

FCC AND IC CERTIFICATION TEST REPORT

FOR

Applicant	:	Harman International Industries, Inc.
Address	:	8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES
Equipment under Test	:	BLUETOOTH HEADSET
Model No.	:	REFLECT FLOW
Trade Mark	:	JBL
FCC ID	:	APIREFLECTFLOW
IC	:	6132A-REFLECTFLOW
Manufacturer	:	Harman International Industries, Inc.
Address	:	8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES

Issued By: Dongguan Dongdian Testing Service Co., Ltd.

Add: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan
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REPORT

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TEST REPORT DECLARE

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Model No.	:	REFLECT FLOW
Trade mark	:	JBL
Manufacturer	:	Harman International Industries, Inc.
Address	:	8500 Balboa Boulevard, Northridge, CA 91329, UNITED STATES

Test Standard Used:

FCC Rules and Regulations Part 15 Subpart C, RSS-247 Issue 2 February 2017.

Test procedure used:

ANSI C63.10:2013, RSS-Gen Issue 5, Apr. 2018.

We Declare:

The equipment described above is tested by Dongguan Dongdian Testing Service Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Dongguan Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC&IC standards.

Report No.:	DDT-R20022505-1E4		
Date of Receipt:	Feb. 27, 2020	Date of Test:	Feb. 27, 2020 ~ Apr. 12, 2020

Prepared By:

Talent Zhang

Talent Zhang/Engineer

Approved By:



Damon Hu/EMC Manager

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Dongguan Dongdian Testing Service Co., Ltd.

Revision history

Rev.	Revisions	Issue Date	Revised By
---	Initial issue	Mar. 22, 2019	
Rev. 01	Added NTC circuit on the original PCB. The original report number is SZEM190201089501, all the data was retested.	Apr. 13, 2020	Talent Zhang

1. Summary of test results

Description of Test Item	Standard	Results
Maximum Peak Output Power	FCC Part 15: 15.247(b)(1) ANSI C63.10:2013 RSS-247 Issue 2	PASS
20dB Bandwidth and 99% Bandwidth	FCC Part 15: 15.215 ANSI C63.10:2013 RSS-247 Issue 2	PASS
Carrier Frequency Separation	FCC Part 15: 15.247(a)(1) ANSI C63.10:2013 RSS-247 Issue 2	PASS
Number Of Hopping Channel	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10:2013 RSS-247 Issue 2	PASS
Dwell Time	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.10:2013 RSS-247 Issue 2	PASS
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.10:2013 RSS-247 Issue 2 RSS-Gen Issue 5	PASS
Band Edge Compliance	FCC Part 15: 15.247(d) ANSI C63.10:2013 RSS-247 Issue 2 RSS-Gen Issue 5	PASS
Power Line Conducted Emissions	FCC Part 15: 15.207 ANSI C63.10:2013 RSS-Gen Issue 5	PASS
Antenna requirement	FCC Part 15: 15.203 RSS-Gen Issue 5	PASS
Note: This report added NTC circuit on the original PCB, all the data was retested and recorded in this report.		

2. General test information

2.1. Description of EUT

EUT* Name	: BLUETOOTH HEADSET
Model Number	: REFLECT FLOW
EUT function description	: Please reference user manual of this device
Power supply	: DC 5V from external charging case DC 3.7V Polymer Li-ion built-in battery
Radio Specification	: Bluetooth V5.0
Operation frequency	: 2402MHz-2480MHz
Modulation	: GFSK, $\pi/4$ -DQPSK, 8DPSK
Data rate	: 1 Mbps, 2 Mbps, 3 Mbps
Antenna Type	: Left side: LDS antenna, maximum PK gain: 0.71dBi Right side: LDS antenna, maximum PK gain: -0.06dBi
Sample Type	: Series production

Note: EUT is the ab. of equipment under test.

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

2.2. Accessories of EUT

Description of Accessories	Manufacturer	Model number	Description	Remark
USB Cable	Harman	N/A	Length: 220mm, unshielded	N/A

2.3. Assistant equipment used for test

Assistant equipment	Manufacturer	Model number	EMC Compliance	SN
Notebook	Lenovo Beijing Co. Ltd.	ThinkPad	FCC/CE	TP00015A
Adapter	SAMSUNG	EP-TA200	N/A	Input: 100-240~, 50/60Hz, 0.5A; Output: 9V/1.67A or 5V/2A

2.4. Block diagram of EUT configuration for test

EUT

Test software: BQB_20190830.EXE

The test software was used to control EUT work in Continuous Tx mode, and select test channel, wireless mode as below table.

Tested mode, channel, information			
Mode	Setting Tx Power	Channel	Frequency (MHz)
GFSK hopping on Tx mode	/	CH0 to CH78	2402 to 2480
$\pi/4$ -DQPSK hopping on Tx mode	/	CH0 to CH78	2402 to 2480
8DPSK hopping on Tx mode	/	CH0 to CH78	2402 to 2480
GFSK hopping off Tx mode	/	CH0	2402
	/	CH39	2441
	/	CH78	2480
$\pi/4$ -DQPSK hopping off Tx mode	/	CH0	2402
	/	CH39	2441
	/	CH78	2480
8DPSK hopping off Tx mode	/	CH0	2402
	/	CH39	2441
	/	CH78	2480

2.5. Deviations of test standard

No Deviation.

2.6. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	21-25 °C
Humidity range:	40-75%
Pressure range:	86-106 kPa

2.7. Test laboratory

Dongguan Dongdian Testing Service Co., Ltd

Add: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China, 523808

Tel: +86-0769-38826678, <http://www.dgddt.com>, Email: ddt@dgddt.com

CNAS Accreditation No. L6451; A2LA Accreditation No. 3870.01

FCC Designation Number: CN1182; FCC Test Firm Registration Number: 540522

Industry Canada site registration number: 10288A-1

2.8. Measurement uncertainty

Test Item	Uncertainty
Bandwidth	1.1%
Peak Output Power (Conducted) (Spectrum analyzer)	0.86 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 1.38 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Peak Output Power (Conducted) (Power Sensor)	0.74 dB
Power Spectral Density	0.74 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 1.38 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$)
Frequencies Stability	6.7×10^{-8} (Antenna couple method) 5.5×10^{-8} (Conducted method)
Conducted spurious emissions	0.86 dB ($10 \text{ MHz} \leq f < 3.6 \text{ GHz}$); 1.40 dB ($3.6 \text{ GHz} \leq f < 8 \text{ GHz}$) 1.66 dB ($8 \text{ GHz} \leq f < 22 \text{ GHz}$)
Uncertainty for radio frequency (RBW<20 kHz)	3×10^{-8}
Temperature	0.4 °C
Humidity	2 %
Uncertainty for Radiation Emission test (30 MHz-1 GHz)	4.70 dB (Antenna Polarize: V) 4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1 GHz-40 GHz)	4.10 dB (1-6 GHz) 4.40 dB (6 GHz-18 GHz) 3.54 dB (18 GHz-26 GHz) 4.30 dB (26 GHz-40 GHz)
Uncertainty for Power line conduction emission test	3.32 dB (150 kHz-30 MHz)

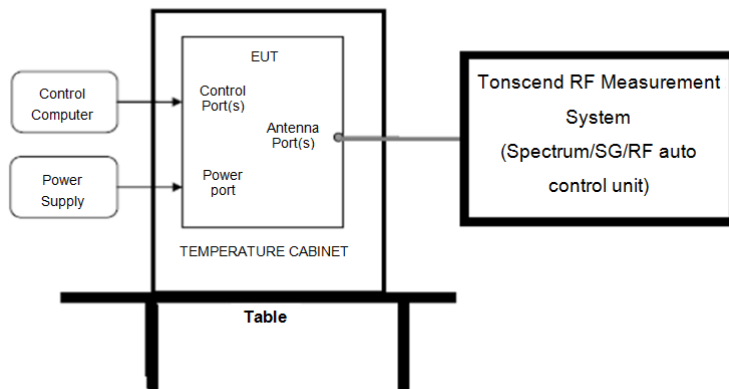
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. Equipment used during test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
RF Connected Test (Tonscend RF Measurement System)					
Spectrum analyzer	R&S	FSU26	200071	Sep. 29, 2019	1 Year
Wideband Radio Communication tester	R&S	CMW500	117491	Jun. 25, 2019	1 Year
Vector Signal Generator	Agilent	E8267D	US49060192	Sep. 29, 2019	1 Year
Vector Signal Generator	Agilent	N5182A	MY48180737	Jun. 25, 2019	1 Year
Power Sensor	Agilent	U2021XA	MY55150010	Jun. 28, 2019	1 Year
Power Sensor	Agilent	U2021XA	MY55150011	Jun. 28, 2019	1 Year
DC Power Source	MATRIS	MPS-3005L-3	D813058W	Jun. 25, 2019	1 Year
RF Cable	Micable	C10-01-01-1	100309	Sep. 29, 2019	1 Year
Temp&Humi Programmable	ZHIXIANG	ZXGDJS-150L	ZX170110-A	Oct. 21, 2019	1 Year
Test Software	JS Tonscend	JS1120-3	Ver.2.7	N/A	N/A
Radiation 1#chamber					
EMI Test Receiver	R&S	ESU8	100316	Sep. 29, 2019	1 Year
Spectrum analyzer	Agilent	E4447A	MY50180031	Jun. 25, 2019	1 Year
Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	Nov. 15, 2019	1 Year
Active Loop antenna	Schwarzbeck	FMZB-1519	1519-038	Sep. 29, 2019	1 Year
Double Ridged Horn Antenna	R&S	HF907	100276	Nov. 15, 2019	1 Year
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	790	Sep. 29, 2019	1 Year
Pre-amplifier	A.H.	PAM-0118	360	Sep. 29, 2019	1 Year
Pre-amplifier	TERA-MW	TRLA-0040 G35	101303	Sep. 29, 2019	1 Year
RF Cable	HUBSER	CP-X2+ CP-X1	W11.03+ W12.02	Sep. 29, 2019	1 Year
RF Cable	N/A	5m+6m+1m	06270619	Sep. 29, 2019	1 Year
MI Cable	HUBSER	C10-01-01-1 M	1091629	Sep. 29, 2019	1 Year
Test software	Audix	E3	V 6.11111b	N/A	N/A
Power Line Conducted Emissions Test					
EMI Test Receiver	R&S	ESU8	100316	Sep. 29, 2019	1 Year
LISN 1	R&S	ENV216	101109	Sep. 29, 2019	1 Year
LISN 2	R&S	ESH2-Z5	100309	Sep. 29, 2019	1 Year
Pulse Limiter	R&S	ESH3-Z2	101242	Sep. 29, 2019	1 Year
CE Cable 1	HUBSER	N/A	W10.01	Sep. 29, 2019	1 Year
Test software	Audix	E3	V 6.11111b	N/A	N/A

4. Maximum Peak Output Power

4.1. Block diagram of test setup



4.2. Limits

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W.

