



TEST REPORT NO: RU1296/7399  
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FCC ID: NEO50-1467SERIES

**REPORT ON THE CERTIFICATION TESTING OF A  
AERIAL FACILITIES LIMITED  
50-146701 800MHz 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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<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:	NEO50-1467SERIES
PURPOSE OF TEST:	Certification
TEST SPECIFICATION:	FCC RULES CFR 47, Part 90 Subpart I
TEST RESULT:	Compliant to Specification
EQUIPMENT UNDER TEST:	50-146701 800MHz Channelised Air interface
EQUIPMENT TYPE:	Private Land Mobile Repeater
MAXIMUM GAIN:	Uplink = 83.38 dB Downlink = 88.43 dB
MAXIMUM INPUT:	Uplink = -58.42 dBm Downlink = -52.42 dBm
MAXIMUM OUTPUT CONDUCTED:	Uplink = 24.96 dBm Downlink = 36.01 dBm
ANTENNA TYPE:	Uplink Yagi Downlink Distributed Antenna System
ANTENNA GAINLOSS:	Uplink = 10 dBi Downlink = N/A, Leaky Feed Antenna
MAXIMUM OUTPUT RADIATED:	Uplink = 34.96 dBm
NUMBER OF CHANNELS:	Uplink = N/A Wideband Downlink = N/A Wideband
CHANNEL SPACING:	Wideband
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



### 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 [ ]	Class B [X]
Downlink	Class A [ ]	Class B [X]
  - 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	[ ]
Two channel	[ ]
Multi-channel	[X]
  - 8. Channel spacing:
 

Narrowband	[ ]
Wideband	[X]
  - 9. Test Location:
 

TRL Compliance Limited	
Up Holland	[X]
Long Green	[ ]
  - 10. Modifications made during test program: No modifications were performed.

**System description:**

The 50-146701 is a bi-directional amplifier. The uplink is wideband and operates over two frequency ranges, 811.0 MHz – 816.0 MHz and 821.0 MHz – 824.0 MHz. The downlink is wideband and operates over two frequency ranges, 856 .0MHz – 861.0 MHz and 866.0 MHz – 869.0 MHz.

## 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
811.0	-56.5	0.42	42.5	-17.27	82.15	25.23	72.63
813.5	-58.0	0.42	42.5	-17.54	83.38	24.96	74.10
816.0	-57.5	0.42	42.5	-17.56	82.86	24.94	73.37
821.0	-56.0	0.42	42.5	-16.95	81.97	25.55	73.04
822.5	-57.5	0.42	42.5	-17.12	83.30	25.38	74.10
824.0	-56.0	0.42	42.5	-17.64	81.28	24.86	72.05

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
811.0	82.15	25.43	10	35.43
813.5	83.38	24.96	10	34.96
816.0	82.86	24.94	10	34.94
821.0	81.97	25.55	10	35.55
822.5	83.30	25.38	10	35.38
824.0	81.28	24.86	10	34.86

Notes: 1. The Antenna is a yagi with 10 dBi Gain.

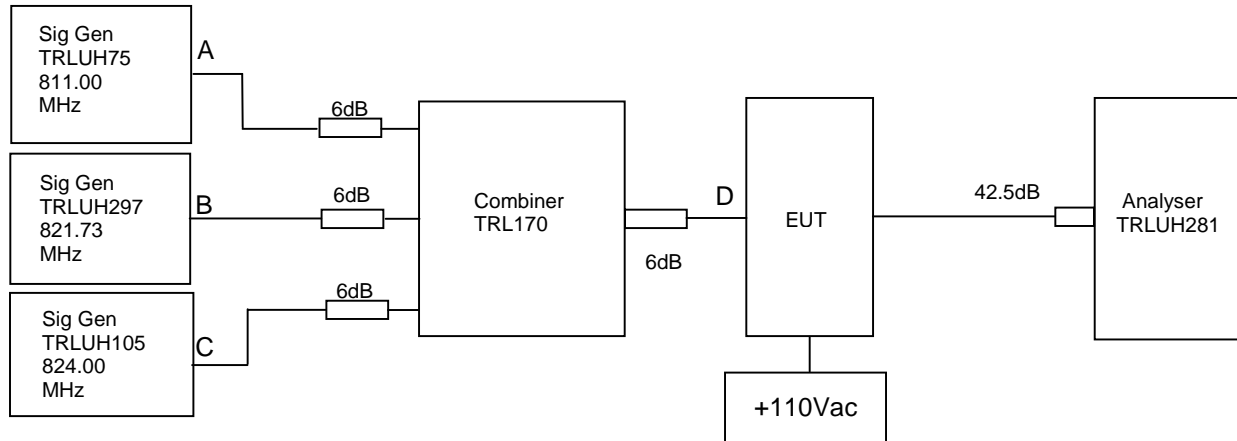
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ATTENUATOR	BIRD	8304-300-N	N/A	220	X
ATTENUATOR	BIRD	8304-0600N	N/A	246	X
ATTENUATOR	BIRD	8308-100	N/A	112	X

## TRANSMITTER TESTS

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

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 42.5dB. The signal generators were set to the input frequencies listed below.

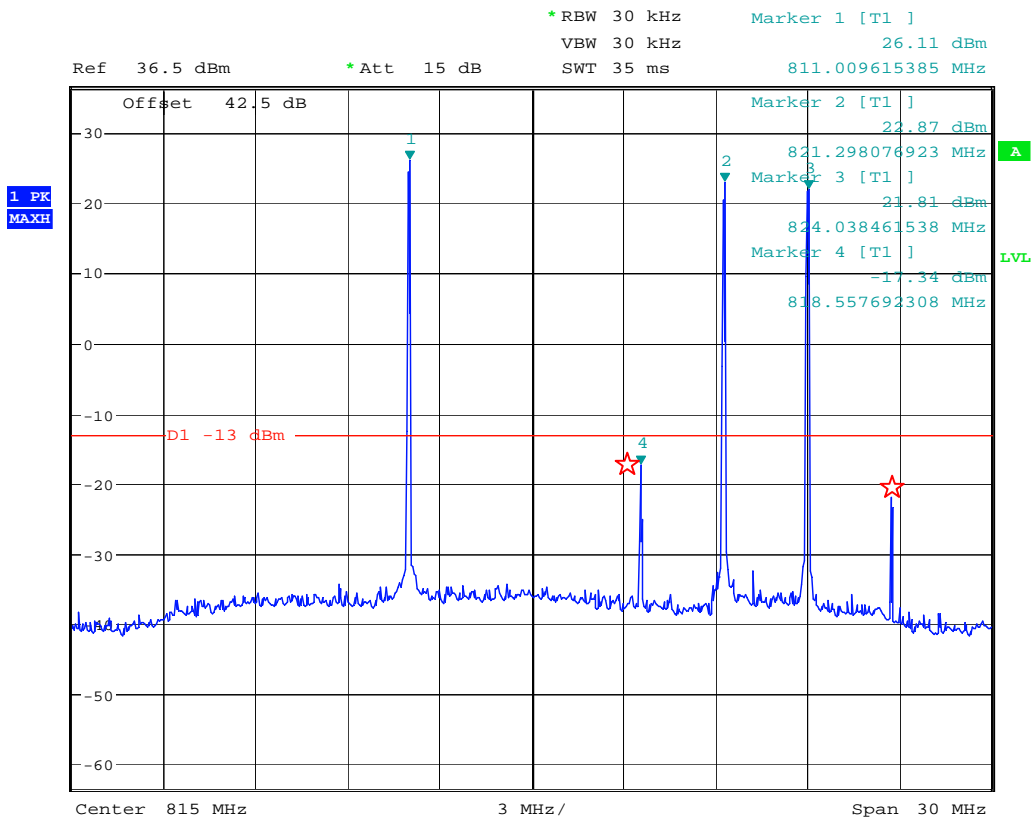
RF Input Frequency (MHz)			Highest Intermodulation Product Level & Frequency (dBm) & (MHz)	Limit (dBm)
811.00	821.73	824.00	-17.34 dBm @ 818.55769 MHz	-13

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	2022D	119215/058	UH75	X
SIGNAL GENERATOR	MARCONI	2023	112224/040	UH105	X
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
COMBINER	ELCOM	RC-4-50	N/A	170	X

### Intermodulation Inband

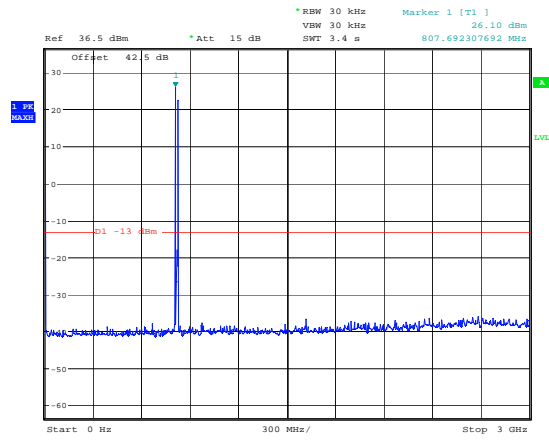


Date: 3.JAN.2007 17:03:27

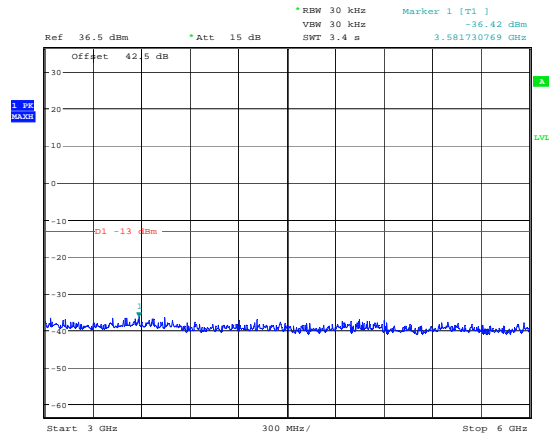
The above plot shows that all products (designated by ☆) are below the spurious limit.



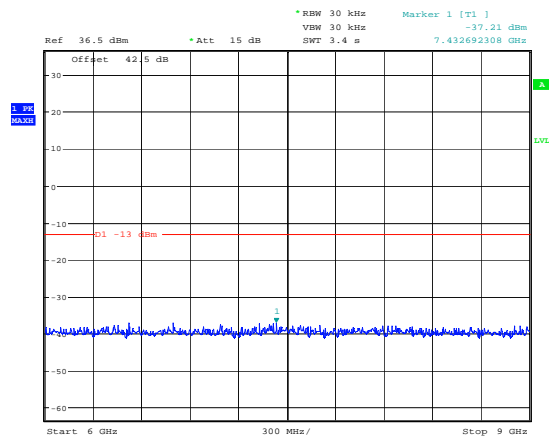
## Intermodulation Wideband



Date: 3.JAN.2007 17:04:41



Date: 3.JAN.2007 17:05:14



Date: 3.JAN.2007 17:05:40

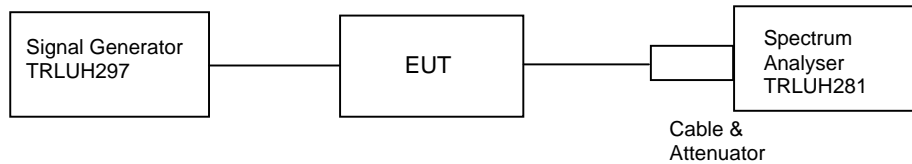
The above plot shows that there are no products outside the bands over the spurious limit.

## TRANSMITTER TESTS

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

Ambient temperature = 16°C  
 Relative humidity = 65%  
 Supply voltage = +110Vac  
 Channel number = See test results

Radio Laboratory



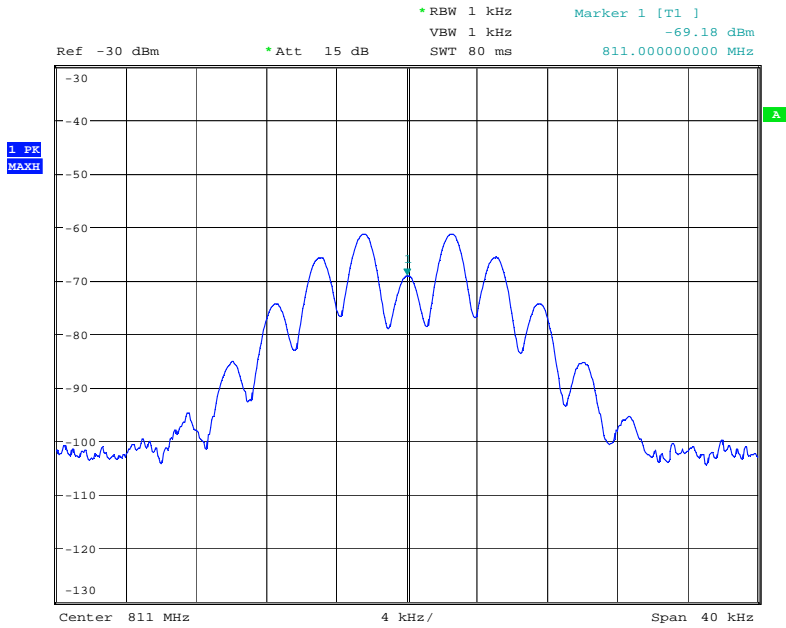
This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level required for the selected channel and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at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

Note: The cables and attenuators had the following losses.

1. Cable and attenuators between EUT and spectrum analyser 42.5dB
2. Cable between signal generator and EUT 0.42dB

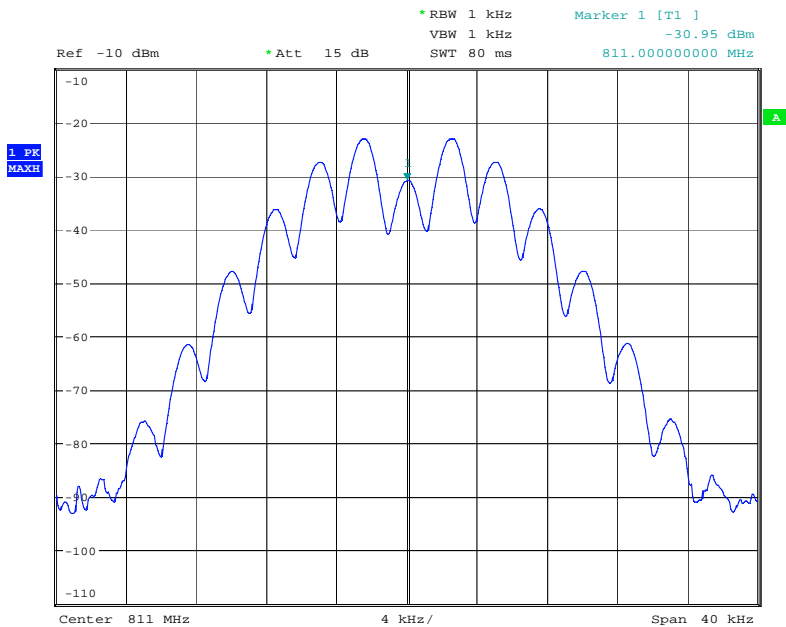
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>
ATTENUATOR	BIRD	8308-100	N/A	112	<b>X</b>

### 811.0 MHz Signal Generator, deviation set to 5 kHz



Date: 4.JAN.2007 11:21:08

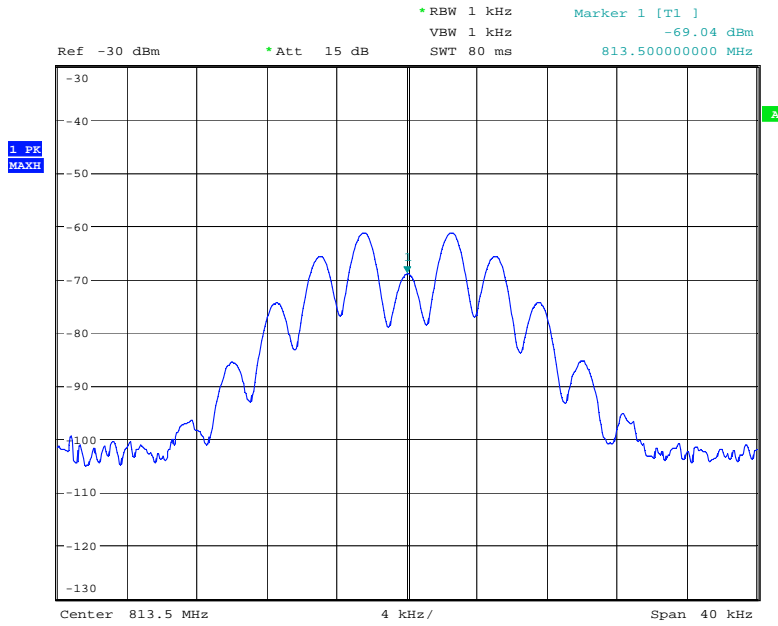
### 811.0 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 4.JAN.2007 11:13:19

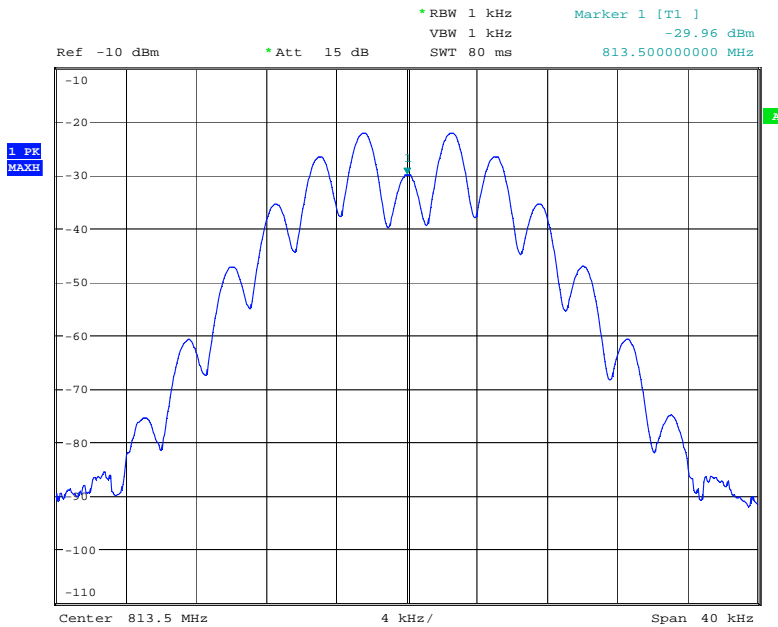
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

813.5 MHz Signal Generator, deviation set to 5kHz



Date: 4.JAN.2007 11:20:52

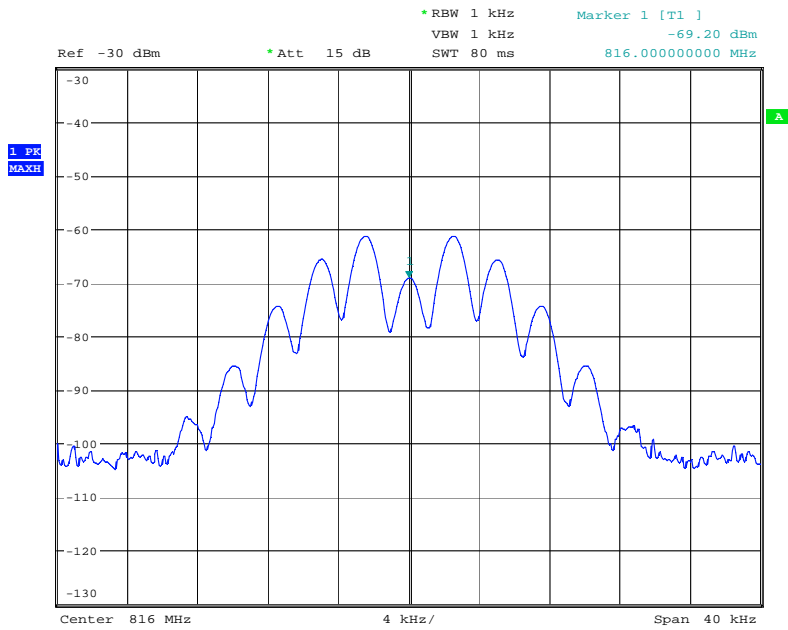
813.5 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 4.JAN.2007 11:13:40

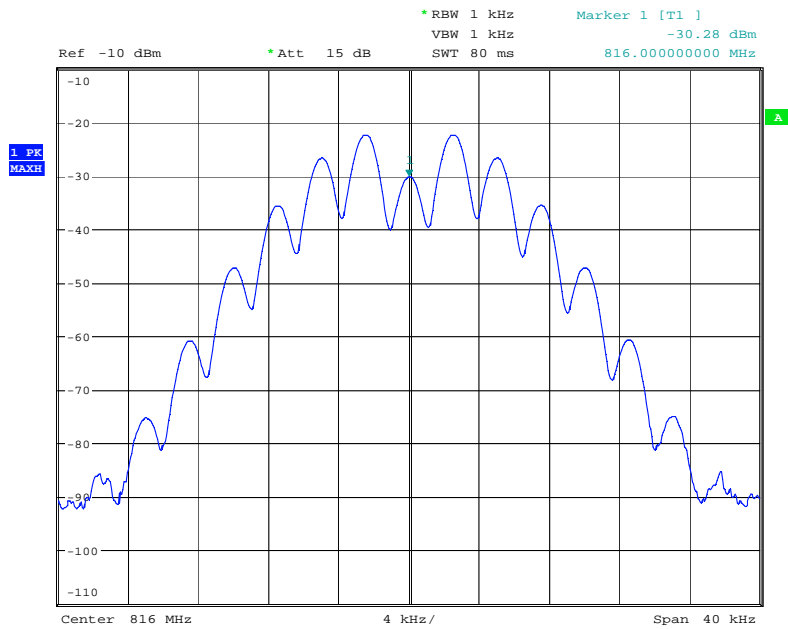
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 816.0 MHz Signal Generator, deviation set to 5kHz



Date: 4.JAN.2007 11:20:15

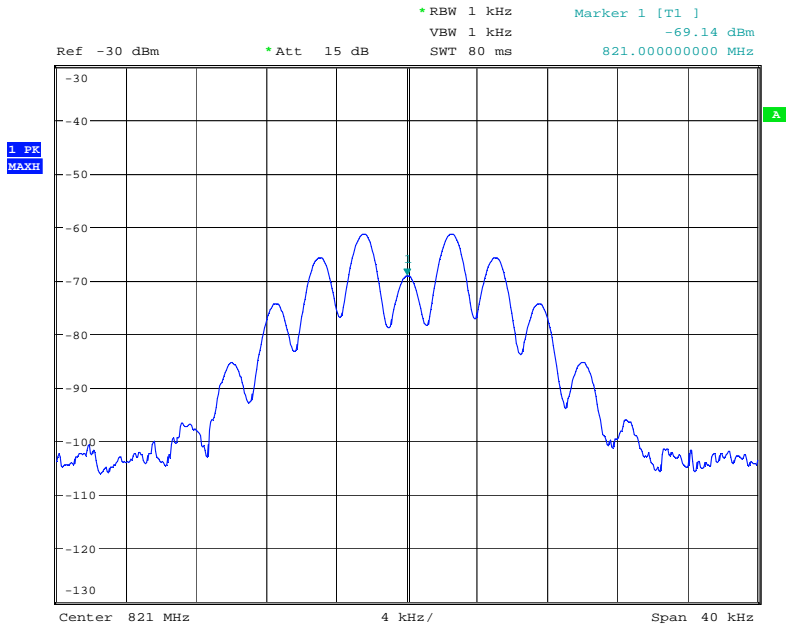
### 816.0 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 4.JAN.2007 11:14:26

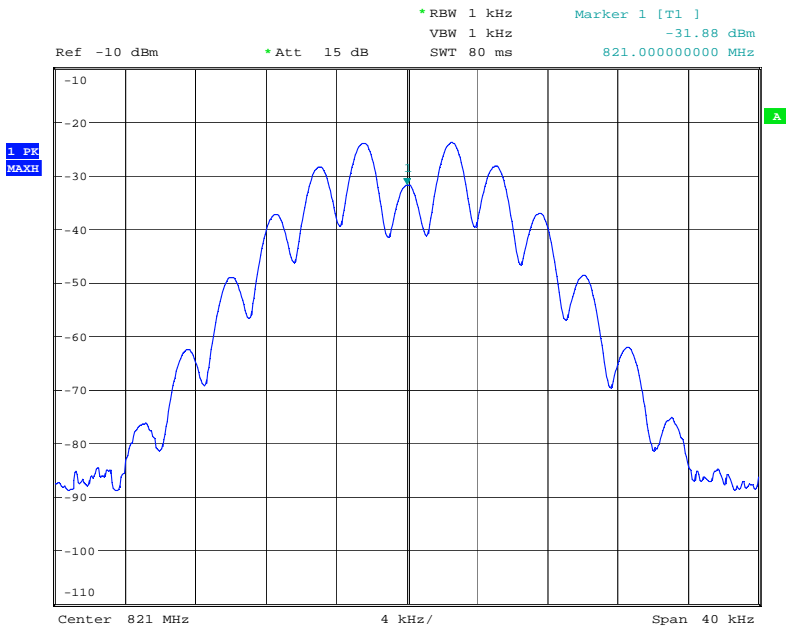
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 821.0 MHz Signal Generator, deviation set to 5kHz



