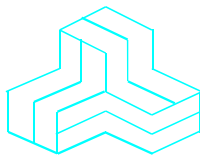


# ENGINEERING TEST REPORT



**MOBEXCOM DVR Vehicular Repeater**  
**Model: MOBEXCOM DVR 700**

**FCC ID: LO6-DVRS700**

*Applicant:*

**Futurecom Systems Group, ULC**  
3277 Langstaff Road  
Concord, Ontario  
Canada, L4K 5P8

***Tested in Accordance With***

**Federal Communications Commission (FCC)**  
**47 CFR, Parts 2 and 90 (Subpart R)**

**UltraTech's File No.: 18FSG176\_FCC90R**

This Test report is Issued under the Authority of  
Tri M. Luu  
Vice President of Engineering  
UltraTech Group of Labs

Date: October 18, 2018

Report Prepared by: Dan Huynh

Tested by: Nimisha Desai

Issued Date: October 18, 2018

Test Dates: August 8 - September 25, 2018

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by any agency of the US Government.*
- *This test report shall not be reproduced, except in full, without a written approval from UltraTech*

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APEC TEL CA0001



1309



CA 0001/2049



AT-1945



SL2-IN-E-1119R



Korea KCC-RRA  
CA2049

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File #: 18FSG176 FCC90R  
October 18, 2018

*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

|                  |                                                                            |
|------------------|----------------------------------------------------------------------------|
| Reference:       | FCC Parts 2 and 90 (Subpart R)                                             |
| Title:           | Code of Federal Regulations (CFR) Title 47 Telecommunication, Parts 2 & 90 |
| Purpose of Test: | To gain FCC Equipment Authorization for Radio operating in Part 90.        |
| Test Procedures: | ANSI/TIA-603-E, ANSI C63.26                                                |

### 1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

### 1.3. NORMATIVE REFERENCES

| Publication                | Year | Title                                                                                                                                                               |
|----------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC CFR Parts 0-19, 80-End | 2018 | Code of Federal Regulations, Title 47 – Telecommunication                                                                                                           |
| ANSI C63.4                 | 2014 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz |
| ANSI C63.26                | 2015 | American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services                                                                   |
| ANSI/TIA-603-E             | 2016 | Land Mobile FM or PM Communications Equipment Measurement and Performance Standards                                                                                 |

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## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

| Applicant              |                                                                                                               |
|------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Name:</b>           | Futurecom Systems Group, ULC                                                                                  |
| <b>Address:</b>        | 3277 Langstaff Road<br>Concord, ON<br>Canada L4K 5P8                                                          |
| <b>Contact Person:</b> | Mr. Tony Bombera<br>Phone #: 905 532 1114<br>Fax #: 905 660 6858<br>Email Address: tony.bombera@futurecom.com |

| Manufacturer           |                                                                                                               |
|------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Name:</b>           | Futurecom Systems Group, ULC                                                                                  |
| <b>Address:</b>        | 3277 Langstaff Road<br>Concord, ON<br>Canada L4K 5P8                                                          |
| <b>Contact Person:</b> | Mr. Tony Bombera<br>Phone #: 905 532 1114<br>Fax #: 905 660 6858<br>Email Address: tony.bombera@futurecom.com |

### 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

|                                             |                                                                                                                                                                                                                                                            |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Brand Name:</b>                          | Futurecom Systems Group, ULC                                                                                                                                                                                                                               |
| <b>Product Name:</b>                        | MOBEXCOM DVR Vehicular Repeater                                                                                                                                                                                                                            |
| <b>Model Name or Number:</b>                | MOBEXCOM DVR 700                                                                                                                                                                                                                                           |
| <b>Serial Number:</b>                       | Preproduction                                                                                                                                                                                                                                              |
| <b>Type of Equipment:</b>                   | Licensed Non-Broadcast Station Transmitter                                                                                                                                                                                                                 |
| <b>Power Supply Requirement:</b>            | 13.8 VDC                                                                                                                                                                                                                                                   |
| <b>Transmitting/Receiving Antenna Type:</b> | Non-integral                                                                                                                                                                                                                                               |
| <b>Operational Description:</b>             | The Futurecom MOBEXCOM DVR Vehicular Repeater is designed to interface to a range of mobile radios. It permits expanded operation of portable radios. The MOBEXCOM DVR Vehicular Repeater communicates with the mobile radio using a serial data protocol. |

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## 2.3. EUT'S TECHNICAL SPECIFICATIONS

| Transmitter                     |                                                                                                                                                                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment Type:                 | Mobile                                                                                                                                                                                                                                            |
| Intended Operating Environment: | [ x ] Commercial<br>[ x ] Light Industry & Heavy Industry                                                                                                                                                                                         |
| Power Supply Requirement:       | 13.8 Vdc                                                                                                                                                                                                                                          |
| RF Output Power Rating:         | 1 to 20 W                                                                                                                                                                                                                                         |
| Operating Frequency Range:      | 764-776 MHz, 794-806 MHz                                                                                                                                                                                                                          |
| RF Output Impedance:            | 50 Ohms                                                                                                                                                                                                                                           |
| Channel Spacing:                | 12.5 kHz & 25.0 kHz                                                                                                                                                                                                                               |
| Emission Designation:           | 11K0F3E, 16K0F3E, 7K30F1E, 8K10F1E                                                                                                                                                                                                                |
| Oscillator Frequencies:         | Digital signal frequencies:<br>32.768 kHz, 16.0 MHz, 29.4912 MHz, 144.0 MHz and 120 MHz<br><br>Analogue signal frequency:<br>LO1: Rx Freq - 109.65 MHz (Rx), LO2: 107.85 MHz & LO3: Tx Freq + 110.51875 MHz<br><br>Reference Oscillator: 14.4 MHz |
| Antenna Connector Type:         | TNC female                                                                                                                                                                                                                                        |

## 2.4. LIST OF EUT'S PORTS

| Port Number | EUT's Port Description | Number of Identical Ports | Connector Type       | Cable Type (Shielded/Non-shielded) |
|-------------|------------------------|---------------------------|----------------------|------------------------------------|
| 1           | DC Input Port          | 1                         | Jack                 | Non-shielded                       |
| 2           | RF IN/OUT Port         | 2                         | TNC                  | Shielded                           |
| 3           | RS-232 Port            | 1                         | 9 pin male circular  | Non-shielded                       |
| 4           | Mobile Radio Port      | 1                         | 20 pin male circular | Non-shielded                       |
| 5           | USB*                   | 1                         | USB                  | Shielded                           |

\* The USB port is a service port. It is only used during configuration/programming.

## 2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

None.

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### EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

#### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

|                     |                |
|---------------------|----------------|
| Temperature:        | 21° C to 24° C |
| Humidity:           | 45 to 51%      |
| Pressure:           | 102 kPa        |
| Power input source: | 13.8 VDC       |

#### 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

|                                  |                                                                                                                          |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Operating Modes:</b>          | The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data. |
| <b>Special Test Software:</b>    | Operating software provided by Futurecom for selecting operating channel frequency and power                             |
| <b>Special Hardware Used:</b>    | N/A                                                                                                                      |
| <b>Transmitter Test Antenna:</b> | The EUT is tested with the transmitter antenna port terminated to a 50 $\Omega$ RF Load.                                 |

| Transmitter Test Signals                                                                                                                                                                                          |                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Frequency Band(s):</b>                                                                                                                                                                                         | <ul style="list-style-type: none"><li>764-776 MHz</li><li>794-806 MHz</li></ul>                                   |
| <b>Frequency(ies) Tested:</b><br>(near top, near middle and near bottom in the frequency range of operation.)                                                                                                     | <ul style="list-style-type: none"><li>764 MHz, 770 MHz and 775 MHz</li><li>794 MHz, 800 MHz and 805 MHz</li></ul> |
| <b>Transmitter Wanted Output Test Signals:</b> <ul style="list-style-type: none"><li>RF Power Output (measured maximum output power):</li><li>Normal Test Modulation:</li><li>Modulating signal source:</li></ul> | <p>20 W</p> <p>FM Data &amp; Voice</p> <p>external</p>                                                            |

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## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with ANAB File No.: AT-1945.

### 4.2. APPLICABILITY & SUMMARY OF EMISSION TEST RESULTS

| FCC Section(s)                     | Test Requirements                                        | Applicability (Yes/No) |
|------------------------------------|----------------------------------------------------------|------------------------|
| 90.541 & 2.1046                    | RF Power Output                                          | Yes                    |
| 1.1307, 1.1310,<br>2.1091 & 2.1093 | RF Exposure Limit                                        | N/A                    |
| 90.539 & 2.1055                    | Frequency Stability                                      | Yes                    |
| 2.1047(a)                          | Audio Frequency Response                                 | N/A                    |
| 2.1047(b)                          | Modulation Limiting                                      | N/A                    |
| 2.1049                             | Occupied Bandwidth                                       | N/A                    |
| 90.543(a)                          | Adjacent Channel Power                                   | Yes                    |
| 90.543(c), 2.1057 &<br>2.1051      | Emission Limits - Spurious Emissions at Antenna Terminal | Yes                    |
| 90.543(c), 2.1057 &<br>2.1053      | Emission Limits - Field Strength of Spurious Emissions   | Yes                    |

### 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

### 4.4. DEVIATION OF STANDARD TEST PROCEDURES

None.

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## EXHIBIT 5. TEST DATA

### 5.1. RF POWER OUTPUT [§§ 2.1046 & 90.541]

#### 5.1.1. Limits

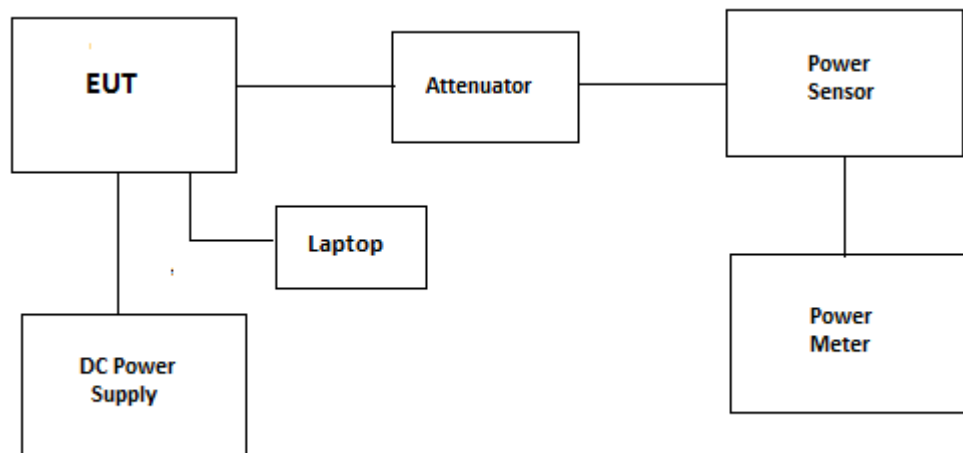
The transmitting power and antenna height of base, mobile, portable and control stations operating in the 769-775 MHz and 799-805 MHz frequency bands must not exceed the maximum limits in this section. Power limits are listed in effective radiated power (ERP).

- (a) The transmitting power and antenna height of base stations must not exceed the limits given in paragraph (a) of §90.635.
- (b) The transmitting power of a control station must not exceed 200 watts ERP.
- (c) The transmitting power of a mobile unit must not exceed 100 watts ERP.
- (d) The transmitting power of a portable (hand-held) unit must not exceed 3 watts ERP.
- (e) Transmitters operating on the narrowband low power channels listed in §90.531(b)(3) and (4), must not exceed 2 watts ERP.

#### 5.1.2. Method of Measurements

TIA-603-E, ANSI C63.26

#### 5.1.3. Test Arrangement





#### 5.1.4. Test Data

| Power Setting | Channel Spacing (kHz) | Frequency MHz | Measured Power |       | Power Rating |      |
|---------------|-----------------------|---------------|----------------|-------|--------------|------|
|               |                       |               | (dBm)          | (W)   | (dBm)        | (W)  |
| High<br>20 W  | 12.5                  | 764.000       | 43.12          | 20.51 | 43.01        | 20.0 |
|               |                       | 770.000       | 43.00          | 19.95 | 43.01        | 20.0 |
|               |                       | 775.000       | 43.13          | 20.56 | 43.01        | 20.0 |
|               | 25                    | 764.000       | 43.14          | 20.61 | 43.01        | 20.0 |
|               |                       | 770.000       | 43.01          | 20.00 | 43.01        | 20.0 |
|               |                       | 775.000       | 43.11          | 20.46 | 43.01        | 20.0 |
|               | 12.5                  | 794.000       | 43.04          | 20.14 | 43.01        | 20.0 |
|               |                       | 800.000       | 43.00          | 19.95 | 43.01        | 20.0 |
|               |                       | 805.000       | 42.97          | 19.82 | 43.01        | 20.0 |
|               | 25                    | 794.000       | 43.04          | 20.14 | 43.01        | 20.0 |
|               |                       | 800.000       | 43.02          | 20.04 | 43.01        | 20.0 |
|               |                       | 805.000       | 42.98          | 19.86 | 43.01        | 20.0 |
| Low<br>1W     | 12.5                  | 764.000       | 30.54          | 1.13  | 30.00        | 1.0  |
|               |                       | 770.000       | 30.64          | 1.16  | 30.00        | 1.0  |
|               |                       | 775.000       | 30.70          | 1.17  | 30.00        | 1.0  |
|               | 25                    | 764.000       | 30.54          | 1.13  | 30.00        | 1.0  |
|               |                       | 770.000       | 30.66          | 1.16  | 30.00        | 1.0  |
|               |                       | 775.000       | 30.70          | 1.17  | 30.00        | 1.0  |
|               | 12.5                  | 794.000       | 30.60          | 1.15  | 30.00        | 1.0  |
|               |                       | 800.000       | 30.66          | 1.16  | 30.00        | 1.0  |
|               |                       | 805.000       | 30.64          | 1.16  | 30.00        | 1.0  |
|               | 25                    | 794.000       | 30.61          | 1.15  | 30.00        | 1.0  |
|               |                       | 800.000       | 30.65          | 1.16  | 30.00        | 1.0  |
|               |                       | 805.000       | 30.64          | 1.16  | 30.00        | 1.0  |

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### 5.3. FREQUENCY STABILITY [§§ 2.1055 & 90.539]

#### 5.3.1. Limits

##### § 90.539 Frequency Stability

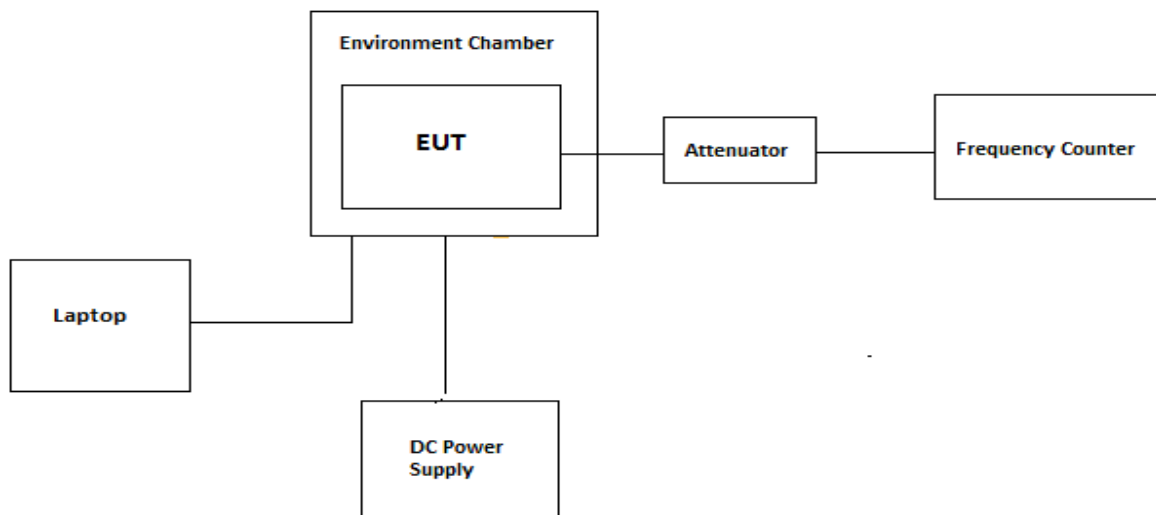
Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the frequency stability requirements in this section.

- (a) Mobile, portable and control transmitters must normally use automatic frequency control (AFC) to lock on to the base station signal.
- (b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.
- (c) The frequency stability of mobile, portable, and control transmitters operating in the narrowband segment must be 400 parts per billion or better when AFC is locked to the base station. When AFC is not locked to the base station, the frequency stability must be at least 1.0 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2 channel aggregate), and 2.5 ppm for 25 kHz (4 channel aggregate).
- (d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better.
- (e) The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

#### 5.3.2. Method of Measurements

FCC 47 CFR 2.1055, TIA-603-E, ANSI C63.26

#### 5.3.3. Test Arrangement



#### 5.3.4. Test Data

|                                    |                                      |                                              |                                               |
|------------------------------------|--------------------------------------|----------------------------------------------|-----------------------------------------------|
| Test Frequency:                    |                                      | 764 MHz                                      |                                               |
| Full Power Level:                  |                                      | 20.51 W                                      |                                               |
| Frequency Tolerance Limit:         |                                      | 1.5 ppm or 1146 Hz                           |                                               |
| Max. Frequency Tolerance Measured: |                                      | -322 Hz (0.42 ppm)                           |                                               |
| Input Voltage Rating:              |                                      | 13.8 VDC (Nominal)                           |                                               |
| Ambient Temperature (°C)           | Frequency Drift (Hz)                 |                                              |                                               |
|                                    | Supply Voltage (Nominal)<br>13.8 VDC | Supply Voltage (85% of Nominal)<br>11.73 VDC | Supply Voltage (115% of Nominal)<br>15.87 VDC |
| -30                                | -308                                 | --                                           | --                                            |
| -20                                | -300                                 | --                                           | --                                            |
| -10                                | -322                                 | --                                           | --                                            |
| 0                                  | -320                                 | --                                           | --                                            |
| +10                                | -296                                 | --                                           | --                                            |
| +20                                | -193                                 | -194                                         | -195                                          |
| +30                                | -97                                  | --                                           | --                                            |
| +40                                | -44                                  | --                                           | --                                            |
| +50                                | 30                                   | --                                           | --                                            |
| +60                                | 45                                   | --                                           | --                                            |

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## 5.5. EMISSION LIMITATIONS [§90.543]

### 5.5.1. Limits

#### § 90.543 Emission Limitations

Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Class A and Class B signal boosters retransmitting signals in the 769-775 MHz and 799-805 MHz frequency bands are exempt from the limits listed in paragraph (a) of this section when simultaneously retransmitting multiple signals and instead shall be subject to the limit listed in paragraph (c) of this section when operating in this manner. Transmitters operating in 758-768 MHz and 788-798 MHz bands must meet the emission limitations in (e) of this section.

- (a) The adjacent channel power (ACP) requirements for transmitters designed for various channel sizes are shown in the following tables. Mobile station requirements apply to handheld, car mounted and control station units. The tables specify a value for the ACP as a function of the displacement from the channel center frequency and measurement bandwidth. In the following tables, "(s)" indicates a swept measurement may be used.

