

# 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 : DRTFCC2304-0047

2. Customer

- Name (FCC) : SEMES
- Address (FCC) : 77 4sandan 5-gil Jiksan-eup Seobuk-gu Cheonan-si South Korea

3. Use of Report : FCC Original Grant

4. Product Name / Model Name : S-DAQ / SRC-BAMVC3

FCC ID : 2AN5B-SRC-BAMVC3

5. FCC Regulation(s): Part 15.247

Test Method used: KDB558074 D01v05r02, ANSI C63.10-2013

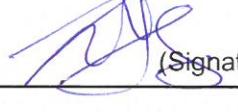
6. Date of Test : 2022.07.19 ~ 2023.04.05

7. Location of Test :  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.  
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : JaeHyeok Bang 	Technical Manager Name : JaeJin Lee 
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2023 . 04 . 10 .

**Dt&C Co., Ltd.**

If this report is required to confirmation of authenticity, please contact to [report@dtnc.net](mailto:report@dtnc.net)

## Test Report Version

<b>Test Report No.</b>	<b>Date</b>	<b>Description</b>	<b>Revised by</b>	<b>Reviewed by</b>
DRTFCC2304-0047	Apr, 10. 2023	Initial issue	JaeHyeok Bang	JaeJin Lee

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## 1. General Information

### 1.1. Description of EUT

Equipment Class	Digital Transmission System (DTS)
Product Name	S-DAQ
Model Name	SRC-BAMVC3
Add Model Name	-
Firmware Version Identification Number	1.0
EUT Serial Number	Conducted : 220615VC30004 Radiated : No Specified
Power Supply	DC 24 V
Modulation Technique	▪ 802.11b: CCK, DSSS ▪ 802.11g: OFDM
Antenna Specification	Antenna Type: Dipole Antenna Gain: 4.16 dBi (PK)

Band	Mode	Tx. frequency(MHz)	Max. conducted power(dBm)
2.4 GHz	802.11b	2 412 ~ 2 462	16.27
	802.11g	2 412 ~ 2 462	21.79

### 1.2. Declaration by the applicant / manufacturer

N/A

### 1.3. Testing Laboratory

#### Dt&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.

The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.

- FCC & IC MRA Designation No. : KR0034
- ISED#: 5740A

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### 1.4. Testing Environment

#### Ambient Condition

▪ Temperature	+20 °C ~ +25 °C
▪ Relative Humidity	+35 % ~ +45 %

### 1.5. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Antenna-port conducted emission	1.3 dB (The confidence level is about 95 %, $k = 2$ )
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, $k = 2$ )
Radiated emission (1 GHz Below)	4.8 dB (The confidence level is about 95 %, $k = 2$ )
Radiated emission (1 GHz ~ 18 GHz)	5.0 dB (The confidence level is about 95 %, $k = 2$ )
Radiated emission (18 GHz Above)	5.2 dB (The confidence level is about 95 %, $k = 2$ )

## 1.6. Test Equipment List

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	22/12/16	23/12/16	MY50410163
Spectrum Analyzer	Agilent Technologies	N9020A	22/06/24	23/06/24	US47360812
Spectrum Analyzer	Agilent Technologies	N9020A	22/06/24	23/06/24	MY46471622
Receiver	Rohde Schwarz	ESCI3	22/09/19	23/09/19	100798
DC Power Supply	Agilent Technologies	6674A	22/06/24	23/06/24	3501A01103
DC Power Supply	SM technico	SDP30-5D	22/06/24	23/06/24	305DNF079
Multimeter	FLUKE	17B+	22/12/16	23/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	22/12/16	23/12/16	255571
Signal Generator	ANRITSU	MG3695C	22/12/16	23/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	22/12/16	23/12/16	120612-1
Thermohygrometer	BODYCOM	BJ5478	22/12/16	23/12/16	120612-2
Loop Antenna	ETS-Lindgren	6502	22/12/16	24/12/16	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	22/12/16	23/12/16	3362
Horn Antenna	ETS-Lindgren	3117	22/12/16	23/12/16	00140394
Horn Antenna	A.H.Systems Inc.	SAS-574	22/06/24	23/06/24	155
PreAmplifier	H.P	8447D	22/12/16	23/12/16	2944A07774
PreAmplifier	Agilent Technologies	8449B	22/06/24	23/06/24	3008A02108
PreAmplifier	A.H.Systems Inc.	PAM-1840VH	22/06/24	23/06/24	163
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	22/06/24	23/06/24	7
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	22/06/24	23/06/24	2
High Pass Filter	Wainwright Instruments	WHKX6-6320-8000-26500-40CC	22/06/24	23/06/24	2
Attenuator	Aeroflex/Weinschel	86-10-11	22/06/24	23/06/24	408
EMI Test Receiver	ROHDE&SCHWARZ	ESCI7	23/01/31	24/01/31	100910
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	22/08/22	23/08/22	101333
LISN	SCHWARZBECK	NSLK 8128 RC	22/10/26	23/10/26	8128 RC-387
Thermo Hygro Meter	TESTO	608-H1	23/01/13	24/01/13	45084791
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A MA2490A	22/12/16 22/12/16	23/12/16 23/12/16	1338004 1249303
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-1
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-2
Cable	Junkosah	MWX241/B	23/01/04	24/01/04	M-3
Cable	Junkosah	MWX221	23/01/04	24/01/04	M-4
Cable	Junkosah	MWX221	23/01/04	24/01/04	M-5
Cable	Dt&C	Cable	23/01/04	24/01/04	M-6
Cable	JUNFLON	J12J101757-00	23/01/04	24/01/04	M-7
Cable	HUBER+SUHNER	SUCOFLEX104	23/01/04	24/01/04	M-8
Cable	HUBER+SUHNER	SUCOFLEX106	23/01/04	24/01/04	M-9
Cable	Junkosha	MWX241	23/01/03	24/01/03	mmW-1
Cable	Junkosha	MWX342	23/01/03	24/01/03	mmW-4
Cable	Dt&C	Cable	23/01/04	24/01/04	RFC-69
Cable	Junkosah	MWX342	23/01/04	24/01/04	RFC-72
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0177
Test Software	tsj	Noise Terminal Measurement	NA	NA	Version 2.00.0185

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.

## 2. 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.

### 2.1. 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.

### 2.2. 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.

### 2.3. 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 as stated on section 12.1 of the KDB558074 D01v05r02.

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.

### 2.4. 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.

## 2.5. Description of Test Modes

The EUT has been tested with the operating condition for maximizing the emission characteristics. A test program is used to control the EUT for staying in continuous transmitting.

### Transmitting Configuration of EUT

Mode	Data rate
802.11b	1 Mbps ~ 11 Mbps
802.11g	6 Mbps ~ 54 Mbps

### EUT Operation test setup

- **Test Software:** TeraTerm 4.105
- **Power setting:** Refer to the table below.

### Test Mode

Test mode	Worst case data rate	Power setting	Tested Frequency (MHz)		
TM 1	802.11b 11 Mbps	15	2 412	2 437	2 462
TM 2	802.11g 54 Mbps	15	2 412	2 437	2 462

Note1: The worst case data rate was determined according to the power measurements.

Note2: The power measurement results for all modes and data rate were reported.

### 3. Antenna Requirements

#### According to Part 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 External antenna employs a unique antenna connector.**

**Therefore this E.U.T complies with the requirement of Part 15.203**

## 4. Summary of Test Result

FCC part section(s)	Test Description	Limit	Test Condition	Status Note 1
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	C
15.247(b)	Maximum Peak Output Power	< 1 Watt		C
15.247(d)	Unwanted Emissions(Conducted)	20 dBc in any 100 kHz BW		C
15.247(e)	Power Spectral Density	< 8 dBm / 3 kHz		C
15.247(d) 15.205 15.209	Unwanted Emissions(Radiated)	Part 15.209 limits (Refer to section 5.5)	Radiated	C Note 3
15.207	AC Power-Line Conducted Emissions	Part 15.207 limits (Refer to section 5.6)	AC Line Conducted	C
15.203	Antenna Requirements	Part 15.203 (Refer to section 3)	-	C

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 test item was performed in three orthogonal EUT positions and the worst case data was reported.

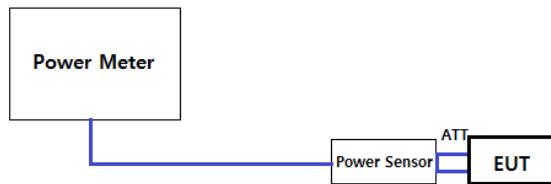
## 5. Test Result

### 5.1. Maximum Peak Conducted Output Power

#### Test Requirements and limit, Part 15.247(b)

The maximum permissible conducted output power is 1 Watt.

#### 5.1.1. Test Setup



#### 5.1.2. Test Procedures

- KDB558074 D01v05r02 - Section 8.3.1.3
- ANSI C63.10-2013 – Section 11.9.1.3

#### RBW ≥ DTSPKPM1 Peak-reading power meter method

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.

- KDB558074 D01v05r02 - Section 8.3.2.3
- ANSI C63.10-2013 – Section 11.9.2.3

#### Method AVGPM-G

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.

#### 5.1.3. Test Results

- Refer to the next page

Mode	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm)							
			Data Rate (Mbps)							
			1	2	5.5	11	-	-	-	-
802.11b	2.412	PK	16.14	16.11	15.82	<b>16.27</b>	-	-	-	-
		AV	13.72	13.71	13.83	13.96	-	-	-	-
	2.437	PK	16.01	16.03	15.77	16.08	-	-	-	-
		AV	13.64	13.67	13.71	13.75	-	-	-	-
	2.462	PK	15.52	15.50	15.31	15.55	-	-	-	-
		AV	13.15	13.11	13.21	13.26	-	-	-	-

Mode	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm)							
			Data Rate (Mbps)							
			6	9	12	18	24	36	48	54
802.11g	2.412	PK	18.99	18.44	18.89	18.55	20.61	20.70	21.04	<b>21.79</b>
		AV	13.55	12.91	12.88	12.97	12.91	12.71	12.92	13.46
	2.437	PK	18.66	18.30	18.56	18.48	20.68	20.76	20.92	21.68
		AV	13.18	12.70	12.75	12.83	12.63	12.53	12.81	13.07
	2.462	PK	18.35	17.93	18.30	17.98	20.11	20.33	20.43	21.44
		AV	12.90	12.21	12.31	12.46	12.16	12.31	12.24	12.72

## 5.2. 6 dB Bandwidth

### Test Requirements and limit, Part 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 EUT's antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

**The minimum permissible 6 dB bandwidth is 500 kHz.**

#### 5.2.1. Test Setup

Refer to the APPENDIX I.

#### 5.2.2. Test Procedures

- **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)  $\geq 3 \times$  RBW.
3. Detector = **Peak**.
4. Trace mode = **max hold**.
5. Sweep = **auto couple**.
6. Allow the trace to stabilize.
7. Option 1 - 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.

Option 2 - The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW  $\geq 3 \times$  RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be  $\geq 6$  dB.

#### 5.2.3. Test Results

Test Mode	Frequency	Test Results (MHz)
TM 1	2 412	7.68
	2 437	7.67
	2 462	7.40
TM 2	2 412	16.51
	2 437	16.52
	2 462	16.53

