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FCC ID TEST REPORT

Under
FCC 15 Subpart C, Paragraph 15.247
Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz
☒DSS - Spread Spectrum Transmitter

Prepared For:

Moochies Technologies LTD

159 Wardour Street, London, W1F 8WH, UK

FCC ID: 2AW9Z-MW12
EUT: Kids 4G Smartwatch Phone
Model: MW12

July 17, 2020 **Issue Date:**
Original Report **Report Type:**
 **Test Engineer:** Jacky Huang
 **Review By:** Apollo Liu / Manager

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Report Revision History

Report #	Version	Description	Issued Date
KSZ2020032301J04	Rev.01	Initial issue of report	July 17, 2020

1. General Information

1. 1 Notes

The test results of this report relate exclusively to the test item specified in 1.6. The KMO Lab does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the KMO Lab.

1. 2 Testing Laboratory

Test Firm Name:	**Ke Mei Ou Lab Co., Ltd.**
Test Firm Address:	2013-2016, 20th Floor, Business Center, Jiahui Xin Cheng, No 3027, Shen Nan Road, Fu Tian, Shen Zhen, Guang Dong, P. R. China
FCC Designation Number:	CN1532
Test Firm Registration Number:	344480
Internet:	www.kmolab.com
Email:	kmo@kmolab.com
ANSI-ASQ National Accreditation Board/ACLASS ISO/IEC 17025 Accredited Lab for telecommunication standards. The Registration Number is AT-1532. The testing quality system meets with ISO/IEC-17025 requirements, This approval results is accepted by MRA of ILAC.	

1. 3 Details of Applicant

Name	Moochies Technologies LTD
Address	159 Wardour Street, London, W1F 8WH, UK

1. 4 Application Details

Date of Receipt of Application	: March 23, 2020
Date of Receipt of Test Item	: May 11, 2020
Date of Test	: May 11 ~ July 17, 2020

1. 5 Details of Manufacturer

Name	Moochies Technologies LTD
Address	159 Wardour Street, London, W1F 8WH, UK

1. 6 Test Item

EUT Feature				
EUT Description:	Kids 4G Smartwatch Phone			
Brand Name:	Moochies			
Model Name:	MW12			
EUT RF Technology:	☒Bluetooth BT ☐ Bluetooth v4.0 LE ☐Bluetooth v4.2 LE			
HW Version:	G4H-MB			
SW Version:	G4P_EMMC_240_5M_COMMON_OVERSEA_20190919_17.19.00			
EUT Stage:	☒Identical Prototype ☐Production			
Note: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.				

Additional Information

Standard Product Specification				
Tx/Rx Frequency Range	2402~2480 MHz			
Number of Channels	79			
Carrier Frequency of Each Channel	f=2402+k MHz (k=0,1,2…,78)			
Antenna Type / Gain	Internal PCB Antenna / gain 1.1 dBi			
Type of Modulation	Bluetooth BR 1Mbps: GFSK Bluetooth EDR 2Mbps: π/4-DQPSK Bluetooth EDR 3Mbps: 8DPSK			
EUT Operational Condition	☐ AC			
	☒ DC → ☒ From Battery → ☐ External AC adapter ☐ POE			
	☒ Li-ion battery			
Specification of Accessory				
☒**Li-ion Battery**	**Brand Name**	N/A	**Model Name**	663032V
	Power Rating	3.7V, 700mAh, 2.59Wh		

1. 7 Applicable Standards

Applicable Standards
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards: FCC Part 15 Subpart C 15.247 FCC KDB Publish No. 558074 D01 DTS Meas. Guidance v05r02 FCC KDB 414788 D01 Radiated Test Site v01r01 ANSI C63.10-2013
Note: 1) All test items were verified and recorded according to the standards and without any deviation during the test. 2) This EUT has also been tested and complied with the requirements of FCC 15 Part 15, Subpart B, recorded in a separate test report.

2. Technical Test

2. 1 Summary of Test Results

The EUT has been tested according to the following specifications:

FCC Rules	Test Type	Limit	Result	Notes
15.247(a)(1)	Number of Hopping Channels	>15	PASS	Complies.
15.247(a)(1)	Hopping Channel Separation	≥ 2/3 of 20dB BW	PASS	Complies.
15.247(a)(1)	Dwell Time	≤ 0.4sec in 31.6sec period	PASS	Complies.
15.247(a)(1)	20dB Bandwidth	N/A	PASS	Complies.
15.247(b)(1)	Conducted Output Power	<=1 w for 1Mbps <=125 mW for 2,3Mbp	PASS	Complies.
15.247(d)	Radiated Band Edges and Radiated Spurious Emission	FCC 15.209(a) & 15.247(d)	PASS	Complies
15.247(d)	Conducted Band Edges	≤ 20dBc	PASS	Complies
15.247(d)	Conducted Spurious Emission	≤ 20dBc	PASS	Complies
15.207	Conducted Emission	FCC15.207(a)	PASS	Complies
15.203 & 15.247(b)	Antenna Requirement	N/A	PASS	Complies
15.247(i) & 1.1307(b)(1) & 2.1091	Maximum Permissible Exposure (MPE)	< 1mW/cm^2	PASS	Complies

2. 2 Antenna Requirement

A. Regulation

Per § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

B. Result

The EUT has one internal PCB antenna, which was permanently attached and the gain is 1.1 dBi, Therefore the EUT complies with Section 15.203 of the FCC rules.

2. 3 Measurement Uncertainty

Measurement	Frequency	Uncertainty
Conducted emissions	0.15MHz~30MHz	1.72
Radiated emissions	30MHz ~ 300MHz	3.88
Radiated emissions	300MHz ~1000MHz	3.86
Radiated emissions	>1000MHz	4.42
Bandwidth	-	5%
Peak Power	-	1.10
Peak Power Spectral Density	-	1.10
Band Edges Measurement	-	1.10

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

3. EUT Modifications

No modification by test lab.

4. Conducted Power Line Test

4. 1 Test Equipment

Please refer to Section 10 this report.

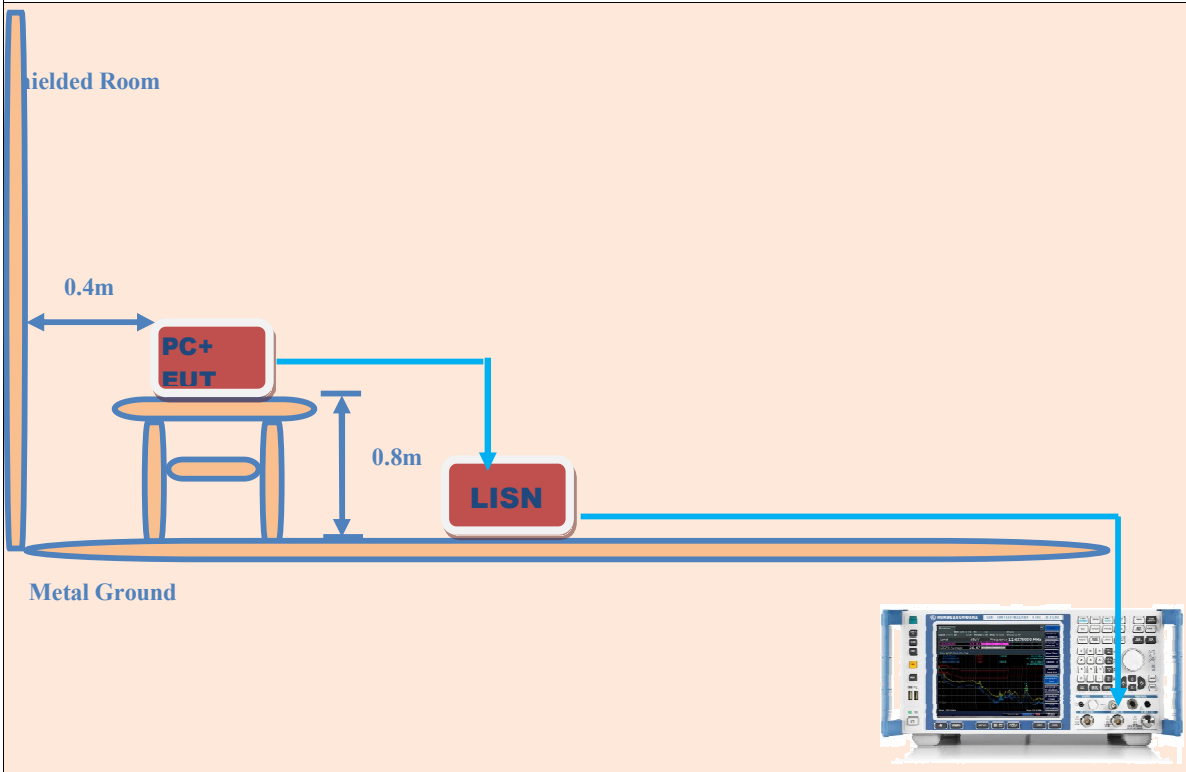
4. 2 Test Procedure

Test Method	
☒	The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission., the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement. Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

4. 3 Test Setup

Test Setup

AC Line Conducted Emissions



This test is applicable for radio equipment and/or ancillary equipment for fixed use powered by the AC mains.
This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment.
This test assesses the level of internally generated electrical noise present on the AC power input/output ports.

4. 4 Configuration of the EUT

Bluetooth Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

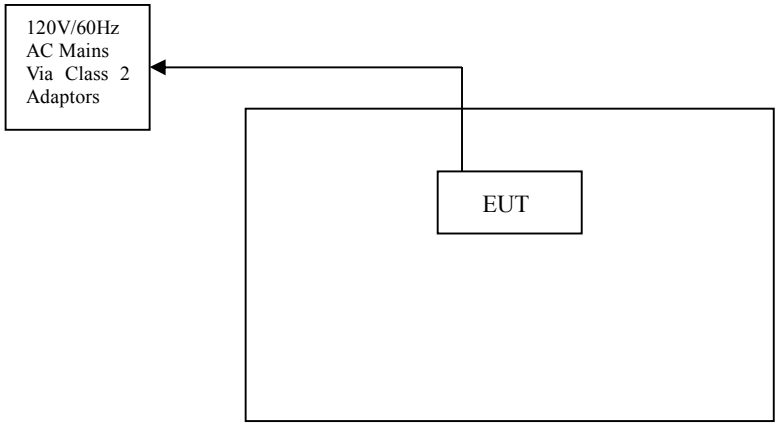
Summary Tables of Test Mode			
Test Item	**Data Rate / Modulation**		
	GFSK BT BR 1Mbps	**π /4-DQPSK BT EDR 2Mbps**	**8DPSK BT EDR 3Mbps**
Conducted Cases	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Test Item	**BT BR 1Mbps GFSK**		
Radiated Cases	Mode 1: CH00_2402 MHz (Power by battery) Mode 2: CH39_2441 MHz (Power by battery) Mode 3: CH78_2480 MHz (Power by battery)		
AC Conducted Emission	EUT is power by battery only.		

EUT Operation Test Setup	
Pre-Scan has been conducted to determine the worst-case mode from all possible combinations. Only the worst test mode data was reported. For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit/receive.	
Pre-Scan Mode	
Test Mode	**Operating Description**
1	EUT with GFSK
2	EUT with π /4-DQPSK
3	EUT with 8DPSK
Conducted Emissions → Final	
Test Mode	**Operating Description**
1	EUT with GFSK
2	EUT with π /4-DQPSK
3	EUT with 8DPSK
AC Conducted Emissions → Final	
1	EUT with Charger
Radiated Emissions → Final	
Test Mode	**Operating Description**
1	EUT with GFSK
2	EUT with π /4-DQPSK
3	EUT with 8DPSK
Note: The test modes were carried out for all operation modes (include link and idle). The final test mode of the EUT was the worst test mode for Mode 1, and its test data was reported.	

Support Unit				
Device	**Manufacturer**	**Model # Serial #**	**FCC ID/ DoC**	**Cable**
Notebook	LENOVO	20195	DoC	1.5m unshielded power cord
-	-	-	-	-

4. 5 EUT Operating Condition

Operating condition is according to ANSI C63.10:2013.
a. Setup the EUT and simulators as shown on follow.
b. Enable RF signal and confirm EUT active.
c. Modulate output capacity of EUT up to specification.



4. 6 Conducted Power Line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)	
Frequency Range (MHz)	**QP/AV**
0.15 – 0.5	66-56/56-46
0.5 – 5.0	56/46
5.0 - 30	60/50

Note: In the above table, the tighter limit applies at the band edges.

4. 7 Conducted Power Line Test Result

The EUT is power by battery only.

5. FCC Part 15.247 Requirements for FHSS Systems

5. 1 Test Equipment

Please refer to Section 10 this report.

5. 2 Test Procedure

Refer to FCC 15.247(a)(2), ANSI C63.10:2013; FCC KDB Publication No.558074 D01 DTS Meas Guidance v05r02

20 dB Bandwidth:
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set the spectrum analyzer as RBW = 30 kHz, VBW = 100 kHz, Span = 2 MHz, Sweep = 100ms.
d. Mark the peak frequency and –20dB (upper and lower) frequency.
e. Repeat until all the rest channels are investigated.

Peak Power:
Use the following spectrum analyzer settings:
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured; VBW ⩾ RBW; Sweep = auto
Detector function = peak; Trace = max hold

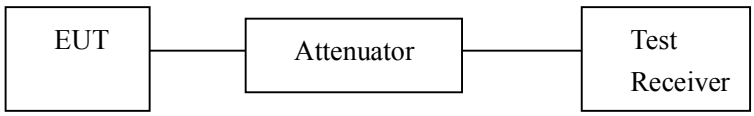
100kHz Bandwidth of Band Edges Measurement:
a. The transmitter output was connected to the spectrum analyzer via a low lose cable.
b. Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100kHz bandwidth from band edge.
c. The band edges was measured and recorded.

Frequency Separation:
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set the spectrum analyzer as RBW = 100 kHz, VBW = 100 kHz, Span = 2 MHz, Sweep = 100ms.
d. Set center frequency spectrum analyzer = middle of hopping channel.

Number of Hopping Frequency:
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set spectrum analyzer Start=2400MHz, Stop=2483.5MHz, RBW = 100 kHz, VBW = 300 kHz, Sweep=100ms
d. Max hold, view and count how many channel in the band.

Time of Occupancy (Dwell Time):
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
c. Set center frequency of spectrum analyzer = operating frequency, RBW = 100 kHz, VBW = 300 kHz, Sweep=2ms
d. Repeat above procedures until all frequency measured were complete.

5. 3 Test Setup



5. 4 Configuration of the EUT

Same as section 4.4 of this report

5. 5 EUT Operating Condition

Same as section 4.5 of this report

5. 6 Limit

20 dB Bandwidth: For frequency hopping systems operating in the 2400MHz~2483.5MHz no limit for 20dB bandwidth
Peak Power: For frequency hopping systems operating in the 2400~2483.5MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725~5850MHz band: 1Watt. For all other frequency hopping systems in the 2400~2483.5MHz band: 0.125Watts.
100kHz Bandwidth of Band Edges Measurement: According to §15.247(c), in any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).
Peak Power Spectral Density: According to §15.247(d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission
Frequency Separation: According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.
Number of Hopping Frequency: According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400~2483.5MHz bands shall use at least 15 hopping frequencies.
Time of Occupancy (Dwell Time): According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400~2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

5. 7 Test Result

A. 20 dB Bandwidth

Refer to Appendix_DSS_BT.

B. Peak Power

Refer to Appendix_DSS_BT.

C. 100kHz Band Edges Measurement

Refer to Appendix_DSS_BT.

D. Frequency Separation

Refer to Appendix_DSS_BT.

E. Number of Hopping Frequency

Refer to Appendix_DSS_BT.

F. Time of Occupancy (Dwell Time)

Refer to Appendix_DSS_BT.

