# TEST REPORT

| KOSTEC Co., Ltd.<br>28(175-20, Annyeong-dong) 406-gil sejaro,<br>Hwaseong-si, Gyeonggi-do, Korea<br>Tel:031-222-4251, Fax:031-222-4252 | Report No.: KST-FCR-210014(1) | KOSTEC Co., Ltd.<br>http://www.kostec.org |
|---|---|---|

1. Applicant

   • Name : Audio-Technica Corporation

   • Address : 2-46-1 Nishi-naruse, Machida, Tokyo, 194-8666, Japan

2. Test Item

   • Product Name: STEREO TRANSMITTER

   • Model Name: ATW-T3205DF2

   • Brand: audio-technica

   • FCC ID: JFZT3205DF2

3. Manufacturer

   • Name : Audio-Technica Corporation

   • Address : 2-46-1 Nishi-naruse, Machida, Tokyo, 194-8666, Japan

4. Date of Test : 2021. 05. 25. ~ 2021. 05. 27, 2021. 07.12.

5. Test Method Used : FCC CFR 47, Part 2 & 74 Subpart H-Low Power Auxiliary Stations
   ANSI/TIA-603-E-2016
   ANSI C63.26-2015
   ANSI C63.4-2014

6. Test Result : Compliance

7. Note: -

**Supplementary Information**

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI/TIA-603-E-2016

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

| Affirmation | Tested by<br>Name : Choo, Kwang-Yeol (Signature) | Technical Manager<br>Name : Park, Gyeong-Hyeon (Signature) |
|---|---|---|

**2021. 07. 13.**

**KOSTEC Co., Ltd.**

# Table of Contents

# 1. GENERAL INFORMATION

## 1.1 Test Facility

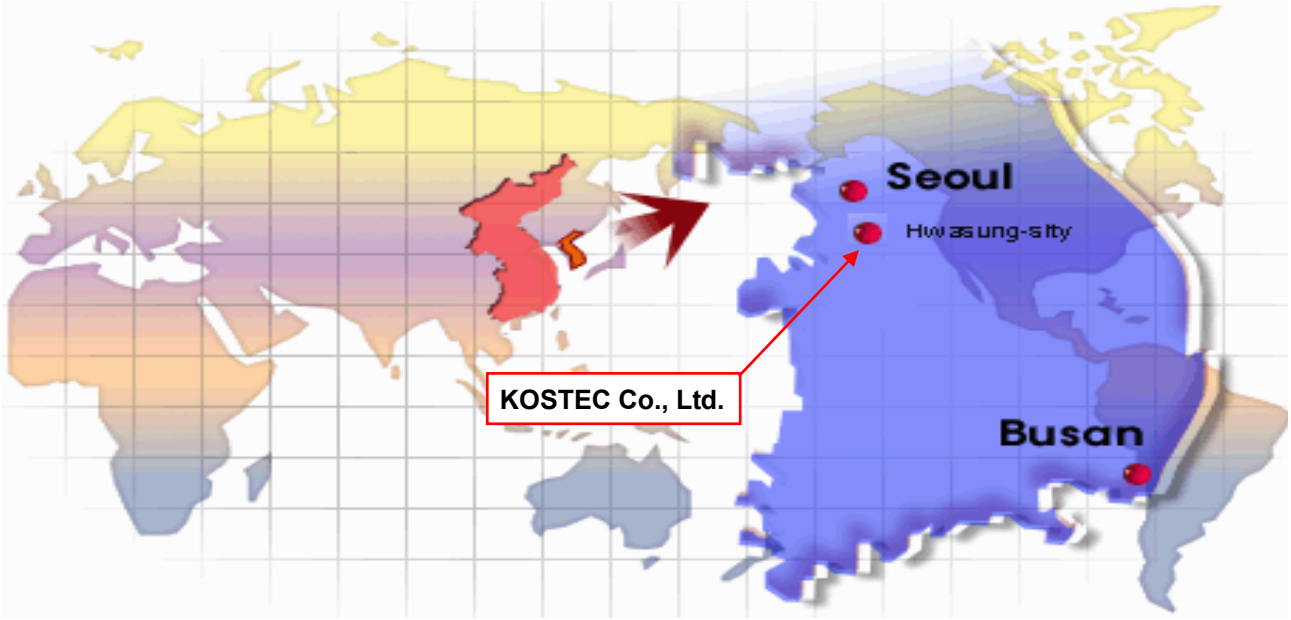
### Test laboratory and address

KOSTEC Co., Ltd.
28(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea
Telephone Number: 82-31-222-4251
Facsimile Number: 82-31-222-4252

### Registration information

KOLAS No.: KT232
RRA (National Radio Research Agency): KR0041
FCC Designation No.: KR0041
IC Designation No.: KR0041
VCCI Membership No.: 2005

## 1.2 Location



## 1.3 Revision History of test report

| Rev. | Revisions | Effect page | Reviewed | Date |
|---|---|---|---|---|
| - | Initial issue | All | Park, Gyeong-Hyeon | 2021. 05. 27. |
| 1 | Revise equipment description and re-test emission mask | 5 Page, 25~30 Page | Park, Gyeong-Hyeon | 2021. 07. 13. |

## 2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

| | |
|---|---|
| Equipment Name | STEREO TRANSMITTER |
| Model No | ATW-T3205DF2 |
| Type of Equipment | Licensed Broadcast Transmitter Fixed to Face (UHF Wireless Microphone) |
| Intended Operating Environment | General Population/Uncontrolled Exposure |
| Serial Number | Proto type |
| Primary User Functions of EUT | One-Way Wireless Voice Communication |
| RF Output Power Rating | 50 mW (High) / 10 mW (Low)-Selectable |
| Operating Frequency Range | 470 MHz ~ 608 MHz |
| RF Output Impedance | 50 Ω |
| Channel Spacing | 25 kHz |
| Modulation | FM for analog voice |
| Occupied Bandwidth (99%) | 105 kHz |
| Emission Designation | 105KF3E |
| Power Source | Adaptor: Input/100~240Vac, Output/12 Vdc 1 A |
| Hardware Version | TP2 |
| Software Version | MCU:0.0.6 / FPGA : 0.2.0 |
| Antenna Description | Whip Antenna, Max 1.298 dBi |
| FCC ID | JFZT3205DF2 |
| Remark | The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description. |

# 3. SYSTEM CONFIGURATION FOR TEST

## 3.1 Characteristics of equipment

The Equipment Under Test (EUT) use for Fixed type UHF Wireless Microphone

## 3.2 Used peripherals list

| Description | Model No. | Serial No. | Manufacture | Remark |
|---|---|---|---|---|
| AC ADAPTER AD-SC1210AO | KSAS0121200100VU | P#9277-01660B | Audio-technica | - |

## 3.3 Product Modification

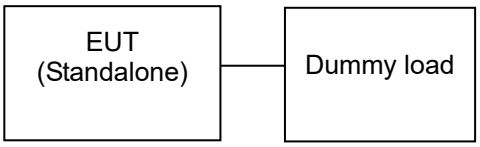
N/A

## 3.4 Operating Mode

Constantly transmitting with a modulated and unmodulated carrier at maximum power on the low, middle and high channels. Radiated emissions tests were performed with antenna ports terminated.

## 3.5 Test Setup of EUT

The measurements were taken in continuous transmit mode.



## 3.6 Table for Carrier Frequencies

| Modulation Type | Tested Channel | Channel separation (kHz) | Test freq. (MHz) |
|---|---|---|---|
| Analog | Low | 25 | 470.125 |
| | Mid | | 539.000 |
| | High | | 607.875 |

## 3.7 Used Test Equipment List

| No. | Instrument | Model | S/N | Manufacturer | Next Cal Date | Cal interval | used |
|---|---|---|---|---|---|---|---|
| 1 | T & H Chamber | PL-3J | 15003623 | ESPEC CORP | 2021.11.04 | 1 year | ☐ |
| 2 | T & H Chamber | SH-662 | 93000067 | ESPEC CORP | 2021.09.02 | 1 year | ☒ |
| 3 | T & H Chamber | SH-641 | 92006831 | ESPEC CORP | 2022.03.29 | 1 year | ☐ |
| 4 | Spectrum Analyzer | 8563EC | 3046A00527 | Agilent Technology | 2022.01.19 | 1 year | ☐ |
| 5 | Spectrum Analyzer | FSV30 | 104029 | Rohde & Schwarz | 2021.09.01 | 1 year | ☐ |
| 6 | Spectrum Analyzer | FSV30 | 20-353063 | Rohde & Schwarz | 2022.01.19 | 1 year | ☐ |
| 7 | Spectrum Analyzer | FSV40 | 101727 | Rohde & Schwarz | 2022.07.19 | 1 year | ☐ |
| 8 | Signal Analyzer | FSW43 | 101294 | Rohde & Schwarz | 2022.02.18 | 1 year | ☒ |
| 9 | Signal Analyzer | FSW85 | 101602 | Rohde & Schwarz | 2022.06.30 | 1 year | ☐ |
| 10 | EMI Test Receiver | ESCI7 | 100823 | Rohde & Schwarz | 2022.01.20 | 1 year | ☒ |
| 11 | EMI Test Receiver | ESI | 837514/004 | Rohde & Schwarz | 2021.08.31 | 1 year | ☐ |
| 12 | Vector Signal Analyzer | 89441A | 3416A02620 | Agilent Technology | 2022.01.20 | 1 year | ☐ |
| 13 | Network Analyzer | 8753ES | US39172348 | AGILENT | 2021.09.01 | 1 year | ☐ |
| 14 | EPM Series Power meter | E4418B | GB39512547 | Agilent Technology | 2022.01.19 | 1 year | ☐ |
| 15 | RF Power Sensor | E9300A | MY41496631 | Agilent Technology | 2022.01.19 | 1 year | ☐ |
| 16 | Microwave Frequency Counter | 5352B | 2908A00480 | Agilent Technology | 2022.01.19 | 1 year | ☐ |
| 17 | Audio Analyzer | 8903B | 3514A16919 | Agilent Technology | 2022.01.19 | 1 year | ☒ |
| 18 | Audio Telephone Analyzer | DD-5601CID | 520010281 | CREDIX | 2022.01.18 | 1 year | ☐ |
| 19 | Modulation Analyzer | 8901A | 3041A05716 | H.P | 2022.01.18 | 1 year | ☒ |
| 20 | Digital storage Oscilloscope | TDS3052 | B015962 | Tektronix | 2021.08.31 | 1 year | ☐ |
| 21 | ESG-D Series Signal Generator | E4436B | US39260458 | Agilent Technology | 2022.01.18 | 1 year | ☒ |
| 22 | Vector Signal Generator | SMBV100A | 257557 | Rohde & Schwarz | 2022.01.18 | 1 year | ☐ |
| 23 | GNSS Signal Generator | TC-2800A | 2800A000494 | TESCOM CO., LTD. | 2022.01.19 | 1 year | ☐ |
| 24 | Signal Generator | SMB100A | 179628 | Rohde & Schwarz | 2022.05.04 | 1 year | ☒ |
| 25 | Signal Generator | N5173B | MY57280148 | KEYSIGHT | 2022.06.11 | 1 year | ☐ |
| 26 | SLIDAC | None | 0207-4 | Myoung sung Ele. | 2022.01.20 | 1 year | ☐ |
| 27 | DC Power supply | DRP-5030 | 9028029 | Digital Electronic Co.,Ltd | 2022.01.20 | 1 year | ☐ |
| 28 | DC Power supply | E3610A | KR24104505 | Agilent Technology | 2022.01.19 | 1 year | ☐ |
| 29 | DC Power supply | UP-3005T | 68 | Unicon Co.,Ltd | 2022.01.20 | 1 year | ☐ |
| 30 | DC Power Supply | SM 3004-D | 114701000117 | DELTA ELEKTRONIKA | 2022.01.19 | 1 year | ☐ |
| 31 | DC Power supply | 6632B | MY43004005 | Agilent Technology | 2022.01.20 | 1 year | ☐ |
| 32 | DC Power Supply | 6632B | MY43004137 | Agilent Technology | 2022.01.20 | 1 year | ☒ |
| 33 | Termination | 1433-3 | LM718 | WEINSCHEL | 2022.07.16 | 1 year | ☐ |
| 34 | Termination | 1432-3 | QR946 | AEROFLEX/WEINSCHEL | 2022.07.16 | 1 year | ☐ |
| 35 | Attenuator | 24-30-34 | BX5630 | Aeroflex / Weinschel | 2021.12.04 | 1 year | ☐ |
| 36 | Attenuator | 8498A | 3318A09485 | HP | 2022.01.19 | 1 year | ☒ |
| 37 | Step Attenuator | 8494B | 3308A32809 | HP | 2022.01.19 | 1 year | ☐ |
| 38 | RF Step Attenuator | RSP | 100091 | Rohde & Schwarz | 2022.01.19 | 1 year | ☐ |
| 39 | Attenuator | 18B50W-20F | 64671 | INMET | 2022.01.19 | 1 year | ☐ |
| 40 | Attenuator | 10 dB | 1 | Rohde & Schwarz | 2022.05.04 | 1 year | ☐ |
| 41 | Attenuator | 54A-10 | 74564 | WEINSCHEL | 2021.09.02 | 1 year | ☐ |
| 42 | Attenuator | 56-10 | 66920 | WEINSCHEL | 2022.05.04 | 1 year | ☐ |
| 43 | Attenuator | 48-30-33-LIM | BL5350 | Weinschel Corp. | 2022.07.16 | 1 year | ☐ |
| 44 | Power divider | 11636B | 51212 | HP | 2022.01.21 | 1 year | ☐ |
| 45 | 3Way Power divider | KPDSU3W | 00070365 | KMW | 2021.08.31 | 1 year | ☐ |
| 46 | 4Way Power divider | 70052651 | 173834 | KRYTAR | 2022.01.19 | 1 year | ☐ |
| 47 | 3Way Power divider | 1580 | SQ361 | WEINSCHEL | 2022.05.04 | 1 year | ☐ |
| 48 | OSP | OSP120 | 101577 | Rohde & Schwarz | 2022.06.14 | 1 year | ☐ |
| 49 | White noise audio filter | ST31EQ | 101902 | SoundTech | 2021.08.31 | 1 year | ☐ |
| 50 | Dual directional coupler | 778D | 17693 | HEWLETT PACKARD | 2022.01.19 | 1 year | ☐ |

