Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

7.5 Band edge emission with 37.1 dBi antenna gain

7.5.1 General

This test was performed to verify the EUT band edge emission including all associated side bands was attenuated at least 50 dB below the unmodulated carrier level or below the general spurious emission limit. Specification test limits are given in Table 7.5.1.

Table 7.5.1 Band edge emission limits

Frequency band, MHz	Field strength limit, dBµV/m		Attenuation below carrier, dBc
	Peak	Average	
24000 - 24250	at 3 m distance		50
	74.0	54.0	
	at 0.75 m distance		
	86.0	66.0	

*- The limit for 0.75 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$Lim_{S2} = Lim_{S1} + 20 \log (S_1/S_2),$$

where S_1 and S_2 – standard defined and test distance respectively in meters.

7.5.2 Test procedure

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

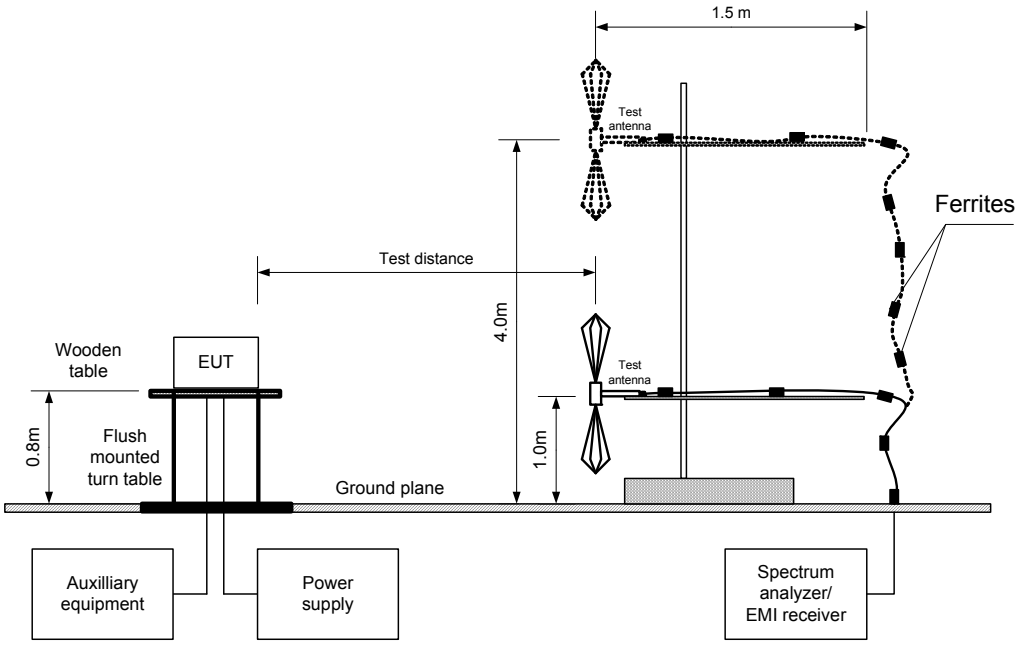
7.5.2.2 The spectrum analyzer frequency span was set to capture all major modulation sidebands of emission and sweep time was set sufficiently slow to ensure peak measurements. Spectrum analyzer was set in peak hold mode and time sufficient for trace stabilization was allowed.

7.5.2.3 The frequency of modulation envelope points beyond which power level drops below the band edge emission limit was measured.

7.5.2.4 The test results were recorded in Table 7.5.2, Table 7.5.3 and shown in the associated plots.

Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Figure 7.5.1 Band edge emission measurement set up



Test specification:	**Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions**		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	**Relative Humidity:** 43 %	**Air Pressure:** 1010 hPa	**Power:** -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Table 7.5.2 Band edge emission test results

OPERATING FREQUENCY RANGE: 24000 – 24080 MHz
DETECTOR USED: Peak / Average
RESOLUTION BANDWIDTH: 1000 kHz
VIDEO BANDWIDTH: 3000 kHz
TEST DISTANCE: 0.75 m
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Antenna polarization	Band edge emission, dBµV/m, peak	Limit, dBµV/m	Margin, dB**	Band edge emission, dBµV/m, average	Limit, dBµV/m	Margin, dB**	Verdict
Channel Bandwidth 20 MHz; Modulation: QPSK								
24000	Vert	78.88	86.0	-7.12	65.87	66.0	-0.13	Pass
24000	Hor	78.96	86.0	-7.04	65.77	66.0	-0.23	
Channel Bandwidth 20 MHz; Modulation: 2048 QAM								
24000	Vert	78.91	86.0	-7.09	65.75	66.0	-0.25	Pass
24000	Hor	77.95	86.0	-8.05	65.82	66.0	-0.18	
Channel Bandwidth 30 MHz; Modulation: QPSK								
24000	Vert	78.46	86.0	-7.54	65.72	66.0	-0.28	Pass
24000	Hor	77.99	86.0	-8.01	65.79	66.0	-0.21	
Channel Bandwidth 30 MHz; Modulation: 2048 QAM								
24000	Vert	78.93	86.0	-7.07	65.29	66.0	-0.71	Pass
24000	Hor	78.45	86.0	-7.55	65.86	66.0	-0.14	
Channel Bandwidth 40 MHz; Modulation: QPSK								
24000	Vert	78.69	86.0	-7.31	65.57	66.0	-0.43	Pass
24000	Hor	78.68	86.0	-7.32	65.87	66.0	-0.13	
Channel Bandwidth 40 MHz; Modulation: 2048 QAM								
24000	Vert	77.96	86.0	-8.04	65.58	66.0	-0.42	Pass
24000	Hor	78.85	86.0	-7.15	65.79	66.0	-0.21	
Channel Bandwidth 50 MHz; Modulation: QPSK								
24000	Vert	78.98	86.0	-7.02	65.82	66.0	-0.18	Pass
24000	Hor	78.87	86.0	-7.13	65.88	66.0	-0.12	
Channel Bandwidth 50 MHz; Modulation: 2048 QAM								
24000	Vert	78.93	86.0	-7.07	65.53	66.0	-0.47	Pass
24000	Hor	78.48	86.0	-7.52	65.87	66.0	-0.13	
Channel Bandwidth 60 MHz; Modulation: QPSK								
24000	Vert	78.28	86.0	-7.72	65.87	66.0	-0.13	Pass
24000	Hor	78.83	86.0	-7.17	65.75	66.0	-0.25	
Channel Bandwidth 60 MHz; Modulation: 2048 QAM								
24000	Vert	78.64	86.0	-7.36	65.83	66.0	-0.17	Pass
24000	Hor	78.83	86.0	-7.17	65.88	66.0	-0.12	

* - Measured frequency beyond which the emission dropped 50 dB below the carrier emission or below the field strength limit whichever was a less stringent
** - Margin = Band edge limit – Band edge frequency

Test specification:	**Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions**		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	**Relative Humidity:** 43 %	**Air Pressure:** 1010 hPa	**Power:** -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Table 7.5.3 High Band edge emission test results

OPERATING FREQUENCY RANGE: 24170 – 24250 MHz
DETECTOR USED: Peak / Average
RESOLUTION BANDWIDTH: 1000 kHz
VIDEO BANDWIDTH: 3000 kHz
TEST DISTANCE: 3 m
MODULATING SIGNAL: PRBS
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Antenna polarization	Band edge emission, dBµV/m, peak	Limit, dBµV/m	Margin, dB**	Band edge emission, dBµV/m, average	Limit, dBµV/m	Margin, dB**	Verdict
Channel Bandwidth 20 MHz; Modulation: QPSK								
24000	Vert	80.89	89.8	-8.91	69.78	69.8	-0.02	Pass
24000	Hor	80.54	89.7	-9.16	69.55	69.7	-0.15	
Channel Bandwidth 20 MHz; Modulation: 2048 QAM								
24000	Vert	80.69	89.2	-8.51	69.14	69.2	-0.06	Pass
24000	Hor	81.77	89.6	-7.83	69.46	69.6	-0.14	
Channel Bandwidth 30 MHz; Modulation: QPSK								
24250	Vert	80.82	88.7	-5.88	68.56	68.7	-0.14	Pass
24250	Hor	80.97	87.9	-6.93	67.78	67.9	-0.12	
Channel Bandwidth 30 MHz; Modulation: 2048 QAM								
24250	Vert	80.58	88.7	-8.12	68.52	68.7	-0.18	Pass
24250	Hor	80.28	87.3	-7.02	67.28	67.3	-0.02	
Channel Bandwidth 40 MHz; Modulation: QPSK								
24250	Vert	79.79	86.5	-6.71	66.24	66.5	-0.26	Pass
24250	Hor	80.78	86.7	-5.92	66.53	66.7	-0.17	
Channel Bandwidth 40 MHz; Modulation: 2048 QAM								
24250	Vert	79.94	86.6	-6.66	66.45	66.6	-0.15	Pass
24250	Hor	81.54	86.8	-5.26	66.63	66.8	-0.17	
Channel Bandwidth 50 MHz; Modulation: QPSK								
24250	Vert	79.62	86.0	-6.38	65.84	66.0	-0.16	Pass
24250	Hor	80.55	86.0	-5.45	65.77	66.0	-0.23	
Channel Bandwidth 50 MHz; Modulation: 2048 QAM								
24250	Vert	80.44	86.0	-5.56	65.86	66.0	-0.14	Pass
24250	Hor	79.74	86.0	-6.26	65.77	66.0	-0.23	
Channel Bandwidth 60 MHz; Modulation: QPSK								
24250	Vert	79.69	86.0	-8.31	65.78	66.0	-0.22	Pass
24250	Hor	80.25	86.0	-7.75	65.82	66.0	-0.18	
Channel Bandwidth 60 MHz; Modulation: 2048 QAM								
24250	Vert	79.99	86.0	-7.75	65.91	66.0	-0.09	Pass
24250	Hor	80.18	86.0	-7.75	65.83	66.0	-0.17	

* - Measured frequency beyond which the emission dropped 50 dB below the carrier emission or below the field strength limit whichever was a less stringent
** - Margin = Band edge limit – Band edge frequency

Reference numbers of test equipment used

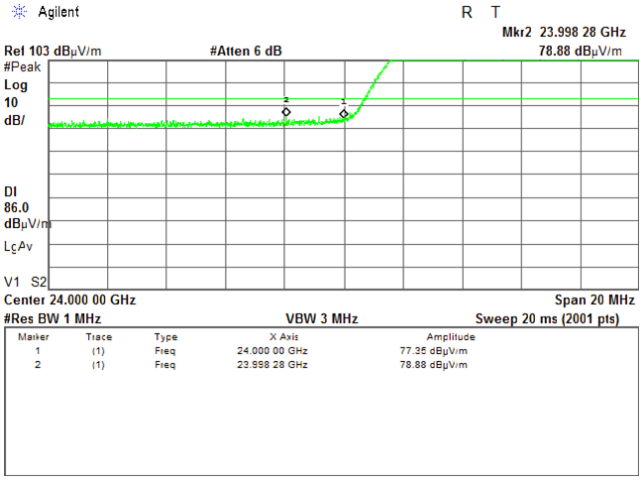
HL 0768	HL 3818	HL 3903					

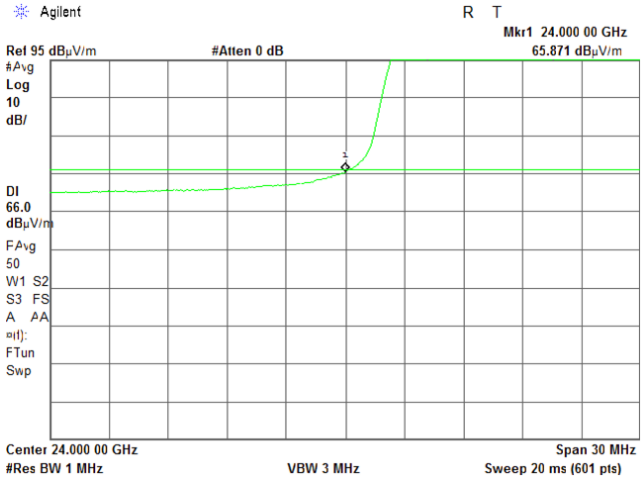
Full description is given in Appendix A.

Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.1 Low band edge emission test result

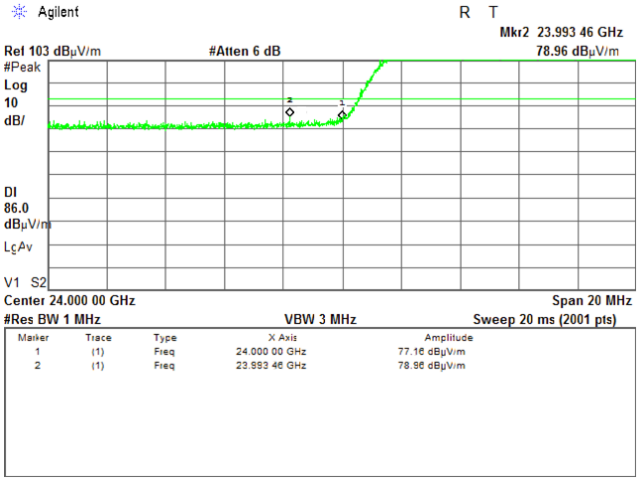
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 20 MHz
MODULATION: QPSK

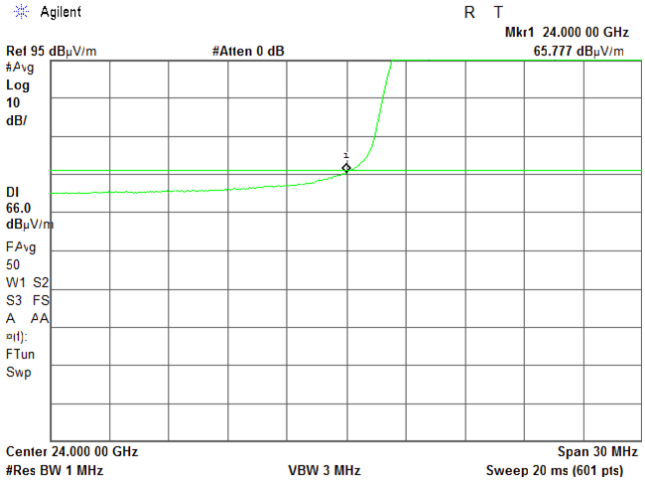




Plot 7.5.2 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 20 MHz
MODULATION: QPSK

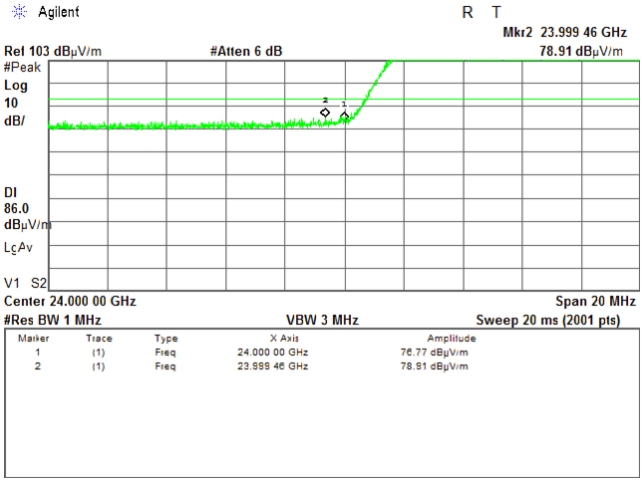


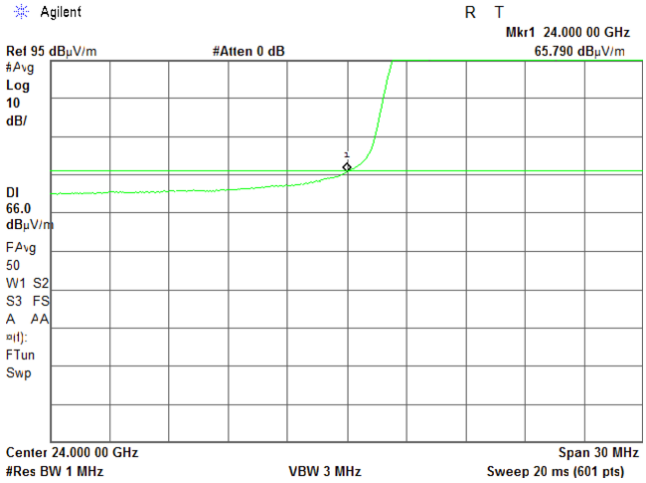


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.3 Low band edge emission test result

