



TEST REPORT NO: RU1296/7397  
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FCC ID: NEO50-1465SERIES

**REPORT ON THE CERTIFICATION TESTING OF A  
AERIAL FACILITIES LIMITED  
50-146501 VHF CHANNELISED AIR INTERFACE  
WITH RESPECT TO  
THE FCC RULES CFR 47, PART 90 Subpart I  
PRIVATE LAND MOBILE REPEATER.**

TEST DATE: 18<sup>th</sup> December 2006 – 4<sup>th</sup> January 2007

TESTED BY: \_\_\_\_\_ D WINSTANLEY

APPROVED BY: \_\_\_\_\_ J CHARTERS  
RADIO SECTION  
LEADER

DATE: 26<sup>th</sup> January 2007  
\_\_\_\_\_

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## CONTENTS

	<b>PAGE</b>		
CERTIFICATE OF CONFORMITY & COMPLIANCE	3		
APPLICANT'S SUMMARY	4		
EQUIPMENT TEST CONDITIONS	5		
TESTS REQUIRED	5		
TEST RESULTS	6-51		
		<b>ANNEX</b>	
PHOTOGRAPHS		A	
PHOTOGRAPH No. 1: Test setup			
PHOTOGRAPH No. 2: EUT Front Overview			
PHOTOGRAPH No. 3: EUT Rear Overview			
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST		B	
EQUIPMENT CALIBRATION		C	
MEASUREMENT UNCERTAINTY		D	
SYSTEM DIAGRAM		E	
<b>Notes:</b>			
1. Component failure during test		YES	<input type="checkbox"/>
		NO	<input checked="" type="checkbox"/>
2. 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

FCC IDENTITY:	NEO50-1465SERIES
PURPOSE OF TEST:	Certification
TEST SPECIFICATION:	FCC RULES CFR 47, Part 90 Subpart I
TEST RESULT:	Compliant to Specification
EQUIPMENT UNDER TEST:	50-146501 VHF Channelised Air Interface
EQUIPMENT TYPE:	Private Land Mobile Repeater
MAXIMUM GAIN:	Uplink = 84.63 dB Downlink = 89.51 dB
MAXIMUM INPUT:	Uplink = -59.26 dBm Downlink = -61.26 dBm
MAXIMUM OUTPUT CONDUCTED:	Uplink = 25.37 dBm Downlink = 28.25 dBm
ANTENNA TYPE:	Uplink Yagi Downlink Distributed Antenna System
ANTENNA GAIN:	Uplink = 7.5 dBi Downlink = N/A, Leaky Feed Antenna
MAXIMUM OUTPUT RADIATED:	Uplink = 32.87 dBm
NUMBER OF CHANNELS:	Uplink = 5 Downlink = 5
CHANNEL BANDWIDTH:	15 kHz
FREQUENCY GENERATION:	N/A
MODULATION TYPE:	F3E
POWER SOURCE(s):	+110Vac
TEST DATE(s):	18 <sup>th</sup> December 2006 – 4 <sup>th</sup> January 2007
ORDER No(s):	41051
APPLICANT:	Aerial Facilities Limited
ADDRESS:	Aerial House Asheridge Road Chesham Buckinghamshire HP5 1TU
TESTED BY:	----- D WINSTANLEY
APPROVED BY:	----- J CHARTERS RADIO SECTION LEADER

## APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT): 50-146501 VHF Channelised Air Interface

EQUIPMENT TYPE: Private Land Mobile Repeater

PURPOSE OF TEST: Certification

TEST SPECIFICATION(s): FCC RULES CFR 47, Part 90 Subpart I

TEST RESULT: COMPLIANT Yes   
No

APPLICANT'S CATEGORY: MANUFACTURER   
IMPORTER   
DISTRIBUTOR   
TEST HOUSE   
AGENT

APPLICANT'S ORDER No(s): 41051

APPLICANT'S CONTACT PERSON(s): Mr Peter Bradfield

E-mail address: Peterb@aerial.co.uk

APPLICANT: Aerial Facilities Limited

ADDRESS: Aerial House  
Asheridge Road  
Chesham  
Buckinghamshire  
HP5 1TU  
United Kingdom

TEL: +44 (0)1494 777000

FAX: +44 (0)1494 778456

MANUFACTURER: Aerial Facilities Limited

EUT(s) COUNTRY OF ORIGIN: United Kingdom

TEST LABORATORY: TRL Compliance Ltd

UKAS ACCREDITATION No: 0728

TEST DATE(s): 18<sup>th</sup> December 2006 – 4<sup>th</sup> January 2007

TEST REPORT No: RU1296/7397

**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

Notes:

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

- 2. Product class:
 

Uplink	Class A <input checked="" type="checkbox"/>	Class B <input type="checkbox"/>
Downlink	Class A <input checked="" type="checkbox"/>	Class B <input type="checkbox"/>
  - 3. Product Use: Private Land Mobile Repeater
  - 4. Emission Designator: F3E
  - 5. Temperatures: Ambient (Tnom) 22°C
  - 6. Supply Voltages: Vnom +110Vac
- Note: Vnom voltages are as stated above unless otherwise shown on the test report page
- 7. Equipment Category:
 

Single channel	<input type="checkbox"/>
Two channel	<input type="checkbox"/>
Multi-channel	<input checked="" type="checkbox"/>
  - 8. Channel Bandwidth:
 

Narrowband	<input checked="" type="checkbox"/>	15 kHz
Wideband	<input type="checkbox"/>	
  - 9. Test Location:
 

TRL Compliance Limited	
Up Holland	<input checked="" type="checkbox"/>
Long Green	<input type="checkbox"/>
  - 10. Modifications made during test program: No modifications were performed.

**System description:**

The 50-146501 is a bi-directional amplifier. The uplink is channelised and utilizes 5 channels and operates between the frequencies 151.355 MHz – 154.980MHz. The downlink is channelised and utilizes 5 channels and operates between the frequencies 153.965 MHz – 158.925MHz.

## COMPLIANCE TESTS

### TRANSMITTER TESTS

#### AMPLIFIER GAIN – CONDUCTED – Part 2.1046 – UPLINK

Ambient temperature = 22°C  
 Relative humidity = 46%  
 Supply voltage = +110Vac  
 Channel number = See test results

Radio Laboratory



Frequency MHz	Signal Generator Input Level dBm	Input Losses dB	Output Losses dB	Level at Spectrum Analyser dBm	EUT Gain dB	Conducted Output Power dBm	Gain After 10dB Input Level Increase dB
151.355	-50.5	0.26	32.13	-3.21	79.39	28.92	70.69
154.6575	-45.0	0.26	32.13	-3.97	73.42	28.16	63.59
154.755	-55.5	0.26	32.13	-4.83	83.06	27.30	73.19
154.785	-59.0	0.26	32.13	-6.76	84.63	25.37	75.03
154.980	-47.0	0.26	32.13	-5.26	74.13	26.87	64.28

Notes: 1. The signal generator input was increased by 10dBs and the level of the output signal remeasured.

Frequency MHz	EUT Gain dB	Conducted Output Power dBm	Antenna Gain dBi	Radiated Output Power dBm
151.355	79.39	28.92	7.5	36.42
154.6575	73.42	28.16	7.5	35.66
154.755	83.06	27.30	7.5	34.80
154.785	84.63	25.37	7.5	32.87
154.980	74.13	26.87	7.5	34.37

Notes: 1. The Antenna is a yagi with 7.5 dBi Gain.

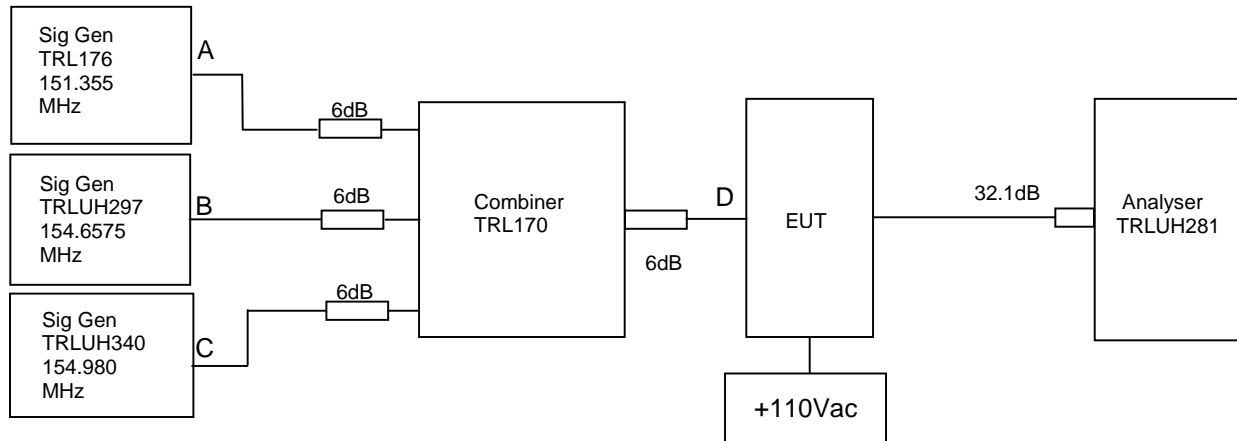
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>

## TRANSMITTER TESTS

### AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053– UPLINK

Ambient temperature = 15°C  
 Relative humidity = 45%  
 Supply voltage = +110Vac

Radio Laboratory



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 10dB above the maximum input of the selected channel. The cable and attenuator loss between the EUT and the spectrum analyser was 32.1dB. The signal generators were set to the input frequencies listed below.

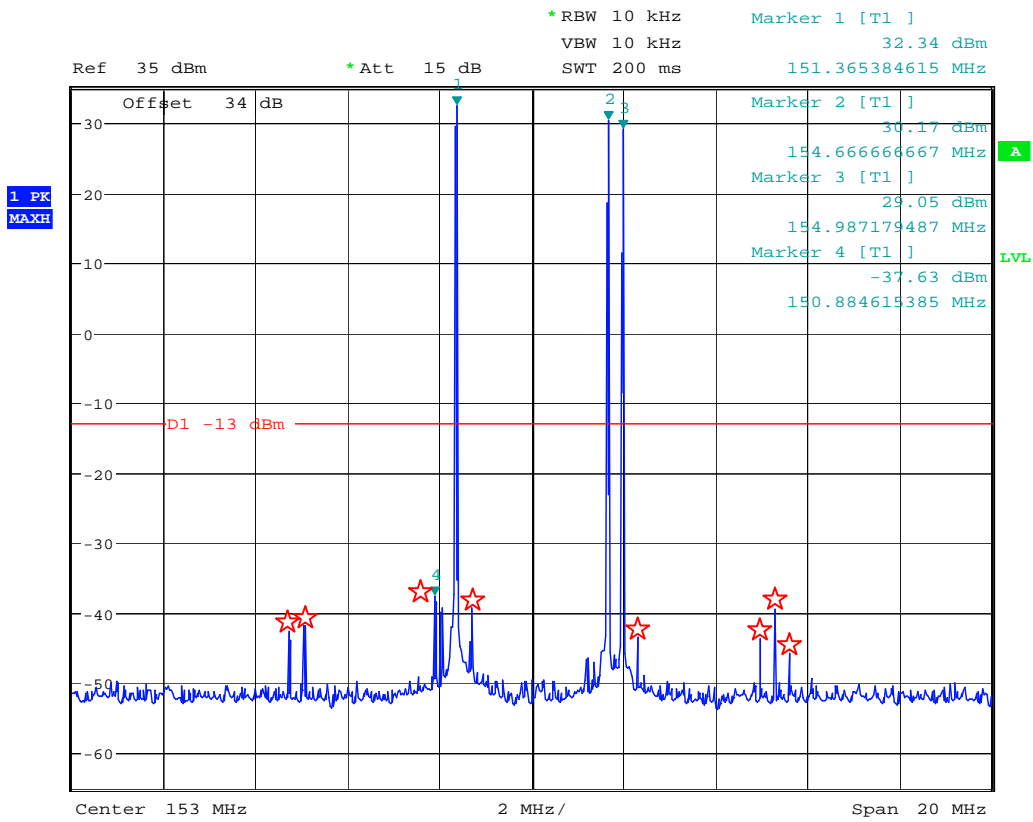
RF Input Frequency (MHz)			Highest Intermodulation Product Level & Frequency (dBm) & (MHz)	Limit (dBm)
151.355	154.6575	154.980	-30.60 dBm @ 3.20513 MHz	-13

Sweep data is shown on the next pages are for worst case intermodulation product:

#### Test equipment used for intermodulation test

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
SIGNAL GENERATOR	HP	83630B	3722A00588	UH340	X
COMBINER	ELCOM	RC-4-50	N/A	170	X

### Intermodulation Inband

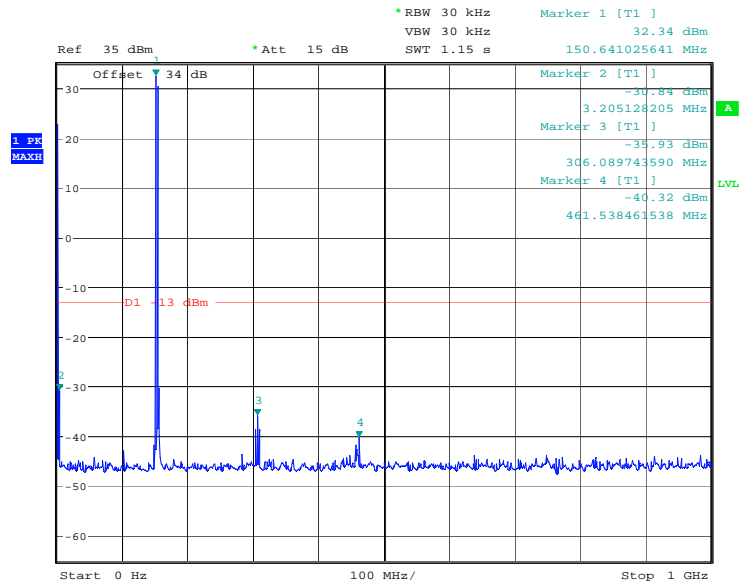


Date: 20.DEC.2006 10:05:28

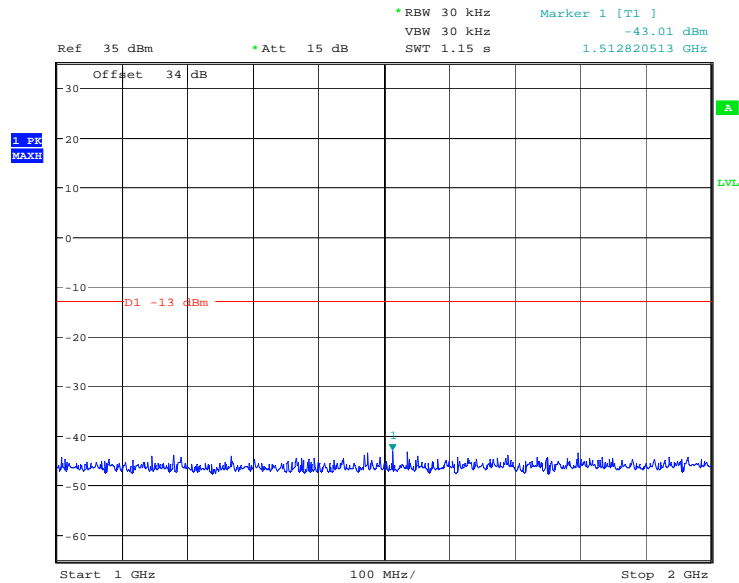
The above plot shows that all products (designated by ☆) are below the spurious limit.



### Intermodulation Wideband



Date: 20.DEC.2006 10:10:51



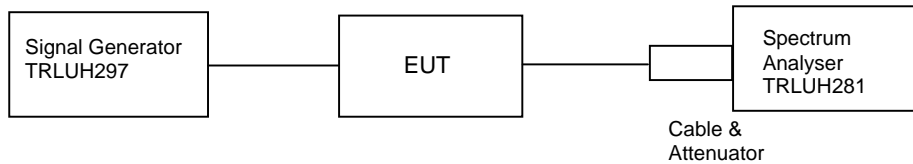
Date: 20.DEC.2006 10:11:08

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

**TRANSMITTER TESTS**

**AMPLIFIER MODULATED CHANNEL TEST – CONDUCTED – Part 2.1049– UPLINK**

Ambient temperature = 17°C Radio Laboratory  
 Relative humidity = 65%  
 Supply voltage = +110Vac  
 Channel number = See test results



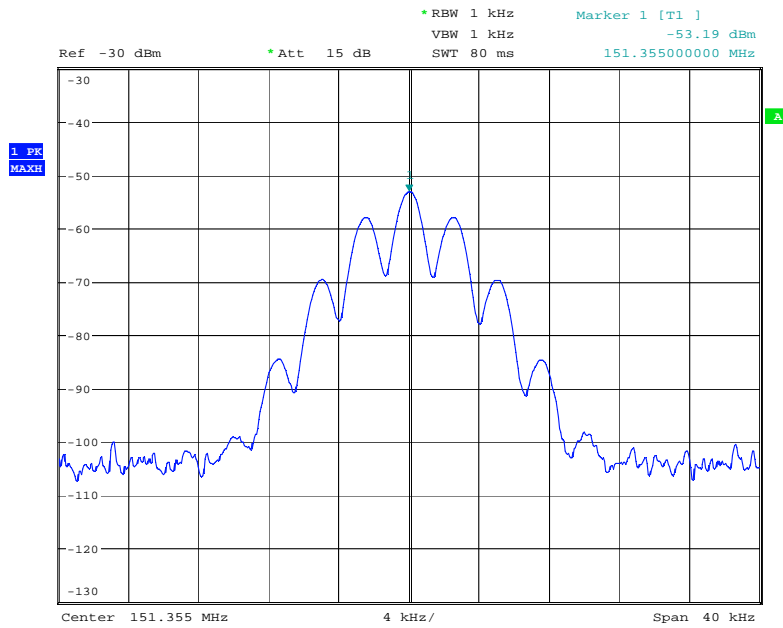
This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level required for the selected channel and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at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

Note: The cables and attenuators had the following losses.

