TEST REPORT

Elpro 905U-K Spread Spectrum Radio Modem

Tested for compliance with the

Code of Federal Regulations (CFR) 47

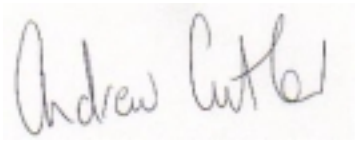
Part 15 – Radio Frequency Devices, Subpart C – Intentional Radiators

Section 15.247 – Operation in the band 902 – 928 MHz

For

ELPRO Technologies PTY Ltd

This Test Report is issued with the authority of:



Andrew Cutler - General Manager

Prepared by:

Karen Miller – Office Administrator

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1. CLIENT INFORMATION

Company Name	ELPRO Technologies Pty Ltd
Address	9/12 Billabong Street Stafford
State	Queensland 4053
Country	Australia
Contact	John White

2. DESCRIPTION OF TEST SAMPLE

Brand Name	ELPRO
Model Number	905U-K
Product	Radio Modem
Manufacturer	ELPRO Technologies Pty Ltd
Country of Origin	Australia
Serial Number	0102100 9999
FCC ID	O9PELP905K

3. SUMMARY OF TEST RESULTS

Testing was carried out in accordance with the test methods defined in 47 CFR Part 15 and in particular Sections 15.203, 15.205, 15.207, 15.209 and 15.247.

CLAUSE	TEST PERFORMED	RESULT
15.203	antenna requirement	Complies
15.205	operation in restricted bands	Complies
15.207	conducted emissions	Complies
15.209	radiated emissions	Complies
15.247:		
(a)(1)(i)	channel occupancy / bandwidth	Complies
(b)(2)	peak output power	Complies
(b)(4)	radio frequency hazard	Complies
(c)	out of band emissions	Complies

4. ARTICLES SUBMITTED

1 x ELPRO 905U-K Spread Spectrum Radio Modem, Sn# 0102100 9999 consisted of the following items:

- 902 – 928 MHz frequency hopping spread spectrum transmitter
- Ever Glow DDU200045 120 Vac / 20 Vdc AC Adaptor
- Antenna agencies YU800/6 Yagi antenna. Sn# 191201.
- ZCG Scalar CFD/890EL Whip antenna. Sn# 0003164.
- ZCG Scalar SG900-6 Whip antenna. Sn# 0003991.

The device has no external user controls.

Testing was carried out using software control, which allowed the following changes to be made:

- Frequency hopping in two bands: 902 – 915 MHz and 915 – 928 MHz.
- Frequency hopping using 8 different pseudo random sequences
- Changes in modulation:
  - None,
  - 115.2 kbps (bit reversals at 115200 bits per second),
  - 57.6 kbps (bit reversals at 57600 bits per second),
  - 19.2 kbps (bit reversals at 19200 bits per second).
- Single frequency operation.

The sample consisted of a transmitter only and did not include a receiver.

5. TEST SAMPLE DESCRIPTION

The sample tested is a frequency hopping spread spectrum transceiver, with a serial data input, with the following specifications:

Rated Transmitter Output Power

1 watt

Test frequencies

902 – 915 MHz

915 – 928 MHz

50 frequencies in a pseudo random sequence and a frequency spacing of 250 kHz with a one-guard frequency at the bottom and top of the frequency band, which is not used in the hop sets.

Frequency Range

902.0 – 928.0 MHz

Modulation Type

The following modulation type was utilised:
- Frequency Hopping Spread Spectrum.
- 115.2 kbps (bit reversals at 115200 bits per second).

Power Supply

Ever Glow DDU200045 120 Vac / 20 Vdc AC Adaptor

External Ports

The Radio Telemetry Module has the following ports:
- antenna port which has a reverse SMA connector (unique connector)
- Data port.

Spread Spectrum Radio Operation

The transceiver is controlled by a microprocessor, which performs the hopping, data transmit and data receive functions.

Eight hop sets are programmed into the microprocessors non-volatile memory at the factory. The hop set number, used by the transmitter, is programmed by the user.

One unit communicates with another unit using data packets that have a maximum size of 300ms. Each packet sent to another unit is acknowledged by the receiving unit. If an acknowledge message is not received within the timeout period then the transmitter will retry the message.

Each data packet comprises of 30ms of training data reversals and synchronization words, which allows the receiver to lock onto a valid data packet.

The hop sets used by the transceiver have been calculated using a random number generator and selected so that they are mutually orthogonal (have a very low cross correlation). Each hop set contains 50 frequencies.

The hop set is listed in memory in its random order, so that the transmitter simply uses the next value in the hop set list, when it is required to make a transmission.

So each time the transmitter wants to transmit it selects the next frequency in the hop set that it is using, programs the transceivers PLL to that frequency, starts the RF PA and then modulates the transmitter with the data required to be sent.

So each transmission is on a different frequency in the list (even retries) and hence all frequencies are used equally. The other receiving unit which acknowledges the transmission is using the same hop set, but its transmission are not synchronized (it will be in a different position in the same hop set) with the sending unit.

For example if the hop set list was 21,83,115,81,113,65,105,61 (8 channel hop set). Each of these numbers is a channel number using a spacing of 125kHz (we only use odd channel numbers because we use a 250kHz channel spacing) and starting from 902MHz.

The sequence of transmissions would be as follows:

1st transmission ---> channel 21
good acknowledge received <-----
2nd transmission ---> channel 83
bad acknowledge received <------
3rd transmission (retry of 2nd transmission) ----> channel 115
good acknowledge received <-----
4th transmission ----> channel 81
….
….
….
8th transmission ----> channel 61
good acknowledge received <-----
9th transmission ----> channel 21 (goes back to start of sequence)

Attached in appendix A are details of the hop sets for this transceiver.

6. ATTESTATION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification with the following conditions:

The test sample was selected by the client.

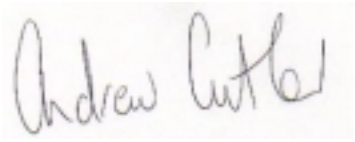
The report relates only to the sample tested.

This report does not contain corrections or erasures.

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

In addition this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations. To the best of my knowledge, these tests were performed using measurement procedures that are consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards.

I further certify that the necessary measurements were made by EMC Technologies NZ Ltd, 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand.



Andrew Cutler
General Manager
EMC Technologies NZ Ltd

7. TRANSMITTER TEST RESULTS

Section 15.203 – Antenna requirement

The antennas that attach to this system use a unique connector.

The connector used is a reverse SMA connector, which is not a standard antenna connector.

A photograph of this unique connector is contained within this report.

Section 15.205 – Restricted bands of operation

Refer to measurements made with reference to Section 15.247 (c)

Section 15.207 – Conducted emissions

Conducted emissions testing was carried out over the frequency range of 450 kHz to 30 MHz.

Testing was carried out at the laboratory's MacKelvie Street screened room.

The device was placed on top of the test table, which is 1m x 1.5m, 80cm above the screened room floor which acts as the horizontal ground plane. In addition the device was positioned 40cm away from the screened room wall which acts as the vertical ground plane. The artificial mains network was bonded to the screened room floor. At all times the device was kept more than 80cm from the artificial mains network.