| No. | Instrument | Model | S/N | Manufacturer | Next Cal Date | Cal interval | used |
|---|---|---|---|---|---|---|---|
| 51 | Dual directional coupler | 772D | 2839A00924 | HEWLETT PACKARD | 2022.01.19 | 1 year | ☐ |
| 52 | Band rejection filter | 3TNF-0006 | 26 | DOVER Tech | 2022.01.19 | 1 year | ☐ |
| 53 | Band rejection filter | 3TNF-0007 | 311 | DOVER Tech | 2022.01.19 | 1 year | ☐ |
| 54 | Band rejection filter | WTR-BRF2442-84NN | 09020001 | WAVE TECH Co.,LTD | 2022.01.19 | 1 year | ☐ |
| 55 | Band rejection filter | WRCJV12-5695-5725-5825-5855-50SS | 1 | Wainwright Instruments GmbH | 2022.05.04 | 1 year | ☐ |
| 56 | Band rejection filter | WRCJV12-5120-5150-5350-5380-40SS | 4 | Wainwright Instruments GmbH | 2022.05.04 | 1 year | ☐ |
| 57 | Band rejection filter | WRCGV10-2360-2400-2500-2540-50SS | 2 | Wainwright Instruments GmbH | 2022.05.04 | 1 year | ☐ |
| 58 | Band rejection filter | CTF-155M-S1 | 001 | RF One Electronics | 2021.08.31 | 1 year | ☐ |
| 59 | Band rejection filter | CTF-435M-S1 | 001 | RF One Electronics | 2021.08.31 | 1 year | ☒ |
| 60 | Band rejection filter | CTF-5890M-70MS1 | 1 | RF One Electronics | 2022.01.19 | 1 year | ☐ |
| 61 | Highpass Filter | WHJS1100-10EF | 1 | WAINWRIGHT | 2022.01.19 | 1 year | ☒ |
| 62 | Highpass Filter | WHJS3000-10EF | 1 | WAINWRIGHT | 2022.01.19 | 1 year | ☐ |
| 63 | Highpass Filter | WHNX6-5530-7000-26500-40CC | 2 | Wainwright Instruments GmbH | 2022.05.04 | 1 year | ☐ |
| 64 | Highpass Filter | WHNX6-2370-3000-26500-40CC | 4 | Wainwright Instruments GmbH | 2022.05.04 | 1 year | ☐ |
| 65 | WideBand Radio Communication Tester | CMW500 | 102276 | Rohde & Schwarz | 2022.01.19 | 1 year | ☐ |
| 66 | WideBand Radio Communication Tester | CMW500 | 117235 | Rohde & Schwarz | 2022.01.19 | 1 year | ☐ |
| 67 | WideBand Radio Communication Tester(with CMX500) | CMW500 | 167157 | Rohde & Schwarz | 2022.04.09 | 1 year | ☐ |
| 68 | Bluetooth Tester | TC-3000B | 3000B6A0166 | TESCOM CO., LTD. | 2022.01.18 | 1 year | ☐ |
| 69 | Loop Antenna | 6502 | 9203-0493 | EMCO | 2023.05.31 | 2 year | ☒ |
| 70 | BiconiLog Antenna | 3142B | 1745 | EMCO | 2022.04.24 | 2 year | ☒ |
| 71 | Trilog-Broadband Antenna(R) | VULB 9168 | 9168-606 | SCHWARZBECK | 2022.09.21 | 2 year | ☐ |
| 72 | Biconical Antenna(T) | VUBA9117 | 9117-342 | Schwarz beck | 2022.03.24 | 2 year | ☐ |
| 73 | Horn Antenna | 3115 | 9605-4834 | EMCO | 2022.03.06 | 2 year | ☒ |
| 74 | Horn Antenna | QMS-00208 | 21909 | STEATITE ANTENNA | 2022.12.04 | 2 year | ☐ |
| 75 | Horn Antenna(R) | 3117 | 00135191 | ETS-LINDGREN | 2022.04.29 | 2 year | ☐ |
| 76 | Horn Antenna(T) | 3115 | 2996 | EMCO | 2022.02.14 | 2 year | ☒ |
| 77 | Horn Antenna(R) | BBHA 9170 | 9170-722 | SCHWARZBECK | 2022.05.12 | 2 year | ☐ |
| 78 | Horn Antenna(T) | BBHA 9170 | 743 | SCHWARZBECK | 2023.01.21 | 2 year | ☐ |
| 79 | AMPLIFIER(A_10) | TK-PA6S | 120009 | TESTEK | 2022.01.19 | 1 year | ☒ |
| 80 | AMPLIFIER(C_3) | TK-PA01S | 200141-L | TESTEK | 2021.09.23 | 1 year | ☐ |
| 81 | PREAMPLIFIER(C_3) | 8449B | 3008A02577 | Agilent | 2022.01.19 | 1 year | ☐ |
| 82 | RF PRE AMPLIFIER | SCU08F2 | 100762 | Rohde & Schwarz | 2021.12.04 | 1 year | ☐ |
| 83 | AMPLIFIER | TK-PA18 | 150003 | TESTEK | 2022.01.21 | 1 year | ☐ |
| 84 | AMPLIFIER | TK-PA1840H | 160010-L | TESTEK | 2022.01.21 | 1 year | ☐ |
| 85 | Horn Antenna | M19RH | T01 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 86 | Horn Antenna | M19RH | R01 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 87 | Horn Antenna | M12RH | T02 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 88 | Horn Antenna | M12RH | R02 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 89 | Horn Antenna | M08RH | T03 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 90 | Horn Antenna | M08RH | R03 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 91 | Horn Antenna | M05RH | T04 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 92 | Horn Antenna | M05RH | R04 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 93 | Horn Antenna | M03RH | T05 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 94 | Horn Antenna | M03RH | R05 | OML, Inc. | 2022.05.29 | 2 year | ☐ |
| 95 | Harmonic Mixer | M12HWD | 200529-1 | OML, Inc. | 2022.07.12 | 1 year | ☐ |
| 96 | Harmonic Mixer | M08HWD | 200529-1 | OML, Inc. | 2022.07.12 | 1 year | ☐ |
| 97 | Harmonic Mixer | M05HWD | 200529-1 | OML, Inc. | 2022.07.12 | 1 year | ☐ |
| 98 | Harmonic Mixer | M03HWD | 200529-1 | OML, Inc. | 2022.07.12 | 1 year | ☐ |
| 99 | Source Module | S19MS-A | 200529-1 | OML, Inc. | 2022.07.02 | 1 year | ☐ |
| 100 | Source Module | S12MS-A | 200529-1 | OML, Inc. | 2022.07.02 | 1 year | ☐ |
| 101 | Source Module | S08MS-A | 200529-1 | OML, Inc. | 2022.07.02 | 1 year | ☐ |
| 102 | Source Module | S05MS-A | 200529-1 | OML, Inc. | 2022.07.02 | 1 year | ☐ |
| 103 | Source Module | S03MS-A | 200529-1 | OML, Inc. | 2022.07.02 | 1 year | ☐ |

# 4. SUMMARY TEST RESULTS

| Description of Test | FCC Rule | Test report Clause | Used | Test Result |
|---|---|---|---|---|
| RF Output Power | 2.1046, 74.861(e)(1)(ii) | Clause 5.1 | ☒ | Compliance |
| Modulation Characteristics | 2.1047(a), 74.861(e)(3) | Clause 5.2 | ☒ | Compliance |
| Occupied Bandwidth & Emission Mask | 2.1049(c)(i), 74.861(e)(5)(6)(7) | Clause 5.3 | ☒ | Compliance |
| Spurious Emission On Antenna Port | 2.1051, 74.861(e)(6)(iii) | Clause 5.4 | ☒ | Compliance |
| Radiated Spurious Emissions | 2.1053, 74.861(e)(6)(iii) | Clause 5.5 | ☒ | Compliance |
| Frequency Stability | 2.1055, 74.861(e)(4) | Clause 5.6 | ☒ | Compliance |
| Compliance/pass : The EUT complies with the essential requirements in the standard.<br>Not Compliance : The EUT does not comply with the essential requirements in the standard.<br>N/A : The test was not applicable in the standard. | | | | |

**Procedure Reference**

FCC CFR 47, Part 2 & 74 Subpart H-Low Power Auxiliary Stations
ANSI/TIA-603-E-2016
ANSI C63.26-2015
ANSI C63.4-2014
KDB 206256 D01

# 5. MEASUREMENT RESULTS

## 5.1 RF Output Power

### 5.1.1 Standard Applicable [FCC §74.861(e)(1)(ii) & §2.1046]

According to §74.861(e)(1)(ii)of the FCC Rules, for low power auxiliary station operating in the 470 MHz ~ 608 MHz, the power of the measured unmodulated carrier power and the output of the transmitter conducted power(antenna input power)may not exceed 250 mW.

### 5.1.2 Test Environment conditions

• Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

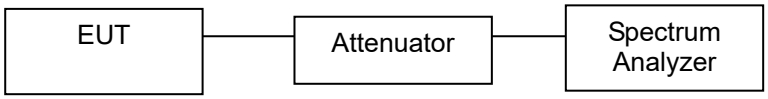
### 5.1.3 Measurement Procedure

The transmitter output was connected to the spectrum analyzer with an attenuator. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun, If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

The spectrum analyzer is set to the as follows :

- RBW : 1 MHz
- VBW : 3 MHz

### 5.1.4 Test setup




### 5.1.5 Measurement Result

| Frequency [MHz] | Power Level | Conducted output Power [mW] | Limit [dBm] | Test Results |
|---|---|---|---|---|
| 470.125 | Low | 8.68 | 250 mW | Compliance |
| 539.000 | Low | 5.26 | | Compliance |
| 607.875 | Low | 6.55 | | Compliance |
| 470.125 | High | 46.25 | 250 mW | Compliance |
| 539.000 | High | 26.01 | | Compliance |
| 607.875 | High | 36.49 | | Compliance |

## 5.2 Modulation Characteristics

### 5.2.1 Standard Applicable [FCC §Part 74.861(e)(3) §2.1047(a)]

According to §2.1047(a) of the FCC Rules, for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100 Hz to 5000 Hz shall be measured. For equipment required to have an audio low-pass filter, the frequency response of the filter, or of all circuity installed between the modulation limiter and the modulated stage shall be measured.

According to §74.861(e)(3) of the FCC Rules, any form of modulation may be used. A maximum deviation of ±75 kHz is permitted when frequency modulation is employed.

| CH spacing | Frequency deviation |
|---|---|
| 25 kHz | 75 kHz |

Part 2.1047(a) A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

| Audio frequency | Minimum Attenuation Rel. to 1 kHz Attenuation |
|---|---|
| 3 - 20 kHz | 60 log10(f/3) dB where f is in kHz |
| 20 - 30 kHz | 50 dB |

### 5.2.2 Test Environment conditions

• Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

### 5.2.3 Measurement Procedure

• Audio frequency response

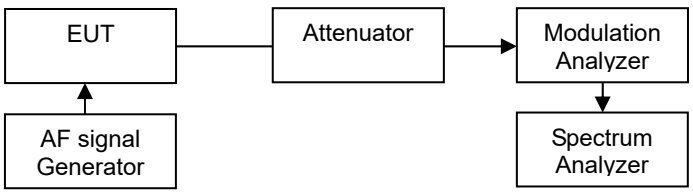
The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA-603-E-2016. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1 000, 3 000 and 5 000 Hz.

• Test frequency: Mid

• Modulation Limit

The carrier frequency deviation was measured with the tone adjust the audio input for 60 % of rated system deviation at 1 kHz using this level as a reference (0 dB) and vary the input level from –20 to +20 dB. Record the frequency deviation obtained as a function of the input level at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

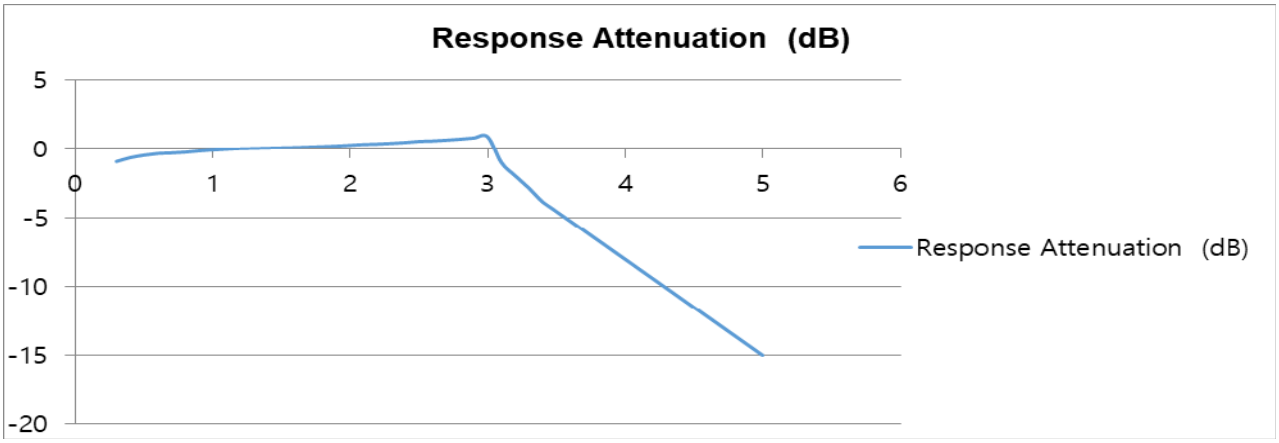
### 5.2.4 Test setup



### 5.2.5 Measurement Result

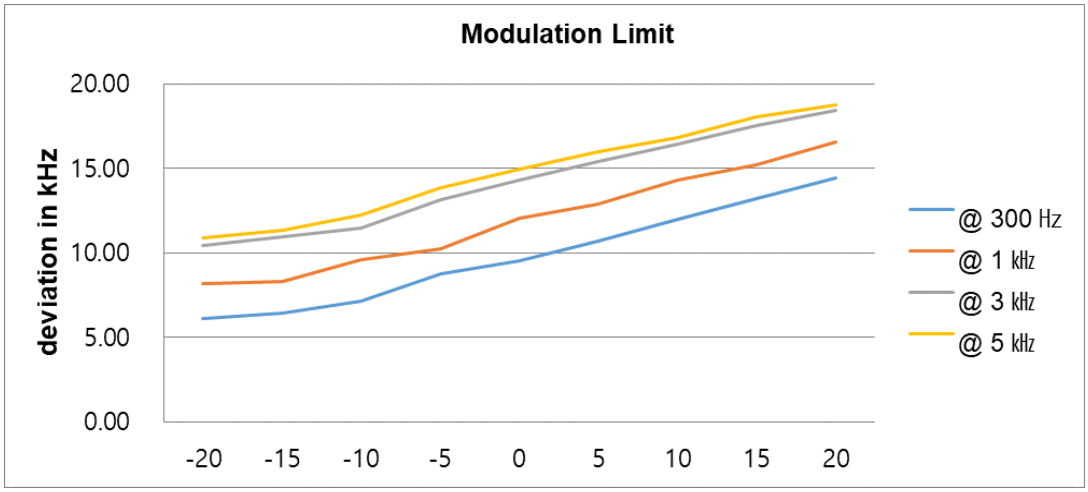
- Audio frequency response

| Audio Frequency (Hz) | Response Attenuation (dB) | Audio Frequency (Hz) | Response Attenuation (dB) |
|---|---|---|---|
| 300 | -0.87 | 2 800 | 0.72 |
| 400 | -0.59 | 2 900 | 0.79 |
| 500 | -0.41 | 3 000 | 0.88 |
| 600 | -0.29 | 3 100 | -0.96 |
| 700 | -0.25 | 3 200 | -1.91 |
| 800 | -0.19 | 3 300 | -2.83 |
| 900 | -0.11 | 3 400 | -3.87 |
| 1 000 | -0.03 | 3 500 | -4.56 |
| 1 200 | 0.08 | 4 000 | -8.17 |
| 1 400 | 0.13 | 5 000 | -15.53 |
| 1 600 | 0.18 | - | - |
| 1 800 | 0.25 | - | - |
| 2 000 | 0.35 | - | - |
| 2 100 | 0.41 | - | - |
| 2 200 | 0.44 | - | - |
| 2 300 | 0.49 | - | - |
| 2 400 | 0.55 | - | - |
| 2 500 | 0.63 | - | - |
| 2 600 | 0.66 | - | - |
| 2 700 | 0.72 | - | - |



• Modulation Limit

| Audio input Level (dB) | Frequency Deviation (kHz) | | | | Limit (kHz) |
|---|---|---|---|---|---|
| | @ 300 Hz | @ 1 kHz | @ 3 kHz | @ 5 kHz | |
| -20 | 6.12 | 8.15 | 10.41 | 10.87 | 75 |
| -15 | 4.45 | 8.32 | 10.92 | 11.32 | 75 |
| -10 | 7.17 | 9.58 | 11.48 | 12.21 | 75 |
| -5 | 8.76 | 10.20 | 13.17 | 13.84 | 75 |
| 0 | 9.51 | 12.06 | 14.30 | 14.97 | 75 |
| 5 | 10.70 | 12.89 | 15.38 | 16.01 | 75 |
| 10 | 12.01 | 14.30 | 16.40 | 16.80 | 75 |
| 15 | 13.20 | 15.20 | 17.50 | 18.20 | 75 |
| 20 | 14.40 | 16.56 | 18.40 | 18.73 | 75 |



## 5.3 Occupied Bandwidth & Emission Mask

### 5.3.1 Standard Applicable [FCC §74.861(e)(5)(6) & §2.1049(c)(1)]

With radiotelephone transmitters, according to §2.1049(c)(1) of the FCC Rules, “other than single sideband or independent sideband transmitter-when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulation circuit.” According to §74.861(e)(5) & §74.861(e)(6) of FCC Rules,

(5) the operating bandwidth shall not exceed 200 kHz

(6) (i) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;

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

(iii) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43+10\log_{10}$ (mean output power in watts) dB;

(7) Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2.2 (Figure 4) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08). The requirements of this paragraph (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in §73.3700(a)(2) of this chapter.

### 5.3.2 Test Environment conditions

• Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

### 5.3.3 Measurement Procedure

• **Occupied Bandwidth**

The EUT was modulated by 2.5 kHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50 % of rated system deviation. Rated system deviation is 75 kHz.

The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.

Measure the maximum width of the emission that is 26 dB down from the peak of the emission. The 99 % occupied bandwidth is the frequency bandwidth of the signal power at the 99 % channel power of occupied bandwidth.