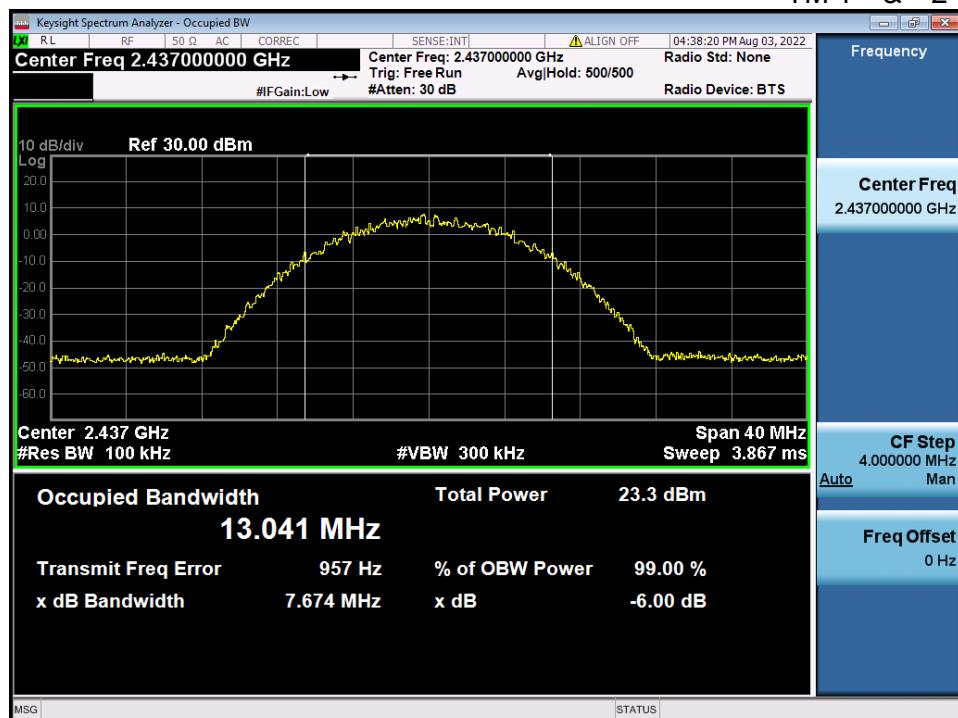
### 6 dB Bandwidth

TM 1 & 2 412



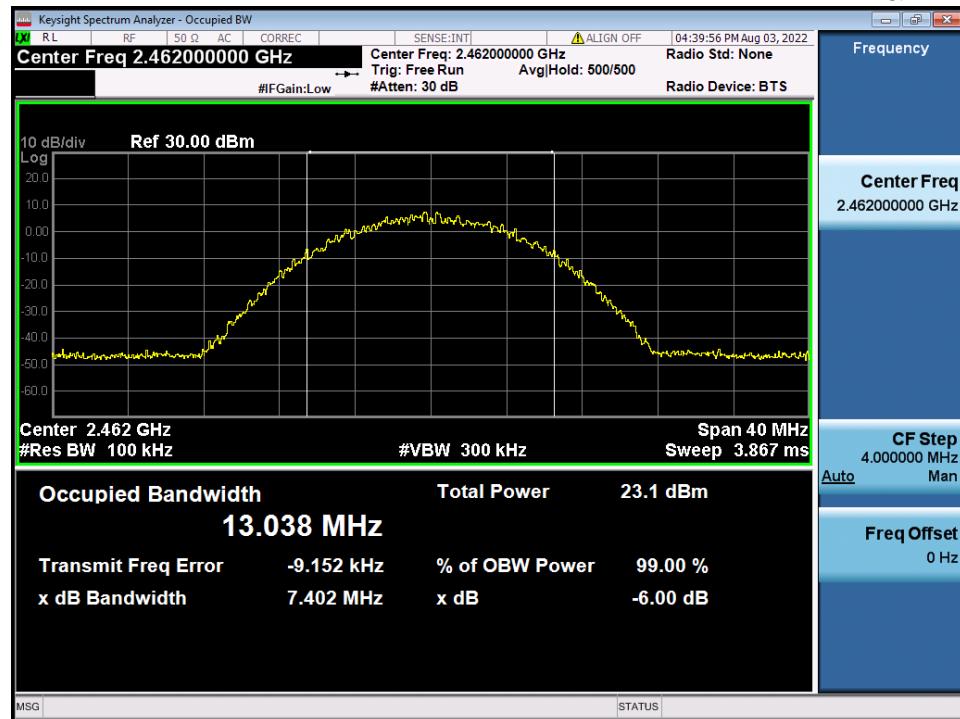
### 6 dB Bandwidth

TM 1 & 2 437



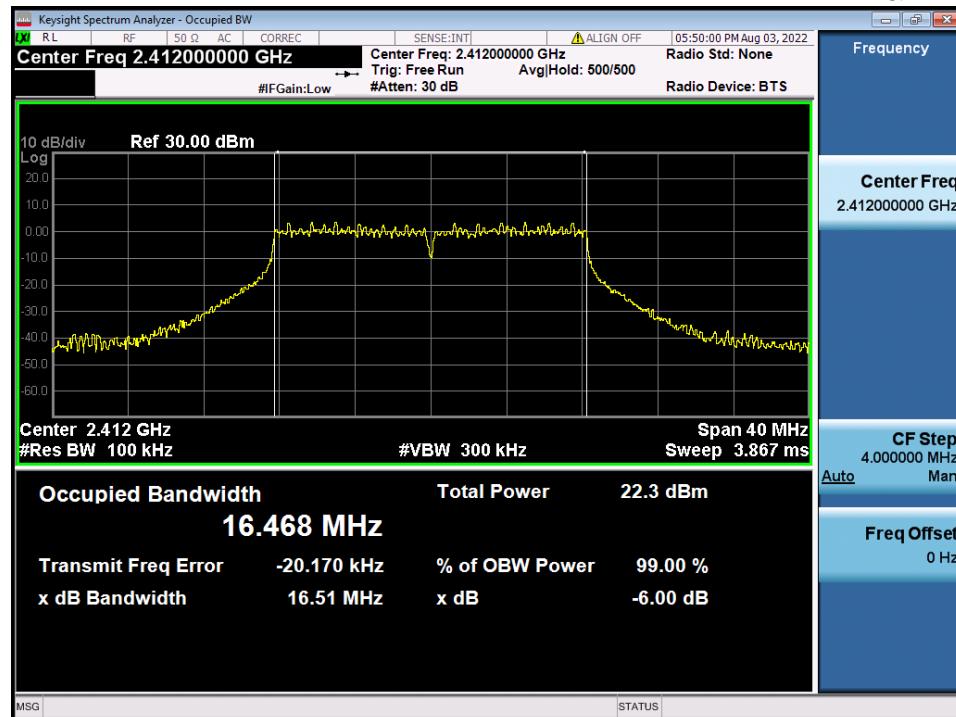
**6 dB Bandwidth**

TM 1 &amp; 2 462



## 6 dB Bandwidth

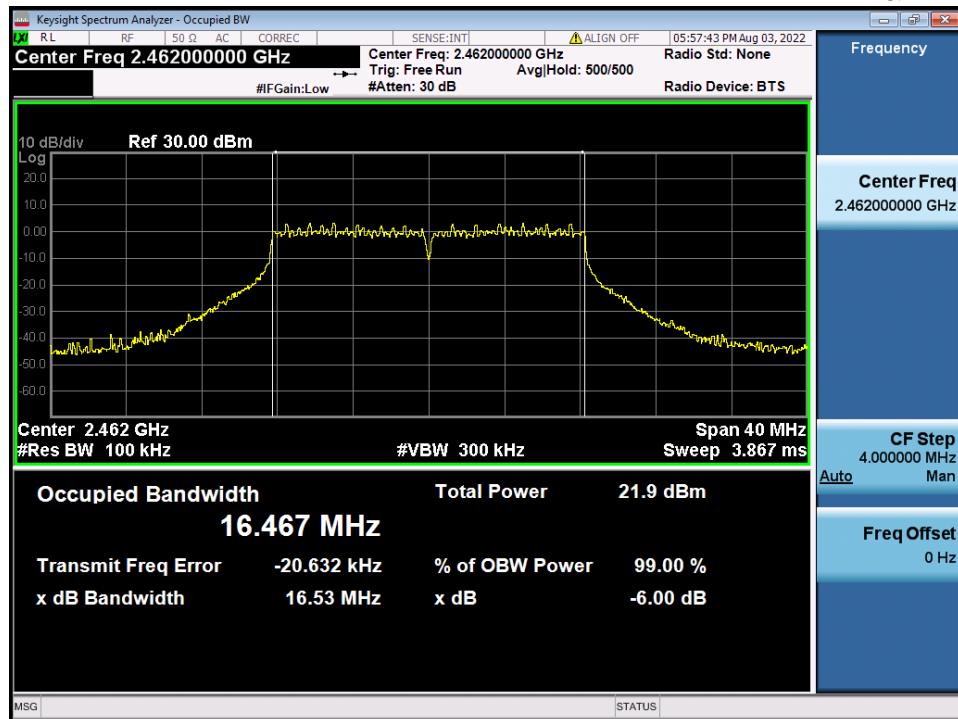
TM 2 &amp; 2 412



## 6 dB Bandwidth

TM 2 &amp; 2 437



**6 dB Bandwidth****TM 2 & 2 462**

### 5.3. Power Spectral Density

#### Test requirements and limit, Part 15.247(e)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

**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.**

#### 5.3.1. Test Setup

Refer to the APPENDIX I.

#### 5.3.2. Test Procedures

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

#### Method PKPSD (peak PSD)

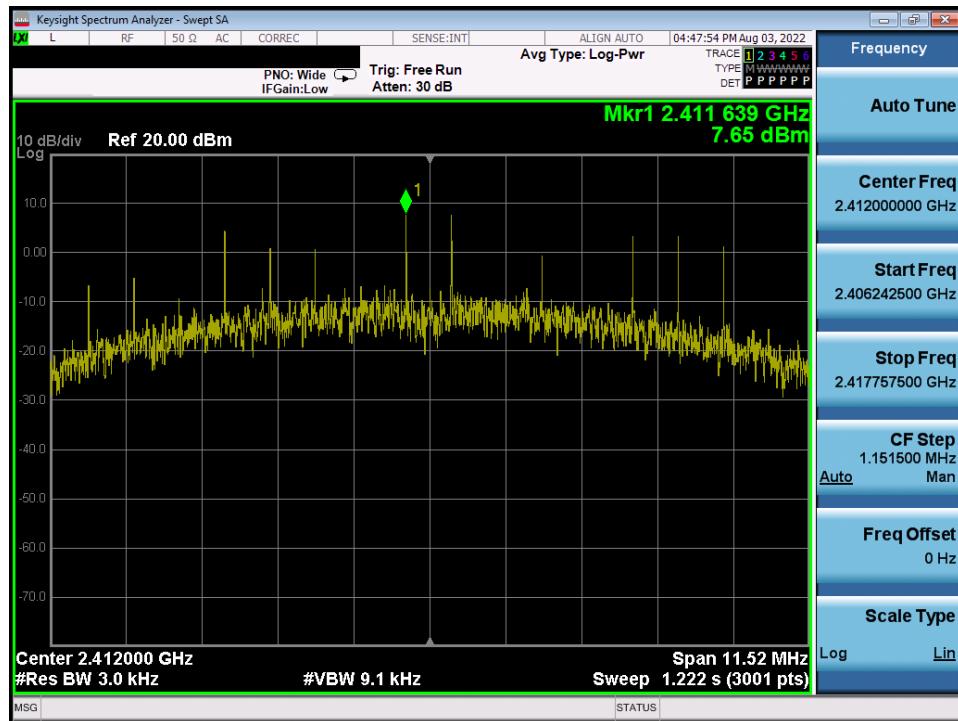
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to **1.5 times** the DTS bandwidth.
3. Set the RBW : **3 kHz ≤ RBW ≤ 100 kHz**.
4. Set the VBW  $\geq 3 \times \text{RBW}$ .
5. Detector = **peak**.
6. Sweep time = **auto couple**.
7. Trace mode = **max hold**.
8. Allow 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.

#### 5.3.3. Test Results

Test Mode	Frequency	RBW	PKPSD (dBm)	Limit (dBm / 3 kHz)
TM 1	2 412	3 kHz	7.65	8.00
	2 437	3 kHz	7.38	8.00
	2 462	3 kHz	7.15	8.00
TM 2	2 412	3 kHz	-11.64	8.00
	2 437	3 kHz	-11.92	8.00
	2 462	3 kHz	-12.04	8.00

