TEST REPORT

| DT&C Co., Ltd. |
|----------------------------------------------------------------------------|
| 42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042 |
| Tel: 031-321-2664, Fax: 031-321-1664 |

| 1. Report No : DRTFCC2006-0167 |
|-----------------------------------------------------------------------------------------------------|
| 2. Customer |
| Name : HYUNDAI MOBIS CO., LTD. |
| Address : 203, Teheran-ro Gangnam-gu, Seoul, South Korea 135-977 |
| 3. Use of Report : FCC Original Grant |
| 4. Product Name / Model Name : DISPLAY CAR SYSTEM / DA330G2AN FCC ID : TQ8-DA330G2AN |
| 5. Test Method Used : KDB558074 D01v05r02, ANSI C63.10-2013 Test Specification : FCC Part 15.247 |
| 6. Date of Test : 2020.03.27 ~ 2020.04.13 |
| 7 Location of Test : X Permanent Testing Lab On Site Testing |
| 8. Testing Environment : See appended test report. |
| 9. Test Result : Refer to the attached test result. |
| The results shown in this test report refer only to the sample(s) tested unless otherwise stated. |
| Affirmation Tested by Name : InHee Bae |
| |
| |
| 2020. 06. 12. |
| 2020. 00. 12. |
| DT&C Co., Ltd. |
| Not abided by KS Q ISO / IEC 17025 and KOLAS accreditation. |
| If this report is required to confirmation of authenticity, please contact to report@dtnc.net |

TDt&C



Test Report Version

| Test Report No. | Date | Description | Revised By | Reviewed by |
|-----------------|---------------|---------------|------------|-------------|
| DRTFCC2006-0167 | Jun. 12, 2020 | Initial issue | InHee Bae | JaeJin Lee |
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1. EUT DESCRIPTION

| FCC Equipment Class | Digital Transmission System(DTS) | | |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Product | DISPLAY CAR SYSTEM | | |
| Model Name | DA330G2AN | | |
| Add Model Name | DA330G2GG, DA330G2FG, DA331G2GG, DA330G2GN, DA330G2GL, DA330G2MG, DA330G2FN, DA330G2EG, DA330G2EP, DA331G2EP, DA332G2EP, DA333G2EP, DA330G2UA, DT330G2AN, DA330G2GU, DA331G2FN, DA331G2EG, DA334G2EP, DA335G2EP, DA336G2EP, DA337G2EP, DA331G2UA, DT331G2AN, DA330G7GG, DA331G7GG, DA330G7GN, DA330G7GL, DA330G7EG, DA330G7EP, DA331G7EP, DA332G7EP, DA333G7EP, DA330G7UA, DT330G7AN | | |
| Hardware Version | V 1.0 | | |
| Software Version | V 1.0 | | |
| Power Supply | DC 14.4 V | | |
| Frequency Range | • 802.11b/g/n(20 MHz) : 2412 MHz ~ 2462 MHz | | |
| Max. RF Output Power | 2.4GHz Band • 802.11b : 7.72 dBm • 802.11g : 15.01 dBm • 802.11n (HT20) : 14.98 dBm | | |
| Modulation Type | • 802.11b: CCK, DSSS • 802.11g/n: OFDM | | |
| Antenna Specification | Antenna type: PCB Pattern Antenna Antenna gain: -0.01 dBi | | |

2. INFORMATION ABOUT TESTING

2.1 Test mode

| Test | Worst case data rate | Tested Frequency(MHz) | | |
|------|------------------------|-----------------------|--------|---------|
| mode | | Lowest | Middle | Highest |
| TM 1 | 802.11b 1 Mbps | 2412 | 2437 | 2462 |
| TM 2 | 802.11g 6 Mbps | 2412 | 2437 | 2462 |
| ТМ 3 | 802.11n(HT20) MCS 0 | 2412 | 2437 | 2462 |

Note 1: The worst case data rate is determined as above test mode according to the power measurements. Note 2: The power measurement results for all modes and data rate were reported.

2.2 Auxiliary equipment

| Equipment | Model No. | Serial No. | Manufacturer | Note |
|-----------|-----------|------------|--------------|------|
| - | - | - | - | - |
| - | - | - | - | - |

2.3 Tested environment

| Temperature | : | 23 °C ~ 25 °C |
|---------------------------|---|---------------|
| Relative humidity content | : | 43 % ~ 46 % |
| Details of power supply | : | DC 14.4 V |

2.4 EMI suppression Device(s) / Modifications

EMI suppression device(s) added and/or modifications made during testing \rightarrow None

2.5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014 and ANSI C 63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

| Test items | Measurement uncertainty |
|------------------------------------------------|----------------------------------------------------|
| Transmitter Output Power | 0.7 dB (The confidence level is about 95 %, k = 2) |
| Conducted spurious emission | 1.0 dB (The confidence level is about 95 %, k = 2) |
| Radiated spurious emission (1 GHz Below) | 4.9 dB (The confidence level is about 95 %, k = 2) |
| Radiated spurious emission (1 GHz ~ 18 GHz) | 5.1 dB (The confidence level is about 95 %, k = 2) |
| Radiated spurious emission (18 GHz Above) | 5.3 dB (The confidence level is about 95 %, k = 2) |

3. SUMMARY OF TESTS

| FCC Part | RSS Std. | Parameter | Limit | Test Condition | Status Note 1 |
|-------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------|----------------------|------------------|
| 15.247(a) | RSS-247 [5.2] | 6 dB Bandwidth | > 500 kHz | | С |
| 15.247(b) | RSS-247 [5.4] | Transmitter Output Power | < 1 Watt | | С |
| 15.247(d) | RSS-247 [5.5] | Out of Band Emissions / Band Edge | 20 dBc in any 100 kHz BW | Conducted | С |
| 15.247(e) | RSS-247 [5.2] | Transmitter Power Spectral Density | < 8 dBm/3 kHz | | С |
| - | RSS-Gen [6.7] | Occupied Bandwidth (99 %) RSS-Gen(6.7) | | | NA |
| 15.247(d) 15.205 15.209 | RSS-247 [5.5] RSS-GEN [8.9] RSS-GEN [8.10] | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | FCC 15.209 limits | Radiated | С |
| 15.207 | RSS-Gen [8.8] | AC Line Conducted Emissions | FCC 15.207 limits | AC Line Conducted | NA Note3 |
| 15.203 | - | Antenna Requirements | FCC 15.203 | - | С |

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

Note 2: For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated with OATS.

Note 3: This device is installed in a car. Therefore the power source is a battery of car.

4. TEST METHODOLOGY

The measurement procedures described in the ANSI C63.10-2013 and the guidance provided in KDB558074 D01v05r02 were used in measurement of the EUT.

The EUT was tested per the guidance of KDB558074 D01v05r02. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing.

4.1 EUT configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB558074 D01v05r02.

So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector

Radiated Emissions

Basically the radiated tests were performed with KDB558074 D01v05r02. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013.

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

4.4 Description of test modes

The EUT has been tested with all modes of operating conditions to determine the worst case emission characteristics. A test program is used to control the EUT for staying in continuous transmitting mode.



5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

| DT&C Co., L | td. | |
|------------------|---------|-------------------------------------------------------------------------------------|
| | | conducted measurement facility used to collect the radiated data are located at the |
| 42, Yurim-ro, 1 | 54beon | ı-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. |
| The test site co | omplies | with the requirements of § 2.948 according to ANSI C63.4-2014. |
| - FCC MRA | Desig | nation No. : KR0034 |
| www.dtpo.pot | | |
| www.dtnc.net | | |
| Tolonhono | | + 82-31-321-2664 |
| Telephone | • | |

6.2 Equipment

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, loop, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The internal antenna is printed on the PCB. Therefore this E.U.T Complies with the requirement of §15.203



8. TEST RESULT

8.1 6dB bandwidth

Test Requirements and limit, §15.247(a)

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

The minimum permissible 6 dB bandwidth is 500 kHz.

Test Configuration:

Refer to the APPENDIX I.

Test Procedure:

- KDB558074 D01v05r02 Section 8.2
- ANSI C63.10-2013 Section 11.8.2
- 1. Set resolution bandwidth (RBW) = 100 kHz.
- 2. Set the video bandwidth (VBW) \ge 3 x RBW.
- (<u>RBW : 100 kHz / VBW : 300 kHz</u>)
- 3. Detector = **Peak**.
- 4. Trace mode = **Max hold**.
- 5. Sweep = Auto couple.
- 6. Allow the trace to stabilize.
- 7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

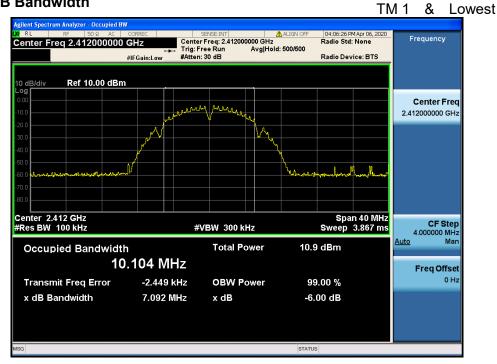
Test Results: Comply

| Test Mode | Frequency | Test Results[MHz] |
|-----------|-----------|-------------------|
| | Lowest | 7.09 |
| TM 1 | Middle | 7.12 |
| | Highest | 7.11 |
| | Lowest | 16.35 |
| TM 2 | Middle | 16.33 |
| | Highest | 15.83 |
| | Lowest | 17.33 |
| ТМ 3 | Middle | 17.52 |
| | Highest | 17.29 |



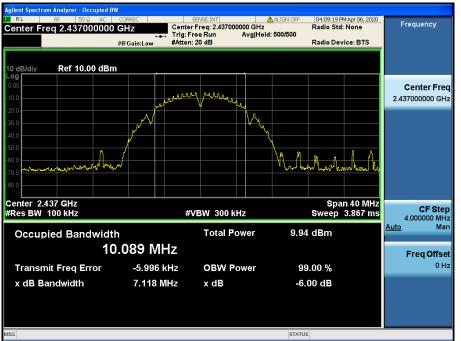
RESULT PLOTS

6 dB Bandwidth

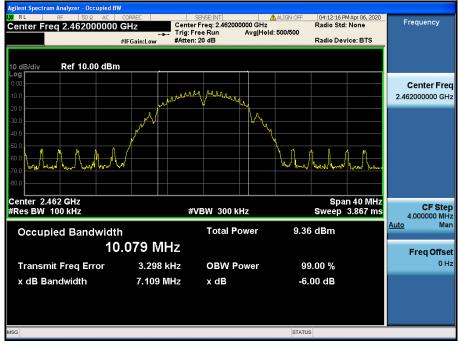


6 dB Bandwidth

TM 1 & Middle



TM 1 & Highest



Dt&C

TM 2 & Lowest nt Spectrum Analyzer Occupied BV CHZ Center Freq: 2.41200000 GHz Trig: Freq Run Avg|Hold: 500/500 #Rten:Low #Atten: 30 dB 04:17:15 PM Apr 06, 2020 Radio Std: None Frequency Center Freq 2.412000000 GHz Radio Device: BTS Ref 10.00 dBm oa **Center Freq** 2.412000000 GHz 1. toul A. . . A. with Center 2.412 GHz #Res BW 100 kHz Span 40 MHz Sweep 3.867 ms CF Step 4.000000 MHz #VBW 300 kHz <u>Auto</u> Man **Occupied Bandwidth** Total Power 10.6 dBm 16.413 MHz Freq Offset 0 Hz Transmit Freq Error -9.600 kHz **OBW Power** 99.00 % x dB Bandwidth 16.35 MHz x dB -6.00 dB

