



<b>Test specification: Section 90.219(e)(3), Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

## 7.6 Radiated spurious emission measurements

### 7.6.1 General

This test was performed to measure radiated spurious emissions from the EUT. Specification test limits are given in Table 7.6.1.

**Table 7.6.1 Radiated spurious emission test limits**

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm	Equivalent field strength limit @ 3m, dB( $\mu$ V/m) <sup>***</sup>
0.009 – 10 <sup>th</sup> harmonic*	43+10logP <sup>**</sup>	-13	84.4

\* - Excluding the in band emission within  $\pm 250$  % of the authorized bandwidth from the carrier

\*\* - P is transmitter output power in Watts

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

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

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

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

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

### 7.6.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.6.3.1 The EUT was set up as shown in Figure 7.6.2, energized and the performance check was conducted.

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

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

### 7.6.4 Test procedure for substitution ERP measurements of spurious

7.6.4.1 The test equipment was set up as shown in Figure 7.6.3 and energized.

7.6.4.2 RF signal generator was set to the frequency of investigated spurious emission and the RF output level was preliminary adjusted to produce the same field strength as it was measured from the EUT.

7.6.4.3 The test antenna height was swept from 1 to 4 m to find maximum emission from substitution antenna and RF signal generator output was fine adjusted to produce the same field strength as it was measured from the EUT.

7.6.4.4 The above procedure was performed in both, horizontal and vertical, polarizations of the test and substitution antennas.

7.6.4.5 The ERP of spurious emissions was calculated as a sum of signal generator output power in dBm and antenna gain in dBd reduced by cable loss in dB.

7.6.4.6 The above procedure was repeated at the rest of investigated frequencies.

7.6.4.7 The worst test results (the lowest margins) were recorded in Table 7.6.3 and shown in the associated plots.



<b>Test specification: Section 90.219(e)(3), Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Figure 7.6.1 Setup for spurious emission field strength measurements in 9 kHz to 30 MHz band

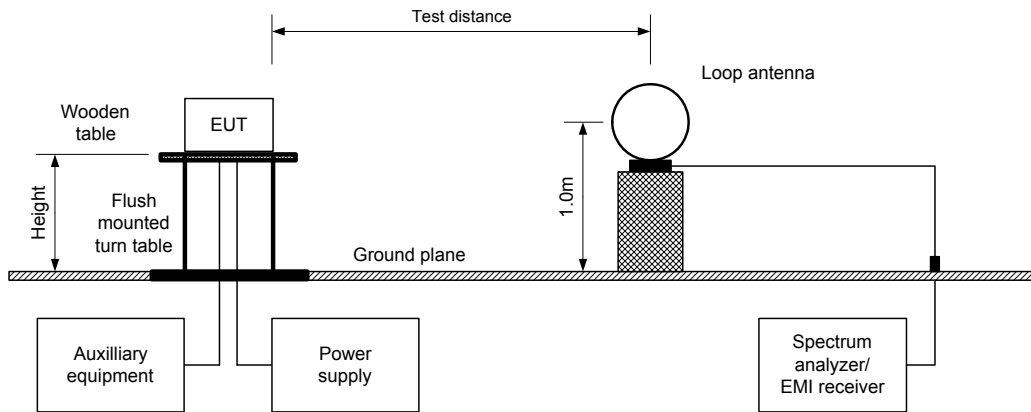
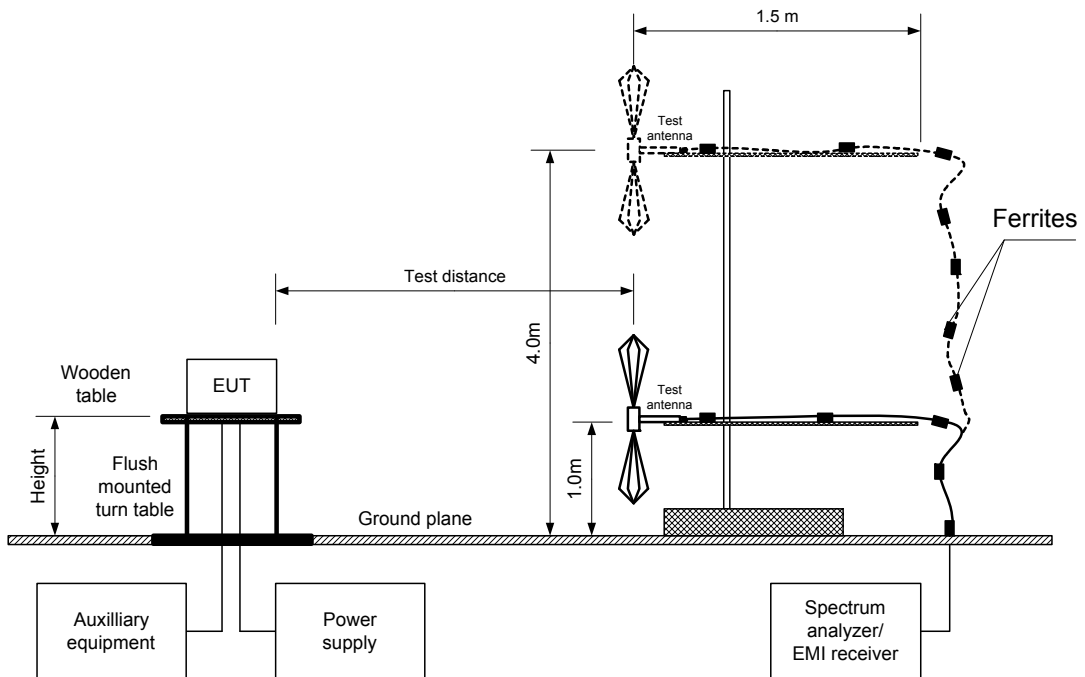


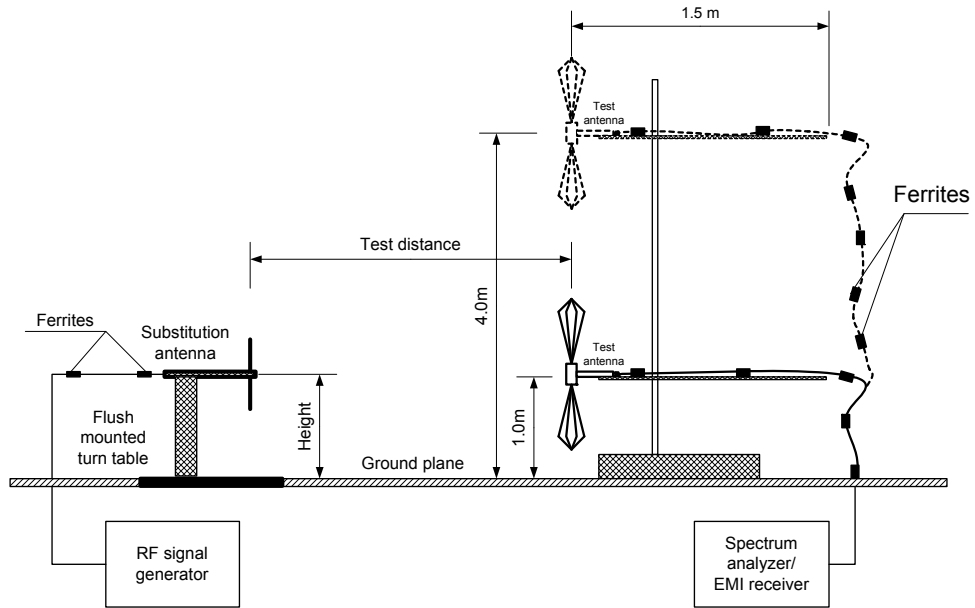
Figure 7.6.2 Setup for spurious emission field strength measurements above 30 MHz





<b>Test specification:</b> Section 90.219(e)(3), Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS		
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Figure 7.6.3 Setup for substitution ERP measurements of spurious





<b>Test specification: Section 90.219(e)(3), Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Table 7.6.2 Spurious emission field strength test results**

OPERATING FREQUENCY RANGE: 421.363 – 423.075 MHz Downlink  
426.363 – 428.075 MHz Uplink

TEST DISTANCE: 3 m

TEST SITE: Semi anechoic chamber

EUT HEIGHT: 0.8 m and 1.5 m

INVESTIGATED FREQUENCY RANGE: 0.009 – 5000 MHz

DETECTOR USED: Peak

VIDEO BANDWIDTH: > Resolution bandwidth

TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)  
Biconilog (30 MHz – 1000 MHz)  
Double ridged guide (above 1000 MHz)

MODULATION: Unmodulated

TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	Field strength, dB(µV/m)	Limit, dB(µV/m)	Margin, dB*	RBW, kHz	Antenna polarization	Antenna height, m	Turn-table position**, degrees	Verdict
<b>Downlink</b>								
<b>Low carrier frequency</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>Mid carrier frequency</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>High carrier frequency</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>Uplink</b>								
<b>Low carrier frequency</b>								
3220.390000	68.29	84.4	-16.11	1000	H	1.00	149	Pass
<b>Mid carrier frequency</b>								
3220.519833	69.64	84.4	-14.76	1000	H	1.00	145	Pass
<b>High carrier frequency</b>								
3220.519833	69.22	84.4	-15.18	1000	H	1.02	145	Pass

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



<b>Test specification:</b> Section 90.219(e)(3), Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Table 7.6.3 Substitution ERP of spurious test results

OPERATING FREQUENCY RANGE: 421.363 – 423.075 MHz Downlink  
426.363 – 428.075 MHz Uplink

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

SUBSTITUTION ANTENNA HEIGHT: 0.8 m

DETECTOR USED: Peak

VIDEO BANDWIDTH: > Resolution bandwidth

SUBSTITUTION ANTENNA TYPE: Tunable dipole (30 MHz – 1000 MHz)  
Double ridged guide (above 1000 MHz)

Frequency, MHz	Field strength, dB(µV/m)	RBW, kHz	Antenna polarization	RF generator output, dBm	Ant gain, dBd	Cable loss, dB	ERP, dBm	Limit, dBm	Margin, dB*	Verdict
<b>Downlink</b>										
<b>Low carrier frequency</b>										
All emissions were found more than 20 dB below the limit										Pass
<b>Mid carrier frequency</b>										
All emissions were found more than 20 dB below the limit										Pass
<b>High carrier frequency</b>										
All emissions were found more than 20 dB below the limit										Pass
<b>Uplink</b>										
<b>Low carrier frequency</b>										
3220.3900	68.29	1000	Horizontal	-32.97	5.41	2.93	-30.49	-13.0	-17.49	Pass
<b>Mid carrier frequency</b>										
3220.5198	69.64	100	Horizontal	-31.62	5.41	2.93	-29.14	-13.0	-16.14	Pass
<b>High carrier frequency</b>										
3220.5198	69.22	100	Vertical	-32.04	5.41	2.93	-29.56	-13.0	-16.56	Pass

\*- Margin = Spurious emission – specification limit.

Reference numbers of test equipment used

HL 4360	HL 3903	HL 4011	HL 5311	HL 5309	HL 5288
HL 5085	HL 5405	HL 0446	HL 4933		

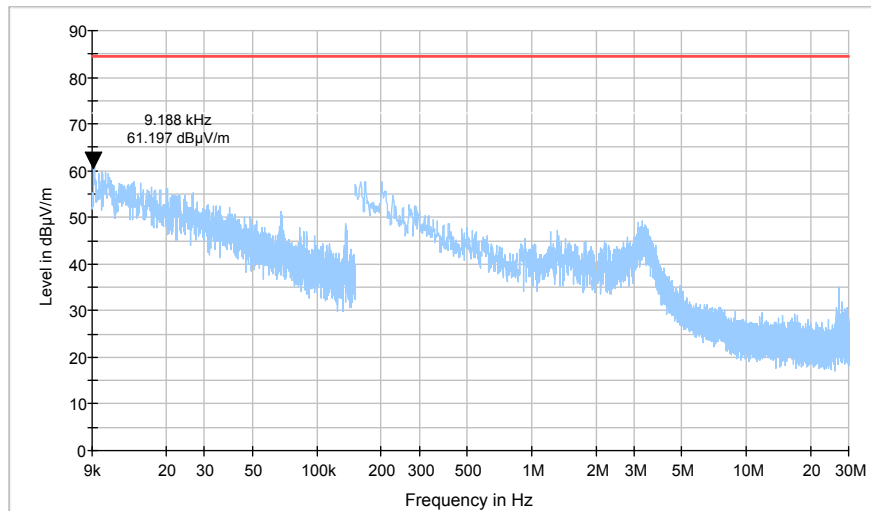
Full description is given in Appendix A.



<b>Test specification:</b> Section 90.219(e)(3), Radiated spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

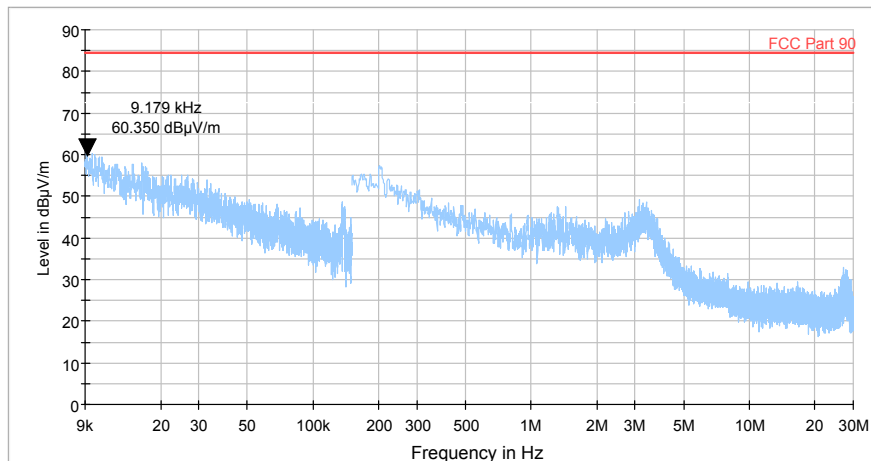
**Plot 7.6.1 Radiated emission measurements in 9 - 30000 kHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Low 421.363 MHz – Downlink  
 426.363 MHz – Uplink  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m



**Plot 7.6.2 Radiated emission measurements in 9 - 30000 kHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Mid 422.525 MHz – Downlink  
 427.525 MHz – Uplink  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

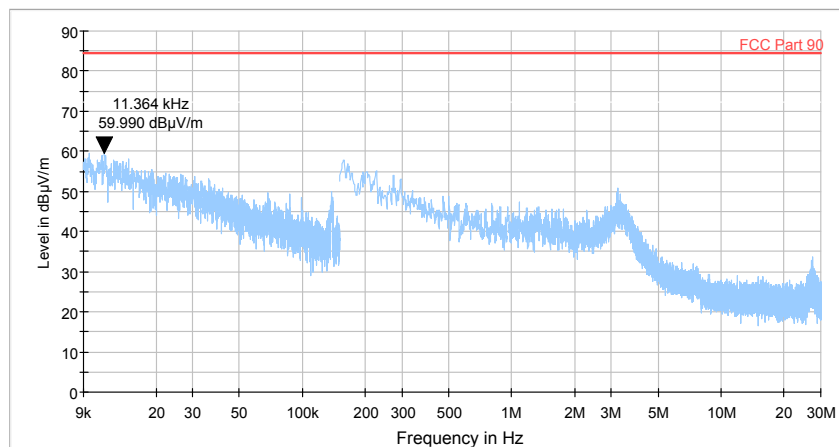




<b>Test specification: Section 90.219(e)(3), Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

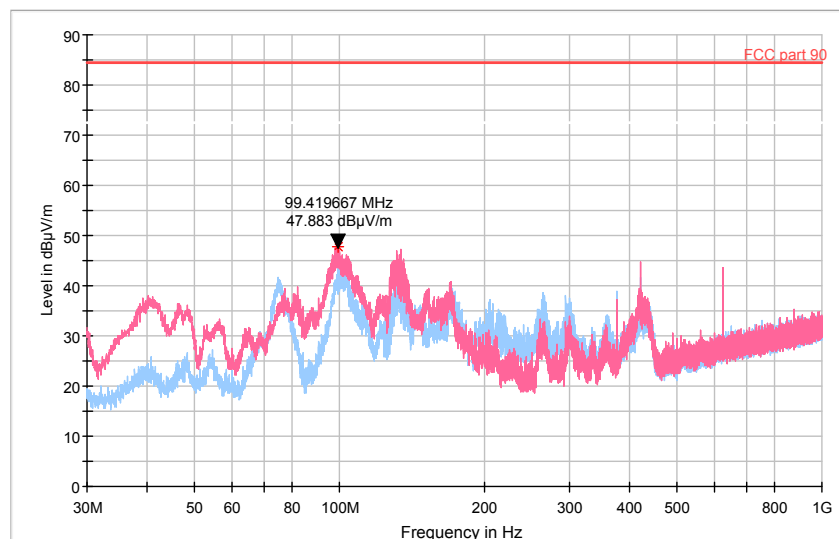
**Plot 7.6.3 Radiated emission measurements in 9 - 30000 kHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: High 423.075 MHz – Downlin  
 428.075 MHz – Uplink  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m



