

FCC PART 22, 74, 80 and 90

## TEST REPORT

For

### Hytera Communications Corporation Limited

Hytera Tower, Hi-Tech Industrial Park North, 9108# Beihuan Road, Nanshan District, Shenzhen,  
518057 China

**FCC ID:YAMHP70XVHF**

|                                        |                                                                                                                                                                                                                                                       |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Report Type:</b><br>Original Report | <b>Product Type:</b><br>Digital Portable Radio                                                                                                                                                                                                        |
| <b>Report Number:</b> RDG191213008-00A |                                                                                                                                                                                                                                                       |
| <b>Report Date:</b> 2020-01-22         |                                                                                                                                                                                                                                                       |
| <b>Reviewed By:</b>                    | Ivan Cao<br>Assistant Manager<br>                                                                                                                                 |
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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

|                                            |                |                                             |
|--------------------------------------------|----------------|---------------------------------------------|
| <b>EUT Name:</b>                           |                | Digital Portable Radio                      |
| <b>EUT Model:</b>                          |                | HP702 VHF                                   |
| <b>Mutiple Models:</b>                     |                | HP700 VHF,HP706 VHF,HP708 VHF,HP705 VHF     |
| <b>Modulation Type:</b>                    |                | FM, 4FSK                                    |
| <b>Channel Spacing:</b>                    |                | 12.5/25 kHz                                 |
| <b>Frequency Range:</b>                    |                | 136-174 MHz                                 |
| <b>Rated Output Power:<br/>(Conducted)</b> |                | High Power Level: 5W<br>Low Power Level: 1W |
| <b>Rated Input Voltage:</b>                |                | DC 7.7V from battery or DC 12V from charger |
| <b>Adapter<br/>Information</b>             | <b>Model:</b>  | HKA01212010-XQ                              |
|                                            | <b>Input:</b>  | AC 100-240V 50/60Hz 0.5A                    |
|                                            | <b>Output:</b> | DC 12V 1A                                   |
| <b>Serial Number:</b>                      |                | RDG191213008-RF-S1                          |
| <b>EUT Received Date:</b>                  |                | 2019.12.16                                  |
| <b>EUT Received Status:</b>                |                | Good                                        |

*Note: The series product, models HP700 VHF,HP706 VHF,HP708 VHF,HP705 VHF and HP702 VHF are electrically identical, The difference between them please refer to the declaration letter for details. For marketing purpose, we selected HP702 VHF for fully test.*

### Objective

This test report is prepared on behalf of *Hytera Communications Corporation Limited* in accordance with Part 2, and Part 22,74,80 and 90 of the Federal Communication Commissions rules.

### Related Submittal(s)/Grant(s)

FCC Part 15C DTS&DSS submissions with FCC ID: YAMHP70XVHF

### Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 22 – Public Mobile Service  
 Part 74 – Experimental Radio, Auxiliary, Special Broadcast and other Program Distributonal Service  
 Part 80 –Stations in the Maritime Services  
 Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA 603-D.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## Measurement Uncertainty

| Parameter                     | Measurement Uncertainty                      |
|-------------------------------|----------------------------------------------|
| Occupied Channel Bandwidth    | $\pm 5\%$                                    |
| RF output power, conducted    | $\pm 0.61\text{dB}$                          |
| Unwanted Emissions, radiated  | 30MHz ~ 1GHz: 5.85 dB<br>1G~26.5GHz: 5.23 dB |
| Unwanted Emissions, conducted | $\pm 1.5\text{ dB}$                          |
| Temperature                   | $\pm 1^\circ\text{C}$                        |
| Humidity                      | $\pm 5\%$                                    |
| DC and low frequency voltages | $\pm 0.4\%$                                  |
| Duty Cycle                    | 1%                                           |

*Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.*

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

## Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “ $\Delta$ ”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in a test mode which has been done in the factory.

### EUT Exercise Software

No exercise software was used.

### Special Accessories

No special accessory was used.

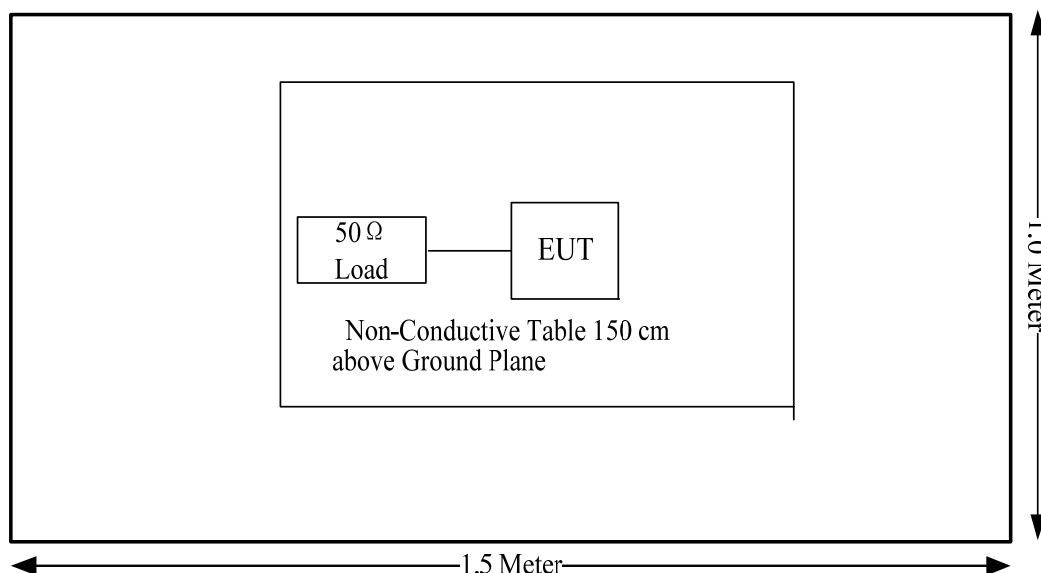
### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

| Manufacturer | Description               | Model | Serial Number |
|--------------|---------------------------|-------|---------------|
| Weinschel    | 50 $\Omega$ Load Terminal | MD477 | 1440-3        |
| HP           | RF Communication Tester   | 8920A | 3438A05201    |

### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

| FCC Rules                                                                    | Description of Test                   | Results    |
|------------------------------------------------------------------------------|---------------------------------------|------------|
| §1.1310 and §2.1093                                                          | RF Exposure                           | Compliance |
| §2.1046; § 22.727;<br>§80.215; §74.461; §90.205                              | RF Output Power                       | Compliance |
| §2.1047                                                                      | Modulation Characteristic             | Compliance |
| §2.1049; §22.357; § 22.731;<br>§74.462; §80.205; §80.207<br>§90.209; §90.210 | Occupied Bandwidth & Emission Mask    | Compliance |
| §2.1051; §22.861; §74.462;<br>§80.211; §90.210                               | Spurious Emission at Antenna Terminal | Compliance |
| §2.1053; §22.861;<br>§74.462; §80.211; §90.210                               | Spurious Radiated Emissions           | Compliance |
| §2.1055; § 22.355;<br>§74.464; §80.209; §90.213                              | Frequency Stability                   | Compliance |
| §90.214                                                                      | Transient Frequency Behavior          | Compliance |

**TEST EQUIPMENT LIST**

| Manufacturer                         | Description                              | Model                  | Serial Number | Calibration Date | Calibration Due Date |
|--------------------------------------|------------------------------------------|------------------------|---------------|------------------|----------------------|
| <b>Radiated emissions below 1GHz</b> |                                          |                        |               |                  |                      |
| R&S                                  | EMI Test Receiver                        | ESCI                   | 100035        | 2019-08-03       | 2020-08-03           |
| Sunol Sciences                       | Antenna                                  | JB3                    | A060611-2     | 2017-08-25       | 2020-08-25           |
| EMCO                                 | Adjustable Dipole Antenna                | 3121C                  | 9109-753      | N/A              | N/A                  |
| Unknown                              | Coaxial Cable                            | C-NJNJ-50              | C-1000-01     | 2019-09-05       | 2020-09-05           |
| Unknown                              | Coaxial Cable                            | C-NJNJ-50              | C-0400-02     | 2019-09-05       | 2020-09-05           |
| Unknown                              | Coaxial Cable                            | C-NJNJ-50              | C-0530-01     | 2019-09-24       | 2020-09-24           |
| Sonoma                               | Amplifier                                | 310N                   | 185914        | 2019-10-13       | 2020-10-13           |
| Agilent                              | Signal Generator                         | E8247C                 | MY43321350    | 2019-12-10       | 2020-12-10           |
| Ouli                                 | Bandpass Filter                          | 136-174M               | 021           | 2019-07-23       | 2020-07-23           |
| <b>Radiated emissions above 1GHz</b> |                                          |                        |               |                  |                      |
| Agilent                              | Spectrum Analyzer                        | E4440A                 | SG43360054    | 2019-05-09       | 2020-05-09           |
| TDK RF                               | Horn Antenna                             | HRN-0118               | 130 084       | 2018-10-12       | 2021-10-12           |
| ETS-Lindgren                         | Horn Antenna                             | 3115                   | 000 527 35    | 2018-10-12       | 2021-10-12           |
| Unknown                              | Coaxial Cable                            | C-SJSJ-50              | C-0800-01     | 2019-09-05       | 2020-09-05           |
| Unknown                              | Coaxial Cable                            | C-NJNJ-50              | C-0200-02     | 2019-09-05       | 2020-09-05           |
| MITEQ                                | Amplifier                                | AFS42-00101800-25-S-42 | 2001271       | 2019-09-05       | 2020-09-05           |
| Agilent                              | Signal Generator                         | E8247C                 | MY43321350    | 2019-12-10       | 2020-12-10           |
| <b>RF Conducted Test</b>             |                                          |                        |               |                  |                      |
| Rohde & Schwarz                      | Signal Analyzer                          | FSIQ26                 | 831929/005    | 2019-08-03       | 2020-08-03           |
| Unknown                              | Coaxial Cable                            | C-SJ00-0010            | C0010/02      | Each time        | N/A                  |
| Unknown                              | Coaxial Cable                            | C-SJ00-0010            | C0010/05      | Each time        | N/A                  |
| E-Microwave                          | Blocking Control                         | EMDCB-00036            | 0E01201048    | Each time        | N/A                  |
| E-Microwave                          | Coaxial Attenuators                      | EMCA40-200SN-6         | 0E01201046    | Each time        | N/A                  |
| Ouli                                 | Bandpass Filter                          | 136-174M               | 021           | 2019-07-23       | 2020-07-23           |
| HP                                   | RF Communications Test Set               | 8920A                  | 3438A05201    | 2019-05-09       | 2020-05-09           |
| ESPEC                                | Constant temperature and humidity Tester | ESX-4CA                | 018 463       | 2019-03-26       | 2020-03-26           |
| UNI-T                                | Multimeter                               | UT39A                  | M130199938    | 2019-07-23       | 2020-07-23           |

**\* Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

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## **FCC §1.1310 & §2.1093 - RF EXPOSURE**

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### **Applicable Standard**

FCC§1.1310 and §2.1093.

### **Test Result**

Compliance, please refer to the SAR report: RDG191213008-20A.

**FCC §2.1046 & § 22.727 & §74.461 & §80.215& §90.205 - RF OUTPUT POWER**

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**Applicable Standard**

FCC §2.1046, § 22.727, §74.461, §80.215 and §90.205

**Test Procedure**

Conducted RF Output Power:

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Spectrum Analyzer Setting:

|         |           |
|---------|-----------|
| R B/W   | Video B/W |
| 100 kHz | 300 kHz   |

**Test Data****Environmental Conditions**

|                           |        |
|---------------------------|--------|
| <b>Temperature:</b>       | 24.1°C |
| <b>Relative Humidity:</b> | 60 %   |
| <b>ATM Pressure:</b>      | 102kPa |

*The testing was performed by Blake Yang on 2019-12-30*

*Test Mode: Transmitting*

**Test Result:** Compliance. Please refer to following table.

| Modulation Mode | Channel Separation | $f_c$    | Reading (w)      |                 | Note        |
|-----------------|--------------------|----------|------------------|-----------------|-------------|
|                 |                    | MHz      | High Power Level | Low Power Level |             |
| FM              | 12.5kHz            | 136.0125 | 5.970            | 1.189           | For federal |
|                 |                    | 155.7525 | 5.715            | 1.062           | For part 90 |
|                 |                    | 173.3875 | 5.508            | 1.104           | For federal |
| 4FSK            | 12.5kHz            | 136.0125 | 5.649            | 1.127           | For federal |
|                 |                    | 155.7525 | 5.794            | 1.099           | For part 90 |
|                 |                    | 173.3875 | 5.916            | 1.086           | For federal |
| FM              | 25kHz              | 154.0125 | 5.888            | 1.057           | FCC part 80 |
| FM              | 12.5kHz            | 161.1    | 5.559            | 1.102           | FCC part 74 |
|                 | 25kHz              |          | 5.861            | 1.091           |             |
| 4FSK            | 12.5kHz            |          | 5.675            | 1.140           |             |
| FM              | 12.5kHz            | 150.8125 | 5.984            | 1.059           | FCC part 22 |
|                 | 25kHz              |          | 3.532            | 1.114           |             |
| 4FSK            | 12.5kHz            |          | 5.636            | 1.127           |             |

Note: The high rated power level is 5 W, and low rated power level is 1 W.

## **FCC §2.1047 - MODULATION CHARACTERISTIC**

### **Applicable Standard**

FCC §2.1047

- (a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
- (b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

### **Test Procedure**

Test Method: TIA/EIA-603 2.2.3

### **Test Data**

#### **Environmental Conditions**

|                           |        |
|---------------------------|--------|
| <b>Temperature:</b>       | 24.1°C |
| <b>Relative Humidity:</b> | 60 %   |
| <b>ATM Pressure:</b>      | 102kPa |

*The testing was performed by Blake Yang on 2019-12-30*

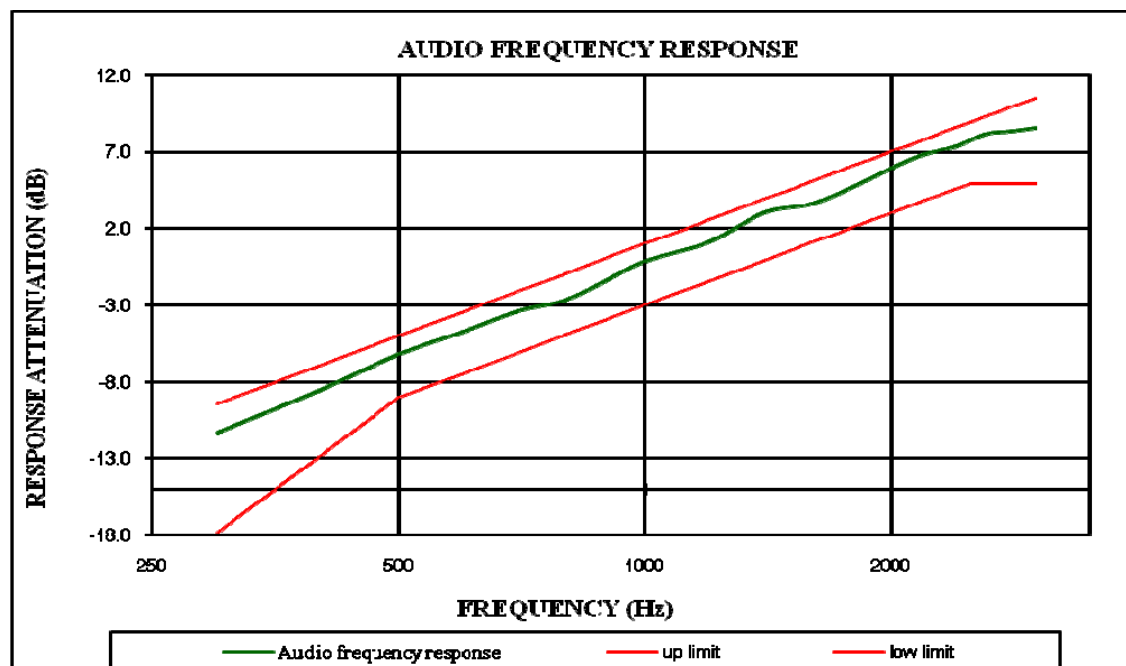
*Test Mode: Transmitting*

**Result:** Compliance.

**Audio Frequency Response – High Power****12.5kHz:**

Carrier Frequency: 155.7525 MHz

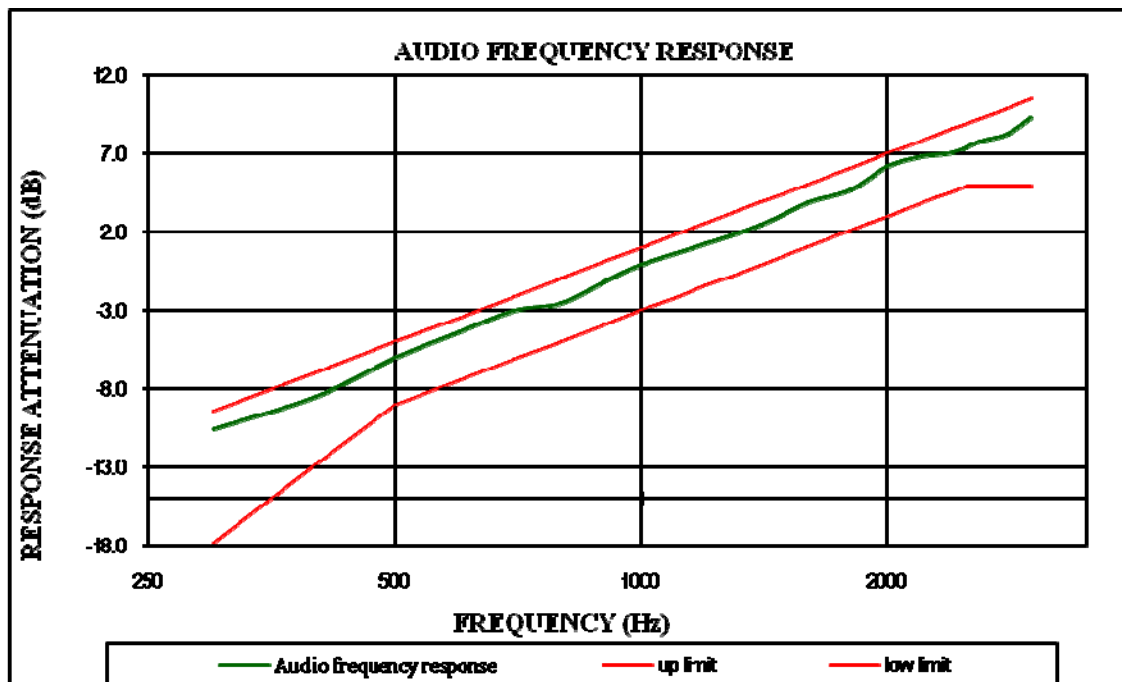
| Modulation Frequency (Hz) | Response data (dB) |
|---------------------------|--------------------|
| 300                       | -11.28             |
| 400                       | -8.55              |
| 500                       | -6.22              |
| 600                       | -4.74              |
| 700                       | -3.40              |
| 800                       | -2.66              |
| 900                       | -1.37              |
| 1000                      | 0.00               |
| 1200                      | 1.15               |
| 1400                      | 3.06               |
| 1600                      | 3.61               |
| 1800                      | 4.75               |
| 2000                      | 5.96               |
| 2200                      | 6.84               |
| 2400                      | 7.33               |
| 2600                      | 8.14               |
| 2800                      | 8.31               |
| 3000                      | 8.52               |



25 kHz:

Carrier Frequency: 150.8125 MHz

| Modulation Frequency (Hz) | Response data (dB) |
|---------------------------|--------------------|
| 300                       | -10.56             |
| 400                       | -8.50              |
| 500                       | -6.07              |
| 600                       | -4.37              |
| 700                       | -3.00              |
| 800                       | -2.52              |
| 900                       | -1.18              |
| 1000                      | 0.00               |
| 1200                      | 1.23               |
| 1400                      | 2.47               |
| 1600                      | 3.91               |
| 1800                      | 4.70               |
| 2000                      | 6.19               |
| 2200                      | 6.80               |
| 2400                      | 7.08               |
| 2600                      | 7.80               |
| 2800                      | 8.25               |
| 3000                      | 9.28               |