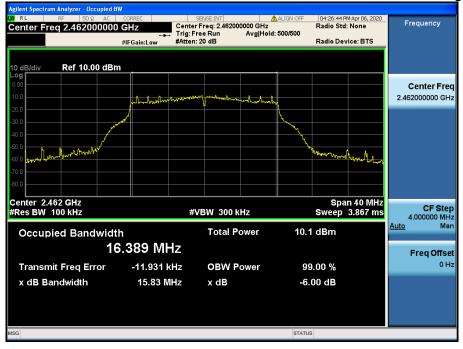
STATUS

6 dB Bandwidth

TM 2 & Middle



TM 2 & Highest

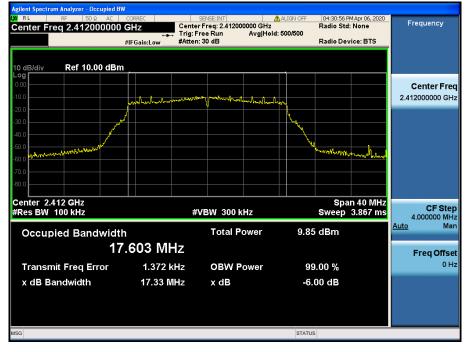


FCC ID: TQ8-DA330G2AN

6 dB Bandwidth

Dt&C

TM 3 & Lowest

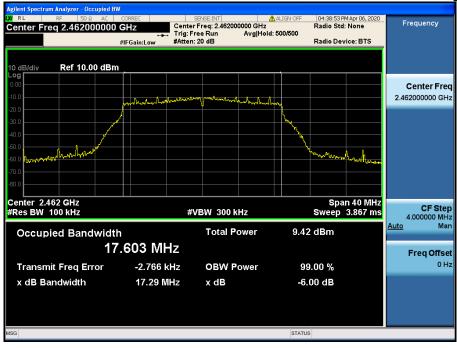


6 dB Bandwidth





TM 3 & Highest

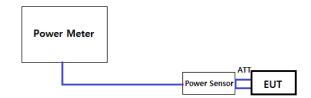


8.2 Maximum peak conducted output power

Test Requirements and limit, §15.247(b)

The maximum permissible conducted output power is 1 Watt.

Test Configuration



Test Procedure

1. PKPM1 Peak power meter method of KDB558074 D01V05R02

The maximum conducted output powers were measured using a broadband peak RF power meter which has greater video bandwidth than DUT's DTS bandwidth and utilize a fast-responding diode detector.

2. Method AVGPM-G (Measurement using a gated RF average power meter) of KDB558074 D01V05R02

The average conducted output powers were measured using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.



Test Results: Comply

| Erog | | Maximum Peak Conducted Output Power (dBm) for <u>802.11b</u> | | | | | | | | | | |
|----------------|------|--------------------------------------------------------------|------|------|------|---|---|---|---|--|--|--|
| Freq. (MHz) | Det. | Data Rate [Mbps] | | | | | | | | | | |
| | | 1 | 2 | 5.5 | 11 | - | - | - | - | | | |
| 2412 | PK | 7.72 | 7.69 | 7.65 | 7.39 | - | - | - | - | | | |
| 2412 | AV | 4.61 | 4.54 | 4.60 | 4.28 | - | - | - | - | | | |
| 2437 | PK | 6.41 | 6.38 | 6.40 | 6.35 | - | - | - | - | | | |
| 2437 | AV | 3.31 | 3.30 | 3.24 | 3.28 | - | - | - | - | | | |
| 2462 | PK | 5.80 | 5.72 | 5.76 | 5.70 | - | - | - | - | | | |
| 2402 | AV | 2.75 | 2.73 | 2.69 | 2.70 | - | - | - | - | | | |

| F ree at | | Maximum Peak Conducted Output Power (dBm) for 802.11g | | | | | | | | | |
|-----------------|------|-------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|--|--|
| Freq. (MHz) | Det. | Data Rate [Mbps] | | | | | | | | | |
| | | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 | | |
| 2412 | PK | 15.01 | 14.88 | 14.12 | 14.23 | 13.50 | 13.95 | 13.01 | 12.98 | | |
| 2412 | AV | 4.96 | 4.97 | 4.99 | 4.93 | 4.70 | 4.69 | 4.80 | 4.73 | | |
| 2437 | PK | 13.98 | 13.83 | 13.90 | 13.91 | 13.88 | 13.87 | 13.79 | 13.93 | | |
| 2437 | AV | 4.02 | 3.95 | 3.98 | 3.83 | 4.00 | 3.97 | 3.92 | 3.99 | | |
| 2462 | PK | 13.71 | 13.56 | 13.68 | 13.62 | 13.60 | 13.59 | 13.60 | 13.63 | | |
| 2402 | AV | 3.58 | 3.53 | 3.48 | 3.51 | 3.52 | 3.49 | 3.50 | 3.55 | | |

| F ree a | | Maximum Peak Conducted Output Power (dBm) for <u>802.11n(HT20)</u> | | | | | | | | | |
|-----------------------|----|--------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|--|--|
| Freq. Det. | | Data Rate [MCS] | | | | | | | | | |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| 2412 | PK | 14.98 | 14.12 | 14.15 | 14.16 | 14.32 | 14.02 | 14.15 | 14.05 | | |
| 2412 | AV | 4.86 | 4.41 | 4.39 | 4.55 | 4.76 | 4.61 | 4.39 | 4.62 | | |
| 2437 | PK | 12.92 | 12.83 | 12.88 | 12.91 | 12.76 | 12.77 | 12.90 | 12.86 | | |
| 2437 | AV | 3.25 | 3.13 | 3.18 | 3.11 | 3.21 | 3.10 | 3.23 | 3.18 | | |
| 2462 | PK | 13.37 | 13.24 | 13.27 | 13.30 | 13.28 | 13.29 | 13.31 | 13.34 | | |
| 2402 | AV | 2.85 | 2.84 | 2.80 | 2.79 | 2.77 | 2.81 | 2.80 | 2.76 | | |

8.3 Maximum power spectral density

Test requirements and limit, §15.247(e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Configuration:

Refer to the APPENDIX I.

Test Procedure

- KDB558074 D01v05r02 Section 8.4
- ANSI C63.10-2013 Section 11.10.2

Method PKPSD (peak PSD)

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. Set the span to 1.5 times the DTS bandwidth.
- 3. Set the RBW to : $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- 4. Set the VBW \geq 3 x RBW
- 5. Detector = **Peak**
- 6. Sweep time = **Auto couple**
- 7. Trace mode = **Max hold.**
- 8. Allow trace to fully stabilize.

9. Use the **peak marker function** to determine the maximum amplitude level within the RBW.

10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Results: Comply

| Test Mode | Frequency | RBW | PKPSD [dBm] |
|-----------|-----------|-------|-------------|
| | Lowest | 3 kHz | -17.38 |
| TM 1 | Middle | 3 kHz | -18.51 |
| | Highest | 3 kHz | -18.97 |
| | Lowest | 3 kHz | -19.88 |
| TM 2 | Middle | 3 kHz | -19.42 |
| | Highest | 3 kHz | -19.56 |
| | Lowest | 3 kHz | -20.21 |
| TM 3 | Middle | 3 kHz | -19.54 |
| | Highest | 3 kHz | -21.14 |

RESULT PLOTS



Maximum PPSD

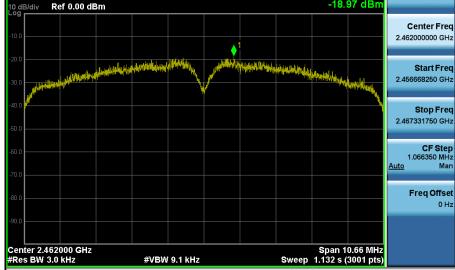
TM 1 & Middle



B/div

gilent Spectrum Analyzer - Swept SA

TM 1 & Highest Center Freq 2.462000000 GHz PNO: Wide C IFGain:Low Atten: 10 dB ALIGN OFF pr 06, 2020 Frequency 04:13:10 RACE 123456 TYPE MWWWWW DET PPPPP Mkr1 2.462 889 GHz -18.97 dBm Auto Tune **Center Freq** 2.462000000 GHz ٠



🛈 Dt&C



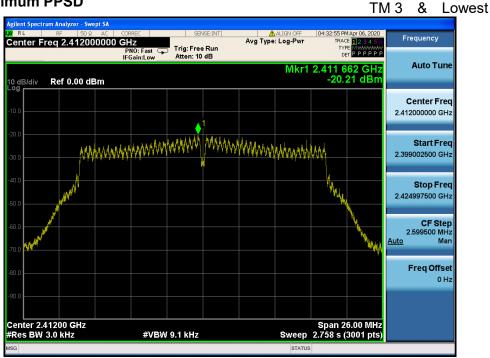
Maximum PPSD

TM 2 & Middle





🛈 Dt&C



Maximum PPSD









8.4 Out of band emissions at the band edge / conducted spurious emissions

Test requirements and limit, §15.247(d)

§15.247(d) specifies that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

If **the peak output power procedure** is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated **by at least 20 dB** relative to the maximum measured in-band peak PSD level.

If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to **15.247(b)(3)** requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in band average PSD level. In either case, attenuation to levels below the general emission limits specified in §15.209(a) is not required.

Test Configuration:

Refer to the APPENDIX I.

Test Procedure

- KDB558074 D01v05r02 Section 8.5
- ANSI C63.10-2013 Section 11.11

- Reference level measurement

- 1. Set instrument center frequency to DTS channel center frequency.
- 2. Set the span to \geq 1.5 times the DTS bandwidth.
- 3. Set the RBW = **100 kHz**.
- 4. Set the VBW \geq 3 x RBW.
- 5. Detector = **Peak.**
- 6. Sweep time = **Auto couple**.
- 7. Trace mode = **Max hold.**
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum PSD level.

- Emission level measurement

- 1. Set the center frequency and span to encompass frequency range to be measured.
- 2. Set the RBW = 100 kHz. (Actual 1 MHz , See below note)
- 3. Set the VBW ≥ 3 x RBW. (Actual 3 MHz, See below note)
- 4. Detector = **Peak**.
- 5. Ensure that the number of measurement points \geq Span / RBW.
- 6. Sweep time = **Auto couple.**
- 7. Trace mode = **Max hold.**
- 8. Allow the trace to stabilize. (this may take some time, depending on the extent of the span)
- 9. Use the peak marker function to determine the maximum amplitude level.

