

TEST REPORT NO: RU1136/5780

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REPORT ON THE CERTIFICATION TESTING OF A Aerial Facilities Limited Cell Enhancer WITH RESPECT TO THE FCC RULES CFR 47, PART 90 Subpart H PRIVATE LAND MOBILE REPEATER.

TEST DATE: 16th September 2004 – 17th September 2004

TESTED BY:		J CHARTERS
APPROVED BY:		P GREEN PRODUCT MANAGER EMC
DATE:	29 th September 2004	
Distribution:		

Copy Nos: 1. Aerial Facilities Limited

2. TCB: TRL Compliance Services Limited

3. TRL EMC

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LONG GREEN FORTHAMPTON GLOUCESTER GL19 4QH UNITED KINGDOM TELEPHONE +44 (0)1684 833818 FAX +44 (0)1684 833858 E-MAIL test@trlcompliance.com www.trlcompliance.com



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Notes: 1. Component failure during test	YES [] NO [X]
2. If Yes, details of failure:	

If Yes, details of failure:

3. The facilities used for the testing of the product contain in this report are FCC Listed.



CERTIFICATE OF CONFORMITY & COMPLIANCE

APPROVED BY:		P GREEN PRODUCT MANAGER EMC
TESTED BY:		J CHARTERS
ADDRESS:	Aerial House Latimer Park, Latimer Chesham Buckinghamshire HP5 1TU United Kingdom	
APPLICANT:	Aerial Facilities Limited	
ORDER No(s):	26773	
TEST DATE(s):	16 th September 2004 – 17 th September 200	4
POWER SOURCE(s):	+110 Vac	
MODULATION TYPE:	F3E	
FREQUENCY GENERATION:	N/A	
NUMBER OF CHANNELS:	Channel No. Uplink 6 Downlink	6
CHANNEL SPACING:	25 kHz	
ANTENNA TYPE:	Not applicable	
MAXIMUM OUTPUT	+26.84 dBm	
MAXIMUM INPUT	-87.34 dBm	
MAXIMIUM GAIN	114.18 dB	
EQUIPMENT TYPE:	Private Land Mobile Repeater	
EQUIPMENT UNDER TEST:	Cell Enhancer	
TEST RESULT:	Compliant to Specification	
TEST SPECIFICATION:	FCC RULES CFR 47, Part 90 Subpart H	
PURPOSE OF TEST:	CERTIFICATION	
FCC IDENTITY:	NE0-50-0780-VHF	

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APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT): Cell Enhancer **EQUIPMENT TYPE:** Private Land Mobile Repeater PURPOSE OF TEST: **CERTIFICATION** FCC RULES CFR 47, Part 90 Subpart H TEST SPECIFICATION(s): TEST RESULT: COMPLIANT Yes [X] APPLICANT'S CATEGORY: MANUFACTURER **IMPORTER** DISTRIBUTOR TEST HOUSE **AGENT** APPLICANT'S ORDER No(s): 26773 APPLICANT'S CONTACT PERSON(s): Mr Peter Bradfield E-mail address: Peterb@aerial.co.uk APPLICANT: Aerial Facilities Limited ADDRESS: Aerial House Latimer Park, Latimer Chesham Buckinghamshire HP5 1TU United Kingdom TEL: +44 (0)1494777020 FAX: +44 (0)149477002 MANUFACTURER: Aerial Facilities Limited EUT(s) COUNTRY OF ORIGIN: United Kingdom TEST LABORATORY: TRL EMC UKAS ACCREDITATION No: 0728 16th September 2004 – 17th September 2004 TEST DATE(s) RU1136/5780 TEST REPORT No:

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EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.	TEST/EXAMINATION	RULE PART	APPLICABILITY	RESULT
	RF Power Output	90.205	Yes	Complies
	Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A
	Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A
	Modulation Limiting	TIA EIA-603.3.2.6	N/A	N/A
	Occupied Bandwidth	90.210	Yes	Complies
	Spurious Emissions at Antenna Terminals	90.210	Yes	Complies
	Field Strength of Spurious Emissions	90.210	Yes	Complies
	Frequency Stability	90.213	N/A(note 1)	N/A
	Transient behaviour	90.214	N/A(note 2)	N/A

- 1 The EUT does not contain signal generation circuitry, therefore the test was not performed.
 2 The EUT is not a keyed carrier system, therefore the test was not performed.

2.	Product Use:		Private Land Mobile F	Repeater	
3.	Emission Designator:		F3E		
4.	Temperatures:		Ambient (Tnom)	21°C	
5.	Supply Voltages:		Vnom	+110 Vac	
	Note: Vnom voltages are as stated above	unless other	wise shown on the tes	t report page	
6.	Equipment Category:		Single channel Two channel Multi-channel	[] [] [X]	
7.	Channel spacing:		Narrowband Wideband	[X] []	25 kHz
8.	Test Location	TRL Complia	ance Services Up Holland Long Green	[X] []	
9	Modifications made during test program		N	lo modification	s were performed

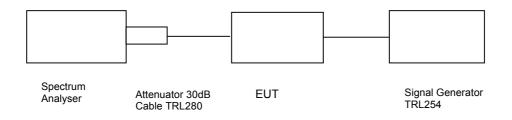
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COMPLIANCE TESTS

AMPLIFIER GAIN - CONDUCTED - PART 2.1046 - UPLINK

22°C Radio Laboratory Ambient temperature

Relative humidity = 51% Supply voltage +110 Vac Channel number = See test results



Frequency MHz	Signal Generator input level dBm	Cable & Attenuator loss dB	Level at Spectrum Analyser dBm	Gain dB	Gain after 20dB input level increase dBm
160.53	-82.24	29.84	-3	109.8	89.38
160.935	-88.03	29.84	-4.9	112.97	92.99
161.415	-87.34	29.48	-2.1	114.19	94.78

Notes:

- 1.
- The level of the signal generator takes into consideration the loss from the cable.