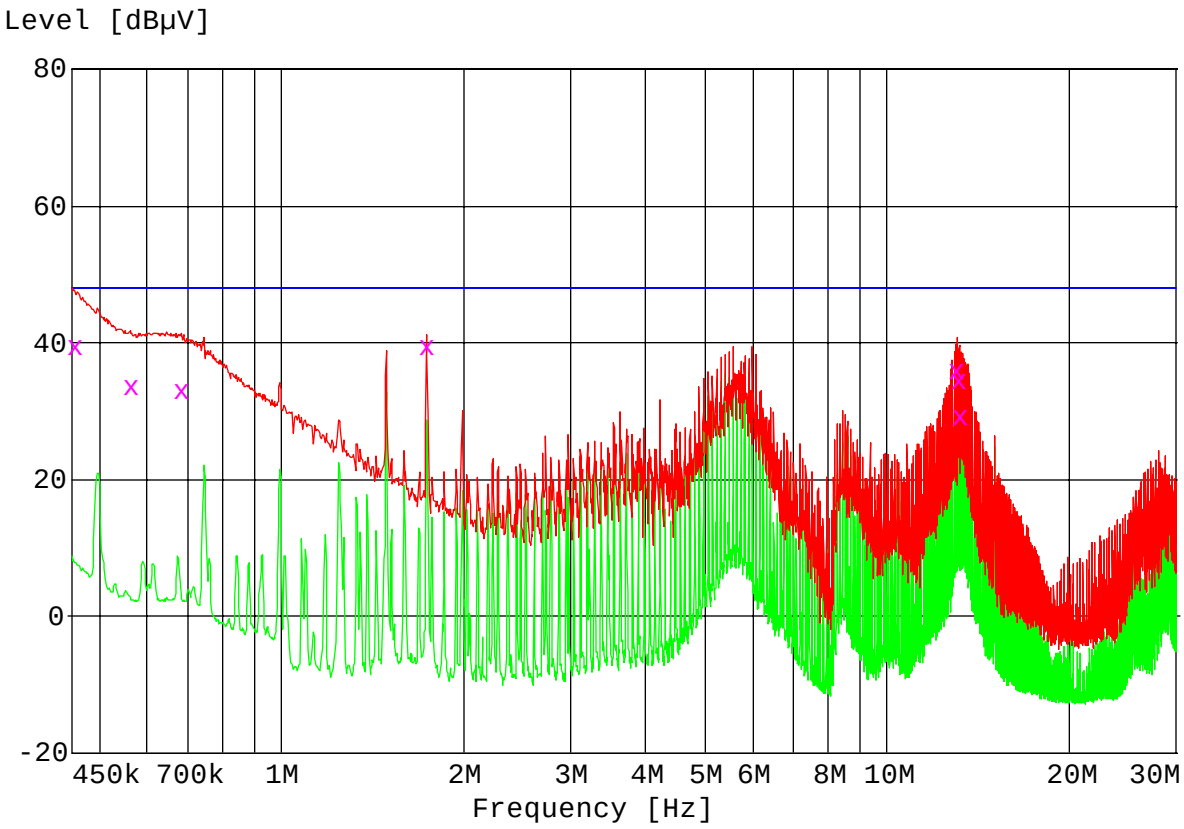
Measurement uncertainty with a confidence interval of 95% is:
- Mains terminal tests (0.15 - 30 MHz) ± 2.2 dB

Result: Complies with a 8.4 dB margin at 0.454 MHz (Quasi Peak).

Conducted Emissions Results

Comments:	***Device tested at 110 Vac while transmitting continuously using hop set 0.***

KEY			
Peak		Quasi Peak	X
Average		Average	+



Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Exceed	Phase	Rechecks dBµV
0.454000	39.6	48.00	8.4		N	*39.0*
0.562000	33.6	48.00	14.3		N	
0.684000	33.0	48.00	14.9		N	
1.735000	39.5	48.00	8.5		N	*39.7*
12.990000	35.9	48.00	12.0		N	
13.075000	34.5	48.00	13.4		N	
13.160000	29.2	48.00	18.7		L1	

Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Exceed	Phase	Rechecks dBµV
No results recorded						

Section 15.209 – Radiated emissions

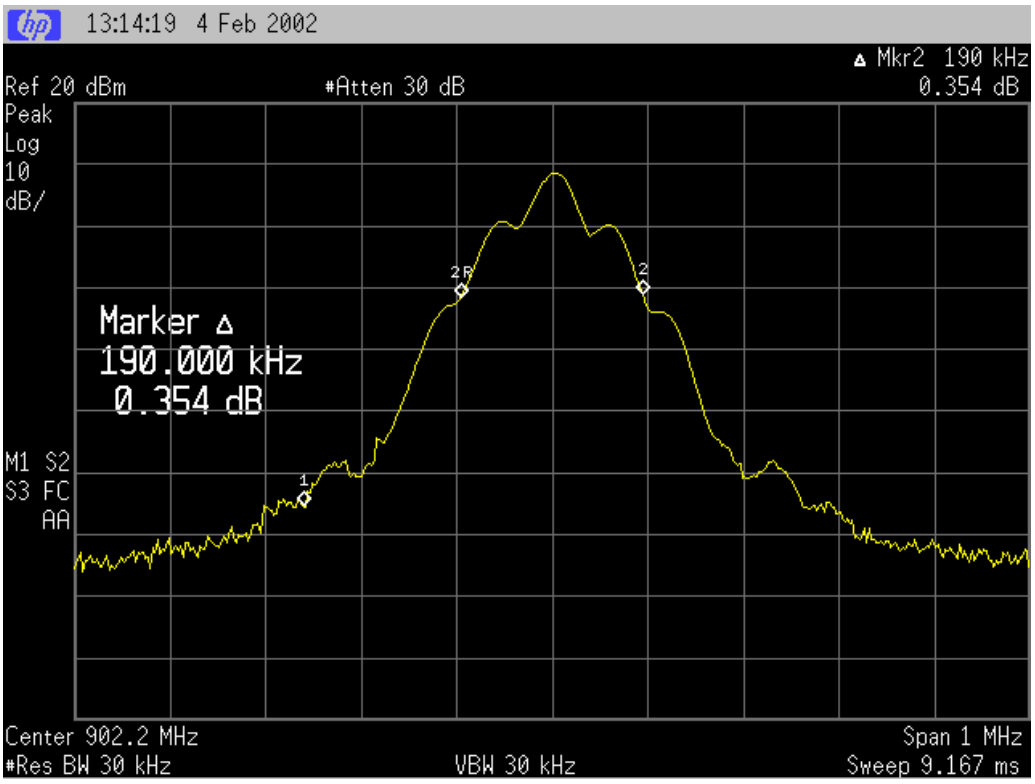
In accordance with section 15.247(c), attenuation below the general limits specified in Section 15.209(a) is not required.