Date: 4.JAN.2007 11:20:01

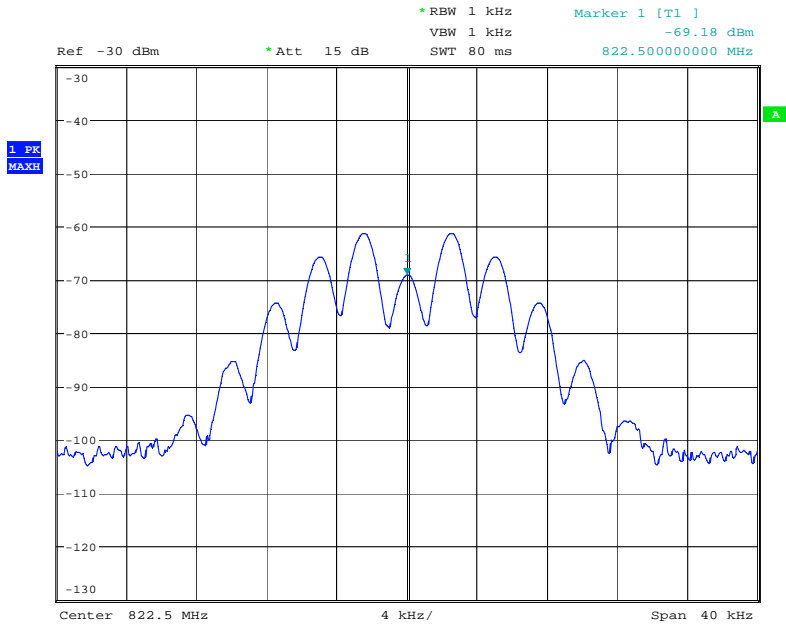
### 821.0 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 4.JAN.2007 11:14:47

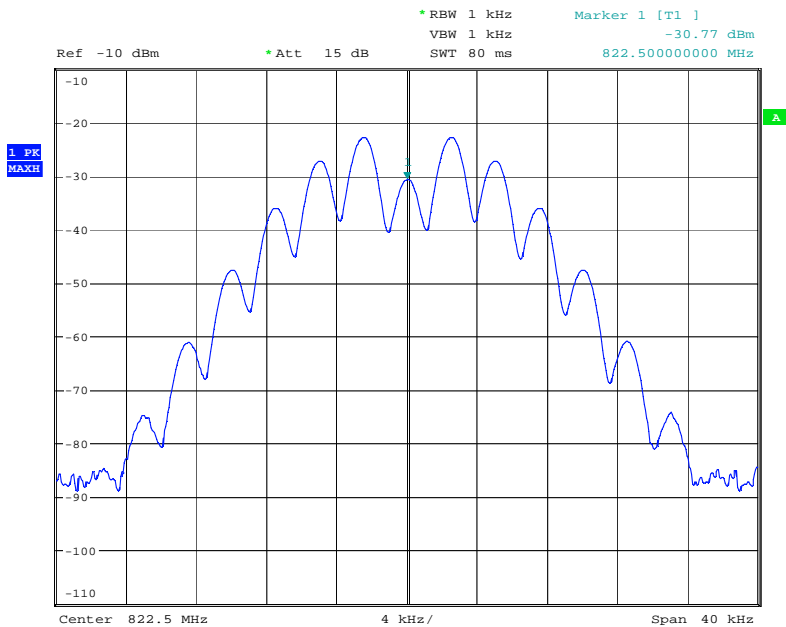
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 822.5 MHz Signal Generator, deviation set to 5kHz



Date: 4.JAN.2007 11:19:20

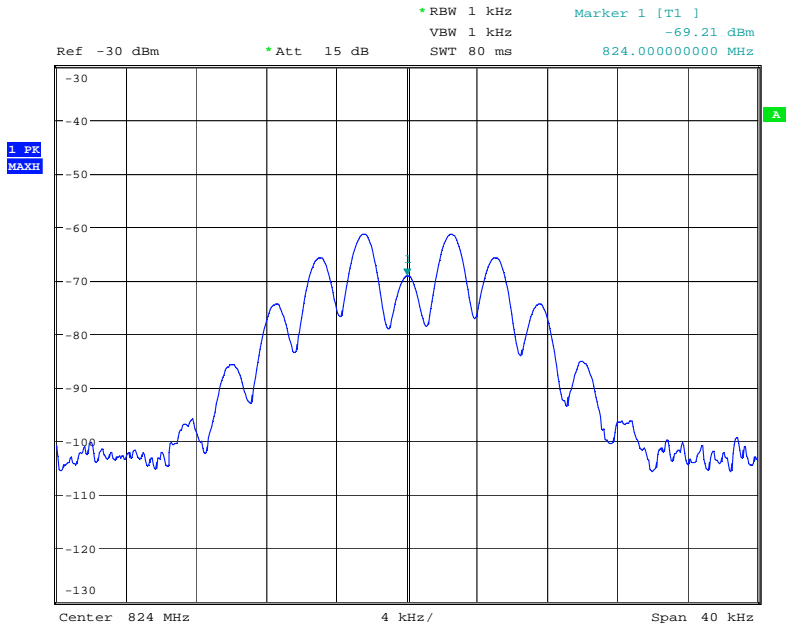
### 822.5 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 4.JAN.2007 11:15:36

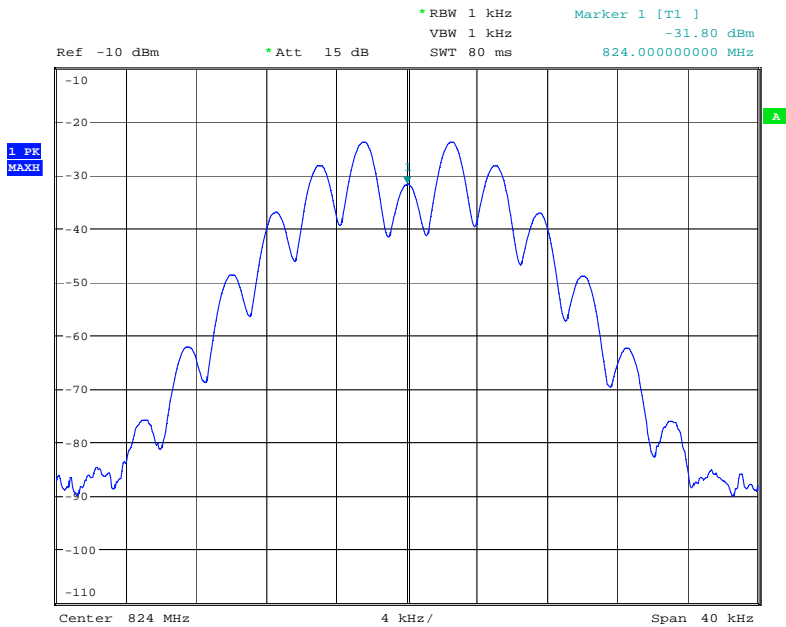
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 824.0 MHz Signal Generator, deviation set to 5kHz



Date: 4.JAN.2007 11:18:56

### 824.0 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 4.JAN.2007 11:15:52

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

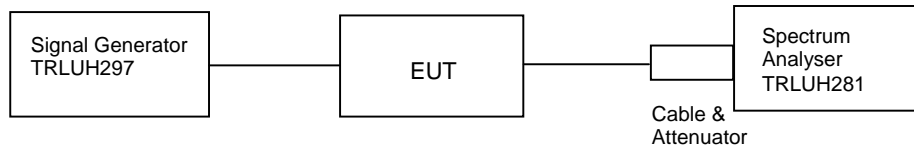


## TRANSMITTER TESTS

### 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 that 250% of the authorised bandwidth

At least 43 + 10 log PdB

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

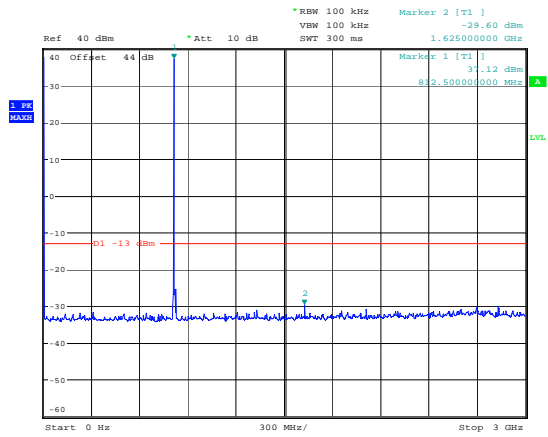
## RESULTS

FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	ATTENUATOR & CABLE LOSSES (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
0 Hz – 9 GHz	1622.006	-74.83	42.98	-31.85	-13
	1626.990	-72.98	42.98	-30.00	-13
	1632.006	-73.34	42.98	-30.36	-13
	1641.980	-73.00	42.98	-30.02	-13
	1645.019	-73.37	42.98	-30.39	-13
	1648.000	-72.92	42.98	-29.94	-13

The test equipment used for the Transmitter Conducted Emissions:

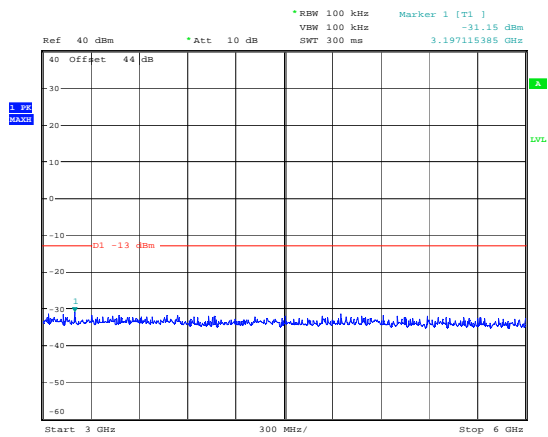
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>
ATTENUATOR	BIRD	8308-100	N/A	112	<b>X</b>
CABLE	TRL	N/A	N/A	UH273	<b>X</b>

Conducted emissions 811.0 MHz 0 – 3GHz



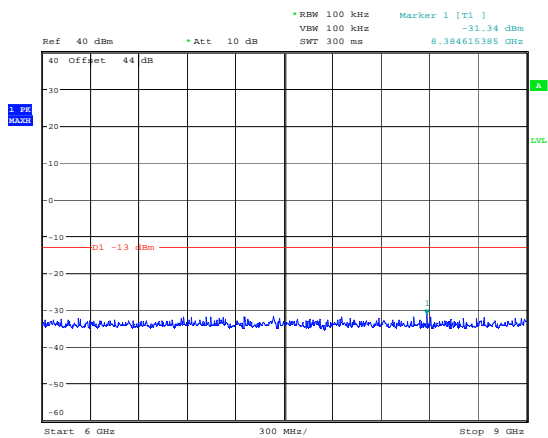
Date: 20.DEC.2006 14:36:52

Conducted emissions 811.0 MHz 3 – 6GHz



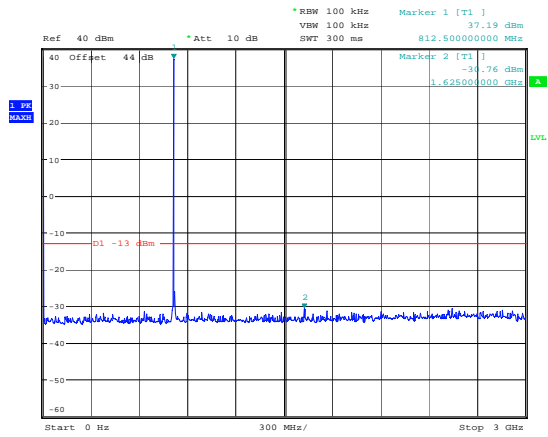
Date: 20.DEC.2006 14:37:09

Conducted emissions 811.0 MHz 6 – 9GHz



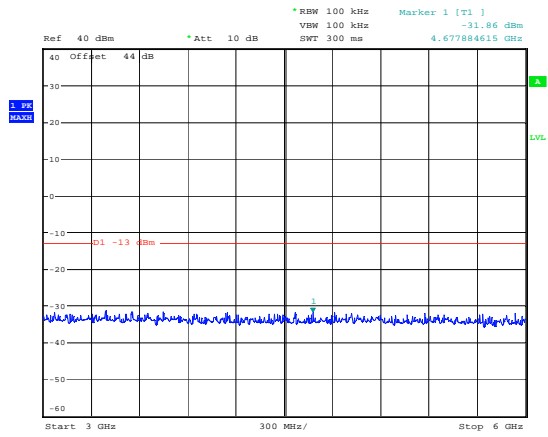
Date: 20.DEC.2006 14:37:29

Conducted emissions 813.5 MHz 0 – 3GHz



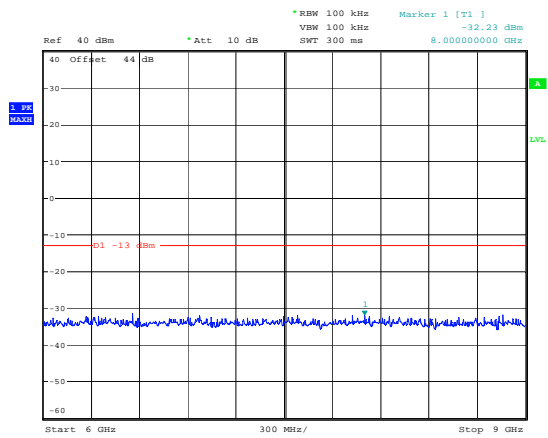
Date: 20.DEC.2006 14:39:45

Conducted emissions 813.5 MHz 3 – 6GHz



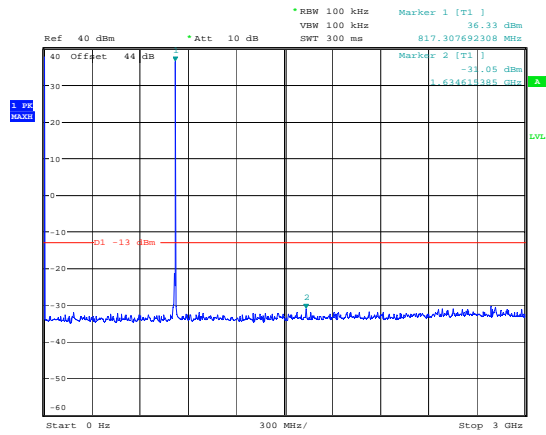
Date: 20.DEC.2006 14:40:01

Conducted emissions 813.5 MHz 6 – 9GHz



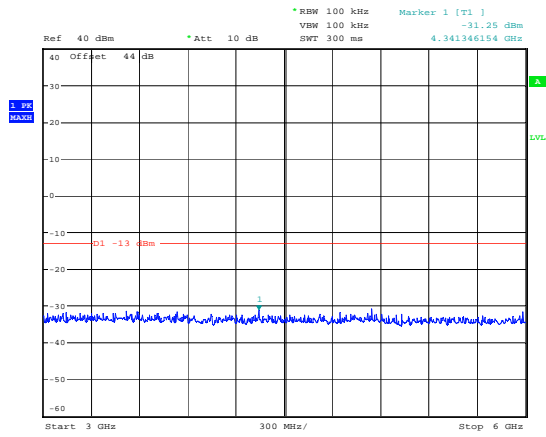
Date: 20.DEC.2006 14:40:15

Conducted emissions 816.0 MHz 0 – 3GHz



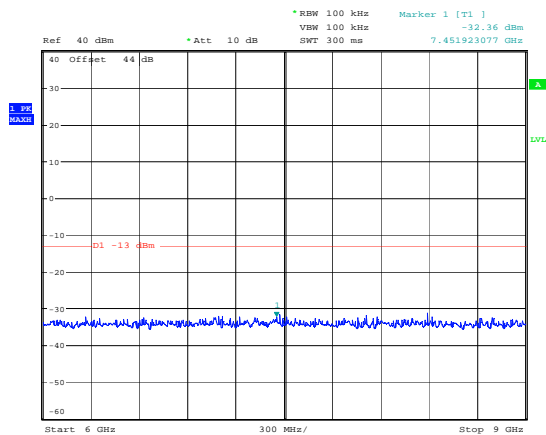
Date: 20.DEC.2006 14:42:35

Conducted emissions 816.0 MHz 3 – 6GHz



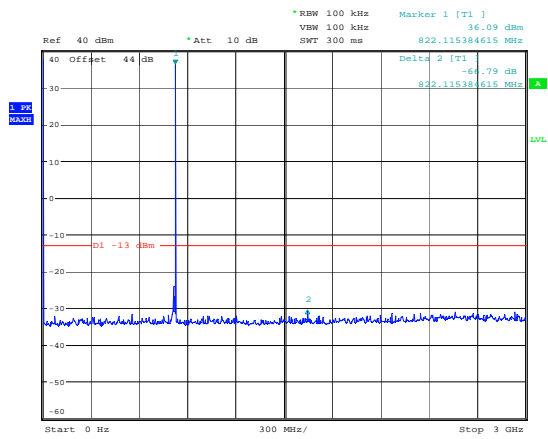
Date: 20.DEC.2006 14:42:55

Conducted emissions 816.0 MHz 6 – 9GHz



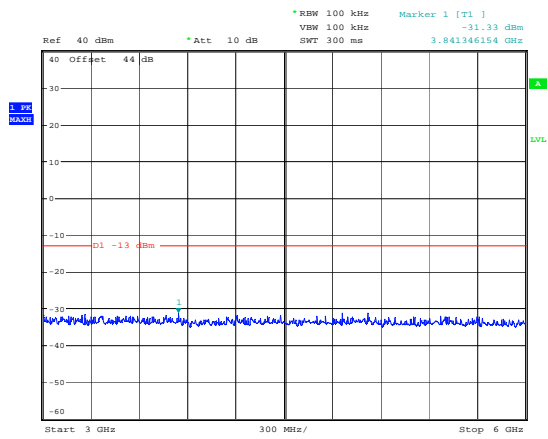
Date: 20.DEC.2006 14:43:11

Conducted emissions 821.0 MHz 0 – 3GHz



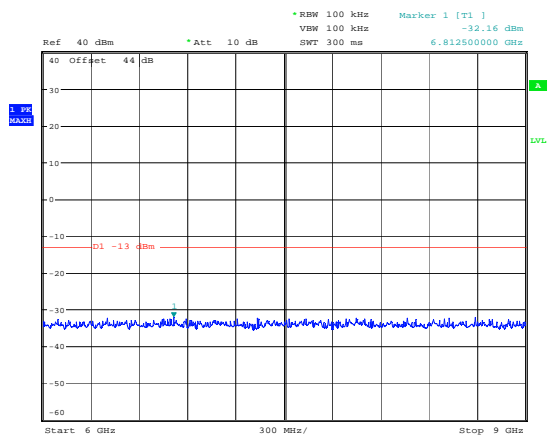
Date: 20.DEC.2006 14:46:12

Conducted emissions 821.0 MHz 3 – 6GHz



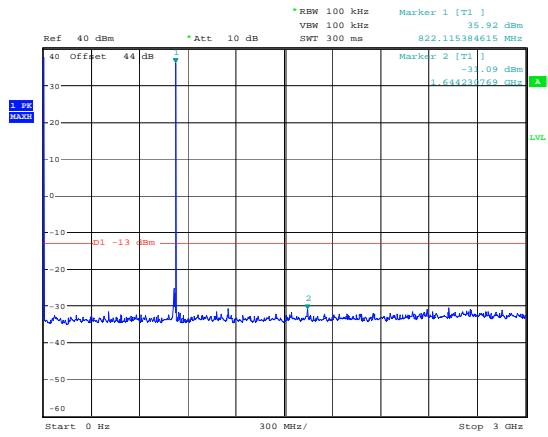
Date: 20.DEC.2006 14:46:46

Conducted emissions 821.0 MHz 6 – 9GHz



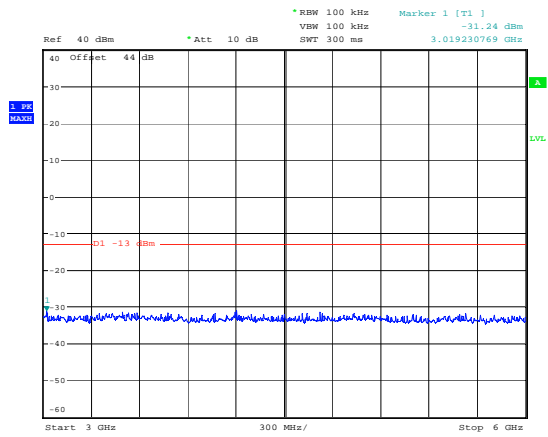
Date: 20.DEC.2006 14:47:13

Conducted emissions 822.5 MHz 0 – 3GHz



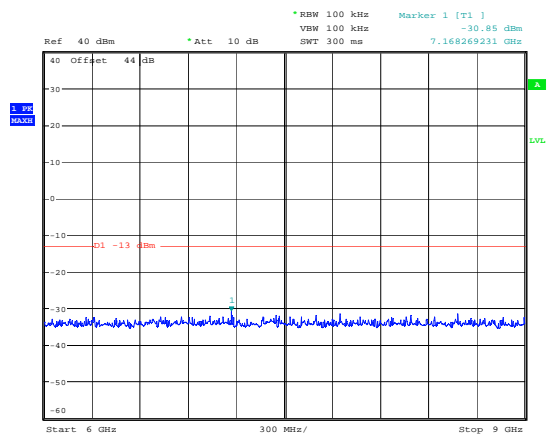
Date: 20.DEC.2006 14:48:34

Conducted emissions 822.5 MHz 3 – 6GHz



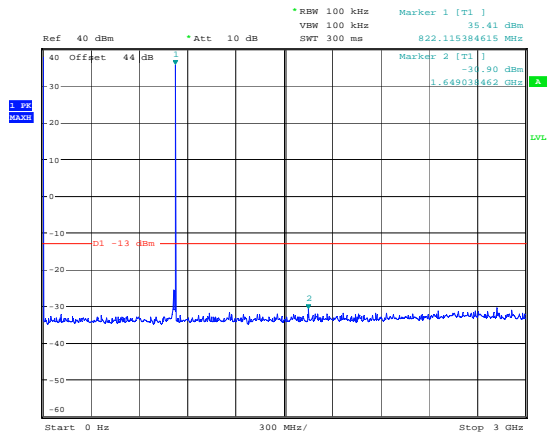
Date: 20.DEC.2006 14:49:06

Conducted emissions 822.5 MHz 6 – 9GHz



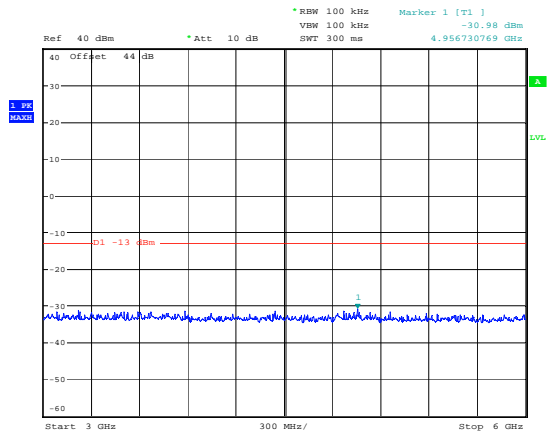
Date: 20.DEC.2006 14:49:37

Conducted emissions 824.0 MHz 0 – 3GHz



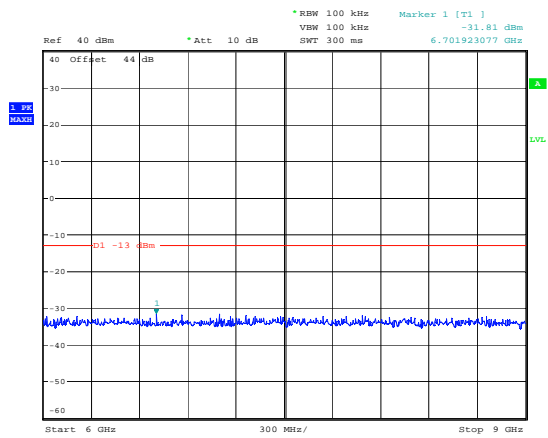
Date: 20.DEC.2006 14:51:17

Conducted emissions 824.0 MHz 3 – 6GHz



Date: 20.DEC.2006 14:51:49

Conducted emissions 824.0 MHz 6 – 9GHz



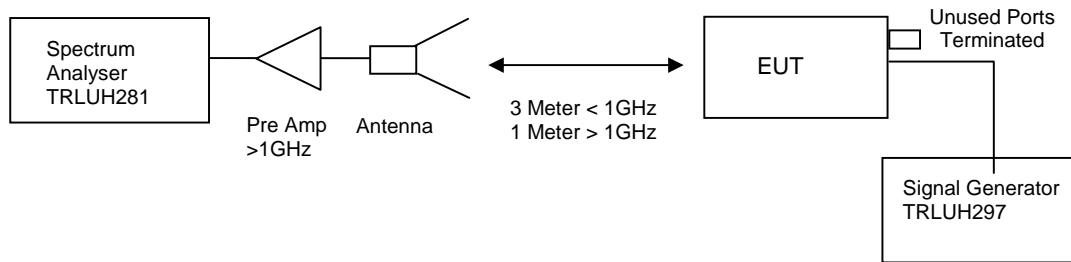
Date: 20.DEC.2006 14:52:18

## TRANSMITTER TESTS

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

Ambient temperature = 14°C  
 Relative humidity = 50%  
 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	76.6	44.15	1.00	5.8	50.95	-46.43	-13
	99.9	54.04	1.12	10.3	65.46	-31.92	-13
	106.0	48.20	1.14	10.9	60.24	-37.14	-13
	113.9	48.93	1.20	11.3	61.43	-35.95	-13
1GHz – 9GHz	No Significant Emissions Within 20dB of the Limit						-13

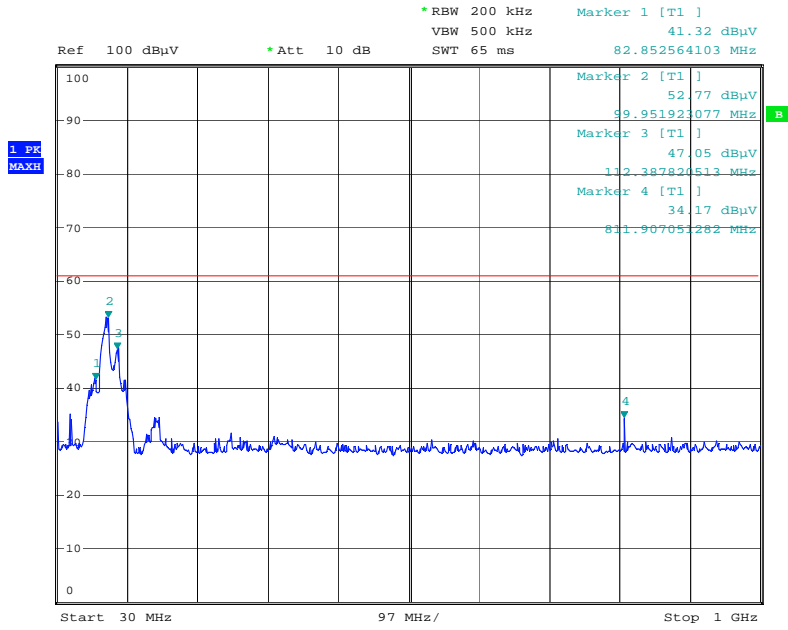
Note: Worst case emissions for each frequency are recorded.

