# **TEST REPORT**

715		DT&C Co., Ltd.
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1. Report N	lo : DRTFCC2201-0017	7
2. Custome	er	
• Name (F	CC) : HYUNDAI MOBIS	CO., LTD.
<ul> <li>Address</li> </ul>	(FCC) : 203, Teheran-ro	Gangnam-gu Seoul South Korea 135-977
3. Use of F	Report : FCC Original Gra	nt
	Name / Model Name : DI : TQ8-VT230SKAN	SPLAY CAR SYSTEM / VT230SKAN
	gulation(s): Part 15.247 hod used: KDB558074 D	001v05r02, ANSI C63.10-2013
6. Date of	Test : 2021.10.21 ~ 2021	.11.30
7. Location	of Test : 🛛 Permanent	Testing Lab On Site Testing
8. Testing I	Environment : See appen	ided test report.
9. Test Res	sult : Refer to the attache	d test result.
	shown in this test report refe port is not related to KOLAS	er only to the sample(s) tested unless otherwise stated. accreditation.
Affirmation	Tested by	Reviewed by
Ammadon	Name : JaeHyeok Bang	(Signature) Name : JaeJin Lee (Signature)
		2022.01.20.
		DT&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

# **Test Report Version**

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2201-0017	Jan, 20. 2022	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	DISPLAY CAR SYSTEM
Model Name	VT230SKAN
Add Model Name	VT240SKAN
Firmware Version Identification Number	1.0
EUT Serial Number	Conducted : NAL356787730731090, Radiated : NAL356787731514057
Power Supply	DC 14.4 V
Frequency Range	• 802.11b/g/n(20 MHz) : 2 412 MHz ~ 2 462 MHz
Modulation Technique	• 802.11b: CCK, DSSS • 802.11g/n: OFDM
Antenna Specification	Antenna Type: Pattern Antenna Gain: -1.19 dBi (PK)

Band	Mode	Tx. frequency(MHz)	Max. conducted power(dBm)
	802.11b	2 412 ~ 2 462	10.96
2.4 GHz	802.11g	2 412 ~ 2 462	19.87
	802.11n (HT20)	2 412 ~ 2 462	18.60

# 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

www.dtnc.net		
Telephone	:	+ 82-31-321-2664
FAX	:	+ 82-31-321-1664

# 1.4. Testing Environment

Ambient Condition	
<ul> <li>Temperature</li> </ul>	+20 °C ~ +25 °C
<ul> <li>Relative Humidity</li> </ul>	+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	0.9 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)	4.9 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)	5.3 dB (The confidence level is about 95 %, k = 2)

# 1.6. Test Equipment List

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	21/12/16	22/12/16	MY50410399
Spectrum Analyzer	Agilent Technologies	N9020A	21/12/16	22/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	21/06/24	22/06/24	US47360812
DC Power Supply	Agilent Technologies	66332A	21/06/24	22/06/24	US37474125
DC Power Supply	SM techno	SDP30-5D	21/06/24	22/06/24	305DMG305
DC Power Supply	SM techno	SDP30-5D	21/06/24	22/06/24	305DNF079
Multimeter	FLUKE	17B+	21/12/16	22/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	21/12/16	22/12/16	255571
Signal Generator	ANRITSU	MG3695C	21/12/16	22/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	21/12/16	22/12/16	120612-2
Thermohygrometer	BODYCOM	BJ5478	21/06/24	22/06/24	N/A
Thermohygrometer	XIAOMI	MHO-C201	21/12/16	22/12/16	00089675
Loop Antenna	Schwarzbeck	FMZB1513	20/02/19	22/02/19	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	21/12/16	22/12/16	3362
Horn Antenna	ETS-Lindgren	3117	21/06/24	22/06/24	00143278
Horn Antenna	A.H.Systems Inc.	SAS-574	21/06/24	22/06/24	155
PreAmplifier	tsj	MLA-0118-B01-40	21/12/16	22/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	21/06/24	22/06/24	16966-10728
PreAmplifier	H.P	8447D	21/12/16	22/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935-1000- 15000-40SS	21/06/24	22/06/24	8
High Pass Filter	Wainwright Instruments	WHKX10-2838- 3300-18000-60SS	21/06/24	22/06/24	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	21/06/24	22/06/24	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	21/06/24	22/06/24	16012202
Attenuator	SRTechnology	F01-B0606-01	21/06/24	22/06/24	13092403
Attenuator	Aeroflex/Weinschel	56-3	21/06/24	22/06/24	Y2370
Attenuator	SMAJK	SMAJK-2-3	21/06/24	22/06/24	2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2488B MA2491A	21/12/16	22/12/16	0910025 0845333
Cable	DT&C	Cable	21/01/08	22/01/08	G-1
Cable	DT&C	Cable	21/01/08	22/01/08	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	21/01/08	22/01/08	G-3
Cable	DT&C	Cable	21/01/08	22/01/08	G-4
Cable	Radiall	TESTPRO3	21/01/08	22/01/08	M-01
Cable	DT&C	Cable	21/01/08	22/01/08	M-02
Cable	HUBER+SUHNER	SUCOFLEX 104	21/01/08	22/01/08	M-03
Cable	Junkosha	MWX221	21/01/08	22/01/08	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	21/01/08	22/01/08	M-09
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-1
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-4
Cable	DT&C	Cable	21/01/05	22/01/05	RFC-01
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0177

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
802.11n(HT20)	MCS 0 ~ MCS 7

# **EUT** Operation test setup

- Test Software: Software application in EUT.

- Power setting: Default of EUT.

#### **Test Mode**

Test mode	Worst case data rate	Teste	d Frequency (I	MHz)
TM 1	802.11b 1 Mbps	2 412	2 437	2 462
TM 2	802.11g 6 Mbps	2 412	2 437	2 462
ТМ 3	802.11n(HT20) MCS 0	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 antenna is permanently printed on the PCB. (Refer to Internal Photo file.) Therefore this E.U.T complies with the requirement of Part 15.203

# 4. Summary of Test Result

0 kHz Vatt Bc in any kHz BW IBm / 3 kHz	nducted	c c c c
Bc in any kHz BW	nducted	c
kHz BW	nducted	
IBm / 3 kHz		С
15.209 limits er to section 5.5)	adiated	С
	N N	A Note3
	-	С
•	15.207 limits A er to section 5.6) Co 15.203 er to section 3) e	15.207 limits       AC Line         er to section 5.6)       Conducted         15.203       -         er to section 3)       -         e       -         bechoic chamber which is correlated with OA



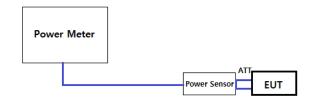
# 5. Test Result

# 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)								
			1	2	5.5	11	-	-	-	-	
	2 412	PK	10.96	10.81	10.80	10.88	-	-	-	-	
		AV	7.78	7.68	7.70	7.72	-	-	-	-	
802.11b	2 437	PK	10.54	10.40	10.38	10.48	-	-	-	-	
002.110		AV	7.40	7.31	7.36	7.39	-	-	-	-	
	2 462	PK	10.35	10.38	10.34	10.35	-	-	-	-	
		AV	7.26	7.27	7.24	7.25	-	-	-	-	

