TEST REPORT NO: RU1181/6240

COPY NO: 2

ISSUE NO: 1

FCC ID: NEO50-1225Series

**REPORT ON THE CERTIFICATION TESTING OF A**
**AERIAL FACILITIES LIMITED**
**55-122501 CELL ENHANCER**
**WITH RESPECT TO**
**THE FCC RULES CFR 47, PART 90 Subpart I**
**PRIVATE LAND MOBILE REPEATER.**

TEST DATE: 12th April 2005 – 14th April 2005

TESTED BY: John Charters — Digitally signed by John Charters DN: CN = John Charters, C = GB, O = TRL Compliance Ltd Reason: I am the author of this document Date: 2006.01.06 10:04:11 Z — J CHARTERS

APPROVED BY: Peter Green — Digitally signed by Peter Green DN: CN = Peter Green, C = GB Reason: I am approving this document Date: 2006.01.06 10:12:54 Z — P GREEN PRODUCT MANAGER EMC

DATE: 5th January 2006

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FS 21805

## CONTENTS



**Notes:**

1. Component failure during test — YES [ ] NO [X]
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: | NEO50-1225Series |
| PURPOSE OF TEST: | Certification |
| TEST SPECIFICATION: | FCC RULES CFR 47, Part 90 Subpart I |
| TEST RESULT: | Compliant to Specification |
| EQUIPMENT UNDER TEST: | 55-122501 Cell Enhancer |
| EQUIPMENT TYPE: | Private Land Mobile Repeater |
| MAXIMIUM GAIN | Uplink = 98.35 dB<br>Downlink = 98.90 dB |
| MAXIMUM INPUT | Uplink = -78.5 dBm<br>Downlink = -73.0 dBm |
| MAXIMUM OUTPUT | Uplink = 19.85 dBm<br>Downlink = 25.90 dBm (radiating cable system) |
| ANTENNA TYPE: | Not applicable |
| CHANNEL SPACING: | Uplink 12.5 kHz<br>Downlink 12.5 kHz |
| NUMBER OF CHANNELS: | Uplink = 6<br>Downlink = 6 |
| FREQUENCY GENERATION: | N/A |
| MODULATION TYPE: | F3E |
| POWER SOURCE(s): | +110Vac |
| TEST DATE(s): | 12th April 2005 – 14th April 2005 |
| ORDER No(s): | 30090 |
| APPLICANT: | Aerial Facilities Limited |
| ADDRESS: | Aerial House<br>Asheridge Road<br>Chesham<br>Buckinghamshire<br>HP5 1TU<br>United Kingdom |
| TESTED BY: | John Charters<br>Digitally signed by John Charters<br>DN: CN = John Charters, C = GB, O = TRL Compliance Ltd<br>Reason: I am the author of this document<br>Date: 2006.01.06 10:04:46 Z<br>J CHARTERS |
| APPROVED BY: | Peter Green<br>Digitally signed by Peter Green<br>DN: CN = Peter Green, C = GB<br>Reason: I am approving this document<br>Date: 2006.01.06 10:13:11 Z<br>P GREEN<br>PRODUCT MANAGER EMC |

## APPLICANT'S SUMMARY

| | |
|---|---|
| EQUIPMENT UNDER TEST (EUT): | 55-122501 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 [X]<br>No [ ] |
| APPLICANT'S CATEGORY: | MANUFACTURER [X]<br>IMPORTER [ ]<br>DISTRIBUTOR [ ]<br>TEST HOUSE [ ]<br>AGENT [ ] |
| APPLICANT'S ORDER No(s): | 30090 |
| APPLICANT'S CONTACT PERSON(s): | Mr Peter Bradfield |
| E-mail address: | Peterb@aerial.co.uk |
| APPLICANT: | Aerial Facilities Limited |
| ADDRESS: | Aerial House<br>Asheridge Road<br>Chesham<br>Buckinghamshire<br>HP5 1TU<br>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 EMC |
| UKAS ACCREDITATION No: | 0728 |
| TEST DATE(s) | 12th April 2005 – 14th April 2005 |
| TEST REPORT No: | RU1181/6240 |

## 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 [X] Class B [ ]
   Downlink Class A [X] Class B [ ]
3. Product Use: Private Land Mobile Repeater
4. Emission Designator: F3E
5. Temperatures: Ambient (Tnom) 25°C
6. Supply Voltages: Vnom +110Vac

   Note: Vnom voltages are as stated above unless otherwise shown on the test report page
7. Equipment Category: Single channel [ ]
   Two channel [ ]
   Multi-channel [X]
8. Channel spacing: Narrowband [X] 12.5 kHz
   Wideband [ ]
9. Test Location TRL Compliance Services
   Up Holland [X]
   Long Green [ ]
11. Modifications made during test program No modifications were performed.

**System description:**

The 55-122501 cell enhancer is a Bi-directional amplifier, consisting of an uplink and a downlink. The uplink operates in the frequency band 162 – 165.25 MHz, the uplink is narrowband and is capable of supporting 6 channels with a channel spacing of 12.5 kHz. The downlink operates in the frequency band 167 – 175.2 MHz, the downlink is narrowband and is capable of supporting 6 channels with a channel spacing of 12.5 kHz.

**COMPLIANCE TESTS**

**AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – UPLINK**

| | | | |
|---|---|---|---|
| Ambient temperature | = | 25°C | Radio Laboratory |
| Relative humidity | = | 37% | |
| Supply voltage | = | +110Vac | |
| Channel number | = | See test results | |

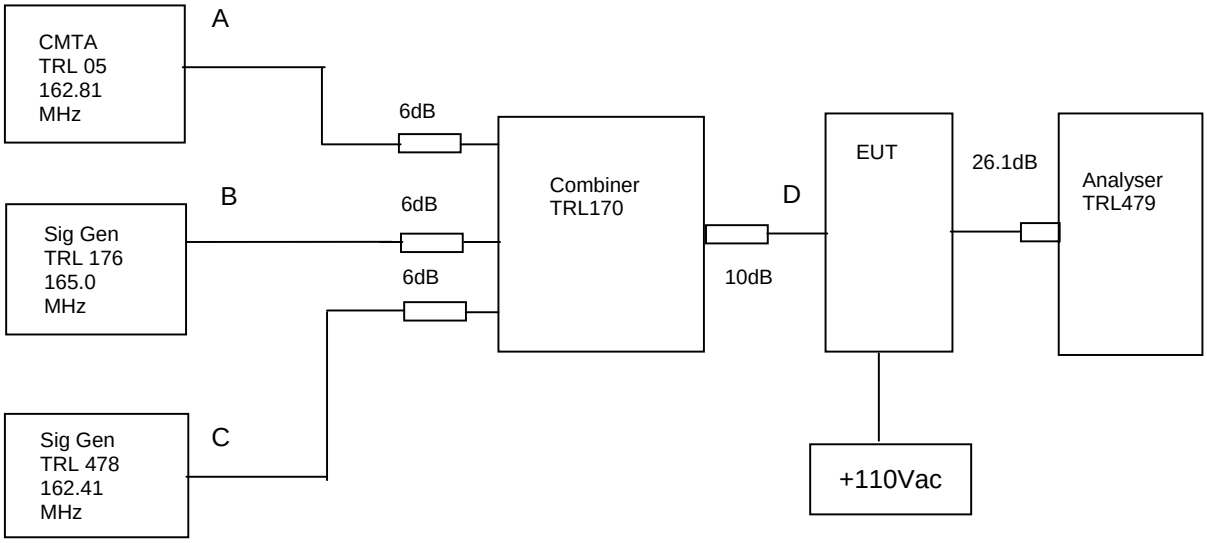

| Frequency MHz | Signal Generator input level dBm | Cable & Attenuator loss dB | Level at Spectrum Analyser dBm | Gain dB | Gain after 10dB input level increase dBm |
|---|---|---|---|---|---|
| 162.0 MHz | -75.0 | 26.6 | -6.25 | 95.35 | 85.56 |
| 163.5 MHz | -78.5 | 26.6 | -6.75 | 98.35 | 89.81 |
| 165.0 MHz | -75.0 | 26.6 | -6.39 | 95.21 | 85.57 |

Notes:
1. The level of the signal generator takes into consideration the loss from the cable.
2. The signal generator input was increased by 20dBs and the level of the output signal remeasured

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | **X** |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |

**AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – PART 2.1053– UPLINK**

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




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 10dBm above the maximum input of –75.0 dBm. The cable and attenuator loss between the EUT and the spectrum analyser was 26.1dB.

| RF Input Frequency (MHz) | | | Highest Intermodulation Product Level (dBm) | Limit (dBm) |
|---|---|---|---|---|
| 162.81 | 165.00 | 162.41 | -27.67 dBm @164.600 MHz | -13 |
| 162.81 | 165.00 | 162.41 | -18.14 dBm @ 163.200MHz (note 1) | -13 |

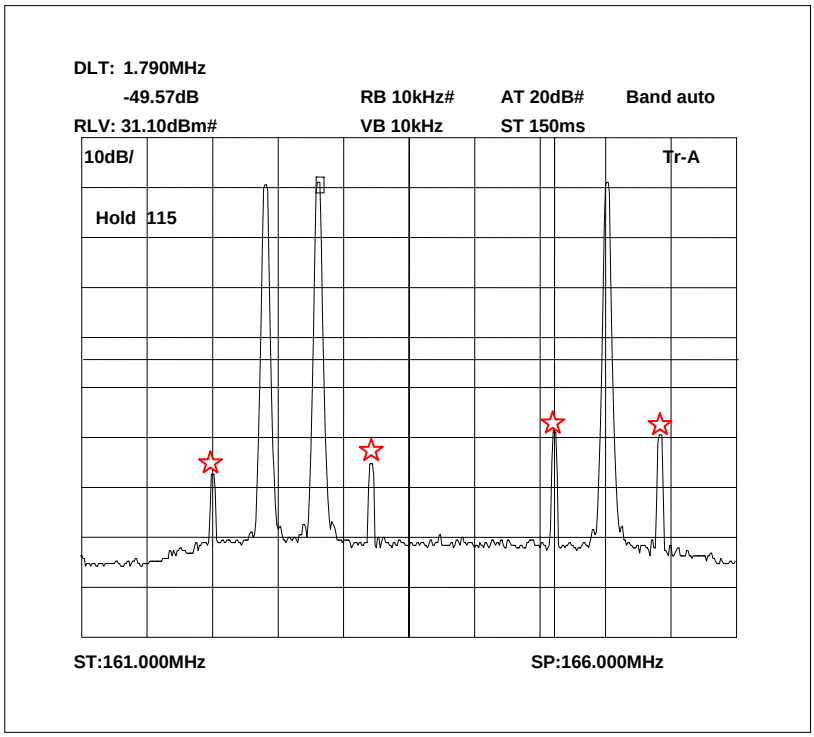
Note 1 6 active channels, 3 as above 3 channels set to frequencies where intermodulation products occur

Sweep data is shown on the next page:

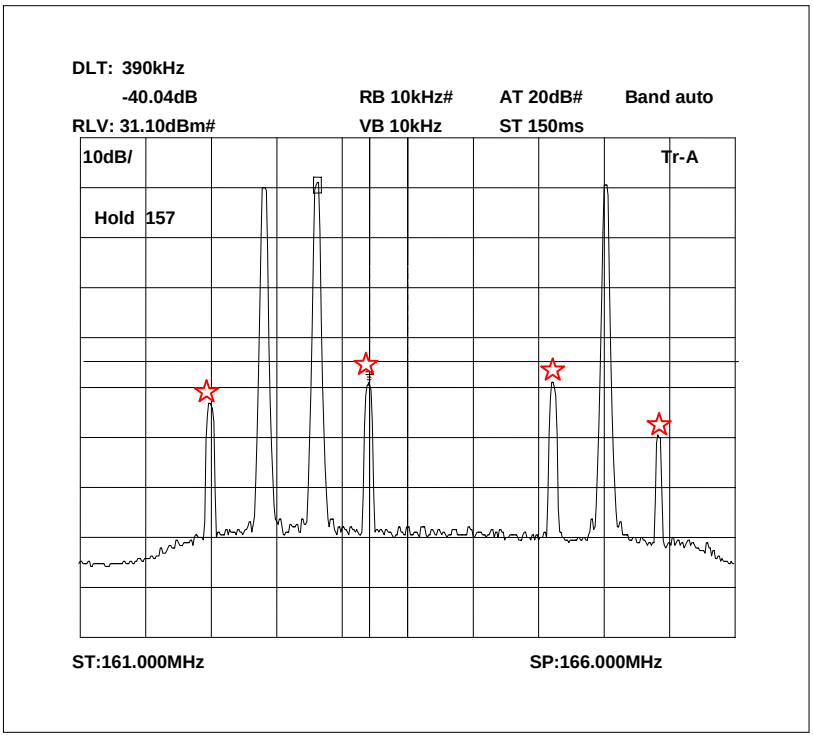
Test equipment used for intermodulation test

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119562/02 | 254 | **X** |
| CMTA | ROHDE & SCHWARZ | CMTA52 | 894715/033 | 05 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |
| COMBINER | ELCOM | RC-4-50 | N/A | 170 | **X** |

Intermodulation Inband



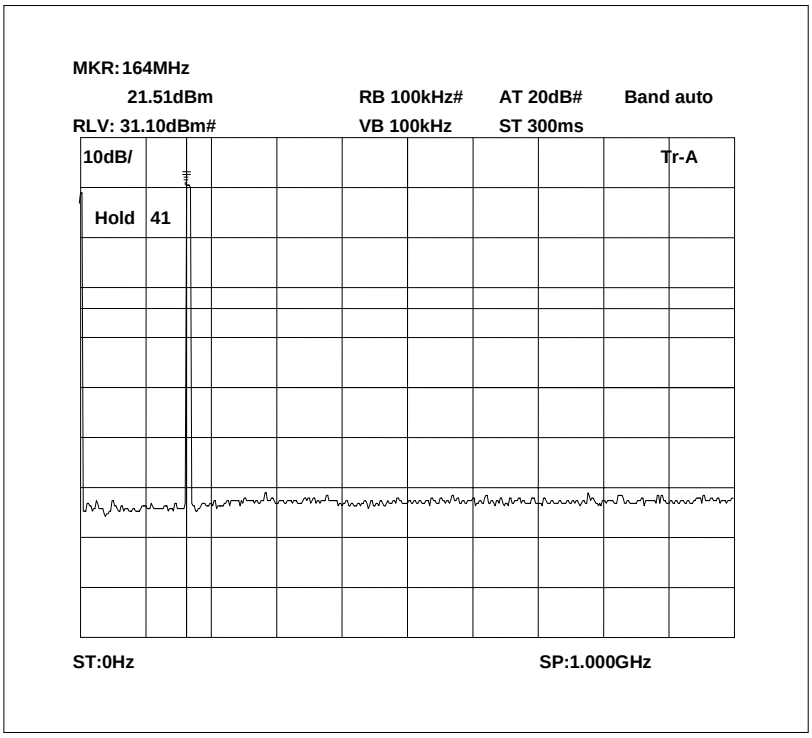

3 active channels, frequencies as per setup diagram above



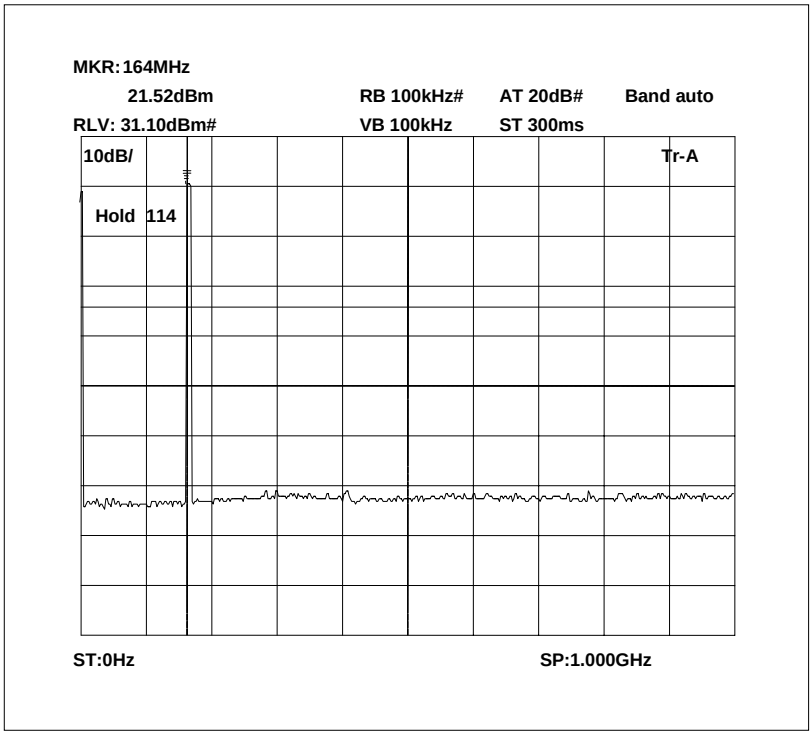

6 active channels, 3 as per above, 3 channels set to frequencies where intermodulation products occur

The above plots show that all products (designated by ☆) are at least 40dB below the fundamentals.