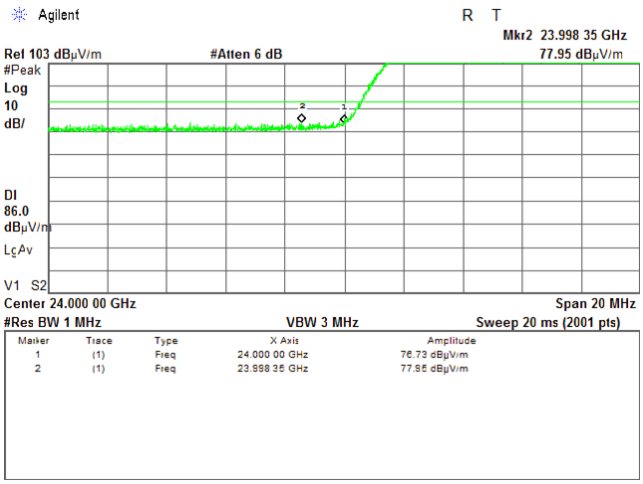
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	2048QAM

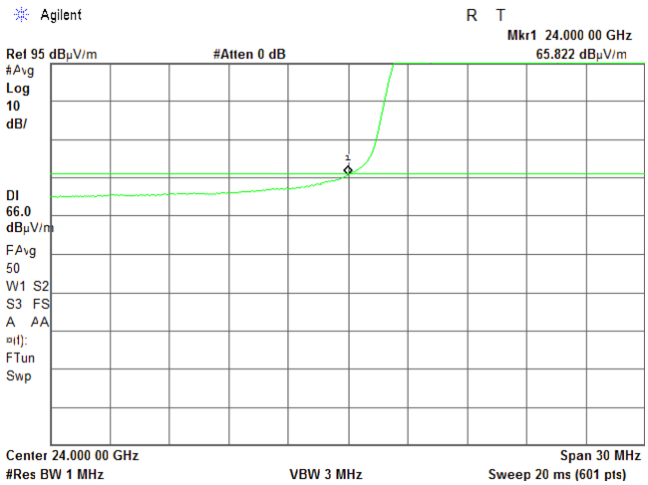




Plot 7.5.4 Low band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	2048QAM

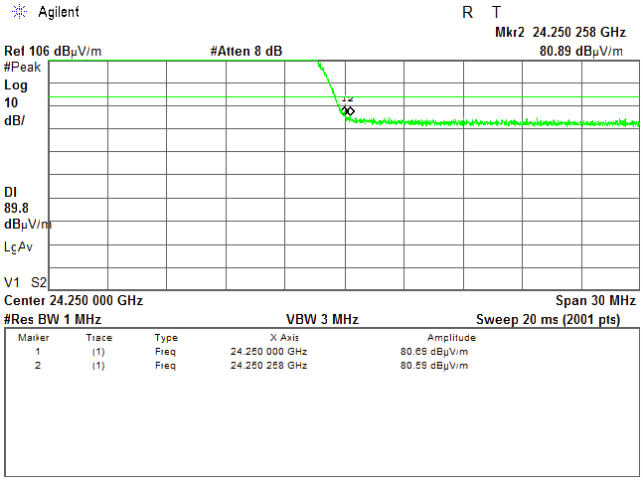


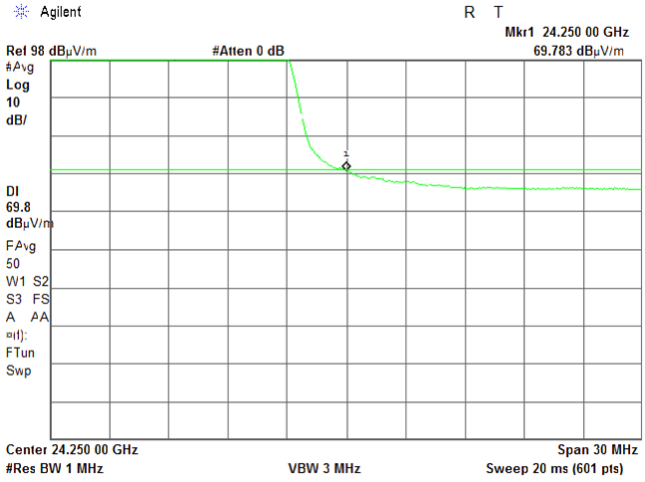


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.5 High band edge emission test result

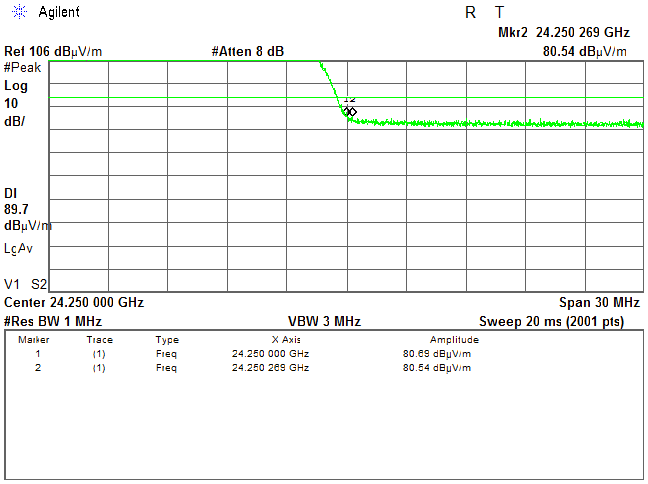
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 20 MHz
MODULATION: QPSK

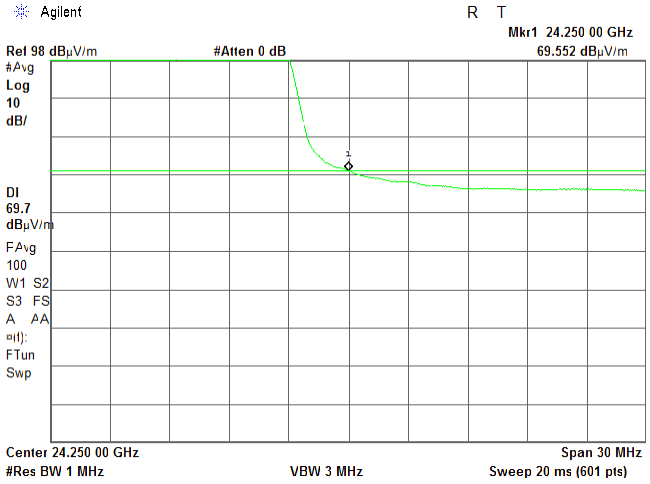




Plot 7.5.6 High band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 20 MHz
MODULATION: QPSK

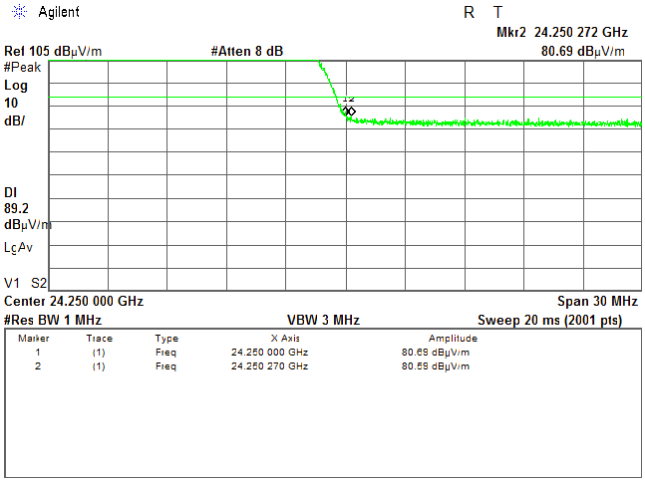


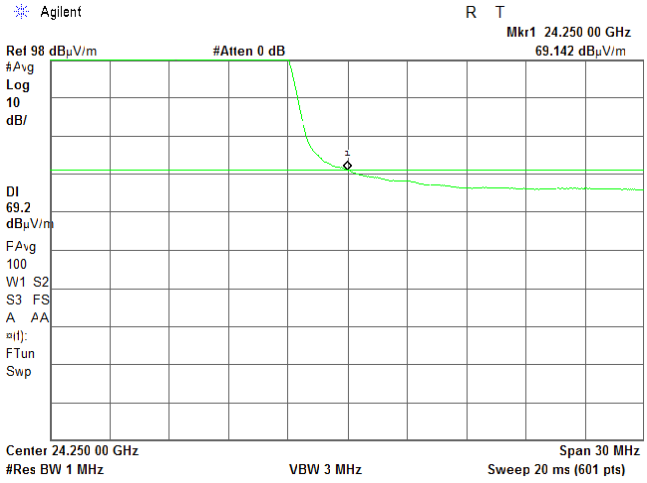


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.7 High band edge emission test result

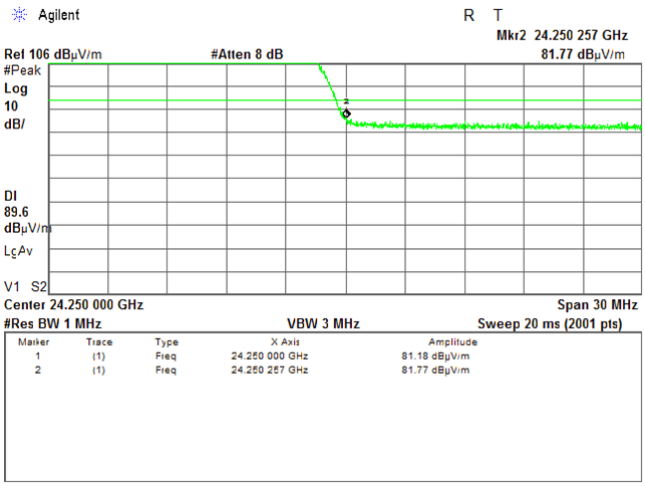
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	2048QAM

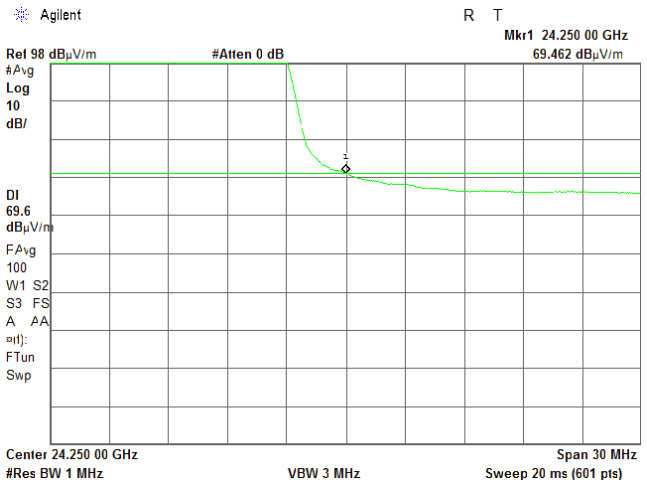




Plot 7.5.8 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	2048QAM

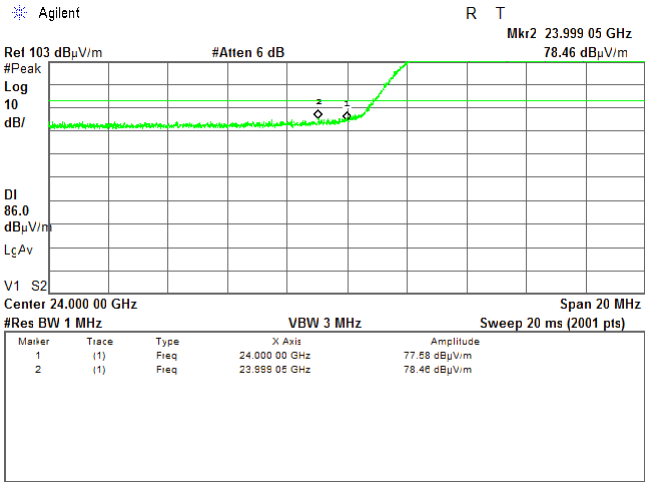


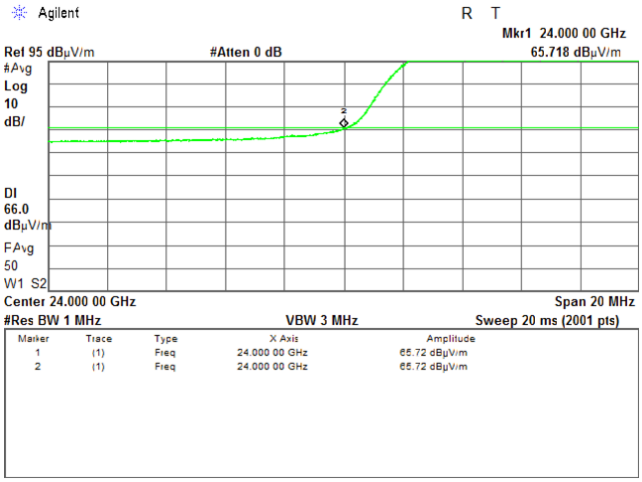


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.9 Low band edge emission test result

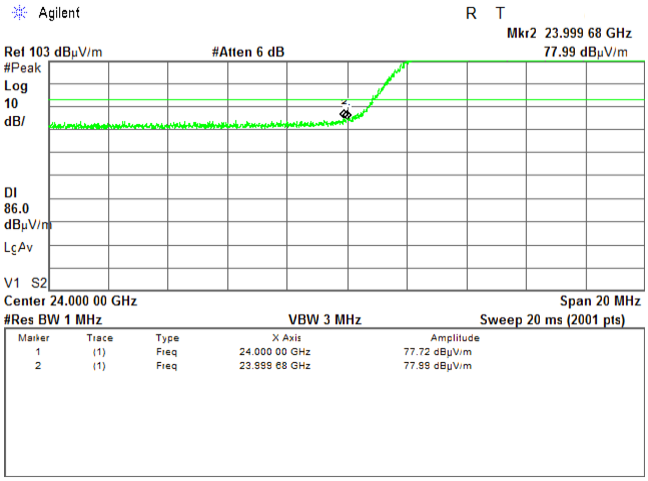
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 30 MHz
MODULATION: QPSK