6. Transmitter Spurious Radiated Emission at 3 Meters

6. 1 Test Equipment

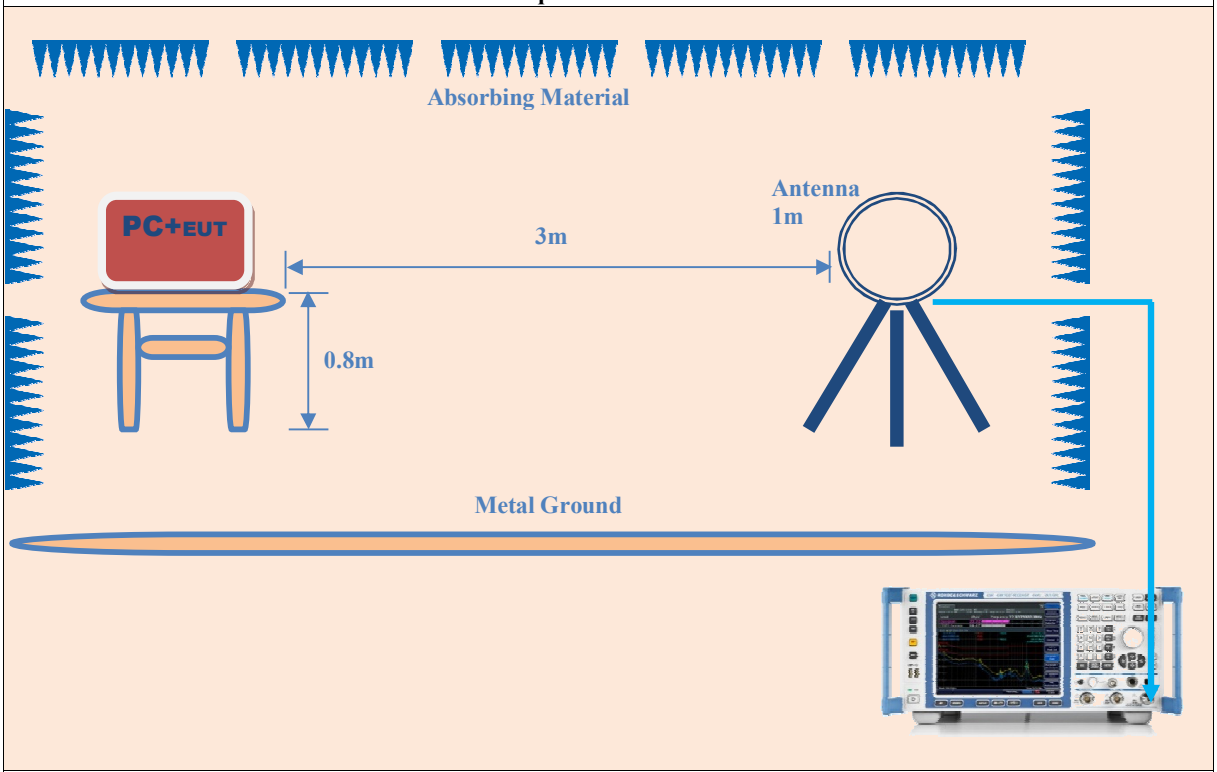
Please refer to Section 10 this report.

6. 2 Test Procedure

1. The EUT was tested according to ANSI C63.10:2013.
2. The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8m. All set up is according to ANSI C63.10:2013.
3. The frequency spectrum from 9kHz to 25 GHz was investigated. All readings from 9kHz to 150kHz are quasi-peak values with a resolution bandwidth of 200 Hz. All readings from 150kHz to 30MHz are quasi-peak values with a resolution bandwidth of 9 KHz. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 KHz Measurements were made at 3 meters. All readings are above 1 GHz , peak values with a resolution bandwidth of 1 MHz . Measurements were made at 3 meters.
4. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. The Receiving antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency. Emissions below 30MHz were measured with a loop antenna while emission above 30MHz were measured using a broadband E-field antenna.
5. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**QP**" in the data table.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 8 and 13 of ANSI C63.10:2013.

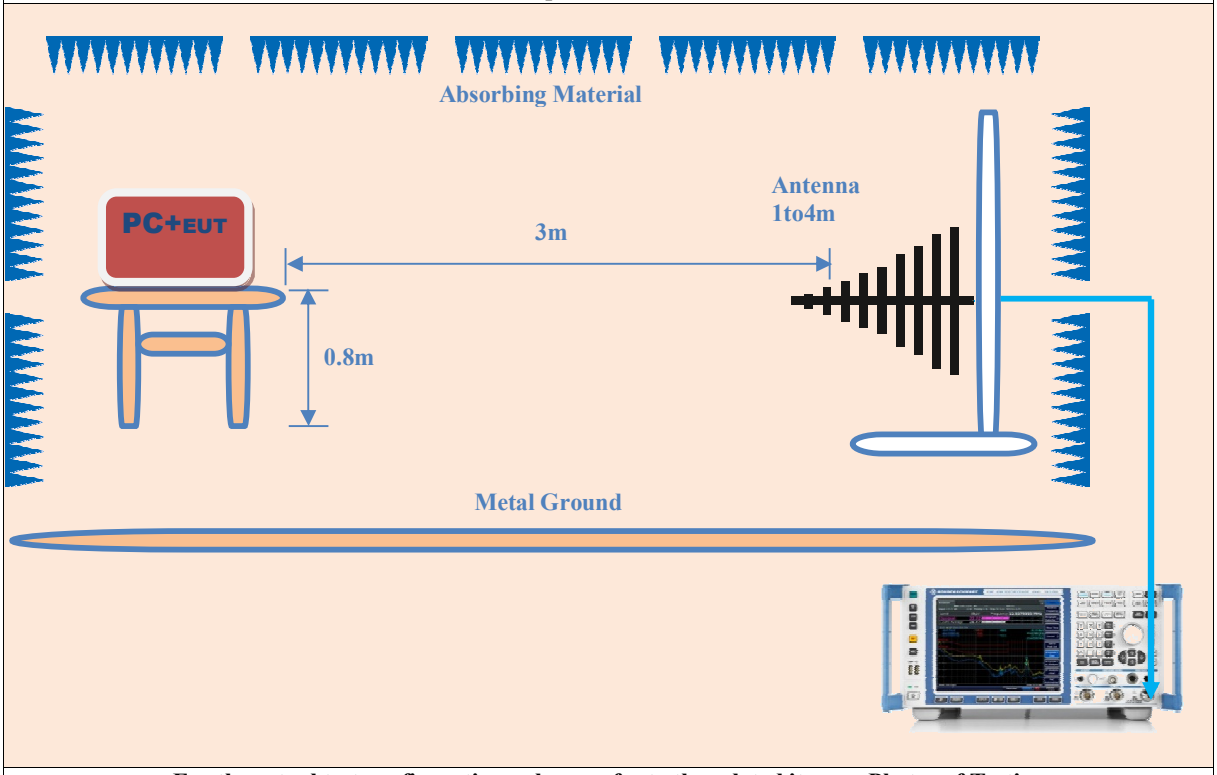
6. 3 Test Setup

For Frequencies below 30MHz



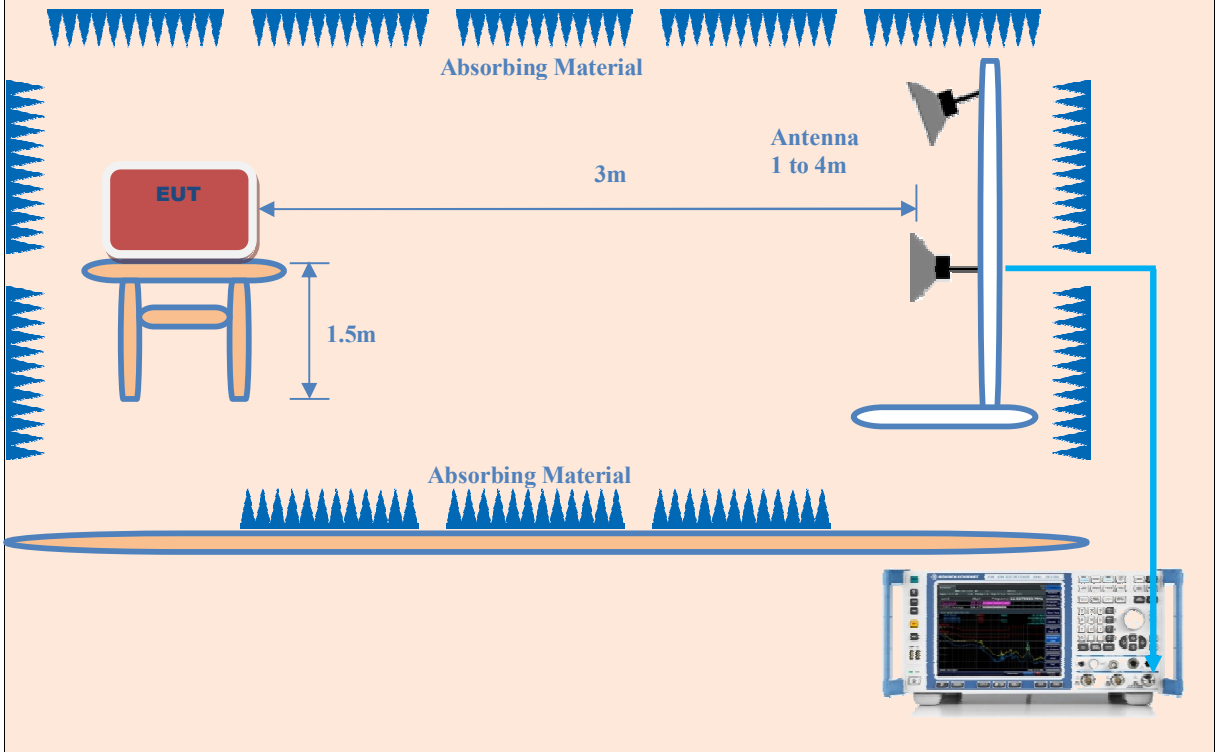
For the actual test configuration , please refer to the related items – Photos of Testing

For Frequencies below 1GHz



For the actual test configuration , please refer to the related items – Photos of Testing

For Frequencies above 1GHz



For the actual test configuration , please refer to the related items – Photos of Testing

6. 4 Configuration of the EUT
Same as section 4.4 of this report

6. 5 EUT Operating Condition
Same as section 4.5 of this report.

6. 6 Limit
In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in section 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in section 15.205(a) shall not exceed the general radiated emission limits specified in section 15.209(a)

Note:
Applies to harmonics/spurious emissions that fall in the restricted bands listed in section 15.205.Themaximum permitted average field strength is listed in section 15.209.
47 CFR § 15.237(c): The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in section 15.35 for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para, 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	[2]
13.36–13.41.			

[1]UntilFebruary1,1999,thisrestrictedbandshallbe0.490–0.510MHz.
[2]Above38.6

FCC 47 CFR, Part 15.209(a) – Field Strength Limits within Restricted Frequency Bands

Frequency(MHz)	Fieldstrength (microvolts/meter)	Measure-mentdis-tance (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
Above960	500	3

6. 7 Test Result

Test Mode 1										
Restricted Frequency Bands Data_GFSK CH Low										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2390.000	56.60	46.05	0.90	57.50	46.95	Horiz./	74.0	54.0	-16.50	-7.05
2390.000	56.76	46.50	0.90	57.66	47.40	Vert.	74.0	54.0	-16.34	-6.60
Restricted Frequency Bands Data_GFSK CH High										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2483.500	56.49	46.22	0.90	57.39	47.12	Horiz./	74.0	54.0	-16.61	-6.88
2483.500	61.58	48.69	0.90	62.48	49.59	Vert.	74.0	54.0	-11.52	-4.41

Test Mode 2										
Restricted Frequency Bands Data_ π /4-DQPSK CH Low										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2390.000	56.61	44.67	0.90	57.51	45.57	Horiz./	74.0	54.0	-16.49	-8.43
2390.000	57.18	45.41	0.90	58.08	46.31	Vert.	74.0	54.0	-15.92	-7.69
Restricted Frequency Bands Data_ π /4-DQPSK CH High										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2483.500	56.12	45.65	0.90	57.02	46.55	Horiz./	74.0	54.0	-16.98	-7.45
2483.500	58.28	48.37	0.90	59.18	49.27	Vert.	74.0	54.0	-14.82	-4.73

Test Mode 3										
Restricted Frequency Bands Data_8DPSK CH Low										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2483.500	56.56	44.94	0.90	57.46	45.84	Horiz./	74.0	54.0	-16.54	-8.16
2483.500	57.12	45.17	0.90	58.02	46.07	Vert.	74.0	54.0	-15.98	-7.93
Restricted Frequency Bands Data_8DPSK CH High										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2483.500	57.19	45.98	0.90	58.09	46.88	Horiz./	74.0	54.0	-15.91	-7.12
2483.500	58.74	48.83	0.90	59.64	49.73	Vert.	74.0	54.0	-14.36	-4.27

Test Mode 1										
Harmonics Radiated Emission Data_CH Low										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
4804.000	41.22	31.92	10.10	51.32	42.02	Horiz./	74.0	54.0	-22.68	-11.98
4804.000	41.53	32.25	10.10	51.63	42.35	Vert.	74.0	54.0	-22.37	-11.65
7206.000	39.58	29.43	13.10	52.68	42.53	Horiz./	74.0	54.0	-21.32	-11.47
7206.000	39.82	29.74	13.10	52.92	42.84	Vert.	74.0	54.0	-21.08	-11.16
24020.00	-	-	-	-	-	-	-	-	-	-
24020.00	-	-	-	-	-	-	-	-	-	-
Harmonics Radiated Emission Data_CH Mid										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
4882.000	41.19	31.52	10.10	51.29	41.62	Horiz./	74.0	54.0	-22.71	-12.38
4882.000	41.59	31.68	10.10	51.69	41.78	Vert.	74.0	54.0	-22.31	-12.22
7323.000	39.26	29.44	13.10	52.36	42.54	Horiz./	74.0	54.0	-21.64	-11.46
7323.000	39.44	29.52	13.10	52.54	42.62	Vert.	74.0	54.0	-21.46	-11.38
24410.00	-	-	-	-	-	-	-	-	-	-
24410.00	-	-	-	-	-	-	-	-	-	-
Harmonics Radiated Emission Data_CH High										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
4960.000	42.03	32.44	10.10	52.13	42.54	Horiz./	74.0	54.0	-21.87	-11.46
4960.000	42.28	32.55	10.10	52.38	42.65	Vert.	74.0	54.0	-21.62	-11.35
7440.000	40.06	29.95	13.10	53.16	43.05	Horiz./	74.0	54.0	-20.84	-10.95
7440.000	40.14	30.08	13.10	53.24	43.18	Vert.	74.0	54.0	-20.76	-10.82
24800.00	-	-	-	-	-	-	-	-	-	-
24800.00	-	-	-	-	-	-	-	-	-	-

Note: (1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.
(3) Span shall wide enough to fully capture theemission being measured;
Set RBW = 1 MHz, VBW= 3MHz for f > 1 GHzfor peak measurement.
For average measurement: VBW = 10 Hz, whenduty cycle is no less than 98 percent. VBW ≥ 1/T,when duty cycle is less than 98 percent where T isthe minimum transmission duration over which thetransmitter is on and is transmitting at its maximumpower control level for the tested mode of operation.
(4) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
(5)Where an emission level is indicated by a –, levels had a margin greater than 20 dBwhen compared to the limit.

General Radiated Emission Data
For Frequency below 30MHz

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
N/A						
N/A						
N/A						
N/A						
N/A						
N/A						

Note: (1) All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
(2) "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
(3) Emission Level = Reading Level + Probe Factor + Cable Loss.

For Frequency from 30MHz to 1GHz

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
N/A						
N/A						
N/A						
N/A						
N/A						
N/A						

Note: (1) All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
(2) "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
(3) Emission Level = Reading Level + Probe Factor + Cable Loss.

