



TEST REPORT NO: RU1296/7398
COPY NO: 1
ISSUE NO: 1
FCC ID: NEO50-146601

**REPORT ON THE CERTIFICATION TESTING OF A
AERIAL FACILITIES LIMITED
50-146601 CELL ENHANCER
WITH RESPECT TO
THE FCC RULES CFR 47, PART 90 Subpart I
PRIVATE LAND MOBILE REPEATER.**

TEST DATE: 18th – 22nd December 2006

TESTED BY: _____ D WINSTANLEY

APPROVED BY: _____ J CHARTERS
RADIO SECTION
LEADER

DATE: 26th January 2007

Distribution:

- Copy Nos:
1. Aerial Facilities Limited
 2. TCB: TRL Compliance Limited
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Notes:			
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:	NEO50-146601
PURPOSE OF TEST:	Certification
TEST SPECIFICATION:	FCC RULES CFR 47, Part 90 Subpart I
TEST RESULT:	Compliant to Specification
EQUIPMENT UNDER TEST:	50-146601 Cell Enhancer
EQUIPMENT TYPE:	Private Land Mobile Repeater
MAXIMUM GAIN:	Uplink = 83.54 dB Downlink = 84.76 dB
MAXIMUM INPUT:	Uplink = -58.52 dBm Downlink = -55.55 dBm
MAXIMUM OUTPUT CONDUCTED:	Uplink = 25.02 dBm Downlink = 29.21 dBm
ANTENNA TYPE:	Uplink Yagi Downlink Distributed Antenna System
ANTENNA GAIN:	Uplink = 9 dBi Downlink = N/A, Leaky Feed Antenna
MAXIMUM OUTPUT RADIATED:	Uplink = 34.02 dBm
NUMBER OF CHANNELS:	Uplink = 6 Downlink = 6
CHANNEL BANDWIDTH:	15 kHz
FREQUENCY GENERATION:	N/A
MODULATION TYPE:	F3E
POWER SOURCE(s):	+110Vac
TEST DATE(s):	18 th – 22 nd December 2006
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):	50-146601 Cell Enhancer
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 <input checked="" type="checkbox"/> No <input type="checkbox"/>
APPLICANT'S CATEGORY:	MANUFACTURER <input checked="" type="checkbox"/> IMPORTER <input type="checkbox"/> DISTRIBUTOR <input type="checkbox"/> TEST HOUSE <input type="checkbox"/> AGENT <input type="checkbox"/>
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 th – 22 nd December 2006
TEST REPORT No:	RU1296/7398

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) | 17°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:

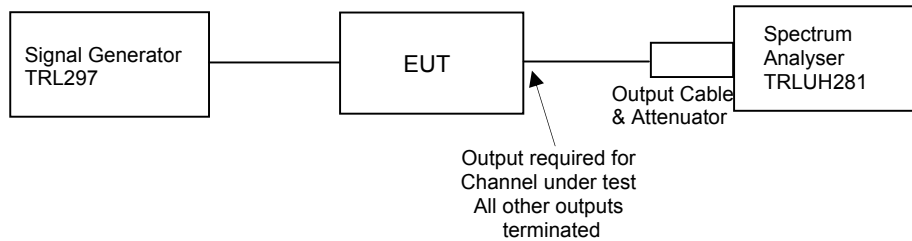
The 50-146601 is a bi-directional amplifier. The uplink is channelised and utilizes 6 channels and operates between the frequencies 458.750 MHz - 484.0375. The uplink consists of 1 input path and 3 output paths. The downlink is channelised and utilizes 6 channels and operates between the frequencies 453.750 MHz - 485.6375. The downlink consists of 3 input paths and 1 output path.

COMPLIANCE TESTS

AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – UPLINK

Ambient temperature = 19°C
 Relative humidity = 48%
 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
458.7500	-55.0	0.48	32.38	-7.78	80.08	24.60	70.70
460.0375	-58.0	0.52	32.38	-7.36	83.54	25.02	74.18
470.7125	-52.0	0.60	32.33	-7.02	77.91	25.45	68.94
474.2625	-57.0	0.50	32.30	-7.62	82.18	24.68	72.78
476.8375	-55.0	0.50	32.30	-6.87	80.93	25.43	71.29
484.0375	-57.5	0.46	32.31	-7.14	83.13	25.17	73.65

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
458.7500	80.08	24.60	9	33.60
460.0375	83.54	25.02	9	34.02
470.7125	77.91	25.45	9	34.45
474.2625	82.18	24.68	9	33.68
476.8375	80.93	25.43	9	34.43
484.0375	83.13	25.17	9	34.17

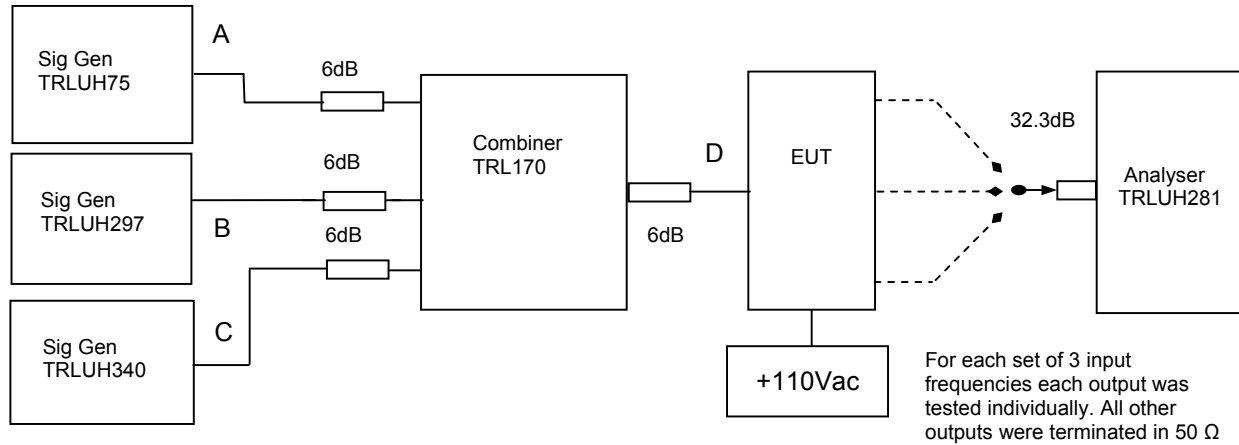
Notes: 1. The Antenna is a yagi with 9dBi Gain.

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

AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – PART 2.1053– UPLINK

Ambient temperature = 21°C
 Relative humidity = 46%
 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 32.3dB. The signal generators were set to the input frequencies listed below and for each set of 3 frequencies each antenna port was checked individually. Unused outputs were terminated in 50Ω. The results recoded below are for the worst case intermodulation product from any of the 3 antenna ports for the combination of input frequencies.

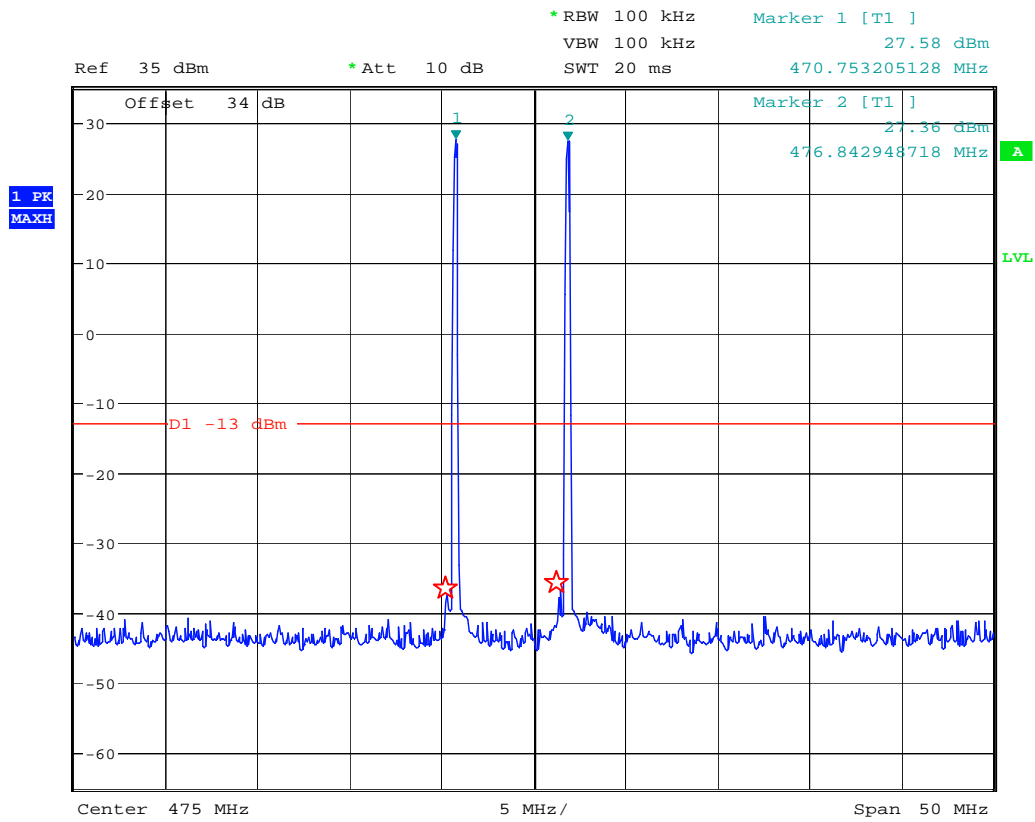
RF Input Frequency (MHz)			Highest Intermodulation Product Level & Frequency (dBm) & (MHz)	Limit (dBm)
476.8375	470.7125	458.7500	-30.89 dBm @ 4.00641 MHz	-13
484.0375	474.2625	460.0375	-31.07 dBm @ 8.01280 MHz	-13
484.0375	460.0375	458.7500	-31.61 dBm @ 24.0384 MHz	-13
484.0375	476.8375	458.7500	No Significant Products	-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
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
SIGNAL GENERATOR	MARCONI	2022D	119215/058	UH75	X
SIGNAL GENERATOR	HP	83630B	3722A00588	UH340	X
COMBINER	ELCOM	RC-4-50	N/A	170	X

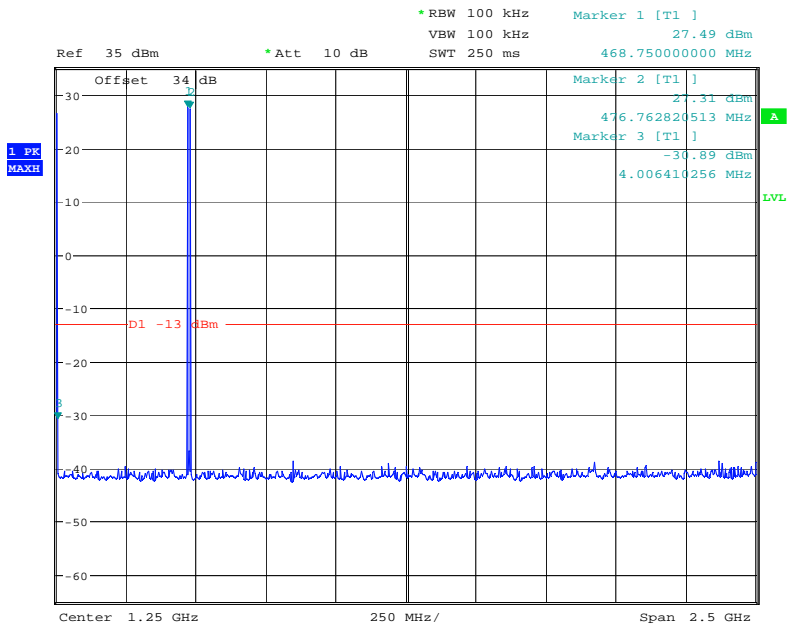
Intermodulation Inband



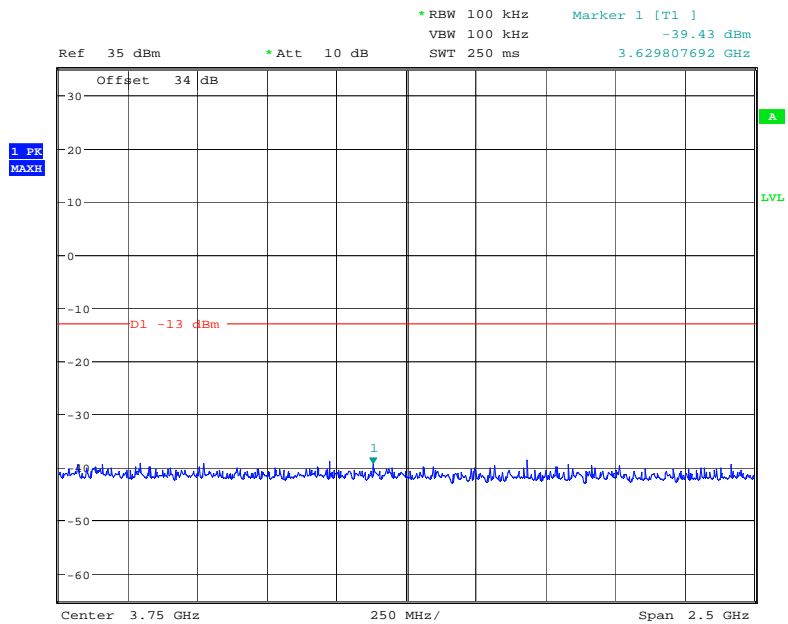
Date: 19.DEC.2006 12:36:01

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

Intermodulation Wideband



Date: 19.DEC.2006 12:35:21



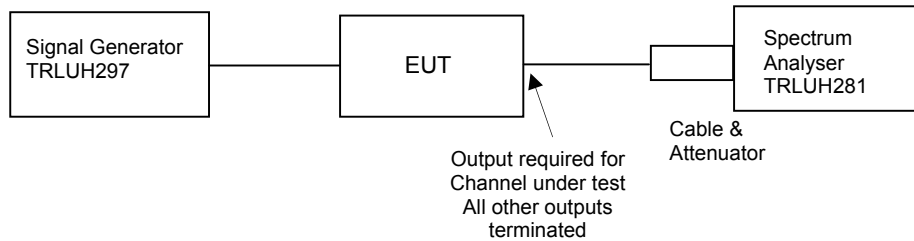
Date: 19.DEC.2006 12:34:59

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 = 19°C Radio Laboratory
 Relative humidity = 48%
 Supply voltage = +110Vac
 Channel number = See test results



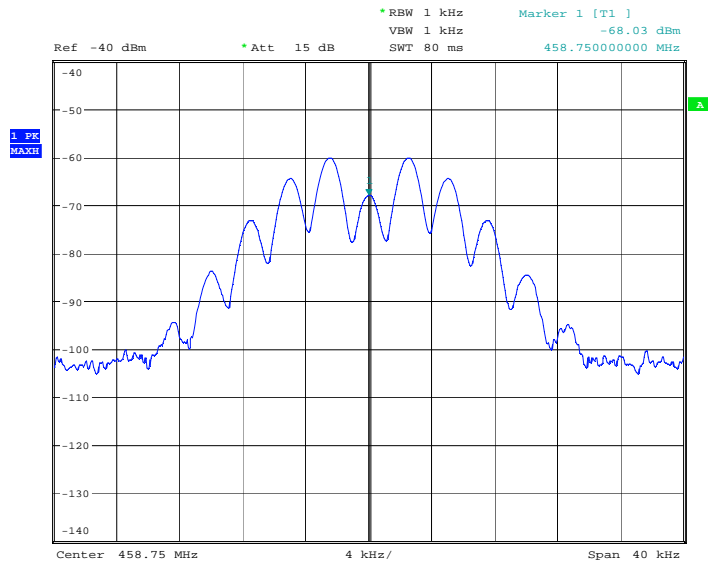
This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level required for the selected channel and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at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

Note: The cables and attenuators had the following losses.