**Plot 7.6.4 Radiated emission measurements in 30 - 1000 MHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Low 421.363 MHz – Downlink  
 426.363 MHz – Uplink  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

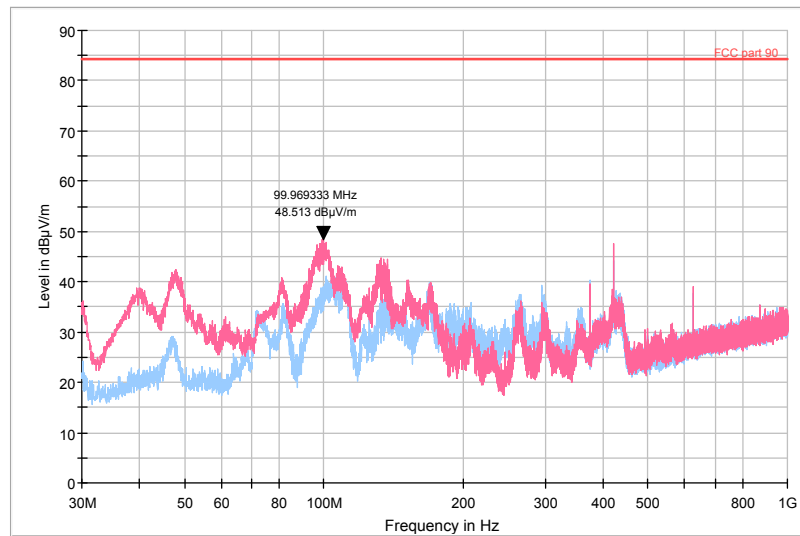




<b>Test specification: Section 90.219(e)(3), Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

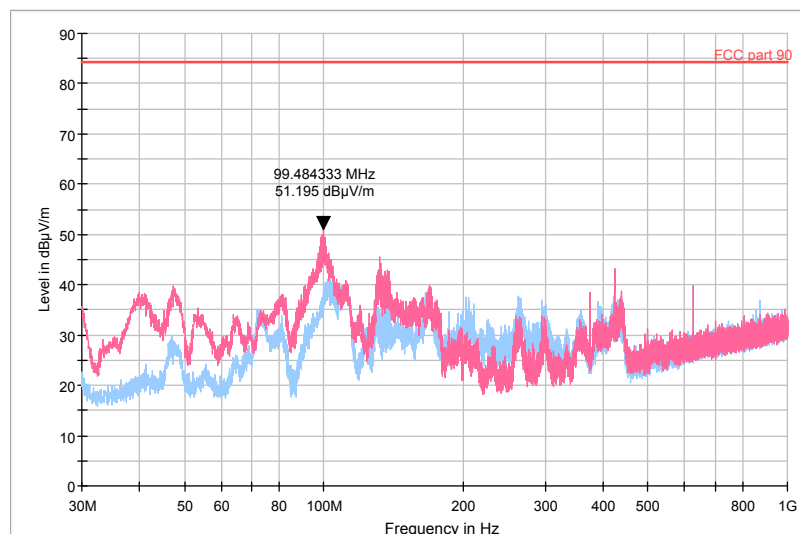
**Plot 7.6.5 Radiated emission measurements in 30 - 1000 MHz range**

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY: Mid	422.525 MHz – Downlink 427.525 MHz – Uplink
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



**Plot 7.6.6 Radiated emission measurements in 30 - 1000 MHz range**

TEST SITE:	Semi anechoic chamber
CARRIER FREQUENCY: High	423.075 MHz – Downlink 428.075 MHz – Uplink
ANTENNA POLARIZATION:	Vertical and Horizontal
TEST DISTANCE:	3 m



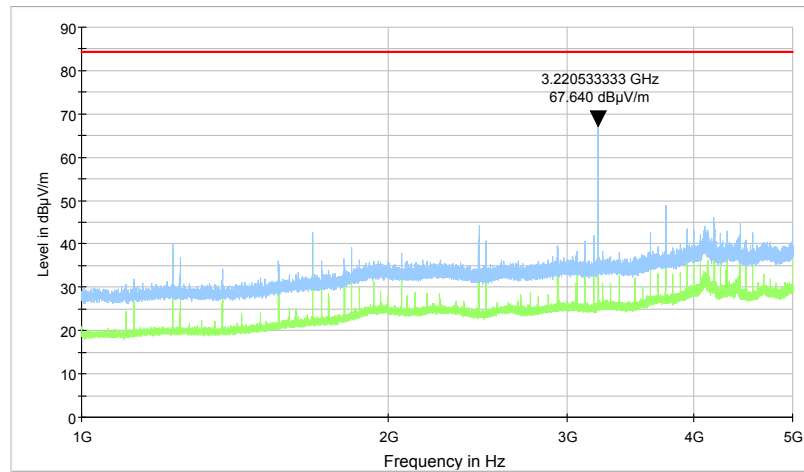




<b>Test specification: Section 90.219(e)(3), Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

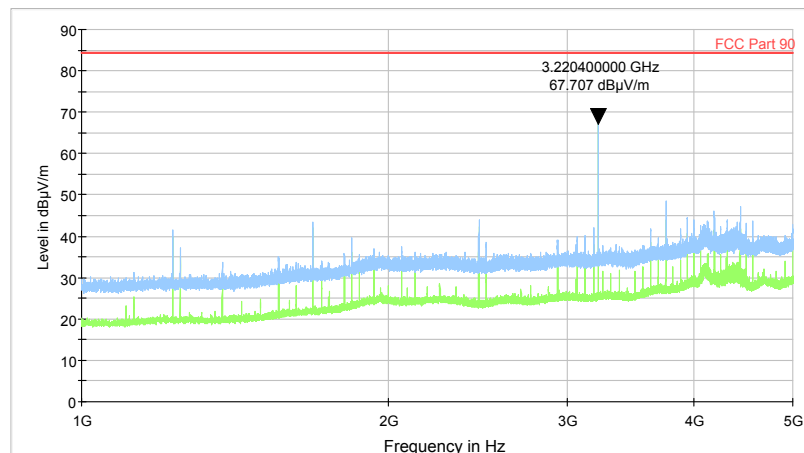
**Plot 7.6.7 Radiated emission measurements in 1000 - 5000 MHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Low 421.363 MHz – Downlink  
 426.363 MHz – Uplink  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m



**Plot 7.6.8 Radiated emission measurements in 1000 - 5000 MHz range**

TEST SITE: Semi anechoic chamber  
 CARRIER FREQUENCY: Mid 422.525 MHz – Downlink  
 427.525 MHz – Uplink  
 ANTENNA POLARIZATION: Vertical and Horizontal  
 TEST DISTANCE: 3 m

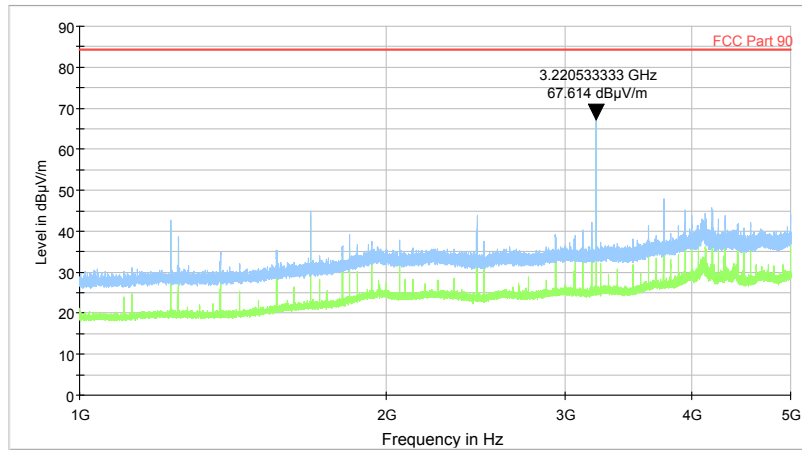




<b>Test specification: Section 90.219(e)(3), Radiated spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1053; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 17-Oct-19			
<b>Temperature:</b> 24.8 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1014 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Plot 7.6.9 Radiated emission measurements in 1000 - 5000 MHz range

TEST SITE: Semi anechoic chamber  
CARRIER FREQUENCY: High 423.075 MHz – Downlin  
428.075 MHz – Uplink  
ANTENNA POLARIZATION: Vertical and Horizontal  
TEST DISTANCE: 3 m





<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

## 7.7 Spurious emissions at RF antenna connector test

### 7.7.1 General

This test was performed to measure spurious emissions at RF antenna connector. Specification test limits are given in Table 7.7.1.

Table 7.7.1 Spurious emission limits

Frequency, MHz	Attenuation below carrier, dBc	ERP of spurious, dBm
0.009 – 10th harmonic*	43+10logP**	-13.0

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

\*\* - P is transmitter output power in Watts

### 7.7.2 Test procedure

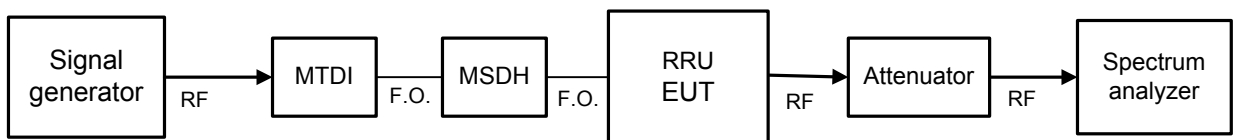
7.7.2.1 The EUT was set up as shown in Figure 7.7.1, energized and its proper operation was checked.

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

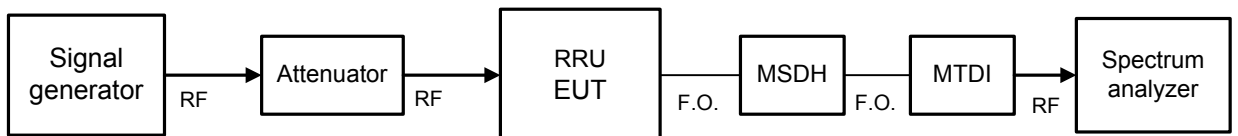
7.7.2.3 The spurious emission was measured with spectrum analyzer as provided in Table 7.7.2, Table 7.7.3 and the associated plots.

Figure 7.7.1 Spurious emission test setup

#### Checking DL path



#### Checking UL path





<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Table 7.7.2 Spurious emission test results, Downlink

OPERATING FREQUENCY RANGE: 421.363 – 423.075 MHz (Downlink)  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 4400 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: Unmodulated  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
<b>Low carrier frequency</b>									
All emissions were found more than 20 dB below limit									Pass
<b>Mid carrier frequency</b>									
All emissions were found more than 20 dB below limit									Pass
<b>High carrier frequency</b>									
All emissions were found more than 20 dB below limit									Pass

\*- Margin = Spurious emission – specification limit.

Table 7.7.3 Spurious emission test results, Uplink

OPERATING FREQUENCY RANGE: 426.363 – 428.075 MHz (Uplink)  
 INVESTIGATED FREQUENCY RANGE: 0.009 – 4400 MHz  
 DETECTOR USED: Peak  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: Unmodulated  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Attenuation below carrier, dBc	Limit, dBc	Margin, dB*	Verdict
<b>Low carrier frequency</b>									
All emissions were found more than 20 dB below limit									Pass
<b>Mid carrier frequency</b>									
All emissions were found more than 20 dB below limit									Pass
<b>High carrier frequency 423.075 MHz</b>									
All emissions were found more than 20 dB below limit									Pass

\*- Margin = Spurious emission – specification limit.

## Reference numbers of test equipment used

HL 0539	HL 3322	HL 3433	HL 3787	HL 3818	
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Full description is given in Appendix A.



HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.7.1 Spurious emission measurements in 9 - 150 kHz range at carrier frequency, Downlink**

OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

421.363 – 423.075 MHz  
SERV/MOB  
Maximum gain  
Below AGC level

CARRIER FREQUENCY: Low 421.363 MHz

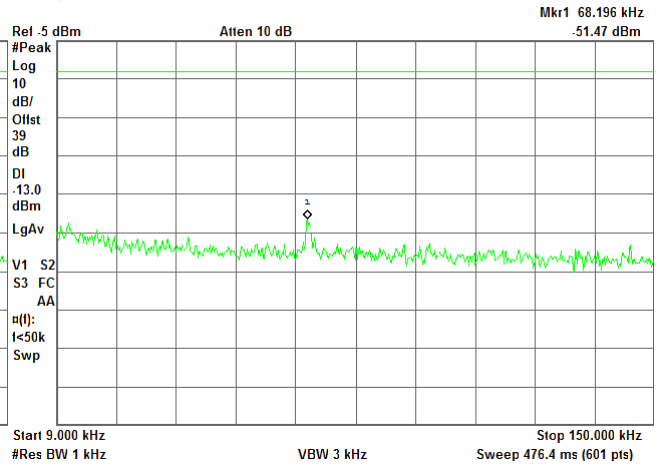
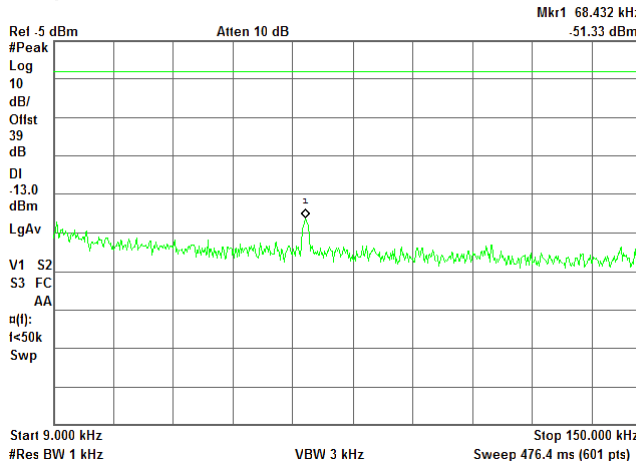
\* Agilent 01:34:03 Feb 20, 2019

R T

CARRIER FREQUENCY: Mid 422.525 MHz

\* Agilent 02:28:33 Feb 20, 2019

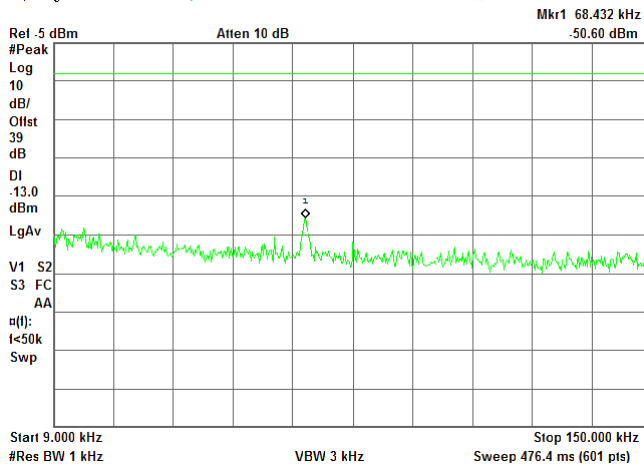
R T



CARRIER FREQUENCY: High 423.075 MHz

\* Agilent 02:13:46 Feb 20, 2019

R T





HERMON LABORATORIES

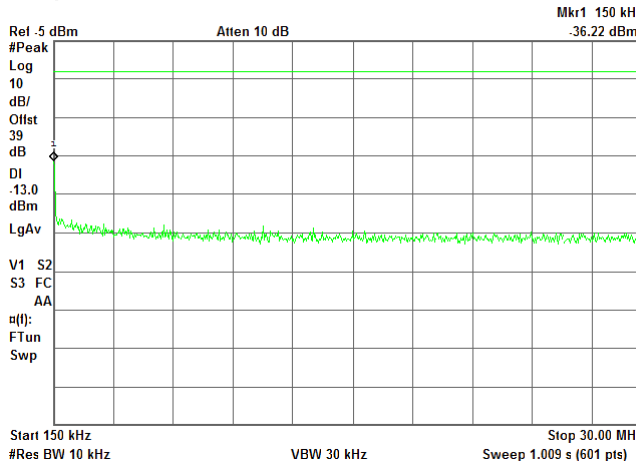
<b>Test specification: Section 90.219(e)(3), Conducted spurious emissions</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict: PASS</b>	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.7.2 Spurious emission measurements in 0.15 - 30.0 MHz range at carrier frequency, Downlink**

OPERATING FREQUENCY RANGE: 421.363 – 423.075 MHz  
 OUTPUT PORT: SERV/MOB  
 CONFIGURATION: Maximum gain  
 INPUT POWER: Below AGC level

