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Dates of Tests: Jan 3 ~ Feb 4, 2016

Test Report S/N: LR500111702A

Test Site : LTA CO., LTD.

RF TEST REPORT

FCC ID

APPLICANT

VSOXP-400D**YEONHWA M TECH CO.,LTD**

| | | |
|---------------------------|---|-----------------------------------|
| Device Category | : | Private Land Mobile Radio Service |
| Manufacturing Description | : | UHF Transceiver |
| Manufacturer | : | YEONHWA M TECH CO.,LTD |
| Trade name | : | X Radio |
| Model name | : | XP-400D |
| Variant Model | : | XP-450D, XR-400D |
| Serial number | : | Identical prototype |
| FCC Rule Part(s) | : | §90 |
| Frequency Range | : | 410 ~ 470 MHz |
| RF Output Power | : | 4.8 W |
| Channel Separation | : | 12.5 kHz |
| Emission Designators: | : | 11K0F3E, 7K90FXD, 7K90FXE |
| Data of issue | : | Feb 4, 2017 |

This test report is issued under the authority of:

The test was supervised by:

Yong-Cheol Wang, Manager

Hee-Cheon Kwon, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. This report must not be used by the applicant to claim product endorsement by NVLAP or any agency of the U.S. Government.

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1. General information

1-1 Test Performed

Company name : LTA Co., Ltd.
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 Web site : <http://www.ltalab.com>
 E-mail : chahn@ltalab.com
 Telephone : +82-31-323-6008
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competent of calibration and testing laboratory”.

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

| Agency | Country | Accreditation No. | Validity | Reference |
|--------|---------|-------------------|------------|-----------------------|
| NVLAP | U.S.A | 200723-0 | 2017-09-30 | ECT accredited Lab. |
| RRL | KOREA | KR0049 | - | EMC accredited Lab. |
| FCC | U.S.A | 610755 | 2017-04-21 | FCC filing |
| FCC | U.S.A | 649054 | 2017-04-13 | FCC CAB |
| VCCI | JAPAN | R2133(10m), C2307 | 2017-06-21 | VCCI registration |
| VCCI | JAPAN | T-2009 | 2017-12-23 | VCCI registration |
| VCCI | JAPAN | G-563 | 2018-12-13 | VCCI registration |
| IC | CANADA | 5799A-1 | 2019-11-07 | IC filing |
| KOLAS | KOREA | NO.551 | 2017-01-08 | KOLAS accredited Lab. |

2. Information about test item

2-1 Client & Manufacturer

Company name : YEONHWA M TECH CO.,LTD
 Address : 36, Jeonpa-ro 44beon-gil Manan-gu, Anyang-si, Gyeonggi-do, Korea
 TEL / FAX : +82-31-444-7270 / +82-31-444-7271

2-2 Equipment Under Test (EUT)

Trade name : X Radio
 Model name : XP-400D
 Variant Model : XP-450D, XR-400D
 Date of receipt : Jan 3, 2016
 EUT condition : Identical prototype
 Frequency Range : 410 ~ 470 MHz
 RF output power : 4.8 W
 Channel Separation : 12.5 kHz
 Power Source : DC 7.5 V by battery (Li-ion)
 Firmware version : V1.0

2-3 Tested frequency

| | LOW | MID | HIGH |
|-----------------|----------|----------|----------|
| Frequency (MHz) | 410.0125 | 440.0125 | 469.7000 |

The time division multiple access (TDMA) mode of operation provides two voice paths in a 12.5 kHz channel bandwidth and a data rate of 9600 bits per second in a channel bandwidth of 12.5 kHz. This is equivalent to one voice path per 6.25 kHz of channel bandwidth and 4800 bits per second or greater in a 6.25 kHz channel bandwidth. The SLR 5700 conforms to the spectrum efficiency requirements of FCC rule § 90.203 (j) (5).

3. Test Report

3.1 Summary of tests

| FCC Rules | Description of Test | Results |
|---------------------------|---------------------------------------|---------|
| §1.1307(b); §2.1093 | RF Exposure | C |
| §2.1046; §90.205 | RF Output Power | C |
| §2.1047; §90.207 | Modulation Characteristic | C |
| §2.1049; §90.209; §90.210 | Occupied Bandwidth & Emission Mask | C |
| §2.1051; §90.210 | Spurious Emission at Antenna Terminal | C |
| §2.1053; §90.210 | Spurious Radiated Emissions | C |
| §2.1055; §90.213 | Frequency Stability | C |
| §90.214 | Transient Frequency Behavior | C |

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification :

- FCC Part2, Part 90
- ANCI C 63.4-2014
- TIA/EIA-603-D

3.2 TEST RESULTS

3.2.1 RF EXPOSURE

Applicable Standard :

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

Result : Complies

Please refer to SAR Report Number : LR500111702B

3.2.2 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.

The spectrum analyzer is setting:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Sweep = auto

VBW = 300 kHz

Detector function = peak

Trace = max hold

Test Result : Compliance.

Measurement Data: Transmitting

| Modulation | Channel Separation (kHz) | Frequency (MHz) | Power Level | Output Power (dBm) | Output Power (w) | Result |
|------------|--------------------------|-----------------|-------------|--------------------|------------------|--------|
| Analog | 12.5 | 410.0125 | 4.8 W | 36.16 | 4.13 | Pass |
| | 12.5 | 440.0125 | 4.8 W | 36.16 | 4.13 | Pass |
| | 12.5 | 469.7000 | 4.8 W | 35.47 | 3.52 | Pass |
| Digital | 12.5 | 410.0125 | 4.8 W | 36.11 | 4.08 | Pass |
| | 12.5 | 440.0125 | 4.8 W | 36.12 | 4.09 | Pass |
| | 12.5 | 469.7000 | 4.8 W | 35.41 | 3.48 | Pass |

Note : The rated Power is 3 W. The limit of the high output power is 3.0 W ~ 4.8 W

3.2.3 MODULATION CHARACTERISTIC

Applicable Standard : FCC§2.1047and §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

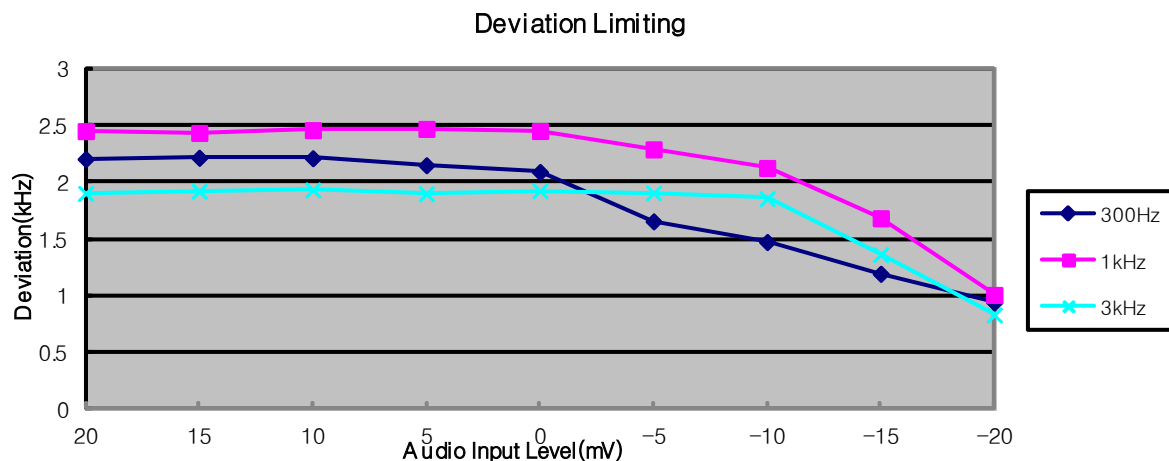
Test Method : TIA -603-D 2.2.3

Test Result : Compliance.

Measurement Data: Analog Modulation

(Carrier Frequency : 440.0125 MHz, Channel Separation : 12.5 kHz)

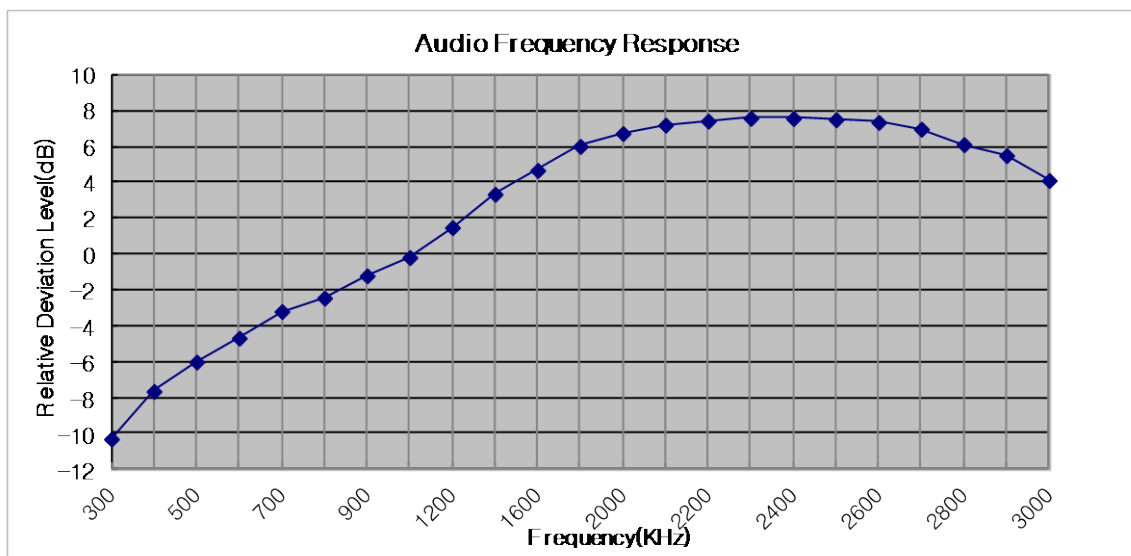
| Audio Input Level [dB] | Frequency Deviation (kHz) | | | Limit [kHz] |
|------------------------|---------------------------|---------|---------|-------------|
| | @ 300 Hz | @ 1 kHz | @ 3 kHz | |
| 20.0 | 2.203 | 2.448 | 1.901 | 2.5 |
| 15.0 | 2.214 | 2.432 | 1.920 | 2.5 |
| 10.0 | 2.210 | 2.457 | 1.932 | 2.5 |
| 5.0 | 2.148 | 2.468 | 1.898 | 2.5 |
| 0.0 | 2.089 | 2.449 | 1.924 | 2.5 |
| -5.0 | 1.655 | 2.288 | 1.905 | 2.5 |
| -10.0 | 1.473 | 2.124 | 1.854 | 2.5 |
| -15.0 | 1.194 | 1.682 | 1.362 | 2.5 |
| -20.0 | 0.942 | 1.009 | 0.832 | 2.5 |



Measurement Data: Audio Frequency Response

(Carrier Frequency : 440.0125 MHz, Channel Separation : 12.5 kHz)

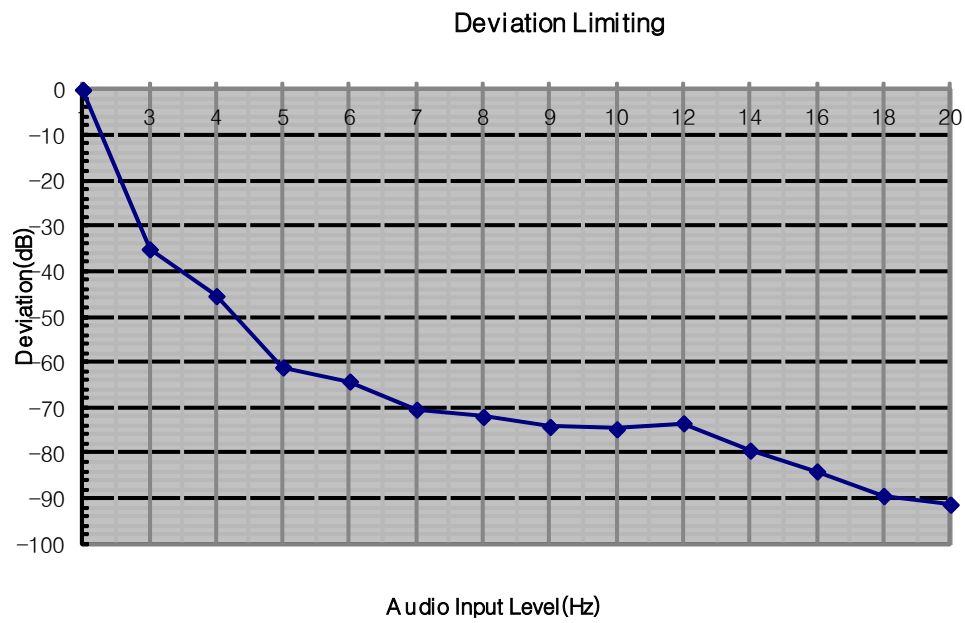
| Audio Frequency (Hz) | Response Attenuation (dB) |
|----------------------|---------------------------|
| 300 | -10.31 |
| 400 | -7.65 |
| 500 | -6.01 |
| 600 | -4.68 |
| 700 | -3.19 |
| 800 | -2.44 |
| 900 | -1.20 |
| 1000 | -0.18 |
| 1200 | 1.49 |
| 1400 | 3.35 |
| 1600 | 4.68 |
| 1800 | 6.02 |
| 2000 | 6.74 |
| 2100 | 7.21 |
| 2200 | 7.43 |
| 2300 | 7.59 |
| 2400 | 7.58 |
| 2500 | 7.51 |
| 2600 | 7.36 |
| 2700 | 6.98 |
| 2800 | 6.12 |
| 2900 | 5.51 |
| 3000 | 4.12 |



Measurement Data: Audio Frequency low pass filter response

(Carrier Frequency : 440.0125 MHz, Channel Separation : 12.5 kHz)

| Audio Frequency (kHz) | Response Attenuation (dB) | Limit (dB) |
|--------------------------|------------------------------|---------------|
| 1.0 | 0.0 | / |
| 3.0 | -35.1 | 0.0 |
| 4.0 | -45.4 | -12.5 |
| 5.0 | -61.1 | -22.2 |
| 6.0 | -64.2 | -30.1 |
| 7.0 | -70.4 | -36.8 |
| 8.0 | -72.0 | -42.6 |
| 9.0 | -74.2 | -47.7 |
| 10.0 | -74.7 | -52.3 |
| 12.0 | -73.4 | -60.2 |
| 14.0 | -79.4 | -66.9 |
| 16.0 | -84.0 | -72.7 |
| 18.0 | -89.4 | -77.8 |
| 20.0 | -91.3 | -82.4 |



3.2.4 OCCUPIED BANDWIDTH EMISSION MASK

Applicable Standard : FCC §2.1049, §90.209 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 $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.