4.3. Test Procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) Measure the maximum output power of EUT by spectrum analyzer with PK detector and RBW=3 MHz (above 20 dB bandwidth of measured signal), VBW=10 MHz

Note: The attenuator loss was inputted into spectrum analyzer as amplitude offset.

4.4. Test Result

Left side:

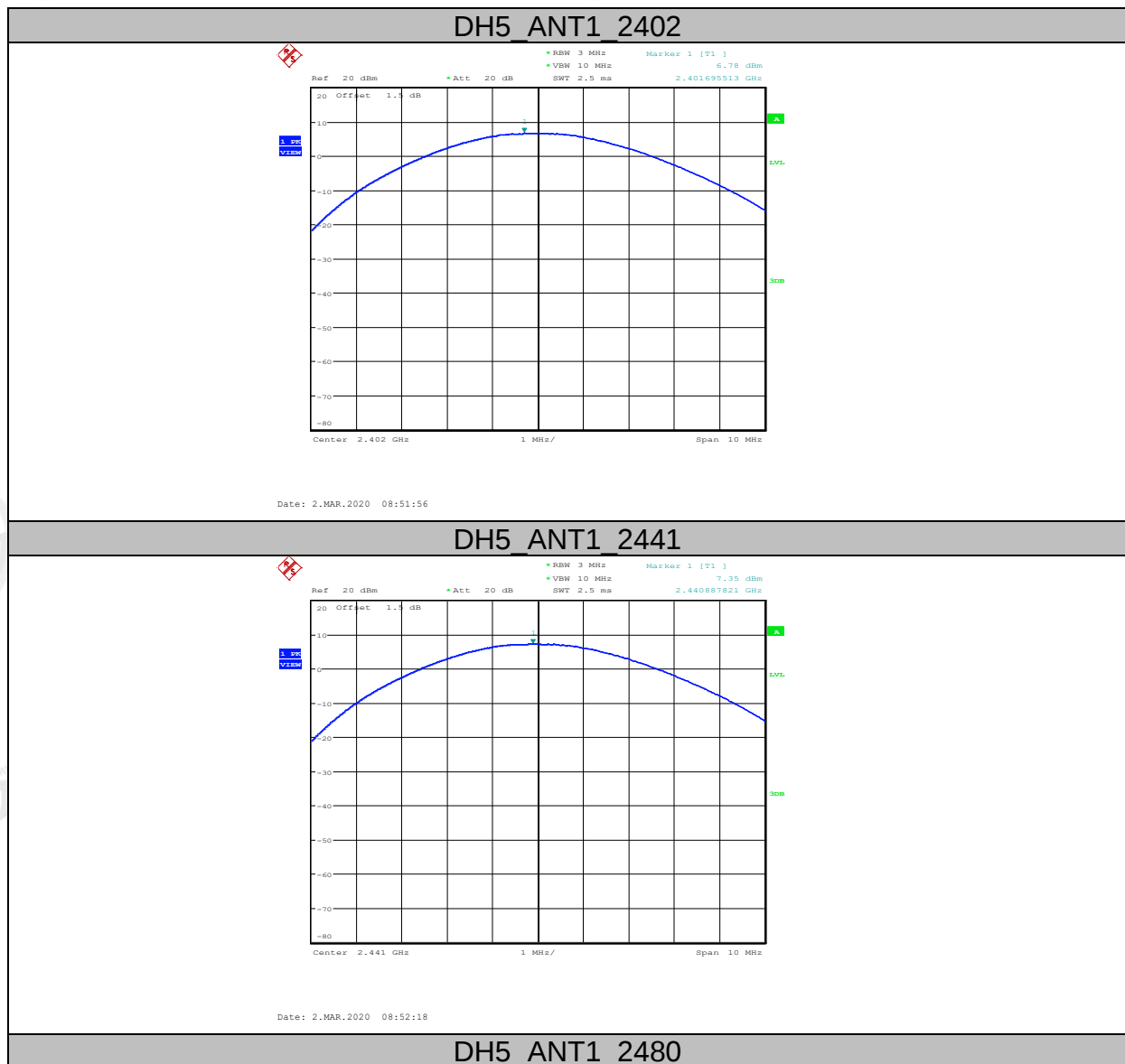
Mode	Antenna	Freq. (MHz)	Result (dBm)	Limit (dBm)	Conclusion
GFSK	ANT1	2402	6.78	21	PASS
	ANT1	2441	7.35	21	PASS
	ANT1	2480	7.48	21	PASS
$\pi/4$ -DQPSK	ANT1	2402	6.76	21	PASS
	ANT1	2441	7.32	21	PASS
	ANT1	2480	7.53	21	PASS
8DPSK	ANT1	2402	6.78	21	PASS
	ANT1	2441	7.35	21	PASS
	ANT1	2480	7.54	21	PASS

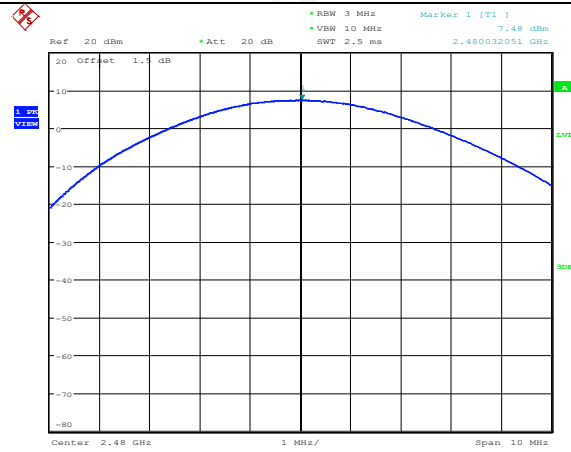
Right side:

Mode	Antenna	Freq. (MHz)	Result (dBm)	Limit (dBm)	Conclusion
GFSK	ANT1	2402	7.22	21	PASS
	ANT1	2441	7.76	21	PASS
	ANT1	2480	7.19	21	PASS
$\pi/4$ -DQPSK	ANT1	2402	7.21	21	PASS
	ANT1	2441	6.78	21	PASS
	ANT1	2480	7.24	21	PASS
8DPSK	ANT1	2402	7.24	21	PASS
	ANT1	2441	6.77	21	PASS
	ANT1	2480	7.24	21	PASS

