

# FCC TEST REPORT

## (Part 15, Subpart C)

Applicant:	HMD Global Oy
Address:	Bertel Jungin aukio 9,02600 Espoo,Finland



Manufacturer or Supplier:	HMD Global Oy
Address:	Bertel Jungin aukio 9,02600 Espoo,Finland
Product:	Mobile phone
Brand Name:	NOKIA
Model Name:	TA-1541
FCC ID:	2AJOTTA-1541
Date of tests:	Jan. 16, 2023 ~ Feb. 23, 2023

The tests have been carried out according to the requirements of the following standard:

☒ **FCC Part 15, Subpart C, Section 15.247**

☒ **ANSI C63.10-2013**

**CONCLUSION: The submitted sample was found to COMPLY with the test requirement**

Prepared by Chao Wu Engineer / Mobile Department	Approved by Peibo Sun Manager / Mobile Department
 Date: Feb. 23, 2023	 Date: Feb. 23, 2023

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P23010004-2RF05	Original release	Feb. 23, 2023

## 1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
STANDARD	TEST TYPE AND LIMIT	RESULT	TEST LAB*
15.207	AC Power Conducted Emission	Compliance	A
15.247(a)(1) (iii)	Number of Hopping Frequency Used	Compliance	A
15.247(a)(1) (iii)	Dwell Time on Each Channel	Compliance	A
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	Compliance	A
15.247(b)	Maximum Peak Output Power	Compliance	A
15.247(d)& 15.209	Transmitter Radiated Emissions	Compliance	A
15.247(d)	Out of band Measurement	Compliance	A
15.203	Antenna Requirement	Compliance	A

### NOTE:

1. If the Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.
2. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
3. This report refers to the data of W7L-P23010004-1RF05(model:TA-1536, FCC ID: 2AJOTTA-1536), the difference of TA-1536 and TA-1541 is TA-1541 change model name, TA-1536 is dual card, TA-1541 is single card, and functions are realized through software. In this report verify CE worse case and replaces CE test data, other test data of this report is copied from the report W7L-P23010004-1RF05(model:TA-1536, FCC ID: 2AJOTTA-1536).

### \*Test Lab Information Reference

#### Lab A:

Huarui 7Layers High Technology (Suzhou) Co., Ltd.

#### Lab Address:

Tower N, Innovation Center, 88 Zhuyi Road, High-tech District, Suzhou City, Anhui Province

#### Accredited Test Lab Cert 6613.01

The FCC Site Registration No. is 434559; The Designation No. is CN1325.

## 1.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	UNCERTAINTY
AC Power Conducted emissions	$\pm 2.70\text{dB}$
Radiated emissions (30MHz~1GMHz)	$\pm 4.98\text{dB}$
Radiated emissions (1GMHz ~6GMHz)	$\pm 4.70\text{dB}$
Radiated emissions (6GMHz ~18GMHz)	$\pm 4.60\text{dB}$
Radiated emissions (18GMHz ~40GMHz)	$\pm 4.12\text{dB}$
Conducted emissions	$\pm 4.01\text{dB}$
Occupied Channel Bandwidth	$\pm 43.58\text{KHz}$
Conducted Output power	$\pm 2.06\text{dB}$
Power Spectral Density	$\pm 0.85\text{ dB}$

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

## 2 GENERAL INFORMATION

### 2.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	Mobile phone
<b>BRAND NAME</b>	NOKIA
<b>MODEL NAME</b>	TA-1541
<b>NOMINAL VOLTAGE</b>	3.85Vdc (Li-ion, battery) 5.0Vdc (adapter)
<b>MODULATION TECHNOLOGY</b>	FHSS
<b>MODULATION TYPE</b>	GFSK, 8DPSK, $\pi/4$ DQPSK
<b>OPERATING FREQUENCY</b>	2402MHz~2480MHz
<b>NUMBER OF CHANNEL</b>	79
<b>MAX. OUTPUT POWER</b>	12.56mW (Max. Measured)
<b>ANTENNA TYPE</b>	PIFA Antenna with 1.2dBi gain
<b>HW VERSION</b>	SPR_S63Q0
<b>SW VERSION</b>	00WW_0_090
<b>I/O PORTS</b>	Refer to user's manual
<b>CABLE SUPPLIED</b>	USB cable1: non-shielded cable, with w/o ferrite core, 1 meter USB cable2: non-shielded cable, with w/o ferrite core, 1 meter USB cable3: non-shielded cable, with w/o ferrite core, 1 meter Earphone: non-shielded cable, with w/o ferrite core, 1.2 meter

#### NOTE:

- For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
- For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
- The product of TA-1541(FCC ID: 2AJOTTA-1541) have version and components manufacturer from a second supplier. The first version is 090, the second one is 103, only the version changes, and the RF parameters do not change, components manufacturer with following changes as below:

NO.	Change Description		specifications	first supplier	specifications	second supplier
1	PCBA	64GB EMMC	FEMDNN064G-A3 A56 BWCTARV11X64 G	Longsys	FEMDNN064G-A3 A56 BWCTARV11X64G	Biwin





2		2GB LPDDR	FLXC2002G-N2 BWMZEX32H2A-1 6G-X	Longsys	FLXC2002G-N2 BWMZEX32H2A-1 6G-X	Biwin
3		3GB LPDDR	FLXC4003G-50 BWMEXX32H2A-2 4Gb-X	Longsys	FLXC4003G-50 BWMEXX32H2A-2 4Gb-X	Biwin
4		4GB LPDDR	FLXC2004G-30 BWMZCX32H2A-3 2G-X	Longsys	FLXC2004G-30 BWMZCX32H2A-3 2G-X	Biwin
5		PCB	/	KINGSHINE	/	WUZH U
6	LCM	LCD	6.517 HKC, 360min,400typ, 2.5D	TCL	6.517 BOE (B8), 360min,400typ, 2.5D	Lian Chuan g
7	Front camera	Camera	8M FF COM	Lian Heyingxiang	8M FF COM	Shijia
8	Rear camera	Camera	13M-AF COB	Lian Heyingxiang	13M-AF COB	Ruiche ng
9	Macro CAM	Camera	2M FF	Shijia	2M FF	Lian Heying xiang
10	fingerprint	module	Back fingerprint	Hedayuan	Back fingerprint	Sanyin gxin
11	Speaker		1712 1W	Dong Sheng	1712 1W	Xin Rongd a
12	Vibrator		1027 FPC	Kai Long	1027 FPC	Chao Yin
13	Receiver		0809	Dong Sheng	0809	Xin Rongd a
14	FPC		/	Lante	/	Kaihon gxing
15	Battery		5000MAH	Gaoyuan	5000MAH	Feng Hua
16	Data cable		2A typeC	Yuwei	2A typeC	Juwei

4. List of Accessory:

ACCESSORIES	BRAND	MANUFACTURER	MODEL	SPECIFICATION
LCD Panel 1	HKC	MianYang HKC Optoelectronics Technology Co., Ltd.	QM065HS03-1	6.517
LCD Panel 2	BOE	BOE	BV065WBQ-L1B	6.517
Battery 1	Nokia	Guangdong Fenghua New Energy Co.,Ltd.	WT510	Capacity : 3.85 Vdc, 4900mAh
Battery 2	Nokia	HUNAN GAOYUAN BATTERY Co., Ltd.	WT510	Capacity : 3.85 Vdc, 4900mAh
AC Adapter	Nokia	SHENZHEN BAIJUNDA ELECTRONICS.,LTD	AD-010U	I/P: 100-240Vac, 0.35A, O/P: 5.0Vdc, 2.0A
Earphone	Juwei Electronics Co., LTD	Juwei Electronics Co., LTD	JWEP1252-H21H	Signal Line, 1.2meter
USB Cable 1	Juwei Electronics Co., LTD	Juwei Electronics Co., LTD	JWUB1536-H21H	Signal Line, 1.0meter
USB Cable 2	Yu Wei	Dongguan Yuwei Electronic Technology Co., Ltd.	CH2212TC	Signal Line, 1.0meter
USB Cable 3	Sai bao	Saibao (Jiangxi) Industrial Co., Ltd	SHM1-A003A	Signal Line, 1.0meter

## 2.2 DESCRIPTION OF TEST MODES

79 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

## 2.2.1 CONFIGURATION OF SYSTEM UNDER TEST

Please see section 5 photograph of the test configuration for reference.

## 2.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports.

The worst case was found when positioned on X axis for radiated emission.

Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE<1G	RE≥1G	PLC	APCM	
-	√	√	√	√	-

Where **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission

**RE≥1G**: Radiated Emission above 1GHz  
**APCM**: Antenna Port Conducted Measurement

### RADIATED EMISSION TEST (BELOW 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	39	FHSS	8DPSK	3DH5

### RADIATED EMISSION TEST (ABOVE 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

**POWER LINE CONDUCTED EMISSION TEST:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture) and packet type.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	39	FHSS	8DPSK	3DH5

**ANTENNA PORT CONDUCTED MEASUREMENT:**

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	0, 39, 78	FHSS	GFSK	DH1/DH3/DH5
0 to 78	0, 39, 78	FHSS	$\pi/4$ DQPSK	2DH1/2DH3/2DH5
0 to 78	0, 39, 78	FHSS	8DPSK	3DH1/3DH3/3DH5

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (SYSTEM)	TESTED BY
RE<1G	23deg. C, 70%RH	DC 5V By Adapter	Jace Hu
RE≥1G	23deg. C, 70%RH	DC 5V By Adapter	Jace Hu
PLC	25deg. C, 52%RH	DC 5V By Adapter	James Fu
APCM	25deg. C, 60%RH	DC 3.85V By Battery	James Fu

## 2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C. Section 15.247**

**ANSI C63.10-2013**

- NOTE:**
1. All test items have been performed and recorded as per the above standards.
  2. The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (Certification). The test report has been issued separately.

## 2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Desktop	Lenovo	M73 SFF	PC04GRQV	N/A
2	Desktop	Lenovo	M73 SFF	PC06CS27	N/A
3	Laptop	Lenovo	Thnikpad L440	R90FTFKN	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	AC Line: Unshielded, Detachable 1.5m
2	AC Line: Unshielded, Detachable 1.5m
3	AC Line: Unshielded, Detachable 1.5m

### 3 TEST TYPES AND RESULTS

#### 3.1 CONDUCTED EMISSION MEASUREMENT

##### 3.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
0.15 ~ 0.5 0.5 ~ 5 5 ~ 30	Quasi-peak	Average
	66 to 56	56 to 46
	56	46
	60	50

- NOTE:** 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

##### 3.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR3	102749	Feb.25,22	Feb.24,24
ELEKTRA test software	Rohde&Schwarz	ELEKTRA	NA	N/A	N/A
LISN network	Rohde&Schwarz	ENV216	102640	Feb.17,22	Feb.16,24
CABLE	Rohde&Schwarz	W61.01	N/A	Oct.31,22	Apr.29,23
CABLE	Rohde&Schwarz	W601	N/A	Oct.31,22	Apr.29,23

- NOTE:** 1. The test was performed in CE shielded room.
2. The calibration interval of the above test instruments is 6 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

##### 3.1.3 TEST PROCEDURES

- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels

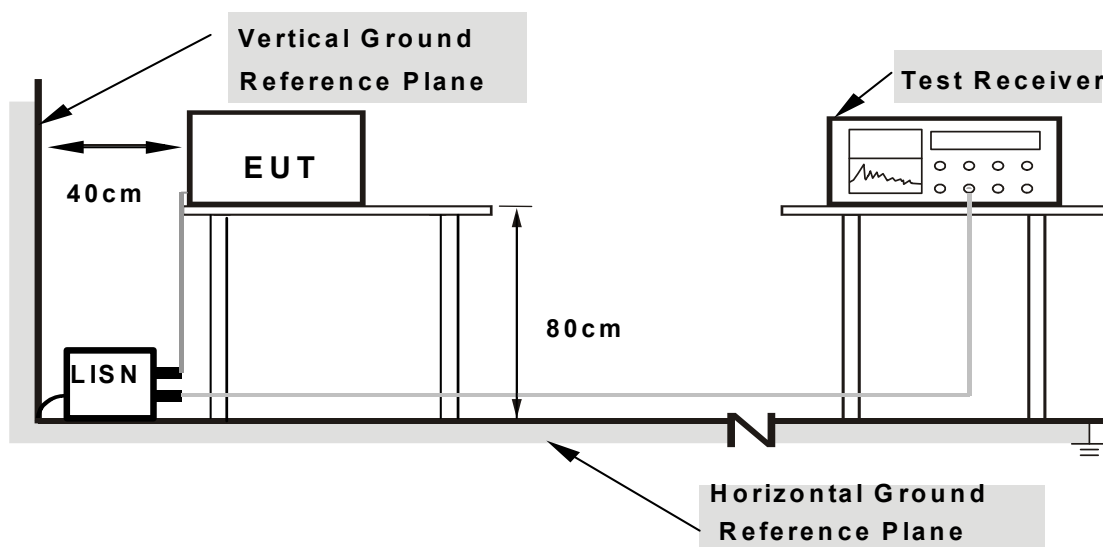
under (Limit - 20dB) was not recorded.

**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

### 3.1.4 DEVIATION FROM TEST STANDARD

No deviation.

### 3.1.5 TEST SETUP



**Note: 1. Support units were connected to second LISN.**

**2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes**

For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 3.1.6 EUT OPERATING CONDITIONS

- Turned on the power and connected of all equipment.
- EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.



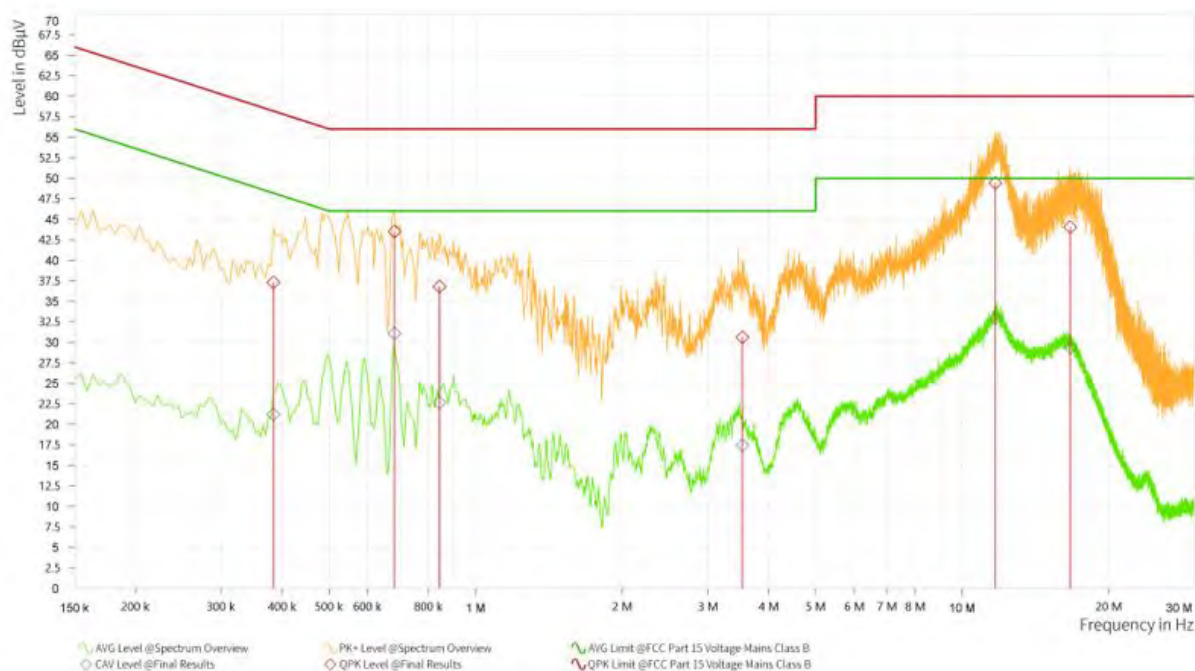
### 3.1.7 TEST RESULTS

#### CONDUCTED WORST-CASE DATA:

Frequency Range	150KHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120Vac, 60Hz	Environmental Conditions	26deg. C, 51%RH
Tested By	Chao Wu		

Rg	Frequency [MHz]	QPK Level [dBμV]	QPK Limit [dBμV]	QPK Margin [dB]	CAV Level [dBμV]	CAV: AVG Limit [dBμV]	CAV Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]
1	0.384	37.31	58.19	20.88	21.21	48.19	26.98	10.01	L1	9.000
1	0.681	43.51	56.00	12.49	31.10	46.00	14.90	9.99	L1	9.000
1	0.843	36.81	56.00	19.19	22.65	46.00	23.35	9.92	L1	9.000
1	3.534	30.59	56.00	25.41	17.45	46.00	28.55	9.79	L1	9.000
1	11.702	49.40	60.00	10.60	32.90	50.00	17.10	9.98	L1	9.000
1	16.692	44.05	60.00	15.95	29.33	50.00	20.67	10.08	L1	9.000

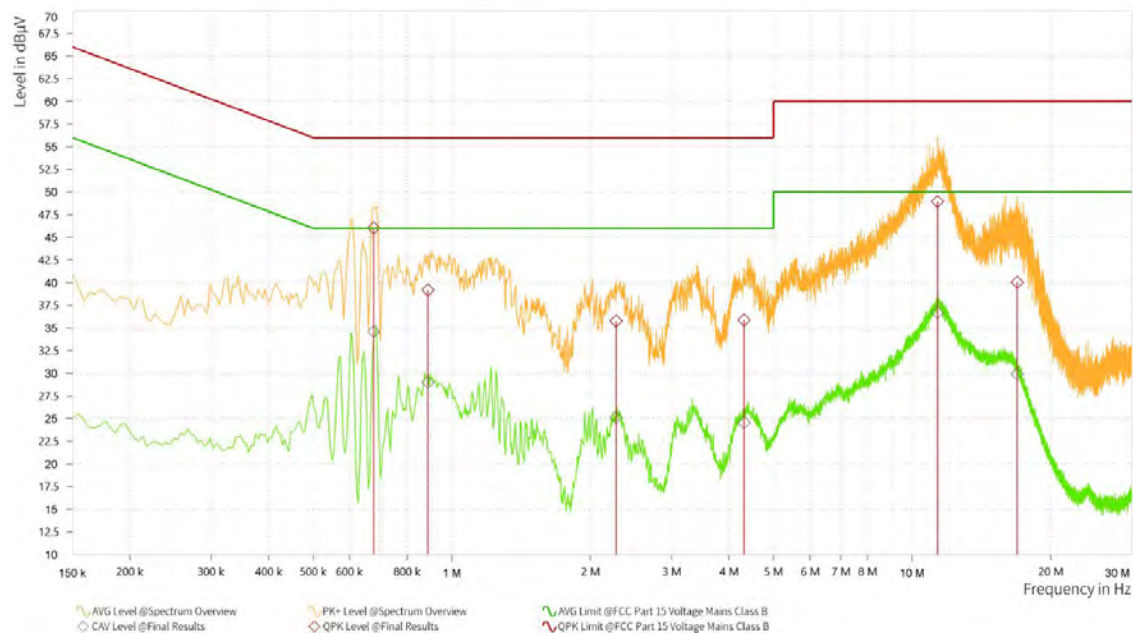
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
  2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
  3. The emission levels of other frequencies were very low against the limit.
  4. Margin value = Limit value - Emission level
  5. Correction factor = Insertion loss + Cable loss
  6. Emission Level = Correction Factor + Reading Value.



Frequency Range	150KHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120Vac, 60Hz	Environmental Conditions	26deg. C, 51%RH
Tested By	Chao Wu		

Rg	Frequency [MHz]	QPK Level [dBμV]	QPK Limit [dBμV]	QPK Margin [dB]	CAV Level [dBμV]	CAV: AVG Limit [dBμV]	CAV Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]
1	0.677	46.04	56.00	9.96	34.60	46.00	11.40	10.00	N	9.000
1	0.888	39.19	56.00	16.81	28.99	46.00	17.01	9.91	N	9.000
1	2.274	35.76	56.00	20.24	25.13	46.00	20.87	9.78	N	9.000
1	4.313	35.86	56.00	20.14	24.56	46.00	21.44	9.81	N	9.000
1	11.360	48.95	60.00	11.05	36.70	50.00	13.30	10.00	N	9.000
1	16.935	40.05	60.00	19.95	29.93	50.00	20.07	10.14	N	9.000

- REMARKS:** 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.  
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.  
3. The emission levels of other frequencies were very low against the limit.  
4. Margin value = Limit value - Emission level  
5. Correction factor = Insertion loss + Cable loss  
6. Emission Level = Correction Factor + Reading Value.



## 3.2 RADIATED EMISSION AND BANDEDGE MEASUREMENT

### 3.2.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a). Other emissions shall be at least 20dB below the highest level of the desired power.

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

### 3.2.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Pre-Amplifier	R&S	SCU18F1	100815	Aug.30,22	Aug.29,24
Pre-Amplifier	R&S	SCU08F1	101028	Sep.16,22	Sep.15,24
Signal Generator	R&S	SMB100A	182185	Feb.16,22	Feb.15,24
3m Fully-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-E MC-01 Chamber	Nov.25,22	Nov.24,25
3m Semi-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-E MC-02 Chamber	Nov.25,22	Nov.24,25
EMI TEST Receiver	R&S	ESW44	101973	Feb.25,22	Feb.24,24
Bilog Antenna	SCHWARZBECK	VULB 9163	1264	Feb.28,22	Feb.27,24
Horn Antenna	ETS-LINDGREN	3117	227836	Aug.22,22	Aug.21,24
Horn Antenna (18GHz-40GHz)	Steatite Q-par Antennas	QMS 00880	23486	Feb.23,22	Feb.22,24
Horn Antenna	Steatite Q-par Antennas	QMS 00208	23485	Aug.22,22	Aug.21,24
Loop Antenna	SCHWARZ	HFH2-Z2/Z2E	100976	Feb.23,22	Feb.22,24
WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW500	169399	Jun.27,22	Jun.26,24
Test Software	ELEKTRA	ELEKTRA4.32	N/A	N/A	N/A
Open Switch and Control Unit	R&S	OSP220	101964	N/A	N/A
DC Source	HYELEC	HY3010B	551016	Aug.31,22	Aug.30,24
Hygrothermograph	DELI	20210528	SZ014	Sep.06,22	Sep.05,24
PC	LENOVO	E14	HRSW0024	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-7.00M	N/A	N/A	N/A
TMC-AMI18843A(CABLE)	R&S	HF290-NMNM-4.00M	N/A	N/A	N/A
CABLE	R&S	W13.02	N/A	Oct.31,22	Apr.29,23
CABLE	R&S	W12.14	N/A	Oct.31,22	Apr.29,23

- NOTE:**
1. The calibration interval of the above test instruments is 6 months or 24 months or 36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
  2. The test was performed in 3m Chamber.



### 3.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be performed using fresh batteries. The turntable was rotated to maximize the emission level.

**NOTE:**

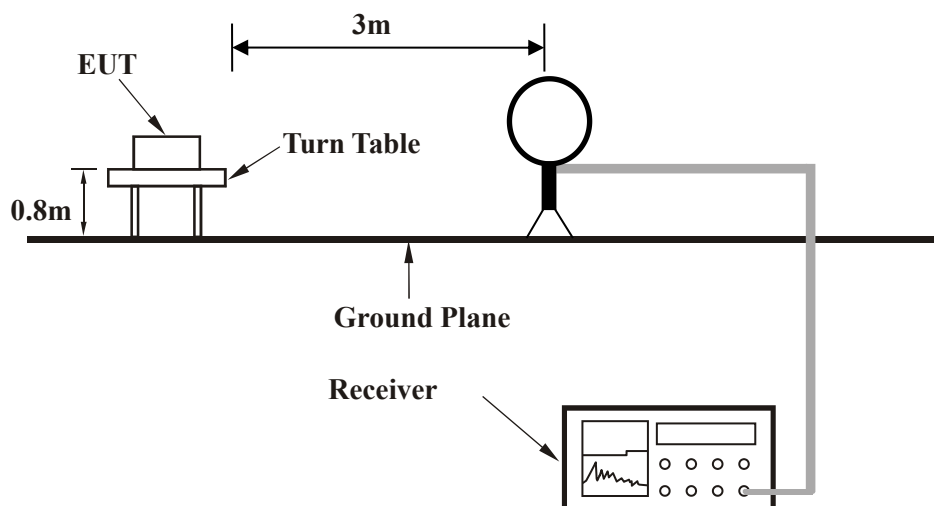
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
4. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from  $20\log(\text{dwell time}/100 \text{ ms})$ , in an effort to demonstrate compliance with the 15.209 limit.
5. All modes of operation were investigated and the worst-case emissions are reported.

### 3.2.4 DEVIATION FROM TEST STANDARD

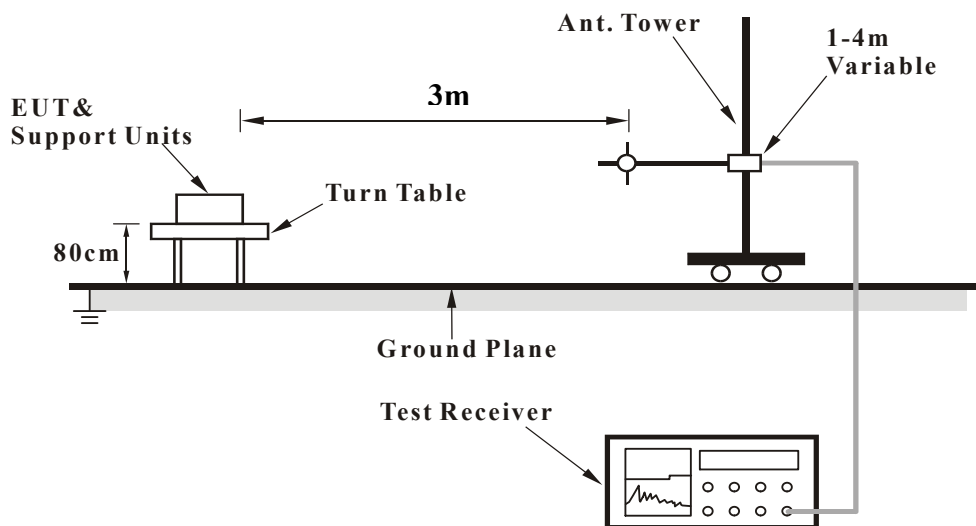
No deviation.