Emission Mask E—6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3 \text{ kHz})$ or $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.
- 3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps

must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

Analog :

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

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

Digital :

The 99% energy rule (title 47CFR 2.989) was used for digital mode and is more accurate than Carson's rule. It basically states that 99% of the modulation energy falls within X kHz, in this case, 7.9 kHz

Measurements were performed in accordance with TIA/EIA. The emission mask was obtained from 47CFR 90.210(d)

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.

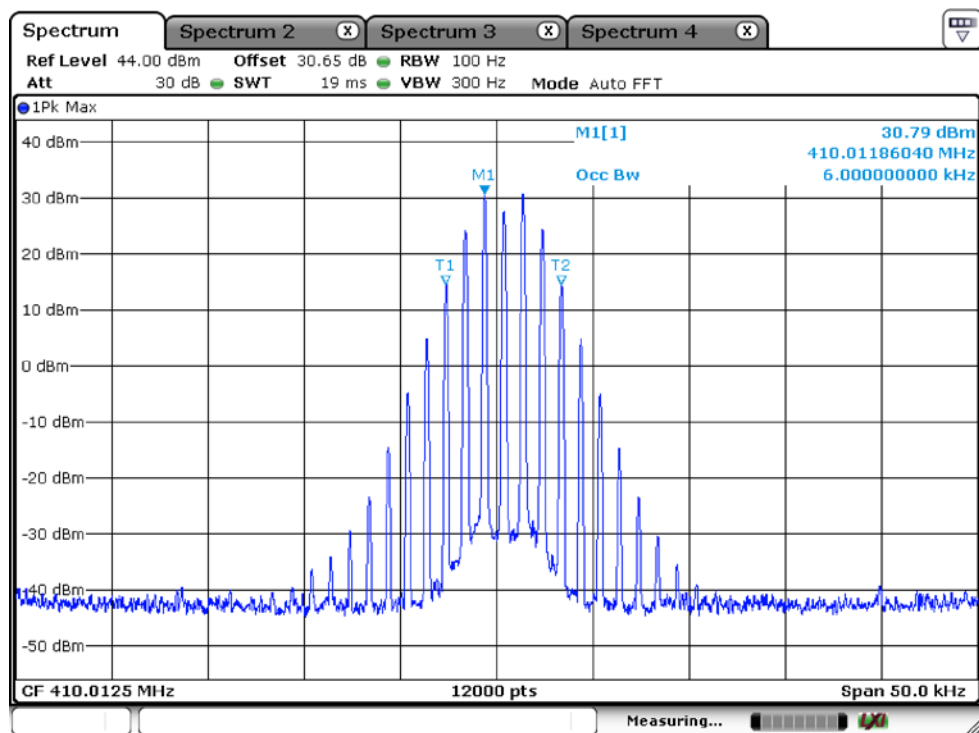
Test Result : Compliance.

Measurement Data: Transmitting

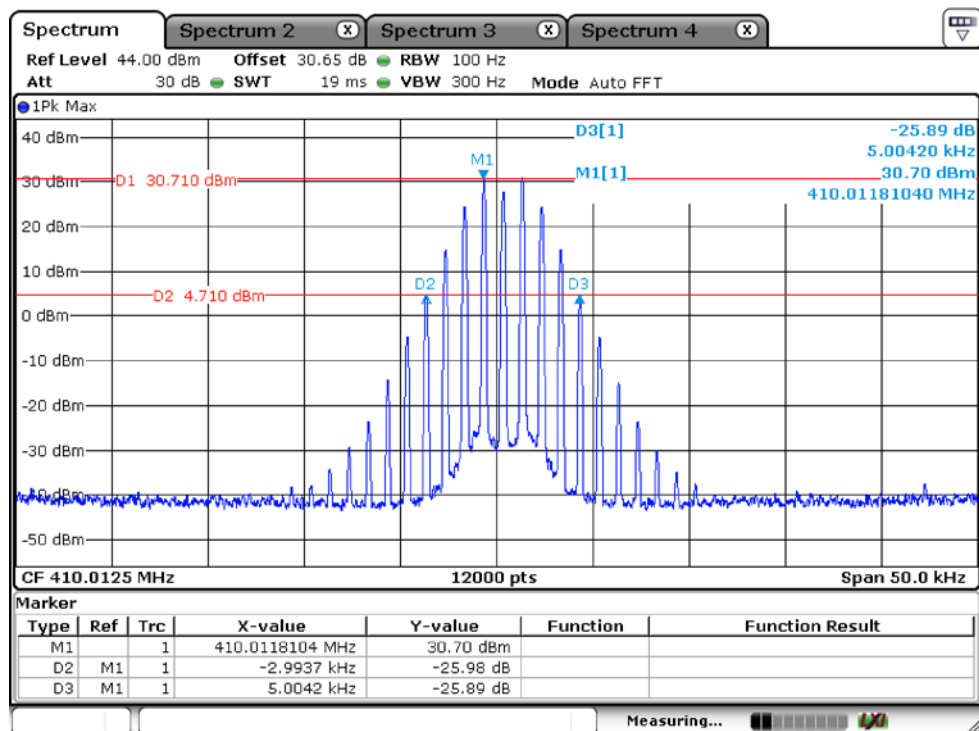
| Modulation | Frequency (MHz) | Channel Space (kHz) | Power Level | 99% Occupied Bandwidth (kHz) | 26dB Emissions Bandwidth (kHz) | FCC Limit (kHz) |
|------------|-----------------|---------------------|-------------|------------------------------|--------------------------------|-----------------|
| Analog | 410.0125 | 12.5 | 4.8 W | 6.0 | 7.99 | 11.25 |
| | 440.0125 | 12.5 | 4.8 W | 6.0 | 8.01 | 11.25 |
| | 469.7000 | 12.5 | 4.8 W | 6.0 | 8.01 | 11.25 |
| Digital | 410.0125 | 12.5 | 4.8 W | 7.85 | 10.05 | 11.25 |
| | 440.0125 | 12.5 | 4.8 W | 7.92 | 10.07 | 11.25 |
| | 469.7000 | 12.5 | 4.8 W | 7.89 | 10.19 | 11.25 |

Analog Modulation :

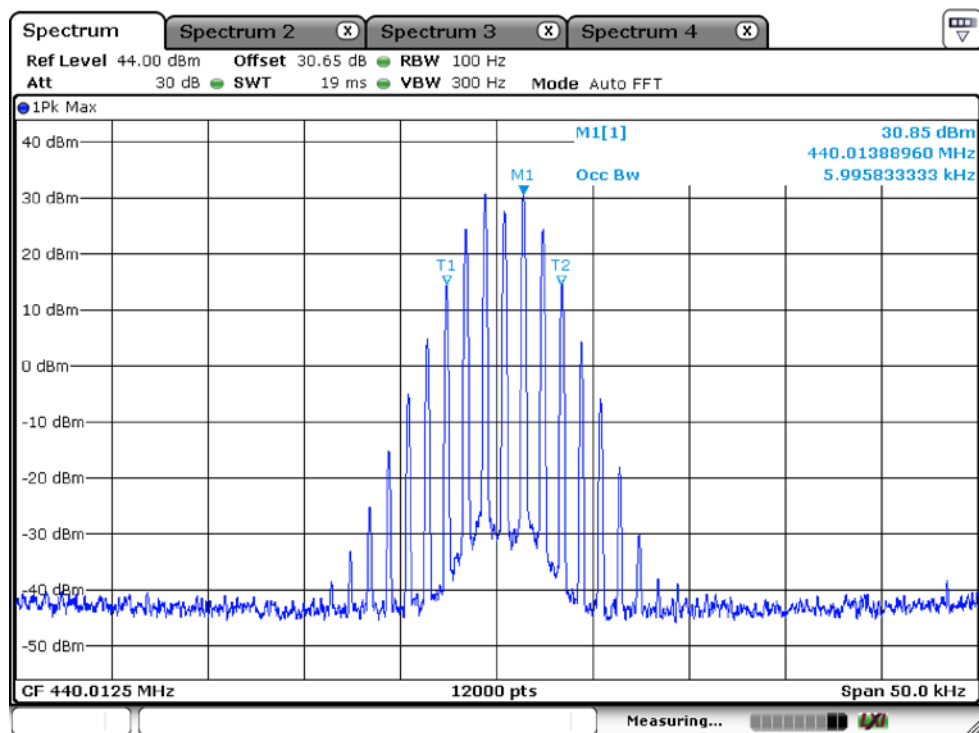
99% Occupied Bandwidth, 410.0125 MHz (4.8W)



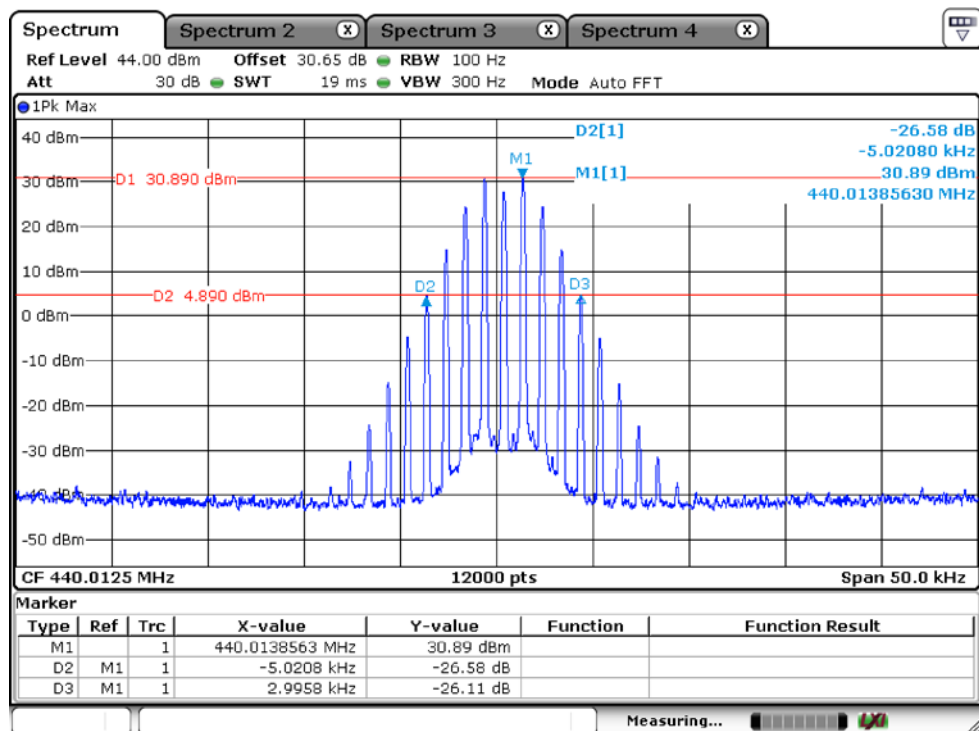
26 dB Emissions Bandwidth 12.5 kHz, 410.0125 MHz (4.8 W)



