



Test specification:	Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz		
Test procedure:	ANSI C63.10, Sections 9.9, 9.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	29-Apr-19		
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

7.4 Out of band radiated emissions above 40 GHz up to 200 GHz

7.4.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Spurious emission field strength limits

Frequency, GHz	Power density at 3 m distance pW/cm ²	Distance, m	Field strength dB(μV/m)*, peak	Field strength dB(μV/m)*, average
40 – 220	90.0	3.0	105.30	85.30
60 - 90	90.0	1.0	114.8**	94.8
90 - 140	90.0	0.10	114.8**	114.8**
140 - 200	90.0	0.005	160.90**	140.90**

*- The limit is provided in average values.

**- The limit for 1 m and other test distance was calculated using the inverse distance extrapolation factor as follows:

$$\text{for far field: } \text{Lim}_{S_2} = \text{Lim}_{S_1} + 20 \log(S_1/S_2),$$

where S_1 – standard defined distance in meters;

S_2 – measurement distance in meters (according to ANSI C63.10)

7.4.2 Test procedure for spurious emission field strength measurements

7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

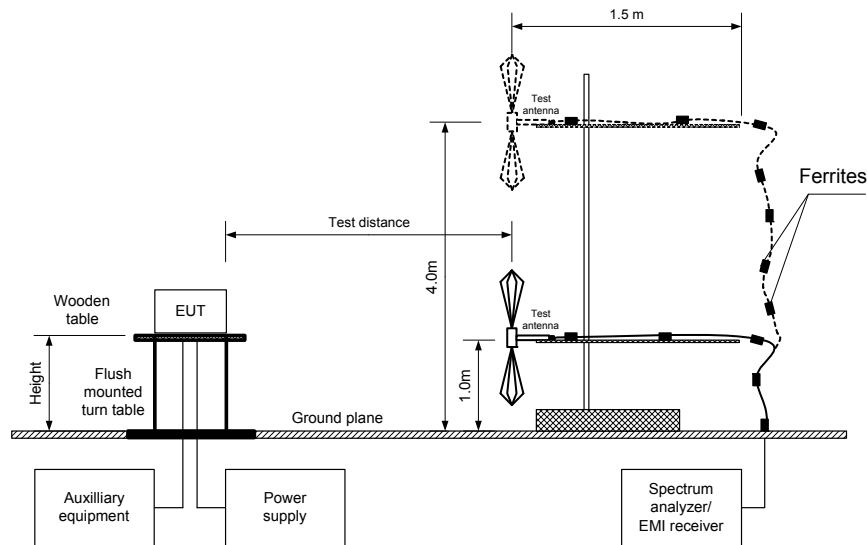
7.4.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.4.2.3 The test results were recorded in Table 7.4.2 and are shown in the associated plots.



Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

Figure 7.4.1 Spurious emission field strength above 40 GHz test set up





Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

Table 7.4.2 Spurious emission field strength test results

TEST DISTANCE: 0.005 - 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: CW
 TRANSMITTER OUTPUT POWER: Maximum
 INVESTIGATED FREQUENCY RANGE: 40 – 200 GHz
 RESOLUTION BANDWIDTH: 1000 kHz
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Standard Gain Horn 24 dB (40-60 GHz)
 Standard Gain Horn 24 dB (50-75 GHz)
 Standard Gain Horn 24 dB (75-110 GHz)
 Standard Gain Horn 24dB (90-140 GHz)
 Standard Gain Horn 24 dB (140-220 GHz)

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=1 kHz)			Verdict
	Polariz.	Height, m		Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	Measured, dB(µV/m)	Limit, dB(µV/m)	Margin, dB**	
Low carrier frequency 57024.0 MHz										
No emissions were found										Pass
Mid carrier frequency 61000.0 MHz										
No emissions were found										Pass
High carrier frequency 65000.0 MHz										
No emissions were found										Pass

*- EUT front panel refer to 0 degrees position of turntable.
 **- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 0747	HL 0748	HL 0770	HL 0771	HL 0772	HL 1295	HL 1299	HL 1300
HL 1303	HL 1304	HL 1306	HL 1312	HL 2909	HL 3235	HL 3290	HL 3291
HL 3294	HL 3297	HL 3305	HL 3329	HL 3433	HL 3434	HL 5174	HL 3901
HL 4023	HL 5376	HL 5380					

Full description is given in Appendix A.



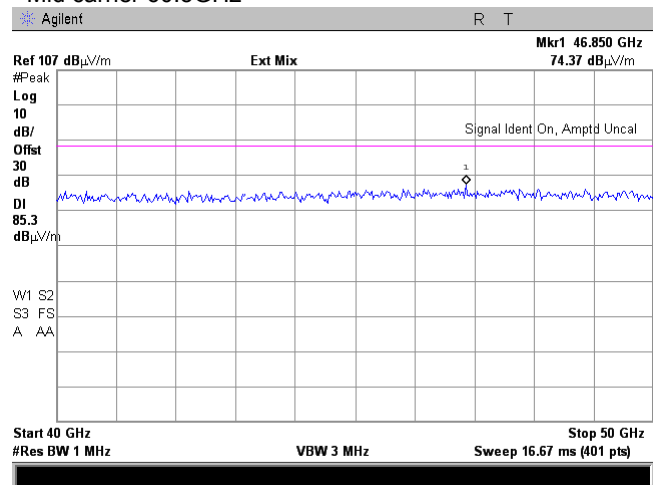
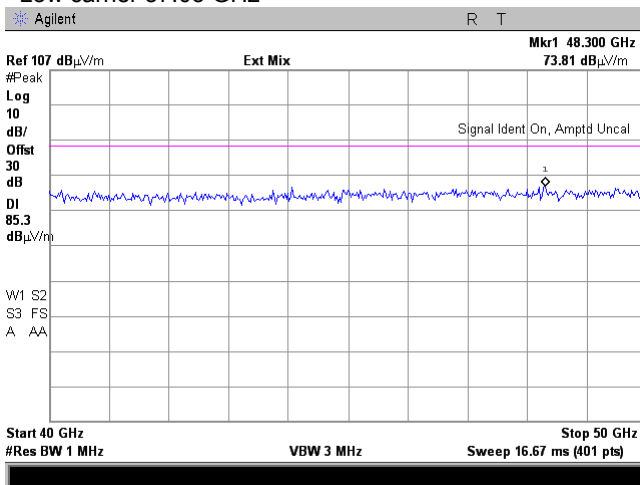
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

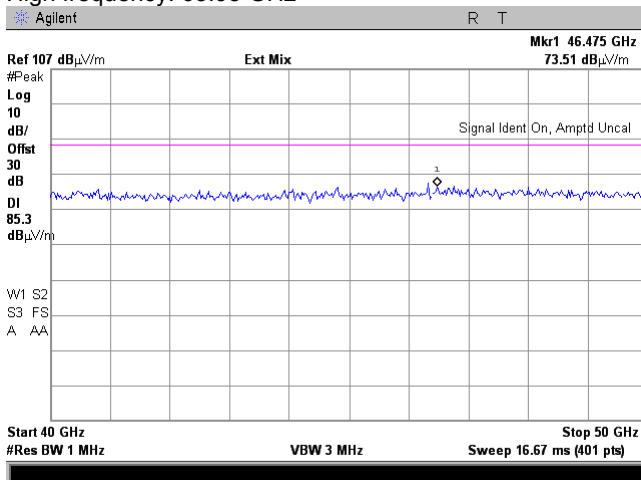
Plot 7.4.1 Spurious emission measurements in 40 – 50 GHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR:
Low carrier 57.05 GHz

OATS
3 m
Vertical and Horizontal
Peak
Mid carrier 60.5GHz



High frequency: 63.95 GHz





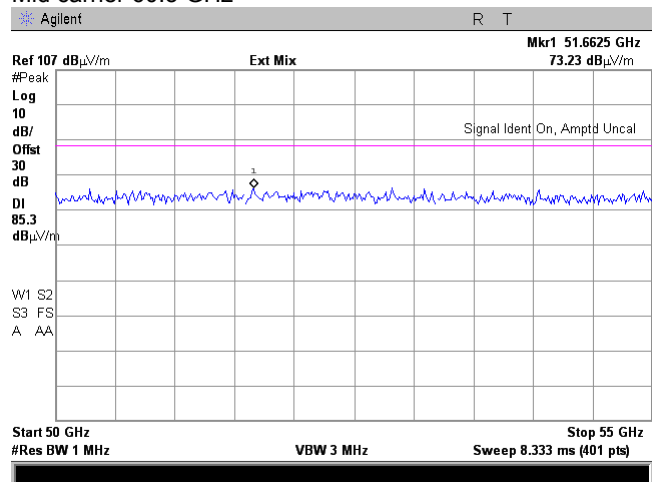
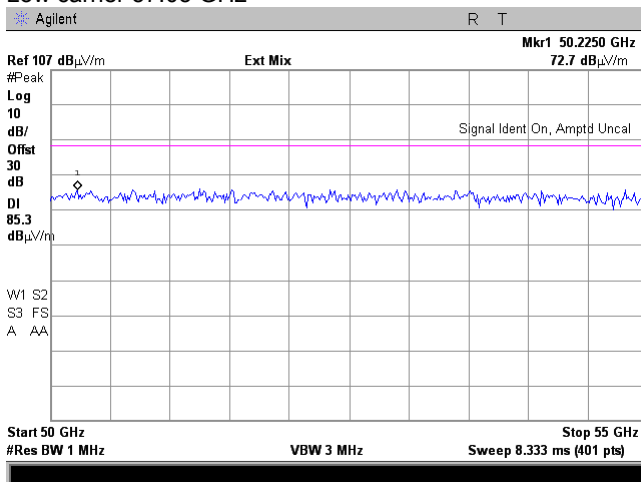
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

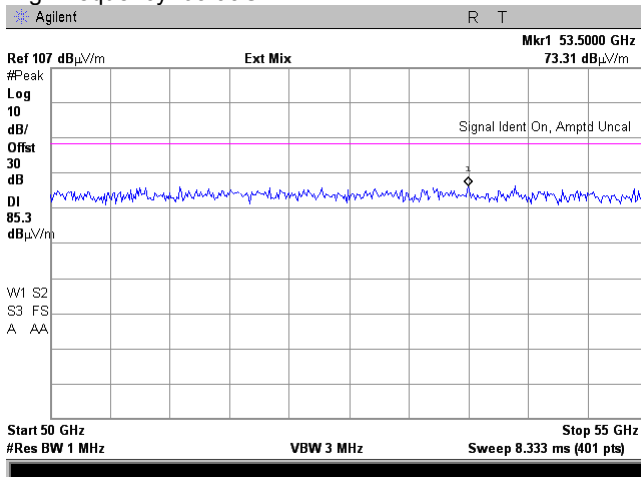
Plot 7.4.2 Spurious emission measurements in 50 – 55 GHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR:
Low carrier 57.05 GHz

OATS
3 m
Vertical and Horizontal
Peak
Mid carrier 60.5 GHz



High frequency: 63.95GHz





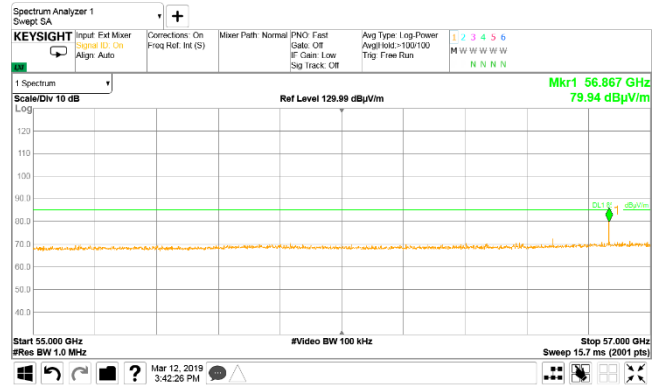
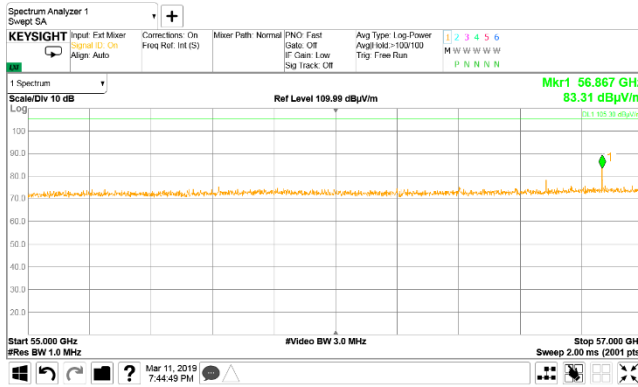
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

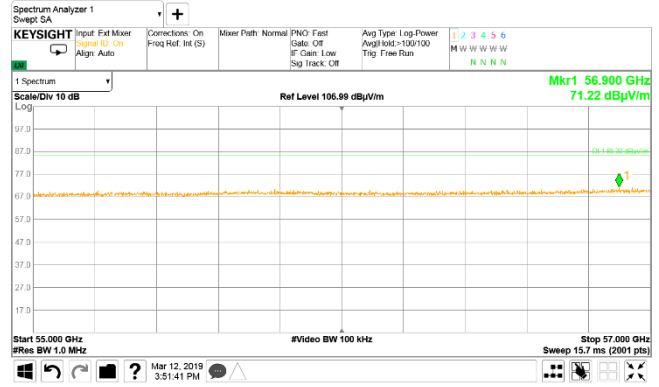
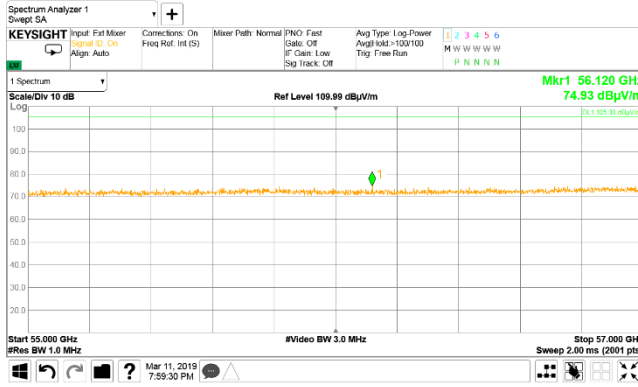
Plot 7.4.3 Spurious emission measurements in 55 – 57 GHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

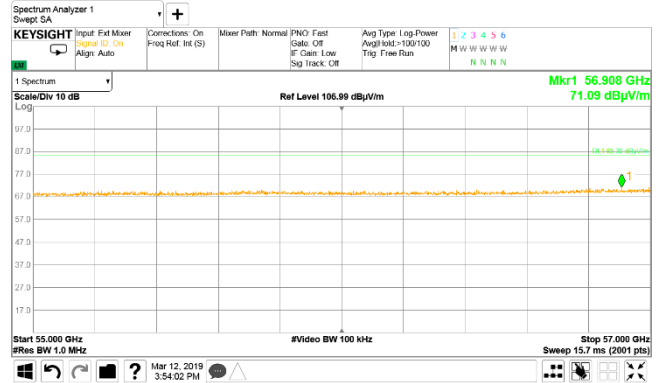
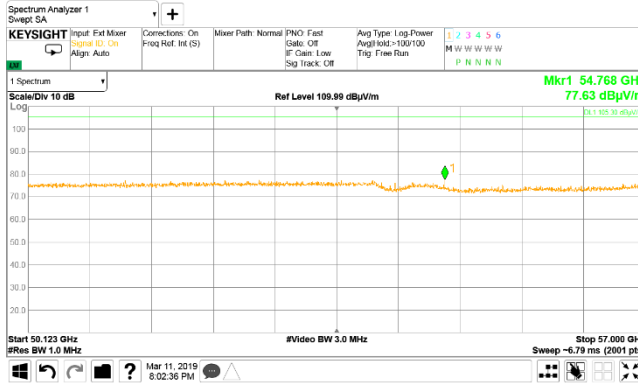
OATS
3 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





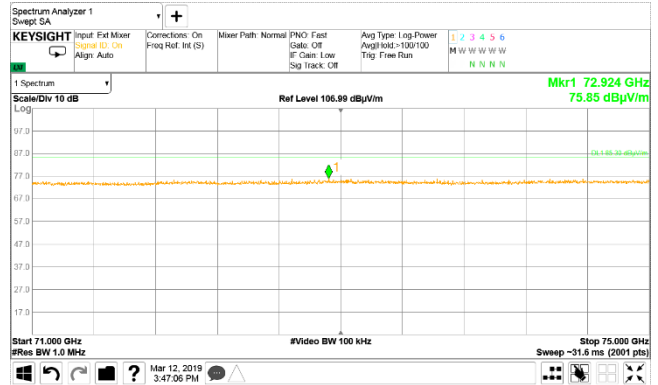
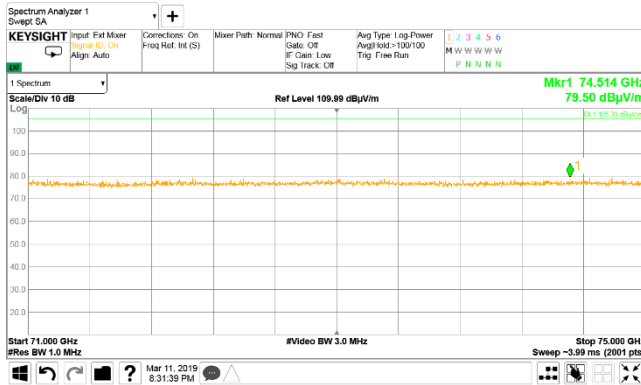
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