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

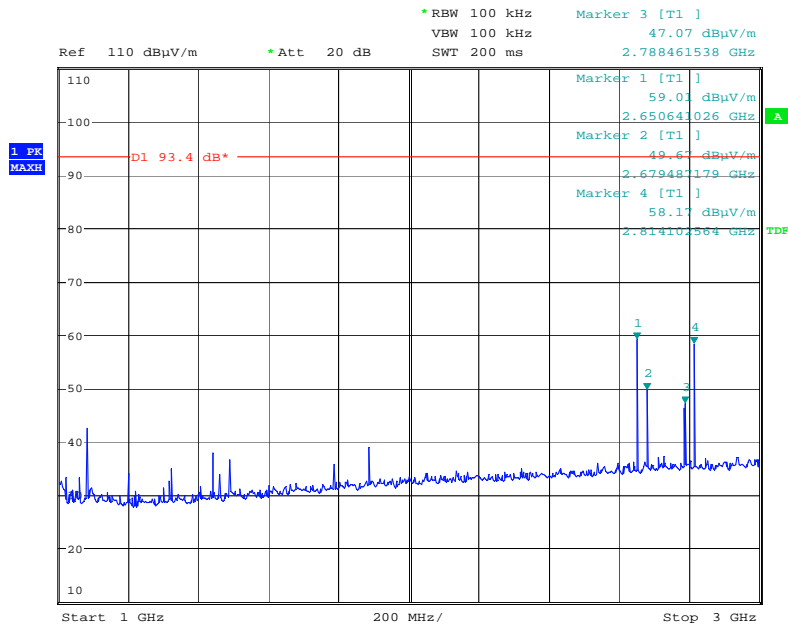


Radiated emissions 811.0 MHz 30MHz – 1GHz



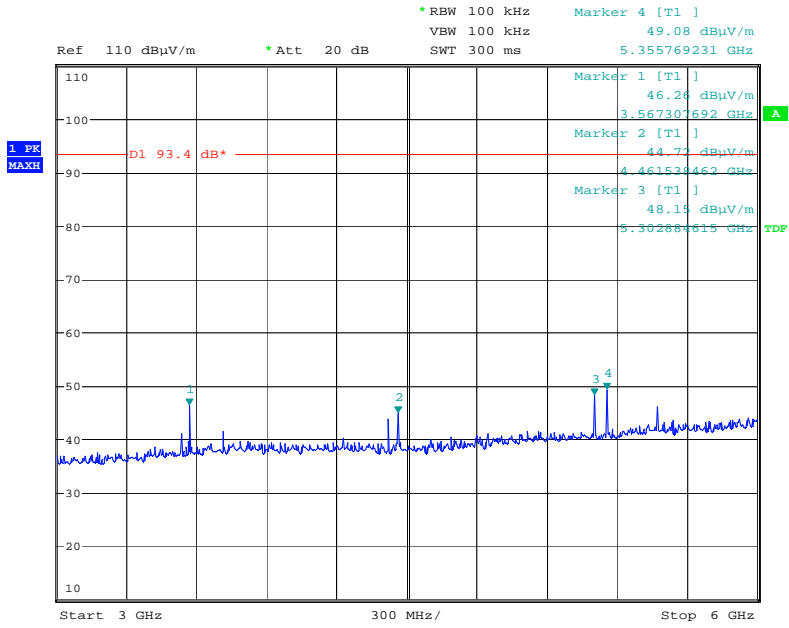
Date: 22.DEC.2006 12:49:46

Radiated emissions 811.0 MHz 1 – 3GHz



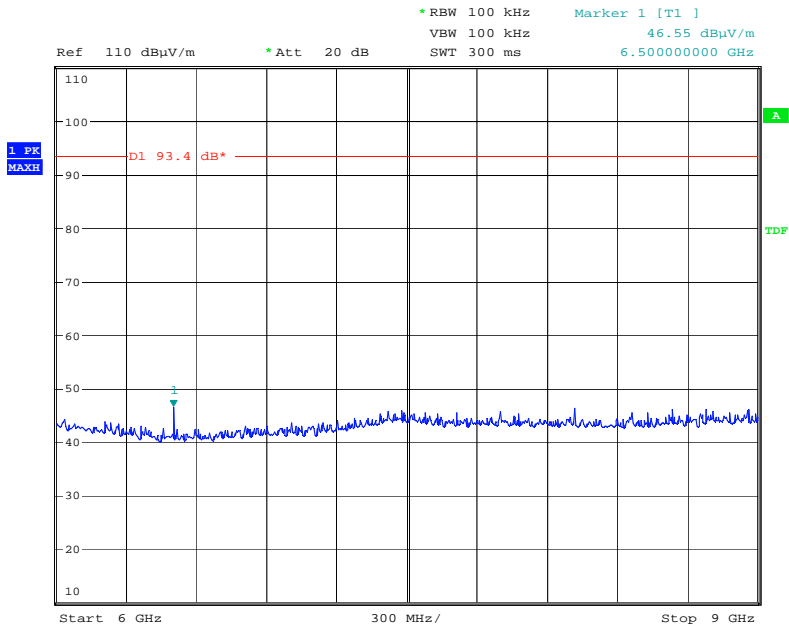
Date: 21.DEC.2006 14:43:19

Radiated emissions 811.0 MHz 3 – 6GHz



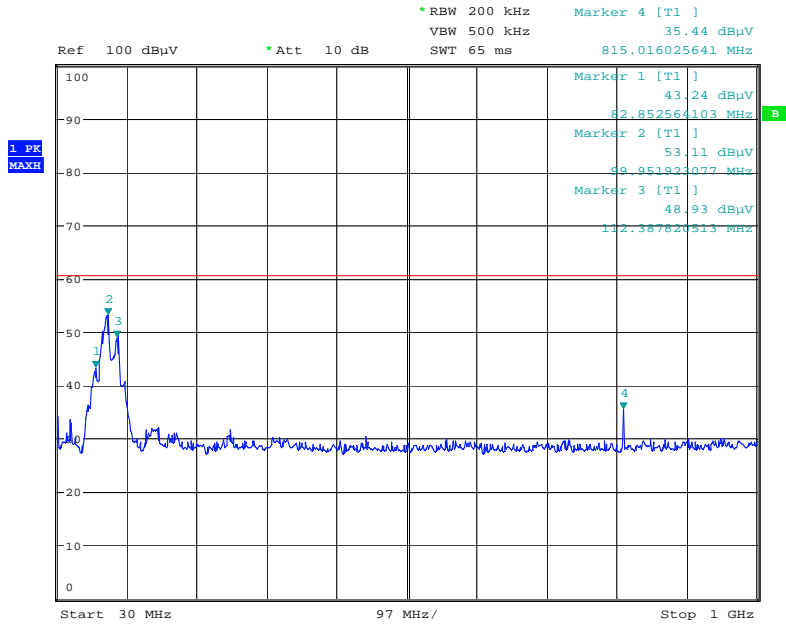
Date: 21.DEC.2006 14:42:56

Radiated emissions 811.0 MHz 6 – 9GHz



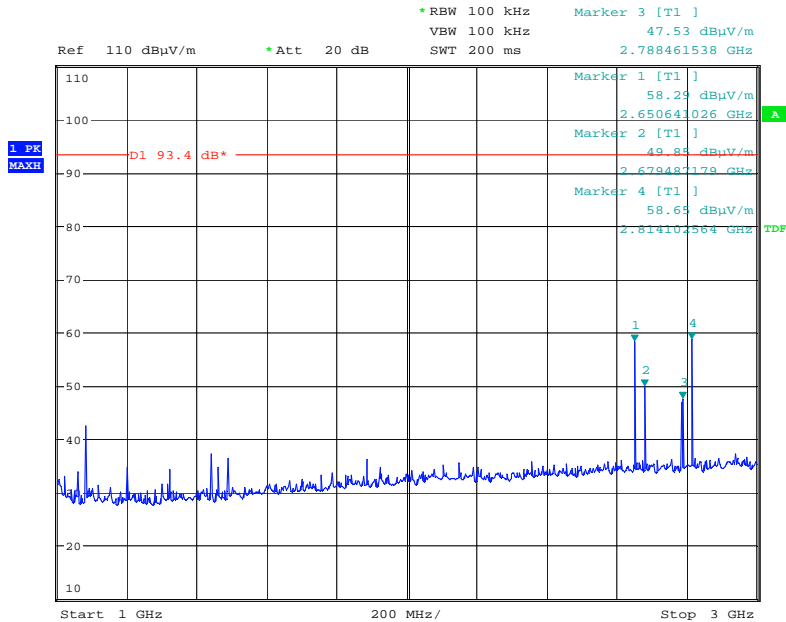
Date: 21.DEC.2006 14:42:24

Radiated emissions 813.5 MHz 30MHz – 1GHz



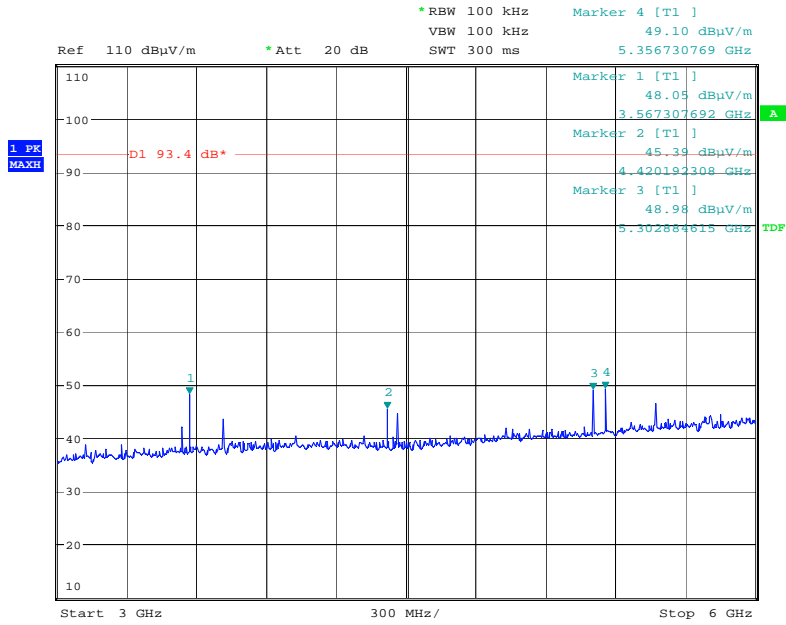
Date: 22.DEC.2006 12:50:55

Radiated emissions 813.5 MHz 1 – 3GHz



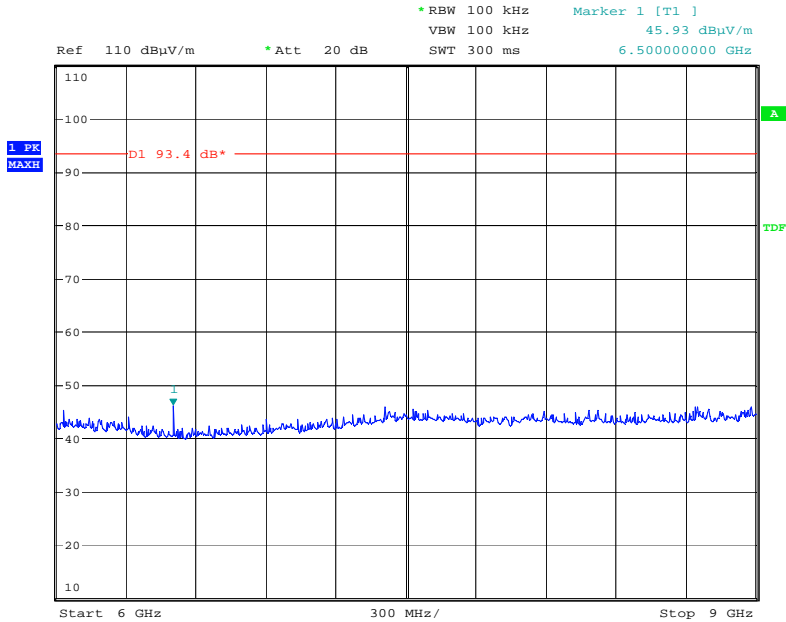
Date: 21.DEC.2006 14:43:48

Radiated emissions 813.5 MHz 3 – 6GHz



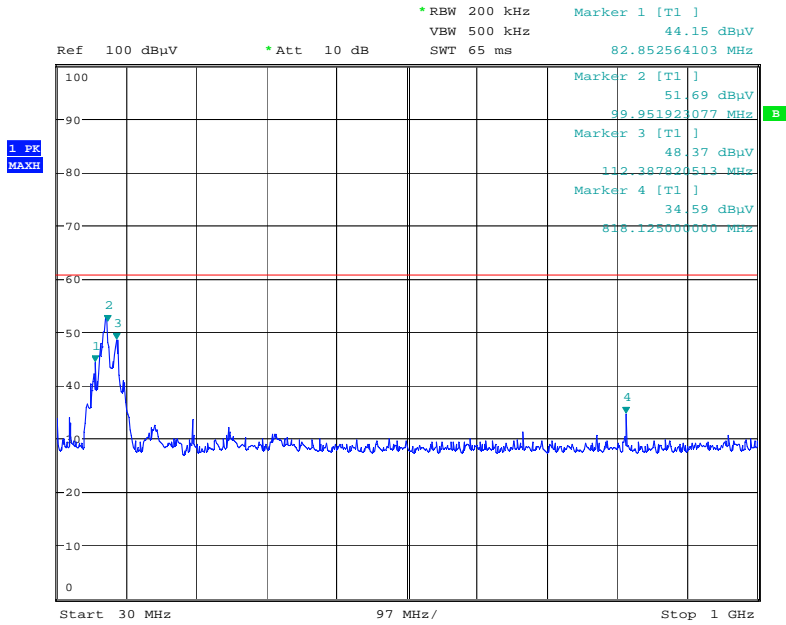
Date: 21.DEC.2006 14:44:41

Radiated emissions 813.5 MHz 6 – 9GHz



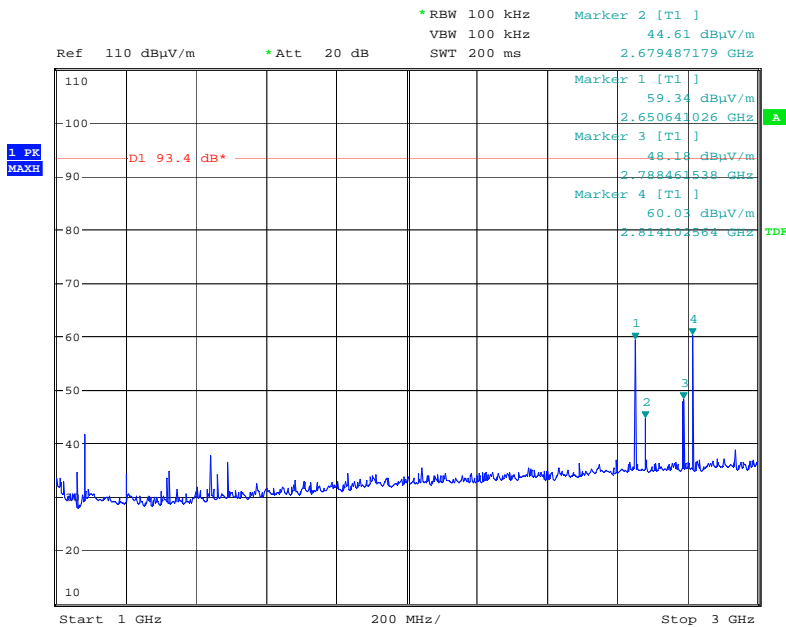
Date: 21.DEC.2006 14:52:08

Radiated emissions 816.0 MHz 30MHz – 1GHz



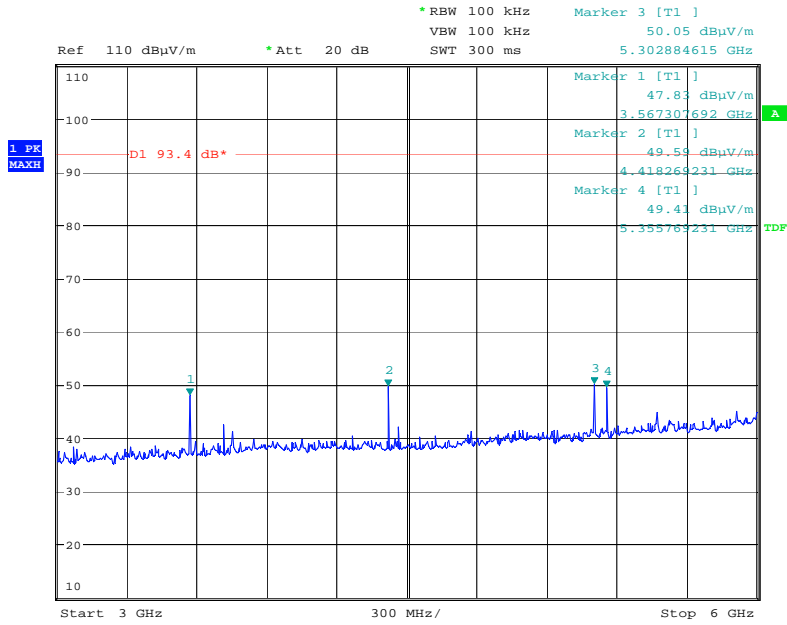
Date: 22.DEC.2006 12:52:59

Radiated emissions 816.0 MHz 1 – 3GHz



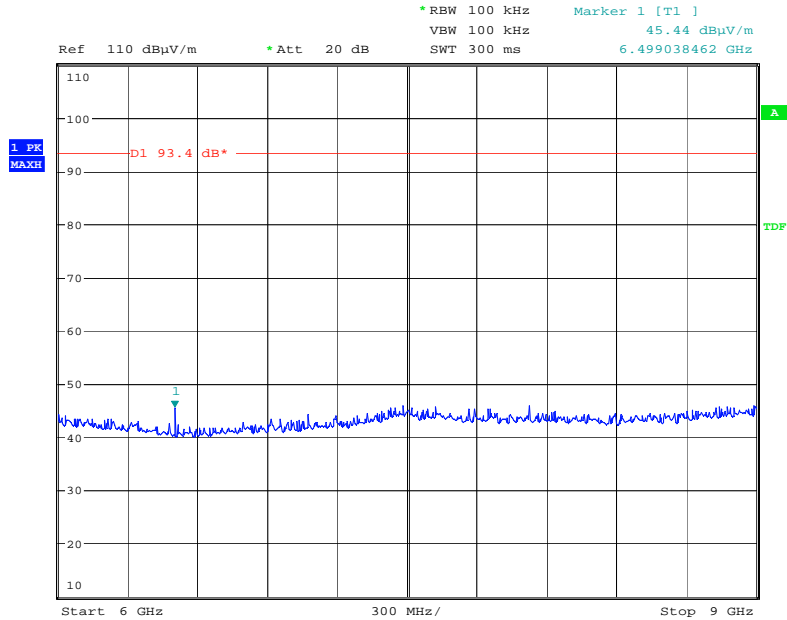
Date: 21.DEC.2006 14:57:29

Radiated emissions 816.0 MHz 3 – 6GHz



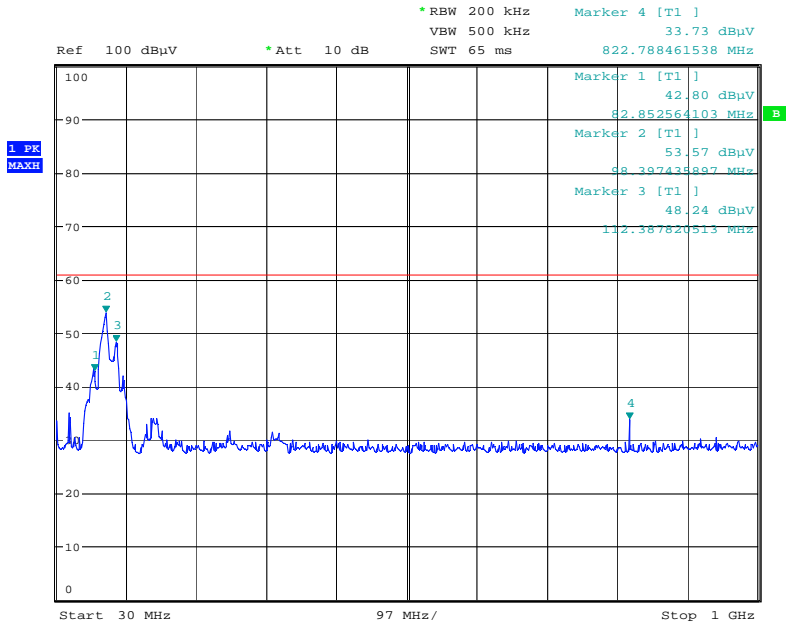
Date: 21.DEC.2006 14:56:55

Radiated emissions 816.0 MHz 6 – 9GHz



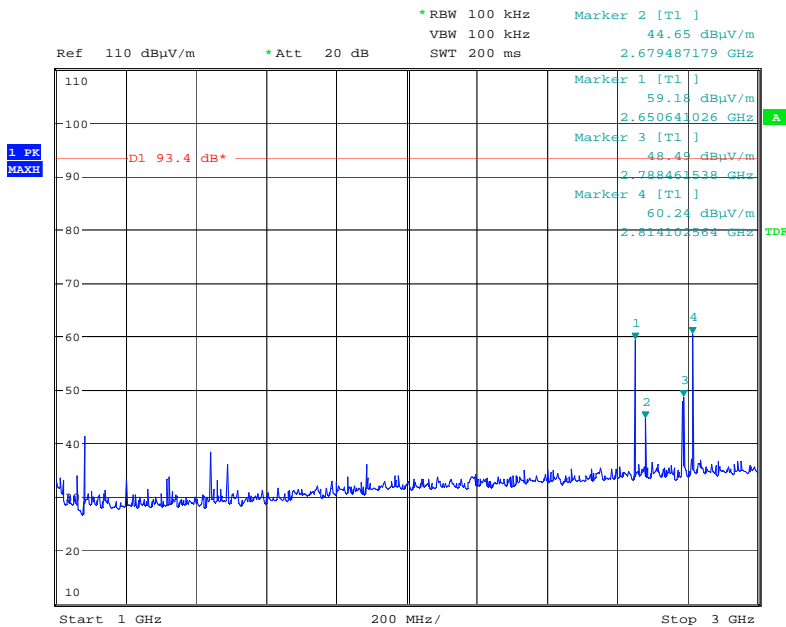
Date: 21.DEC.2006 14:56:26

Radiated emissions 821.0 MHz 30MHz – 1GHz



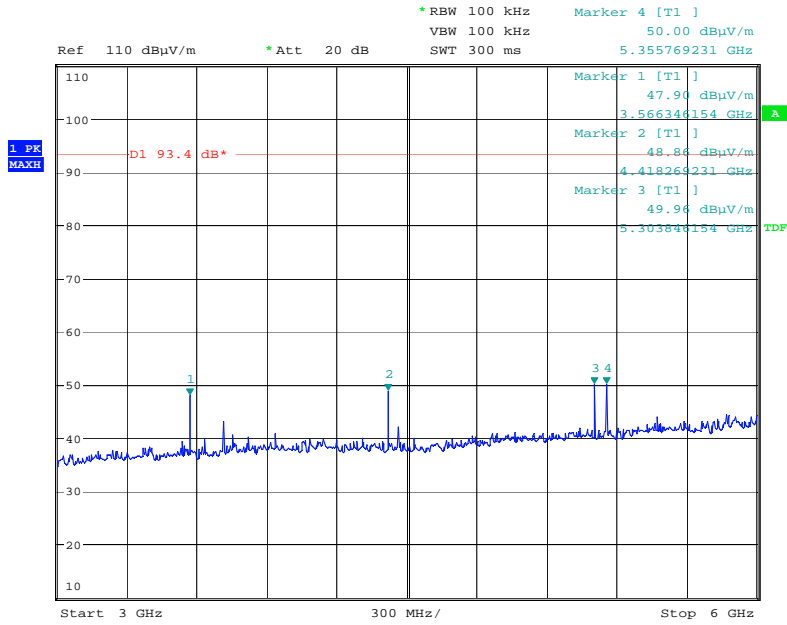
Date: 22.DEC.2006 12:54:03

Radiated emissions 821.0 MHz 1 – 3GHz



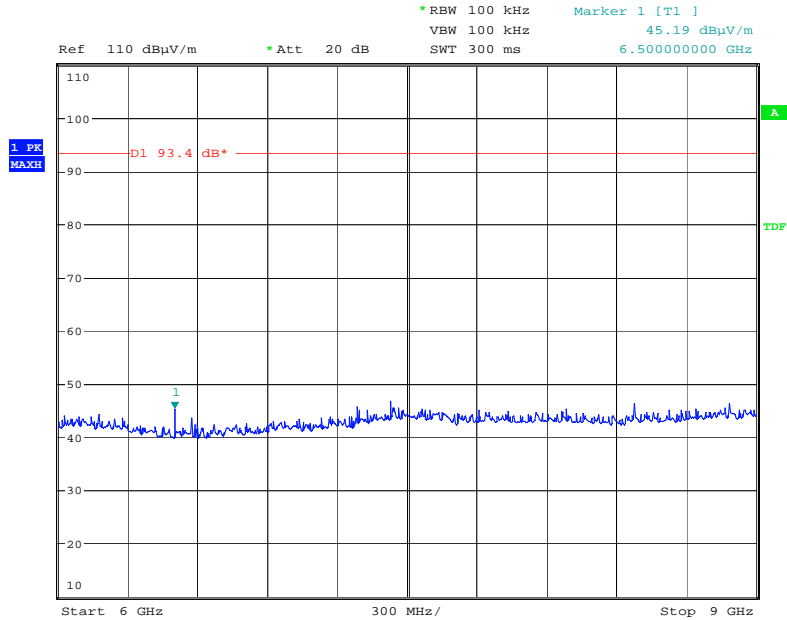
Date: 21.DEC.2006 14:58:04

Radiated emissions 821.0 MHz 3 – 6GHz



Date: 21.DEC.2006 14:58:32

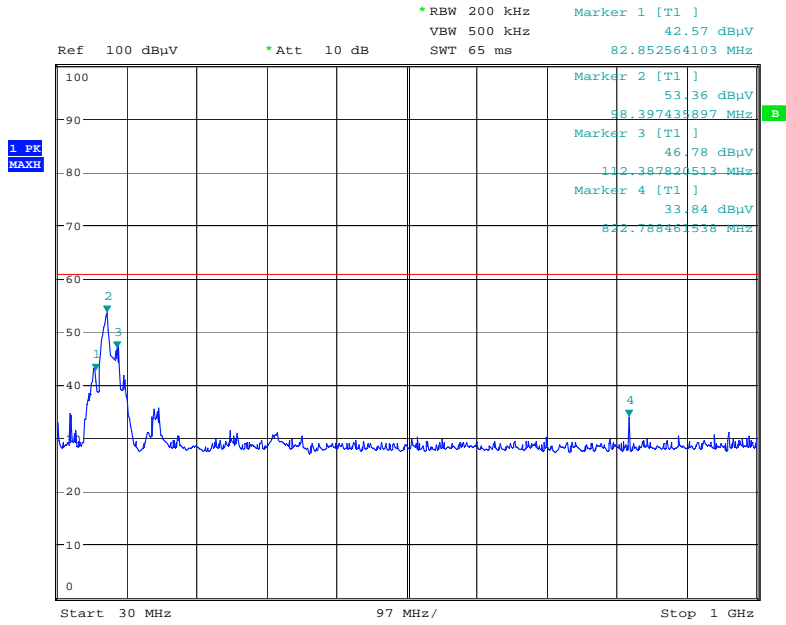
Radiated emissions 821.0 MHz 6 – 9GHz



Date: 21.DEC.2006 14:58:49

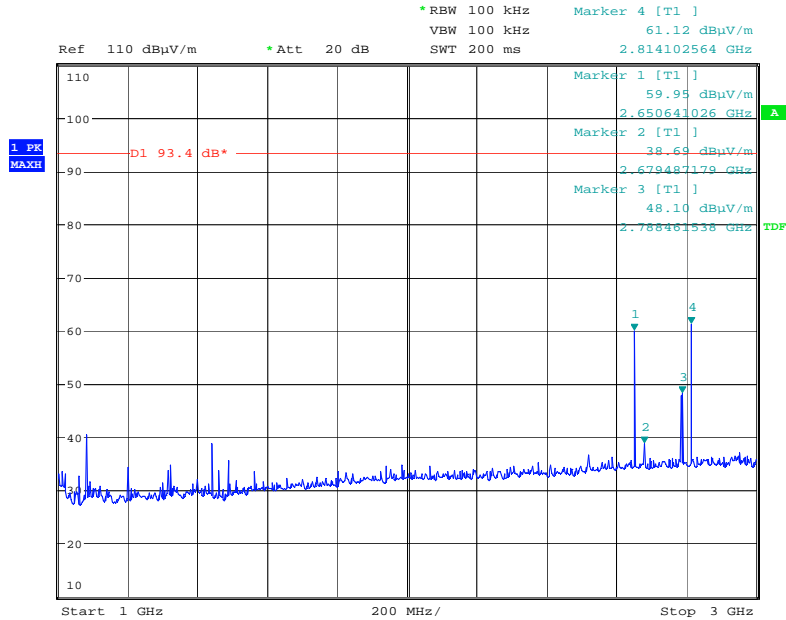