Mode	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm)								
			Data Rate (Mbps)								
			6	9	12	18	24	36	48	54	
	2 412	PK	19.87	19.78	19.35	19.02	18.12	18.93	18.00	17.71	
		AV	9.63	9.56	9.58	9.02	9.13	9.10	9.32	9.15	
902 11a	2 437	PK	19.59	19.47	19.53	19.54	19.46	19.48	19.52	19.45	
802.11g		AV	9.07	9.05	8.89	8.96	9.02	9.02	8.96	8.91	
	2 462	PK	19.51	19.47	19.47	19.50	19.40	19.42	19.44	19.33	
		AV	8.87	8.72	8.85	8.83	8.69	8.80	8.78	8.82	

Mode	Freq. (MHz)	Det.	Maximum Peak Conducted Output Power (dBm)								
			0	1	2	3	4	5	6	7	
	2 412	PK	18.60	18.23	18.00	18.42	17.48	18.25	17.81	17.76	
		AV	8.41	8.36	8.32	8.00	8.06	8.06	8.16	8.00	
802.11n	2 437	PK	18.27	18.24	18.17	18.24	18.22	18.08	18.26	18.26	
(HT20)		AV	7.89	7.73	7.78	7.88	7.69	7.70	7.79	7.69	
	2 462	PK	18.40	18.38	18.28	18.31	18.23	18.30	18.23	18.32	
		AV	8.01	7.95	7.92	7.81	7.89	7.93	7.96	7.85	

# 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)  $\ge$  3 x 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  $\ge$  3 × 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  $\ge$  6 dB.

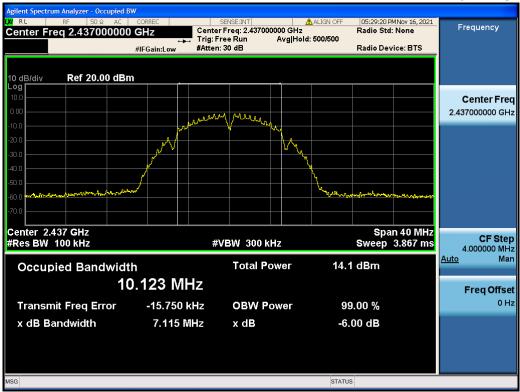
# 5.2.3. Test Results

Test Mode	Frequency	Test Results (MHz)
	2 412	7.11
TM 1	2 437	7.12
	2 462	7.10
	2 412	16.29
TM 2	2 437	16.31
	2 462	16.08
	2 412	16.84
ТМ 3	2 437	16.90
	2 462	16.47



### 6 dB Bandwidth

#### TM 1 & 2 437



TM 1 & 2462 nt Spectrum Analyz Occupied BV CORREC SENSE:INT ALIGN OFF GHZ Center Freq: 2.462000000 GHz Trig: Freq Run Avg|Hold: 500/500 #IFGain:Low #Atten: 30 dB 05:36:22 PMNov 16, 2021 Radio Std: None Frequency Center Freq 2.462000000 GHz Radio Device: BTS Ref 20.00 dBm Center Freq 2.462000000 GHz mm mu m.M Center 2.462 GHz #Res BW 100 kHz Span 40 MHz Sweep 3.867 ms CF Step 4.000000 MHz Man #VBW 300 kHz <u>Auto</u> Occupied Bandwidth Total Power 14.0 dBm 10.087 MHz Freq Offset -20.598 kHz 99.00 % 0 Hz Transmit Freq Error OBW Power -6.00 dB 7.101 MHz x dB Bandwidth x dB STATUS SG



# 6 dB Bandwidth

# TM 2 & 2 437





**Dt&C** 



#### 6 dB Bandwidth

# TM 3 & 2 437





# 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 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.

# 5.3.3. Test Results

Test Mode	Frequency	RBW	PKPSD (dBm)	Limit (dBm / 3 kHz)
	2 412	3 kHz	-14.21	8.00
TM 1	2 437	3 kHz	-14.72	8.00
	2 462	3 kHz	-13.65	8.00
	2 412	3 kHz	-13.97	8.00
TM 2	2 437	3 kHz	-14.45	8.00
	2 462	3 kHz	-14.47	8.00
	2 412	3 kHz	-14.96	8.00
ТМ 3	2 437	3 kHz	-15.12	8.00
	2 462	3 kHz	-15.39	8.00



TM 1 & 2412



#### **Power Spectral Density**

TM 1 & 2437





TM 1 & 2462





TM 2 & 2412



# **Power Spectral Density**

# TM 2 & 2437



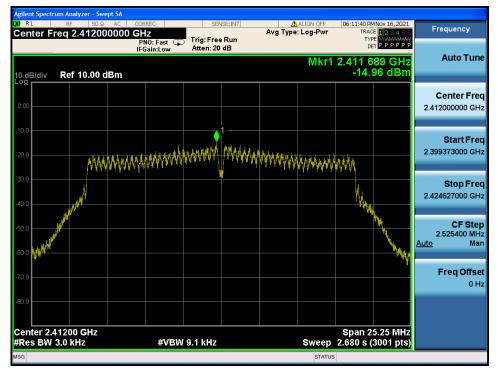


TM 2 & 2462





TM 3 & 2412



#### Power Spectral Density

#### TM 3 & 2437





TM 3 & 2462



# 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 emiss	sion(conducted) w	as lested with beit	Jw settings.		
Frequency range	RBW	VBW	Detector	Trace	Sweep Point
9 kHz ~ 30 MHz	100 kHz	300 kHz			
30 MHz ~ 10 GHz	1 MHz	3 MHz	Peak	Max Hold	40 001
10 GHz ~ 25 GHz	1 MHz	3 MHz			

Note: The unwanted emission(conducted) was tested with below settings.

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.

