ACCREDITED
TESTING LABORATORY
CERTIFICATE # 4821.01

BACL
Bay Area Compliance Labs Corp.

# FCC PART 90

# TEST REPORT

For

## RCA Communications Systems

133 West Market Street, Suite 227, Indianapolis, Indiana 46204, United States

**FCC ID: XYH-RDR4300V**

| **Report Type:** | **Product Type:** |
|---|---|
| Original Report | Digital Two-Way Radio |

**Report Number:** RSZ180308004-00A

**Report Date:** 2018-05-25

**Reviewed By:** Rocky Kang, RF Engineer

**Prepared By:** Bay Area Compliance Laboratories Corp. (Shenzhen)
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# GENERAL INFORMATION

## Product Description for Equipment under Test (EUT)

The *RCA Communications Systems's* product, model number: *RDR4380V* (FC*C ID: XYH-RDR4300V)* or the "EUT" in this report was a *Digital Two-Way Radio*, which was measured approximately: 11.8 cm (L) × 9.0 cm (W) × 4.8 cm (H) for charger part, 27.2 cm (L) × 6.3 cm (W) × 3.5 cm (H) for handset part, rated with input voltage: DC 7.4V from battery or DC 12V from adapter.

**EUT Specification:**

| | |
|---|---|
| **Operating frequency band** | 136-174MHz |
| **Modulation type** | 4FSK, FM |
| **Channel separation** | 12.5kHz |
| **Rate Output Power** | High: 5W<br>Low: 1W |

Adapter Information:
Model: XY12S-1201000Q-UW
Input: AC 100-240V, 50/60Hz, 0.5A
Output: DC 12V, 1.0A

*Notes: This series products model: RDR4350V, RDR4320V and RDR4380V are identical schematics, the difference among them are the model name, LCD display and keyboards. Model RDR4380V was selected for fully testing, the detailed information can be referred to the declaration which was stated and guaranteed by the applicant.*

**All measurement and test data in this report was gathered from production sample serial number: 1800275A for RDR4380V, 1800275B for RDR4350V, 1800275C for RDR4320V (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-03-08.*

## Objective

This test report is prepared on behalf of *RCA Communications Systems* in accordance with Part 2, and Part 90 of the Federal Communication Commissions rules.

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

FCC Part 15.247 DSS submissions with FCC ID: XYH-RDR4300V.

## 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 90 – Private Land Mobile Radio Service

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

## Measurement Uncertainty

| Parameter | uncertainty |
|---|---|
| Occupied Channel Bandwidth | ±5% |
| RF Output Power with Power meter | ±0.5dB |
| RF conducted test with spectrum | ±1.5dB |
| All emissions, radiated | ±4.88dB |
| Temperature | ±3℃ |
| Humidity | ±6% |
| Supply voltages | ±0.4% |

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 342867, the FCC Designation No. : CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

# 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.

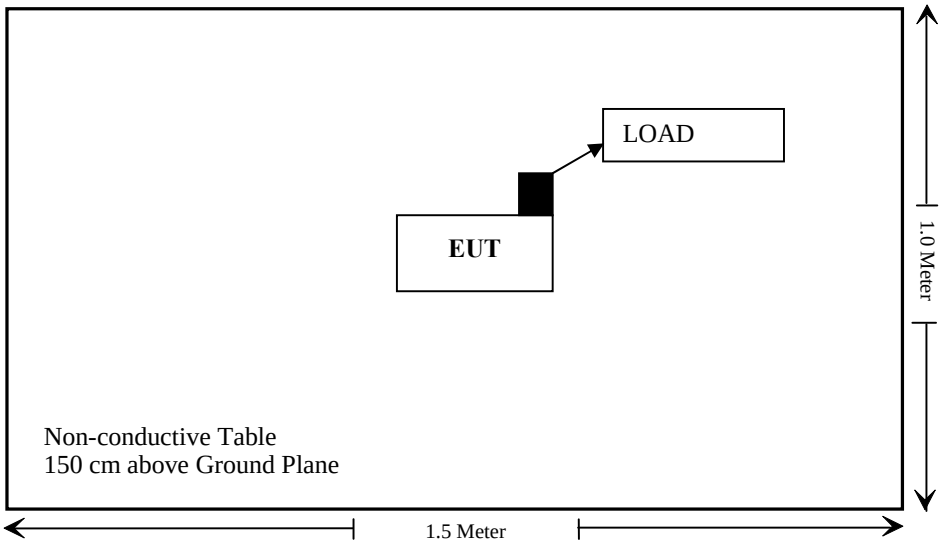
## Equipment Modifications

No modification was made to the EUT tested.

## Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| N/A | Load | N/A | N/A |

## Block Diagram of Test Setup



# SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Results |
|---|---|---|
| §2.1093 | RF Exposure | Compliance |
| §2.1046; §90.205 | RF Output Power | Compliance |
| §2.1047; §90.207 | Modulation Characteristic | Compliance |
| §2.1049; §90.210 | Occupied Bandwidth & Emission Mask | Compliance |
| §2.1051;§90.210 | Spurious Emission at Antenna Terminal | Compliance |
| §2.1053;§90.210 | Spurious Radiated Emissions | Compliance |
| §2.1055;§90.213 | Frequency Stability | Compliance |
| §90.214 | Transient Frequency Behavior | Compliance |

# TEST EQUIPMENT LIST

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| **Radiated Emission Test** | | | | | |
| Rohde & Schwarz | EMI Test Receiver | ESCI | 101120 | 2018-01-11 | 2019-01-11 |
| HP | Amplifier | HP8447E | 1937A01046 | 2017-11-19 | 2018-05-17 |
| HP | Amplifier | HP8447E | 1937A01046 | 2018-05-17 | 2018-11-19 |
| Sunol Sciences | Broadband Antenna | JB1 | A040904-2 | 2017-12-17 | 2020-12-16 |
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 8386001028 | 2017-04-24 | 2018-04-24 |
| Rohde & Schwarz | Signal Analyzer | FSIQ26 | 8386001028 | 2018-04-24 | 2019-04-24 |
| Sunol Sciences | Horn Antenna | DRH-118 | A052604 | 2017-12-22 | 2020-12-21 |
| HP | Synthesized Sweeper | HP 8341B | 2624A00116 | 2017-07-02 | 2018-07-01 |
| Mini | Amplifier | ZVA-183-S+ | 5969001149 | 2017-05-21 | 2018-05-21 |
| Mini | Amplifier | ZVA-183-S+ | 5969001149 | 2018-05-21 | 2019-05-21 |
| A.H. System | Horn Antenna | SAS-200/571 | 135 | 2015-08-18 | 2018-08-17 |
| Ducommun technologies | RF Cable | UFA210A-1-4724-30050U | MFR64369 223410-001 | 2017-11-19 | 2018-05-17 |
| Ducommun technologies | RF Cable | UFA210A-1-4724-30050U | MFR64369 223410-001 | 2018-05-17 | 2018-11-19 |
| Ducommun technologies | RF Cable | 104PEA | 218124002 | 2017-11-19 | 2018-05-17 |
| Ducommun technologies | RF Cable | 104PEA | 218124002 | 2018-05-17 | 2018-11-19 |
| Ducommun technologies | RF Cable | RG-214 | 1 | 2017-11-19 | 2018-05-17 |
| Ducommun technologies | RF Cable | RG-214 | 1 | 2018-05-17 | 2018-11-19 |
| Ducommun technologies | RF Cable | RG-214 | 2 | 2017-11-22 | 2018-05-22 |
| Ducommun technologies | RF Cable | RG-214 | 2 | 2018-05-22 | 2018-11-22 |
| COM POWER | Dipole Antenna | AD-100 | 041000 | 2017-08-18 | 2018-08-18 |
| N/A | Band Pass Filter | N/A | N/A | 2017-05-21 | 2018-05-21 |
| N/A | Band Pass Filter | N/A | N/A | 2018-05-21 | 2019-05-21 |

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| **RF Conducted test** | | | | | |
| Rohde & Schwarz | SPECTRUM ANALYZER | FSU26 | 200120 | 2017-12-05 | 2018-12-05 |
| HP Agilent | RF Communication test set | 8920A | 3325U00859 | 2017-06-14 | 2018-06-13 |
| LEADER | MILLIVOLTMETER | LMV-181A | 6041126 | 2017-10-12 | 2018-10-12 |
| Hewlett-Packard | Frequency Counter | 5343A | 2232A00827 | 2016-08-29 | 2019-08-29 |
| ESPEC | Temperature & Humidity Chamber | EL-10KA | 09107726 | 2017-11-22 | 2018-11-22 |
| Ducommun technologies | RF Cable | RG-214 | 3 | 2017-11-22 | 2018-05-22 |
| N/A | 30dB Attenuator | 53-30-43 | PG633 | 2017-11-22 | 2018-05-22 |
| HP Agilent | RF Communication test set | 8920B | 3325U00859 | 2017-10-25 | 2018-10-25 |

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

# FCC §1.1307(b) & §2.1093 - RF EXPOSURE

## Applicable Standard

According to FCC §1.1307(b) and §2.1093, protable device operates Part 90 should be subjected to rountine environmental evaluation for RF exposure prior or equipment authorization or use.

