



TEST REPORT NO: RU1069/4858  
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ISSUE NO: 1  
FCC ID: NEO50-0637Series

**REPORT ON THE CERTIFICATION TESTING OF A  
Aerial Facilities Limited  
Channelised Bi-Directional RF Amplifier (50-063701)  
WITH RESPECT TO  
THE FCC RULES CFR 47, PART 90 Subpart K  
PRIVATE LAND MOBILE REPEATER.**

TEST DATE: 29<sup>th</sup> September – 6<sup>th</sup> October 2003

TESTED BY: ..... J CHARTERS  
APPROVED BY: ..... P GREEN  
PRODUCT MANAGER  
EMC  
DATE: .....

Distribution:

- Copy Nos:
1. Aerial Facilities Limited
  2. TCB: TRL Compliance Services Limited
  3. TRL EMC

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FS 21805

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|  | <b>ANNEX</b> |
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| PHOTOGRAPH No. 1: Test setup                 |              |
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| APPLICANT'S SUBMISSION OF DOCUMENTATION LIST | B            |

- Notes:**
- |    |   |     |                                     |
|----|---|-----|-------------------------------------|
| 1. | Component failure during test   | YES | <input type="checkbox"/>            |
|    |   | NO  | <input checked="" type="checkbox"/> |
| 2. | If Yes, details of failure:   |     |                                     |
| 3. | The facilities used for the testing of the product contain in this report are FCC Listed. |     |                                     |



## CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY: NEO50-0637Series

PURPOSE OF TEST: CERTIFICATION

TEST SPECIFICATION: FCC RULES CFR 47, Part 90 Subpart K

TEST RESULT: Compliant to Specification

EQUIPMENT UNDER TEST: Channelised Bi-Directional RF Amplifier (50-063701)

EQUIPMENT TYPE: Private Land Mobile Repeater

MAXIMUM GAIN: 83.9dB

MAXIMUM INPUT: -56dBm

MAXIMUM OUTPUT: 25dBm

ANTENNA TYPE: Not applicable

CHANNEL SPACING: 12.5kHz

| NUMBER OF CHANNELS: | Channel No. | Uplink     | Downlink                      |
|---------------------|-------------|------------|-------------------------------|
|                     | 1           | 452.050MHz | 457.050MHz                    |
|                     | 2           | 452.300MHz | 475.300MHz                    |
|                     | 3           | 452.775MHz | 457.775MHz                    |
|                     | 4           | 453.225MHz | 457.850MHz                    |
|                     | 5           | 452.850MHz | 458.225MHz                    |
|                     | 6           | n/a        | Simplex Channel<br>452.850MHz |

FREQUENCY GENERATION: N/A

MODULATION TYPE: F3E

POWER SOURCE(s): 115Vac

TEST DATE(s): 29<sup>th</sup> September – 6<sup>th</sup> October 2003

ORDER No(s): 20424

APPLICANT: Aerial Facilities Limited

ADDRESS: Aerial House  
Latimer Park, Latimer  
Chesham  
Buckinghamshire  
HP5 1TU  
United Kingdom

TESTED BY: ..... J CHARTERS

APPROVED BY: ..... P GREEN  
PRODUCT  
MANAGER EMC

## APPLICANT'S SUMMARY

|                                |  |
|--------------------------------|--|
| EQUIPMENT UNDER TEST (EUT):    | Channelised Bi-Directional RF Amplifier (50-063701)  |
| EQUIPMENT TYPE:                | 50-063701  |
| PURPOSE OF TEST:               | CERTIFICATION  |
| TEST SPECIFICATION(s):         | FCC RULES CFR 47, Part 90 Subpart K  |
| TEST RESULT:                   | COMPLIANT      Yes <input checked="" type="checkbox"/><br>No <input type="checkbox"/>  |
| APPLICANT'S CATEGORY:          | MANUFACTURER <input checked="" type="checkbox"/><br>IMPORTER <input type="checkbox"/><br>DISTRIBUTOR <input type="checkbox"/><br>TEST HOUSE <input type="checkbox"/><br>AGENT <input type="checkbox"/> |
| APPLICANT'S ORDER No(s):       | 20424  |
| APPLICANT'S CONTACT PERSON(s): | Mr Peter Bradfield   |
| E-mail address:                | Peterb@aerial.co.uk  |
| APPLICANT:                     | Aerial Facilities Limited  |
| ADDRESS:                       | Aerial House<br>Latimer Park, Latimer<br>Chesham<br>Buckinghamshire<br>HP5 1TU<br>United Kingdom   |
| TEL:                           | +44 (0)1494777020  |
| FAX:                           | +44 (0)149477020   |
| MANUFACTURER:                  | Aerial Facilities Limited  |
| EUT(s) COUNTRY OF ORIGIN:      | United Kingdom   |
| TEST LABORATORY:               | TRL EMC  |
| UKAS ACCREDITATION No:         | 0728   |
| TEST DATE(s)                   | 29 <sup>th</sup> September – 6 <sup>th</sup> October 2003  |
| TEST REPORT No:                | RU1069/4858  |

### EQUIPMENT TEST / EXAMINATIONS REQUIRED

|    |   |                   |                      |               |
|----|---|-------------------|----------------------|---------------|
| 1. | <b>TEST/EXAMINATION</b>                 | <b>RULE PART</b>  | <b>APPLICABILITY</b> | <b>RESULT</b> |
|    | 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 Use: Private Land Mobile Repeater
  3. Emission Designator: F3E
  4. Temperatures: Ambient (Tnom) 20°C
  5. Supply Voltages: Vnom 115Vac
- Note: Vnom voltages are as stated above unless otherwise shown on the test report page
6. Equipment Category:
 

|                |                                     |
|----------------|-------------------------------------|
| Single channel | <input type="checkbox"/>            |
| Two channel    | <input type="checkbox"/>            |
| Multi-channel  | <input checked="" type="checkbox"/> |
  7. Channel spacing:
 

|            |                                     |         |
|------------|-------------------------------------|---------|
| Narrowband | <input checked="" type="checkbox"/> | 12.5kHz |
| Wideband   | <input type="checkbox"/>            |         |
  8. Test Location
 

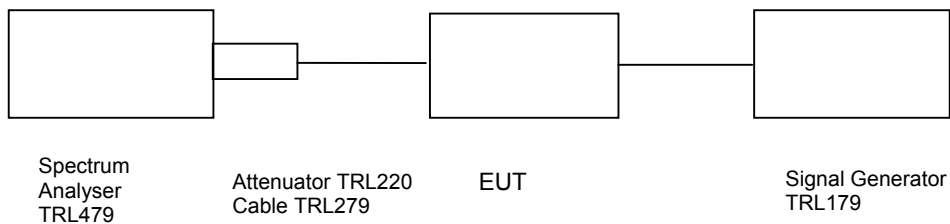
|                         |                                     |
|-------------------------|-------------------------------------|
| TRL Compliance Services |                                     |
| Up Holland              | <input checked="" type="checkbox"/> |
| Long Green              | <input type="checkbox"/>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

## COMPLIANCE TESTS

### AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – UPLINK

Ambient temperature = 20°C  
 Relative humidity = 54%  
 Supply voltage = 115Vac  
 Channel number = See test results

Radio Laboratory



| Frequency<br>MHz | Signal Generator<br>input level<br>dBm | Cable & Attenuator<br>loss<br>dB | Level at Spectrum<br>Analyser<br>dBm | Gain<br>dB | Gain after 20dB<br>input level<br>increase<br>dBm |
|------------------|--|----------------------------------|--------------------------------------|------------|---|
| 452.05MHz        | -56.3                                  | 26.6                             | -2.1                                 | 80.9       | 80.9  |
| 452.30MHz        | -56.2                                  | 26.6                             | -1.9                                 | 80.9       | 80.9  |
| 452.775MHz       | -56.1                                  | 26.6                             | -2.5                                 | 81.05      | 81.05   |

#### Notes:

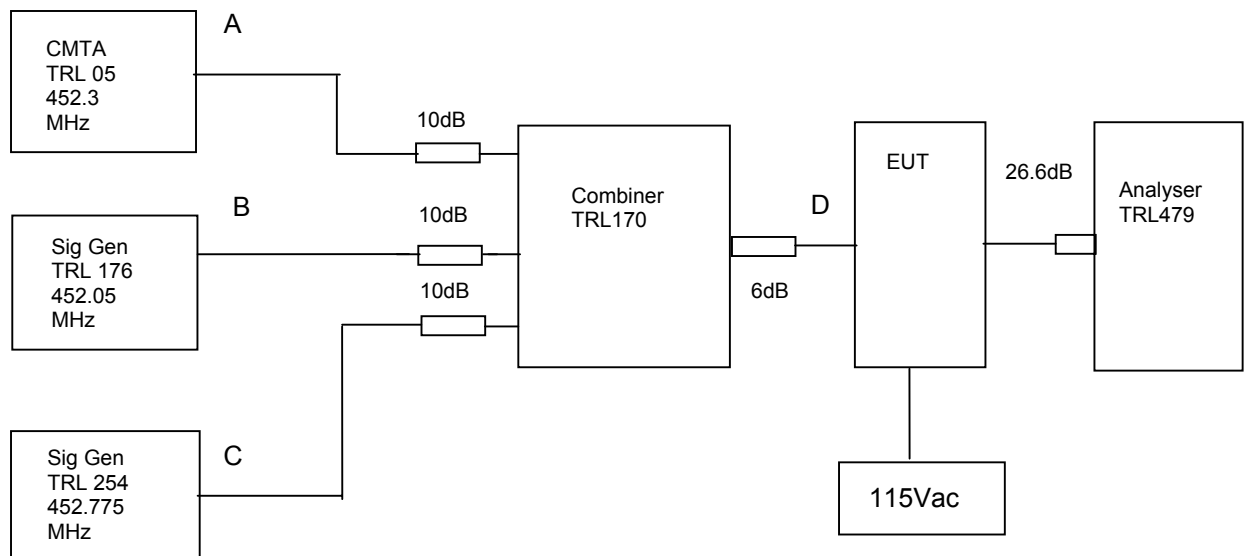
1. The level of the signal generator takes into consideration the loss from the cable.
2. The signal generator input was increased by 20dBs and the level of the output signal remeasured

| TYPE OF<br>EQUIPMENT | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

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

Ambient temperature = 20°C  
Relative humidity = 54%  
Supply voltage = 115Vac

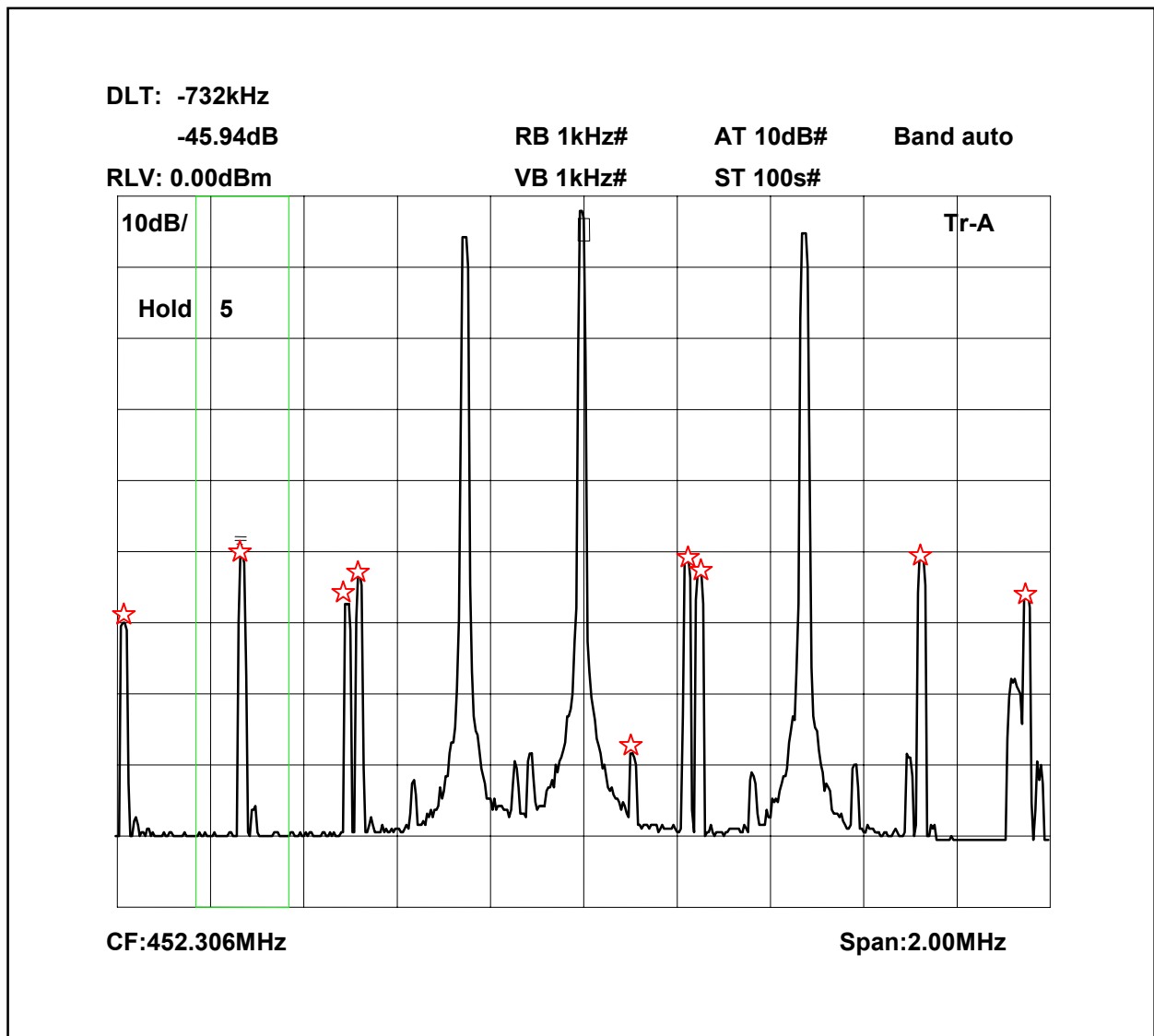
Radio Laboratory




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 the maximum input of –56.1dBm. The cable and attenuator loss between the EUT and the spectrum analyser was 26.6dB.

Sweep data is shown on the next page:

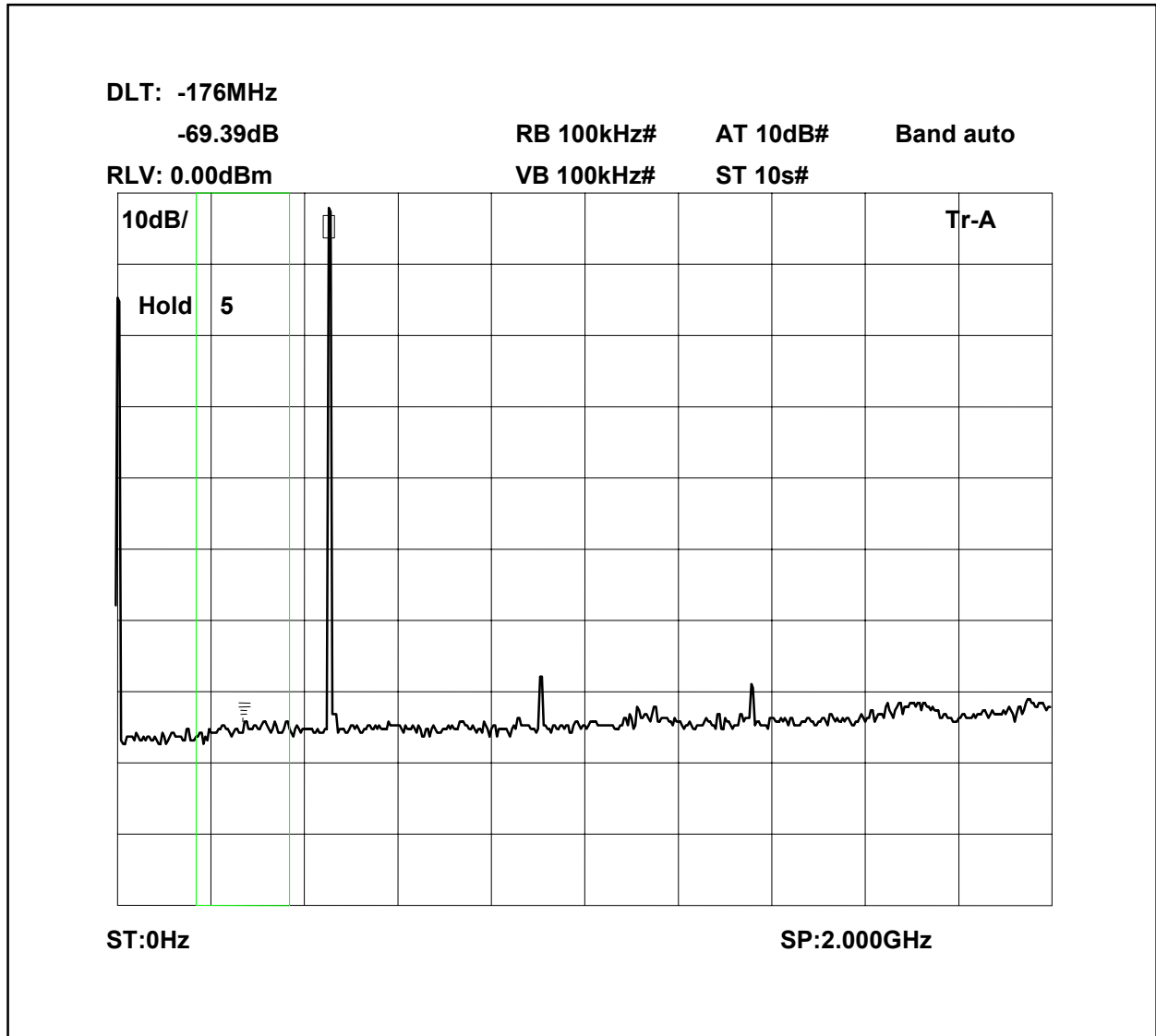
# Intermodulaion Inband



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



# Intermodulation Wideband



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

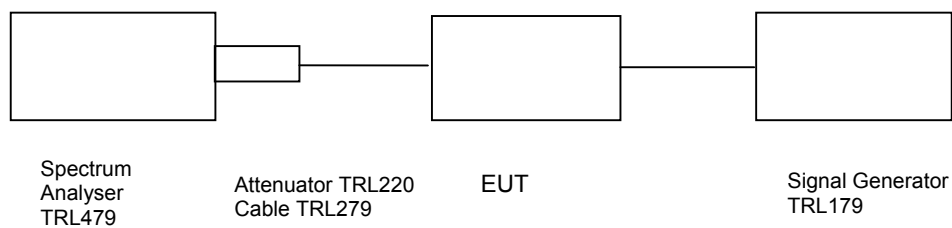
Test equipment used for intermodulation test

| TYPE OF EQUIPMENT | MAKER/<br>SUPPLIER | MODEL No | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|-------------------|--------------------|----------|------------|--------|-----------------------------|
| SPECTRUM ANALYSER | ANRITSU            | MS2665C  | MT26089    | 479    | <b>X</b>                    |
| SIGNAL GENERATOR  | MARCON             | 2042     | 119562/02  | 254    | <b>X</b>                    |
| CMTA              | ROHDE &<br>SCHWARZ | CMTA52   | 894715/033 | 05     | <b>X</b>                    |
| SIGNAL GENERATOR  | MARCON             | 2042     | 119388/080 | 179    | <b>X</b>                    |
| COMBINER          | ELCOM              | RC-4-50  | N/A        | 170    | <b>X</b>                    |

## TRANSMITTER TESTS

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

|                     |   |                  |                  |
|---------------------|---|------------------|------------------|
| Ambient temperature | = | 20°C             | Radio Laboratory |
| Relative humidity   | = | 54%              |                  |
| Supply voltage      | = | 115Vac           |                  |
| Channel number      | = | See test results |                  |

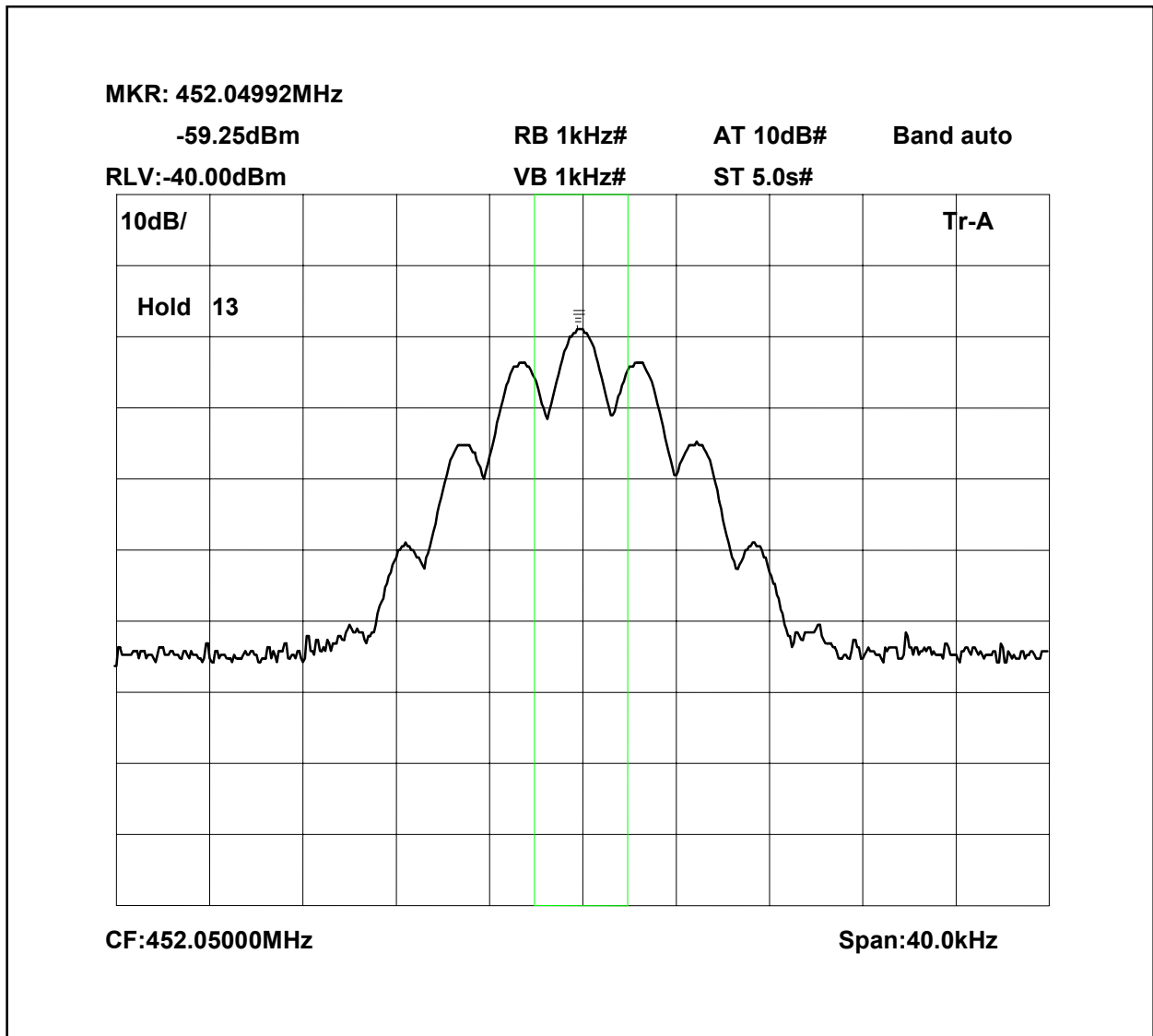


This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level (-56.1dBm) and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at the output of the EUT.

Note: The cables and attenuators had the following losses.

