



|  |                                |                               |                       |
|--|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 section 6.10  |                                |                               |                       |
| <b>Test mode:</b> Compliance   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 25-Dec-17 - 19-Feb-18  |                                |                               |                       |
| <b>Temperature:</b> 24.3 °C  | <b>Relative Humidity:</b> 43 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> -48 VDC |
| <b>Remarks:</b> 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,<br>MHz | Field strength limit, dB $\mu$ V/m |         | Attenuation below carrier,<br>dBc |
|------------------------|------------------------------------|---------|-----------------------------------|
|                        | Peak                               | Average |                                   |
| 24000 - 24250          | <b>at 3 m distance</b>             |         | 50                                |
|                        | 74.0                               | 54.0    |                                   |
|                        | <b>at 0.75 m distance</b>          |         |                                   |
|                        | 86.0                               | 66.0    |                                   |

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

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

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

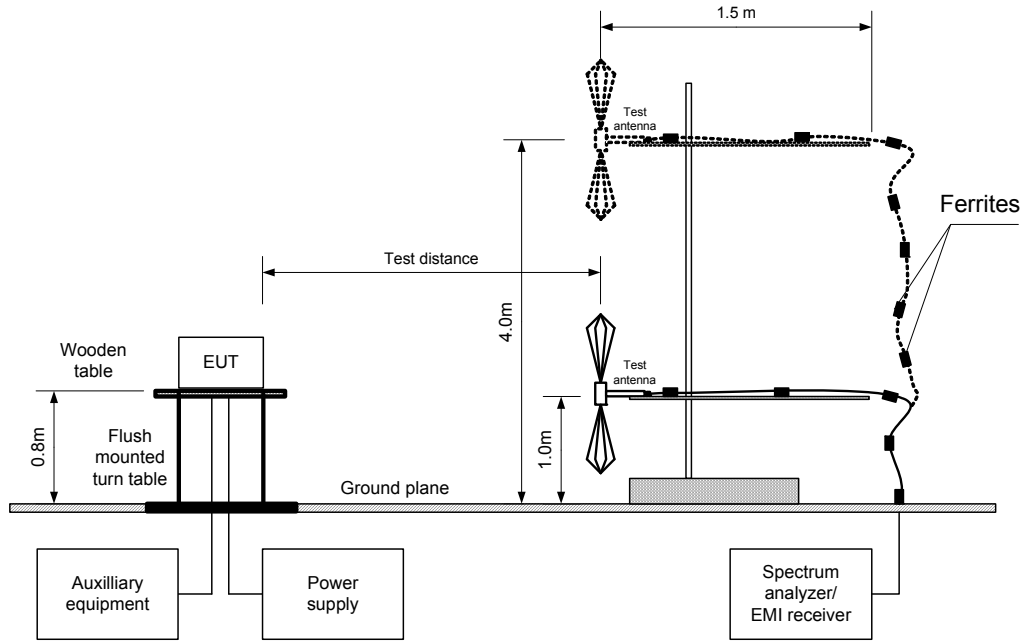
### 7.5.2 Test procedure

- 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.



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

Figure 7.5.1 Band edge emission measurement set up





|  |                                |                               |                       |
|--|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 section 6.10  |                                |                               |                       |
| <b>Test mode:</b> Compliance   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 25-Dec-17 - 19-Feb-18  |                                |                               |                       |
| <b>Temperature:</b> 24.3 °C  | <b>Relative Humidity:</b> 43 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> -48 VDC |
| <b>Remarks:</b> 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



|  |                                |                               |                       |
|--|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.249(d)/ RSS-310, section 3.10, Band edge emissions |                                |                               |                       |
| <b>Test procedure:</b> ANSI C63.10 section 6.10  |                                |                               |                       |
| <b>Test mode:</b> Compliance   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 25-Dec-17 - 19-Feb-18  |                                |                               |                       |
| <b>Temperature:</b> 24.3 °C  | <b>Relative Humidity:</b> 43 % | <b>Air Pressure:</b> 1010 hPa | <b>Power:</b> -48 VDC |
| <b>Remarks:</b> 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.



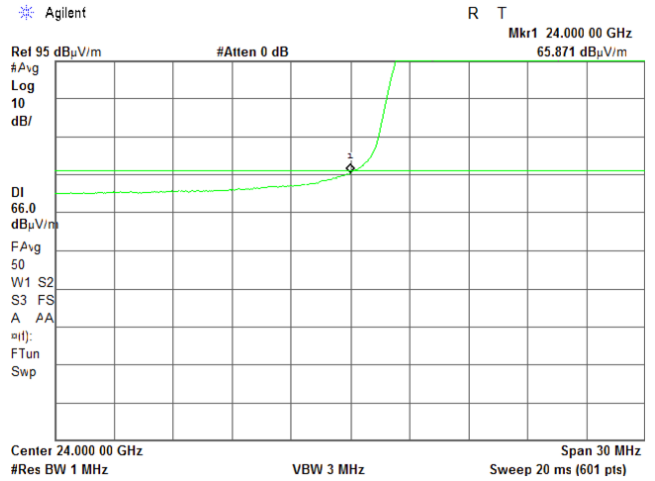
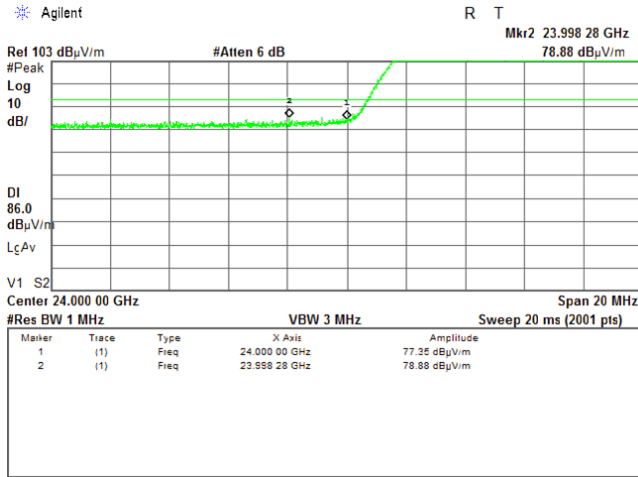
HERMON LABORATORIES

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

Plot 7.5.1 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

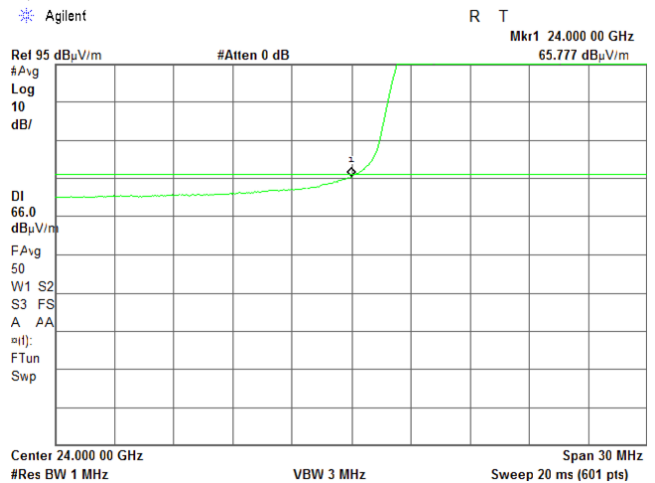
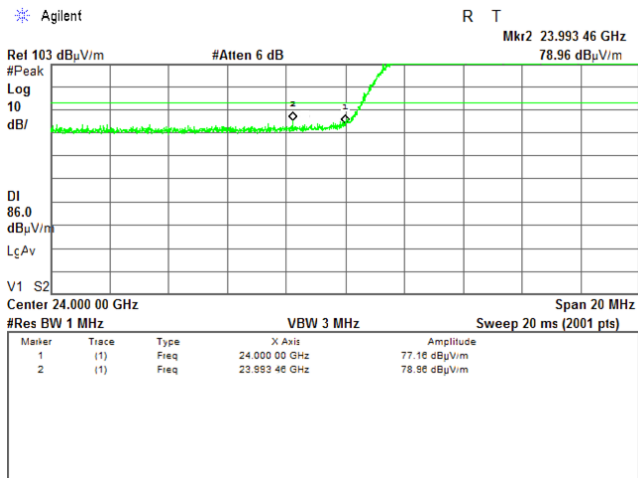
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
20 MHz  
QPSK



Plot 7.5.2 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
20 MHz  
QPSK





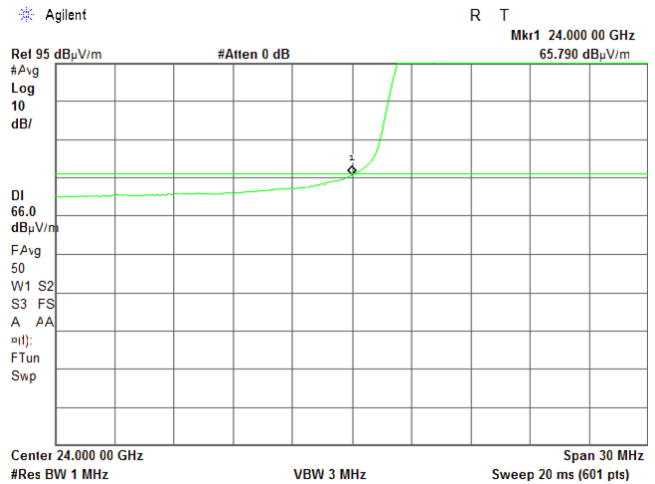
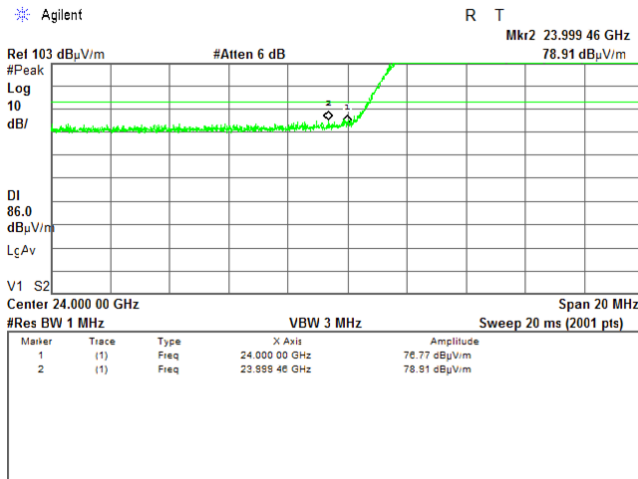
HERMON LABORATORIES

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

Plot 7.5.3 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

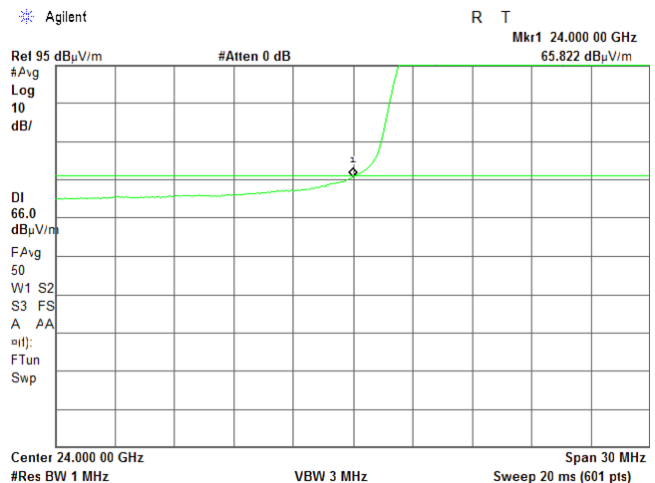
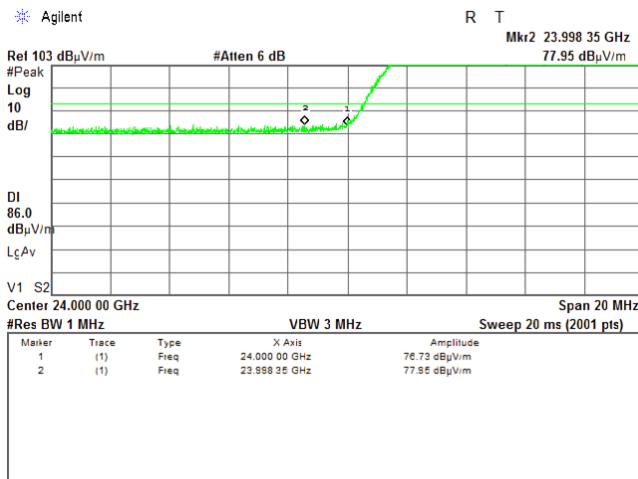
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
60 MHz  
2048QAM



Plot 7.5.4 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
60 MHz  
2048QAM