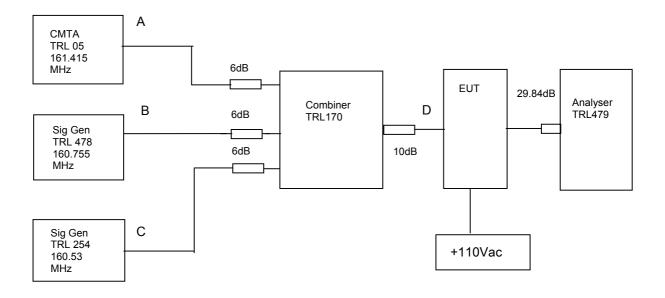
 The signal generator input was increased by 20dBs and the level of the output signal remeasured

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	х
ATTENUATOR	AFL	10-002530	8616	N/A	x
CABLE	ROSENBERGER	MICRO COAX	N/A	280	х
SIGNAL GENERATOR	MARCONI	2042	119562/021	254	х

AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS - CONDUCTED - PART 2.1053- UPLINK

Ambient temperature = 22°C Radio Laboratory

Relative humidity = 51% Supply voltage = +110 Vac

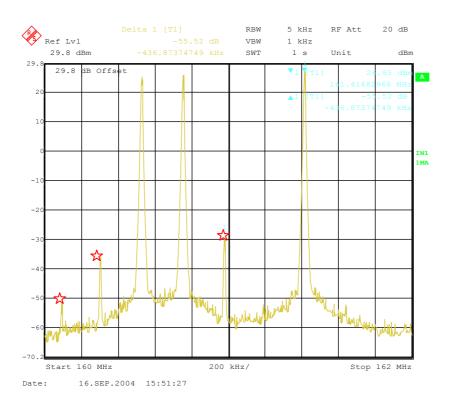


The Intermodulation and spurious products were measured with the amplifier operating at maximum gain. A three tone test was conducted using the equipment as above. The input power level was adjusted so the level at point D was the maximum input of -82.2dBm. The cable and attenuator loss between the EUT and the spectrum analyser was 29.84dB. This loss was taken into account by adjusting the analysers level offset.

Sweep data is shown on the next page:

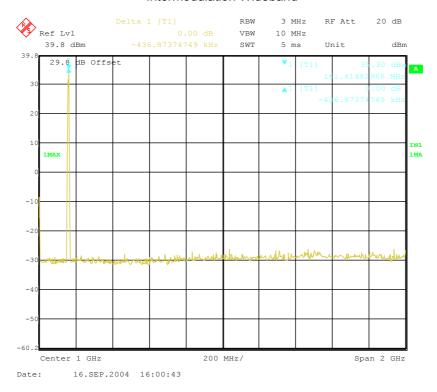
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Intermodulation Inband



The above plot shows that all products (designated by) are at least 40dB below the fundamentals.

Intermodulation Wideband



The above plot shows that there are no products outside the bands.

Test equipment used for intermodulation test

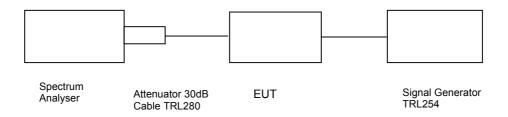
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	x
SIGNAL GENERATOR	MARCONI	2042	119562/021	254	х
СМТА	ROHDE & SCHWARZ	CMTA52	894715/033	05	х
SIGNAL GENERATOR	ROHDE & SCHWARZ	SMR 20	834671/003	478	х
COMBINER	ELCOM	RC-4-50	N/A	170	х

TRANSMITTER TESTS

AMPLIFER MODULATED CHANNEL TEST - CONDUCTED - Part 2.1049- UPLINK

Ambient temperature = 23°C Radio Laboratory

Relative humidity = 51% Supply voltage = +110 Vac Channel number = See test results



This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level (-82.2dBm) and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at the output of the EUT.

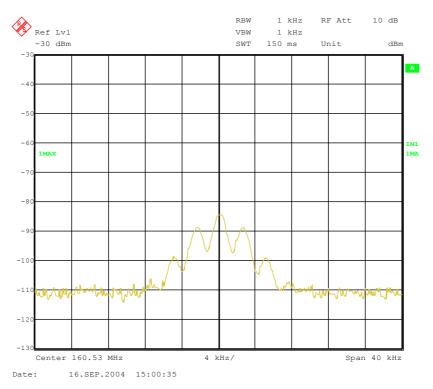
Note: The cables and attenuators had the following losses.

- 1. Cable TRL280 and attenuator 30dB 29.84dB
- 2. Cable between signal generator and EUT 0.04dB

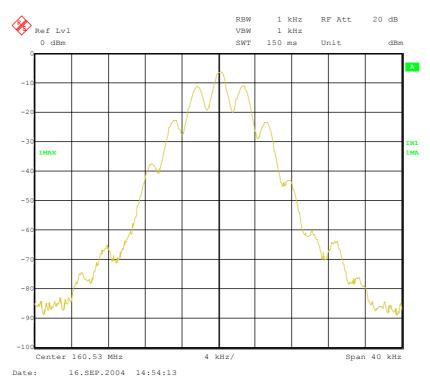
The test equipment used for the Transmitter Modulated Channel tests is shown below:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	х
ATTENUATOR	AFL	10-002530	8616	N/A	x
CABLE	ROSENBERGER	MICRO COAX	N/A	280	х
SIGNAL GENERATOR	MARCONI	2042	119562/021	254	х

160.53 Signal Generator deviation set to 2.5kHz

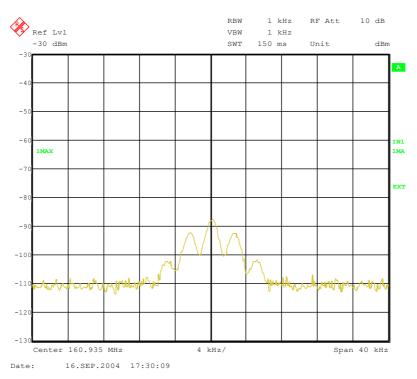


160.53 Signal Generator and EUT deviation set to 2.5kHz

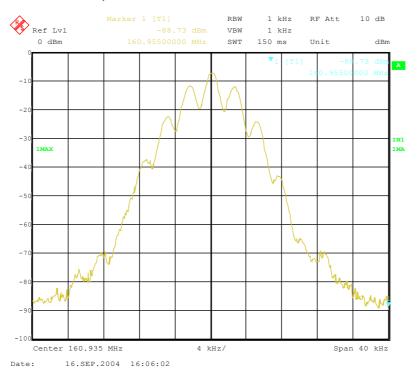


The above plots depicting the output waveshape show no measurable distortion visible. When compared to the input signal.

