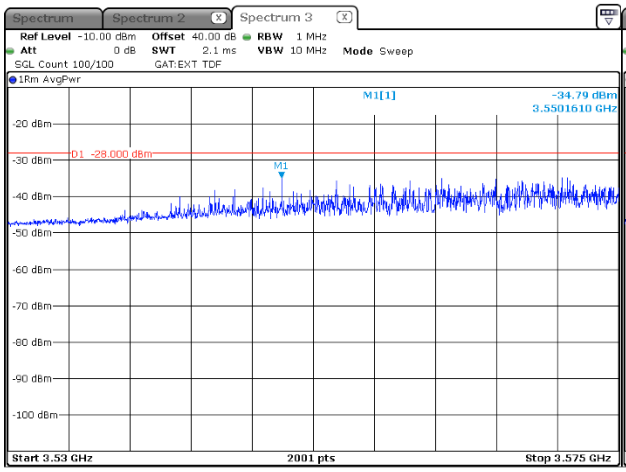
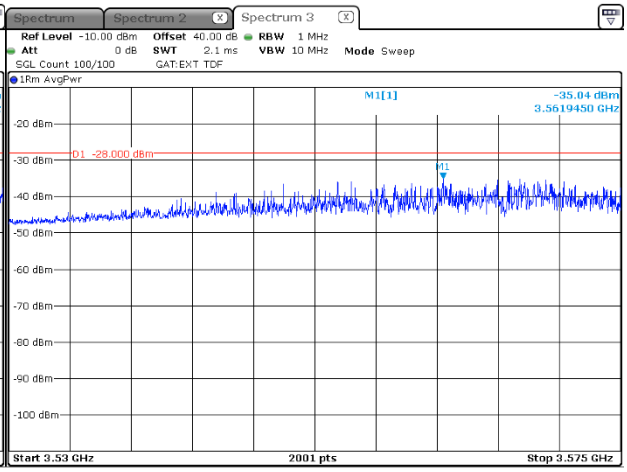
Test specification:	Section 96.41(e), Emission mask		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	19-Jul-20 - 29-Nov-20		
Temperature: 24.2 ºC	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.22 Emission outside the fundamental test results in 3530 - 3575 GHz range at mid carrier frequency

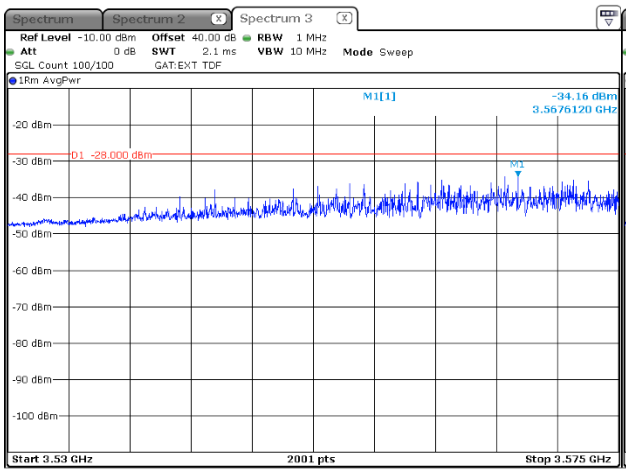
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: #1



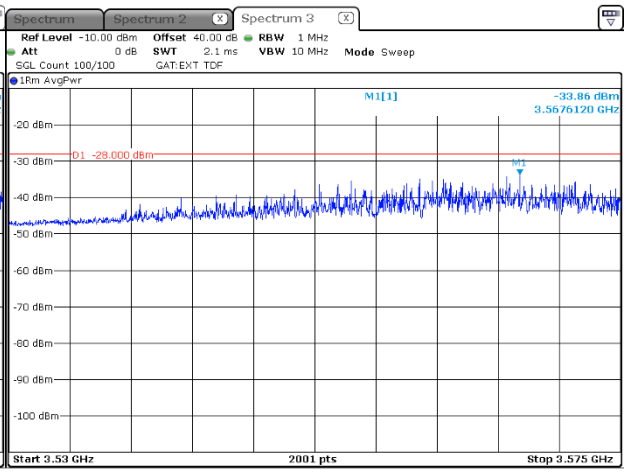
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



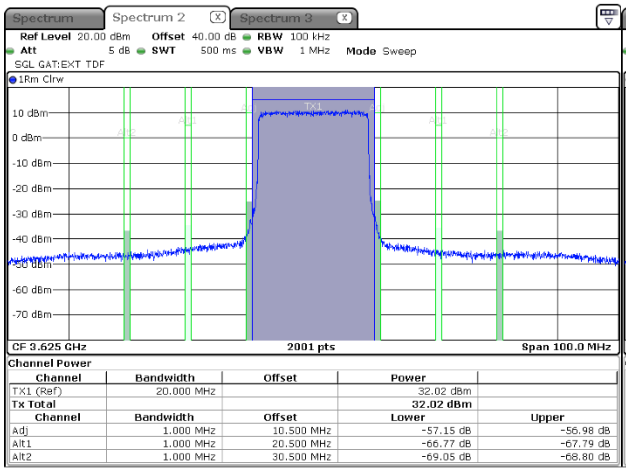
ANTENNA CHAIN: #4



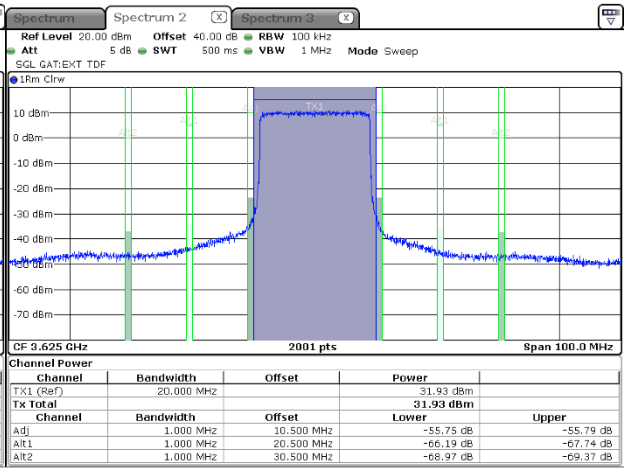
Test specification:	Section 96.41(e), Emission mask		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	19-Jul-20 - 29-Nov-20		
Temperature: 24.2 ºC	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.23 Emission outside the fundamental test results in 3575 - 3675 GHz range at mid carrier frequency

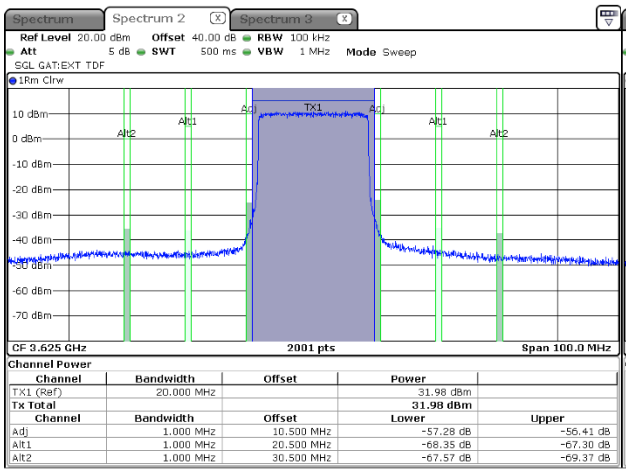
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: #1



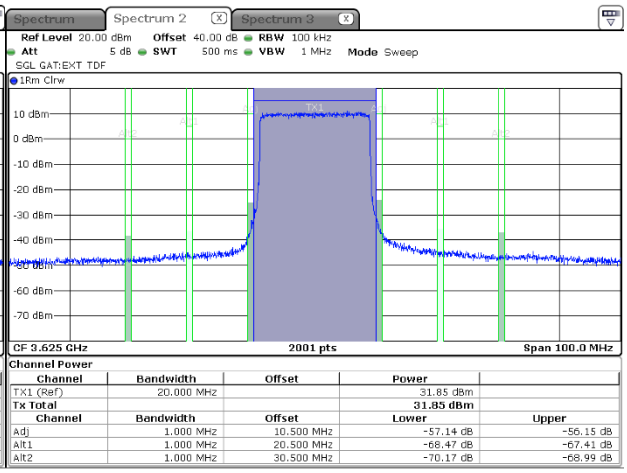
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