### 3.2.5 TEST SETUP

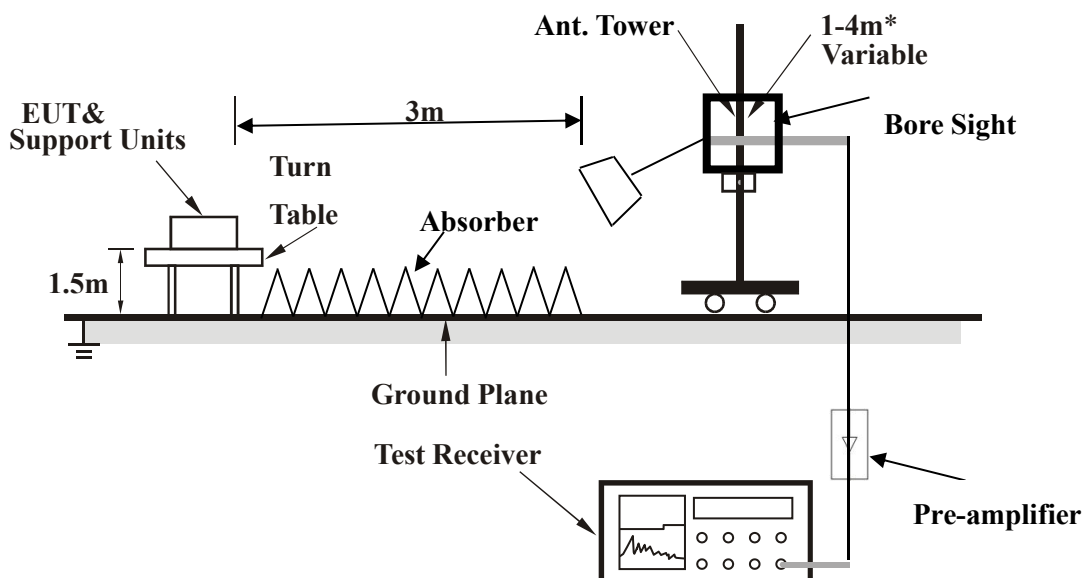
#### <Frequency Range 9KHz~30MHz >



#### < Frequency Range 30MHz~1GHz >



### <Frequency Range above 1GHz>



**Note:** Above 1G is a directional antenna

Depends on the EUT height and the antenna 3dB beamwidth both, refer to section 7.3 of CISPR 16-2-3.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 3.2.6 EUT OPERATING CONDITIONS

- Set the EUT under full load condition and placed them on a testing table.
- Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.
- The necessary accessories enable the EUT in full functions.

### 3.2.7 TEST RESULTS

**NOTE** : The 9K~30MHz amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required in the report.

#### BELOW 1GHz WORST-CASE DATA:

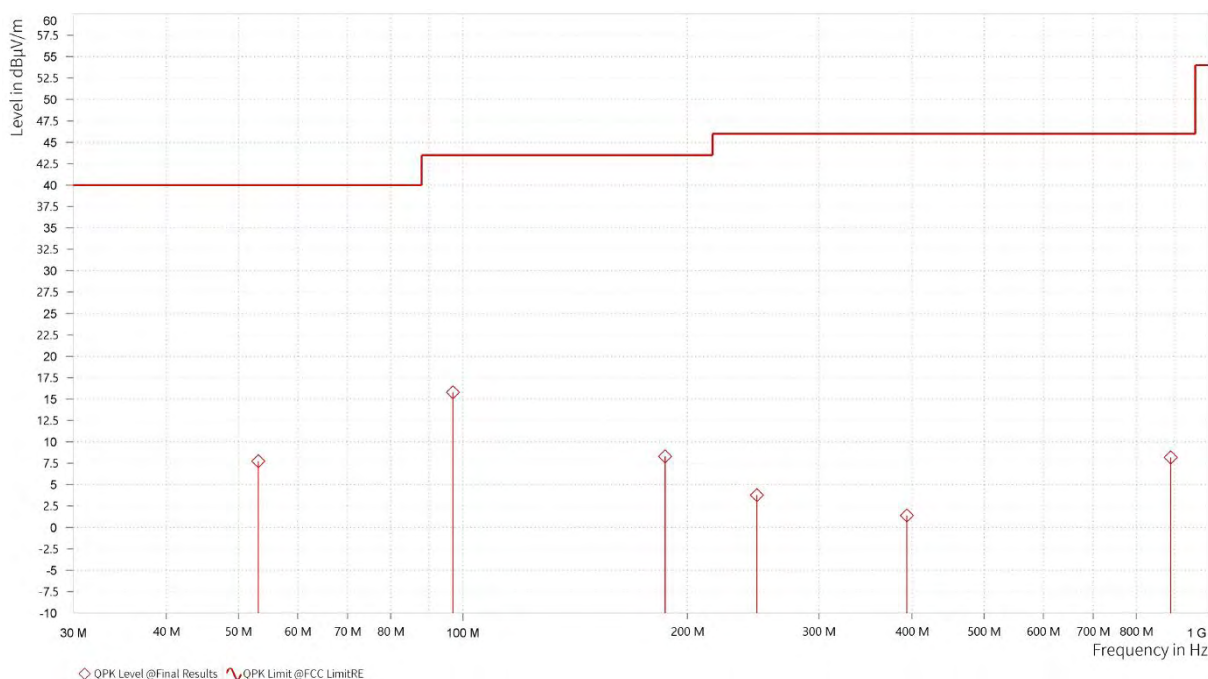
30 MHz – 1GHz data:

BT\_8DPSK

<b>CHANNEL</b>	Channel 39	<b>DETECTOR FUNCTION</b>	Quasi-Peak (QP)
<b>FREQUENCY RANGE</b>	30MHz ~ 1GHz		

#### ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]
1	53.135	7.74	40.00	32.26	-18.88	H	332.3	1	120.000
1	96.930	15.79	43.50	27.71	-21.63	H	145.1	2	120.000
1	186.655	8.30	43.50	35.20	-24.29	H	224.8	1	120.000
1	247.814	3.79	46.00	42.21	-22.95	H	251.7	2	120.000
1	393.799	1.39	46.00	44.61	-20.45	H	145.1	2	120.000
1	889.663	8.20	46.00	37.80	-12.69	H	5.7	1	120.000





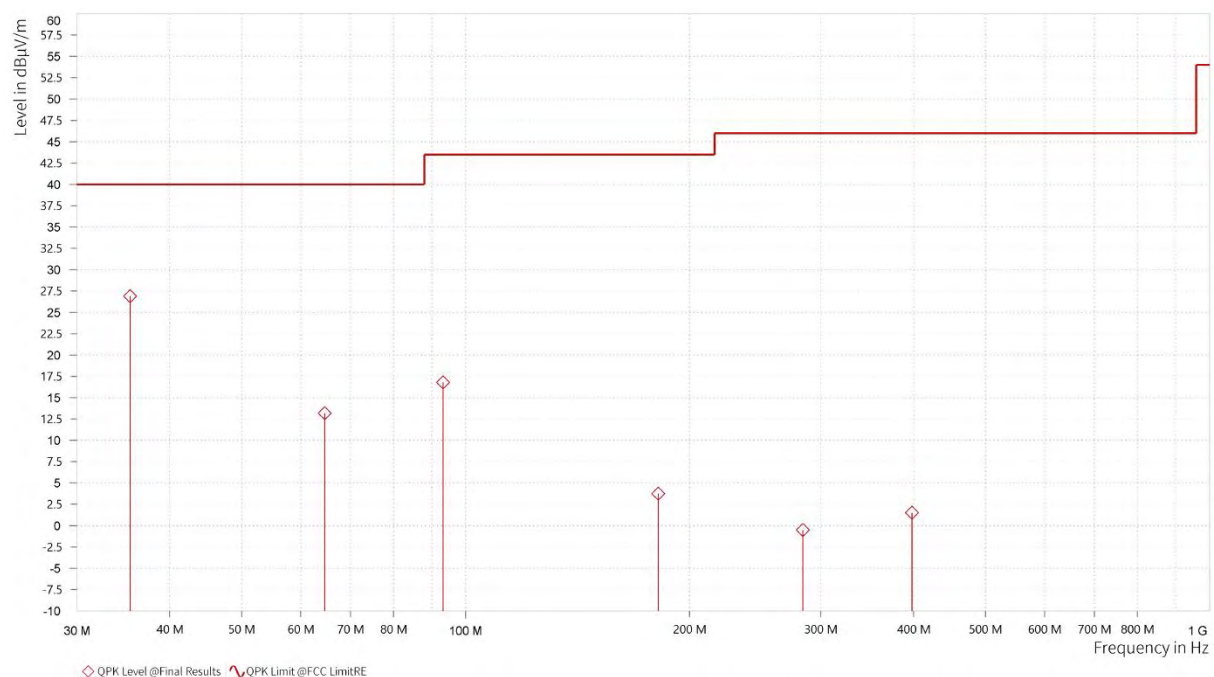
**REMARKS:**

1. Emission Level(dBuV/m) = Read Level(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission level.

CHANNEL	Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M
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Rg	Frequency [MHz]	QPK Level [dBμV/m]	QPK Limit [dBμV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]
1	35.384	26.89	40.00	13.11	-20.00	V	214.9	1	120.000
1	64.629	13.17	40.00	26.83	-20.23	V	323.3	1	120.000
1	93.244	16.79	43.50	26.71	-23.00	V	214.9	1	120.000
1	181.563	3.75	43.50	39.75	-25.47	V	323.3	1	120.000
1	284.043	-0.53	46.00	46.53	-22.42	V	214.9	1	120.000
1	398.164	1.50	46.00	44.50	-20.39	V	5	1	120.000



#### REMARKS:

1. Emission Level(dBuV/m) = Read Level(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission level.

## ABOVE 1GHz WORST-CASE DATA:

**Note:** 1. For radiated emissions testing the full testing range of different modes have been scanned only the worst case harmonic data is reported in the sheet.

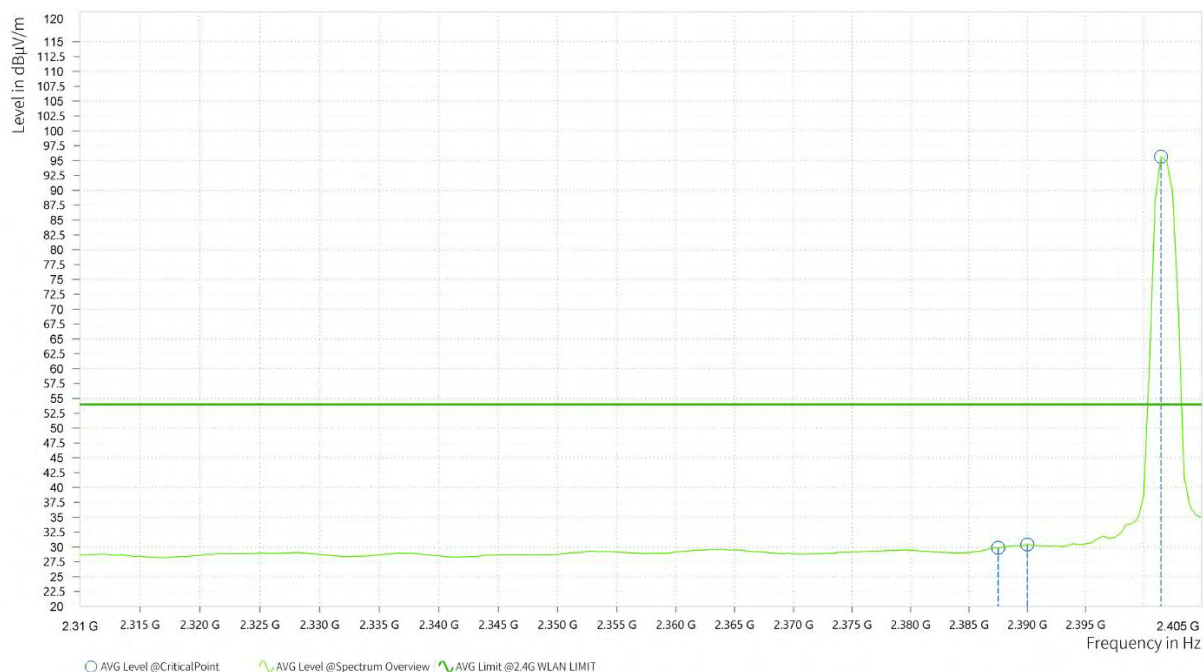
2. All other emissions that greater than 20dB below the limit were not recorded

## BT\_GFSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

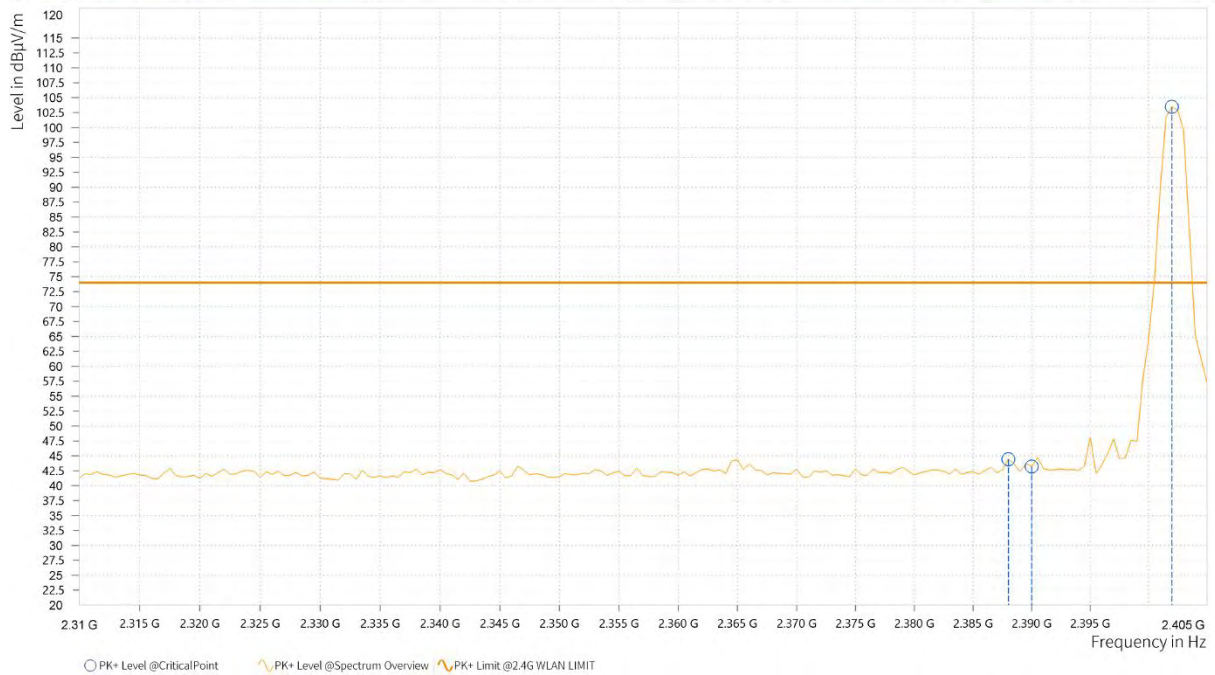
## ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,387.500	29.85	54.00	24.15	9.82	H	297	2
1	2,390.000	30.41	54.00	23.59	9.84	H	297	2
1	2,401.500	95.64			9.85	H	297	2





Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,388.000	44.44	74.00	29.56	9.82	H	218.3	1
1	2,390.000	43.21	74.00	30.79	9.84	H	68.9	1
1	2,402.000	103.47			9.85	H	262.4	2





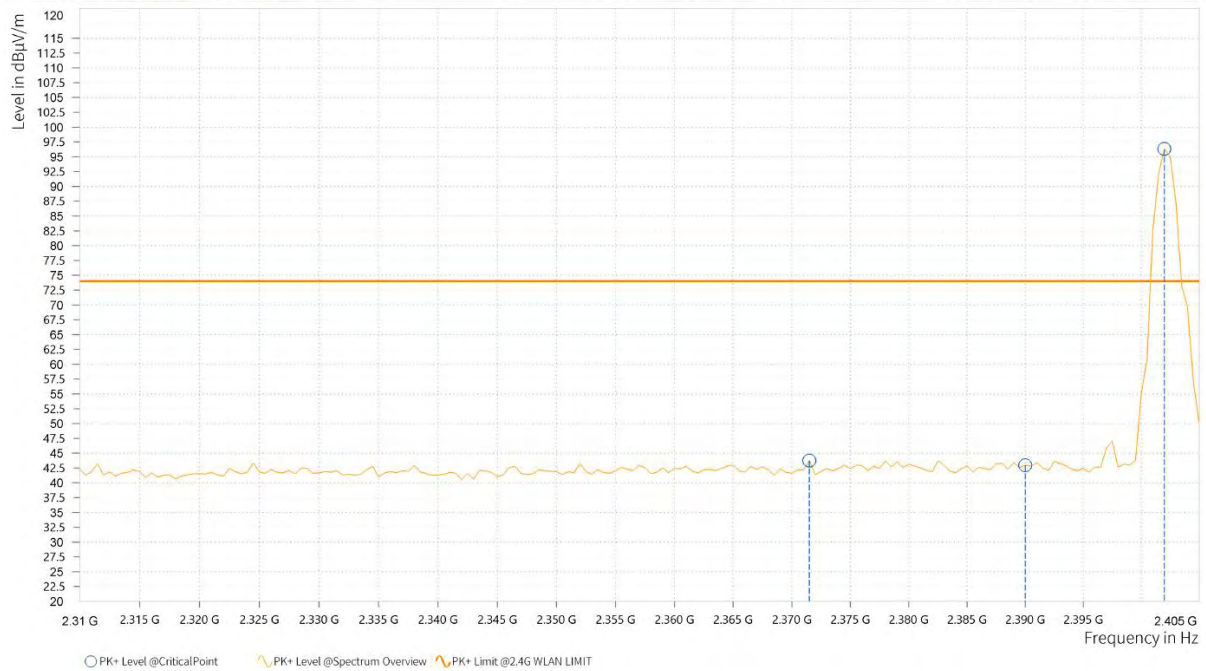
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,389.000	29.89	54.00	24.11	9.83	V	303	2
1	2,390.000	29.92	54.00	24.08	9.84	V	128.7	1
1	2,401.500	90.91			9.85	V	128.7	1





Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,371.500	43.73	74.00	30.27	9.69	V	1	2
1	2,390.000	42.95	74.00	31.05	9.84	V	55.8	1
1	2,402.000	96.33			9.85	V	158.5	1

**REMARKS:**

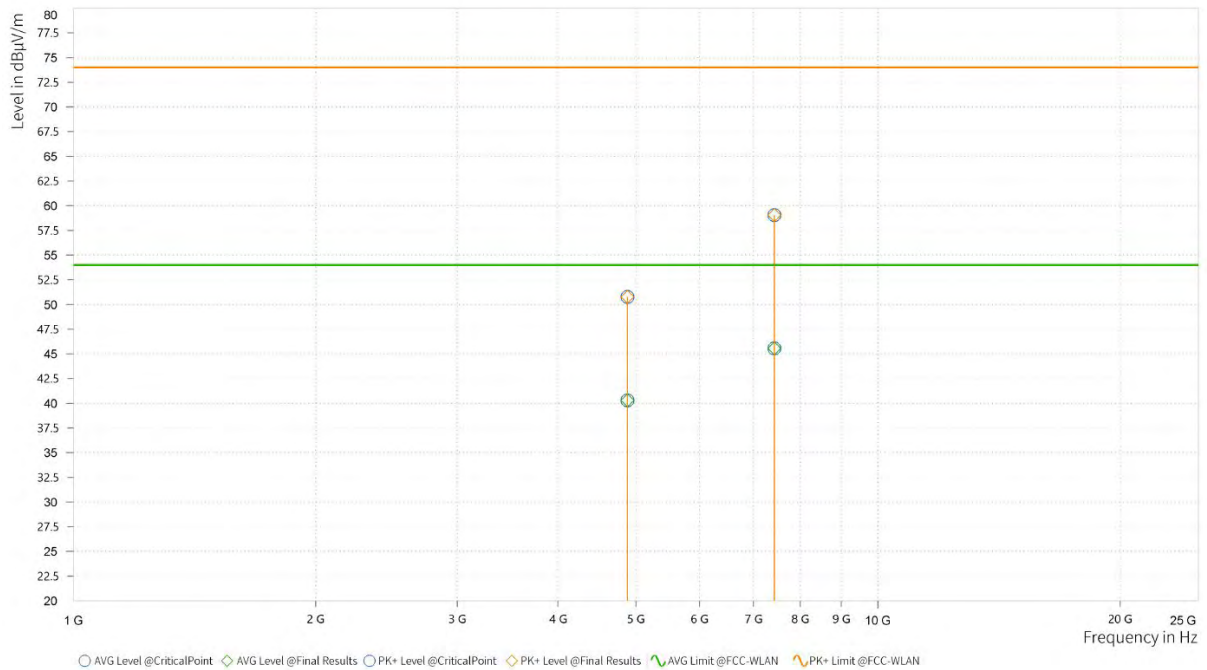
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
2. 2402MHz: Fundamental frequency.



CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

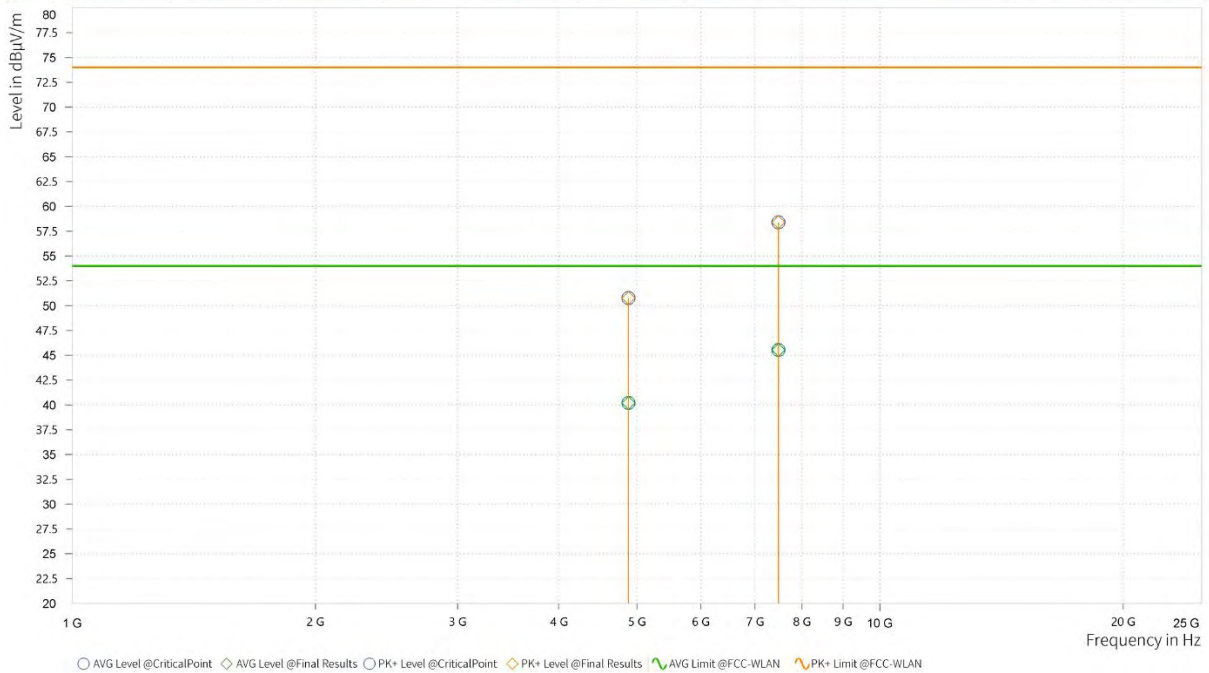
Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
3	4,881.971	50.76	74.00	23.24	40.30	54.00	13.70	15.95	H	359	2
4	7,433.050	59.04	74.00	14.96	45.56	54.00	8.44	23.94	H	359	2





**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
3	4,881.971	50.77	74.00	23.23	40.20	54.00	13.80	15.95	V	1	2
4	7,483.625	58.41	74.00	15.59	45.54	54.00	8.46	23.86	V	11.8	2



**REMARKS:**

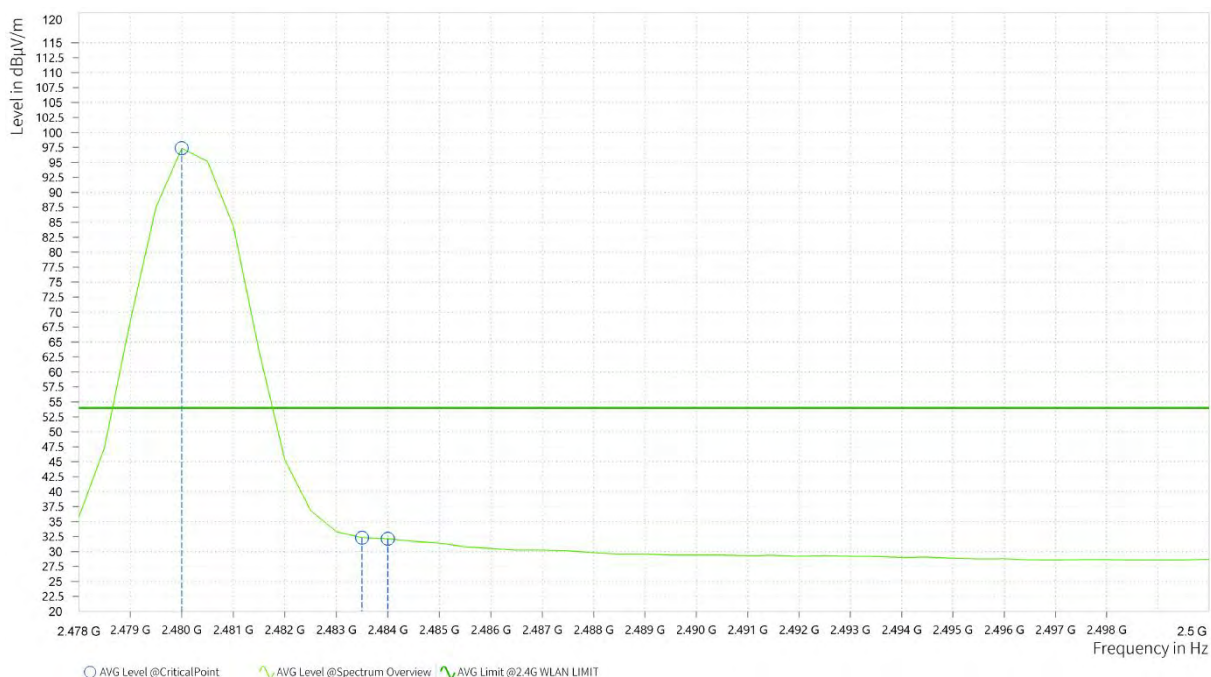
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
2. 2441MHz: Fundamental frequency.



