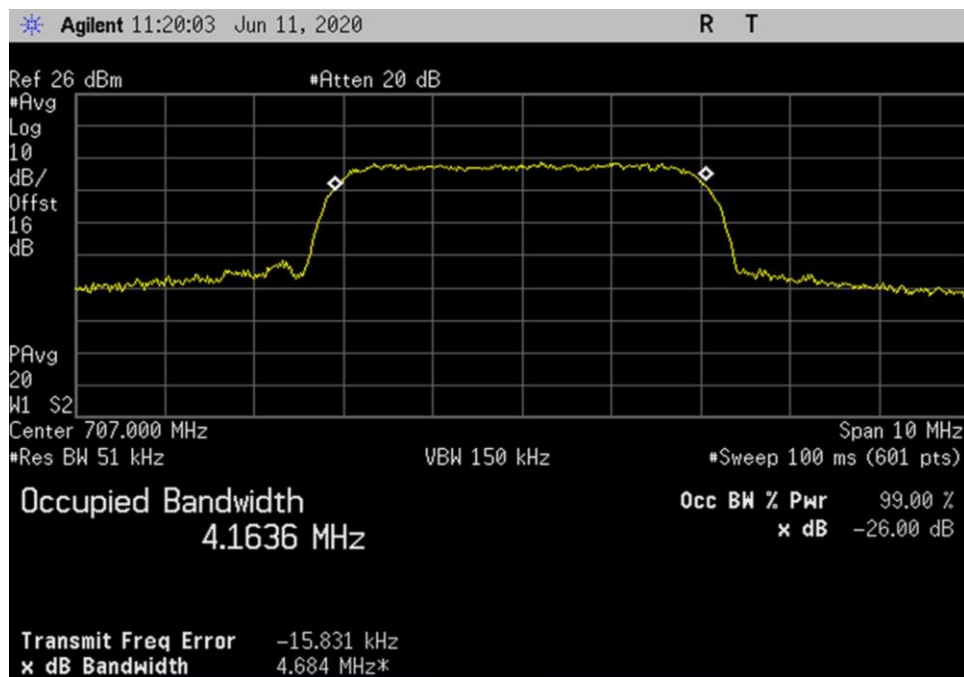
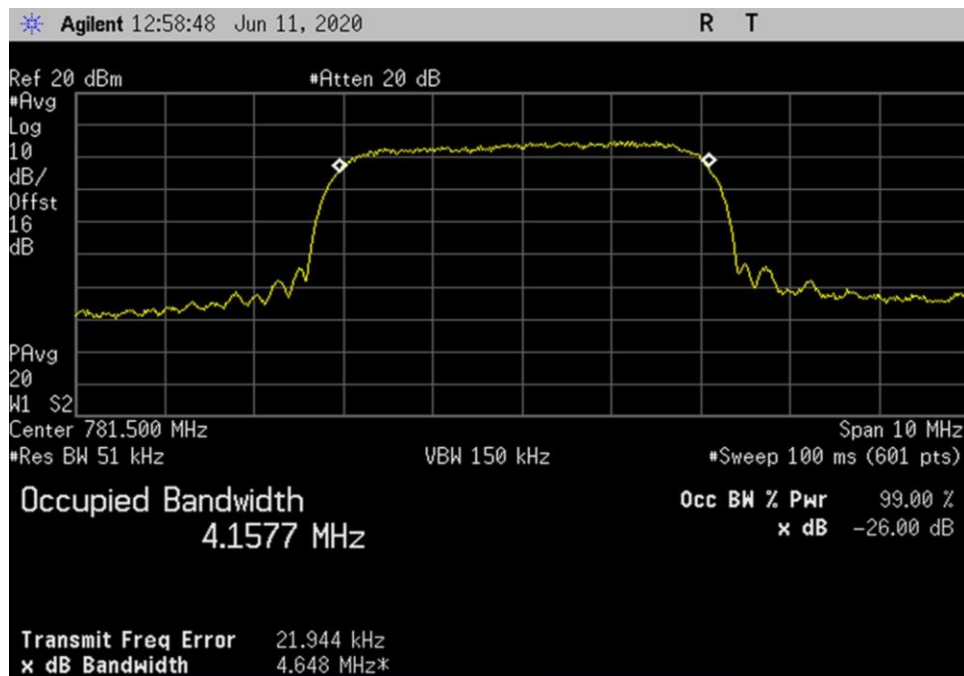


