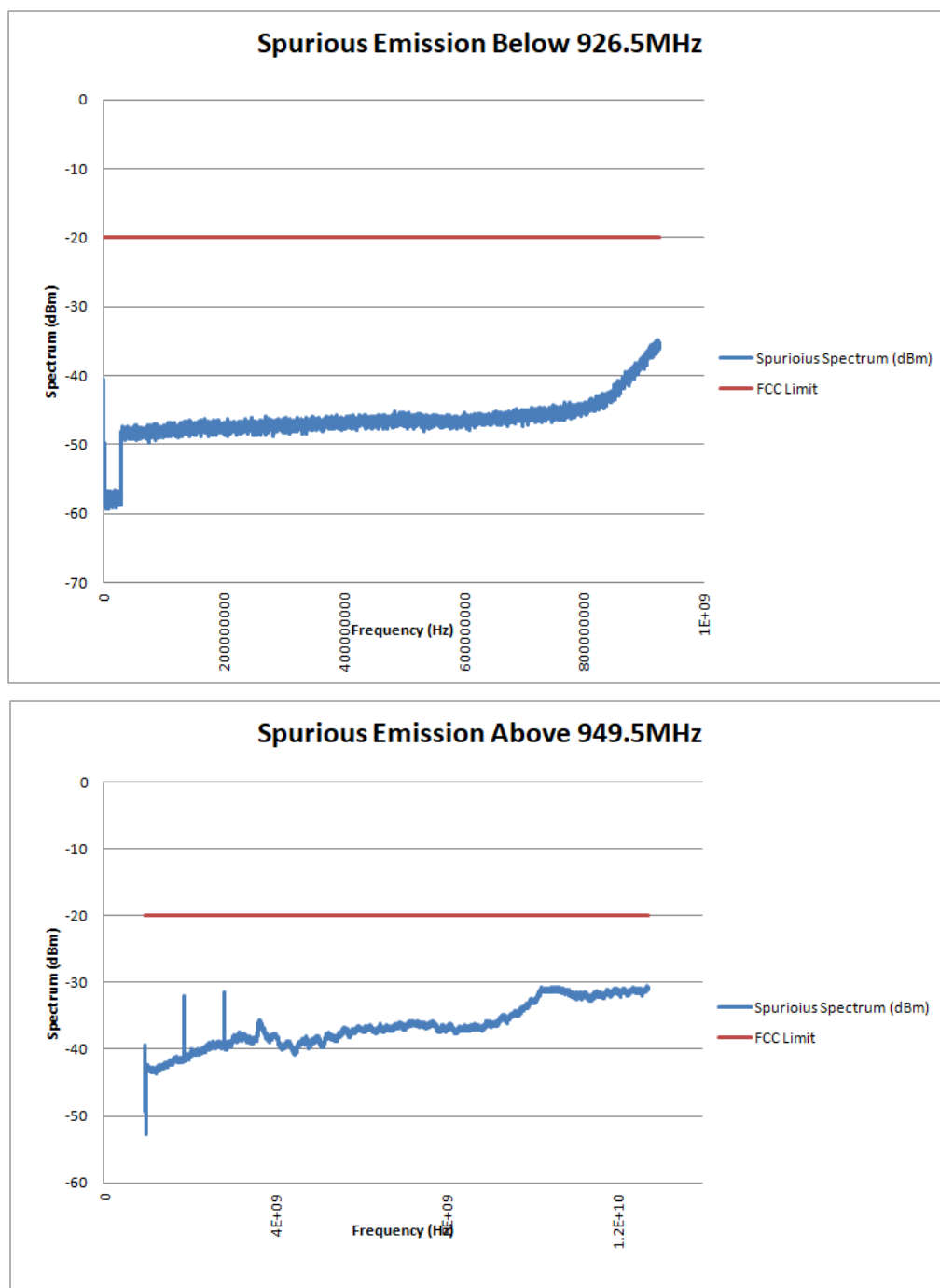
F1-7.27 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW + 4xNB IoT,
937.2/938.4/938.7/939.0/939.3MHz Tx1