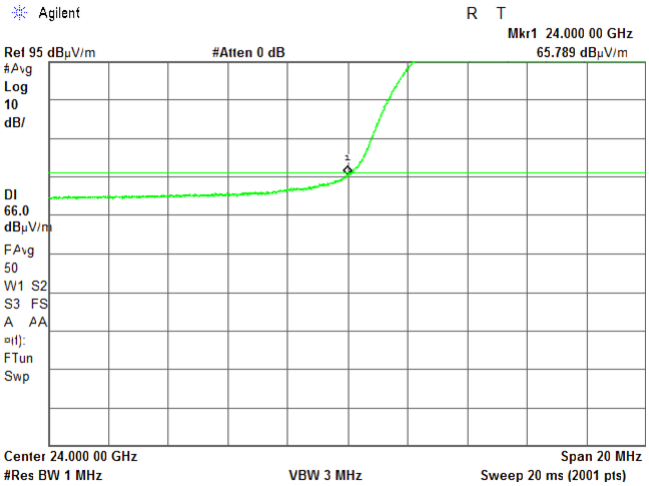




Plot 7.5.10 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 30 MHz
MODULATION: QPSK

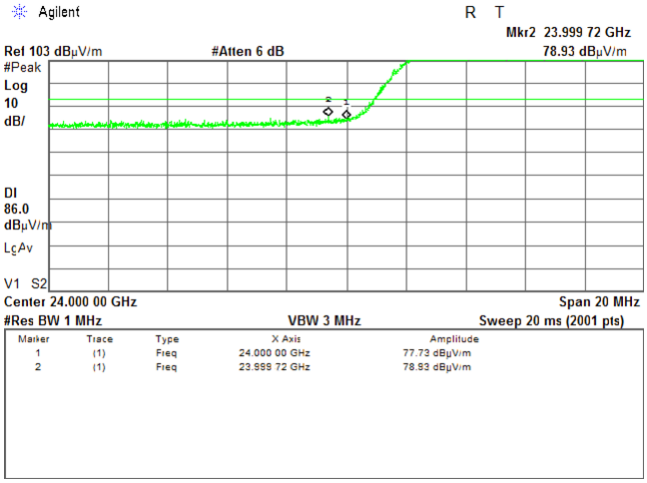


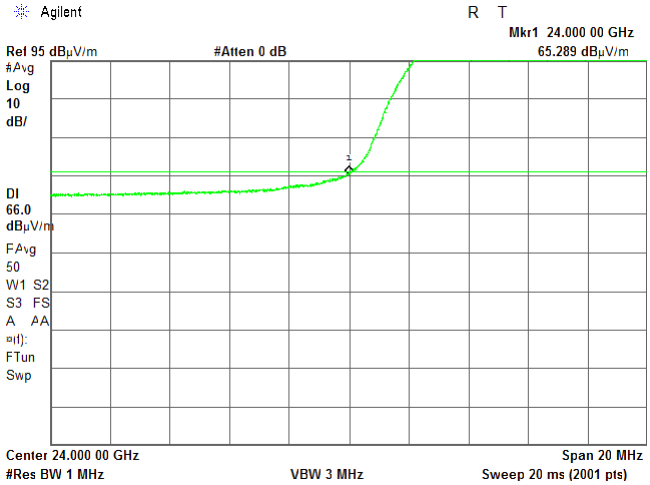


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.11 Low band edge emission test result

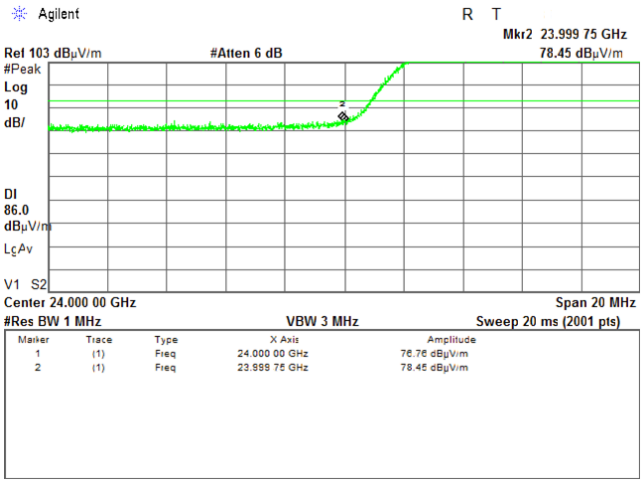
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	30 MHz
MODULATION:	2048QAM

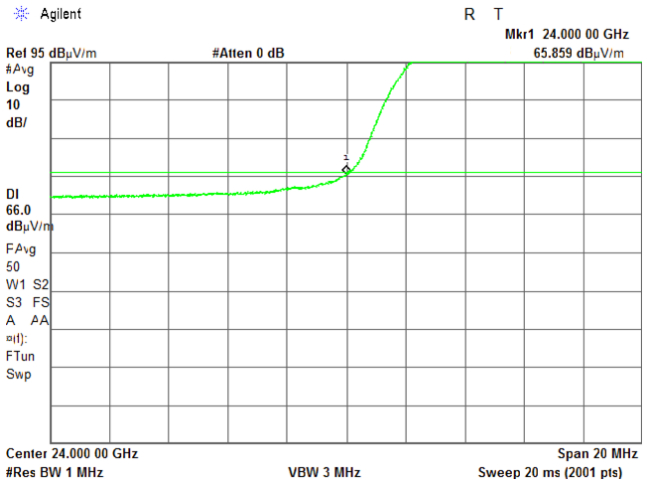




Plot 7.5.12 Low band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	30 MHz
MODULATION:	2048QAM

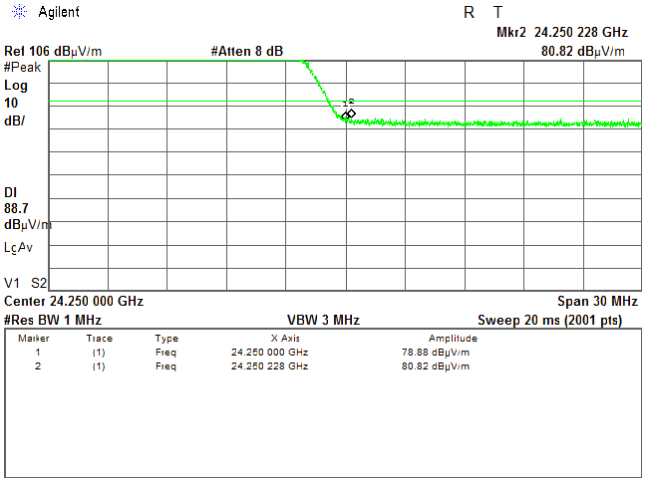


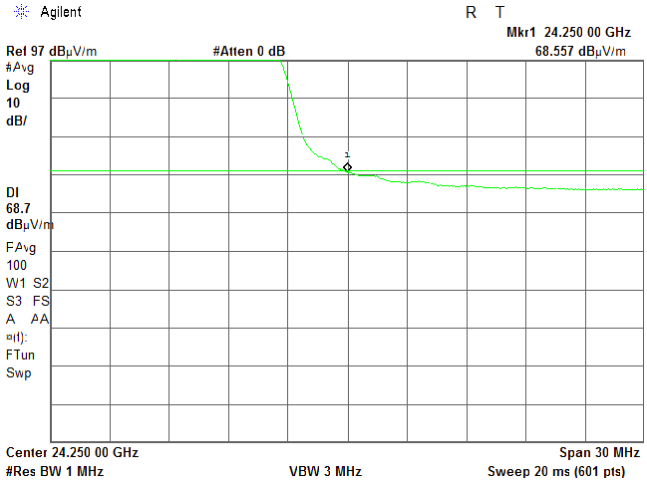


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.13 High band edge emission test result

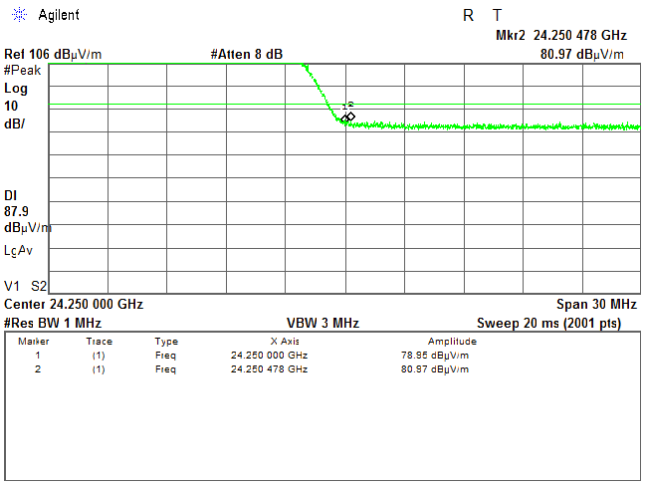
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	30 MHz
MODULATION:	QPSK

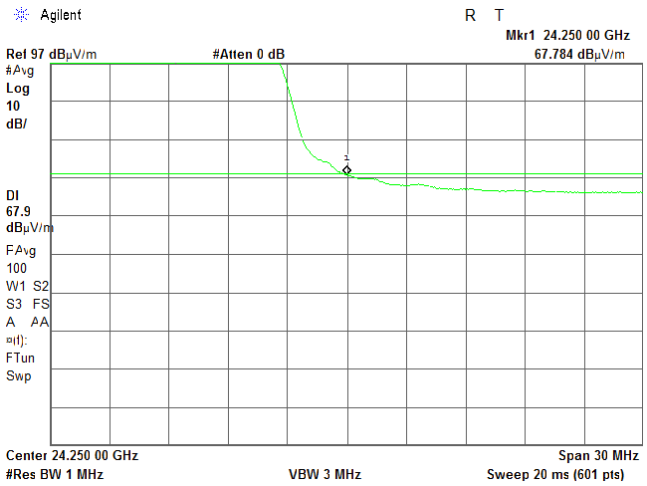




Plot 7.5.14 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	30 MHz
MODULATION:	QPSK

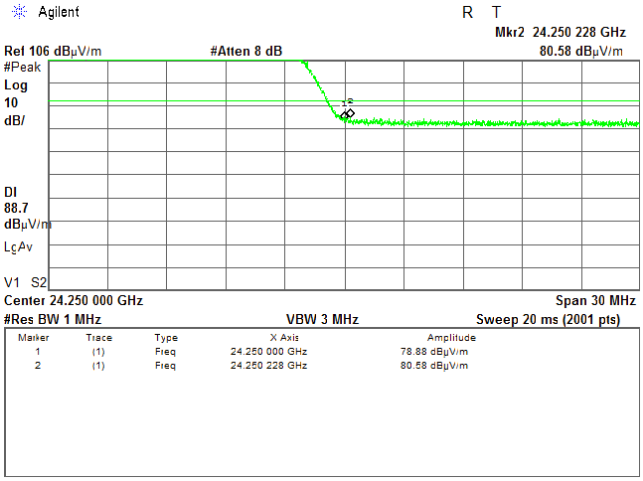


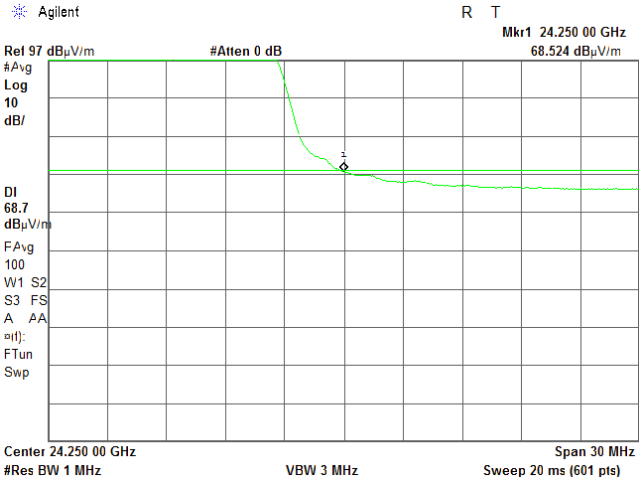


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.15 High band edge emission test result

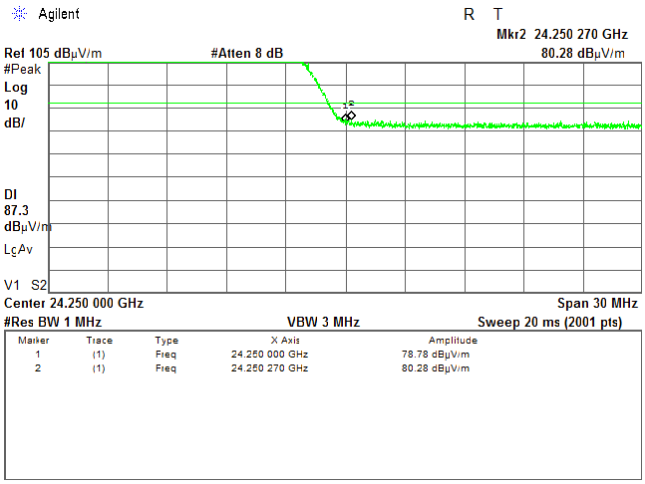
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical and Horisontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	30 MHz
MODULATION:	2048QAM

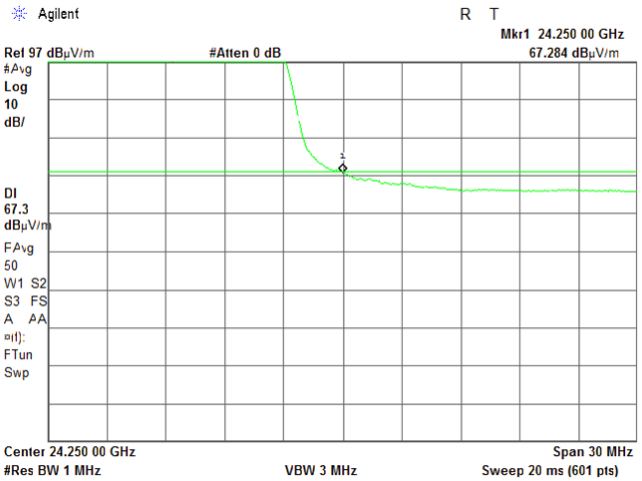




Plot 7.5.16 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	30 MHz
MODULATION:	2048QAM

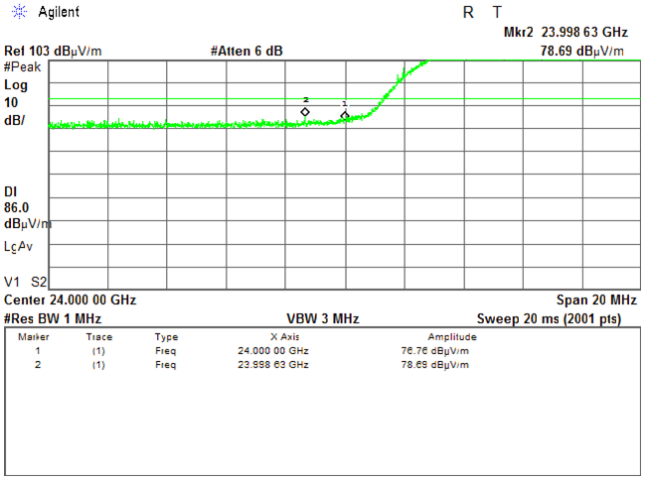


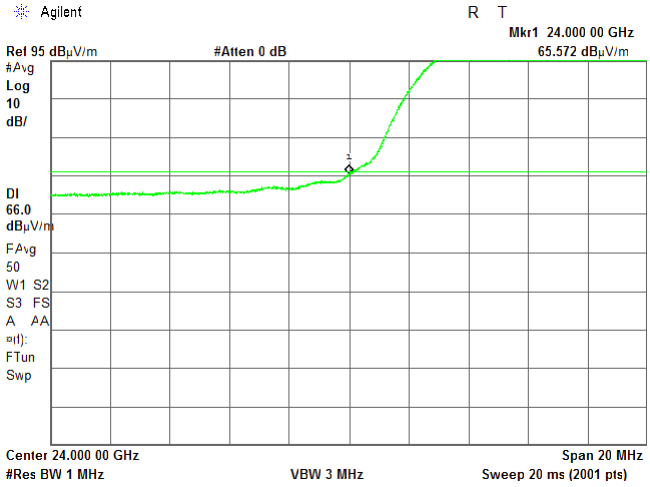


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.17 Low band edge emission test result