Note : The conducted spurious emission was tested with below settings. Frequency range: 9 kHz ~ 30 MHz RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

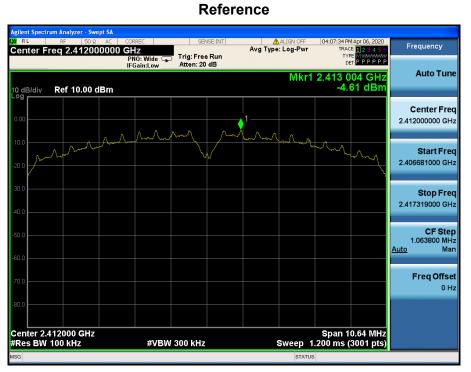
Frequency range: 30 MHz ~ 10 GHz, 10 GHz ~25 GHz RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

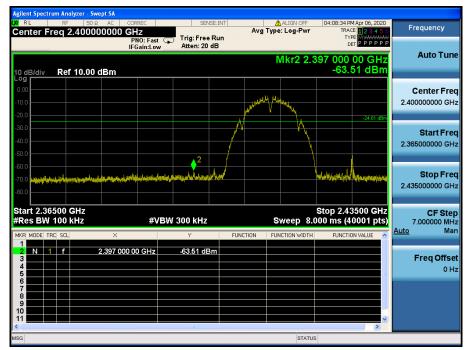
If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

RESULT PLOTS

TM 1 & Lowest



Low Band-edge



| Agilent Spectrum Analyzer - Swep X RL RF 50 2 Center Freq 15.00450 | DC CORREC | SENSE:IN Trig: Free Run Atten: 20 dB | Avg | ALIGN OFF Type: Log-Pwr | 04:08:41 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P P P P P P | Frequency |
|--------------------------------------------------------------------------|-----------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------|----------------------------------|
| 10 dB/div Ref 10.00 dl | | Atten: 20 dB | | 1 | //kr1 300.7 kHz -55.55 dBm | Auto Tune |
| -10.0 | | | | | | Center Free 15.004500 MH |
| -20.0 | | | | | -24.61 dBm | Start Fre 9.000 kH |
| -60.0 -70.0 -80.0 | etchatragerallerfactoristic | el perholafisplatrospillenated dave | the the sector of the sector o | งส _า กรุ่มหารถึงให้สุดกรุ่งสา | an da ka kasara dagin kari kada salaya kasar | Stop Fre 30.000000 MH |
| Start 9 kHz #Res BW 100 kHz | #VBV | V 300 kHz | | • | Stop 30.00 MHz 33 ms (40001 pts) | CF Ste 2.999100 MH Auto Ma |
| MKR MODE TRC SCL 1 N 1 f 3 4 5 0 | × 300.7 kHz | √ -55.55 dBm | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE | Freq Offse |
| 6 7 7 8 9 9 9 10 11 1 | | | | | ~ | |
| ISG | | un. | | STATUS | DC Coupled | |

| Agilent Spectrum Analyzer - Swep | | | | | | |
|-------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------|-------------------------------------------|----------------------------|
| RE RF 50 Ω Center Freq 5.015000 | AC CORREC | SENSE:IN | Avg Type | ALIGN OFF | 04:08:50 PM Apr 06, 2020 TRACE 12345 6 | Frequency |
| | PNO: Fast C | Trig: Free Run Atten: 20 dB | | | | |
| | | | | Mkr | 5 9.426 73 GHz -54.97 dBm | Auto Tune |
| 10 dB/div Ref 10.00 d | Bm | | | | -04.57 0.011 | |
| 0.00 | | | | | | Center Freq |
| -10.0 | | | | | | 5.015000000 GHz |
| -20.0 | | | | | -24.61 dBm | |
| -30.0 | | | | | | Start Freq |
| -40.0 | AA2 | | | | ▲ 53 | 30.000000 MHz |
| -50.0 | 2 1 | | and at biographic star. Joseph and a | | | |
| | | Contraction of the second s | and an interest of the second second second | and all the party sectors | | Stop Freq |
| 470.0 | | | | | | 10.00000000 GHz |
| -80.0 | | | | | | |
| Start 30 MHz | | | | | Stop 10.000 GHz | |
| #Res BW 1.0 MHz | #VB | W 3.0 MHz | S | weep 18 | .67 ms (40001 pts) | 997.000000 MHz Auto Man |
| MKR MODE TRC SCL | × 2.412 08 GHz | ۲ -1.43 dBm | FUNCTION FUN | ICTION WIDTH | FUNCTION VALUE | Auto |
| 2 N 1 f | 3.228 63 GHz | -54.08 dBm | | | | Eren Offent |
| 3 N 1 f 4 N 1 f | 9.529 91 GHz 3.109 73 GHz | -54.84 dBm -54.86 dBm | | | | Freq Offset 0 Hz |
| 5 N 1 f | 9.426 73 GHz | -54.97 dBm | | | 3 | 0112 |
| 7 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | ~ | |
| < | | ш | | | | |
| MSG | | | | STATUS | | |

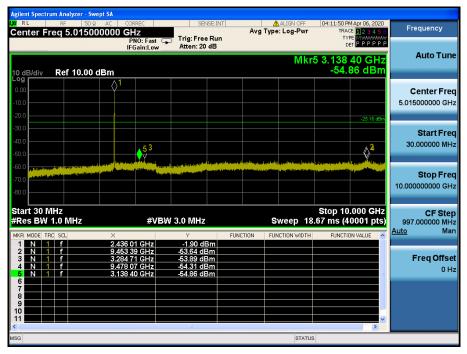


TM 1 & Middle

Reference



| RL RF | | RREC | SENSE: | | ALIGN OFF | 04:11:42 PM A | Apr 06, 2020 | Frequency |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------|-----------------------------------------------------|---------------------------------------------------------------------------|
| enter Freq 15.0 | Р | NO: Fast 🕞 Gain:Low | Trig: Free Ri Atten: 20 dE | un | Type: Log-Pwr | TYPE | 1 2 3 4 5 6 M WWWWW P P P P P P | |
| dB/div Ref 10 | .00 dBm | | | | Γ | 0 Wkr1 284 -54.6 | .9 kHz 2 dBm | Auto Tur |
| | | | | | | | | Center Fre 15.004500 Mi |
| 0.0 | | | | | | | -25:16 dBm | Start Fre 9.000 kł |
| | | | | | | | | |
| 0.0 | f Anger of States and S | Hilymalyna diwara | un landari natada na natadan | the state of the s | narthyalat mathyrinethysister) | netween Nativilles | يىلى يەلىكىرە ئە يەھرەي (ئەلى يەلىكىرە ئە يەھرەي | |
| tart 9 kHz Res BW 100 kHz | | | V 300 kHz | | Sweep 5.3 | Stop 30. 333 ms (40 | .00 MHz 001 pts) | 30.000000 M CF Ste 2.999100 M |
| tart 9 kHz Res BW 100 kHz KR MODE TRC SCL 1 N 1 f 2 3 | × | | | FUNCTION | | Stop 30. | .00 MHz 001 pts) | Stop Fro 30.000000 MI CF Sto 2.999100 MI Auto Mi Freq Offs |
| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | × | #VBV | V 300 kHz Y | FUNCTION | Sweep 5.3 | Stop 30. 333 ms (40 | .00 MHz 001 pts) | 30.000000 Mi CF Ste 2.999100 Mi <u>Auto</u> M |
| 00 4444444 tart 9 kHz Res BW 100 kHz Res BW 100 kHz 1 1 N 1 2 3 4 4 5 5 | × | #VBV | V 300 kHz Y | FUNCTION | Sweep 5.3 | Stop 30. 333 ms (40 | .00 MHz 001 pts) | 30.000000 Mi CF Ste 2.999100 Mi <u>Auto</u> M Freq Offs |



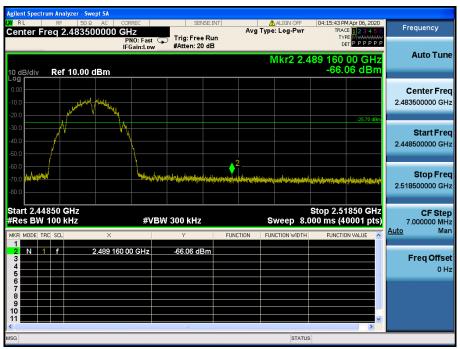
| Agilent Spectrum Analyzer - Swept SA | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------|-------------------------|---------------------------------------------------------------------------------|-----------------------------------------------|
| 040 RL RF 50Ω AC Center Freq 17.500000000 | 0 GHz PNO: Fast 😱 Trig: Free | Avg Typ e Run | ALIGN OFF e: Log-Pwr | 04:11:58 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 TYPE MMMMMM DET P P P P P P | Frequency |
| 10 dB/div Ref 10.00 dBm | IFGain:Low Atten: 20 | | Mkr3 23 | .830 375 GHz -42.51 dBm | Auto Tune |
| -10.0 | | | | | Center Freq 17.500000000 GHz |
| -30.0 | | | | -25.16 dBm | Start Fred 10.000000000 GHz |
| -60.0 (Anticipation of the second sec | | | | | Stop Fred 25.000000000 GH: |
| Start 10.000 GHz #Res BW 1.0 MHz | #VBW 3.0 MHz | | | Stop 25.000 GHz 0 ms (40001 pts) | CF Step 1.500000000 GH: <u>Auto</u> Mar |
| 1 N 1 f 23.96 2 N 1 f 24.55 3 N 1 f 23.83 4 5 | 5 375 GHz -41.84 df 9 000 GHz -42.14 df 0 375 GHz -42.51 df | Bm | | | Freq Offset 0 Hz |
| 6 7 8 9 10 11 | | | | | |
| K MSG | | | STATUS | | |

TM 1 & Highest

Reference

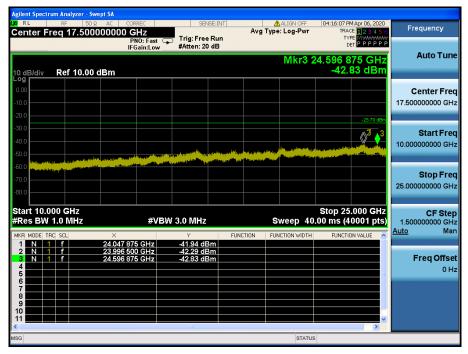


High Band-edge



| Agilent Spectrum Analyzer - | | | | | |
|----------------------------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------|
| Center Freq 15.00 | PNO: Fast | SENSE:INT | Avg Type: Log-Pwr | 04:15:50 PM Apr 06, 2020 TRACE 2 3 4 5 6 TYPE MWWWWW DET P P P P P | Frequency |
| 10 dB/div Ref 10.0 | IFGain:Low | #Atten: 20 dB | | Vkr1 281.9 kHz -54.06 dBm | Auto Tune |
| 0.00 | | | | | Center Fred 15.004500 MH; |
| -20.0 -30.0 -40.0 -50.0 | | | | -25.70 dBm | Start Free 9.000 kH |
| -60.0 -70.0 -80.0 | 6สารณาของการเรื่องการสารมูลเป็นเขาไปสาย | uternation have been a state of the state of | hathattaalatensilaten alaanaa taalaadi hadhadhadha | รัชกาะไฟซ์สู่เสม.584มีขา _ไ ประสงญร์สู่มาชิงภูช | Stop Free 30.000000 MH: |
| Start 9 kHz #Res BW 100 kHz | #VE | SW 300 kHz | Sweep 5.3 | Stop 30.00 MHz 333 ms (40001 pts) | CF Stej 2.999100 MH Auto Ma |
| MKR MODE TRC SCL | × 281.9 kHz | -54.06 dBm | UNCTION FUNCTION WIDTH | FUNCTION VALUE | <u>Auto</u> Ma |
| 2 3 4 5 | | | | | Freq Offse 0 H |
| 6 7 8 9 10 | | | | | |
| 11 | | m | | × | |
| ISG | | | STATUS | DC Coupled | |