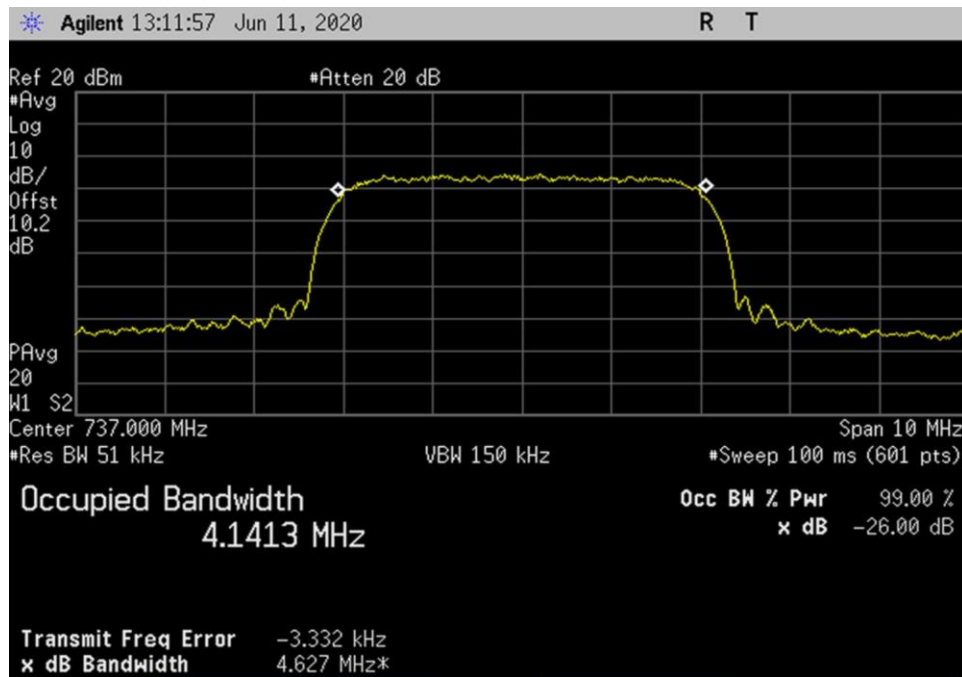
WCDMA Output



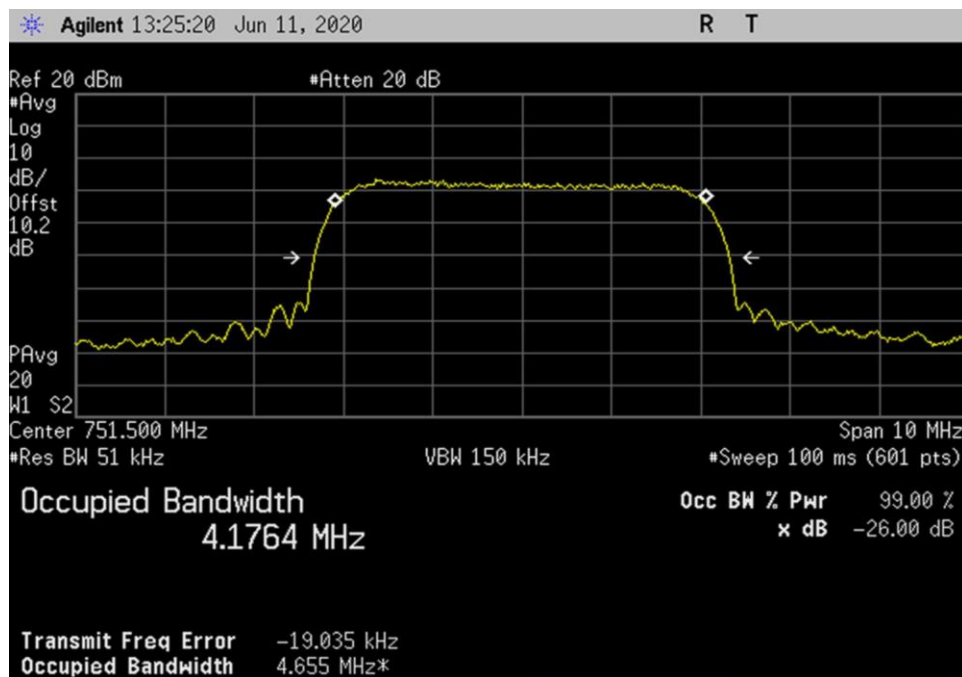
UL_698-716_WCDMA_707MHz



UL_776-787_WCDMA_781.5MHz



DL_728-746_WCDMA_737MHz



DL_746-757_WCDMA_751.5MHz

7.11 Oscillation Detection

Test Setup/Conditions

Test Location:	Fremont	Test Engineer:	E. Wu
Test Date(s):	6/12/2020 and 6/15/2020		
Configuration:	1		
Test Setup:	See General Test Setup		

Environmental Conditions 6/12/2020

Temperature (°C)	22.5	Relative Humidity (%):	43	Pressure: kPa	101.5
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Environmental Conditions 6/15/2020

Temperature (°C)	23.5	Relative Humidity (%):	40	Pressure: kPa	101.4
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Test Equipment

Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P07192	Cable	Astro	32022-29094K-29094K-48TC	11/27/2019	11/27/2021
03360	Cable	Astrolab	32022-2-29094-36TC	4/9/2020	4/9/2022
03418	Signal Generator	Agilent	E4438C	5/13/2019	5/13/2021
02660	Spectrum Analyzer	Agilent	E4446A	10/19/2018	10/19/2020
P06898	Cable	Astrolab	32022-29094K-29094K-48TC	3/25/2020	3/25/2022
C00082	Directional Coupler	MECA Electronics, Inc	722-10-1.500V	11/27/2019	11/27/2020
03468	Band Pass Filter	K & L	4CS10-781.5/E12.2-O/O	7/15/2019	7/15/2021
03469	Band Pass Filter	K & L	4CS10-751.5/E12-O/O	7/15/2019	7/15/2021
03467	Band Pass Filter	K & L	4FV50-731/H30-O/O	7/15/2019	7/15/2021
03446	Band Pass Filter	K & L	4FV50-707/H18-O/O	7/15/2019	7/15/2021
02475	Attenuator	HP	8494B	4/12/2019	4/12/2021
03429	Attenuator	HP	8496B	4/26/2019	4/26/2021
P06909	Attenuator	Pasternack	PE7083	1/7/2020	1/7/2022

Summary of Results

Pass: All oscillations detections and mitigations occur within 0.3 seconds in uplink bands, within 1 second in the downlink bands and the noise level is below the -70dBm/MHz limit.

7.11.2 Oscillation restart tests

Oscillation detection				Time Between restart		Number of restart	
Frequency MHz	Measured Sec	Limit Sec	Peak Level dBm	Measured Sec	Limit At least sec	Measured	Limit
UL 698-716	0.100	0.3	25.4	66	60	3	5
UL 776-787	0.250	0.3	34.1	66	60	3	5
DL 728-746	0.275	1.0	21.6	68	60	3	5
DL 746-757	0.125	1.0	23.5	68	60	3	5

The booster continues to mitigate at least 1 minute before restarting. The plots demonstrate after 3 restarts (the limit is 5 restart), the booster does not resume operation until manually reset.

7.11.3 Test procedure for measuring oscillation mitigation or shutdown

	UL 698-716	UL 776-787	
Max Gain Isolation dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Limit dB
+5dB	10.6	10.5	12.0
+4dB	13.4*	12.1*	12.0
+3dB	16.0*	14.2*	12.0
+2dB	18.8*	15.2*	12.0
+1dB	24.5*	17.2*	12.0
0dB	**	19.7*	12.0
-1dB	**	**	12.0
-2dB	**	**	12.0
-3dB	**	**	12.0
-4dB	**	**	12.0
-5dB	**	**	12.0