1. Cable and attenuators between EUT and spectrum analyser 32.1dB
2. Cable between signal generator and EUT 0.26dB

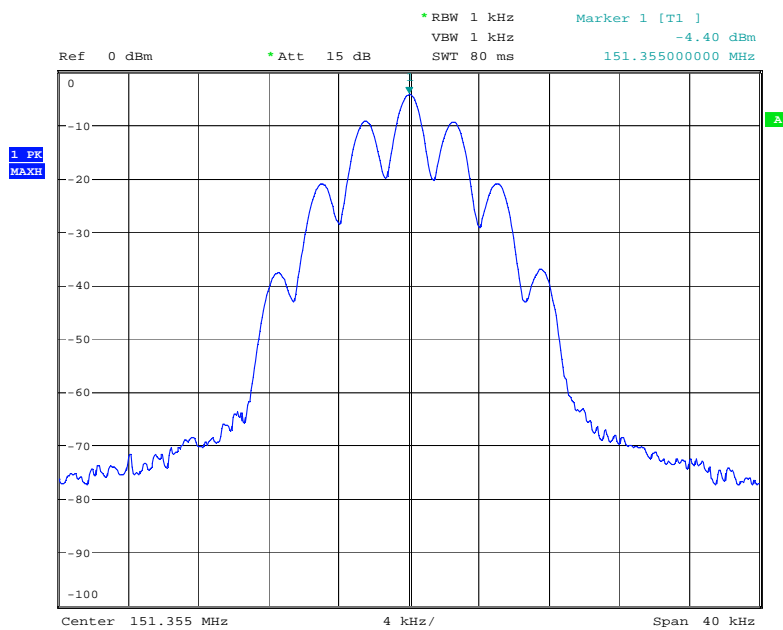
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>

### 151.355 MHz Signal Generator, deviation set to 2.5 kHz



Date: 4.JAN.2007 11:28:51

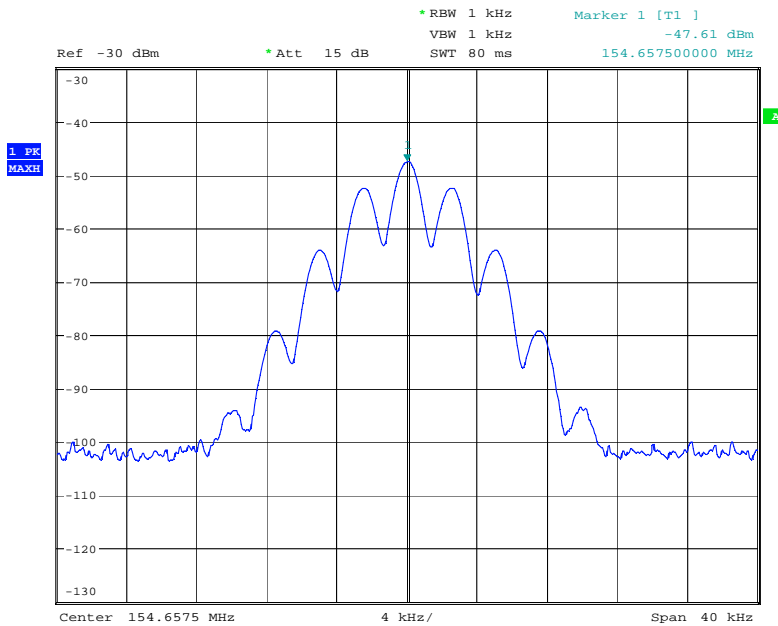
### 151.355 MHz Signal Generator and EUT, deviation set to 2.5 kHz



Date: 3.JAN.2007 14:12:07

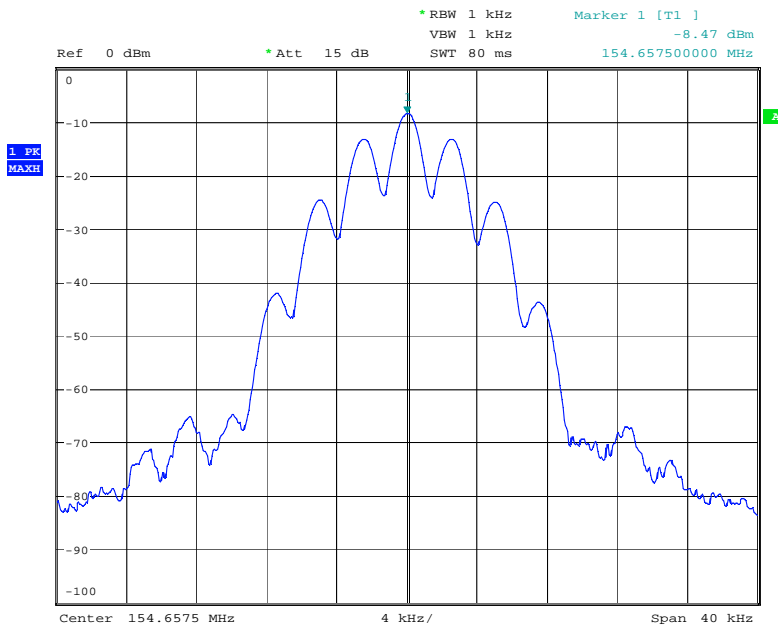
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 154.6575 MHz Signal Generator, deviation set to 2.5kHz



Date: 4.JAN.2007 11:26:38

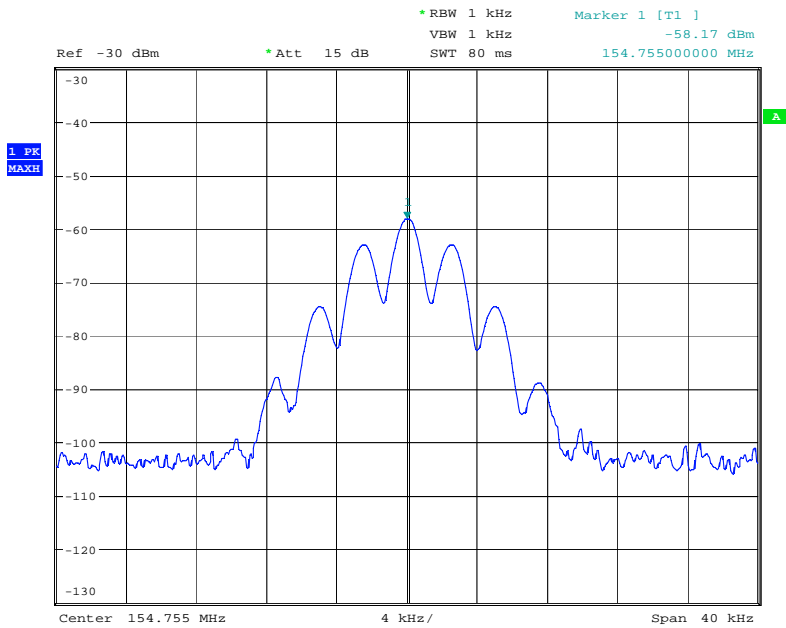
### 154.6575 MHz Signal Generator and EUT, deviation set to 2.5kHz



Date: 3.JAN.2007 14:14:05

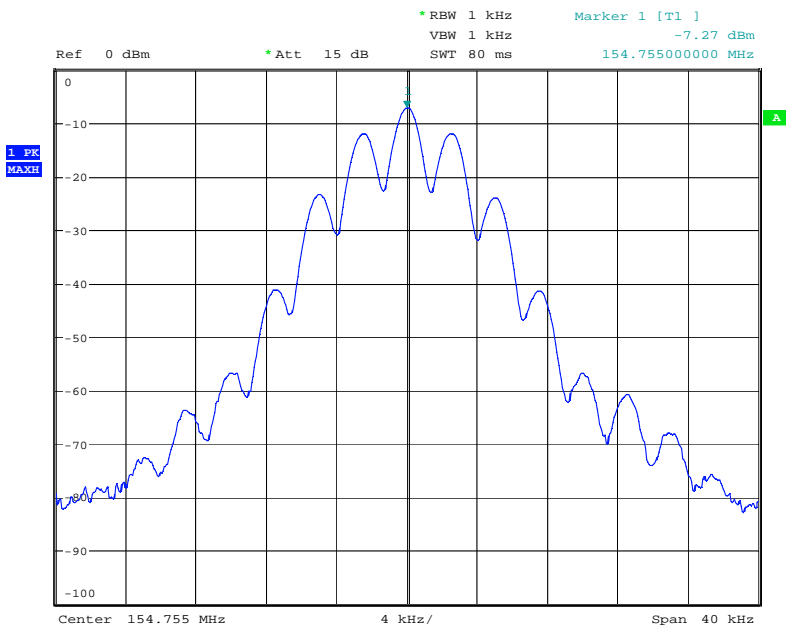
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 154.755 MHz Signal Generator, deviation set to 2.5kHz



Date: 4.JAN.2007 11:27:15

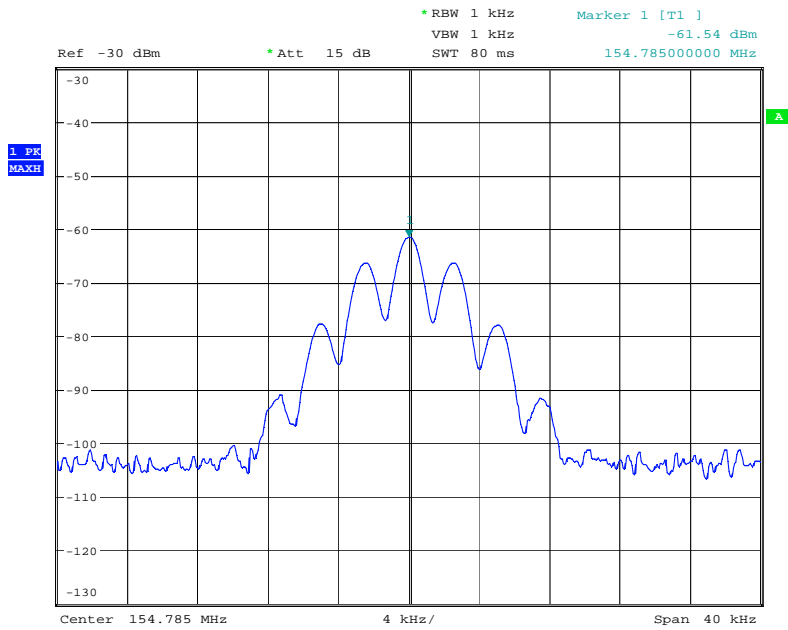
### 154.755 MHz Signal Generator and EUT, deviation set to 2.5kHz



Date: 3.JAN.2007 14:56:13

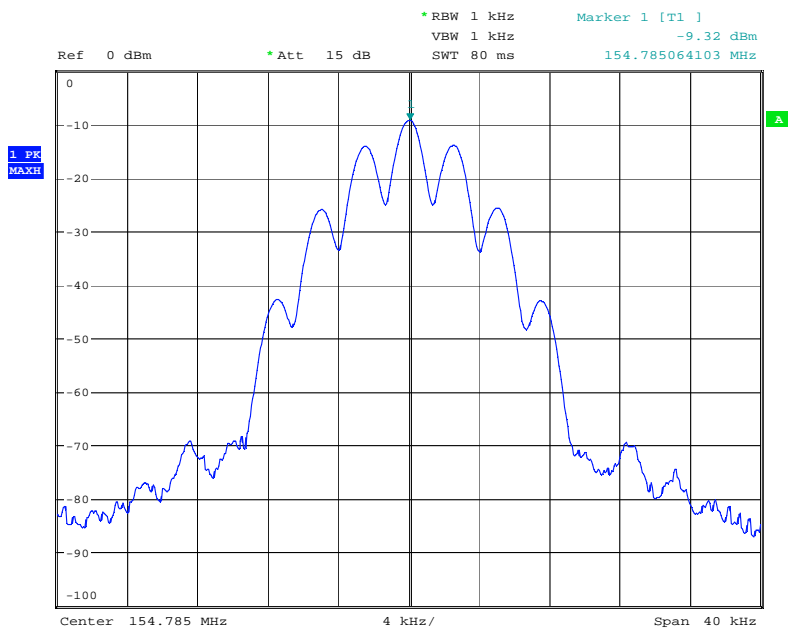
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 154.785 MHz Signal Generator, deviation set to 2.5kHz



Date: 4.JAN.2007 11:28:00

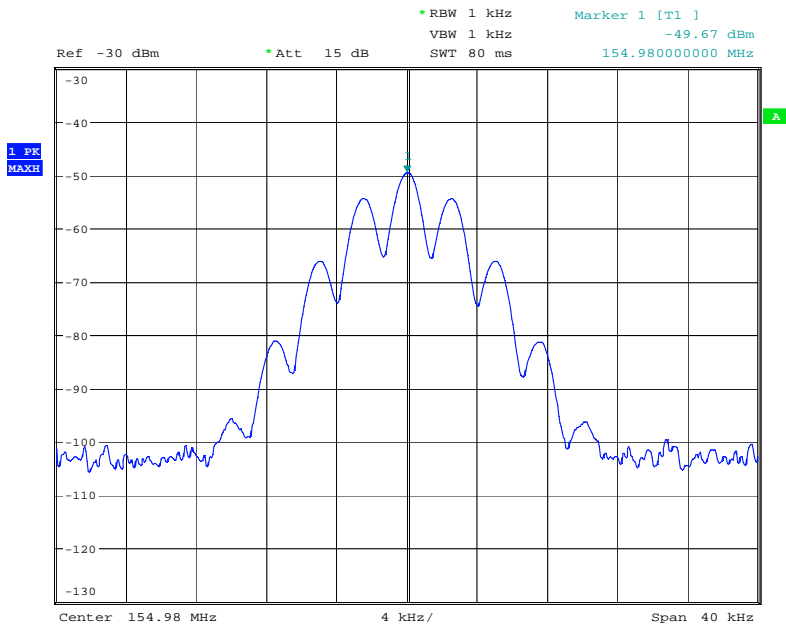
### 154.785 MHz Signal Generator and EUT, deviation set to 2.5kHz



Date: 3.JAN.2007 14:13:34

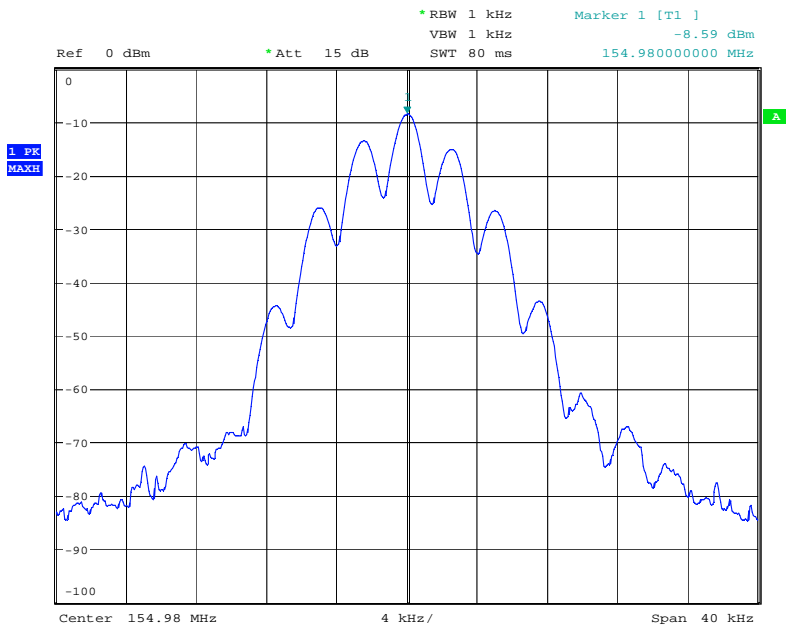
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 154.980 MHz Signal Generator, deviation set to 2.5kHz



Date: 4.JAN.2007 11:28:26

### 154.980 MHz Signal Generator and EUT, deviation set to 2.5kHz



Date: 3.JAN.2007 14:13:04

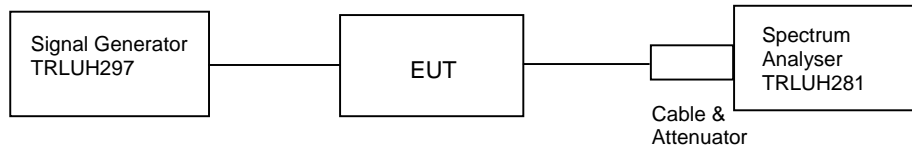
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

## TRANSMITTER TESTS

### AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053 – UPLINK

Ambient temperature = 15°C  
 Relative humidity = 45%  
 Supply voltage = +110Vac

Radio Laboratory  
 Test Signal = F3E



The test was set up as per the diagram. The input signal was set to the maximum input level required for the selected channel. The unit was tested operating at maximum power and on each operating frequency.