**Result:** Compliance.

Please refer to SAR Report Number: RSZ180308004-20A.

# FCC §2.1046 & §90.205 - RF OUTPUT POWER

## Applicable Standard

FCC §2.1046 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

| | |
|---|---|
| **Temperature:** | 25 ℃ |
| **Relative Humidity:** | 50 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nancy Wang on 2018-03-25.*

*Test Mode: Transmitting*

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

| Modulation | Channel Separation (kHz) | Frequency (MHz) | Power Level | Output Power (dBm) | Output Power (W) | Result |
|---|---|---|---|---|---|---|
| Analog | 12.5 | 136.0125 | High | 37.02 | 5.04 | Pass |
| | | | Low | 29.94 | 0.99 | Pass |
| | 12.5 | 155.7525 | High | 37.47 | 5.58 | Pass |
| | | | Low | 30.33 | 1.08 | Pass |
| | 12.5 | 173.9875 | High | 37.09 | 5.12 | Pass |
| | | | Low | 29.90 | 0.98 | Pass |

| Modulation | Channel Separation (kHz) | Frequency (MHz) | Power Level | Output Power (dBm) | Output Power (W) | Result |
|---|---|---|---|---|---|---|
| Digital | 12.5 | 136.0125 | High | 37.03 | 5.05 | Pass |
| | | | Low | 29.91 | 0.98 | Pass |
| | 12.5 | 155.7525 | High | 37.48 | 5.60 | Pass |
| | | | Low | 30.34 | 1.08 | Pass |
| | 12.5 | 173.9875 | High | 37.09 | 5.12 | Pass |
| | | | Low | 29.90 | 0.98 | Pass |

Note: The rated high power is 5W. The limit of the high output power is 4W-6W.
The rated low power is 1W. The limit of the low output power is 0.8W-1.2W.

# FCC §2.1047 & §90.207 - MODULATION CHARACTERISTIC

## Applicable Standard

FCC§2.1047 and §90.207:

(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-D

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 ℃ |
| **Relative Humidity:** | 50 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nancy Wang on 2017-03-28.*

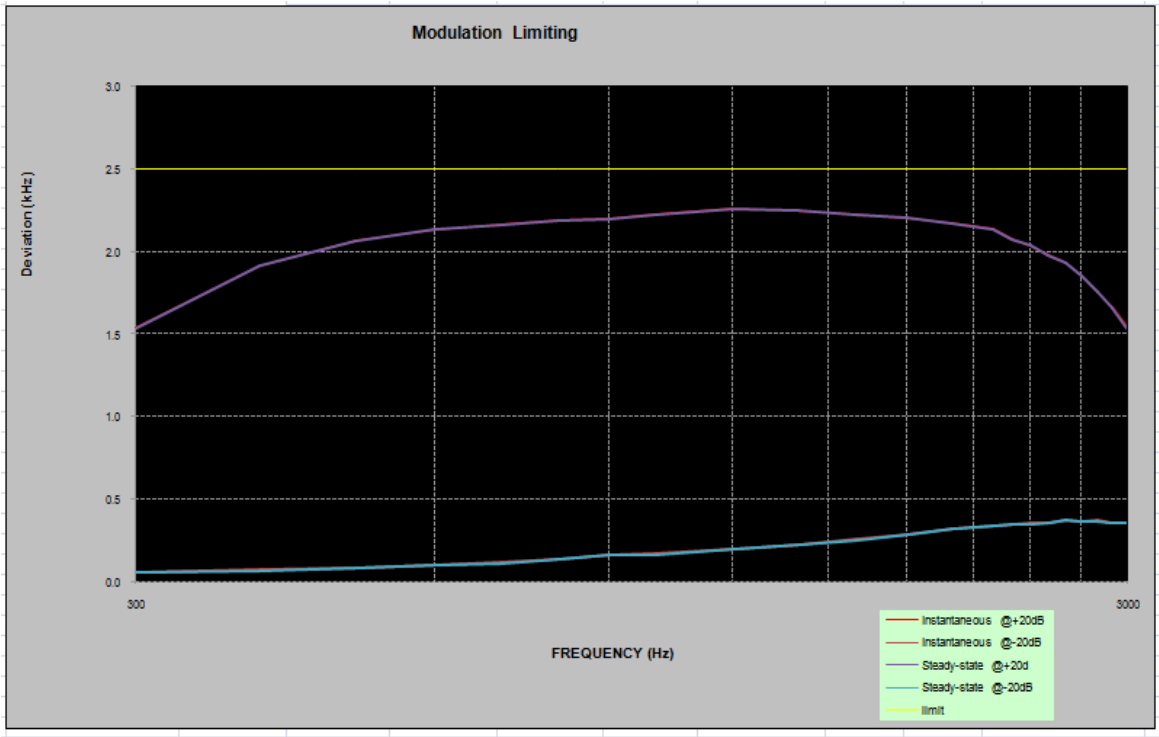
Please refer to the following tables and plots.

**Analog Modulation:**

## MODULATION LIMITING

Carrier Frequency: 155.7525 MHz, Channel Separation=12.5 kHz

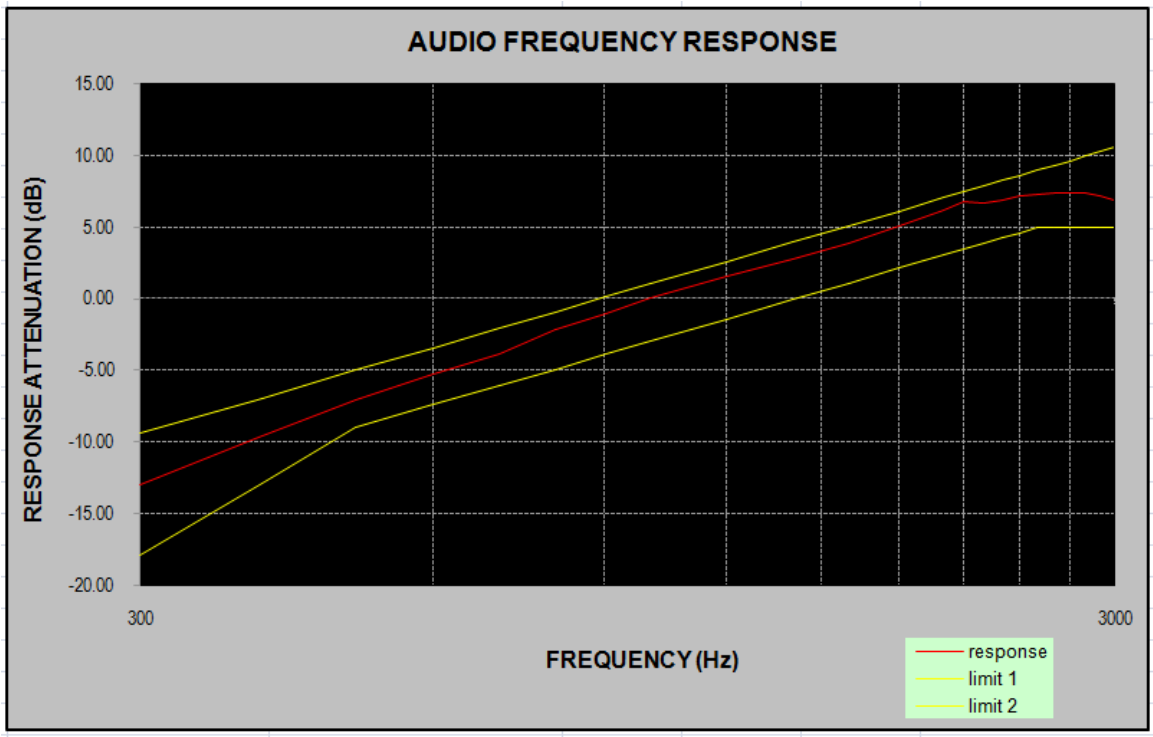
| Audio Frequency (Hz) | Instantaneous | | Steady-state | | FCC Limit [kHz] |
|---|---|---|---|---|---|
| | DEVIATION (@+20dB) [kHz] | DEVIATION (@-20dB) [kHz] | DEVIATION (@+20dB) [kHz] | DEVIATION (@-20dB) [kHz] | |
| 300 | 1.541 | 0.057 | 1.539 | 0.055 | 2.500 |
| 400 | 1.914 | 0.071 | 1.911 | 0.068 | 2.500 |
| 500 | 2.069 | 0.085 | 2.064 | 0.082 | 2.500 |
| 600 | 2.132 | 0.101 | 2.133 | 0.098 | 2.500 |
| 700 | 2.164 | 0.113 | 2.161 | 0.111 | 2.500 |
| 800 | 2.192 | 0.134 | 2.191 | 0.133 | 2.500 |
| 900 | 2.204 | 0.161 | 2.201 | 0.160 | 2.500 |
| 1000 | 2.226 | 0.165 | 2.227 | 0.163 | 2.500 |
| 1200 | 2.260 | 0.197 | 2.258 | 0.195 | 2.500 |
| 1400 | 2.248 | 0.225 | 2.246 | 0.222 | 2.500 |
| 1600 | 2.227 | 0.255 | 2.224 | 0.253 | 2.500 |
| 1800 | 2.202 | 0.287 | 2.202 | 0.287 | 2.500 |
| 2000 | 2.175 | 0.318 | 2.171 | 0.315 | 2.500 |
| 2100 | 2.160 | 0.330 | 2.155 | 0.328 | 2.500 |
| 2200 | 2.138 | 0.339 | 2.132 | 0.339 | 2.500 |
| 2300 | 2.078 | 0.347 | 2.076 | 0.344 | 2.500 |
| 2400 | 2.037 | 0.352 | 2.039 | 0.350 | 2.500 |
| 2500 | 1.979 | 0.355 | 1.974 | 0.352 | 2.500 |
| 2600 | 1.933 | 0.372 | 1.931 | 0.371 | 2.500 |
| 2700 | 1.855 | 0.362 | 1.854 | 0.359 | 2.500 |
| 2800 | 1.762 | 0.370 | 1.760 | 0.367 | 2.500 |
| 2900 | 1.659 | 0.354 | 1.656 | 0.352 | 2.500 |
| 3000 | 1.545 | 0.357 | 1.540 | 0.357 | 2.500 |