1. Cable TRL279 and attenuator TRL220 26.6dB
2. Cable between signal generator and EUT 0.85dB

452.05MHz Signal Generator deviation set to 2.5kHz



MR: 452.04992MHz

-4.24dBm

RLV: 0.00dBm

RB 1kHz#

VB 1kHz#

AT 10dB#

ST 5.0s#

Band auto

10dB/

Hold 5

Tr-A

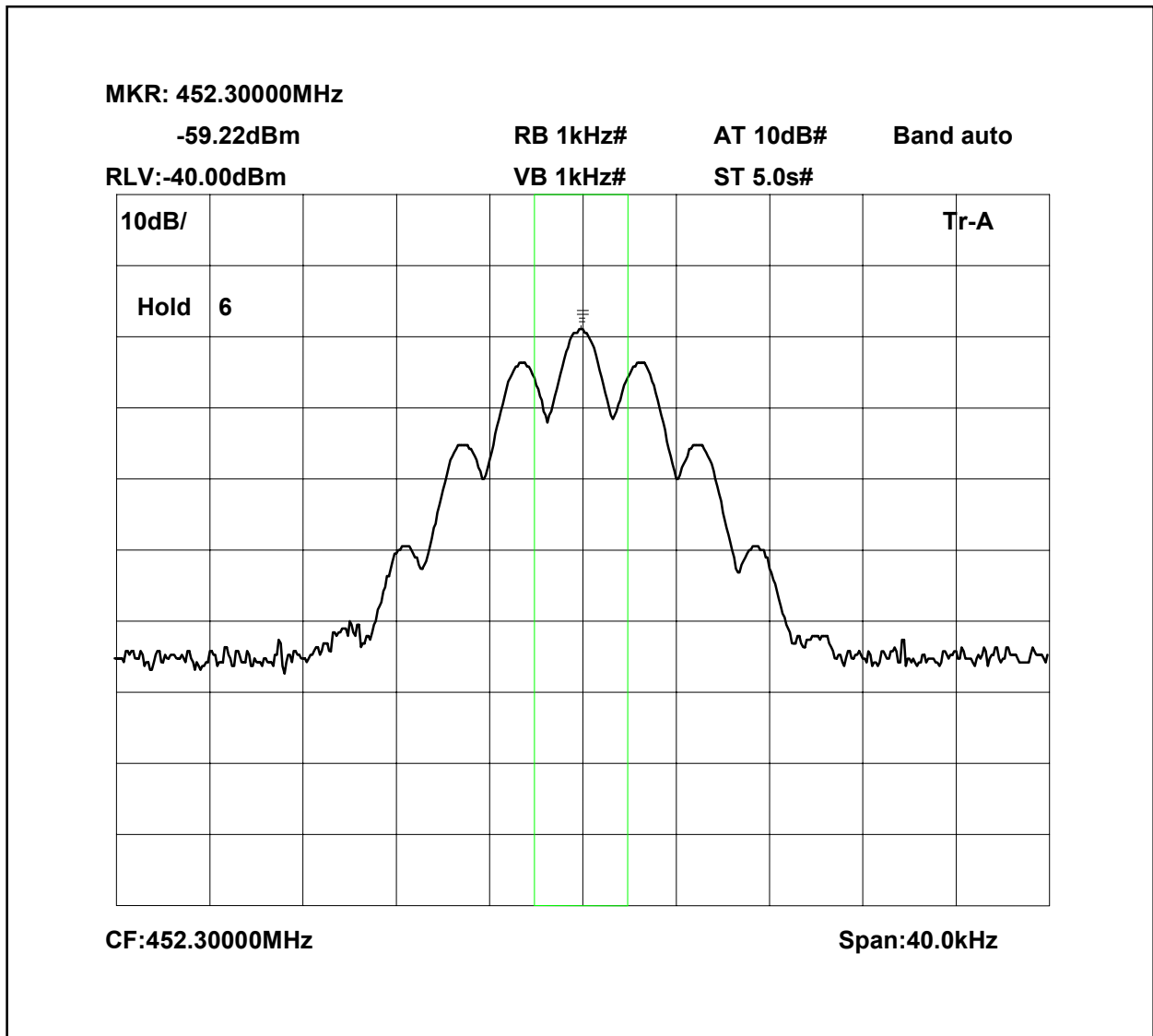
CF:452.05000MHz

Span:40.0kHz

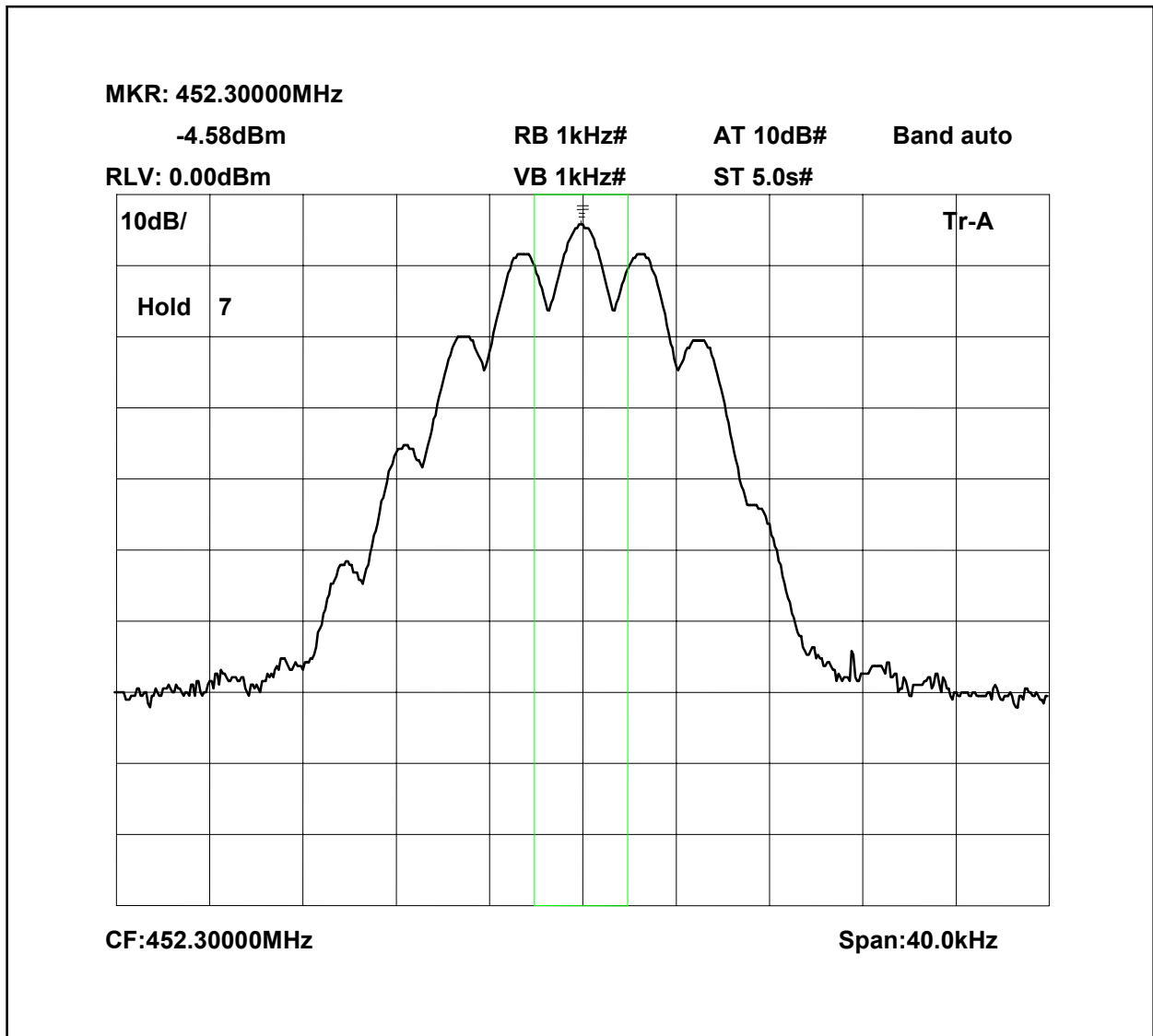
Detailed description: The figure is a spectrum plot from a software-defined radio (SDR) application. It features a black trace on a white grid. The trace shows a signal with a main peak at 452.05000 MHz, which is marked by a vertical green line. The signal has a bandwidth of 40.0 kHz. The plot includes various measurement parameters: MR (Marker) at 452.04992 MHz, RB (Resolution Bandwidth) at 1 kHz, VB (Video Bandwidth) at 1 kHz, AT (Attenuation) at 10 dB, ST (Sweep Time) at 5.0 s, and Band (Bandwidth) set to auto. The signal level is -4.24 dBm, and the reference level is 0.00 dBm. The plot also shows a 10 dB/div scale and a 5-second hold time. The trace is labeled 'Tr-A'.

RF335 iss02

452.30MHz Signal Generator deviation set to 2.5kHz

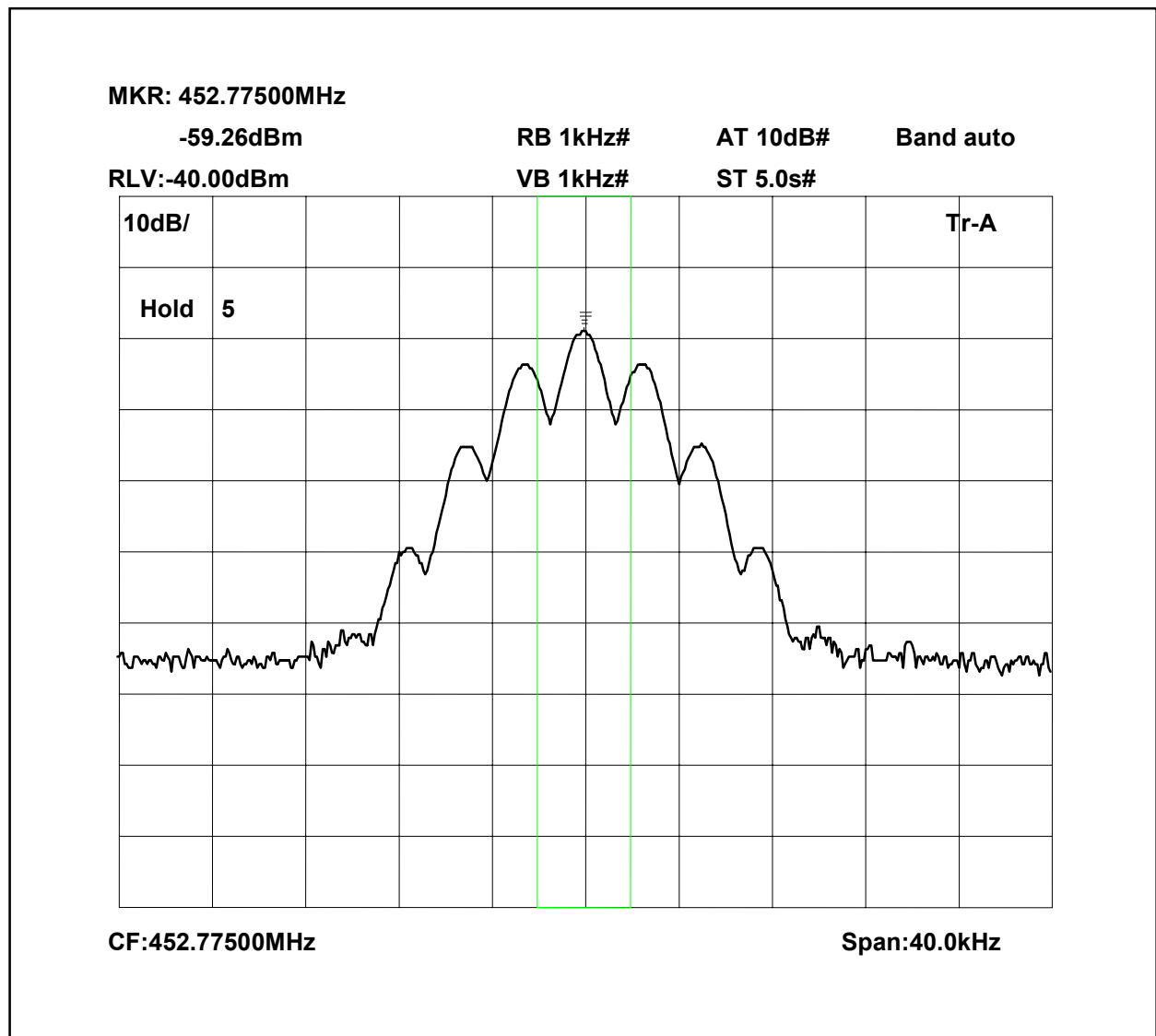


452.30MHz Signal Generator and amplifier deviation set to 2.5kHz



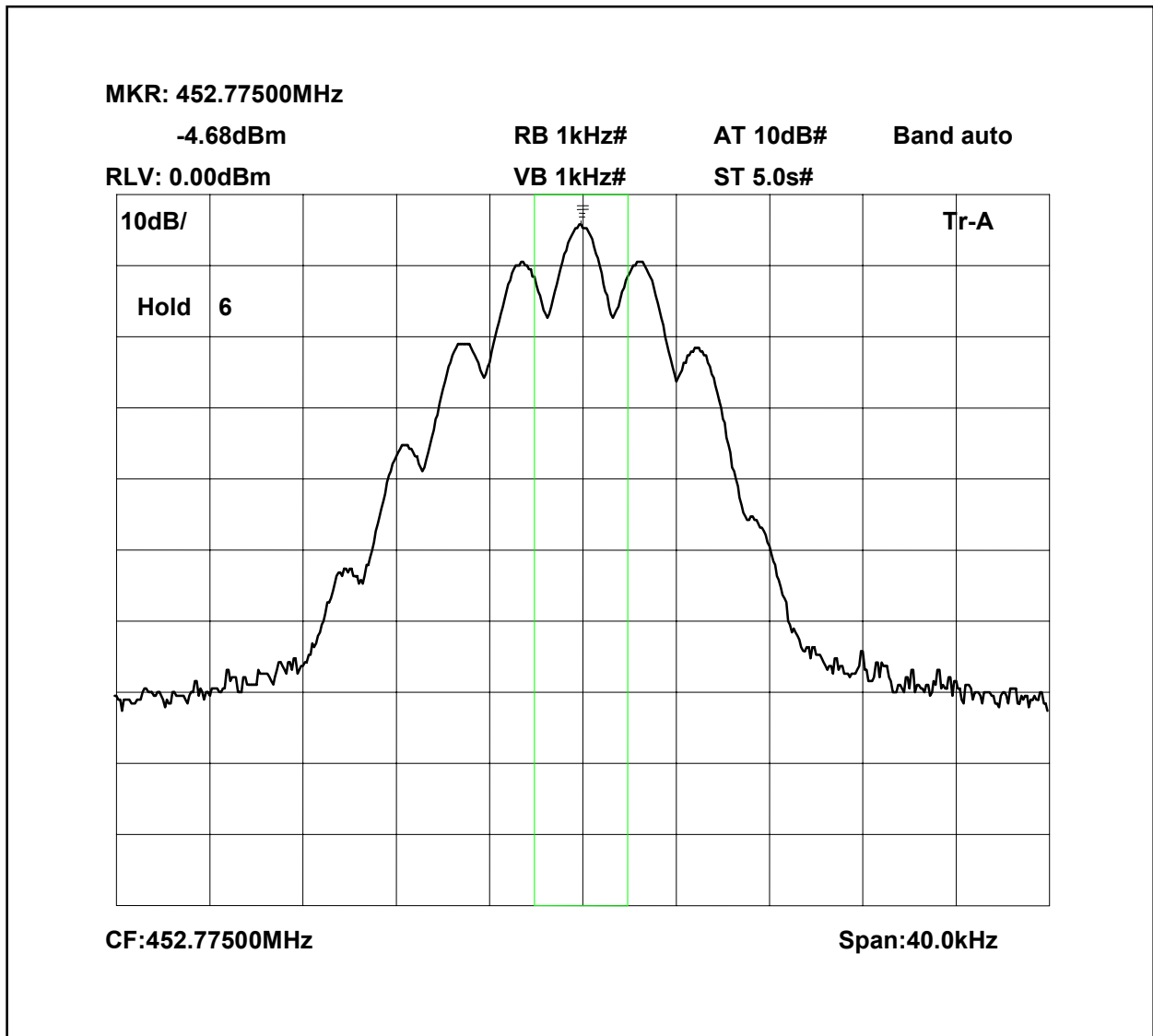
The above plots depicting the output waveshape show no measurable distortion visible when compared to the input signal.

452.775MHz Signal Generator deviation set to 2.5kHz





452.775MHz Signal Generator deviation set to 2.5kHz



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

The test equipment used for the Transmitter Modulated Channel tests is shown overleaf:

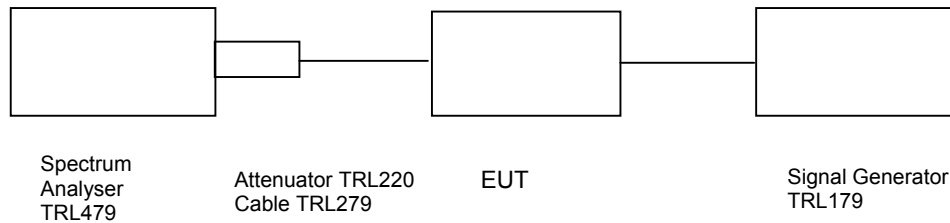
| TYPE OF EQUIPMENT | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL EQUIPMENT USED |
|-------------------|--------------------|------------|------------|--------|-----------------------|
| SPECTRUM ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>              |
| ATTENUATOR        | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>              |
| CABLE             | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>              |
| SIGNAL GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>              |

## TRANSMITTER TESTS

### AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – Part 2.1051 – UPLINK

Ambient temperature = 20°C  
 Relative humidity = 54%  
 Supply voltage = 115Vac

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

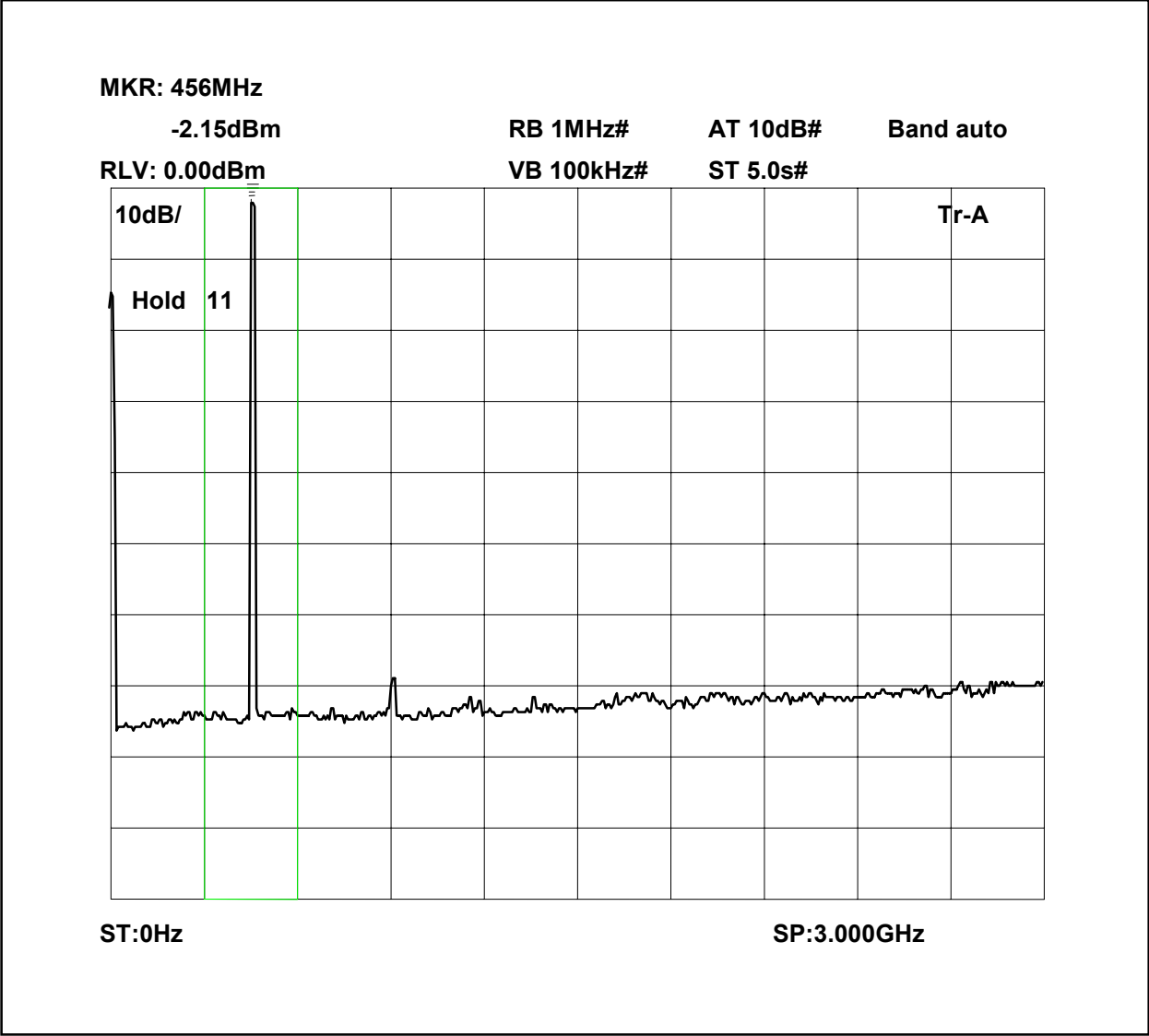
At least  $43 + 10 \log P_{dB}$

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

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    | <b>X</b>              |
| ATTENUATOR        | BIRD           | 8304-300-N | N/A        | 220    | <b>X</b>              |
| CABLE             | ROSENBERGER    | MICRO COAX | N/A        | 279    | <b>X</b>              |
| SIGNAL GENERATOR  | MARCON         | 2042       | 119388/080 | 179    | <b>X</b>              |

Conducted emissions 452.05MHz 0 - 3GHz



MKR: 3.823GHz  
-69.16dBm  
RB 1MHz#  
AT 10dB#  
Band auto

RLV: 0.00dBm  
VB 100kHz#  
ST 5.0s#

10dB/

Hold 6

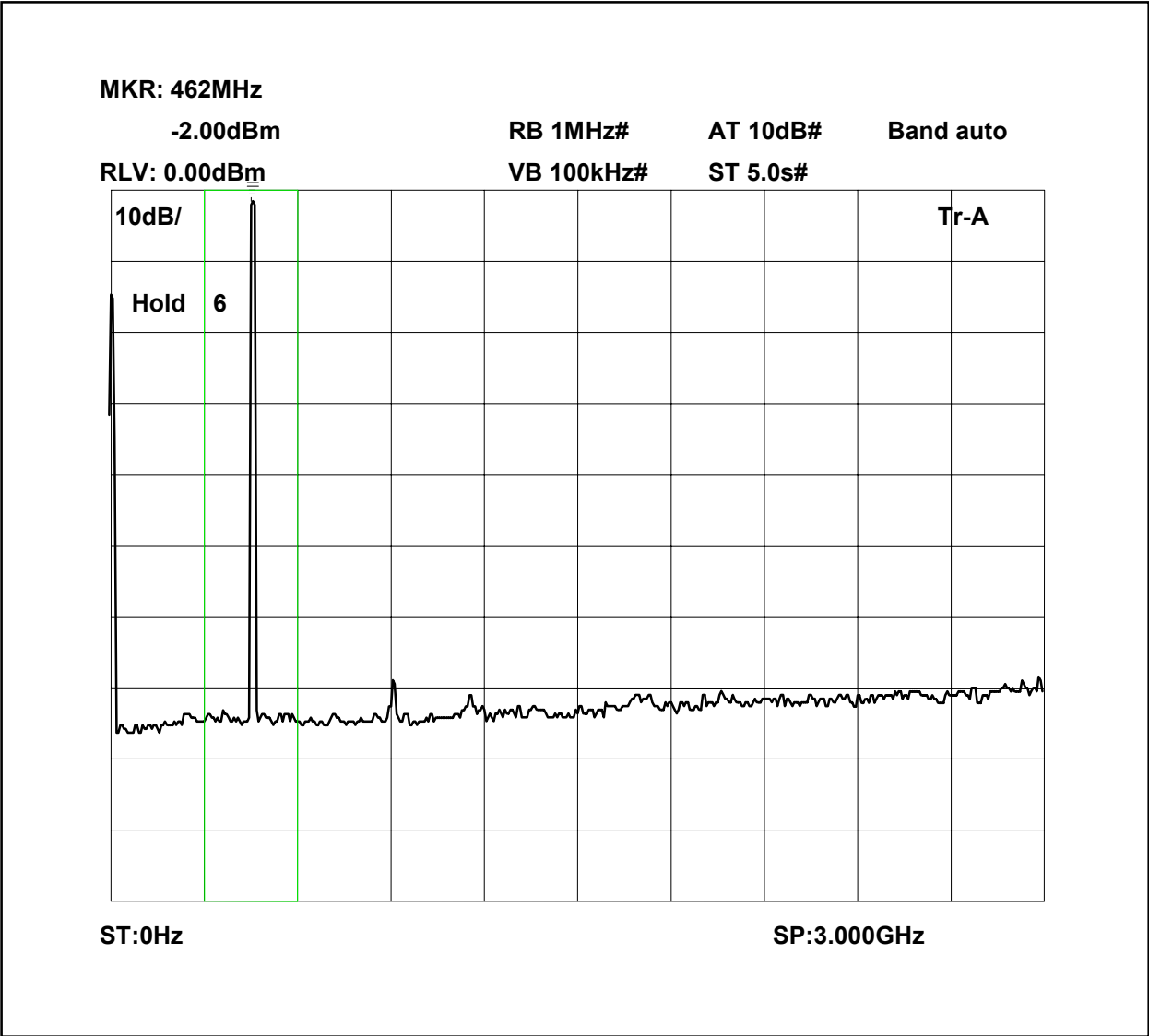
Tr-A

ST:2.900GHz

SP:10.000GHz

The figure is a spectrum plot with a grid. The horizontal axis represents frequency, with labels 'ST:2.900GHz' at the left and 'SP:10.000GHz' at the right. The vertical axis represents power, with a label '10dB/' at the top left. A trace labeled 'Tr-A' is shown, which is a noisy signal. The signal level is indicated as '-69.16dBm'. Other parameters shown include 'RB 1MHz#', 'AT 10dB#', 'Band auto', 'RLV: 0.00dBm', 'VB 100kHz#', 'ST 5.0s#', and 'Hold 6'. The plot shows a relatively flat signal level across the frequency range, with a slight increase in power towards the right side of the plot.

