

# FCC 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:

## **YEALINK (XIAMEN) NETWORK TECHNOLOGY CO., LTD.**

309, 3rd Floor, No.16, Yun Ding North Road, Huli District, Xiamen City, Fujian, China

|                                  |
|----------------------------------|
| <b>FCC ID: T2C-BT42</b>          |
| <b>EUT: Bluetooth USB Dongle</b> |
| <b>Model: BT42</b>               |

|                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------|
| July 29, 2019<br><b>Issue Date:</b>                                                                                            |
| Original Report<br><b>Report Type:</b>                                                                                         |
| <br><b>Test Engineer: Jacky Huang</b>       |
| <br><b>Review By: Apollo Liu / Manager</b> |

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**Report Revision History**

| <b>Report #</b>  | <b>Version</b> | <b>Description</b>      | <b>Issued Date</b> |
|------------------|----------------|-------------------------|--------------------|
| KSZ2019062702J01 | Rev.01         | Initial issue of report | July 29, 2019      |

# 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

|                                                                                                                                                                                                                                                                     |                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Firm Name:</b>                                                                                                                                                                                                                                              | <b>Ke Mei Ou Lab Co., Ltd.</b>                                                                                                |
| <b>Test Firm Address:</b>                                                                                                                                                                                                                                           | 2013-2016, 20th Floor, Business Center, Jiahui Xin Cheng, No 3027, Shen Nan Road, Fu Tian, Shen Zhen, Guang Dong, P. R. China |
| <b>FCC Designation Number:</b>                                                                                                                                                                                                                                      | CN1532                                                                                                                        |
| <b>Test Firm Registration Number:</b>                                                                                                                                                                                                                               | 344480                                                                                                                        |
| <b>Internet:</b>                                                                                                                                                                                                                                                    | <a href="http://www.kmolab.com">www.kmolab.com</a>                                                                            |
| <b>Email:</b>                                                                                                                                                                                                                                                       | <a href="mailto:kmo@kmolab.com">kmo@kmolab.com</a>                                                                            |
| ANSI-ASQ National Accreditation Board/ACCLASS 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:** YEALINK (XIAMEN) NETWORK TECHNOLOGY CO., LTD.  
**Address:** 309, 3rd Floor, No.16, Yun Ding North Road, Huli District, Xiamen City, Fujian, China

## 1.4 Application Details

**Date of Receipt of Application:** June 27, 2019  
**Date of Receipt of Test Item:** July 4, 2019  
**Date of Test :** July 4~July 23, 2019

## 1.5 Details of Manufacturer

**Name:** Same as applicant  
**Address:** Same as applicant

## 1.6 Test Item

| EUT Feature                                                                                                                                        |                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EUT Description:</b>                                                                                                                            | Bluetooth USB Dongle                                                                                                                                                                 |
| <b>Brand Name:</b>                                                                                                                                 | YeaLink                                                                                                                                                                              |
| <b>Model Name:</b>                                                                                                                                 | BT42                                                                                                                                                                                 |
| <b>EUT RF Technology:</b>                                                                                                                          | <input checked="" type="checkbox"/> Bluetooth BT <input type="checkbox"/> Bluetooth v4.0 LE <input type="checkbox"/> Bluetooth v4.2 LE<br><input type="checkbox"/> Bluetooth v5.0 LE |
| <b>HW Version:</b>                                                                                                                                 | WF50V                                                                                                                                                                                |
| <b>SW Version:</b>                                                                                                                                 | BT42                                                                                                                                                                                 |
| <b>EUT Stage:</b>                                                                                                                                  | <input checked="" type="checkbox"/> Identical Prototype <input type="checkbox"/> 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           |                                                                                                                                                                                                                                                                                      |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tx/Rx Frequency Range</b>             | 2402~2480 MHz                                                                                                                                                                                                                                                                        |
| <b>Number of Channels</b>                | 79                                                                                                                                                                                                                                                                                   |
| <b>Carrier Frequency of Each Channel</b> | f=2402+k MHz (k=0,1,2,...,78)                                                                                                                                                                                                                                                        |
| <b>Antenna Type / Gain</b>               | Internal PCB Antenna / gain 3 dBi                                                                                                                                                                                                                                                    |
| <b>Type of Modulation</b>                | Bluetooth BR 1Mbps: GFSK<br>Bluetooth EDR 2Mbps: $\pi/4$ -DQPSK<br>Bluetooth EDR 3Mbps: 8DPSK                                                                                                                                                                                        |
| <b>EUT Operational Condition</b>         | <input type="checkbox"/> AC<br><input checked="" type="checkbox"/> DC → <input type="checkbox"/> From Battery <input checked="" type="checkbox"/> External AC adapter <input type="checkbox"/> POE <input checked="" type="checkbox"/> PC<br><input type="checkbox"/> Li-ion battery |

## 1.7 Applicable Standards

| Applicable Standards                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:</p> <p>FCC Part 15 Subpart C 15.247<br/>FCC KDB Publish No. 558074 D01 DTS Meas. Guidance v05r02<br/>FCC KDB 414788 D01 Radiated Test Site v01r01<br/>ANSI C63.10-2013</p>                      |
| <p>Note:</p> <ol style="list-style-type: none"><li>1) All test items were verified and recorded according to the standards and without any deviation during the test.</li><li>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.</li></ol> |

## 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                         | $\geq 2/3$ of 20dB BW                                           | PASS   | Complies. |
| 15.247(a)(1)                      | Dwell Time                                         | $\leq 0.4\text{sec}$ in 31.6sec period                          | PASS   | Complies. |
| 15.247(a)(1)                      | 20dB Bandwidth                                     | N/A                                                             | PASS   | Complies. |
| 15.247(b)(1)                      | Conducted Output Power                             | $\leq 1\text{ w}$ for 1Mbps<br>$\leq 125\text{ mW}$ for 2,3Mbps | 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                               | $\leq 20\text{dBc}$                                             | PASS   | Complies  |
| 15.247(d)                         | Conducted Spurious Emission                        | $\leq 20\text{dBc}$                                             | 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)                 | $< 1\text{mW}/\text{cm}^2$                                      | 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 3 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                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> | <p>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.</p> <p>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.</p> |

4.3 Test Setup

| Test Setup                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| AC Line Conducted Emissions                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| <p>The diagram illustrates the test setup for AC line conducted emissions within a shielded room. A red box labeled 'PC+ EUT' is placed on a stand, positioned 0.4m from the left wall and 0.8m above the floor. A blue line connects the EUT to a red box labeled 'LISN' on the floor. A blue line also connects the LISN to a spectrum analyzer on the right. The floor is labeled 'Metal Ground'.</p>                                                 |  |
| <p>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.</p> |  |

#### 4.4 Configuration of the EUT

##### Description of Bluetooth Test Mode

| Channel | Frequency (MHz) | Bluetooth RF Output Power |     |                     |     |            |     |
|---------|-----------------|---------------------------|-----|---------------------|-----|------------|-----|
|         |                 | Data Rate / Modulation    |     |                     |     |            |     |
|         |                 | GFSK_DH5                  |     | $\pi/4$ -DQPSK_2DH5 |     | 8DPSK_3DH5 |     |
|         |                 | 1Mbps                     |     | 2Mbps               |     | 3Mbps      |     |
| CH00    | 2402            | 3.09                      | dBm | 3.92                | dBm | 3.34       | dBm |
| CH39    | 2441            | 2.33                      | dBm | 3.06                | dBm | 2.36       | dBm |
| CH78    | 2480            | 2.30                      | dBm | 3.30                | dBm | 2.88       | dBm |

Note:

- 1) All the test data for each data rate were verified, but only the worst case was reported.
- 2) The data rate was set in 1Mbps for all the test items due to the highest RF output power.

##### 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<br>BT BR 1Mbps                                                                                               | $\pi/4$ -DQPSK<br>BT EDR 2Mbps                                          | 8DPSK<br>BT EDR 3Mbps                                                   |
| Conducted Cases             | Mode 1: CH00_2402 MHz<br>Mode 2: CH39_2441 MHz<br>Mode 3: CH78_2480 MHz                                           | Mode 4: CH00_2402 MHz<br>Mode 5: CH39_2441 MHz<br>Mode 6: CH78_2480 MHz | Mode 7: CH00_2402 MHz<br>Mode 8: CH39_2441 MHz<br>Mode 9: CH78_2480 MHz |
| Test Item                   | BT EDR 2Mbps                                                                                                      |                                                                         |                                                                         |
| Radiated Cases              | Mode 1: CH00_2402 MHz (Power by PC)<br>Mode 2: CH39_2441 MHz (Power by PC)<br>Mode 3: CH78_2480 MHz (Power by PC) |                                                                         |                                                                         |
| AC Conducted Emission       | Mode 4                                                                                                            |                                                                         |                                                                         |

| 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 $\pi/4$ -DQPSK |
| 3                                                                                                                                                                                            | EUT with 8DPSK          |
| Conducted Emissions → Final                                                                                                                                                                  |                         |
| Test Mode                                                                                                                                                                                    | Operating Description   |
| 1                                                                                                                                                                                            | EUT with GFSK           |
| 2                                                                                                                                                                                            | EUT with $\pi/4$ -DQPSK |
| 3                                                                                                                                                                                            | EUT with 8DPSK          |
| AC Conducted Emissions → Final                                                                                                                                                               |                         |
| 2                                                                                                                                                                                            | EUT with PC             |
| Radiated Emissions → Final                                                                                                                                                                   |                         |
| Test Mode                                                                                                                                                                                    | Operating Description   |
| 1                                                                                                                                                                                            | EUT with GFSK           |
| 2                                                                                                                                                                                            | EUT with $\pi/4$ -DQPSK |
| 3                                                                                                                                                                                            | EUT with 8DPSK          |
| Note: The test modes were carried out for all operation modes (include link and idle).<br>The final test mode of the EUT was the worst test mode for Mode 2, and its test data was reported. |                         |

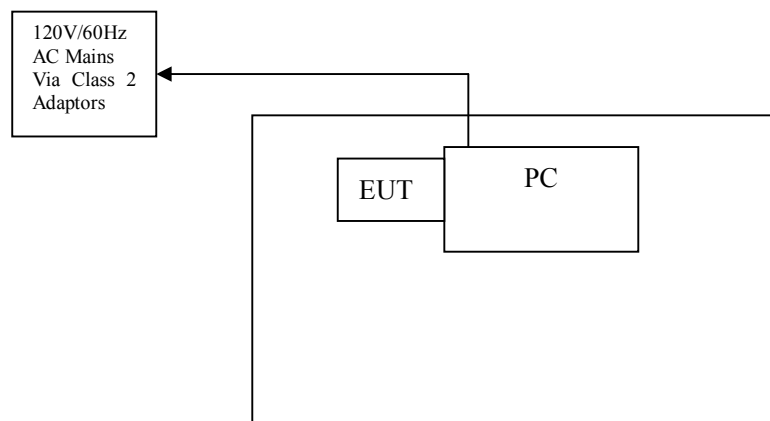
| Support Unit |              |                     |                |                            |
|--------------|--------------|---------------------|----------------|----------------------------|
| Device       | Manufacturer | Model #<br>Serial # | FCC ID/<br>DoC | Cable                      |
|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



## 4.5 EUT Operating Condition

Operating condition is according to ANSI C63.10:2013.

- Setup the EUT and simulators as shown on follow.
- Enable RF signal and confirm EUT active.
- Modulate output capacity of EUT up to specification.