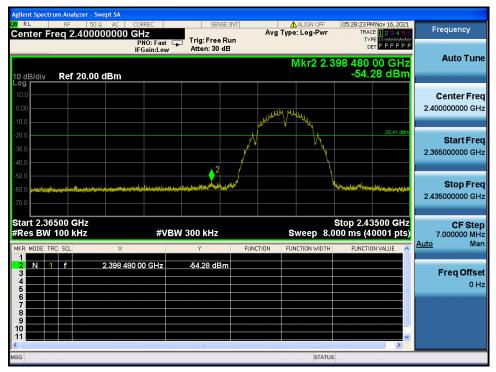
# 5.4.3. Test Results

TM 1 & 2412

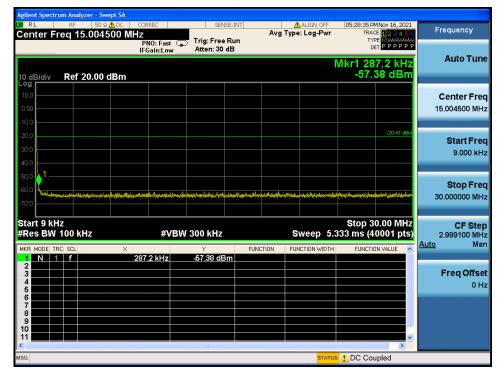
#### Reference

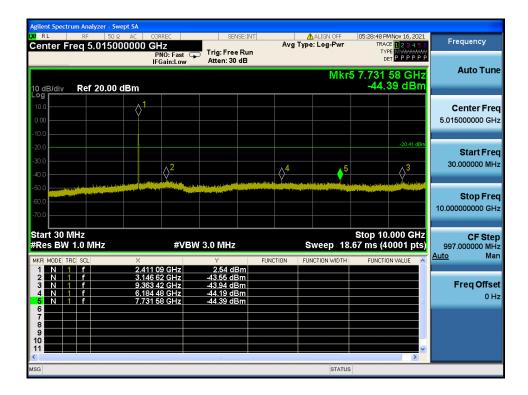


# Low Band-edge









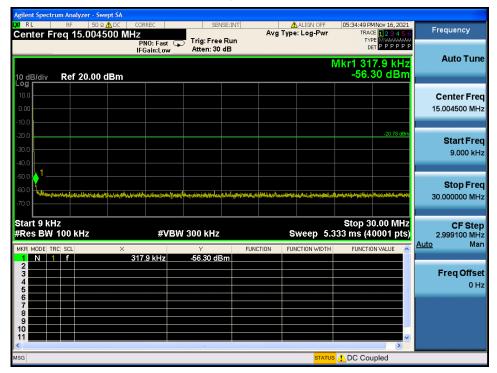


#### nt Spectrum Analyzer - Swept SA 05:29:01 PMNov 16, 2021 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P P P P P Center Freq 17.500000000 GHz PNO: Fast IFGain:Low Atten: 30 dB RL ALIGN OFF Frequency Auto Tune Mkr3 21.291 250 GHz -37.08 dBm Ref 20.00 dBm I0 dB/div -og **Center Freq** 17.500000000 GHz Start Freq <mark>♦</mark>3 ∱ 10.00000000 GHz Stop Freq 25.00000000 GHz Start 10.000 GHz #Res BW 1.0 MHz Stop 25.000 GHz Sweep 40.00 ms (40001 pts) **CF Step** 1.500000000 GHz <u>uto</u> Man #VBW 3.0 MHz Auto FUNCTION FUNC 24.711 250 GHz 21.879 250 GHz 21.291 250 GHz -35.24 dBm -36.95 dBm -37.08 dBm f **Freq Offset** N Δ 0 Hz 5678910 11 STATUS

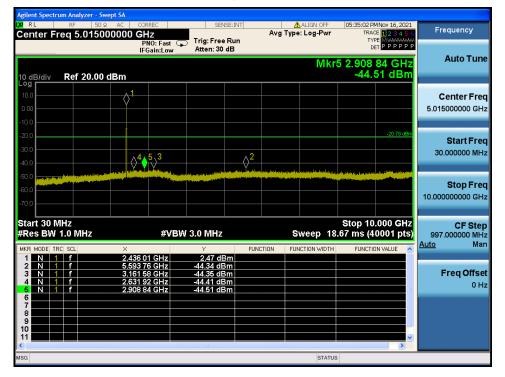
#### TM 1 & 2437

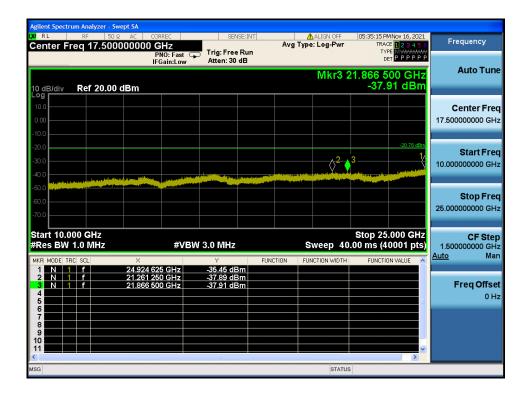
#### Reference









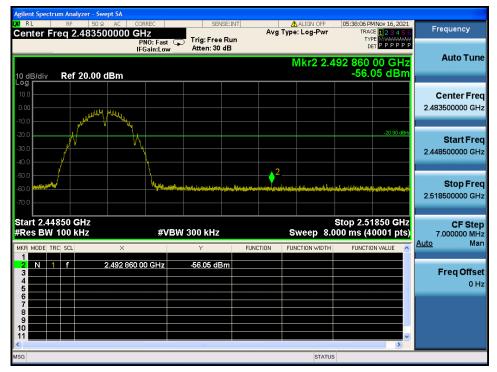


# TM 1 & 2462

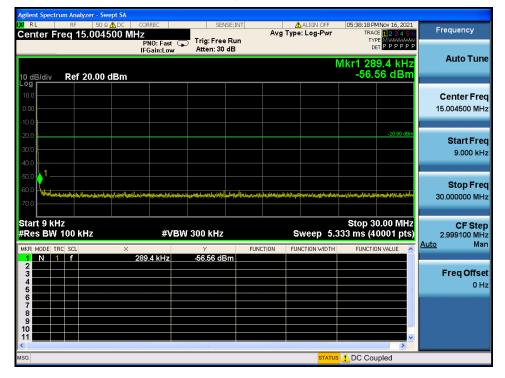
#### Reference

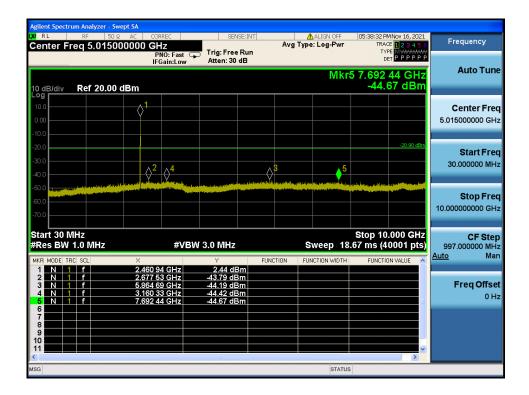


# **High Band-edge**









Agilent Spectrum Analyzer -					
XI RE S Center Freq 17.50		SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	05:38:45 PMNov 16, 2021 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 20.0	PNO: Fast IFGain:Low	Trig: Free Run Atten: 30 dB	Mkr3 2	түре Милини Det P P P P P P 21.801 625 GHz -37.39 dBm	Auto Tune
- 0 g 10.0 0.00 					Center Free 17.500000000 GH
20.0	انىيىلى بىرى بىرى بىرى بىرى بىرى بىرى بىرى ب	a de la constante de la constan		-20.90 dBm 32 1,	Start Free 10.000000000 GH:
-50.0 					Stop Free 25.000000000 GH:
Start 10.000 GHz ≉Res BW 1.0 MHz		W 3.0 MHz		Stop 25.000 GHz .00 ms (40001 pts)	CF Step 1.500000000 GH Auto Mar
MKR         MODE         TRC         SCL           1         N         1         f           2         N         1         f           3         N         1         f           5	× 24.954 250 GHz 24.265 750 GHz 21.801 625 GHz	Y FL -35.05 dBm -35.60 dBm -37.39 dBm	INCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offse 0 H:
9 10 11				×	