7. Photos of Testing

Please refer to Exhibits _External Test Setup Photos

8. Photographs – EUT

Please refer to Exhibits _External Photos & Internal Photos

9. FCC ID Label

Please refer to Exhibits _ ID Label & Location Info

10. Test Equipment

The following test equipment were used during the radiated & conducted emission test:

Equipment/ Facilities	Manufacturer	Model #	Serial No.	Cal/Char Date	Due Date
Turntable	Innco systems GmbH	CT-0801	N/A	NCR	NCR
Antenna Tower	Innco systems GmbH	MA-4640-XP-ET	N/A	NCR	NCR
Controller	Innco systems GmbH	CO3000	955/38850716L	NCR	NCR
Pre-Amplifier	Agilent	87405C	MY47010722	Dec.6, 2019	Dec.6, 2021
EMI Test Receiver	Rohde & Schwarz	ESR7	101091	Nov.21, 2018	Nov.21, 2020
Spectrum Analyzer	Rohde & Schwarz	FSP40	100273	Dec.14, 2019	Dec.14, 2021
Vector Signal Generator	Rohde & Schwarz	SMU200A	101824	Dec.13, 2017	Dec.13, 2020
Signal Generator	Rohde & Schwarz	SMB100A	177847	Dec.13, 2017	Dec.13, 2020
Power Meter	Rohde & Schwarz	OSP-B157	KMO-HK015	Dec.13, 2017	Dec.13, 2020
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	124004	Jan. 14, 2020	Jan. 14, 2023
Regulatory Test System 30 MHz to 40 GHz	Rohde & Schwarz	TS8997	KMO-HK015	Dec.13, 2017	Dec.13, 2020
Trilog-Super Broadband Antenna	SCHWARZBECK	VULB9161	9161-4079	Nov.27, 2018	Nov.27, 2021
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-565	Nov.29, 2018	Nov.29, 2021
AMN	Rohde & Schwarz	ESH3-Z5	100197	Dec.25, 2017	Dec.25, 2020
AMN	CYBERTEK	EM5040A	E115040054	Nov.21, 2018	Nov.21, 2021
KMO Shielded Room	KMO	KMO-001	N/A	NCR	NCR
Coaxial Cable with N-Connectors	SCHWARZBECK	AK9515H	95549	Sep.18, 2019	Sep.18, 2021
3m Anechoic Chamber	KMO	KMO-3AC	N/A	Dec.23, 2019	Dec.23, 2021
Temperature Chamber	TABAI	PSL-4GTW	N/A	Feb.10, 2019	Feb.10, 2021

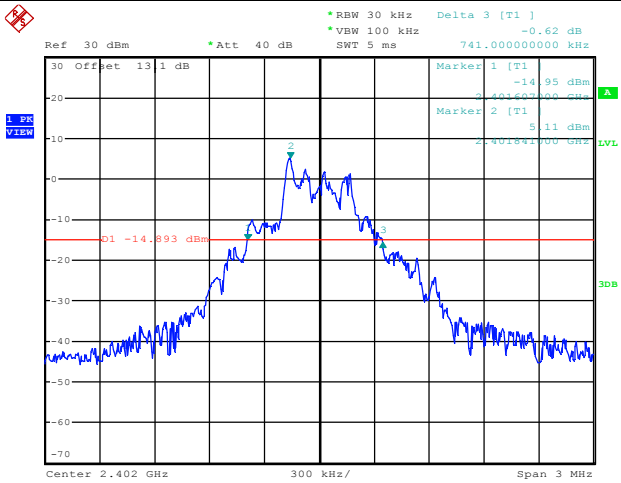
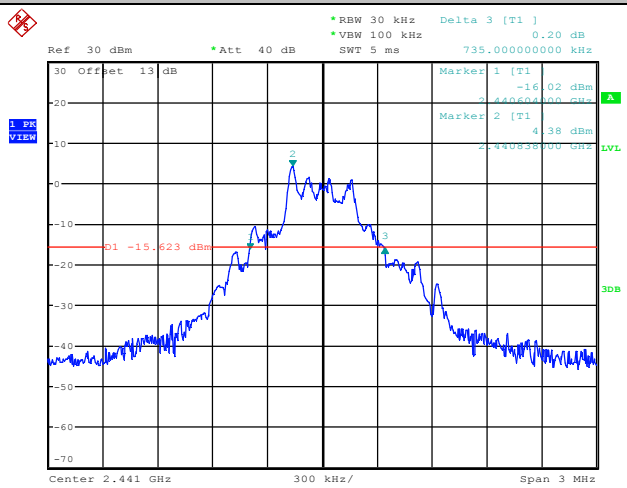
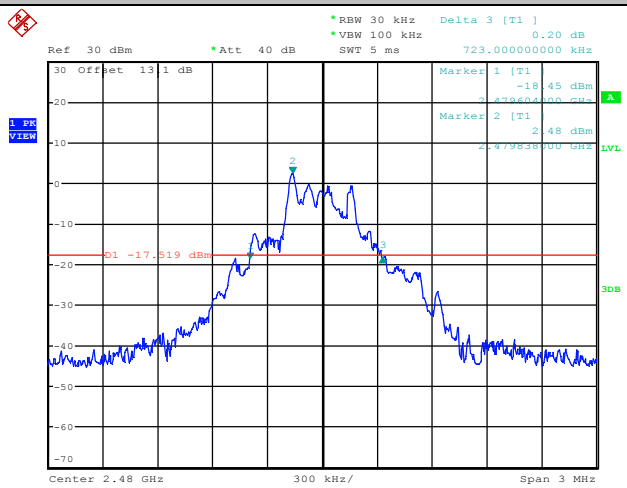
----------End of Report ----------

AppendixA: 20dBEmission Bandwidth

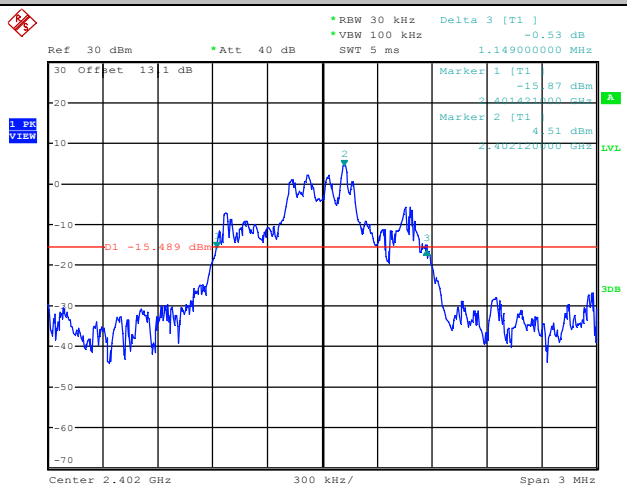
Test Result

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.741	2401.607	2402.348	---	PASS
		2441	0.735	2440.604	2441.339	---	PASS
		2480	0.723	2479.604	2480.327	---	PASS
2DH5	Ant1	2402	1.149	2401.421	2402.570	---	PASS
		2441	1.158	2440.418	2441.576	---	PASS
		2480	1.119	2479.421	2480.540	---	PASS
3DH5	Ant1	2402	1.143	2401.430	2402.573	---	PASS
		2441	1.116	2440.433	2441.549	---	PASS
		2480	1.116	2479.430	2480.546	---	PASS

Test Graphs

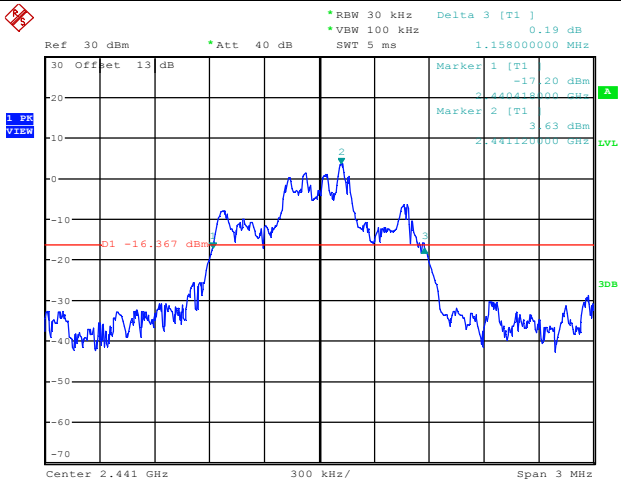
DH5_Ant1_2402
 Date: 5.JUL.2020 10:42:16
DH5_Ant1_2441
 Date: 5.JUL.2020 10:45:51
DH5_Ant1_2480
 Date: 5.JUL.2020 10:50:06

2DH5_Ant1_2402



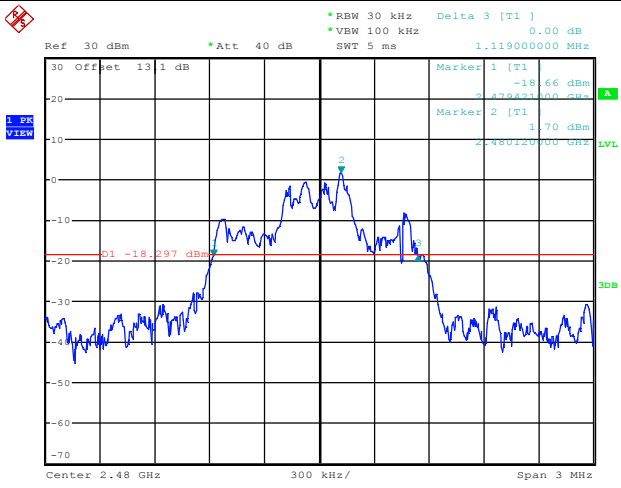
Date: 5.JUL.2020 10:53:04

2DH5_Ant1_2441



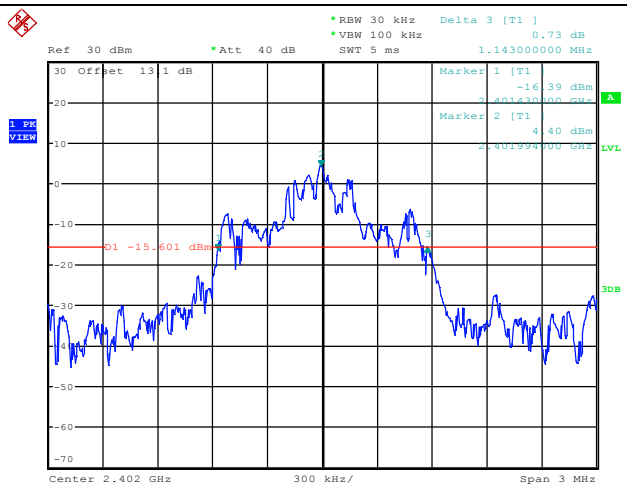
Date: 5.JUL.2020 10:58:33

2DH5_Ant1_2480



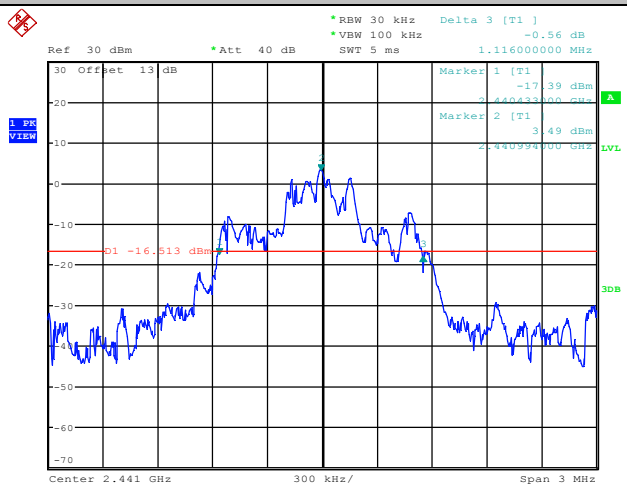
Date: 5.JUL.2020 11:06:19

3DH5_Ant1_2402



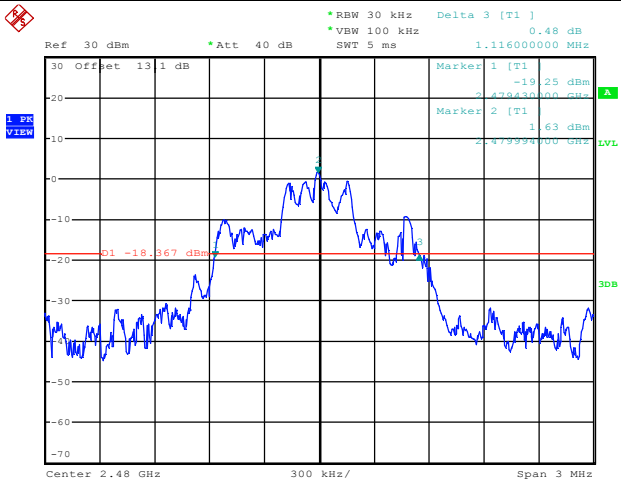
Date: 5.JUL.2020 11:11:34

3DH5_Ant1_2441



Date: 5.JUL.2020 11:16:40

3DH5_Ant1_2480



Date: 5.JUL.2020 11:20:28

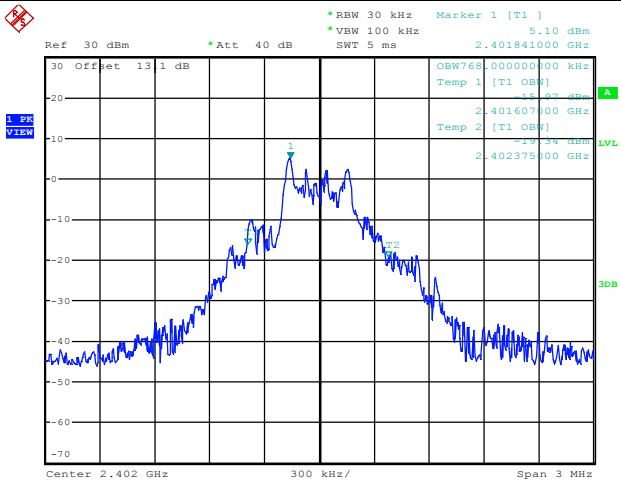
AppendixB: Occupied Channel Bandwidth

Test Result

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.768	0.000	0.000	---	PASS
		2441	0.786	0.000	0.000	---	PASS
		2480	0.771	0.000	0.000	---	PASS
2DH5	Ant1	2402	1.086	0.000	0.000	---	PASS
		2441	1.08	0.000	0.000	---	PASS
		2480	1.089	0.000	0.000	---	PASS
3DH5	Ant1	2402	1.053	0.000	0.000	---	PASS
		2441	1.068	0.000	0.000	---	PASS
		2480	1.071	0.000	0.000	---	PASS