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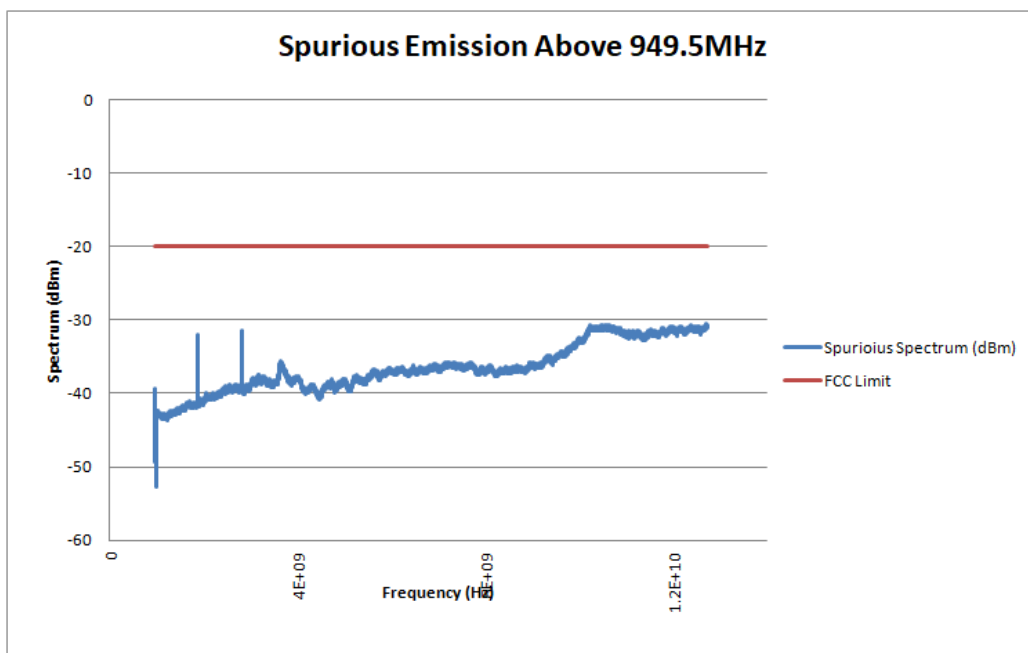
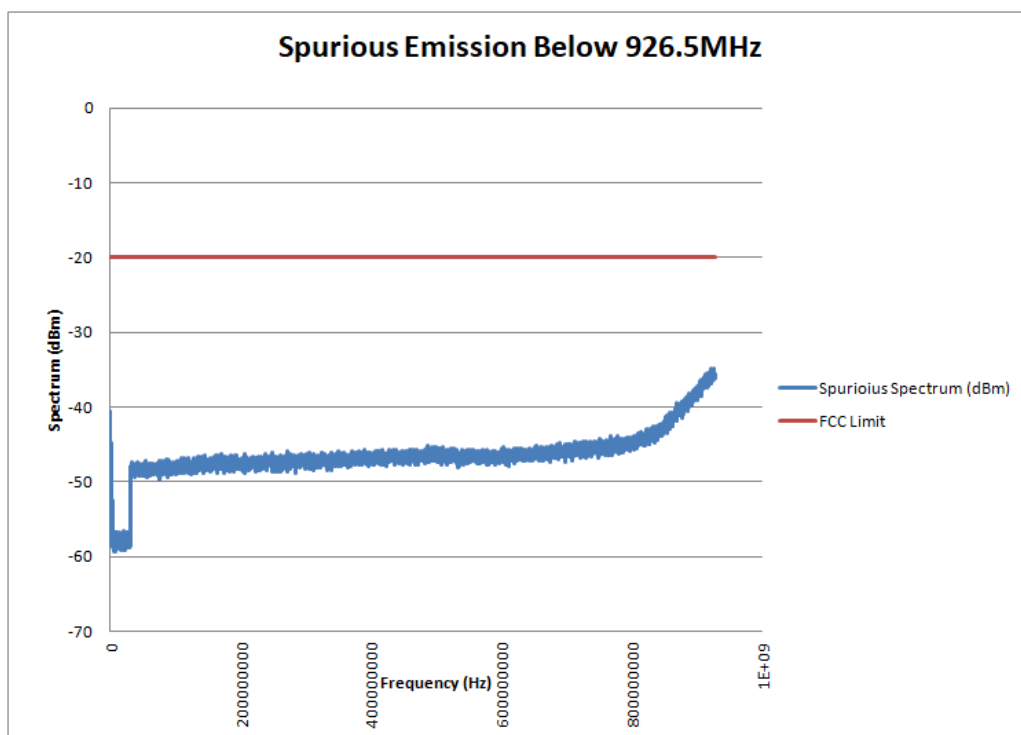
F1-7.28 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW + 4xNB IoT,
937.2/938.4/938.7/939.0/939.3MHz Tx2

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F1-7.29 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW + 4xNB IoT, 938.8/936.7/937.0/937.3/937.6MHz Tx1

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F1-7.30 Conducted Spurious Emissions, Power Output 80 Watts, 1.4MHz BW + 4xNBIoT, 938.8/936.7/937.0/937.3/937.6MHz Tx2

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F1-8 Radiated Spurious Emissions per CFR 47 2.1051

Specification Requirement 47 CFR §27.1509(b) - Emission Limits:

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) in watts by at least the following amounts:

(b) For 900 MHz broadband operations in the 936.5-939.5 MHz band, by at least $50 + 10 \log (P)$ dB.