Modulation Limiting
Deviation (kHz)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
300
3000
FREQUENCY (Hz)
Instantaneous @+20dB
Instantaneous @-20dB
Steady-state @+20d
Steady-state @-20dB
limit

## Audio Frequency Response

Carrier Frequency: 155.7525 MHz, Channel Separation=12.5 kHz

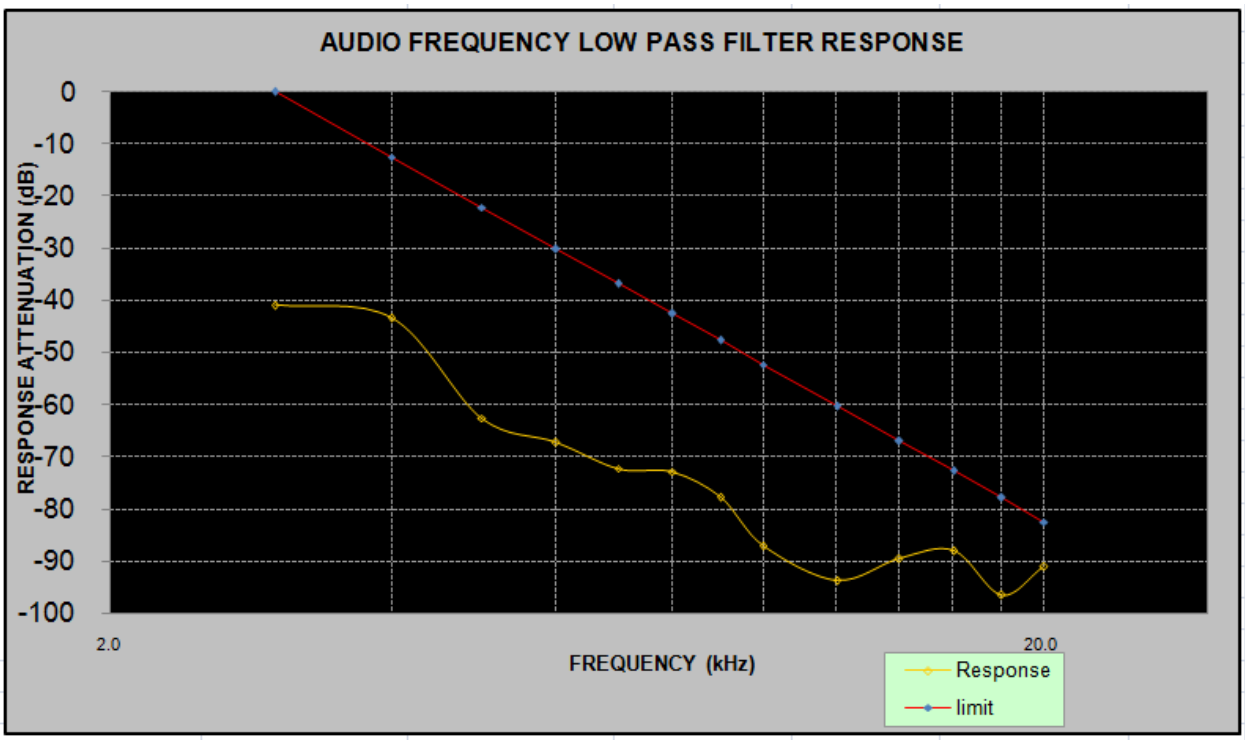
| Audio Frequency (Hz) | Response Attenuation (dB) |
|---|---|
| 300 | -13.00 |
| 400 | -9.63 |
| 500 | -7.09 |
| 600 | -5.22 |
| 700 | -3.82 |
| 800 | -2.16 |
| 900 | -1.07 |
| 1000 | 0.00 |
| 1200 | 1.51 |
| 1400 | 2.76 |
| 1600 | 3.88 |
| 1800 | 5.06 |
| 2000 | 6.12 |
| 2100 | 6.70 |
| 2200 | 6.62 |
| 2300 | 6.87 |
| 2400 | 7.12 |
| 2500 | 7.21 |
| 2600 | 7.32 |
| 2700 | 7.38 |
| 2800 | 7.34 |
| 2900 | 7.17 |
| 3000 | 6.83 |


AUDIO FREQUENCY RESPONSE
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
RESPONSE ATTENUATION (dB)
300
3000
FREQUENCY (Hz)
response
limit 1
limit 2

**Audio frequency lows pass filter response**

Carrier Frequency: 155.7525 MHz, Channel Separation=12.5 kHz

| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|---|---|---|
| 1.0 | 0.0 | / |
| 3.0 | -40.95 | 0.0 |
| 4.0 | -43.47 | -12.5 |
| 5.0 | -62.53 | -22.2 |
| 6.0 | -67.18 | -30.1 |
| 7.0 | -72.24 | -36.8 |
| 8.0 | -72.80 | -42.6 |
| 9.0 | -77.85 | -47.7 |
| 10.0 | -87.07 | -52.3 |
| 12.0 | -93.72 | -60.2 |
| 14.0 | -89.55 | -66.9 |
| 16.0 | -88.04 | -72.7 |
| 18.0 | -96.53 | -77.8 |
| 20.0 | -90.95 | -82.5 |



# FCC §2.1049 & §90.210 – OCCUPIED BANDWIDTH & EMISSION MASK

## Applicable Standard

FCC §2.1049 and §90.210

Emission Mask D - 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

1) For any frequency removed from the center of the authorized bandwidth $f_0$ to 5.625 kHz removed from $f_0$, 0dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ($f_d$ –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz at least: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

## 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 and the spectrum was recorded in the frequency band ±50 kHz from the carrier frequency.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 ℃ |
| **Relative Humidity:** | 50 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nancy Wang on 2018-03-28.*

| Modulation | Channel Separation (kHz) | Frequency (MHz) | Power Level | 99% Occupied Bandwidth (kHz) | 26 dB Emissions Bandwidth (kHz) |
|---|---|---|---|---|---|
| Analog | 12.5 | 155.7525 | High | 10.00 | 10.38 |
| | | | Low | 10.00 | 10.38 |
| Digital | 12.5 | 155.7525 | High | 6.92 | 9.23 |
| | | | Low | 6.73 | 8.08 |

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

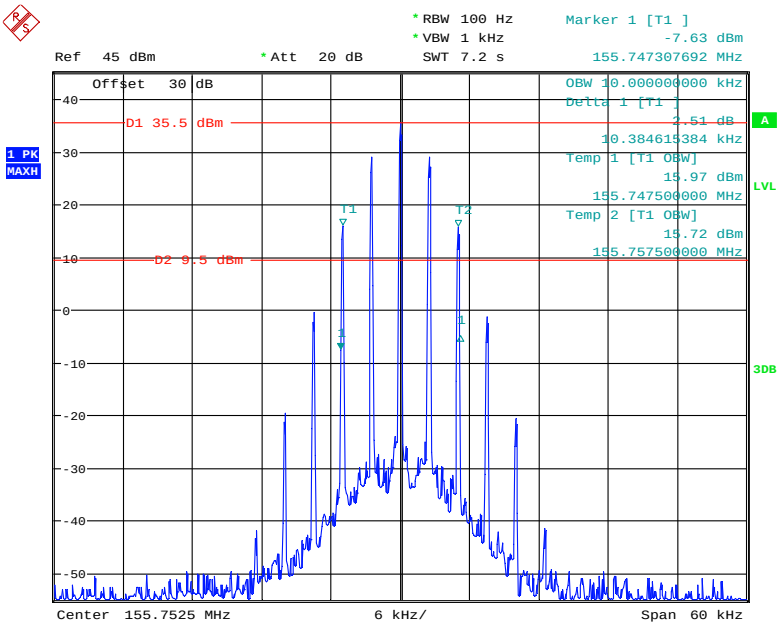
Emission Designator Per CFR 47 §2.201& §2.202&, Bn = 2M + 2D

**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 kHz + 2.5 kHz) = 11 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 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, 6.92 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.