Intermodulation Wideband




3 active channels



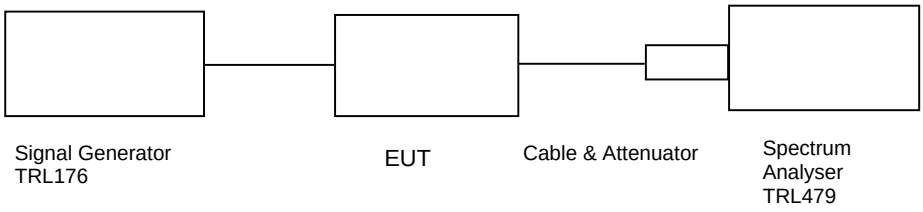

6 active channels

The above plots show that there are no products outside the bands.

**TRANSMITTER TESTS**

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

| | | | |
|---|---|---|---|
| Ambient temperature | = | 24$^{o}$C | Radio Laboratory |
| Relative humidity | = | 37% | |
| Supply voltage | = | +110Vac | |
| Channel number | = | See test results | |



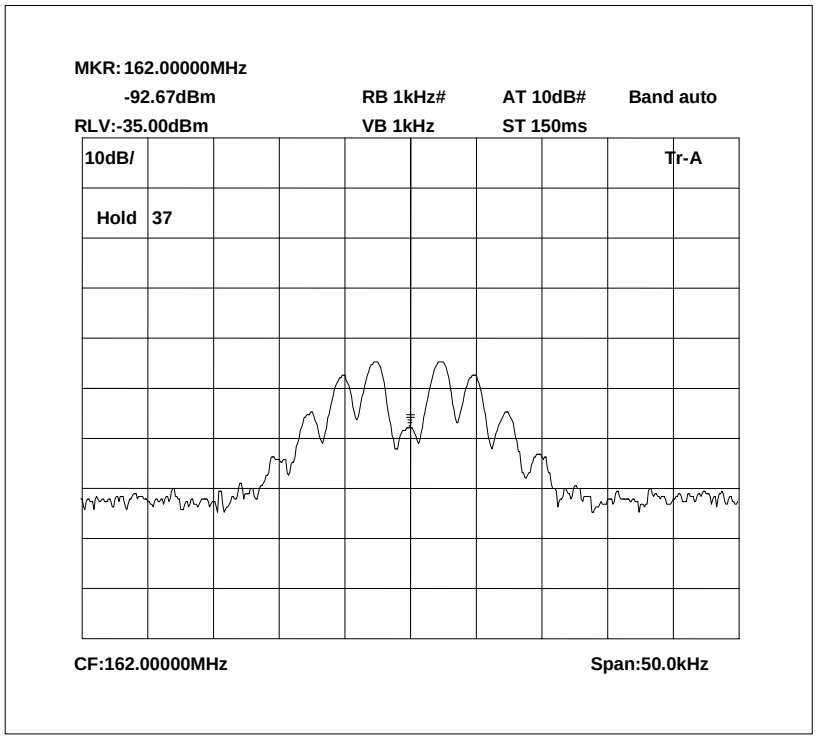

This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level (-75dBm) and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at the output of the EUT.

Note: The cables and attenuators had the following losses.

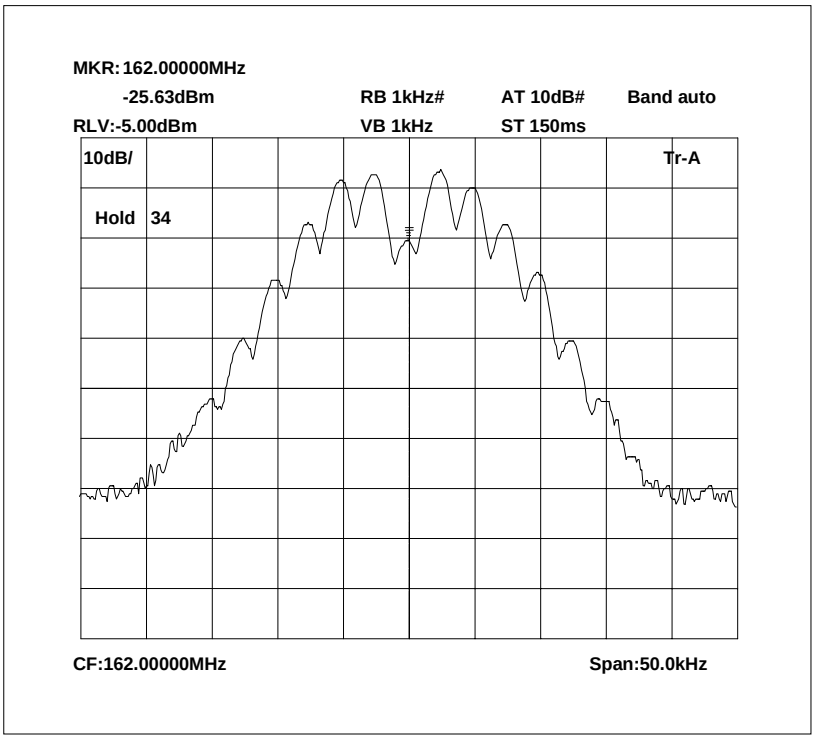
1. Cable and attenuator between EUT and spectrum analyser 26.1dB
2. Cable between signal generator and EUT 0.5dB

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | **X** |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |

162.0 MHz Signal Generator, deviation set to 5kHz

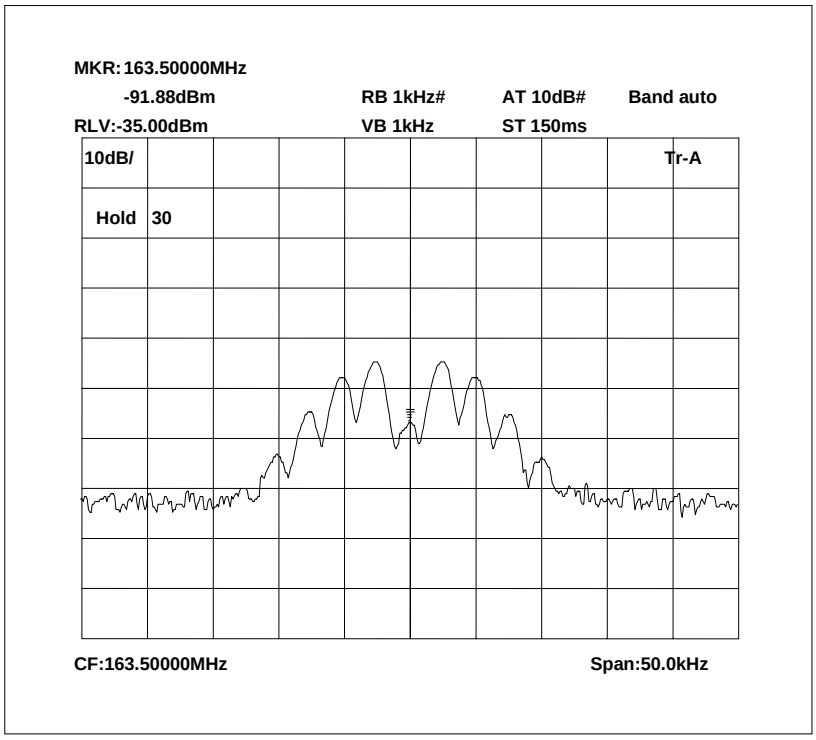



172.0 MHz Signal Generator and EUT, deviation set to 5kHz

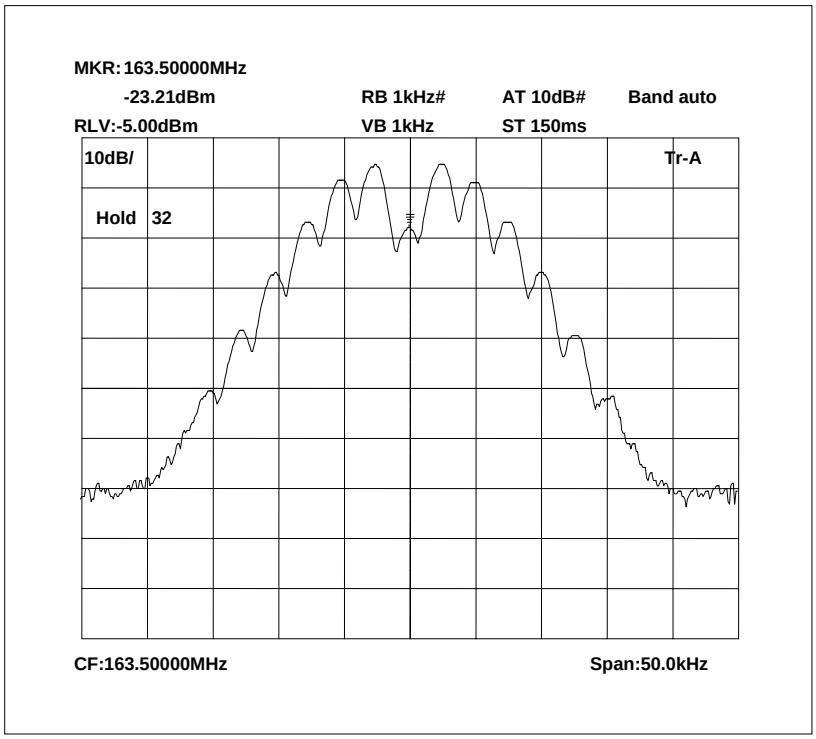



The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

163.5 MHz Signal Generator, deviation set to 5kHz

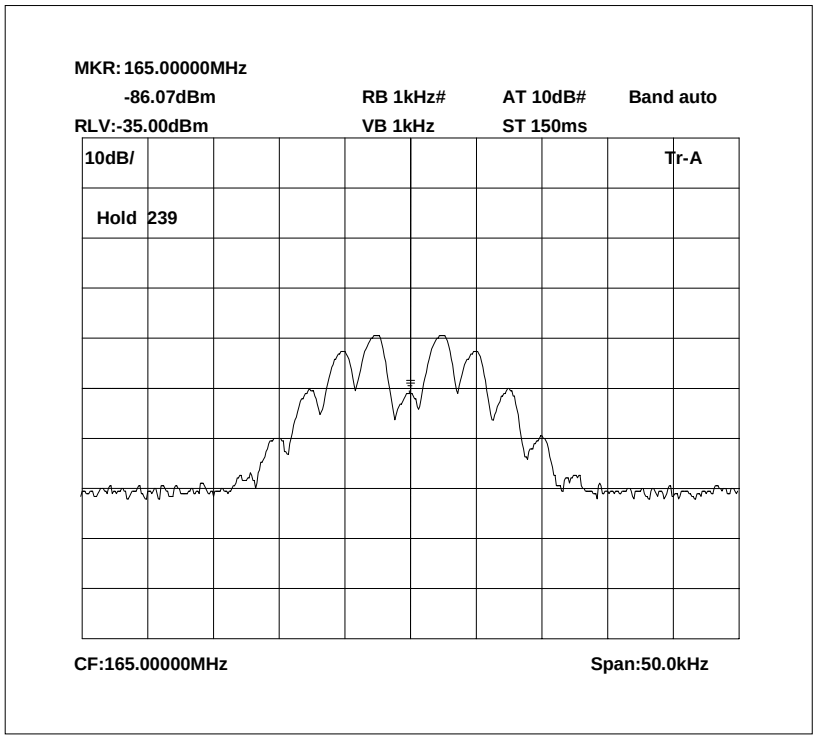



163.5 MHz Signal Generator and EUT, deviation set to 5kHz

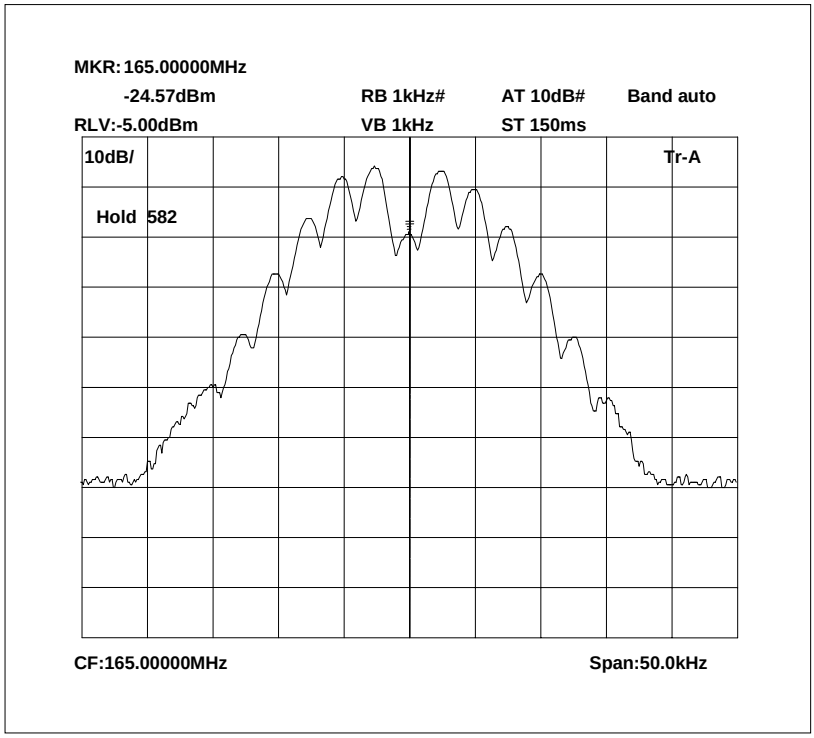



The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

165.0 MHz Signal Generator, deviation set to 5kHz




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




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

**TRANSMITTER TESTS**

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

| | | | | | |
|---|---|---|---|---|---|
| Ambient temperature | = | 24°C | Radio Laboratory | | |
| Relative humidity | = | 36% | Test Signal | = | F3E |
| Supply voltage | = | +110Vac | | | |