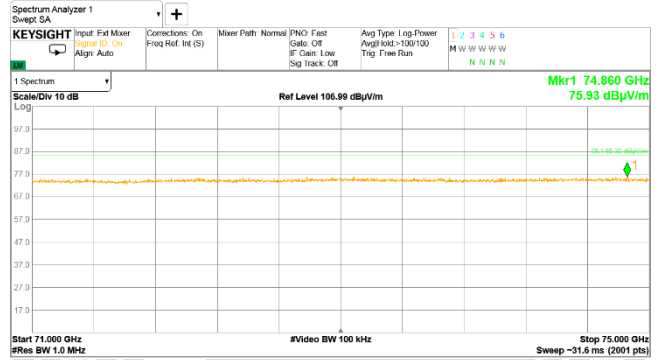
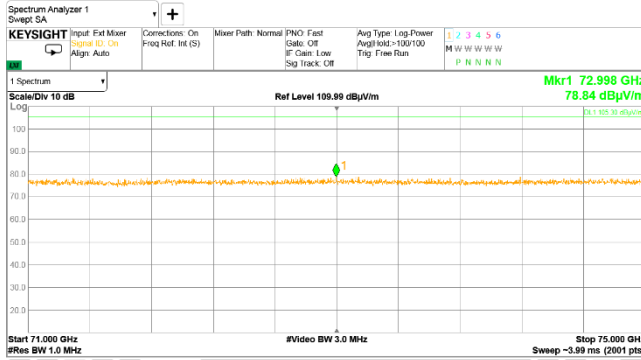
Plot 7.4.4 Spurious emission measurements in 71 – 75 GHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

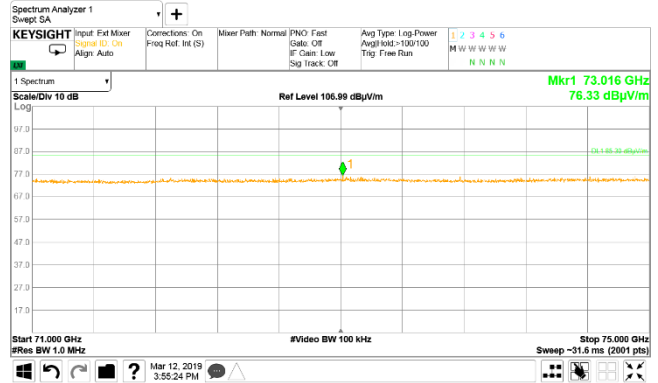
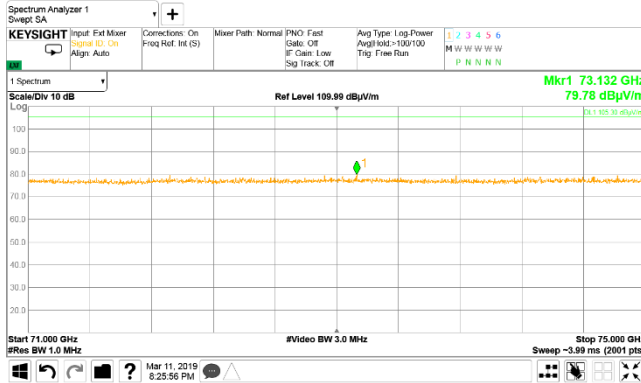
OATS
1 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





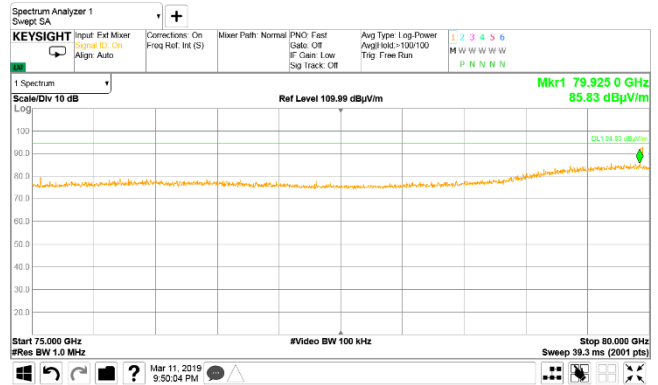
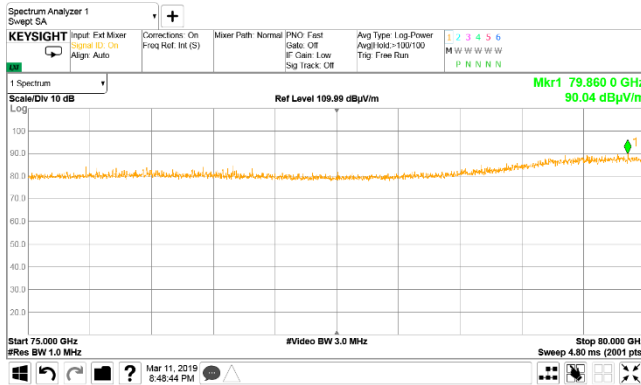
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict:	PASS
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

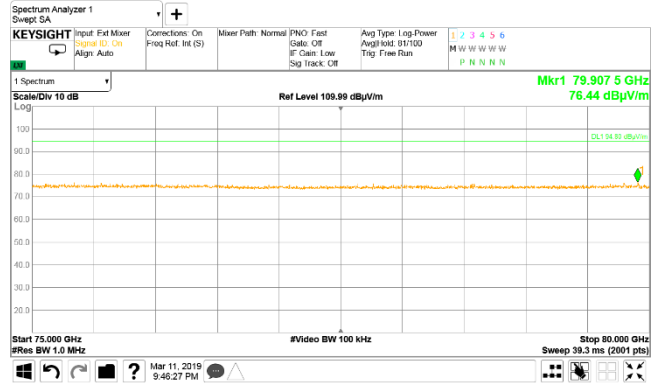
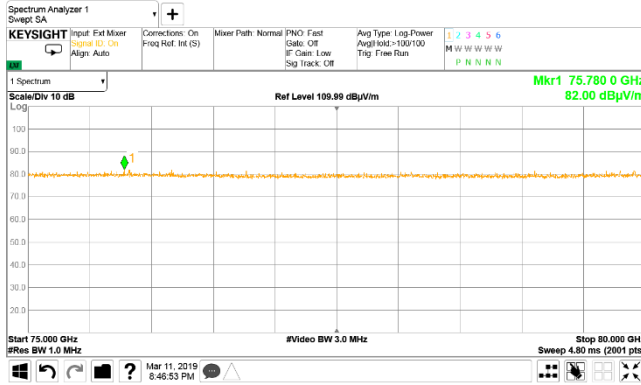
Plot 7.4.5 Spurious emission measurements in 75 – 80 GHz range

TEST SITE:
 TEST DISTANCE:
 ANTENNA POLARIZATION:
 DETECTOR: Peak
 RBW = 1MHz; VBW = 3MHz
 Low carrier 57.05 GHz

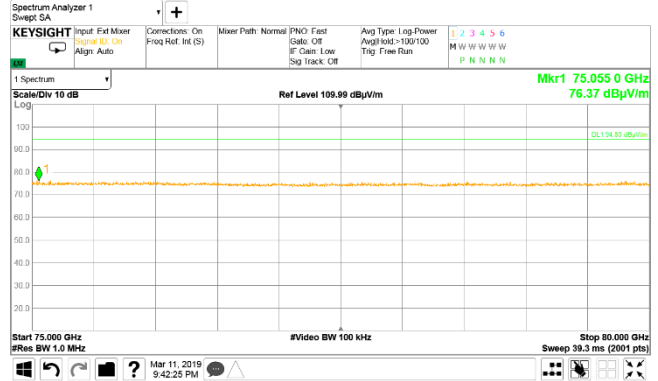
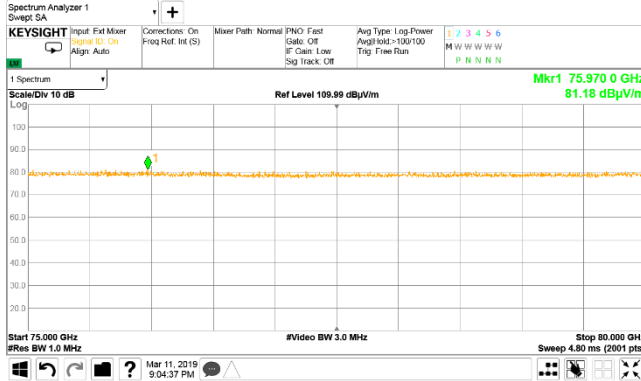
OATS
 1 m
 Vertical and Horizontal
 DETECTOR: Peak
 RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





HERMON LABORATORIES

Test specification:	Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz		
Test procedure:	ANSI C63.10, Sections 9.9, 9.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	29-Apr-19		
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			



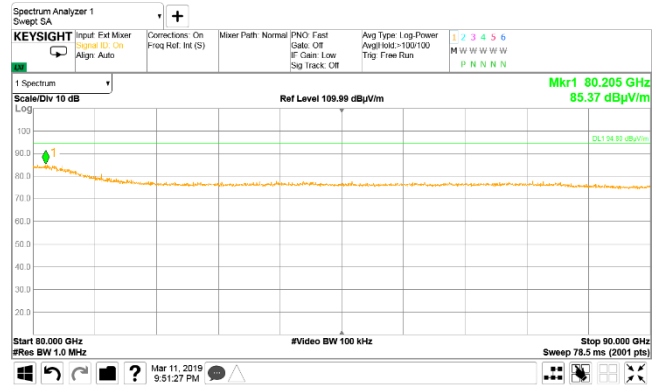
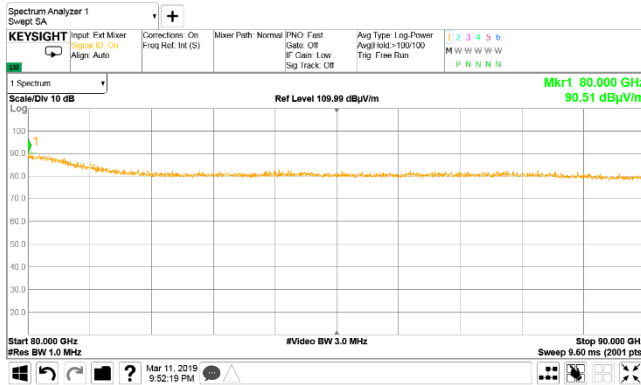
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict:	PASS
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

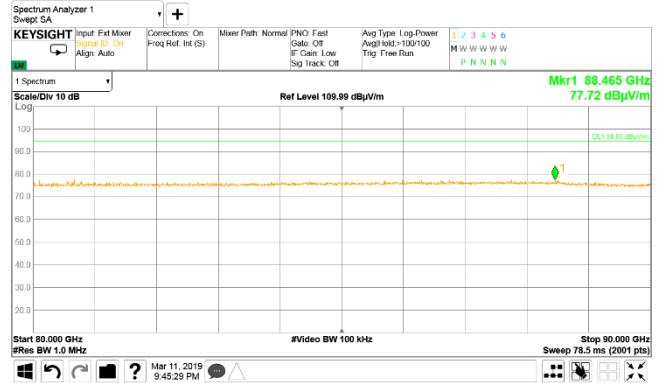
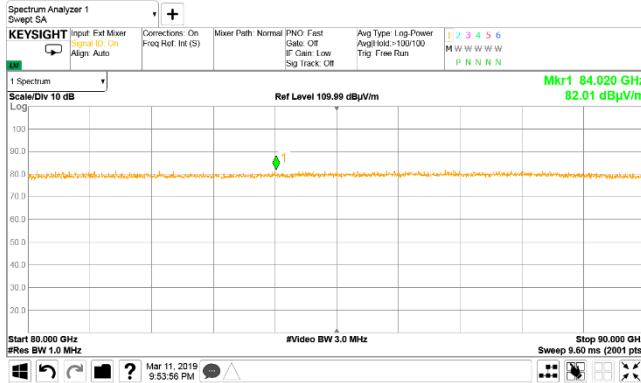
Plot 7.4.6 Spurious emission measurements in 80 – 90 GHz range

TEST SITE:
 TEST DISTANCE:
 ANTENNA POLARIZATION:
 DETECTOR: Peak
 RBW = 1MHz; VBW = 3MHz
 Low carrier 57.05 GHz

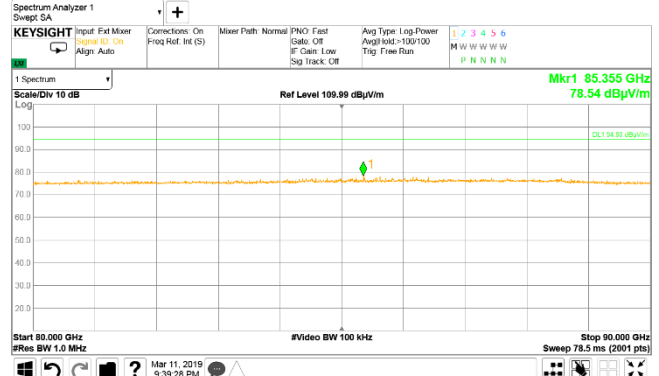
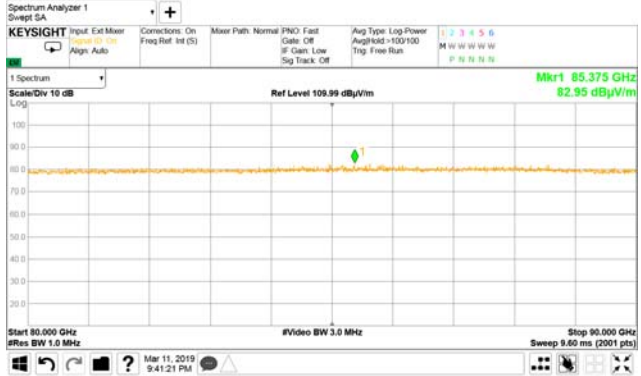
OATS
 1 m
 Vertical and Horizontal
 DETECTOR: Peak
 RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz



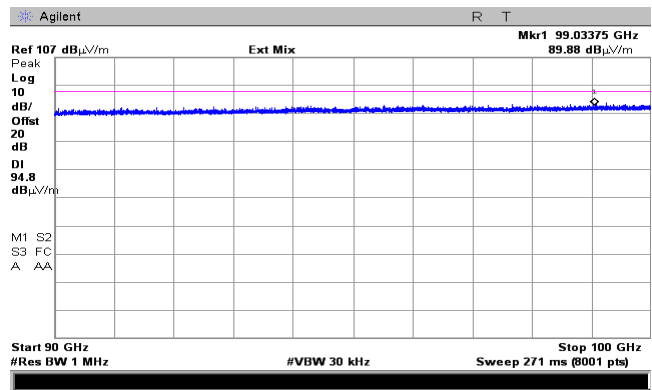
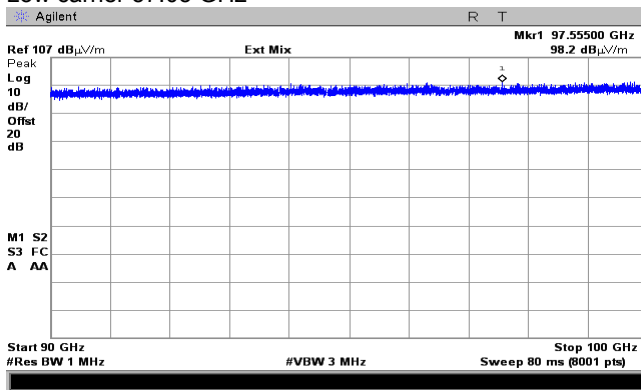


HERMON LABORATORIES

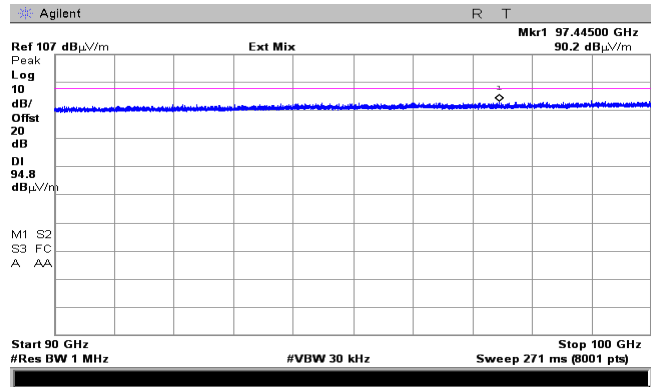
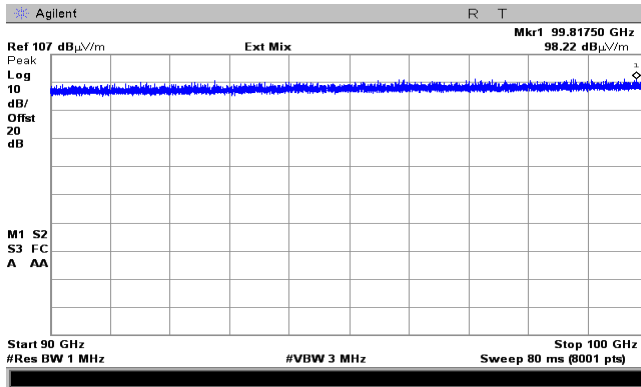
Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

Plot 7.4.7 Spurious emission measurements in 90 to 100 GHz

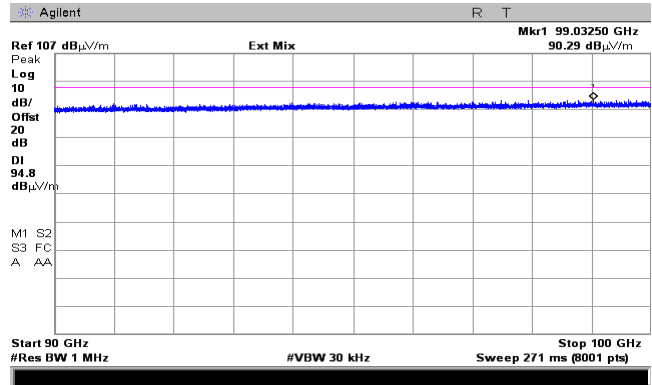
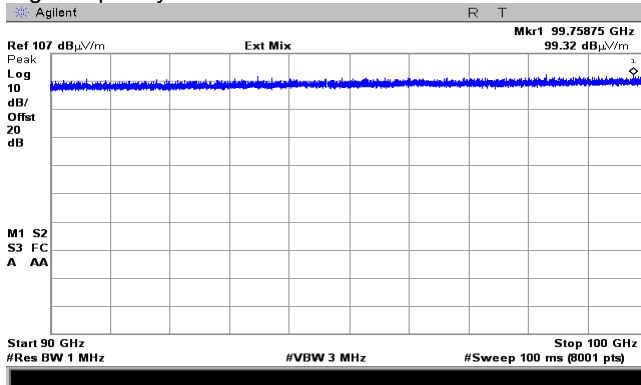
TEST SITE:	OATS
TEST DISTANCE:	1 m
ANTENNA POLARIZATION:	Vertical and Horizontal
DETECTOR:	Peak
DETECTOR:	Peak
RBW = 1MHz; VBW = 3MHz	RBW = 1MHz; VBW = 30 kHz
Low carrier 57.05 GHz	



