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 : DRTFCC2308-0111

2. Customer

• Name (FCC) : HANWHA CORPORATION / Name (IC) : HANWHA CORPORATION

• Address (FCC) : 86, Cheonggyecheon-ro, Jung-gu, Seoul South Korea
Address (IC) : 86, Cheonggyecheon-ro, Jung-gu Seoul 04541 Korea (Republic Of)

3. Use of Report : FCC & IC Certification

4. Product Name / Model Name : HiTRONIC BLASTER / HEBS-B-3A
FCC ID : 2ATCL-HEBS-B-3A
IC : 31141-HEBSB3A

5. FCC Regulation(s): Part 15.247
IC Standard(s): RSS-247 Issue 2, RSS-Gen Issue 5
Test Method used: ANSI C63.10-2013, KDB789033 D02v02r01, KDB662911 D01v02r01

6. Date of Test : 2023.06.16 ~ 2023.07.14

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 (Signature)	Technical Manager Name : JaeJin Lee (Signature)

2023 . 08 . 18 .

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
DRTFCC2308-0111	Aug, 18. 2023	Initial issue	JaeHyeok Bang	JaeJin Lee

Table of Contents

1. General Information

1.1. Description of EUT

Equipment Class	Digital Transmission System (DTS)
Product Name	HiTRONIC BLASTER
Product Marketing Name (PMN)	HEBS-B-3A
Model Name	HEBS-B-3A
Add Model Name	-
Firmware Version Identification Number	1.0.0
EUT Serial Number	Conducted: F220301000038, Radiated: F220301000317
Power Supply	DC 10.8 V
Modulation Technique	▪ 802.11b: CCK, DSSS ▪ 802.11g/n/ac: OFDM
Antenna Specification	Antenna Type: Chip Antenna Gain: Refer to the table below

ands	**SISO**		**MIMO (CDD)** Note 1.
	ANT 1 [dBi]	**ANT 2 [dBi]**	**Directional Gain [dBi]**
2.4 GHz	2.23	2.23	**5.24**

Note 1. Directional gain (Correlated signal with unequal antenna gain and equal transmit power)

$10 \log [(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi

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	
▪ Temperature	+21 ℃ ~ +24 ℃
▪ Relative Humidity	+40 % ~ +43 %

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	1.0 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)	4.8 dB (The confidence level is about 95 %, k = 2)
Radiated emission (18 GHz Above)	4.94 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	23/06/23	24/06/24	MY46471622
Spectrum Analyzer	Agilent Technologies	N9020A	22/12/16	23/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	23/06/23	24/06/23	US47360812
DC Power Supply	Agilent Technologies	66332A	23/06/23	24/06/23	US37474125
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
Thermohygrometer	BODYCOM	BJ5478	23/06/22	24/06/22	N/A
Loop Antenna	ETS-Lindgren	6502	22/04/22	24/04/22	00203480
Hybrid Antenna	Schwarzbeck	VULB 9160	22/12/16	23/12/16	3362
Horn Antenna	ETS-Lindgren	3117	23/06/23	24/06/23	00143278
Horn Antenna	A.H.Systems Inc.	SAS-574	23/06/23	24/06/23	155
PreAmplifier	tsj	MLA-0118-B01-40	22/12/16	23/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	23/06/23	24/06/23	16966-10728
PreAmplifier	H.P	8447D	22/12/16	23/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	23/06/23	24/06/23	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	23/06/23	24/06/23	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	23/06/23	24/06/23	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	23/06/23	24/06/23	16012202
Attenuator	Aeroflex/Weinschel	56-3	23/06/23	24/06/23	Y2370
Attenuator	SMAJK	SMAJK-2-3	23/06/23	24/06/23	3
Attenuator	SMAJK	SMAJK-2-3	23/06/23	24/06/23	2
Attenuator	Aeroflex/Weinschel	86-10-11	23/06/23	24/06/23	408
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2496A MA2411B	22/12/16	23/12/16	1338004 1911481
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
Cable	Dt&C	Cable	23/01/04	24/01/04	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	23/01/04	24/01/04	G-3
Cable	Dt&C	Cable	23/01/04	24/01/04	G-4
Cable	OMT	YSS21S	23/01/04	24/01/04	G-5
Cable	Junkosha	MWX241	23/01/03	24/01/03	mmW-1
Cable	Junkosha	MWX241	23/01/03	24/01/03	mmW-4
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	23/01/04	24/01/04	M-02
Cable	JUNKOSHA	MWX241/B	23/01/04	24/01/04	M-03
Cable	JUNKOSHA	J12J101757-00	23/01/04	24/01/04	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	23/01/04	24/01/04	M-09
Cable	Dt&C	Cable	23/01/04	24/01/04	RFC-69
Cable	Radiall	TESTPRO3	23/01/04	24/01/04	RFC-70
Test Software (AC Line Conducted)	tsj	EMI Measurement	NA	NA	Version 2.00.0185
Test Software (Radiated)	tsj	EMI 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	SISO		MIMO(CDD)	MIMO(SDM)
	Ant 1	Ant 2	Ant 1 & 2	Ant 1 & 2
	Data rate			
802.11b	1 Mbps ~ 11 Mbps	1 Mbps ~ 11 Mbps	1 Mbps ~ 11 Mbps	-
802.11g	6 Mbps ~ 54 Mbps	6 Mbps ~ 54 Mbps	6 Mbps ~ 54 Mbps	-
802.11n(HT20)	MCS 0 ~ MCS 7	MCS 0 ~ MCS 7	MCS 0 ~ MCS 7	MCS 8 ~ MCS 15
802.11n(HT40)	MCS 0 ~ MCS 7	MCS 0 ~ MCS 7	MCS 0 ~ MCS 7	MCS 8 ~ MCS 15

EUT Operation test setup

- Test Software: Tera Term 4.104.0.0, Qualcomm Radio Control Tool 4.0.74.0

- Power setting: Refer to the table below.

Mode	Frequency [MHz]	Power Setting
802.11b	2 412	13.5
	2 437	12.5
	2 462	13.5
802.11g	2 412	14.5
	2 437	17
	2 462	12
802.11n (HT20)	2 412	14.5
	2 437	17
	2 462	11.5
802.11n (HT40)	2 422	9
	2 437	11
	2 452	9

Test Mode

Test mode	Data rate	ANT configuration	Tested Frequency (MHz)		
TM 1	802.11b 1 Mbps	CDD Multiple transmitting	2 412	2 437	2 462
TM 2	802.11g 6 Mbps	CDD Multiple transmitting	2 412	2 437	2 462
TM 3	802.11n(HT20) MCS 0	CDD Multiple transmitting	2 412	2 437	2 462
TM 4	802.11n(HT40) MCS 0	CDD Multiple transmitting	2 422	2 437	2 452

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 attached on the device.
Therefore this E.U.T complies with the requirement of Part 15.203

4. Summary of Test Result

FCC part section(s)	RSS section(s)	Test Description	Limit	Test Condition	Status Note 1
15.247(a)	RSS-247[5.2]	6 dB Bandwidth	> 500 kHz	Conducted	NT Note 4
15.247(b)	RSS-247[5.4]	Maximum Peak Output Power	< 1 Watt (conducted), FCC & IC < 4 Watt (e.i.r.p), IC		NT Note 4
15.247(d)	RSS-247[5.5]	Unwanted Emissions(Conducted)	20 dBc in any 100 kHz BW		NT Note 4
15.247(e)	RSS-247[5.3]	Power Spectral Density	< 8 dBm / 3 kHz		NT Note 4
-	RSS-Gen[6.7]	Occupied Bandwidth (99 %)	NA		NT Note 4
15.247(d) 15.205 15.209	RSS-247[5.5] RSS-Gen[8.9] RSS-Gen[8.10]	Unwanted Emissions(Radiated)	Part 15.209 limits (Refer to section 5.1)	Radiated	C Note 3
15.207	RSS-Gen[8.8]	AC Power-Line Conducted Emissions	Part 15.207 limits (Refer to section 5.2)	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.
Note 4: These test items were not performed because this device uses the granted module.
(FCC ID: MCQ-CCIMX8, IC: 1846A-CCIMX8)
Please refer to the test report of the granted module

5. Test Result

5.1. Unwanted Emissions (Radiated)

▣ **Test Requirements and limit,**

Part 15.247(d), Part 15.205, Part 15.209 & RSS-247 [5.5], RSS-Gen [8.9], RSS-Gen [8.10]

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 & RSS-Gen[8.9]: General requirement

Frequency (MHz)	FCC Limit (uV/m)	IC Limit (μA/m)	Measurement Distance (m)
0.009 – 0.490	2 400 / F (kHz)	6.37/F (F in kHz)	300
0.490 – 1.705	24 000 / F (kHz)	63.7/F (F in kHz)	30
1.705 – 30.0	30	0.08	30

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

- RSS-Gen[8.10]: Restricted frequency bands

MHz	MHz	MHz	MHz	MHz	GHz
0.090 ~ 0.110	8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 345.8 ~ 3 358	9.0 ~ 9.2
0.495 ~ 0.505	8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1 427	3 500 ~ 4 400	9.3 ~ 9.5
2.173 5 ~ 2.190 5	8.414 25 ~ 8.414 75	108 ~ 138	1 435 ~ 1 626.5	4 500 ~ 5 150	10.6 ~ 12.7
3.020 ~ 3.026	12.29 ~ 12.293	149.9 ~ 150.05	1 645.5 ~ 1 646.5	5 350 ~ 5 460	13.25 ~ 13.4
4.125 ~ 4.128	12.519 75 ~ 12.520 25	156.524 75 ~	1 660 ~ 1 710	7 250 ~ 7 750	14.47 ~ 14.5
4.177 25 ~ 4.177 75	12.576 75 ~ 12.577 25	156.525 25	1 718.8 ~ 1 722.2	8 025 ~ 8 500	15.35 ~ 16.2
4.207 25 ~ 4.207 75	13.36 ~ 13.41	156.7 ~ 156.9	2 200 ~ 2 300		17.7 ~ 21.4
5.677 ~ 5.683	16.42 ~ 16.423	162.01 25 ~ 167.17	2 310 ~ 2 390		22.01 ~ 23.12
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 483.5 ~ 2 500		23.6 ~ 24.0
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 655 ~ 2 900		31.2 ~ 31.8
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	3 260 ~ 3 267		36.43 ~ 36.5
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 332 ~ 3 339		Above 38.6

5.1.1. Test Setup

Refer to the APPENDIX I.