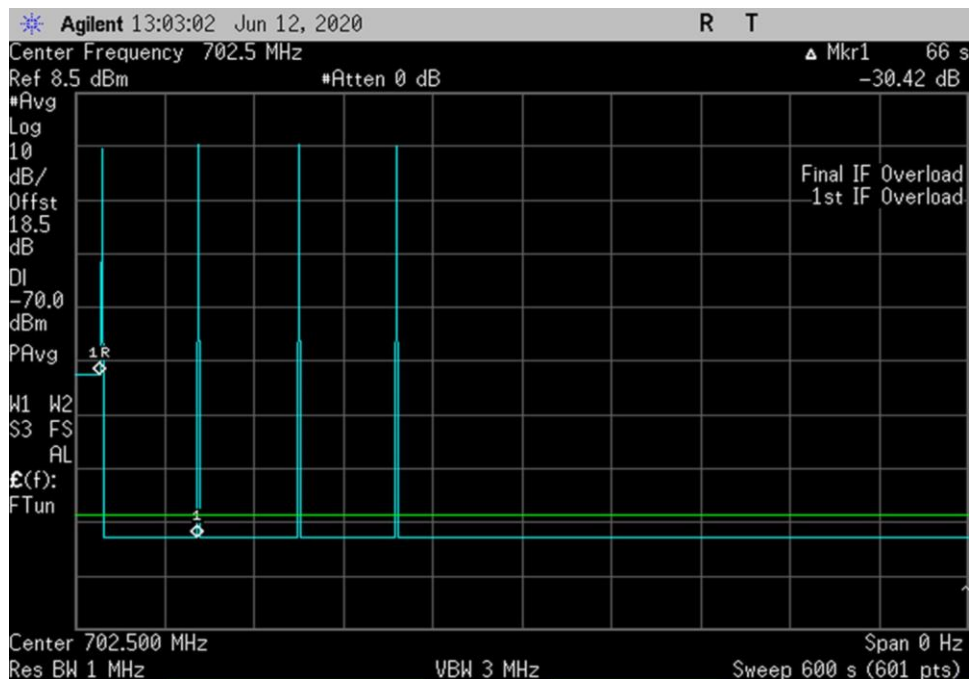
	DL 728-746	DL 746-775	
Max Gain Isolation dB	Pk-Pk Difference dB	Pk-Pk Difference dB	Limit dB
+5dB	11.8	8.9	12.0
+4dB	14.0*	9.8	12.0
+3dB	16.9*	11.6	12.0
+2dB	20.6*	13.6*	12.0
+1dB	29.2*	15.4*	12.0
0dB	**	20.7*	12.0
-1dB	**	26.4*	12.0
-2dB	**	73.3*	12.0
-3dB	**	**	12.0
-4dB	**	**	12.0
-5dB	**	**	12.0

* The measured difference exceeds the limit for a period of less than 300 second before device mitigates or shuts down. The maximum recorded time prior to shutdown was 141 seconds for the Uplink bands and 148 seconds for the Downlink bands.

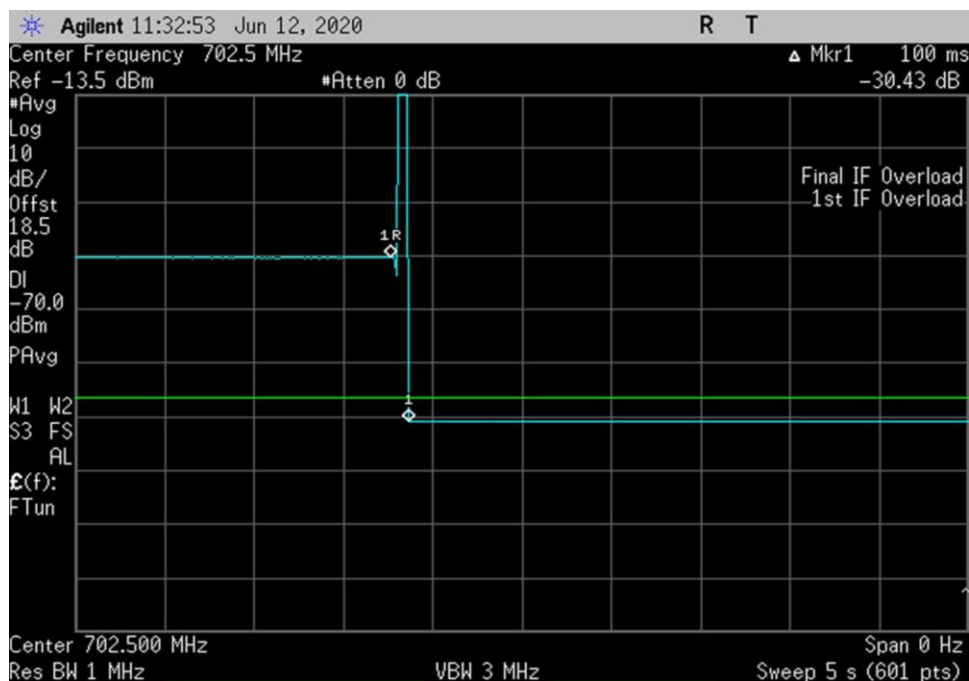
** The device shuts down immediately.