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





HERMON LABORATORIES

Test specification:	Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz		
Test procedure:	ANSI C63.10, Sections 9.9, 9.12		
Test mode:	Compliance	Verdict:	PASS
Date(s):	29-Apr-19		
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			



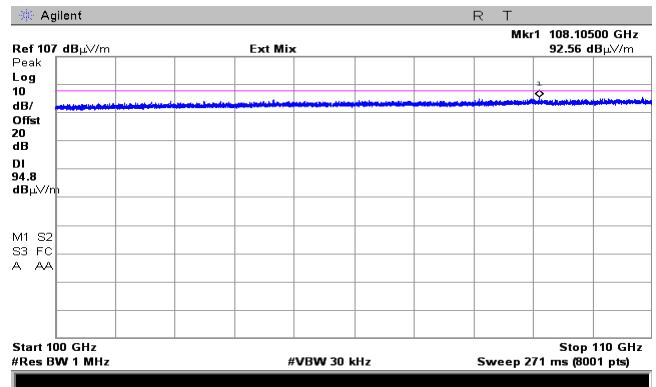
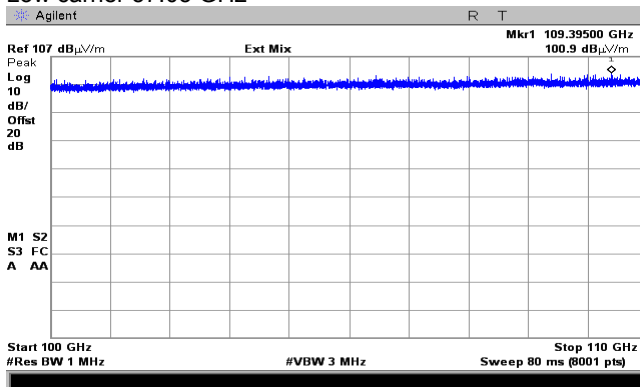
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance	Verdict: PASS		
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

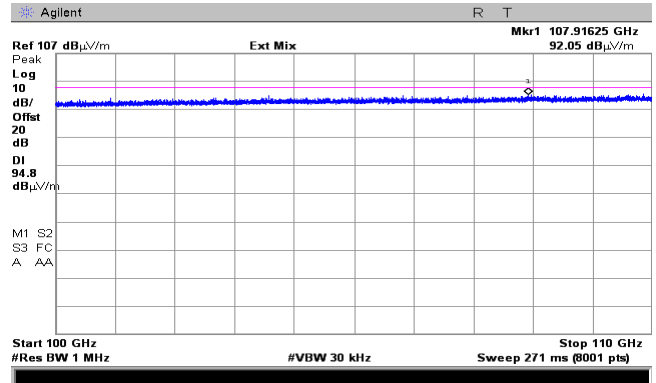
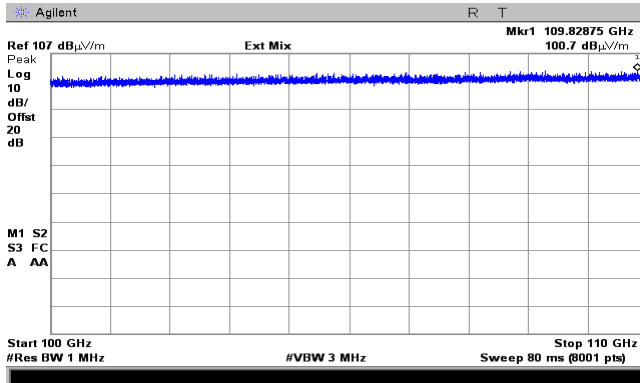
Plot 7.4.8 Spurious emission measurements in 100 – 110 GHz range

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

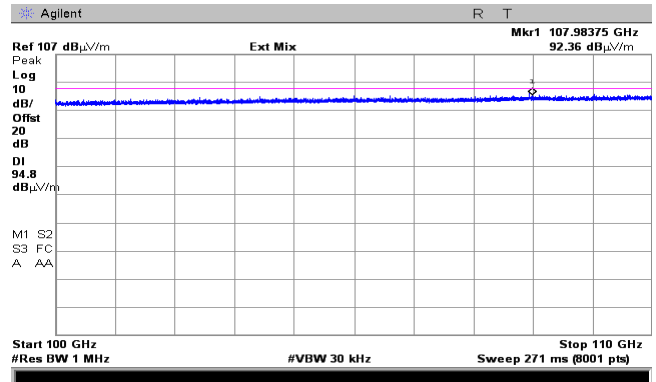
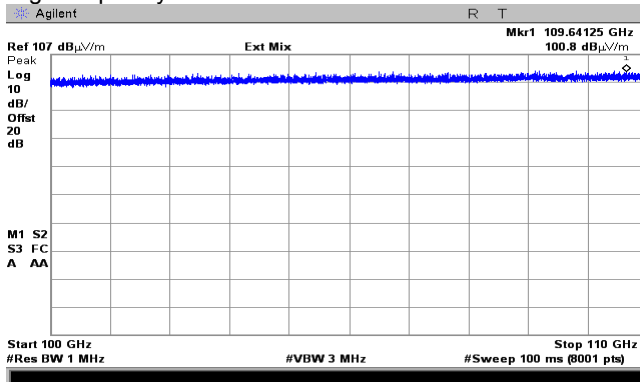
OATS
1 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 30 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz



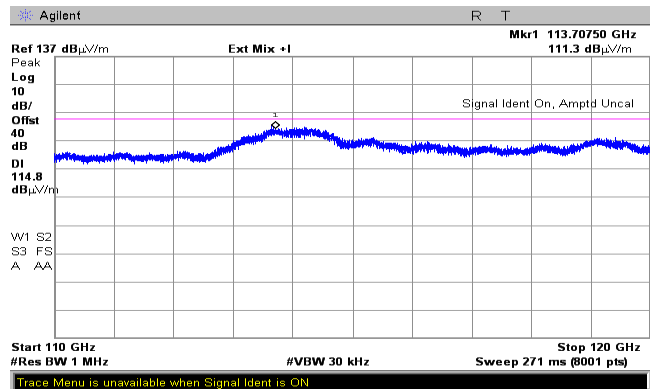
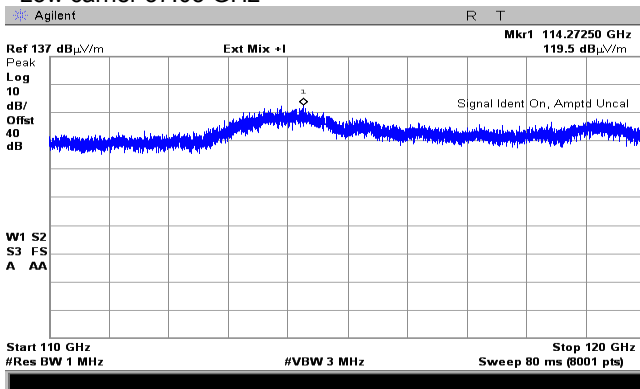


HERMON LABORATORIES

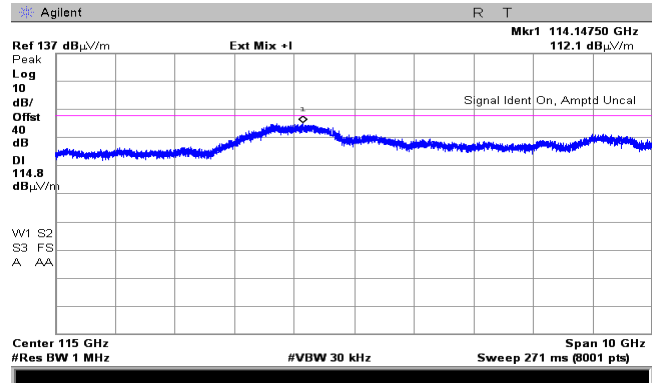
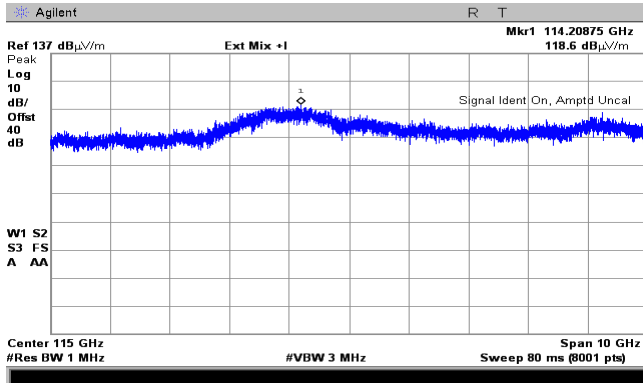
Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz	
Test procedure: ANSI C63.10, Sections 9.9, 9.12	
Test mode: Compliance	Verdict: PASS
Date(s): 29-Apr-19	
Temperature: 24 °C	Relative Humidity: 54 %
	Air Pressure: 1002 hPa
	Power: 5 VDC
Remarks:	

Plot 7.4.9 Spurious emission test results at low carrier frequency from 110 to 120 GHz

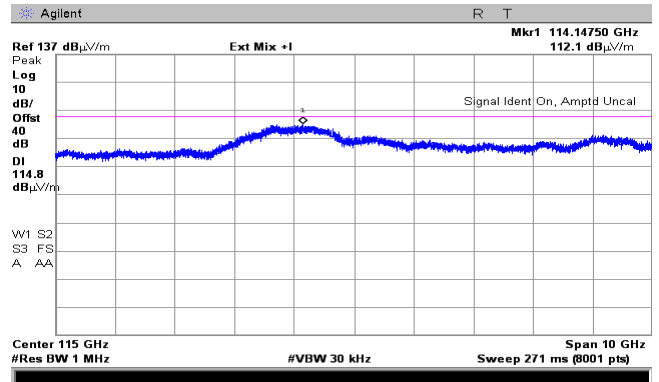
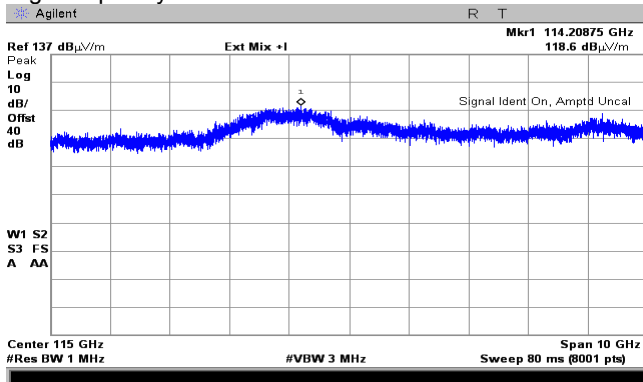
TEST SITE:	OATS
TEST DISTANCE:	0.1 m
ANTENNA POLARIZATION:	Vertical and Horizontal
DETECTOR: Peak	DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz	RBW = 1MHz; VBW = 30 kHz
Low carrier 57.05 GHz	



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





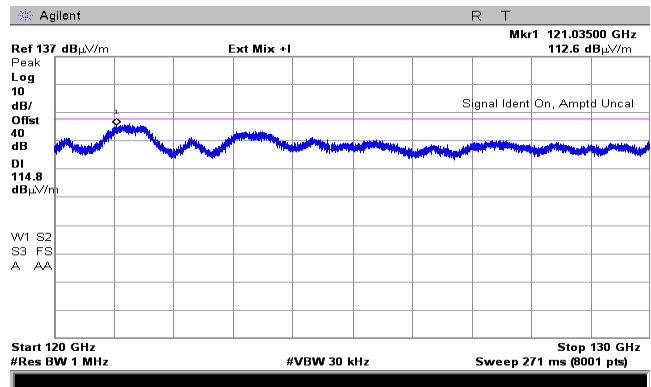
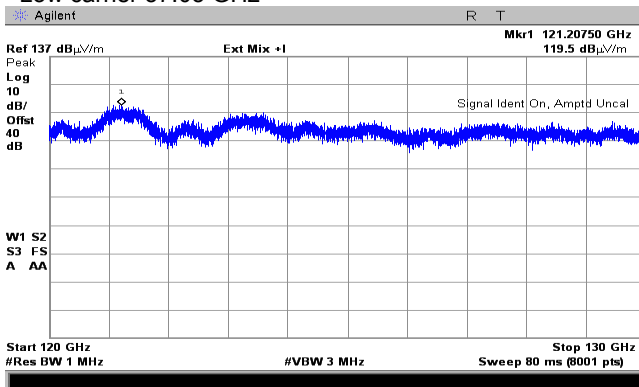
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

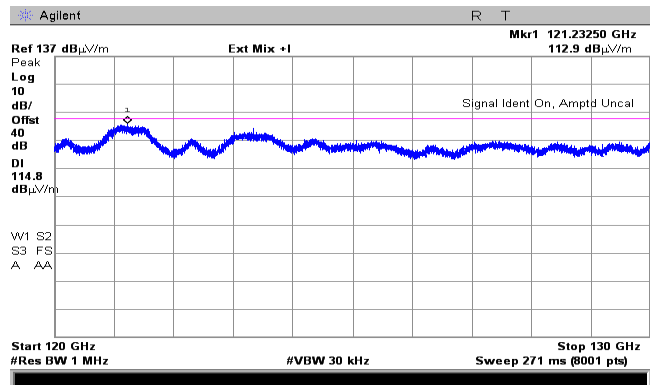
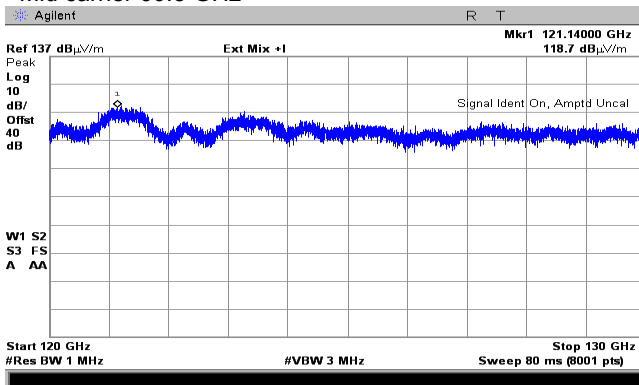
Plot 7.4.10 Spurious emission test results at low carrier frequency from 120 to 130 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

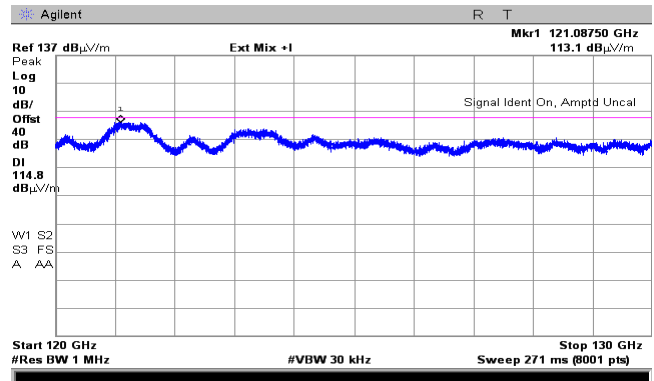
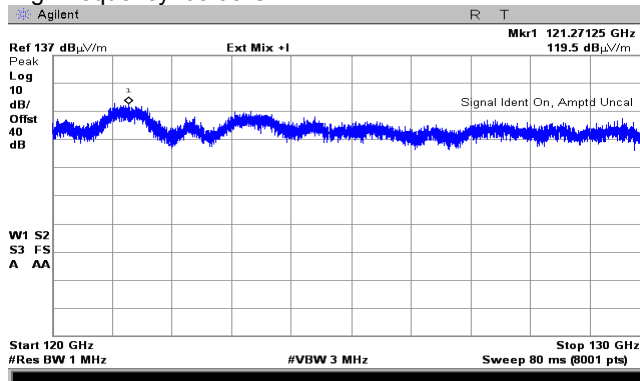
OATS
0.1 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 30 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





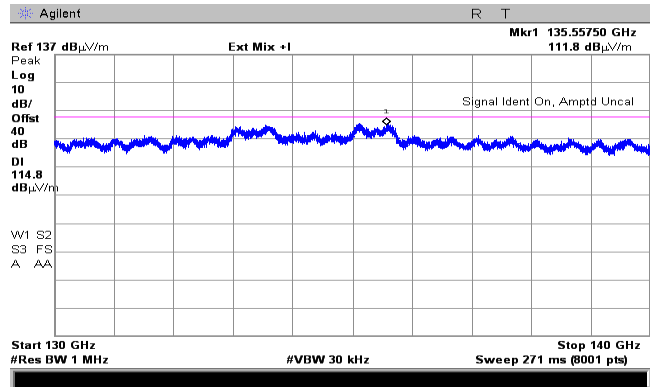
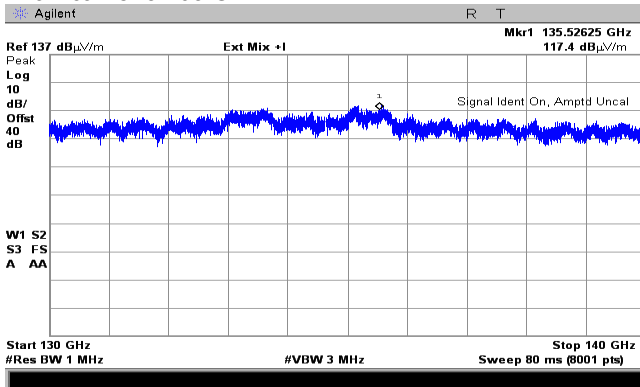
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