The spectrum analyzer is set to the as follows :

- RBW : 1 kHz
- VBW : >3 x RBW
- Detector function : peak
- Trace : max hold

**• Emission Mask**

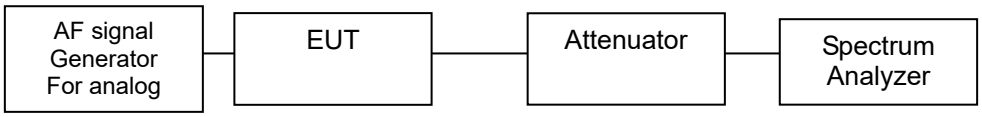
• Voice Modulation Through a Voice Input Port @ 2.1049(c)(1)

The transmitter was modulated by a 2.5 kHz tone signal at an input level 16 dB greater than that required to produce 50 % modulation (e.g.: ±75 kHz peak deviation at 1 kHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

The spectrum analyzer is set to the as follows

- RBW = 1 kHz
- VBW: >3 x RBW”

### 5.3.4 Test setup




### 5.3.5 Measurement Result

| Frequency [MHz] | Power Level | 99 % Bandwidth [kHz] | Limit [kHz] | Test Results |
|---|---|---|---|---|
| 470.125 | Low | 101.99 | ≤200 | Compliance |
| 539.000 | Low | 101.99 | | Compliance |
| 607.875 | Low | 101.88 | | Compliance |
| 470.125 | High | 102.09 | ≤200 | Compliance |
| 539.000 | High | 102.24 | | Compliance |
| 607.875 | High | 102.25 | | Compliance |

* Emission Designator :
- Calculated Emission : 2M + 2D = (2 x 2.5 kHz) + (2 x 50 kHz) = 105kF3E