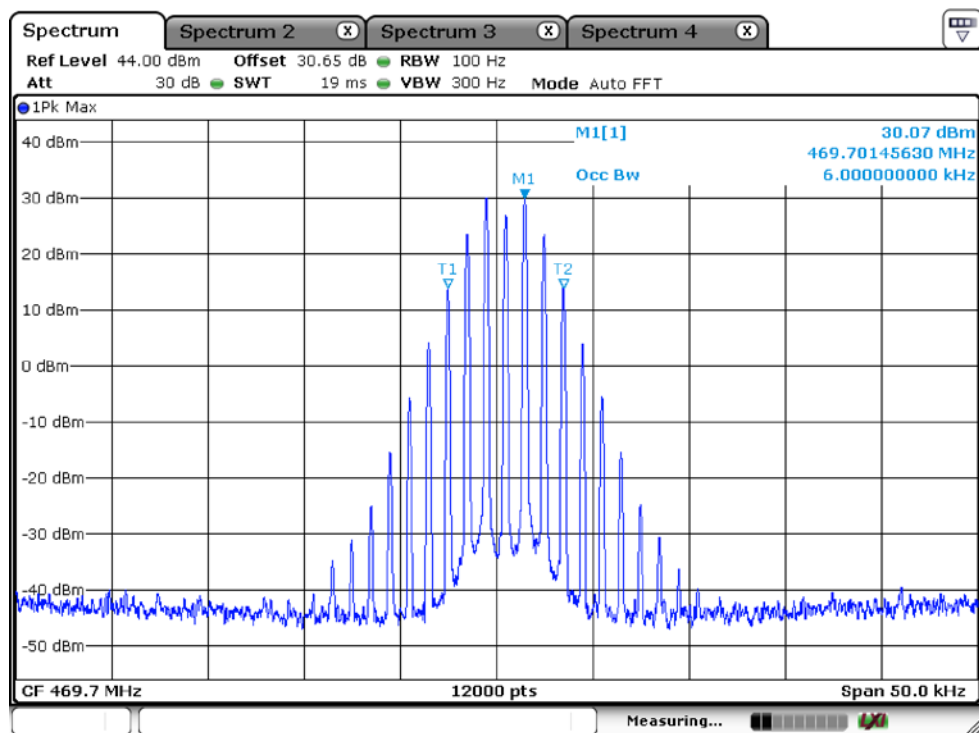
99% Occupied Bandwidth, 440.0125 MHz (4.8W)



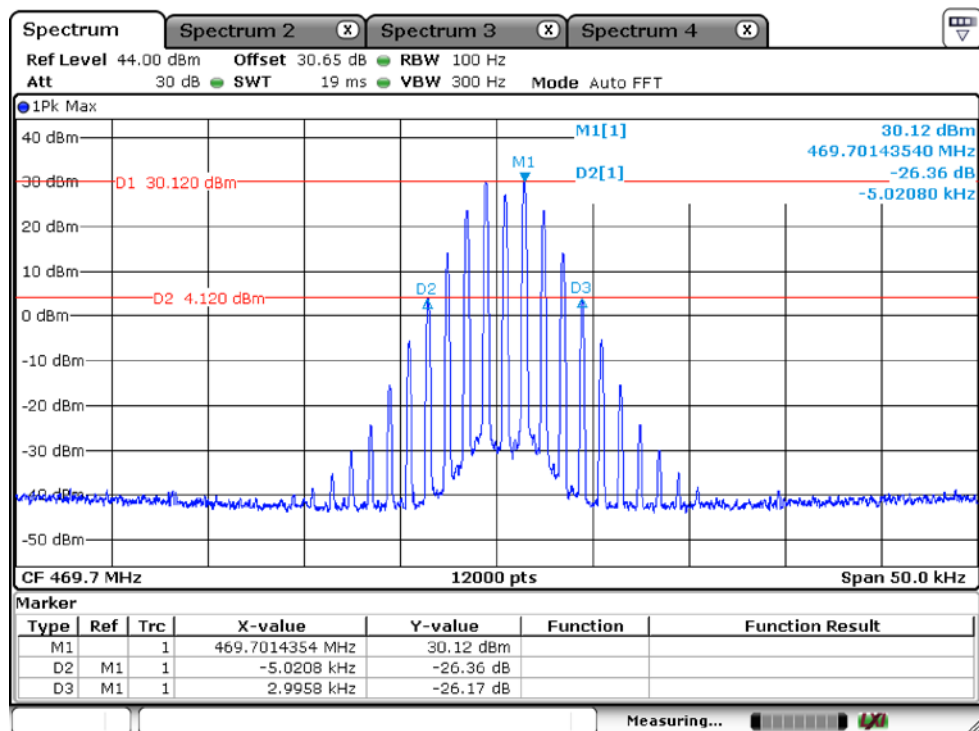
26 dB Emissions Bandwidth 12.5 kHz, 440.0125 MHz (4.8 W)



99% Occupied Bandwidth, 469.7000 MHz (4.8W)

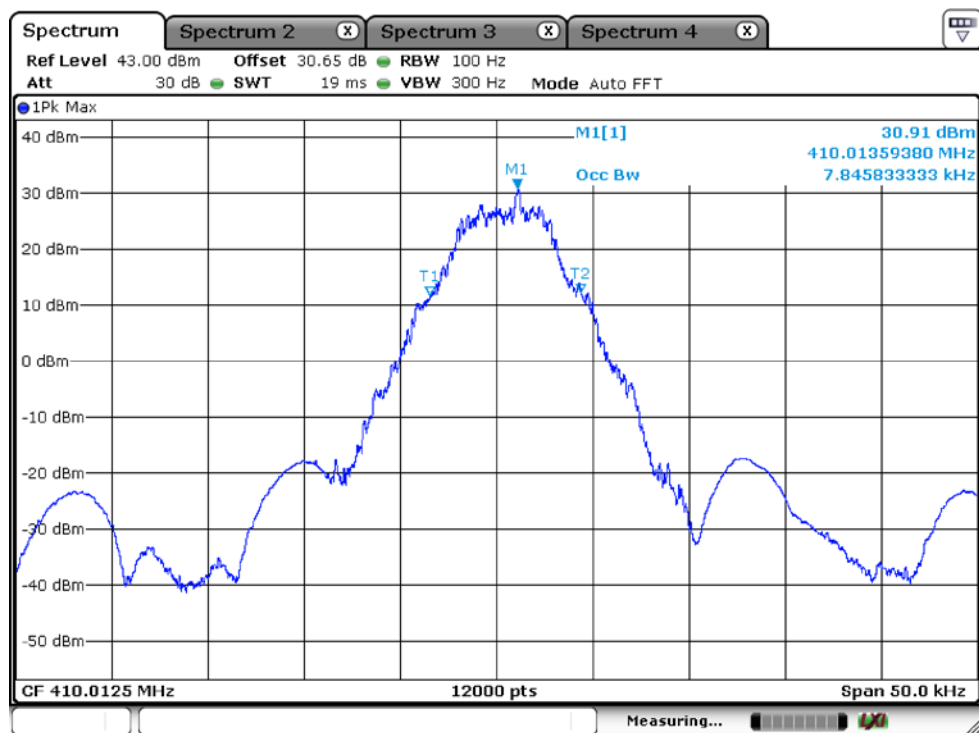


26 dB Emissions Bandwidth 12.5 kHz, 469.7000 MHz (4.8 W)

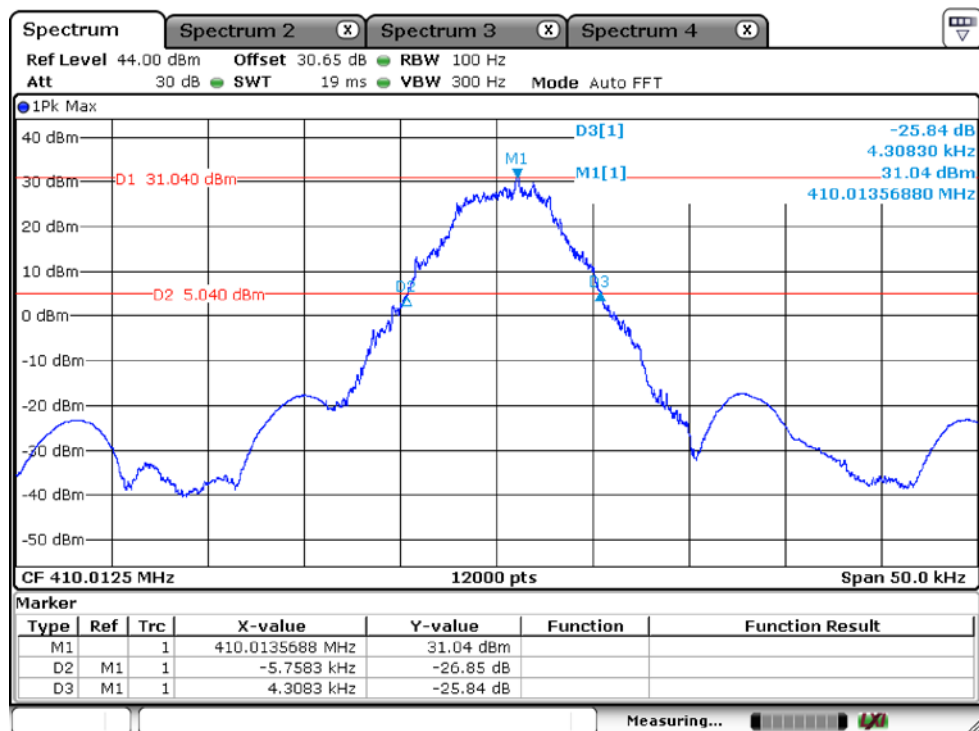


Digital Modulation :

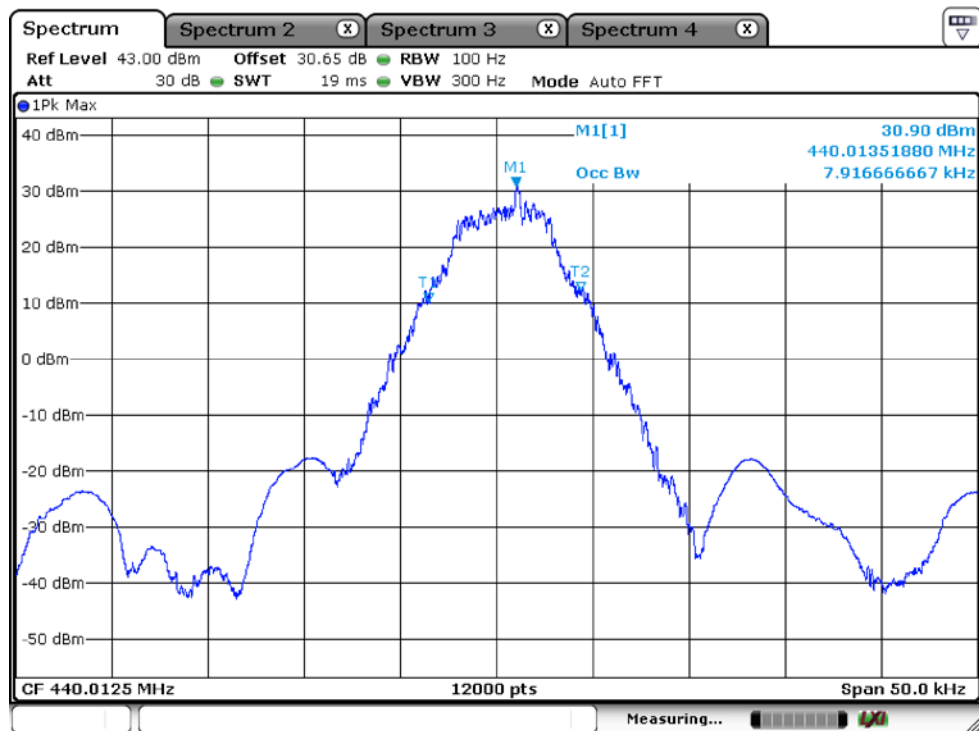
99% Occupied Bandwidth, 410.0125 MHz (4.8W)



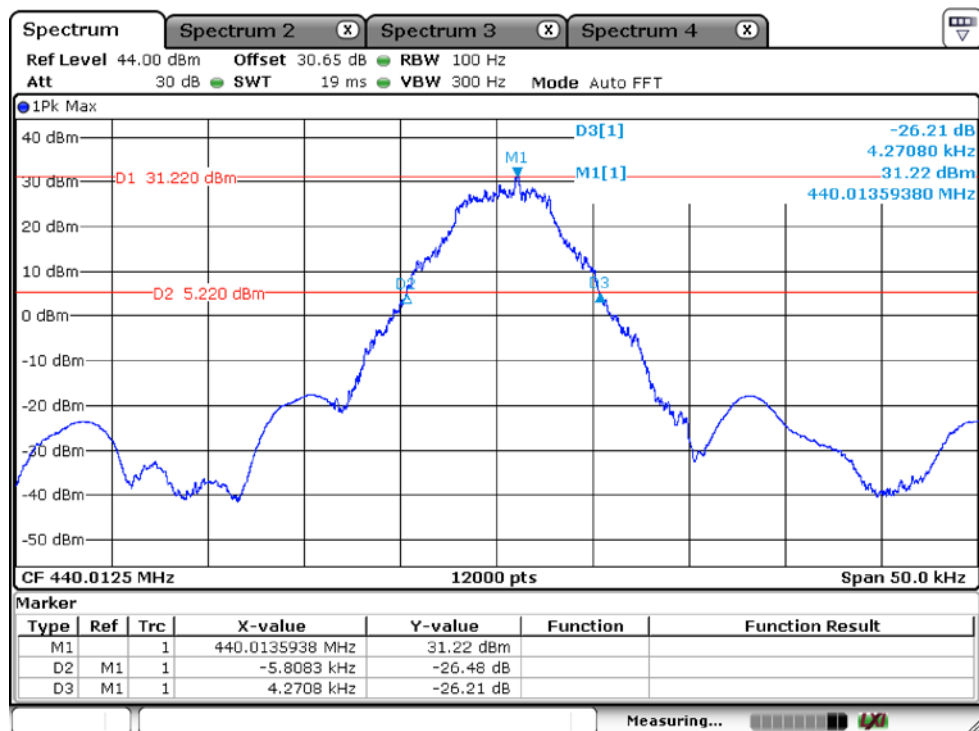
26 dB Emissions Bandwidth 12.5 kHz, 410.0125 MHz (4.8 W)