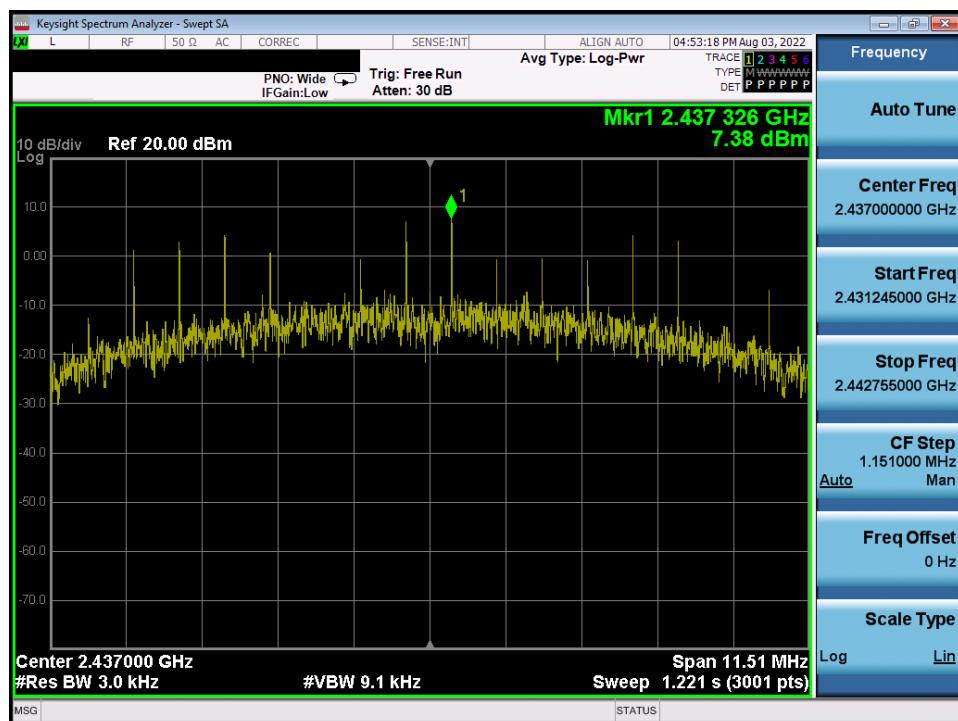
## Power Spectral Density

TM 1 &amp; 2 412



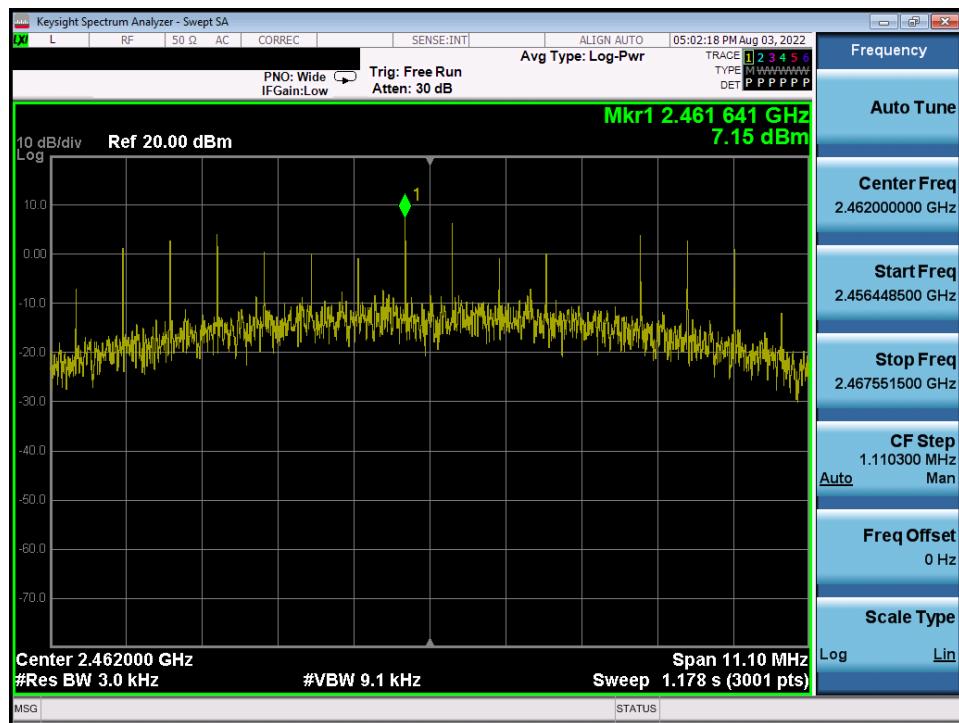
## Power Spectral Density

TM 1 &amp; 2 437



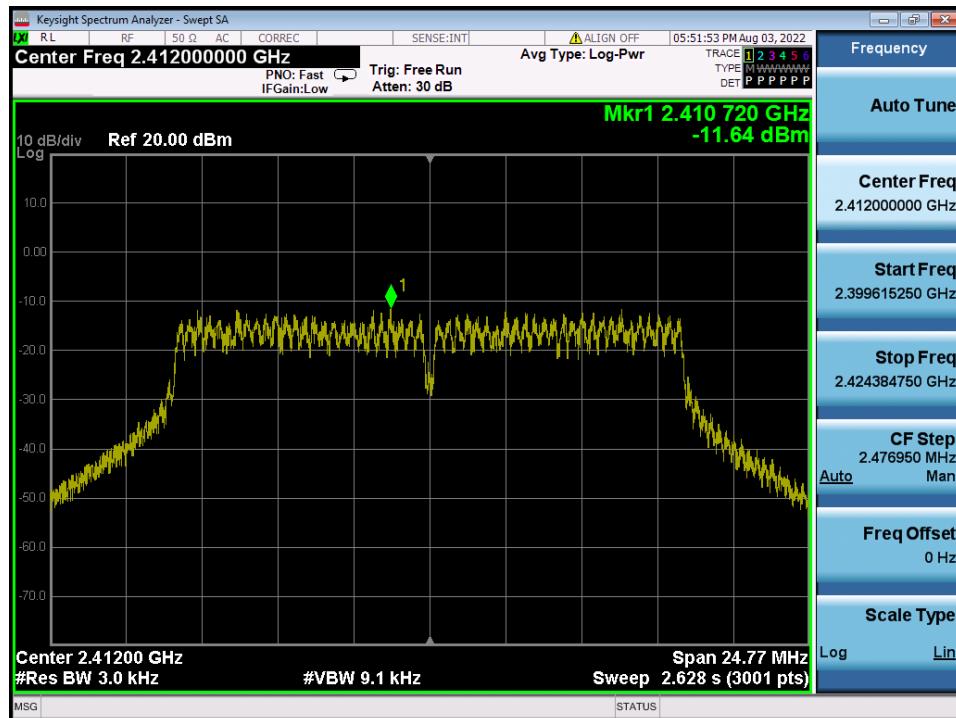
**Power Spectral Density**

TM 1 &amp; 2 462



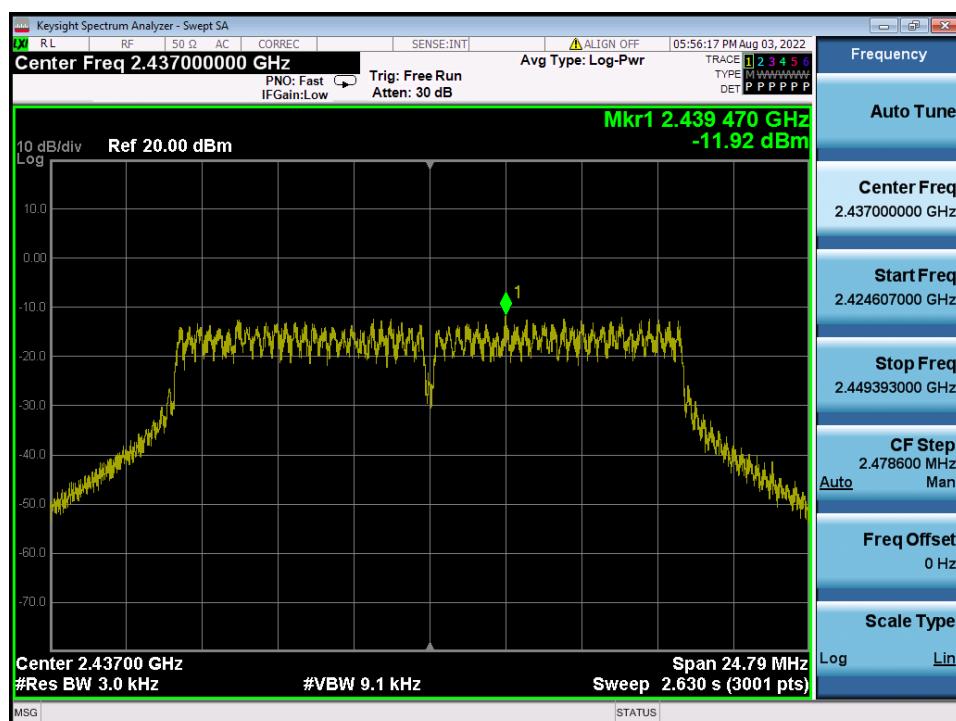
## Power Spectral Density

TM 2 & 2 412



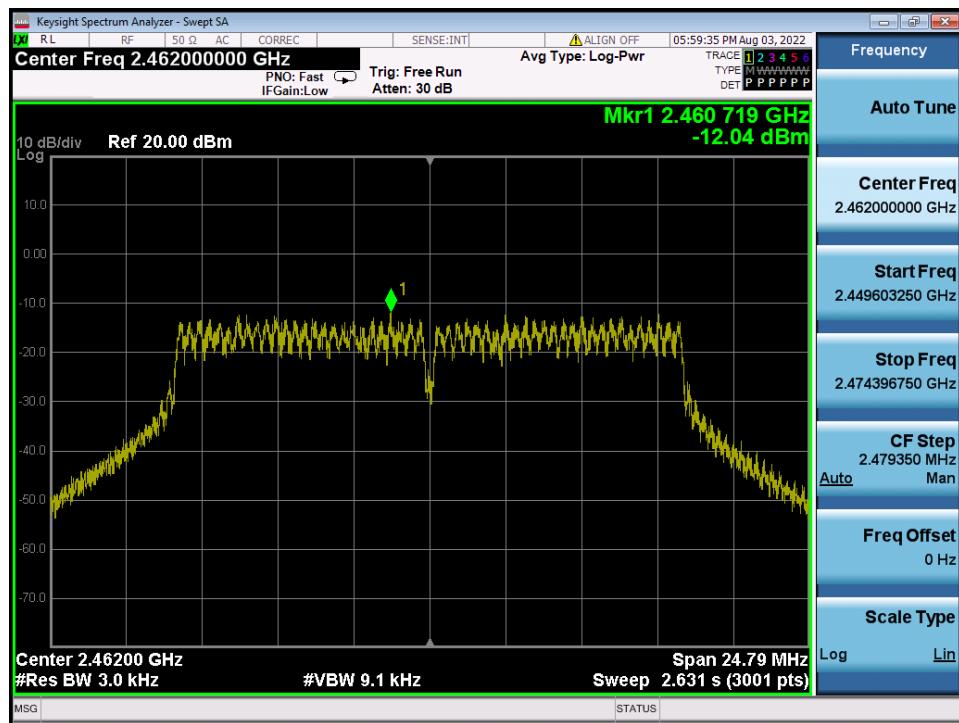
## Power Spectral Density

TM 2 & 2 437



**Power Spectral Density**

TM 2 &amp; 2 462



## 5.4. Unwanted Emissions (Conducted)

### Test requirements and limit, Part 15.247(d)

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 inband average PSD level.

In either case, attenuation to levels below the general emission limits specified in §15.209(a) is not required.

### 5.4.1. Test Setup

Refer to the APPENDIX I including path loss

### 5.4.2. Test Procedures

- 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

**LIMIT LINE = 20 dB below of the reference 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  $\geq$  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 unwanted emission(conducted) was tested with below settings.

Frequency range	RBW	VBW	Detector	Trace	Sweep Point
9 kHz ~ 30 MHz	100 kHz	300 kHz	Peak	Max Hold	40 001
30 MHz ~ 10 GHz	1 MHz	3 MHz			
10 GHz ~ 25 GHz	1 MHz	3 MHz			

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 = 2 001 to get accurate emission level within 100 kHz BW.

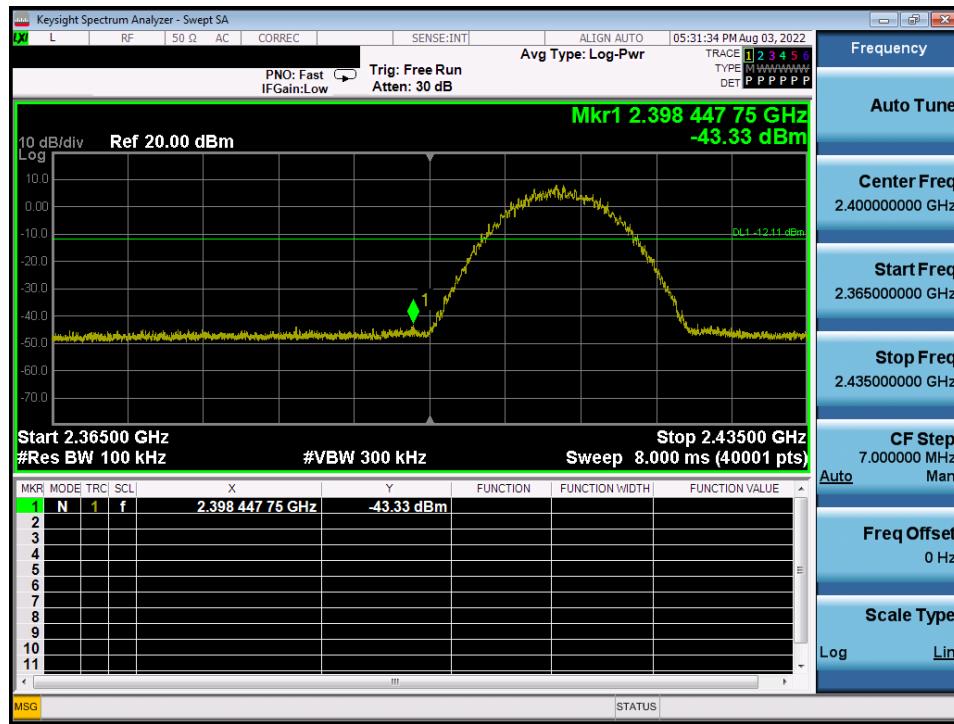
### 5.4.3. Test Results

TM 1 & 2 412

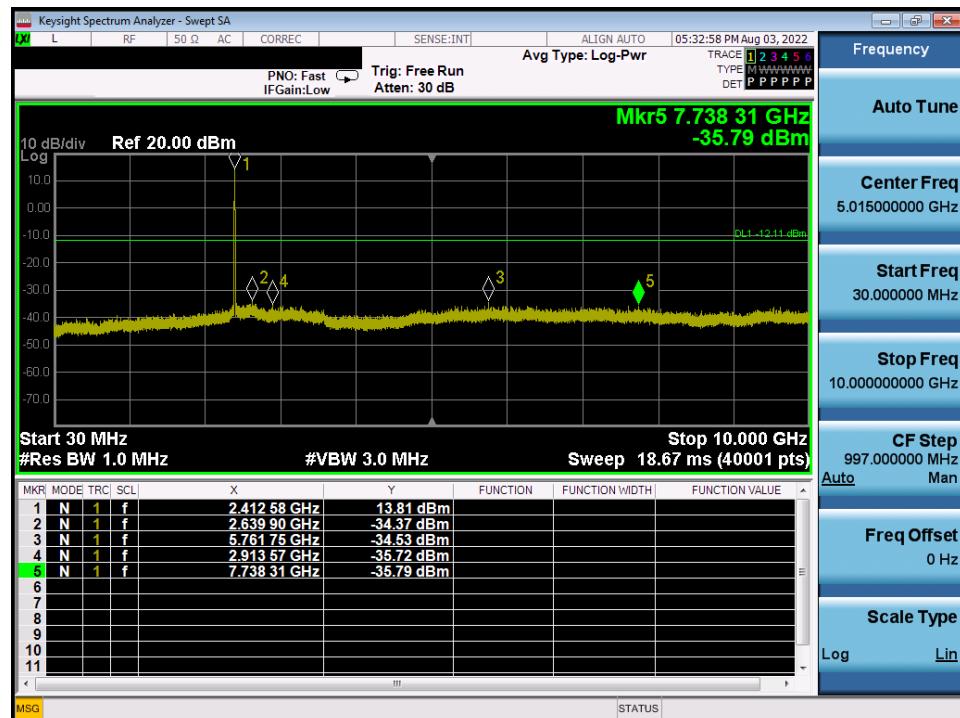
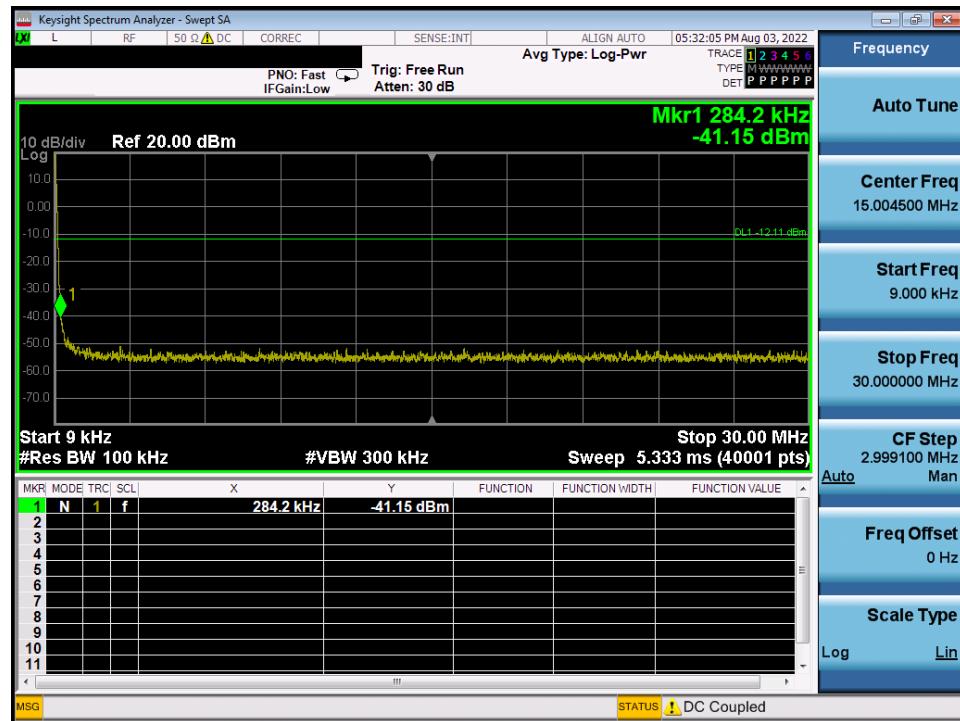
#### Reference