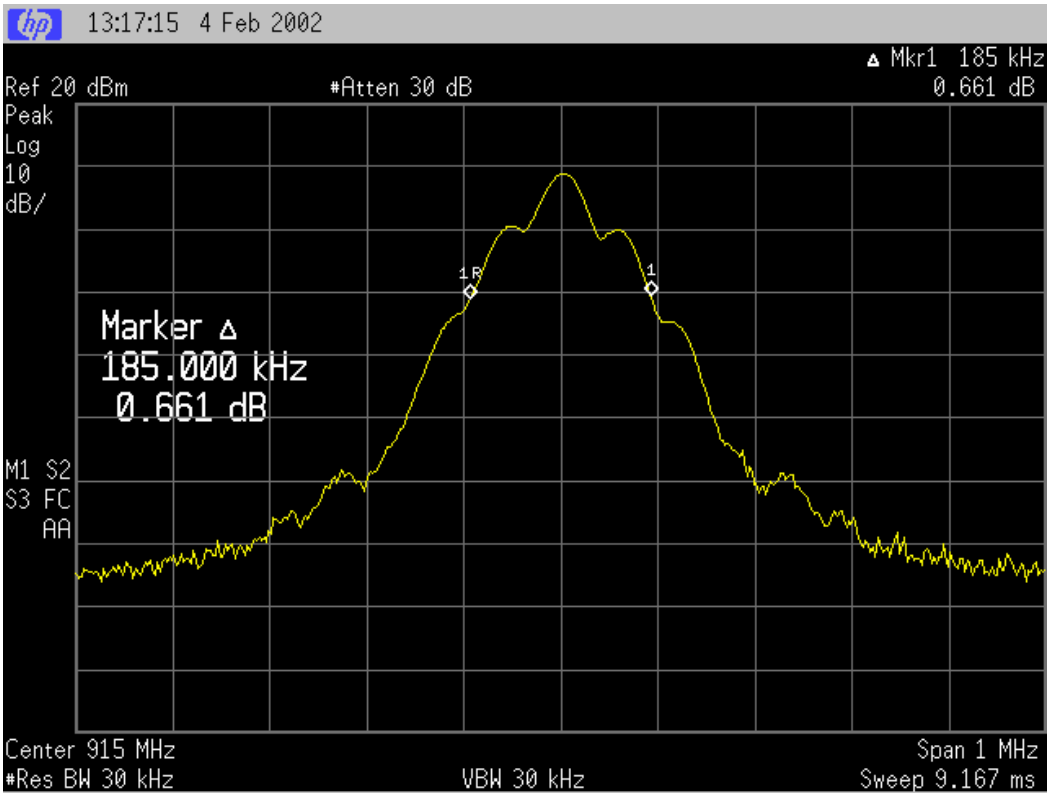
However radiated emissions that fall within the restricted bands, as defined in Section 15.205(a), must comply with the radiated emission limits specified in Section 15.209(a).

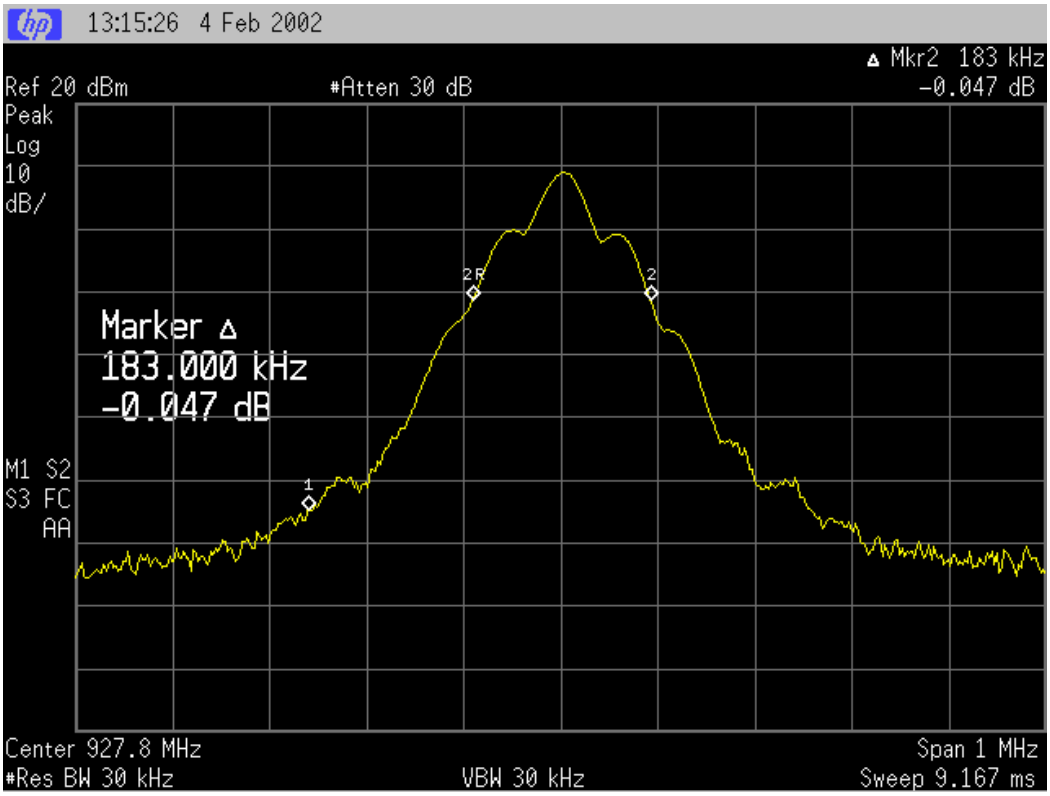
Section 15.247 (a) (1) (i) - Channel occupancy / bandwidth

Measurements were carried out on 3 single frequencies across the operating range of the transceiver with 115.2 kbps modulation being applied.

At each frequency the 20 dB bandwidth was measured using a spectrum analyser.







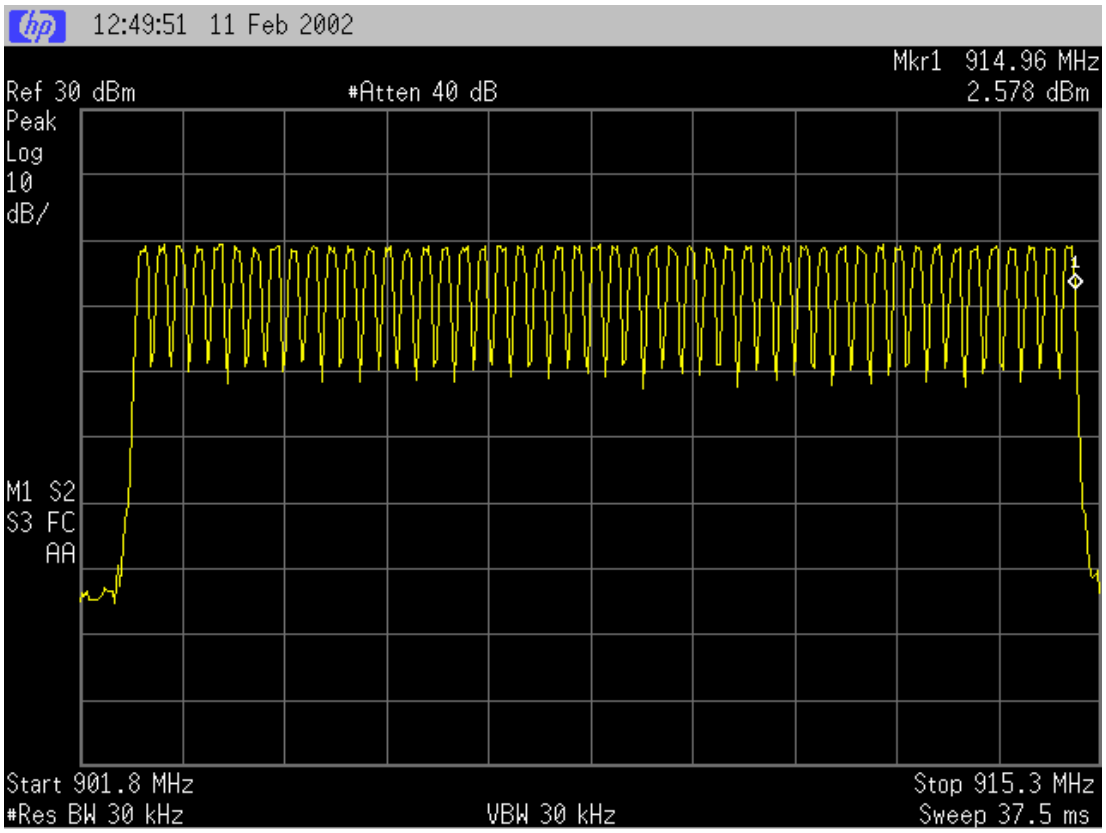
The bandwidth was observed to be:

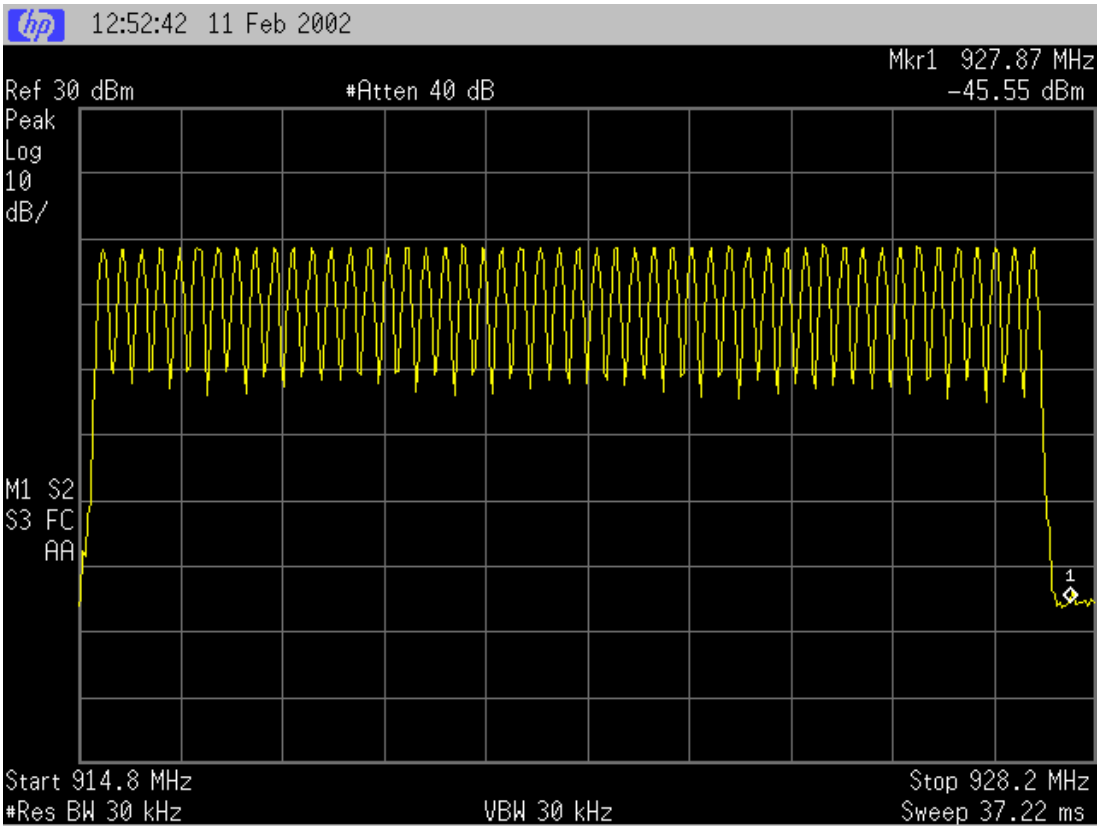
902.2 MHz	190 kHz
915.0 MHz	185 kHz
927.8 MHz	183 kHz

Testing was carried out in accordance with the less than 250 kHz requirements.

For a bandwidth of less than 250 kHz at least 50 channels should be used.

Tests were carried out between 902 – 915 MHz and 915 – 928 MHz that show that this device uses 50 channels in each of these bands.