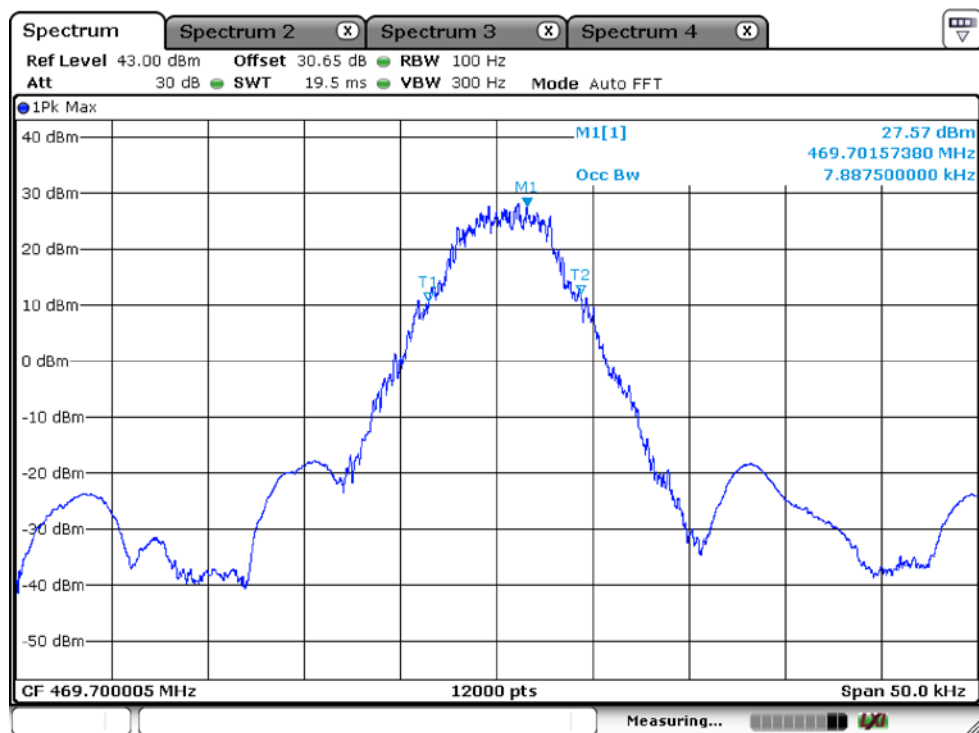
99% Occupied Bandwidth, 440.0125 MHz (4.8W)



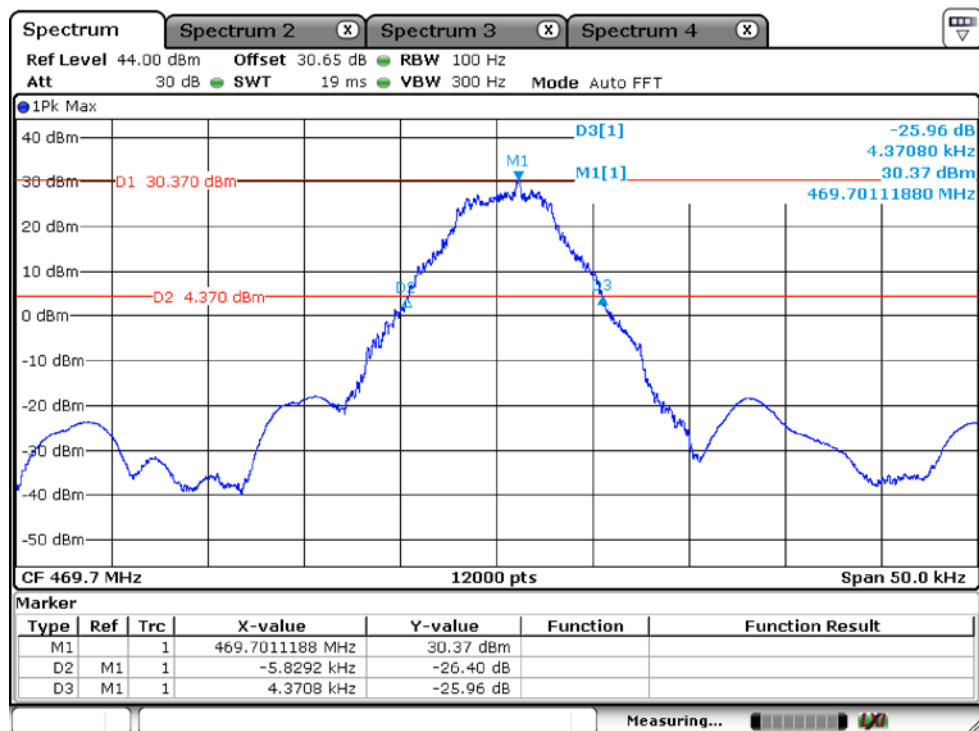
26 dB Emissions Bandwidth 12.5 kHz, 440.0125 MHz (4.8 W)



99% Occupied Bandwidth, 469.7000 MHz (4.8W)



26 dB Emissions Bandwidth 12.5 kHz, 469.7000 MHz (4.8 W)



3.2.5 SPURIOUS EMISSIONS AT ANTENNA

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 $7.27 (f_d - 2.88 \text{ kHz})$ 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.

Emission Mask E — 6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3 \text{ kHz})$ or $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.
- 3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.

The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under

test, an alternate procedure may be used provided prior Commission approval is obtained.

Test Procedure

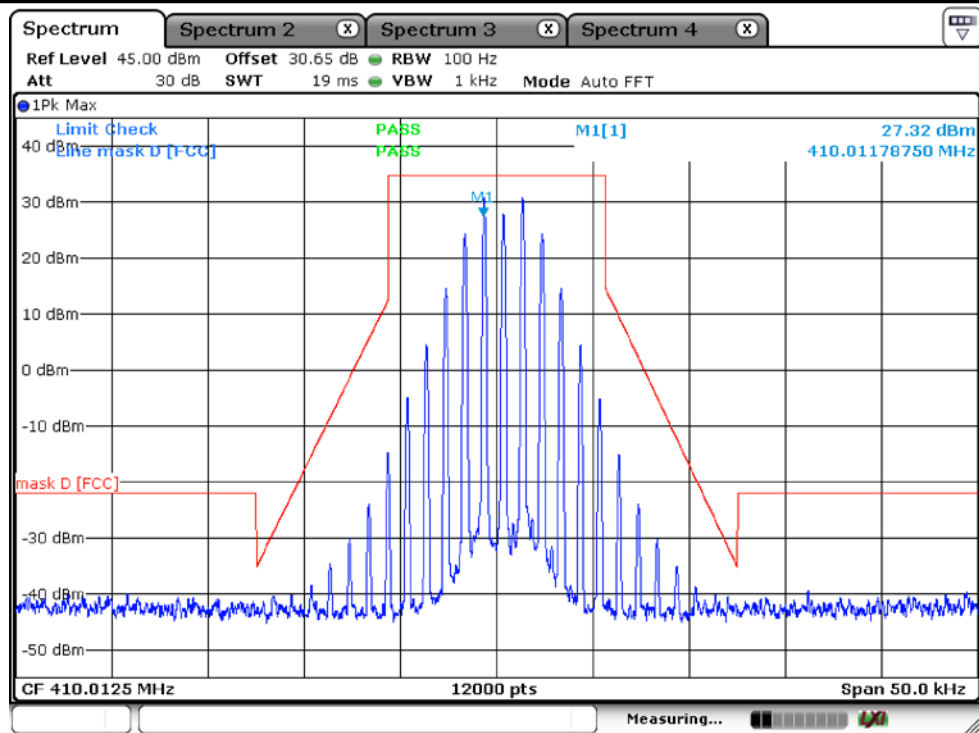
The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for below 1 GHz, and 1 MHz for above 1 GHz. sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Test Result : **Compliance.**

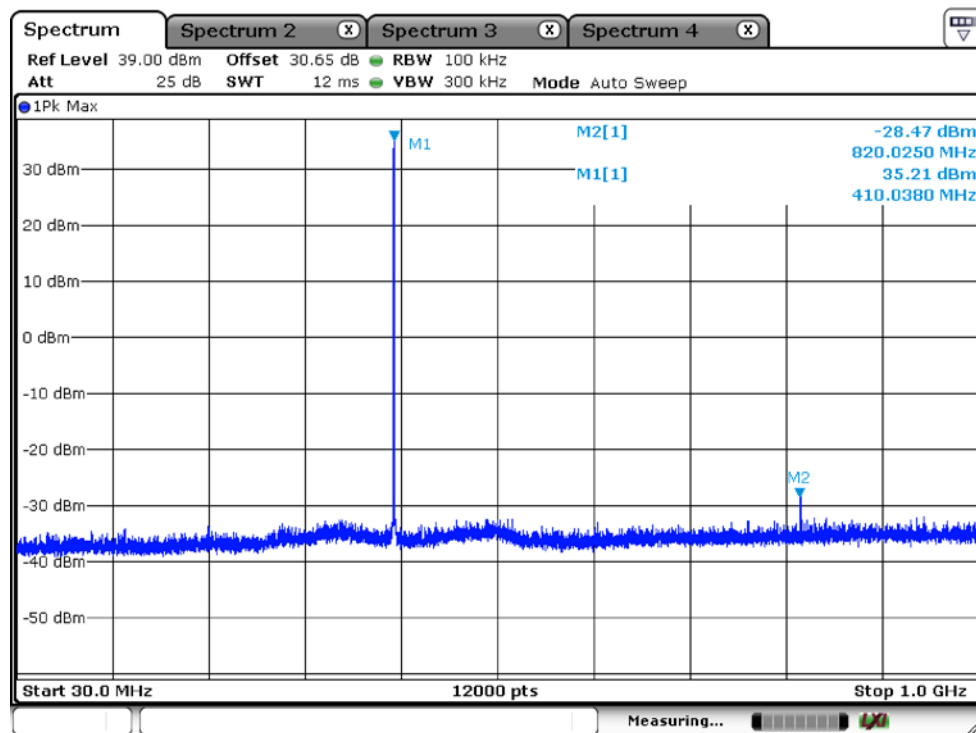
| Modulation | Frequency (MHz) | Channel Space (kHz) | Maximum Conducted Spurious Emissions Below 1 GHz | | Maximum Conducted Spurious Emissions Above 1 GHz | | FCC Limit |
|------------|-----------------|---------------------|--|---------------|--|---------------|-----------|
| | | | Frequency (MHz) | Results (dBm) | Frequency (MHz) | Results (dBm) | |
| Analog | 410.0125 | 12.5 | 820.0250 | -28.47 | 1230.21 | -26.45 | -20 dBm |
| | 440.0125 | | 880.0840 | -29.71 | 1320.21 | -27.53 | |
| | 469.7000 | | 939.4150 | -30.34 | 1409.38 | -31.37 | |
| Digital | 410.0125 | 12.5 | 820.0250 | -28.39 | 1230.21 | -25.94 | |
| | 440.0125 | | 880.0840 | -28.31 | 1320.21 | -27.78 | |
| | 469.7000 | | 939.4150 | -29.49 | 1409.38 | -31.30 | |

Analog Modulation :