## 5.3.6 Test Plot

99 % band width / Power level: Low

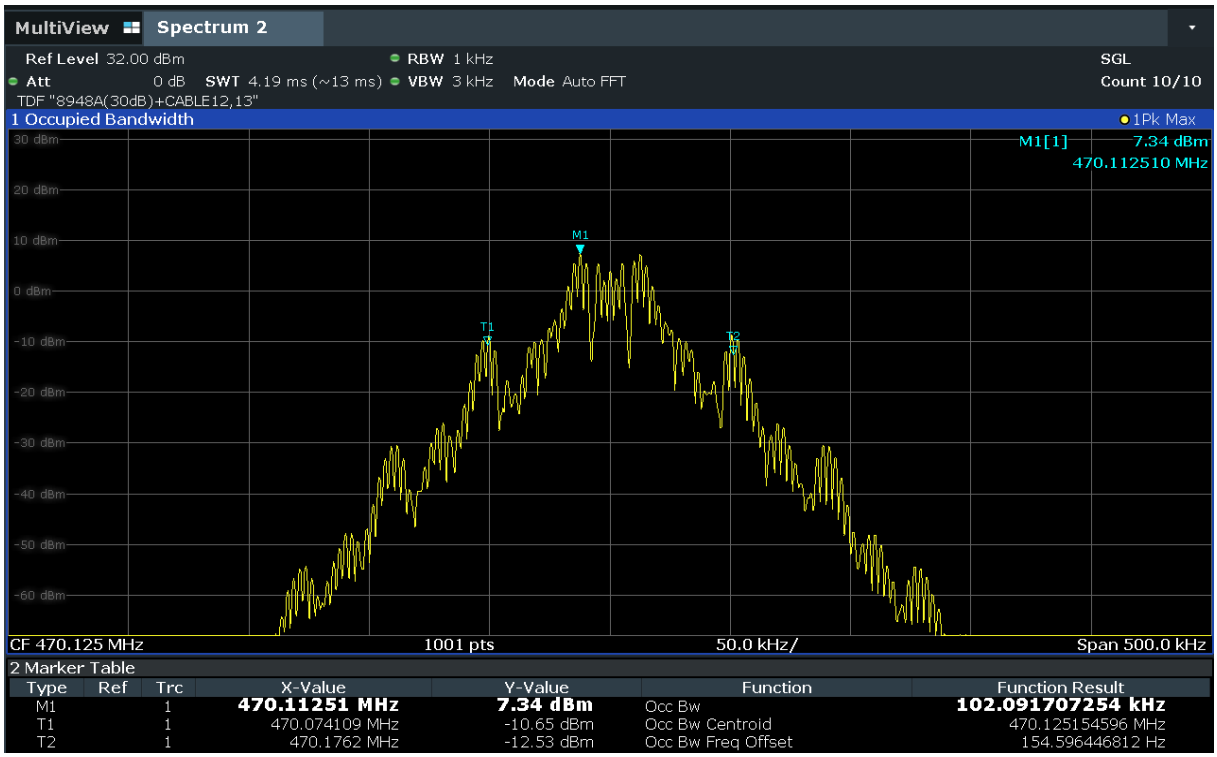
CH Low : 470.125 MHz


CH Middle : 539.000 MHz

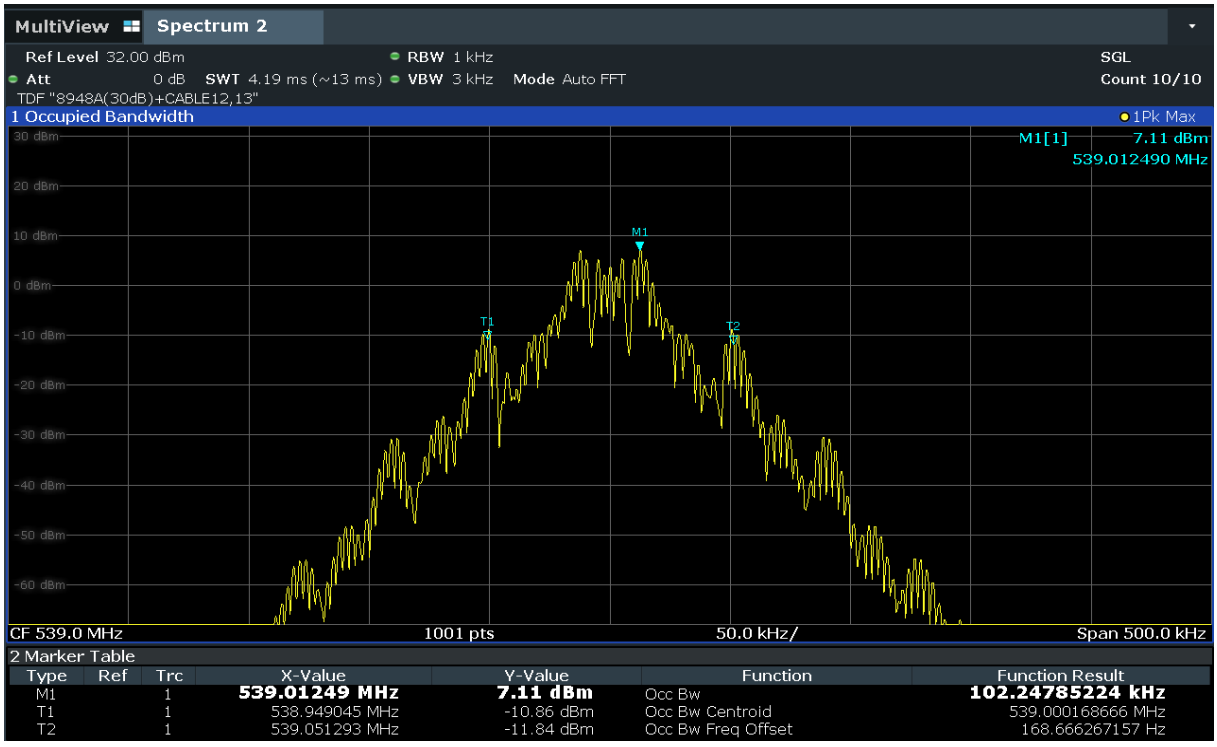
CH High : 607.875 MHz

## 99 % band width / Power level: High

CH Low : 470.125 MHz



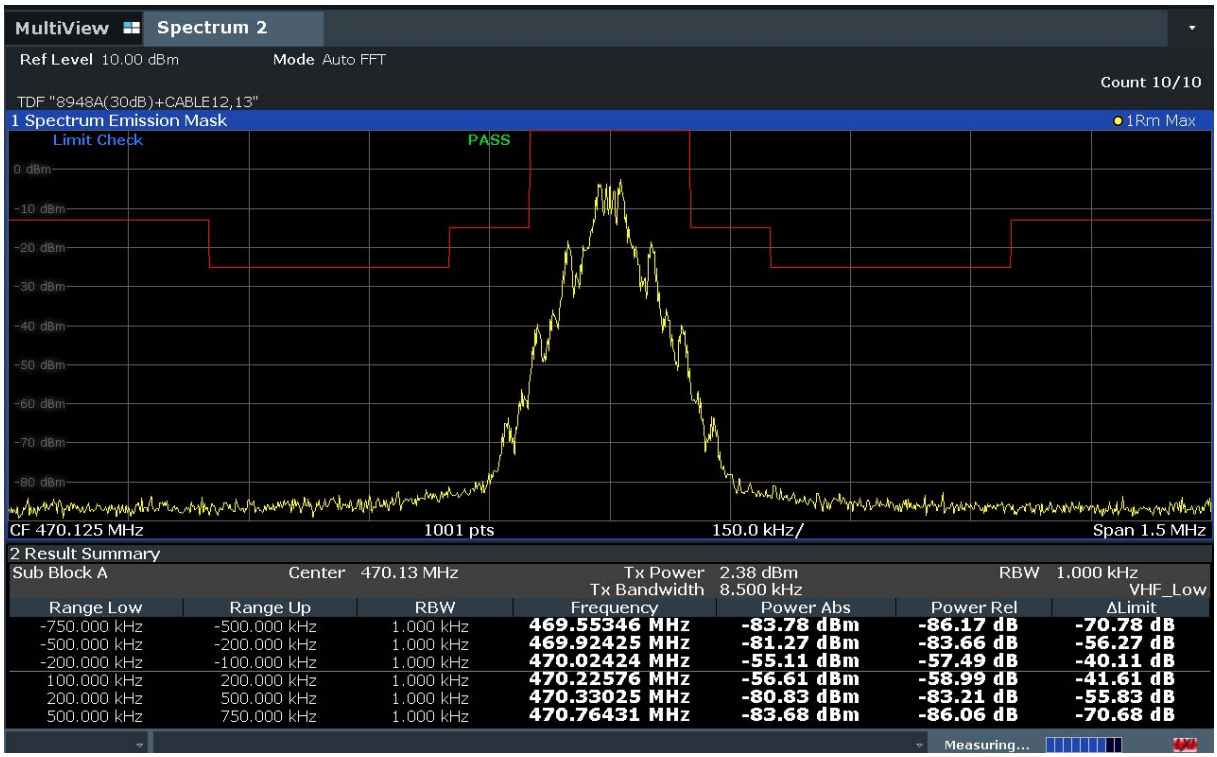

CH Middle : 539.000 MHz



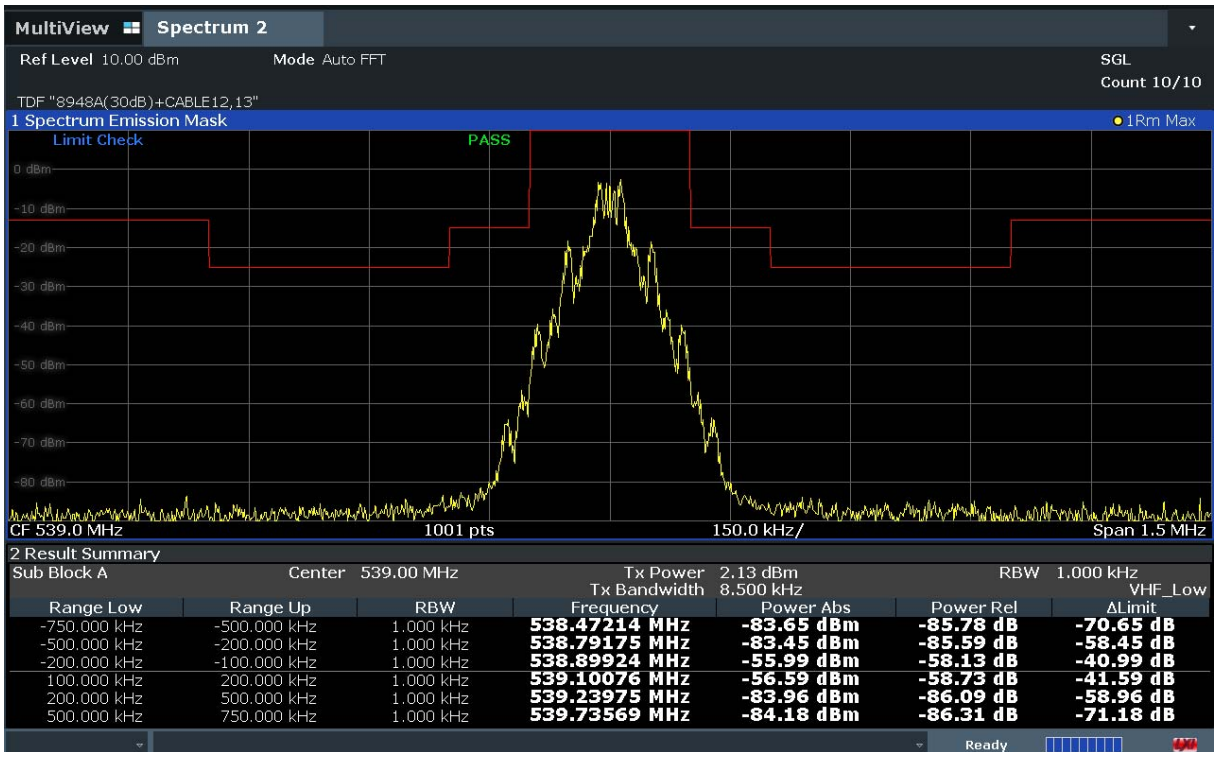
CH High : 607.875 MHz

## Emission Mask 1 / Power level: Low

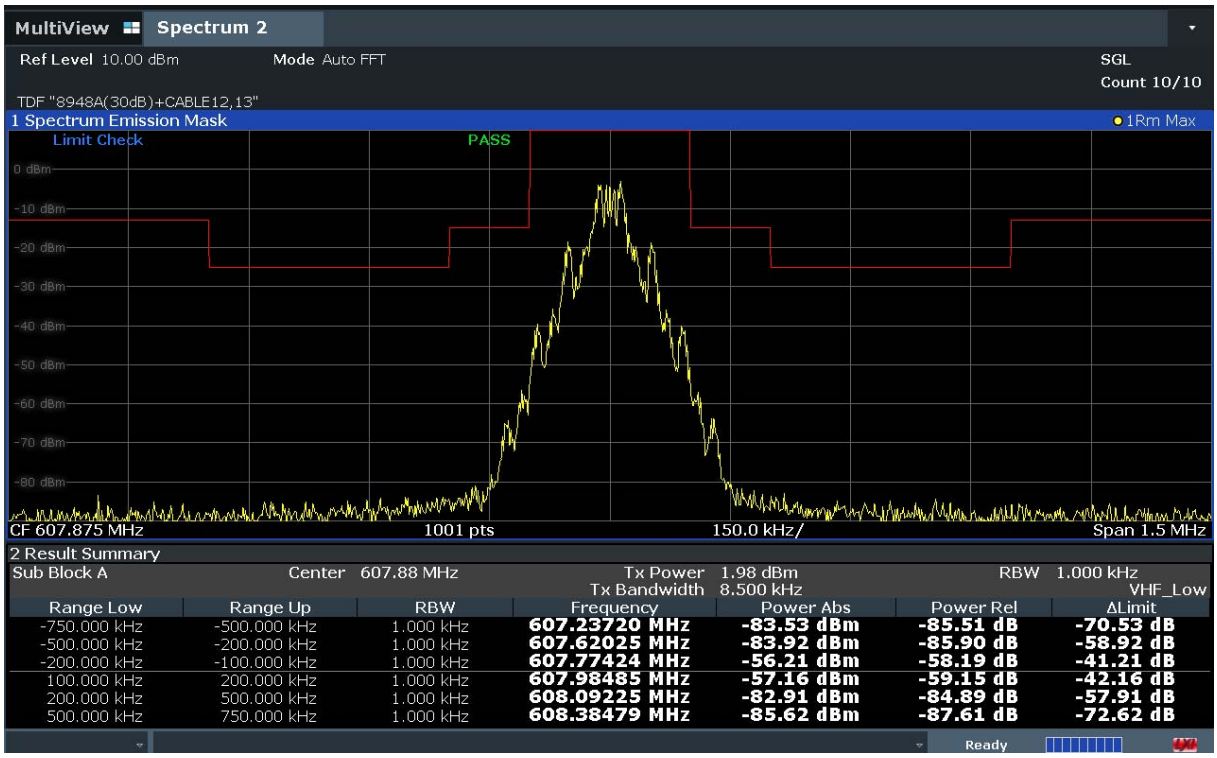
CH Low : 470.125 MHz




CH Middle : 539.000 MHz

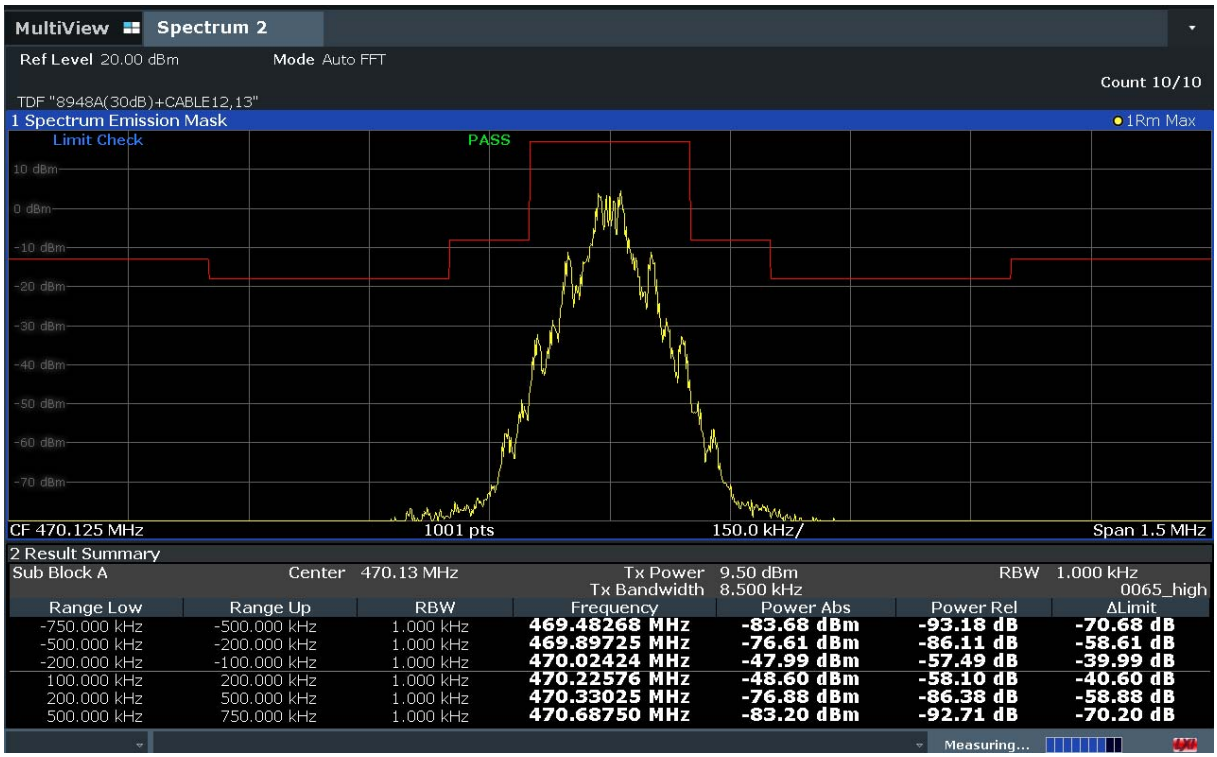


CH High : 607.875 MHz

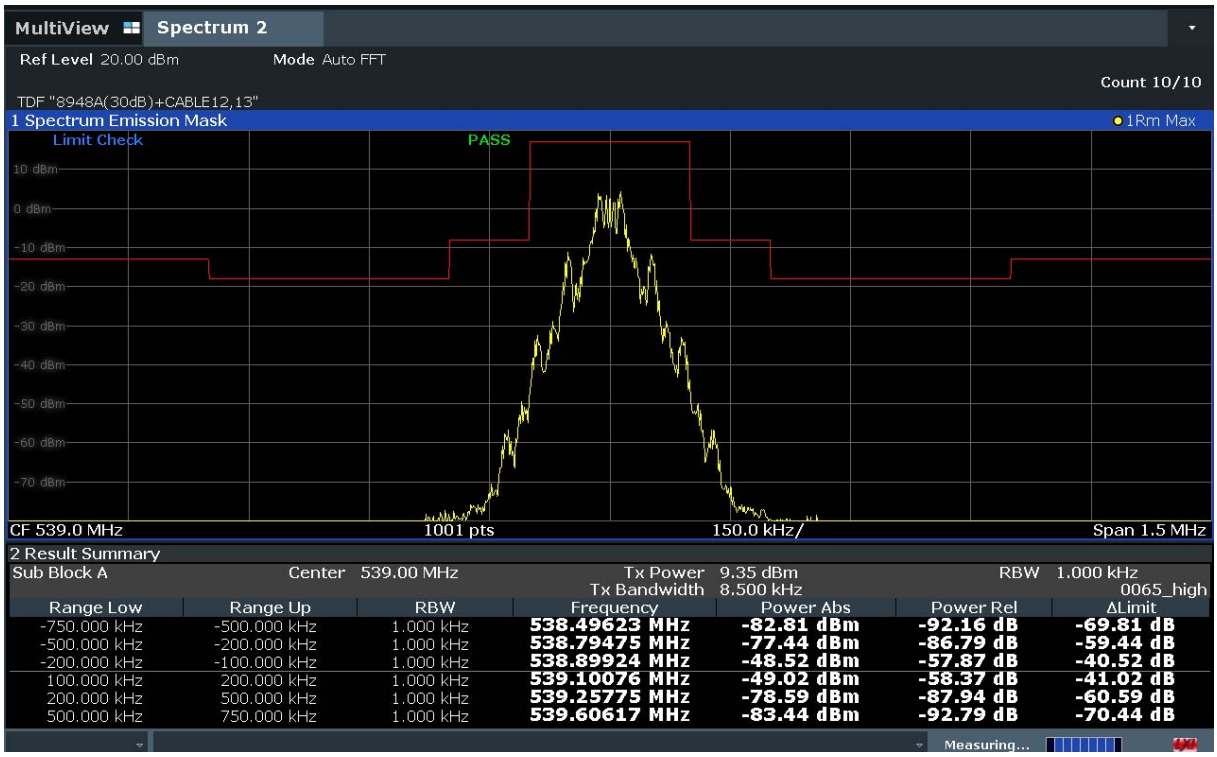


## Emission Mask 1 / Power level: High

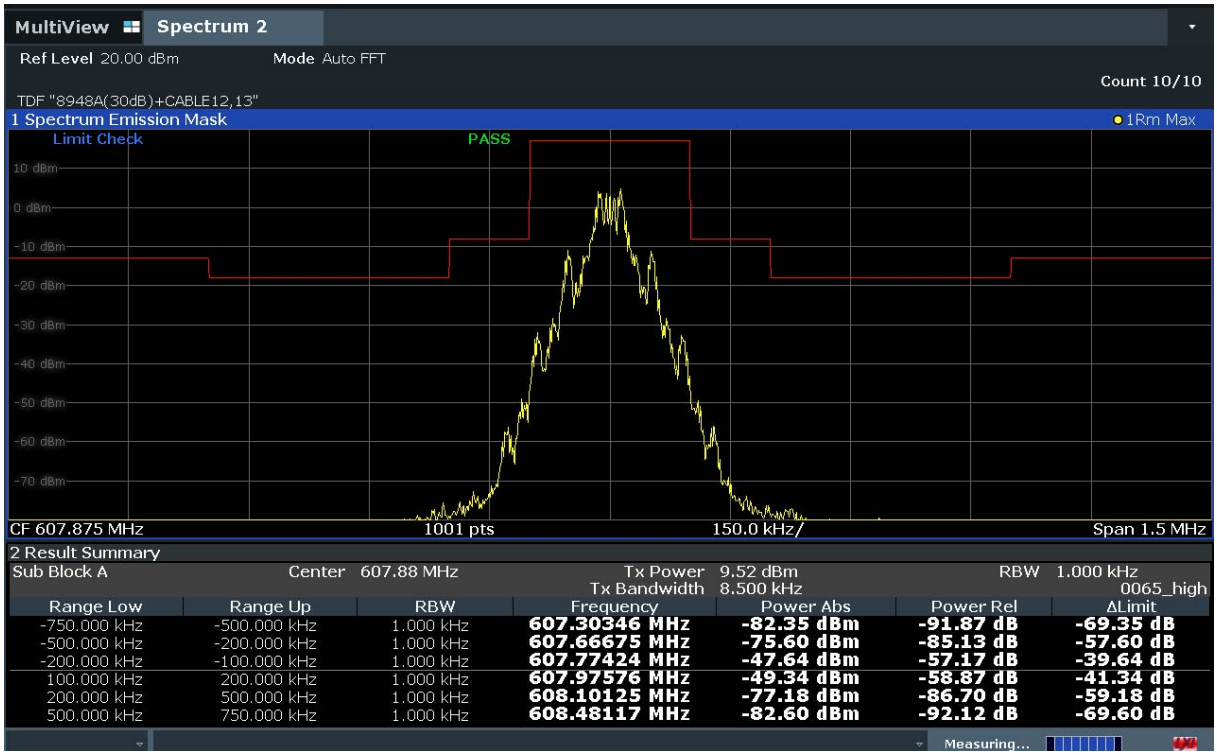
CH Low : 470.125 MHz




CH Middle : 539.000 MHz

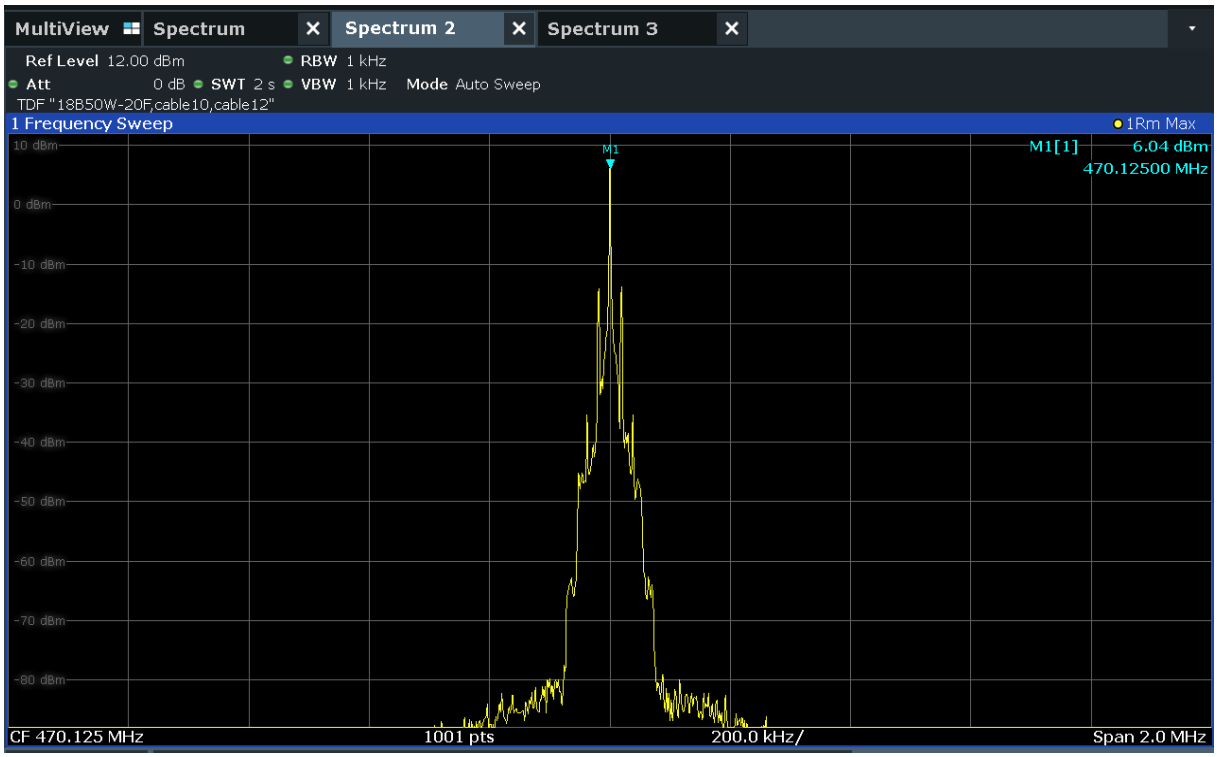


CH High : 607.875 MHz