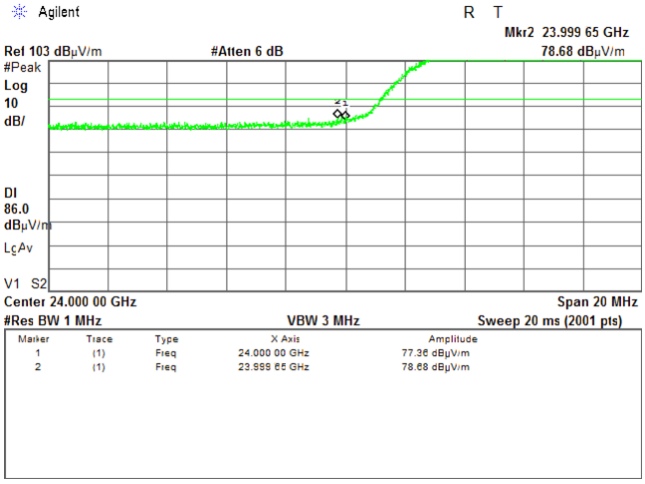
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 40 MHz
MODULATION: QPSK

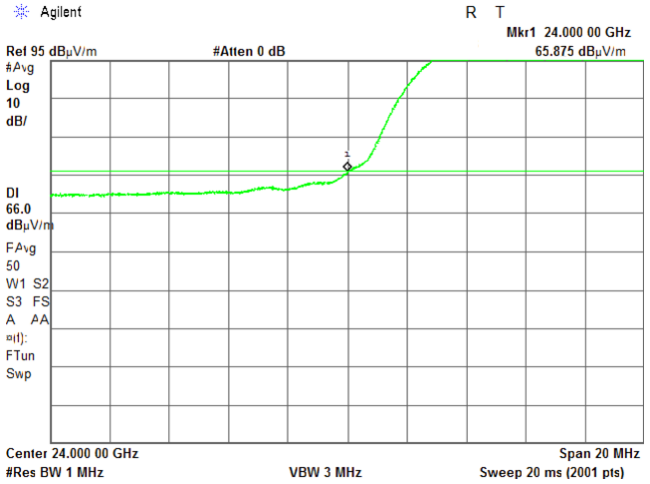




Plot 7.5.18 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 40 MHz
MODULATION: QPSK

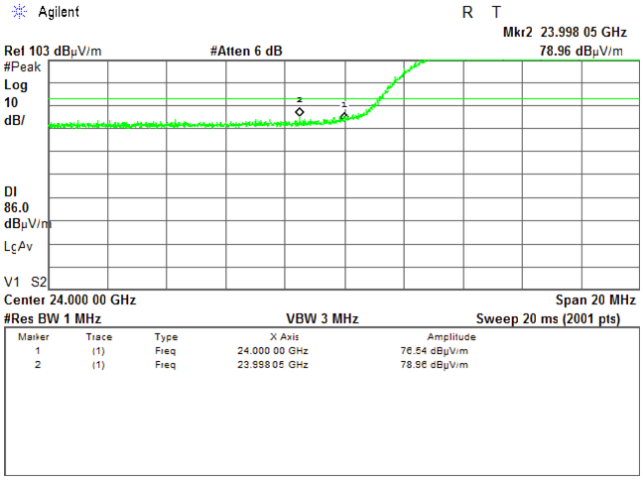


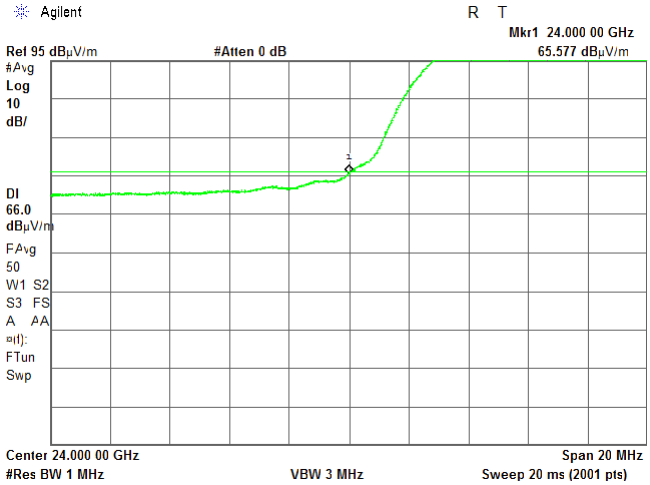


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.19 Low band edge emission test result

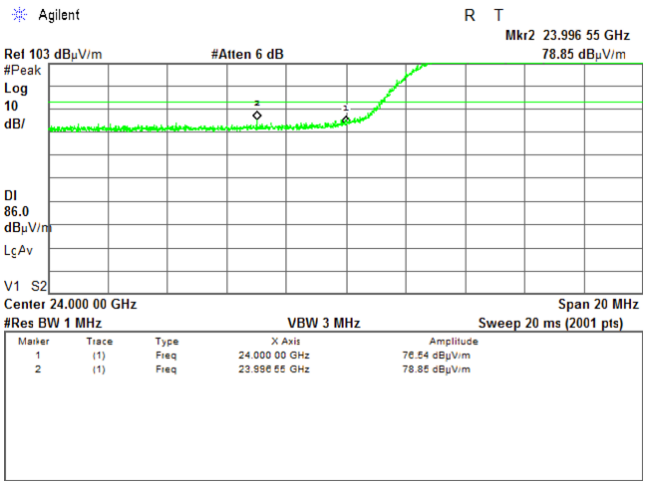
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 40 MHz
MODULATION: 2048QAM

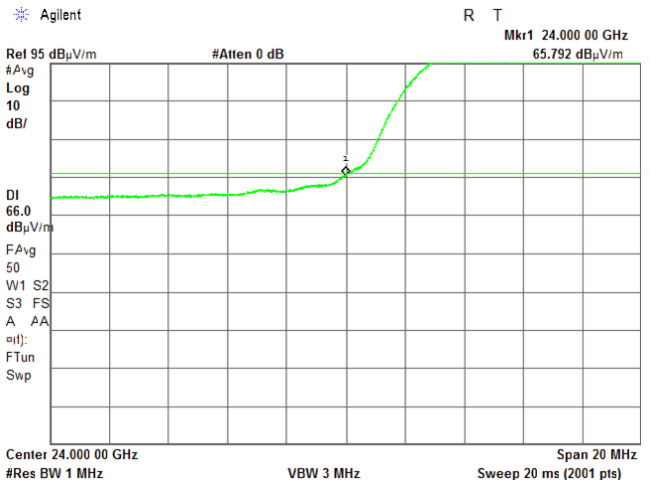




Plot 7.5.20 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 40 MHz
MODULATION: 2048QAM

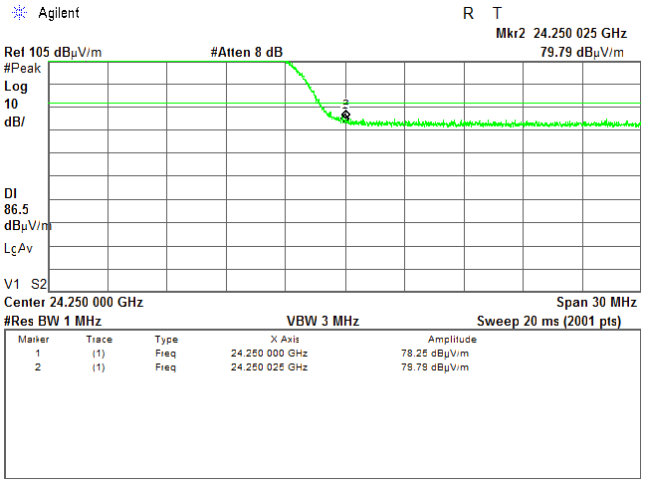


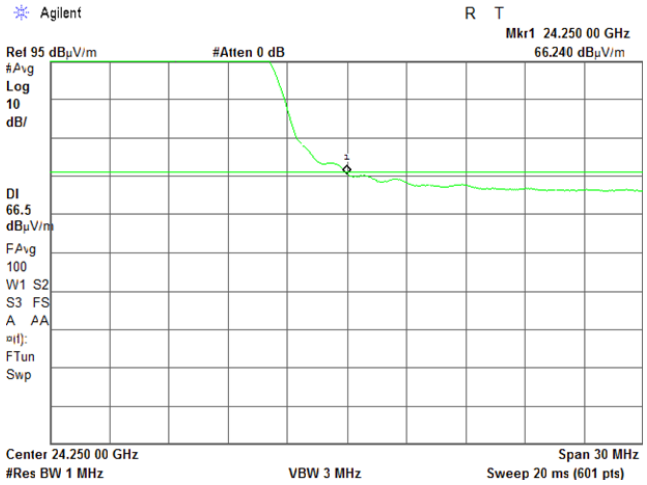


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.21 High band edge emission test result

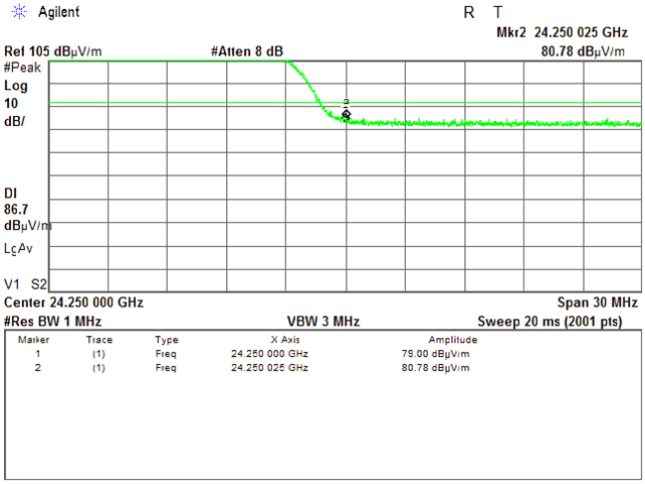
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	40 MHz
MODULATION:	QPSK

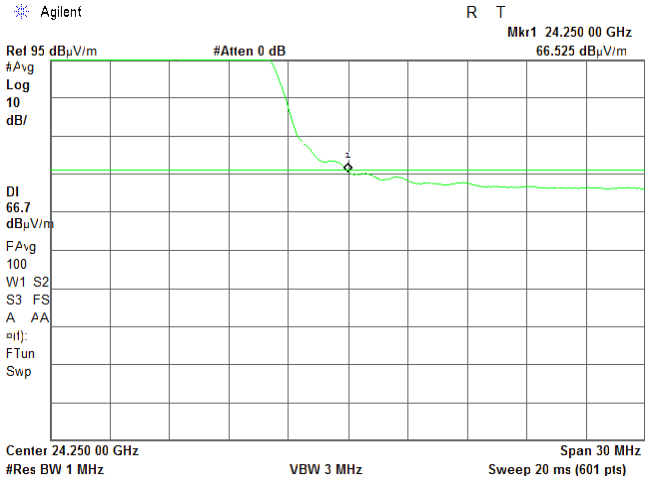




Plot 7.5.22 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	40 MHz
MODULATION:	QPSK

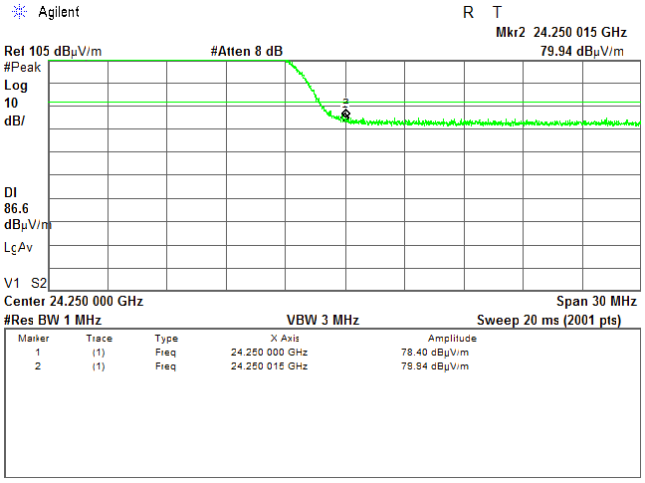


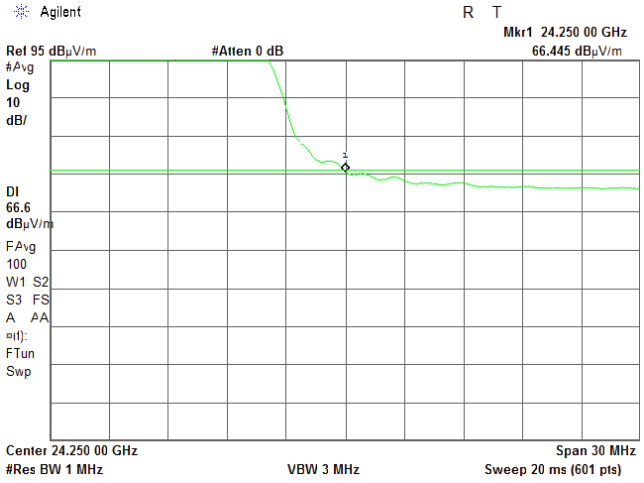


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.23 High band edge emission test result

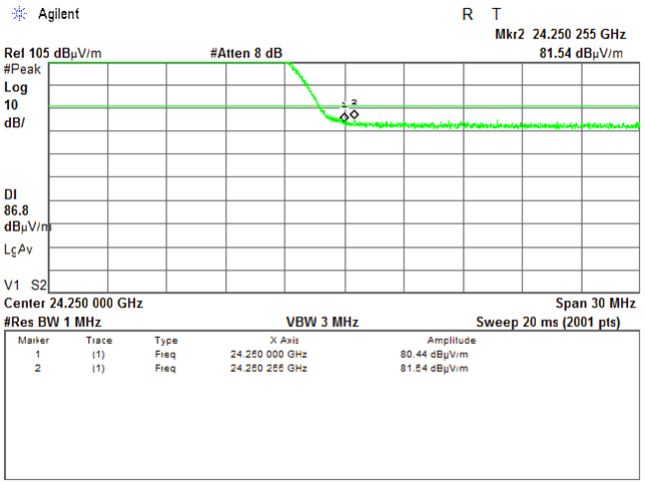
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	40 MHz
MODULATION:	2048QAM

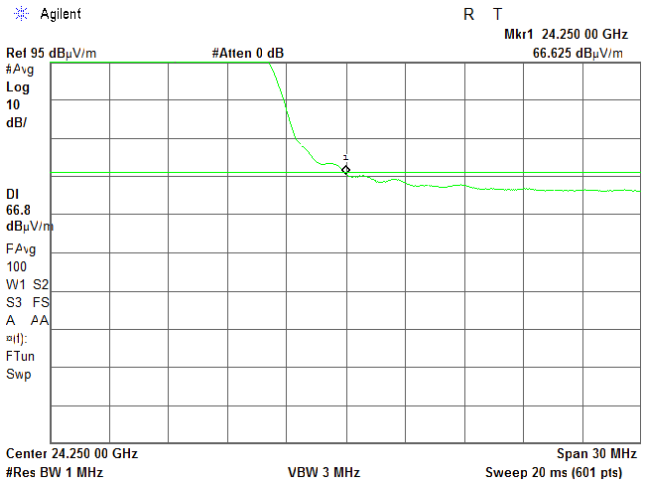




Plot 7.5.24 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	40 MHz
MODULATION:	2048QAM