1. Cable and attenuators between EUT and spectrum analyser 32.3dB
2. Cable between signal generator and EUT 0.5dB

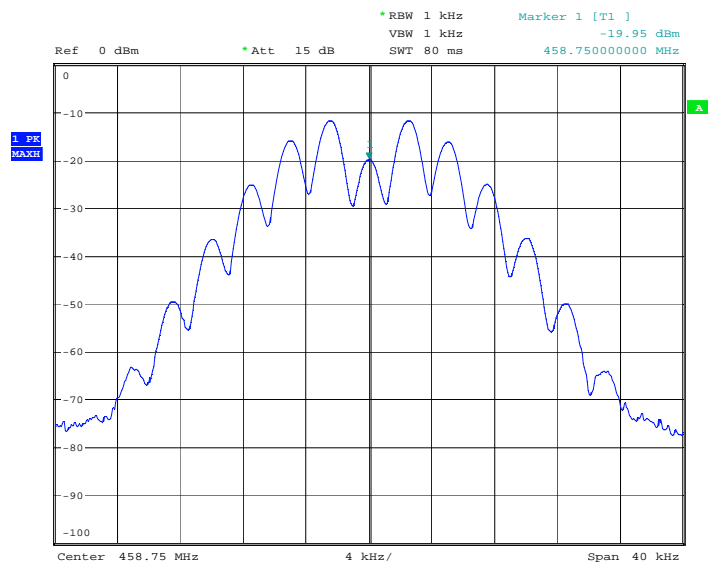
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ATTENUATOR	BIRD	8304-300-N	N/A	220	X
ATTENUATOR	BIRD	8304-0600N	N/A	246	X

458.750 MHz Signal Generator, deviation set to 5 kHz



Date: 18.DEC.2006 16:04:53

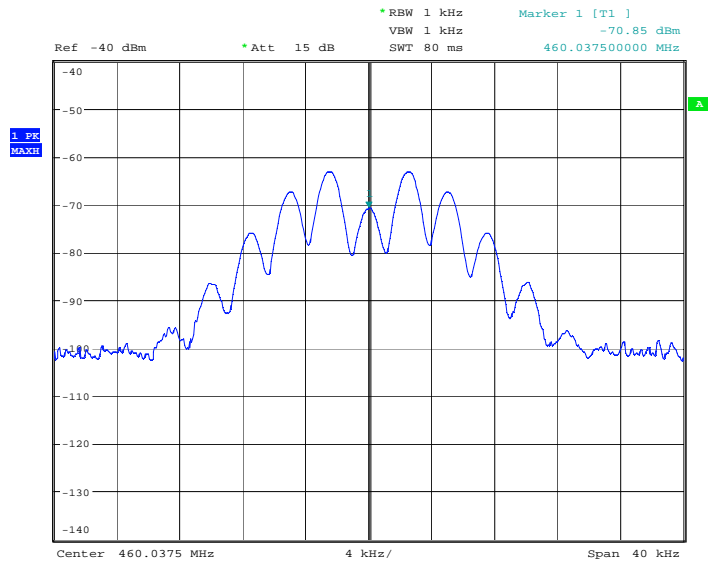
458.750 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 18.DEC.2006 15:08:01

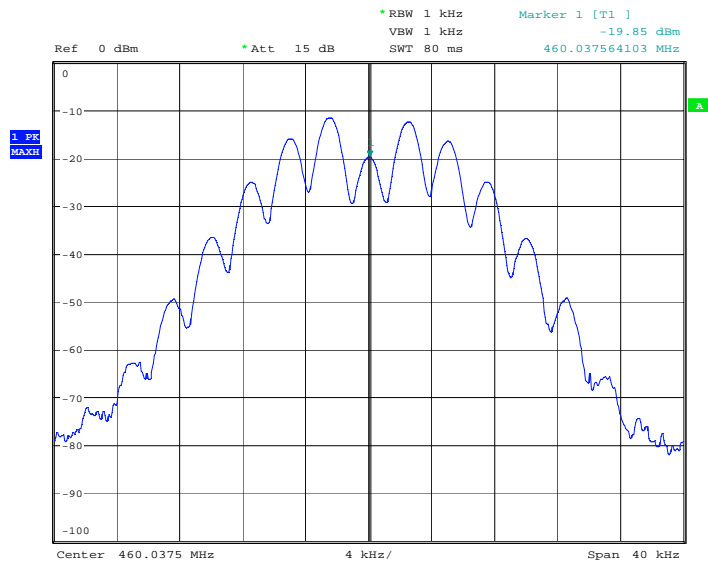
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

460.0375 MHz Signal Generator, deviation set to 5kHz



Date: 18.DEC.2006 16:01:16

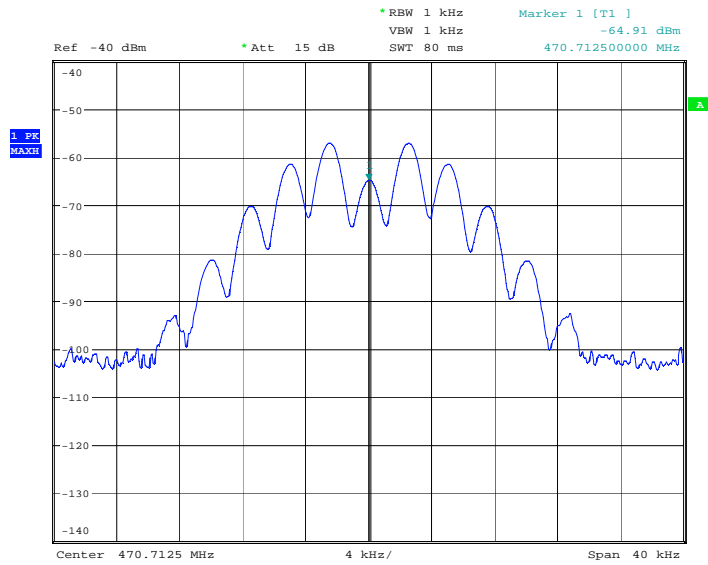
460.0375 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 18.DEC.2006 15:14:32

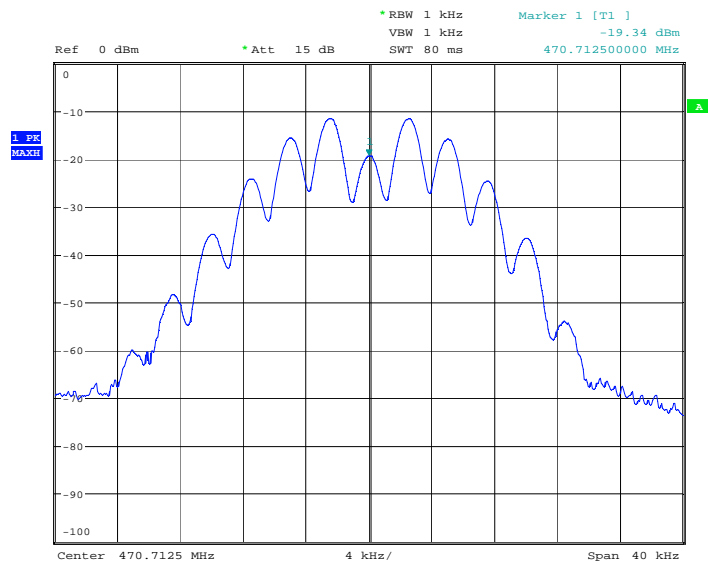
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

470.7125 MHz Signal Generator, deviation set to 5kHz



Date: 18.DEC.2006 16:03:28

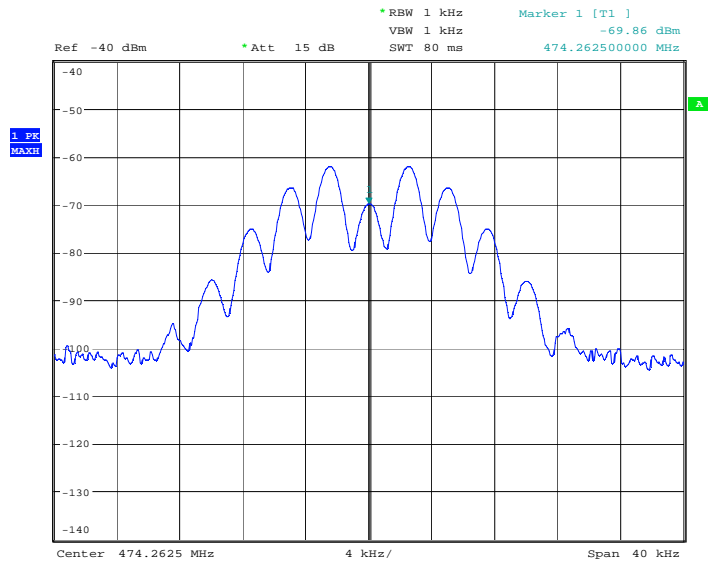
470.7125 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 18.DEC.2006 15:10:50

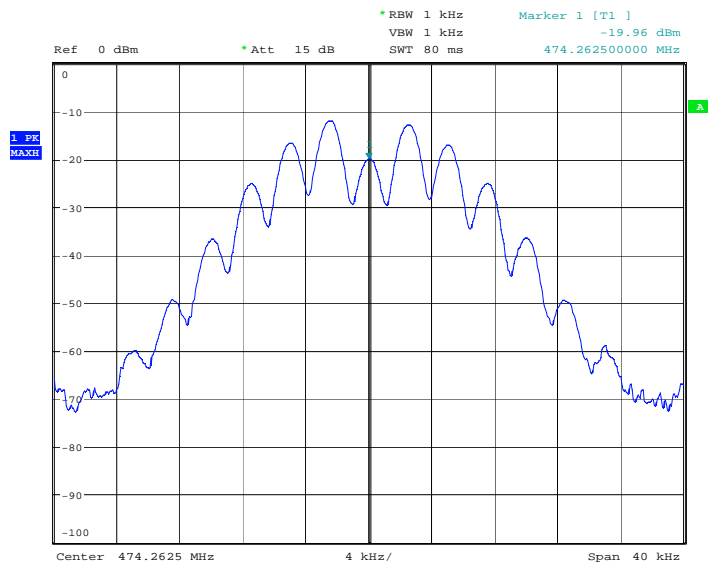
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

474.2625 MHz Signal Generator, deviation set to 5kHz



Date: 18.DEC.2006 16:02:05

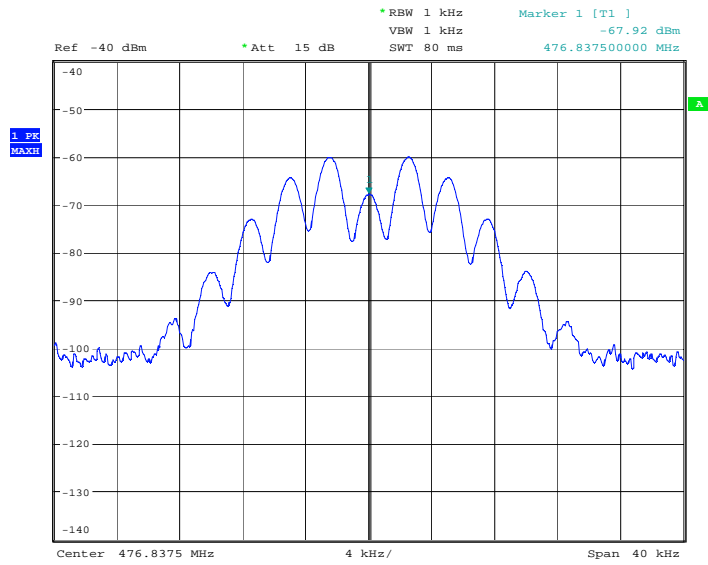
474.2625 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 18.DEC.2006 15:14:59

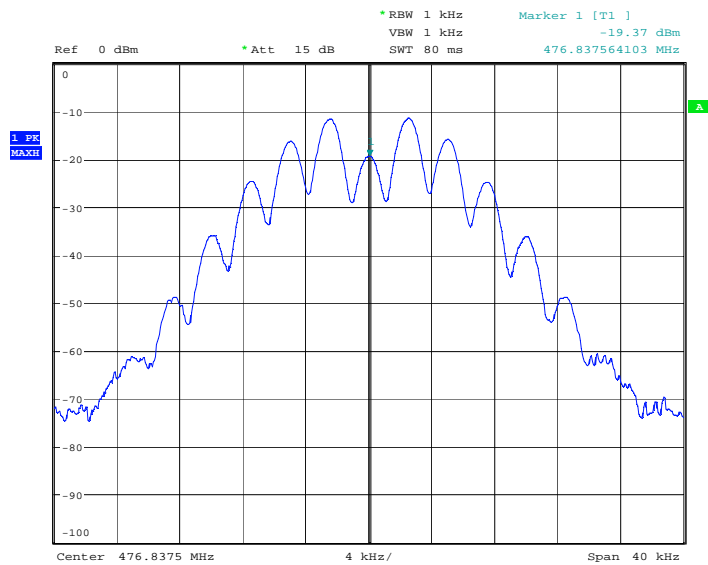
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

476.8375 MHz Signal Generator, deviation set to 5kHz



Date: 18.DEC.2006 16:04:11

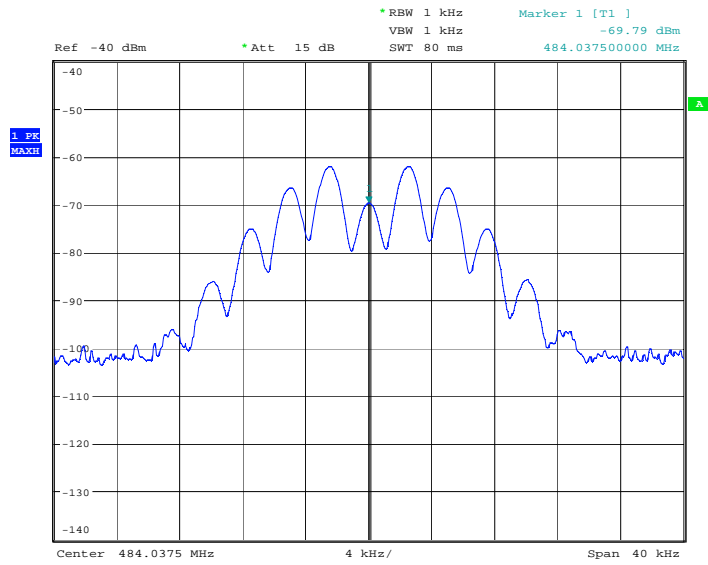
476.8375 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 18.DEC.2006 15:10:02

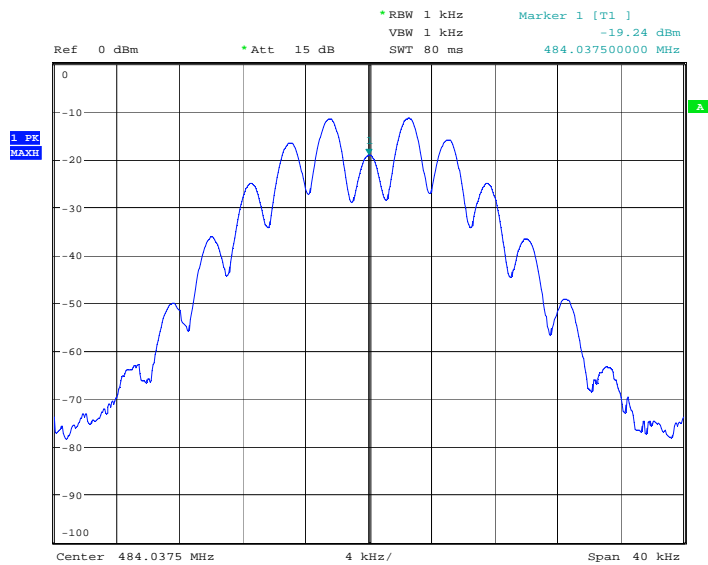
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

484.0375 MHz Signal Generator, deviation set to 5kHz



Date: 18.DEC.2006 16:02:30

484.0375 MHz Signal Generator and EUT, deviation set to 5kHz



Date: 18.DEC.2006 15:16:23

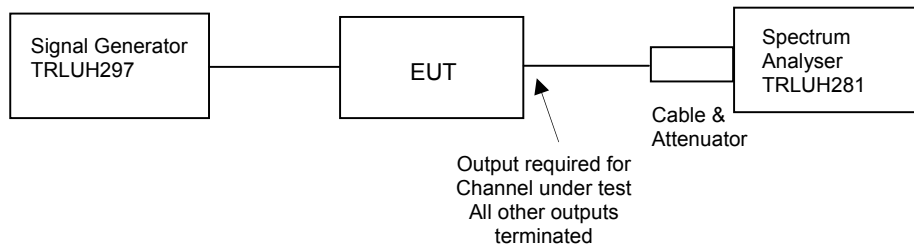
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053 – UPLINK

Ambient temperature = 20°C
 Relative humidity = 48%
 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 $43 + 10 \log \text{PdB}$

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

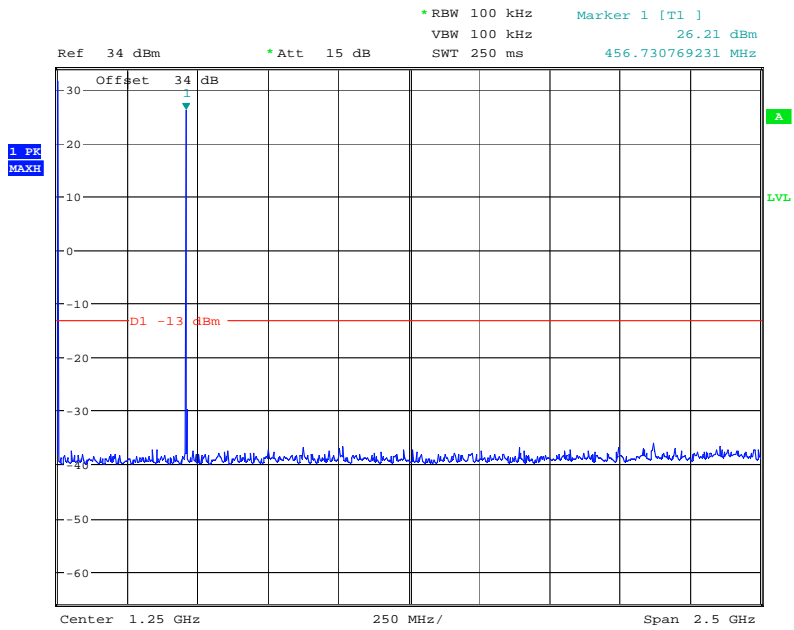
RESULTS

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

The test equipment used for the Transmitter Conducted Emissions:

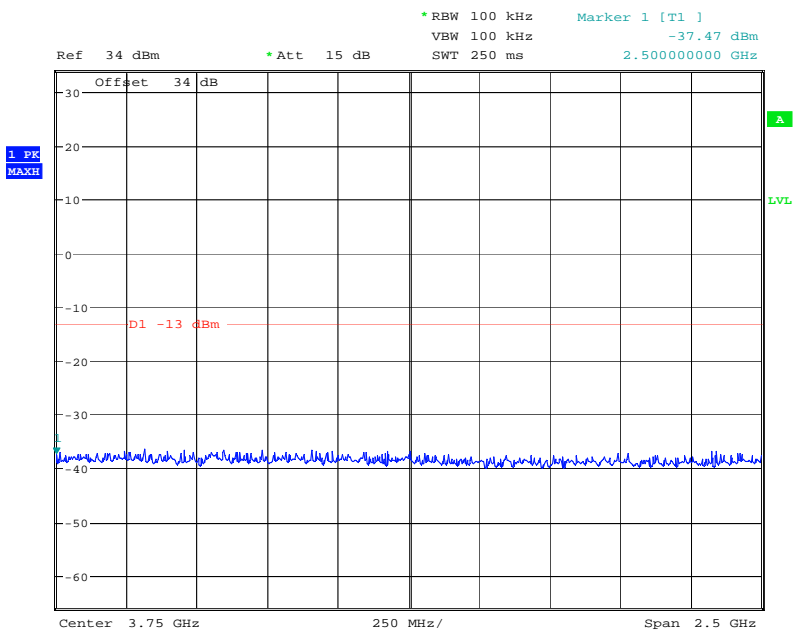
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ATTENUATOR	BIRD	8304-300-N	N/A	220	X
ATTENUATOR	BIRD	8304-0600N	N/A	246	X
CABLE	TRL	N/A	N/A	UH273	X