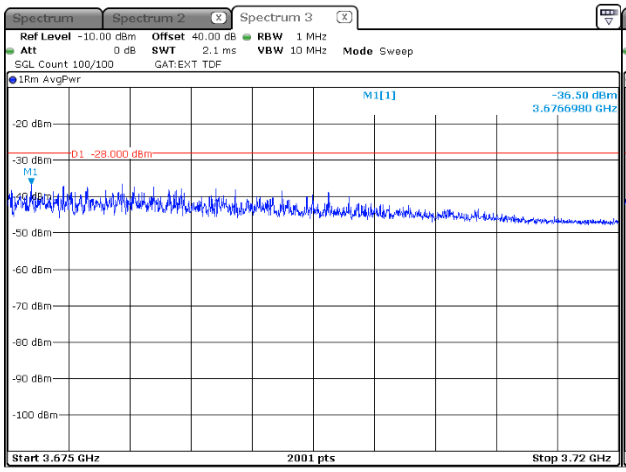
ANTENNA CHAIN: #4



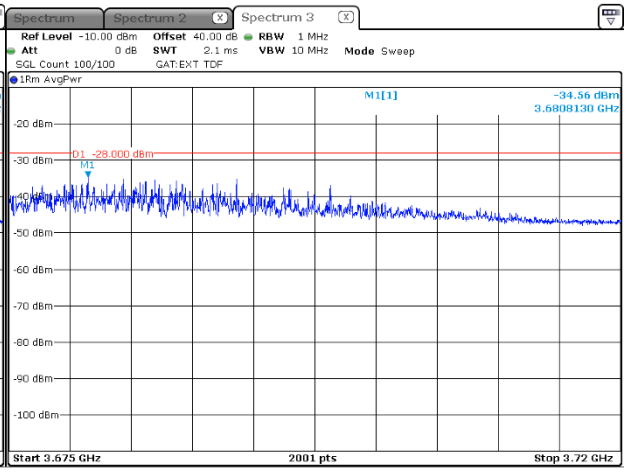
Test specification:	**Section 96.41(e), Emission mask**		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	19-Jul-20 - 29-Nov-20		
Temperature: 24.2 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1010 hPa	**Power:** 48 VDC
Remarks:			

Plot 7.4.24 Emission outside the fundamental test results in 3675 - 3720 GHz range at mid carrier frequency

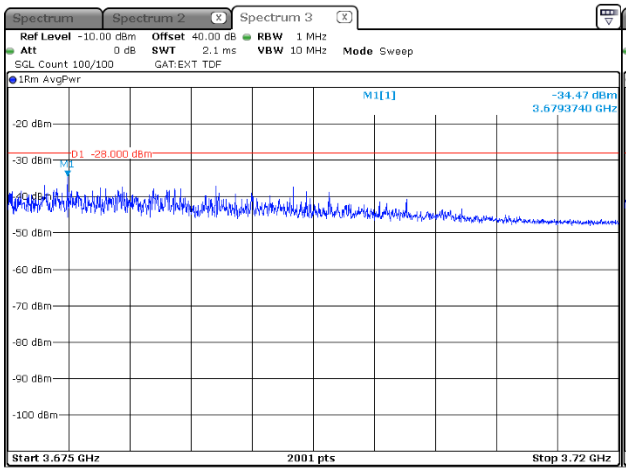
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: #1



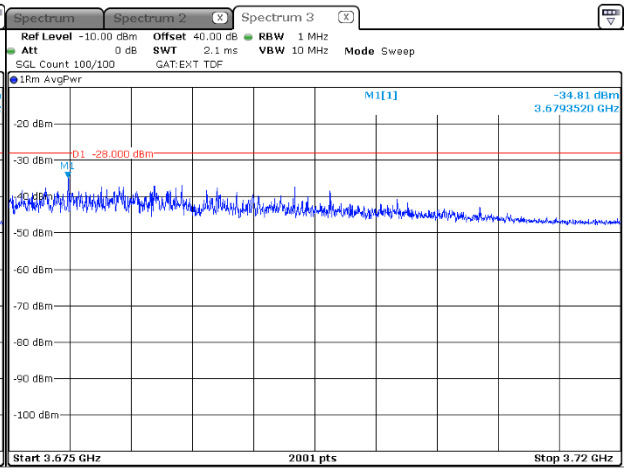
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



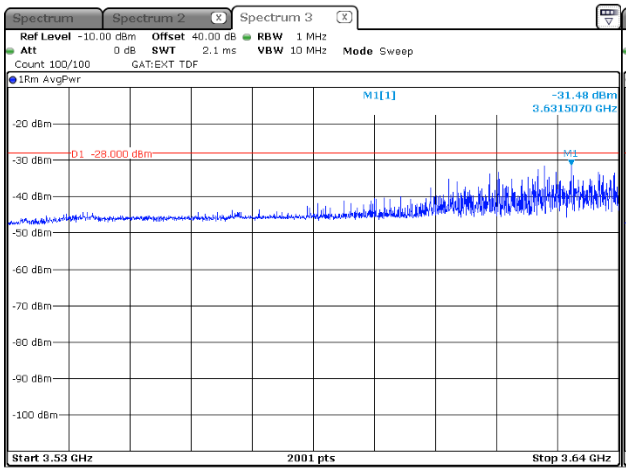
ANTENNA CHAIN: #4



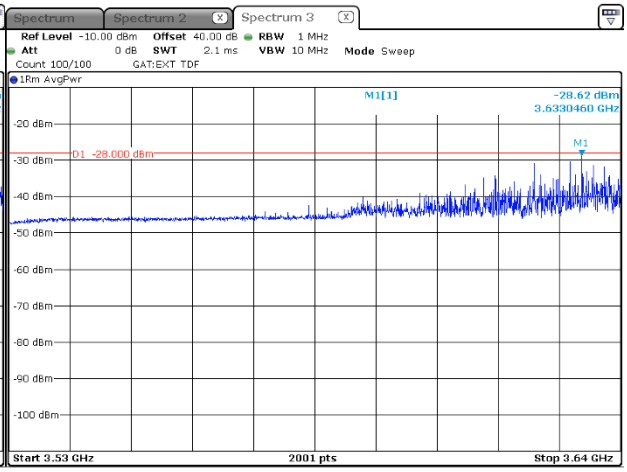
Test specification:	Section 96.41(e), Emission mask		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	19-Jul-20 - 29-Nov-20		
Temperature: 24.2 ºC	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.25 Emission outside the fundamental test results in 3530 – 3640 GHz range at high carrier frequency

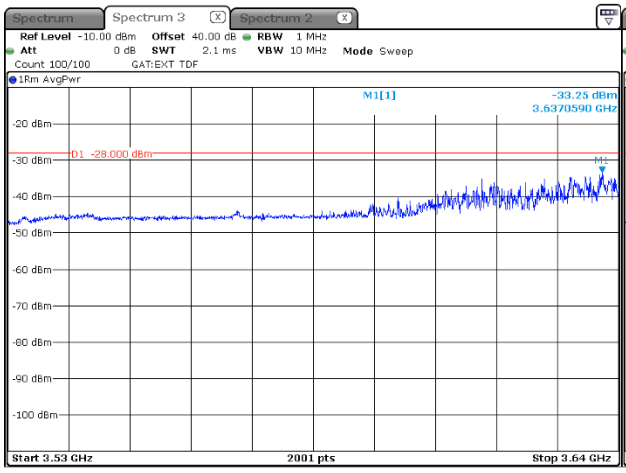
MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: #1



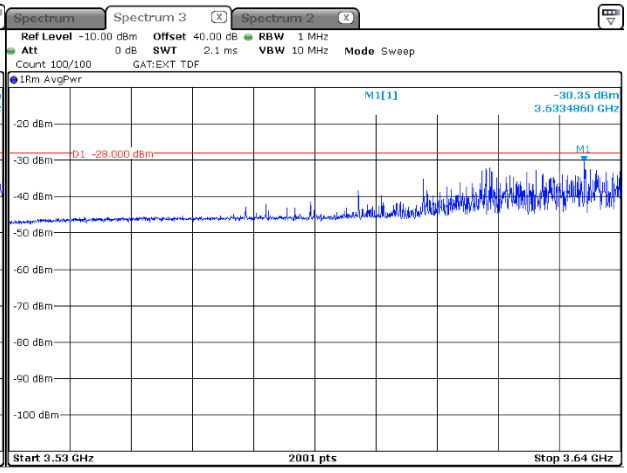
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