<b>CHANNEL</b>	TX Channel 78	<b>DETECTOR FUNCTION</b>	Peak (PK) Average (AV)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		

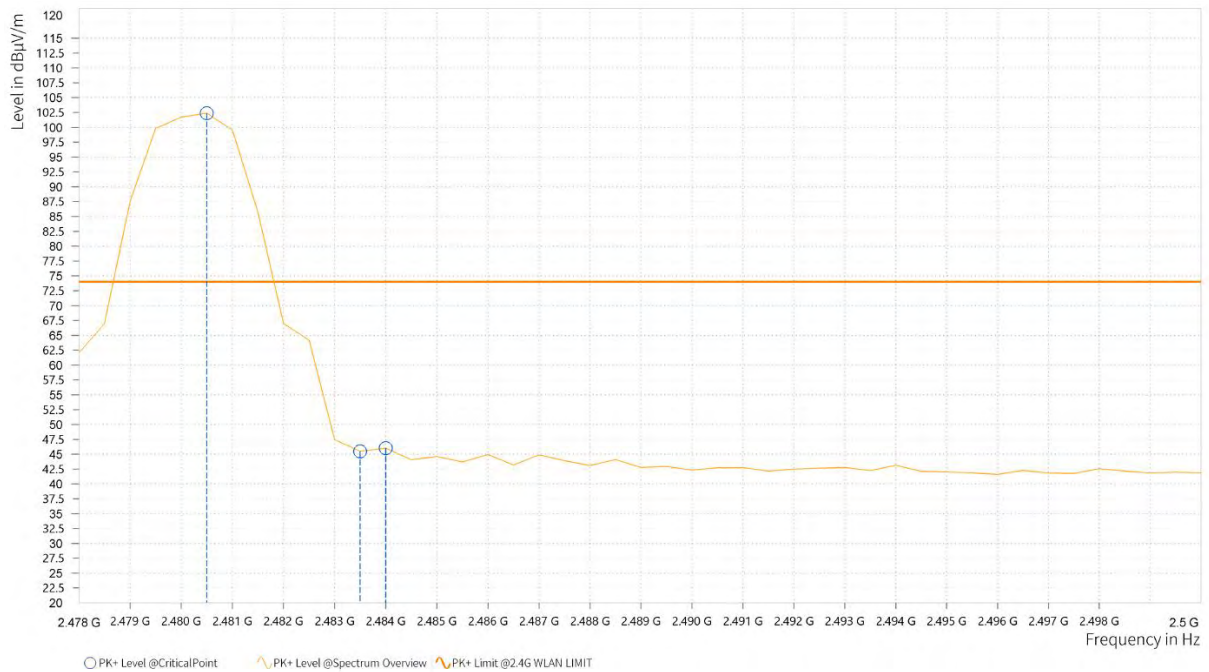
**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.000	97.37			9.89	H	225.3	2
1	2,483.500	32.30	54.00	21.70	9.88	H	163.3	1
1	2,484.000	32.12	54.00	21.88	9.88	H	225.3	2



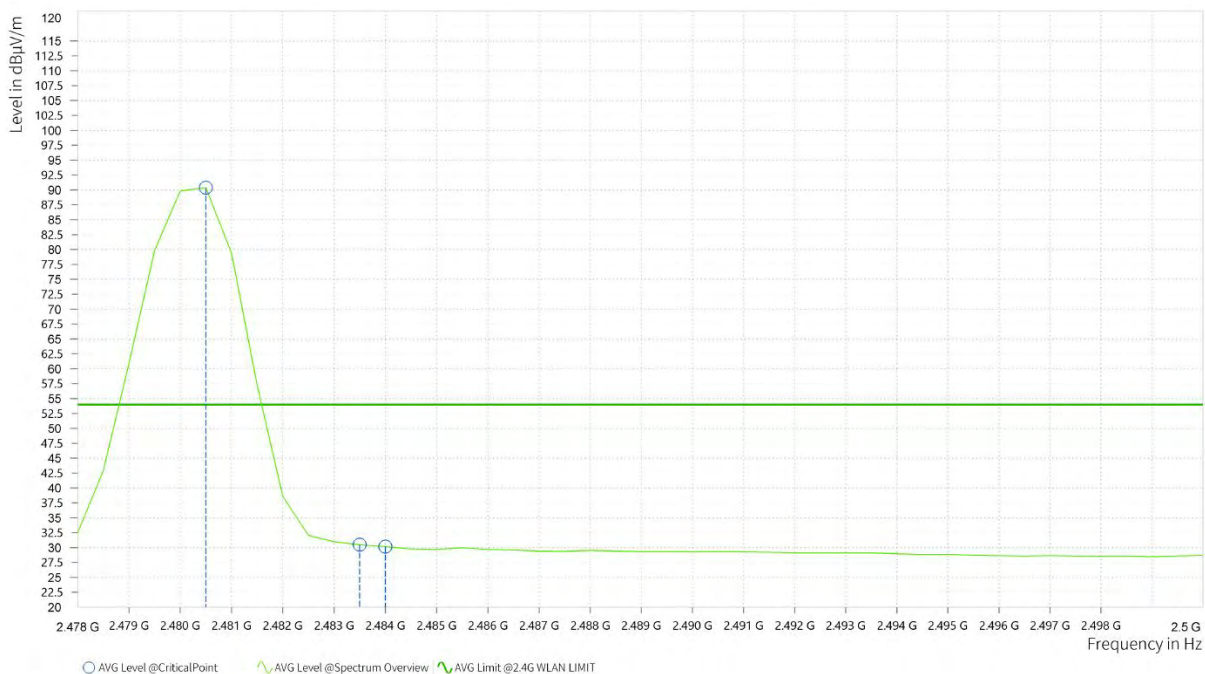


Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.500	102.37			9.89	H	236.1	2
1	2,483.500	45.49	74.00	28.51	9.88	H	236.1	2
1	2,484.000	46.02	74.00	27.98	9.88	H	236.1	2



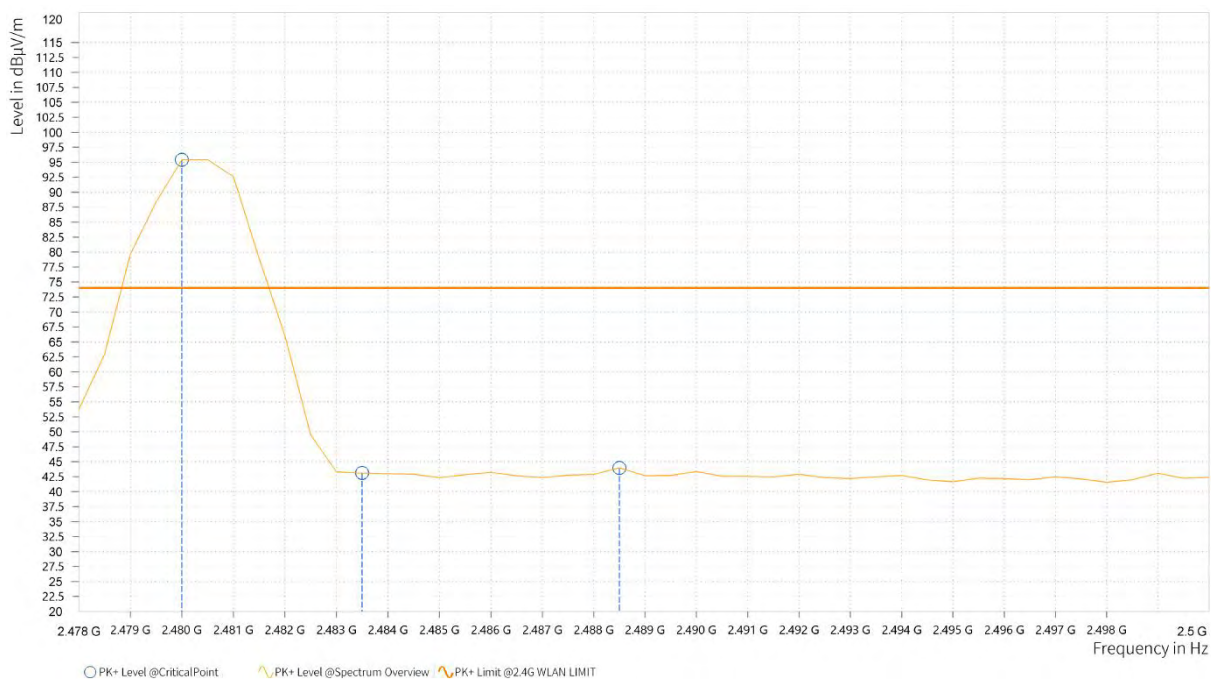
**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.500	90.39			9.89	V	168	1
1	2,483.500	30.48	54.00	23.52	9.88	V	168	1
1	2,484.000	30.16	54.00	23.84	9.88	V	196.8	1





Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.000	95.40			9.89	V	147.8	1
1	2,483.500	43.10	74.00	30.90	9.88	V	71.3	1
1	2,488.500	43.97	74.00	30.03	9.88	V	147.8	1



## REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
- 2480MHz: Fundamental frequency.

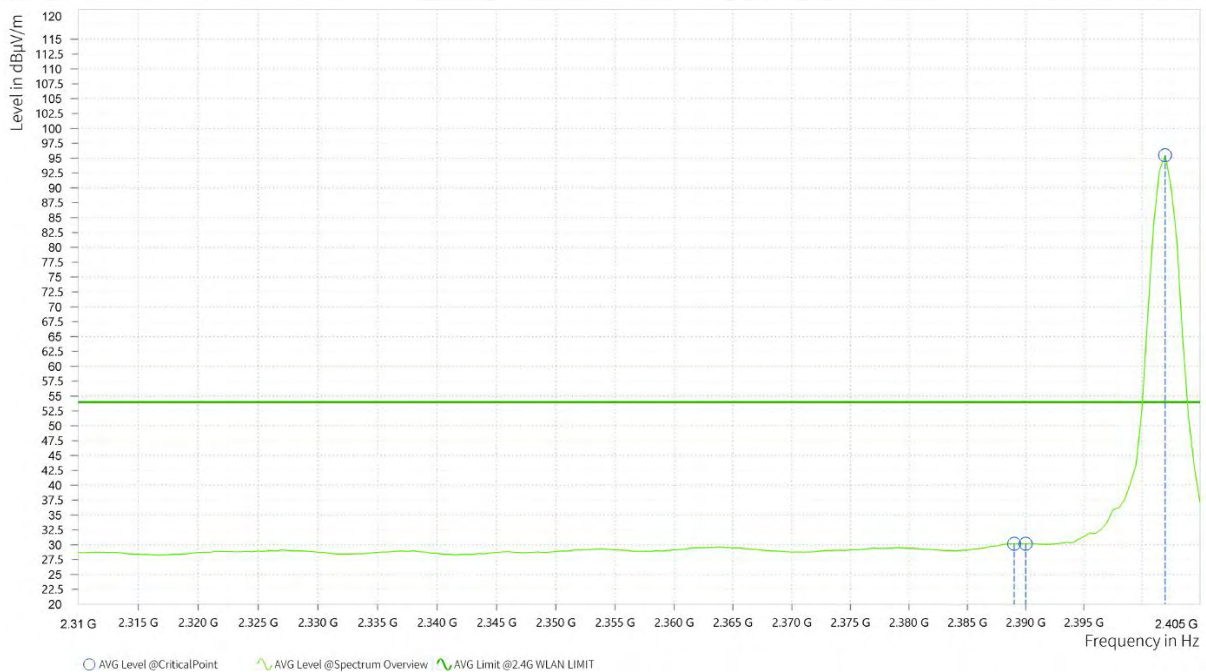


BT\_π/4-DQPSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

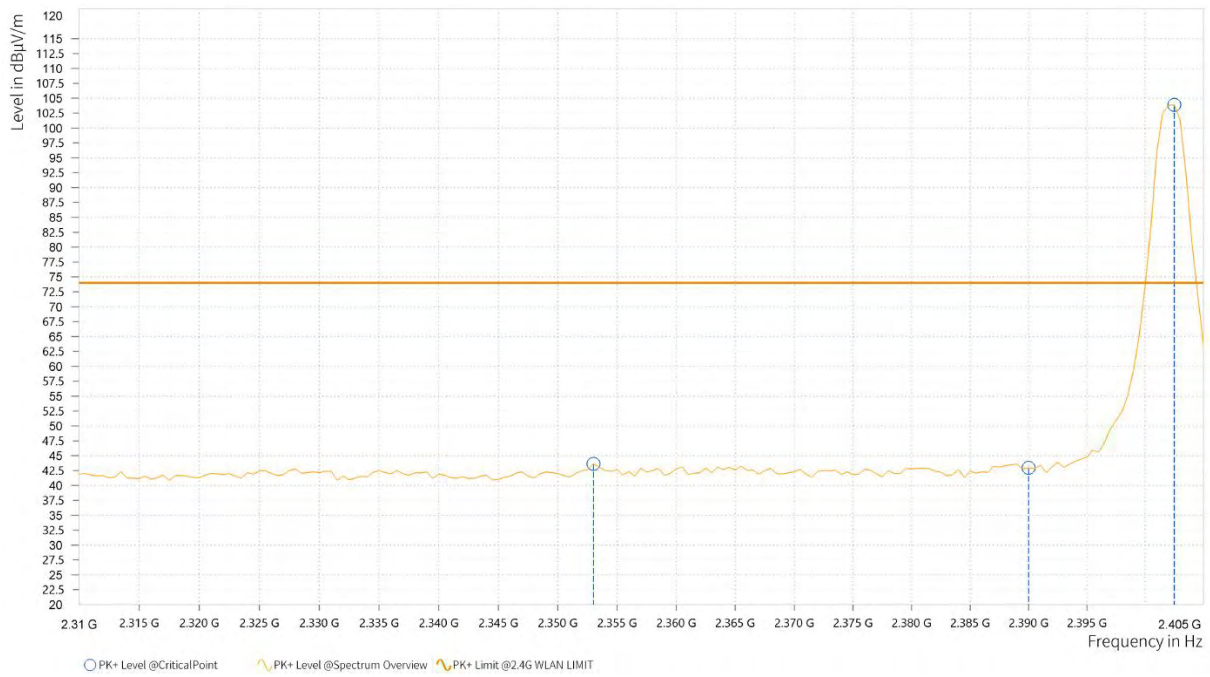
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,389.000	30.16	54.00	23.84	9.83	H	301.8	2
1	2,390.000	30.14	54.00	23.86	9.84	H	301.8	2
1	2,402.000	95.49			9.85	H	301.8	2





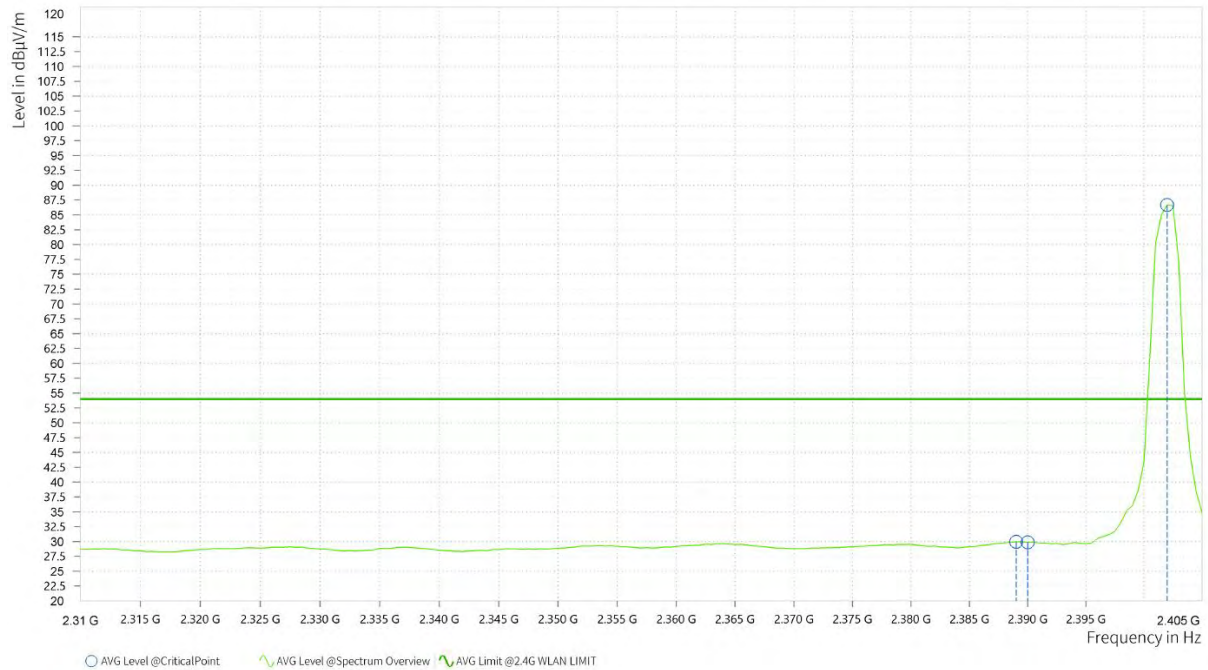
Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,353.000	43.63	74.00	30.37	9.60	H	312.5	2
1	2,390.000	42.97	74.00	31.03	9.84	H	225.4	1
1	2,402.500	103.90			9.85	H	237.2	2





ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

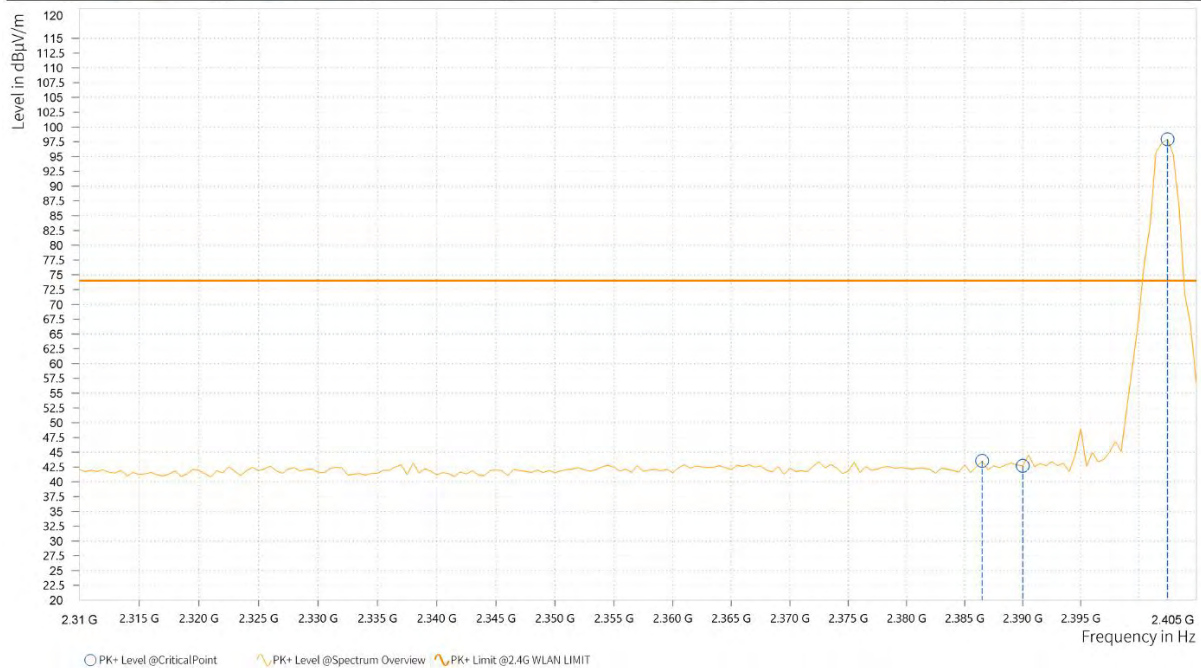
Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,389.000	29.95	54.00	24.05	9.83	V	120.3	1
1	2,390.000	29.85	54.00	24.15	9.84	V	359	2
1	2,402.000	86.68			9.85	V	120.3	1







Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,386.500	43.53	74.00	30.47	9.81	V	264.8	2
1	2,390.000	42.72	74.00	31.28	9.84	V	248.1	1
1	2,402.500	97.94			9.85	V	147.8	1



#### REMARKS:

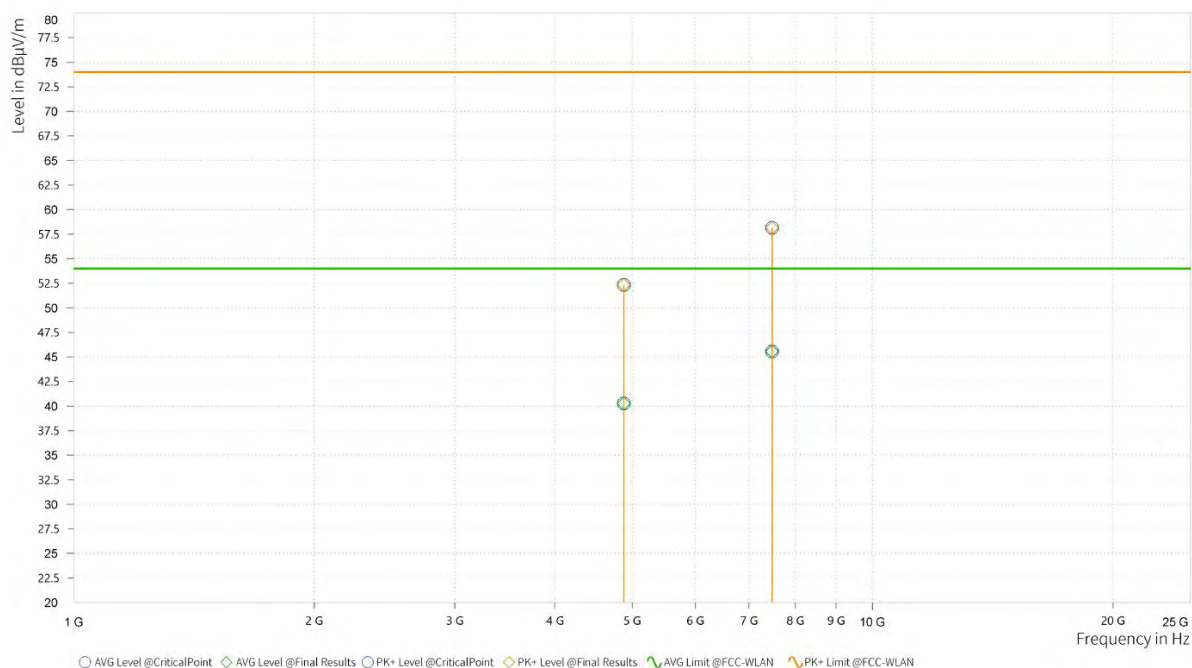
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
2. 2402MHz: Fundamental frequency.



<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

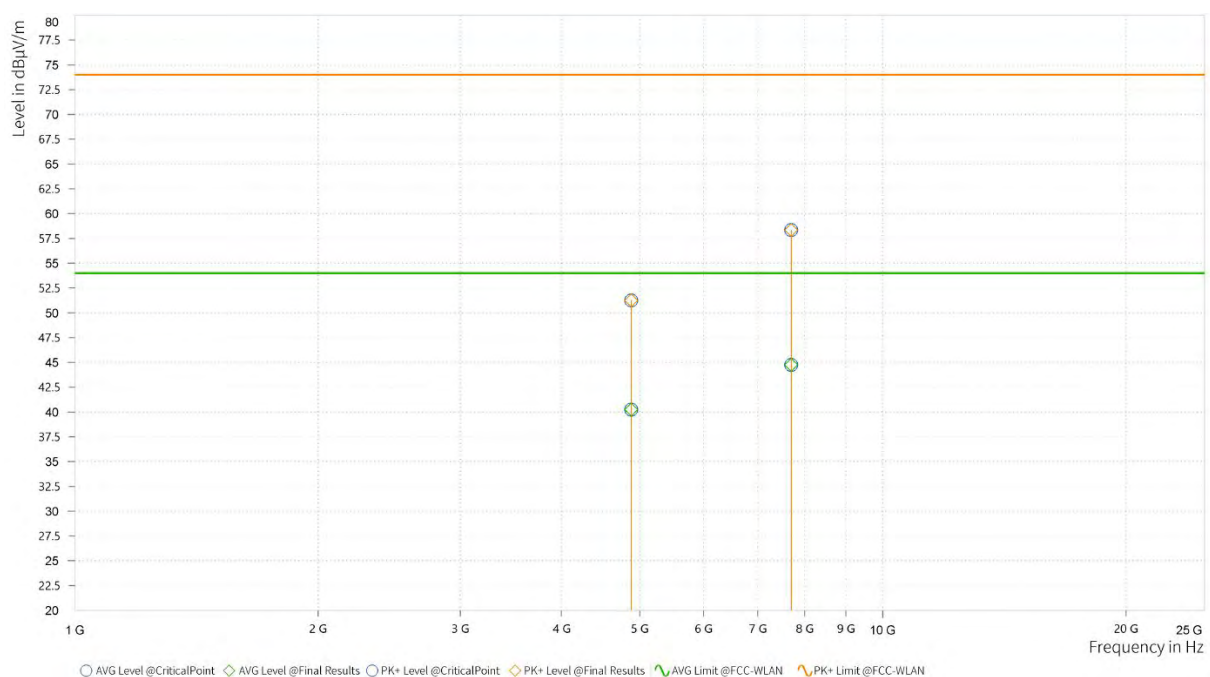
**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
3	4,881.971	52.32	74.00	21.68	40.28	54.00	13.72	15.95	H	237.4	1
4	7,487.875	58.16	74.00	15.84	45.56	54.00	8.44	23.87	H	10.5	2



ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
3	4,881.971	51.26	74.00	22.74	40.25	54.00	13.75	15.95	V	123.8	2
4	7,702.925	58.34	74.00	15.66	44.75	54.00	9.25	24.33	V	1	2



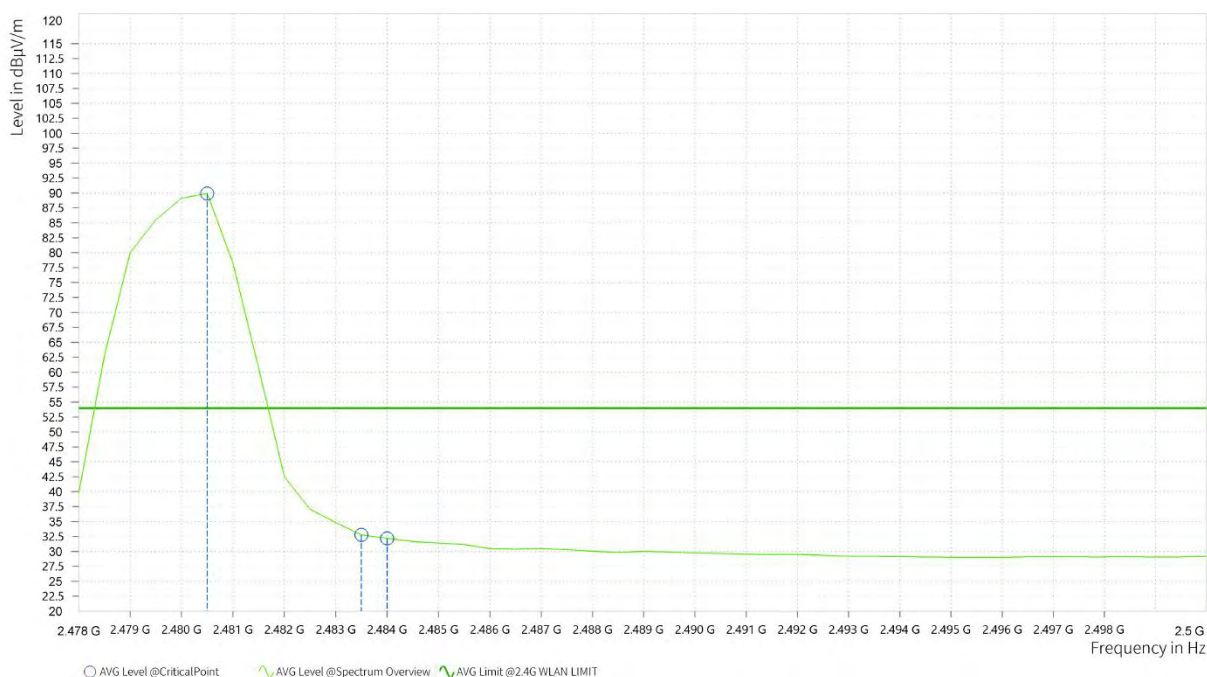
REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
- 2441MHz: Fundamental frequency.