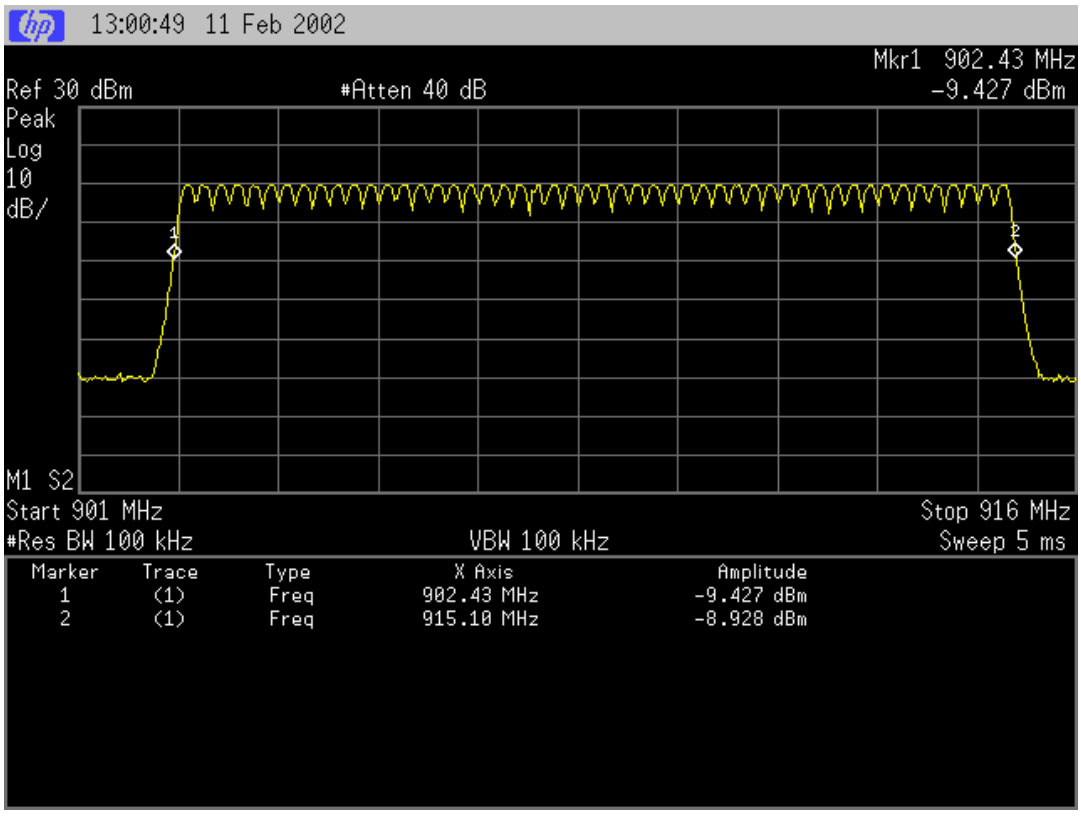


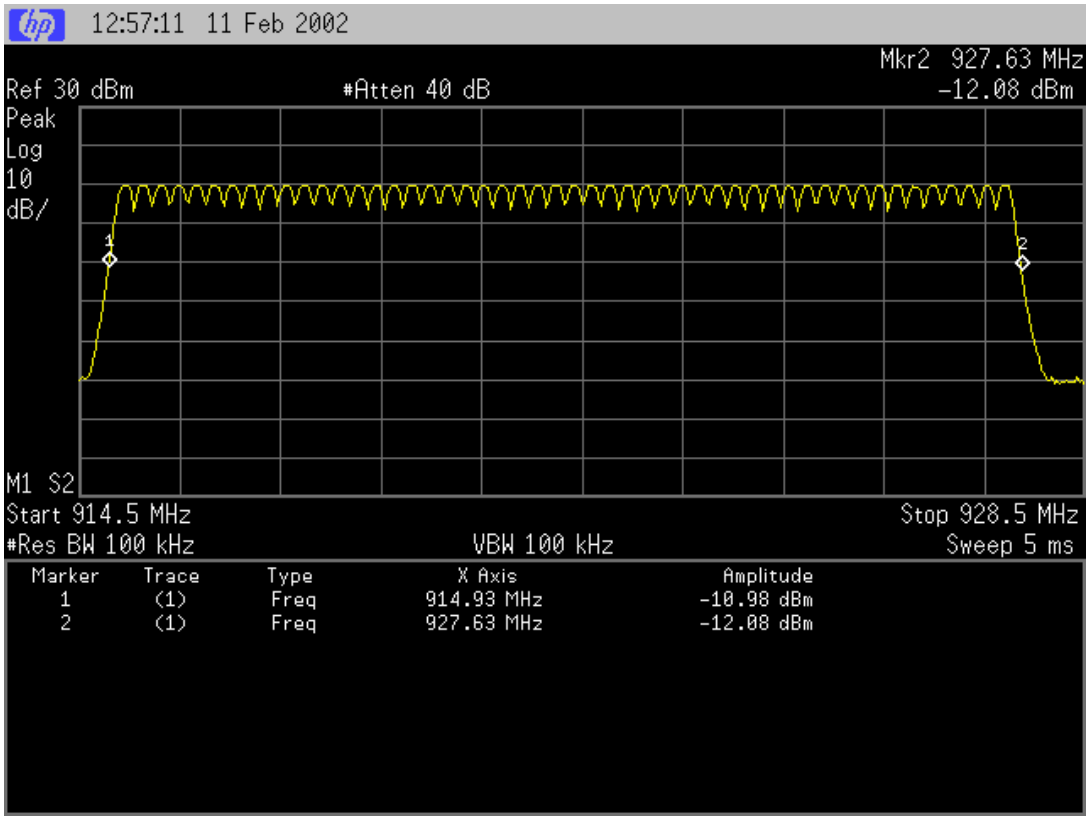


Band edge measurements were carried out to determine that the fundamental emissions from the device fell within the band edges of 902.0 – 928.0 MHz at the –20 dB emission level.

Measurements at the band edges were made using a resolution bandwidth of 100 kHz.

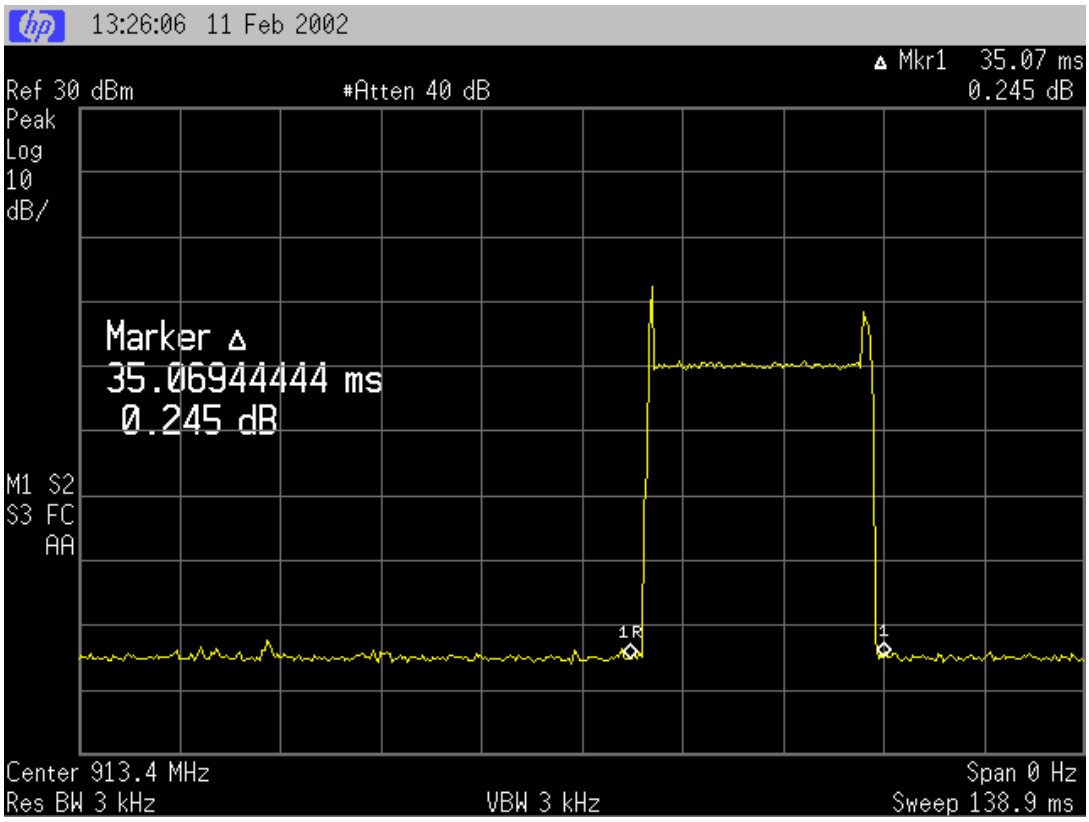
The fundamental emissions were observed to stay within the band 902 – 928 MHz when measurements were made at the –20 dB points.