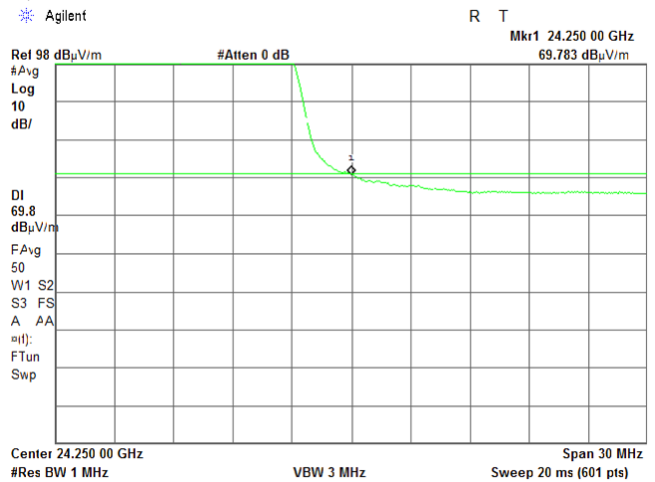
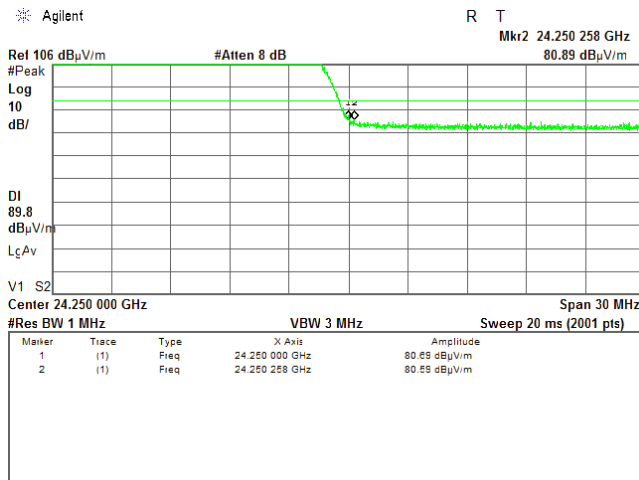
HERMON LABORATORIES

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

### Plot 7.5.5 High band edge emission test result

TEST SITE:  
 TEST DISTANCE:  
 ANTENNA POLARIZATION:  
 EUT POSITION:  
 EMISSION BANDWIDTH:  
 MODULATION:

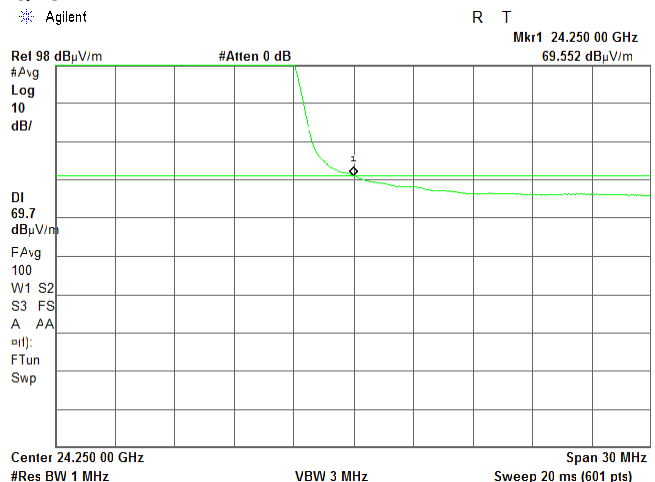
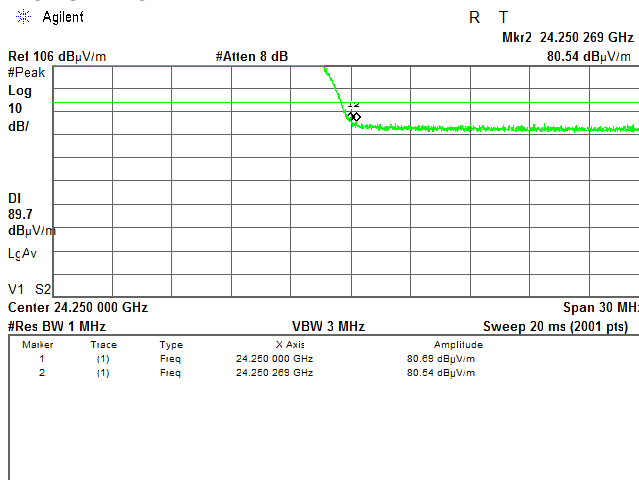
OATS  
 0.75 m  
 Vertical  
 Typical (Vertical)  
 20 MHz  
 QPSK



### Plot 7.5.6 High band edge emission test result

TEST SITE:  
 TEST DISTANCE:  
 ANTENNA POLARIZATION:  
 EUT POSITION:  
 EMISSION BANDWIDTH:  
 MODULATION:

OATS  
 0.75 m  
 Horizontal  
 Typical (Vertical)  
 20 MHz  
 QPSK





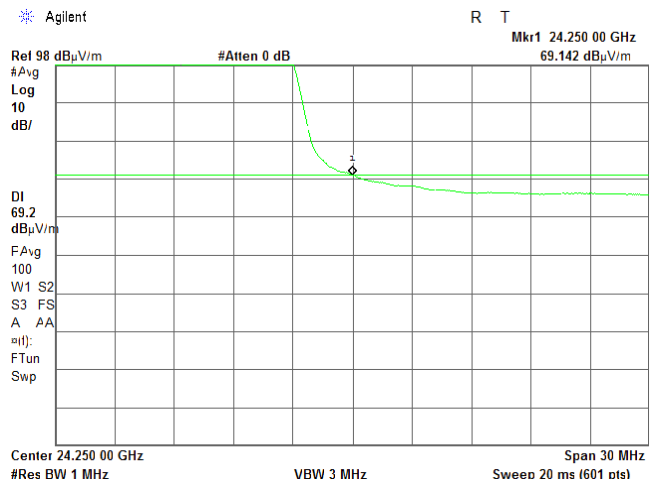
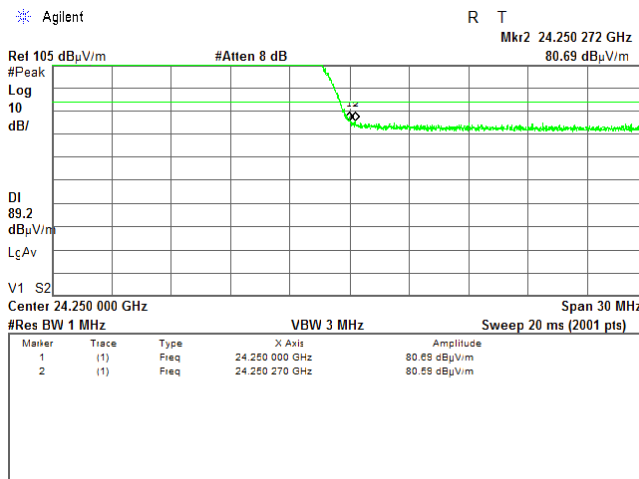
HERMON LABORATORIES

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

Plot 7.5.7 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

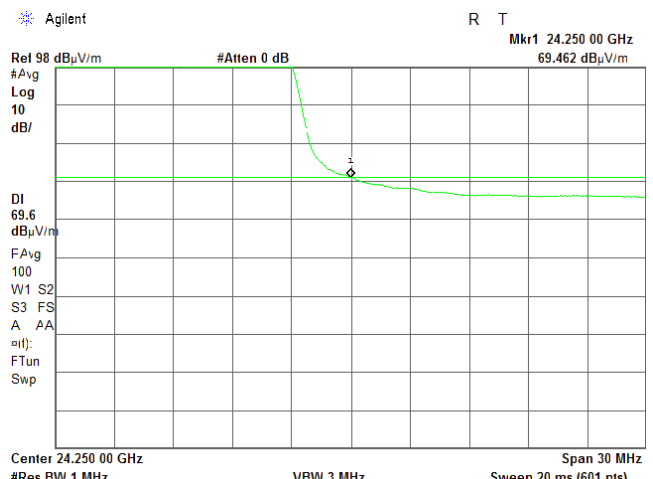
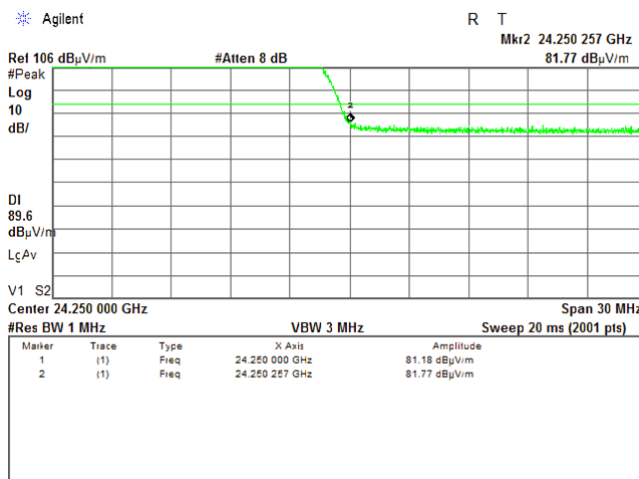
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
60 MHz  
2048QAM



Plot 7.5.8 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
60 MHz  
2048QAM







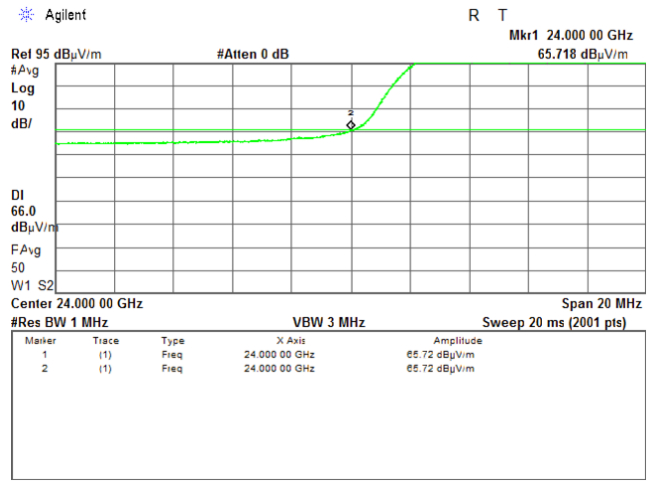
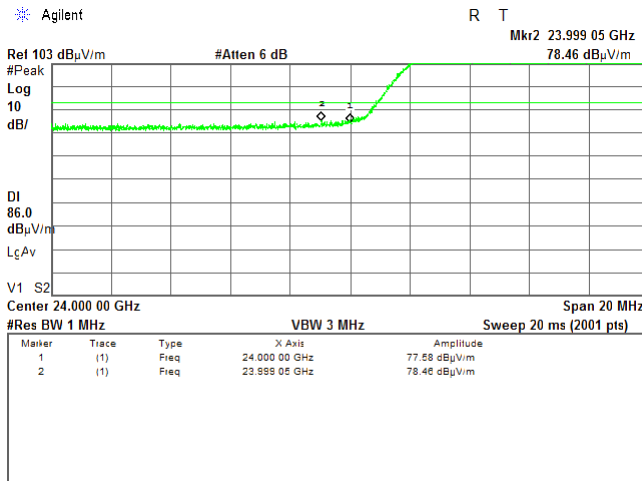
HERMON LABORATORIES

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

Plot 7.5.9 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

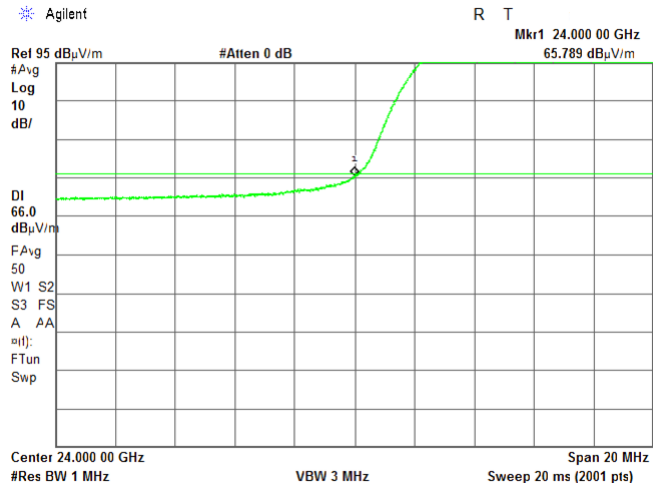
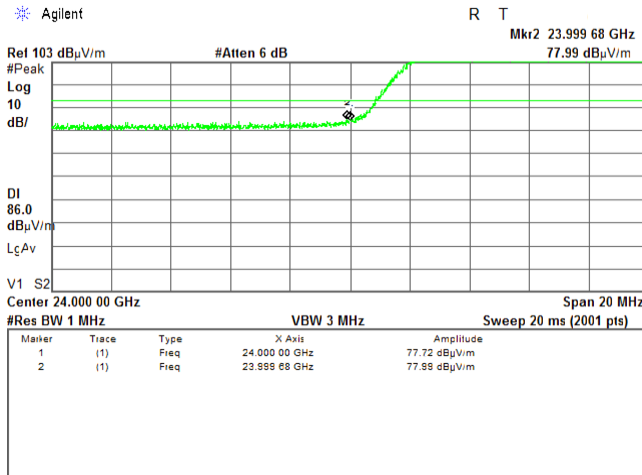
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
30 MHz  
QPSK