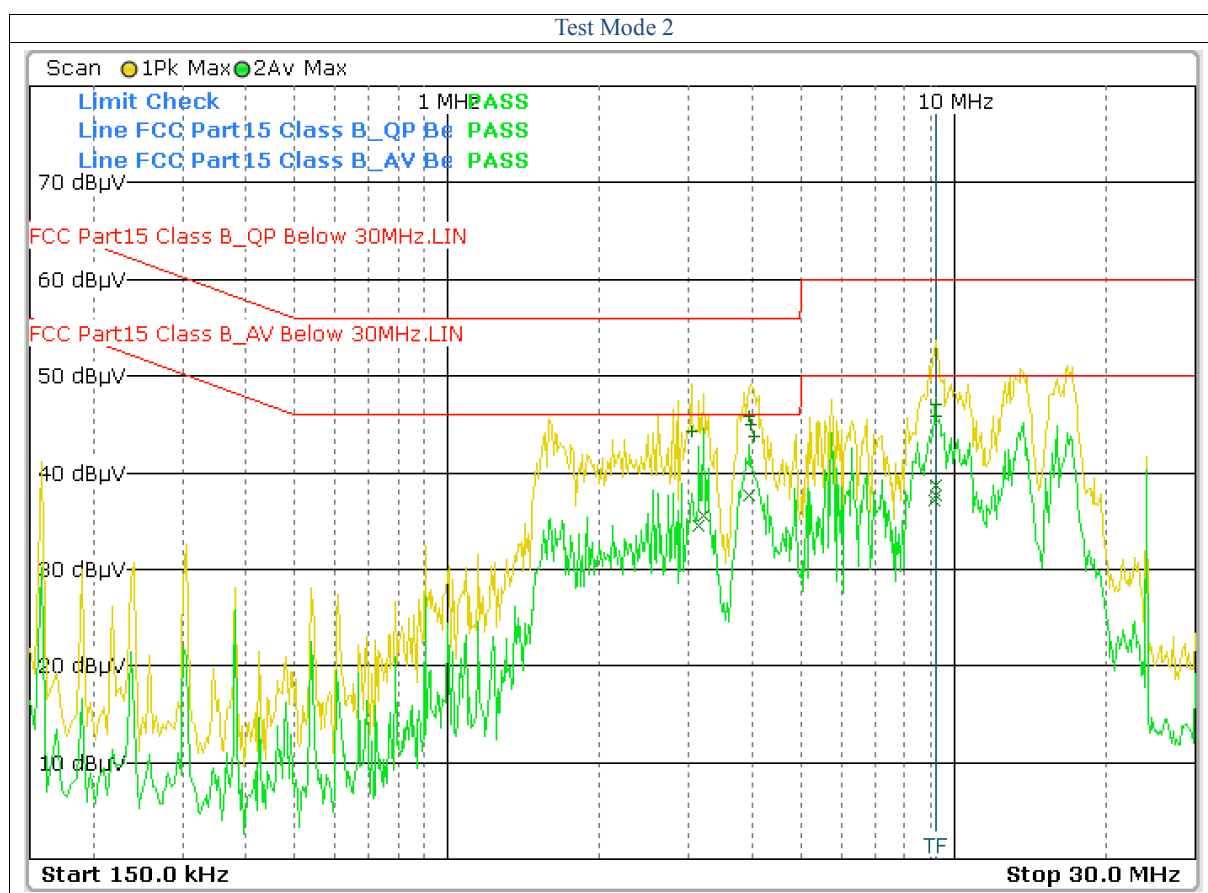


## 4.6 Conducted Power Line Emission Limits

| 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.

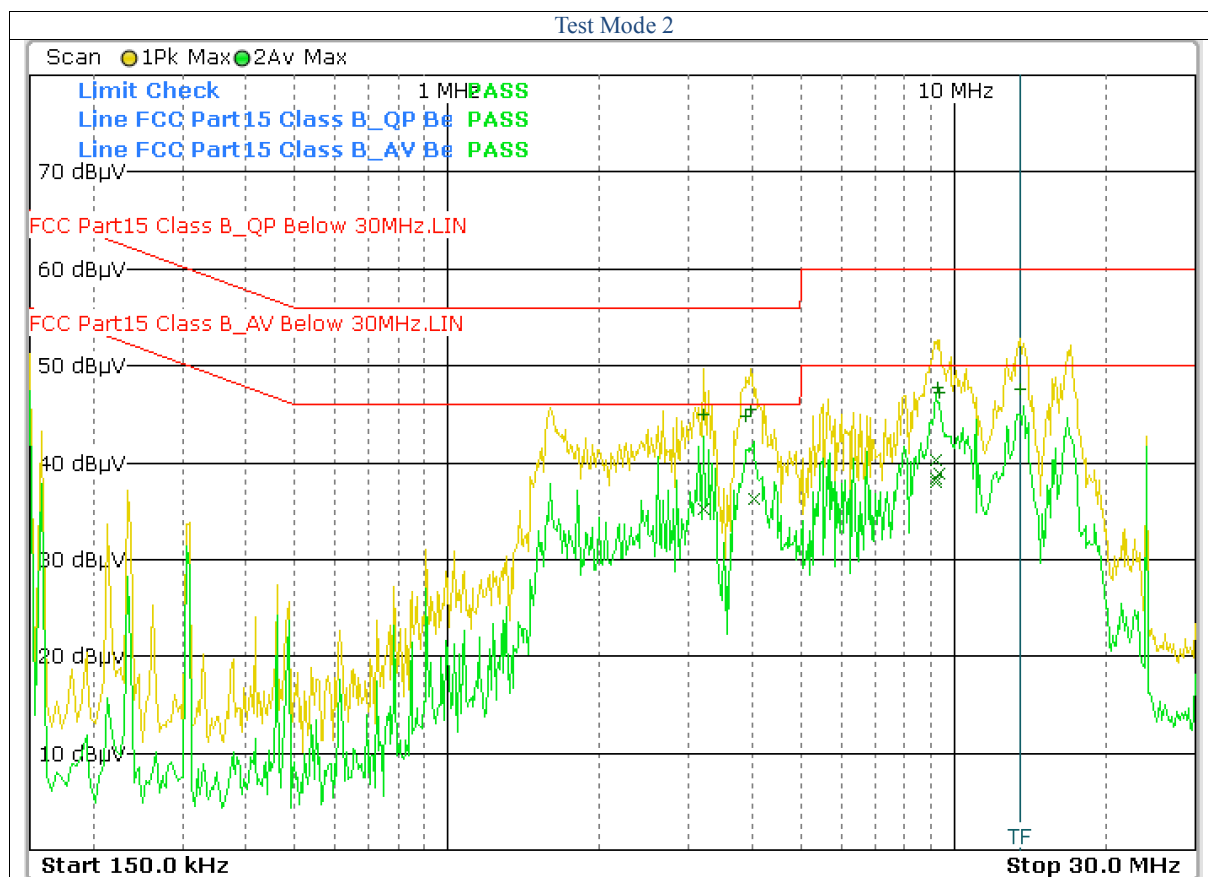
## 4.7 Conducted Power Line Test Result



| FCC15           |                   |       |             |                 |       |              |              |       |              |        |
|-----------------|-------------------|-------|-------------|-----------------|-------|--------------|--------------|-------|--------------|--------|
| Frequency (MHz) | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV) |       | Line/Neutral | Limit (dBuV) |       | Margin(dBuV) |        |
|                 | QP                | AV    |             | QP              | AV    |              | QP           | AV    | QP           | AV     |
| 3.030           | 33.78             | 24.04 | 10.50       | 44.28           | 34.54 | Line         | 56.00        | 46.00 | -11.72       | -11.46 |
| 3.930           | 35.34             | 25.07 | 10.50       | 45.84           | 35.57 | Line         | 56.00        | 46.00 | -10.16       | -10.43 |
| 3.974           | 34.55             | 27.18 | 10.50       | 45.05           | 37.68 | Line         | 56.00        | 46.00 | -10.95       | -8.32  |
| 4.046           | 33.19             | 26.70 | 10.50       | 43.69           | 37.20 | Line         | 56.00        | 46.00 | -12.31       | -8.80  |
| 9.210           | 36.30             | 28.03 | 10.70       | 47.00           | 38.73 | Line         | 60.00        | 50.00 | -13.00       | -11.27 |
| 9.230           | 35.13             | 27.01 | 10.70       | 45.83           | 37.71 | Line         | 60.00        | 50.00 | -14.17       | -12.29 |
| FCC15           |                   |       |             |                 |       |              |              |       |              |        |

## Note:

- 1.Uncertainty in conducted emission measured is <+/-2dB.
- 2.The emission levels of other frequencies were very low against the limit.
- 3.All Reading Levels are Quasi-Peak and Average value.
- 4.Emission = Meter Reading + Factor; Factor = Insertion Loss + Cable Loss.
- 5.Margin Value= Emission Level - Limit Value.



| FCC15           |                   |       |             |                 |       |              |              |       |              |        |
|-----------------|-------------------|-------|-------------|-----------------|-------|--------------|--------------|-------|--------------|--------|
| Frequency (MHz) | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV) |       | Line/Neutral | Limit (dBuV) |       | Margin(dBuV) |        |
|                 | QP                | AV    |             | QP              | AV    |              | QP           | AV    | QP           | AV     |
| 3.210           | 34.43             | 24.79 | 10.50       | 44.93           | 35.29 | Neutral      | 56.00        | 46.00 | -11.07       | -10.71 |
| 3.886           | 34.21             | 25.81 | 10.50       | 44.71           | 36.31 | Neutral      | 56.00        | 46.00 | -11.29       | -9.69  |
| 4.022           | 34.95             | 26.44 | 10.50       | 45.45           | 36.94 | Neutral      | 56.00        | 46.00 | -10.55       | -9.06  |
| 9.218           | 37.07             | 27.82 | 10.50       | 47.57           | 38.32 | Neutral      | 60.00        | 50.00 | -12.43       | -11.68 |
| 9.238           | 37.00             | 27.28 | 10.70       | 47.70           | 37.98 | Neutral      | 60.00        | 50.00 | -12.30       | -12.02 |
| 9.386           | 36.45             | 28.13 | 10.70       | 47.15           | 38.83 | Neutral      | 60.00        | 50.00 | -12.85       | -11.17 |
| FCC15           |                   |       |             |                 |       |              |              |       |              |        |

**Note:**

- 1.Uncertainty in conducted emission measured is <+/- 2dB.
- 2.The emission levels of other frequencies were very low against the limit.
- 3.All Reading Levels are Quasi-Peak and Average value.
- 4.Emission = Meter Reading + Factor; Factor = Insertion Loss + Cable Loss.
- 5.Margin Value= Emission Level - Limit Value.

## 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:

- Place the EUT on the table and set it in the transmitting mode.
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- Set the spectrum analyzer as RBW = 30 kHz, VBW = 100 kHz, Span = 2 MHz, Sweep = 100ms.
- Mark the peak frequency and -20dB (upper and lower) frequency.
- 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:

- The transmitter output was connected to the spectrum analyzer via a low loss cable.
- Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100kHz bandwidth from band edge.
- The band edges was measured and recorded.

#### Frequency Separation:

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

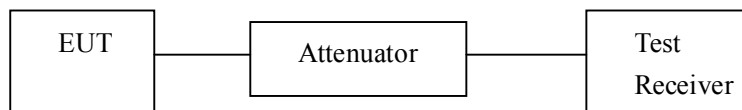
#### Number of Hopping Frequency:

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

#### Time of Occupancy (Dwell Time):

- Place the EUT on the table and set it in the transmitting mode.
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- Set center frequency of spectrum analyzer = operating frequency, RBW = 100 kHz, VBW = 300 kHz, Sweep=2ms
- 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 is 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. Occupied Channel Bandwidth**

Refer to Appendix\_DSS\_BT.

### **C. Peak Power**

Refer to Appendix\_DSS\_BT.

