



## FCC CFR 47 Part 80 Radar Test Report

|                             |                                                                        |
|-----------------------------|------------------------------------------------------------------------|
| <b>APPLICANT</b>            | Guidance Marine Limited                                                |
| <b>ADDRESS</b>              | 5 Tiber Way, Meridian Business Park<br>Leicester LE19 1RP              |
| <b>FCC ID</b>               | VYMRAD-1100                                                            |
| <b>MODEL NUMBER</b>         | RAD-1100                                                               |
| <b>PRODUCT DESCRIPTION</b>  | Series 4 Responder Radar                                               |
| <b>DATE SAMPLE RECEIVED</b> | FEB 20 2020                                                            |
| <b>FINAL TEST DATE</b>      | AUG 10 2020                                                            |
| <b>TESTED BY</b>            | Franklin Rose                                                          |
| <b>APPROVED BY</b>          | Tim Royer                                                              |
| <b>TEST RESULTS</b>         | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL |

| Report Number                     | Report Version | Description      | Issue Date  |
|-----------------------------------|----------------|------------------|-------------|
| 325UT20_PT80 Radar<br>TestReport_ | Rev1           | Initial Issue    | AUG 10 2020 |
| 325UT20_PT80 Radar<br>TestReport_ | Rev2           | Clerical Updates | SEP 18 2020 |

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

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## SIGNATURE PAGE

Timco Engineering, Inc. attests that:

|                                     |                                                                                                                                             |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | The EUT tested herein <b>fulfills</b> all approval requirements and/or the customer requirements as identified in this test report.         |
| <input type="checkbox"/>            | The EUT tested herein <b>does not fulfill</b> all approval requirements and/or the customer requirements as identified in this test report. |

This report relates only to the Equipment Under Test (EUT) sample(s) tested.

This report shall not be reproduced except in full without the written approval of Timco Engineering, Inc.

To the best of my knowledge and belief, this device has been tested in accordance with the standards identified in this test report, and these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that measurements were made at:

Timco Engineering Inc.  
849 NW State Road 45  
Newberry, FL 32669



**Name and Title** Franklin Rose, Project Manager / EMC Specialist



**Name and Title** Tim Royer, Project Manager / EMC Engineer

**Date** AUG 10 2020

## GENERAL INFORMATION

The EUT is described by the manufacturer as an "Active Microwave Target" working in the band 9.2 – 9.3 GHz, and its class of device is not otherwise described within FCC 47 CFR Part 80. The EUT aides in dynamic positioning in the vicinity of an Oil Platform or similar asset.

The EUT can only be used in conjunction with FCC ID VYMRADASCAN. The device is unable to respond to any other device. It receives a Horizontally-polarized signal transmitted by FCC ID VYMRADASCAN, modulates the signal using SSB to encode information onto the "reflection", and it employs an amplifier in the final stage before re-transmit, which is designed to change the polarity by 90 degrees to Vertical.

The EUT is not considered a RACON (Radar Beacon) as it operates in a dissimilar manner.

## Testing Information

|                                |                                                                                              |                                                    |                                           |
|--------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------|
| <b>EUT Description</b>         | Series 4 Responder Radar                                                                     |                                                    |                                           |
| <b>FCC ID</b>                  | VYMRAD-1100                                                                                  |                                                    |                                           |
| <b>Model Number</b>            | RAD-1100                                                                                     |                                                    |                                           |
| <b>Operating Band(s)</b>       | Band 1: 9.2 – 9.3 GHz                                                                        |                                                    |                                           |
| <b>Emission Designator</b>     | 131MP0N                                                                                      |                                                    |                                           |
| <b>Measurement Method</b>      | 99% Occupied Bandwidth                                                                       |                                                    |                                           |
| <b>Modulation</b>              | n/a. Device only re-transmits radar emission (P0N)                                           |                                                    |                                           |
| <b>EUT Power Source</b>        | <input type="checkbox"/> 110–120 VAC                                                         | <input checked="" type="checkbox"/> DC Power       | <input type="checkbox"/> Battery Operated |
| <b>Test Item</b>               | <input type="checkbox"/> Prototype                                                           | <input checked="" type="checkbox"/> Pre-Production | <input type="checkbox"/> Production       |
| <b>Type of Equipment</b>       | <input checked="" type="checkbox"/> Fixed                                                    | <input type="checkbox"/> Mobile                    | <input type="checkbox"/> Portable         |
| <b>Antenna Connector</b>       | n/a (receive and transmit antennas are internal, PCB trace antenna)                          |                                                    |                                           |
| <b>Modification to the EUT</b> | The EUT was not modified.                                                                    |                                                    |                                           |
| <b>Test Exercise</b>           | The EUT was operated in accordance with the user manual.                                     |                                                    |                                           |
| <b>Applicable Standards</b>    | FCC CFR 47 Part 2, Part 80, using ANSI C63.26-2015<br>Referencing: ITU-R M.1177-4            |                                                    |                                           |
| <b>Test Conditions</b>         | Laboratory temperature: 26°C, Relative humidity: 50%                                         |                                                    |                                           |
| <b>Test Facility</b>           | Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. Designation #: US1070 |                                                    |                                           |

## SUMMARY OF TESTING

| FCC Rule Parts                                              | Testing Performed                               | Result      |
|-------------------------------------------------------------|-------------------------------------------------|-------------|
| 2.1046(a), 80.215(a)(3),<br>80.215(n)(3)                    | RF Power Output                                 | <b>PASS</b> |
| 2.1033(c)(4), 2.1049(i),<br>80.205(a), (d),<br>80.273(a)(6) | Occupied Bandwidth & Modulation Characteristics | <b>PASS</b> |
| 80.211(f)(1), (2)                                           | Emission Masks                                  | <b>PASS</b> |
| 2.1051(a), 2.1057(a)(1),<br>80.211(f)(3)                    | Spurious Emissions at Antenna Terminals         | <b>PASS</b> |
| 2.1053(a), 2.1057(a)(1),<br>80.211(f)(3)                    | Field Strength of Spurious Emissions            | <b>PASS</b> |
| 2.1055(a)(2)                                                | Frequency Stability                             | <b>n/a</b>  |

## RF POWER OUTPUT

**Rule Part No.:** FCC Part 2.1046(a), 80.215(a)(3), 80.215(n)(3)

### Requirements:

#### §80.215 Transmitter power.

(a) Transmitter power shown on the radio station authorization is the maximum power the licensee is authorized to use. Power is expressed in the following terms:

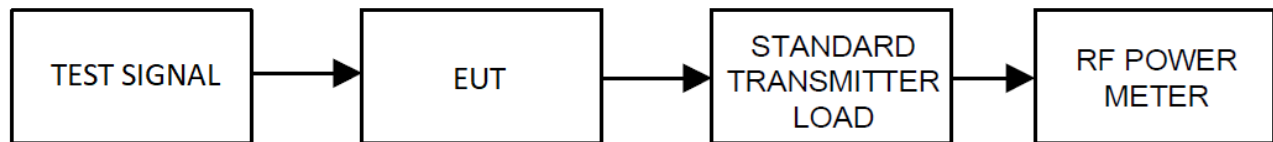
(3) For PON and F3N emission: Mean power;

(n) For radiodetermination stations operating above 2400 MHz the output power must be as follows:

(3) For all other transponder stations the output power must not exceed 20 watts peak e.i.r.p. Licensees of non-selectable transponder coast stations operating in the 2920-3100 MHz and 9320-9500 MHz bands must notify in writing the USCG District Commander of any incremental increase of their station's output power above 5 watts peak e.i.r.p.

**Test Procedure:** ANSI C63.26

### Test Setup Block Diagram:

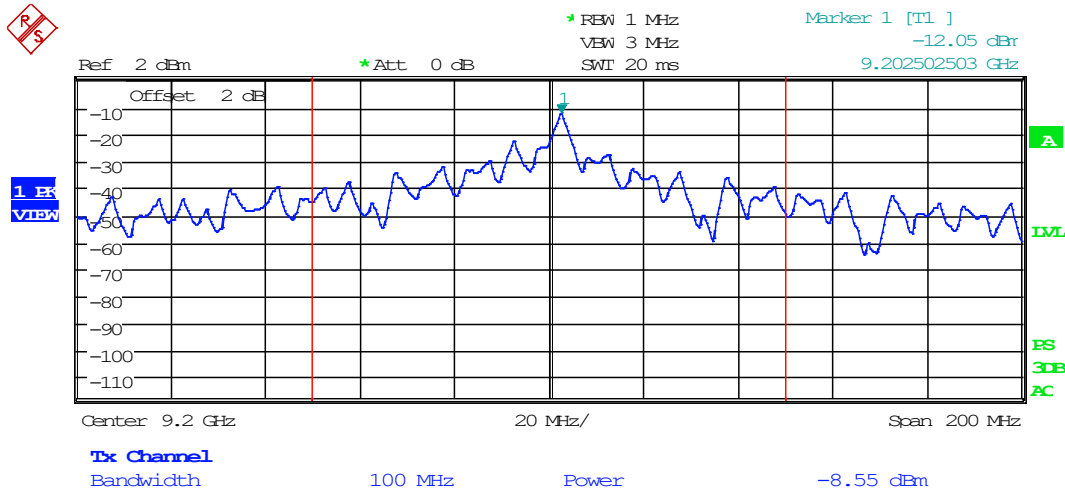


**Note:** The test procedure has been modified to include an input signal. This provides the EUT with the frequency/signal source. This conducted input signal bypasses the Receive Antenna, and thus receive antenna gain has been added to the final power output.

**Note:** The test procedure has been modified to measure the power output over the modulated band by using Channel Power measurement.