Conducted emissions 458.750 MHz 0 – 2.5GHz



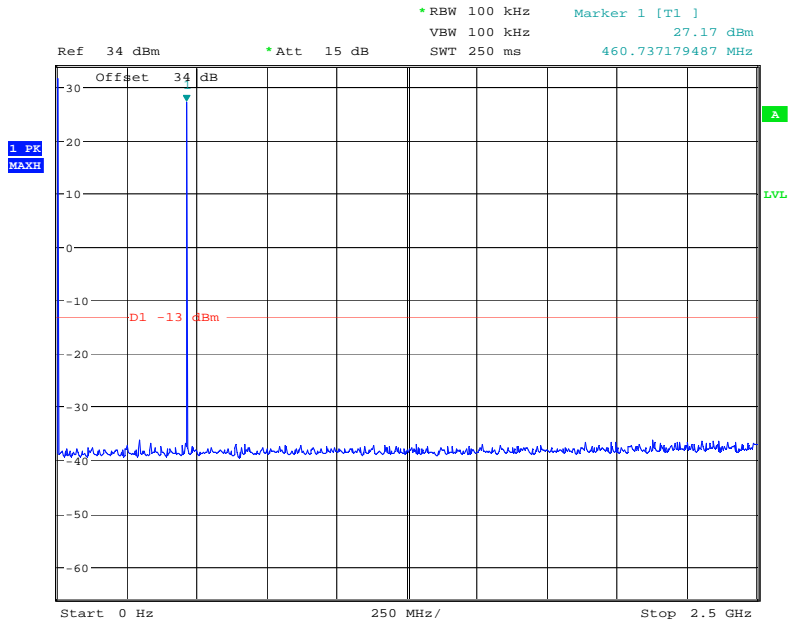
Date: 18.DEC.2006 15:28:59

Conducted emissions 458.750 MHz 2.5 – 5GHz



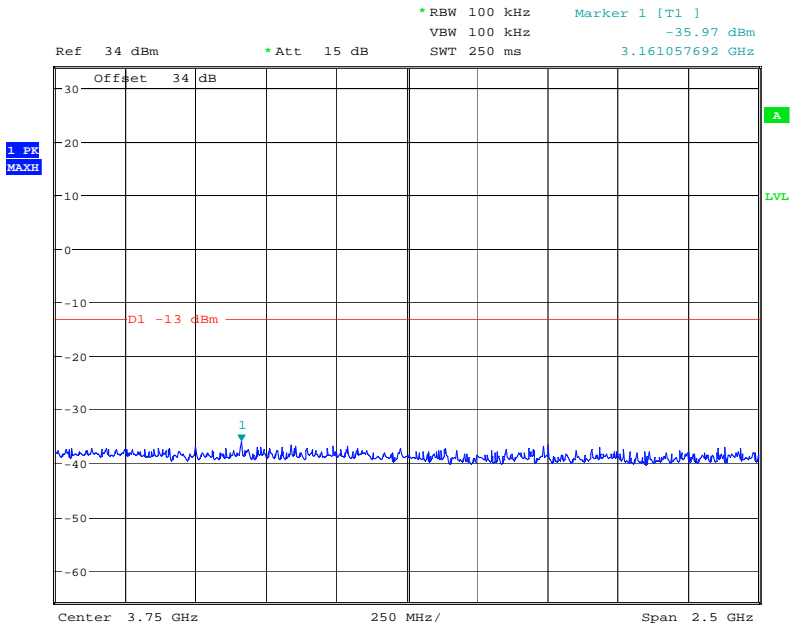
Date: 18.DEC.2006 15:29:23

Conducted emissions 460.0375 MHz 0 – 2.5GHz



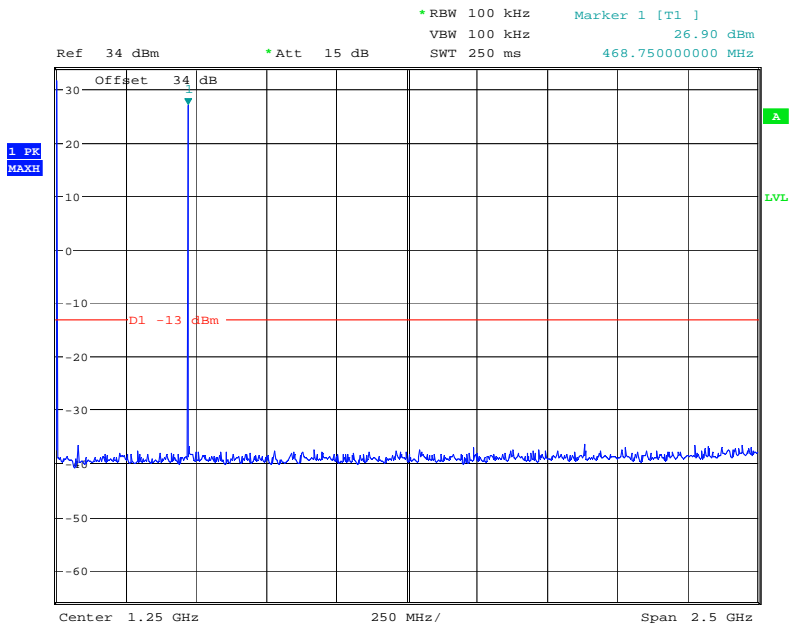
Date: 18.DEC.2006 15:20:32

Conducted emissions 460.0375 MHz 2.5 – 5GHz



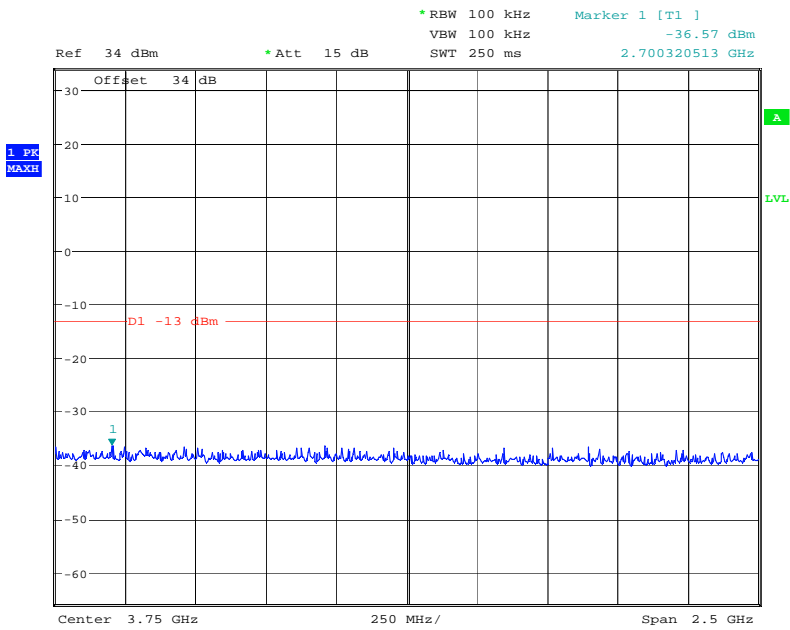
Date: 18.DEC.2006 15:20:52

Conducted emissions 470.7125 MHz 0 – 2.5GHz



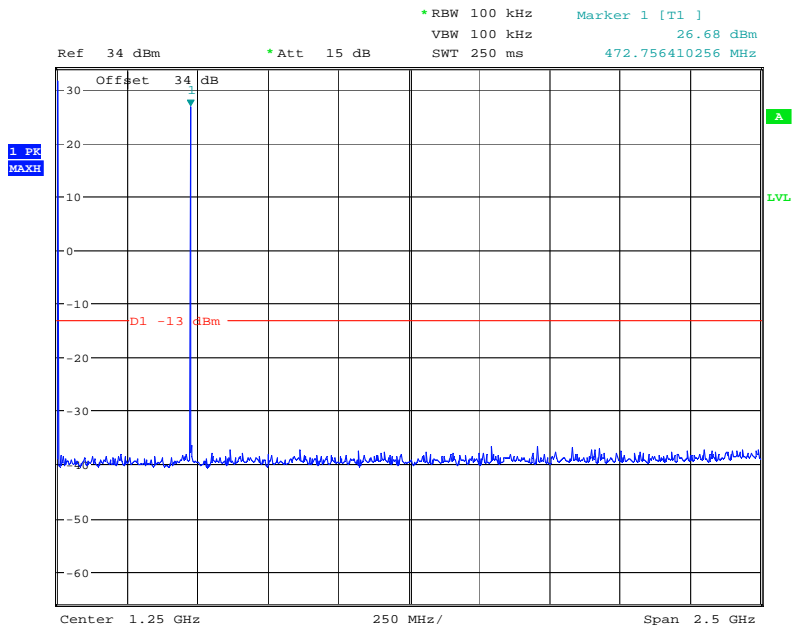
Date: 18.DEC.2006 15:25:49

Conducted emissions 470.7125 MHz 2.5 – 5GHz



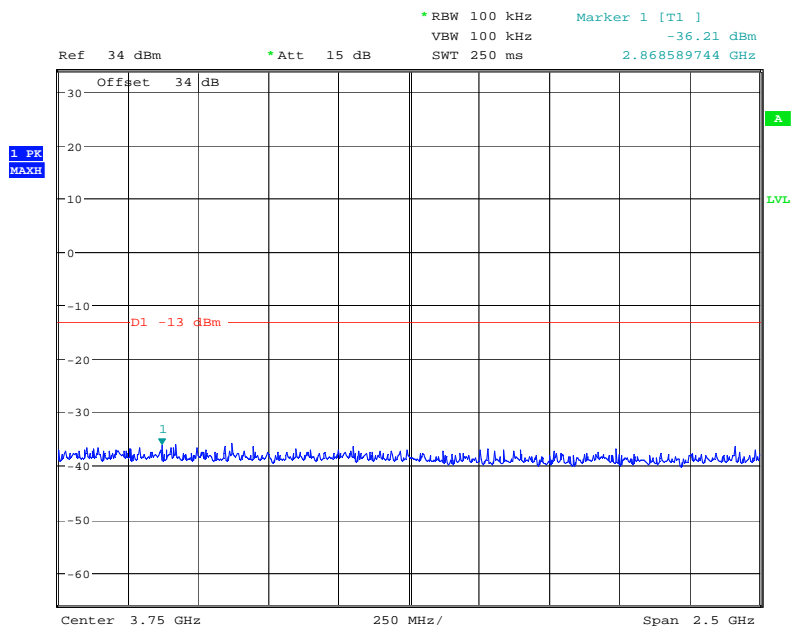
Date: 18.DEC.2006 15:26:06

Conducted emissions 474.2625 MHz 0 – 2.5GHz



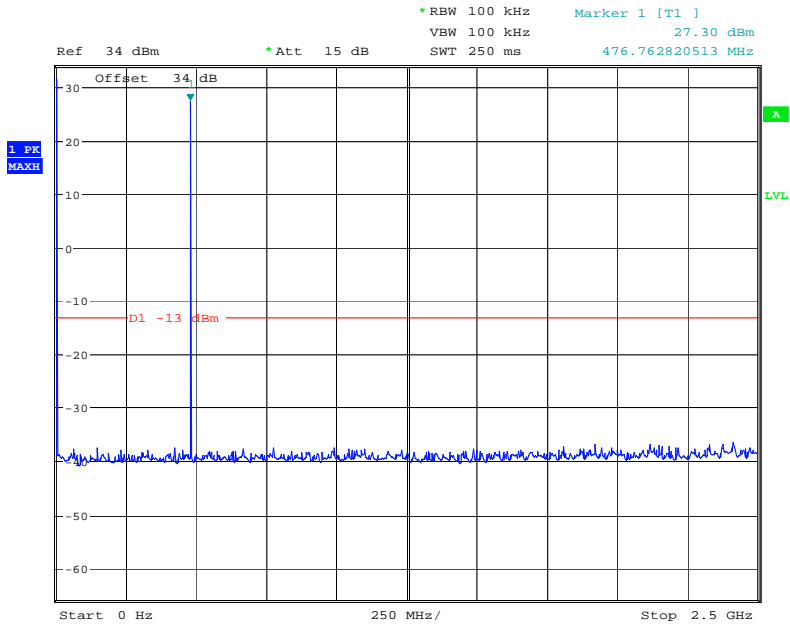
Date: 18.DEC.2006 15:22:11

Conducted emissions 474.2625 MHz 2.5 – 5GHz



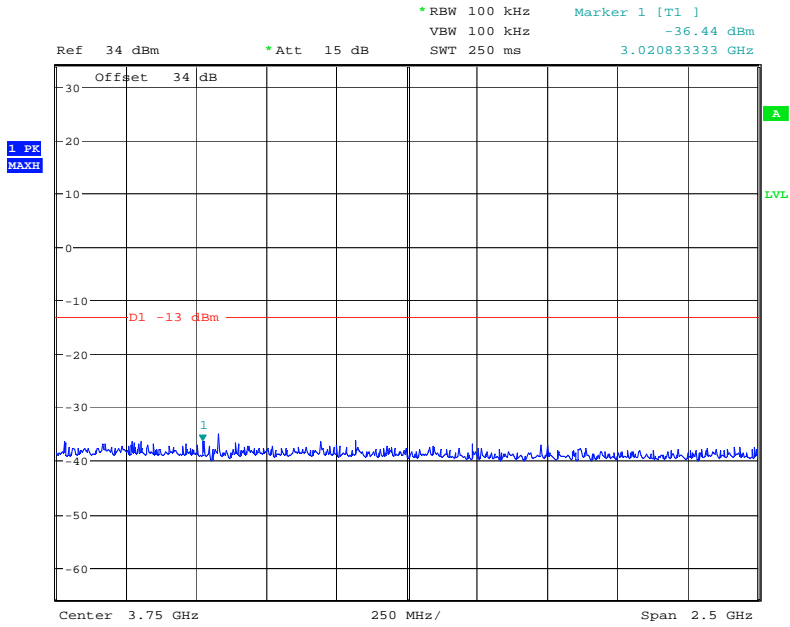
Date: 18.DEC.2006 15:22:35

Conducted emissions 476.8375 MHz 0 – 2.5GHz



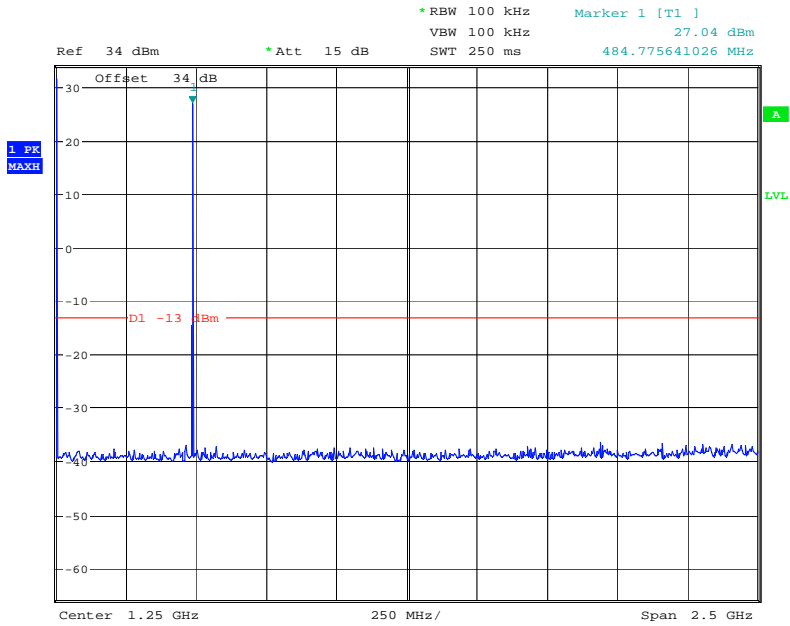
Date: 18.DEC.2006 15:27:06

Conducted emissions 476.8375 MHz 2.5 – 5GHz



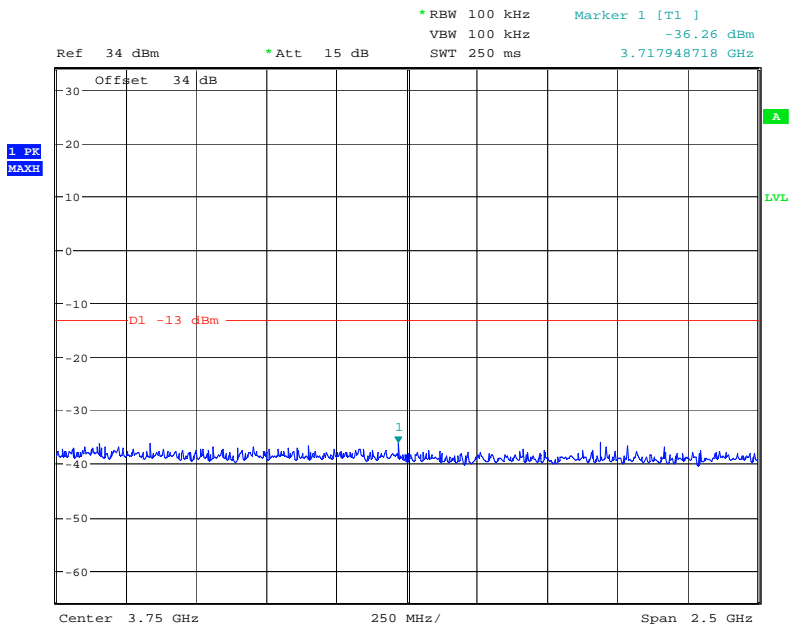
Date: 18.DEC.2006 15:27:30

Conducted emissions 484.0375 MHz 0 – 2.5GHz



Date: 18.DEC.2006 15:23:30

Conducted emissions 484.0375 MHz 2.5 – 5GHz



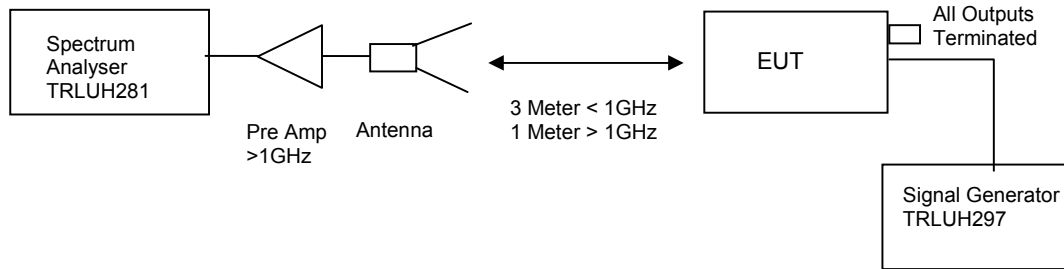
Date: 18.DEC.2006 15:24:02

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – RADIATED – Part 2.1053– UPLINK

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

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 than 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

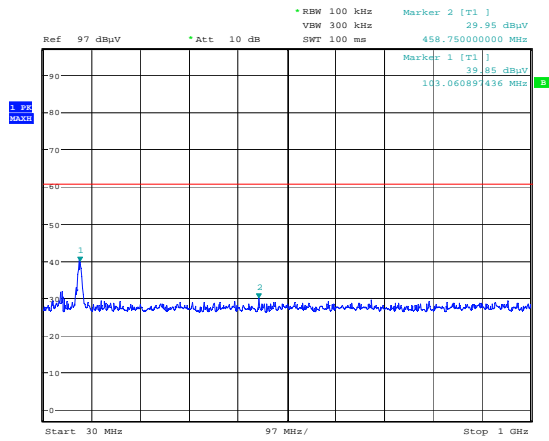
FREQUENCY RANGE	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	CALCULATED EIRP (dBm)	LIMIT (dBm)
30MHz – 1GHz	95.288	43.43	1.1	9.3	53.83	-43.55	-13
1GHz – 5GHz	No Significant Emissions Within 20dB of the Limit						-13

Note: Worst case emissions for each frequency are recorded.

