

**Addendum to
Certification Test Report**

Description of Tests Performed

**RELM Communications
Model: RPU516A**

FCC ID: ARURPU416A

1.0 RF Power Output - FCC Section 2.1046

This test was performed by RELM Communications and the data supplied to ACS for inclusion into the test report. TIA/EIA-603 section 2.2.1 was the guiding procedure for measuring. The RF output power was measured using an HP 8901A Modulation Analyzer. Results were reported in section 7.2.1 of the test report and are given again below for convenience:

Applicable rule parts and limits

- FCC Part 22 – Less than 100 Watts
- FCC Part 74.461 – Less than 100 Watts
- FCC Part 80.215 – Less than 50 Watts
- FCC Part 90.205 – Less than 500 Watts

Results

Freq.(MHz)	Wide (Watts/Amps)
450.05	4.12/1.46
460.5	4.43/1.44
469.95	4.36/1.42

Conclusion

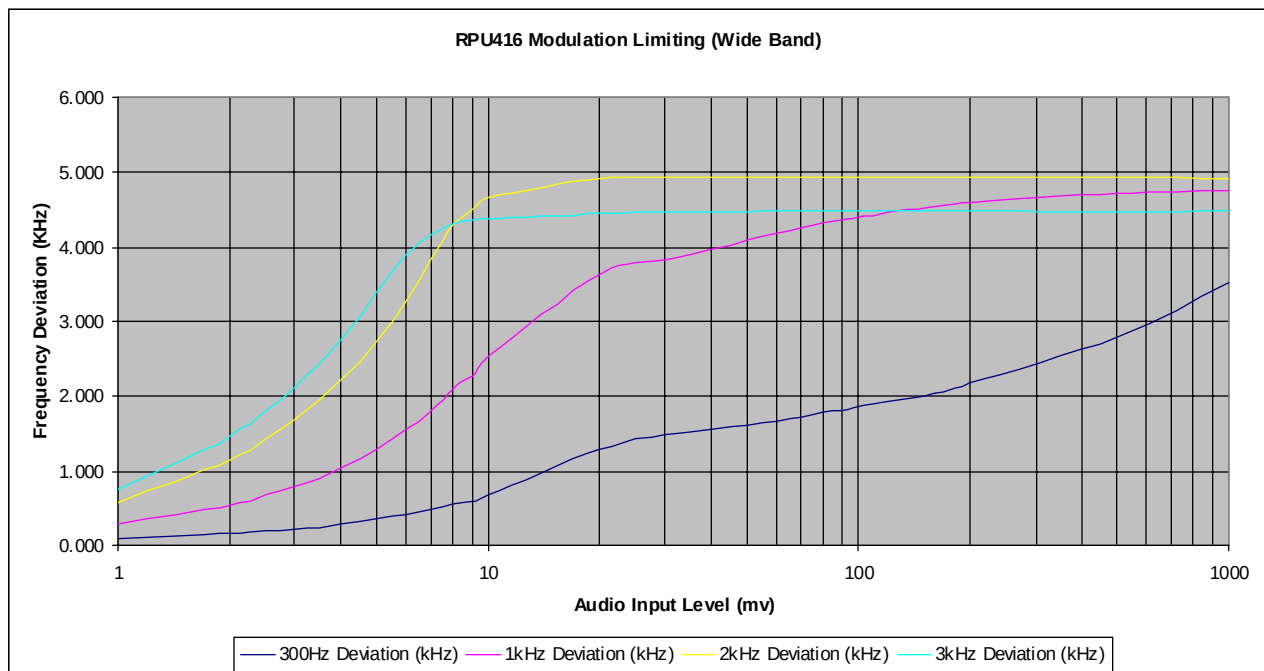
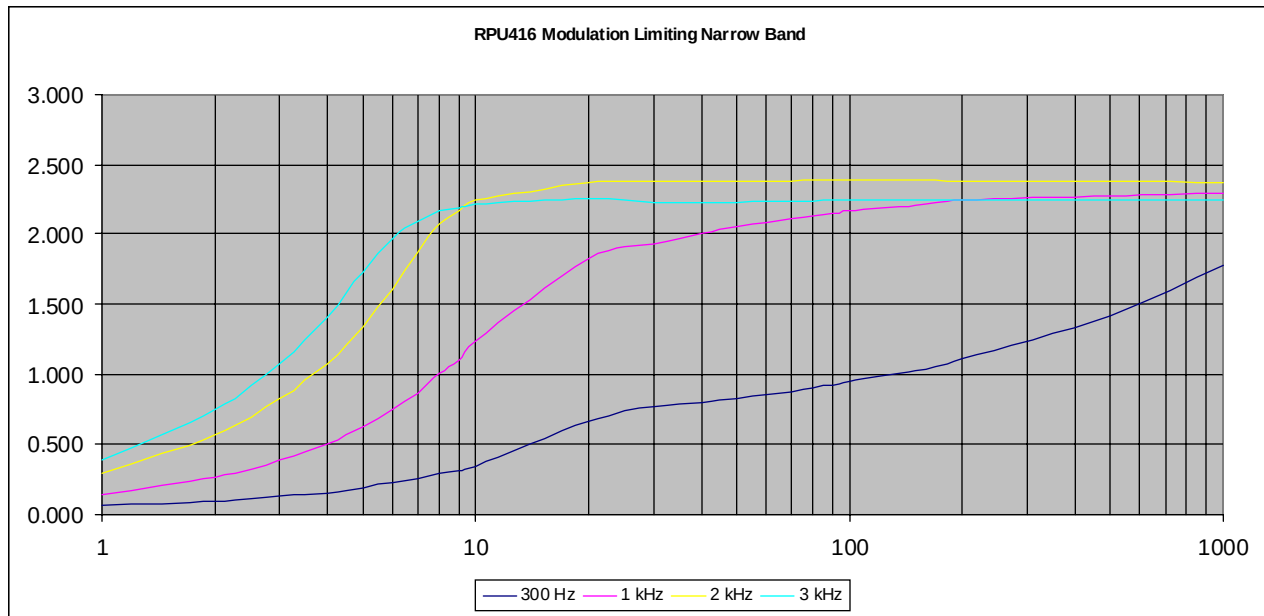
The EUT complies with all applicable parts of the rules.