**12.5 kHz Mobile Transmitter ACP Requirements**

| Offset from center frequency (kHz) | Measurement bandwidth (kHz) | Maximum ACP relative (dBc) |
|------------------------------------|-----------------------------|----------------------------|
| 9.375                              | 6.25                        | -40                        |
| 15.625                             | 6.25                        | -60                        |
| 21.875                             | 6.25                        | -60                        |
| 37.50                              | 25.00                       | -60                        |
| 62.50                              | 25.00                       | -65                        |
| 87.50                              | 25.00                       | -65                        |
| 150.00                             | 100                         | -65                        |
| 250.00                             | 100                         | -65                        |
| 350.00                             | 100                         | -65                        |
| >400 to 12 MHz                     | 30 (s)                      | -75                        |
| 12 MHz to paired receive band      | 30 (s)                      | -75                        |
| In the paired receive band         | 30 (s)                      | -100                       |

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### 25 kHz Mobile Transmitter ACP Requirements

| Offset from center frequency (kHz) | Measurement bandwidth (kHz) | Maximum ACP relative (dBc) |
|------------------------------------|-----------------------------|----------------------------|
| 15.625                             | 6.25                        | -40                        |
| 21.875                             | 6.25                        | -60                        |
| 37.50                              | 25                          | -60                        |
| 62.50                              | 25                          | -65                        |
| 87.50                              | 25                          | -65                        |
| 150.00                             | 100                         | -65                        |
| 250.00                             | 100                         | -65                        |
| 350.00                             | 100                         | -65                        |
| >400 kHz to 12 MHz                 | 30 (s)                      | -75                        |
| 12 MHz to paired receive band      | 30 (s)                      | -75                        |
| In the paired receive band         | 30 (s)                      | -100                       |

#### 5.5.2. Method of Measurements

TIA-603-E & ANSI 63.26

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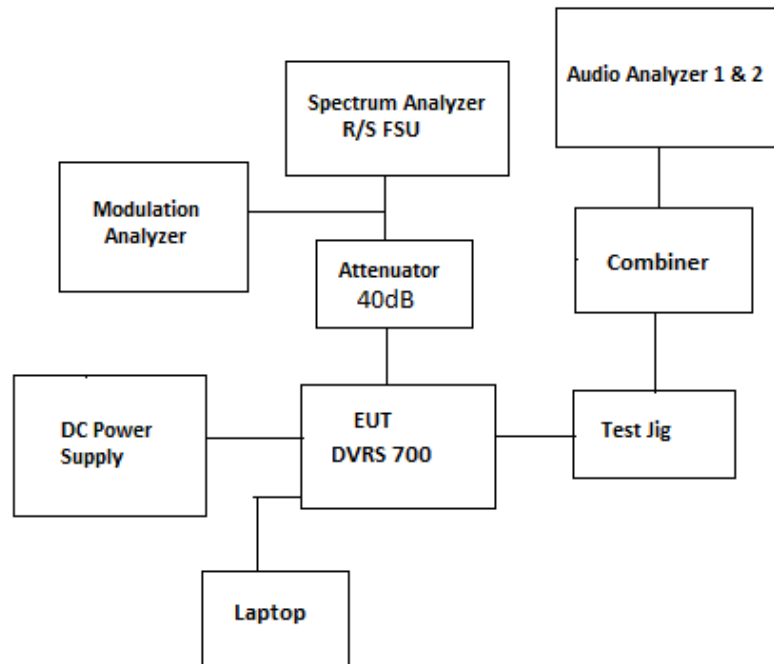
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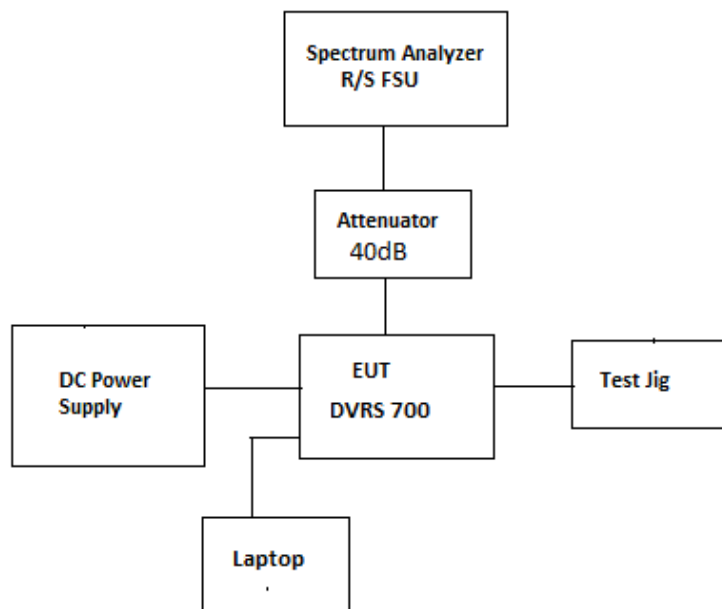
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### 5.5.3. Test Arrangement

#### Analog Test Setup



#### Digital Test Setup



#### 5.5.4. Test Data

| Mode<br>Frequency (MHz)<br>Channel Spacing (kHz) |                    | Analog<br>770<br>12.5 |                 |                 |                            |
|--------------------------------------------------|--------------------|-----------------------|-----------------|-----------------|----------------------------|
| Offset (kHz)                                     | Resolution BW (Hz) | Measurement BW (KHz)  | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 9.375                                            | 100                | 6.25                  | -42.29          | -43.34          | -40                        |
| 15.625                                           | 100                | 6.25                  | -67.77          | -68.27          | -60                        |
| 21.875                                           | 100                | 6.25                  | -70.22          | -70.76          | -60                        |
| 37.5                                             | 300                | 25                    | -67.67          | -67.87          | -60                        |
| 62.5                                             | 300                | 25                    | -70.35          | -70.31          | -65                        |
| 87.5                                             | 300                | 25                    | -72.27          | -75.51          | -65                        |
| 150                                              | 1000               | 100                   | -69.31          | -69.59          | -65                        |
| 250                                              | 1000               | 100                   | -73.56          | -73.4           | -65                        |
| 350                                              | 1000               | 100                   | -75.93          | -75.87          | -65                        |
| 400                                              | 30000              | 30(Swept)             | <-80            | <-80            | -80                        |
| 12M                                              | 30000              | 30(Swept)             | <-80            | <-80            | -80                        |
| In receive band                                  | 30000              | 30(Swept)             | <-100           | <-100           | -100                       |

| Mode<br>Frequency (MHz)<br>Channel Spacing (kHz) |                    | Analog<br>775<br>12.5 |                 |                 |                            |
|--------------------------------------------------|--------------------|-----------------------|-----------------|-----------------|----------------------------|
| Offset (kHz)                                     | Resolution BW (Hz) | Measurement BW (kHz)  | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 9.375                                            | 100                | 6.25                  | -42.05          | -43.68          | -40                        |
| 15.625                                           | 100                | 6.25                  | -68.44          | -68.31          | -60                        |
| 21.875                                           | 100                | 6.25                  | -71.58          | -71.05          | -60                        |
| 37.5                                             | 300                | 25                    | -67.89          | -68.19          | -60                        |
| 62.5                                             | 300                | 25                    | -70.98          | -70.44          | -65                        |
| 87.5                                             | 300                | 25                    | -71.91          | -72.03          | -65                        |
| 150                                              | 1000               | 100                   | -69.29          | -69.39          | -65                        |
| 250                                              | 1000               | 100                   | -73.11          | -73.40          | -65                        |
| 350                                              | 1000               | 100                   | -75.93          | -76.03          | -65                        |
| 400                                              | 30000              | 30(Swept)             | <-80            | <-80            | -80                        |
| 12M                                              | 30000              | 30(Swept)             | <-80            | <-80            | -80                        |
| In receive band                                  | 30000              | 30(Swept)             | <-100           | <-100           | -100                       |

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| Mode                  |                    | Analog               |                 |                 |                            |
|-----------------------|--------------------|----------------------|-----------------|-----------------|----------------------------|
| Frequency (MHz)       |                    | 800                  |                 |                 |                            |
| Channel Spacing (kHz) |                    | 12.5                 |                 |                 |                            |
| Offset (kHz)          | Resolution BW (Hz) | Measurement BW (kHz) | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 9.375                 | 100                | 6.25                 | -42.07          | -42.92          | -40                        |
| 15.625                | 100                | 6.25                 | -67.21          | -67.82          | -60                        |
| 21.875                | 100                | 6.25                 | -69.61          | -70.08          | -60                        |
| 37.5                  | 300                | 25                   | -68.25          | -67.99          | -60                        |
| 62.5                  | 300                | 25                   | -72.11          | -72.29          | -65                        |
| 87.5                  | 300                | 25                   | -74.08          | -74.71          | -65                        |
| 150                   | 1000               | 100                  | -69.77          | -69.87          | -65                        |
| 250                   | 1000               | 100                  | -74.10          | -73.83          | -65                        |
| 350                   | 1000               | 100                  | -76.43          | -76.18          | -65                        |
| 400                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| 12M                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| In receive band       | 30000              | 30(Swept)            | <-100           | <-100           | -100                       |

| Mode                  |                    | Analog               |                 |                 |                            |
|-----------------------|--------------------|----------------------|-----------------|-----------------|----------------------------|
| Frequency (MHz)       |                    | 805                  |                 |                 |                            |
| Channel Spacing (kHz) |                    | 12.5                 |                 |                 |                            |
| Offset (kHz)          | Resolution BW (Hz) | Measurement BW (kHz) | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 9.375                 | 100                | 6.25                 | -42.36          | -43.14          | -40                        |
| 15.625                | 100                | 6.25                 | -66.95          | -67.00          | -60                        |
| 21.875                | 100                | 6.25                 | -69.12          | -69.86          | -60                        |
| 37.5                  | 300                | 25                   | -68.66          | -69.17          | -60                        |
| 62.5                  | 300                | 25                   | -72.10          | -71.84          | -65                        |
| 87.5                  | 300                | 25                   | -74.85          | -74.20          | -65                        |
| 150                   | 1000               | 100                  | -70.21          | -70.28          | -65                        |
| 250                   | 1000               | 100                  | -74.41          | -74.18          | -65                        |
| 350                   | 1000               | 100                  | -76.80          | -77.01          | -65                        |
| 400                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| 12M                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| In receive band       | 30000              | 30(Swept)            | <-100           | <-100           | -100                       |

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| Mode                  |                    | Analog               |                 |                 |                            |
|-----------------------|--------------------|----------------------|-----------------|-----------------|----------------------------|
| Frequency (MHz)       |                    | 770                  |                 |                 |                            |
| Channel Spacing (kHz) |                    | 25                   |                 |                 |                            |
| Offset (kHz)          | Resolution BW (Hz) | Measurement BW (kHz) | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 15.625                | 100                | 6.25                 | -59.21          | -60.81          | -40                        |
| 21.875                | 100                | 6.25                 | -69.45          | -69.71          | -60                        |
| 37.5                  | 300                | 25                   | -66.34          | -66.69          | -60                        |
| 62.5                  | 300                | 25                   | -69.40          | -69.46          | -65                        |
| 87.5                  | 300                | 25                   | -71.59          | -71.01          | -65                        |
| 150                   | 1000               | 100                  | -69.26          | -69.10          | -65                        |
| 250                   | 1000               | 100                  | -72.87          | -73.07          | -65                        |
| 350                   | 1000               | 100                  | -75.65          | -75.30          | -65                        |
| 400                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| 12M                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| In receive band       | 30000              | 30(Swept)            | <-100           | <-100           | -100                       |

| Mode                  |                    | Analog               |                 |                 |                            |
|-----------------------|--------------------|----------------------|-----------------|-----------------|----------------------------|
| Frequency (MHz)       |                    | 775                  |                 |                 |                            |
| Channel Spacing (kHz) |                    | 25                   |                 |                 |                            |
| Offset (kHz)          | Resolution BW (Hz) | Measurement BW (kHz) | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 15.625                | 100                | 6.25                 | -58.72          | -60.26          | -40                        |
| 21.875                | 100                | 6.25                 | -68.82          | -68.89          | -60                        |
| 37.5                  | 300                | 25                   | -66.89          | -66.77          | -60                        |
| 62.5                  | 300                | 25                   | -69.68          | -70.02          | -65                        |
| 87.5                  | 300                | 25                   | -71.13          | -70.86          | -65                        |
| 150                   | 1000               | 100                  | -69.00          | -69.12          | -65                        |
| 250                   | 1000               | 100                  | -73.06          | -73.02          | -65                        |
| 350                   | 1000               | 100                  | -75.68          | -75.52          | -65                        |
| 400                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| 12M                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| In receive band       | 30000              | 30(Swept)            | <-100           | <-100           | -100                       |

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| Mode                  |                    | Analog               |                 |                 |                            |
|-----------------------|--------------------|----------------------|-----------------|-----------------|----------------------------|
| Frequency (MHz)       |                    | 800                  |                 |                 |                            |
| Channel Spacing (kHz) |                    | 25                   |                 |                 |                            |
| Offset (kHz)          | Resolution BW (Hz) | Measurement BW (kHz) | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 15.625                | 100                | 6.25                 | -59.75          | -59.66          | -40                        |
| 21.875                | 100                | 6.25                 | -70.51          | -70.39          | -60                        |
| 37.5                  | 300                | 25                   | -67.03          | -67.29          | -60                        |
| 62.5                  | 300                | 25                   | -70.65          | -70.53          | -65                        |
| 87.5                  | 300                | 25                   | -72.78          | -72.97          | -65                        |
| 150                   | 1000               | 100                  | -69.47          | -69.47          | -65                        |
| 250                   | 1000               | 100                  | -73.58          | -73.77          | -65                        |
| 350                   | 1000               | 100                  | -76.17          | -75.99          | -65                        |
| 400                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| 12M                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| In receive band       | 30000              | 30(Swept)            | <-100           | <-100           | -100                       |

| Mode                  |                    | Analog               |                 |                 |                            |
|-----------------------|--------------------|----------------------|-----------------|-----------------|----------------------------|
| Frequency (MHz)       |                    | 805                  |                 |                 |                            |
| Channel Spacing (kHz) |                    | 25                   |                 |                 |                            |
| Offset (kHz)          | Resolution BW (Hz) | Measurement BW (kHz) | Lower ACP (dBc) | Upper ACP (dBc) | Maximum ACP Relative (dBc) |
| 15.625                | 100                | 6.25                 | -59.08          | -60.45          | -40                        |
| 21.875                | 100                | 6.25                 | -69.89          | -70.25          | -60                        |
| 37.5                  | 300                | 25                   | -68.08          | -68.24          | -60                        |
| 62.5                  | 300                | 25                   | -70.81          | -70.66          | -65                        |
| 87.5                  | 300                | 25                   | -73.34          | -73.32          | -65                        |
| 150                   | 1000               | 100                  | -69.48          | -69.24          | -65                        |
| 250                   | 1000               | 100                  | -73.27          | -73.42          | -65                        |
| 350                   | 1000               | 100                  | -76.21          | -76.42          | -65                        |
| 400                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| 12M                   | 30000              | 30(Swept)            | <-80            | <-80            | -80                        |
| In receive band       | 30000              | 30(Swept)            | <-100           | <-100           | -100                       |

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| <b>Mode</b>                  |                           | <b>Digital 12.5 kHz</b>     |                        |                        |                                   |
|------------------------------|---------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|
| <b>Frequency (MHz)</b>       |                           | <b>770</b>                  |                        |                        |                                   |
| <b>Channel Spacing (kHz)</b> |                           | <b>12.5</b>                 |                        |                        |                                   |
| <b>Offset (kHz)</b>          | <b>Resolution BW (Hz)</b> | <b>Measurement BW (kHz)</b> | <b>Lower ACP (dBc)</b> | <b>Upper ACP (dBc)</b> | <b>Maximum ACP Relative (dBc)</b> |
| 9.375                        | 100                       | 6.25                        | -40.32                 | -42.28                 | -40                               |
| 15.625                       | 100                       | 6.25                        | -70.13                 | -70.55                 | -60                               |
| 21.875                       | 100                       | 6.25                        | -72.69                 | -72.49                 | -60                               |
| 37.5                         | 300                       | 25                          | -70.32                 | -69.86                 | -65                               |
| 62.5                         | 300                       | 25                          | -72.48                 | -72.14                 | -65                               |
| 87.5                         | 300                       | 25                          | -74.67                 | -74.72                 | -65                               |
| 150                          | 1000                      | 100                         | -69.01                 | -69.27                 | -65                               |
| 250                          | 1000                      | 100                         | -73.28                 | -72.97                 | -65                               |
| 350                          | 1000                      | 100                         | -75.51                 | -75.81                 | -65                               |
| 400                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| 12M                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| In receive band              | 30000                     | 30(Swept)                   | <-100                  | <-100                  | -100                              |

| <b>Mode</b>                  |                           | <b>Digital 12.5 kHz</b>     |                        |                        |                                   |
|------------------------------|---------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|
| <b>Frequency (MHz)</b>       |                           | <b>775</b>                  |                        |                        |                                   |
| <b>Channel Spacing (kHz)</b> |                           | <b>12.5</b>                 |                        |                        |                                   |
| <b>Offset (kHz)</b>          | <b>Resolution BW (Hz)</b> | <b>Measurement BW (kHz)</b> | <b>Lower ACP (dBc)</b> | <b>Upper ACP (dBc)</b> | <b>Maximum ACP Relative (dBc)</b> |
| 9.375                        | 100                       | 6.25                        | -40.36                 | -42.53                 | -40                               |
| 15.625                       | 100                       | 6.25                        | -68.99                 | -69.23                 | -60                               |
| 21.875                       | 100                       | 6.25                        | -71.67                 | -72.92                 | -60                               |
| 37.5                         | 300                       | 25                          | -68.86                 | -69.75                 | -65                               |
| 62.5                         | 300                       | 25                          | -72.24                 | -72.26                 | -65                               |
| 87.5                         | 300                       | 25                          | -72.62                 | -72.24                 | -65                               |
| 150                          | 1000                      | 100                         | -69.62                 | -69.48                 | -65                               |
| 250                          | 1000                      | 100                         | -73.31                 | -73.39                 | -65                               |
| 350                          | 1000                      | 100                         | -76.20                 | -76.21                 | -65                               |
| 400                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| 12M                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| In receive band              | 30000                     | 30(Swept)                   | <-100                  | <-100                  | -100                              |

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| <b>Mode</b>                  |                           | <b>Digital 12.5 kHz</b>     |                        |                        |                                   |
|------------------------------|---------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|
| <b>Frequency (MHz)</b>       |                           | <b>800</b>                  |                        |                        |                                   |
| <b>Channel Spacing (kHz)</b> |                           | <b>12.5</b>                 |                        |                        |                                   |
| <b>Offset (kHz)</b>          | <b>Resolution BW (Hz)</b> | <b>Measurement BW (kHz)</b> | <b>Lower ACP (dBc)</b> | <b>Upper ACP (dBc)</b> | <b>Maximum ACP Relative (dBc)</b> |
| 9.375                        | 100                       | 6.25                        | -40.75                 | -42.20                 | -40                               |
| 15.625                       | 100                       | 6.25                        | -68.90                 | -68.36                 | -60                               |
| 21.875                       | 100                       | 6.25                        | -70.53                 | -71.99                 | -60                               |
| 37.5                         | 300                       | 25                          | -67.63                 | -67.95                 | -65                               |
| 62.5                         | 300                       | 25                          | -70.29                 | -70.84                 | -65                               |
| 87.5                         | 300                       | 25                          | -72.79                 | -73.14                 | -65                               |
| 150                          | 1000                      | 100                         | -70.36                 | -70.37                 | -65                               |
| 250                          | 1000                      | 100                         | -74.82                 | -74.49                 | -65                               |
| 350                          | 1000                      | 100                         | -76.98                 | -76.79                 | -65                               |
| 400                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| 12M                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| In receive band              | 30000                     | 30(Swept)                   | <-100                  | <-100                  | -100                              |

| <b>Mode</b>                  |                           | <b>Digital 12.5 kHz</b>     |                        |                        |                                   |
|------------------------------|---------------------------|-----------------------------|------------------------|------------------------|-----------------------------------|
| <b>Frequency (MHz)</b>       |                           | <b>805</b>                  |                        |                        |                                   |
| <b>Channel Spacing (kHz)</b> |                           | <b>12.5</b>                 |                        |                        |                                   |
| <b>Offset (kHz)</b>          | <b>Resolution BW (Hz)</b> | <b>Measurement BW (kHz)</b> | <b>Lower ACP (dBc)</b> | <b>Upper ACP (dBc)</b> | <b>Maximum ACP Relative (dBc)</b> |
| 9.375                        | 100                       | 6.25                        | -40.42                 | -44.12                 | -40                               |
| 15.625                       | 100                       | 6.25                        | -70.00                 | -69.06                 | -60                               |
| 21.875                       | 100                       | 6.25                        | -71.81                 | -72.95                 | -60                               |
| 37.5                         | 300                       | 25                          | -67.89                 | -68.06                 | -65                               |
| 62.5                         | 300                       | 25                          | -70.83                 | -71.32                 | -65                               |
| 87.5                         | 300                       | 25                          | -73.68                 | -73.16                 | -65                               |
| 150                          | 1000                      | 100                         | -69.94                 | -69.38                 | -65                               |
| 250                          | 1000                      | 100                         | -73.97                 | -73.91                 | -65                               |
| 350                          | 1000                      | 100                         | -76.72                 | -76.62                 | -65                               |
| 400                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| 12M                          | 30000                     | 30(Swept)                   | <-80                   | <-80                   | -75                               |
| In receive band              | 30000                     | 30(Swept)                   | <-100                  | <-100                  | -100                              |