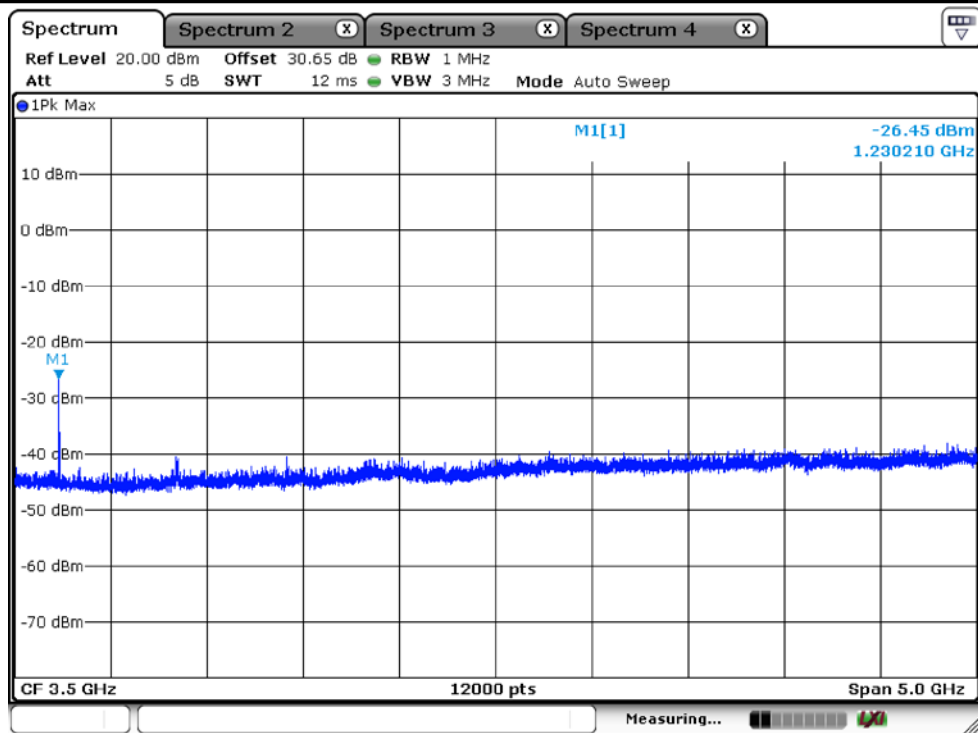
Emission Mask D, 12.5 kHz, 410.0125 MHz



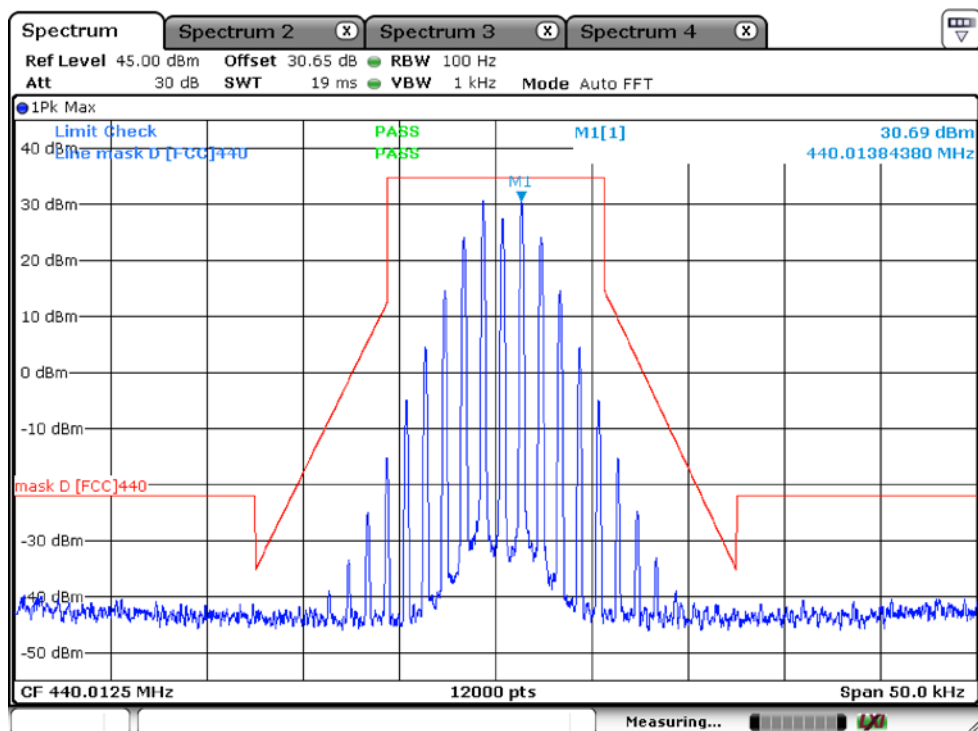
30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 410.0125 MHz



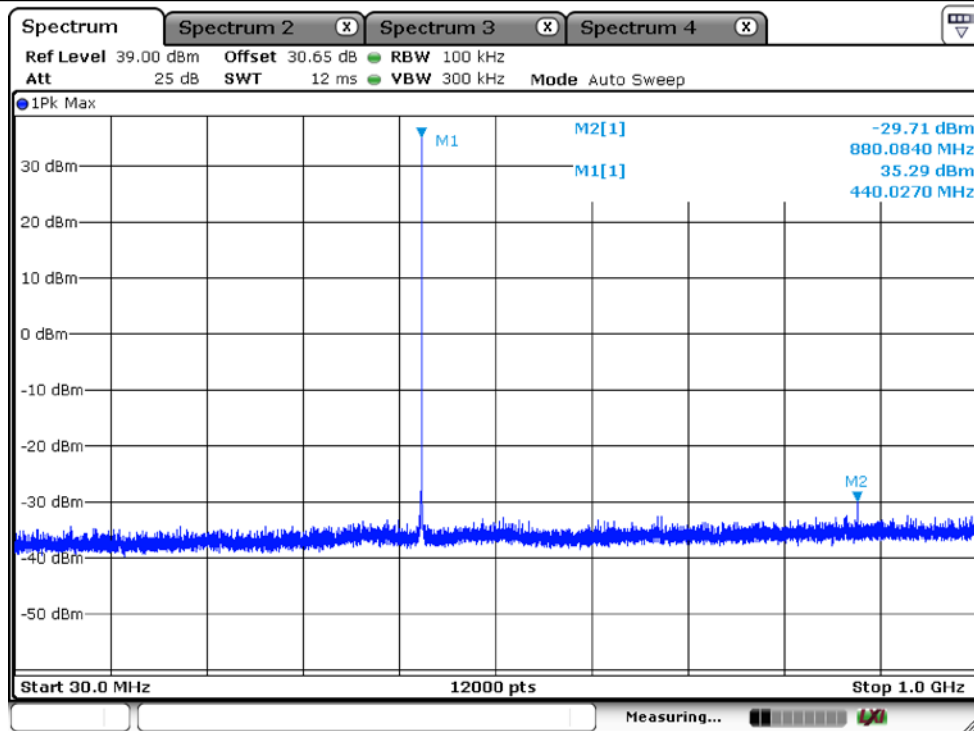
1 GHz – 6 GHz, Spacing Channel 12.5 kHz, 410.0125 MHz



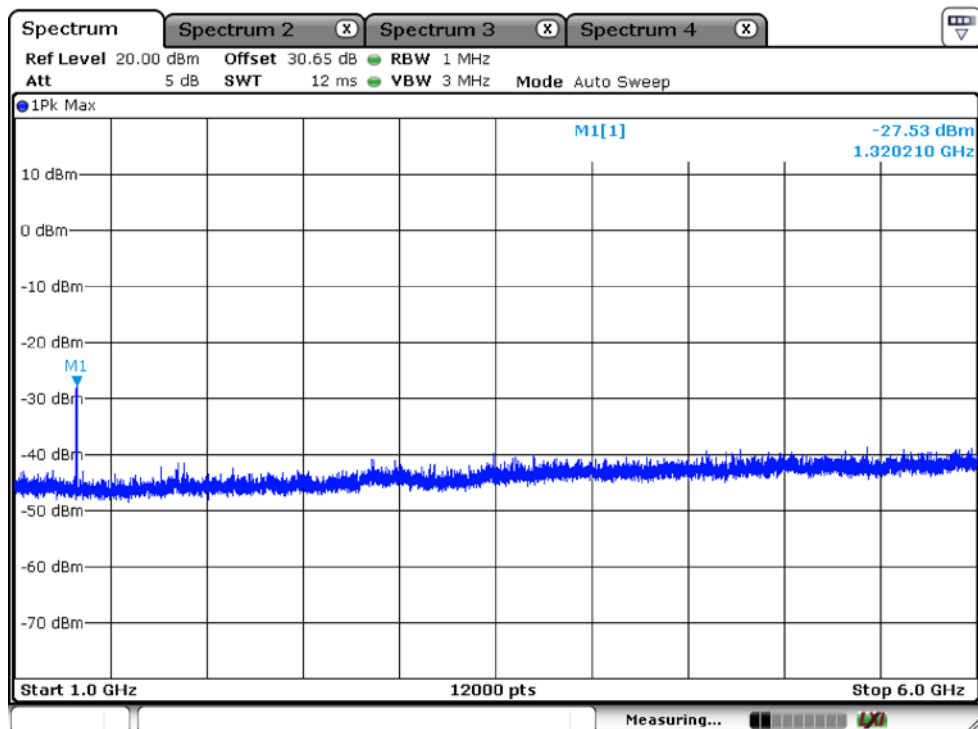
Emission Mask D, 12.5 kHz, 440.0125 MHz



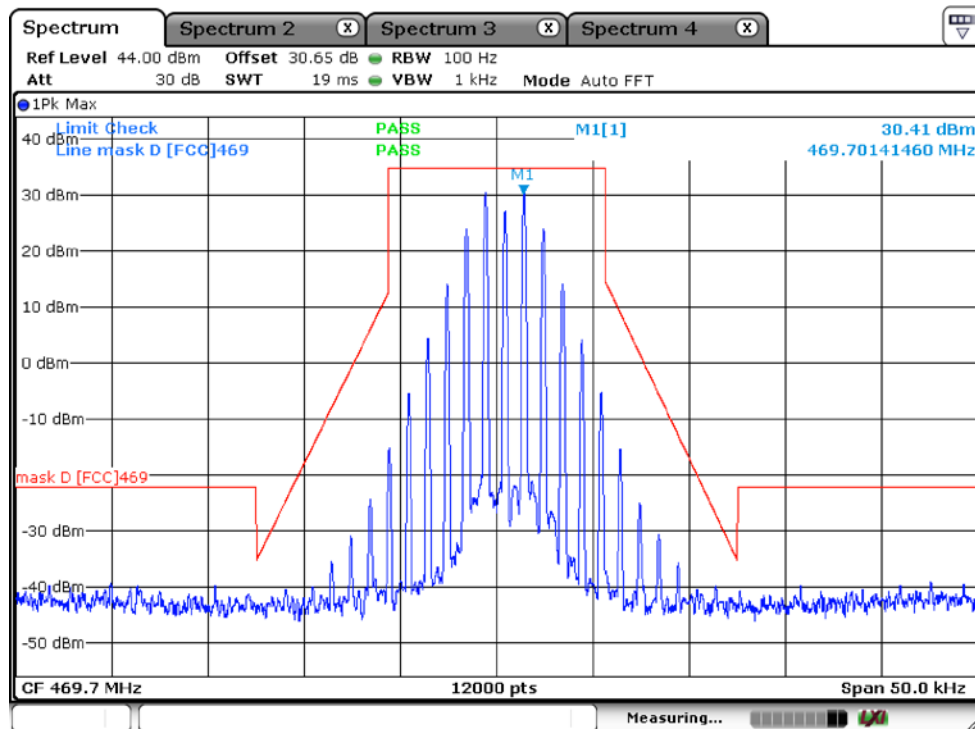
30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 440.0125 MHz



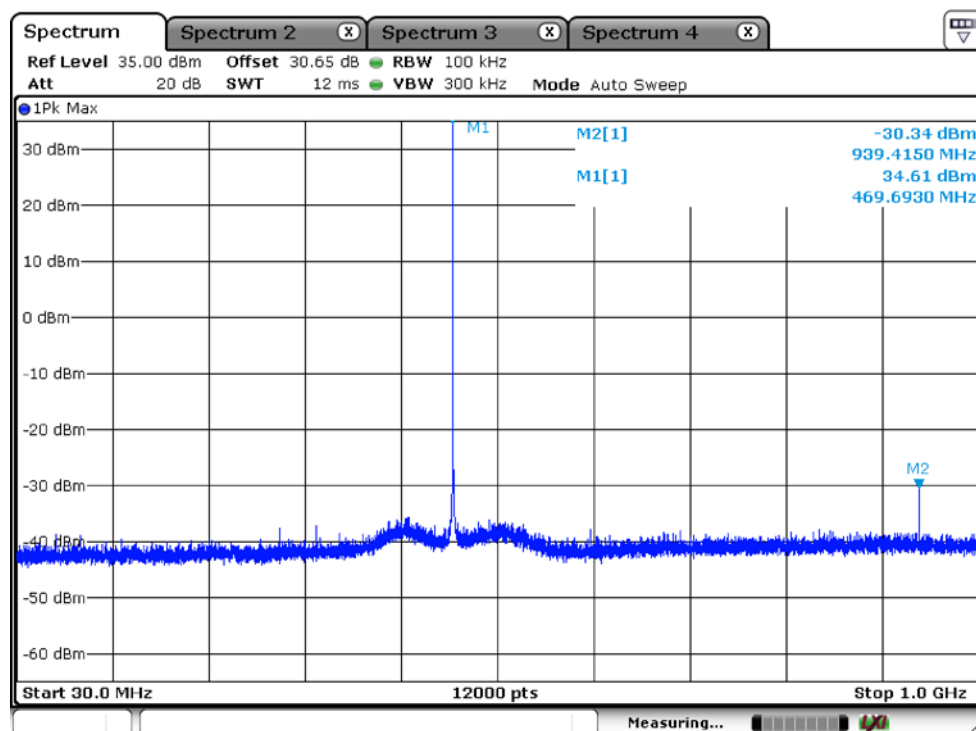
1 GHz – 6 GHz, Spacing Channel 12.5 kHz, 440.0125 MHz