Radiated emissions 822.5 MHz 30MHz – 1GHz



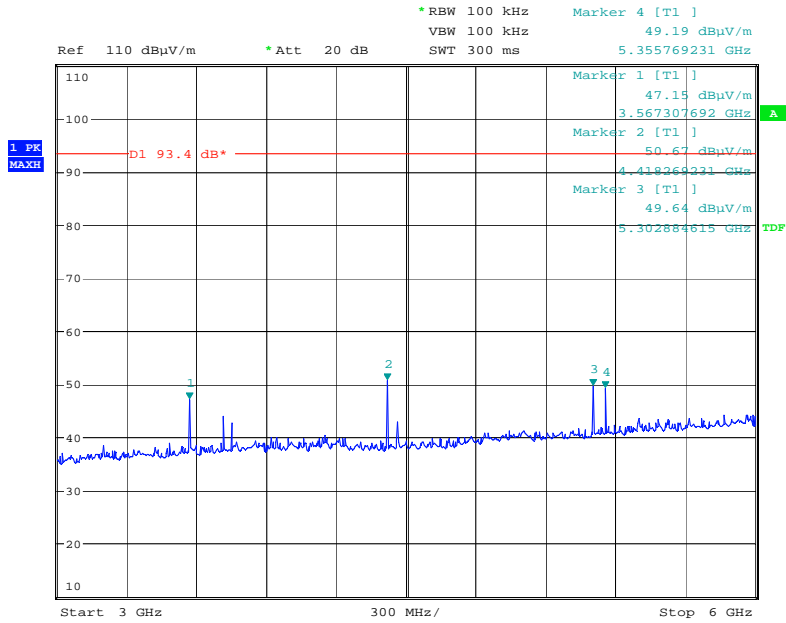
Date: 22.DEC.2006 12:56:07

Radiated emissions 822.5 MHz 1 – 3GHz



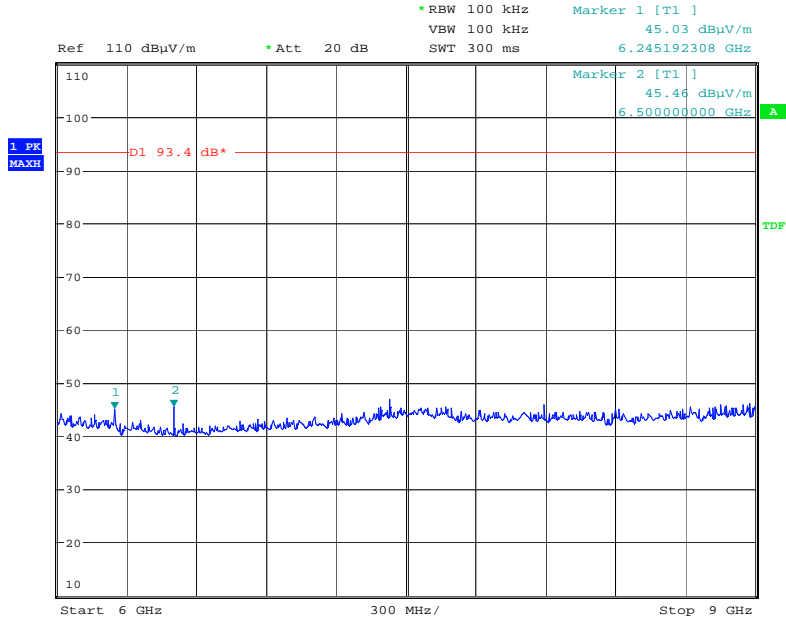
Date: 21.DEC.2006 15:04:05

Radiated emissions 822.5 MHz 3 – 6GHz



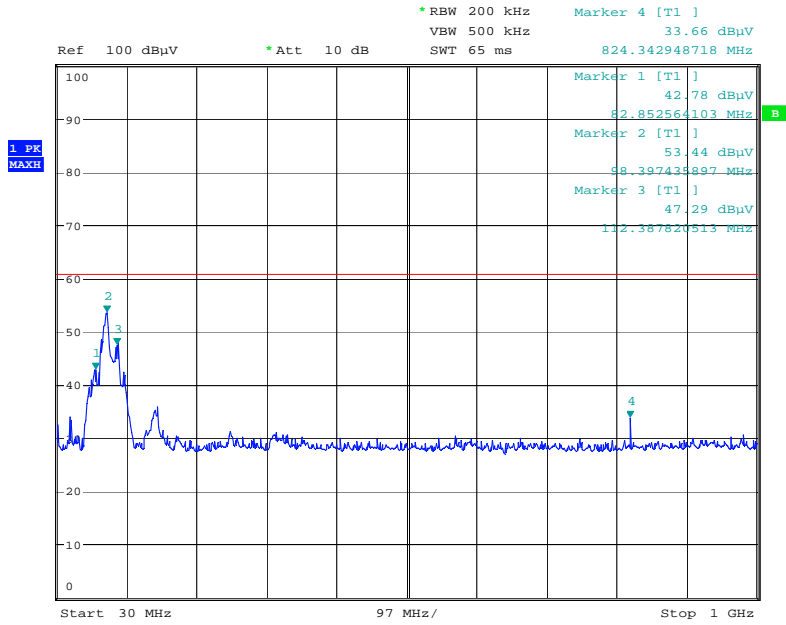
Date: 21.DEC.2006 15:03:12

Radiated emissions 822.5 MHz 6 – 9GHz



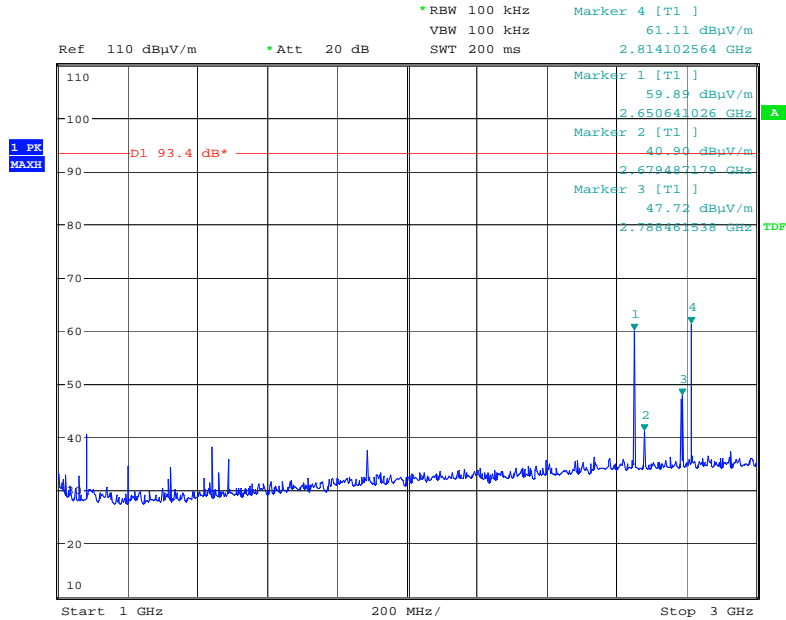
Date: 21.DEC.2006 15:02:36

Radiated emissions 824.0 MHz 30MHz – 1GHz



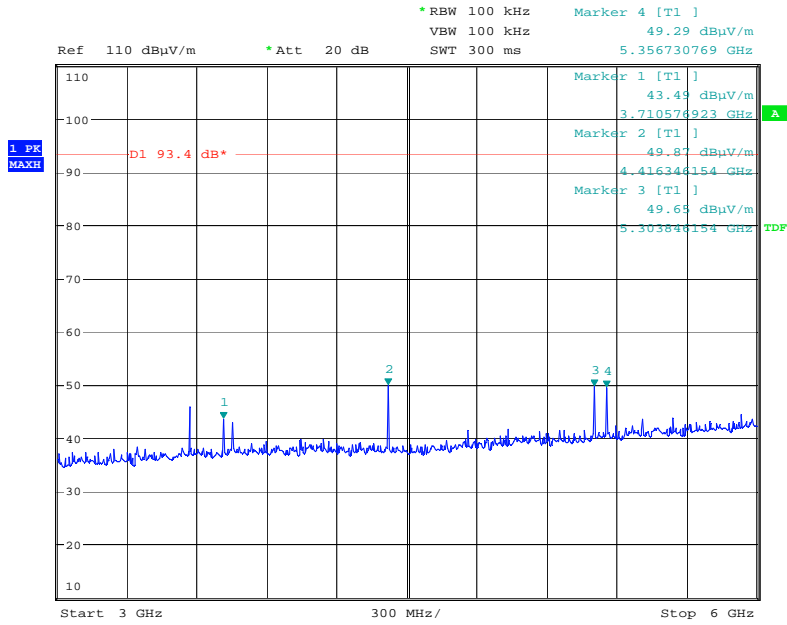
Date: 22.DEC.2006 12:56:58

Radiated emissions 824.0 MHz 1 – 3GHz



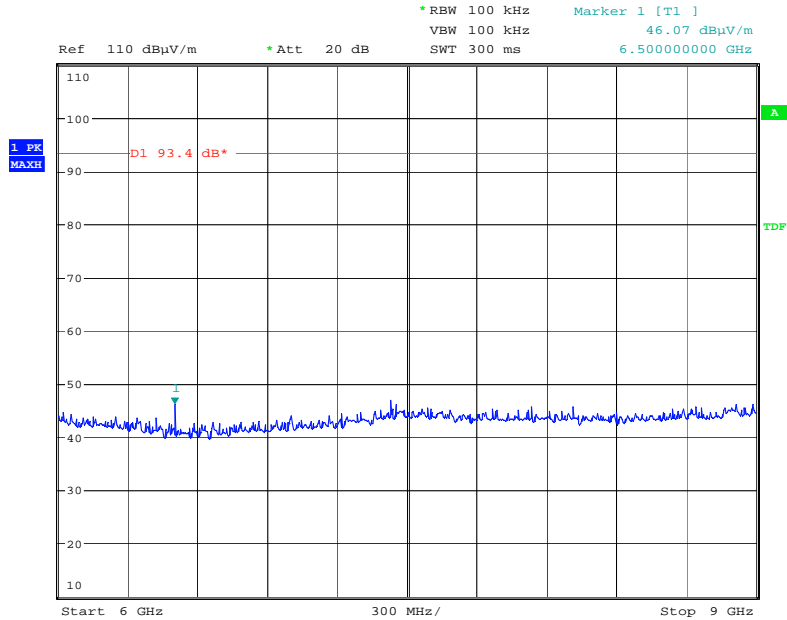
Date: 21.DEC.2006 15:05:09

Radiated emissions 824.0 MHz 3 – 6GHz



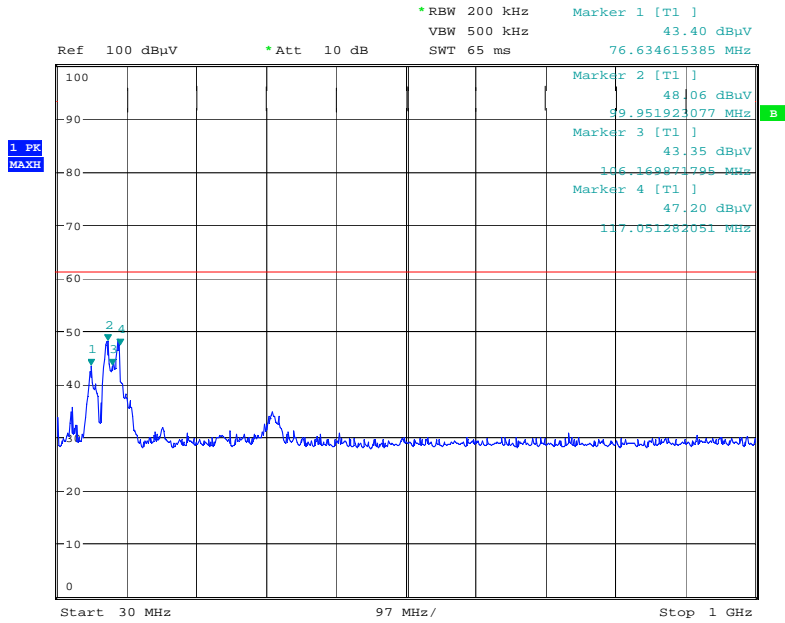
Date: 21.DEC.2006 15:06:08

Radiated emissions 824.0 MHz 6 – 9GHz



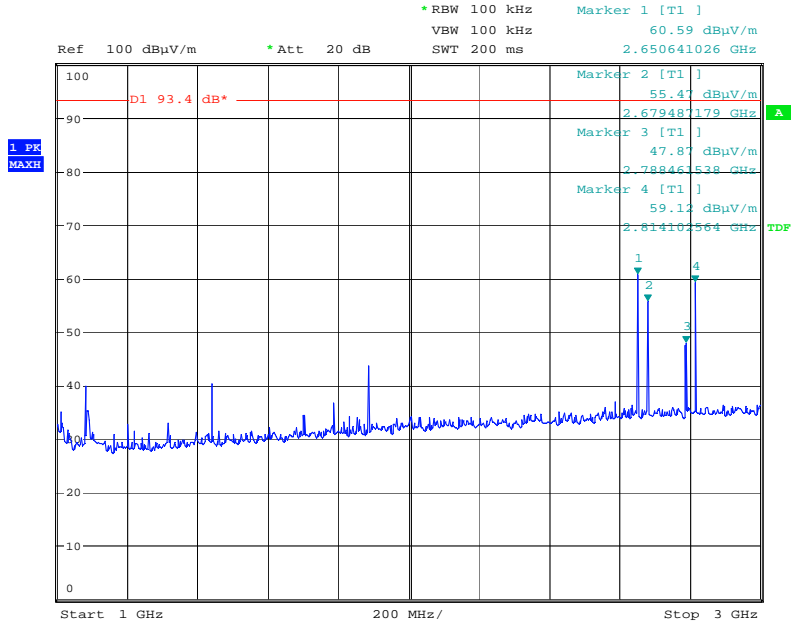
Date: 21.DEC.2006 15:06:40

Radiated emissions no input signal 30MHz – 1GHz



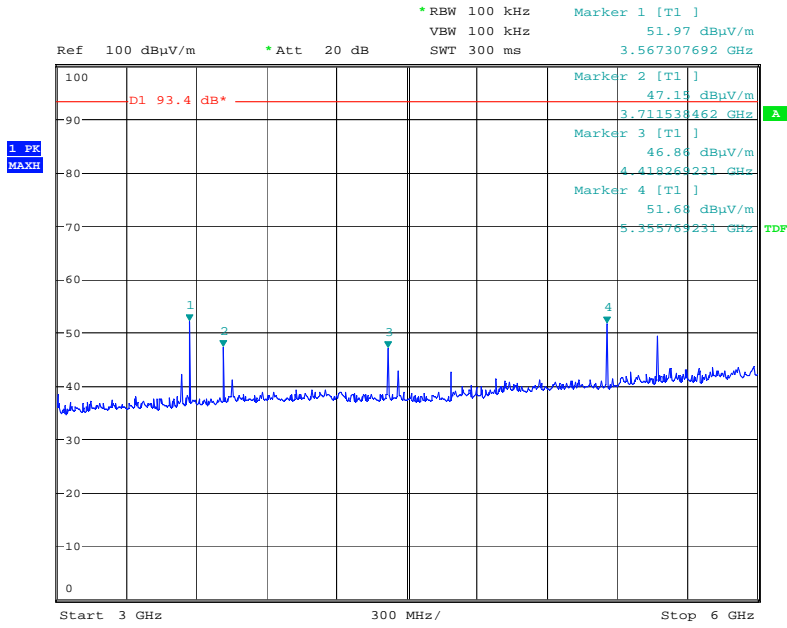
Date: 22.DEC.2006 12:28:07

Radiated emissions no input signal 1 – 3GHz



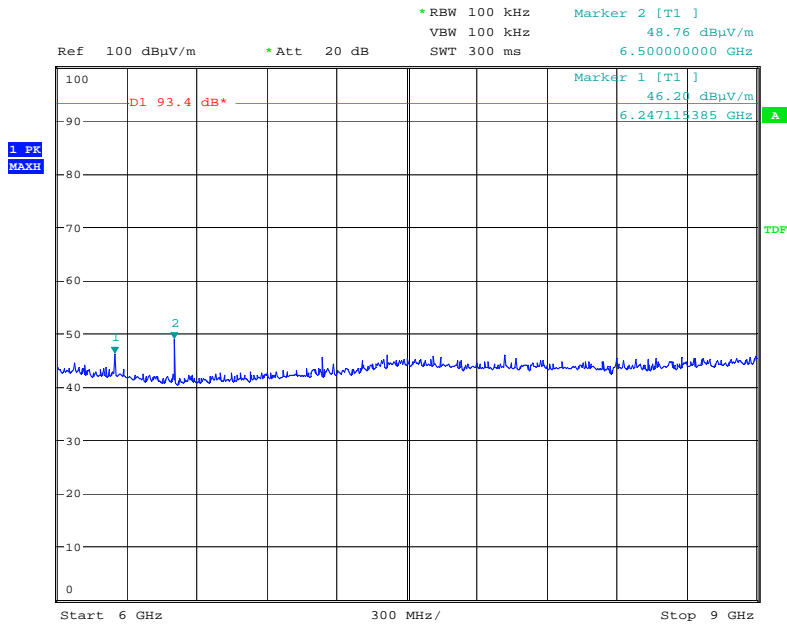
Date: 21.DEC.2006 12:21:51

Radiated emissions no input signal 3 – 6GHz



Date: 21.DEC.2006 12:22:37

Radiated emissions no input signal 6 – 9GHz



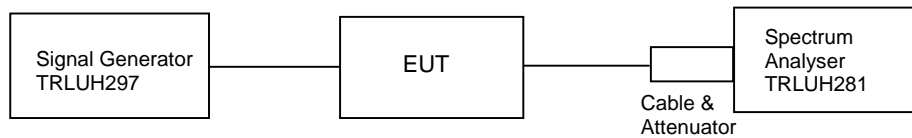
Date: 21.DEC.2006 12:26:38

## TRANSMITTER TESTS

### AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – DOWNLINK

Ambient temperature = 16°C  
 Relative humidity = 64%  
 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
856.0	-52.0	0.42	42.5	-7.63	87.29	34.87	78.43
858.5	-52.5	0.42	42.5	-7.03	88.39	35.47	79.35
861.0	-52.0	0.42	42.5	-6.49	88.43	36.01	79.46
866.0	-51.5	0.42	42.5	-7.47	86.95	35.03	78.00
867.5	-52.5	0.42	42.5	-7.25	88.17	35.25	79.15
869.0	-50.5	0.42	42.5	-7.06	86.36	35.44	77.29

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.