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## 5.6. TRANSMITTER ANTENNA POWER SPURIOUS/HARMONIC CONDUCTED EMISSIONS [§ 90.543(c)]

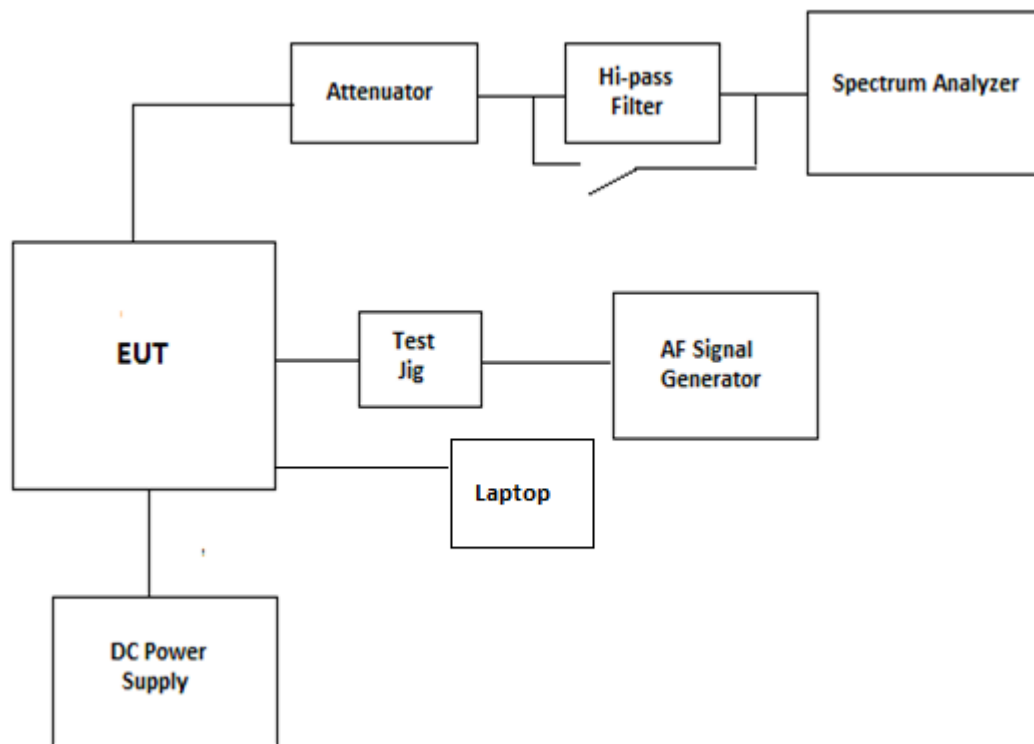
### 5.6.1. Limits

**§ 90.543(c) Out-of-band emission limit.** On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least  $43 + 10\log(P)$  dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

### 5.6.2. Method of Measurements

TIA-603-E, ANSI C63.26

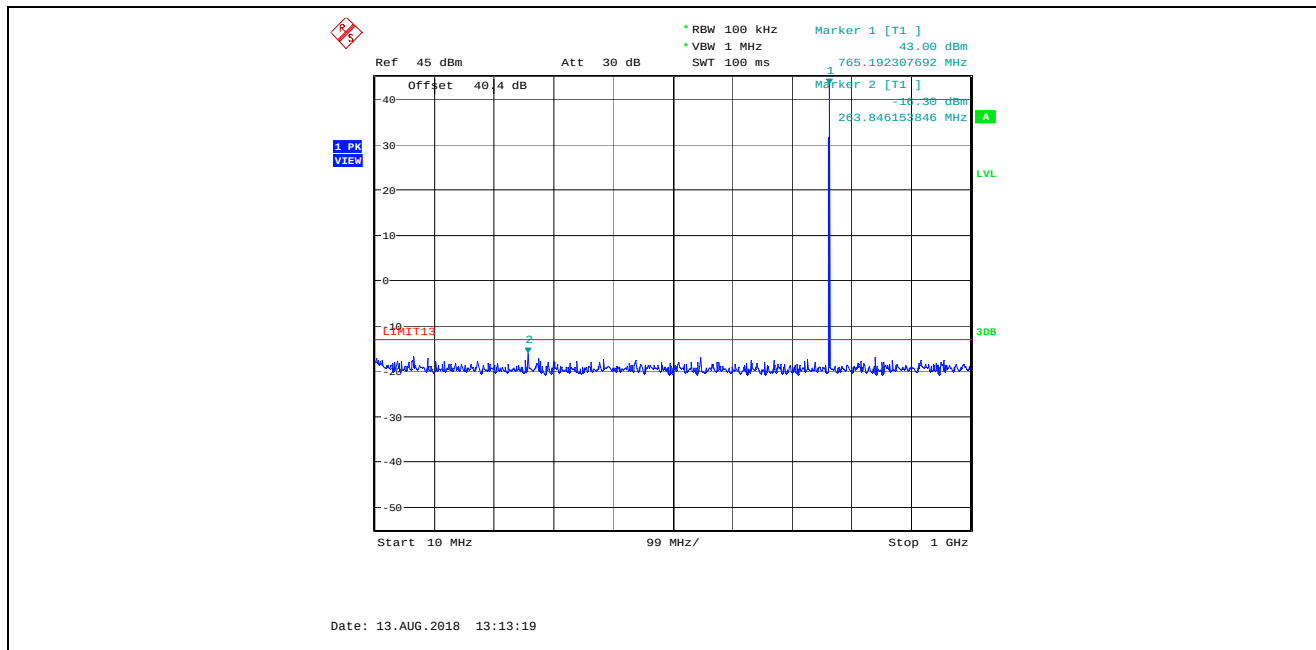
### 5.6.3. Test Arrangement



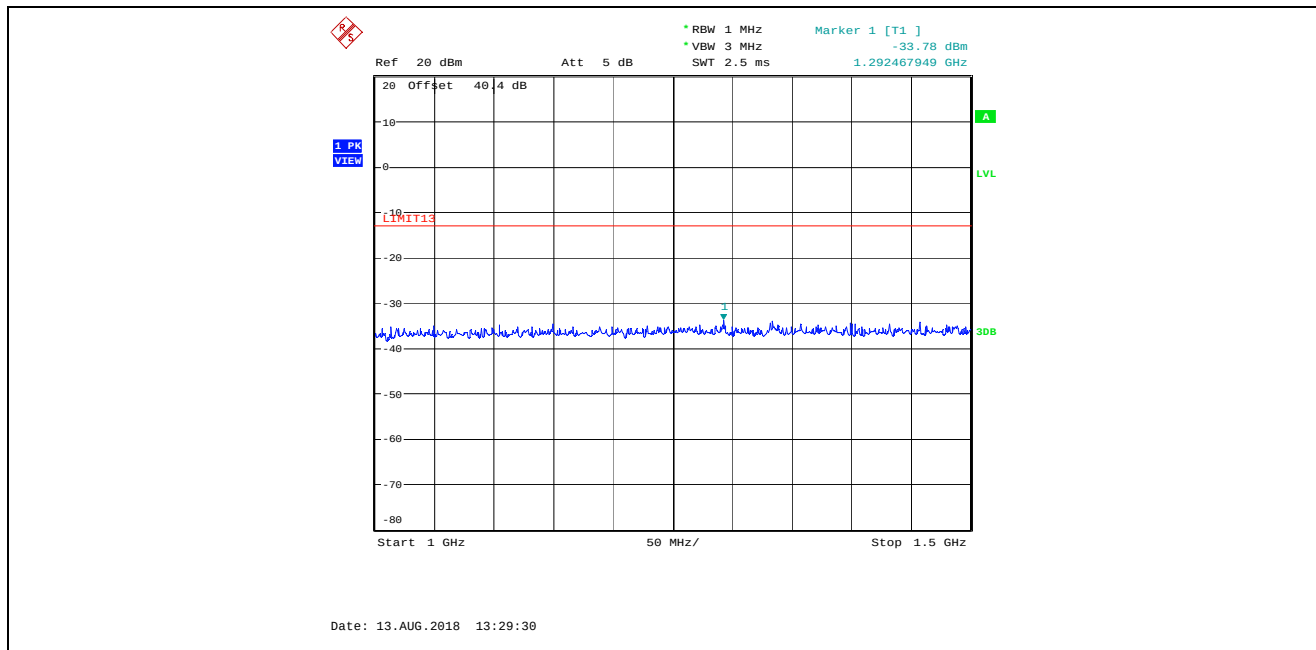
## 5.6.4. Test Data

### 5.6.4.1. 764 – 776 MHz Band

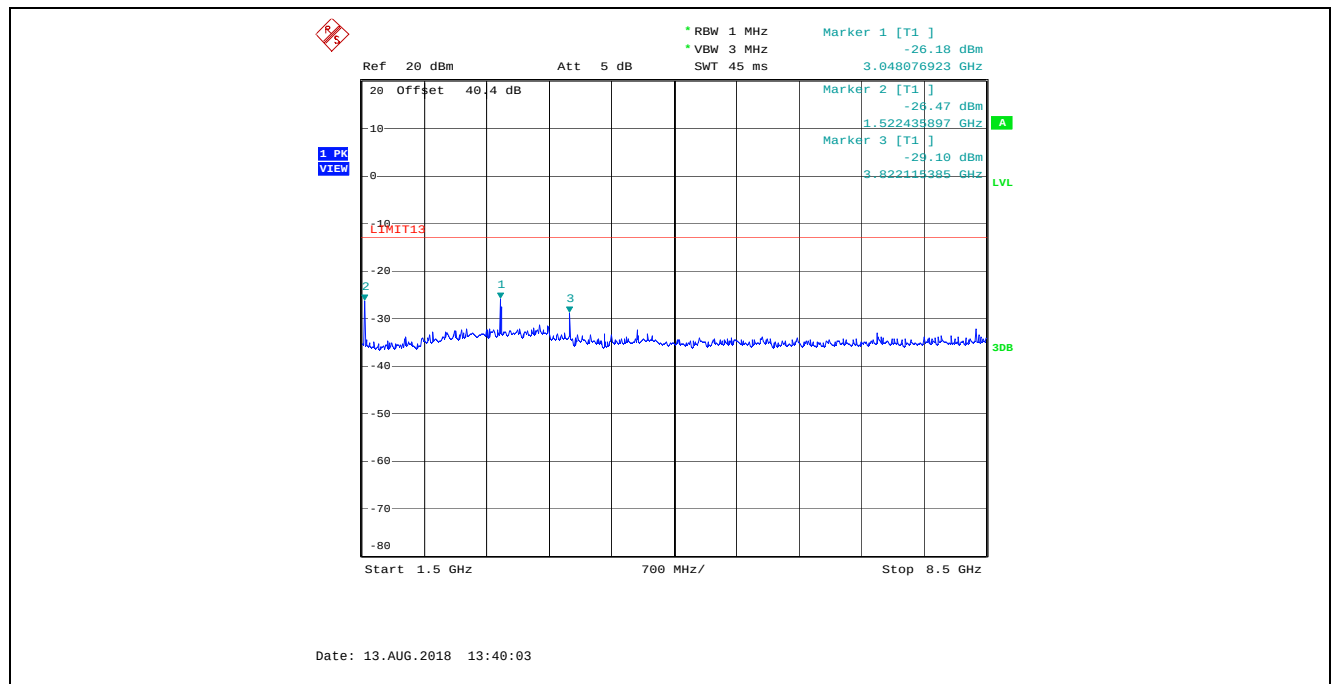
**Plot 5.6.4.1.1.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 764 MHz, 10 MHz – 1 GHz



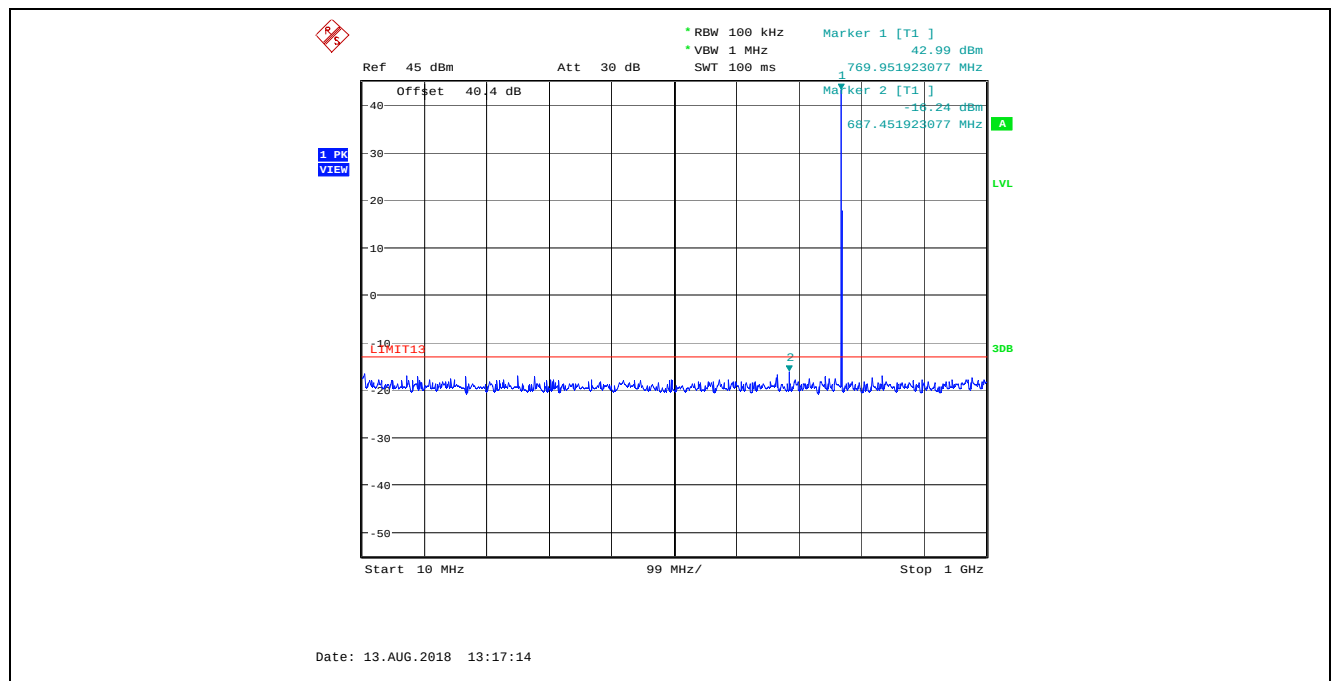
**Plot 5.6.4.1.2.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 764 MHz, 1GHz – 1.5 GHz



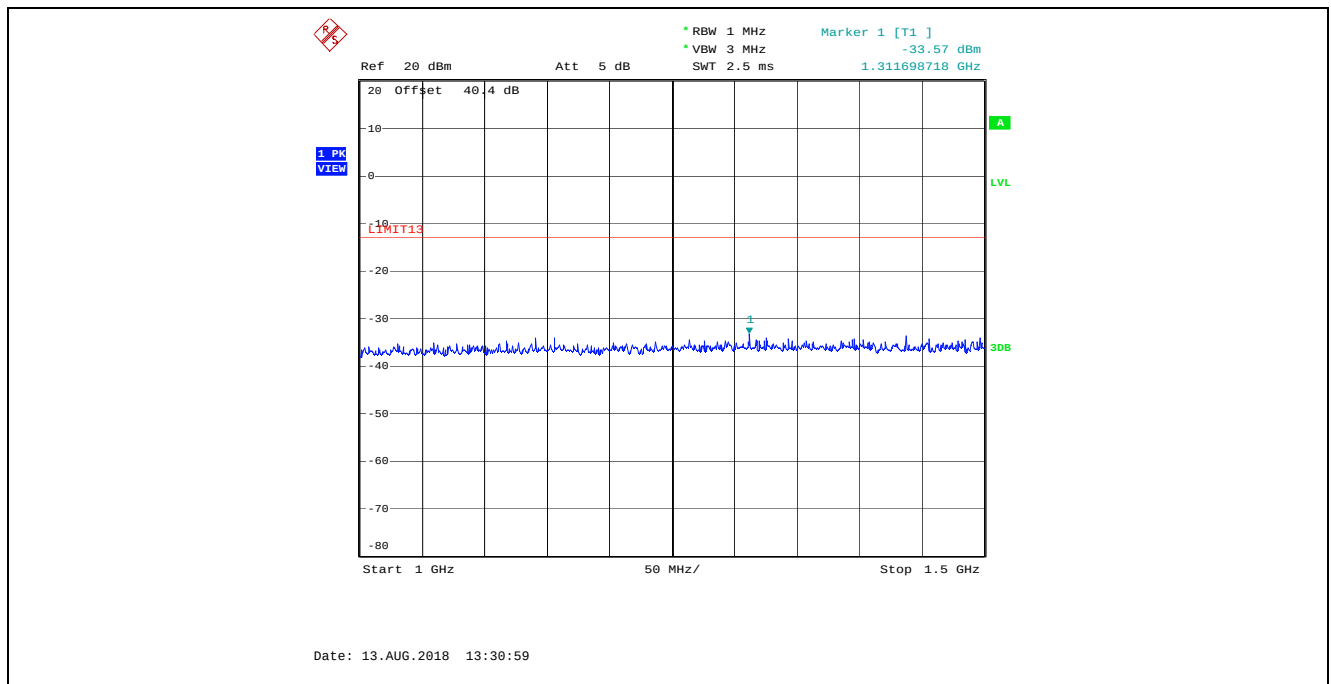
**Plot 5.6.4.1.3.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 764 MHz, 1.5 GHz – 8.5 GHz