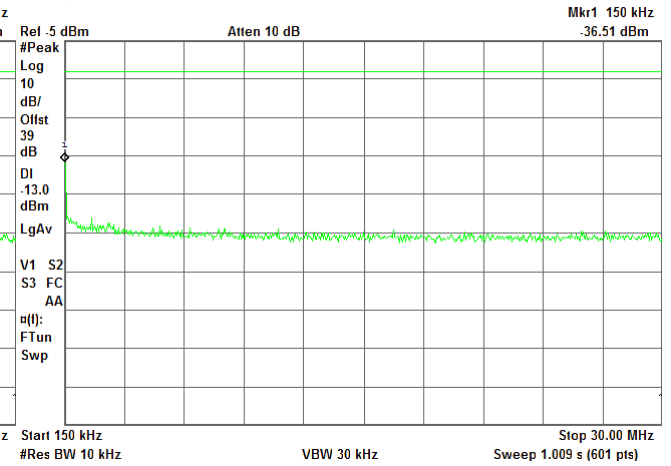
CARRIER FREQUENCY: Low 421.363 MHz

Agilent 01:36:51 Feb 20, 2019 R T



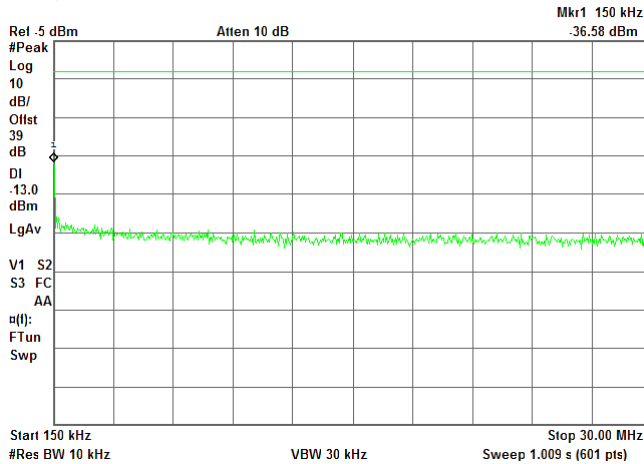
CARRIER FREQUENCY: Mid 422.525 MHz

Agilent 02:27:33 Feb 20, 2019 R T



CARRIER FREQUENCY: High 423.075 MHz

Agilent 02:14:54 Feb 20, 2019 R T





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.7.3 Spurious emission measurements in 30 - 1000 MHz range at carrier frequency, Downlink**

OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

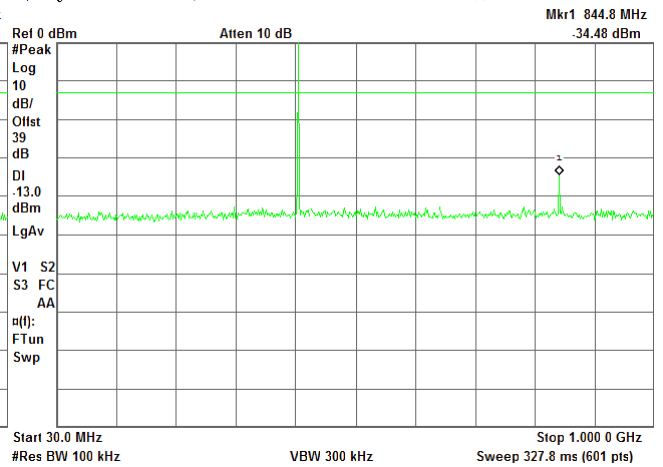
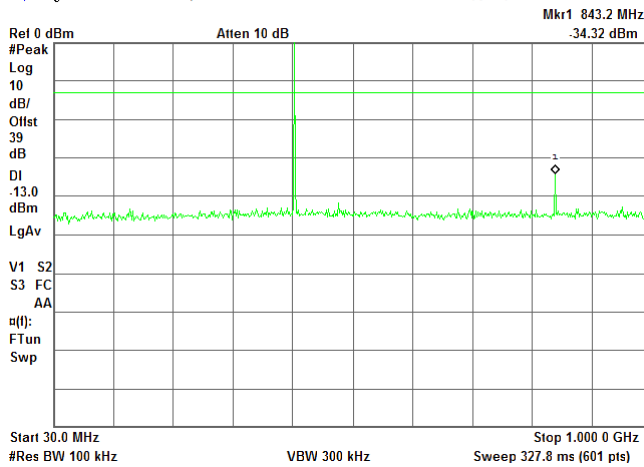
421.363 – 423.075 MHz  
SERV/MOB  
Maximum gain  
Below AGC level

CARRIER FREQUENCY: Low 421.363 MHz

CARRIER FREQUENCY: Mid 422.525 MHz

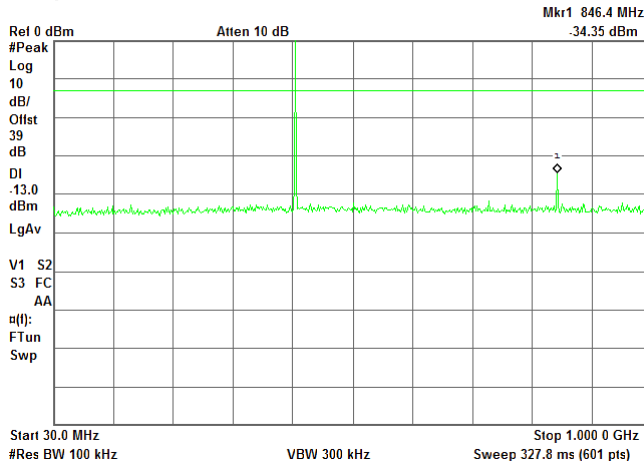
Agilent 01:59:23 Feb 20, 2019 R T

Agilent 02:22:40 Feb 20, 2019 R T



CARRIER FREQUENCY: High 423.075 MHz

Agilent 02:09:02 Feb 20, 2019 R T





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

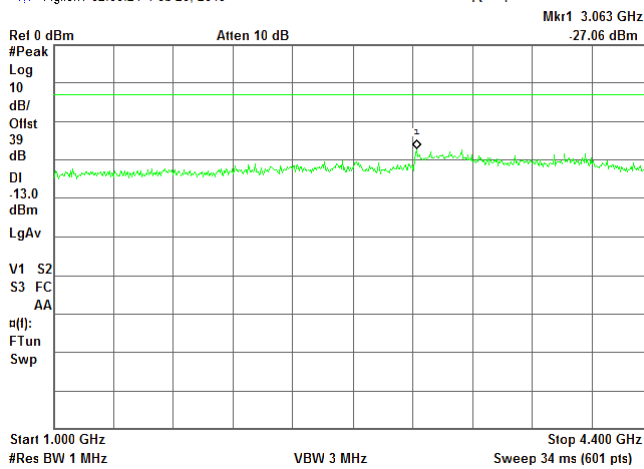
**Plot 7.7.4 Spurious emission measurements in 1000 - 4400 MHz range at carrier frequency, Downlink**

OPERATING FREQUENCY RANGE: 421.363 – 423.075 MHz  
 OUTPUT PORT: SERV/MOB  
 CONFIGURATION: Maximum gain  
 INPUT POWER: Below AGC level

CARRIER FREQUENCY: Low 421.363 MHz

Agilent 02:00:24 Feb 20, 2019

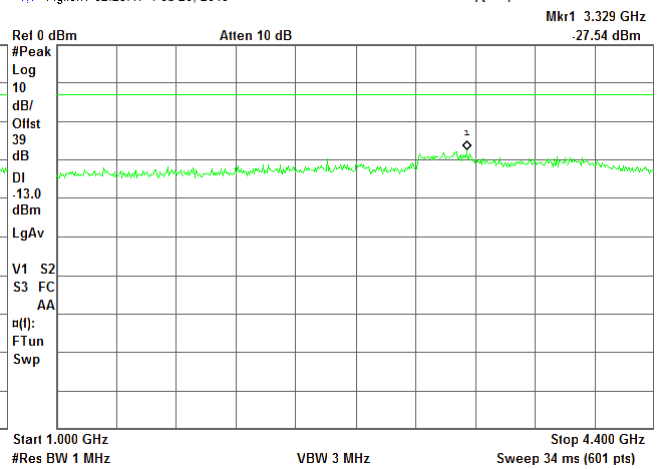
R T



CARRIER FREQUENCY: Mid 422.525 MHz

Agilent 02:23:47 Feb 20, 2019

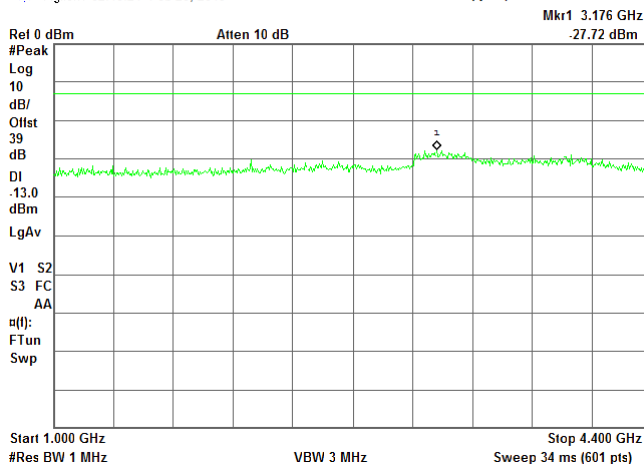
R T



CARRIER FREQUENCY: High 423.075 MHz

Agilent 02:10:21 Feb 20, 2019

R T







HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions	
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3	
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b> 10-Oct-19	
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %
<b>Remarks:</b>	

**Plot 7.7.5 Spurious emission measurements in 9 - 150 kHz range at carrier frequency, Uplink**

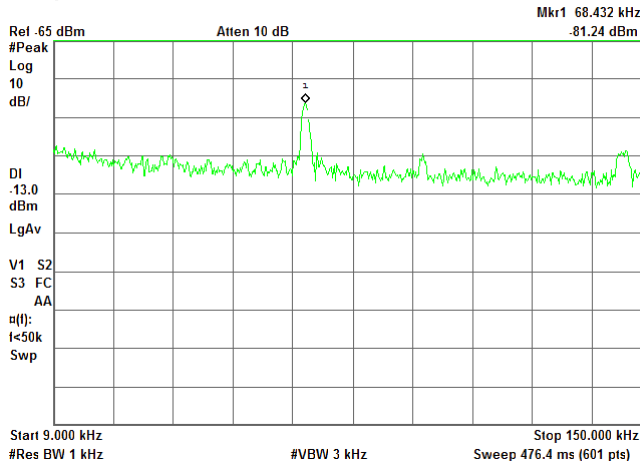
OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

426.363 – 428.075 MHz  
UL1 (KPR1)  
Maximum gain  
Below AGC level

CARRIER FREQUENCY: Low 426.363 MHz

Agilent 03:19:35 Feb 20, 2019

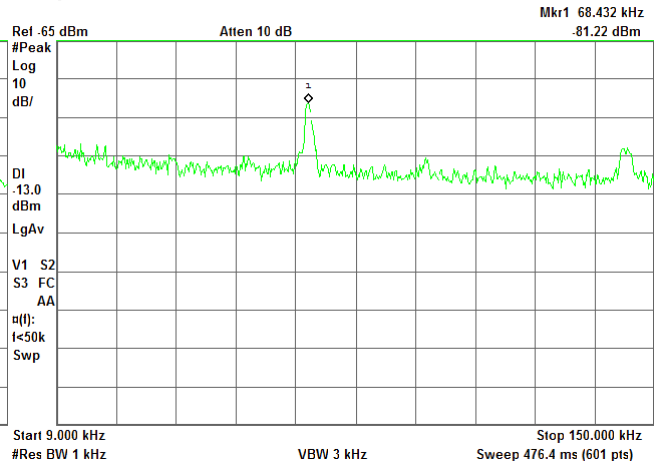
R T



CARRIER FREQUENCY: Mid 427.425 MHz

Agilent 03:05:23 Feb 20, 2019

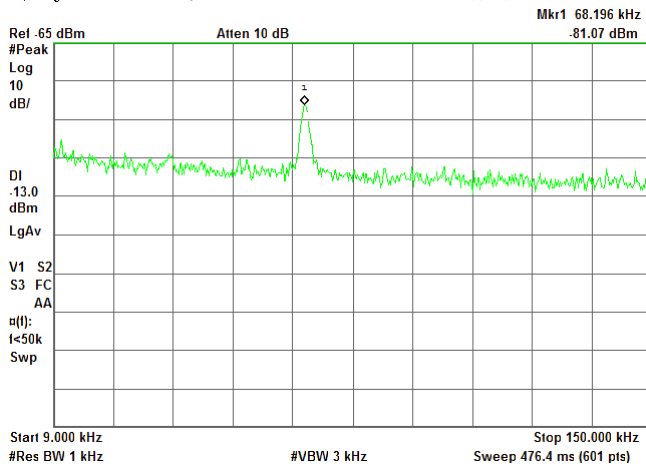
R T



CARRIER FREQUENCY: High 428.075 MHz

Agilent 03:21:49 Feb 20, 2019

R T



Note: applied limit -13 dBm



HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.7.6 Spurious emission measurements in 0.15 - 30.0 MHz range at carrier frequency, Uplink**

OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

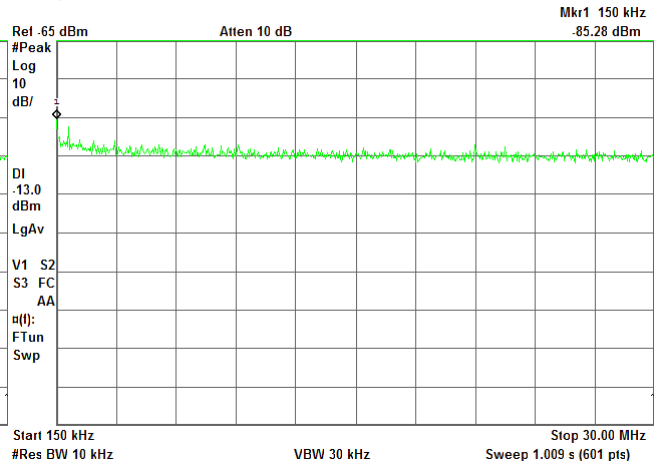
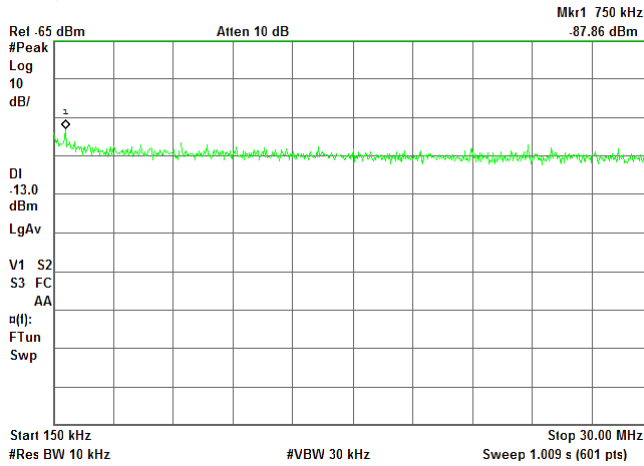
426.363 – 428.075 MHz  
UL1 (KPR1)  
Maximum gain  
Below AGC level

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz

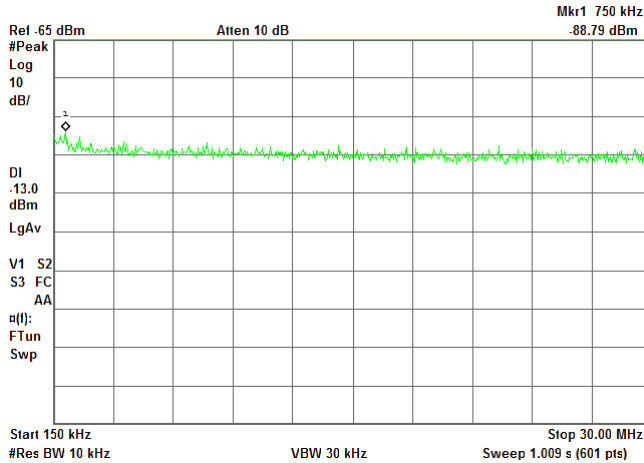
Agilent 03:17:10 Feb 20, 2019

Agilent 03:04:02 Feb 20, 2019



CARRIER FREQUENCY: High 428.075 MHz

Agilent 03:23:44 Feb 20, 2019



Note: applied limit -13 dBm



HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.7.7 Spurious emission measurements in 30.0 - 1000 MHz range at carrier frequency, Uplink**

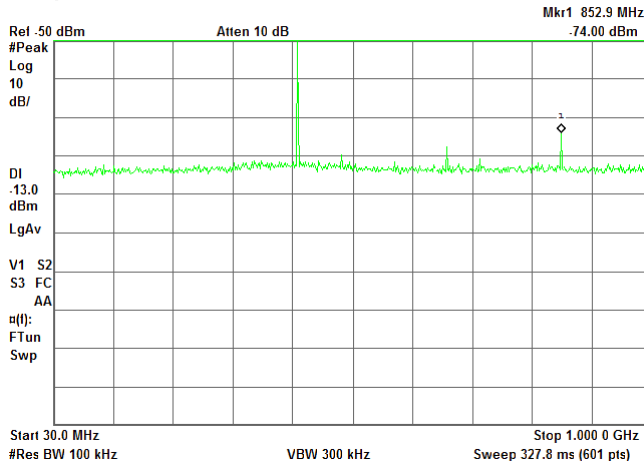
OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