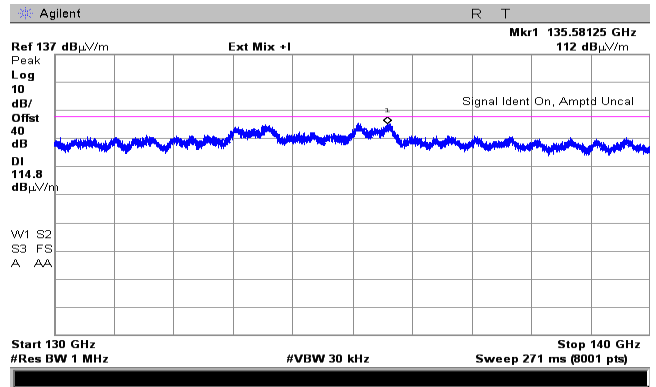
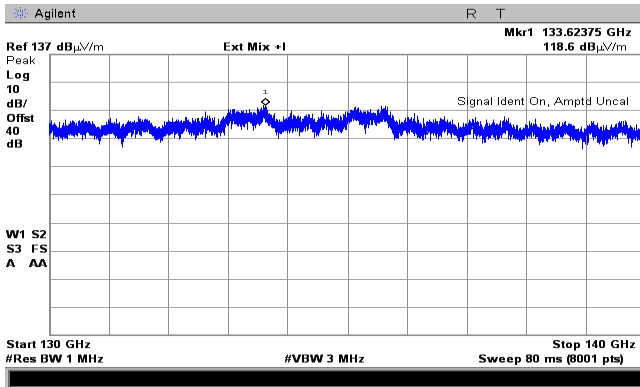
Plot 7.4.11 Spurious emission test results at low carrier frequency from 130 to 140 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

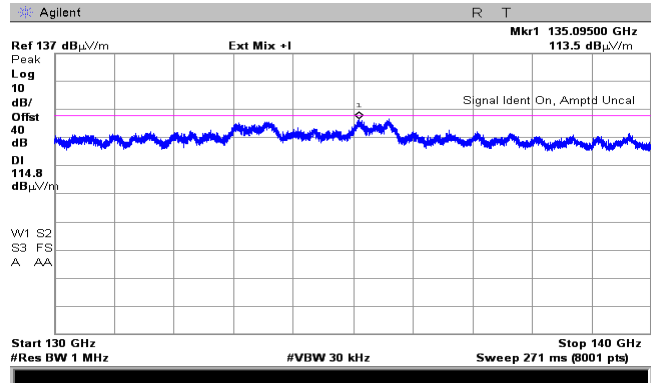
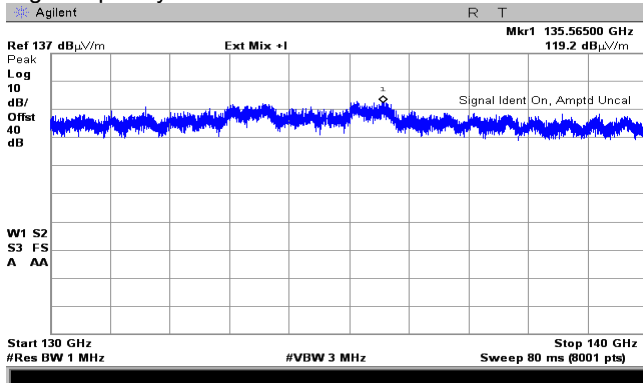
OATS
0.1 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 30 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





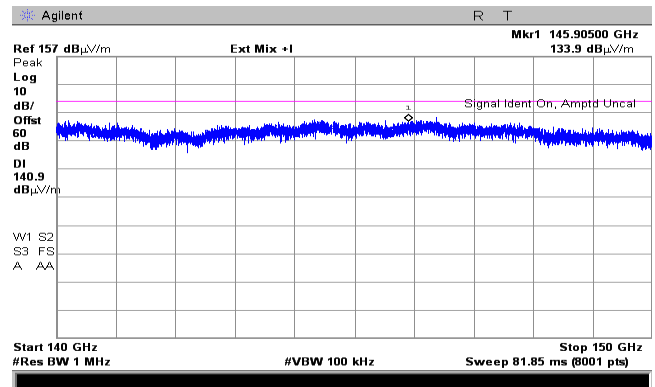
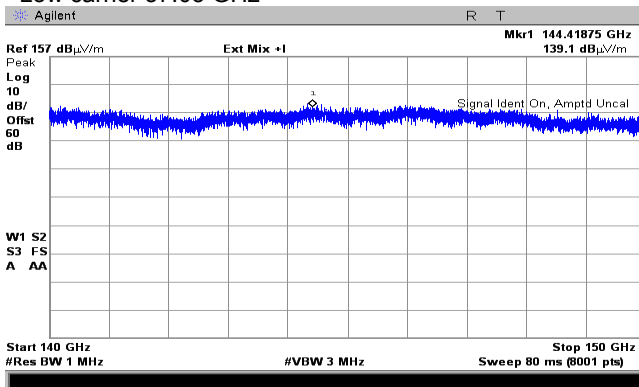
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

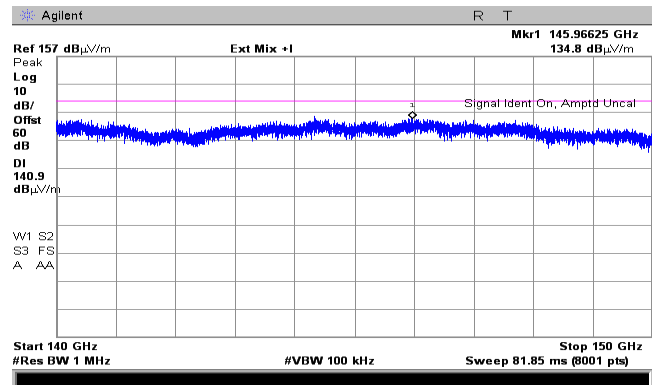
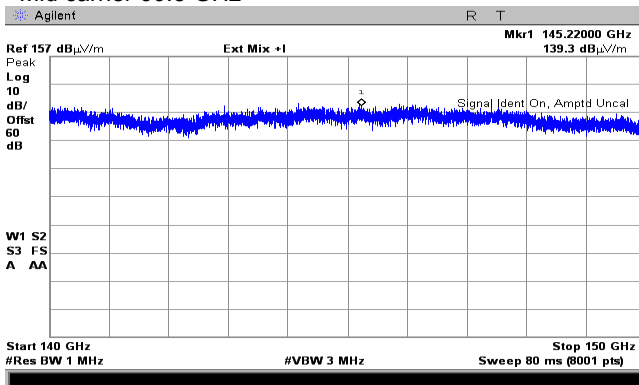
Plot 7.4.12 Spurious emission test results at low carrier frequency from 140 to 150 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

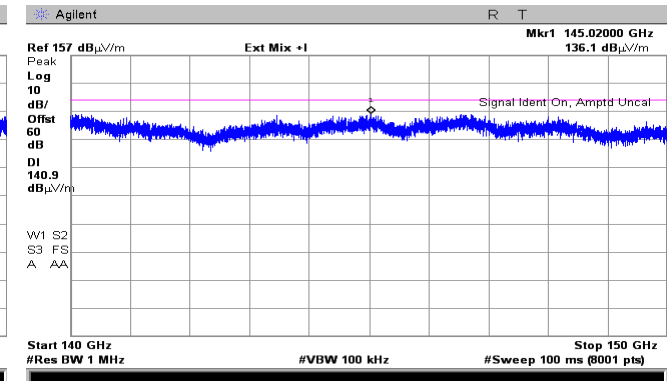
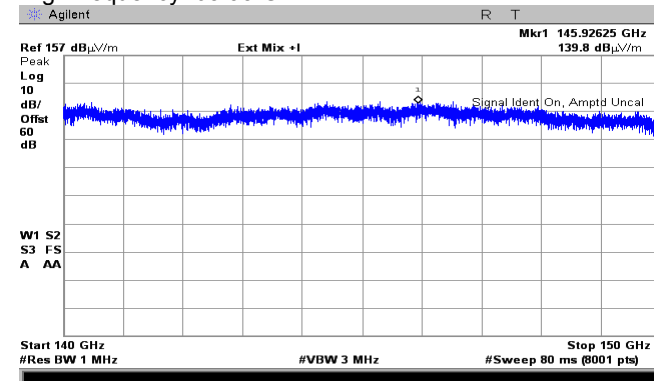
OATS
0.005 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





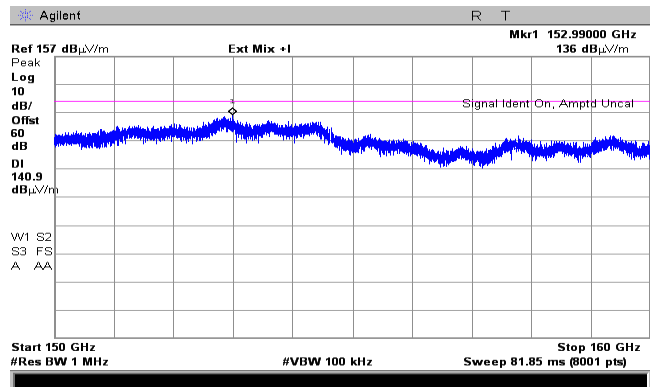
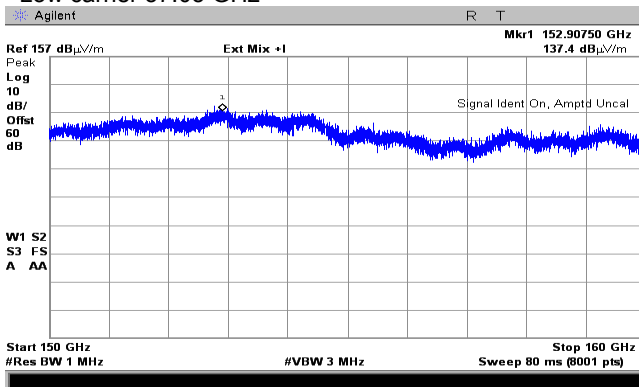
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

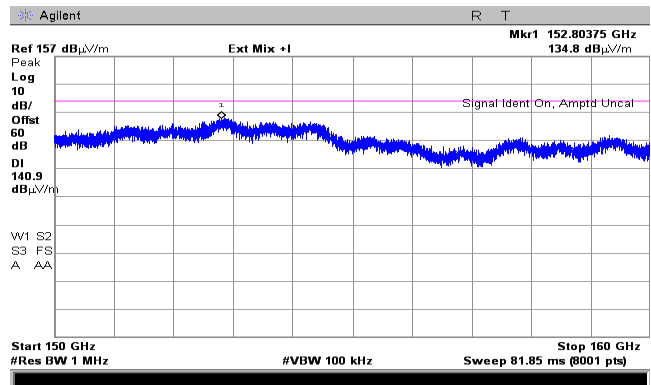
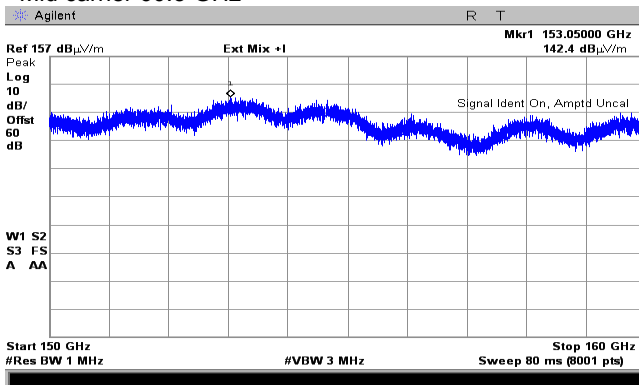
Plot 7.4.13 Spurious emission test results at low carrier frequency from 150 to 160 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

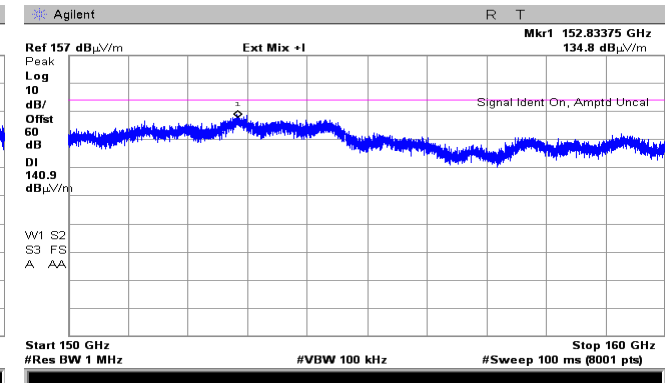
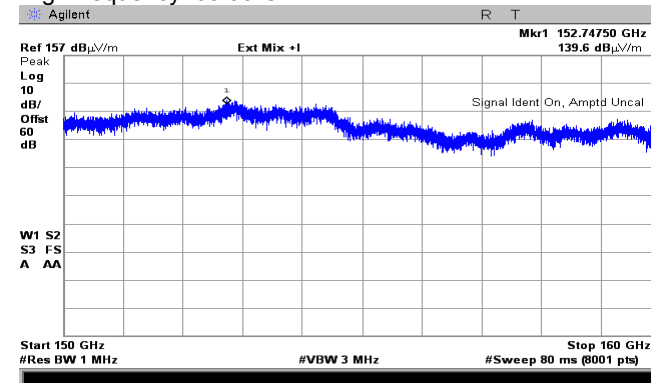
OATS
0.005 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





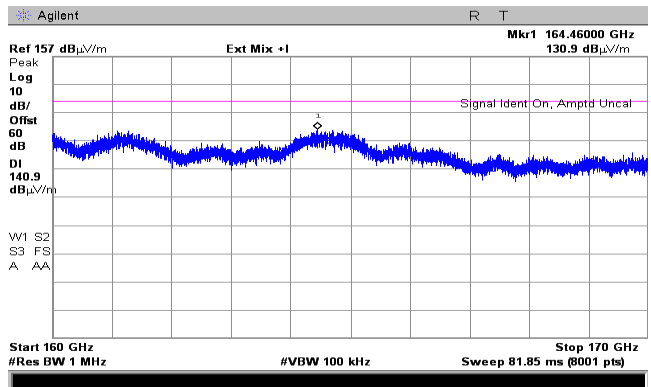
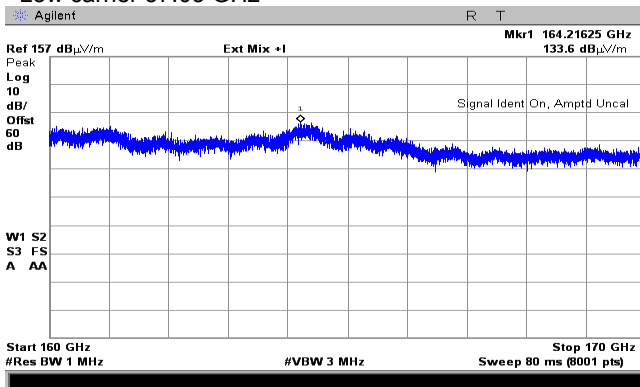
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

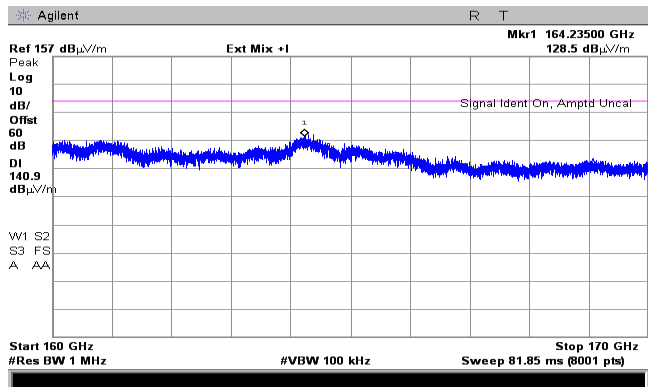
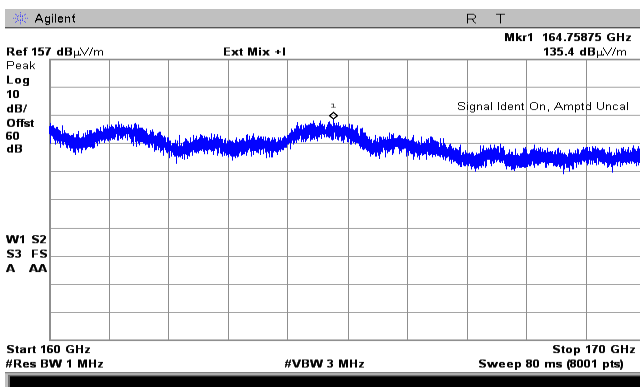
Plot 7.4.14 Spurious emission test results at low carrier frequency from 160 to 170 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

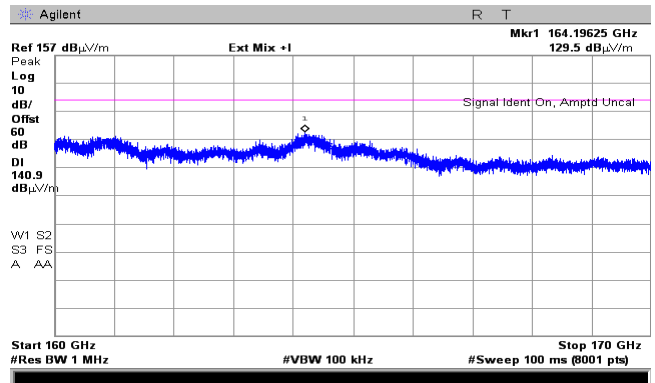
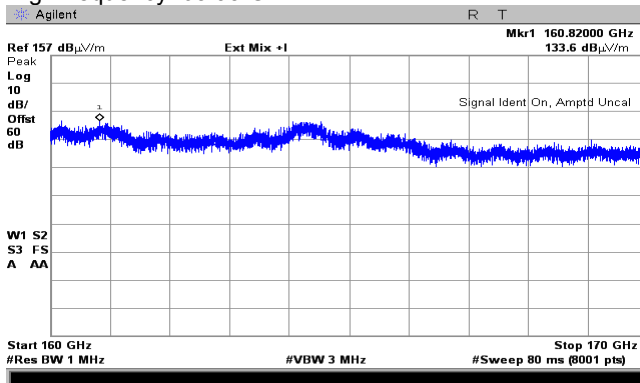
OATS
0.005 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





