



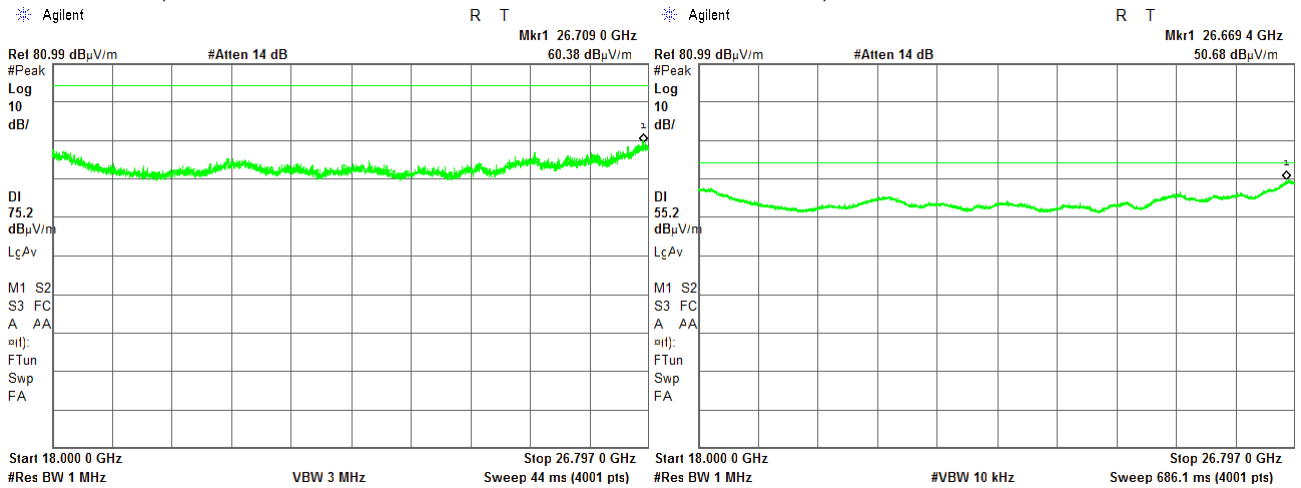
HERMON LABORATORIES

Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Apr-19 - 14-Apr-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1009 hPa	Power: 56 VDC
Remarks:			

Plot 7.5.13 Radiated emission measurements in 18000 – 26797 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:
RBW = 1 MHz; VBW = 3 MHz

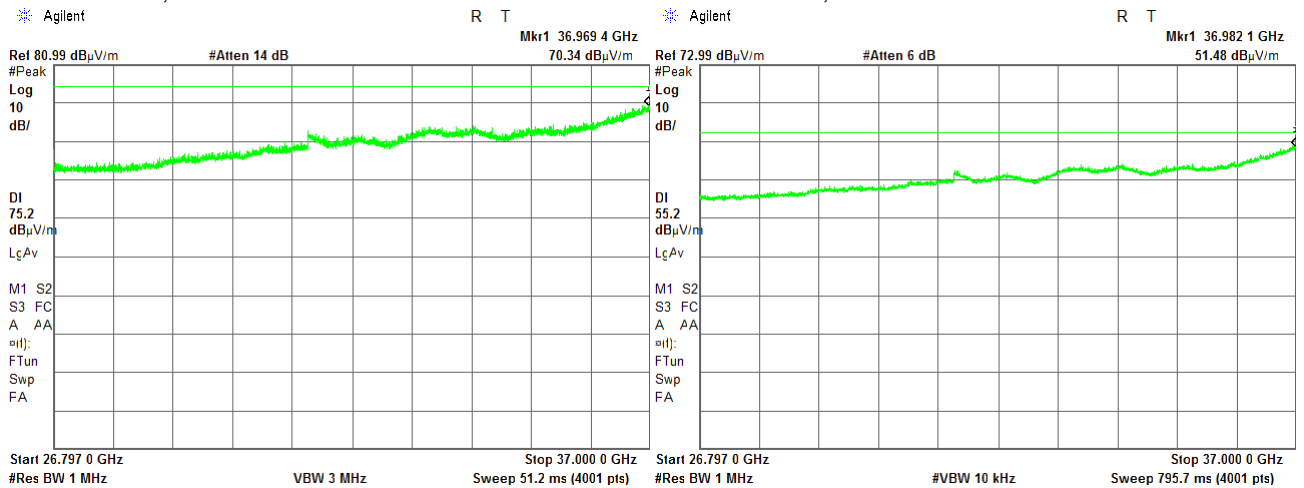
OATS
Low
Vertical and Horizontal
3 m
RBW = 1 MHz; VBW = 10 kHz



Plot 7.5.14 Radiated emission measurements in 26797 – 37000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:
RBW = 1 MHz; VBW = 3 MHz

OATS
Low
Vertical and Horizontal
3 m
RBW = 1 MHz; VBW = 10 kHz





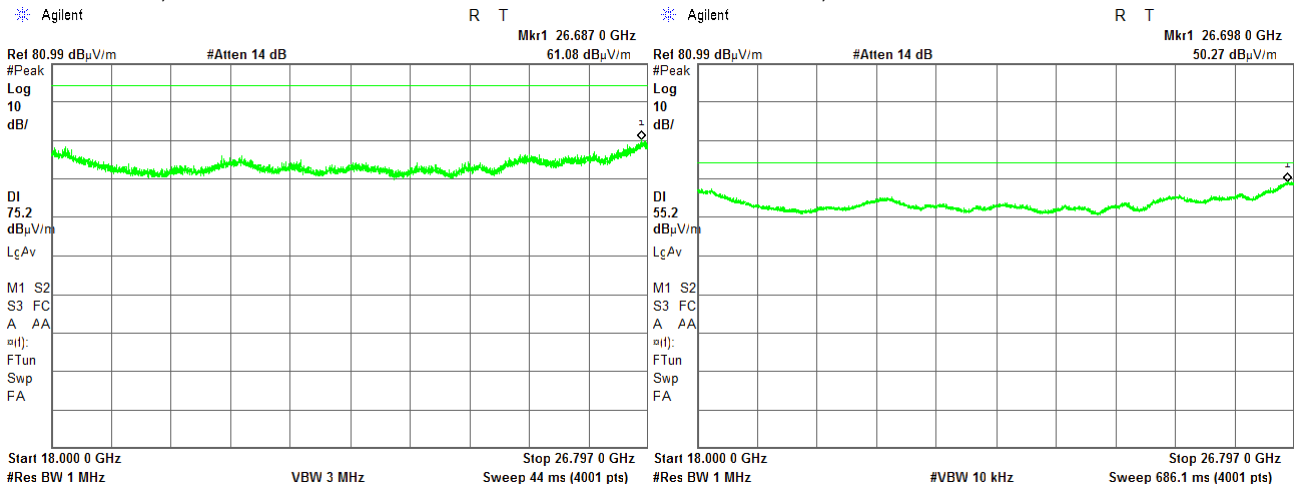
HERMON LABORATORIES

Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Apr-19 - 14-Apr-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1009 hPa	Power: 56 VDC
Remarks:			

Plot 7.5.15 Radiated emission measurements in 18000 – 26797 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:
RBW = 1 MHz; VBW = 3 MHz

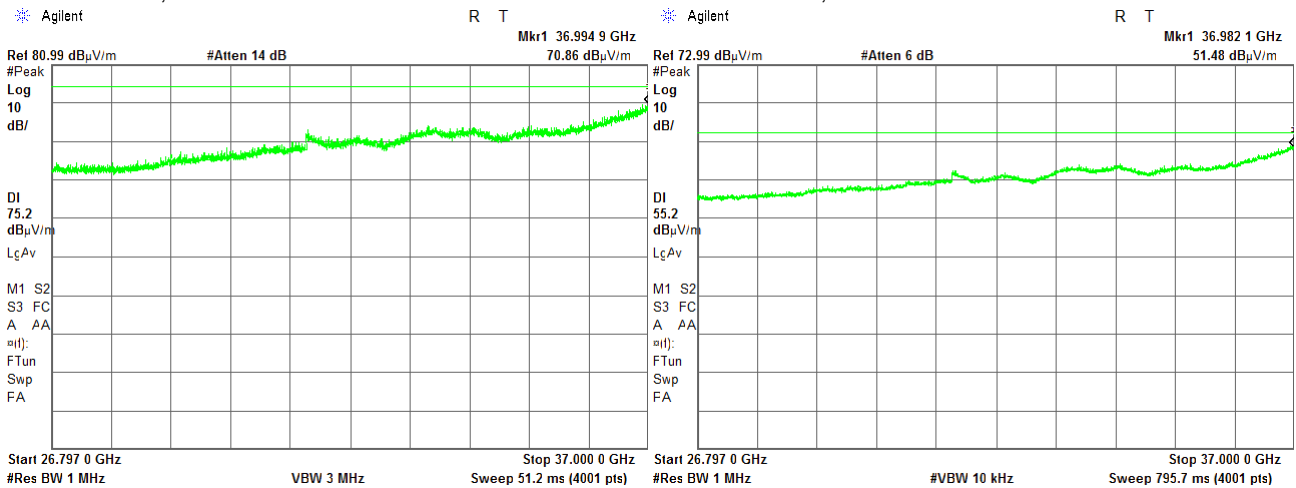
OATS
Mid
Vertical and Horizontal
3 m
RBW = 1 MHz; VBW = 10 kHz



Plot 7.5.16 Radiated emission measurements in 26797 – 37000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:
RBW = 1 MHz; VBW = 3 MHz