Conducted emissions 452.30MHz 0 - 3GHz



MR: 3.695GHz  
-69.32dBm  
RB 1MHz#  
AT 10dB#  
Band auto

RLV: 0.00dBm  
VB 100kHz#  
ST 5.0s#

10dB/

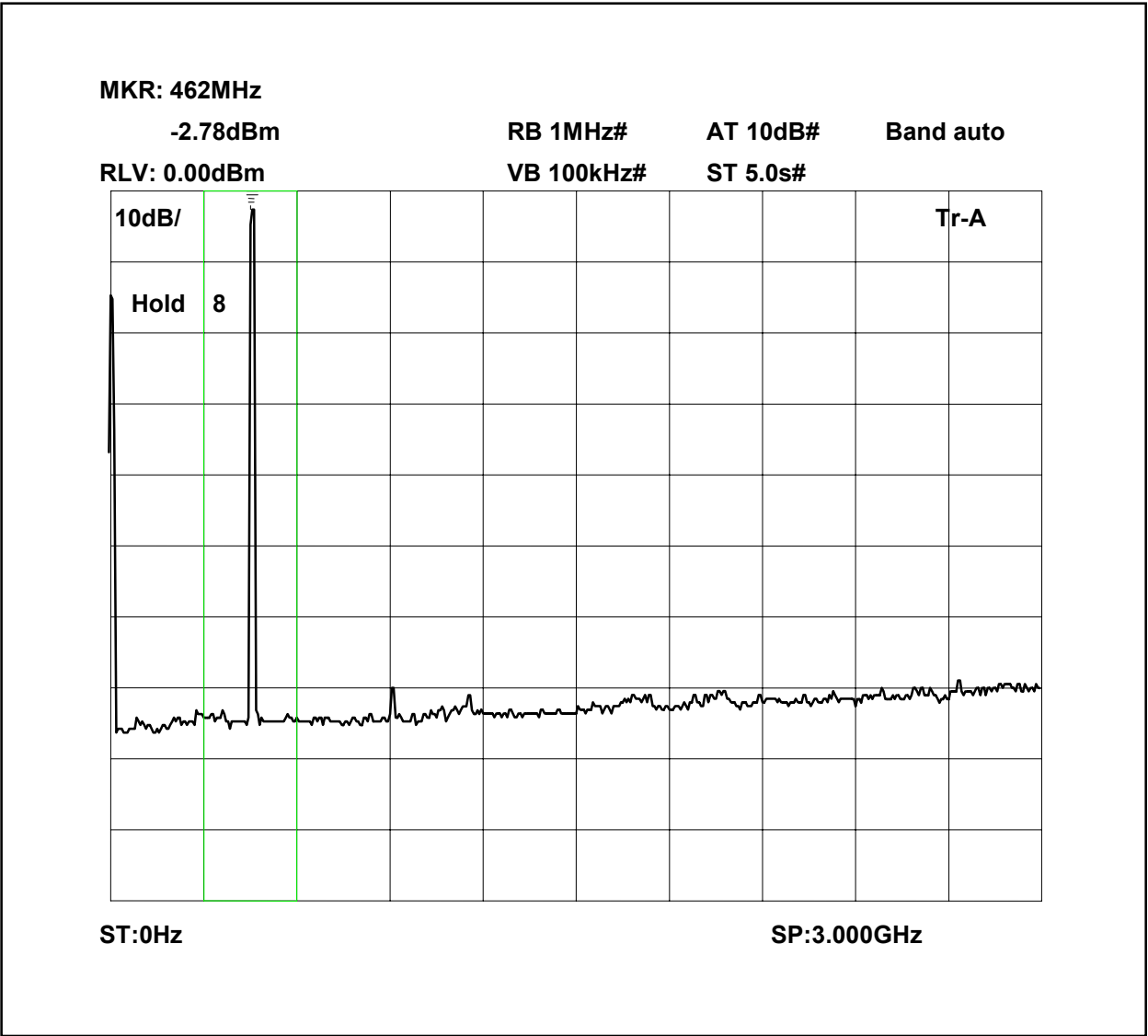
Hold 7

Tr-A

ST:2.900GHz

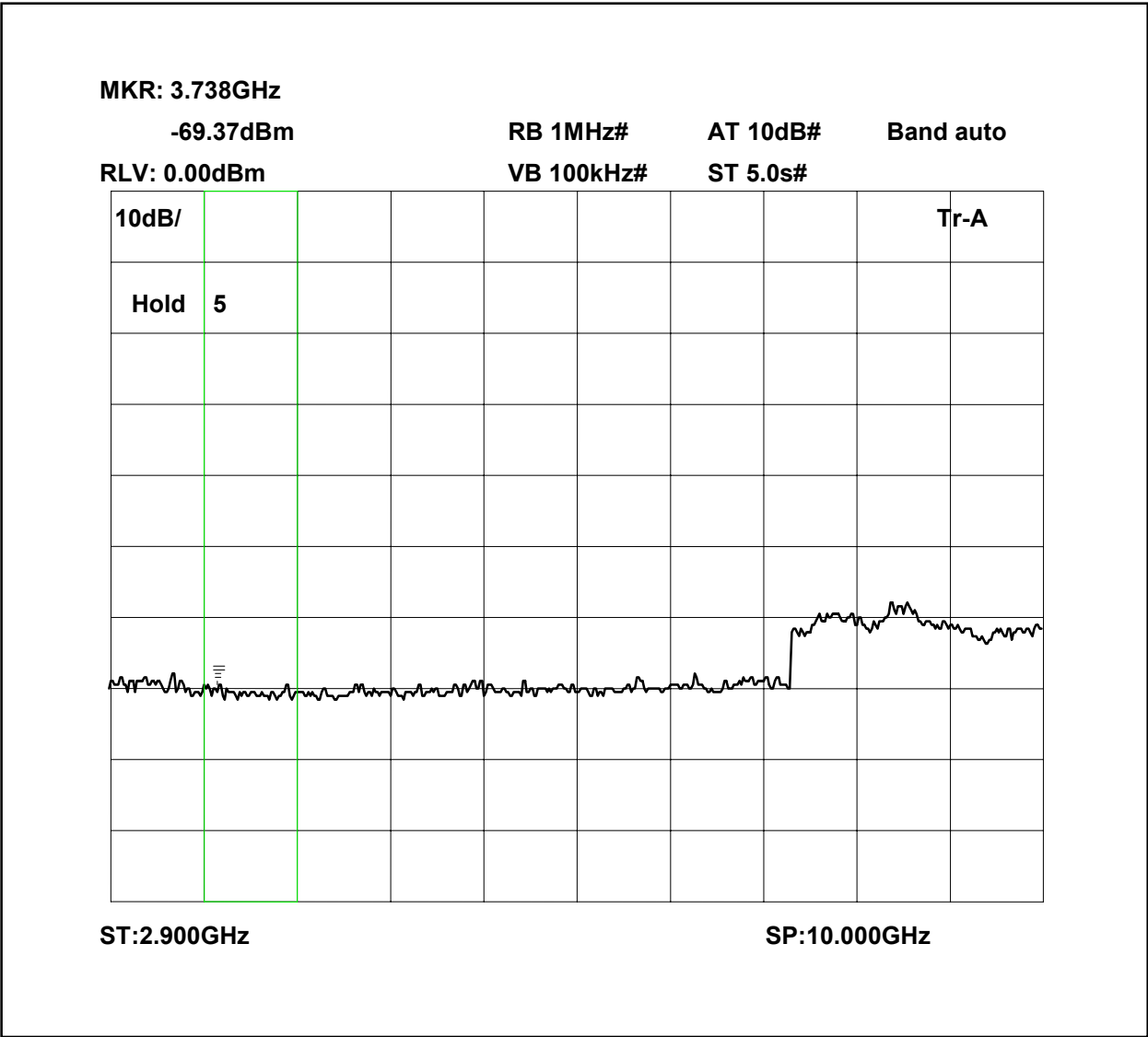
SP:10.000GHz

Conducted emissions 452.775MHz 0 - 3GHz





Conducted emissions 452.775MHz 2.9 - 10GHz

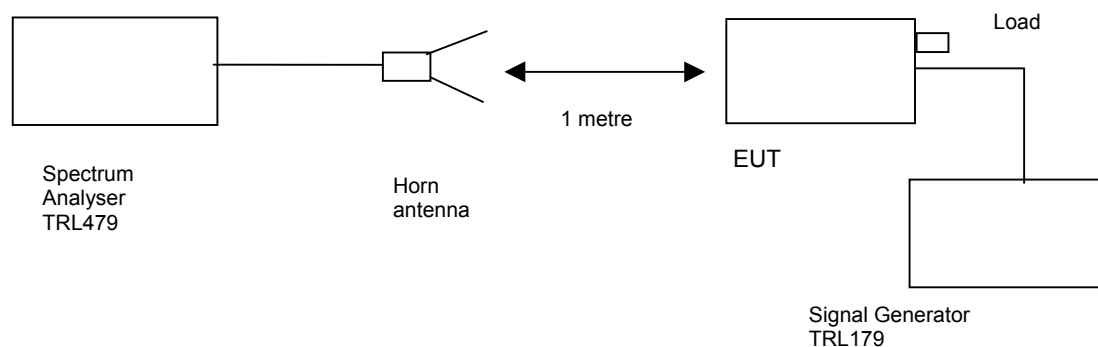


## TRANSMITTER TESTS

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

Ambient temperature = 20°C  
Relative humidity = 54%  
Conditions = OATS  
Supply voltage = 115Vac  
Supply Frequency = N/A

Test Signal = F3E



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

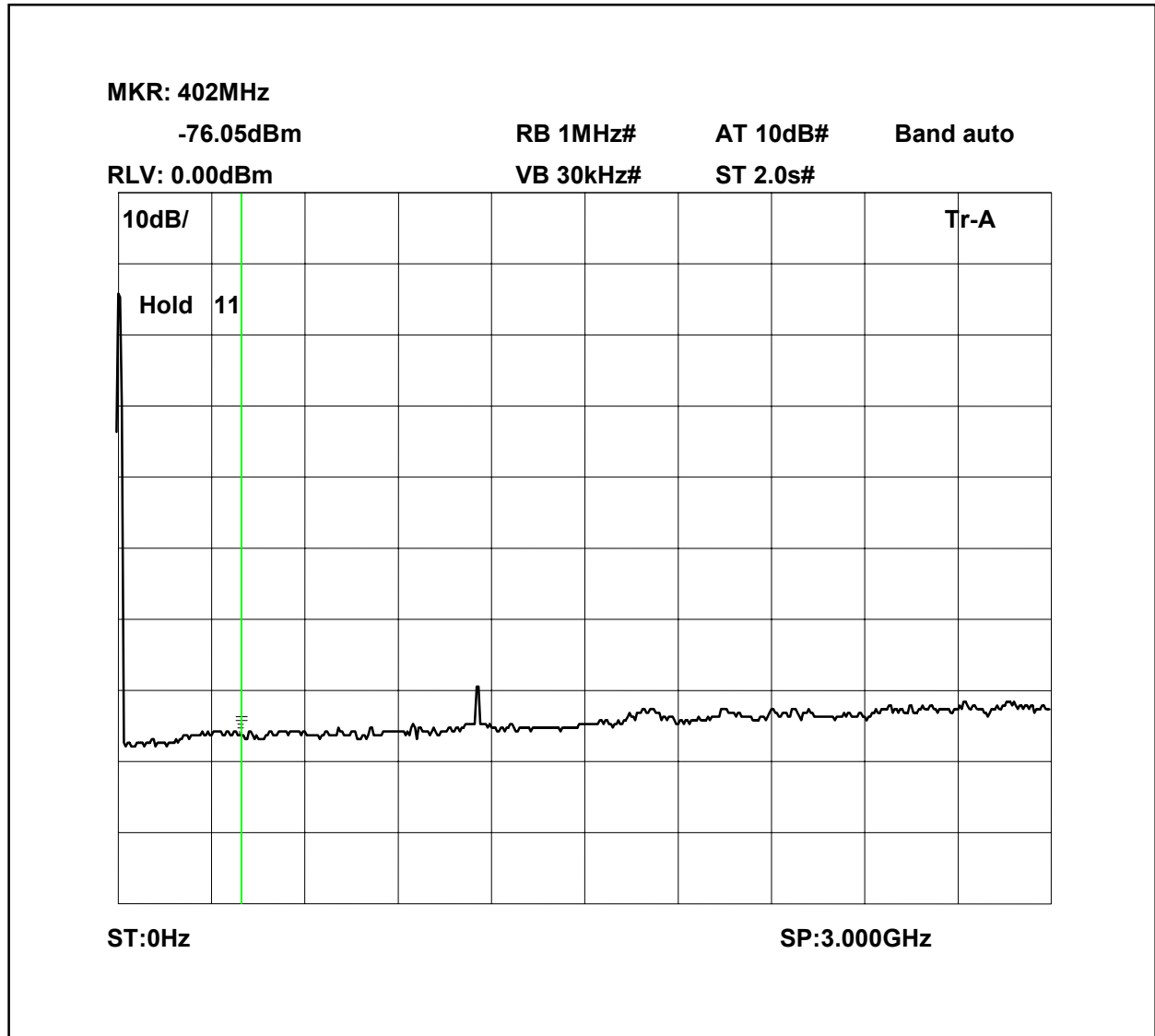
The Spurious limit was calculated as follows:

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

At least  $43 + 10 \log \text{ PdB}$

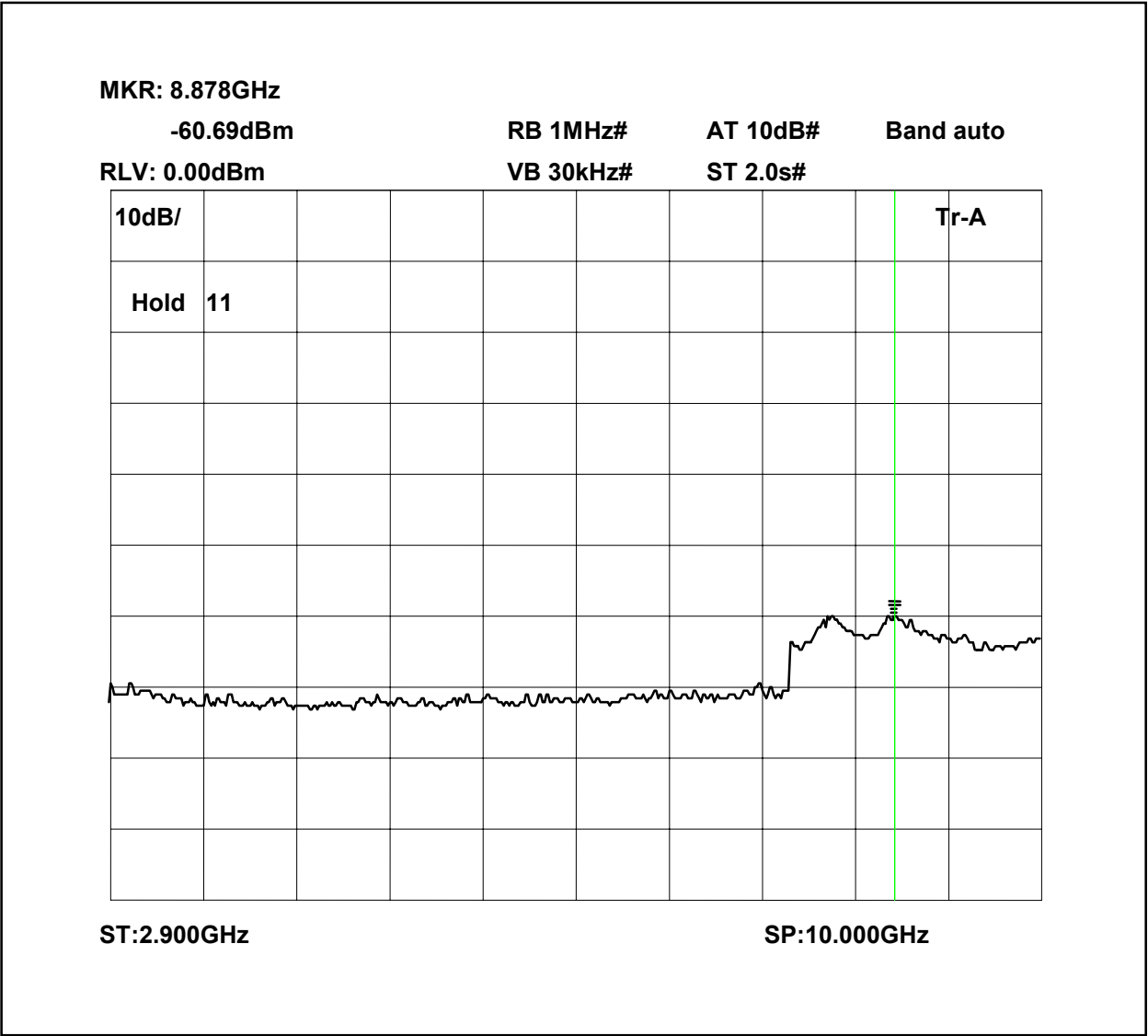
$$(10\log P_{\text{watts}}) - (43 + 10\log (P_{\text{watts}} * 1000)) = \text{LIMIT} = -13 \text{ dBm}$$

Radiated emissions 452.05MHz 0-3GHz



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

Radiated emissions 452.05MHz 2.9-10GHz



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

MKR: 402MHz  
-76.42dBm  
RB 1MHz#  
AT 10dB#  
Band auto  
RLV: 0.00dBm  
VB 30kHz#  
ST 2.0s#

10dB/

Hold 8

Tr-A

ST:0Hz

SP:3.000GHz

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MKR: 8.878GHz  
-60.35dBm  
RB 1MHz#  
AT 10dB#  
Band auto

RLV: 0.00dBm  
VB 30kHz#  
ST 2.0s#

10dB/

Hold 6

Tr-A

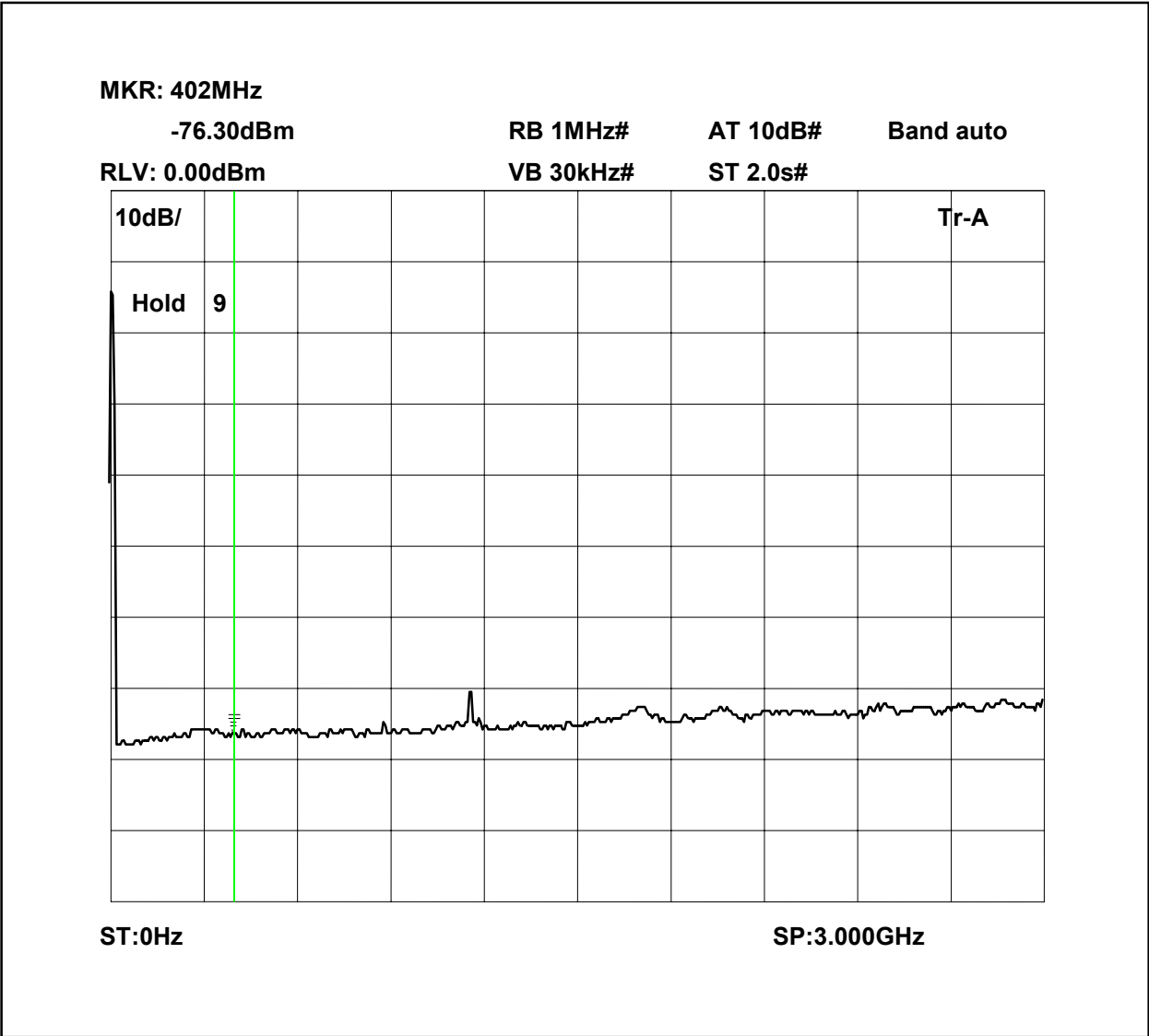
ST:2.900GHz

SP:10.000GHz

Detailed description: The figure is a spectrum analyzer display. At the top, it shows the center frequency 'MKR: 8.878GHz' and the signal level '-60.35dBm'. Below this, it lists resolution bandwidth 'RB 1MHz#', attenuation 'AT 10dB#', and 'Band auto'. Further down, it shows reference level 'RLV: 0.00dBm', video bandwidth 'VB 30kHz#', and sweep time 'ST 2.0s#'. The main plot area has a grid. A vertical green line is positioned at the center frequency. The trace, labeled 'Tr-A', shows a noisy baseline that rises to a peak at the center frequency. The peak is marked with a small icon. The y-axis is labeled '10dB/' and the x-axis has labels 'ST:2.900GHz' and 'SP:10.000GHz'. A 'Hold 6' indicator is present in the top left of the plot area.

RF335 iss02

Radiated emissions 452.775MHz 0-3GHz



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

MR: 8.878GHz  
-60.33dBm  
RB 1MHz#  
AT 10dB#  
Band auto  
RLV: 0.00dBm  
VB 30kHz#  
ST 2.0s#

10dB/

Hold 16

Tr-A

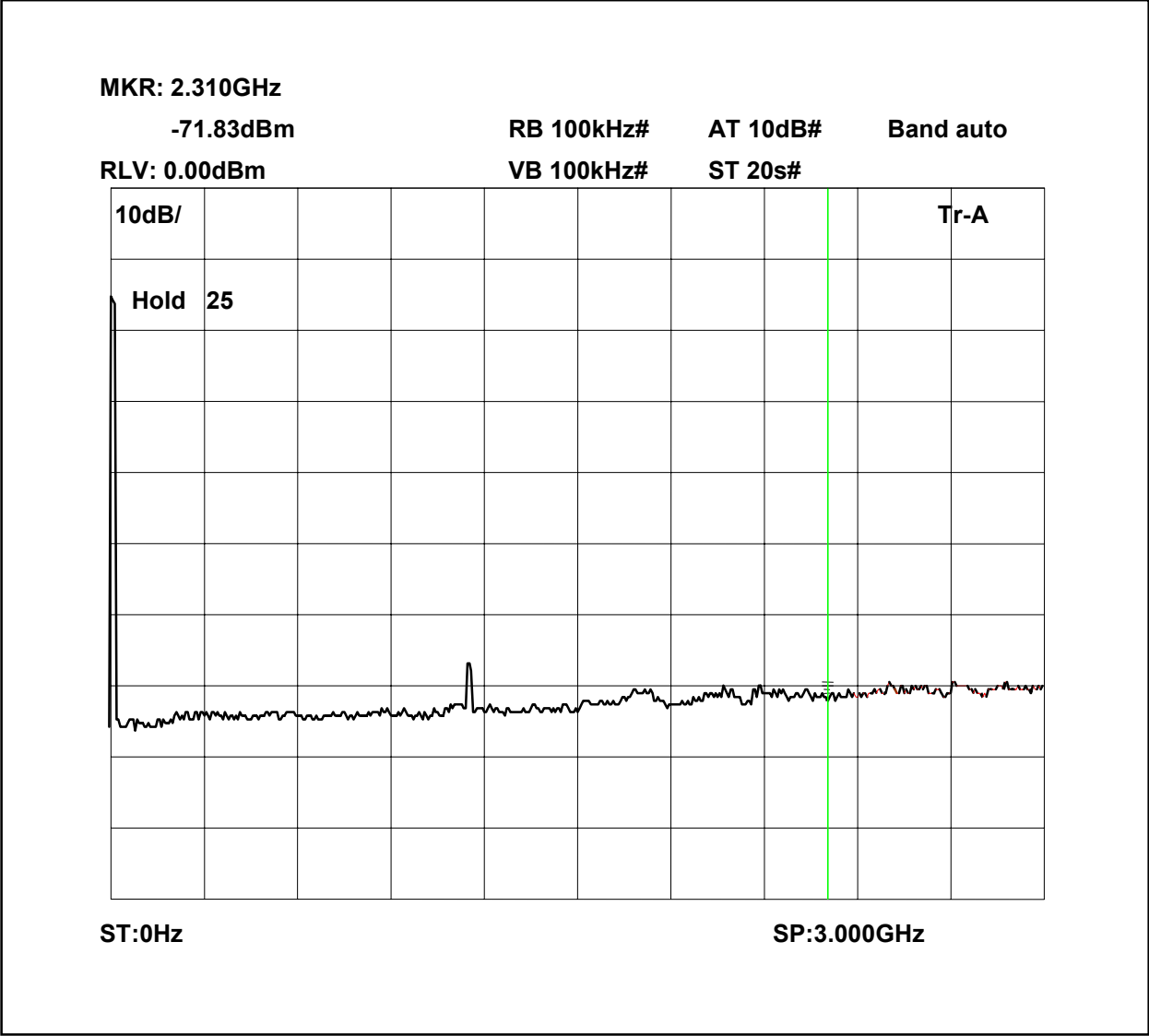
ST:2.900GHz

SP:10.000GHz

RF335 iss02



Radiated emissions no input signal 0-3GHz



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

**MKR: 8.523GHz**  
**-53.15dBm**      **RB 1MHz#**      **AT 10dB#**      **Band auto**  
**RLV:-30.00dBm**      **VB 1MHz#**      **ST 10s#**