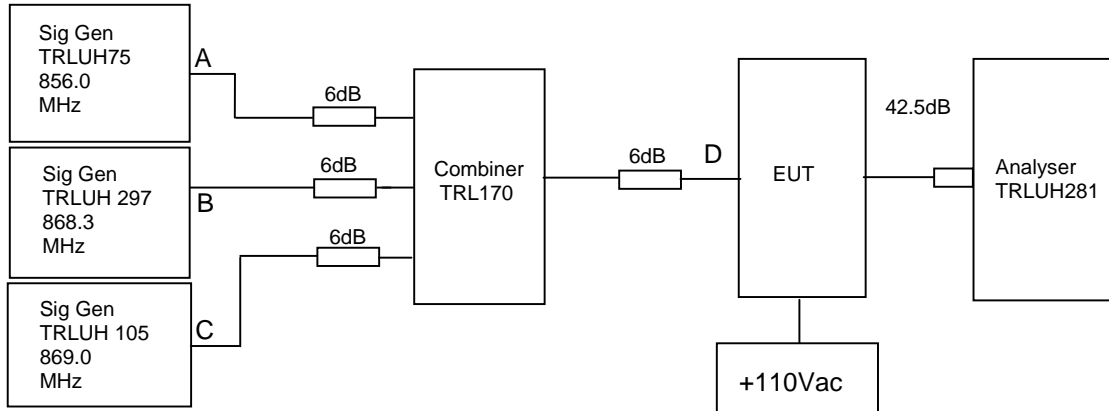
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8308-100	N/A	112	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<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 42.5dB. The signal generators were set to the input frequencies listed below.

RF Input Frequency (MHz)			Highest Intermodulation Product Level & Frequency (dBm)	Limit (dBm)
856.0	868.3	869.0	-15.21dBm @ 867.59615 MHz	-13

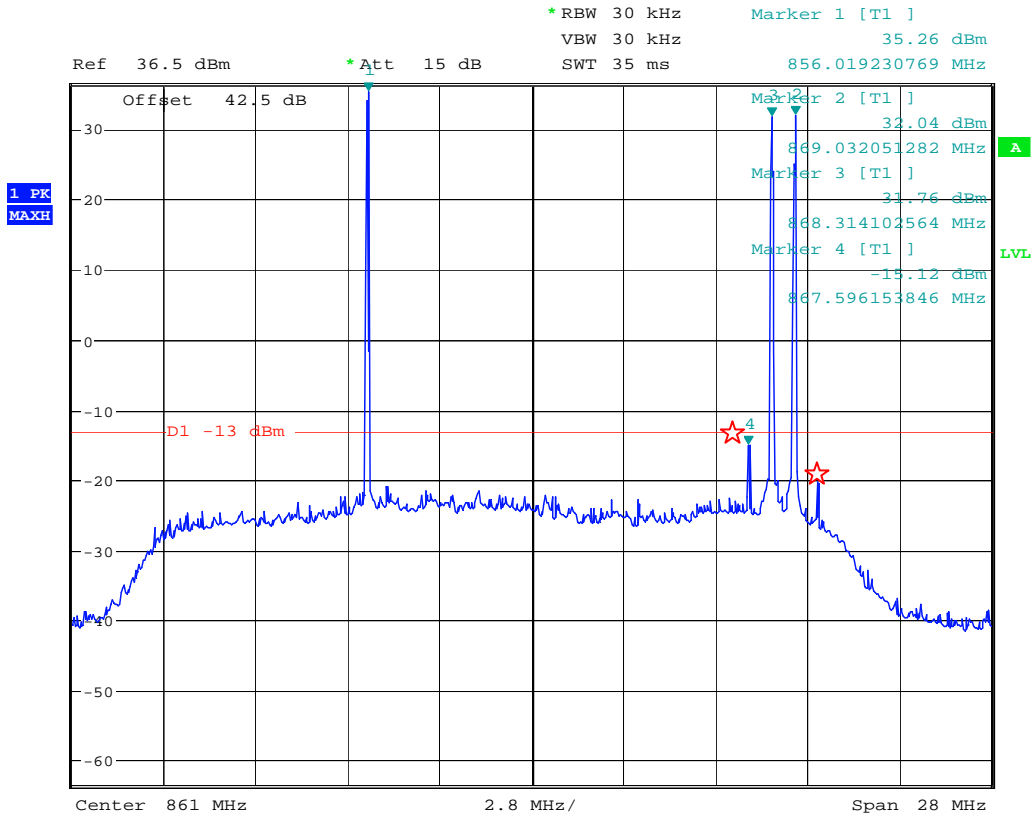
Sweep data is shown on the next pages are for worst case intermodulation product:

#### 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
SIGNAL GENERATOR	MARCONI	2023	112224/040	UH105	X
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
COMBINER	ELCOM	RC-4-50	N/A	170	X



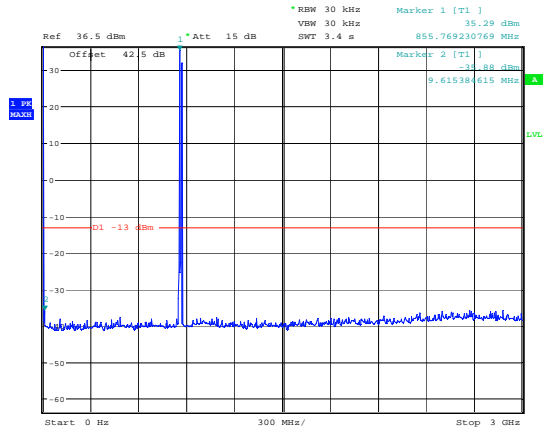
### Intermodulation Inband



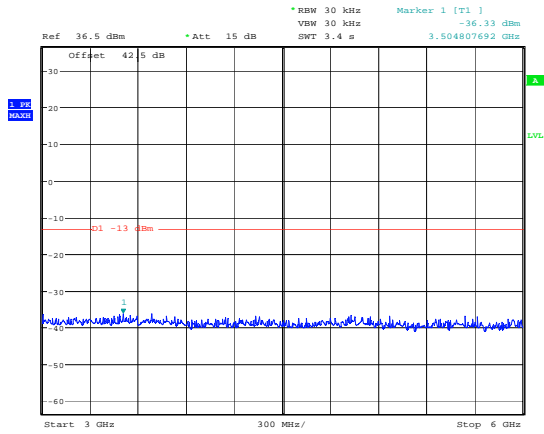
Date: 3.JAN.2007 16:27:20

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

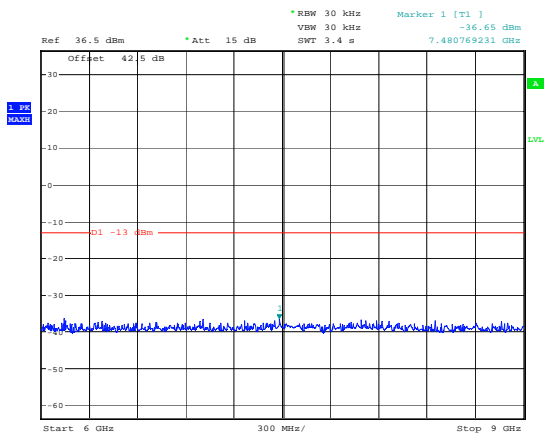
## Intermodulation Wideband



Date: 3.JAN.2007 16:28:49



Date: 3.JAN.2007 16:29:19



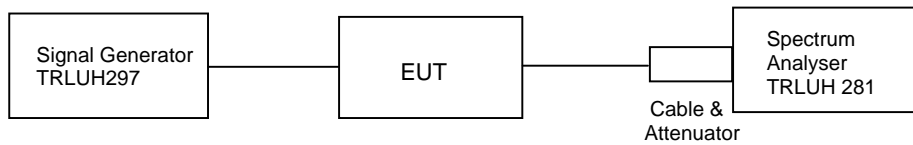
Date: 3.JAN.2007 16:30:09

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 = 16°C Radio Laboratory  
 Relative humidity = 65%  
 Supply voltage = +110Vac  
 Channel number = See test results



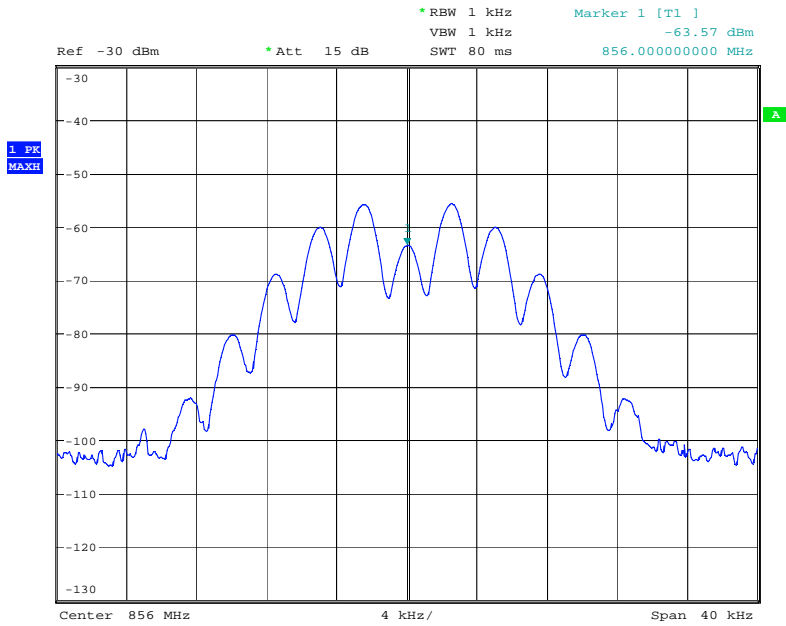
This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level required for the selected channel and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at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

Note: The cables and attenuators had the following losses.

1. Cable and attenuator between EUT and spectrum analyser 42.5dB
2. Cable between signal generator and EUT 0.42dB

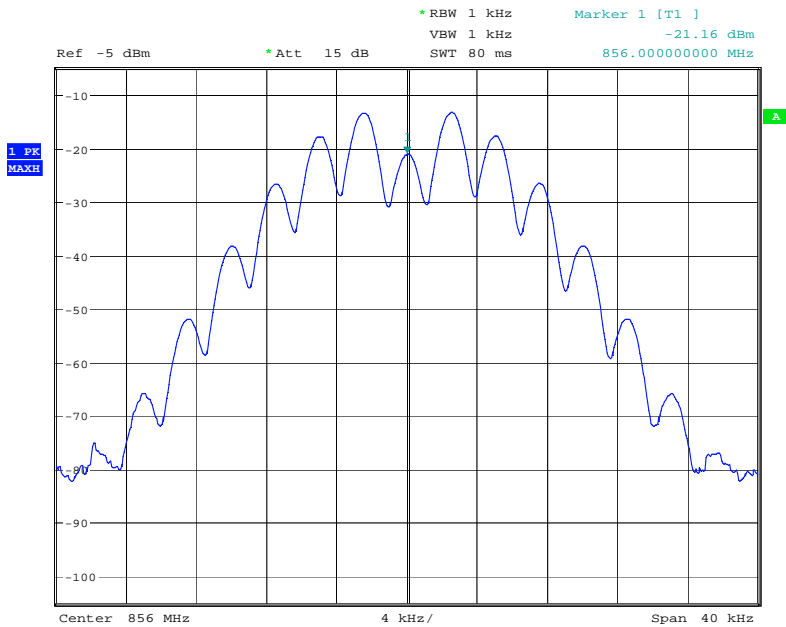
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	<b>X</b>
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	<b>X</b>
ATTENUATOR	BIRD	8308-100	N/A	112	<b>X</b>
ATTENUATOR	BIRD	8304-300-N	N/A	220	<b>X</b>
ATTENUATOR	BIRD	8304-0600N	N/A	246	<b>X</b>

856.0 MHz Signal Generator, deviation set to 5 kHz



Date: 4.JAN.2007 11:22:47

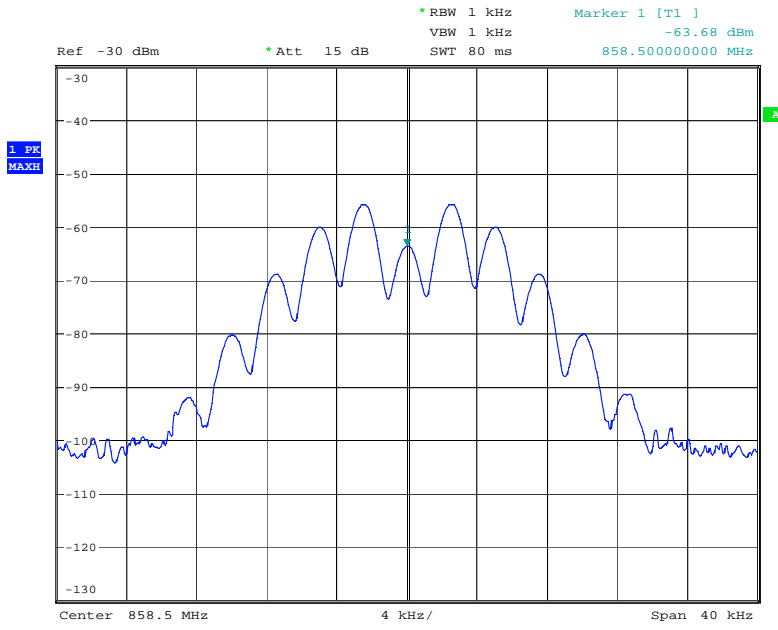
856.0 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 4.JAN.2007 11:08:59

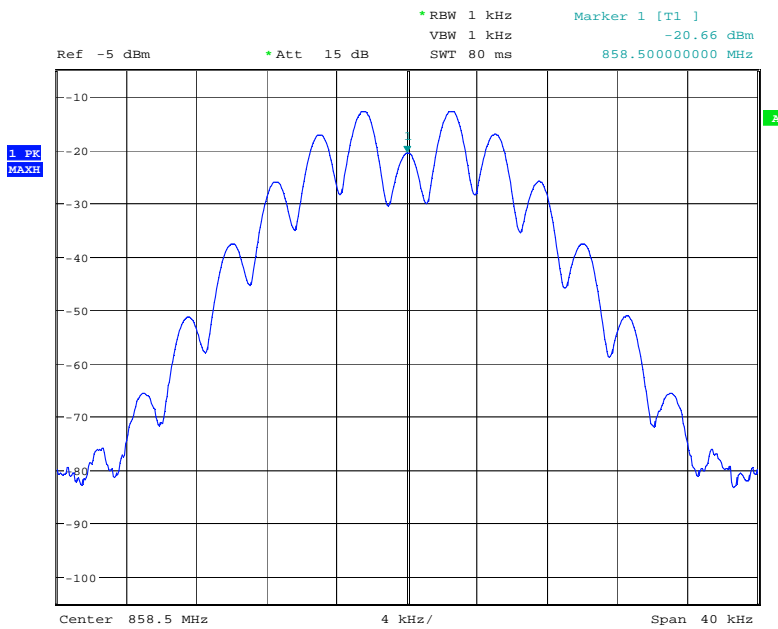
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 858.5 MHz Signal Generator, deviation set to 5 kHz



Date: 4.JAN.2007 11:23:08

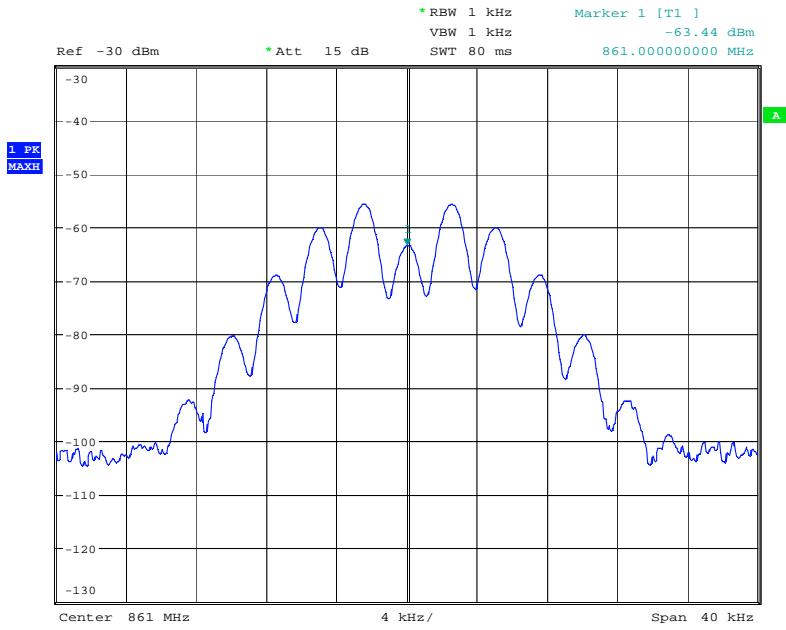
### 858.5 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 4.JAN.2007 11:08:38

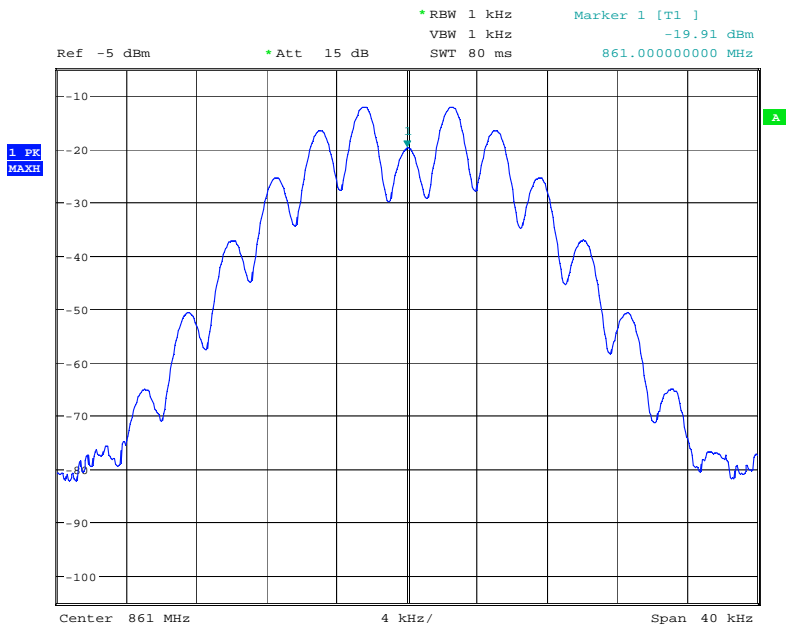
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

### 861.0 MHz Signal Generator, deviation set to 5 kHz



Date: 4.JAN.2007 11:23:44

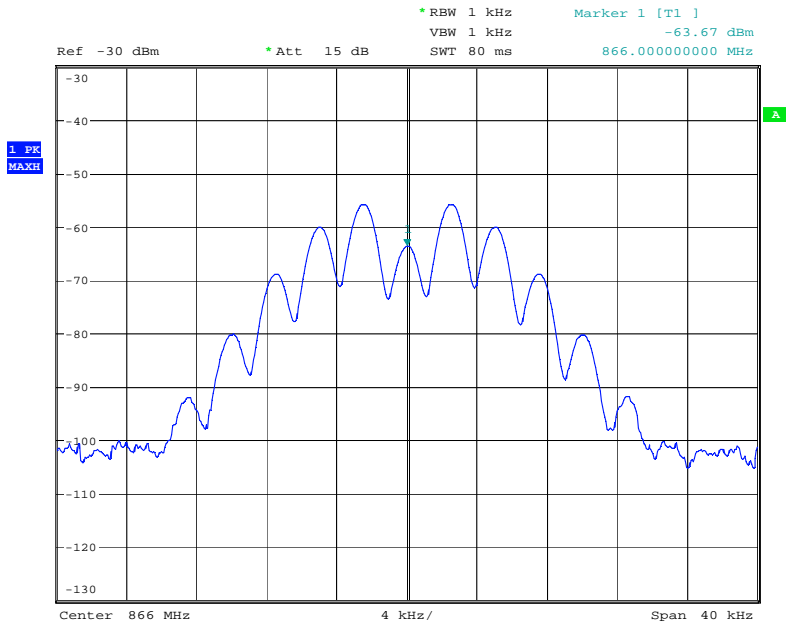
### 861.0 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 4.JAN.2007 11:07:50

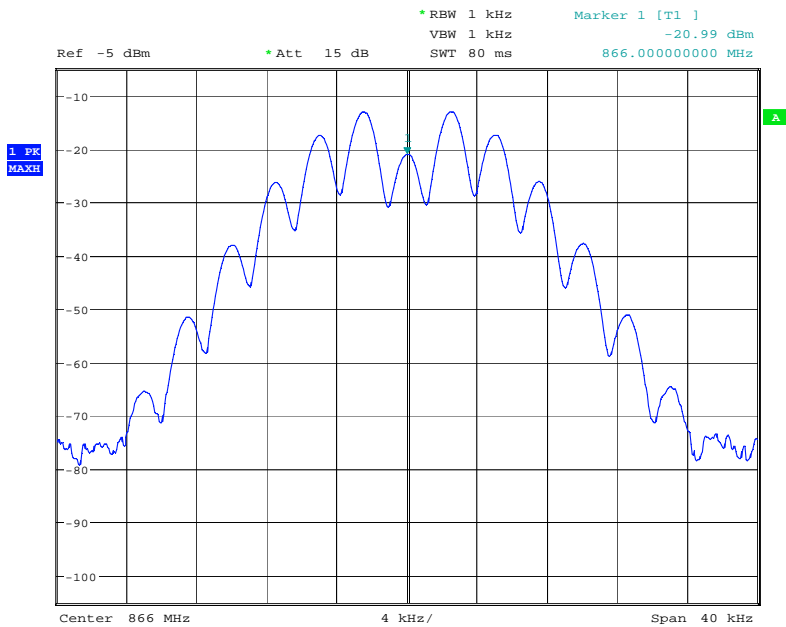
The above plots depicting the output waweshape show no measurable distortion visible when compared to the input signal.

### 866.0 MHz Signal Generator, deviation set to 5 kHz



Date: 4.JAN.2007 11:24:01

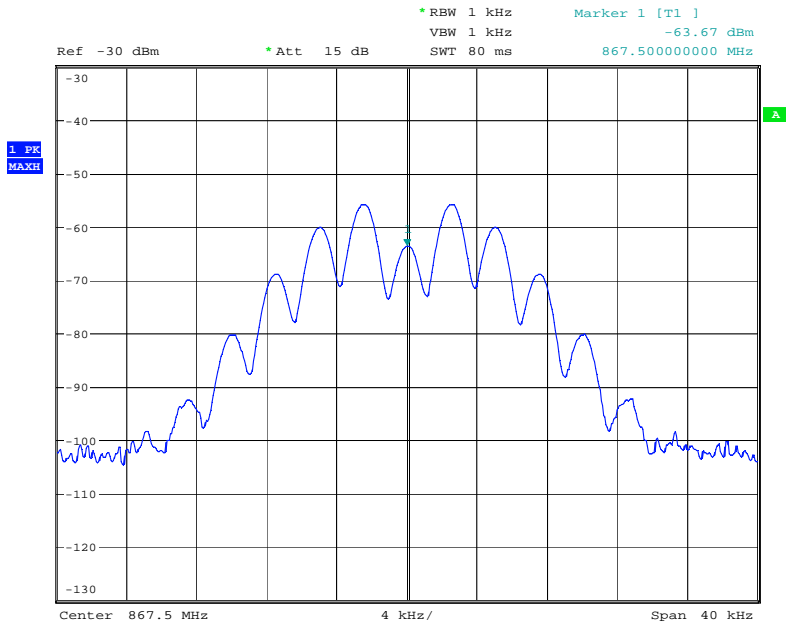
### 866.0 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 4.JAN.2007 11:07:28

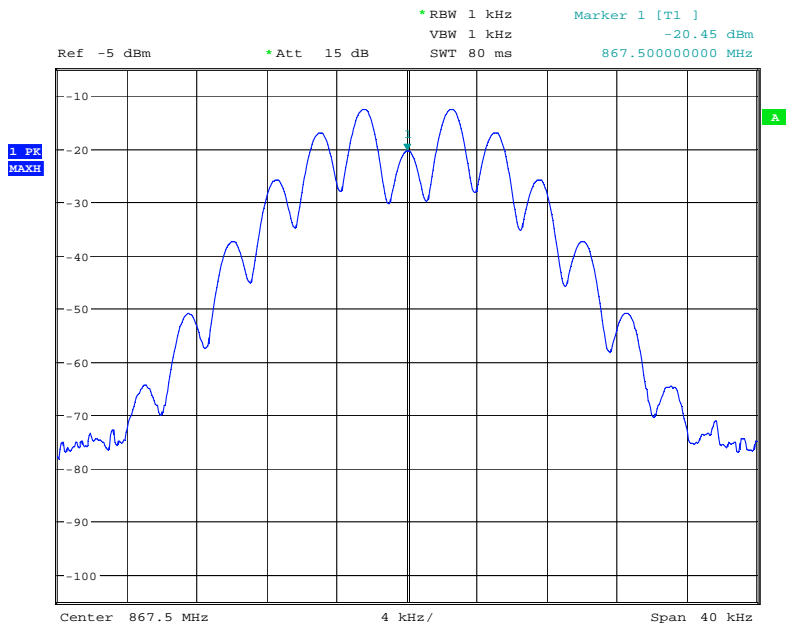
The above plots depicting the output waweshape show no measurable distortion visible when compared to the input signal.