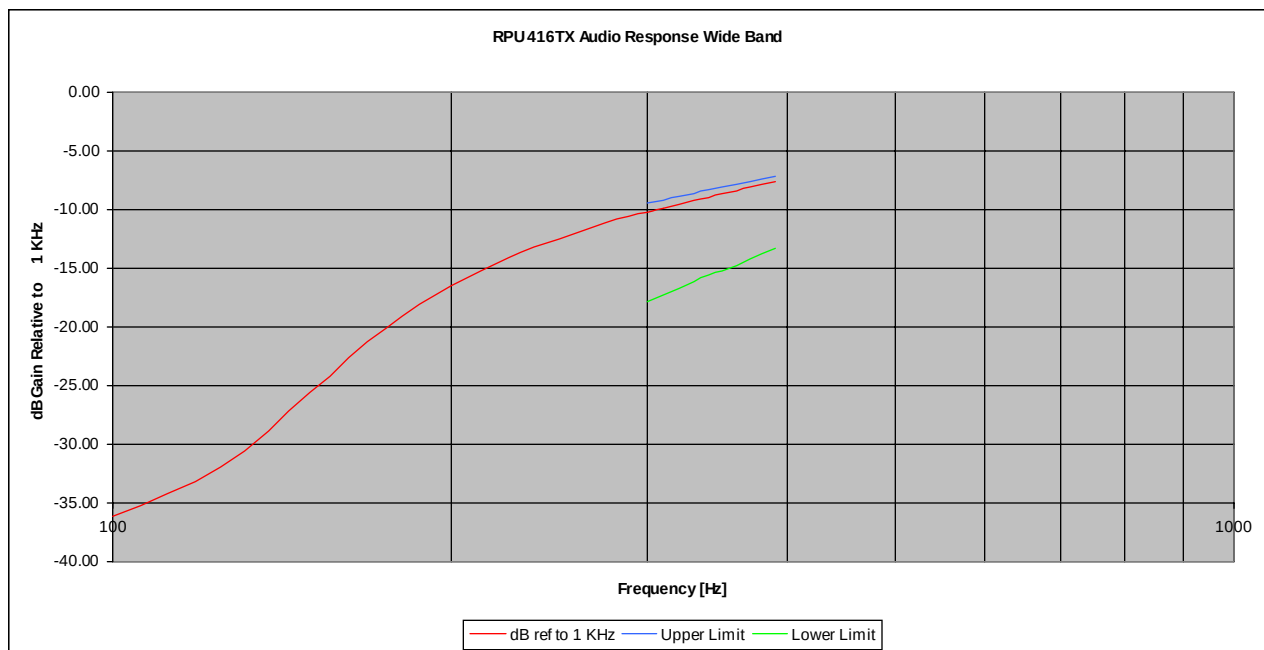
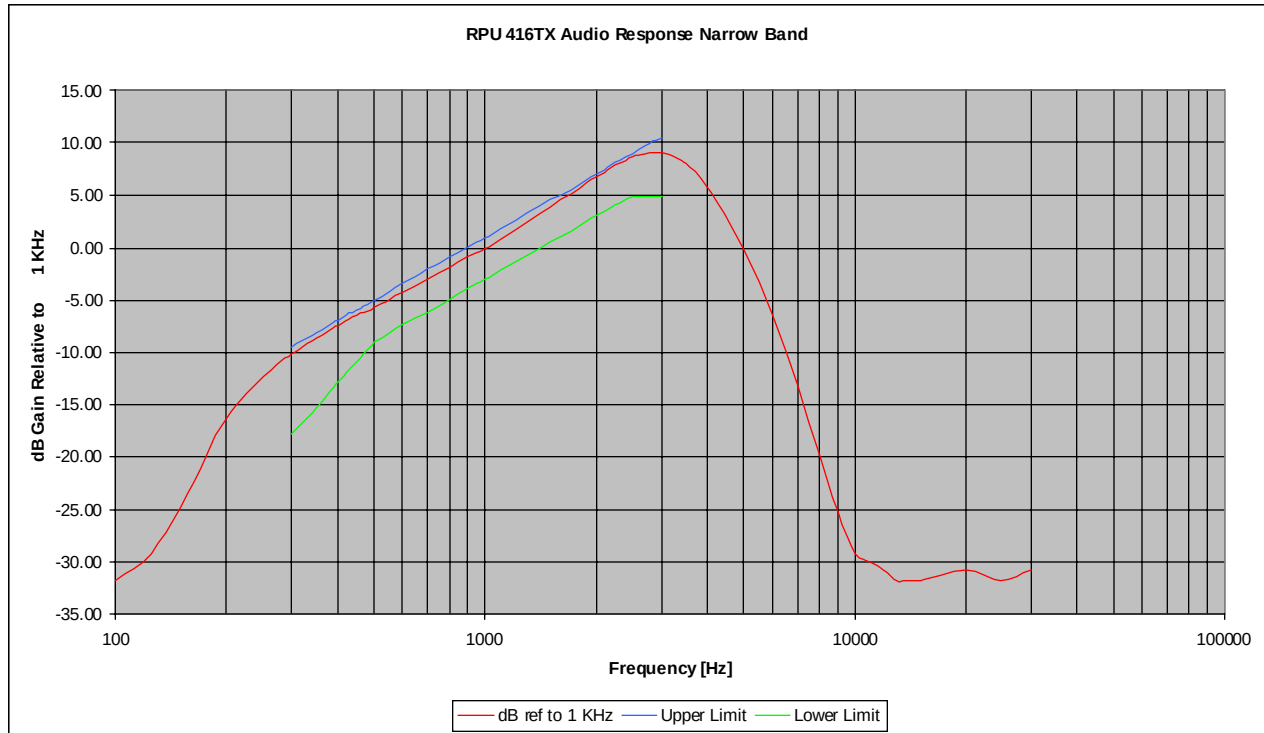
2.0 Modulation Characteristics - FCC Section 2.1047