5.1.2. 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 ≥ 3 x RBW.
3. Detector = RMS (Number of points ≥ 2 x Span / RBW)
4. Averaging type = power (i.e., RMS).
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.
7. A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
   1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1 / D), where D is the duty cycle.
   2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1 / D), where D is the duty cycle.
   3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Duty Cycle Correction factor

Test Mode	Date rate	T_{on}(ms)	T_{on+off} (ms)	D = T_{on} / (T_{on+off})	DCCF = 10 log(1/D) (dB)
TM 1	1 Mbps	12.210	12.320	0.991 1	0.04
TM 2	6 Mbps	2.028	2.144	0.945 9	0.24
TM 3	MCS 0	1.887	2.004	0.941 6	0.26
TM 4	MCS 0	0.928	1.035	0.896 6	0.47

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

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

5.1.3. 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

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	2 388.38	H	X	PK	50.79	4.58	N/A	N/A	55.37	74.00	18.63
	2 389.33	H	X	AV	41.28	4.58	N/A	N/A	45.86	54.00	8.14
	4 823.86	H	Z	PK	51.87	2.19	N/A	N/A	54.06	74.00	19.94
	4 823.92	H	Z	AV	43.70	2.19	N/A	N/A	45.89	54.00	8.11
2 437	4 870.62	H	Z	PK	50.43	2.09	N/A	N/A	52.52	74.00	21.48
	4 870.77	H	Z	AV	40.18	2.09	N/A	N/A	42.27	54.00	11.73
2 462	2 489.37	H	X	PK	52.21	5.70	N/A	N/A	57.91	74.00	16.09
	2 489.18	H	X	AV	42.33	5.70	N/A	N/A	48.03	54.00	5.97
	4 923.74	H	Z	PK	50.85	2.52	N/A	N/A	53.37	74.00	20.63
	4 923.97	H	Z	AV	42.03	2.52	N/A	N/A	44.55	54.00	9.45

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	2 389.17	H	X	PK	50.76	4.58	N/A	N/A	55.34	74.00	18.66
	2 388.91	H	X	AV	39.72	4.58	0.24	N/A	44.54	54.00	9.46
	4 824.30	H	Z	PK	54.25	2.19	N/A	N/A	56.44	74.00	17.56
	4 824.02	H	Z	AV	44.29	2.19	0.24	N/A	46.72	54.00	7.28
2 437	4 874.01	H	Z	PK	52.45	2.08	N/A	N/A	54.53	74.00	19.47
	4 874.04	H	Z	AV	44.29	2.08	0.24	N/A	46.61	54.00	7.39
2 462	2 483.53	H	X	PK	55.59	5.62	N/A	N/A	61.21	74.00	12.79
	2 483.64	H	X	AV	44.29	5.62	0.24	N/A	50.15	54.00	3.85
	4 923.84	H	Z	PK	51.46	2.52	N/A	N/A	53.98	74.00	20.02
	4 923.79	H	Z	AV	42.64	2.52	0.24	N/A	45.40	54.00	8.60

Radiated Emissions data(1 GHz ~ 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)
2 412	2 389.30	H	X	PK	49.51	4.58	N/A	N/A	54.09	74.00	19.91
	2 389.78	H	X	AV	39.44	4.58	0.26	N/A	44.28	54.00	9.72
	4 824.28	H	Z	PK	54.18	2.19	N/A	N/A	56.37	74.00	17.63
	4 824.04	H	Z	AV	44.70	2.19	0.26	N/A	47.15	54.00	6.85
2 437	4 873.23	H	Z	PK	52.31	2.08	N/A	N/A	54.39	74.00	19.61
	4 873.94	H	Z	AV	43.42	2.08	0.26	N/A	45.76	54.00	8.24
2 462	2 484.03	H	X	PK	54.51	5.62	N/A	N/A	60.13	74.00	13.87
	2 483.64	H	X	AV	44.24	5.62	0.26	N/A	50.12	54.00	3.88
	4 924.02	H	Z	PK	51.25	2.52	N/A	N/A	53.77	74.00	20.23
	4 924.02	H	Z	AV	41.82	2.52	0.26	N/A	44.60	54.00	9.40

Radiated Emissions data(1 GHz ~ 25 GHz) : TM 4

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)
2 422	2 388.46	H	X	PK	49.56	4.58	N/A	N/A	54.14	74.00	19.86
	2 387.89	H	X	AV	39.61	4.58	0.47	N/A	44.66	54.00	9.34
	4 843.92	H	Z	PK	51.13	2.15	N/A	N/A	53.28	74.00	20.72
	4 843.93	H	Z	AV	42.55	2.15	0.47	N/A	45.17	54.00	8.83
2 437	4 873.98	H	Z	PK	51.89	2.08	N/A	N/A	53.97	74.00	20.03
	4 873.79	H	Z	AV	42.48	2.08	0.47	N/A	45.03	54.00	8.97
2 452	2 485.70	H	X	PK	60.29	5.65	N/A	N/A	65.94	74.00	8.06
	2 485.99	H	X	AV	44.48	5.65	0.47	N/A	50.60	54.00	3.40
	4 904.38	H	Z	PK	51.33	2.41	N/A	N/A	53.74	74.00	20.26
	4 904.02	H	Z	AV	42.07	2.41	0.47	N/A	44.95	54.00	9.05

5.2. AC Power-Line Conducted Emissions

▣ **Test Requirements and limit, Part 15.207 & RSS-Gen [8.8]**

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

5.2.1. Test Setup

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

5.2.2. 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 × 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.

5.2.3. Test Results

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

AC Power-Line Conducted Emissions (Graph)