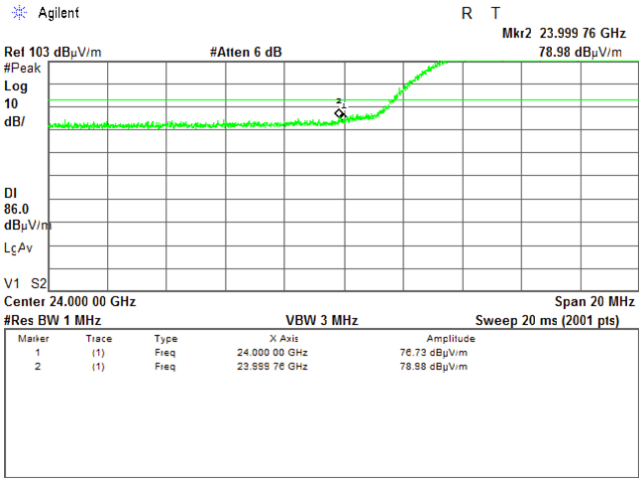


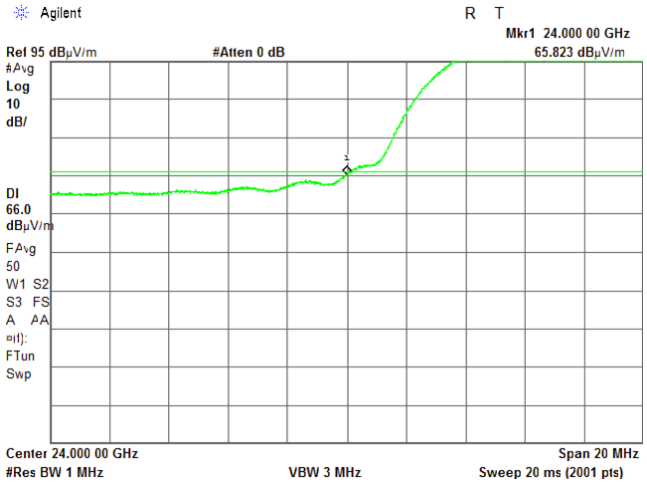


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.25 Low band edge emission test result

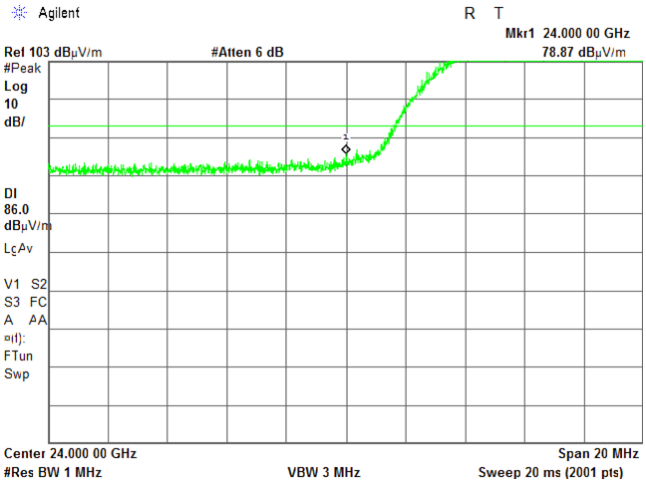
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 50 MHz
MODULATION: QPSK

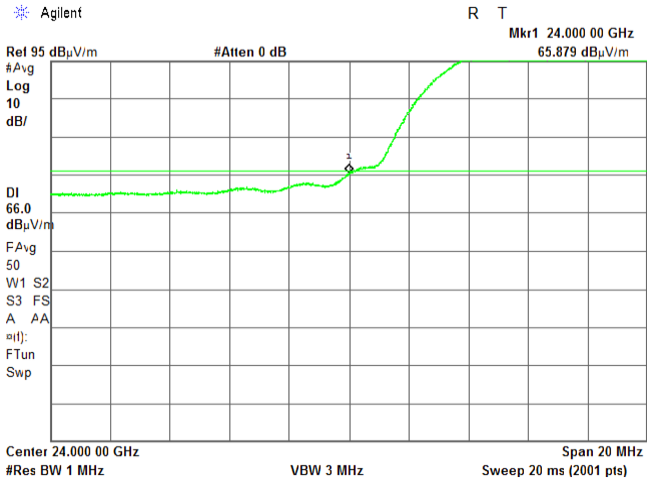




Plot 7.5.26 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 50 MHz
MODULATION: QPSK

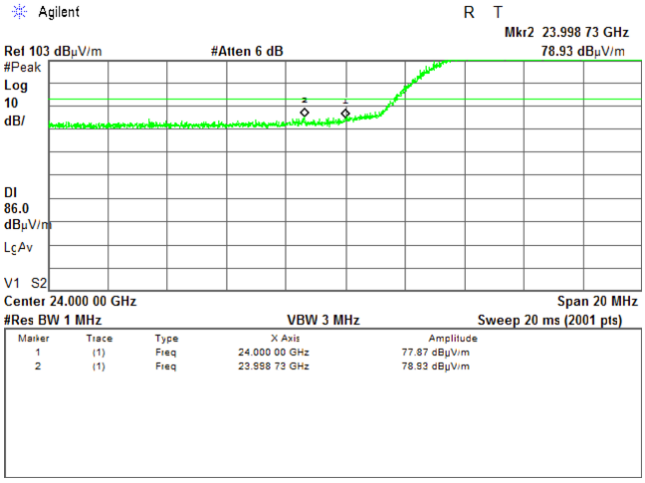


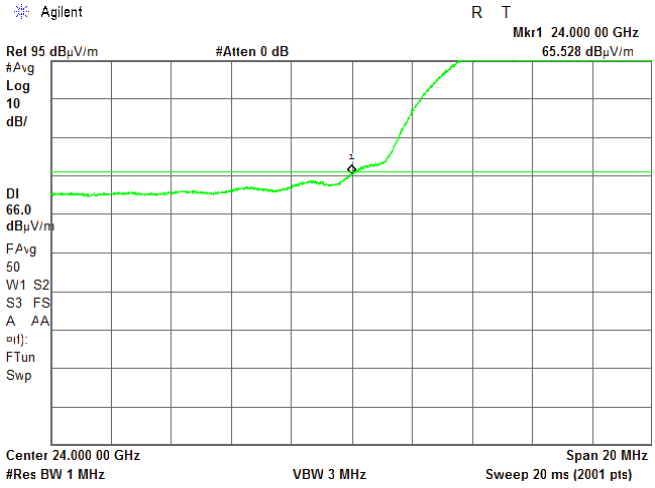


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.27 Low band edge emission test result

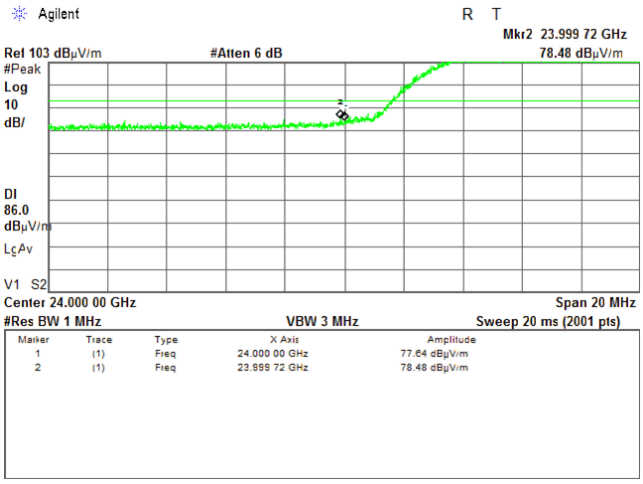
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	50 MHz
MODULATION:	2048 QAM

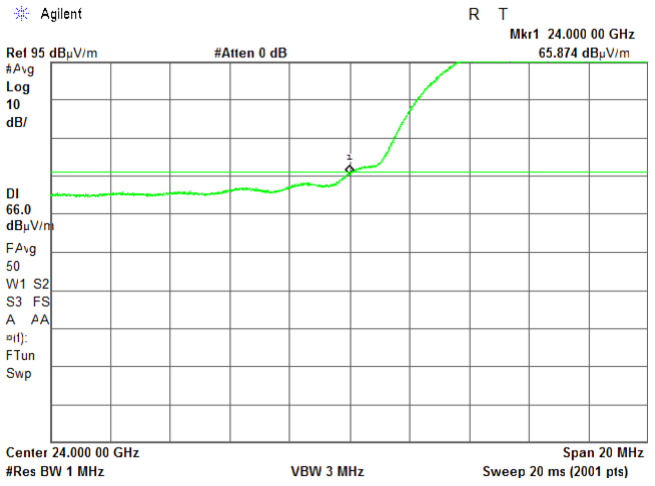




Plot 7.5.28 Low band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	50 MHz
MODULATION:	2048 QAM

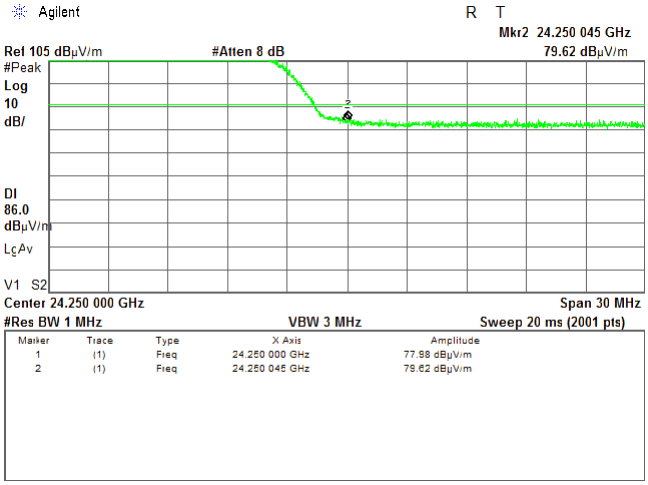


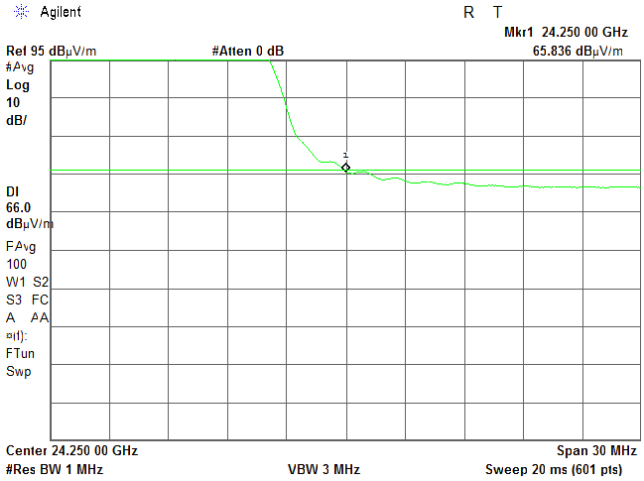


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.29 High band edge emission test result

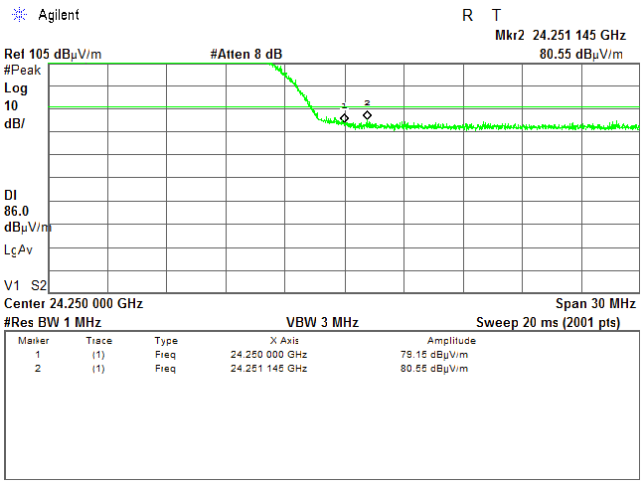
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical and Horisontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 50 MHz
MODULATION: QPSK

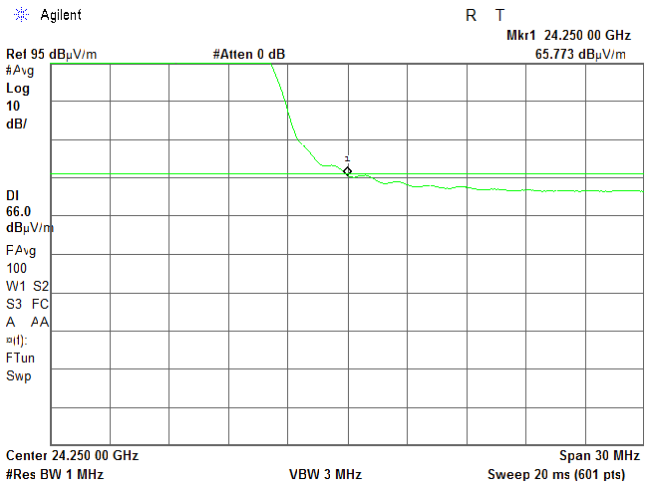




Plot 7.5.30 High band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 50 MHz
MODULATION: QPSK

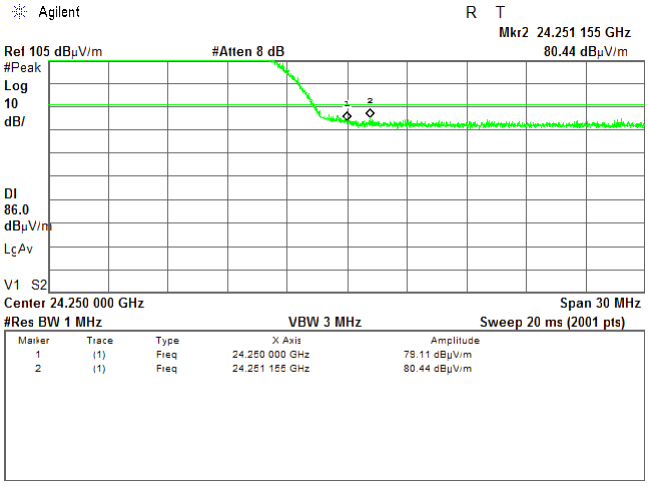


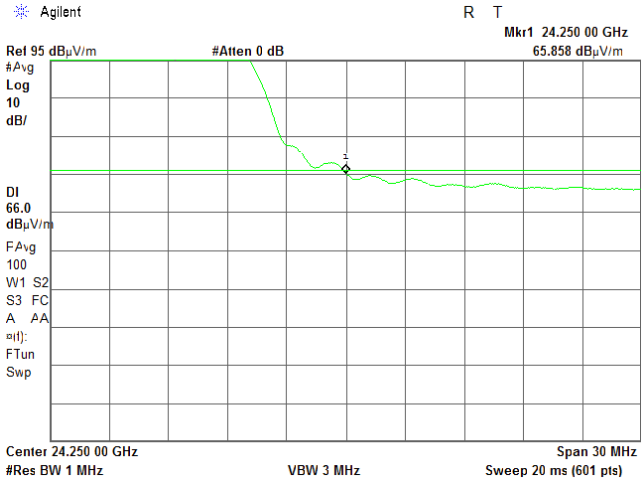


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.31 High band edge emission test result