7.11.2 Oscillation Restart Tests

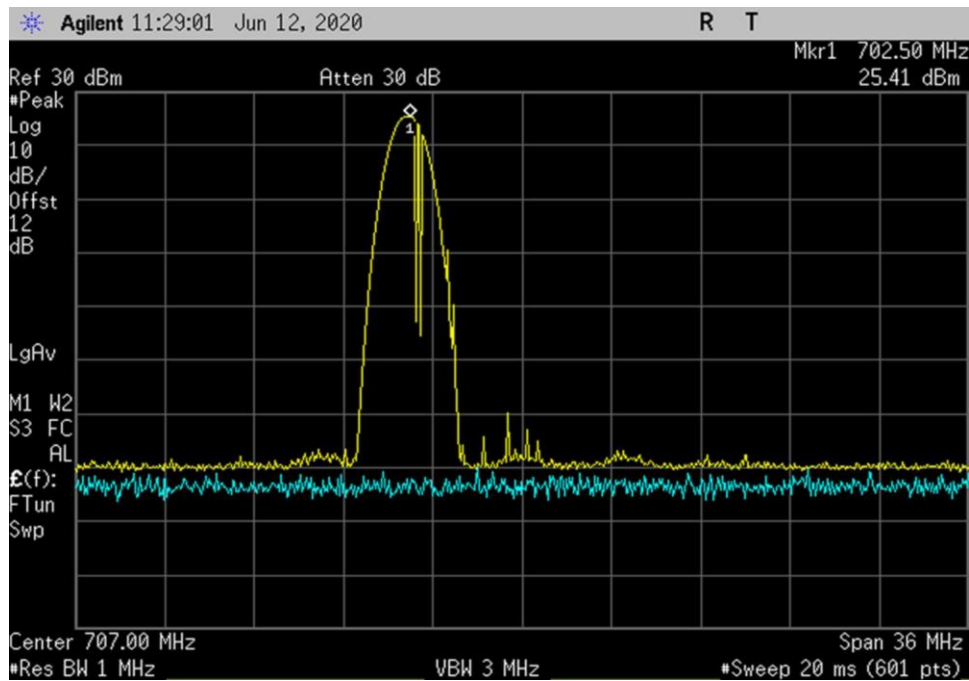
Plots



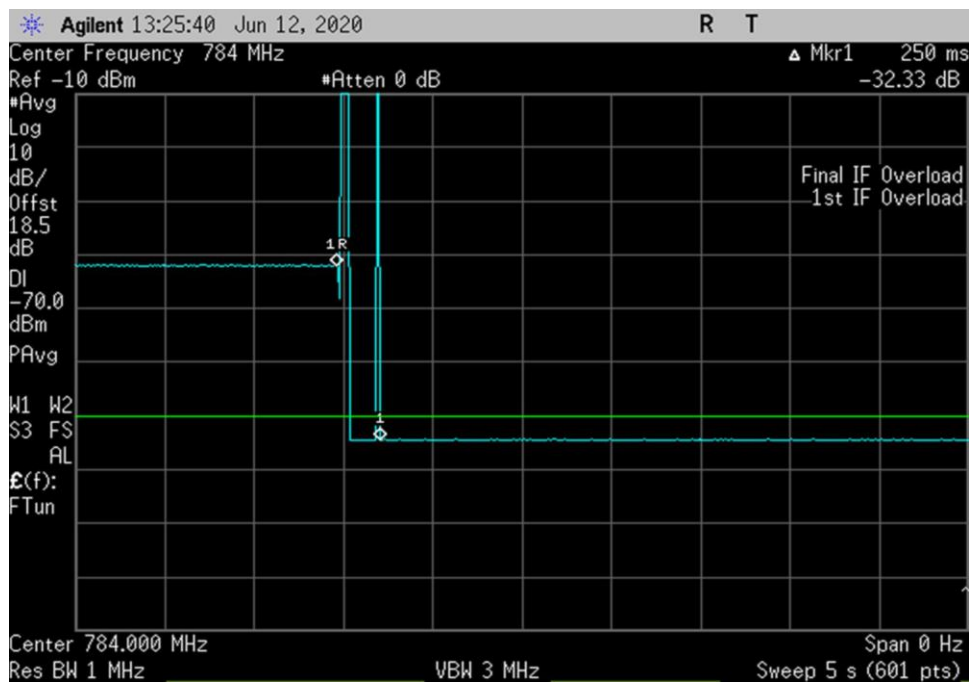
UL_698-716_600sec_702.5MHz



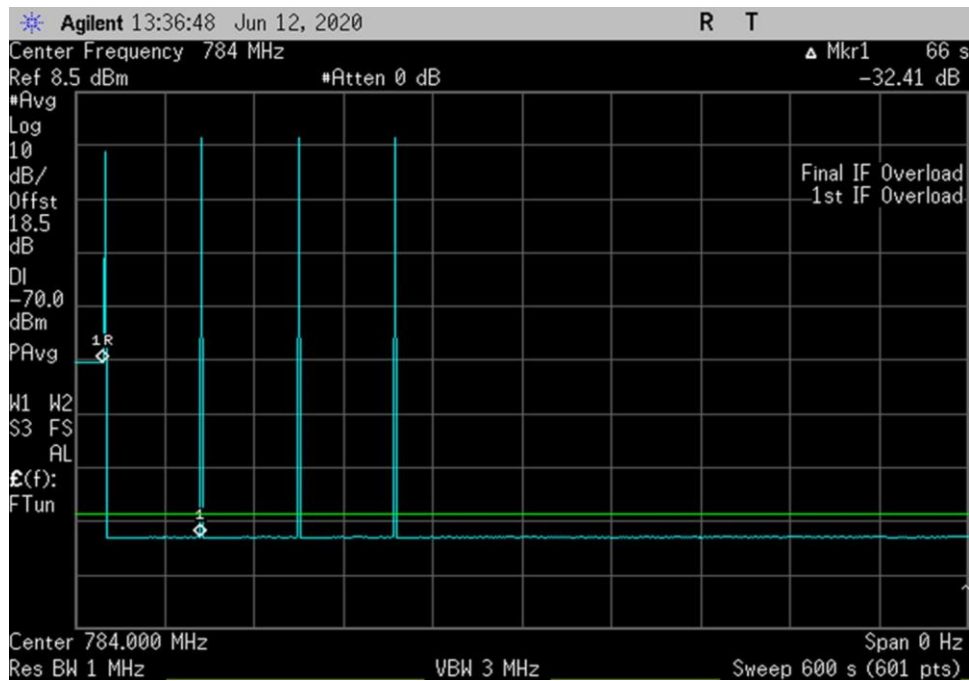
UL_698-716_702.5MHz



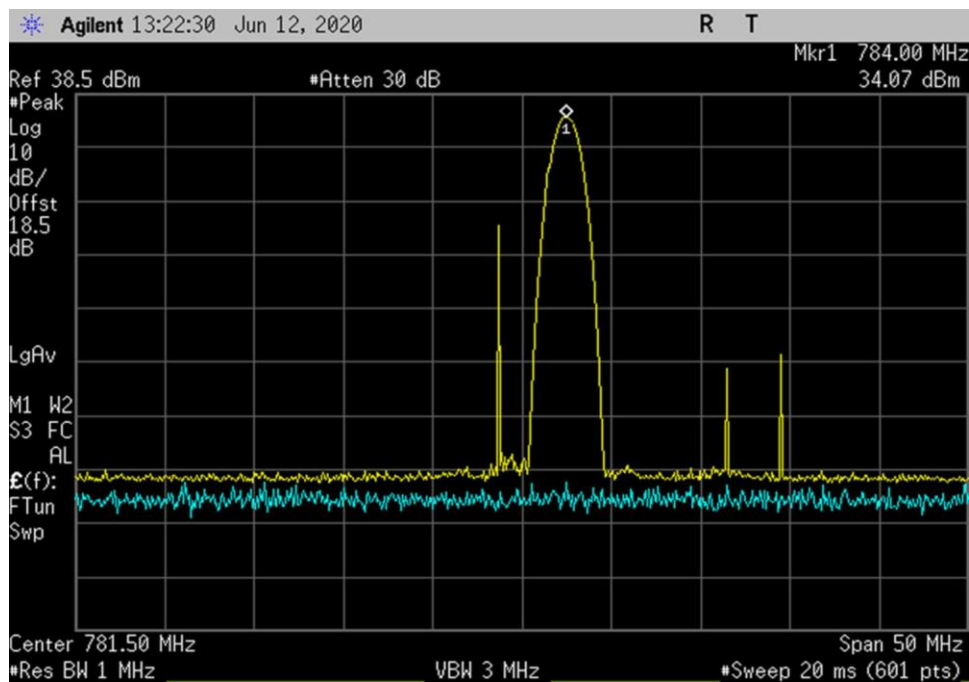
UL_698-716_Pk_707MHz



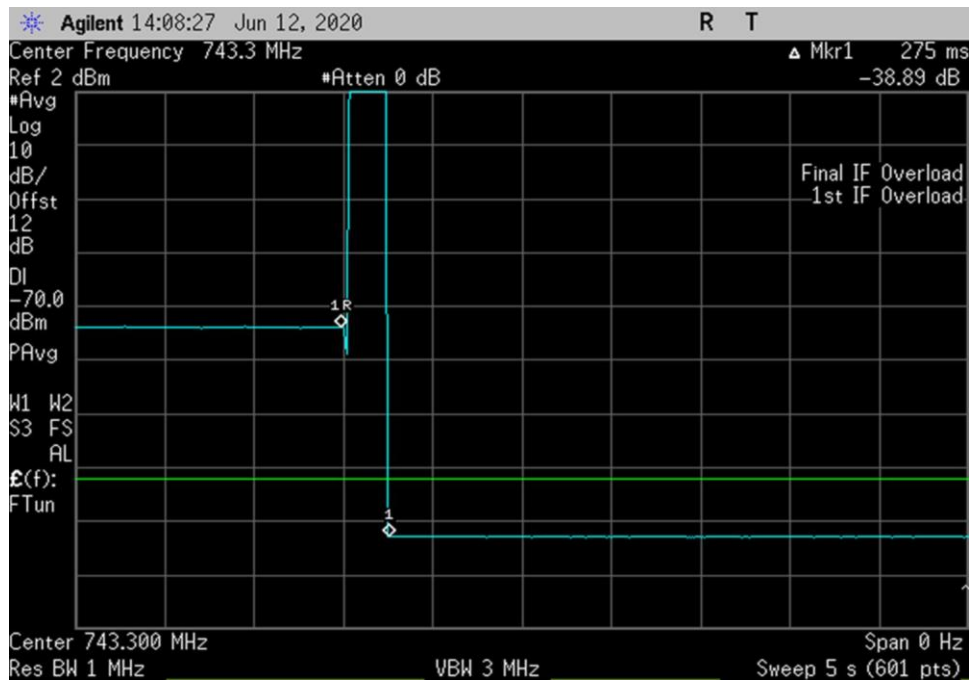
UL_776-787_784MHz



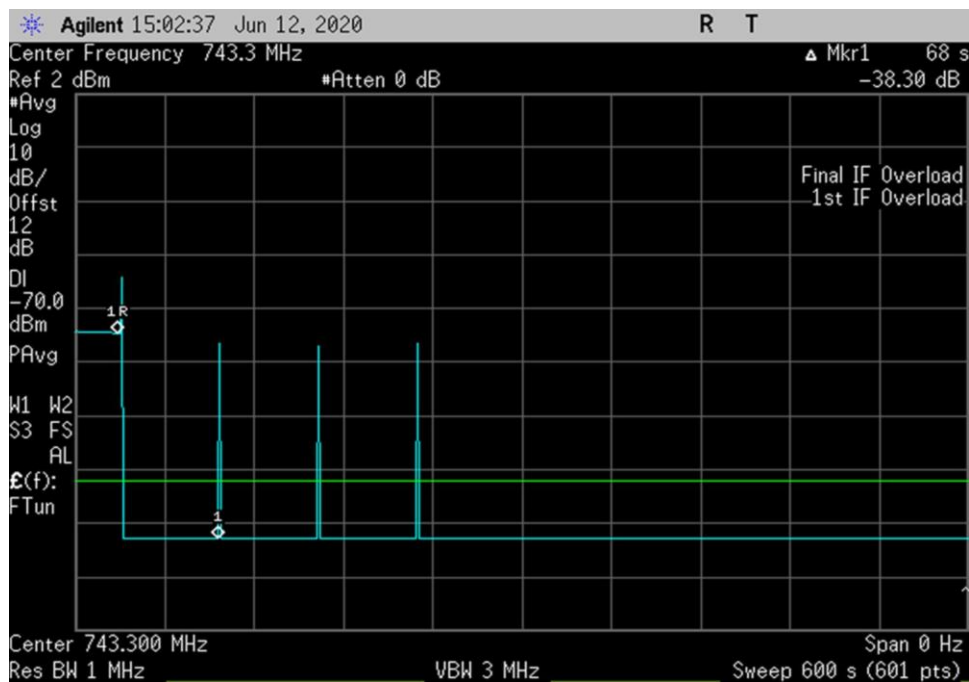
UL_776-787_600sec_784MHz



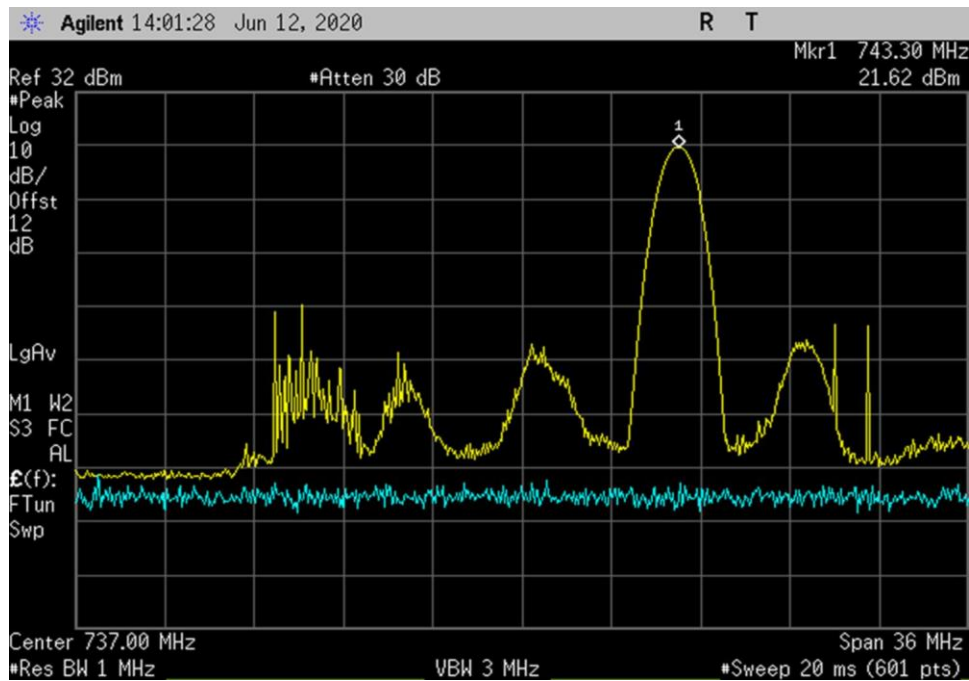