## RF POWER OUTPUT

**Test Data: Power Output 9.2 GHz**

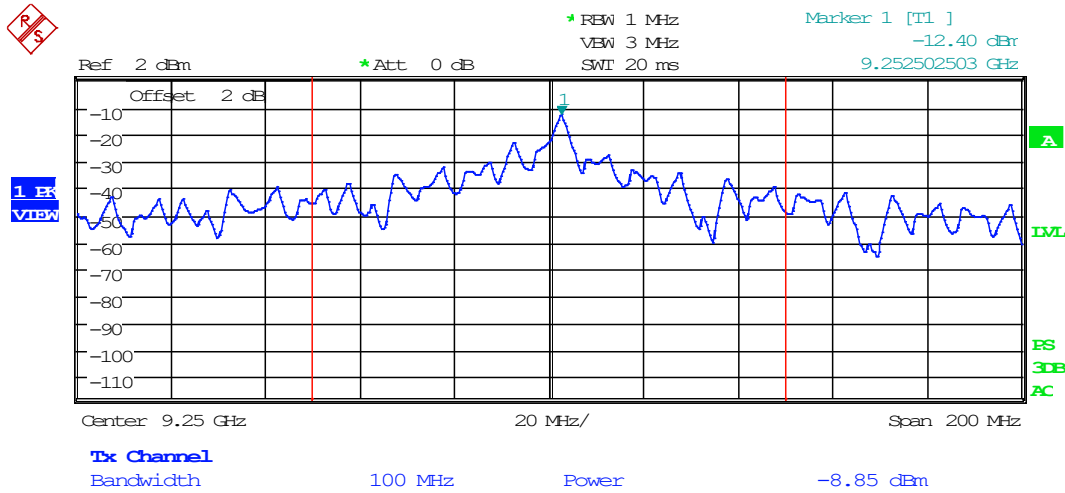


Date: 7.AUG.2020 13:03:08

| Frequency | Measured Level (dBm) | Receive Ant. Gain (dB) | Output (dBm) | Rated Power (dBm) | Margin (dBm) |
|-----------|----------------------|------------------------|--------------|-------------------|--------------|
| 9200.00   | -8.55                | 12.25                  | 3.70         | 4.00              | 0.30         |

## RF POWER OUTPUT

**Test Data: Power Output 9.25 GHz**



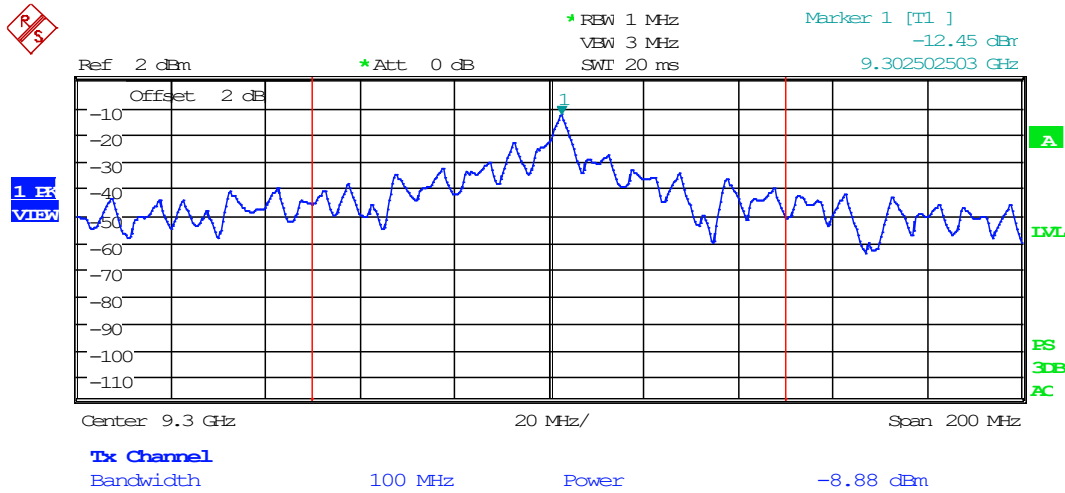
Date: 7.AUG.2020 13:03:59

| Frequency | Measured Level (dBm) | Receive Ant. Gain (dB) | Output (dBm) | Rated Power (dBm) | Margin (dBm) |
|-----------|----------------------|------------------------|--------------|-------------------|--------------|
| 9250.00   | -8.85                | 12.25                  | 3.40         | 4.00              | 0.60         |



## RF POWER OUTPUT

**Test Data: Power Output 9.3 GHz**



Date: 7.AUG.2020 13:01:42

| Frequency | Measured Level (dBm) | Receive Ant. Gain (dB) | Output (dBm) | Rated Power (dBm) | Margin (dBm) |
|-----------|----------------------|------------------------|--------------|-------------------|--------------|
| 9300.00   | -8.88                | 12.25                  | 3.37         | 4.00              | 0.63         |

## **POWER AT THE FINAL AMPLIFIER**

**Rule Part No.:** FCC Part 2.1033(c)(8)

### **Requirement:**

(c) Applications for equipment other than that operating under parts 15, 11 and 18 of this chapter shall be accompanied by a technical report containing the following information:

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

### **Test Data: Power at the Final Amplifier**

INPUT POWER: (4 VDC) (0.35 A) = **1.4 Watts Max**

## OCCUPIED BANDWIDTH

**Rule Part No.:** Part 2.1033(c)(4), 2.1049(i), Part 80.205(a), (d)

### §2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(i) Transmitters designed for other types of modulation—when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

### §80.205 Bandwidths.

(a) An emission designator shows the necessary bandwidth for each class of emission of a station except that in ship earth stations it shows the occupied or necessary bandwidth, whichever is greater. The following table gives the class of emission and corresponding emission designator and authorized bandwidth:

| Class of emission | Emission designator | Authorized bandwidth (kHz) |
|-------------------|---------------------|----------------------------|
| PON               | ( <sup>12</sup> )   | ( <sup>12</sup> )          |

<sup>12</sup>Applicable to radiolocation and associated telecommand ship stations operating on 154.585 MHz, 159.480 MHz, 160.725 MHz, 160.785 MHz, 454.000 MHz, and 459.000 MHz; emergency position indicating radiobeacons operating in the 406.000-406.1000 MHz frequency band; and data transmissions in the 156-162 MHz band.

(d) The authorized classes of emission are as follows:

| Types of stations                | Classes of emission |
|----------------------------------|---------------------|
| <b>Ship Stations<sup>1</sup></b> |                     |
| Radiodetermination:              |                     |
| 2.4-9.5 GHz                      | PON.                |
| <b>Land Stations<sup>1</sup></b> |                     |
| Radiodetermination:              |                     |
| 2.4-9.6 GHz                      | PON.                |

<sup>1</sup>Excludes distress, EPIRBs, survival craft, and automatic link establishment.

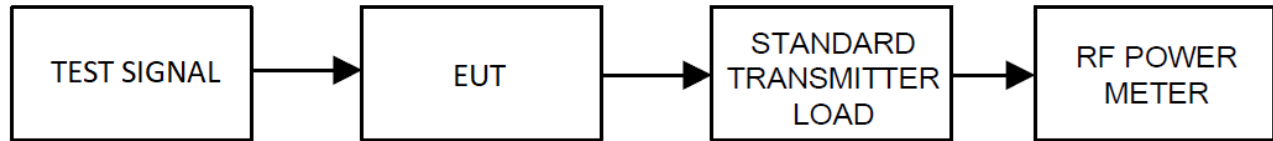
(g) Radar stations operating in the bands above 2.4 GHz may use any type of modulation consistent with the bandwidth requirements in §80.209(b).

**Test Procedure:** ANSI C63.26, 5.4.4

**Note:** The receiver's automatic 99% Occupied Bandwidth function was used. The function is identical in operation to the measurement method of ANSI C63.26, 5.4.4, Step e).

## OCCUPIED BANDWIDTH

### Test Setup Block Diagram:



**Note:** The test procedure has been modified to include an input signal. This provides the EUT with the frequency/signal source.

### Test Data: Occupied Bandwidth Measurement Table

| Frequency | 99% Occupied Bandwidth (MHz) |
|-----------|------------------------------|
| 9.25 GHz  | 131.38 MHz                   |

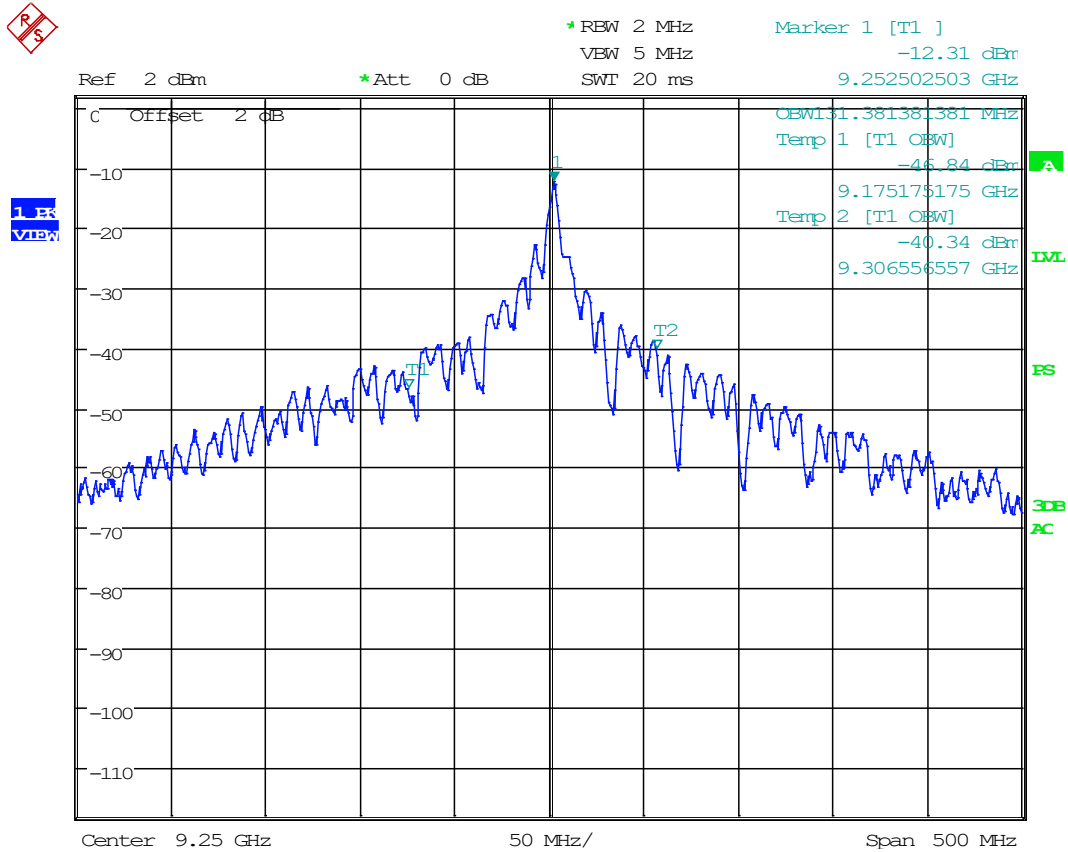
Max Occupied Bandwidth of EUT = **131.38 MHz**