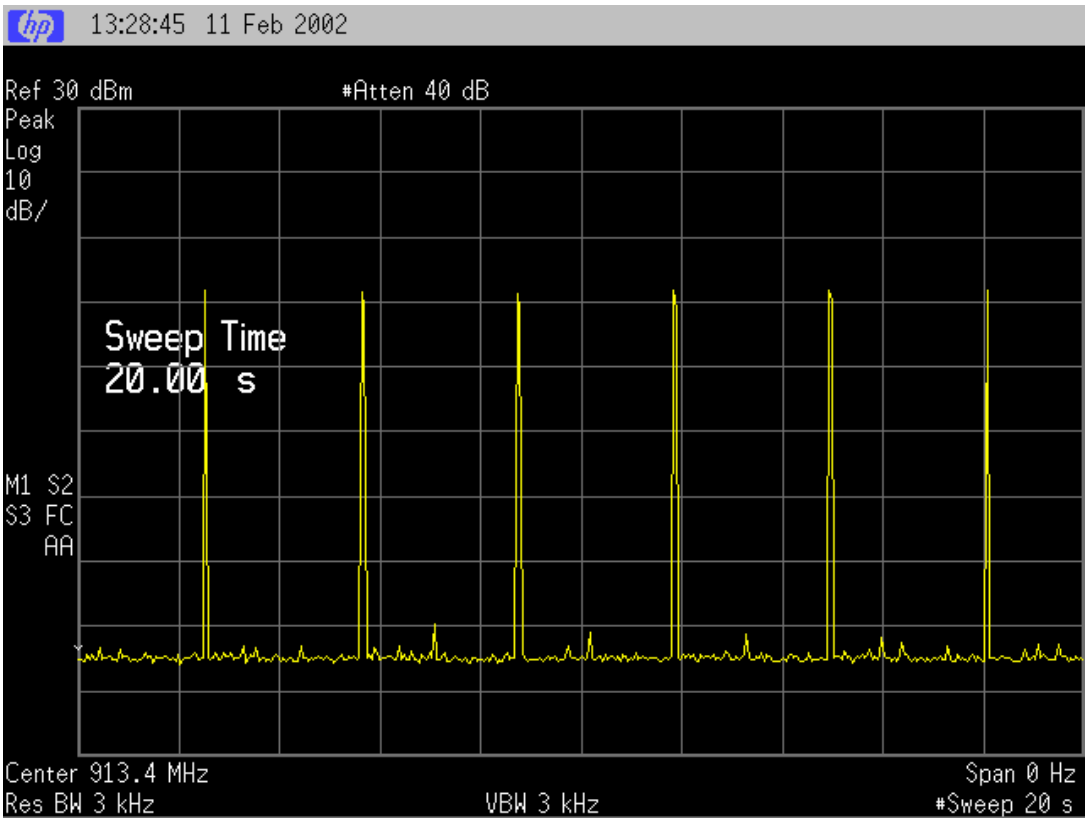




The average time occupancy on any frequency shall not exceed 400 milliseconds in any 20 second period.

Using a spectrum analyser with a 0 Hz frequency span the "on frequency time" was determined to be 35 mS.





With the spectrum analyser still operating with a 0 Hz frequency span the transmitter was observed to be "on frequency", on average, 6 times in any 20 second period.

Therefore 35 mS x 6 times = 210 mS.

Result: Complies

Section 15.247 (b) (2) – Peak output power

Measurements were carried out at the RF output terminals of the transmitter using a 20 dB power attenuator and a spectrum analyser.

Measurements were carried out when the transmitter was not being modulated and while operating on a single frequency.

Measurements were made with the input voltage set to 110 Vac.

RF power output (Watts)			
Frequency (MHz)	**Level (dBm)**	**Rated (dBm)**	**Limit (dBm)**
902.875	29.6	30.0	30.0
915.375	29.7	30.0	30.0
927.125	29.7	30.0	30.0

Variation of the supply voltage did not vary the output power significantly.

Attached in appendix B are details of the antennas to be sold with this transmitter.
Antenna gains are as follows:
- SG900-6 collinear antenna with CC10/900 kit 5 dBi
- SG900-6 collinear antenna with CC20/900 kit 2 dBi
- YU6/900 6 element yagi with CC20/900 kit 4 dBi

The transmitter output power can remain at +30 dBm for all of the above antennas, as the gain of each antenna set up is less than 6 dBi.

Limits:
The maximum peak output power for frequency hopping systems operating in the 902 – 928 MHz shall not exceed 1 watt for systems employing at least 50 channels. Antenna gains to be less than 6 dBi.

Result: Complies

Measurement Uncertainty: *±0.5 dB*

Section 15.247 (b) (4) – Radio Frequency Hazard Information

As per Section 15.247 (b) (4) spread spectrum transmitters operating in the 902 – 928 MHz band are required to be operated in a manner that ensures that the public is not exposed to RF energy levels in accordance with CFR 47, Section 1.1307(b)(1).

In accordance with this section and also Section 2.1091 this device has been defined as a mobile device whereby a distance of 20 cm can normally be maintained between the user and the device.

In accordance with Section 1.1310 the Maximum Permissible Exposure (MPE) limits for the General Population / Uncontrolled Exposure of f/1500 have been applied.

The maximum distance from the antenna at which the MPE is met or exceeded is calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain and separation distance in metres:

E, V/m = $(\sqrt{}\ (30 * P * G)) / d$

Power density, $mW/m^2 = E^2/3770$

E for MPE: $(902/1500) = E^2/3770$

$E = \sqrt{}(902/1500)*3770$

$E = \underline{47.6\ V/m}$

This transmitter is to be sold with a variety of antennas the details of which are contained in appendix B. The SG900-6 collinear antenna when used with the CC10/900 kit has the highest gain of 5 dBi (gain = 3.2). The maximum transmitter power measured was at 29.7 dBm = 0.93 watts.

Therefore:

$d = \sqrt{}\ (30 * P * G) / E$

$= \sqrt{}\ (30 * 0.93 * 3.2) / 47.6$

$= \underline{0.198 \text{ metres or } 19.8 \text{ cm}}$

Calculations show that this device, with the described antennas, meets the MPE requirement for mobile devices, falling below the 20 cm clearance required.

Section 15.247 (c) – Out of band emissions

Using a spectrum analyser and an external 20 dB attenuator the power reference level was determined to be +29.7 dBm.

Conducted measurements were carried out at the antenna port.

Measurements were made with the device operating in single frequency mode.

A check was also made with the device operating in frequency hopping mode around the frequency band of operation and at the harmonic frequencies. No significant differences were observed when compared to the levels observed when operating in single frequency mode.

Frequency: 925.0 MHz

Measured Spurious Emission		
Emission (MHz)	**Emission level (dBm)**	**Limit (dBm)**
915.0	-47.1	9.7
935.0	-46.6	9.7
957.0	-47.1	9.7
1850.0	-50.5	9.7
2775.0	-56.3	9.7
3700.0	-	9.7
4625.0	-	9.7
5550.0	-	9.7
6475.0	-41.0	9.7
7400.0	-	9.7
8325.0	-	9.7
9250.0	-	9.7

Limit
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum transmitter is operating, the RF power produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

Result: Complies

Measurement Uncertainty: *±3.3 dB*

Radiated emission measurements were required in the restricted frequency bands as per Section 15.205 with the limits as per Section 15.209.

Measurements were carried out in frequency hopping mode below 1000 MHz and in single frequency mode (902.875 MHz) above 1000MHz.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Dakota Lane, Ardmore Aerodrome, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated on February 11, 2000.

The device was placed on the test table top which was a total of 0.8 m above the test site ground plane.

Measurements of the radiated field were made with the antenna located at a 3 m horizontal distance from the boundary of the device under test.

Measurements below 1000 MHz were made using a quasi peak detector with a bandwidth of 120 kHz.

Measurements above 1000 MHz were made using an average detector with a bandwidth of 1.0 MHz.

The device was powered at 110 Vac.

Emission levels were determined when each of the supplied antennas were attached.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height with an automated antenna tower. The emission is measured in both vertical and horizontal antenna polarisations.

The emission level is determined in field strength by taking the following into consideration:

Level (dBµV/m) = Receiver Reading (dBµV) + Antenna Factor (dB) + Coax Loss (dB)

General emissions while operating in spread spectrum mode with the co linear whip antenna attached.