Freq (MHz)	Antenna Polarization	Attenuation Below Output Power (dB)
1873.2	H	127.3
1873.2	V	127.0
2809.8	H	119.4
2809.8	V	119.4
3746.4	H	115.8
3746.4	V	115.6
4683	H	116.3
4683	V	116.3
5619.6	H	113.8
5619.6	V	113.8
6556.2	H	110.8
6556.2	V	110.4
7492.8	H	107.3
7492.8	V	107.3
8429.4	H	108.7
8429.4	V	108.7
9366	H	106.6
9366	V	106.6

Carrier frequency = 936.6MHz

Modulation - NBLoT

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

Minimum attenuation = $50 + 10 \cdot \log(50) = 67\text{dB}$

Freq (MHz)	Antenna Polarization	Attenuation Below Output Power (dB)
1878.8	H	127.4
1878.8	V	127.1
2818.2	H	119.4
2818.2	V	119.4
3757.6	H	115.7
3757.6	V	115.6
4697	H	116.3
4697	V	116.3
5636.4	H	113.9
5636.4	V	113.9
6575.8	H	110.9
6575.8	V	110.5
7515.2	H	107.3
7515.2	V	107.3
8454.6	H	108.7
8454.6	V	108.7
9394	H	106.6
9394	V	106.6

Carrier frequency = 939.4MHz

Modulation - NB-IoT

Minimum attenuation = $50 + 10 \cdot \log(50) = 67\text{dB}$

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

Freq (MHz)	Antenna Polarization	Attenuation Below Output Power (dB)
1876	H	128.7
1876	V	128.7
2814	H	121.6
2814	V	121.6
3752	H	117.9
3752	V	117.9
4690	H	118.7
4690	V	118.7
5628	H	116.5
5628	V	116.5
6566	H	112.8
6566	V	112.8
7504	H	109.7
7504	V	109.7
8442	H	109.2
8442	V	109.1
9380	H	107.1
9380	V	107.1

Carrier frequency = 938MHz

Modulation - 3MHz LTE

Minimum attenuation = $50 + 10 \cdot \log(80) = 69\text{dB}$

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

F1.9 Oscillator Frequency Stability per CFR 47 2.1055

Specification Requirement: Reference Part 27.54

Measurement made with a PXA Signal Analyzer per ANSI C63.26.

The temperature data was only taken over the range 5C to 40C because the product is intended for temperature-controlled environments and is only specified to operate over that range.

<u>EXHIBIT</u>	<u>DESCRIPTION</u>
F1-9.1	Frequency Stability Vs Temperature
F1-9.2	Frequency Stability Vs Voltage

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

Frequency Stability in PPM. Limit +/- 0.05PPM.						
Time (min)	Initial 20C	40C	30C	20C	10C	5C
0.5	-0.000087	-0.000001	-0.000025	0.000087	0.000066	-0.000063
1	-0.000054	0.000152	-0.000007	0.000123	-0.000060	-0.000023
1.5	0.000033	0.000013	0.000013	0.000075	-0.000061	-0.000022
2	-0.000133	-0.000039	0.000100	-0.000052	0.000062	-0.000151
2.5	0.000202	0.000072	-0.000064	-0.000159	-0.000023	0.000199
3	0.000198	-0.000033	-0.000010	0.000144	0.000005	0.000057
3.5	0.000175	-0.000026	0.000197	0.000006	0.000068	0.000015
4	0.000008	0.000094	-0.000022	0.000029	0.000045	-0.000081
4.5	0.000007	-0.000017	0.000017	-0.000044	0.000145	-0.000070
5	-0.000029	0.000117	0.000059	0.000325	0.000113	-0.000006
5.5	0.000005	-0.000002	0.000007	-0.000043	0.000032	-0.000021
6	-0.000078	0.000051	0.000037	0.000037	0.000011	-0.000015
6.5	0.000085	0.000013	-0.000068	0.000061	-0.000049	0.000036
7	-0.000004	0.000030	0.000005	0.000060	0.000068	-0.000001
7.5	-0.000030	0.000103	-0.000028	-0.000044	0.000094	0.000003
8	-0.000036	0.000007	0.000066	0.000000	-0.000023	0.000072
8.5	-0.000138	0.000140	0.000058	0.000058	-0.000077	-0.000075
9	0.000137	0.000054	0.000031	-0.000073	-0.000002	-0.000011
9.5	0.000186	0.000003	0.000075	-0.000031	0.000002	-0.000097
10	-0.000107	0.000035	-0.000072	-0.000050	-0.000057	0.000229