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

The Spurious limit was calculated as follows:

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

At least 43 + 10 log PdB

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

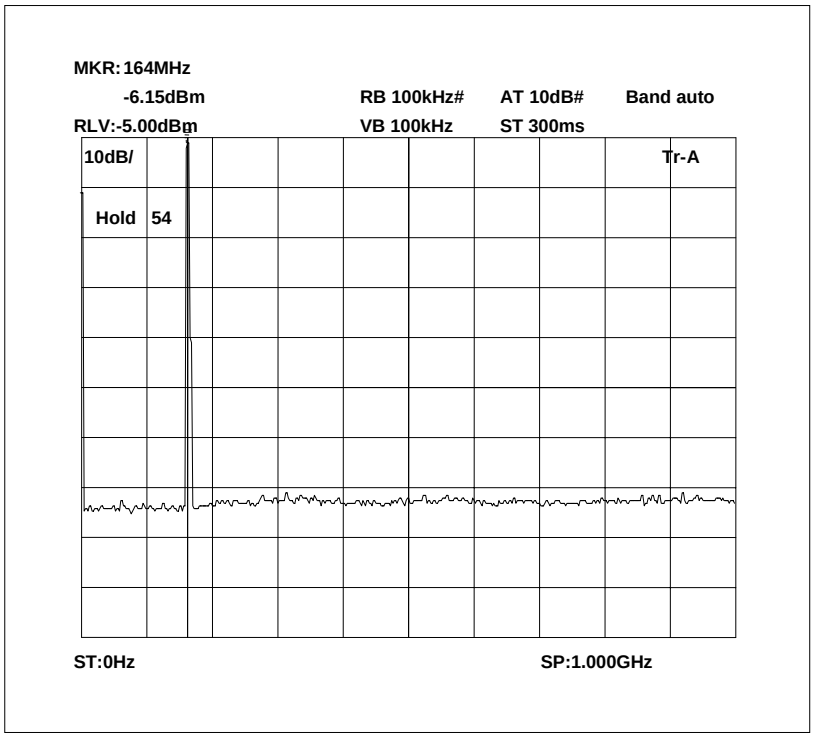
## RESULTS

| FREQUENCY RANGE | FREQ. (MHz) | MEASURED LEVEL (dBm) | ATTENUATOR & CABLE LOSSES (dB) | EMISSION LEVEL (dBm) | LIMIT (dBm) |
|---|---|---|---|---|---|
| 0 – 2GHz | No Significant Emissions | | | | -13 |

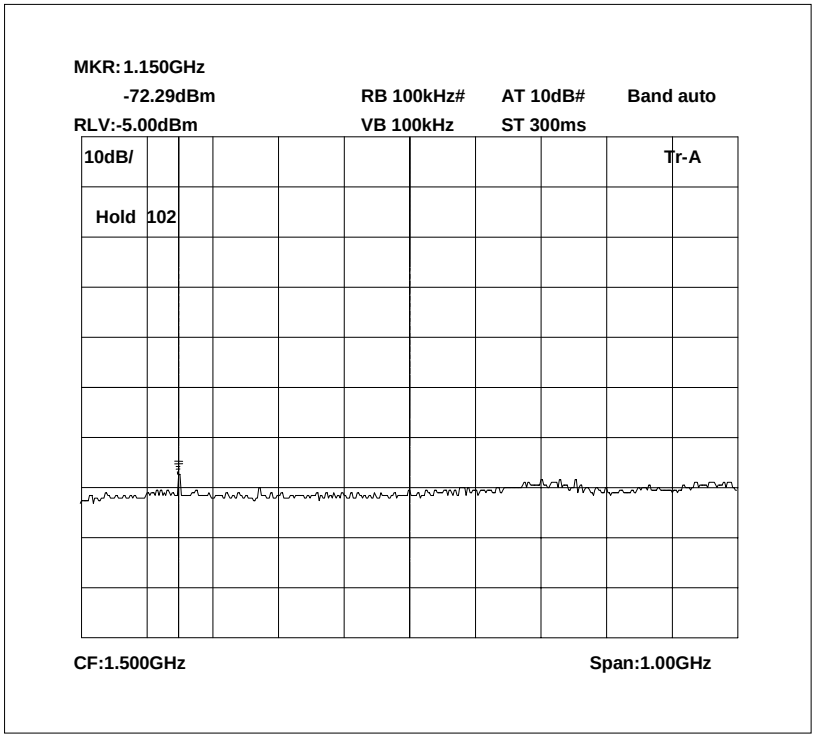
The test equipment used for the Transmitter Conducted Emissions:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | **X** |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |

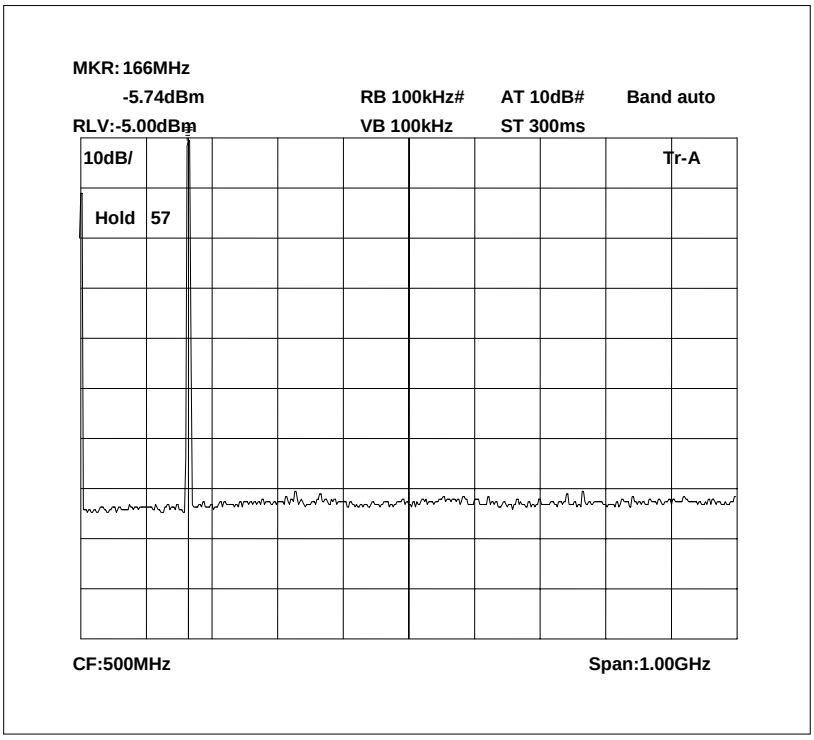
Conducted emissions 162.0 MHz 0 – 1GHz



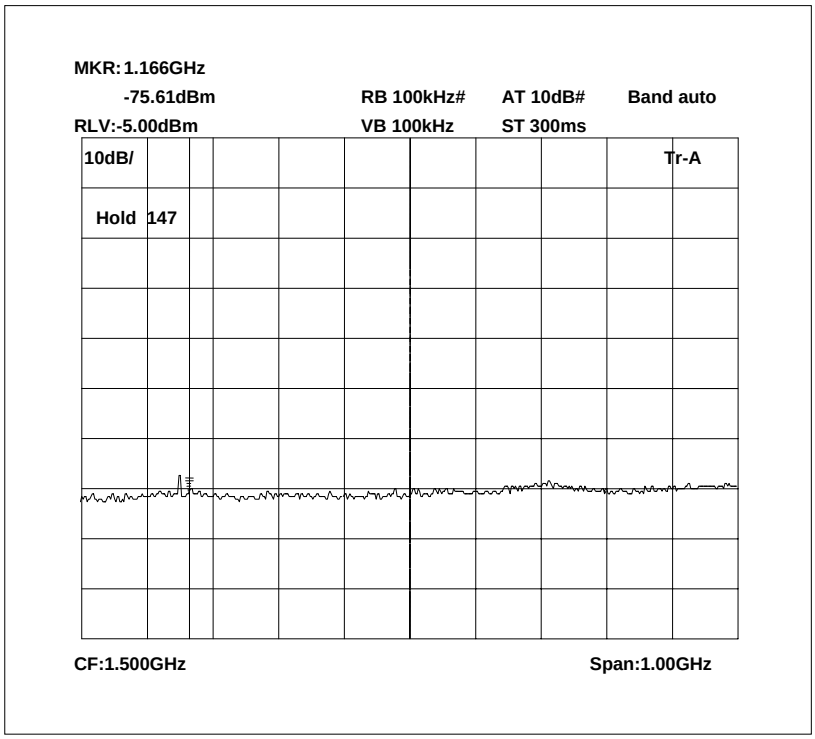

Conducted emissions 162.0 MHz 1 – 2GHz



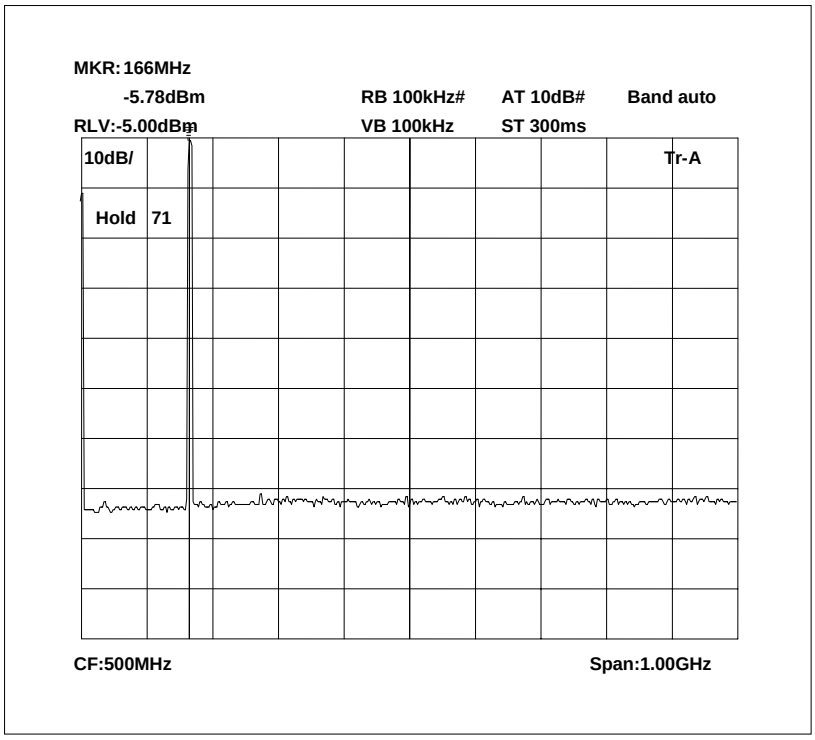
Conducted emissions 163.5 MHz 0 – 1GHz



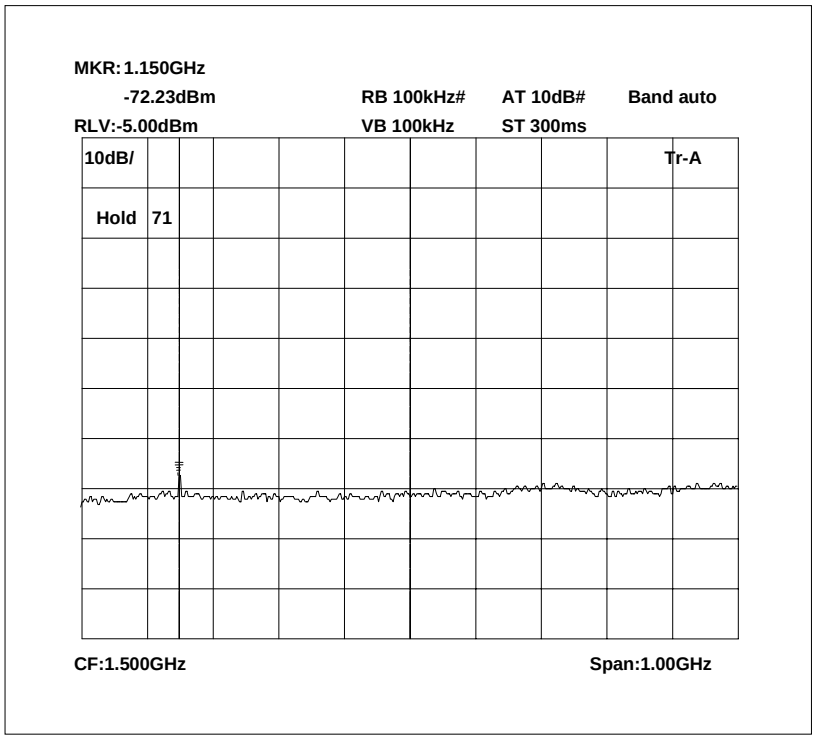

Conducted emissions 163.5 MHz 1 – 2GHz



Conducted emissions 165.0 MHz 0 – 1GHz




Conducted emissions 165.0 MHz 1 – 2GHz

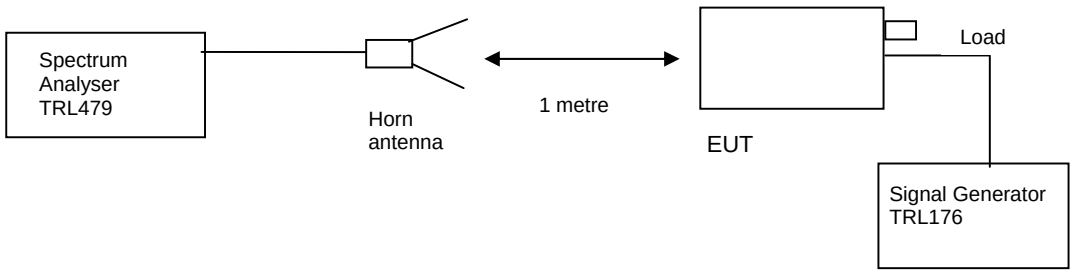


**TRANSMITTER TESTS**

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

Ambient temperature = 17°C
Relative humidity = 49%
Conditions = OATS
Supply voltage = +110Vac
Supply Frequency = 60Hz

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 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 PdB

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

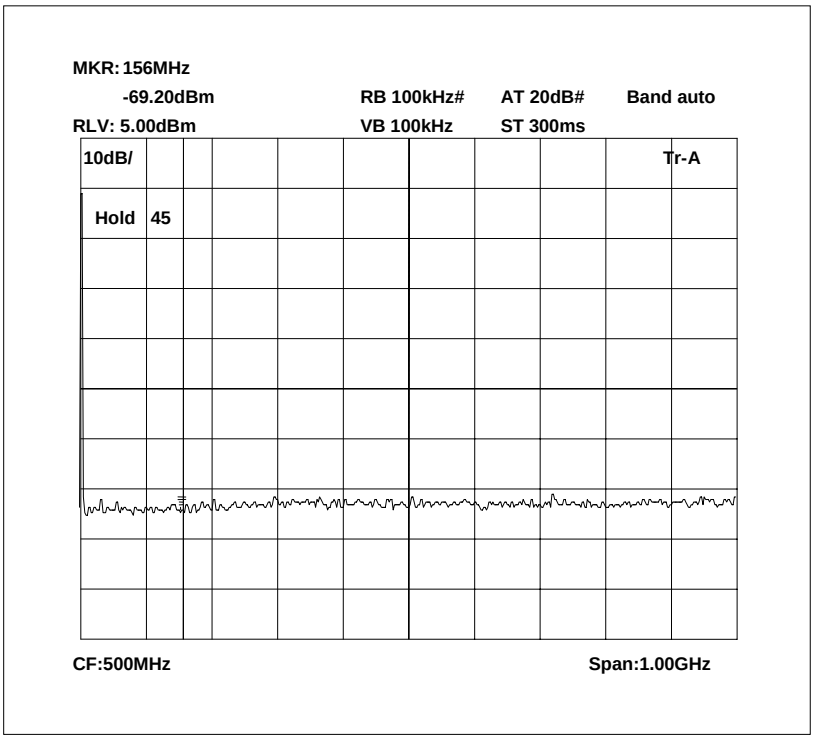
**RESULTS**

| FREQUENCY RANGE | FREQ. (MHz) | MEAS. Rx. (dBµV) | CABLE LOSS (dB) | ANT FACTOR | FIELD STRENGTH (dBµV/m) | CALCULATED EIRP (dBm) | LIMIT (dBm) |
|---|---|---|---|---|---|---|---|
| 0 – 2 GHz | No Significant Emissions | | | | | | -13 |