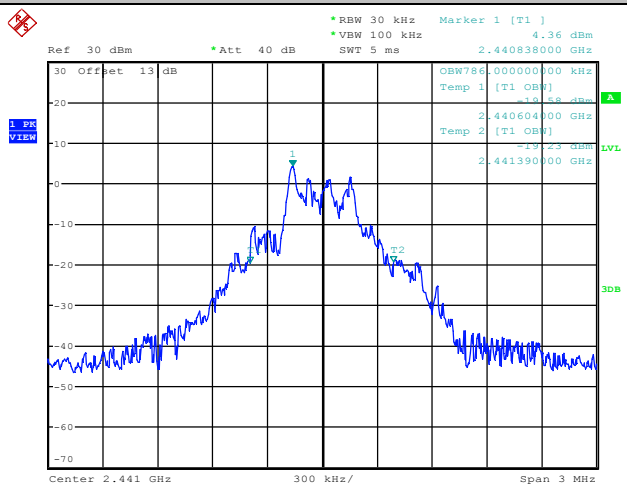
Test Graphs

DH5_Ant1_2402



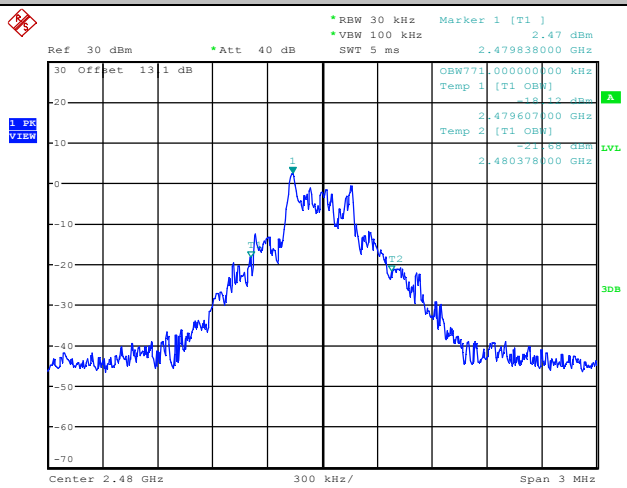
Date: 5.JUL.2020 10:42:29

DH5_Ant1_2441



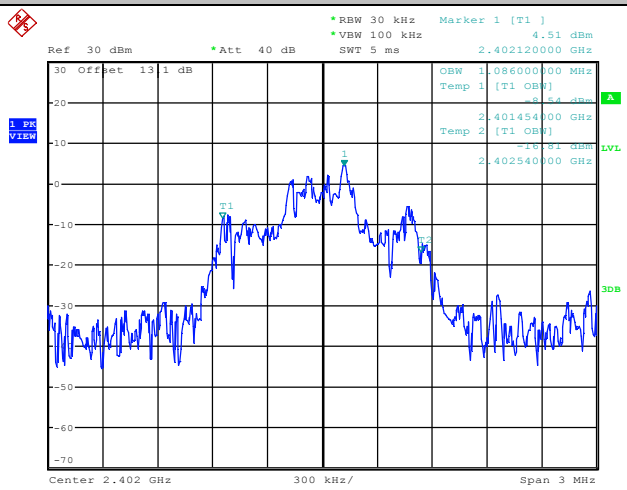
Date: 5.JUL.2020 10:46:04

DH5_Ant1_2480



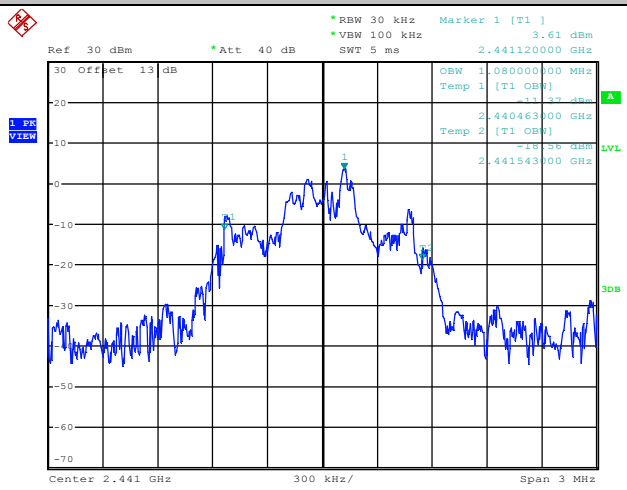
Date: 5.JUL.2020 10:50:19

2DH5_Ant1_2402



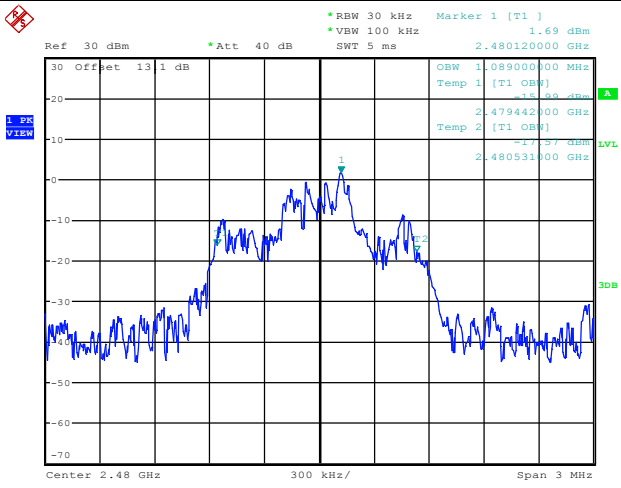
Date: 5.JUL.2020 10:53:17

2DH5_Ant1_2441



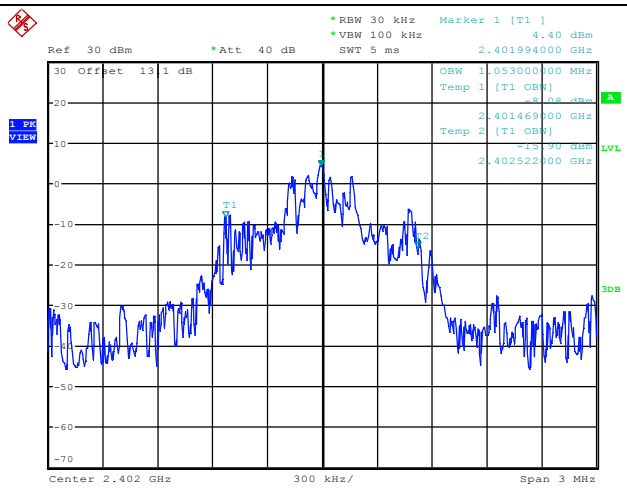
Date: 5.JUL.2020 10:58:46

2DH5_Ant1_2480



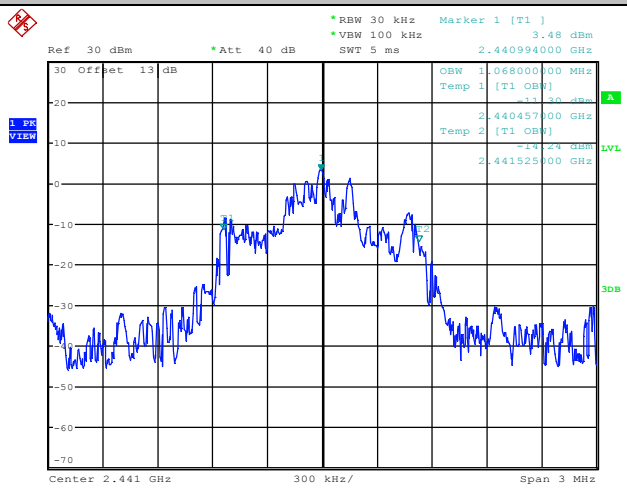
Date: 5.JUL.2020 11:06:32

3DH5_Ant1_2402



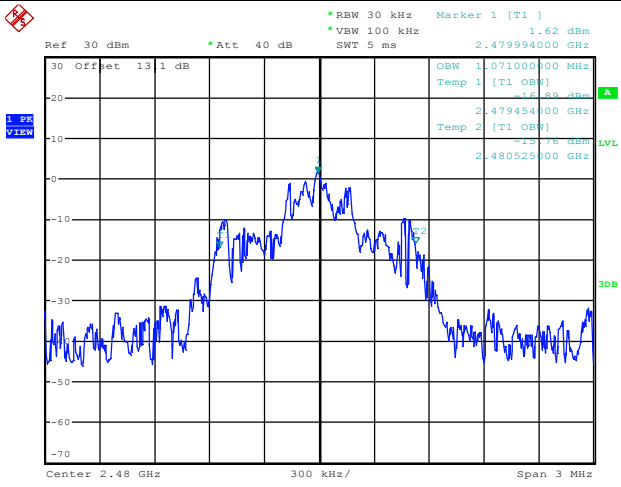
Date: 5.JUL.2020 11:11:47

3DH5_Ant1_2441



Date: 5.JUL.2020 11:16:53

3DH5_Ant1_2480



Date: 5.JUL.2020 11:20:41

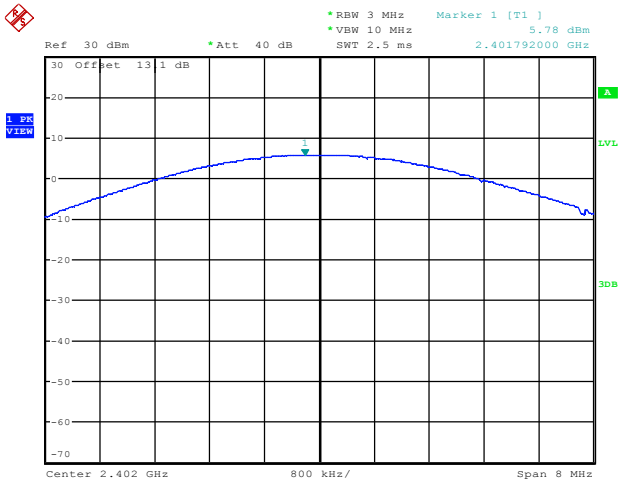
AppendixC: Maximum conducted output power

Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	5.78	<=30	PASS
		2441	5.2	<=30	PASS
		2480	3.49	<=30	PASS
2DH5	Ant1	2402	6.49	<=20.97	PASS
		2441	6.00	<=20.97	PASS
		2480	4.01	<=20.97	PASS
3DH5	Ant1	2402	6.49	<=20.97	PASS
		2441	5.81	<=20.97	PASS
		2480	3.86	<=20.97	PASS

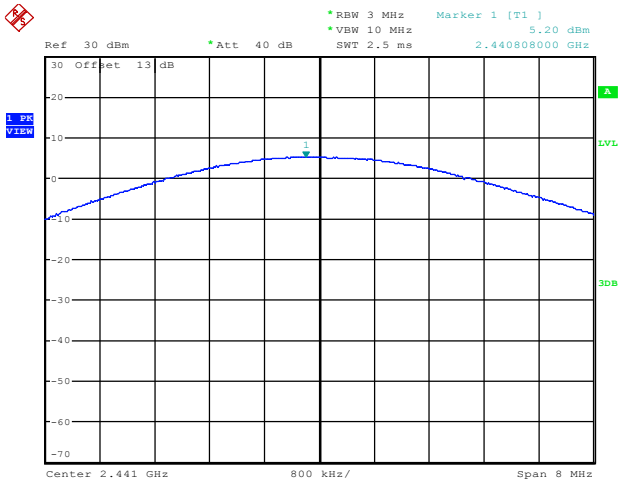
Test Graphs

DH5_Ant1_2402



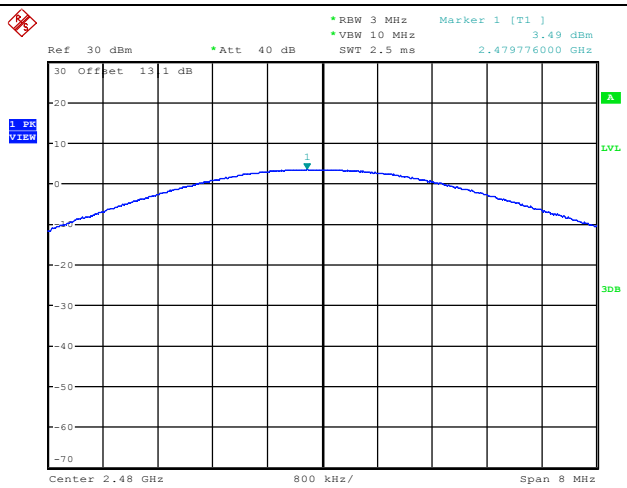
Date: 5.JUL.2020 10:37:07

DH5_Ant1_2441



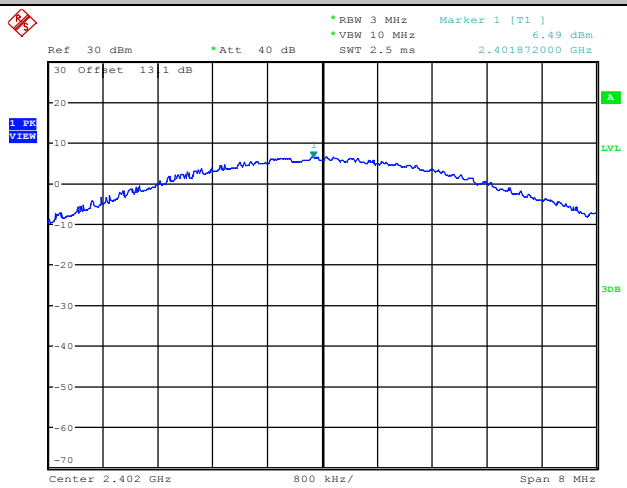
Date: 5.JUL.2020 10:37:21

DH5_Ant1_2480



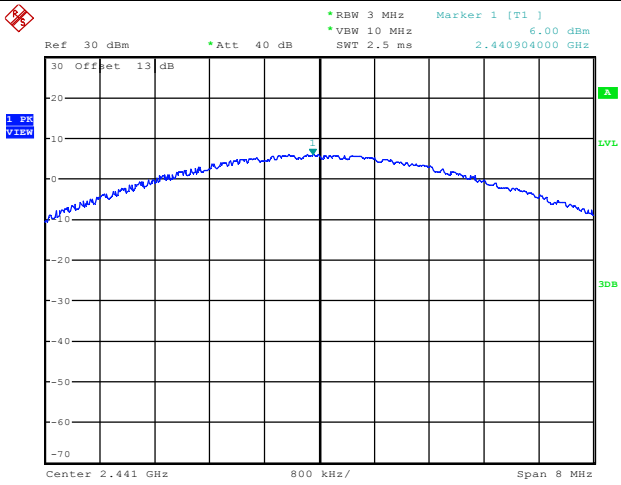
Date: 5.JUL.2020 10:37:40

2DH5_Ant1_2402



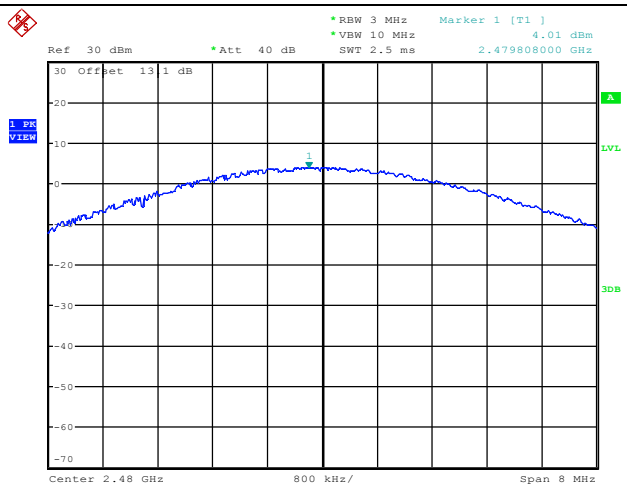
Date: 5.JUL.2020 10:38:01

2DH5_Ant1_2441

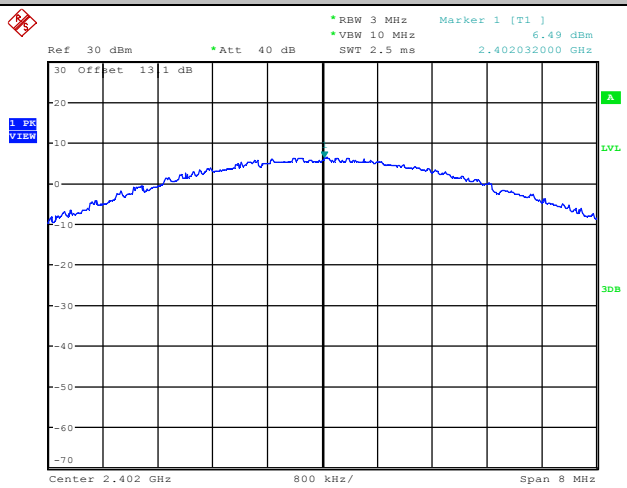


Date: 5.JUL.2020 10:38:43

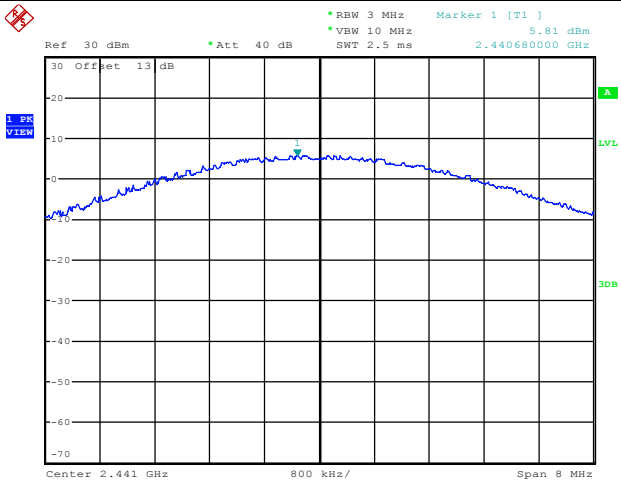
2DH5_Ant1_2480



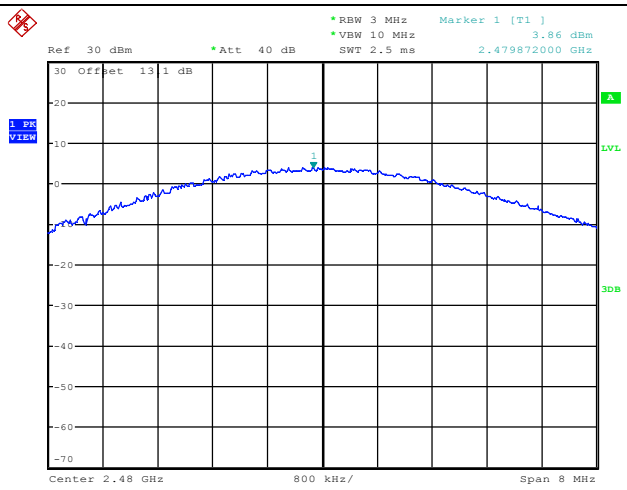
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480



Date: 5.JUL.2020 10:41:09

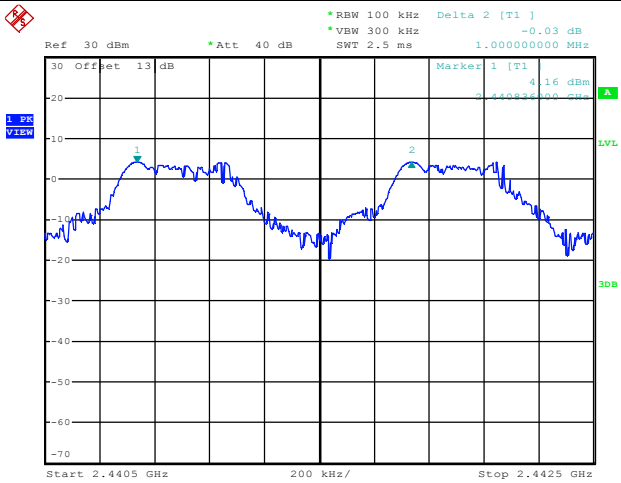
AppendixD: Carrier frequency separation

Test Result

TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	1	>=0.741	PASS
2DH5	Ant1	Hop	1.004	>=0.772	PASS
3DH5	Ant1	Hop	1	>=0.762	PASS