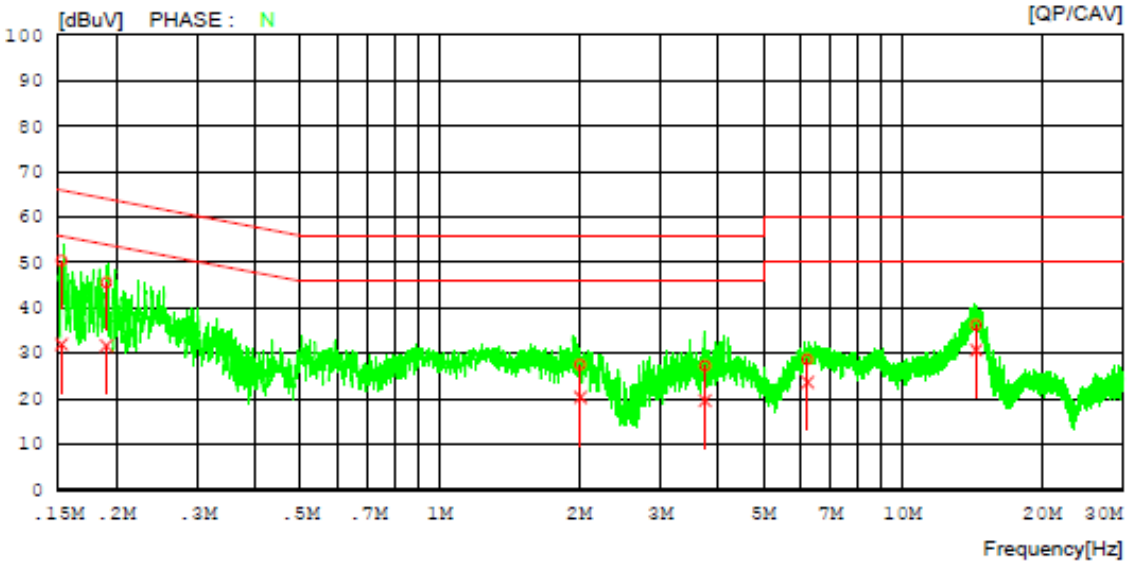
Results of Conducted Emission

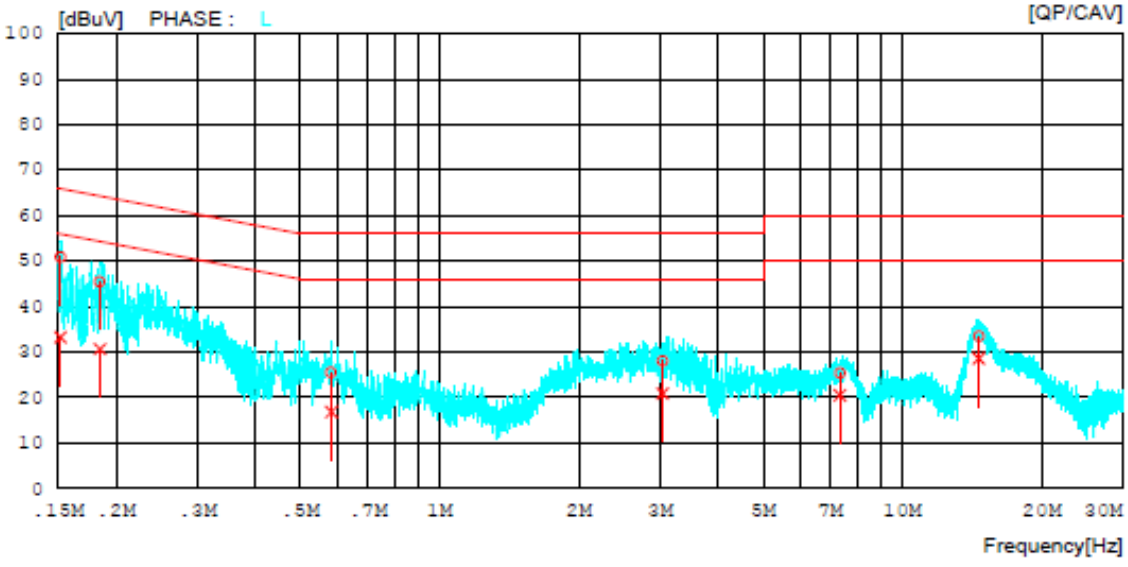
DTNC

Date 2023-07-14

Order No.		Referrence No.	
Model No.	HEBS-B-3A	Power Supply	
Serial No.		Temp/Humi.	21 'C / 41 %
Test Condition	WLAN 2.4G	Operator	J.H.Bang
Memo	b_2412		

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





AC Power-Line Conducted Emissions (List)

Results of Conducted Emission

DTNC

Date 2023-07-14

Order No.		Referrence No.	
Model No.	HEBS-B-3A	Power Supply	
Serial No.		Temp/Humi.	21 'C / 41 %
Test Condition	WLAN 2.4G	Operator	J.H.Bang
Memo	b_2412		

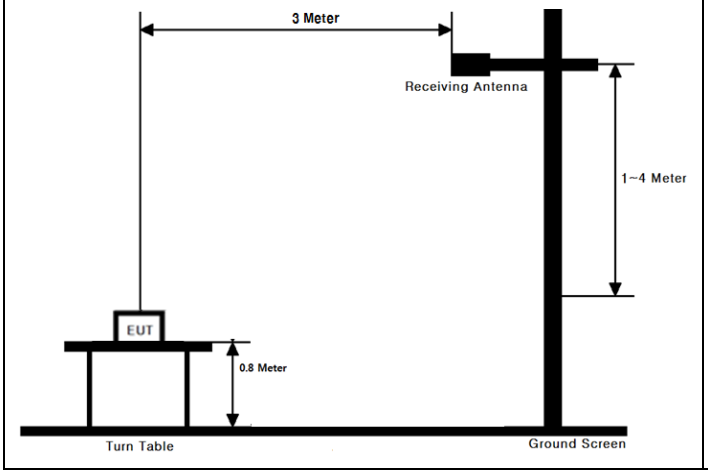
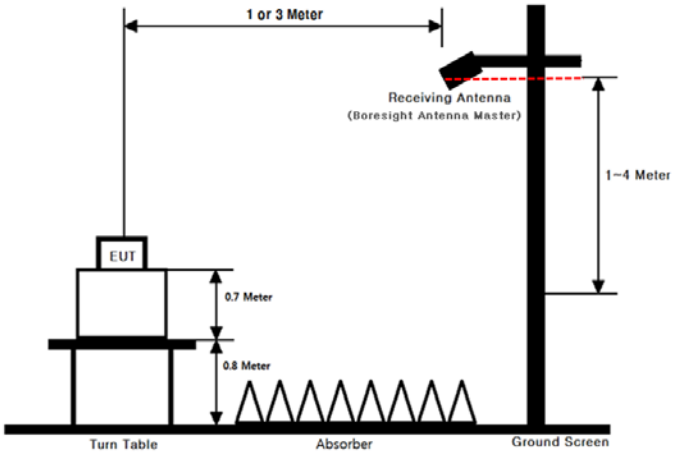
LIMIT : FCC P15.207 AV
FCC P15.207 QP

NO	FREQ	READING QP	READING CAV	C.FACTOR	RESULT QP	RESULT CAV	LIMIT QP	LIMIT CAV	MARGIN QP	MARGIN CAV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15243	40.52	22.11	9.91	50.43	32.02	65.87	55.87	15.44	23.85	N
2	0.19049	35.69	21.81	9.89	45.58	31.70	64.02	54.02	18.44	22.32	N
3	2.01280	17.59	10.41	9.94	27.53	20.35	56.00	46.00	28.47	25.65	N
4	3.74640	17.30	9.68	9.97	27.27	19.65	56.00	46.00	28.73	26.35	N
5	6.24420	18.63	13.68	10.03	28.66	23.71	60.00	50.00	31.34	26.29	N
6	14.43940	26.12	20.55	10.17	36.29	30.72	60.00	50.00	23.71	19.28	N
7	0.15166	40.92	23.27	9.91	50.83	33.18	65.91	55.91	15.08	22.73	L
8	0.18437	35.54	20.73	9.89	45.43	30.62	64.29	54.29	18.86	23.67	L
9	0.58290	15.55	6.92	9.90	25.45	16.82	56.00	46.00	30.55	29.18	L
10	3.03160	18.05	10.88	9.96	28.01	20.84	56.00	46.00	27.99	25.16	L
11	7.33660	15.26	10.39	10.05	25.31	20.44	60.00	50.00	34.69	29.56	L
12	14.62840	23.22	18.35	10.18	33.40	28.53	60.00	50.00	26.60	21.47	L

