



**REPORT ON THE CERTIFICATION TESTING OF A
AXELL WIRELESS
4008D DIGITAL REPEATER
MW-DCSB-40D95-800-12-AC-IP95
WITH RESPECT TO
FCC RULES CFR 47, PART 90 Subpart I
PRIVATE LAND MOBILE REPEATER
AND
INDUSTRY CANADA
RSS-131
ZONE ENHANCERS FOR
LAND MOBILE SERVICES**

TEST REPORT NO: 9F2902WRP1
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ICID: 8749A-300ZC2

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INDUSTRY CANADA
RSS-131
ZONE ENHANCERS FOR
LAND MOBILE SERVICES**



TEST DATE: 21st December 2009 – 19th January 2010

TESTED BY: _____ D WINSTANLEY

APPROVED BY: _____ J CHARTERS
RADIO PRODUCT
MANAGER

DATE: 2nd February 2010

Distribution:

- Copy Nos:
1. Axell Wireless
 2. TCB: TRaC EMC & Safety
 3. TRaC Telecoms & Radio

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The results herein relate only to the sample tested. Full results are contained in the relevant works order file.

UP HOLLAND

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CONTENTS

	PAGE	
CERTIFICATE OF CONFORMITY & COMPLIANCE	4	
APPLICANT'S SUMMARY	5	
EQUIPMENT TEST CONDITIONS	6	
TESTS REQUIRED	6	
TEST RESULTS	7 - 59	
		ANNEX
PHOTOGRAPHS	A	
PHOTOGRAPH No. 1: Test setup		
PHOTOGRAPH No. 2: Overview		
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST	B	
EQUIPMENT CALIBRATION	C	
MEASUREMENT UNCERTAINTY	D	
PASSBAND PLOTS	E	
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: NEODCSB40D958AC

UNIQUE PRODUCT CODE: 8749A-300ZC2

PURPOSE OF TEST: Certification

TEST SPECIFICATION: FCC RULES CFR 47, Part 90 Subpart I & RSS-131

TEST RESULT: Compliant to Specification

EQUIPMENT UNDER TEST: W-DCSB-40D95-800-24-AC-IP95

EQUIPMENT TYPE: Private Land Mobile Repeater / Zone Enhancer

MAXIMUM GAIN: Uplink = 96.49 dB
Downlink = 94.87 dB

MAXIMUM INPUT: Uplink = -68.7 dBm
Downlink = -54.7 dBm

MAXIMUM OUTPUT CONDUCTED: Uplink = 27.79 dBm
Downlink = 40.17 dBm

MAXIMUM NUMBER OF CHANNELS: 12 software selected channels per system

CHANNEL SPACING: 25 kHz

POWER SOURCE(s): +110Vac

TEST DATE(s): 21st December 2009 - 19th January 2010

APPLICANT: Axell Wireless

ADDRESS: Aerial House
Asheridge Road
Chesham
Buckinghamshire
HP5 1TU

TESTED BY: _____ D WINSTANLEY

APPROVED BY: _____ J CHARTERS
RADIO
PRODUCT
MANAGER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT): W-DCSB-40D95-800-24-AC-IP95

EQUIPMENT TYPE: Private Land Mobile Repeater / Zone Enhancer

PURPOSE OF TEST: Certification

TEST SPECIFICATION(s): FCC RULES CFR 47, Part 90 Subpart I & RSS-131

TEST RESULT: COMPLIANT Yes
No

APPLICANT'S CATEGORY: MANUFACTURER
IMPORTER
DISTRIBUTOR
TEST HOUSE
AGENT

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

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

APPLICANT: Axell Wireless

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

TEL: +44 (0)1494 777000

FAX: +44 (0)1494 778456

MANUFACTURER: Axell Wireless

EUT(s) COUNTRY OF ORIGIN: United Kingdom

TEST LABORATORY: TRaC Telecoms & Radio, Up Holland

UKAS ACCREDITATION No: 0971

TEST DATE(s): 21st December 2009 – 19th January 2010

TEST REPORT No: 9F2902WRP1

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.	TEST/EXAMINATION	FCC RULE PART	IC RULE PART	RESULT
	RF Power Output	90.205	4.3	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	4.3.2	Complies
	Spurious Emissions at Antenna Terminals	90.210	4.4	Complies
	Field Strength of Spurious Emissions	90.210	4.4	Complies
	Frequency Stability	90.213	4.5	N/A (note 1)
	Transient behaviour	90.214	N/A	N/A (note 2)
	20dB bandwidth	N/A	4.2	Complies
	Passband Gain	N/A	4.2	Complies

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 (s): | F1E, F3E, GXW, G1E | | |
| 5. | Temperatures: | Ambient (Tnom) | 24°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 | <input checked="" type="checkbox"/> | |
| 8. | Channel spacing: | Narrowband | <input checked="" type="checkbox"/> | 25 kHz |
| | | Wideband | [] | |
| 9. | Test Location | TRaC Telecoms & Radio | | |
| | | Up Holland | <input checked="" type="checkbox"/> | |
| | | Hull | [] | |
| 10. | Modifications made during test program | No modifications were performed. | | |

System description:

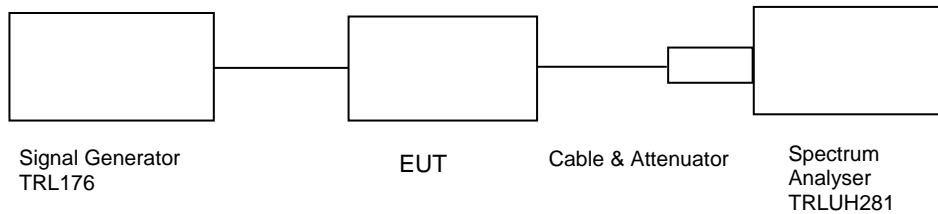
Axell4008D IP65 Digital Multi-Channel Signal Booster provides indoor and outdoor communications coverage for the complete 800MHz Public Safety spectrum assigned to the wireless networks. The system supports advanced Digital Signal Processing (DSP) technology, programmable digital filters - where each filter supports up to 12 channels. The MW-DCSB-40D95-800-12-AC- is a Digital Multi Channel Selective Signal Booster 800, 12 channels; 40dBm composite 95 dB gain; AC powering.

COMPLIANCE TESTS

AMPLIFIER GAIN – CONDUCTED – UPLINK

Ambient temperature = 13°C
 Relative humidity = 63%
 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
806.0	-67.2	0.4	40.7	-13.00	95.30	27.70	85.30
815.0	-68.3	0.4	40.7	-12.91	96.49	27.79	86.49
824.0	-58.6	0.4	40.7	-15.22	84.48	25.48	74.76

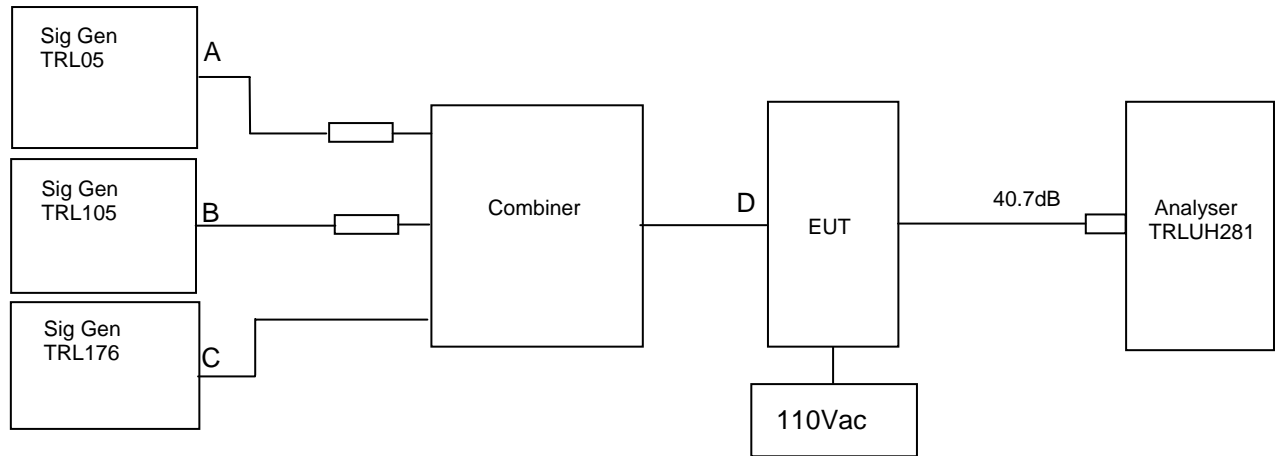
Notes: 1. The signal generator input was increased by 10dBs and the level of the output signal remeasured.

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – PART 2.1053– UPLINK

Ambient temperature = 19°C
 Relative humidity = 51%
 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. The cable and attenuator loss between the EUT and the spectrum analyser was 40.7dB.

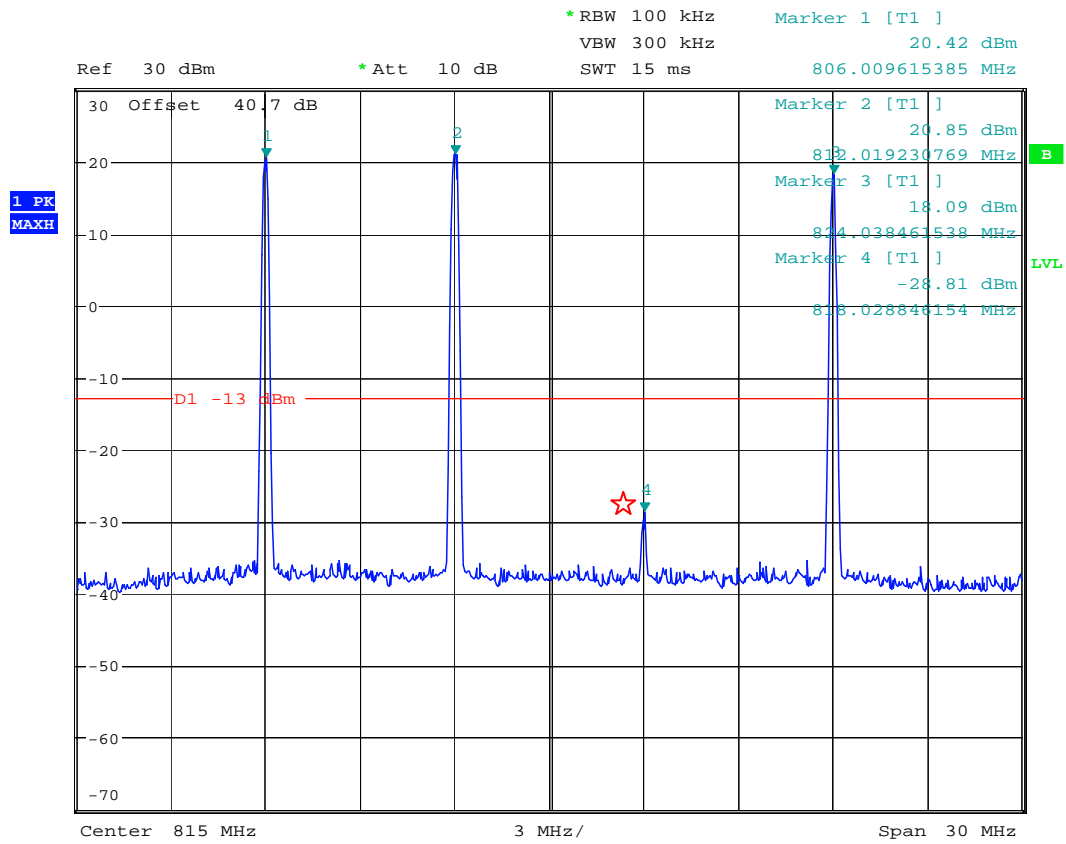
RF Input Frequency (MHz)			Highest Intermodulation Product Level (dBm)	Limit (dBm)
806.0	812.0	824.0	-28.81 dBm @ 818.028 MHz	-13

Sweep data is shown on the next page:

Test equipment used for intermodulation test

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
SIGNAL GENERATOR	MARCONI	2023	112224/040	UH105	X
CMTA	ROHDE & SCHWARZ	CMTA52	894715/033	05	X
COMBINER	AXELL	05003005	N/A	N/A	X
CIRCULATORS	AXELL	N/A	646063 & 646073	N/A	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

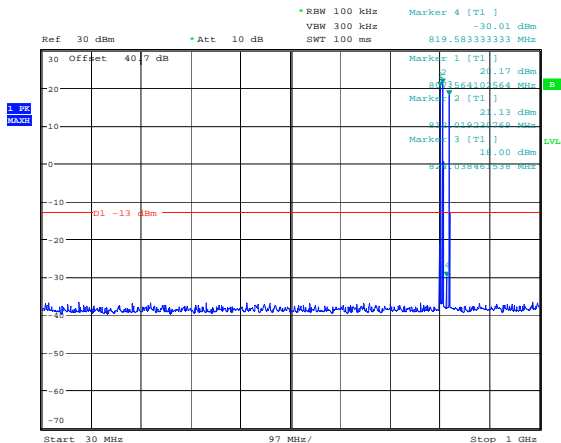
Intermodulation Inband



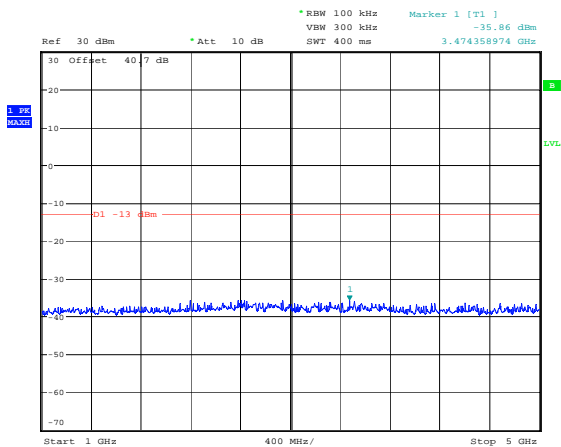
Date: 21.DEC.2009 13:45:07

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

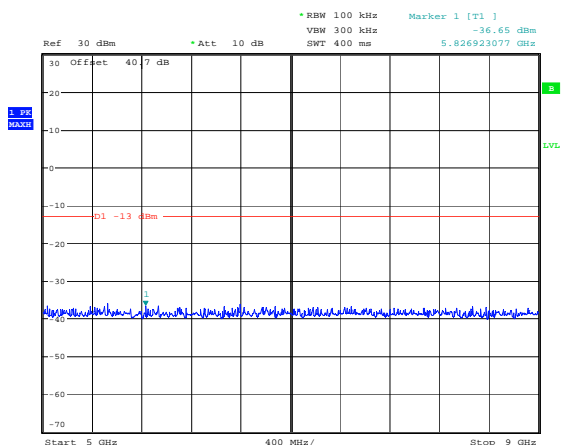
Intermodulation Wideband



Date: 21.DEC.2009 13:45:51



Date: 21.DEC.2009 13:46:03



Date: 21.DEC.2009 13:46:16

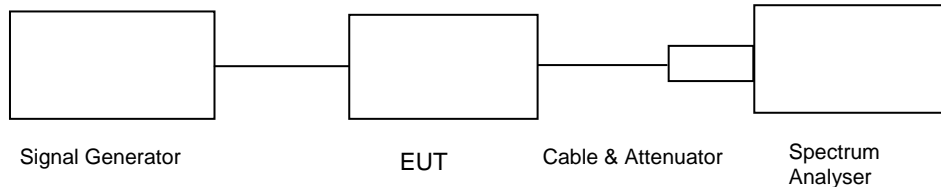
The above plot shows that there are no products outside the bands.