The Spurious limit was calculated as follows:

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

At least  $43 + 10 \log P_{dB}$

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

## RESULTS

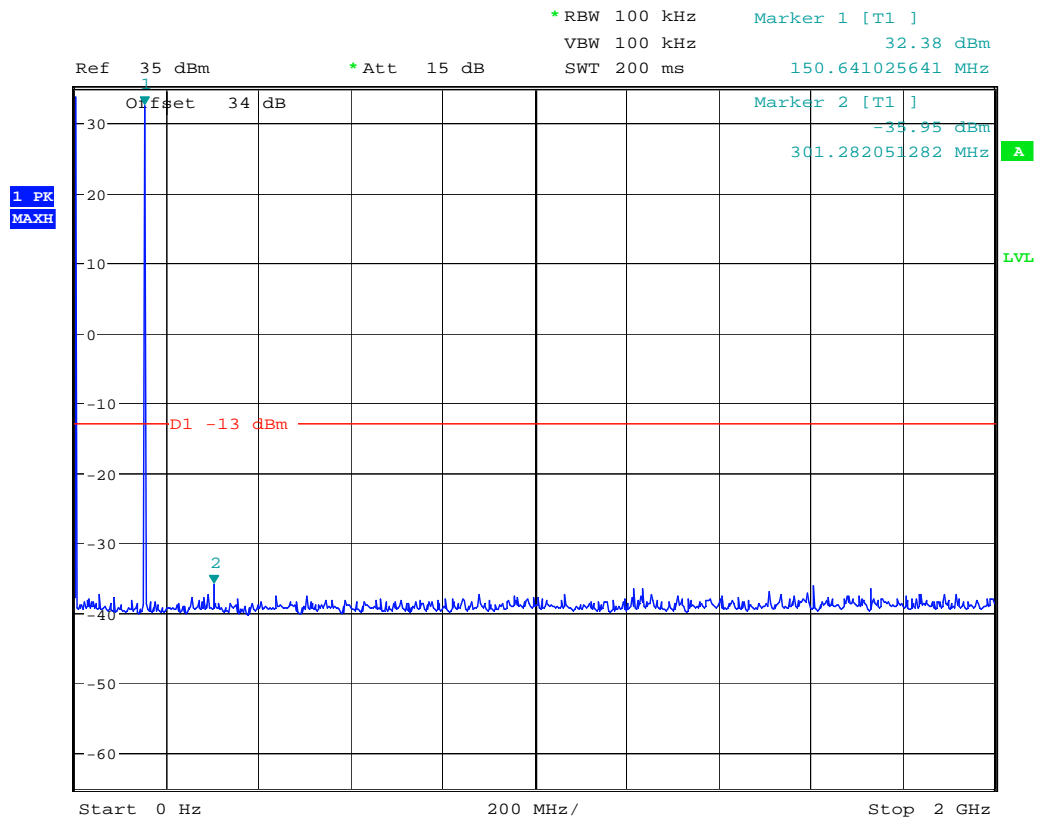
FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	ATTENUATOR & CABLE LOSSES (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
0 Hz – 5 GHz	No Significant emissions within 20dB of the Limit				-13

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	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>
CABLE	TRL	N/A	N/A	UH273	<b>X</b>

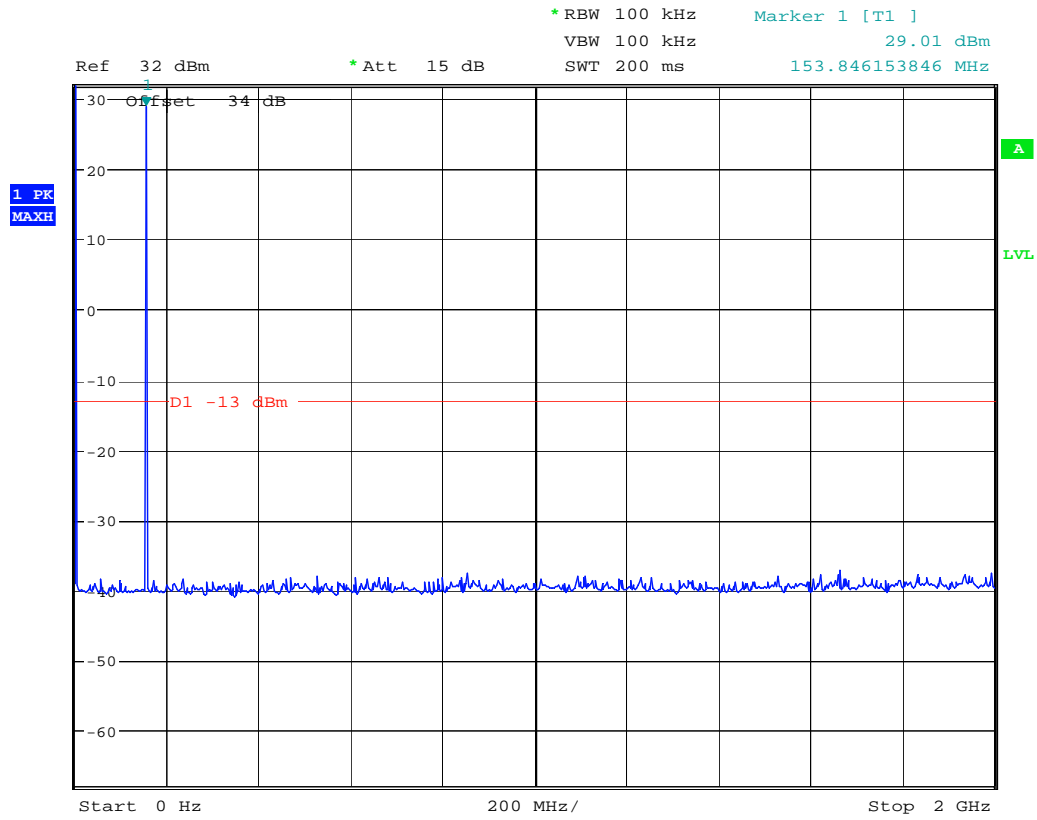


# Conducted emissions 151.355 MHz 0 – 2GHz



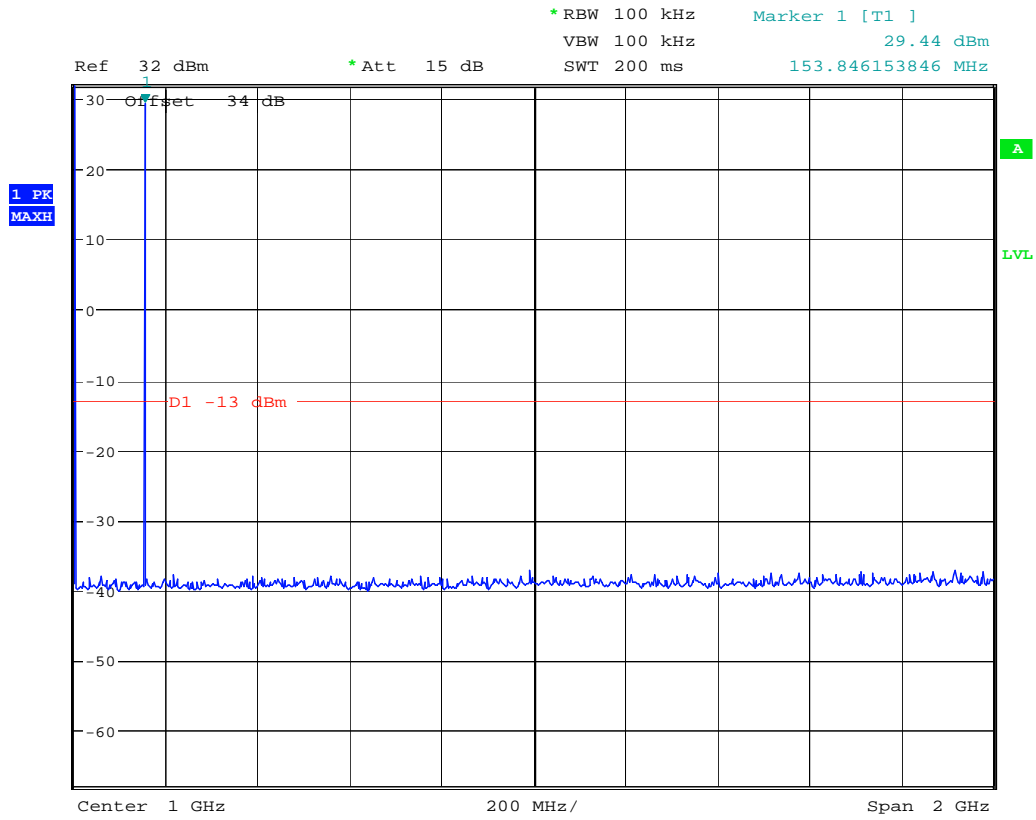
Date: 20.DEC.2006 09:40:50

Conducted emissions 154.6575 MHz 0 – 2GHz



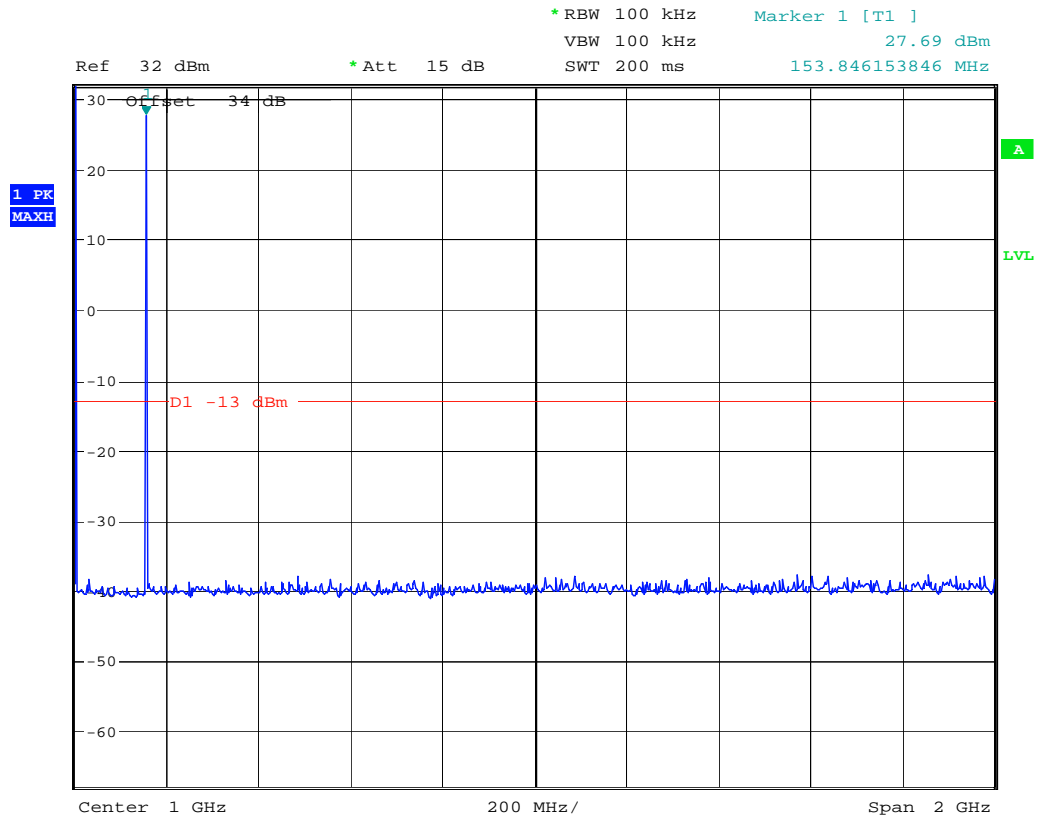
Date: 20.DEC.2006 09:30:17

# Conducted emissions 154.755 MHz 0 – 2GHz



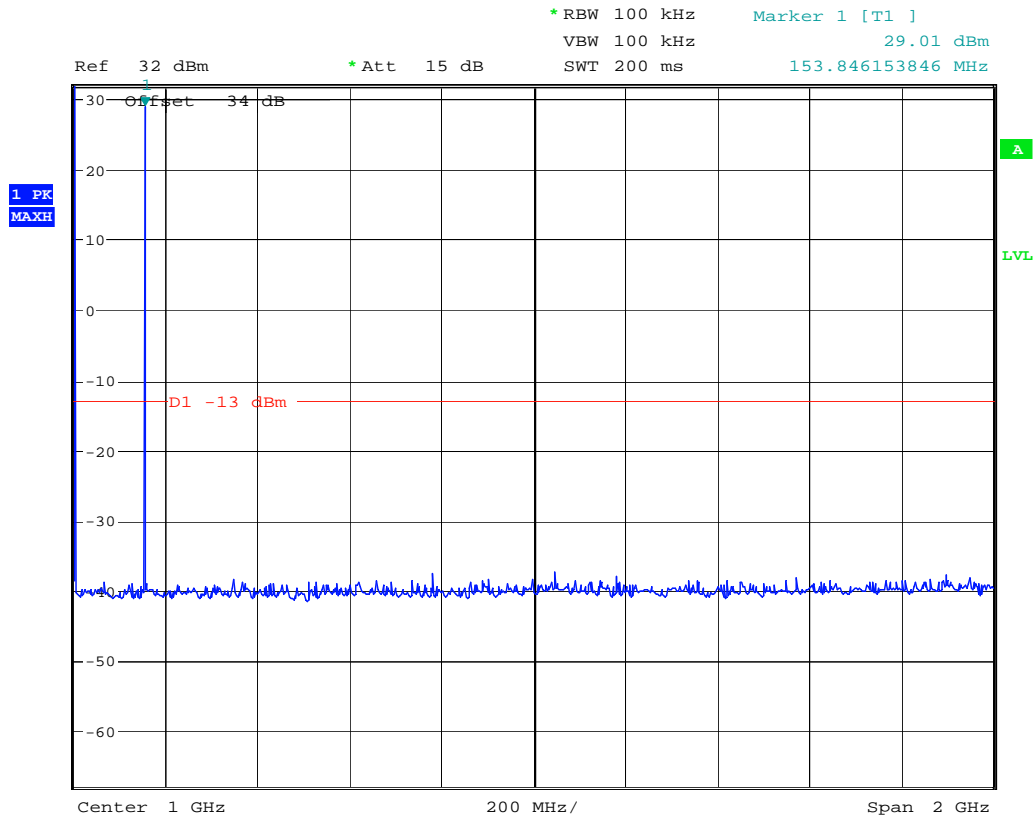
Date: 20.DEC.2006 09:34:08

Conducted emissions 154.785 MHz 0 – 2GHz



Date: 20.DEC.2006 09:38:07

# Conducted emissions 154.980 MHz 0 – 2.5GHz



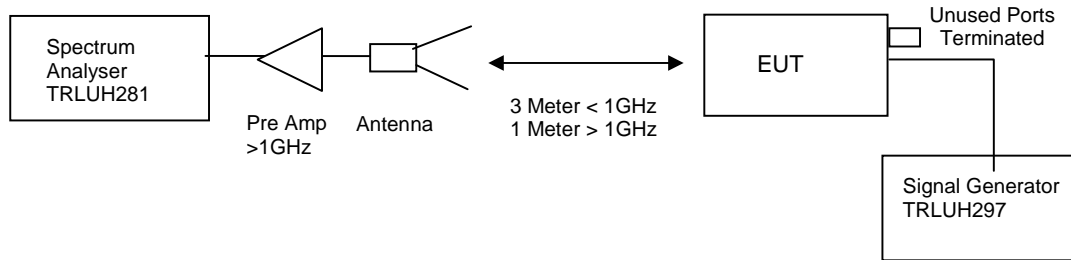
Date: 20.DEC.2006 09:37:27

## TRANSMITTER TESTS

### AMPLIFIER SPURIOUS EMISSIONS – RADIATED – Part 2.1053– UPLINK

Ambient temperature = 15°C  
 Relative humidity = 44%  
 Conditions = OATS  
 Supply voltage = +110Vac

Test Signal = F3E



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 each operating frequency with a 50 ohm load on 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  $43 + 10 \log \text{PdB}$

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

## RESULTS

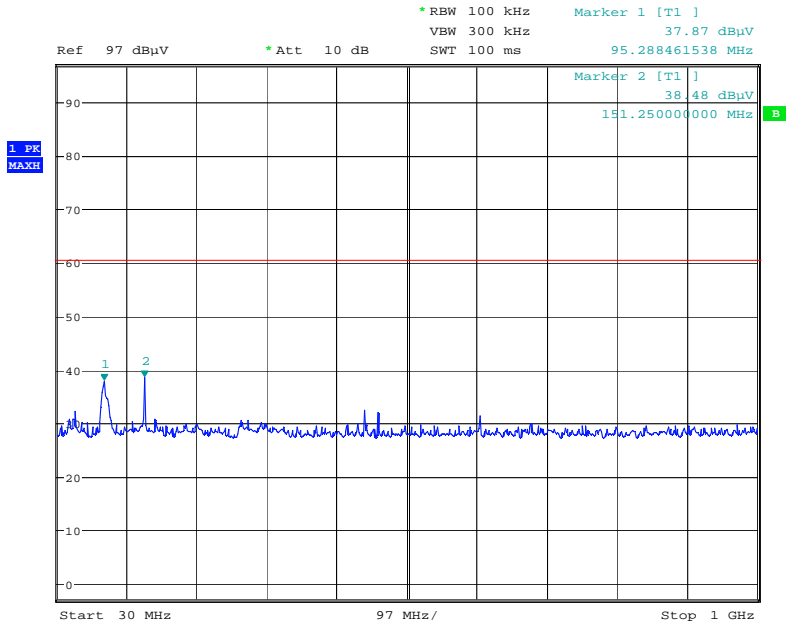
FREQUENCY RANGE	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	CALCULATED EIRP (dBm)	LIMIT (dBm)
30MHz – 1GHz	95.288	37.25	1.1	9.3	48.67	-48.71	-13
1GHz – 5GHz	No Significant Emissions Within 20dB of the Limit						-13

Note: Worst case emissions for each frequency are recorded.