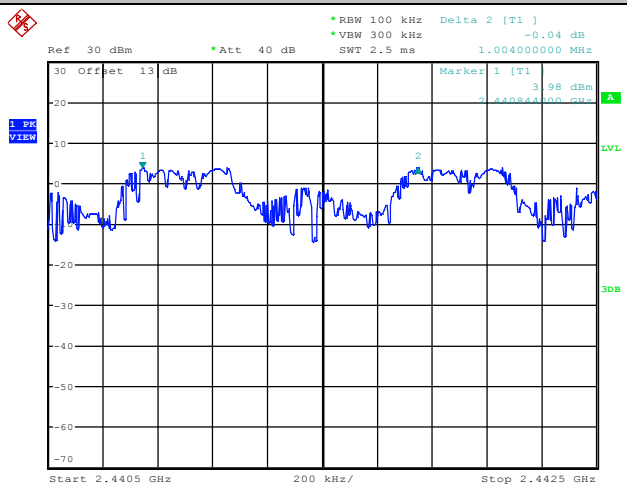
Test Graphs

DH5_Ant1_Hop



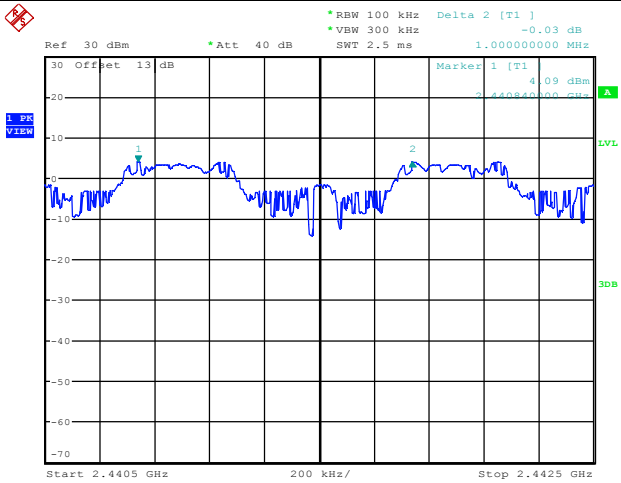
Date: 5.JUL.2020 11:32:08

2DH5_Ant1_Hop



Date: 5.JUL.2020 12:31:27

3DH5_Ant1_Hop



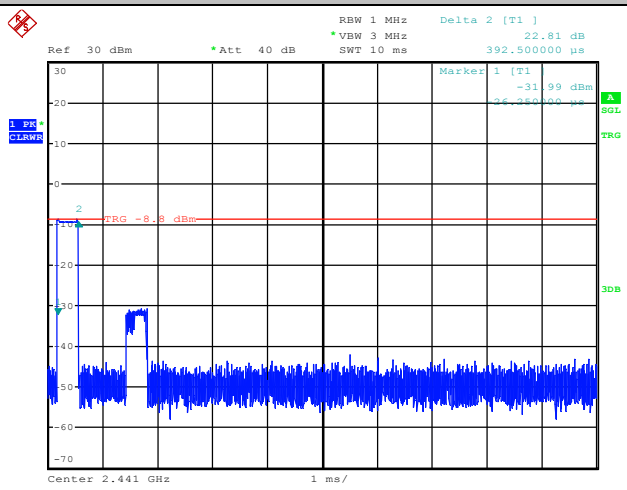
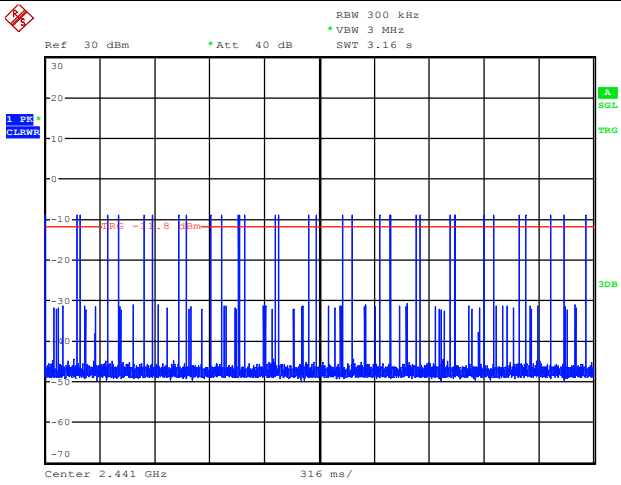
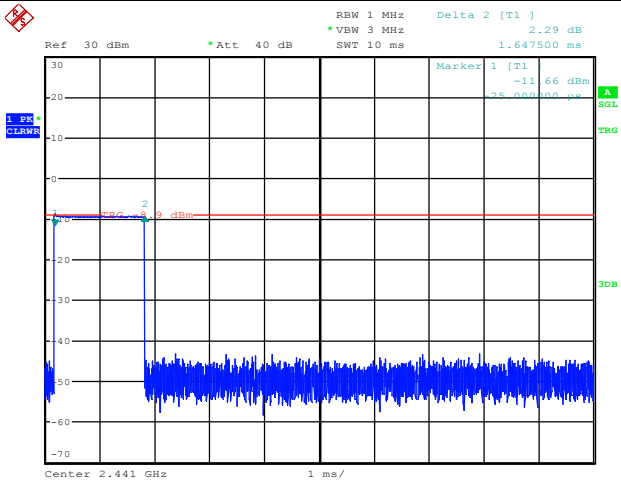
Date: 5.JUL.2020 12:39:54

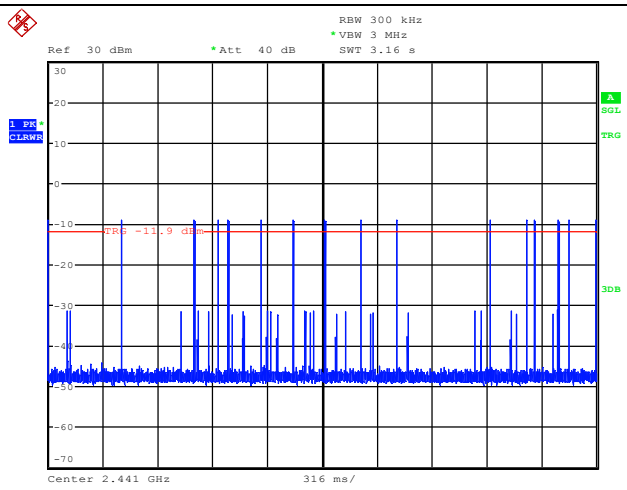
AppendixE: Time of occupancy

Test Result

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.39	320	0.126	<=0.4	PASS
DH3	Ant1	Hop	1.65	160	0.264	<=0.4	PASS
DH5	Ant1	Hop	2.90	110	0.319	<=0.4	PASS
2DH1	Ant1	Hop	0.39	330	0.127	<=0.4	PASS
2DH3	Ant1	Hop	1.64	140	0.229	<=0.4	PASS
2DH5	Ant1	Hop	2.89	130	0.375	<=0.4	PASS
3DH1	Ant1	Hop	0.38	330	0.126	<=0.4	PASS
3DH3	Ant1	Hop	1.63	170	0.278	<=0.4	PASS
3DH5	Ant1	Hop	2.88	80	0.231	<=0.4	PASS

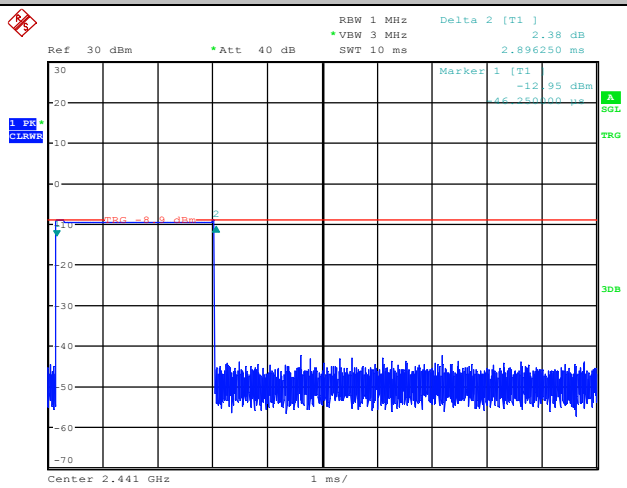
Test Graphs

DH1_Ant1_Hop
 Date: 5.JUL.2020 11:40:46
 Date: 5.JUL.2020 11:40:52
DH3_Ant1_Hop
 Date: 5.JUL.2020 11:43:29