426.363 – 428.075 MHz  
UL1 (KPR1)  
Maximum gain  
Below AGC level

CARRIER FREQUENCY: Low 426.363 MHz

Agilent 03:08:36 Feb 20, 2019

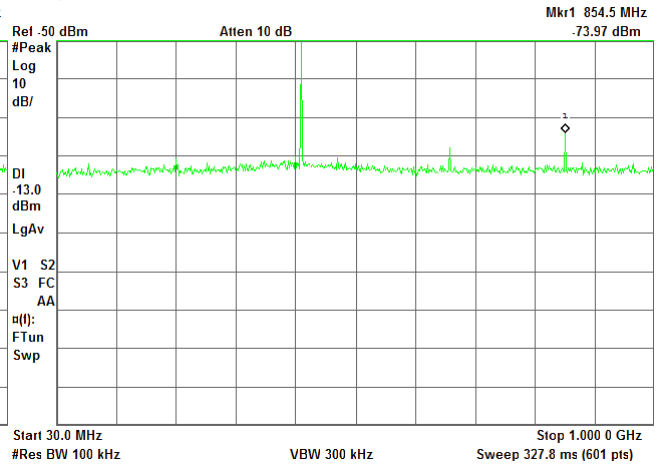
R T



CARRIER FREQUENCY: Mid 427.425 MHz

Agilent 02:57:54 Feb 20, 2019

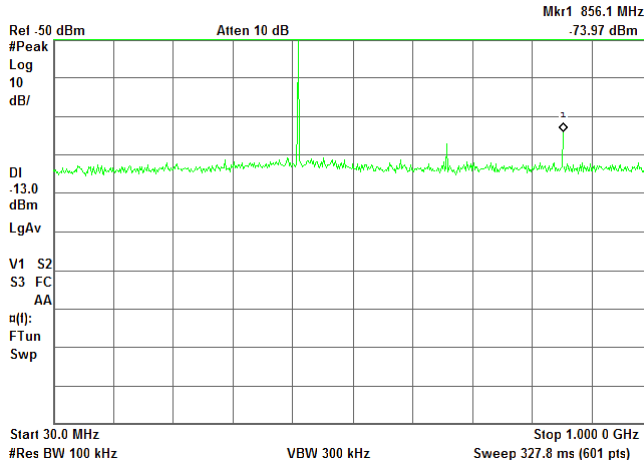
R T



CARRIER FREQUENCY: High 428.075 MHz

Agilent 03:09:59 Feb 20, 2019

R T



Note: applied limit -13 dBm



HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(e)(3), Conducted spurious emissions			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.3			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.7.8 Spurious emission measurements in 1000 - 4400 MHz range at carrier frequency, Uplink**

OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

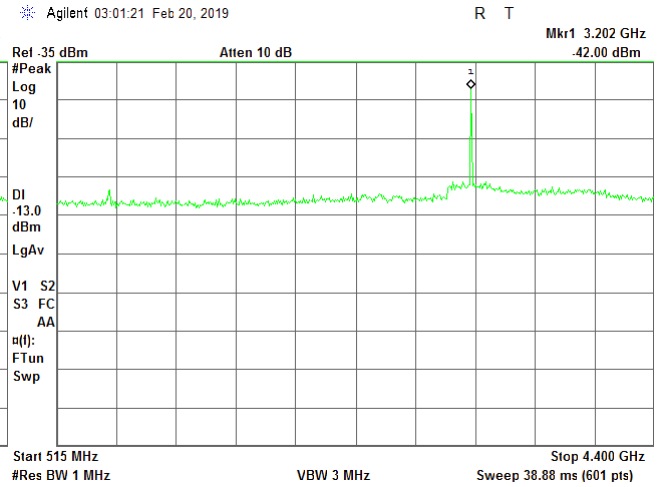
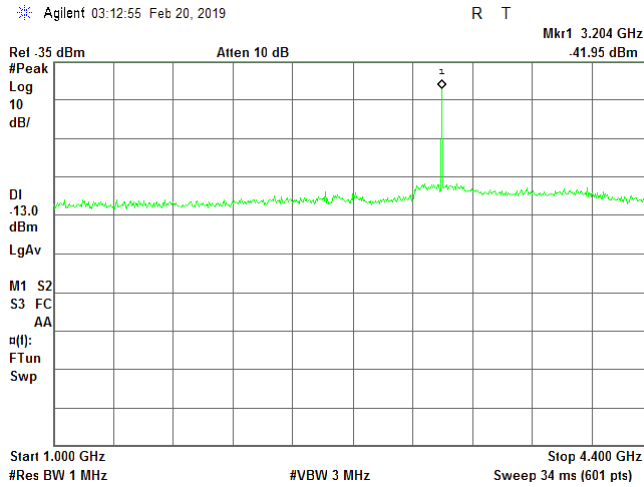
426.363 – 428.075 MHz  
UL1 (KPR1)  
Maximum gain  
Below AGC level

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz

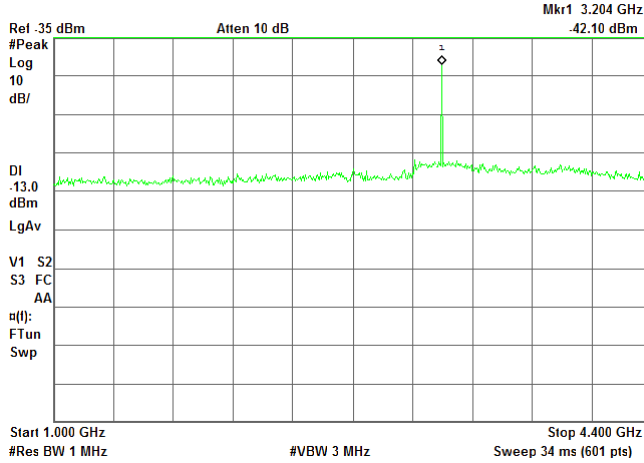
Agilent 03:12:55 Feb 20, 2019

Agilent 03:01:21 Feb 20, 2019



CARRIER FREQUENCY: High 428.075 MHz

Agilent 03:11:30 Feb 20, 2019



Note: applied limit -13 dBm



<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

## 7.8 ERP intermodulation product test

### 7.8.1 General

This test was performed to measure the ERP Intermodulation product (out-of-band spurious emissions) at RF antenna connector. Specification test limits are given in Table 7.8.1.

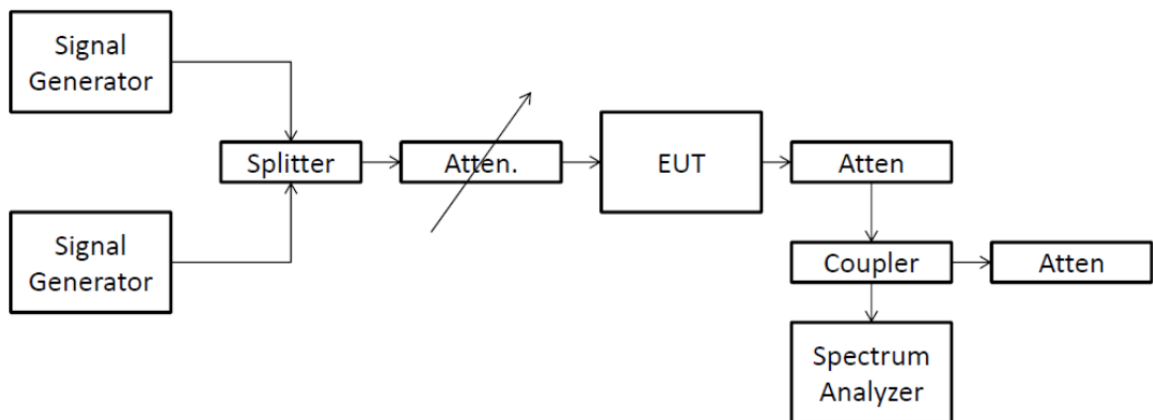
Table 7.8.1 ERP Intermodulation product limit

Frequency range, MHz	ERP Intermodulation product limit, dBm/10 kHz
421.363 – 423.075 MHz Downlink 426.363 – 428.075 MHz Uplink	-30.0

### 7.8.2 Test procedure

- 7.8.2.1 The EUT was set up as shown in Figure 7.8.1, energized and its proper operation was checked.
- 7.8.2.2 Signal generator A was configured for CW operation at the  $f_0$  frequency of appropriate frequency band,
- 7.8.2.3 Signal generator B was configured for CW operation tuned available channel spacing (e.g. 25, 12.5 or 6.25 kHz) above the frequency  $f_0$  or below the frequency  $f_0$  of the same frequency band.
- 7.8.2.4 The generator amplitudes were set so that the power from each into RF combiner was equivalent.
- 7.8.2.5 The signal generator's amplitudes were increased equally until just below the EUT's AGC threshold level was reached and all intermodulation products were measured.
- 7.8.2.6 The intermodulation products were measured with spectrum analyzer as provided in the associated plots.
- 7.8.2.7 The EUT was tested with the composite input power level set to 3 dB above the AGC threshold level to show AGC operation, worst case results taken.
- 7.8.2.8 The test was repeated for all available channel spacing.  
The test was repeated for all uplink and downlink operational bands. The test results are provided in Table 7.7.2 and associated plots..

Figure 7.8.1 ERP Intermodulation product test setup





<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Table 7.8.2 ERP Intermodulation product test results

OPERATING FREQUENCY RANGE: 421.363 – 423.075 MHz (Downlink)  
 INVESTIGATED FREQUENCY RANGE: 100 kHz  
 DETECTOR USED: RMS  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: CW  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm		Attenuator, dB	Cable loss, dB	RBW, Hz	Spurious emission, dBm	Limit, dBm/10 kHz	Margin, dB*	Verdict
	Below AGC	Above AGC							
<b>Channel spacing 6.25 kHz</b>									
<b>Low carrier frequency 421.363 MHz</b>									
421.3563	-33.68	-33.18	Included	Included	300	-33.18	-30.0	-3.18	Pass
421.3757	-32.23	-32.23	Included	Included	300	-32.23	-30.0	-2.23	Pass
<b>Mid carrier frequency 422.525 MHz</b>									
422.5183	-34.28	-33.71	Included	Included	300	-33.71	-30.0	-3.71	Pass
422.5377	-32.32	-33.23	Included	Included	300	-32.32	-30.0	-2.32	Pass
<b>High carrier frequency 423.075 MHz</b>									
423.0627	-31.90	-33.31	Included	Included	300	-31.90	-30.0	-1.90	Pass
423.0808	-31.91	-32.60	Included	Included	300	-31.91	-30.0	-1.91	Pass
<b>Channel spacing 12.5 kHz</b>									
<b>Low carrier frequency 421.363 MHz</b>									
421.3501	-32.73	-33.40	Included	Included	300	-32.73	-30.0	-2.73	Pass
421.3882	-31.78	-33.52	Included	Included	300	-31.78	-30.0	-1.78	Pass
<b>Mid carrier frequency 422.525 MHz</b>									
422.5121	-37.45	-35.13	Included	Included	300	-35.13	-30.0	-5.13	Pass
422.5502	-36.62	-34.07	Included	Included	300	-34.07	-30.0	-4.07	Pass
<b>High carrier frequency 423.075 MHz</b>									
423.0580	-36.06	-34.94	Included	Included	300	-34.94	-30.0	-4.94	Pass
423.0870	-38.34	-35.07	Included	Included	300	-35.07	-30.0	-5.07	Pass
<b>Channel spacing 25 kHz</b>									
<b>Low carrier frequency 421.363 MHz</b>									
421.3375	-32.69	-32.86	Included	Included	300	-32.69	-30.0	-2.69	Pass
421.4132	-32.01	-33.10	Included	Included	300	-32.01	-30.0	-2.01	Pass
<b>Mid carrier frequency 422.525 MHz</b>									
422.4995	-37.42	-34.31	Included	Included	300	-34.31	-30.0	-4.31	Pass
422.5751	-38.45	-34.21	Included	Included	300	-34.21	-30.0	-4.21	Pass
<b>High carrier frequency 423.075 MHz</b>									
423.0252	-32.83	-34.72	Included	Included	300	-32.83	-30.0	-2.83	Pass
423.0996	-33.65	-35.80	Included	Included	300	-33.65	-30.0	-3.65	Pass

\*- Margin = Spurious emission – specification limit.



<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Table 7.8.3 ERP Intermodulation product test results**

OPERATING FREQUENCY RANGE: 426.363 – 428.075 MHz (Uplink)  
 INVESTIGATED FREQUENCY RANGE: 100 kHz  
 DETECTOR USED: RMS  
 VIDEO BANDWIDTH: ≥ Resolution bandwidth  
 MODULATION: CW  
 TRANSMITTER OUTPUT POWER SETTINGS: Maximum

Frequency, MHz	SA reading, dBm	Attenuator, dB	Cable loss, dB	RBW, kHz	Spurious emission, dBm	Limit, dBm/10 kHz	Margin, dB*	Verdict
<b>Channel spacing 6.25 kHz</b>								
<b>Low carrier frequency 426.363 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>Mid carrier frequency 427.525 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>High carrier frequency 428.075 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>Channel spacing 12.5 kHz</b>								
<b>Low carrier frequency 426.363 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>Mid carrier frequency 427.525 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>High carrier frequency 428.075 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>Channel spacing 25 kHz</b>								
<b>Low carrier frequency 426.363 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>Mid carrier frequency 427.525 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass
<b>High carrier frequency 428.075 MHz</b>								
All emissions were found more than 20 dB below the limit								Pass

\*- Margin = Spurious emission – specification limit.

**Reference numbers of test equipment used**

HL 0539	HL 3322	HL 3433	HL 3787	HL 3818	
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Full description is given in Appendix A.



HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Plot 7.8.1 ERP Intermodulation product measurements at 6.25 kHz channel spacing, Downlink

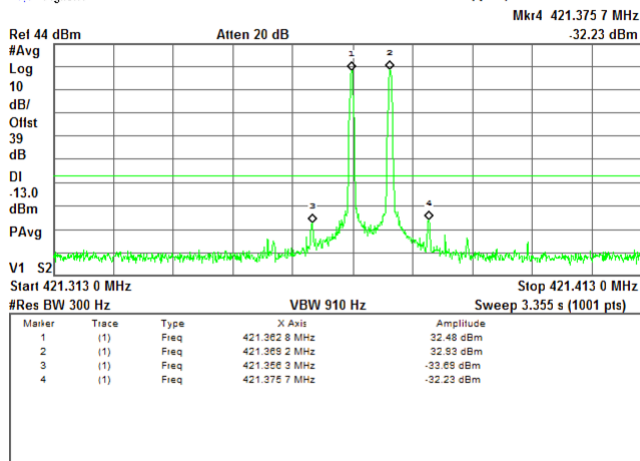
OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

421.363 – 423.075 MHz  
SERV/MOB  
Maximum gain  
Below AGC threshold level

CARRIER FREQUENCY: Low 421.363 MHz

\* Agilent

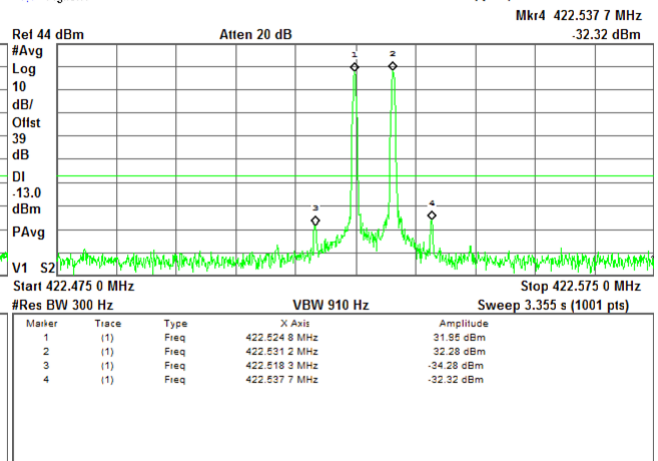
R T



CARRIER FREQUENCY: Mid 422.525 MHz

\* Agilent

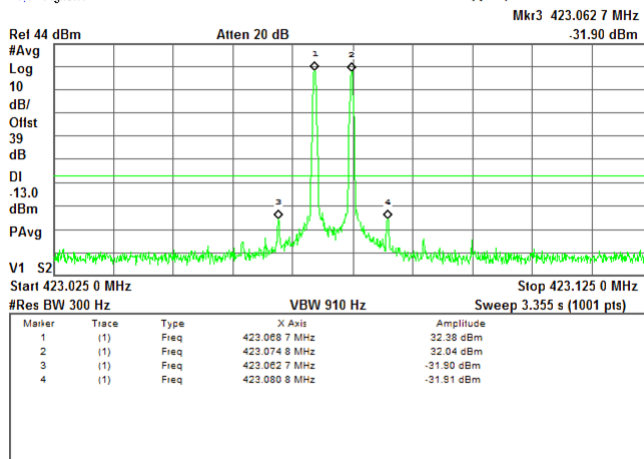
R T



CARRIER FREQUENCY: High 423.075 MHz

\* Agilent

R T







HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Plot 7.8.2 ERP Intermodulation product measurements at 6.25 kHz channel spacing, Downlink