The test equipment used for the Transmitter Spurious Emissions:

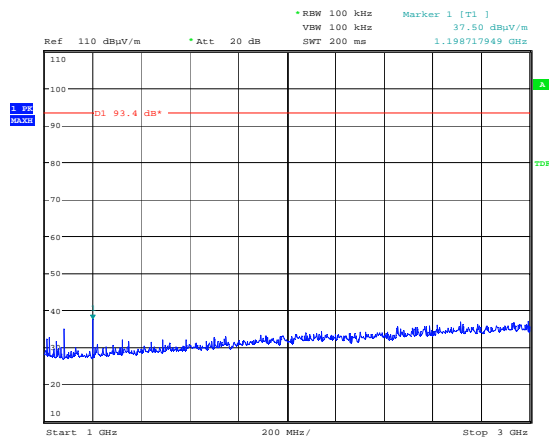
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ANTENNA	CHASE	CBL6612B	2803	UH93	X
ANTENNA	EMCO	3115	9010-3580	138	X
PRE AMPLIFIER	HP	8449B	3008A016	572	X

Radiated emissions 458.7500 MHz 30MHz – 1GHz



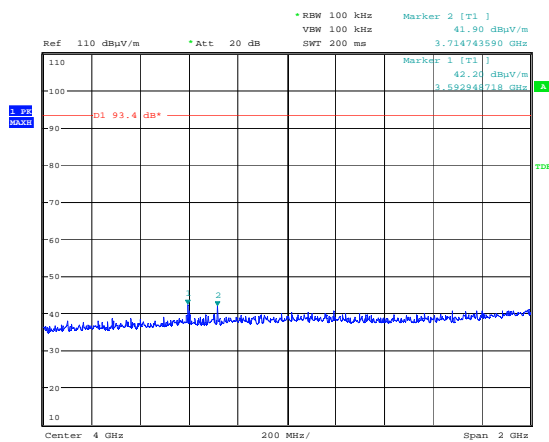
Date: 22.DEC.2006 11:43:37

Radiated emissions 458.7500 MHz 1 – 3GHz



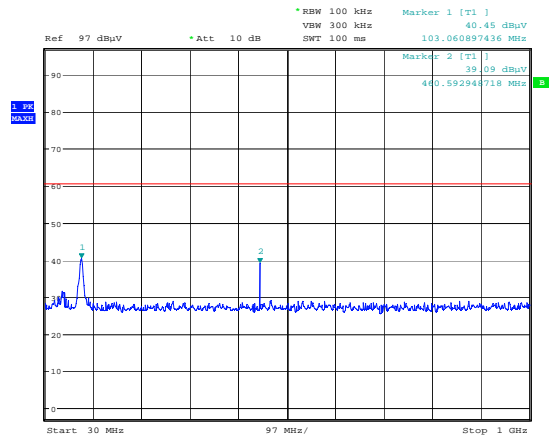
Date: 21.DEC.2006 16:35:37

Radiated emissions 458.7500 MHz 3 – 5GHz



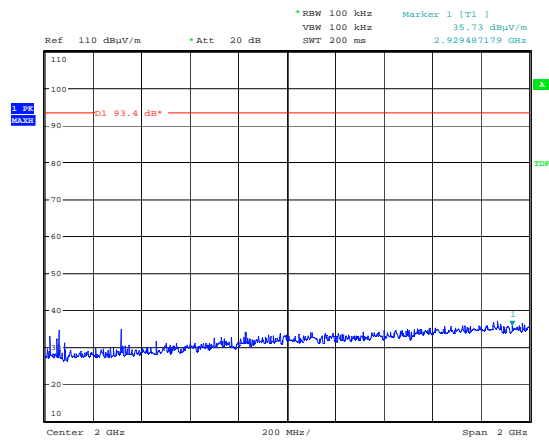
Date: 21.DEC.2006 16:36:11

Radiated emissions 460.0375 MHz 30MHz – 1GHz



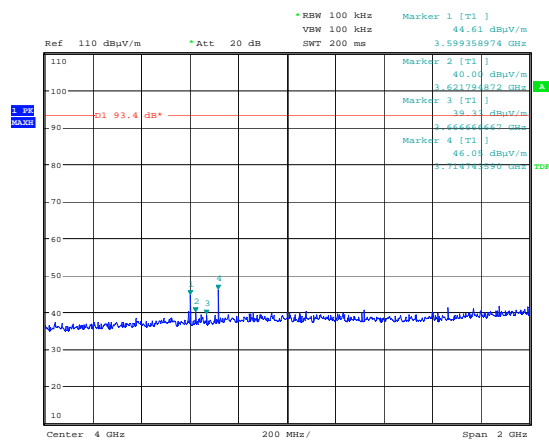
Date: 22.DEC.2006 11:38:06

Radiated emissions 460.0375 MHz 1 – 3GHz



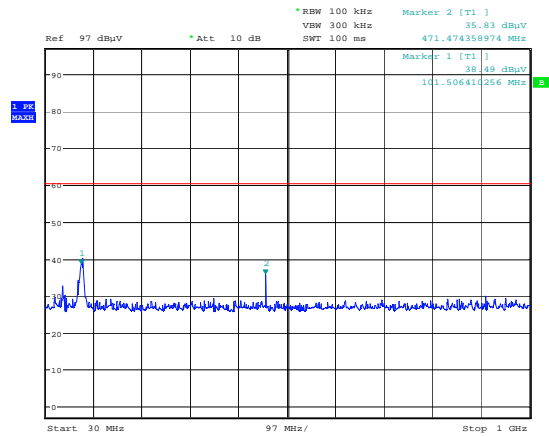
Date: 21.DEC.2006 16:22:18

Radiated emissions 460.0375 MHz 3 – 5GHz



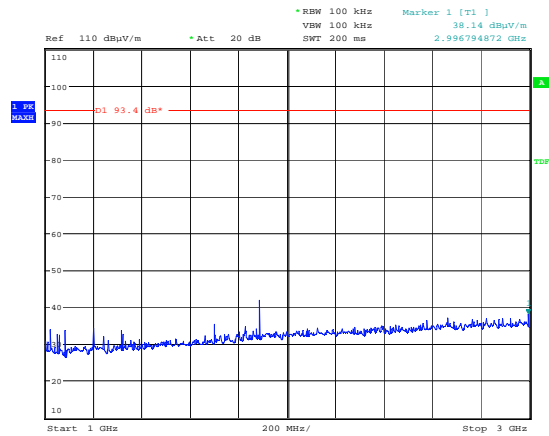
Date: 21.DEC.2006 16:22:48

Radiated emissions 470.7125 MHz 30MHz – 1GHz



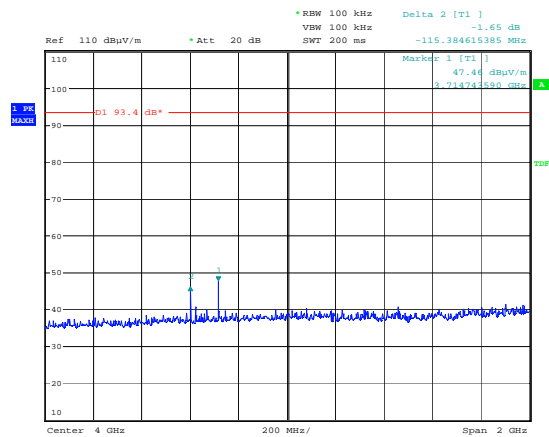
Date: 22.DEC.2006 11:34:22

Radiated emissions 470.7125 MHz 1 – 3GHz



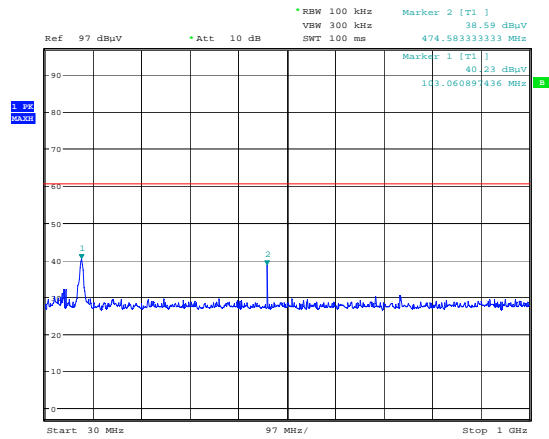
Date: 21.DEC.2006 16:15:56

Radiated emissions 470.7125 MHz 3 – 5GHz



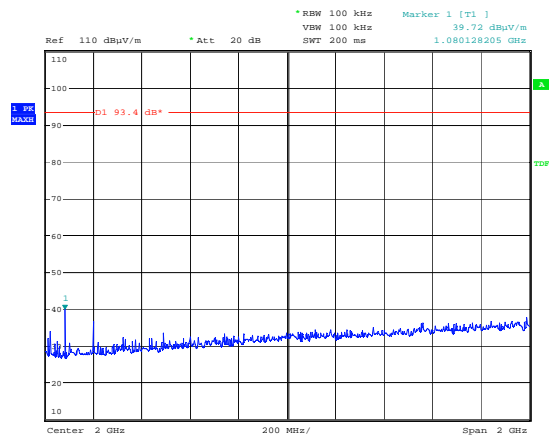
Date: 21.DEC.2006 16:16:15

Radiated emissions 474.2625 MHz 30MHz – 1GHz



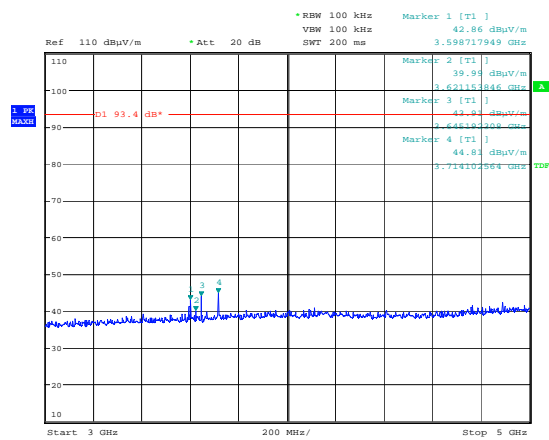
Date: 22.DEC.2006 11:39:37

Radiated emissions 474.2625 MHz 1 – 3GHz



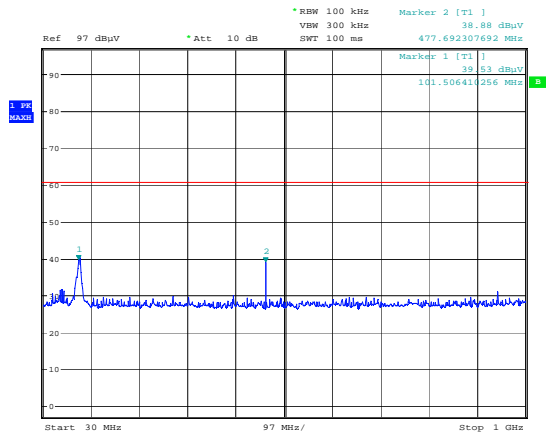
Date: 21.DEC.2006 16:29:22

Radiated emissions 474.2625 MHz 3 – 5GHz



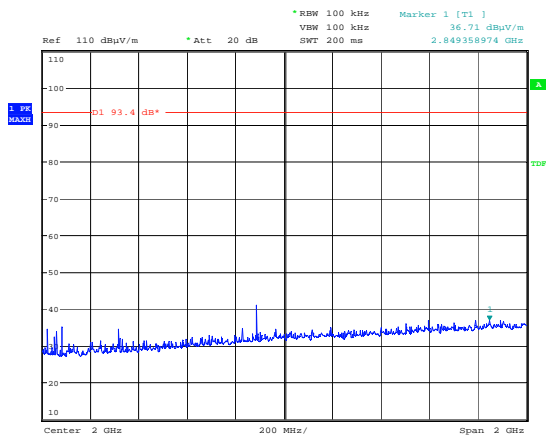
Date: 21.DEC.2006 16:29:09

Radiated emissions 476.8375 MHz 30MHz – 1GHz



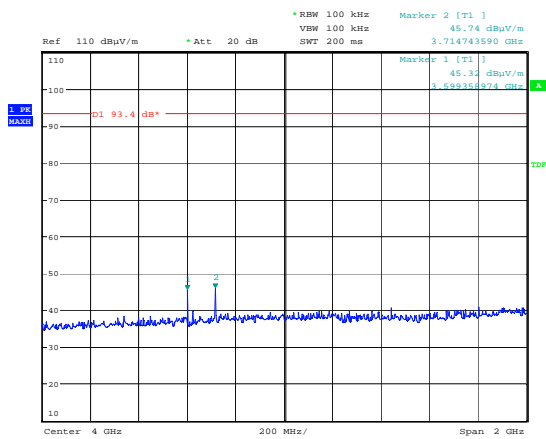
Date: 22.DEC.2006 11:35:35

Radiated emissions 476.8375 MHz 1 – 3GHz



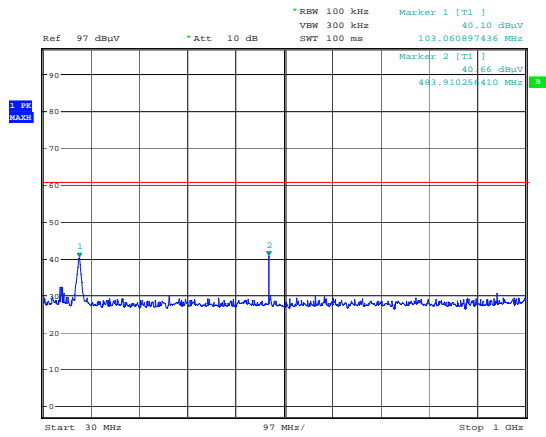
Date: 21.DEC.2006 16:21:03

Radiated emissions 476.8375 MHz 3 – 5GHz



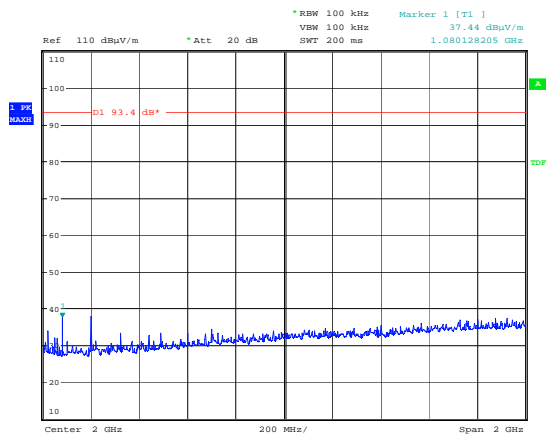
Date: 21.DEC.2006 16:20:30

Radiated emissions 484.0375 MHz 30MHz – 1GHz



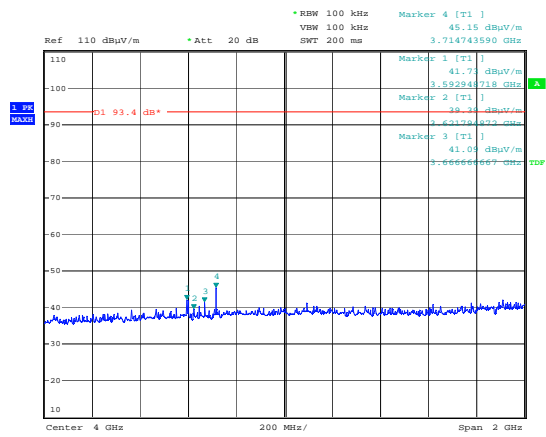
Date: 22.DEC.2006 11:41:52

Radiated emissions 484.0375 MHz 1 – 3GHz



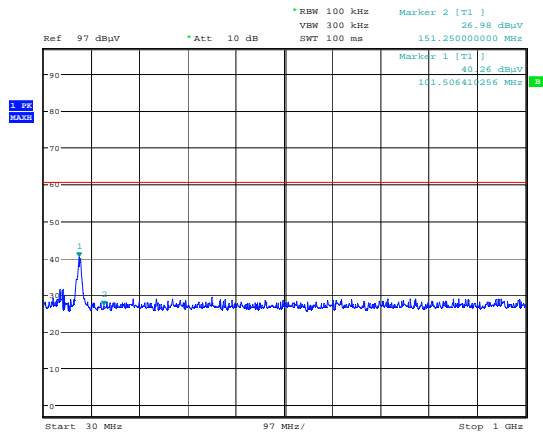
Date: 21.DEC.2006 16:30:21

Radiated emissions 484.0375 MHz 3 – 5GHz



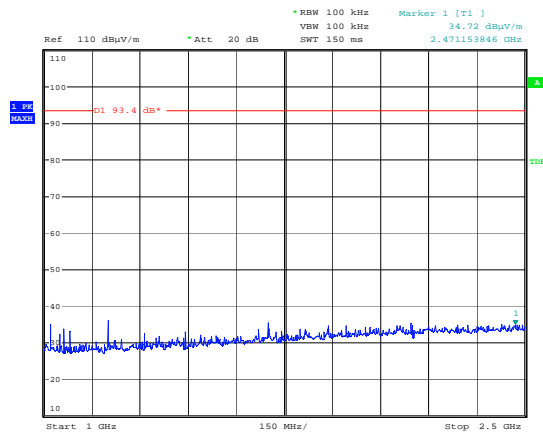
Date: 21.DEC.2006 16:31:09

Radiated emissions no input signal 30MHz – 1GHz



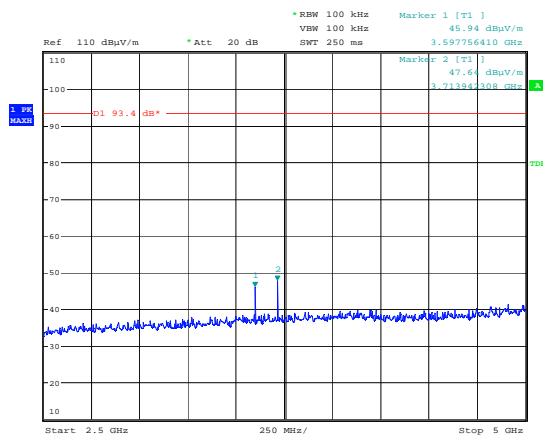
Date: 22.DEC.2006 11:32:07

Radiated emissions no input signal 1 – 2.5GHz



Date: 21.DEC.2006 16:07:06

Radiated emissions no input signal 2.5 – 5GHz

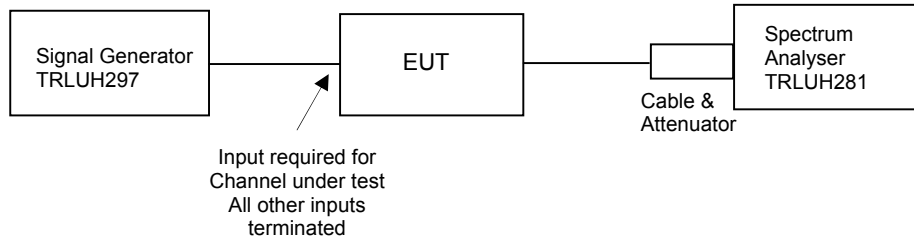


Date: 21.DEC.2006 16:08:31

AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – DOWNLINK

Ambient temperature = 17°C
 Relative humidity = 52%
 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
453.7500	-55.0	0.35	32.29	-3.66	84.04	28.69	74.91
465.0375	-55.0	0.55	32.35	-3.14	84.76	29.21	75.10
471.2625	-55.0	0.60	32.33	-5.69	82.24	26.64	72.63
479.8375	-43.5	0.46	32.31	-3.27	73.00	29.04	63.64
481.0375	-46.0	0.46	32.31	-3.56	75.21	28.75	65.23
485.6375	-49.5	0.47	32.32	-2.71	79.58	29.61	69.75