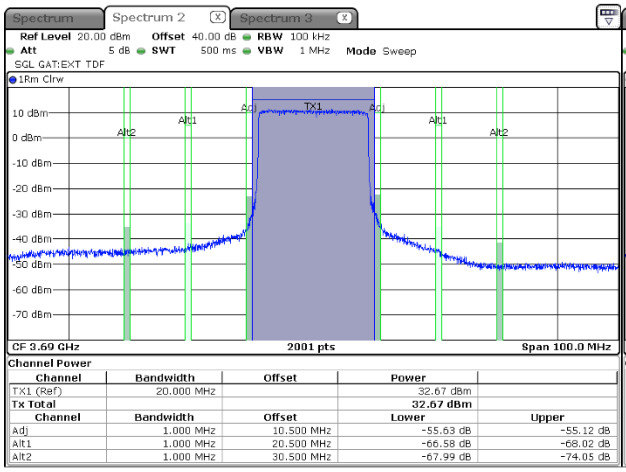
ANTENNA CHAIN: #4



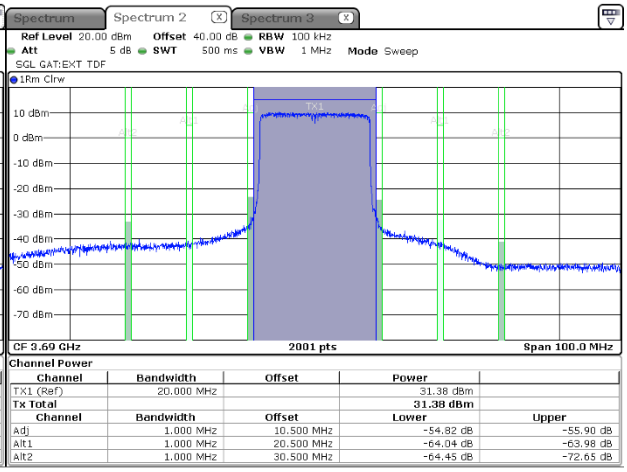
Test specification:	Section 96.41(e), Emission mask		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	19-Jul-20 - 29-Nov-20		
Temperature: 24.2 ºC	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.26 Emission outside the fundamental test results in 3640 - 3740 GHz range at high carrier frequency

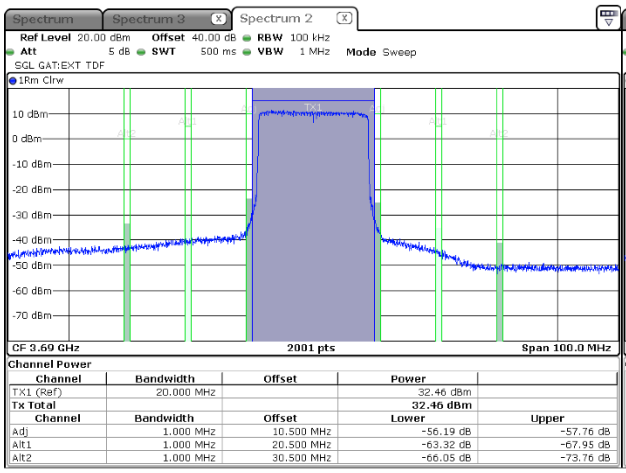
MODULATION: QPSK
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: #1



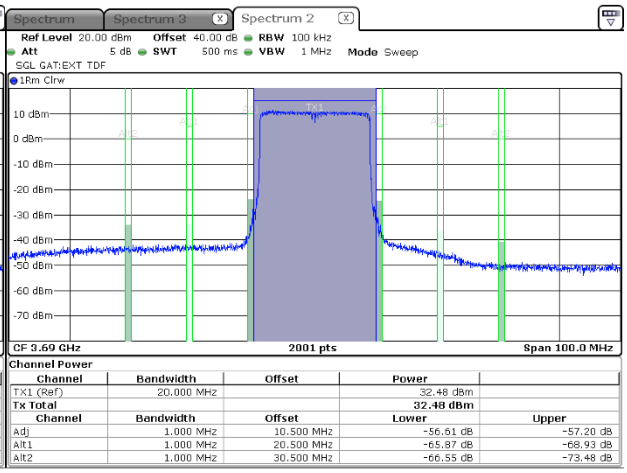
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



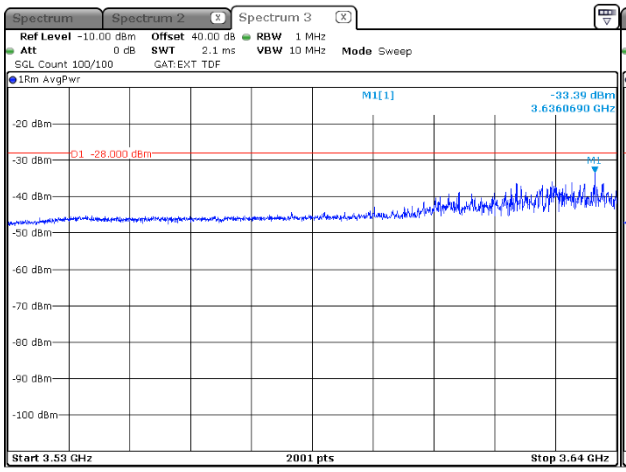
ANTENNA CHAIN: #4



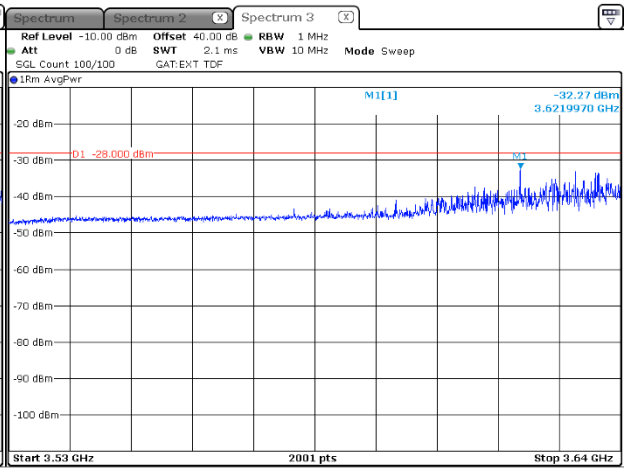
Test specification:	Section 96.41(e), Emission mask		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	19-Jul-20 - 29-Nov-20		
Temperature: 24.2 ºC	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.27 Emission outside the fundamental test results in 3530 - 3640 GHz range at high carrier frequency

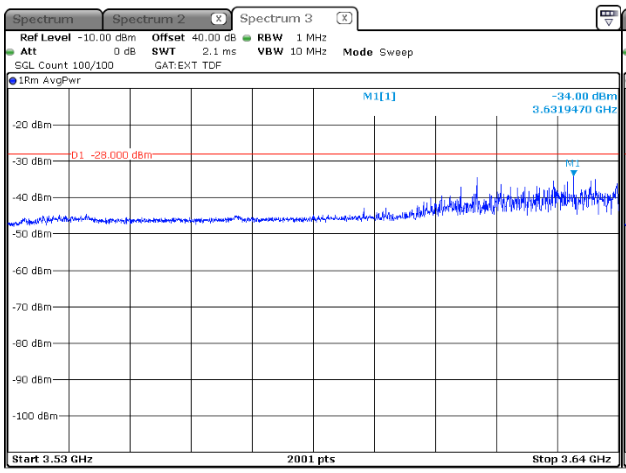
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: #1



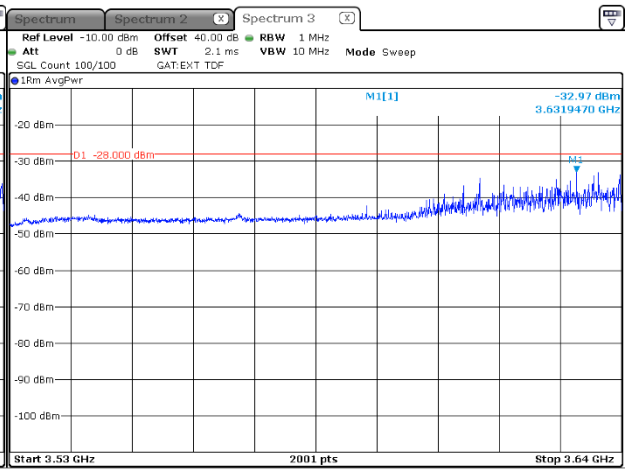
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