**5dB/**      **Tr-A**  
**Hold 5**

**ST:2.900GHz**      **SP:10.000GHz**

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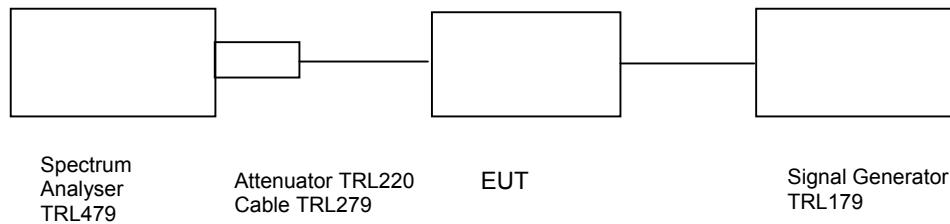
The test equipment used for the Transmitter Spurious Emissions:

| TYPE OF EQUIPMENT    | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| HORN                 | EMCO               | 3115       | 9010-3581  | 139    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

## AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – DOWNLINK

Ambient temperature = 20°C  
 Relative humidity = 54%  
 Supply voltage = 115Vac  
 Channel number = See test results

Radio Laboratory



| Frequency<br>MHz | Signal Generator<br>input level<br>dBm | Cable & Attenuator<br>loss<br>dB | Level at Spectrum<br>Analyser<br>dBm | Gain<br>dB | Gain after 20dB<br>input level<br>increase<br>dBm |
|------------------|--|----------------------------------|--------------------------------------|------------|---|
| 457.05MHz        | -58.4                                  | 26.6                             | -3.9                                 | 81.95      | 81.95   |
| 457.30MHz        | -58.6                                  | 26.6                             | -3.3                                 | 83.05      | 83.05   |
| 457.85MHz        | -60.3                                  | 26.6                             | -3.0                                 | 83.9       | 83.9  |

### Notes:

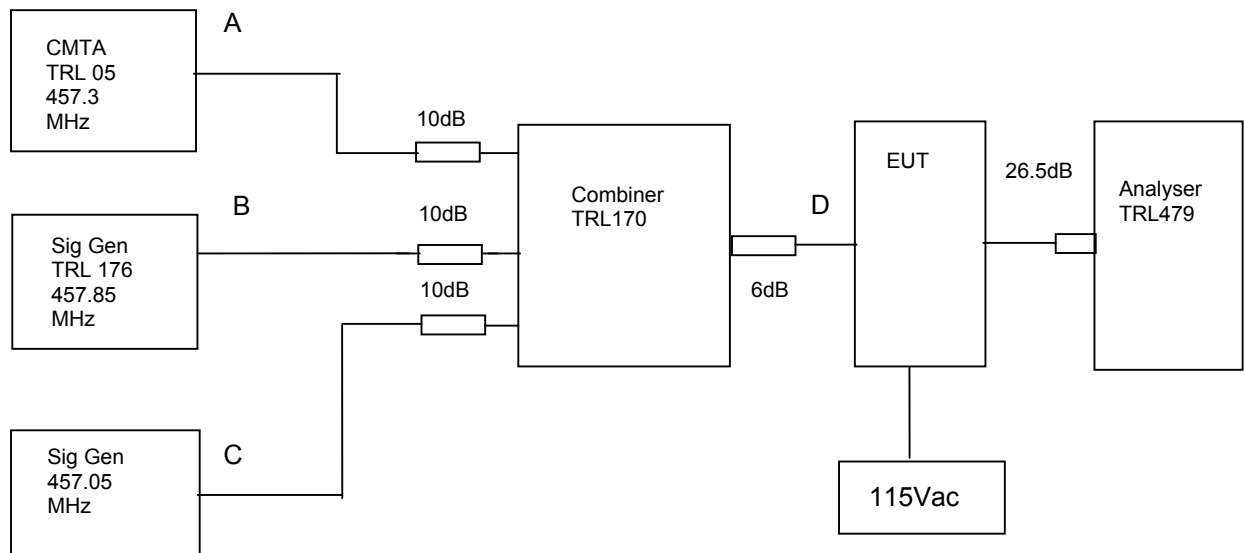
1. The level of the signal generator takes into consideration the loss from the cable.
2. The signal generator input was increased by 20dBs and the level of the output signal remeasured

| TYPE OF<br>EQUIPMENT | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-200   | N/A        | 103    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

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

Ambient temperature = 20°C  
 Relative humidity = 54%  
 Supply voltage = 115Vac

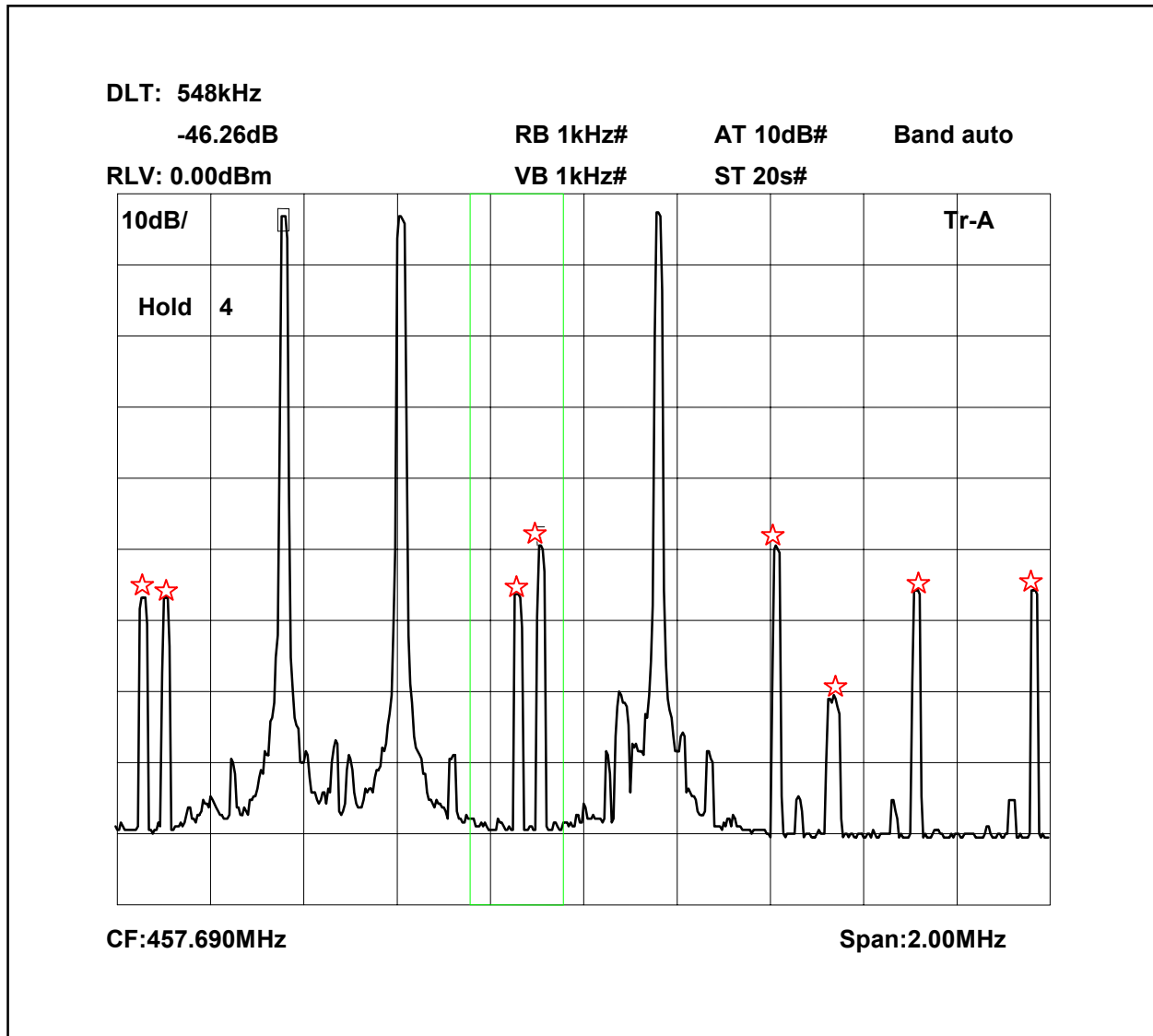
Radio Laboratory



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 the maximum input of -58.4dBm. The cable and attenuators loss between the EUT and the spectrum analyser was 26.6dB.

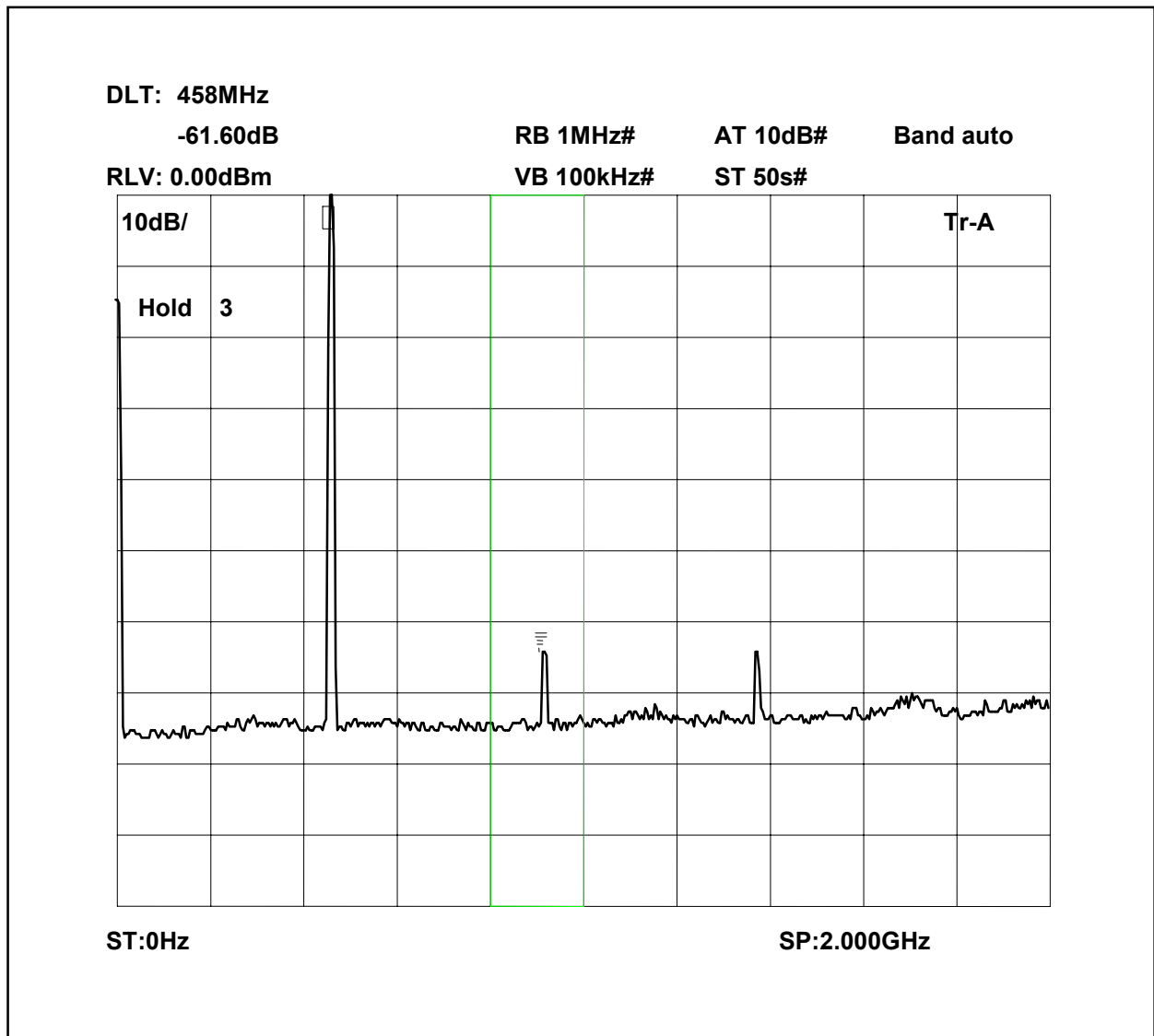
Sweep data is shown on the next page:

# Intermodulation Inband



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

# Intermodulation Wideband



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

Test equipment used for intermodulation test

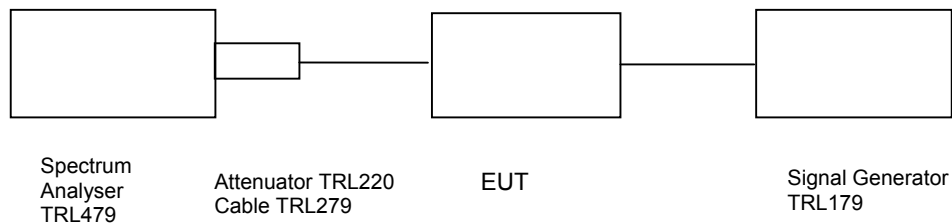
| TYPE OF EQUIPMENT    | MAKER/<br>SUPPLIER | MODEL No | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|----------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C  | MT26089    | 479    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042     | 119562/02  | 254    | <b>X</b>                    |
| CMTA                 | ROHDE &<br>SCHWARZ | CMTA52   | 894715/033 | 05     | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042     | 119388/080 | 179    | <b>X</b>                    |
| COMBINER             | ELCOM              | RC-4-50  | N/A        | 170    | <b>x</b>                    |



## TRANSMITTER TESTS

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

|                     |   |                  |                  |
|---------------------|---|------------------|------------------|
| Ambient temperature | = | 20°C             | Radio Laboratory |
| Relative humidity   | = | 54%              |                  |
| Supply voltage      | = | 115Vac           |                  |
| Channel number      | = | See test results |                  |

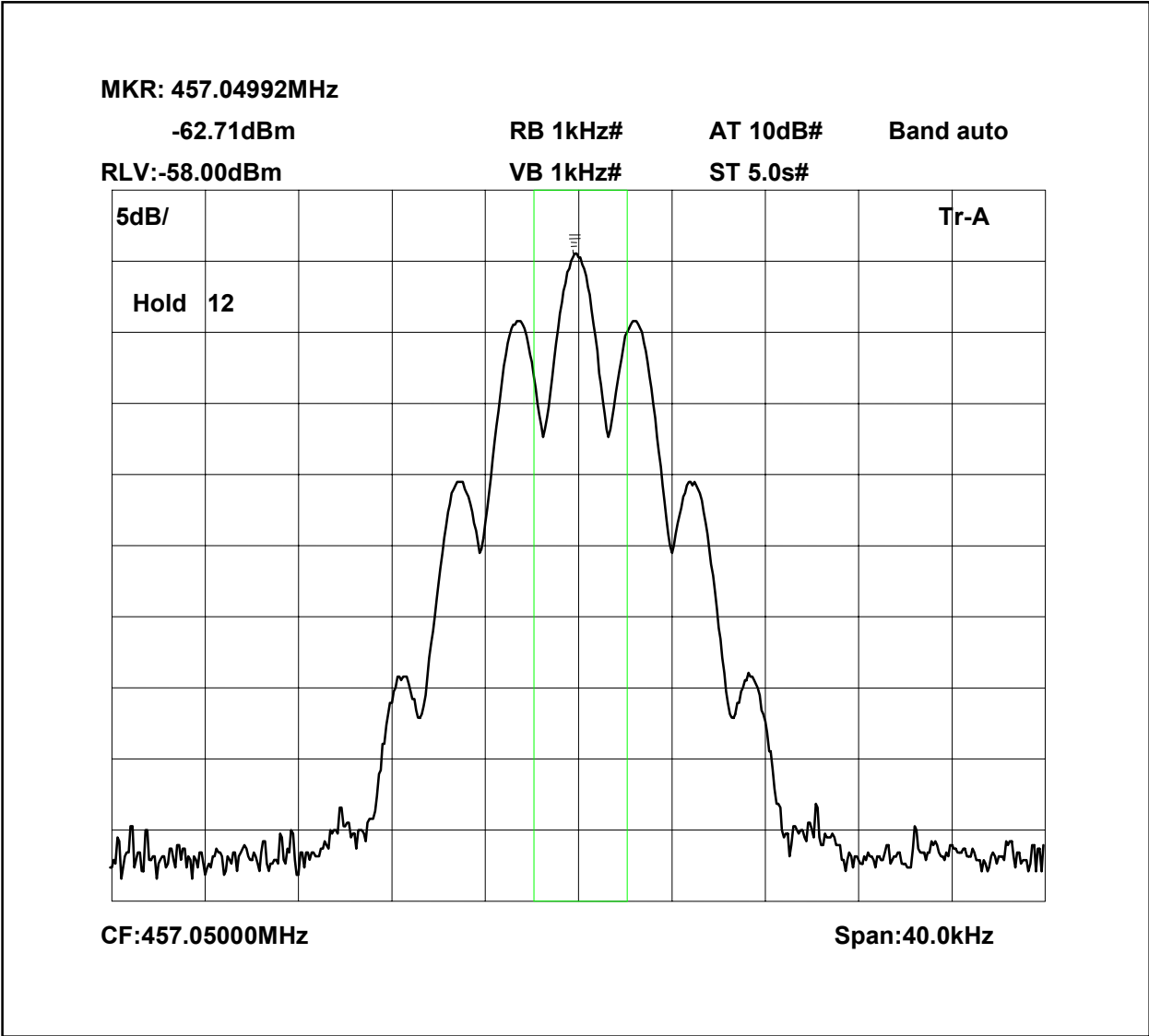


This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level (-58.4dBm) and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at the output of the EUT.

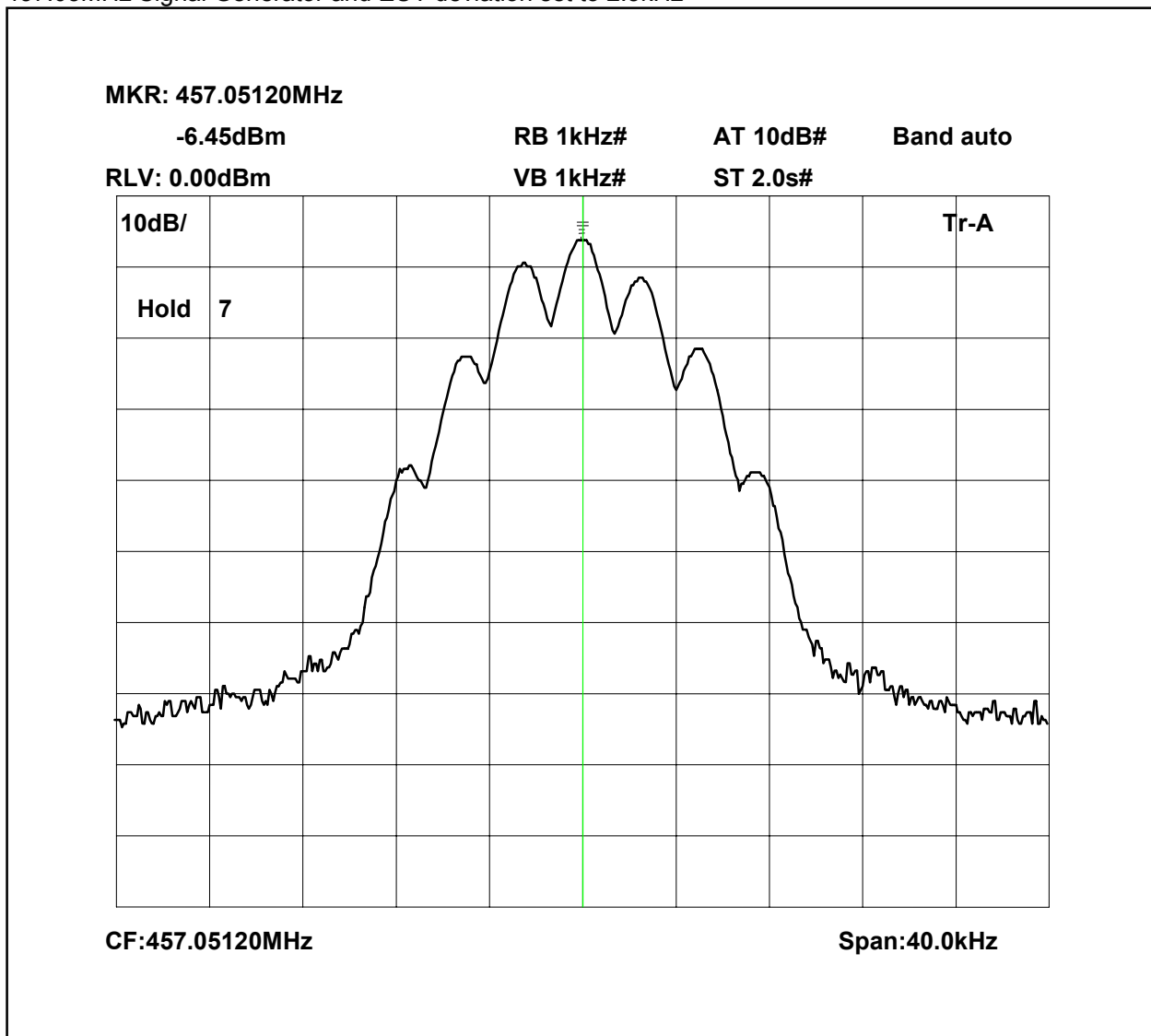
Note: The cables and attenuators had the following losses.

1. Cable TRL279 and attenuators TRL220 = 26.6dB
2. Cable between signal generator and EUT = 0.85dB

457.05MHz Signal Generator deviation set to 2.5kHz

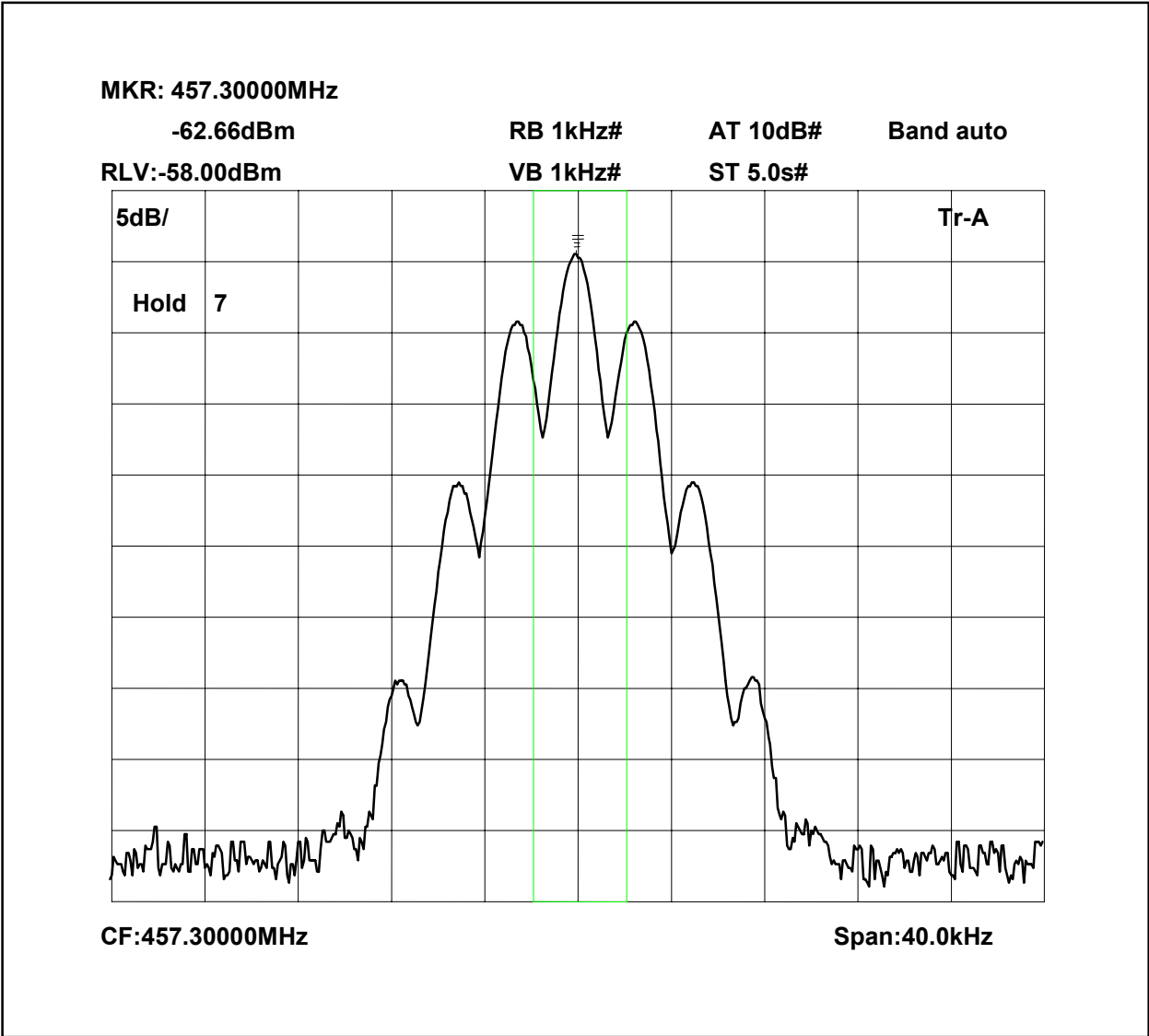


457.05MHz Signal Generator and EUT deviation set to 2.5kHz

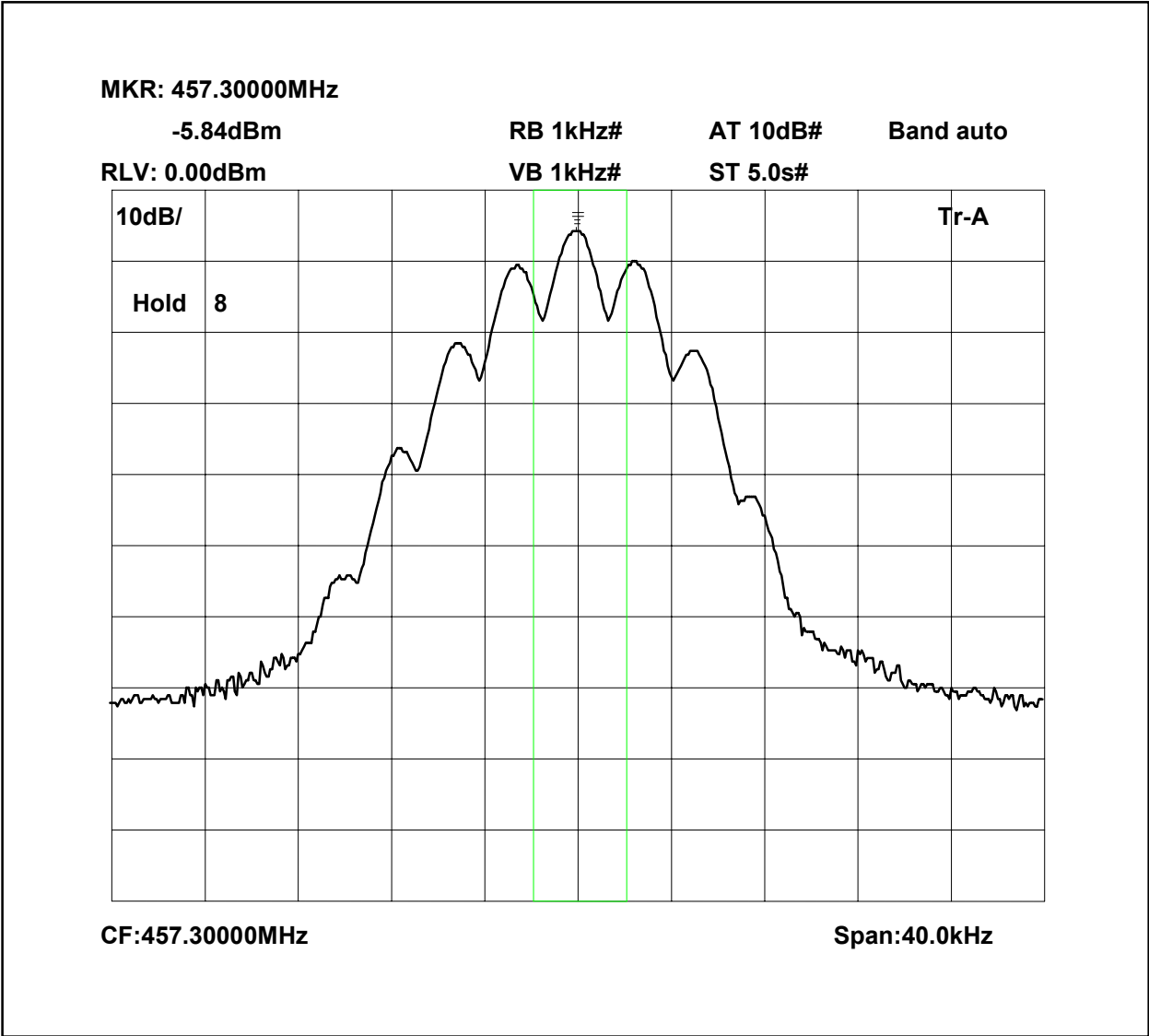


The above plots depicting the output waveshape show no measurable distortion visible, when compared to the input signal.