160.935 Signal Generator deviation set to 2.5kHz

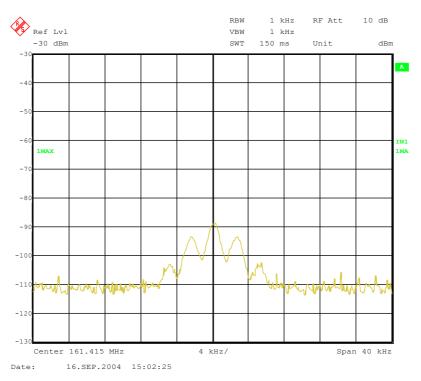


160.935 Signal Generator and amplifier deviation set to 2.5kHz

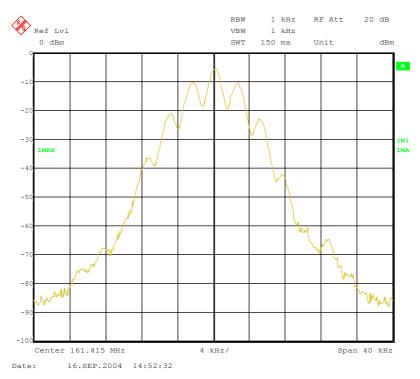


The above plots depicting the output waveshape show no measurable distortion visible. When compared to the input signal.

161.415 Signal Generator deviation set to 2.5kHz



161.415 Signal Generator deviation set to 2.5kHz



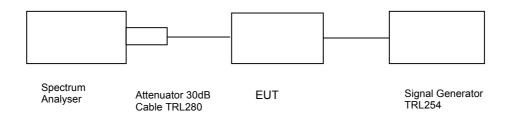
The above plots depicting the output waveshape show no measurable distortion visible. When compared to the input signal.

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS - CONDUCTED - Part 2.1051- UPLINK

Ambient temperature = 23°C Radio Laboratory

Relative humidity = 51% Test Signal = F3E Supply voltage = +110 Vac



The test was set up as per the diagram. The level at the input was adjusted to compensate for the loss of the interconnecting cable. The unit was tested operating at maximum power and on three test frequencies.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log PdB

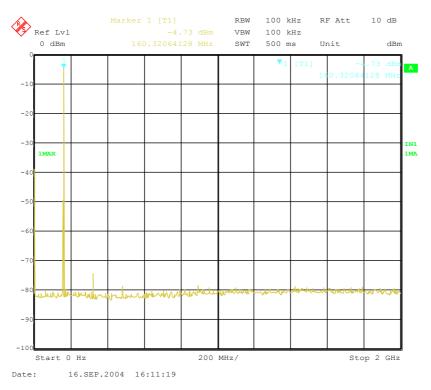
$$(10logP_{watts}) - (43+10log (P_{watts} * 1000)) = LIMIT = -13 dBm$$

The test equipment used for the Transmitter Conducted Emissions:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	х
ATTENUATOR	AFL	10-002530	8616	N/A	х
CABLE	ROSENBERGER	MICRO COAX	N/A	280	х
SIGNAL GENERATOR	MARCONI	2042	119562/021	254	х