### 867.5 MHz Signal Generator, deviation set to 5 kHz



Date: 4.JAN.2007 11:24:44

### 867.5 MHz Signal Generator and EUT, deviation set to 5 kHz

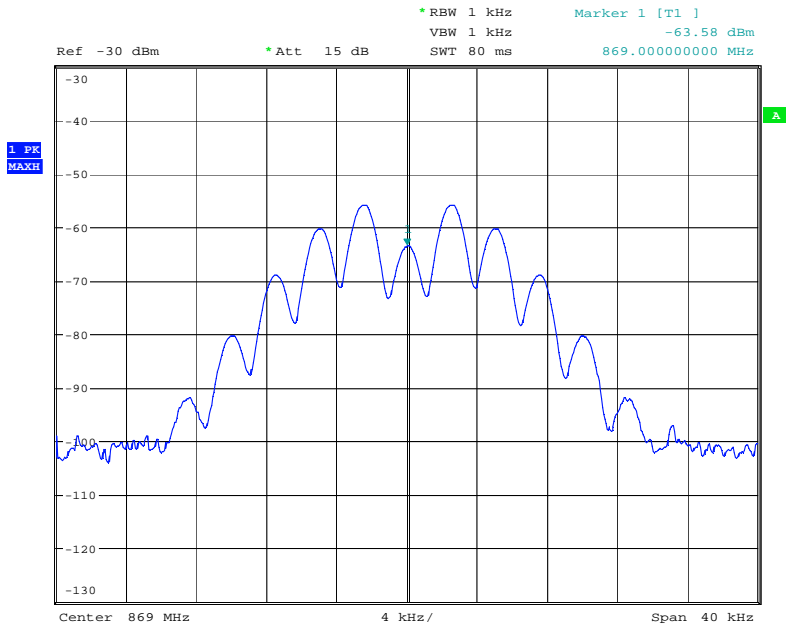


Date: 4.JAN.2007 11:06:44

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

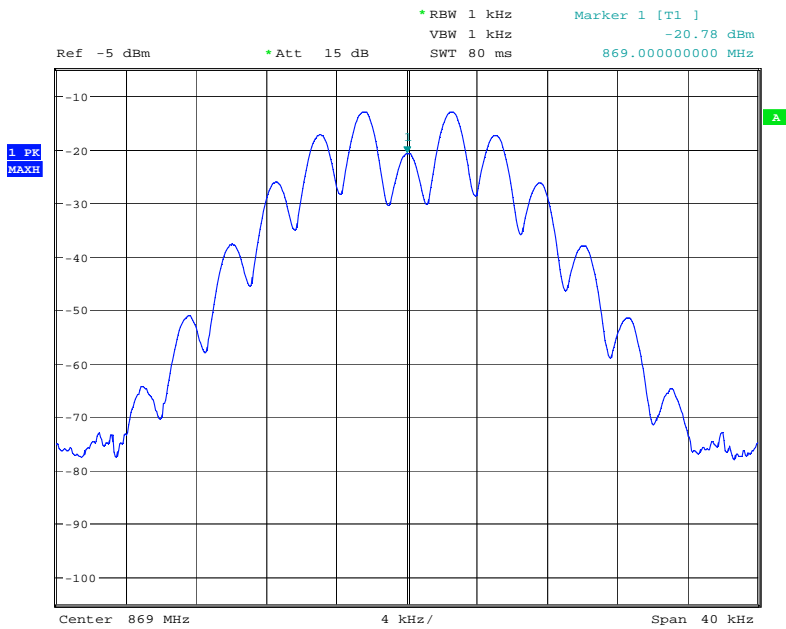


### 869.0 MHz Signal Generator, deviation set to 5 kHz



Date: 4.JAN.2007 11:25:16

### 869.0 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 4.JAN.2007 11:06:18

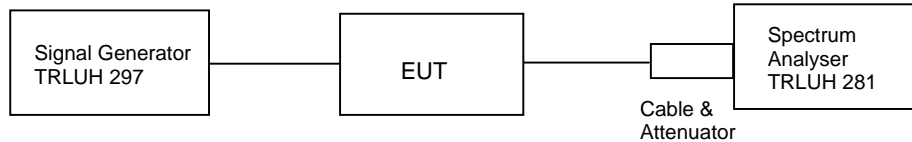
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

## TRANSMITTER TESTS

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

Ambient temperature = 21°C  
 Relative humidity = 35%  
 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  $43 + 10 \log P_{dB}$

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

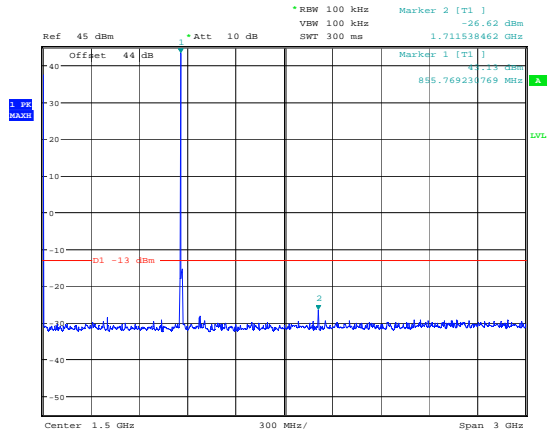
## RESULTS

FREQUENCY RANGE	FREQ. (MHz)	MEASURED LEVEL (dBm)	ATTENUATOR & CABLE LOSSES (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
0 Hz – 9 GHz	1711.990	-69.79	43.27	-26.52	-13
	1716.500	-71.82	43.27	-28.55	-13
	1722.000	-70.05	43.27	-26.78	-13
	1732.000	-75.27	43.27	-32.00	-13
	1734.987	-73.62	43.27	-30.35	-13
	1737.990	-73.48	43.27	-30.21	-13
	2568.012	-70.71	46.63	-27.08	-13
	2575.490	-71.36	46.63	-27.73	-13
	2583.019	-71.00	46.63	-27.37	-13
	2598.011	-72.96	46.63	-29.33	-13
	2602.486	-71.44	46.63	-27.81	-13
	2607.000	-71.05	46.63	-27.42	-13

The test equipment used for the Transmitter Conducted Emissions:

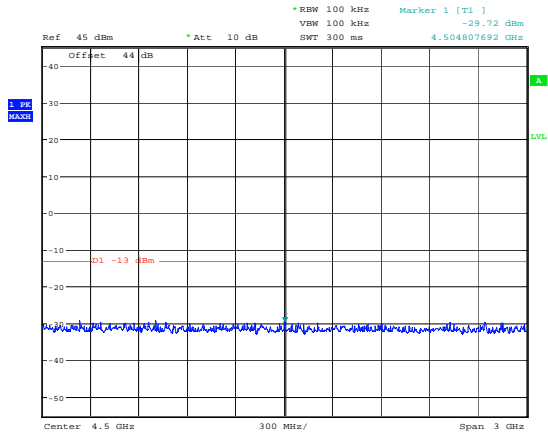
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ATTENUATOR	BIRD	8308-100	N/A	112	X
ATTENUATOR	BIRD	8304-300-N	N/A	220	X
ATTENUATOR	BIRD	8304-0600N	N/A	246	X

Conducted emissions 856.0 MHz 0 – 3GHz



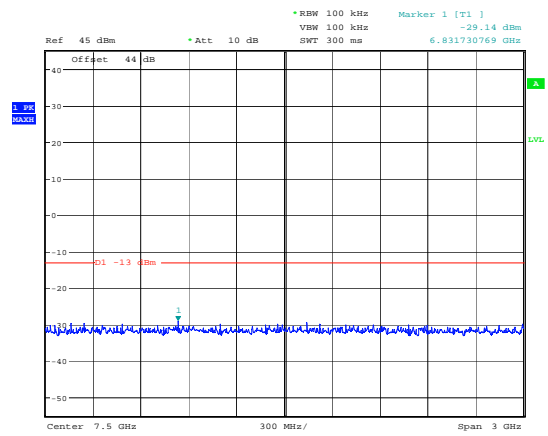
Date: 20.DEC.2006 12:02:47

Conducted emissions 856.0 MHz 3 – 6GHz



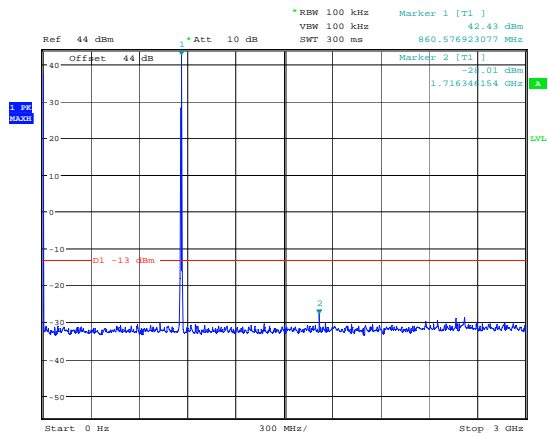
Date: 20.DEC.2006 12:03:09

Conducted emissions 856.0 MHz 6 – 9GHz



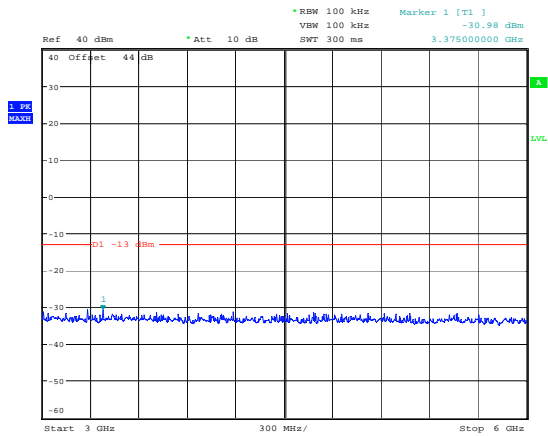
Date: 20.DEC.2006 12:03:24

Conducted emissions 858.5 MHz 0 – 3GHz



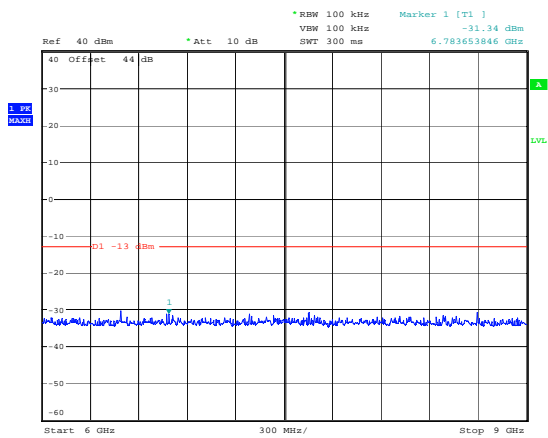
Date: 20.DEC.2006 12:07:57

Conducted emissions 858.5 MHz 3 – 6GHz



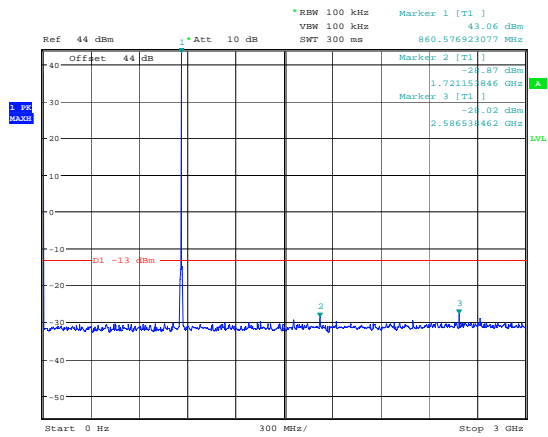
Date: 20.DEC.2006 12:08:47

Conducted emissions 858.5 MHz 6 – 9GHz



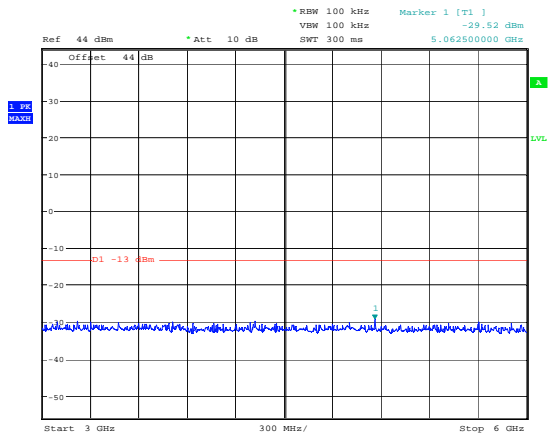
Date: 20.DEC.2006 12:09:15

Conducted emissions 861.0 MHz 0 – 3GHz



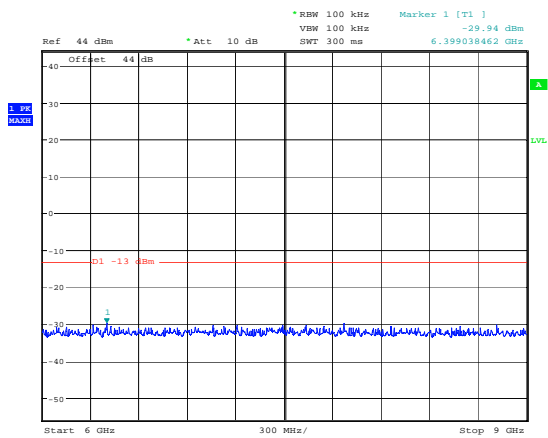
Date: 20.DEC.2006 12:16:47

Conducted emissions 861.0 MHz 3 – 6GHz



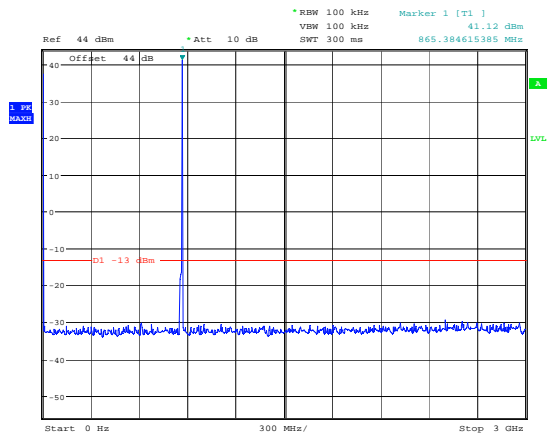
Date: 20.DEC.2006 12:17:09

Conducted emissions 861.0 MHz 6 – 9GHz



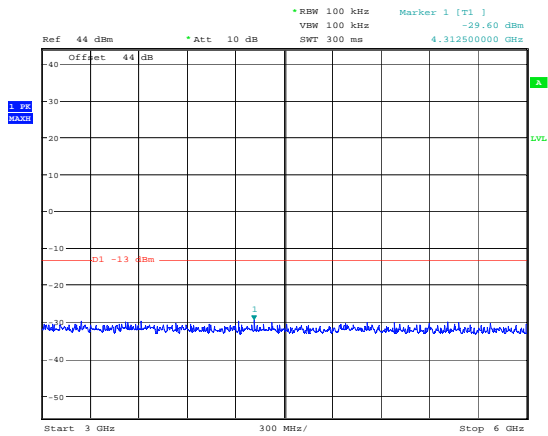
Date: 20.DEC.2006 12:17:24

Conducted emissions 866.0 MHz 0 – 3GHz



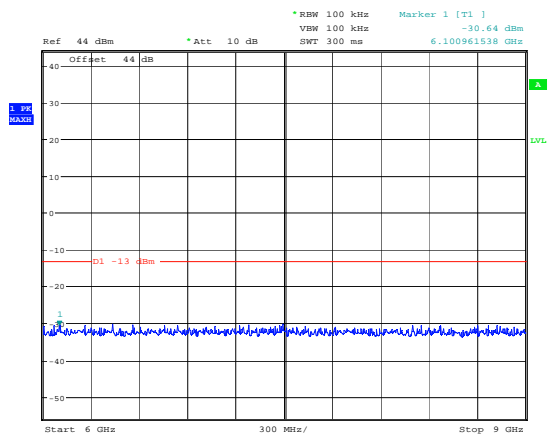
Date: 20.DEC.2006 12:20:08

Conducted emissions 866.0 MHz 3 – 6GHz



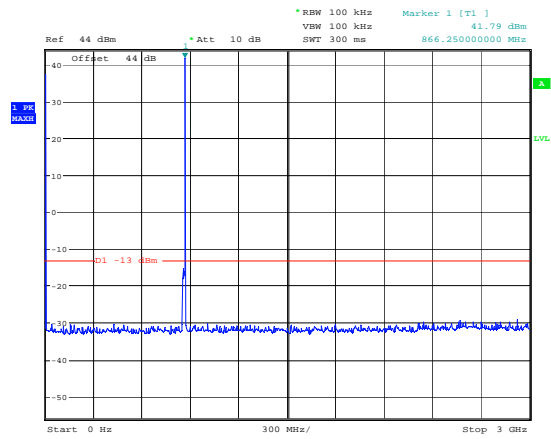
Date: 20.DEC.2006 12:21:27

Conducted emissions 866.0 MHz 6 – 9GHz



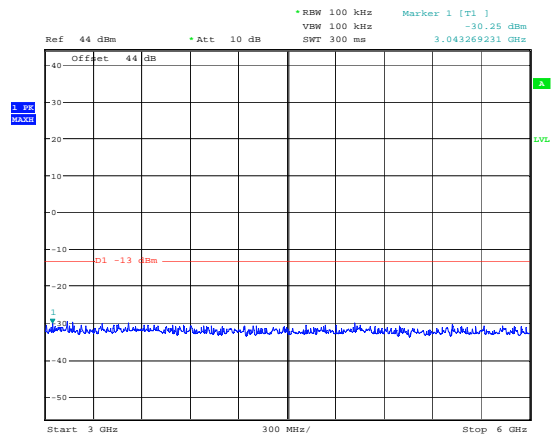
Date: 20.DEC.2006 12:21:39

Conducted emissions 867.5 MHz 0 – 3GHz



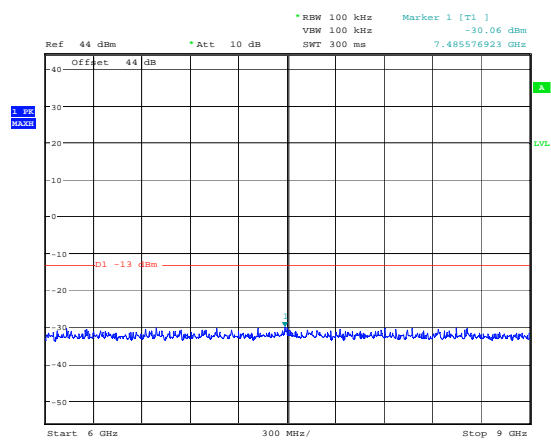
Date: 20.DEC.2006 12:24:03

Conducted emissions 867.5 MHz 3 – 6GHz



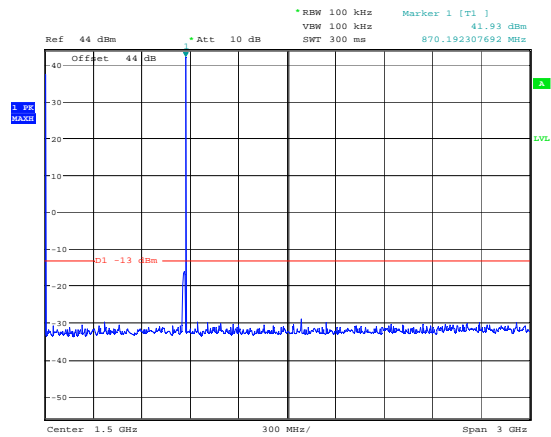
Date: 20.DEC.2006 12:24:39

Conducted emissions 867.5 MHz 6 – 9GHz



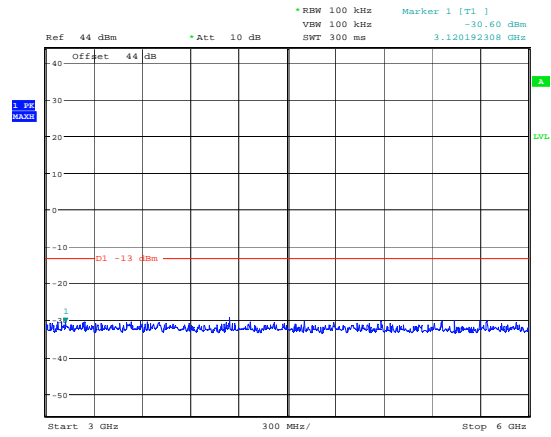
Date: 20.DEC.2006 12:24:53

Conducted emissions 869.0 MHz 0 – 3GHz



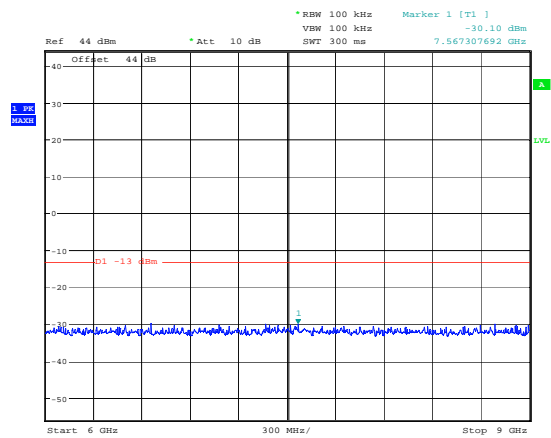
Date: 20.DEC.2006 12:27:03

Conducted emissions 869.0 MHz 3 – 6GHz



Date: 20.DEC.2006 12:27:18

Conducted emissions 869.0 MHz 6 – 9GHz



Date: 20.DEC.2006 12:27:36

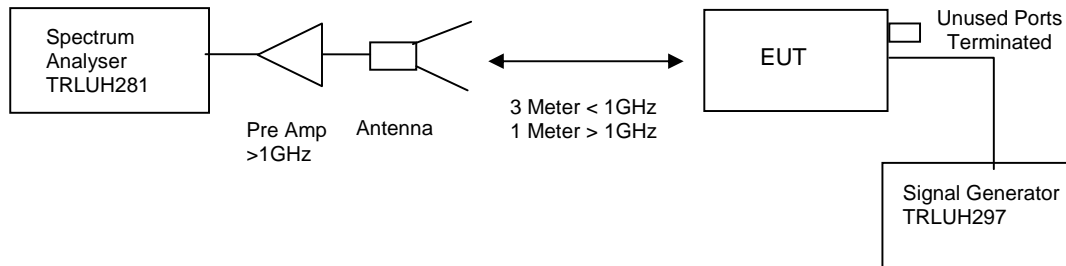


## TRANSMITTER TESTS

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

Ambient temperature = 14°C  
 Relative humidity = 50%  
 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  $43 + 10 \log P_{dB}$