457.30MHz Signal Generator deviation set to 2.5kHz

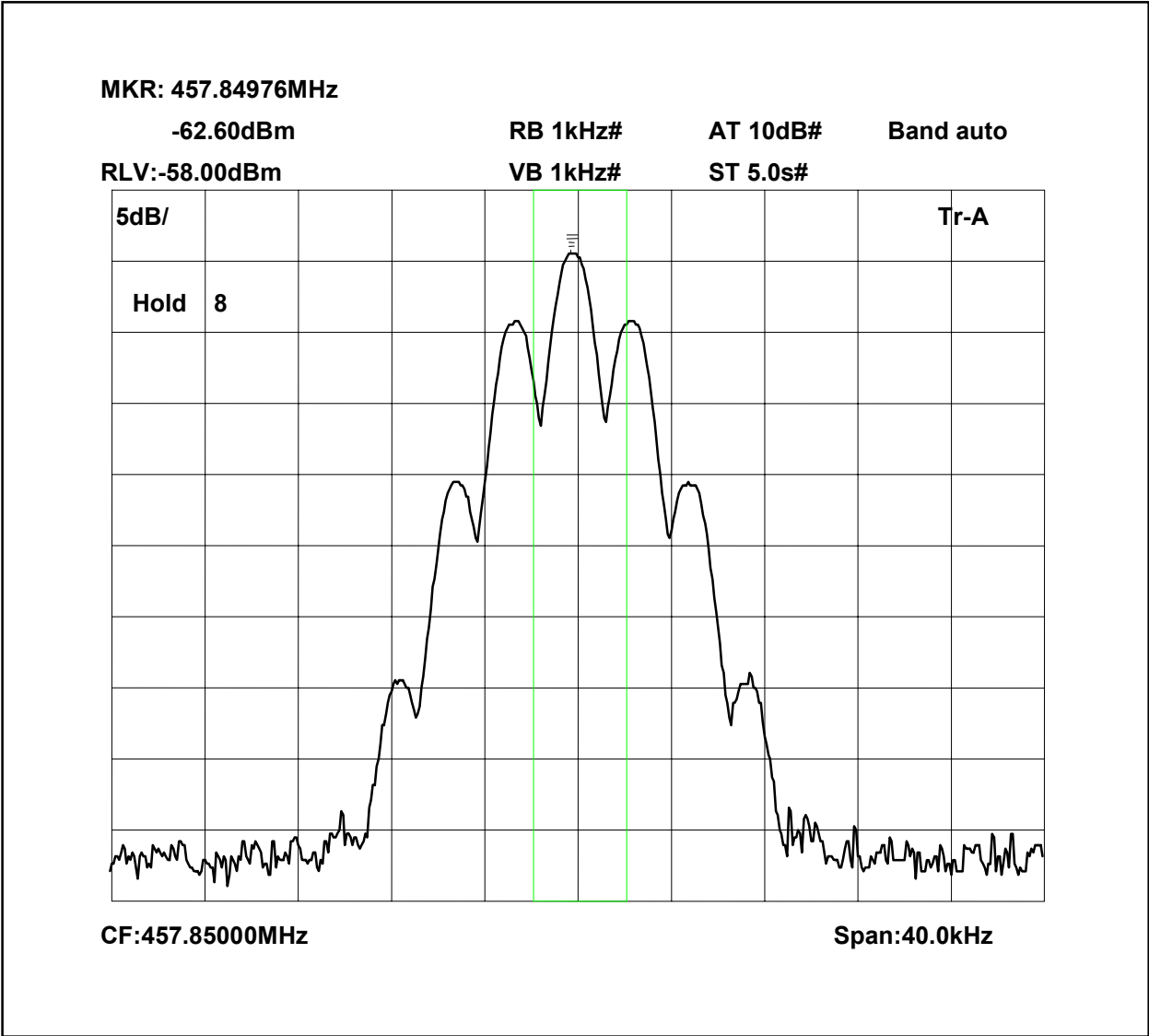


457.30MHz Signal Generator and amplifier deviation set to 2.5kHz

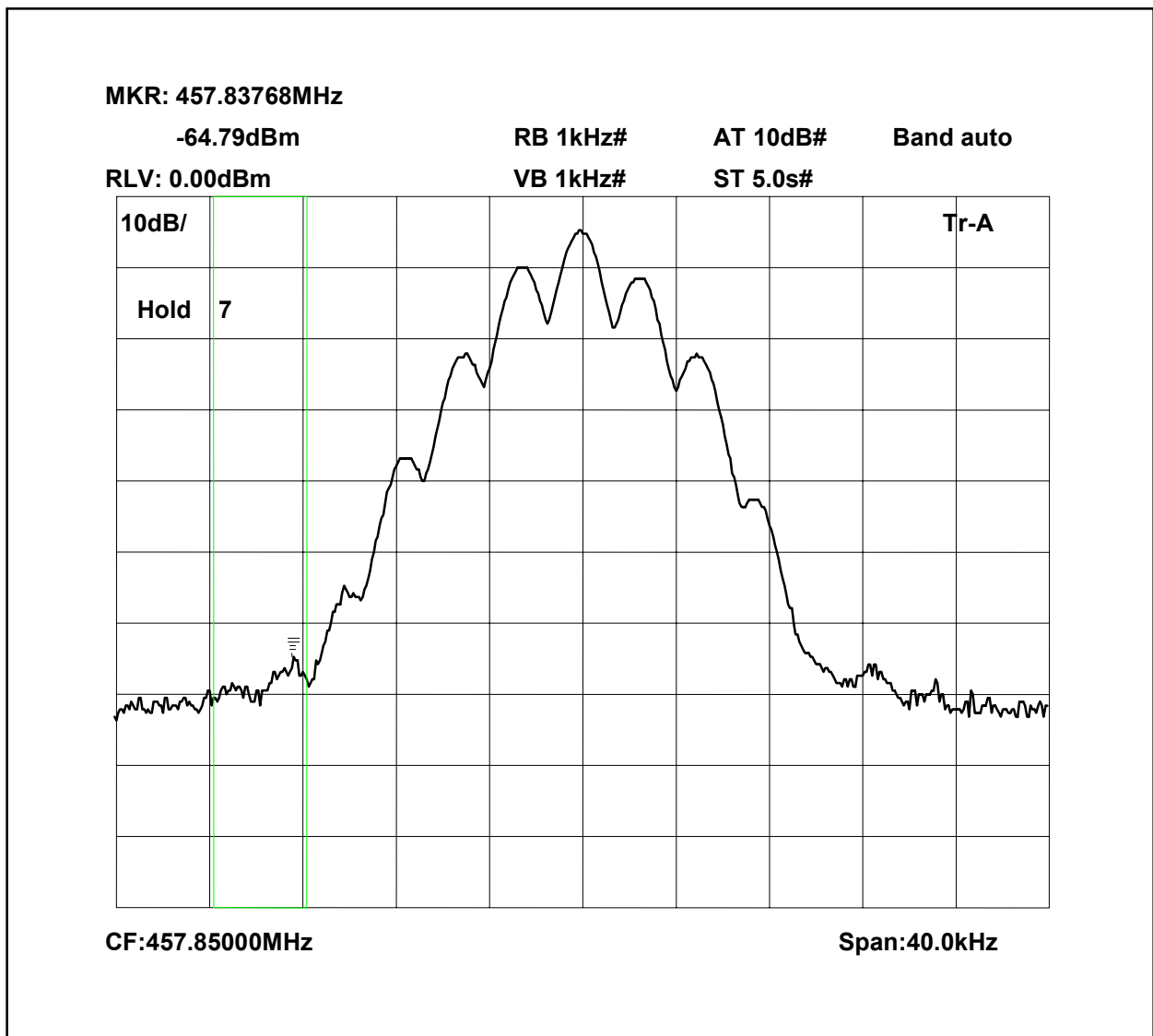


The above plots depicting the output waveshape show no measurable distortion visible, when compared to the input signal.

457.85MHz Signal Generator deviation set to 2.5kHz



457.85MHz Signal Generator deviation set to 2.5kHz



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

The test equipment used for the Transmitter modulated channel tests is shown overleaf:

| TYPE OF EQUIPMENT    | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-200   | N/A        | 103    |                             |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

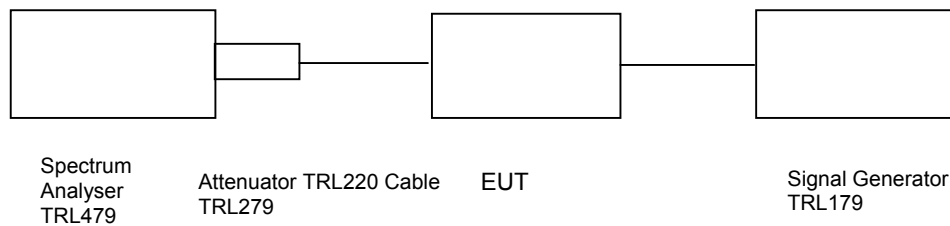


## TRANSMITTER TESTS

### AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – Part 2.1051 – DOWNLINK

Ambient temperature = 20°C  
 Relative humidity = 54%  
 Supply voltage = 115Vac

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 that 250% of the authorised bandwidth

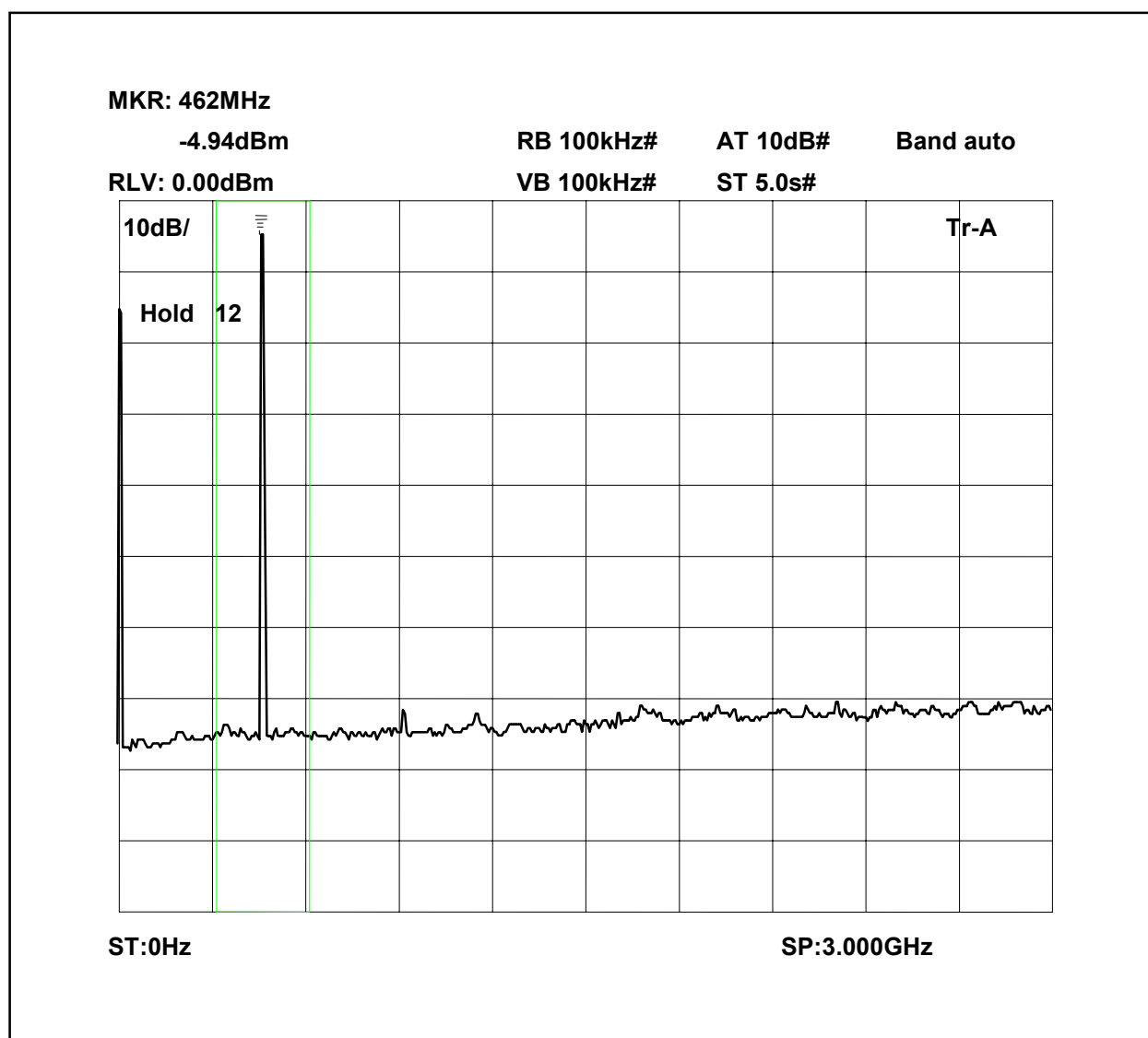
At least 43 + 10 log PdB

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

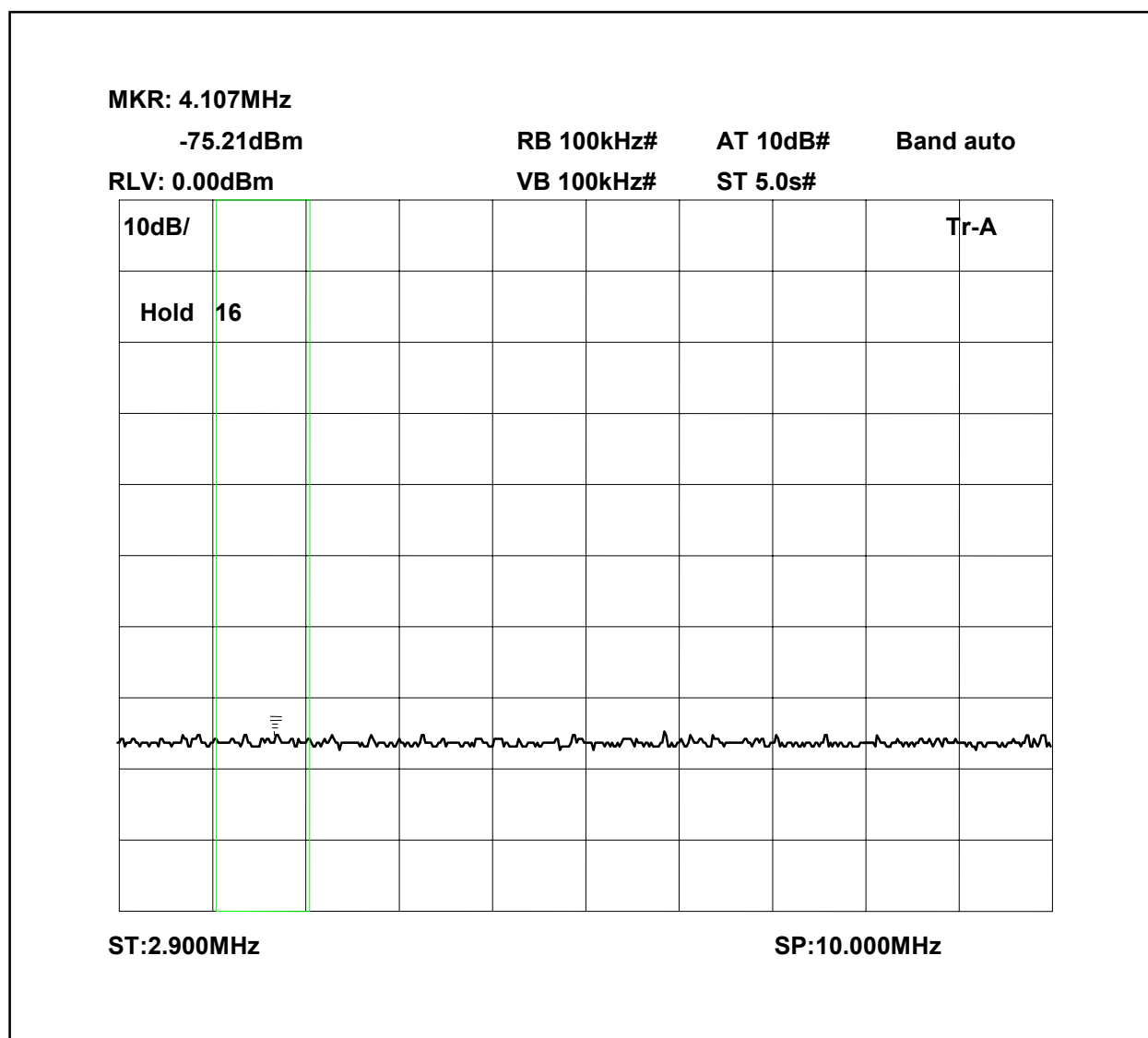
The test equipment used for the Transmitter Conducted Emissions:

| TYPE OF EQUIPMENT    | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-200   | N/A        | 103    |                             |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