- 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	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

AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – PART 2.1053– DOWNLINK

Ambient temperature = 20°C
 Relative humidity = 46%
 Supply voltage = +110Vac

Radio Laboratory

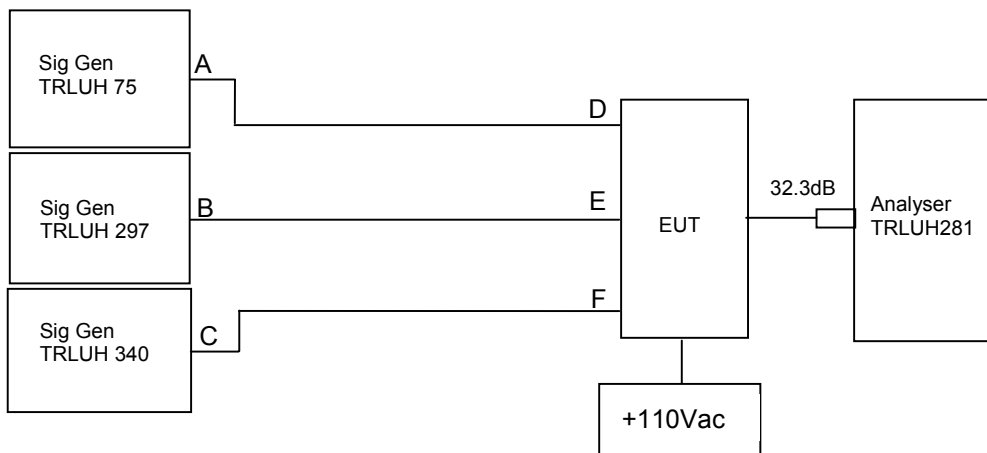
The Intermodulation and spurious products were measured with the amplifier operating at maximum gain. A three tone test was conducted using the equipment as below. The input power level was adjusted so the levels at points D, E & F were 10dB above the maximum input of the selected channel. The cable and attenuators loss between the EUT and the spectrum analyser was 32.3dB. The test setup was varied to test several input options to the EUT. Due to 3 inputs and 6 operating frequencies the setup was varied to cover intermodulation products being produced through RF being fed into 1 input, 2 inputs and all 3 inputs depending upon how many channels were available for the input.

RF Inputs

D = RX (NYPD) 2 Channels
 E = RX (R. ISLAND) 3 Channels
 F = RX/TX (Omni) 1 Channel

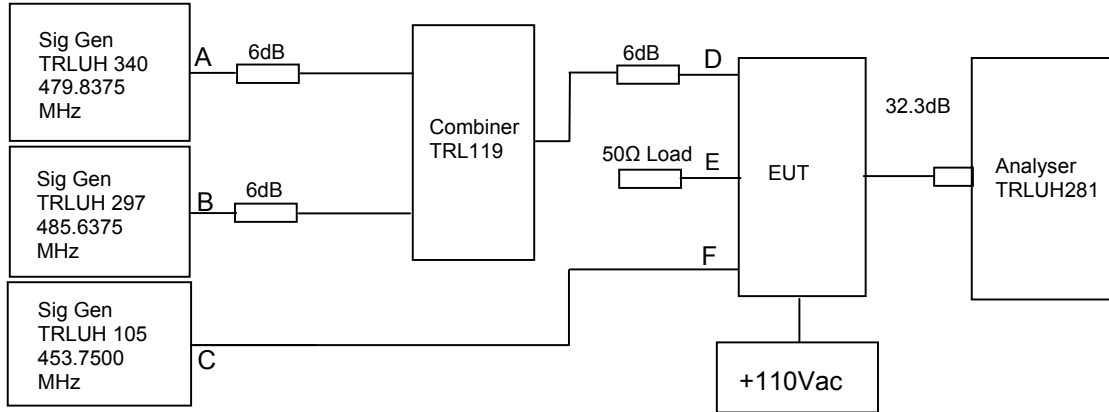
Test Setups & Results

Test setup to test top, bottom and next to top operating channels and top, bottom and next to bottom operating channels.



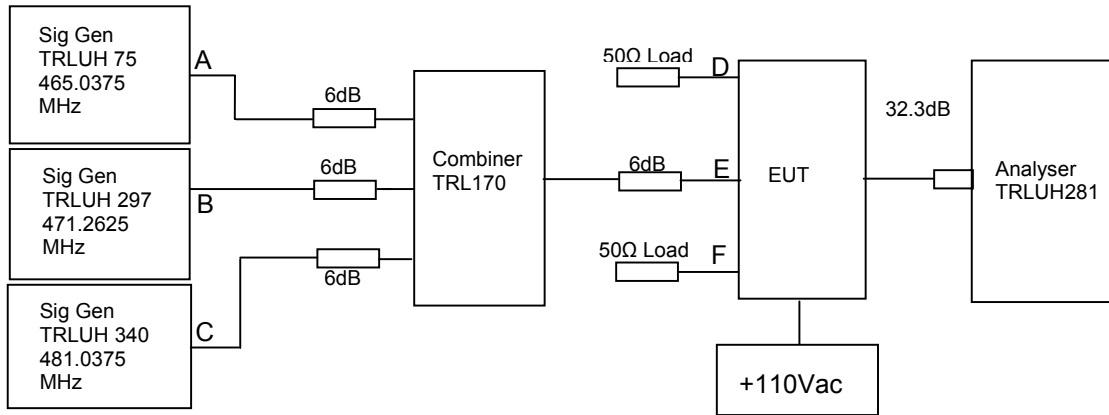
RF Input Frequency (MHz)			Highest Intermodulation Product Level (dBm)	Limit (dBm)
C	A	B		
453.7500	485.6375	481.0375	-25.83dBm @ 32.0513 MHz	-13
453.7500	485.6375	465.0375	-24.51dBm @ 12.0190 MHz	-13

Test Setup to test 2 x NYPD and 1x OMNI Channels



RF Input Frequency (MHz)			Highest Intermodulation Product Level (dBm)	Limit (dBm)
485.6375	479.8375	453.7500	-25.50 dBm @ 4.0060 MHz	-13

Test Setup to test 3 x R. ISLAND Channels.



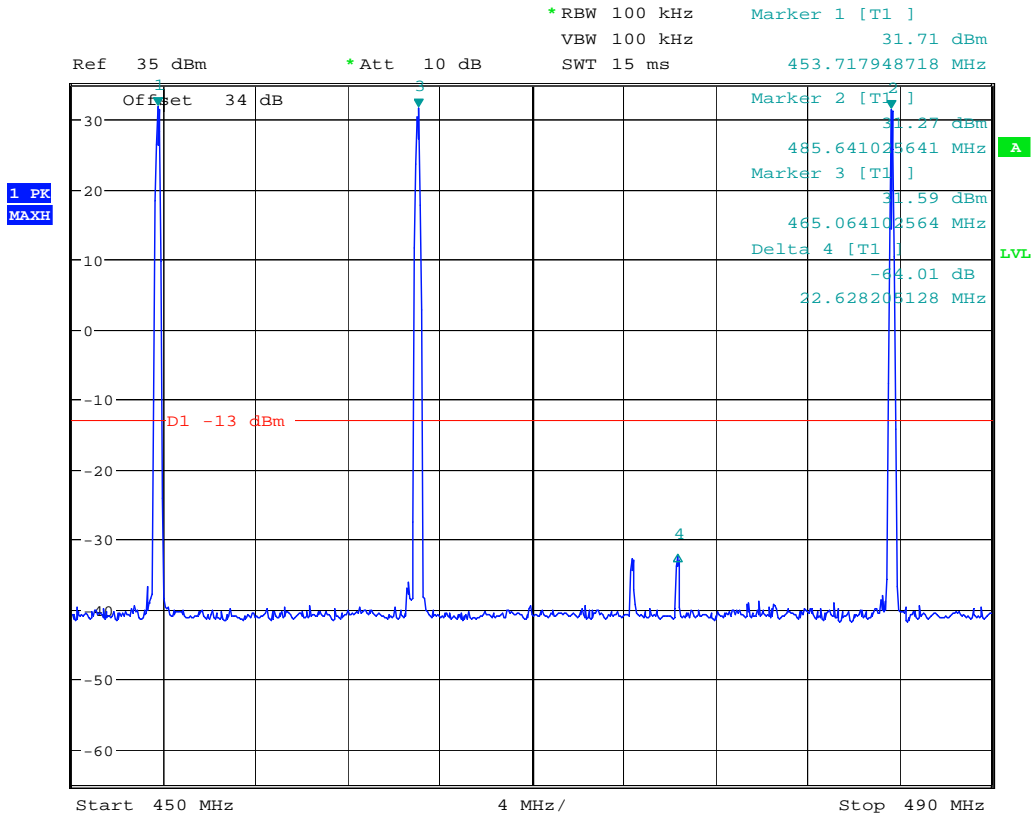
RF Input Frequency (MHz)			Highest Intermodulation Product Level (dBm)	Limit (dBm)
465.0375	471.2625	481.0375	-26.05 dBm @ 16.0256 MHz	-13

Sweep data shown on pages 36 & 37 are for the setup that produces the 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
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

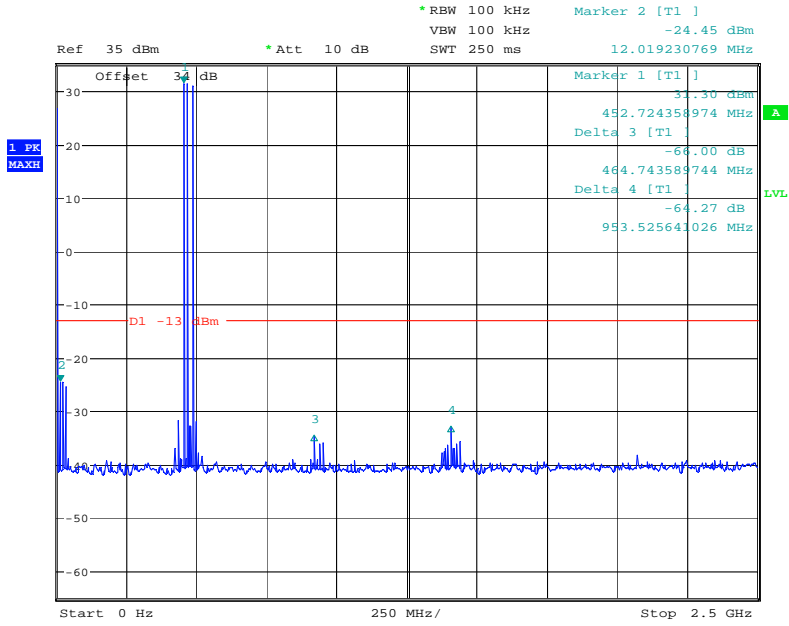
Intermodulation Inband



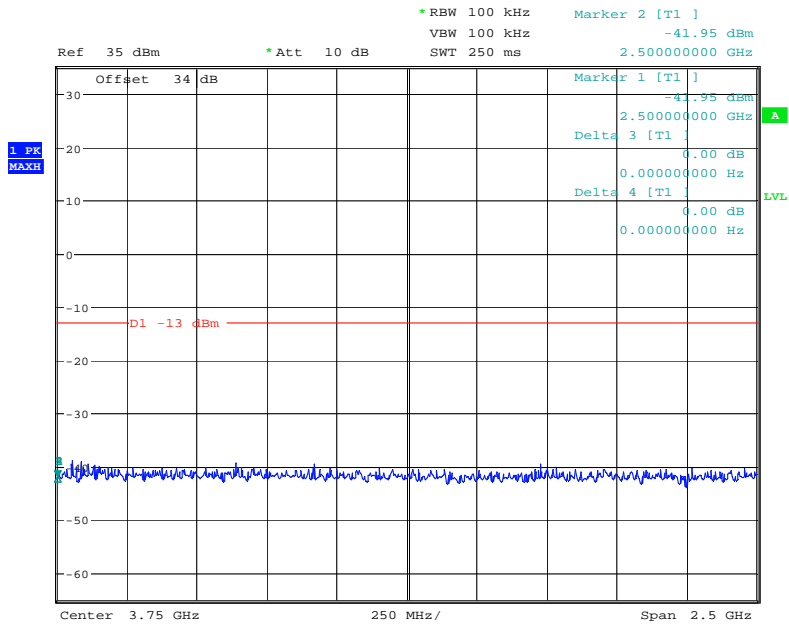
Date: 19.DEC.2006 11:12:04

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

Intermodulation Wideband



Date: 19.DEC.2006 11:14:26



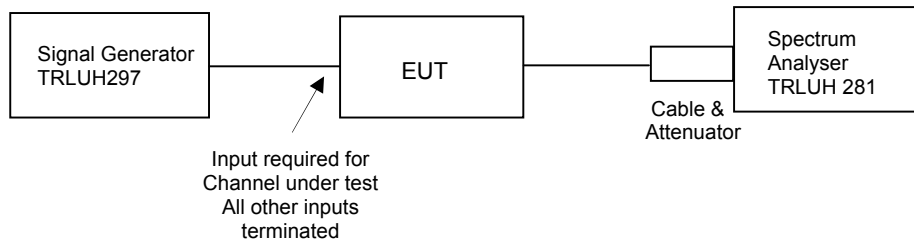
Date: 19.DEC.2006 11:14:44

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



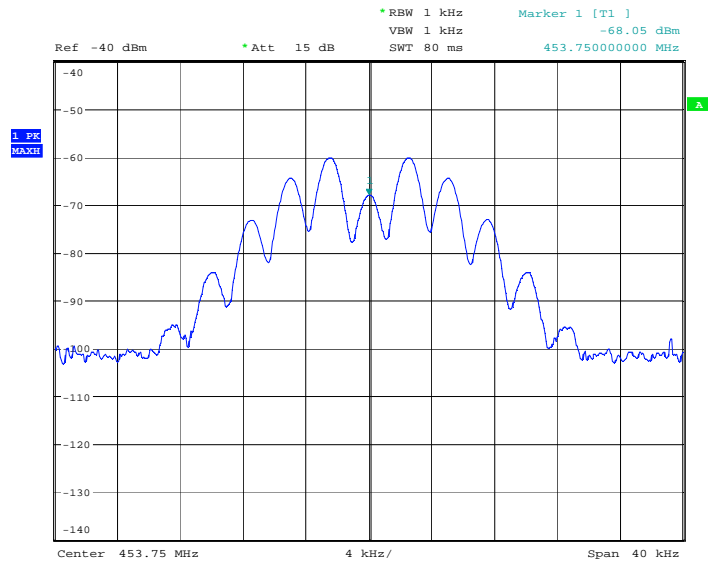
This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level required for the selected channel and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at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

Note: The cables and attenuators had the following losses.