| Agilent Spectrum Analyzer - Swept SA | | | | | | |
|------------------------------------------|-------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------|
| RL RF 50 Ω AC Center Freq 5.01500000 | | SENSE:INT | | ALIGN OFF e: Log-Pwr | 04:15:59 PM Apr 06, 202 TRACE 12345 | Frequency |
| | PNO: Fast 🖵 IFGain:Low | Trig: Free Run #Atten: 20 dB | | | TYPE MWWWWW DET P P P P P | P |
| | | | | Mkr | 5 7.556 60 GH | Auto Tune |
| 10 dB/div Ref 10.00 dBm | | | | | -54.63 dBn | |
| | <mark>⟩1</mark> | | | | | Our transformer |
| -10.0 | | | | | | Center Freq 5.015000000 GHz |
| -10.0 | | | | | | 5.015000000 GH2 |
| -30.0 | | | | | -25.70 dB | 1 |
| -40.0 | | | | | | Start Freq |
| -40.0 | _∧4 | | 3 | ▲5 | 2 | 30.000000 MHz |
| | | والقوط فحطف والمراجع والمراجع | and the state of t | an ya Maran Latanan | and the state of the | |
| -50.0 | and the second states in the second | | فأنويها يحاجزون لالتعاقمي لاه | na ya miduli na matani a sina a | and provide the second seco | Stop Freq |
| -70.0 | | | | | | 10.00000000 GHz |
| -00.0 | | | | | | |
| Start 30 MHz | | | | | Stop 10.000 GH | |
| #Res BW 1.0 MHz | #VBW | 3.0 MHz | | Sweep 18. | .67 ms (40001 pts | 997.000000 MHz Auto Man |
| MKR MODE TRC SCL X | 461 18 GHz | -2.15 dBm | FUNCTION FL | INCTION WIDTH | FUNCTION VALUE | Adio |
| 2 N 1 f 9 | 441 93 GHz | -53.81 dBm | | | | |
| 3 N 1 f 5. 4 N 1 f 3 | 757 77 GHz 124 19 GHz | -54.47 dBm -54.50 dBm | | | | Freq Offset 0 Hz |
| 5 N 1 f 7. | 556 60 GHz | -54.63 dBm | | | | 0 HZ |
| 7 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| < | | iii | | | | |
| MSG | | | | STATUS | | |



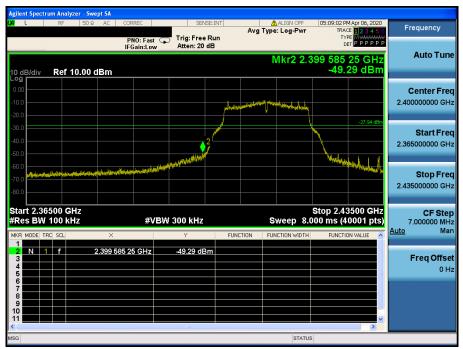
Dt&C

TM 2 & Lowest

Reference



Low Band-edge



| <mark>,X/</mark> L RF 50Ω/ | pt SA | SENSE:INT | 🛕 ALIGN OFF | 05:09:28 PM Apr 06, 2020 | Fragueser |
|-----------------------------------------|--------------------------------------|-----------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------|
| | PNO: Fast | Trig: Free Run Atten: 20 dB | Avg Type: Log-Pwr | TRACE 123456 TYPE MWWWWW DET PPPPP | Frequency |
| 10 dB/div Ref 10.00 d | IFGain:Low_ | Atten. 20 GB | | Mkr1 281.9 kHz -55.52 dBm | Auto Tune |
| 0.00 -10.0 | | | | | Center Freq 15.004500 MHz |
| -30.0 -40.0 -50.0 | | | | -27.94 dBm | Start Freq 9.000 kHz |
| -60.0 -70.0 -80.0 | Maaaa,ahistiinaayiinaa,isooniytiinaa | Manufalonistusitiyi netalon sedil | aper ¹ Nicht die entgeschieft nach anteres ¹ . Higherter ¹¹ 5 | an sa tha an | Stop Freq 30.000000 MHz |
| Start 9 kHz #Res BW 100 kHz | | W 300 kHz | | Stop 30.00 MHz 333 ms (40001 pts) | CF Step 2.999100 MHz Auto Mar |
| MKR MODE TRC SCL | × 281.9 kHz | Y FU -55.52 dBm | INCTION FUNCTION WIDTH | FUNCTION VALUE | |
| 2 2 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | | | | | Freq Offset 0 Hz |
| 3 4 | | | | | |

| Agilent Spectrum Analyzer - Sw LX/ L RF 50 Ω | | SENSE:INT | | | | |
|-------------------------------------------------|----------------------------------------------|---------------------------------------|-------------|---------------------------|-----------------------------------------------|---------------------------|
| LX/ L RF 50 Ω | | | | ALIGN OFF e: Log-Pwr | 05:10:02 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 | Frequency |
| | PNO: Fast (IFGain:Low | Atten: 20 dB | | | TYPE MWWWWWW DET P P P P P | |
| 10 dB/div Ref 10.00 | dBm | | | Mkr | 3 3.148 37 GHz -56.85 dBm | Auto Tune |
| 0.00 | 1 | | | | | Center Freq |
| -10.0 | | | | | | 5.015000000 GHz |
| -30.0 | | | | | -27.94 dBm | Start Freq |
| -40.0 | 3 | | | | | 30.000000 MHz |
| -60.0 | | | | te angle freshing his ord | | Stop Freq |
| -70.0 -10.0000 (60000) | | | | | | 10.000000000 GHz |
| Start 30 MHz #Res BW 1.0 MHz | #VB | W 300 kHz | s | weep 29 | Stop 10.000 GHz .33 ms (40001 pts) | CF Step 997.000000 MHz |
| MKR MODE TRC SCL | Х | Y | FUNCTION FU | INCTION WIDTH | FUNCTION VALUE | <u>Auto</u> Man |
| 1 N 1 f 2 N 1 f 3 N 1 f | 2.411 33 GHz 9.480 56 GHz 3.148 37 GHz | -1.88 dBm -56.46 dBm -56.85 dBm | | | | Freq Offset |
| | 3.146 37 GHZ | -56.65 dBiii | | | | 0 Hz |
| 6 6 7 8 8 | | | | | | |
| 9 10 | | | | | | |
| | | | | | × | |
| MSG | | | | STATUS | | |

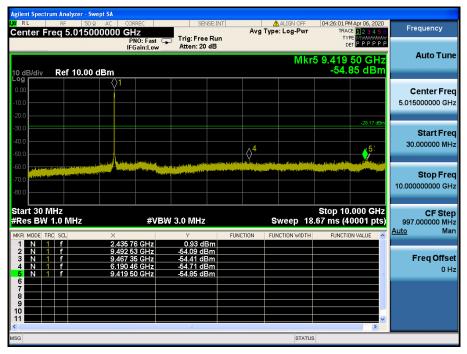


TM 2 & Middle

Reference



| RL RF 50 Ω <u>▲</u> enter Freq 15.00450 | DC CORREC | SENSE:IN | Avg | ALIGN OFF | 04:25:52 PM Apr 06, TRACE 1 2 3 TYPE MWAA | 456 Fre | quency |
|--------------------------------------------|-------------------------|--------------------------------------|-------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------|------------------------|
| | IFGain:Low | Atten: 20 dB | | | er P P P //kr1 281.9 F -53.44 dl | KHZ | Auto Tur |
| dB/div Ref 10.00 df | BM | | | | | с | enter Fr 004500 M |
| 1.0 1.0 1.0 | | | | | -281 | 17 dBm | Start Fre 9.000 ki |
| | ndiopingladaticalprassi | มีประกัน มีราการมีการให้เกิดรังสารไป | horpmany sairabhar dhitheanna | 1.001111111111111111111111111111111111 | han in the states of the second s | ////// 30. | Stop Fr 000000 M |
| art 9 kHz tes BW 100 kHz | #VE | 300 kHz | FUNCTION | Sweep 5.3 | Stop 30.00 F 33 ms (40001 | pts) 2. | CF St 999100 M N |
| R MODE TRC SCL | × 281.9 kHz | -53.44 dBm | | | | | |



| Agilent Spectrum Analyzer - Swept SA | | | | | |
|--------------------------------------------------------|-------------------|-------------------------------------|------------------------------|---------------------------------------------------------------------------------|----------------------------------------|
| 04/ RL RF 50 Ω AC Center Freq 17.50000000 | PNO: East Trig: F | SENSE:INT Av ree Run 20 dB | ALIGN OFF g Type: Log-Pwr | 04:26:09 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P | Frequency |
| 10 dB/div Ref 10.00 dBm | IFGailleow Prees | . 20 48 | Mkr3 2 | 4.311 125 GHz -43.69 dBm | Auto Tune |
| -10.0 | | | | | Center Freq 17.500000000 GHz |
| -30.0 | | | | -28.17.48m | Start Freq 10.000000000 GHz |
| -60.0 -70.0 -60.0 | | | | | Stop Fred 25.000000000 GH: |
| Start 10.000 GHz #Res BW 1.0 MHz | #VBW 3.0 MI | HZ | Sweep 40 | Stop 25.000 GHz .00 ms (40001 pts) | CF Step 1.500000000 GHz Auto Mar |
| 1 N 1 f 24.06 2 N 1 f 24.53 3 N 1 f 24.31 4 5 | | dBm dBm | | | Freq Offset 0 Hz |
| 6 7 8 9 10 11 | | | | ~ | |
| MSG | | | STATUS | | |

TM 2 & Highest

Reference



High Band-edge



| RL RF | r - Swept SA 50 Ω 🚹 DC 🔋 CORF | | NSE:INT | ALIGN OFF | 04:29:54 PM Ap | × 06, 2020 | |
|-----------------------------------------|----------------------------------|------------------------------------------|----------------------------------------------|----------------------------------------|------------------------|--------------------------|-----------------------------------------|
| enter Freq 15. | 004500 MHz | IO: Fast Trig: Free ain:Low Atten: 20 | Avg e Run | Type: Log-Pwr | TRACE | 23456 WWWWWW PPPPP | Frequency |
| 0 dB/div Ref 10 | 1.00 dBm | am:Luw Atten: 20 | | ſ | /lkr1 305. -55.12 | | Auto Tune |
| | | | | | | | Center Fre 15.004500 M⊦ |
| 40.0 40.0 50.0 | | | | | | -28.40 dBm | Start Fre 9.000 k⊦ |
| 50.0 70.0 30.0 | Ruful midsen Ininerrykies, | มสถานหลายใหญ่ เมินไปประกัน เกิดเรื่อง | atomustikistikistikistikistikistikistikistik | etinengenenen ^g erender der | litertissenen intissen | heironauthlahet | Stop Fre 30.000000 MH |
| tart 9 kHz Res BW 100 kHz | | #VBW 300 kHz | | Sweep 5.3 | · · | 01 pts) | CF Ste 2.999100 Mł Auto Mi |
| KR MODE TRC SCL | × 305.: | 2 kHz -55.12 dE | FUNCTION | FUNCTION WIDTH | FUNCTION V | ALUE 🛆 | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 5 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 | | | | | | | |
| 3 4 5 6 7 8 | | | | | | | Freq Offs 0 F |

| Agilent Spectrum Analyzer - Swe | | | | | |
|-----------------------------------------|----------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------|
| RL RF 50 Ω Center Freq 5.01500 | | SENSE:INT | ALIGN OFF Avg Type: Log-Pwr | 04:30:03 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 | Frequency |
| | PNO: Fast G | Trig: Free Run Atten: 20 dB | | | |
| 10 dB/div Ref 10.00 c | dBm | | Mkr | 5 5.693 96 GHz -55.02 dBm | Auto Tune |
| Log 0.00 -10.0 -20.0 | | | | | Center Freq 5.015000000 GHz |
| -30.0 | | | 5 <u>2</u> | -28 40 dBm | Start Freq 30.000000 MHz |
| -60.0 -70.0 -80.0 | | | and in the subscription of the second s | | Stop Freq 10.000000000 GHz |
| Start 30 MHz #Res BW 1.0 MHz | #VBV | V 3.0 MHz | Sweep 18 | Stop 10.000 GHz .67 ms (40001 pts) | CF Step 997.000000 MHz Auto Man |
| MKR MODE TRC SCL 1 N 1 f 2 N 1 f | × 2.460 94 GHz 6.800 88 GHz | Y FL 1.11 dBm -53.47 dBm | JNCTION FUNCTION WIDTH | FUNCTION VALUE | <u>Auto</u> Marr |
| 3 N 1 F 4 N 1 F 5 N 1 F 6 7 | 9.548 11 GHz 9.515 71 GHz 5.693 96 GHz | -54.12 dBm -54.96 dBm -55.02 dBm | | = | Freq Offset 0 Hz |
| 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 | | 11 | | × > | |
| MSG | | | STATUS | 8 | |