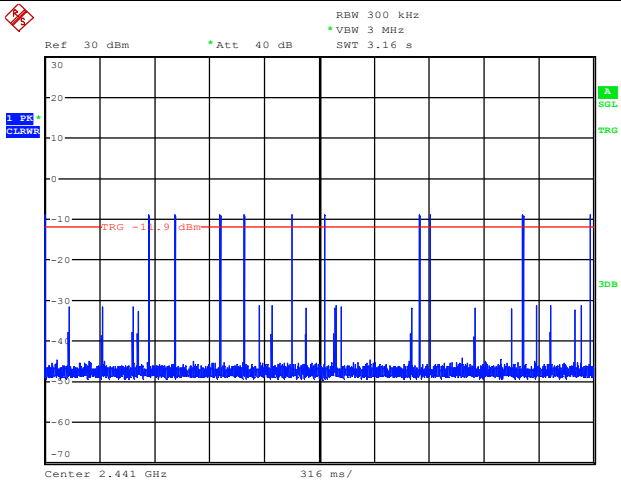


Date: 5.JUL.2020 11:43:35

DH5_Ant1_Hop

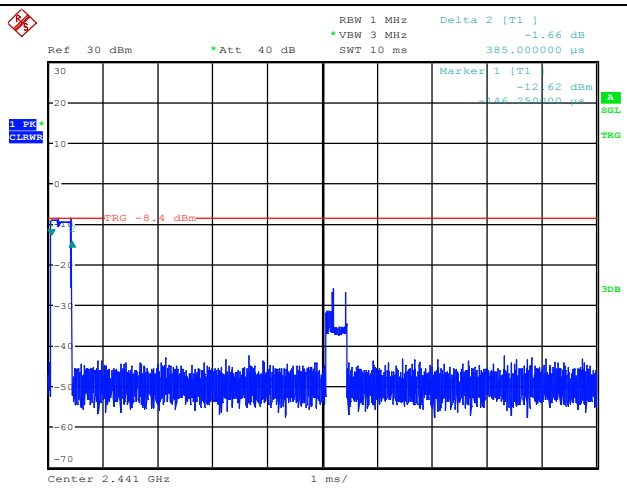


Date: 5.JUL.2020 11:38:34

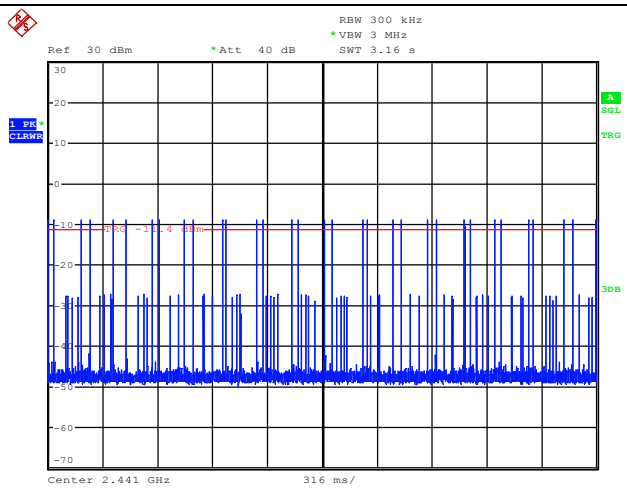


Date: 5.JUL.2020 11:38:40

2DH1_Ant1_Hop

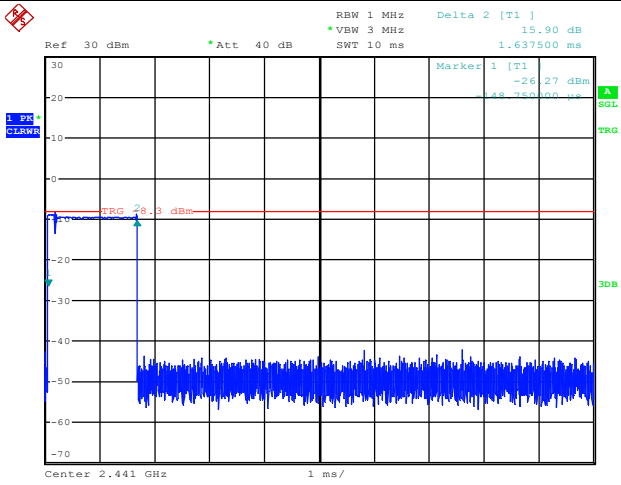


Date: 5.JUL.2020 12:05:13

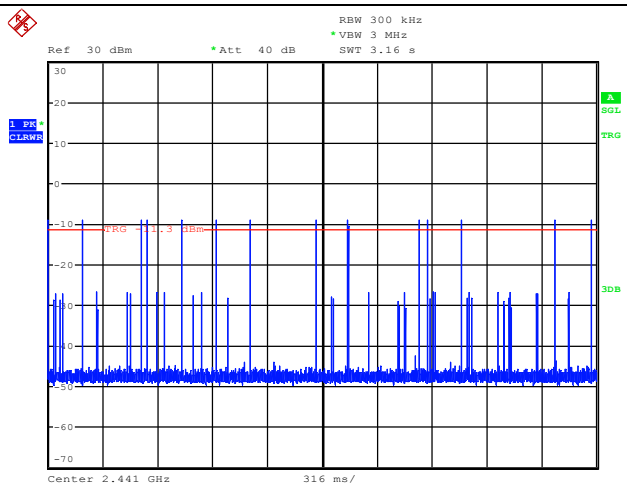


Date: 5.JUL.2020 12:05:18

2DH3_Ant1_Hop

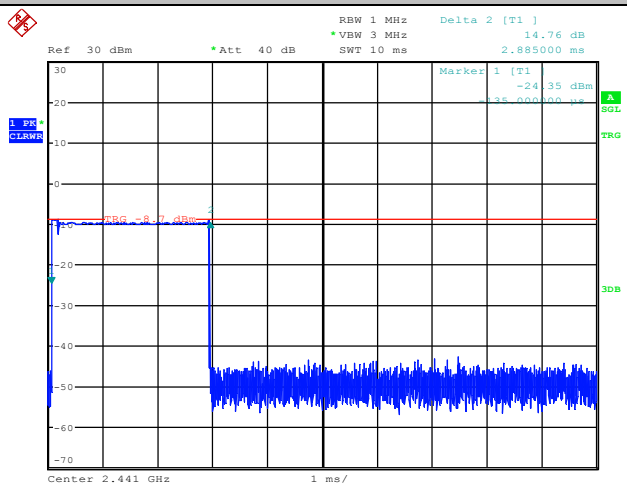


Date: 5.JUL.2020 12:07:14

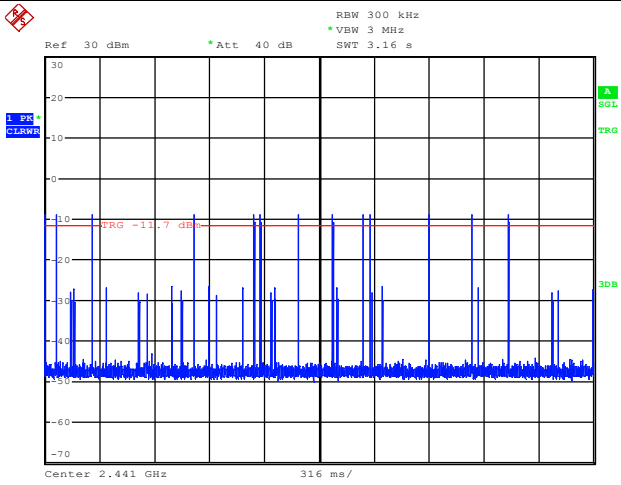


Date: 5.JUL.2020 12:07:20

2DH5_Ant1_Hop

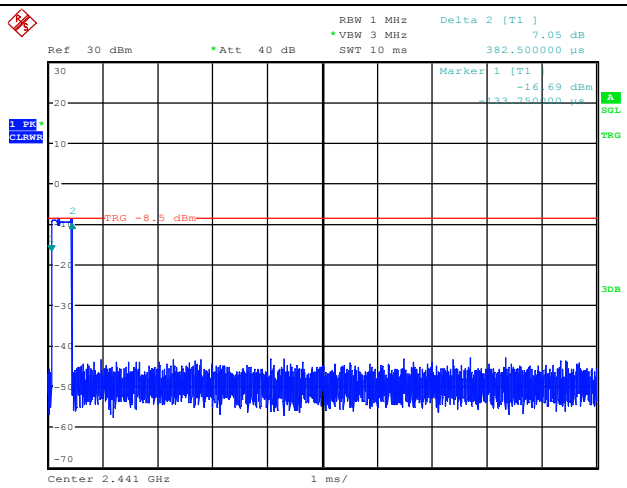


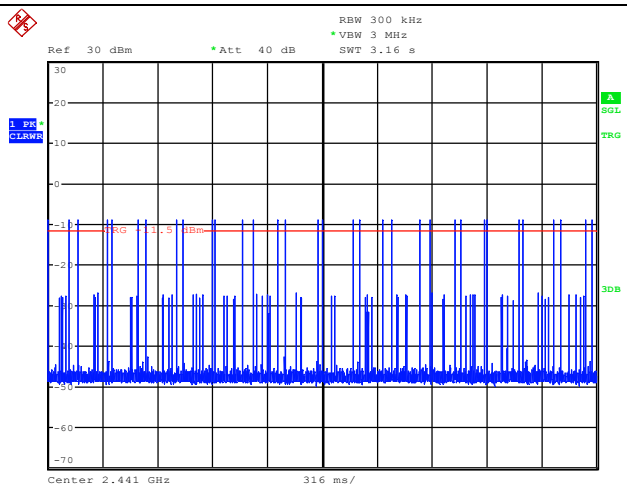
Date: 5.JUL.2020 12:03:57



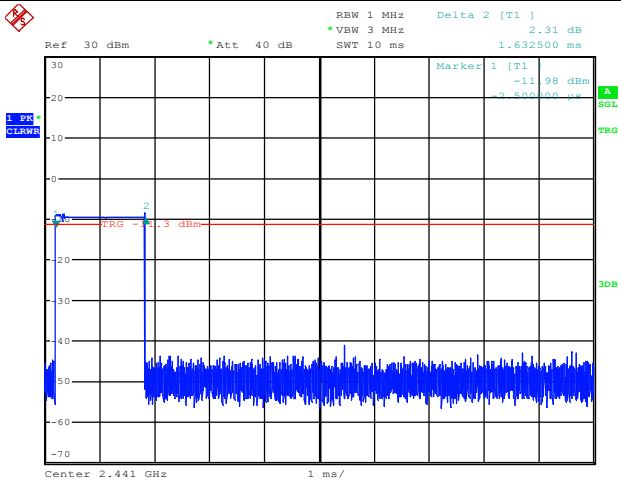
Date: 5.JUL.2020 12:04:03

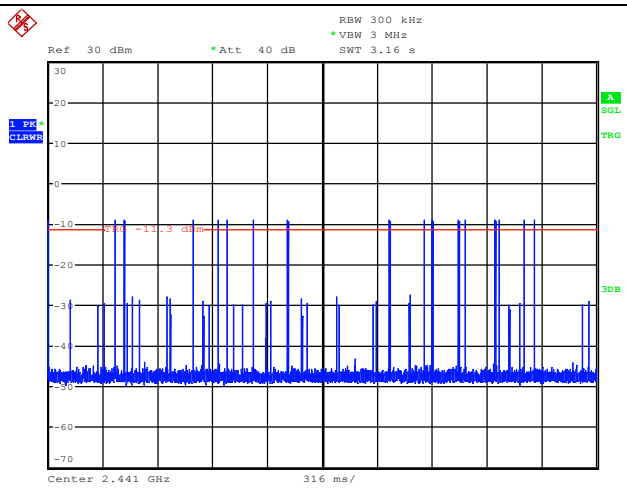
3DH1_Ant1_Hop





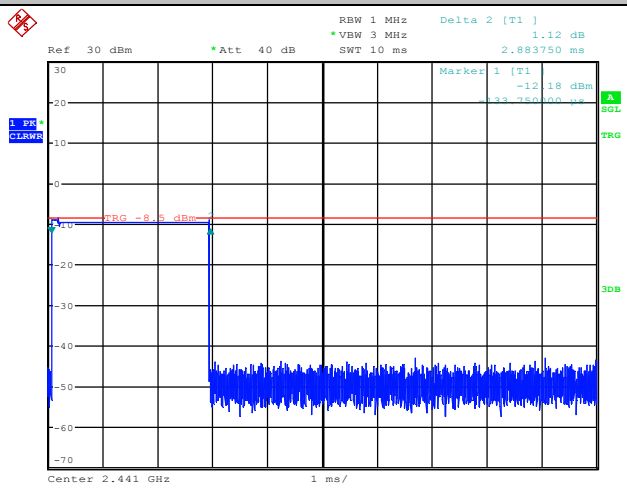
3DH3_Ant1_Hop



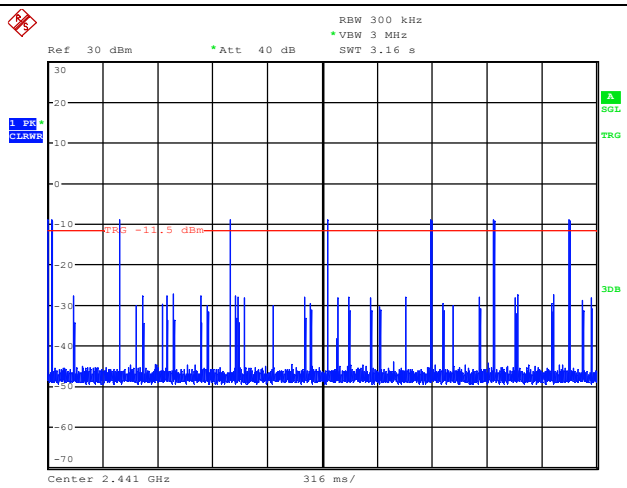


Date: 5.JUL.2020 12:23:12

3DH5_Ant1_Hop



Date: 5.JUL.2020 12:15:50



Date: 5.JUL.2020 12:15:56

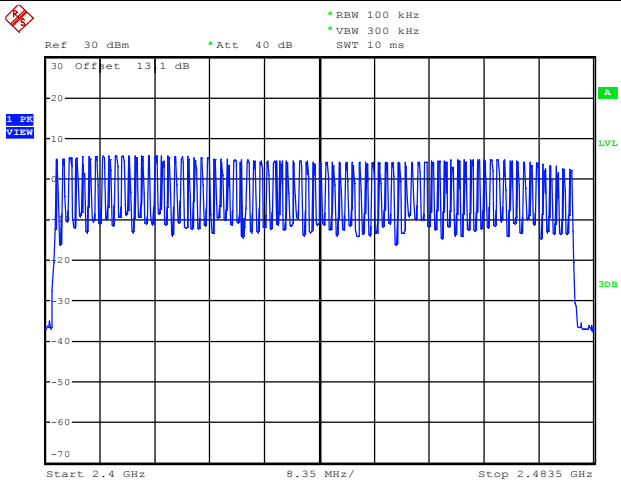
AppendixF: Number of hopping channels

Test Result

TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	>=15	PASS
2DH5	Ant1	Hop	79	>=15	PASS
3DH5	Ant1	Hop	79	>=15	PASS

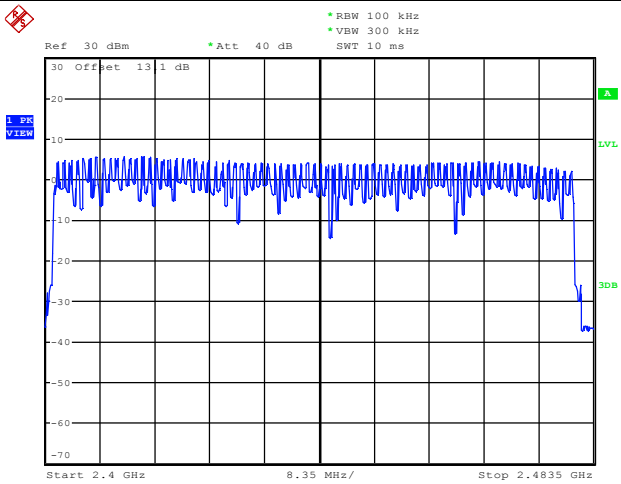
Test Graphs

DH5_Ant1_Hop



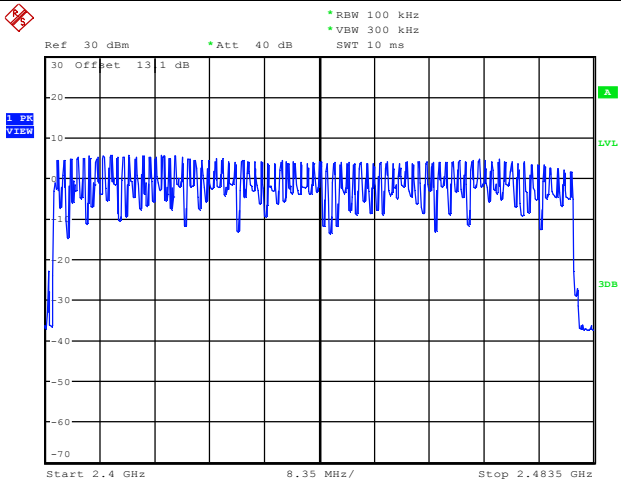
Date: 5.JUL.2020 11:38:22

2DH5_Ant1_Hop



Date: 5.JUL.2020 12:03:44

3DH5_Ant1_Hop



Date: 5.JUL.2020 12:44:32

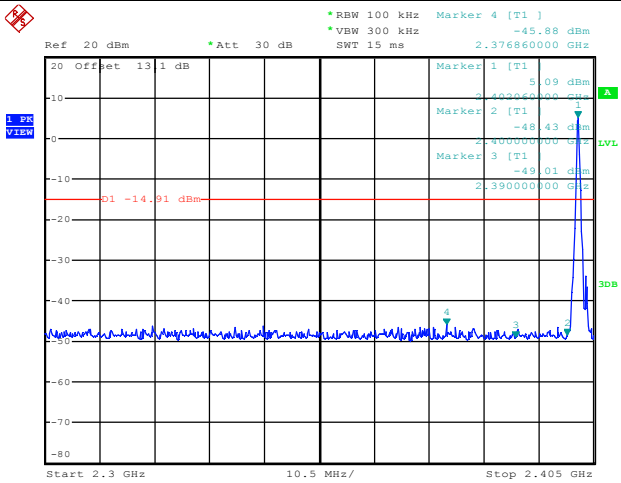
AppendixG:Band edge measurements

Test Result

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	5.09	-45.88	<=-14.91	PASS
		High	2480	2.46	-46.45	<=-17.54	PASS
		Low	Hop_2402	5.12	-45.39	-14.88	PASS
		High	Hop_2480	4.54	-46.07	-15.46	PASS
2DH5	Ant1	Low	2402	4.96	-40.94	<=-15.04	PASS
		High	2480	2.25	-45.75	<=-17.75	PASS
		Low	Hop_2402	4.23	-45.6	-15.77	PASS
		High	Hop_2480	3.87	-46.16	-16.13	PASS
3DH5	Ant1	Low	2402	4.36	-43.4	<=-15.64	PASS
		High	2480	1.75	-45.64	<=-18.25	PASS
		Low	Hop_2402	4.55	-45.82	-15.45	PASS
		High	Hop_2480	3.90	-45.8	-16.1	PASS