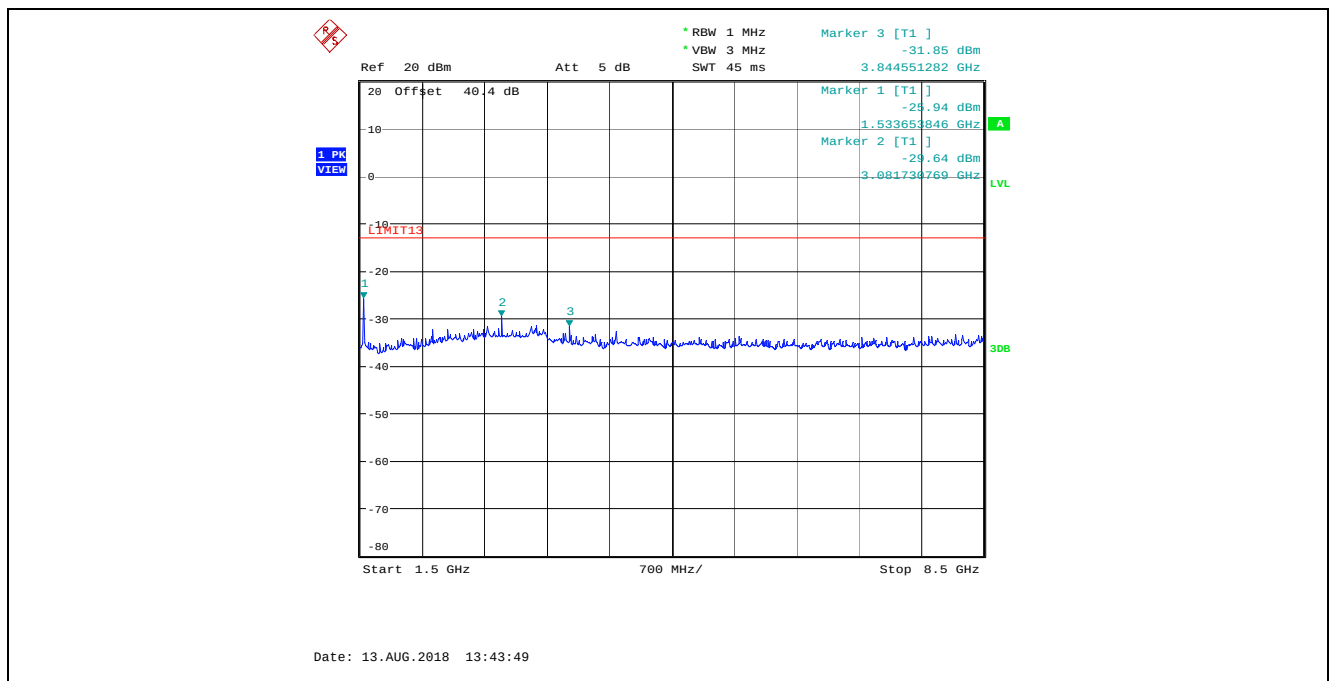
**Plot 5.6.4.1.4.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 770 MHz, 10 MHz – 1 GHz



**Plot 5.6.4.1.5.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 770 MHz, 1 GHz – 1.5 GHz

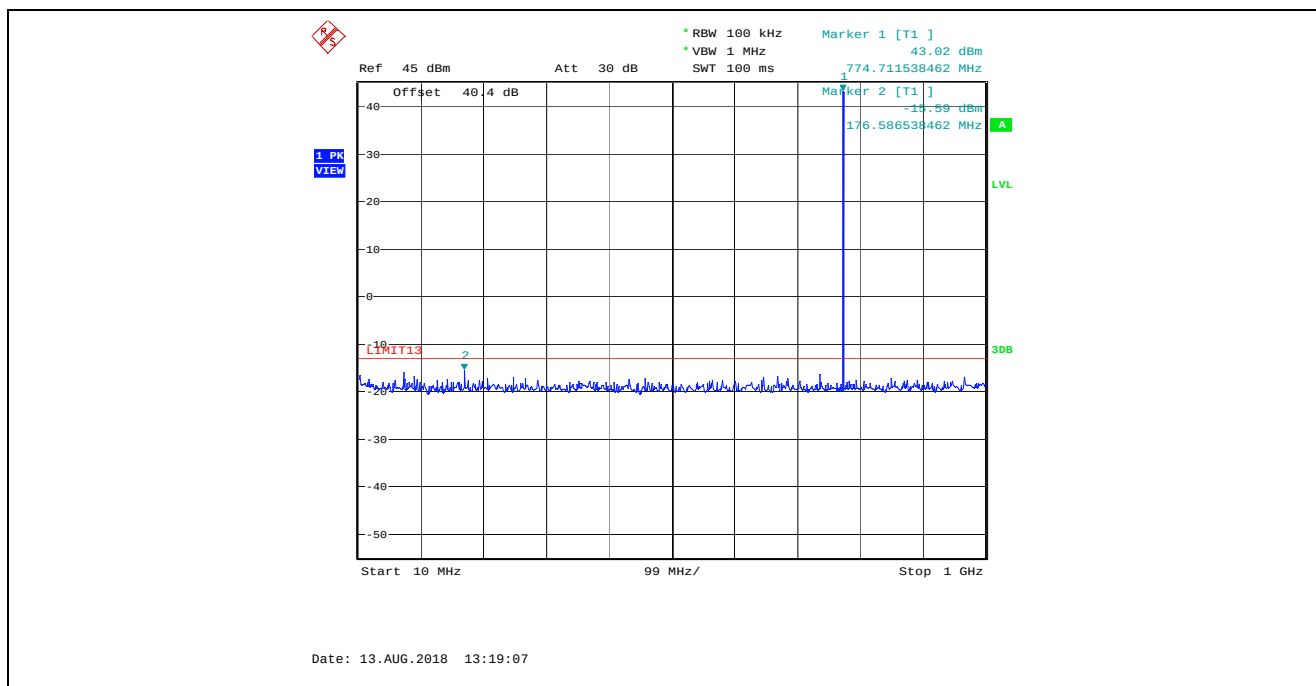


**Plot 5.6.4.1.6.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 770 MHz, 1.5 GHz – 8.5 GHz

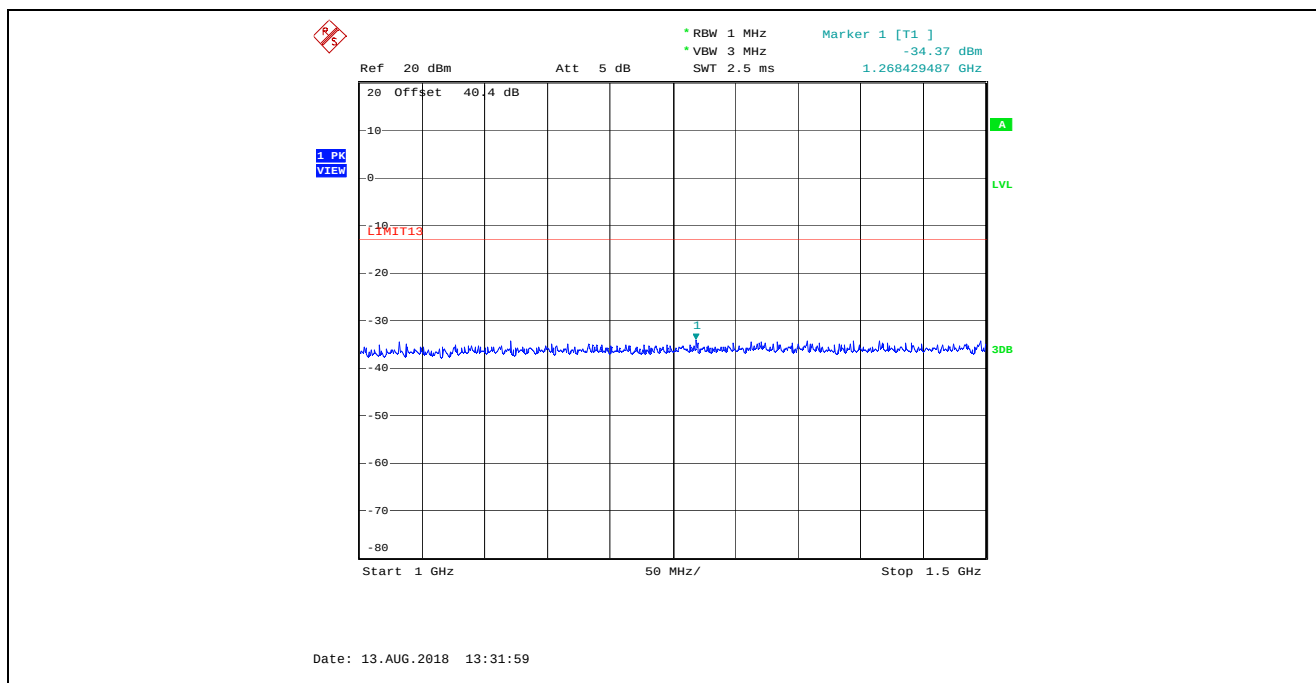




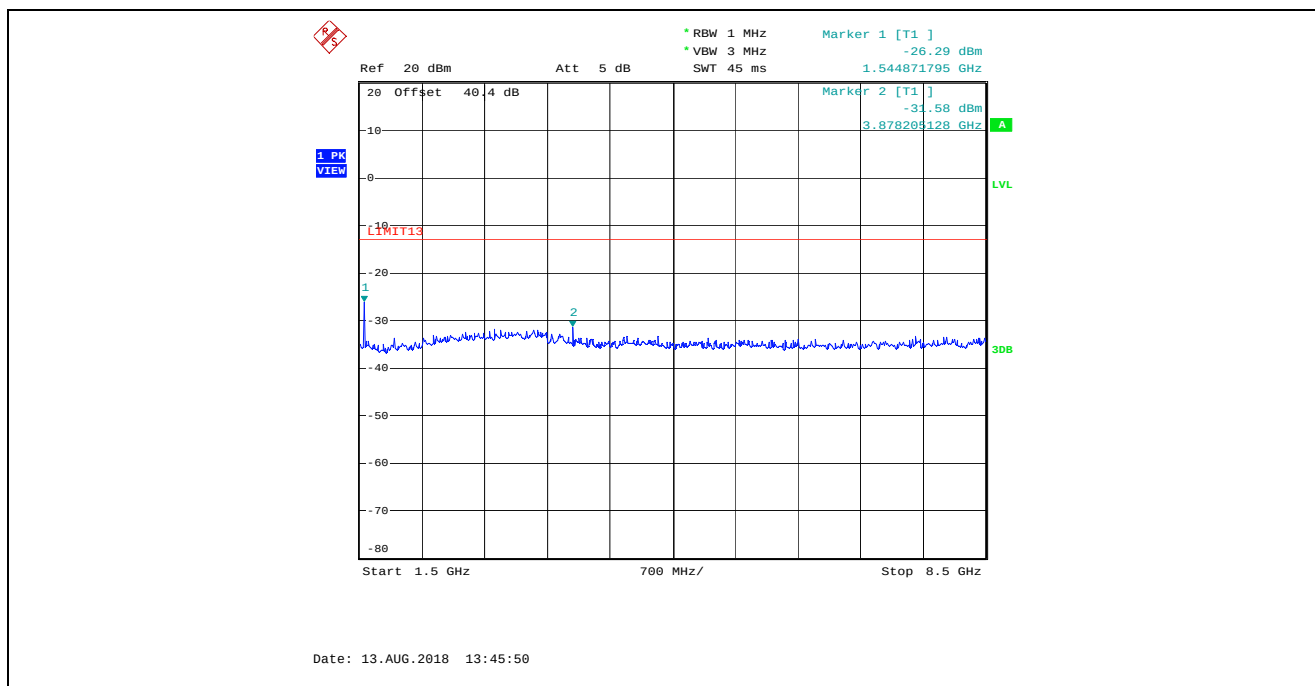
**Plot 5.6.4.1.7.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
High Power, 775 MHz, 10 MHz – 1 GHz



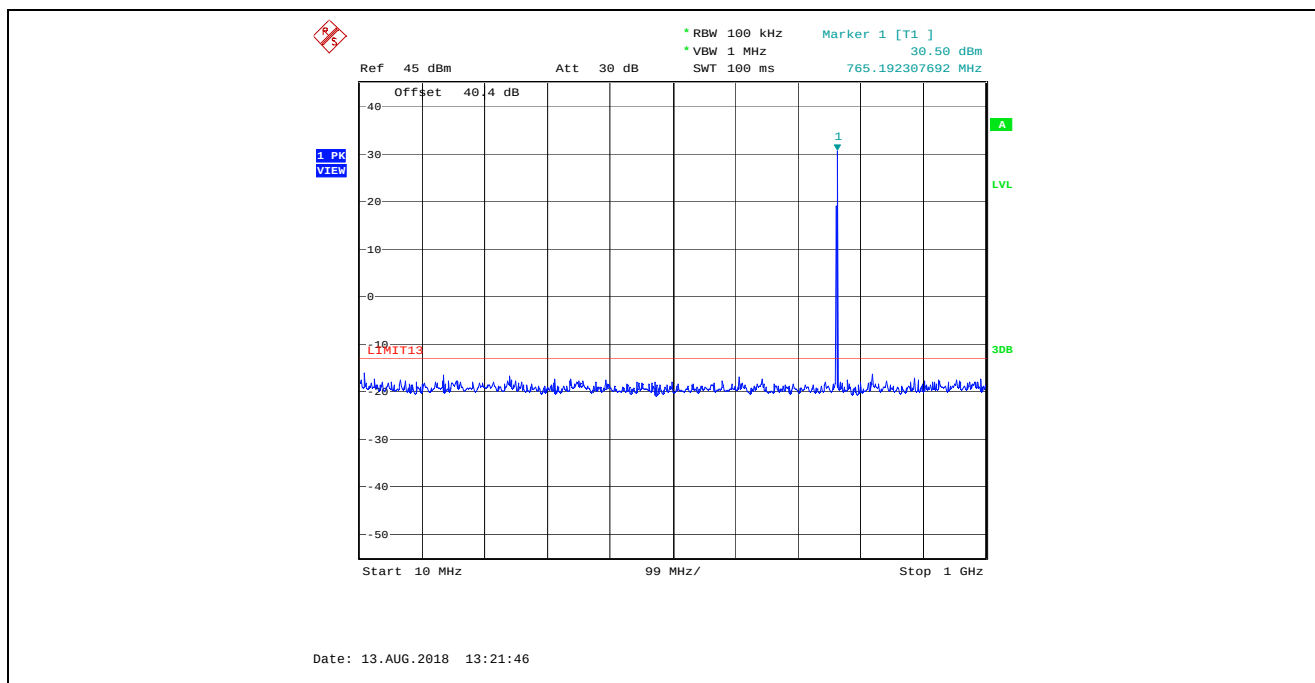
**Plot 5.6.4.1.8.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
High Power, 775 MHz, 1 GHz – 1.5 GHz



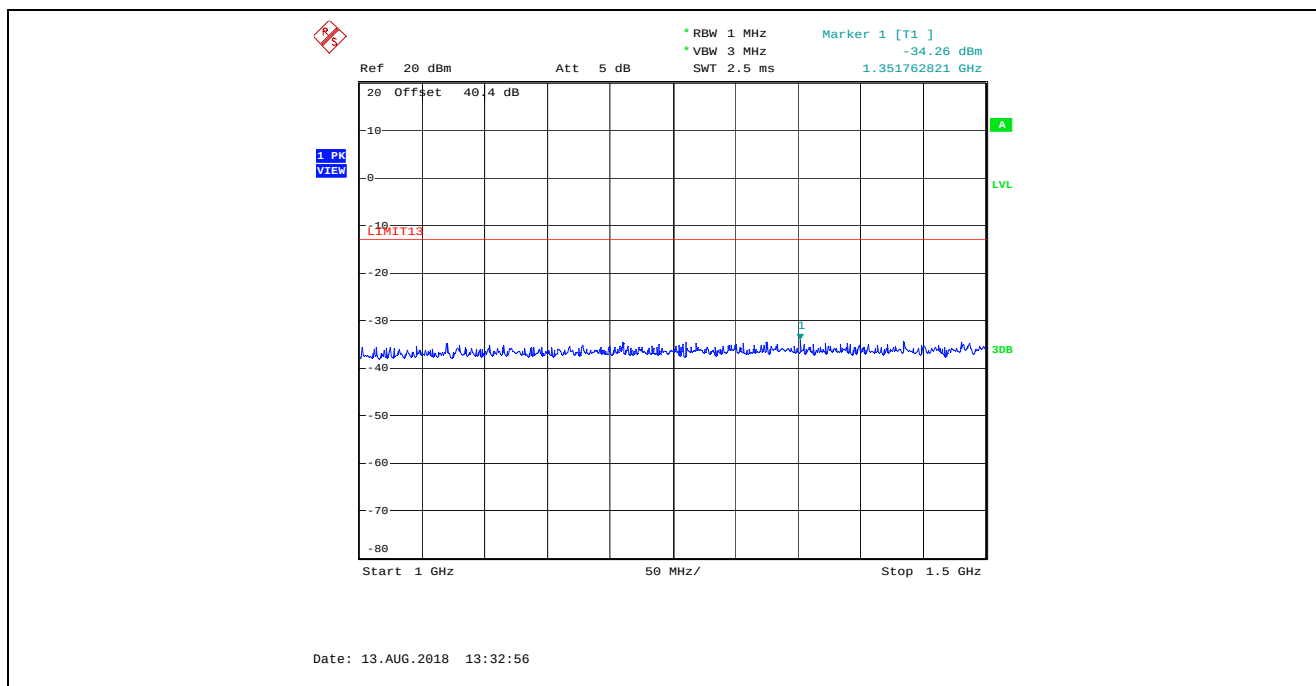
**Plot 5.6.4.1.9.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 775 MHz, 1.5 GHz – 8.5 GHz



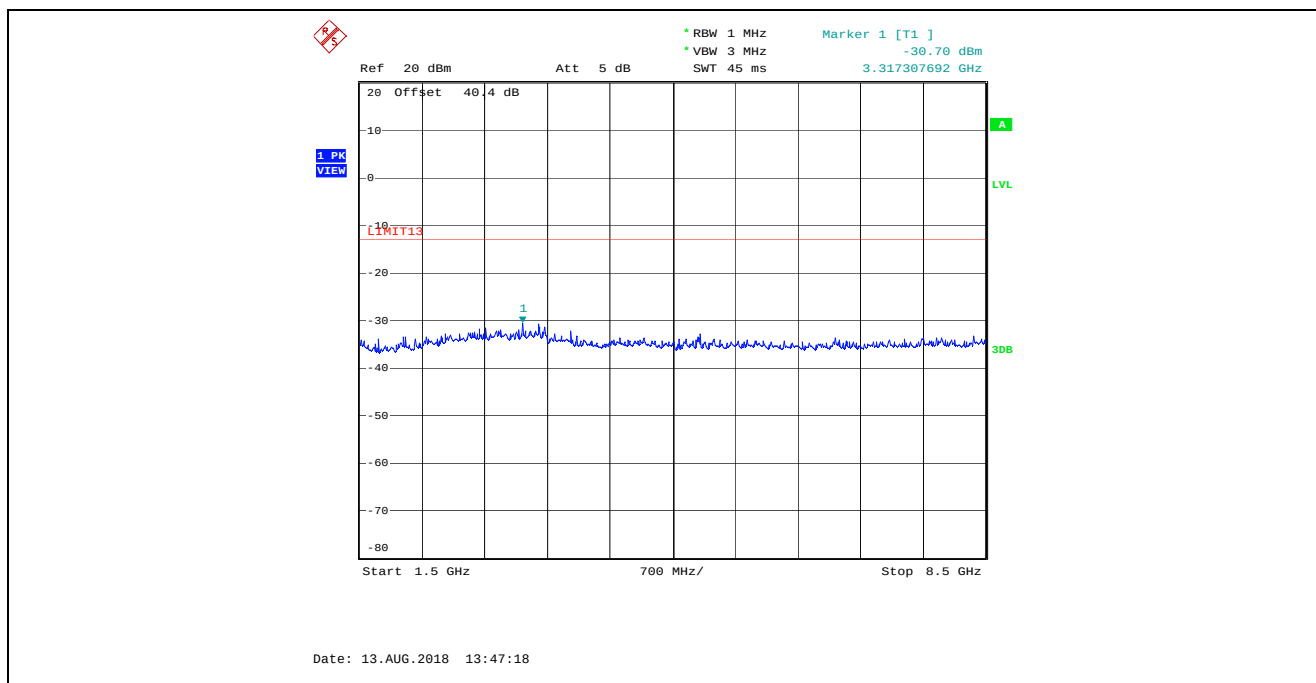
**Plot 5.6.4.1.10.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 764 MHz, 10 MHz – 1 GHz