OATS
Mid
Vertical and Horizontal
3 m
RBW = 1 MHz; VBW = 10 kHz





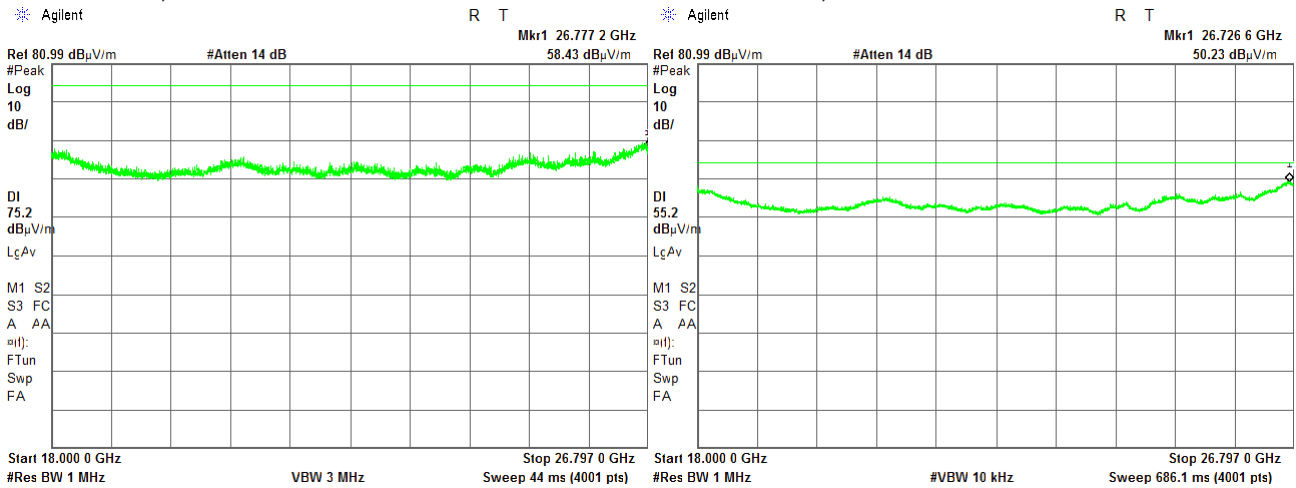
HERMON LABORATORIES

Test specification: Section 96.41(e)(2), Radiated spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 04-Apr-19 - 14-Apr-19			
Temperature: 24 °C	Relative Humidity: 52 %	Air Pressure: 1009 hPa	Power: 56 VDC
Remarks:			

Plot 7.5.17 Radiated emission measurements in 18000 – 26797 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:
RBW = 1 MHz; VBW = 3 MHz

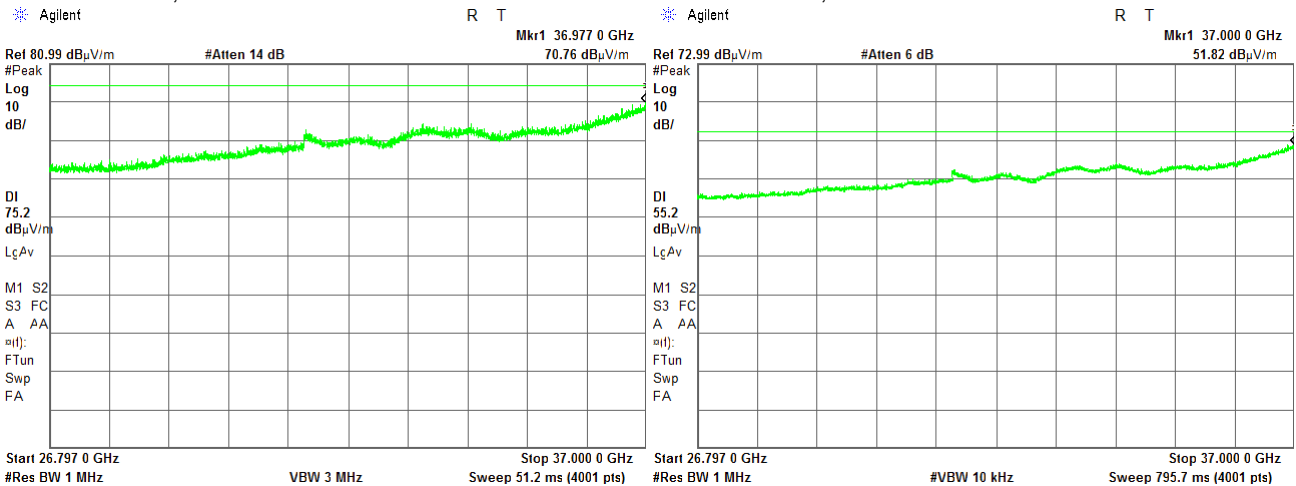
OATS
High
Vertical and Horizontal
3 m
RBW = 1 MHz; VBW = 10 kHz



Plot 7.5.18 Radiated emission measurements in 26797 – 37000 MHz range

TEST SITE:
CARRIER FREQUENCY:
ANTENNA POLARIZATION:
TEST DISTANCE:
RBW = 1 MHz; VBW = 3 MHz

OATS
High
Vertical and Horizontal
3 m
RBW = 1 MHz; VBW = 10 kHz





Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

7.6 Spurious emissions at RF antenna connector test

7.6.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.6.1.

Table 7.6.1 Spurious emission limits

Frequency offset from channel band edge, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0 – 10	NA	-13.0
10 – 20	NA	-25.0
More than 20	NA	-40.0

* - spurious emission limits do not apply to the in band emission within ± 250 % of the authorized bandwidth from the carrier; investigated in course of emission mask testing

** - P is transmitter output power in Watts

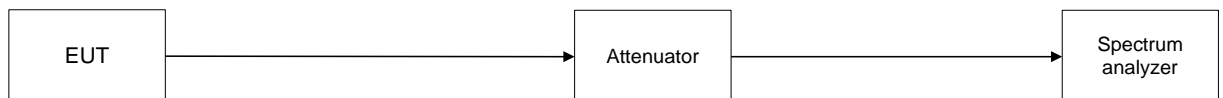
7.6.2 Test procedure

7.6.2.1 The EUT was set up as shown in Figure 7.6.1, energized and its proper operation was checked.

7.6.2.2 The EUT was adjusted to produce maximum available for end user RF output power.

7.6.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.6.2 and associated plots.

Figure 7.6.1 Spurious emission test setup





Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Table 7.6.2 Spurious emission test results

ASSIGNED FREQUENCY RANGE: 3550 - 3700 MHz
 INVESTIGATED FREQUENCY RANGE: 0.009 – 37000 MHz
 DETECTOR USED: Peak
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 MODULATION: QPSK
 MODULATING SIGNAL: PRBS
 CHANNEL SPACING: 10 MHz
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
Low carrier frequency 3555 MHz									
No emissions were found									Pass
Mid carrier frequency 3625 MHz									
No emissions were found									Pass
High carrier frequency 3695 MHz									
No emissions were found									Pass

*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

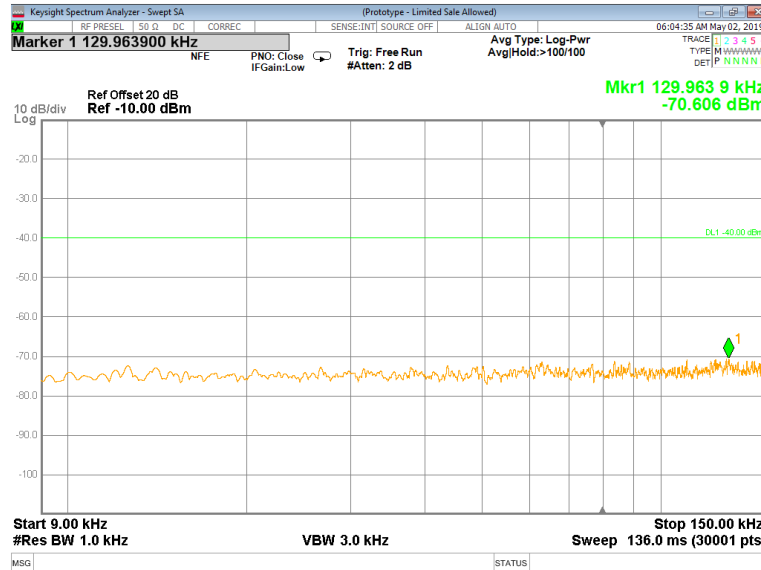
HL 3435	HL 3818	HL 5372	HL 5409		
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Full description is given in Appendix A.

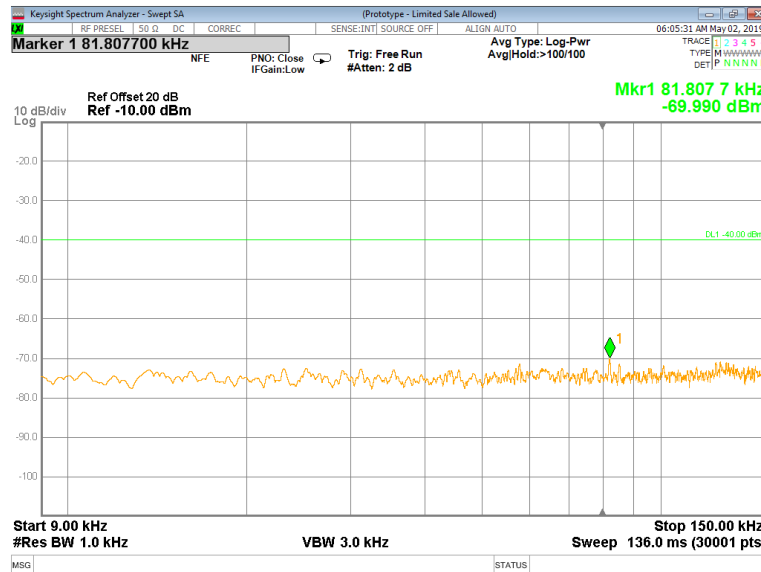


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.1 Spurious emission measurements in 9 - 150 kHz range at low carrier frequency



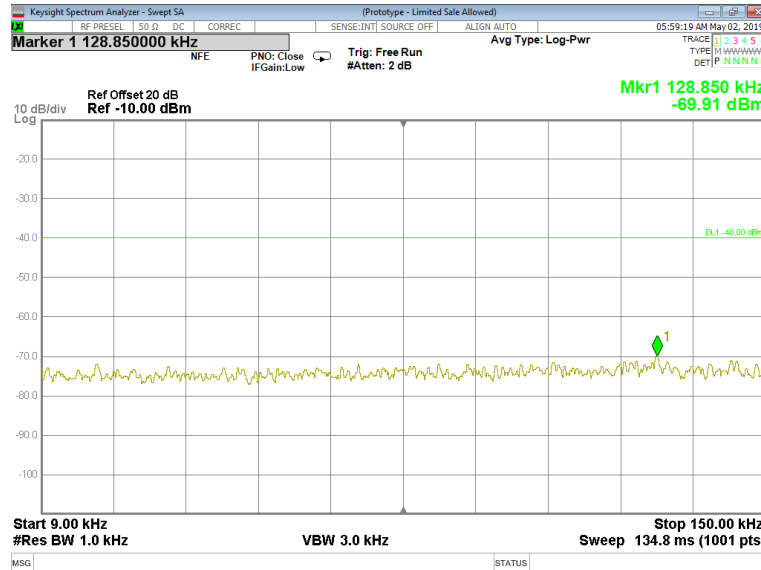
Plot 7.6.2 Spurious emission measurements in 9 - 150 kHz range at mid carrier frequency