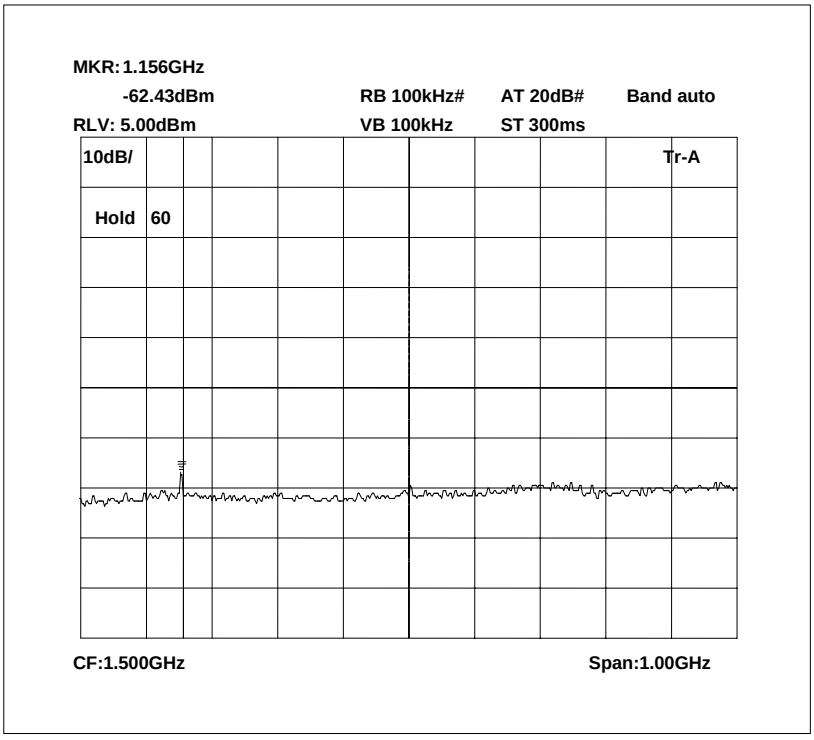
The test equipment used for the Transmitter Spurious Emissions:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| HORN | EMCO | 3115 | 9010-3581 | 139 | **X** |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | **X** |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |

Radiated emissions 162.0 MHz 0 – 1GHz

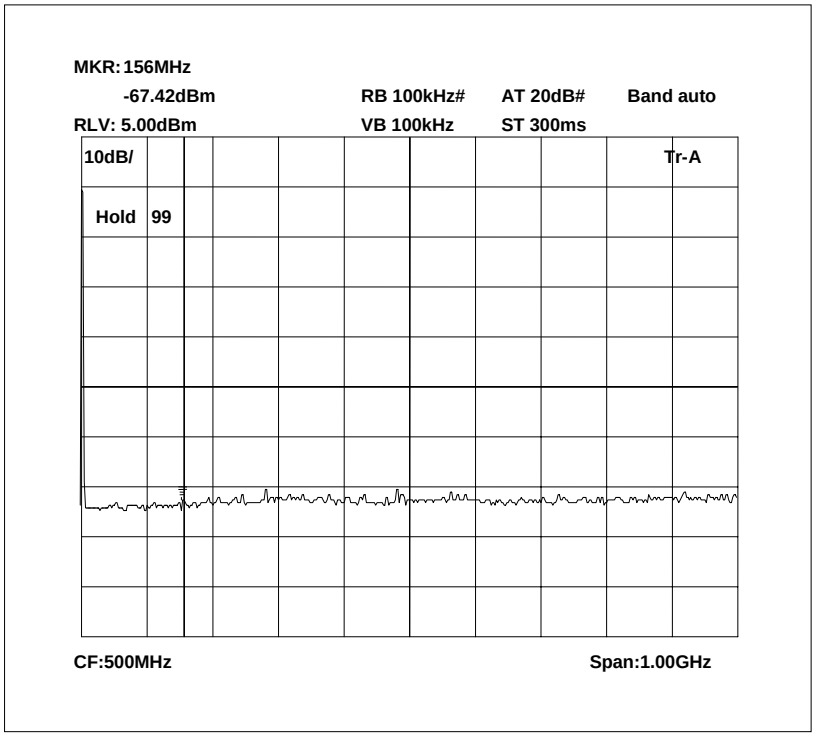



Radiated emissions 162.0 MHz 1 – 2GHz

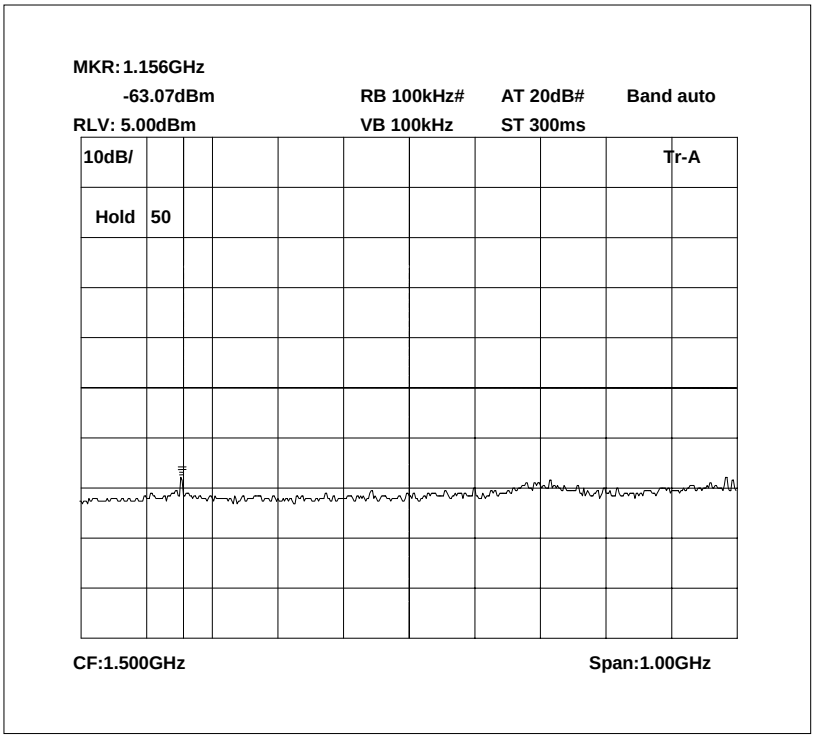



The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions 163.5 MHz 0 – 1GHz

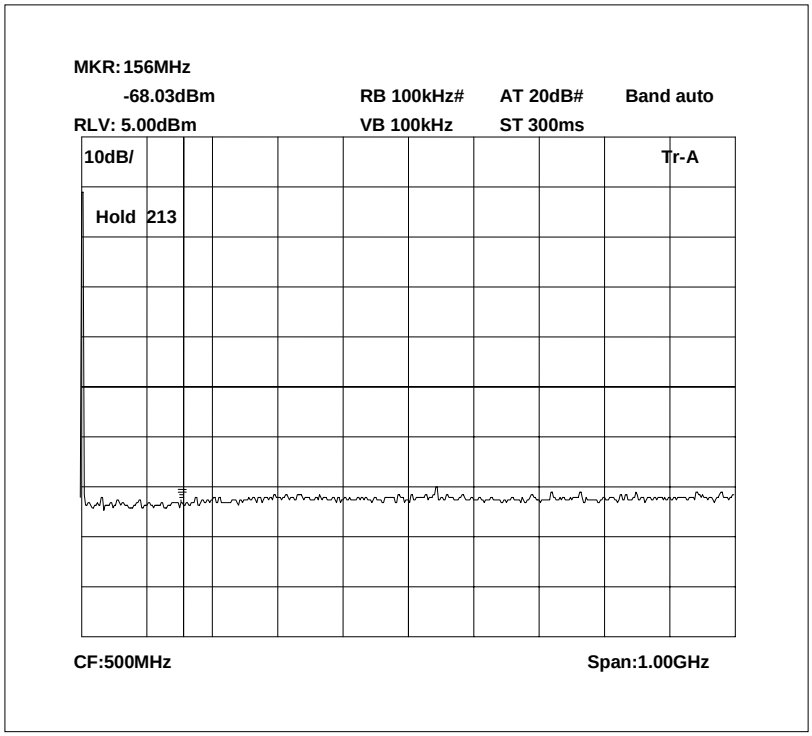



Radiated emissions 163.5 MHz 1 – 2GHz

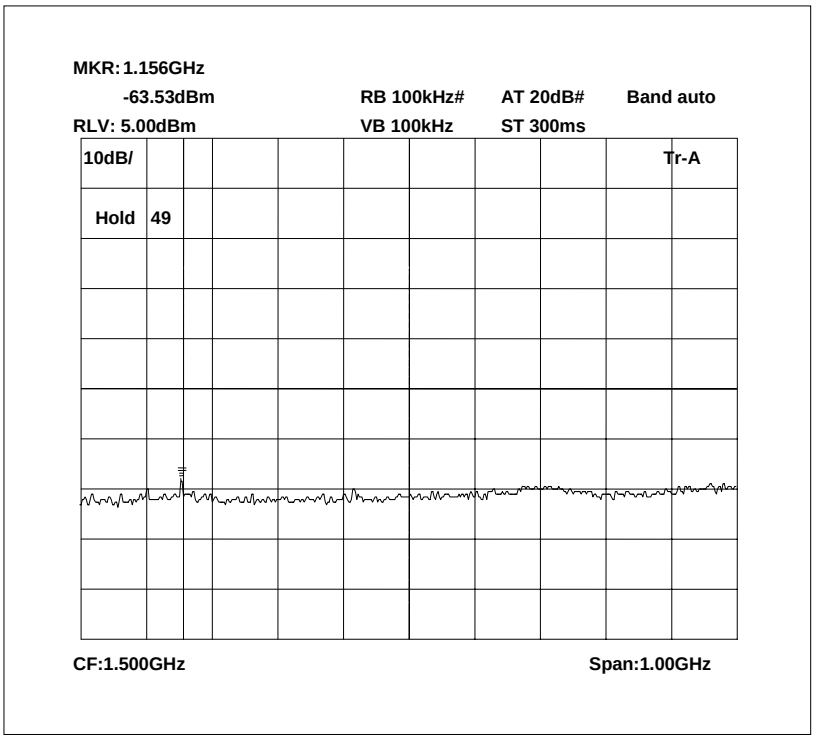



The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions 165.0 MHz 0 – 1GHz

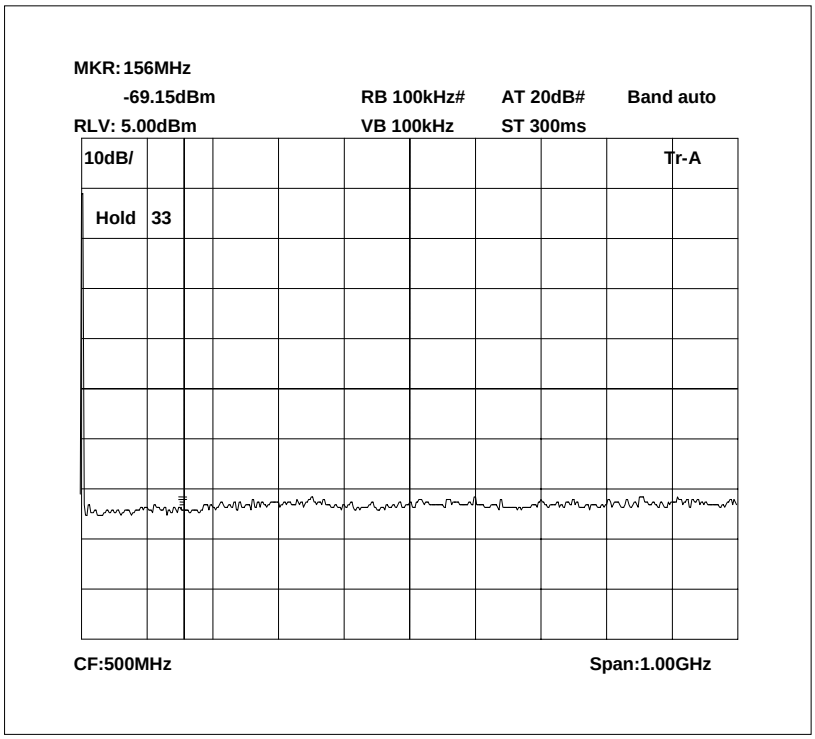



Radiated emissions 165.0 MHz 1 – 2GHz

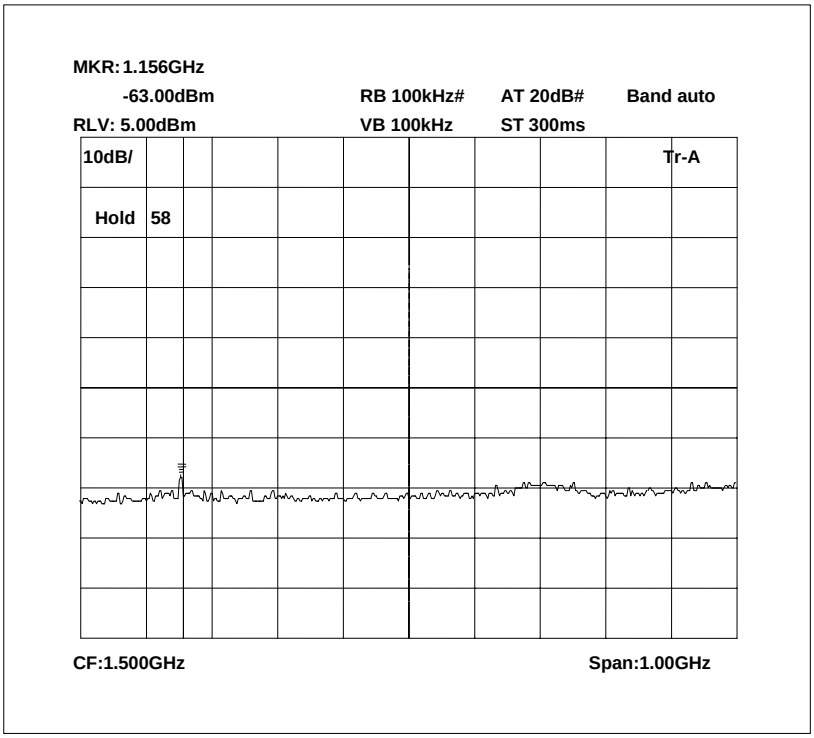



The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions no input signal 0 – 1GHz