Plot 7.5.10 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
30 MHz  
QPSK





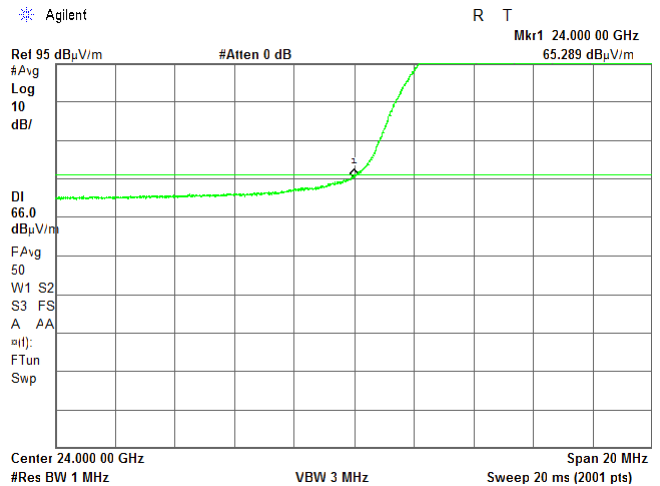
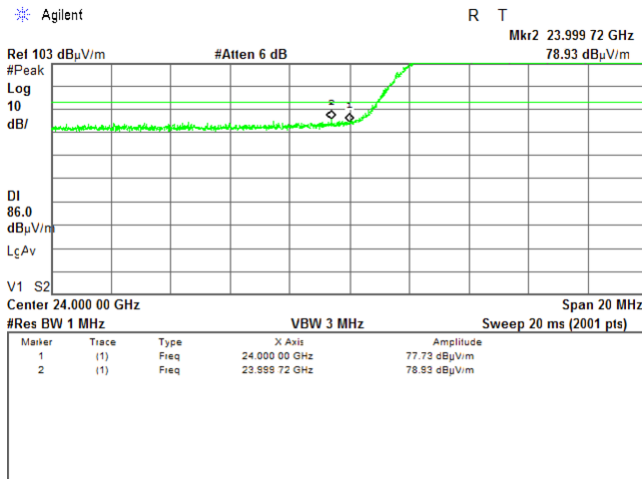
HERMON LABORATORIES

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

Plot 7.5.11 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

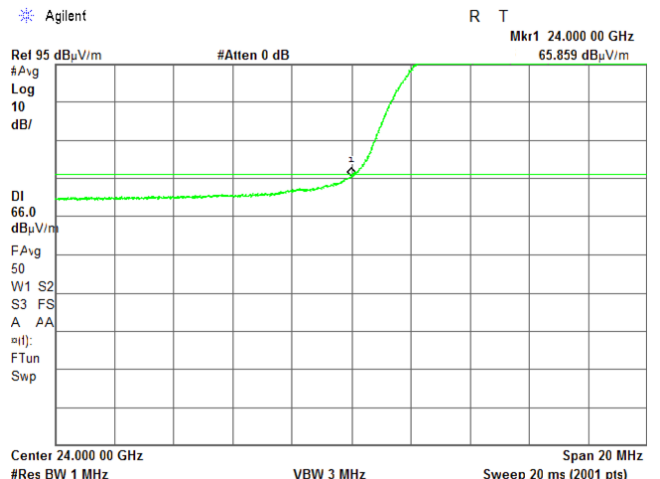
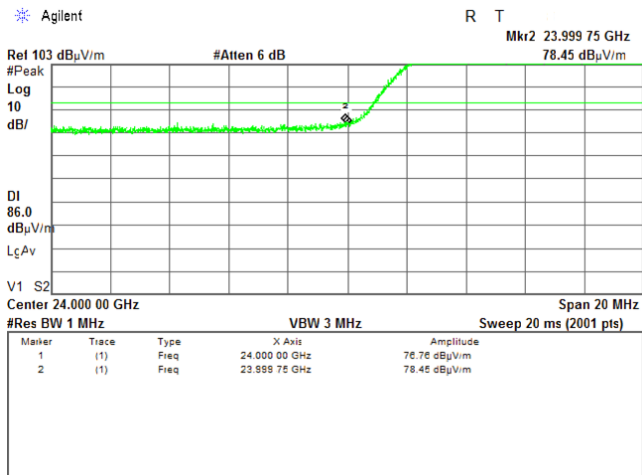
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
30 MHz  
2048QAM



Plot 7.5.12 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
30 MHz  
2048QAM





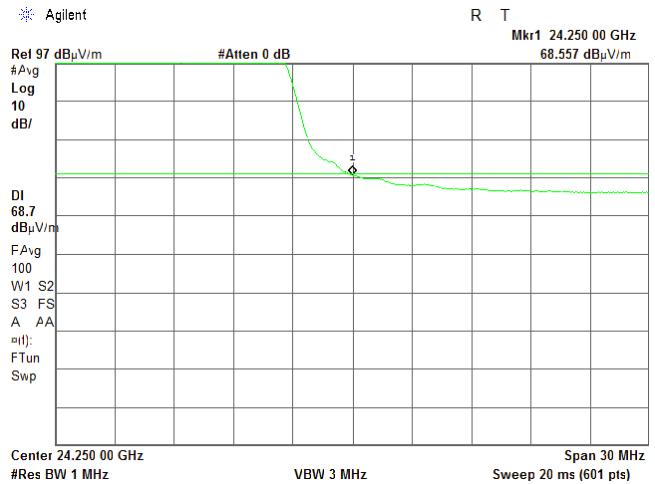
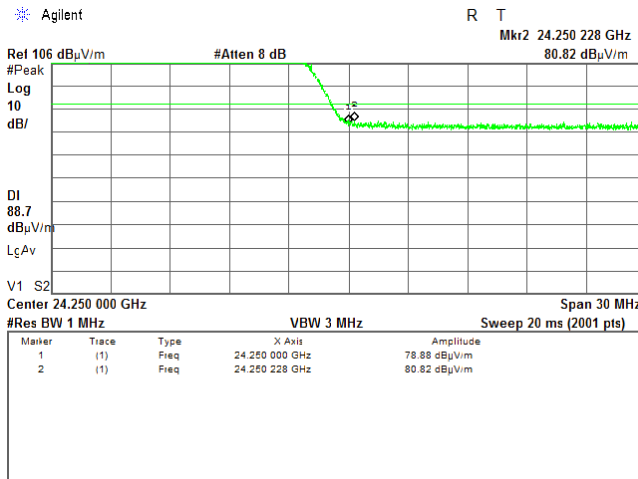
HERMON LABORATORIES

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

Plot 7.5.13 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

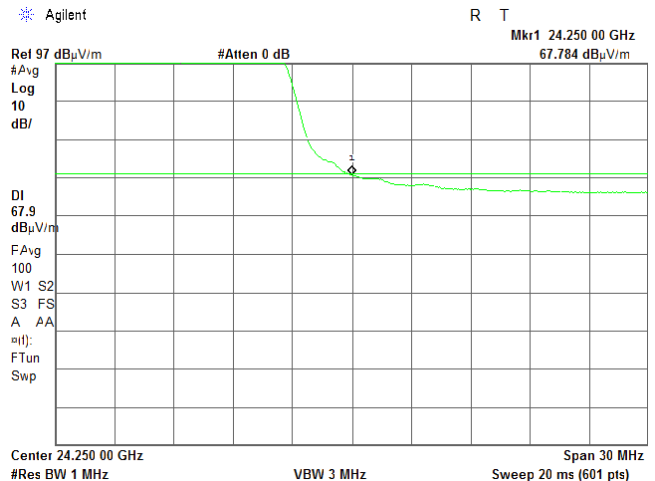
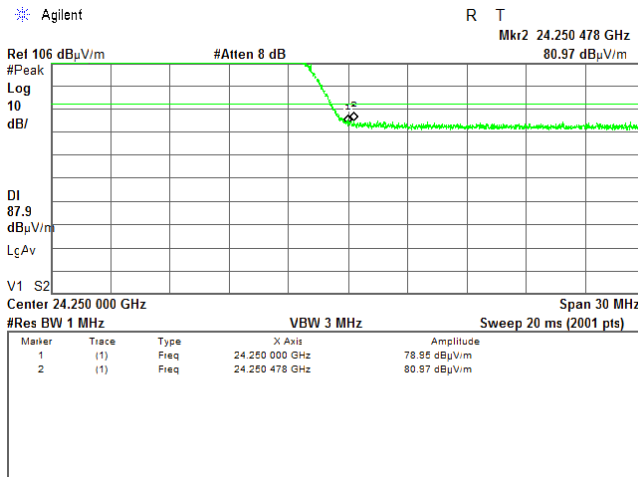
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
30 MHz  
QPSK



Plot 7.5.14 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
30 MHz  
QPSK





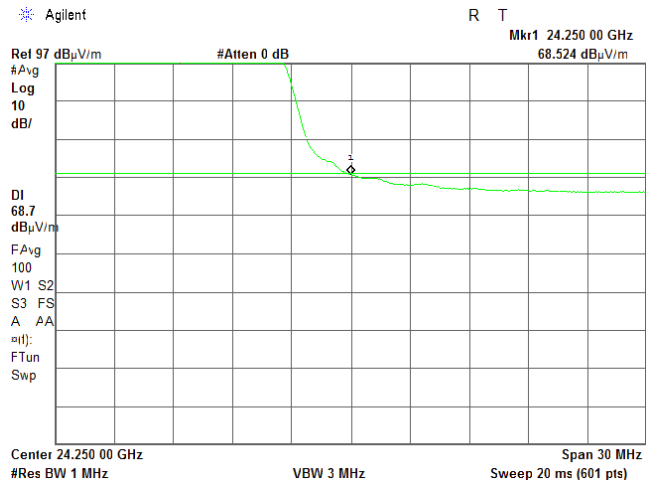
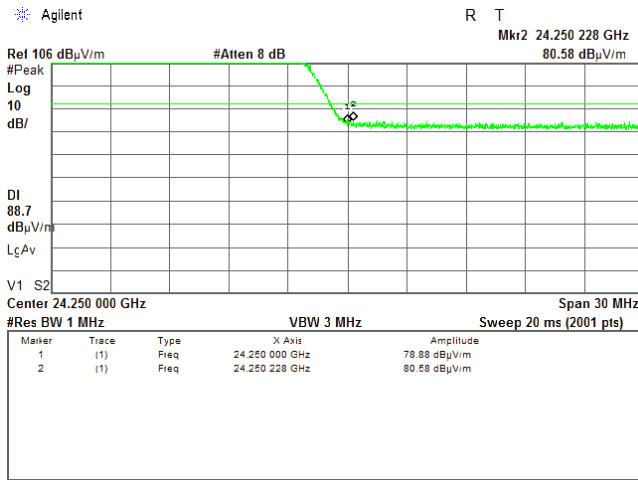
HERMON LABORATORIES

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

Plot 7.5.15 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

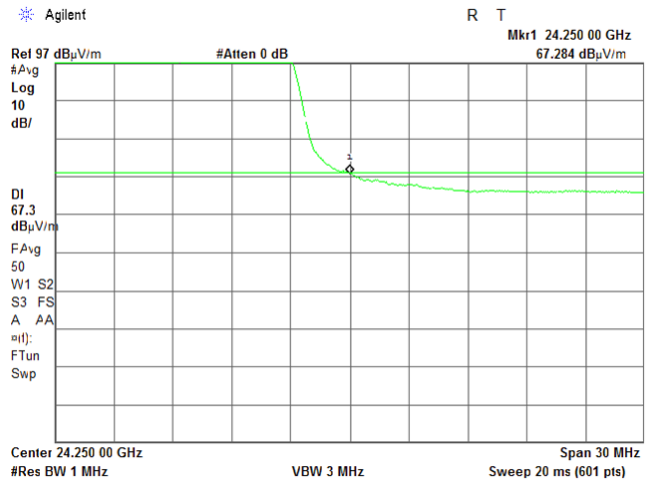
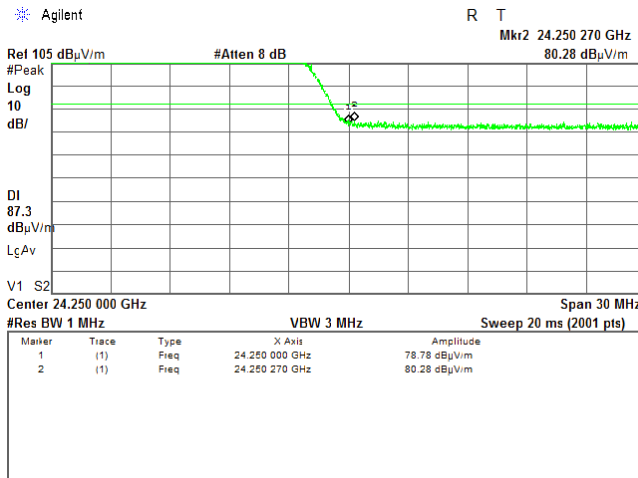
OATS  
0.75 m  
Vertical and Horizontal  
Typical (Vertical)  
30 MHz  
2048QAM