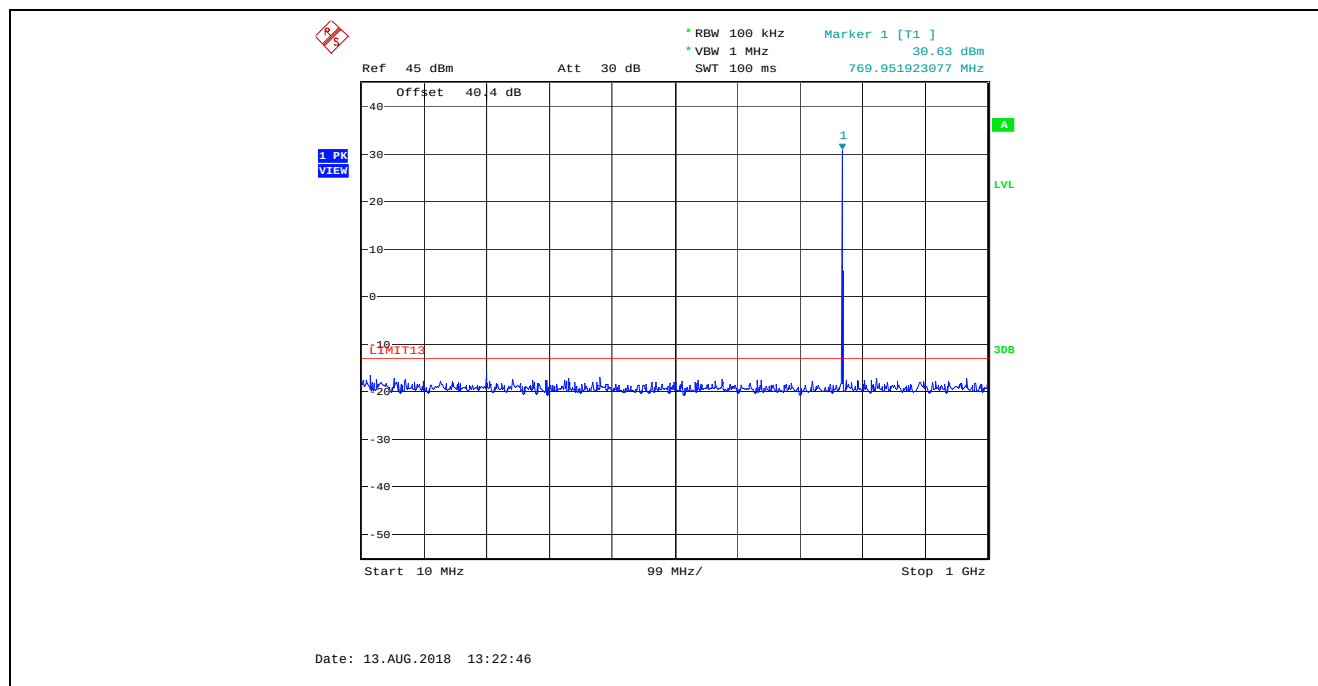
**Plot 5.6.4.1.11.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 764 MHz, 1 GHz – 1.5 GHz



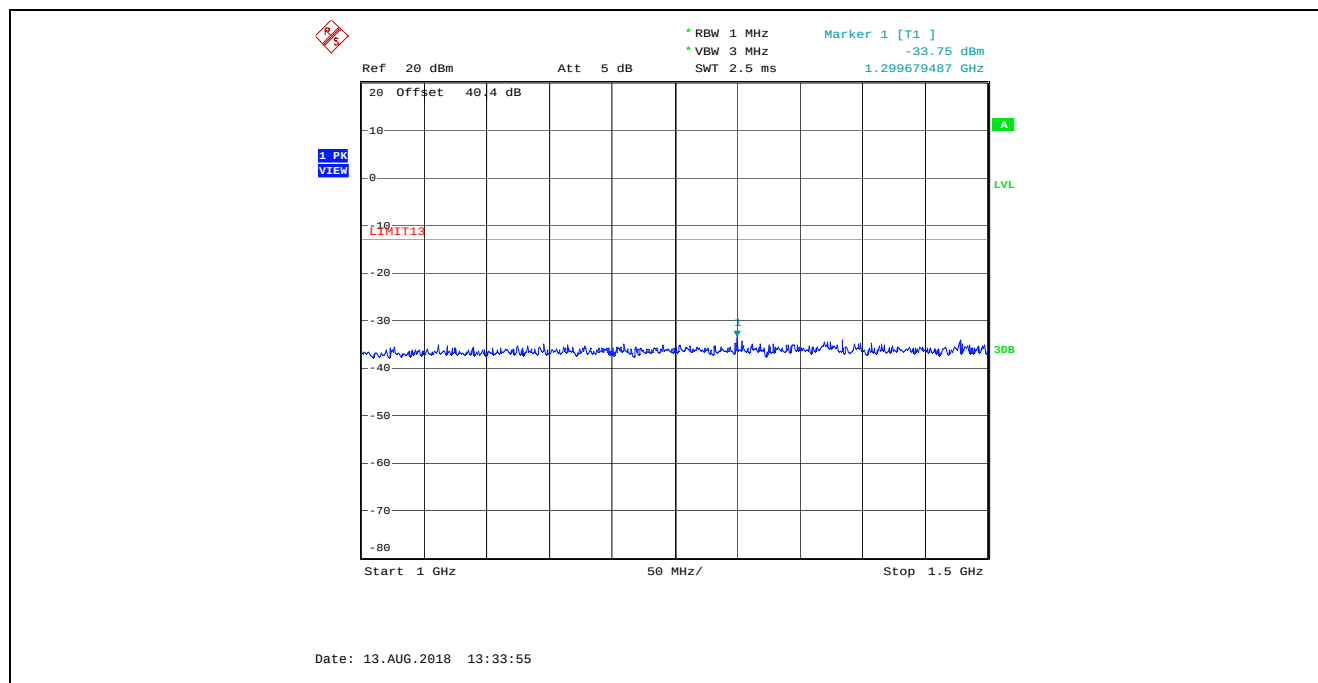
**Plot 5.6.4.1.12.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 764 MHz, 1.5 GHz – 8.5 GHz



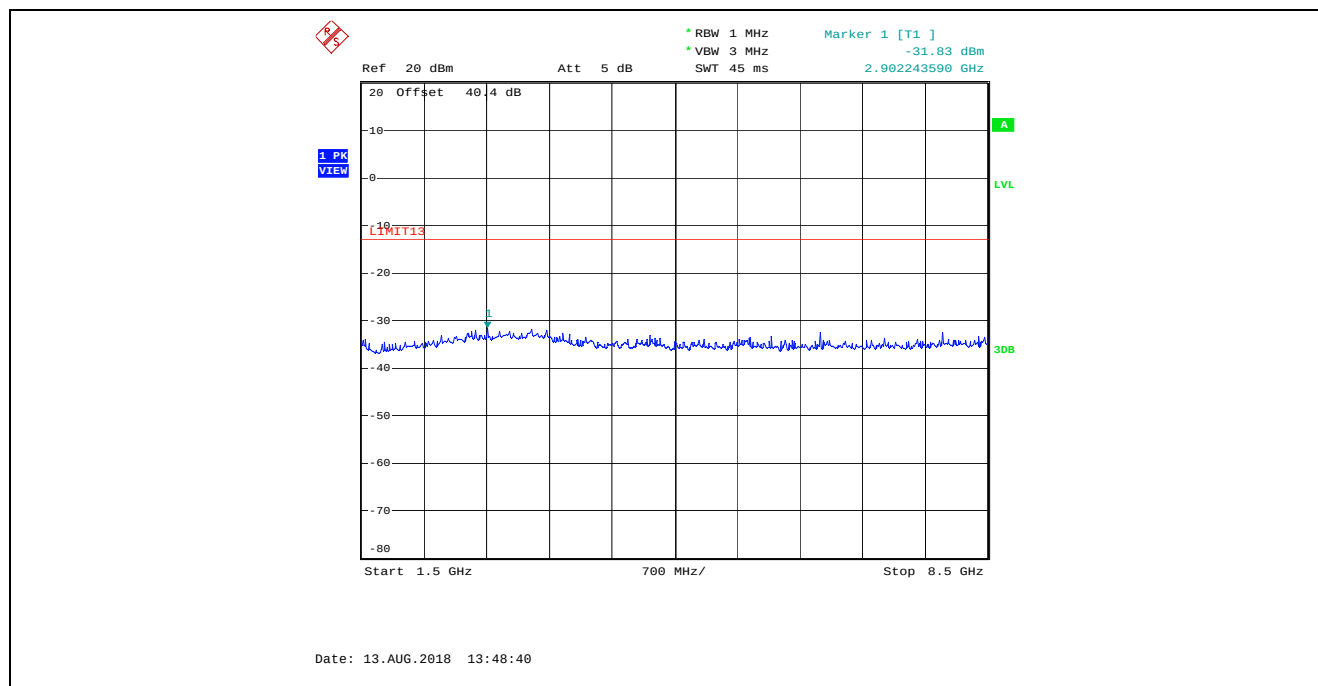
**Plot 5.6.4.1.13.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 770 MHz, 10 MHz – 1 GHz



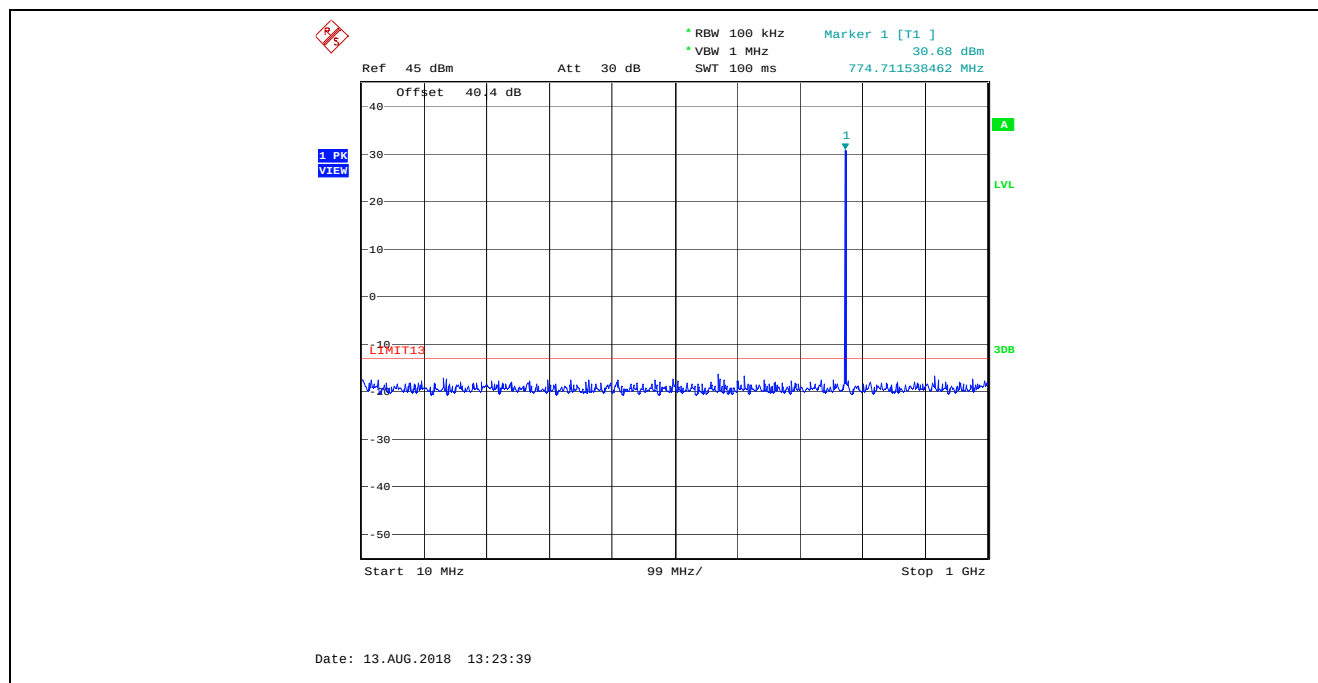
**Plot 5.6.4.1.14.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 770 MHz, 1 GHz – 1.5 GHz



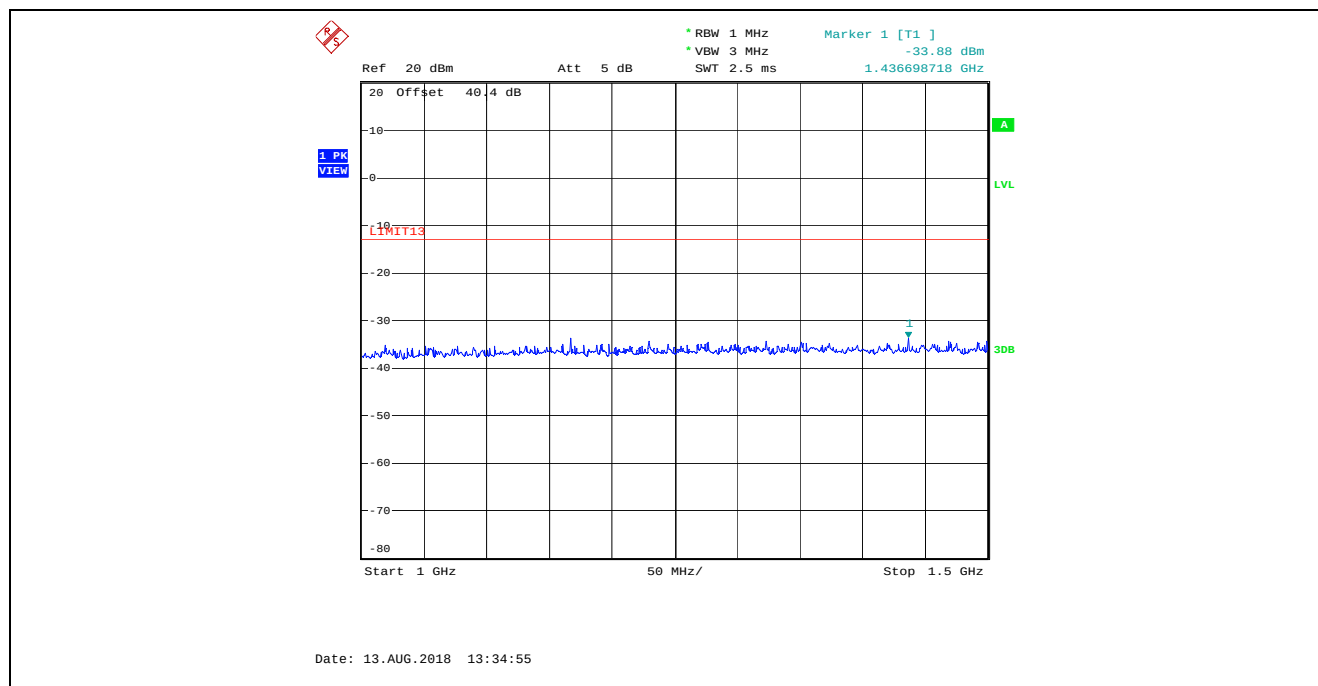
**Plot 5.6.4.1.15.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 770 MHz, 1.5 GHz – 8.5 GHz



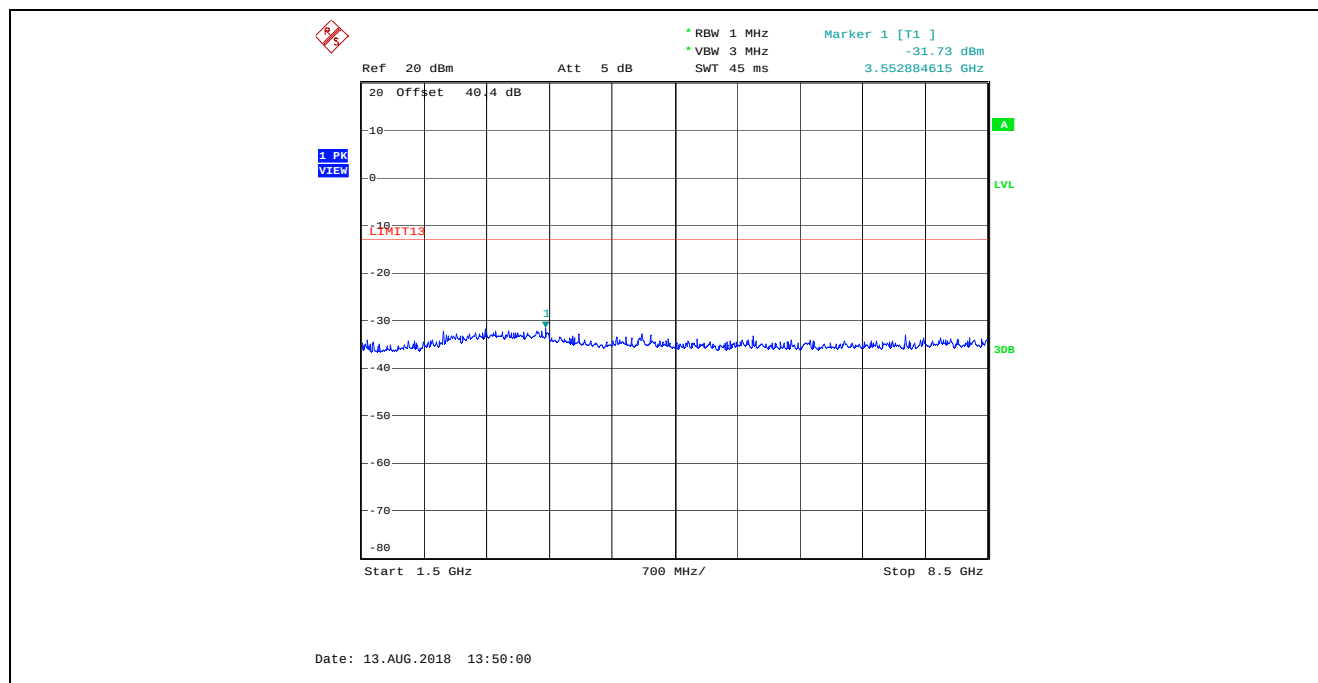
**Plot 5.6.4.1.16.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 775 MHz, 10 MHz – 1 GHz