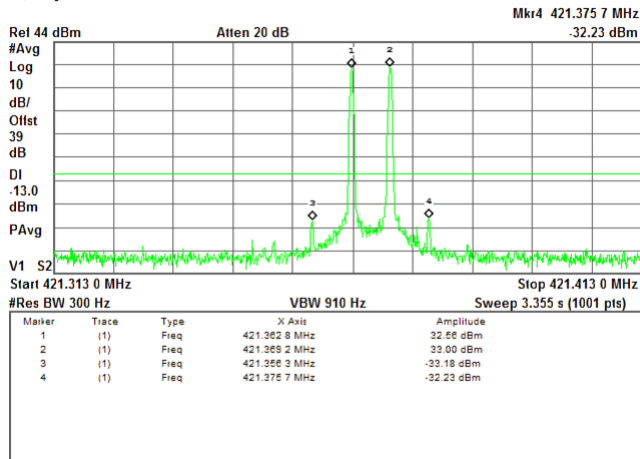
OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

421.363 – 423.075 MHz  
SERV/MOB  
Maximum gain  
AGC threshold level +3dB

CARRIER FREQUENCY: Low 421.363 MHz

\* Agilent

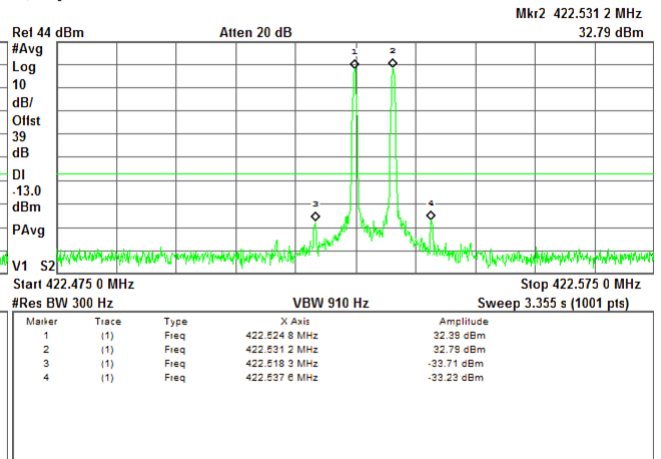
R T



CARRIER FREQUENCY: Mid 422.525 MHz

\* Agilent

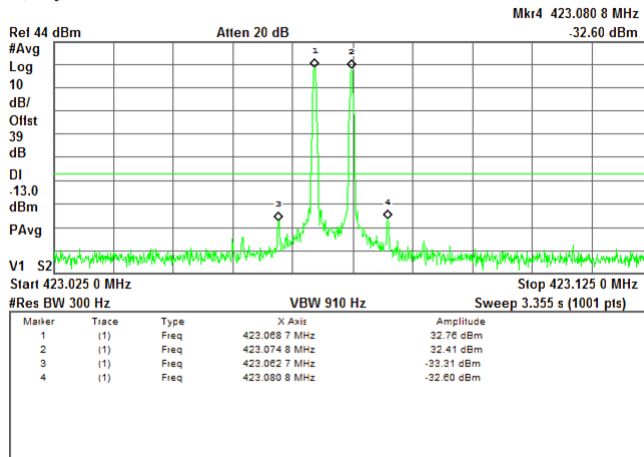
R T



CARRIER FREQUENCY: High 423.075 MHz

\* Agilent

R T





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Plot 7.8.3 ERP Intermodulation product measurements at 12.5 kHz channel spacing, Downlink

OPERATING FREQUENCY RANGE:

421.363 – 423.075 MHz

OUTPUT PORT:

SERV/MOB

CONFIGURATION:

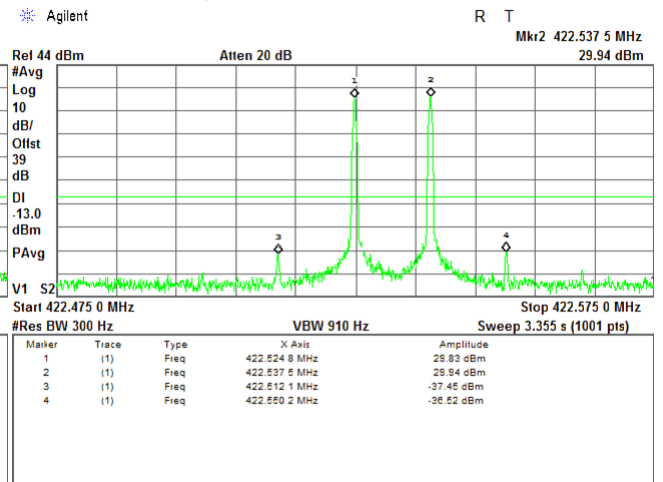
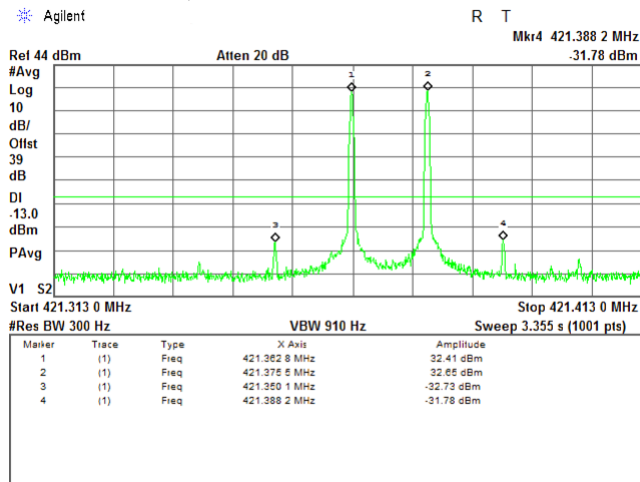
Maximum gain

INPUT POWER:

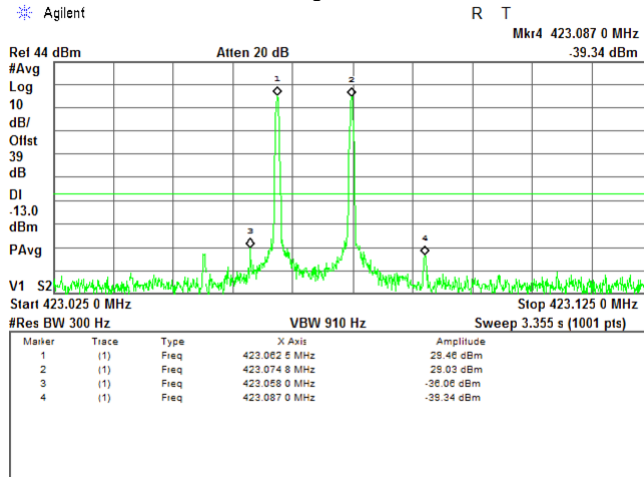
Below AGC threshold level

CARRIER FREQUENCY: Low 421.363 MHz

CARRIER FREQUENCY: Mid 422.525 MHz



CARRIER FREQUENCY: High 423.075 MHz





HERMON LABORATORIES

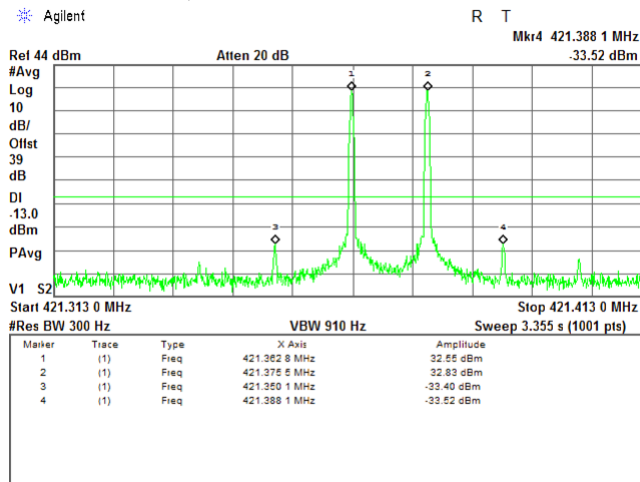
<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Plot 7.8.4 ERP Intermodulation product measurements at 12.5 kHz channel spacing, Downlink

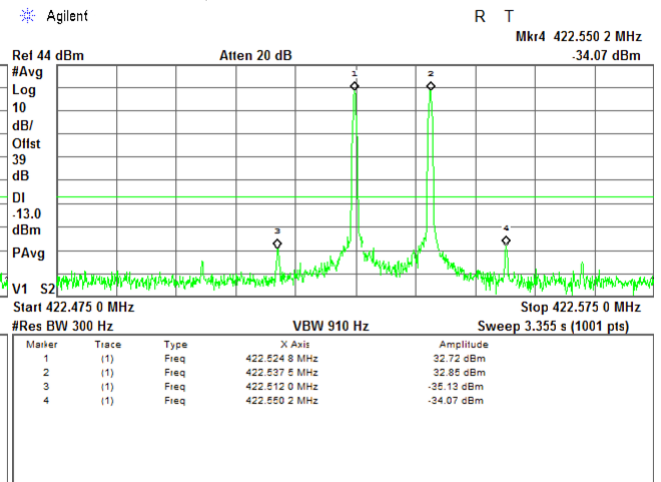
OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

421.363 – 423.075 MHz  
SERV/MOB  
Maximum gain  
AGC threshold level +3dB

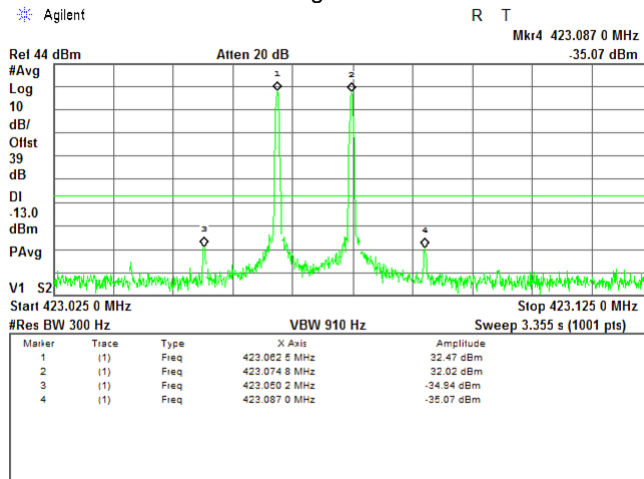
CARRIER FREQUENCY: Low 421.363 MHz



CARRIER FREQUENCY: Mid 422.525 MHz



CARRIER FREQUENCY: High 423.075 MHz





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.8.5 ERP Intermodulation product measurements at 25.0 kHz channel spacing, Downlink**

OPERATING FREQUENCY RANGE:

421.363 – 423.075 MHz

OUTPUT PORT:

SERV/MOB

CONFIGURATION:

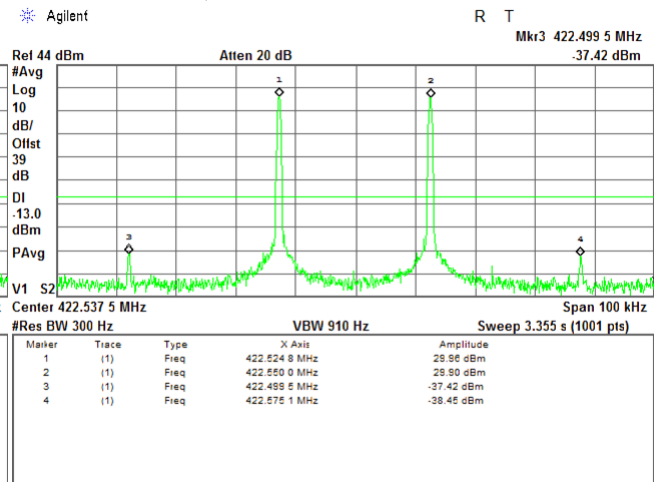
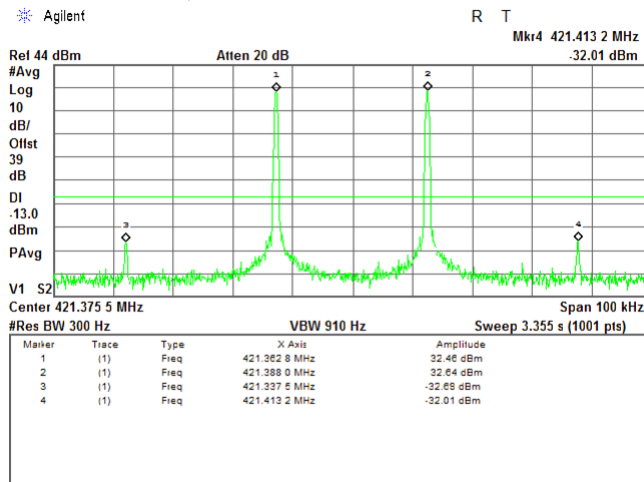
Maximum gain

INPUT POWER:

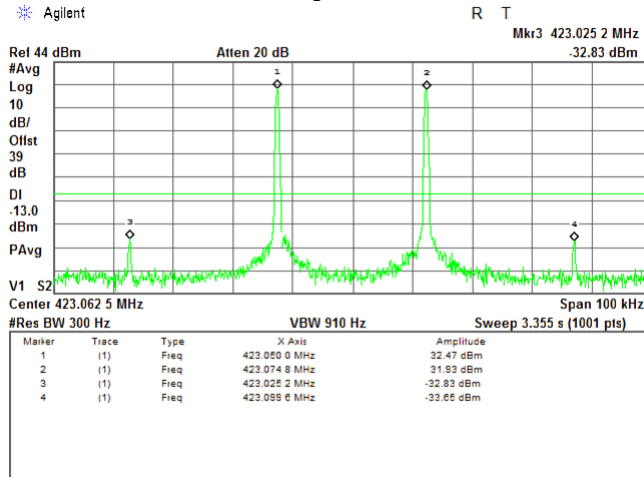
Below AGC threshold level

CARRIER FREQUENCY: Low 421.363 MHz

CARRIER FREQUENCY: Mid 422.525 MHz



CARRIER FREQUENCY: High 423.075 MHz





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

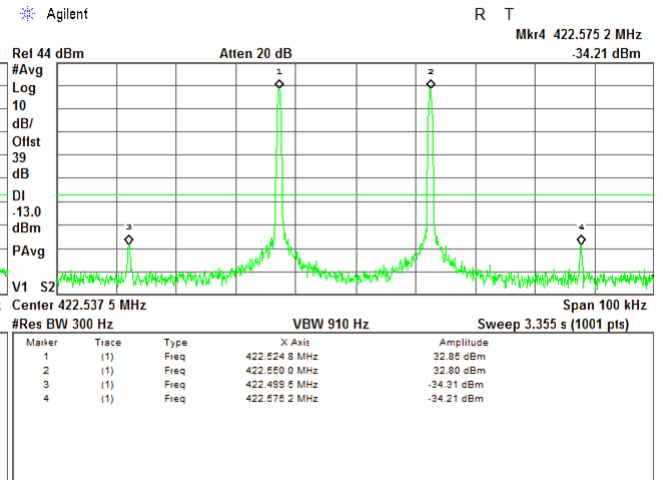
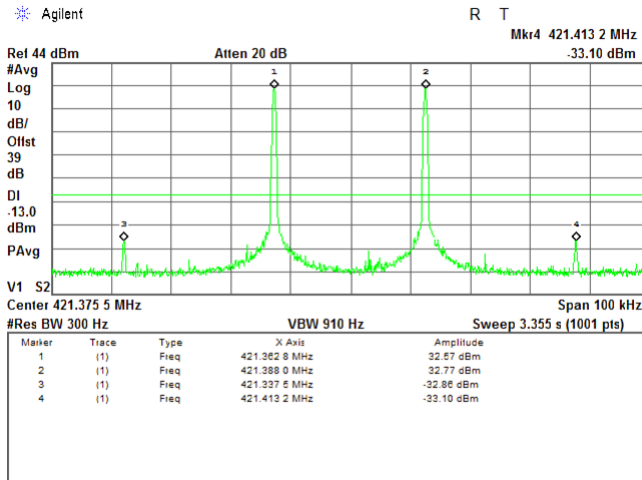
Plot 7.8.6 ERP Intermodulation product measurements at 25.0 kHz channel spacing, Downlink

OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

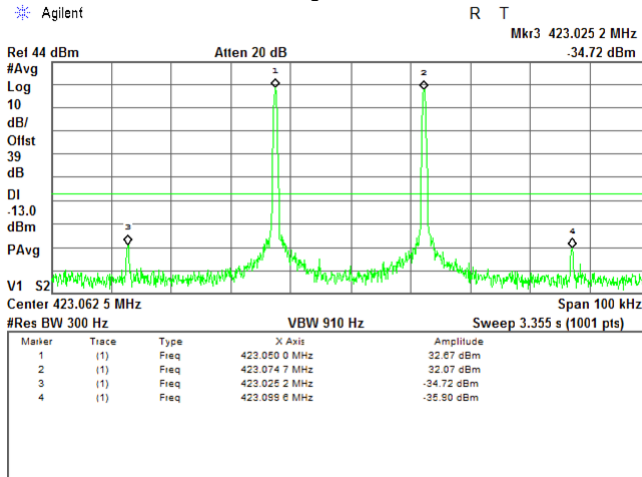
421.363 – 423.075 MHz  
SERV/MOB  
Maximum gain  
AGC threshold level +3dB