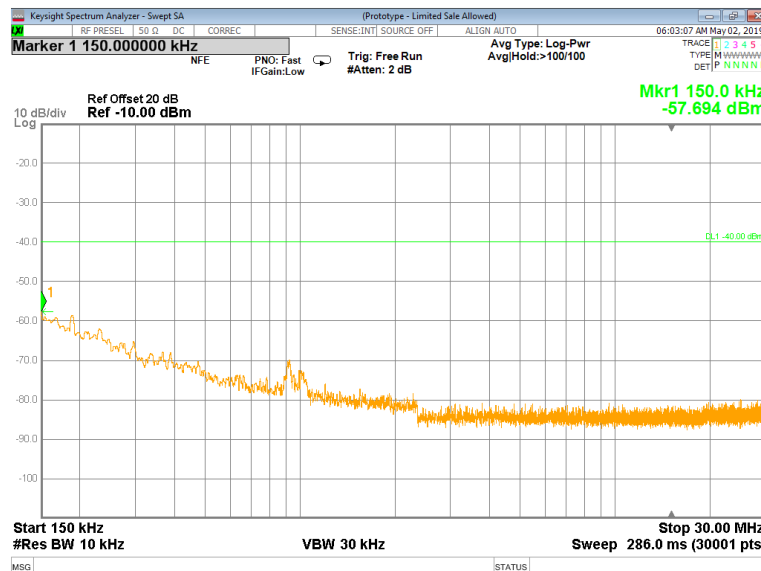


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.3 Spurious emission measurements in 9 - 150 kHz range at high carrier frequency



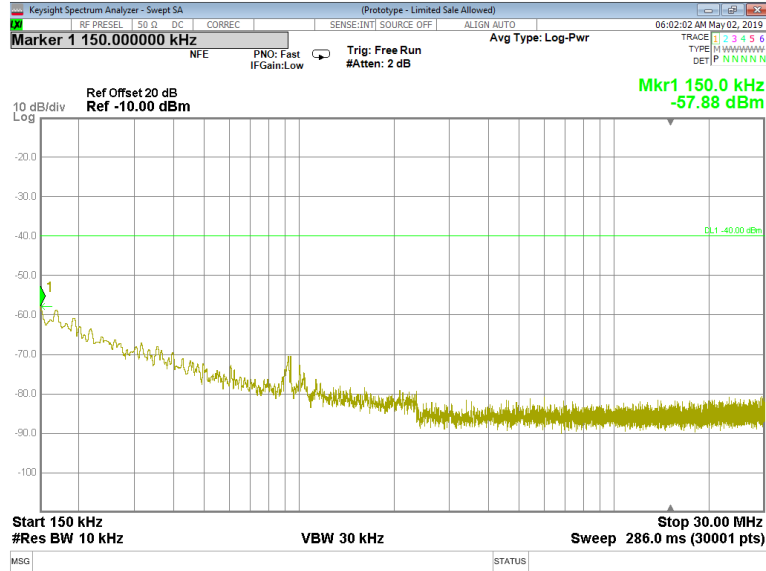
Plot 7.6.4 Spurious emission measurements in 0.15 – 30 MHz range at low carrier frequency



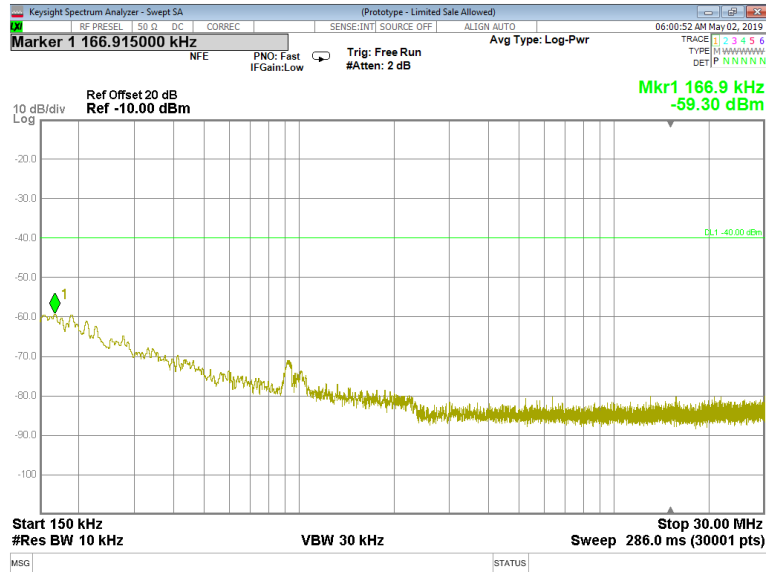


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.5 Spurious emission measurements in 0.15 – 30 MHz range at mid carrier frequency



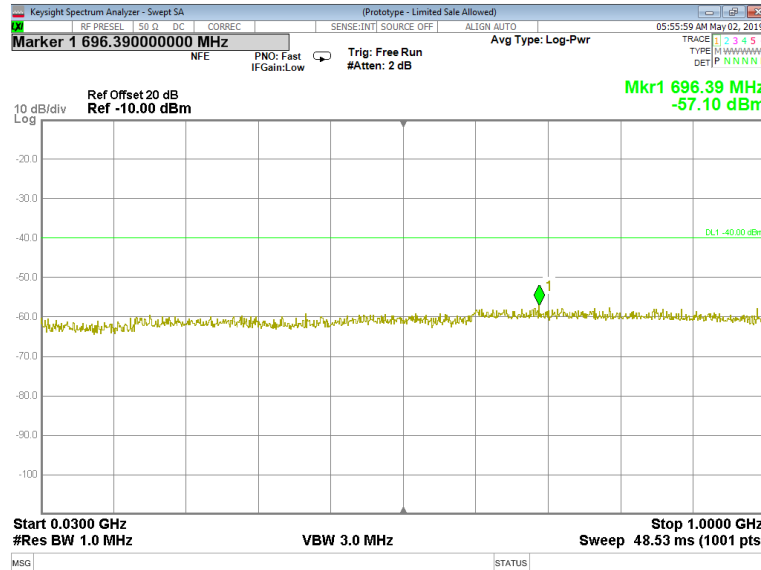
Plot 7.6.6 Spurious emission measurements in 0.15 – 30 MHz range at high carrier frequency



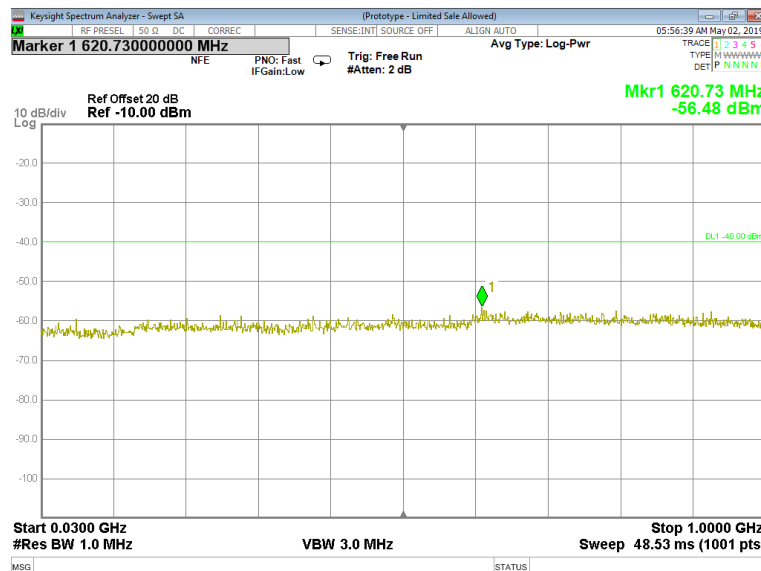


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.7 Spurious emission measurements in 30.0 - 1000 MHz range at low carrier frequency



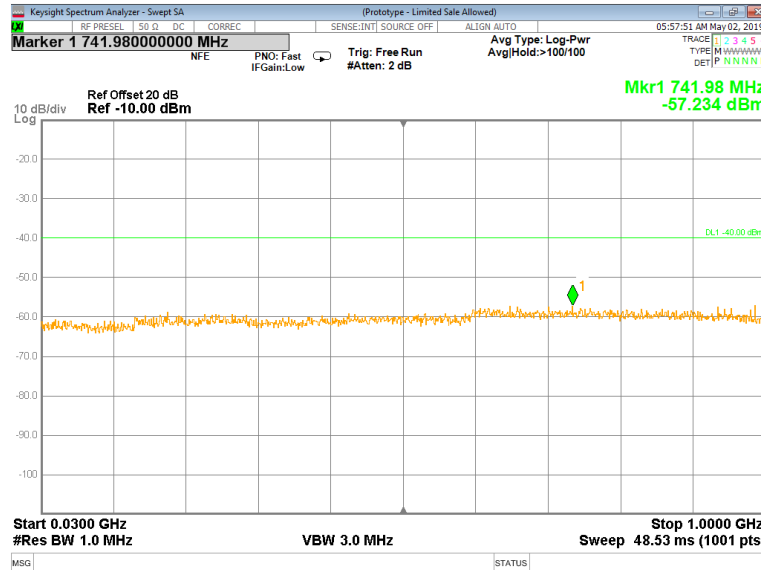
Plot 7.6.8 Spurious emission measurements in 30.0 - 1000 MHz range at mid carrier frequency