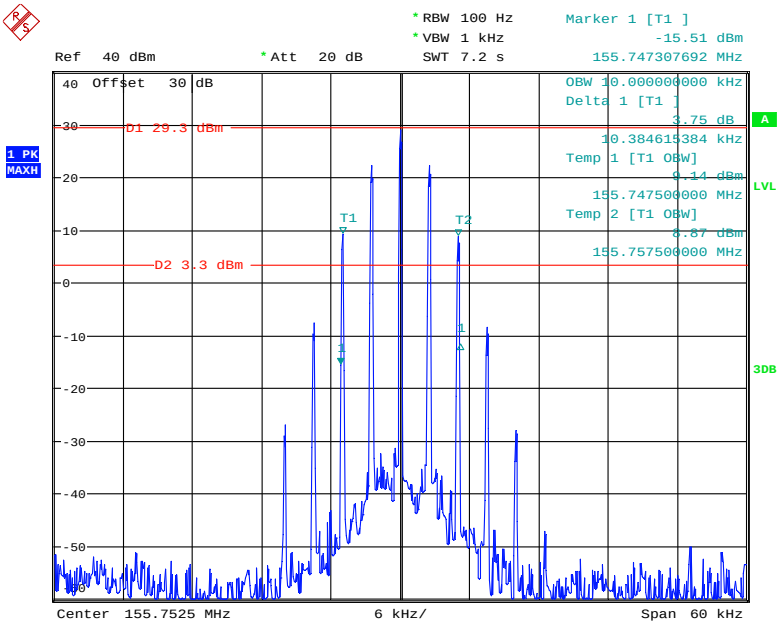
**Analog Modulation:**

**Frequency 155.7525 MHz: 99% Occupied & 26 dB Bandwidth, High Power**



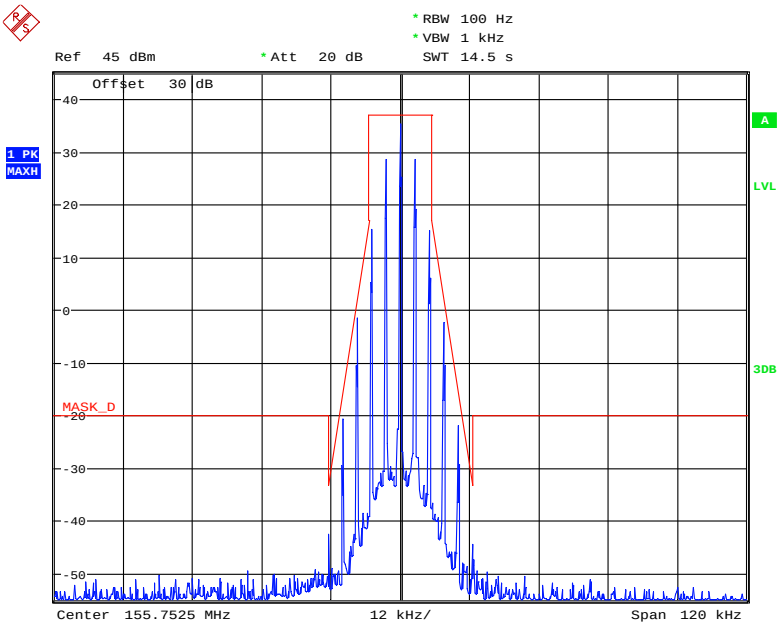

Date: 28.MAR.2018 22:10:12

**Frequency 155.7525 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**



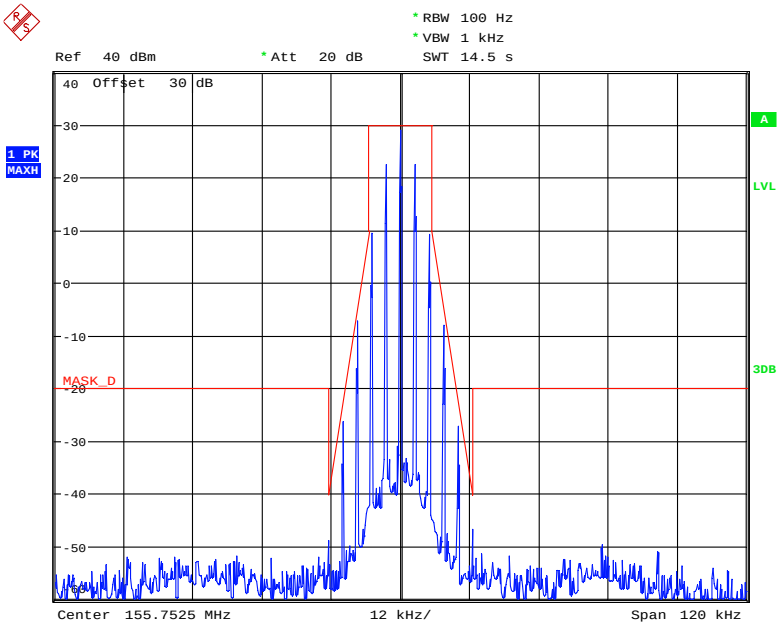

Date: 28.MAR.2018 22:07:51

## Frequency 155.7525 MHz: Emission Mask, High Power




Date: 28.MAR.2018 22:56:51

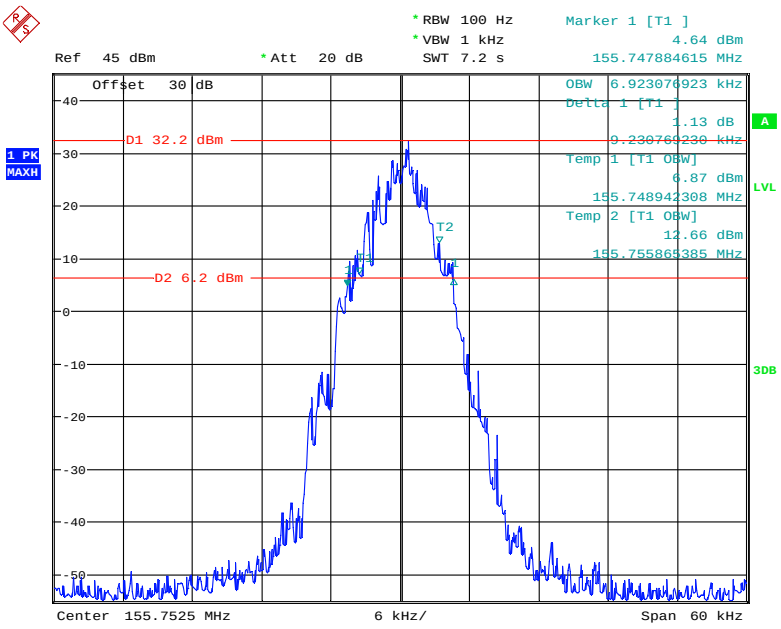
## Frequency 155.7525 MHz: Emission Mask, Low Power




Date: 28.MAR.2018 22:58:24

**Digital Modulation:**

**Frequency 155.7525 MHz: 99% Occupied & 26 dB Bandwidth, High Power**

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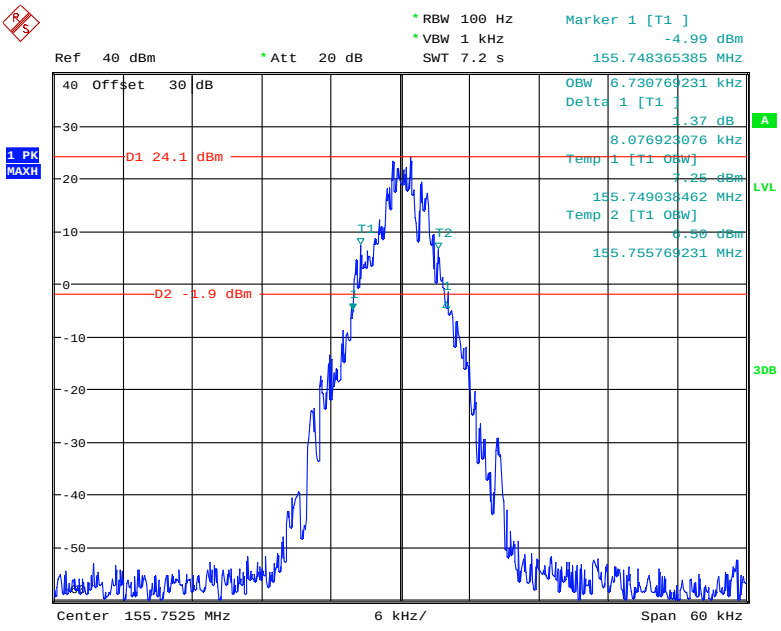
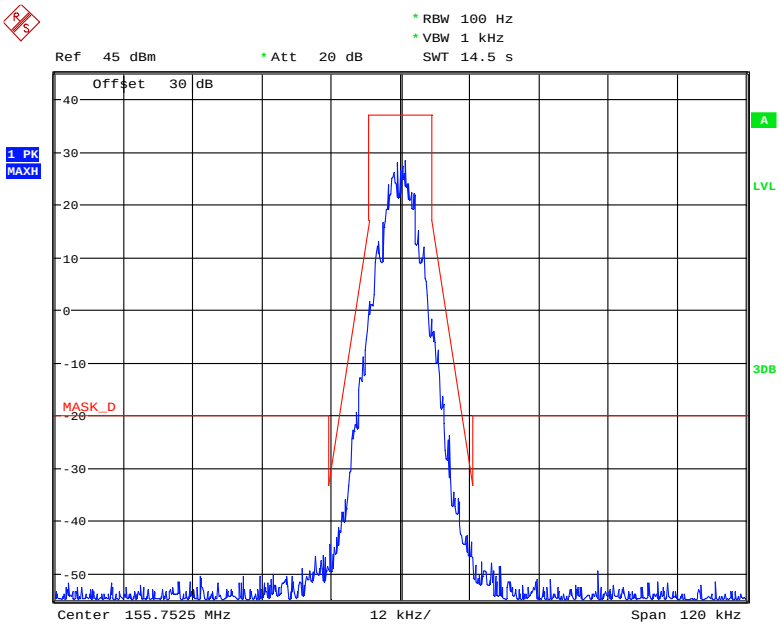
**Frequency 155.7525 MHz: 99% Occupied & 26 dB Bandwidth, Low Power**