**Plot 5.6.4.1.17.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 775 MHz, 1 GHz – 1.5 GHz

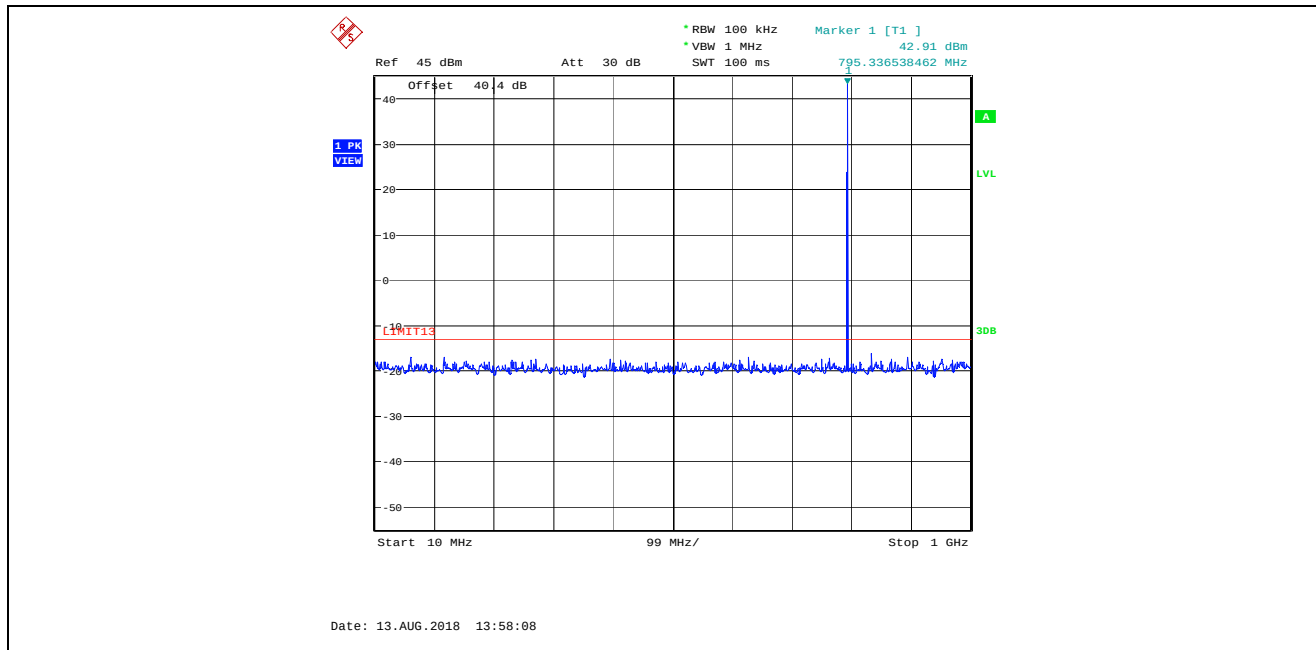


**Plot 5.6.4.1.18.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 775 MHz, 1.5 GHz – 8.5 GHz

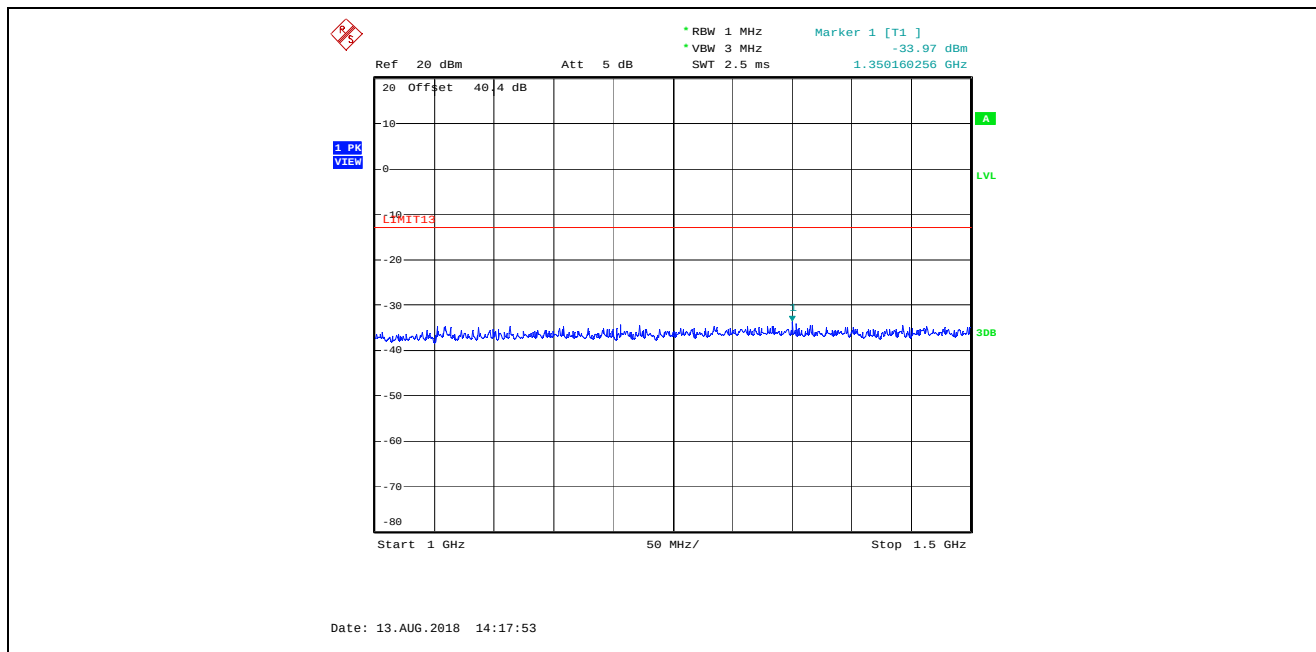


## 5.6.4.2. 794 – 806 MHz Band

**Plot 5.6.4.2.1.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 794 MHz, 10 MHz – 1 GHz



**Plot 5.6.4.2.2.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 794 MHz, 1 GHz – 1.5 GHz



1 PK VIEW

Ref 20 dBm Att 5 dB

\* RBW 1 MHz  
\* VBW 3 MHz  
SWT 45 ms

Marker 2 [T1]  
-20.82 dBm  
1.578525641 GHz

Marker 1 [T1]  
-17.97 dBm  
2.375000000 GHz

LIMIT13

Start 1.5 GHz 700 MHz/ Stop 8.5 GHz

Date: 13.AUG.2018 14:28:55

Ref 45 dBm Att 30 dB RBW 100 kHz VBW 1 MHz SWT 100 ms Marker 1 [T1] 42.85 dBm 800.096153846 MHz

Offset 40.4 dB

1 PK VIEW

LIMIT13

A

LVL

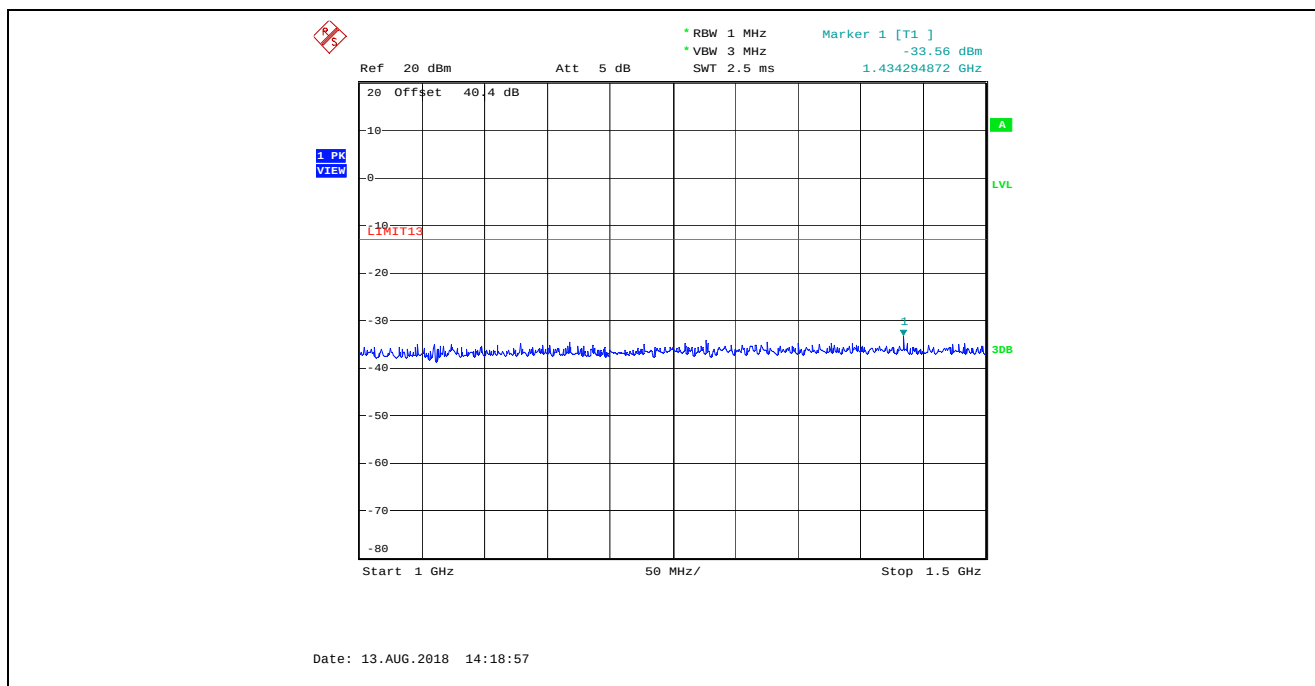
308

Start 10 MHz 99 MHz/ Stop 1 GHz

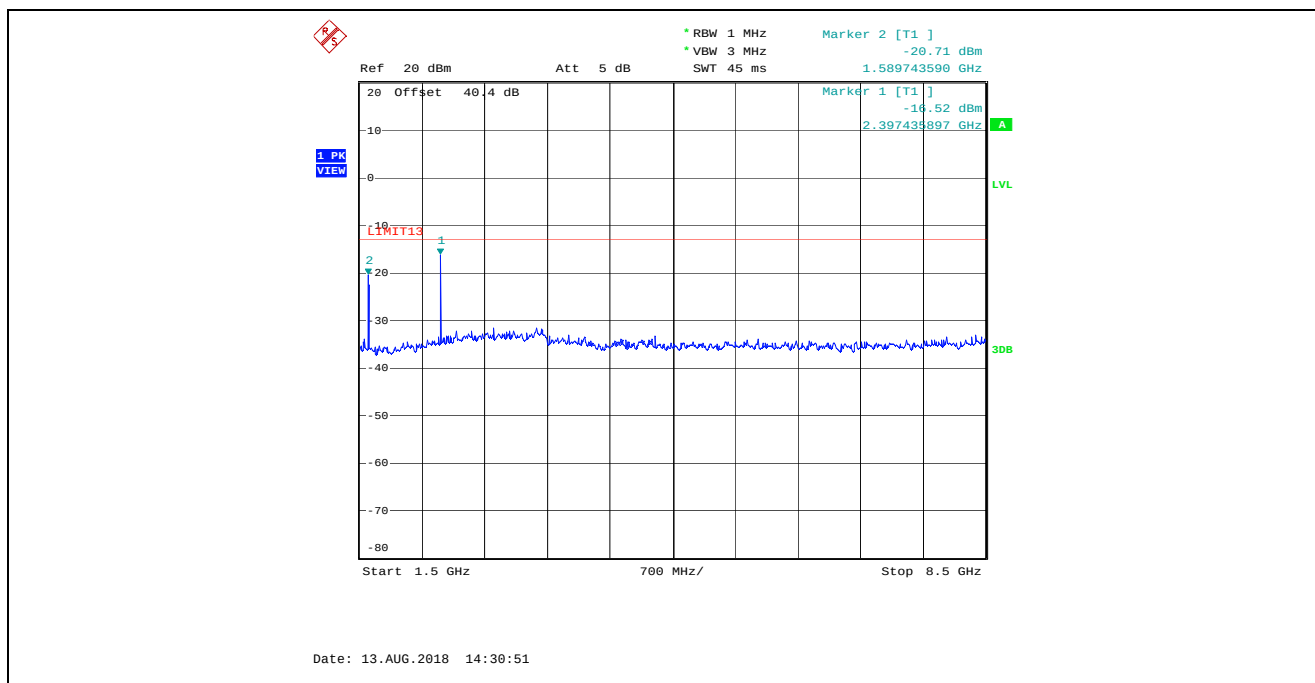
Date: 13.AUG.2018 14:00:12



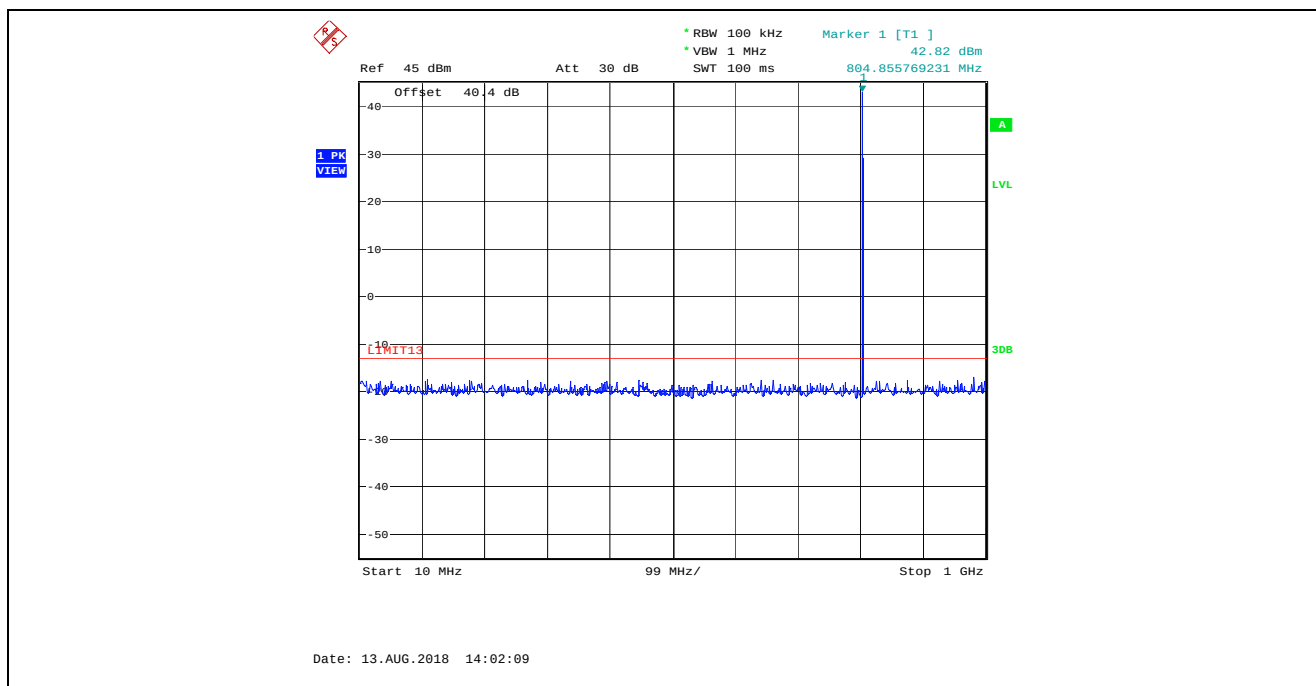
**Plot 5.6.4.2.5.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
High Power, 800 MHz, 1 GHz – 1.5 GHz



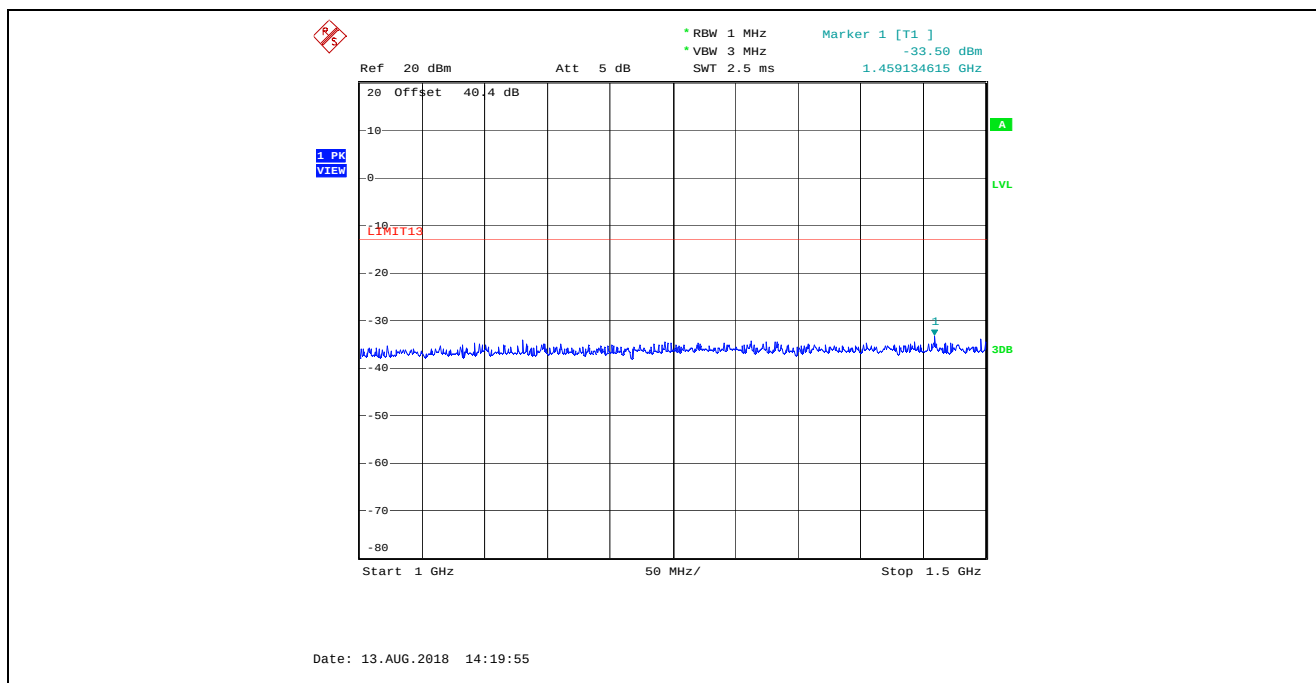
**Plot 5.6.4.2.6.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
High Power, 800 MHz, 1.5 GHz – 8.5 GHz



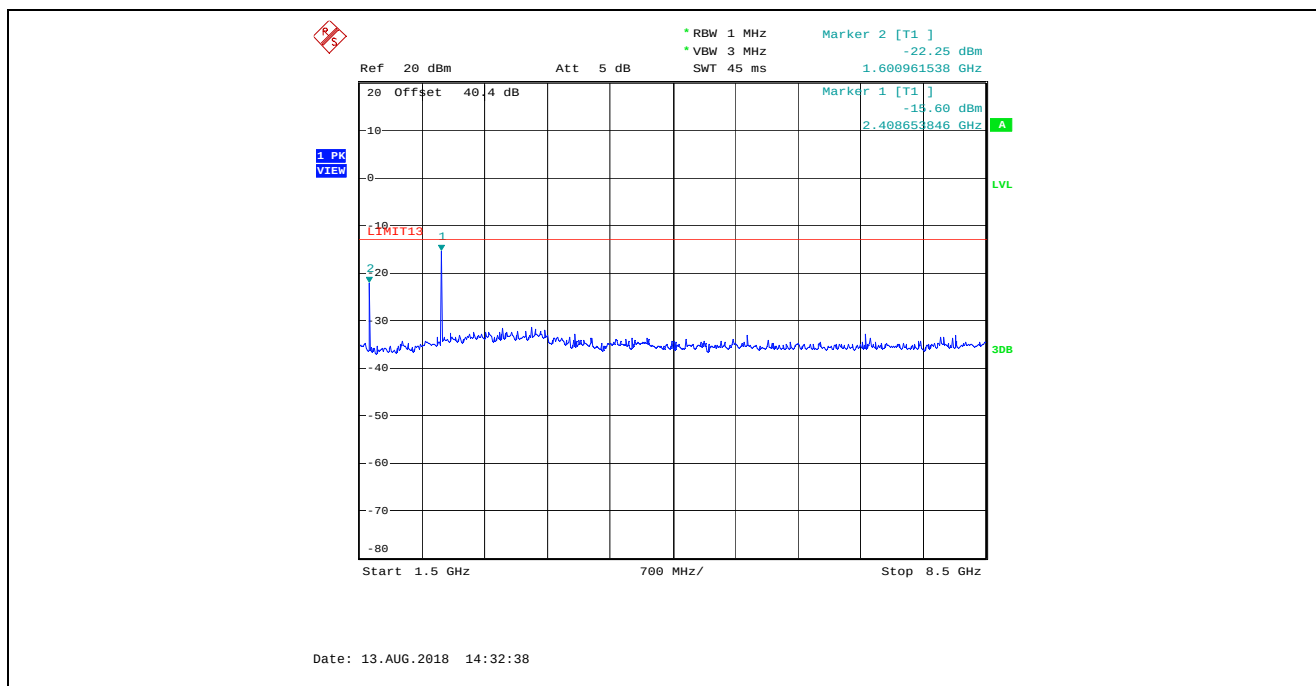
**Plot 5.6.4.2.7.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 805 MHz, 10 MHz – 1 GHz