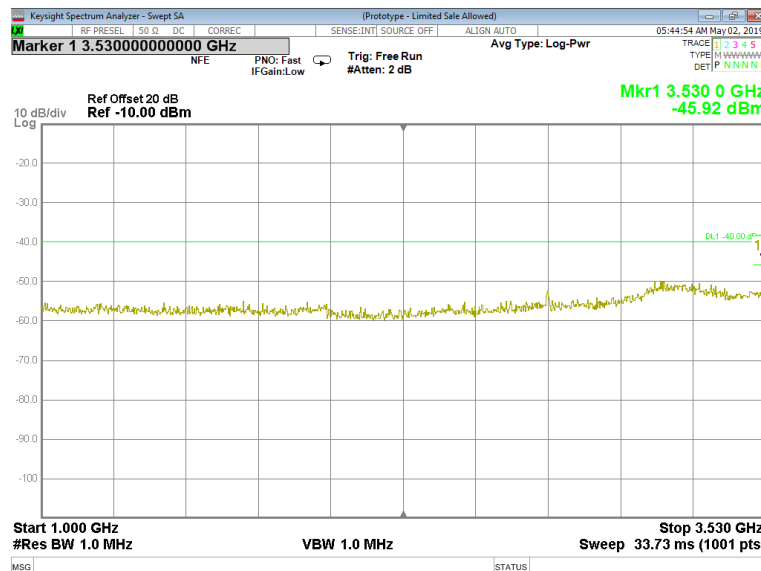


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance	Verdict: PASS		
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.9 Spurious emission measurements in 30.0 - 1000 MHz range at high carrier frequency



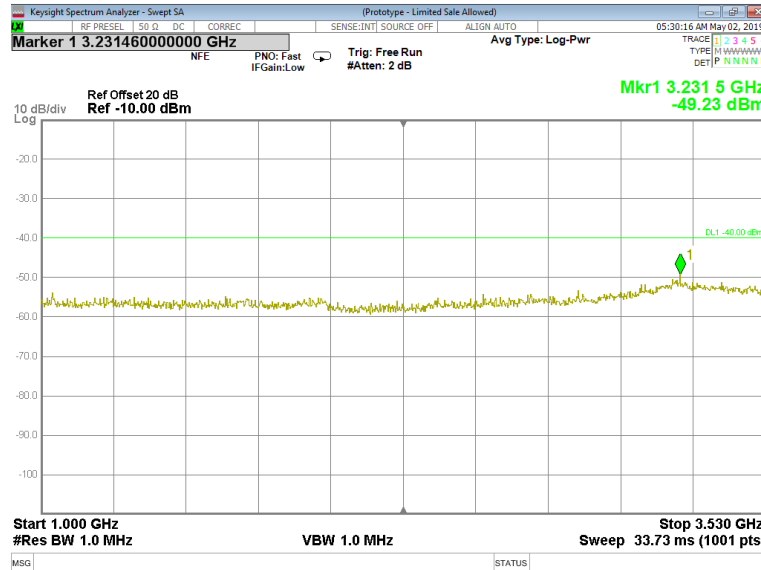
Plot 7.6.10 Spurious emission measurements in 1000 - 3530 MHz range at low carrier frequency



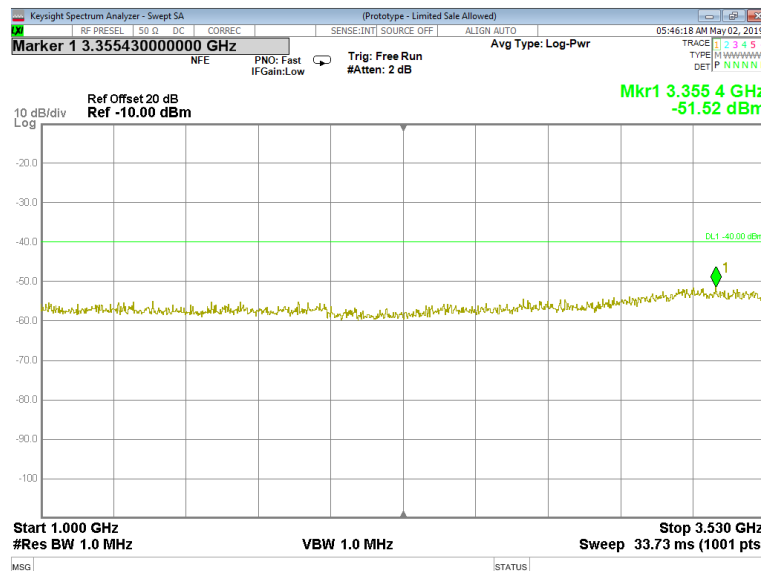


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.11 Spurious emission measurements in 1000 - 3530 MHz at mid carrier frequency



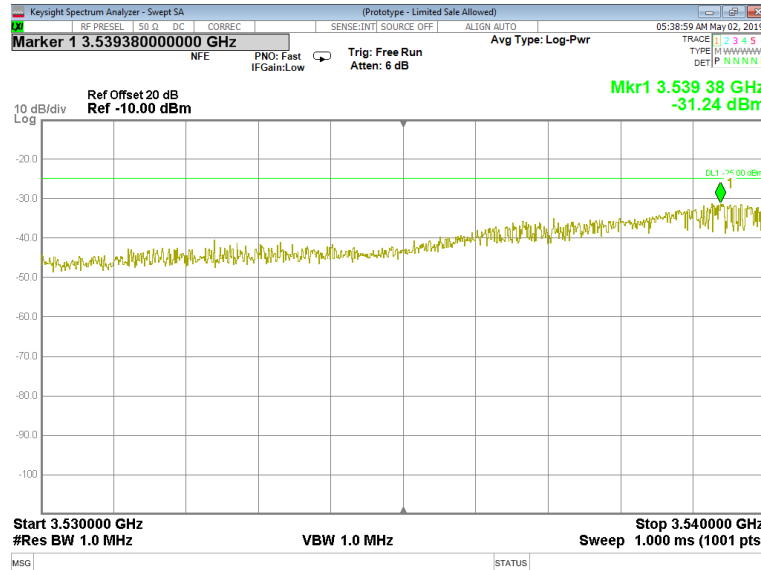
Plot 7.6.12 Spurious emission measurements in 1000 - 3530 MHz at high carrier frequency



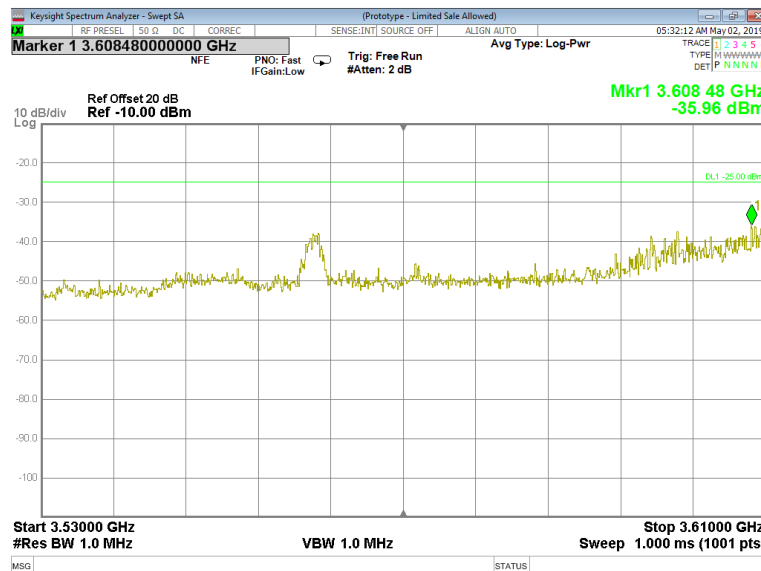


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.13 Spurious emission measurements in 3530 - 3540 MHz range at low carrier frequency



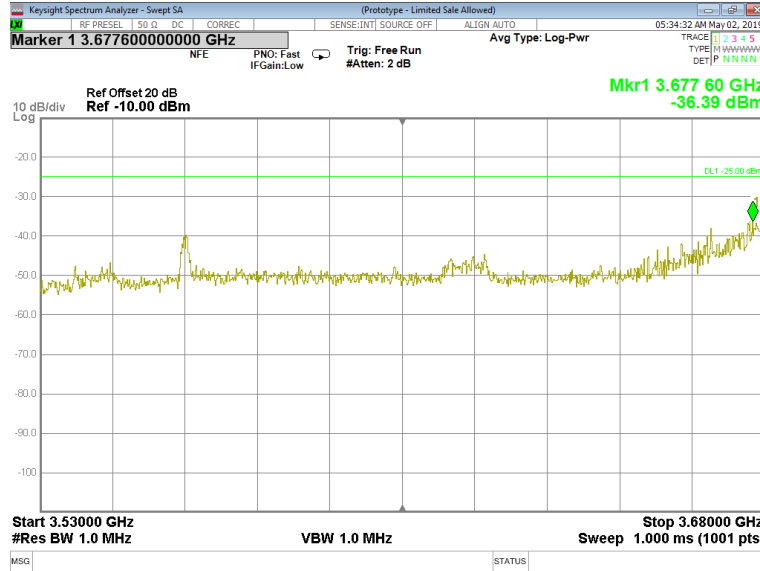
Plot 7.6.14 Spurious emission measurements in 3530 - 3610 MHz at mid carrier frequency



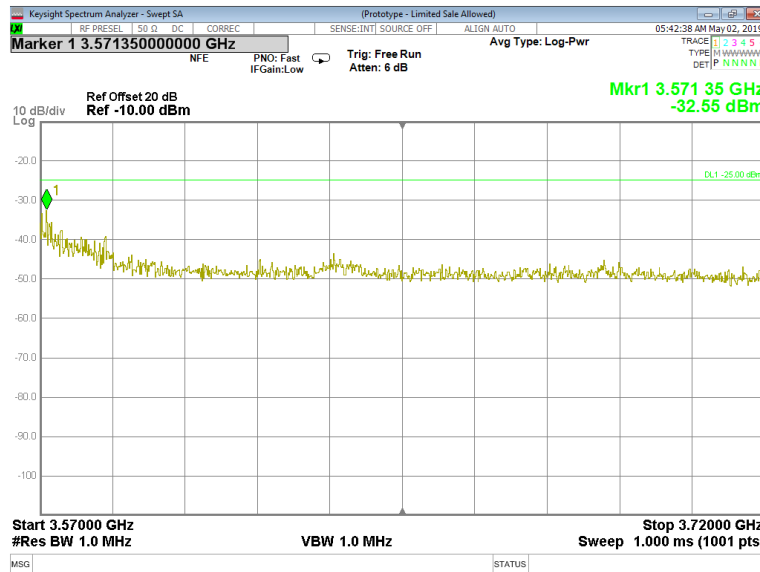


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.15 Spurious emission measurements in 3530 - 3680 MHz at high carrier frequency