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

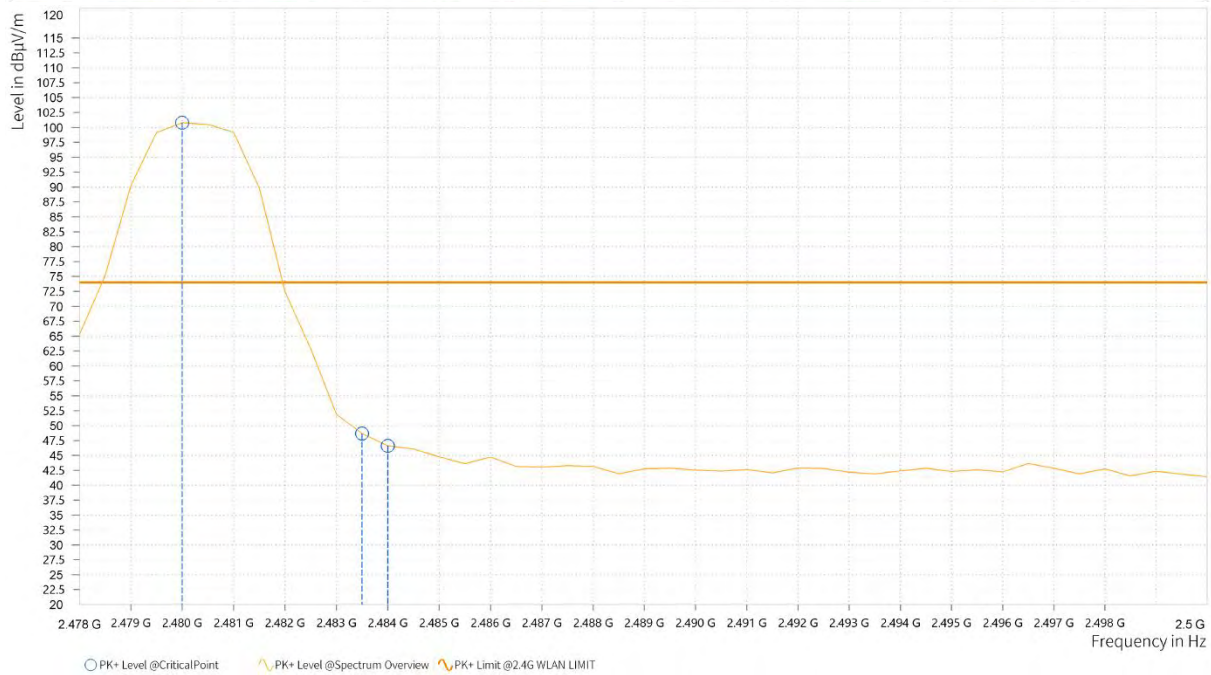
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.500	89.93			9.89	H	175.1	2
1	2,483.500	32.76	54.00	21.24	9.88	H	175.1	2
1	2,484.000	32.19	54.00	21.81	9.88	H	175.1	2





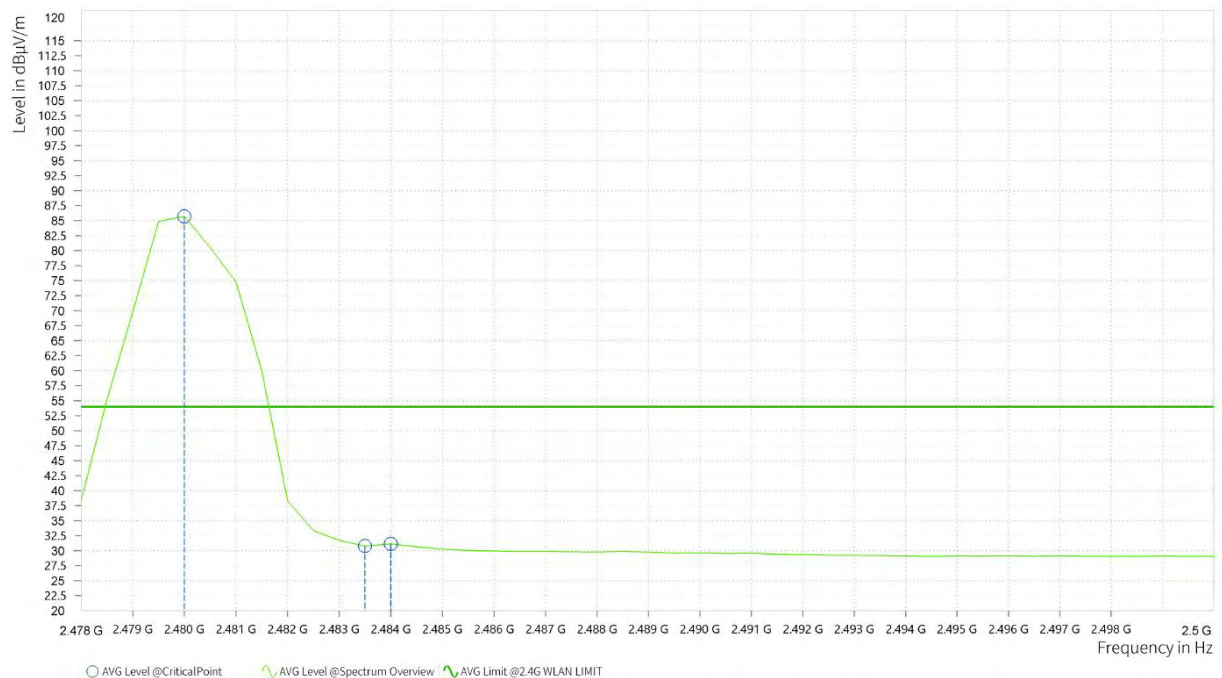
Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.000	100.78			9.89	H	72.5	1
1	2,483.500	48.67	74.00	25.33	9.88	H	236.1	2
1	2,484.000	46.60	74.00	27.40	9.88	H	134.6	2





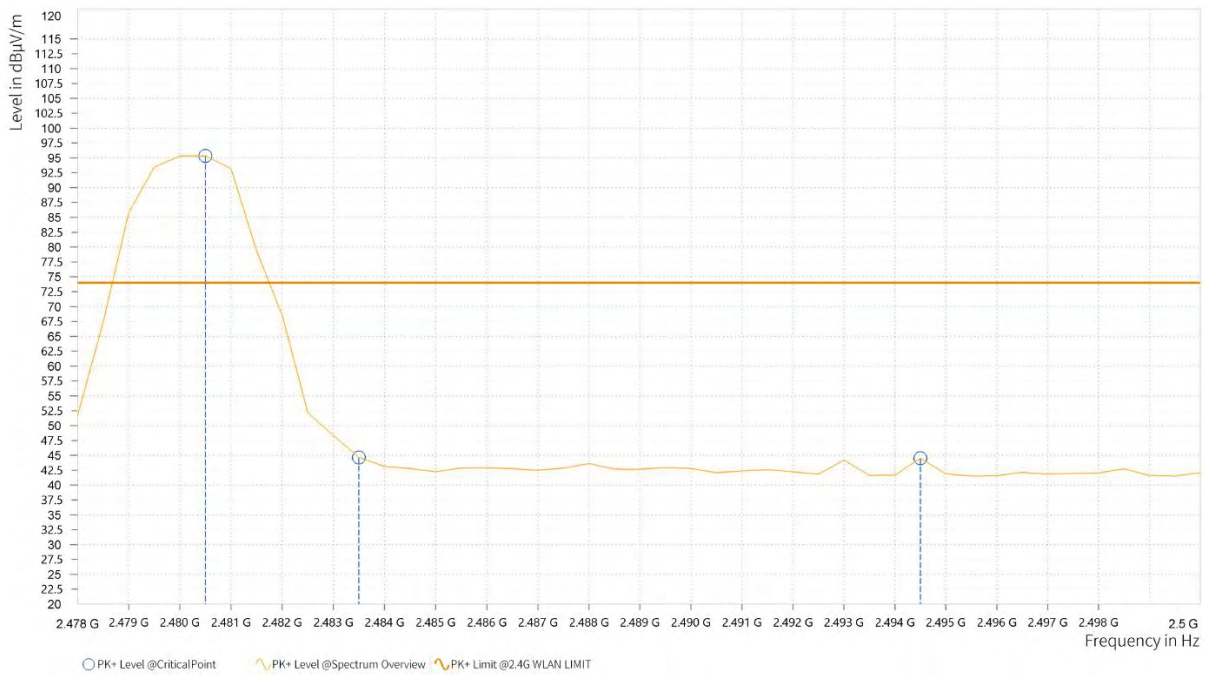
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.000	85.72			9.89	V	5.2	1
1	2,483.500	30.77	54.00	23.23	9.88	V	5.2	1
1	2,484.000	31.13	54.00	22.87	9.88	V	5.2	1





Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.500	95.34			9.89	V	45	1
1	2,483.500	44.65	74.00	29.35	9.88	V	278.2	1
1	2,494.500	44.51	74.00	29.49	9.88	V	350.2	1



#### REMARKS:

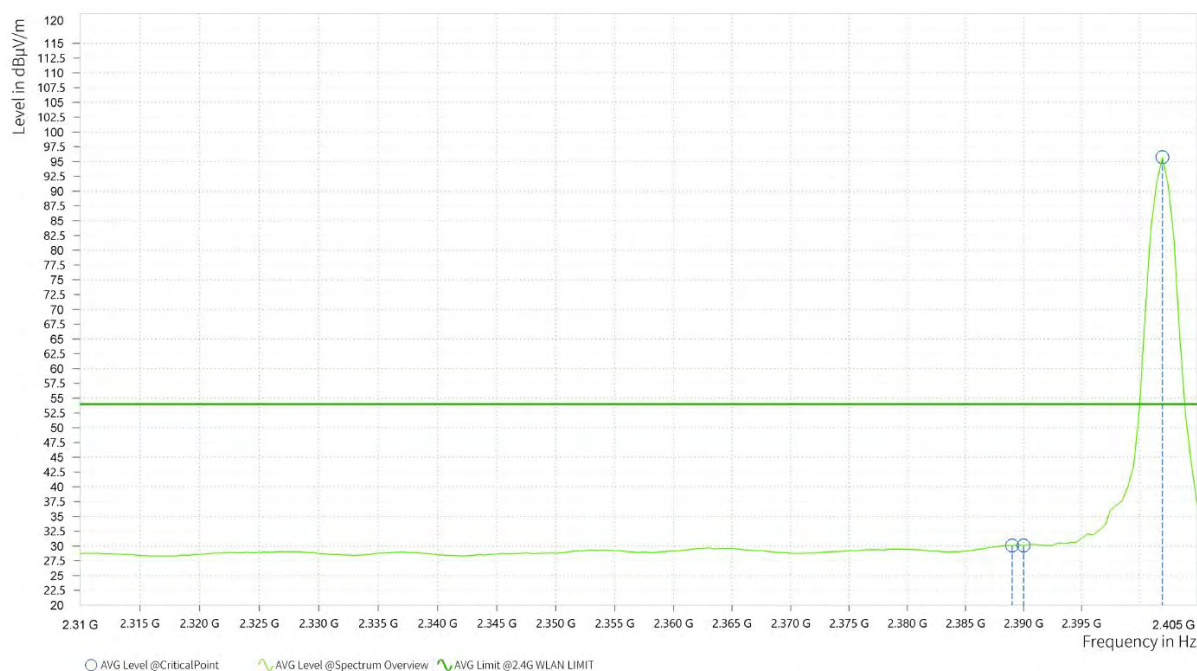
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
2. 2480MHz: Fundamental frequency.

BT\_8DPSK

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

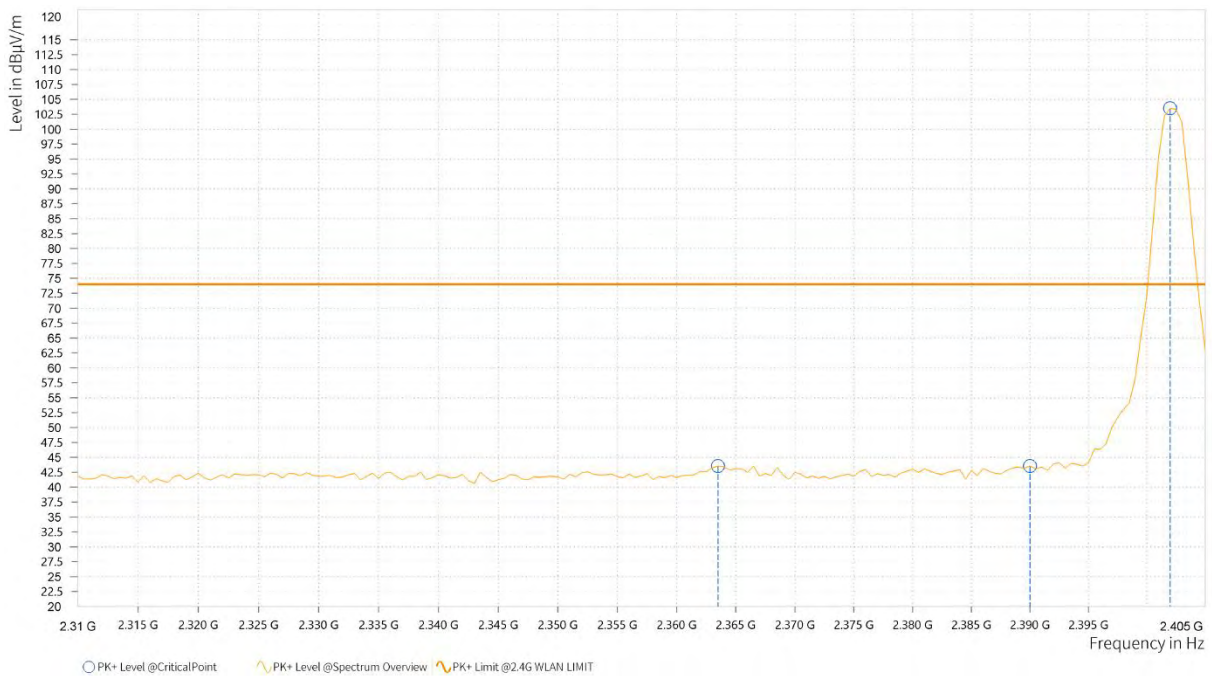
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,389.000	30.06	54.00	23.94	9.83	H	300.6	2
1	2,390.000	30.08	54.00	23.92	9.84	H	238.5	2
1	2,402.000	95.73			9.85	H	300.6	2





Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,363.500	43.54	74.00	30.46	9.64	H	245.7	1
1	2,390.000	43.54	74.00	30.46	9.84	H	264.8	2
1	2,402.000	103.53			9.85	H	169.2	1

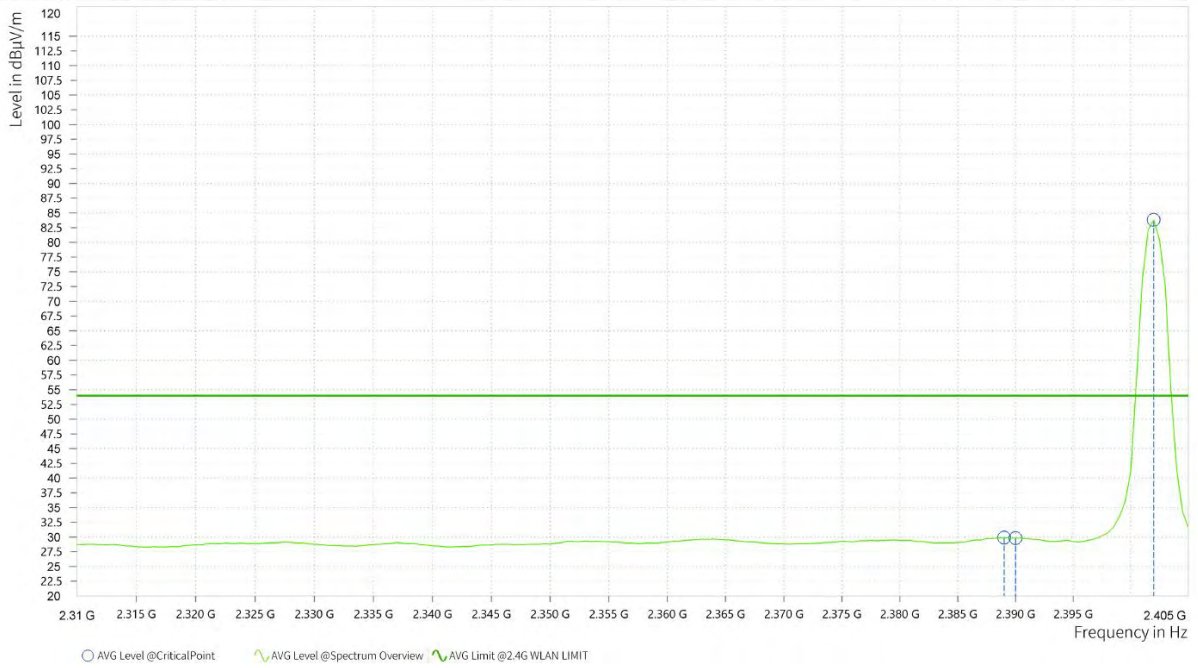






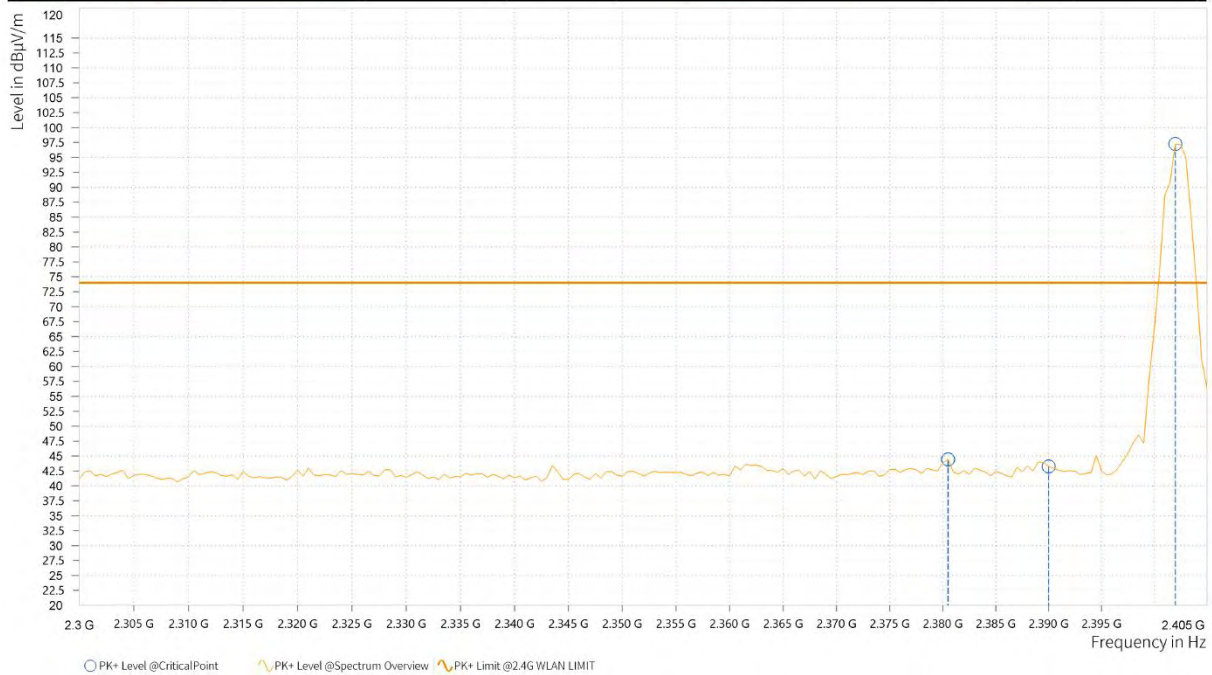
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,389.000	29.92	54.00	24.08	9.83	V	0.9	2
1	2,390.000	29.83	54.00	24.17	9.84	V	359.1	1
1	2,402.000	83.81			9.85	V	52.1	2





Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,380.500	44.43	74.00	29.57	9.76	V	355.8	1
1	2,390.000	43.25	74.00	30.75	9.84	V	1.4	2
1	2,402.000	97.25			9.85	V	146.6	1

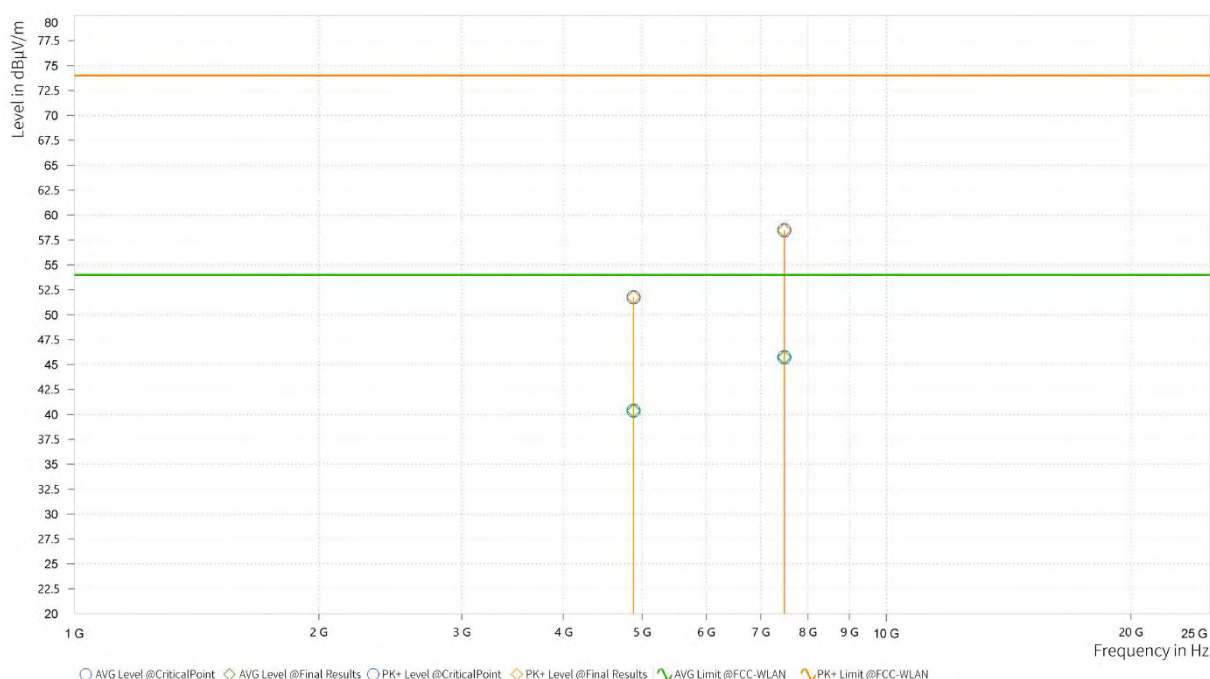
**REMARKS:**

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
2. 2402MHz: Fundamental frequency.

<b>CHANNEL</b>	TX Channel 39	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

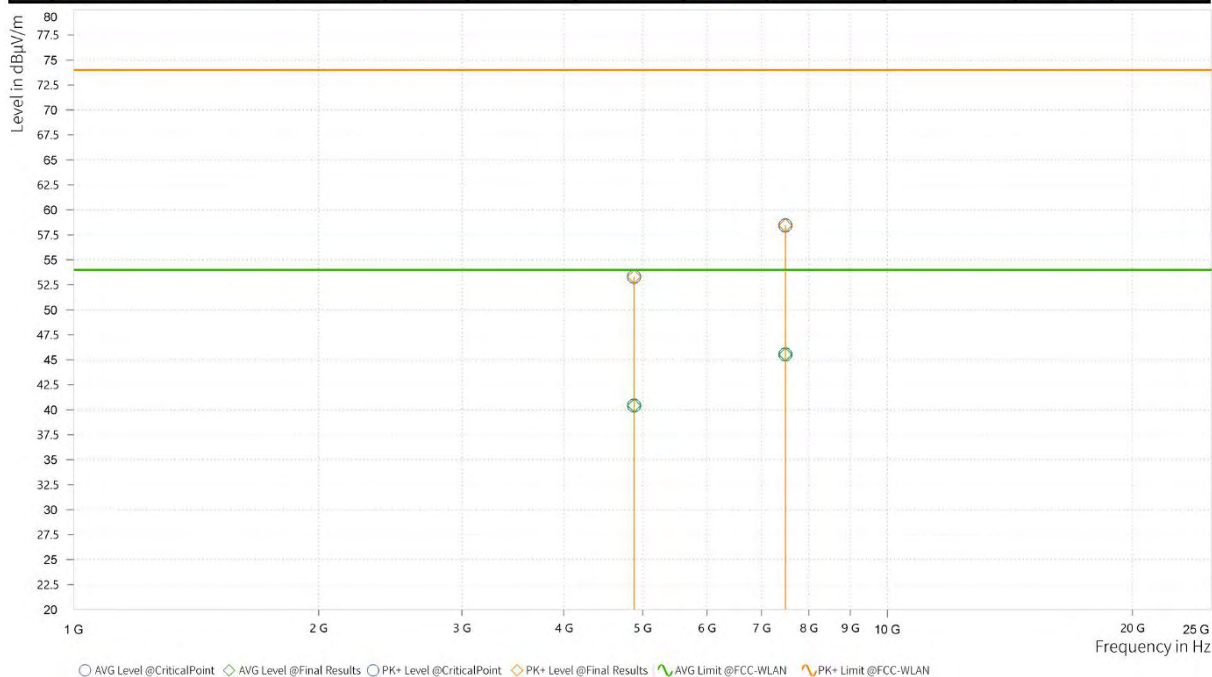
**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
3	4,882.456	51.74	74.00	22.26	40.37	54.00	13.63	15.95	H	359	1
4	7,484.050	58.47	74.00	15.53	45.74	54.00	8.26	23.86	H	0.9	2



**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
3	4,881.971	53.31	74.00	20.69	40.42	54.00	13.58	15.95	V	359	2
4	7,490.425	58.45	74.00	15.55	45.53	54.00	8.47	23.87	V	11.9	2



**REMARKS:**

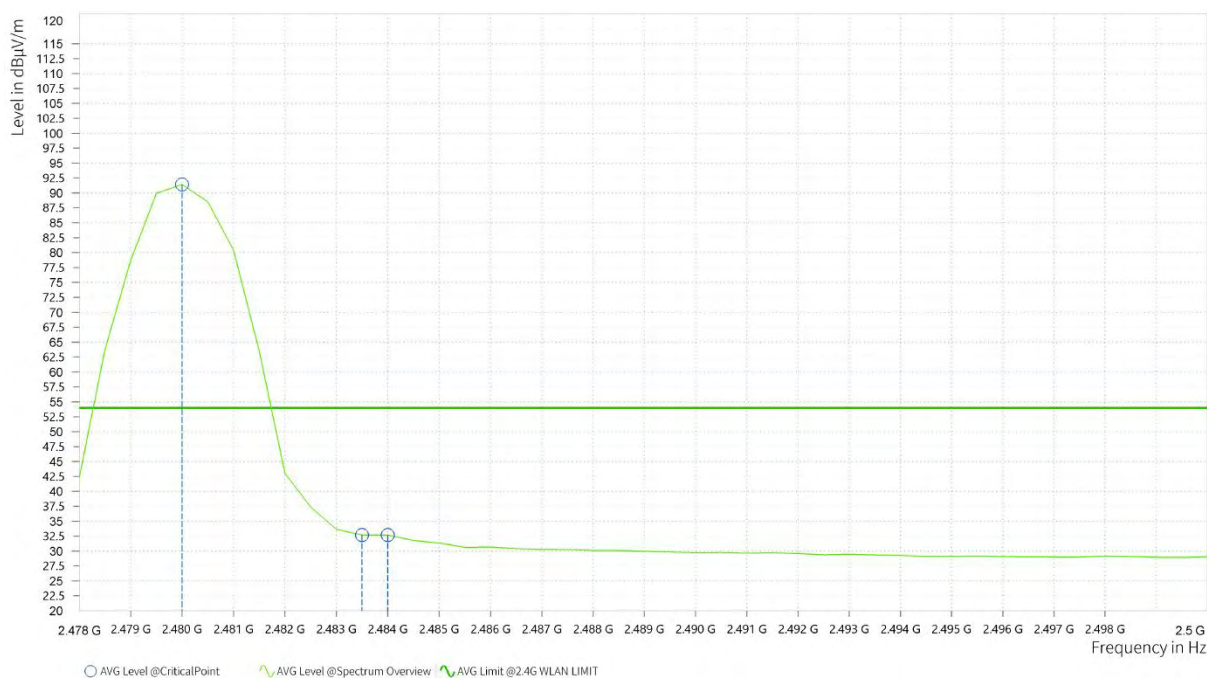
1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
2. 2441MHz: Fundamental frequency.