TRANSMITTER TESTS

AMPLIFIER MODULATED CHANNEL TEST – CONDUCTED – UPLINK

Ambient temperature = 19°C
 Relative humidity = 51%
 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. The following modulation schemes were produced, a 2500Hz FM tone with 2.5 and 5 kHz deviation, C4FM and TDMA Type.

The plots show the signal measured at the signal generator (Black trace) and the signal measured at the output of the EUT (Blue Trace).

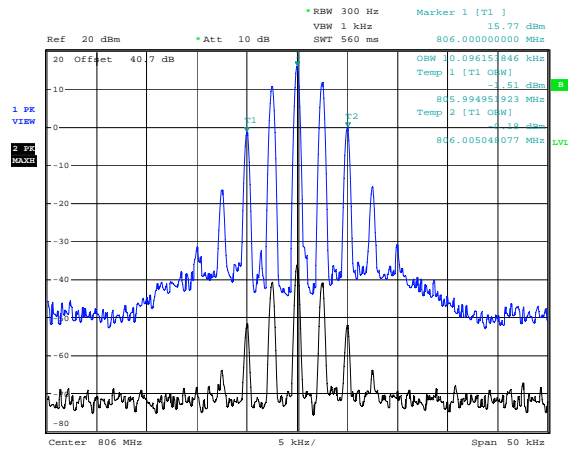
Note: The cables and attenuators had the following losses.

1. Cable and attenuator between EUT and spectrum analyser 40.7dB
2. Cable between signal generator and EUT 0.4dB

Frequency Of Operational Channel	Modulation Type			
	2.5 kHz FM	5 kHz FM	C4FM	TDMA
806.0	10.096 kHz	15.224 kHz	8.653 kHz	27.964 kHz
815.0	10.256 kHz	15.384 kHz	8.605 kHz	27.884 kHz
824.0	10.096 kHz	15.224 kHz	8.461 kHz	28.525 kHz

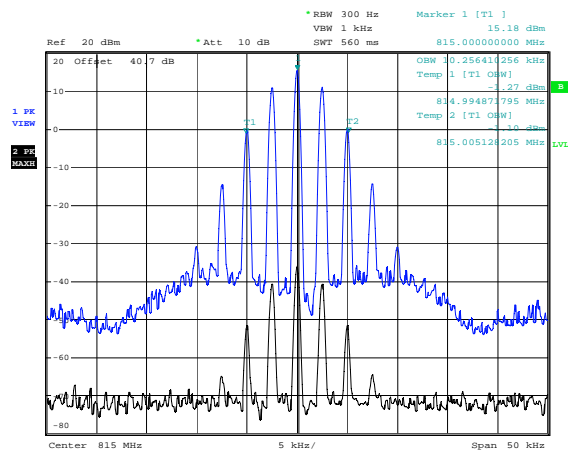
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	IFR	3413	341001/261	N/A	X
SIGNAL GENERATOR	AGILENT	4438C	MY45091850	REF844	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

806.0 FM deviation set to 2.5kHz



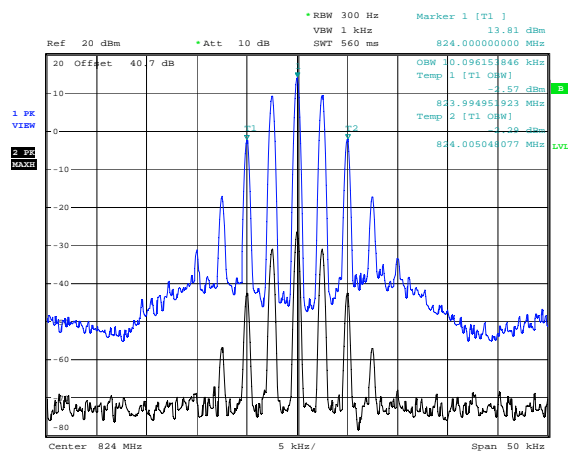
Date: 21.DEC.2009 11:17:11

815.0 FM deviation set to 2.5kHz



Date: 21.DEC.2009 11:13:31

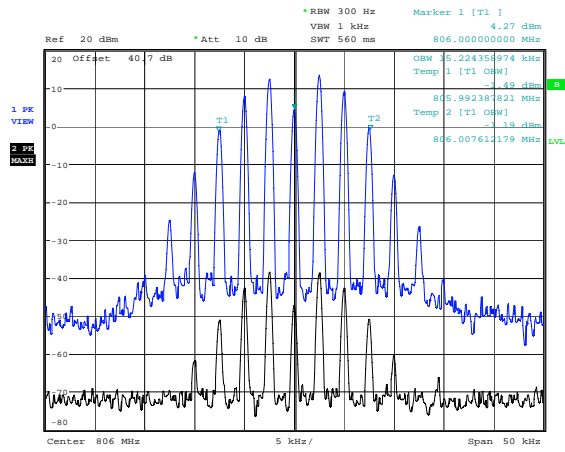
824.0 FM deviation set to 2.5kHz



Date: 21.DEC.2009 11:19:47

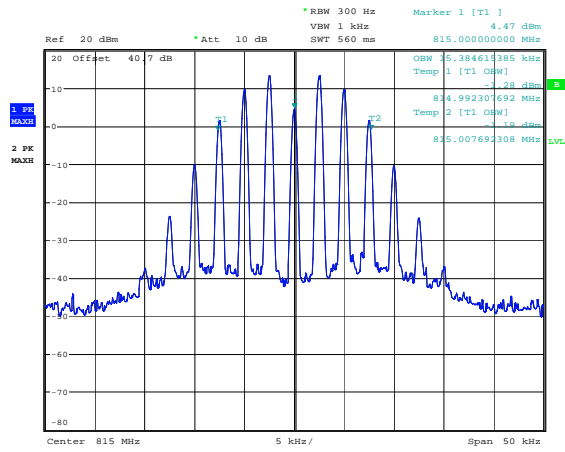
The above plots show no significant distortion visible when compared to the input signal.

806.0 FM deviation set to 5kHz



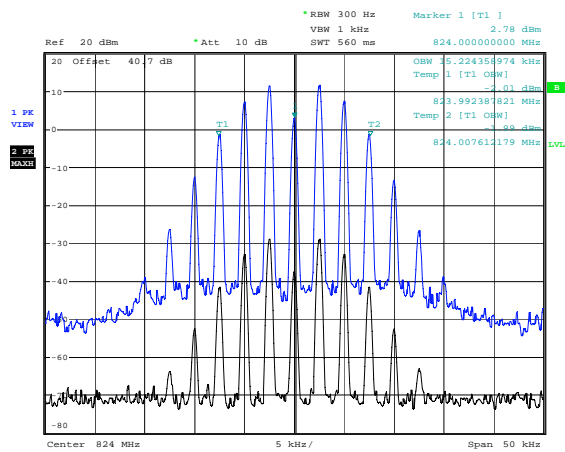
Date: 21.DEC.2009 11:17:37

815.0 FM deviation set to 5kHz



Date: 21.DEC.2009 11:14:12

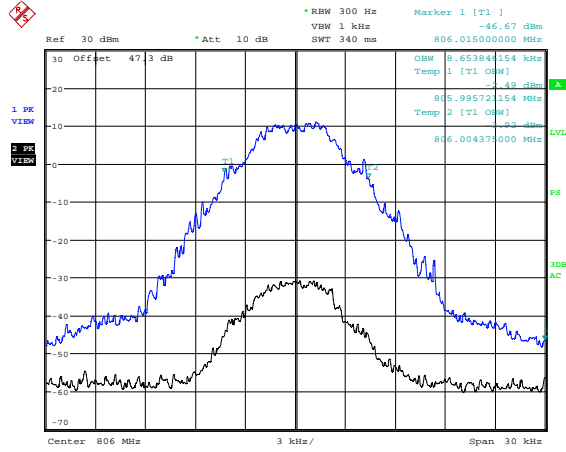
824.0 FM deviation set to 5kHz



Date: 21.DEC.2009 11:19:03

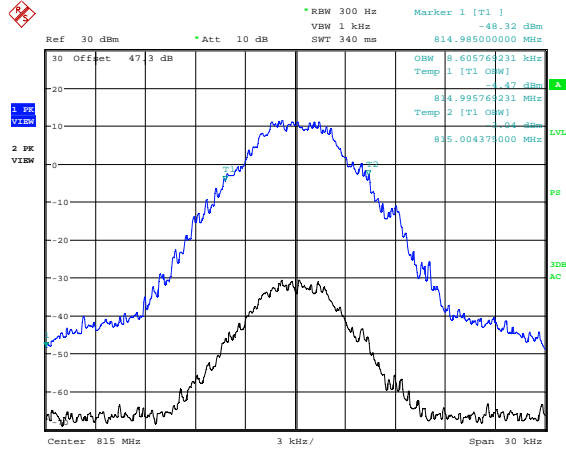
The above plots show no significant distortion visible when compared to the input signal.

806.0 C4FM Modulation



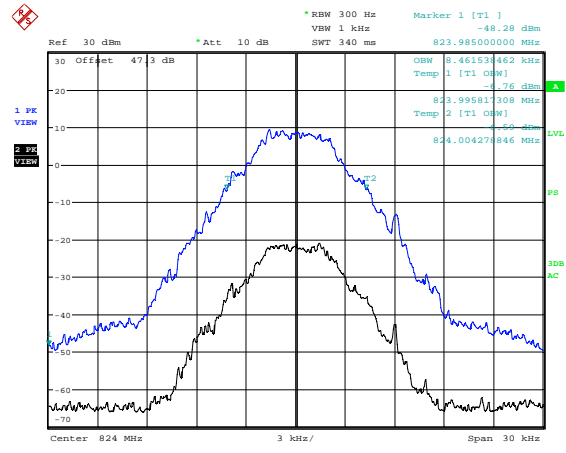
Date: 19.JAN.2010 14:56:58

815.0 C4FM Modulation



Date: 19.JAN.2010 15:06:32

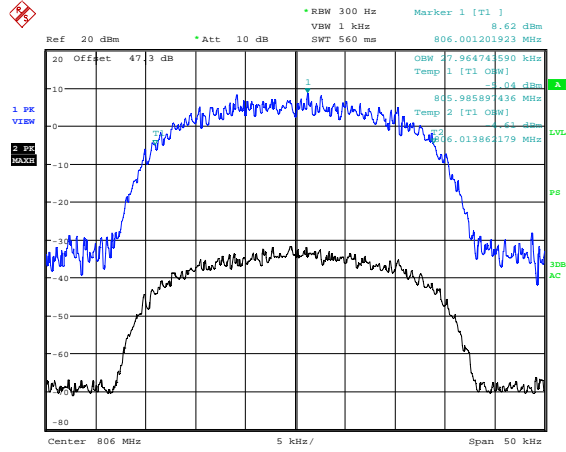
824.0 C4FM Modulation



Date: 19.JAN.2010 15:17:07

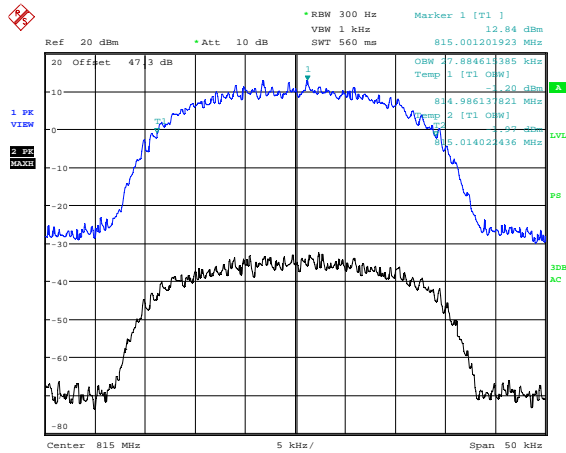
The above plots show no significant distortion visible when compared to the input signal.

806.0 TDMA Modulation



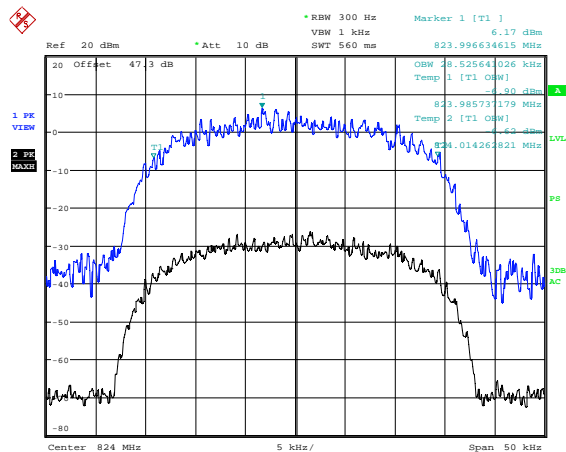
Date: 15.JAN.2010 12:30:54

815.0 TDMA Modulation



Date: 15.JAN.2010 12:35:51

824.0 TDMA Modulation



Date: 15.JAN.2010 12:37:15

The above plots show no significant distortion visible when compared to the input signal.