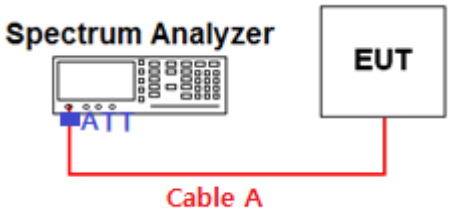
APPENDIX I

Test set up diagrams

- **Radiated Measurement**

Below 1 GHz	Above 1 GHz
	

- **Conducted Measurement**



APPENDIX II

Duty cycle plots

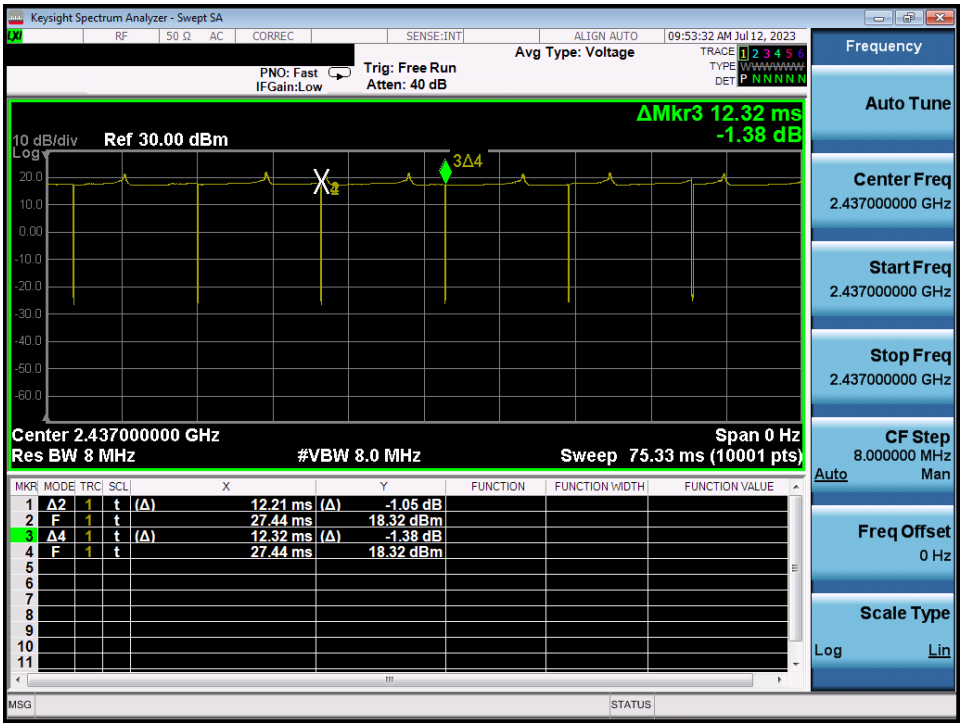
- **Test Procedures**

- KDB558074 D01v05r02 – Section 6

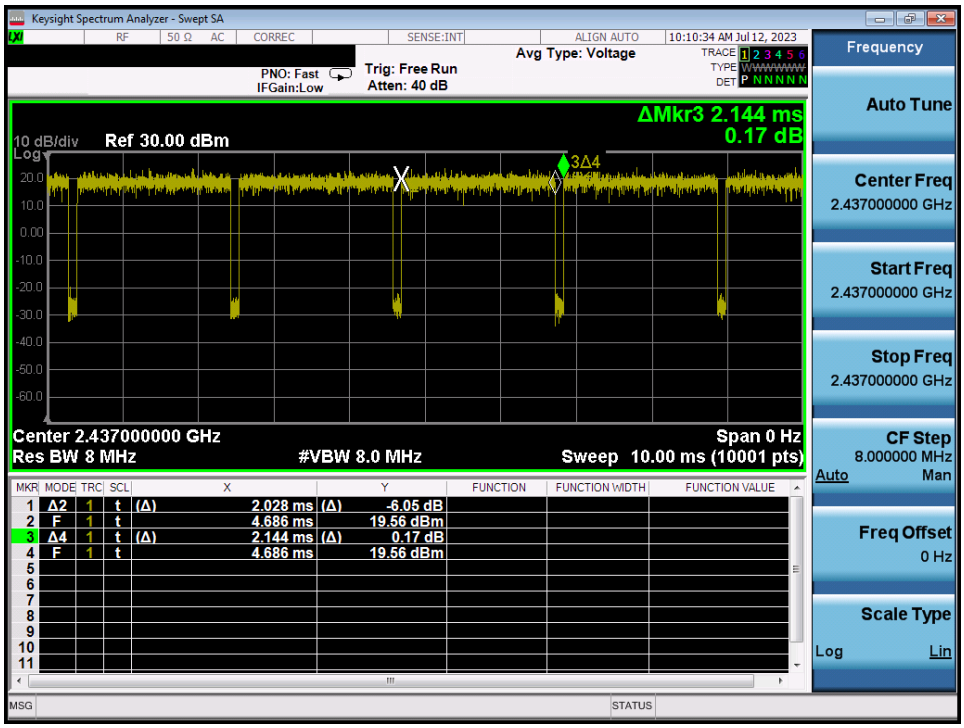
The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ 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 ≤ 16.7 microseconds.)