The test equipment used for the Transmitter Spurious Emissions:

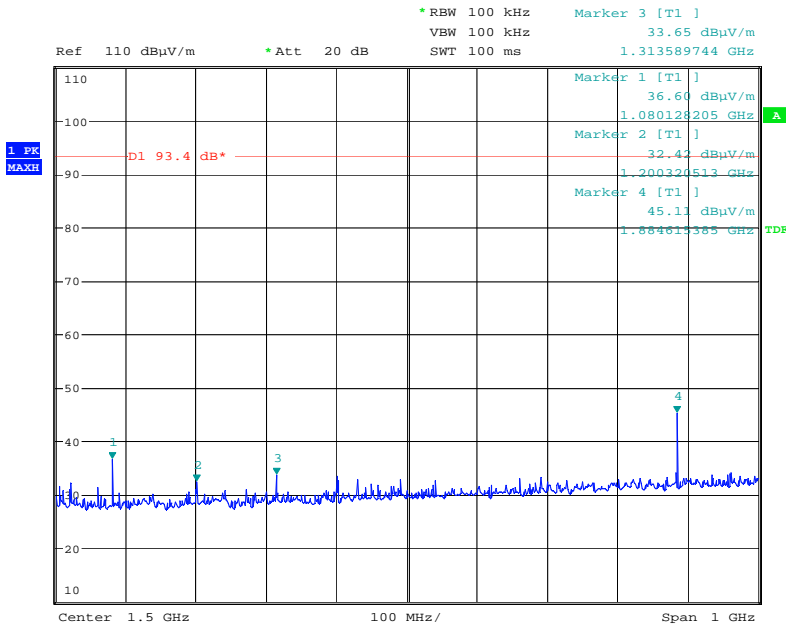
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ANTENNA	CHASE	CBL6612B	2803	UH93	X
ANTENNA	EMCO	3115	9010-3580	138	X
PRE AMPLIFIER	HP	8449B	3008A016	572	X

Radiated emissions 151.355 MHz 30MHz – 1GHz



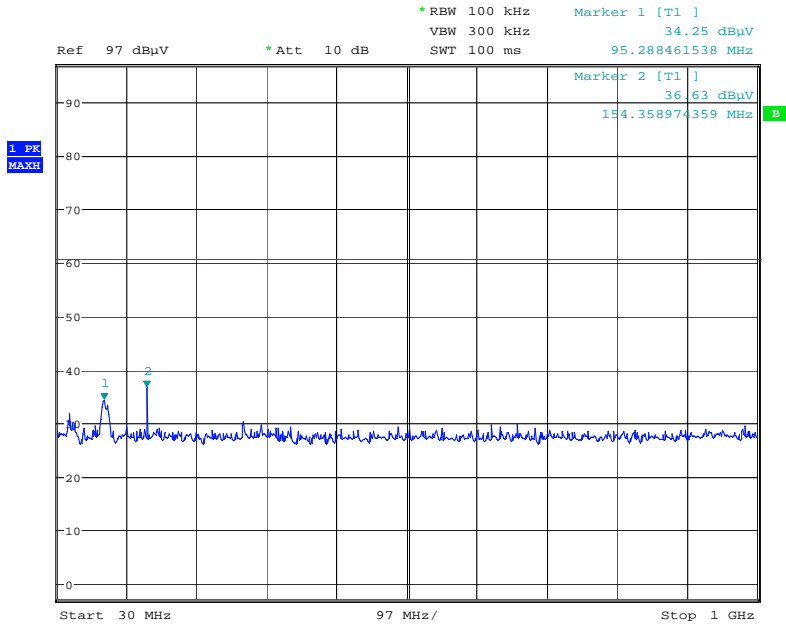
Date: 22.DEC.2006 10:58:24

Radiated emissions 151.355 MHz 1 – 2GHz



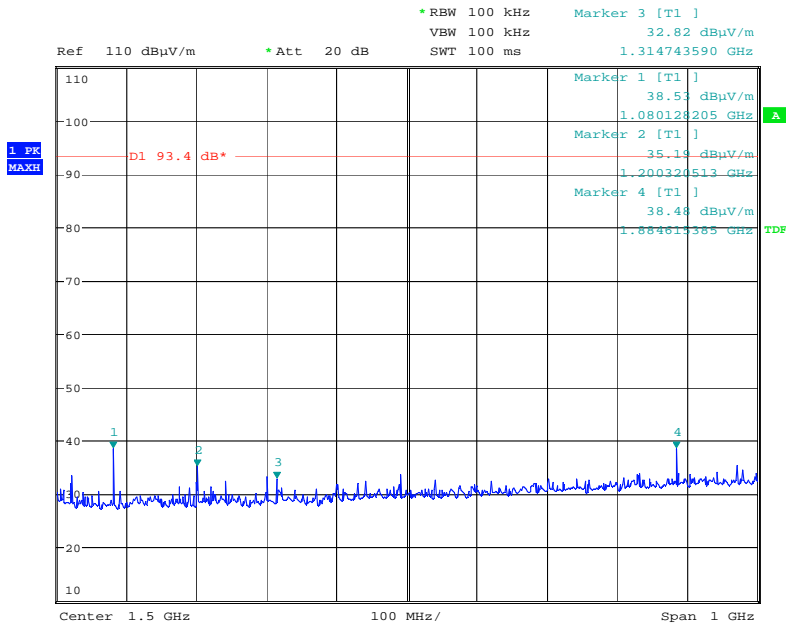
Date: 21.DEC.2006 11:32:09

Radiated emissions 154.6575 MHz 30MHz – 1GHz



Date: 22.DEC.2006 10:53:02

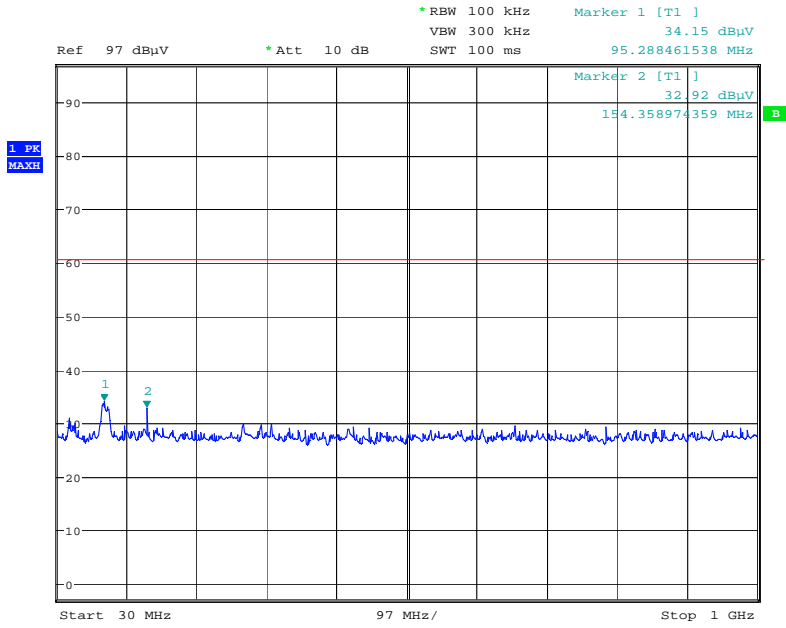
Radiated emissions 154.6575 MHz 1 – 2GHz



Date: 21.DEC.2006 11:38:05

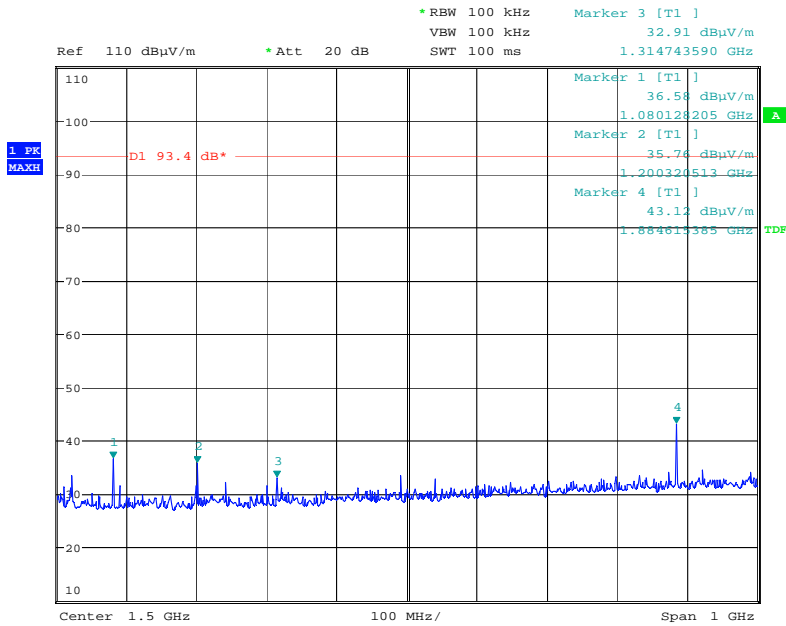


Radiated emissions 154.755 MHz 30MHz – 1GHz



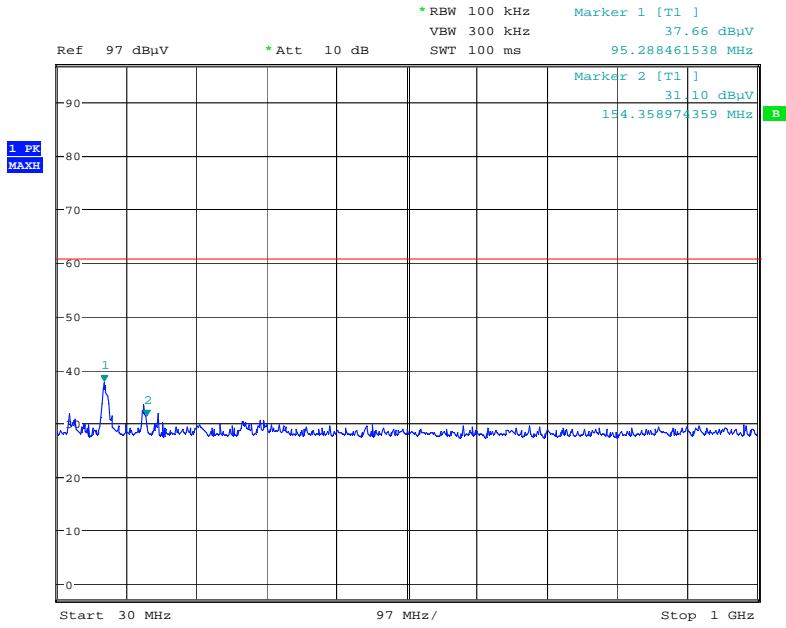
Date: 22.DEC.2006 10:53:27

Radiated emissions 154.755 MHz 1 – 2GHz



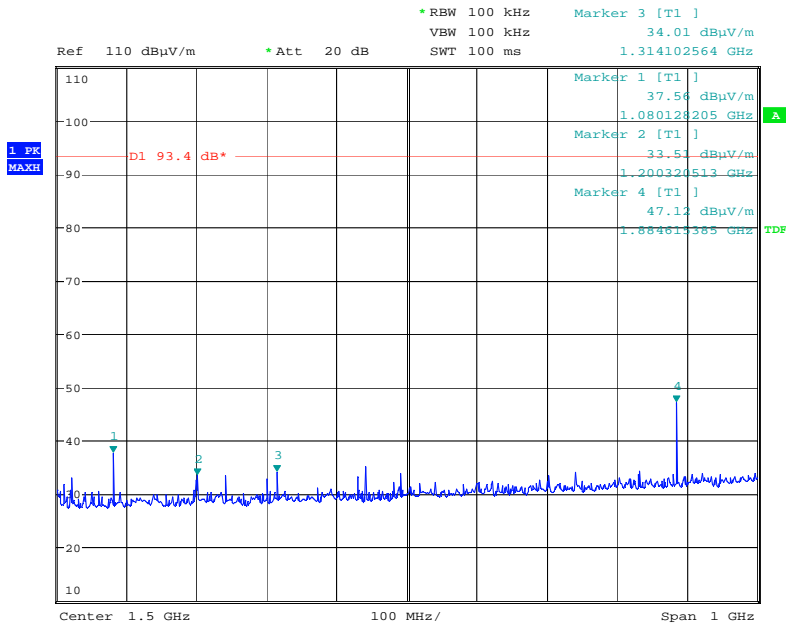
Date: 21.DEC.2006 11:37:20

Radiated emissions 154.785 MHz 30MHz – 1GHz



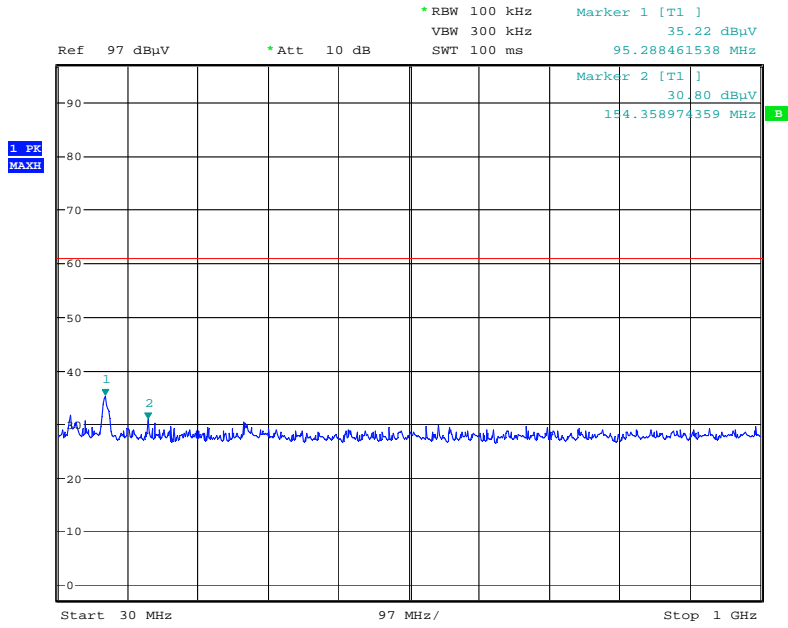
Date: 22.DEC.2006 10:55:01

Radiated emissions 154.785 MHz 1 – 2GHz



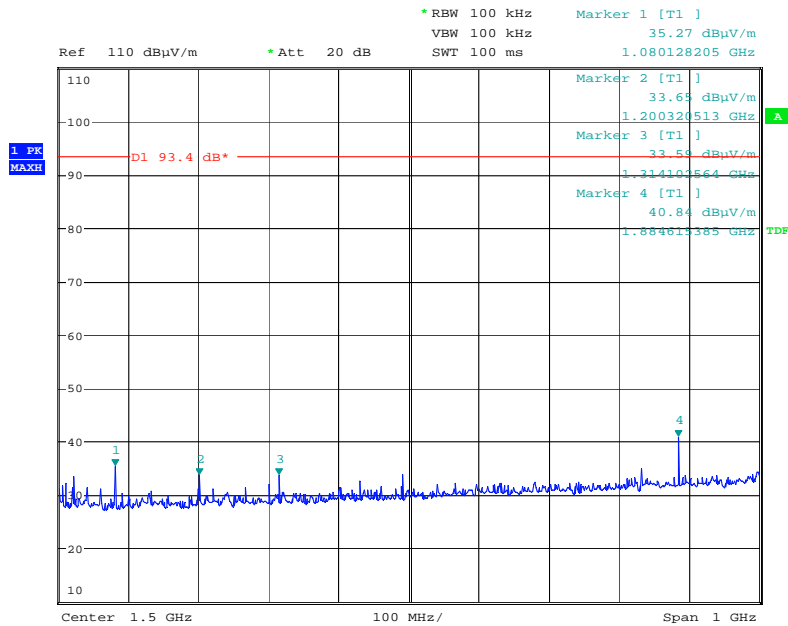
Date: 21.DEC.2006 11:35:59

Radiated emissions 154.980 MHz 30MHz – 1GHz



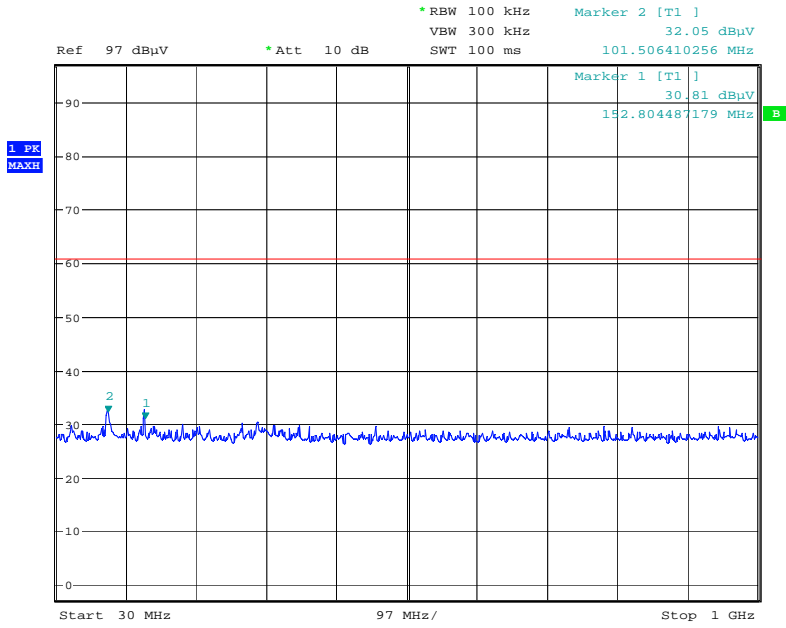
Date: 22.DEC.2006 10:56:06

Radiated emissions 154.980 MHz 1 – 2GHz



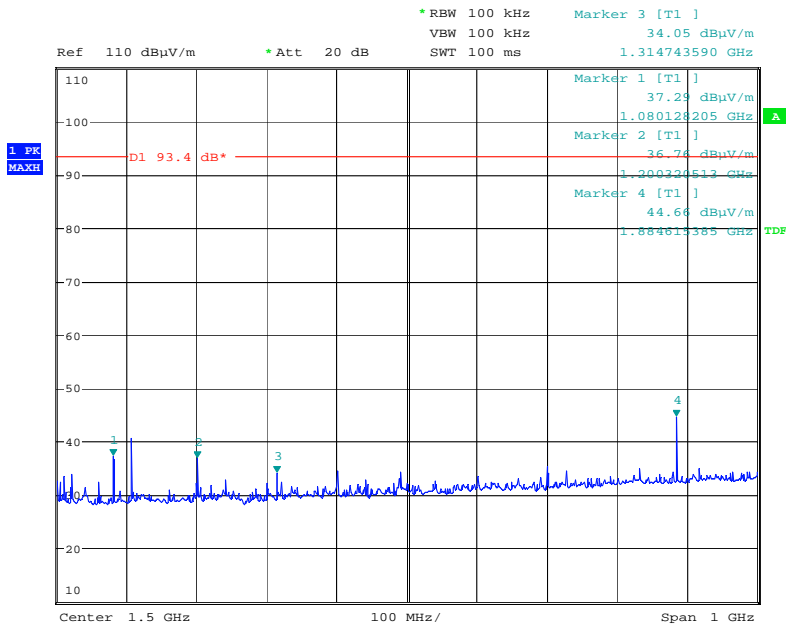
Date: 21.DEC.2006 11:34:24

Radiated emissions no input signal 30MHz – 1GHz



Date: 22.DEC.2006 10:44:32

Radiated emissions no input signal 1 – 2GHz



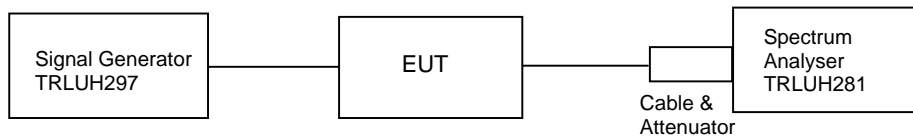
Date: 21.DEC.2006 11:40:21

**TRANSMITTER TESTS**

**AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – DOWNLINK**

Ambient temperature = 22°C  
 Relative humidity = 46%  
 Supply voltage = +110Vac  
 Channel number = See test results

Radio Laboratory



Frequency MHz	Signal Generator input level dBm	Input Cable Loss dB	Output Cable & Attenuator loss dB	Level at Spectrum Analyser dBm	Gain dB	Conducted Output Power dBm	Gain after 10dB input level increase dB
153.965	-55.5	0.26	32.13	-4.07	83.82	28.06	74.02
154.755	-54.0	0.26	32.13	-5.53	80.86	26.60	71.00
154.785	-61.0	0.26	32.13	-4.88	88.51	27.25	78.84
154.980	-51.5	0.26	32.13	-4.89	79.00	27.24	69.13
158.925	-61.0	0.26	32.13	-3.88	89.51	28.25	80.03

- Notes: 1. The signal generator input was increased by 10dBs and the level of the output signal remeasured.  
 2. A Distributed Antenna System (leaky feed) is employed.