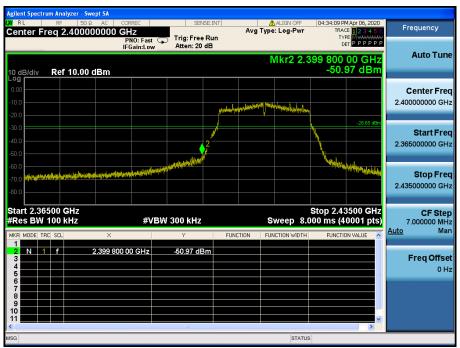


TM 3 & Lowest





Low Band-edge



| | 2 🛕 DC 🕴 CORREC 👘 | SENSE:INT | ALIGN OFF | 04:34:17 PM Apr 06, 2020 | Frequency |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------|--------------------------------------------------|------------------------------------------------------------|--------------------------------------------|
| Center Freq 15.004 | 500 MHz PNO: Fast G IFGain:Low | Trig: Free Run Atten: 20 dB | Avg Type: Log-Pwr | TRACE 123456 TYPE M M M M M M M M M M M M M M M M M M M | |
| 10 dB/div Ref 10.00 | dBm | | | Mkr1 281.9 kHz -55.01 dBm | Auto Tune |
| -10.0 | | | | | Center Freq 15.004500 MHz |
| -20.0 -30.0 -40.0 -50.0 | | | | -28.65 dBm | Start Freq 9.000 kHz |
| -60.0 | ungangtrig-signiska, kelapat dibihan menjedi pas | tergenere terkenste blev beraktere ek | n,thadalathathathathathathathathathathathathatha | nyahan jariha ayaha sahisa nyahar | Stop Freq 30.000000 MHz |
| Start 9 kHz #Res BW 100 kHz | #VBV | V 300 kHz | Sweep 5. | Stop 30.00 MHz 333 ms (40001 pts) | CF Step 2.999100 MHz <u>Auto</u> Man |
| MODE Inc. Sub- 1 1 f 2 3 - - 4 - - - 5 - - - 6 - - - 7 - - - 9 - - - | 281.9 kHz | -55.01 dBm | FORCHON FORCHON WIDTH | FONCTION VALUE | Freq Offset 0 Hz |
| 10 11 • | | | STATUS | DC Coupled | |

| Agilent Spectrum Au | | SENSE:INT | ALIGN OFF | 04:34:25 PM Apr 06, 2020 | |
|-----------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------|-----------------------------------------|----------------------------------------------|
| Center Freq | 5.015000000 GHz PNO: Fast IFGain:Lov | | Avg Type: Log-Pwr | TRACE 123456 TYPE MWWWW DET PPPPP | Frequency |
| | ef 10.00 dBm | | Mkr | 5 3.276 73 GHz -54.52 dBm | Auto Tune |
| Log 0.00 -10.0 -20.0 | | | | | Center Freq 5.015000000 GHz |
| -30.0 | 3,5 | | i dal fini kanana sukanini gadili a manani | -28.65 dBm | Start Freq 30.000000 MHz |
| -60.0 | | | | | Stop Freq 10.000000000 GHz |
| Start 30 MHz #Res BW 1.0 | L X | | Sweep 18 | Stop 10.000 GHz .67 ms (40001 pts) | CF Step 997.000000 MHz <u>Auto</u> Man |
| 1 N 1 f 2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f | 2 410 84 GHz 9 390 83 GHz 3 018 01 GHz 3 303 90 GHz 3 276 73 GHz | 0.32 dBm -54.08 dBm -54.41 dBm -54.43 dBm -54.52 dBm | | | Freq Offset 0 Hz |
| 7 8 9 10 11 | | | | | |
| MSG | | | STATUS | | |

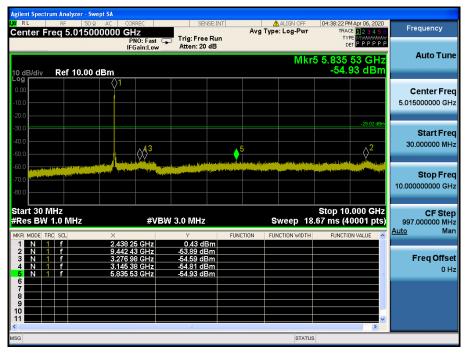


TM 3 & Middle

Reference



| RLRF _50 Ω ▲ DC enter Freq 15.004500 MI | CORREC SENSE HZ PNO: Fast C IFGain:Low Atten: 20 d | Avg Type: Log-Pwr Run | 04:38:13 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P | Frequency |
|-------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------|
| dB/div Ref 10.00 dBm | Irgani.Low Treen. 29 4 | | Mkr1 299.9 kHz -54.65 dBm | Auto Tur |
| | | | | Center Fr 15.004500 M |
| 0 0 0 0 0 0 | | | -29.02 dBm | Start Fr 9.000 k |
| .0 .0 .0 | hallan halan halan halan han halan han halan han han ha | าสร้างกับเรียกไปรู้อยู่เป็นเป็นเป็นเร็า กรุงที่ที่ได้ไปประเทศไตรแรงก่อ | thaip transport that go ft and a laparaphy | Stop Fr 30.000000 М |
| art 9 KHz tes BW 100 KHz R MODE TRC SCL X | #VBW 300 kHz | FUNCTION FUNCTION WIDTH | Stop 30.00 MHz .333 ms (40001 pts) | CF St 2.999100 M <u>Auto</u> M |
| | 233.3 KTZ | | | Freq Offs 0 |



| | um Analyzer - S | | | | | | |
|-----------------------------------------------|-----------------|------------------------------------------------------|--------------|----------------------------------------------------------------------|----------------|-----------------------------------------------|----------------------------------------|
| Center Fi | | Ω AC CORREC | SENSE | Avg | ALIGN OFF | 04:38:30 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 | Frequency |
| | | PNO: F IFGain:I | | | | | Auto Tune |
| 10 dB/div | Ref 10.00 | dBm | | | Mkr3 2 | 4.615 625 GHz -42.76 dBm | Auto Tune |
| Log 0.00 -10.0 -20.0 | | | | | | | Center Freq 17.500000000 GHz |
| -30.0 -40.0 -50.0 | | | | e kan sa sa di kang da di kan sa | | -29.02 dBm | Start Freq 10.000000000 GHz |
| -60.0 ********* -70.0 | | | | | | | Stop Freq 25.000000000 GHz |
| Start 10.0 #Res BW | 1.0 MHz | | ≇VBW 3.0 MHz | | | Stop 25.000 GHz .00 ms (40001 pts) | CF Step 1.500000000 GHz Auto Man |
| MKR MODE TR 1 N 1 2 N 1 3 N 1 4 5 | f f | × 23.933 500 GH 24.006 250 GH 24.615 625 GH | z -42.44 dBn | n | FUNCTION WIDTH | FUNCTION VALUE | Freq Offset 0 Hz |
| 6 7 8 9 10 11 | | | | | | - | |
| MSG | | | | | STATUS | | |

TM 3 & Highest

Reference

nt So ctrum Analy ent S/ 04:41:06 PM Apr 06, 2020 TRACE 2 3 4 5 6 TYPE M WWWWW DET P P P P P 24 RL RF | 50.9 AL | WARNES Center Freq 2.462000000 GHz PN0: Fast IFGain:Low Atten: 20 dB ALIGN OFF Frequency Auto Tune Mkr1 2.463 271 GHz -8.97 dBm Ref 10.00 dBm 10 dB/div Loa **Center Freq** 2.462000000 GHz 1 minuthinklinkpoor maline u-hours and marked Start Freq 2.449029500 GHz Stop Freq 2.474970500 GHz CF Step 2.594100 MHz Man Auto Freq Offset 0 Hz Center 2.46200 GHz #Res BW 100 kHz Span 25.94 MHz Sweep 2.600 ms (3001 pts) #VBW 300 kHz

High Band-edge



| Agilent Spectrum Analyze | 50 Ω 🛕 DC 🔋 CORREC 📔 | SENSE:II | | ALIGN OFF | 04:42:14 PM | Apr 06, 2020 | Frequency |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------|-------------------------|--------------------|----------------------------------------------|-------------------------------------|
| Center Freq 15. | UU45UU MHZ PNO: Fast IFGain:Lov | | | | TYPE DET | PPPPP | Auto Tune |
| 10 dB/div Ref 10 | 0.00 dBm | | | | /lkr1 281 -56.3 | .9 KH2 2 dBm | |
| 0.00 -10.0 | | | | | | | Center Freq 15.004500 MHz |
| -20.0 | | | | | | -28.97 dBm | Otort From |
| -40.0 -50.0 | | | | | | | Start Freq 9.000 kHz |
| -60.0 -70.0 -80.0 | reserved to the section of the secti | ระการในปัตวารกระการกระการ(เป็นการก | Allehander wie ein bei andere fahler | hanapatrihatillasiyadan | uitionstationige | alahanan da kana kana kana kana kana kana ka | Stop Freq 30.000000 MHz |
| Start 9 kHz #Res BW 100 kH | | BW 300 kHz | | Sweep 5.3 | 33 ms (40 | | CF Step 2.999100 MHz Auto Man |
| MKR MODE TRC SCL | × 281.9 kHz | ∀ -56.32 dBm | FUNCTION | FUNCTION WIDTH | FUNCTION | I VALUE | |
| | | | | | | = | Freq Offset 0 Hz |
| 6 7 8 9 10 | | | | | | | |
| 11 | | | | | | > | |
| MSG | | | | STATUS | L DC Coup | oled | |

| | m Analyzer - Swe | | | | | | | | | |
|----------------|-----------------------|----------------------|----------------------|-----------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------|
| Center Fre | RF 50 Ω eq 5.01500 | AC CORF | | | E:INT | | ALIGN OFF e: Log-Pwr | TRAC | M Apr 06, 2020 CE 123456 | Frequency |
| | | PN | 0:Fast G ain:Low | Trig: Free Atten: 20 d | | | | TYI DI | ET P P P P P P | |
| | | | | | | | Mkr | 5 9.438 | 19 GHz | Auto Tune |
| 10 dB/div | Ref 10.00 c | lBm | | | | | | | 84 dBm | |
| | | | | | | | | | | Contor From |
| -10.0 | | | | | | | | | | Center Freq 5.015000000 GHz |
| -20.0 | | | | | | | | | | 3.013000000 GH2 |
| -30.0 | | | | | | | | | -28.97 dBm | |
| -40.0 | | | | | | | | | | Start Freq |
| -40.0 | | <mark>\</mark> 2 | | | | | | | <u>∧</u> 5↓ | 30.000000 MHz |
| | | (hand a line of the | | والمتعادية والمعادية والم | | and a state of the state of the | | a ang tang tang tang tang tang tang tang | State of State | |
| -70.0 | | March 19 and 19 and | States and Longitude | A DESCRIPTION OF THE OWNER OF THE | للناهم فأز ملطامه وب | | المنظم مشاكستهم | and the second secon | and participation of the second second | Stop Freq |
| -80.0 | | | | | | | | | | 10.00000000 GHz |
| -00.0 | | | | | | | | | | |
| Start 30 MI | | | | | | | | | .000 GHz | CF Step |
| #Res BW 1 | | | #VBV | V 3.0 MHz | | | weep 18 | · · | | 997.000000 MHz Auto Man |
| MKR MODE TRC | SCL f | × 2.461 18 | GHZ | ۲ -0.40 dB | | ICTION FU | NCTION WIDTH | FUNCTIO | ON VALUE | <u>Auto</u> mart |
| 2 N 1 | f | 2,493 34 | GHz | -52.71 dB | n | | | | | Eren Offent |
| 3 N 1 4 N 1 | f f | 9.412 02 9.533 15 | GHz | -53.66 dB -54.25 dB | n | | | | | Freq Offset 0 Hz |
| 5 N 1 | f | 9.438 19 | GHz | -54.84 dB | n | | | | = | 0112 |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 10 | | | | | | | | | ~ | |
| < | | | | | | | | | > | |
| MSG | | | | | | | STATUS | 6 | | |