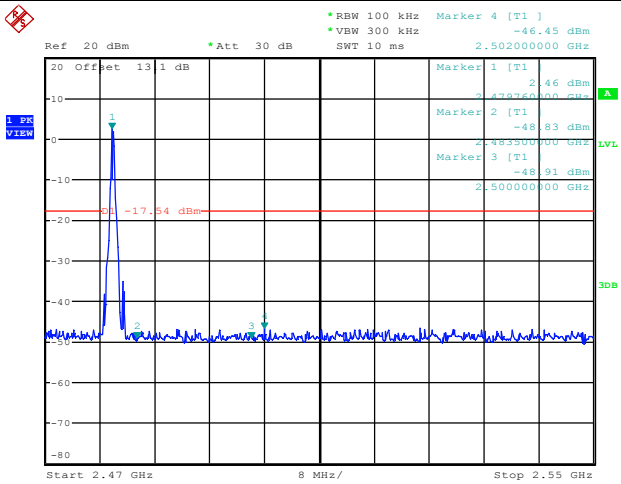
Test Graphs

DH5_Ant1_Low_2402



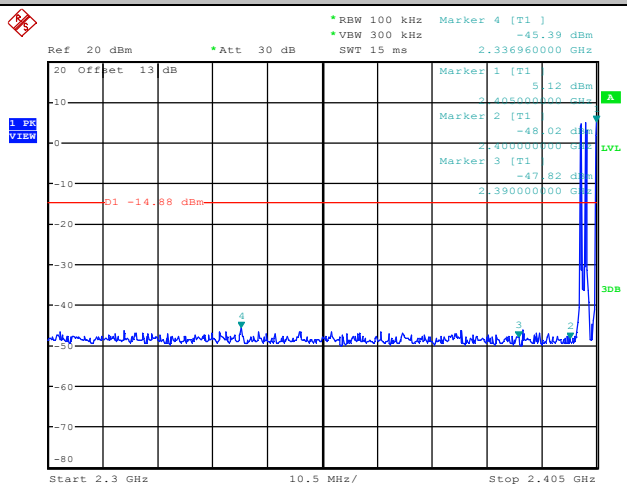
Date: 5.JUL.2020 10:42:41

DH5_Ant1_High_2480



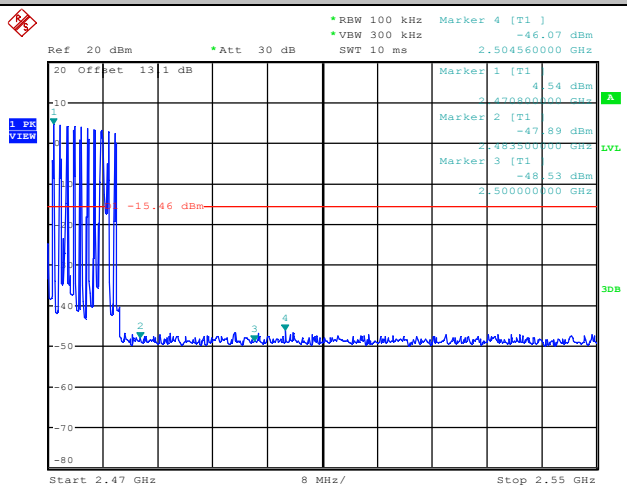
Date: 5.JUL.2020 10:50:32

DH5_Ant1_Low_Hop_2402



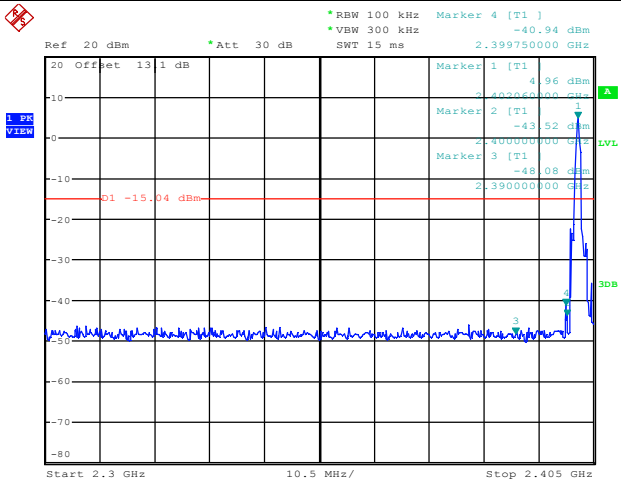
Date: 5.JUL.2020 11:25:30

DH5_Ant1_High_Hop_2480



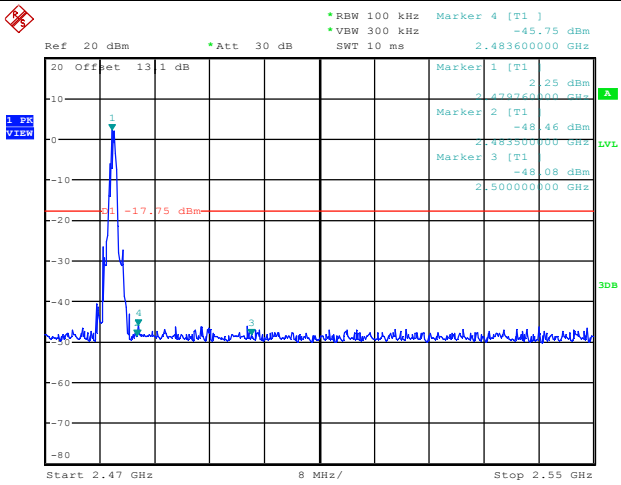
Date: 5.JUL.2020 11:46:02

2DH5_Ant1_Low_2402



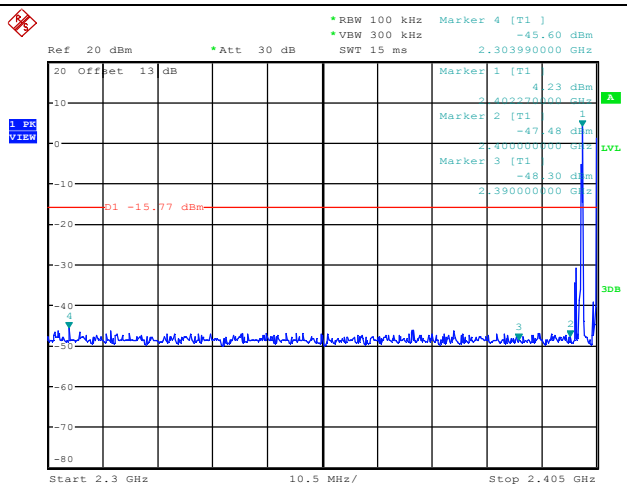
Date: 5.JUL.2020 10:53:30

2DH5_Ant1_High_2480



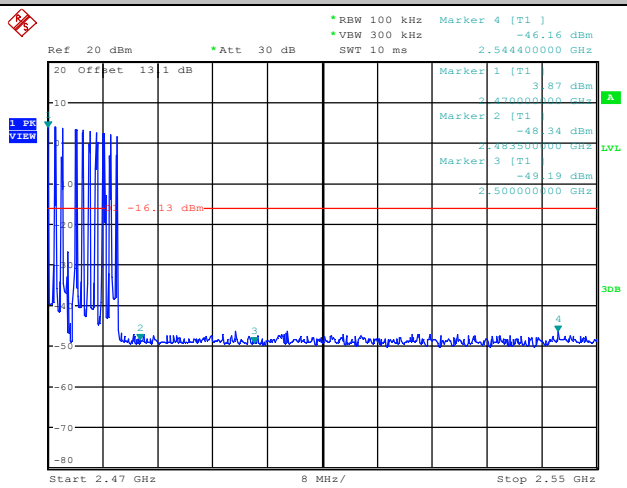
Date: 5.JUL.2020 11:06:44

2DH5_Ant1_Low_Hop_2402



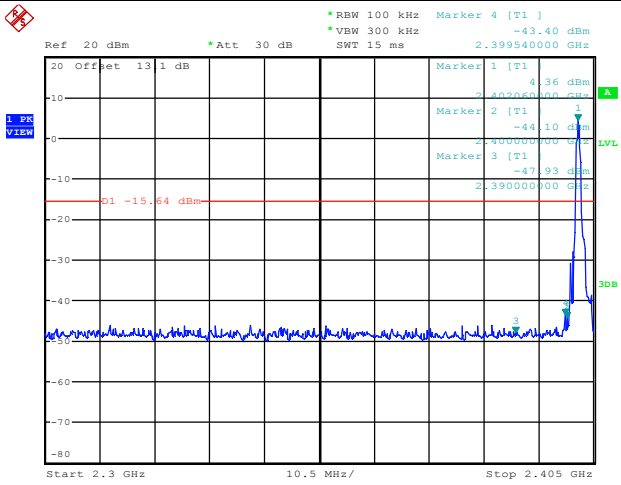
Date: 5.JUL.2020 11:49:47

2DH5_Ant1_High_Hop_2480



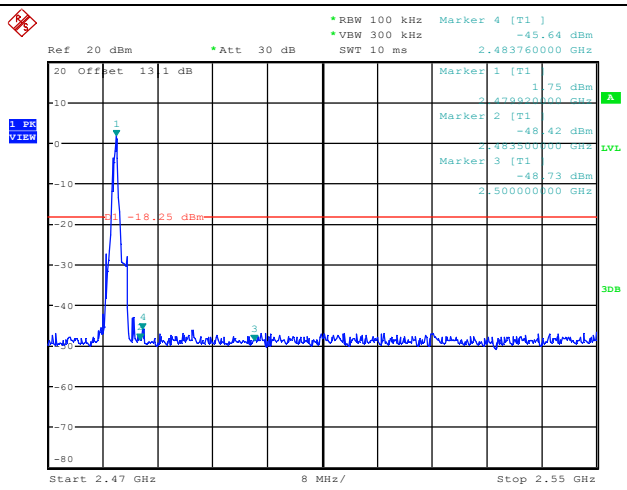
Date: 5.JUL.2020 12:09:01

3DH5_Ant1_Low_2402



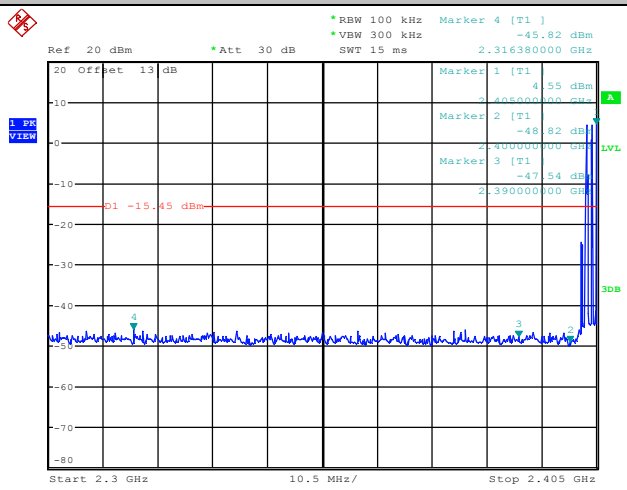
Date: 5.JUL.2020 11:11:59

3DH5_Ant1_High_2480



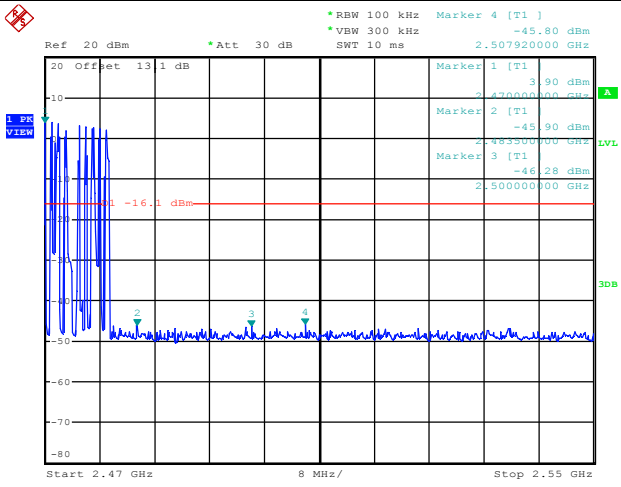
Date: 5.JUL.2020 11:20:54

3DH5_Ant1_Low_Hop_2402



Date: 5.JUL.2020 12:10:16

3DH5_Ant1_High_Hop_2480



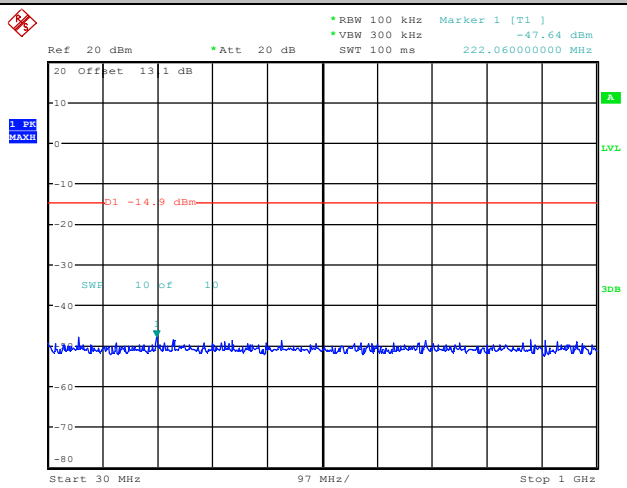
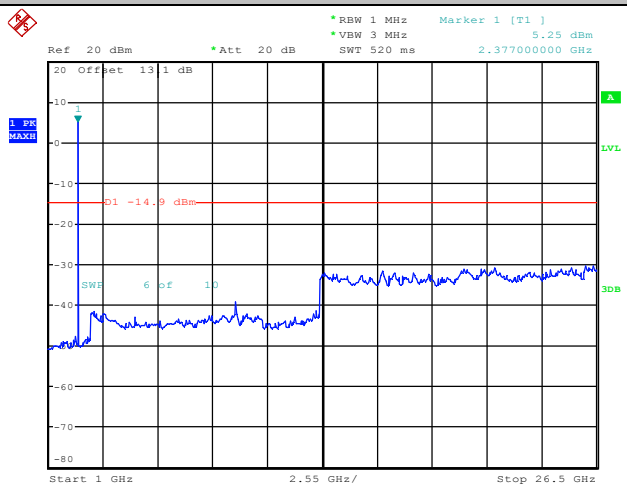
Date: 5.JUL.2020 12:25:05

AppendixH:Conducted SpuriousEmission

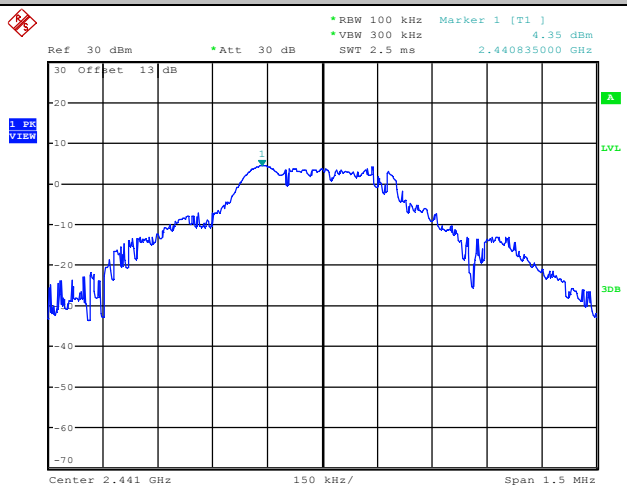
Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	5.10	5.10	---	PASS
			30~1000	30~1000	-47.64	<=-14.9	PASS
			1000~26500	1000~26500	<=-14.9	<=-14.9	PASS
		2441	Reference	4.35	4.35	---	PASS
			30~1000	30~1000	-47.89	<=-15.65	PASS
			1000~26500	1000~26500	-28.97	<=-15.65	PASS
		2480	Reference	2.46	2.46	---	PASS
			30~1000	30~1000	-48.48	<=-17.54	PASS
			1000~26500	1000~26500	-30.18	<=-17.54	PASS
2DH5	Ant1	2402	Reference	4.96	4.96	---	PASS
			30~1000	30~1000	-47.88	<=-15.04	PASS
			1000~26500	1000~26500	<=-15.04	<=-15.04	PASS
		2441	Reference	3.97	3.97	---	PASS
			30~1000	30~1000	-47.9	<=-16.03	PASS
			1000~26500	1000~26500	-30.96	<=-16.03	PASS
		2480	Reference	1.72	1.72	---	PASS
			30~1000	30~1000	-48.6	<=-18.28	PASS
			1000~26500	1000~26500	-30.9	<=-18.28	PASS
3DH5	Ant1	2402	Reference	4.85	4.85	---	PASS
			30~1000	30~1000	-47.39	<=-15.15	PASS
			1000~26500	1000~26500	<=-15.15	<=-15.15	PASS
		2441	Reference	3.92	3.92	---	PASS
			30~1000	30~1000	-48.16	<=-16.08	PASS
			1000~26500	1000~26500	-30.52	<=-16.08	PASS
		2480	Reference	2.07	2.07	---	PASS
			30~1000	30~1000	-47.99	<=-17.93	PASS
			1000~26500	1000~26500	-30.14	<=-17.93	PASS

Test Graphs

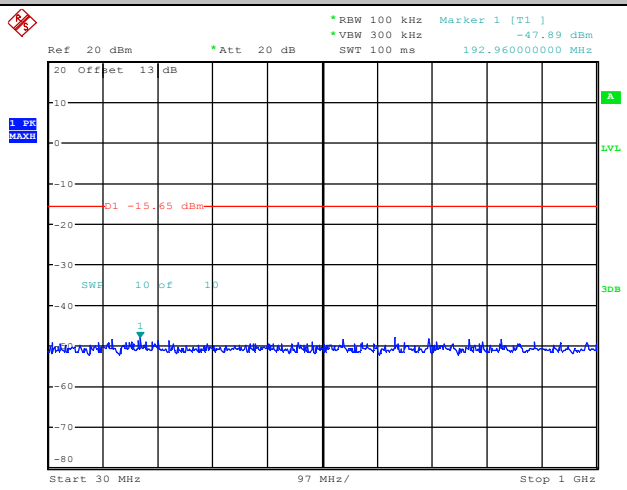
DH5_Ant1_2402_0~Reference
 Date: 5.JUL.2020 10:43:47
DH5_Ant1_2402_30~1000
 Date: 5.JUL.2020 10:43:58
DH5_Ant1_2402_1000~26500
 Date: 5.JUL.2020 10:44:13