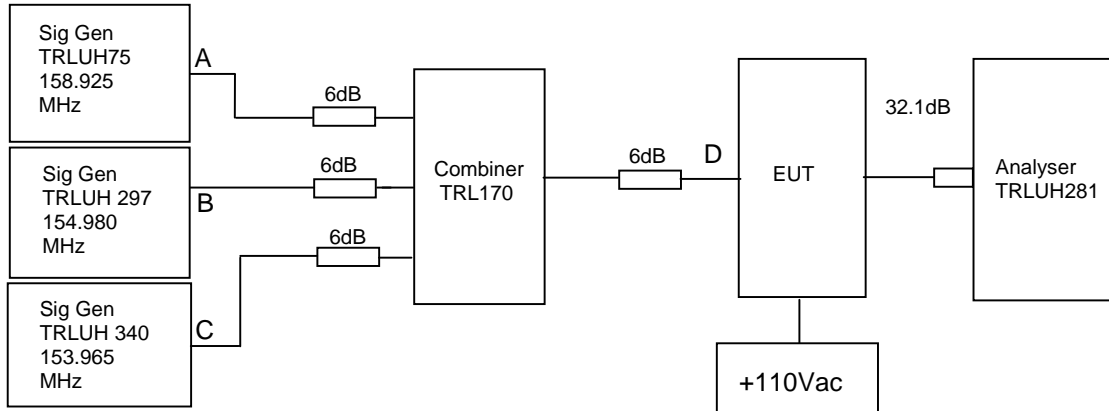
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>

## TRANSMITTER TESTS

### AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053 – DOWNLINK

Ambient temperature = 17°C  
 Relative humidity = 65%  
 Supply voltage = +110Vac

Radio Laboratory



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 10dB above the maximum input of the selected channel. The cable and attenuator loss between the EUT and the spectrum analyser was 32.1dB. The signal generators were set to the input frequencies listed below.

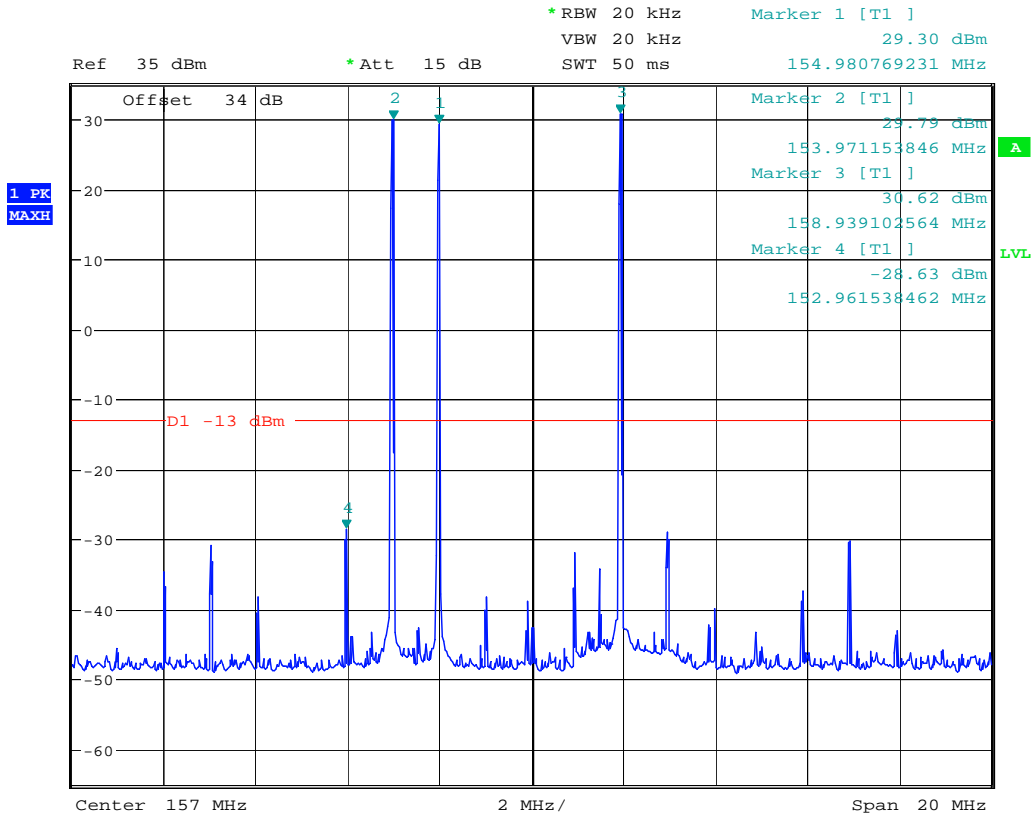
RF Input Frequency (MHz)			Highest Intermodulation Product Level (dBm)	Limit (dBm)
158.925	154.980	153.965	-28.63 dBm @ 152.96154 MHz	-13

Sweep data is shown on the next pages are for worst case intermodulation product:

#### Test equipment used for intermodulation test

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	EQUIPMENT USED
SIGNAL GENERATOR	MARCONI	2022D	119215/058	UH75	X
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
SIGNAL GENERATOR	HP	83630B	3722A00588	UH340	X
COMBINER	ELCOM	RC-4-50	N/A	170	X
COMBINER	ELCOM	RC-3-50	N/A	119	X

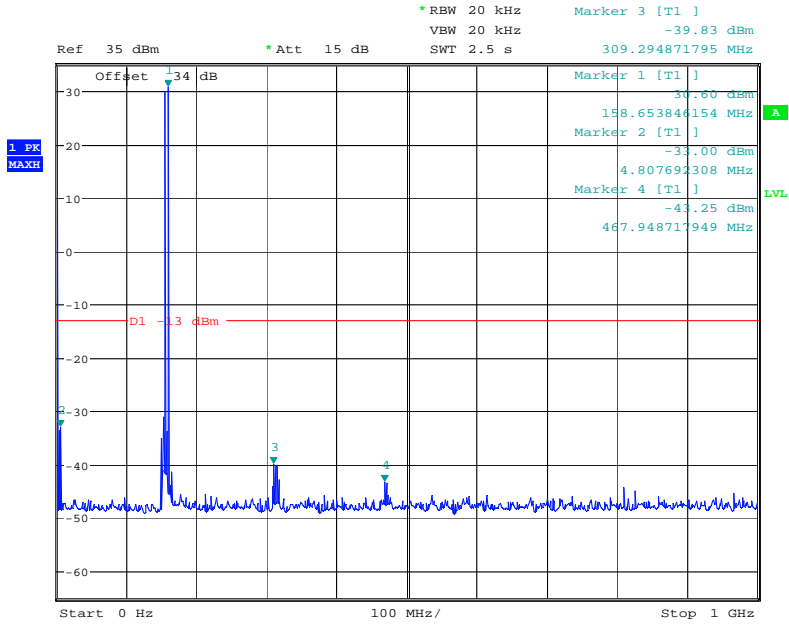
### Intermodulation Inband



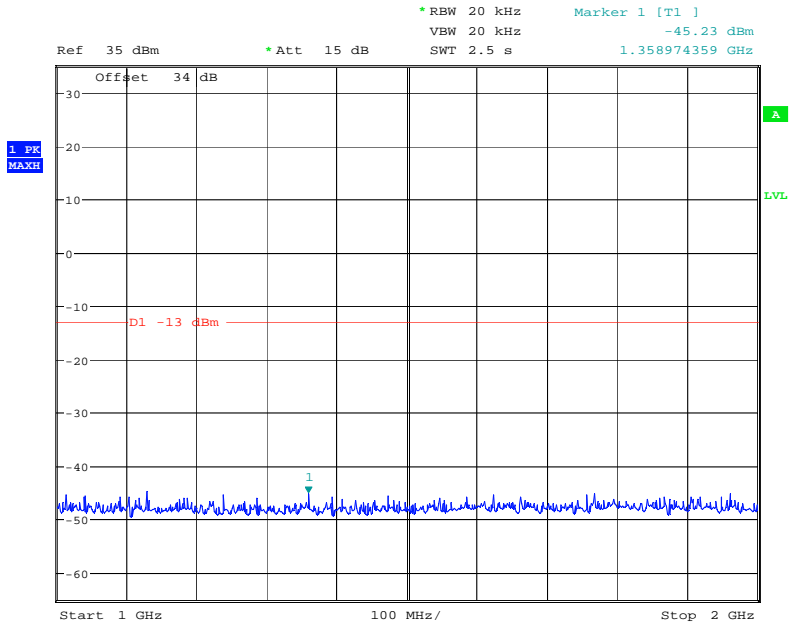
Date: 20.DEC.2006 10:41:29

The above plot shows that all products (designated by ☆) are below the spurious limit.

### Intermodulation Wideband



Date: 20.DEC.2006 10:48:00



Date: 20.DEC.2006 10:45:31

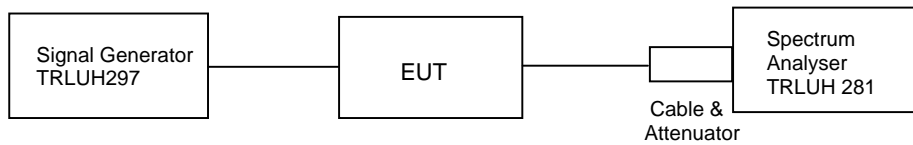
The above plot shows that there are no products outside the bands over the spurious limit.



**TRANSMITTER TESTS**

**AMPLIFIER MODULATED CHANNEL TEST – CONDUCTED – Part 2.1049– DOWNLINK**

Ambient temperature = 17°C Radio Laboratory  
 Relative humidity = 52%  
 Supply voltage = +110Vac  
 Channel number = See test results



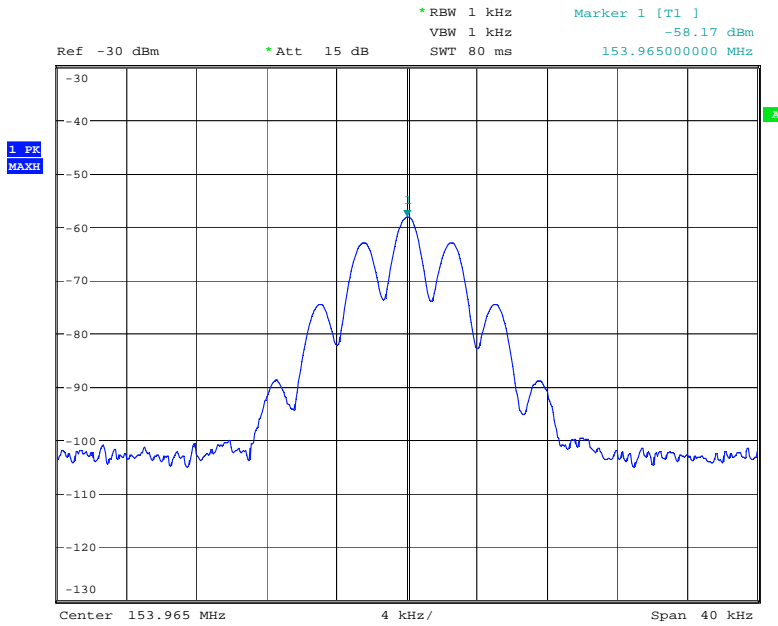
This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level required for the selected channel and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at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

Note: The cables and attenuators had the following losses.

1. Cable and attenuator between EUT and spectrum analyser 32.1dB
2. Cable between signal generator and EUT 0.26dB

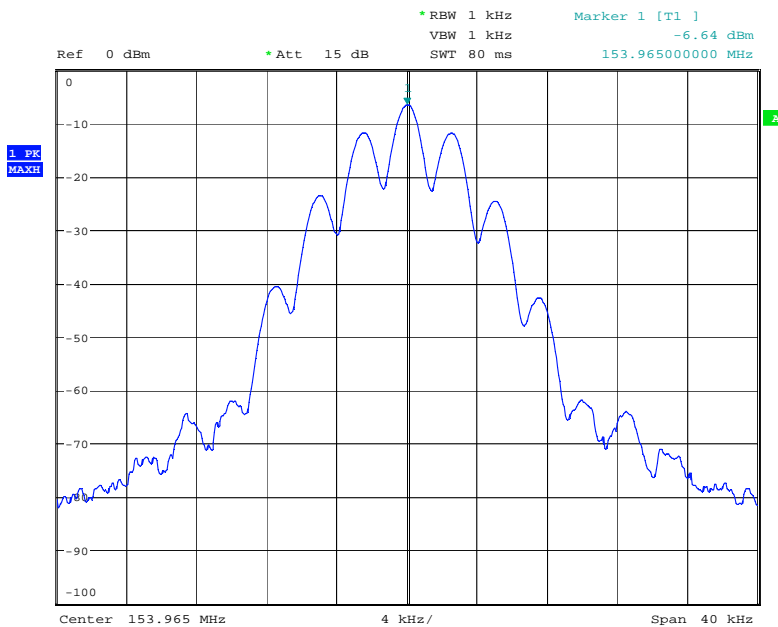
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>

### 153.965 MHz Signal Generator, deviation set to 2.5 kHz



Date: 4.JAN.2007 11:29:39

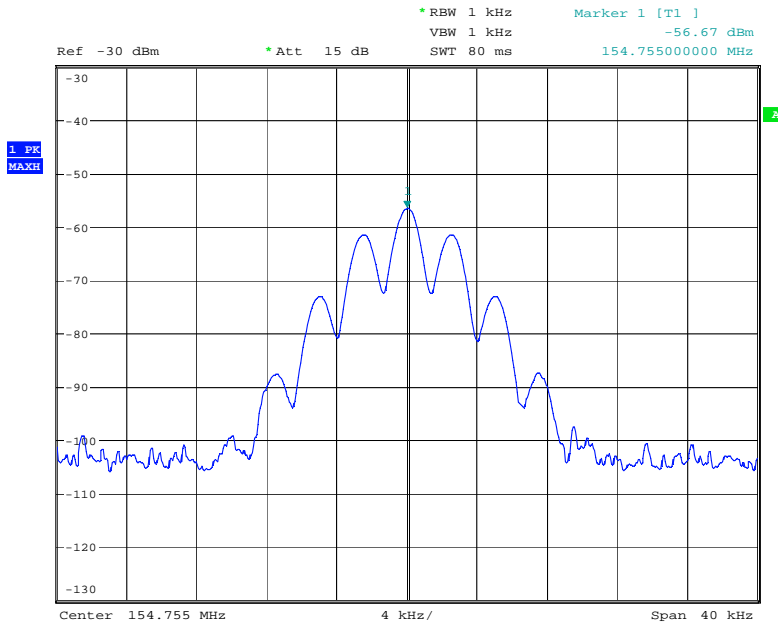
### 153.965 MHz Signal Generator and EUT, deviation set to 2.5 kHz



Date: 3.JAN.2007 14:22:34

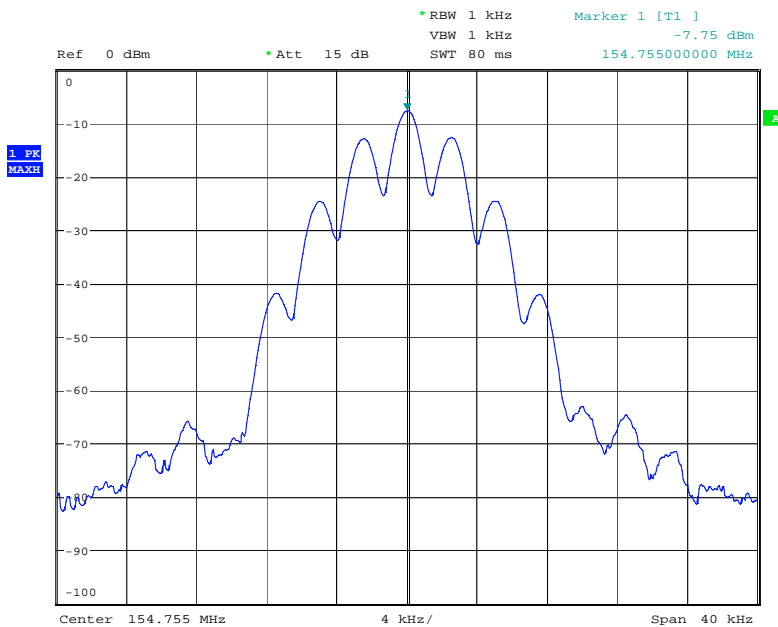
The above plots depicting the output wavseshape show no measurable distortion visible when compared to the input signal.