<b>CHANNEL</b>	TX Channel 78	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 25GHz		Average (AV)

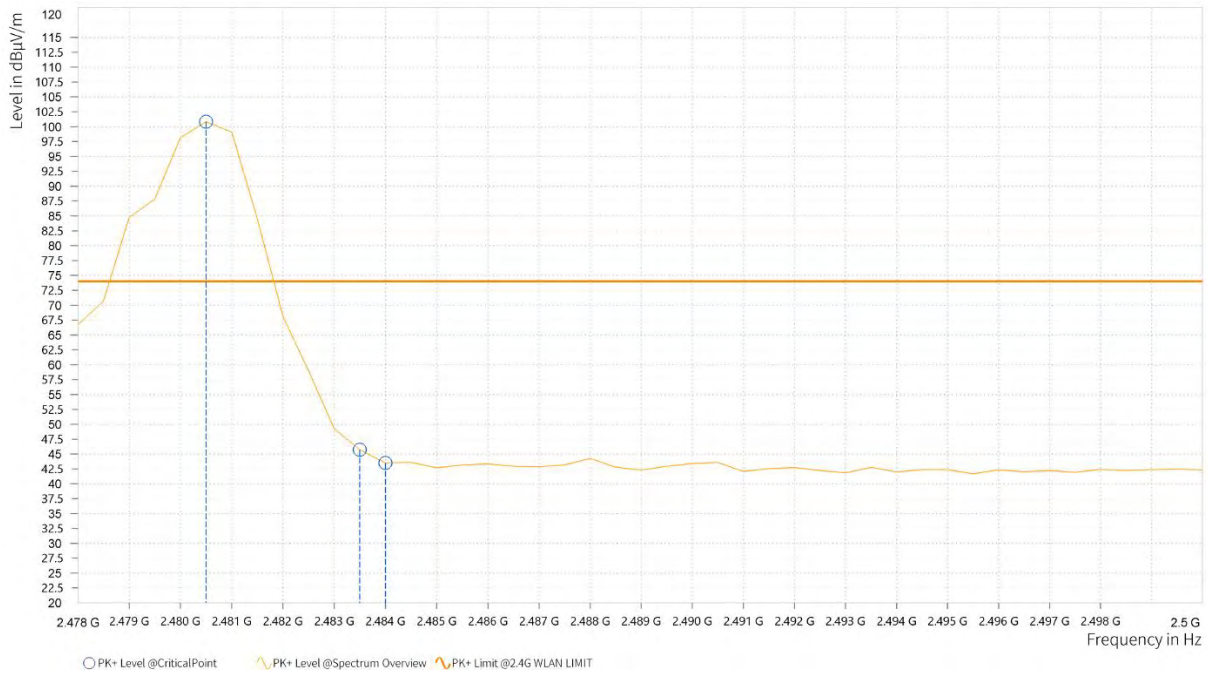
**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.000	91.41			9.89	H	186	1
1	2,483.500	32.68	54.00	21.32	9.88	H	300.6	2
1	2,484.000	32.68	54.00	21.32	9.88	H	300.6	2



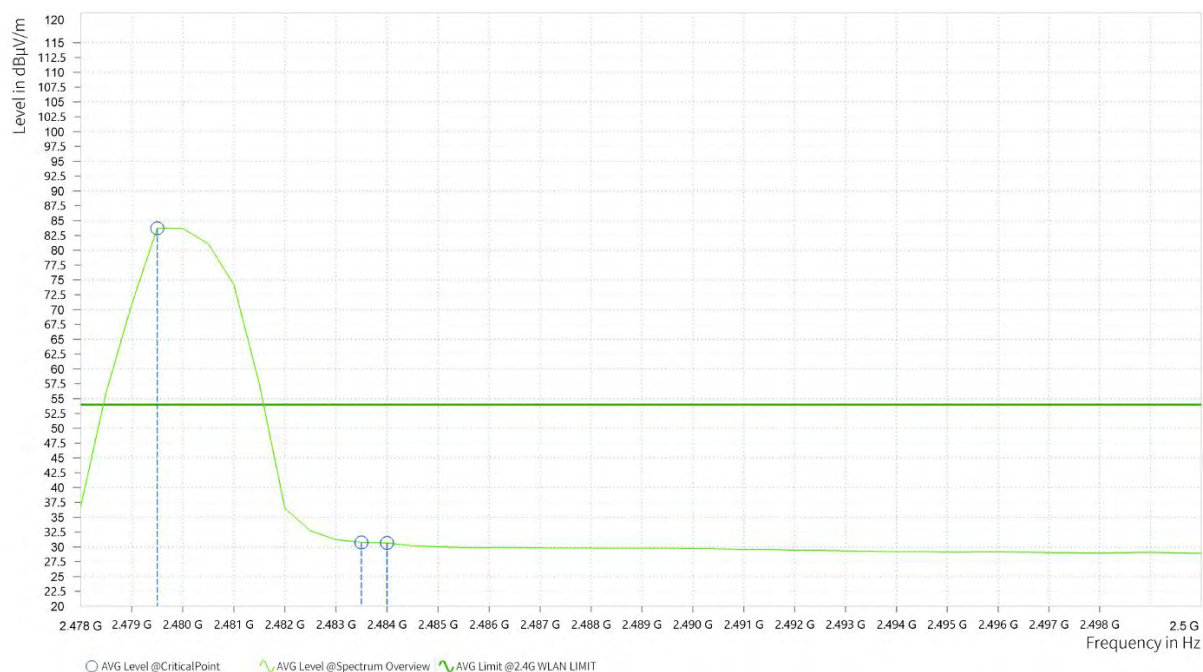


Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,480.500	100.83			9.89	H	177.7	1
1	2,483.500	45.71	74.00	28.29	9.88	H	227.7	2
1	2,484.000	43.51	74.00	30.49	9.88	H	310.2	2



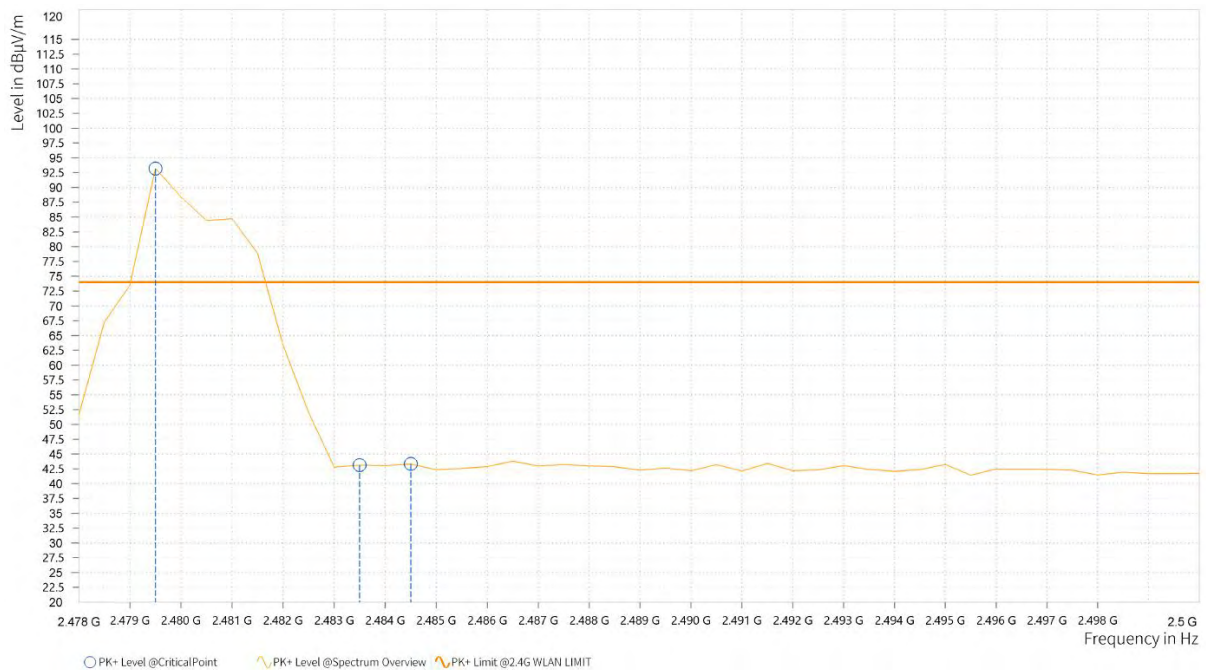
**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

Rg	Frequency [MHz]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,479.500	83.70			9.90	V	122.7	1
1	2,483.500	30.75	54.00	23.25	9.88	V	122.7	1
1	2,484.000	30.66	54.00	23.34	9.88	V	122.7	1





Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,479.500	93.20			9.90	V	150.2	1
1	2,483.500	43.14	74.00	30.86	9.88	V	285.2	2
1	2,484.500	43.32	74.00	30.68	9.88	V	359.1	1



## REMARKS:

- Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor  
Margin value = Limit value – Emission level.
- 2480MHz: Fundamental frequency.

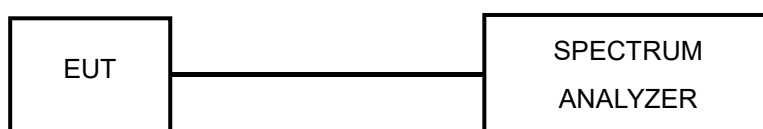


### 3.3 NUMBER OF HOPPING FREQUENCY USED

#### 3.3.1 LIMIT OF HOPPING FREQUENCY USED

At least 15 channels frequencies, and should be equally spaced.

#### 3.3.2 TEST SETUP



#### 3.3.3 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	R&S	ESW 44	101973	Feb.25,22	Feb.24,24
Open Switch and Control Unit	R&S	OSP-B157W8	100836	N/A	N/A
Vector Signal Generator	R&S	SMBV100B	102176	Feb.16,22	Feb.15,24
Signal Generator	R&S	SMB100A03	182185	Feb.16,22	Feb.15,24
Wideband Radio Communication	R&S	CMW500	169399	Jun.26,22	Jun.25,24
Hygrothermograph	DELI	20210528	SZ015	Sep.06,22	Sep.05,24
PC	LENOVO	E14	HRSW0024	N/A	N/A
CABLE	R&S	J12J103539-00-1	SEP-03-20-069	Oct.31,22	Apr.29,23
CABLE	R&S	J12J103539-00-1	SEP-03-20-070	Oct.31,22	Apr.29,23
Test Software	EMC32	EMC32	N/A	N/A	N/A
Temperature Chamber	votsch	VT4002	58566078100050	May.31,22	May.30,24

#### NOTE:

1. The calibration interval of the above test instruments is 6 months or 24 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.

### 3.3.4 TEST PROCEDURES

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- d. Set the SA on View mode and then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were completed.

### 3.3.5 DEVIATION FROM TEST STANDARD

No deviation.

### 3.3.6 TEST RESULTS

There are 79 hopping frequencies in the hopping mode. Please refer to next two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

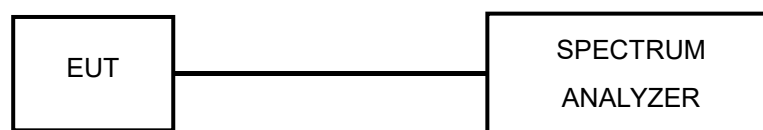
Please Refer to Appendix Of this test report.

### 3.4 DWELL TIME ON EACH CHANNEL

#### 3.4.1 LIMIT OF DWELL TIME USED

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### 3.4.2 TEST SETUP



#### 3.4.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

#### 3.4.4 TEST PROCEDURES

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- e. Repeat above procedures until all different time-slot modes have been completed.



### 3.4.5 DEVIATION FROM TEST STANDARD

No deviation.

### 3.4.6 TEST RESULTS

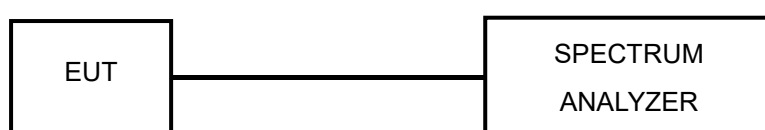
Please Refer to Appendix Of this test report

### 3.5 CHANNEL BANDWIDTH

#### 3.5.1 LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

#### 3.5.2 TEST SETUP



#### 3.5.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

#### 3.5.4 TEST PROCEDURE

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

#### 3.5.5 DEVIATION FROM TEST STANDARD

No deviation.

### 3.5.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

### 3.5.7 TEST RESULTS

Please Refer to Appendix Of this test report.

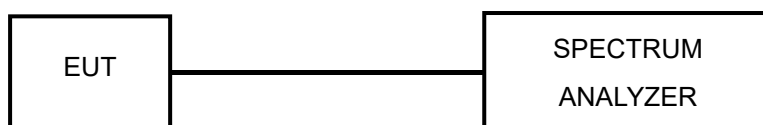


### 3.6 HOPPING CHANNEL SEPARATION

#### 3.6.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater).

#### 3.6.2 TEST SETUP



#### 3.6.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

#### 3.6.4 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

#### 3.6.5 DEVIATION FROM TEST STANDARD

No deviation.



### 3.6.6 TEST RESULTS

Please Refer to Appendix Of this test report.

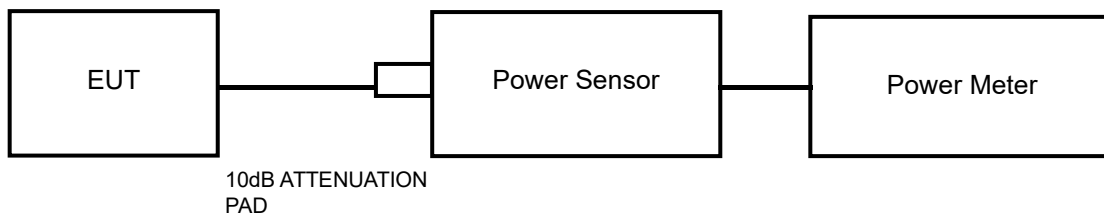


### 3.7 MAXIMUM OUTPUT POWER

#### 3.7.1 LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT

The Maximum Output Power Measurement is 125mW.

#### 3.7.2 TEST SETUP



#### 3.7.3 TEST INSTRUMENTS

Refer to section 3.3.3 to get information of above instrument.

#### 3.7.4 TEST PROCEDURES

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

### 3.7.5 DEVIATION FROM TEST STANDARD

No deviation.

### 3.7.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



### 3.7.7 TEST RESULTS

#### 3.7.7.1 MAXIMUM PEAK OUTPUT POWER

Please Refer to Appendix Of this test report.

### 3.7.7.2 Average Output Power (FOR REFERENCE)

The average power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

Please Refer to Appendix Of this test report.



### **3.8 OUT OF BAND MEASUREMENT**

#### **3.8.1 LIMITS OF OUT OF BAND MEASUREMENT**

Below -20dB of the highest emission level of operating band (in 100KHz RBW).

#### **3.8.2 TEST INSTRUMENTS**

Refer to section 3.3.3 to get information of above instrument.

#### **3.8.3 TEST PROCEDURE**

The transmitter output was connected to the spectrum analyzer via a low loss cable. Spectrum Analyzer was set RBW to 100 kHz and VBW to 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

#### **3.8.4 DEVIATION FROM TEST STANDARD**

No deviation.

#### **3.8.5 EUT OPERATING CONDITION**

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### **3.8.6 TEST RESULTS**

The spectrum plots are attached on the following images. D1 line indicates the highest level. D2 line indicates the 20dB offset below D1. It shows compliance to the requirement.

Please Refer to Appendix Of this test report.



## 4 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



## **5 MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications are made to the EUT by the lab during the test.



## 6 APPENDIX

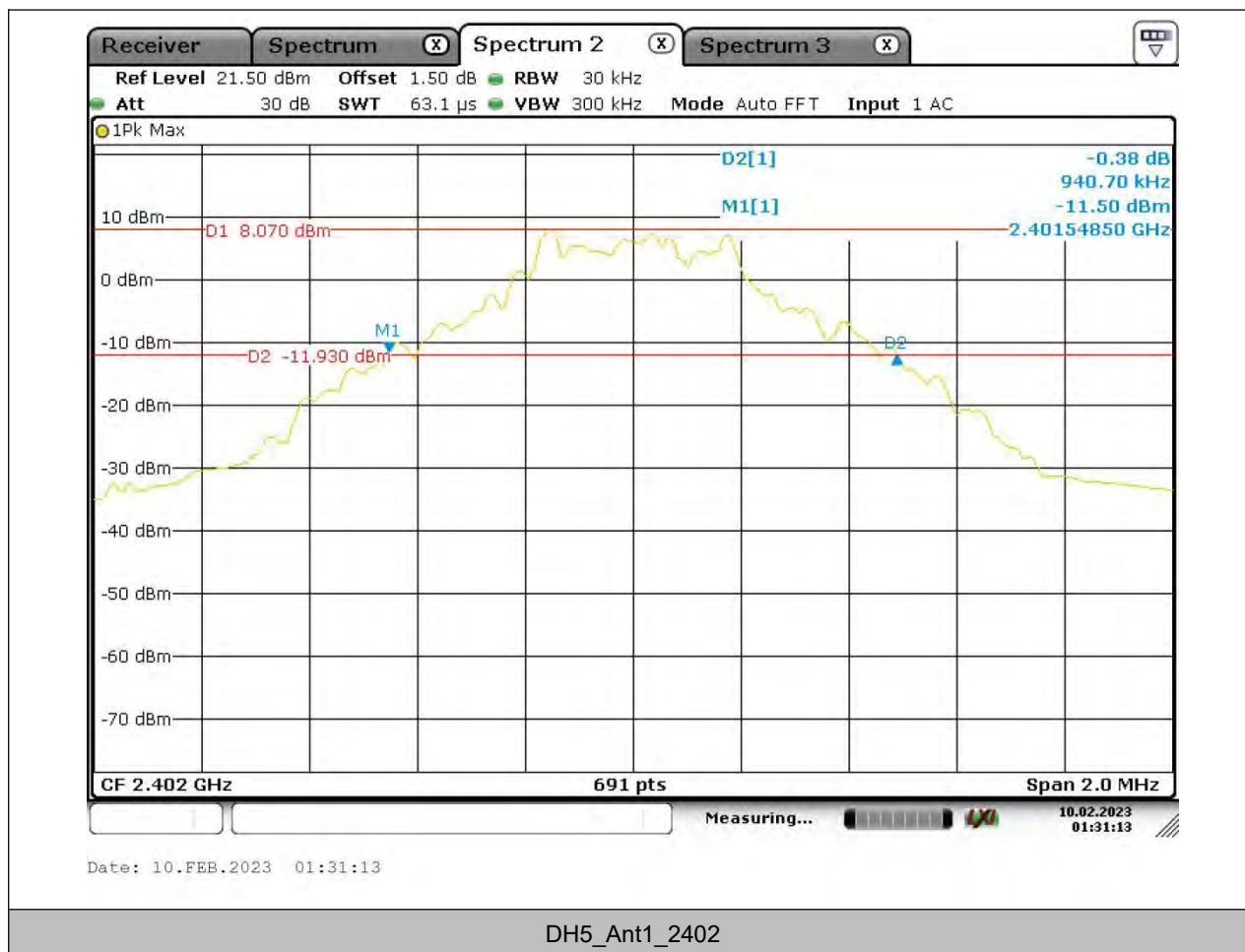
### 20DB EMISSION BANDWIDTH

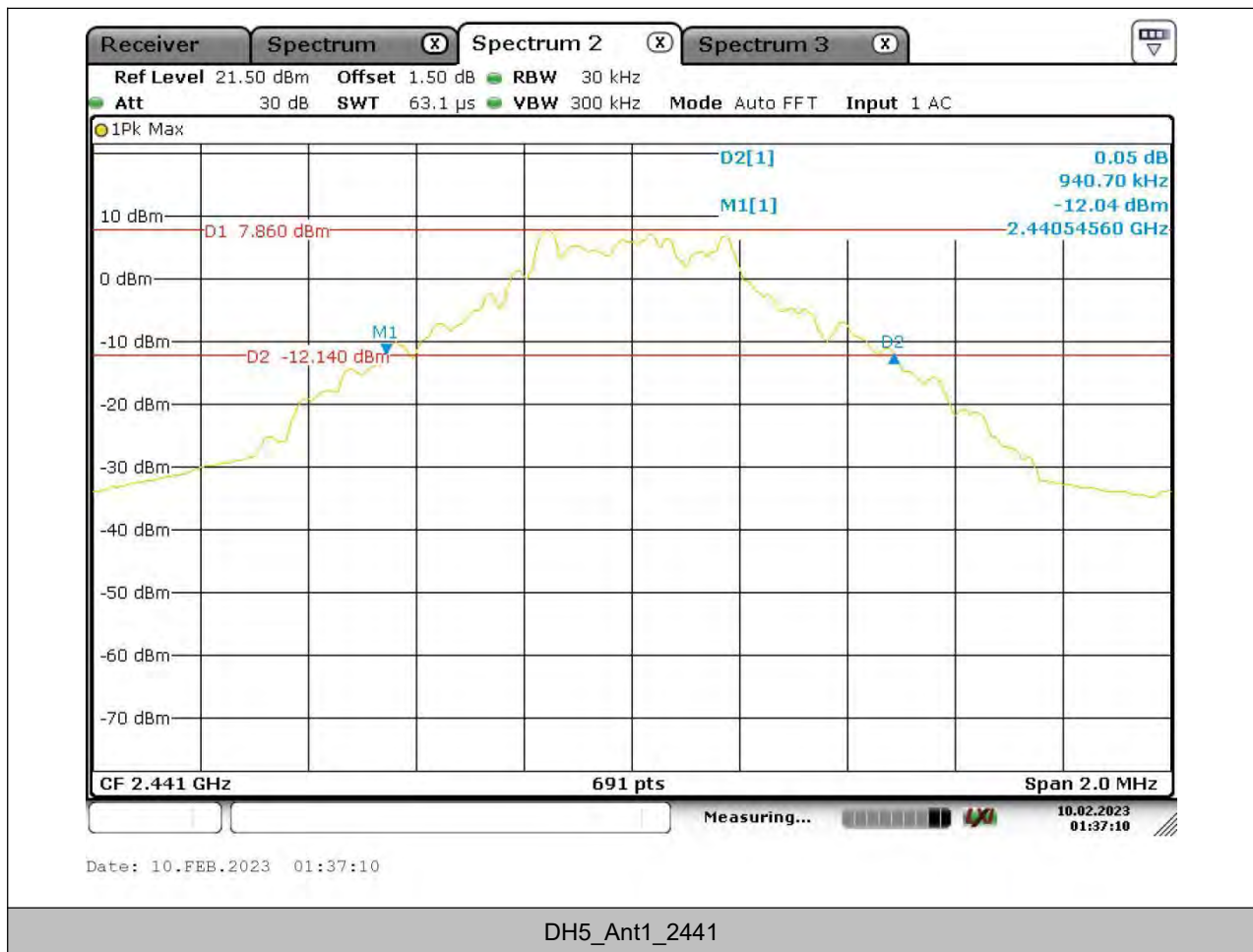
#### TEST RESULT

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.9407	2401.549	2402.490	---	PASS
		2441	0.9407	2440.546	2441.487	---	PASS
		2480	0.9407	2479.542	2480.483	---	PASS
2DH5	Ant1	2402	1.2851	2401.375	2402.660	---	PASS
		2441	1.2851	2440.375	2441.660	---	PASS
		2480	1.2822	2479.375	2480.657	---	PASS
3DH5	Ant1	2402	1.2880	2401.360	2402.648	---	PASS
		2441	1.2880	2440.363	2441.651	---	PASS
		2480	1.2880	2479.363	2480.651	---	PASS