### **D. Frequency Separation / Carrier frequency separation**

Refer to Appendix\_DSS\_BT.

### **E. Time of occupancy / Time of Occupancy (Dwell Time)**

Refer to Appendix\_DSS\_BT.

### **F. Number of Hopping Frequency / Number of hopping channels**

Refer to Appendix\_DSS\_BT.

### **G.100kHz Band Edges Measurement**

Refer to Appendix\_DSS\_BT.

### **H. Conducted SpuriousEmission**

Refer to Appendix\_DSS\_BT.

### **I. Duty Cycle**

Refer to Appendix\_DSS\_BT.

## 6. Transmitter Spurious Radiated Emission at 3 Meters

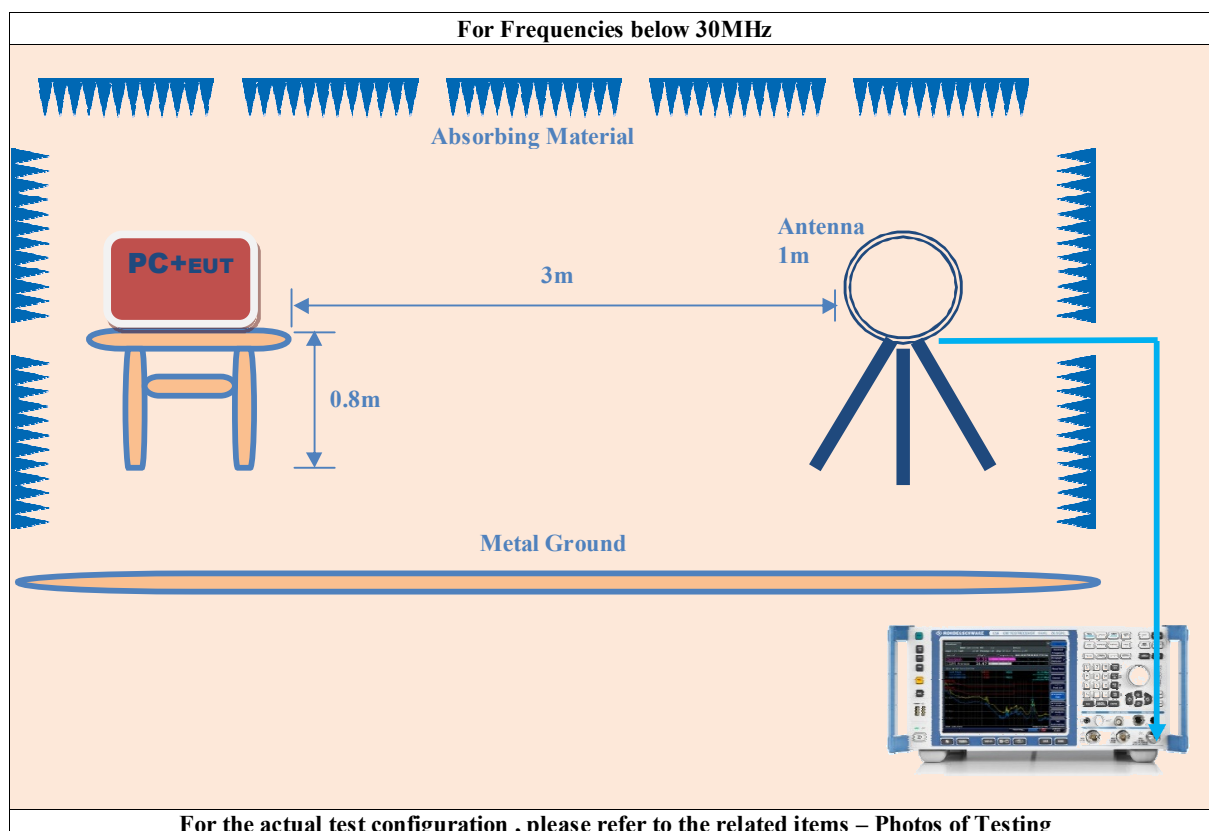
### 6.1 Test Equipment

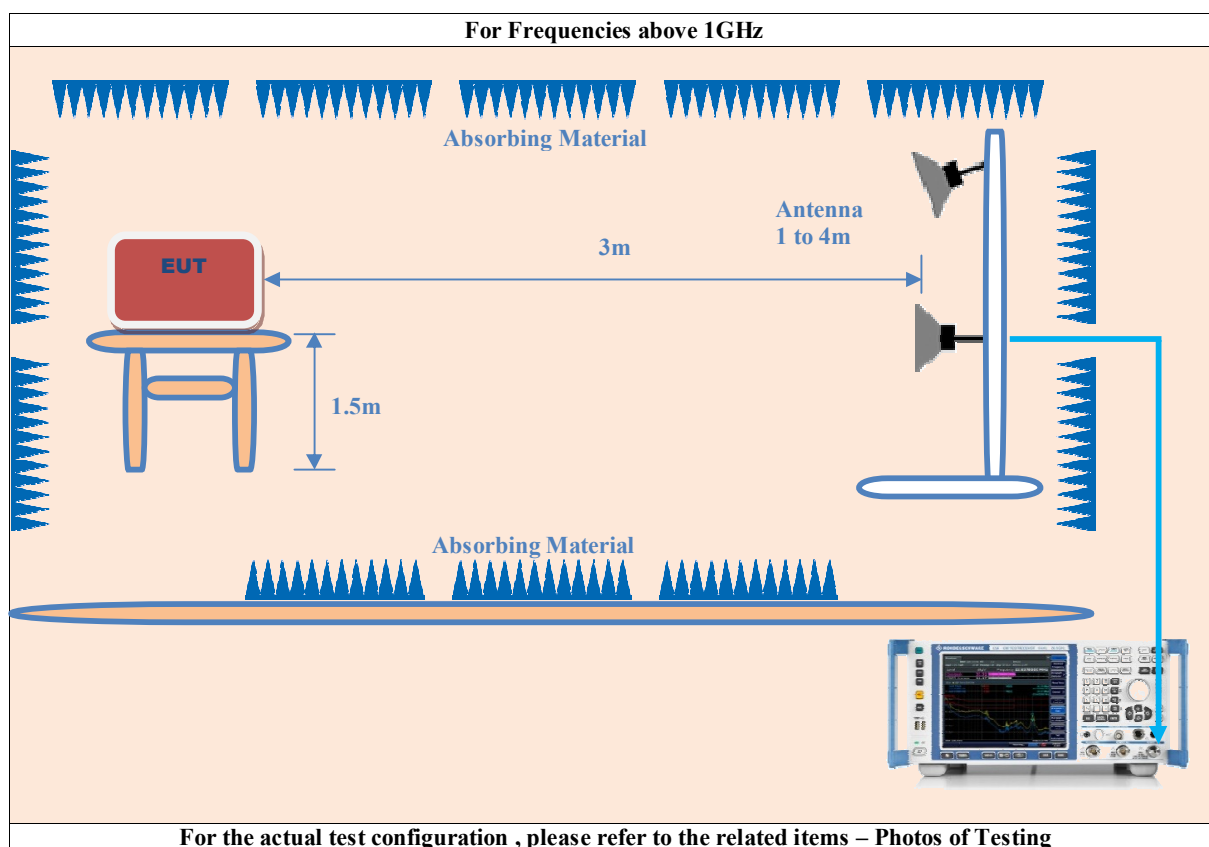
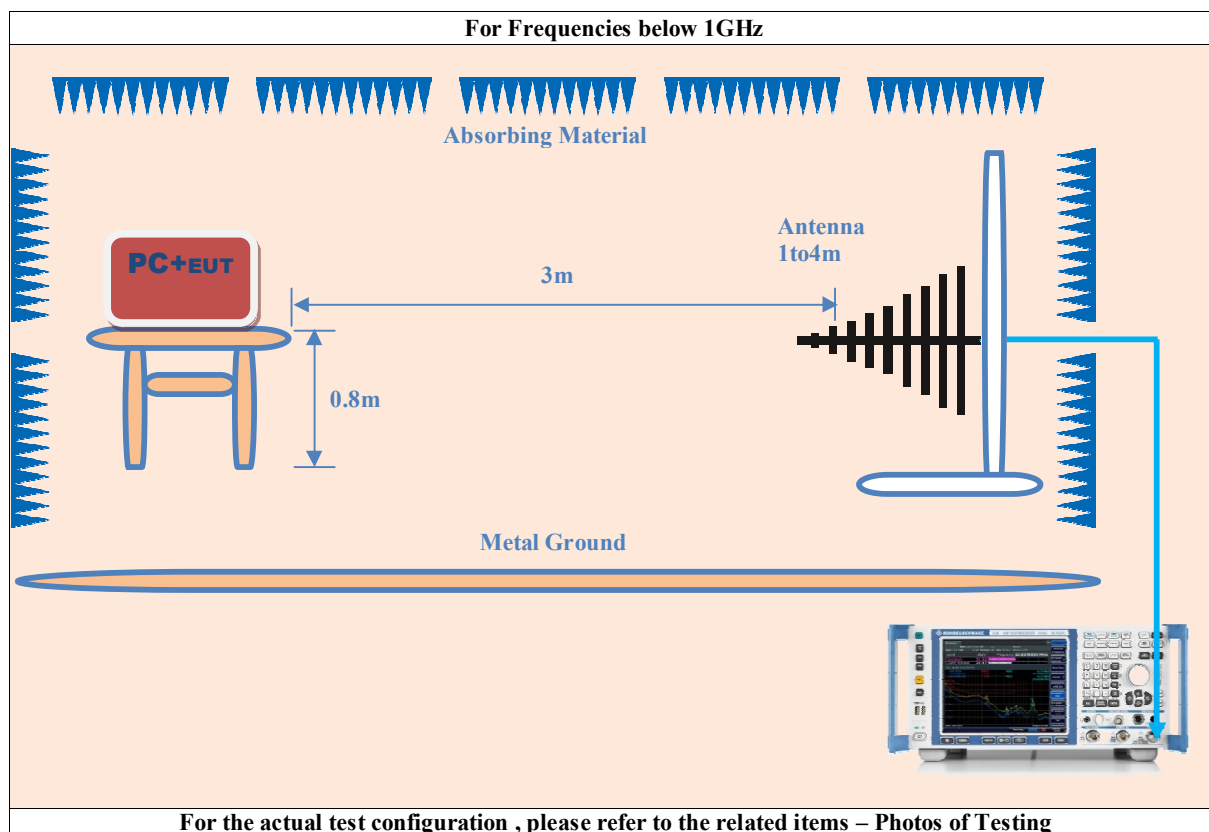
Please refer to Section 10 this report.