#### Low Band-edge



### Conducted Spurious Emissions



### Conducted Spurious Emissions

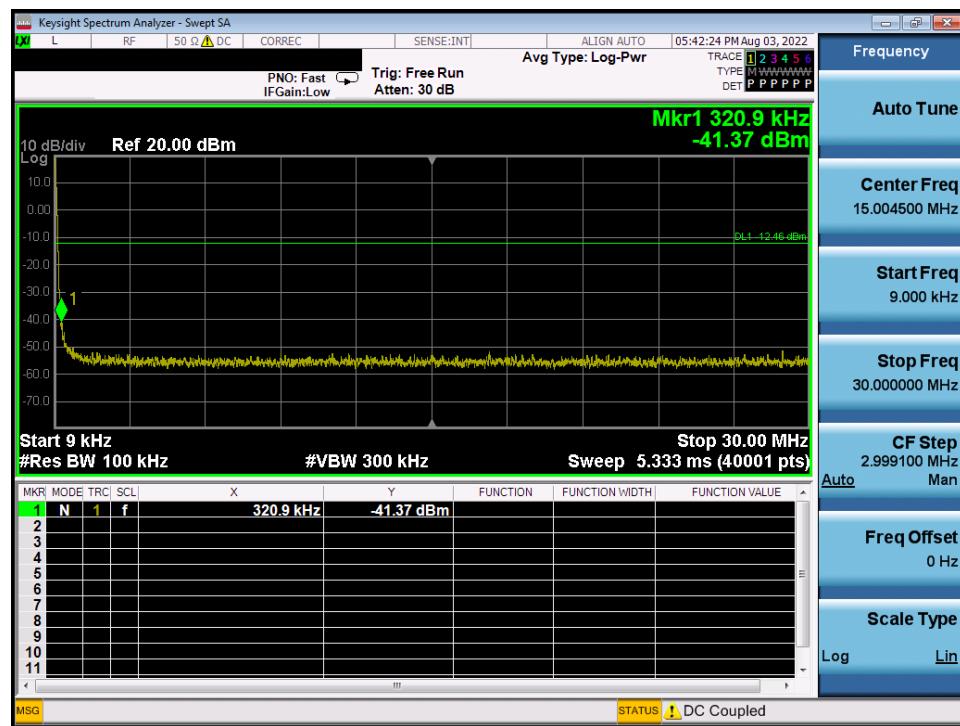


## TM 1 &amp; 2 437

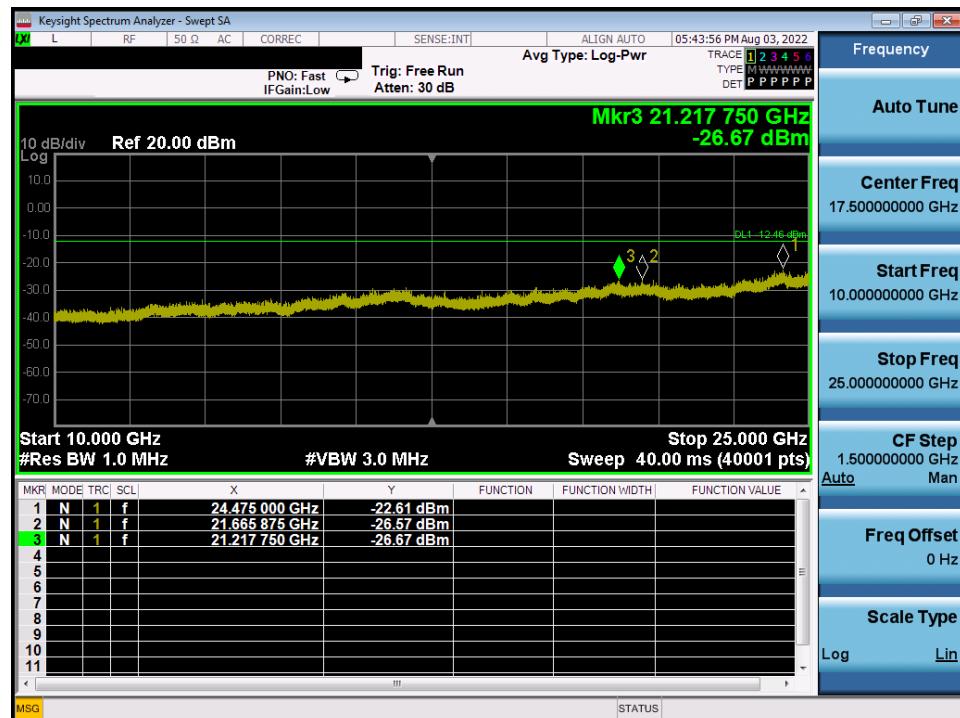
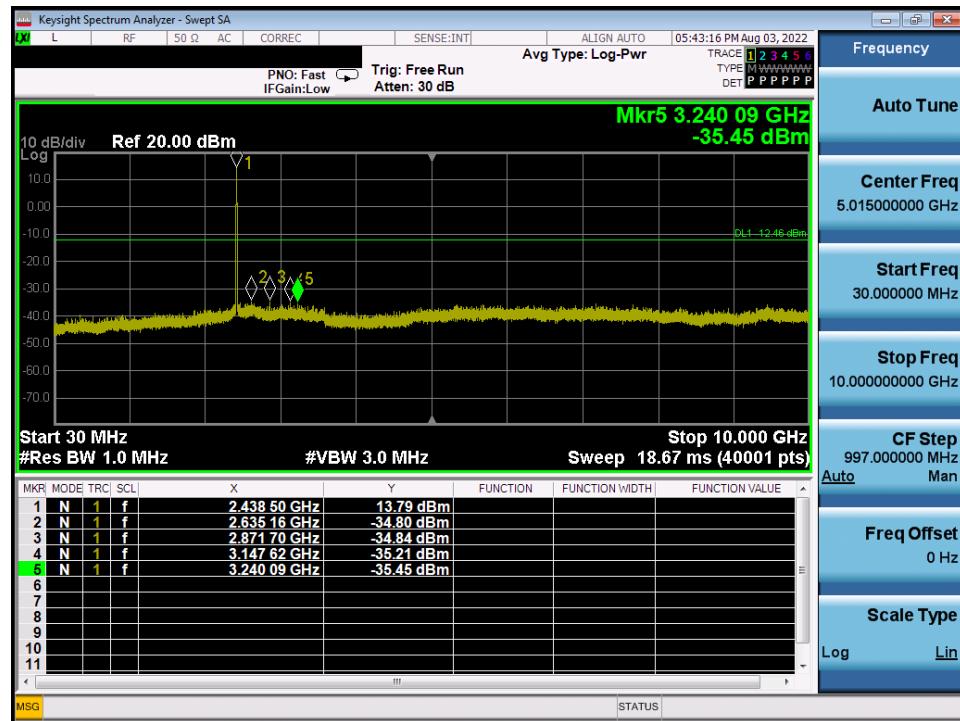
## Reference



## Conducted Spurious Emissions



### Conducted Spurious Emissions

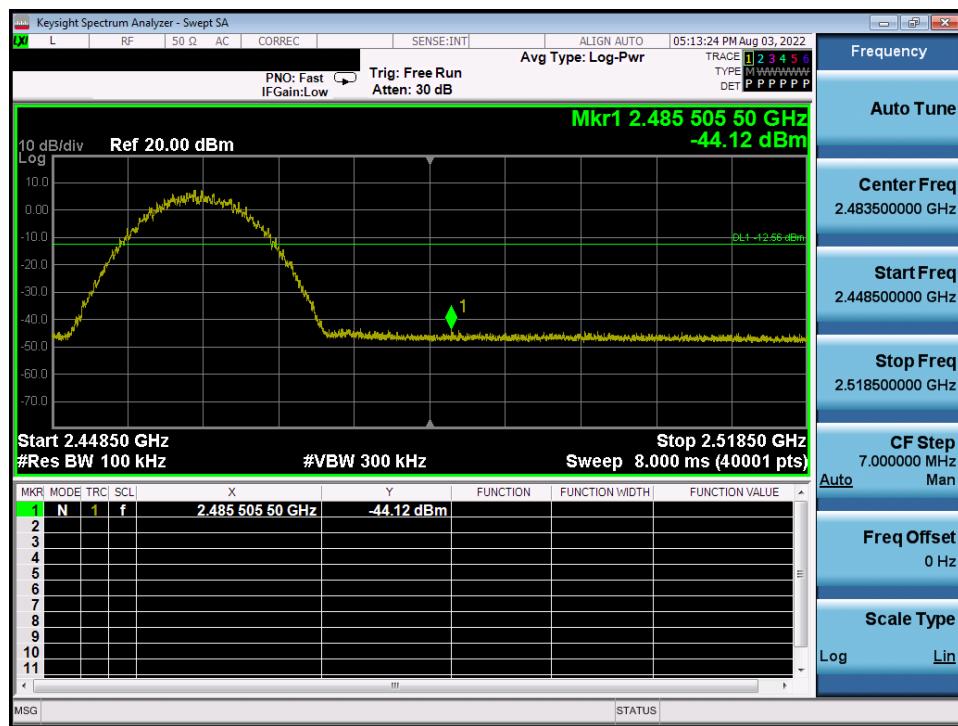


## TM 1 & 2 462

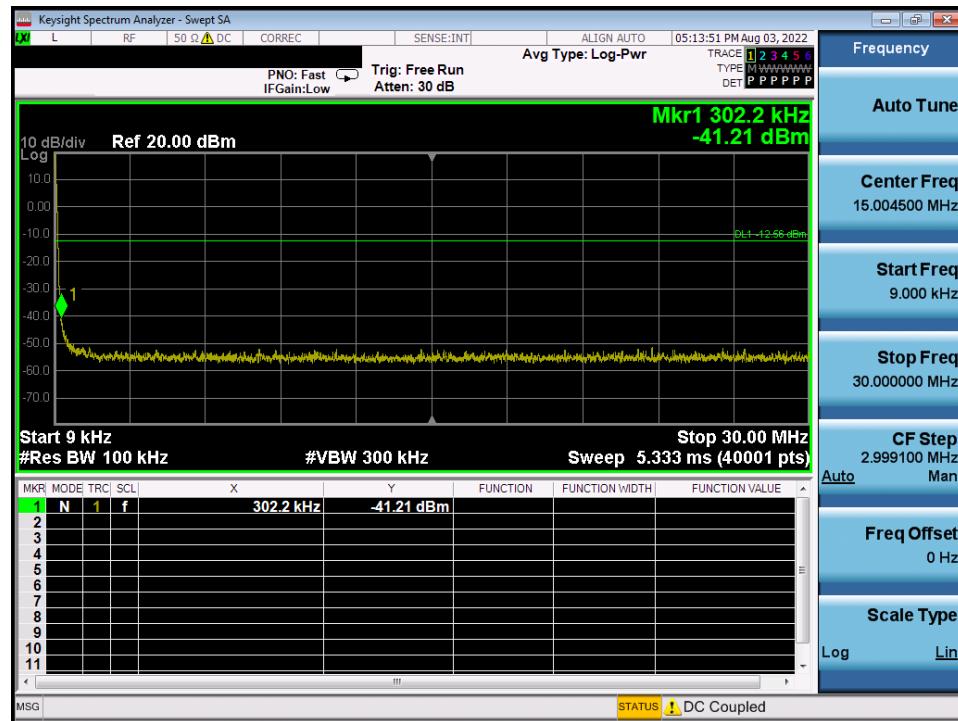
### Reference



### High Band-edge

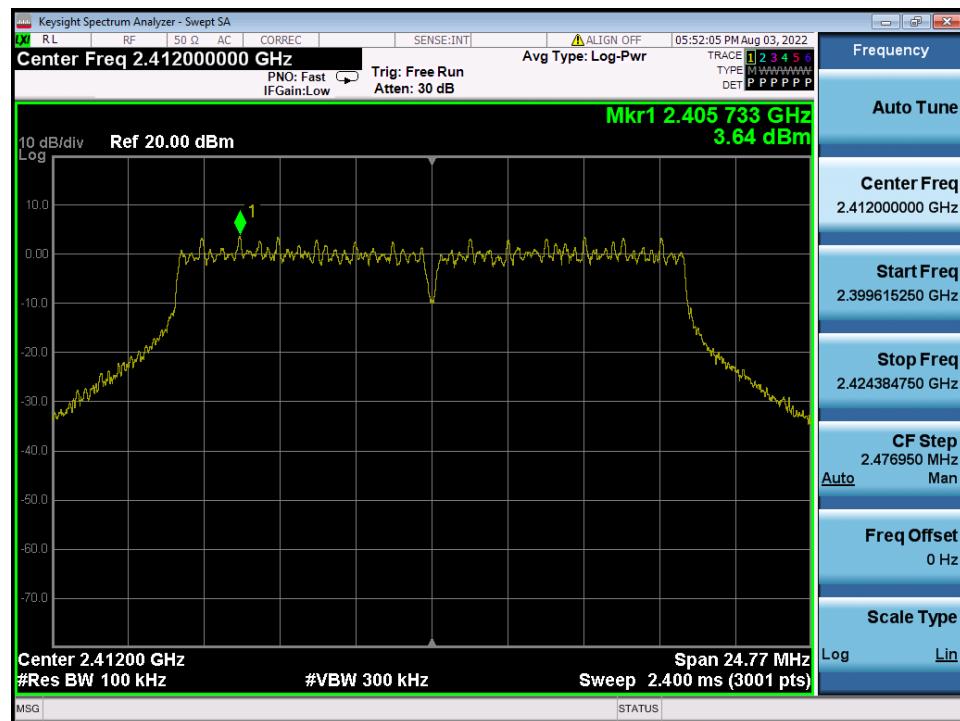
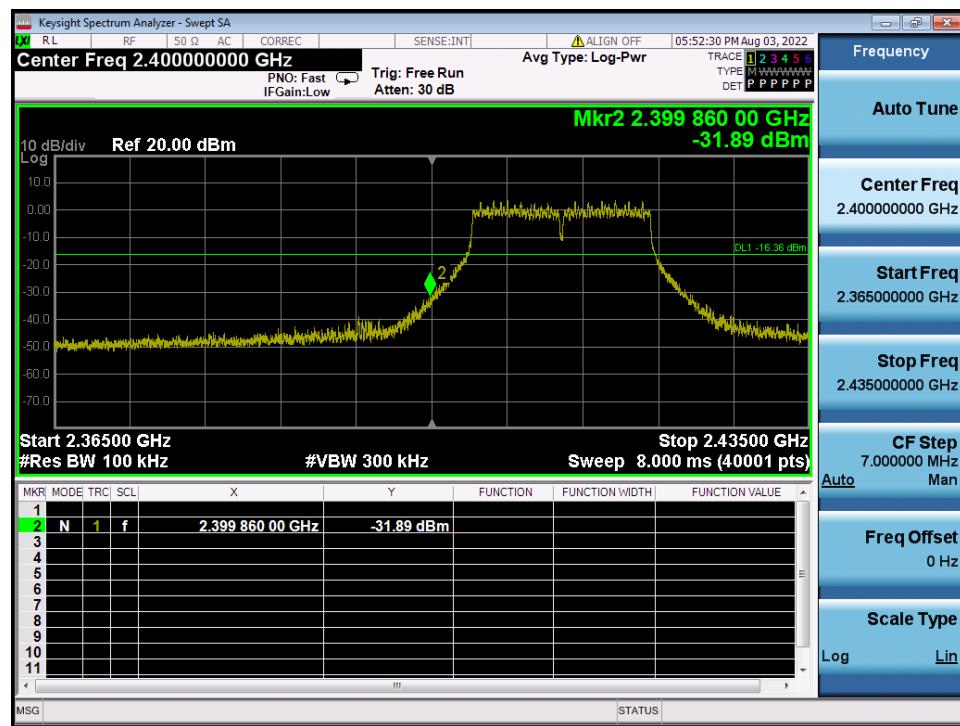


## Conducted Spurious Emissions

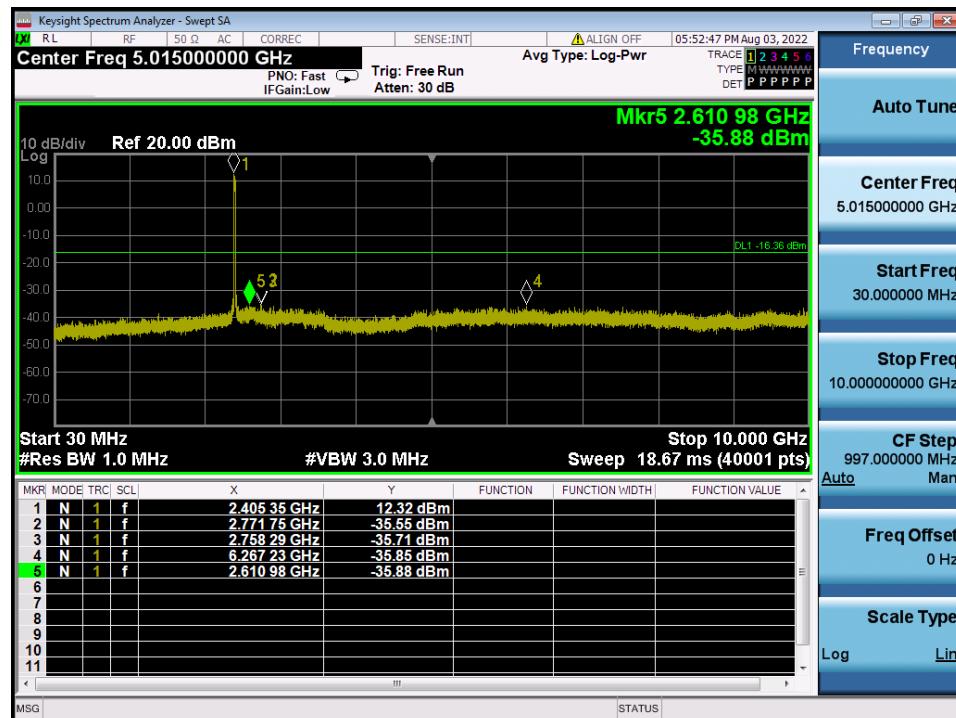
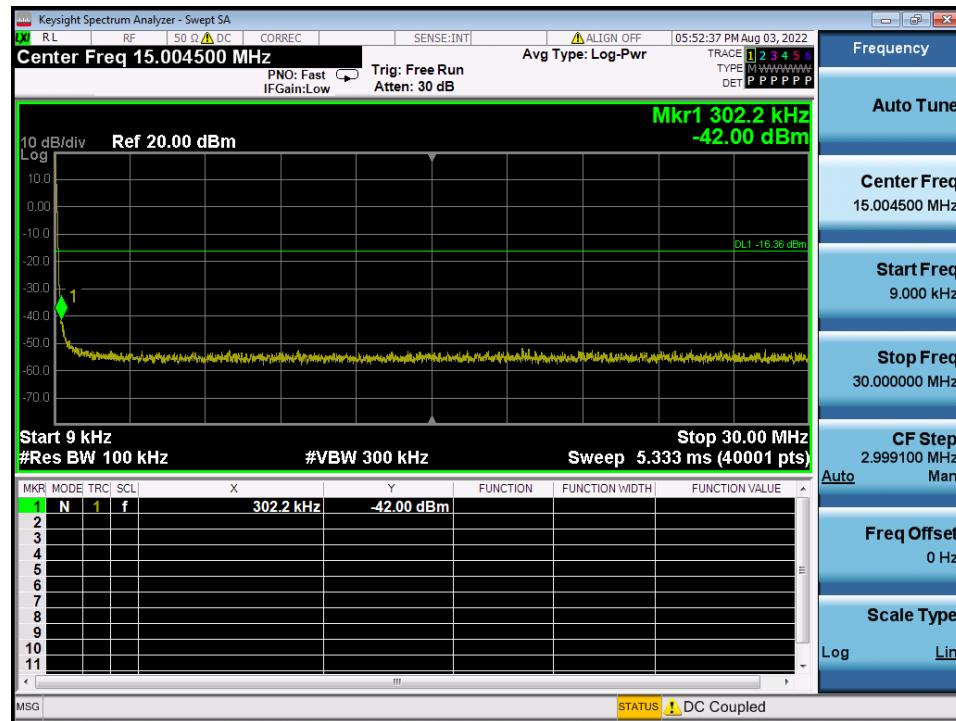