F1-9.1 Frequency Stability Vs Temperature

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

Frequency Stability over Voltage in PPM. Limit +/- 0.05PPM. Tested at return to 20C											
Time (min)	85% 102V	88% 105.6V	91% 109.2V	94% 112.8V	97% 116.4V	100% 120V	103% 123.6V	106% 127.2V	109% 130.8V	112% 134.4V	115% 138V
0.5	-0.000130	-0.000055	0.000056	0.000032	0.000092	0.000071	0.000120	-0.000012	0.000007	0.000132	0.000021
1	0.000188	0.000059	-0.000038	-0.000030	0.000043	-0.000064	-0.000018	0.000047	0.000066	0.000115	-0.000063
1.5	0.000030	0.000101	0.000079	0.000032	-0.000087	0.000054	-0.000023	-0.000012	-0.000088	0.000051	0.000076
2	-0.000019	0.000063	0.000122	0.000061	0.000017	0.000049	0.000070	0.000009	0.000097	-0.000057	0.000076
2.5	0.000086	0.000008	-0.000064	0.000202	0.000090	0.000129	-0.000069	0.000033	0.000069	0.000026	0.000031
3	0.000146	0.000048	0.000110	0.000028	0.000093	-0.000200	-0.000143	0.000012	0.000058	0.000160	0.000080
3.5	0.000012	-0.000004	-0.000020	-0.000050	-0.000003	-0.000036	-0.000038	0.000121	-0.000083	0.000070	0.000085
4	0.000051	-0.000066	-0.000001	-0.000119	0.000041	0.000003	0.000040	0.000014	0.000064	0.000083	0.000032
4.5	0.000046	0.000095	-0.000129	-0.000155	0.000044	0.000116	0.000097	-0.000051	0.000114	0.000058	-0.000064
5	-0.000035	0.000085	-0.000054	0.000106	0.000036	0.000038	0.000004	-0.000010	0.000012	0.000017	0.000050

F1-9.2 Frequency Stability Vs Voltage

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

F1.10 Modulation Characteristics per CFR 47 2.1047

Measurement made with a PXA Signal Analyzer per ANSI C63.26.

Error Vector Magnitude Performance

Bandwidth	Modulation	EVM
3MHz	256QAM	3.32%
3MHz	64QAM	4.49%
3MHz	16QAM	4.74%
3MHz	QPSK	4.77%
1.4MHz	256QAM	3.45%
1.4MHz	64QAM	4.63%
1.4MHz	16QAM	4.72%
1.4MHz	QPSK	4.98%
200kHz	QPSK	11.66%

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

F1-11: Test Location

(for all tests except radiated emissions)

Motorola Solutions, Inc., Schaumburg Lab
2000 Progress Parkway, Schaumburg, IL 60196
FCC Registration Number 786245
Test Engineer Matt Nawrocki