# **Dt&C**

# TM 2 & 2412

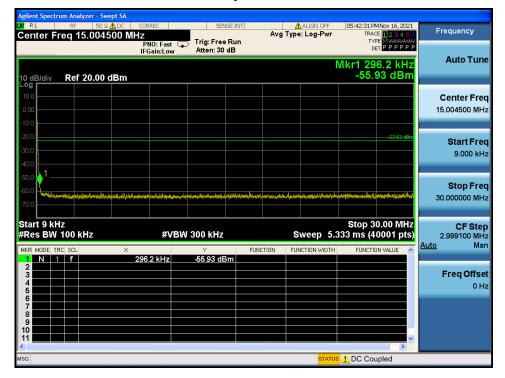
#### Reference

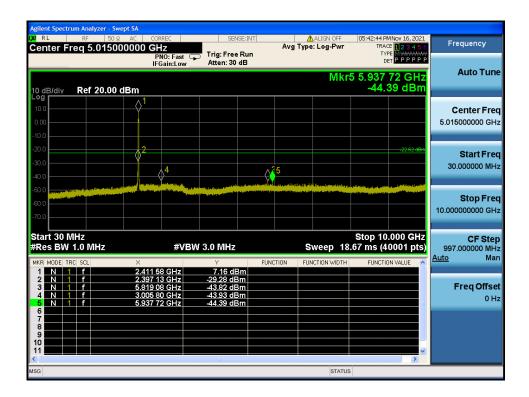


#### Low Band-edge









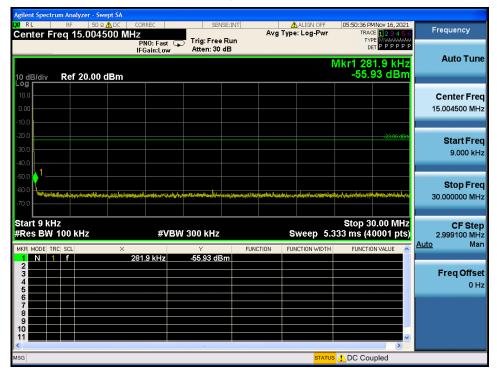




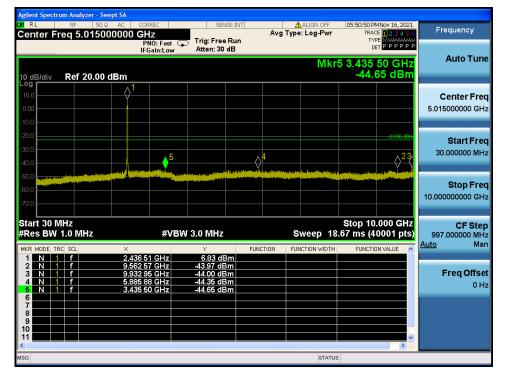
#### TM 2 & 2437

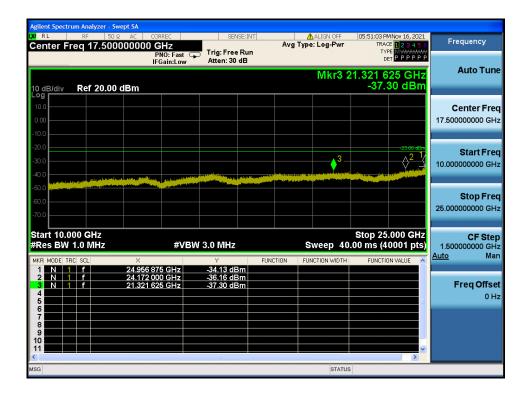
#### Reference











#### TM 2 & 2462

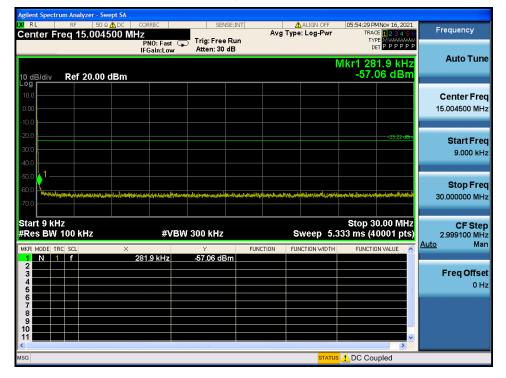
#### Reference

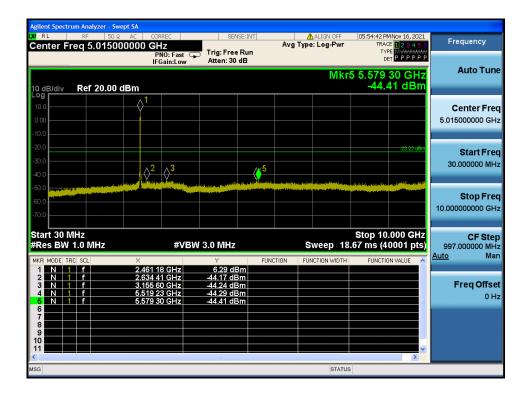


#### **High Band-edge**













#### TM 3 & 2412

#### Reference



#### Low Band-edge





Agilent Spectrum Ana								
Center Freq 1		IORREC 7	SENSE:I	Avg	ALIGN OFF	TRACE	Nov 16, 2021	Frequency
		PNO: Fast 🖵 IFGain:Low	) Trig: Free Ru Atten: 30 dB	n		De <sup>r</sup> Mkr1 281	PPPPPP 8 dBm	Auto Tune
Log 10.0 0.00								Center Freq 15.004500 MHz
-20.0							-23:55 dBm	Start Freq 9.000 kHz
-50.0	of the sector of the last of the sector of	and and the second s	notanosijakan dod su ijelji su he	ilite, contaction Lack, shii	atherese interactions and beause	n fan stad of some i staat fran	myythidaasy	Stop Freq 30.000000 MHz
Start 9 kHz #Res BW 100		#VBW	300 kHz		Sweep 5.	333 ms (40		CF Step 2.999100 MHz Auto Man
MKR MODE TRC SCL	×	81.9 kHz	۲ -56.28 dBm	FUNCTION	FUNCTION WIDTH	FUNCTIO	VALUE	
2 3 4 5 6								<b>Freq Offset</b> 0 Hz
7 8 9 9 10								
11			Ш				<u>&gt;</u>	
MSG					STATU	🛚 🧘 DC Cou	pled	