TRANSMITTER TESTS

PASSBAND GAIN & BANDWIDTH – CONDUCTED - UPLINK

Ambient temperature = 8°C
 Relative humidity = 78%
 Supply voltage = +110Vac
 Channel number = See test results

Radio Laboratory

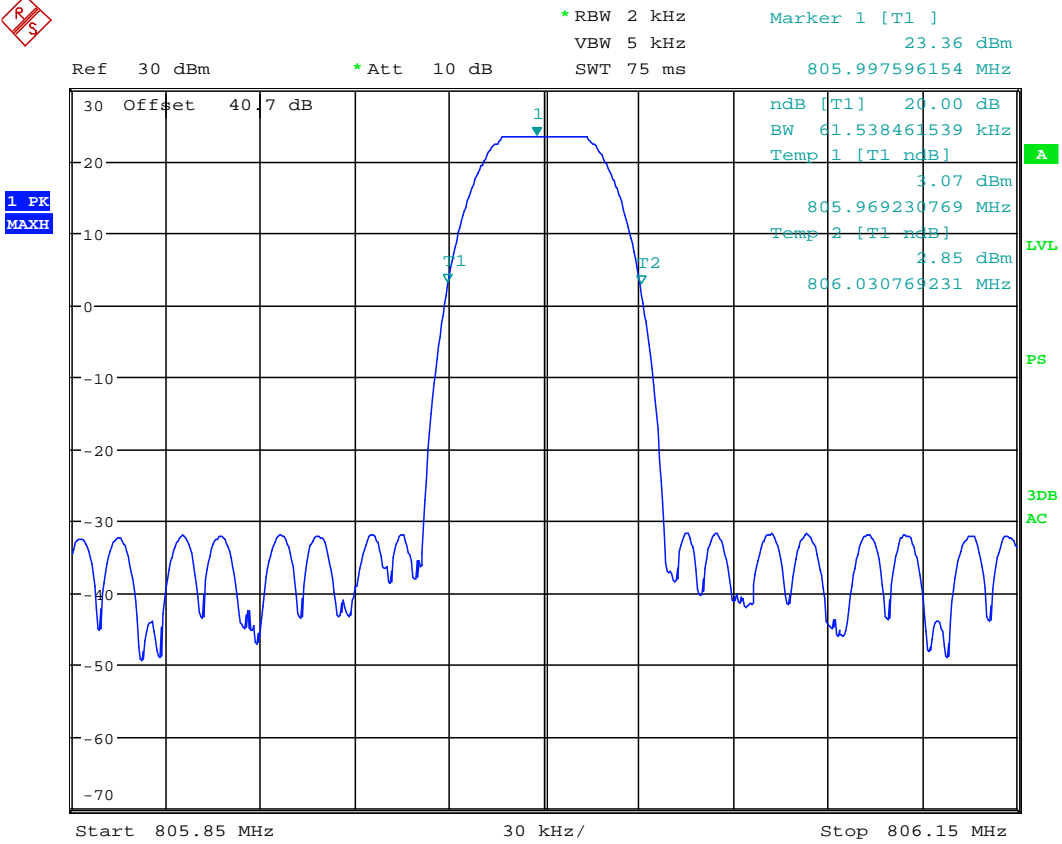


Frequency MHz	fl	fh	20 dB Bandwidth
806.0 – 824.0	805.969230 MHz	824.030286 MHz	18.061056 MHz

1. fl applies to lower frequency of the lowest operating channel
2. fh applies to upper frequency of the highest operating channel

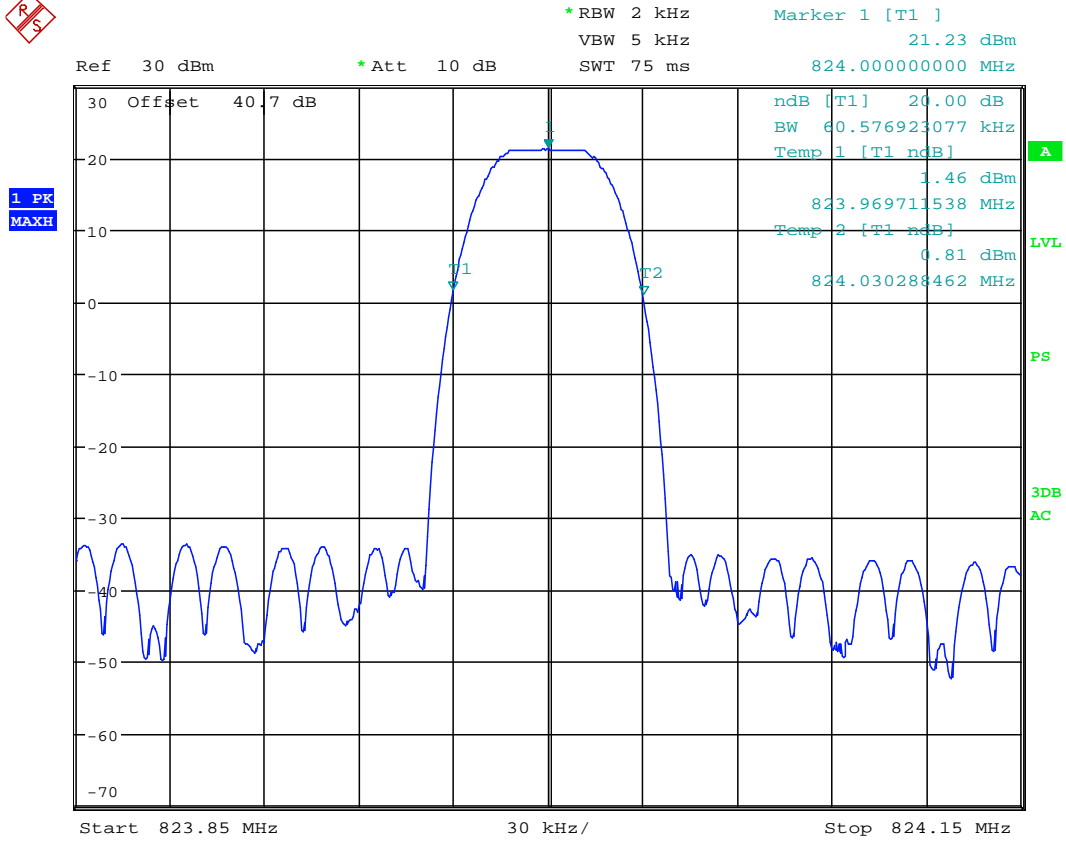
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

UPLINK – LOWEST OPERATING CHANNEL



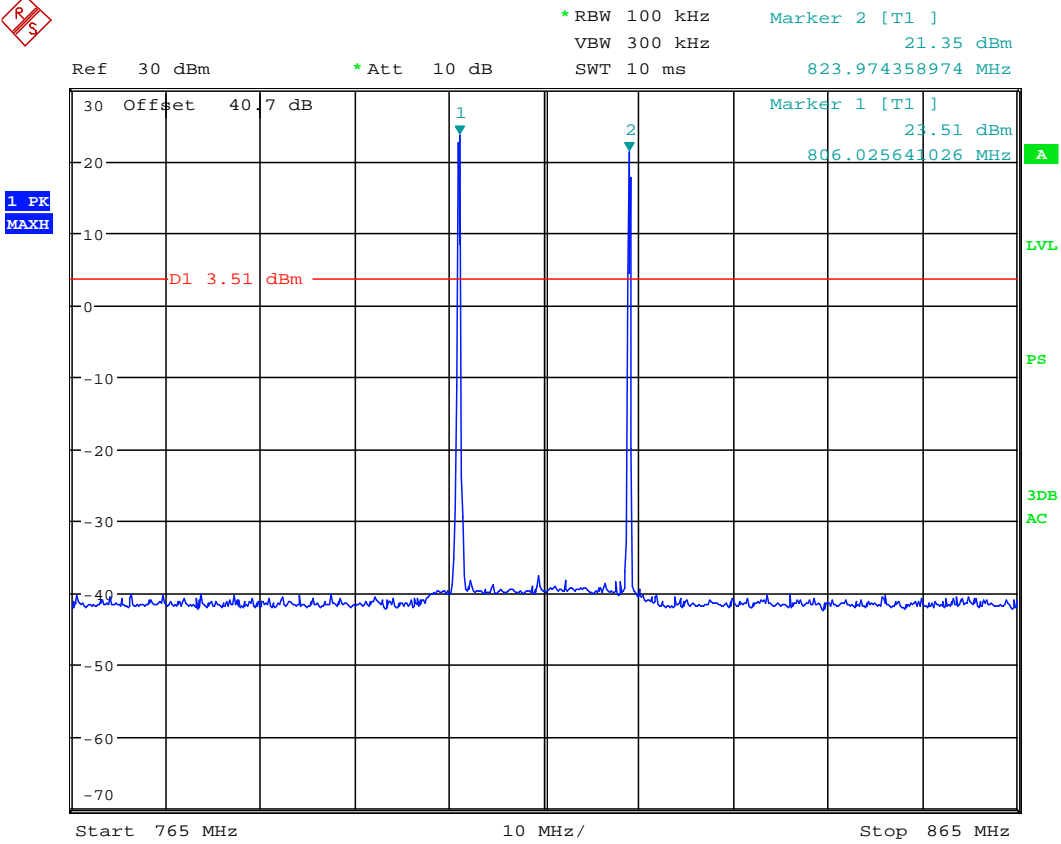
Date: 15.JAN.2010 14:29:47

UPLINK – HIGHEST OPERATING CHANNEL



Date: 15.JAN.2010 14:33:47

UPLINK PASSBAND



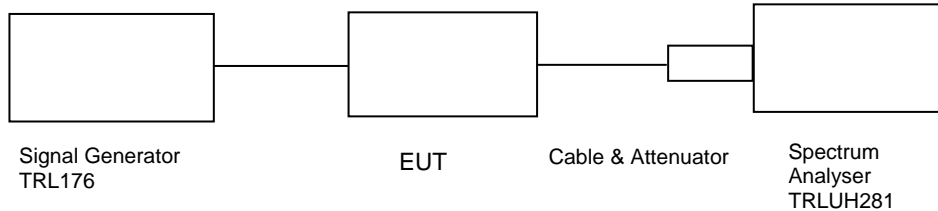
Date: 15.JAN.2010 15:01:51

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – UPLINK

Ambient temperature = 19°C
 Relative humidity = 51%
 Supply voltage = +110Vac

Radio Laboratory



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

The Spurious limit was calculated as follows:

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

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

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

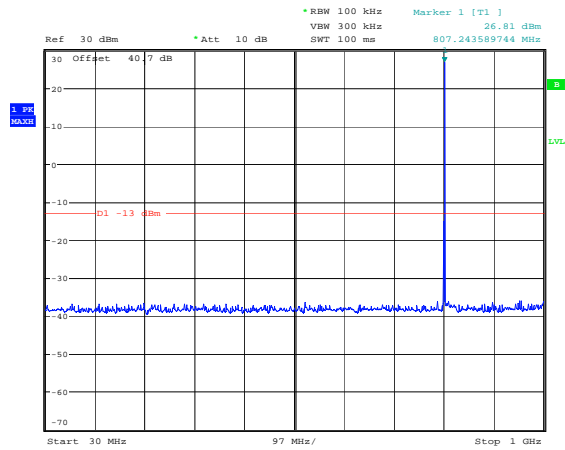
RESULTS

FREQUENCY RANGE	EUT FREQ (MHz)	EMISSION FREQ. (MHz)	MEASURED LEVEL (dBm)	ATTEN & CABLE LOSSES (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
30 MHz - 9 GHz	No Significant Emissions Within 20dB of Limit					-13

The test equipment used for the Transmitter Conducted Emissions:

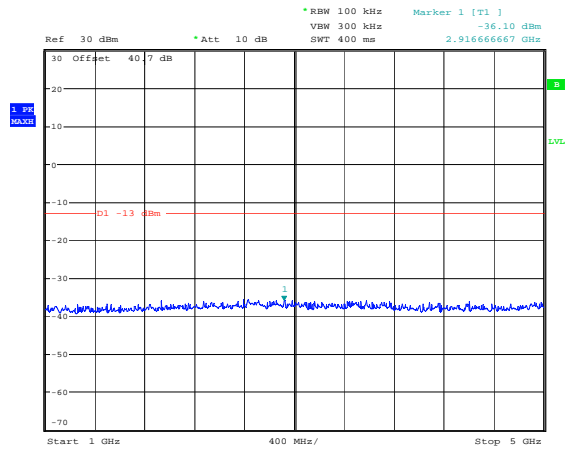
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