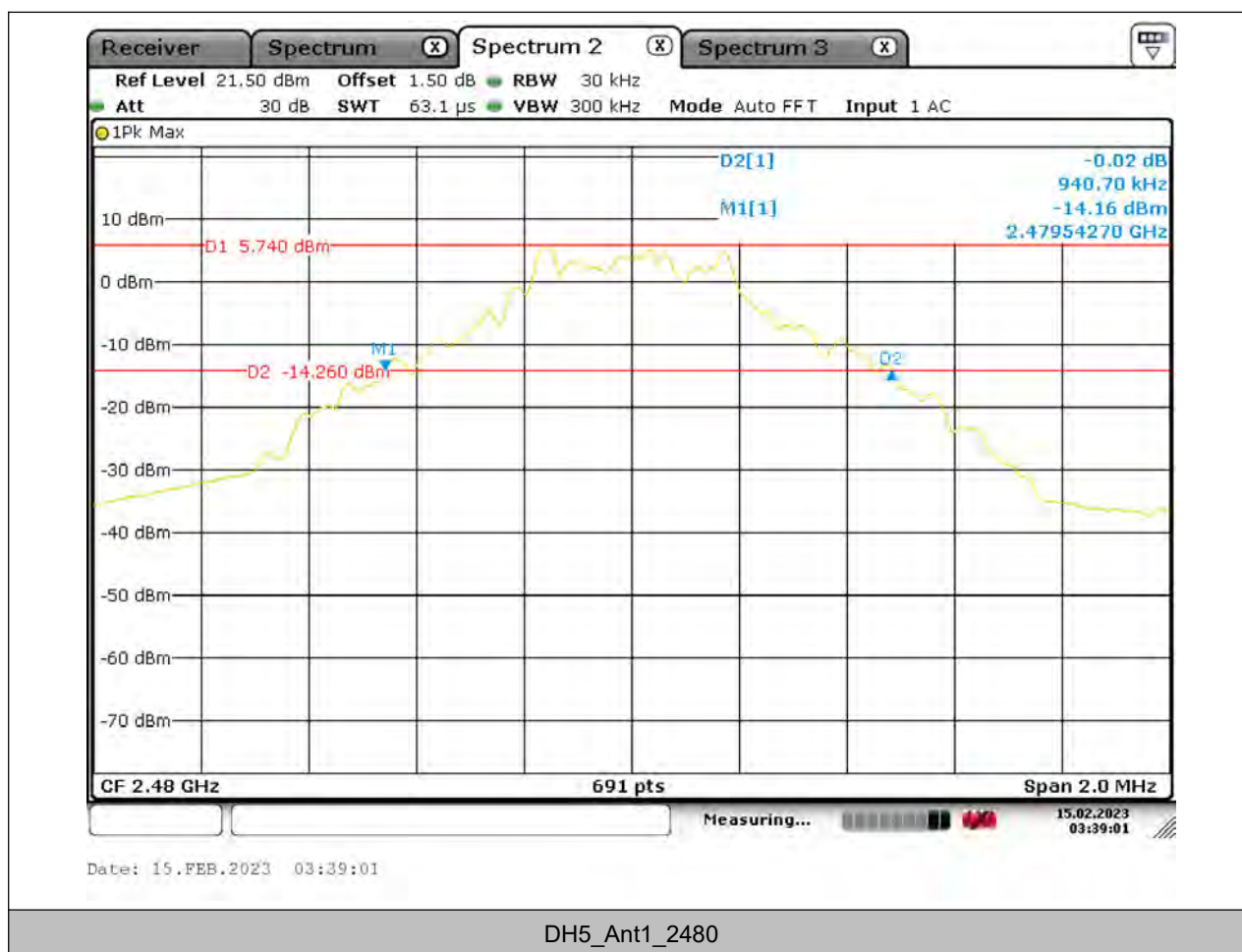


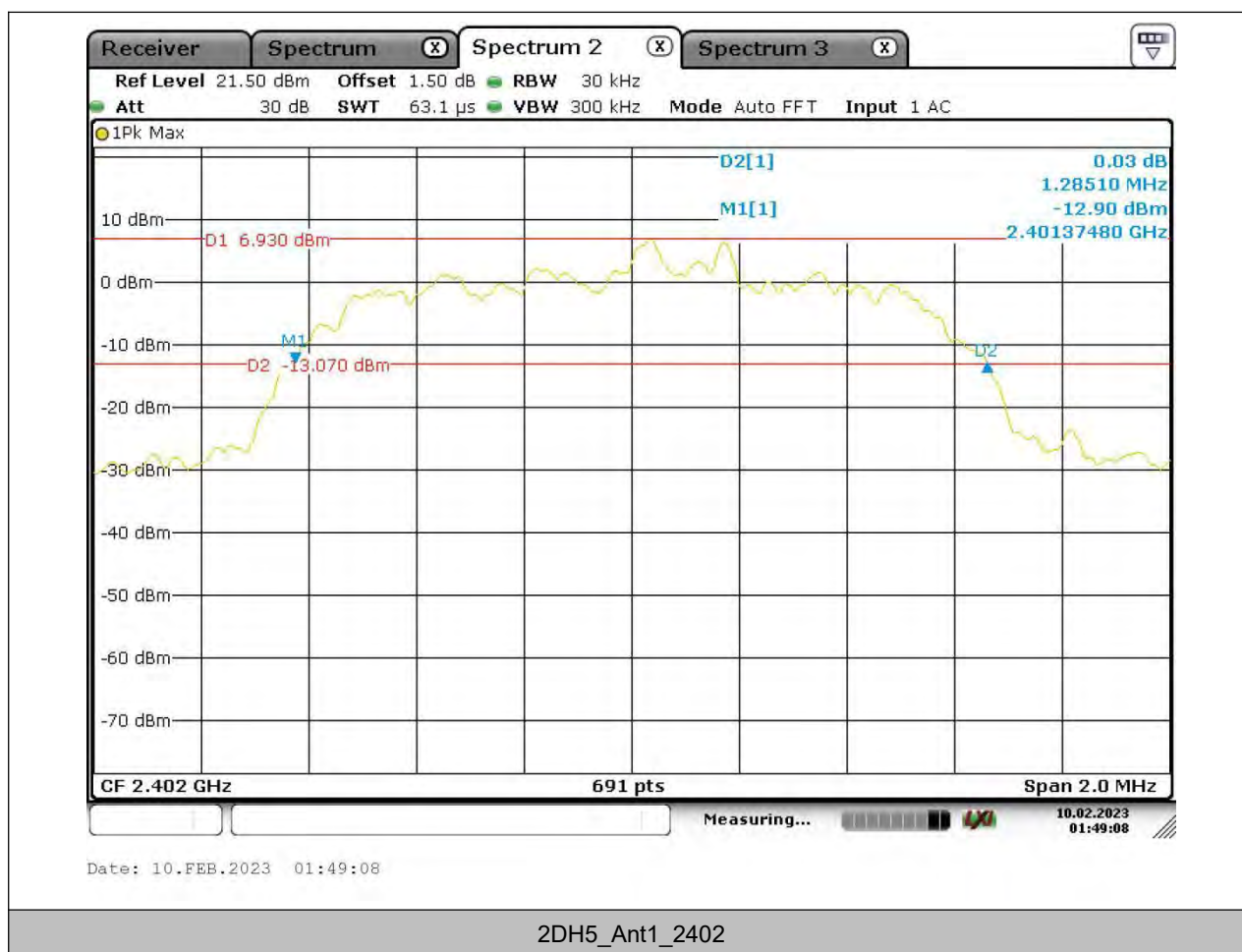
## TEST GRAPHS

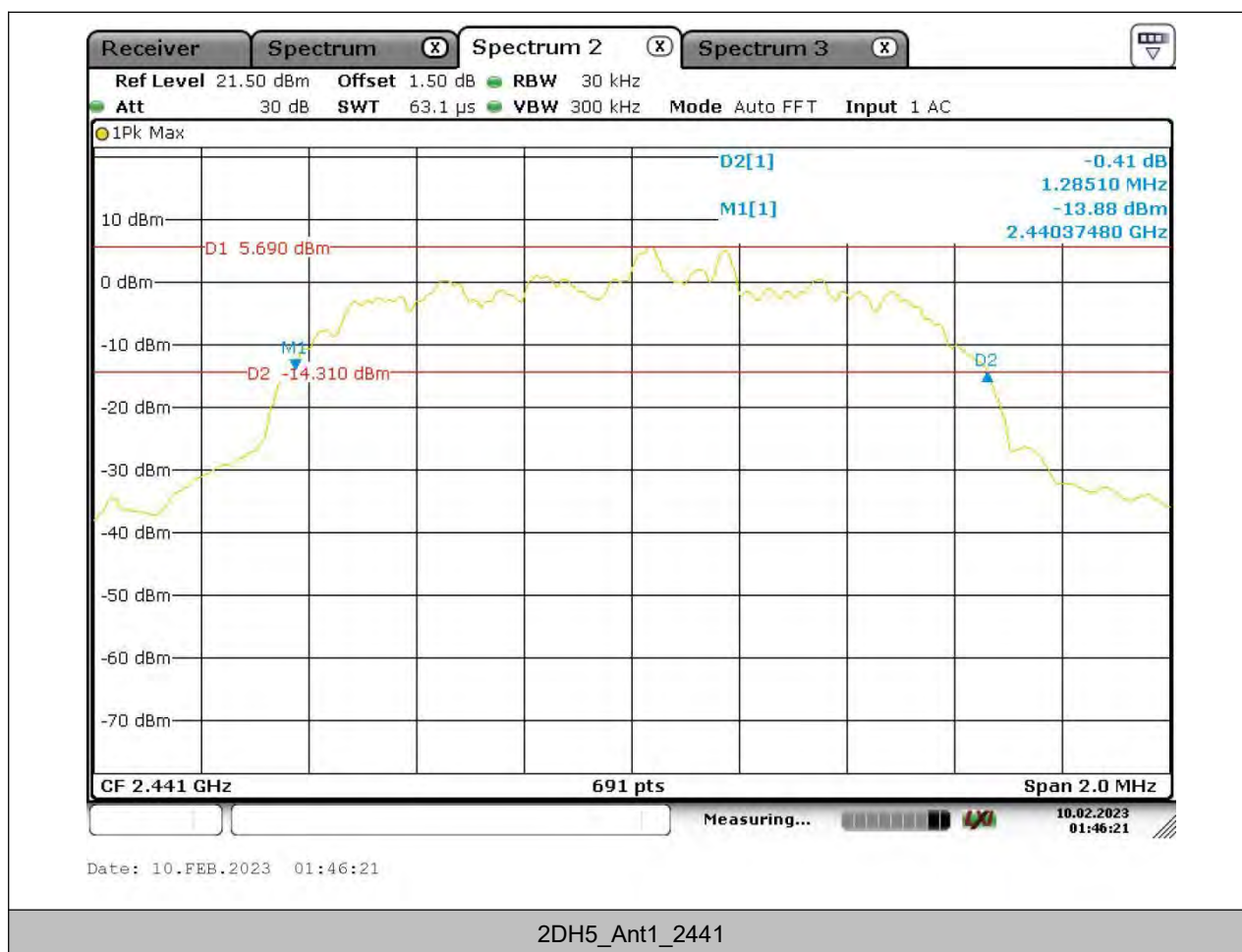


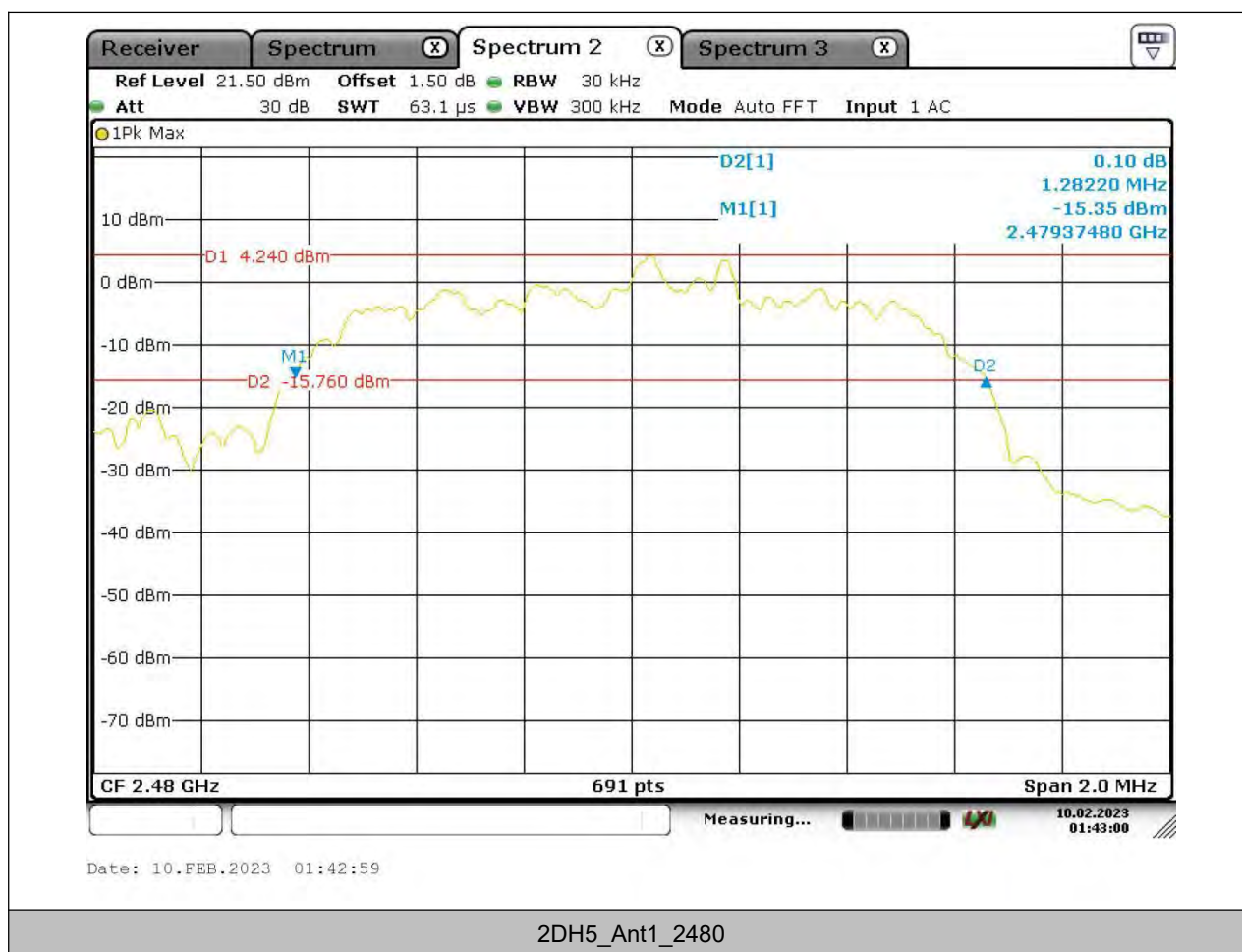


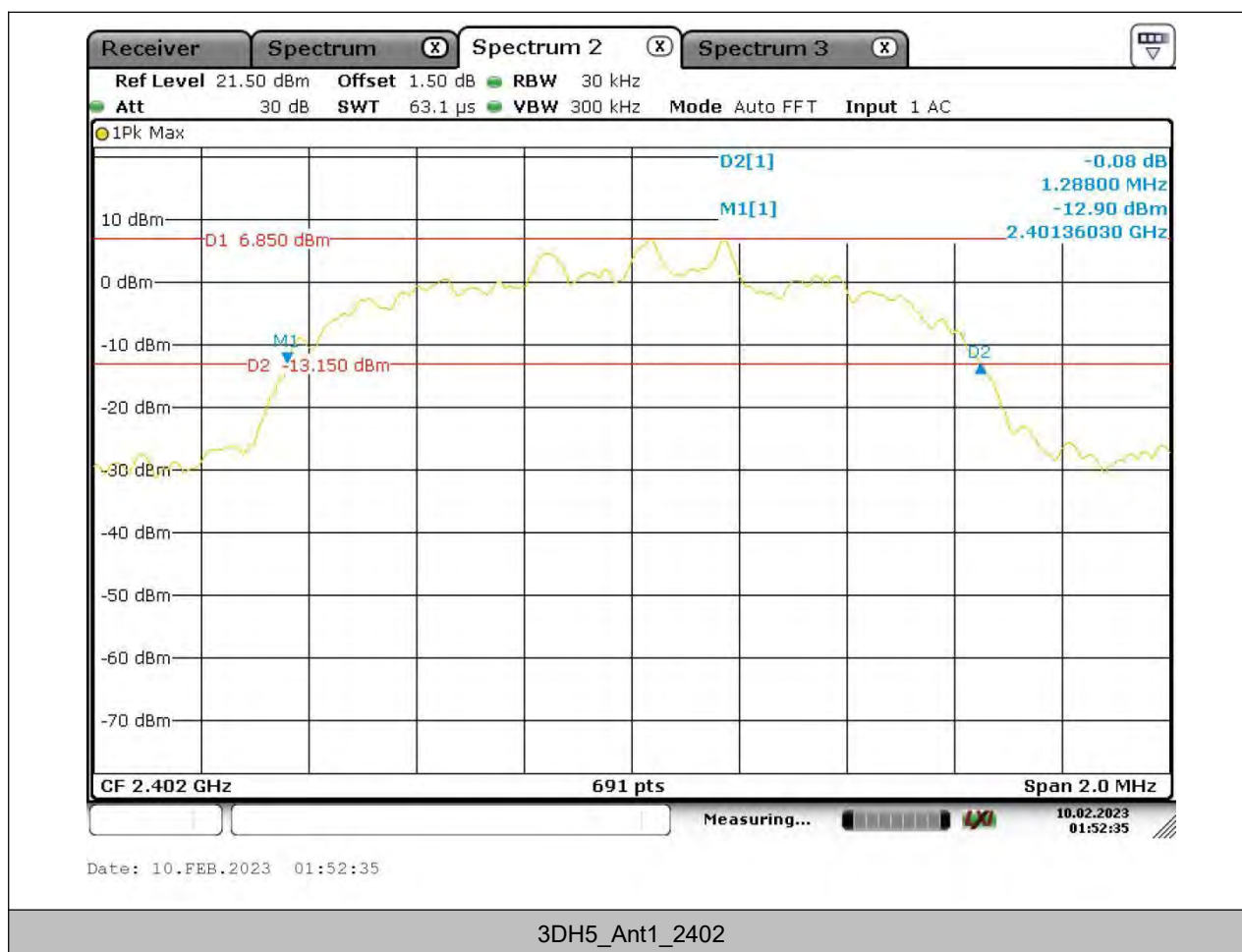


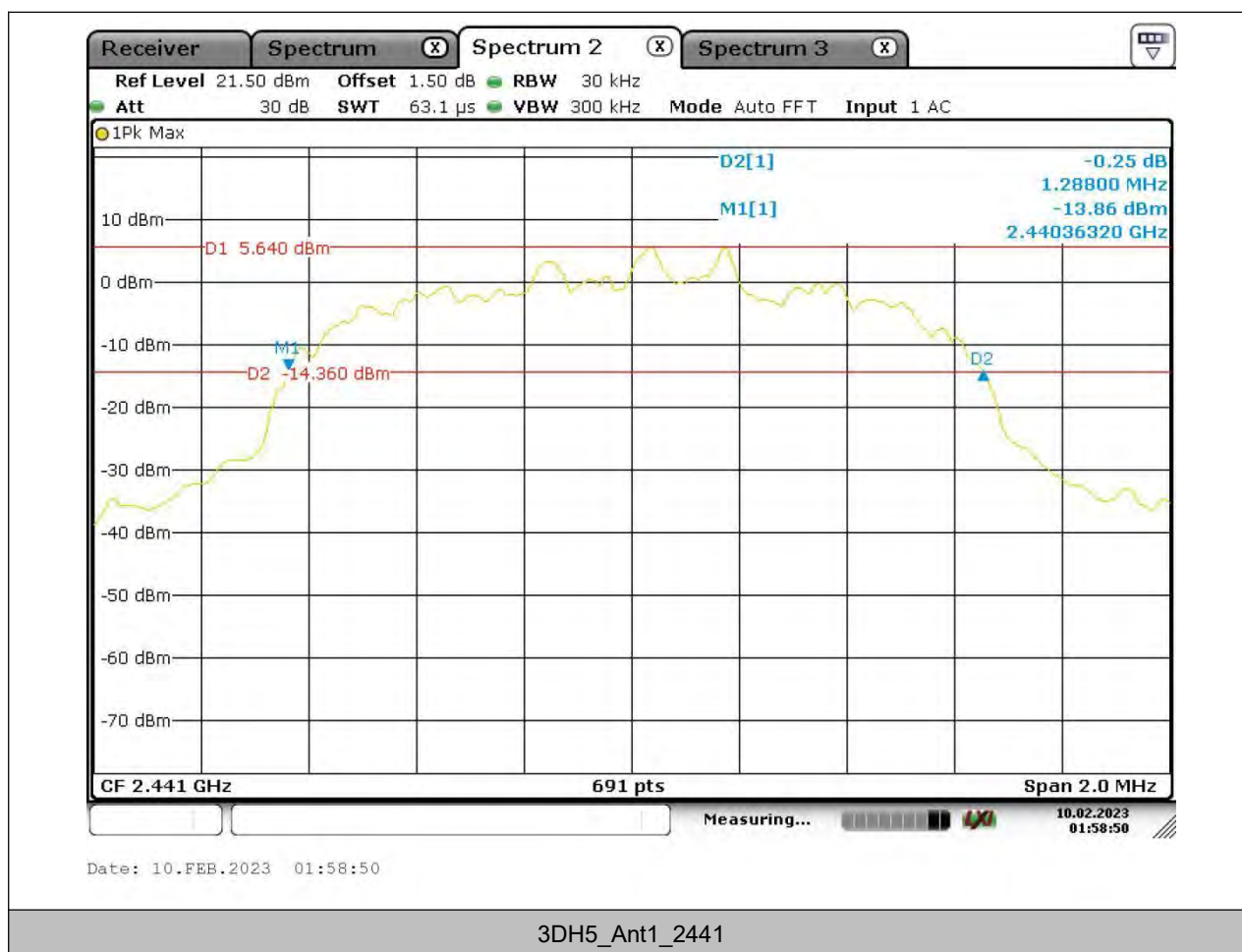




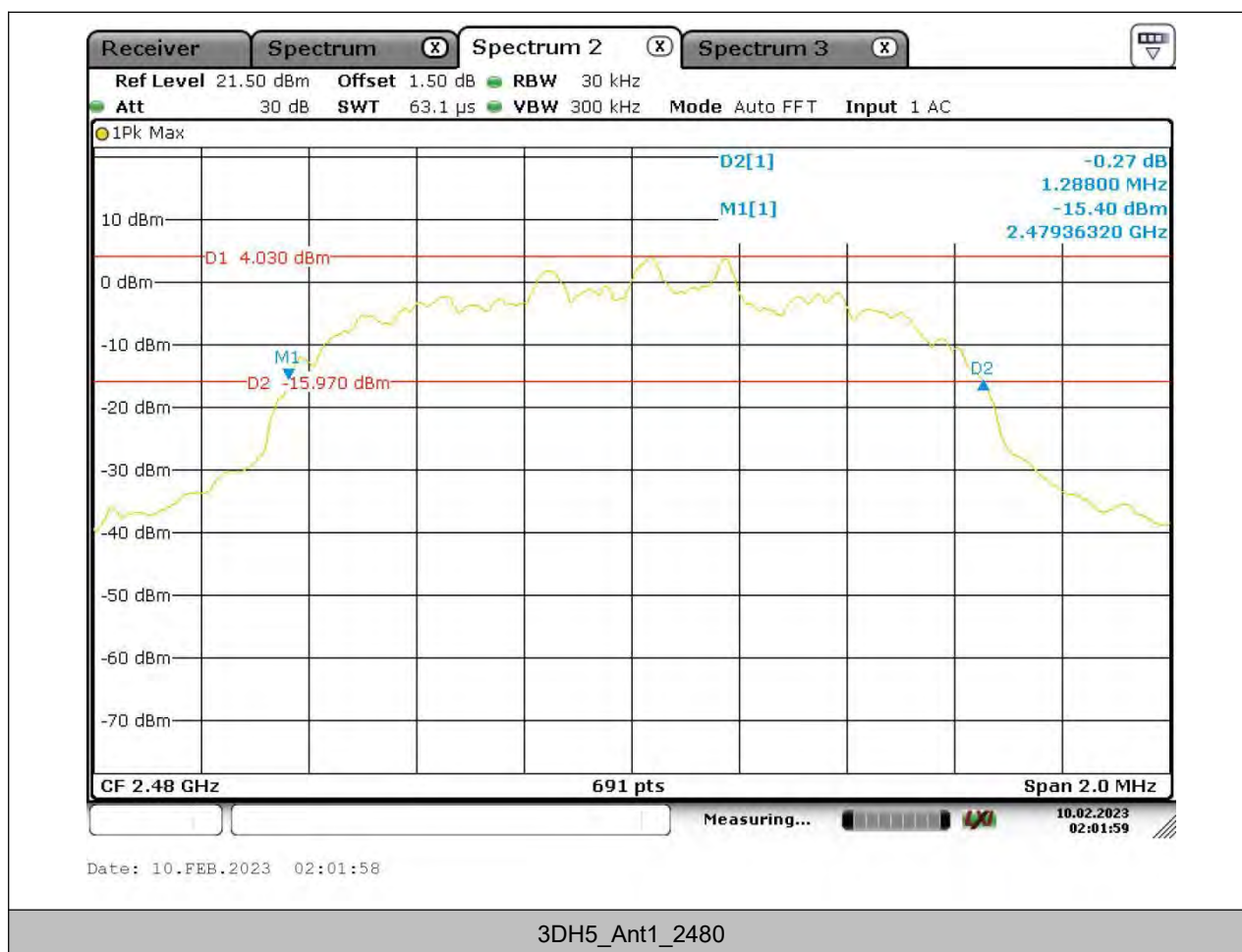












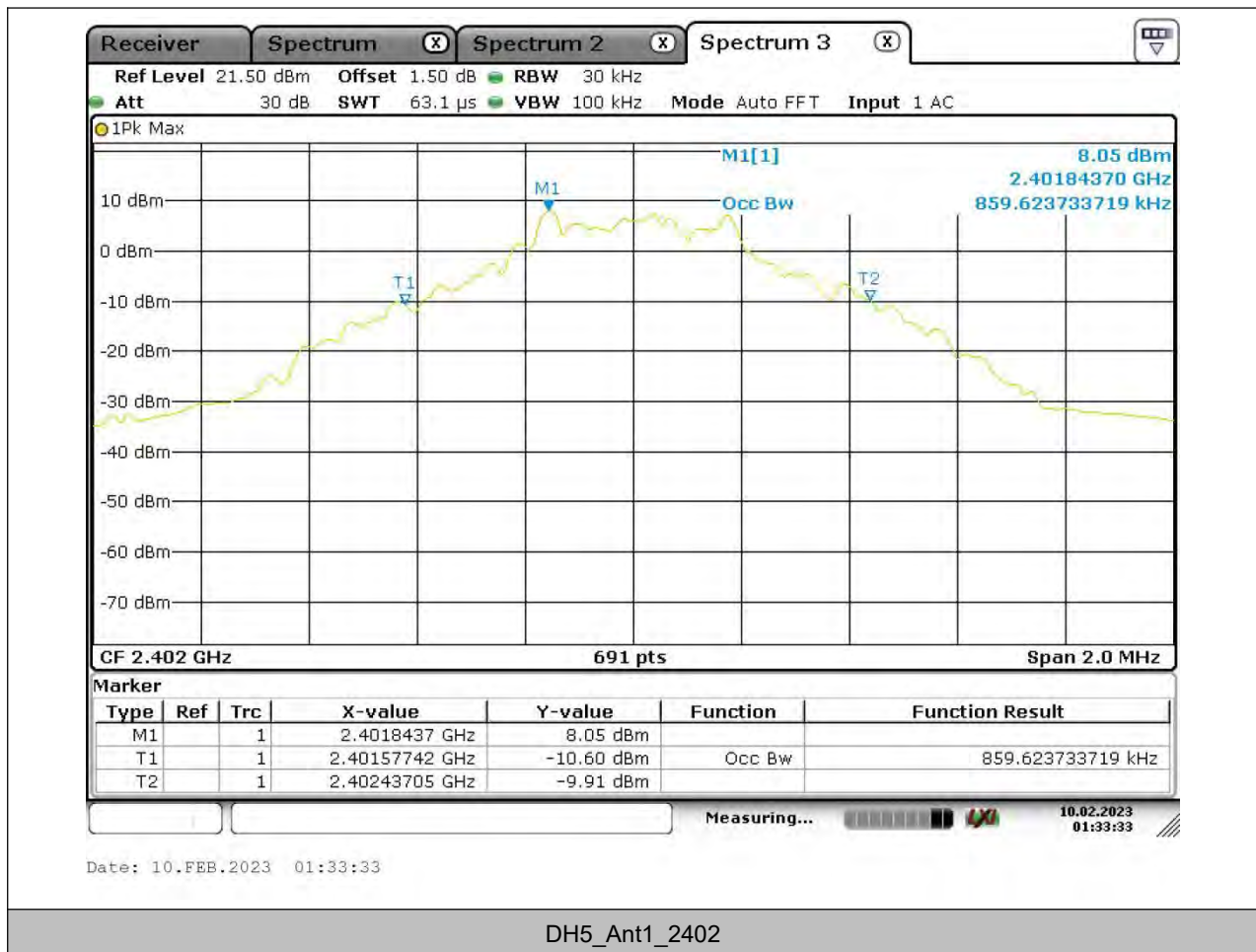


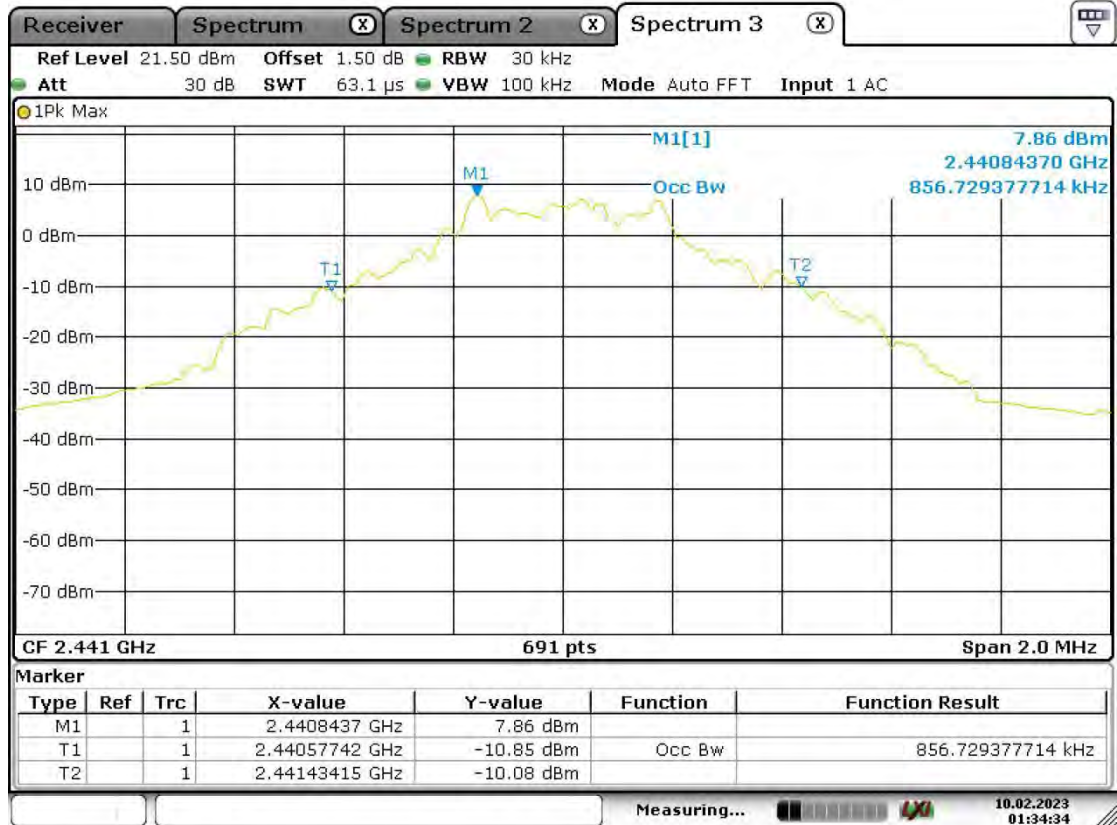
**OCCUPIED CHANNEL BANDWIDTH**  
**TEST RESULT**