Emission Designator = **131MP0N**

Method of Measurement = **99% OBW**

## OCCUPIED BANDWIDTH

Test Data: 9.25 GHz 99% OBW Plot



Date: 7.AUG.2020 13:06:43

## EMISSION MASK

**Rule Part No.:** 80.211(f)(1), (2)

### Requirements:

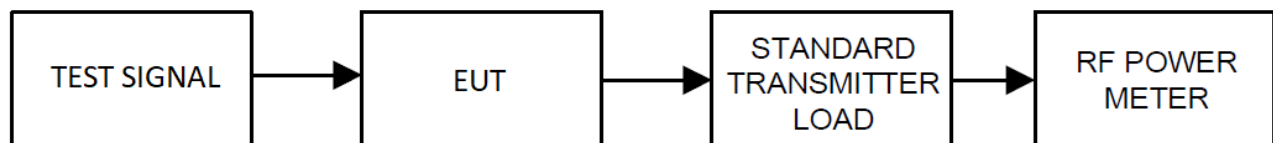
(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

**Test Procedure:** ANSI C63.26, 5.4.4; ITU-R M.1177-4

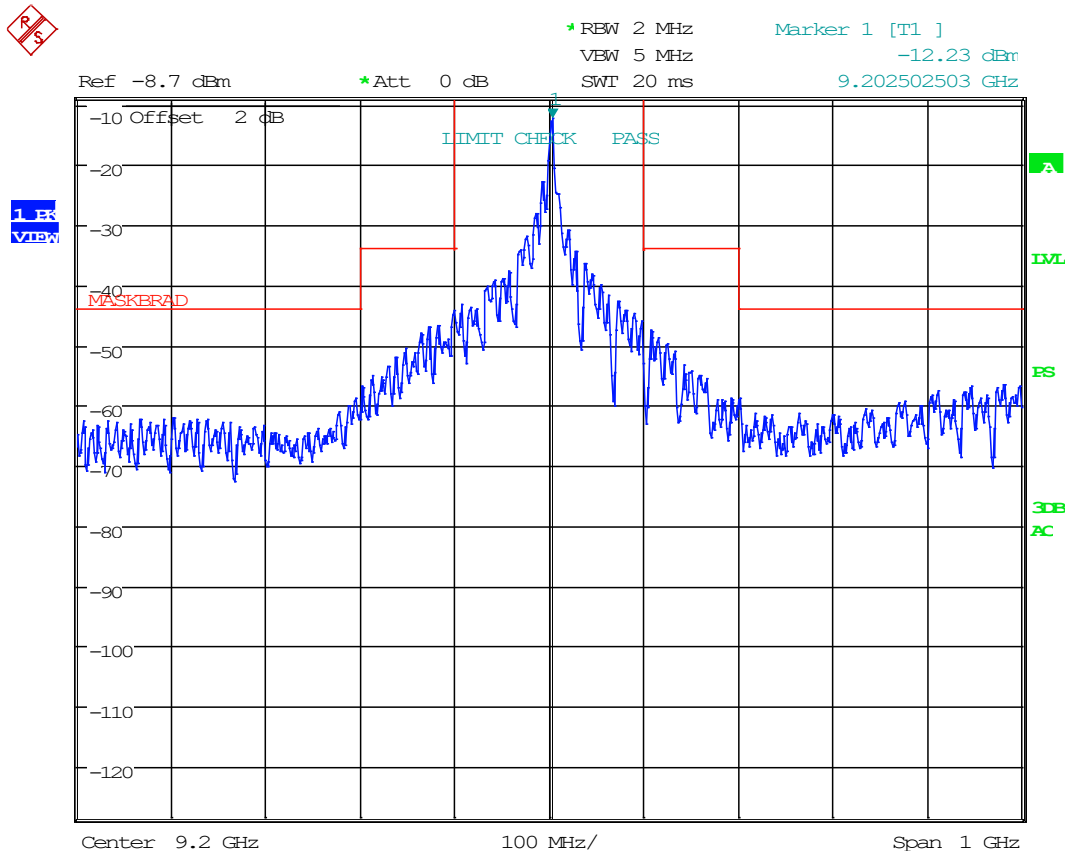
### Test Setup Block Diagram:



**Note:** The test procedure has been modified to include an input signal. This provides the EUT with the frequency/signal source.

## EMISSION MASK

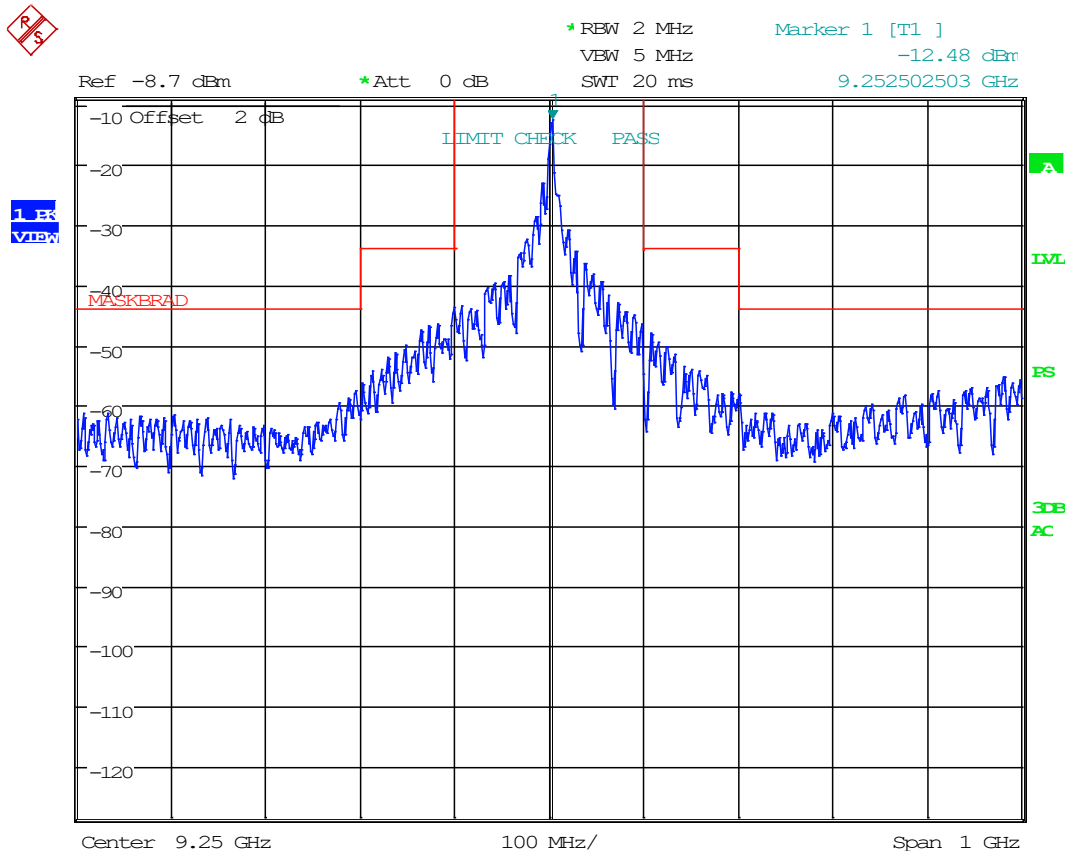
Test Data: Mask B, 9.2 GHz



Date: 7.AUG.2020 13:12:07

## EMISSION MASK

Test Data: Mask B, 9.25 GHz

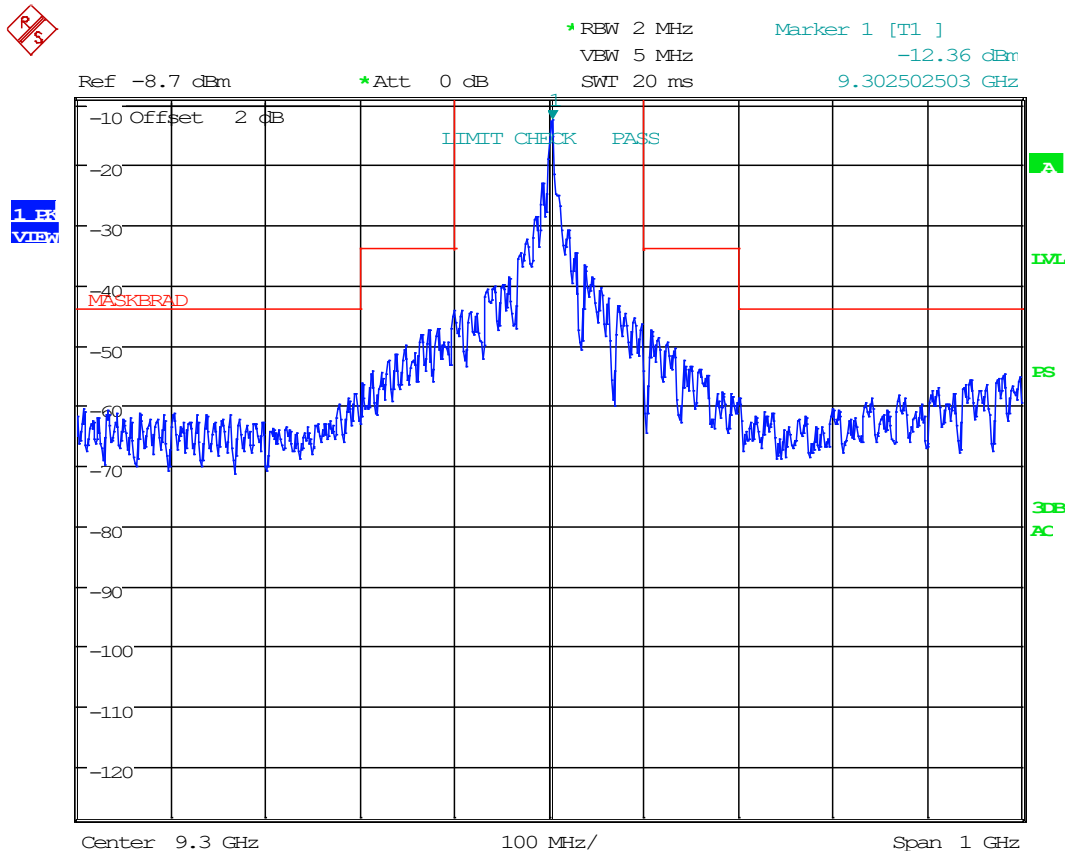


Date: 7.AUG.2020 13:11:27



## EMISSION MASK

Test Data: Mask B, 9.3 GHz



Date: 7.AUG.2020 13:12:45

## SPURIOUS EMISSIONS AT ANTENNA TERMINAL (CONDUCTED)

**Rule Part No.:** Part 2.1051(a), 2.1057(a)(1), 80.211(f)(3)

### §2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

### §2.1057 Frequency spectrum to be investigated.

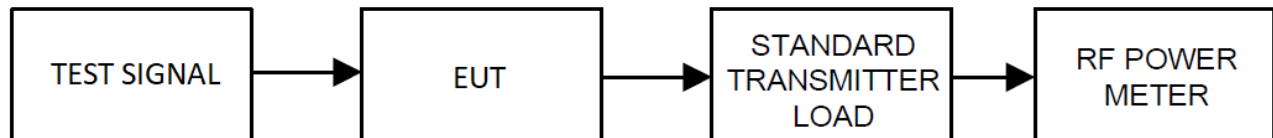
(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus  $10\log_{10}$  (mean power in watts) dB.