Conducted emissions 806.0 MHz 30MHz – 1GHz



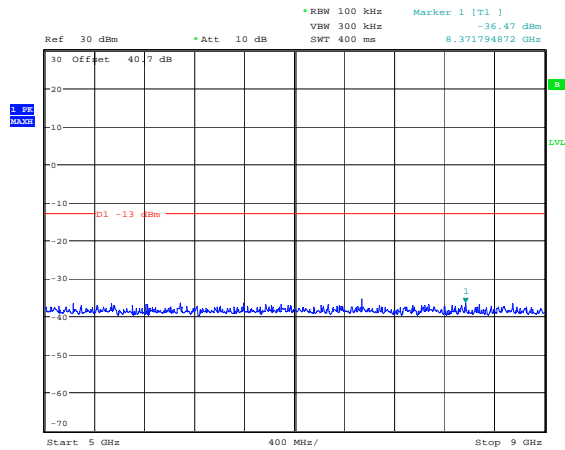
Date: 21.DEC.2009 10:41:12

Conducted emissions 806.0 MHz 1 – 5GHz



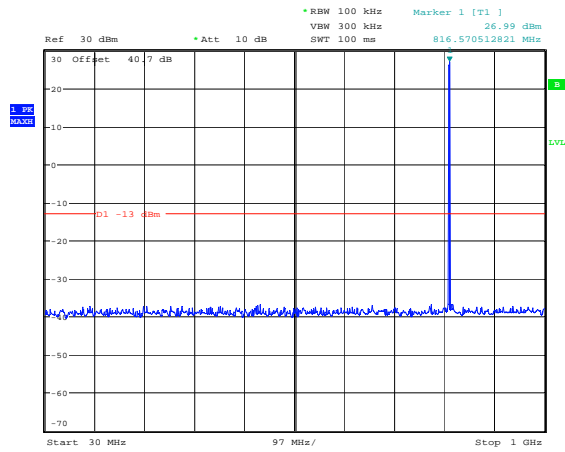
Date: 21.DEC.2009 10:41:45

Conducted emissions 806.0 MHz 5 – 9GHz



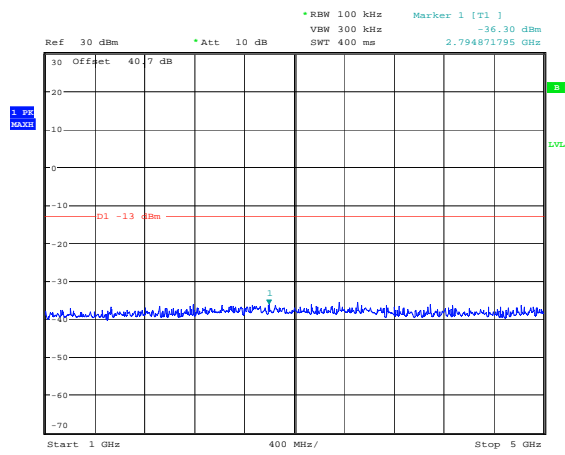
Date: 21.DEC.2009 10:42:16

Conducted emissions 815.0 MHz 30MHz – 1GHz



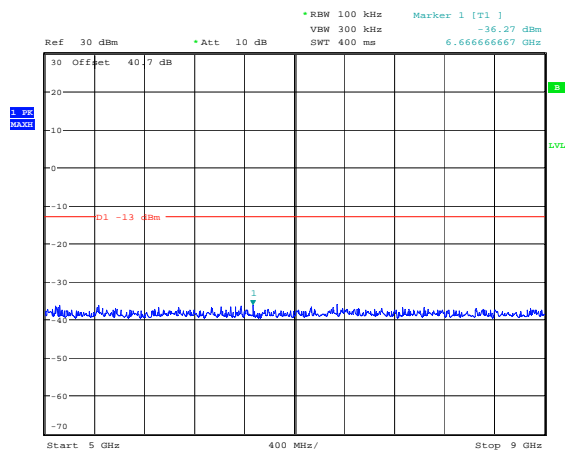
Date: 21.DEC.2009 10:39:26

Conducted emissions 815.0 MHz 1 – 5GHz



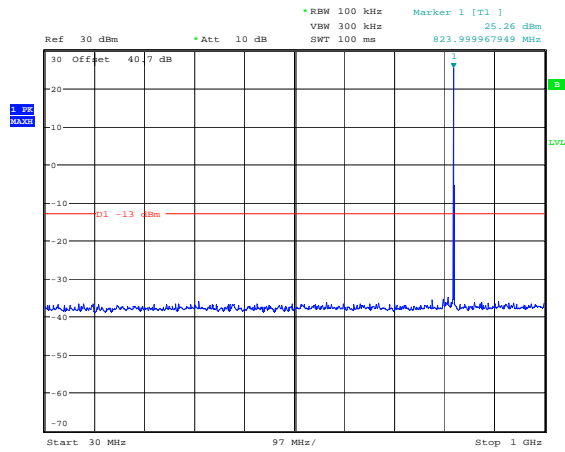
Date: 21.DEC.2009 10:39:40

Conducted emissions 815.0 MHz 5 – 9GHz



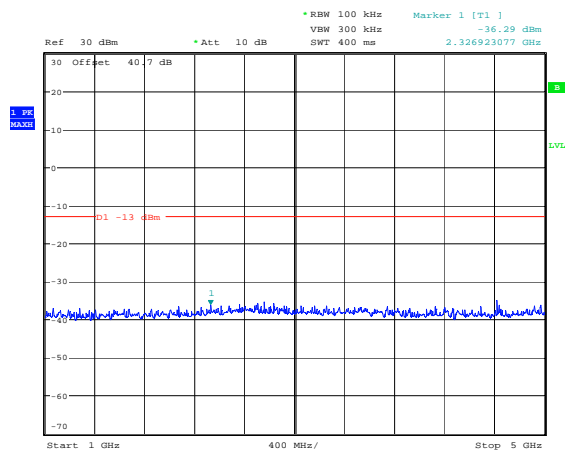
Date: 21.DEC.2009 10:39:58

Conducted emissions 824.0 MHz 30MHz – 1GHz



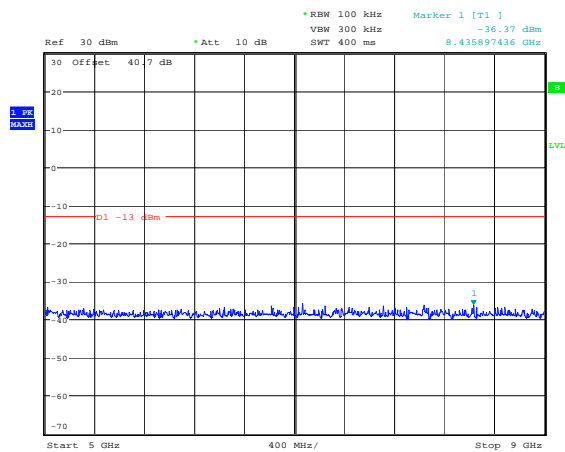
Date: 21.DEC.2009 10:37:59

Conducted emissions 824.0 MHz 1 – 5GHz



Date: 21.DEC.2009 10:38:19

Conducted emissions 824.0 MHz 5 – 9GHz

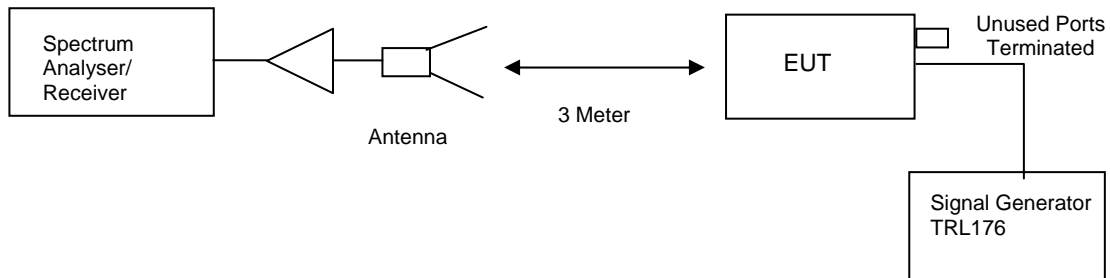


Date: 21.DEC.2009 10:38:35

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – RADIATED – UPLINK

Ambient temperature = 5°C
 Relative humidity = 81%
 Conditions = OATS
 Supply voltage = +110Vac
 Supply Frequency = N/A



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

The Spurious limit was calculated as follows:

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

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

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

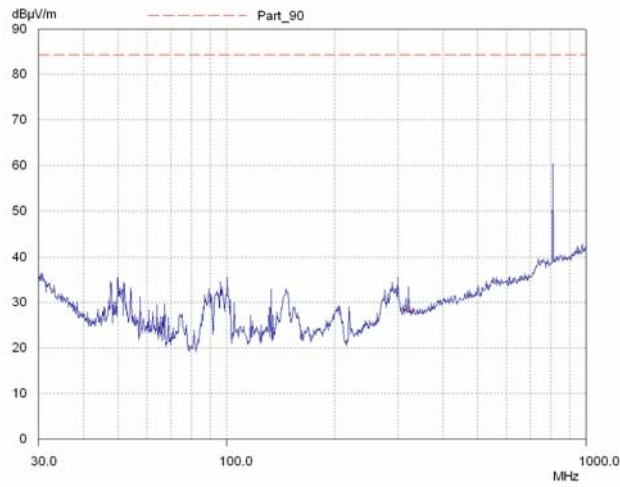
RESULTS

FREQUENCY RANGE	EUT FREQ (MHz)	FREQ. (MHz)	EIRP (dBm)	LIMIT (dBm)
30MHz – 9 GHz	No Significant Emissions Within 20 dB of Limit			-13

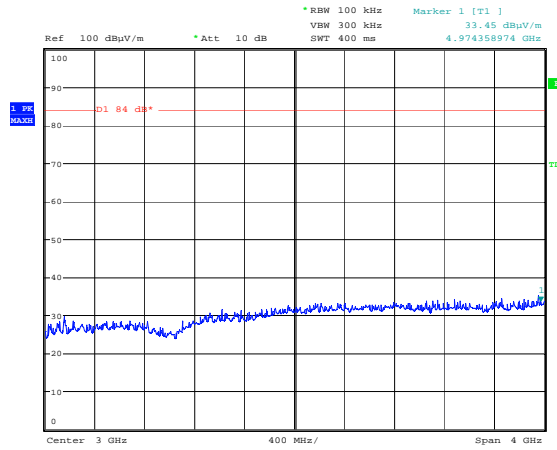
The test equipment used for the Transmitter Spurious Emissions:

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	X
HORN	EMCO	3115	9010-3580	138	X
PRE AMPLIFIER	HP	8449B	3008A016	572	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ANTENNA	YORK	CBL611/A	1618	UH191	X
PRE AMPLIFIER	WATRKINS JOHNSON	6201-69	2740	UH372	X
RECEIVER	RHODE & SCHWARZ	ESVS10	825890/006	UH04	X