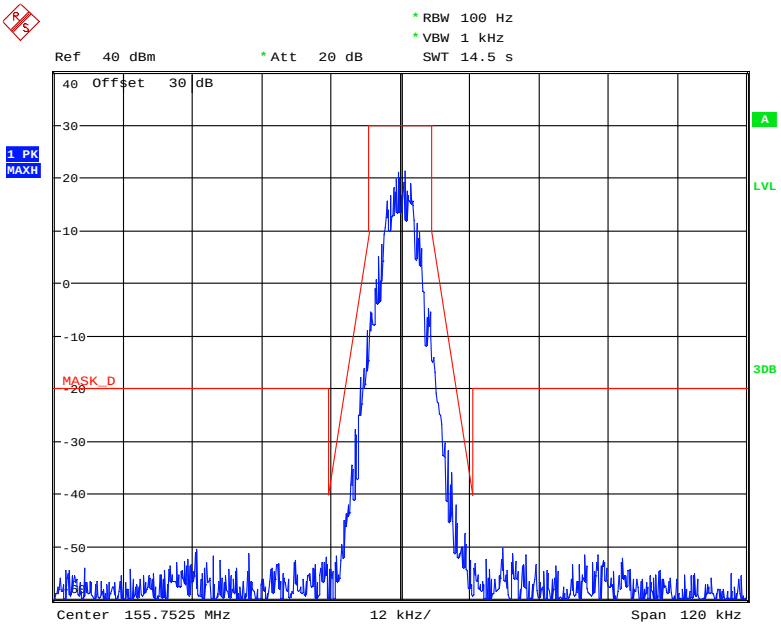

Date: 28.MAR.2018 22:13:44

## Frequency 155.7525 MHz: Emission Mask, High Power




Date: 28.MAR.2018 22:55:50

## Frequency 155.7525 MHz: Emission Mask, Low Power




Date: 28.MAR.2018 22:59:15

# FCC §2.1051 & §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

## Applicable Standard

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

1) For any frequency removed from the center of the authorized bandwidth $f_0$ to 5.625 kHz removed from $f_0$, 0 dB.

2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 5.626 kHz but no more than 12.5 kHz, at least 7.27 ($f_d$ –2.88 kHz) dB.

3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

## 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$^{th}$ harmonic.

## Test Data

### Environmental Conditions

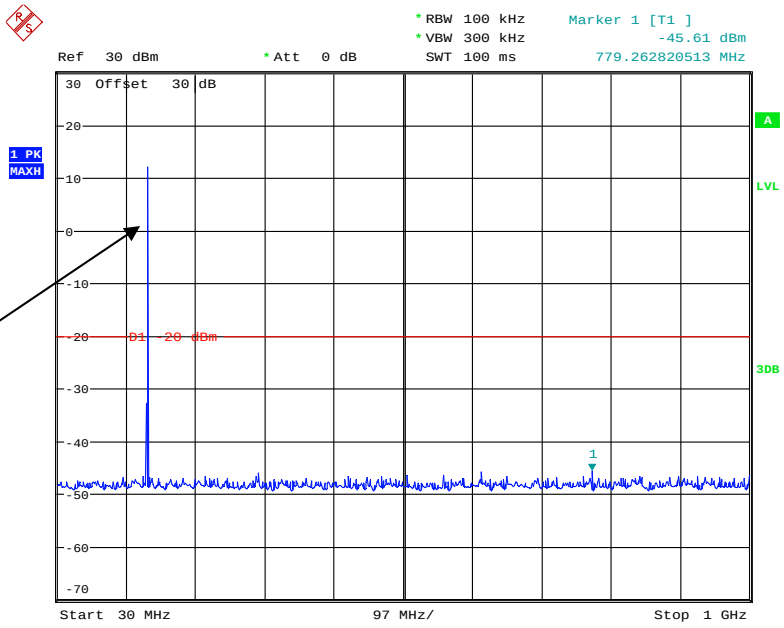
| | |
|---|---|
| **Temperature:** | 25 ℃ |
| **Relative Humidity:** | 50 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nancy Wang on 2018-03-25*

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

**Analog Modulation:**

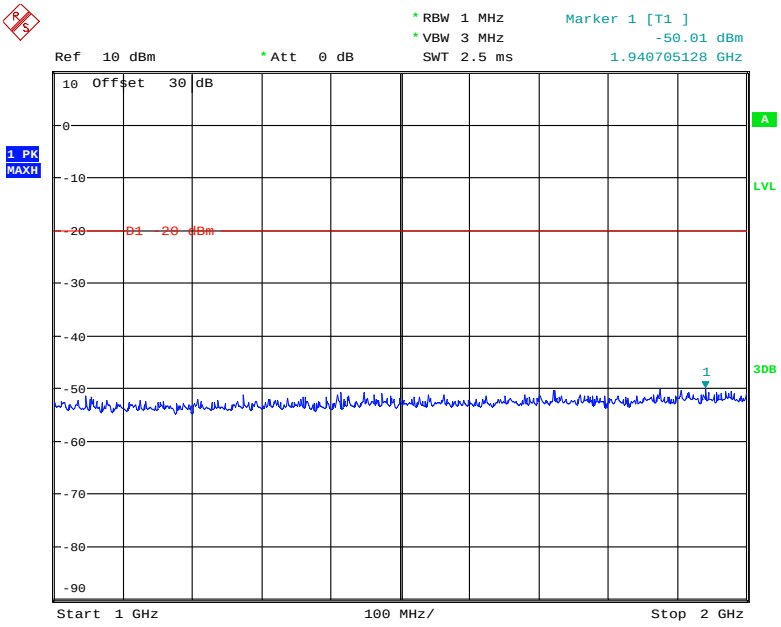
**30MHz – 1 GHz, Spacing Channel 12.5 kHz**




Fund.test with notch filter

Date: 25.MAR.2018 16:12:13

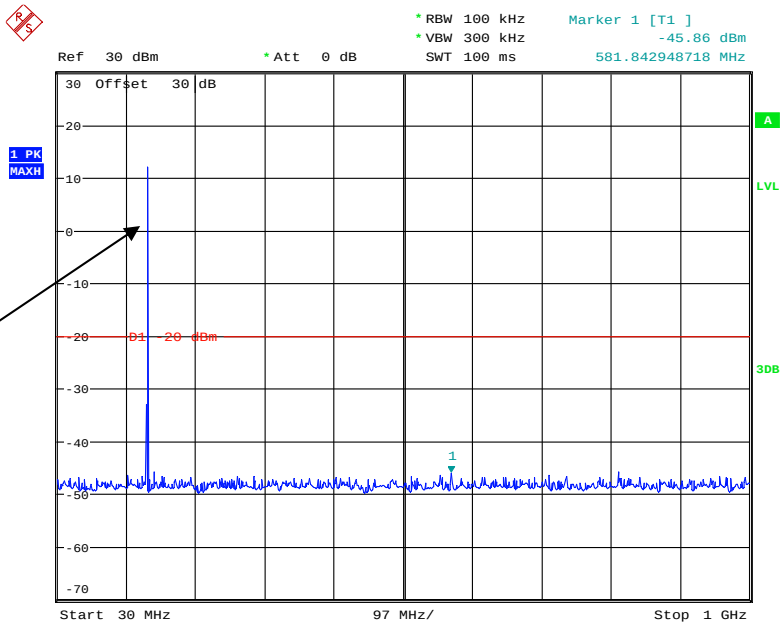
**1 GHz – 2 GHz, Spacing Channel 12.5 kHz**