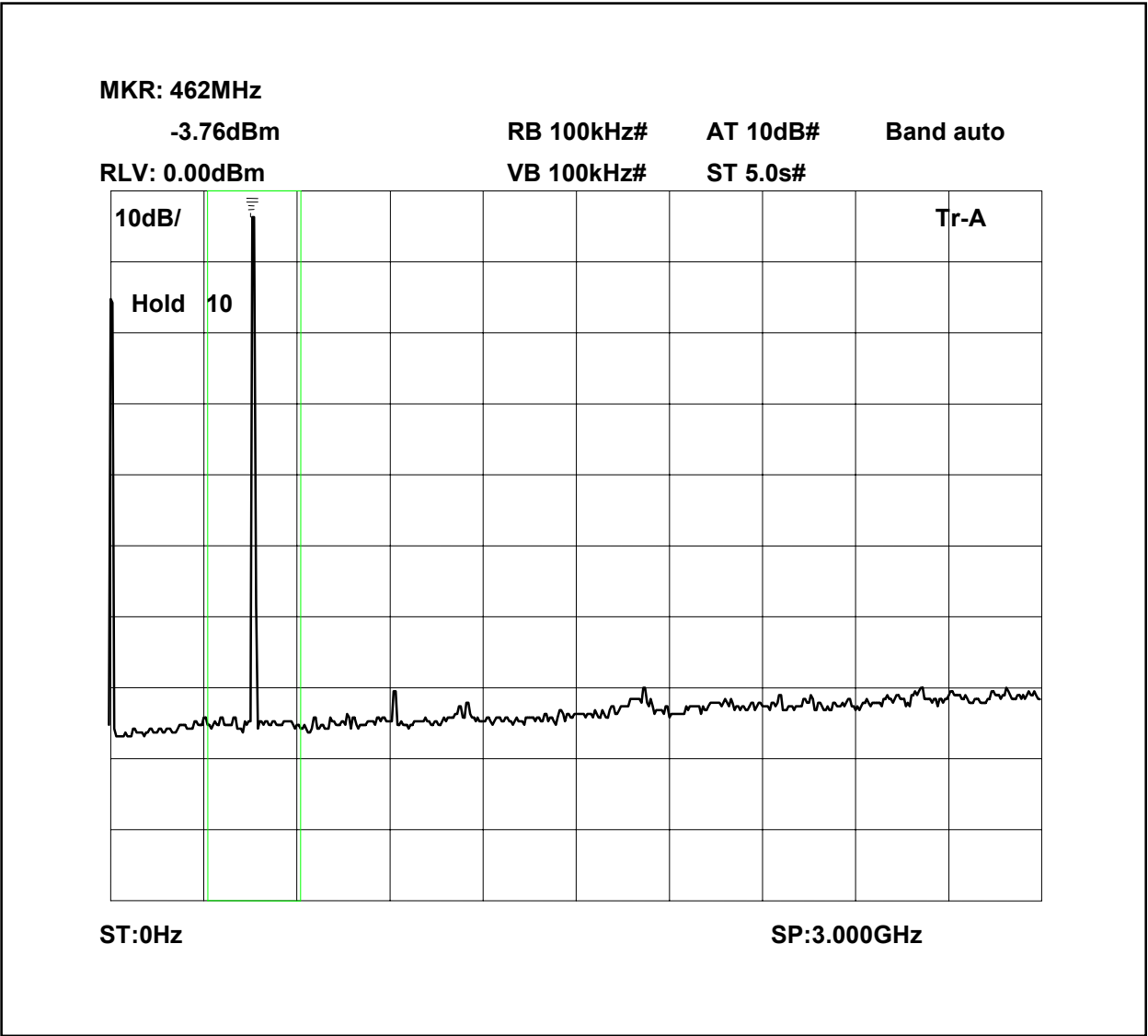
Conducted emissions 457.05MHz 0-3GHz



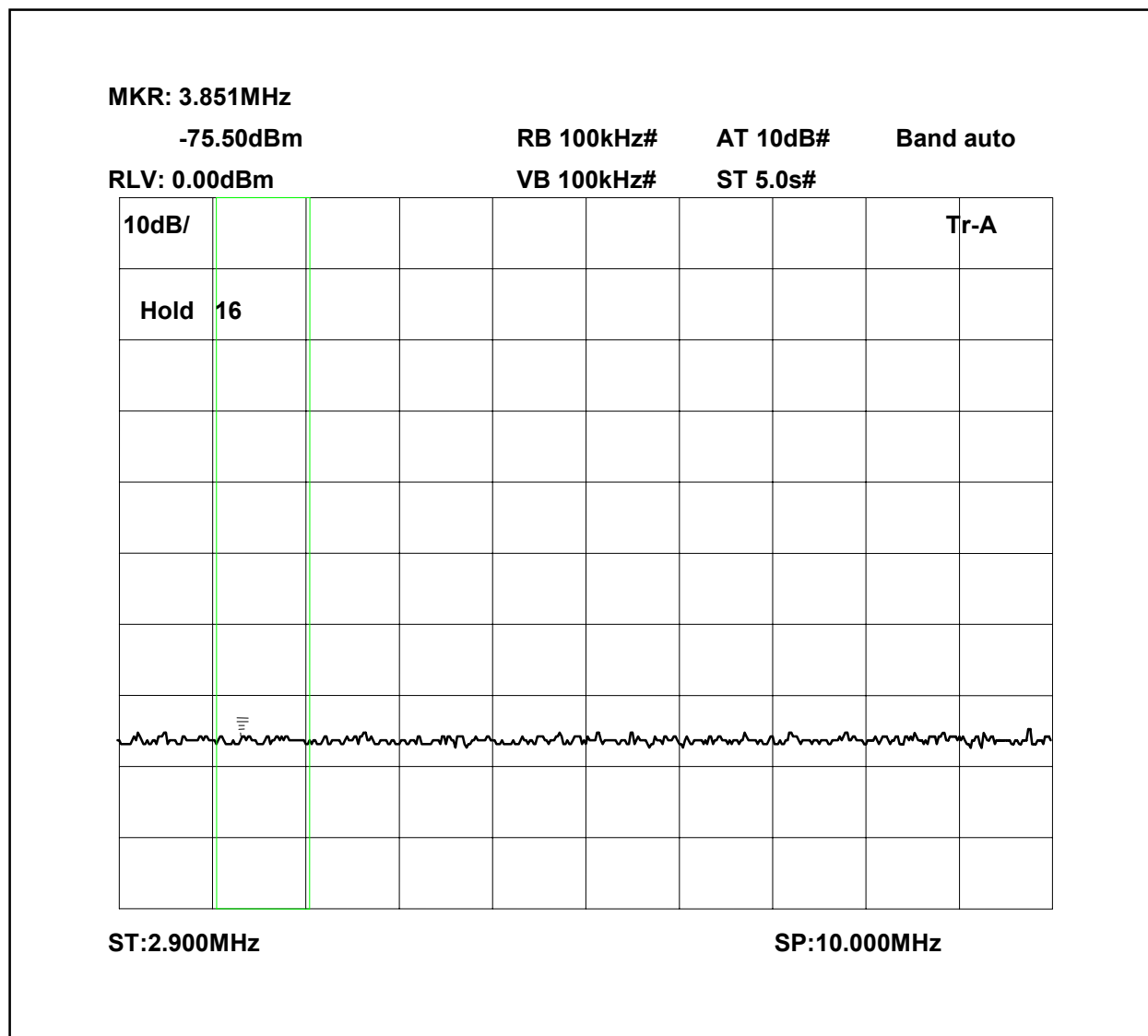
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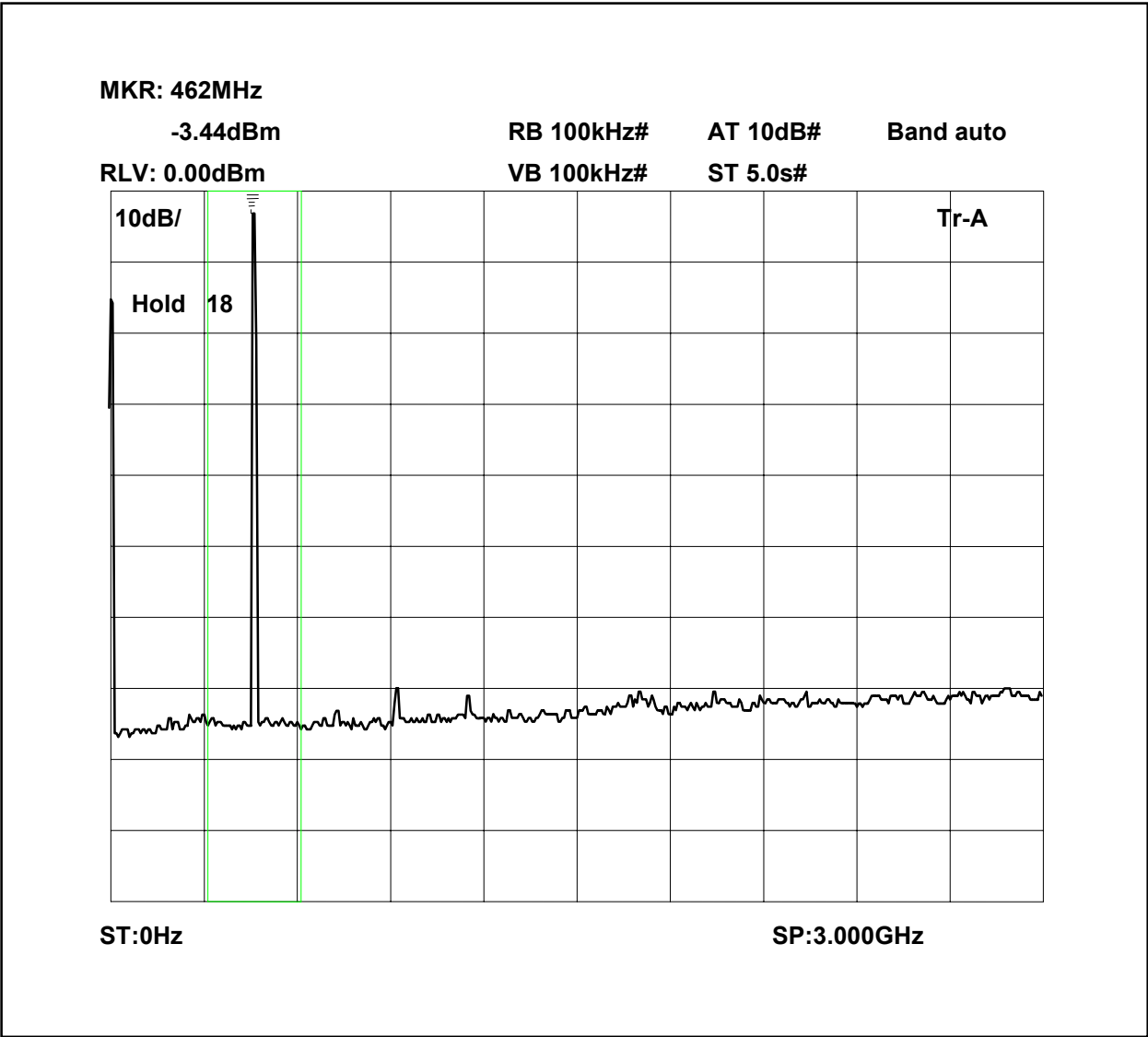
Conducted emissions 457.30MHz 0-3GHz

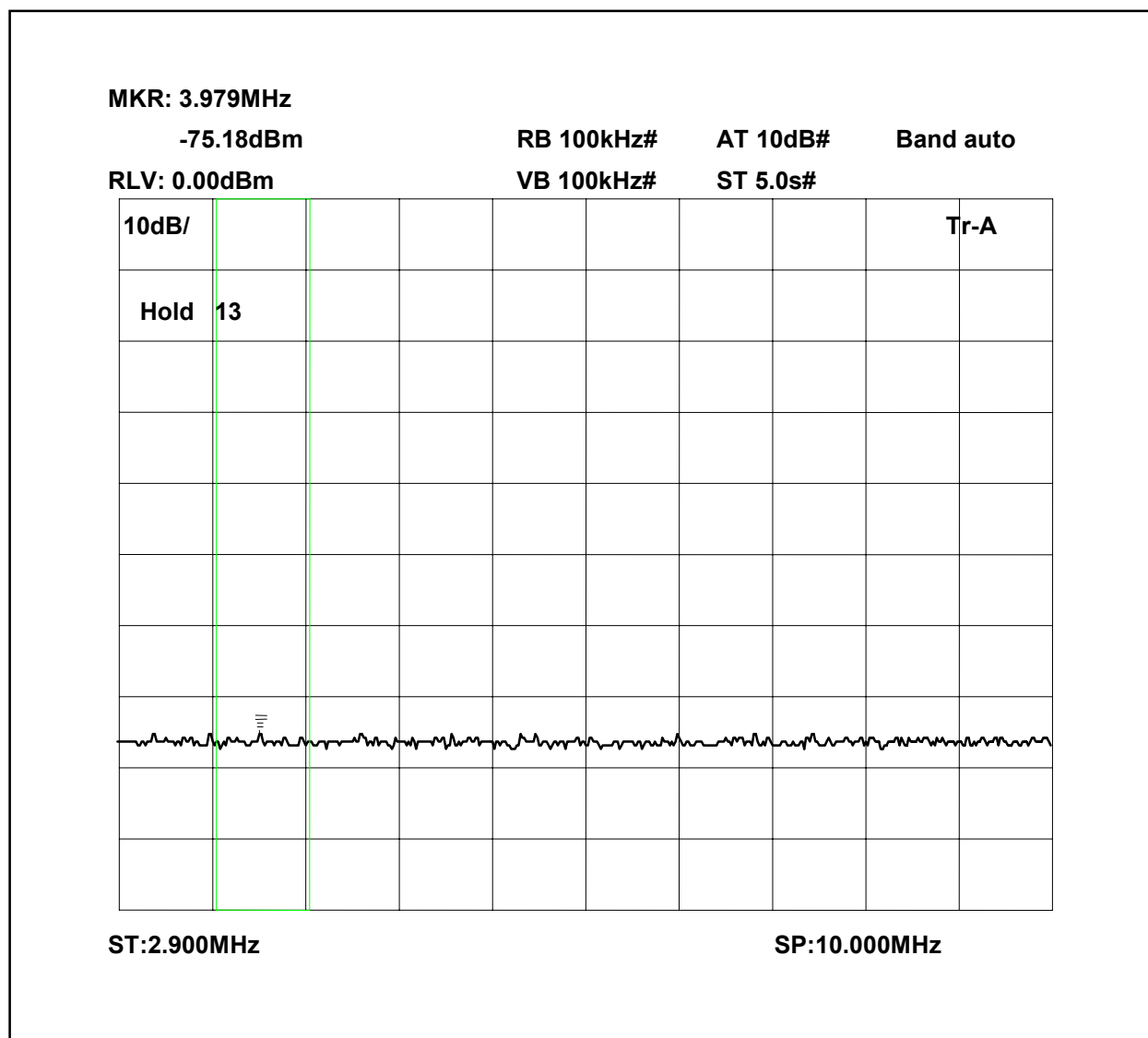


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Conducted emissions 457.85MHz 0-3GHz



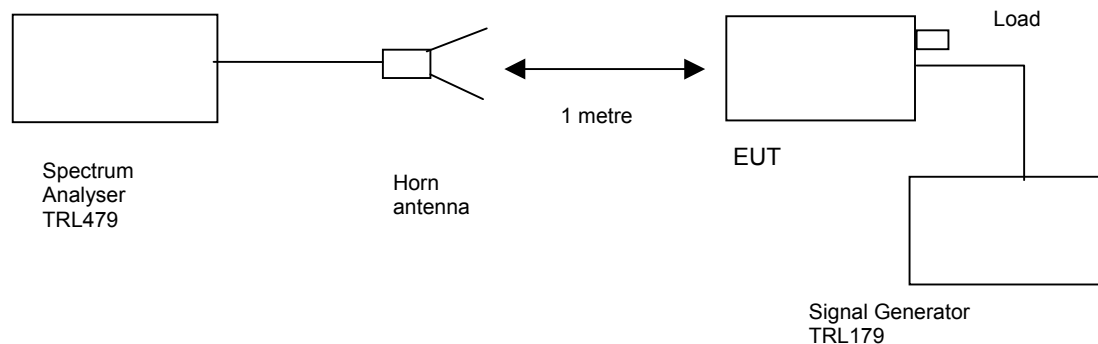


## TRANSMITTER TESTS

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

Ambient temperature = 20°C  
Relative humidity = 54%  
Conditions = OATS  
Supply voltage = 115Vac  
Supply Frequency = N/A

Test Signal = F3E



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

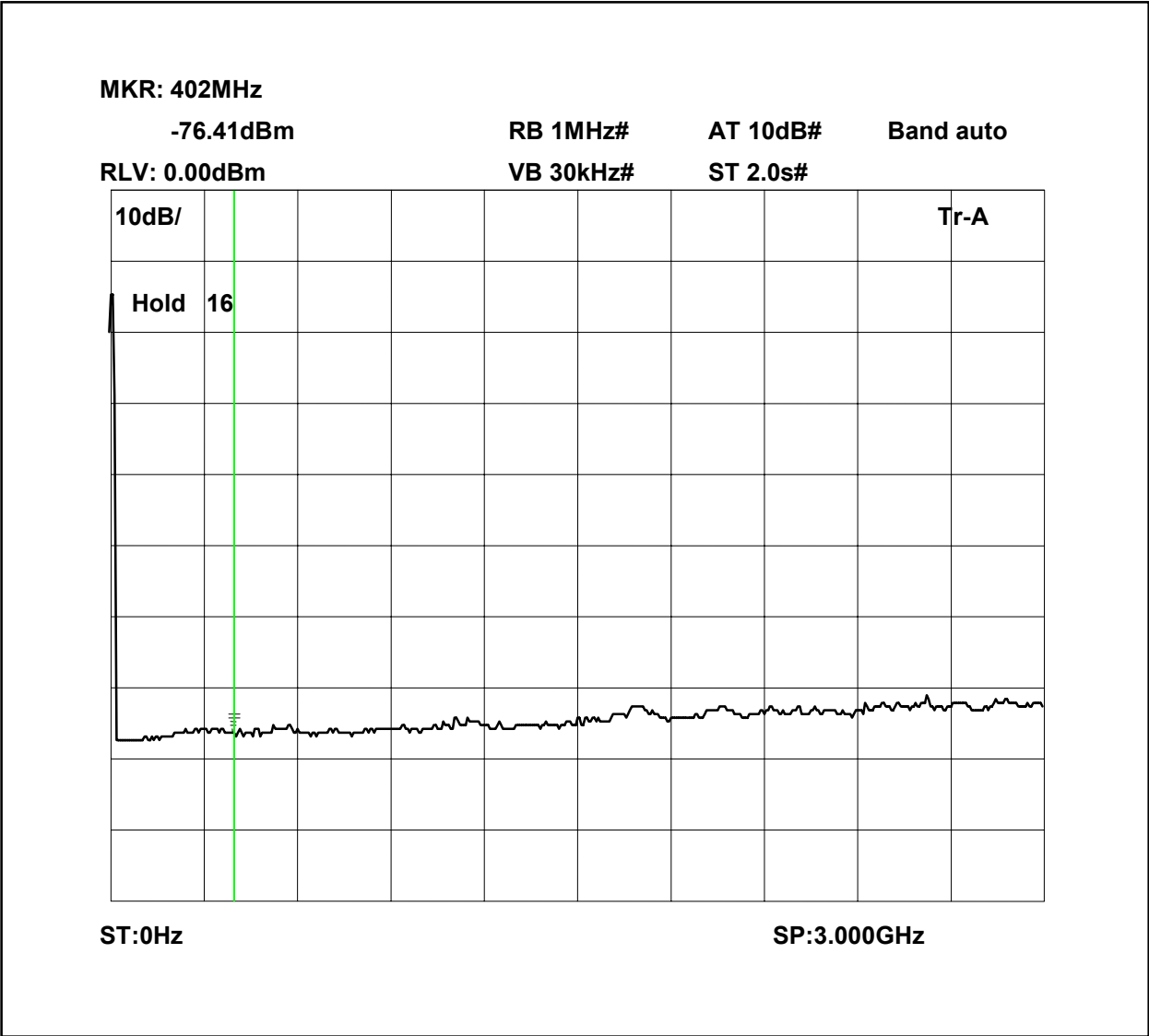
On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

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

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



Radiated emissions 457.05MHz 0-3GHz



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

MR: 8.878GHz  
-60.66dBm  
RB 1MHz#  
AT 10dB#  
Band auto  
RLV: 0.00dBm  
VB 30kHz#  
ST 2.0s#

10dB/

Hold 9

Tr-A

ST:2.900GHz

SP:10.000GHz

RF335 iss02

MKR: 402MHz  
-76.47dBm  
RB 1MHz#  
AT 10dB#  
Band auto  
RLV: 0.00dBm  
VB 30kHz#  
ST 2.0s#

10dB/

Hold 14

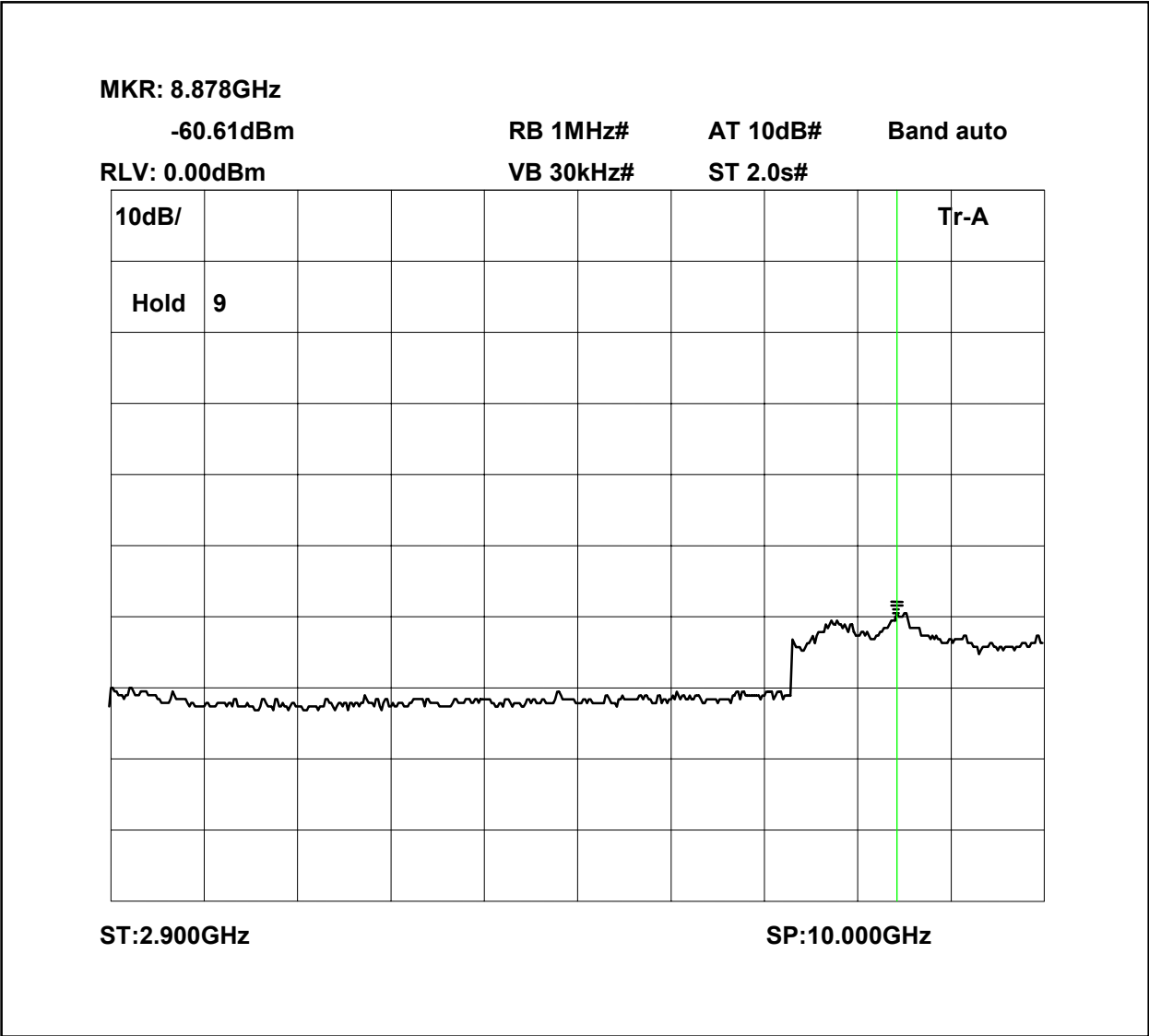
Tr-A

ST:0Hz

SP:3.000GHz

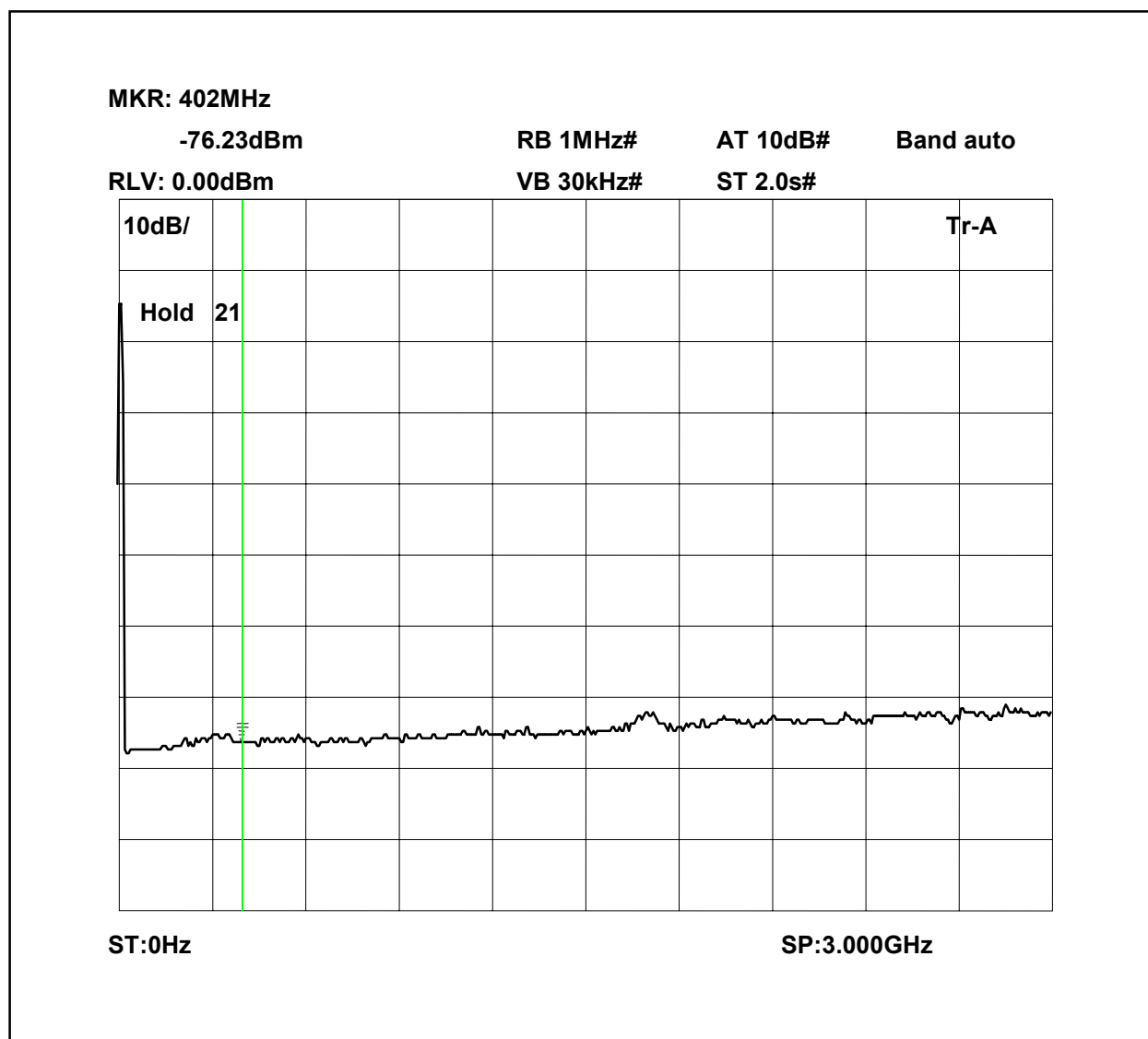
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Radiated emissions 457.30MHz 2.9-10GHz