Radiated emissions 806.0 30MHz – 1GHz

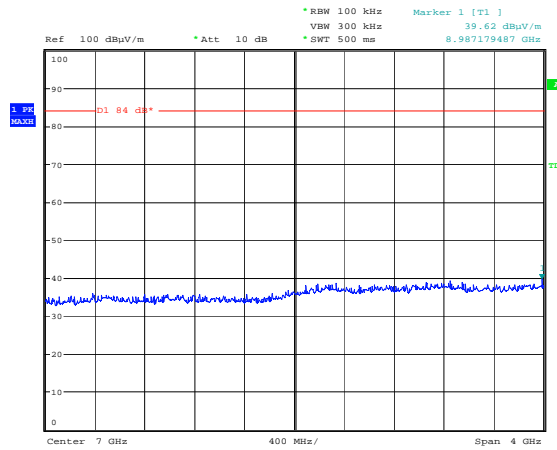


Radiated emissions 806.0 1 – 5GHz



Date: 21.DEC.2009 15:32:27

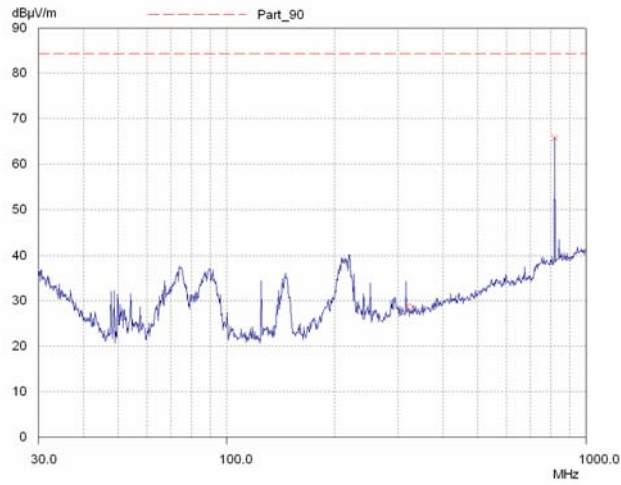
Radiated emissions 806.0 5 – 9GHz



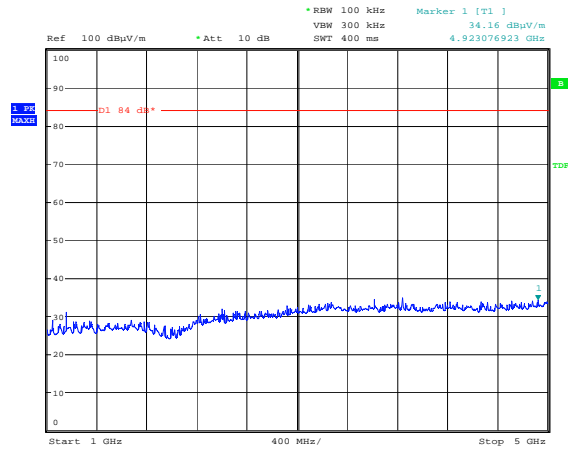
Date: 21.DEC.2009 15:32:12

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

Radiated emissions 815.0 30MHz – 1GHz

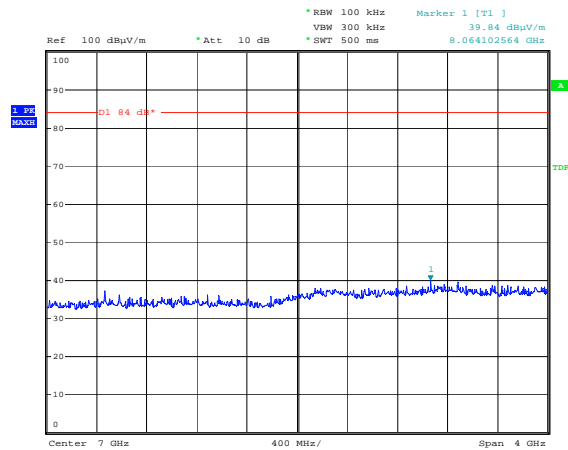


Radiated emissions 815.0 1 – 5GHz



Date: 21.DEC.2009 15:34:45

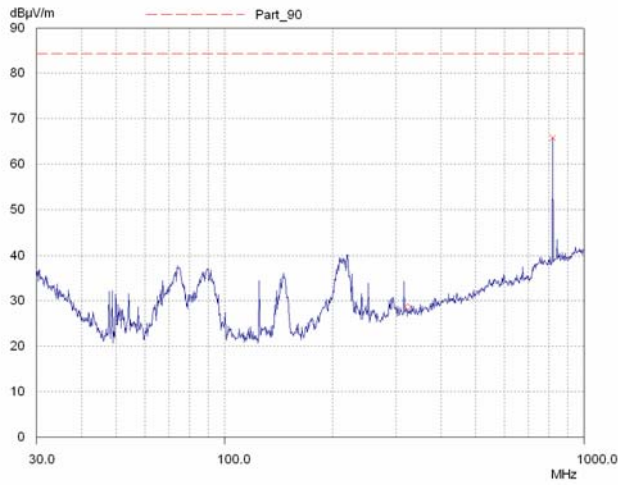
Radiated emissions 815.0 5 – 9GHz



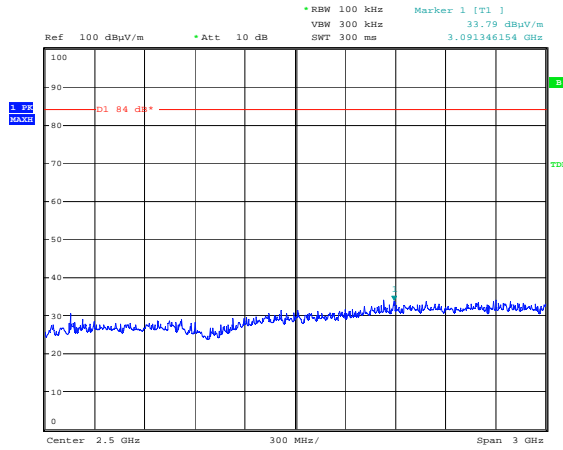
Date: 21.DEC.2009 15:34:59

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

Radiated emissions 824.0 30MHz – 1GHz

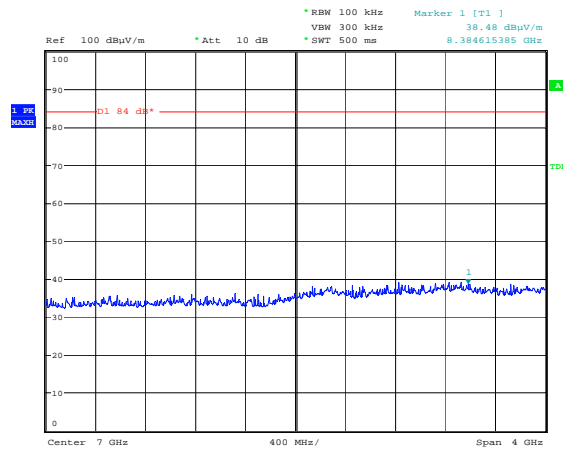


Radiated emissions 824.0 1 – 5GHz



Date: 21.DEC.2009 15:38:04

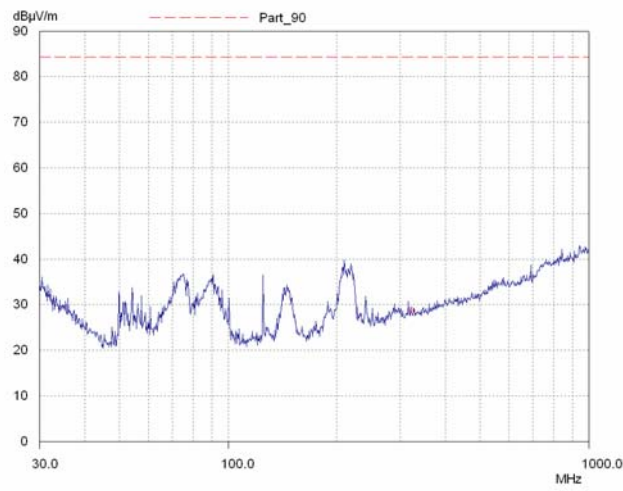
Radiated emissions 815.0 5 – 9GHz



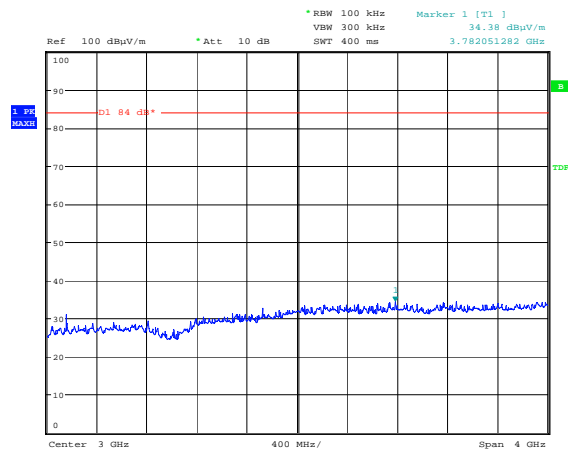
Date: 21.DEC.2009 15:37:50

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

Radiated emissions no input signal 30MHz – 1GHz

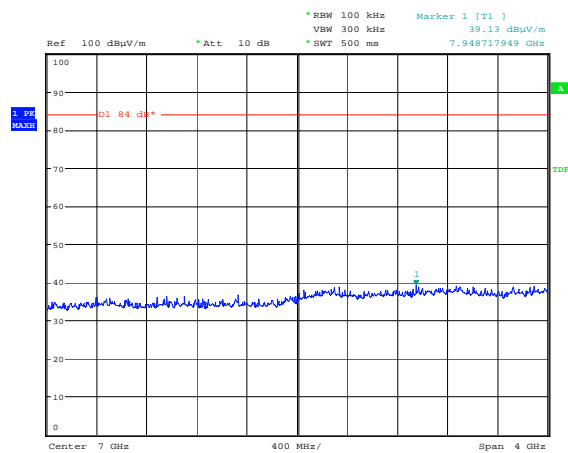


Radiated emissions no input signal 1 – 5GHz



Date: 21.DEC.2009 15:26:52

Radiated emissions no input signal 5 – 9GHz



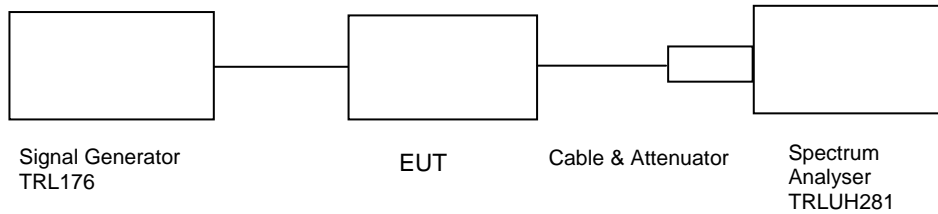
Date: 21.DEC.2009 15:27:15

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

AMPLIFIER GAIN – CONDUCTED – DOWNLINK

Ambient temperature = 13°C
 Relative humidity = 63%
 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
851.0	-53.5	0.4	40.7	-2.56	91.54	38.14	81.53
860.0	-54.3	0.4	40.7	-0.53	94.87	40.17	84.86
869.0	-53.1	0.4	40.7	-1.98	92.22	38.72	82.24

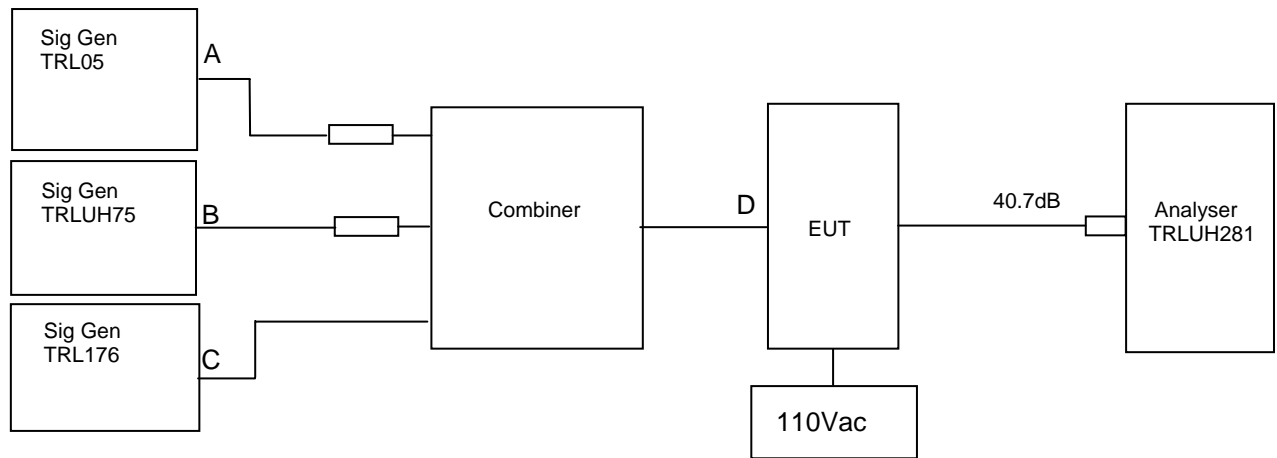
Notes: 1. The signal generator input was increased by 10dBs and the level of the output signal remeasured.

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – PART 2.1053– DOWNLINK

Ambient temperature = 19°C
 Relative humidity = 51%
 Supply voltage = +110Vac

Radio Laboratory



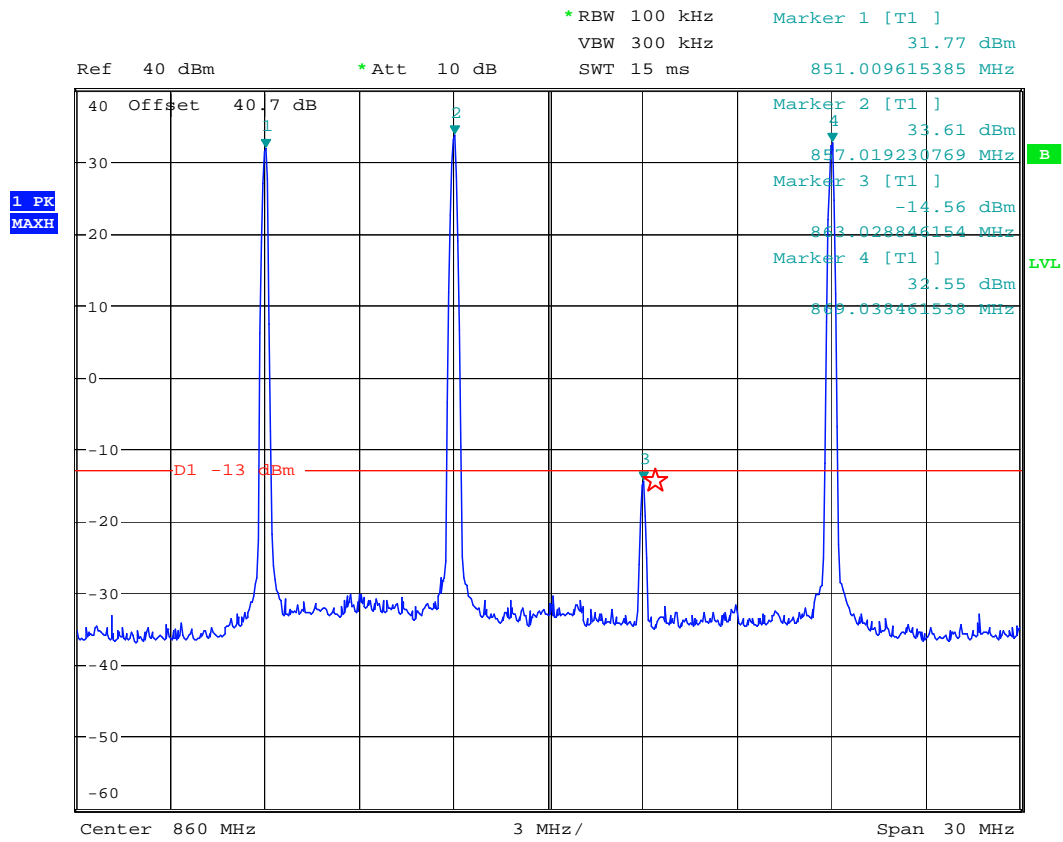
The intermodulation and spurious products were measured with the amplifier operating at maximum gain. A three tone test was conducted using the equipment as above. The input power level was adjusted so the level at point D was 10dB above the maximum input. The cable and attenuator loss between the EUT and the spectrum analyser was 40.7dB.

RF Input Frequency (MHz)			Highest Intermodulation Product Level (dBm)	Limit (dBm)
851.0	857.0	869.0	-14.56 dBm @ 863.028 MHz	-13

Test equipment used for intermodulation test

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	R&S	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
SIGNAL GENERATOR	MARCONI	2022D	119215/058	UH75	X
CMTA	ROHDE & SCHWARZ	CMTA52	894715/033	05	X
COMBINER	AXELL	05003005	N/A	N/A	X
CIRCULATORS	AXELL	N/A	646063 & 646073	N/A	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

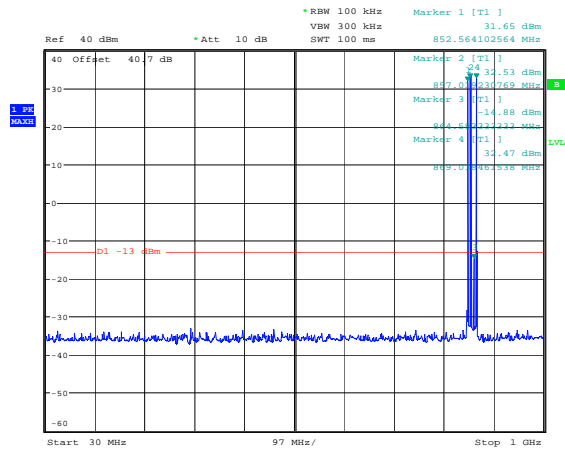
Intermodulation Inband



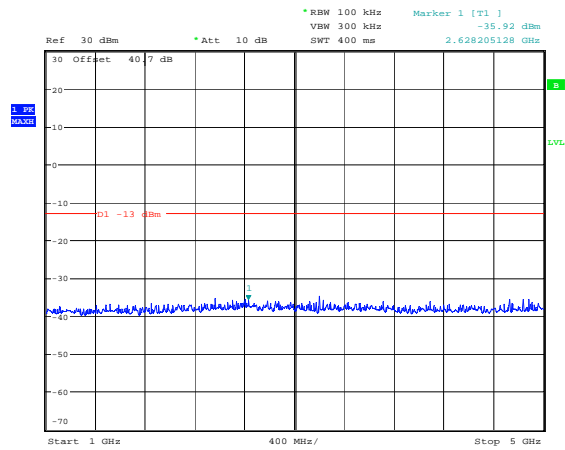
Date: 21.DEC.2009 13:35:43

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

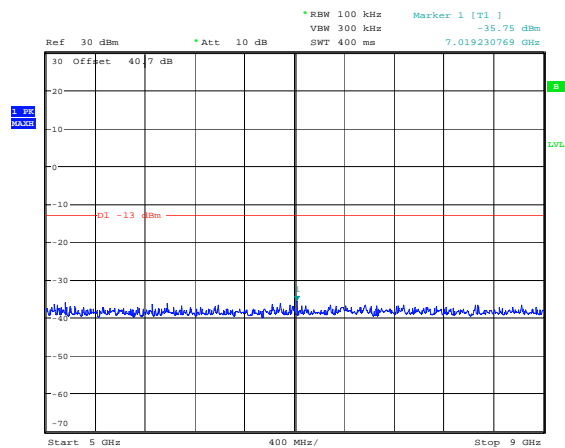
Intermodulation Wideband



Date: 21.DEC.2009 13:36:11



Date: 21.DEC.2009 13:36:30



Date: 21.DEC.2009 13:36:44

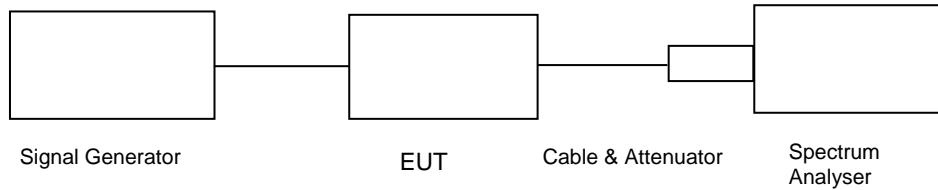
The above plot shows that there are no products outside the bands

TRANSMITTER TESTS

AMPLIFIER MODULATED CHANNEL TEST – CONDUCTED – DOWNLINK

Ambient temperature = 24°C
 Relative humidity = 56%
 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. The following modulation schemes were produced, a 2500Hz FM tone with 2.5 and 5 kHz deviation, C4FM and TDMA Type.

The plots show the signal measured at the signal generator (Black trace) and the signal measured at the output of the EUT (Blue Trace).

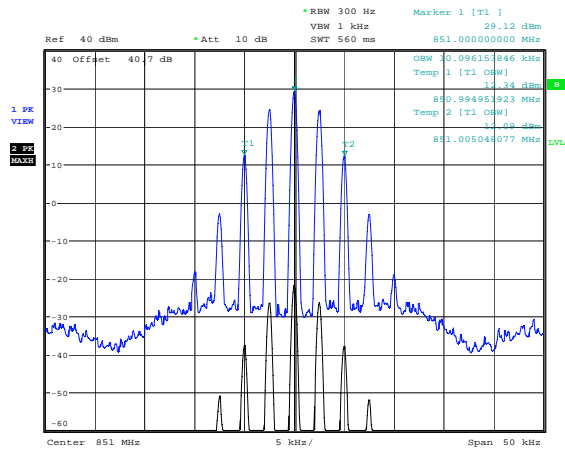
Note: The cables and attenuators had the following losses.