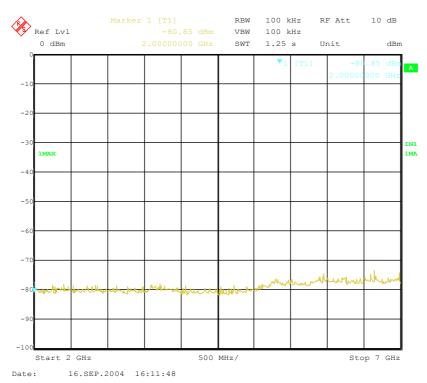
Conducted emissions 160.53MHz

0 - 2GHz



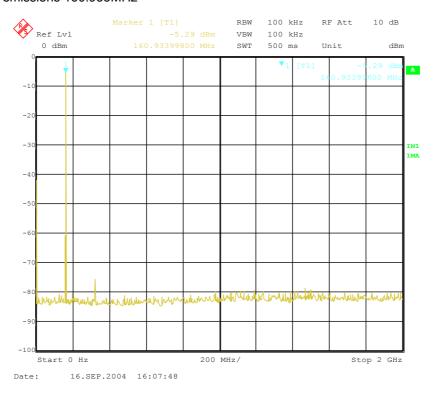
Conducted emissions 160.53MHz

2 - 7GHz



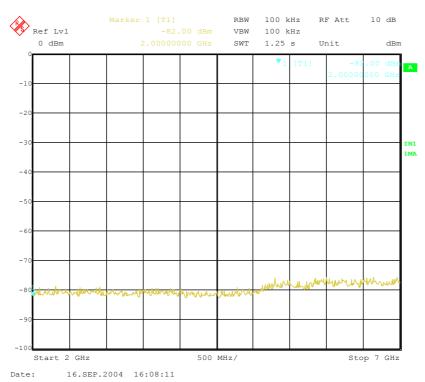
Conducted emissions 160.935MHz

0 - 2GHz



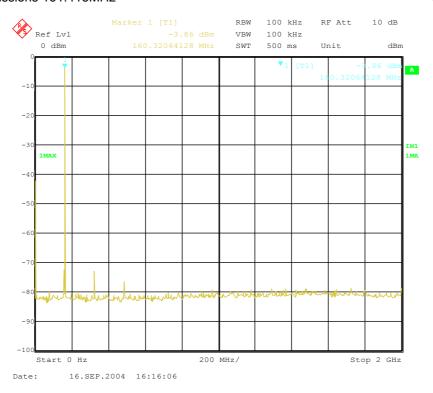
Conducted emissions 160.935MHz

2 - 7GHz



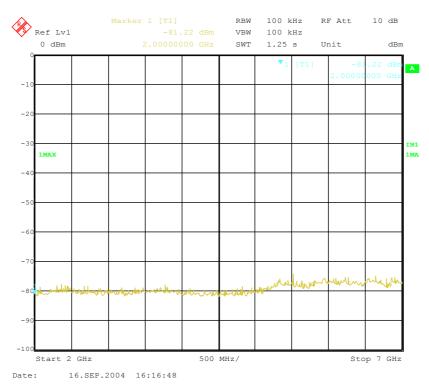
Conducted emissions 161.415MHz

0 - 2GHz



Conducted emissions 161.415MHz

2 - 7GHz

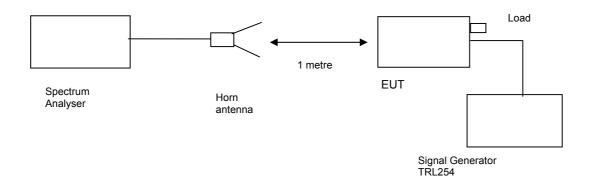


TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS - RADIATED - Part 2.1053- UPLINK

Ambient temperature = 18°C Test Signal = F3E

Relative humidity = 51%
Conditions = OATS
Supply voltage = +110 Vac
Supply Frequency = N/A



The test was set up as per the diagram. The level at the input was adjusted to compensate for the loss of the interconnecting cable. The unit was tested operating maximum power on three test frequencies with a 50 ohm load connected to the output. The unit was also tested with the signal generator replaced by another 50ohm load.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log PdB

$$(10logP_{watts}) - (43+10log (P_{watts} * 1000)) = LIMIT = -13 dBm$$

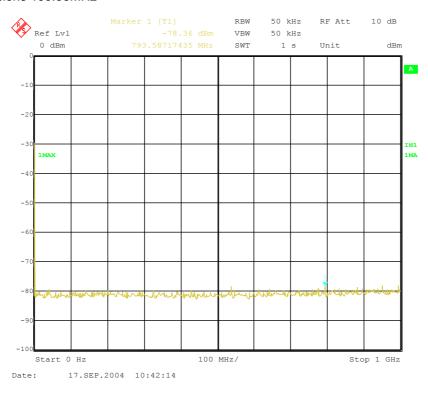
The test equipment used for the Transmitter Spurious Emissions:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	X
HORN	EMCO	3115	9010-3581	139	x
50Ω LOAD	RHODE & SCHWARZ	200.0019.55	300804/32	UH227	х
CABLE	ROSENBERGER	MICRO COAX	N/A	280	x
SIGNAL GENERATOR	MARCONI	2042	119388/021	254	х

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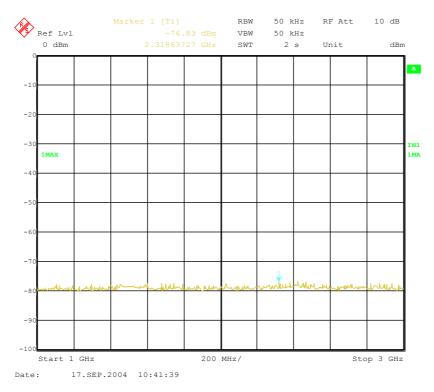
Radiated emissions 160.53MHz