RL RF 50 Ω enter Freg 5.015000		SENSE:INT	ALIGN OFF	06:12:58 PMNov 16, 2021 TRACE 1 2 3 4 5 6	Frequency
enter med 3.013000	PNO: Fast IFGain:Low	Trig: Free Run Atten: 30 dB			
) dB/div Ref 20.00 dB	3m		Mkr	5 2.687 50 GHz -44.59 dBm	Auto Tur
	1				<b>Center Fr</b> 5.015000000 G
0.0	5 ↓4		203	-23.55 dBm	Start Fr 30.000000 M
0.0 0.0 0.0					<b>Stop Fr</b> 10.000000000 G
tart 30 MHz Res BW 1.0 MHz	#VE	3.0 MHz	Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Sto 997.000000 M
KR MODE TRC SCL	× 2.411 33 GHz	۲ 5.31 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> M
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	5.583 79 GHz 5.824 81 GHz 3.209 68 GHz 2.687 50 GHz	-44.22 dBm -44.24 dBm -44.53 dBm -44.59 dBm			Freq Offs 0
6 7 8 9 9 0					
1				~	

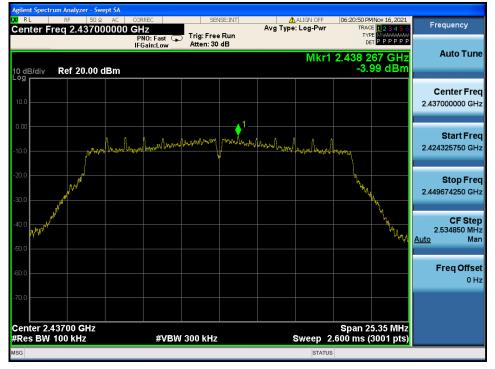


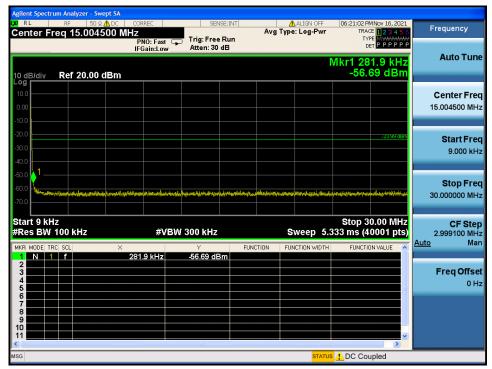




TM 3 & 2437

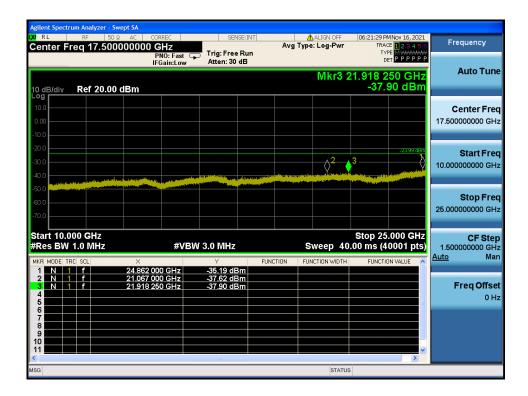
#### Reference







Agilent Spectrum Analyzer - Swep					
Center Freq 5.01500		SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	06:21:16 PM Nov 16, 2021 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast G IFGain:Low	⊃ Trig: Free Run Atten: 30 dB		түре Милини түре Милини рет Р Р Р Р Р Р <b>r5 5.512 25 GHz</b> -44.82 dBm	Auto Tune
10 dB/div Ref 20.00 d	Bm				Center Freq 5.015000000 GHz
-20.0	$\langle \rangle^2 \langle \rangle^3$	<b>5</b>	4	-23.99 dem	Start Free 30.000000 MHz
-50.0 -70.0					Stop Freq 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBV	V 3.0 MHz	Sweep 1	Stop 10.000 GHz 8.67 ms (40001 pts)	CF Step 997.000000 MHz Auto Mar
MKR MODE TRC SCL	× 2.438 75 GHz	Y FI 4.46 dBm	INCTION FUNCTION WIDT	FUNCTION VALUE	Mato Mai
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	2.665 32 GHz 2.983 61 GHz 5.871 67 GHz 5.512 25 GHz	-44.42 dBm -44.49 dBm -44.67 dBm -44.82 dBm			Freq Offset 0 Hz
7 8 9 10 11					
< MSG		111	STAT	JS	



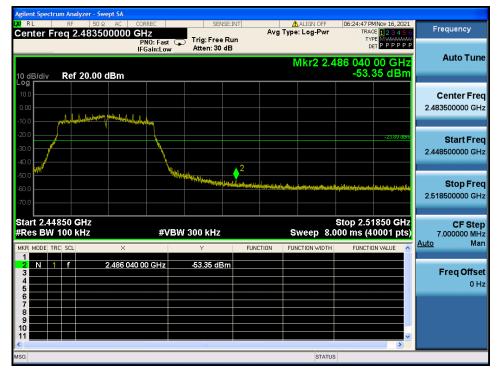
# **Dt&C**

#### TM 3 & 2462

#### Reference



#### **High Band-edge**





Agilent Spectrum Analyzer - Sv						
Center Freg 15.004	2 ADC CORREC	SENSE:INT	Avg Type:		06:25:00 PMNov 16, 2021 TRACE 123456	Frequency
10 dB/div Ref 20.00	PNO: Fast IFGain:Low	Trig: Free Run Atten: 30 dB		MI	түре Милиний рет Р Р Р Р Р Р Р (r1 281.9 kHz -55.75 dBm	Auto Tune
10.0 0.00 -10.0						Center Freq 15.004500 MHz
-20.0					-23.89 dbm	Start Freq 9.000 kHz
-50.0	فيتجرماهم أيوا وتصدحا حمدوته بعتمام وتو	maidestigael.marineuror.vis.htjall.	برأياد ومتروبين فأطرفهم وتعادلته هو	udala gill bet bei işkiri di bira	Serverentationski frysta Instanspilijanski	Stop Freq 30.000000 MHz
Start 9 kHz #Res BW 100 kHz	#VE	W 300 kHz	Sw		Stop 30.00 MHz 3 ms (40001 pts)	CF Step 2.999100 MHz Auto Mar
MKR MODE TRC SCL	× 281.9 kHz	۲ -55.75 dBm	FUNCTION FUNC	TION WIDTH	FUNCTION VALUE	Man
						Freq Offset 0 Hz
7 8 9 10						
<					×	
MSG				STATUS 🤰	DC Coupled	

	Ω AC CORREC	SENSE:INT	ALIGN OFF	06:25:13 PMNov 16, 2021 TRACE 1 2 3 4 5 6	Frequency
enter Freq 5.0150	PNO: Fast ( IFGain:Low	Trig: Free Run Atten: 30 dB	Avg Type. Logi Wi		
0 dB/div Ref 20.00			Mkr	5 3.000 56 GHz -44.55 dBm	Auto Tur
og	<u>1</u>				
10.0					Center Fre
					5.015000000 GI
10.0					
20.0				-23.89 dBm	Start Fr
80.0	5.24			<u> </u>	30.000000 M
0.0					
0.0 percentant line for a line					Oton En
0.0					Stop Fr 10.000000000 G
0.0					10.00000000 G
tart 30 MHz				Stop 10.000 GHz	
Res BW 1.0 MHz	#VB	W 3.0 MHz	Sweep 18	.67 ms (40001 pts)	CF Ste 997.000000 M
KR MODE TRC SCL	×		FUNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> M
1 N 1 f	2.463 18 GHz	4.64 dBm			
2 N 1 f 3 N 1 f	9.369 40 GHz 3.193 48 GHz	-44.08 dBm -44.10 dBm			Freq Offs
4 N 1 f	3.288 45 GHz	-44.52 dBm			0
5 N 1 f	3.000 56 GHz	-44.55 dBm		=	0
6					
8					
9					
9				~	





#### 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	2 4000 / 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

MHz	MHz	MHz	MHz	GHz	GHz
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 ≥ 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.