Date: 25.MAR.2018 16:13:53

**Digital Modulation:**

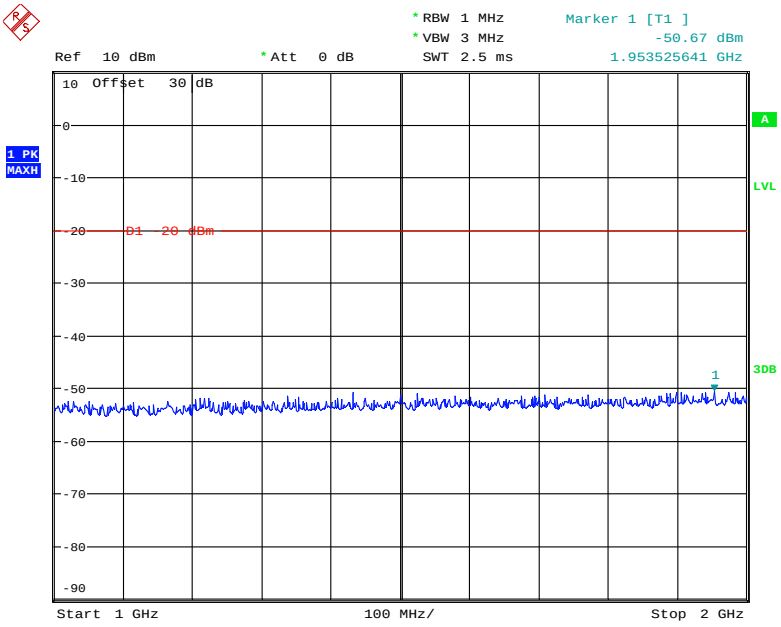
**30MHz – 1 GHz, Spacing Channel 12.5 kHz**




Fund.test with notch filter

Date: 25.MAR.2018 16:11:35

**1 GHz – 2 GHz, Spacing Channel 12.5 kHz**




Date: 25.MAR.2018 16:14:53

# FCC §2.1053 & §90.210 - RADIATED SPURIOUS EMISSIONS

## Applicable Standard

FCC §2.1053 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 1g (TXpwr in Watts/0.001)-the absolute level

Spurious attenuation limit in dB =50+10 $Log_{10}$ (power out in Watts) for EUT with a 12.5 kHz channel bandwidth.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23~25 ℃ |
| **Relative Humidity:** | 49~50 % |
| **ATM Pressure:** | 100.0~101.0 kPa |

*The testing was performed by Nancy Wang from 2018-03-31 to 2018-05-25.*

*Test Mode: Transmitting(High power level)*

**30MHz - 2GHz:**
For model: RDR4380V

| Frequency (MHz) | Receiver Reading (dBμV) | Turn Table Angle Degree | Rx Antenna | | Substituted | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/V) | Level (dBm) | Cable Loss (dB) | Antenna Gain (dB) | | | |
| Analog Modulation 155.7525MHz | | | | | | | | | | |
| 311.505 | 59.01 | 219 | 1.2 | H | -44.0 | 0.36 | 0.0 | -44.36 | -20 | 24.36 |
| 311.505 | 64.08 | 297 | 1.5 | V | -38.9 | 0.36 | 0.0 | -39.26 | -20 | 19.26 |
| 467.2575 | 53.95 | 159 | 1.9 | H | -49.8 | 0.48 | 0.0 | -50.28 | -20 | 30.28 |
| 467.2575 | 53.72 | 79 | 1.3 | V | -46.1 | 0.48 | 0.0 | -46.58 | -20 | 26.58 |
| 623.01 | 46.46 | 347 | 2.4 | H | -52.4 | 0.58 | 0.0 | -52.98 | -20 | 32.98 |
| 623.01 | 55.33 | 277 | 2.3 | V | -41.7 | 0.58 | 0.0 | -42.28 | -20 | 22.28 |
| 778.7625 | 60.12 | 52 | 2.4 | H | -40.3 | 0.63 | 0.0 | -40.93 | -20 | 20.93 |
| 778.7625 | 62.23 | 209 | 1.0 | V | -34.3 | 0.63 | 0.0 | -34.93 | -20 | 14.93 |
| 934.515 | 57.41 | 255 | 1.6 | H | -37.3 | 0.73 | 0.0 | -38.03 | -20 | 18.03 |
| 934.515 | 59.58 | 276 | 1.9 | V | -34.4 | 0.73 | 0.0 | -35.13 | -20 | 15.13 |
| 1090.27 | 50.64 | 271 | 1.1 | H | -57.9 | 1.60 | 6.20 | -53.30 | -20 | 33.30 |
| 1090.27 | 57.05 | 356 | 1.4 | V | -52.3 | 1.60 | 6.20 | -47.70 | -20 | 27.70 |
| 1246.02 | 51.28 | 163 | 1.7 | H | -56.7 | 1.50 | 6.80 | -51.40 | -20 | 31.40 |
| 1246.02 | 58.79 | 190 | 1.8 | V | -48.9 | 1.50 | 6.80 | -43.60 | -20 | 23.60 |
| 1401.77 | 43.25 | 179 | 1.0 | H | -64.7 | 1.60 | 7.90 | -58.40 | -20 | 38.40 |
| 1401.77 | 44.25 | 269 | 1.2 | V | -64.0 | 1.60 | 7.90 | -57.70 | -20 | 37.70 |
| Digital Modulation 155.7525MHz | | | | | | | | | | |
| 311.505 | 53.82 | 336 | 1.7 | H | -49.2 | 0.36 | 0.0 | -49.56 | -20 | 29.56 |
| 311.505 | 63.83 | 46 | 2.3 | V | -39.2 | 0.36 | 0.0 | -39.56 | -20 | 19.56 |
| 467.2575 | 46.27 | 49 | 2.2 | H | -57.5 | 0.48 | 0.0 | -57.98 | -20 | 37.98 |
| 467.2575 | 46.19 | 32 | 1.0 | V | -53.6 | 0.48 | 0.0 | -54.08 | -20 | 34.08 |
| 623.01 | 44.34 | 101 | 1.6 | H | -54.5 | 0.58 | 0.0 | -55.08 | -20 | 35.08 |
| 623.01 | 54.99 | 292 | 1.3 | V | -42.0 | 0.58 | 0.0 | -42.58 | -20 | 22.58 |
| 778.7625 | 64.96 | 164 | 1.2 | H | -35.5 | 0.63 | 0.0 | -36.13 | -20 | 16.13 |
| 778.7625 | 60.67 | 227 | 2.3 | V | -35.9 | 0.63 | 0.0 | -36.53 | -20 | 16.53 |
| 934.515 | 56.62 | 96 | 2.1 | H | -38.1 | 0.73 | 0.0 | -38.83 | -20 | 18.83 |
| 934.515 | 55.58 | 11 | 2.1 | V | -38.4 | 0.73 | 0.0 | -39.13 | -20 | 19.13 |
| 1090.27 | 51.51 | 189 | 1.9 | H | -57.0 | 1.60 | 6.20 | -52.40 | -20 | 32.40 |
| 1090.27 | 58.33 | 291 | 1.8 | V | -51.1 | 1.60 | 6.20 | -46.50 | -20 | 26.50 |
| 1246.02 | 53.34 | 66 | 2.4 | H | -54.6 | 1.50 | 6.80 | -49.30 | -20 | 29.30 |
| 1246.02 | 58.97 | 173 | 2.5 | V | -48.7 | 1.50 | 6.80 | -43.40 | -20 | 23.40 |
| 1401.77 | 42.58 | 225 | 1.1 | H | -65.4 | 1.60 | 7.90 | -59.10 | -20 | 39.10 |
| 1401.77 | 43.82 | 300 | 1.2 | V | -64.4 | 1.60 | 7.90 | -58.10 | -20 | 38.10 |