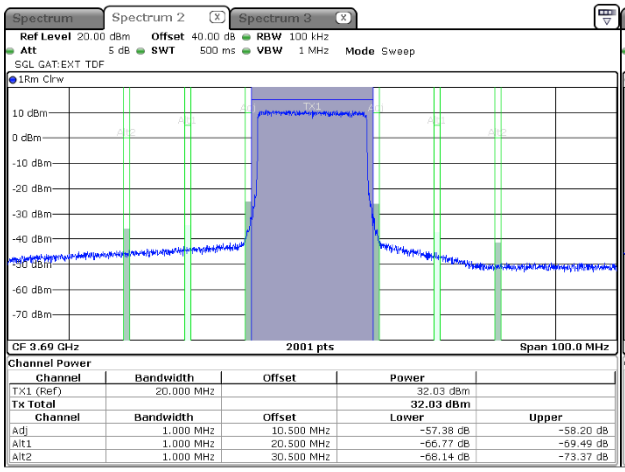
ANTENNA CHAIN: #4



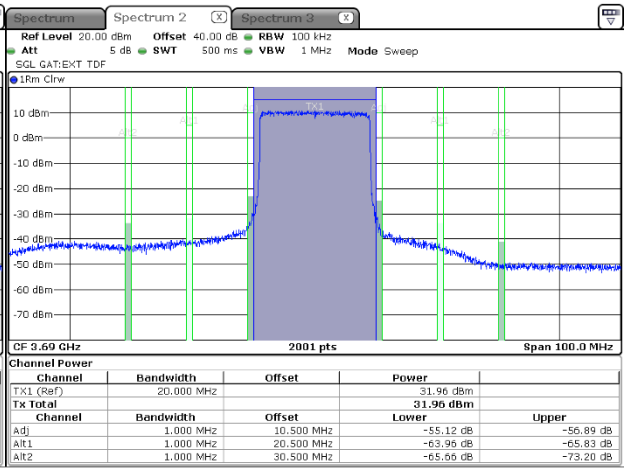
Test specification:	Section 96.41(e), Emission mask		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	19-Jul-20 - 29-Nov-20		
Temperature: 24.2 ºC	Relative Humidity: 49 %	Air Pressure: 1010 hPa	Power: 48 VDC
Remarks:			

Plot 7.4.28 Emission outside the fundamental test results in 3640 - 3740 GHz range at high carrier frequency

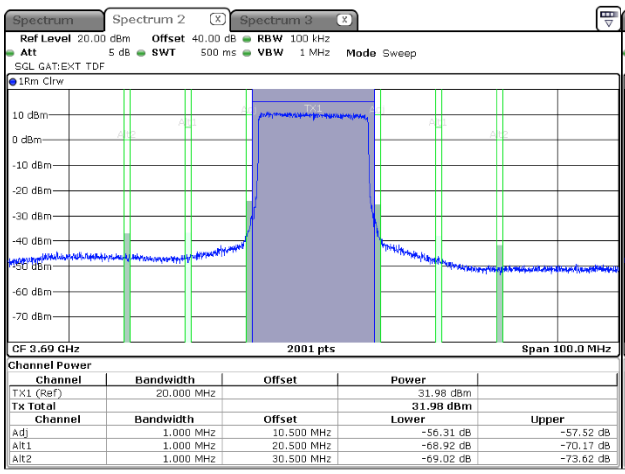
MODULATION: 256QAM
CHANNEL SPACING: 20 MHz
ANTENNA CHAIN: #1



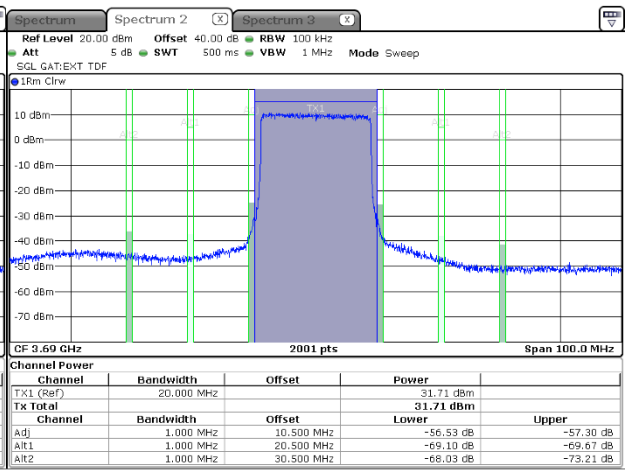
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



ANTENNA CHAIN: #4



Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

7.5 Radiated spurious emission measurements

7.5.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Radiated spurious emission test limits

Frequency, MHz	EIRP of spurious, dBm	Equivalent field strength limit @ 3m, dB(μV/m)***
0.09 – below 3530.0	-40.0	55.2
3720.0 – 10th harmonic*	-40.0	55.2

*** - Equivalent field strength limit was calculated from maximum allowed ERP of spurious as follows: E=sqrt(30×P×1.64)/r, where P is ERP in Watts, 1.64 is numeric gain of ideal dipole and r is antenna to EUT distance in meters

7.5.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.5.2.1 The EUT was set up as shown in Figure 7.5.1, energized and the performance check was conducted.

7.5.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna was rotated around its vertical axis.

7.5.2.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

7.5.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.5.3.1 The EUT was set up as shown in Figure 7.5.2, energized and the performance check was conducted.

7.5.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer. To find maximum radiation the turntable was rotated 360^0 and the measuring antenna height was swept from 1 to 4 m in both, vertical and horizontal, polarizations.

7.5.3.3 The worst test results (the lowest margins) were recorded in Table 7.5.2 and shown in the associated plots.

Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Figure 7.5.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

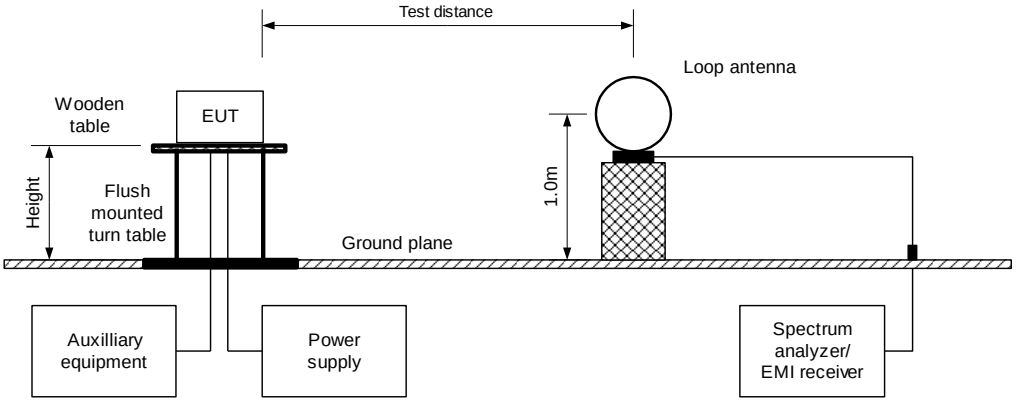
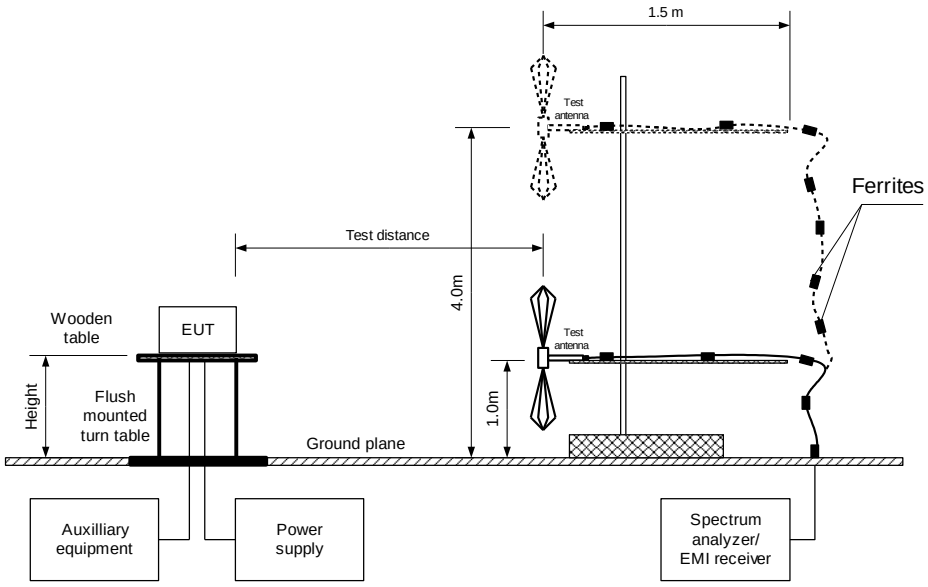


Figure 7.5.2 Setup for spurious emission field strength measurements above 30 MHz



Test specification:	**Section 96.41(e)(2), Radiated spurious emissions**		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	**Relative Humidity:** 52 %	**Air Pressure:** 1011 hPa	**Power:** 48 VDC
Remarks:			

Table 7.5.2 Spurious emission field strength test results

ASSIGNED FREQUENCY RANGE:	3550 - 3700 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Active loop (9 kHz – 30 MHz) Biconilog (30 MHz – 1000 MHz)
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees
113.084	46.85	55.20	-8.35	100	V	1.02	-55.0
127.536	50.33	55.20	-4.87	100	V	1.04	12.0
140.511	32.49	55.20	-22.71	100	V	1.00	59.0
168.888	38.80	55.20	-16.40	100	H	1.75	-171.0
325.013	32.91	55.20	-22.29	100	V	1.75	-166.0
374.982	46.85	55.20	-8.35	100	V	1.02	-55.0

*****- Margin = Field strength of spurious – calculated field strength limit.
******- EUT front panel refers to 0 degrees position of turntable.