DH5_Ant1_2441_0~Reference



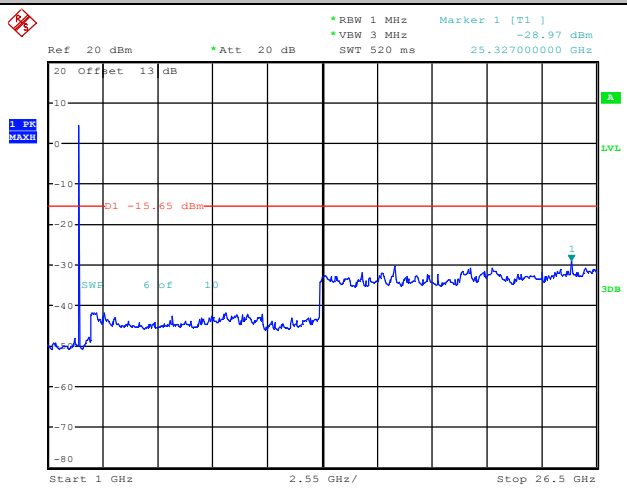
Date: 5.JUL.2020 10:46:11

DH5_Ant1_2441_30~1000



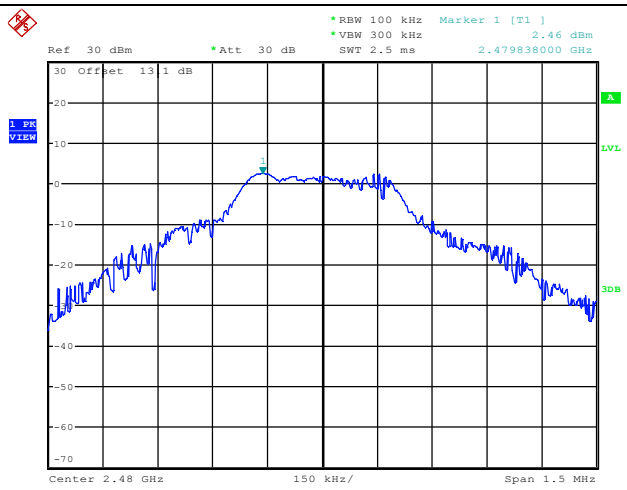
Date: 5.JUL.2020 10:46:22

DH5_Ant1_2441_1000~26500



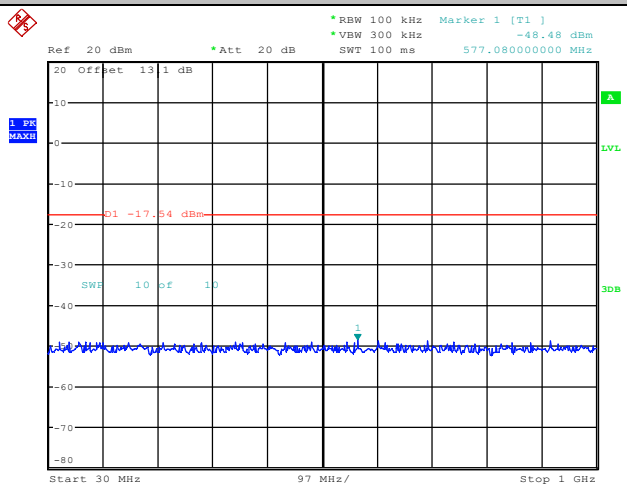
Date: 5.JUL.2020 10:46:37

DH5_Ant1_2480_0~Reference



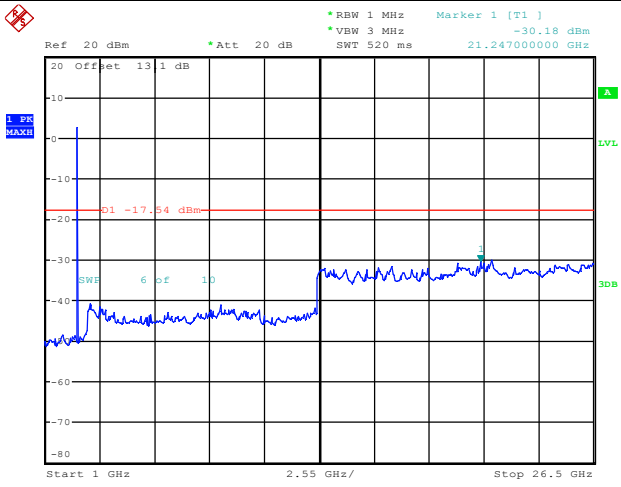
Date: 5.JUL.2020 10:51:37

DH5_Ant1_2480_30~1000



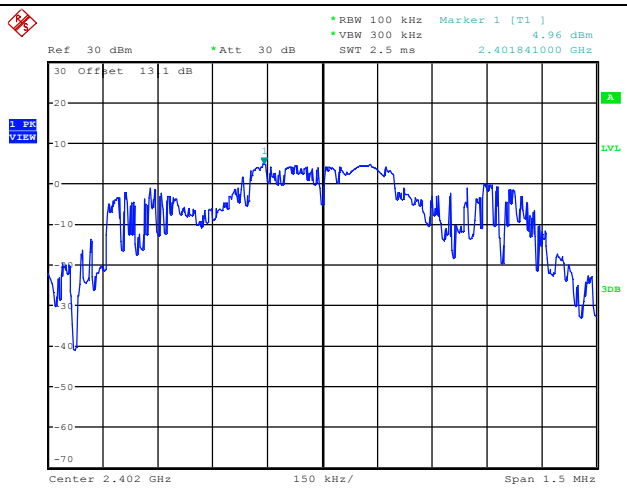
Date: 5.JUL.2020 10:51:48

DH5_Ant1_2480_1000~26500



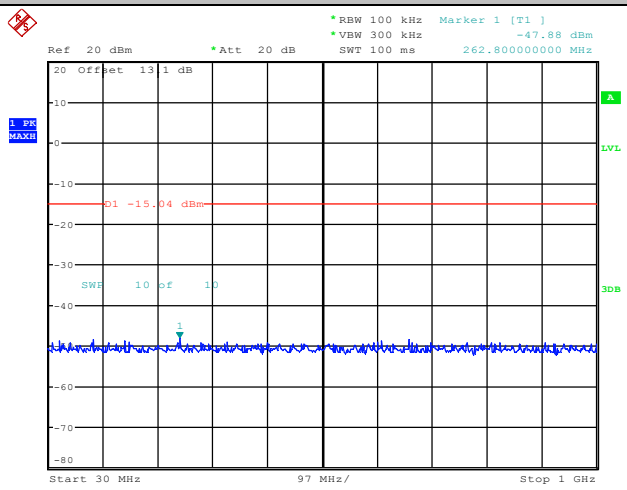
Date: 5.JUL.2020 10:52:03

2DH5_Ant1_2402_0~Reference



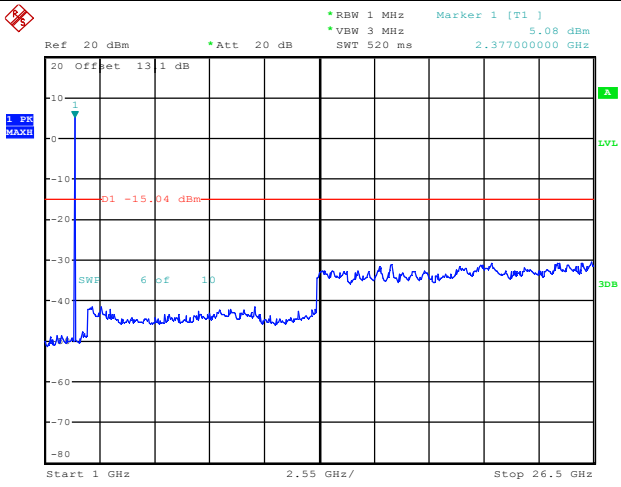
Date: 5.JUL.2020 10:54:40

2DH5_Ant1_2402_30~1000



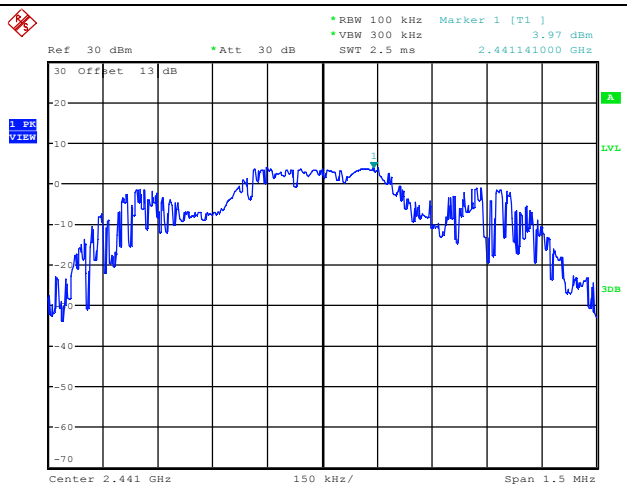
Date: 5.JUL.2020 10:54:50

2DH5_Ant1_2402_1000~26500

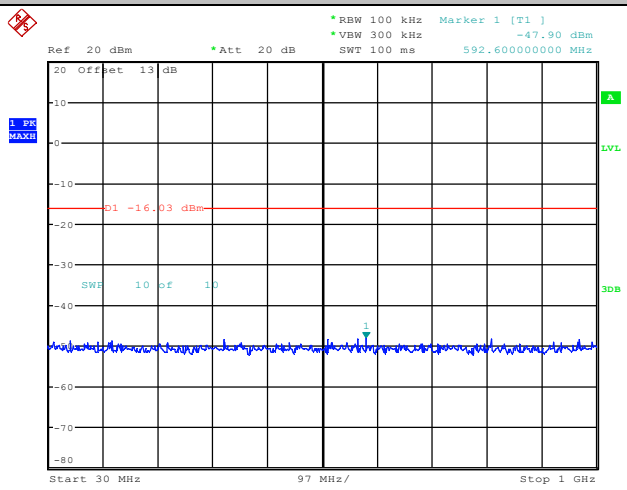


Date: 5.JUL.2020 10:55:05

2DH5_Ant1_2441_0~Reference



2DH5_Ant1_2441_30~1000



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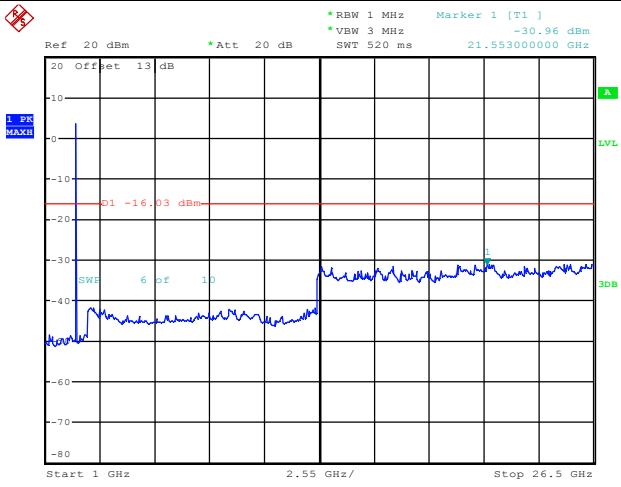

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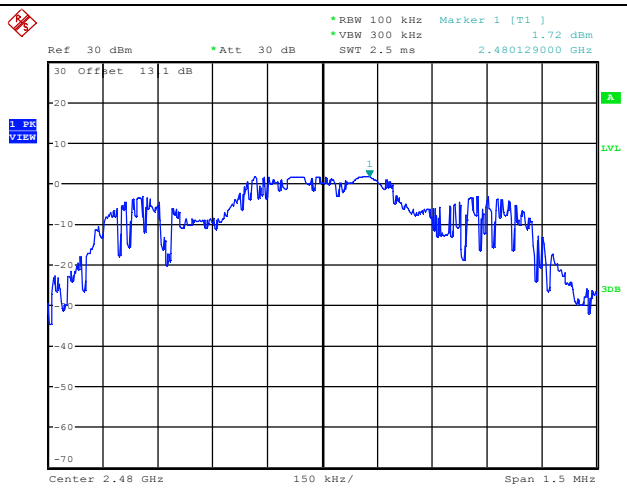

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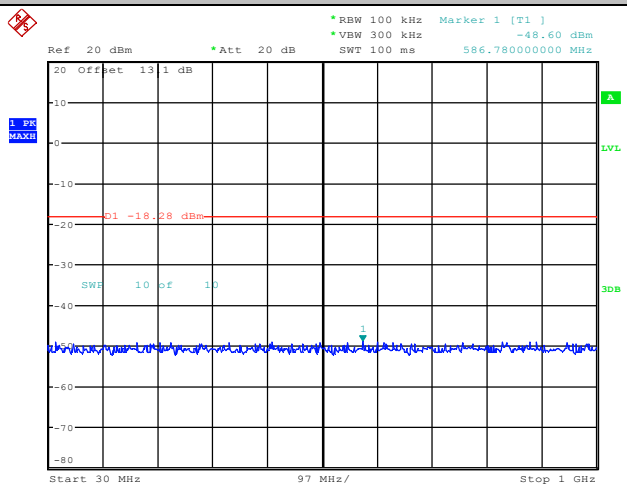

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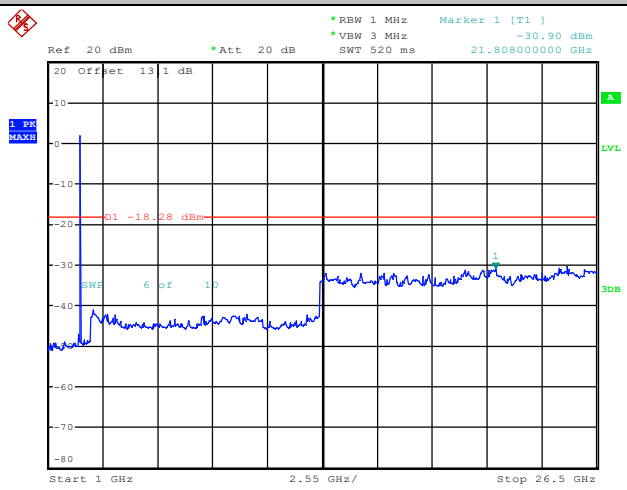

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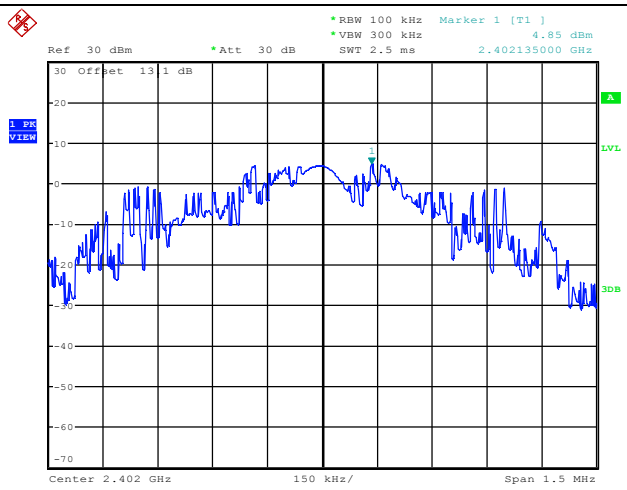

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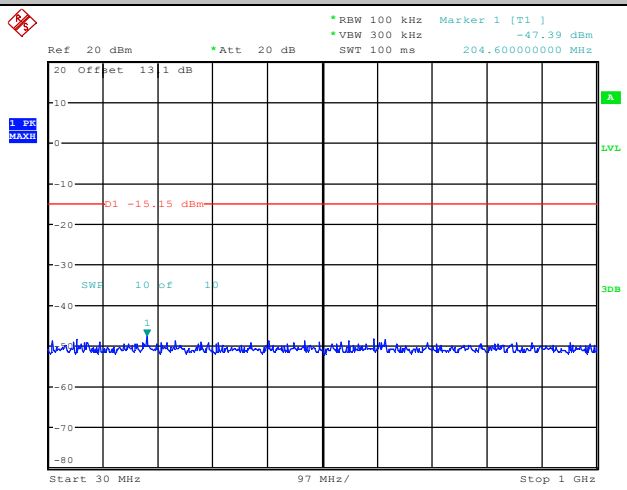

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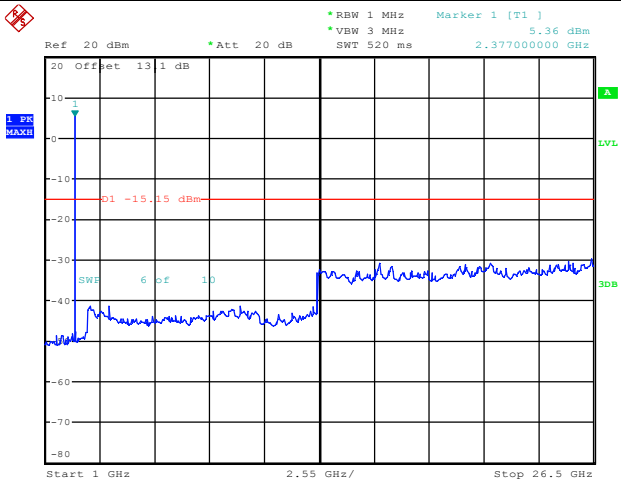

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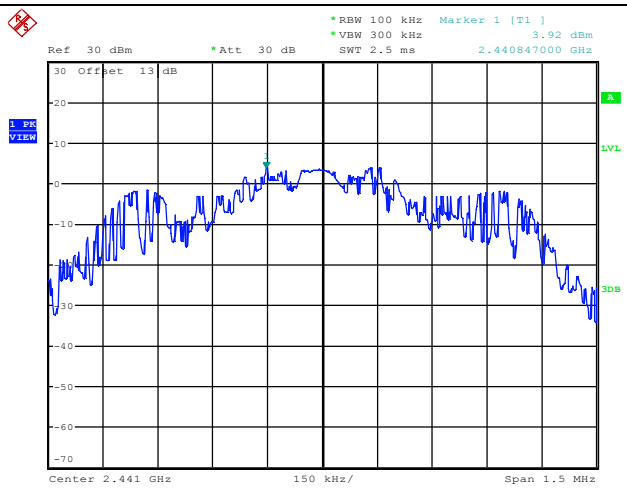

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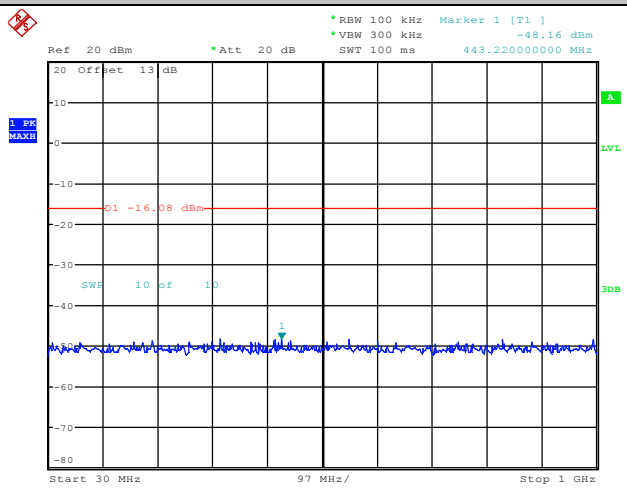

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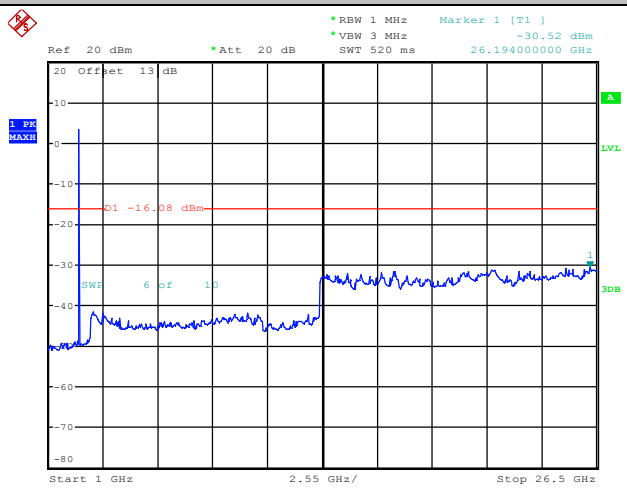

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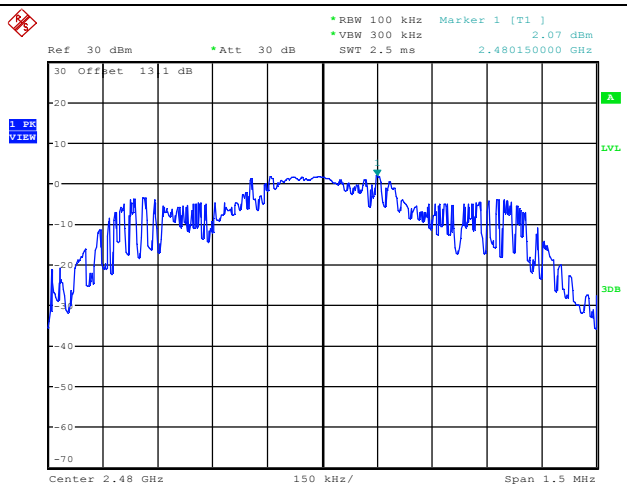

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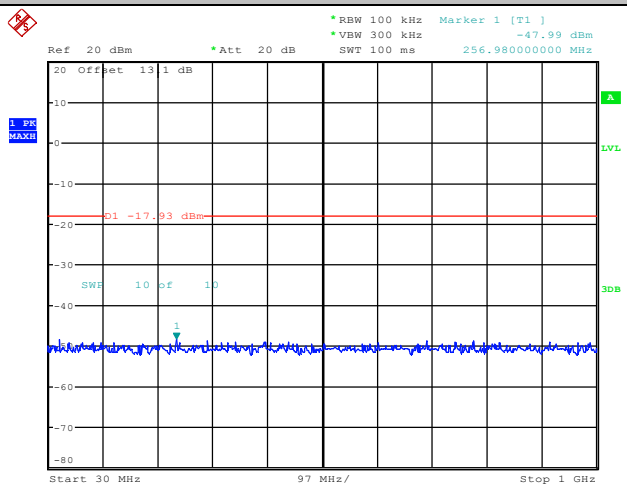

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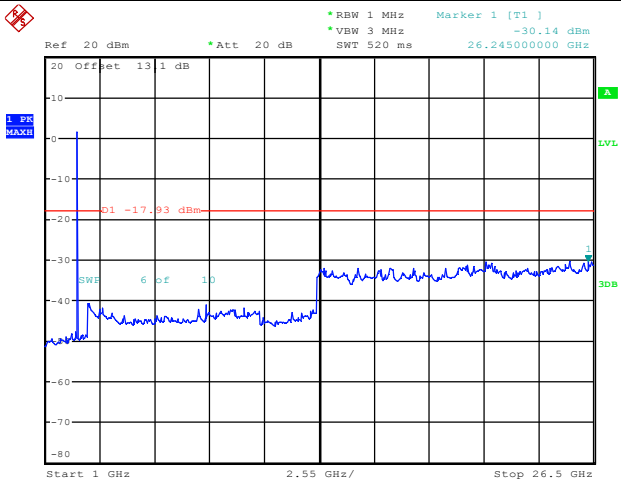

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