4.5. Original test data

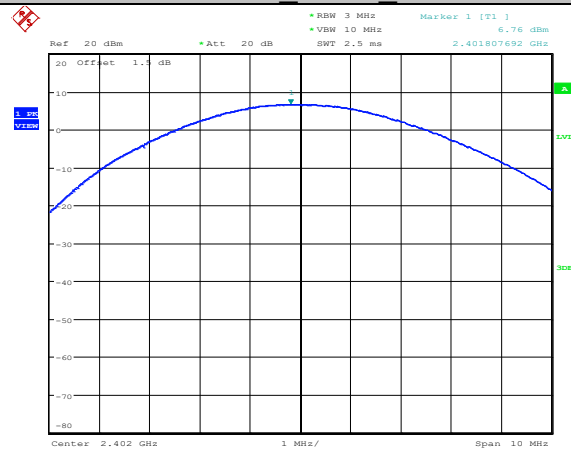
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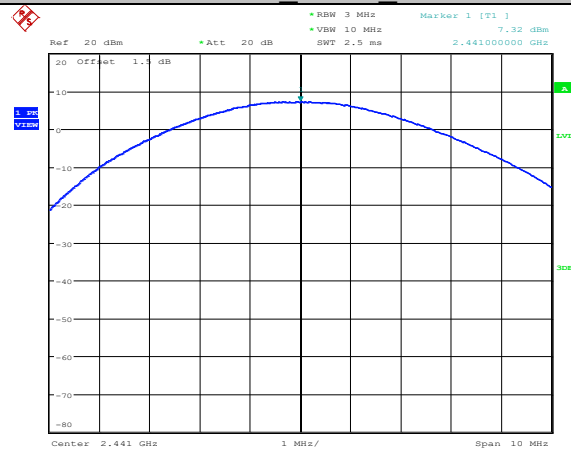
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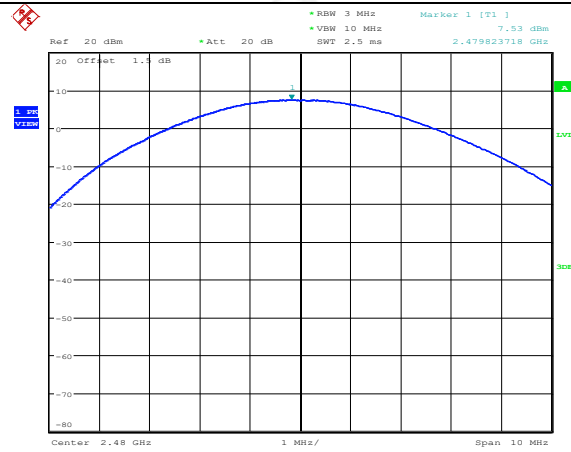
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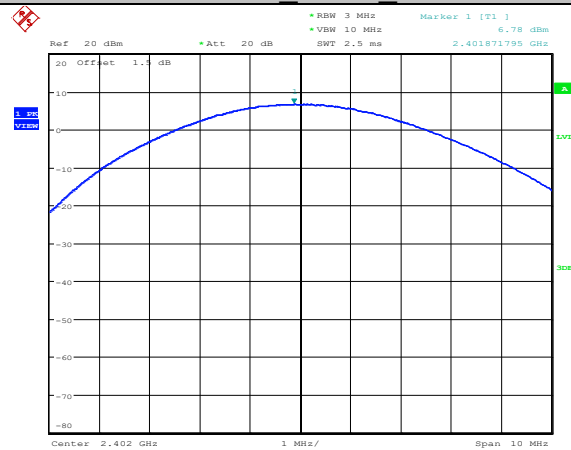
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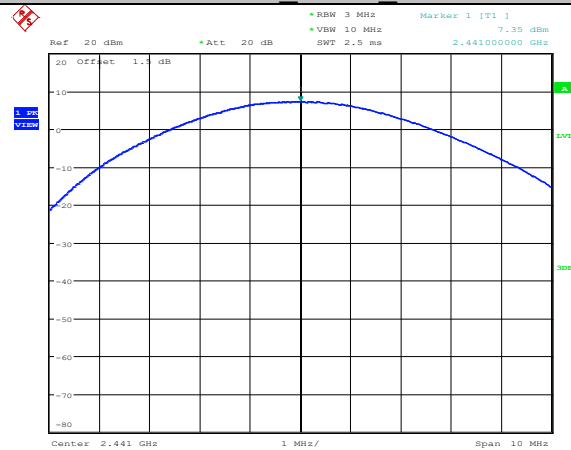
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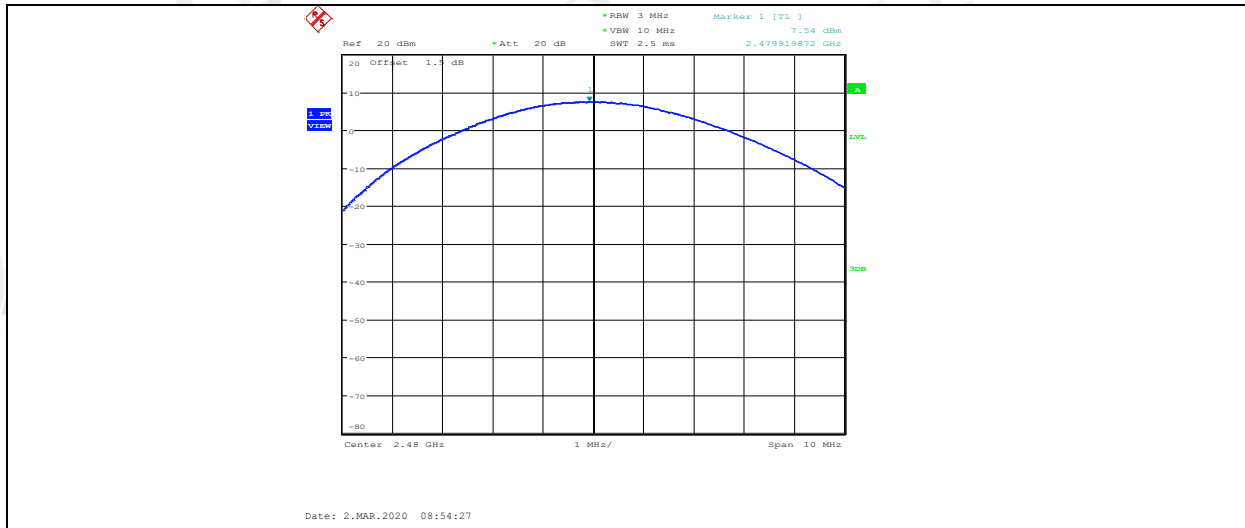
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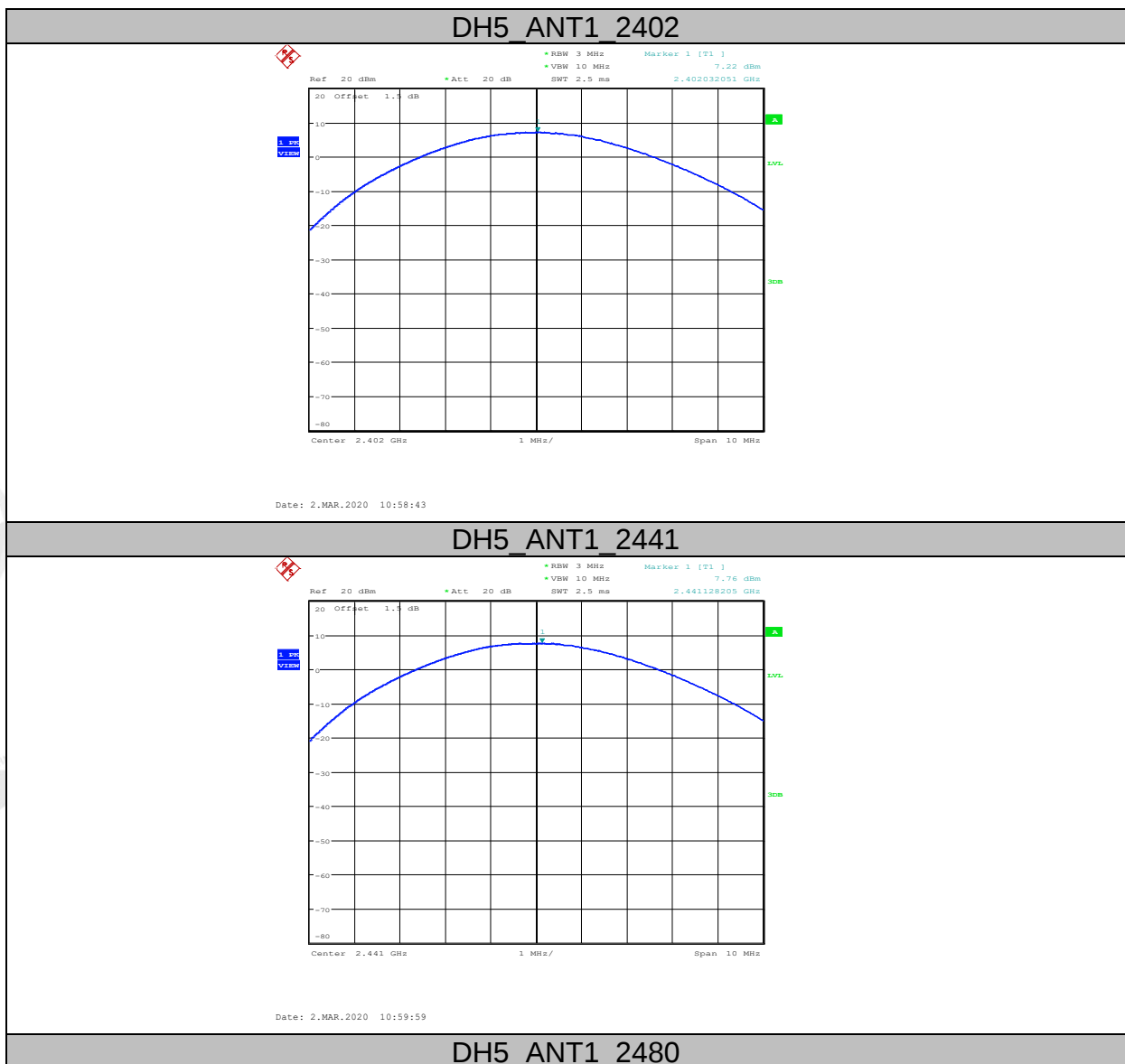