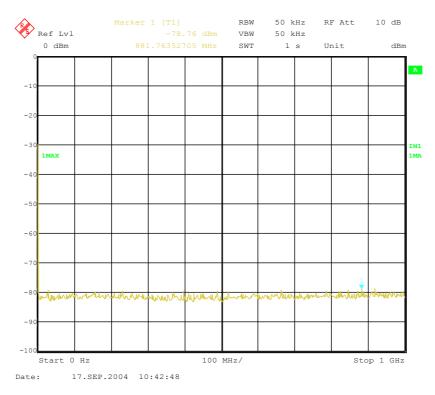
0-1 GHz



Radiated emissions 160.53MHz

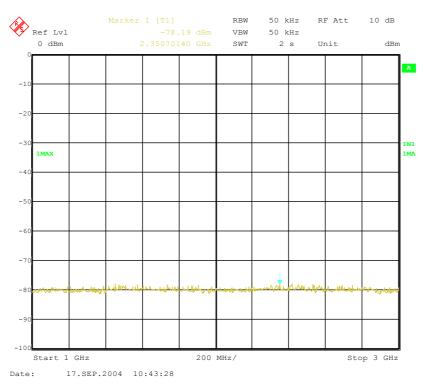
1-3GHz





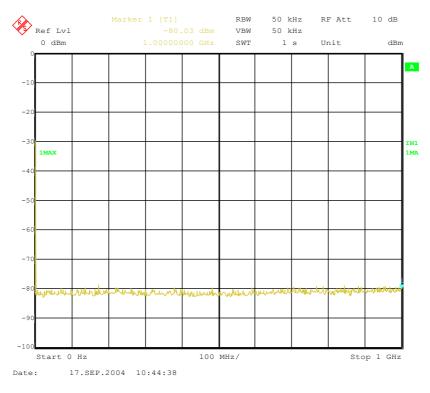
Radiated emissions 160.935MHz

1-3GHz



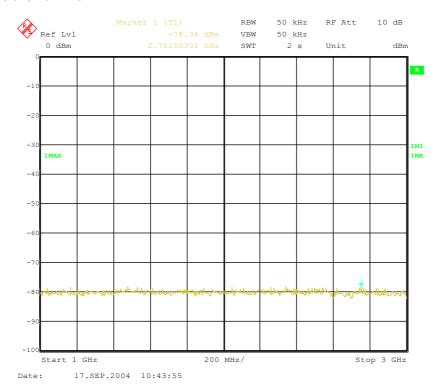
Radiated emissions 161.415MHz

0-1GHz



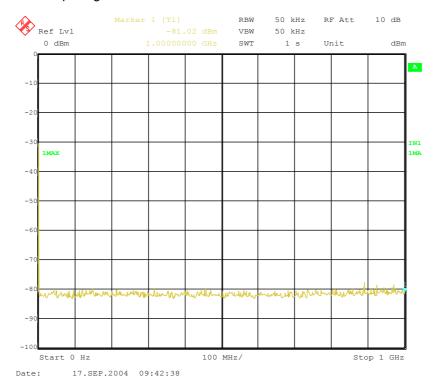
Radiated emissions 161.415MHz

1-3GHz



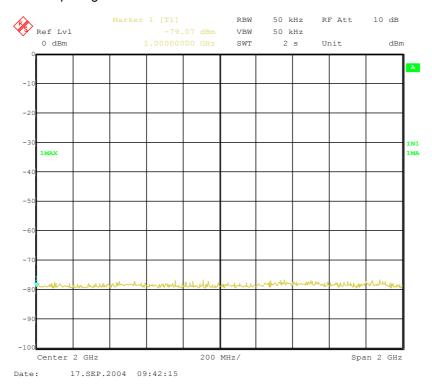
Radiated emissions no input signal

0-1GHz



Radiated emissions no input signal

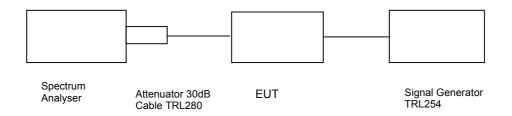
1-3GHz



AMPLIFIER GAIN - CONDUCTED - PART 2.1046 - DOWNLINK

22°C Radio Laboratory Ambient temperature =

Relative humidity 51% = Supply voltage Channel number +110 Vac See test results



Frequency MHz	Signal Generator input level dBm	Cable & Attenuator loss dB	Level at Spectrum Analyser dBm	Gain dB	Gain after 20dB input level increase dBm
160.380 MHz	-82.33	29.84	-7.92	104.25	84.79
160.665 MHz	-81.43	29.84	-8.40	102.84	83.52
161.556 MHz	-78.83	29.84	-6.66	102.01	82.26

Notes:

- The level of the signal generator takes into consideration the loss from the cable.

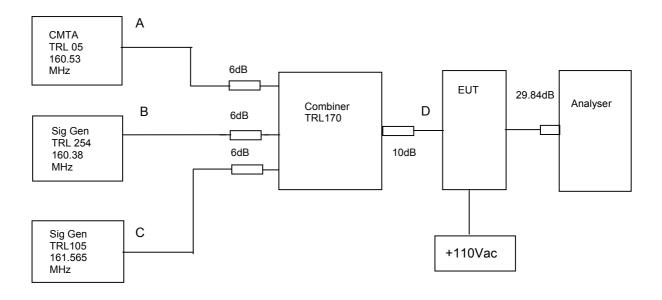
 The signal generator input was increased by 20dBs and the level of the output signal remeasured The EUT's downlink path had 10dB's of internal attenuation switched in.

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	х
ATTENUATOR	AFL	10-002530	8616	N/A	x
CABLE	ROSENBERGER	MICRO COAX	N/A	280	x
SIGNAL GENERATOR	MARCONI	2042	119388/021	254	х

AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS - CONDUCTED - PART 2.1053- DOWNLINK

Ambient temperature = 22°C Radio Laboratory

Relative humidity = 51% Supply voltage = +110 Vac

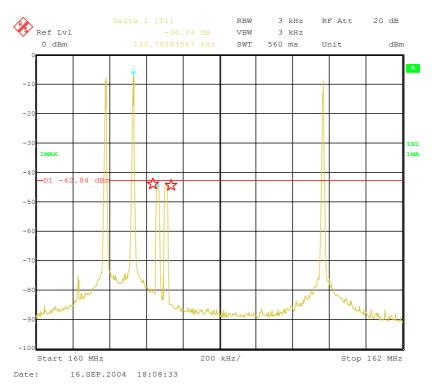


The Intermodulation and spurious products were measured with the amplifier operating at maximum gain. A three tone test was conducted using the equipment as above. The input power level was adjusted so the level at point D was the maximum input of -78.83dBm. The cable and attenuators loss between the EUT and the spectrum analyser was 29.84 dB. The EUT's downlink path had 10dB's of internal attenuation switched in.

Sweep data is shown on the next page:

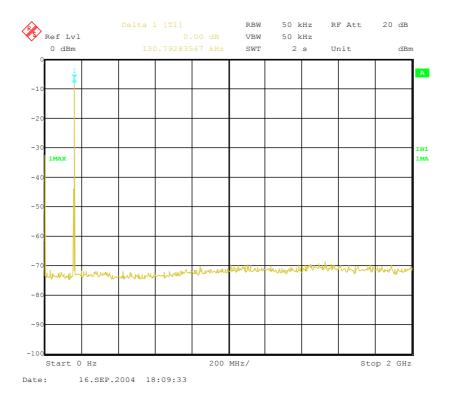
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Intermodulation Inband



The above plot shows that all products (designated by) are at least 40dB below the fundamentals.

Intermodulation Wideband



The above plot shows that there are no products outside the bands.