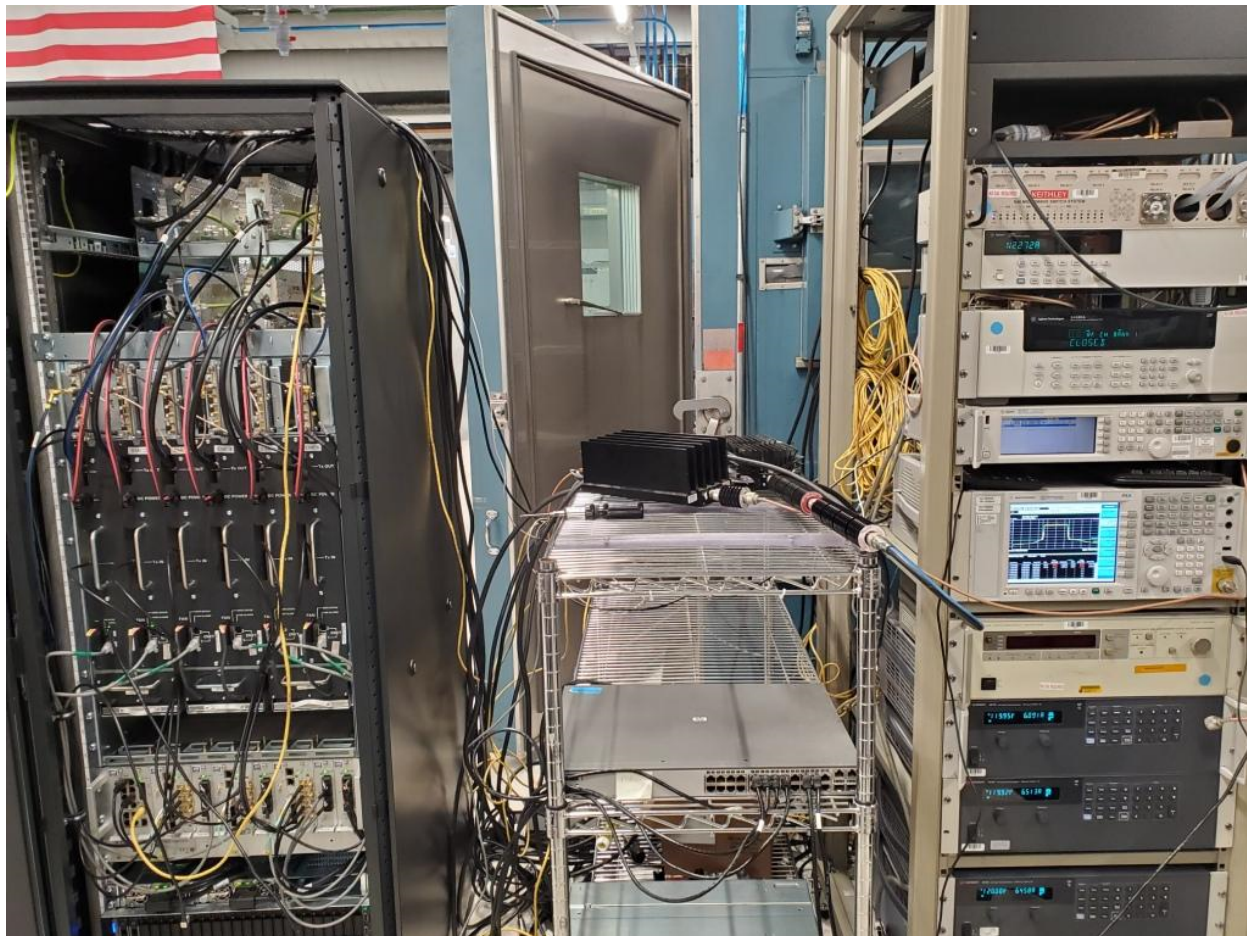
(for radiated emissions)

Elite Electronic Engineering Inc.
1516 Centre Circle Dr., Downers Grove, IL 60515
FCC Registration Number 269750
Test Engineer: Rick King