For model: RDR4320V

| Frequency (MHz) | Receiver Reading (dBμV) | Turn Table Angle Degree | Rx Antenna | | Substituted | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/V) | Level (dBm) | Cable Loss (dB) | Antenna Gain (dB) | | | |
| Analog Modulation 155.7525MHz | | | | | | | | | | |
| 311.505 | 57.31 | 309 | 1.7 | H | -45.7 | 0.71 | 0.0 | -46.41 | -20 | 26.41 |
| 311.505 | 62.19 | 265 | 1.5 | V | -40.8 | 0.71 | 0.0 | -41.51 | -20 | 21.51 |
| 467.2575 | 51.24 | 230 | 1.8 | H | -52.5 | 0.48 | 0.0 | -52.98 | -20 | 32.98 |
| 467.2575 | 51.53 | 124 | 2.4 | V | -48.3 | 0.48 | 0.0 | -48.78 | -20 | 28.78 |
| 623.01 | 45.37 | 82 | 1.2 | H | -53.5 | 0.58 | 0.0 | -54.08 | -20 | 34.08 |
| 623.01 | 43.41 | 183 | 2.4 | V | -53.6 | 0.58 | 0.0 | -54.18 | -20 | 34.18 |
| 778.7625 | 58.29 | 306 | 1.9 | H | -42.2 | 0.63 | 0.0 | -42.83 | -20 | 22.83 |
| 778.7625 | 60.34 | 43 | 1.7 | V | -36.2 | 0.63 | 0.0 | -36.83 | -20 | 16.83 |
| 934.515 | 55.67 | 150 | 2.1 | H | -39.0 | 0.73 | 0.0 | -39.73 | -20 | 19.73 |
| 934.515 | 57.24 | 276 | 1.2 | V | -36.7 | 0.73 | 0.0 | -37.43 | -20 | 17.43 |
| 1090.27 | 48.69 | 225 | 1.7 | H | -59.9 | 1.60 | 6.20 | -55.30 | -20 | 35.30 |
| 1090.27 | 45.38 | 333 | 1.0 | V | -64.0 | 1.60 | 6.20 | -59.40 | -20 | 39.40 |
| 1246.02 | 49.62 | 275 | 1.5 | H | -58.4 | 1.50 | 6.80 | -53.10 | -20 | 33.10 |
| 1246.02 | 56.28 | 49 | 1.7 | V | -51.4 | 1.50 | 6.80 | -46.10 | -20 | 26.10 |
| 1401.77 | 43.22 | 357 | 2.4 | H | -64.7 | 1.60 | 7.90 | -58.40 | -20 | 38.40 |
| 1401.77 | 43.87 | 37 | 2.5 | V | -64.3 | 1.60 | 7.90 | -58.00 | -20 | 38.00 |
| Digital Modulation 155.7525MHz | | | | | | | | | | |
| 311.505 | 51.82 | 247 | 2.3 | H | -51.2 | 0.71 | 0.0 | -51.91 | -20 | 31.91 |
| 311.505 | 61.37 | 226 | 1.9 | V | -41.6 | 0.71 | 0.0 | -42.31 | -20 | 22.31 |
| 467.2575 | 45.36 | 1 | 2.0 | H | -58.4 | 0.48 | 0.0 | -58.88 | -20 | 38.88 |
| 467.2575 | 45.1 | 193 | 1.2 | V | -54.7 | 0.48 | 0.0 | -55.18 | -20 | 35.18 |
| 623.01 | 44.22 | 359 | 2.2 | H | -54.7 | 0.58 | 0.0 | -55.28 | -20 | 35.28 |
| 623.01 | 52.31 | 193 | 1.6 | V | -44.7 | 0.58 | 0.0 | -45.28 | -20 | 25.28 |
| 778.7625 | 62.37 | 276 | 1.4 | H | -38.1 | 0.63 | 0.0 | -38.73 | -20 | 18.73 |
| 778.7625 | 58.19 | 225 | 1.4 | V | -38.3 | 0.63 | 0.0 | -38.93 | -20 | 18.93 |
| 934.515 | 54.41 | 147 | 2.1 | H | -40.3 | 0.73 | 0.0 | -41.03 | -20 | 21.03 |
| 934.515 | 53.77 | 127 | 1.1 | V | -40.2 | 0.73 | 0.0 | -40.93 | -20 | 20.93 |
| 1090.27 | 49.43 | 25 | 1.1 | H | -59.1 | 1.60 | 6.20 | -54.50 | -20 | 34.50 |
| 1090.27 | 56.28 | 335 | 2.0 | V | -53.1 | 1.60 | 6.20 | -48.50 | -20 | 28.50 |
| 1246.02 | 51.88 | 289 | 1.3 | H | -56.1 | 1.50 | 6.80 | -50.80 | -20 | 30.80 |
| 1246.02 | 56.91 | 220 | 1.4 | V | -50.8 | 1.50 | 6.80 | -45.50 | -20 | 25.50 |
| 1401.77 | 43.11 | 39 | 2.2 | H | -64.8 | 1.60 | 7.90 | -58.50 | -20 | 38.50 |
| 1401.77 | 43.84 | 133 | 2.4 | V | -64.4 | 1.60 | 7.90 | -58.10 | -20 | 38.10 |

For model: RDR4350V

| Frequency (MHz) | Receiver Reading (dBμV) | Turn Table Angle Degree | Rx Antenna | | Substituted | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/V) | Level (dBm) | Cable Loss (dB) | Antenna Gain (dB) | | | |
| Analog Modulation 155.7525MHz | | | | | | | | | | |
| 311.505 | 58.23 | 106 | 1.4 | H | -44.8 | 0.71 | 0.0 | -45.51 | -20 | 25.51 |
| 311.505 | 63.43 | 54 | 1.7 | V | -39.6 | 0.71 | 0.0 | -40.31 | -20 | 20.31 |
| 467.2575 | 52.84 | 25 | 2.2 | H | -50.9 | 0.48 | 0.0 | -51.38 | -20 | 31.38 |
| 467.2575 | 52.53 | 178 | 1.7 | V | -47.3 | 0.48 | 0.0 | -47.78 | -20 | 27.78 |
| 623.01 | 45.88 | 136 | 1.2 | H | -53.0 | 0.58 | 0.0 | -53.58 | -20 | 33.58 |
| 623.01 | 54.29 | 174 | 2.0 | V | -42.7 | 0.58 | 0.0 | -43.28 | -20 | 23.28 |
| 778.7625 | 59.88 | 289 | 2.3 | H | -40.6 | 0.63 | 0.0 | -41.23 | -20 | 21.23 |
| 778.7625 | 61.29 | 52 | 1.5 | V | -35.2 | 0.63 | 0.0 | -35.83 | -20 | 15.83 |
| 934.515 | 56.87 | 140 | 2.3 | H | -37.8 | 0.73 | 0.0 | -38.53 | -20 | 18.53 |
| 934.515 | 59.24 | 35 | 2.2 | V | -34.7 | 0.73 | 0.0 | -35.43 | -20 | 15.43 |
| 1090.27 | 50.02 | 75 | 2.1 | H | -58.5 | 1.60 | 6.20 | -53.90 | -20 | 33.90 |
| 1090.27 | 56.34 | 81 | 2.4 | V | -53.1 | 1.60 | 6.20 | -48.50 | -20 | 28.50 |
| 1246.02 | 50.13 | 91 | 2.3 | H | -57.8 | 1.50 | 6.80 | -52.50 | -20 | 32.50 |
| 1246.02 | 57.51 | 286 | 2.2 | V | -50.2 | 1.50 | 6.80 | -44.90 | -20 | 24.90 |
| 1401.77 | 43.33 | 44 | 1.0 | H | -64.6 | 1.60 | 7.90 | -58.30 | -20 | 38.30 |
| 1401.77 | 43.87 | 92 | 2.3 | V | -64.3 | 1.60 | 7.90 | -58.00 | -20 | 38.00 |

| Frequency (MHz) | Receiver Reading (dBμV) | Turn Table Angle Degree | Rx Antenna | | Substituted | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Height (m) | Polar (H/V) | Level (dBm) | Cable Loss (dB) | Antenna Gain (dB) | | | |
| Digital Modulation 155.7525MHz | | | | | | | | | | |
| 311.505 | 53.17 | 89 | 2.1 | H | -49.8 | 0.71 | 0.0 | -50.51 | -20 | 30.51 |
| 311.505 | 63.22 | 175 | 1.2 | V | -39.8 | 0.71 | 0.0 | -40.51 | -20 | 20.51 |
| 467.2575 | 45.82 | 8 | 2.0 | H | -57.9 | 0.48 | 0.0 | -58.38 | -20 | 38.38 |
| 467.2575 | 45.61 | 77 | 2.2 | V | -54.2 | 0.48 | 0.0 | -54.68 | -20 | 34.68 |
| 623.01 | 44.93 | 33 | 2.0 | H | -54.0 | 0.58 | 0.0 | -54.58 | -20 | 34.58 |
| 623.01 | 53.81 | 214 | 2.3 | V | -43.2 | 0.58 | 0.0 | -43.78 | -20 | 23.78 |
| 778.7625 | 63.87 | 177 | 2.1 | H | -36.6 | 0.63 | 0.0 | -37.23 | -20 | 17.23 |
| 778.7625 | 59.34 | 329 | 2.3 | V | -37.2 | 0.63 | 0.0 | -37.83 | -20 | 17.83 |
| 934.515 | 55.72 | 172 | 2.3 | H | -39.0 | 0.73 | 0.0 | -39.73 | -20 | 19.73 |
| 934.515 | 54.83 | 216 | 1.7 | V | -39.1 | 0.73 | 0.0 | -39.83 | -20 | 19.83 |
| 1090.27 | 50.87 | 39 | 2.3 | H | -57.7 | 1.60 | 6.20 | -53.10 | -20 | 33.10 |
| 1090.27 | 57.62 | 64 | 1.8 | V | -51.8 | 1.60 | 6.20 | -47.20 | -20 | 27.20 |
| 1246.02 | 52.39 | 162 | 1.3 | H | -55.6 | 1.50 | 6.80 | -50.30 | -20 | 30.30 |
| 1246.02 | 57.84 | 285 | 2.3 | V | -49.8 | 1.50 | 6.80 | -44.50 | -20 | 24.50 |
| 1401.77 | 42.31 | 307 | 1.9 | H | -65.6 | 1.60 | 7.90 | -59.30 | -20 | 39.30 |
| 1401.77 | 42.94 | 215 | 1.3 | V | -65.3 | 1.60 | 7.90 | -59.00 | -20 | 39.00 |