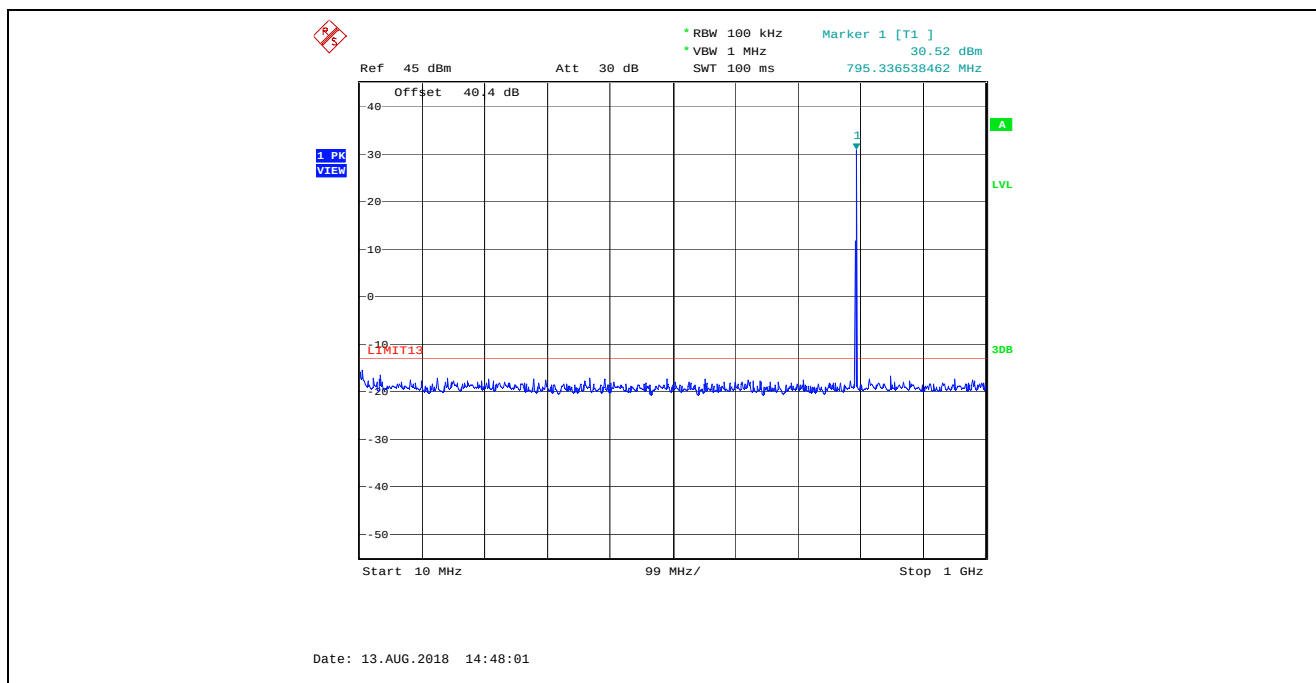
**Plot 5.6.4.2.8.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 805 MHz, 1 GHz – 1.5 GHz



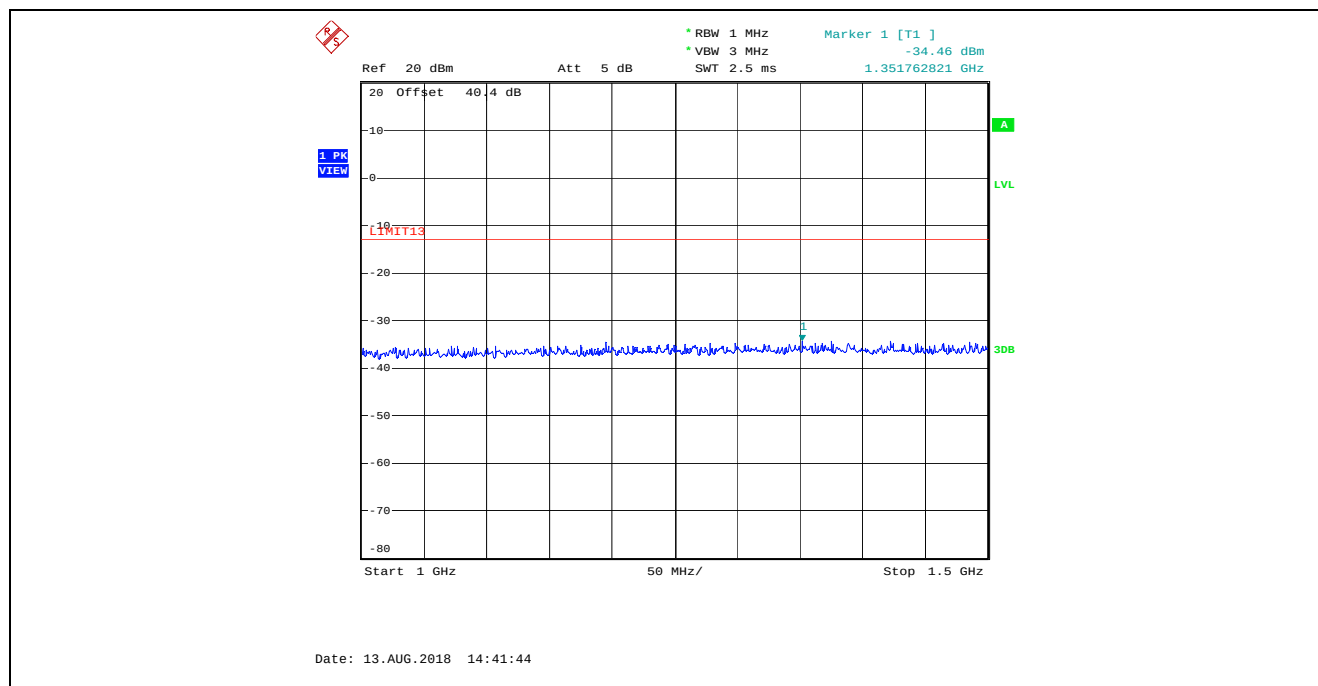
**Plot 5.6.4.2.9.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 High Power, 805 MHz, 1.5 GHz – 8.5 GHz



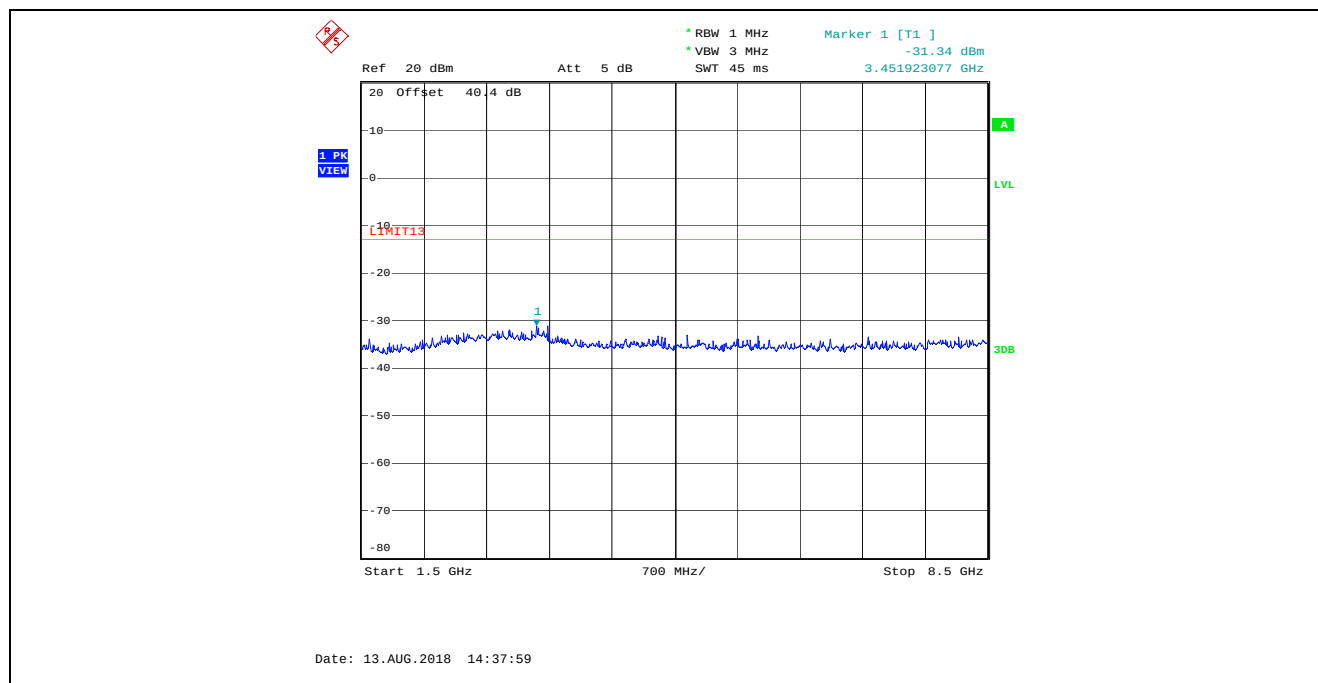
**Plot 5.6.4.2.10.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 794 MHz, 10 MHz – 1 GHz



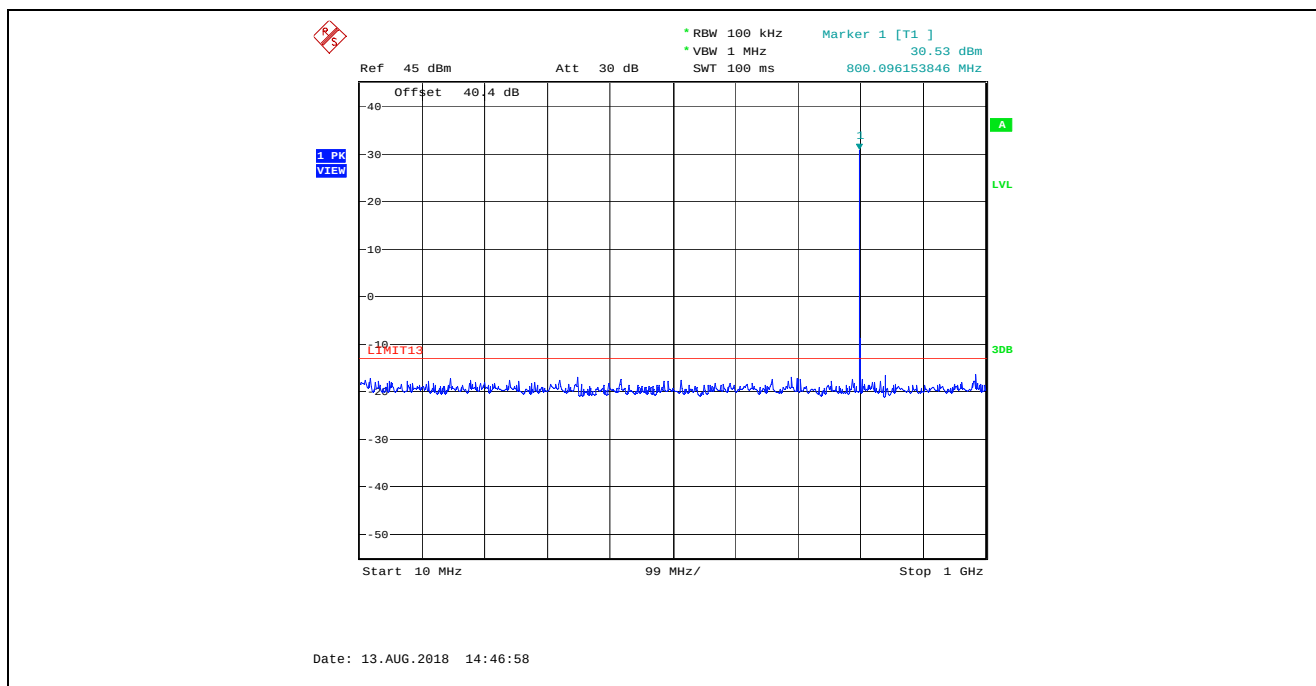
**Plot 5.6.4.2.11.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 794 MHz, 1 GHz – 1.5 GHz



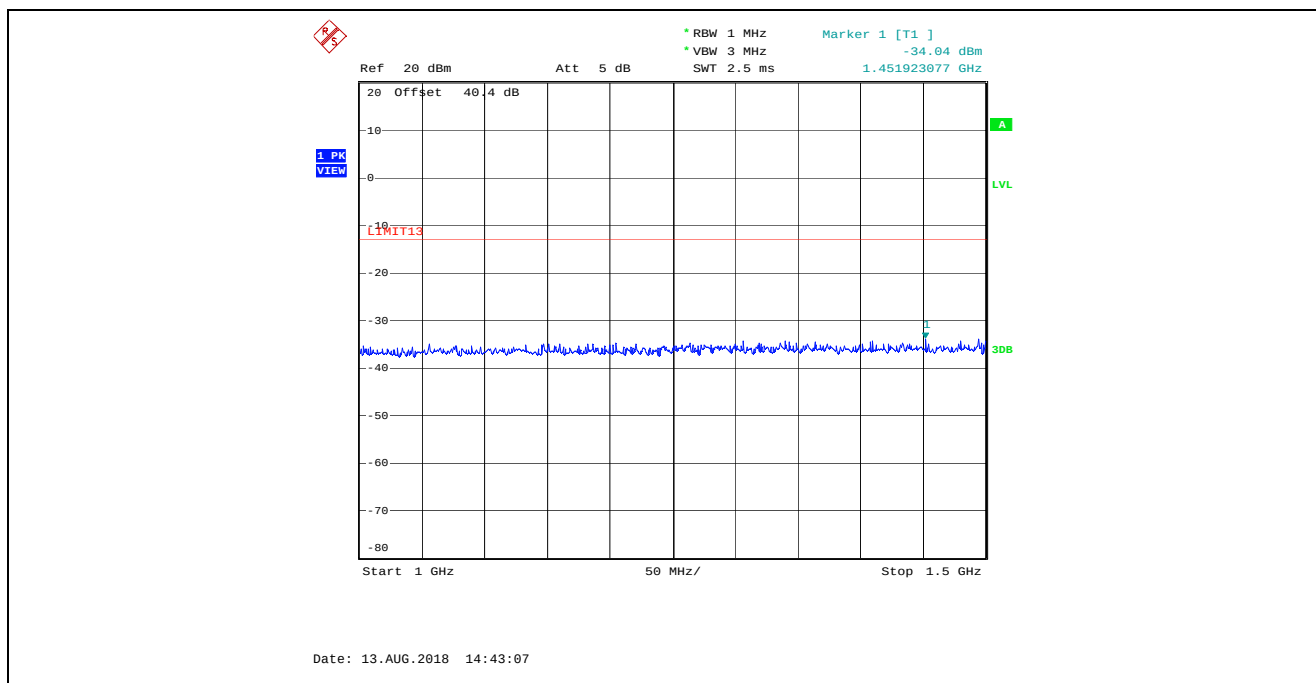
**Plot 5.6.4.2.12.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 794 MHz, 1.5 GHz – 8.5 GHz



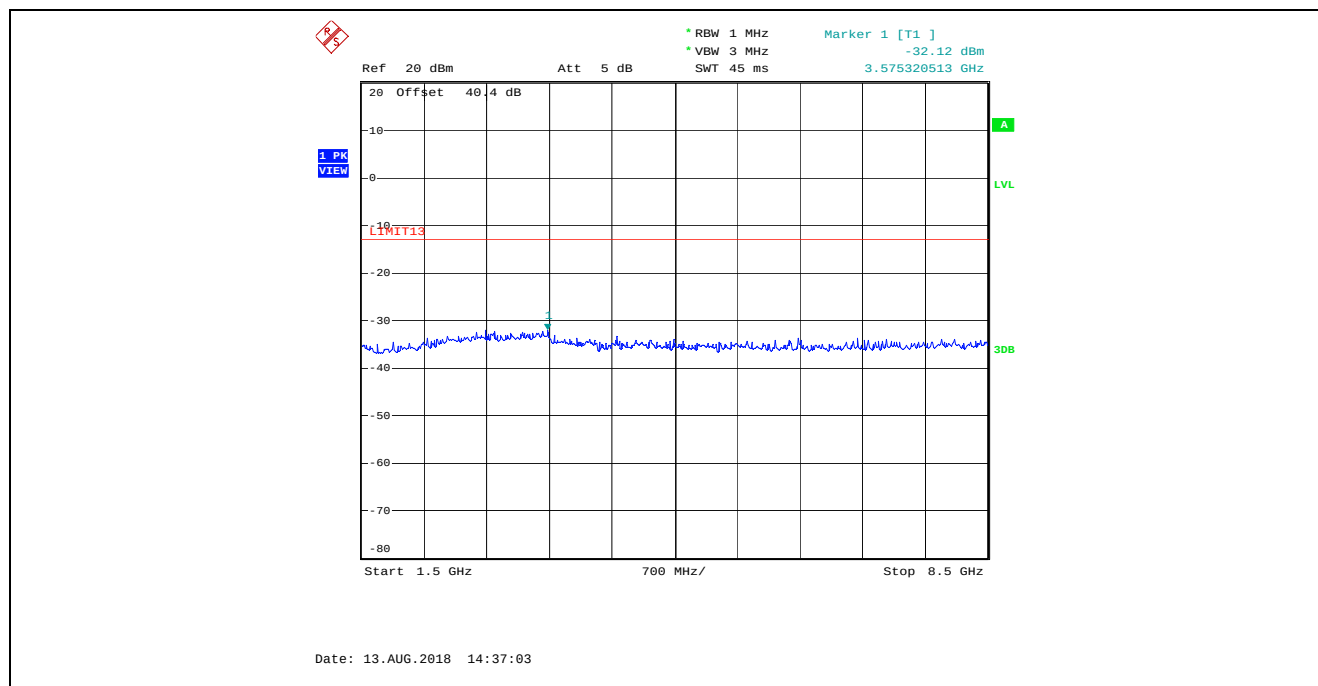
**Plot 5.6.4.2.13.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 800 MHz, 10 MHz – 1 GHz



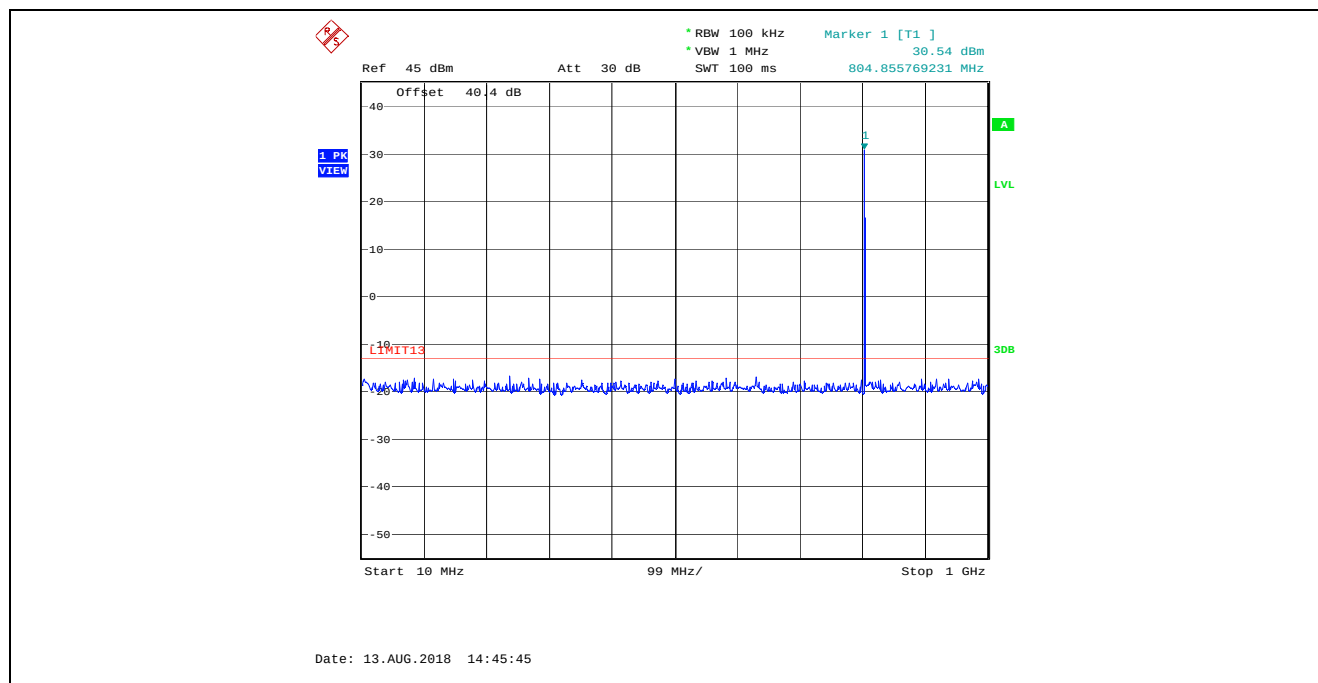
**Plot 5.6.4.2.14.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 800 MHz, 1 GHz – 1.5 GHz