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.8596	2401.577	2402.437	---	PASS
		2441	0.8567	2440.577	2441.434	---	PASS
		2480	0.8567	2479.577	2480.434	---	PASS
2DH5	Ant1	2402	1.1867	2402.415	2403.602	---	PASS
		2441	1.1809	2440.415	2441.596	---	PASS
		2480	1.1809	2480.415	2481.596	---	PASS
3DH5	Ant1	2402	1.1838	2402.415	2403.599	---	PASS
		2441	1.1809	2440.418	2441.599	---	PASS
		2480	1.1925	2480.406	2481.599	---	PASS



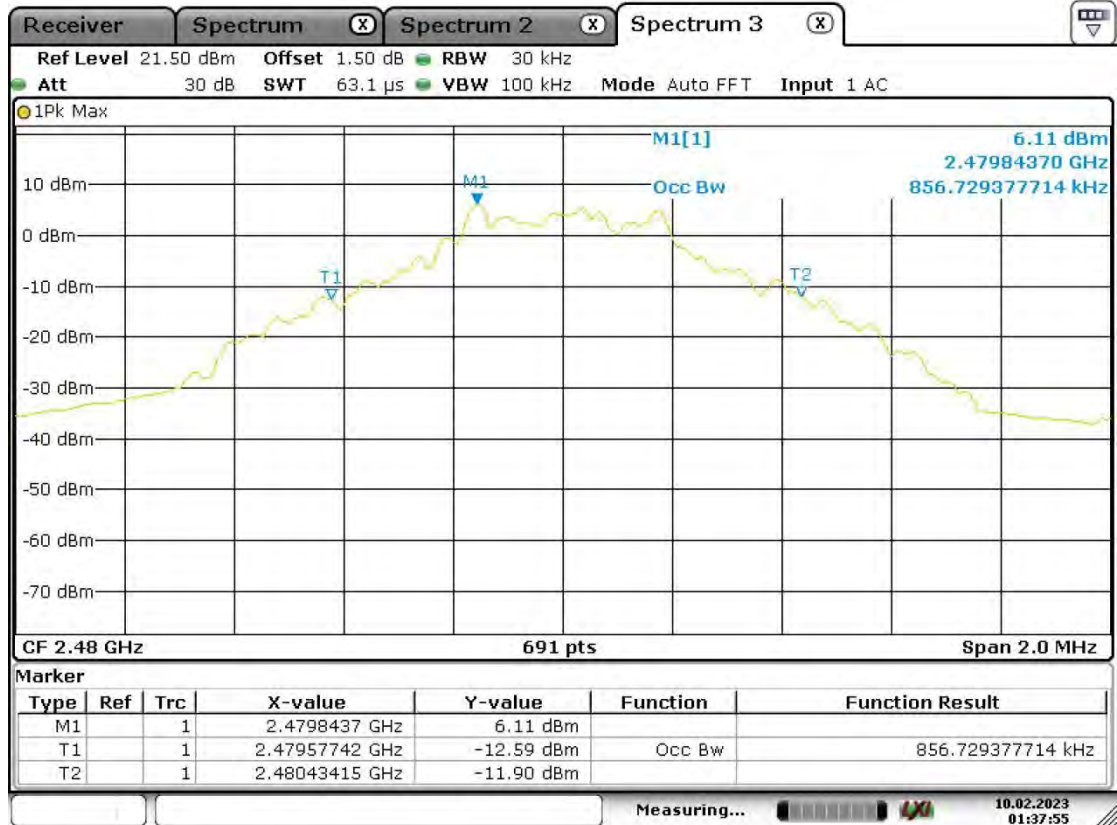
## TEST GRAPHS





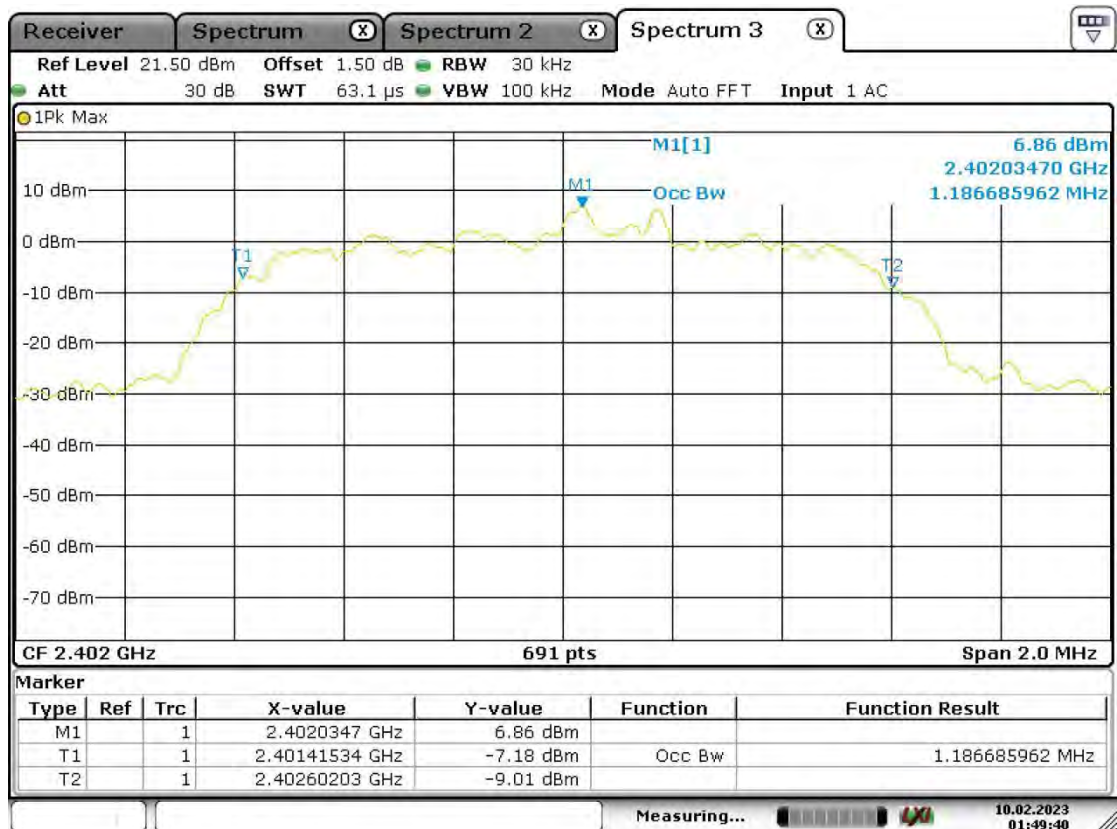
Date: 10.FEB.2023 01:34:34

DH5\_Ant1\_2441



Date: 10.FEB.2023 01:37:55

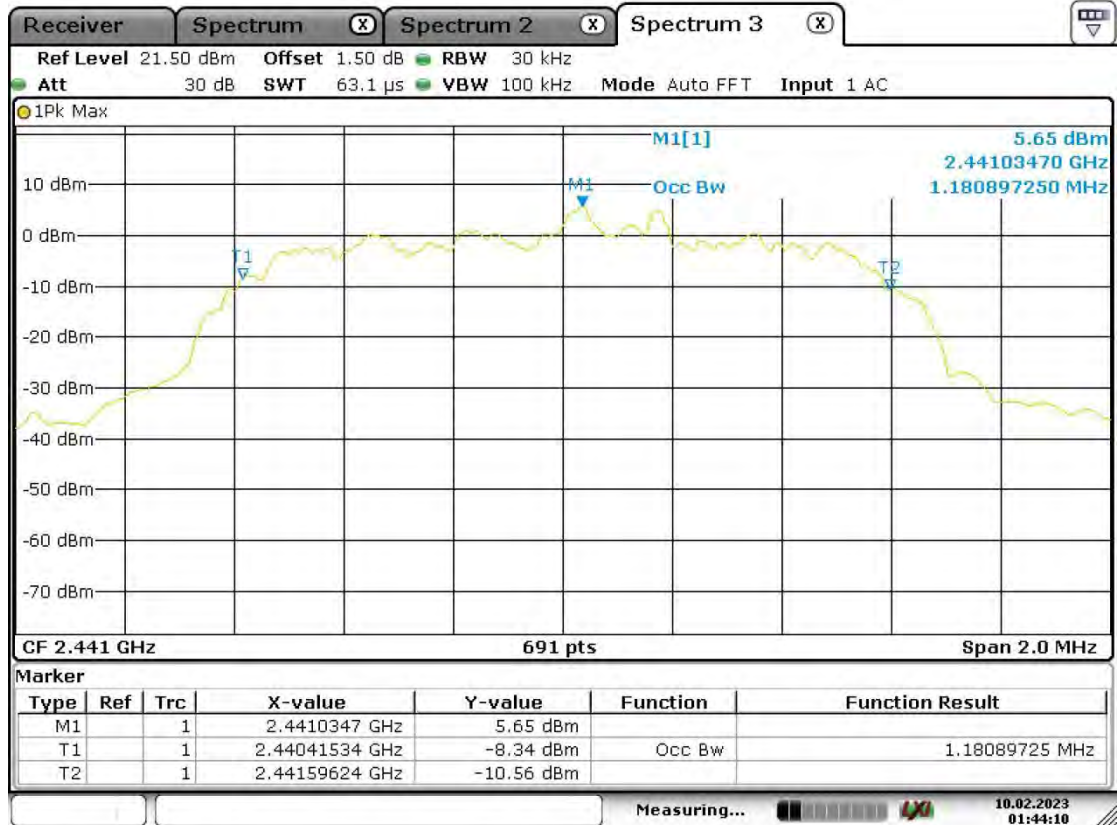
DH5\_Ant1\_2480



Date: 10.FEB.2023 01:49:39

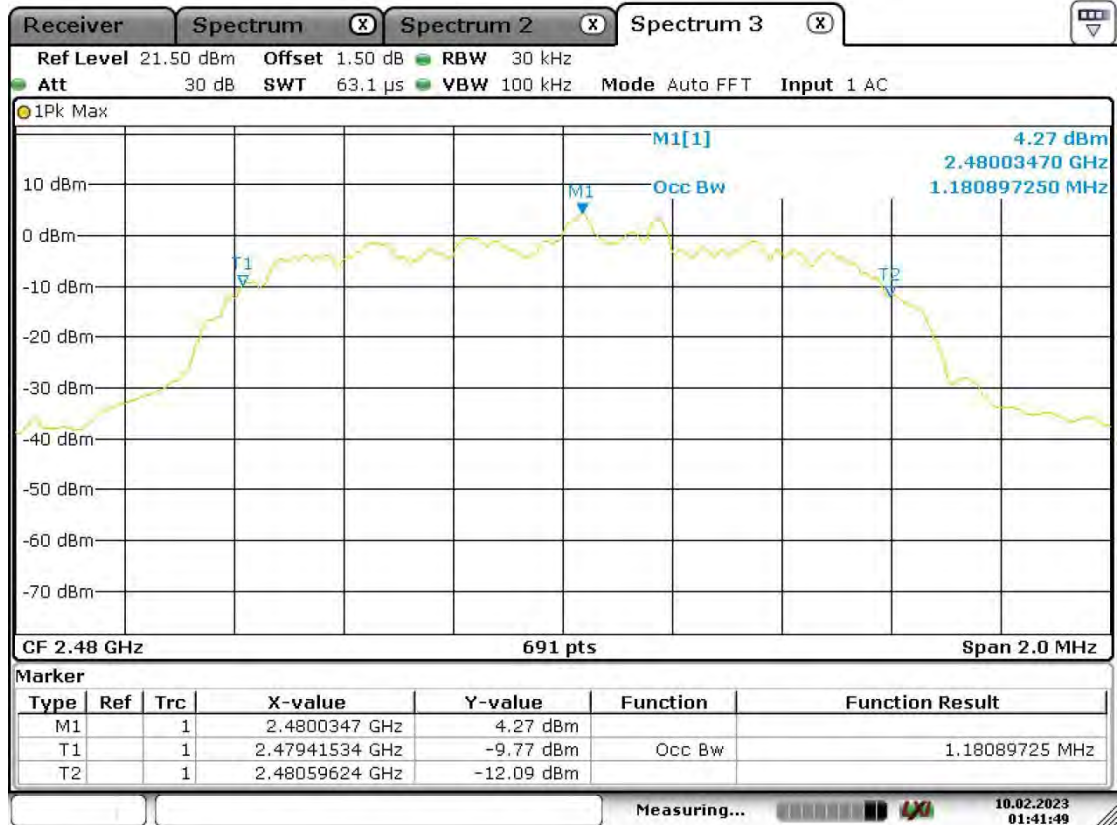
2DH5\_Ant1\_2402





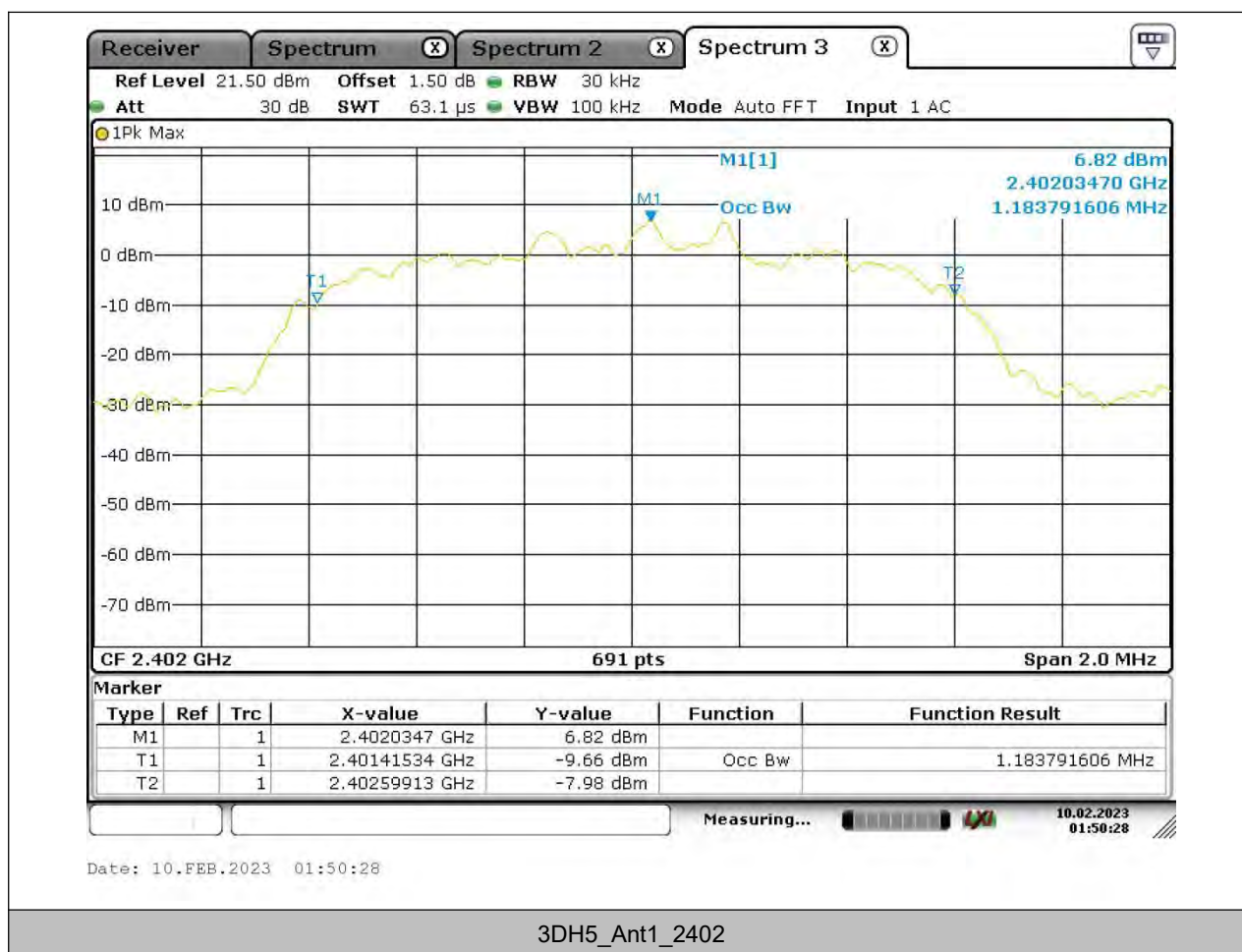
Date: 10.FEB.2023 01:44:10

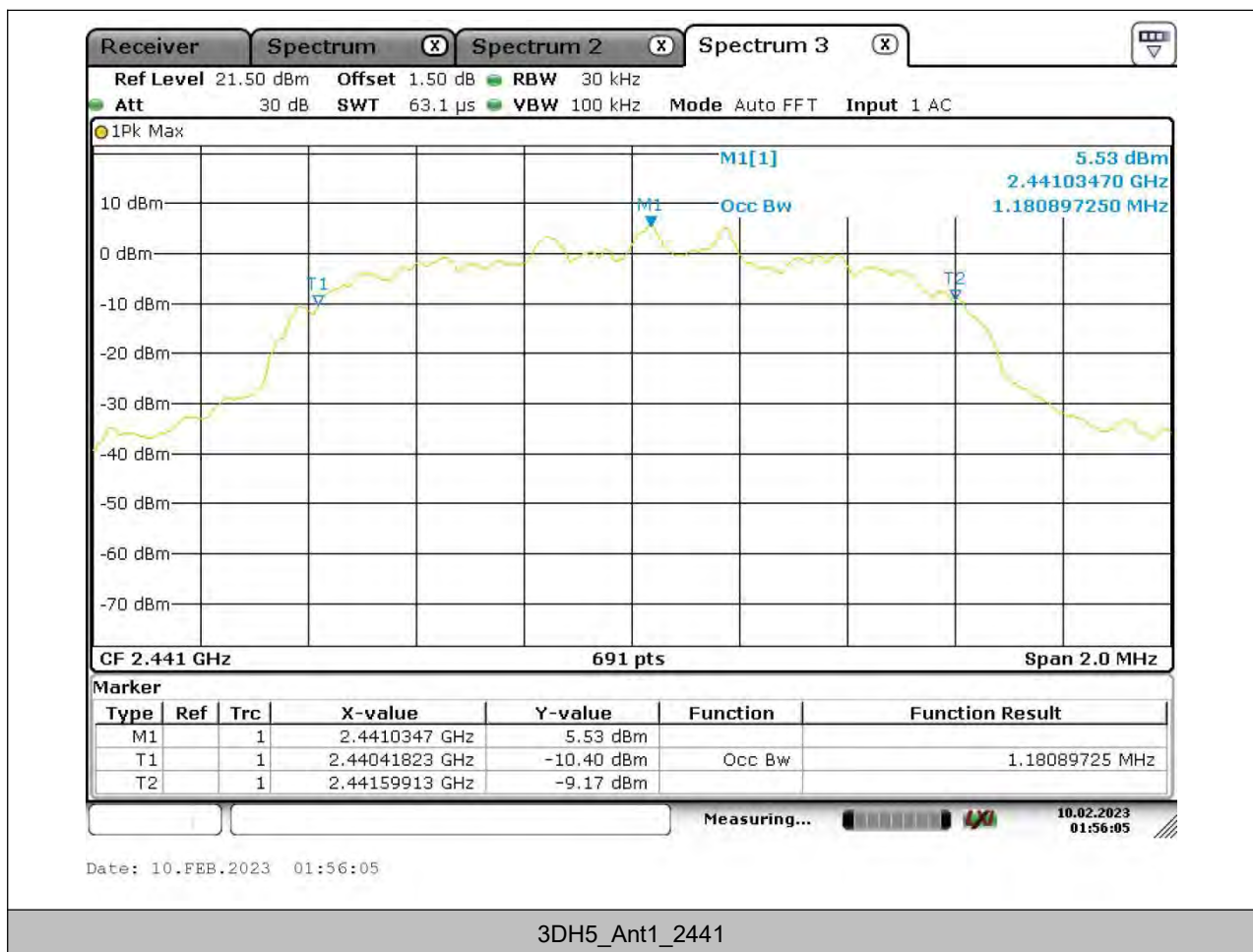
2DH5\_Ant1\_2441

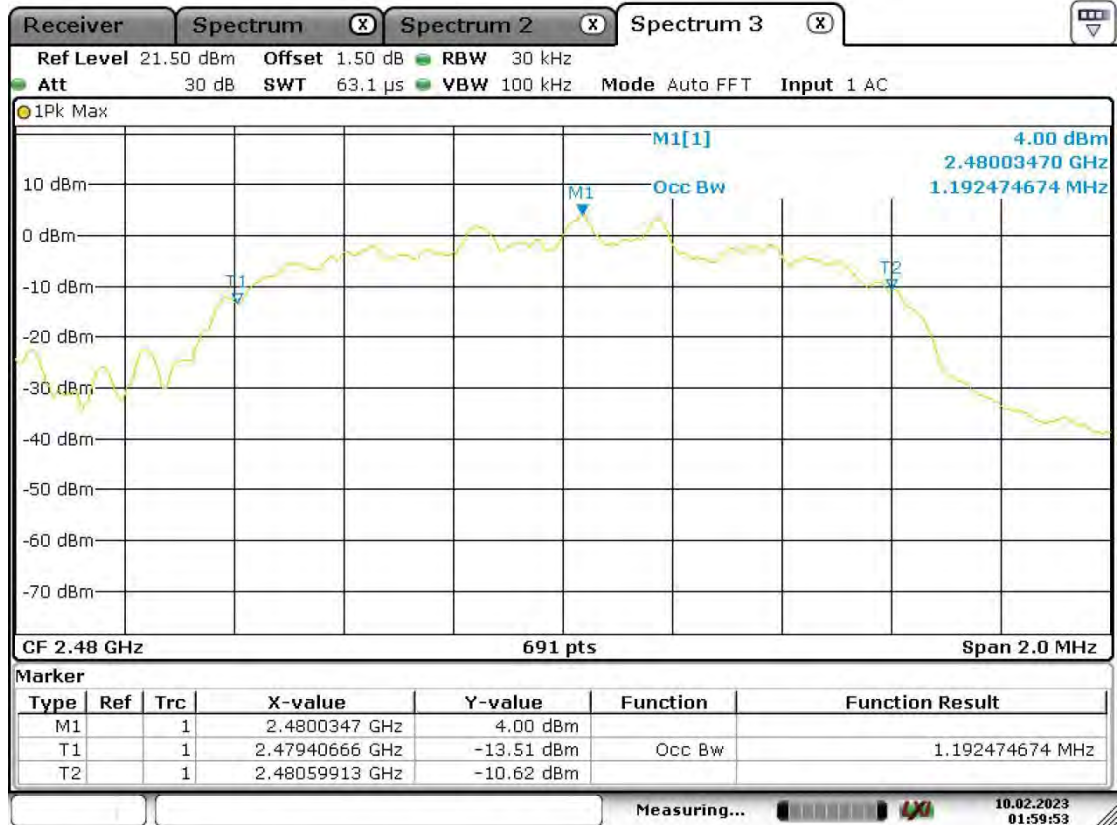


Date: 10.FEB.2023 01:41:49

2DH5\_Ant1\_2480







Date: 10.FEB.2023 01:59:52

3DH5\_Ant1\_2480



## MAXIMUM CONDUCTED OUTPUT POWER

### TEST RESULT PEAK

TestMode	Antenna	Channel	Peak Power[dBm]	Peak Power[mw]	Conducted Limit[mw]	Verdict	Power setting
DH5	Ant1	2402	9.45	8.81	≤125	PASS	4
		2441	9.08	8.09	≤125	PASS	4
		2480	7.98	6.28	≤125	PASS	4
2DH5	Ant1	2402	10.83	12.11	≤125	PASS	4
		2441	9.65	9.23	≤125	PASS	4
		2480	8.74	7.48	≤125	PASS	4
3DH5	Ant1	2402	10.99	12.56	≤125	PASS	4
		2441	9.92	9.82	≤125	PASS	4
		2480	9.05	8.04	≤125	PASS	4

### TEST RESULT AVERAGE

TestMode	Antenna	Channel	Average Power	Conducted Limit[dBm]	Verdict	Power setting
DH5	Ant1	2402	9.39	/	PASS	4
		2441	8.98	/	PASS	4
		2480	7.94	/	PASS	4
2DH5	Ant1	2402	8.41	/	PASS	4
		2441	7.01	/	PASS	4
		2480	6.16	/	PASS	4
3DH5	Ant1	2402	8.40	/	PASS	4
		2441	6.99	/	PASS	4
		2480	6.11	/	PASS	4