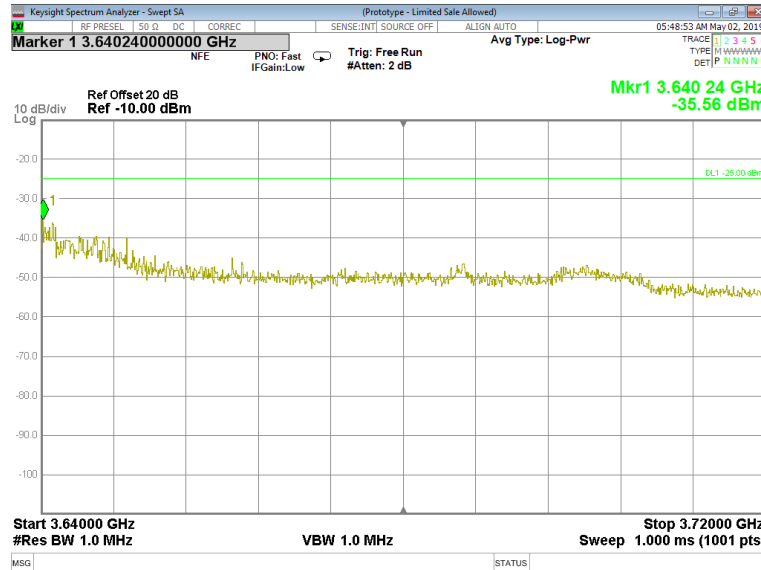
Plot 7.6.16 Spurious emission measurements in 3570 - 3720 MHz range at low carrier frequency



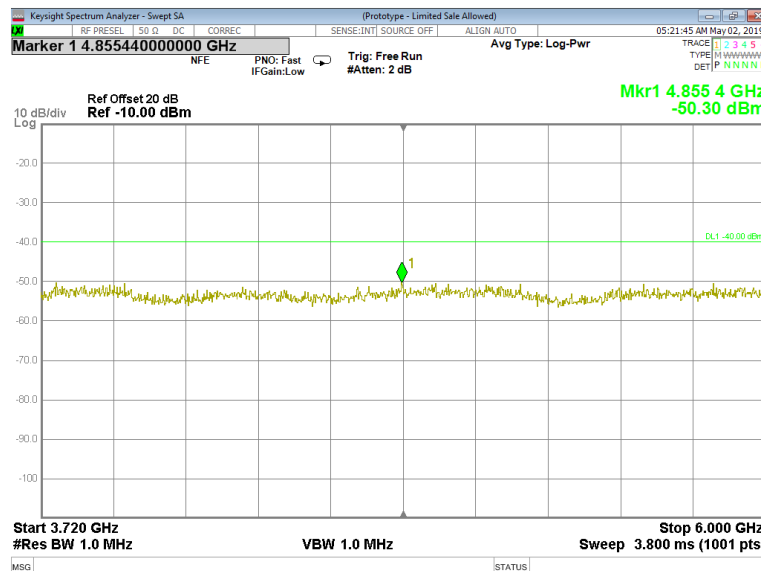


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.17 Spurious emission measurements in 3640 - 3720 MHz range at mid carrier frequency



Plot 7.6.18 Spurious emission measurements in 3720 - 6000 MHz range at low carrier frequency

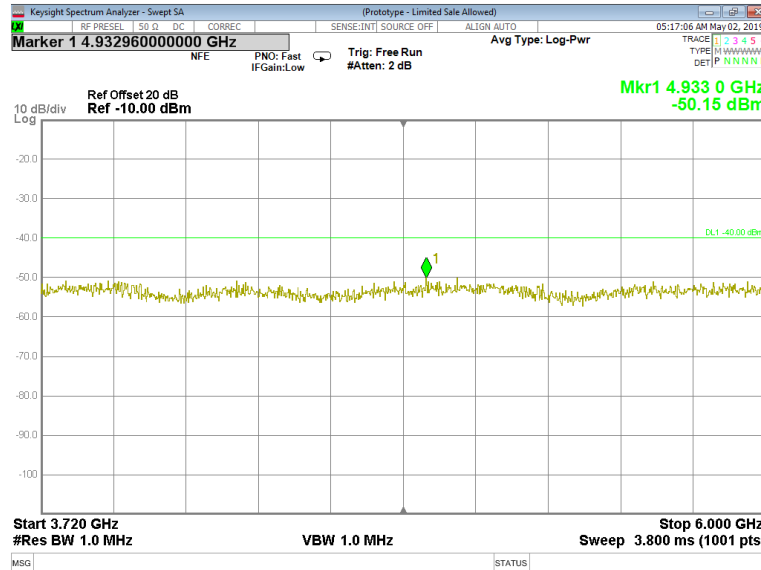




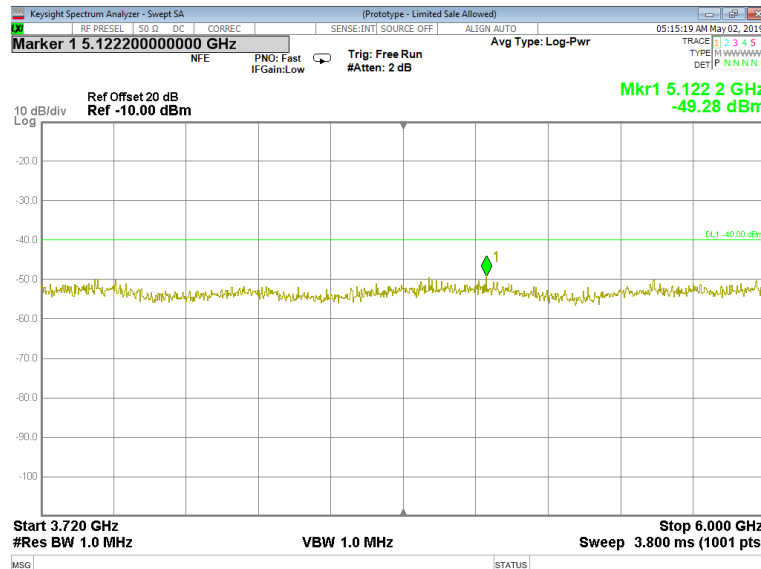
HERMON LABORATORIES

Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict:	PASS
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.19 Spurious emission measurements in 3720 - 6000 MHz at mid carrier frequency



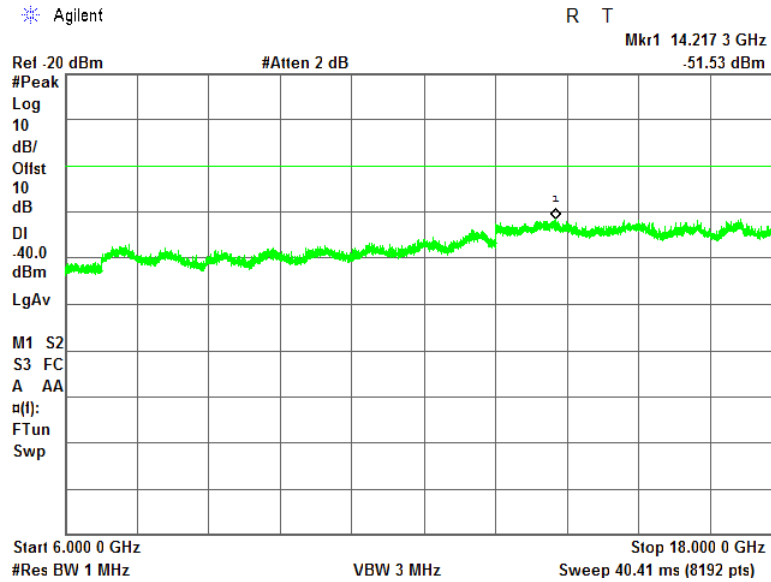
Plot 7.6.20 Spurious emission measurements in 3720 - 6000 MHz at high carrier frequency



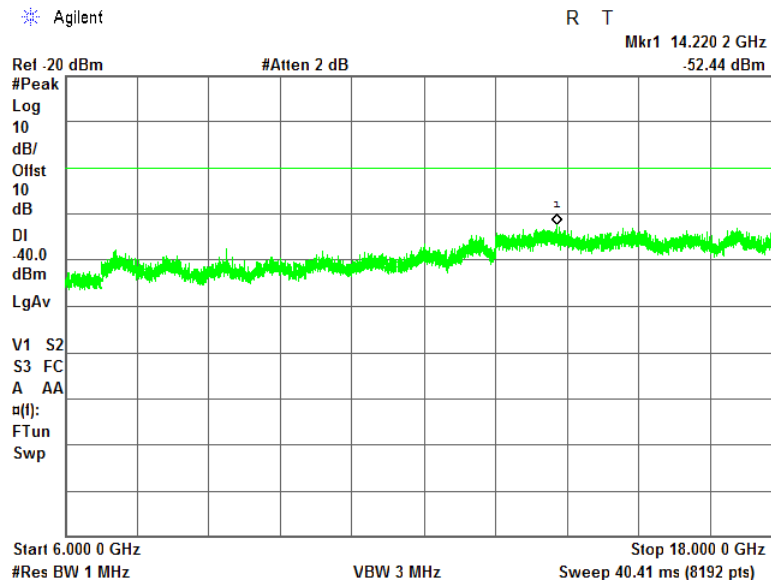


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.21 Spurious emission measurements in 6000 - 18000 MHz range at low carrier frequency



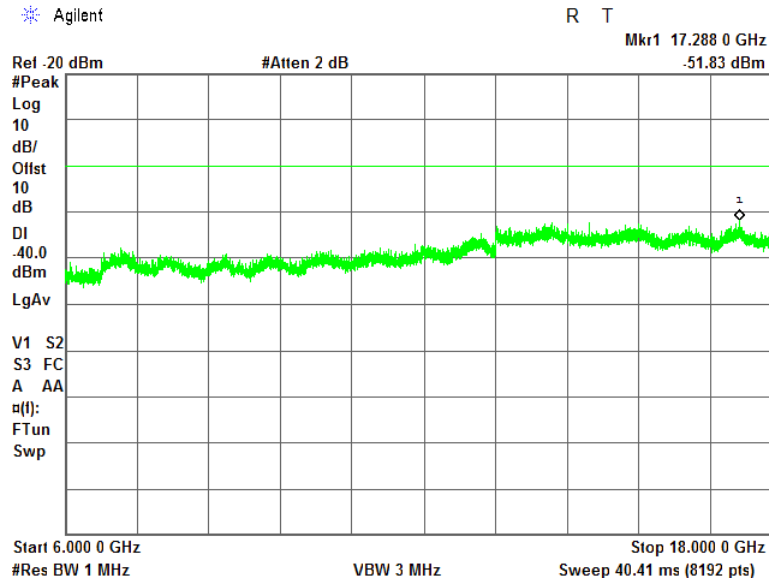
Plot 7.6.22 Spurious emission measurements in 6000 - 18000 MHz at mid carrier frequency