## Conducted Spurious Emissions

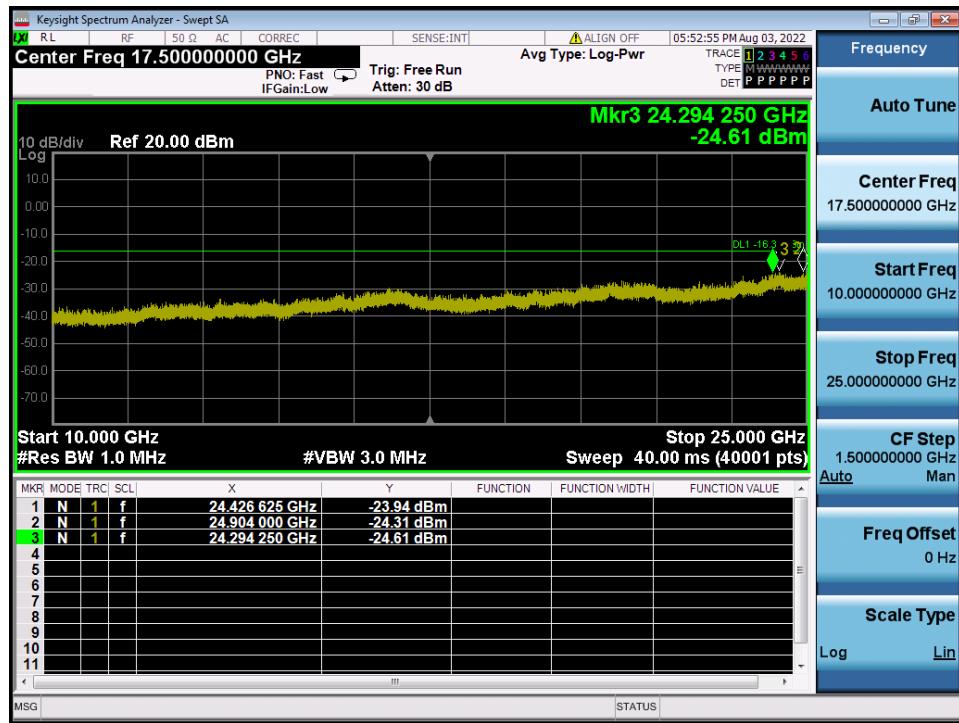


**TM 2 & 2 412**
**Reference**

**Low Band-edge**


### Conducted Spurious Emissions

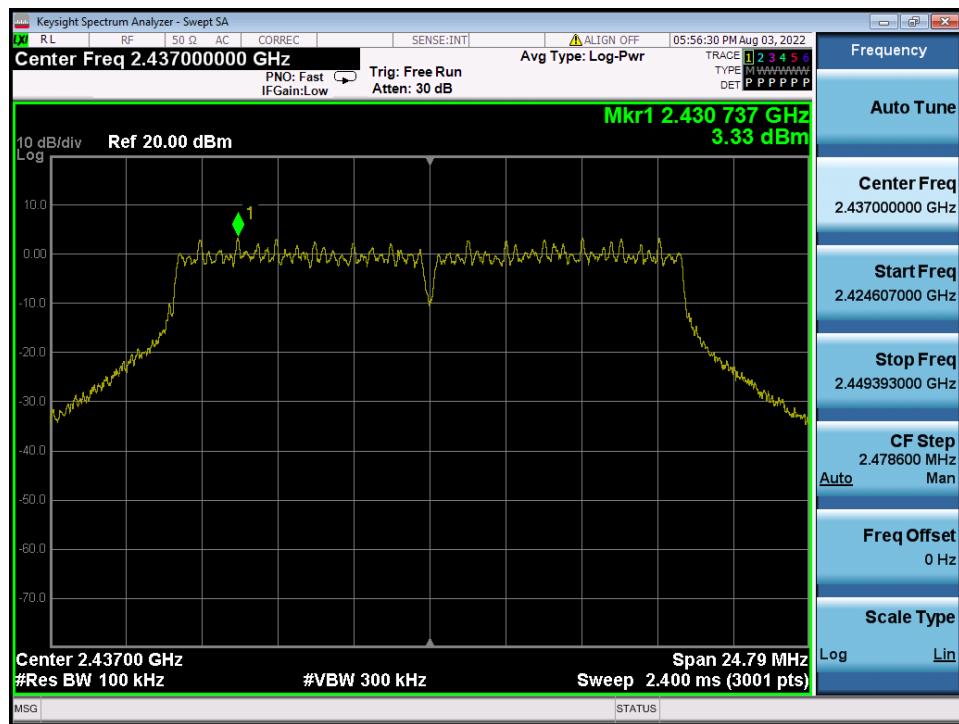


### Conducted Spurious Emissions

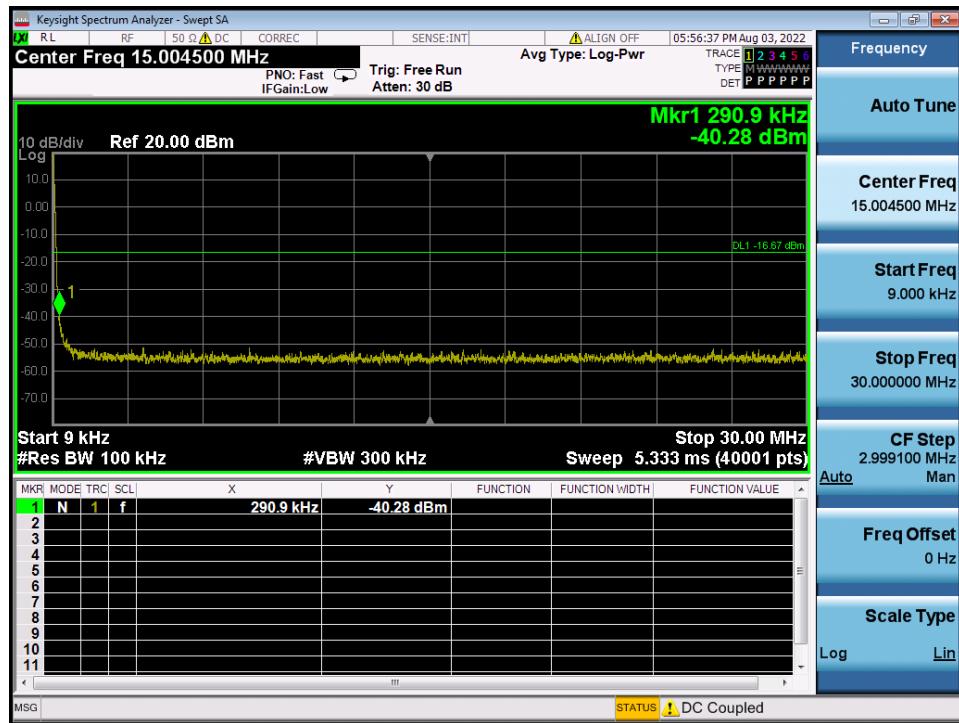


## TM 2 & 2 437

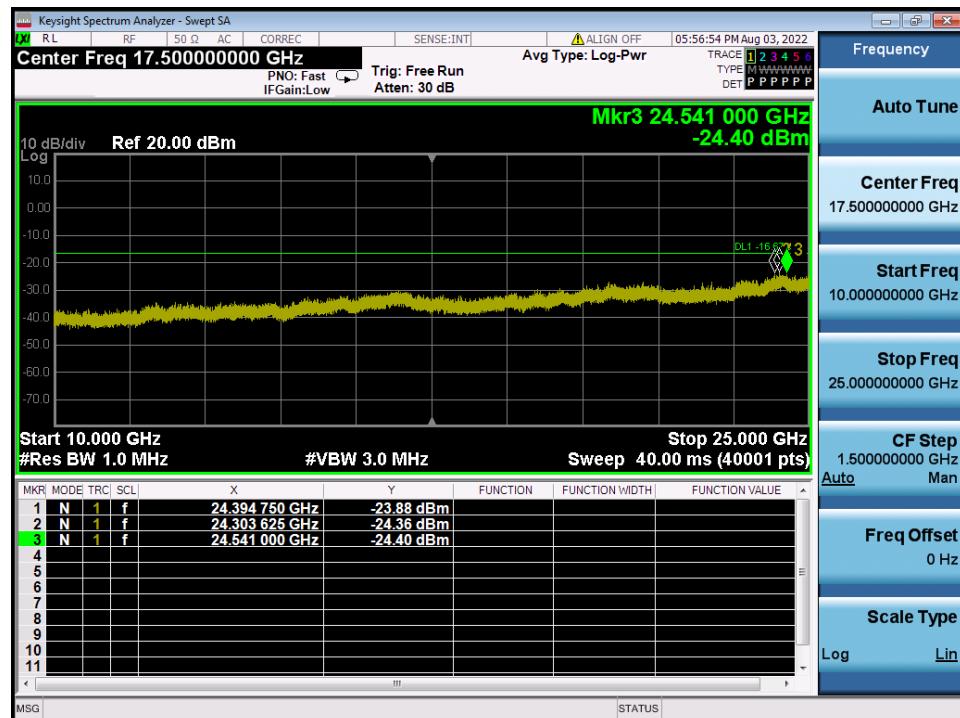
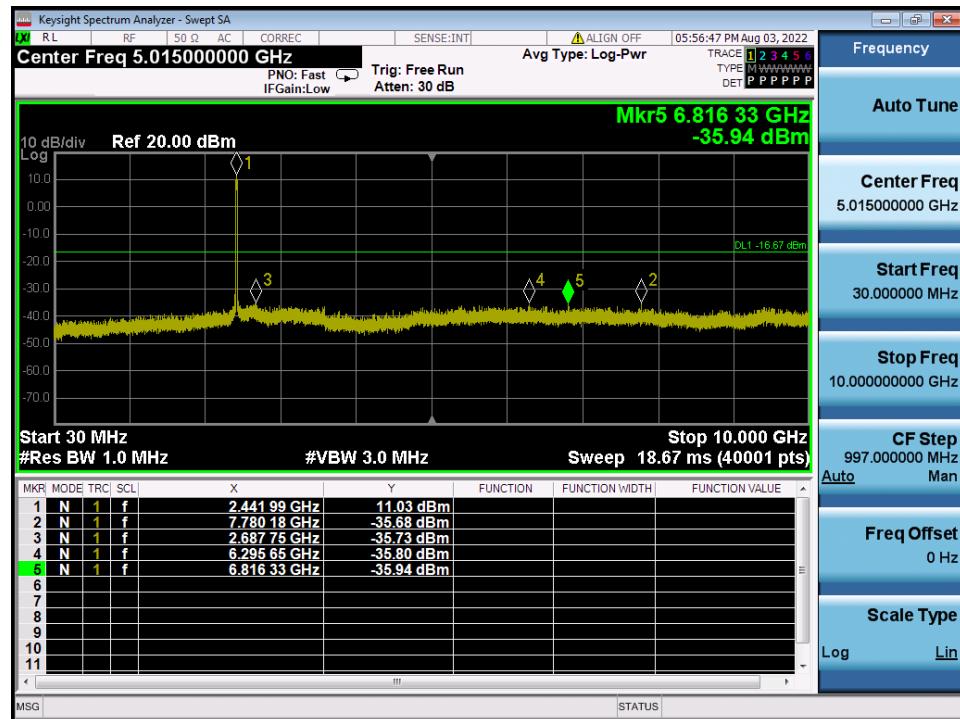
### Reference