### Test Setup Block Diagram:

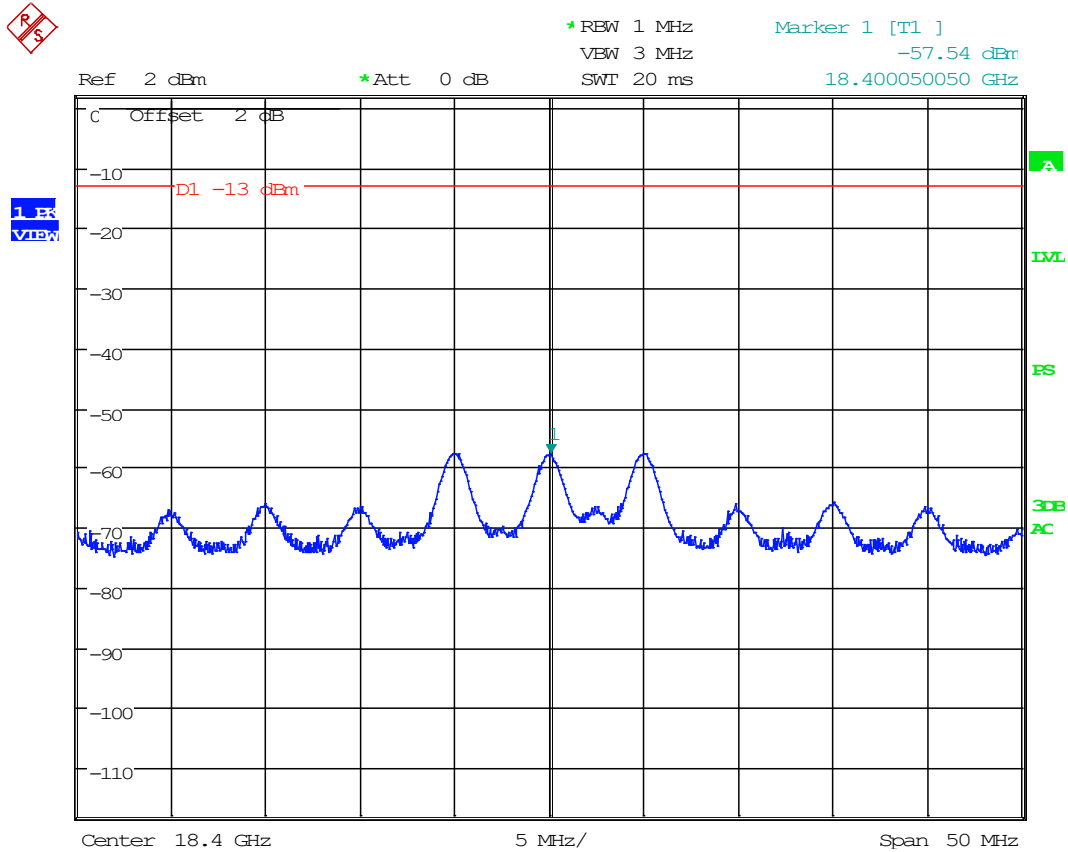


**Note:** The test procedure has been modified to include an input signal. This provides the EUT with the frequency/signal source.

**Note:** The harmonic frequencies are provided below. All other emissions were at the noise floor of the receiving test equipment (> 20 dB below the fundamental).

## UNWANTED SPURIOUS EMISSIONS

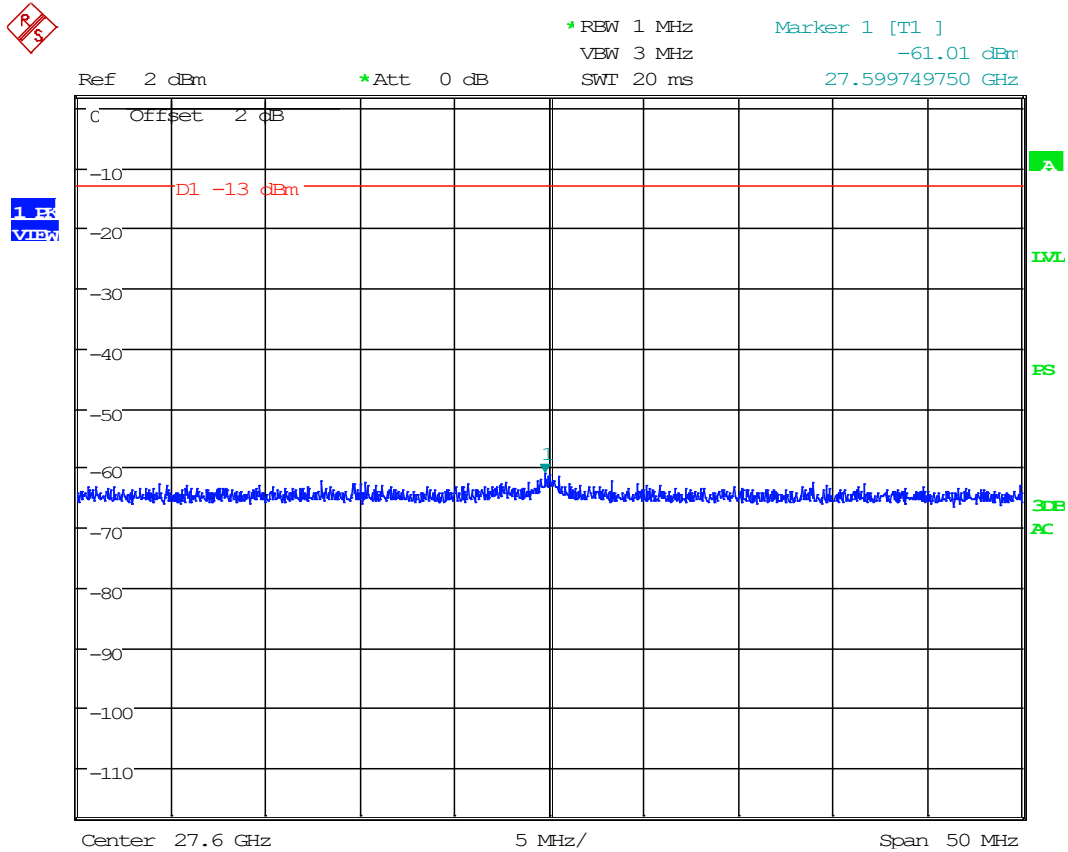
Test Data: 9.2 GHz, 2<sup>nd</sup> Harmonic



Date: 7.AUG.2020 12:57:14

## UNWANTED SPURIOUS EMISSIONS

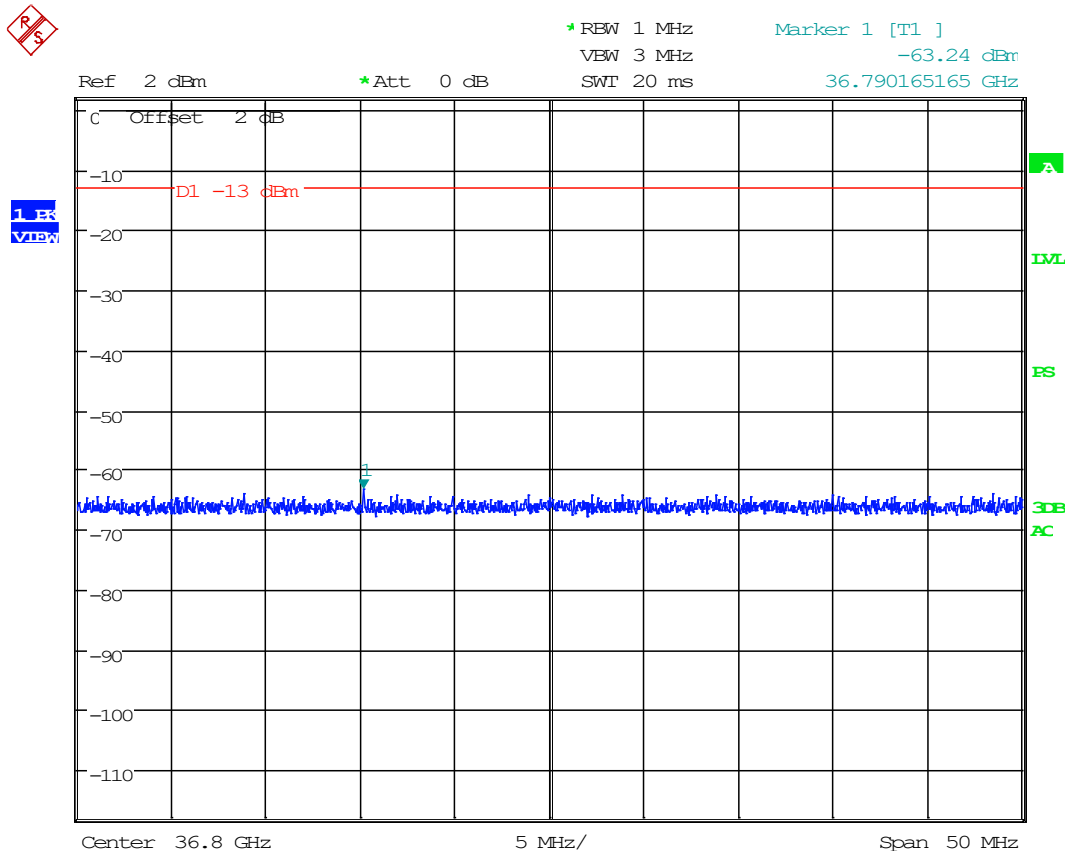
Test Data: 9.2 GHz, 3<sup>rd</sup> Harmonic