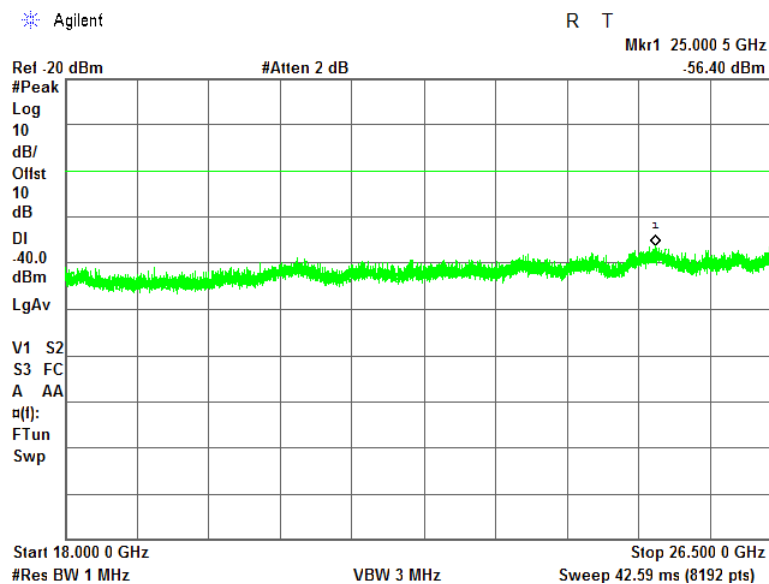


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.23 Spurious emission measurements in 6000 - 18000 MHz at high carrier frequency



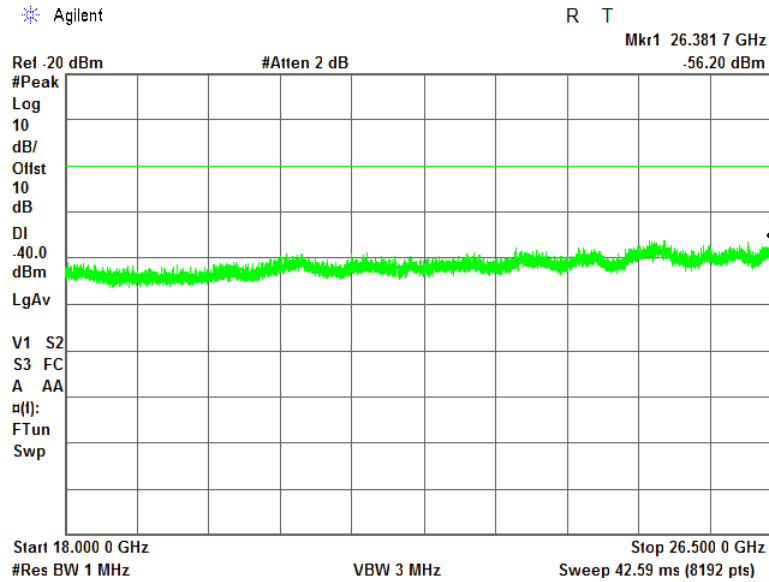
Plot 7.6.24 Spurious emission measurements in 18000 - 26500 MHz range at low carrier frequency



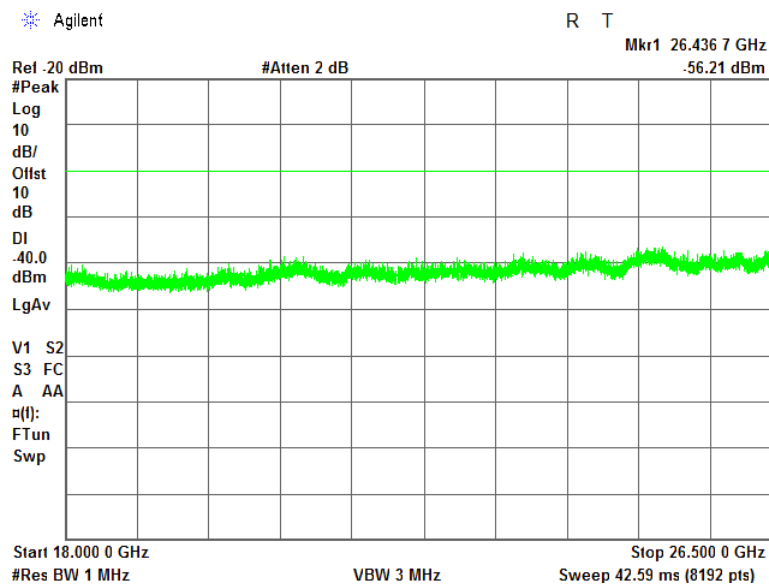


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.25 Spurious emission measurements in 18000 - 26500 MHz at mid carrier frequency



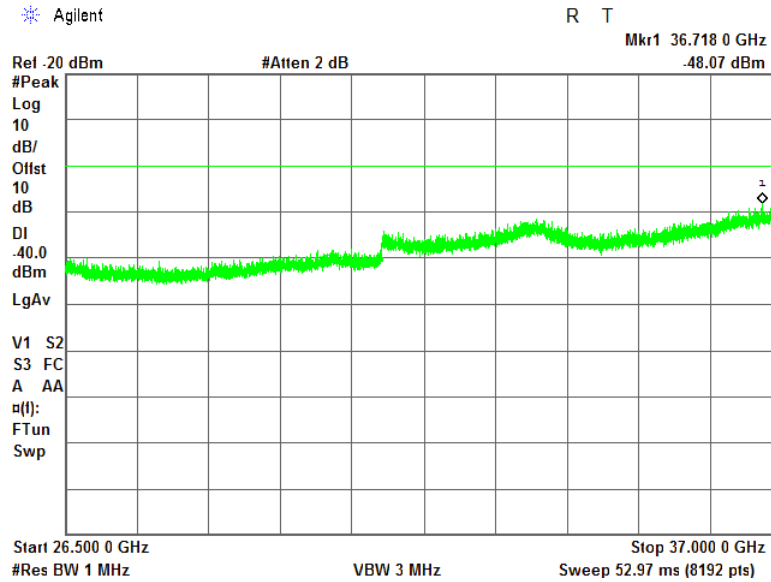
Plot 7.6.26 Spurious emission measurements in 18000 - 26500 MHz at high carrier frequency



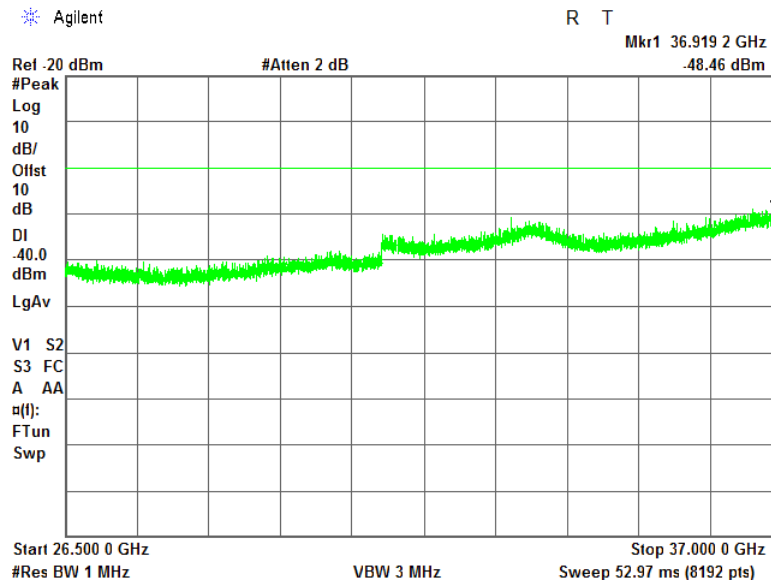


Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.27 Spurious emission measurements in 26500 - 37000 MHz range at low carrier frequency



Plot 7.6.28 Spurious emission measurements in 26500 - 37000 MHz at mid carrier frequency

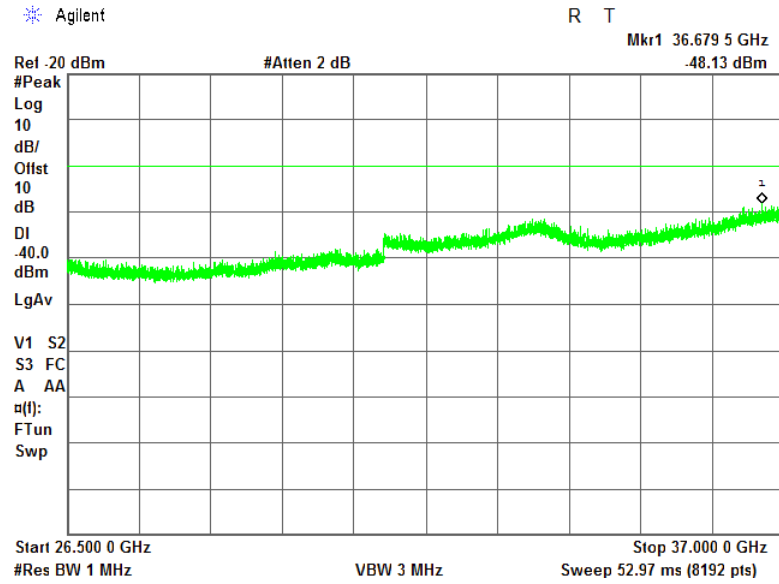




HERMON LABORATORIES

Test specification: Section 96.41(e)(3), Conducted spurious emissions			
Test procedure: Section 96.41(e)(3)			
Test mode: Compliance		Verdict: PASS	
Date(s): 2-May-19 - 5-May-19			
Temperature: 24.2 °C	Relative Humidity: 48 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Plot 7.6.29 Spurious emission measurements in 26500 - 37000 MHz at high carrier frequency





Test specification: Section 2.1055, Frequency stability			
Test procedure: 47 CFR, Section 2.1055			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Apr-19 - 14-Apr-19			
Temperature: 24.1 °C	Relative Humidity: 47 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

7.7 Frequency stability test

7.7.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.7.1.