### Conducted Spurious Emissions

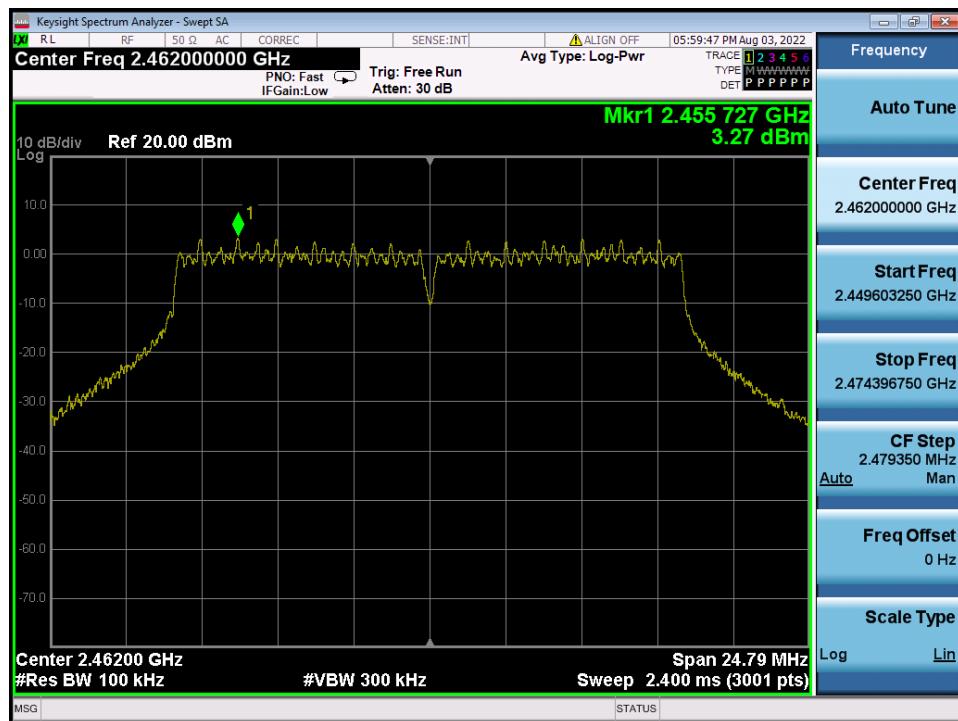


### Conducted Spurious Emissions

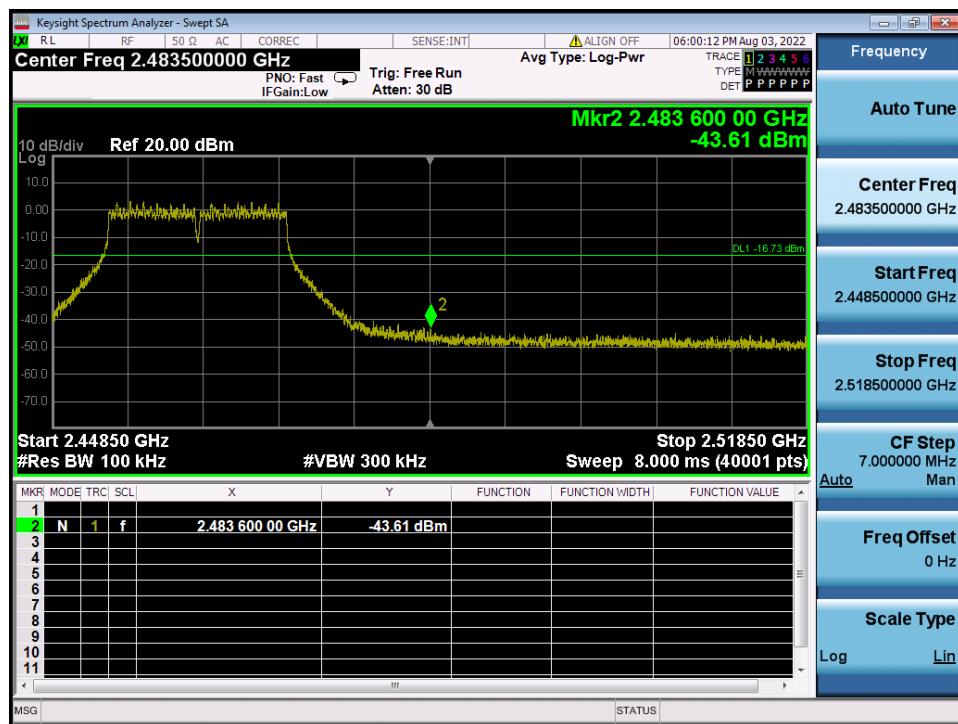


## TM 2 & 2 462

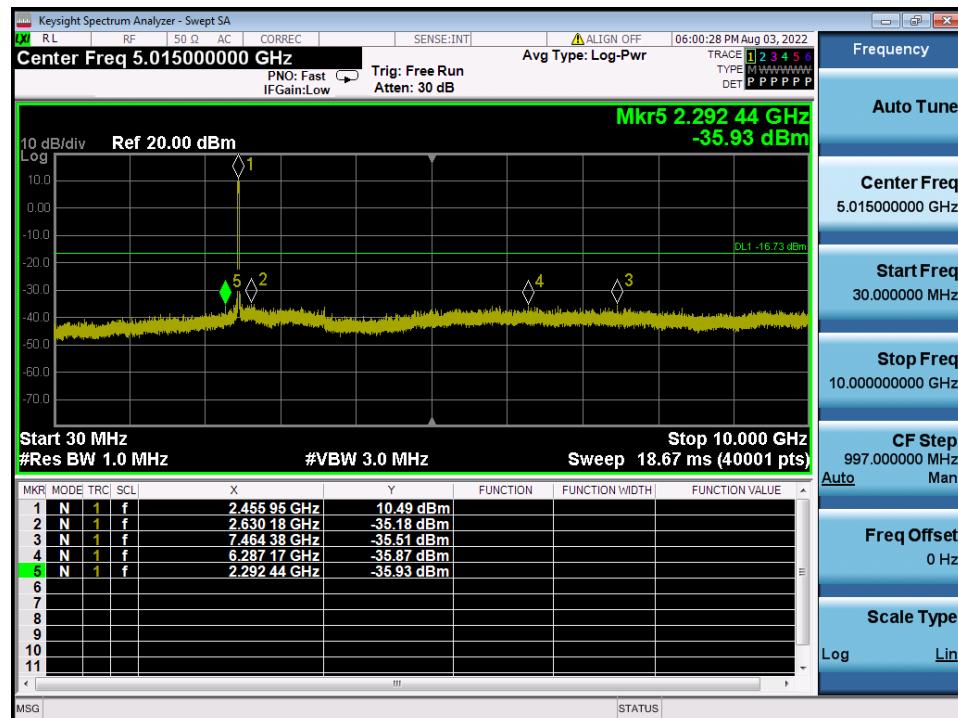
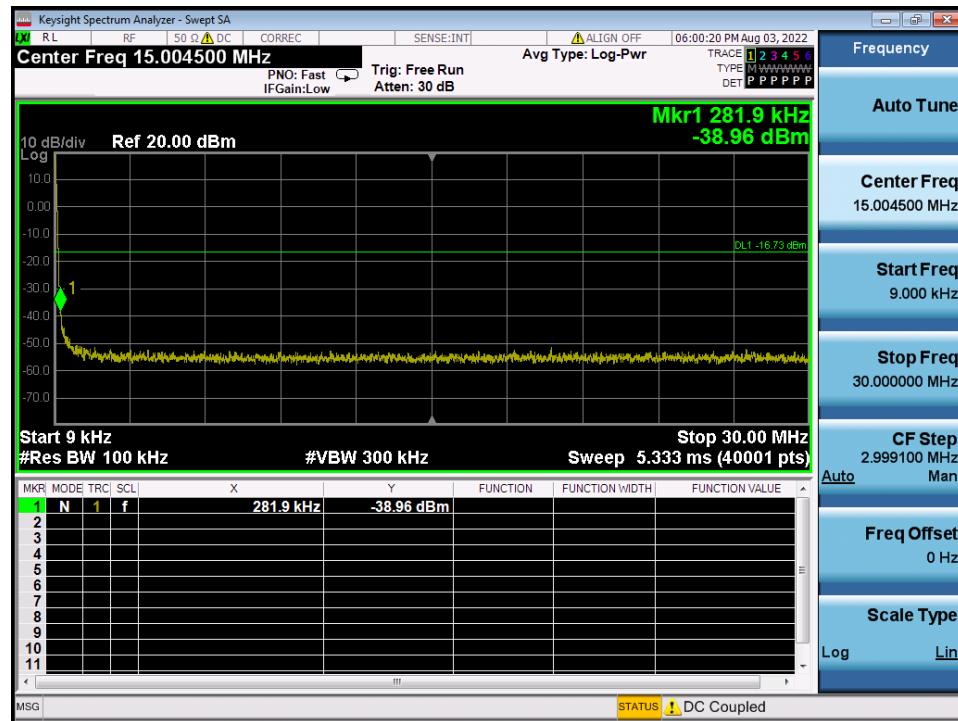
### Reference



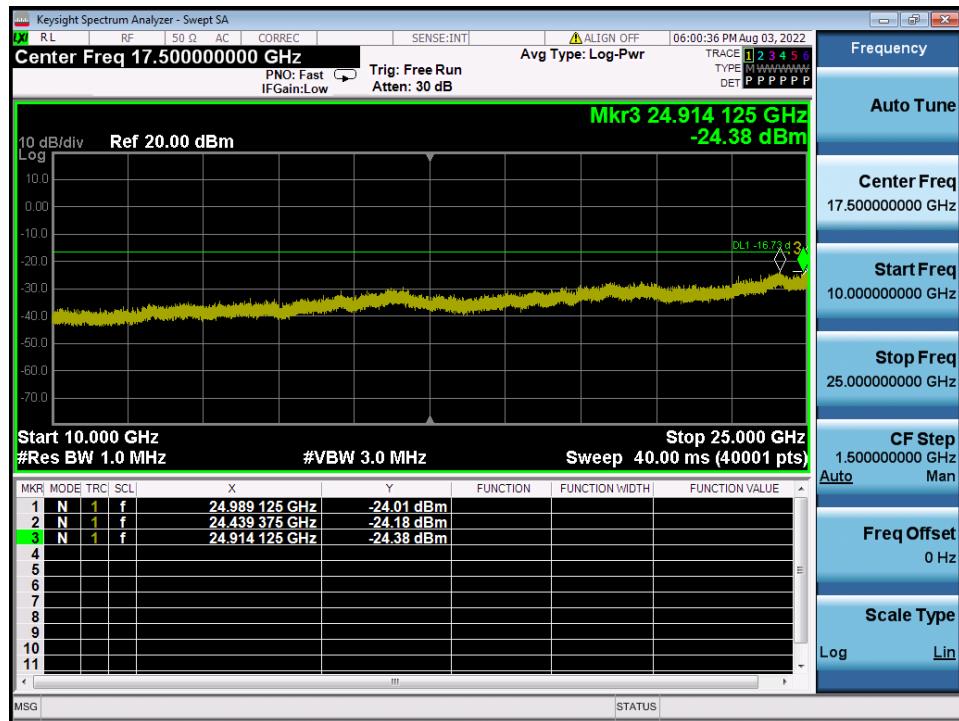
### High Band-edge



### Conducted Spurious Emissions



### Conducted Spurious Emissions



## 5.5. Unwanted Emissions (Radiated)

### Test Requirements and limit,

#### Part 15.247(d), Part 15.205, Part 15.209

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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 that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of Part 15.247 the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

#### - Part 15.209: General requirement

Frequency (MHz)	FCC Limit (uV/m)	Measurement Distance (m)
0.009 – 0.490	2 400 / F (kHz)	300
0.490 – 1.705	24 000 / F (kHz)	30
1.705 – 30.0	30	30

Frequency (MHz)	FCC Limit (uV/m)	Measurement Distance (m)
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

\*\*Except as provided in paragraph (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.

**- Part 15.205(a): Restricted band of operation**

<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>MHz</b>	<b>GHz</b>	<b>GHz</b>
0.009 ~ 0.110	8.414 25 ~ 8.414 75	108 ~ 121.94	1 300 ~ 1 427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1 435 ~ 1 626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.173 5 ~ 2.190 5	12.519 75 ~ 12.520 25	149.9 ~ 150.05	1 645.5 ~ 1 646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.576 75 ~ 12.577 25	156.524 75 ~ 156.525 25	1 660 ~ 1 710	8.025 ~ 8.5	22.01 ~ 23.12
4.177 25 ~ 4.177 75	13.36 ~ 13.41	156.7 ~ 156.9	1 718.8 ~ 1 722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.207 25 ~ 4.207 75	16.42 ~ 16.423	162.012 5 ~ 167.17	2 200 ~ 2 300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 310 ~ 2 390	10.6 ~ 12.7	36.43 ~ 36.5
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 483.5 ~ 2 500	13.25 ~ 13.4	Above 38.6
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	2 655 ~ 2 900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 260 ~ 3 267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 332 ~ 3 339		
8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1 240	3 345.8 ~ 3 358		
			3 600 ~ 4 400		

### 5.5.1. Test Setup

Refer to the APPENDIX I.

### 5.5.2. Test Procedures

1. 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.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 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.

#### **Note: Measurement Instrument Setting for Radiated Emission Measurements.**

- **KDB558074 D01v05r02 - Section 8.6**
- **ANSI C63.10-2013 – Section 11.12**

#### **1. Frequency Range Below 1 GHz**

RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak

#### **2. Frequency Range > 1 GHz**

Peak Measurement > 1 GHz

RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes

Average Measurement > 1 GHz

1. RBW = 1 MHz (unless otherwise specified).

2. VBW  $\geq$  3 x RBW.

3. Detector = RMS (Number of points  $\geq$  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 ( $\geq$  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	$T_{on}$ (ms)	$T_{on+off}$ (ms)	$D = T_{on} / (T_{on+off})$	$DCCF = 10 \log(1/D)$ (dB)
TM 1	11 Mbps	1.208	1.293	0.934 3	0.30
TM 2	54 Mbps	0.248	0.338	0.733 7	1.34

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

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

### 5.5.3. Test Results

#### Test Notes.

1. The radiated emissions below 1GHz were investigated 9 kHz to 1 GHz and the worst case data was reported.
2. Information of Distance Correction Factor

For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.

In this case, the distance correction factor is applied to the result.

- Calculation of distance factor

At frequencies below 30 MHz =  $40 \log(\text{tested distance} / \text{specified distance})$

At frequencies at or above 30 MHz =  $20 \log(\text{tested distance} / \text{specified distance})$

When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.

3. Sample Calculation.

Margin = Limit – Result / Result = Reading + TF + DCCF + DCF / TF = AF + CL + HL + AL – AG

Where, TF = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, HL = High pass filter Loss,

AL = Attenuator Loss, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

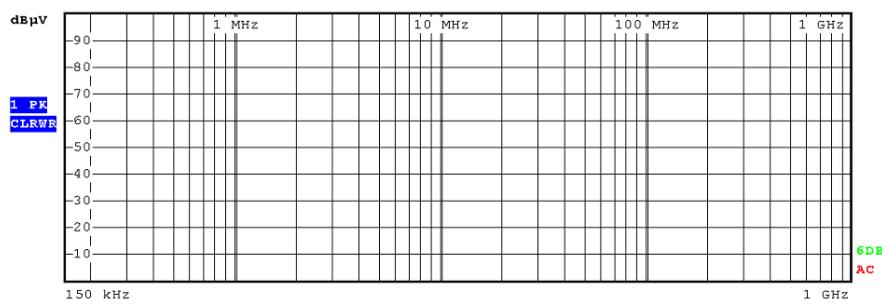
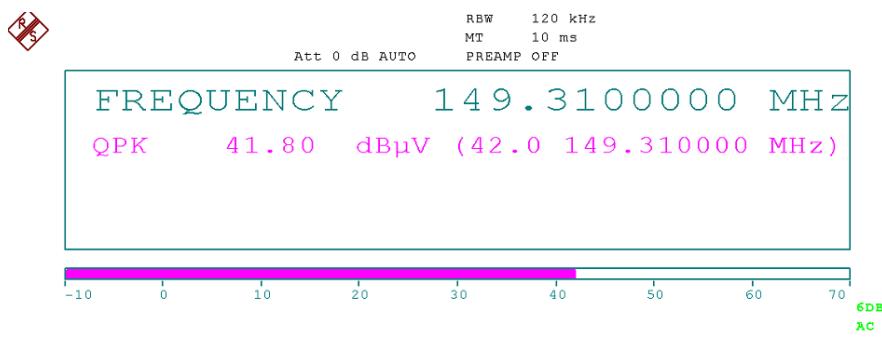
#### 9 kHz ~ 1 GHz Data (Modulation : GFSK)

##### ▪ Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
146.400	H	X	QPK	38.80	-6.65	N/A	N/A	32.15	43.52	11.37
149.310	V	X	QPK	42.00	-6.52	N/A	N/A	35.48	43.52	8.04
150.280	H	X	QPK	41.70	-6.51	N/A	N/A	35.19	43.52	8.33
159.010	H	X	QPK	40.40	-6.49	N/A	N/A	33.91	43.52	9.61

#### TM1 & Lowest & X & Ver

#### Detector Mode : QPK



**Test Notes.**

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

## 2. Information of Distance Correction Factor

For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.

In this case, the distance correction factor is applied to the result.

## - Calculation of distance factor

At frequencies below 30 MHz =  $40 \log(\text{tested distance} / \text{specified distance})$

At frequencies at or above 30 MHz =  $20 \log(\text{tested distance} / \text{specified distance})$

When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied.

## 3. Sample Calculation.

Margin = Limit – Result / Result = Reading + TF + DCCF + DCF / TF = AF + CL + HL + AL – AG

Where, TF = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, HL = High pass filter Loss,

AL = Attenuator Loss, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

**Radiated Emissions data(1 GHz ~ 25 GHz) : TM 1**

Tested Frequency (MHz)	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin(dB)
2 412	2 388.80	H	Z	PK	54.35	3.53	N/A	N/A	57.88	74.00	16.12
	2 388.38	H	Z	AV	44.78	3.53	0.30	N/A	48.61	54.00	5.39
	4 824.03	H	Z	PK	41.55	8.12	N/A	N/A	49.67	74.00	24.33
	4 823.93	H	Z	AV	31.81	8.12	0.30	N/A	40.23	54.00	13.77
	7 236.63	H	Z	PK	46.03	10.60	N/A	N/A	56.63	74.00	17.37
	7 234.63	H	Z	AV	35.93	10.60	0.30	N/A	46.83	54.00	7.17
2 437	4 874.11	H	Z	PK	40.82	8.24	N/A	N/A	49.06	74.00	24.94
	4 873.28	H	Z	AV	30.45	8.24	0.30	N/A	38.99	54.00	15.01
	7 310.71	H	Z	PK	40.11	10.63	N/A	N/A	50.74	74.00	23.26
	7 312.12	H	Z	AV	29.30	10.63	0.30	N/A	40.23	54.00	13.77
2 462	2 484.96	H	Z	PK	52.52	3.78	N/A	N/A	56.30	74.00	17.70
	2 485.16	H	Z	AV	42.62	3.78	0.30	N/A	46.70	54.00	7.30
	4 923.75	H	Z	PK	41.03	8.38	N/A	N/A	49.41	74.00	24.59
	4 923.69	H	Z	AV	30.91	8.38	0.30	N/A	39.59	54.00	14.41
	7 385.95	H	Z	PK	44.45	10.74	N/A	N/A	55.19	74.00	18.81
	7 385.59	H	Z	AV	34.65	10.74	0.30	N/A	45.69	54.00	8.31

Radiated Emissions data(1 GHz ~ 25 GHz) : TM 2

Tested Frequency (MHz)	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin(dB)
2 412	2 389.83	V	Y	PK	63.62	3.53	N/A	N/A	67.15	74.00	6.85
	2 389.00	V	Y	AV	47.65	3.53	1.34	N/A	52.52	54.00	1.48
	4 824.19	H	Z	PK	41.80	8.12	N/A	N/A	49.92	74.00	24.08
	4 821.57	H	Z	AV	30.98	8.12	1.34	N/A	40.44	54.00	13.56
	7 233.31	H	Z	PK	46.81	10.60	N/A	N/A	57.41	74.00	16.59
	7 234.41	H	Z	AV	32.43	10.60	1.34	N/A	44.37	54.00	9.63
2 437	4 873.60	H	Z	PK	40.42	8.24	N/A	N/A	48.66	74.00	25.34
	4 874.82	H	Z	AV	30.48	8.24	1.34	N/A	40.06	54.00	13.94
	7 311.99	H	Z	PK	40.29	10.63	N/A	N/A	50.92	74.00	23.08
	7 306.52	H	Z	AV	29.27	10.62	1.34	N/A	41.23	54.00	12.77
2 462	2 483.80	V	Y	PK	62.74	3.78	N/A	N/A	66.52	74.00	7.48
	2 483.66	V	Y	AV	47.63	3.78	1.34	N/A	52.75	54.00	1.25
	4 917.83	H	Z	PK	40.98	8.37	N/A	N/A	49.35	74.00	24.65
	4 919.01	H	Z	AV	30.80	8.37	1.34	N/A	40.51	54.00	13.49
	7 391.21	H	Z	PK	46.18	10.75	N/A	N/A	56.93	74.00	17.07
	7 391.72	H	Z	AV	32.37	10.75	1.34	N/A	44.46	54.00	9.54

## 5.6. AC Power-Line Conducted Emissions

### ■ Test Requirements and limit, Part 15.207

An intentional radiator that 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 (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5.0	56	46
5 ~ 30	60	50

\* Decreases with the logarithm of the frequency

### 5.6.1. Test Setup

See test photographs for the actual connections between EUT and support equipment.