Plot 7.5.16 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
30 MHz  
2048QAM





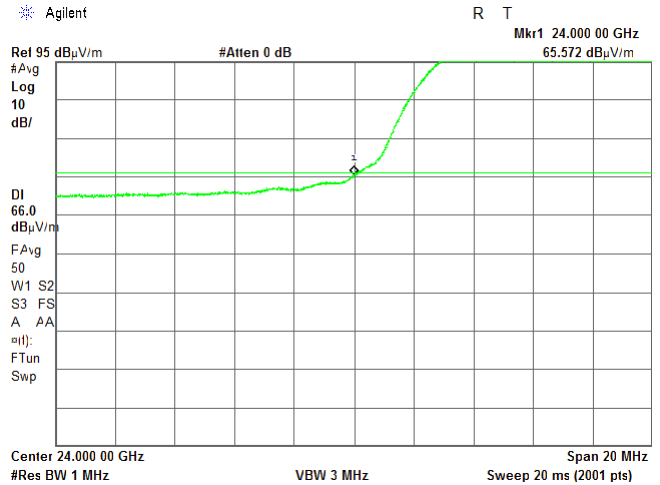
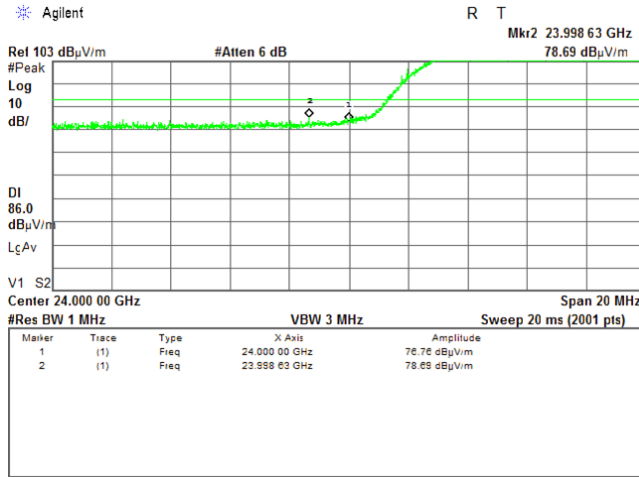
HERMON LABORATORIES

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

Plot 7.5.17 Low band edge emission test result

TEST SITE:  
 TEST DISTANCE:  
 ANTENNA POLARIZATION:  
 EUT POSITION:  
 EMISSION BANDWIDTH:  
 MODULATION:

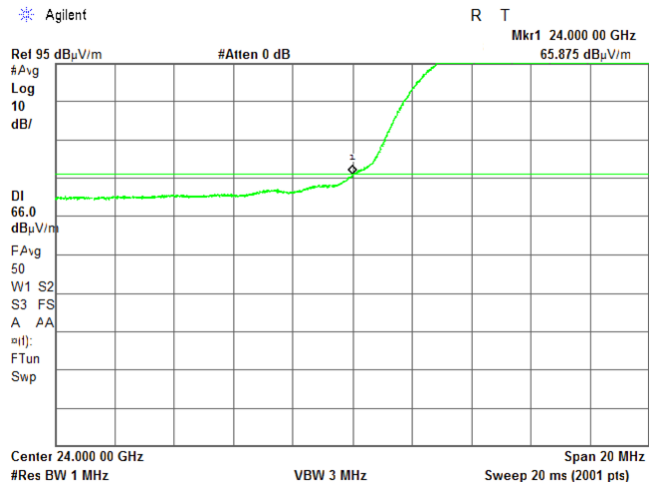
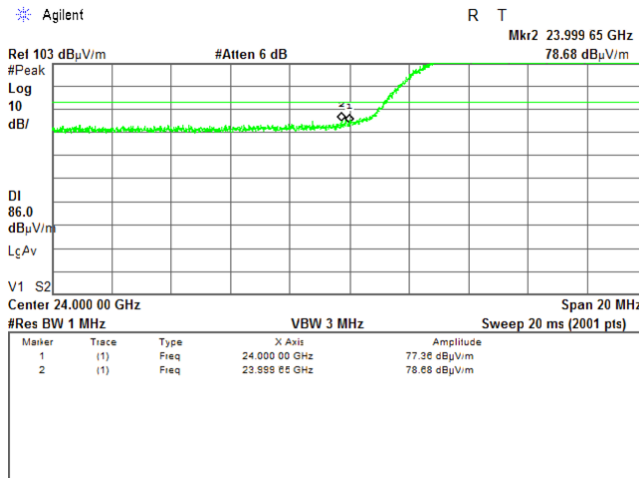
OATS  
 0.75 m  
 Vertical  
 Typical (Vertical)  
 40 MHz  
 QPSK



Plot 7.5.18 Low band edge emission test result

TEST SITE:  
 TEST DISTANCE:  
 ANTENNA POLARIZATION:  
 EUT POSITION:  
 EMISSION BANDWIDTH:  
 MODULATION:

OATS  
 0.75 m  
 Horizontal  
 Typical (Vertical)  
 40 MHz  
 QPSK





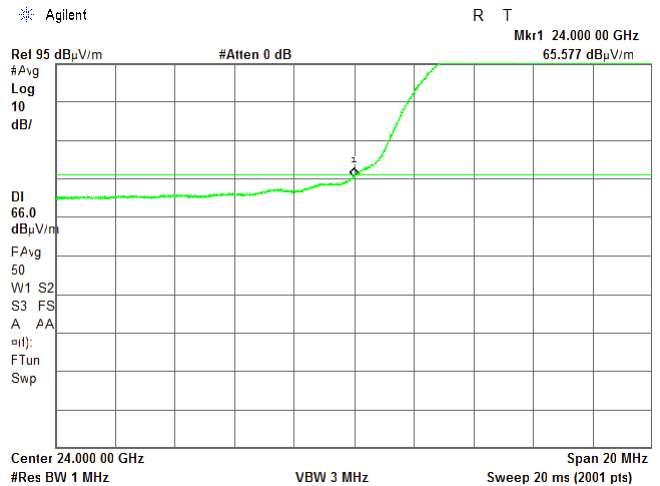
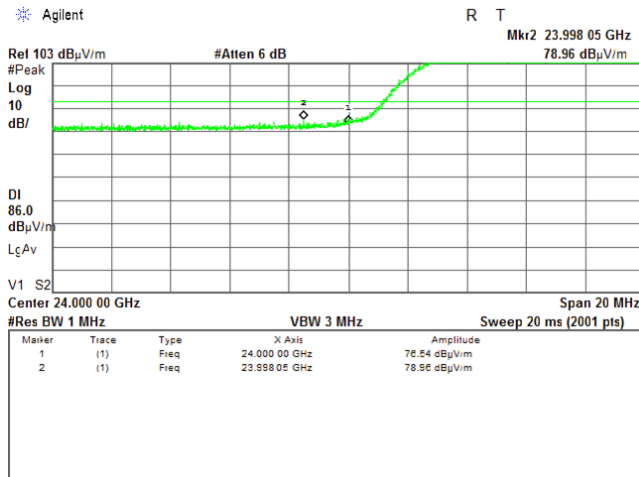
HERMON LABORATORIES

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

Plot 7.5.19 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

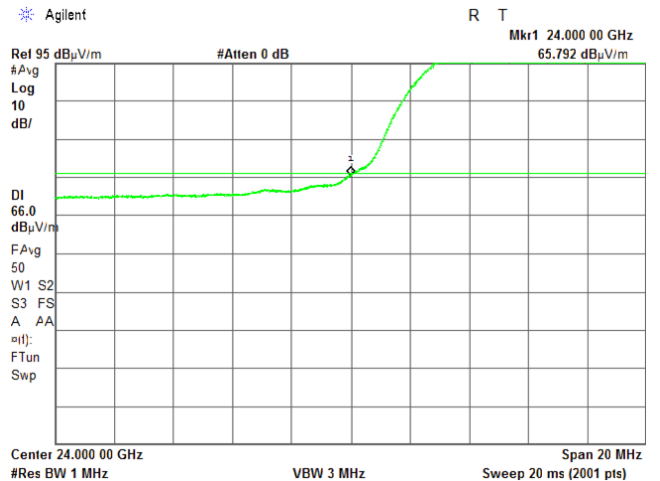
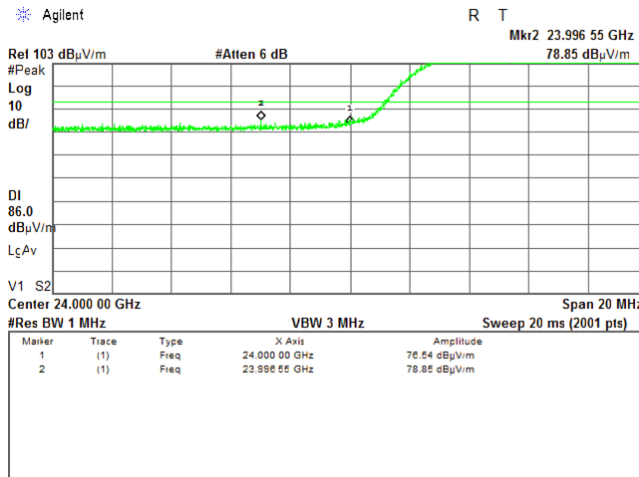
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
40 MHz  
2048QAM



Plot 7.5.20 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
40 MHz  
2048QAM





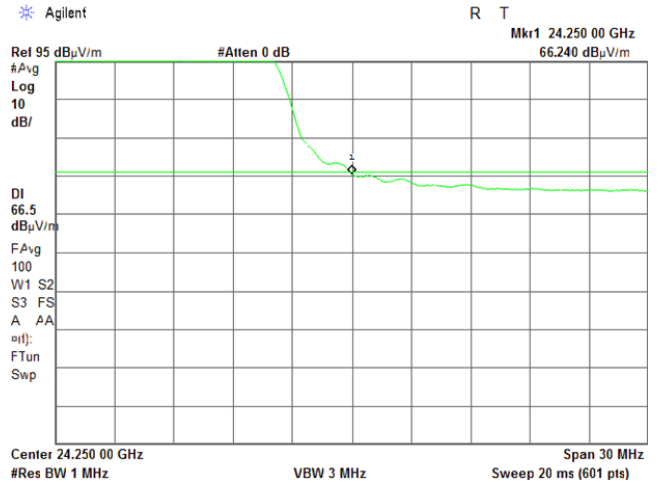
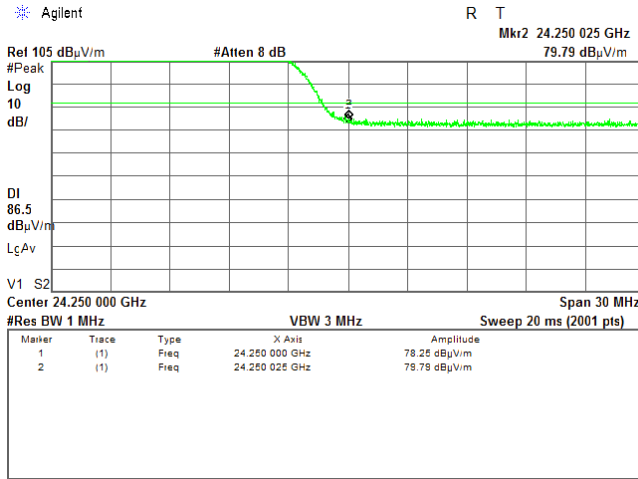
HERMON LABORATORIES