1. Cable and attenuator between EUT and spectrum analyser 40.7dB
2. Cable between signal generator and EUT 0.4dB

Frequency Of Operational Channel	Modulation Type			
	2.5 kHz FM	5 kHz FM	C4FM	TDMA
851.0	10.096 kHz	15.224 kHz	8.509 kHz	27.884 kHz
860.0	10.256 kHz	15.224 kHz	8.461 kHz	28.125 kHz
869.0	10.096 kHz	15.224 kHz	8.563 kHz	28.125 kHz

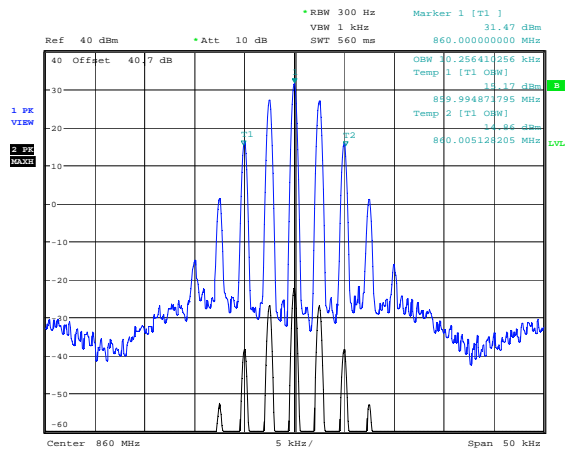
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	IFR	3413	341001/261	N/A	X
SIGNAL GENERATOR	AGILENT	4438C	MY45091850	REF844	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

851.0 FM deviation set to 2.5kHz



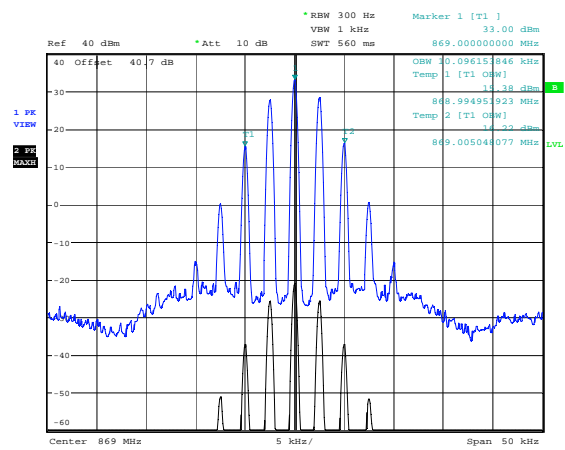
Date: 21.DEC.2009 11:53:51

860.0 FM deviation set to 2.5kHz



Date: 21.DEC.2009 11:56:02

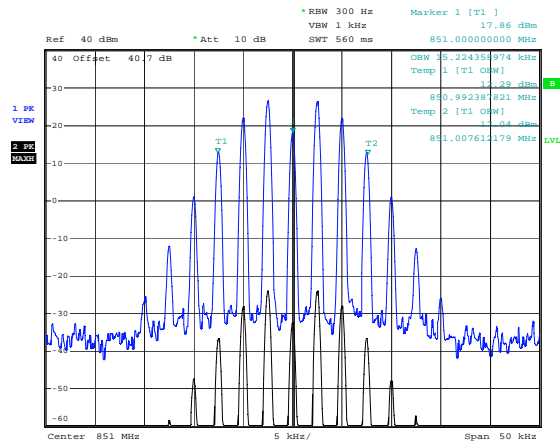
869.0 FM deviation set to 2.5kHz



Date: 21.DEC.2009 11:57:30

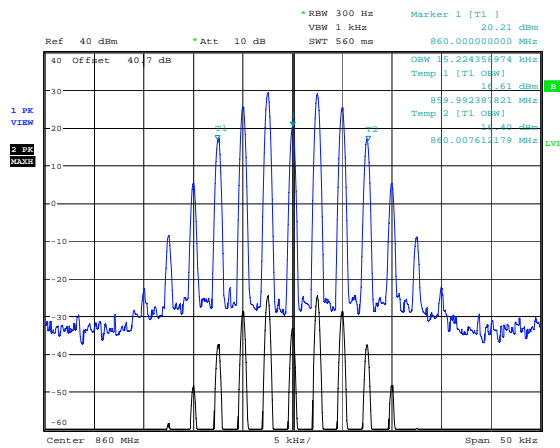
The above plots show no significant distortion visible when compared to the input signal.

851.0 FM deviation set to 5kHz



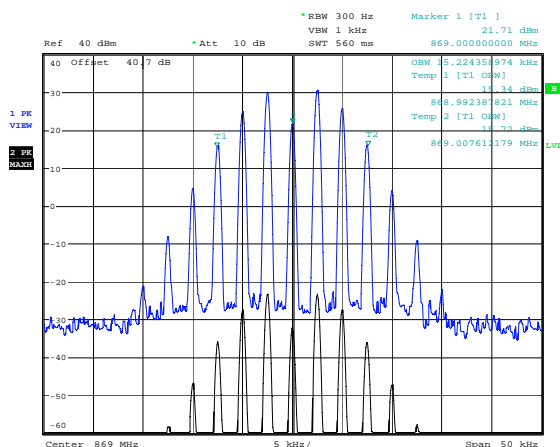
Date: 21.DEC.2009 11:54:35

860.0 FM deviation set to 5kHz



Date: 21.DEC.2009 11:55:28

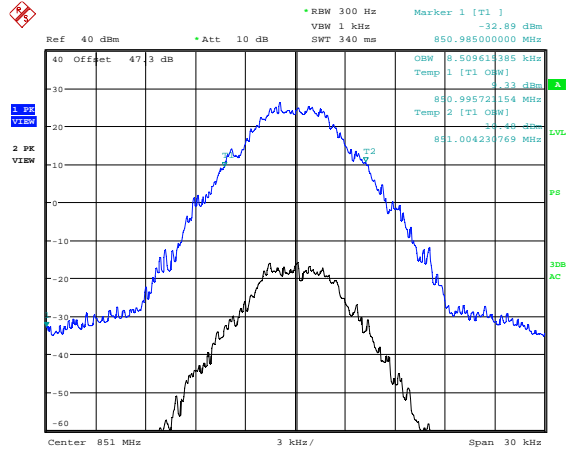
869.0 FM deviation set to 5kHz



Date: 21.DEC.2009 11:58:10

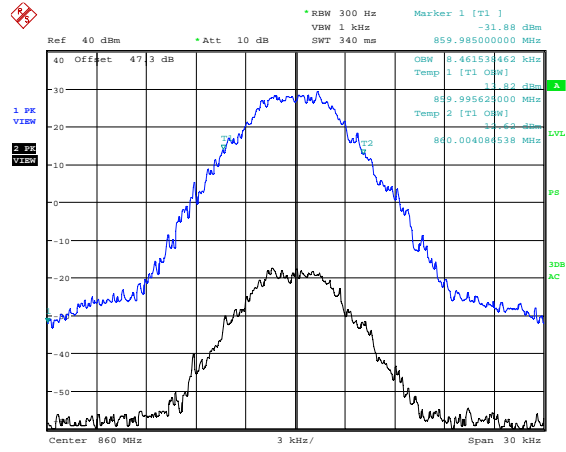
The above plots show no significant distortion visible when compared to the input signal.

851.0 C4FM Modulation



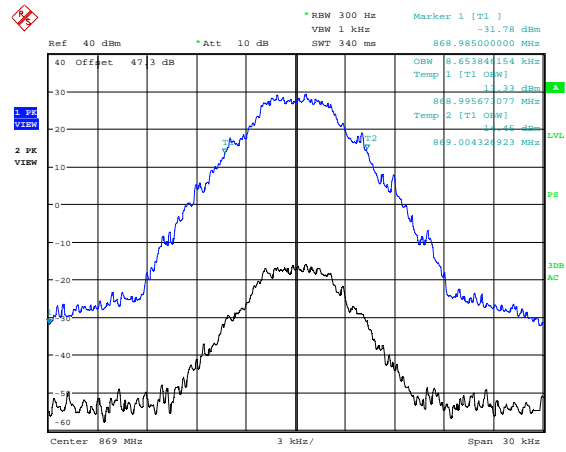
Date: 19.JAN.2010 15:46:48

860.0 C4FM Modulation



Date: 19.JAN.2010 16:00:03

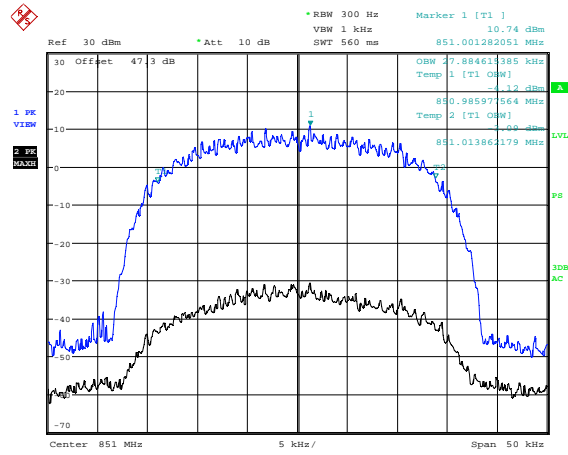
869.0 C4FM Modulation



Date: 19.JAN.2010 16:05:25

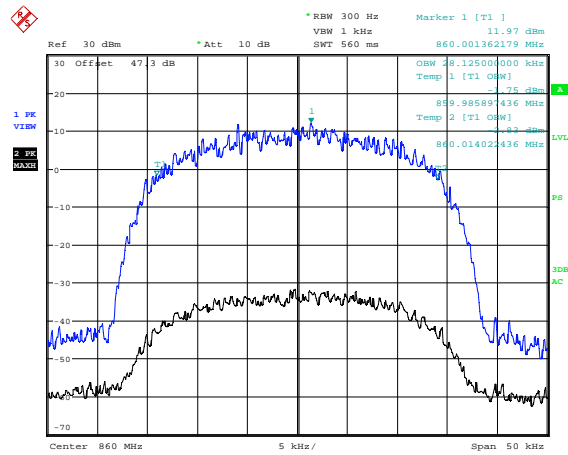
The above plots show no significant distortion visible when compared to the input signal.

851.0 TDMA Modulation



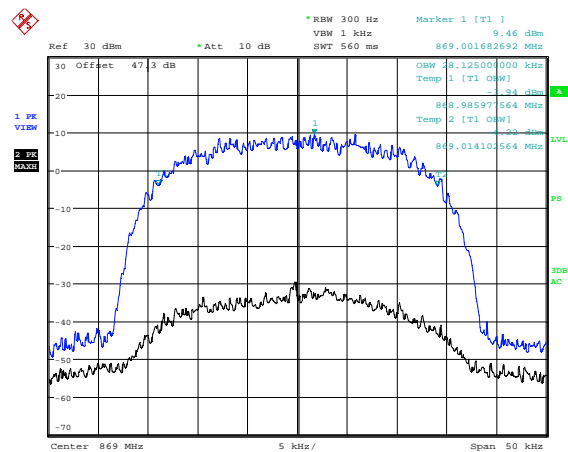
Date: 15.JAN.2010 12:28:12

860.0 TDMA Modulation



Date: 15.JAN.2010 12:24:27

869.0 TDMA Modulation



Date: 15.JAN.2010 12:26:14

The above plots show no significant distortion visible when compared to the input signal.

TRANSMITTER TESTS

PASSBAND GAIN & BANDWIDTH – CONDUCTED - DOWNLINK

Ambient temperature = 8°C
 Relative humidity = 78%
 Supply voltage = +110Vac
 Channel number = See test results

Radio Laboratory

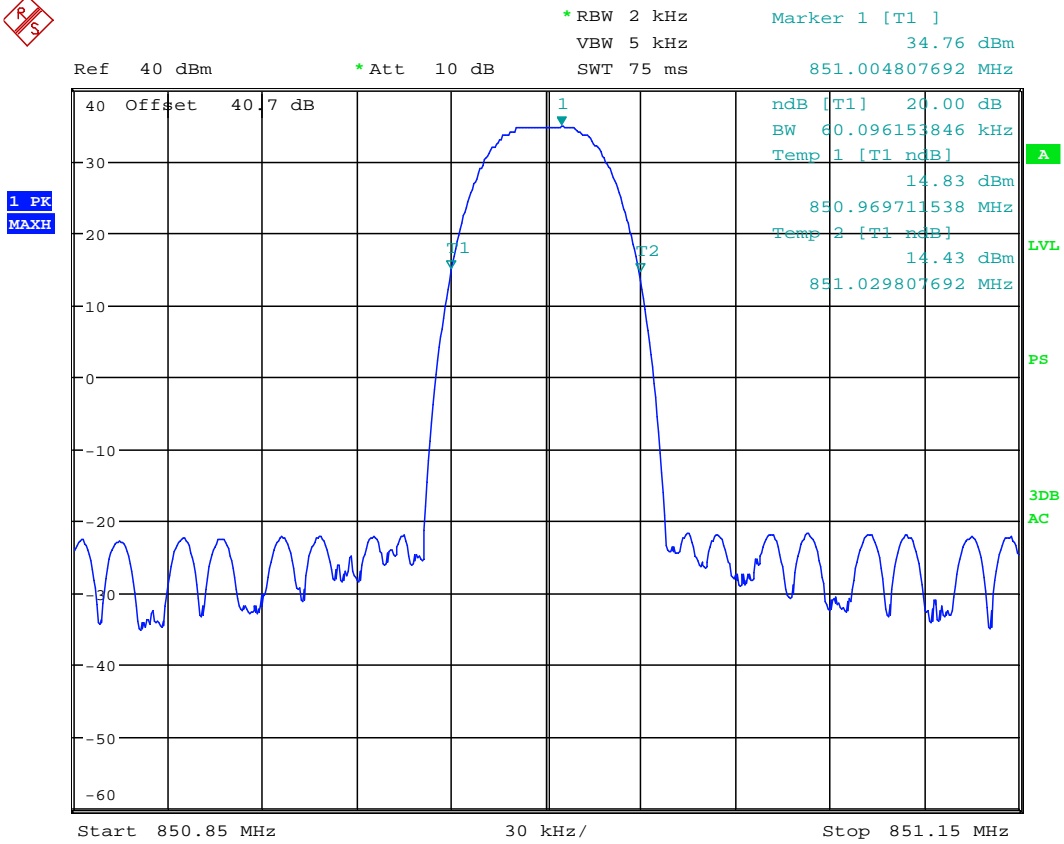


Frequency MHz	fl	fh	20 dB Bandwidth
806.0 – 824.0	850.969711 MHz	869.029807	18.0660096 MHz

1. fl applies to lower frequency of the lowest operating channel
2. fh applies to upper frequency of the highest operating channel