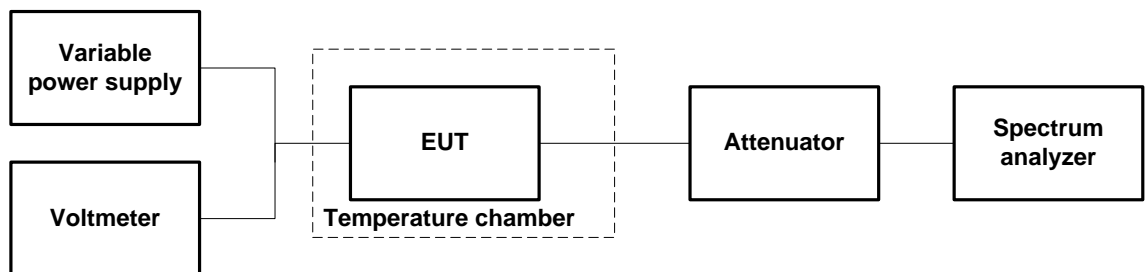
Table 7.7.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
3555.0	NA	NA
3625.0		NA
3695.0		NA

7.7.2 Test procedure

- 7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and its proper operation was checked.
- 7.7.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.7.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.7.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.7.2.5 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.
- 7.7.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.7.2.

Figure 7.7.1 Frequency stability test setup





HERMON LABORATORIES

Test specification: Section 2.1055, Frequency stability			
Test procedure: 47 CFR, Section 2.1055			
Test mode: Compliance		Verdict: PASS	
Date(s): 11-Apr-19 - 14-Apr-19			
Temperature: 24.1 °C	Relative Humidity: 47 %	Air Pressure: 1010 hPa	Power: 56 VDC
Remarks:			

Table 7.7.2 Frequency stability test results

OPERATING FREQUENCY: 3550 – 3700 MHz
 NOMINAL POWER VOLTAGE: 56 VDC
 TEMPERATURE STABILIZATION PERIOD: 20 min
 POWER DURING TEMPERATURE TRANSITION: Off
 SPECTRUM ANALYZER MODE: Counter
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 1 kHz
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Verdict
		Start up	1 st min	2 nd min	3 rd min	4 th min	5 th min	10 th min	Positive	Negative	
Low frequency 3555.0 MHz											
-30	nominal	3554.99999	3554.99997	3554.99998	3554.99998	3555.00000	3554.99999	3554.99999	20	-5	Comply
-20	nominal	3554.99999	NA	NA	NA	NA	NA	3554.99999	14	0	Comply
-10	nominal	3554.99998	NA	NA	NA	NA	NA	3554.99998	7	0	Comply
0	nominal	3554.99999	3554.99999	3554.99999	3554.99998	3554.99998	3554.99998	3554.99999	14	0	Comply
10	nominal	3554.99998	NA	NA	NA	NA	NA	3554.99999	8	-2	Comply
20	15%	3554.99999	NA	NA	NA	NA	NA	3554.99999	12	0	Comply
20	nominal	3555.00005	NA	NA	NA	NA	NA	3554.99998	68	0	Comply
20	-15%	3554.99999	NA	NA	NA	NA	NA	3554.99998	13	0	Comply
30	nominal	3554.99999	3554.99998	3554.99998	554.999998	3554.99999	3554.99999	3555.00000	19	0	Comply
40	nominal	3554.99999	NA	NA	NA	NA	NA	3554.99999	12	0	Comply
50	nominal	3554.99999	NA	NA	NA	NA	NA	3554.99999	16	0	Comply
Mid frequency 3625.0 MHz											
-30	nominal	3624.99998	3624.99999	3625.00000	3624.99999	3624.99998	3625.00000	3625.00000	3	-20	Comply
-20	nominal	3625.00000	NA	NA	NA	NA	NA	3624.99999	0	-9	Comply
-10	nominal	3625.00000	NA	NA	NA	NA	NA	3625.00000	1	-4	Comply
0	nominal	3624.99999	3624.99999	3625.000000	3625.00000	3624.99999	3624.99999	3624.99998	0	-17	Comply
10	nominal	3624.99999	NA	NA	NA	NA	NA	3624.99999	0	-9	Comply
20	15%	3624.99999	NA	NA	NA	NA	NA	3625.00000	0	-10	Comply
20	nominal	3624.99999	NA	NA	NA	NA	NA	3625.00000	0	-5	Comply
20	-15%	3624.99999	NA	NA	NA	NA	NA	3624.99999	0	-8	Comply
30	nominal	3624.99998	3624.99999	3625.000.00	3624.99998	3625.00000	3624.99999	3624.99999	0	-21	Comply
40	nominal	3624.99998	NA	NA	NA	NA	NA	3625.00001	9	-24	Comply
50	nominal	3625.00000	NA	NA	NA	NA	NA	3625.00000	2	0	Comply
High frequency 3695.0 MHz											
-30	nominal	3694.99998	3694.99998	3694.99999	3694.99999	3694.99999	3694.99998	3694.99999	0	-10	Comply
-20	nominal	3694.99999	NA	NA	NA	NA	NA	3694.99998	0	-9	Comply
-10	nominal	3694.99999	NA	NA	NA	NA	NA	3694.99999	2	0	Comply
0	nominal	3694.99998	3694.99998	3694.99998	3694.99998	3694.99998	3694.99998	3694.99999	0	-11	Comply
10	nominal	3694.99998	NA	NA	NA	NA	NA	3694.99999	3	-7	Comply
20	15%	3694.99999	NA	NA	NA	NA	NA	3694.99997	0	-22	Comply
20	nominal	3694.99999	NA	NA	NA	NA	NA	3694.99999	4	0	Comply
20	-15%	3695.00000	NA	NA	NA	NA	NA	3694.99999	6	0	Comply
30	nominal	3694.99999	3694.99999	3694.99999	3694.99999	3694.99999	3694.99999	3694.99999	0	-5	Comply
40	nominal	3694.99999	NA	NA	NA	NA	NA	3695.00000	6	-1	Comply
50	nominal	3694.99998	NA	NA	NA	NA	NA	3694.99999	0	-7	Comply

* - Reference frequency

Reference numbers of test equipment used

HL 2909	HL 2358	HL 5391				
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Full description is given in Appendix A.

**8 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
2358	Power Supply, 2 X 0-36VDC / 5A, 5VDC / 5A	Horizon Electronics	DHR3655 D	767469	03-Jun-18	03-Jun-19
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	04-Apr-19	04-Apr-20
3301	Power Meter, P-series, 50 MHz to 40 GHz	Agilent Technologies	N1911A	MY45101057	28-Apr-19	28-Apr-20
3302	Power sensor, P-Series, 50 MHz to 40 GHz, -35/30 to 20 dBm	Agilent Technologies	N1922A	MY45240586	28-Apr-19	28-Apr-20
3433	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25679	15-Apr-19	15-Apr-20
3435	Precision Fixed Attenuator, 50 Ohm, 5 W, 10 dB, DC to 18 GHz	Mini-Circuits	BW-S10W5+	NA	04-Mar-19	04-Mar-20
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	24-Apr-19	24-Apr-20
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFL EX 102A	1226/2A	07-Apr-19	07-Apr-20
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	31-Dec-18	31-Dec-19
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
5112	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11SK/5500MM	502494/2EA	18-Apr-19	18-Apr-20
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	08-Feb-19	08-Feb-22
5372	MXE EMI receiver, 3 Hz to 44 GHz	Keysight Technologies	N9038A	MY57290155	21-May-18	21-May-19
5391	Temperature/Humidity Cycle Chamber, -77 - +177 deg., Humidity Range 20% RH to 95% RH	Thermotron	SM-8C	27737	22-Jul-18	22-Jul-19
5405	RF cable, 18 GHz, N-N, 6 m	Huber-Suhner	SF118/11N(x2)	500023/118	01-Aug-18	01-Aug-19
5409	RF cable, 40 GHz, SMA-SMA, 2 m	Huber-Suhner	SF102EA/11SK/11SK/2000MM	503973/2EA	19-Aug-18	19-Aug-19

**9 APPENDIX B Measurement uncertainties****Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements**

Test description	Expanded uncertainty
Transmitter tests	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	$\pm 8\%$
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
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz $\pm 13.9\%$
Duty cycle, timing (Tx ON / OFF) and average factor measurements	$\pm 1.0\%$
Unintentional radiator tests	
Conducted emissions with LISN	9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB
Radiated emissions at 3 m measuring distance	
Horizontal polarization	Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB
Vertical polarization	Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 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.



10 APPENDIX C Test facility 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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website: www.hermonlabs.com

Person for contact: Mr. Michael Nikishin, EMC&Radio group manager

11 APPENDIX D Specification references

FCC 47CFR part 96: 2018	Citizens Broadband Radio Service
FCC 47CFR part 1: 2018	Practice and procedure
FCC 47CFR part 2: 2018	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.26:2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications.
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.
KDB 971168 D01 v03r01	Measurement Guidance for Certification of Licensed Digital Transmitters
KDB 940660 D01 v01	Certification and Test Procedures for Citizens Broadband Radio Service Devices Authorized under Part 96
KDB 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
KDB 662911 D02 v01	MIMO with Cross-Polarized Antenna



12 APPENDIX E Test equipment correction factors

Antenna factor
Active loop antenna
Model 6502, S/N 2857, HL 0446

Frequency, MHz	Measured antenna factor, dBS/m
0.009	-32.5
0.010	-33.4
0.020	-37.9
0.050	-40.6
0.075	-41.0
0.100	-41.2
0.150	-41.2
0.250	-41.2
0.500	-41.3
0.750	-41.3
1.000	-41.4
2.000	-41.4
3.000	-41.4
4.000	-41.5
5.000	-41.5
10.000	-41.8
15.000	-42.2
20.000	-42.9
25.000	-43.9
30.000	-45.4

Antenna factor is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



Antenna factor
Trilog antenna
Model ALX-8000E, Frankonia, S/N 00809, HL 5288, 30-1000 MHz

Frequency, MHz	Antenna factor, dB/m		
	Vert Up	Vert Down	Delta
30	-51.19	-51.28	0.09
35	-44.03	-44.12	0.09
40	-43.07	-43.12	0.05
45	-39.61	-39.79	0.18
50	-37.84	-38.14	0.3
60	-34.93	-34.9	0.03
70	-29.76	-29.66	0.1
80	-27.69	-27.82	0.13
90	-29.05	-29.07	0.02
100	-31.19	-31.19	0
120	-31.61	-31.6	0.01
140	-28.13	-28.06	0.07
160	-27.71	-27.75	0.04
180	-26.19	-26.15	0.04
200	-28.2	-28.15	0.05
250	-27.45	-27.47	0.02
300	-29.61	-29.63	0.02
400	-31.77	-31.78	0.01
500	-32.81	-32.81	0
600	-33.64	-33.61	0.03
700	-34.21	-34.21	0
800	-35.66	-35.66	0
900	-36.99	-36.91	0.08
1000	-38	-37.91	0.09

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field intensity in dB(μ V/m).