This test was performed by RELM Communications and the data supplied to ACS for inclusion into the test report. TIA/EIA 603 2.2.3 was the guiding procedure for this test. The measurement was made using an HP8920A RF Communications Test Set. Results of the test were reported in Appendices B and C of the report, but are given below again for convenience.

Applicable rule parts and limits

- Part 22 – N/A
- FCC Part 74.463 - Each new remote pickup broadcast station authorized to operate with a power output in excess of 3 watts shall be equipped with a device which will automatically prevent modulation in excess of the limits set forth in this subpart. If frequency modulation is employed, the emissions shall conform to 74.462.
- FCC Part 80.213 - Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent. This requirement does not apply to survival craft transmitters, to transmitters that do not require a license or to transmitters whose output power does not exceed 3 watts.
- FCC Part 90.205 - Transmitters utilizing analog emissions that are equipped with an audio low-pass filter must meet the emission mask requirements of 90.210.

Results



Conclusion

The EUT complies with all applicable parts of the rules.

Occupied Bandwidth (FCC Section 2.1049)

This test was performed by RELM Communications and the data supplied to ACS for inclusion into the test report. TIA/EIA 603 2.2.11 was the guiding procedure for this test. The measurement was made using an HP8920A RF Communications Test Set and an HP8561A Spectrum Analyzer. Results of the test are reported in Appendix E of the report.

Applicable rule parts and limits**25 KHz**

- FCC Part 22.359
- FCC Part 74.462
- FCC Part 80.211
- FCC Part 90.210

Emission Mask B. For transmitters that are equipped with an audio lowpass filter pursuant to § 90.211(a), the power of any emission must be below the unmodulated carrier power (P) as follows:

- On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB or:
 - o $43 + 10 \log (4.12) = 49.14\text{dB}$ Low Channel
 - o $43 + 10 \log (4.43) = 49.46\text{dB}$ Mid Channel
 - o $43 + 10 \log (4.36) = 49.39\text{dB}$ High Channel

12.5 KHz

- FCC Part 90.210

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
- On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d \mp 2.88 \text{ kHz})$ dB.
- On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
 - $50 + 10 \log (4.12) = 56.14\text{dB}$ Low Channel
 - $50 + 10 \log (4.43) = 56.46\text{dB}$ Mid Channel
 - $50 + 10 \log (4.36) = 56.39\text{dB}$ High Channel

Conclusion

The EUT complies with all applicable parts of the rules.

Spurious Emissions at Antenna Terminal - FCC Section 2.1051

This test was performed by RELM Communications and the data supplied to ACS for inclusion into the test report. TIA/EIA 603 2.2.13 was the guiding procedure for this test. The measurement was made by connecting the EUT directly to the an HP8561A Spectrum Analyzer. Results of the test are reported in Appendix F of the report.

Applicable rule parts and limits

- FCC Part 22.359
- FCC Part 74.462
- FCC Part 80.211
- FCC Part 90.210

25 KHz - On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB:

- o $43+10 \log (4.12) = 49.14\text{dB}$ Low Channel
- o $43+10 \log (4.43) = 49.46\text{dB}$ Mid Channel
- o $43+10 \log (4.36) = 49.39\text{dB}$ High Channel

12.5 KHz - On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

- $50+10 \log (4.12) = 56.14\text{dB}$ Low Channel
- $50+10 \log (4.43) = 56.46\text{dB}$ Mid Channel
- $50+10 \log (4.36) = 56.39\text{dB}$ High Channel

- FCC Part 90.210

Conclusion

The EUT complies with all applicable parts of the rules.

Field Strength of Spurious Radiation - FCC Section 2.1053

Radiated spurious emissions were performed on an open area test site operated by ACS, Inc. The site have been fully described, submitted to, and accepted by the FCC and Industry Canada. FCC registration number 89450 and Industry Canada Lab Code IC 4175 have been assigned in recognition of the site. The site is also in conformance with publication CISPR16.