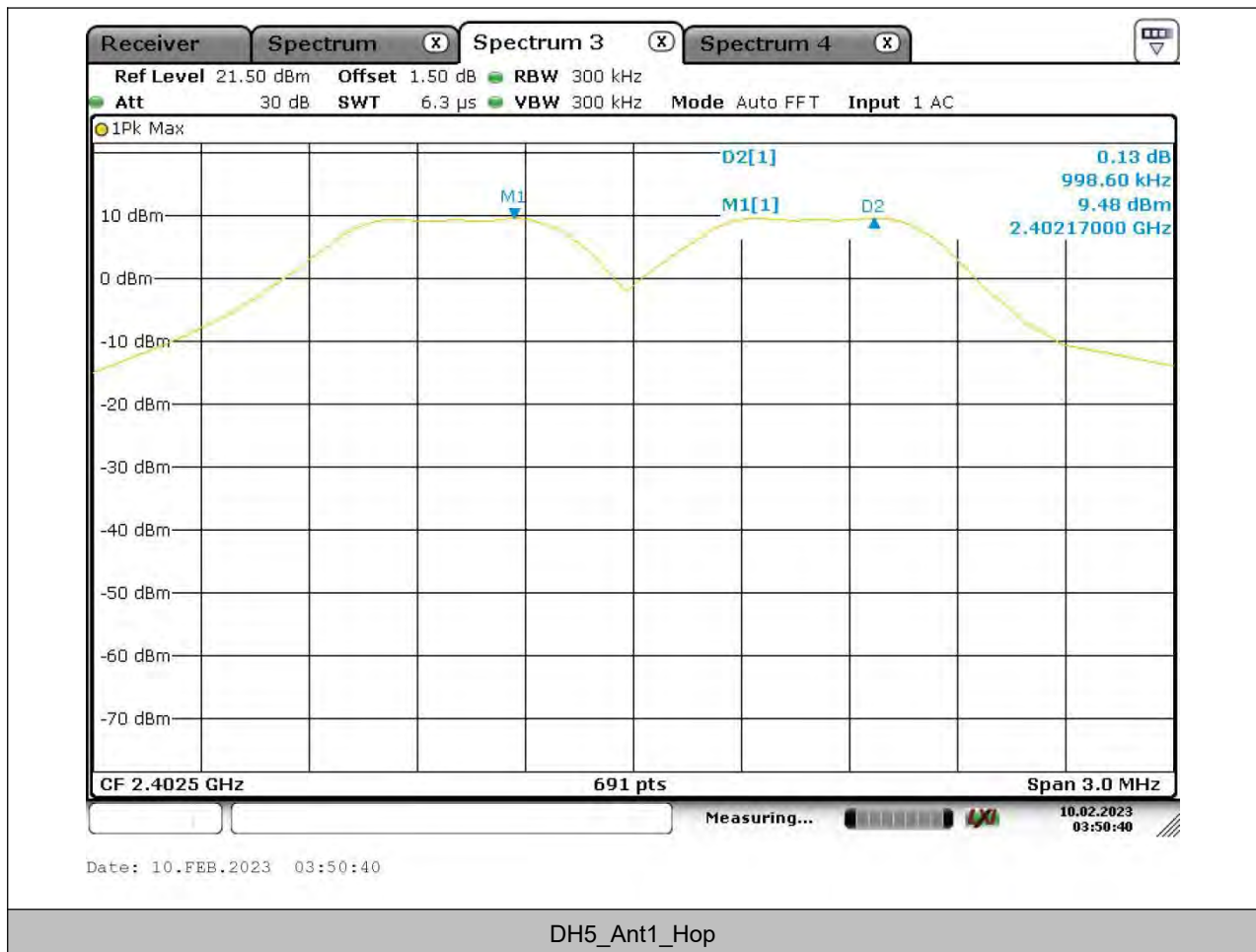
## CARRIER FREQUENCY SEPARATION

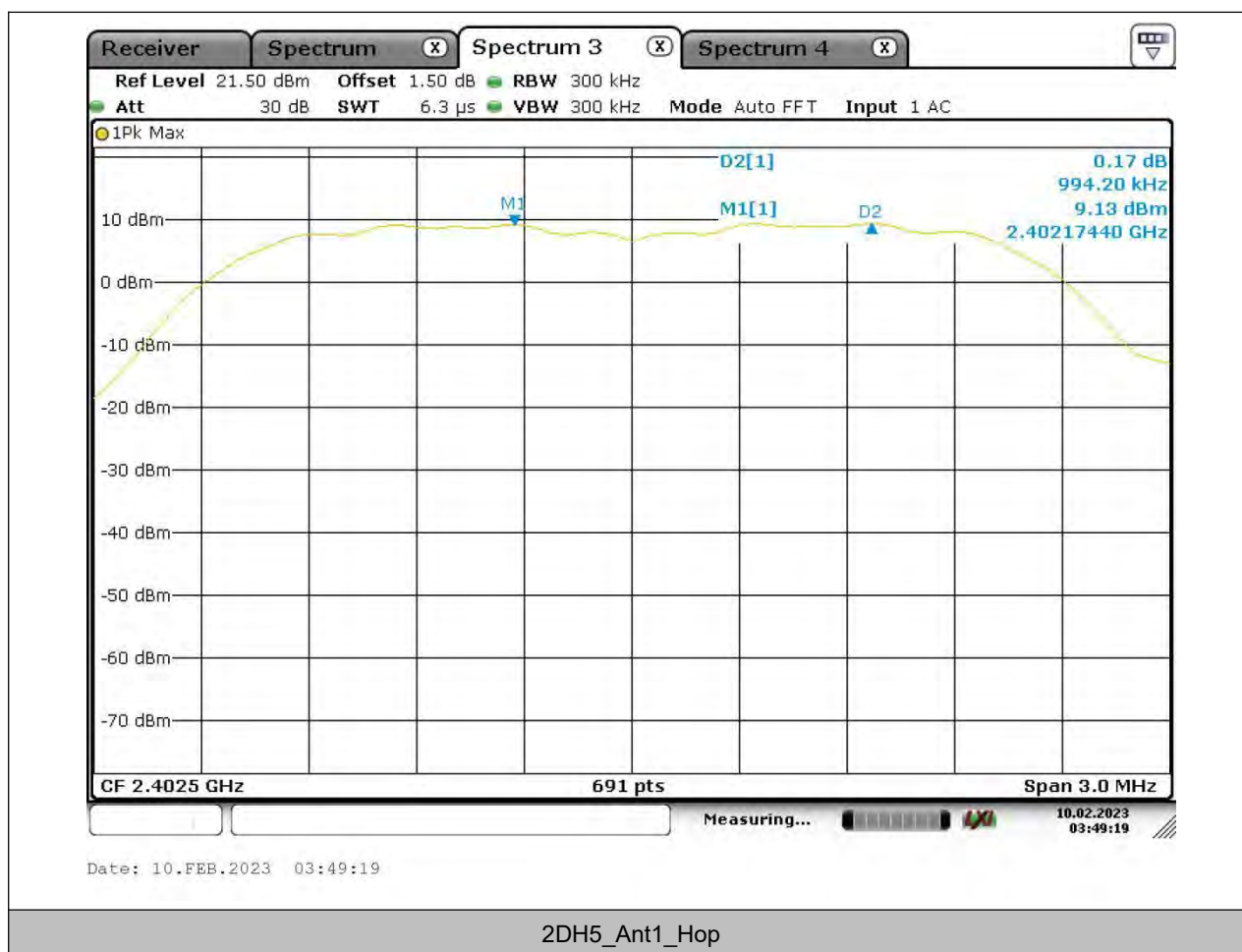
### TEST RESULT

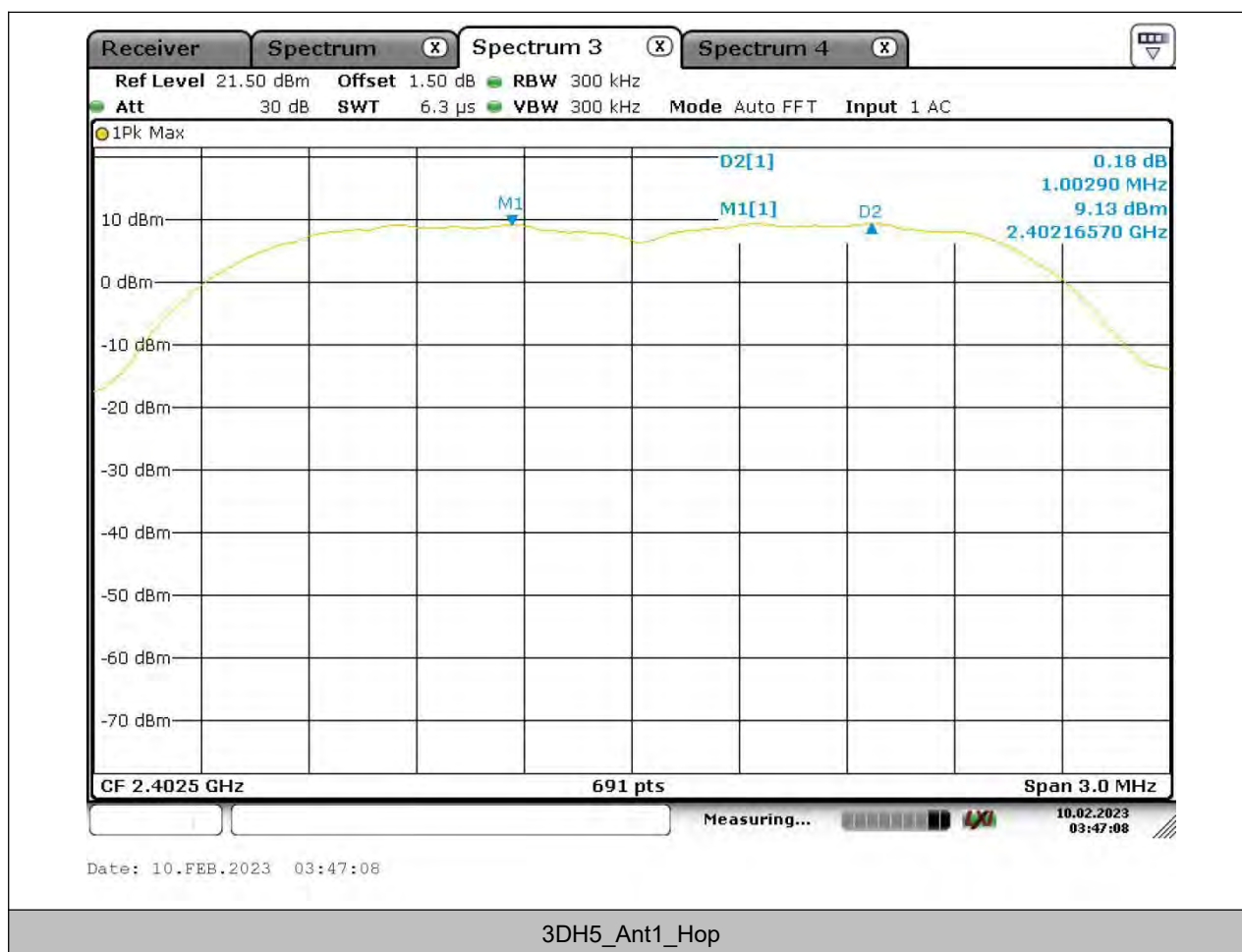
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	Hop	0.9986	$\geq 0.6271$	PASS
2DH5	Ant1	Hop	0.9942	$\geq 0.8567$	PASS
3DH5	Ant1	Hop	1.0029	$\geq 0.8586$	PASS



## TEST GRAPHS









## TIME OF OCCUPANCY

### TEST RESULT

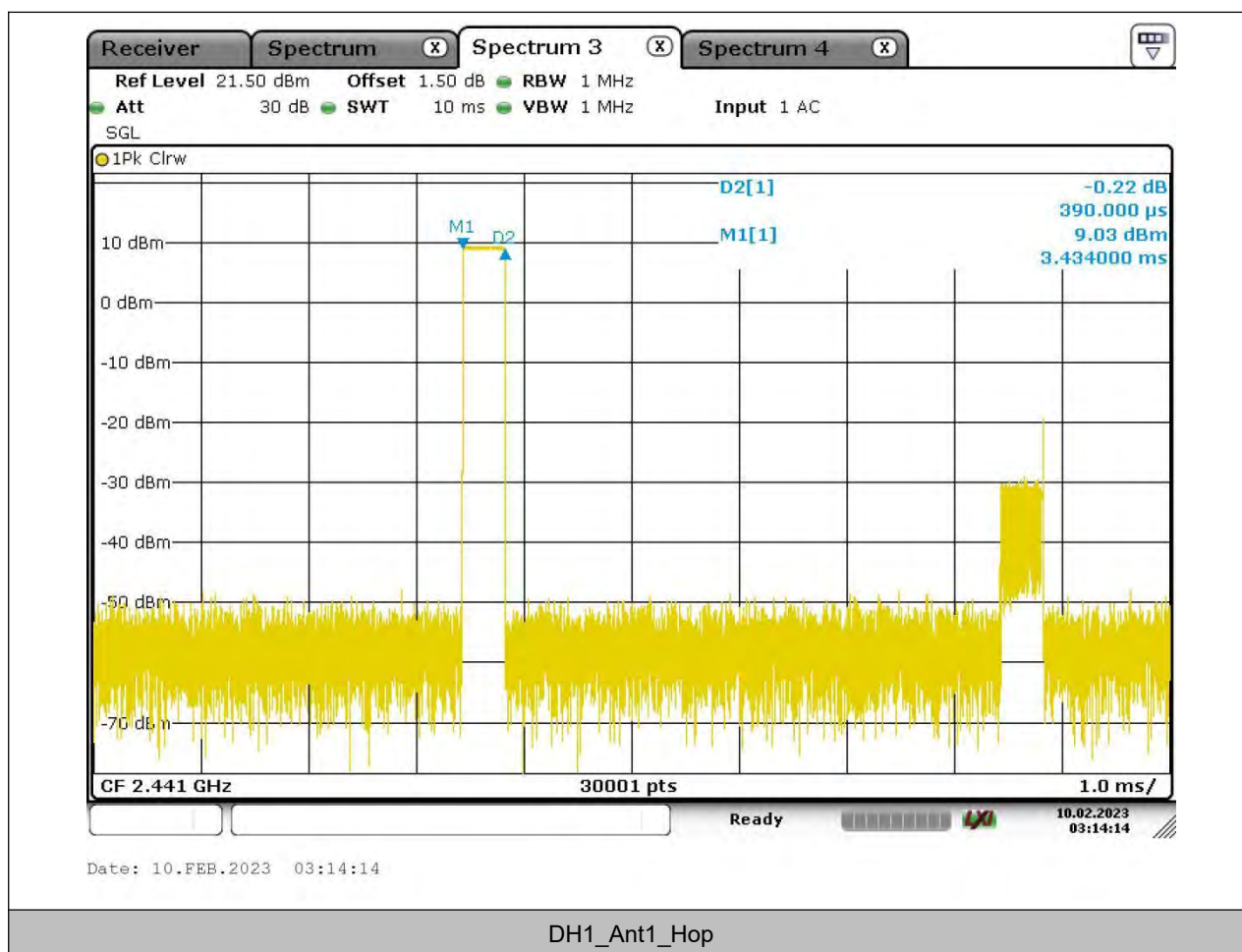
TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.390	294	0.115	≤0.4	PASS
DH3	Ant1	Hop	1.646	152	0.250	≤0.4	PASS
DH5	Ant1	Hop	2.894	114	0.330	≤0.4	PASS
2DH1	Ant1	Hop	0.383	287	0.110	≤0.4	PASS
2DH3	Ant1	Hop	1.634	159	0.260	≤0.4	PASS
2DH5	Ant1	Hop	2.882	102	0.294	≤0.4	PASS
3DH1	Ant1	Hop	0.380	222	0.084	≤0.4	PASS
3DH3	Ant1	Hop	1.630	181	0.295	≤0.4	PASS
3DH5	Ant1	Hop	2.882	103	0.296	≤0.4	PASS

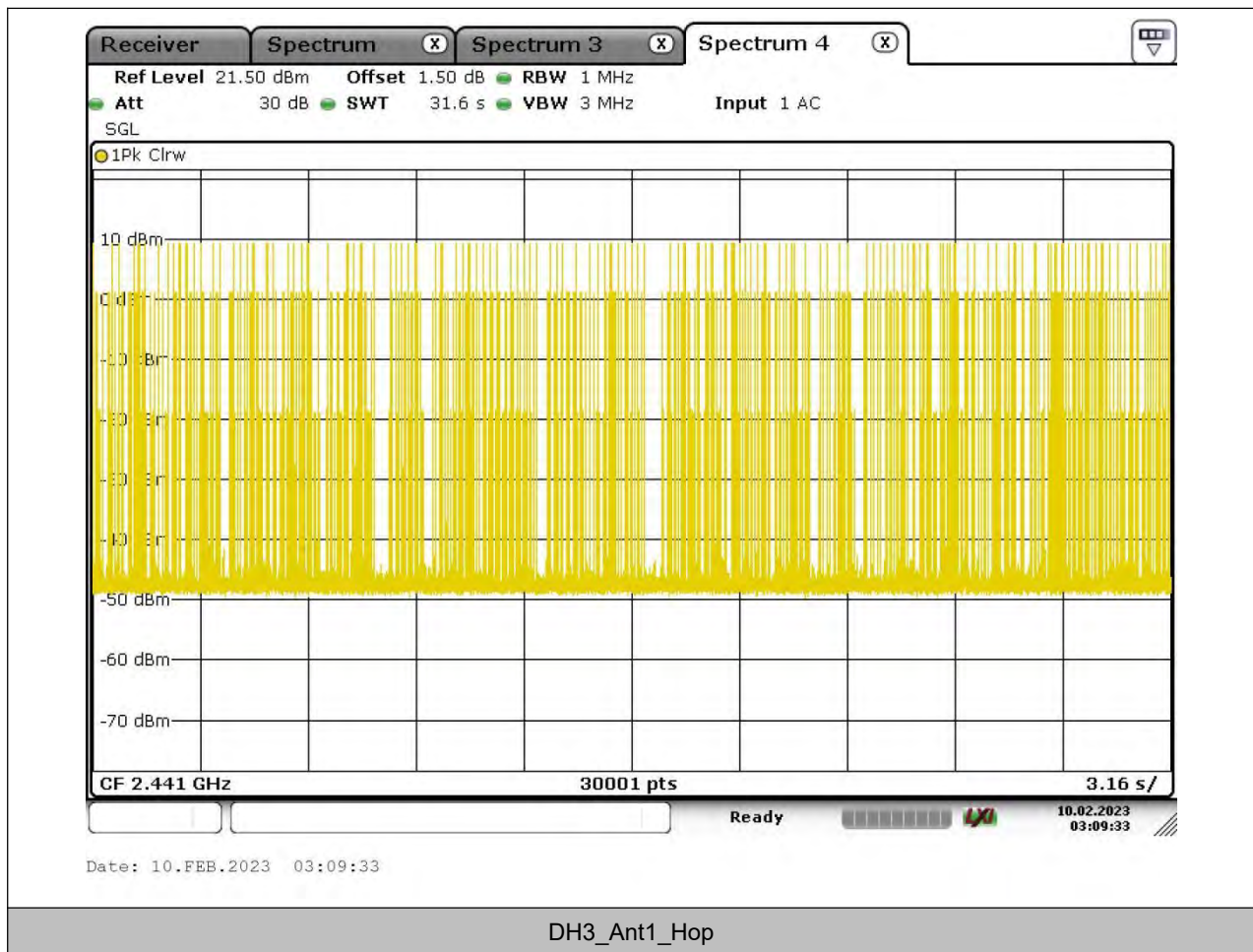


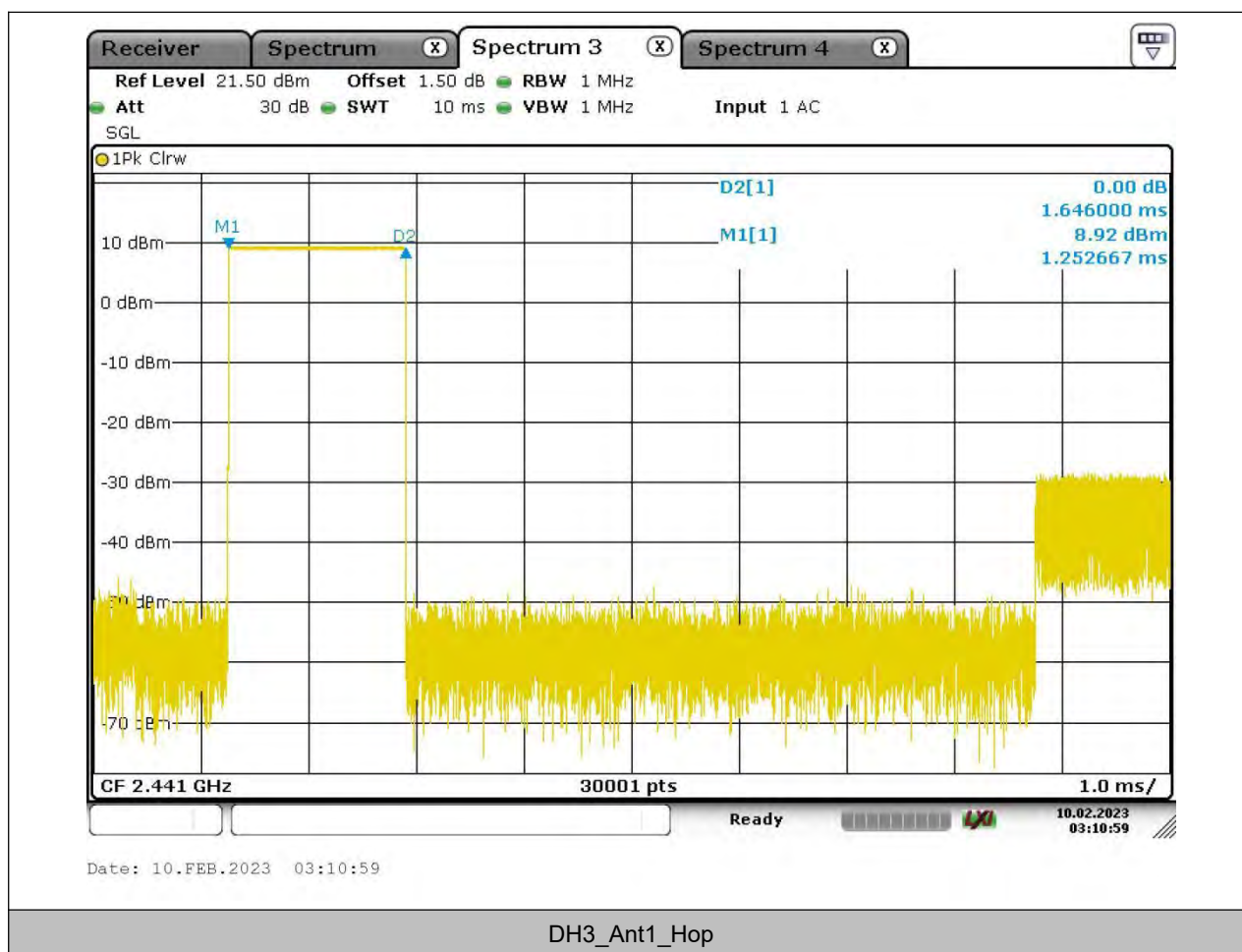
## TEST GRAPHS

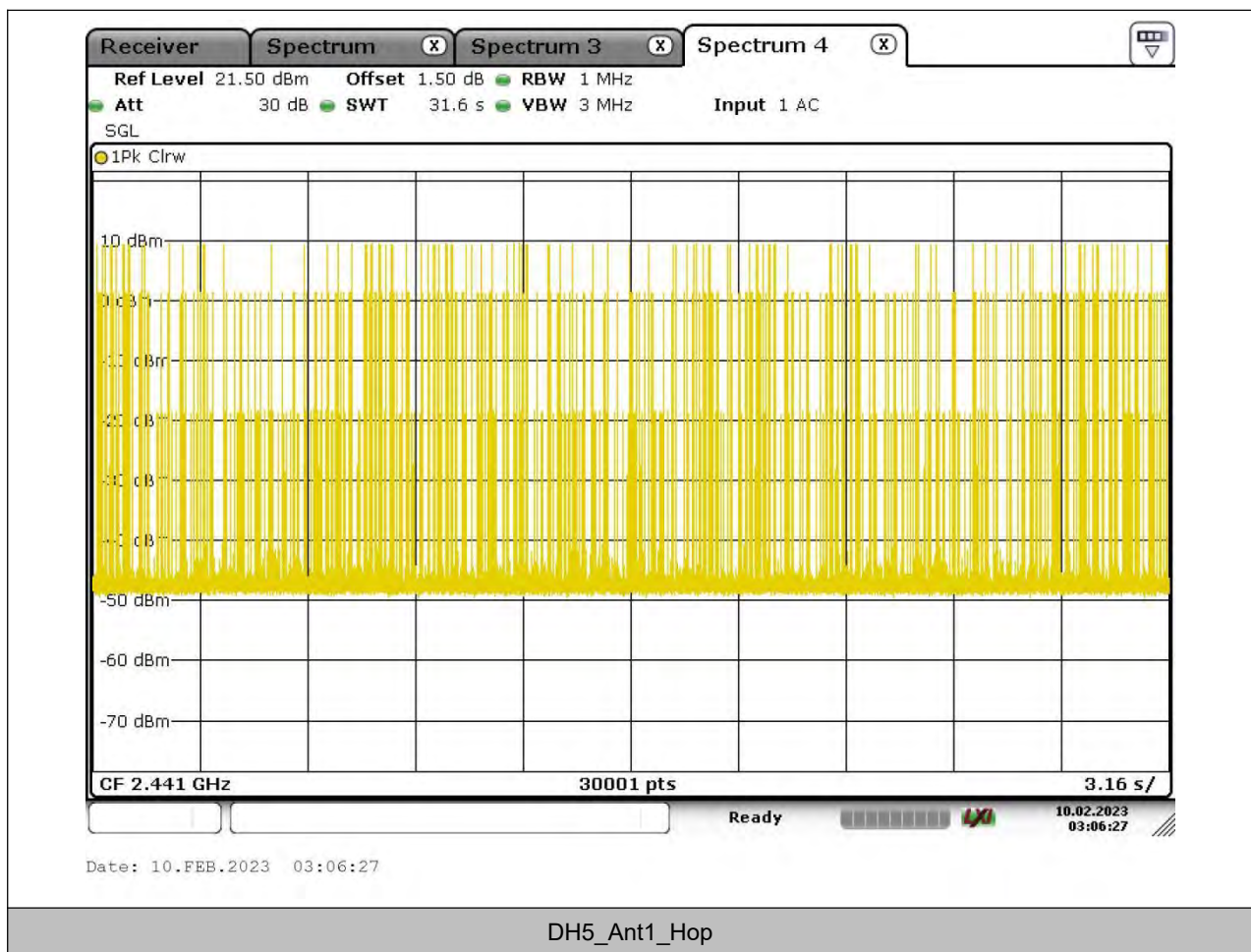














BUREAU  
VERITAS

Test Report No.: W7L-P23010004-2RF05