Frequency	Level		Recheck	Limit	Margin	Result	Worst Case
	Vertical	Horizontal					Antenna
MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB		
73.730	19.5			40.0	-20.5	Pass	Vertical
109.100	18.1			43.5	-25.4	Pass	Vertical
110.660	19.7			43.5	-23.8	Pass	Vertical
114.798	19.1			43.5	-24.4	Pass	Vertical
116.165	18.0			43.5	-25.5	Pass	Vertical
122.885		17.0		43.5	-26.5	Pass	Horizontal
132.820	19.5			43.5	-24.0	Pass	Vertical
149.968	21.6	18.1		43.5	-21.9	Pass	Vertical
240.035	28.6	36.7	36.7	46.0	-9.3	Pass	Horizontal
245.773	24.1	26.9		46.0	-19.1	Pass	Horizontal
251.918	34.3	33.6	34.3	46.0	-11.7	Pass	Vertical
258.060		29.9		46.0	-16.1	Pass	Horizontal
264.035		23.2		46.0	-22.8	Pass	Horizontal
280.018	23.5			46.0	-22.5	Pass	Vertical
325.650	19.6	22.5		46.0	-23.5	Pass	Horizontal
399.380	18.3	19.0		46.0	-27.0	Pass	Horizontal
408.058	23.6			46.0	-22.4	Pass	Vertical

SG900-6 collinear antenna with the CC20/900 kit

Frequency	Level		Recheck	Limit	Margin	Result	Worst Case
	Vertical	Horizontal					Antenna
MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV		
2708.620	54.0	46.2	54.0	54.0	0.0	Uncert	Vertical
6320.110	51.1	46.9		54.0	-3.9	Uncert	Vertical

As per DA 00-705 a duty cycle correction factor can be applied to the above results.

The dwell time per channel has been measured to be 35 mS.

Correction factor = 20log (35 ms / 100 ms) = -9.1 dB

A –9.1 dB correction factor would give the following results:

Frequency	Level		Level	Limit	Margin	Result	Worst Case
	Vertical	Correction					Antenna
MHz	dBuV/m	Factor	dBuV/m	dBuV/m	dB		
2708.620	54.0	-9.1	44.9	54.0	-9.1	Complies	Vertical
6320.110	51.1	-9.1	42.0	54.0	-12.0	Complies	Vertical

YU6/900 6 element yagi with CC20/900 kit

Frequency	Level		Recheck	Limit	Margin	Result	Worst Case
	Vertical	Horizontal					Antenna
MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB		
2708.620	36.8	45.6	45.4	54.0	-8.4	Pass	Horizontal
5417.200	36.3	43.5		54.0	-10.5	Pass	Horizontal
6320.110	39.0	44.4		54.0	-9.6	Pass	Horizontal

Result:

Complies when using the YU6/900 6 element yagi with CC20/900 kit

Complies when using the SG900-6 collinear antenna with the CC20/900 kit when the duty cycle correction factor as defined in DA 00-705 is applied.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 10,000 MHz) ± 4.1 dB

8. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial #	Asset
Attenuator 20 dB	Hewlett Packard	8491B	22146	E1041
RF Power Meter	Hewlett Packard	HP 436A	2512A22439	E1198
Spectrum Analyser	Hewlett Packard	E 7405A	US 39150142	3776
Measurement Receiver	Rohde & Schwarz	ESCS 30	839873/1	E1595
Aerial Controller	EMCO	1090	9112-1062	3710
Aerial Mast	EMCO	1070-1	9203-1661	3708
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709
Biconical Antenna	Schwarzbeck	BBA 9106	-	3612
Log Periodic Antenna	Schwarzbeck	UHALP 9107	-	3702
Horn Antenna	EMCO	3115	9511-4629	E1526

9. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd registration with the Federal Communications Commission as a listed facility, Registration Number: 90838, which was updated on February 11th, 2000.

In addition testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to the New Zealand Code of Laboratory Management Practice incorporating ISO Guide 25: 1990 and ISO 9002: 1994.

All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to the New Zealand Code of Laboratory Management Practice incorporating ISO Guide 25: 1990 and ISO 9002: 1994.

International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with 25 accreditation bodies in 21 economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

Appendix A – Hop Frequency details

Hop set 1 – 8

#1	21	83	115	81	113	65	105	61
#2	21	83	115	67	107	77	47	97
#3	21	83	51	99	81	49	97	57
#4	21	113	105	103	61	119	69	111
#5	147	211	145	209	193	189	167	171
#6	121	183	151	191	155	219	207	163
#7	147	163	165	219	197	169	139	207
#8	147	211	171	121	197	127	159	217
#1	902.625	910.375	914.375	910.125	914.125	908.125	913.125	907.625
#2	902.625	910.375	914.375	908.375	913.375	909.625	905.875	912.125
#3	902.625	910.375	906.375	912.375	910.125	906.125	912.125	907.125
#4	902.625	914.125	913.125	912.875	907.625	914.875	908.625	913.875
#5	918.375	926.375	918.125	926.125	924.125	923.625	920.875	921.375
#6	915.125	922.875	918.875	923.875	919.375	927.375	925.875	920.375
#7	918.375	920.375	920.625	927.375	924.625	921.125	917.375	925.875
#8	918.375	926.375	921.375	915.125	924.625	915.875	919.875	927.125

Hop set 9 – 16

#1	103	71	45	95	69	107	77	111
#2	69	43	31	89	117	75	111	65
#3	101	59	103	61	39	29	87	117
#4	65	93	71	45	117	109	73	95
#5	133	203	137	205	169	183	123	159
#6	177	147	133	181	149	173	145	189
#7	137	153	213	145	161	217	131	203
#8	131	175	133	203	193	135	153	163
#1	912.875	908.875	905.625	911.875	908.625	913.375	909.625	913.875
#2	908.625	905.375	903.875	911.125	914.625	909.375	913.875	908.125
#3	912.625	907.375	912.875	907.625	904.875	903.625	910.875	914.625
#4	908.125	911.625	908.875	905.625	914.625	913.625	909.125	911.875
#5	916.625	925.375	917.125	925.625	921.125	922.875	915.375	919.875
#6	922.125	918.375	916.625	922.625	918.625	921.625	918.125	923.625
#7	917.125	919.125	926.625	918.125	920.125	927.125	916.375	925.375
#8	916.375	921.875	916.625	925.375	924.125	916.875	919.125	920.375

Hop set 17 –24

#1	73	109	63	41	93	55	37	91
#2	105	81	113	73	109	63	41	29
#3	67	43	95	79	113	77	111	65
#4	57	91	55	37	75	47	33	85
#5	217	195	141	207	129	201	191	125
#6	199	159	193	213	205	203	161	139
#7	129	159	181	167	183	143	209	193
#8	219	149	179	187	189	125	199	169
#1	909.125	913.625	907.875	905.125	911.625	906.875	904.625	911.375
#2	913.125	910.125	914.125	909.125	913.625	907.875	905.125	903.625
#3	908.375	905.375	911.875	909.875	914.125	909.625	913.875	908.125
#4	907.125	911.375	906.875	904.625	909.375	905.875	904.125	910.625
#5	927.125	924.375	917.625	925.875	916.125	925.125	923.875	915.625
#6	924.875	919.875	924.125	926.625	925.625	925.375	920.125	917.375
#7	916.125	919.875	922.625	920.875	922.875	917.875	926.125	924.125
#8	927.375	918.625	922.375	923.375	923.625	915.625	924.875	921.125

Hop set 25 – 32

#1	119	75	47	33	89	53	99	79
#2	87	53	35	27	23	85	51	99
#3	105	71	109	63	41	93	119	69
#4	81	97	101	77	107	63	41	87
#5	199	127	173	165	155	215	131	153
#6	129	185	179	175	197	201	171	169
#7	189	151	179	123	199	141	177	133
#8	165	183	167	139	177	155	215	195
#1	914.875	909.375	905.875	904.125	911.125	906.625	912.375	909.875
#2	910.875	906.625	904.375	903.375	902.875	910.625	906.375	912.375
#3	913.125	908.875	913.625	907.875	905.125	911.625	914.875	908.625
#4	910.125	912.125	912.625	909.625	913.375	907.875	905.125	910.875
#5	924.875	915.875	921.625	920.625	919.375	926.875	916.375	919.125
#6	916.125	923.125	922.375	921.875	924.625	925.125	921.375	921.125
#7	923.625	918.875	922.375	915.375	924.875	917.625	922.125	916.625
#8	920.625	922.875	920.875	917.375	922.125	919.375	926.875	924.375