Test specification:	**Section 96.41(e)(2), Radiated spurious emissions**		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	**Relative Humidity:** 52 %	**Air Pressure:** 1011 hPa	**Power:** 48 VDC
Remarks:			

Table 7.5.3 Field strength of spurious emissions above 1 GHz within restricted bands

ASSIGNED FREQUENCY RANGE:	3550 - 3700 MHz
TEST DISTANCE:	3 m
TEST SITE:	Semi anechoic chamber
INVESTIGATED FREQUENCY RANGE:	0.009 – 1000 MHz
DETECTOR USED:	Peak
VIDEO BANDWIDTH:	> Resolution bandwidth
TEST ANTENNA TYPE:	Double ridged guide (above 1000 MHz)
MODULATION:	QPSK
MODULATING SIGNAL:	PRBS
TRANSMITTER OUTPUT POWER SETTINGS:	Maximum

Frequency, MHz	Antenna		Azimuth, degrees*	Peak field strength(VBW=3 MHz)			Average field strength(VBW=10 Hz)			Verdict
	Polarization	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										
14223.612	V	2.55	119	61.17	75.2	-14.03	52.00	55.20	-3.20	Pass
Mid carrier frequency										
No emissions were found.										Pass
High carrier frequency										
No emissions were found.										Pass

Reference numbers of test equipment used

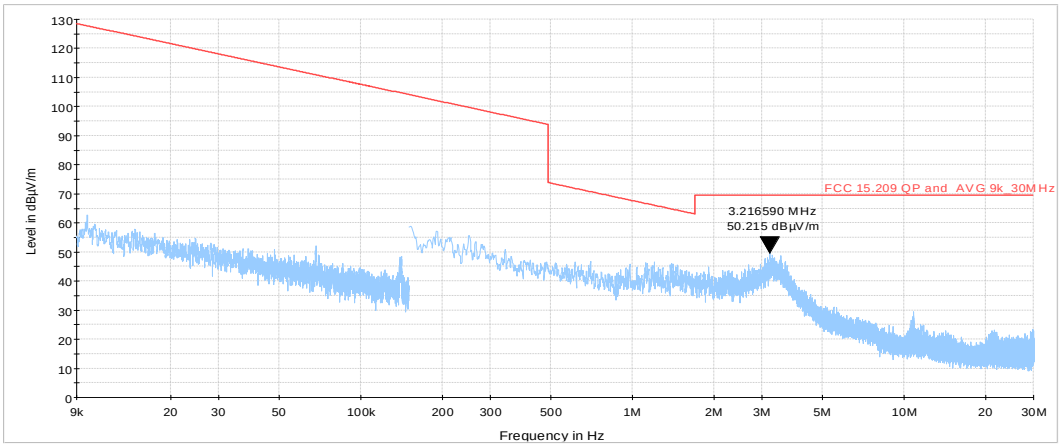
HL 0030	HL 0446	HL 0614	HL 0661	HL 3903	HL 4278	HL 4360	HL 4933
HL 4956	HL 5111	HL 5288					

Full description is given in Appendix A.

Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

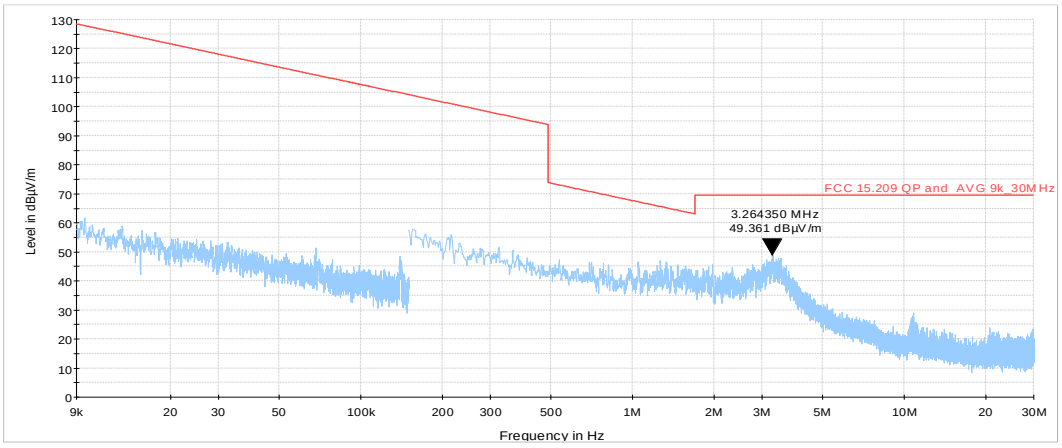
Plot 7.5.1 Radiated emission measurements in 9 kHz - 30 MHz range

TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Low
TEST DISTANCE: 3 m



Plot 7.5.2 Radiated emission measurements in 9 kHz - 30 MHz range

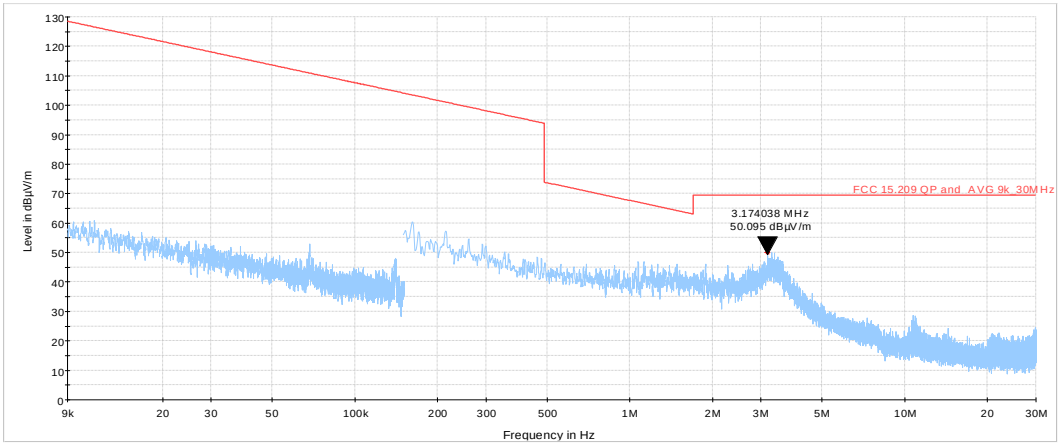
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: Mid
TEST DISTANCE: 3 m



Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.5.3 Radiated emission measurements in 9 kHz - 30 MHz range

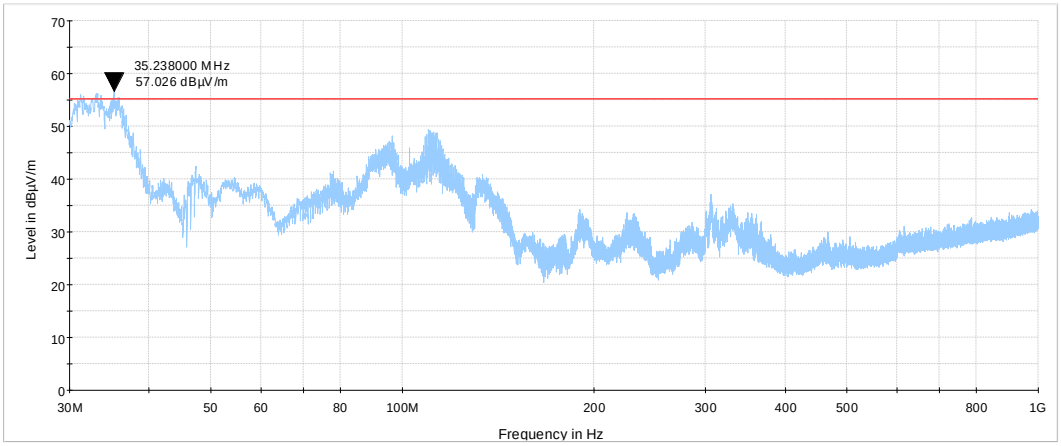
TEST SITE: Semi anechoic chamber
CARRIER FREQUENCY: High
TEST DISTANCE: 3 m



Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

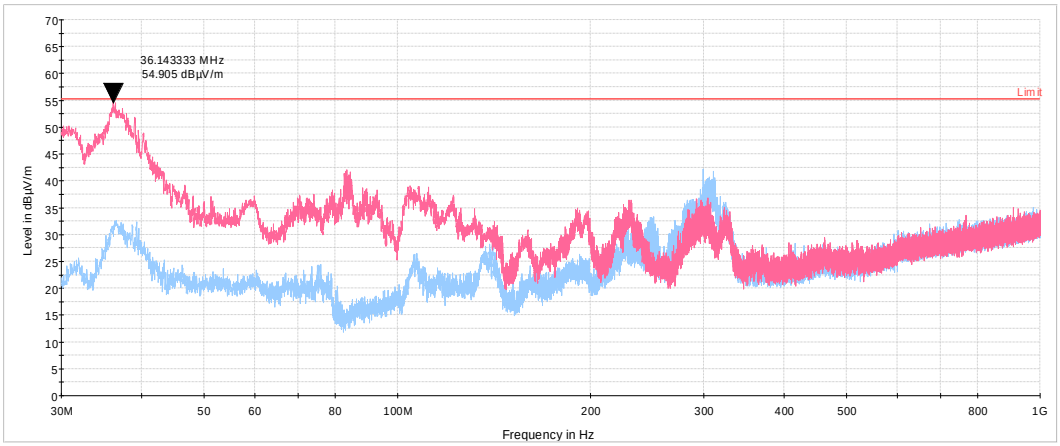
Plot 7.5.4 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.5.5 Radiated emission measurements in 30 - 1000 MHz range

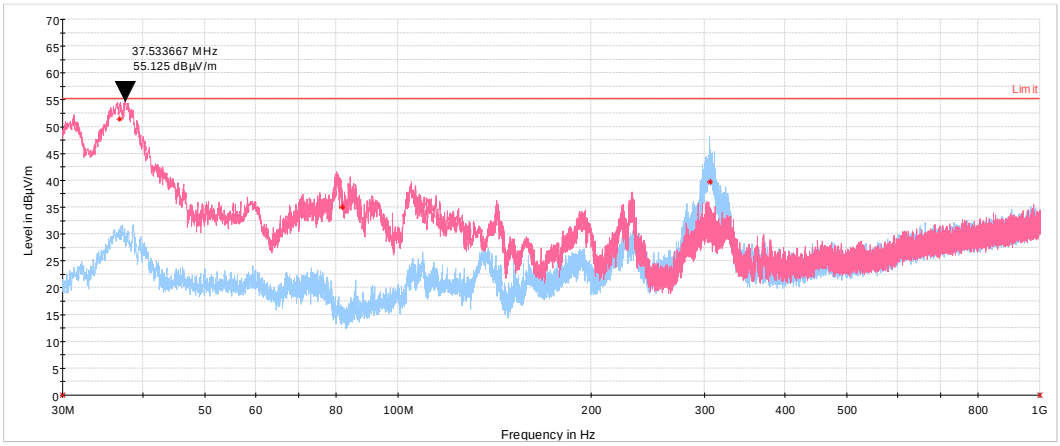
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

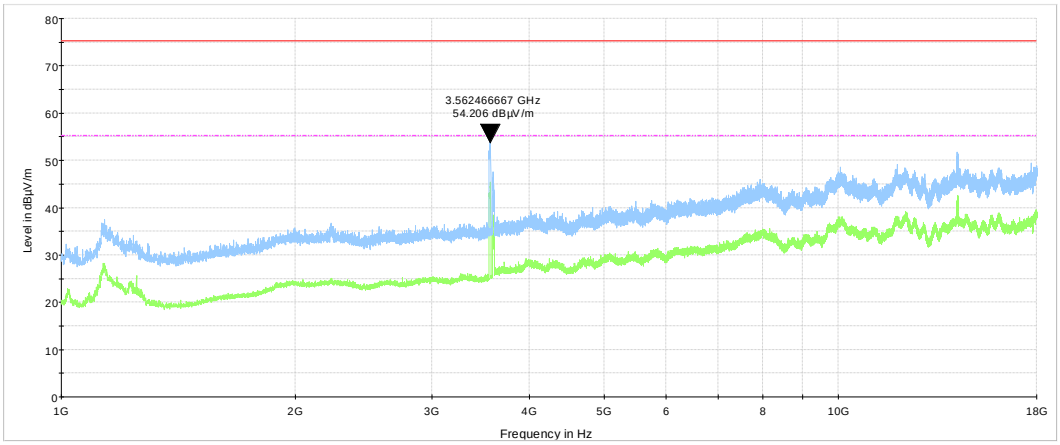
Plot 7.5.6 Radiated emission measurements in 30 - 1000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.5.7 Radiated emission measurements in 1000 – 18000 MHz range

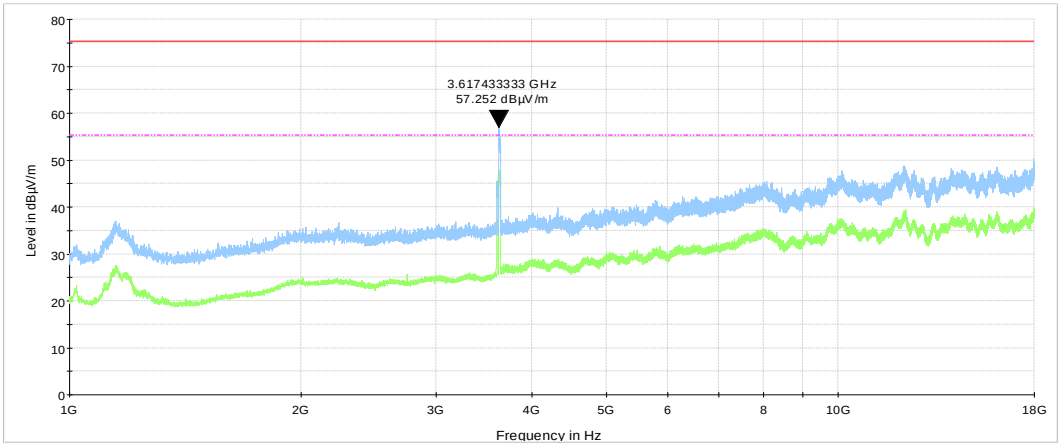
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

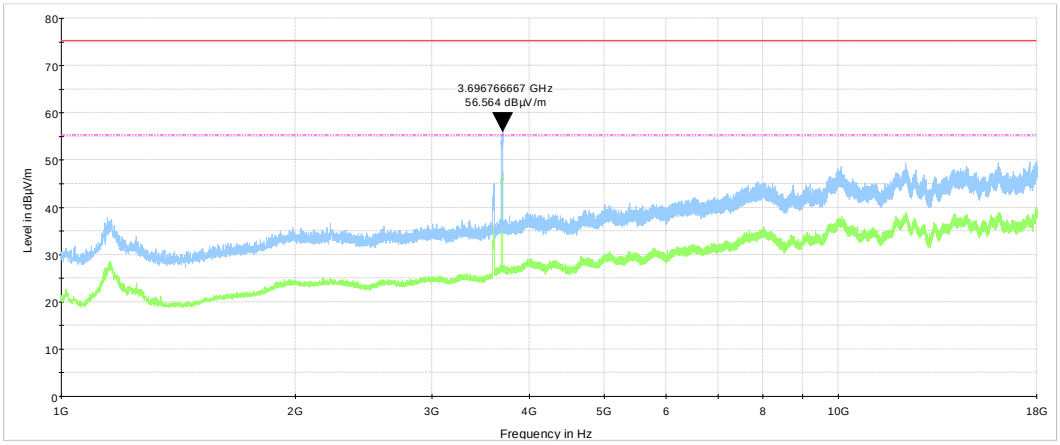
Plot 7.5.8 Radiated emission measurements in 1000 – 18000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.5.9 Radiated emission measurements in 1000 – 18000 MHz range

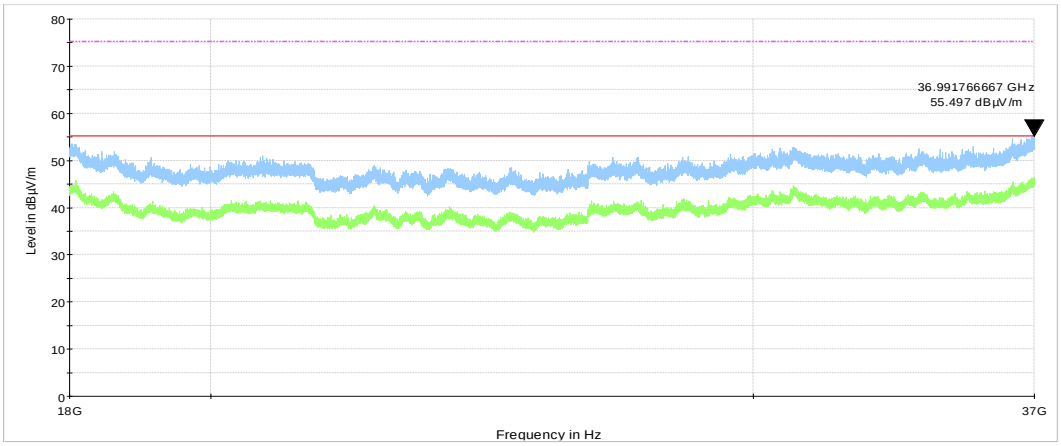
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