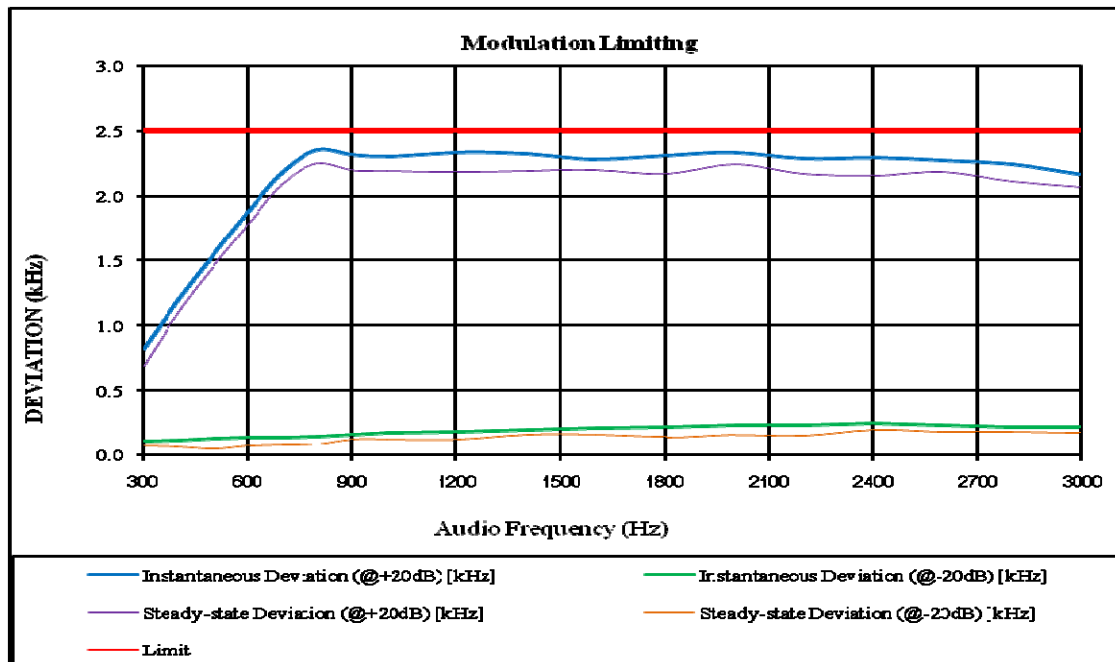


**MODULATION LIMITING – High Power**

12.5kHz

Carrier Frequency: 155.7525 MHz

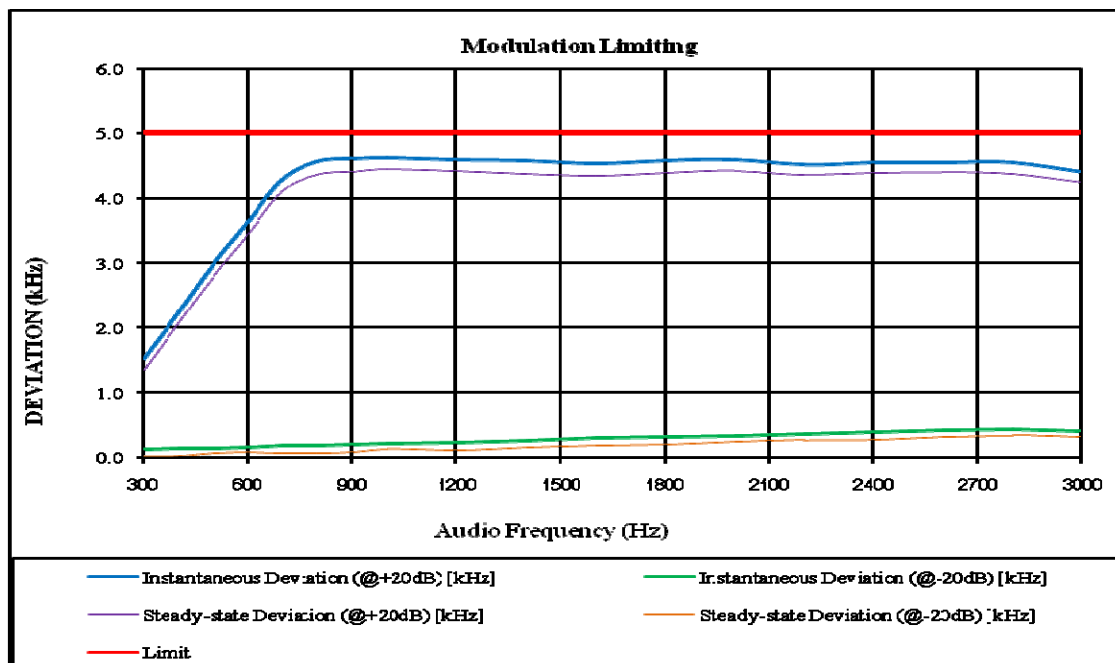
| Audio Frequency (Hz) | Instantaneous            |                          | Steady-state             |                          | Limit [KHz] |
|----------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------|
|                      | Deviation (@+20dB) [KHz] | Deviation (@-20dB) [KHz] | Deviation (@+20dB) [KHz] | Deviation (@-20dB) [KHz] |             |
| 300                  | 0.815                    | 0.112                    | 0.685                    | 0.072                    | 2.5         |
| 400                  | 1.197                    | 0.118                    | 1.107                    | 0.068                    | 2.5         |
| 500                  | 1.546                    | 0.131                    | 1.456                    | 0.051                    | 2.5         |
| 600                  | 1.871                    | 0.141                    | 1.771                    | 0.071                    | 2.5         |
| 700                  | 2.182                    | 0.138                    | 2.092                    | 0.078                    | 2.5         |
| 800                  | 2.352                    | 0.145                    | 2.252                    | 0.085                    | 2.5         |
| 900                  | 2.318                    | 0.163                    | 2.198                    | 0.123                    | 2.5         |
| 1000                 | 2.305                    | 0.176                    | 2.195                    | 0.126                    | 2.5         |
| 1200                 | 2.336                    | 0.185                    | 2.186                    | 0.125                    | 2.5         |
| 1400                 | 2.327                    | 0.201                    | 2.197                    | 0.161                    | 2.5         |
| 1600                 | 2.282                    | 0.213                    | 2.202                    | 0.163                    | 2.5         |
| 1800                 | 2.312                    | 0.224                    | 2.172                    | 0.144                    | 2.5         |
| 2000                 | 2.334                    | 0.238                    | 2.244                    | 0.158                    | 2.5         |
| 2200                 | 2.291                    | 0.236                    | 2.171                    | 0.156                    | 2.5         |
| 2400                 | 2.296                    | 0.248                    | 2.156                    | 0.198                    | 2.5         |
| 2600                 | 2.276                    | 0.235                    | 2.186                    | 0.185                    | 2.5         |
| 2800                 | 2.244                    | 0.223                    | 2.114                    | 0.183                    | 2.5         |
| 3000                 | 2.165                    | 0.218                    | 2.065                    | 0.178                    | 2.5         |



25kHz:

Carrier Frequency: 150.8125 MHz

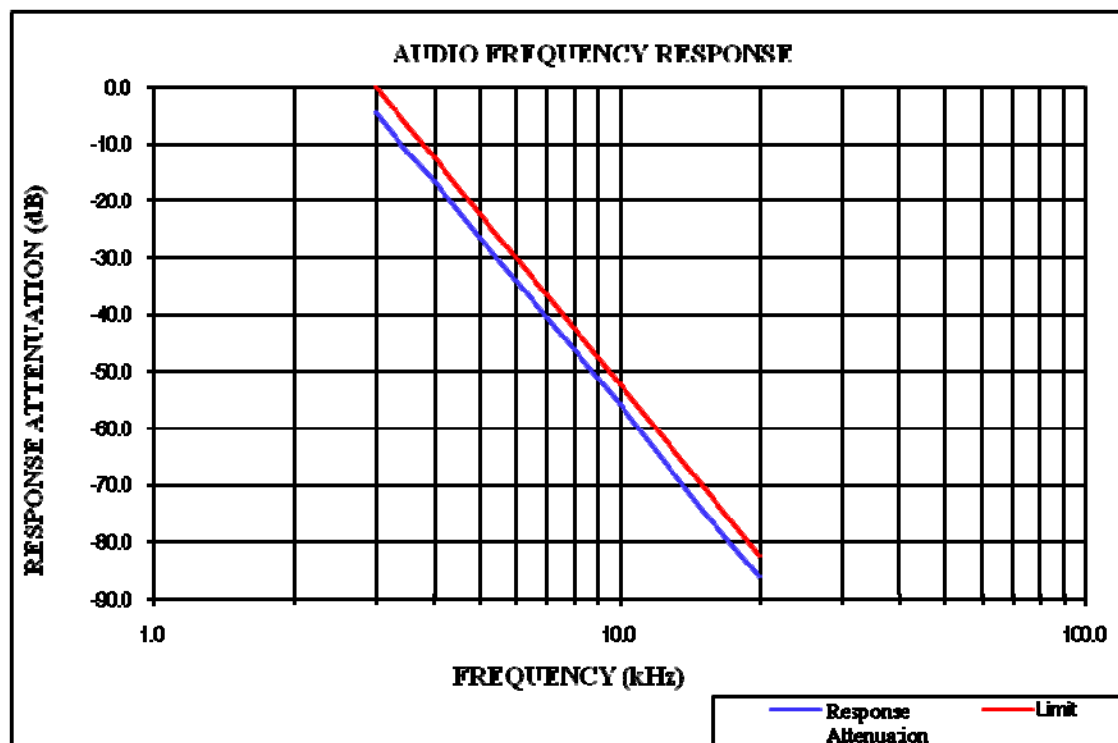
| Audio Frequency (Hz) | Instantaneous            |                          | Steady-state             |                          | Limit [KHz] |
|----------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------|
|                      | Deviation (@+20dB) [KHz] | Deviation (@-20dB) [KHz] | Deviation (@+20dB) [KHz] | Deviation (@-20dB) [KHz] |             |
| 300                  | 1.518                    | 0.133                    | 1.338                    | 0.023                    | 5           |
| 400                  | 2.236                    | 0.145                    | 2.076                    | 0.025                    | 5           |
| 500                  | 2.982                    | 0.147                    | 2.802                    | 0.067                    | 5           |
| 600                  | 3.621                    | 0.161                    | 3.431                    | 0.081                    | 5           |
| 700                  | 4.284                    | 0.185                    | 4.104                    | 0.075                    | 5           |
| 800                  | 4.563                    | 0.187                    | 4.363                    | 0.077                    | 5           |
| 900                  | 4.608                    | 0.202                    | 4.408                    | 0.092                    | 5           |
| 1000                 | 4.623                    | 0.219                    | 4.443                    | 0.139                    | 5           |
| 1200                 | 4.591                    | 0.233                    | 4.421                    | 0.123                    | 5           |
| 1400                 | 4.579                    | 0.266                    | 4.379                    | 0.156                    | 5           |
| 1600                 | 4.531                    | 0.302                    | 4.341                    | 0.192                    | 5           |
| 1800                 | 4.582                    | 0.317                    | 4.392                    | 0.207                    | 5           |
| 2000                 | 4.591                    | 0.337                    | 4.421                    | 0.247                    | 5           |
| 2200                 | 4.518                    | 0.373                    | 4.358                    | 0.273                    | 5           |
| 2400                 | 4.547                    | 0.397                    | 4.387                    | 0.277                    | 5           |
| 2600                 | 4.548                    | 0.424                    | 4.398                    | 0.324                    | 5           |
| 2800                 | 4.551                    | 0.445                    | 4.371                    | 0.345                    | 5           |
| 3000                 | 4.408                    | 0.418                    | 4.238                    | 0.328                    | 5           |



**Audio Frequency Low Pass Filter Response – High Power****12.5kHz:**

Carrier Frequency: 155.7525 MHz

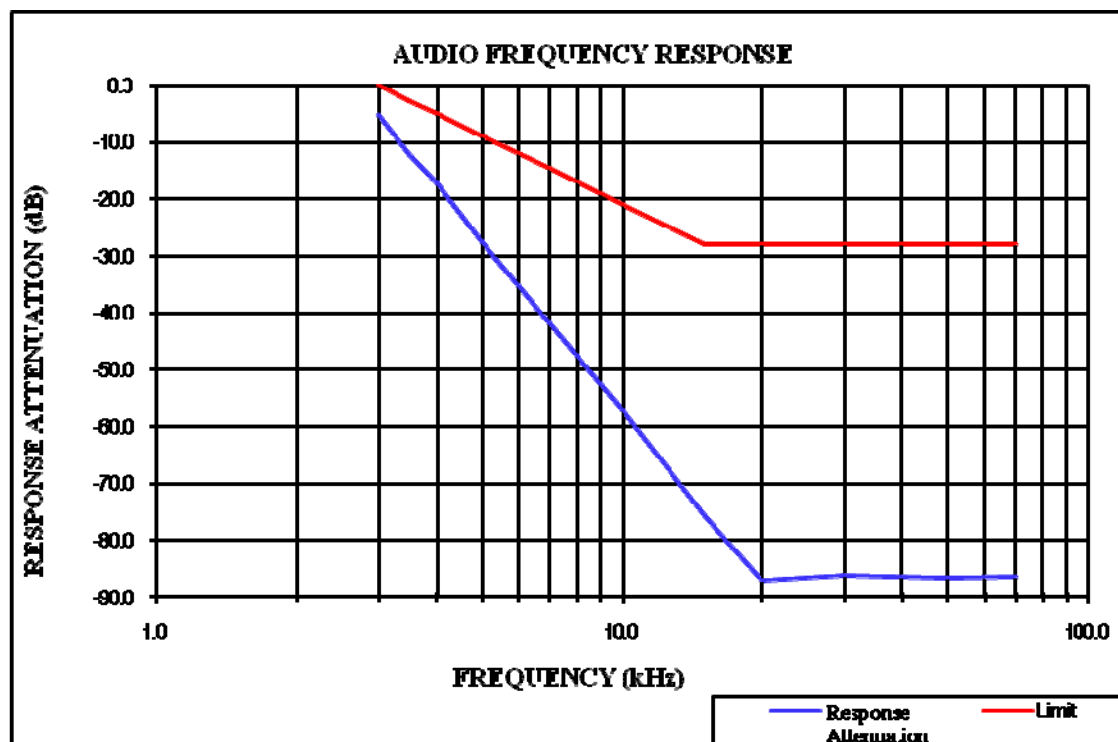
| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|-----------------------|---------------------------|------------|
| 3.0                   | -4.5                      | 0.0        |
| 3.5                   | -11.2                     | -6.7       |
| 4.0                   | -16.5                     | -12.5      |
| 5.0                   | -26.5                     | -22.2      |
| 7.0                   | -40.7                     | -36.8      |
| 10.0                  | -55.8                     | -52.3      |
| 15.0                  | -74.3                     | -69.9      |
| 20.0                  | -86.3                     | -82.5      |



25kHz:

Carrier Frequency: 150.8125 MHz

| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|-----------------------|---------------------------|------------|
| 3.0                   | -5.2                      | 0.0        |
| 3.5                   | -12.1                     | -2.7       |
| 4.0                   | -17.2                     | -5.0       |
| 5.0                   | -27.6                     | -8.9       |
| 7.0                   | -41.9                     | -14.7      |
| 10.0                  | -57.0                     | -20.9      |
| 15.0                  | -75.6                     | -28.0      |
| 20.0                  | -87.0                     | -28.0      |
| 30.0                  | -86.3                     | -28.0      |
| 50.0                  | -86.7                     | -28.0      |
| 70.0                  | -86.4                     | -28.0      |



**FCC §2.1049 & §22.357 & § 22.731 & §74.462 & 80.205& §80.207& §90.209 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK****Applicable Standard**

FCC §2.1049, §22.357, § 22.731, §74.462, §80.205, §80.207, §90.209 and §90.210

**Test Procedure**

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 Hz or 300 Hz and the spectrum was recorded in the frequency band  $\pm 50$  kHz from the carrier frequency.

**Test Data****Environmental Conditions**

|                           |        |
|---------------------------|--------|
| <b>Temperature:</b>       | 24.1°C |
| <b>Relative Humidity:</b> | 60 %   |
| <b>ATM Pressure:</b>      | 102kPa |

*The testing was performed by Blake Yang on 2019-12-30*

Test mode: transmitting

| Modulation Mode | Channel Separation | f <sub>c</sub> (MHz) | 99% Occupied Bandwidth (kHz) | 26 dB Bandwidth (kHz) | Power Level | Note        |
|-----------------|--------------------|----------------------|------------------------------|-----------------------|-------------|-------------|
| FM              | 12.5kHz            | 155.7525             | 9.920                        | 10.321                | High        | FCC part 90 |
|                 |                    |                      | 10.020                       | 10.421                | Low         |             |
| 4FSK            | 12.5kHz            |                      | 7.214                        | 9.218                 | High        |             |
|                 |                    |                      | 6.914                        | 9.719                 | Low         |             |
| FM              | 25kHz              | 154.0125             | 15.030                       | 15.832                | High        | FCC part 80 |
|                 |                    |                      | 15.030                       | 15.832                | Low         |             |
| FM              | 12.5kHz            | 161.1                | 10.020                       | 10.421                | High        | FCC part 74 |
|                 |                    |                      | 10.020                       | 10.421                | Low         |             |
|                 | 25kHz              |                      | 15.03                        | 15.832                | High        |             |
|                 |                    |                      | 15.030                       | 15.832                | Low         |             |
| 4FSK            | 12.5kHz            |                      | 7.214                        | 9.469                 | High        |             |
|                 |                    |                      | 7.315                        | 9.269                 | Low         |             |
| FM              | 12.5kHz            | 150.8125             | 9.920                        | 10.421                | High        | FCC part 22 |
|                 |                    |                      | 10.020                       | 10.421                | Low         |             |
|                 | 25kHz              |                      | 15.030                       | 15.832                | High        |             |
|                 |                    |                      | 15.030                       | 15.832                | Low         |             |
| 4FSK            | 12.5kHz            |                      | 7.214                        | 9.319                 | High        |             |
|                 |                    |                      | 7.315                        | 9.319                 | Low         |             |

Note: Emission bandwidth was based on calculation method instead of measurement.

Emission Designator

Per CFR 47 §2.201& §2.202, BW = 2M + 2D

#### For FM Mode (Channel Spacing: 12.5 kHz)

Emission Designator 11K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 2.5 kHz deviation.

$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 2.5 \text{ kHz}) = 11 \text{ kHz} = 11K0$

F3E portion of the designator represents an FM voice transmission

Therefore, the entire designator for 12.5 kHz channel spacing FM mode is 11K0F3E.

#### For FM Mode (Channel Spacing: 25 kHz)

Emission Designator 16K0F3E

In this case, the maximum modulating frequency is 3.0 kHz with a 5.0 kHz deviation.

$BW = 2(M+D) = 2*(3.0 \text{ kHz} + 5.0 \text{ kHz}) = 16 \text{ kHz} = 16K0$

F3E portion of the designator represents an FM voice transmission

Therefore, the entire designator for 25 kHz channel spacing FM mode is 16K0F3E.

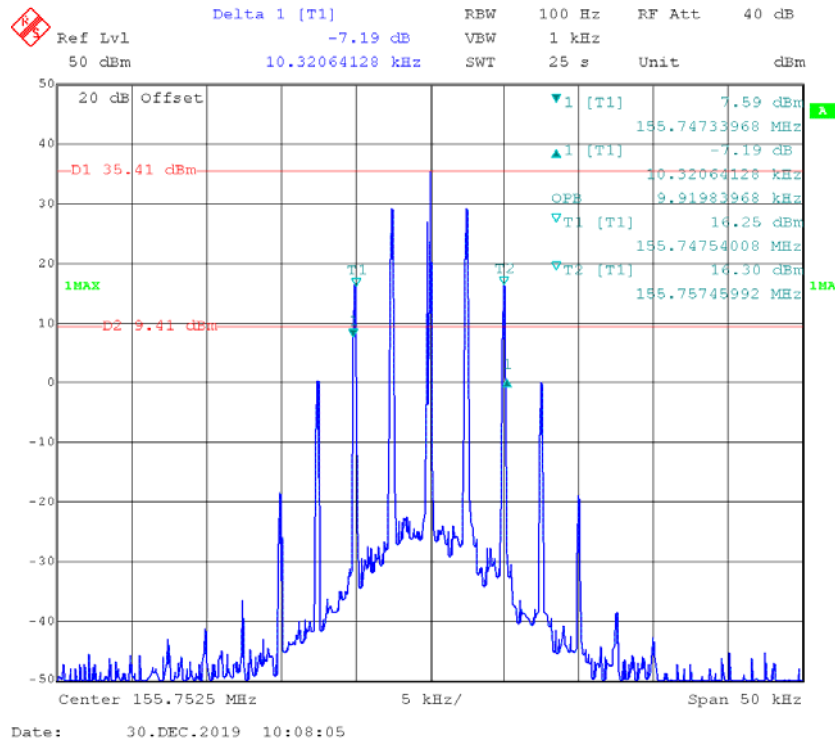
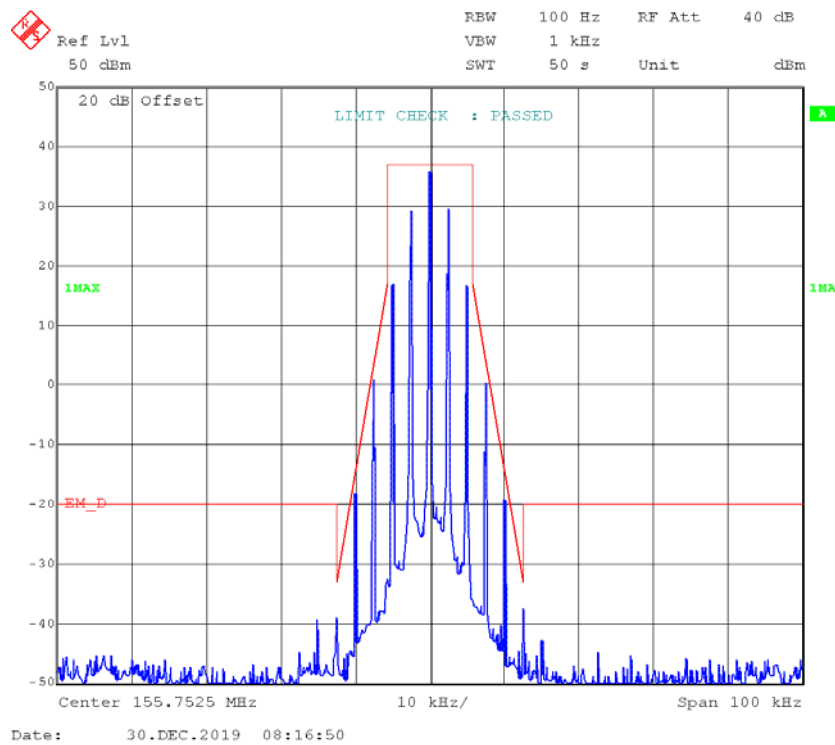
#### For Digital Mode (Channel Spacing: 12.5 kHz)

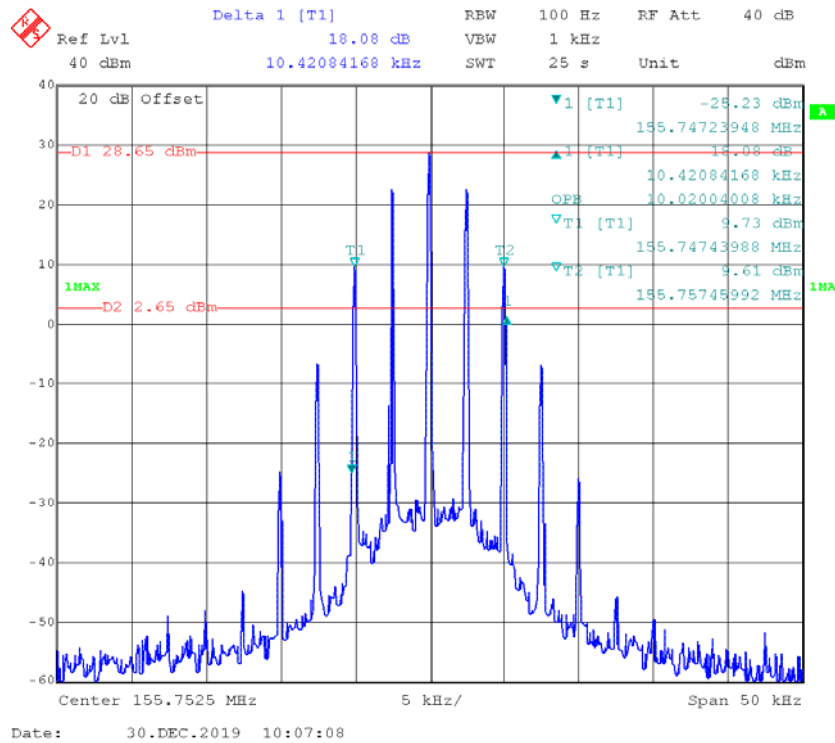
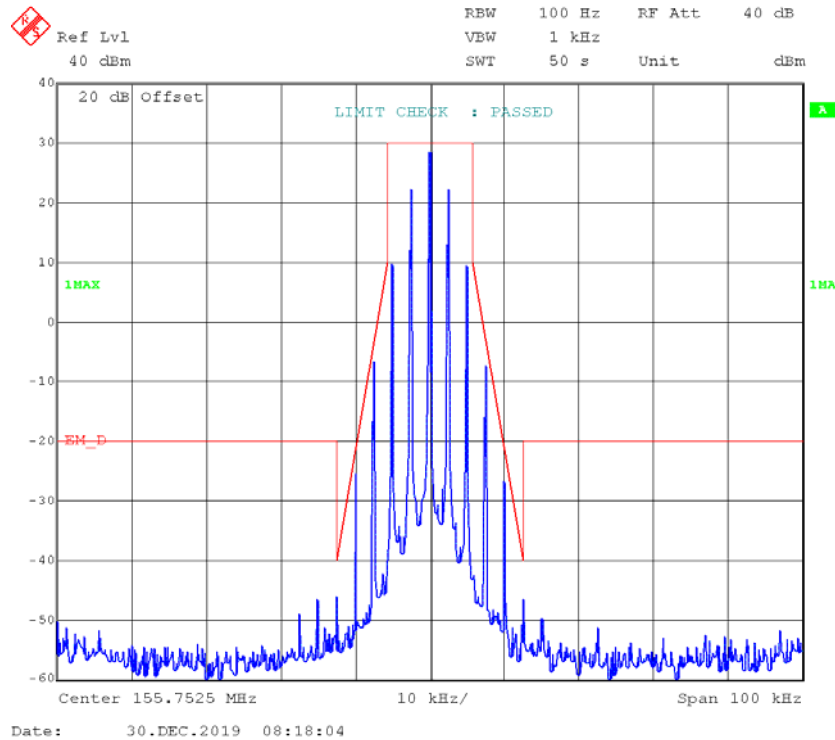
Emission Designator 7K60F1D and 7K60F1E