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

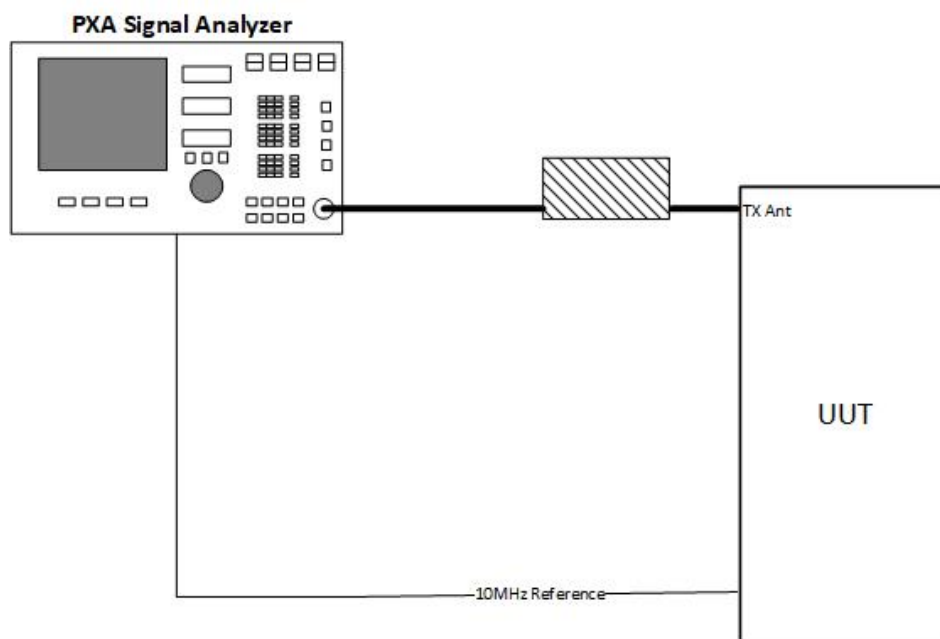
F1-12: Test Setup

F1-12.1: Motorola Solutions

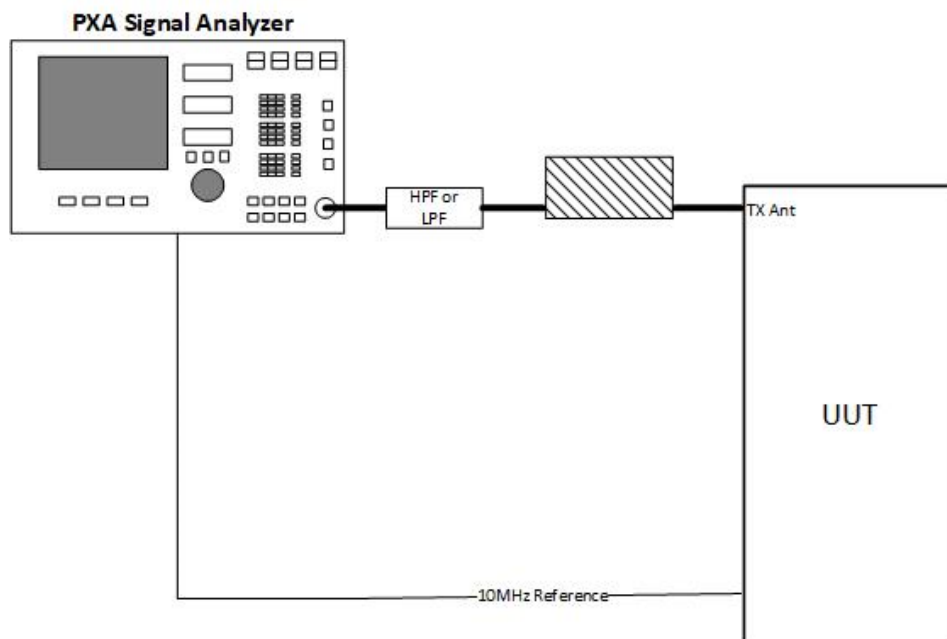


Photo

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



Block Diagram



Block Diagram Conducted Spurious Emissions

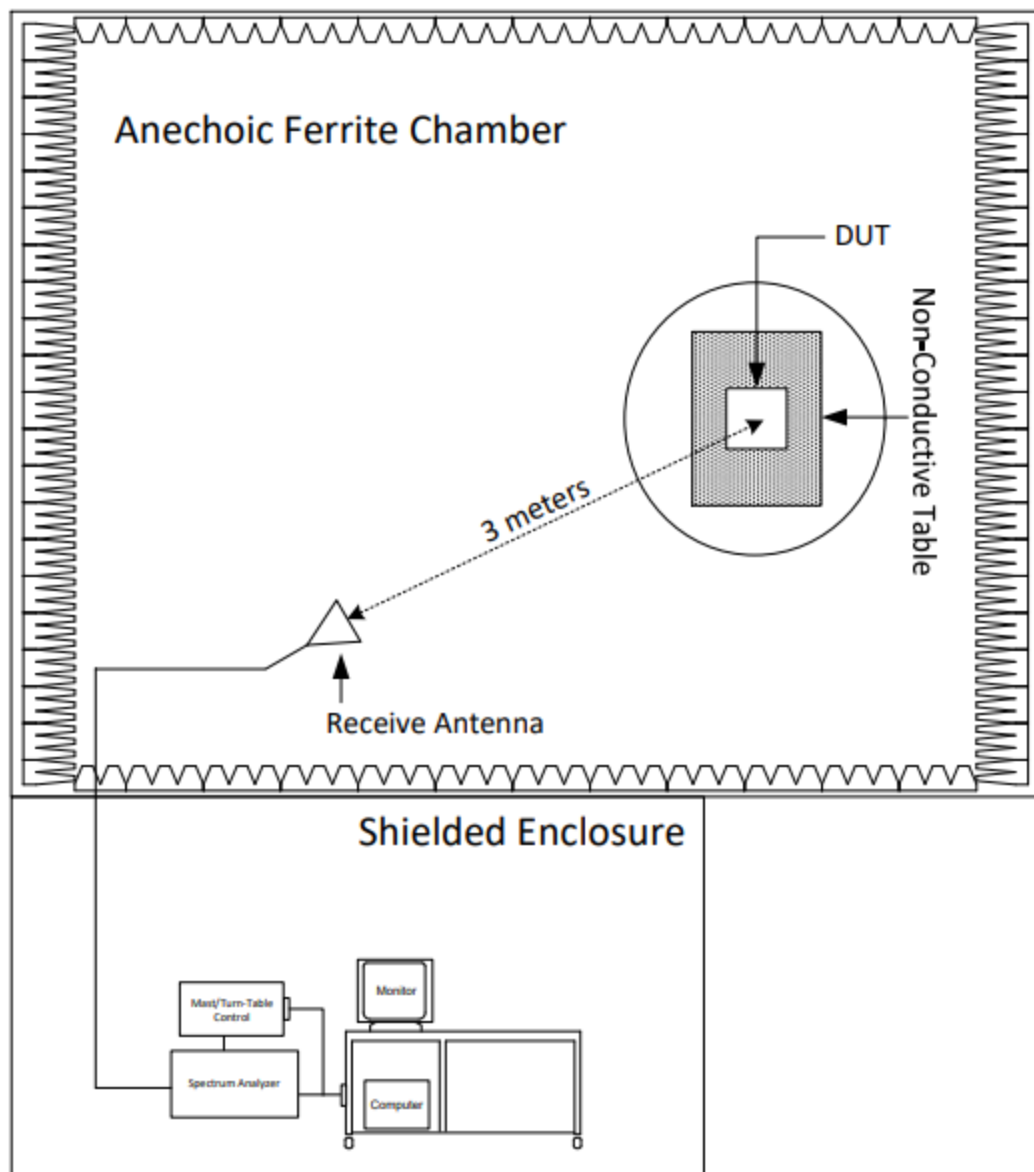
Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