1. Cable and attenuator between EUT and spectrum analyser 32.3dB
2. Cable between signal generator and EUT 0.5dB

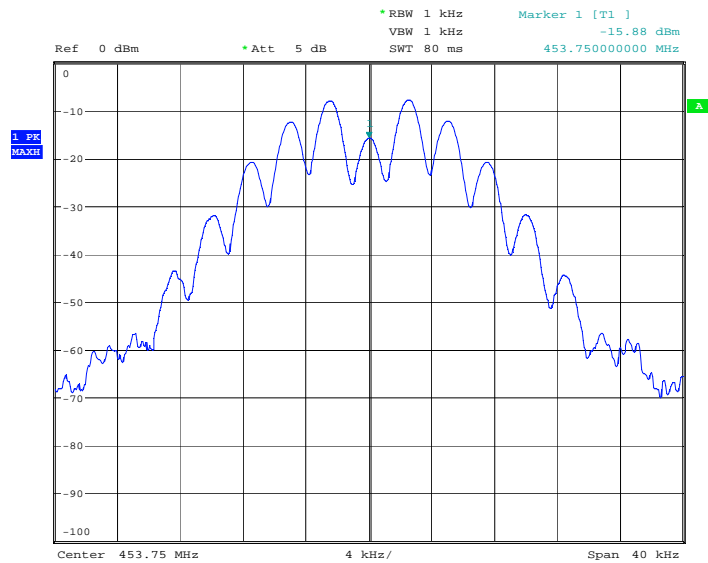
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ATTENUATOR	BIRD	8304-300-N	N/A	220	X
ATTENUATOR	BIRD	8304-0600N	N/A	246	X

453.7500 MHz Signal Generator, deviation set to 5 kHz



Date: 18.DEC.2006 16:08:16

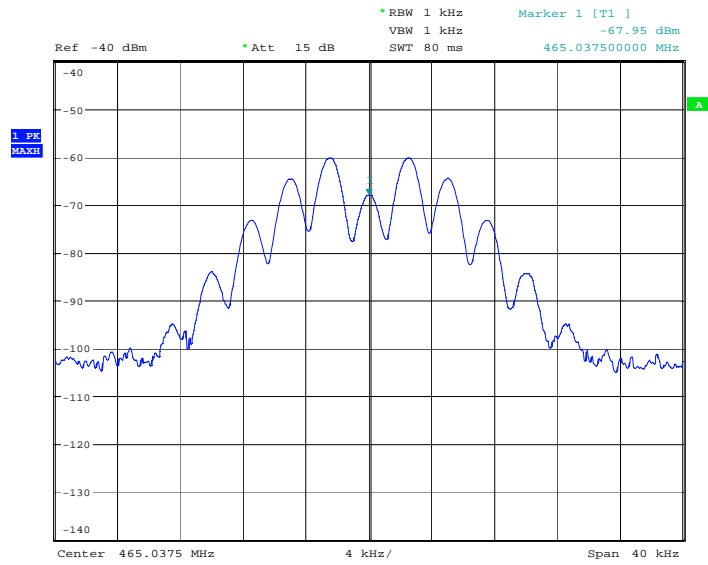
453.7500 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 18.DEC.2006 12:58:05

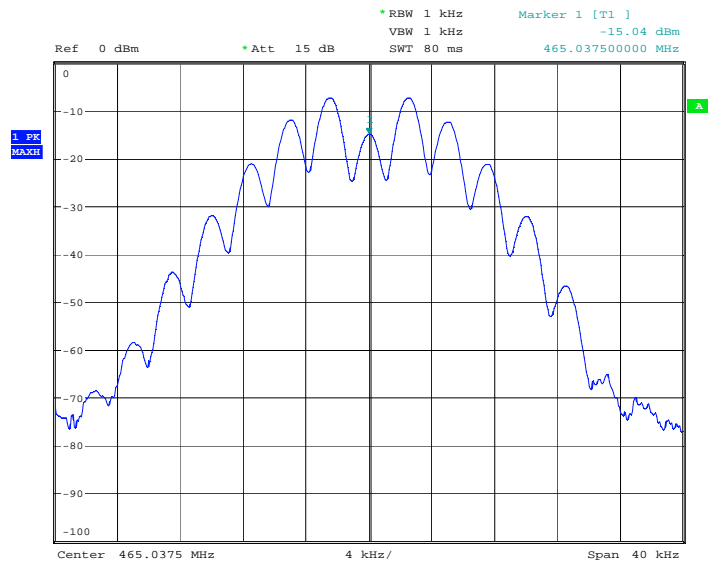
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

465.0375 MHz Signal Generator, deviation set to 5 kHz



Date: 18.DEC.2006 16:09:24

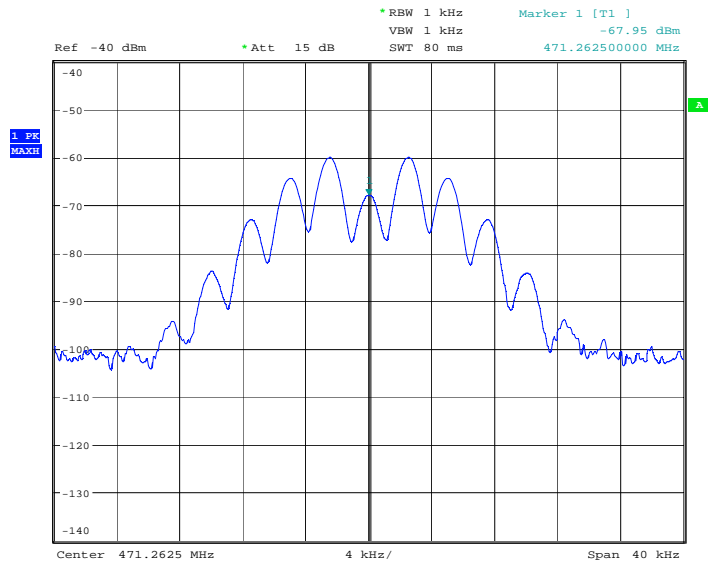
465.0375 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 18.DEC.2006 13:04:24

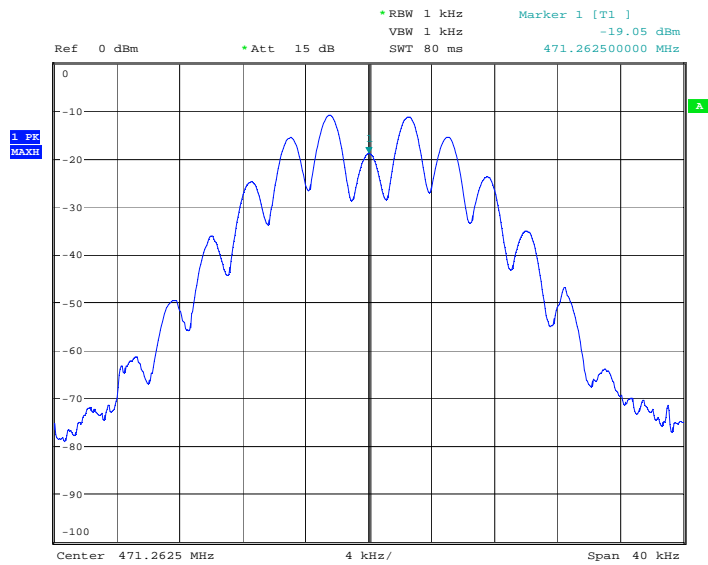
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

471.2625 MHz Signal Generator, deviation set to 5 kHz



Date: 18.DEC.2006 16:09:47

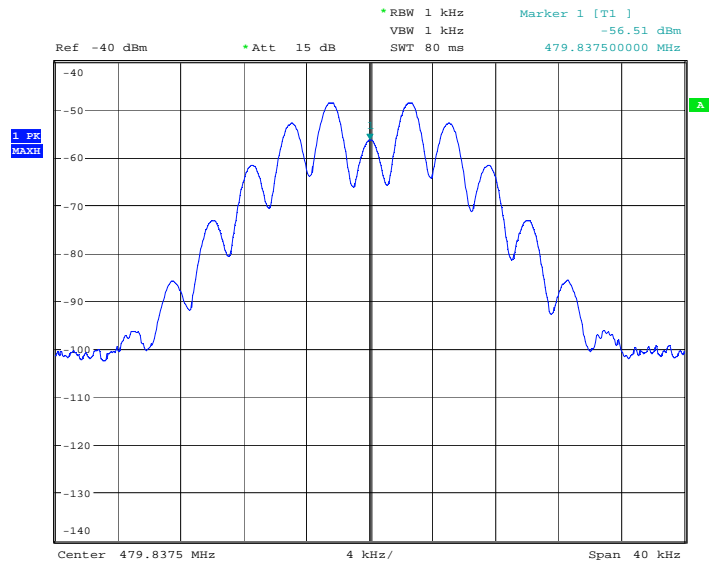
471.2625 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 18.DEC.2006 13:04:57

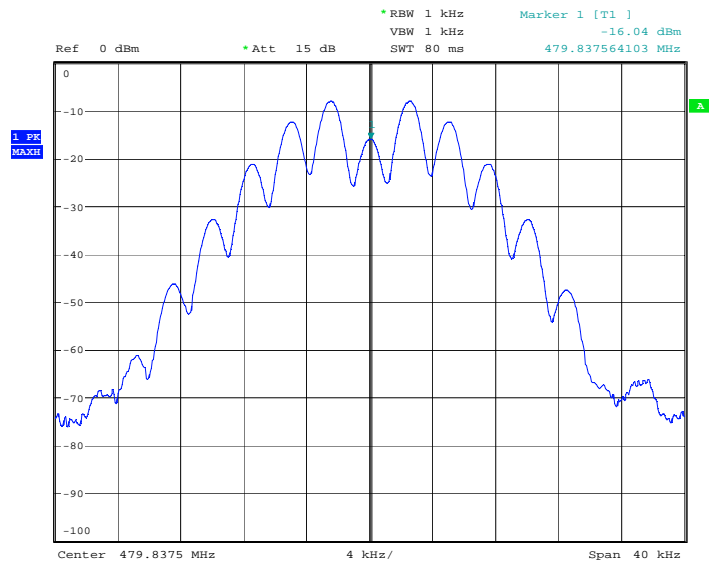
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

479.8375 MHz Signal Generator, deviation set to 5 kHz



Date: 18.DEC.2006 16:06:39

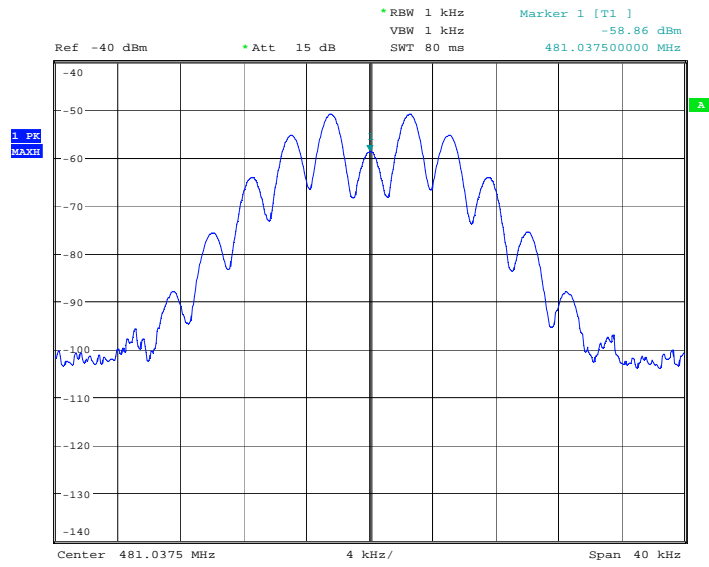
479.8375 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 18.DEC.2006 13:01:17

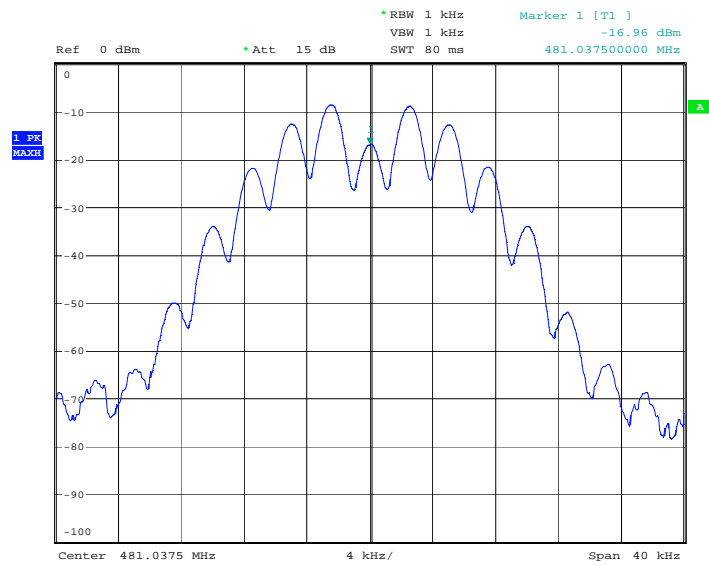
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

481.0375 MHz Signal Generator, deviation set to 5 kHz



Date: 18.DEC.2006 16:10:44

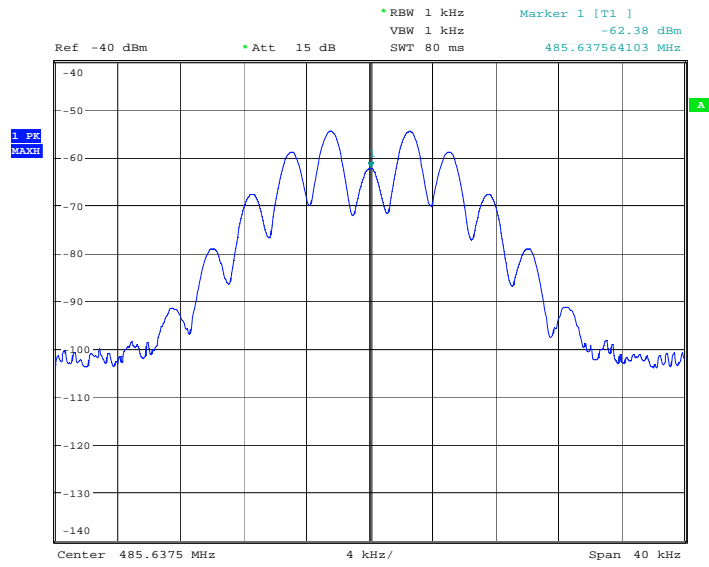
481.0375 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 18.DEC.2006 13:06:08

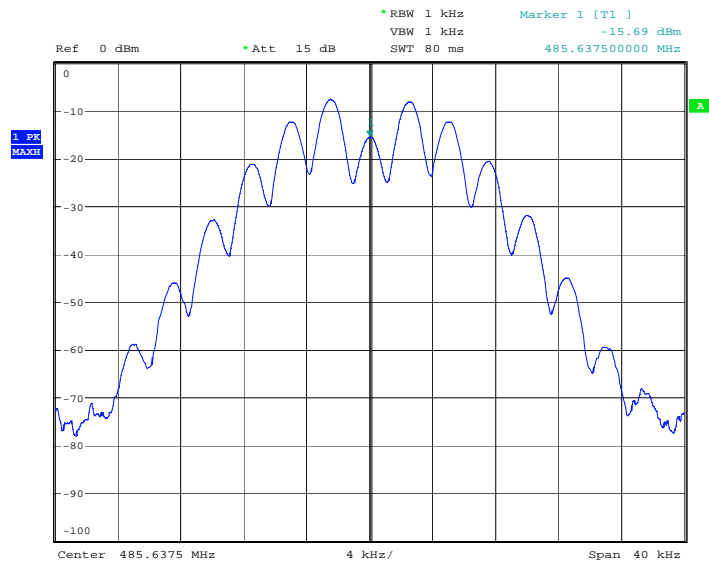
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

485.6375 MHz Signal Generator, deviation set to 5 kHz



Date: 18.DEC.2006 16:07:48

485.6375 MHz Signal Generator and EUT, deviation set to 5 kHz



Date: 18.DEC.2006 13:01:50

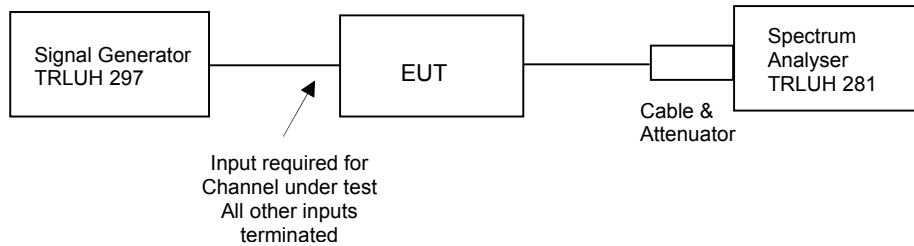
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – Part 2.1053 – DOWNLINK

Ambient temperature = 19°C
 Relative humidity = 48%
 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

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

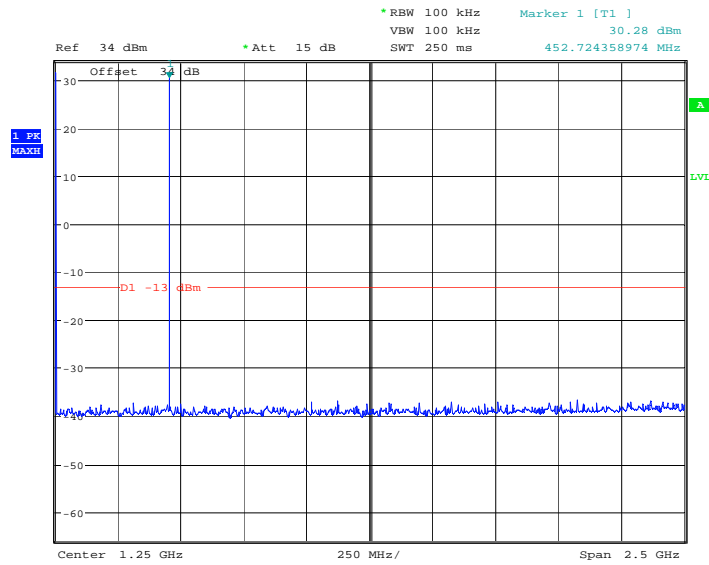
RESULTS

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:

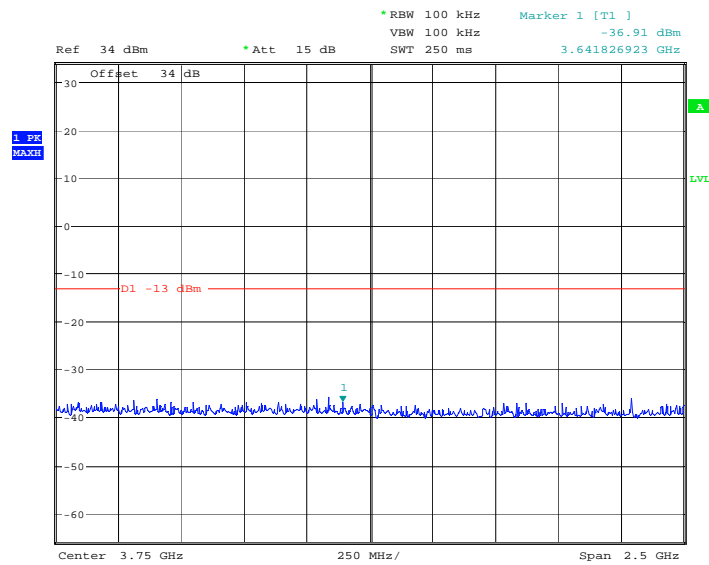
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ATTENUATOR	BIRD	8304-300-N	N/A	220	X
ATTENUATOR	BIRD	8304-0600N	N/A	246	X