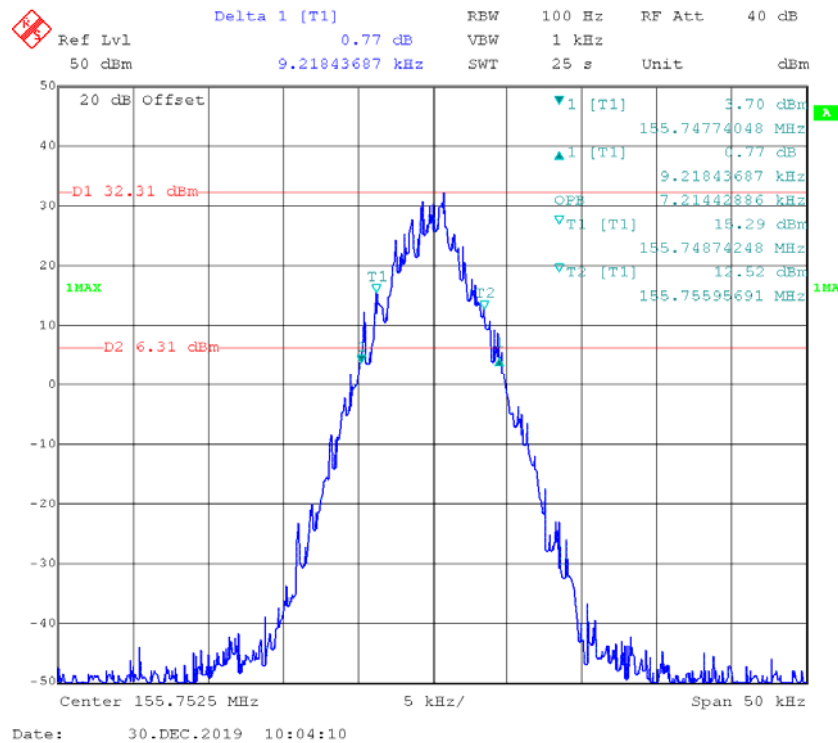
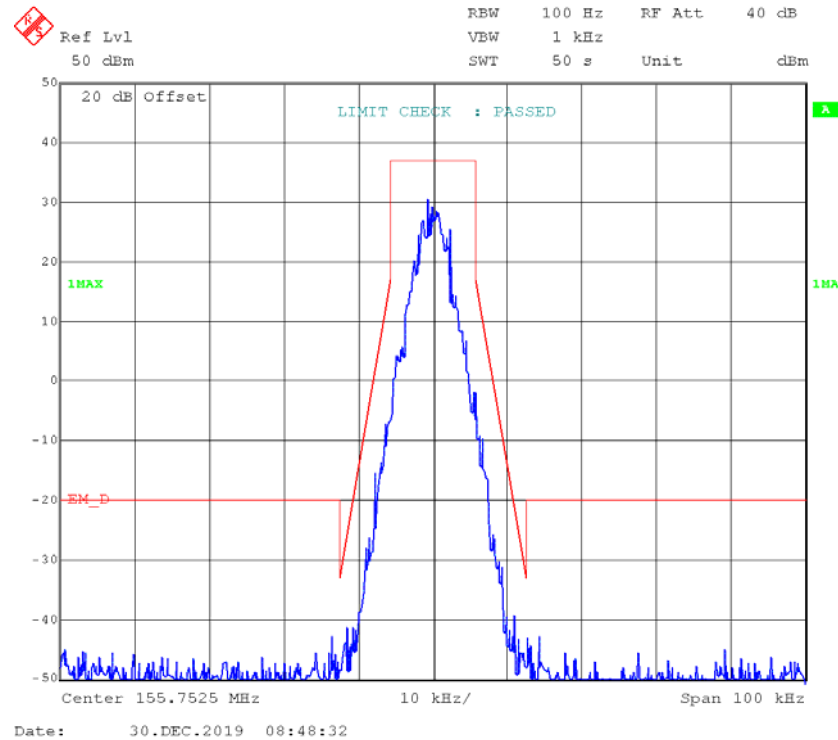
The 99% energy rule (title 47CFR 2.1049) was used for digital mode. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.60 kHz. The emission mask was obtained from 47CFR 90.210(d).

F1D and F1E portion of the designator indicates digital information.

Therefore, the entire designator for 12.5 kHz channel spacing digital mode is 7K60F1D and 7K60F1E.

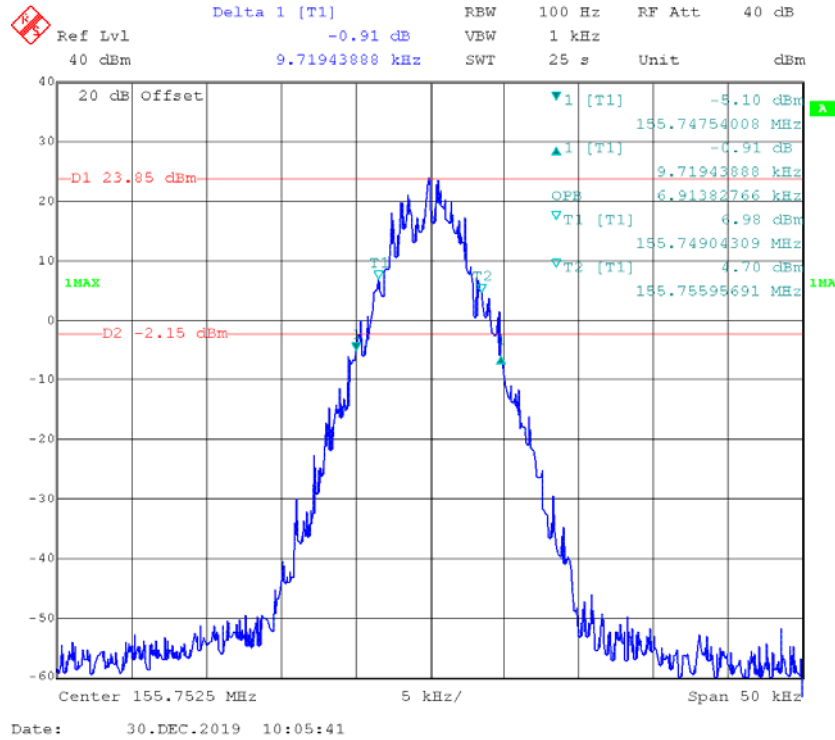
**Part 90:****FM,12.5kHz,High Power - Frequency 155.7525 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

**FM,12.5kHz,Low Power - Frequency 155.7525 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

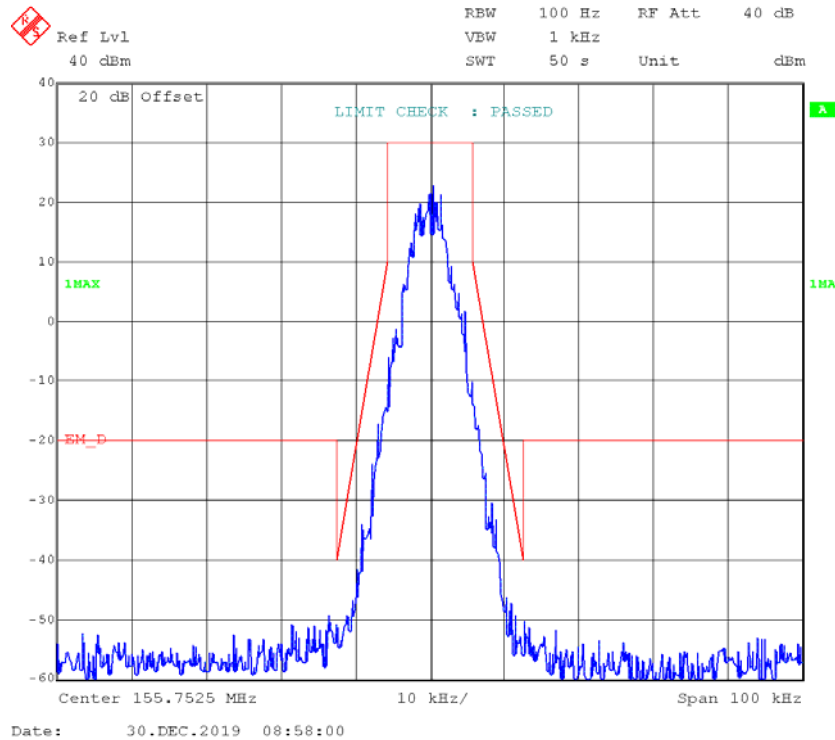
**4FSK,12.5kHz,High Power - Frequency 155.7525 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

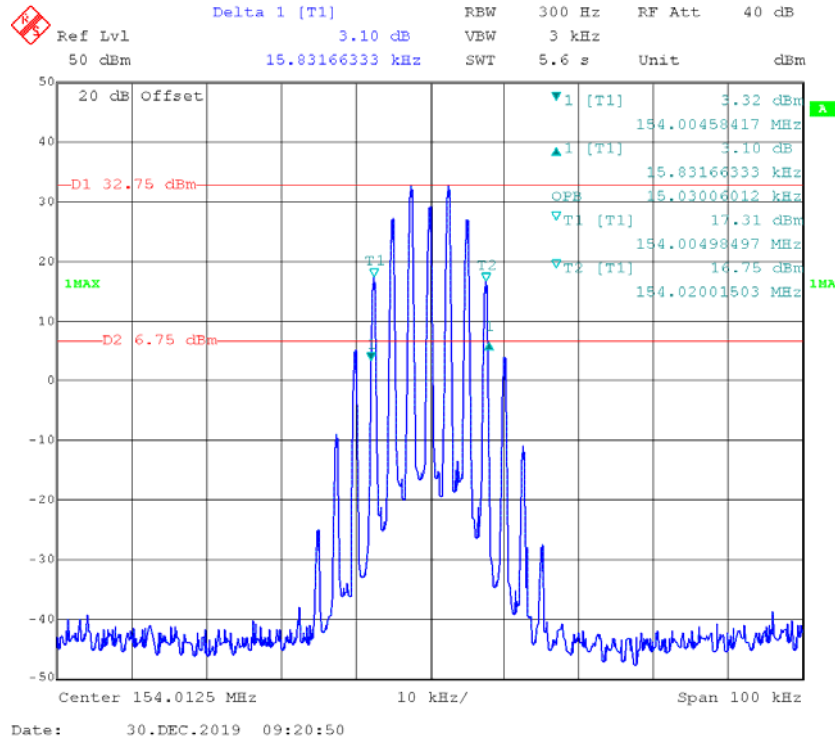
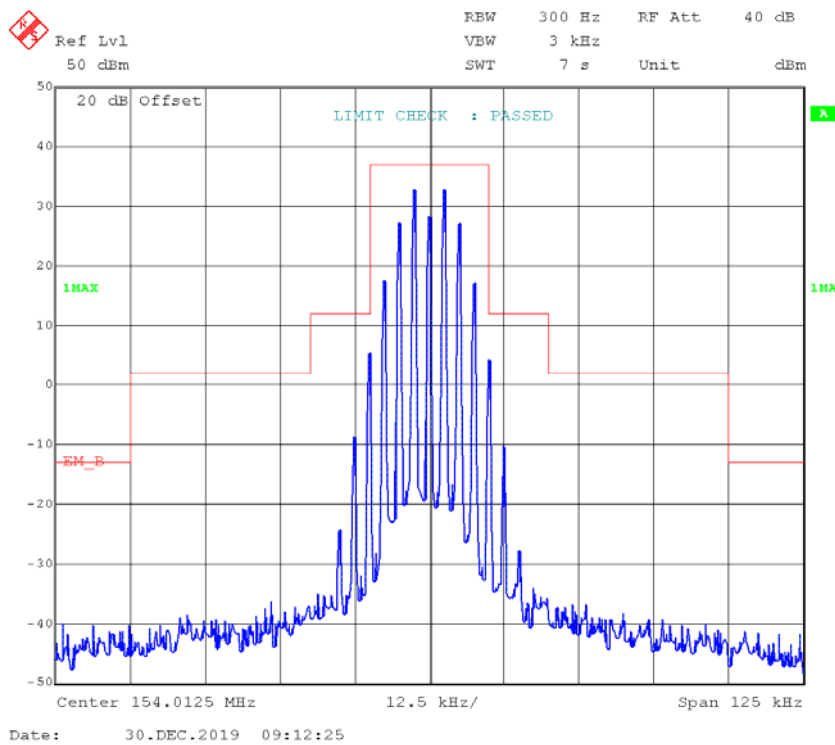
**4FSK,12.5kHz,Low Power - Frequency155.7525 MHz:**

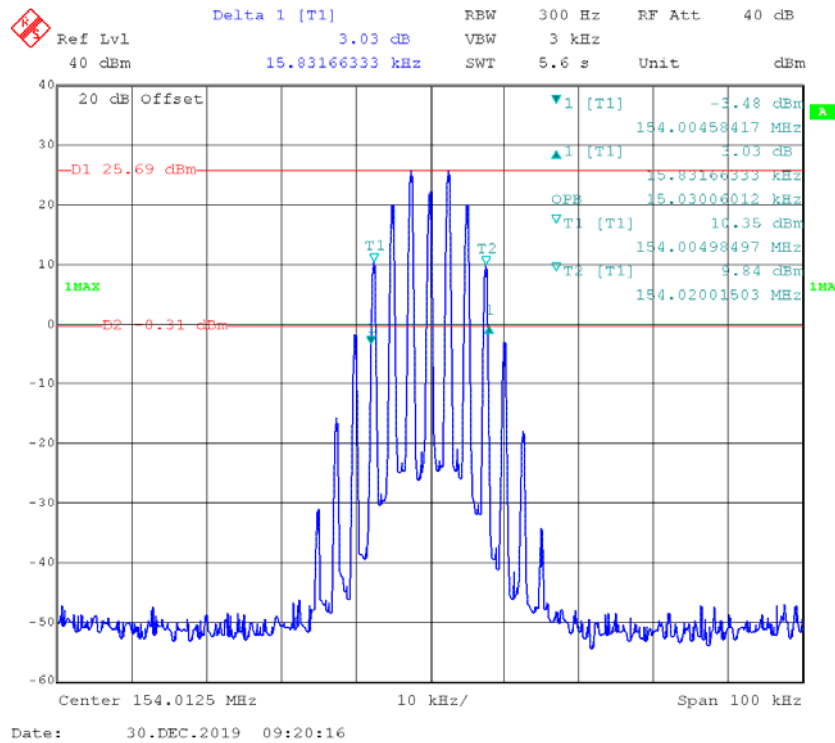
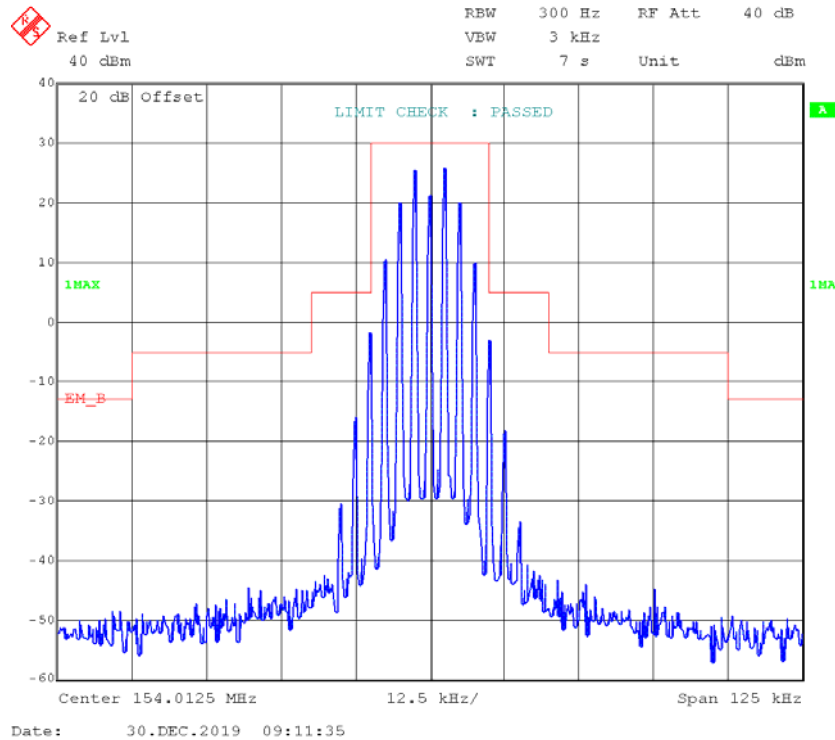
**99% Occupied & 26 dB Bandwidth**

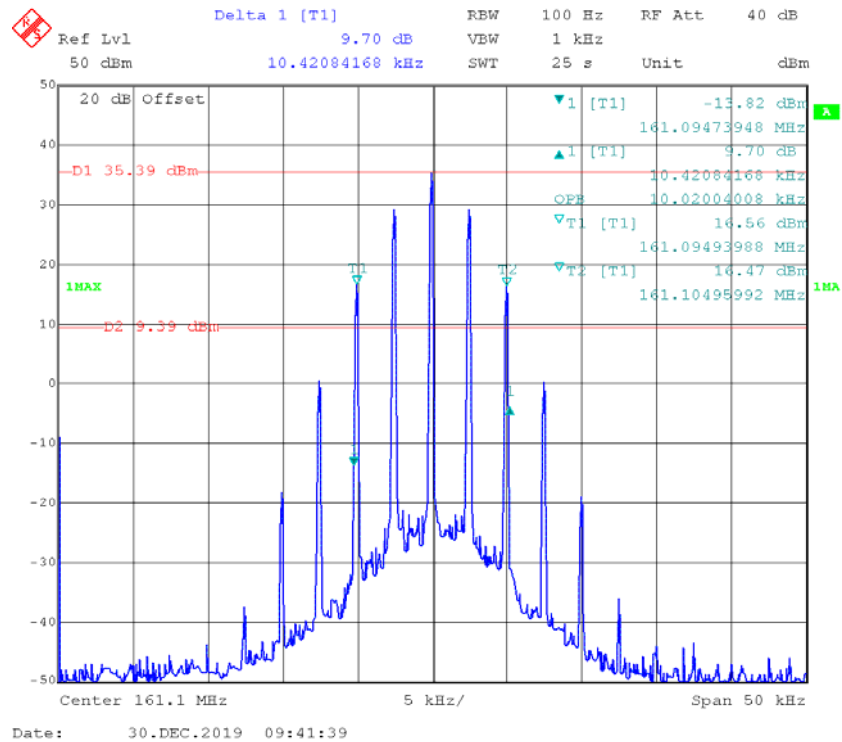
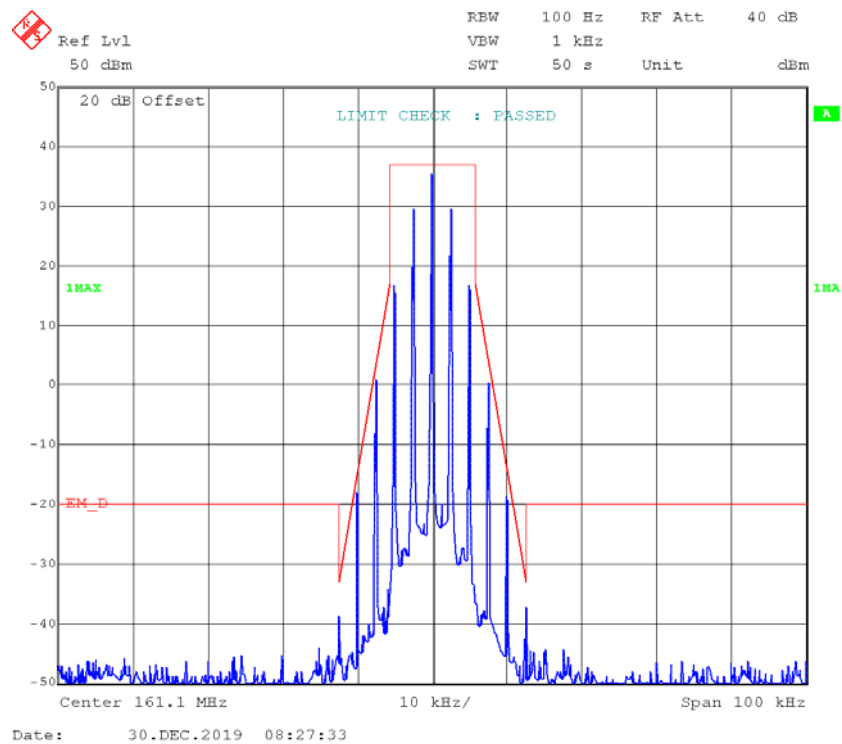


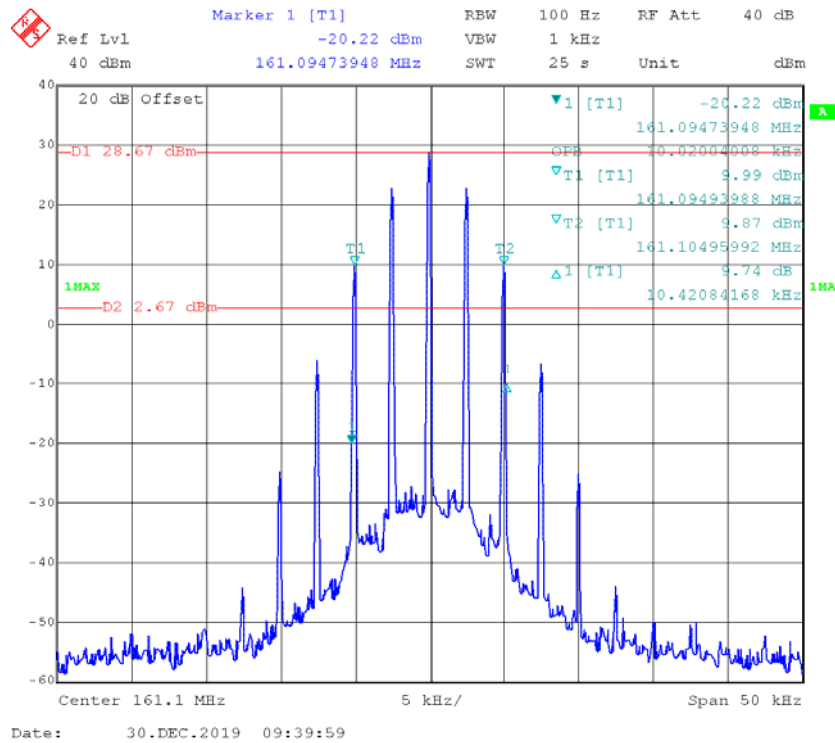
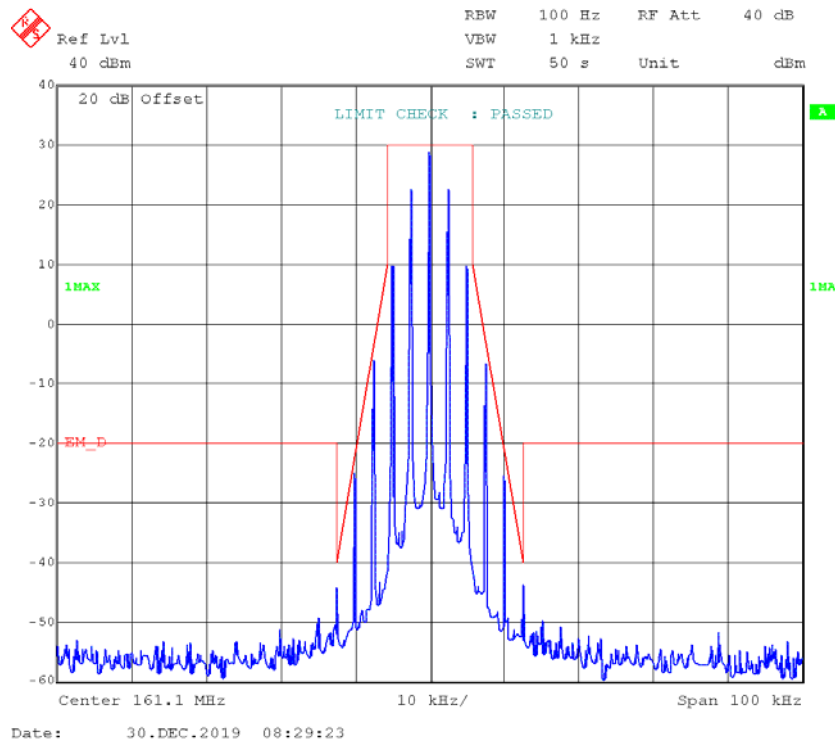
**Emission Mask**