8.5 Radiated spurious emissions

Test Requirements and limit, §15.247(d), §15.205, §15.209

In any 100 kHz bandwidth outside the operating frequency band, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 KHz bandwidth within the band. In case the emission fall within the restricted band specified on 15.205(a) and (b), then the 15.209(a) limit in the table below has to be followed.

• FCC Part 15.209(a) and (b)

| Frequency (MHz) | Limit (uV/m) | Measurement Distance (meter) | | |
|-----------------|---------------|------------------------------|--|--|
| 0.009 - 0.490 | 2400/F (kHz) | 300 | | |
| 0.490 – 1.705 | 24000/F (kHz) | 30 | | |
| 1.705 – 30.0 | 30 | 30 | | |
| 30 ~ 88 | 100 ** | 3 | | |
| 88 ~ 216 | 150 ** | 3 | | |
| 216 ~ 960 | 200 ** | 3 | | |
| Above 960 | 500 | 3 | | |

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

• FCC Part 15.205 (a): Only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | MHz | GHz | GHz |
|-------------------|---------------------|-------------------|-----------------|--------------|---------------|
| 0.009 ~ 0.110 | 8.41425 ~ 8.41475 | 108 ~ 121.94 | 1300 ~ 1427 | 4.5 ~ 5.15 | 14.47 ~ 14.5 |
| 0.495 ~ 0.505 | 12.29 ~ 12.293 | 123 ~ 138 | 1435 ~ 1626.5 | 5.35 ~ 5.46 | 15.35 ~ 16.2 |
| 2.1735 ~ 2.1905 | 12.51975 ~ 12.52025 | 149.9 ~ 150.05 | 1645.5 ~ 1646.5 | 7.25 ~ 7.75 | 17.7 ~ 21.4 |
| 4.125 ~ 4.128 | 12.57675 ~ 12.57725 | 156.52475 ~ | 1660 ~ 1710 | 8.025 ~ 8.5 | 22.01 ~ 23.12 |
| 4.17725 ~ 4.17775 | 13.36 ~ 13.41 | 156.52525 | 1718.8 ~ 1722.2 | 9.0 ~ 9.2 | 23.6 ~ 24.0 |
| 4.20725 ~ 4.20775 | 16.42 ~ 16.423 | 156.7 ~ 156.9 | 2200 ~ 2300 | 9.3 ~ 9.5 | 31.2 ~ 31.8 |
| 6.215 ~ 6.218 | 16.69475 ~ 16.69525 | 162.0125 ~ 167.17 | 2310 ~ 2390 | 10.6 ~ 12.7 | 36.43 ~ 36.5 |
| 6.26775 ~ 6.26825 | 16.80425 ~ 16.80475 | 167.72 ~ 173.2 | 2483.5 ~ 2500 | 13.25 ~ 13.4 | Above 38.6 |
| 6.31175 ~ 6.31225 | 25.5 ~ 25.67 | 240 ~ 285 | 2655 ~ 2900 | | |
| 8.291 ~ 8.294 | 37.5 ~ 38.25 | 322 ~ 335.4 | 3260 ~ 3267 | | |
| 8.362 ~ 8.366 | 73 ~ 74.6 | 399.90 ~ 410 | 3332 ~ 3339 | | |
| 8.37625 ~ 8.38675 | 74.8 ~ 75.2 | 608 ~ 614 | 3345.8 ~ 3358 | | |
| | | 960 ~ 1240 | 3600 ~ 4400 | | |
| | | | | | |

• FCC Part 15.205(b): The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

Test Configuration

Refer to the APPENDIX I.

Test Procedure

- 1. The EUT is placed on a non-conductive table, emission measurements at below 1 GHz, the table height is 80 cm and above 1 GHz, the table height is 1.5 m.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 1 or 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.

- KDB558074 D01v05r02 - Section 8.6

- ANSI C63.10-2013 – Section 11.12

Peak Measurement

RBW = As specified in below table, VBW \ge 3 x RBW, Sweep = Auto, Detector = Peak, Trace mode = Max Hold until the trace stabilizes.

| Frequency | RBW |
|-------------|-------------|
| 9-150 kHz | 200-300 Hz |
| 0.15-30 MHz | 9-10 kHz |
| 30-1000 MHz | 100-120 kHz |
| >1000 MHz | 1 MHz |

Average Measurement:

- 1. RBW = 1 MHz (unless otherwise specified).
- 2. VBW \geq 3 x RBW.
- 3. Detector = RMS (Number of points ≥ 2 x Span / RBW)
- 4. Averaging type = power. (i.e., RMS)
- 5. Sweep time = auto.
- 6. Perform a trace average of at least 100 traces.
- 7. A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
- 1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1/D), where D is the duty cycle.
- 2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1/D), where D is the duty cycle.
- 3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Duty Cycle Correction factor

| Test Mode | Date rate | Date rate Ton(ms) Ton+off (ms) | | D = T _{on} / (T _{on+off}) | DCCF = 10 log(1/D) (dB) |
|-----------|------------|--------------------------------|--------|----------------------------------------------|----------------------------|
| TM 1 | 1Mbps | 12.420 | 12.510 | 0.9928 | N/A |
| TM 2 | 6Mbps | 2.064 | 2.166 | 0.9529 | 0.21 |
| TM 3 | TM 3 MCS 0 | | 2.022 | 0.9496 | 0.22 |

Note1: Where, T= Transmission duration / D= Duty cycle

Note2: Please refer to the appendix I for duty cycle plots.

Test Results: Comply

| Tested Frequency | Frequency (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---------------------|--------------------|------------|---------------------------|------------------|-------------------|---------------|--------------|-------------|--------------------|-------------------|----------------|
| | 2389.08 | V | Х | PK | 48.94 | 4.80 | N/A | N/A | 53.74 | 74.00 | 20.26 |
| | 2388.94 | V | Х | AV | 38.64 | 4.80 | N/A | N/A | 43.44 | 54.00 | 10.56 |
| Lowest | 4825.21 | V | Х | PK | 49.40 | 0.94 | N/A | N/A | 50.34 | 74.00 | 23.66 |
| | 4821.97 | V | Х | AV | 39.48 | 0.92 | N/A | N/A | 40.40 | 54.00 | 13.60 |
| Middle | 4875.93 | V | Х | PK | 49.54 | 1.22 | N/A | N/A | 50.76 | 74.00 | 23.24 |
| wildule | 4872.75 | V | Х | AV | 39.51 | 1.17 | N/A | N/A | 40.68 | 54.00 | 13.32 |
| | 2492.36 | V | Х | PK | 49.13 | 5.38 | N/A | N/A | 54.51 | 74.00 | 19.49 |
| Llighoot | 2483.70 | V | Х | AV | 39.04 | 5.25 | N/A | N/A | 44.29 | 54.00 | 9.71 |
| Highest | 4922.89 | V | Х | PK | 49.61 | 1.44 | N/A | N/A | 51.05 | 74.00 | 22.95 |
| - | 4922.35 | V | Х | AV | 39.68 | 1.44 | N/A | N/A | 41.12 | 54.00 | 12.88 |

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : TM 1

Note.

- 1. The radiated emissions were investigated up to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

3. Information of Distance Factor.

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance) = 20 log(1 m / 3 m) = -9.54 dB



| Tested Frequency | Frequency (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---------------------|--------------------|------------|---------------------------|------------------|-------------------|---------------|--------------|-------------|--------------------|-------------------|----------------|
| | 2387.54 | V | Х | PK | 49.32 | 4.79 | N/A | N/A | 54.11 | 74.00 | 19.89 |
| Louvoot | 2389.38 | V | Х | AV | 38.59 | 4.80 | 0.21 | N/A | 43.60 | 54.00 | 10.40 |
| Lowest | 4824.50 | V | Х | PK | 49.90 | 0.94 | N/A | N/A | 50.84 | 74.00 | 23.16 |
| | 4823.22 | V | Х | AV | 39.20 | 0.93 | 0.21 | N/A | 40.34 | 54.00 | 13.66 |
| Middle | 4874.87 | V | Х | PK | 49.71 | 1.19 | N/A | N/A | 50.90 | 74.00 | 23.10 |
| Middle | 4872.64 | V | Х | AV | 39.46 | 1.17 | 0.21 | N/A | 40.84 | 54.00 | 13.16 |
| | 2486.60 | V | Х | PK | 48.92 | 5.30 | N/A | N/A | 54.22 | 74.00 | 19.78 |
| Highest | 2483.90 | V | Х | AV | 38.73 | 5.26 | 0.21 | N/A | 44.20 | 54.00 | 9.80 |
| | 4925.12 | V | Х | PK | 49.52 | 1.45 | N/A | N/A | 50.97 | 74.00 | 23.03 |
| | 4925.59 | V | Х | AV | 39.30 | 1.45 | 0.21 | N/A | 40.96 | 54.00 | 13.04 |

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : <u>TM 2</u>

Note.