Duly Cycle C	enteentae				
Test Mode	Date rate T <sub>on</sub> (ms)		T <sub>on+off</sub> (ms)	$D=T_{on}/(T_{on+off})$	DCCF = 10 log(1/D) (dB)
TM 1	1 Mbps	8.610	8.705	0.989 1	0.05
TM 2	6 Mbps	1.428	1.530	0.933 3	0.30
TM 3	MCS 0	1.336	1.437	0.929 7	0.32

#### Duty Cycle Correction factor

Note1: Where, T= Transmission duration / D= Duty cycle Note2: Please refer to the appendix II for duty cycle plots.

This test report is prohibited to copy or reissue in whole or in part without the approval of DT&C Co., Ltd. TRF-RF-232(04)210316

#### 5.5.3. Test Results

#### **Test Notes** -

1. The radiated emissions were investigated 9 kHz 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 factor is applied to the result.

- Calculation of distance correction factor

At frequencies below 30 MHz = 40 log( tested distance / specified distance )

At frequencies at or above 30 MHz = 20 log( tested distance / 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

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)
	2 388.85	Н	Х	PK	49.98	4.46	N/A	N/A	54.44	74.00	19.56
2 412	2 388.38	Н	Х	AV	39.75	4.46	N/A	N/A	44.21	54.00	9.79
2 412	4 824.23	Н	Х	PK	49.53	2.33	N/A	N/A	51.86	74.00	22.14
	4 824.17	Н	Х	AV	39.37	2.33	N/A	N/A	41.70	54.00	12.30
2 437	4 873.47	Н	Х	PK	49.90	2.16	N/A	N/A	52.06	74.00	21.94
2 437	4 873.37	Н	Х	AV	39.32	2.16	N/A	N/A	41.48	54.00	12.52
	2 484.09	Н	Х	PK	50.20	5.40	N/A	N/A	55.60	74.00	18.40
2.462	2 484.48	Н	Х	AV	39.58	5.41	N/A	N/A	44.99	54.00	9.01
2 462	4 923.77	Н	Х	PK	49.68	2.44	N/A	N/A	52.12	74.00	21.88
	4 923.87	Н	Х	AV	39.19	2.44	N/A	N/A	41.63	54.00	12.37

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

#### Radiated Emissions data(9 kHz ~ 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)
	2 389.53	V	Х	PK	52.72	4.46	N/A	N/A	57.18	74.00	16.82
2 412	2 389.83	V	Х	AV	41.83	4.46	0.30	N/A	46.59	54.00	7.41
2 412	4 824.92	V	Х	PK	49.67	2.33	N/A	N/A	52.00	74.00	22.00
	4 824.48	V	Х	AV	39.30	2.33	0.30	N/A	41.93	54.00	12.07
2 437	4 873.54	V	Х	PK	49.67	2.16	N/A	N/A	51.83	74.00	22.17
2 437	4 873.16	V	Х	AV	39.34	2.16	0.30	N/A	41.80	54.00	12.20
	2 484.53	V	Х	PK	50.09	5.41	N/A	N/A	55.50	74.00	18.50
2 462	2 484.02	V	Х	AV	40.32	5.40	0.30	N/A	46.02	54.00	7.98
2 462	4 924.88	V	Х	PK	49.71	2.45	N/A	N/A	52.16	74.00	21.84
	4 924.25	V	Х	AV	39.02	2.45	0.30	N/A	41.77	54.00	12.23



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

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)
	2 389.32	V	Х	PK	51.32	4.46	N/A	N/A	55.78	74.00	18.22
2 412	2 389.63	V	Х	AV	40.66	4.46	0.32	N/A	45.44	54.00	8.56
2 412	4 824.31	V	Х	PK	49.66	2.33	N/A	N/A	51.99	74.00	22.01
	4 824.25	V	Х	AV	39.32	2.33	0.32	N/A	41.97	54.00	12.03
2 437	4 872.53	V	Х	PK	49.60	2.17	N/A	N/A	51.77	74.00	22.23
2 437	4 872.30	V	Х	AV	39.24	2.17	0.32	N/A	41.73	54.00	12.27
	2 483.70	V	Х	PK	50.52	5.40	N/A	N/A	55.92	74.00	18.08
2 462	2 483.53	V	Х	AV	40.94	5.40	0.32	N/A	46.66	54.00	7.34
2 462	4 923.63	V	Х	PK	49.57	2.44	N/A	N/A	52.01	74.00	21.99
	4 923.31	V	Х	AV	39.00	2.44	0.32	N/A	41.76	54.00	12.24



## 5.6 AC Power-Line Conducted Emissions

#### 5.6.1. Test Setup

NA

### 5.6.2 Limit

According to §15.207(a) for 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 ~ 0.50	66 to 56 *	56 to 46 *	
0.5 ~ 5.0	56	46	
5 ~ 30	60	50	

\* Decreases with the logarithm of the frequency

#### 5.6.3 Test Procedure

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

- 1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 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.

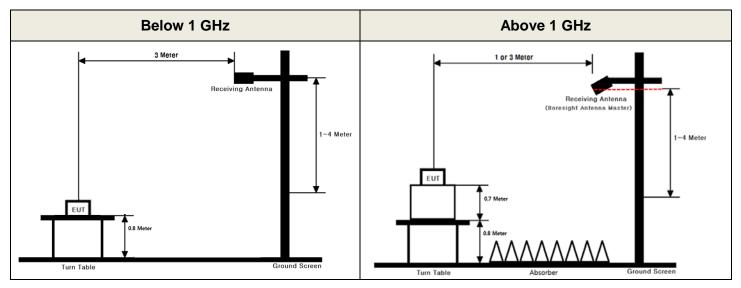
#### 5.6.4 Test Results

NA

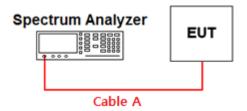
### **APPENDIX I**

### Test set up diagrams

Radiated Measurement



Conducted Measurement





### **APPENDIX II**

#### **Duty cycle plots**

#### Test Procedures

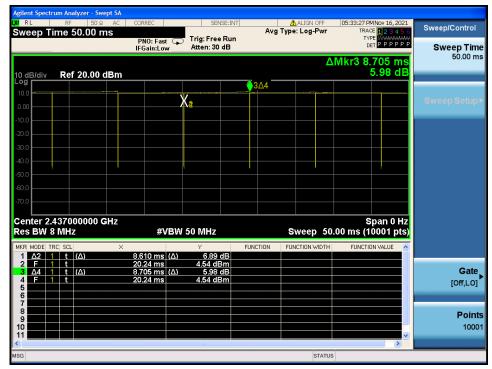
#### - KDB558074 D01v05r02 - Section 6

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.)