**part 80:****FM,25kHz,High Power - Frequency 154.0125MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

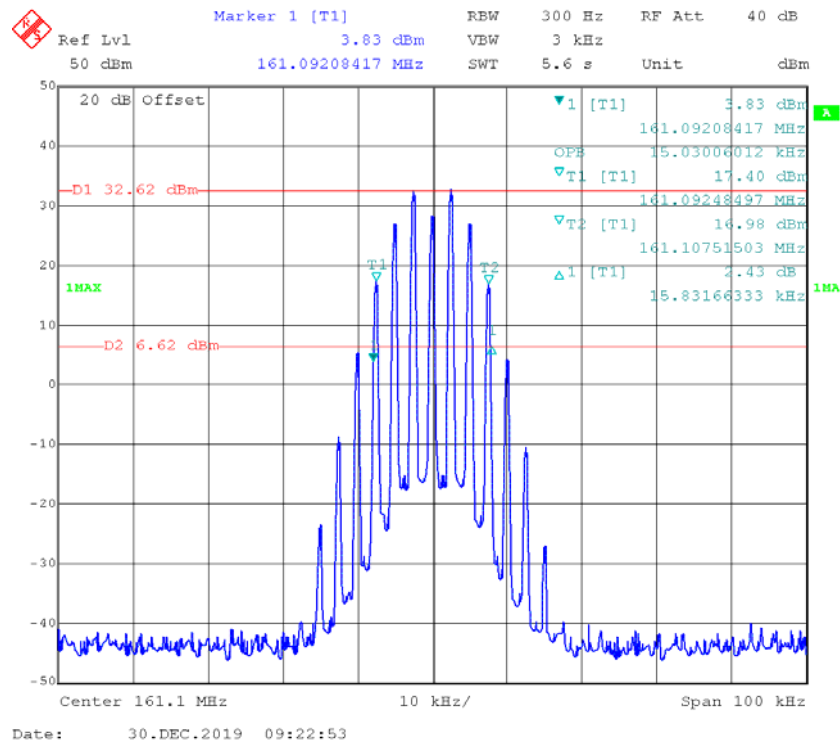
**FM,25kHz,Low Power - Frequency 154.0125 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

**part 74:****FM,12.5kHz,High Power - Frequency 161.1 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

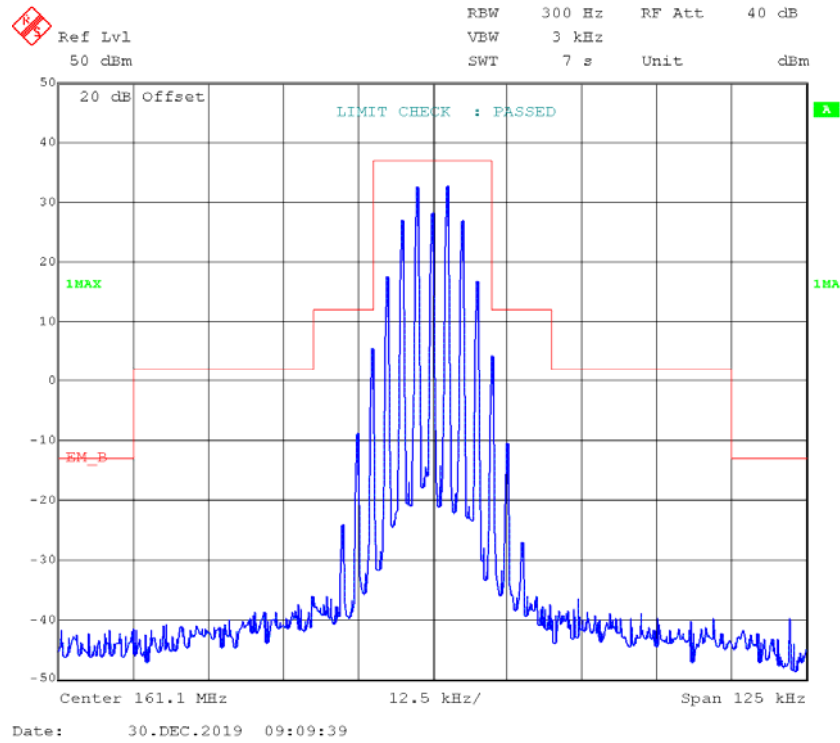
**FM,12.5kHz,Low Power – Frequency 161.1 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

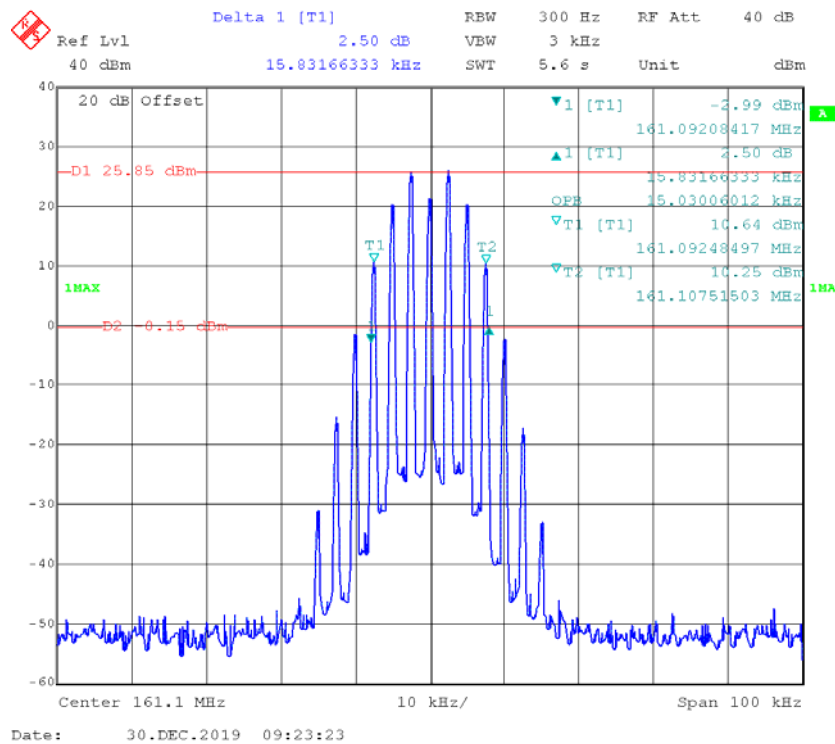
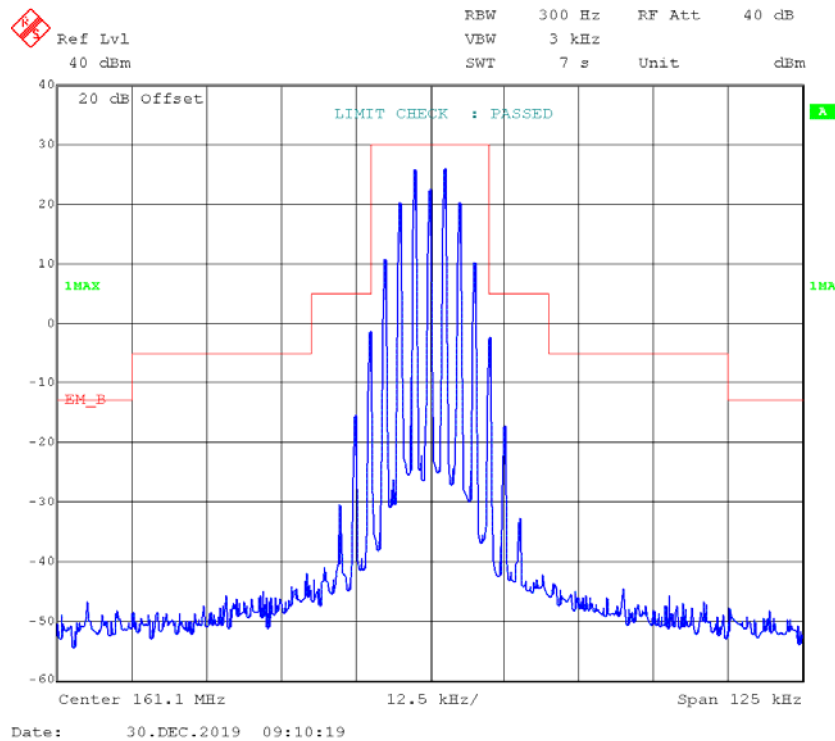
**FM,25kHz,High Power - Frequency 161.1 MHz**

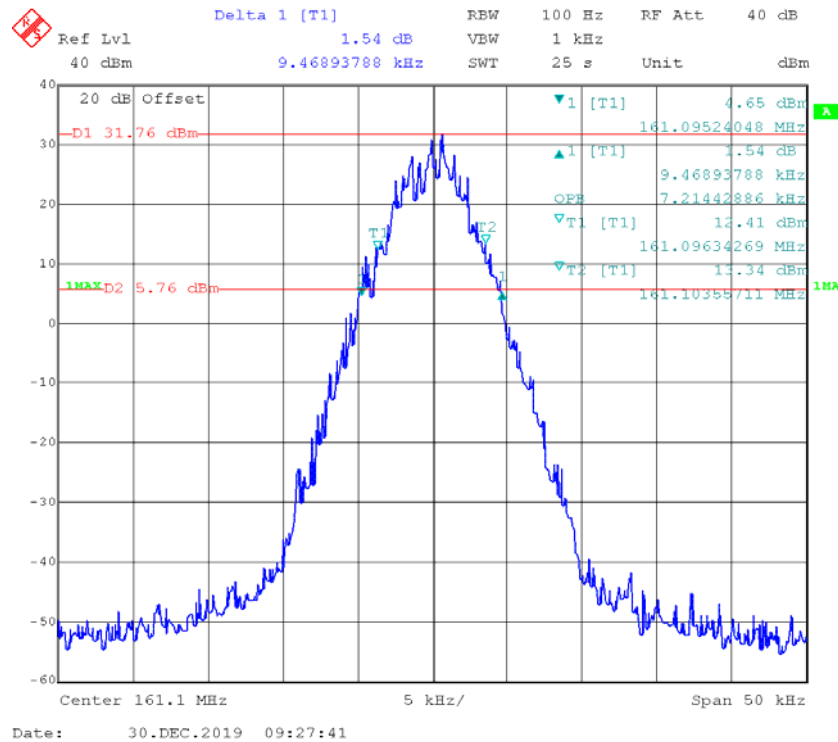
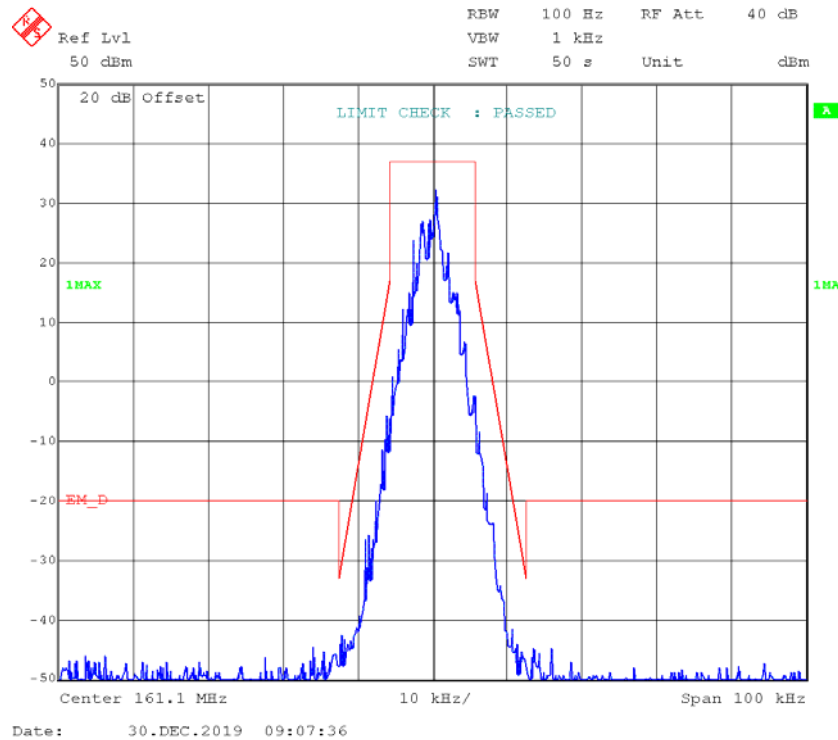
**: 99% Occupied & 26 dB Bandwidth**



**Emission Mask**

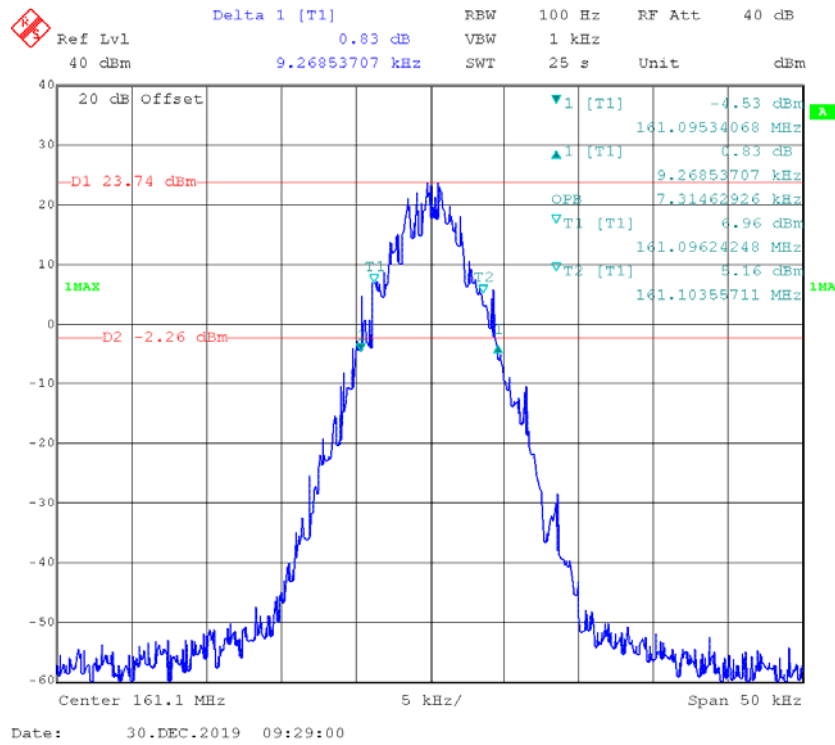


**FM,25kHz,Low Power - Frequency 161.1 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

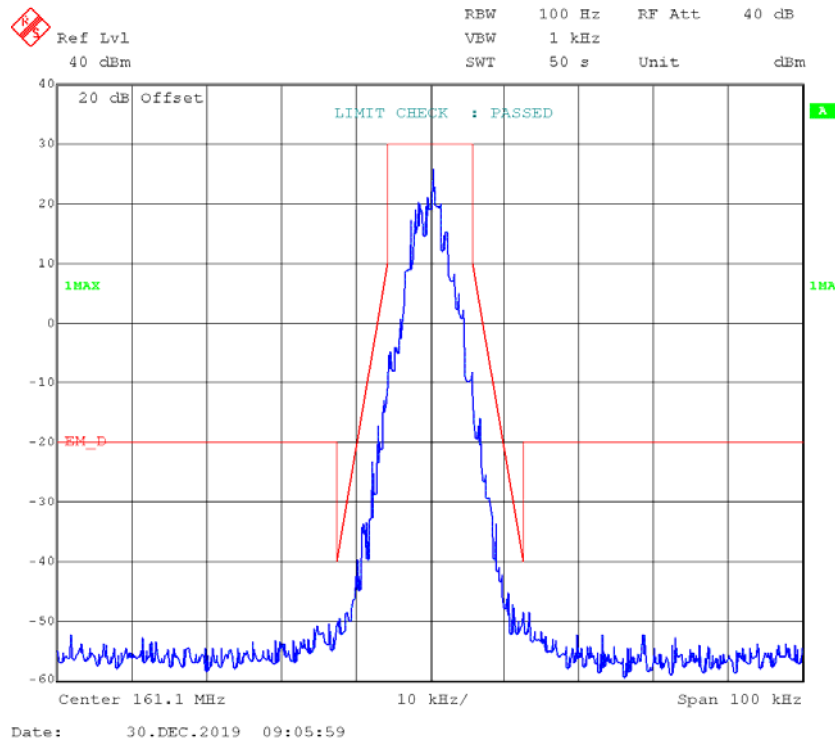
**4FSK ,12.5kHz, High Power - Frequency 161.1 MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

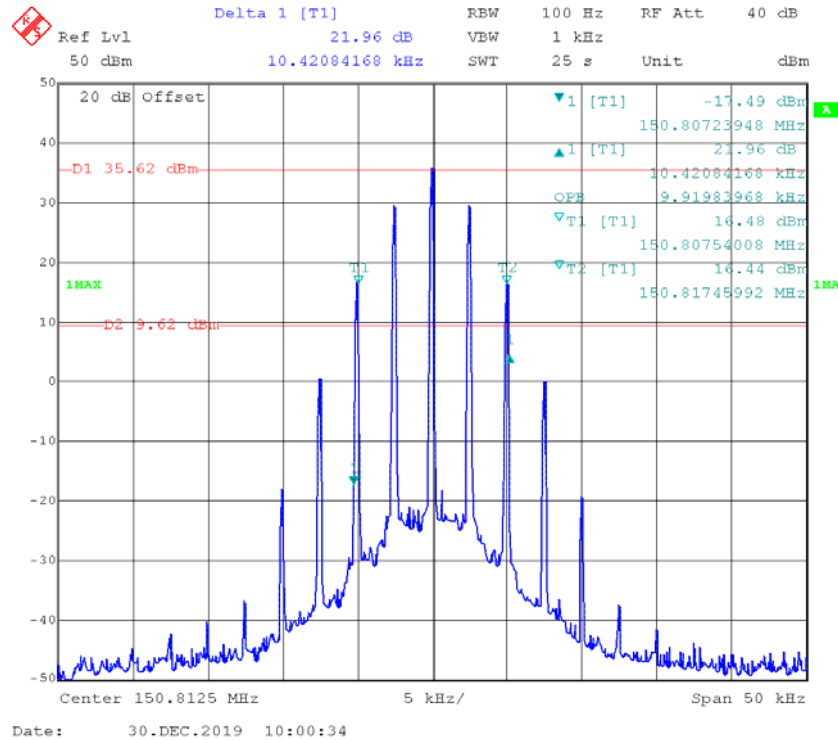
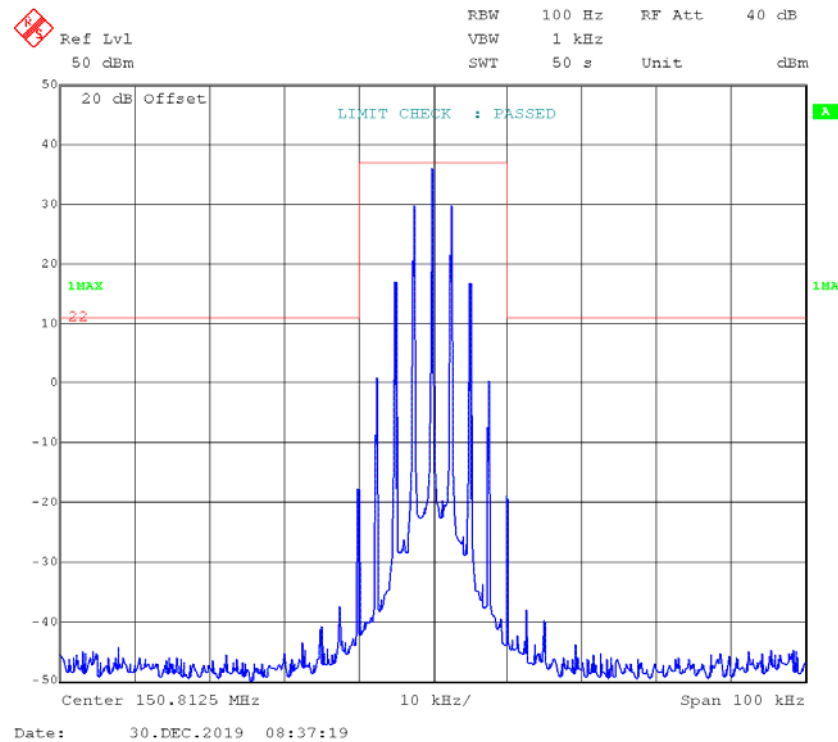
4FSK ,12.5kHz, Low Power - Frequency161.1 MHz:

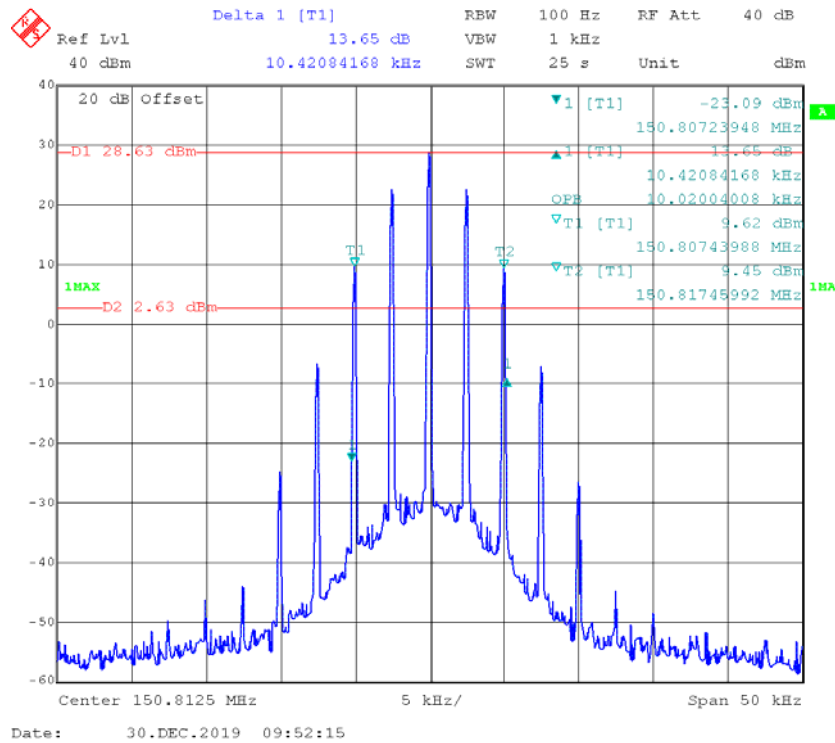
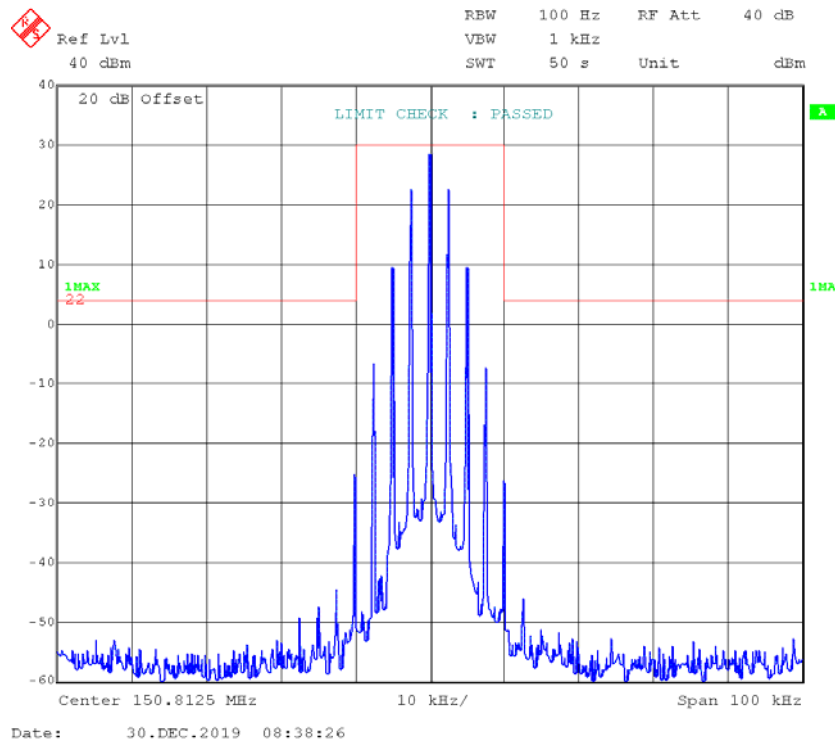
99% Occupied & 26 dB Bandwidth



Emission Mask

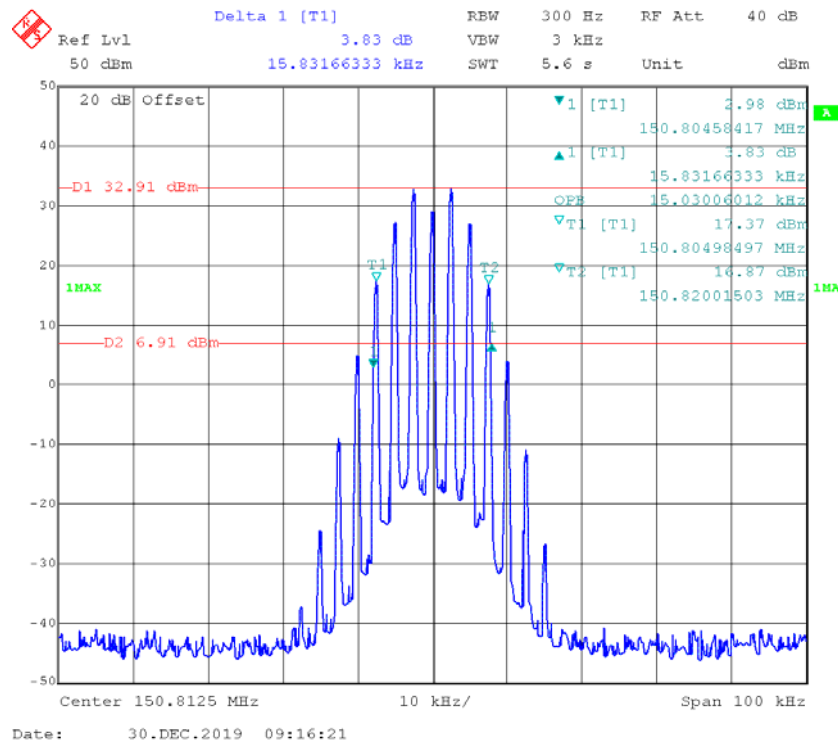


**part 22:****FM,12.5kHz,High Power - Frequency 150.8125MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

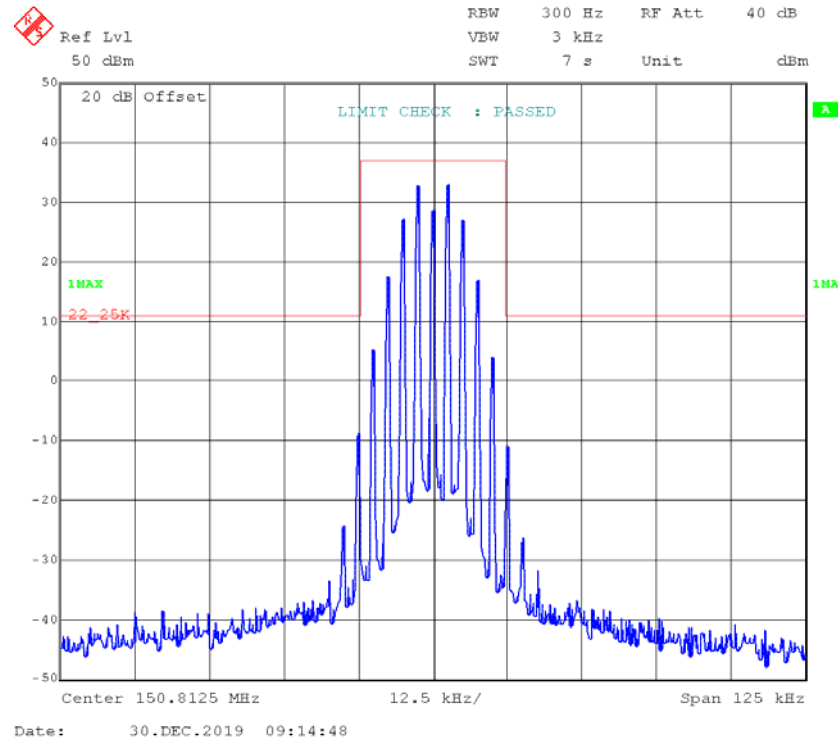
**FM,12.5kHz,Low Power - Frequency 150.8125MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

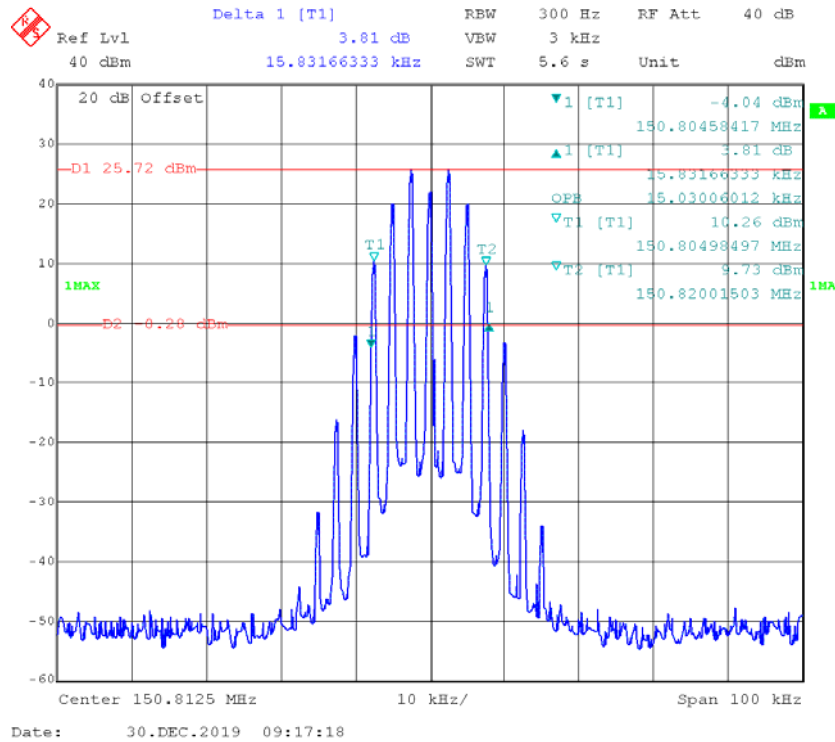
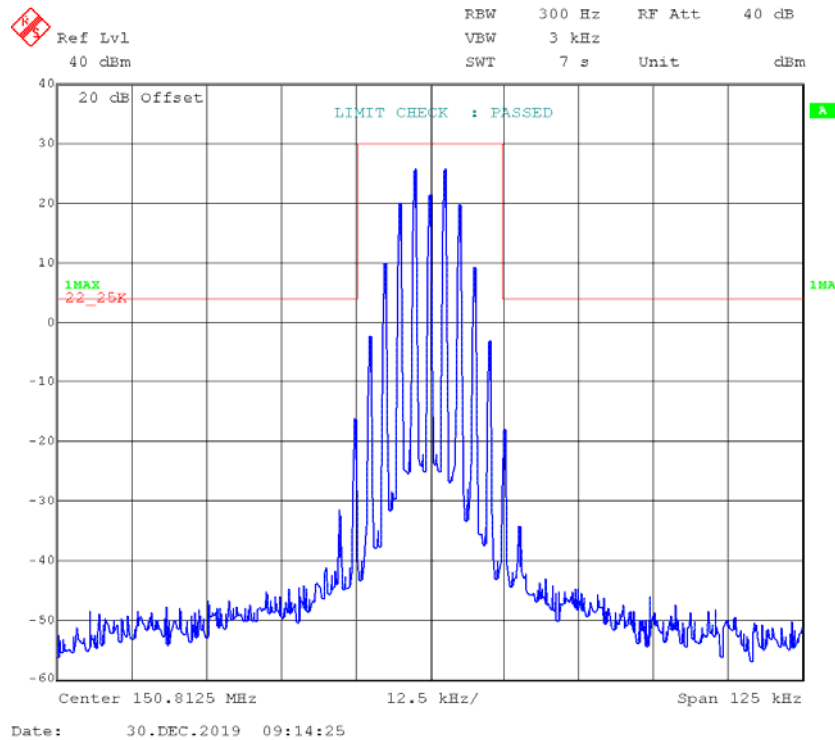
**FM,25kHz,High Power - Frequency 150.8125 MHz:**

**99% Occupied & 26 dB Bandwidth**

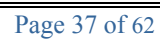


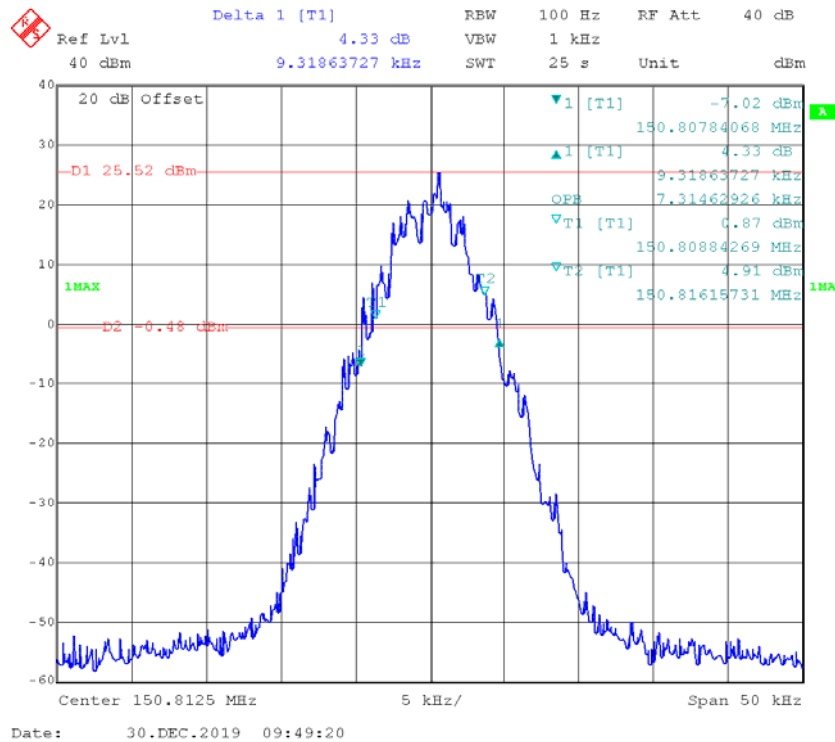
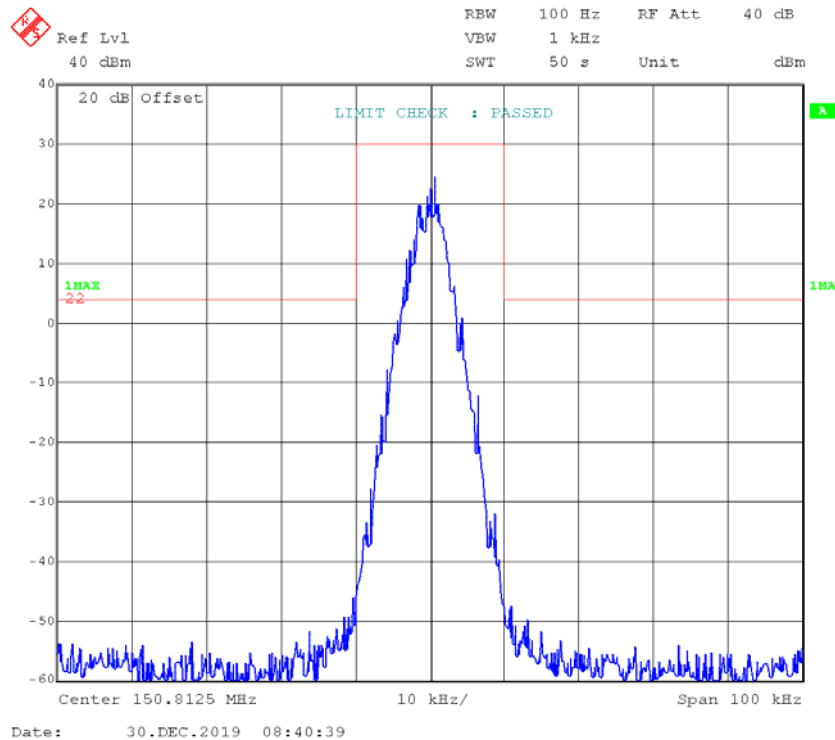
**Emission Mask**



**FM,25kHz,Low Power - Frequency 150.8125MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

## 99% Occupied & 26 dB Bandwidth



**4FSK,12.5kHz,Low Power - Frequency 150.8125MHz:****99% Occupied & 26 dB Bandwidth****Emission Mask**

**FCC §2.1051 & §22.861 & §74.462 & § 80.211 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS**

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**Applicable Standard**

FCC §2.1051, §22.861, §74.462, §80.211, and §90.210

**Test Procedure**

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100kHz for below 1GHz, and 1MHz for above 1GHz. Sufficient scans were taken to show any out of band emissions up to 10<sup>th</sup> harmonic.

**Test Data****Environmental Conditions**

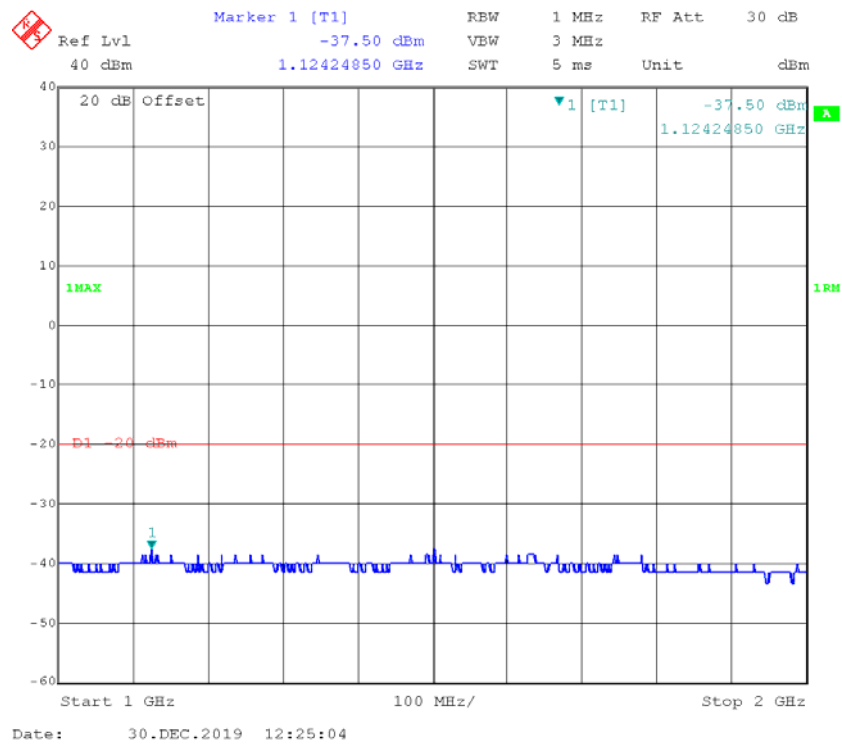
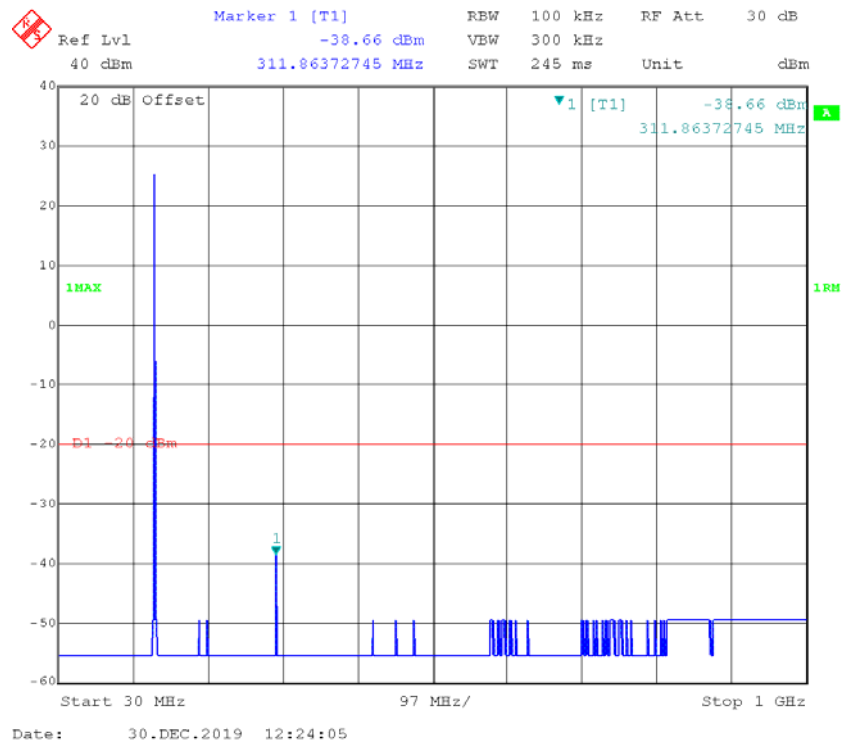
|                           |        |
|---------------------------|--------|
| <b>Temperature:</b>       | 24.1°C |
| <b>Relative Humidity:</b> | 60 %   |
| <b>ATM Pressure:</b>      | 102kPa |

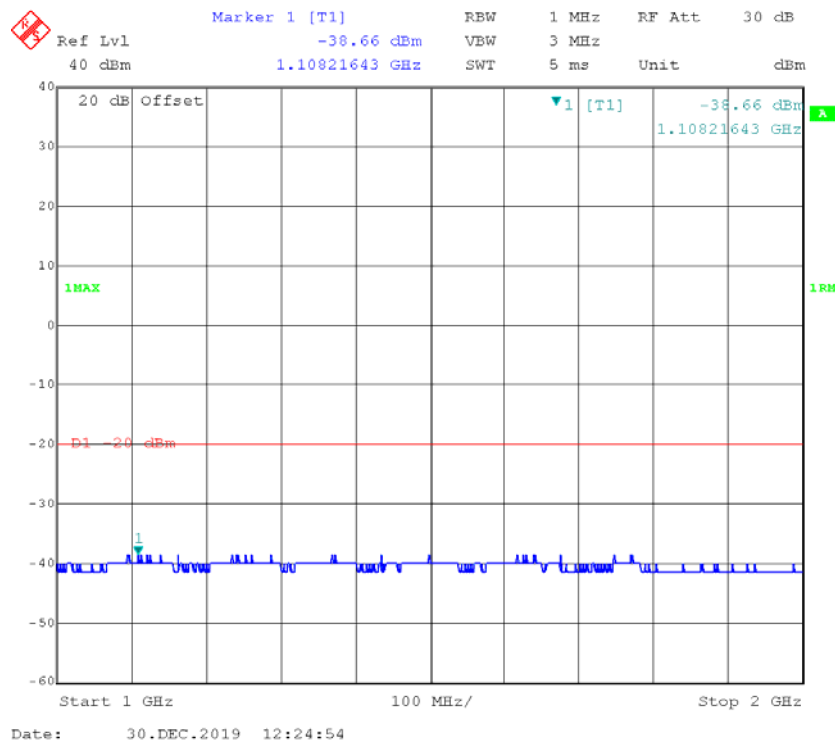
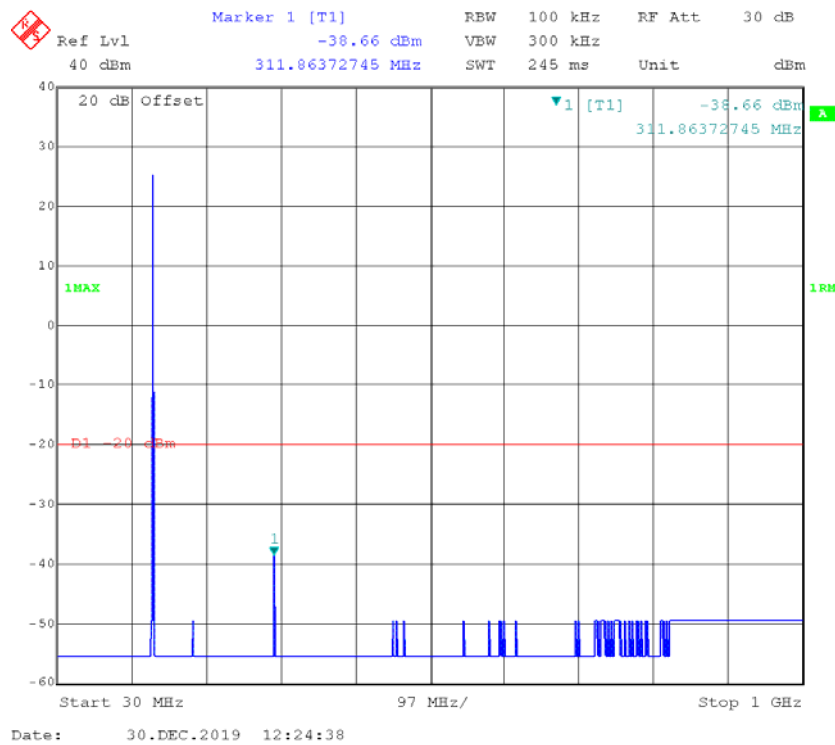
*The testing was performed by Blake Yang on 2019-12-30*