CARRIER FREQUENCY: Low 421.363 MHz

CARRIER FREQUENCY: Mid 422.525 MHz



CARRIER FREQUENCY: High 423.075 MHz





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.8.7 ERP Intermodulation product measurements at 6.25 kHz channel spacing, Uplink**

OPERATING FREQUENCY RANGE:

426.363 – 428.075 MHz

OUTPUT PORT:

UL1 (KPR1)

CONFIGURATION:

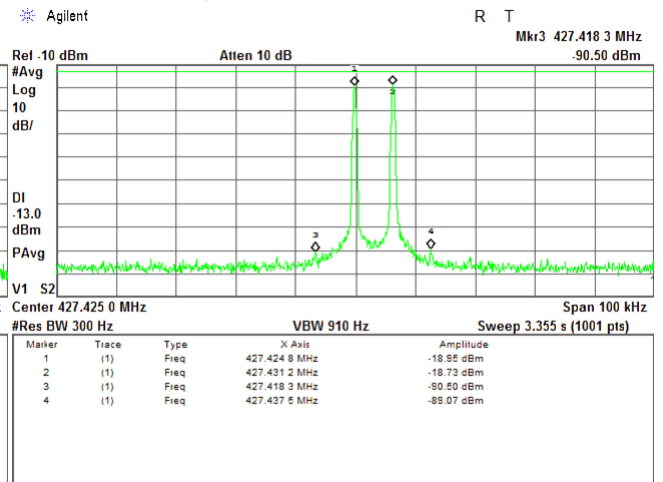
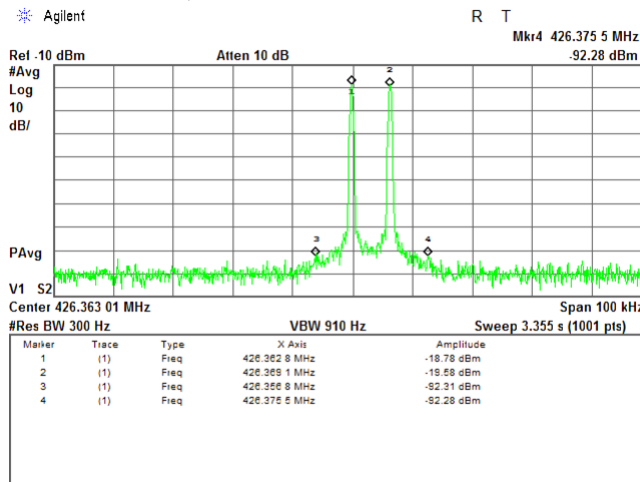
Maximum gain

INPUT POWER:

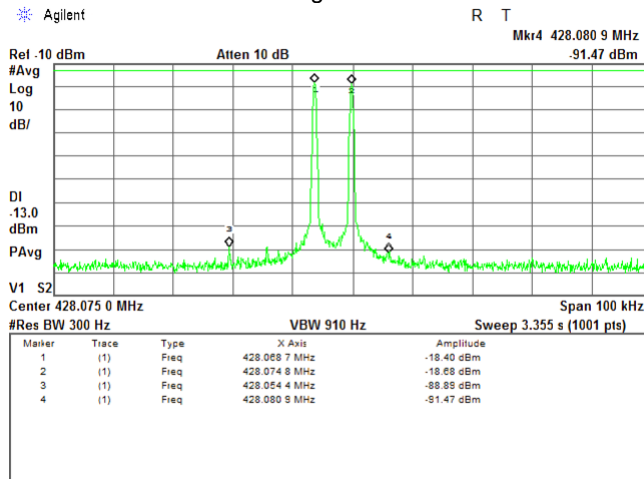
Below AGC threshold level

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz



CARRIER FREQUENCY: High 428.075 MHz





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Plot 7.8.8 ERP Intermodulation product measurements at 6.25 kHz channel spacing, Uplink

OPERATING FREQUENCY RANGE:

426.363 – 428.075 MHz

OUTPUT PORT:

UL1 (KPR1)

CONFIGURATION:

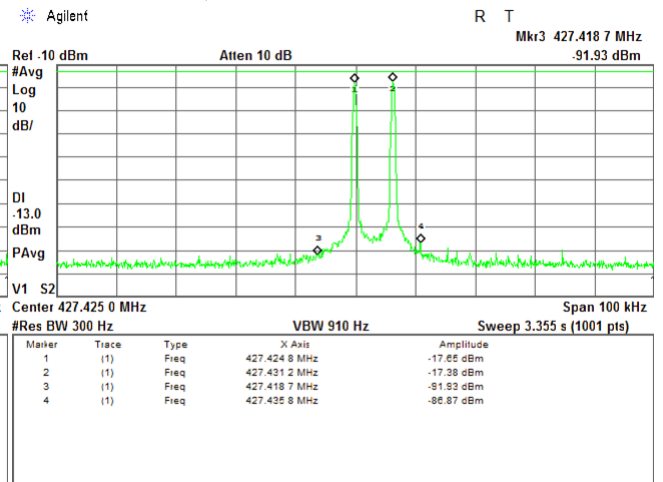
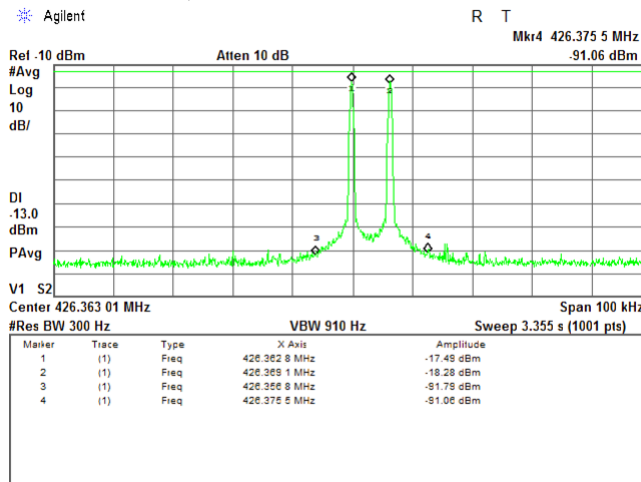
Maximum gain

INPUT POWER:

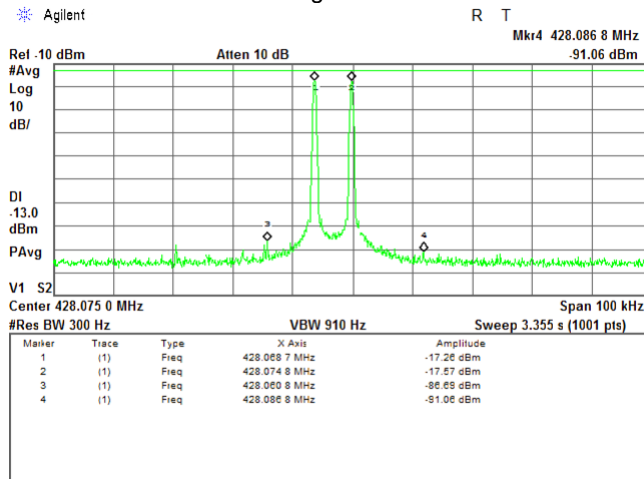
AGC threshold level +3dB

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz



CARRIER FREQUENCY: High 428.075 MHz





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

**Plot 7.8.9 ERP Intermodulation product measurements at 12.5 kHz channel spacing, Uplink**

OPERATING FREQUENCY RANGE:

426.363 – 428.075 MHz

OUTPUT PORT:

UL1 (KPR1)

CONFIGURATION:

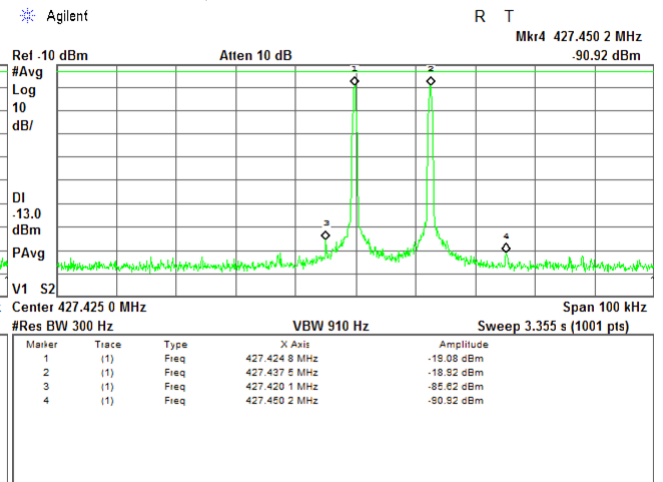
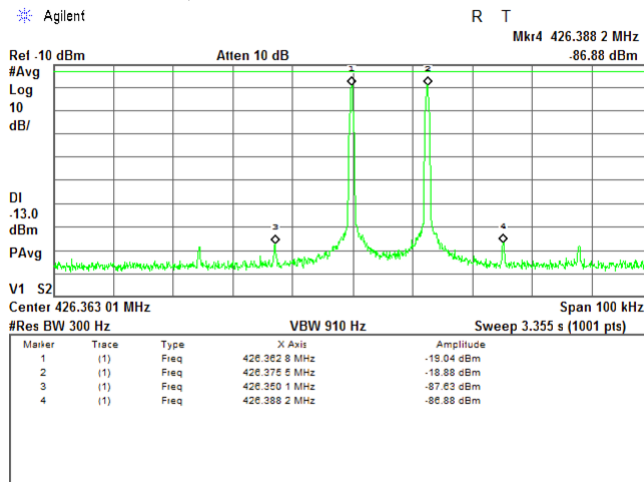
Maximum gain

INPUT POWER:

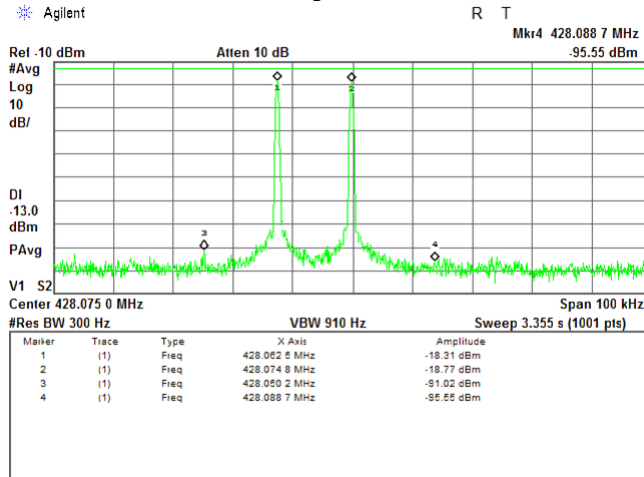
Below AGC threshold level

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz



CARRIER FREQUENCY: High 428.075 MHz







HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

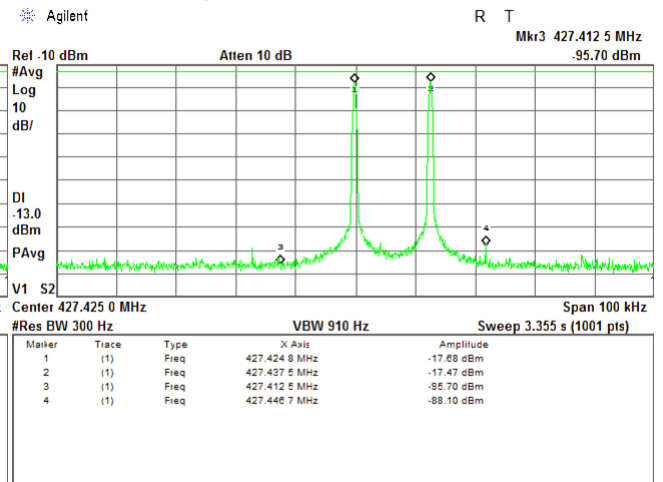
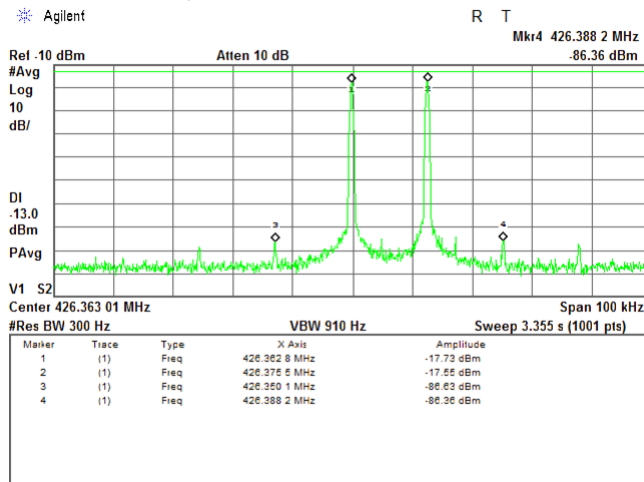
**Plot 7.8.10 ERP Intermodulation product measurements at 12.5 kHz channel spacing, Uplink**

OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

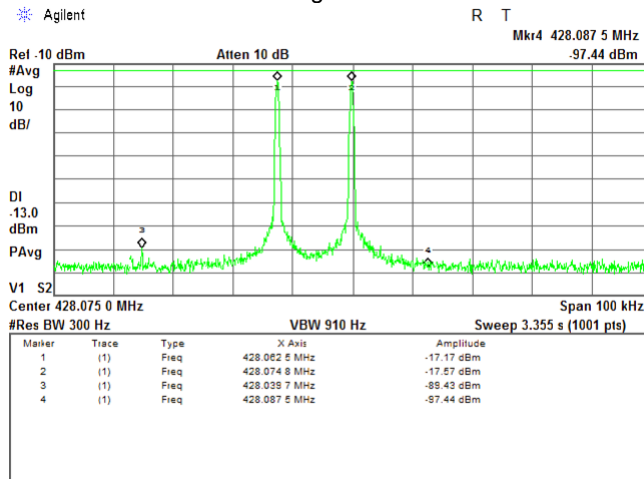
426.363 – 428.075 MHz  
UL1 (KPR1)  
Maximum gain  
AGC threshold level +3dB

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz



CARRIER FREQUENCY: High 428.075 MHz





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

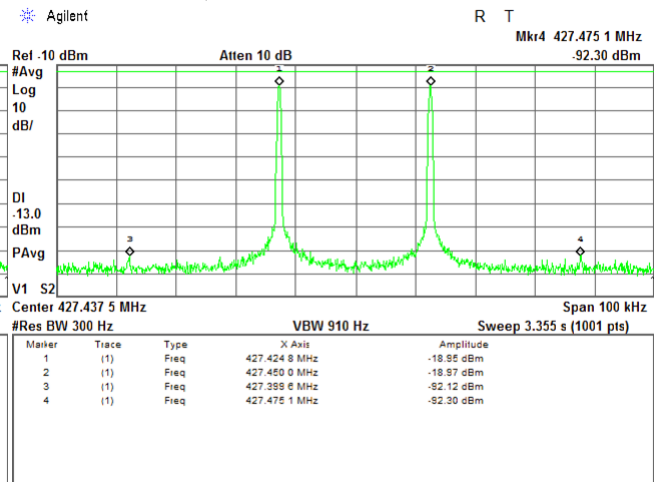
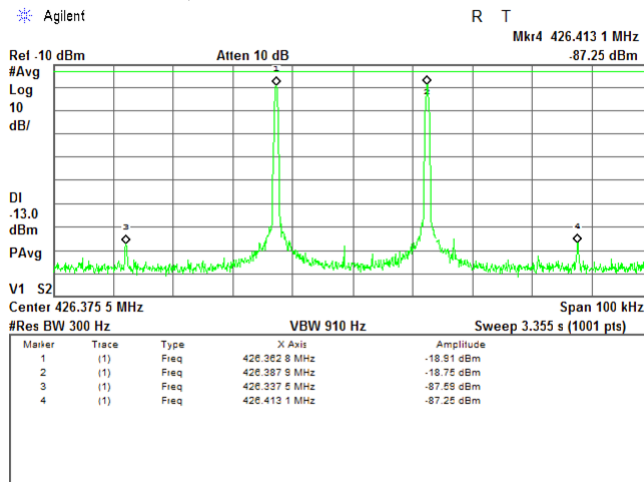
Plot 7.8.11 ERP Intermodulation product measurements at 25.0 kHz channel spacing, Uplink

OPERATING FREQUENCY RANGE:  
OUTPUT PORT:  
CONFIGURATION:  
INPUT POWER:

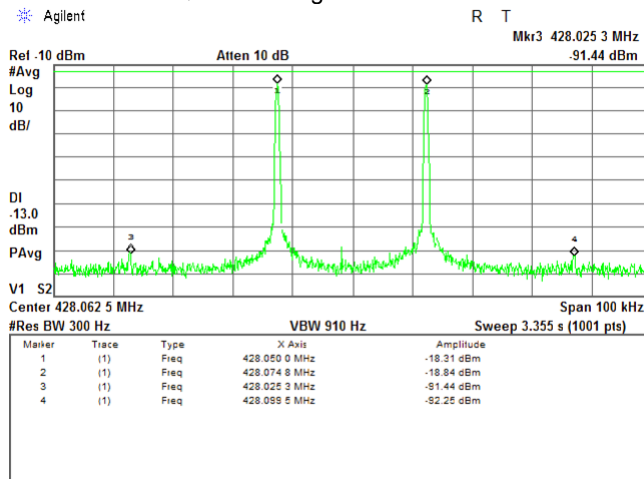
426.363 – 428.075 MHz  
UL1 (KPR1)  
Maximum gain  
Below AGC threshold level

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz



CARRIER FREQUENCY: High 428.075 MHz





HERMON LABORATORIES

<b>Test specification:</b> Section 90.219(d)(6)(i), ERP of intermodulation product			
<b>Test procedure:</b> 47 CFR, Sections 2.1051; KDB 935210 D05 v01r04, section 4.7.2			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Plot 7.8.12 ERP Intermodulation product measurements at 25.0 kHz channel spacing, Uplink

OPERATING FREQUENCY RANGE:

426.363 – 428.075 MHz

OUTPUT PORT:

UL1 (KPR1)

CONFIGURATION:

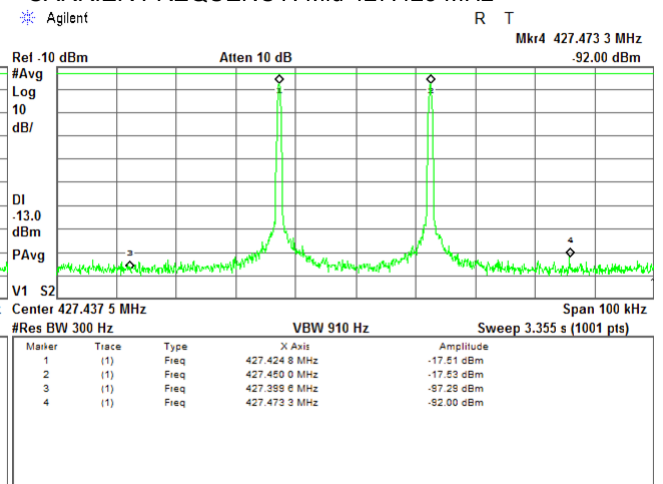
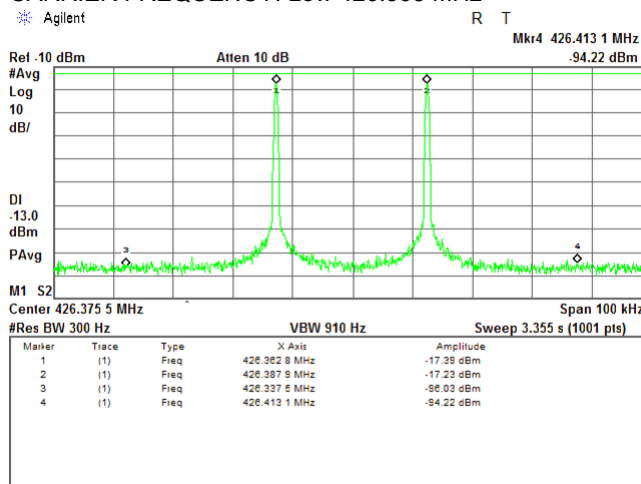
Maximum gain

INPUT POWER:

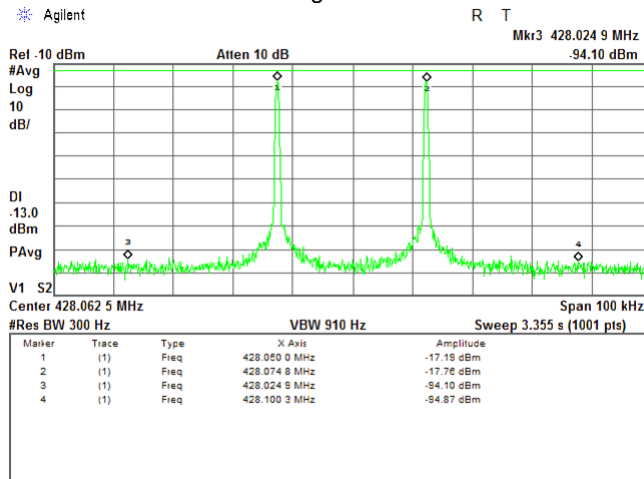
AGC threshold level +3dB

CARRIER FREQUENCY: Low 426.363 MHz

CARRIER FREQUENCY: Mid 427.425 MHz



CARRIER FREQUENCY: High 428.075 MHz





<b>Test specification: Section 90.213, Frequency stability</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1055; KDB 935210 D05 v01r04, section 4.8			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

## 7.9 Frequency stability test

### 7.9.1 General

This test was performed to measure frequency stability of transmitter RF carrier. Specification test limits are given in Table 7.9.1.

Table 7.9.1 Frequency stability limits

Assigned frequency, MHz	Maximum allowed frequency displacement	
	ppm	Hz
421.363	0.5	210
422.525		211
423.075		211
426.363		213
427.425		213
428.075		214

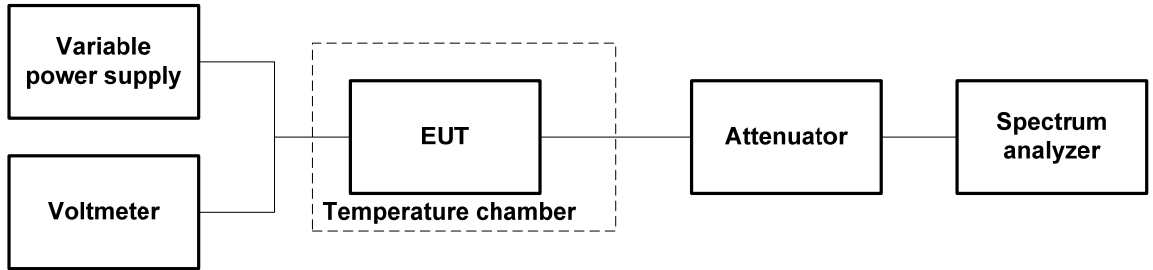
### 7.9.2 Test procedure

- 7.9.2.1 The EUT was set up as shown in Figure 7.9.1, energized and its proper operation was checked.
- 7.9.2.2 The EUT power was turned off. Temperature within test chamber was set to +30°C and a period of time sufficient to stabilize all of the oscillator circuit components was allowed.
- 7.9.2.3 The EUT was powered on and carrier frequency was measured at start up moment and then every minute until frequency had been stabilized or 10 minutes elapsed whichever reached the last. The EUT was powered off.
- 7.9.2.4 The above procedure was repeated at 0°C and at the lowest test temperature.
- 7.9.2.5 The EUT was powered on and carrier frequency was measured at start up moment and at the end of stabilization period at the rest of test temperatures and voltages. The EUT was powered off.
- 7.9.2.6 Frequency displacement was calculated and compared with the limit as provided in Table 7.9.2, Table 7.9.3.



<b>Test specification: Section 90.213, Frequency stability</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1055; KDB 935210 D05 v01r04, section 4.8			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Figure 7.9.1 Frequency stability test setup





HERMON LABORATORIES

<b>Test specification: Section 90.213, Frequency stability</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1055; KDB 935210 D05 v01r04, section 4.8			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Table 7.9.2 Frequency stability test results

OPERATING FREQUENCY: 421.363 – 423.075 MHz (Downlink)  
 NOMINAL POWER VOLTAGE: 120V  
 TEMPERATURE STABILIZATION PERIOD: 20 min  
 POWER DURING TEMPERATURE TRANSITION: Off  
 SPECTRUM ANALYZER MODE: Counter  
 RESOLUTION BANDWIDTH: 100 Hz  
 VIDEO BANDWIDTH: 300 Hz  
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	1 <sup>st</sup> min	2 <sup>nd</sup> min	3 <sup>rd</sup> min	4 <sup>th</sup> min	5 <sup>th</sup> min	10 <sup>th</sup> min	Positive	Negative			
<b>Low frequency 421.363 MHz</b>													
-30	nominal	421.36279	421.3628	421.36278	421.36277	421.36278	421.36277	421.36281	27	-8	210	-183	Pass
-20	nominal	421.36277	NA	NA	NA	NA	NA	421.36280	22	-8		-188	Pass
-10	nominal	421.36277	NA	NA	NA	NA	NA	421.36276	-8	-18		-192	Pass
0	nominal	421.362785	421.36277	421.36278	421.36276	421.36278	421.36276	421.36279	12	-18		-192	Pass
10	nominal	421.362805	NA	NA	NA	NA	NA	421.36279	27	-18		-183	Pass
20	+15%	421.363779	NA	NA	NA	NA	NA	421.36278	1	1		-209	Pass
20	nominal	421.362785	NA	NA	NA	NA	NA	421.36278*	7	0		-203	Pass
20	-15%	421.363779	NA	NA	NA	NA	NA	421.36278	1	0		-209	Pass
30	nominal	421.362787	421.36278	421.36278	421.36279	421.36279	421.36278	421.36279	9	-3		-201	Pass
40	nominal	421.36208	NA	NA	NA	NA	NA	421.36280	22	-3		-188	Pass
50	nominal	421.362812	NA	NA	NA	NA	NA	421.36280	34	0	-176	Pass	
<b>Mid frequency 422.525 MHz</b>													
-30	nominal	422.524775	422.52478	422.5248	422.5248	422.52478	422.52477	422.52477	24	-11	211	-187	Pass
-20	nominal	422.524775	NA	NA	NA	NA	NA	422.52477	-1	-11		-212	Pass
-10	nominal	422.52478	NA	NA	NA	NA	NA	422.52476	4	-16		-207	Pass
0	nominal	422.524765	422.52474	422.52475	422.52476	422.52478	422.52476	422.52476	-1	-36		-175	Pass
10	nominal	422.524815	NA	NA	NA	NA	NA	422.52482	39	39		-172	Pass
20	+15%	422.52478	NA	NA	NA	NA	NA	422.52478	4	1		-207	Pass
20	nominal	422.524783	NA	NA	NA	NA	NA	422.52478*	7	0		-204	Pass
20	-15%	422.52478	NA	NA	NA	NA	NA	422.52479	9	4		-202	Pass
30	nominal	422.524787	422.52478	422.52479	422.52479	422.52479	422.52478	422.52479	11	-1		-200	Pass
40	nominal	422.5248	NA	NA	NA	NA	NA	422.52478	24	-1		-187	Pass
50	nominal	422.524812	NA	NA	NA	NA	NA	422.52481	36	36	-175	Pass	
<b>High frequency 423.075 MHz</b>													
-30	nominal	423.074745	423.07476	423.07476	423.07477	423.07478	423.07478	423.07478	-5	-40	211	-171	Pass
-20	nominal	423.07476	NA	NA	NA	NA	NA	423.07478	-10	-25		-186	Pass
-10	nominal	423.074745	NA	NA	NA	NA	NA	423.07479	5	-40		-171	Pass
0	nominal	423.07479	423.07477	423.07477	423.07479	423.07478	423.07478	423.07480	10	-20		-191	Pass
10	nominal	423.07482	NA	NA	NA	NA	NA	423.07483	40	35		-171	Pass
20	+15%	423.074782	NA	NA	NA	NA	NA	423.07478	-2	-3		-208	Pass
20	nominal	423.074782	NA	NA	NA	NA	NA	423.07479*	0	-3		-208	Pass
20	-15%	423.074782	NA	NA	NA	NA	NA	423.07479	2	-3		-208	Pass
30	nominal	423.074774	423.07478	423.07478	423.07478	423.07478	423.07478	423.07478	-10	-11		-200	Pass
40	nominal	423.074775	NA	NA	NA	NA	NA	423.07479	2	-10		-201	Pass
50	nominal	423.074787	NA	NA	NA	NA	NA	423.07481	27	2	-184	Pass	

\* - Reference frequency



HERMON LABORATORIES

<b>Test specification: Section 90.213, Frequency stability</b>			
<b>Test procedure:</b> 47 CFR, Sections 2.1055; KDB 935210 D05 v01r04, section 4.8			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 10-Oct-19			
<b>Temperature:</b> 21.6 °C	<b>Relative Humidity:</b> 49 %	<b>Air Pressure:</b> 1016 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

Table 7.9.3 Frequency stability test results

OPERATING FREQUENCY: 426.363 – 428.075 MHz (Uplink)  
 NOMINAL POWER VOLTAGE: 120V  
 TEMPERATURE STABILIZATION PERIOD: 20 min  
 POWER DURING TEMPERATURE TRANSITION: Off  
 SPECTRUM ANALYZER MODE: Counter  
 RESOLUTION BANDWIDTH: 100 Hz  
 VIDEO BANDWIDTH: 300 Hz  
 MODULATION: Unmodulated

T, °C	Voltage, V	Frequency, MHz							Max frequency drift, Hz		Limit, Hz	Margin, Hz	Verdict
		Start up	1 <sup>st</sup> min	2 <sup>nd</sup> min	3 <sup>rd</sup> min	4 <sup>th</sup> min	5 <sup>th</sup> min	10 <sup>th</sup> min	Positive	Negative			
<b>Low frequency 426.363 MHz</b>													
-30	nominal	426.36277	426.36274	426.36276	426.362785	426.36276	426.36278	426.36278	-27	-72	213	-141	Pass
-20	nominal	426.362775	NA	NA	NA	NA	NA	426.362785	-27	-72		-141	Pass
-10	nominal	426.36278	NA	NA	NA	NA	NA	426.362755	-32	-57		-156	Pass
0	nominal	426.36272	426.362795	426.362785	426.362765	426.362775	426.36278	426.36277	-17	-92		-121	Pass
10	nominal	426.362785	NA	NA	NA	NA	NA	426.362795	-17	-92		-121	Pass
20	+15%	426.3628	NA	NA	NA	NA	NA	426.362812	0	-27		-186	Pass
20	nominal	426.3628	NA	NA	NA	NA	NA	426.362812	0	-12		-201	Pass
20	-15%	426.3628	NA	NA	NA	NA	NA	426.362878	66	-12		-147	Pass
30	nominal	426.362812	426.362787	426.3628	426.3628	426.362787	426.362787	426.362787	0	-25		-188	Pass
40	nominal	426.362787	NA	NA	NA	NA	NA	426.3628	-12	-25		-188	Pass
50	nominal	426.362812	NA	NA	NA	NA	NA	426.3628	0	0		-213	Pass
<b>Mid frequency 427.425 MHz</b>													
-30	nominal	427.424755	427.42478	427.42478	427.424785	427.424765	427.424765	427.424785	-15	-45	213	-168	Pass
-20	nominal	427.42479	NA	NA	NA	NA	NA	427.42477	-10	-30		-183	Pass
-10	nominal	427.42477	NA	NA	NA	NA	NA	427.42474	-30	-60		-153	Pass
0	nominal	427.424775	427.42477	427.424765	427.42478	427.42477	427.42476	427.42477	-20	-40		-173	Pass
10	nominal	427.424805	NA	NA	NA	NA	NA	427.424785	5	-15		-198	Pass
20	+15%	427.42480	NA	NA	NA	NA	NA	427.424787	0	-13		-200	Pass
20	nominal	427.424787	NA	NA	NA	NA	NA	427.42480*	0	-13		-200	Pass
20	-15%	427.424837	NA	NA	NA	NA	NA	427.42480	37	0		-176	Pass
30	nominal	427.42480	427.424775	427.424837	427.4248	427.424812	427.4248	427.424812	37	-25		-176	Pass
40	nominal	427.424787	NA	NA	NA	NA	NA	427.42480	0	-13		-200	Pass
50	nominal	427.424825	NA	NA	NA	NA	NA	427.424812	25	12		-188	Pass
<b>High frequency 428.075 MHz</b>													
-30	nominal	428.07478	428.07478	428.07479	428.07476	428.074775	428.074805	428.074775	-7	-52	214	-162	Pass
-20	nominal	428.074775	NA	NA	NA	NA	NA	428.074785	-27	-37		-177	Pass
-10	nominal	428.074745	NA	NA	NA	NA	NA	428.07476	-52	-67		-147	Pass
0	nominal	428.07477	428.074785	428.074755	428.074775	428.07475	428.074765	428.07479	-22	-62		-152	Pass
10	nominal	428.074805	NA	NA	NA	NA	NA	428.074795	-7	-17		-197	Pass
20	+15%	428.07480	NA	NA	NA	NA	NA	428.074812	0	-12		-202	Pass
20	nominal	428.074812	NA	NA	NA	NA	NA	428.074812	0	0		-214	Pass
20	-15%	428.074787	NA	NA	NA	NA	NA	428.074825	13	-25		-189	Pass
30	nominal	428.074812	428.074837	428.0748	428.074812	428.074812	428.074812	428.07480	25	-12		-189	Pass
40	nominal	428.074812	NA	NA	NA	NA	NA	428.07485	38	0		-176	Pass
50	nominal	428.074825	NA	NA	NA	NA	NA	428.074812	13	0		-201	Pass

\* - Reference frequency

Reference numbers of test equipment used

HL 2909	HL 1809	HL 1205	HL 3286		
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Full description is given in Appendix A.