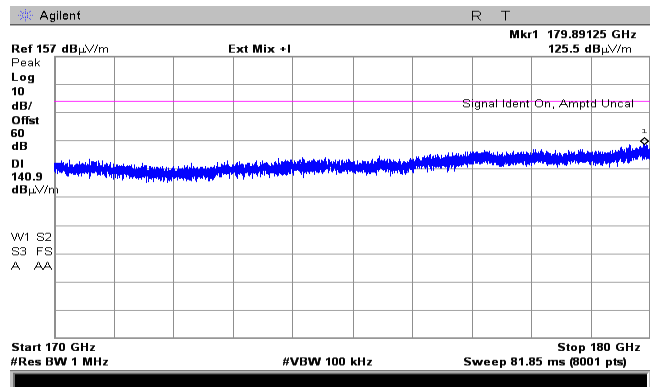
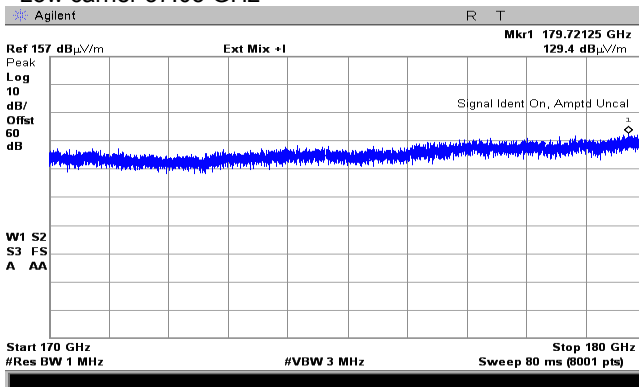
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

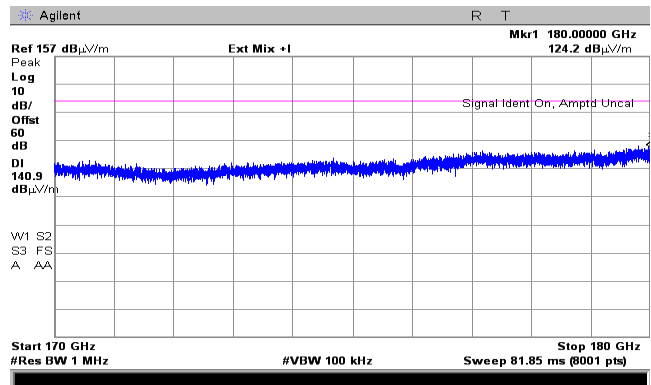
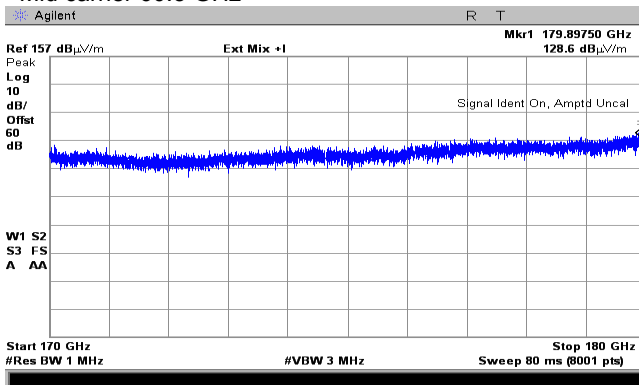
Plot 7.4.15 Spurious emission test results at low carrier frequency from 170 to 180 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

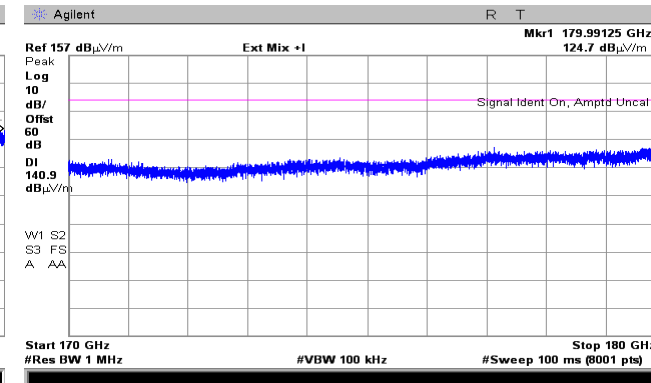
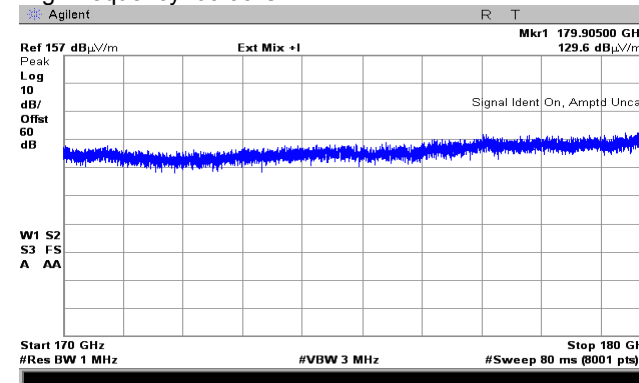
OATS
0.005 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





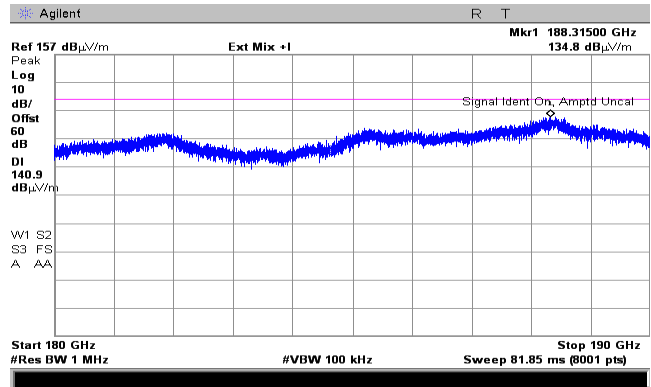
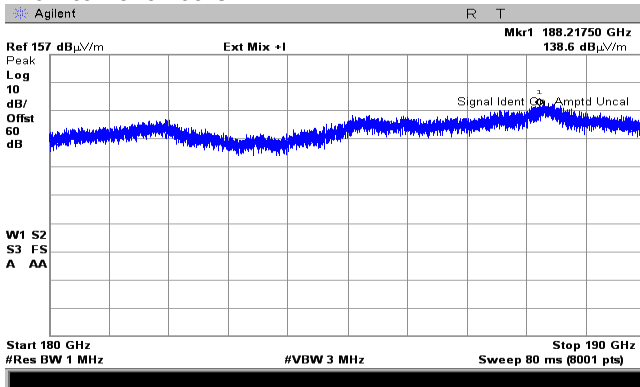
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

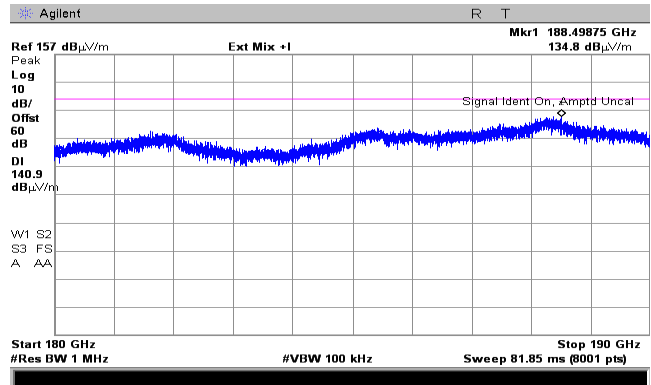
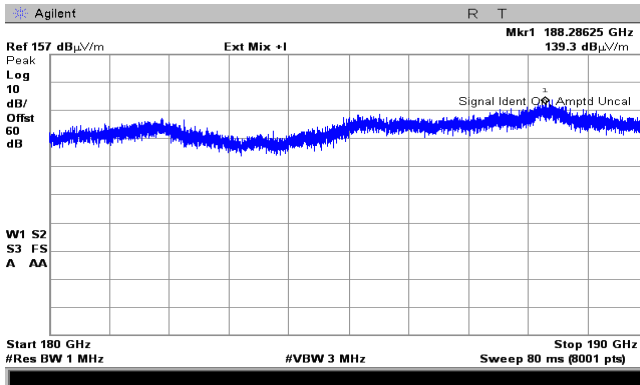
Plot 7.4.16 Spurious emission test results at low carrier frequency from 180 to 190 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

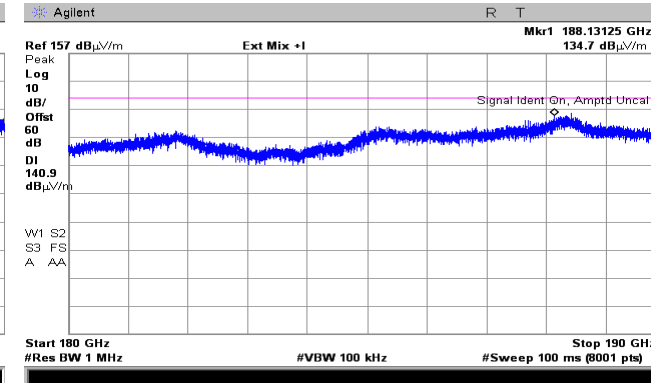
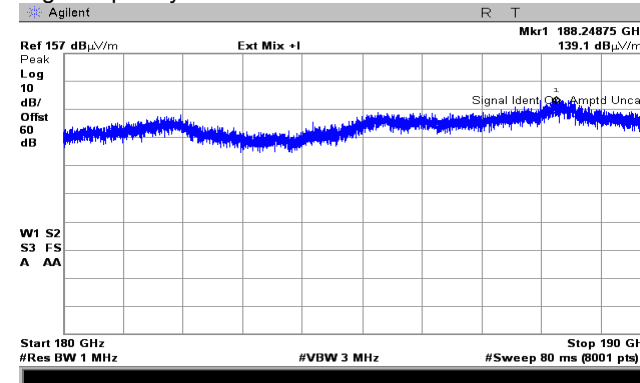
OATS
0.005 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





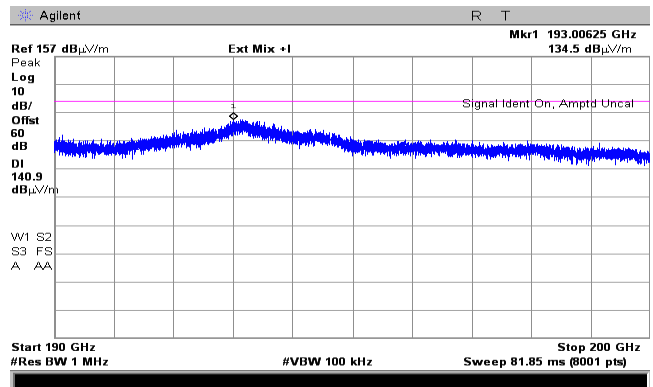
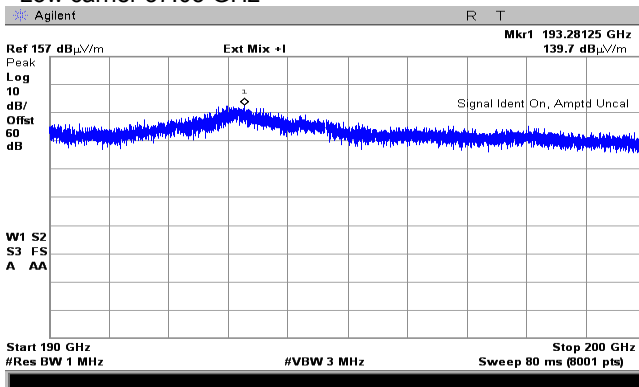
HERMON LABORATORIES

Test specification: Section 15.255(d)(3), Out of band radiated emissions above 40 GHz up to 200GHz			
Test procedure: ANSI C63.10, Sections 9.9, 9.12			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1002 hPa	Power: 5 VDC
Remarks:			

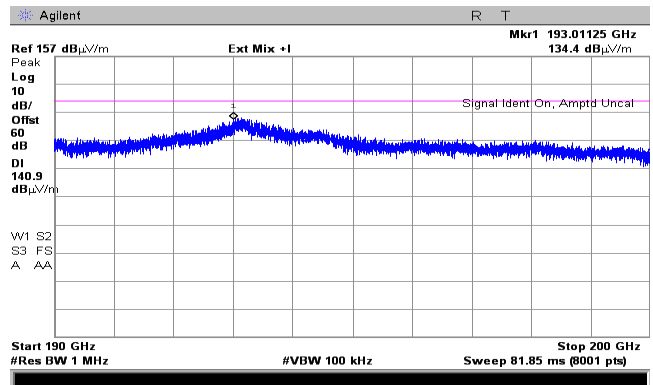
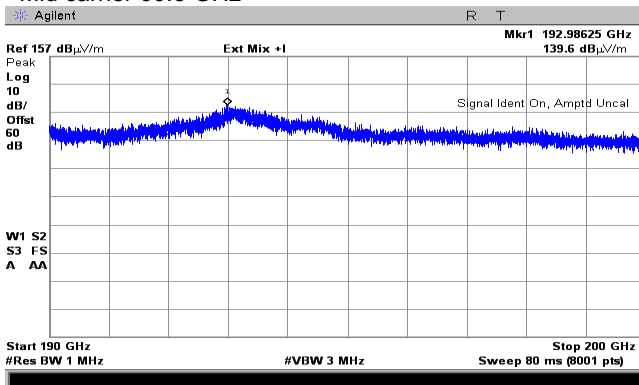
Plot 7.4.17 Spurious emission test results at low carrier frequency from 190 to 200 GHz

TEST SITE:
TEST DISTANCE:
ANTENNA POLARIZATION:
DETECTOR: Peak
RBW = 1MHz; VBW = 3MHz
Low carrier 57.05 GHz

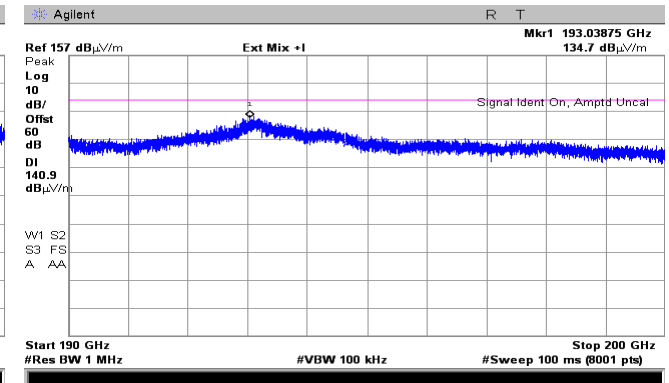
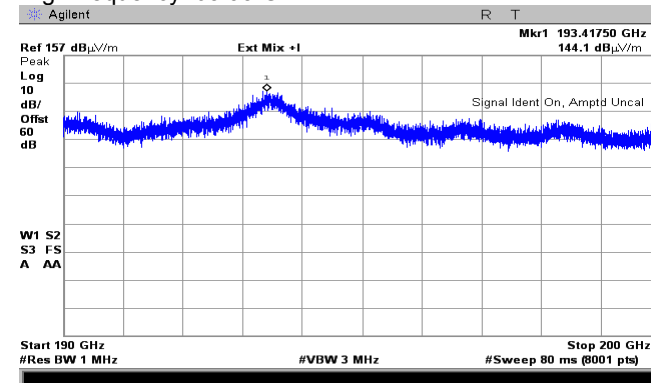
OATS
0.005 m
Vertical and Horizontal
DETECTOR: Peak
RBW = 1MHz; VBW = 100 kHz



Mid carrier 60.5 GHz



High frequency: 63.95 GHz





Test specification: Section 15.255(f), Frequency stability			
Test procedure: ANSI C63.10, Section 9.14			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1003 hPa	Power: 5 VDC
Remarks:			

7.5 Frequency stability test

7.5.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.5.1.