Test Equipment List

Manufacturer	Model	Description	Serial #	Calibration Due Date
Keysight	N9030A	PXA Signal Analyzer	MY53310751	8/10/20
Keysight	E5071C	ENA Vector Network Analyzer	MY46316134	8/11/20
Microwave Circuits	H1G013G1	High Pass Filter	162035	n/a
Mini-Circuits	SLP-8550	Low Pass Filter	B75013	n/a

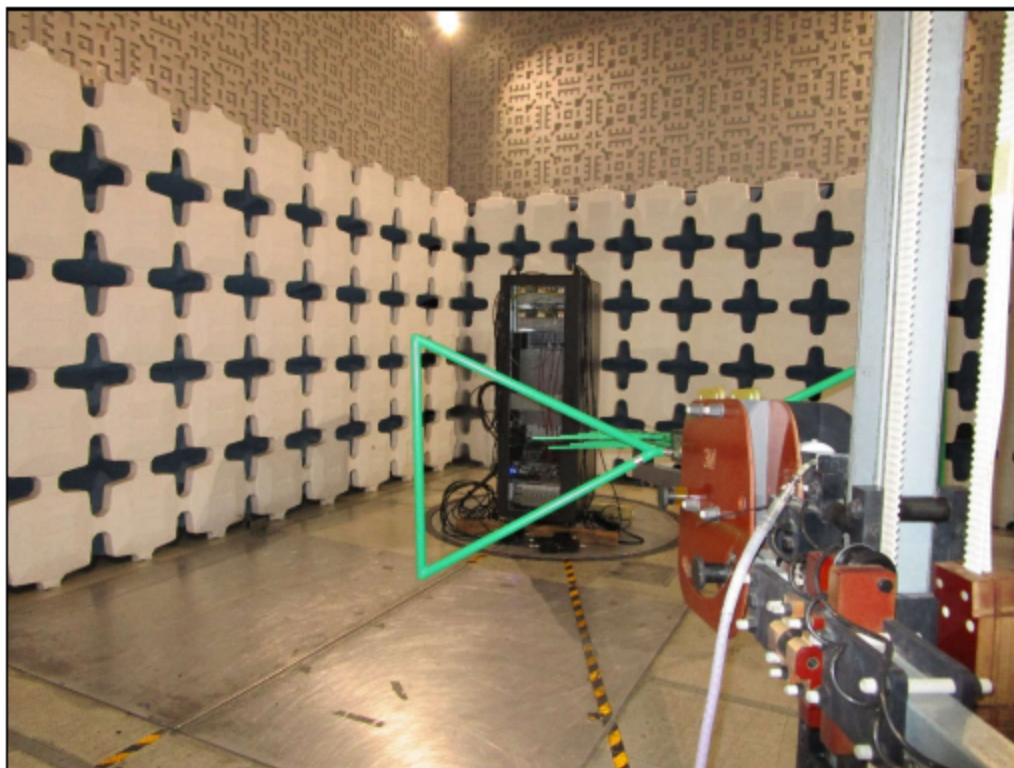
Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