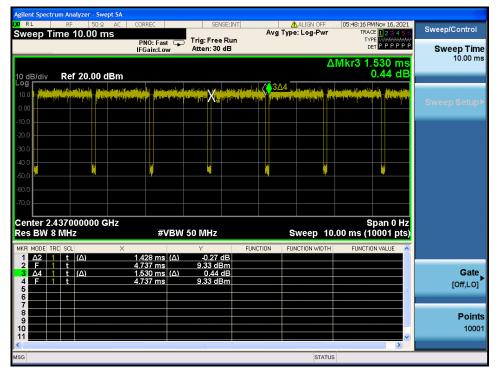
#### **Duty Cycle**

TM 1 & 2 437 MHz



#### **Duty Cycle**

TM 2 & 2 437 MHz



#### TM 3 & 2 437 MHz

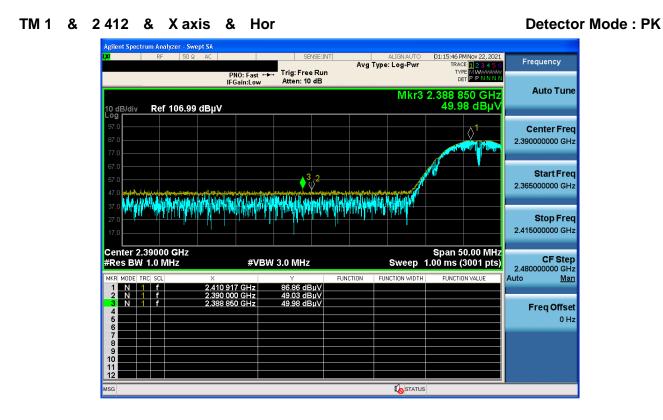
### **Duty Cycle**

Agilent Spectrum Analyzer - Swept SA (X) RL RF 50 Q AC Sweep Time 8.000 ms		SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN OFF	06:18:38 PMNov 16, 2021 TRACE 1 2 3 4 5 6 TYPE WWWWWWW DET P P P P P	Sweep/Control Sweep Time
10 dB/div Ref 20.00 dBm			Δ	Mkr3 1.437 ms -0.45 dB	8.000 ms
Log 10.0 makes also a still frantstated tations also 0.00 makes also a still frantstated tations also -10.0				settelanoga os benefitation efectivation antiget filosoficione proprioritation for	Sweep Setup⊧
-20.0					
-40.0 -50.0 -60.0				אן אין אין אין אין אין אין אין אין אין א	
-70.0 Center 2.437000000 GHz Res BW 8 MHz	#VBW 5	0 MHz	Sweep 8.0	Span 0 Hz 00 ms (10001 pts)	
MKR MODE TRC SCL X	1.336 ms (∆)	Y FUNC	TION FUNCTION WIDTH	FUNCTION VALUE	
2     F     1     t       3     Δ4     1     t     (Δ)       4     F     1     t       5     6     6     6	3.653 ms 1.437 ms (∆) 3.653 ms	9.02 dBm -0.45 dB 9.02 dBm		=	Gate [Off,LO]
7 8 9 10 11					<b>Point</b> : 1000
MSG		III	STATUS		



### **APPENDIX III**

### **Unwanted Emissions (Radiated) Test Plot**



#### TM 1 & 2412 & Xaxis & Hor

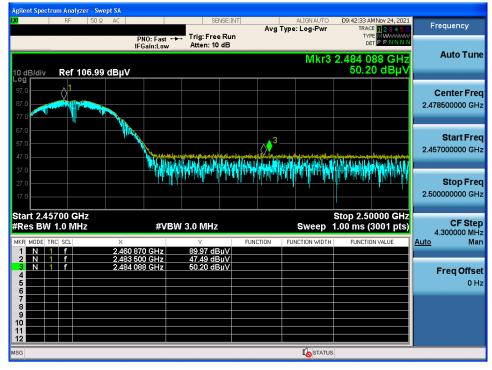
Agilent Spectrum Analyzer - Swept S.	iA				
<b>ΙΧΙ</b> RF 50Ω AG	c	SENSE:INT	ALIGN AUTO Avg Type: RMS	01:21:00 PMNov 22, 2021 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast ↔→ IFGain:Low	Trig: Free Run Atten: 10 dB	Avg Hold: 200/200	TYPE A WWWWW DET A P N N N N 2.388 383 GHz	Auto Tune
10 dB/div Ref 106.99 dB	βμV			39.748 dBµV	
97.0 87.0 77.0					Center Freq 2.390000000 GHz
67.0 57.0 47.0 37.0					Start Freq 2.365000000 GHz
27.0					<b>Stop Freq</b> 2.415000000 GHz
Center 2.39000 GHz #Res BW 1.0 MHz		3.0 MHz*		Span 50.00 MHz 1.00 ms (3001 pts)	CF Step 2.48000000 GHz
1 N 1 f 2		Y FU 83.878 dBµV 38.860 dBµV	NCTION FUNCTION WIDTH	FUNCTION VALUE	Auto <u>Man</u>
3 N 1 f 2 4 5 6 6		39.748 dBµV			Freq Offset 0 Hz
7 8 9 9 10					
11 12 MSG			STATUS		



#### TM 1 & 2462 & Xaxis & Hor

#### **Detector Mode : PK**





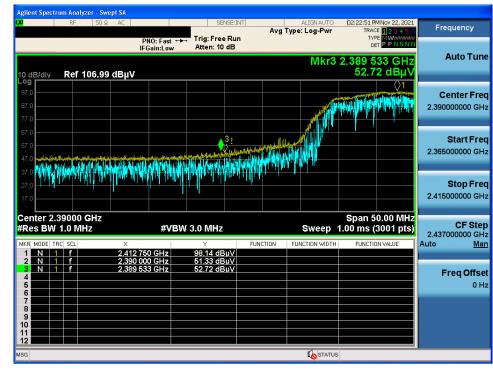
#### TM 1 & 2462 & Xaxis & Hor

#### Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB PNO: Fast • IFGain:Low DET Auto Tune Mkr3 2.484 477 GHz 39.577 dBµ∨ Ref 106.99 dBµV 10 dB/div Loa **Center Freq** 2.478500000 GHz Start Freq 2.457000000 GHz ∕<mark>2∕</mark>3 Stop Freq 2.50000000 GHz Stop 2.50000 GHz 1.00 ms (3001 pts) Start 2.45700 GHz CF Step 4.300000 MHz #VBW 3.0 MHz\* #Res BW 1.0 MHz Sweep FUNCTION FUNCTION WIDT Auto Man 2.461 142 GHz 2.483 500 GHz 2.484 477 GHz <u>39.112 dBµ`</u> 39.577 dBµ` N **Freq Offset** 0 Hz