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

LOWEST OPERATING CHANNEL

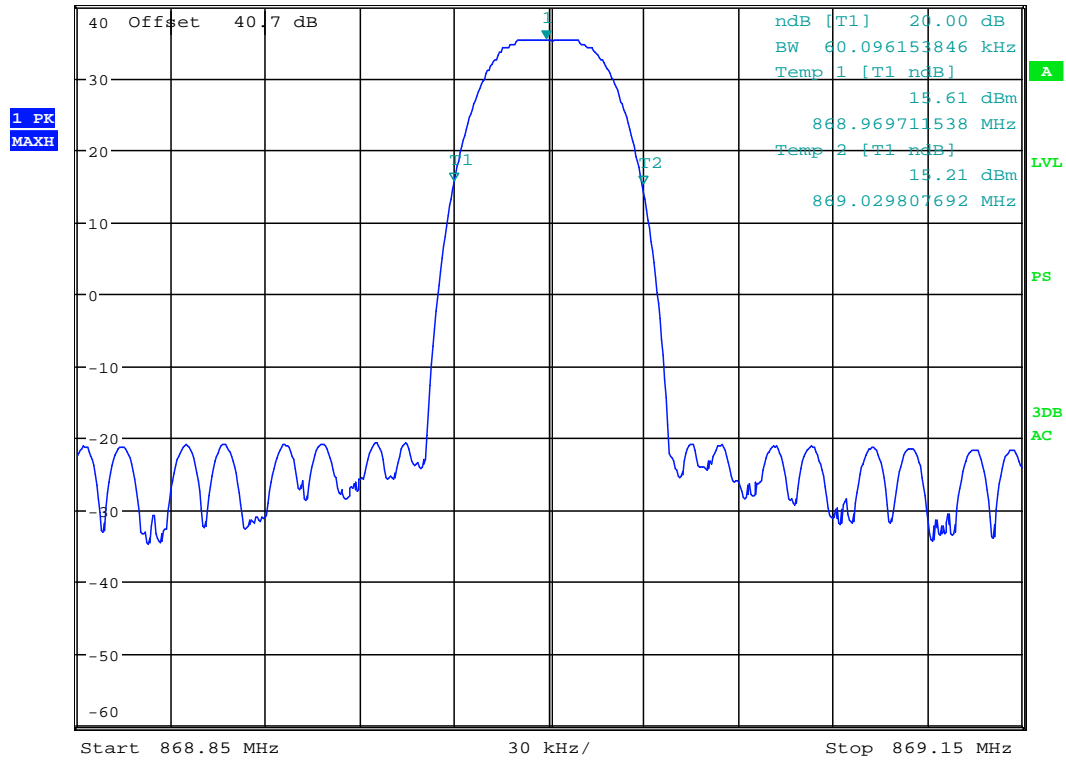


Date: 15.JAN.2010 15:26:04

HIGHEST OPERATING CHANNEL

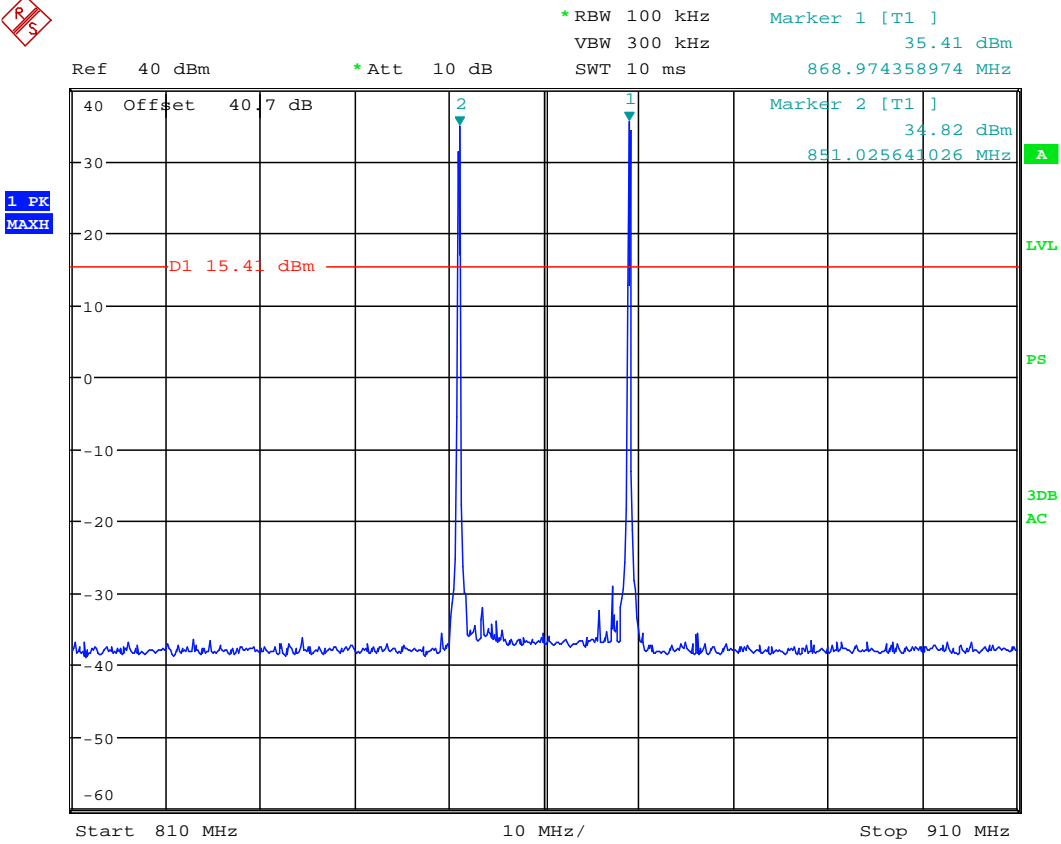


*RBW 2 kHz Marker 1 [T1]
 VBW 5 kHz 35.27 dBm
 Ref 40 dBm *Att 10 dB SWT 75 ms 868.999038462 MHz



Date: 15.JAN.2010 15:29:09

PASSBAND



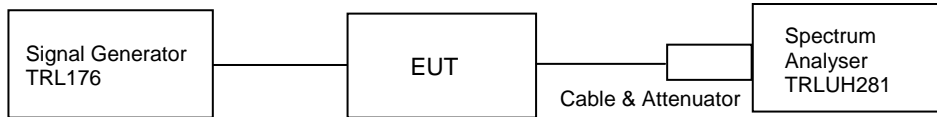
Date: 15.JAN.2010 15:49:24

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – DOWNLINK

Ambient temperature = 19°C
 Relative humidity = 51%
 Supply voltage = +110Vac

Radio Laboratory 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 at maximum power and on three test frequencies.

The Spurious limit was calculated as follows:

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

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

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

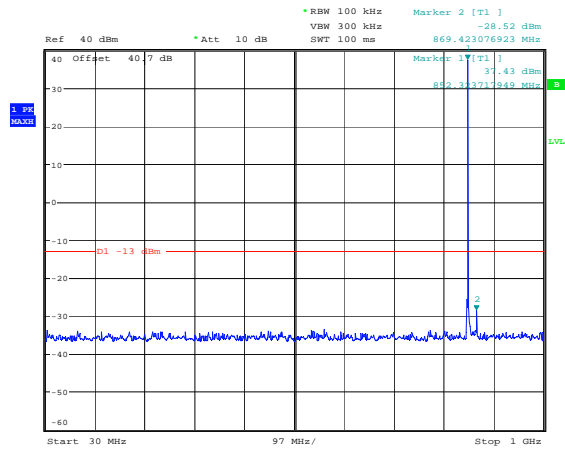
RESULTS

FREQUENCY RANGE	EUT FREQ (MHz)	EMISSION FREQ. (MHz)	MEASURED LEVEL (dBm)	ATTEN & CABLE LOSSES (dB)	EMISSION LEVEL (dBm)	LIMIT (dBm)
30 MHz - 9 GHz	851.0	868.891	-69.05	40.7	-28.35	-13
	869.0	850.897	-70.56	40.7	-29.86	-13

The test equipment used for the Transmitter Conducted Emissions:

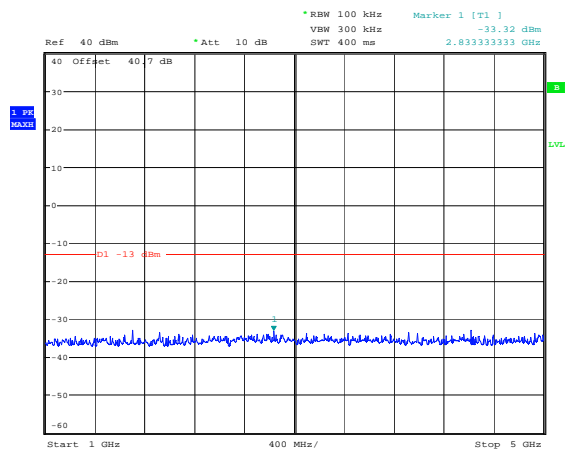
TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	RHODE & SCHWARZ	FSU46	200034	UH281	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ATTENUATOR	SPINNER	745357	57224	U225	X
ATTENUATOR	AXELL	20 dB 100W	N/A	N/A	X
CABLE	TRaC	N/A	N/A	UH253	X
CABLE	TRaC	N/A	N/A	UH273	X
CABLE	TRaC	N/A	N/A	UH274	X

Conducted emissions 851.0 30 MHz – 1GHz



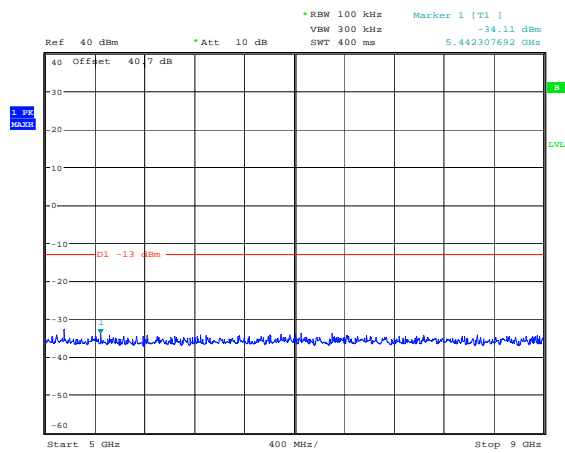
Date: 21.DEC.2009 11:48:21

Conducted emissions 851.0 1 – 5GHz



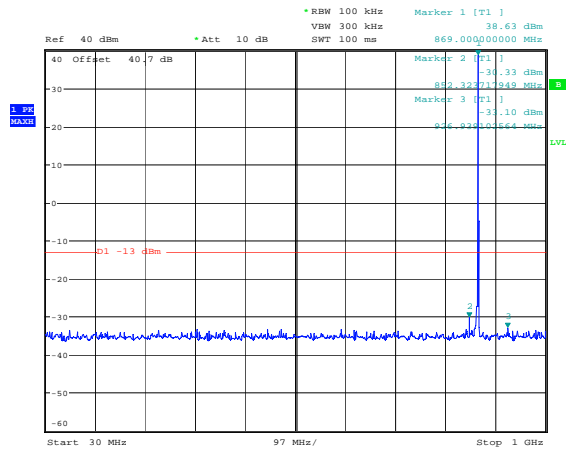
Date: 21.DEC.2009 11:48:42

Conducted emissions 851.0 5 – 9GHz



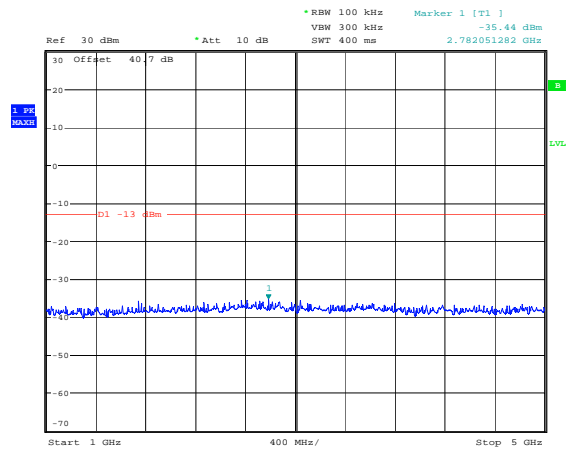
Date: 21.DEC.2009 11:48:55

Conducted emissions 869.0 30 MHz – 1GHz



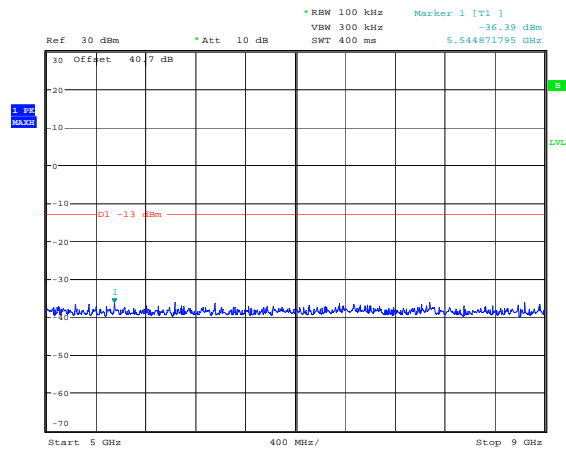
Date: 21.DEC.2009 11:41:07

Conducted emissions 869.0 1 – 5GHz



Date: 21.DEC.2009 11:41:27

Conducted emissions 869.0 5 – 9GHz

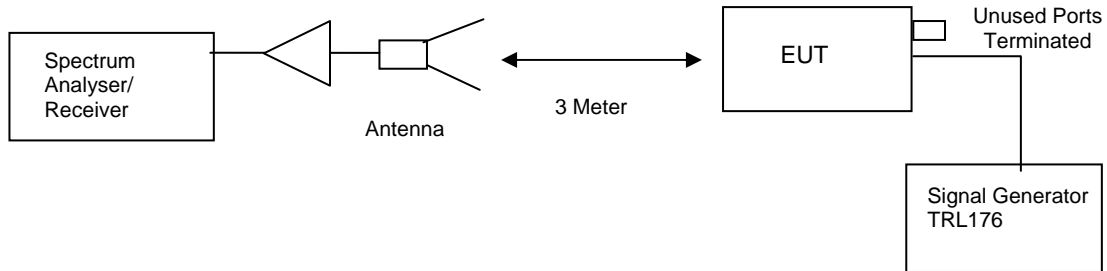


Date: 21.DEC.2009 11:41:44

TRANSMITTER TESTS

AMPLIFIER SPURIOUS EMISSIONS – RADIATED – DOWNLINK

Ambient temperature = 17°C
 Relative humidity = 48%
 Conditions = OATS
 Supply voltage = +110Vac
 Supply Frequency = N/A



The test was set up as per the diagram. The level at the input was adjusted to compensate for the loss of the interconnecting cable. The unit was tested operating maximum power on three test frequencies with a 50 ohm load 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 $43 + 10 \log P_{dB}$

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

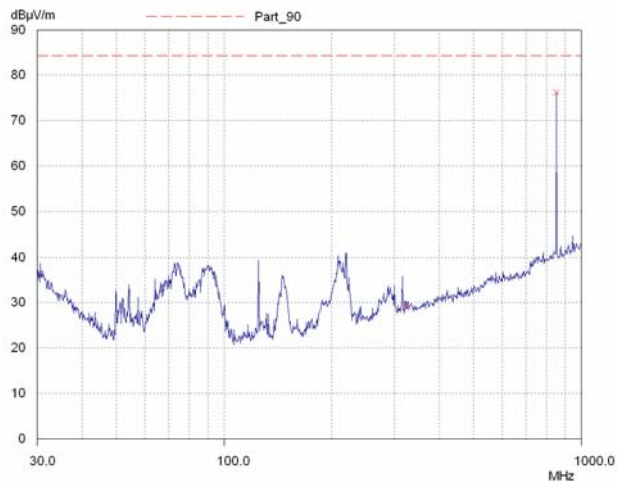
RESULTS

FREQUENCY RANGE	EUT FREQ (MHz)	FREQ. (MHz)	EIRP (dBm)	LIMIT (dBm)
30MHz – 9 GHz	851.0	1702.0	-28.26	-13
	860.0	1720.0	-22.16	-13
	869.0	1738.0	-26.06	-13