Date: 7.AUG.2020 12:57:49

## UNWANTED SPURIOUS EMISSIONS

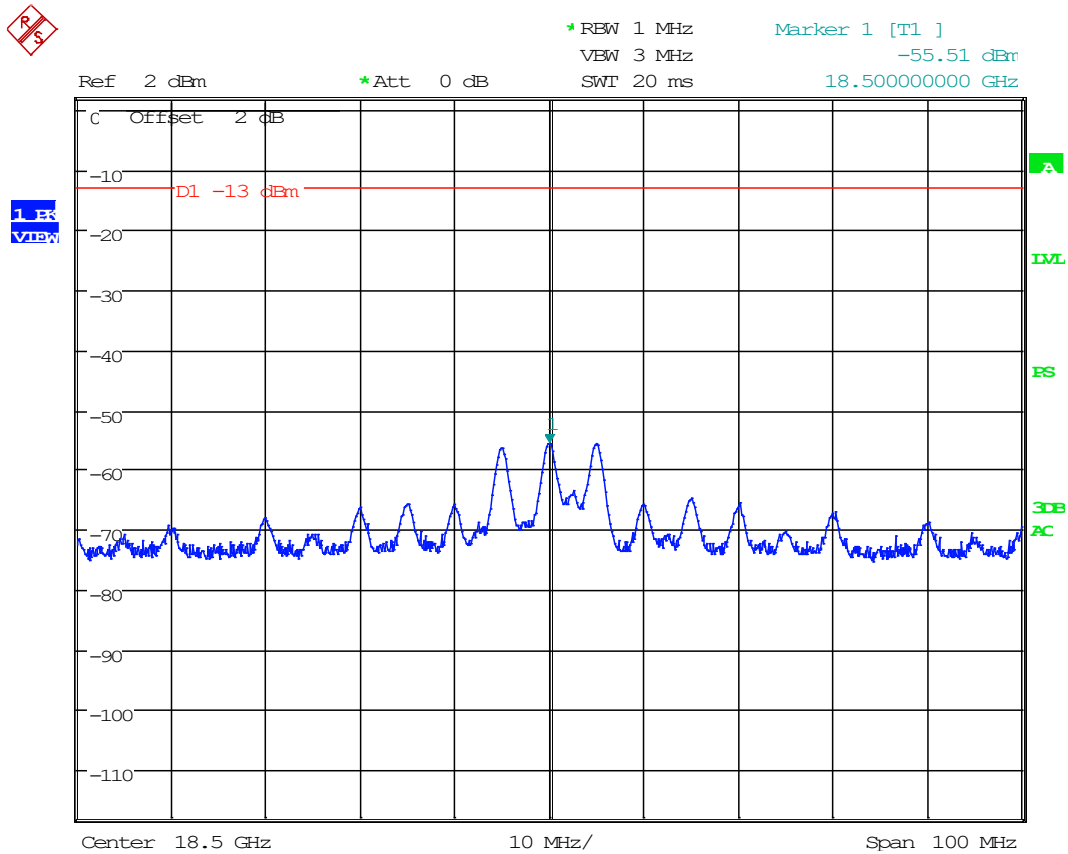
Test Data: 9.2 GHz, 4<sup>th</sup> Harmonic



Date: 7.AUG.2020 12:58:19

## UNWANTED SPURIOUS EMISSIONS

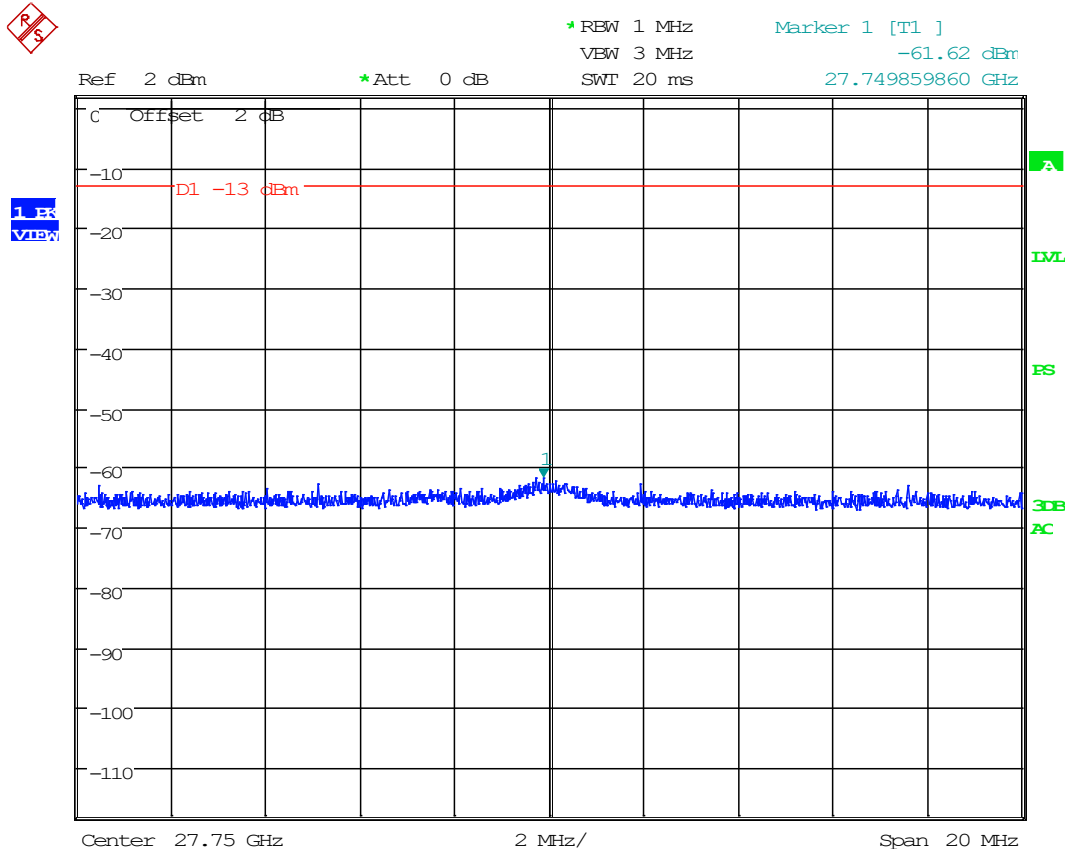
Test Data: 9.25 GHz, 2<sup>nd</sup> Harmonic



Date: 7.AUG.2020 12:54:44

## UNWANTED SPURIOUS EMISSIONS

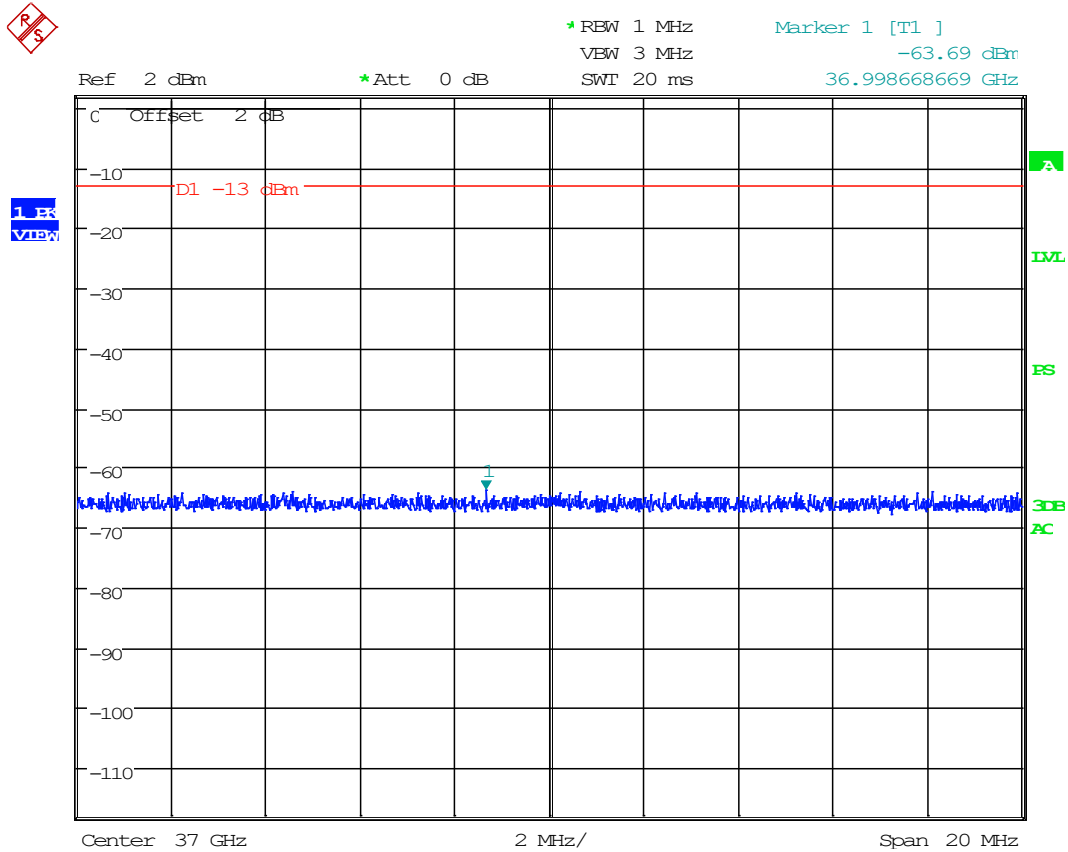
Test Data: 9.25 GHz, 3<sup>rd</sup> Harmonic