*Test Mode: Transmitting, please refer to the following plots.*

## Part 90

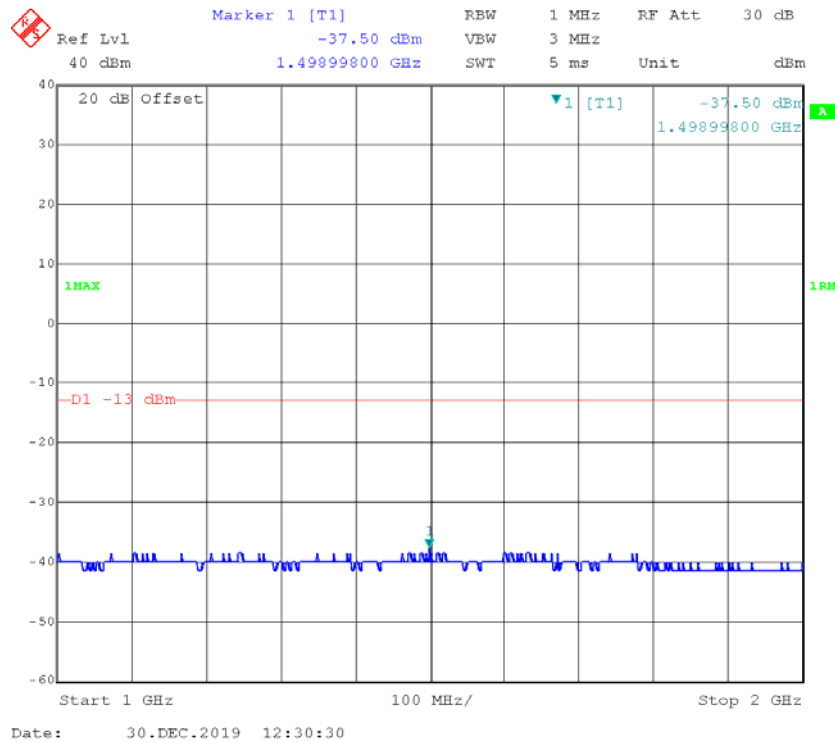
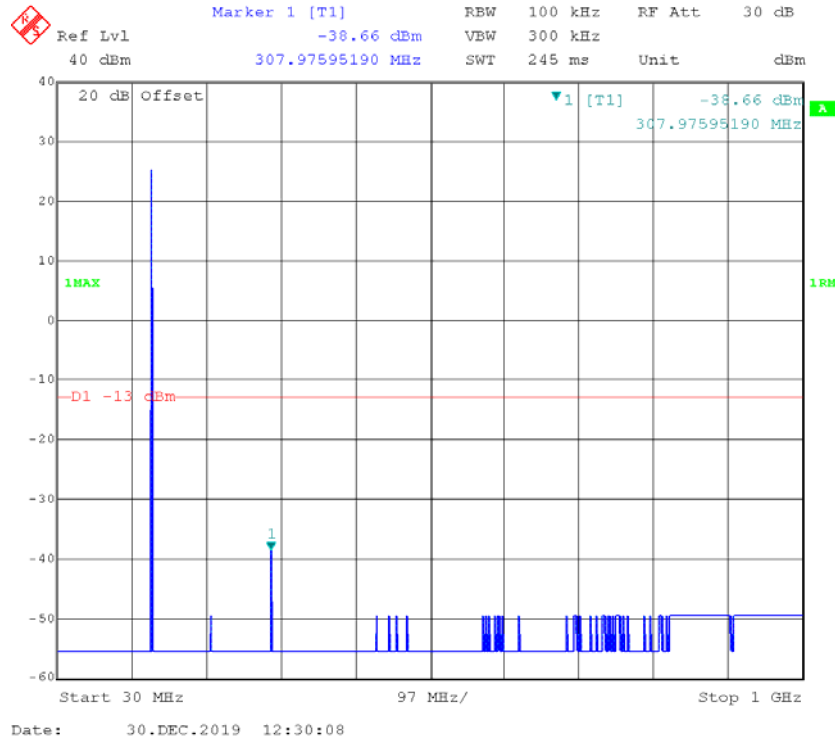
## 12.5kHz,FM, High power, 155.7525MHz



**12.5kHz,4FSK, High power, 155.7525 MHz**

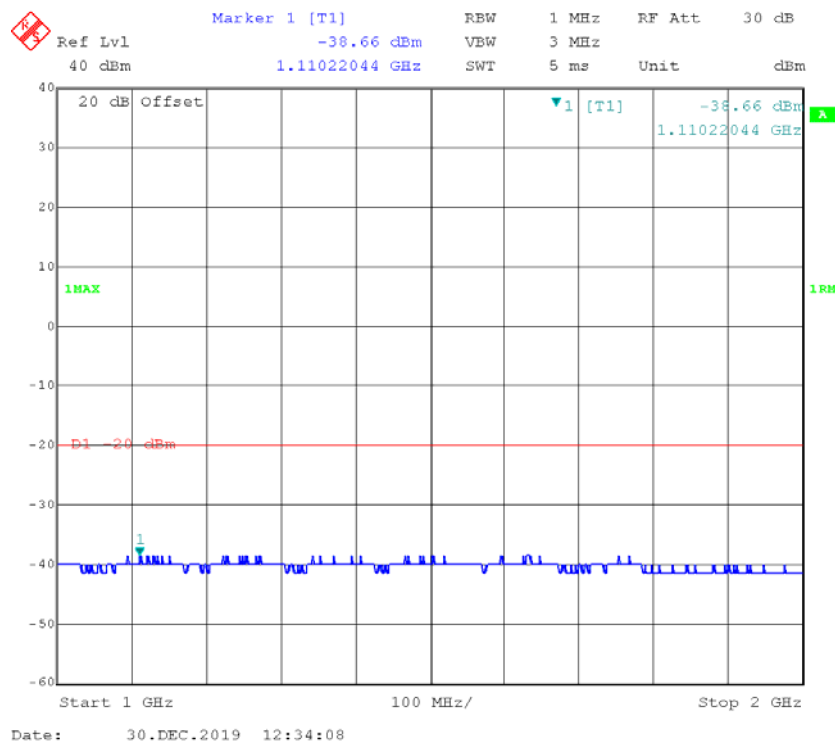
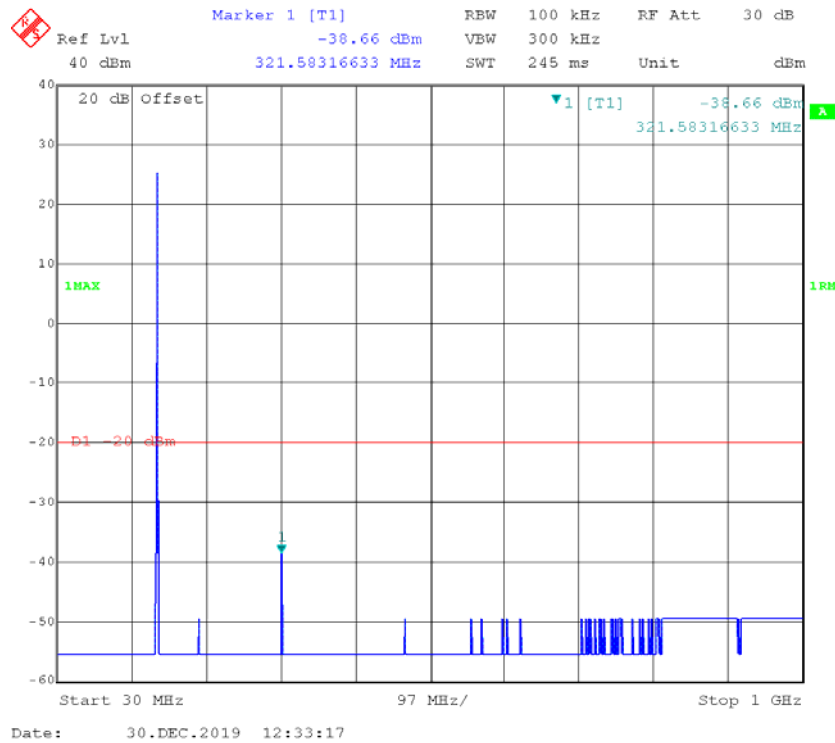
Part 80

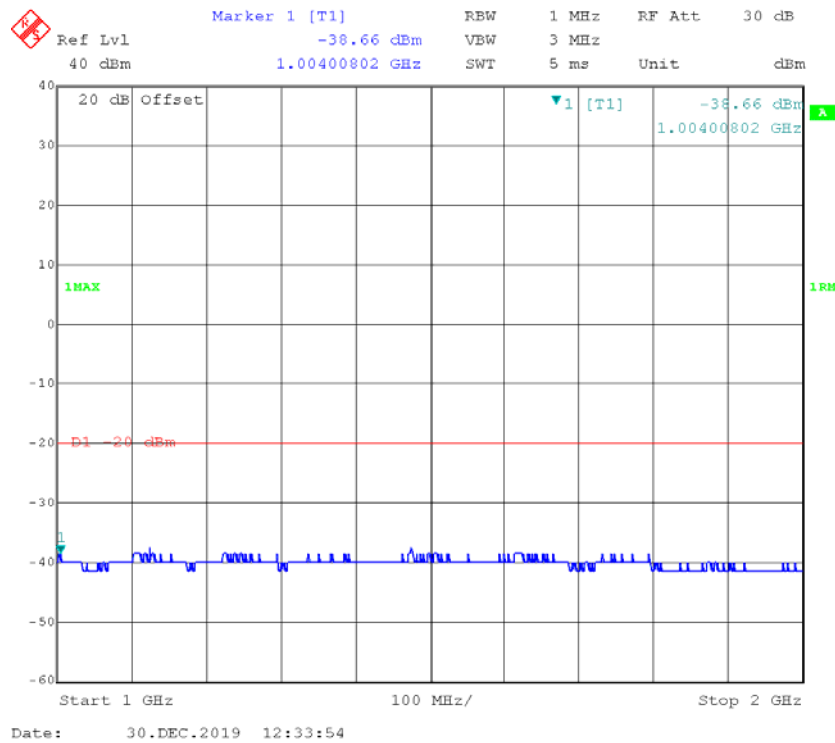
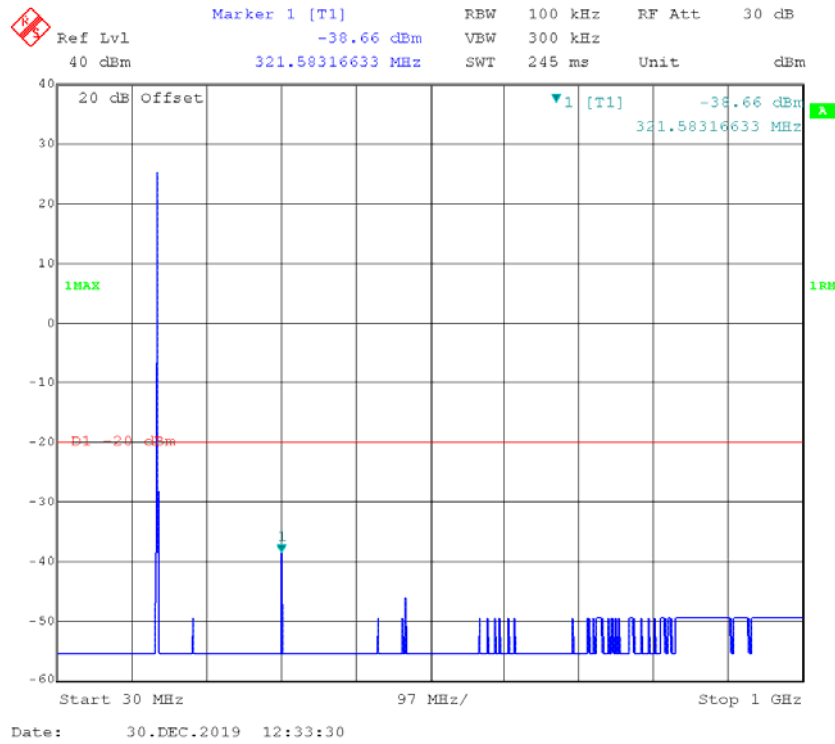
25kHz, FM, High power, 154.0125 MHz



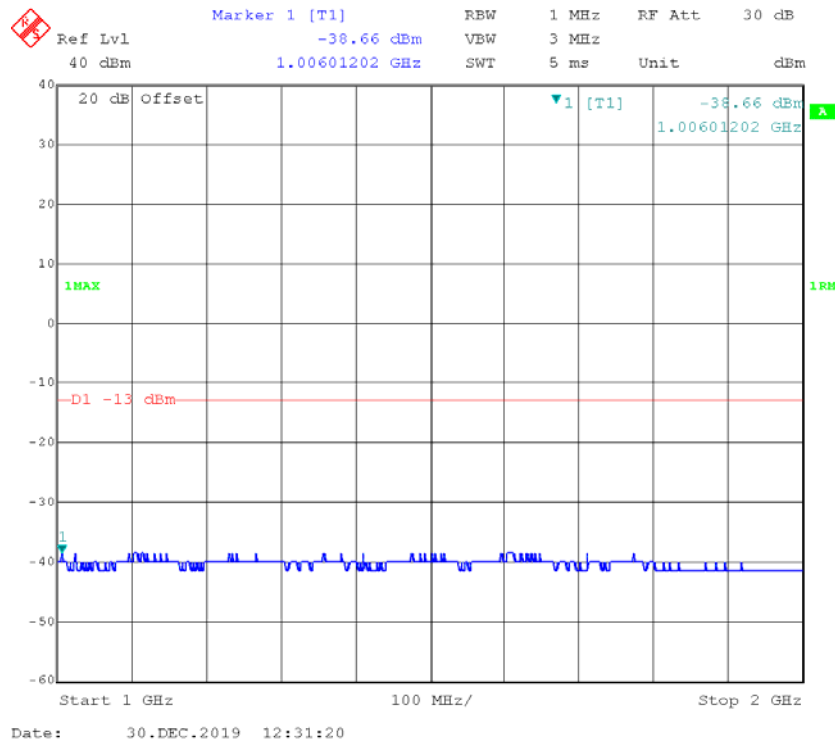
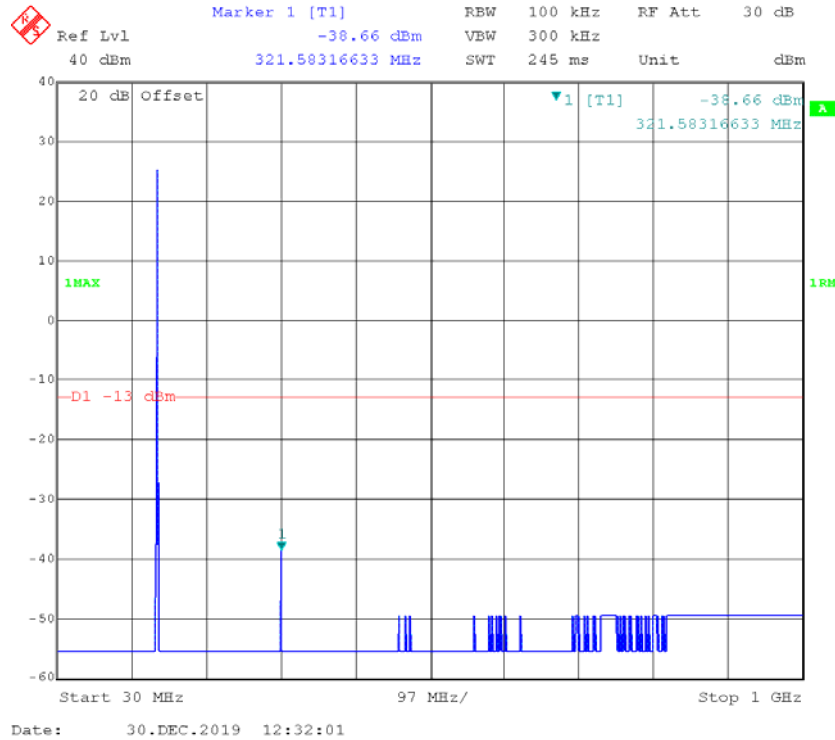
## Part 74

## 12.5kHz,FM, High power, 161.1MHz



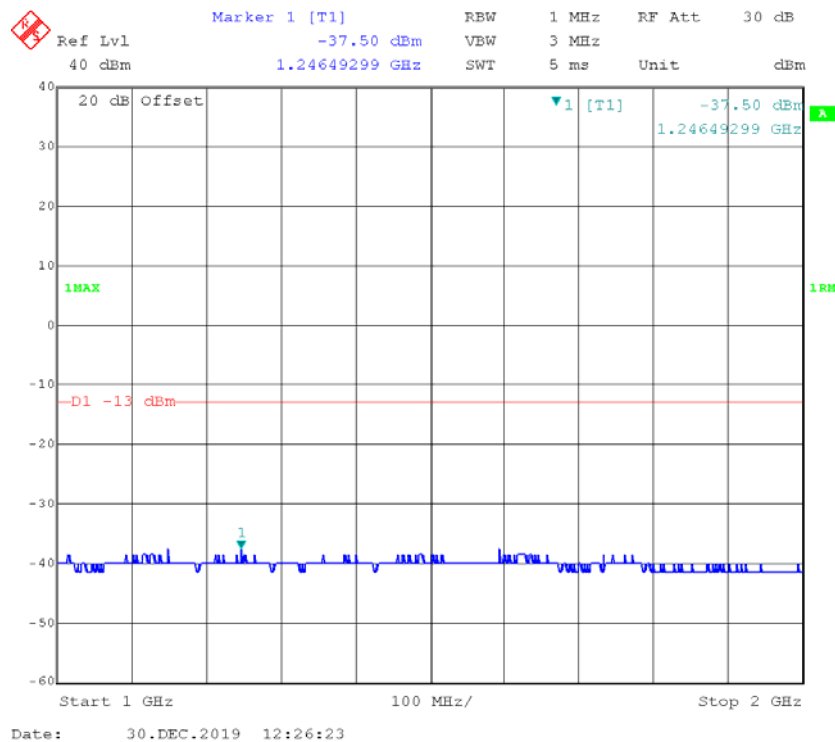
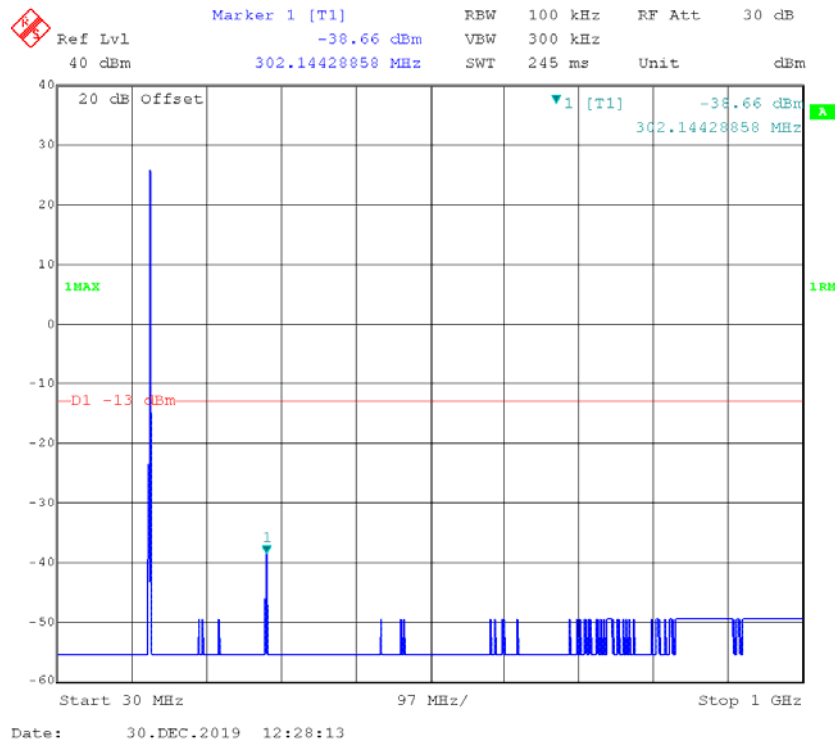
**12.5kHz,4FSK, High power, 161.1 MHz**

### 25kHz,FM, High power, 161.1 MHz

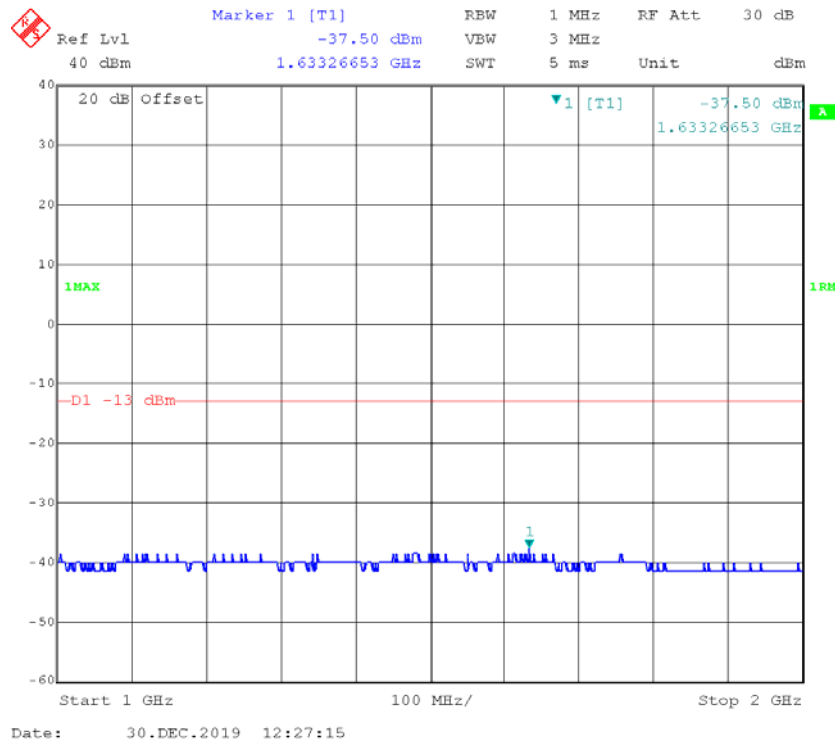
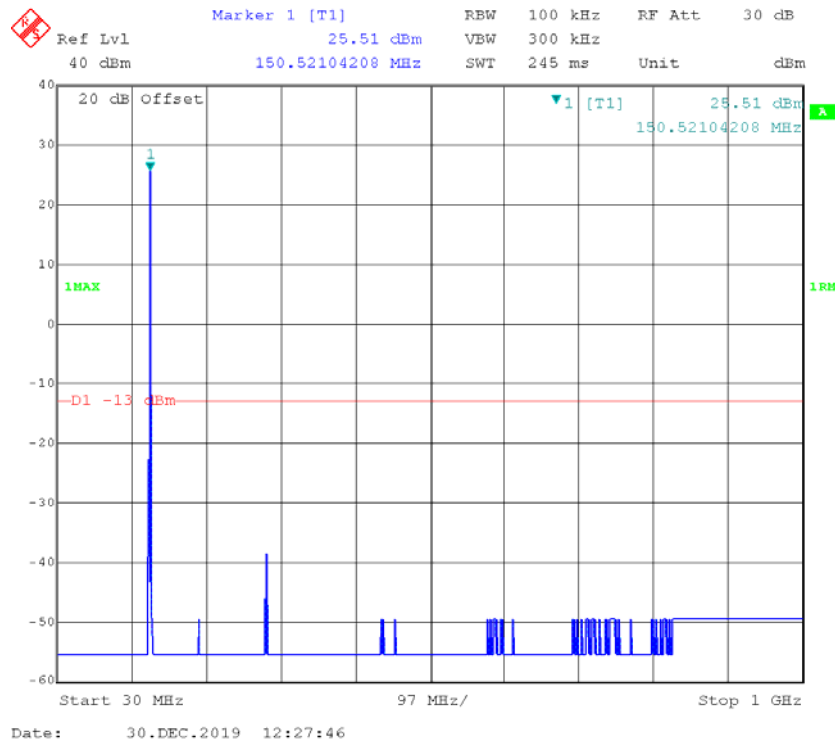