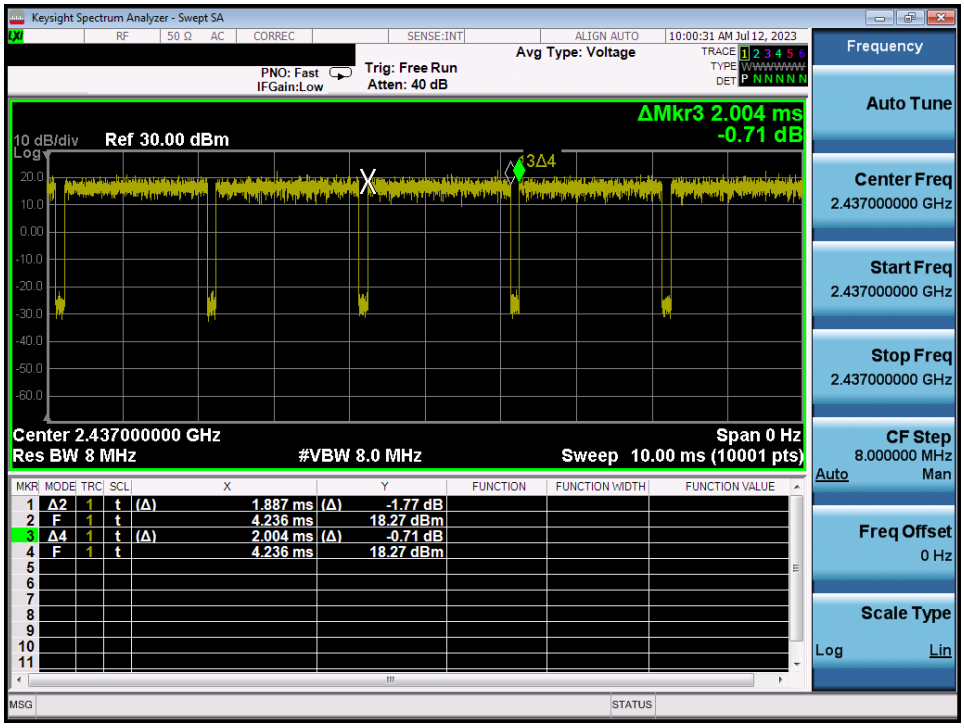
Duty Cycle TM 1 & 2 437 MHz



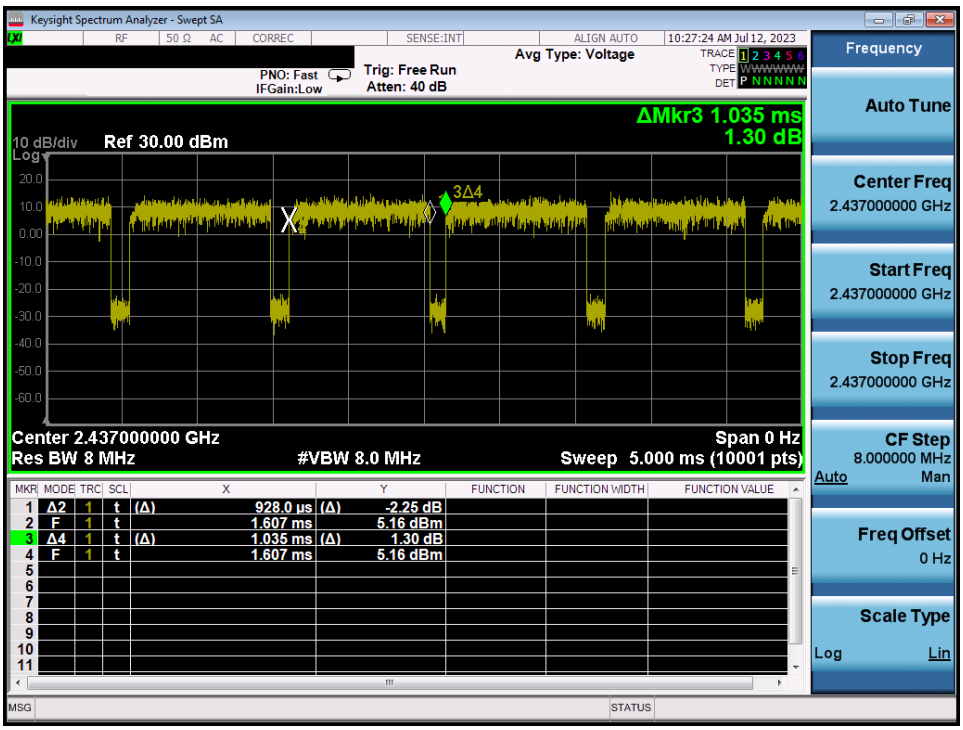
Duty Cycle TM 2 & 2 437 MHz



Duty Cycle TM 3 & 2 437 MHz



Duty Cycle TM 4 & 2 437 MHz

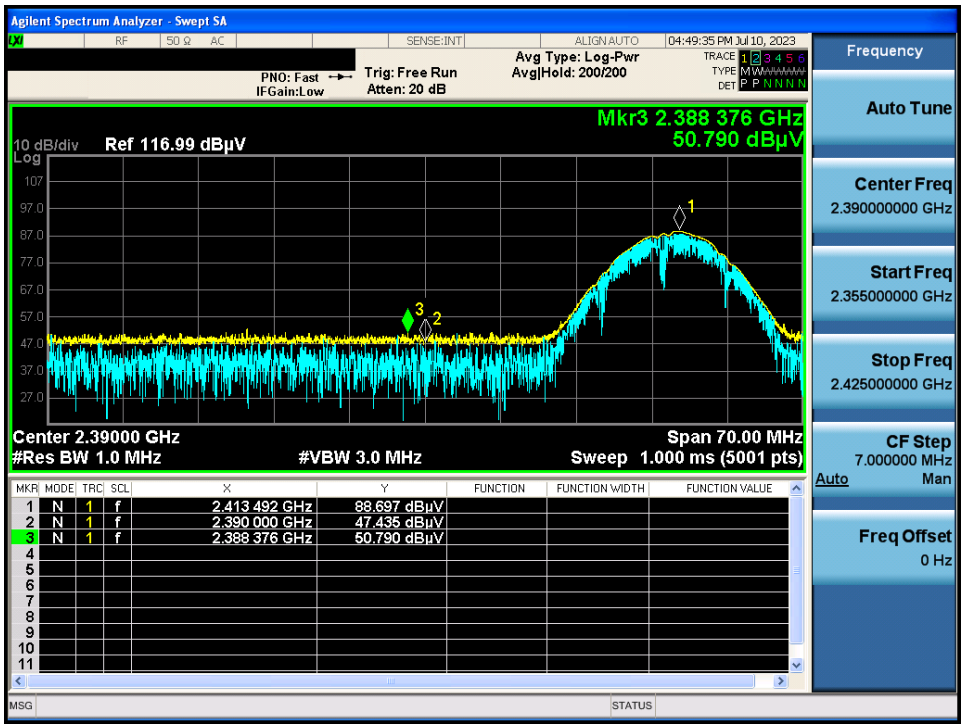


APPENDIX III

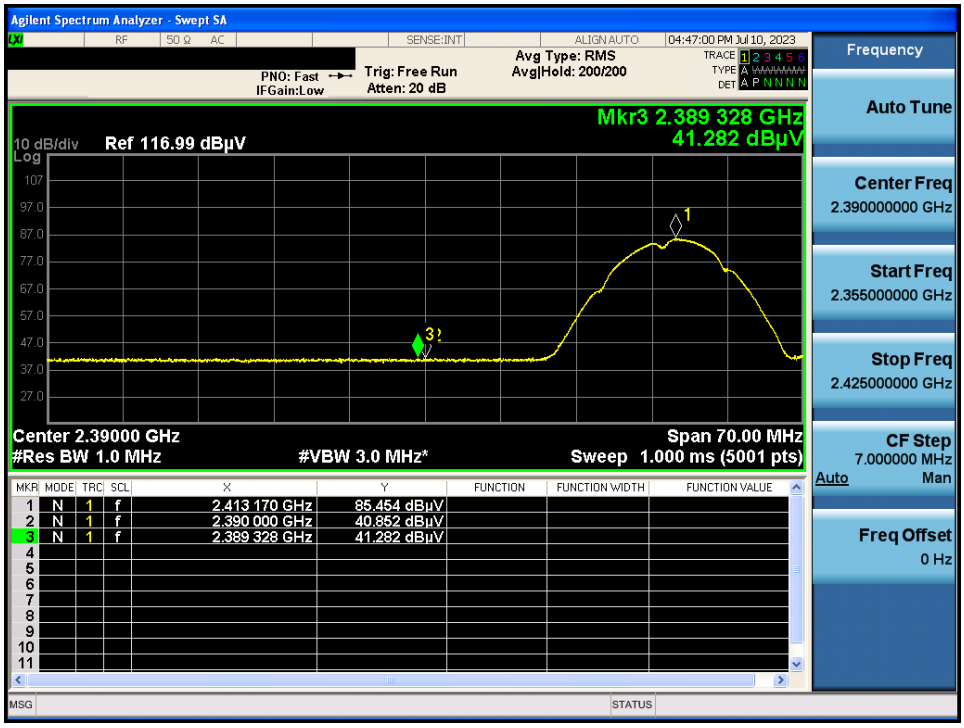
Unwanted Emissions (Radiated) Test Plot

- **Single antenna data**

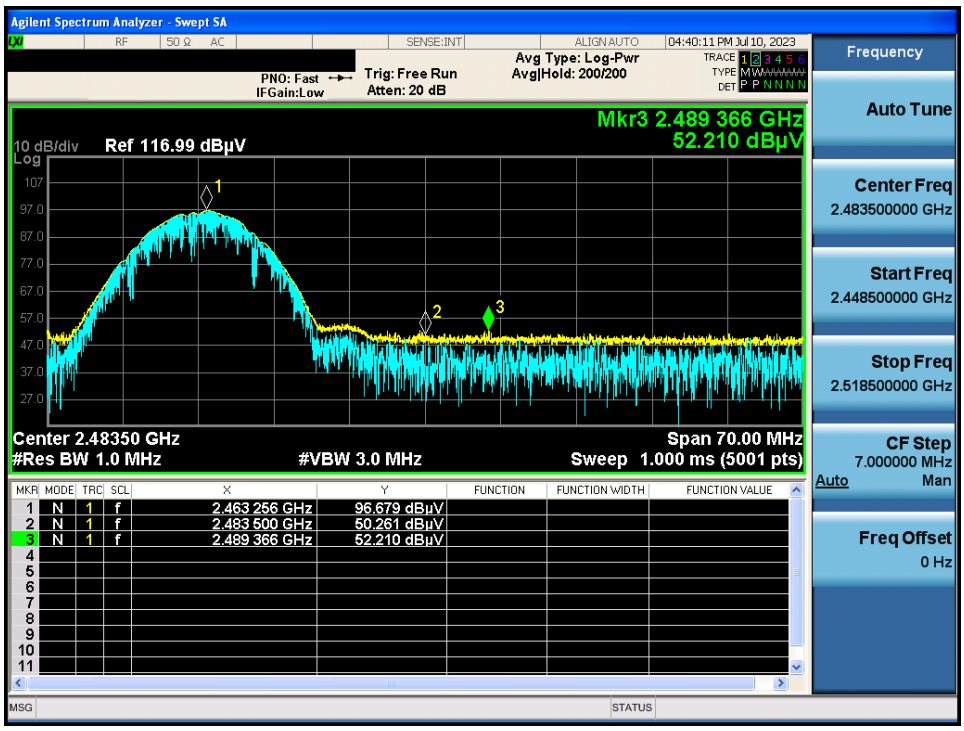
TM 1 & 2 412 & X axis & Hor **Detector Mode : PK**



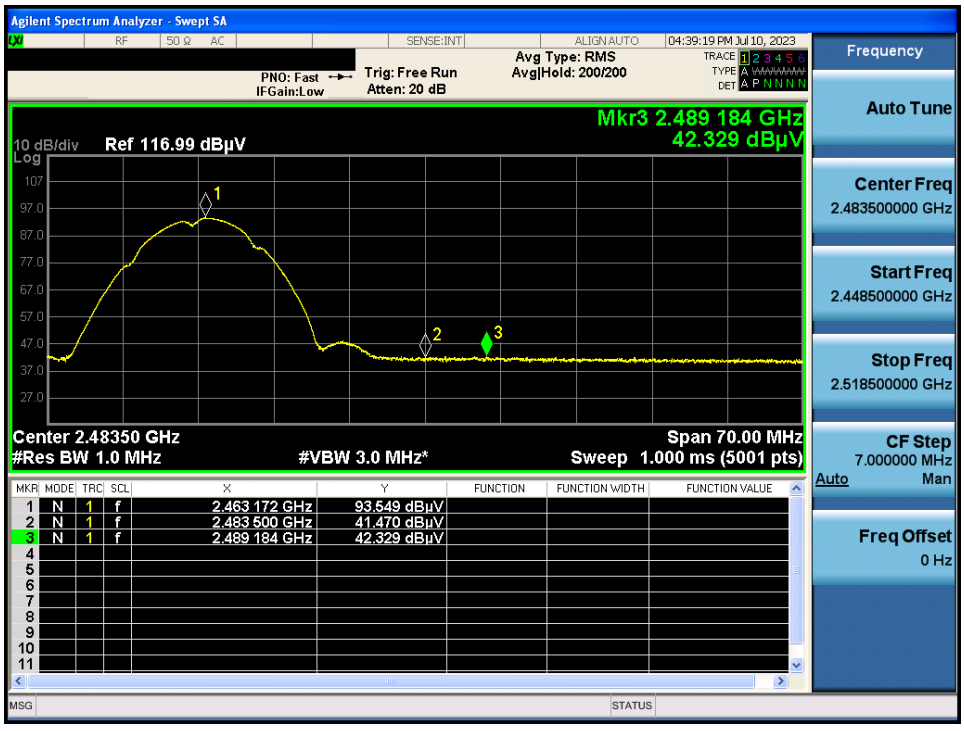
TM 1 & 2 412 & X axis & Hor **Detector Mode : AV**



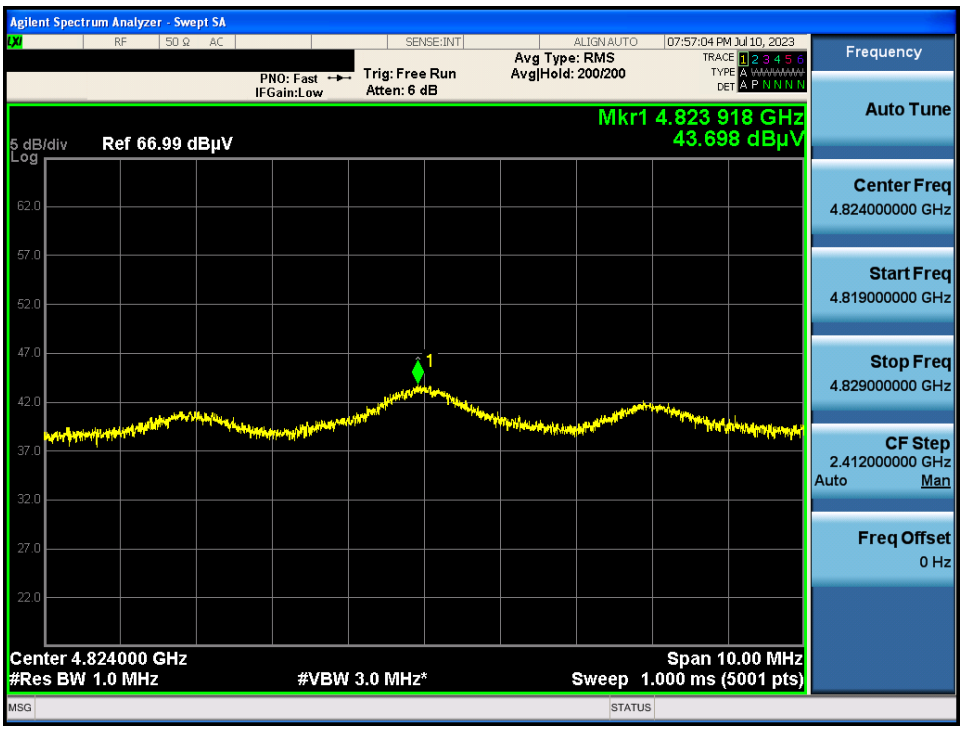
TM 1 & 2 462 & X axis & Hor **Detector Mode : PK**