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

Plot 7.5.21 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

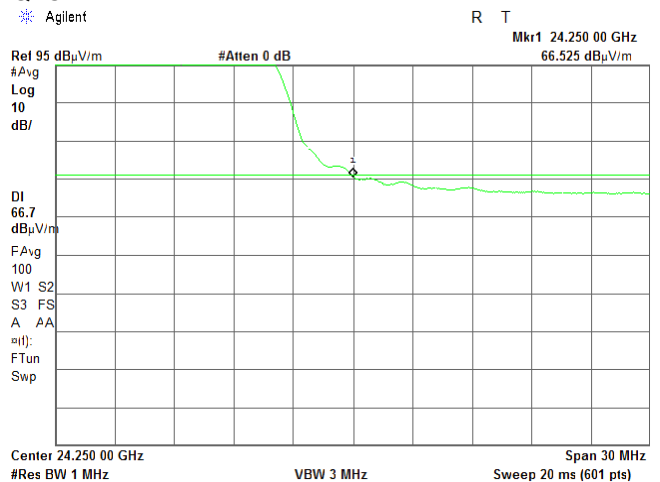
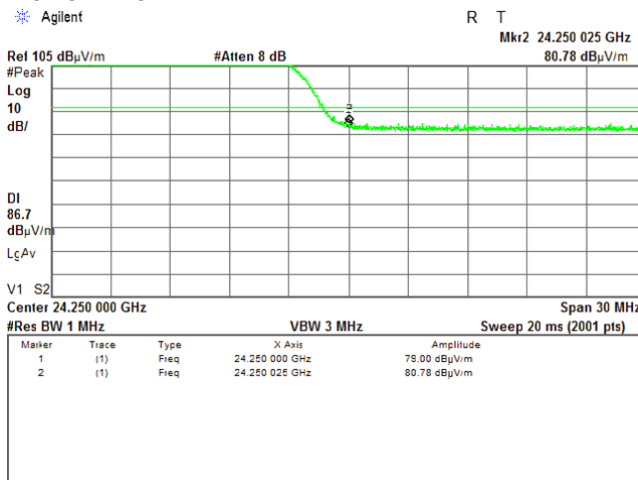
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
40 MHz  
QPSK



Plot 7.5.22 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
40 MHz  
QPSK





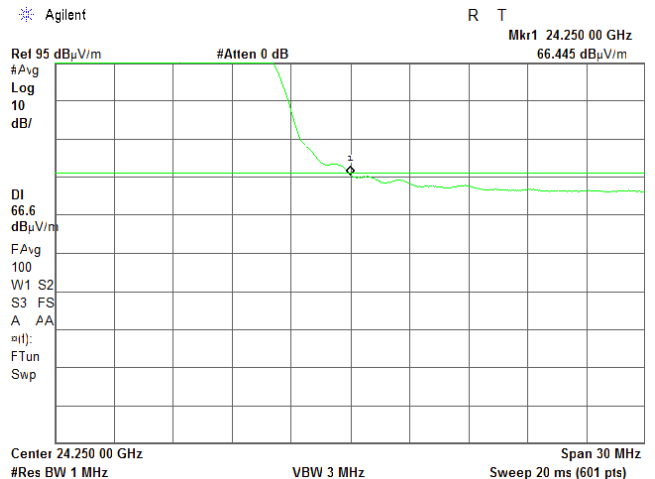
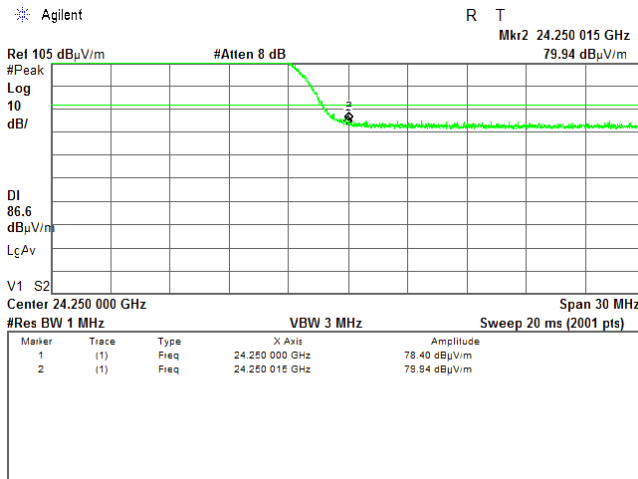
HERMON LABORATORIES

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

Plot 7.5.23 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

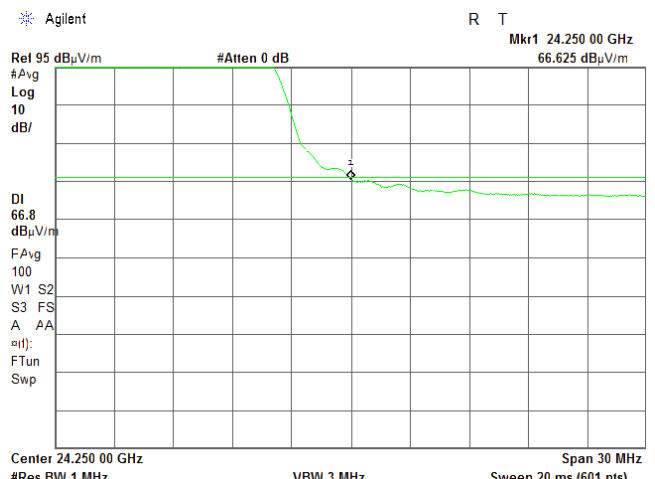
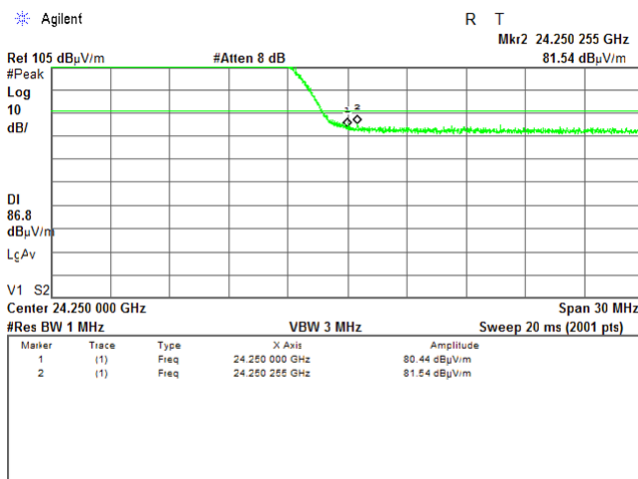
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
40 MHz  
2048QAM



Plot 7.5.24 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
40 MHz  
2048QAM







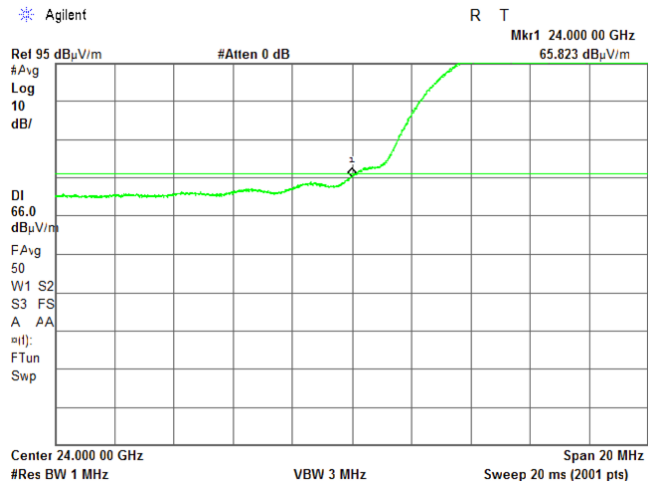
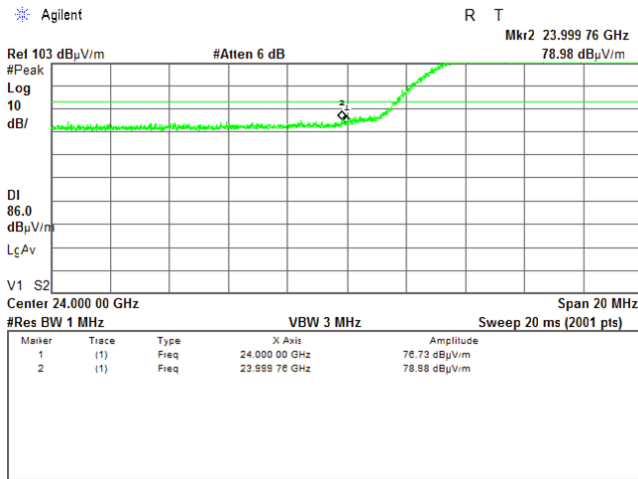
HERMON LABORATORIES

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

Plot 7.5.25 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

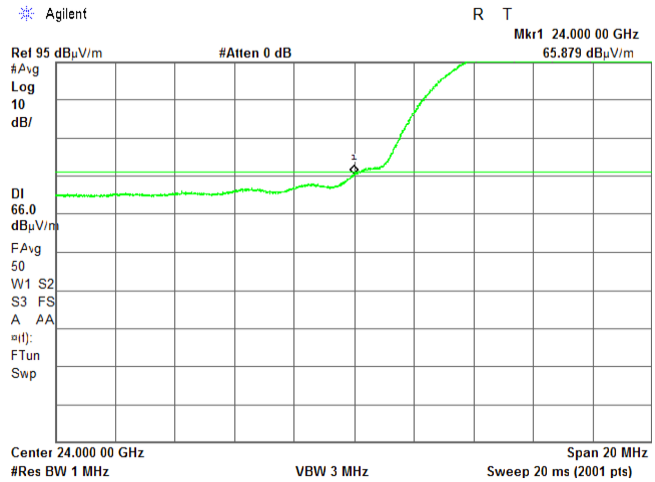
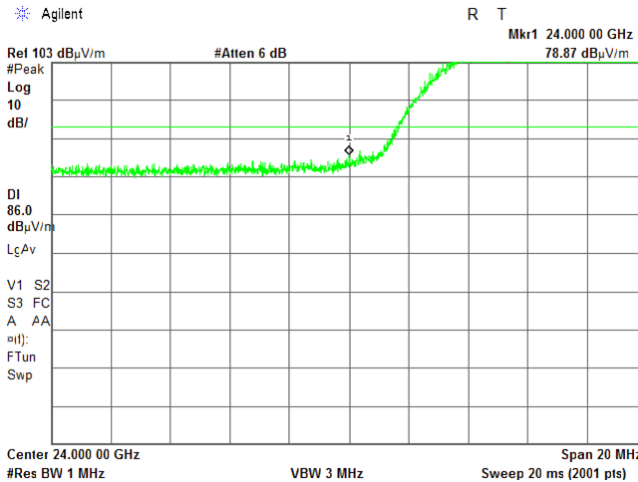
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
50 MHz  
QPSK



Plot 7.5.26 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
50 MHz  
QPSK





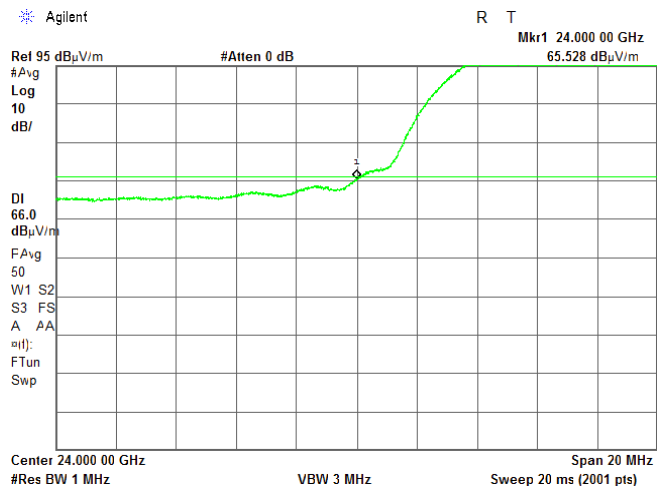
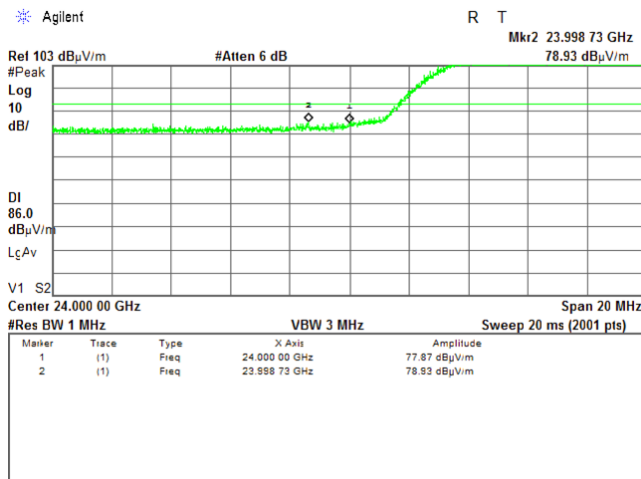
HERMON LABORATORIES