### 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







## 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. The maximum 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    |
| 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     | (?)         |
| 13.36–13.41.....       |                     |               |             |

<sup>1</sup>Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

<sup>2</sup>Above 38.6

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

| Frequency (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                             |

## 6.7 Test Result

| Test Mode 1                                       |                   |       |             |                   |       |               |                |      |            |        |
|---------------------------------------------------|-------------------|-------|-------------|-------------------|-------|---------------|----------------|------|------------|--------|
| Restricted Frequency Bands Data_GFSK CH Low       |                   |       |             |                   |       |               |                |      |            |        |
| Frequency (MHz)                                   | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./ Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                                   | PK                | AV    |             | PK                | AV    |               | PK             | AV   | PK         | AV     |
| 2390.000                                          | 53.75             | 41.47 | 0.90        | 54.65             | 42.37 | Horiz./       | 74.0           | 54.0 | -19.35     | -11.63 |
| 2390.000                                          | 51.97             | 40.74 | 0.90        | 52.87             | 41.64 | Vert.         | 74.0           | 54.0 | -21.13     | -12.36 |
| Restricted Frequency Bands Data_GFSK CH High      |                   |       |             |                   |       |               |                |      |            |        |
| Frequency (MHz)                                   | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./ Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                                   | PK                | AV    |             | PK                | AV    |               | PK             | AV   | PK         | AV     |
| 2483.500                                          | 53.02             | 40.95 | 0.90        | 53.92             | 41.85 | Horiz./       | 74.0           | 54.0 | -20.08     | -12.15 |
| 2483.500                                          | 51.23             | 40.05 | 0.90        | 52.13             | 40.95 | Vert.         | 74.0           | 54.0 | -21.87     | -13.05 |
| Test Mode 2                                       |                   |       |             |                   |       |               |                |      |            |        |
| Restricted Frequency Bands Data_π/4-DQPSK CH Low  |                   |       |             |                   |       |               |                |      |            |        |
| Frequency (MHz)                                   | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./ Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                                   | PK                | AV    |             | PK                | AV    |               | PK             | AV   | PK         | AV     |
| 2390.000                                          | 54.36             | 42.25 | 0.90        | 55.26             | 43.15 | Horiz./       | 74.0           | 54.0 | -18.74     | -10.85 |
| 2390.000                                          | 52.37             | 41.67 | 0.90        | 53.27             | 42.57 | Vert.         | 74.0           | 54.0 | -20.73     | -11.43 |
| Restricted Frequency Bands Data_π/4-DQPSK CH High |                   |       |             |                   |       |               |                |      |            |        |
| Frequency (MHz)                                   | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./ Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                                   | PK                | AV    |             | PK                | AV    |               | PK             | AV   | PK         | AV     |
| 2483.500                                          | 53.93             | 41.29 | 0.90        | 54.83             | 42.19 | Horiz./       | 74.0           | 54.0 | -19.17     | -11.81 |
| 2483.500                                          | 52.39             | 41.09 | 0.90        | 53.29             | 41.99 | Vert.         | 74.0           | 54.0 | -20.71     | -12.01 |
| Test Mode 3                                       |                   |       |             |                   |       |               |                |      |            |        |
| Restricted Frequency Bands Data_8DPSK CH Low      |                   |       |             |                   |       |               |                |      |            |        |
| Frequency (MHz)                                   | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./ Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                                   | PK                | AV    |             | PK                | AV    |               | PK             | AV   | PK         | AV     |
| 2390.000                                          | 53.89             | 41.66 | 0.90        | 54.79             | 42.56 | Horiz./       | 74.0           | 54.0 | -19.21     | -11.44 |
| 2390.000                                          | 52.47             | 39.78 | 0.90        | 53.37             | 40.68 | Vert.         | 74.0           | 54.0 | -20.63     | -13.32 |
| Restricted Frequency Bands Data_8DPSK CH High     |                   |       |             |                   |       |               |                |      |            |        |
| Frequency (MHz)                                   | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./ Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                                   | PK                | AV    |             | PK                | AV    |               | PK             | AV   | PK         | AV     |
| 2483.500                                          | 53.23             | 41.29 | 0.90        | 54.13             | 42.19 | Horiz./       | 74.0           | 54.0 | -19.87     | -11.81 |
| 2483.500                                          | 51.77             | 39.33 | 0.90        | 52.67             | 40.23 | Vert.         | 74.0           | 54.0 | -21.33     | -13.77 |

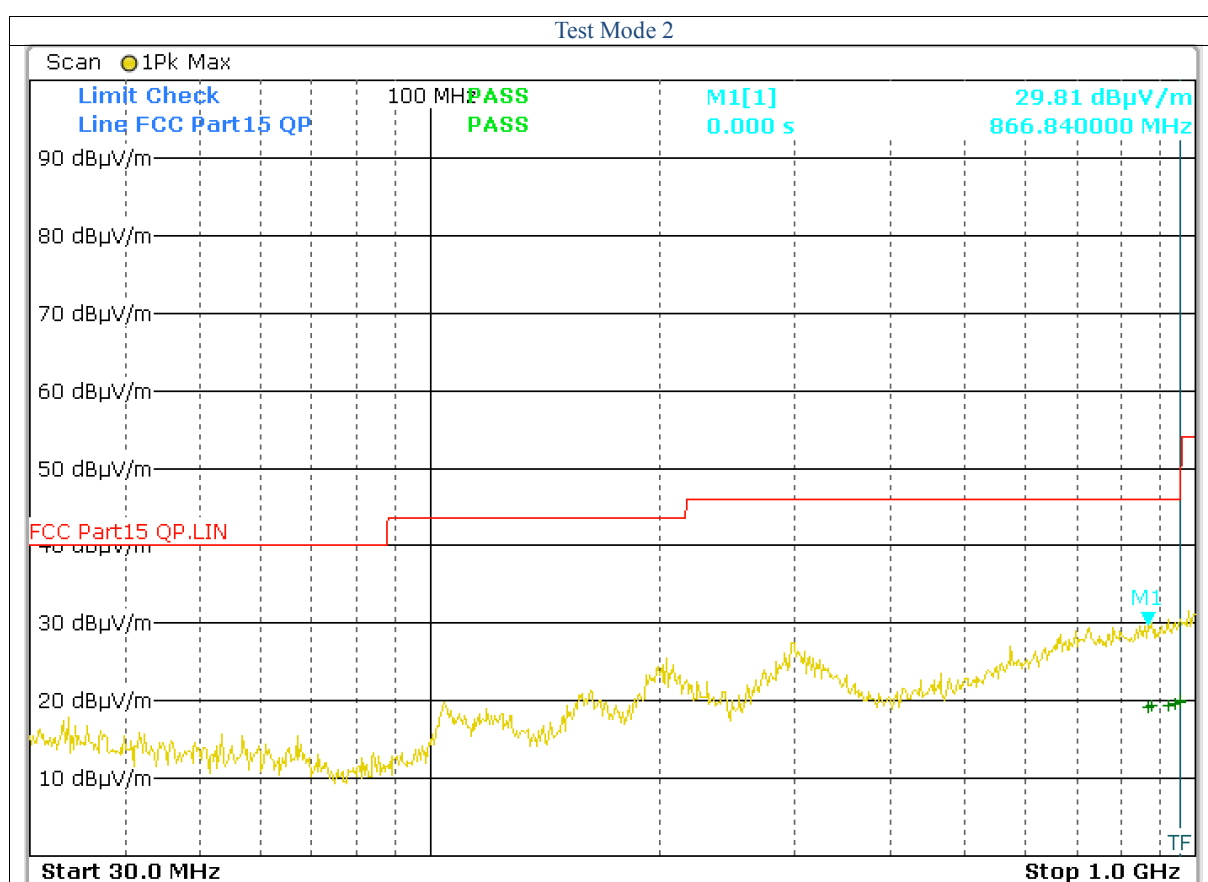
| Test Mode 2                              |                   |       |             |                   |       |              |                |      |            |        |
|------------------------------------------|-------------------|-------|-------------|-------------------|-------|--------------|----------------|------|------------|--------|
| Harmonics Radiated Emission Data_CH Low  |                   |       |             |                   |       |              |                |      |            |        |
| Frequency (MHz)                          | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                          | PK                | AV    |             | PK                | AV    |              | PK             | AV   | PK         | AV     |
| 4804.000                                 | 41.55             | 32.57 | 10.10       | 51.65             | 42.67 | Horiz./      | 74.0           | 54.0 | -22.35     | -11.33 |
| 4804.000                                 | 39.96             | 31.11 | 10.10       | 50.06             | 41.21 | Vert.        | 74.0           | 54.0 | -23.94     | -12.79 |
| 7206.000                                 | 39.33             | 28.19 | 13.10       | 52.43             | 41.29 | Horiz./      | 74.0           | 54.0 | -21.57     | -12.71 |
| 7206.000                                 | 38.18             | 28.28 | 13.10       | 51.28             | 41.38 | Vert.        | 74.0           | 54.0 | -22.72     | -12.62 |
| 24020.00                                 | -                 | -     | -           | -                 | -     | -            | -              | -    | -          | -      |
| 24020.00                                 | -                 | -     | -           | -                 | -     | -            | -              | -    | -          | -      |
| Harmonics Radiated Emission Data_CH Mid  |                   |       |             |                   |       |              |                |      |            |        |
| Frequency (MHz)                          | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                          | PK                | AV    |             | PK                | AV    |              | PK             | AV   | PK         | AV     |
| 4882.000                                 | 39.55             | 31.05 | 10.10       | 49.65             | 41.15 | Horiz./      | 74.0           | 54.0 | -24.35     | -12.85 |
| 4882.000                                 | 38.87             | 31.77 | 10.10       | 48.97             | 41.87 | Vert.        | 74.0           | 54.0 | -25.03     | -12.13 |
| 7323.000                                 | 36.58             | 29.78 | 13.10       | 49.68             | 42.88 | Horiz./      | 74.0           | 54.0 | -24.32     | -11.12 |
| 7323.000                                 | 35.76             | 28.91 | 13.10       | 48.86             | 42.01 | Vert.        | 74.0           | 54.0 | -25.14     | -11.99 |
| 24410.00                                 | -                 | -     | -           | -                 | -     | -            | -              | -    | -          | -      |
| 24410.00                                 | -                 | -     | -           | -                 | -     | -            | -              | -    | -          | -      |
| Harmonics Radiated Emission Data_CH High |                   |       |             |                   |       |              |                |      |            |        |
| Frequency (MHz)                          | Read Level (dBuV) |       | Factor (dB) | Emission (dBuV/m) |       | Horiz./Vert. | Limit (dBuV/m) |      | Margin(dB) |        |
|                                          | PK                | AV    |             | PK                | AV    |              | PK             | AV   | PK         | AV     |
| 4960.000                                 | 38.58             | 32.53 | 10.10       | 48.68             | 42.63 | Horiz./      | 74.0           | 54.0 | -25.32     | -11.37 |
| 4960.000                                 | 37.59             | 31.86 | 10.10       | 47.69             | 41.96 | Vert.        | 74.0           | 54.0 | -26.31     | -12.04 |
| 7440.000                                 | 35.98             | 29.77 | 13.10       | 49.08             | 42.87 | Horiz./      | 74.0           | 54.0 | -24.92     | -11.13 |
| 7440.000                                 | 35.53             | 28.87 | 13.10       | 48.63             | 41.97 | Vert.        | 74.0           | 54.0 | -25.37     | -12.03 |
| 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 the emission being measured;  
Set RBW = 1 MHz, VBW = 3MHz for  $f > 1$  GHz for peak measurement.  
For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW  $\geq 1/T$ , when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power 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 dB when compared to the limit.