UL_776-787_Pk_781.5MHz



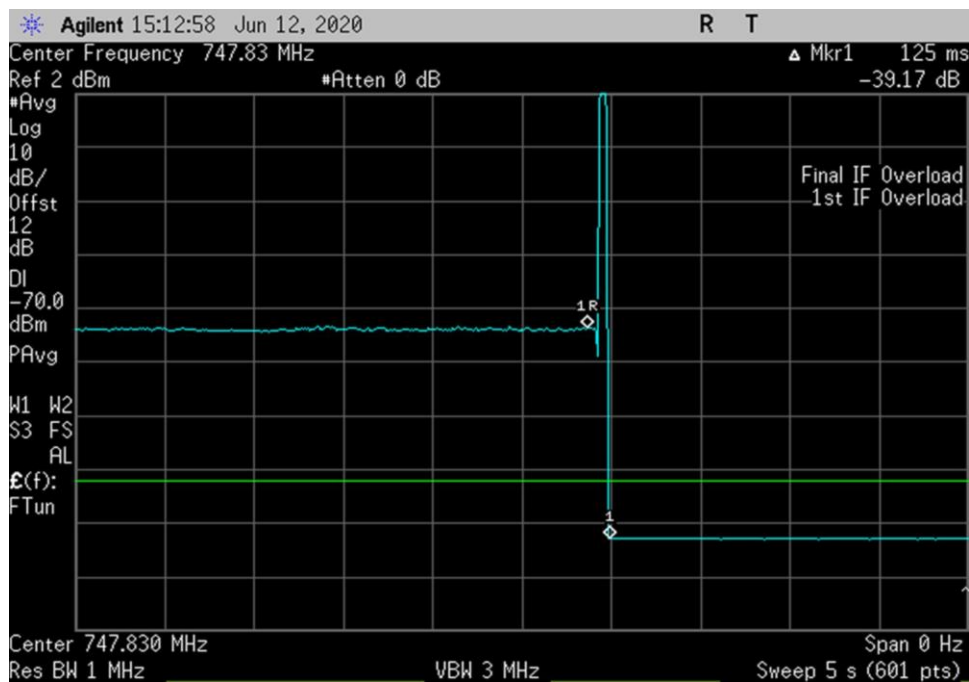
DL_728-746_ 743.3MHz



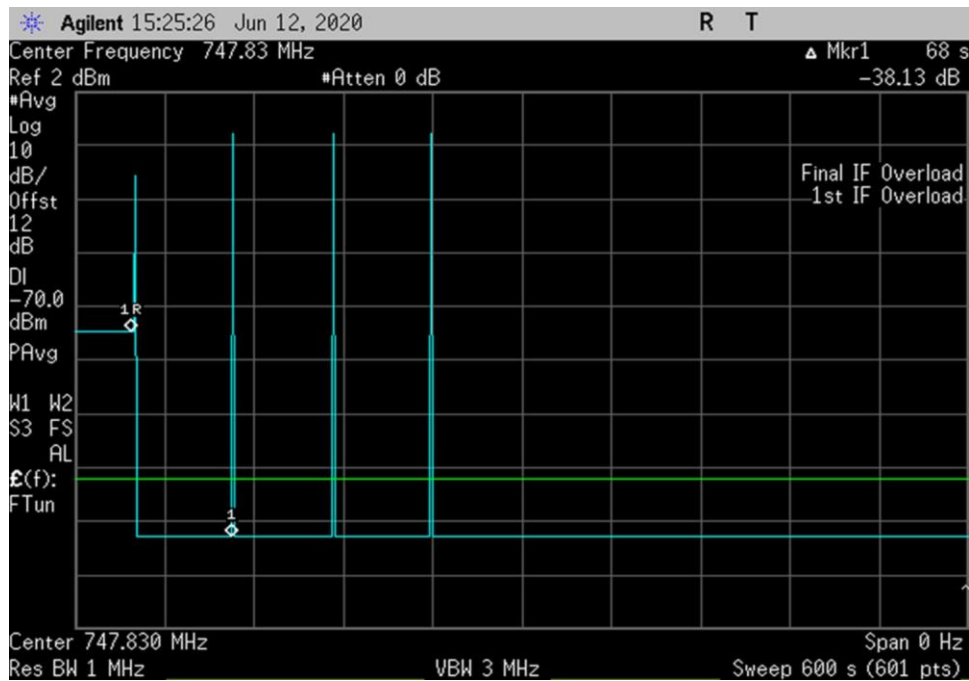
DL_728-746_600sec_ 743.3MHz



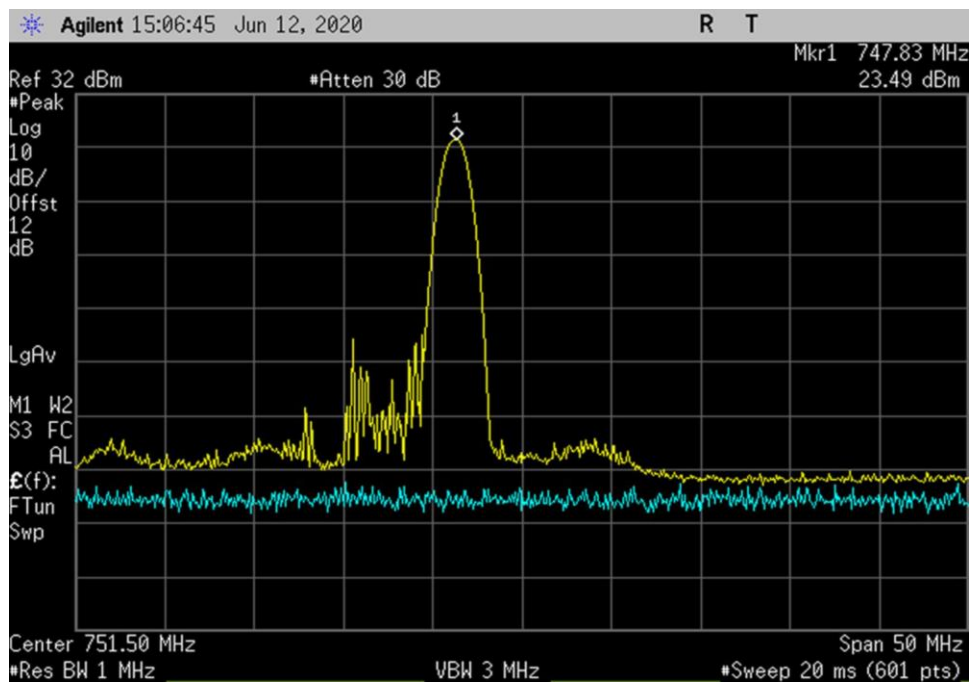
DL_728-746_Pk_737MHz



DL_746-757_747.83MHz



DL_746-757_600sec_747.83MHz



DL_746-757_Pk_751.5MHz

7.12 Radiated Spurious Emissions

Test Setup/Conditions

Test Location:	Fremont	Test Engineer:	E. Wu
Test Date(s):	6/16/2020		
Configuration:	1		
Test Setup:	Frequency range of measurement = 9 kHz- 8 GHz. 9 kHz - 150 kHz -> RBW=200 Hz VBW=200 Hz 150 kHz - 30 MHz -> RBW=9 kHz VBW=9 kHz 30 MHz - 1000MHz -> RBW=120 kHz VBW=120 kHz 1000 MHz-8000MHz -> RBW=1 MHz VBW=1 MHz No spurious emissions were found within 20dB of the limit line. 27.53(f) For operations in the 698-716 MHz, 776-787 MHz, 728-746 MHz, and 746-757MHz, shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.		