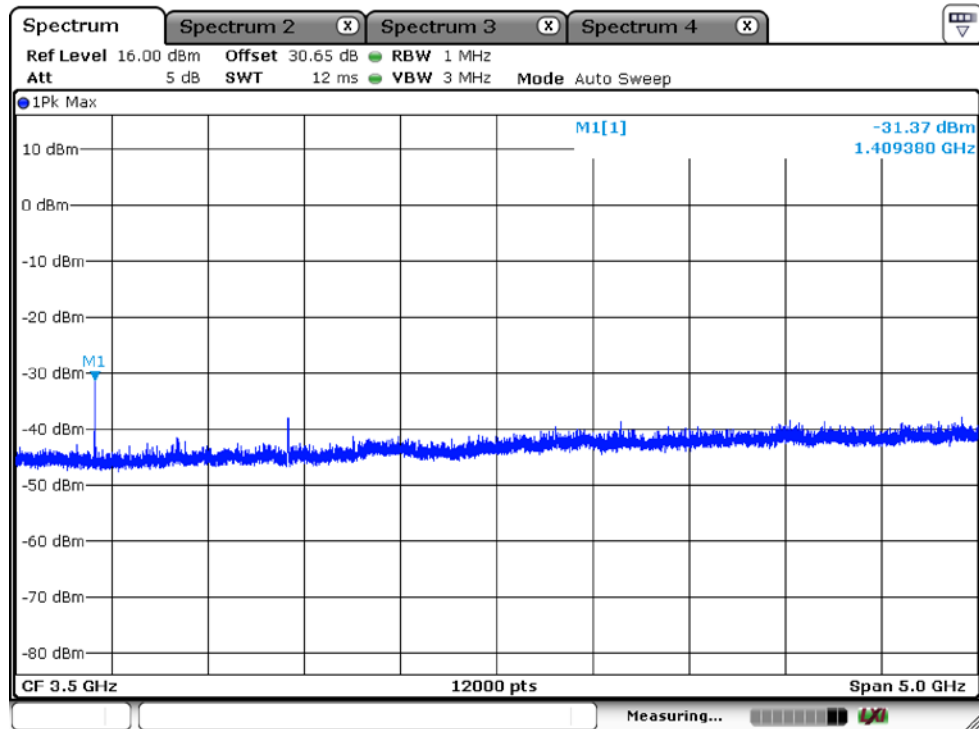
Emission Mask D, 12.5 kHz, 469.7000 MHz



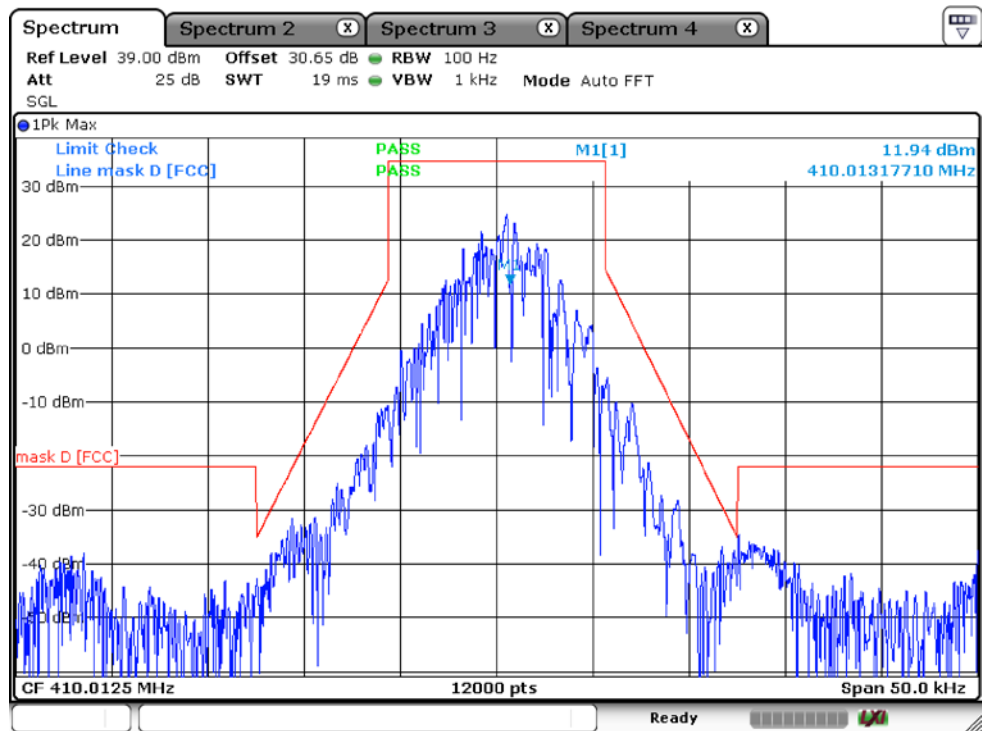
30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 469.7000 MHz



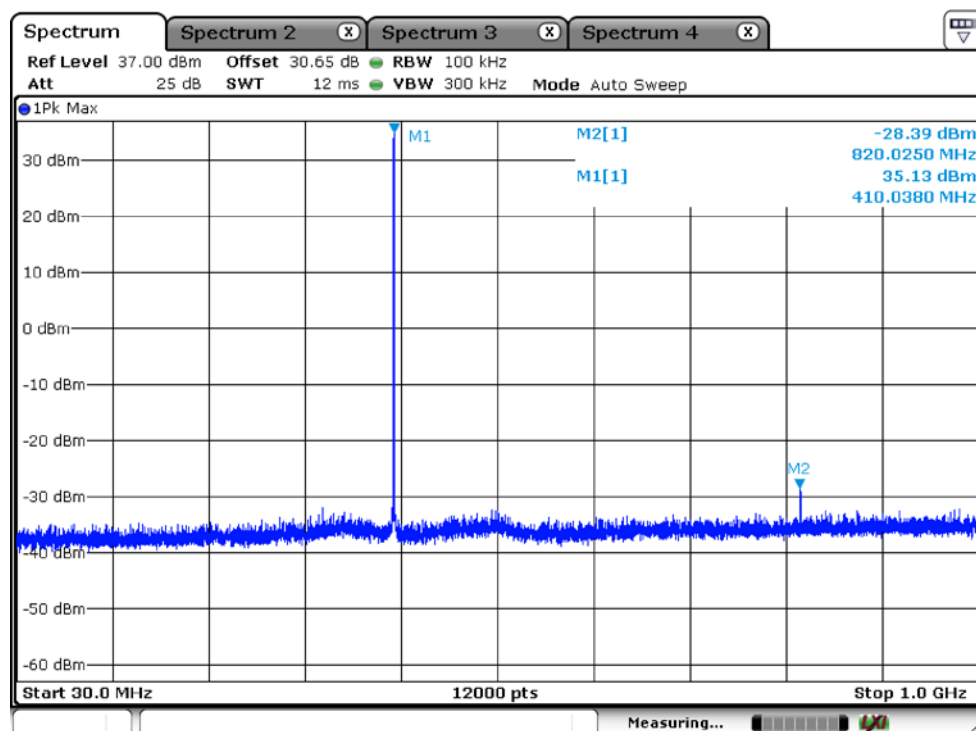
1 GHz – 6 GHz, Spacing Channel 12.5 kHz, 469.7000 MHz



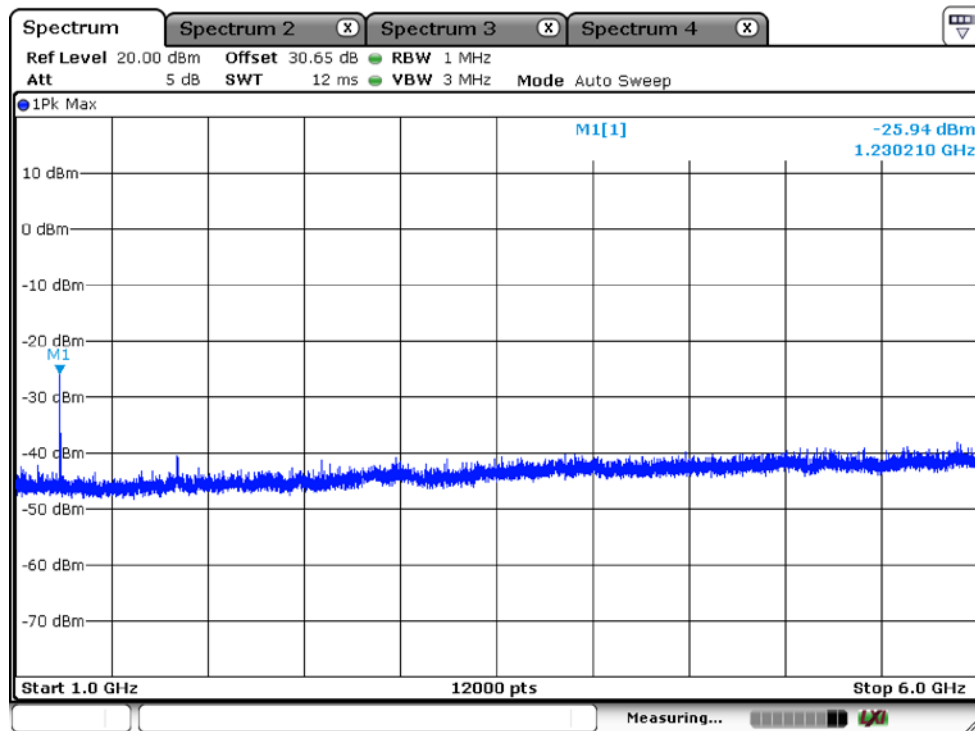
Emission Mask D, 12.5 kHz, 410.0125 MHz



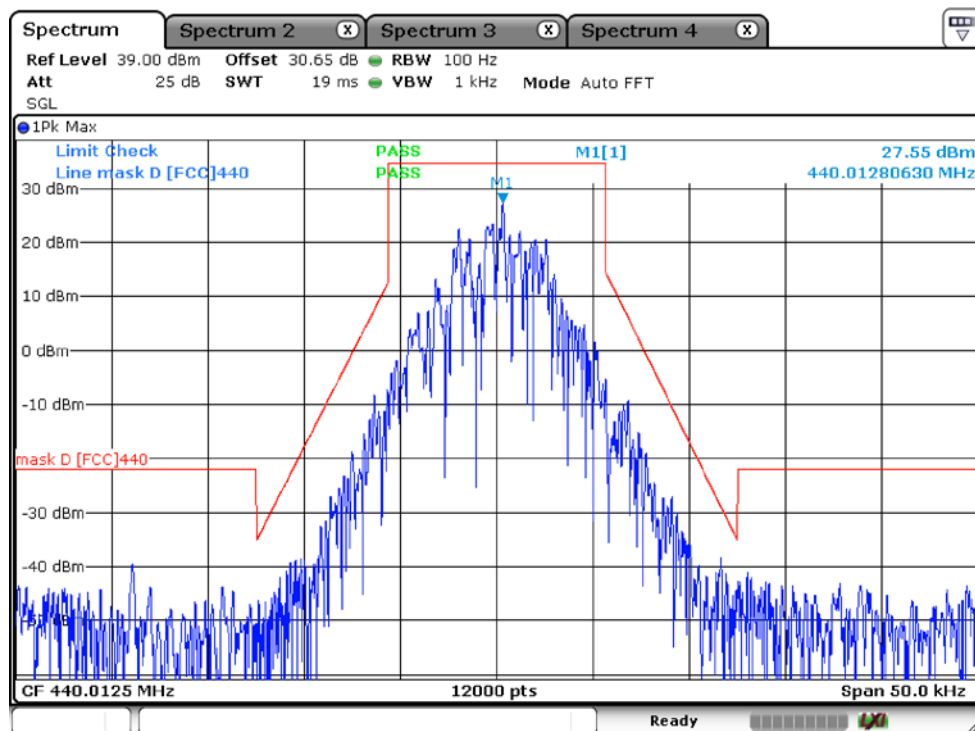
30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 410.0125 MHz