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

Radiated emissions 457.85MHz 0-3GHz



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

MKR: 8.878GHz  
-60.47dBm  
RB 1MHz#  
AT 10dB#  
Band auto

RLV: 0.00dBm  
VB 30kHz#  
ST 2.0s#

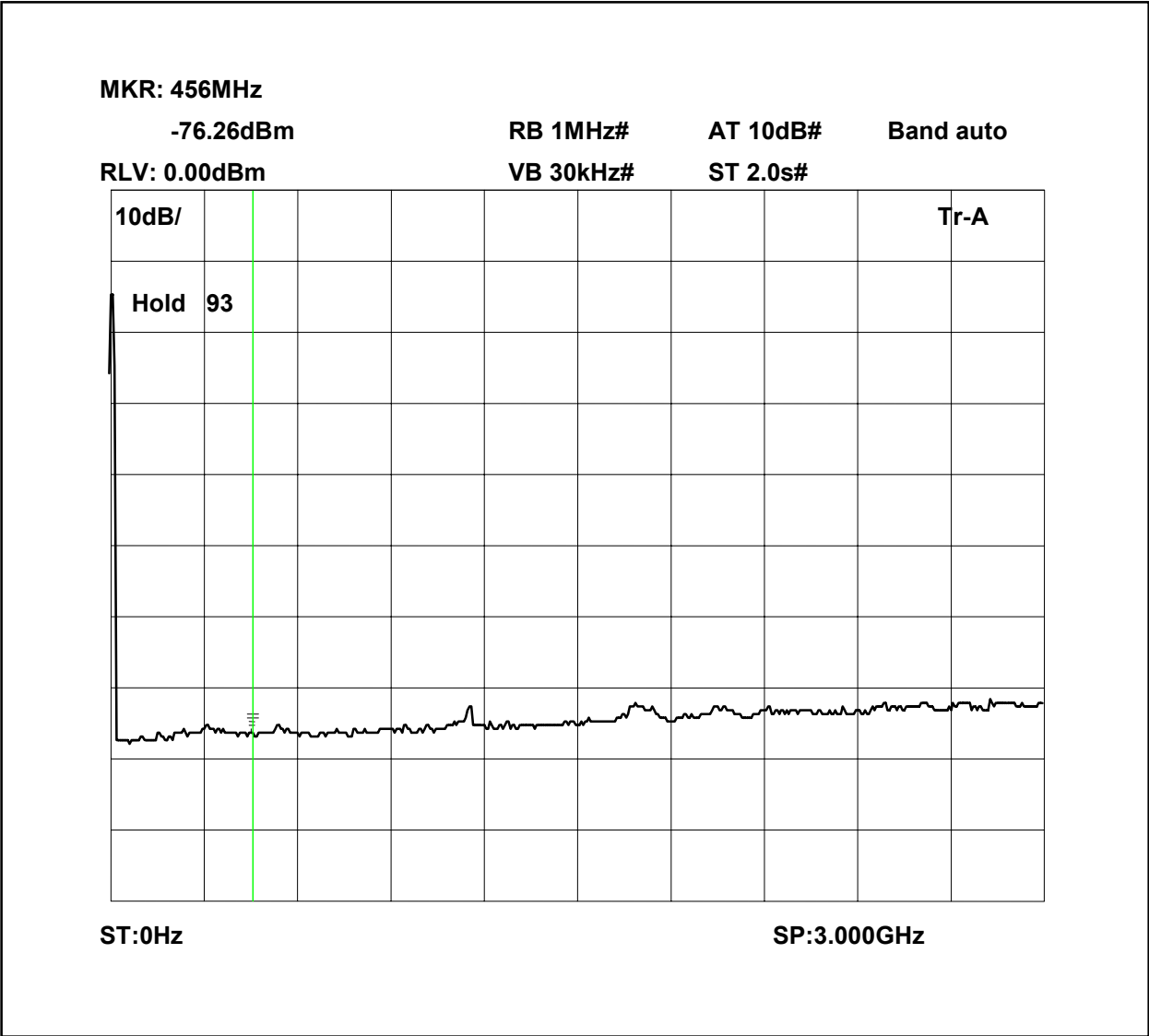
10dB/  
Hold 9

Tr-A

ST:2.900GHz  
SP:10.000GHz

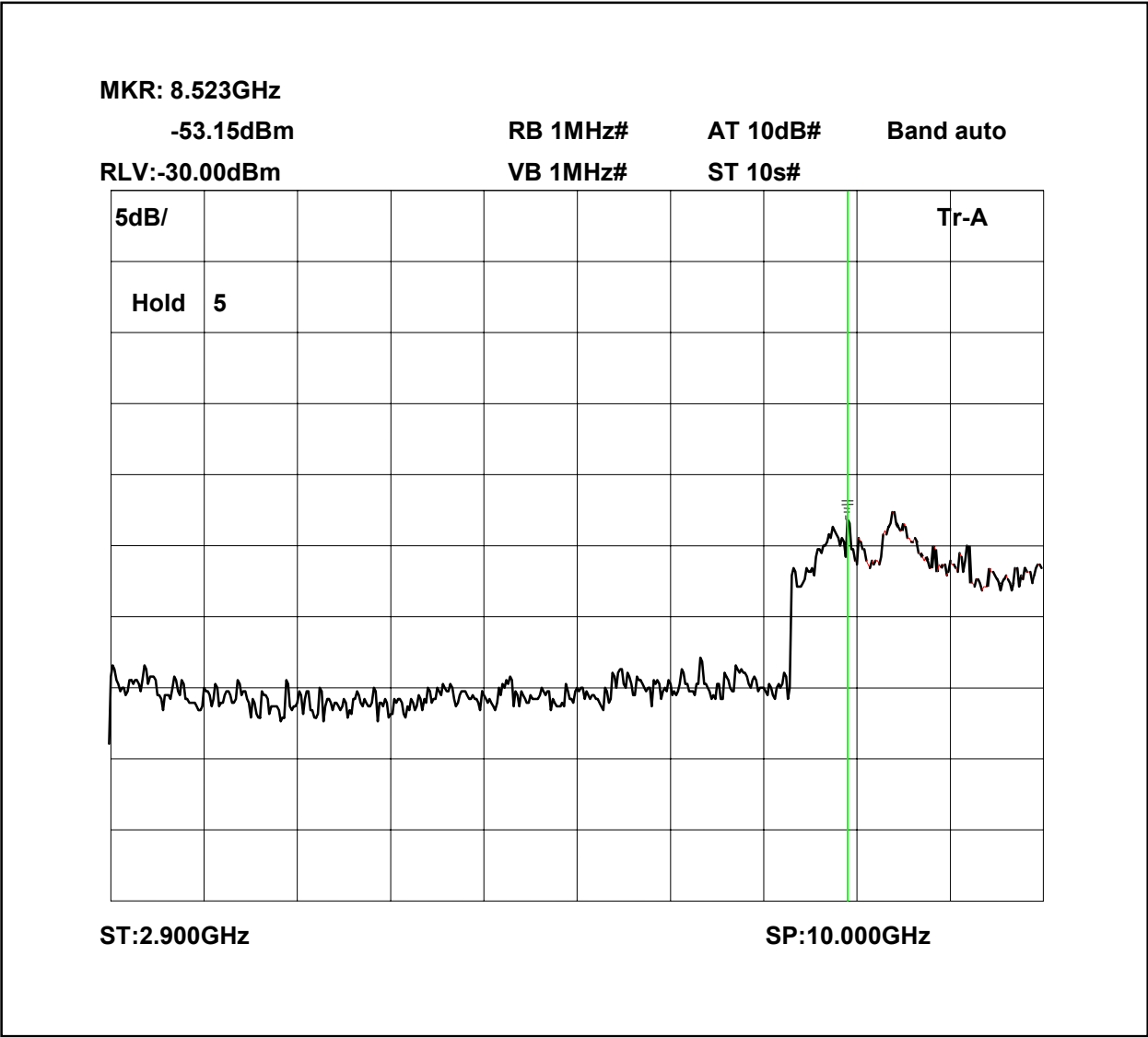
RF335 iss02

Radiated emissions no input signal 0-3GHz



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

Radiated emissions no input signal 2.9-10GHz



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



The test equipment used for the Transmitter Spurious Emissions:

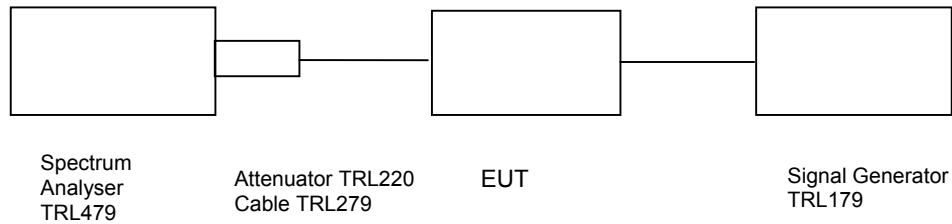
| TYPE OF EQUIPMENT | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|-------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| HORN              | EMCO               | 3115       | 9010-3581  | 139    | <b>X</b>                    |
| ATTENUATOR        | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| ATTENUATOR        | BIRD               | 8308-100   | N/A        | 112    | <b>X</b>                    |
| CABLE             | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

## COMPLIANCE TESTS

### AMPLIFIER GAIN – CONDUCTED – PART 2.1046 – SIMPLEX

Ambient temperature = 20°C  
 Relative humidity = 54%  
 Supply voltage = 115Vac  
 Channel number = See test results

Radio Laboratory



| Frequency<br>MHz | Signal Generator<br>input level<br>dBm | Cable & Attenuator<br>loss<br>dB | Level at Spectrum<br>Analyser<br>dBm | Gain<br>dB | Gain after 20dB<br>input level<br>increase<br>dBm |
|------------------|--|----------------------------------|--------------------------------------|------------|---|
| 452.85MHz        | -55.5                                  | 26.6                             | -4.45                                | 77.65      | 77.65   |

#### Notes:

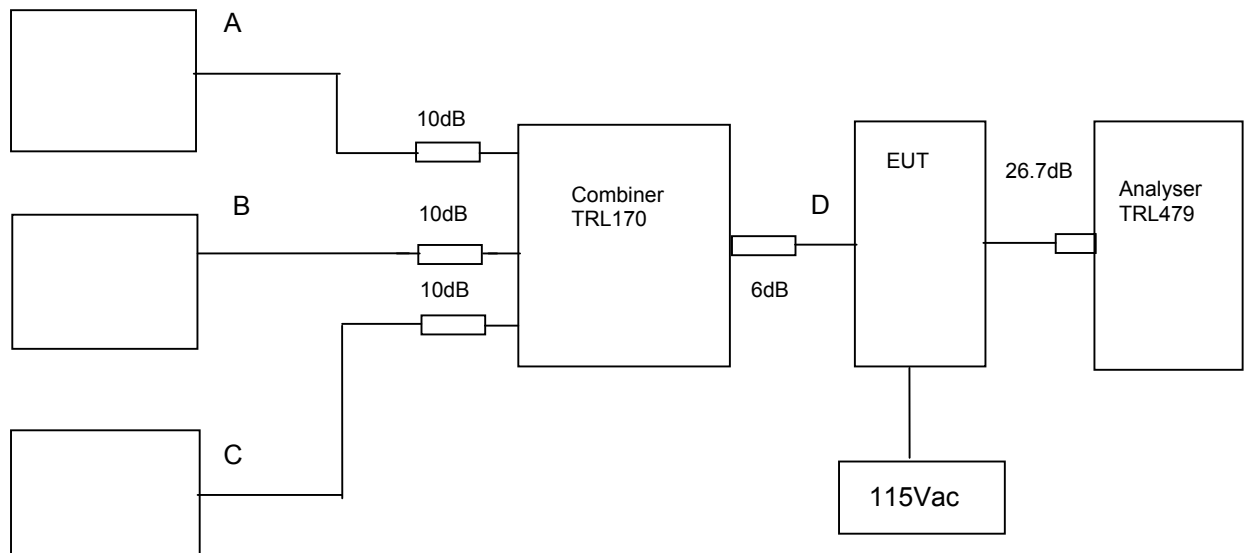
1. The level of the signal generator takes into consideration the loss from the cable.
2. The signal generator input was increased by 20dBs and the level of the output signal remeasured

| TYPE OF<br>EQUIPMENT | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

## AMPLIFIER INTERMODULATION SPURIOUS EMISSIONS – CONDUCTED – PART 2.1053– SMIPLEX

Ambient temperature = N/A  
Relative humidity = N/A  
Supply voltage = 115Vac

Radio Laboratory



The Intermodulation and spurious products test was not performed as this part of the unit only has one channel and separate RF inputs and outputs.

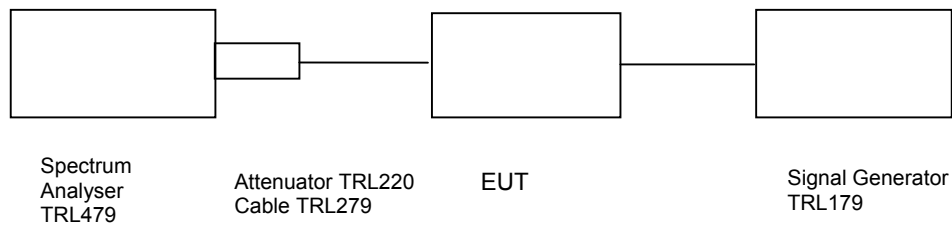
Test equipment used for intermodulation test

| TYPE OF EQUIPMENT | MAKER/<br>SUPPLIER | MODEL No | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|-------------------|--------------------|----------|------------|--------|-----------------------------|
| SPECTRUM ANALYSER | ANRITSU            | MS2665C  | MT26089    | 479    |                             |
| SIGNAL GENERATOR  | MARCON             | 2042     | 119562/02  | 254    |                             |
| CMTA              | ROHDE &<br>SCHWARZ | CMTA52   | 894715/033 | 05     |                             |
| SIGNAL GENERATOR  | MARCON             | 2042     | 119388/080 | 179    |                             |
| COMBINER          | ELCOM              | RC-4-50  | N/A        | 170    |                             |

## TRANSMITTER TESTS

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

|                     |   |                  |                  |
|---------------------|---|------------------|------------------|
| Ambient temperature | = | 20°C             | Radio Laboratory |
| Relative humidity   | = | 54%              |                  |
| Supply voltage      | = | 115Vac           |                  |
| Channel number      | = | See test results |                  |

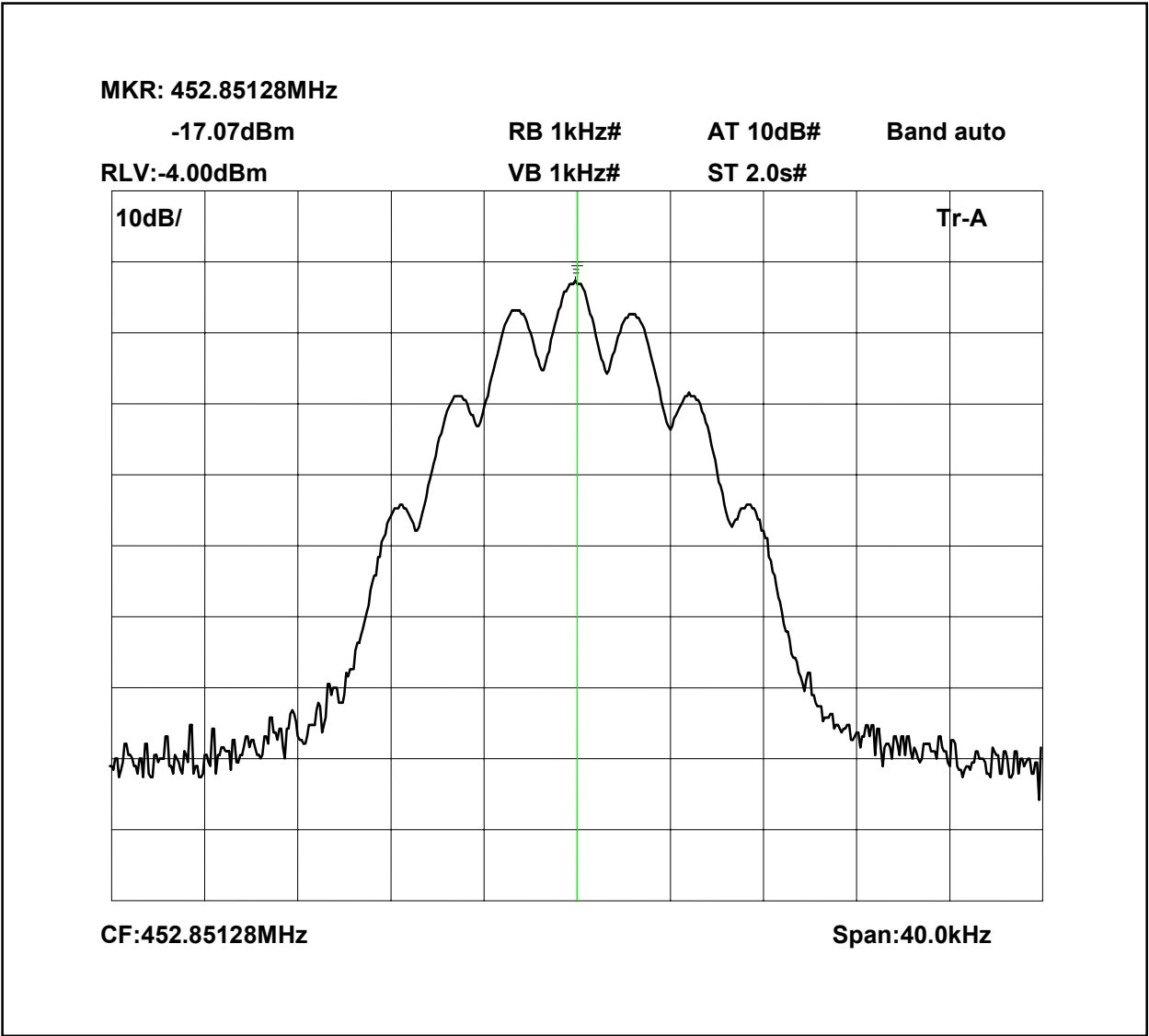


This test was performed to show that the amplifier does not alter the input signal in any way. The input signal was set to the maximum input level (-29.1dBm) and modulated with a 2500Hz tone. The plots show the signal measured at the signal generator and the signal measured at the output of the EUT.

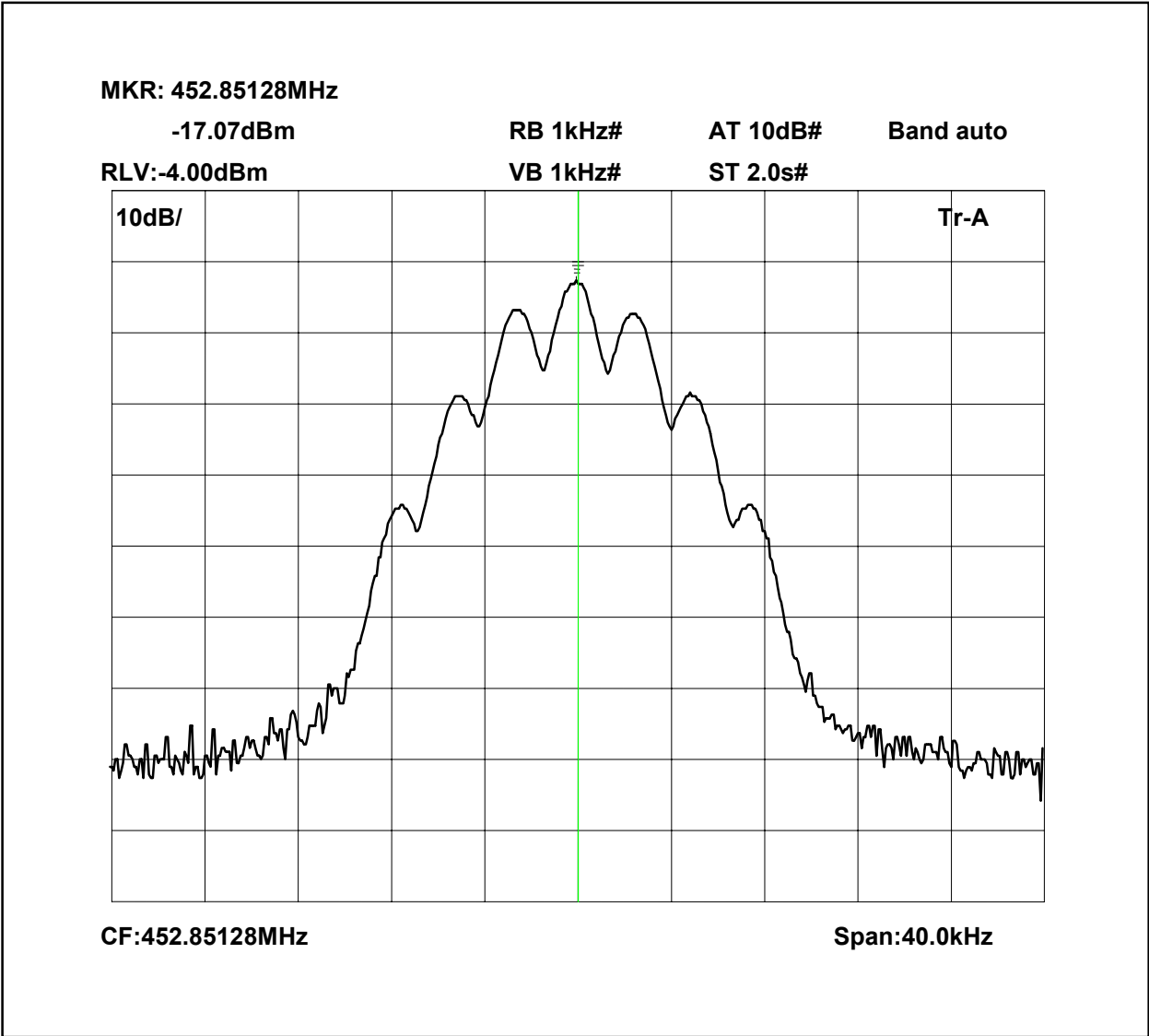
Note: The cables and attenuators had the following losses.

3. Cable TRL279 and attenuator TRL220 26.6dB
4. Cable between signal generator and EUT 0.4dB

452.85MHz Signal Generator deviation set to 2.5kHz



452.85MHz Signal Generator and EUT deviation set to 2.5kHz



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

| TYPE OF EQUIPMENT    | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

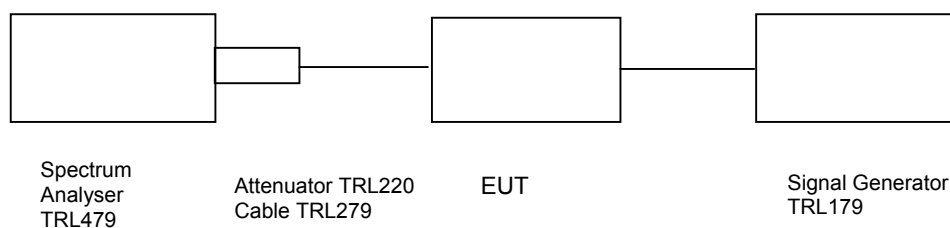


## TRANSMITTER TESTS

### AMPLIFIER SPURIOUS EMISSIONS – CONDUCTED – Part 2.1051 – UPLINK

Ambient temperature = 20°C  
 Relative humidity = 54%  
 Supply voltage = 115Vac

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 that 250% of the authorised bandwidth

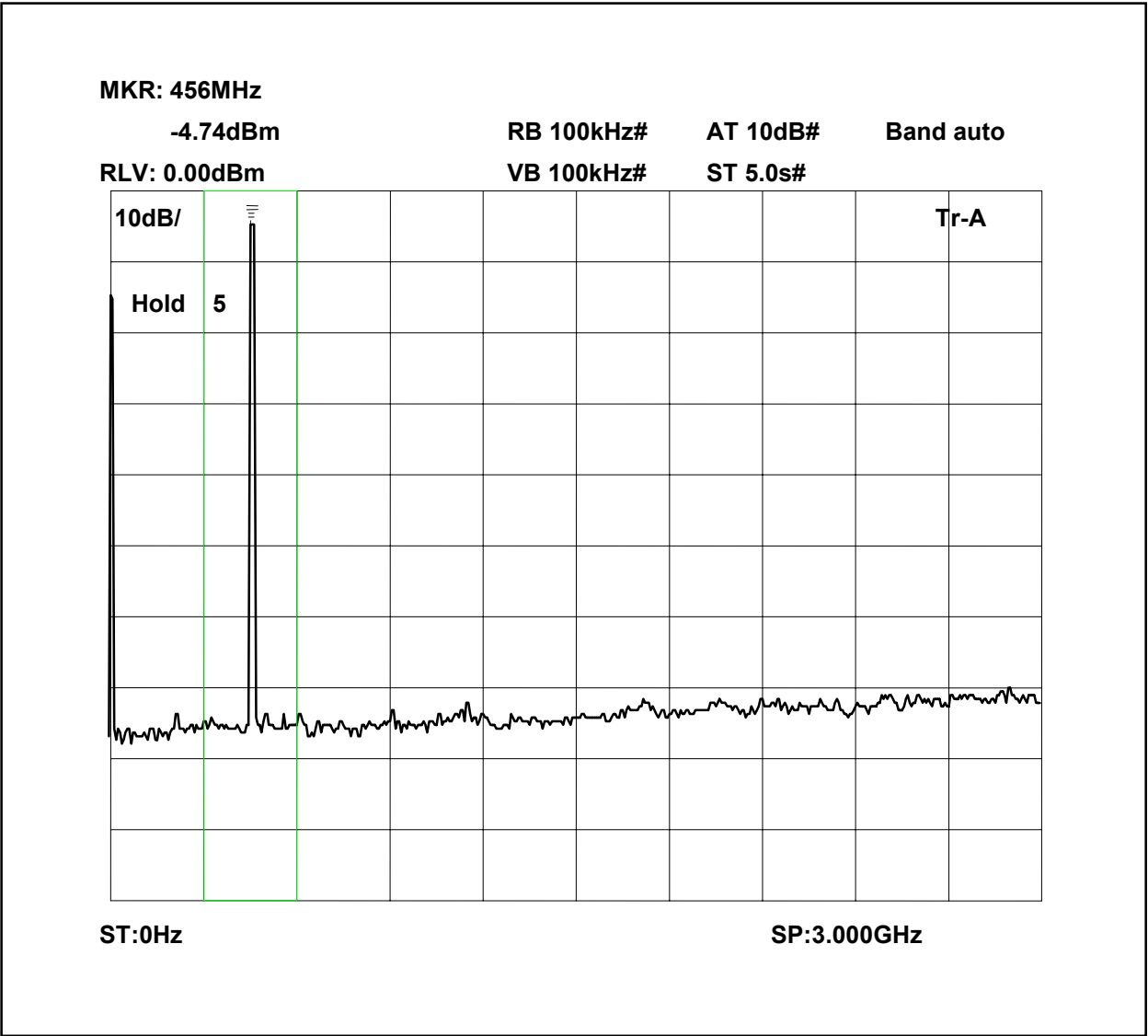
At least  $43 + 10 \log \text{PdB}$

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

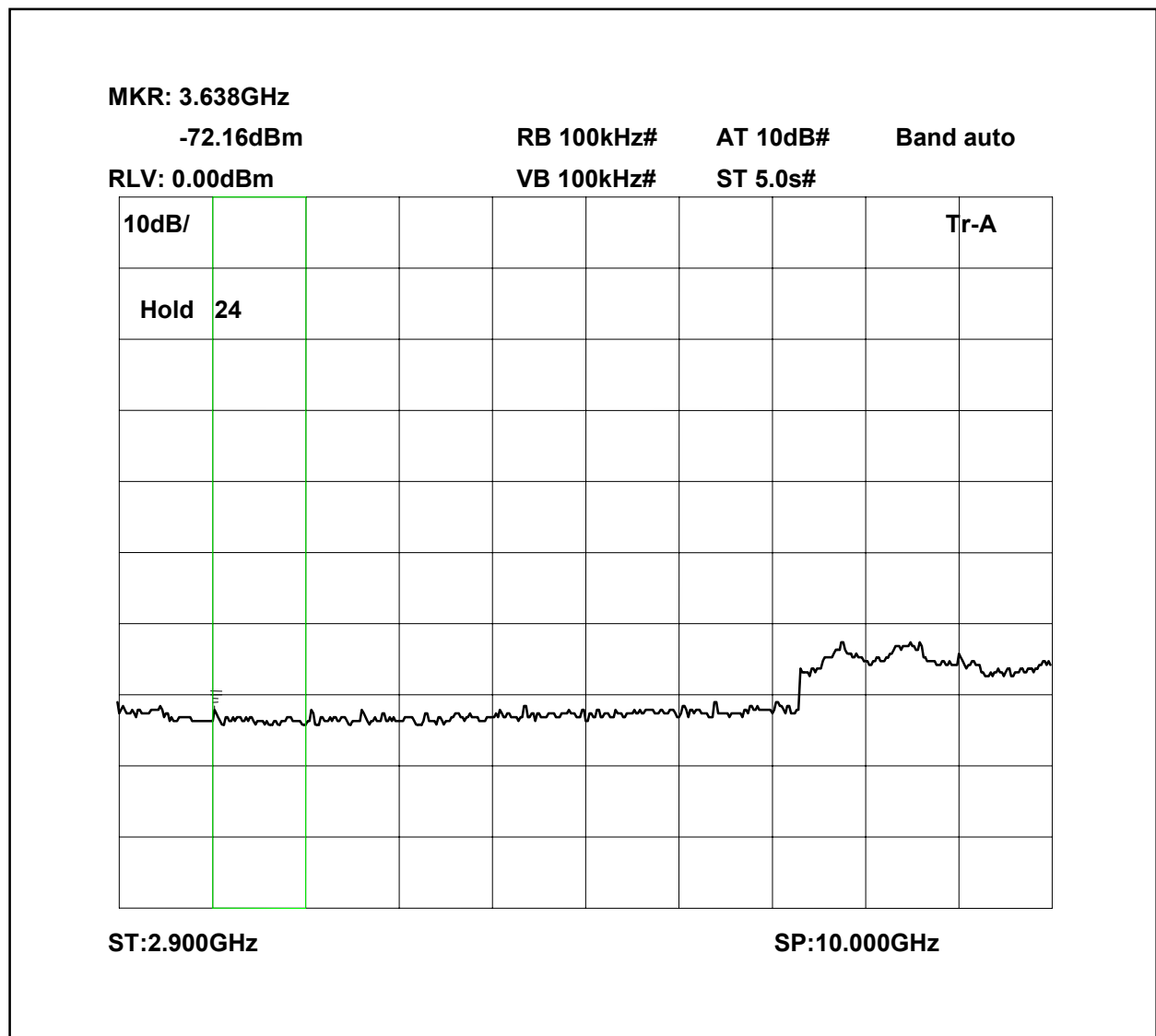
The test equipment used for the Transmitter Conducted Emissions:

| TYPE OF EQUIPMENT    | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

Conducted emissions 452.85MHz 0 - 3GHz



Conducted emissions 452.85MHz 2.9 - 5GHz

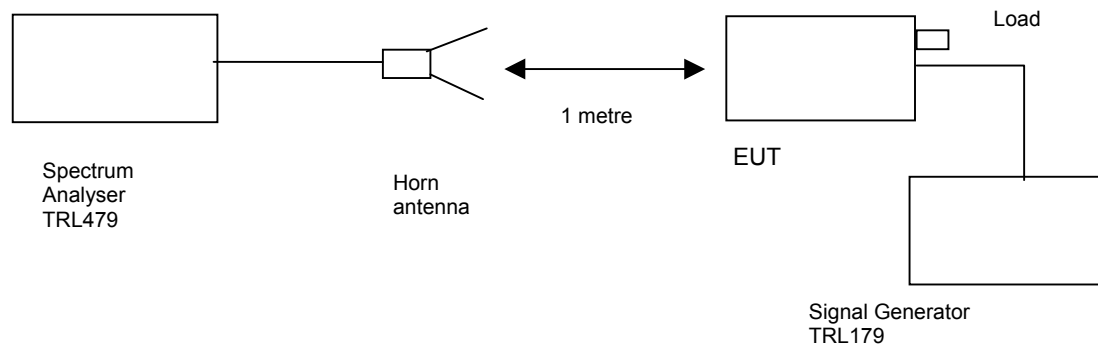


## TRANSMITTER TESTS

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

Ambient temperature = 20°C  
Relative humidity = 54%  
Conditions = OATS  
Supply voltage = 115Vac  
Supply Frequency = N/A