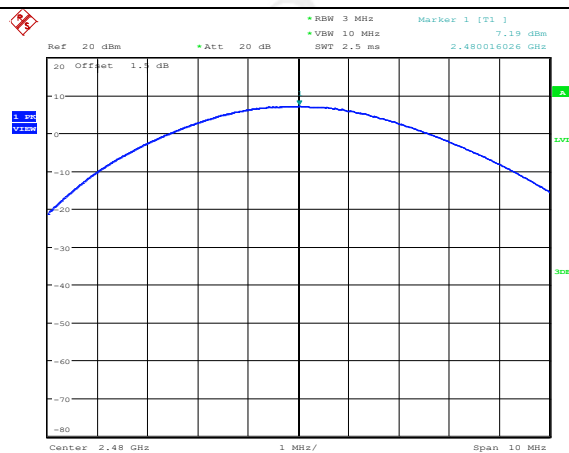
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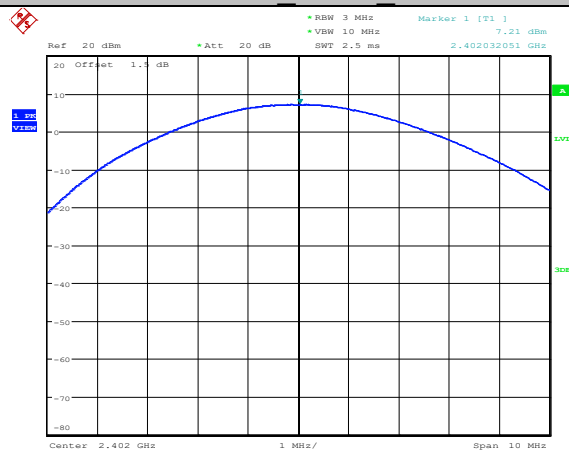
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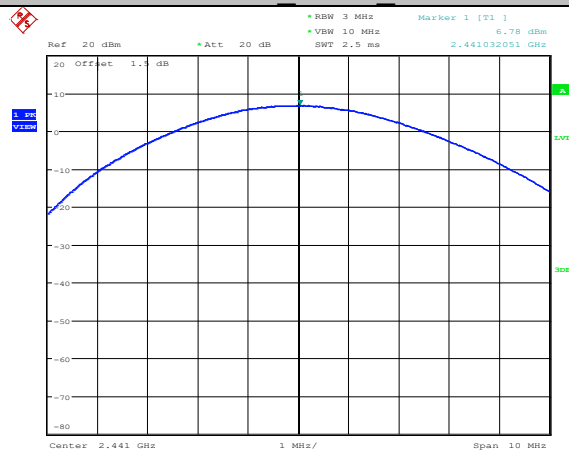
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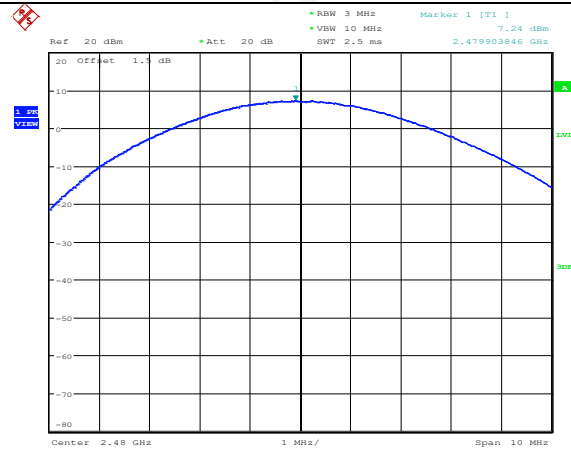
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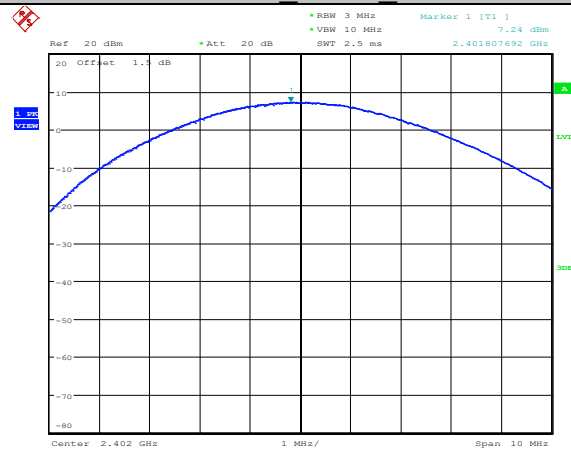
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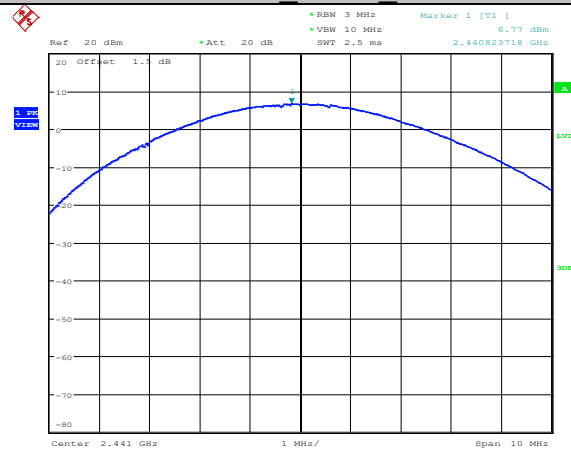
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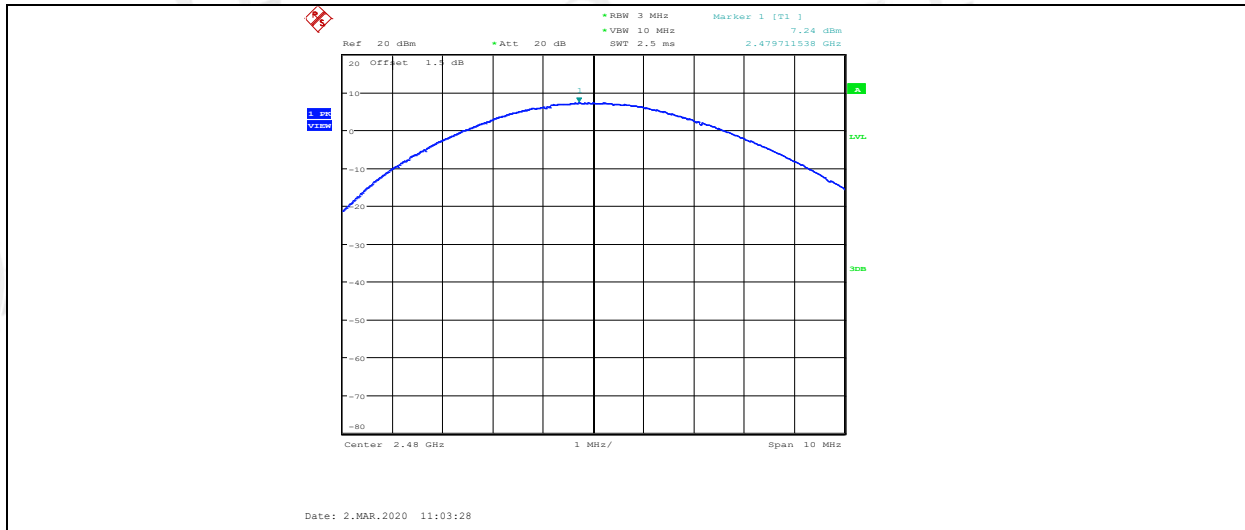
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Date: 2.MAR.2020 11:10:55

3DH5 ANT1 2480



5. 20dB Bandwidth and 99% Bandwidth

5.1. Block diagram of test setup

Same as section 4.1

5.2. Limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

5.3. Test Procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 kHz RBW and 100 kHz VBW. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

5.4. Test Result

Left side:

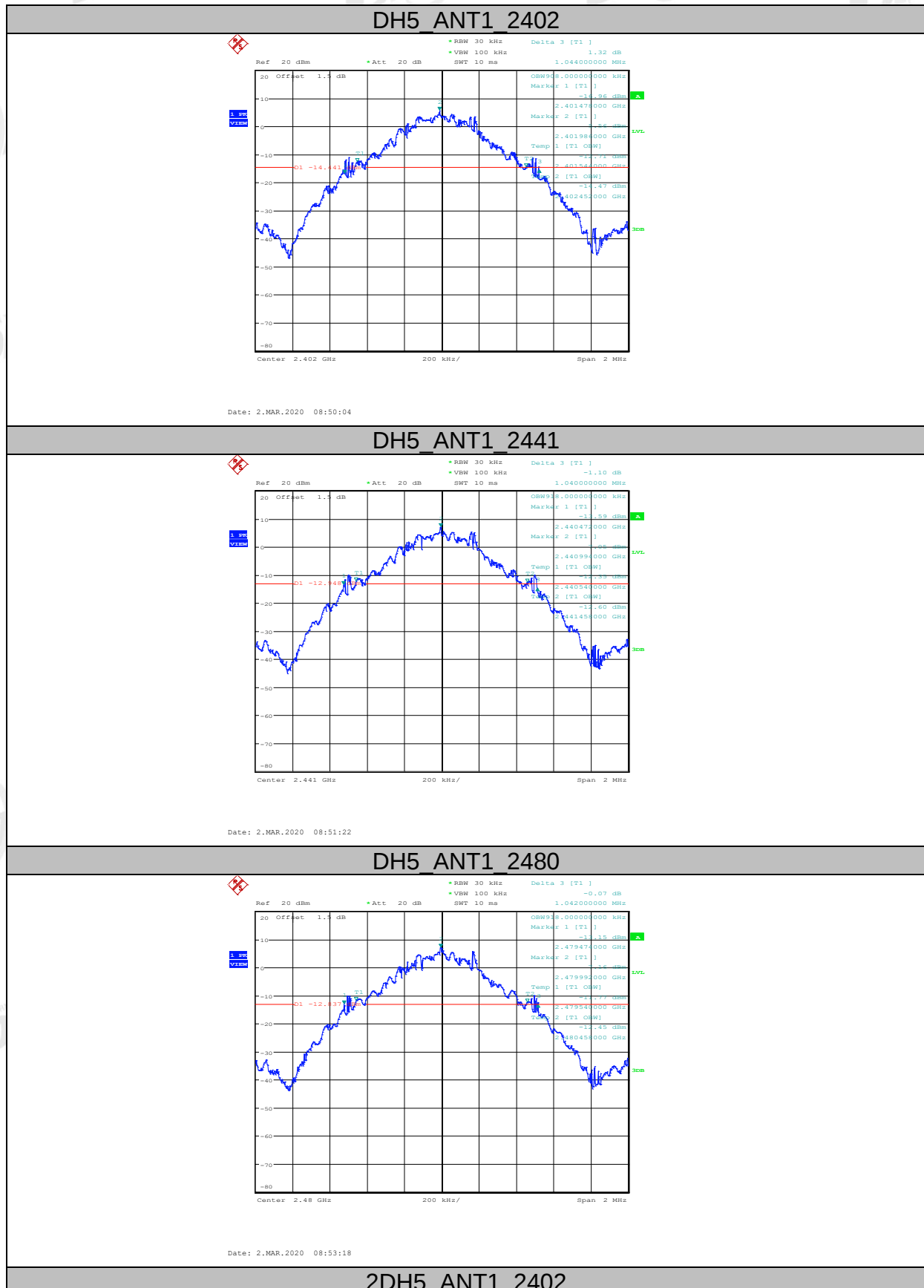
Mode	Freq. (MHz)	20 dB bandwidth Result (MHz)	99% bandwidth Result (MHz)	Conclusion
GFSK	2402	1.044	0.908	PASS
	2441	1.040	0.918	PASS
	2480	1.042	0.918	PASS
$\pi/4$ -DQPSK	2402	1.186	1.162	PASS
	2441	1.230	1.164	PASS
	2480	1.186	1.166	PASS
8DPSK	2402	1.256	1.174	PASS
	2441	1.204	1.156	PASS
	2480	1.204	1.156	PASS