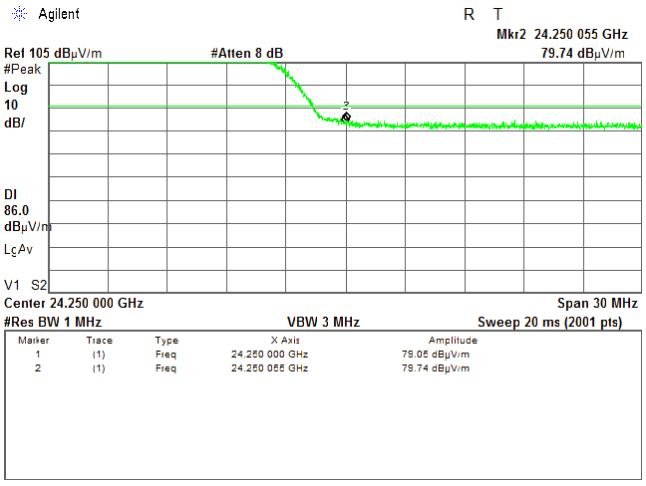
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical and Horisontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	50 MHz
MODULATION:	2048 QAM

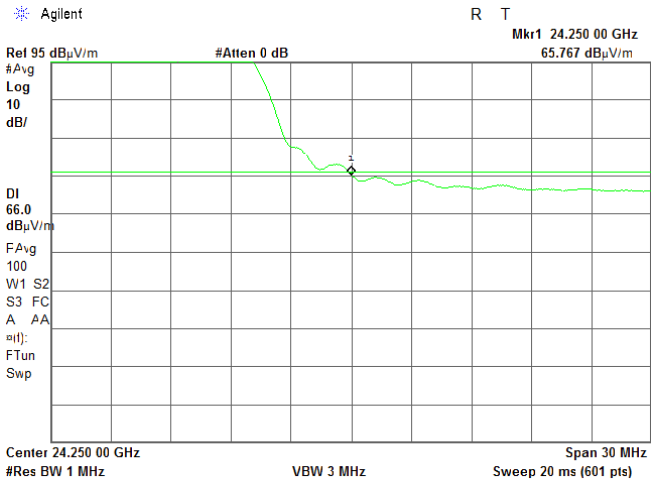




Plot 7.5.32 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	50 MHz
MODULATION:	2048 QAM

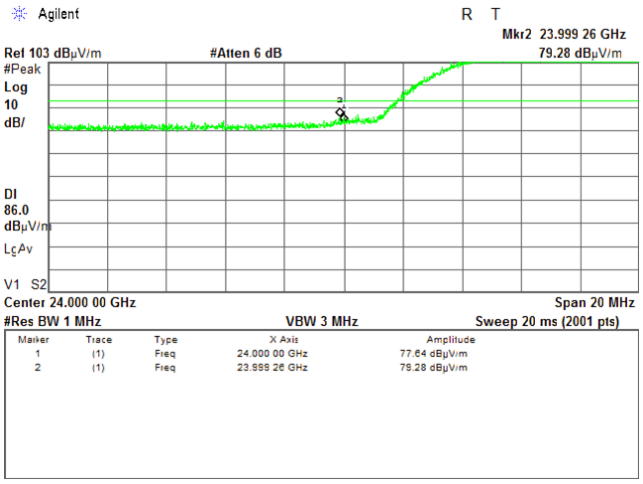


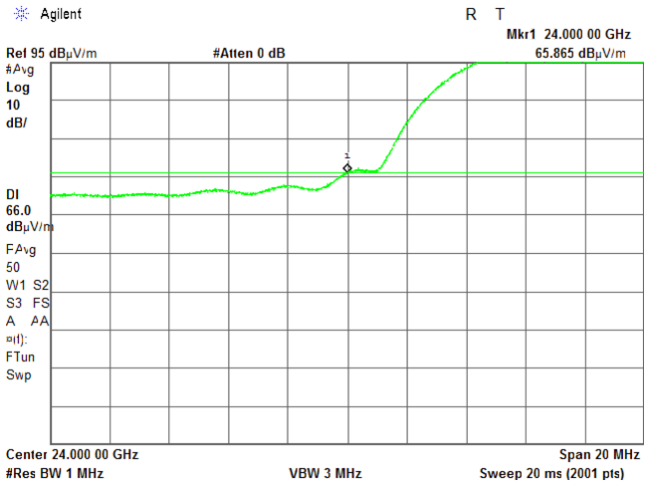


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.33 Low band edge emission test result

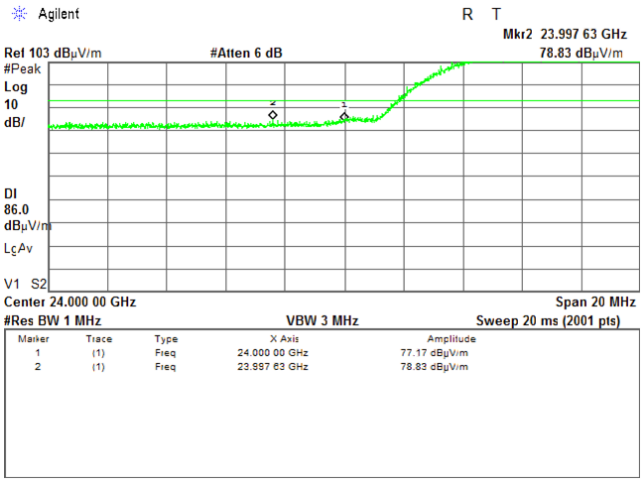
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 60 MHz

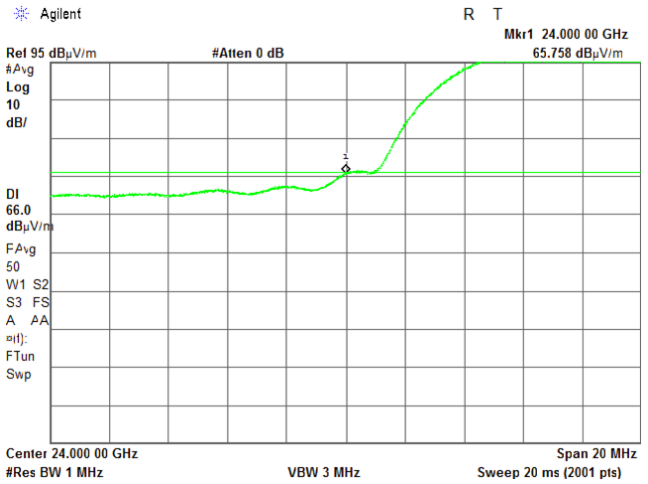




Plot 7.5.34 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 60 MHz
MODULATION: QPSK

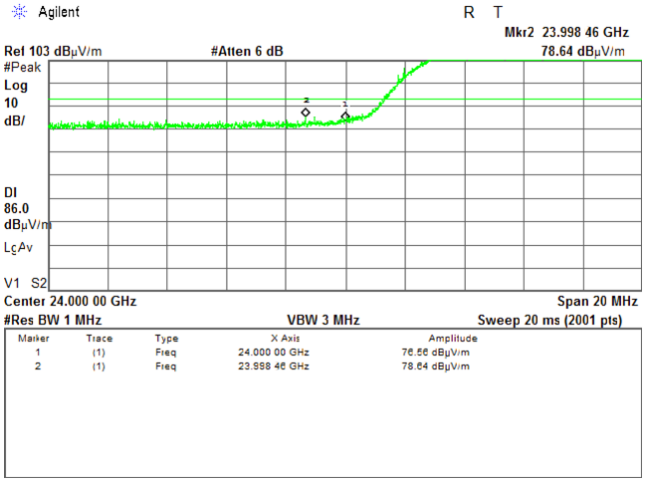


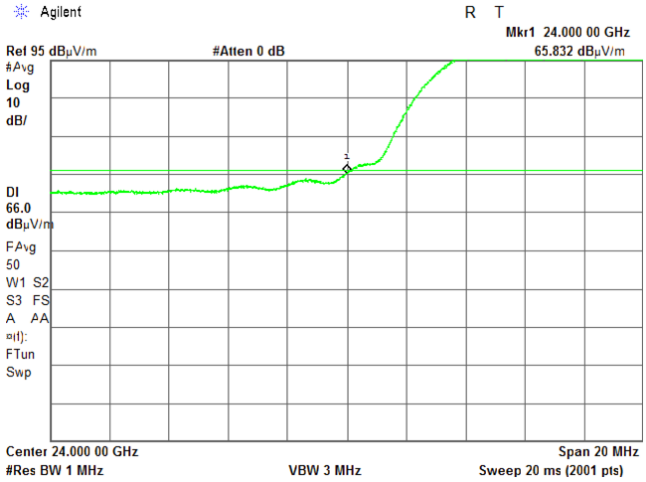


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.35 Low band edge emission test result

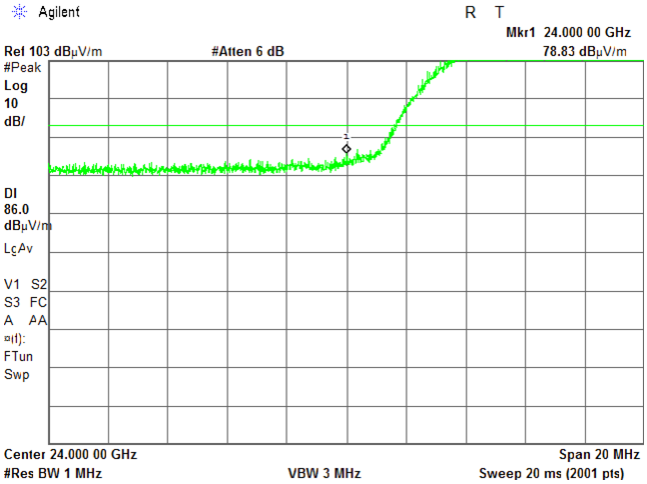
TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 60 MHz
MODULATION: 2048 QAM

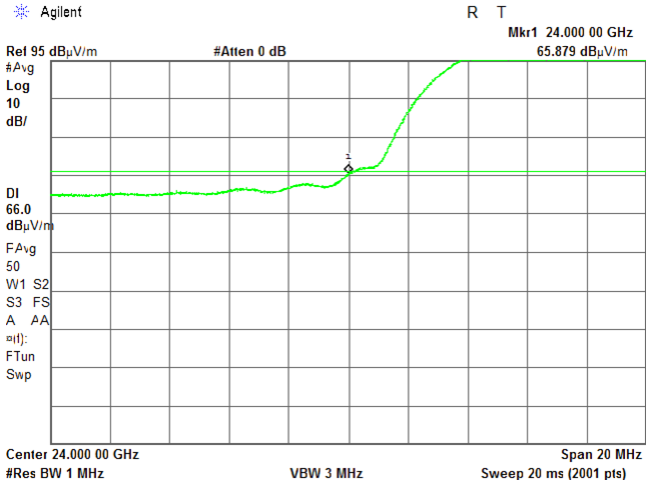




Plot 7.5.36 Low band edge emission test result

TEST SITE: OATS
TEST DISTANCE: 0.75 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
EMISSION BANDWIDTH: 60 MHz
MODULATION: 2048 QAM

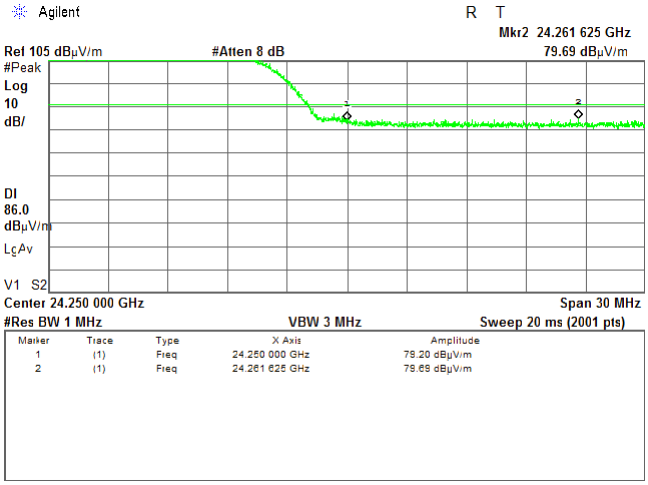


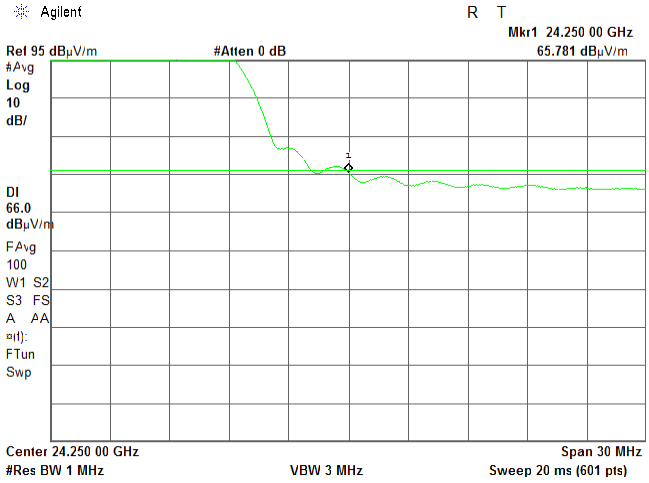


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.37 High band edge emission test result

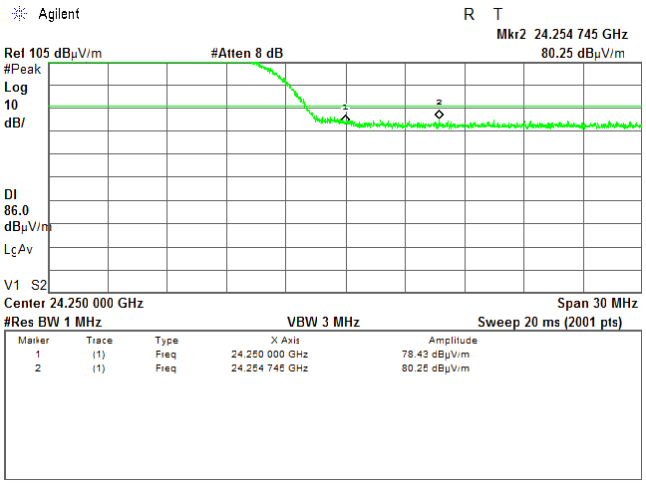
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	QPSK