Conducted emissions 453.7500 MHz 0 – 2.5GHz



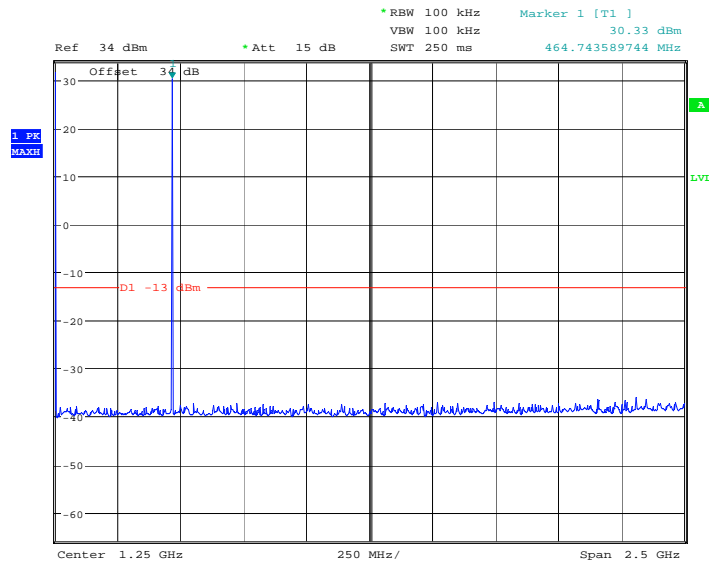
Date: 18.DEC.2006 14:25:21

Conducted emissions 453.7500 MHz 2.5 – 5GHz



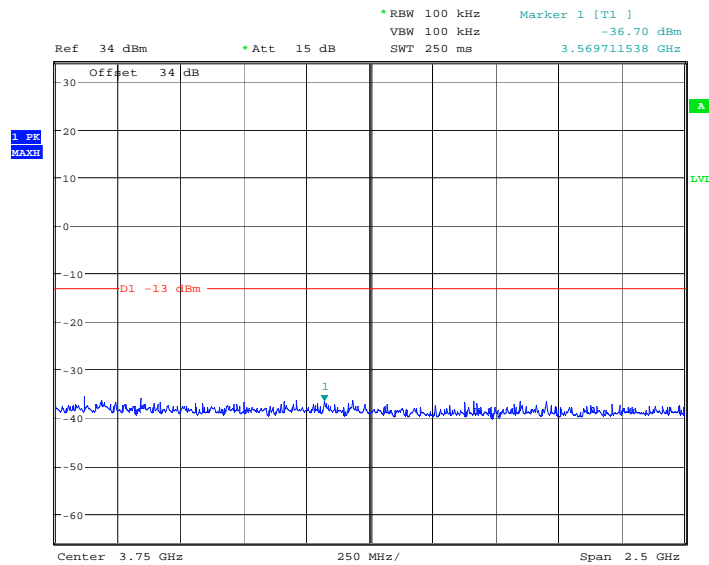
Date: 18.DEC.2006 14:25:37

Conducted emissions 465.0375 MHz 0 – 2.5GHz



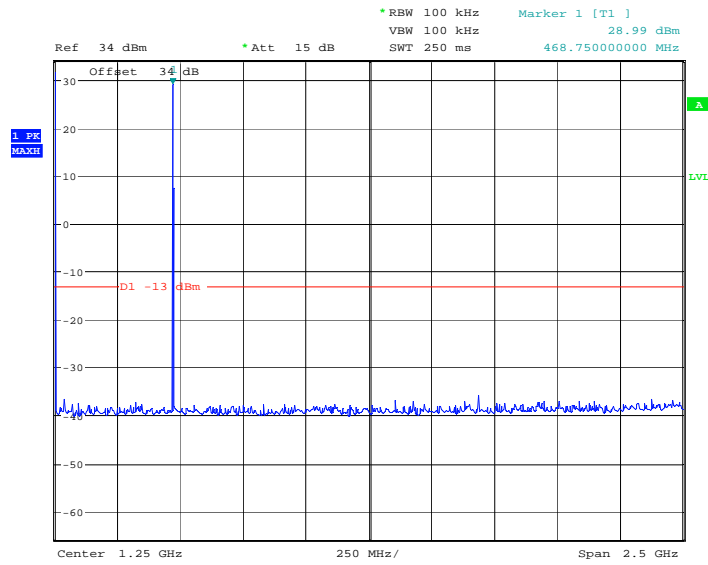
Date: 18.DEC.2006 14:20:17

Conducted emissions 465.0375 MHz 2.5 – 5GHz



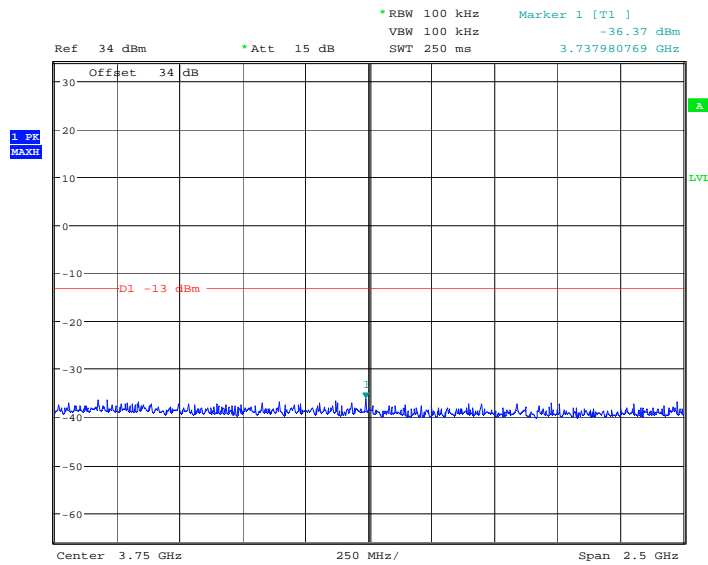
Date: 18.DEC.2006 14:20:40

Conducted emissions 471.2625 MHz 0 – 2.5GHz



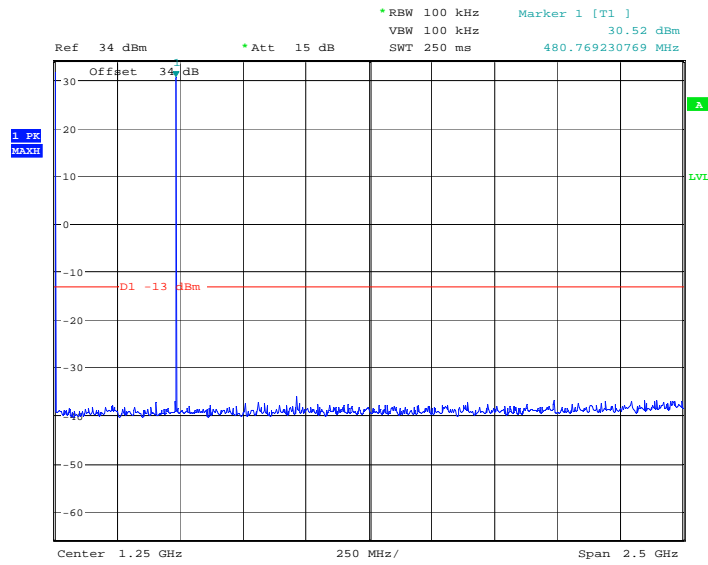
Date: 18.DEC.2006 14:19:05

Conducted emissions 471.2625 MHz 2.5 – 5GHz



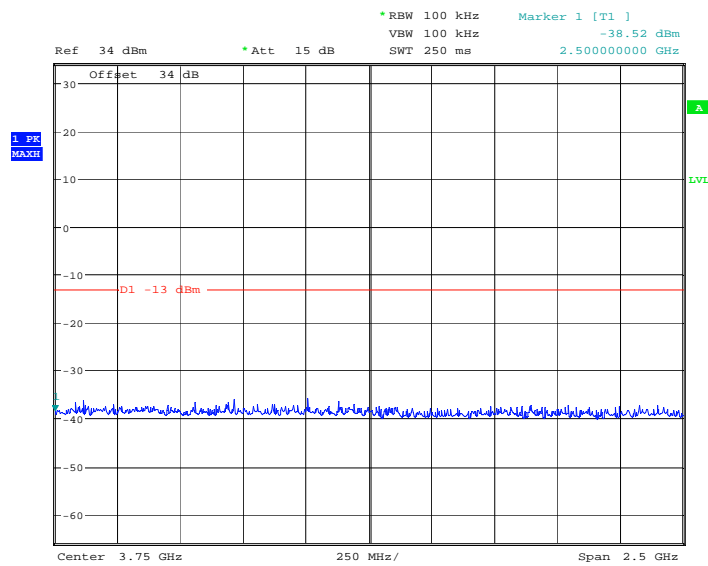
Date: 18.DEC.2006 14:19:23

Conducted emissions 479.8375 MHz 0 – 2.5GHz



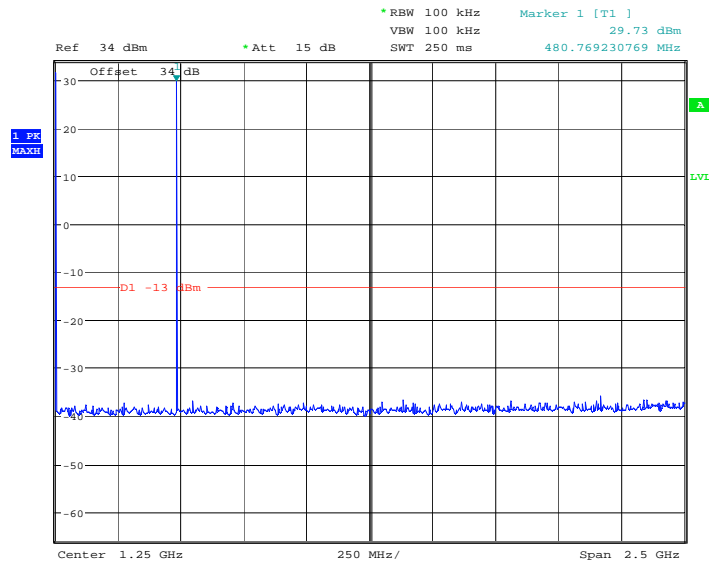
Date: 18.DEC.2006 14:22:24

Conducted emissions 479.8375 MHz 2.5 – 5GHz



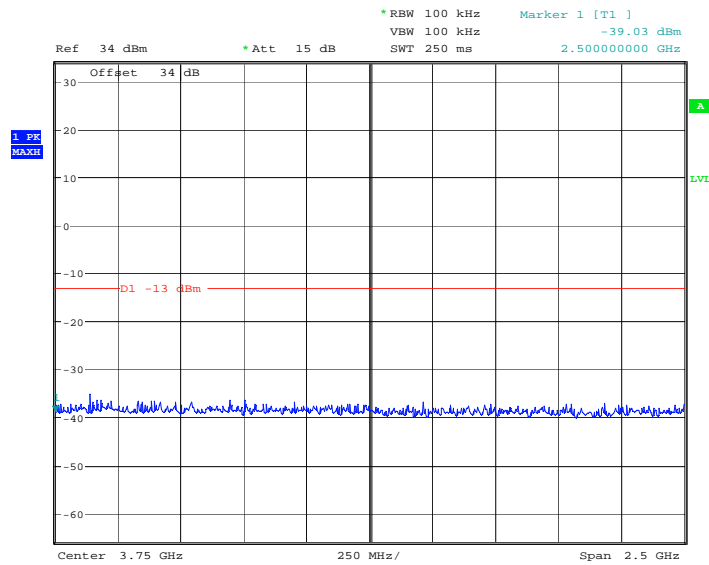
Date: 18.DEC.2006 14:22:50

Conducted emissions 481.0375 MHz 0 – 2.5GHz



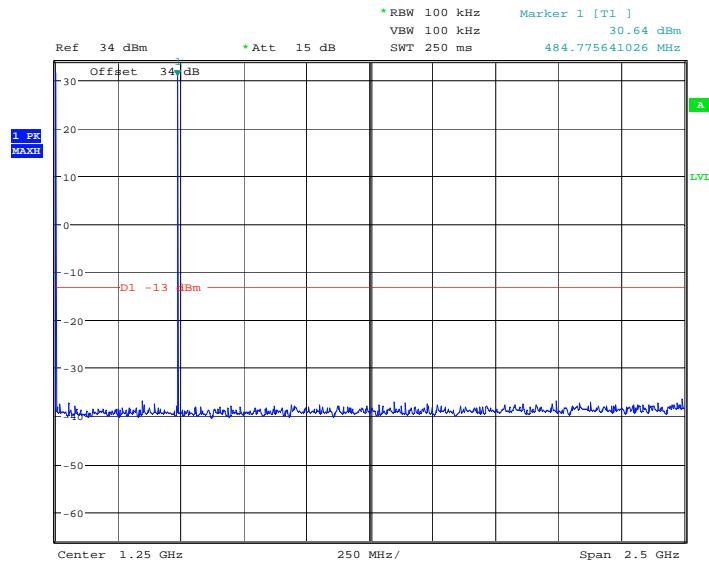
Date: 18.DEC.2006 14:17:39

Conducted emissions 481.0375 MHz 2.5 – 5GHz



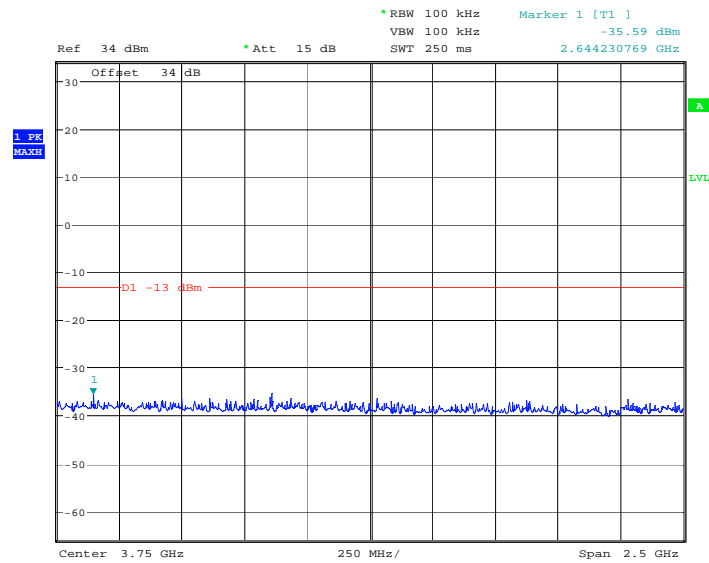
Date: 18.DEC.2006 14:18:01

Conducted emissions 485.6375 MHz 0 – 2.5GHz



Date: 18.DEC.2006 14:23:39

Conducted emissions 485.6375 MHz 2.5 – 5GHz



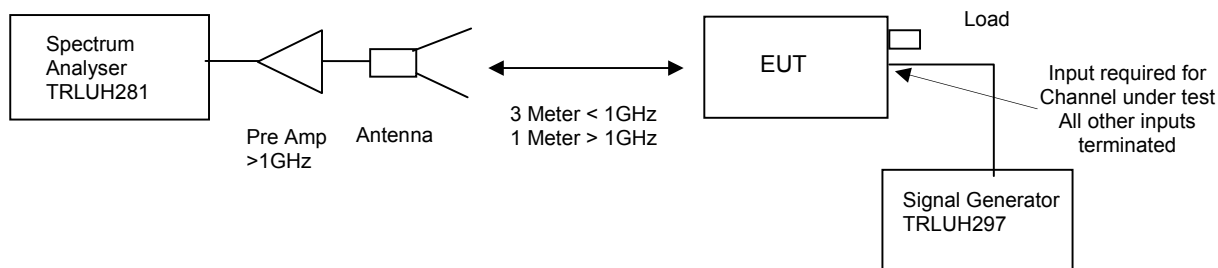
Date: 18.DEC.2006 14:24:04

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – RADIATED – Part 2.1053– DOWNLINK

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

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

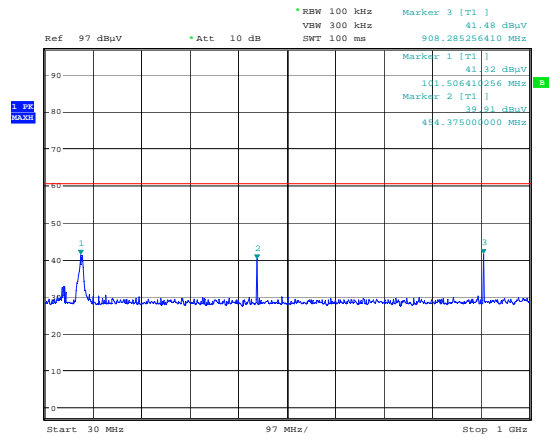
FREQUENCY RANGE	FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	CALCULATED EIRP (dBm)	LIMIT (dBm)
30MHz – 1GHz	95.288	43.43	1.1	9.3	52.88	-43.55	-13
	908.285	39.91	3.9	20.9	64.71	-32.67	-13
	962.692	32.76	4.0	21.3	41.47	-39.32	-13
1GHz – 5GHz	No Significant Emissions Within 20dB of the Limit						-13

Note: Worst case emissions for each frequency are recorded.

The test equipment used for the Transmitter Spurious Emissions:

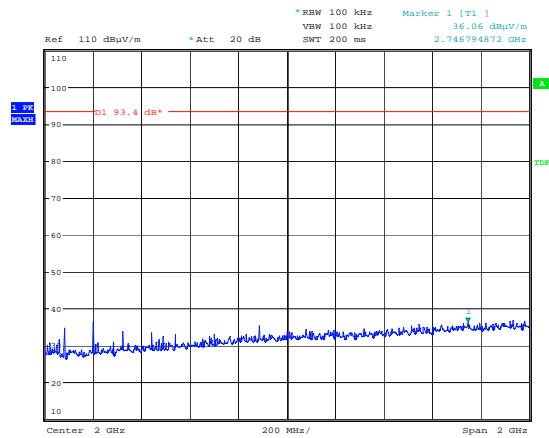
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	R&S	SML 03	102268	UH297	X
ANTENNA	CHASE	CBL6612B	2803	UH93	X
ANTENNA	EMCO	3115	9010-3580	138	X
PRE AMPLIFIER	HP	8449B	3008A016	572	X