<b>Test specification:</b> Sections 90.219(e)(2), 90.219(d)(6)(ii), 90.219(d)(6)(iii), Noise figure and ERP of noise test			
<b>Test procedure:</b> KDB 935210 D05 v01r04, section 4.6			
<b>Test mode:</b> Compliance		<b>Verdict:</b> PASS	
<b>Date(s):</b> 06-Oct-19			
<b>Temperature:</b> 24.2 °C	<b>Relative Humidity:</b> 48 %	<b>Air Pressure:</b> 1009 hPa	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>			

## 7.10 Noise figure test

### 7.10.1 General

This test was performed to measure the noise figure at RF antenna connector. Specification test limits are given in Table 7.10.1.

Table 7.10.1 Noise figure and ERP of noise limits

Operating frequency band	Noise figure limit, dB
<b>Class B Booster</b>	
421.363 – 423.075 (Downlink)	9.0
426.363 – 428.075 (Uplink)	9.0
Operating frequency	ERP of noise limit, dBm/10 kHz
Within the passband	-43
More than 1 MHz outside the passband	-70

### 7.10.2 Test procedure

7.10.2.1 The EUT was set up as shown in Figure 7.10.1, energized and its proper operation was checked.

7.10.2.2 The noise figure was measured with Noise Figure Analyzer as provided in the associated plots.

7.10.2.3 The test results are provided in Table 7.10.2 and the associated plots.

7.10.2.4 The ERP of noise test results are provided in Table 7.10.3 and the associated plots.

Figure 7.10.1 Noise figure calibration test setup

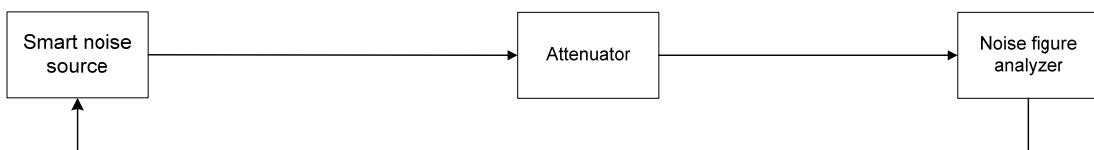
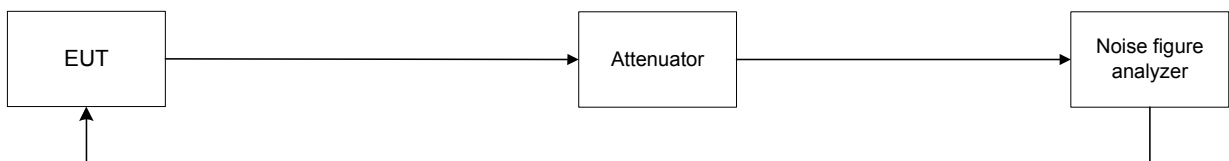


Figure 7.10.2 Noise figure measurement test setup







<b>Test specification:</b> Sections 90.219(e)(2), 90.219(d)(6)(ii), 90.219(d)(6)(iii), Noise figure and ERP of noise test	
<b>Test procedure:</b> KDB 935210 D05 v01r04, section 4.6	
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b> 06-Oct-19	
<b>Temperature:</b> 24.2 °C	<b>Relative Humidity:</b> 48 %
<b>Air Pressure:</b> 1009 hPa	
<b>Power:</b> 120 V/60 Hz	
<b>Remarks:</b>	

Table 7.10.2 Noise figure test results

Frequency, MHz	Noise figure, dB	Limit, dB	Margin, dB	Verdict
<b>Frequency range, 421.3 – 423.1 MHz Downlink</b>				
421.300	7.88	9.0	-1.12	Pass
421.550	7.44	9.0	-1.56	Pass
421.900	7.48	9.0	-1.52	Pass
422.450	8.34	9.0	-0.66	Pass
423.100	7.59	9.0	-1.41	Pass
<b>Frequency range, 426.3 – 428.1 MHz Uplink</b>				
426.350	2.81	9.0	-6.19	Pass
426.650	2.68	9.0	-6.32	Pass
427.250	2.53	9.0	-6.47	Pass
427.800	2.65	9.0	-6.35	Pass
428.100	2.37	9.0	-6.63	Pass

Table 7.10.3 ERP of noise test results

Frequency, MHz	SA Reading, dBm/10kHz	Antenna assembly gain***, dBd	ERP of noise, dBm/10kHz	ERP limit, dBm	Margin*, dB	Verdict
<b>Frequency range 421.3 – 423.1 MHz</b>						
<b>Downlink In-Band</b>						
422.402	-41.65	-6.0	-47.65	-43.0	-4.65	Pass
<b>Downlink Out-of-Band</b>						
420.308	-69.26	-6.0	-75.26	-70.0	-5.26	Pass
424.075	-64.18	-6.0	-70.18	-70.0	-0.18	Pass
<b>Frequency range 426.3 – 428.1 MHz</b>						
<b>Uplink In-Band</b>						
427.728	-71.61	0.0	-71.61	-43.0	-28.61	Pass
<b>Uplink Out-of-Band</b>						
425.820	-80.04	0.0	-80.04	-70.0	-10.04	Pass
428.664	-79.35	0.0	-79.35	-70.0	-9.35	Pass

\* - Margin = Maximum ERP – specification limit  
\*\* - ERP = SA reading + Antenna Assembly gain (dBd)

**Reference numbers of test equipment used**

HL 3433	HL 3434	HL 3818	FSVA3030*	FS-SNS40*		
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Full description is given in Appendix A.

\* Refer to Table 8.1.



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<b>Test specification:</b> Sections 90.219(e)(2), 90.219(d)(6)(ii), 90.219(d)(6)(iii), Noise figure and ERP of noise test	
<b>Test procedure:</b> KDB 935210 D05 v01r04, section 4.6	
<b>Test mode:</b> Compliance	<b>Verdict:</b> PASS
<b>Date(s):</b> 06-Oct-19	
<b>Temperature:</b> 24.2 °C	<b>Relative Humidity:</b> 48 %
	<b>Air Pressure:</b> 1009 hPa
	<b>Power:</b> 120 V/60 Hz
<b>Remarks:</b>	

Plot 7.10.1 Noise figure test results in frequency range 421.3 – 423.1 MHz

DETECTOR USED:  
NOISE FIGURE:  
CONFIGURATION:

Average  
Within the passband  
Downlink



Plot 7.10.2 Noise figure test results in frequency range 426.3 – 428.1 MHz

DETECTOR USED:  
NOISE FIGURE:  
CONFIGURATION:

Average  
Within the passband  
Uplink

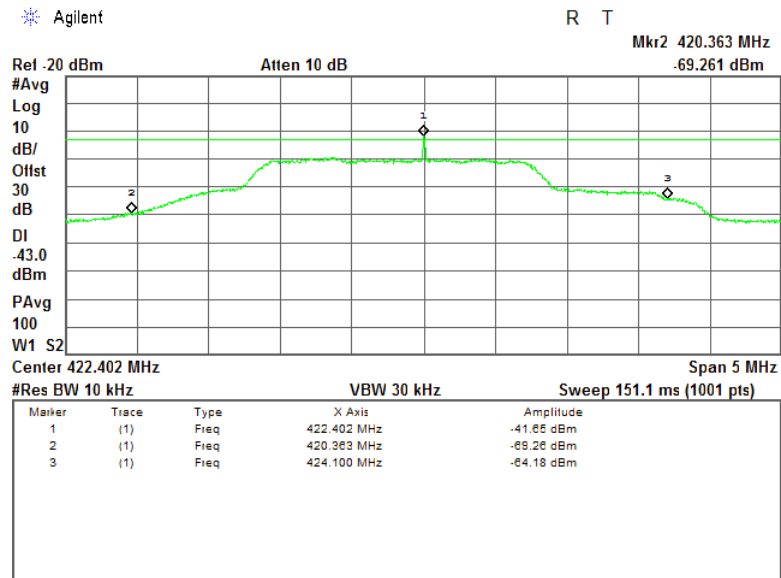




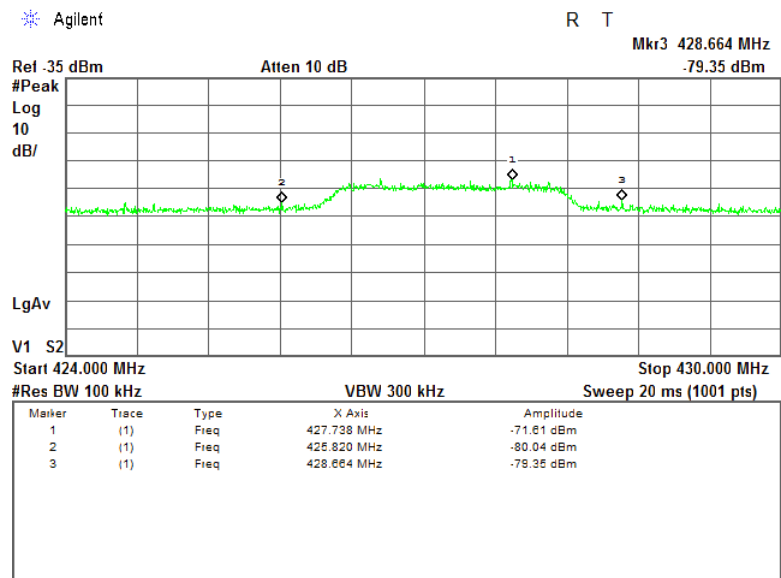
HERMON LABORATORIES

<b>Test specification:</b>		<b>Sections 90.219(e)(2), 90.219(d)(6)(ii), 90.219(d)(6)(iii), Noise figure and ERP of noise test</b>	
<b>Test procedure:</b>		KDB 935210 D05 v01r04, section 4.6	
<b>Test mode:</b>		Compliance	
<b>Date(s):</b>		06-Oct-19	
<b>Temperature:</b> 24.2 °C		<b>Relative Humidity:</b> 48 %	
<b>Air Pressure:</b> 1009 hPa		<b>Power:</b> 120 V/60 Hz	
<b>Remarks:</b>			
		<b>Verdict: PASS</b>	

Plot 7.10.3 ERP of noise test results in Downlink



Plot 7.10.4 ERP of noise test results in Uplink





### 8 APPENDIX A Test equipment and ancillaries used for tests

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./ Check	Due Cal./ Check
0446	Antenna, Loop, Active, 10 (9) kHz - 30 MHz	EMCO	6502	2857	24-Feb-19	24-Feb-20
0539	Generator Signal, 10 kHz - 1.2 GHz	Marconi Instruments	2023	112121/041	09-Jul-19	09-Jul-20
1205	One phase voltage regulator, 2kVA, 0-250V	Hermon Laboratories	TDGC-2	109	21-Apr-19	21-Apr-20
1809	HygroThermometer, Min/Max Memory	Delta TRAK	13301	NA	11-Aug-19	11-Aug-20
2909	Spectrum analyzer, ESA-E, 100 Hz to 26.5 GHz	Agilent Technologies	E4407B	MY41444762	04-Apr-19	04-Apr-20
3286	Temperature Chamber, (-50 to +170) °C	Thermotron	EL-8-CH-1-1-CO2	21-9048	18-Nov-18	18-Nov-19
3433	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25679	15-Apr-19	15-Apr-20
3434	Test Cable , DC-18 GHz, 1.5 m, SMA - SMA	Mini-Circuits	CBL-5FT-SMSM+	25683	15-Apr-19	15-Apr-20
3818	PSA Series Spectrum Analyzer, 3 Hz- 44 GHz	Agilent Technologies	E4446A	MY48250288	24-Apr-19	24-Apr-20
3903	Microwave Cable Assembly, 40.0 GHz, 1.5 m, SMA/SMA	Huber-Suhner	SUCOFLEX 102A	1226/2A	07-Apr-19	07-Apr-20
4011	Temp. & Humidity Meter, (-50 - +70) deg, (20 - 99 )% RH	Mad Electronics	HTC-1	NA	11-Aug-19	11-Aug-20
4354	Vector Signal Generator, 100 kHz to 6.0 GHz	Rohde & Schwarz	SMJ 100A	1403.4507K02-101777-rc	02-May-19	02-May-20
4360	EMI Test Receiver, 20 Hz to 40 GHz.	Rohde & Schwarz	ESU40	100322	31-Dec-18	31-Dec-19
4933	Active Horn Antenna, 1 GHz to 18 GHz	Com-Power Corporation	AHA-118	701046	06-Jan-19	06-Jan-20
5085	Attenuator, 4 dB, DC - 6 GHz, 1 W	Mini-Circuits	UNAT-4+	NA	08-Feb-19	08-Feb-20
5288	Trilog Antenna, 25 MHz - 8 GHz, 100W	Frankonia	ALX-8000E	00809	08-Feb-19	08-Feb-22
5309	Antenna Mast, 1-4 meter, Pneumatic polarization	Dolev Ltd	FMB 1-4	NA	24-Apr-19	24-Apr-20
5311	Controller	Dolev Ltd	FC-06	FC06.1-2016-024	24-Apr-19	24-Apr-20
5405	RF cable, 18 GHz, N-N, 6 m	Huber-Suhner	SF118/11N(x2)	500023/118	11-Aug-19	11-Aug-20
5409	RF cable, 40 GHz, SMA-SMA, 2 m	Huber-Suhner	SF102EA/11SK/11SK/2000M	503973/2EA	11-Aug-19	11-Aug-20
5472	Power Splitter / Combiner 0.5-1 GHz	Mini Circuits	ZAPD-1	NA	21-Jan-19	21-Jan-21



### 8.1 Test equipment and ancillaries used for tests

HL No.	Description	Manufacturer	Model	Ser. No.	Last Cal.	Due Cal.
NA	Signal & Spectrum Analyzer	Rohde & Schwarz	FSVA3030	100835	06-Feb-19	06-Feb-20
NA	Smart Noise Source	Rohde & Schwarz	FS-SNS40	114014	02-Jul-19	02-Jul-20

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

Test description	Expanded uncertainty
<b>Transmitter tests</b>	
Carrier power conducted at antenna connector	± 1.7 dB
Carrier power radiated (substitution method)	± 4.5 dB
Occupied bandwidth	±8%
Conducted emissions at RF antenna connector	9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB
Spurious emissions radiated 30 MHz – 40 GHz (substitution method)	± 4.5 dB
Frequency error	30 – 300 MHz: ± 50.5 Hz (1.68 ppm) 300 – 1000 MHz: ± 168 Hz (0.56 ppm)
Transient frequency behaviour	187 Hz ± 13.9 %
Duty cycle, timing (Tx ON / OFF) and average factor measurements	± 1.0 %

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 facility description

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

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for relevant parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; Recognized by Innovation, Science and Economic Development Canada for wireless and terminal testing (ISED), ISED #2186A, CAB identifier is IL1001; Certified by VCCI, Japan (the registration numbers are R-10808 for OATS, R-11082 for anechoic chamber, G-10869 for RE measurements above 1 GHz, C-10845 for conducted emissions site and T-11606 for conducted emissions at telecommunication ports).

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

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

## 11 APPENDIX D Specification references

47CFR part 90:2018	Private land mobile radio services
47CFR part 2: 2018	Frequency allocations and radio treaty matters; general rules and regulations
ANSI C63.26-2015 (clause 7)	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
KDB 935210 D02 v04r02	Signal Boosters Certification Requirements
KDB 935210 D05 v01r04	Measurements Guidance for Industrial and Non-consumer Signal Booster, Repeater and Amplifier Devices



## 12 APPENDIX E Test equipment correction factors

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

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

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

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

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



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

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

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

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



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

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



**Cable loss**  
**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, 1.5 m, SMA-SMA, S/N 1226/2A**  
**HL 3903**

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



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

Frequency, MHz	Cable loss, dB	Frequency, MHz	Cable loss, dB
0.1	0.04	5500	2.61
50	0.24	6000	2.88
100	0.33	6500	2.92
200	0.47	7000	2.97
300	0.57	7500	3.05
400	0.66	8000	3.16
500	0.75	8500	3.28
600	0.81	9000	3.49
700	0.87	9500	3.52
800	0.93	10000	3.63
900	0.99	10500	3.73
1000	1.06	11000	3.84
1100	1.10	11500	3.97
1200	1.15	12000	4.02
1300	1.19	12500	4.13
1400	1.27	13000	4.17
1500	1.31	13500	4.28
1600	1.37	14000	4.35
1700	1.40	14500	4.56
1800	1.42	15000	4.87
1900	1.46	15500	4.76
2000	1.50	16000	4.81
2500	1.71	16500	4.87
3000	1.90	17000	5.01
3500	2.03	17500	5.05
4000	2.23	18000	5.52
4500	2.42		
5000	2.46		



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

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



### 13 APPENDIX F Abbreviations and acronyms

A	ampere
AC	alternating current
AM	amplitude modulation
AVRG	average (detector)
BB	broad band
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
QP	quasi-peak
RE	radiated emission
RF	radio frequency
rms	root mean square
Rx	receive
s	second
T	temperature
Tx	transmit
V	volt

END OF DOCUMENT