Environmental Conditions

Temperature (°C)	22.9	Relative Humidity (%):	43	Pressure: kPa	101.6
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Test Equipment

Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03471	Spectrum Analyzer	Agilent	E4440A	2/11/2020	2/11/2022
P01187	Cable	Andrews	CNT-195	8/20/2018	8/20/2020
P07508	Preamp	Sonoma	310N	10/15/2018	10/15/2020
P06691	Cable	Pasternack	PE3062-180	3/25/2020	3/25/2022
P00880	Cable	Pasternack	RG214U	3/25/2020	3/25/2022
P06049	Attenuator	Pasternack	PE7002-6	5/11/2020	5/11/2022
00852	Biconilog Antenna	Schaffner	CBL 6111C	4/14/2020	4/14/2022
03302	Cable	Astrolab	32026-29094K-29094K-72TC	1/9/2020	1/9/2022
P01210	Cable	Andrews	FSJ1P-50A-4A	12/18/2018	12/18/2020
03713	Preamp	B & Z	01001800-221055-202525	5/22/2019	5/22/2021
P06900	Cable	Astrolab	32022-29094K-29094K-36TC	1/7/2020	1/7/2022
02157	Horn Antenna	EMCO	3115	1/15/2019	1/15/2021
AN00432	Loop Antenna	EMCO	6502	2/19/2019	2/19/2021
P06909	Attenuator	Pasternack	PE7083	1/7/2020	1/7/2022

Summary of Results

Pass: All Radiated Spurious Emissions were found with more than 20dB margin of the limit line.

Frequency Range of measurement 9kHz – 22GHz

LIMIT LINE FOR SPURIOUS RADIATED EMISSION

$$\text{REQUIRED ATTENUATION} = 43 + 10 \log P \text{ (dB)}$$

For radiated spurious emission measured at 3 meter test distance,

$$\begin{aligned} \text{Required attenuation} &= 43 + 10 \log P_{t \text{ at 3 meter}} \text{ dB} \\ \text{Limit line (dBuV)} &= E_{\text{dBuV}} - \text{Attenuation} \end{aligned}$$

E_{dBuV} = Measured field strength at 3 meter in dBuV/m

Power Density (Isotropic)

$$P_D = \frac{P_t}{4\pi r^2}$$

P_D = Power Density in Watts /m²

P_t = Average Transmit Power

r = Test distance

Field Intensity E (V/m)

$$E = \sqrt{P_D \times 377}$$

$$E = \frac{\sqrt{P_t \times 377}}{4\pi r^2}$$

$$E = \sqrt{\frac{P_t \times 30}{r^2}}$$

$$P_t = \left(\frac{E^2 \times r^2}{30} \right)$$

$$10 \log P_t = 10 \log E^2 (\text{V/m}) + 10 \log r^2 - 10 \log 30$$

$$10 \log P_t = 20 \log E (\text{V/m}) + 20 \log r - 10 \log 30$$

At 3 meter, $r = 3 \text{ m}$

$$10 \log P_t = 20 \log E (\text{V/m}) + 20 \log 3 - 10 \log 30$$

$$10 \log P_t = 20 \log E (\text{V/m}) + 9.54 - 14.77$$

$$10 \log P_t = 20 \log E (\text{V/m}) - 5.23$$

$$\text{Since } 20 \log E (\text{V/m}) = 20 \log E (\text{uV/m}) - 120$$

$$10 \log P_t = 20 \log E (\text{uV/m}) - 120 - 5.23$$

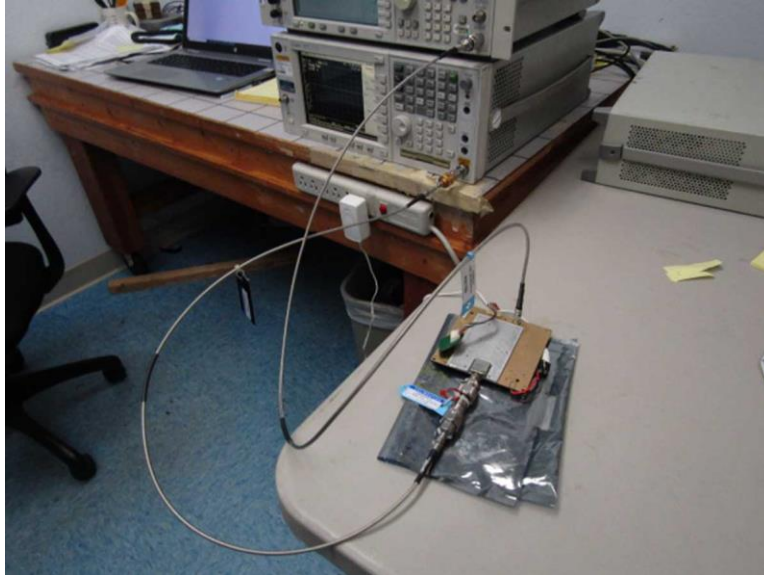
$$10 \log P_t = 20 \log E (\text{uV/m}) - 125.23$$

$$\begin{aligned} \text{Limit line (dBuV) at 3 meter} &= E_{\text{dBuV}} - \text{Attenuation} \\ &= E_{\text{dBuV}} - (43 + 10 \log P_t \text{ at 3 meter}) \\ &= E_{\text{dBuV}} - 43 - 10 \log P_t \text{ at 3 meter} \\ &= E_{\text{dBuV}} - 43 - (20 \log E (\text{uV/m}) - 125.23) \\ &= E_{\text{dBuV}} - 43 - 20 \log E (\text{uV/m}) + 125.23 \\ &= E_{\text{dBuV}} - 20 \log E (\text{uV/m}) + 82.23 \end{aligned}$$