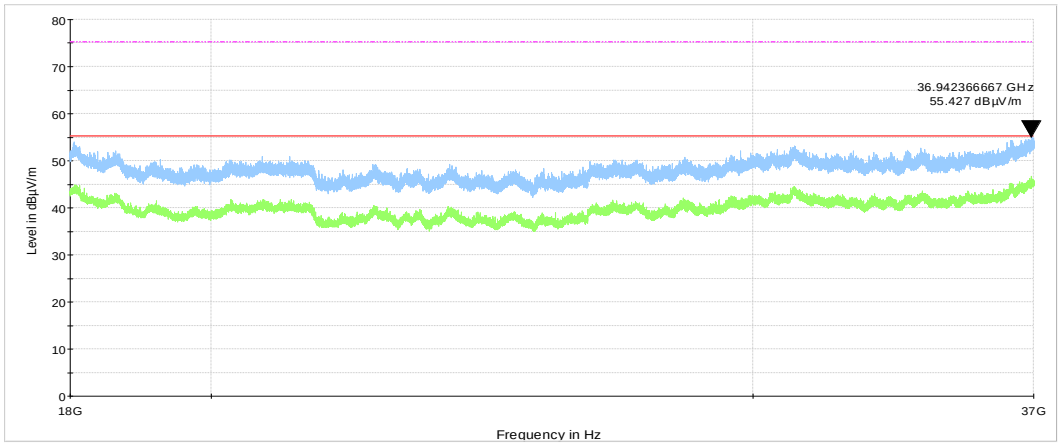
Plot 7.5.10 Radiated emission measurements in 18000 – 37000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Low
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Plot 7.5.11 Radiated emission measurements in 18000 – 37000 MHz range

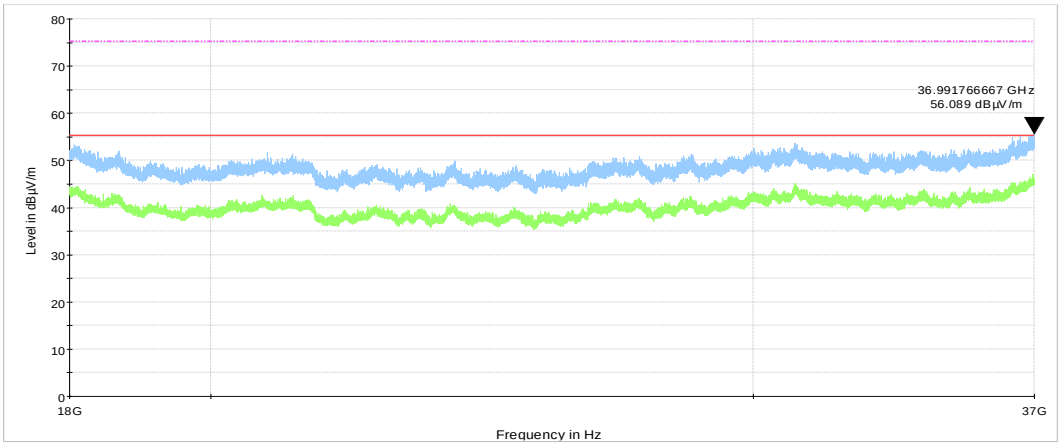
TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	Mid
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 96.41(e)(2), Radiated spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	20-Apr-20		
Temperature: 24 ºC	Relative Humidity: 52 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

Plot 7.5.12 Radiated emission measurements in 18000 – 37000 MHz range

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY:	High
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



Test specification:	Section 96.41(e)(3), Conducted spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	23-Apr-20 - 01-Dec-20		
Temperature: 24.1 ºC	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 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, MHz	Conducted power of spurious, dBm/MHz
0.009– below 3530.0	-40.0
3720.0 – 10th harmonic*	-40.0

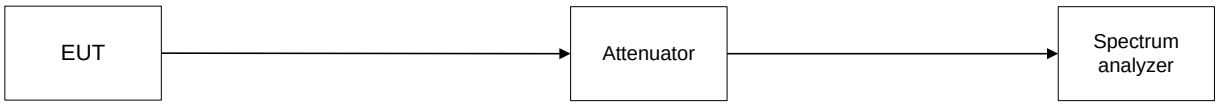
7.6.2 Test procedure

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):	23-Apr-20 - 01-Dec-20		
Temperature: 24.1 ºC	**Relative Humidity:** 49 %	**Air Pressure:** 1011 hPa	**Power:** 48 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: 256QAM
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum
NUMBER ANTENNA PORTS: N = 2

Frequency, MHz	SA reading, dBm***	Attenuator, dB	Cable loss, dB	RBW, kHz	Total Spurious emission, dBm	Limit, dBm	Margin, dB*	Verdict
Channel spacing 10 MHz								
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
Channel spacing 20 MHz								
Low carrier frequency 3560 MHz								
No emissions were found								Pass
Mid carrier frequency 3625 MHz								
No emissions were found								Pass
High carrier frequency 3690 MHz								
No emissions were found								Pass

*****- Margin = Total spurious emission - specification limit.
****** - Total emission = Maximum emission per chain + 10*log(N)
****** - SA Reading over 1 chain = Max SA reading (Chains #1&2 or chains #3&4)

Reference numbers of test equipment used

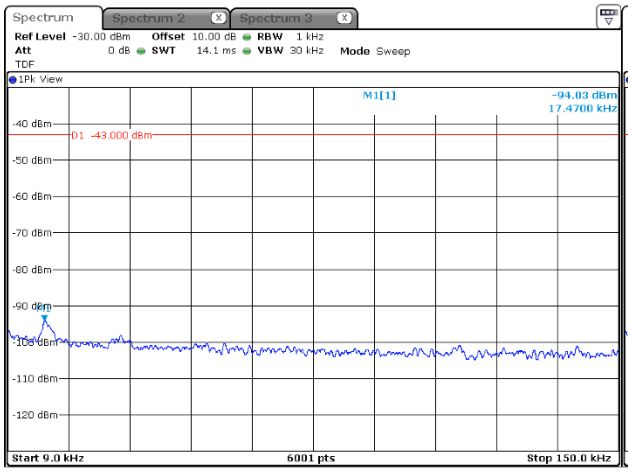
HL 4355	HL 3901	HL 3355	HL 5175	HL 1295	HL 5372	HL 5286	HL 4342
HL 5608	HL 5233						

Full description is given in Appendix A.

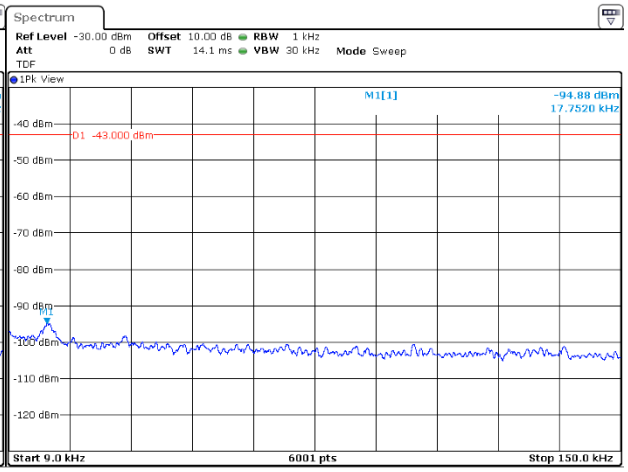
Test specification:	Section 96.41(e)(3), Conducted spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	23-Apr-20 - 01-Dec-20		
Temperature: 24.1 ºC	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

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

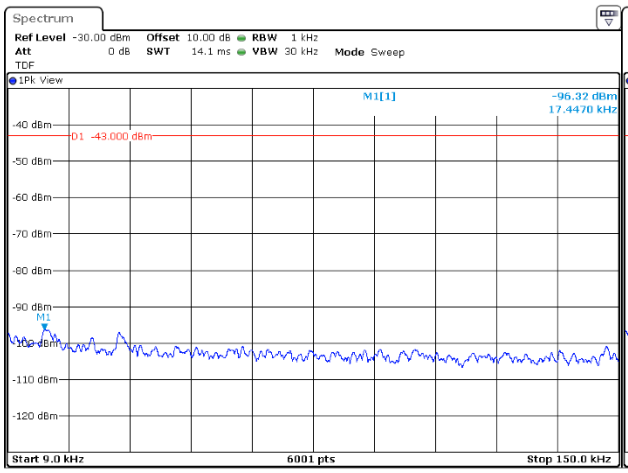
MODULATION: 256QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: #1