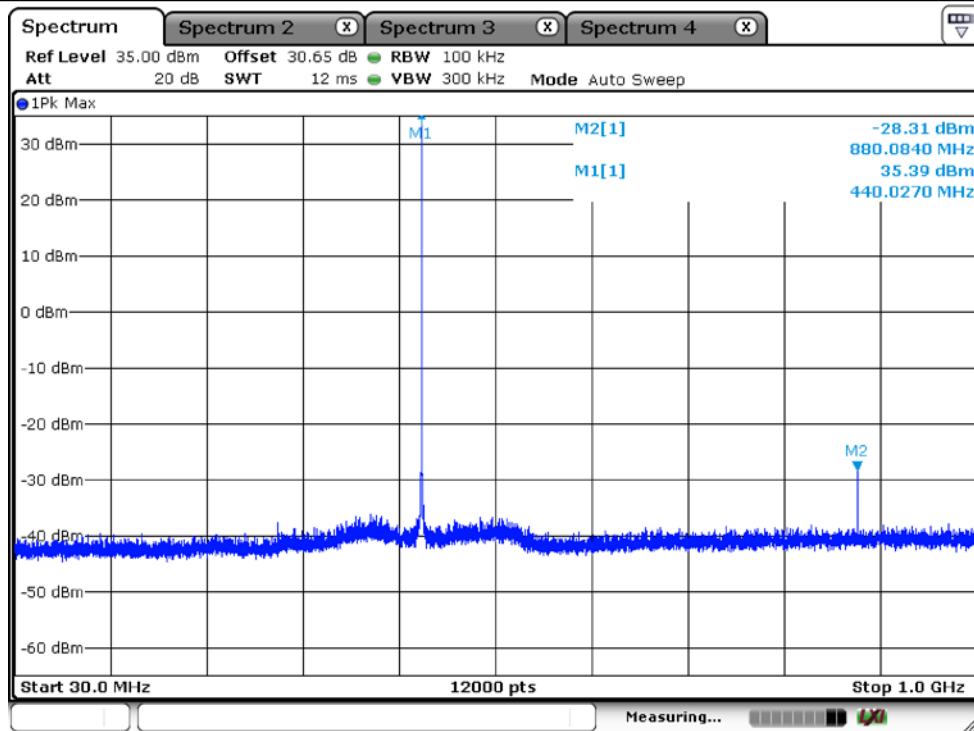
1 GHz – 6 GHz, Spacing Channel 12.5 kHz, 410.0125 MHz



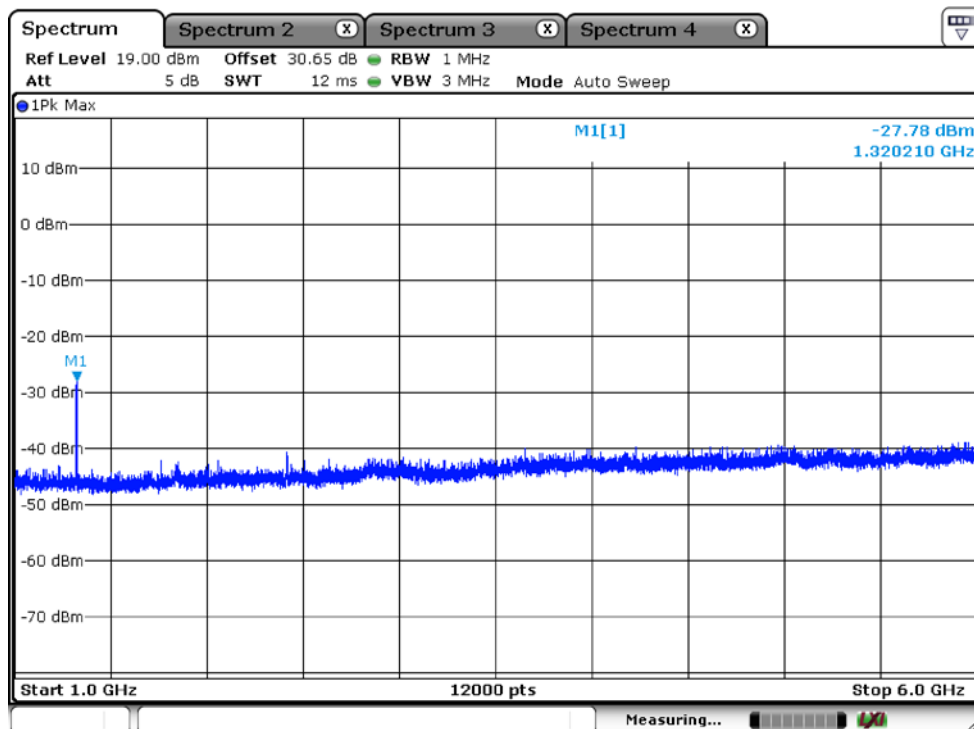
Emission Mask D, 12.5 kHz, 440.0125 MHz



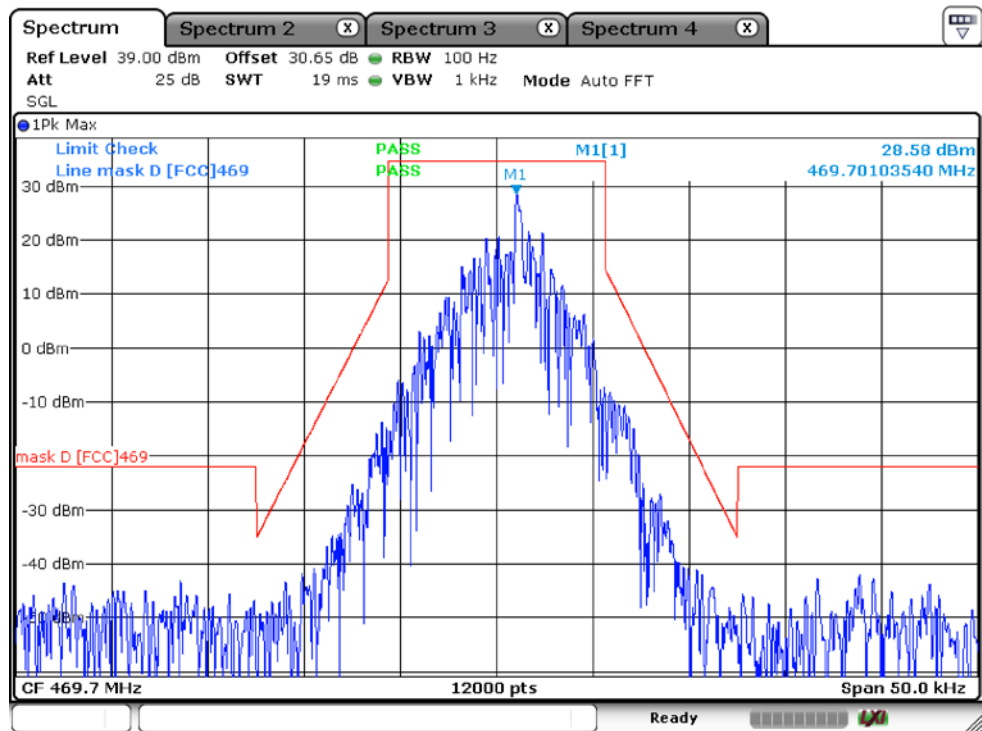
30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 440.0125 MHz



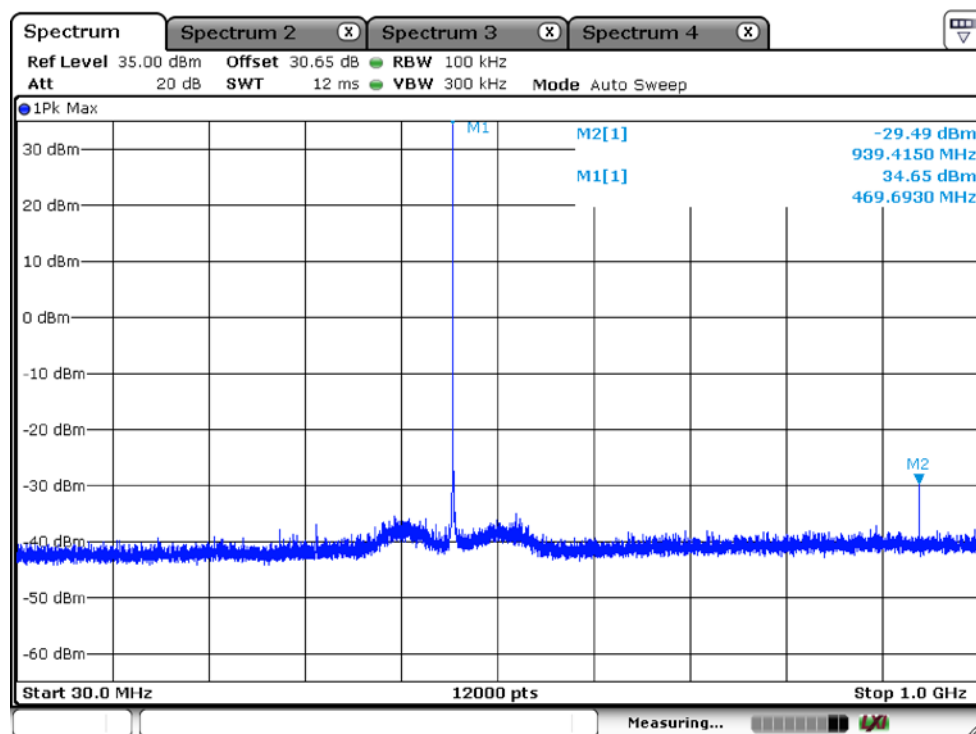
1 GHz – 6 GHz, Spacing Channel 12.5 kHz, 440.0125 MHz



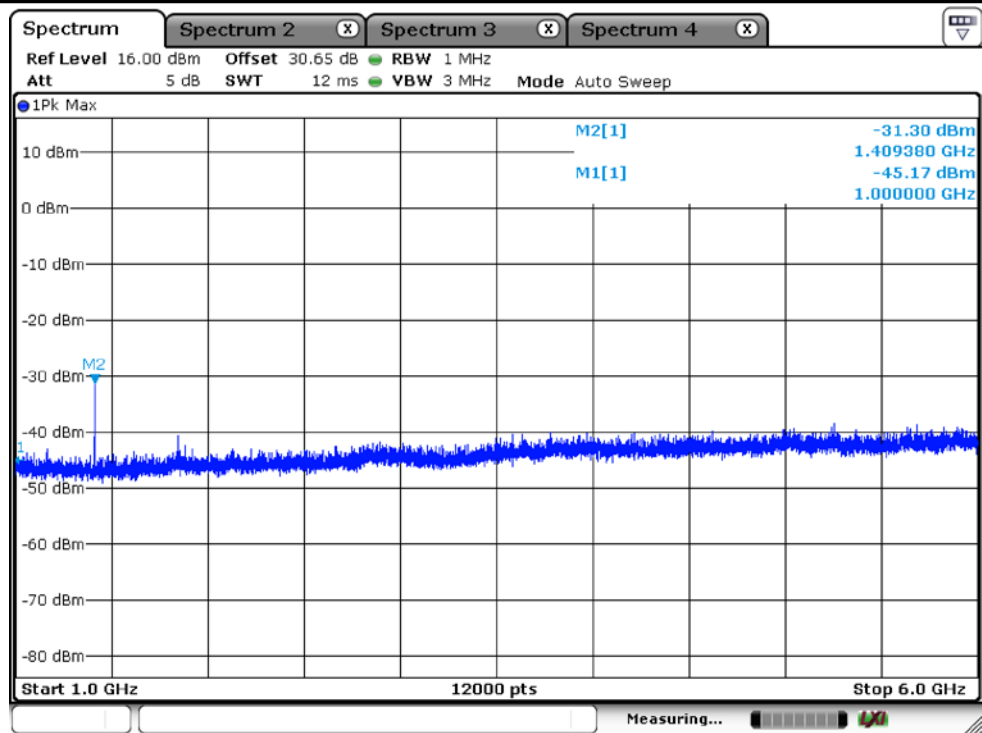
Emission Mask D, 12.5 kHz, 469.7000 MHz



30 MHz – 1 GHz, Spacing Channel 12.5 kHz, 469.7000 MHz



1 GHz – 6 GHz, Spacing Channel 12.5 kHz, 469.7000 MHz



3.2.6 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 = $10 + 10 \log_{10}(\text{TXpwr in Watts}/0.001)$ - the absolute level

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

Spurious attenuation limit in dB = $55 + 10 \log_{10}(\text{power out in Watts})$ for EUT with a 6.25 kHz channel bandwidth.

Test Result : Compliance.