Test equipment used for intermodulation test

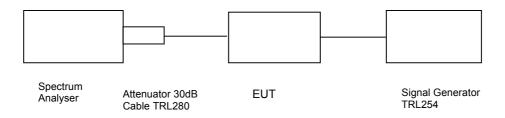
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	х
SIGNAL GENERATOR	MARCON	2042	119562/021	254	x
SIGNAL GENERATOR	ROHDE & SCHWARZ	SMR 20	834671/003	478	х
SIGNAL GENERATOR	MARCONI	2023	112224/040	105	x
COMBINER	ELCOM	RC-4-50	N/A	170	х

TRANSMITTER TESTS

AMPLIFER MODULATED CHANNEL TEST - CONDUCTED - Part 2.1049- DOWNLINK

Ambient temperature = 23°C Radio Laboratory

Relative humidity = 51% Supply voltage = +110 Vac Channel number = See test results



This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level (-81.43) and modulated with a 5000Hz tone. The plots show the signal measured at the signal generator and the signal measured at the output of the EUT. The EUT's downlink path had 10dB's of internal attenuation switched in.

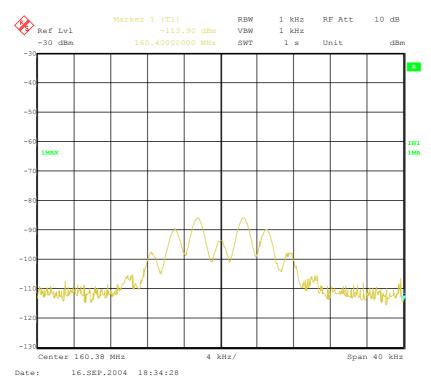
Note: The cables and attenuators had the following losses.

- 1. Cable TRL280 and 30dB attenuator = 29.84dB
- 2. Cable between signal generator and EUT = 0.04dB

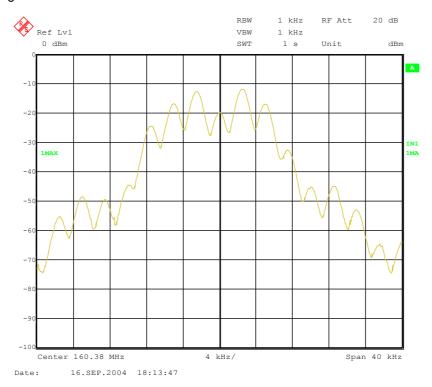
The test equipment used for the Transmitter modulated channel tests is shown below:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	х
ATTENUATOR	AFL	10-002530	8616	N/A	x
CABLE	ROSENBERGER	MICRO COAX	N/A	280	x
SIGNAL GENERATOR	MARCONI	2042	119388/021	254	х

160.380 MHz Signal Generator deviation set to 5kHz

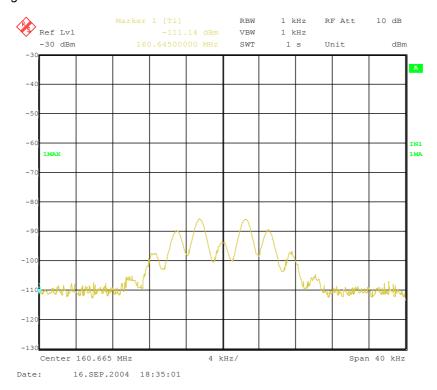


160.380 MHz Signal Generator and EUT deviation set to 5kHz

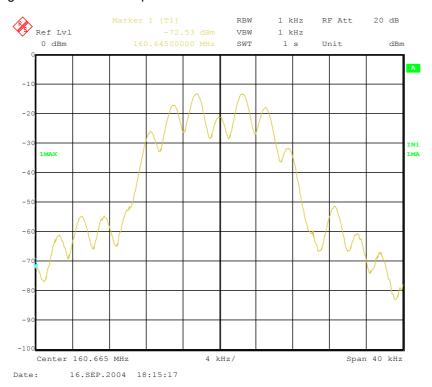


The above plots depicting the output wave shape show no measurable distortion visible. When compared to the input signal.

160.665 MHz Signal Generator deviation set to 5kHz

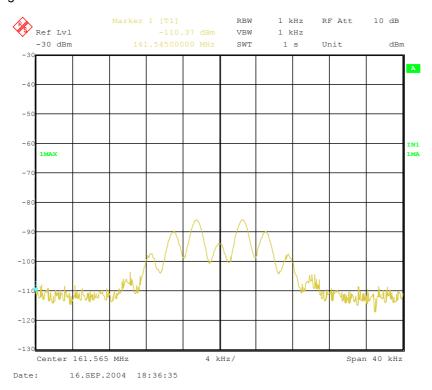


160.665 MHz Signal Generator and amplifier deviation set to 5kHz

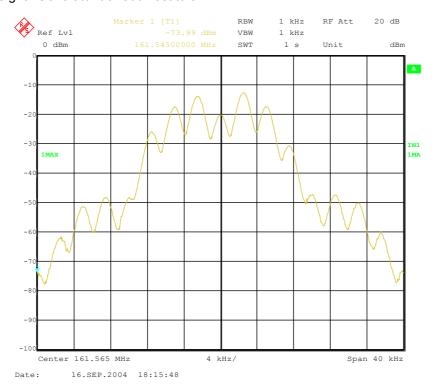


The above plots depicting the output wave shape show no measurable distortion visible. When compared to the input signal.

161.556 MHz Signal Generator deviation set to 5kHz



161.556 MHz Signal Generator deviation set to 5kHz



The above plots depicting the output wave shape show no measurable distortion visible. When compared to the input signal.