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

Plot 7.5.27 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

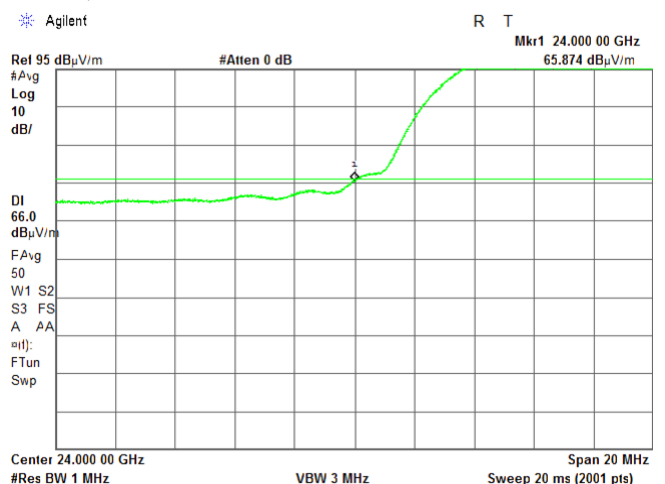
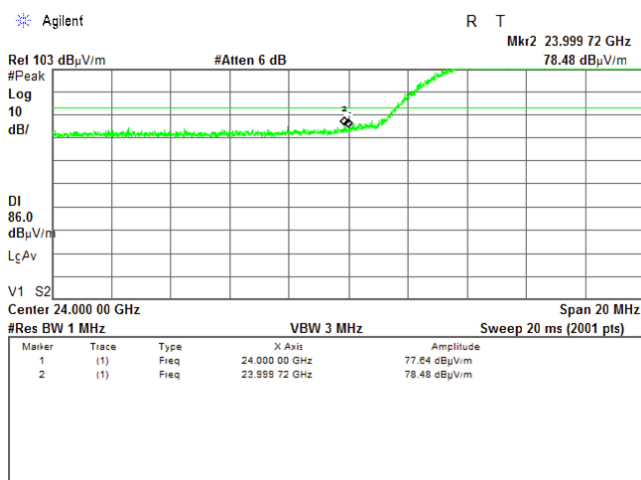
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
50 MHz  
2048 QAM



Plot 7.5.28 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
50 MHz  
2048 QAM





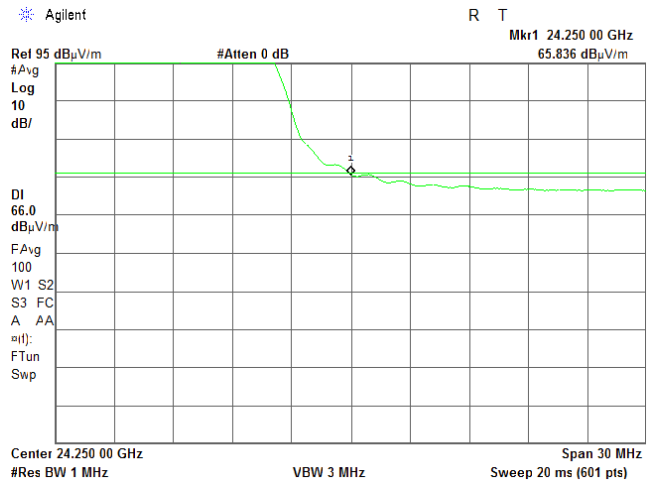
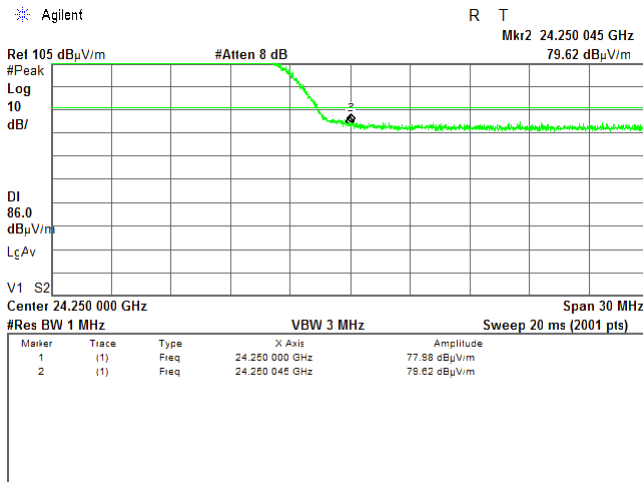
HERMON LABORATORIES

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

Plot 7.5.29 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

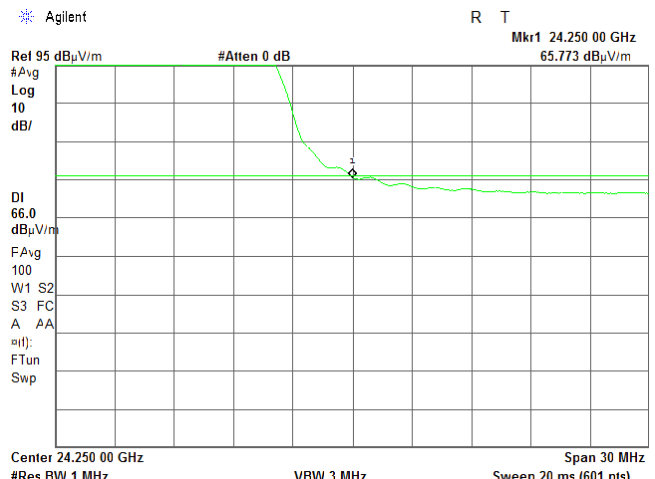
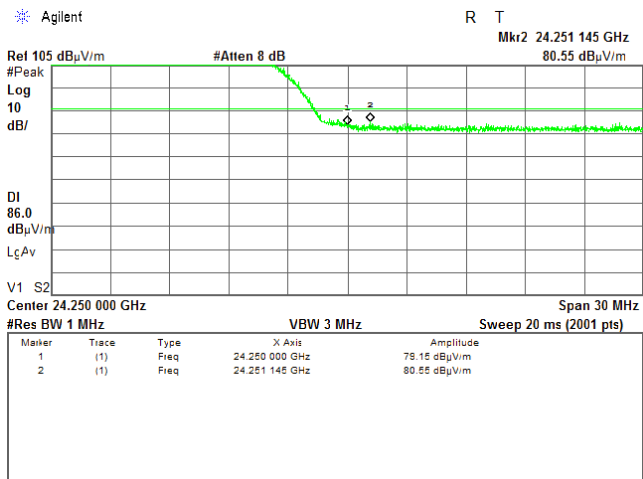
OATS  
0.75 m  
Vertical and Horizontal  
Typical (Vertical)  
50 MHz  
QPSK



Plot 7.5.30 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
50 MHz  
QPSK





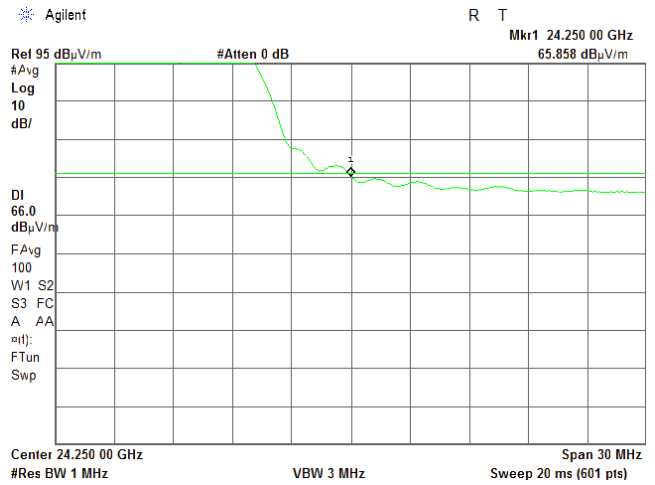
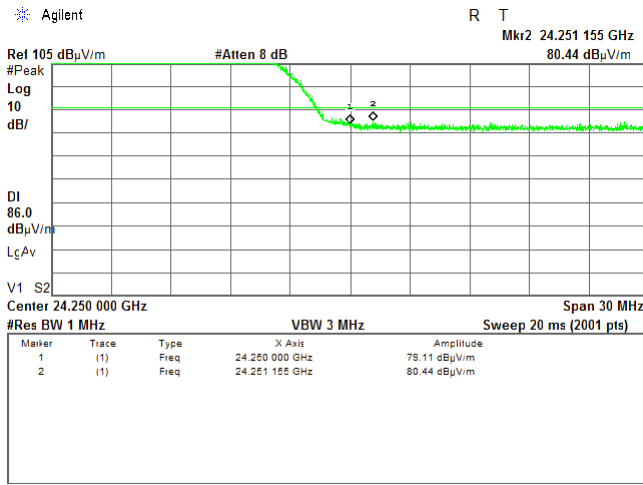
HERMON LABORATORIES

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

**Plot 7.5.31 High band edge emission test result**

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

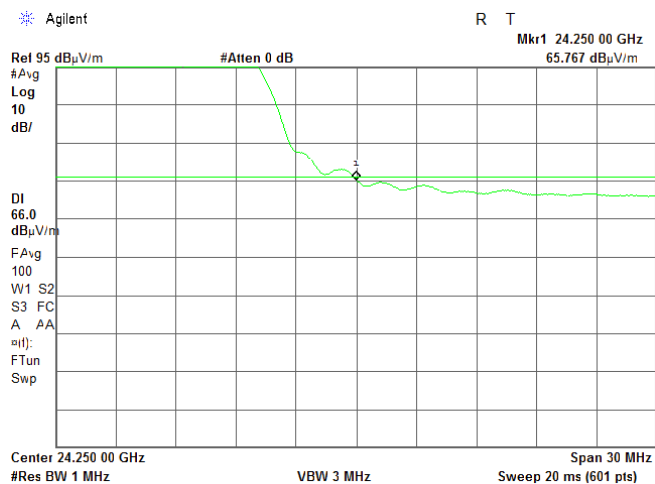
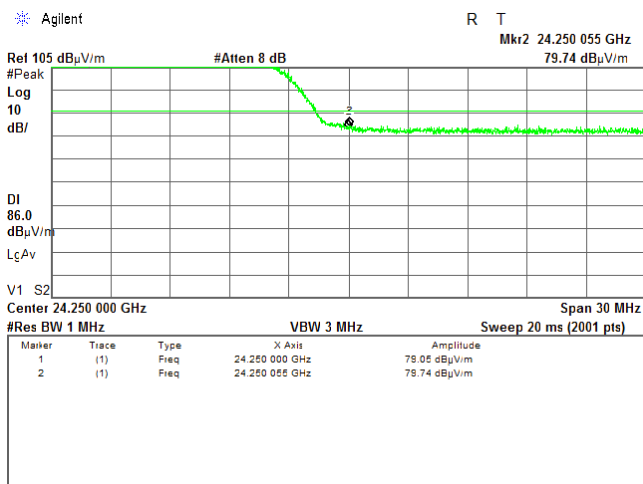
OATS  
0.75 m  
Vertical and Horizontal  
Typical (Vertical)  
50 MHz  
2048 QAM



**Plot 7.5.32 High band edge emission test result**

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
50 MHz  
2048 QAM





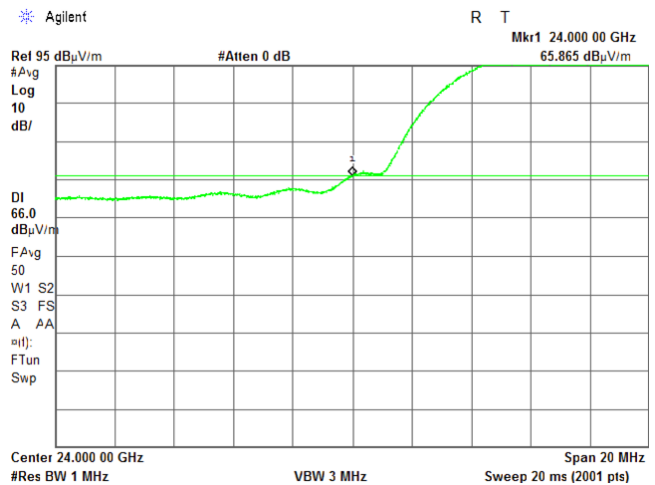
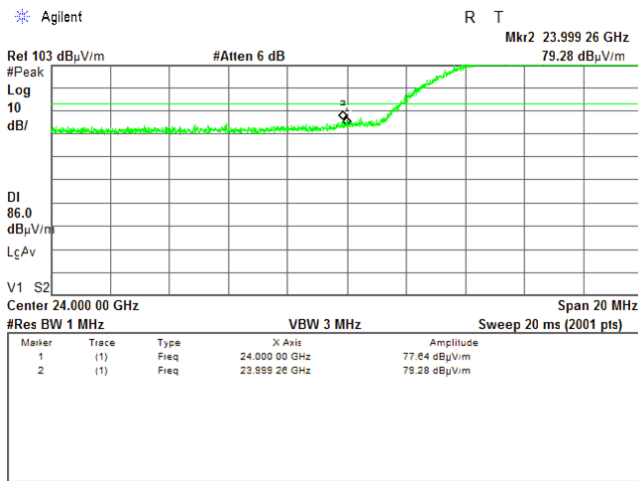
HERMON LABORATORIES