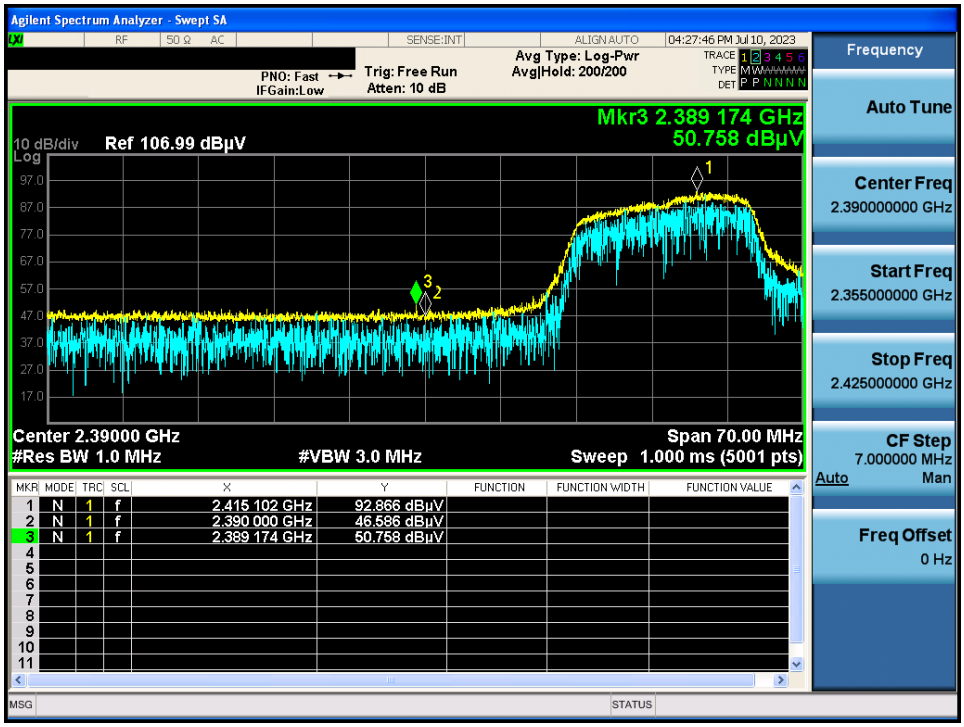
TM 1 & 2 462 & X axis & Hor **Detector Mode : AV**



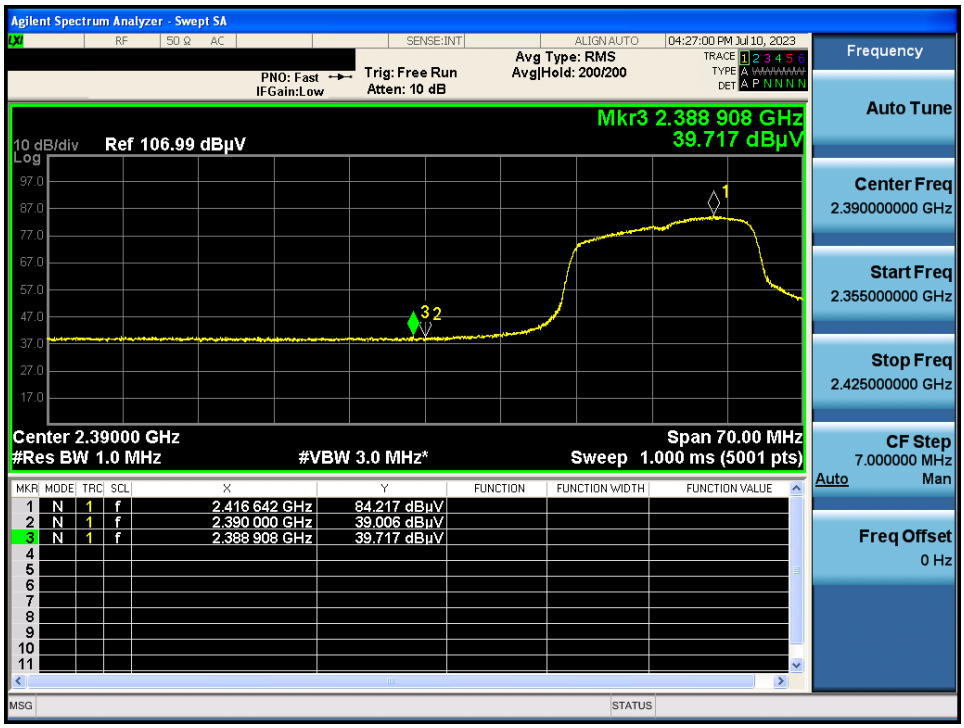
TM 1 & 2 412 & Z axis & Hor **Detector Mode : AV**



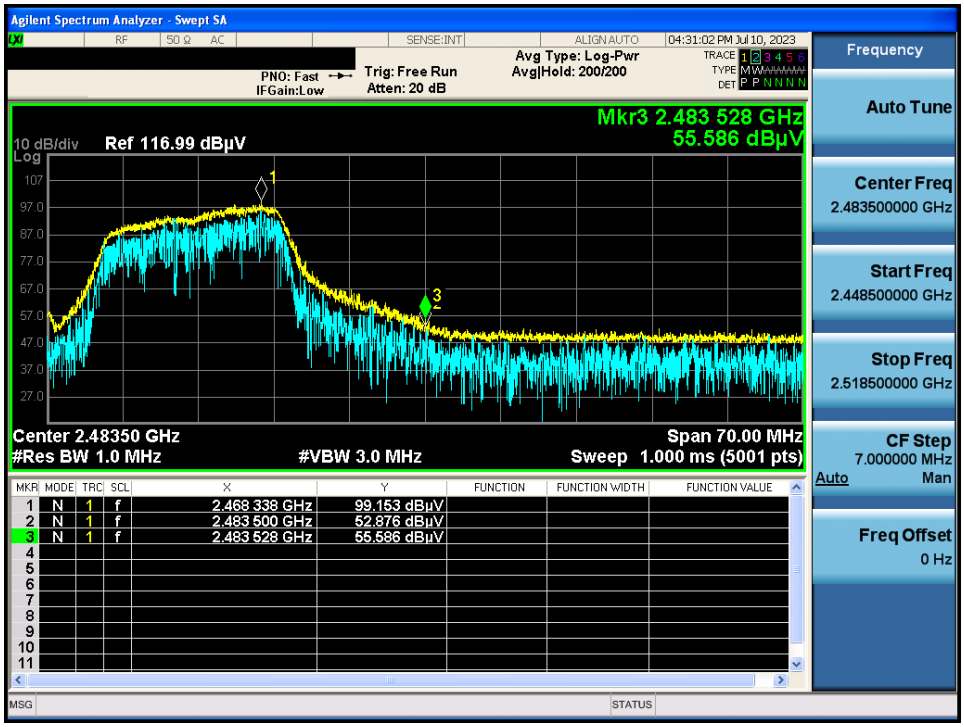
TM 2 & 2 412 & X axis & Hor **Detector Mode : PK**



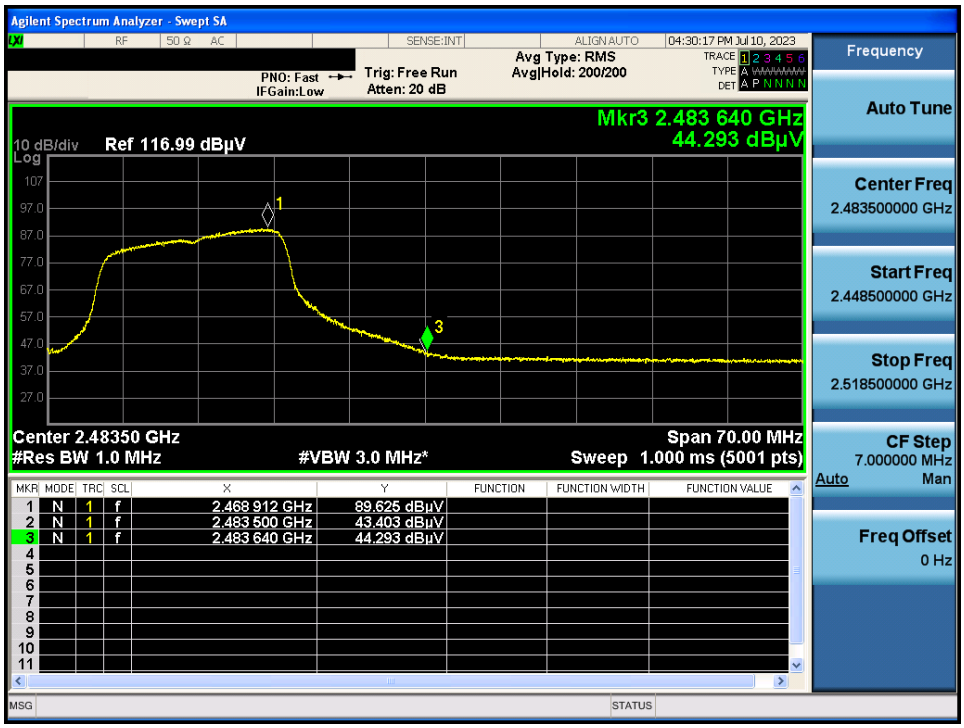
TM 2 & 2 412 & X axis & Hor **Detector Mode : AV**