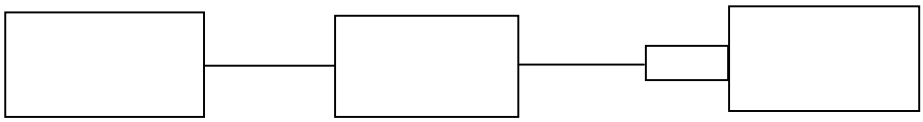

Radiated emissions no input signal 1 – 2GHz




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

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

| | | | |
|---|---|---|---|
| Ambient temperature | = | 25°C | Radio Laboratory |
| Relative humidity | = | 37% | |
| Supply voltage | = | +110Vac | |
| Channel number | = | See test results | |



Signal Generator TRL176 | EUT | Cable & Attenuator | Spectrum Analyser TRL479

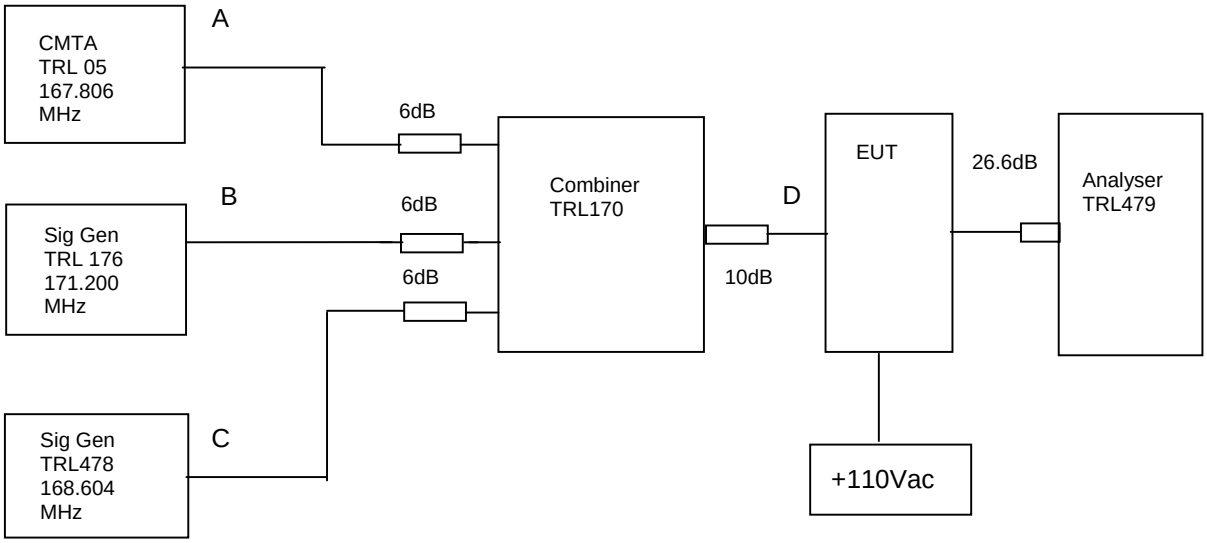
| Frequency MHz | Signal Generator input level dBm | Cable & Attenuator loss dB | Level at Spectrum Analyser dBm | Gain dB | Gain after 10dB input level increase dBm |
|---|---|---|---|---|---|
| 167.0 | -70 | 26.6 | -3.02 | 93.58 | 83.72 |
| 169.5 | -73 | 26.6 | -0.07 | 99.53 | 89.12 |
| 172.0 | -71 | 26.6 | -0.98 | 96.62 | 86.83 |

Notes:
1. The level of the signal generator takes into consideration the loss from the cable.
2. The signal generator input was increased by 20dBs and the level of the output signal remeasured.

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| ATTENUATOR | BIRD | 8304-200 | N/A | 103 | **X** |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | **X** |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |

**AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – PART 2.1053– DOWNLINK**

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




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 10dBm above the maximum input of -70.0dBm.The cable and attenuators loss between the EUT and the spectrum analyser was 26.6 dB.

| RF Input Frequency (MHz) | | | Highest Intermodulation Product Level (dBm) | Limit (dBm) |
|---|---|---|---|---|
| 167.806 | 168.604 | 171.200 | -26.3 dBm @ 170.402MHz | -13 |
| 167.806 | 168.604 | 171.200 | -20.87 dBm @ 169.380 MHz (note1) | -13 |

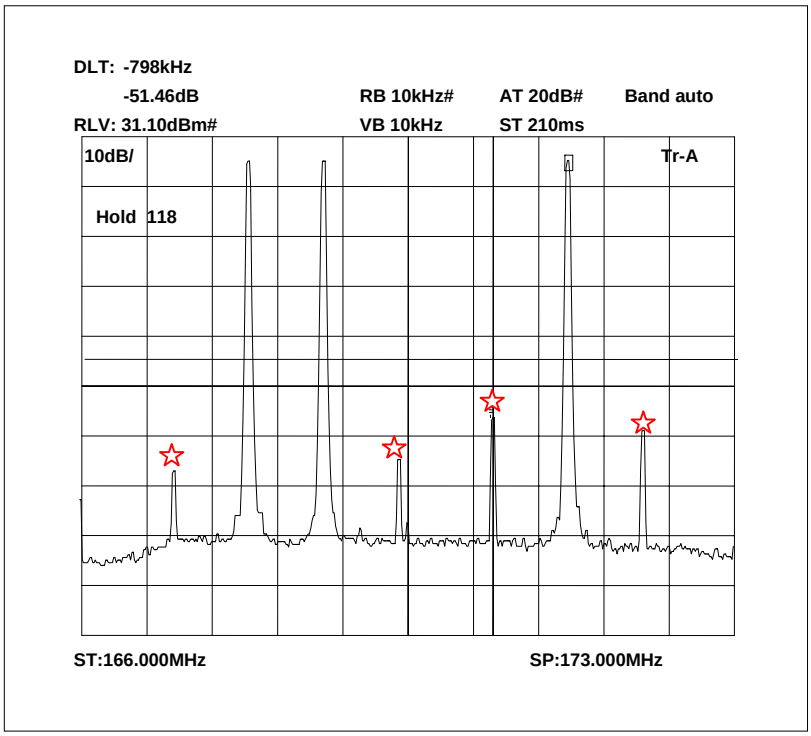
Note 1 6 active channels, 3 as above 3 channels set to frequencies where intermodulation products occur

Sweep data is shown on the next page:

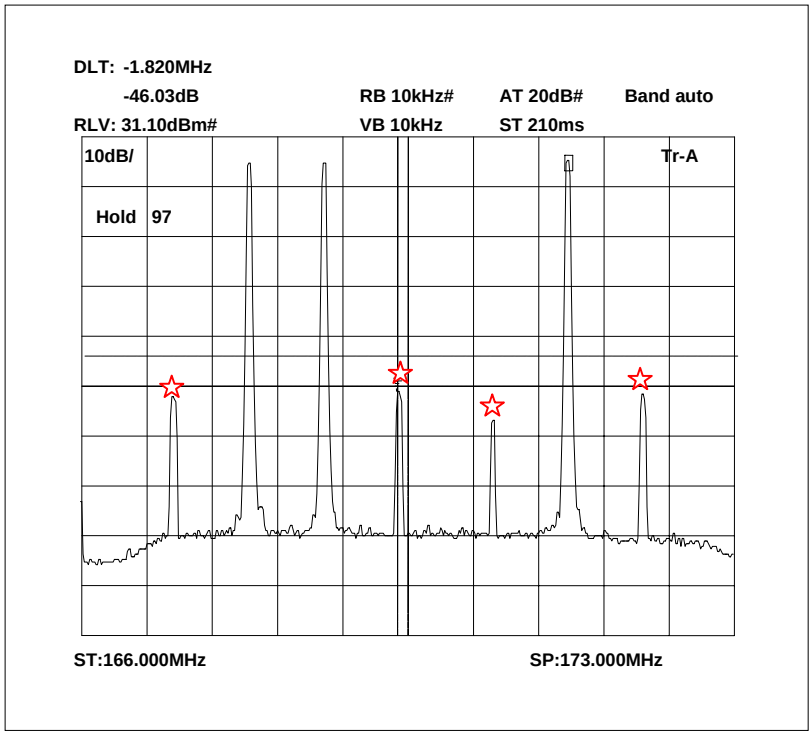
Test equipment used for intermodulation test

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119562/02 | 254 | **X** |
| CMTA | ROHDE & SCHWARZ | CMTA52 | 894715/033 | 05 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |
| COMBINER | ELCOM | RC-4-50 | N/A | 170 | **X** |

Intermodulation Inband



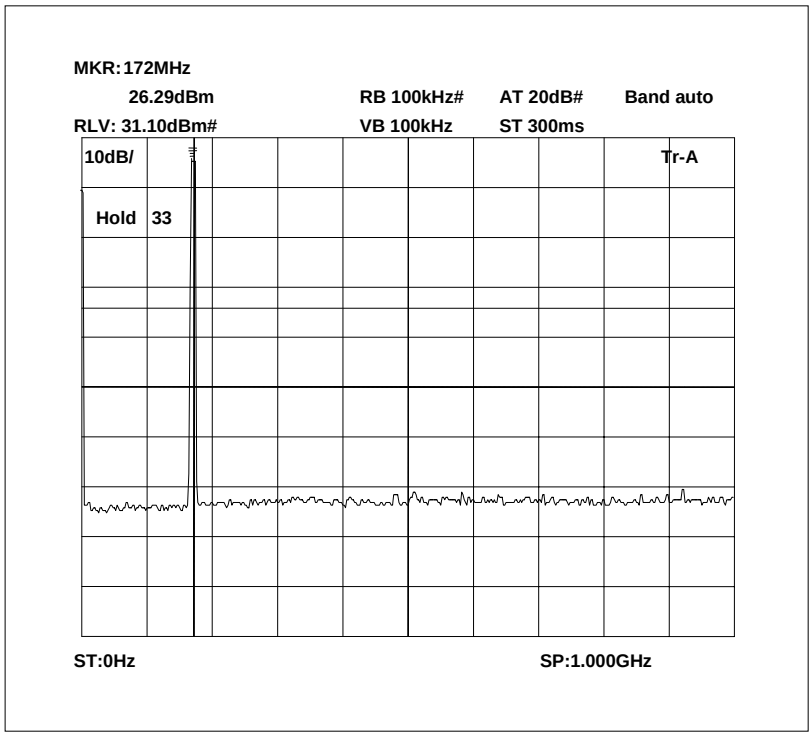

3 active channels, frequencies as per setup diagram above



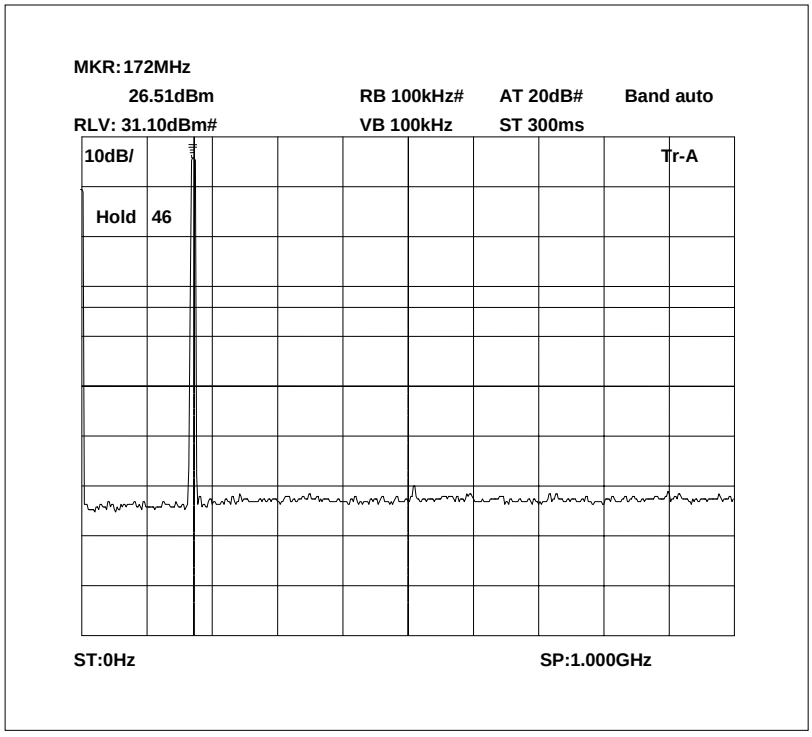

6 active channels, 3 as per above, 3 channels set to frequencies where intermodulation products occur

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

Intermodulation Wideband




3 active channels



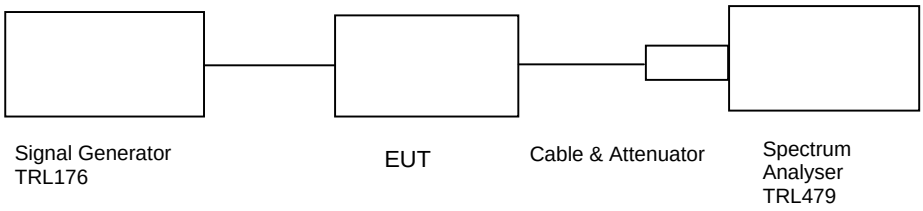

6 active channels

The above plots show that there are no products outside the bands.

**TRANSMITTER TESTS**

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

| | | | |
|---|---|---|---|
| Ambient temperature | = | 24°C | Radio Laboratory |
| Relative humidity | = | 37% | |
| Supply voltage | = | +110Vac | |
| Channel number | = | See test results | |



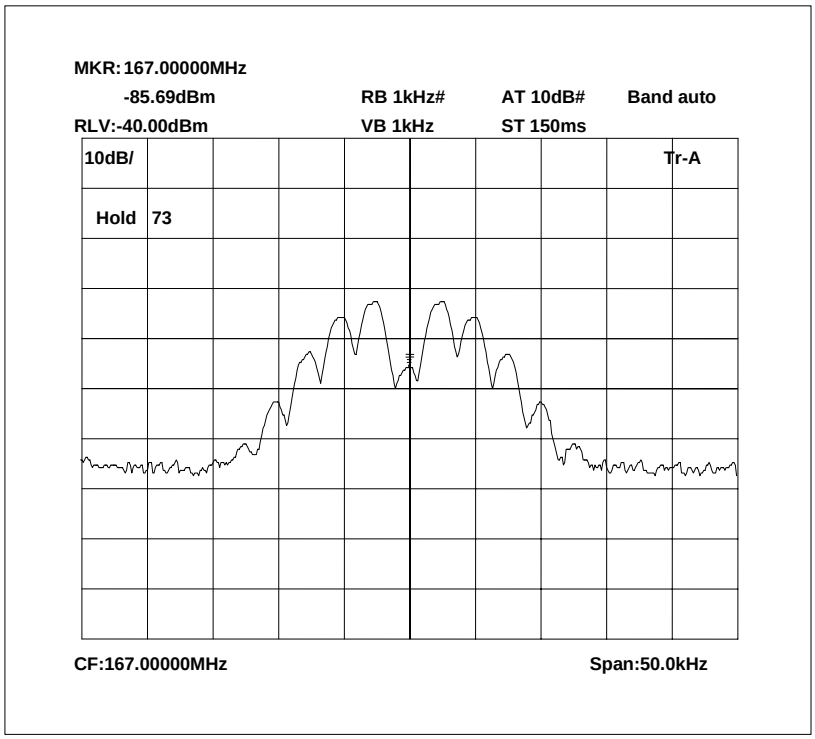

This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level (-70dBm) and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at the output of the EUT.

Note: The cables and attenuators had the following losses.