- 1. The radiated emissions were investigated up to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F + DCCF + DCF / T.F = AF + CL – AG Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

3. Information of Distance Factor.

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance) = 20 log(1 m / 3 m) = -9.54 dB



| Tested Frequency | Frequency (MHz) | ANT Pol | EUT Position (Axis) | Detector Mode | Reading (dBuV) | T.F (dB/m) | DCCF (dB) | DCF (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---------------------|--------------------|------------|---------------------------|------------------|-------------------|---------------|--------------|-------------|--------------------|-------------------|----------------|
| | 2388.94 | V | Х | PK | 48.32 | 4.80 | N/A | N/A | 53.12 | 74.00 | 20.88 |
| Lowoot | 2389.30 | V | Х | AV | 38.51 | 4.80 | 0.22 | N/A | 43.53 | 54.00 | 10.47 |
| Lowest | 4824.57 | V | Х | PK | 49.88 | 0.94 | N/A | N/A | 50.82 | 74.00 | 23.18 |
| | 4824.85 | V | Х | AV | 39.15 | 0.94 | 0.22 | N/A | 40.31 | 54.00 | 13.69 |
| Middle | 4873.78 | V | Х | PK | 49.68 | 1.17 | N/A | N/A | 50.85 | 74.00 | 23.15 |
| Middle | 4873.80 | V | Х | AV | 39.32 | 1.17 | 0.22 | N/A | 40.71 | 54.00 | 13.29 |
| | 2486.82 | V | Х | PK | 48.55 | 5.30 | N/A | N/A | 53.85 | 74.00 | 20.15 |
| Highest | 2483.96 | V | Х | AV | 38.75 | 5.26 | 0.22 | N/A | 44.23 | 54.00 | 9.77 |
| | 4925.49 | V | Х | PK | 49.47 | 1.45 | N/A | N/A | 50.92 | 74.00 | 23.08 |
| | 4922.60 | V | Х | AV | 39.42 | 1.44 | 0.22 | N/A | 41.08 | 54.00 | 12.92 |

Radiated Spurious Emissions data(9 kHz ~ 25 GHz) : TM 3

Note.

- 1. The radiated emissions were investigated up to 25GHz. And no other spurious and harmonic emissions were found above listed frequencies.
- 2. Sample Calculation.

Margin = Limit – Result / Result = Reading + T.F + DCCF + DCF / T.F = AF + CL – AG Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

3. Information of Distance Factor.

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance) = 20 log(1 m / 3 m) = -9.54 dB

8.6 Power-line conducted emissions

Test Requirements and limit, §15.207

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

| Frequency Range | Conducted Limit (dBuV) | | | | | |
|-----------------|------------------------|------------|--|--|--|--|
| (MHz) | Quasi-Peak | Average | | | | |
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * | | | | |
| 0.5 ~ 5 | 56 | 46 | | | | |
| 5 ~ 30 | 60 | 50 | | | | |

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Procedure

- 1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
- 2. The EUT is connected via LISN to the test power supply.
- 3. The measurement results are obtained as described below:
- 4. Detectors Quasi Peak and Average Detector.
- Test Results: NA

9. LIST OF TEST EQUIPMENT

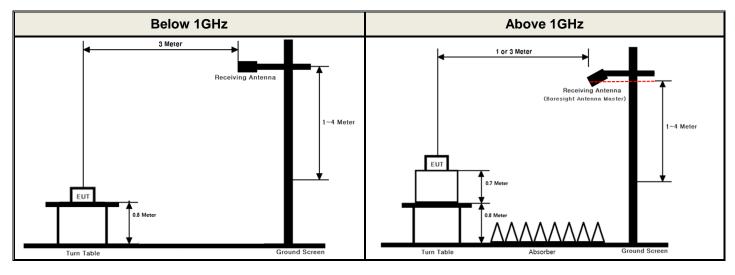
| Туре | Manufacturer | Model | Cal.Date (yy/mm/dd) | Next.Cal.Date (yy/mm/dd) | S/N |
|----------------------------------------|------------------------|---------------------------------|------------------------|-----------------------------|--------------------|
| Spectrum Analyzer | Agilent Technologies | N9020A | 19/12/16 | 20/12/16 | MY49060056 |
| Spectrum Analyzer | Agilent Technologies | N9020A | 19/12/16 | 20/12/16 | MY48011700 |
| Spectrum Analyzer | Agilent Technologies | N9020A | 19/12/16 | 20/12/16 | MY48010133 |
| DC Power Supply | Agilent Technologies | 66332A | 19/06/25 | 20/06/25 | MY43001173 |
| DC Power Supply | SM techno | SDP30-5D | 19/06/24 | 20/06/24 | 305DMG305 |
| Multimeter | FLUKE | 17B | 19/12/16 | 20/12/16 | 26030065WS |
| Signal Generator | Rohde Schwarz | SMBV100A | 19/12/16 | 20/12/16 | 255571 |
| Signal Generator | ANRITSU | MG3695C | 19/12/16 | 20/12/16 | 173501 |
| Thermohygrometer | BODYCOM | BJ5478 | 19/12/18 | 20/12/18 | 120612-1 |
| Thermohygrometer | BODYCOM | BJ5478 | 19/12/18 | 20/12/18 | 120612-2 |
| Thermohygrometer | BODYCOM | BJ5478 | 19/06/25 | 20/06/25 | N/A |
| Loop Antenna | Schwarzbeck | FMZB1513 | 20/02/19 | 22/02/19 | 1513-128 |
| BILOG ANTENNA | Schwarzbeck | VULB 9160 | 19/04/23 | 21/04/23 | 9160-3362 |
| Horn Antenna | ETS-Lindgren | 3115 | 20/01/30 | 22/01/30 | 6419 |
| Horn Antenna | A.H.Systems Inc. | SAS-574 | 19/07/03 | 21/07/03 | 155 |
| PreAmplifier | tsj | MLA-0118-B01-40 | 19/12/16 | 20/12/16 | 1852267 |
| PreAmplifier | tsj | MLA-1840-J02-45 | 19/06/27 | 20/06/27 | 16966-10728 |
| PreAmplifier | H.P | 8447D | 19/12/16 | 20/12/16 | 2944A07774 |
| High Pass Filter | Wainwright Instruments | WHKX12-935-1000- 15000-40SS | 19/06/26 | 20/06/26 | 8 |
| High Pass Filter | Wainwright Instruments | WHKX10-2838-3300- 18000-60SS | 19/06/26 | 20/06/26 | 1 |
| High Pass Filter | Wainwright Instruments | WHNX8.0/26.5-6SS | 19/06/27 | 20/06/27 | 3 |
| Attenuator | Hefei Shunze | SS5T2.92-10-40 | 19/06/27 | 20/06/27 | 16012202 |
| Attenuator | SRTechnology | F01-B0606-01 | 19/06/27 | 20/06/27 | 13092403 |
| Attenuator | Aeroflex/Weinschel | 20515 | 19/06/27 | 20/06/27 | Y2370 |
| Attenuator | SMAJK | SMAJK-2-3 | 19/06/27 | 20/06/27 | 2 |
| Attenuator | Aeroflex/Weinschel | 56-3 | 19/06/25 | 20/06/25 | Y2342 |
| Power Meter & Wide Bandwidth Sensor | Anritsu | ML2495A MA2490A | 19/06/24 | 20/06/24 | 1306007 1249001 |
| EMI Receiver | ROHDE&SCHWARZ | ESW44 | 19/07/30 | 20/07/30 | 101645 |
| Cable | Junkosha | MWX241 | 20/01/13 | 21/01/13 | G-04 |
| Cable | Junkosha | MWX241 | 20/01/13 | 21/01/13 | G-07 |
| Cable | DT&C | Cable | 20/01/13 | 21/01/13 | G-13 |
| Cable | DT&C | Cable | 20/01/13 | 21/01/13 | G-14 |
| Cable | HUBER+SUHNER | SUCOFLEX 104 | 20/01/13 | 21/01/13 | G-15 |
| Cable | Radiall | TESTPRO3 | 20/01/16 | 21/01/16 | M-01 |
| Cable | Junkosha | MWX315 | 20/01/16 | 21/01/16 | M-05 |
| Cable | Junkosha | MWX221 | 20/01/16 | 21/01/16 | M-06 |
| Cable | Radiall | TESTPRO3 | 20/01/15 | 21/01/15 | RF-64 |

Note 1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017 Note 2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

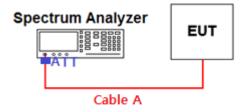
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

| Frequency (GHz) | Path Loss (dB) | Frequency (GHz) | Path Loss (dB) |
|-----------------------|----------------|-----------------|----------------|
| 0.03 | 2.59 | 15 | 7.27 |
| 1 | 2.86 | 20 | 9.27 |
| 2.412 & 2.437 & 2.462 | 4.16 | 25 | 9.87 |
| 5 | 5.30 | - | - |
| 10 | 6.38 | - | - |

Note 1: The path loss from EUT to Spectrum analyzer was measured and used for test. Path loss (S/A's correction factor) = Cable A

APPENDIX II

Duty cycle plots

Test Procedure

Duty Cycle was measured using section 6.0 b) of KDB558074 D01v05r02 :

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW \geq OBW if possible; otherwise, set RBW to the largest available value. Set VBW \geq RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T \leq 16.7 microseconds.)

Duty Cycle

Frequency Avg Type: Log-Pwr Center Freq 2.437000000 GHz Trig: Free Run Atten: 30 dB Auto Tune ∆Mkr3 Ref 20.00 dBm 3/4 **Center Freq** Xe 2.437000000 GHz Start Freq 2.437000000 GHz Stop Freq 2.437000000 GHz Span 0 Hz Sweep 50.00 ms (10001 pts) CF Step 8.000000 MHz Man Center 2.437000000 GHz Res BW 8 MHz #VBW 50 MHz Auto t (Δ) 6 t (Δ) Frea Offset íΔì 6 15 dF 0 Hz STATUS

TM 1 & Middle

Dt&C

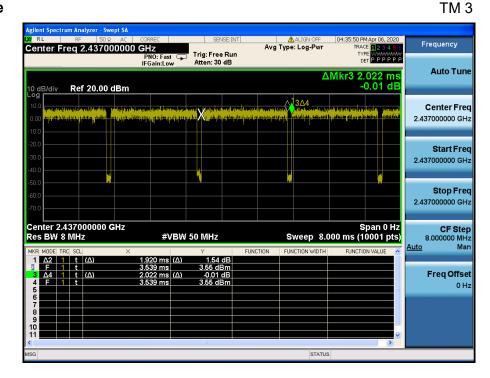
TM 2 &

Middle

Duty Cycle

| Agilent Spectrum Analyzer - Swept SA | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------|---------------------------------------------------|------------------------------------------|
| X RL RF 50Ω AC Center Freq 2.437000000 | CORREC GHZ | SENSE:INT | ALIGN OFF Avg Type: Log-Pwr | 04:23:37 PM Apr 06, 2020 TRACE 1 2 3 4 5 6 | Frequency |
| | PNO: Fast 😱 IFGain:Low | Trig: Free Run Atten: 30 dB | | DET PPPPP | Auto Tun |
| 10 dB/div Ref 20.00 dBm 10 0 mm proprint altra international 0.00 dataset provided to data altra international -10 0 | | | 4 ang na harang ang na harang sa harang sa ang na harang a | | Center Fre 2.437000000 GH |
| -20.0 -30.0 -40.0 | | | | | Start Fre 2.437000000 GH |
| -50.0 | | | | | Stop Fre 2.437000000 GH |
| Center 2.437000000 GHz Res BW 8 MHz | #VBW | 50 MHz | Sweep 8. | Span 0 Hz 000 ms (10001 pts) FUNCTION VALUE | CF Stej 8.000000 MH <u>Auto</u> Ma |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | 2.064 ms (Δ) 2.127 ms 2.166 ms (Δ) 2.127 ms | -1.01 dB 1.89 dBm 2.19 dB 1.89 dBm | | | Freq Offse 0 H |
| 6 7 8 9 10 11 | | | | | |
| MSG | | | STATU | | |