Date: 7.AUG.2020 12:55:34

## UNWANTED SPURIOUS EMISSIONS

Test Data: 9.25 GHz, 4<sup>th</sup> Harmonic

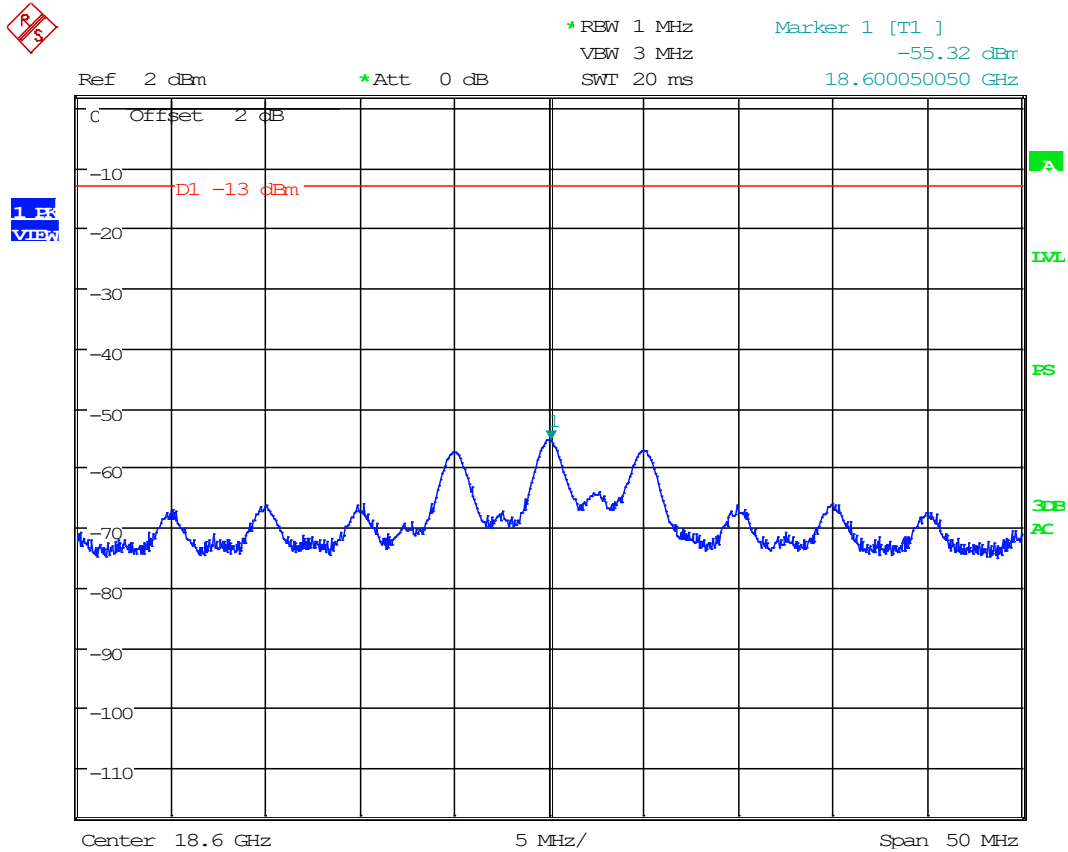


Date: 7.AUG.2020 12:56:06



## UNWANTED SPURIOUS EMISSIONS

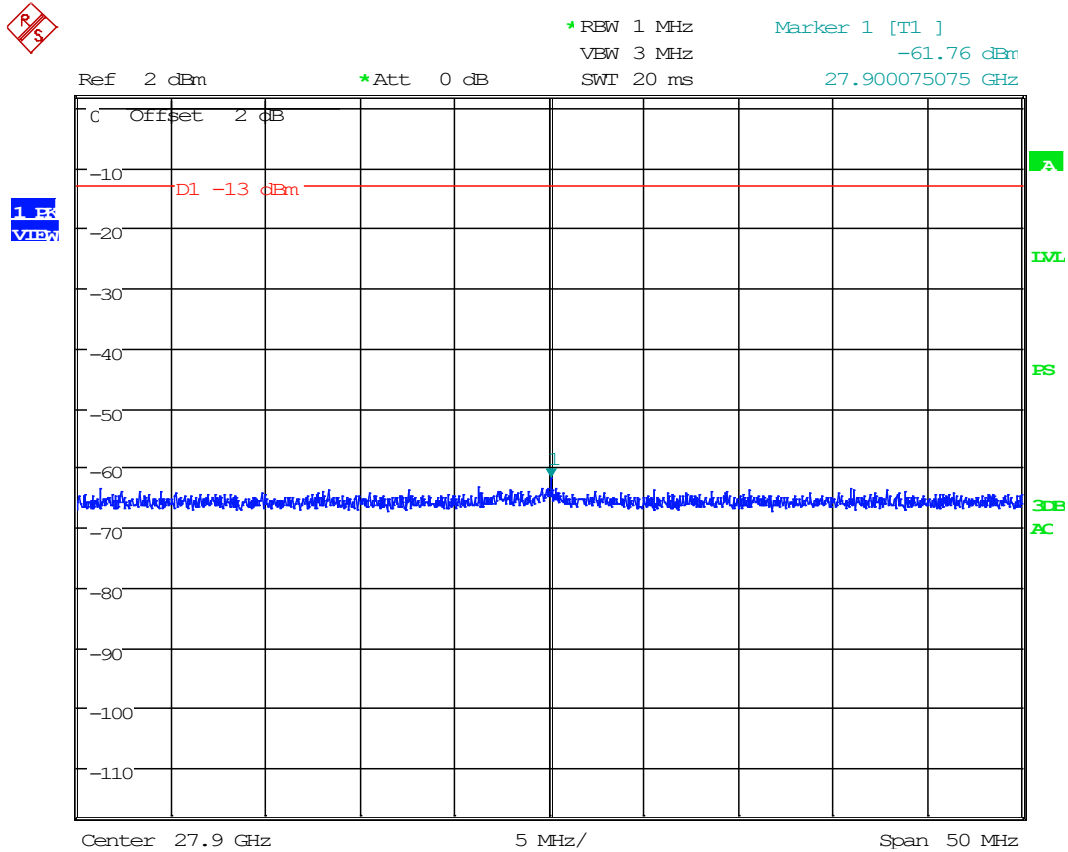
Test Data: 9.3 GHz, 2<sup>nd</sup> Harmonic



Date: 7.AUG.2020 12:59:35

## UNWANTED SPURIOUS EMISSIONS

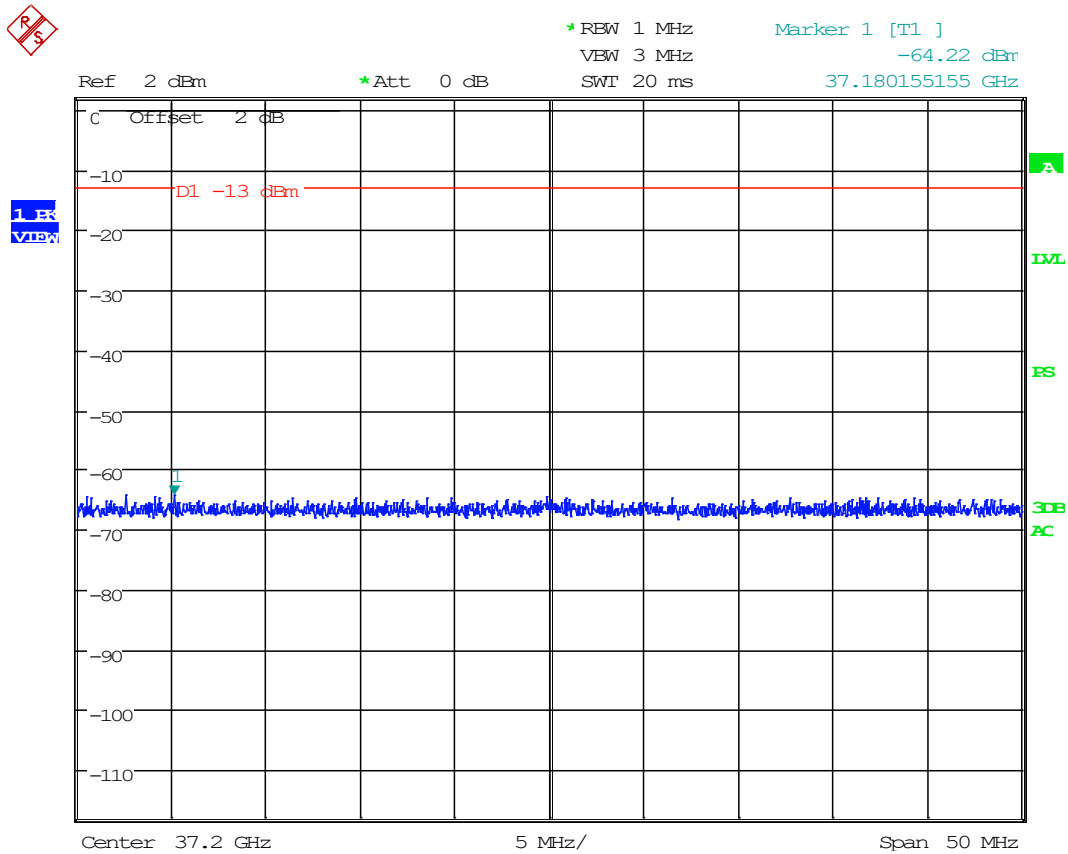
Test Data: 9.3 GHz, 3<sup>rd</sup> Harmonic



Date: 7.AUG.2020 13:00:11

## UNWANTED SPURIOUS EMISSIONS

Test Data: 9.3 GHz, 4<sup>th</sup> Harmonic



Date: 7.AUG.2020 13:00:41

## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Part No.:** Part 2.1053(a), 2.1057(a)(1), 80.211(f)(3)

### Requirements:

#### **§2.1053 Measurements required: Field strength of spurious radiation.**

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

#### **§2.1057 Frequency spectrum to be investigated.**

(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

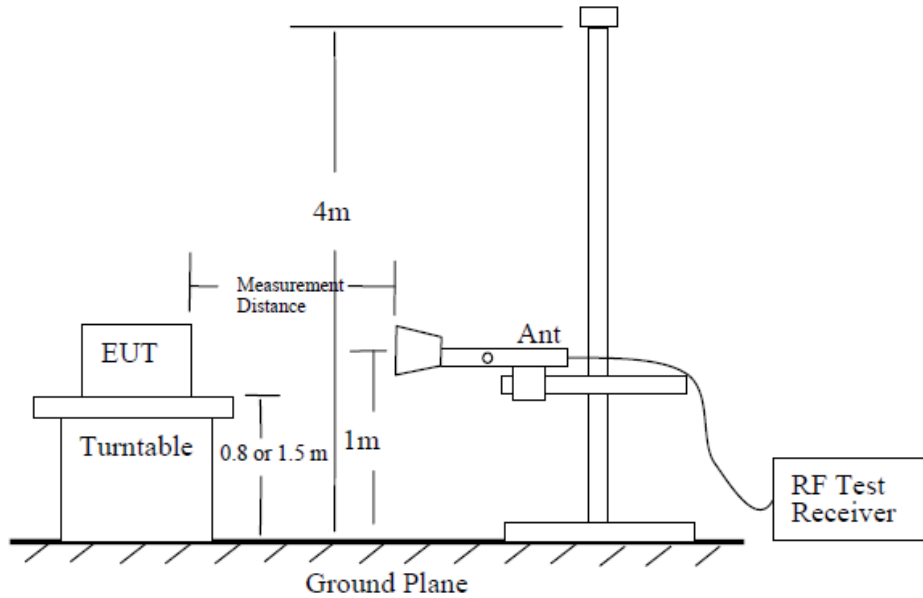
(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus  $10\log_{10}$  (mean power in watts) dB.