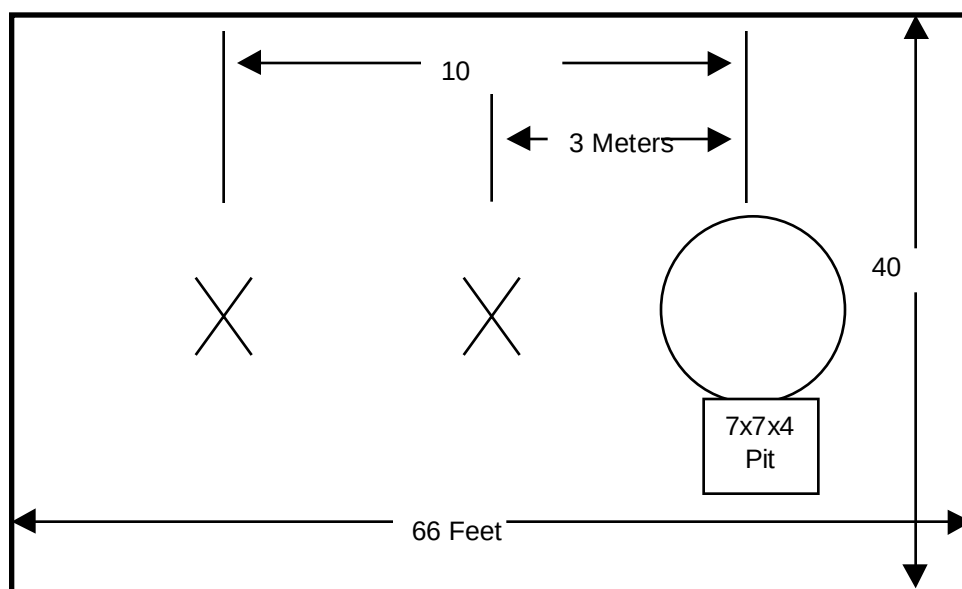
Radiated Emission Site Description

An open area test site(OATS) was used for measuring the radiated spurious emissions. The OATS was constructed in accordance with ANSI C63.4 and consists of a 40' x 66' concrete pad covered with perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane, however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4. A diagram of the Open Area Test Site is shown below:



Open Area Test Site

Applicable rule parts and limits

- FCC Part 22.359
- FCC Part 74.462
- FCC Part 80.211
- FCC Part 90.210

25 KHz - On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB:

- o $43 + 10 \log (4.12) = 49.14\text{dB}$ Low Channel
- o $43 + 10 \log (4.43) = 49.46\text{dB}$ Mid Channel
- o $43 + 10 \log (4.36) = 49.39\text{dB}$ High Channel

12.5 KHz - On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

- $50 + 10 \log (4.12) = 56.14\text{dB}$ Low Channel
- $50 + 10 \log (4.43) = 56.46\text{dB}$ Mid Channel
- $50 + 10 \log (4.36) = 56.39\text{dB}$ High Channel

- FCC Part 90.210

Results

25 kHz – The middle channel produced the highest power of 4.43 Watts. At this power level, the radiated spurious emission should be 49.4dB below the carrier. This value represents the worst case and was used to determine compliance of all channels with the requirements. Results are shown below:

Low Channel - 25kHz Channel Spacing						
Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Correction Factors (dB)	Corrected Level (dBm)	Attenuation Below Carrier (dB)	Final Result (Pass/Fail)
1350	3	-61.00	3.08	-57.92	107.38	PASS
1800.2	3	-61.9	8.71	-53.19	102.65	PASS
2250.25	3	-52.7	14.08	-38.62	88.08	PASS
2700.3	3	-46.3	18.63	-27.67	77.13	PASS
3150.35	3	-52.8	22.80	-30.00	79.46	PASS
3600.4	3	-55.7	28.01	-27.69	77.15	PASS
4050.45	3	-64.1	34.14	-29.96	79.42	PASS
4500.5	3	-64.3	40.04	-24.26	73.72	PASS
4950.55	3	-73.3	42.71	-30.59	80.05	PASS
Middle Channel - 25kHz Channel Spacing						
Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Correction Factors (dB)	Corrected Level (dBm)	Attenuation Below Carrier (dB)	Final Result (Pass/Fail)
1381.5	3	-66.2	3.48	-62.72	112.18	PASS
1842	3	-53	9.24	-43.77	93.23	PASS
2302.5	3	-53.8	14.68	-39.12	88.58	PASS
2763	3	-48.6	19.15	-29.45	78.91	PASS
3223.5	3	-45.3	23.60	-21.70	71.16	PASS
3684	3	-63.9	29.15	-34.75	84.21	PASS
4144.5	3	-66.9	35.38	-31.52	80.98	PASS
4605	3	-66.3	40.66	-25.64	75.10	PASS
5065.5	3	-66.8	37.91	-28.89	78.35	PASS
High Channel - 25kHz Channel Spacing						
Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Correction Factors (dB)	Corrected Level (dBm)	Attenuation Below Carrier (dB)	Final Result (Pass/Fail)
1409.85	3	-47.7	3.83	-43.87	93.33	PASS
1879.8	3	-60.8	9.71	-51.09	100.55	PASS
2349.75	3	-56.5	15.22	-41.28	90.74	PASS
2819.7	3	-51.3	19.63	-31.67	81.13	PASS
3289.65	3	-46.3	24.32	-21.98	71.44	PASS
3759.6	3	-66.8	30.19	-36.61	86.07	PASS
4229.55	3	-66.1	36.49	-29.61	79.07	PASS
4699.5	3	-66.4	41.22	-25.18	74.64	PASS
5169.45	3	-67.1	29.83	-37.27	86.73	PASS

12.5 kHz – The middle channel produced the highest power of 4.43 Watts. At this power level, the radiated spurious emission should be 56.4dB below the carrier. This value represents the worst case and was used to determine compliance of all channels with the requirements. Results are shown below:

Low Channel - 12.5kHz Channel Spacing						
Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Correction Factors (dB)	Corrected Level (dBm)	Attenuation Below Carrier (dB)	Final Result (Pass/Fail)
1350	3	-62.20	3.08	-59.12	115.52	PASS
1800.2	3	-59.8	8.71	-51.09	107.49	PASS
2250.25	3	-53.9	14.08	-39.82	96.22	PASS
2700.3	3	-54.1	18.63	-35.47	91.87	PASS
3150.35	3	-57.6	22.80	-34.80	91.20	PASS
3600.4	3	-60.1	28.01	-32.09	88.49	PASS
4050.45	3	-66.4	34.14	-32.26	88.66	PASS
4500.5	3	-67.1	40.04	-27.06	83.46	PASS
4950.55	3	-67.4	42.71	-24.69	81.09	PASS
Middle Channel – 12.5kHz Channel Spacing						
Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Correction Factors (dB)	Corrected Level (dBm)	Attenuation Below Carrier (dB)	Final Result (Pass/Fail)
1381.5	3	-61.70	3.48	-58.22	114.62	PASS
1842	3	-56.1	9.24	-46.87	103.27	PASS
2302.5	3	-57.4	14.68	-42.72	99.12	PASS
2763	3	-51.4	19.15	-32.25	88.65	PASS
3223.5	3	-51.8	23.60	-28.20	84.60	PASS
3684	3	-60.4	29.15	-31.25	87.65	PASS
4144.5	3	-62.1	35.38	-26.72	83.12	PASS
4605	3	-62	40.66	-21.34	77.74	PASS
5065.5	3	-63.2	37.91	-25.29	81.69	PASS
High Channel – 12.5kHz Channel Spacing						
Frequency (MHz)	Antenna Distance (m)	Level (dBm)	Correction Factors (dB)	Corrected Level (dBm)	Attenuation Below Carrier (dB)	Final Result (Pass/Fail)
1409.85	3	-48.1	3.83	-44.27	100.67	PASS
1879.8	3	-61.1	9.71	-51.39	107.79	PASS
2349.75	3	-55.8	15.22	-40.58	96.98	PASS
2819.7	3	-54.6	19.63	-34.97	91.37	PASS
3289.65	3	-52.3	24.32	-27.98	84.38	PASS
3759.6	3	-67.9	30.19	-37.71	94.11	PASS
4229.55	3	-68.9	36.49	-32.41	88.81	PASS
4699.5	3	-69.1	41.22	-27.88	84.28	PASS
5169.45	3	-68.4	29.83	-38.57	94.97	PASS