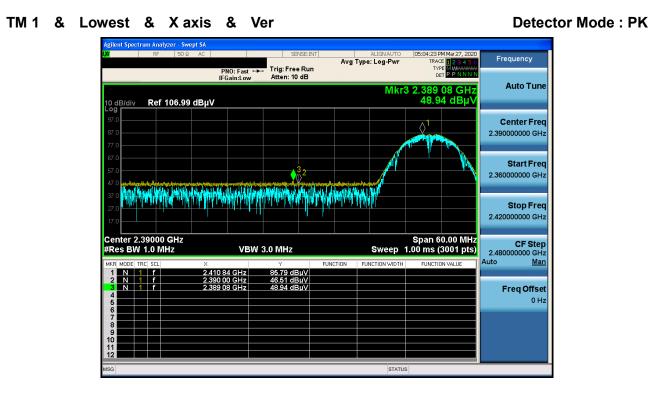
& Middle



Duty Cycle

APPENDIX III

Unwanted Emissions (Radiated) Test Plot

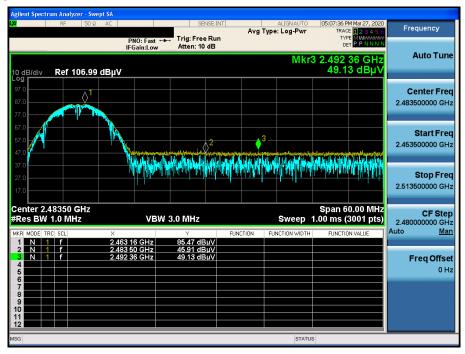


TM 1 & Lowest & X axis & Ver

5:01 PM Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB TYPE PNO: Fast IFGain:Low Auto Tune Mkr3 2.388 94 GH: 38.637 dBµ\ Ref 106.99 dBµV 0 dB/div **Center Freq** 2.39000000 GHz Start Freq 2.36000000 GHz a dini a mini ka Stop Freq 2.420000000 GHz Center 2.39000 GHz #Res BW 1.0 MHz Span 60.00 MHz Sweep 1.00 ms (3001 pts) CF Step 2.48000000 GHz VBW 3.0 MHz* Auto Man 2.411 00 GHz 2.390 00 GHz 2.388 94 GHz Freq Offset 0 Hz STATUS

Detector Mode : PK

TM 1 & Highest & X axis & Ver



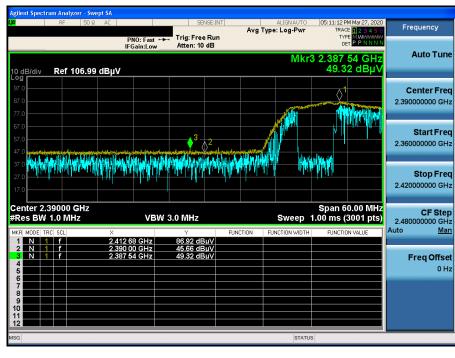
TM 1 & Highest & X axis & Ver

Frequency Avg Type: RMS Avg|Hold: 200/200 A WARAA Trig: Free Run Atten: 10 dB PNO: Fast ↔ IFGain:Low TYP Ļ Auto Tune Mkr3 2.483 70 GH 39.037 dBµ dB/di Ref 106.99 dBµV **Center Freq** 2.483500000 GHz Start Freq ere helden under sonder sonder in der der eine der eine der eine der eine der eine der eine der der der der der 2.453500000 GHz a. htil Stop Freq 2.513500000 GHz Center 2.48350 GHz #Res BW 1.0 MHz Span 60.00 MHz 1.00 ms (3001 pts) **CF Step** 2.480000000 GHz Auto <u>Man</u> VBW 3.0 MHz* Sweep 2.463 04 GHz 2.483 50 GHz 2.483 70 GHz 82.685 37.966 39.037 Freq Offset 0 Hz STATUS



TM 2 & Lowest & X axis & Ver





TM 2 & Lowest & X axis & Ver

Frequency Avg Type: RMS Avg|Hold: 200/200 PNO: Fast H IFGain:Low Trig: Free Run Atten: 10 dB TYPE A WARAN Ļ Auto Tune Mkr3 2.389 38 GH 38.586 dBµ Ref 106.99 dBµV 0 dB/div **Center Freq** 2.390000000 GH; Start Freq 2.360000000 GHz a a hai na fa ya haki ka na ka ka na ka ka na ahi Stop Freq 2.42000000 GHz **CF Step** 2.480000000 GHz Auto Center 2.39000 GHz #Res BW 1.0 MHz Span 60.00 MHz 1.00 ms (3001 pts) VBW 3.0 MHz* Sweep 79.002 37.837 38.586 2.390 00 GHz Freq Offset 0 Hz STATUS

TM 2 & Highest & X axis & Ver

Detector Mode : PK

| Agilent Spectrum Analyzer - Swept SA | | | | | | | |
|--------------------------------------|------------------------|----------------------------------------------------|----------|----------------------------|--------------------------------------|------------------------------|-------------------------------|
| LXU RF 50Ω AC | | SENSE:1 | | ALIGNAUTO Type: Log-Pwr | TRAC | M Mar 27, 2020 | Frequency |
| | PNO: Fast 🔸 | Trig: Free Ru Atten: 10 dB | n - | | TYP DE | E MWARAAAAA T P P N N N N | |
| | II Gam.Low | | | Mkr | 3 2.486 | 60 GHz | Auto Tune |
| 10 dB/div Ref 106.99 dBµV | | | | | | 2 dBµV | |
| 97.0 | | | | | | | Center Freq |
| 87.0 | | | | | | | 2.483500000 GHz |
| | N . | | | | | | |
| 67.0 | MM. | | | | | | Otert Eron |
| 57.0 | | ×2 | 3 | | | | Start Freq 2.453500000 GHz |
| 47.0 | - North Constant | | | staal (Margi) Ani aasi ka | and the same particular to the state | International particular | 2.40000000000112 |
| 37.0 | | 的时代 | 柳柳柳竹梢 | Hall Mille | | WWW NWY | |
| 27.0 | | | | herde Erdikteni | - Fills | for reaching | Stop Freq 2.513500000 GHz |
| 17.0 | | | | | | | 2.515500000 GH2 |
| Center 2.48350 GHz | | | | | Span 6 | 0.00 MHz | CF Step |
| #Res BW 1.0 MHz | VBW | 3.0 MHz | | Sweep | 1.00 ms (| 3001 pts) | 2.480000000 GHz |
| MKR MODE TRC SCL X | | Y | FUNCTION | FUNCTION WIDTH | FUNCTIO | IN VALUE | Auto <u>Man</u> |
| 2 N 1 f 2.4 | 53 10 GHz 33 50 GHz | 88.03 dBµV 45.53 dBµV | | | | | |
| 3 N 1 f 2.4 | 36 60 GHz | 48.92 dBµV | | | | | Freq Offset |
| 5 | | | | | | | 0 Hz |
| 7 | | | | | | | |
| 8 9 | | | | | | | |
| 10 | | | | | | | |
| 12 | | | | | | | |
| MSG | | | | STATU | IS | | |

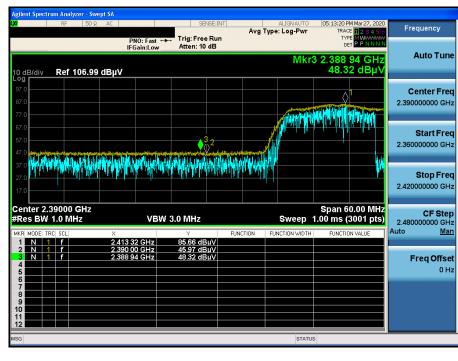
TM 2 & Highest & X axis & Ver

Frequency Avg Type: RMS Avg|Hold: 200/200 PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 10 dB TYPE DET A WARAAA A P N N N Auto Tune Mkr3 2.483 90 GH: 38.728 dBµ\ Ref 106.99 dBµV dBidi **Center Freq** A¹ 2.483500000 GHz and the second 1. 140 Start Freq 2.453500000 GHz Stop Freq 2.513500000 GHz Center 2.48350 GHz #Res BW 1.0 MHz Span 60.00 MHz 1.00 ms (3001 pts) **CF Step** 2.480000000 GHz Auto <u>Man</u> VBW 3.0 MHz* Sweep 2.462 94 GHz 2.483 50 GHz 2.483 90 GHz 38.659 38.728 Freq Offset 0 Hz STATUS



TM 3 & Lowest & X axis & Ver





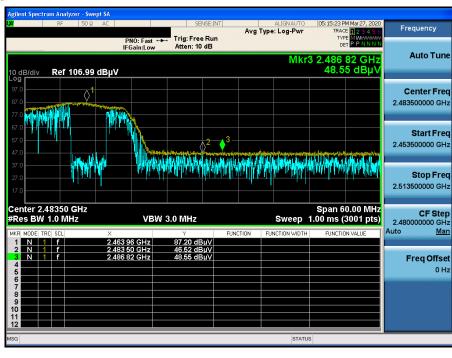
TM 3 & Lowest & X axis & Ver

Frequency Avg Type: RMS Avg|Hold: 200/200 PNO: Fast H IFGain:Low A WATAN A P N N N Trig: Free Run Atten: 10 dB TYPE DET Ļ Auto Tune Mkr3 2.389 30 GH 38.511 dBµ Ref 106.99 dBµV 0 dB/div **Center Freq** 2.390000000 GH; Start Freq 2.360000000 GHz Stop Freq 2.42000000 GHz **CF Step** 2.480000000 GHz Auto Center 2.39000 GHz #Res BW 1.0 MHz Span 60.00 MHz 1.00 ms (3001 pts) VBW 3.0 MHz* Sweep 78.064 d 37.751 d 38.511 d 2.390 00 GHz Freq Offset 0 Hz STATUS



TM 3 & Highest & X axis & Ver





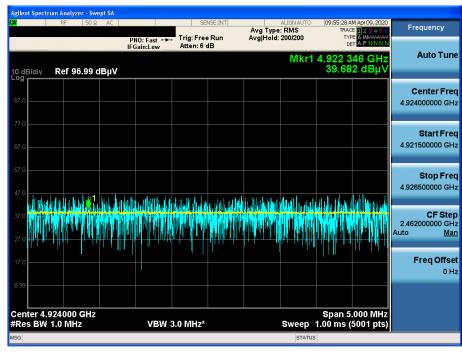
TM 3 & Highest & X axis & Ver

Frequency Avg Type: RMS Avg|Hold: 200/200 A WARA Trig: Free Run Atten: 10 dB PNO: Fast ↔ IFGain:Low TYP Ļ Auto Tune Mkr3 2.483 96 GH 38.751 dBµ Ref 106.99 dBµV dB/div **Center Freq** 2.483500000 GH; Start Freq 2.453500000 GHz Stop Freq 2.513500000 GHz Span 60.00 MHz 1.00 ms (3001 pts) Center 2.48350 GHz #Res BW 1.0 MHz **CF Step** 2.480000000 GHz Auto <u>Man</u> VBW 3.0 MHz* Sweep 79.215 38.198 38.751 2.483 50 GHz 2.483 96 GHz Freq Offset 0 Hz STATUS

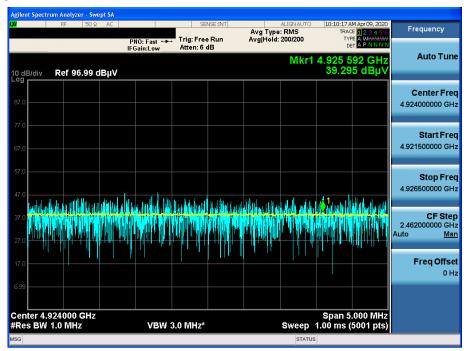
Dt&C

TM 1 & Highest & X axis & Ver





TM 2 & Highest & X axis & Ver





TM 3 & Highest & X axis & Ver