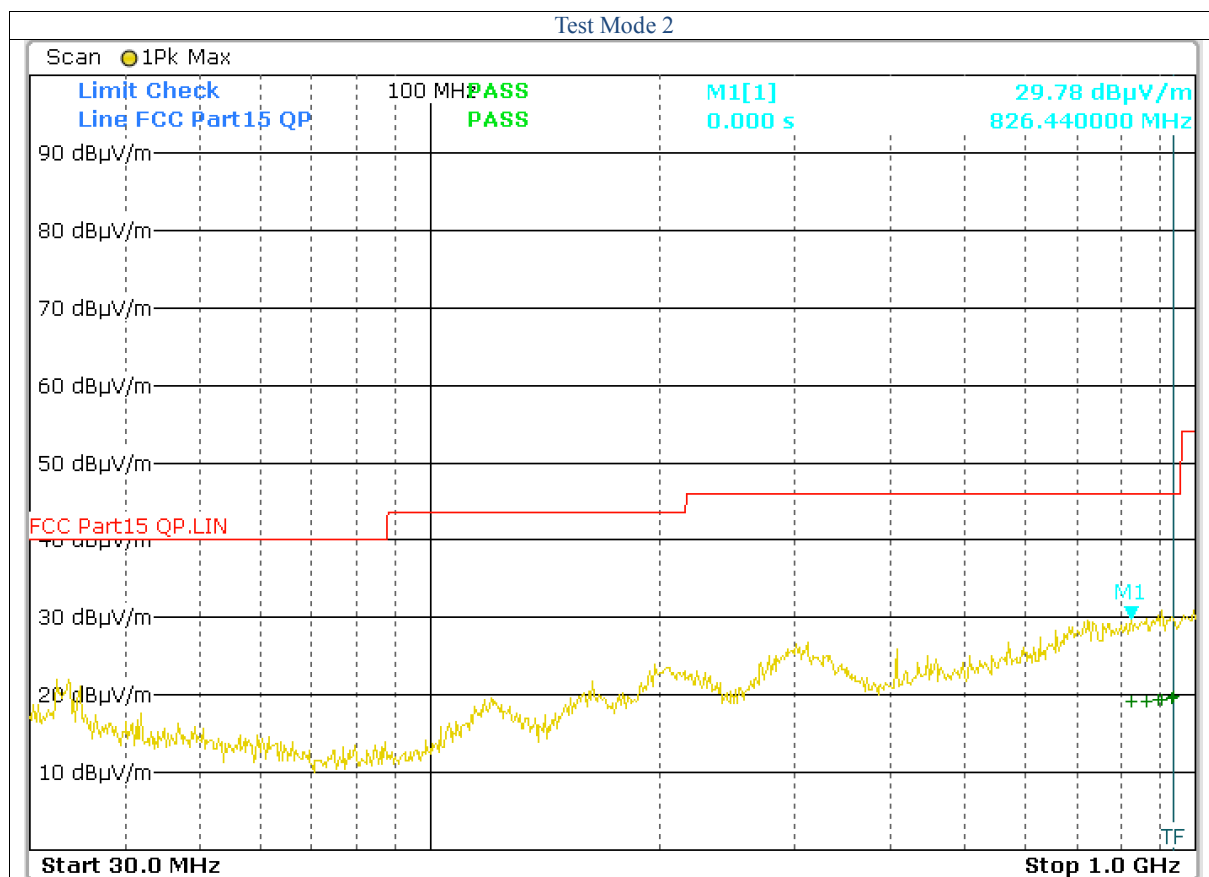
**For Frequency below 30MHz**

| 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             |                   |             |                   | Horiz./       |                |             |
| N/A             |                   |             |                   | Horiz./       |                |             |
| N/A             |                   |             |                   | Horiz./       |                |             |
| N/A             |                   |             |                   | Horiz./       |                |             |
| N/A             |                   |             |                   | Horiz./       |                |             |
| N/A             |                   |             |                   | Horiz./       |                |             |



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

- 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**

Refer to Exhibits\_ Test Setup Photo

## **8. Photographs – EUT**

Refer to Exhibits\_External Photos & Internal Photos

## 9. FCC ID Label

Refer to Exhibits\_ID Label & Location Info



## 10. Test Equipment

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

| Equipment/<br>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, 2017   | Dec.6, 2019   |
| Pre-Amplifier                      | Com-Power          | PAM-840       | N/A           | Dec.6, 2017   | Dec.6, 2019   |
| Horn Antenna                       | SCHWARZBECK        | BBHA 9170     | N/A           | Dec.6, 2017   | Dec.6, 2019   |
| EMI Test Receiver                  | Rohde & Schwarz    | ESR7          | 101091        | Nov. 21, 2018 | Nov. 21, 2020 |
| Spectrum Analyzer                  | Rohde & Schwarz    | FSP40         | 100273        | Dec.14, 2017  | Dec.14, 2019  |
| Loop Antenna                       | Rohde & Schwarz    | HFH2-Z2       | 100022        | Feb.21, 2018  | Feb.21, 2020  |
| Trilog-Super Broadband<br>Antenna  | SCHWARZBECK        | VULB9161      | 9161-4079     | Nov. 27, 2018 | Nov. 27, 2021 |
| Broad-Band Horn<br>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<br>N-Connectors | SCHWARZBECK        | AK9515H       | 95549         | Sep.18, 2017  | Sep.18, 2019  |
| 3m Anechoic Chamber                | KMO                | KMO-3AC       | N/A           | Dec.23, 2017  | Dec.23, 2019  |
| Temperature<br>Chamber             | TABAI              | PSL-4GTW      | N/A           | Feb.10, 2019  | Feb.10, 2021  |

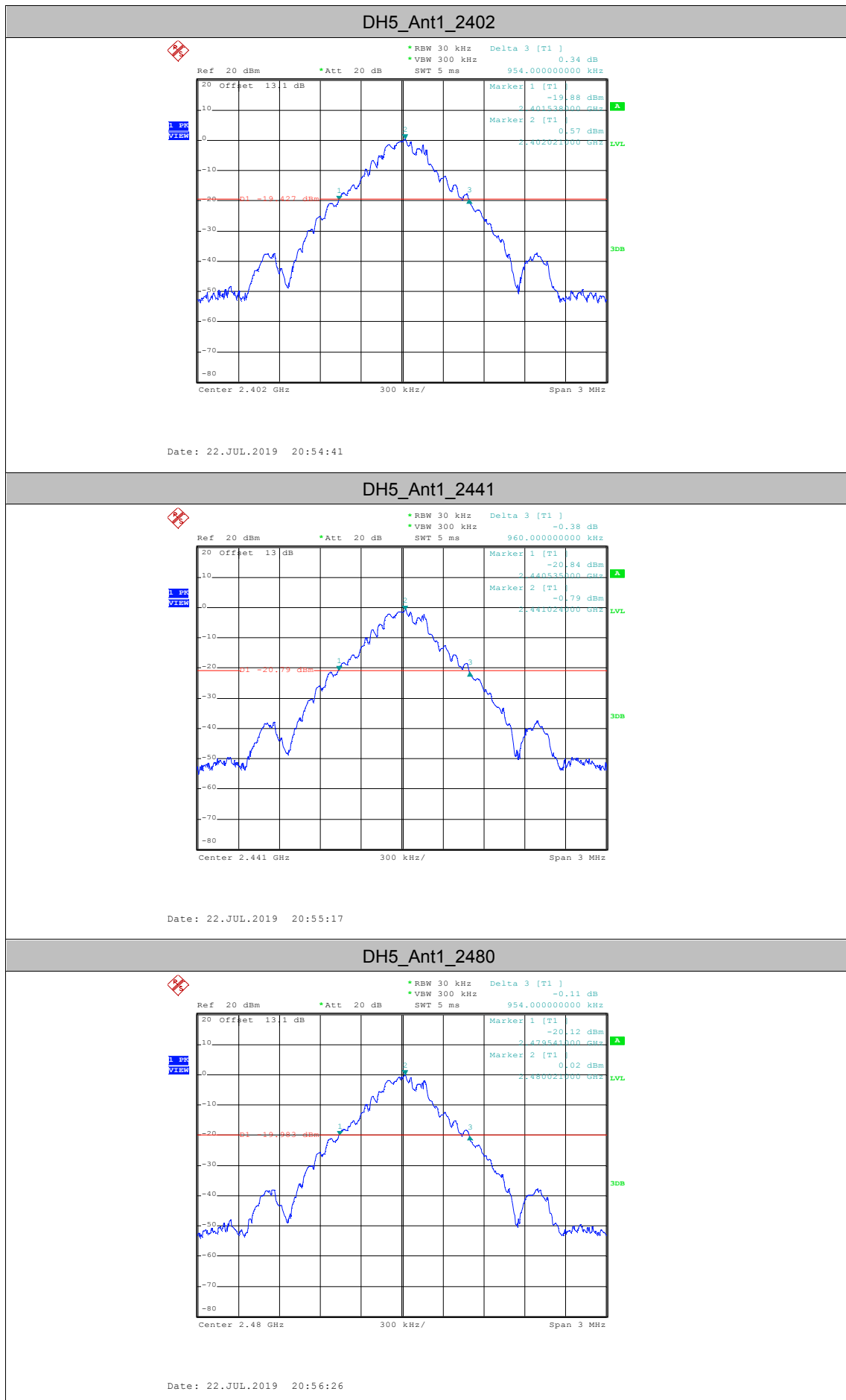
-----End of Report-----

## AppendixA: 20dBEmission Bandwidth

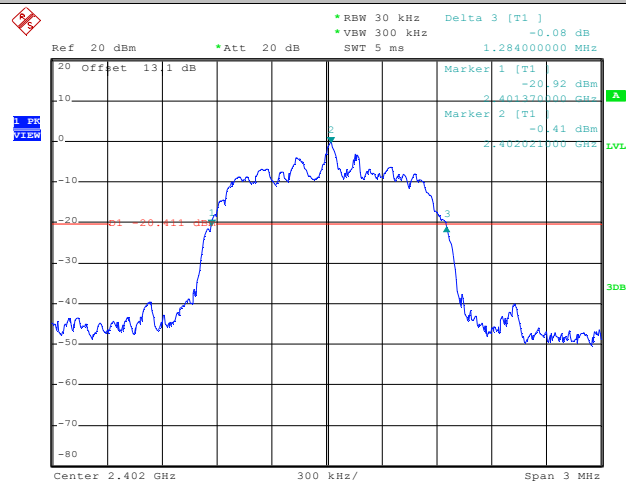
### Test Result

| TestMode | Antenna | Channel | 20db EBW[MHz] | FL[MHz]  | FH[MHz]  | Limit[MHz] | Verdict |
|----------|---------|---------|---------------|----------|----------|------------|---------|
| DH5      | Ant1    | 2402    | 0.954         | 2401.538 | 2402.492 | ---        | PASS    |
|          |         | 2441    | 0.960         | 2440.535 | 2441.495 | ---        | PASS    |
|          |         | 2480    | 0.954         | 2479.541 | 2480.495 | ---        | PASS    |
| 2DH5     | Ant1    | 2402    | 1.284         | 2401.370 | 2402.654 | ---        | PASS    |
|          |         | 2441    | 1.278         | 2440.373 | 2441.651 | ---        | PASS    |
|          |         | 2480    | 1.284         | 2479.370 | 2480.654 | ---        | PASS    |
| 3DH5     | Ant1    | 2402    | 1.290         | 2401.358 | 2402.648 | ---        | PASS    |
|          |         | 2441    | 1.290         | 2440.358 | 2441.648 | ---        | PASS    |
|          |         | 2480    | 1.290         | 2479.358 | 2480.648 | ---        | PASS    |