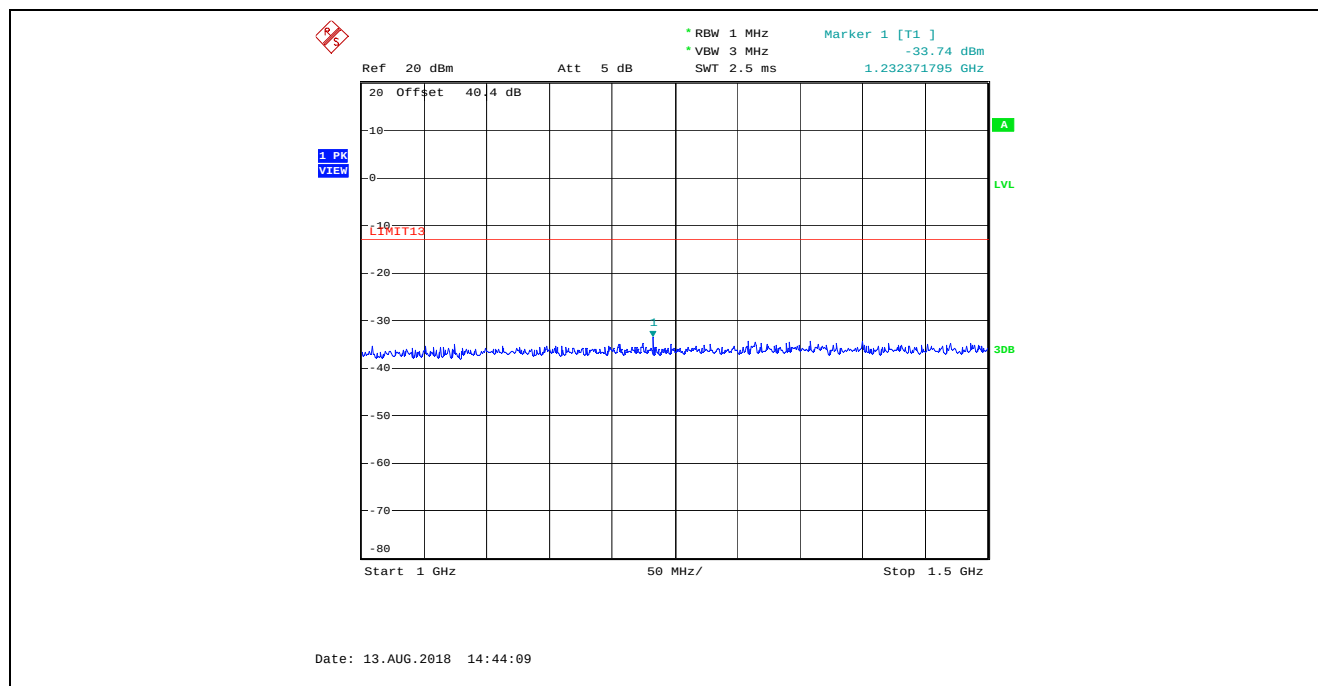
**Plot 5.6.4.2.15.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 800 MHz, 1.5 GHz – 8.5 GHz



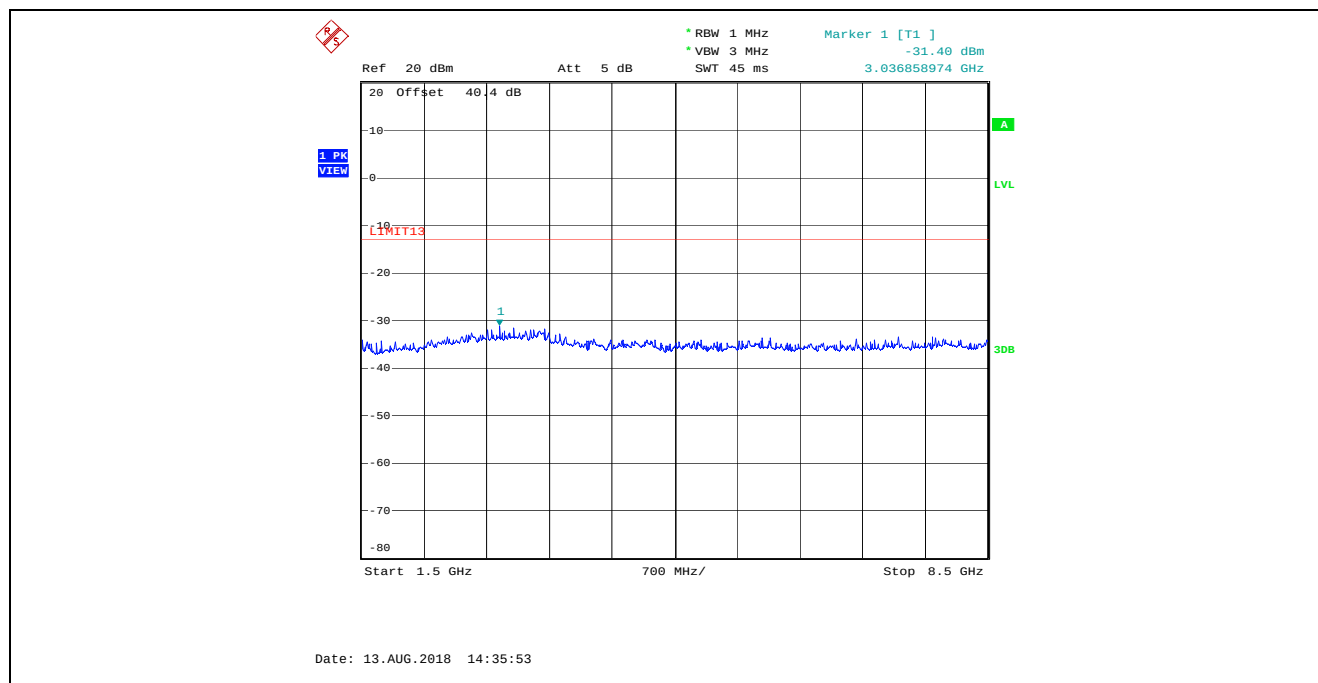
**Plot 5.6.4.2.16.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
 Low Power, 805 MHz, 10 MHz – 1 GHz



**Plot 5.6.4.2.17.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 805 MHz, 1 GHz – 1.5 GHz



**Plot 5.6.4.2.18.** Transmitter Spurious Emissions at Antenna Terminal, Analog 12.5 kHz Channel Spacing  
Low Power, 805 MHz, 1.5 GHz – 8.5 GHz



## 5.7. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 90.543(c) & (e)]

### 5.7.1. Limits

#### § 90.543

c) *Out-of-band emission limit.* On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least  $43 + 10\log(P)$  dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

(e) For operations in the 758-768 MHz and the 788-798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

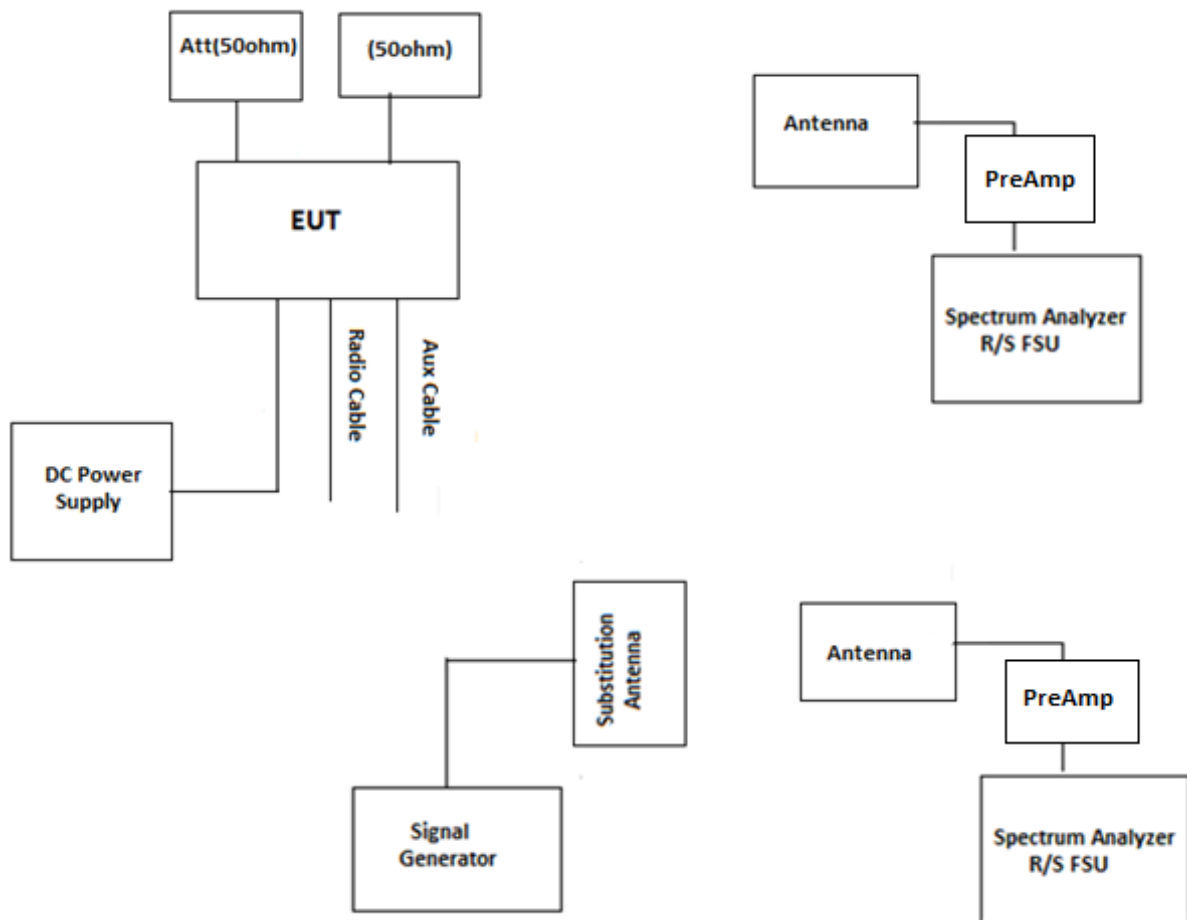
- (1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $76 + 10\log(P)$  dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than  $65 + 10\log(P)$  dB in a 6.25 kHz band segment, for mobile and portable stations.
- (3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least  $43 + 10\log(P)$  dB.
- (4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.
- (5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 kHz may be employed.
- (f) For operations in the 758-775 MHz and 788-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to  $-70$  dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and  $-80$  dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

### 5.7.2. Method of Measurements

TIA-603-E / ANSI C63.26



### 5.7.3. Test Arrangement



#### 5.7.4. Test Data

##### Remarks:

- FCC 90.543(e) is not applicable for this device, transmit signals are not wideband or discrete signals.
- The rf spurious/harmonic emission characteristics between 2 different channel spacing operations and different modulations (voice/digital) are identical. Therefore, the following radiated emissions were performed on the radio set with 12.5 kHz channel spacing operation.
- The radiated emissions were performed at 3 meters distance. At its maximum power for worst case.
- The emissions were scanned from 30 MHz to 8.5 GHz; all spurious emissions that are in excess of 20dB below the specified limit shall be recorded.

##### 5.7.4.1. 764 - 776 MHz Band

| <b>Carrier Frequency:</b> |                  | 764 MHz                |                            |           |             |             |
|---------------------------|------------------|------------------------|----------------------------|-----------|-------------|-------------|
| <b>Limit:</b>             |                  | -13 dBm                |                            |           |             |             |
| Frequency (MHz)           | E-Field (dBμV/m) | EMI Detector (Peak/QP) | Antenna Polarization (H/V) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 30 - 8500                 | *                | Peak                   | H/V                        | *         | -13         | *           |

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

| <b>Carrier Frequency:</b> |                  | 770 MHz                |                            |           |             |             |
|---------------------------|------------------|------------------------|----------------------------|-----------|-------------|-------------|
| <b>Limit:</b>             |                  | -13 dBm                |                            |           |             |             |
| Frequency (MHz)           | E-Field (dBμV/m) | EMI Detector (Peak/QP) | Antenna Polarization (H/V) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 30 - 8500                 | *                | Peak                   | H/V                        | *         | -13         | *           |

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

| <b>Carrier Frequency:</b> |                  | 775 MHz                |                            |           |             |             |
|---------------------------|------------------|------------------------|----------------------------|-----------|-------------|-------------|
| <b>Limit:</b>             |                  | -13 dBm                |                            |           |             |             |
| Frequency (MHz)           | E-Field (dBμV/m) | EMI Detector (Peak/QP) | Antenna Polarization (H/V) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 30 - 8500                 | *                | Peak                   | H/V                        | *         | -13         | *           |

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

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File #: 18FSG176\_FCC90R  
October 18, 2018

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

#### 5.7.4.2. 794 - 806 MHz Band

| <b>Carrier Frequency:</b> |                  | 794 MHz                |                            |           |             |             |
|---------------------------|------------------|------------------------|----------------------------|-----------|-------------|-------------|
| <b>Limit:</b>             |                  | -13 dBm                |                            |           |             |             |
| Frequency (MHz)           | E-Field (dBμV/m) | EMI Detector (Peak/QP) | Antenna Polarization (H/V) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 2382                      | 66.78            | Peak                   | V                          | -31.35    | -13         | -18.4       |
| 2382                      | 66.07            | Peak                   | H                          | -33.35    | -13         | -20.4       |

| <b>Carrier Frequency:</b> |                  | 800 MHz                |                            |           |             |             |
|---------------------------|------------------|------------------------|----------------------------|-----------|-------------|-------------|
| <b>Limit:</b>             |                  | -13 dBm                |                            |           |             |             |
| Frequency (MHz)           | E-Field (dBμV/m) | EMI Detector (Peak/QP) | Antenna Polarization (H/V) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 2400                      | 69.22            | Peak                   | V                          | -29.75    | -13         | -16.8       |
| 2400                      | 67.56            | Peak                   | H                          | -32.85    | -13         | -19.9       |

| <b>Carrier Frequency:</b> |                  | 805 MHz                |                            |           |             |             |
|---------------------------|------------------|------------------------|----------------------------|-----------|-------------|-------------|
| <b>Limit:</b>             |                  | -13 dBm                |                            |           |             |             |
| Frequency (MHz)           | E-Field (dBμV/m) | EMI Detector (Peak/QP) | Antenna Polarization (H/V) | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 2415                      | 69.00            | Peak                   | V                          | -31.05    | -13         | -18.1       |
| 2415                      | 68.52            | Peak                   | H                          | -32.65    | -13         | -19.7       |

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File #: 18FSG176\_FCC90R  
October 18, 2018

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

## EXHIBIT 6. TEST EQUIPMENT LIST

| Test Instruments                          | Manufacturer       | Model No.             | Serial No.   | Frequency Range         | Cal. Due Date |
|-------------------------------------------|--------------------|-----------------------|--------------|-------------------------|---------------|
| Power Meter                               | HP                 | 436A                  | 2709A27515   | 100KHz-sensor dependent | 04 May 2019   |
| Power Sensor                              | HP                 | 8482A                 | MY41172054   | 10MHz-18GHz             | 26 Oct 2019   |
| Attenuator(30dB)                          | Aeroflex\Weinschel | 46-30-34              | BR9127       | DC-18GHz                | See Note 1    |
| Attenuator(10dB)                          | Aeroflex\Weinschel | 46-10-34              | BS4336       | DC-18GHz                | See Note 1    |
| Power Supply                              | Dr. meter          | HY5020E               | 013141252    | 1-40V, DC 20A           | See Note 1    |
| Multimeter                                | Tenma              | 72-6202               | 02080027     | ---                     | 14 Dec 2019   |
| Spectrum Analyzer                         | Rohde & Schwarz    | FSU                   | 100398       | 20Hz-26.5GHz            | 06 Oct 2019   |
| AF Signal Generator                       | HP                 | HP-8920B              | US39064699   | 30MHz-1GHz              | 20 Mar 2020   |
| Hi-pass filter                            | K&L                | 11SH10-1500/T8000-0/0 | 2            | Cut off 1500MHz         | See Note 1    |
| Log Periodic Antenna                      | ETS                | 93148                 | 1101         | 200-2000MHz             | 05 Oct 2018   |
| Preamplifier                              | Com-Power          | PAM-118A              | 551016       | 500MHz-18GHz            | 09 Mar 2019   |
| Preamplifier                              | Com-Power          | PA-103                | 161040       | 1-1000MHz               | 16 May 2019   |
| Bicon Antenna                             | ETS                | 3110B                 | 3379         | 30-200MHz               | 06 Feb 2020   |
| Horn Antenna                              | ETS                | 3117                  | 00119425     | 1-18GHz                 | 29 Jun 2019   |
| Horn Antenna                              | ETS-Lindgren       | 3115                  | 5061         | 1-18GHz                 | 30 Apr 2020   |
| Frequency Counter                         | EIP                | 545A                  | 2683         | 10MHz-1GHz              | 07 Aug 2020   |
| Attenuator(20dB)                          | Weinschel          | WA 35-20-33           | A164         | DC-8.5GHz               | See Note 1    |
| Attenuator(20dB)                          | Aeroflex\Weinschel | 34-20-34              | BP6023       | DC-18GHz                | See Note 1    |
| Multimeter                                | Fluke              | 8842A                 | 5021295      | ---                     | 23 Oct 2019   |
| Combiner                                  | Weinschel 93458    | 1515                  | PS119        | DC-18GHz                | See Note 1    |
| Modulation Analyzer                       | HP                 | HP-8901B              | 3226A04606   | 150KHz-1300MHz          | 23 Mar 2020   |
| Dual Channel Arbitrary Waveform Generator | Kuman              | FY6600-60M            | 170966000106 | DC-60MHz                | 02 Apr 2020   |

Note 1: Internal Verification/Calibration check

## ULTRATECH GROUP OF LABS

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File #: 18FSG176\_FCC90R  
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All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

## EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

### 7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

|       | Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz): | Measured (dB) | Limit (dB) |
|-------|---------------------------------------------------------------------------|---------------|------------|
| $u_c$ | Combined standard uncertainty:<br>$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$ | $\pm 2.39$    | $\pm 2.6$  |
| $U$   | Expanded uncertainty U:<br>$U = 2u_c(y)$                                  | $\pm 4.79$    | $\pm 5.2$  |

|       | Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):   | Measured (dB) | Limit (dB) |
|-------|---------------------------------------------------------------------------|---------------|------------|
| $u_c$ | Combined standard uncertainty:<br>$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$ | $\pm 2.39$    | $\pm 2.6$  |
| $U$   | Expanded uncertainty U:<br>$U = 2u_c(y)$                                  | $\pm 4.78$    | $\pm 5.2$  |

|       | Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz): | Measured (dB) | Limit (dB)          |
|-------|--------------------------------------------------------------------------------------|---------------|---------------------|
| $u_c$ | Combined standard uncertainty:<br>$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$            | $\pm 1.87$    | Under consideration |
| $U$   | Expanded uncertainty U:<br>$U = 2u_c(y)$                                             | $\pm 3.75$    | Under consideration |

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