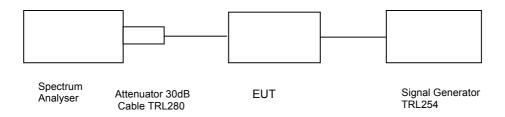
TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS - CONDUCTED - Part 2.1051- DOWNLINK

Ambient temperature = 23°C Radio Laboratory

Relative humidity = 51% Test Signal = F3E

Supply voltage = +110 Vac



The test was set up as per the diagram. The level at the input was adjusted to compensate for the loss of the interconnecting cable. The unit was tested operating at maximum power and on three test frequencies. The EUT's downlink path had 10dB's of internal attenuation switched in.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log PdB

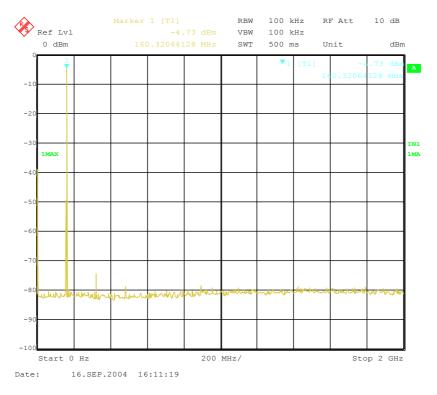
 $(10logP_{watts}) - (43+10log (P_{watts} * 1000)) = LIMIT = -13 dBm$

The test equipment used for the Transmitter Conducted Emissions:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	x
ATTENUATOR	AFL	10-002530	8616	N/A	х
CABLE	ROSENBERGER	MICRO COAX	N/A	280	x
SIGNAL GENERATOR	MARCONI	2042	119388/021	254	х

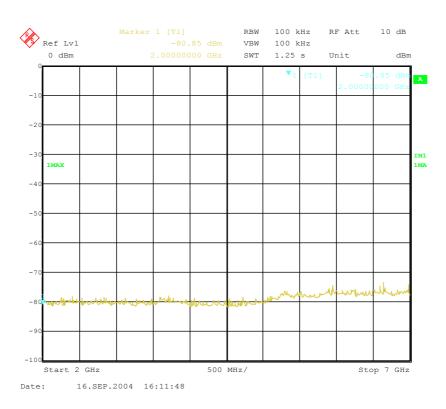
Conducted emissions 160.380 MHz

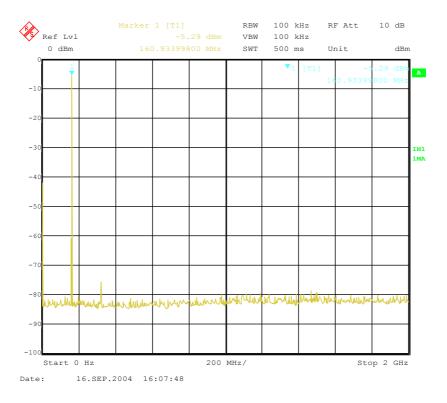
0-2GHz



Conducted emissions 160.380 MHz

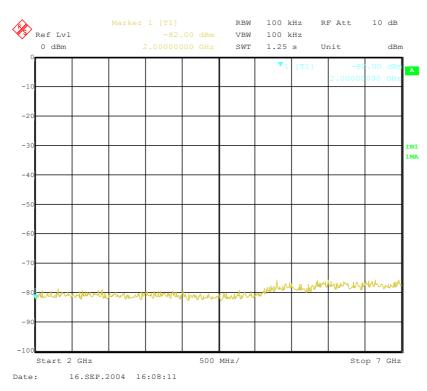
2-7GHz

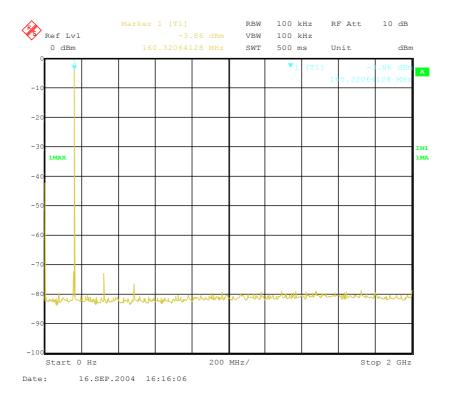




Conducted emissions 160.665 MHz

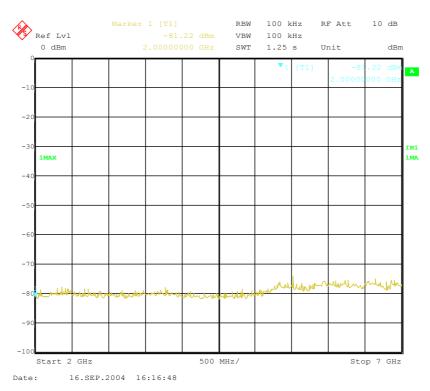
2-7GHz





Conducted emissions 161.556 MHz

2-7GHz

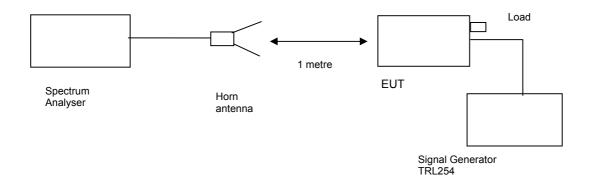


TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS - RADIATED - Part 2.1053- DOWNLINK

Ambient temperature = 18°C Test Signal = F3E

Relative humidity = 51%
Conditions = OATS
Supply voltage = +110 Vac
Supply Frequency = N/A



The test was set up as per the diagram. The level at the input was adjusted to compensate for the loss of the interconnecting cable. The unit was tested operating maximum power on three test frequencies with a 50 ohm load connected to the output. The unit was also tested with the signal generator replaced by another 50ohm load. The EUT's downlink path had 10dB's of internal attenuation switched in.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log PdB

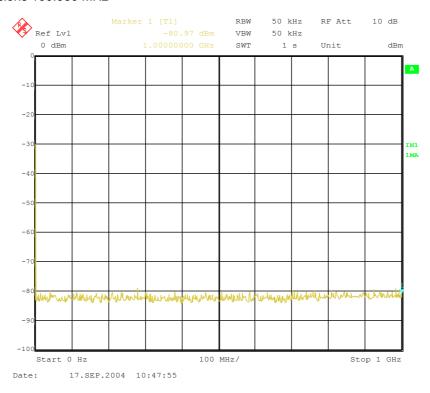
 $(10logP_{watts}) - (43+10log (P_{watts} * 1000)) = LIMIT = -13 dBm$

The test equipment used for the Transmitter Spurious Emissions:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No SERIAL No		TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	ESIB 7	100 182	630	X
HORN	EMCO	3115	9010-3581	139	x
50Ω LOAD	RHODE & SCHWARZ	200.0019.55	300804/32	UH227	х
CABLE	ROSENBERGER	MICRO COAX	N/A	280	x
SIGNAL GENERATOR	MARCONI	2042	119388/021	254	х