## Test Graphs

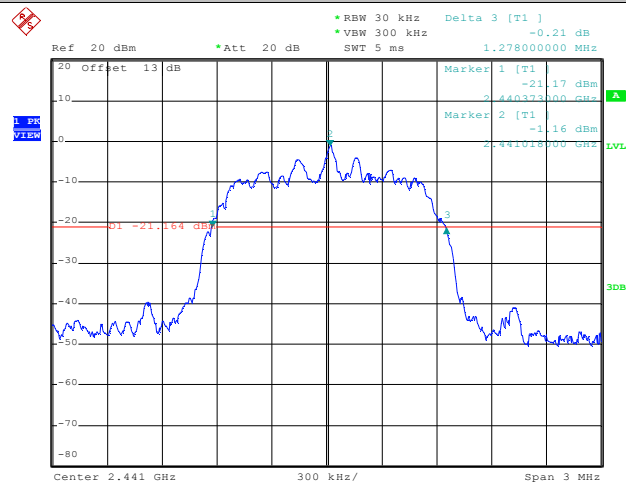


### 2DH5\_Ant1\_2402



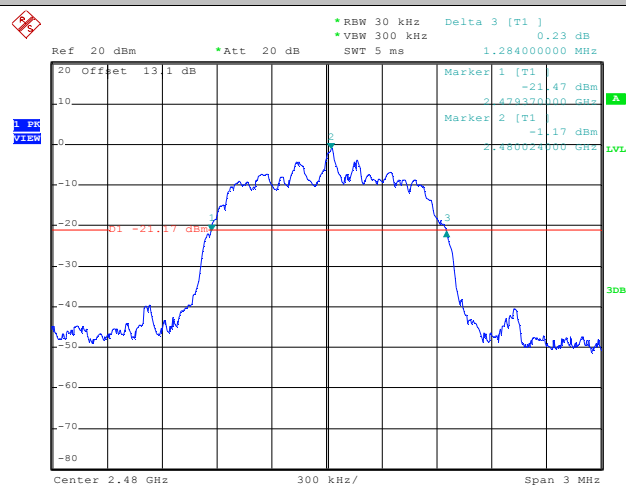
Date: 22.JUL.2019 20:57:42

### 2DH5\_Ant1\_2441



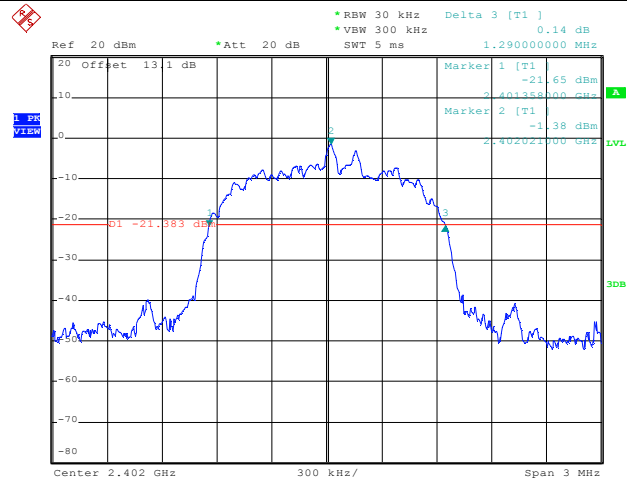
Date: 22.JUL.2019 20:58:58

### 2DH5\_Ant1\_2480



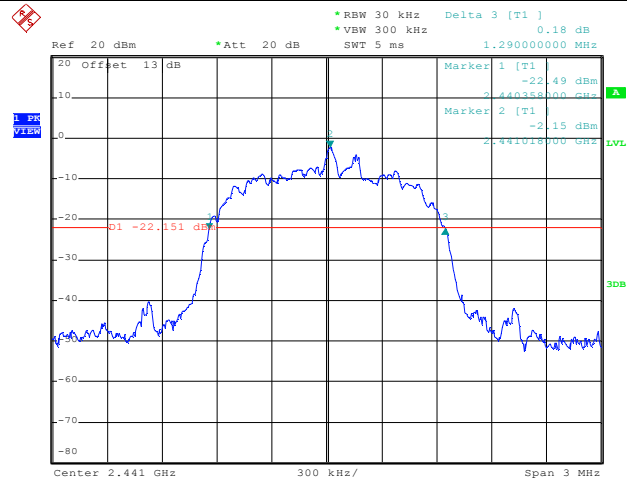
Date: 22.JUL.2019 20:59:22

### 3DH5\_Ant1\_2402



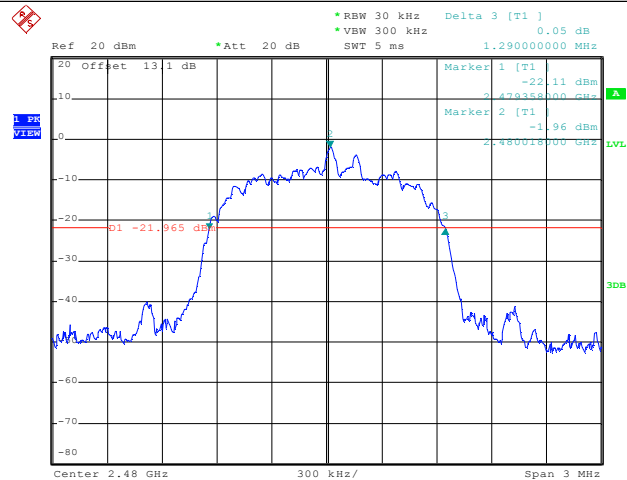
Date: 22.JUL.2019 21:00:13

### 3DH5\_Ant1\_2441



Date: 22.JUL.2019 21:01:26

### 3DH5\_Ant1\_2480



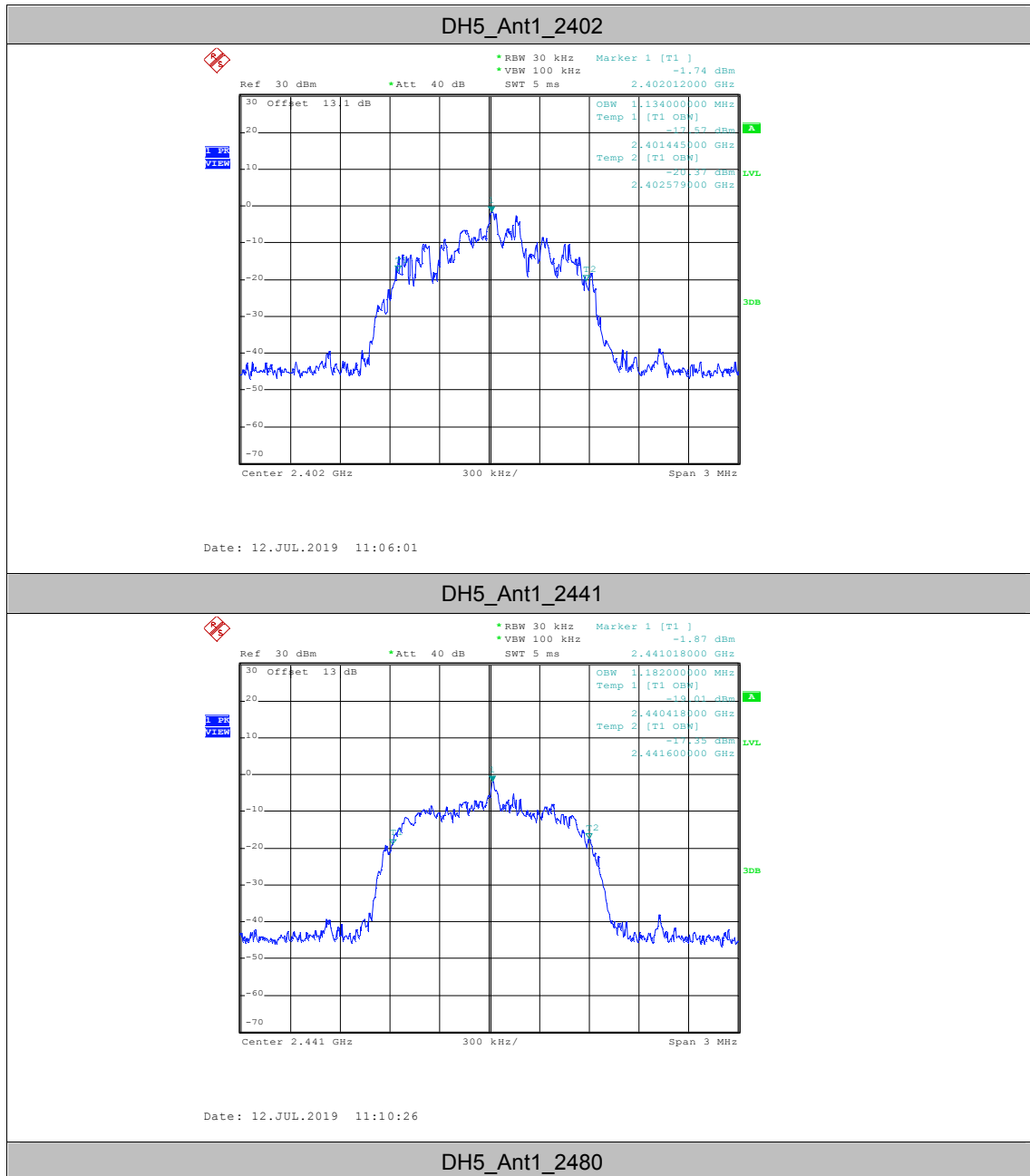
Date: 22.JUL.2019 21:02:58

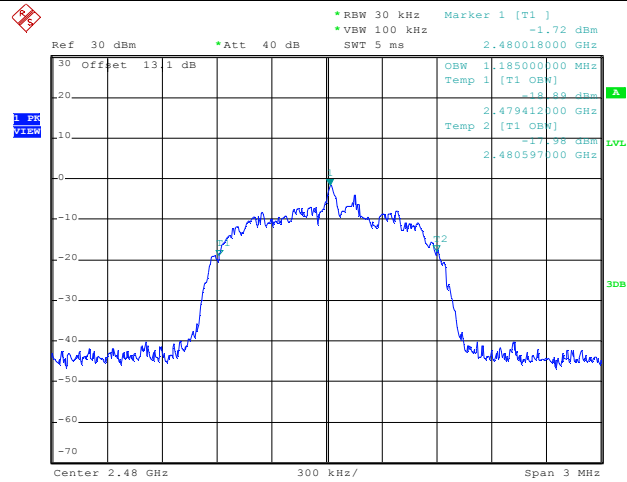
## AppendixB: Occupied Channel Bandwidth

### Test Result

| TestMode | Antenna | Channel | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|---------|-----------|---------|---------|------------|---------|
| DH5      | Ant1    | 2402    | 1.134     | 0.000   | 0.000   | ---        | PASS    |
|          |         | 2441    | 1.182     | 0.000   | 0.000   | ---        | PASS    |
|          |         | 2480    | 1.185     | 0.000   | 0.000   | ---        | PASS    |
| 2DH5     | Ant1    | 2402    | 1.167     | 0.000   | 0.000   | ---        | PASS    |
|          |         | 2441    | 1.176     | 0.000   | 0.000   | ---        | PASS    |
|          |         | 2480    | 1.191     | 0.000   | 0.000   | ---        | PASS    |
| 3DH5     | Ant1    | 2402    | 1.158     | 0.000   | 0.000   | ---        | PASS    |
|          |         | 2441    | 1.179     | 0.000   | 0.000   | ---        | PASS    |
|          |         | 2480    | 1.188     | 0.000   | 0.000   | ---        | PASS    |