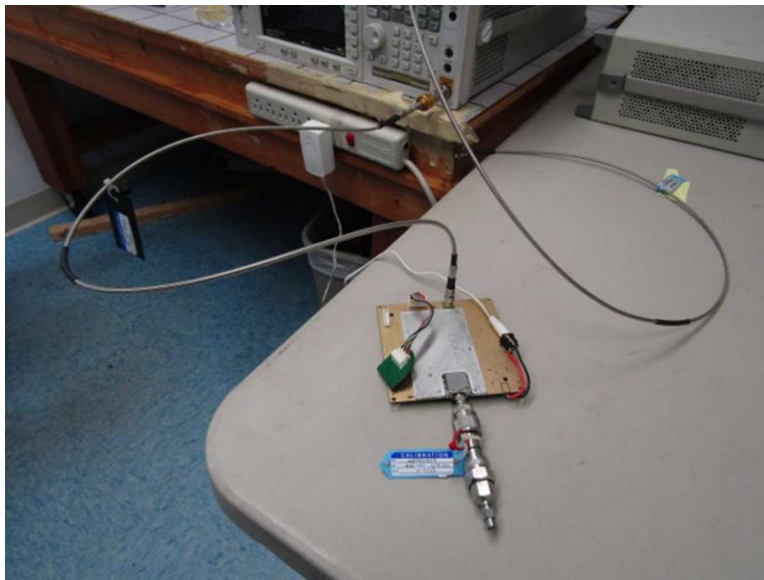
$$\text{Since } 20 \log E (\text{uV/m}) = E \text{ in dBuV/m} = E_{\text{dBuV}} - E_{\text{dBuV}} + 82.23$$

$$\text{Radiated Emission limit 3 meter} = 82.23 \text{ dBuV at any power level measured in dBuV}$$

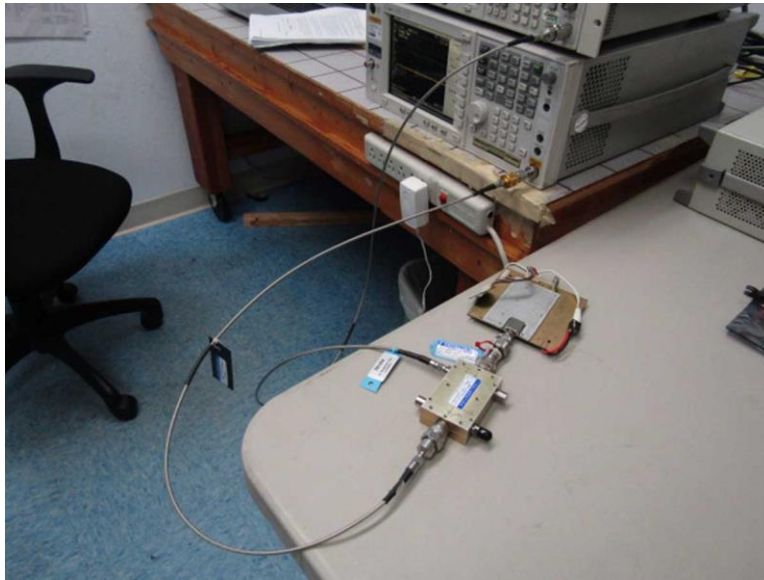
Exhibit A: Test Setup Photos



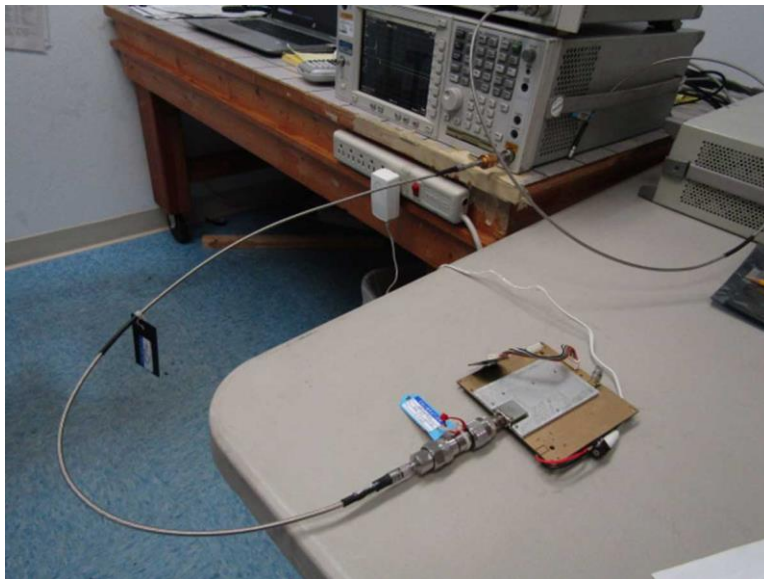
Section 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.10 Test Setup



Section 7.7 Max Noise Test Setup



Section 7.7 Variable Noise Test Setup



Section 7.8 Test Setup



Section 7.9 Test Setup



Section 7.11.2 Test Setup



Section 7.11.3 Test Setup



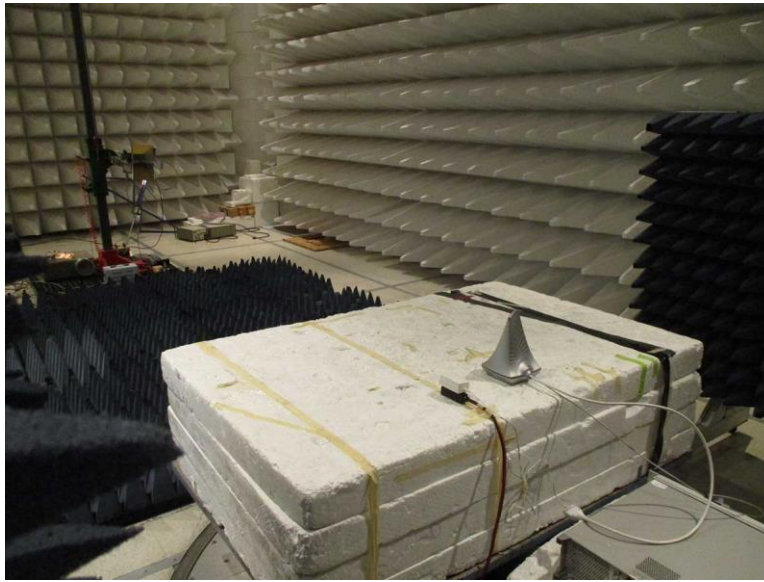
Section 7.12 Below 1GHz Test Setup



Section 7.12 Below 1GHz Test Setup



Section 7.12 Above 1GHz Test Setup



Section 7.12 Above 1GHz Test Setup