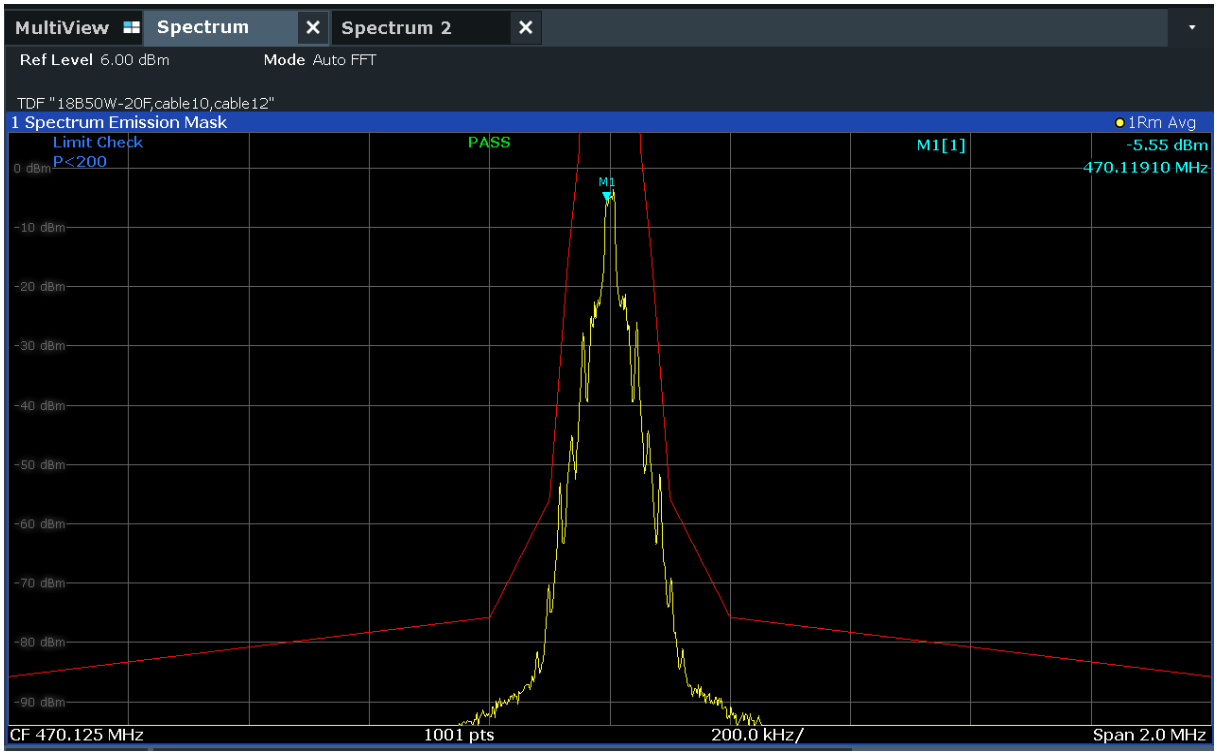


## Emission Mask 2 / Power level: Low

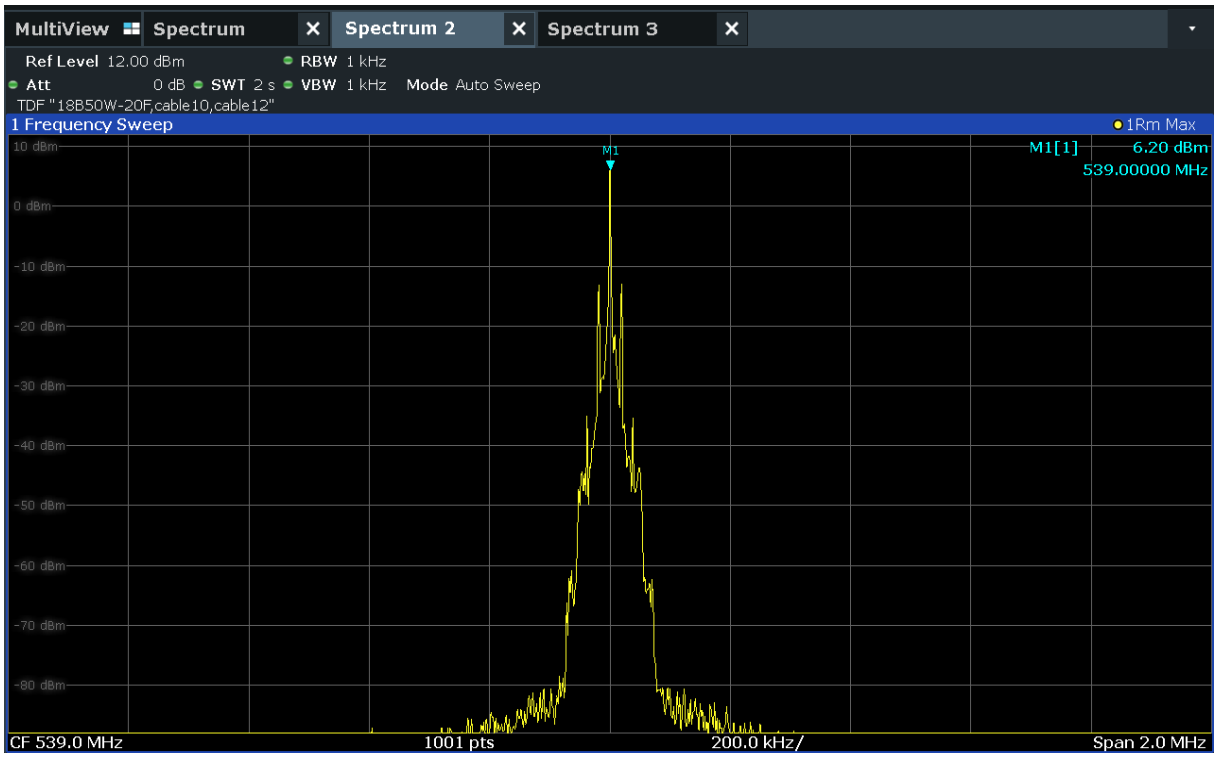
CH Low : 470.125 MHz Reference



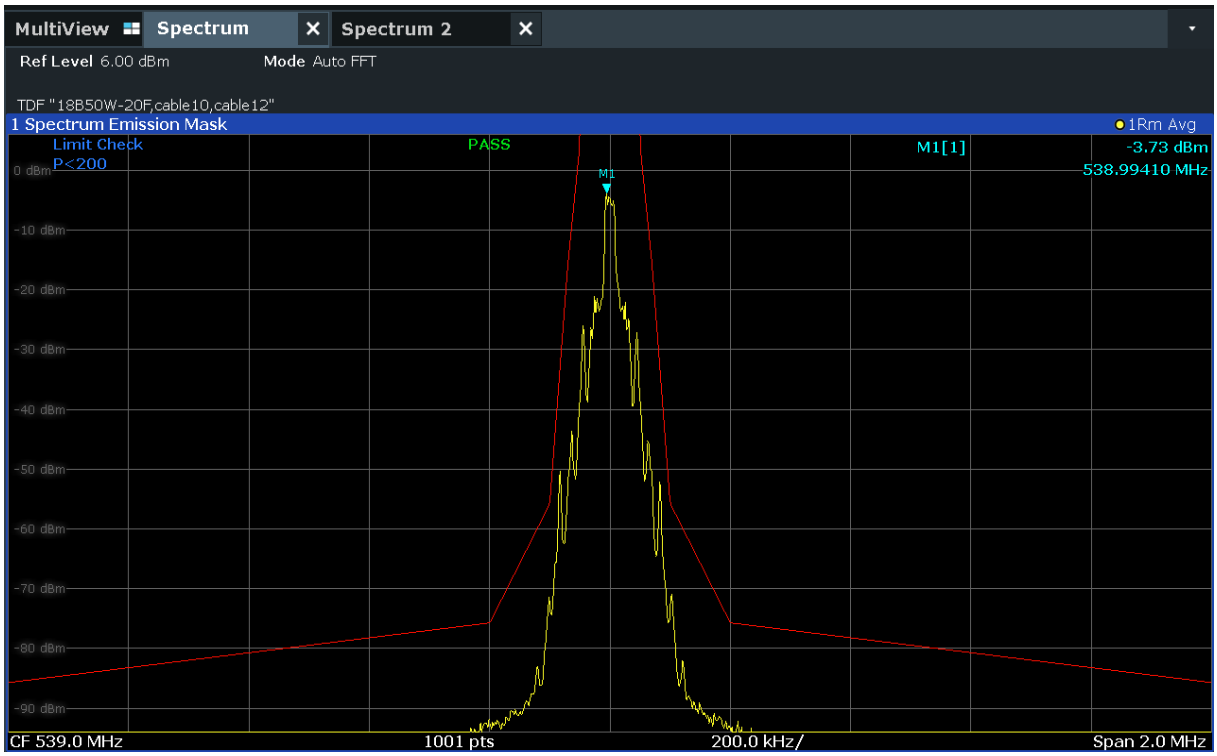

CH Low : 470.125 MHz



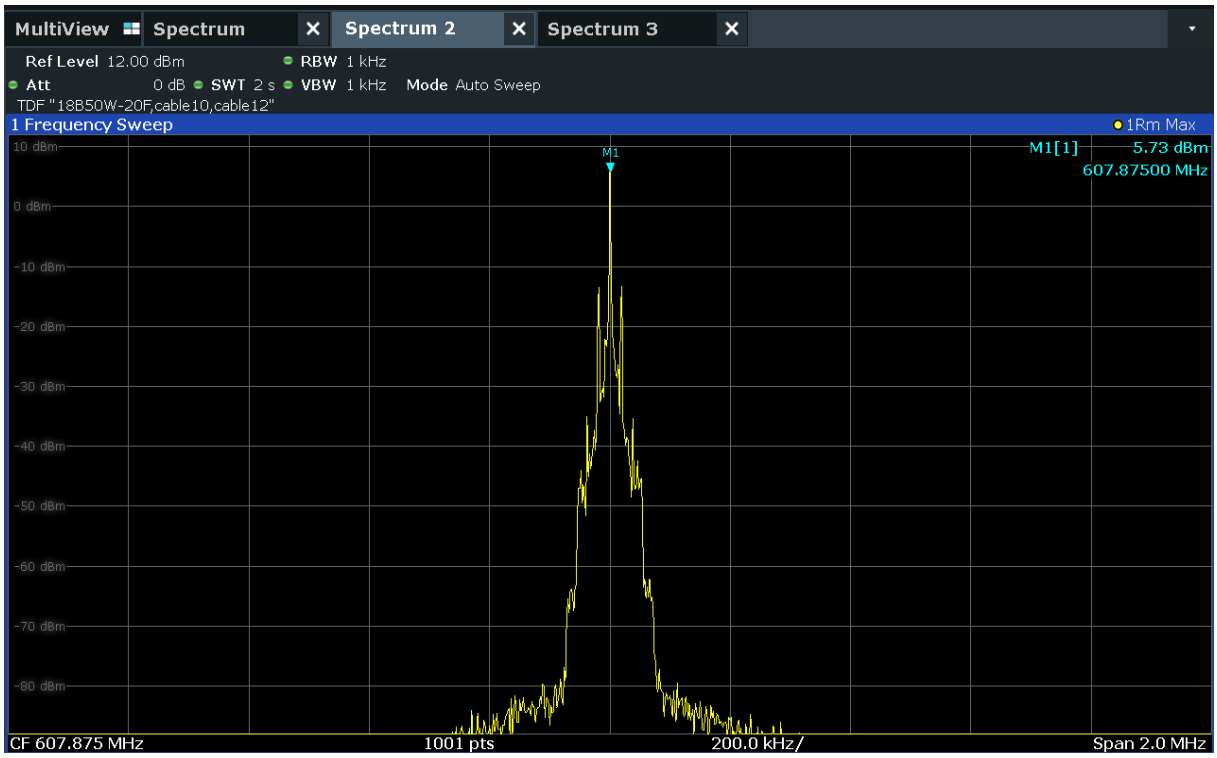
CH Middle : 539.000 MHz Reference



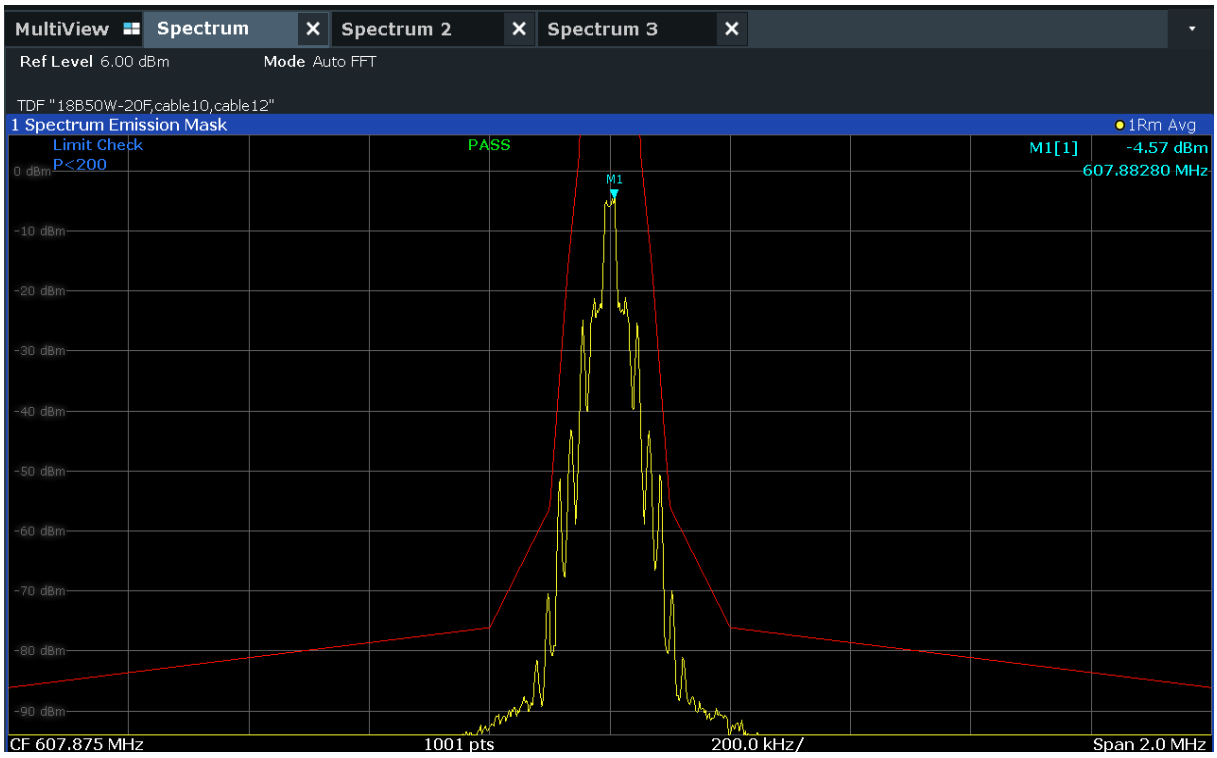

CH Middle : 539.000 MHz



CH High : 607.875 MHz Reference

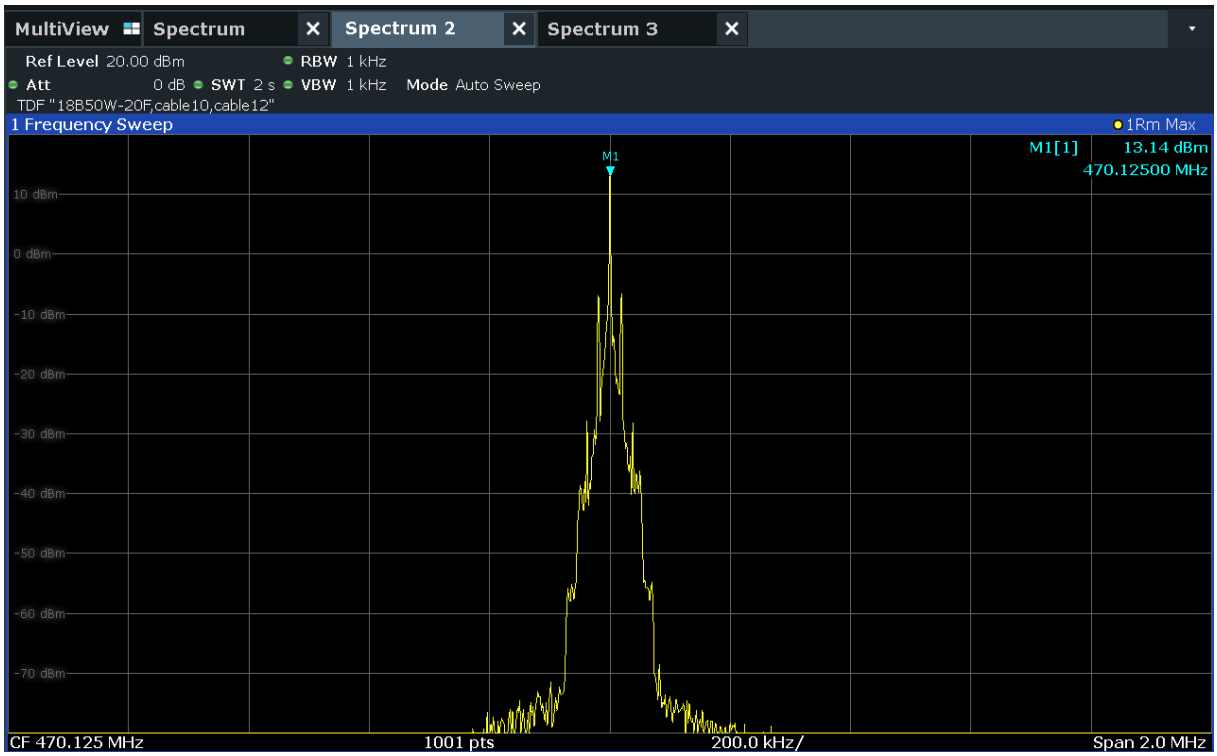



CH High : 607.875 MHz

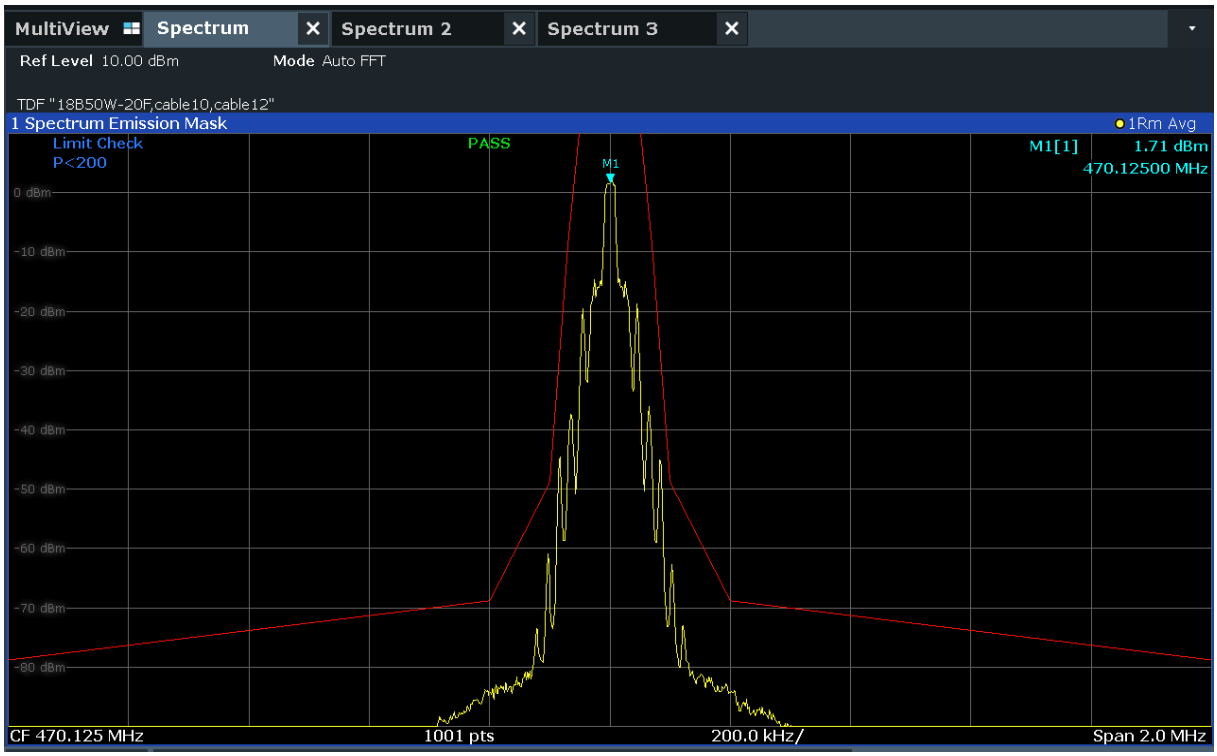


## Emission Mask 2 / Power level: High

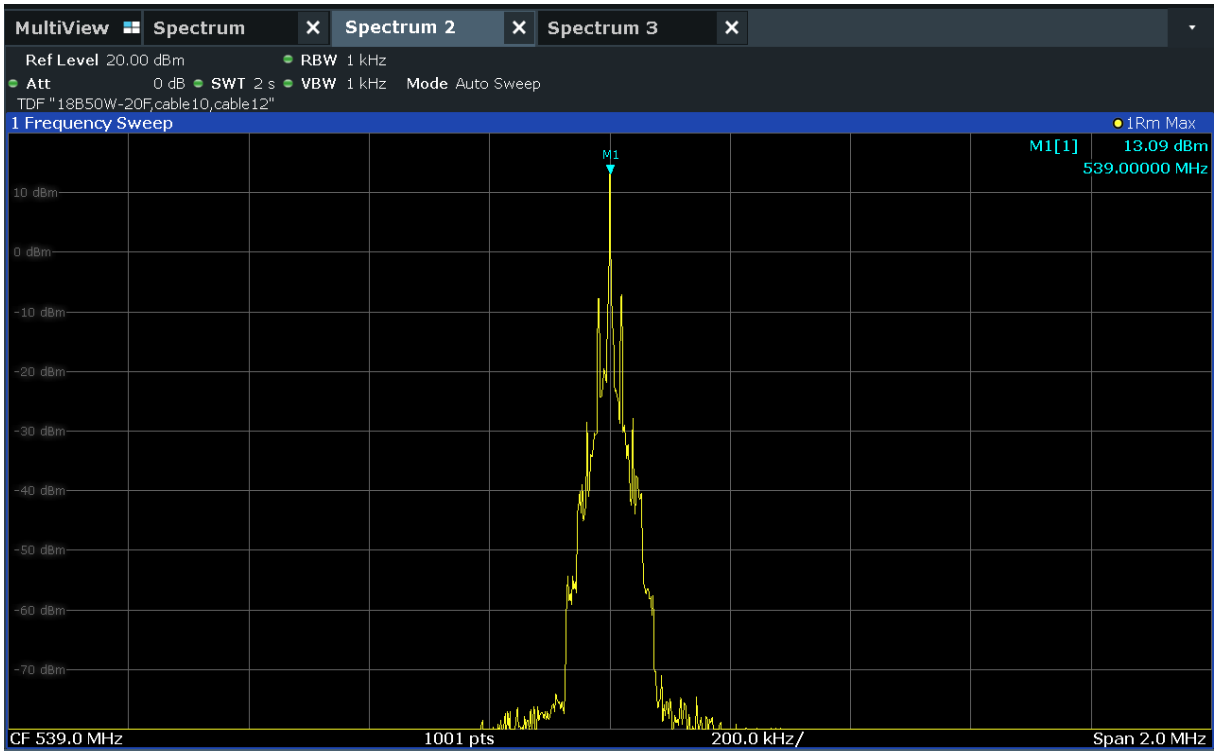
CH Low : 470.125 MHz Reference



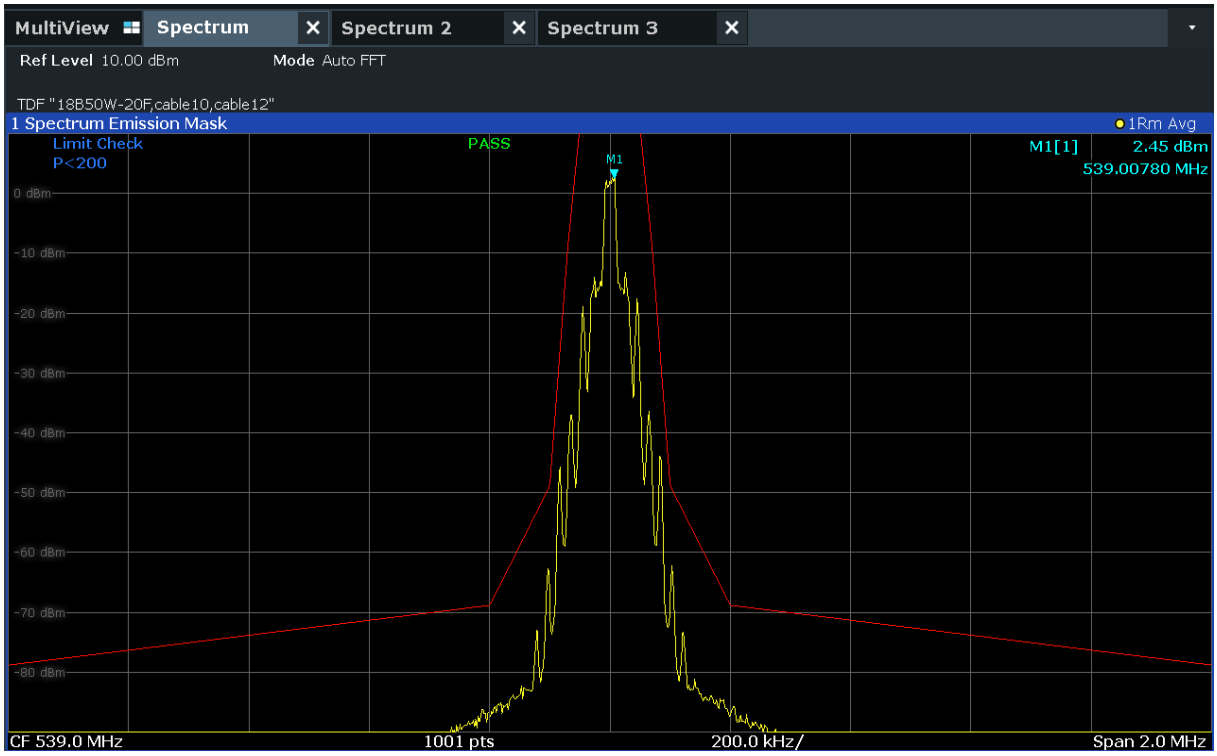

CH Low : 470.125 MHz



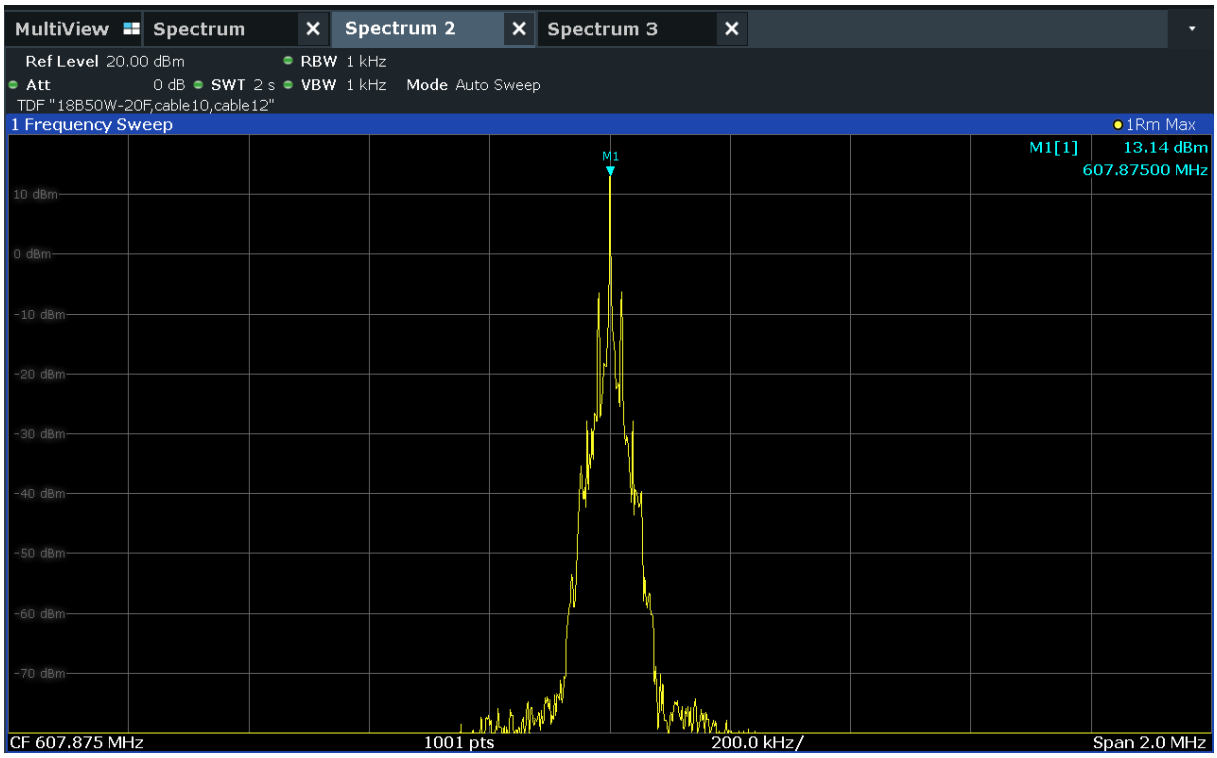
CH Middle : 539.000 MHz Reference



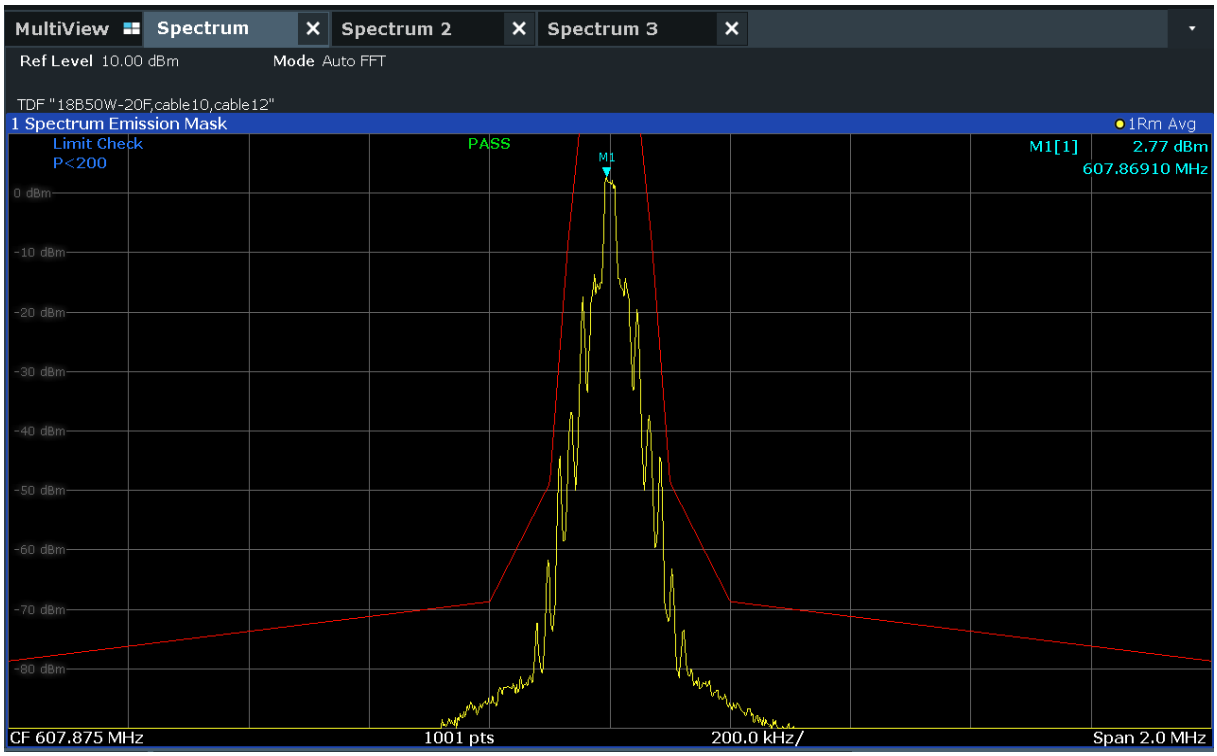

CH Middle : 539.000 MHz Reference



CH High : 607.875 MHz Reference




CH High : 607.875 MHz



## 5.4 Spurious Emission On Antenna Port

### 5.4.1 Standard Applicable [FCC §74.861(e)(6)(iii), §2.1051]

According to §2.1051 of the FCC Rules, the radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be specified

According to §74.861(e)(6) of the FCC Rules, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(iii) On any frequency removed from the operating frequency by more than 250 percent up to and including 250 percent of the authorized bandwidth: at least 43 plus $10\log_{10}$(output power in watts) dB.

### 5.4.2 Test Environment conditions

• Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

### 5.4.3 Measurement Procedure

The carrier was modulated 100 % using a 2 500 Hz tone. The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA-603-E-2016. The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