### 5.6.2. Test Procedures

Conducted emissions from the EUT were measured according to the ANSI C63.10-2013.

1. The test procedure is performed in a 6.5 m x 3.5 m x 3.5 m (L x W x H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) x 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

### 5.6.3. Test Results

Refer to the next page. (The worst case data was reported. TM 1 & Lowest)

## AC Power-Line Conducted Emissions (Graph)

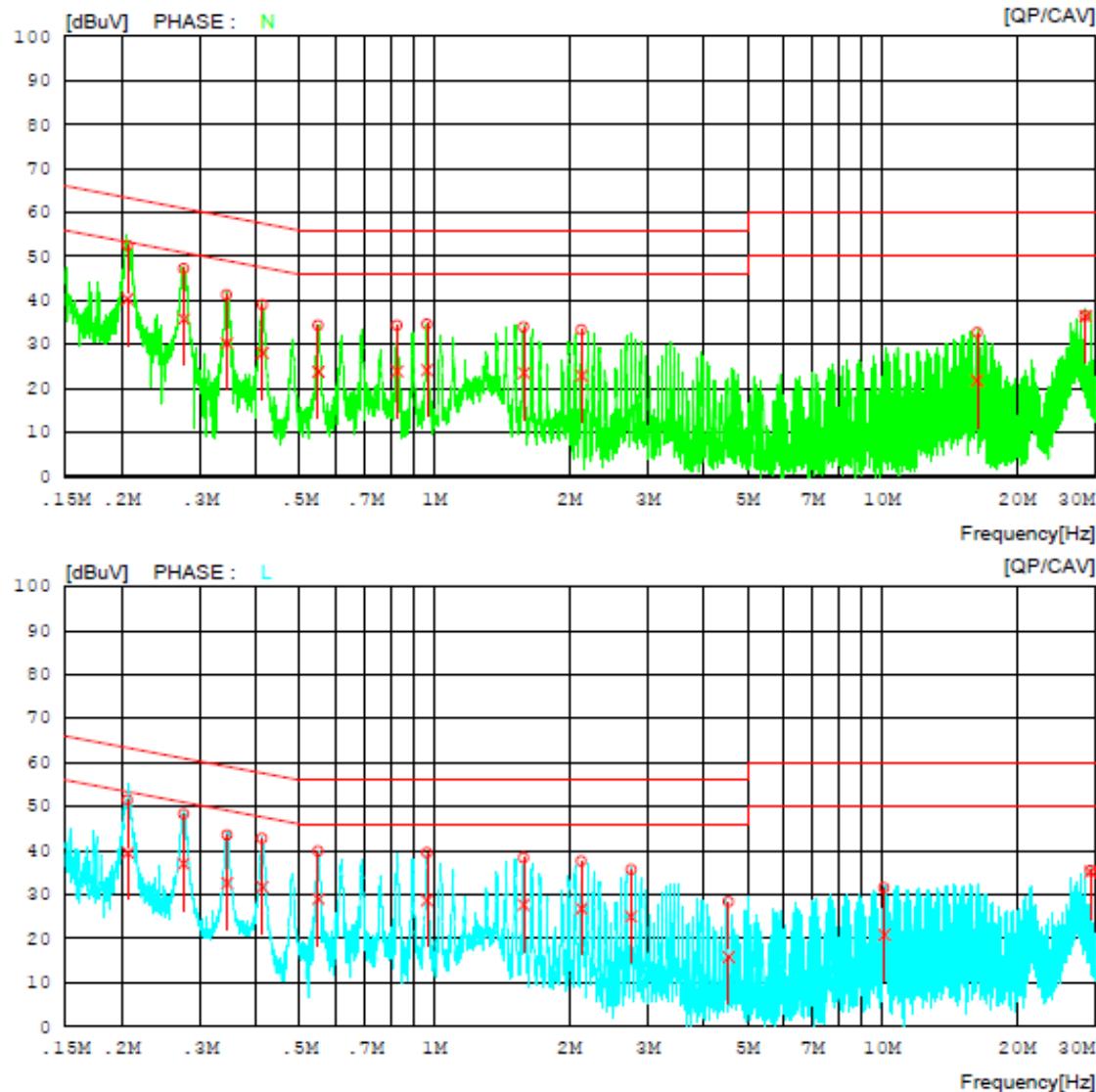
Results of Conducted Emission

DTNC

Date 2023-04-05

Order No.	DTNC2207-05780	Reference No.	
Model No.	SRC-BAMVC3	Power Supply	
Serial No.		Temp/Humi.	23 °C / 45 %
Test Condition	2.4GHz	Operator	J.H.Bang

Memo

LIMIT : FCC P15.207 AV  
FCC P15.207 QP

## AC Power-Line Conducted Emissions (List)

Results of Conducted Emission

DTNC

Date 2023-04-05

Order No.	DTNC2207-05780	Reference No.	
Model No.	SRC-BAMVC3	Power Supply	
Serial No.		Temp/Humi.	
Test Condition	2.4GHz	Operator	23 'C / 45 %

Memo

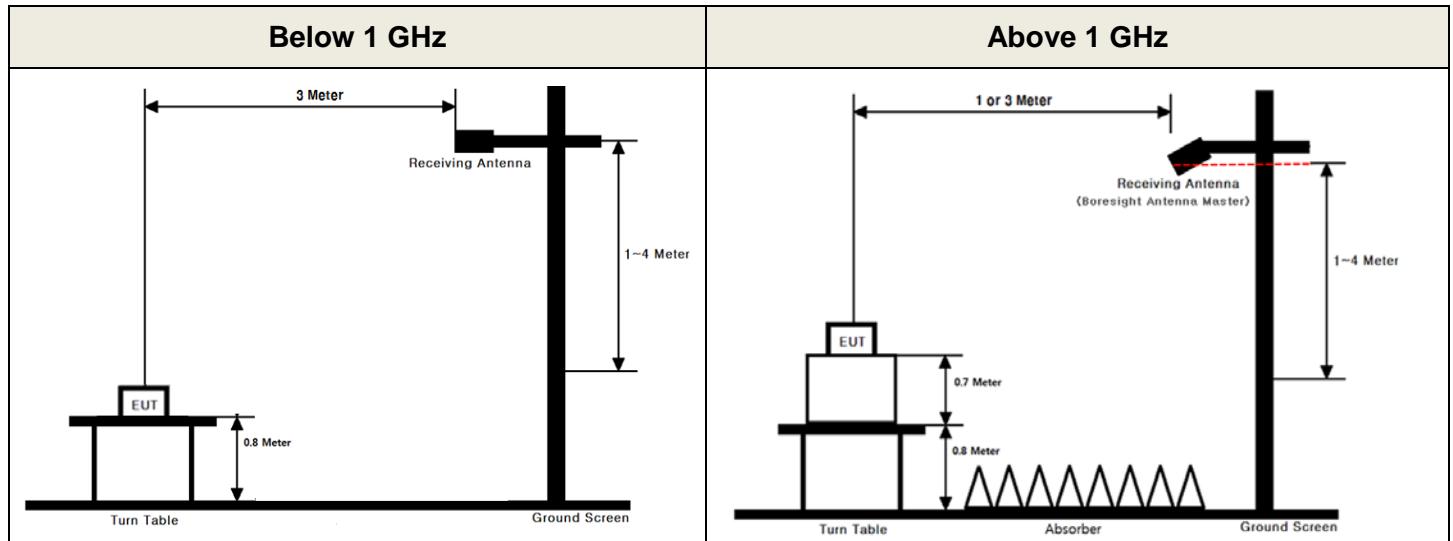
LIMIT : FCC P15.207 AV  
FCC P15.207 QP

NO	FREQ [MHz]	READING		C.FACTOR	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	CAV [dBuV]		QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	QP [dBuV]	CAV [dBuV]	
1	0.20645	42.53	30.38	9.98	52.51	40.36	63.35	53.35	10.84	12.99	N
2	0.27558	37.20	25.87	9.99	47.19	35.86	60.95	50.95	13.76	15.09	N
3	0.34376	31.33	20.33	9.99	41.32	30.32	59.11	49.11	17.79	18.79	N
4	0.41292	29.07	18.14	9.99	39.06	28.13	57.59	47.59	18.53	19.46	N
5	0.55056	24.32	13.80	10.00	34.32	23.80	56.00	46.00	21.68	22.20	N
6	0.82559	24.33	13.96	10.00	34.33	23.96	56.00	46.00	21.67	22.04	N
7	0.96307	24.59	14.21	10.01	34.60	24.22	56.00	46.00	21.40	21.78	N
8	1.58400	23.94	13.54	10.03	33.97	23.57	56.00	46.00	22.03	22.43	N
9	2.13160	23.33	12.82	10.04	33.37	22.86	56.00	46.00	22.63	23.14	N
10	16.30680	22.15	11.22	10.57	32.72	21.79	60.00	50.00	27.28	28.21	N
11	28.44800	25.80	25.75	10.66	36.46	36.41	60.00	50.00	23.54	13.59	N
12	0.20666	41.56	29.59	9.88	51.44	39.47	63.34	53.34	11.90	13.87	L
13	0.27535	38.39	27.15	9.89	48.28	37.04	60.95	50.95	12.67	13.91	L
14	0.34443	33.68	22.67	9.89	43.57	32.56	59.10	49.10	15.53	16.54	L
15	0.41257	32.86	21.85	9.89	42.75	31.74	57.60	47.60	14.85	15.86	L
16	0.55070	30.00	19.09	9.90	39.90	28.99	56.00	46.00	16.10	17.01	L
17	0.96300	29.44	18.67	9.97	39.41	28.64	56.00	46.00	16.59	17.36	L
18	1.58260	28.36	17.62	10.03	38.39	27.65	56.00	46.00	17.61	18.35	L
19	2.13320	27.57	16.71	10.04	37.61	26.75	56.00	46.00	18.39	19.25	L
20	2.75120	25.62	14.94	10.05	35.67	24.99	56.00	46.00	20.33	21.01	L
21	4.54280	18.28	5.75	10.09	28.37	15.84	56.00	46.00	27.63	30.16	L
22	10.11340	21.27	10.63	10.21	31.48	20.84	60.00	50.00	28.52	29.16	L
23	29.22920	25.08	24.69	10.38	35.46	35.07	60.00	50.00	24.54	14.93	L

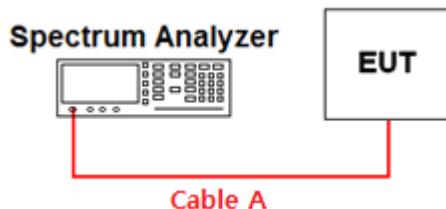
## APPENDIX I

### Test set up diagrams

- **Radiated Measurement**



- **Conducted Measurement**



## APPENDIX II

### Duty cycle plots

- Test Procedures

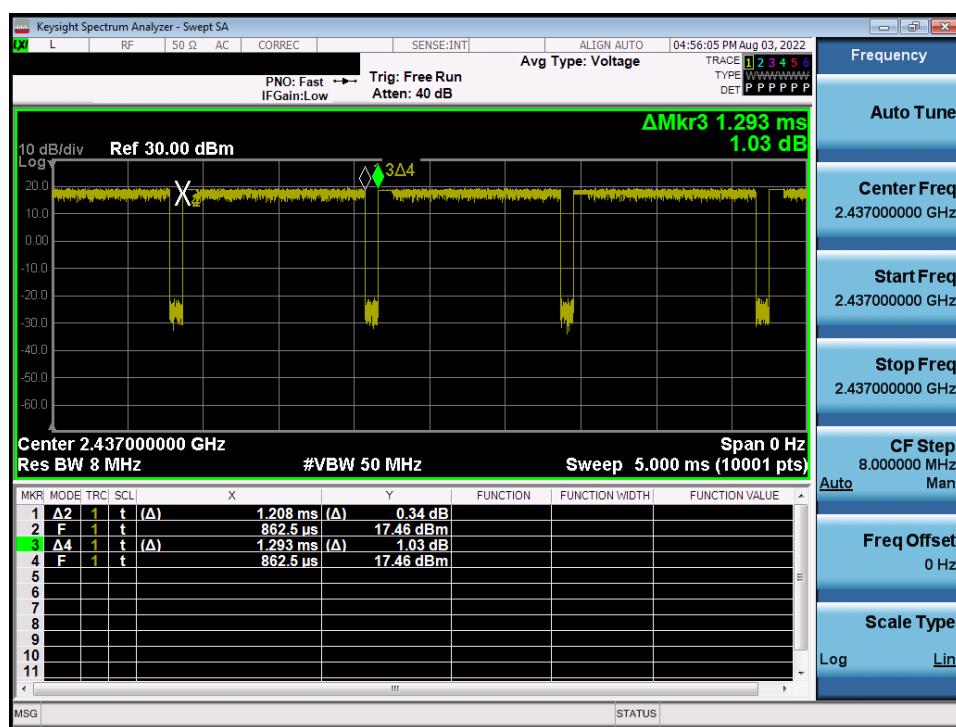
- KDB558074 D01v05r02 – Section 6

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.)