Test Signal = F3E



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

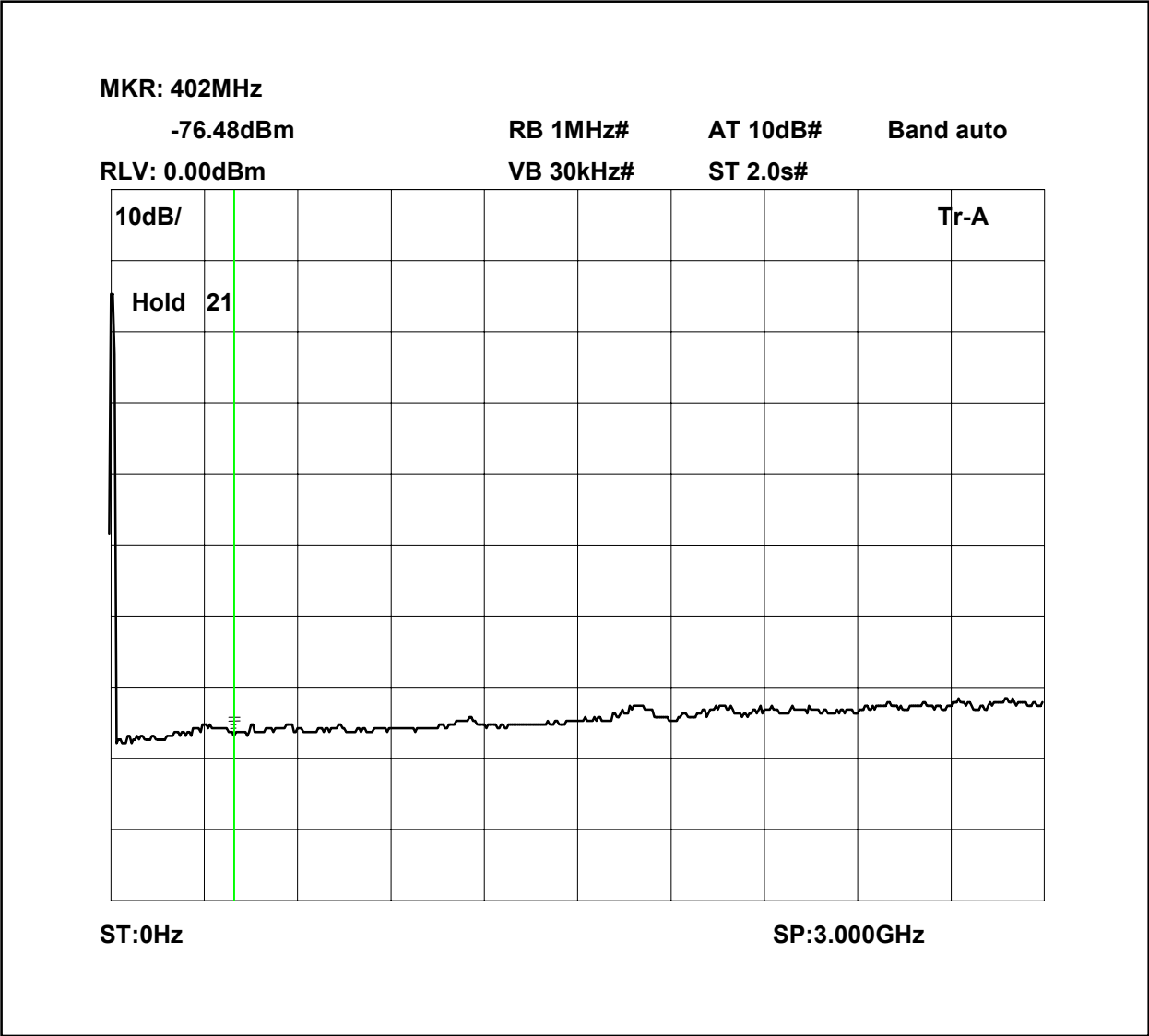
The Spurious limit was calculated as follows:

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

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

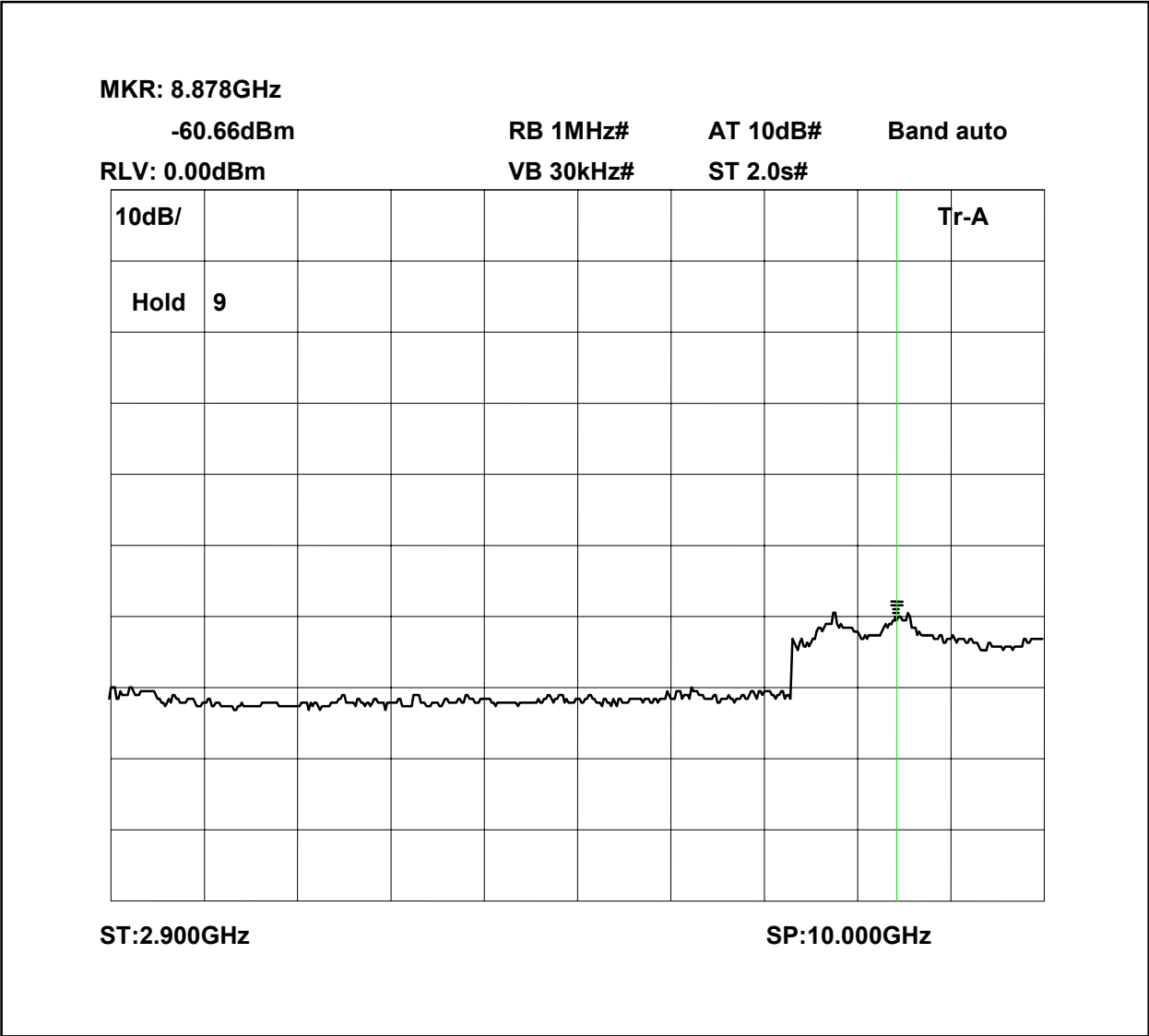
$$(10\log P_{\text{watts}}) - (43 + 10\log (P_{\text{watts}} * 1000)) = \text{LIMIT} = -13 \text{ dBm}$$

Radiated emissions 452.85MHz 0-3GHz



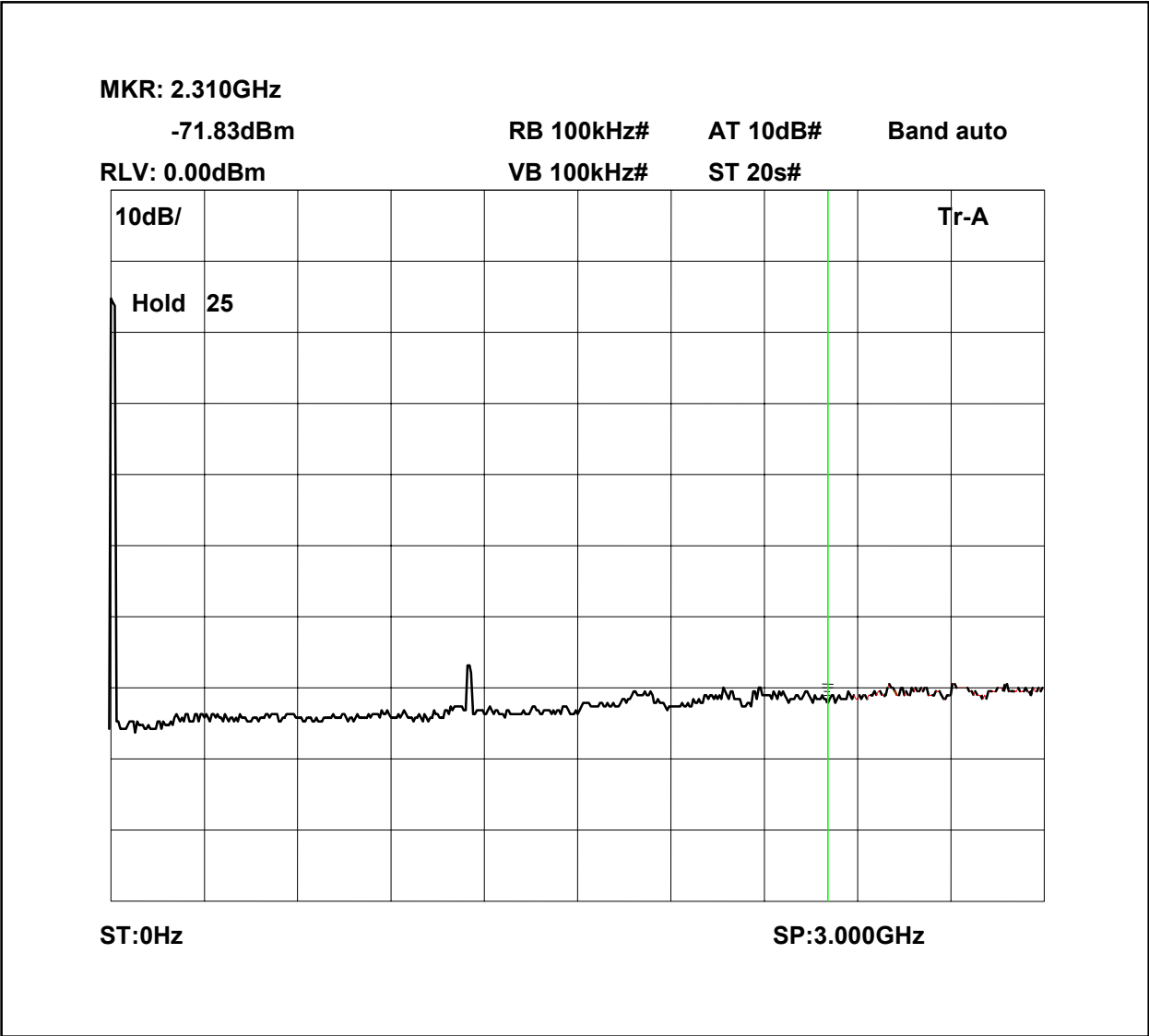
The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions 452.85MHz 2.9-10GHz



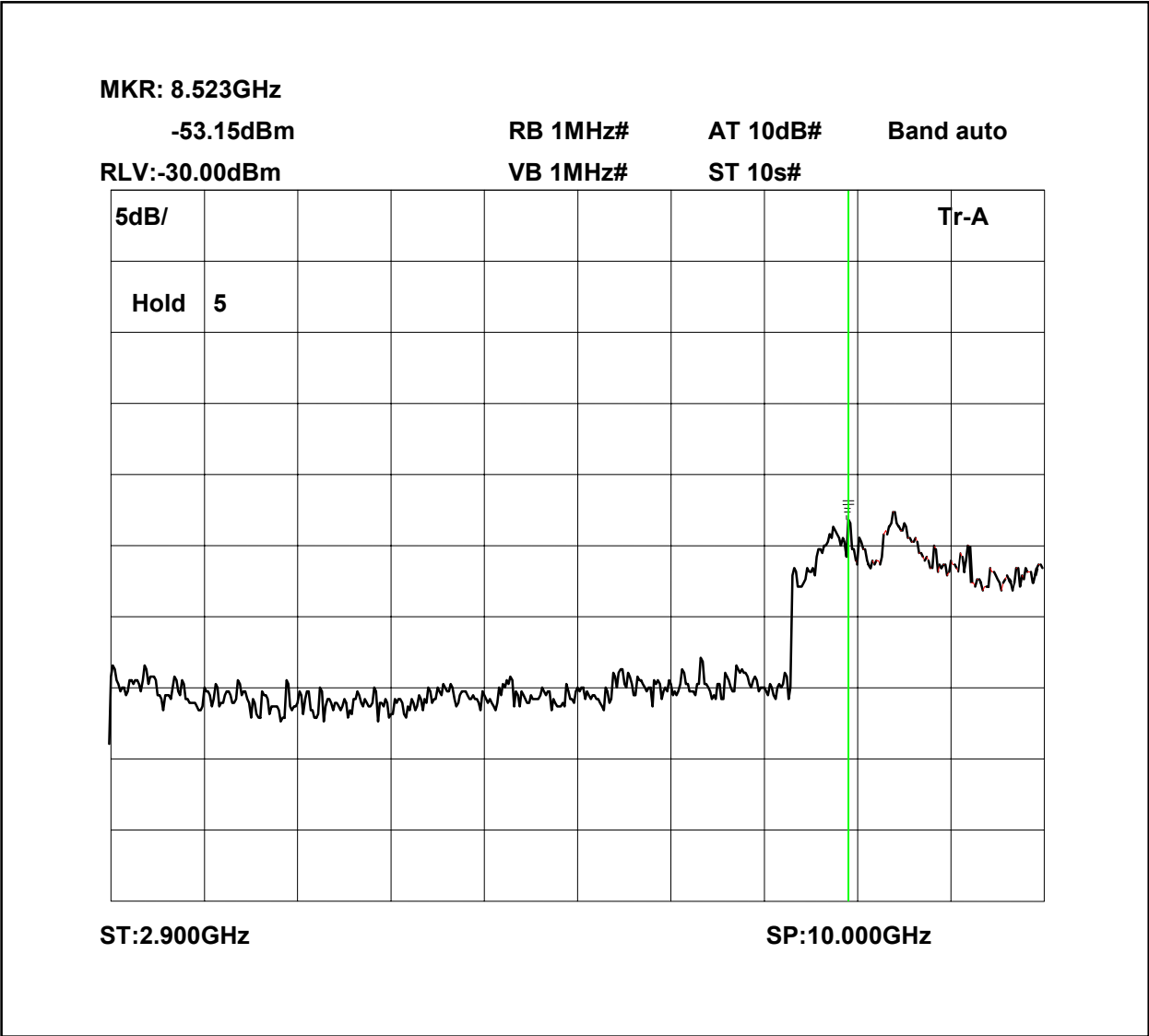
The above test results show that there were no emissions within 20dBs of the –13dBm limit.

Radiated emissions no input signal 0-3GHz



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

Radiated emissions no input signal 2.9-10GHz



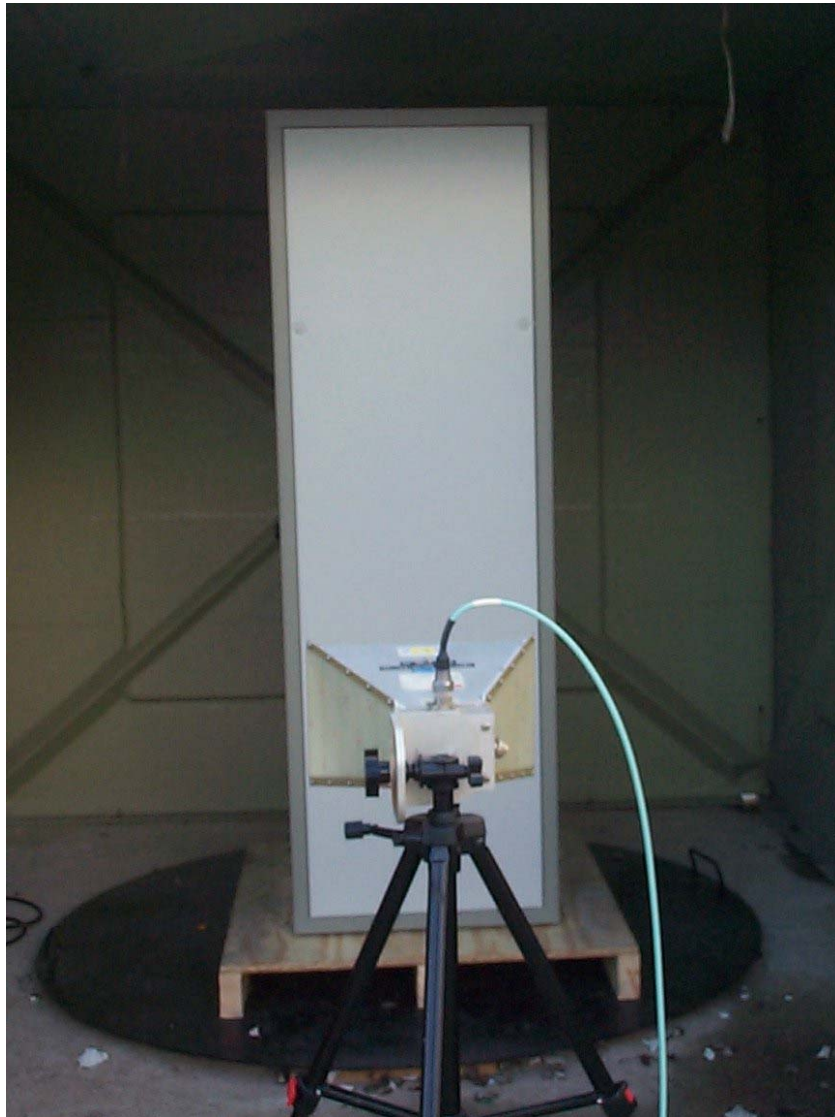
The above test results show that there were no emissions within 20dBs of the –13dBm limit.



The test equipment used for the Transmitter Spurious Emissions:

| TYPE OF EQUIPMENT    | MAKER/<br>SUPPLIER | MODEL No   | SERIAL No  | TRL No | ACTUAL<br>EQUIPMENT<br>USED |
|----------------------|--------------------|------------|------------|--------|-----------------------------|
| SPECTRUM<br>ANALYSER | ANRITSU            | MS2665C    | MT26089    | 479    | <b>X</b>                    |
| HORN                 | EMCO               | 3115       | 9010-3581  | 139    | <b>X</b>                    |
| ATTENUATOR           | BIRD               | 8304-300-N | N/A        | 220    | <b>X</b>                    |
| CABLE                | ROSENBERGER        | MICRO COAX | N/A        | 279    | <b>X</b>                    |
| SIGNAL<br>GENERATOR  | MARCON             | 2042       | 119388/080 | 179    | <b>X</b>                    |

**ANNEX A**  
**PHOTOGRAPHS**





**ANNEX B**

**APPLICANT'S SUBMISSION OF DOCUMENTATION LIST**

## APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

|    |  |   |             |                                     |
|----|--|---|-------------|-------------------------------------|
| a. | TCB  | - | APPLICATION | <input checked="" type="checkbox"/> |
|    |  | - | FEE         | <input checked="" type="checkbox"/> |
| b. | AGENT'S LETTER OF AUTHORISATION            | - |             | <input checked="" type="checkbox"/> |
| c. | MODEL(s) vs IDENTITY                       | - |             | <input type="checkbox"/>            |
| d. | ALTERNATIVE TRADE NAME DECLARATION(s)      | - |             | <input type="checkbox"/>            |
| e. | LABELLING                                  | - | PHOTOGRAPHS | <input type="checkbox"/>            |
|    |  | - | DECLARATION | <input type="checkbox"/>            |
|    |  | - | DRAWINGS    | <input type="checkbox"/>            |
| f. | TECHNICAL DESCRIPTION                      | - |             | <input checked="" type="checkbox"/> |
| g. | BLOCK DIAGRAMS                             | - | Tx          | <input checked="" type="checkbox"/> |
|    |  | - | Rx          | <input type="checkbox"/>            |
|    |  | - | PSU         | <input type="checkbox"/>            |
|    |  | - | AUX         | <input type="checkbox"/>            |
| h. | CIRCUIT DIAGRAMS                           | - | Tx          | <input type="checkbox"/>            |
|    |  | - | Rx          | <input type="checkbox"/>            |
|    |  | - | PSU         | <input type="checkbox"/>            |
|    |  | - | AUX         | <input type="checkbox"/>            |
| i. | COMPONENT LOCATION                         | - | Tx          | <input type="checkbox"/>            |
|    |  | - | Rx          | <input type="checkbox"/>            |
|    |  | - | PSU         | <input type="checkbox"/>            |
|    |  | - | AUX         | <input type="checkbox"/>            |
| j. | PCB TRACK LAYOUT                           | - | Tx          | <input type="checkbox"/>            |
|    |  | - | Rx          | <input type="checkbox"/>            |
|    |  | - | PSU         | <input type="checkbox"/>            |
|    |  | - | AUX         | <input type="checkbox"/>            |
| k. | BILL OF MATERIALS                          | - | Tx          | <input type="checkbox"/>            |
|    |  | - | Rx          | <input type="checkbox"/>            |
|    |  | - | PSU         | <input type="checkbox"/>            |
|    |  | - | AUX         | <input type="checkbox"/>            |
| l. | USER INSTALLATION / OPERATING INSTRUCTIONS | - |             | <input checked="" type="checkbox"/> |