### 5.4.4 Test setup

Refer 5.3.4

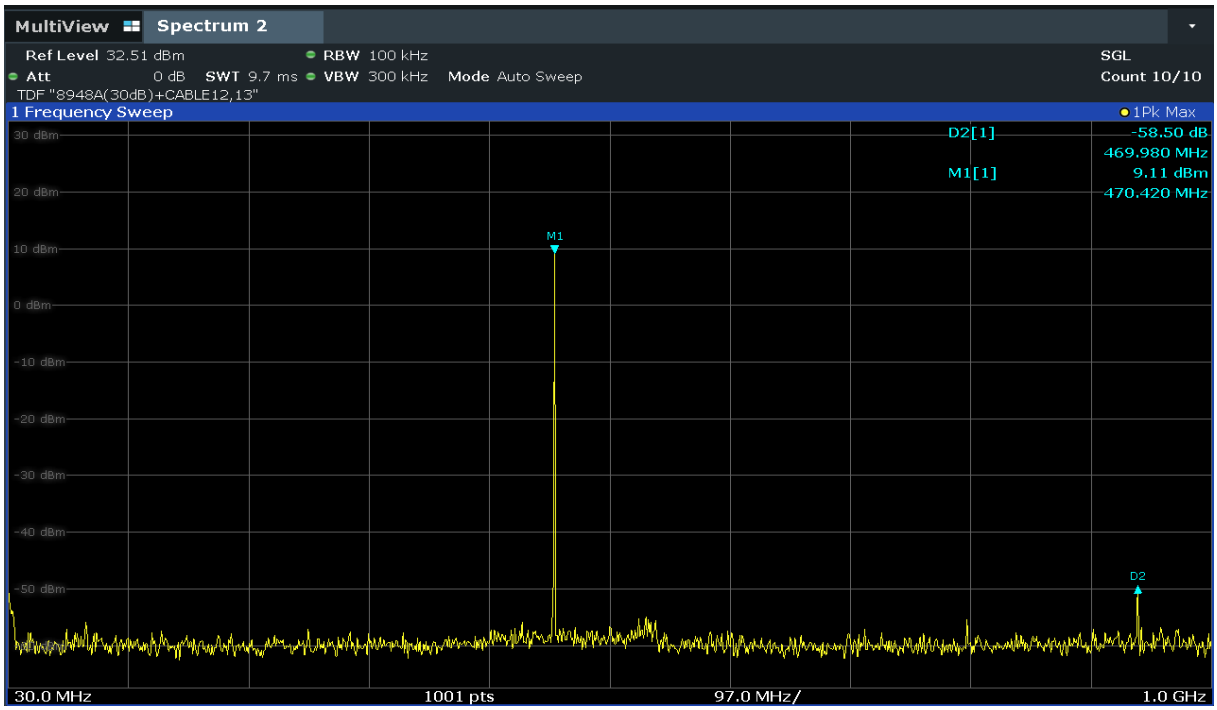
### 5.4.5 Measurement Result

See the 5.4.6 Test plots

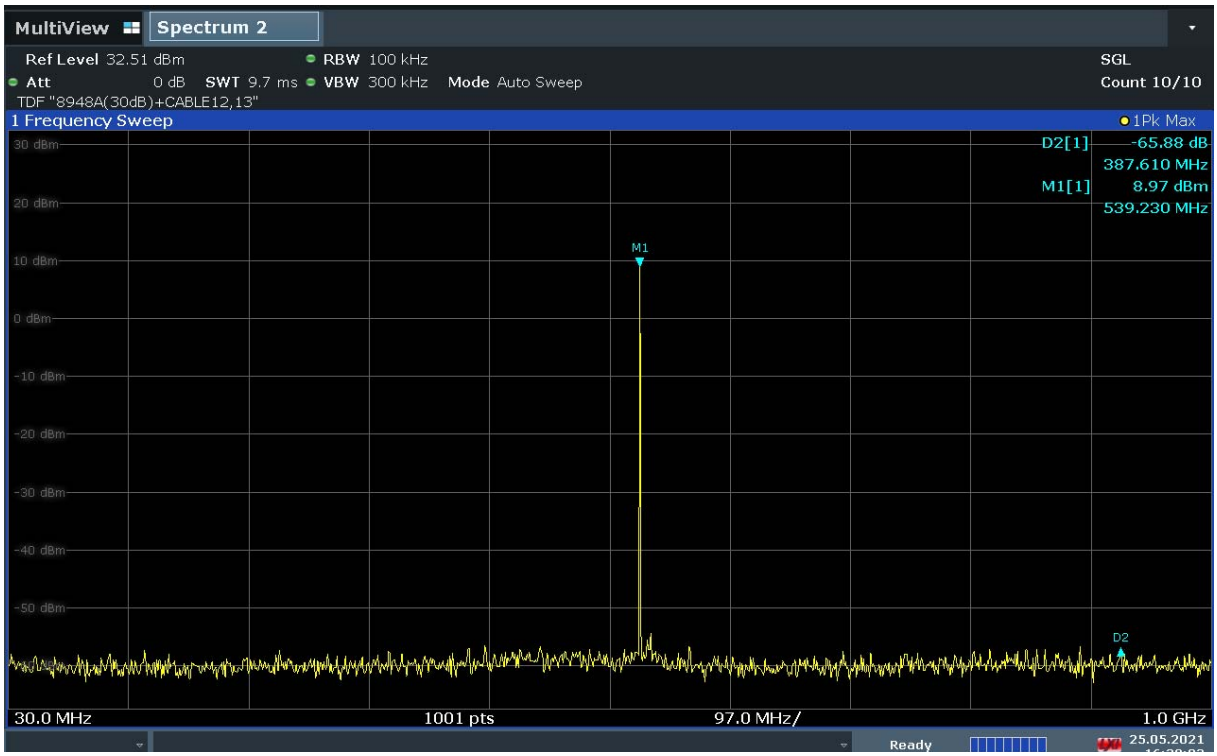
5.4.6 Test Plot

Below 1GHz / Power level: Low

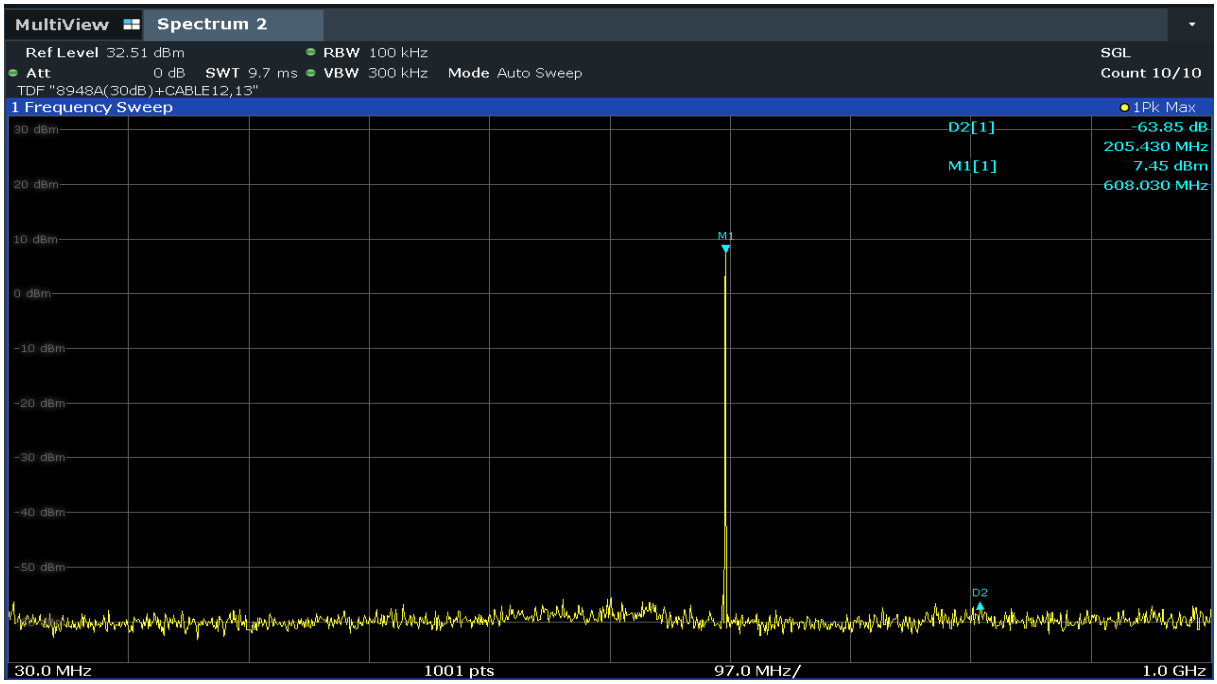
CH Low : 470.125 MHz




CH Middle : 539.000 MHz

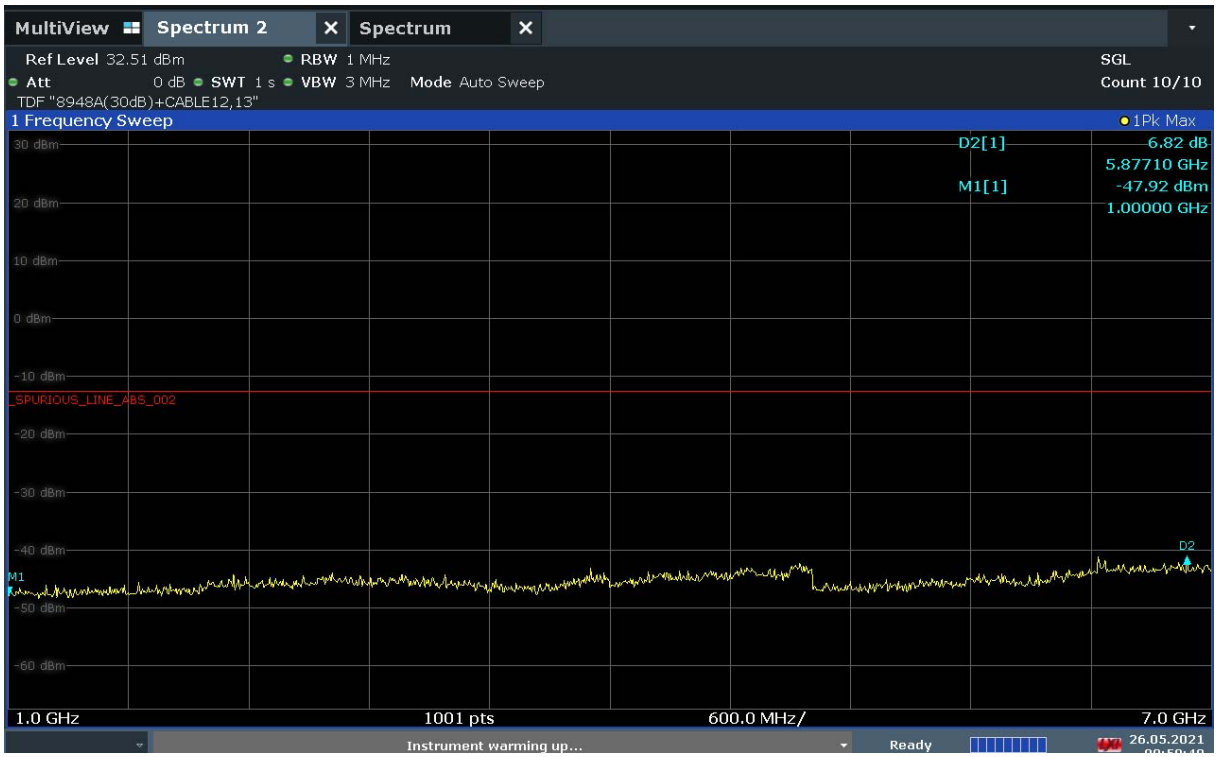


CH High : 607.875MHz

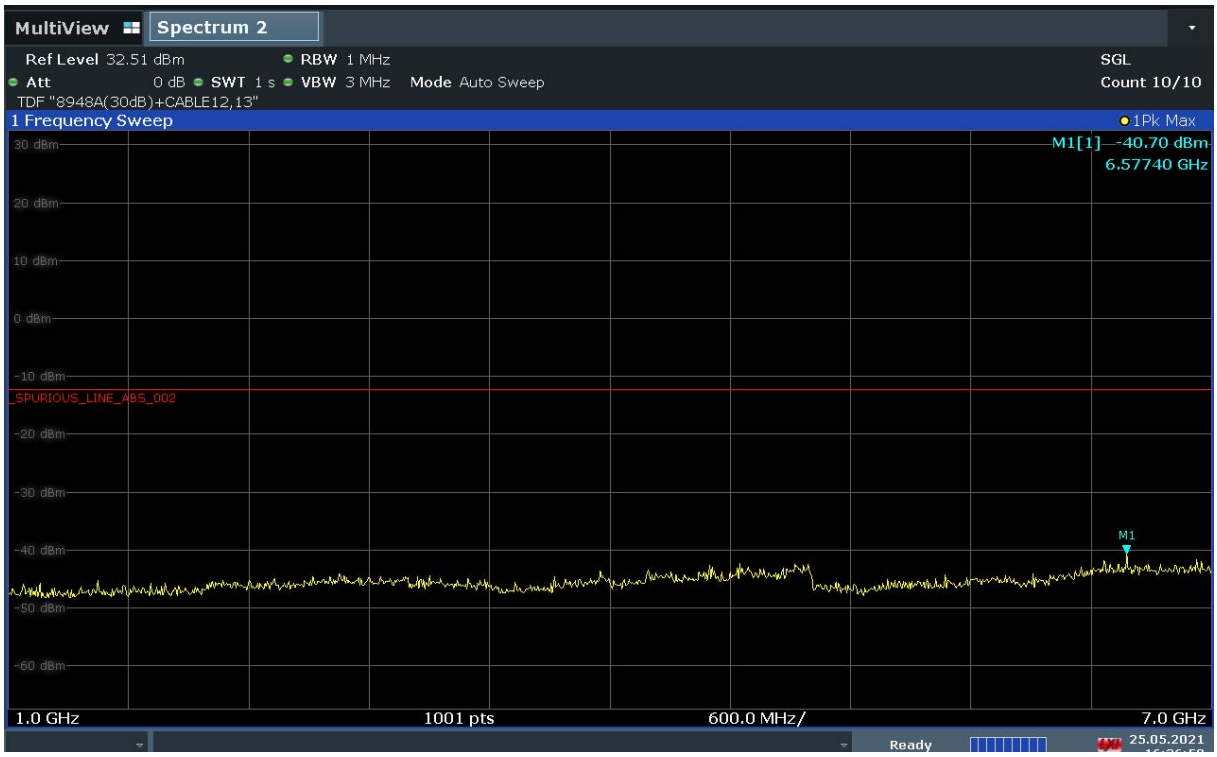


## Above 1GHz / Power level: Low

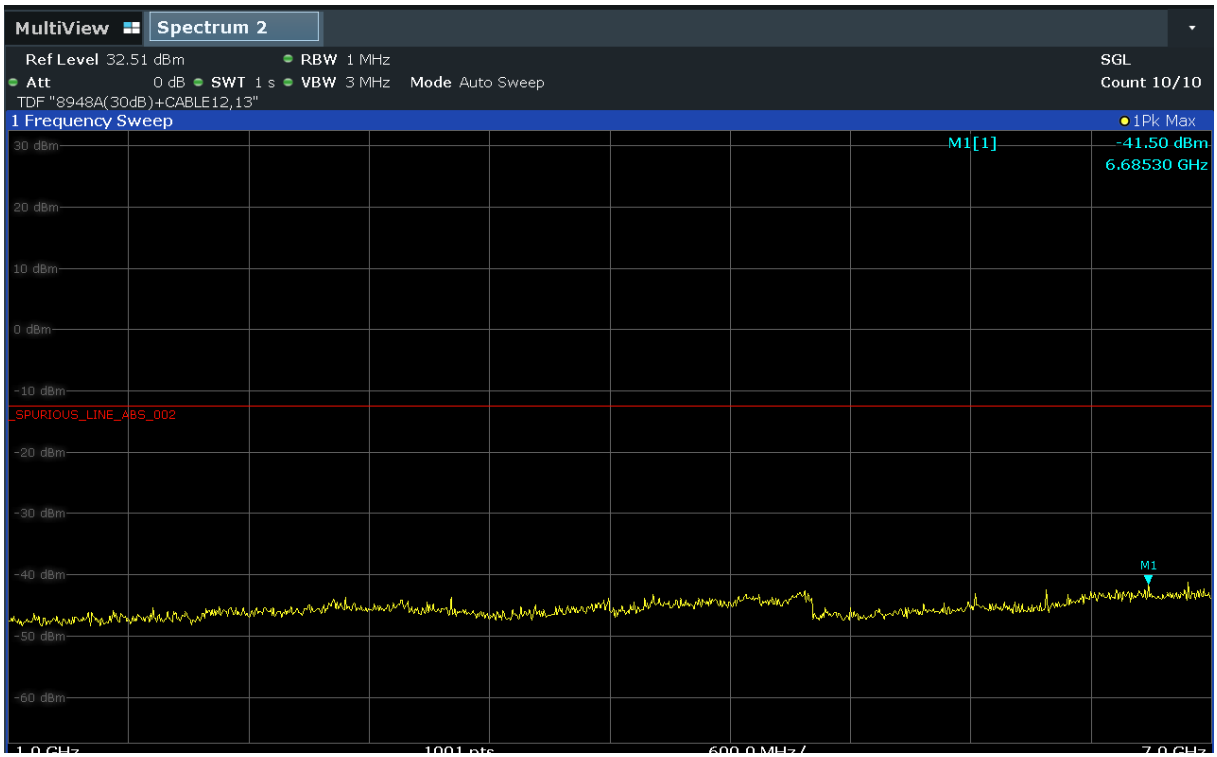
CH Low : 470.125 MHz




CH Middle : 539.000 MHz



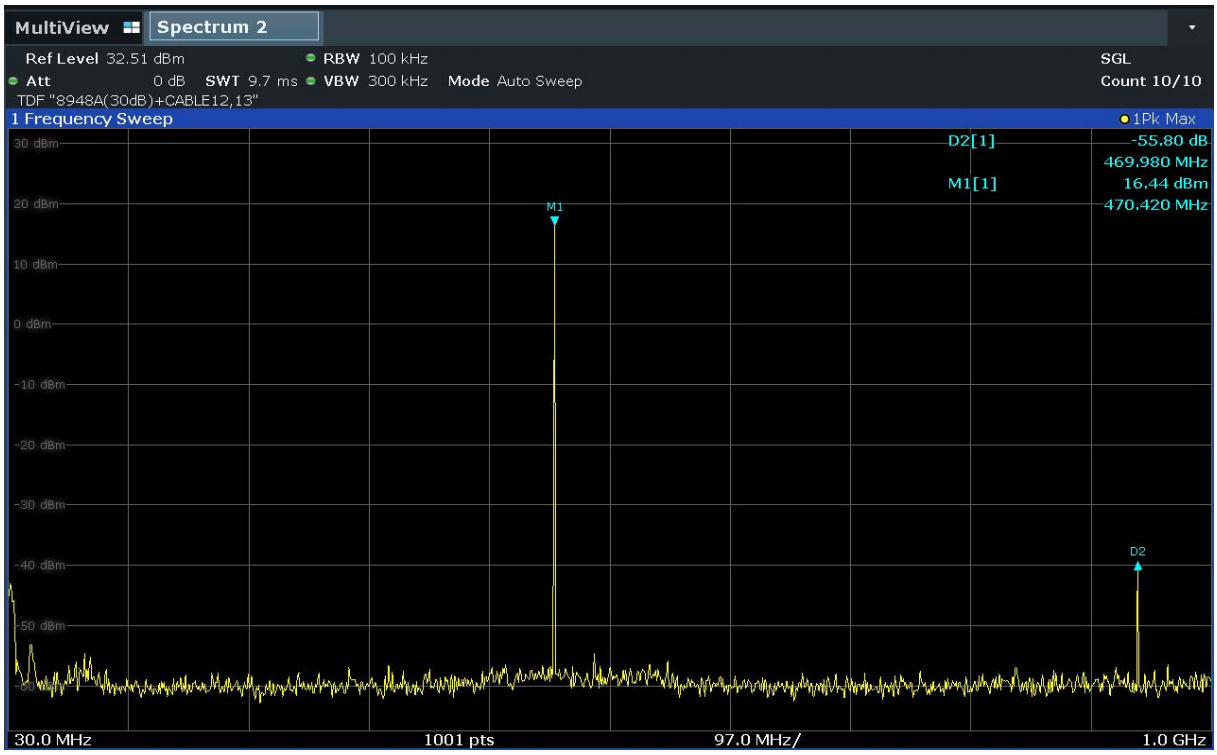
CH High : 607.875 MHz



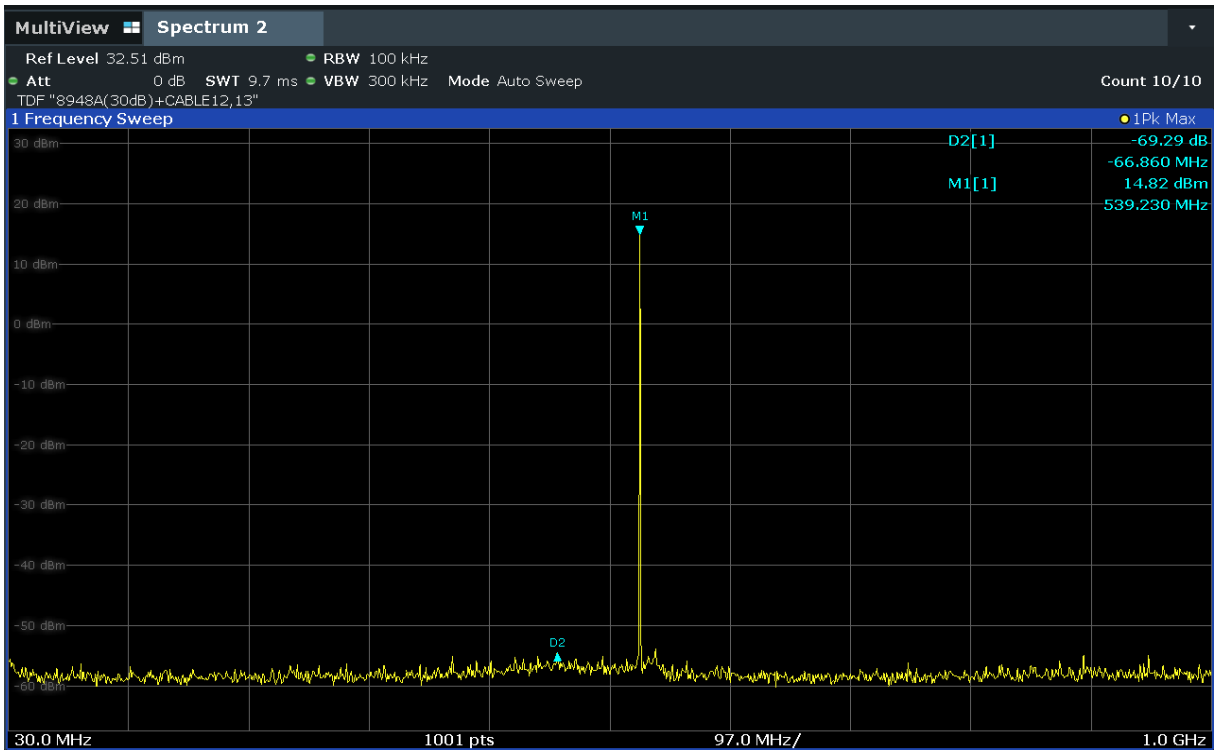

※Above 1GHz, no radiated spurious signals were detected at less than 6 dB for operating channels.