Radiated emissions 453.7500 MHz 30MHz – 1GHz



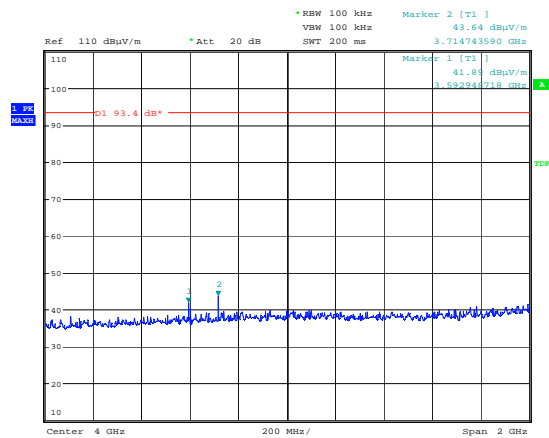
Date: 22.DEC.2006 11:49:47

Radiated emissions 453.7500 MHz 1 – 3GHz



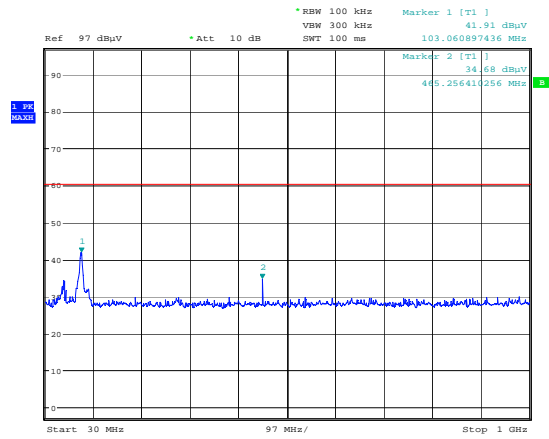
Date: 21.DEC.2006 16:39:10

Radiated emissions 453.7500 MHz 3 – 5GHz



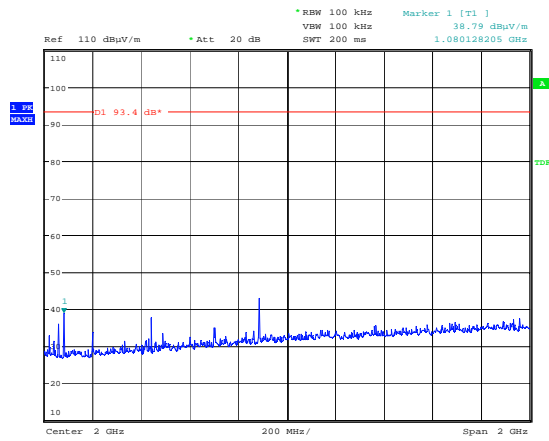
Date: 21.DEC.2006 16:38:15

Radiated emissions 465.0375 MHz 30MHz – 1GHz



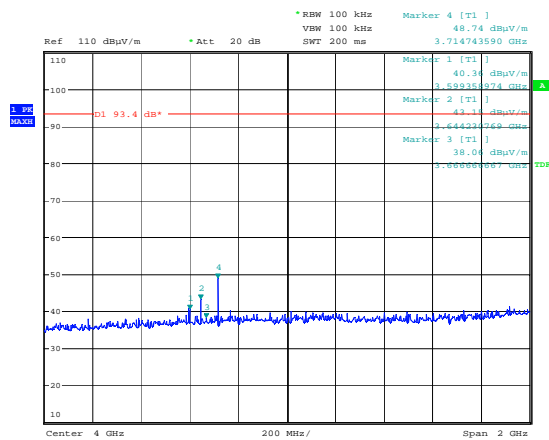
Date: 22.DEC.2006 11:57:29

Radiated emissions 465.0375 MHz 1 – 3GHz



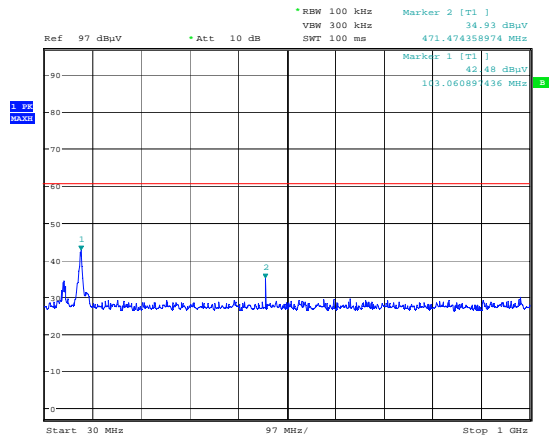
Date: 21.DEC.2006 17:00:12

Radiated emissions 465.0375 MHz 3 – 5GHz



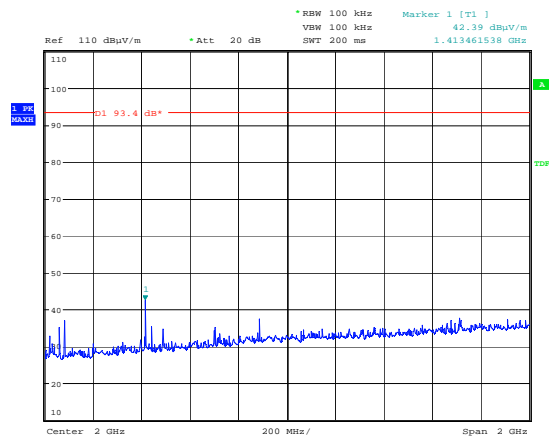
Date: 21.DEC.2006 17:00:02

Radiated emissions 471.2625 MHz 30MHz – 1GHz



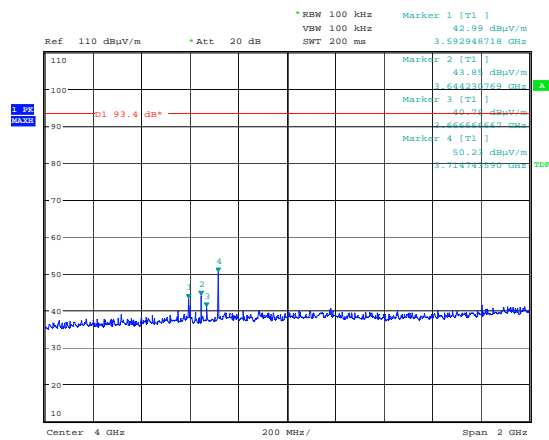
Date: 22.DEC.2006 11:59:27

Radiated emissions 471.2625 MHz 1 – 3GHz



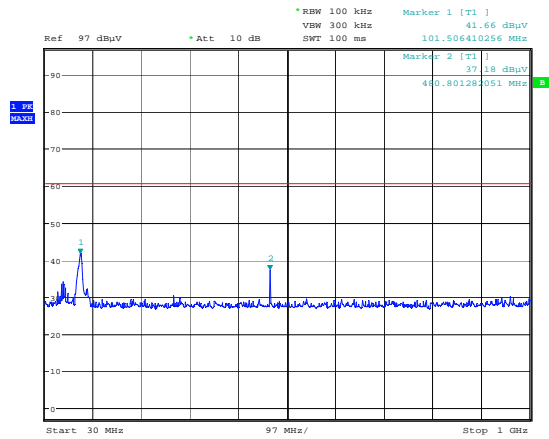
Date: 21.DEC.2006 17:02:06

Radiated emissions 471.2625 MHz 3 – 5GHz



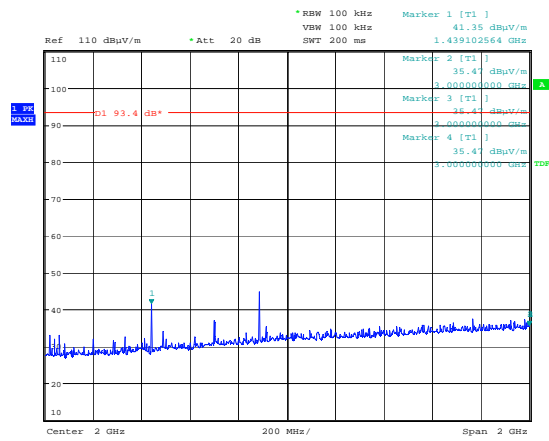
Date: 21.DEC.2006 17:02:42

Radiated emissions 479.8375 MHz 30MHz – 1GHz



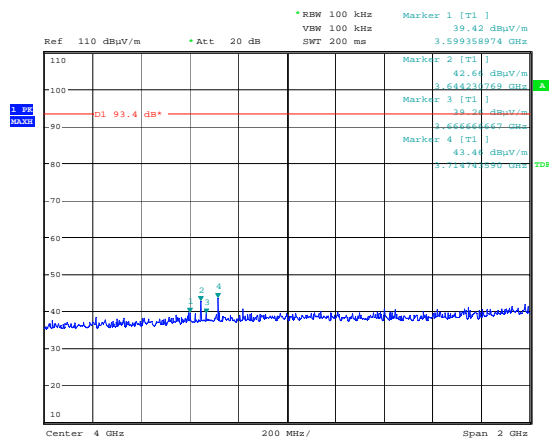
Date: 22.DEC.2006 11:52:02

Radiated emissions 479.8375 MHz 1 – 3GHz



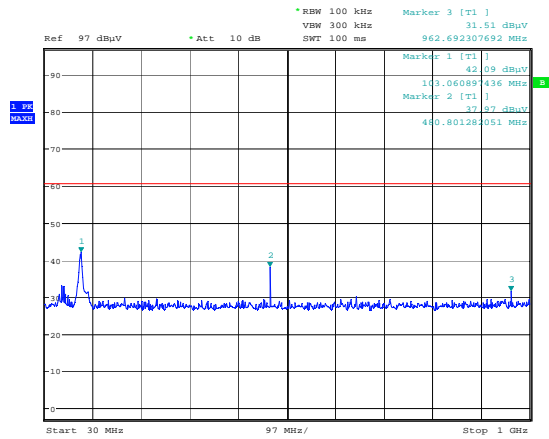
Date: 21.DEC.2006 16:47:58

Radiated emissions 479.8375 MHz 3 – 5GHz



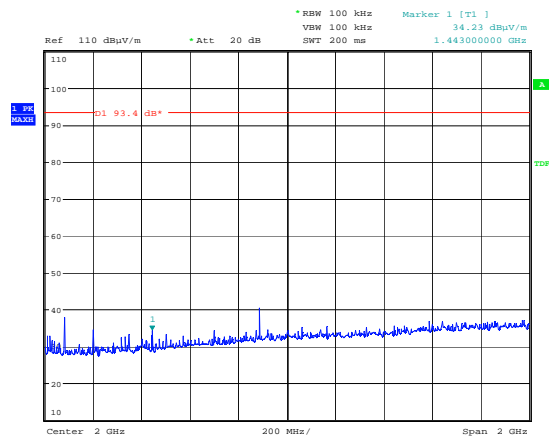
Date: 21.DEC.2006 16:47:32

Radiated emissions 481.0375 MHz 30MHz – 1GHz



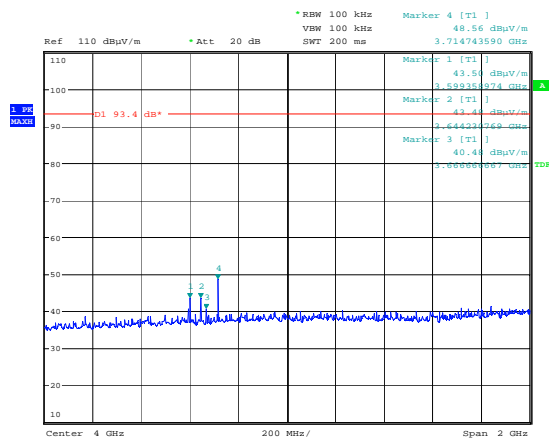
Date: 22.DEC.2006 12:00:49

Radiated emissions 481.0375 MHz 1 – 3GHz



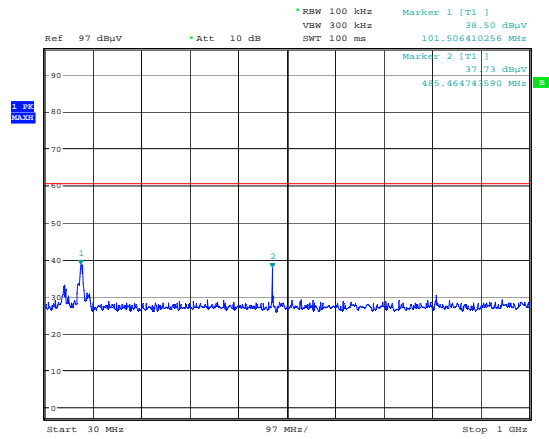
Date: 21.DEC.2006 17:06:19

Radiated emissions 481.0375 MHz 3 – 5GHz



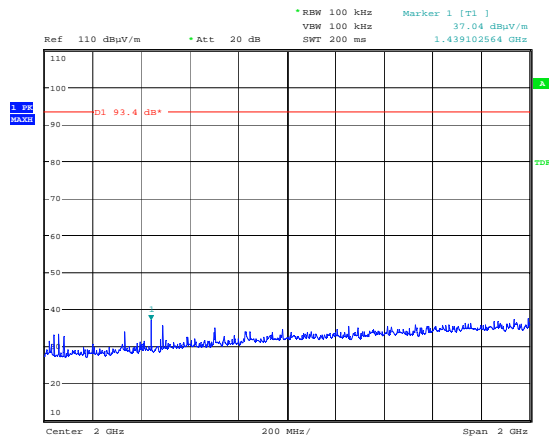
Date: 21.DEC.2006 17:05:55

Radiated emissions 485.6375 MHz 30MHz – 1GHz



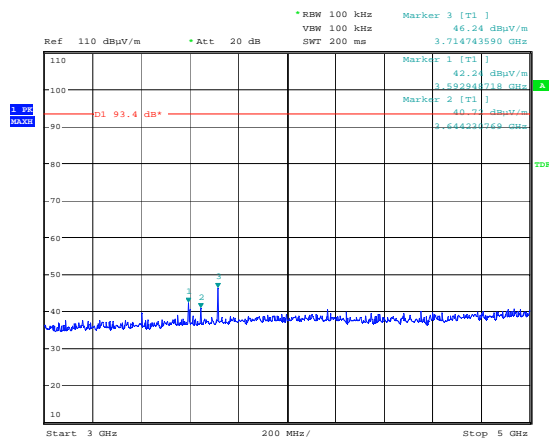
Date: 22.DEC.2006 11:54:27

Radiated emissions 485.6375 MHz 1 – 3GHz



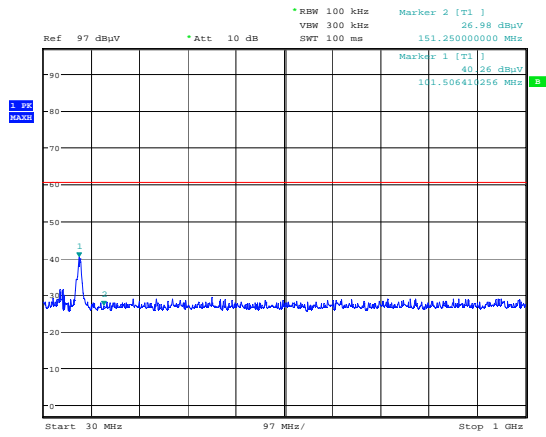
Date: 21.DEC.2006 16:50:11

Radiated emissions 485.6375 MHz 3 – 5GHz



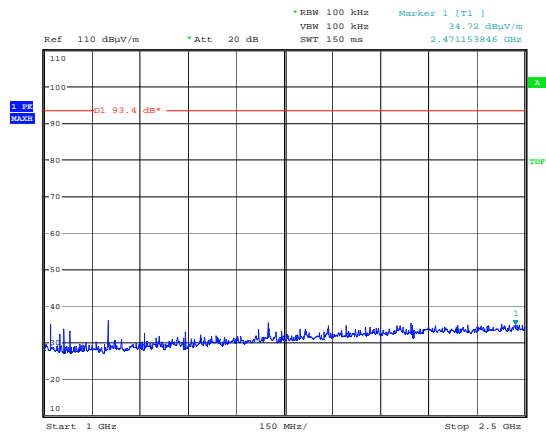
Date: 21.DEC.2006 16:52:19

Radiated emissions no input signal 30MHz – 1GHz



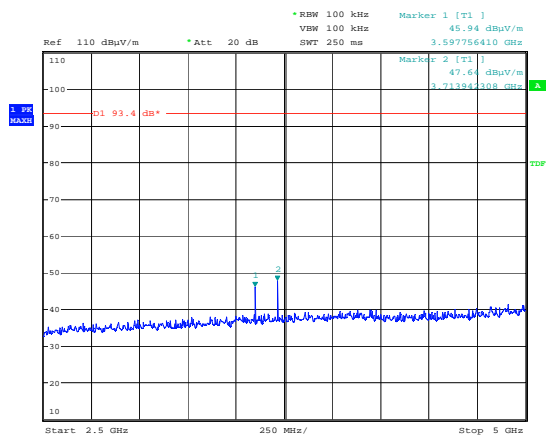
Date: 22.DEC.2006 11:32:07

Radiated emissions no input signal 1 – 2.5GHz



Date: 21.DEC.2006 16:07:06

Radiated emissions no input signal 2.5 – 5GHz

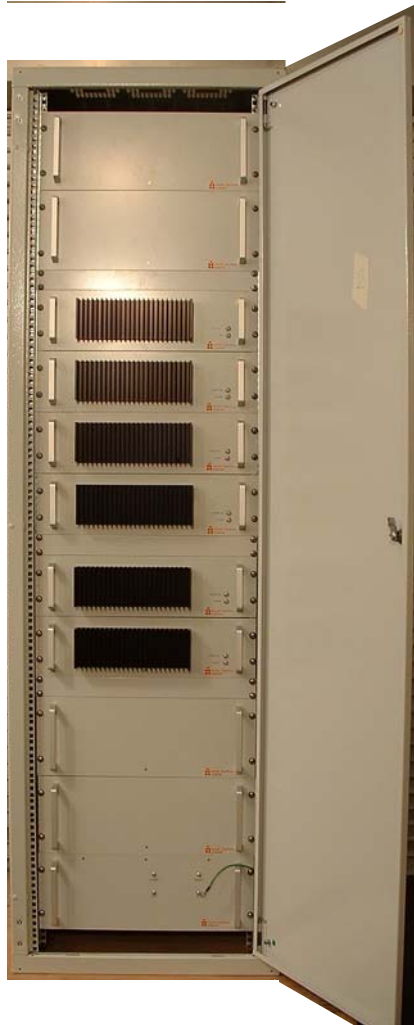


Date: 21.DEC.2006 16:08:31

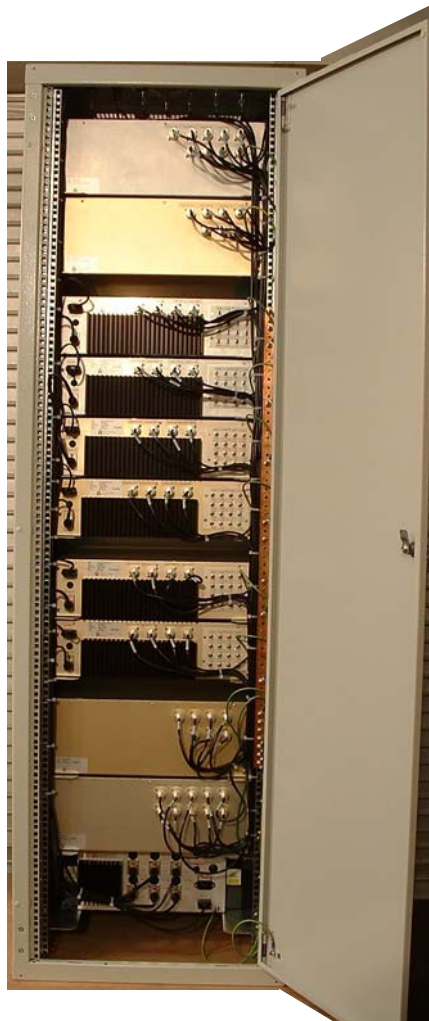
ANNEX A
PHOTOGRAPHS



PHOTOGRAPH No. 2 EUT FRONT OVERVIEW CABINET DOOR OPEN



PHOTOGRAPH No. 3 EUT REAR OVERVIEW CABINET DOOR OPEN



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