TM 2 & 2 462 & X axis & Hor **Detector Mode : PK**

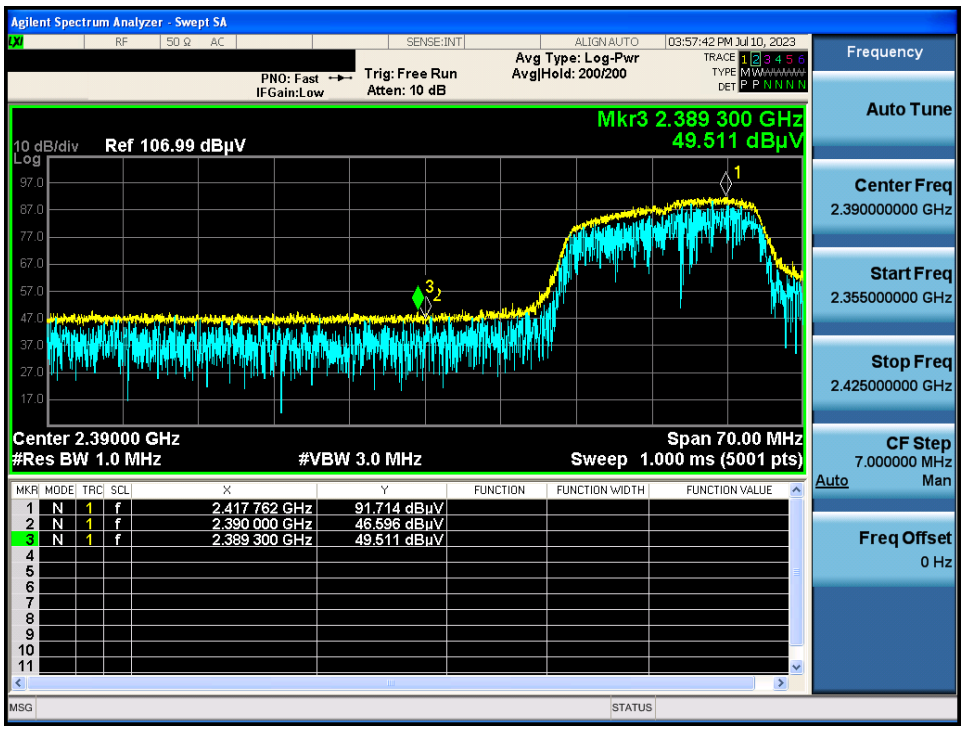


TM 2 & 2 462 & X axis & Hor **Detector Mode : AV**

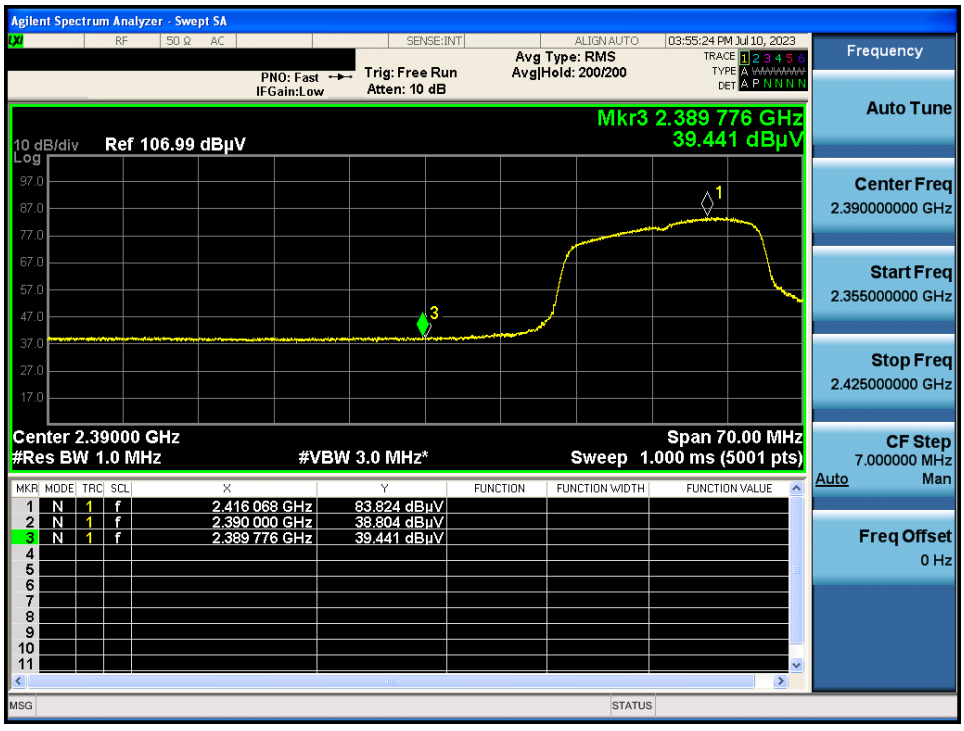


TM 2 & 2 412 & Z axis & Hor **Detector Mode : PK**

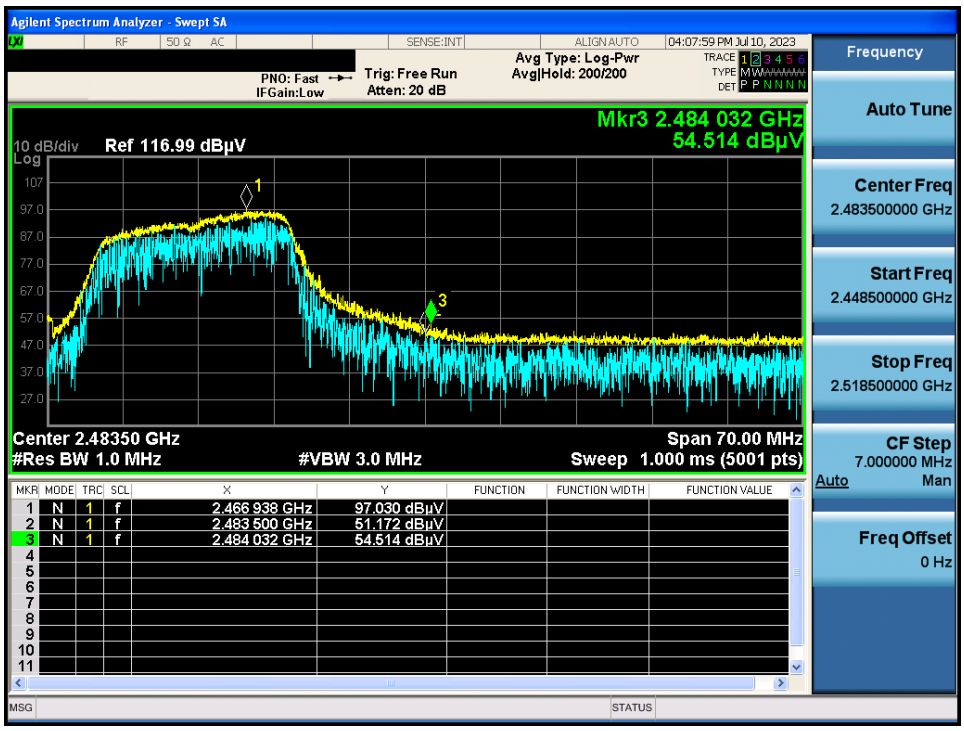
TM 3 & 2 412 & X axis & Hor **Detector Mode : PK**



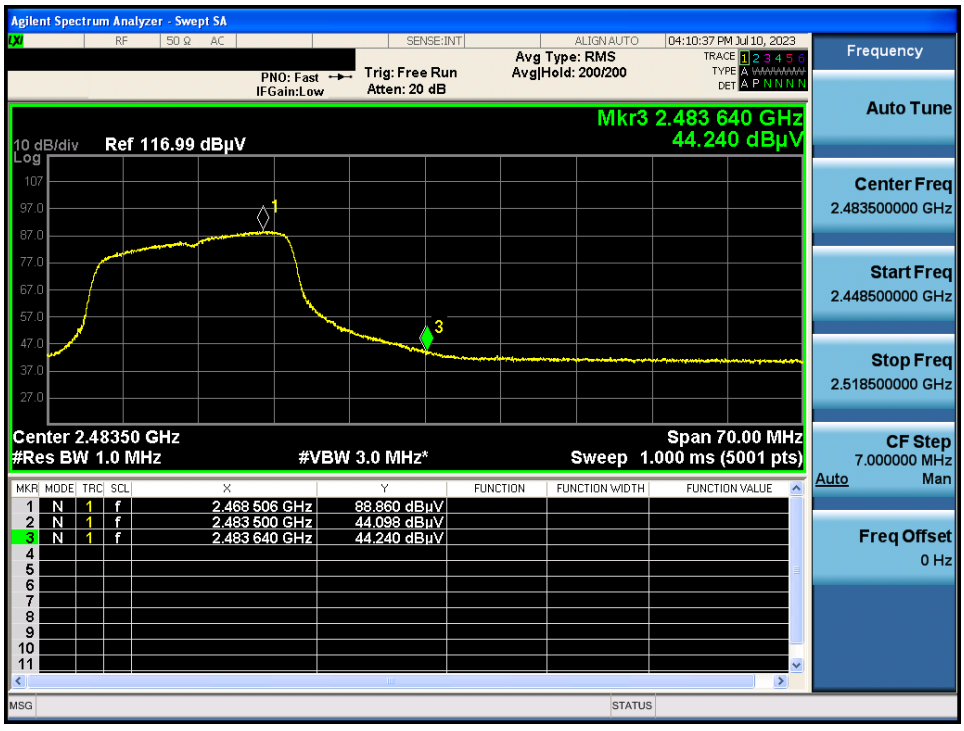
TM 3 & 2 412 & X axis & Hor **Detector Mode : AV**