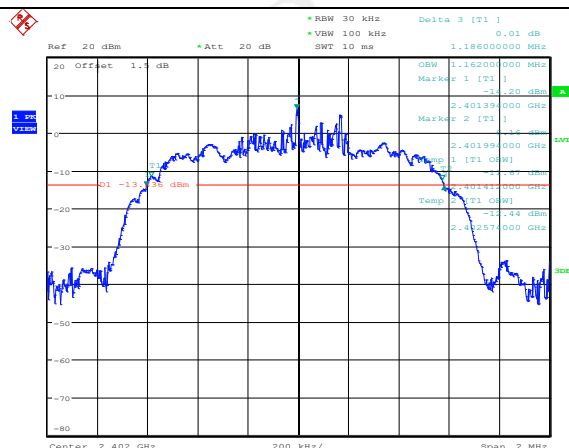
Right side:

Mode	Freq. (MHz)	20 dB bandwidth Result (MHz)	99% bandwidth Result (MHz)	Conclusion
GFSK	2402	1.048	0.904	PASS
	2441	1.040	0.906	PASS
	2480	1.038	0.948	PASS
$\pi/4$ -DQPSK	2402	1.188	1.164	PASS
	2441	1.186	1.156	PASS
	2480	1.190	1.166	PASS
8DPSK	2402	1.202	1.162	PASS
	2441	1.212	1.166	PASS
	2480	1.204	1.162	PASS

5.5. Original test data

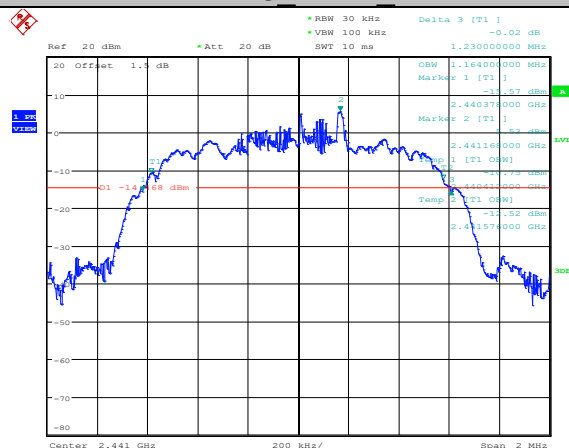
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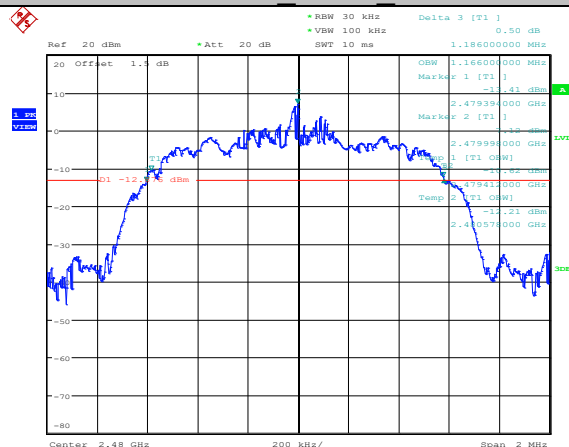
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2DH5 ANT1 2441



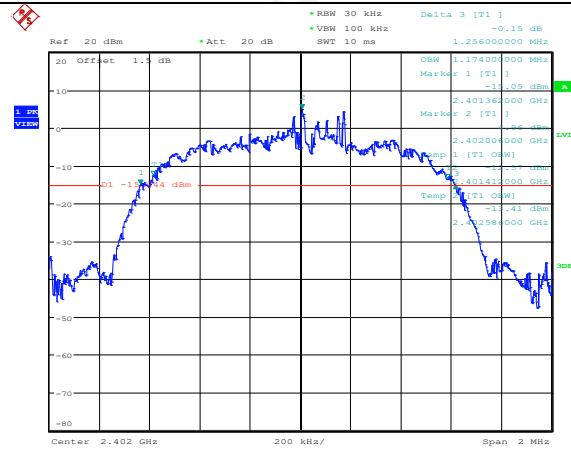
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2DH5 ANT1 2480



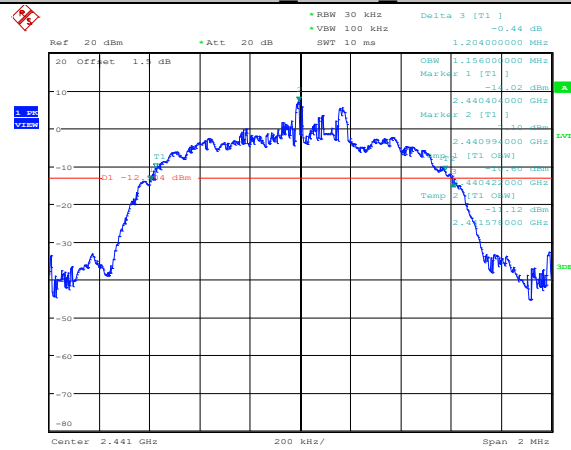
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3DH5 ANT1 2402



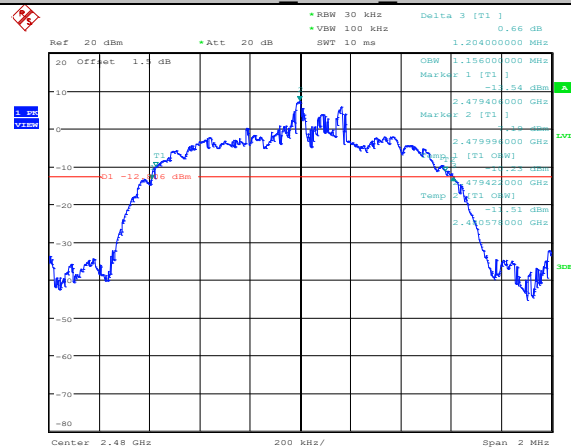
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3DH5 ANT1 2441



Date: 2.MAR.2020 09:02:49

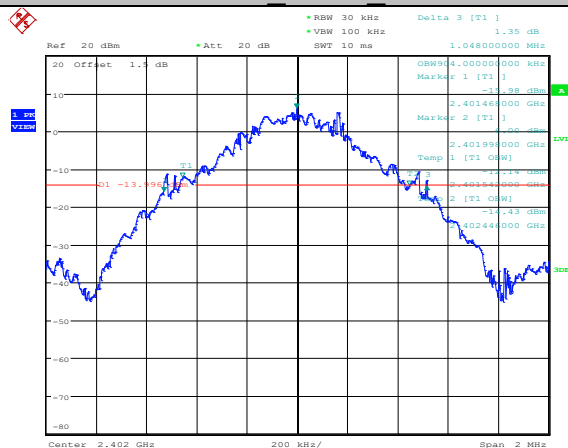
3DH5 ANT1 2480



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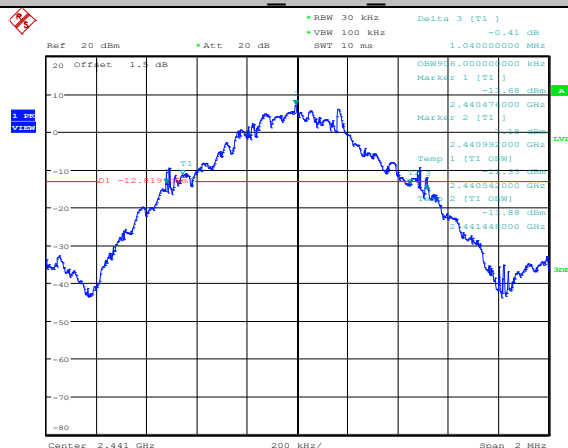
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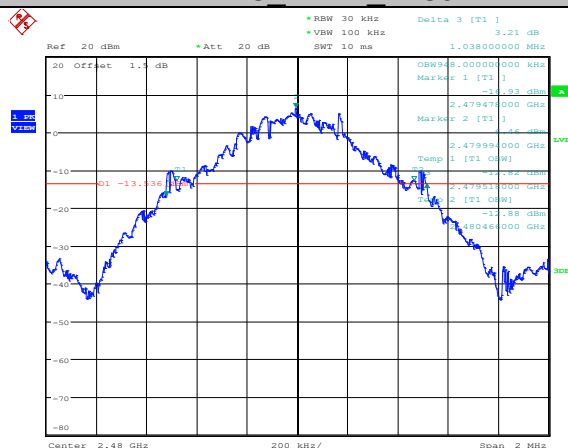
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DH5_ANT1_2441



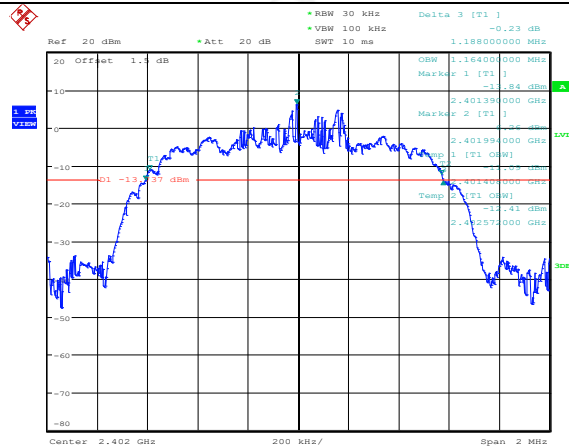
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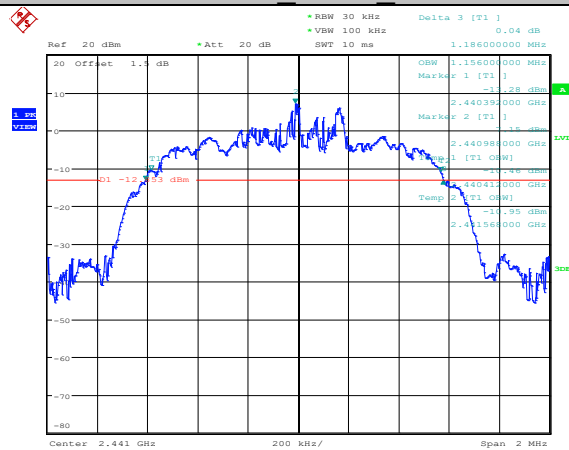
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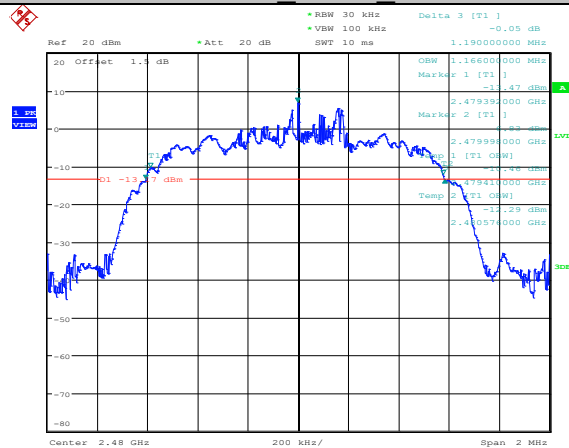
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2DH5 ANT1 2441