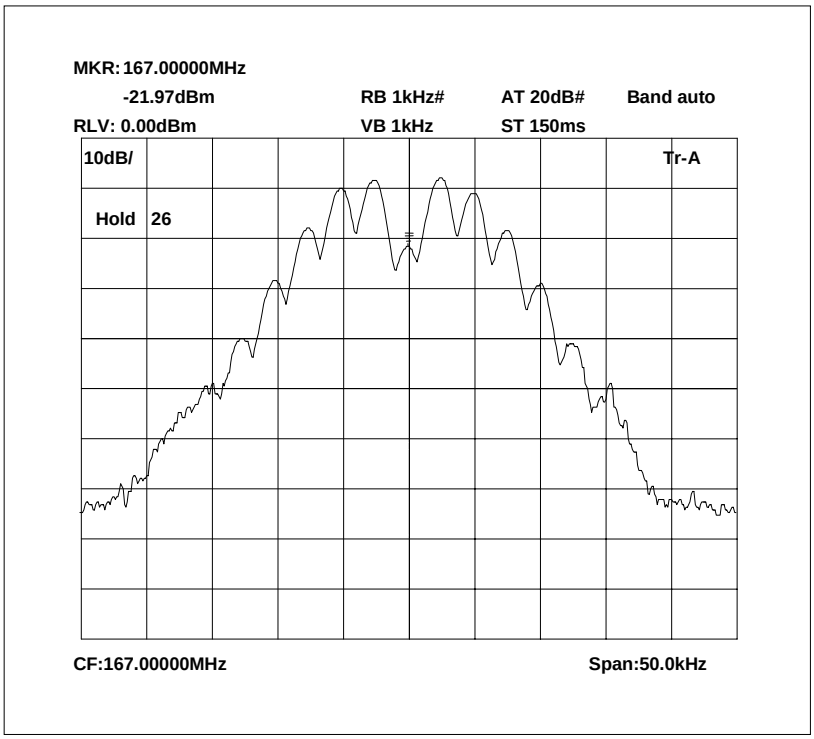
1. Cable and attenuator between EUT and spectrum analyser = 26.1dB
2. Cable between signal generator and EUT = 0.5dB

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| ATTENUATOR | BIRD | 8304-200 | N/A | 103 | |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | **X** |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |

167.0 MHz Signal Generator, deviation set to 5kHz

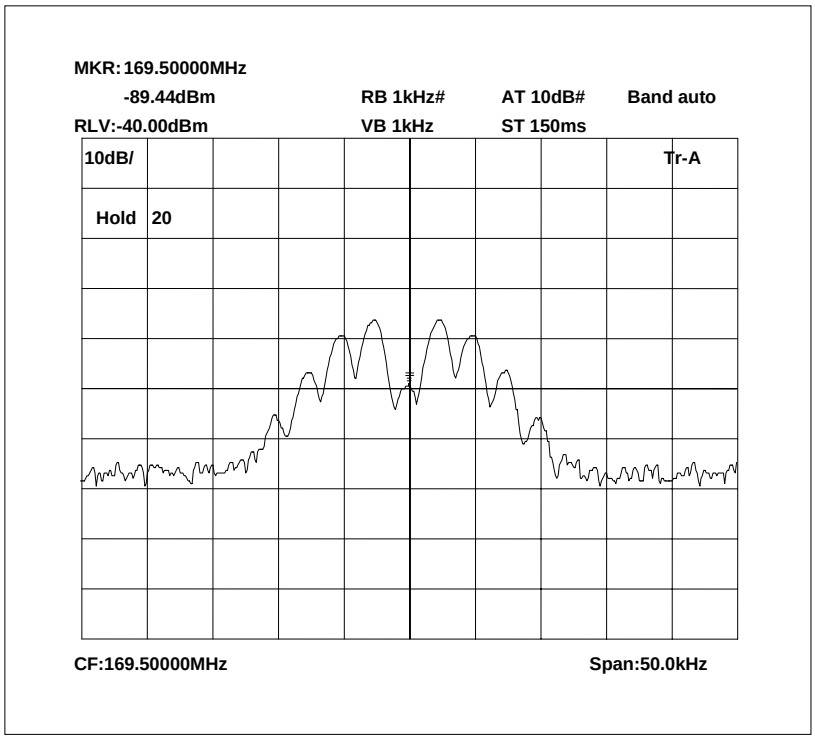



167.0 MHz Signal Generator and EUT, deviation set to 5kHz

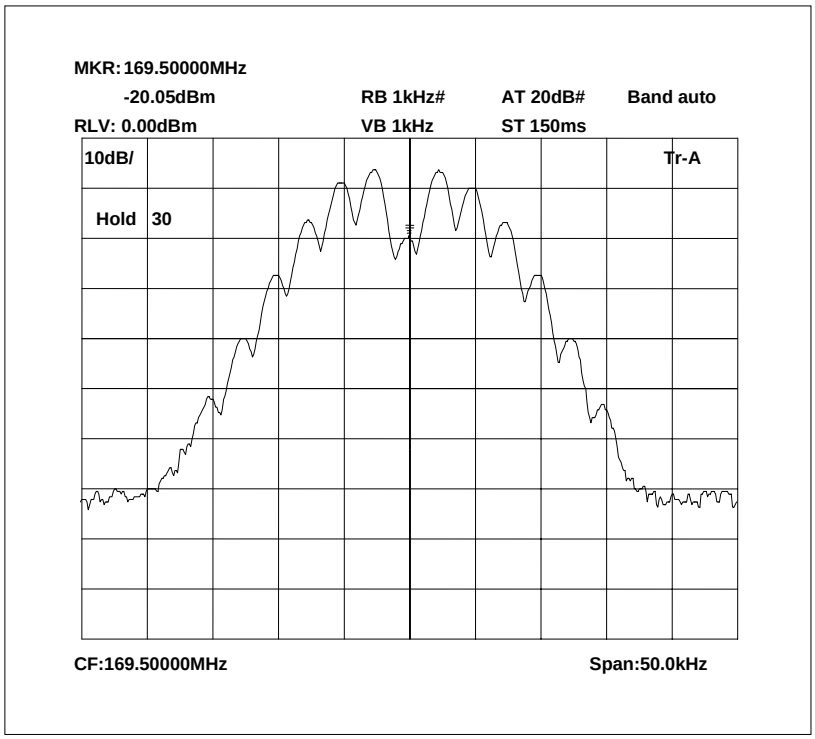



The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

169.5 MHz Signal Generator, deviation set to 5kHz

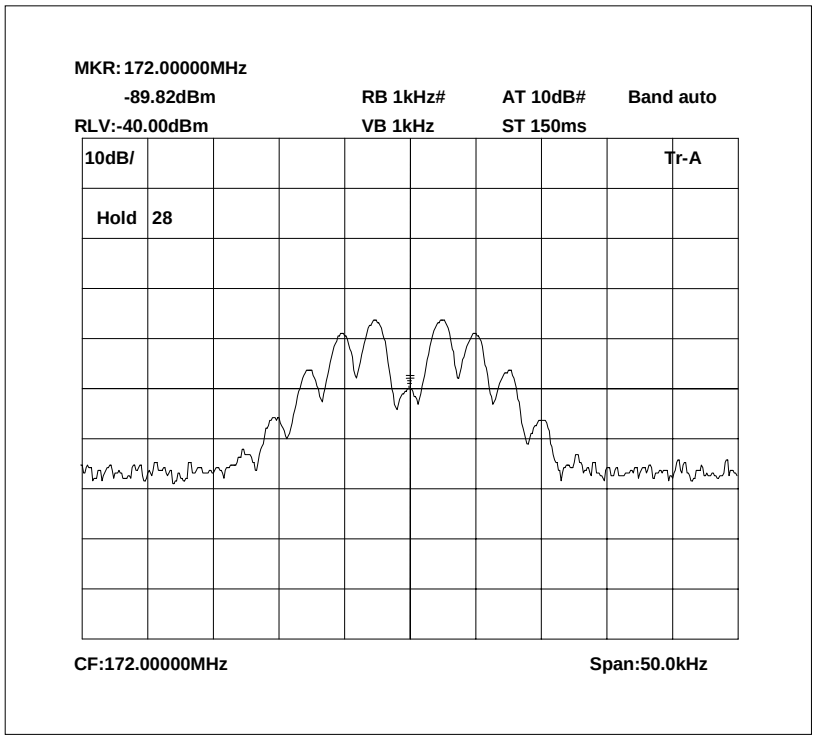



169.5 MHz Signal Generator and EUT, deviation set to 5kHz

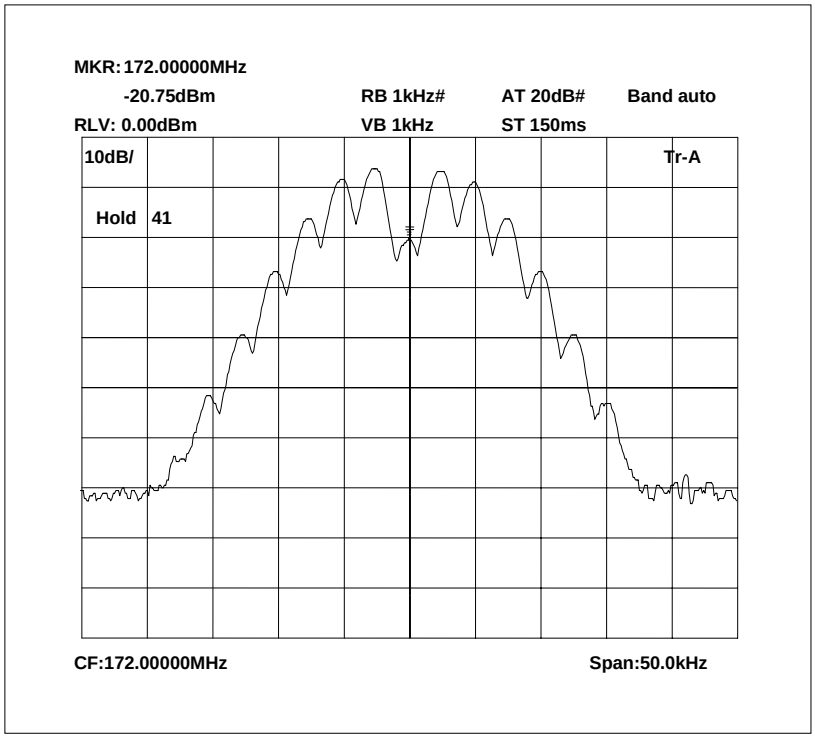



The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

172.0 MHz Signal Generator, deviation set to 5kHz




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




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

**TRANSMITTER TESTS**

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

| | | | | | |
|---|---|---|---|---|---|
| Ambient temperature | = | 24°C | Radio Laboratory | | |
| Relative humidity | = | 37% | Test Signal | = | F3E |
| Supply voltage | = | +110Vac | | | |

Signal Generator TRL478 | EUT | Cable & Attenuator | Spectrum Analyser TRL479

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

The Spurious limit was calculated as follows:

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

At least 43 + 10 log PdB

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

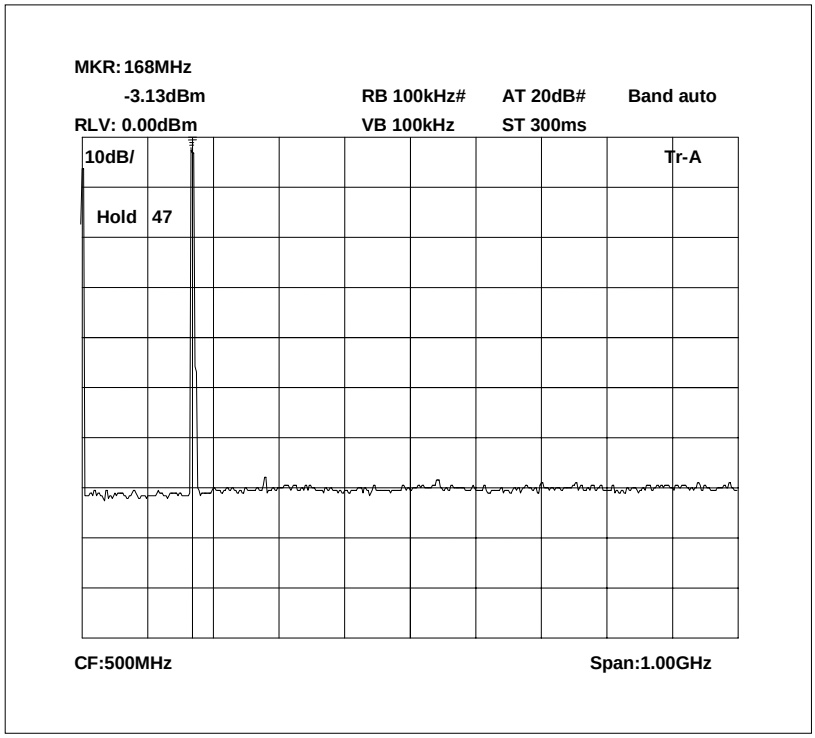
**RESULTS**

| FREQUENCY RANGE | FREQ. (MHz) | MEASURED LEVEL (dBm) | ATTENUATOR & CABLE LOSSES (dB) | EMISSION LEVEL (dBm) | LIMIT (dBm) |
|---|---|---|---|---|---|
| 0 – 2 GHz | No Significant Emissions | | | | -13 |

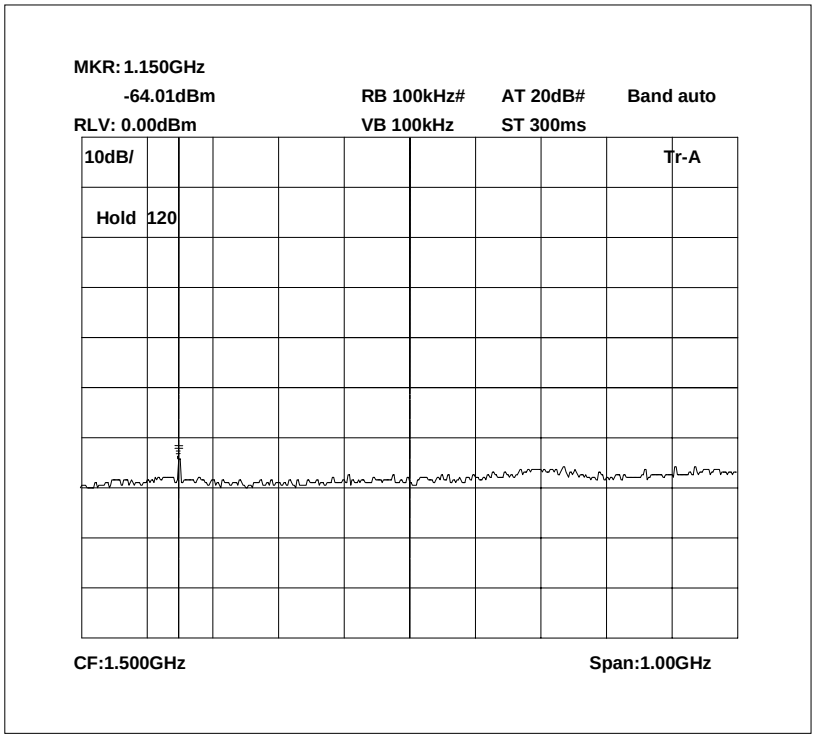
The test equipment used for the Transmitter Conducted Emissions:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| ATTENUATOR | BIRD | 8304-200 | N/A | 103 | |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | **X** |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | RHODE & SCHWARZ | SMR 20 | 834671/003 | 478 | **X** |