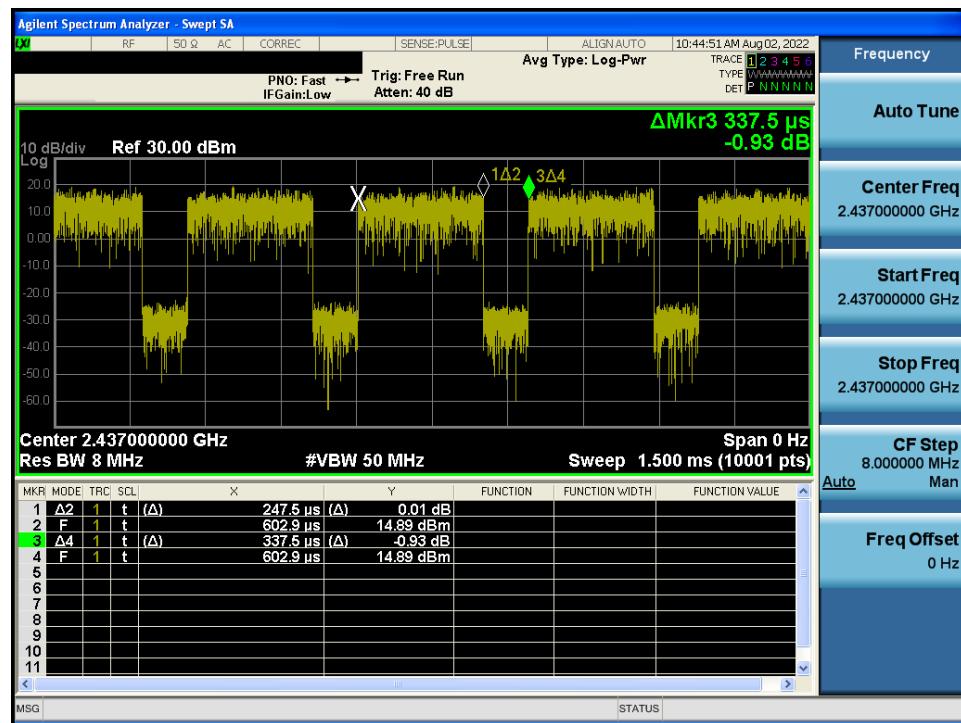
### Duty Cycle

TM 1 & 2 437 MHz



## Duty Cycle

TM 2 & 2 437 MHz

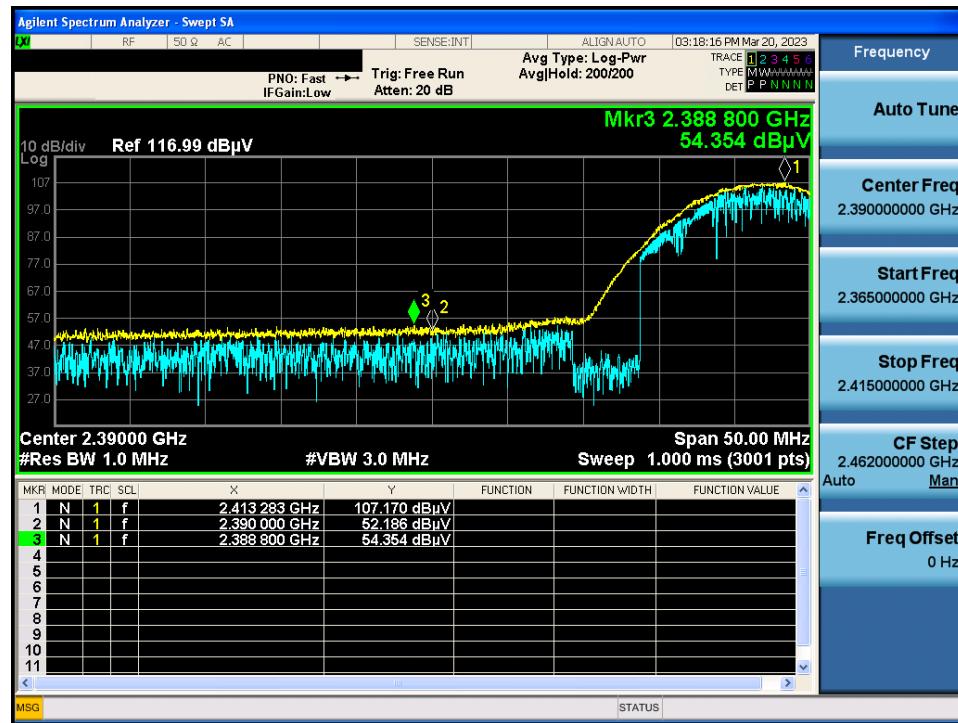


## APPENDIX III

### Unwanted Emissions (Radiated) Test Plot

TM 1 & 2 412 & Z axis & Hor

Detector Mode : PK



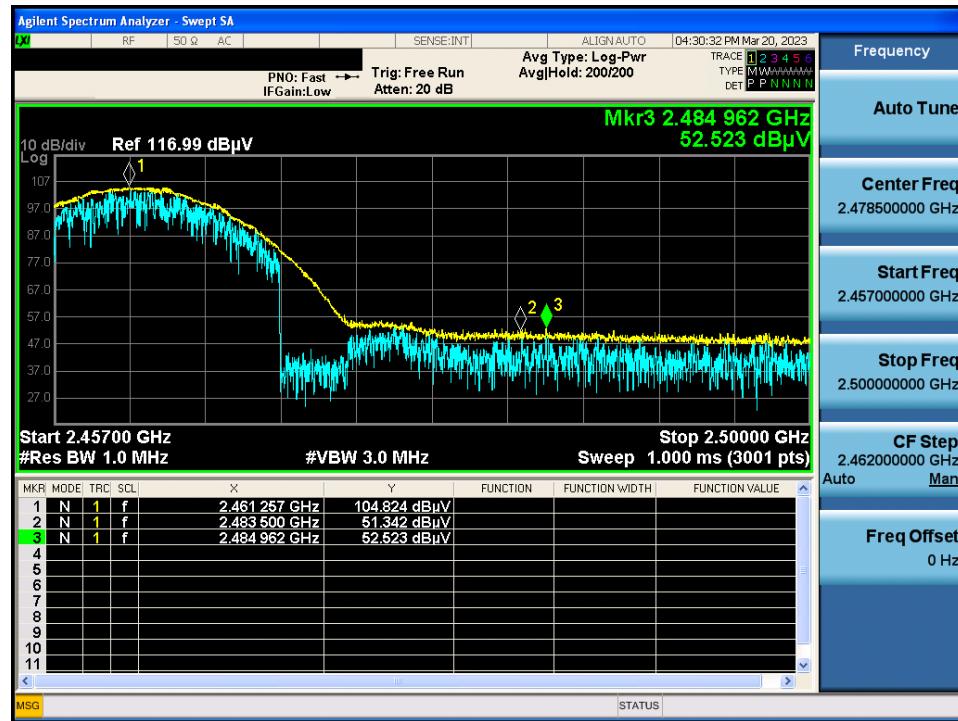
TM 1 & 2 412 & Z axis & Hor

Detector Mode : AV



TM 1 & 2 462 & Z axis & Hor

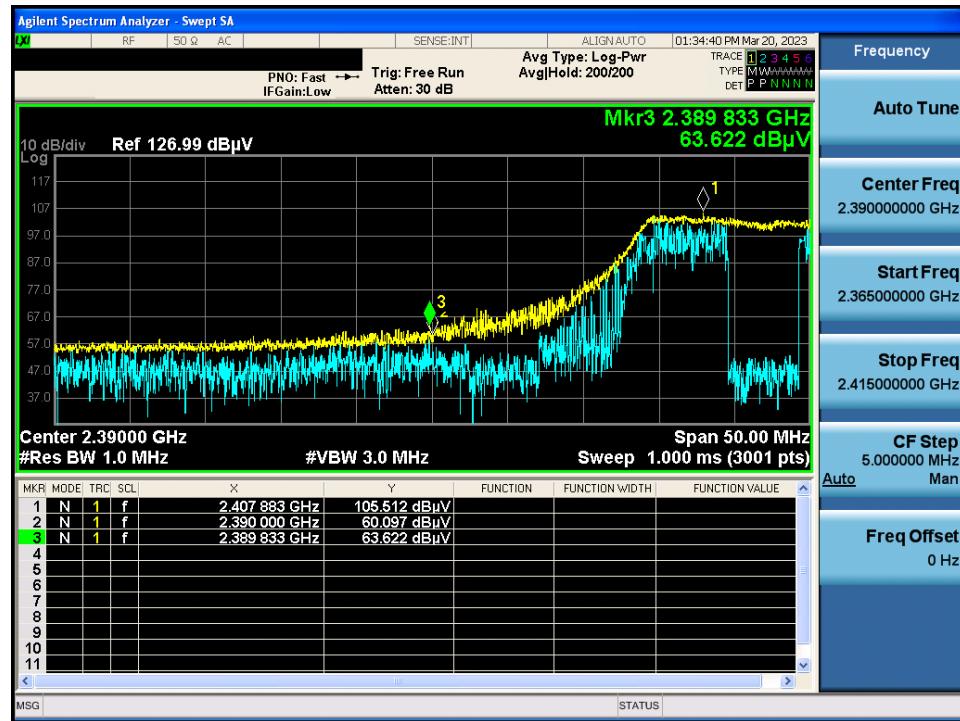
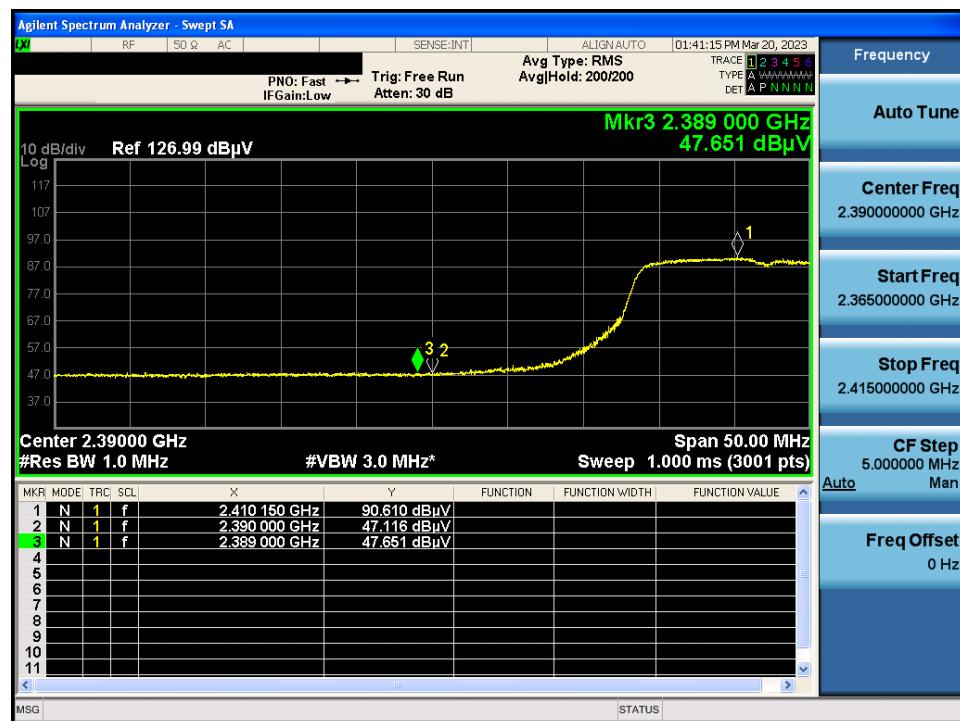
Detector Mode : PK

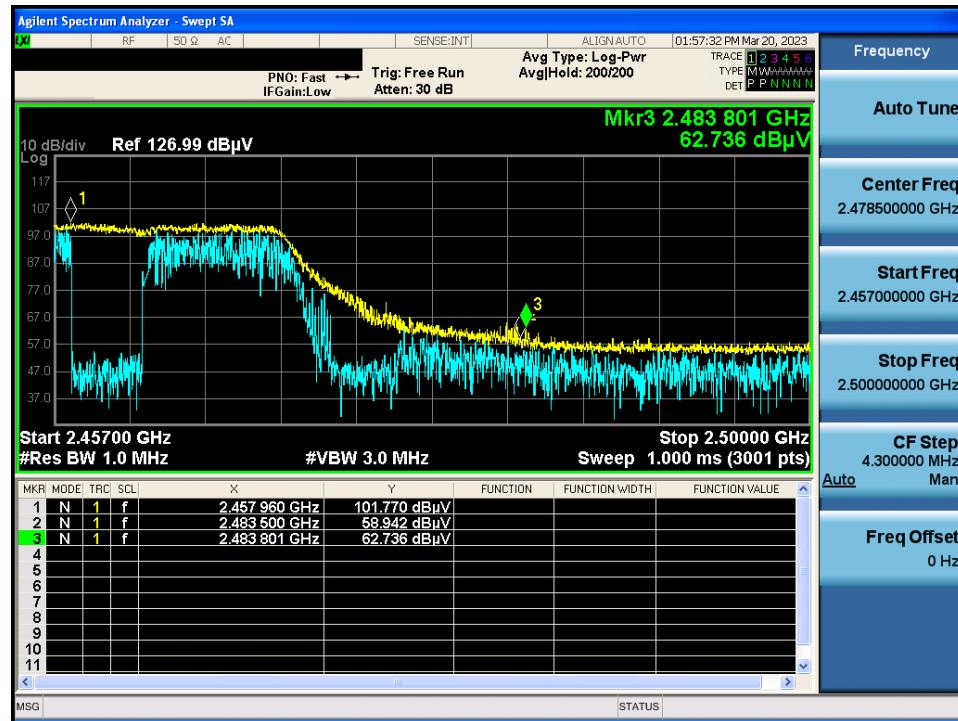


TM 1 & 2 462 & Z axis & Hor

Detector Mode : AV

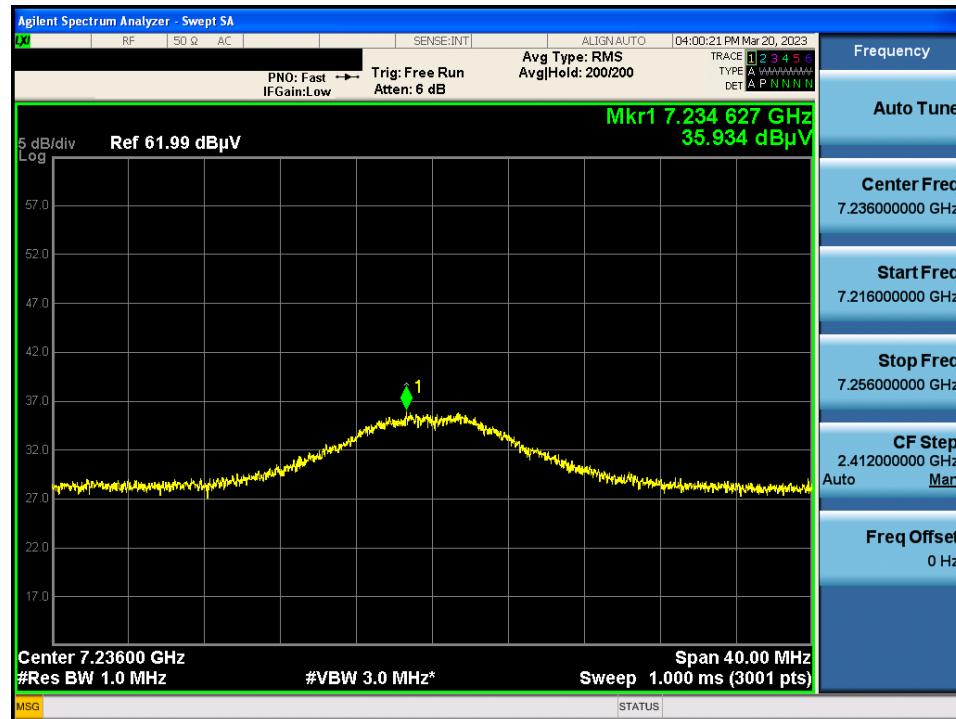


**TM 2 & 2412 & Y axis & Ver**
**Detector Mode : PK**

**TM 2 & 2412 & Y axis & Ver**
**Detector Mode : AV**


**TM 2 & 2462 & Y axis & Ver**
**Detector Mode : PK**

**TM 2 & 2462 & Y axis & Ver**
**Detector Mode : AV**


TM 1 & 2 412 & Z axis & Hor

Detector Mode : AV



TM 2 & 2 462 & Z axis & Hor

Detector Mode : AV