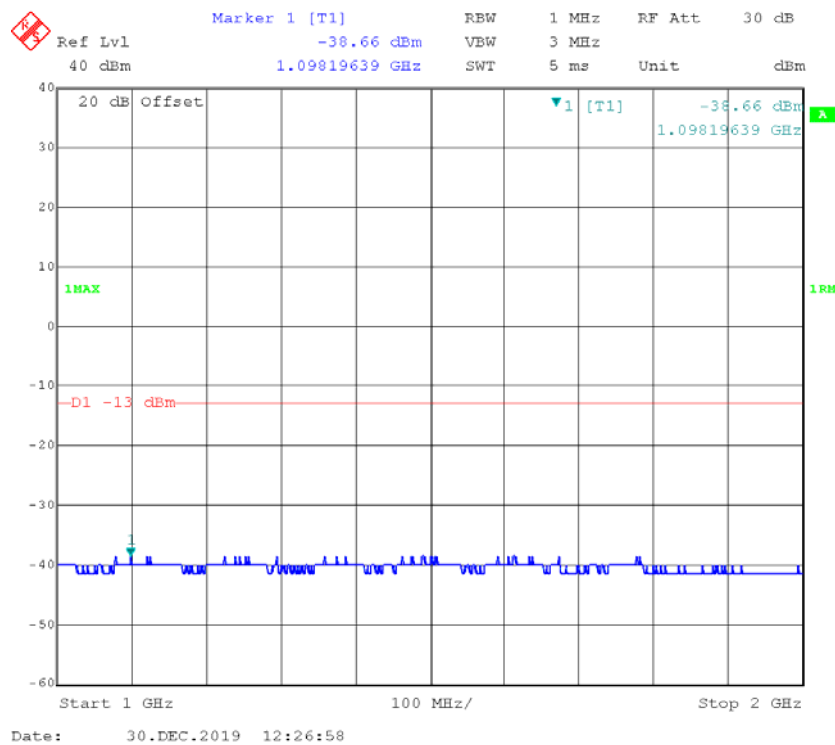
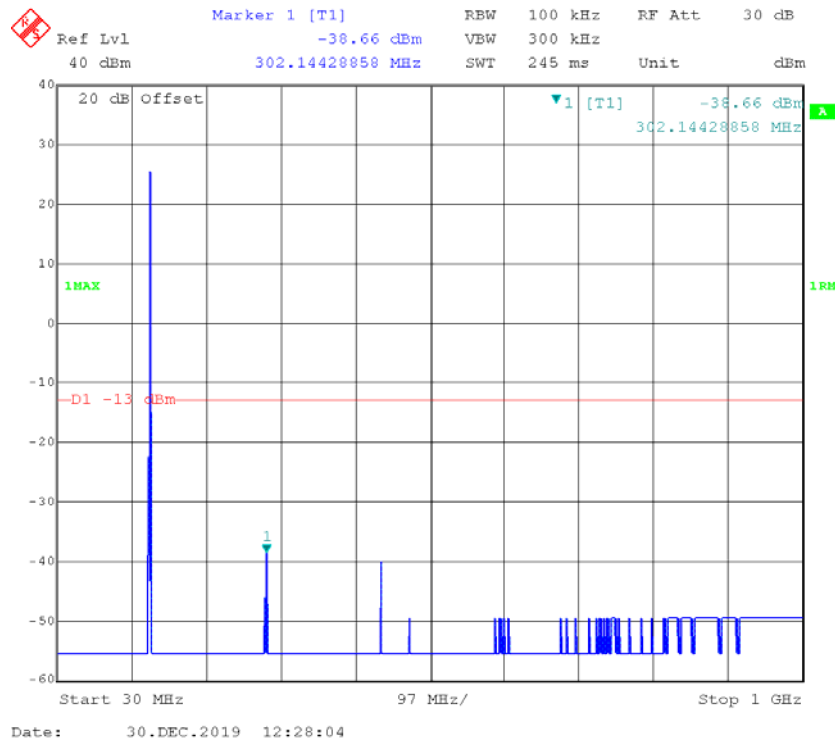
## Part 22

## 12.5kHz,FM, High power, 150.8125MHz



### 12.5kHz,4FSK, High power, 150.8125MHz



**25kHz,FM, High power, 150.8125MHz**

## **FCC §2.1053 & §22.861 & §74.462 & §80.211 & §90.210 - RADIATED SPURIOUS EMISSIONS**

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### **Applicable Standard**

FCC §2.1053, §22.861, §74.462, §80.211 and §90.210

### **Test Procedure**

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to teeth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001)-the absolute level

### **Test Data**

#### **Environmental Conditions**

|                           |          |
|---------------------------|----------|
| <b>Temperature:</b>       | 3.4°C    |
| <b>Relative Humidity:</b> | 36 %     |
| <b>ATM Pressure:</b>      | 101.2kPa |

*The testing was performed by Jackson Zhang and Felix Zhang on 2020-01-12*

*Test Mode: Transmitting(only high power level was tested)*

**30MHz - 2GHz:**  
**Part 90**

| Frequency<br>(MHz)                   | Polar<br>(H/V) | Receiver<br>Reading<br>(dBμV) | Substituted Method            |                              |                       | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------------------------|----------------|-------------------------------|-------------------------------|------------------------------|-----------------------|----------------------------|----------------|----------------|
|                                      |                |                               | Substituted<br>Level<br>(dBm) | Antenna<br>Gain<br>(dBd/dBi) | Cable<br>Loss<br>(dB) |                            |                |                |
| FM,Frequency: 155.7525MHz-12.5 kHz   |                |                               |                               |                              |                       |                            |                |                |
| 311.51                               | H              | 35.78                         | -72.66                        | 0.00                         | 0.32                  | -72.98                     | -20.00         | 52.98          |
| 311.51                               | V              | 36.51                         | -70.15                        | 0.00                         | 0.32                  | -70.47                     | -20.00         | 50.47          |
| 467.26                               | H              | 36.08                         | -69.78                        | 0.00                         | 0.36                  | -70.14                     | -20.00         | 50.14          |
| 467.26                               | V              | 35.11                         | -68.07                        | 0.00                         | 0.36                  | -68.43                     | -20.00         | 48.43          |
| 623.01                               | H              | 34.89                         | -67.19                        | 0.00                         | 0.36                  | -67.55                     | -20.00         | 47.55          |
| 623.01                               | V              | 35.35                         | -64.09                        | 0.00                         | 0.36                  | -64.45                     | -20.00         | 44.45          |
| 778.76                               | H              | 34.92                         | -64.11                        | 0.00                         | 0.47                  | -64.58                     | -20.00         | 44.58          |
| 778.76                               | V              | 35.47                         | -60.46                        | 0.00                         | 0.47                  | -60.93                     | -20.00         | 40.93          |
| 934.52                               | H              | 35.68                         | -58.70                        | 0.00                         | 0.51                  | -59.21                     | -20.00         | 39.21          |
| 934.52                               | V              | 37.30                         | -53.93                        | 0.00                         | 0.51                  | -54.44                     | -20.00         | 34.44          |
| 1090.27                              | H              | 37.85                         | -75.67                        | 7.45                         | 0.99                  | -69.21                     | -20.00         | 49.21          |
| 1090.27                              | V              | 38.73                         | -75.21                        | 7.45                         | 0.99                  | -68.75                     | -20.00         | 48.75          |
| 1246.02                              | H              | 38.35                         | -74.71                        | 7.76                         | 1.14                  | -68.09                     | -20.00         | 48.09          |
| 1246.02                              | V              | 37.96                         | -76.11                        | 7.76                         | 1.14                  | -69.49                     | -20.00         | 49.49          |
| 1401.77                              | H              | 37.63                         | -75.61                        | 9.01                         | 1.20                  | -67.80                     | -20.00         | 47.80          |
| 1401.77                              | V              | 40.39                         | -73.44                        | 9.01                         | 1.20                  | -65.63                     | -20.00         | 45.63          |
| 1557.53                              | H              | 37.88                         | -77.09                        | 9.85                         | 0.96                  | -68.20                     | -20.00         | 48.20          |
| 1557.53                              | V              | 37.97                         | -77.39                        | 9.85                         | 0.96                  | -68.50                     | -20.00         | 48.50          |
| 4FSK,Frequency: 155.7525MHz-12.5 kHz |                |                               |                               |                              |                       |                            |                |                |
| 311.51                               | H              | 35.30                         | -73.14                        | 0.00                         | 0.32                  | -73.46                     | -20.00         | 53.46          |
| 311.51                               | V              | 35.78                         | -70.88                        | 0.00                         | 0.32                  | -71.20                     | -20.00         | 51.20          |
| 467.26                               | H              | 36.20                         | -69.66                        | 0.00                         | 0.36                  | -70.02                     | -20.00         | 50.02          |
| 467.26                               | V              | 35.42                         | -67.76                        | 0.00                         | 0.36                  | -68.12                     | -20.00         | 48.12          |
| 623.01                               | H              | 35.88                         | -66.20                        | 0.00                         | 0.36                  | -66.56                     | -20.00         | 46.56          |
| 623.01                               | V              | 36.01                         | -63.43                        | 0.00                         | 0.36                  | -63.79                     | -20.00         | 43.79          |
| 778.76                               | H              | 35.60                         | -63.43                        | 0.00                         | 0.47                  | -63.90                     | -20.00         | 43.90          |
| 778.76                               | V              | 35.01                         | -60.92                        | 0.00                         | 0.47                  | -61.39                     | -20.00         | 41.39          |
| 934.52                               | H              | 35.22                         | -59.16                        | 0.00                         | 0.51                  | -59.67                     | -20.00         | 39.67          |
| 934.52                               | V              | 37.67                         | -53.56                        | 0.00                         | 0.51                  | -54.07                     | -20.00         | 34.07          |
| 1090.27                              | H              | 38.24                         | -75.28                        | 7.45                         | 0.99                  | -68.82                     | -20.00         | 48.82          |
| 1090.27                              | V              | 38.39                         | -75.55                        | 7.45                         | 0.99                  | -69.09                     | -20.00         | 49.09          |
| 1246.02                              | H              | 38.65                         | -74.41                        | 7.76                         | 1.14                  | -67.79                     | -20.00         | 47.79          |
| 1246.02                              | V              | 38.78                         | -75.29                        | 7.76                         | 1.14                  | -68.67                     | -20.00         | 48.67          |
| 1401.77                              | H              | 37.58                         | -75.66                        | 9.01                         | 1.20                  | -67.85                     | -20.00         | 47.85          |
| 1401.77                              | V              | 37.87                         | -75.96                        | 9.01                         | 1.20                  | -68.15                     | -20.00         | 48.15          |

**Part 80**

| Frequency<br>(MHz)                | Polar<br>(H/V) | Receiver<br>Reading<br>(dBμV) | Substituted Method            |                              |                       | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|-----------------------------------|----------------|-------------------------------|-------------------------------|------------------------------|-----------------------|----------------------------|----------------|----------------|
|                                   |                |                               | Substituted<br>Level<br>(dBm) | Antenna<br>Gain<br>(dBd/dBi) | Cable<br>Loss<br>(dB) |                            |                |                |
| FM, Frequency: 154.0125MHz-25 kHz |                |                               |                               |                              |                       |                            |                |                |
| 308.03                            | H              | 35.41                         | -73.09                        | 0.00                         | 0.32                  | -73.41                     | -13.00         | 60.41          |
| 308.03                            | V              | 37.05                         | -69.71                        | 0.00                         | 0.32                  | -70.03                     | -13.00         | 57.03          |
| 462.04                            | H              | 35.12                         | -70.81                        | 0.00                         | 0.36                  | -71.17                     | -13.00         | 58.17          |
| 462.04                            | V              | 35.33                         | -67.93                        | 0.00                         | 0.36                  | -68.29                     | -13.00         | 55.29          |
| 616.05                            | H              | 35.51                         | -66.67                        | 0.00                         | 0.36                  | -67.03                     | -13.00         | 54.03          |
| 616.05                            | V              | 35.17                         | -64.44                        | 0.00                         | 0.36                  | -64.80                     | -13.00         | 51.80          |
| 770.06                            | H              | 36.80                         | -62.44                        | 0.00                         | 0.46                  | -62.90                     | -13.00         | 49.90          |
| 770.06                            | V              | 35.28                         | -60.83                        | 0.00                         | 0.46                  | -61.29                     | -13.00         | 48.29          |
| 924.08                            | H              | 35.87                         | -58.88                        | 0.00                         | 0.51                  | -59.39                     | -13.00         | 46.39          |
| 924.08                            | V              | 37.09                         | -54.44                        | 0.00                         | 0.51                  | -54.95                     | -13.00         | 41.95          |
| 1078.09                           | H              | 39.57                         | -73.97                        | 7.51                         | 0.96                  | -67.42                     | -13.00         | 54.42          |
| 1078.09                           | V              | 39.63                         | -74.36                        | 7.51                         | 0.96                  | -67.81                     | -13.00         | 54.81          |
| 1232.10                           | H              | 39.17                         | -73.75                        | 7.62                         | 1.12                  | -67.25                     | -13.00         | 54.25          |
| 1232.10                           | V              | 39.21                         | -74.75                        | 7.62                         | 1.12                  | -68.25                     | -13.00         | 55.25          |
| 1386.11                           | H              | 38.40                         | -74.86                        | 8.90                         | 1.20                  | -67.16                     | -13.00         | 54.16          |
| 1386.11                           | V              | 39.03                         | -74.87                        | 8.90                         | 1.20                  | -67.17                     | -13.00         | 54.17          |

**Part 74**

| Frequency<br>(MHz)              | Polar<br>(H/V) | Receiver<br>Reading<br>(dBμV) | Substituted Method            |                              |                       | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------------------------------|----------------|-------------------------------|-------------------------------|------------------------------|-----------------------|----------------------------|----------------|----------------|
|                                 |                |                               | Substituted<br>Level<br>(dBm) | Antenna<br>Gain<br>(dBd/dBi) | Cable<br>Loss<br>(dB) |                            |                |                |
| FM,Frequency: 161.1MHz-12.5 kHz |                |                               |                               |                              |                       |                            |                |                |
| 322.20                          | H              | 35.20                         | -73.04                        | 0.00                         | 0.33                  | -73.37                     | -20.00         | 53.37          |
| 322.20                          | V              | 36.10                         | -70.26                        | 0.00                         | 0.33                  | -70.59                     | -20.00         | 50.59          |
| 483.30                          | H              | 36.12                         | -69.52                        | 0.00                         | 0.36                  | -69.88                     | -20.00         | 49.88          |
| 483.30                          | V              | 35.73                         | -67.23                        | 0.00                         | 0.36                  | -67.59                     | -20.00         | 47.59          |
| 644.40                          | H              | 35.69                         | -66.06                        | 0.00                         | 0.37                  | -66.43                     | -20.00         | 46.43          |
| 644.40                          | V              | 35.57                         | -63.34                        | 0.00                         | 0.37                  | -63.71                     | -20.00         | 43.71          |
| 805.50                          | H              | 35.52                         | -62.85                        | 0.00                         | 0.49                  | -63.34                     | -20.00         | 43.34          |
| 805.50                          | V              | 34.94                         | -60.38                        | 0.00                         | 0.49                  | -60.87                     | -20.00         | 40.87          |
| 966.60                          | H              | 35.74                         | -57.50                        | 0.00                         | 0.51                  | -58.01                     | -20.00         | 38.01          |
| 966.60                          | V              | 34.90                         | -55.41                        | 0.00                         | 0.51                  | -55.92                     | -20.00         | 35.92          |
| 1127.70                         | H              | 39.52                         | -73.73                        | 7.37                         | 1.04                  | -67.40                     | -20.00         | 47.40          |
| 1127.70                         | V              | 39.57                         | -74.27                        | 7.37                         | 1.04                  | -67.94                     | -20.00         | 47.94          |
| 1288.80                         | H              | 38.85                         | -74.64                        | 8.19                         | 1.18                  | -67.63                     | -20.00         | 47.63          |
| 1288.80                         | V              | 39.24                         | -75.17                        | 8.19                         | 1.18                  | -68.16                     | -20.00         | 48.16          |
| 1449.90                         | H              | 39.12                         | -75.08                        | 9.25                         | 1.27                  | -67.10                     | -20.00         | 47.10          |
| 1449.90                         | V              | 39.21                         | -75.34                        | 9.25                         | 1.27                  | -67.36                     | -20.00         | 47.36          |
| FM,Frequency: 161.1MHz-25 kHz   |                |                               |                               |                              |                       |                            |                |                |
| 322.20                          | H              | 35.49                         | -72.75                        | 0.00                         | 0.33                  | -73.08                     | -13.00         | 60.08          |
| 322.20                          | V              | 36.57                         | -69.79                        | 0.00                         | 0.33                  | -70.12                     | -13.00         | 57.12          |
| 483.30                          | H              | 35.33                         | -70.31                        | 0.00                         | 0.36                  | -70.67                     | -13.00         | 57.67          |
| 483.30                          | V              | 35.32                         | -67.64                        | 0.00                         | 0.36                  | -68.00                     | -13.00         | 55.00          |
| 644.40                          | H              | 35.40                         | -66.35                        | 0.00                         | 0.37                  | -66.72                     | -13.00         | 53.72          |
| 644.40                          | V              | 35.92                         | -62.99                        | 0.00                         | 0.37                  | -63.36                     | -13.00         | 50.36          |
| 805.50                          | H              | 35.86                         | -62.51                        | 0.00                         | 0.49                  | -63.00                     | -13.00         | 50.00          |
| 805.50                          | V              | 36.75                         | -58.57                        | 0.00                         | 0.49                  | -59.06                     | -13.00         | 46.06          |
| 966.60                          | H              | 35.10                         | -58.14                        | 0.00                         | 0.51                  | -58.65                     | -13.00         | 45.65          |
| 966.60                          | V              | 38.96                         | -51.35                        | 0.00                         | 0.51                  | -51.86                     | -13.00         | 38.86          |
| 1127.70                         | H              | 39.19                         | -74.06                        | 7.37                         | 1.04                  | -67.73                     | -13.00         | 54.73          |
| 1127.70                         | V              | 39.22                         | -74.62                        | 7.37                         | 1.04                  | -68.29                     | -13.00         | 55.29          |
| 1288.80                         | H              | 39.50                         | -73.99                        | 8.19                         | 1.18                  | -66.98                     | -13.00         | 53.98          |
| 1288.80                         | V              | 39.17                         | -75.24                        | 8.19                         | 1.18                  | -68.23                     | -13.00         | 55.23          |
| 1449.90                         | H              | 38.64                         | -75.56                        | 9.25                         | 1.27                  | -67.58                     | -13.00         | 54.58          |
| 1449.90                         | V              | 38.35                         | -76.20                        | 9.25                         | 1.27                  | -68.22                     | -13.00         | 55.22          |

| 4FSK, Frequency: 161.1MHz-12.5 kHz |   |       |        |      |      |        |        |       |
|------------------------------------|---|-------|--------|------|------|--------|--------|-------|
| 322.20                             | H | 36.24 | -72.00 | 0.00 | 0.33 | -72.33 | -20.00 | 52.33 |
| 322.20                             | V | 36.18 | -70.18 | 0.00 | 0.33 | -70.51 | -20.00 | 50.51 |
| 483.30                             | H | 35.51 | -70.13 | 0.00 | 0.36 | -70.49 | -20.00 | 50.49 |
| 483.30                             | V | 35.44 | -67.52 | 0.00 | 0.36 | -67.88 | -20.00 | 47.88 |
| 644.40                             | H | 35.25 | -66.50 | 0.00 | 0.37 | -66.87 | -20.00 | 46.87 |
| 644.40                             | V | 35.63 | -63.28 | 0.00 | 0.37 | -63.65 | -20.00 | 43.65 |
| 805.50                             | H | 35.29 | -63.08 | 0.00 | 0.49 | -63.57 | -20.00 | 43.57 |
| 805.50                             | V | 35.59 | -59.73 | 0.00 | 0.49 | -60.22 | -20.00 | 40.22 |
| 966.60                             | H | 35.44 | -57.80 | 0.00 | 0.51 | -58.31 | -20.00 | 38.31 |
| 966.60                             | V | 38.05 | -52.26 | 0.00 | 0.51 | -52.77 | -20.00 | 32.77 |
| 1127.70                            | H | 39.59 | -73.66 | 7.37 | 1.04 | -67.33 | -20.00 | 47.33 |
| 1127.70                            | V | 40.05 | -73.79 | 7.37 | 1.04 | -67.46 | -20.00 | 47.46 |
| 1288.80                            | H | 38.47 | -75.02 | 8.19 | 1.18 | -68.01 | -20.00 | 48.01 |
| 1288.80                            | V | 38.83 | -75.58 | 8.19 | 1.18 | -68.57 | -20.00 | 48.57 |
| 1449.90                            | H | 35.57 | -78.63 | 9.25 | 1.27 | -70.65 | -20.00 | 50.65 |
| 1449.90                            | V | 35.68 | -78.87 | 9.25 | 1.27 | -70.89 | -20.00 | 50.89 |