#### TM 2 & 2412 & X axis & Ver

#### **Detector Mode : PK**



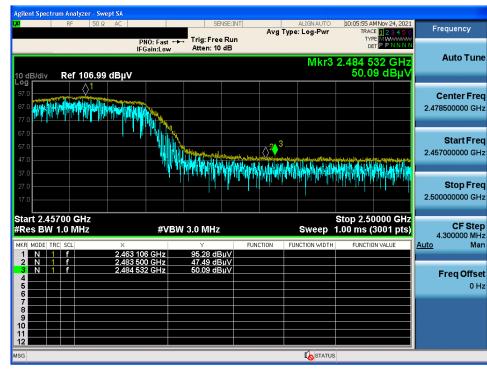
#### TM 2 & 2412 & Xaxis & Ver

#### Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB PNO: Fast IFGain:Low Auto Tune Mkr3 2.389 833 GH: 10 dB/div Log Ref 106.99 dBµV 41.833 dBµ\ **Center Freq** 2.39000000 GHz Start Freq 2.365000000 GHz 3 Stop Freq 2.415000000 GHz Center 2.39000 GHz #Res BW 1.0 MHz Span 50.00 MHz CF Step 2.437000000 GHz #VBW 3.0 MHz\* 1.00 ms (3001 pts) Sweep FUNCTION WIDT Auto Man FUNCTION 41.427 dBµ 41.833 dBµ Freq Offset 0 Hz



### TM 2 & 2462 & X axis & Ver

#### **Detector Mode : PK**



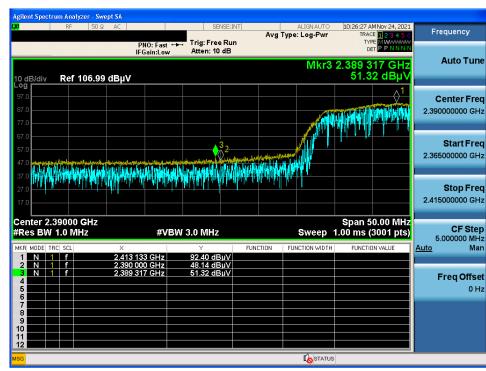
#### TM 2 & 2462 & X axis & Ver

#### Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB PNO: Fast • IFGain:Low DET Auto Tune Mkr3 2.484 016 GHz 40.322 dBµ∨ 10 dB/div Ref 106.99 dBµV **Center Freq** 2.478500000 GHz Start Freq 2.457000000 GHz ⊘€3 Stop Freq 2.50000000 GHz Stop 2.50000 GHz 1.00 ms (3001 pts) Start 2.45700 GHz CF Step 4.300000 MHz #VBW 3.0 MHz\* #Res BW 1.0 MHz Sweep Man FUNCTION FUNCTION WIDT Auto 2.461 243 GH2 2.483 500 GHz 2.484 016 GHz 38.971 40.322 **Freq Offset** 0 Hz



#### TM 3 & 2 412 & X axis & Ver

#### **Detector Mode : PK**



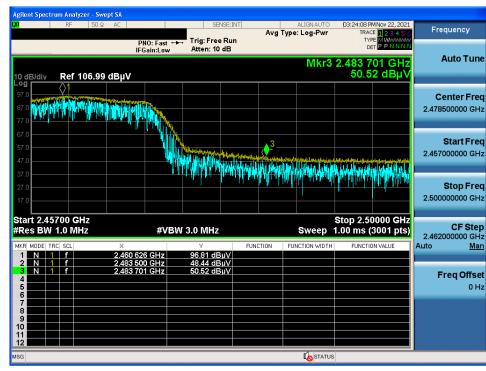
#### TM 3 & 2412 & Xaxis & Ver

#### Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB PNO: Fast IFGain:Low Auto Tune Mkr3 2.389 633 GHz 40.659 dBµV 10 dB/div Log Ref 106.99 dBµV **Center Freq** $\Diamond$ 2.39000000 GHz Start Freq 2.365000000 GHz Stop Freq 2.415000000 GHz Center 2.39000 GHz #Res BW 1.0 MHz Span 50.00 MHz CF Step 5.000000 MHz #VBW 3.0 MHz\* 1.00 ms (3001 pts) Sweep Man FUNCTION FUNCTION WIDT FUNCTION ' Auto 40 659 **Freq Offset** 0 Hz



#### TM 3 & 2462 & Xaxis & Ver

#### **Detector Mode : PK**



#### TM 3 & 2462 & Xaxis & Ver

#### Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB PNO: Fast + IFGain:Low DET Auto Tune Mkr3 2.483 529 GHz 40.939 dBµ∨ Ref 106.99 dBµV 10 dB/div Loa 1 **Center Freq** 2.478500000 GHz Start Freq 2.457000000 GHz ▲3 Stop Freq 2.50000000 GHz Stop 2.50000 GHz 1.00 ms (3001 pts) Start 2.45700 GHz CF Step 2.46200000 GHz #VBW 3.0 MHz\* #Res BW 1.0 MHz Sweep FUNCTION FUNCTION WIDT Auto Man 2.461 214 2.483 500 2.483 529 40 939 **Freq Offset** 0 Hz

**Detector Mode : AV** 



#### TM 1 & 2412 & Xaxis & Hor



#### TM 2 & 2412 & Xaxis & Hor

#### :44 PM TRACE Frequency Avg Type: RMS Avg|Hold: 200/200 Trig: Free Run Atten: 6 dB TYF DET A WWW PNO: Fast ↔↔ IFGain:Low Auto Tune Mkr1 4.824 476 7 GHz 39.301 dBµV Ref 66.99 dBµV 5 dB/div Log **Center Freq** 4.824000000 GHz Start Freq 4.821500000 GHz Stop Freq 4.826500000 GHz CF Step 2.412000000 GHz Auto Man Freq Offset 0 Hz Center 4.824000 GHz #Res BW 1.0 MHz Span 5.000 MHz Sweep 1.00 ms (3001 pts) #VBW 3.0 MHz\* STATUS

#### **Detector Mode : AV**

#### TM 3 & 2 412 & X axis & Ver

	RF 50Ω AC		SENSE:INT	ALIGN AUTO Avg Type: RMS	03:39:40 PMNov 22, 2021 TRACE 1 2 3 4 5 6	Frequency
		PNO: Fast 🔸	. Trig: Free Run Atten: 6 dB	Avg Hold: 200/200	DET A P N N N	<b>A</b>
dB/div	Ref 66.99 dBµ\	¢.		Mkr1 4	.824 245 0 GHz 39.323 dBµV	Auto Tun
i2.0						Center Fre 4.824000000 GF
2.0						Start Fre 4.821500000 GH
2.0			1-			<b>Stop Fre</b> 4.826500000 Gi
2.0	ento tapottoto quandatista.ch	(*************************************	ารัฐการที่สุดสุดสูงสาราวที่สูงสารสิญชัง (ค.ศ.	and 1997 and 1997 and 1999 and 1999 and 1999 and 1999 and 1999	energreen-enterneter	CF Ste 2.412000000 GF Auto <u>M</u> a
2.0						Freq Offs 01
	24000 GHz I.0 MHz	#VBW	3.0 MHz*	Sweep	Span 5.000 MHz 1.00 ms (3001 pts)	
G				I STATUS		