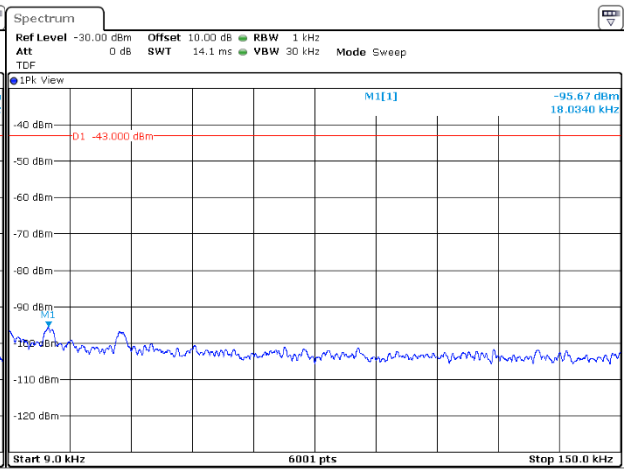
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



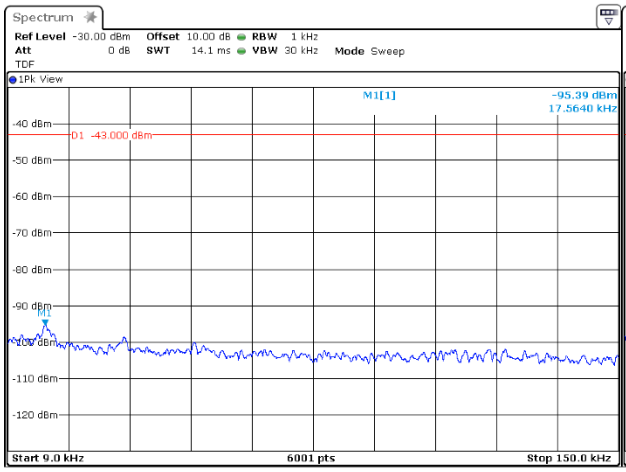
ANTENNA CHAIN: #4



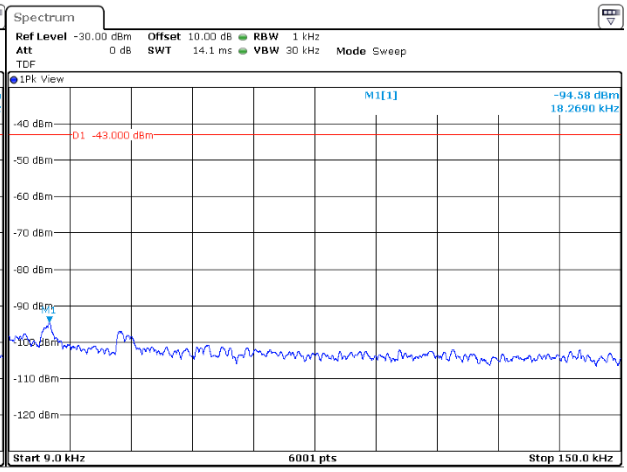
Test specification:	Section 96.41(e)(3), Conducted spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	23-Apr-20 - 01-Dec-20		
Temperature: 24.1 ºC	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

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

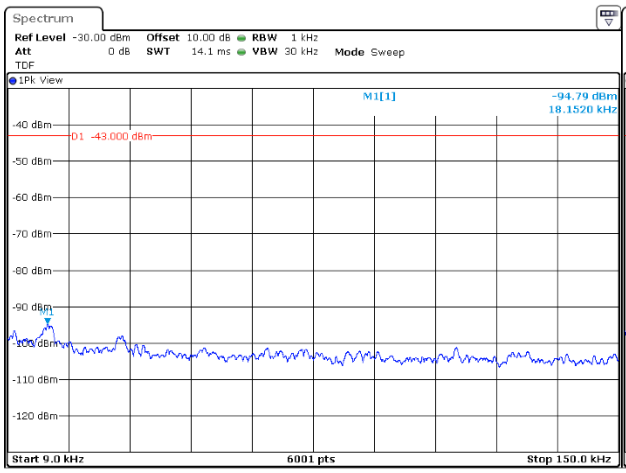
MODULATION: 256QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: #1



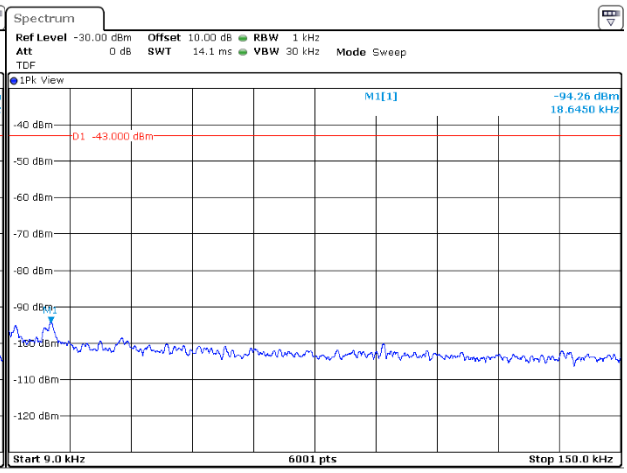
ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



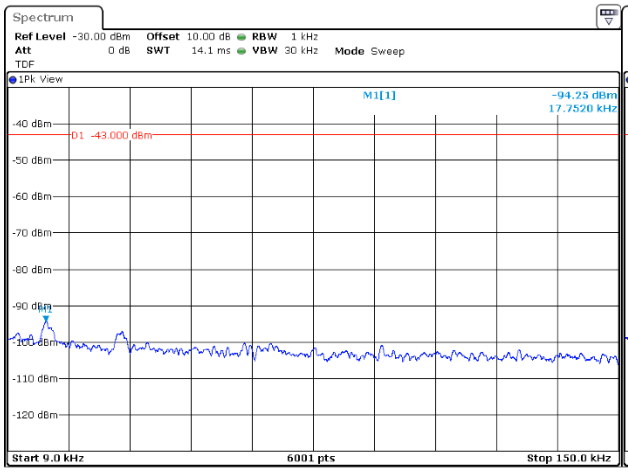
ANTENNA CHAIN: #4



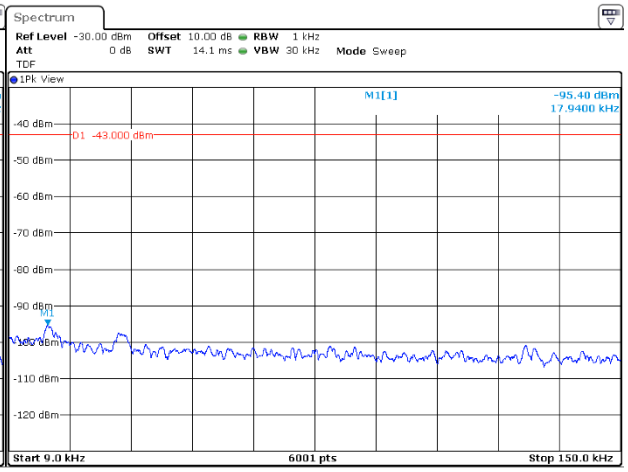
Test specification:	Section 96.41(e)(3), Conducted spurious emissions		
Test procedure:	Section 96.41(e)(3)		
Test mode:	Compliance	Verdict:	PASS
Date(s):	23-Apr-20 - 01-Dec-20		
Temperature: 24.1 ºC	Relative Humidity: 49 %	Air Pressure: 1011 hPa	Power: 48 VDC
Remarks:			

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

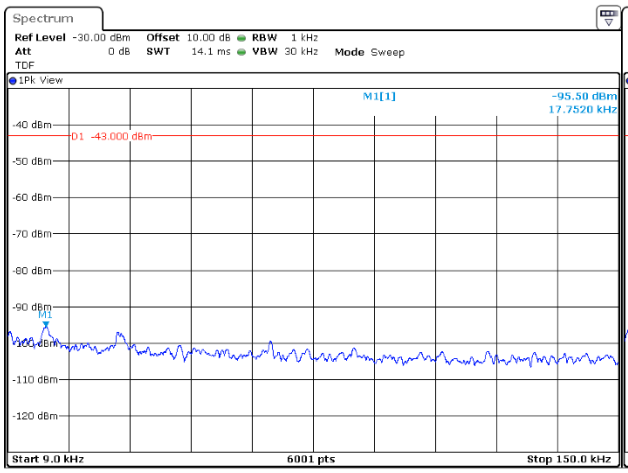
MODULATION: 256QAM
CHANNEL SPACING: 10 MHz
ANTENNA CHAIN: #1



ANTENNA CHAIN: #2



ANTENNA CHAIN: #3



ANTENNA CHAIN: #4