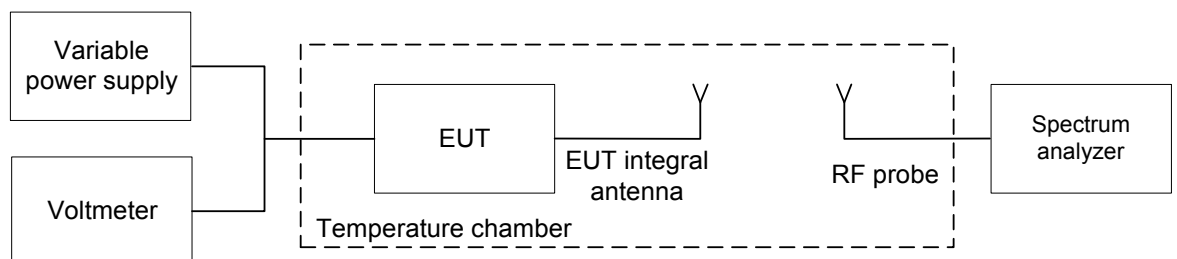
Table 7.5.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement
57050	NA
60500	
66950	

7.5.2 Test procedure

- 7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and its proper operation was checked.
- 7.5.2.2 The EUT power was turned off. Temperature within test chamber was set to +40°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.5.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 20 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.5.2.4 The above procedure was repeated at -30°C and at the lowest test temperature.
- 7.5.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.5.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.5.2

Figure 7.5.1 Frequency stability test setup





HERMON LABORATORIES

Test specification: Section 15.255(f), Frequency stability			
Test procedure: ANSI C63.10, Section 9.14			
Test mode: Compliance		Verdict: PASS	
Date(s): 29-Apr-19			
Temperature: 24 °C	Relative Humidity: 54 %	Air Pressure: 1003 hPa	Power: 5 VDC
Remarks:			

Table 7.5.2 Frequency stability test results

OPERATING FREQUENCY: 57050 – 63950 MHz
 TEMPERATURE STABILIZATION PERIOD: 20 min
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 3 kHz
 VIDEO BANDWIDTH: 10 kHz
 MODULATION: CW

T, °C	Voltage, V	Frequency, MHz						Max frequency drift, kHz		
		Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	Posit	Negative
Low frequency 57.05 GHz										
-20	nominal	57049.047	NA	NA	NA	NA	NA	57049.048	97.600	0.000
-10	nominal	57049.022	NA	NA	NA	NA	NA	57049.021	71.600	0.000
0	nominal	57049.032	57049.033	57049.032	57049.033	57049.032	57049.032	57049.033	82.600	0.000
10	nominal	57049.005	NA	NA	NA	NA	NA	57049.010	59.200	0.000
20	15%	57048.957	NA	NA	NA	NA	NA	57048.960	9.500	0.000
20	nominal	57048.957	NA	NA	NA	NA	NA	57048.957	7.000	0.000
20	-15%	57048.956	NA	NA	NA	NA	NA	57048.950	5.200	0.000
30	nominal	57049.010	57049.009	57049.010	57049.009	57049.016	57049.016	57049.015	65.500	0.000
40	nominal	57049.016	NA	NA	NA	NA	NA	57049.006	65.600	0.000
50	nominal	57048.981	NA	NA	NA	NA	NA	57048.980	30.400	0.000
Mid frequency 61.5GHz										
-20	nominal	60498.977	NA	NA	NA	NA	NA	60498.978	84.800	0.000
-10	nominal	60498.972	NA	NA	NA	NA	NA	60498.974	80.400	0.000
0	nominal	60498.968	60498.969	60498.969	60498.969	60498.967	60498.969	60498.969	75.400	0.000
10	nominal	60498.951	NA	NA	NA	NA	NA	60498.953	59.800	0.000
20	15%	60498.891	NA	NA	NA	NA	NA	60498.893	0.000	-2.700
20	nominal	60498.886	NA	NA	NA	NA	NA	60498.893	0.000	-7.600
20	-15%	60498.889	NA	NA	NA	NA	NA	60498.892	0.000	-4.000
30	nominal	60498.955	60498.956	60498.557	60498.556	60498.554	60498.955	60498.953	62.400	-339.200
40	nominal	60498.947	NA	NA	NA	NA	NA	60498.948	54.500	0.000
50	nominal	60498.918	NA	NA	NA	NA	NA	60498.918	84.800	0.000
High frequency 63.95 GHz										
-20	nominal	63948.911	NA	NA	NA	NA	NA	63948.912	95.550	0.000
-10	nominal	63948.911	NA	NA	NA	NA	NA	63948.911	94.650	0.000
0	nominal	63948.914	63948.914	63948.915	63948.916	63948.917	63948.917	63948.918	101.050	0.000
10	nominal	63948.893	NA	NA	NA	NA	NA	63948.893	76.850	0.000
20	15%	63948.825	NA	NA	NA	NA	NA	63948.824	5.450	0.000
20	nominal	63948.819	NA	NA	NA	NA	NA	63948.816	0.000	-3.000
20	-15%	63948.824	NA	NA	NA	NA	NA	63948.819	7.100	0.000
30	nominal	63948.895	63948.895	63948.897	63948.897	63948.898	63948.899	63948.897	82.550	0.000
40	nominal	63948.885	NA	NA	NA	NA	NA	63948.884	68.650	0.000
50	nominal	63948.859	NA	NA	NA	NA	NA	63948.857	42.450	0.000

* - Reference frequency

Reference numbers of test equipment used

HL 0770	HL 0771	HL 3294	HL 4164	HL 4482	HL 5376	HL 5380
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Full description is given in Appendix A.



Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.10, Section 6.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 23 °C	Relative Humidity: 51 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

7.6 Conducted emissions

7.6.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.6.1. The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

Table 7.6.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)	
	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

* The limit decreases linearly with the logarithm of frequency.

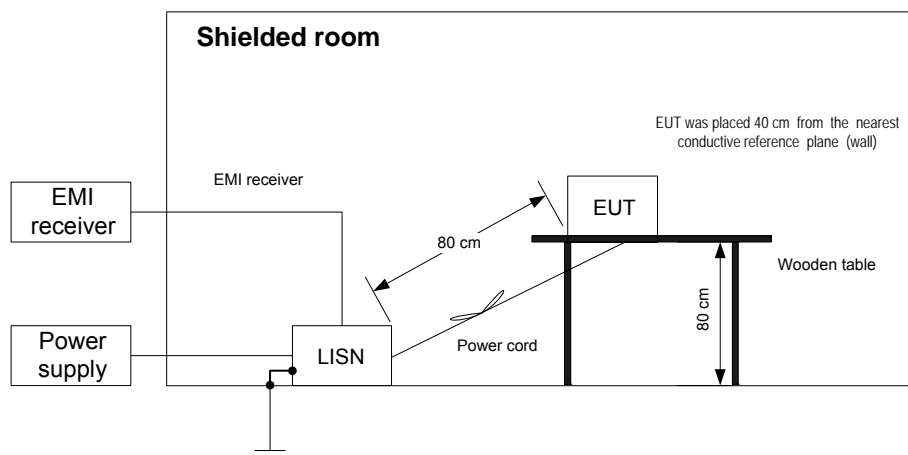
7.6.2 Test procedure

7.6.2.1 The EUT was set up as shown in Figure 7.6.1 and associated photographs, energized and the performance check was conducted.

7.6.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 7.6.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

7.6.2.3 The position of the device cables was varied to determine maximum emission level.

Figure 7.6.1 Setup for conducted emission measurements, table-top equipment





HERMON LABORATORIES

Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.10, Section 6.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 23 °C	Relative Humidity: 51 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

Table 7.6.2 Conducted emission test results

LINE: AC mains
LIMIT: Class B
EUT OPERATING MODE: Transmitter mode Low
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.153	53.15	48.99	65.88	-16.89	40.24	55.88	-15.64	L1	Pass
0.180	51.06	46.84	64.52	-17.68	38.23	54.52	-16.29		
0.205	48.04	44.02	63.45	-19.43	37.12	53.45	-16.33		
0.410	42.99	40.06	57.66	-17.60	34.01	47.66	-13.65		
0.430	42.21	32.23	57.27	-25.04	30.71	47.27	-16.56		
0.915	38.95	32.2	56.00	-23.80	25.97	46.00	-20.03		
0.153	52.91	48.98	65.88	-16.90	41.73	55.88	-14.15	L2	Pass
0.180	51.11	46.71	64.52	-17.81	39.13	54.52	-15.39		
0.204	49.13	44.02	63.45	-19.43	37.03	53.45	-16.42		
0.229	48.12	42.63	62.50	-19.87	35.07	52.50	-17.43		
0.405	43.13	38.01	57.75	-19.74	34.99	47.75	-12.76		
0.627	39.19	31.97	56.00	-24.03	26.23	46.00	-19.77		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 5372	HL 4227	HL 2888	HL 2382	HL 0495	HL 3979
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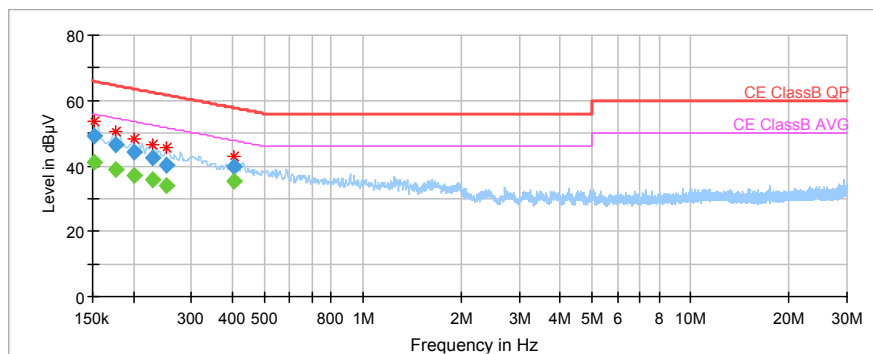
Full description is given in Appendix A.



Test specification: Section 15.207(a), Conducted emission			
Test procedure: ANSI C63.10, Section 6.2			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 23 °C	Relative Humidity: 51 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

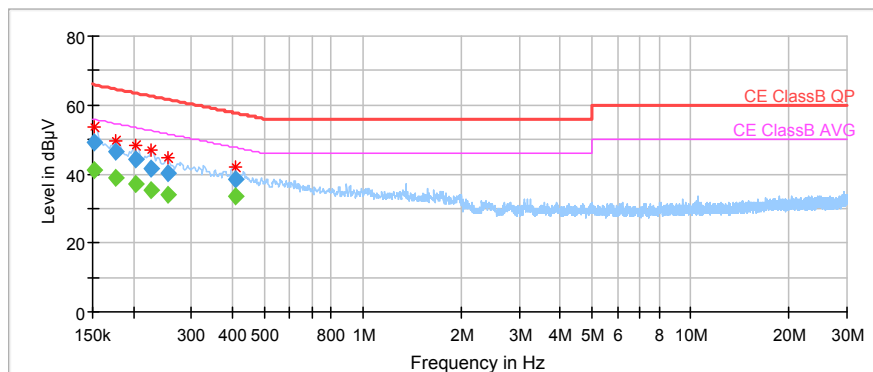
Plot 7.6.3 Conducted emission measurements

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Transmitter
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.6.4 Conducted emission measurements

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Transmitter
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK





Test specification: Section 15.203, Antenna requirement			
Test procedure: Visual inspection / supplier declaration			
Test mode: Compliance		Verdict: PASS	
Date(s): 02-Jun-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1009 hPa	Power: 5 VDC
Remarks:			

7.7 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.7.1.

Table 7.7.1 Antenna requirements

Requirement	Rationale	Verdict
The transmitter antenna is permanently attached	Visual inspection	Comply
The transmitter employs a unique antenna connector	NA	
The transmitter requires professional installation	NA	



Test specification: Section 15.107, Conducted emission at AC power port			
Test procedure: ANSI C63.4, Sections 7			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

8 Emission tests according to 47CFR part 15 subpart B requirements

8.1 Conducted emissions

8.1.1 General

This test was performed to measure common mode conducted emissions at the mains power port. Specification test limits are given in Table 8.1.1. The worst test results (the lowest margins) were recorded in Table 8.1.2 and shown in the associated plots.

Table 8.1.1 Limits for conducted emissions

Frequency, MHz	Class B limit, dB(μV)		Class A limit, dB(μV)	
	QP	AVRG	QP	AVRG
0.15 - 0.5	66 - 56*	56 - 46*	79	66
0.5 - 5.0	56	46	73	60
5.0 - 30	60	50	73	60

* The limit decreases linearly with the logarithm of frequency.

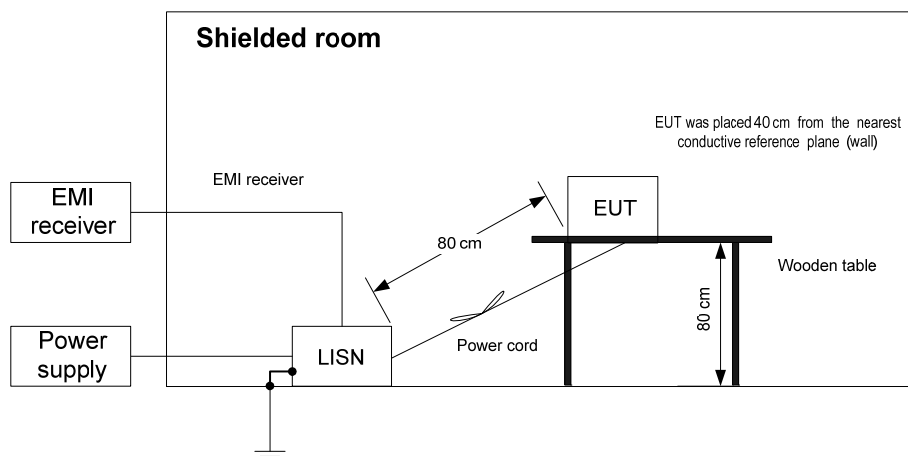
8.1.2 Test procedure

8.1.2.1 The EUT was set up as shown in Figure 8.1.1 and associated photographs, energized and the performance check was conducted.

8.1.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer in the frequency range referred to in Table 8.1.2. Unused coaxial connector of the LISN was terminated with 50 Ohm. Quasi-peak and average detectors were used throughout the testing.

8.1.2.3 The position of the device cables was varied to determine maximum emission level.

Figure 8.1.1 Setup for conducted emission measurements, table-top equipment





Test specification: Section 15.107, Conducted emission at AC power port			
Test procedure: ANSI C63.4, Sections 7			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

Table 8.1.2 Conducted emission test results

LINE: AC mains
LIMIT: Class B
EUT OPERATING MODE: Stand-by
EUT SET UP: TABLE-TOP
TEST SITE: SHIELDED ROOM
DETECTORS USED: PEAK / QUASI-PEAK / AVERAGE
FREQUENCY RANGE: 150 kHz - 30 MHz
RESOLUTION BANDWIDTH: 9 kHz

Frequency, MHz	Peak emission, dB(µV)	Quasi-peak			Average			Line ID	Verdict
		Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*	Measured emission, dB(µV)	Limit, dB(µV)	Margin, dB*		
0.153	53.11	48.95	65.88	-16.93	40.21	55.88	-15.67	L1	Pass
0.180	51.03	46.83	64.52	-17.69	38.21	54.52	-16.31		
0.205	47.99	43.98	63.45	-19.47	37.13	53.45	-16.32		
0.410	42.91	40.01	57.66	-17.65	33.98	47.66	-13.68		
0.430	41.97	32.12	57.27	-25.15	30.67	47.27	-16.60		
0.915	38.68	32.21	56.00	-23.79	25.96	46.00	-20.04		
0.153	52.89	48.96	65.88	-16.92	41.68	55.88	-14.20	L2	Pass
0.180	51.02	46.67	64.52	-17.85	39.01	54.52	-15.51		
0.204	49.00	43.96	63.45	-19.49	36.99	53.45	-16.46		
0.229	48.02	42.60	62.50	-19.90	35.98	52.50	-16.52		
0.405	43.11	37.98	57.75	-19.77	34.89	47.75	-12.86		
0.627	39.13	31.89	56.00	-24.11	26.12	46.00	-19.88		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

HL 5372	HL 4227	HL 2888	HL 2382	HL 0495	HL 3979
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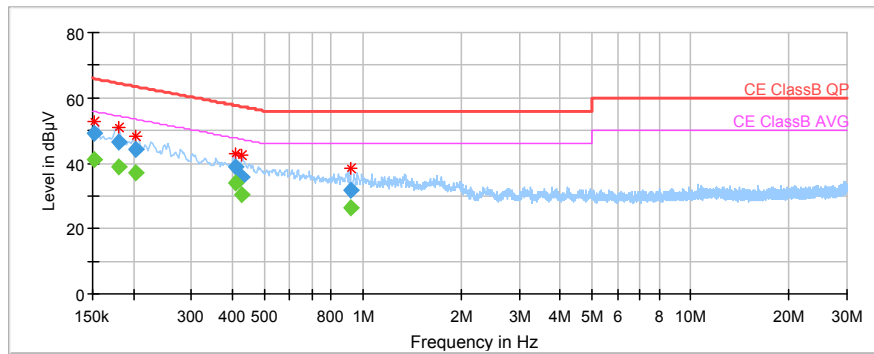
Full description is given in Appendix A.



Test specification: Section 15.107, Conducted emission at AC power port			
Test procedure: ANSI C63.4, Sections 7			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

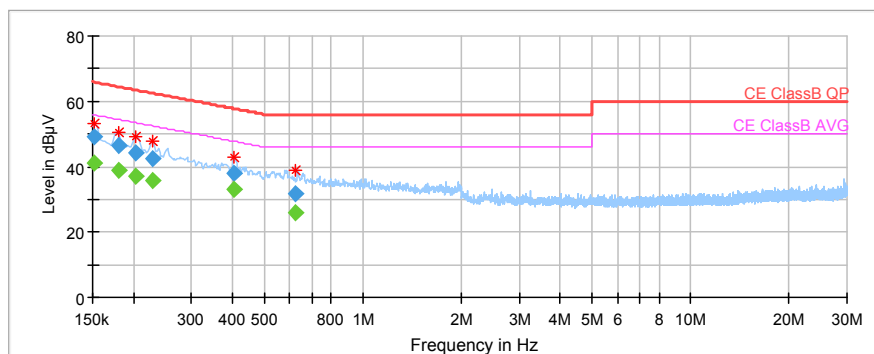
Plot 8.1.1 Conducted emission measurements

LINE: L1
LIMIT: Class B
EUT OPERATING MODE: Stand-by
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 8.1.2 Conducted emission measurements

LINE: L2
LIMIT: Class B
EUT OPERATING MODE: Receive
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK





Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 8			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

8.2 Radiated emission measurements

8.2.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.2.1.

Table 8.2.1 Radiated emission test limits

Frequency, MHz	Class B limit, dB(μV/m)		Class A limit, dB(μV/m)	
	10 m distance	3 m distance	10 m distance	3 m distance
30 - 88	29.5*	40.0	39.0	49.5*
88 - 216	33.0*	43.5	43.5	54.0*
216 - 960	35.5*	46.0	46.4	56.9*
Above 960	43.5*	54.0	49.5	60.0*

* The limit for test distance other than specified was calculated using the inverse linear distance extrapolation factor as follows: $Lim_{S2} = Lim_{S1} + 20 \log(S1/S2)$, where $S1$ and $S2$ – standard defined and test distance respectively in meters.

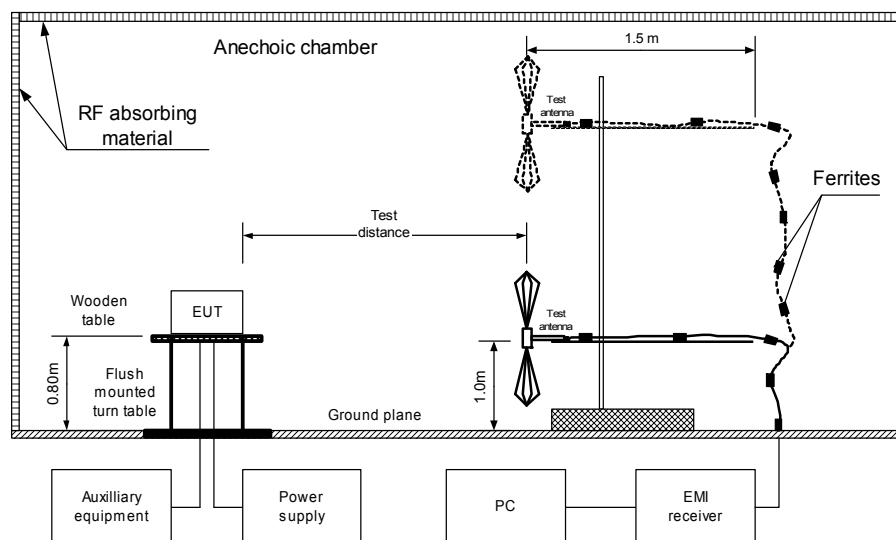
8.2.2 Test procedure for measurements in semi-anechoic chamber

8.2.2.1 The EUT was set up as shown in Figure 8.2.1 and associated photograph/s, energized and the performance check was conducted.