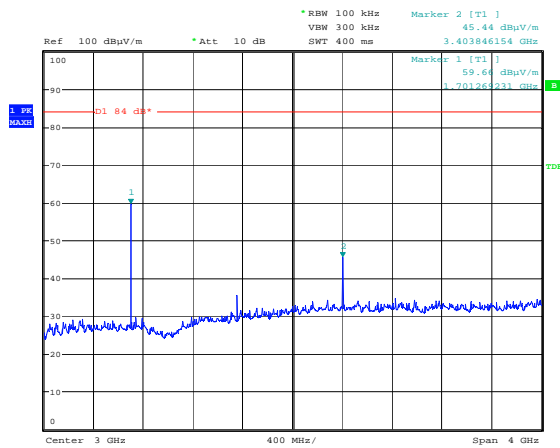
The test equipment used for the Transmitter Spurious Emissions:

TYPE OF EQUIPMENT	MAKER/SUPPLIER	MODEL No	SERIAL No	REF No	ACTUAL EQUIPMENT USED
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	X
HORN	EMCO	3115	9010-3580	138	X
PRE AMPLIFIER	HP	8449B	3008A016	572	X
SIGNAL GENERATOR	MARCONI	2042	119388/080	176	X
ANTENNA	YORK	CBL611/A	1618	UH191	X
PRE AMPLIFIER	WATRKINS JOHNSON	6201-69	2740	UH372	X
RECEIVER	RHODE & SCHWARZ	ESVS10	825890/006	UH04	X

Radiated emissions 851.0 30MHz – 1GHz

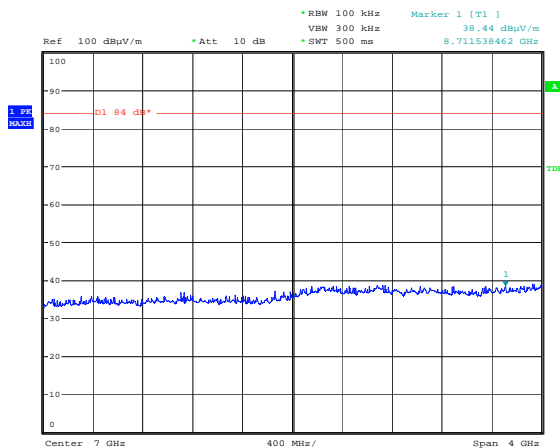


Radiated emissions 851.0 1 – 5GHz



Date: 21.DEC.2009 15:20:58

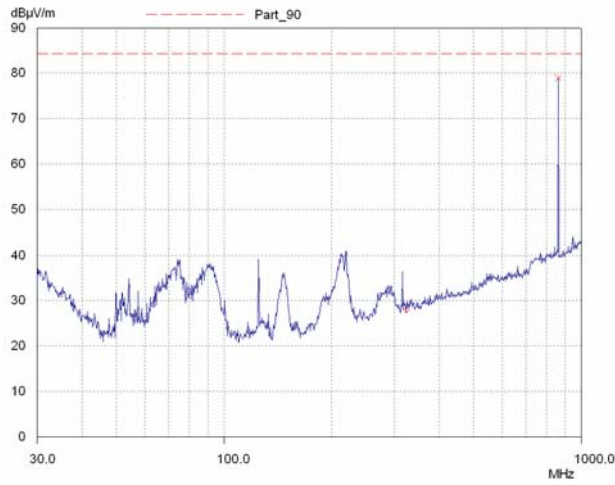
Radiated emissions 851.0 5 – 9GHz



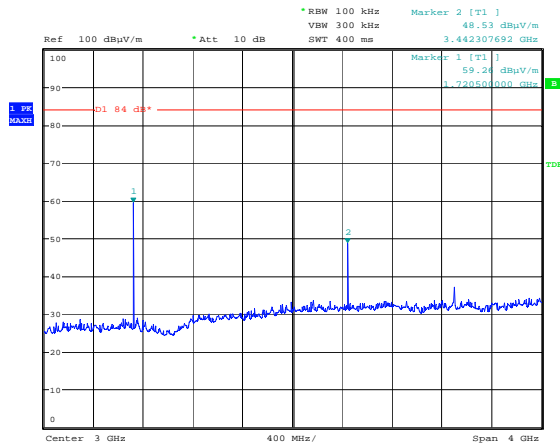
Date: 21.DEC.2009 15:21:30

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

Radiated emissions 860.0 30MHz – 1GHz

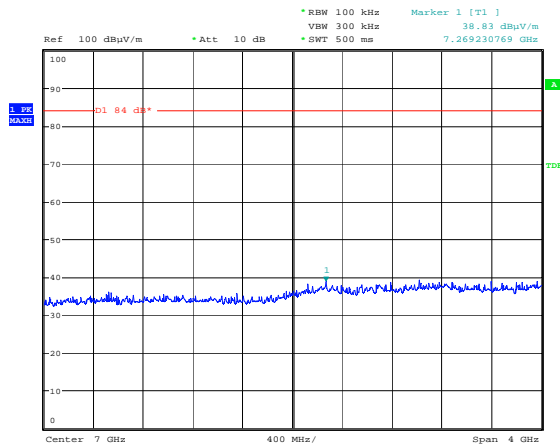


Radiated emissions 860.0 1 – 5GHz



Date: 21.DEC.2009 15:18:36

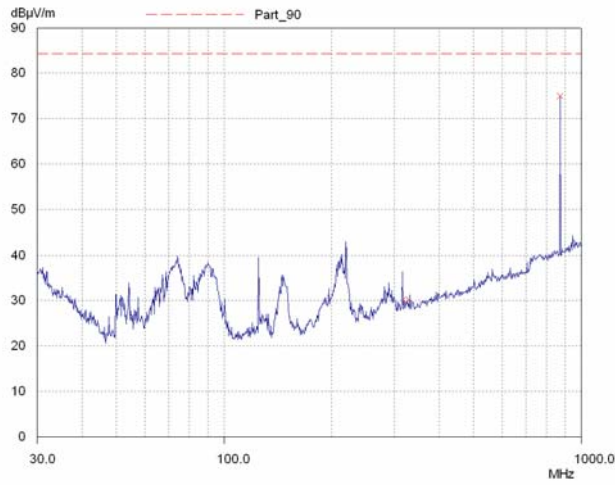
Radiated emissions 860.0 5 – 9GHz



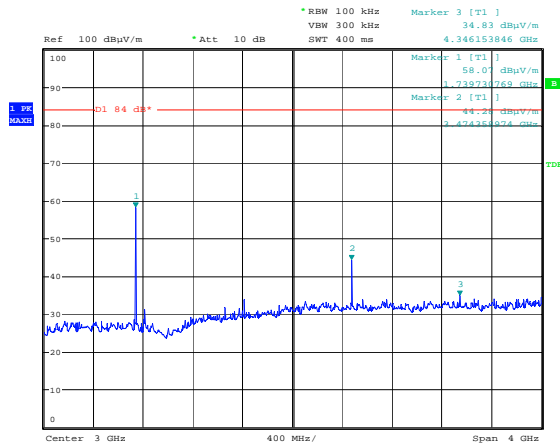
Date: 21.DEC.2009 15:18:24

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

Radiated emissions 869.0 30MHz – 1GHz

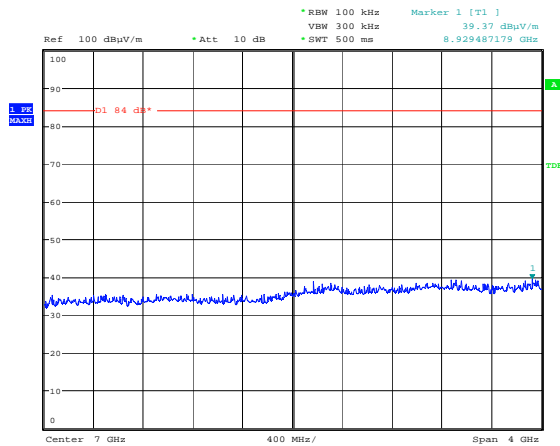


Radiated emissions 869.0 1 – 5GHz



Date: 21.DEC.2009 15:24:37

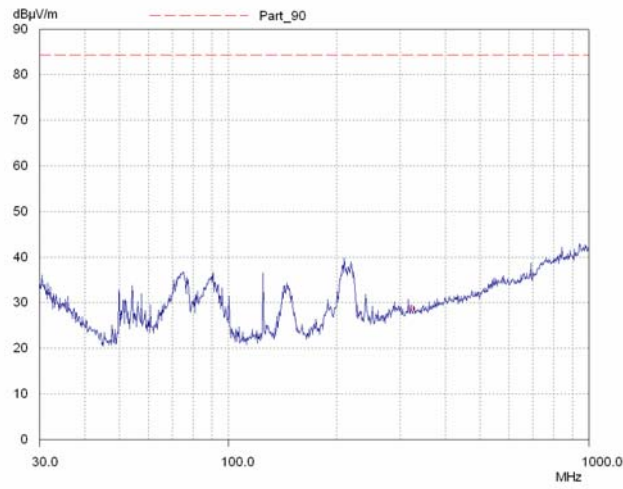
Radiated emissions 869.0 5 – 9GHz



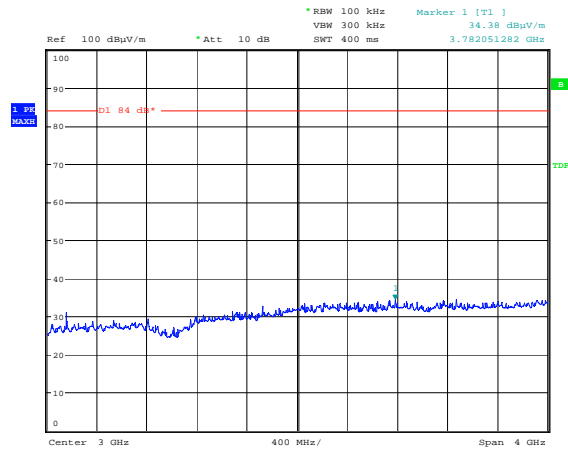
Date: 21.DEC.2009 15:24:23

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

Radiated emissions no input signal 30MHz – 1GHz

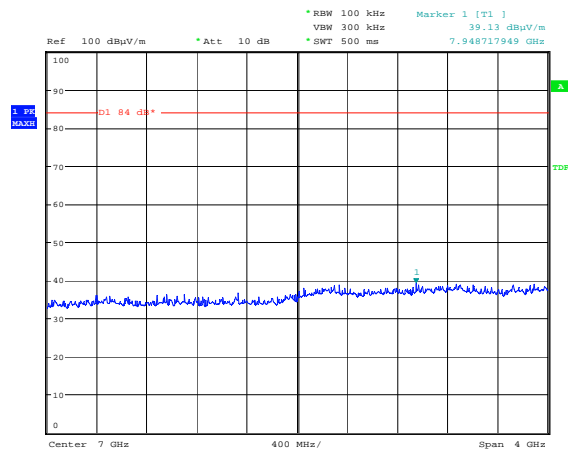


Radiated emissions no input signal 1 – 5GHz



Date: 21.DEC.2009 15:26:52

Radiated emissions no input signal 5 – 9GHz



Date: 21.DEC.2009 15:27:15

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

ANNEX A
PHOTOGRAPHS





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	[X]
		-	DECLARATION	[]
		-	DRAWINGS	[]
f.	TECHNICAL DESCRIPTION	-		[X]
g.	BLOCK DIAGRAMS	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
h.	CIRCUIT DIAGRAMS	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
i.	COMPONENT LOCATION	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
j.	PCB TRACK LAYOUT	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
k.	BILL OF MATERIALS	-	Tx	[X]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
l.	USER INSTALLATION / OPERATING INSTRUCTIONS	-		[X]

ANNEX C
EQUIPMENT CALIBRATION

Number	Equipment Type	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
UH04	Receiver	R&S	19/11/2009	12	19/11/2010
UH06/07	IC OATS Submission	TRL	02/07/2009	24	02/07/2011
UH06/07	NSA Calibration	TRL	19/06/2009	12	19/06/2010
UH028	Log Periodic Ant	Schwarbeck	14/08/2009	24	14/08/2011
UH029	Bicone Antenna	Schwarbeck	13/08/2009	24	13/08/2011
UH075	Signal Generator	Marconi	20/01/2009	12	20/01/2010
UH162	ERP Cable Cal	TRL	01/03/2009	12	01/03/2010
UH191	Bilog	York	01/10/2008	24	01/10/2010
UH225	Attenuator	Spinner		Calibrate In Use	
UH253	1m Cable N type	TRL	15/07/2009	12	15/07/2010
UH254	1m Cable N type	TRL	15/07/2009	12	15/07/2010
UH269	1m Cable N type	TRL	15/07/2009	12	15/07/2010
UH270	1m Cable N type	TRL	15/07/2009	12	15/07/2010
UH271	1.5m Cable N type	TRL	15/07/2009	12	15/07/2010
UH272	1.5m Cable N type	TRL	15/07/2009	12	15/07/2010
UH273	2m Cable N type	TRL	15/07/2009	12	15/07/2010
UH274	2m Cable N type	TRL	15/07/2009	12	15/07/2010
UH281	Spectrum Analyser	R&S	28/10/2008	18	28/04/2010
UH288	1m Cable N type	N/A	15/07/2009	12	15/07/2010
UH291	K-Type Cable	Succoflex	15/07/2009	12	15/07/2010
UH293	K-Type Cable	Megaphase	15/07/2009	12	15/07/2010
UH372	Pre Amplifier	Watkins Johnson	27/11/2008	24	27/11/2010
L005	CMTA	R&S	29/10/2008	18	29/04/2010
L138	1-18GHz Horn	EMCO	10/09/2009	24	10/09/2011
L139	1-18GHz Horn	EMCO	17/08/2009	24	17/08/2011
L176	Signal Generator	Marconi	23/06/2009	12	23/06/2010
L193	Bicone Antenna	Chase	06/05/2008	24	06/05/2010
L203	Log Periodic Ant	Chase	06/05/2008	24	06/05/2010
L479	Analyser	Anritsu	02/10/2009	12	02/10/2010
L572	Pre Amp	Agilent	15/07/2009	12	15/07/2010
REF844	Signal Generator	Agilent	05/03/2008	24	05/03/2010
N/A	Signal Generator	IFR	07/11/2008	24	07/11/2010
N/A	Attenuator	Axell		Calibrate In Use	
N/A	Combiners	Axell		Calibrate In Use	
N/A	Circulators	Axell		Calibrate In Use	

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%**