### 154.755 MHz Signal Generator, deviation set to 2.5 kHz



Date: 4.JAN.2007 11:30:07

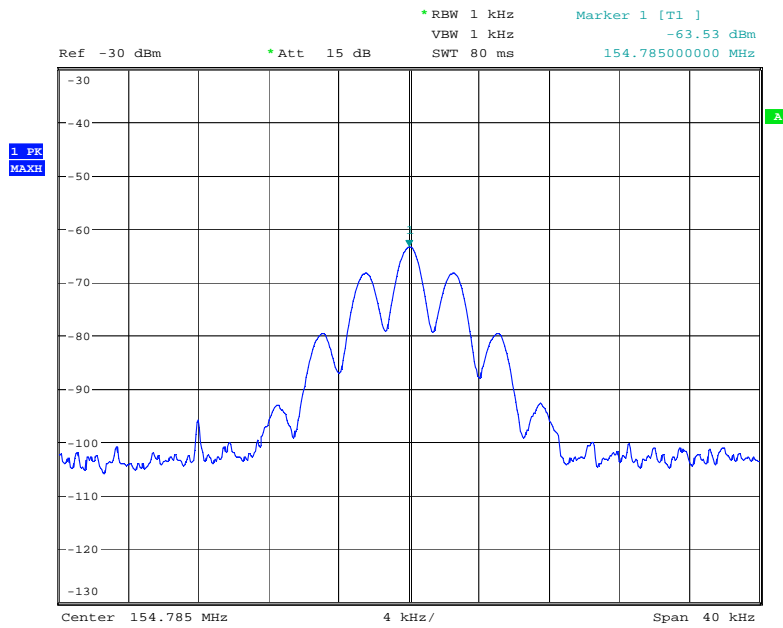
### 154.755 MHz Signal Generator and EUT, deviation set to 2.5 kHz



Date: 3.JAN.2007 14:37:25

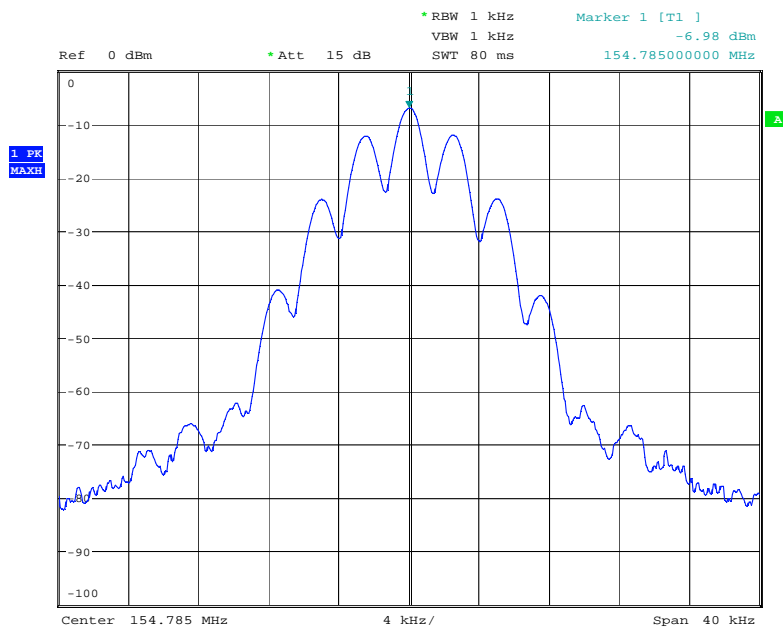
The above plots depicting the output wavseshape show no measurable distortion visible when compared to the input signal.

### 154.785 MHz Signal Generator, deviation set to 2.5 kHz



Date: 4.JAN.2007 11:30:40

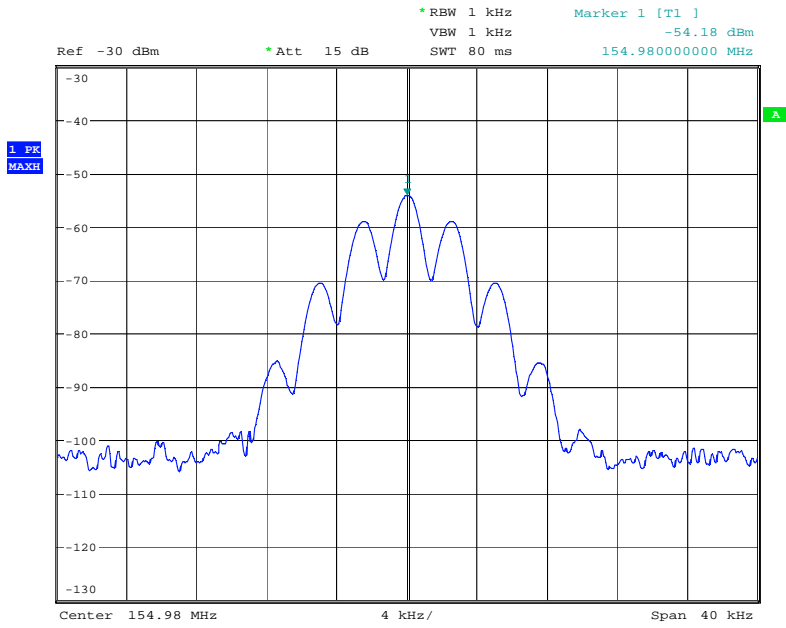
### 154.785 MHz Signal Generator and EUT, deviation set to 2.5 kHz



Date: 3.JAN.2007 14:23:16

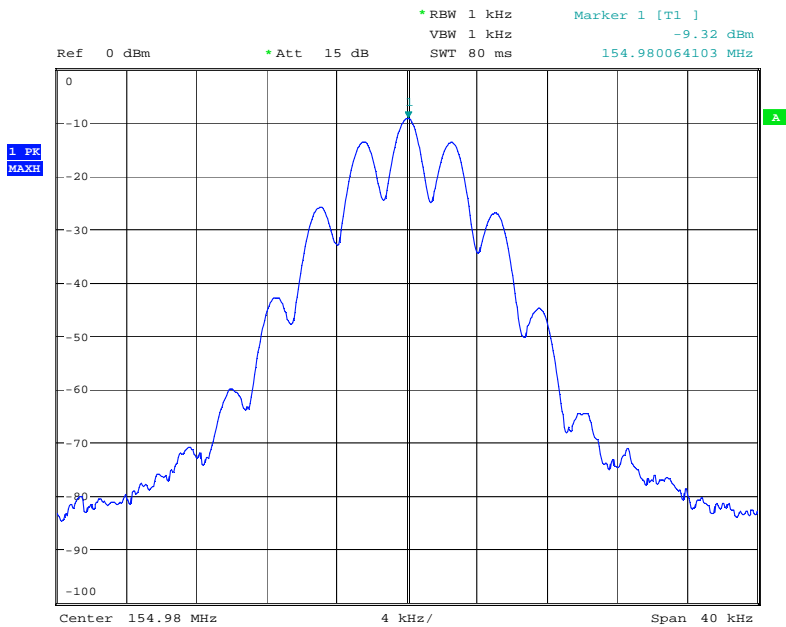
The above plots depicting the output wavelshape show no measurable distortion visible when compared to the input signal.

154.980 MHz Signal Generator, deviation set to 2.5 kHz



Date: 4.JAN.2007 11:31:00

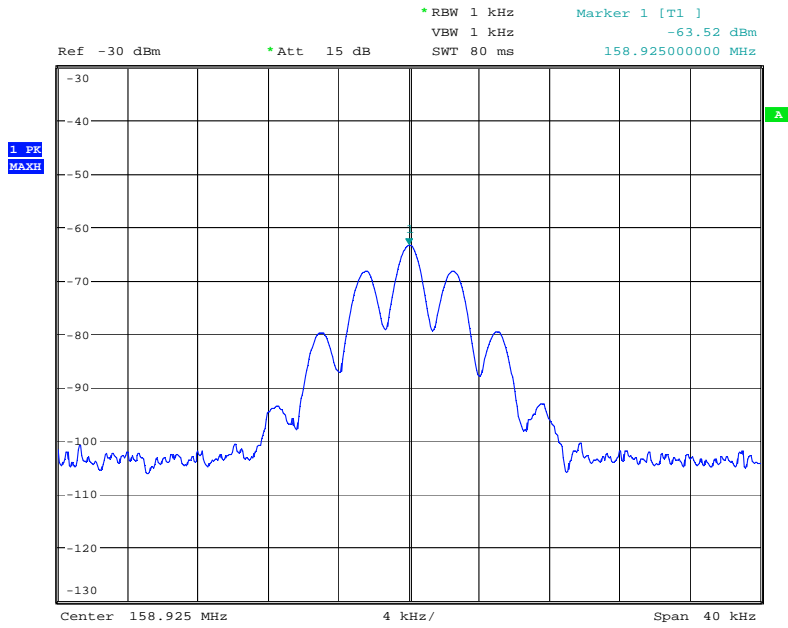
154.980 MHz Signal Generator and EUT, deviation set to 2.5 kHz



Date: 3.JAN.2007 14:22:12

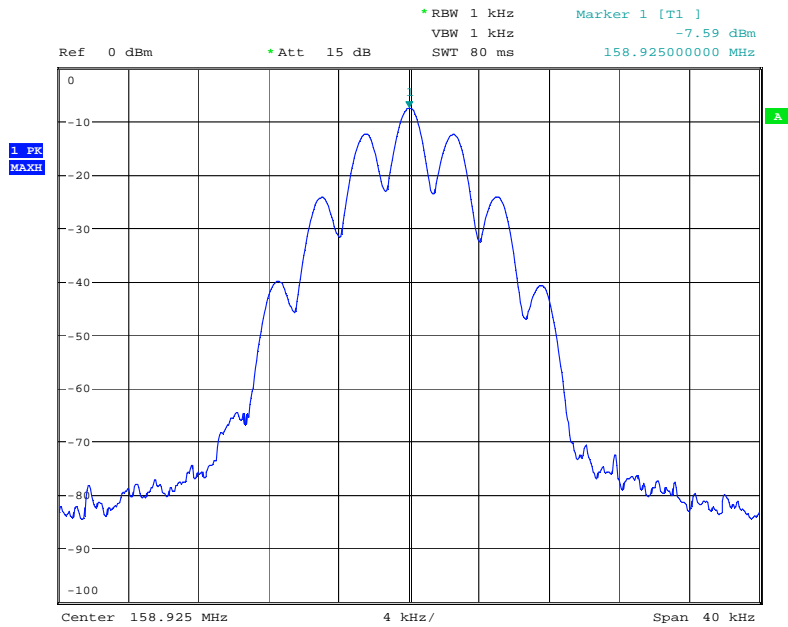
The above plots depicting the output waweshape show no measurable distortion visible when compared to the input signal.

158.925 MHz Signal Generator, deviation set to 2.5 kHz



Date: 4.JAN.2007 11:31:24

158.925 MHz Signal Generator and EUT, deviation set to 2.5 kHz



Date: 3.JAN.2007 14:23:45

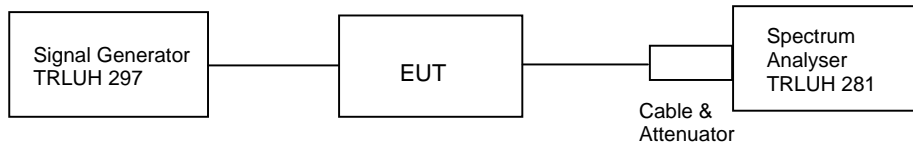
The above plots depicting the output wavelshape show no measurable distortion visible when compared to the input signal.

**TRANSMITTER TESTS**

**AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053 – DOWNLINK**

Ambient temperature = 22°C  
 Relative humidity = 46%  
 Supply voltage = +110Vac

Radio Laboratory Test Signal = F3E



The test was set up as per the diagram. The input signal was set to the maximum input level required for the selected channel. The unit was tested operating at maximum power and on each operating frequency.

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

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

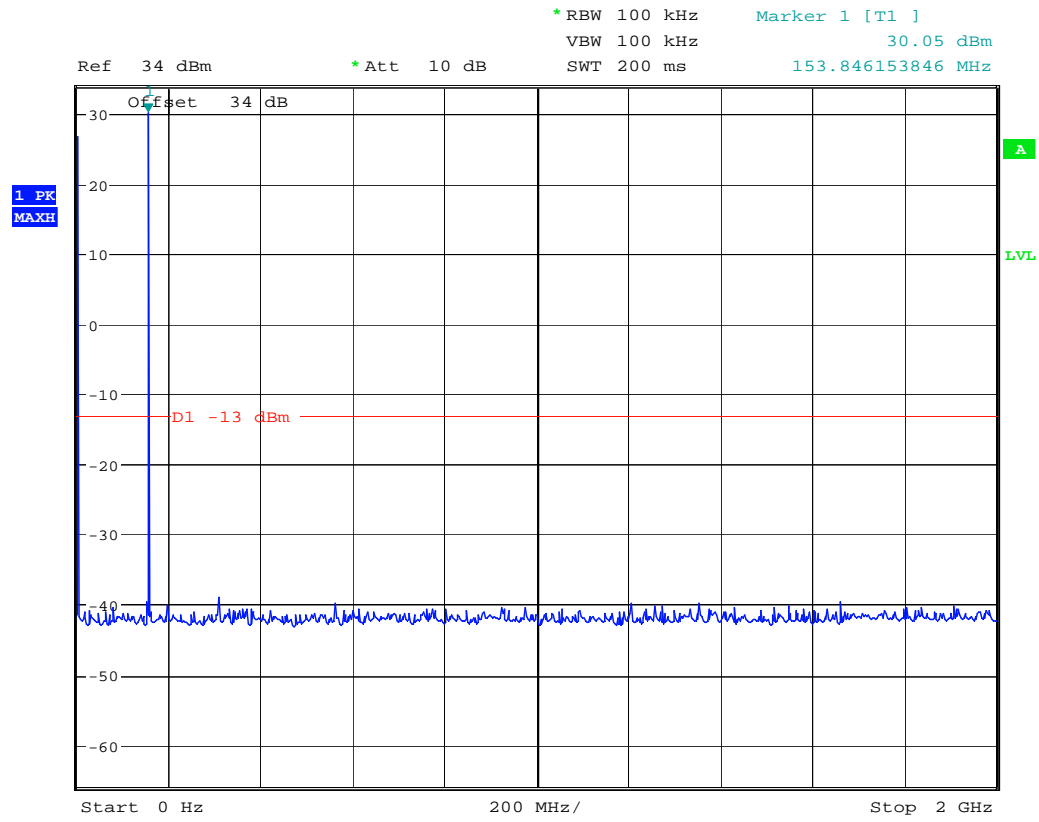
**RESULTS**

FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	ATTENUATOR & CABLE LOSSES (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
0 Hz – 5 GHz	No Significant Emissions Within 20 dB of the Limit				-13

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	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>

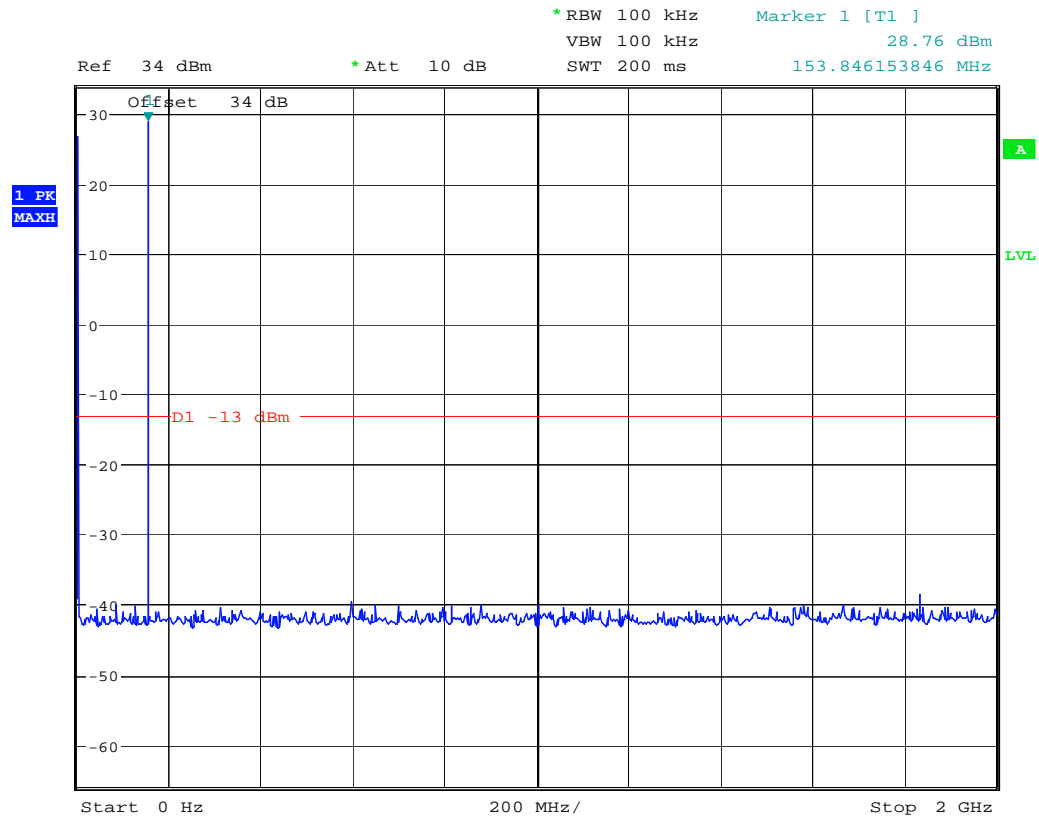
# Conducted emissions 153.965 MHz 0 – 2GHz