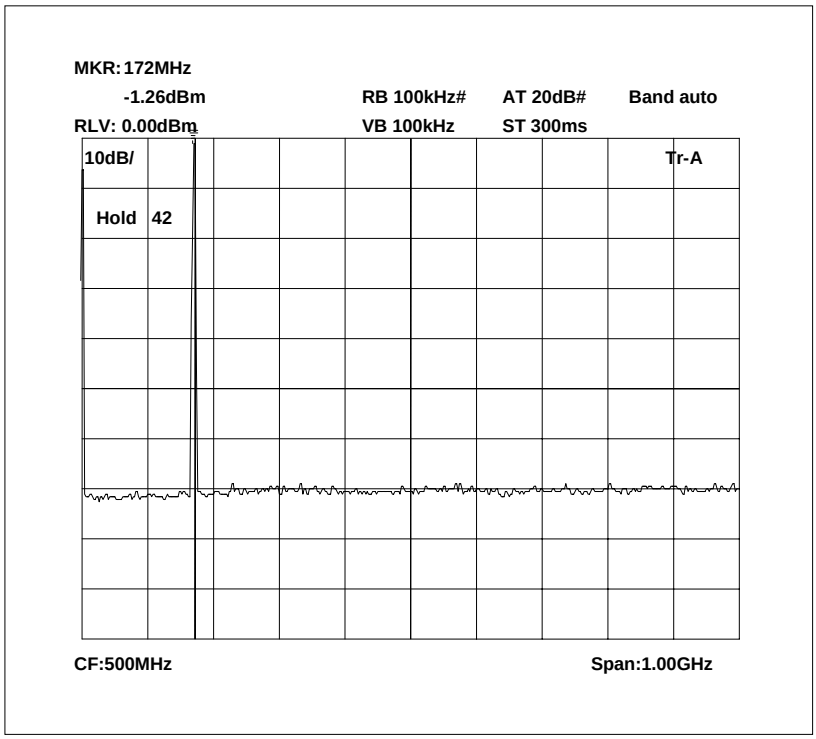
Conducted emissions 167.0 MHz 0 – 1GHz



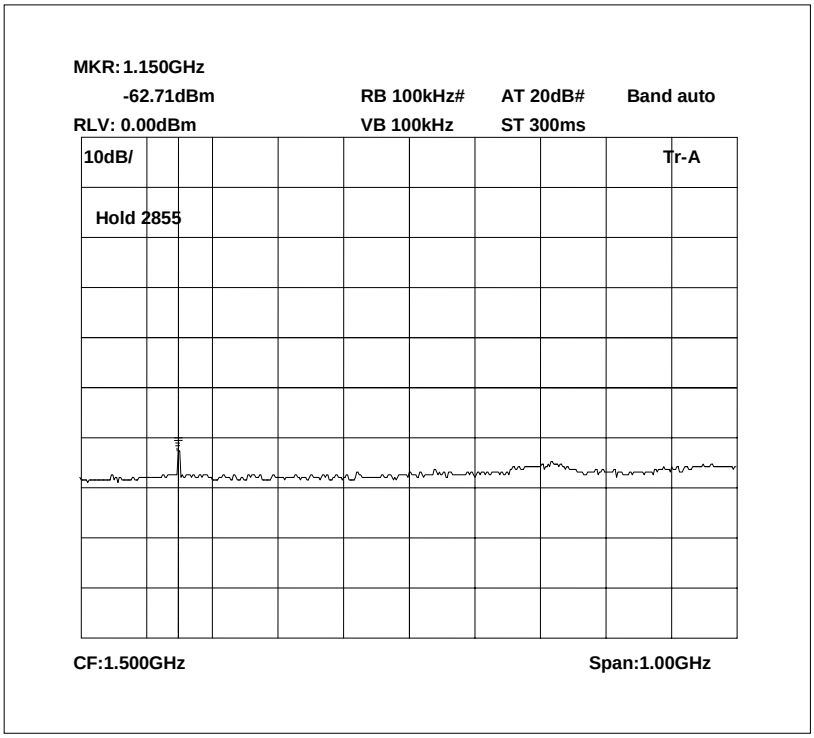

Conducted emissions 167.0 MHz 1 – 2GHz



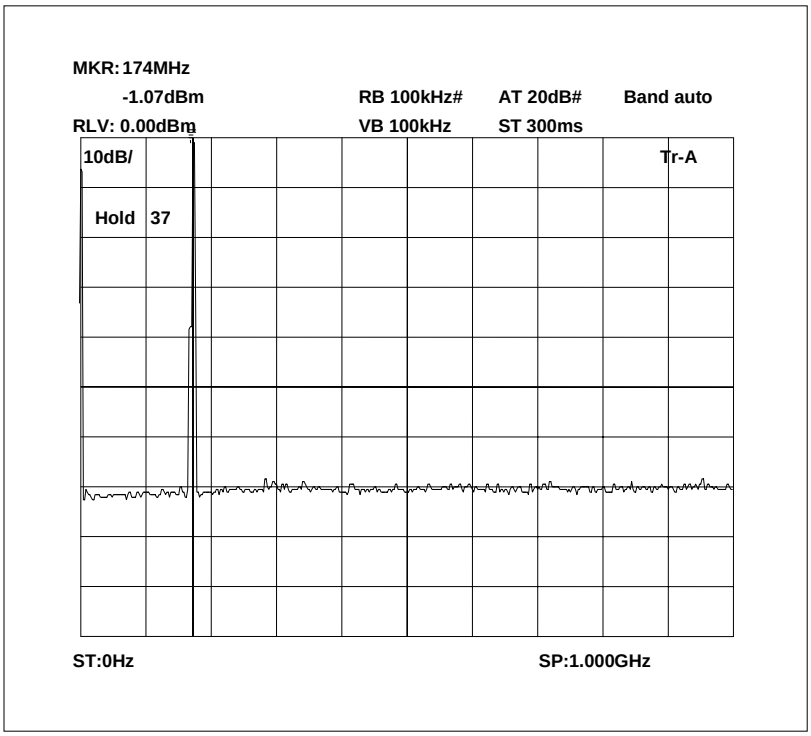
Conducted emissions 169.5 MHz 0 – 1GHz



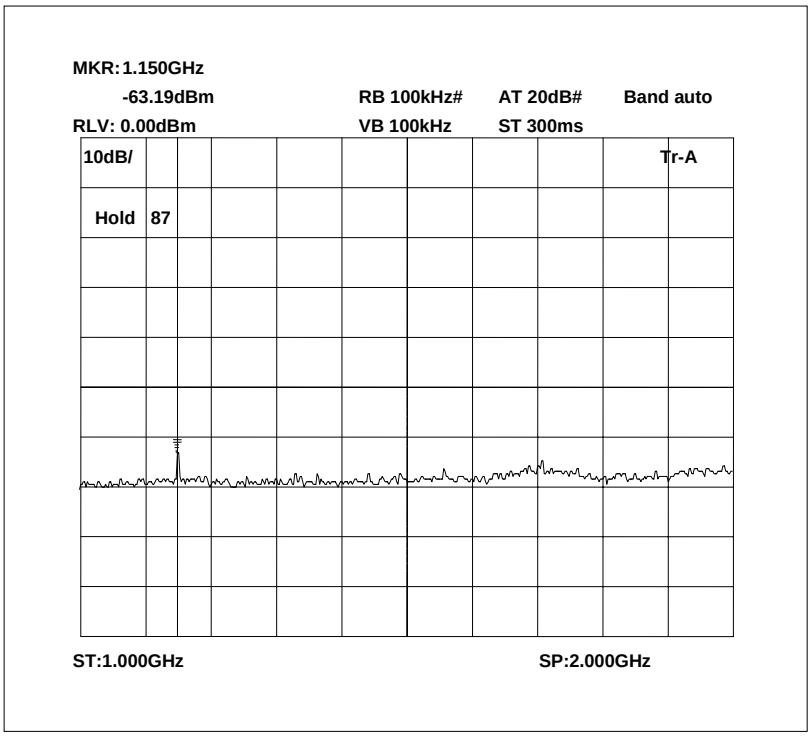

Conducted emissions 169.5 MHz 1 – 2GHz



Conducted emissions 172.0 MHz 0 – 1GHz



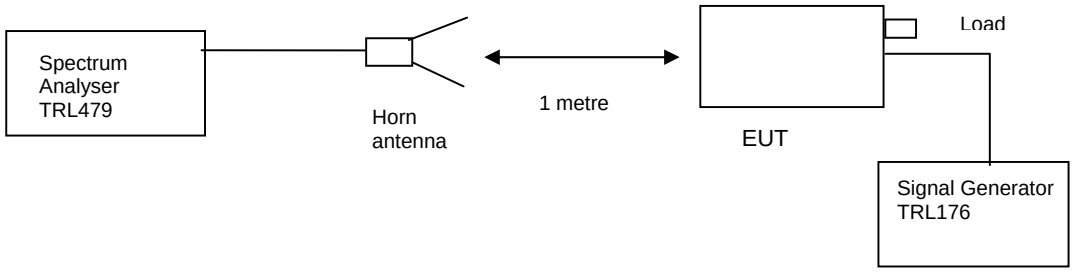

Conducted emissions 172.0 MHz 1 – 2GHz



**TRANSMITTER TESTS**

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

| | | | | | |
|---|---|---|---|---|---|
| Ambient temperature | = | 17°C | Test Signal | = | F3E |
| Relative humidity | = | 49% | | | |
| 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 PdB

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

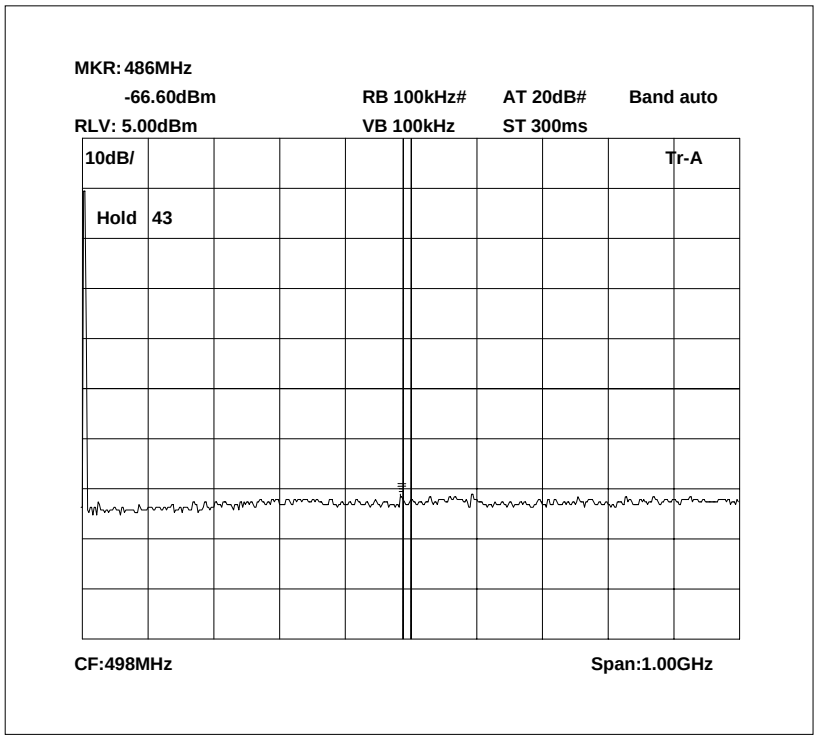
## RESULTS

| FREQUENCY RANGE | FREQ. (MHz) | MEAS. Rx. (dBµV) | CABLE LOSS (dB) | ANT FACTOR | FIELD STRENGTH (dBµV/m) | CALCULATED EIRP (dBm) | LIMIT (dBm) |
|---|---|---|---|---|---|---|---|
| 0 – 2GHz | No Significant Emissions within | | | | | | |

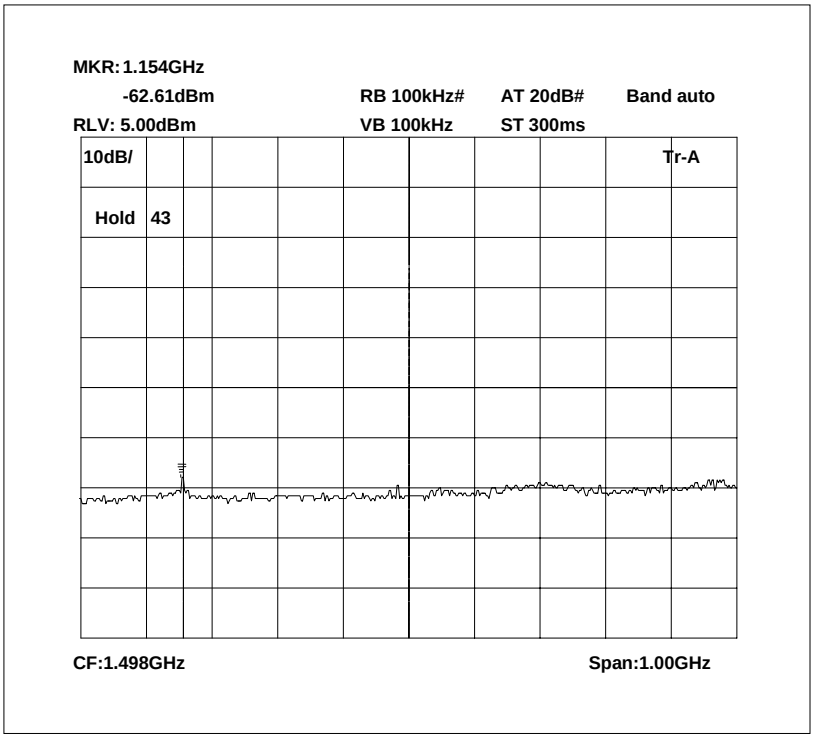
The test equipment used for the Transmitter Spurious Emissions:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ANRITSU | MS2665C | MT26089 | 479 | **X** |
| HORN | EMCO | 3115 | 9010-3581 | 139 | **X** |
| ATTENUATOR | BIRD | 8304-300-N | N/A | 220 | |
| ATTENUATOR | BIRD | 8308-100 | N/A | 112 | |
| CABLE | ROSENBERGER | MICRO COAX | N/A | 280 | **X** |
| SIGNAL GENERATOR | MARCONI | 2042 | 119388/080 | 176 | **X** |