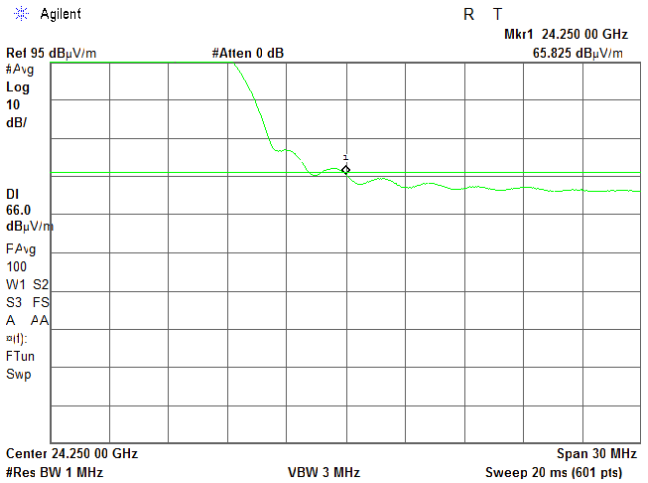




Plot 7.5.38 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	QPSK

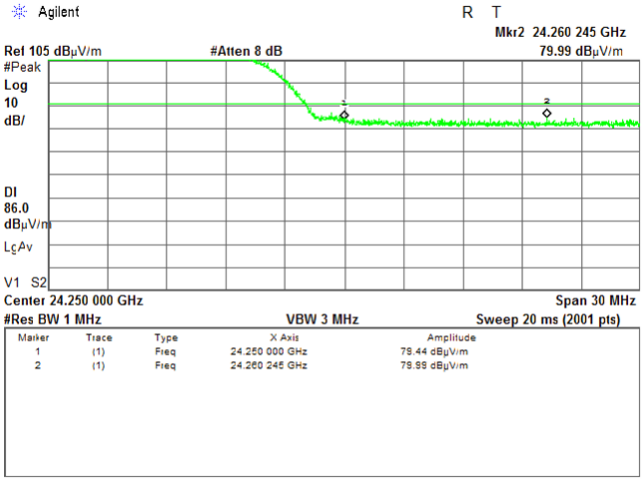


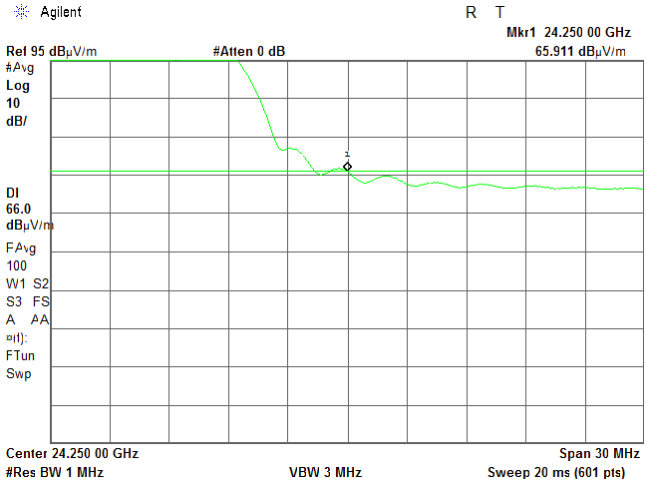


Test specification:	Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions		
Test procedure:	ANSI C63.10 section 6.10		
Test mode:	Compliance	Verdict:	PASS
Date(s):	25-Dec-17 - 19-Feb-18		
Temperature: 24.3 ºC	Relative Humidity: 43 %	Air Pressure: 1010 hPa	Power: -48 VDC
Remarks: EUT with 37.1 dBi antenna gain			

Plot 7.5.39 High band edge emission test result

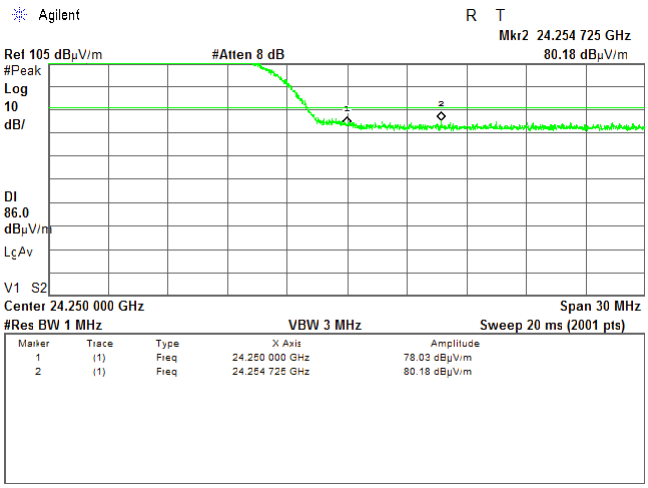
TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Vertical
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	2048QAM

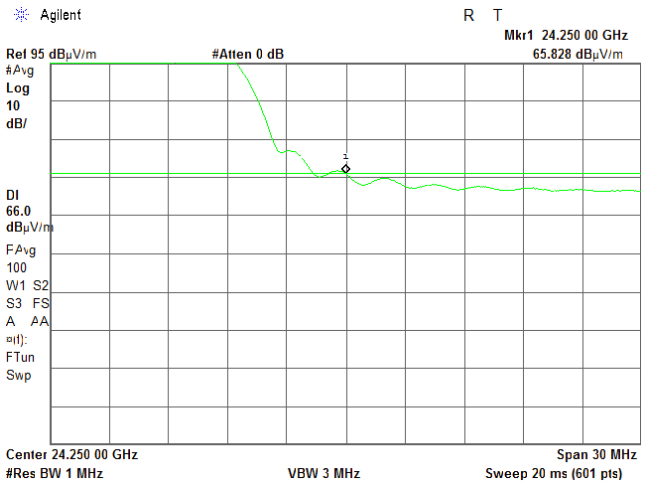




Plot 7.5.40 High band edge emission test result

TEST SITE:	OATS
TEST DISTANCE:	0.75 m
ANTENNA POLARIZATION:	Horizontal
EUT POSITION:	Typical (Vertical)
EMISSION BANDWIDTH:	60 MHz
MODULATION:	2048QAM





Test specification:	Section 15.207(a)/RSS-Gen, section 8.8, Conducted emission		
Test procedure:	ANSI C63.10 section 6.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	04-Sep-17		
Temperature: 24.5 ºC	Relative Humidity: 41 %	Air Pressure: 1011 hPa	Power: 120 VAC
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.

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

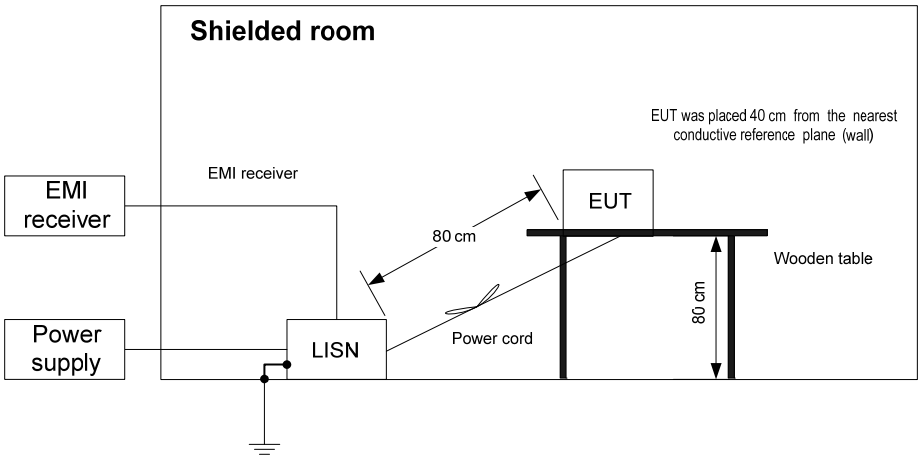
7.6.2.1 The EUT was set up as shown in Figure 7.6.1 and associated photographs, energized and the performance check was conducted.

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.

7.6.2.4 The worst test results (the lowest margins) were recorded in Table 7.6.2 and shown in the associated plots.

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



Test specification:	**Section 15.207(a)/RSS-Gen, section 8.8, Conducted emission**		
Test procedure:	ANSI C63.10 section 6.2		
Test mode:	Compliance	**Verdict:**	PASS
Date(s):	04-Sep-17		
Temperature: 24.5 ºC	**Relative Humidity:** 41 %	**Air Pressure:** 1011 hPa	**Power:** 120 VAC
Remarks:			

Table 7.6.2 Conducted emission test results

LINE: AC mains
EUT OPERATING MODE: Transmit
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*		
0.206450	45.56	45.24	63.41	-18.17	45.23	53.41	-8.18	L1	Pass
0.413300	44.69	44.38	57.62	-13.24	44.38	47.62	-3.24		
0.499375	42.94	42.51	56.01	-13.50	42.50	46.01	-3.51		
4.553315	43.69	42.75	56.00	-13.25	42.30	46.00	-3.70		
5.588100	48.33	47.23	60.00	-12.77	46.63	50.00	-3.37		
15.731088	41.37	40.72	60.00	-19.28	40.49	50.00	-9.51		
0.206585	48.26	47.77	63.40	-15.63	47.70	53.40	-5.70	L2	Pass
0.413465	43.53	43.18	57.62	-14.44	43.19	47.62	-4.43		
0.499633	42.47	42.08	56.01	-13.93	42.07	46.01	-3.94		
4.553963	43.75	42.87	56.00	-13.13	42.44	46.00	-3.56		
5.588738	48.75	47.76	60.00	-12.24	47.22	50.00	-2.78		
15.731683	41.43	40.76	60.00	-19.24	40.66	50.00	-9.34		

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

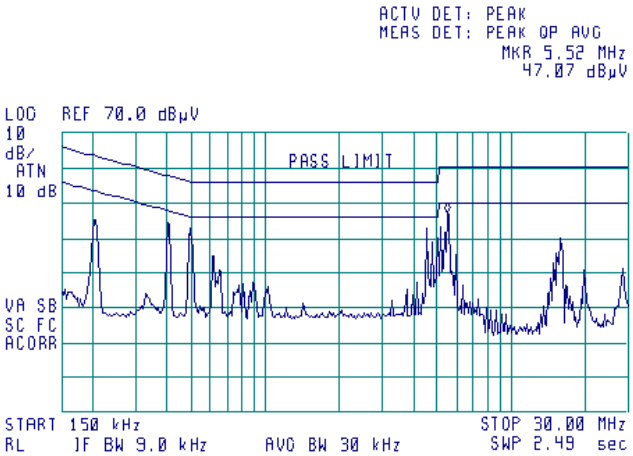
HL 0447	HL 0787	HL 0813	HL 1552	HL 4778			

Full description is given in Appendix A.

Test specification:	Section 15.207(a)/RSS-Gen, section 8.8, Conducted emission		
Test procedure:	ANSI C63.10 section 6.2		
Test mode:	Compliance	Verdict:	PASS
Date(s):	04-Sep-17		
Temperature: 24.5 ºC	Relative Humidity: 41 %	Air Pressure: 1011 hPa	Power: 120 VAC
Remarks:			

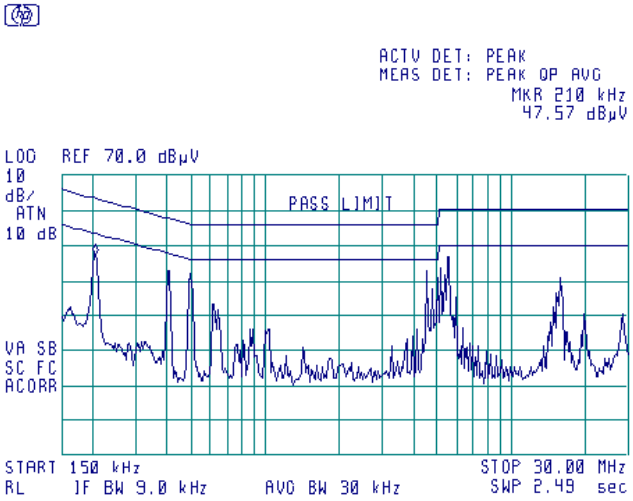
Plot 7.6.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Plot 7.6.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



Test specification:	Section 15.203/ RSS-Gen, Section 8.3, Antenna requirement		
Test procedure:	Visual inspection / supplier declaration		
Test mode:	Compliance	Verdict:	PASS
Date(s):	04-Sep-17		
Temperature: 24.3 ºC	Relative Humidity: 44 %	Air Pressure: 1011 hPa	Power: -48 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	NA	Comply
The transmitter employs a unique antenna connector	Supplier declaration	
The transmitter requires professional installation	NA	

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 kHz - 30 MHz	EMCO	6502	2857	11-Feb-18	11-Feb-19
0447	LISN, 16/2, 300V RMS, 50 Ohm/50 uH + 5 Ohm, STD CISPR 16-1	Hermon Laboratories	LISN 16 - 1	066	08-Nov-17	08-Nov-18
0604	Antenna BiconiLog Log-Periodic/T Bow-TIE, 26 - 2000 MHz	EMCO	3141	9611-1011	12-May-17	12-May-18
0768	Antenna Standard Gain Horn, 18-26.5 GHz, WR-42, 24 dB mid-band gain	Quinstar Technology	QWH-4200-BA	110	11-Jan-18	11-Jan-19
0770	Antenna Standard Gain Horn, 40-60 GHz WR-19, U-band, 24 dB mid-band gain	Quinstar Technology	QWH-1900-AA	118	18-Jul-17	18-Jul-18
0771	Antenna Standard Gain Horn, 60-90 GHz, WR-12, 24 dB mid-band gain	Quinstar Technology	QWH-1200-AA	111	13-Jul-17	13-Jul-18
0772	Antenna Standard Gain Horn, 75-110 GHz, WR-10, 24 dB mid-band gain	Quinstar Technology	QWH-0800-AA	110	13-Jul-17	13-Jul-18
0787	Transient Limiter 9 kHz-200 MHz	Hewlett Packard	11947A	3107A01877	24-Oct-17	24-Oct-18
0813	Cable Coax, 12 m, N-type, up to 3.0 GHz	Hermon Laboratories	C214-12	149	12-Dec-17	12-Dec-18
1299	Transition waveguide ET28S -19R	Custom Microwave	ET28S - 19R	1299	30-Jul-15	30-Jul-18
1300	Transition waveguide ET28S -19R	Custom Microwave	ET28S - 19R	1300	30-Jul-15	30-Jul-18
1552	Cable RF, 8 m	Alpha Wire	RG-214	1552	12-Dec-17	12-Dec-18
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	09-Mar-17	09-Mar-18
3235	Harmonic mixer 40 to 60 GHz	Agilent Technologies	11970U	MY30030182	16-Aug-16	16-Aug-19
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	30-Jul-15	30-Jul-18
3297	Tapered , WR-28, UG-599 to WR-10, UG-387 (26.5-40 GHz to 75-100 GHz)	Quinstar Technology	QWP-AW0000	10381007	30-Jul-15	30-Jul-18
3305	Harmonic mixer 50 to 75 GHz	Agilent Technologies	11970V	MY30030149	16-Aug-16	16-Aug-19
3433	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25679	27-Mar-17	27-Mar-18
3434	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25683	27-Mar-17	27-Mar-18
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	07-May-17	07-May-18
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	07-Feb-18	07-Feb-19
4280	Test Cable , DC-18 GHz, 4.6 m, N/M - N/M	Mini-Circuits	APC-15FT-NMNM+	0763A	24-Aug-17	24-Aug-18

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
4353	Low Loss Armored Test Cable, DC - 18 GHz, 6.2 m, N type-M/N type-M	MegaPhase	NC29-N1N1-244	12025101003	15-Mar-17	15-Mar-18
4778	EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL4777	Hewlett Packard	8542E	30807A00262, 3427A00123	02-Nov-17	02-Nov-18
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	04-Jan-18	04-Jan-19
4956	Active horn antenna, 18 to 40 GHz	Com-Power Corporation	AHA-840	105004	11-Jan-18	11-Jan-19
5112	RF cable, 40 GHz, 5.5 m, K-type	Huber-Suhner	SF102EA/11SK/11SK/5500MM	502494/2EA	27-Jul-17	27-Jul-18
5174	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 10 dB, 5 W	API Weinschel, Inc	75A-10-12	TD854	07-Feb-18	07-Feb-19
5175	Medium Power Fixed Coaxial Attenuator DC to 40 GHz, 20 dB, 5 W	API Weinschel, Inc	75A-20-12	TE289	07-Feb-18	07-Feb-19

9 APPENDIX B 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
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %
Occupied bandwidth	± 8.0 %

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 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 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site and T-1606 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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Person for contact: Mr. Michael Nikishin, EMC&Radio group manager

11 APPENDIX D Specification references

FCC 47CFR part 15: 2016	Radio Frequency Devices
ANSI C63.10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
ANSI C63.2: 1996	American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications
RSS-310 Issue 4: 2015	Licence-Exempt Radio Apparatus:Category II Equipment
RSS-Gen Issue 4: 2014	General Requirements for Compliance of Radio Apparatus

12 APPENDIX E Test equipment correction factors

Correction factor
Line impedance stabilization network
Model LISN 16 - 1
Hermon Laboratories, HL 0447

Frequency, kHz	Correction factor, dB
10	4.9
15	2.86
20	1.83
25	1.25
30	0.91
35	0.69
40	0.53
50	0.35
60	0.25
70	0.18
80	0.14
90	0.11
100	0.09
125	0.06
150	0.04

The correction factor in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.