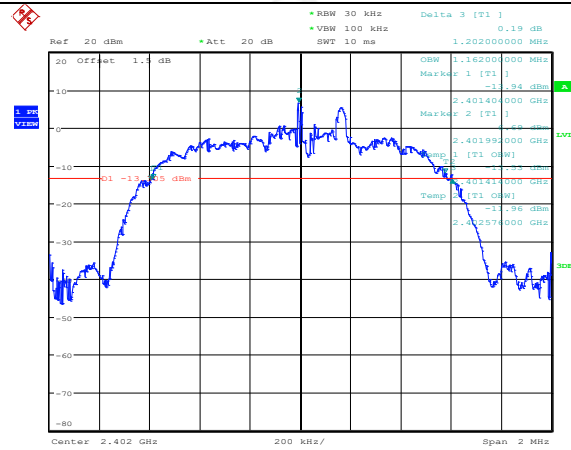
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2DH5 ANT1 2480



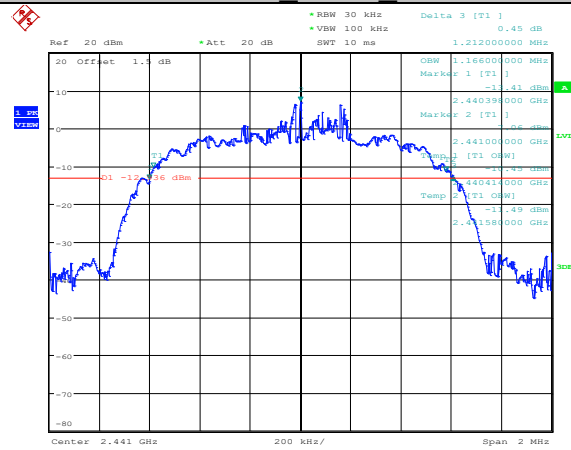
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3DH5 ANT1 2402



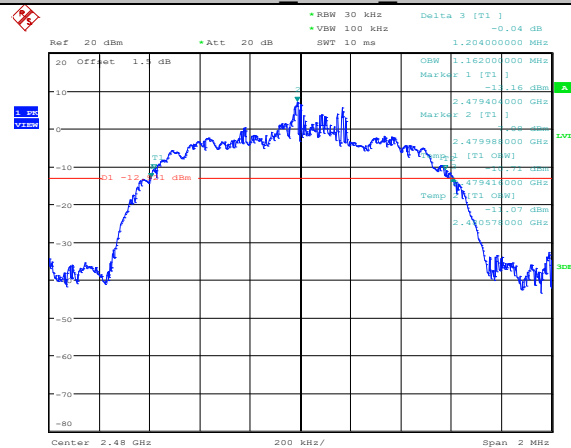
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3DH5_ANT1_2441



Date: 2.MAR.2020 12:47:21

3DH5_ANT1_2480



Date: 2.MAR.2020 12:48:21

6. Carrier Frequency Separation

6.1. Block diagram of test setup

Same as section 4.1

6.2. Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

6.3. Test Procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) The carrier frequency was measured by spectrum analyzer with 100 kHz RBW and 300 kHz VBW.

6.4. Test Result

Left side:

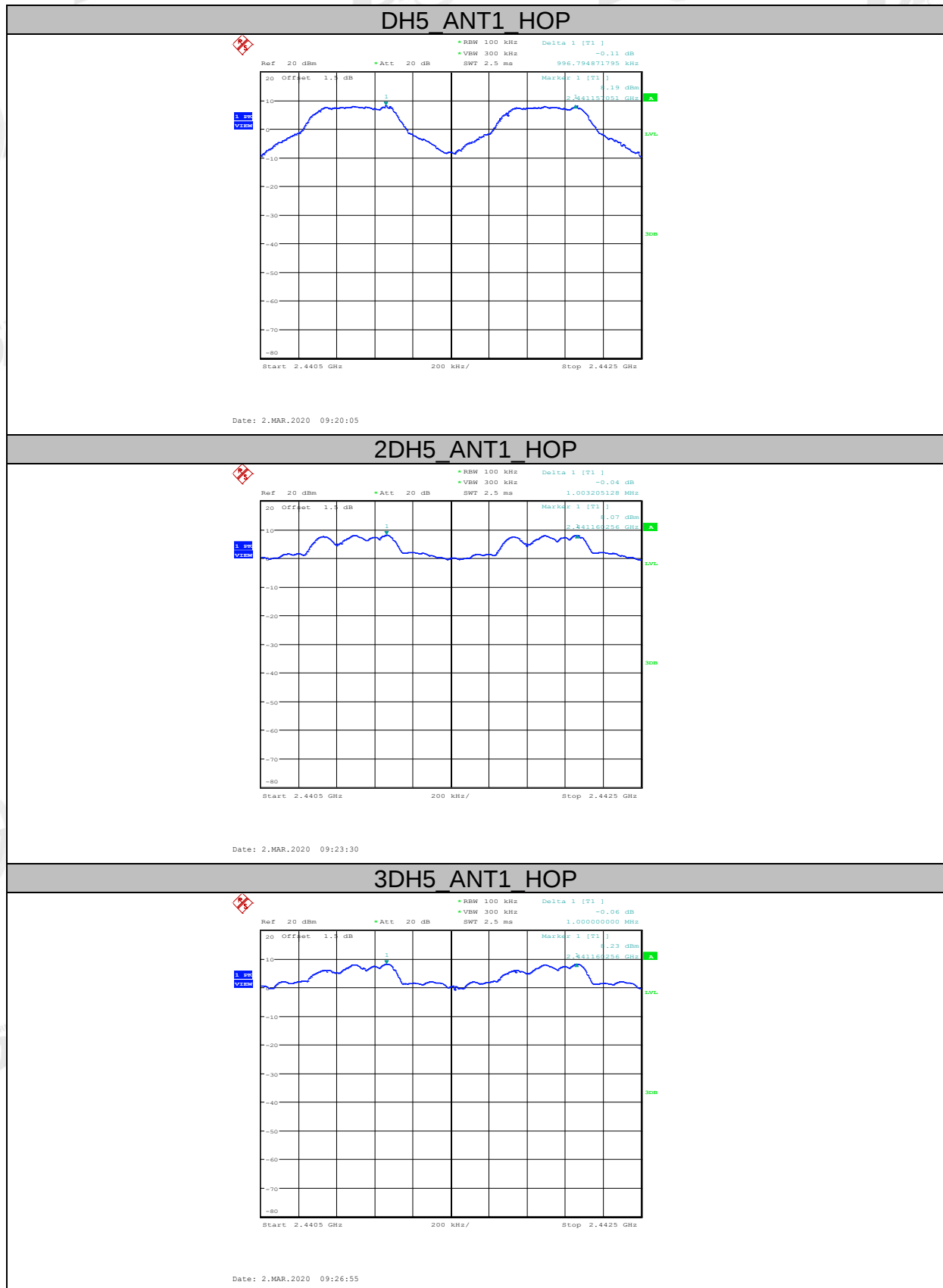
Mode	Channel separation (MHz)	20dB bandwidth (MHz) (worse case)	Limit (MHz) 2/3 of 20dB bandwidth	Conclusion
GFSK	0.997	1.044	≥ 0.696	PASS
$\pi/4$ -DQPSK	1.003	1.230	≥ 0.820	PASS
8DPSK	1.000	1.258	≥ 0.839	PASS

Right side:

Mode	Channel separation (MHz)	20dB bandwidth (MHz) (worse case)	Limit (MHz) 2/3 of 20dB bandwidth	Conclusion
GFSK	0.990	1.048	≥ 0.699	PASS
$\pi/4$ -DQPSK	1.000	1.190	≥ 0.793	PASS
8DPSK	1.000	1.212	≥ 0.808	PASS

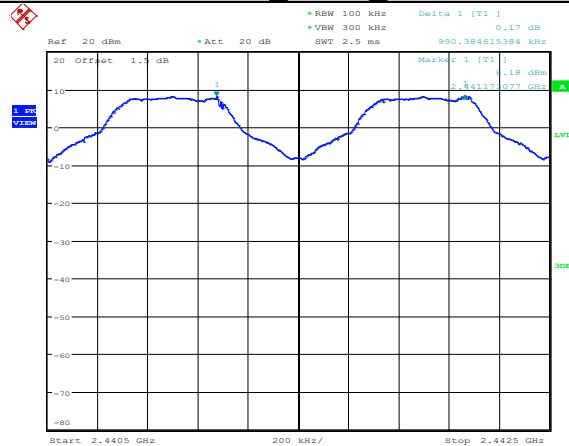
6.5. Original test data

Left side:



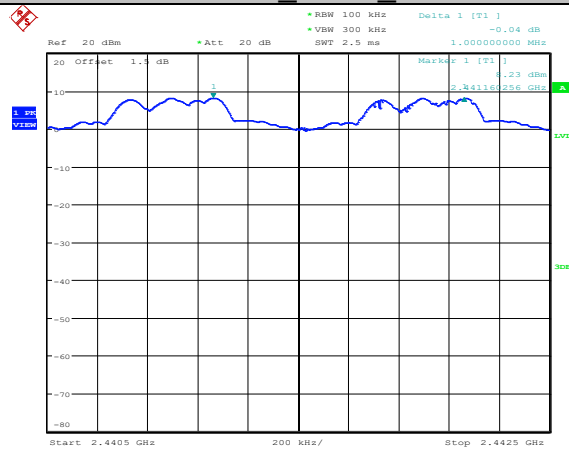
Right side:

DH5_ANT1_HOP



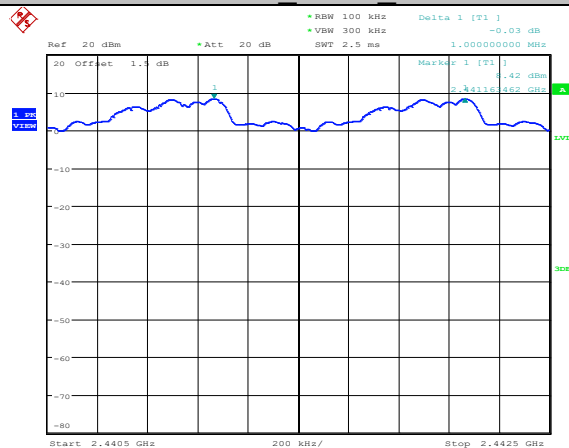
Date: 2.MAR.2020 12:54:33

2DH5_ANT1_HOP



Date: 2.MAR.2020 12:57:39

3DH5_ANT1_HOP



Date: 2.MAR.2020 13:01:34

7. Number Of Hopping Channel

7.1. Block diagram of test setup

Same as section 4.1

7.2. Limits

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

7.3. Test Procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) The number of hopping channel was measured by spectrum analyzer with 100 kHz RBW and 300 kHz VBW.

7.4. Test Result

Left side:

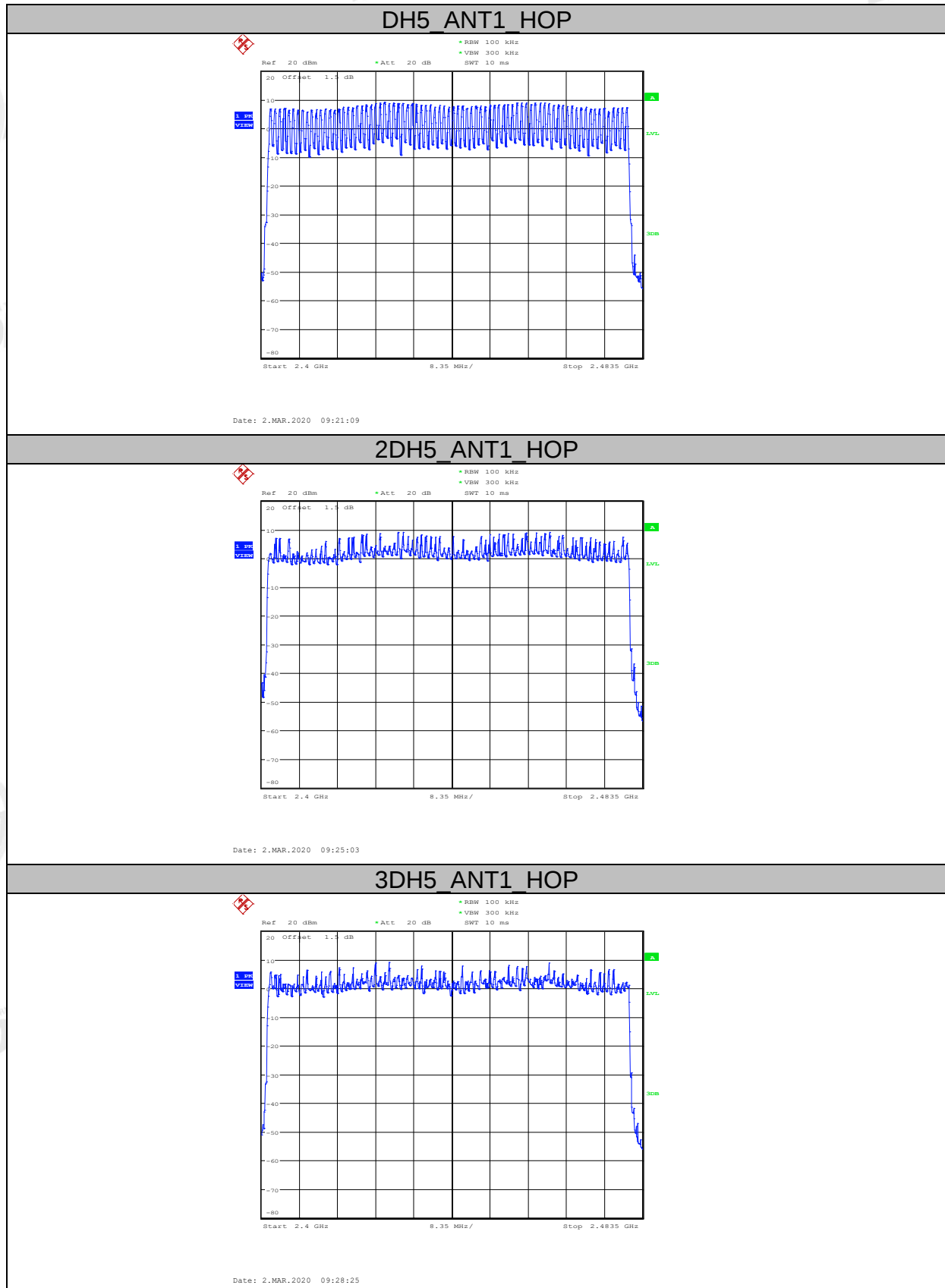
Mode	Number of hopping channel	Limit	Conclusion
GFSK	79	>15	PASS
$\pi/4$ -DQPSK	79	>15	PASS
8DPSK	79	>15	PASS

Right side:

Mode	Number of hopping channel	Limit	Conclusion
GFSK	79	>15	PASS
$\pi/4$ -DQPSK	79	>15	PASS
8DPSK	79	>15	PASS

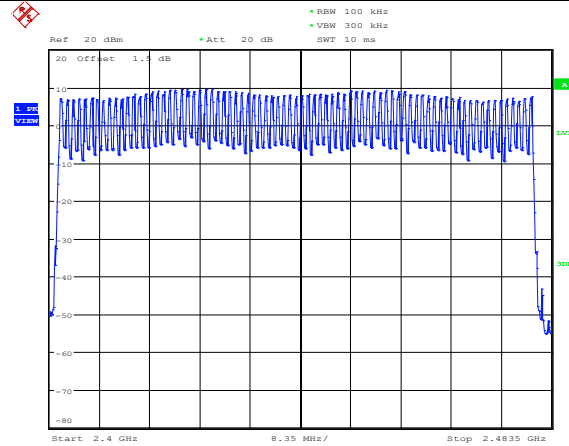
7.5. Original test data

Left side:



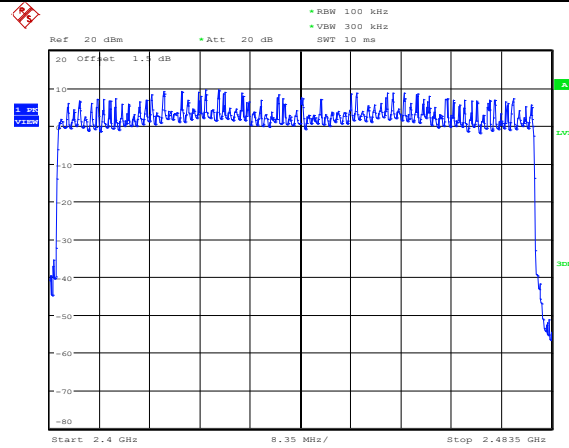
Right side:

DH5_ANT1_HOP



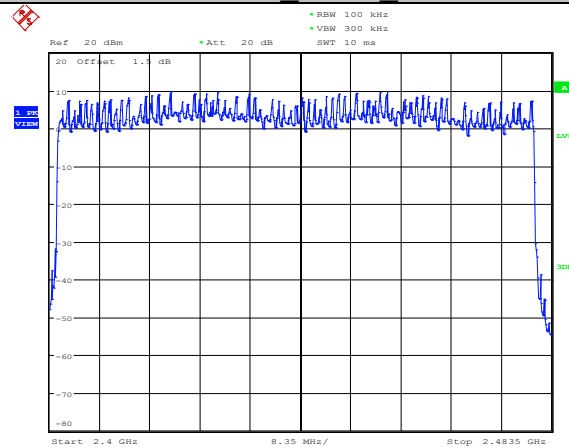
Date: 2.MAR.2020 12:55:37

2DH5_ANT1_HOP



Date: 2.MAR.2020 12:59:26

3DH5_ANT1_HOP



Date: 2.MAR.2020 13:04:24

8. Dwell Time

8.1. Block diagram of test setup

Same as section 4.1

8.2. Limits

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.

8.3. Test Procedure

- (1) Connect EUT's antenna output to spectrum analyzer by RF cable.
- (2) The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$
- (3) Measure the hopping number and on time of each pulse with spectrum analyzer in zero span set, and calculate dwell time with formula $\text{Dwell time} = \text{total hops} \times \text{pulse's on time}$.

8.4. Test Result

Left side:

Mode	Dwell time (s)	Pulse's on time (ms)	Total hops	Limit	Conclusion
DH1	0.070	0.37	188	<400ms	PASS
DH3	0.159	1.62	98	<400ms	PASS
DH5	0.202	2.88	70	<400ms	PASS
2DH1	0.068	0.38	178	<400ms	PASS
2DH3	0.156	1.63	96	<400ms	PASS
2DH5	0.234	2.89	81	<400ms	PASS
3DH1	0.067	0.38	177	<400ms	PASS
3DH3	0.156	1.63	96	<400ms	PASS
3DH5	0.220	2.89	76	<400ms	PASS

Note: $\text{Dwell time} = \text{total hops} \times \text{pulse's on time}$.