Radiated emissions 167.0 MHz 0 – 1GHz

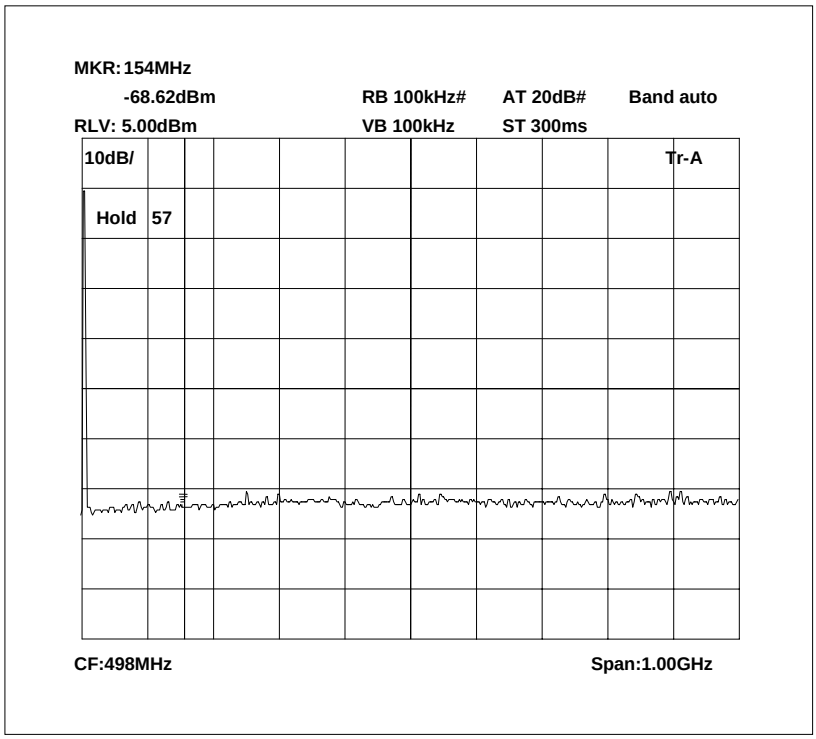



Radiated emissions 167.0 MHz 1 – 2GHz

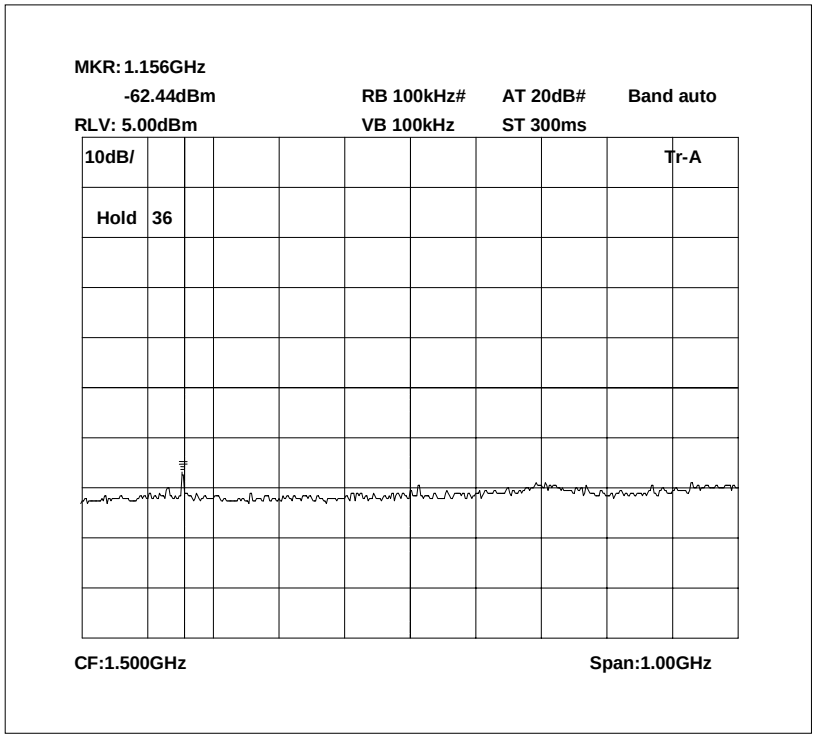



The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions 169.5 MHz 0 – 1GHz

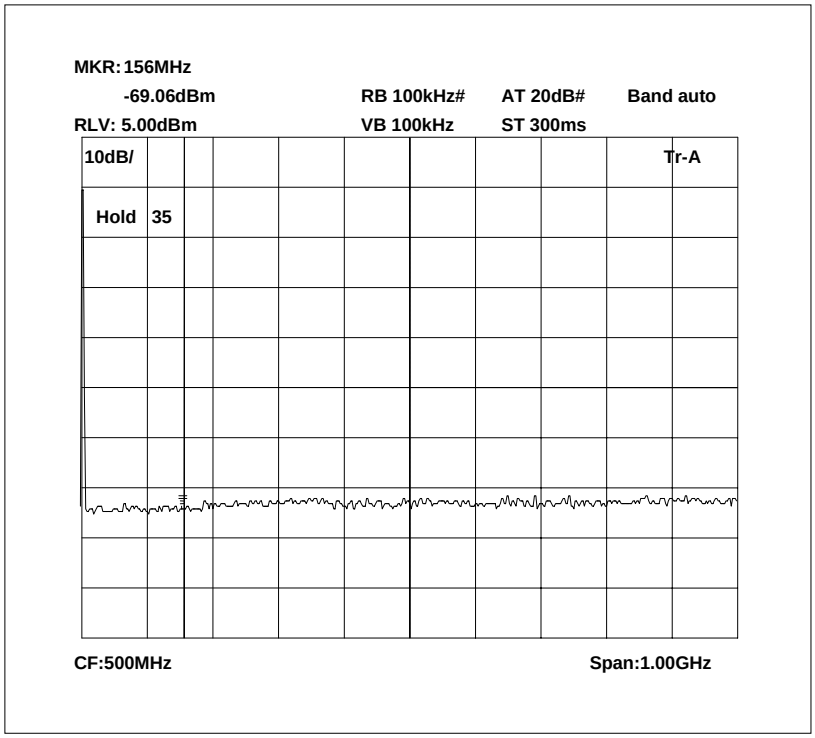



Radiated emissions 169.5 MHz 1 – 2GHz

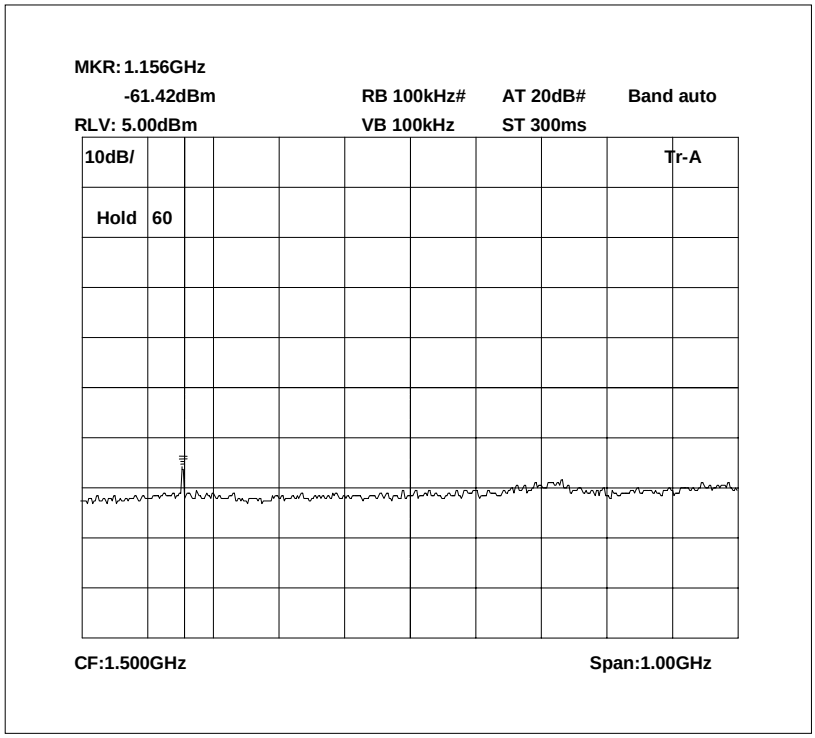



The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions 172.0 MHz 0 – 1GHz

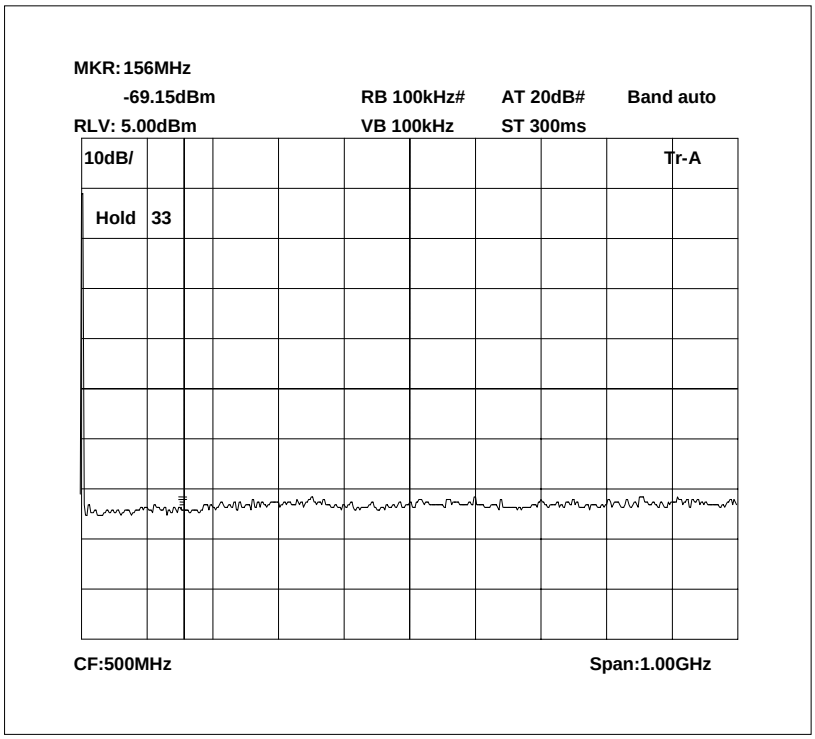



Radiated emissions 172.0 MHz 1 – 2GHz

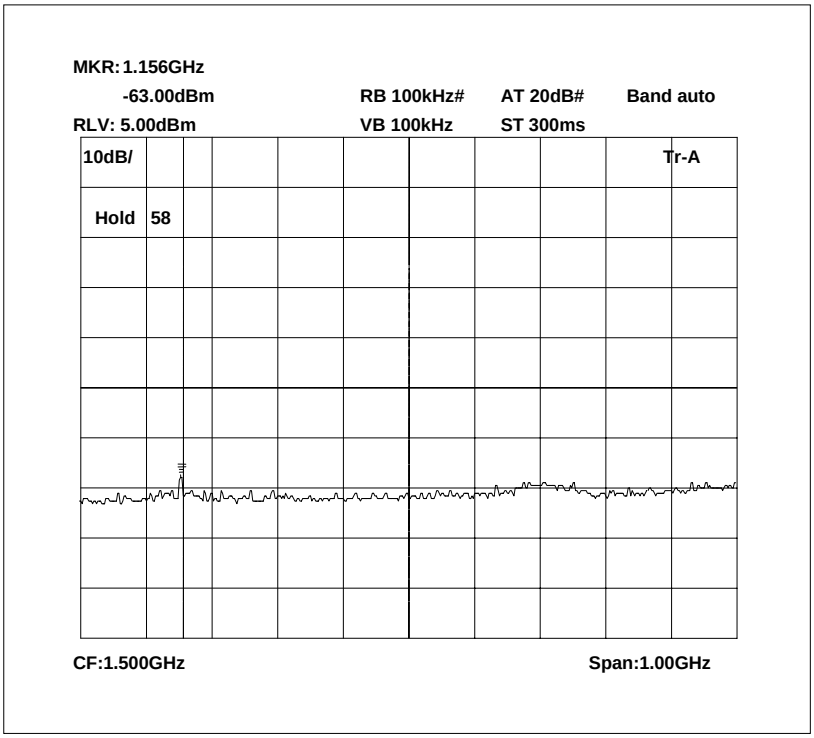



The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions no input signal 0 – 1GHz




Radiated emissions no input signal 1 – 2GHz



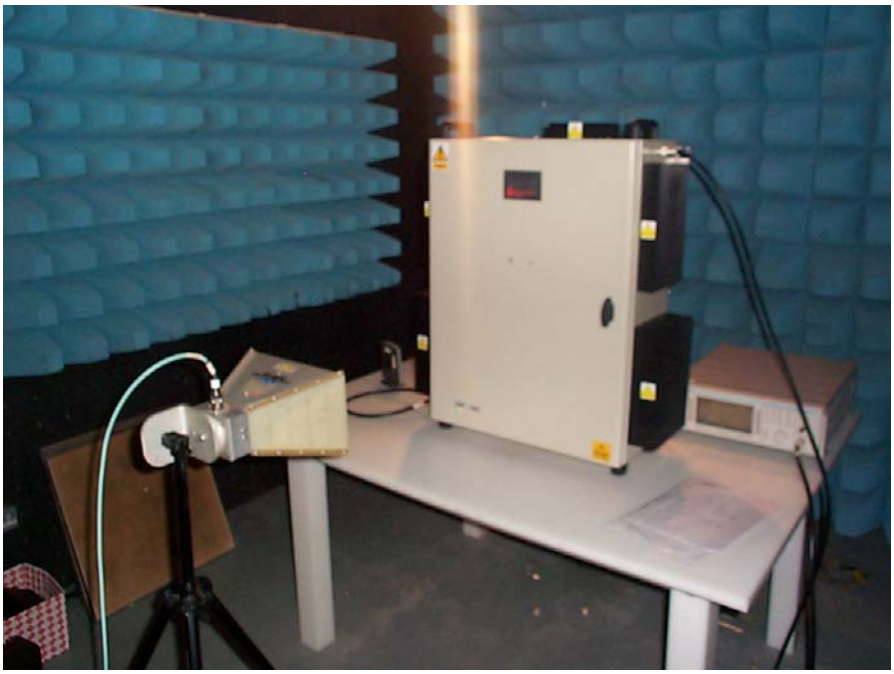

The above test results show that there were no emissions within 20dBs of the –13dBm limit.

## ANNEX A

## PHOTOGRAPHS

PHOTOGRAPH No. 1 **TEST SETUP**

PHOTOGRAPH No. 2 **TEST SETUP**



## ANNEX B

## APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

## APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

| | | | | |
|---|---|---|---|---|
| a. | 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 | 01/03/2005 | 12 | 01/03/2006 |
| UH028 | Log Periodic Ant | Schwarbeck | 28/04/2005 | 24 | 28/04/2007 |
| UH029 | Bicone Antenna | Schwarbeck | 27/04/2005 | 24 | 27/04/2007 |
| UH041 | Multimeter | AVOmeter | 14/12/2004 | 12 | 14/12/2005 |
| UH120 | Spectrum Analyser | Marconi | 15/03/2005 | 12 | 15/03/2006 |
| UH122 | Oscilloscope | Tektronix | 07/06/2005 | 24 | 07/06/2007 |
| UH132 | Power meter | Marconi | 15/12/2004 | 12 | 15/12/2005 |
| UH162 | ERP Cable Cal | TRL | 23/05/2005 | 12 | 23/05/2006 |
| UH253 | 1m Cable N type | TRL | 10/01/2005 | 12 | 10/01/2006 |
| UH254 | 1m Cable N type | TRL | 10/01/2005 | 12 | 10/01/2006 |
| UH265 | Notch filer | Telonic | 24/06/2005 | 12 | 24/06/2006 |
| L005 | CMTA | R&S | 05/12/2005 | 12 | 05/12/2006 |
| L007 | Loop Antenna | R&S | 29/03/2005 | 24 | 29/03/2007 |
| L103 | Attenuator | Bird | | Calibrate in use | |
| L112 | Attenuator | Bird | | 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 |
| L176 | Signal Generator | Marconi | 31/01/2005 | 12 | 31/01/2006 |
| L254 | Signal Generator | Marconi | 13/12/2004 | 12 | 13/12/2005 |
| L280 | 18GHz Cable | Rosenberger | 10/01/2005 | 12 | 10/01/2006 |
| L343 | CCIR Noise Filter | TRL | 07/06/2005 | 12 | 07/06/2006 |
| L426 | Temperature Indicator | Fluke | 14/12/2004 | 12 | 14/12/2005 |
| L479 | Analyser | Anritsu | 18/11/2005 | 12 | 18/11/2006 |
| L552 | Signal Generator | Agilent | 25/04/2005 | 12 | 25/04/2006 |

## 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 (30MHhz – 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**