Date: 19.DEC.2006 15:32:25

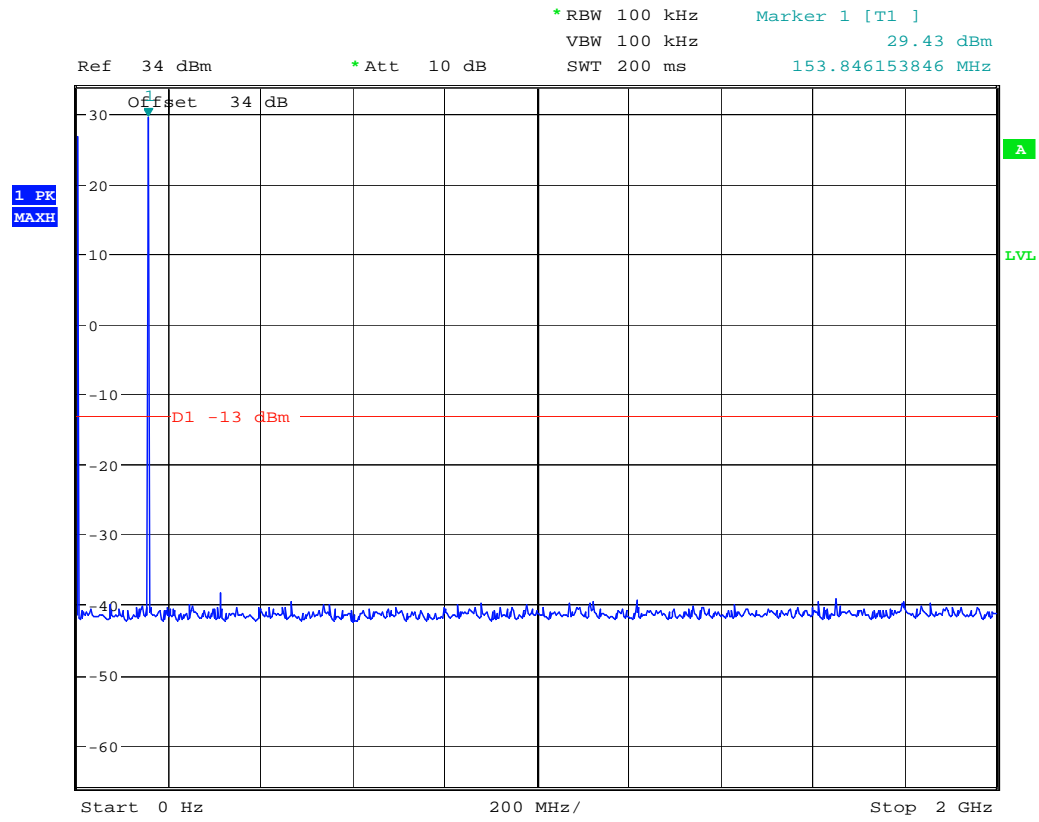


# Conducted emissions 154.755 MHz 0 – 2GHz



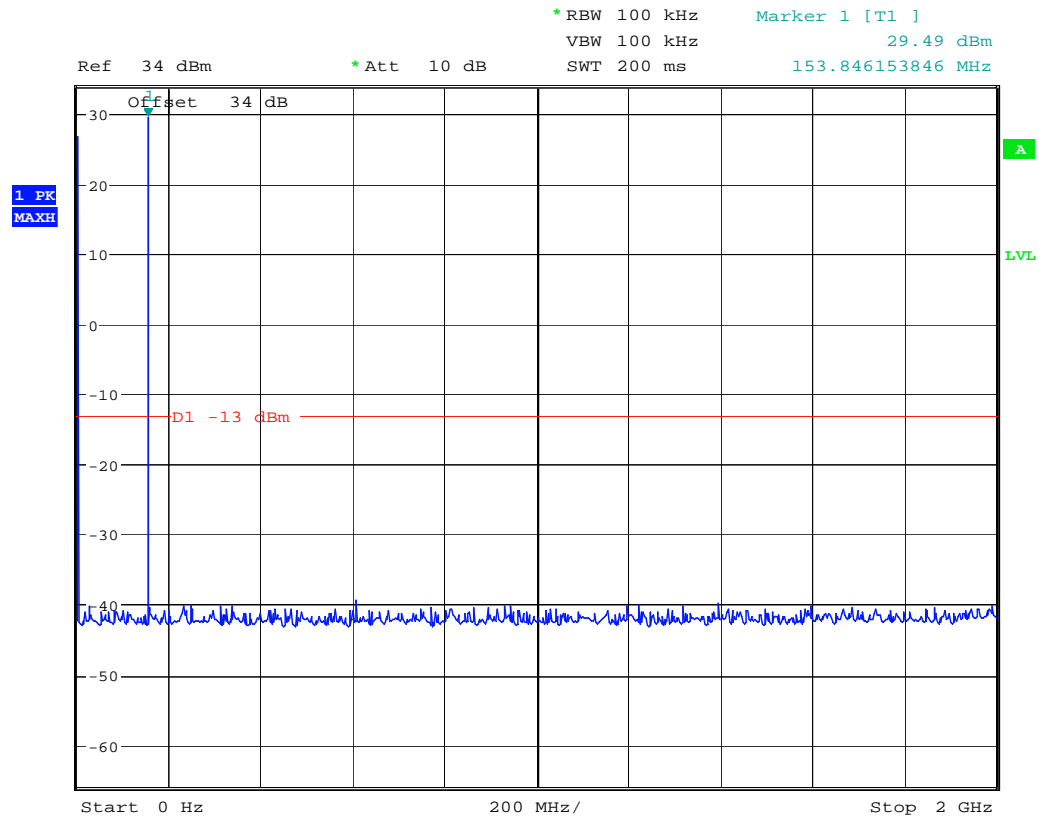
Date: 19.DEC.2006 15:31:17

# Conducted emissions 154.785 MHz 0 – 2GHz



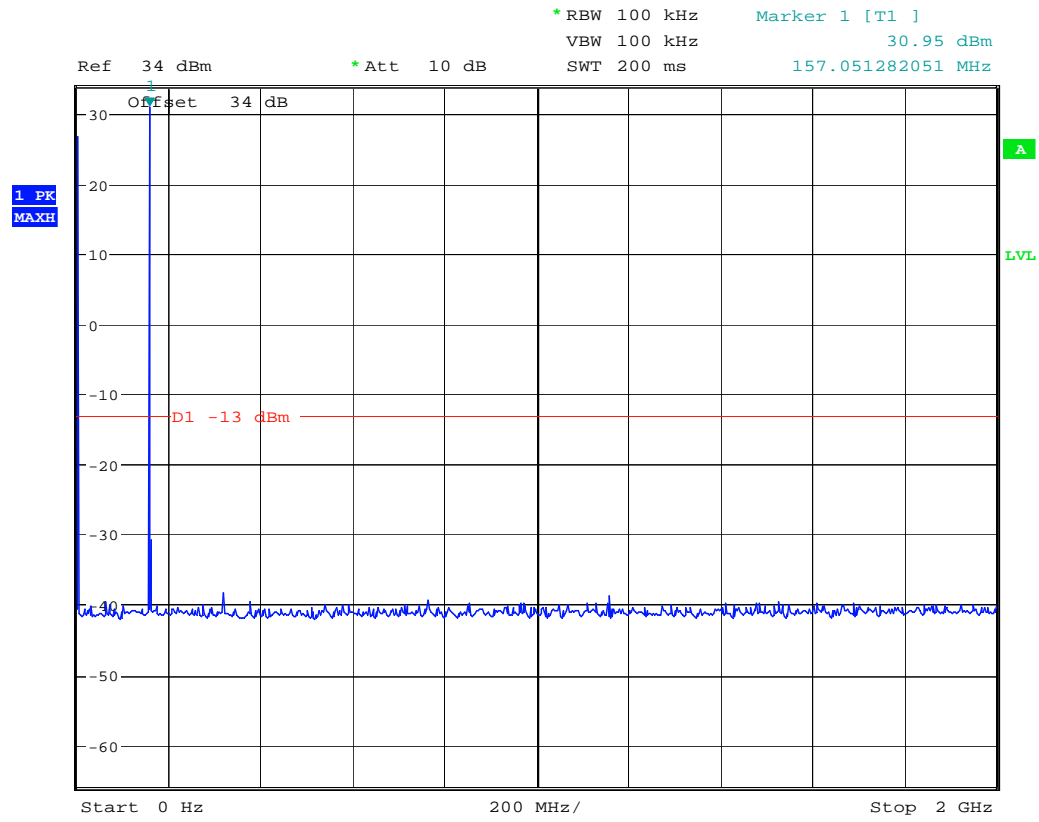
Date: 19.DEC.2006 15:30:09

# Conducted emissions 154.980 MHz 0 – 2GHz



Date: 19.DEC.2006 15:28:31

# Conducted emissions 158.925 MHz 0 – 2GHz



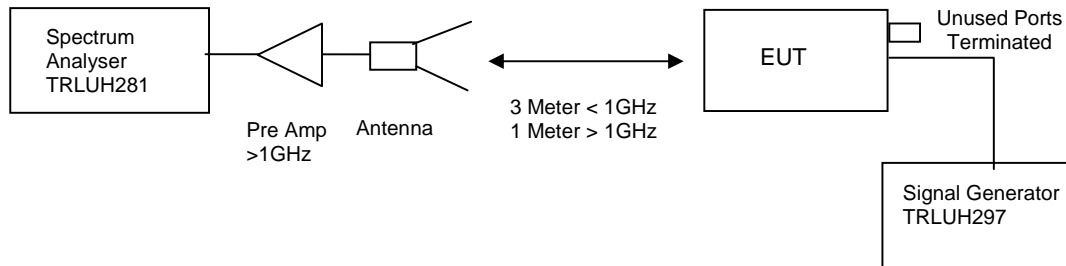
Date: 19.DEC.2006 15:27:17

## TRANSMITTER TESTS

### AMPLIFIER SPURIOUS EMISSIONS – RADIATED – Part 2.1053– DOWNLINK

Ambient temperature = 15°C  
 Relative humidity = 44%  
 Conditions = OATS  
 Supply voltage = +110Vac

Test Signal = F3E



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 each operating frequency with a 50 ohm load on 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  $43 + 10 \log P_{dB}$

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

## RESULTS

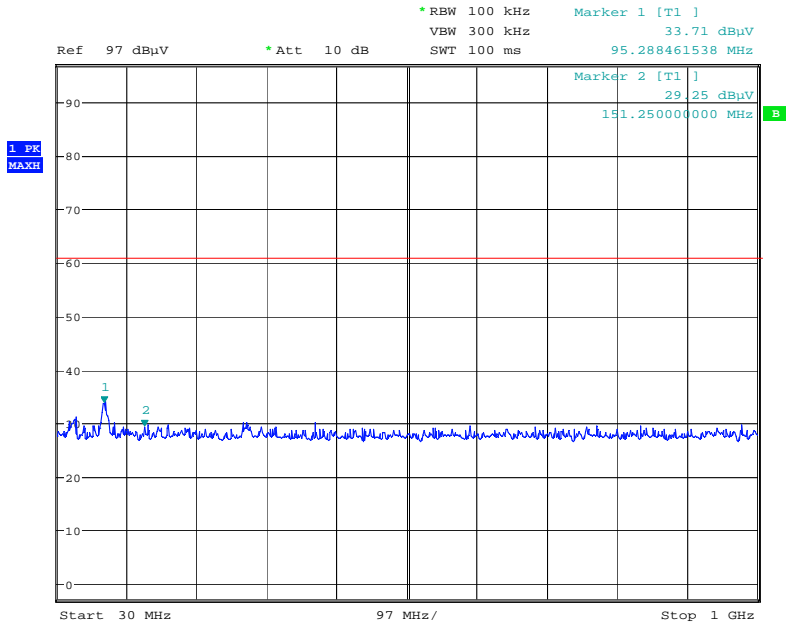
FREQUENCY RANGE	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	CALCULATED EIRP (dBm)	LIMIT (dBm)
30MHz – 1GHz	95.288	35.00	1.1	9.3	45.40	-51.98	-13
1GHz – 5GHz	No Significant Emissions Within 20dB of the Limit						-13

Note: Worst case emissions for each frequency are recorded.

The test equipment used for the Transmitter Spurious Emissions:

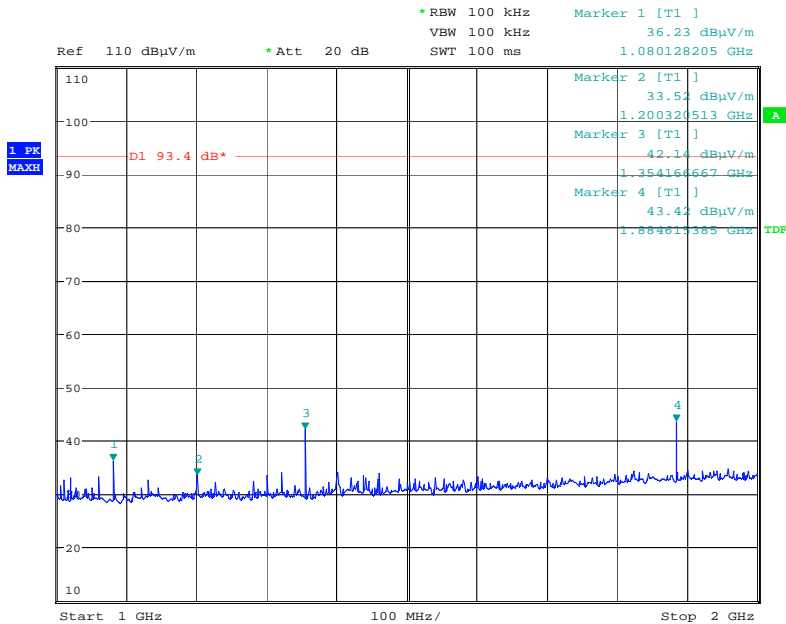
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ANTENNA	CHASE	CBL6612B	2803	UH93	<b>X</b>
ANTENNA	EMCO	3115	9010-3580	138	<b>X</b>
PRE AMPLIFIER	HP	8449B	3008A016	572	<b>X</b>