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

Frequency, MHz	Magnetic antenna factor, dB	Electric antenna factor, dB
0.009	-32.8	18.7
0.010	-33.8	17.7
0.020	-38.3	13.2
0.050	-41.1	10.4
0.075	-41.3	10.2
0.100	-41.6	9.9
0.150	-41.7	9.8
0.250	-41.6	9.9
0.500	-41.8	9.8
0.750	-41.9	9.7
1.000	-41.4	10.1
2.000	-41.5	10.0
3.000	-41.4	10.2
4.000	-41.4	10.1
5.000	-41.5	10.1
10.000	-41.9	9.6
15.000	-41.9	9.6
20.000	-42.2	9.3
25.000	-42.8	8.7
30.000	-44.0	7.5

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

Antenna factor
Standard gain horn antenna
Quinstar Technology
Model QWH
Ser.No.112, HL 0768, 0769, 0770, 0771, 0772

Frequency min, GHz	Frequency max, GHz	Antenna factor, dB(1/m)
18.000	26.500	32.01
26.500	40.000	35.48
40.000	60.000	39.03
60.000	90.000	42.55
90.000	140.000	46.23
140.000	220.000	50.11

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

Antenna factor
Biconilog antenna EMCO Model 3141
Ser.No.1011, HL 0604

Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)	Frequency, MHz	Antenna factor, dB(1/m)
26	7.8	580	20.6	1320	27.8
28	7.8	600	21.3	1340	28.3
30	7.8	620	21.5	1360	28.2
40	7.2	640	21.2	1380	27.9
60	7.1	660	21.4	1400	27.9
70	8.5	680	21.9	1420	27.9
80	9.4	700	22.2	1440	27.8
90	9.8	720	22.2	1460	27.8
100	9.7	740	22.1	1480	28.0
110	9.3	760	22.3	1500	28.5
120	8.8	780	22.6	1520	28.9
130	8.7	800	22.7	1540	29.6
140	9.2	820	22.9	1560	29.8
150	9.8	840	23.1	1580	29.6
160	10.2	860	23.4	1600	29.5
170	10.4	880	23.8	1620	29.3
180	10.4	900	24.1	1640	29.2
190	10.3	920	24.1	1660	29.4
200	10.6	940	24.0	1680	29.6
220	11.6	960	24.1	1700	29.8
240	12.4	980	24.5	1720	30.3
260	12.8	1000	24.9	1740	30.8
280	13.7	1020	25.0	1760	31.1
300	14.7	1040	25.2	1780	31.0
320	15.2	1060	25.4	1800	30.9
340	15.4	1080	25.6	1820	30.7
360	16.1	1100	25.7	1840	30.6
380	16.4	1120	26.0	1860	30.6
400	16.6	1140	26.4	1880	30.6
420	16.7	1160	27.0	1900	30.6
440	17.0	1180	27.0	1920	30.7
460	17.7	1200	26.7	1940	30.9
480	18.1	1220	26.5	1960	31.2
500	18.5	1240	26.5	1980	31.6
520	19.1	1260	26.5	2000	32.0
540	19.5	1280	26.6		
560	19.8	1300	27.0		

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

Antenna factor, HL 4933

COM-POWER CORPORATION

Active Horn Antenna Factor Calibration

1 GHz to 18 GHz

Equipment:	**ACTIVE HORN ANTENNA**
Model:	**AHA-118**
Serial Number:	**701046**
Calibration Distance:	**3 Meter**
Polarization:	**Horizontal**
Calibration Date:	**11/12/2014**

Frequency (GHz)	*Preamplifier Gain (dB)*	*Antenna Factor with pre-amp (dB/m)*	*Frequency (GHz)*	*Preamplifier Gain (dB)*	*Antenna Factor with pre-amp (dB/m)*
1	40.96	-16.47	10	40.94	-1.97
1.5	41.21	-14.53	10.5	40.63	-1.06
2	41.44	-13.30	11	40.74	-1.50
2.5	41.71	-12.87	11.5	40.65	-0.52
3	41.96	-12.26	12	40.76	-0.15
3.5	42.14	-11.77	12.5	41.03	-0.85
4	42.13	-10.91	13	41.37	-0.81
4.5	41.79	-9.41	13.5	41.18	0.05
5	41.44	-7.54	14	40.98	0.36
5.5	40.91	-6.47	14.5	40.81	1.26
6	40.69	-5.48	15	40.65	0.25
6.5	40.64	-5.53	15.5	40.93	-1.05
7	40.76	-4.12	16	41.31	-1.44
7.5	40.94	-3.12	16.5	40.96	-0.80
8	40.68	-1.69	17	40.64	-0.02
8.5	40.08	-1.71	17.5	40.57	1.81
9	40.41	-1.86	18	40.08	3.63
9.5	41.21	-2.73			

Calibration according to ARP 958

Antenna Factor to be added to receiver reading:

Meter Reading (dBuV) + Antenna Factor (dB/m) = Corrected Reading (dBuV/m)

Antenna factor, HL 4956

COM-POWER CORPORATION

Active Horn Antenna Factor Calibration

18 GHz to 40 GHz

Equipment:	**ACTIVE HORN ANTENNA**
Model:	**AHA-840**
Serial Number:	**105004**
Calibration Distance:	**3 meter**
Polarization:	**Horizontal**
Calibration Date:	**1/26/2015**

Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)	Frequency (GHz)	Preamplifier Gain (dB)	Antenna Factor with pre-amp (dB/m)
18	38.83	-1.06	29.5	42.47	-5.33
18.5	39.34	-2.65	30	41.91	-4.86
19	39.71	-3.88	30.5	41.60	-4.64
19.5	39.87	-4.35	31	41.52	-4.60
20	39.98	-3.97	31.5	41.56	-4.79
20.5	40.42	-3.68	32	41.80	-5.21
21	41.12	-4.06	32.5	42.29	-5.54
21.5	41.74	-5.46	33	42.79	-5.63
22	42.14	-6.22	33.5	42.88	-5.38
22.5	42.35	-6.42	34	42.62	-4.76
23	42.50	-6.59	34.5	42.63	-4.84
23.5	42.65	-6.82	35	43.15	-5.13
24	42.81	-7.01	35.5	43.91	-5.83
24.5	42.86	-7.37	36	44.59	-6.39
25	42.73	-7.53	36.5	45.04	-6.64
25.5	42.77	-7.45	37	45.08	-6.40
26	42.85	-7.21	37.5	44.82	-5.75
26.5	42.98	-7.17	38	44.16	-4.58
27	43.14	-7.22	38.5	42.90	-2.66
27.5	43.18	-7.32	39	42.39	-1.71
28	43.04	-7.10	39.5	43.76	-2.49
28.5	43.01	-6.73	40	45.98	-5.21

Calibration per ANSI C63.5: 2006

Standard Site Method, Equations 1-6 (3-antenna)

Corrected Reading (dBµV/m) = Meter Reading (dBµV) + AFE(dB/m)

Cable loss
Cable coax, RG-214, 12 m, s/n 149, HL 0813

No.	Frequency, MHz	Cable loss, dB	Measured uncertainty, dB
1	10	0.27	±0.12
2	30	0.51	±0.12
3	50	0.70	±0.12
4	100	1.05	±0.12
5	150	1.30	±0.13
6	200	1.52	±0.13
7	250	1.71	±0.13
8	300	1.91	±0.13
9	400	2.27	±0.13
10	500	2.56	±0.13
11	600	2.85	±0.14
12	700	3.11	±0.14
13	800	3.37	±0.14
14	900	3.64	±0.14
15	1000	3.90	±0.14

Cable loss
Test Cable, Mini-Circuits, CBL-5FT-SMSM+, SMA-SMA, 18 GHz, 1.5 m
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
Test Cable, Mini-Circuits, CBL-5FT-SMSM+, SMA-SMA, 18 GHz, 1.5 m, S/N 25683
Mini-Circuits, HL 3434

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10.0	0.06	9000	1.96
100	0.16	9500	2.01
500	0.40	10000	2.01
1000	0.57	10500	2.14
1500	0.72	11000	2.21
2000	0.85	11500	2.24
2500	0.95	12000	2.36
3000	1.03	12500	2.47
3500	1.11	13000	2.46
4000	1.21	13500	2.50
4500	1.29	14000	2.53
5000	1.39	14500	2.53
5500	1.46	15000	2.62
6000	1.52	15500	2.70
6500	1.60	16000	2.80
7000	1.68	16500	2.86
7500	1.75	17000	2.88
8000	1.83	17500	2.94
8500	1.88	18000	3.00

Cable loss
Microwave Cable Assembly, Huber-Suhner, 40 GHz, 3.5 m, SMA-SMA, S/N 1225/2A
HL 3901

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.09	9500	4.29	21000	6.67
100	0.41	10000	4.40	22000	6.92
500	0.93	10500	4.52	23000	7.00
1000	1.33	11000	4.64	24000	7.18
1500	1.63	11500	4.76	25000	7.29
2000	1.90	12000	4.87	26000	7.55
2500	2.12	12500	4.99	27000	7.70
3000	2.33	13000	5.11	28000	7.88
3500	2.50	13500	5.20	29000	8.02
4000	2.67	14000	5.31	30000	8.15
4500	2.82	14500	5.42	31000	8.35
5000	2.99	15000	5.51	32000	8.40
5500	3.16	15500	5.58	33000	8.62
6000	3.32	16000	5.68	34000	8.73
6500	3.51	16500	5.78	35000	8.78
7000	3.65	17000	5.91	36000	8.94
7500	3.79	17500	5.99	37000	9.21
8000	3.92	18000	6.07	38000	9.37
8500	4.04	19000	6.36	39000	9.45
9000	4.18	20000	6.49	40000	9.52

Cable loss
Test cable, Mini-Circuits, S/N 0763A, 18 GHz, 4.6 m, N/M - N/M
APC-15FT-NMNM+, HL 4280

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
10	0.21	5000	4.27	10200	6.50	15400	8.49
30	0.26	5100	4.32	10300	6.55	15500	8.50
50	0.34	5200	4.35	10400	6.59	15600	8.55
100	0.51	5300	4.41	10500	6.62	15700	8.58
200	0.63	5400	4.43	10600	6.65	15800	8.61
300	0.73	5500	4.49	10700	6.66	15900	8.64
400	0.91	5600	4.54	10800	6.68	16000	8.68
500	1.07	5700	4.58	10900	6.70	16100	8.72
600	1.21	5800	4.63	11000	6.71	16200	8.73
700	1.33	5900	4.67	11100	6.72	16300	8.75
800	1.45	6000	4.73	11200	6.74	16400	8.77
900	1.55	6100	4.76	11300	6.77	16500	8.80
1000	1.65	6200	4.81	11400	6.81	16600	8.80
1100	1.75	6300	4.86	11500	6.84	16700	8.82
1200	1.85	6400	4.89	11600	6.87	16800	8.83
1300	1.94	6500	4.94	11700	6.89	16900	8.87
1400	2.03	6600	4.95	11800	6.94	17000	8.92
1500	2.11	6700	4.99	11900	7.00	17100	8.96
1600	2.19	6800	5.04	12000	7.05	17200	9.01
1700	2.27	6900	5.04	12100	7.10	17300	9.07
1800	2.34	7000	5.09	12200	7.17	17400	9.09
1900	2.42	7100	5.15	12300	7.23	17500	9.14
2000	2.49	7200	5.19	12400	7.29	17600	9.17
2100	2.56	7300	5.25	12500	7.34	17700	9.21
2200	2.63	7400	5.33	12600	7.38	17800	9.24
2300	2.69	7500	5.39	12700	7.44	17900	9.28
2400	2.76	7600	5.42	12800	7.48	18000	9.31
2500	2.83	7700	5.51	12900	7.55		
2600	2.89	7800	5.58	13000	7.58		
2700	2.95	7900	5.62	13100	7.63		
2800	3.02	8000	5.68	13200	7.67		
2900	3.08	8100	5.73	13300	7.72		
3000	3.15	8200	5.78	13400	7.76		
3100	3.21	8300	5.83	13500	7.81		
3200	3.27	8400	5.87	13600	7.85		
3300	3.33	8500	5.92	13700	7.88		
3400	3.38	8600	5.96	13800	7.93		
3500	3.44	8700	6.00	13900	7.97		
3600	3.49	8800	6.04	14000	8.01		
3700	3.55	8900	6.10	14100	8.05		
3800	3.60	9000	6.13	14200	8.09		
3900	3.65	9100	6.17	14300	8.12		
4000	3.71	9200	6.22	14400	8.15		
4100	3.75	9300	6.25	14500	8.19		
4200	3.81	9400	6.28	14600	8.22		
4300	3.86	9500	6.32	14700	8.26		
4400	3.93	9600	6.36	14800	8.29		
4500	3.98	9700	6.37	14900	8.32		
4600	4.03	9800	6.41	15000	8.36		
4700	4.08	9900	6.42	15100	8.40		
4800	4.13	10000	6.45	15200	8.43		
4900	4.18	10100	6.48	15300	8.44		

Cable loss
Low Loss Armored Test Cable, MegaPhase, 18 GHz, 6.2 m, N type-M/N type-M,
NC29-N1N1-244S/N 12025101 003,
HL 4353

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
50	0.20	9000	2.71
100	0.27	9500	2.81
300	0.47	10000	2.90
500	0.61	10500	2.97
1000	0.87	11000	3.06
1500	1.07	11500	3.13
2000	1.24	12000	3.20
2500	1.39	12500	3.26
3000	1.53	13000	3.34
3500	1.65	13500	3.39
4000	1.77	14000	3.47
4500	1.89	14500	3.54
5000	1.99	15000	3.62
5500	2.07	15500	3.69
6000	2.20	16000	3.76
6500	2.30	16500	3.83
7000	2.39	17000	3.86
7500	2.51	17500	3.94
8000	2.58	18000	4.02
8500	2.65		

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		

13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
A/m	ampere per meter
AM	amplitude modulation
AVRG	average (detector)
cm	centimeter
dB	decibel
dBm	decibel referred to one milliwatt
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dB(μA)	decibel referred to one microampere
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
k	kilo
kHz	kilohertz
LO	local oscillator
m	meter
MHz	megahertz
min	minute
mm	millimeter
ms	millisecond
μs	microsecond
NA	not applicable
NB	narrow band
OATS	open area test site
Ω	Ohm
PM	pulse modulation
PS	power supply
ppm	part per million (10^{-6})
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt
WB	wideband

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