TM 3 & 2 462 & X axis & Hor **Detector Mode : PK**

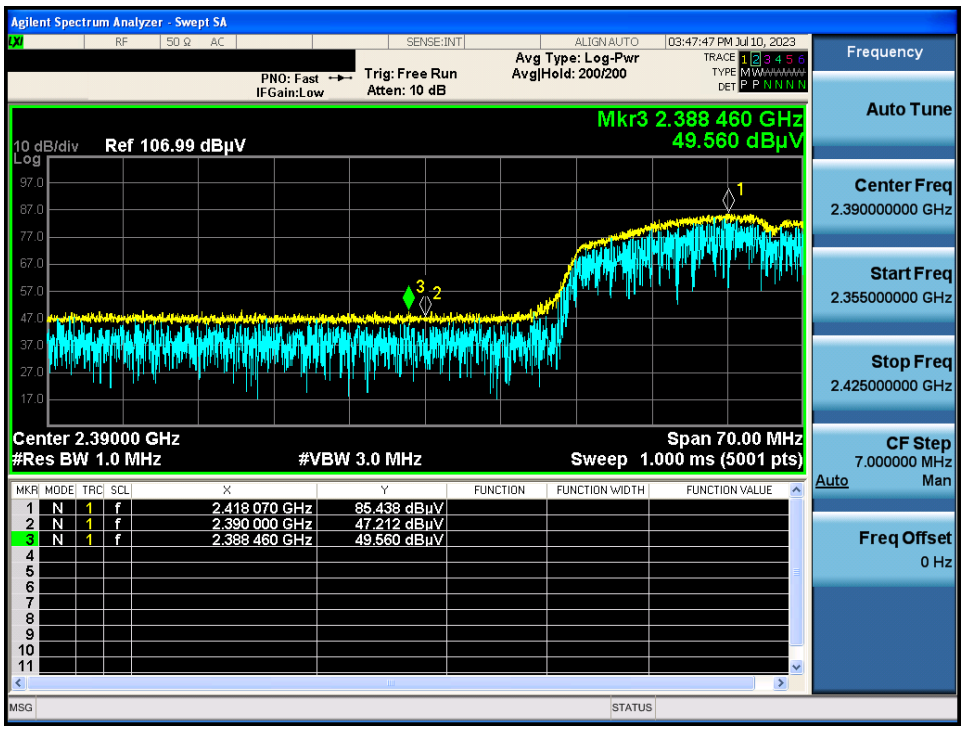


TM 3 & 2 462 & X axis & Hor **Detector Mode : AV**

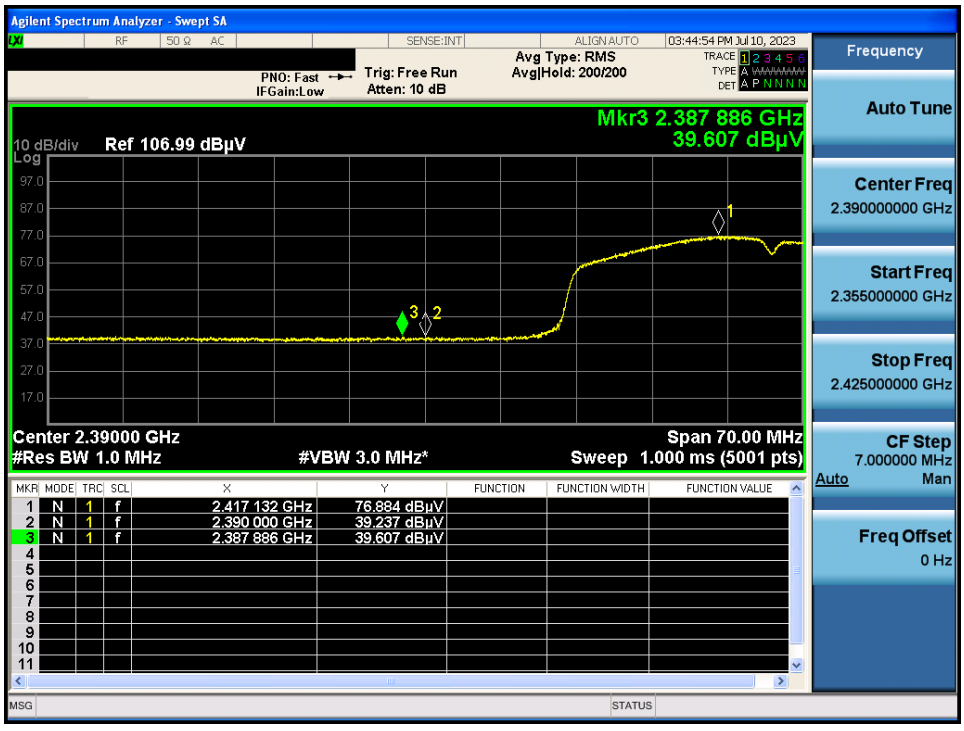


TM 3 & 2 412 & Z axis & Hor **Detector Mode : AV**

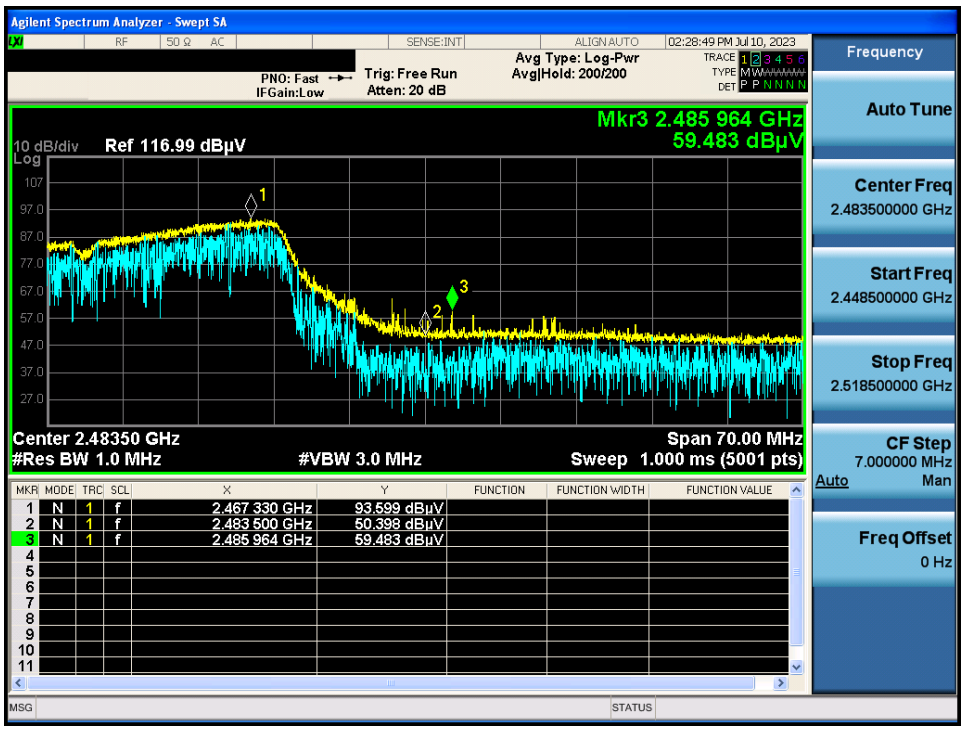
TM 4 & 2 422 & X axis & Hor **Detector Mode : PK**



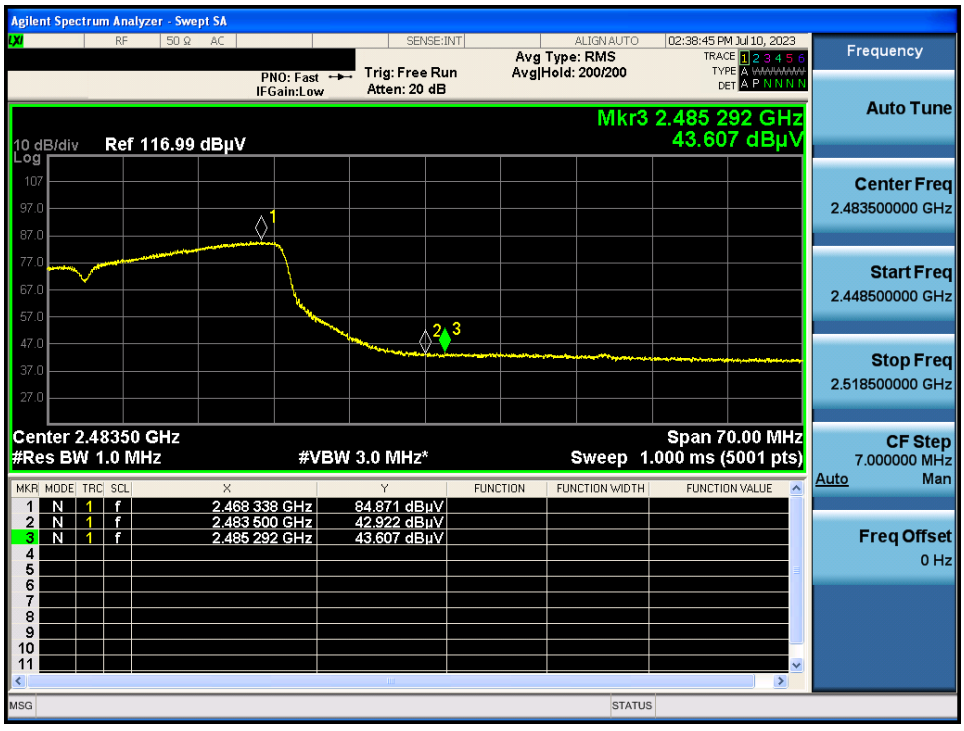
TM 4 & 2 422 & X axis & Hor **Detector Mode : AV**



TM 4 & 2 452 & X axis & Hor **Detector Mode : PK**



TM 4 & 2 452 & X axis & Hor **Detector Mode : AV**



TM 4 & 2 422 & Z axis & Hor **Detector Mode : AV**