## Below 1GHz / Power level: High

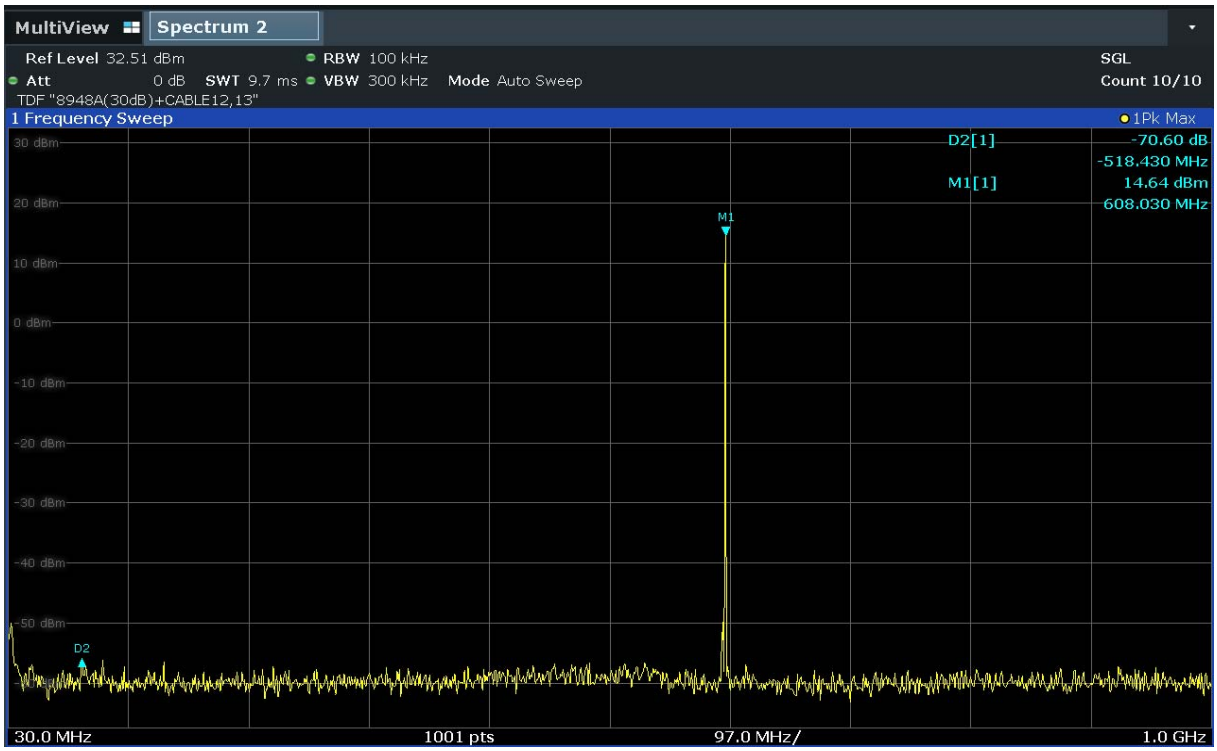
CH Low : 470.125 MHz




CH Middle : 539.000 MHz

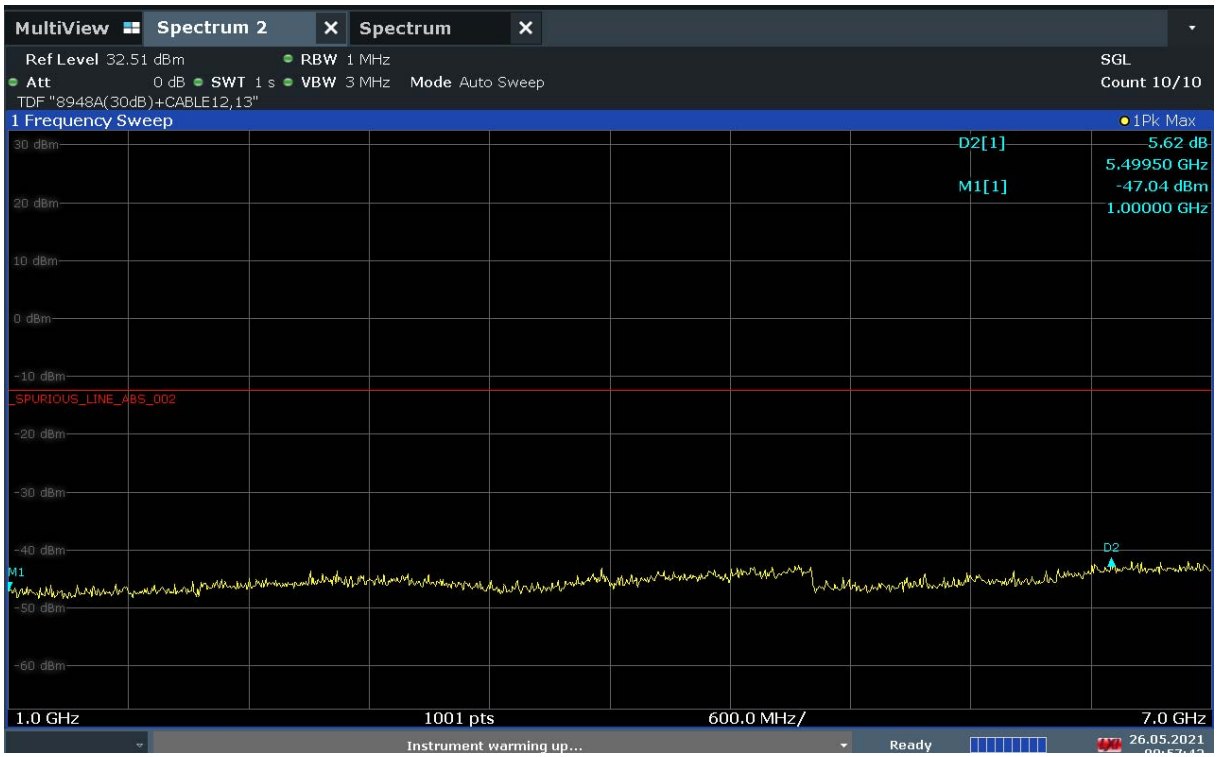


CH High : 607.875 MHz

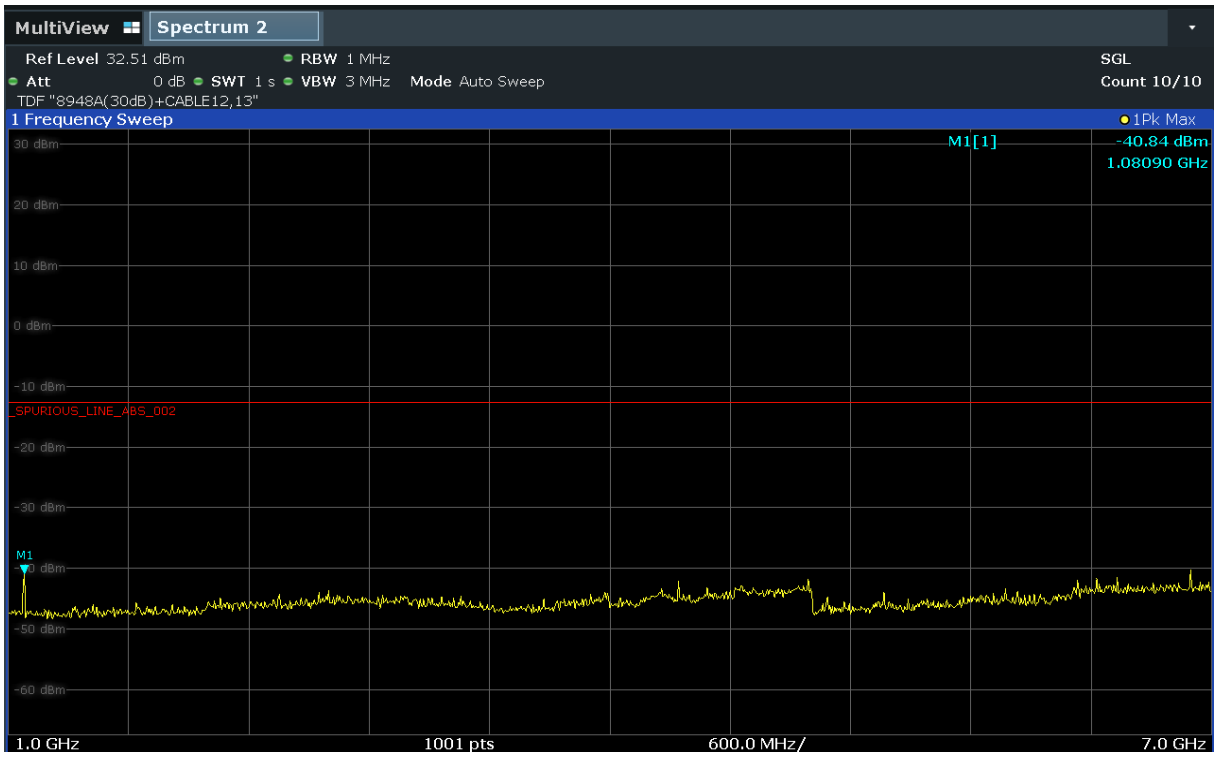


## Above 1GHz / Power level: High

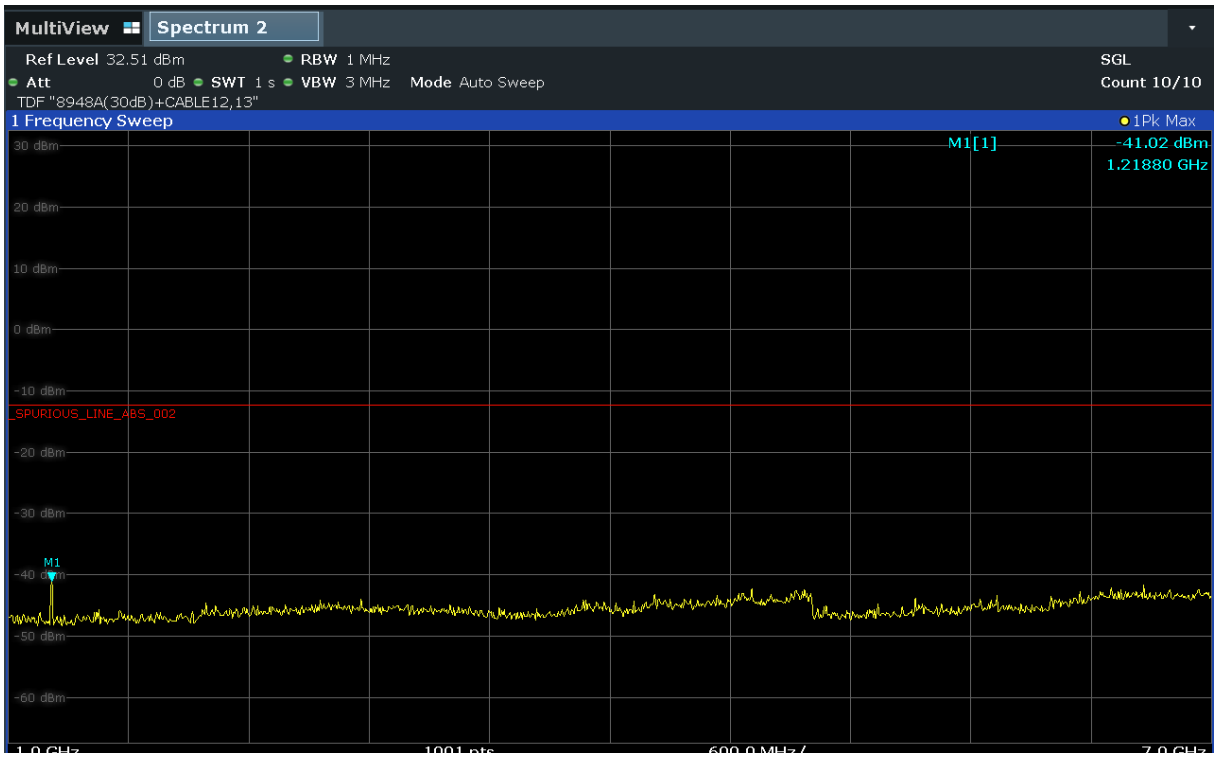
CH Low : 470.125 MHz




CH Middle : 539.000 MHz



CH High : 607.875 MHz




※Above 1GHz, no radiated spurious signals were detected at less than 6 dB for operating channels.

## 5.5 Radiated Spurious Emissions

### 5.5.1 Standard Applicable [FCC §74.861(e)(6)(iii)& §2.1053]

According to §2.1053 of the FCC Rules, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediated circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a half wave dipole antenna.

According to §74.861(e)(6)of the FCC Rules, the mean power of emissions shall be attenuated below the mean out power of the transmitter in accordance with the following schedule:

(iii) On any frequency removed from the operating frequency by more than 250 percent up to and including 250 percent of the authorized bandwidth: at least 43 plus $10\log_{10}$(output power in watts) dB.

### 5.5.2 Test Environment conditions

• Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

### 5.5.3 Measurement Procedure

The EUT was setup according to ANSI/TIA 603E-2016 for compliance to FCC 47CFR part 74 requirements.

As a below test procedure (①~⑬), The result value of measurement is performed to condition of the below; The EUT will operate in continuous transmission mode during the time necessary to perform the measured of the frequency. Substitution method was performed to determine the actual $P_{erp}$(or $P_{eirp}$) emission levels of the EUT.

The following test procedure as below;

The test is performed in a fully pyramidal chamber to determine the accurate frequencies, after maximum emissions level will be checked on a test chamber and measuring distance is 3 m from EUT to test antenna.

① The EUT was set on with continuous transmission mode and placed on a 0.8 meter high non-conductive table on the chamber.

② The test antenna is used on Bi-Log antenna at above 30 MHz, and used on Horn antenna at 1 GHz and then the measurements are repeated with the test antenna for vertical and horizontal polarization. The output of the test antenna will be connected to a measuring receiver, and it is set to tuned over the required standard measuring frequency range.

③ At each frequency at which a relevant spurious component is detected, the test antenna will be raised and lowered through the specified range of heights until an maximum signal level is detected on the measuring receiver.

④ The EUT is position x, y, z axis on rotating through 360 degrees in the horizontal plane, until the Max. signal level is detected by the measuring receiver.

⑤ The receiver is scanned from requested measuring frequency band and then the maximum meter reading is recorded. The radiated emissions were measured with requested standard specification (detector and resolution bandwidth etc.)

⑥ The EUT was then removed and replaced with substitution antenna .The center of the antenna was approximately at the same location as the center of the EUT, and calibrated for the frequency of the spurious component detected.

⑦ Signal generator output port connected with substitution antenna input port. If necessary, may use shield cable between signal generator and substitution antenna

⑧ The frequency of the calibrated signal generator is set to frequency of the spurious component detected, and the input attenuator setting of the measuring receiver was adjust in order to increase the sensitivity of

the measuring receiver, if necessary

⑨ The test antenna was raised and lowered through the specified range of heights to ensure that maximum signal is received.

⑩ The input signal to the substitution antenna was be adjusted until an equal or a known related level to that detected from the transmitter is obtained on the measuring receiver.

⑪ The input signal to the substitution antenna was be recorded as a power level and corrected for any change of input attenuator setting of the measuring receiver

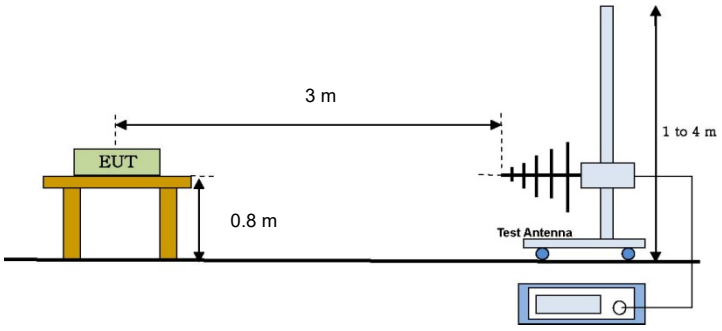
⑫ The measure of $P_{erp}$(or $P_{eirp}$) the spurious components is the larger of the two power levels recorded for each spurious component at the input to the substitution antenna, corrected for the gain of the substitution antenna, if necessary.

⑬ It is correction to signal generator's offset value. In this case of $P_{erp}$(or $P_{eirp}$) shall calculated as follow as formula ;

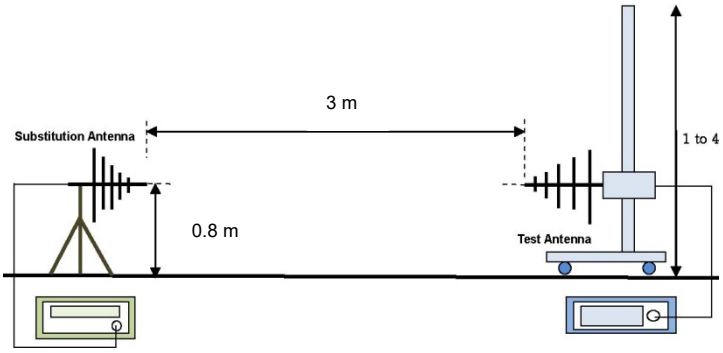
• $P_{erp}$(or $P_{eirp}$) = Signal generator level (dBm) – Cable loss(dB) + Standard Antenna gain

The measurement frequency range from 30 MHz - 10th Harmonic of fundamental was investigated.

### 5.5.4 Test Setup




[ Radiated measurement setup_Below than 1 GHz ]




[ Effective Radiated Power measurement setup ]

※ Above the test antenna is used on Horn antenna at above 1 GHz.

### Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the UCISPR measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Radiated Emission measurement: Below 1 GHz: 3.62 dB (CL: Approx 95 %, k=2)
Above 1 GHz: 4.18 dB (CL: Approx 95 %, k=2)

## 5.5.5 Measurement Result

The following frequencies were selected based on the antenna radiated results, the worst case are presented.

| (30 MHz ~ 7 GHz) | | | | | | | |
|---|---|---|---|---|---|---|---|
| The worst test results high channel 607.875 MHz | | | | | | | |
| Frequency [MHz] | SG. Level [dBm] | ANT.Gain [dBd] | Cable Loss [dB] | P. Mea [dBm] | Limit [dBm] | Margin [dB] | Polarity |
| 799.96 | -39.73 | -2.20 | 1.49 | -43.42 | -13.00 | 30.42 | H |
| 875.80 | -42.80 | -3.95 | 1.49 | -48.24 | -13.00 | 35.24 | H |
| The worst test results high channel 607.875 MHz | | | | | | | |
| Frequency [MHz] | SG. Level [dBm] | ANT.Gain | Cable Loss [dB] | P. Mea [dBm] | Limit [dBm] | Margin [dBm] | Polarity |
| - | - | - | - | - | -13.00 | - | - |

※Above 1GHz, no radiated spurious signals were detected at less than 6 dB for operating channels

## 5.6 Frequency Stability

### 5.6.1 Standard Applicable [FCC §74.861(e)(4) & §2.1055]

According to §2.1055 of the FCC Rules, the frequency stability shall be measure with variation of ambient temperature from -30° C to +50 ° C, and according to FCC 2.1055(d)(1), the frequency stability shall be measured with reducing primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

According to §74.861(e)(4) of the FCC Rules, the frequency tolerance of the transmitter shall be 0.005 percent.

### 5.6.2 Test Environment conditions

• Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

### 5.6.3 Measurement Procedure

EUT connect to Spectrum analyzer, test is performed in T&H chamber.

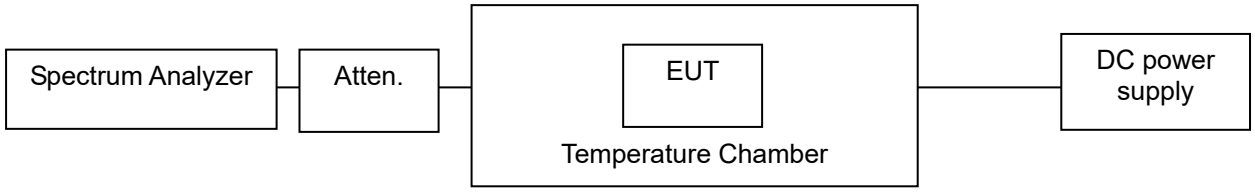
These measurements shall also be performed at normal and extreme test conditions.

▪ Test Method : ANSI/TIA-603-E-2016, clause 2.2.2 for frequency stability tests

-Frequency stability with respect to ambient temperature

-Frequency stability when varying supply voltage

### 5.6.4 Test setup




### 5.6.5 Measurement Result

- Operating frequency : 539.000 MHz
- Channel : mid

| Temp(℃) | Power Supply | Measured Frequency (MHz) | Frequency error (Hz) | Frequency error (%) | Test Results |
|---|---|---|---|---|---|
| 50 | DC 12 ($V_{nom}$) | 539.000 152 | 152 | 0.000028 | Compliance |
| 40 | | 538 999 938 | -62 | -0.000012 | Compliance |
| 30 | | 538.999 864 | -136 | -0.000025 | Compliance |
| 20 | | 539.000 168 | 168 | 0.000031 | Compliance |
| 10 | | 539.000 171 | 171 | 0.000032 | Compliance |
| 0 | | 538.999 952 | -48 | -0.000009 | Compliance |
| -10 | | 539.000 132 | 149 | 0.000024 | Compliance |
| -20 | | 539.000 103 | 103 | 0.000019 | Compliance |
| -30 | | 539.000 146 | 146 | 0.000027 | Compliance |
| Nom Temperature | DC 10.2 ($V_{min}$) | 539.000 169 | 169 | 0.000031 | Compliance |
| Nom Temperature | DC 13.8 ($V_{max}$) | 539.000 164 | 164 | 0.000030 | Compliance |
| Limit | 0.005% | | | | |