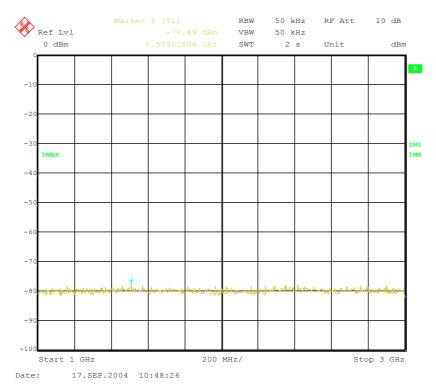
Radiated emissions 160.380 MHz

0-1GHz



Radiated emissions 160.380 MHz

1-3GHz

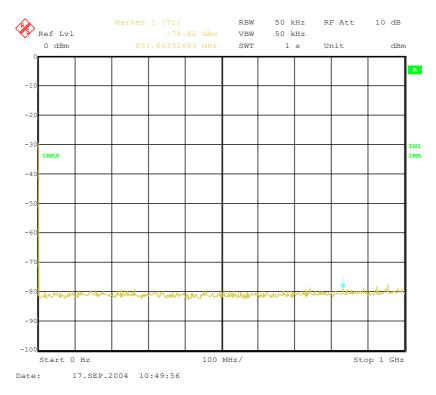


The above test results show that there were no emissions within 20dBs of the -13dBm limit.

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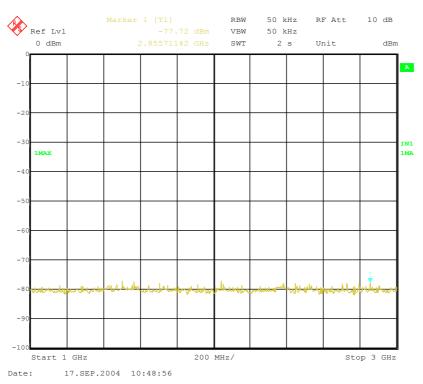
Radiated emissions 160.665 MHz

0-1GHz



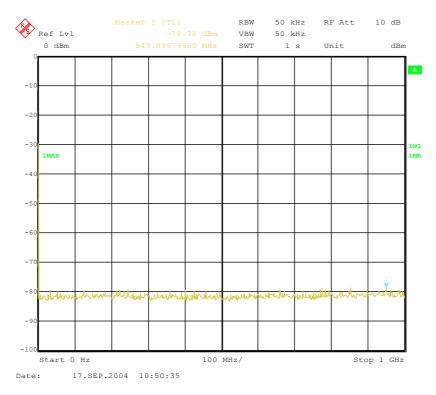
Radiated emissions 160.665 MHz

1-3GHz



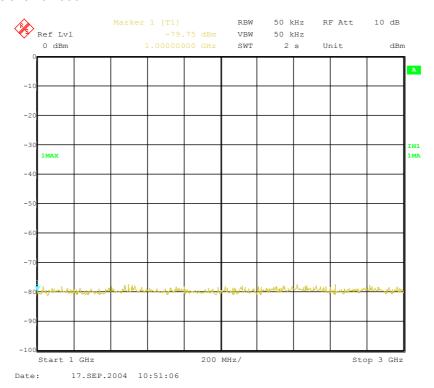
Radiated emissions 161.556 MHz

0-1GHz



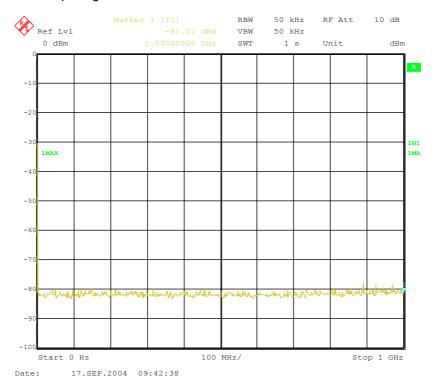
Radiated emissions 161.556 MHz

1-3GHz



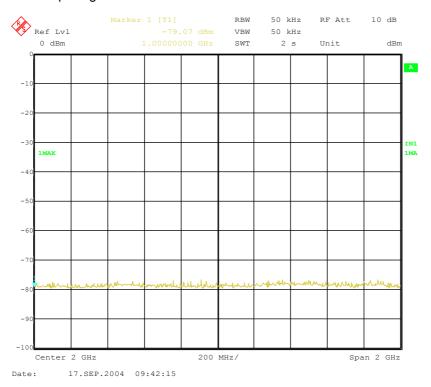
The above test results show that there were no emissions within 20dBs of the -13dBm limit.

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Radiated emissions no input signal

1-3GHz



ANNEX A PHOTOGRAPHS

PHOTOGRAPH No. 1

TEST SETUP



PHOTOGRAPH No. 2

TEST SETUP



ANNEX B APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	ТСВ	-	APPLICATION FEE	[X] [X]
b.	AGENT'S LETTER OF AUTHORISATION	-		[X]
C.	MODEL(s) vs IDENTITY	-		[]
d.	ALTERNATIVE TRADE NAME DECLARATION(s)	-		[]
e.	LABELLING	- - -	PHOTOGRAPHS DECLARATION DRAWINGS	[] [] []
f.	TECHNICAL DESCRIPTION	-		[X]
g.	BLOCK DIAGRAMS	- - -	Tx Rx PSU AUX	[X] [] []
h.	CIRCUIT DIAGRAMS	- - -	Tx Rx PSU AUX	[] [] []
i.	COMPONENT LOCATION	- - -	Tx Rx PSU AUX	[] [] []
j.	PCB TRACK LAYOUT	- - -	Tx Rx PSU AUX	[] [] []
k.	BILL OF MATERIALS	- - -	Tx Rx PSU AUX	[] [] []
l.	USER INSTALLATION / OPERATING INSTRUCTIONS	-		[X]