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

## RESULTS

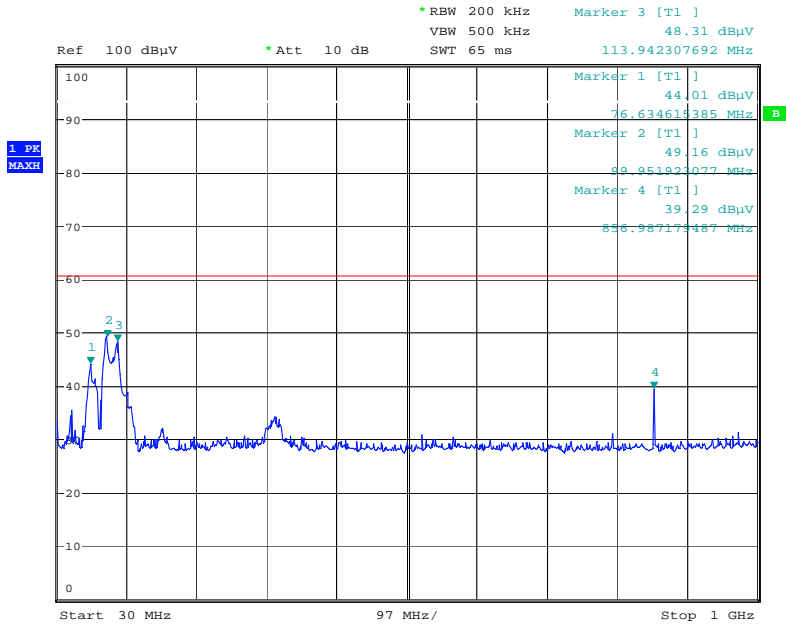
FREQUENCY RANGE	FREQ. (MHz)	MEAS. Rx. (dBμV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBμV/m)	CALCULATED EIRP (dBm)	LIMIT (dBm)
30MHz – 1GHz	76.6	44.86	1.00	5.8	51.66	-45.72	-13
	99.9	50.11	1.12	10.3	61.53	-35.85	-13
	106.0	48.20	1.14	10.9	60.24	-37.14	-13
	113.9	50.48	1.20	11.3	62.98	-34.40	-13
1GHz – 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:

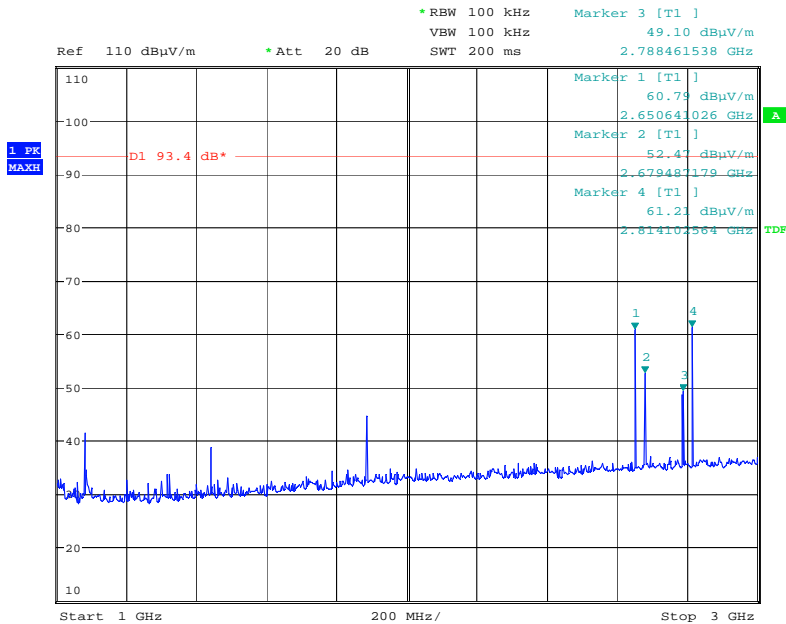
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ANTENNA	CHASE	CBL6612B	2803	UH93	X
ANTENNA	EMCO	3115	9010-3580	138	X
PRE AMPLIFIER	HP	8449B	3008A016	572	X