Frequency Stability - FCC Section 2.1055

This test was performed by RELM Communications and the data supplied to ACS for inclusion into the test report. TIA/EIA 603 2.2.2 was the guiding procedure for this test. The measurement was made by connecting the EUT directly to the an HP8561A Spectrum Analyzer. Results of the test were reported in section 7.2.2 of the report and are given again below for convenience.

Applicable rule parts and limits

- FCC Part 22.355 – 5.0 ppm > 3 Watts
- FCC Part 74.464 - .0005%(5.00 ppm) > 3 Watts
- FCC Part 80.209 – 5.0 ppm > 3 Watts
- FCC Part 90.213 – 5.0 ppm > 2 Watts

Results

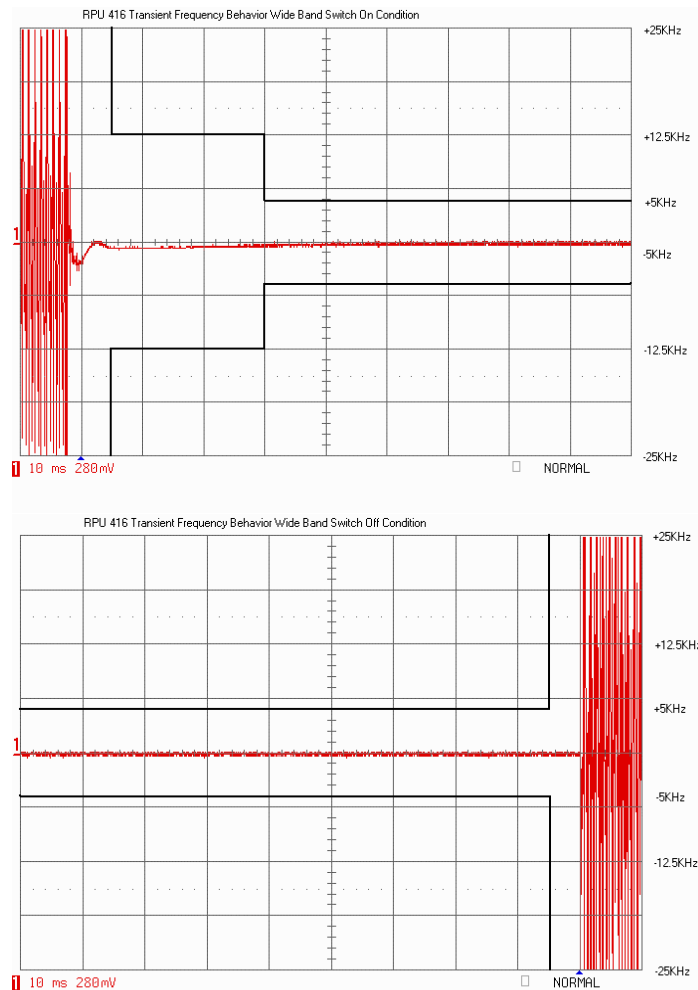
Temperature (C)	Frequency Error (PPM)
60	0.074
50	-0.017
40	-0.095
30	0.000
25	0.076
20	0.200
10	0.625
0	1.020
-10	1.490
-20	1.620
-30	1.440

Conclusion

The EUT complies with all applicable parts of the rules.

Transient Frequency Behavior - FCC Section 90.214

This test was performed by RELM Communications and the data supplied to ACS for inclusion into the test report. TIA/EIA 603 2.2.19 was the guiding procedure for this test. The measurement was made by connecting the EUT directly to a LeCroy digital oscilloscope. Results of the test were reported in Appendix G of the report and are given again below for convenience.

Results**Conclusion**

The EUT complies with all applicable parts of the rules.