8.2.2.2 The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.

8.2.2.3 The worst test results (the lowest margins) were recorded in Table 8.2.2 and shown in the associated plots.

Figure 8.2.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment





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Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 8			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

Table 8.2.2 Radiated emission test results

EUT SET UP: TABLE-TOP
LIMIT: Class B
EUT OPERATING MODE: Stand-by
TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / QUASI-PEAK
FREQUENCY RANGE: 30 MHz – 1000 MHz
RESOLUTION BANDWIDTH: 120 kHz

Frequency, MHz	Peak emission, dB(μV/m)	Quasi-peak			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
		Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
37.761	28.94	22.55	40.0	-17.45	Vertical	104	104	Pass
42.614	25.86	21.83	40.0	-18.17	Vertical	100	171	
119.984	39.93	39.08	43.5	-4.42	Vertical	100	-173	
167.999	34.82	33.53	43.5	-9.97	Vertical	100	-145	
237.645	32.09	26.67	46.0	-19.33	Horizontal	104	-167	
311.980	36.91	35.35	46.0	-10.65	Horizontal	100	115	
359.994	44.09	43.00	46.0	-3.00	Horizontal	102	-156	
839.954	42.65	39.47	46.0	-6.53	Vertical	185	-156	
919.987	43.10	40.51	46.0	-5.49	Horizontal	132	-33	
960.004	46.11	44.12	54.0	-9.88	Horizontal	132	-30	
1000.000	46.31	44.45	54.0	-9.55	Vertical	104	-156	

TEST SITE: SEMI ANECHOIC CHAMBER
TEST DISTANCE: 3 m
DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 18000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

Frequency, MHz	Peak			Average			Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*	Measured emission, dB(μV/m)	Limit, dB(μV/m)	Margin, dB*				
1000.000	38.91	74.0	-35.09	32.22	54.0	-21.78	Vertical	160	-54	Pass
1040.167	44.82	74.0	-29.18	41.81	54.0	-12.19	Vertical	130	-38	
1760.067	47.13	74.0	-26.87	33.29	54.0	-20.71	Horizontal	100	-86	
2414.967	49.92	74.0	-24.08	27.43	54.0	-26.57	Horizontal	101	-123	
3840.067	45.19	74.0	-28.81	35.60	54.0	-18.40	Vertical	102	-27	
7040.033	51.09	74.0	-22.91	43.68	54.0	-10.32	Horizontal	130	-112	
14079.800	58.14	74.0	-15.86	53.70	54.0	-0.30	Horizontal	101	-126	

*- Margin = Measured emission - specification limit.
**- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

HL 0604	HL 3903	HL 4360	HL 4933	HL5405		
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Full description is given in Appendix A.

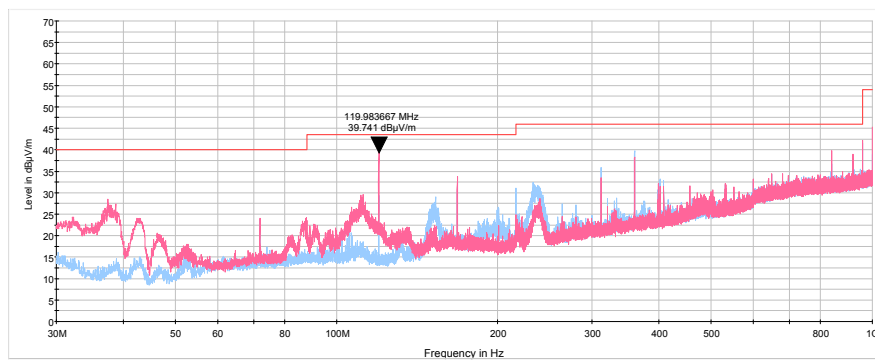


HERMON LABORATORIES

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 8			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

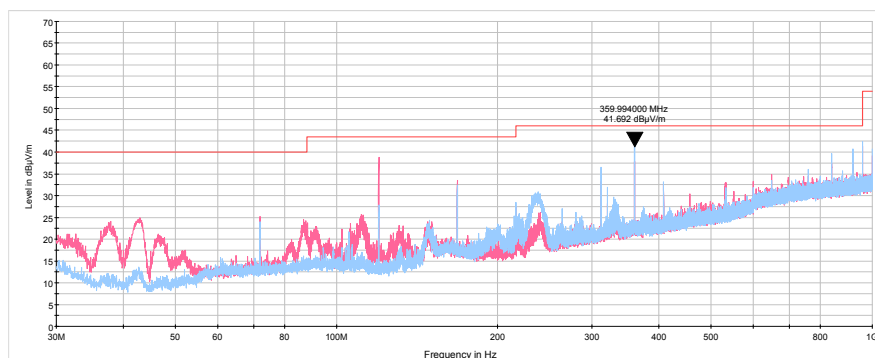
Plot 8.2.1 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by
EUT position: X



Plot 8.2.2 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by
EUT position: Y



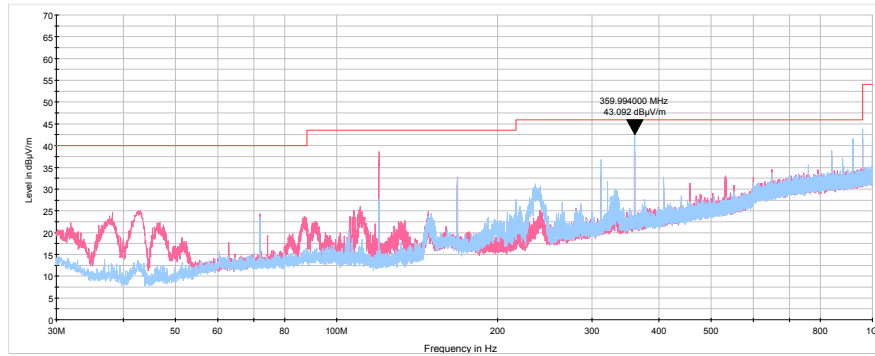


HERMON LABORATORIES

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 8			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

Plot 8.2.3 Radiated emission measurements in 30 - 1000 MHz range, vertical and horizontal antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by
EUT position: Z



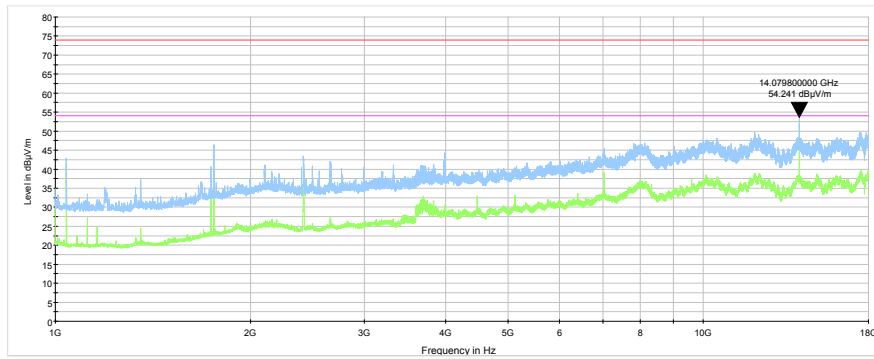


HERMON LABORATORIES

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 8			
Test mode: Compliance	Verdict: PASS		
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

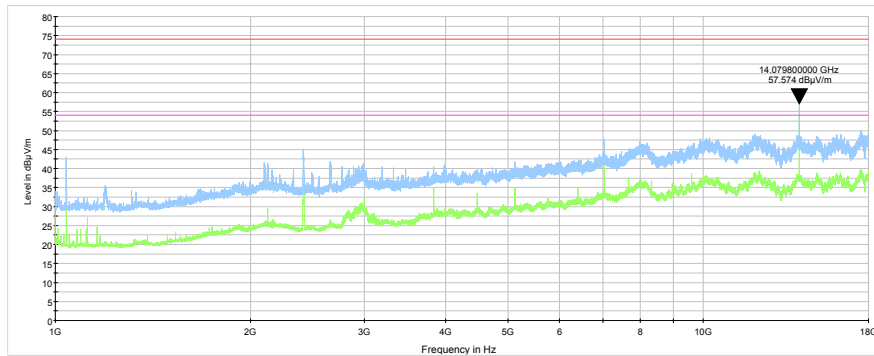
Plot 8.2.4 Radiated emission measurements in 1 - 18 GHz, vertical antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by
EUT position: X



Plot 8.2.5 Radiated emission measurements in 1 - 18 GHz, vertical antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by
EUT position: Y



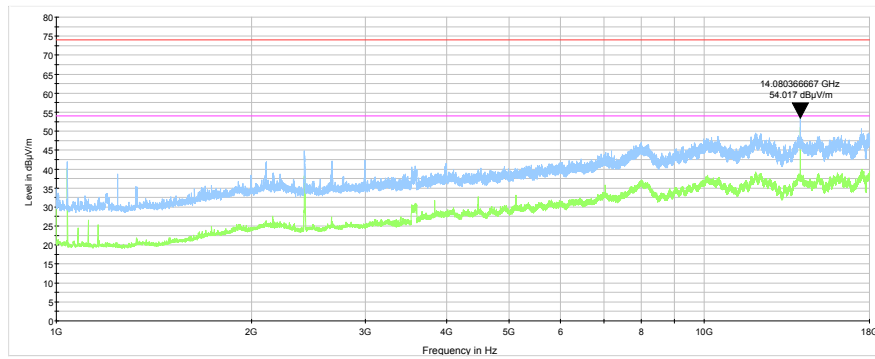


HERMON LABORATORIES

Test specification: Section 15.109, Radiated emission			
Test procedure: ANSI C63.4, Sections 8			
Test mode: Compliance		Verdict: PASS	
Date(s): 27-May-19			
Temperature: 22 °C	Relative Humidity: 49 %	Air Pressure: 1013 hPa	Power: 120 VAC, 60 Hz
Remarks:			

Plot 8.2.6 Radiated emission measurements in 1 - 18 GHz, vertical antenna polarization

TEST SITE: Semi anechoic chamber
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Stand-by
EUT position: Z



**9 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 (9) kHz - 30 MHz	EMCO	6502	2857	24-Feb-19	24-Feb-20
0495	Autotransformer 0-255V, 10A	Variac	EMPL01	495	07-May-19	07-May-20
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	03-Jun-18	03-Jun-20
0747	Mixer, Millimeter Wave Harmonic 90 - 140 GHZ	Oleson Microwave Labs	M08HW	F80429-1	03-Mar-17	03-Mar-20
0748	Mixer Millimeter Wave Harmonic 60 - 90 GHz	Oleson Microwave Labs	M12 HW	E 804 29-1	13-Apr-17	13-Apr-20
0770	Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band, 24 dB mid-band gain	Quinstar Technology	QWH-1900-AA	118	05-Jul-18	05-Jul-19
0771	Antenna Standard Gain Horn, 60-90 GHz, WR-12, 24 dB mid-band gain	Quinstar Technology	QWH-1200-AA	111	05-Jul-18	05-Jul-19
0772	Antenna Standard Gain Horn, 75-110 GHz, WR-10, 24 dB mid-band gain	Quinstar Technology	QWH-0800-AA	110	05-Jul-18	05-Jul-19
1295	Adapter 35WR28Kf, 26.5-40 GHz	Wiltron	35WR28K F	1295	24-Sep-17	24-Sep-19
1299	Transition waveguide ET28S -19R	Custom Microwave	ET28S - 19R		18-Nov-18	18-Nov-20
1300	Transition waveguide ET28S -19R	Custom Microwave	ET28S - 19R		18-Nov-18	18-Nov-20
1301	Transition waveguide ET28S -12R	Custom Microwave	ET28S - 12R		18-Nov-18	18-Nov-20
1303	Transition waveguide ET28S -12R	Custom Microwave	ET28S - 12R	S0951	18-Nov-18	18-Nov-20
1304	Transition waveguide ET28S - 8R	Custom Microwave	ET28S - 8R		18-Nov-18	18-Nov-20
1306	Transition waveguide ET28S - 5R	Custom Microwave	ET28S - 5R		18-Nov-18	18-Nov-20
1312	Mixer Millimeter Wave Harmonic 140-220 GHz	Oleson Microwave Labs	M05HWD	G91112-1	03-Mar-17	03-Mar-20
2382	Transformer, Isolation, 230/230, 1.8 kVA	Taiyo Yuden, Inc.	LGY1.8-21	FJ0411	07-Feb-19	07-Feb-20
2888	LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A, MIL STD 461E, CISPR 16-1	Rolf Heine	NNB-2/16Z	02/10018	19-Mar-19	19-Mar-20
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	04-Apr-19	04-Apr-20
3235	Harmonic mixer 40 to 60 GHz	Agilent Technologies	11970U	MY30030182	16-Aug-16	16-Aug-19
3290	Attenuator, direct reading, 40 to 60 GHz, 0.4 W	Quinstar Technology	QAD-U00000	10381008	01-Apr-19	01-Apr-20
3291	Attenuator, direct reading, 60 to 90 GHz,	Quinstar	QAD-	10381009	01-Apr-19	01-Apr-20



HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
	0.2 W	Technology	E00000			
3294	Tapered transition, WR-28, UG-599 to WR-15, UG-385 (26.5-40 GHz to 50-75 GHz)	Quinstar Technology	QWP-AV0000	10381004	18-Nov-18	18-Nov-20
3295	Tapered transition, WR-28, UG-599 to WR-15, UG-385 (26.5-40 GHz to 50-75 GHz)	Quinstar Technology	QWP-AV0000	10381005	18-Nov-18	18-Nov-20
3297	Tapered , WR-28, UG-599 to WR-10, UG-387 (26.5-40 GHz to 75-100 GHz)	Quinstar Technology	QWP-AW0000	10381007	18-Nov-18	18-Nov-20
3305	Harmonic mixer 50 to 75 GHz	Agilent Technologies	11970V	MY30030149	16-Aug-16	16-Aug-19
3329	Antenna Standard Gain Horn, 140-220 GHz, WR-5, 24 dB mid-band gain	Quinstar Technology			14-Aug-18	14-Aug-19
3433	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25679	15-Apr-19	15-Apr-20
3434	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25683	15-Apr-19	15-Apr-20
3727	Oscilloscope, 1 GHz, 4 channels	LeCroy Corporation	LC584AL	10449	16-Jun-19	16-Jun-20
3901	Microwave Cable Assembly, 40.0 GHz, 3.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1225/2A	07-Apr-19	07-Apr-20
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	07-Apr-19	07-Apr-20
3979	Cable RF, 8 m	Hermon Laboratories	M17/075-RG 214-NEK	002	02-Sep-18	02-Sep-19
4023	Diplexer for use OML mixers with Agilent spectrum analyzer	Oleson Microwave Labs	DPL.26	NA	01-Apr-19	01-Apr-20
4164	DC Power Supply, 60V, 5A	Standig	605D	NA	05-Nov-18	05-Nov-19
4227	Precision Fixed Attenuator, 50 Ohm, 5W, 10dB, DC to 18000 MHz	Mini-Circuits	BW-N10W5+	NA	04-Mar-19	04-Mar-20
4273	Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M	Mini-Circuits	CBL-6FT-SMNM+	70045	24-Jun-19	24-Jun-20
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	31-Dec-18	31-Dec-19
4482	WR28 to WR22 Waveguide Transition, Freq. Range: 33-50GHz, Flange: FBP320/FUGP400 Material: Cu Length: 50mm	A-info (HK) Limited	2822WA-50	J5031121024001	18-Nov-18	18-Nov-20
4933	Active Horn Antenna, 1 GHz to 18 GHz	COM-POWER CORPORATION	AHA-118	701046	06-Jan-19	06-Jan-20
4956	Active horn antenna, 18 to 40 GHz	COM-POWER CORPORATION	AHA-840	105004	25-Jan-19	25-Jan-20
5174	Medium Power Fixed Coaxial Attenuator DC to 18 GHz, 10 dB, 5 W	API Weinschel, Inc	75A-10-12	5174	07-Apr-19	07-Apr-20



HERMON LABORATORIES

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
5372	MXE EMI receiver, 3 Hz to 44 GHz	Keysight Technologies	N9038A	MY57290155	18-Jun-19	18-Jul-20
5376	EXA Signal Analyzer, 10 Hz - 32 GHz	Keysight Technologies	N9010B	MY57470404	18-Mar-19	18-Mar-20
5380	Waveguide Harmonic Mixer 55-90GHz	Keysight Technologies	M1971E	MY56130239	01-Jun-18	01-Jun-20
5405	RF cable, 18 GHz, N-N, 6 m	Huber-Suhner	SF118/11N(x2)	500023/118	01-Aug-18	01-Aug-19



10 APPENDIX B Test equipment correction factors

HL 0604: Antenna BiconiLog Log-Periodic/T Bow-TIE
EMCO, model 3141, serial number 9611-1011

Frequency, MHz	Antenna factor, dB/m		
	Measured	Last	Deviation
30	12.1	12.6	-0.5
35	9.1	9.5	-0.4
40	8.0	8.3	-0.3
45	8.3	8.6	-0.3
50	9.0	9.1	-0.1
60	10.5	10.7	-0.2
70	11.4	11.3	0.1
80	12.3	12.2	0.1
90	13.4	13.2	0.2
100	13.0	13.0	0.0
120	11.4	11.4	0.0
140	12.5	12.4	0.1
160	14.9	14.8	0.1
180	14.4	14.0	0.4
200	13.7	13.9	-0.2
250	16.3	16.4	-0.1
300	17.2	17.5	-0.3
400	19.8	20.2	-0.4
500	22.0	22.4	-0.4
600	24.3	24.5	-0.2
700	25.8	25.6	0.2
800	26.9	26.6	0.3
900	27.3	28.0	-0.7
1000	28.5	29.3	-0.8

The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.