**Part 22**

| Frequency<br>(MHz)                   | Polar<br>(H/V) | Receiver<br>Reading<br>(dBμV) | Substituted Method            |                              |                       | Absolute<br>Level<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|--------------------------------------|----------------|-------------------------------|-------------------------------|------------------------------|-----------------------|----------------------------|----------------|----------------|
|                                      |                |                               | Substituted<br>Level<br>(dBm) | Antenna<br>Gain<br>(dBd/dBi) | Cable<br>Loss<br>(dB) |                            |                |                |
| FM,Frequency: 150.8125MHz-12.5 kHz   |                |                               |                               |                              |                       |                            |                |                |
| 301.63                               | H              | 35.58                         | -73.04                        | 0.00                         | 0.31                  | -73.35                     | -13.00         | 60.35          |
| 301.63                               | V              | 36.81                         | -70.13                        | 0.00                         | 0.31                  | -70.44                     | -13.00         | 57.44          |
| 452.44                               | H              | 35.36                         | -70.71                        | 0.00                         | 0.36                  | -71.07                     | -13.00         | 58.07          |
| 452.44                               | V              | 35.52                         | -67.87                        | 0.00                         | 0.36                  | -68.23                     | -13.00         | 55.23          |
| 603.25                               | H              | 35.56                         | -66.82                        | 0.00                         | 0.36                  | -67.18                     | -13.00         | 54.18          |
| 603.25                               | V              | 35.58                         | -64.35                        | 0.00                         | 0.36                  | -64.71                     | -13.00         | 51.71          |
| 754.06                               | H              | 35.40                         | -64.22                        | 0.00                         | 0.44                  | -64.66                     | -13.00         | 51.66          |
| 754.06                               | V              | 35.62                         | -60.81                        | 0.00                         | 0.44                  | -61.25                     | -13.00         | 48.25          |
| 904.88                               | H              | 35.96                         | -59.47                        | 0.00                         | 0.51                  | -59.98                     | -13.00         | 46.98          |
| 904.88                               | V              | 37.96                         | -54.12                        | 0.00                         | 0.51                  | -54.63                     | -13.00         | 41.63          |
| 1055.69                              | H              | 37.67                         | -75.92                        | 7.62                         | 0.90                  | -69.20                     | -13.00         | 56.20          |
| 1055.69                              | V              | 39.58                         | -74.50                        | 7.62                         | 0.90                  | -67.78                     | -13.00         | 54.78          |
| 1206.50                              | H              | 37.27                         | -75.40                        | 7.37                         | 1.10                  | -69.13                     | -13.00         | 56.13          |
| 1206.50                              | V              | 37.20                         | -76.55                        | 7.37                         | 1.10                  | -70.28                     | -13.00         | 57.28          |
| 1357.31                              | H              | 36.64                         | -76.73                        | 8.70                         | 1.20                  | -69.23                     | -13.00         | 56.23          |
| 1357.31                              | V              | 36.45                         | -77.65                        | 8.70                         | 1.20                  | -70.15                     | -13.00         | 57.15          |
| 1508.13                              | H              | 35.60                         | -79.57                        | 9.55                         | 1.30                  | -71.32                     | -13.00         | 58.32          |
| 1508.13                              | V              | 35.66                         | -79.65                        | 9.55                         | 1.30                  | -71.40                     | -13.00         | 58.40          |
| 4FSK,Frequency: 150.8125MHz-12.5 kHz |                |                               |                               |                              |                       |                            |                |                |
| 301.63                               | H              | 35.76                         | -72.86                        | 0.00                         | 0.31                  | -73.17                     | -13.00         | 60.17          |
| 301.63                               | V              | 36.33                         | -70.61                        | 0.00                         | 0.31                  | -70.92                     | -13.00         | 57.92          |
| 452.44                               | H              | 35.16                         | -70.91                        | 0.00                         | 0.36                  | -71.27                     | -13.00         | 58.27          |
| 452.44                               | V              | 36.99                         | -66.40                        | 0.00                         | 0.36                  | -66.76                     | -13.00         | 53.76          |
| 603.25                               | H              | 35.92                         | -66.46                        | 0.00                         | 0.36                  | -66.82                     | -13.00         | 53.82          |
| 603.25                               | V              | 35.28                         | -64.65                        | 0.00                         | 0.36                  | -65.01                     | -13.00         | 52.01          |
| 754.06                               | H              | 35.38                         | -64.24                        | 0.00                         | 0.44                  | -64.68                     | -13.00         | 51.68          |
| 754.06                               | V              | 36.25                         | -60.18                        | 0.00                         | 0.44                  | -60.62                     | -13.00         | 47.62          |
| 904.88                               | H              | 36.39                         | -59.04                        | 0.00                         | 0.51                  | -59.55                     | -13.00         | 46.55          |
| 904.88                               | V              | 37.07                         | -55.01                        | 0.00                         | 0.51                  | -55.52                     | -13.00         | 42.52          |
| 1055.69                              | H              | 38.11                         | -75.48                        | 7.62                         | 0.90                  | -68.76                     | -13.00         | 55.76          |
| 1055.69                              | V              | 38.54                         | -75.54                        | 7.62                         | 0.90                  | -68.82                     | -13.00         | 55.82          |
| 1206.50                              | H              | 38.17                         | -74.50                        | 7.37                         | 1.10                  | -68.23                     | -13.00         | 55.23          |
| 1206.50                              | V              | 38.51                         | -75.24                        | 7.37                         | 1.10                  | -68.97                     | -13.00         | 55.97          |
| 1357.31                              | H              | 37.39                         | -75.98                        | 8.70                         | 1.20                  | -68.48                     | -13.00         | 55.48          |
| 1357.31                              | V              | 37.41                         | -76.69                        | 8.70                         | 1.20                  | -69.19                     | -13.00         | 56.19          |
| 1508.13                              | H              | 35.85                         | -79.32                        | 9.55                         | 1.30                  | -71.07                     | -13.00         | 58.07          |
| 1508.13                              | V              | 35.83                         | -79.48                        | 9.55                         | 1.30                  | -71.23                     | -13.00         | 58.23          |

| FM, Frequency: 150.8125MHz-25 kHz |   |       |        |      |      |        |        |       |
|-----------------------------------|---|-------|--------|------|------|--------|--------|-------|
| 301.63                            | H | 36.40 | -72.22 | 0.00 | 0.31 | -72.53 | -13.00 | 59.53 |
| 301.63                            | V | 36.11 | -70.83 | 0.00 | 0.31 | -71.14 | -13.00 | 58.14 |
| 452.44                            | H | 35.29 | -70.78 | 0.00 | 0.36 | -71.14 | -13.00 | 58.14 |
| 452.44                            | V | 35.77 | -67.62 | 0.00 | 0.36 | -67.98 | -13.00 | 54.98 |
| 603.25                            | H | 35.34 | -67.04 | 0.00 | 0.36 | -67.40 | -13.00 | 54.40 |
| 603.25                            | V | 35.48 | -64.45 | 0.00 | 0.36 | -64.81 | -13.00 | 51.81 |
| 754.06                            | H | 35.66 | -63.96 | 0.00 | 0.44 | -64.40 | -13.00 | 51.40 |
| 754.06                            | V | 35.44 | -60.99 | 0.00 | 0.44 | -61.43 | -13.00 | 48.43 |
| 904.88                            | H | 35.51 | -59.92 | 0.00 | 0.51 | -60.43 | -13.00 | 47.43 |
| 904.88                            | V | 36.40 | -55.68 | 0.00 | 0.51 | -56.19 | -13.00 | 43.19 |
| 1055.69                           | H | 37.80 | -75.79 | 7.62 | 0.90 | -69.07 | -13.00 | 56.07 |
| 1055.69                           | V | 42.68 | -71.40 | 7.62 | 0.90 | -64.68 | -13.00 | 51.68 |
| 1206.50                           | H | 38.08 | -74.59 | 7.37 | 1.10 | -68.32 | -13.00 | 55.32 |
| 1206.50                           | V | 38.86 | -74.89 | 7.37 | 1.10 | -68.62 | -13.00 | 55.62 |
| 1357.31                           | H | 37.87 | -75.50 | 8.70 | 1.20 | -68.00 | -13.00 | 55.00 |
| 1357.31                           | V | 38.25 | -75.85 | 8.70 | 1.20 | -68.35 | -13.00 | 55.35 |
| 1508.13                           | H | 36.25 | -78.92 | 9.55 | 1.30 | -70.67 | -13.00 | 57.67 |
| 1508.13                           | V | 36.03 | -79.28 | 9.55 | 1.30 | -71.03 | -13.00 | 58.03 |

**Note:**

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

**FCC §2.1055 & § 22.355 & §74.464& §80.209 & §90.213 - FREQUENCY STABILITY**

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**Applicable Standard**

FCC §2.1055, § 22.355, §74.464, §80.209 and §90.213

**Test Procedure**

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

**Test Data****Environmental Conditions**

|                           |        |
|---------------------------|--------|
| <b>Temperature:</b>       | 24.1°C |
| <b>Relative Humidity:</b> | 60 %   |
| <b>ATM Pressure:</b>      | 102kPa |

*The testing was performed by Blake Yang on 2019-12-30*

*Test Mode: Transmitting*

FCC Part 90:

| FM,12.5kHz, Reference Frequency: 155.7525 MHz, Limit: $\pm 2.5$ ppm |                                     |                          |                       |
|---------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                    | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                                 | 7.7                                 | 155.7525244              | 0.16                  |
| -20                                                                 |                                     | 155.7524488              | -0.33                 |
| -10                                                                 |                                     | 155.7525167              | 0.11                  |
| 0                                                                   |                                     | 155.7524957              | -0.03                 |
| 10                                                                  |                                     | 155.7524198              | -0.51                 |
| 20                                                                  |                                     | 155.7524900              | -0.06                 |
| 30                                                                  |                                     | 155.7524683              | -0.20                 |
| 40                                                                  |                                     | 155.7522927              | -1.33                 |
| 50                                                                  |                                     | 155.7525090              | 0.06                  |
| 20                                                                  | 6.2                                 | 155.7525634              | 0.41                  |
| 20                                                                  | 8.4                                 | 155.7525864              | 0.55                  |

| 4FSK, 12.5kHz, Reference Frequency: 155.7525MHz, Limit: $\pm 2.5$ ppm |                                     |                          |                       |
|-----------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                      | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                                   | 7.7                                 | 155.7522956              | -1.31                 |
| -20                                                                   |                                     | 155.7526892              | 1.21                  |
| -10                                                                   |                                     | 155.7525548              | 0.35                  |
| 0                                                                     |                                     | 155.7526508              | 0.97                  |
| 10                                                                    |                                     | 155.7523849              | -0.74                 |
| 20                                                                    |                                     | 155.7526196              | 0.77                  |
| 30                                                                    |                                     | 155.7523794              | -0.77                 |
| 40                                                                    |                                     | 155.7525215              | 0.14                  |
| 50                                                                    |                                     | 155.7526173              | 0.75                  |
| 20                                                                    | 6.2                                 | 155.7525838              | 0.54                  |
| 20                                                                    | 8.4                                 | 155.7525062              | 0.04                  |

FCC Part 80:

| FM,25kHz, Reference Frequency: 154.0125MHz, Limit: $\pm 5.0$ ppm |                                     |                          |                       |
|------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                 | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                              | 7.7                                 | 154.012686               | 1.21                  |
| -20                                                              |                                     | 154.012455               | -0.29                 |
| -10                                                              |                                     | 154.012524               | 0.15                  |
| 0                                                                |                                     | 154.012459               | -0.27                 |
| 10                                                               |                                     | 154.012480               | -0.13                 |
| 20                                                               |                                     | 154.012490               | -0.07                 |
| 30                                                               |                                     | 154.012642               | 0.92                  |
| 40                                                               |                                     | 154.012649               | 0.96                  |
| 50                                                               |                                     | 154.012576               | 0.49                  |
| 20                                                               | 6.2                                 | 154.012547               | 0.31                  |
| 20                                                               | 8.4                                 | 154.012360               | -0.91                 |

FCC Part 74:

| FM, 12.5kHz, Reference Frequency: 161.1 MHz, Limit: $\pm 5.0$ ppm |                                     |                          |                       |
|-------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                  | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                               | 7.7                                 | 161.1001257              | 0.78                  |
| -20                                                               |                                     | 161.0998192              | -1.12                 |
| -10                                                               |                                     | 161.1000421              | 0.26                  |
| 0                                                                 |                                     | 161.1001289              | 0.80                  |
| 10                                                                |                                     | 161.1000379              | 0.24                  |
| 20                                                                |                                     | 161.0999900              | -0.06                 |
| 30                                                                |                                     | 161.0998920              | -0.67                 |
| 40                                                                |                                     | 161.1001265              | 0.79                  |
| 50                                                                |                                     | 161.1000904              | 0.56                  |
| 20                                                                | 6.2                                 | 161.0999516              | -0.30                 |
| 20                                                                | 8.4                                 | 161.0998359              | -1.02                 |

| 4FSK, 12.5kHz, Reference Frequency: 161.1 MHz, Limit: $\pm 5.0$ ppm |                                     |                          |                       |
|---------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                    | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                                 | 7.7                                 | 161.0999084              | -0.57                 |
| -20                                                                 |                                     | 161.0997995              | -1.24                 |
| -10                                                                 |                                     | 161.1000470              | 0.29                  |
| 0                                                                   |                                     | 161.1000495              | 0.31                  |
| 10                                                                  |                                     | 161.1000255              | 0.16                  |
| 20                                                                  |                                     | 161.1001403              | 0.87                  |
| 30                                                                  |                                     | 161.0999103              | -0.56                 |
| 40                                                                  |                                     | 161.1000742              | 0.46                  |
| 50                                                                  |                                     | 161.1001563              | 0.97                  |
| 20                                                                  | 6.2                                 | 161.0998006              | -1.24                 |
| 20                                                                  | 8.4                                 | 161.1000710              | 0.44                  |

| FM, 25kHz, Reference Frequency: 161.1 MHz, Limit: $\pm 5.0$ ppm |                                     |                          |                       |
|-----------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                             | 7.7                                 | 161.0998973              | -0.64                 |
| -20                                                             |                                     | 161.0999654              | -0.21                 |
| -10                                                             |                                     | 161.0999544              | -0.28                 |
| 0                                                               |                                     | 161.1000665              | 0.41                  |
| 10                                                              |                                     | 161.1001516              | 0.94                  |
| 20                                                              |                                     | 161.1000213              | 0.13                  |
| 30                                                              |                                     | 161.0999146              | -0.53                 |
| 40                                                              |                                     | 161.1001535              | 0.95                  |
| 50                                                              |                                     | 161.0999306              | -0.43                 |
| 20                                                              | 6.2                                 | 161.1001420              | 0.88                  |
| 20                                                              | 8.4                                 | 161.0999647              | -0.22                 |

## FCC Part 22:

| FM, 12.5kHz, Reference Frequency: 150.8125MHz, Limit: $\pm 5.0$ ppm |                                     |                          |                       |
|---------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                    | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                                 | 7.7                                 | 150.8126662              | 1.10                  |
| -20                                                                 |                                     | 150.8125147              | 0.10                  |
| -10                                                                 |                                     | 150.8125957              | 0.63                  |
| 0                                                                   |                                     | 150.8123324              | -1.11                 |
| 10                                                                  |                                     | 150.8126002              | 0.66                  |
| 20                                                                  |                                     | 150.8124900              | -0.07                 |
| 30                                                                  |                                     | 150.8123206              | -1.19                 |
| 40                                                                  |                                     | 150.8124140              | -0.57                 |
| 50                                                                  |                                     | 150.8124859              | -0.09                 |
| 20                                                                  | 6.2                                 | 150.8126169              | 0.78                  |
| 20                                                                  | 8.4                                 | 150.8125869              | 0.58                  |

| 4FSK, 12.5kHz, Reference Frequency: 150.8125MHz, Limit: $\pm 5.0$ ppm |                                     |                          |                       |
|-----------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                      | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                                   | 7.7                                 | 150.8123991              | -0.67                 |
| -20                                                                   |                                     | 150.8123486              | -1.00                 |
| -10                                                                   |                                     | 150.8123570              | -0.95                 |
| 0                                                                     |                                     | 150.8126140              | 0.76                  |
| 10                                                                    |                                     | 150.8122971              | -1.35                 |
| 20                                                                    |                                     | 150.8124513              | -0.32                 |
| 30                                                                    |                                     | 150.8126016              | 0.67                  |
| 40                                                                    |                                     | 150.8123700              | -0.86                 |
| 50                                                                    |                                     | 150.8125327              | 0.22                  |
| 20                                                                    | 6.2                                 | 150.8125287              | 0.19                  |
| 20                                                                    | 8.4                                 | 150.8123761              | -0.82                 |

| FM, 25kHz, Reference Frequency: 150.8125MHz, Limit: $\pm 5.0$ ppm |                                     |                          |                       |
|-------------------------------------------------------------------|-------------------------------------|--------------------------|-----------------------|
| Temperature (°C)                                                  | Voltage Supplied (V <sub>DC</sub> ) | Measured Frequency (MHz) | Frequency Error (ppm) |
| -30                                                               | 7.7                                 | 150.8126152              | 0.76                  |
| -20                                                               |                                     | 150.8125622              | 0.41                  |
| -10                                                               |                                     | 150.8123668              | -0.88                 |
| 0                                                                 |                                     | 150.8124181              | -0.54                 |
| 10                                                                |                                     | 150.8124169              | -0.55                 |
| 20                                                                |                                     | 150.8125877              | 0.58                  |
| 30                                                                |                                     | 150.8125496              | 0.33                  |
| 40                                                                |                                     | 150.8126270              | 0.84                  |
| 50                                                                |                                     | 150.8125690              | 0.46                  |
| 20                                                                | 6.2                                 | 150.8125189              | 0.13                  |
| 20                                                                | 8.4                                 | 150.8126833              | 1.22                  |

## FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

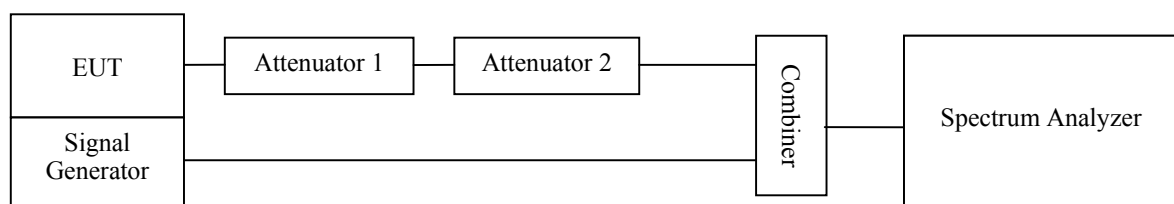
### Applicable Standard

Regulations: FCC §90.214

Test method: ANSI/TIA-603-D 2010, section 2.2.19.3

### Test Procedure

- Connect the EUT and test equipment as shown on the following block diagram.
- Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
- Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at  $\pm 12.5$  kHz deviation and set its output level to -100dBm.
- Turn on the transmitter.
- Supply sufficient attenuation via the RF attenuator to provide an input level to the Spectrum Analyzer that is 40 dB below the maximum allowed input power when the transmitter is operating at its rated power level. Note this power level on the Spectrum Analyzer as  $P_0$ .
- Turn off the transmitter.
- Adjust the RF level of the signal generator to provide RF power equal to  $P_0$ . This signal generator RF level shall be maintained throughout the rest of the measurement.
- Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
- Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at  $\pm 4$  divisions vertically centered on the display. Set trigger mode of the Spectrum Analyzer to "Video", and tune the "trigger level" on suitable level. Then set the "trigger offset" to -10ms for turn on and -15ms for turn off.
- Turn on the transmitter and the transient wave will be captured on the screen of Spectrum Analyzer. Observe the stored display. The instant when the 1 kHz test signal is completely suppressed is considered to be  $t_{on}$ . The trace should be maintained within the allowed divisions during the period  $t_1$  and  $t_2$ .
- Then turn off the transmitter, and another transient wave will be captured on the screen of Spectrum Analyzer. The trace should be maintained within the allowed divisions during the period  $t_3$ .



**Test Data****Environmental Conditions**

|                           |        |
|---------------------------|--------|
| <b>Temperature:</b>       | 24.1°C |
| <b>Relative Humidity:</b> | 60 %   |
| <b>ATM Pressure:</b>      | 102kPa |

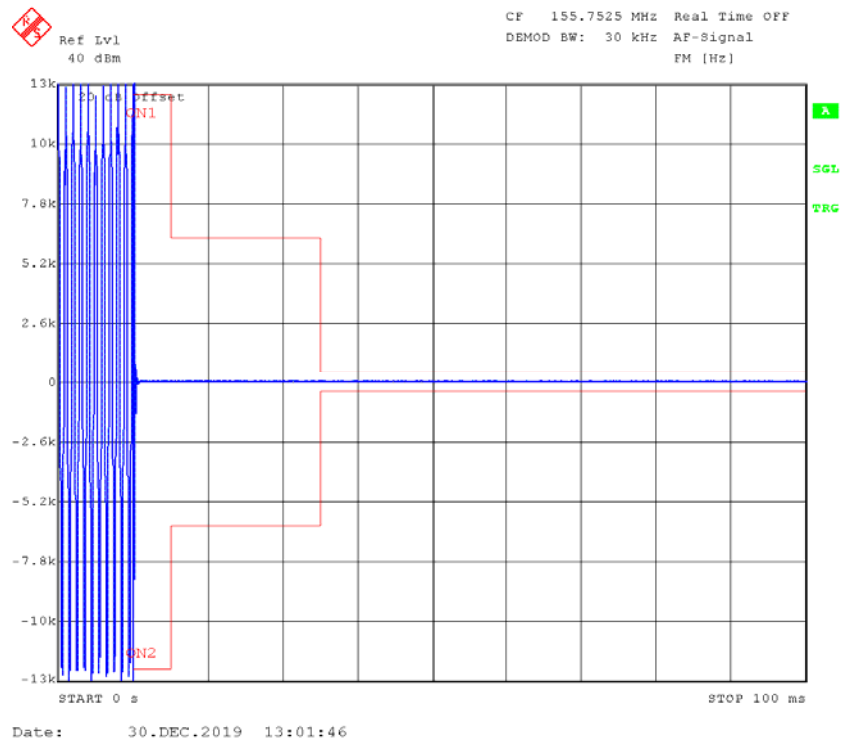
*The testing was performed by Blake Yang on 2019-12-30*

| <b>Channel Spacing<br/>(kHz)</b> | <b>Transient Period<br/>(ms)</b> | <b>Transient Frequency</b> | <b>Result</b> |
|----------------------------------|----------------------------------|----------------------------|---------------|
| 12.5                             | <5( $t_1$ )                      | ±12.5 kHz                  | Pass          |
|                                  | <20( $t_2$ )                     | ±6.25 kHz                  |               |
|                                  | <5( $t_3$ )                      | ±12.5 kHz                  |               |

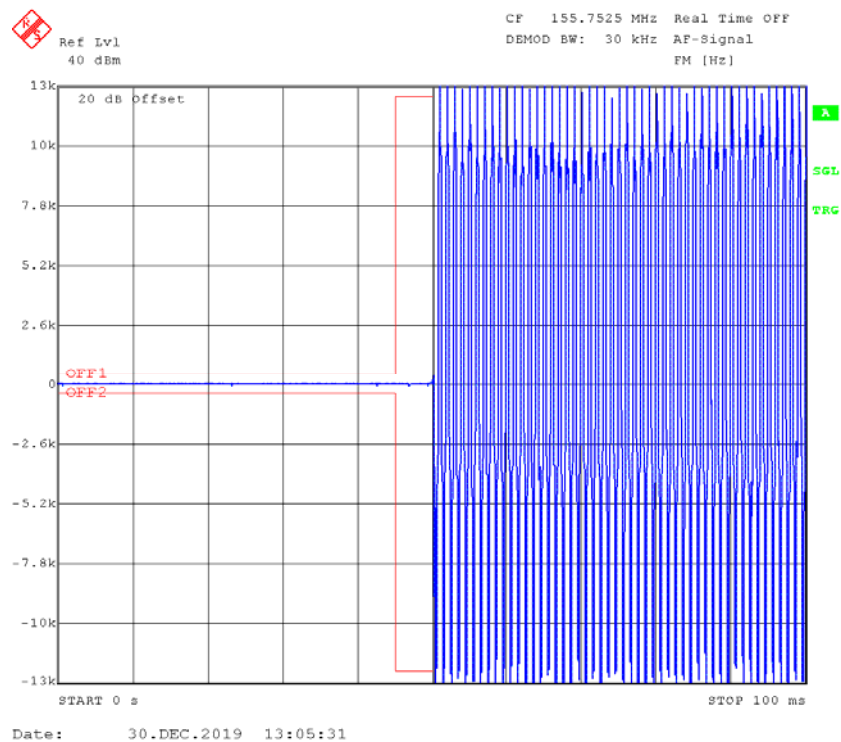
Please refer to the following plots.

# High Power Channel: 155.7525 MHz

## Turn on



## Turn off



\*\*\*\*\* END OF REPORT \*\*\*\*\*