Hop set 33 – 40

#1	49	97	57	101	59	39	29	87
#2	71	45	95	57	101	59	103	61
#3	107	73	45	31	89	53	35	91
#4	53	79	49	89	99	59	39	29
#5	179	143	177	185	187	135	175	121
#6	143	131	125	215	209	211	165	141
#7	175	185	187	125	173	121	149	211
#8	191	151	213	145	209	137	205	129
#1	906.125	912.125	907.125	912.625	907.375	904.875	903.625	910.875
#2	908.875	905.625	911.875	907.125	912.625	907.375	912.875	907.625
#3	913.375	909.125	905.625	903.875	911.125	906.625	904.375	911.375
#4	906.625	909.875	906.125	911.125	912.375	907.375	904.875	903.625
#5	922.375	917.875	922.125	923.125	923.375	916.875	921.875	915.125
#6	917.875	916.375	915.625	926.875	926.125	926.375	920.625	917.625
#7	921.875	923.125	923.375	915.625	921.625	915.125	918.625	926.375
#8	923.875	918.875	926.625	918.125	926.125	917.125	925.625	916.125

Hop set 41 – 48

#1	117	67	43	31	25	85	51	35
#2	39	93	55	37	91	119	79	49
#3	55	37	27	23	85	115	75	47
#4	115	67	43	31	25	83	51	35
#5	197	157	163	219	139	161	181	151
#6	217	167	195	157	137	187	153	135
#7	195	127	201	191	135	205	157	215
#8	201	141	207	157	181	123	173	185
#1	914.625	908.375	905.375	903.875	903.125	910.625	906.375	904.375
#2	904.875	911.625	906.875	904.625	911.375	914.875	909.875	906.125
#3	906.875	904.625	903.375	902.875	910.625	914.375	909.375	905.875
#4	914.375	908.375	905.375	903.875	903.125	910.375	906.375	904.375
#5	924.625	919.625	920.375	927.375	917.375	920.125	922.625	918.875
#6	927.125	920.875	924.375	919.625	917.125	923.375	919.125	916.875
#7	924.375	915.875	925.125	923.875	916.875	925.625	919.625	926.875
#8	925.125	917.625	925.875	919.625	922.625	915.375	921.625	923.125

Hop set 49 and 50

#1	27	23
#2	33	25
#3	33	25
#4	27	23
#5	213	149
#6	127	123
#7	171	155
#8	143	161
#1	903.375	902.875
#2	904.125	903.125
#3	904.125	903.125
#4	903.375	902.875
#5	926.625	918.625
#6	915.875	915.375
#7	921.375	919.375
#8	917.875	920.125

Hop channel numbers are always greater than 20 and less than 220 in order to stay within the 902 to 928 MHz frequency ranges with guard bands at the band edges.

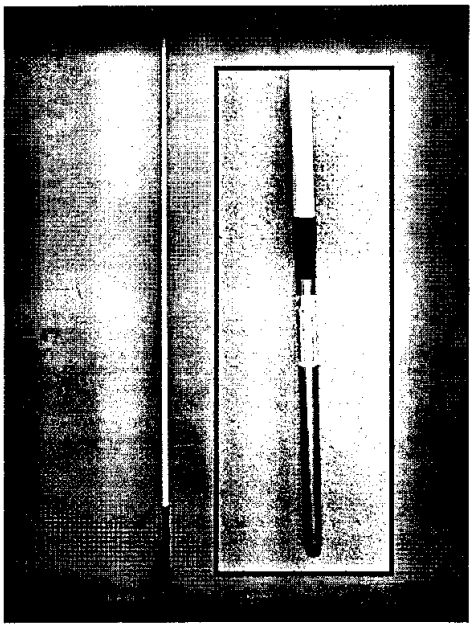
Only odd hops are used which gives a 250kHz channel plan.

Hop Frequency = 900MHz + (hop channel number x 125kHz)

Appendix B – Antenna Characteristics

ELPRO Technologies
The Wireless Alternative

Accessory Data Sheet
SG900-6



General

The SG900-6 collinear antenna is designed for use with the ELPRO 900 series range of telemetry products. The SG900-6 meets specific radio requirements for these products and is a slimline, lightweight antenna which is easily mounted

The SG900-6 is fitted with a N-Type female connector. The CC10/900 and CC20/900 coaxial extender kits are suitable for use with this antenna.

The SG900-6 antenna is mounted at the base tube by U bracket (not supplied). This antenna is used when maximum range is required or as a base station antenna.

The antenna is suitable for external mounting only due to the overall length.

Mounting bracket are supplied separately with this antenna – see part # br_collinear_kit

Specification

Type	Collinear
Nominal gain	8dbi
Frequency	900 –930 MHz
Impedance	50 Ohms
Construction	Fiberglass radome

Length	80" / 2030mm
Connector	N-Type (female)
Color	White
Mounting	¾" / 20mm tube

Note:
Overall gain when use with CC10/900 = 5dBi
Overall gain when use with CC20/900 = 2dBi
Mounting bracket br_collinear_kit (not supplied)

Telemetry made easy by
ELPRO Technologies
9/12 Billabong Street
Stafford QLD 4053
Australia

www.elprotech.com

Part No BRO_SG9006_V1.0

Available from:

ELPRO *Technologies*
The Wireless Alternative

Accessory Data Sheet
YU6/900

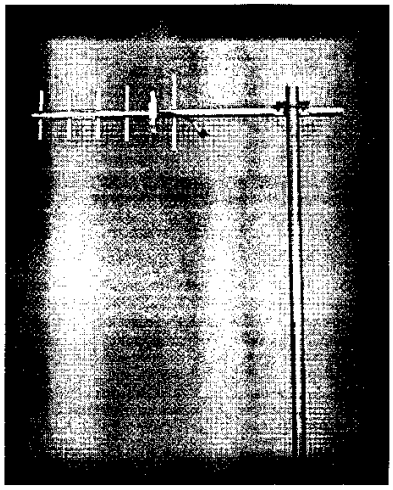
General

The YU6/900 6 element Yagi antenna is made for use with the ELPRO 900 series telemetry products. The CC20/900 coaxial extender is suitable for use with the YU6/900

The YU6/900 is designed for pole mount and to be clear from obstructions. The narrow beamwidth and high front to back ratio is effective in reducing the affects of interference and extending radio range.

A standard female N-Type connection from a 6" / 150mm tail provides a simple connection method when using the ELPRO CC20/900 kit.

Note: Brackets are supplied separately with this antenna – see part # bracket_yagi_kit



YU6/900

Specification

Type	Yagi
Frequency	900 –930 MHz
Impedance	50 Ohms
Construction	Aluminum
F/B ratio dB	17
Beamwidth 'E' Deg	46
Beamwidth 'H' Deg	50

Length	**32" / 820mm**
Width	8" / 20mm
Connector	N-Type (female)
Nominal Gain	10dBi
Overall gain	with CC20/900 = **4dBi**

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Part No ACC_YU6900_1.2

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