F1-12.2: Elite Electronic Engineering



Radiated Measurements Test Setup

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization Horizontal

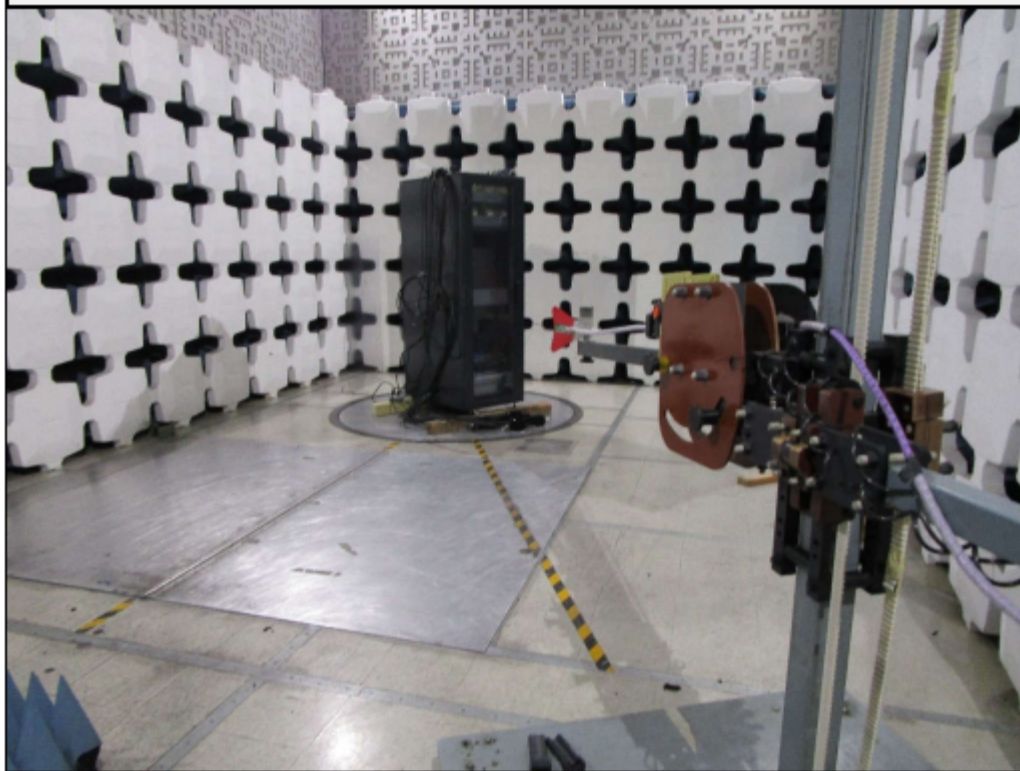


Test Setup for Spurious Radiated Emissions, 30-1000MHz – Antenna Polarization Vertical

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.



Test Setup for Spurious Radiated Emissions, Above 1GHz – Antenna Polarization Horizontal



Test Setup for Spurious Radiated Emissions, Above 1GHz – Antenna Polarization Vertical

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

Test Equipment List – Elite

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	3/11/2021	3/11/2022
CDZ4	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	10/20/2020	10/20/2021
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/28/2020	4/28/2022
R21F	3M ANECHOIC CHAMBER NSA	EMC TEST SYSTEMS	3M ANECHOIC		30MHZ-18GHZ	3/14/2021	3/14/2022
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/11/2021	3/11/2022
VBV2	CISPR EN FCC ICES RE.EXE	ELITE	CISPR EN FCC ICES RE.EXE	---	---	N/A	
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	9/6/2019	9/6/2021

N/A: Not Applicable

I/O: Initial Only

CNR: Calibration Not Required

NOTE 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

Report on Test Measurements for FCC ID ABZ89FC5840 per FCC 47 CFR 27.

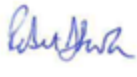
F1-13: Statement of Certification

The technical data supplied with this application, having been taken under my supervision is hereby duly certified. The following is a statement of my qualifications:

College Degree: BSEE, University of Illinois, Urbana-Champaign, Illinois, USA

36 years of Design and Development experience in the field of two-way radio communication.

NAME: Robert Sarocka

SIGNATURE: 

DATE: July 28, 2021

POSITION: Technical Manager

I hereby certify that the above application was prepared under my direction and that to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct:

NAME: Jerry Flondro

SIGNATURE: 

DATE: July 28, 2021

POSITION: Director

REPORT END