30 MHz – 2GHz

| Frequency (MHz) | Receiver Reading (dBμV) | Turn Table Angle Degree | Rx Antenna | | Substituted | | | Absolute Level (dBm) | FCCpart90 | |
|---|-------------------------------|----------------------------------|---------------|----------------|----------------------|-----------------------|-------------------------|----------------------------|----------------|----------------|
| | | | Height (m) | Polar (H/V) | SG Level (dBm) | Cable Loss (dB) | Antenna Gain (dB) | | Limit (dBm) | Margin (dB) |
| Analog Modulation 440.0125 MHz, Channel Spacing 12.5 KHz | | | | | | | | | | |
| 980.24 | 49.24 | 47 | 1.8 | H | -46.41 | 0.81 | 0 | -47.22 | -20 | 27.22 |
| 980.24 | 48.17 | 291 | 1.8 | V | -45.27 | 0.81 | 0 | -46.08 | -20 | 26.08 |
| 1328.04 | 69.88 | 32 | 2.1 | H | -40.20 | 1.15 | 6.40 | -34.95 | -20 | 14.95 |
| 1328.04 | 61.20 | 270 | 2.0 | V | -44.12 | 1.15 | 6.40 | -38.87 | -20 | 18.87 |
| 2100.12 | 55.83 | 98 | 1.9 | H | -50.11 | 1.41 | 7.8 | -43.72 | -20 | 23.72 |
| 2100.12 | 52.21 | 210 | 1.8 | V | -51.36 | 1.41 | 7.8 | -44.97 | -20 | 24.97 |
| Digital Modulation 440.0125 MHz, Channel Spacing 12.5 KHz | | | | | | | | | | |
| 980.24 | 48.77 | 41 | 1.9 | H | -45.29 | 0.81 | 0 | -46.1 | -20 | 26.1 |
| 960.24 | 47.89 | 189 | 1.9 | V | -44.80 | 0.81 | 0 | -45.61 | -20 | 25.61 |
| 1328.04 | 70.15 | 301 | 1.7 | H | -42.38 | 1.15 | 6.40 | -37.13 | -20 | 17.13 |
| 1328.04 | 62.04 | 84 | 1.6 | V | -44.02 | 1.15 | 6.40 | -38.77 | -20 | 18.77 |
| 2100.12 | 58.05 | 192 | 1.8 | H | -46.09 | 1.41 | 7.8 | -39.7 | -20 | 19.70 |
| 2100.12 | 53.14 | 112 | 1.9 | V | -47.81 | 1.41 | 7.8 | -41.42 | -20 | 21.42 |

Note : Absolute Level = SG Level-Cable loss + Antenna Gain

Margin = Limit – Absolute Level

3.2.7 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.

For Analog Modulation

| Reference Frequency : 440.0125 MHz, Limit : ± 2.5 ppm, 12.5 kHz | | | |
|---|--------------------------------------|-------------------------------------|--------------------------|
| Test Environment | | Frequency Measure with Time Elapsed | |
| Temperature (°C) | Power Supplied (V _{DC}) | Measured Frequency (MHz) | Frequency Error (ppm) |
| Frequency Stability versus Input Temperature | | | |
| 50 | 7.5 | 440.012612 | 0.255 |
| 40 | 7.5 | 440.012603 | 0.234 |
| 30 | 7.5 | 440.012633 | 0.302 |
| 20 | 7.5 | 440.012602 | 0.232 |
| 10 | 7.5 | 440.012611 | 0.252 |
| 0 | 7.5 | 440.012427 | -0.166 |
| -10 | 7.5 | 440.012455 | -0.102 |
| -20 | 7.5 | 440.012457 | -0.098 |
| -30 | 7.5 | 440.012469 | -0.070 |
| Frequency Stability versus Input Voltage | | | |
| 20 | 6.2 | 40.012519 | 0.043 |

For Digital Modulation

| Reference Frequency : 440.0125 MHz, Limit : ± 2.5 ppm, 12.5 kHz | | | |
|---|--------------------------------------|-------------------------------------|--------------------------|
| Test Environment | | Frequency Measure with Time Elapsed | |
| Temperature (°C) | Power Supplied (V _{DC}) | Measured Frequency (MHz) | Frequency Error (ppm) |
| Frequency Stability versus Input Temperature | | | |
| 50 | 7.5 | 440.012477 | -0.052 |
| 40 | 7.5 | 440.012485 | -0.034 |
| 30 | 7.5 | 440.012492 | -0.018 |
| 20 | 7.5 | 440.012502 | 0.005 |
| 10 | 7.5 | 440.012515 | 0.034 |
| 0 | 7.5 | 440.012526 | 0.059 |
| -10 | 7.5 | 440.012528 | 0.064 |
| -20 | 7.5 | 440.012530 | 0.068 |
| -30 | 7.5 | 440.012533 | 0.075 |
| Frequency Stability versus Input Voltage | | | |
| 20 | 6.2 | 440.012479 | -0.048 |

3.2.8 TRANSIENT FREQUENCY BEHAVIOR

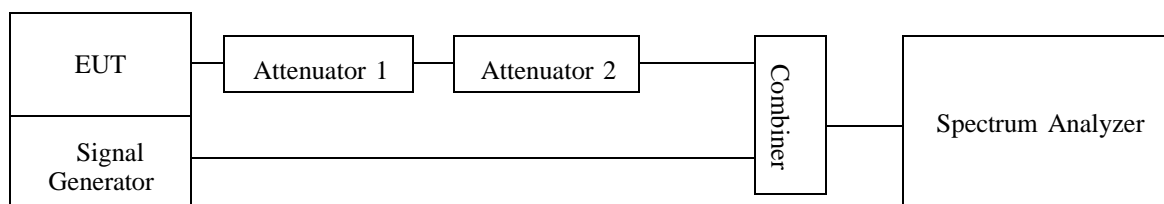
Applicable Standard

Regulations: FCC §90.214

Test method: ANSI/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 -100 dBm.
- 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 "trigger offset" to -10ms for turn on and -15 ms 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 .



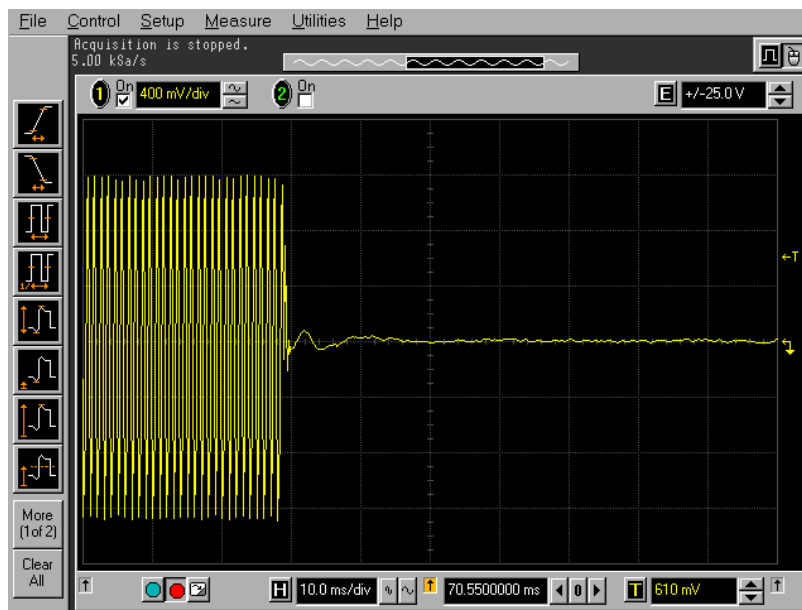
Measurement Data: Transmitting

| Channel Separation (kHz) | Transient Period (ms) | Transient Frequency | Result |
|--------------------------|-----------------------|---------------------|------------|
| 12.5 | 10 (t1) | <+/- 12.5 kHz | Compliance |
| | 25 (t2) | <+/- 6.25 kHz | |
| | 10 (t3) | <+/- 12.5 kHz | |

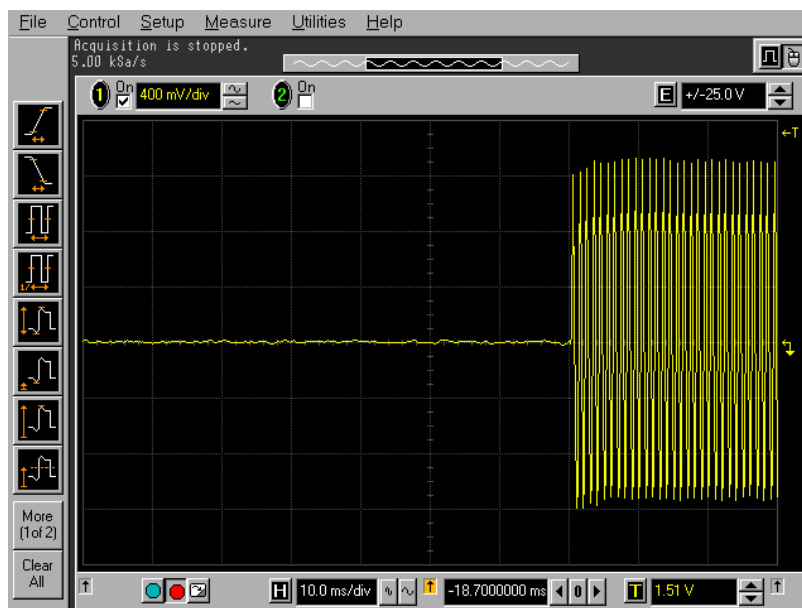
Please refer to the following plots.

Channel Spacing 12.5 kHz

Trun ON



Trun OFF



APPENDIX

TEST EQUIPMENT USED FOR TESTS

| | Description | Model No. | Serial No. | Manufacturer | Interval | Last Cal. Date |
|----|--------------------------------------|------------------|------------|------------------------|----------|----------------|
| 1 | Signal Analyzer (9 kHz ~ 30 GHz) | FSV30 | 100757 | R&S | 1 year | 2016-10-11 |
| 2 | Signal Generator (~ 3.2 GHz) | 8648C | 3623A02597 | HP | 1 year | 2016-03-21 |
| 3 | SYNTHESIZED CW GENERATOR | 83711B | US34490456 | HP | 1 year | 2016-03-21 |
| 4 | Attenuator (3 dB) | 8491A | 37822 | HP | 1 year | 2016-09-12 |
| 5 | Attenuator (10 dB) | 8491A | 63196 | HP | 1 year | 2016-09-12 |
| 6 | Test Receiver (~ 30 MHz) | ESHS10 | 828404/009 | R&S | 1 year | 2016-03-21 |
| 7 | EMI Test Receiver (~ 7 GHz) | ESCI7 | 100722 | R&S | 1 year | 2016-09-12 |
| 8 | RF Amplifier (~ 1.3 GHz) | 8447D | 2944A07974 | HP | 1 year | 2016-09-12 |
| 9 | RF Amplifier (1 ~ 26.5 GHz) | 8449B | 3008A02126 | HP | 1 year | 2016-03-21 |
| 10 | Horn Antenna (1 ~ 18 GHz) | 3115 | 00114105 | ETS | 1 year | 2016-04-21 |
| 11 | DRG Horn (Small)(18GHz ~40GHz) | 3116B | 81109 | ETS-Lindgren | 1 year | 2016-05-03 |
| 12 | DRG Horn (Small) (18GHz ~40GHz) | 3116B | 133350 | ETS-Lindgren | 1 year | 2016-05-03 |
| 13 | TRILOG Antenna | VULB 9160 | 9160-3237 | SCHWARZBECK | 2 year | 2015-04-21 |
| 14 | Temp. Humidity Data Logger | SK-L200TH II A | 00801 | SATO | 1 year | 2016-03-22 |
| 15 | Splitter | 1580 | SL769 | WEINSCHEL | 1 year | 2016-03-22 |
| 16 | Power Divider | 11636A | 06243 | HP | 1 year | 2016-09-12 |
| 17 | DC Power Supply | 6674A | 3637A01657 | Agilent | - | - |
| 18 | Frequency Counter | 5342A | 2826A12411 | HP | 1 year | 2016-03-21 |
| 19 | Power Meter | EPM-441A | GB32481702 | HP | 1 year | 2016-03-22 |
| 20 | Power Sensor | 8481A | 3318A94972 | HP | 1 year | 2016-12-30 |
| 21 | Audio Analyzer | 8903B | 3729A18901 | HP | 1 year | 2016-09-12 |
| 22 | Modulation Analyzer | 8901B | 3749A05878 | HP | 1 year | 2016-09-12 |
| 23 | TEMP & HUMIDITY Chamber | YJ-500 | LTAS06041 | JinYoung Tech | 1 year | 2016-09-12 |
| 24 | Stop Watch | HS-3 | 812Q08R | CASIO | 2 year | 2016-03-22 |
| 25 | LISN | KNW-407 | 8-1430-1 | Kyoritsu | 1 year | 2016-09-12 |
| 26 | Two-Lime V-Network | ESH3-Z5 | 893045/017 | R&S | 1 year | 2016-03-21 |
| 27 | UNIVERSAL RADIO COMMUNICATION TESTER | CMU200 | 106243 | R&S | 1 year | 2016-03-21 |
| 28 | Highpass Filter | WHKX1.5/15G-10SS | 74 | Wainwright Instruments | 1 year | 2016-03-21 |
| 29 | Highpass Filter | WHKX3.0/18G-10SS | 118 | Wainwright Instruments | 1 year | 2016-03-21 |
| 30 | Active Loop Antenna | FMZB1519 | 1519-031 | SCHWARZBECK | 2 year | 2016-01-12 |
| 31 | OSP120 BASE UNIT | OSP120 | 101230 | R&S | 1 year | 2016-03-22 |
| 32 | Signal Generator(100 kHz ~ 40 GHz) | SMB100A | 177621 | R&S | 1 year | 2016-03-22 |
| 33 | Signal Analyzer (10 Hz ~ 40 GHz) | FSV40 | 101367 | R&S | 1 year | 2016-03-22 |