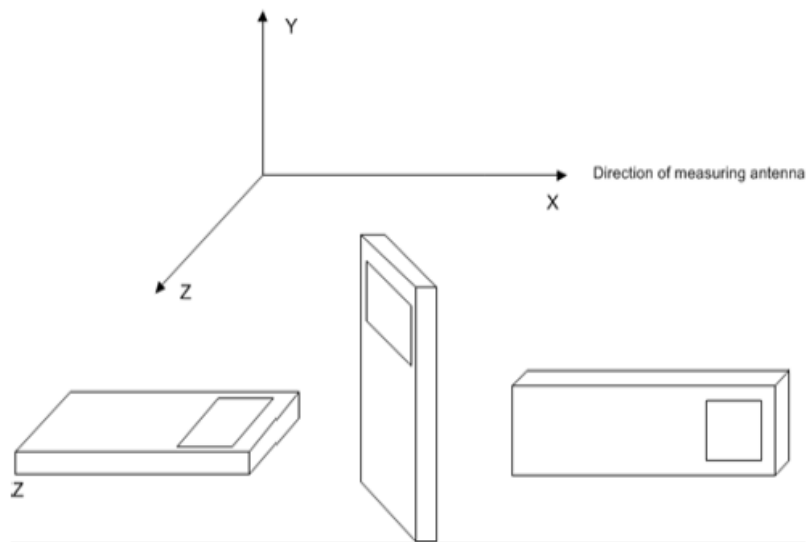
## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Test Procedure:** ANSI C63.26, 5.5.4; ITU-R M.1177-4, ANNEX 1

**Test Site Setup:**



**EUT Orientation(s):**



## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Test Data: 9.2 GHz, Radiated Spurious Emissions**

| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Antenna Polarity | Distance (m) | Field Strength (dBμV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 9200.00               | 43.87                    | PK       | V                | 3.00         | 37.46                   | -59.92    | -13.00               | 46.92       |
| 9200.00               | 103.71                   | PK       | H                | 3.00         | 30.29                   | -67.08    | -13.00               | 54.08       |
| 9200.00               | 180.28                   | PK       | H                | 3.00         | 42.53                   | -54.84    | -13.00               | 41.84       |
| 9200.00               | 180.28                   | PK       | V                | 3.00         | 42.39                   | -54.98    | -13.00               | 41.98       |
| 9200.00               | 291.52                   | PK       | V                | 3.00         | 41.38                   | -56.00    | -13.00               | 43.00       |
| 9200.00               | 296.64                   | PK       | H                | 3.00         | 39.12                   | -58.26    | -13.00               | 45.26       |
| 9200.00               | 423.36                   | PK       | V                | 3.00         | 50.44                   | -46.93    | -13.00               | 33.93       |
| 9200.00               | 428.48                   | PK       | H                | 3.00         | 44.48                   | -52.89    | -13.00               | 39.89       |
| 9200.00               | 504.64                   | PK       | V                | 3.00         | 47.54                   | -49.84    | -13.00               | 36.84       |
| 9200.00               | 674.88                   | PK       | H                | 3.00         | 53.28                   | -44.10    | -13.00               | 31.10       |
| 9200.00               | 992.96                   | PK       | H                | 3.00         | 57.16                   | -40.22    | -13.00               | 27.22       |
| 9200.00               | 998.08                   | PK       | V                | 3.00         | 57.94                   | -39.44    | -13.00               | 26.44       |
| 9200.00               | 1046.50                  | PK       | H                | 3.00         | 48.55                   | -48.83    | -20.00               | 28.83       |
| 9200.00               | 1137.50                  | PK       | V                | 3.00         | 48.78                   | -48.60    | -20.00               | 28.60       |
| 9200.00               | 1409.75                  | PK       | H                | 3.00         | 48.98                   | -48.40    | -20.00               | 28.40       |
| 9200.00               | 1416.25                  | PK       | V                | 3.00         | 48.27                   | -49.11    | -20.00               | 29.11       |
| 9200.00               | 1955.50                  | PK       | H                | 3.00         | 47.65                   | -49.73    | -20.00               | 29.73       |
| 9200.00               | 1957.25                  | PK       | V                | 3.00         | 48.53                   | -48.85    | -20.00               | 28.85       |
| 9200.00               | 2617.75                  | PK       | H                | 3.00         | 45.51                   | -51.87    | -20.00               | 31.87       |
| 9200.00               | 2626.25                  | PK       | V                | 3.00         | 45.30                   | -52.08    | -20.00               | 32.08       |
| 9200.00               | 3583.75                  | PK       | H                | 3.00         | 44.41                   | -52.97    | -20.00               | 32.97       |
| 9200.00               | 3589.50                  | PK       | V                | 3.00         | 44.96                   | -52.42    | -20.00               | 32.42       |
| 9200.00               | 5030.75                  | PK       | V                | 3.00         | 41.96                   | -55.42    | -20.00               | 35.42       |
| 9200.00               | 5556.75                  | PK       | H                | 3.00         | 41.63                   | -55.75    | -20.00               | 35.75       |
| 9200.00               | 6724.00                  | PK       | H                | 3.00         | 42.60                   | -54.78    | -20.00               | 34.78       |
| 9200.00               | 7133.50                  | PK       | V                | 3.00         | 41.97                   | -55.41    | -20.00               | 35.41       |
| 9200.00               | 11271.50                 | PK       | H                | 3.00         | 42.91                   | -54.47    | -20.00               | 34.47       |
| 9200.00               | 11692.75                 | PK       | V                | 3.00         | 43.04                   | -54.34    | -20.00               | 34.34       |
| 9200.00               | 18400.00                 | PK       | H                | 3.00         | 37.14                   | -60.24    | -20.00               | 40.24       |
| 9200.00               | 18400.00                 | PK       | V                | 3.00         | 35.67                   | -61.71    | -20.00               | 41.71       |
| 9200.00               | 27600.00                 | PK       | H                | 3.00         | 35.12                   | -62.26    | -20.00               | 42.26       |
| 9200.00               | 27600.00                 | PK       | V                | 3.00         | 32.19                   | -65.19    | -20.00               | 45.19       |
| 9200.00               | 36800.00                 | PK       | H                | 3.00         | 30.95                   | -66.43    | -20.00               | 46.43       |
| 9200.00               | 36800.00                 | PK       | V                | 3.00         | 28.45                   | -68.93    | -20.00               | 48.93       |

## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Test Data: 9.25 GHz, Radiated Spurious Emissions**

| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Antenna Polarity | Distance (m) | Field Strength (dBμV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 9250.00               | 43.87                    | PK       | V                | 3.00         | 37.26                   | -60.12    | -13.00               | 47.12       |
| 9250.00               | 103.71                   | PK       | H                | 3.00         | 32.58                   | -64.79    | -13.00               | 51.79       |
| 9250.00               | 180.28                   | PK       | V                | 3.00         | 43.70                   | -53.67    | -13.00               | 40.67       |
| 9250.00               | 180.42                   | PK       | H                | 3.00         | 40.10                   | -57.28    | -13.00               | 44.28       |
| 9250.00               | 264.00                   | PK       | V                | 3.00         | 40.10                   | -57.27    | -13.00               | 44.27       |
| 9250.00               | 307.52                   | PK       | H                | 3.00         | 41.37                   | -56.01    | -13.00               | 43.01       |
| 9250.00               | 369.60                   | PK       | V                | 3.00         | 45.48                   | -51.89    | -13.00               | 38.89       |
| 9250.00               | 420.16                   | PK       | H                | 3.00         | 43.89                   | -53.48    | -13.00               | 40.48       |
| 9250.00               | 422.08                   | PK       | V                | 3.00         | 49.80                   | -47.57    | -13.00               | 34.57       |
| 9250.00               | 674.88                   | PK       | H                | 3.00         | 51.85                   | -45.53    | -13.00               | 32.53       |
| 9250.00               | 837.44                   | PK       | V                | 3.00         | 54.81                   | -42.57    | -13.00               | 29.57       |
| 9250.00               | 962.24                   | PK       | H                | 3.00         | 55.82                   | -41.55    | -13.00               | 28.55       |
| 9250.00               | 1226.00                  | PK       | H                | 3.00         | 49.38                   | -48.00    | -20.00               | 28.00       |
| 9250.00               | 1339.00                  | PK       | V                | 3.00         | 48.64                   | -48.74    | -20.00               | 28.74       |
| 9250.00               | 1399.00                  | PK       | H                | 3.00         | 47.90                   | -49.48    | -20.00               | 29.48       |
| 9250.00               | 1866.75                  | PK       | V                | 3.00         | 48.62                   | -48.76    | -20.00               | 28.76       |
| 9250.00               | 1930.75                  | PK       | V                | 3.00         | 46.99                   | -50.39    | -20.00               | 30.39       |
| 9250.00               | 1962.75                  | PK       | H                | 3.00         | 47.71                   | -49.67    | -20.00               | 29.67       |
| 9250.00               | 2708.50                  | PK       | H                | 3.00         | 45.56                   | -51.82    | -20.00               | 31.82       |
| 9250.00               | 2720.50                  | PK       | V                | 3.00         | 45.39                   | -51.99    | -20.00               | 31.99       |
| 9250.00               | 3570.75                  | PK       | H                | 3.00         | 44.16                   | -53.22    | -20.00               | 33.22       |
| 9250.00               | 3584.25                  | PK       | V                | 3.00         | 44.15                   | -53.23    | -20.00               | 33.23       |
| 9250.00               | 4925.50                  | PK       | V                | 3.00         | 41.96                   | -55.42    | -20.00               | 35.42       |
| 9250.00               | 5176.25                  | PK       | H                | 3.00         | 42.56                   | -54.82    | -20.00               | 34.82       |
| 9250.00               | 7009.75                  | PK       | H                | 3.00         | 41.10                   | -56.28    | -20.00               | 36.28       |
| 9250.00               | 7044.00                  | PK       | V                | 3.00         | 41.38                   | -56.00    | -20.00               | 36.00       |
| 9250.00               | 11427.00                 | PK       | V                | 3.00         | 42.17                   | -55.21    | -20.00               | 35.21       |
| 9250.00               | 11847.75                 | PK       | H                | 3.00         | 41.76                   | -55.62    | -20.00               | 35.62       |
| 9250.00               | 18500.00                 | PK       | H                | 3.00         | 36.89                   | -60.49    | -20.00               | 40.49       |
| 9250.00               | 18500.00                 | PK       | V                | 3.00         | 35.56                   | -61.82    | -20.00               | 41.82       |
| 9250.00               | 27750.00                 | PK       | H                | 3.00         | 35.44                   | -61.94    | -20.00               | 41.94       |
| 9250.00               | 27750.00                 | PK       | V                | 3.00         | 32.48                   | -64.90    | -20.00               | 44.90       |
| 9250.00               | 37000.00                 | PK       | H                | 3.00         | 31.46                   | -65.92    | -20.00               | 45.92       |
| 9250.00               | 37000.00                 | PK       | V                | 3.00         | 29.37                   | -68.01    | -20.00               | 48.01       |

## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Test Data: 9.3 GHz, Radiated Spurious Emissions**

| Tuned Frequency (MHz) | Emission Frequency (MHz) | Detector | Antenna Polarity | Distance (m) | Field Strength (dBμV/m) | ERP (dBm) | Spurious Limit (dBm) | Margin (dB) |
|-----------------------|--------------------------|----------|------------------|--------------|-------------------------|-----------|----------------------|-------------|
| 9300.00               | 43.87                    | PK       | V                | 3.00         | 37.48                   | -59.90    | -13.00               | 46.90       |
| 9300.00               | 103.71                   | PK       | H                | 3.00         | 32.03                   | -65.34    | -13.00               | 52.34       |
| 9300.00               | 103.71                   | PK       | V                | 3.00         | 37.26                   | -60.11    | -13.00               | 47.11       |
| 9300.00               | 180.42                   | PK       | H                | 3.00         | 37.99                   | -59.39    | -13.00               | 46.39       |
| 9300.00               | 180.42                   | PK       | V                | 3.00         | 40.73                   | -56.65    | -13.00               | 43.65       |
| 9300.00               | 303.68                   | PK       | H                | 3.00         | 40.67                   | -56.71    | -13.00               | 43.71       |
| 9300.00               | 369.60                   | PK       | V                | 3.00         | 45.00                   | -52.37    | -13.00               | 39.37       |
| 9300.00               | 418.24                   | PK       | V                | 3.00         | 49.74                   | -47.63    | -13.00               | 34.63       |
| 9300.00               | 424.00                   | PK       | H                | 3.00         | 44.87                   | -52.51    | -13.00               | 39.51       |
| 9300.00               | 504.64                   | PK       | V                | 3.00         | 47.13                   | -50.25    | -13.00               | 37.25       |
| 9300.00               | 674.88                   | PK       | H                | 3.00         | 52.57                   | -44.81    | -13.00               | 31.81       |
| 9300.00               | 847.04                   | PK       | V                | 3.00         | 55.86                   | -41.52    | -13.00               | 28.52       |
| 9300.00               | 993.60                   | PK       | H                | 3.00         | 56.61                   | -40.76    | -13.00               | 27.76       |
| 9300.00               | 1022.00                  | PK       | H                | 3.00         | 48.77                   | -48.61    | -20.00               | 28.61       |
| 9300.00               | 1218.00                  | PK       | V                | 3.00         | 50.05                   | -47.33    | -20.00               | 27.33       |
| 9300.00               | 1399.25                  | PK       | H                | 3.00         | 47.98                   | -49.40    | -20.00               | 29.40       |
| 9300.00               | 1858.25                  | PK       | V                | 3.00         | 48.06                   | -49.32    | -20.00               | 29.32       |
| 9300.00               | 1960.25                  | PK       | H                | 3.00         | 48.09                   | -49.29    | -20.00               | 29.29       |
| 9300.00               | 1967.50                  | PK       | V                | 3.00         | 47.87                   | -49.51    | -20.00               | 29.51       |
| 9300.00               | 2612.50                  | PK       | V                | 3.00         | 44.75                   | -52.63    | -20.00               | 32.63       |
| 9300.00               | 2707.00                  | PK       | H                | 3.00         | 46.29                   | -51.09    | -20.00               | 31.09       |
| 9300.00               | 3537.50                  | PK       | H                | 3.00         | 43.42                   | -53.96    | -20.00               | 33.96       |
| 9300.00               | 3595.00                  | PK       | V                | 3.00         | 43.56                   | -53.82    | -20.00               | 33.82       |
| 9300.00               | 4955.25                  | PK       | H                | 3.00         | 41.48                   | -55.90    | -20.00               | 35.90       |
| 9300.00               | 5161.00                  | PK       | V                | 3.00         | 41.87                   | -55.51    | -20.00               | 35.51       |
| 9300.00               | 6743.00                  | PK       | V                | 3.00         | 40.83                   | -56.55    | -20.00               | 36.55       |
| 9300.00               | 7251.50                  | PK       | H                | 3.00         | 41.47                   | -55.91    | -20.00               | 35.91       |
| 9300.00               | 11275.00                 | PK       | V                | 3.00         | 42.86                   | -54.52    | -20.00               | 34.52       |
| 9300.00               | 11302.00                 | PK       | H                | 3.00         | 43.23                   | -54.15    | -20.00               | 34.15       |
| 9300.00               | 18600.00                 | PK       | V                | 3.00         | 36.27                   | -61.11    | -20.00               | 41.11       |
| 9300.00               | 18600.00                 | PK       | V                | 3.00         | 35.59                   | -61.79    | -20.00               | 41.79       |
| 9300.00               | 27900.00                 | PK       | V                | 3.00         | 35.41                   | -61.97    | -20.00               | 41.97       |
| 9300.00               | 27900.00                 | PK       | V                | 3.00         | 32.48                   | -64.90    | -20.00               | 44.90       |
| 9300.00               | 37200.00                 | PK       | V                | 3.00         | 30.84                   | -66.54    | -20.00               | 46.54       |
| 9300.00               | 37200.00                 | PK       | V                | 3.00         | 29.18                   | -68.20    | -20.00               | 48.20       |



## FREQUENCY STABILITY

**Rule Part No.:** Part 2.1055(a)(2), 80.209(b), 80.213(g)

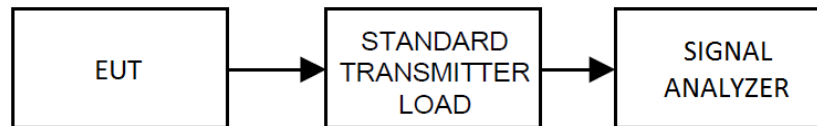
**§80.209 Transmitter frequency tolerances.**

(b) When pulse modulation is used in land and ship radar stations operating in the bands above 2.4 GHz the frequency at which maximum emission occurs must be within the authorized bandwidth and must not be closer than  $1.5/T$  MHz to the upper and lower limits of the authorized bandwidth where "T" is the pulse duration in microseconds. In the band 14.00-14.05 GHz the center frequency must not vary more than 10 MHz from 14.025 GHz.

(g) Radar stations operating in the bands above 2.4 GHz may use any type of modulation consistent with the bandwidth requirements in §80.209(b).

**Test Procedure:** TIA 603-E, 2.2.2

**Test Setup Block Diagram:**



**Note:** This EUT does not incorporate a transmitter, and only re-transmits its received signal. Therefore, Frequency Stability is not applicable to this test item.

## STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16-4 or EN TR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: “Uncertainty in EMC Measurements” and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

| Parameters                           | Measurement Uncertainty |
|--------------------------------------|-------------------------|
| CONDUCTED POWER MEASUREMENT          | $\pm 0.643$ dB          |
| CONDUCTED EMISSIONS 9 kHz – 150 kHz  | $\pm 3.14$ dB           |
| CONDUCTED EMISSIONS 150 kHz – 30 MHz | $\pm 3.08$ dB           |
| RADIATED EMISSIONS 30 MHz – 200 MHz  | $\pm 2.16$ dB           |
| RADIATED EMISSIONS 200 MHz – 1 GHz   | $\pm 2.15$ dB           |
| RADIATED EMISSIONS 1 GHz – 18 GHz    | $\pm 2.14$ dB           |
| RADIATED EMISSIONS 18 GHz – 40 GHz   | $\pm 2.31$ dB           |

**Notes:** (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=1.96$ .

## EMC EQUIPMENT LIST

| Device                                                                | Manufacturer    | Model                              | SN                                           | Calibrati<br>on Date | Cal Due<br>Date |
|-----------------------------------------------------------------------|-----------------|------------------------------------|----------------------------------------------|----------------------|-----------------|
| EMI Test Receiver R & S ESU 40<br>firmware v 4.43 SP 3 BIOS v5.1-24-3 | Rohde & Schwarz | ESU 40                             | 100320                                       | 08/28/18             | 08/28/20        |
| Software: Field Strength Program                                      | Timco           | N/A                                | Version 4.10.7.0                             | N/A                  | N/A             |
| Coaxial Cable - Chamber 3 cable set (backup)                          | Micro-Coax      | Chamber<br>3 cable set<br>(backup) | KMKM-0244-02<br>KMKM-0670-01<br>KFKF-0197-00 | 02/27/19             | 02/27/21        |
| CHAMBER                                                               | Panashield      | 3M                                 | N/A                                          | 03/15/19             | 03/15/21        |
| Antenna: Active Loop                                                  | ETS-Lindgren    | 6502                               | 00062529                                     | 12/11/17             | 12/11/20        |
| Antenna: Biconical 1057                                               | Eaton           | 94455-1                            | 1057                                         | 12/13/17             | 12/13/20        |
| Antenna: Log-Periodic 1243                                            | Electro-Metrics | 96005                              | 1243                                         | 04/20/18             | 04/20/21        |
| Ant: Double-Ridged Horn/ETS Horn 1                                    | ETS-Lindgren    | 3117                               | 00035923                                     | 02/25/20             | 02/25/23        |

**END OF REPORT**