Antenna factor
Active Horn Antenna,
Com-Power Corporation, model: AHA-118, s/n 701046, HL 4933

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
1000	-16.1
1500	-15.1
2000	-10.9
2500	-11.9
3000	-11.1
3500	-10.6
4000	-8.6
4500	-8.3
5000	-5.9
5500	-5.7
6000	-3.3
6500	-4.0
7000	-2.2
7500	-1.7
8000	1.1
8500	-0.8
9000	-1.5
9500	-0.2

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
10000	1.8
10500	1.0
11000	0.3
11500	-0.5
12000	3.1
12500	1.4
13000	-0.3
13500	-0.4
14000	2.5
14500	2.2
15000	1.9
15500	0.5
16000	2.1
16500	1.2
17000	0.6
17500	3.1
18000	4.2

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



Antenna factor
Active Horn Antenna,
Com-Power Corporation, model: AHA-840, s/n 105004, HL 4956

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
18000	2.5
18500	0.5
19000	-1.0
19500	-2.4
20000	-2.5
20500	-2.2
21000	-2.0
21500	-2.7
22000	-3.7
22500	-3.8
23000	-3.7
23500	-5.0
24000	-4.5
24500	-5.0
25000	-4.7
25500	-4.4
26000	-4.3
26500	-5.6
27000	-4.3
27500	-4.9
28000	-5.2
28500	-4.4

Frequency, MHz	Measured antenna factor (with preamplifier), dB/m
29000	-2.7
29500	-2.6
30000	-1.4
30500	-1.5
31000	-1.0
31500	-2.6
32000	-3.3
32500	-3.3
33000	-5.1
33500	-5.2
34000	-1.5
34500	-5.4
35000	-3.3
35500	-4.2
36000	-2.8
36500	-2.6
37000	-1.0
38000	1.8
38500	2.8
39000	1.3
39500	1.3
40000	0.3

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



Cable loss
Test Cable, Mini-Circuits, CBL-5FT-SMSM+, SMA-SMA, 18 GHz, 1.5 m, S/N 25679
Mini-Circuits, HL 3433

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10.0	0.06	9000	2.01
100	0.17	9500	2.06
500	0.41	10000	2.05
1000	0.58	10500	2.18
1500	0.72	11000	2.26
2000	0.86	11500	2.28
2500	0.96	12000	2.43
3000	1.04	12500	2.53
3500	1.13	13000	2.52
4000	1.23	13500	2.56
4500	1.31	14000	2.60
5000	1.41	14500	2.59
5500	1.49	15000	2.67
6000	1.55	15500	2.76
6500	1.63	16000	2.86
7000	1.71	16500	2.91
7500	1.78	17000	2.95
8000	1.86	17500	3.02
8500	1.92	18000	3.07



Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 1.5 m, SMA-SMA, S/N 1226/2A
HL 3903

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	-0.02	9500	1.84	21000	2.98
100	0.15	10000	1.86	22000	3.07
500	0.38	10500	1.93	23000	3.13
1000	0.56	11000	1.99	24000	3.21
1500	0.69	11500	2.04	25000	3.26
2000	0.82	12000	2.10	26000	3.48
2500	0.90	12500	2.15	27000	3.44
3000	0.98	13000	2.21	28000	3.53
3500	1.06	13500	2.25	29000	3.59
4000	1.11	14000	2.29	30000	3.66
4500	1.17	14500	2.34	31000	3.70
5000	1.24	15000	2.36	32000	3.79
5500	1.32	15500	2.40	33000	3.88
6000	1.40	16000	2.45	34000	3.94
6500	1.50	16500	2.48	35000	3.91
7000	1.56	17000	2.56	36000	4.05
7500	1.62	17500	2.58	37000	4.22
8000	1.68	18000	2.60	38000	4.25
8500	1.74	19000	2.84	39000	4.27
9000	1.78	20000	2.88	40000	4.33



Cable loss
RF Cable, Huber-Suhner, 40 GHz, 5.5 m, K type,
SF102EA/11SK/11SK/5500MM, S/N 502494/2EA
HL 5112

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.69	20500	10.18
200	0.97	21000	10.32
300	1.18	21500	10.47
500	1.52	22000	10.60
1000	2.14	22500	10.75
1500	2.62	23000	10.87
2000	3.03	23500	11.00
2500	3.40	24000	11.12
3000	3.73	24500	11.23
3500	4.04	25000	11.35
4000	4.33	25500	11.52
4500	4.60	26000	11.64
5000	4.86	26500	11.73
5500	5.10	27000	11.84
6000	5.34	27500	11.93
6500	5.57	28000	12.05
7000	5.79	28500	12.19
7500	6.00	29000	12.33
8000	6.21	29500	12.44
8500	6.43	30000	12.53
9000	6.62	30500	12.58
9500	6.82	31000	12.71
10000	7.01	31500	12.86
10500	7.17	32000	13.00
11000	7.34	32500	13.11
11500	7.51	33000	13.24
12000	7.68	33500	13.33
12500	7.84	34000	13.44
13000	8.00	34500	13.58
13500	8.16	35000	13.69
14000	8.32	35500	13.81
14500	8.48	36000	13.93
15000	8.63	36500	14.05
15500	8.77	37000	14.24
16000	8.92	37500	14.28
16500	9.08	38000	14.38
17000	9.23	38500	14.50
17500	9.37	39000	14.61
18000	9.51	39500	14.70
18500	9.66	40000	14.83
19000	9.78		
19500	9.92		
20000	10.07		



Cable loss
RF Cable, Huber-Suhner, 18 GHz, 6 m,
SF118/11N(x2), S/N 500023/118
HL 5405

5405



Specific Test Report

Frequency Range [GHz]	IL min S21 [dB]	IL min S12 [dB]	RL max S11 [dB]	RL max S22 [dB]
0.040 - 1.836	-1.431	-1.431	-37.037	-37.704
1.836 - 3.632	-2.062	-2.066	-33.573	-32.848
3.632 - 5.428	-2.576	-2.576	-28.548	-29.602
5.428 - 7.224	-3.013	-3.014	-30.738	-32.523
7.224 - 9.020	-3.415	-3.416	-33.728	-32.257
9.020 - 10.816	-3.772	-3.772	-29.302	-30.735
10.816 - 12.612	-4.138	-4.138	-28.768	-26.255
12.612 - 14.408	-4.456	-4.462	-27.109	-26.151
14.408 - 16.204	-4.786	-4.786	-26.056	-27.116
16.204 - 18.000	-5.113	-5.111	-27.762	-28.508

Type: SF118/11N/11N/6000MM
Sales no.: 10497130
Serial no.: 500023 /118
PA no.: 1956306
Ring no.:
Cable length: 6 m
Test length:
Connector 1: SF_11_N-656
Connector 2: SF_11_N-656
Cable: SUCOFLEX_118
Meas. System: N5230C,MY49001834,A.09.42.22

Time: 7:04:21 AM
Date: 6/6/2018
Inspected by: AZ /111

Start Freq.: 0.04000 GHz
Stop Freq.: 18.00000 GHz
Meas Points: 801
Source Power: -5 dBm



Cable loss
RF Cable, Huber-Suhner, 40 GHz, 2 m, ,
SF102EA/11SK/11SK/2000MM, S/N 503973/2EA
HL 5409

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
100	0.26	20500	3.75
200	0.36	21000	3.80
300	0.45	21500	3.85
500	0.58	22000	3.90
1000	0.82	22500	3.95
1500	0.99	23000	4.00
2000	1.15	23500	4.04
2500	1.28	24000	4.09
3000	1.40	24500	4.13
3500	1.51	25000	4.19
4000	1.61	25500	4.25
4500	1.71	26000	4.30
5000	1.80	26500	4.37
5500	1.89	27000	4.45
6000	1.98	27500	4.47
6500	2.06	28000	4.45
7000	2.14	28500	4.49
7500	2.22	29000	4.57
8000	2.29	29500	4.60
8500	2.36	30000	4.59
9000	2.43	30500	4.63
9500	2.50	31000	4.68
10000	2.58	31500	4.74
10500	2.63	32000	4.81
11000	2.70	32500	4.89
11500	2.76	33000	4.89
12000	2.82	33500	4.92
12500	2.87	34000	4.94
13000	2.94	34500	4.99
13500	3.00	35000	5.07
14000	3.06	35500	5.12
14500	3.11	36000	5.14
15000	3.17	36500	5.22
15500	3.23	37000	5.28
16000	3.29	37500	5.30
16500	3.35	38000	5.39
17000	3.41	38500	5.48
17500	3.47	39000	5.44
18000	3.51	39500	5.45
18500	3.56	40000	5.51
19000	3.60		
19500	3.66		
20000	3.71		



13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
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
dB(μ A)	decibel referred to one microampere
dB Ω	decibel referred to one Ohm
DC	direct current
EIRP	equivalent isotropically radiated power
ERP	effective radiated power
EUT	equipment under test
F	frequency
GHz	gigahertz
GND	ground
H	height
HL	Hermon laboratories
Hz	hertz
ITE	information technology equipment
k	kilo
kHz	kilohertz
LISN	line impedance stabilization network
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μ s	microsecond
NA	not applicable
NB	narrow band
NT	not tested
OATS	open area test site
Ω	Ohm
QP	quasi-peak
PM	pulse modulation
PS	power supply
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
VA	volt-ampere

END OF DOCUMENT