Radiated emissions 153.965 MHz 30MHz – 1GHz



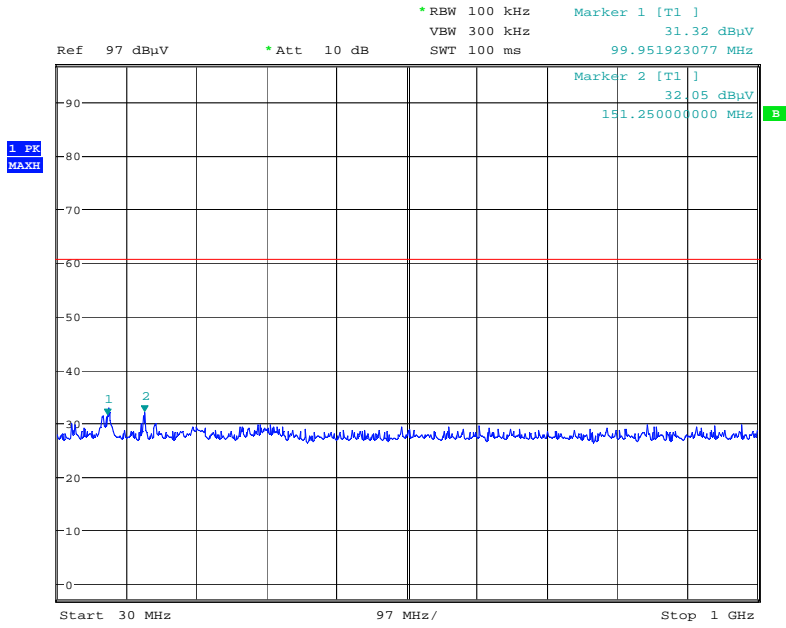
Date: 22.DEC.2006 11:04:11

Radiated emissions 153.965 MHz 1 – 2GHz



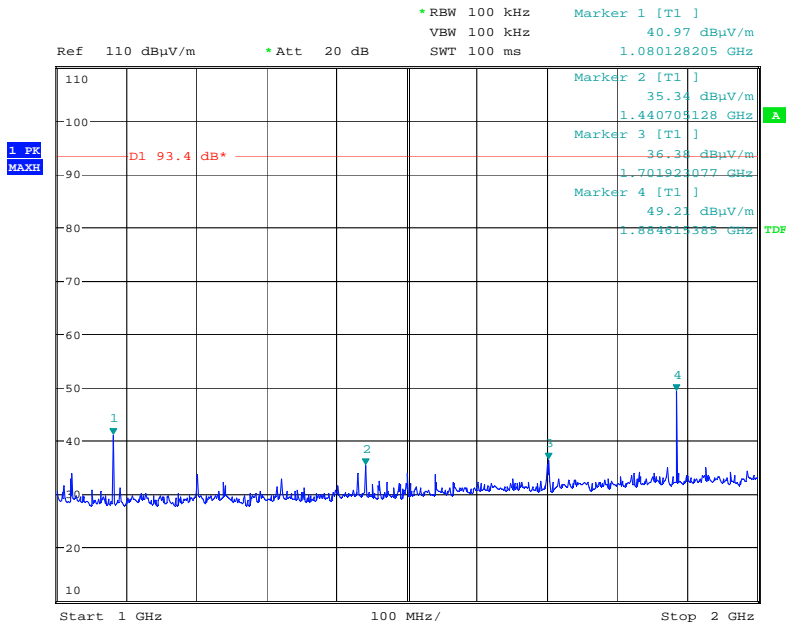
Date: 21.DEC.2006 11:05:47

Radiated emissions 154.755 MHz 30MHz – 1GHz



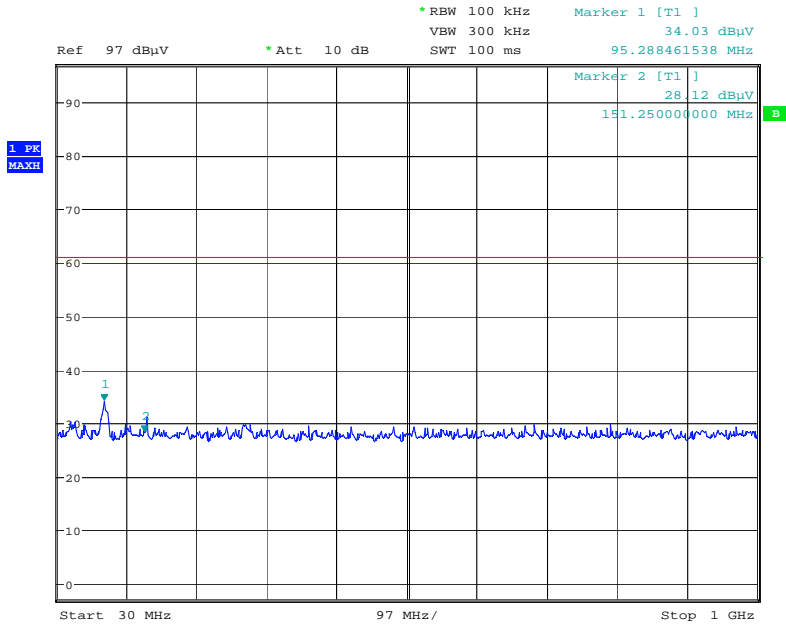
Date: 22.DEC.2006 11:06:16

Radiated emissions 154.755 MHz 1 – 2GHz



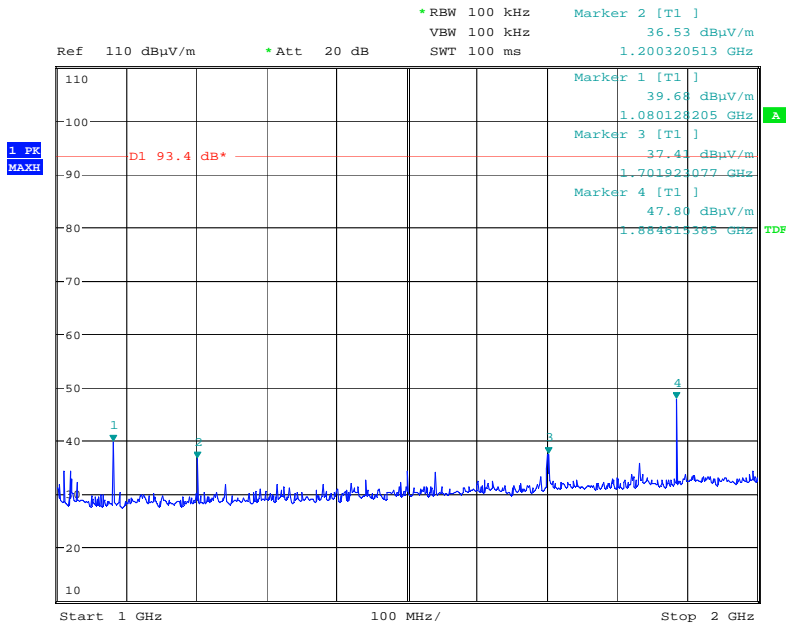
Date: 21.DEC.2006 10:46:14

Radiated emissions 154.785 MHz 30MHz – 1GHz



Date: 22.DEC.2006 11:07:41

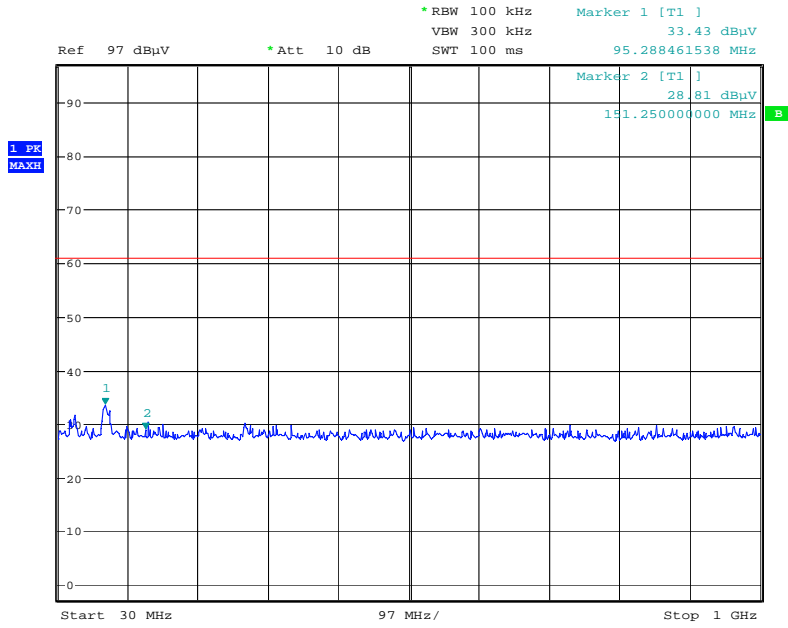
Radiated emissions 154.785 MHz 1 – 2GHz



Date: 21.DEC.2006 10:49:44

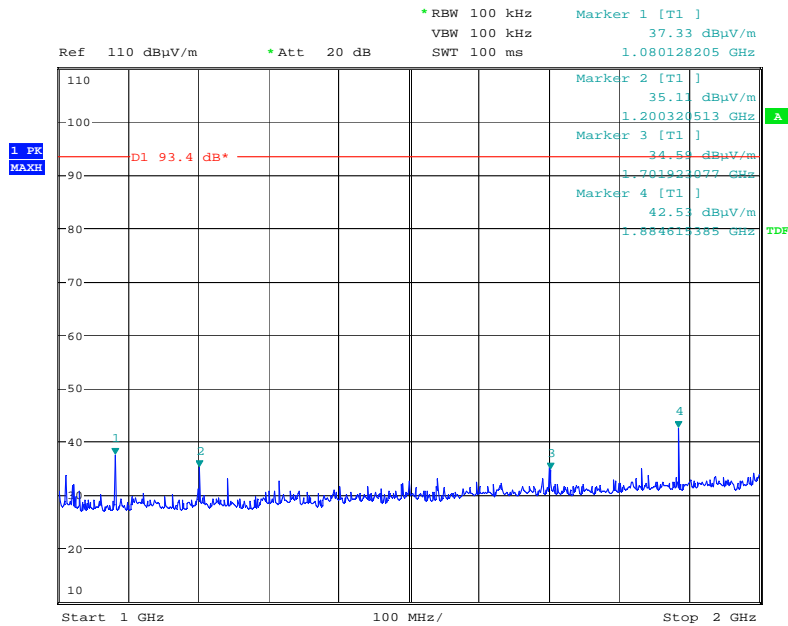


Radiated emissions 154.980 MHz 30MHz – 1GHz



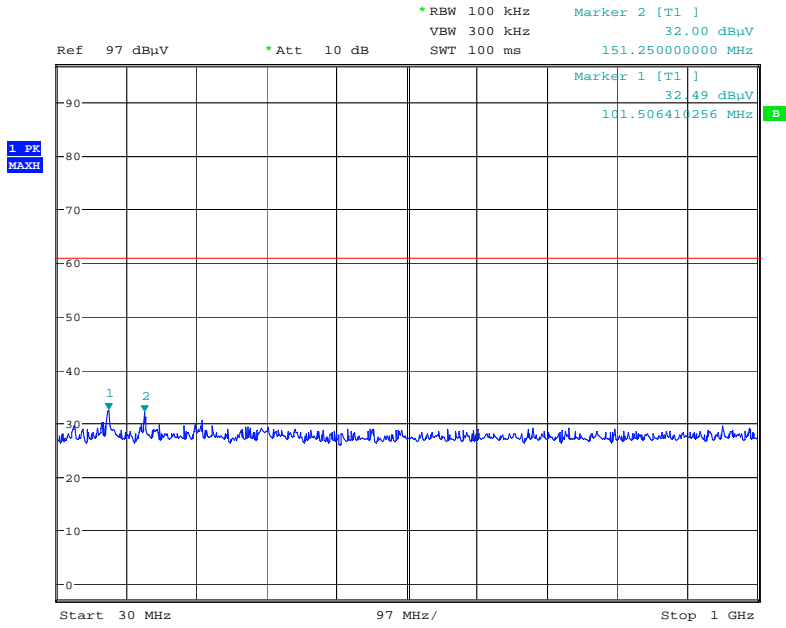
Date: 22.DEC.2006 11:10:10

Radiated emissions 154.980 MHz 1 – 2GHz



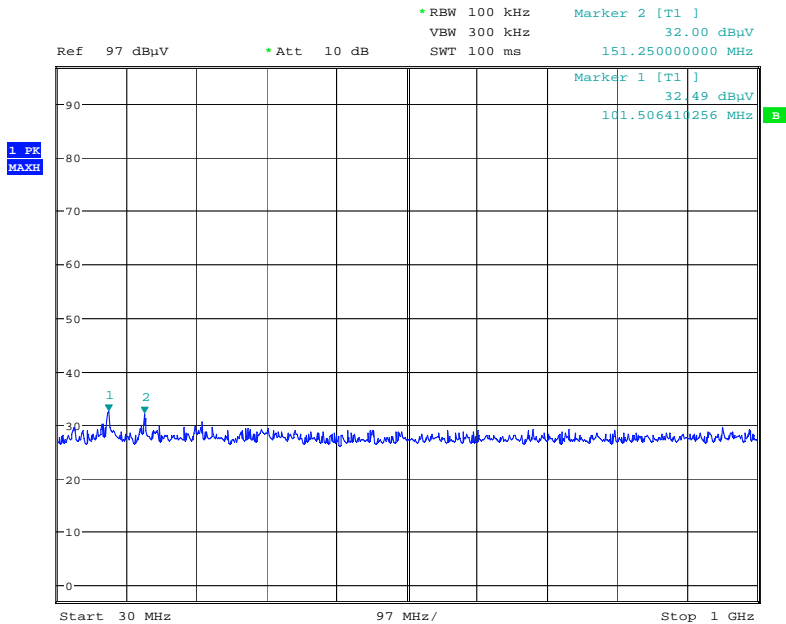
Date: 21.DEC.2006 10:52:10

### Radiated emissions 158.925 MHz 30MHz – 1GHz



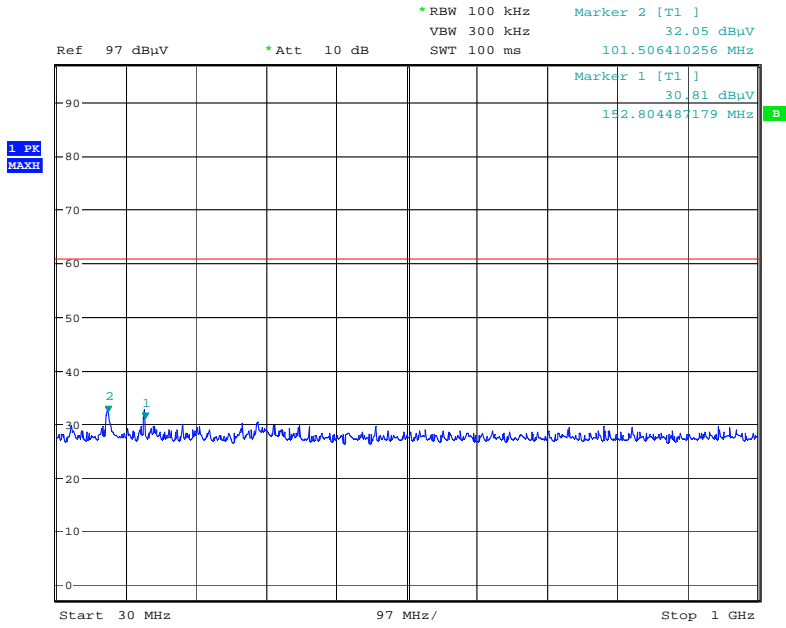
Date: 22.DEC.2006 11:11:44

### Radiated emissions 158.925 MHz 1 – 2GHz



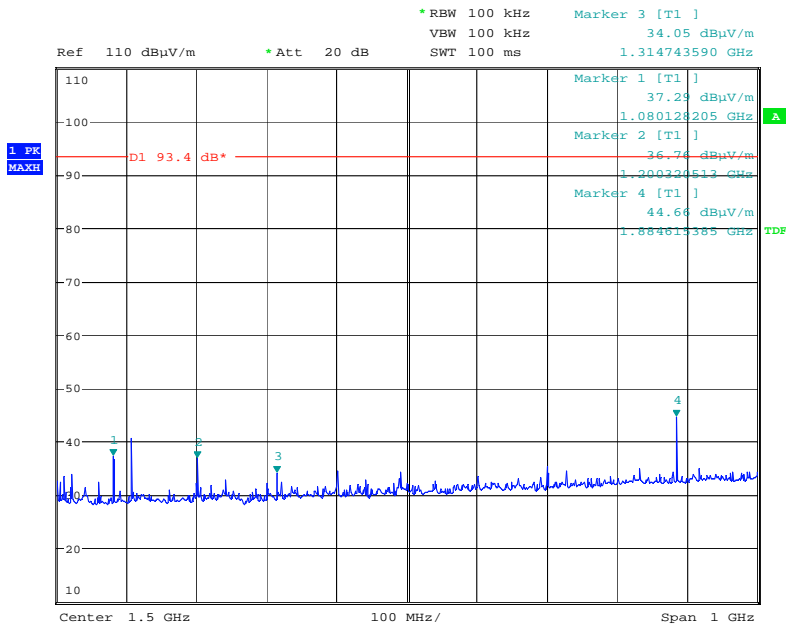
Date: 22.DEC.2006 11:11:44

Radiated emissions no input signal 30MHz – 1GHz



Date: 22.DEC.2006 10:44:32

Radiated emissions no input signal 1 – 2GHz



Date: 21.DEC.2006 11:40:21

**ANNEX A**  
**PHOTOGRAPHS**

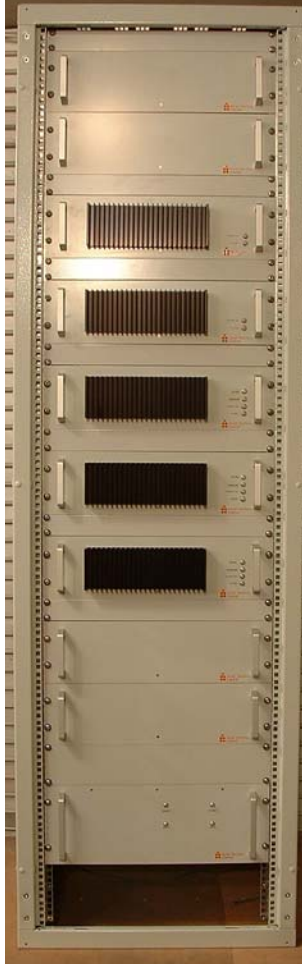
PHOTOGRAPH No. 1

**TEST SETUP**



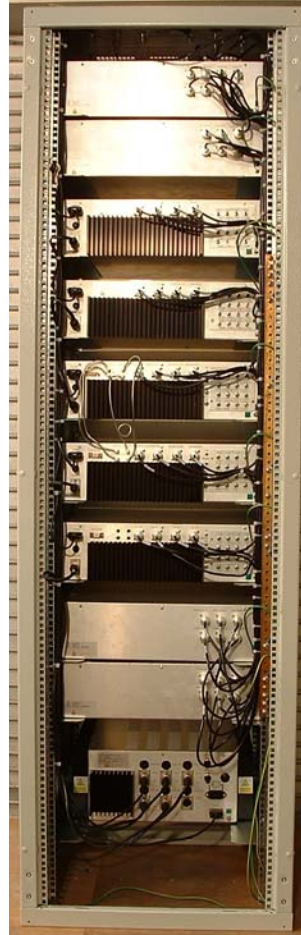
PHOTOGRAPH No. 2

**EUT FRONT OVERVIEW**



PHOTOGRAPH No. 3

**EUT REAR OVERVIEW**



**ANNEX B**  
**APPLICANT'S SUBMISSION OF DOCUMENTATION LIST**



### APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	TCB	-	APPLICATION	[X]
		-	FEE	[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	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
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]

**ANNEX C**  
**EQUIPMENT CALIBRATION**

TRL Number	Equipment Type	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
UH006	3m Range ERP CAL	TRL	08/12/2006	12	08/12/2007
UH075	Signal Generator	Marconi	07/04/2006	12	07/04/2007
UH093	Bilog Antenna	Schaffner	19/08/2005	24	19/08/2007
UH105	Signal Generator	Marconi	07/04/2006	12	07/04/2007
UH253	1m Cable N type	TRL	23/02/2006	12	23/02/2007
UH254	1m Cable N type	TRL	05/01/2006	12	05/01/2007
UH271	1m Cable N type	TRL	23/02/2006	12	23/02/2007
UH273	1m Cable N type	TRL	23/02/2006	12	23/02/2007
UH281	Spectrum Analyser	R&S	24/07/2006	12	24/07/2007
UH297	Signal Generator	R&S	21/04/2006	12	21/04/2007
UH340	Signal Generator	HP	29/06/2005	24	26/06/2007
UH332	Attenuator	Radiall		Calibrate in use	
UH335	Attenuator	Narda		Calibrate in use	
L112	Attenuator	Bird		Calibrate in use	
L119	Combiner	Elcom		Calibrate in use	
L138	1-18GHz Horn	EMCO	15/04/2005	24	15/04/2007
L139	1-18GHz Horn	EMCO	03/05/2005	24	03/05/2007
L170	Combiner	Elcom		Calibrate in use	
L193	Bicone Antenna	Chase	12/10/2003	24	12/10/2005
L203	Log Periodic Ant	Chase	21/10/2003	24	21/10/2005
L220	Attenuator	Bird		Calibrate in use	
L246	Attenuator	Bird		Calibrate in use	
L572	Pre Amp	Agilent	03/02/2006	12	03/02/2007

**ANNEX D**  
**MEASUREMENT UNCERTAINTY**

## Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

### **[1] Adjacent Channel Power**

Uncertainty in test result = **1.86dB**

### **[2] Carrier Power**

Uncertainty in test result (Equipment - TRLUH120) = **2.18dB**

Uncertainty in test result (Equipment – TRL05) = **1.08dB**

Uncertainty in test result (Equipment – TRL479) = **2.48dB**

### **[3] Effective Radiated Power**

Uncertainty in test result = **4.71dB**

### **[4] Spurious Emissions**

Uncertainty in test result = **4.75dB**

### **[5] Maximum frequency error**

Uncertainty in test result (Equipment - TRLUH120) = **119ppm**

Uncertainty in test result (Equipment – TRL05) = **0.113ppm**

Uncertainty in test result (Equipment – TRL479) = **0.265ppm**

### **[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field**

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**, Uncertainty in test result (30MHz – 1GHz) = **4.6dB**, Uncertainty in test result (1GHz-18GHz) = **4.7dB**

### **[7] Frequency deviation**

Uncertainty in test result = **3.2%**

### **[8] Magnetic Field Emissions**

Uncertainty in test result = **2.3dB**

### **[9] Conducted Spurious**

Uncertainty in test result (Equipment TRL479) Up to 8.1GHz = **3.31dB**

Uncertainty in test result (Equipment TRL479) 8.1GHz – 15.3GHz = **4.43dB**

Uncertainty in test result (Equipment TRL479) 15.3GHz – 21GHz = **5.34dB**

Uncertainty in test result (Equipment TRLUH120) Up to 26GHz = **3.14dB**

### **[10] Channel Bandwidth**

Uncertainty in test result = **15.5%**

### **[11] Amplitude and Time Measurement – Oscilloscope**

Uncertainty in overall test level = **2.1dB**, Uncertainty in time measurement = **0.59%**, Uncertainty in Amplitude measurement = **0.82%**

### **[11] Power Line Conduction**

Uncertainty in test result = **3.4dB**

**[12] Spectrum Mask Measurements**

Uncertainty in test result = **2.59%** (frequency)  
Uncertainty in test result = **1.32dB** (amplitude)

**[13] Adjacent Sub Band Selectivity**

Uncertainty in test result = **1.24dB**

**[14] Receiver Blocking – Listen Mode, Radiated**

Uncertainty in test result = **3.42dB**

**[15] Receiver Blocking – Talk Mode, Radiated**

Uncertainty in test result = **3.36dB**

**[16] Receiver Blocking – Talk Mode, Conducted**

Uncertainty in test result = **1.24dB**

**[17] Receiver Threshold**

Uncertainty in test result = **3.23dB**

**[18] Transmission Time Measurement**

Uncertainty in test result = **7.98%**

**ANNEX E**  
**SYSTEM DIAGRAM**