**Note:**
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

# FCC §2.1055 & §90.213 - FREQUENCY STABILITY

## Applicable Standard

FCC §2.1055 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

| | |
|---|---|
| **Temperature:** | 25 ℃ |
| **Relative Humidity:** | 50 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nancy Wang on 2018-03-29.*

*Test Mode: Transmitting*

| Reference Frequency: 155.7525MHz, Limit: ±5.0 ppm, Analog 12.5 kHz | | | |
|---|---|---|---|
| Test Environment | | Frequency Measure with Time Elapsed | |
| Temperature (℃) | Power Supplied ($V_{DC}$) | Measured Frequency error (MHz) | Frequency Error (ppm) |
| Frequency Stability versus Input Temperature | | | |
| 50 | 7.40 | 155.75250 | 0.0000 |
| 40 | 7.40 | 155.75250 | 0.0000 |
| 30 | 7.40 | 155.75253 | 0.1926 |
| 20 | 7.40 | 155.75247 | -0.1926 |
| 10 | 7.40 | 155.75245 | -0.3210 |
| 0 | 7.40 | 155.75247 | -0.1926 |
| -10 | 7.40 | 155.75251 | 0.0642 |
| -20 | 7.40 | 155.75251 | 0.0642 |
| -30 | 7.40 | 155.75249 | -0.0642 |
| Frequency Stability versus Input Voltage | | | |
| 20 | 6.30 | 155.75251 | 0.0642 |

| Reference Frequency: 155.7525MHz, Limit: ±5.0 ppm, Digital 12.5 kHz | | | |
|---|---|---|---|
| Test Environment | | Frequency Measure with Time Elapsed | |
| Temperature (℃) | Power Supplied ($V_{DC}$) | Measured Frequency error (MHz) | Frequency Error (ppm) |
| Frequency Stability versus Input Temperature | | | |
| 50 | 7.40 | 155.75250 | 0.0000 |
| 40 | 7.40 | 155.75253 | 0.1926 |
| 30 | 7.40 | 155.75252 | 0.1284 |
| 20 | 7.40 | 155.75247 | -0.1926 |
| 10 | 7.40 | 155.75245 | -0.3210 |
| 0 | 7.40 | 155.75246 | -0.2568 |
| -10 | 7.40 | 155.75253 | 0.1926 |
| -20 | 7.40 | 155.75248 | -0.1284 |
| -30 | 7.40 | 155.75253 | 0.1926 |
| Frequency Stability versus Input Voltage | | | |
| 20 | 6.30 | 155.75247 | -0.1926 |

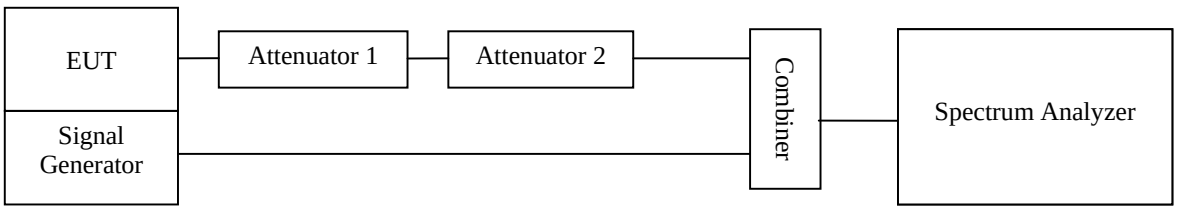
# FCC §90.214 - TRANSIENT FREQUENCY BEHAVIOR

## Applicable Standard

Regulations: FCC §90.214
Test method: TIA-603-D 2010, section 2.2.19.3

## Test Procedure

a) Connect the EUT and test equipment as shown on the following block diagram.
b) Set the Spectrum Analyzer to measure FM deviation, and tune the RF frequency to the transmitter assigned frequency.
c) Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at ±12.5 kHz deviation and set its output level to -100dBm.
d) Turn on the transmitter.
e) 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 $P_0$.
f) Turn off the transmitter.
g) 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.
h) Remove the attenuation 1, so the input power to the Spectrum Analyzer is increased by 30 dB when the transmitter is turned on.
i) Adjust the vertical amplitude control of the spectrum analyzer to display the 1000 Hz at ±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 “tiger offset” to -10ms for turn on and -15ms for turn off.
j) 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 $t_2$.
k) 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

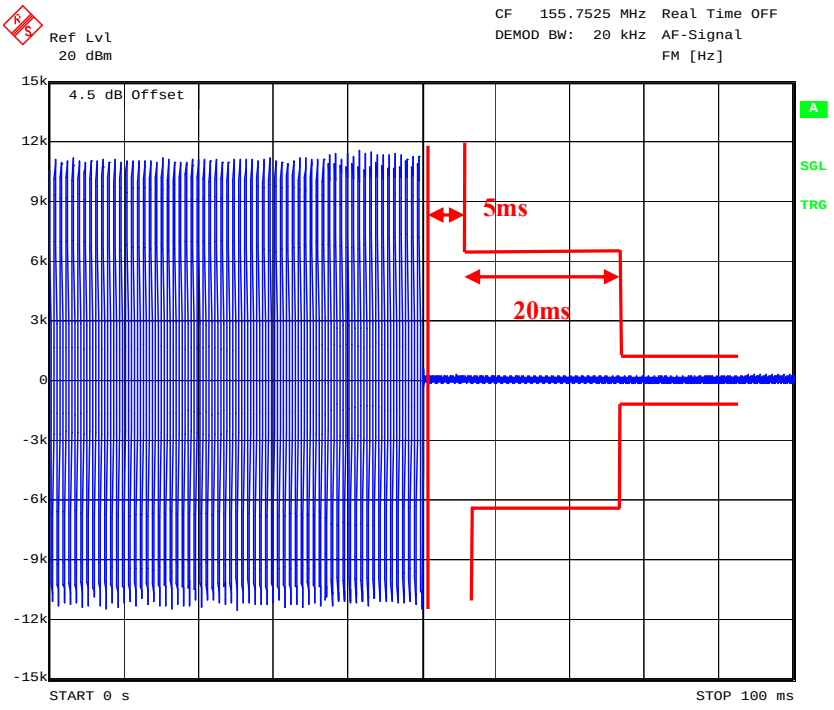
| | |
|---|---|
| **Temperature:** | 25 ℃ |
| **Relative Humidity:** | 50 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Nancy Wang on 2018-03-29.*

| Channel Separation (kHz) | Transient Period (ms) | Transient Frequency | Result |
|---|---|---|---|
| 12.5 | 5 (t1) | <+/-12.5 kHz | Pass |
| | 20(t2) | <+/-6.25 kHz | |
| | 5 (t3) | <+/-12.5 kHz | |

Please refer to the following plots.

**Turn on**

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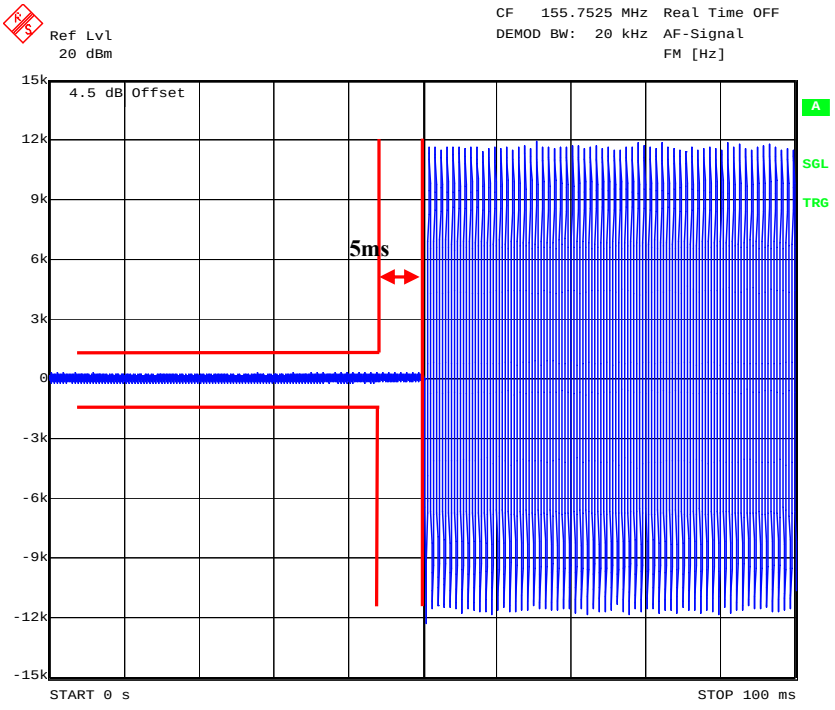
**Turn off**

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