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

Plot 7.5.33 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:

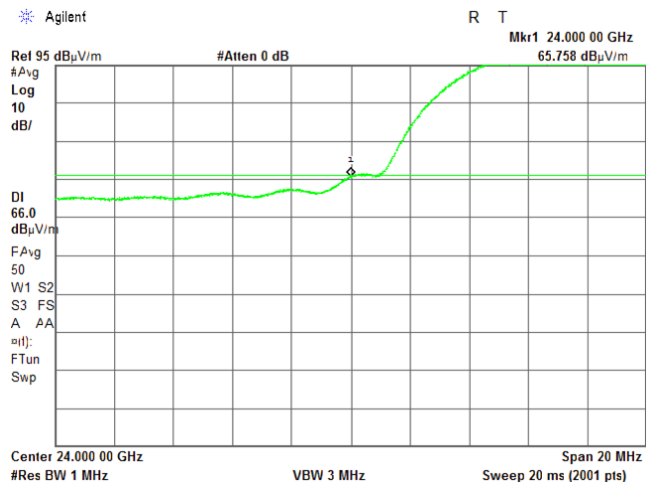
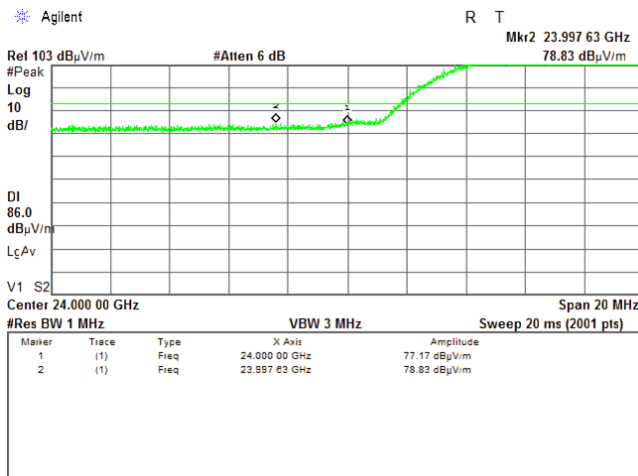
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
60 MHz



Plot 7.5.34 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
60 MHz  
QPSK





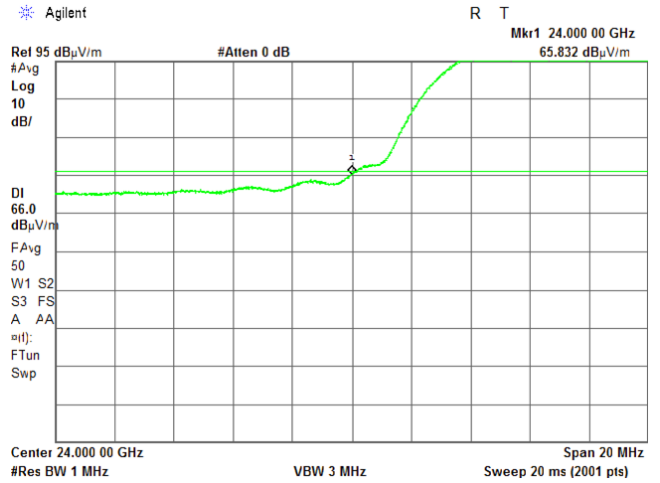
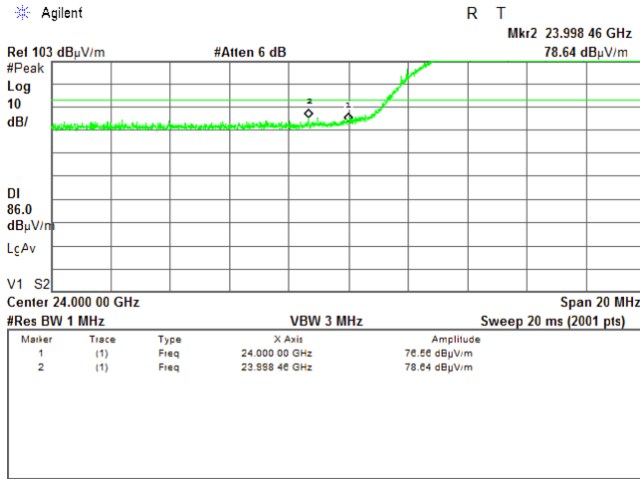
HERMON LABORATORIES

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

Plot 7.5.35 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

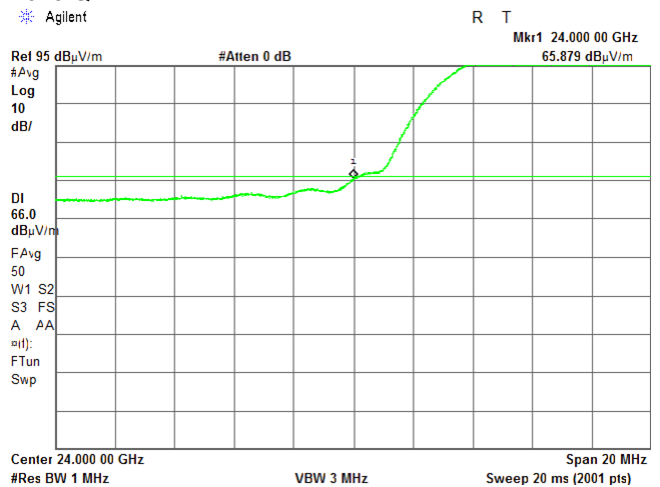
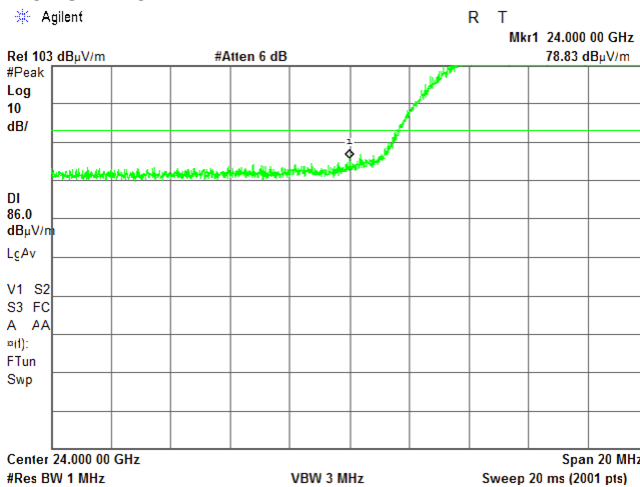
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
60 MHz  
2048 QAM



Plot 7.5.36 Low band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
60 MHz  
2048 QAM





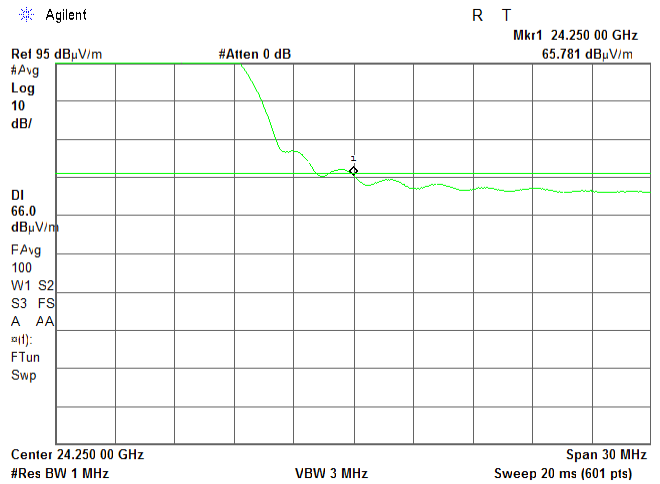
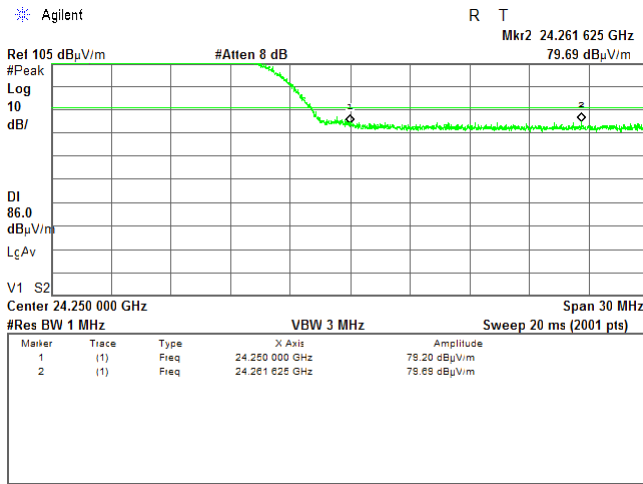
HERMON LABORATORIES

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

Plot 7.5.37 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

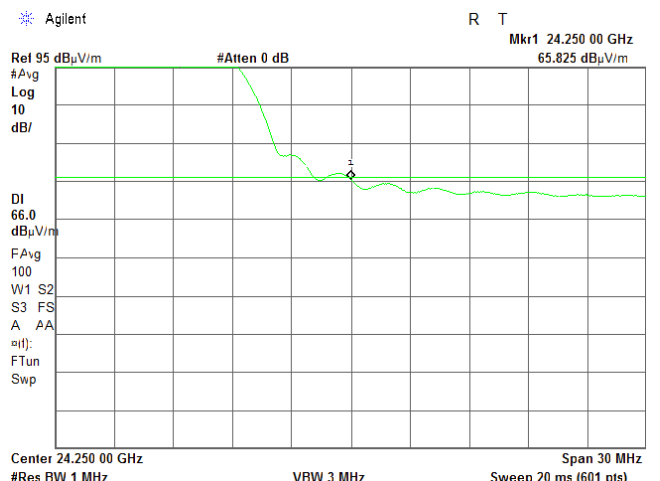
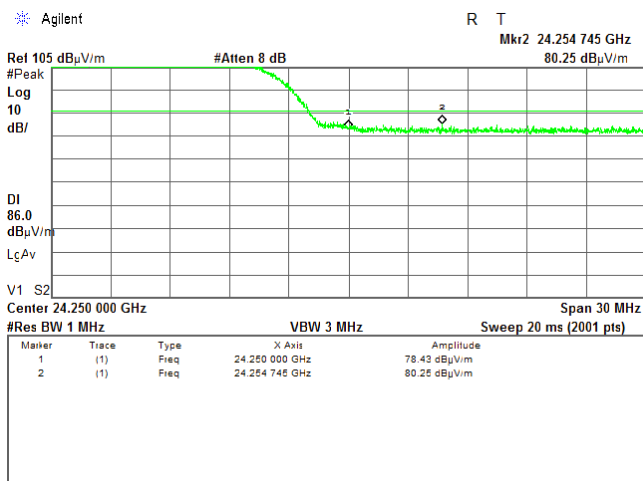
OATS  
0.75 m  
Vertical  
Typical (Vertical)  
60 MHz  
QPSK



Plot 7.5.38 High band edge emission test result

TEST SITE:  
TEST DISTANCE:  
ANTENNA POLARIZATION:  
EUT POSITION:  
EMISSION BANDWIDTH:  
MODULATION:

OATS  
0.75 m  
Horizontal  
Typical (Vertical)  
60 MHz  
QPSK





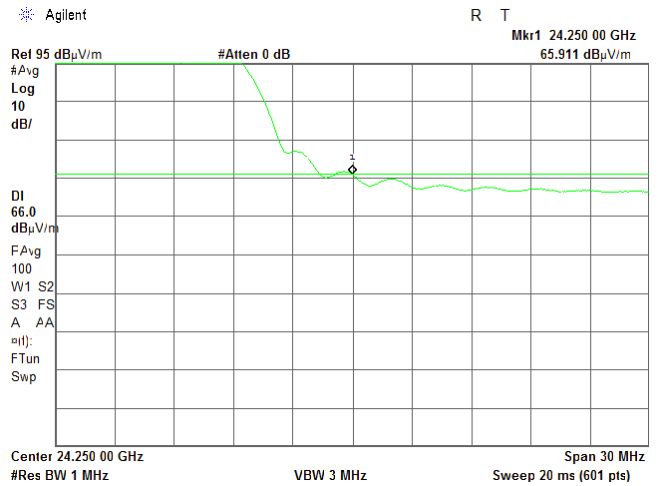
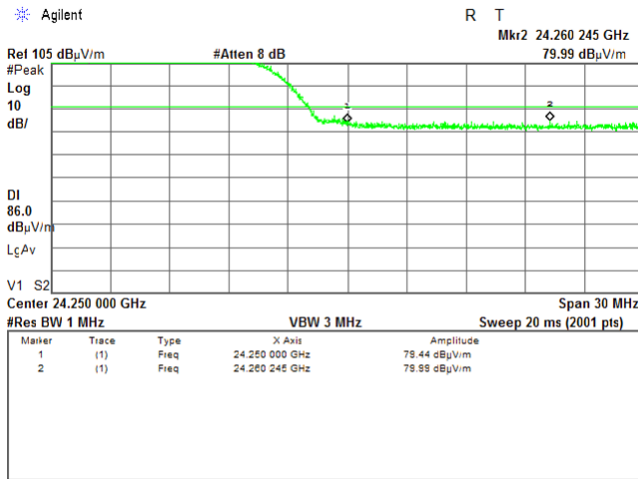
HERMON LABORATORIES

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

Plot 7.5.39 High band edge emission test result

TEST SITE:  
 TEST DISTANCE:  
 ANTENNA POLARIZATION:  
 EUT POSITION:  
 EMISSION BANDWIDTH:  
 MODULATION:

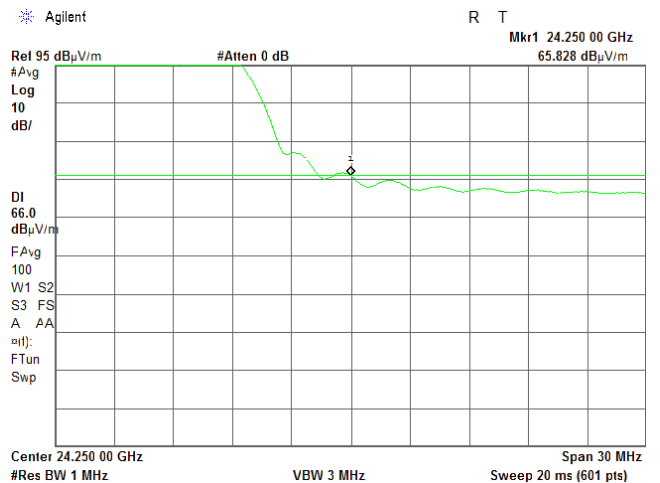
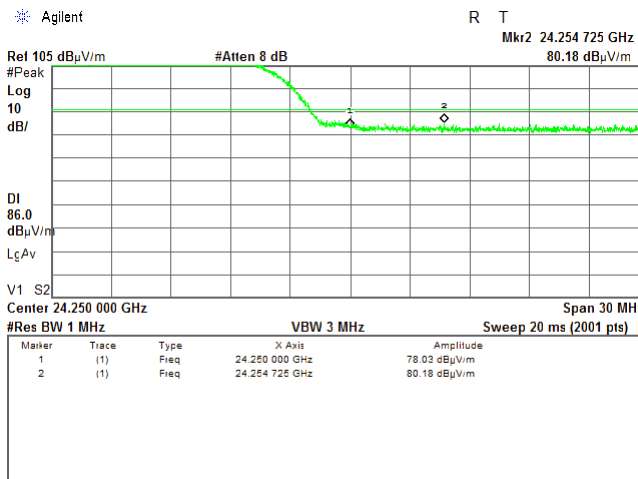
OATS  
 0.75 m  
 Vertical  
 Typical (Vertical)  
 60 MHz  
 2048QAM



Plot 7.5.40 High band edge emission test result

TEST SITE:  
 TEST DISTANCE:  
 ANTENNA POLARIZATION:  
 EUT POSITION:  
 EMISSION BANDWIDTH:  
 MODULATION:

OATS  
 0.75 m  
 Horizontal  
 Typical (Vertical)  
 60 MHz  
 2048QAM







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

## 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

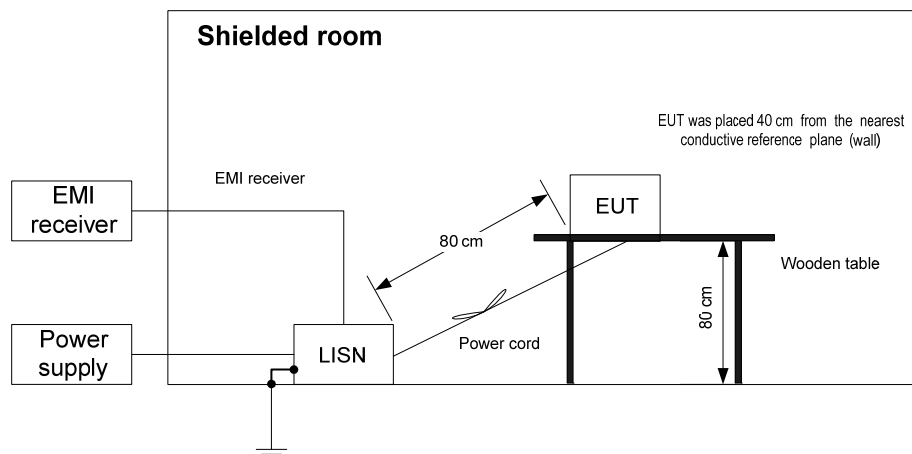
| Frequency, MHz | Class B limit, dB(μV) |          |
|----------------|-----------------------|----------|
|                | QP                    | AVRG     |
| 0.15 - 0.5     | 66 - 56*              | 56 - 46* |
| 0.5 - 5.0      | 56                    | 46       |
| 5.0 - 30       | 60         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





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

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.

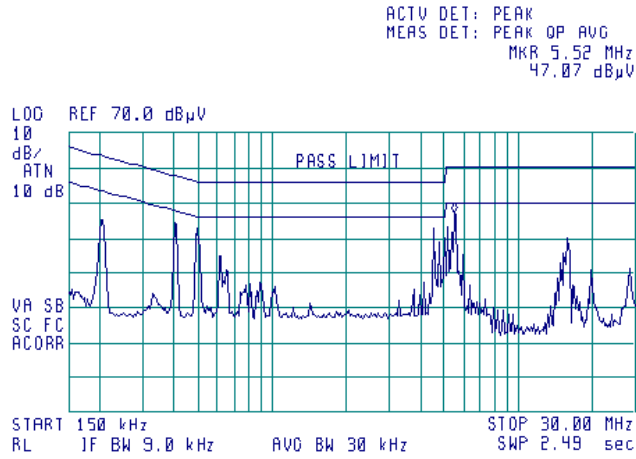


HERMON LABORATORIES

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

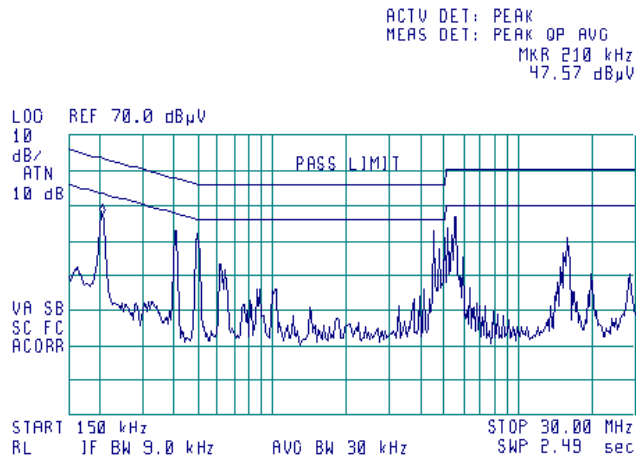
**Plot 7.6.1 Conducted emission measurements**

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





|  |                                |                               |                       |
|--|--------------------------------|-------------------------------|-----------------------|
| <b>Test specification:</b> Section 15.203/ RSS-Gen, Section 8.3, Antenna requirement |                                |                               |                       |
| <b>Test procedure:</b> Visual inspection / supplier declaration                      |                                |                               |                       |
| <b>Test mode:</b> Compliance   |                                | <b>Verdict:</b> PASS          |                       |
| <b>Date(s):</b> 04-Sep-17  |                                |                               |                       |
| <b>Temperature:</b> 24.3 °C  | <b>Relative Humidity:</b> 44 % | <b>Air Pressure:</b> 1011 hPa | <b>Power:</b> -48 VDC |
| <b>Remarks:</b>  |                                |                               |                       |

### 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/5500M | 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: $\pm 3.9$ dB<br>150 kHz to 30 MHz: $\pm 3.8$ dB  |
| Radiated emissions at 10 m measuring distance<br>Horizontal polarization<br><br>Vertical polarization | Biconilog antenna: $\pm 5.0$ dB<br>Biconical antenna: $\pm 5.0$ dB<br>Log periodic antenna: $\pm 5.1$ dB<br>Double ridged horn antenna: $\pm 5.3$ dB<br>Biconilog antenna: $\pm 5.5$ dB<br>Biconical antenna: $\pm 5.5$ dB<br>Log periodic antenna: $\pm 5.6$ dB<br>Double ridged horn antenna: $\pm 5.8$ dB |
| Radiated emissions at 3 m measuring distance<br>Horizontal polarization<br><br>Vertical polarization  | Biconilog antenna: $\pm 5.3$ dB<br>Biconical antenna: $\pm 5.0$ dB<br>Log periodic antenna: $\pm 5.3$ dB<br>Double ridged horn antenna: $\pm 5.3$ dB<br>Biconilog antenna: $\pm 6.0$ dB<br>Biconical antenna: $\pm 5.7$ dB<br>Log periodic antenna: $\pm 6.0$ dB<br>Double ridged horn antenna: $\pm 6.0$ dB |
| Conducted emissions at RF antenna connector   | 9 kHz to 2.9 GHz: $\pm 2.6$ dB<br>2.9 GHz to 6.46 GHz: $\pm 3.5$ dB<br>6.46 GHz to 13.2 GHz: $\pm 4.3$ dB<br>13.2 GHz to 22.0 GHz: $\pm 5.0$ dB<br>22.0 GHz to 26.8 GHz: $\pm 5.5$ dB<br>26.8 GHz to 40.0 GHz: $\pm 4.8$ dB  |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements                                      | $\pm 1.0$ %  |
| Occupied bandwidth  | $\pm 8.0$ %  |

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( $\mu$ V) to convert it into field strength in dB( $\mu$ V/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( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/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( $\mu$ V) to convert it into field strength in dB( $\mu$ V/m).



Antenna factor, HL 4933



### Active Horn Antenna Calibration

1 GHz to 18 GHz

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

| 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



Active Horn Antenna Factor Calibration

18 GHz to 40 GHz

| <b>Equipment:</b>  |                              |  | <b>ACTIVE HORN ANTENNA</b> |                              |  |
|--|------------------------------|--|----------------------------|------------------------------|--|
| <b>Model:</b>  |                              |  | <b>AHA-840</b>             |                              |  |
| <b>Serial Number:</b>  |                              |  | <b>105004</b>              |                              |  |
| <b>Calibration Distance:</b>   |                              |  | <b>3 meter</b>             |                              |  |
| <b>Polarization:</b>   |                              |  | <b>Horizontal</b>          |                              |  |
| <b>Calibration Date:</b>   |                              |  | <b>1/26/2015</b>           |                              |  |
| Frequency<br>(GHz)   | Preamplifier<br>Gain<br>(dB) | Antenna Factor<br>with pre-amp<br>(dB/m) | Frequency<br>(GHz)         | Preamplifier<br>Gain<br>(dB) | Antenna Factor<br>with pre-amp<br>(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                                    |
| <p>Calibration per ANSI C63.5: 2006<br/> <b>Standard Site Method, Equations 1-6 (3-antenna)</b></p> <p>Corrected Reading (dBµV/m) = Meter Reading (dBµV) + AFE(dB/m)</p> |                              |  |                            |                              |  |



**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**

| <b>Frequency,<br/>MHz</b> | <b>Cable loss,<br/>dB</b> | <b>Frequency,<br/>MHz</b> | <b>Cable loss,<br/>dB</b> |
|---------------------------|---------------------------|---------------------------|---------------------------|
| 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( $\mu$ V)   | decibel referred to one microvolt           |
| dB( $\mu$ V/m) | decibel referred to one microvolt per meter |
| dB( $\mu$ A)   | 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                                 |
| $\mu$ s        | microsecond                                 |
| NA             | not applicable                              |
| NB             | narrow band                                 |
| OATS           | open area test site                         |
| $\Omega$       | 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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