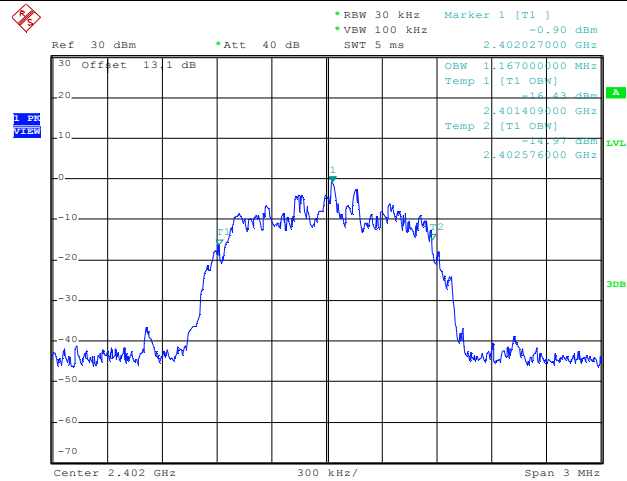
## Test Graphs





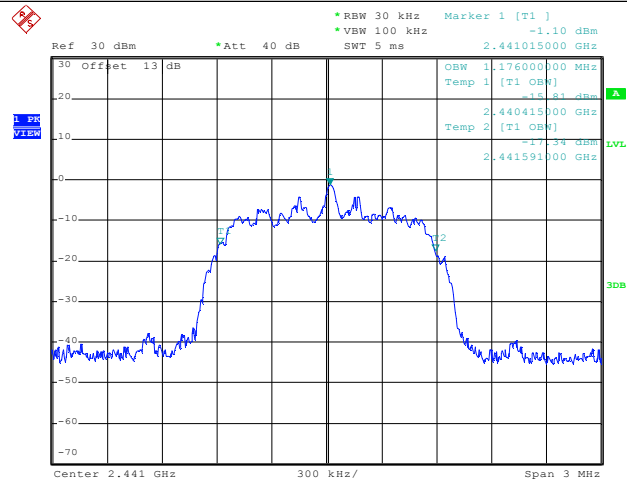
Date: 12.JUL.2019 11:12:21

### 2DH5\_Ant1\_2402



Date: 12.JUL.2019 11:14:49

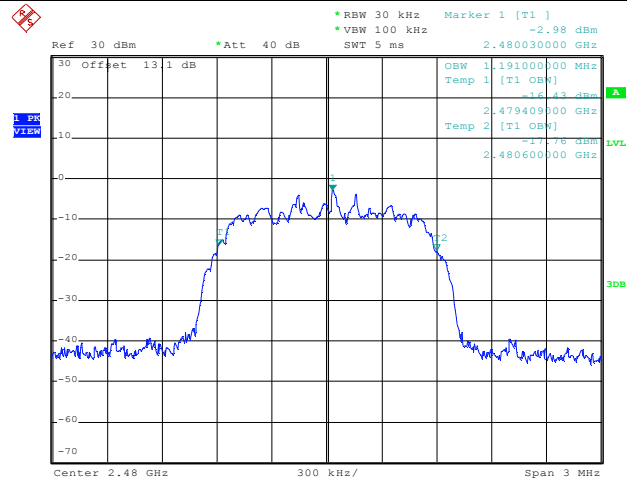
### 2DH5\_Ant1\_2441



Date: 12.JUL.2019 11:16:52

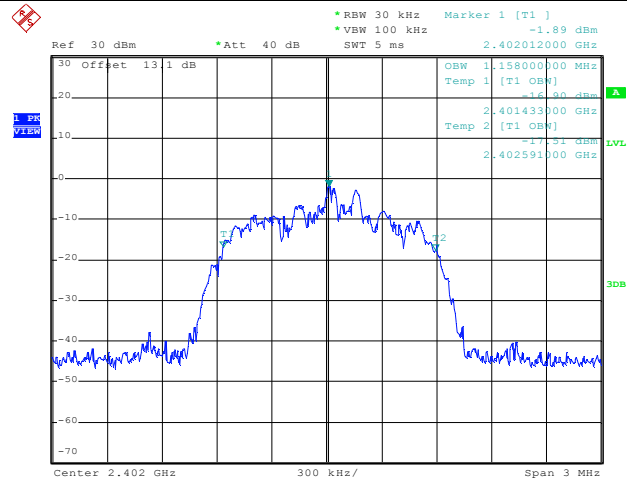
### 2DH5\_Ant1\_2480





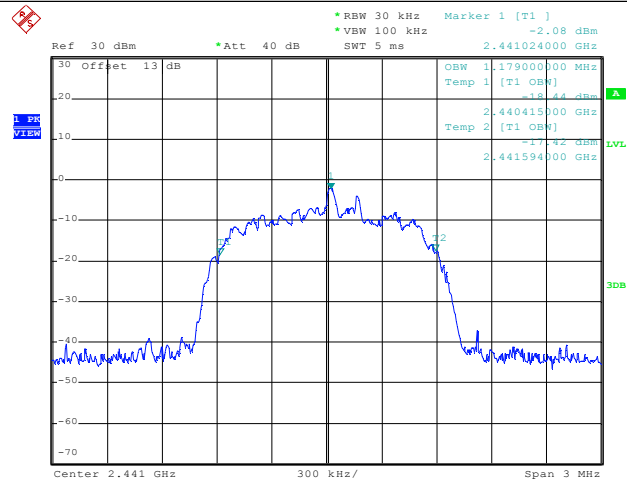
Date: 12.JUL.2019 11:19:34

### 3DH5\_Ant1\_2402



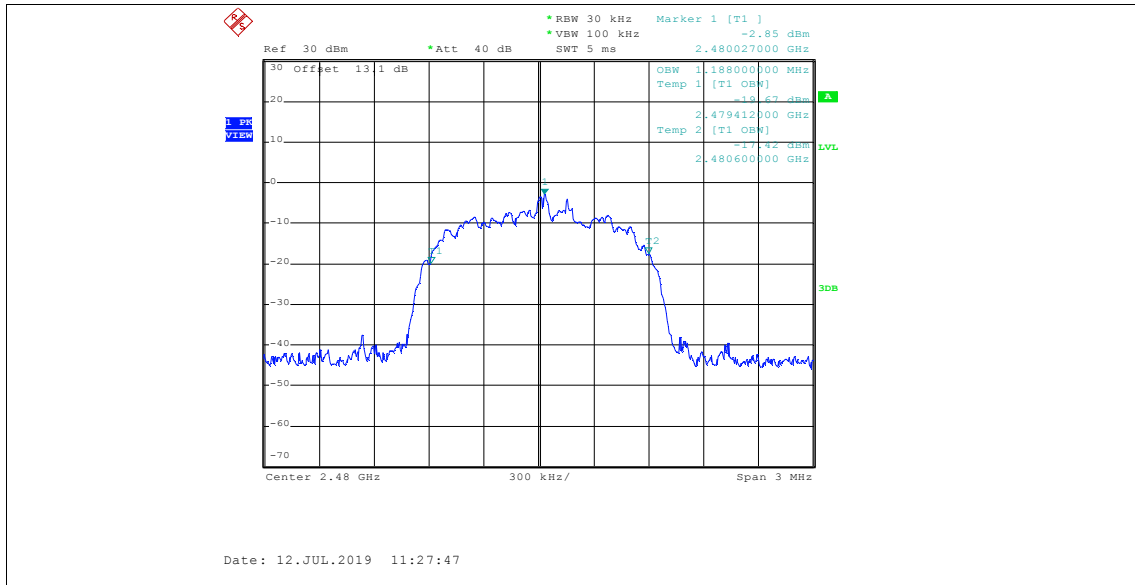
Date: 12.JUL.2019 11:23:27

### 3DH5\_Ant1\_2441



Date: 12.JUL.2019 11:25:59

### 3DH5\_Ant1\_2480

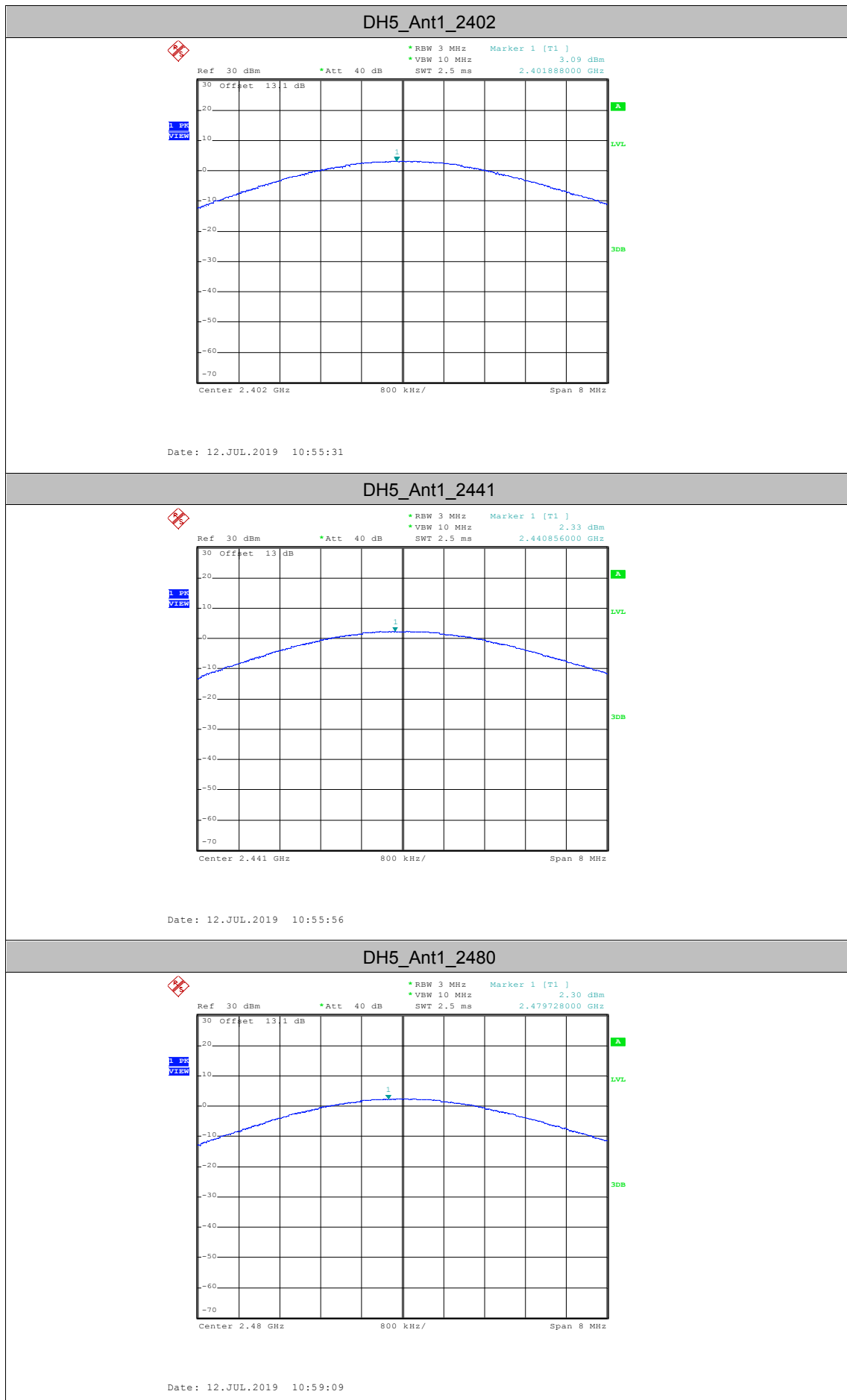


## AppendixC: Maximum conducted output power

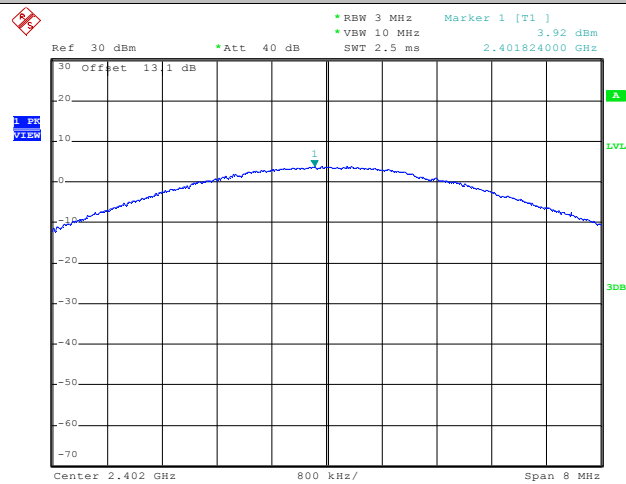
### Test Result

| TestMode | Antenna | Channel | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|---------|-------------|------------|---------|
| DH5      | Ant1    | 2402    | 3.09        | <=20.97    | PASS    |
|          |         | 2441    | 2.33        | <=20.97    | PASS    |
|          |         | 2480    | 2.3         | <=20.97    | PASS    |
| 2DH5     | Ant1    | 2402    | 3.92        | <=30       | PASS    |
|          |         | 2441    | 3.06        | <=30       | PASS    |
|          |         | 2480    | 3.3         | <=30       | PASS    |
| 3DH5     | Ant1    | 2402    | 3.34        | <=30       | PASS    |
|          |         | 2441    | 2.36        | <=30       | PASS    |
|          |         | 2480    | 2.88        | <=30       | PASS    |