Radiated emissions 856.0 MHz 30MHz – 1GHz



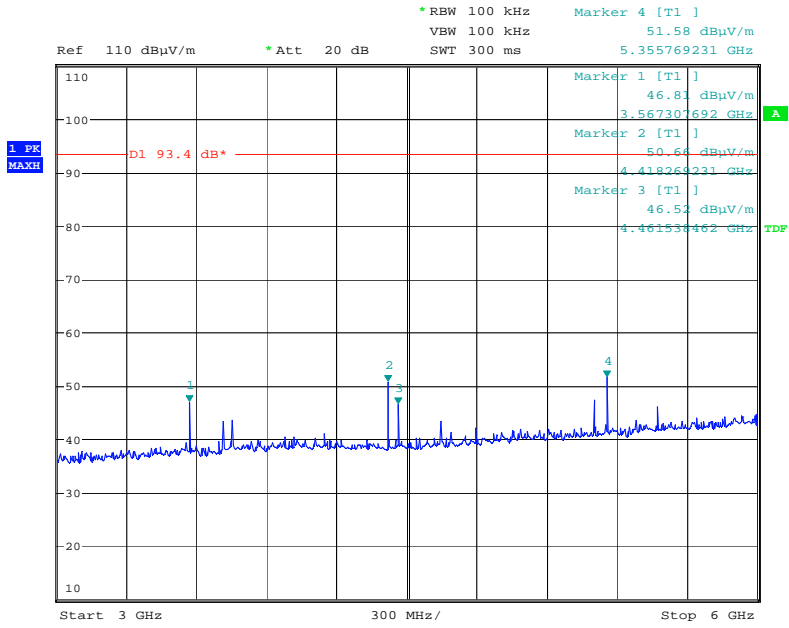
Date: 22.DEC.2006 12:32:51

Radiated emissions 856.0 MHz 1 – 3GHz



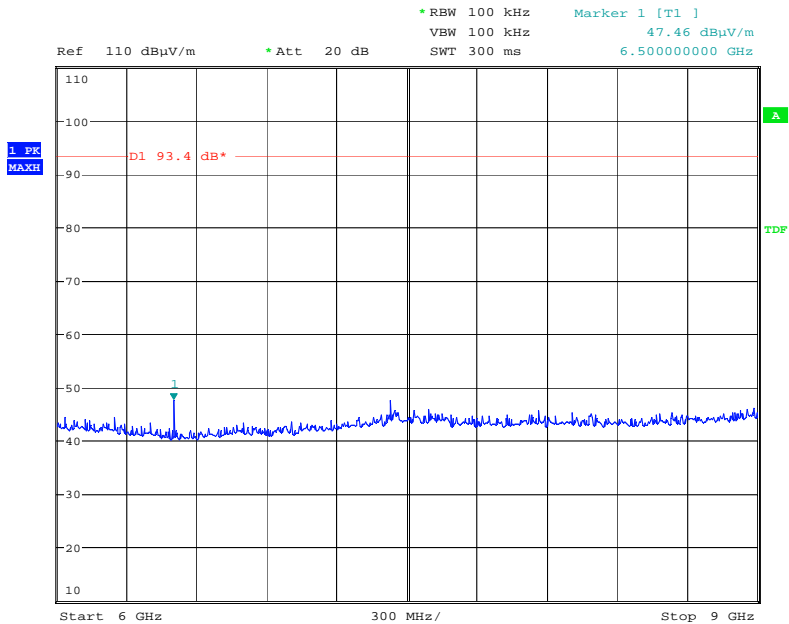
Date: 21.DEC.2006 12:52:59

Radiated emissions 856.0 MHz 3 – 6GHz



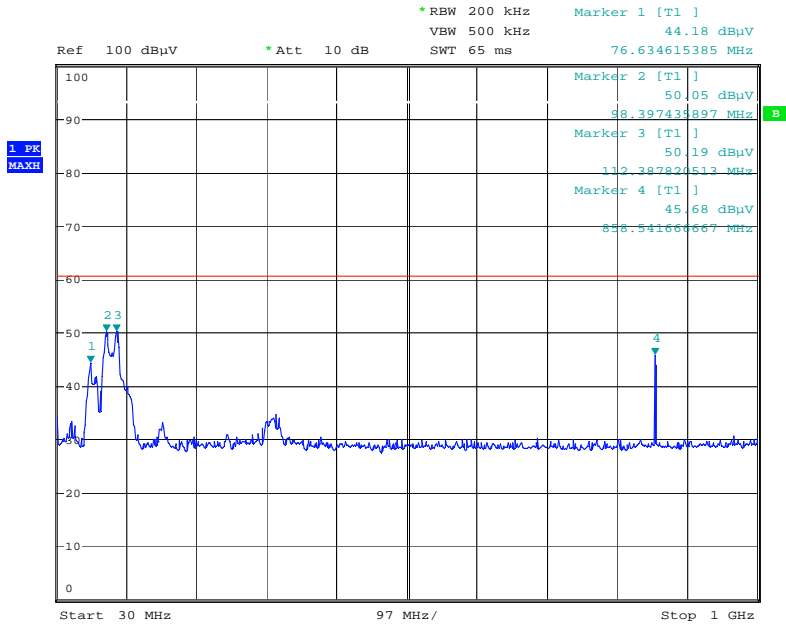
Date: 21.DEC.2006 12:52:23

Radiated emissions 856.0 MHz 6 – 9GHz



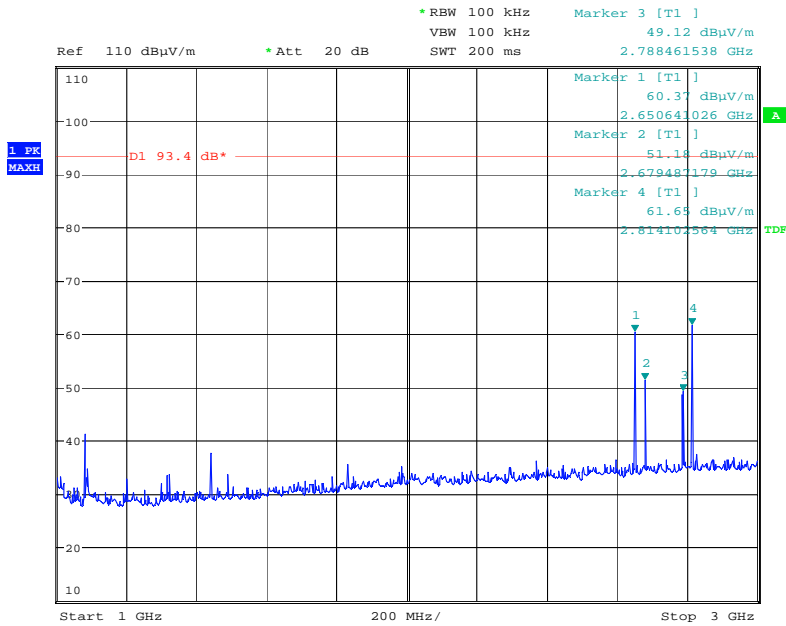
Date: 21.DEC.2006 12:51:22

Radiated emissions 858.5 MHz 30MHz – 1GHz



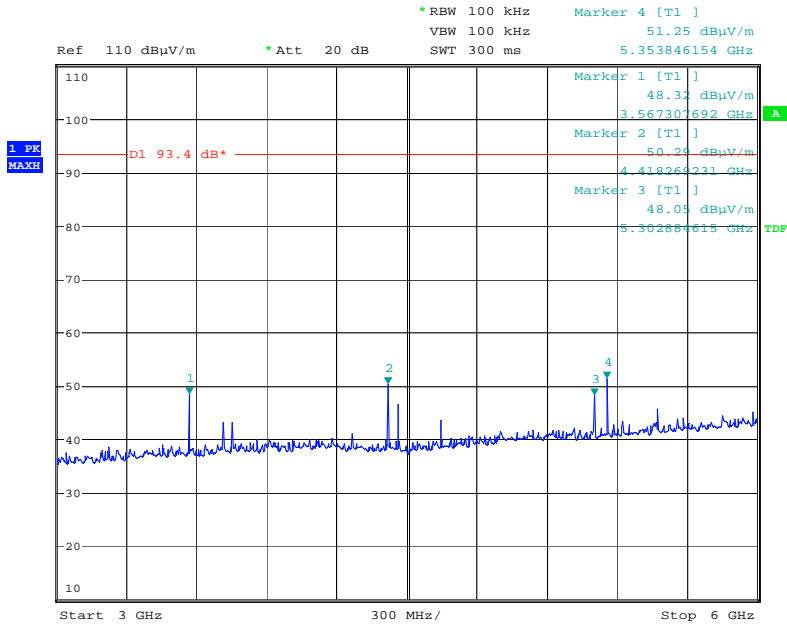
Date: 22.DEC.2006 12:37:48

Radiated emissions 858.5 MHz 1 – 3GHz



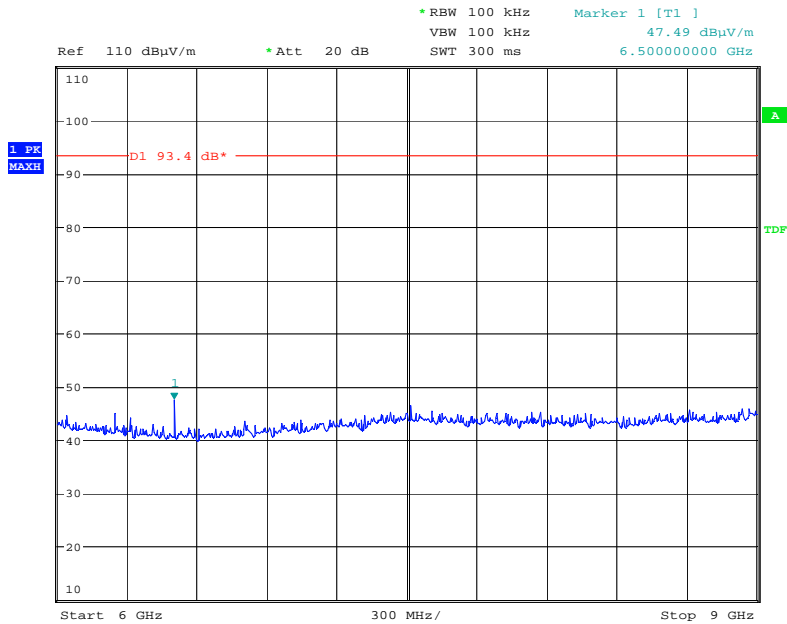
Date: 21.DEC.2006 12:54:07

Radiated emissions 858.5 MHz 3 – 6GHz



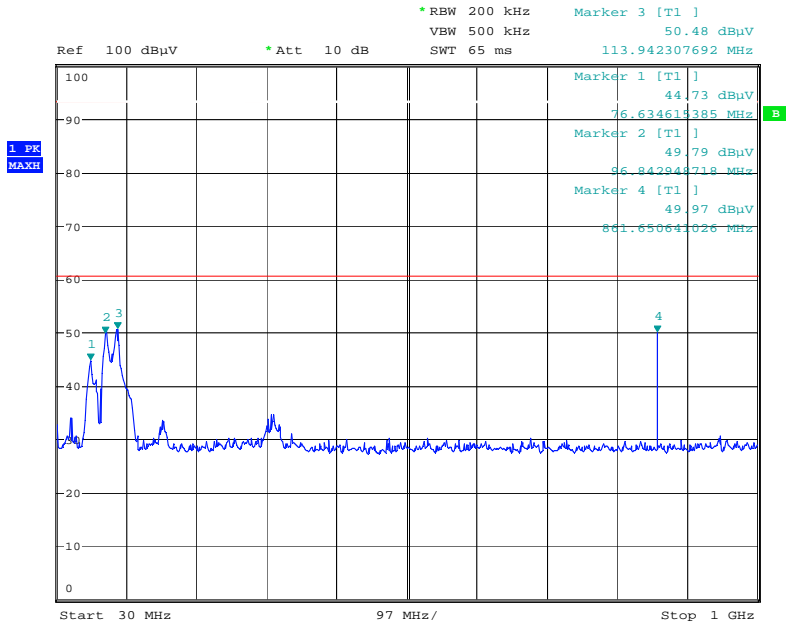
Date: 21.DEC.2006 12:54:53

Radiated emissions 858.5 MHz 6 – 9GHz



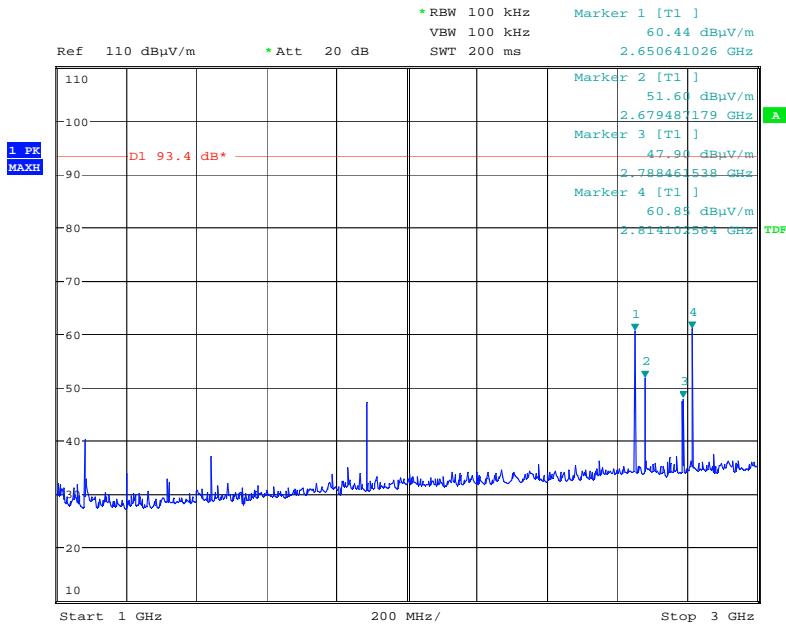
Date: 21.DEC.2006 12:55:13

Radiated emissions 861.0 MHz 30MHz – 1GHz



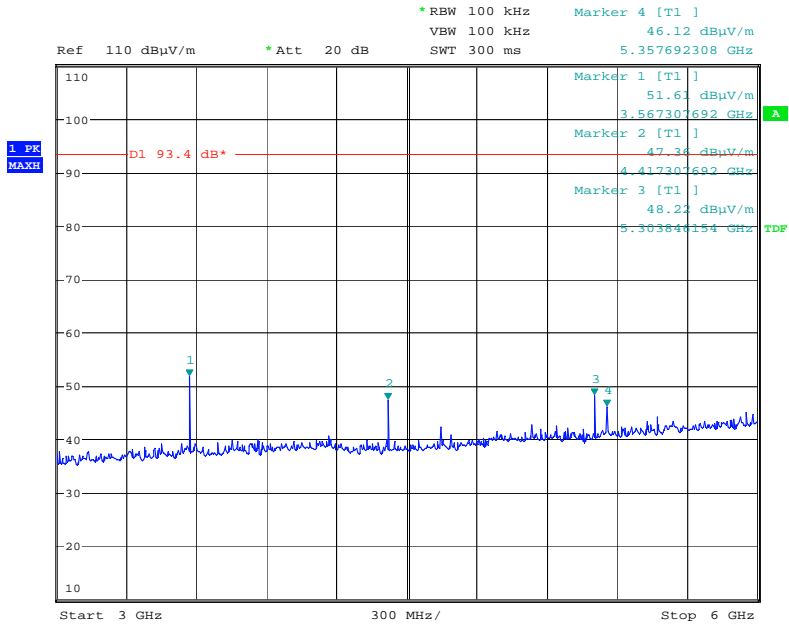
Date: 22.DEC.2006 12:40:54

Radiated emissions 861.0 MHz 1 – 3GHz



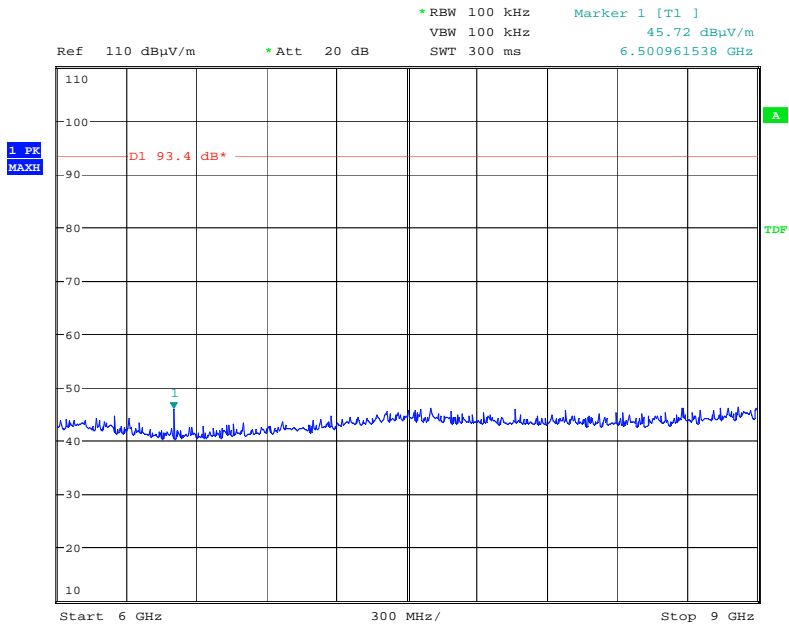
Date: 21.DEC.2006 13:01:38

Radiated emissions 861.0 MHz 3 – 6GHz



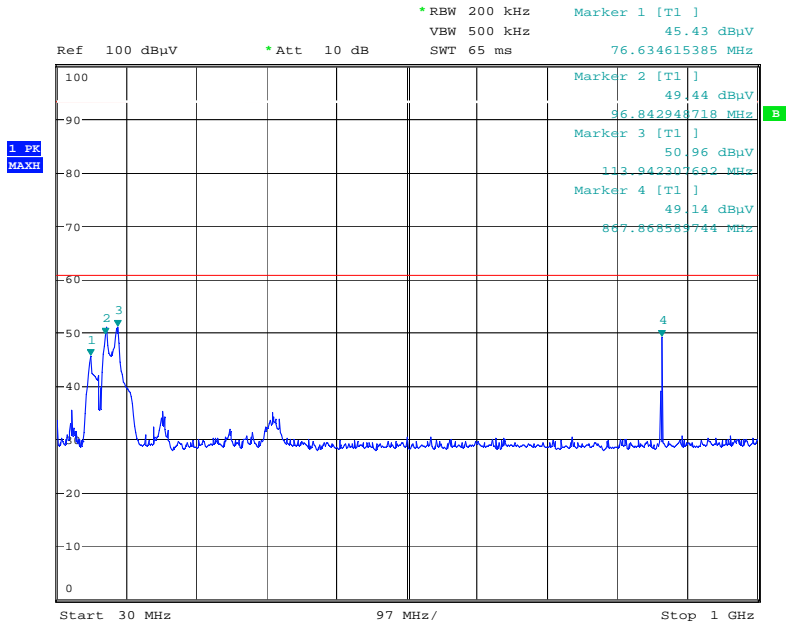
Date: 21.DEC.2006 13:04:42

Radiated emissions 861.0 MHz 6 – 9GHz



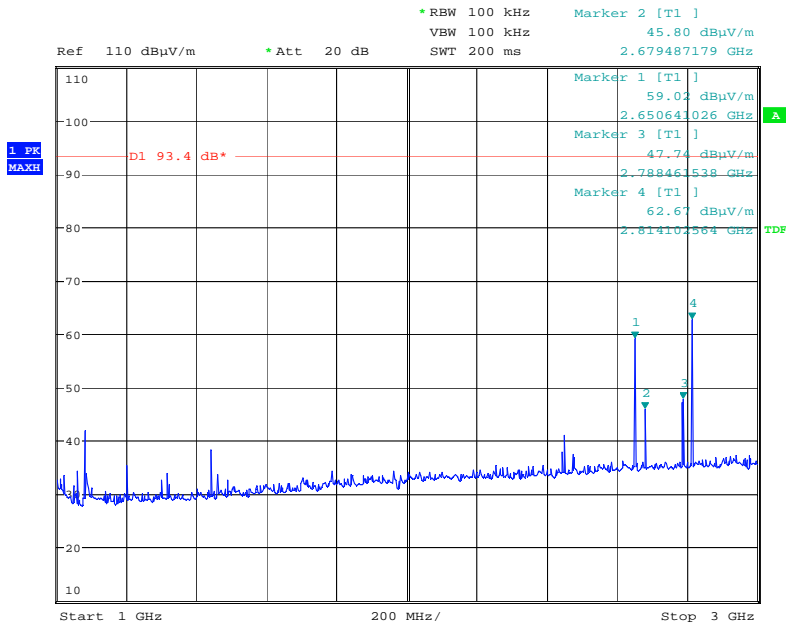
Date: 21.DEC.2006 13:05:12

Radiated emissions 866.0 MHz 30MHz – 1GHz



Date: 22.DEC.2006 12:41:41

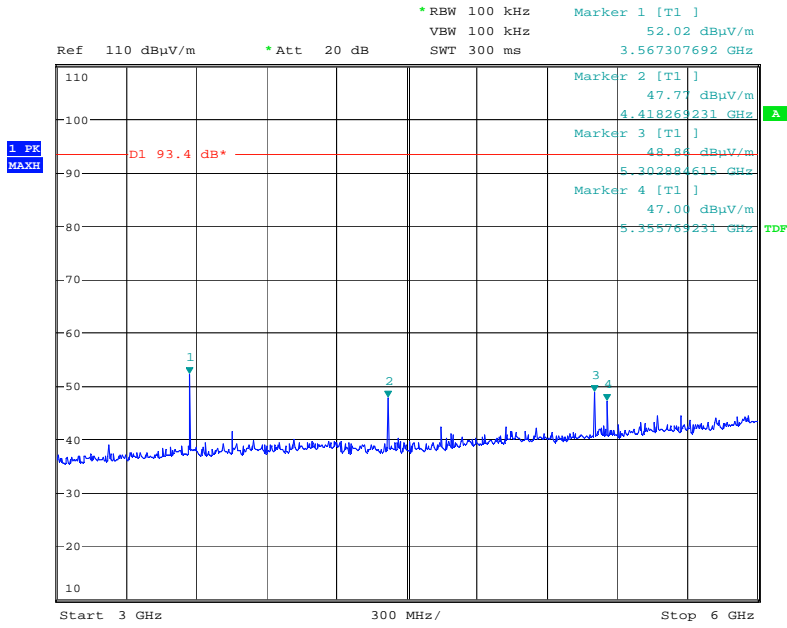
Radiated emissions 866.0 MHz 1 – 3GHz



Date: 21.DEC.2006 13:06:12

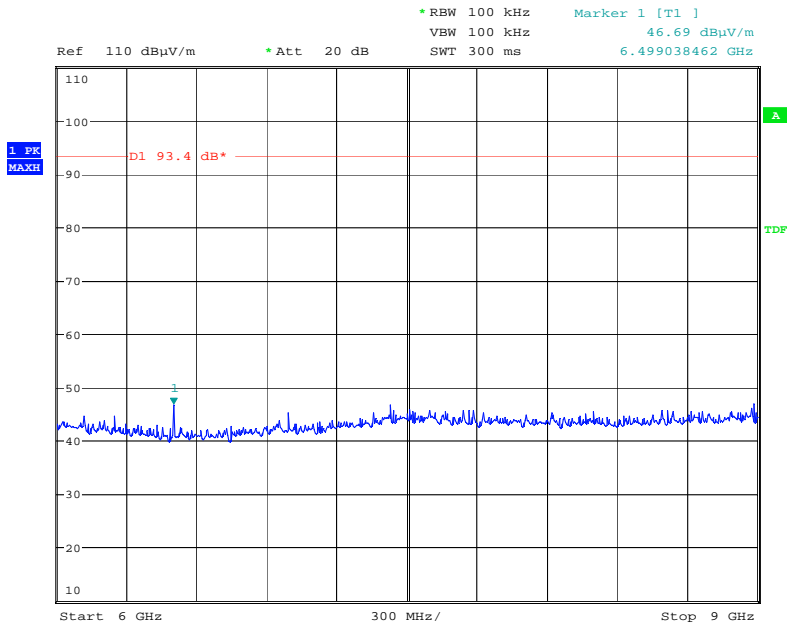


Radiated emissions 866.0 MHz 3 – 6GHz



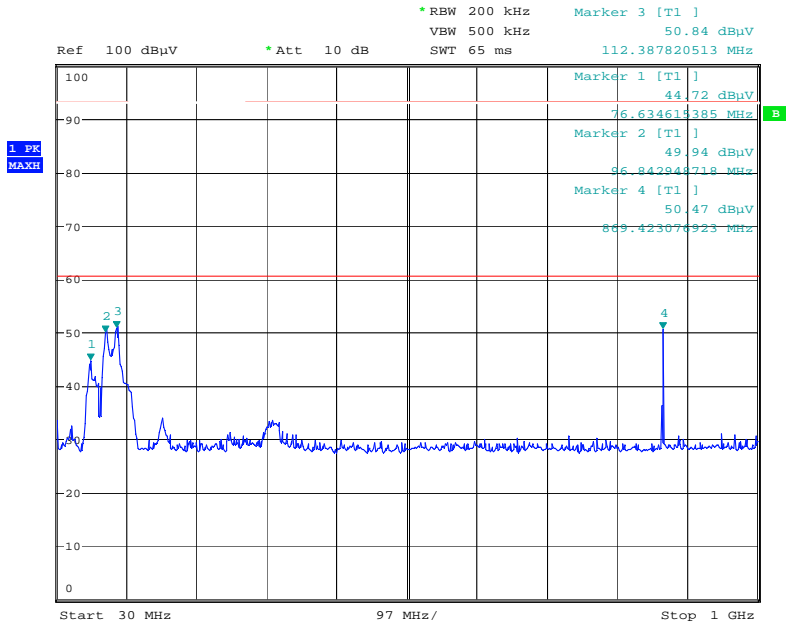
Date: 21.DEC.2006 13:06:48

Radiated emissions 866.0 MHz 6 – 9GHz



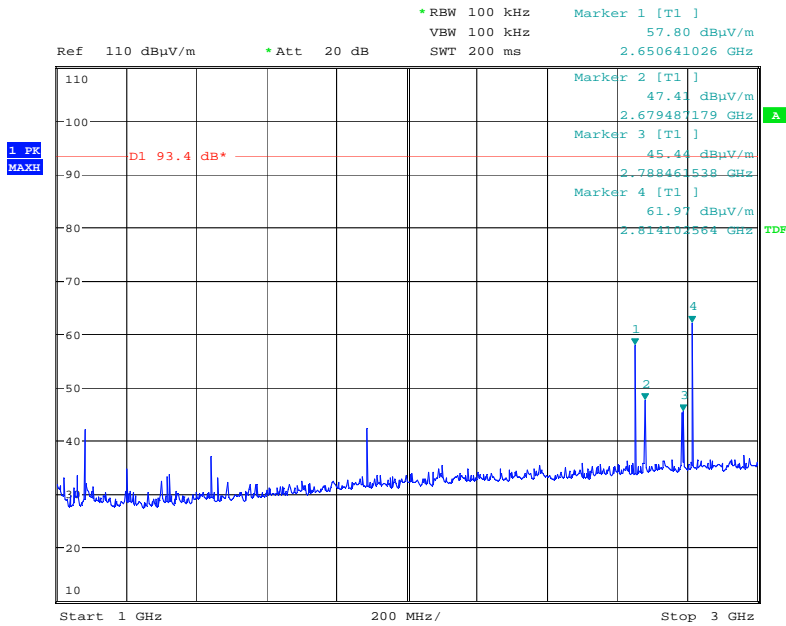
Date: 21.DEC.2006 13:07:12

Radiated emissions 867.5 MHz 30MHz – 1GHz



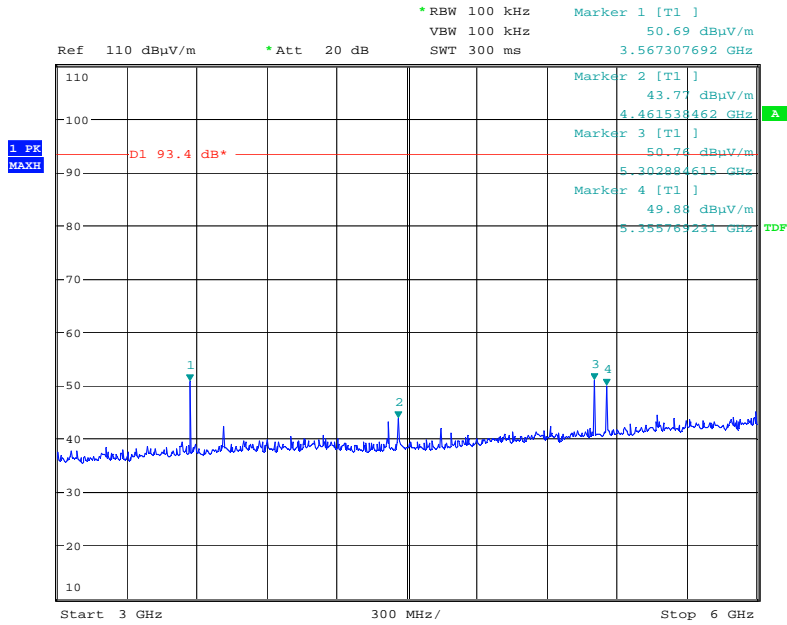
Date: 22.DEC.2006 12:44:06

Radiated emissions 867.5 MHz 1 – 3GHz



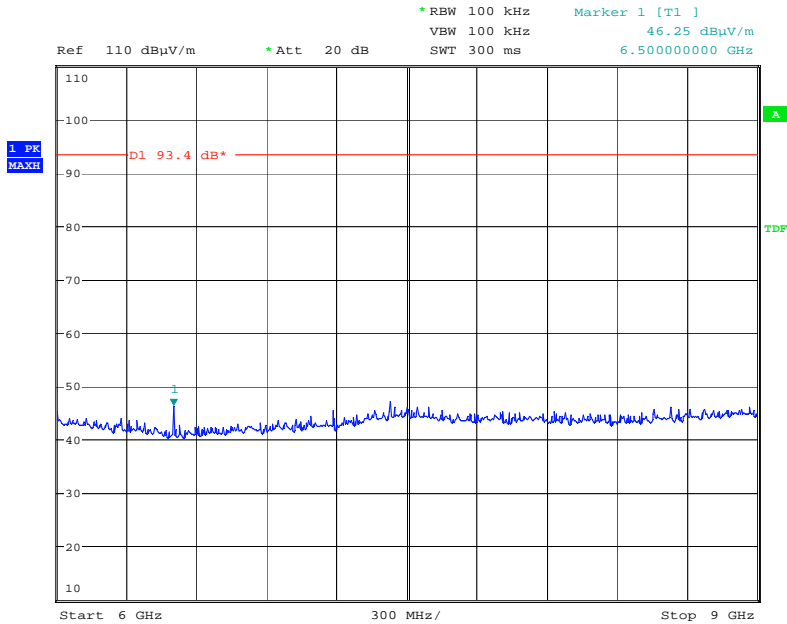
Date: 21.DEC.2006 13:13:55

Radiated emissions 867.5 MHz 3 – 6GHz



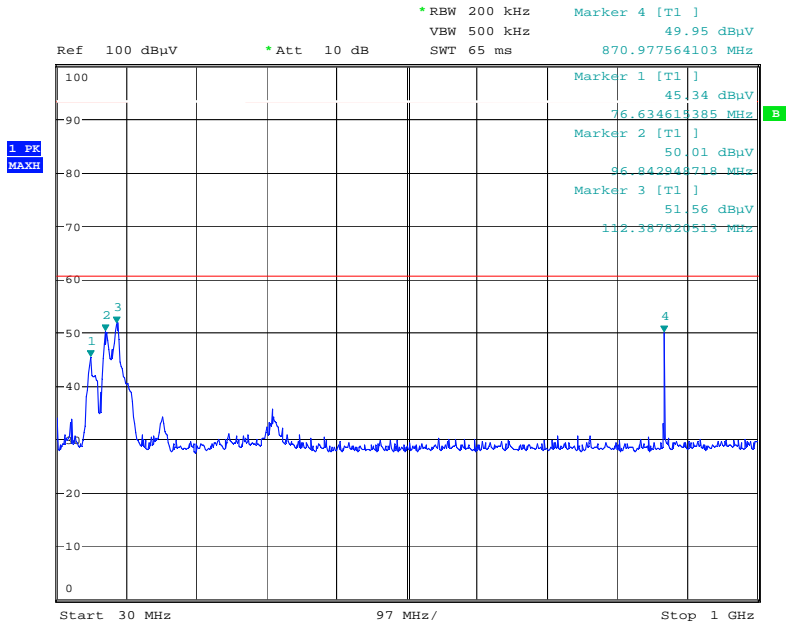
Date: 21.DEC.2006 13:13:16

Radiated emissions 867.5 MHz 6 – 9GHz



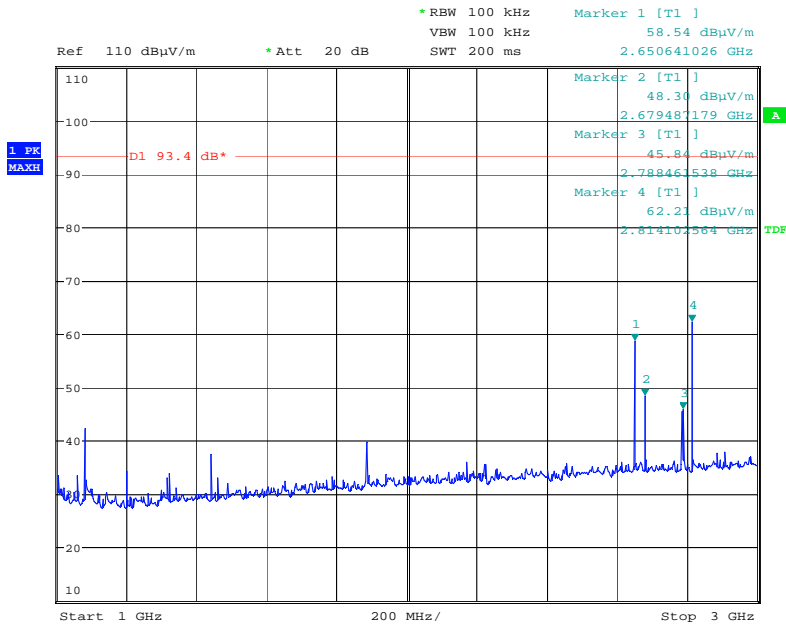
Date: 21.DEC.2006 13:12:26

Radiated emissions 869.0 MHz 30MHz – 1GHz



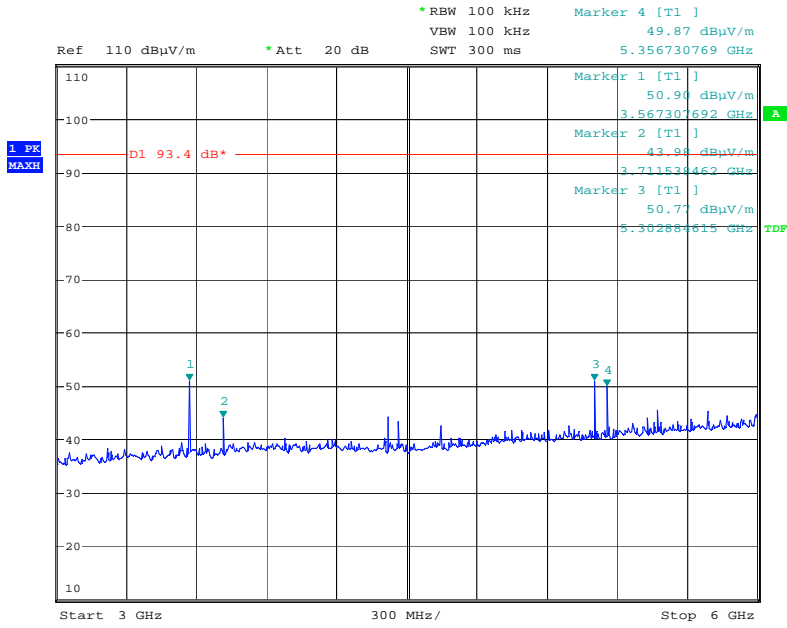
Date: 22.DEC.2006 12:45:06

Radiated emissions 869.0 MHz 1 – 3GHz



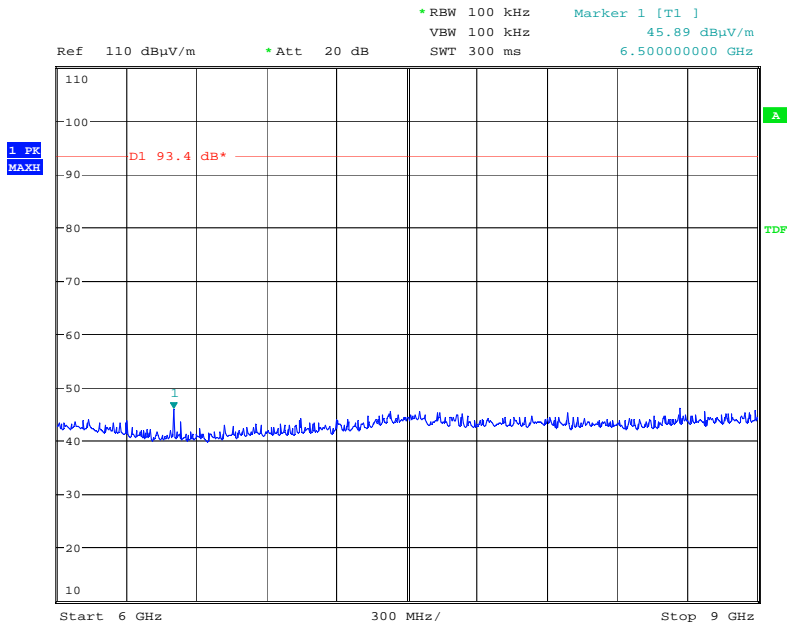
Date: 21.DEC.2006 13:14:28

Radiated emissions 869.0 5 MHz 3 – 6GHz



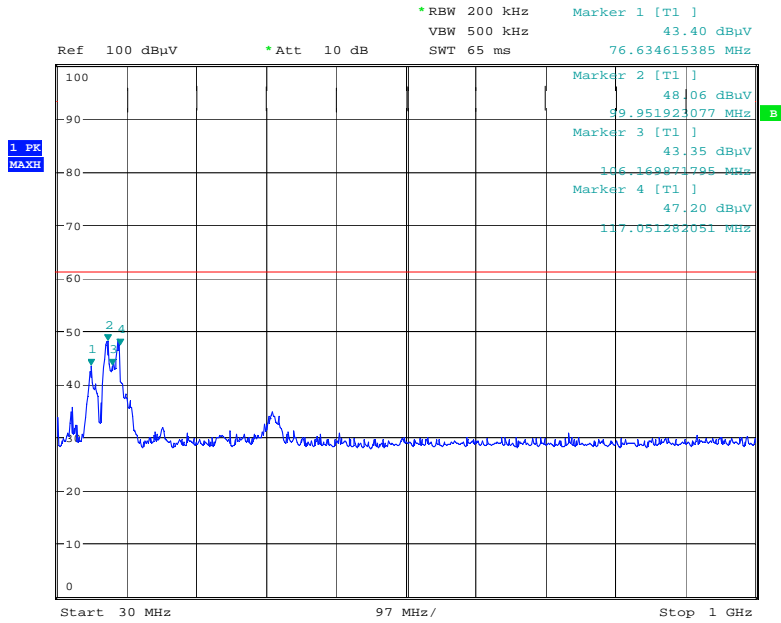
Date: 21.DEC.2006 13:15:04

Radiated emissions 869.0 5 MHz 6 – 9GHz



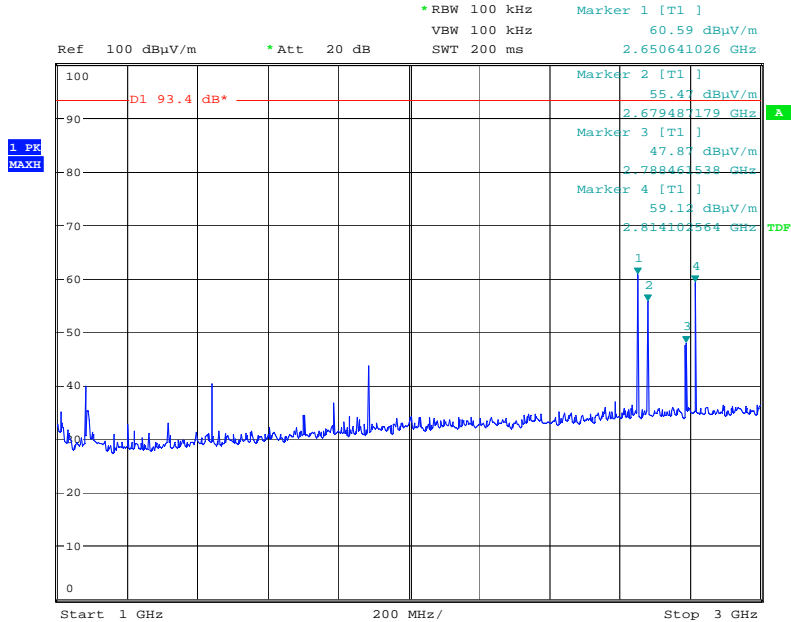
Date: 21.DEC.2006 13:15:21

Radiated emissions no input signal 30MHz – 1GHz



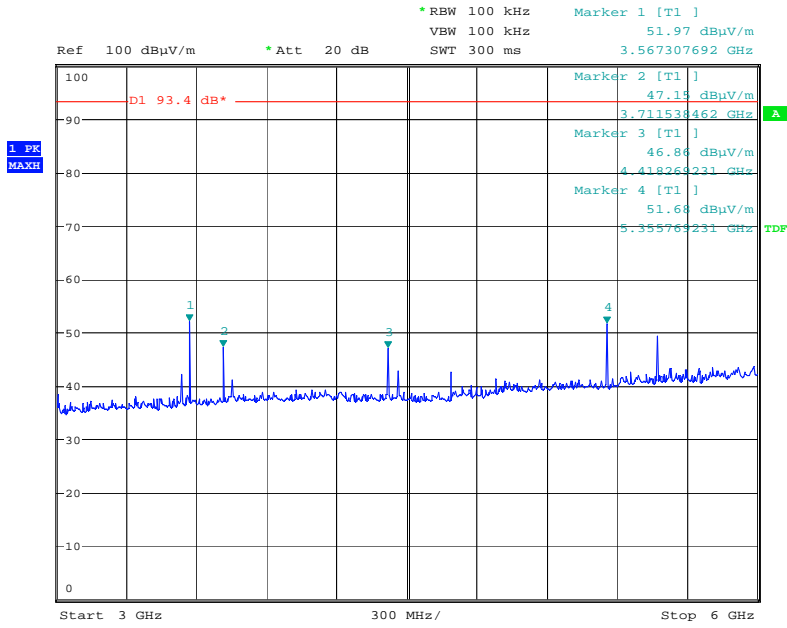
Date: 22.DEC.2006 12:28:07

Radiated emissions no input signal 1 – 3GHz



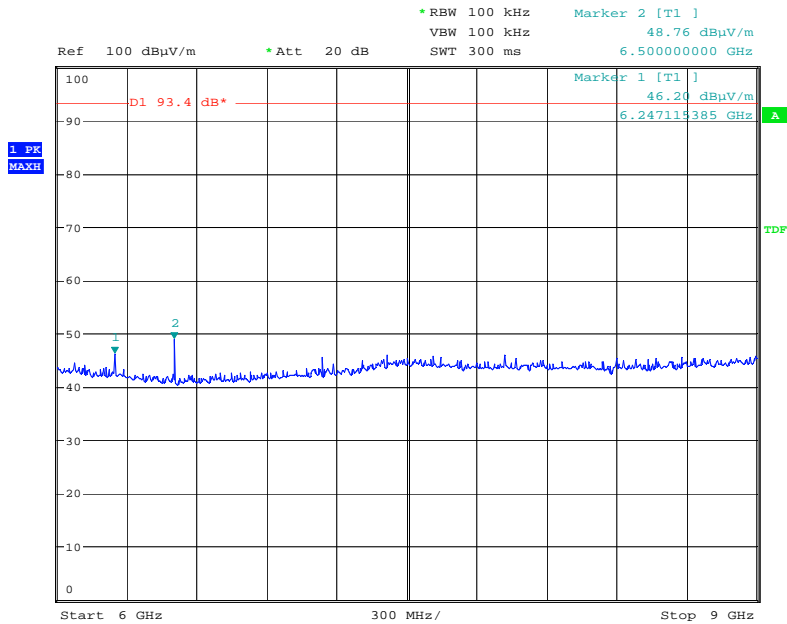
Date: 21.DEC.2006 12:21:51

Radiated emissions no input signal 3 – 6GHz



Date: 21.DEC.2006 12:22:37

Radiated emissions no input signal 6 – 9GHz



Date: 21.DEC.2006 12:26:38

**ANNEX A**  
**PHOTOGRAPHS**



PHOTOGRAPH No. 1

**TEST SETUP**



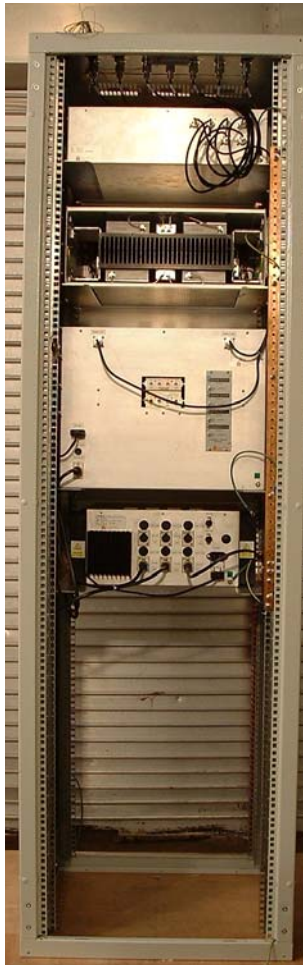
PHOTOGRAPH No. 2

**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**