Right side:

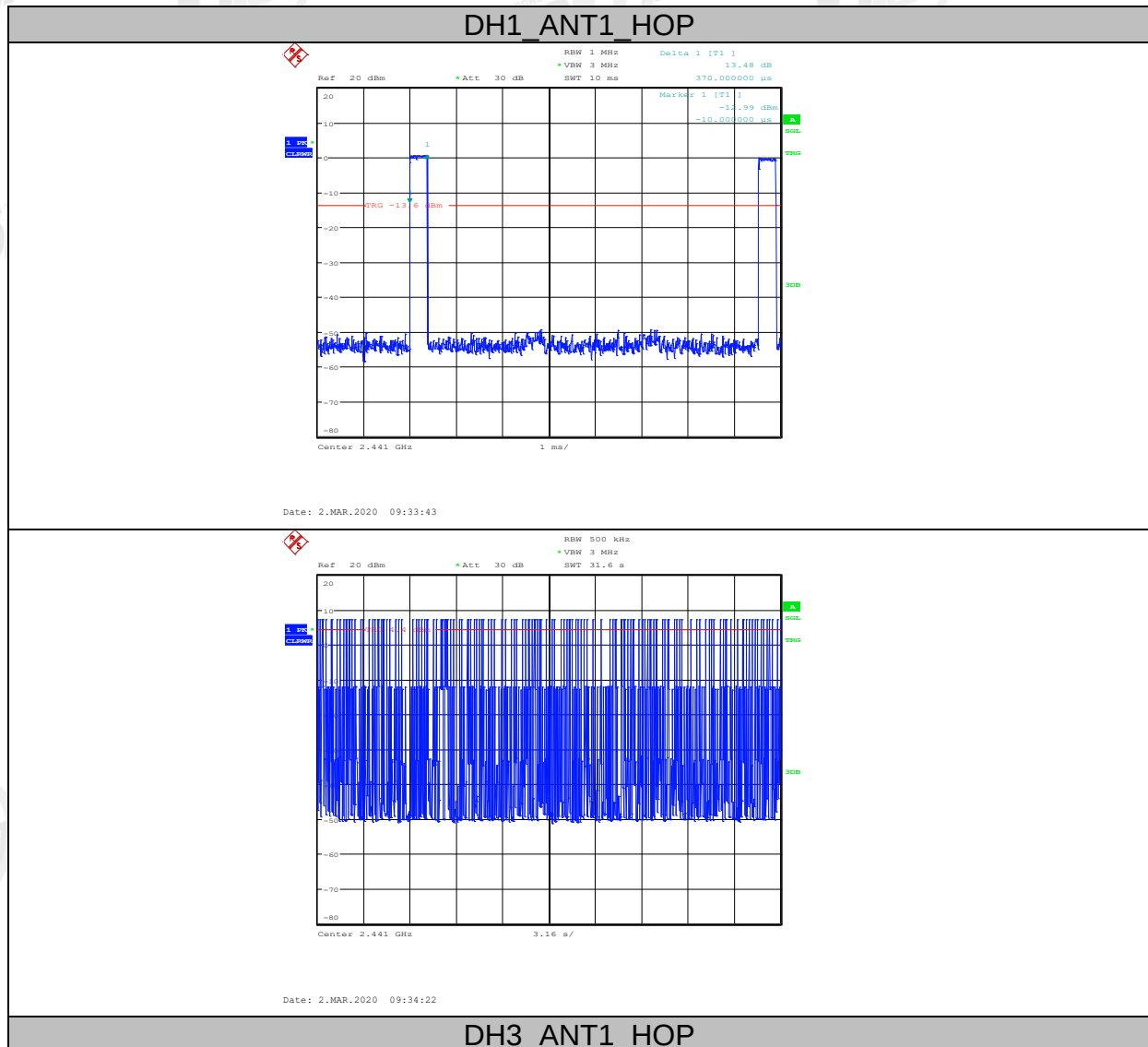
Mode	Dwell time (s)	Pulse's on time (ms)	Total hops	Limit	Conclusion
DH1	0.069	0.37	186	<400ms	PASS
DH3	0.161	1.63	99	<400ms	PASS
DH5	0.213	2.88	74	<400ms	PASS
2DH1	0.071	0.38	187	<400ms	PASS
2DH3	0.167	1.64	102	<400ms	PASS
2DH5	0.240	2.89	83	<400ms	PASS
3DH1	0.071	0.38	186	<400ms	PASS

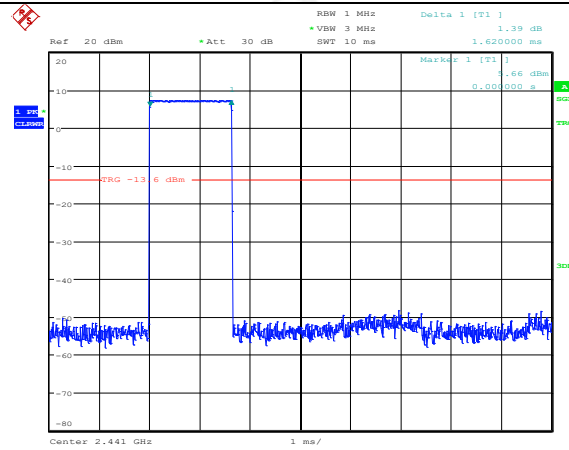
3DH3	0.184	1.64	112	<400ms	PASS
3DH5	0.234	2.89	81	<400ms	PASS

Note: Dwell time = total hops * pulse's on time.

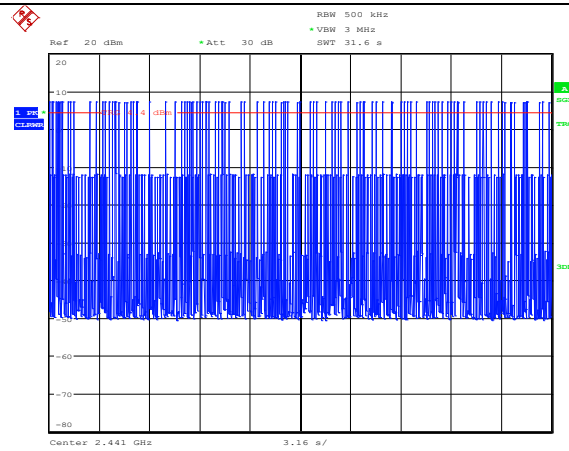
8.5. Original test data

Left side:



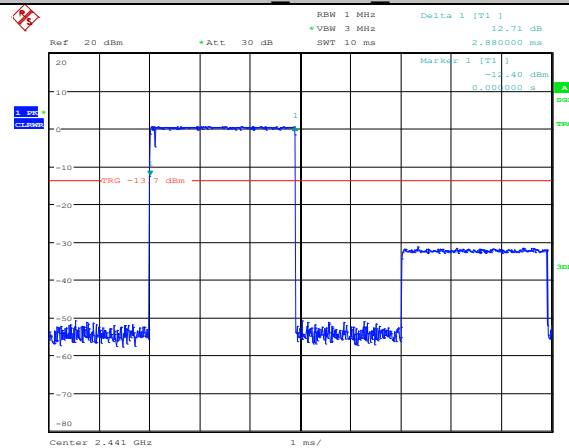


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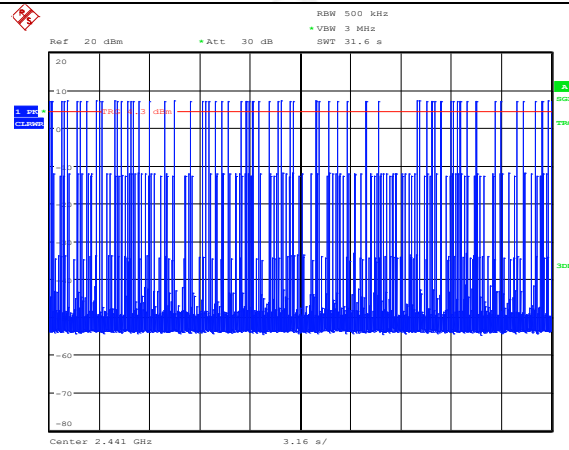


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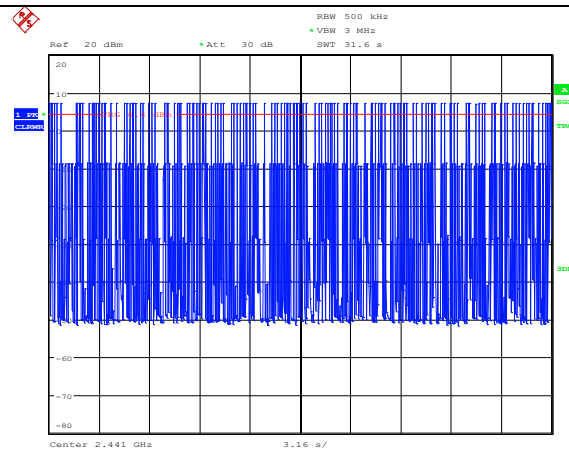
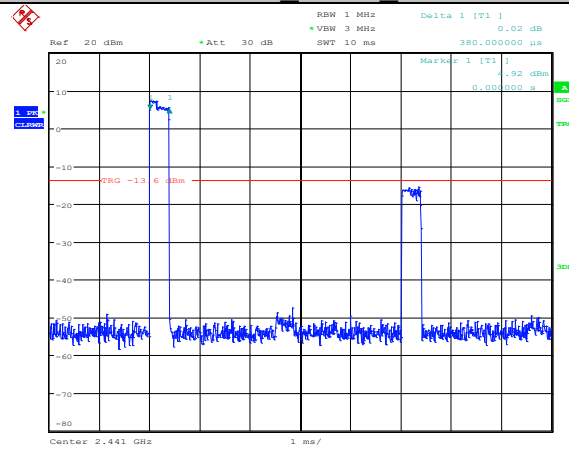
DH5 ANT1 HOP



Date: 2.MAR.2020 09:35:45



2DH1_ANT1_HOP



2DH3_ANT1_HOP