HL 4933 Active Horn Antenna
1 GHz to 18 GHz
COM-POWER CORPORATION AHA-118 , s/n 701046 HL 4933

Frequency, MHz	Measured antenna factor, dB/m
1000	-16.1
1050	-16.0
1100	-15.1
1150	-16.4
1200	-16.0
1250	-15.6
1300	-15.1
1350	-14.8
1400	-15.1
1450	-15.1
1500	-15.5
1550	-15.2
1600	-14.7
1650	-14.4
1700	-14.4
1750	-14.0
1800	-13.6
1850	-12.7
1900	-11.9
1950	-11.9
2000	-11.8
2050	-11.3
2100	-11.3
2150	-11.7
2200	-12.3
2250	-12.3
2300	-12.4
2350	-12.2
2400	-11.7
2450	-11.5
2500	-11.5
2550	-11.5
2600	-11.5
2650	-11.3
2700	-11.3
2750	-11.1
2800	-11.1
2850	-11.3
2900	-11.1
2950	-11.0
3000	-11.1
3050	-10.9
3100	-10.7
3150	-10.6

Frequency, MHz	Measured antenna factor, dB/m
3200	-11.2
3250	-10.8
3300	-10.8
3350	-10.7
3400	-10.3
3450	-10.2
3500	-10.1
3550	-10.4
3600	-10.5
3650	-10.4
3700	-10.4
3750	-10.3
3800	-10.1
3850	-10.0
3900	-9.9
3950	-9.8
4000	-9.7
4050	-9.3
4100	-8.6
4150	-8.2
4200	-8.3
4250	-8.5
4300	-8.5
4350	-8.3
4400	-8.0
4450	-7.7
4500	-7.6
4550	-7.4
4600	-7.5
4650	-7.8
4700	-7.6
4750	-6.8
4800	-6.1
4850	-5.7
4900	-5.8
4950	-5.8
5000	-6.0
5050	-5.7
5100	-5.4
5150	-5.1
5200	-4.6
5250	-4.6
5300	-4.8
5350	-5.1



Frequency, MHz	Measured antenna factor, dB/m
5400	-5.1
5450	-4.6
5500	-4.0
5550	-3.5
5600	-3.1
5650	-3.3
5700	-3.8
5750	-4.3
5800	-4.3
5850	-4.0
5900	-3.5
5950	-3.2
6000	-3.2
6050	-3.2
6100	-3.3
6150	-3.3
6200	-3.1
6250	-2.9
6300	-2.8
6350	-3.0
6400	-3.2
6450	-3.4
6500	-3.7
6550	-3.6
6600	-3.4
6650	-2.9
6700	-2.6
6750	-2.5
6800	-2.6
6850	-2.8
6900	-2.7
6950	-2.3
7000	-2.0
7050	-1.9
7100	-1.8
7150	-1.8
7200	-1.7
7250	-1.7
7300	-1.6
7350	-1.5
7400	-1.5
7450	-1.3
7500	-1.4
7550	-1.3
7600	-1.0
7650	-0.7
7700	-0.3
7750	0.1
7800	0.3
7850	0.4
7900	0.2
7950	0.1
8000	0.2
8050	0.3
8100	0.8
8150	1.1

Frequency, MHz	Measured antenna factor, dB/m
8300	0.8
8350	0.5
8400	0.3
8450	0.5
8500	0.8
8550	0.9
8600	0.9
8650	0.6
8700	0.0
8750	-0.3
8800	0.0
8850	0.5
8900	0.6
8950	0.4
9000	-0.3
9050	-1.0
9100	-1.2
9150	-0.6
9200	-0.1
9250	0.0
9300	-0.1
9350	-0.5
9400	-0.7
9450	-0.4
9500	0.2
9550	0.5
9600	0.5
9650	0.3
9700	0.0
9750	0.0
9800	0.6
9850	1.4
9900	1.8
9950	1.7
10000	1.4
10100	0.8
10200	1.2
10300	1.5
10400	1.1
10500	1.6
10600	3.0
10700	2.9
10800	1.3
10900	1.0
11000	1.1
11100	0.7
11200	1.1
11300	1.5
11400	1.4
11500	0.6
11600	1.0
11700	1.4
11800	0.7
11900	0.9
12000	2.1
12100	2.1



HERMON LABORATORIES

8200	1.1
8250	1.0
12400	2.1
12500	1.2
12600	1.3
12700	2.4
12800	1.8
12900	0.6
13000	0.9
13100	1.1
13200	0.7
13300	0.9
13400	1.8
13500	2.1
13600	1.2
13700	0.8
13800	1.2
13900	1.5
14000	1.7
14100	2.2
14200	2.8
14300	3.0
14400	3.0
14500	3.3
14600	4.0
14700	5.4
14800	5.4
14900	4.7
15000	3.1
15100	2.0
15200	1.5
15300	1.4
15400	1.7
15500	1.9
15600	1.2
15700	0.2
15800	0.6
15900	1.2
16000	0.6
16100	0.6
16200	1.9
16300	2.2
16400	0.9
16500	0.7
16600	1.7
16700	1.3
16800	1.0
16900	2.0
17000	2.4
17100	1.8
17200	1.8
17300	2.5
17400	2.7
17500	3.1
17600	3.7
17700	4.3
17800	4.8
17900	5.7
18000	5.1

12200	0.9
12300	1.6



**HL 4956: Active horn antenna
COM-POWER Corp., model: AHA-840, s/n 105004**

Frequency, MHz	Measured antenna factor, dB/m
18000	5.1
18500	3.6
19000	2.2
19500	0.7
20000	0.7
20500	0.8
21000	0.5
21500	-1.3
22000	-2.1
22500	-2.0
23000	-1.6
23500	-2.9
24000	-2.3
24500	-2.6
25000	-1.8
25500	-1.2
26000	-0.5
26500	-1.2
27000	-0.1
27500	-1.0
28000	-0.7
28500	0.5

Frequency, MHz	Measured antenna factor, dB/m
29500	1.4
30000	2.9
30500	2.9
31000	2.9
31500	1.2
32000	0.7
32500	0.2
33000	-1.7
33500	-2.2
34000	2.3
34500	-1.1
35000	0.7
35500	-1.1
36000	0.1
36500	1.4
37000	3.7
37500	5.8
38000	6.6
38500	7.3
39000	6.5
39500	7.3
40000	7.1

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.

**HL 0446: Active Loop Antenna
EMCO, model: 6502, s/n 2857**

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
10	-33.4	± 1.0
20	-37.8	± 1.0
50	-40.5	± 1.0
75	-41.0	± 1.0
100	-41.2	± 1.0
150	-41.2	± 1.0
250	-41.1	± 1.0
500	-41.2	± 1.0
750	-41.3	± 1.0
1000	-41.3	± 1.0

Frequency,	Measured antenna factor, dBS/m	Measurement uncertainty, dB
2000	-41.4	± 1.0
3000	-41.4	± 1.0
4000	-41.5	± 1.0
5000	-41.5	± 1.0
10000	-41.7	± 1.0
15000	-42.1	± 1.0
20000	-42.7	± 1.0
25000	-44.2	± 1.0
30000	-45.8	± 1.0

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ A/m.



HL 2888 LISN Two-line V-Network 50 Ohm / 50 uH + 5 Ohm, 16A
Rolf Heine, model: NNB-2/16Z, s/n 02/10018, HL 2888

Voltage division factor (insertion loss)

Frequency,	L1, dB	L2, dB	Uncertainty, dB
150	0.09	0.07	±0.09
170	0.08	0.07	±0.09
200	0.08	0.06	±0.09
250	0.09	0.06	±0.09
300	0.09	0.06	±0.09
350	0.09	0.07	±0.09
400	0.09	0.07	±0.09
500	0.09	0.07	±0.09
600	0.09	0.07	±0.09
700	0.10	0.08	±0.09
800	0.10	0.08	±0.09
900	0.11	0.08	±0.09
1000	0.11	0.08	±0.09
1200	0.11	0.09	±0.16
1500	0.12	0.10	±0.16
2000	0.14	0.12	±0.16
2500	0.15	0.12	±0.16
3000	0.16	0.14	±0.16
4000	0.19	0.16	±0.16
5000	0.23	0.19	±0.16
7000	0.30	0.25	±0.16
10000	0.46	0.40	±0.16
15000	0.71	0.62	±0.16
20000	0.94	0.85	±0.16
30000	1.41	1.33	±0.32



HL 3901 Microwave Cable Assembly, 40.0 GHz
3.5 m, SMA/SMA
Huber-Suhner, model: SUCOFLEX 102A, s/n: 1225/2A

HL 3901: Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
50	0.34	±0.06
100	0.47	±0.06
150	0.58	±0.07
200	0.67	±0.07
300	0.82	±0.07
400	0.94	±0.07
500	1.05	±0.07
600	1.15	±0.07
700	1.24	±0.07
800	1.33	±0.07
900	1.41	±0.07
1000	1.49	±0.07
1100	1.56	±0.07
1200	1.62	±0.07
1300	1.69	±0.07
1400	1.76	±0.07
1500	1.82	±0.07
1600	1.88	±0.07
1700	1.94	±0.07
1800	2.00	±0.07
1900	2.05	±0.07
2000	2.11	±0.07
2100	2.16	±0.07
2200	2.21	±0.07
2300	2.26	±0.07
2400	2.32	±0.07
2500	2.36	±0.09
2600	2.42	±0.09
2700	2.47	±0.09
2800	2.52	±0.09
2800	2.52	±0.09
2900	2.57	±0.09
3000	2.62	±0.09
3100	2.67	±0.09
3200	2.72	±0.09
3300	2.76	±0.09
3400	2.80	±0.09
3500	2.84	±0.09
3600	2.88	±0.09
3700	2.93	±0.09
3800	2.96	±0.09
3900	3.00	±0.09
4000	3.04	±0.09
4100	3.08	±0.13
4200	3.11	±0.13
4300	3.15	±0.13
4400	3.19	±0.13
4500	3.22	±0.13
4600	3.26	±0.13

Set / Applied, MHz	Measured, dB	Uncertainty, dB
4700	3.29	±0.13
4800	3.33	±0.13
4900	3.36	±0.13
5000	3.40	±0.13
5100	3.43	±0.13
5200	3.46	±0.13
5300	3.50	±0.13
5400	3.53	±0.13
5500	3.56	±0.13
5600	3.59	±0.13
5700	3.62	±0.13
5800	3.65	±0.13
5900	3.68	±0.13
6000	3.71	±0.13
6100	3.74	±0.13
6200	3.78	±0.13
6300	3.81	±0.13
6400	3.84	±0.13
6500	3.88	±0.13
6600	3.91	±0.13
6700	3.95	±0.13
6800	3.99	±0.13
6900	4.02	±0.13
7000	4.05	±0.13
7100	4.09	±0.13
7200	4.12	±0.13
7300	4.16	±0.13
7400	4.19	±0.13
7500	4.23	±0.13
7600	4.26	±0.13
7700	4.30	±0.13
7800	4.33	±0.13
7900	4.36	±0.13
8000	4.39	±0.13
8100	4.42	±0.13
8200	4.45	±0.13
8300	4.48	±0.13
8400	4.50	±0.13
8500	4.53	±0.13
8600	4.56	±0.13
8700	4.58	±0.13
8800	4.61	±0.13
8900	4.63	±0.13
9000	4.66	±0.13
9100	4.67	±0.13
9200	4.69	±0.13
9300	4.72	±0.13
9400	4.75	±0.13
9500	4.77	±0.13



HL 3901: Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
9600	4.79	±0.13
9700	4.81	±0.13
9800	4.84	±0.13
9900	4.87	±0.13
10000	4.89	±0.13
10100	4.92	±0.13
10200	4.94	±0.13
10300	4.96	±0.13
10400	4.98	±0.13
10500	5.01	±0.13
10600	5.02	±0.13
10700	5.05	±0.13
10800	5.07	±0.13
10900	5.10	±0.13
11000	5.12	±0.13
11100	5.15	±0.13
11200	5.18	±0.13
11300	5.21	±0.13
11400	5.23	±0.13
11500	5.26	±0.13
11600	5.30	±0.13
11700	5.33	±0.13
11800	5.36	±0.13
11900	5.39	±0.13
12000	5.42	±0.13
12100	5.45	±0.16
12200	5.48	±0.16
12300	5.52	±0.16
12400	5.56	±0.16
12500	5.59	±0.22
12600	5.61	±0.22
12700	5.65	±0.22
12800	5.69	±0.22
12900	5.72	±0.22
13000	5.74	±0.22
13100	5.78	±0.22
13200	5.80	±0.22
13300	5.83	±0.22
13400	5.85	±0.22
13500	5.87	±0.22
13600	5.89	±0.22
13700	5.91	±0.22
13800	5.94	±0.22
13900	5.95	±0.22
14000	5.97	±0.22
14100	5.99	±0.22
14200	6.02	±0.22
14300	6.02	±0.22
14400	6.04	±0.22
14500	6.06	±0.22

Set / Applied, MHz	Measured, dB	Uncertainty, dB
14600	6.08	±0.22
14700	6.09	±0.22
14800	6.12	±0.22
14900	6.14	±0.22
15000	6.15	±0.22
15100	6.18	±0.22
15200	6.21	±0.22
15300	6.23	±0.22
15400	6.25	±0.22
15500	6.28	±0.22
15600	6.31	±0.22
15700	6.33	±0.22
15800	6.36	±0.22
15900	6.39	±0.22
16000	6.40	±0.22
16100	6.43	±0.22
16200	6.47	±0.22
16300	6.50	±0.22
16400	6.52	±0.22
16500	6.55	±0.22
16600	6.58	±0.22
16700	6.62	±0.22
16800	6.63	±0.22
16900	6.67	±0.22
17000	6.69	±0.22
17100	6.72	±0.22
17200	6.74	±0.22
17300	6.74	±0.22
17400	6.76	±0.22
17500	6.79	±0.22
17600	6.82	±0.22
17700	6.80	±0.22
17800	6.81	±0.22
17900	6.82	±0.22
17200	6.74	±0.22
17300	6.74	±0.22
17400	6.76	±0.22
17500	6.79	±0.22
17600	6.82	±0.22
17700	6.80	±0.22
17800	6.81	±0.22
17900	6.82	±0.22
18000	6.85	±0.22
18500	6.95	±0.42
19000	7.08	±0.42
19500	7.15	±0.42
20000	7.19	±0.42
20500	7.24	±0.42
21000	7.32	±0.42
21500	7.42	±0.42



HL 3901: Insertion loss

Set / Applied, MHz	Measured, dB	Uncertainty, dB
22000	7.57	±0.42
22500	7.70	±0.42
23000	7.81	±0.42
23500	7.85	±0.42
24000	7.86	±0.42
24500	7.94	±0.42
25000	8.02	±0.42
25500	8.12	±0.42
26000	8.23	±0.42
26500	8.33	±0.42
27000	8.39	±0.57
27500	8.42	±0.57
28000	8.43	±0.57
28500	8.48	±0.57
29000	8.57	±0.57
29500	8.65	±0.57
30000	8.70	±0.57
30500	8.77	±0.57

Set / Applied, MHz	Measured, dB	Uncertainty, dB
31000	8.84	±0.57
31500	8.93	±0.57
32000	9.07	±0.57
33500	9.25	±0.57
34000	9.32	±0.57
34500	9.39	±0.57
35000	9.49	±0.57
35500	9.59	±0.57
36000	9.68	±0.57
36500	9.76	±0.57
37000	9.85	±0.57
37500	9.98	±0.57
38000	10.07	±0.57
38500	10.12	±0.57
39000	10.19	±0.57
39500	10.29	±0.57
40000	10.36	±0.57



HERMON LABORATORIES

HL 5405: RF Cable
Huber-Suhner, model: SF118/11N(x2), s/n: 500023/118
Calibration date: 01-Aug-2018

Set / Applied, MHz	Measured, dB	Uncertainty, dB
0.1	0.01	±0.07
50	0.23	±0.07
100	0.32	±0.07
200	0.45	±0.08
300	0.55	±0.08
400	0.64	±0.08
500	0.71	±0.08
600	0.78	±0.08
700	0.85	±0.08
800	0.91	±0.08
900	0.97	±0.08
1000	1.02	±0.08
1100	1.07	±0.08
1200	1.12	±0.08
1300	1.16	±0.08
1400	1.21	±0.08
1500	1.25	±0.08
1600	1.30	±0.08
1700	1.34	±0.08
1800	1.38	±0.08
1900	1.42	±0.08
2000	1.47	±0.08
2500	1.64	±0.10
3000	1.81	±0.10
3500	1.97	±0.10
4000	2.11	±0.10
4500	2.25	±0.10
5000	2.38	±0.10
5500	2.48	±0.10
6000	2.59	±0.10
6500	2.72	±0.10
7000	2.84	±0.13
7500	2.97	±0.13
8000	3.08	±0.13
8500	3.21	±0.13
9000	3.31	±0.13
9500	3.42	±0.13
10000	3.52	±0.13



11 APPENDIX C Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

Test description	Expanded uncertainty
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB
Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.



12 APPENDIX D Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, Radio, Safety, Environmental and Telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-1082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).

The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing, environmental simulation and calibration (for exact scope please refer to Certificate No. 839.01, 839.03 and 839.04).

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13 APPENDIX E Specification references

47CFR part 15: 2018	Radio Frequency Devices.
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices



14 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AVRG	average (detector)
BB	broad band
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μ V)	decibel referred to one microvolt
dB(μ V/m)	decibel referred to one microvolt per meter
DC	direct current
EMC	electromagnetic compatibility
EMI	electromagnetic interference
EN	European Norm
EUT	equipment under test
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
k	kilo
kHz	kilohertz
kV	kilovolt
L	length
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
OBW	occupied bandwidth
OC	operating channel
OCW	operating channel bandwidth
OFB	operational frequency band
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RBW	resolution bandwidth
RBW _{REF}	reference resolution bandwidth
RE	radiated emission
RF	radio frequency
rms	root mean square
s	second
V	volt
W	width

END OF DOCUMENT