## Test Graphs

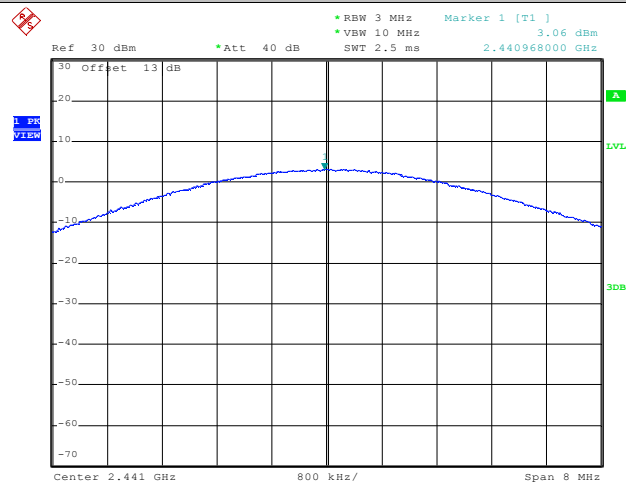


### 2DH5\_Ant1\_2402



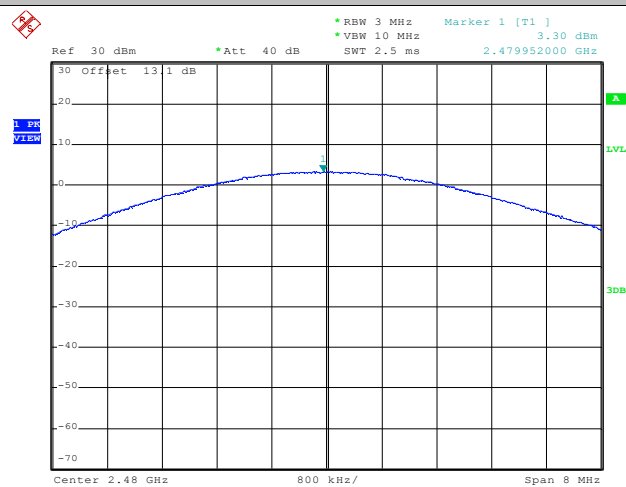
Date: 12.JUL.2019 11:00:03

### 2DH5\_Ant1\_2441



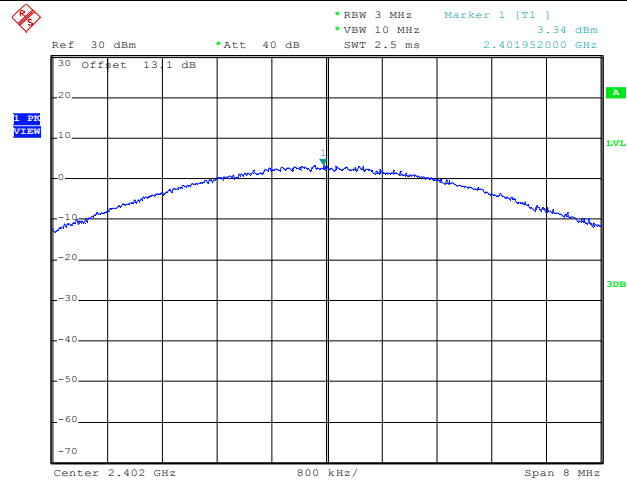
Date: 12.JUL.2019 11:00:31

### 2DH5\_Ant1\_2480



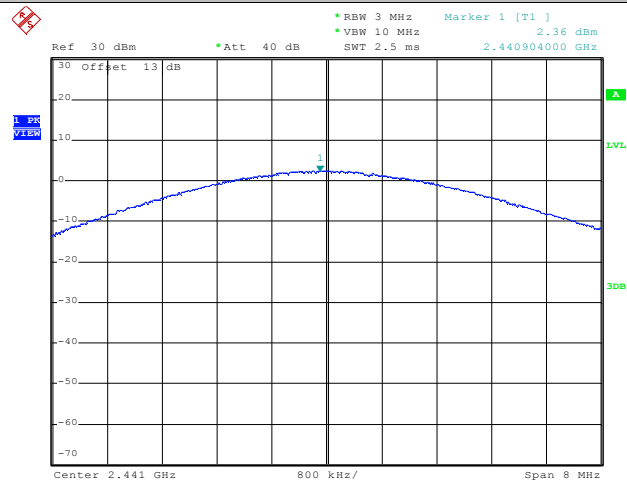
Date: 12.JUL.2019 11:00:51

### 3DH5\_Ant1\_2402



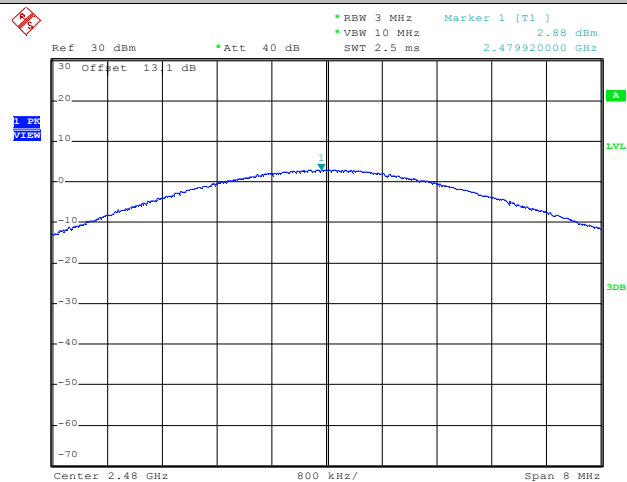
Date: 12.JUL.2019 11:01:20

### 3DH5\_Ant1\_2441



Date: 12.JUL.2019 11:01:52

### 3DH5\_Ant1\_2480



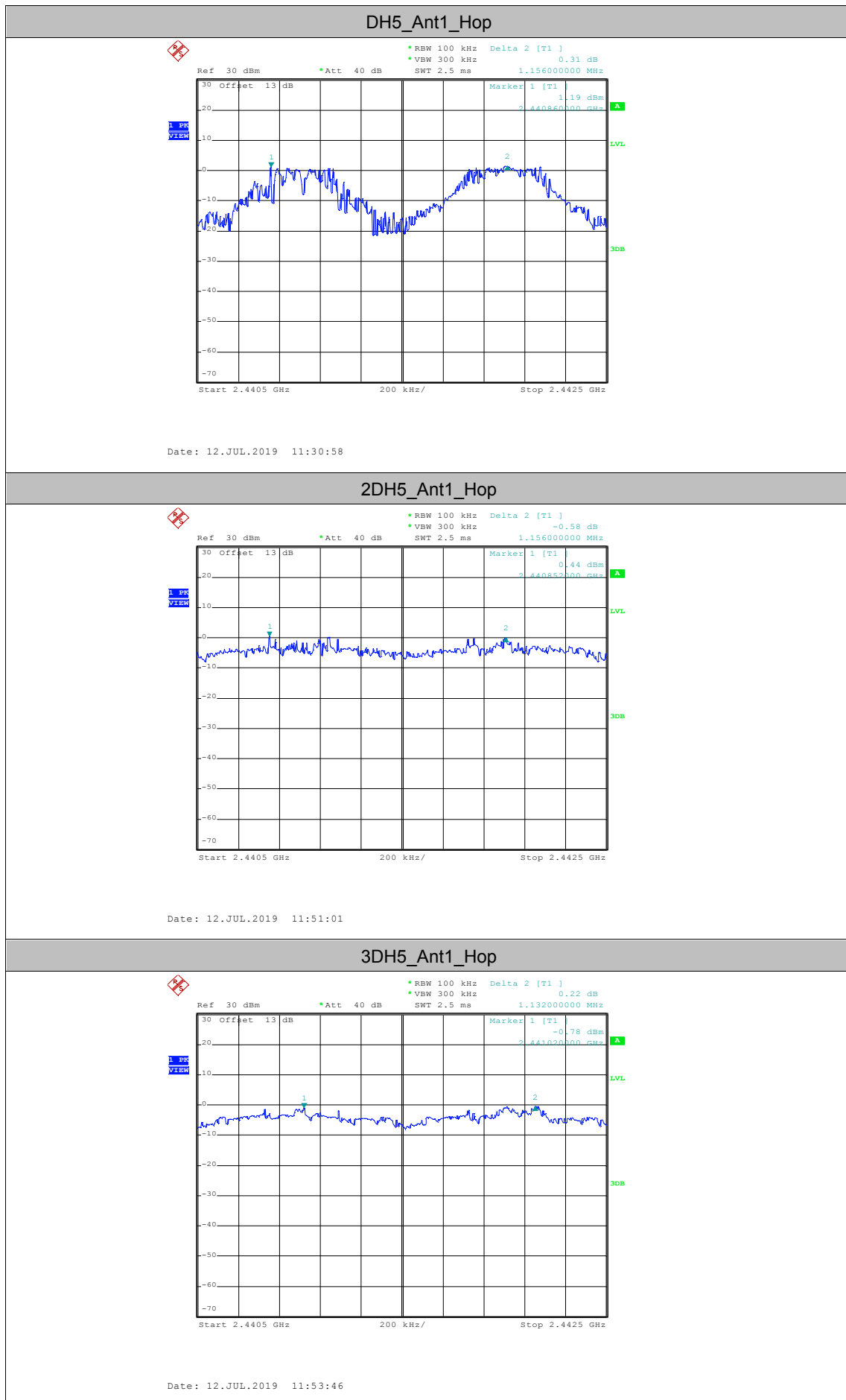
Date: 12.JUL.2019 11:02:16

**AppendixD: Carrier frequency separation**

**Test Result**

| TestMode | Antenna | Channel | Result[MHz] | Limit[MHz]   | Verdict |
|----------|---------|---------|-------------|--------------|---------|
| DH5      | Ant1    | Hop     | 1.156       | $\geq 0.924$ | PASS    |
| 2DH5     | Ant1    | Hop     | 1.156       | $\geq 0.922$ | PASS    |
| 3DH5     | Ant1    | Hop     | 1.132       | $\geq 0.924$ | PASS    |

## Test Graphs





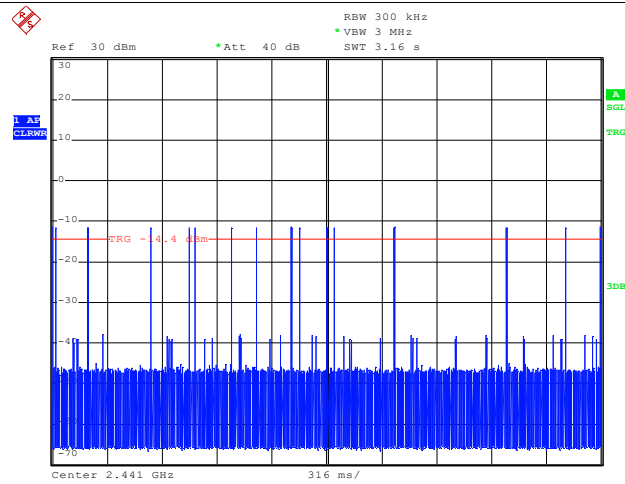
## AppendixE: Time of occupancy

### Test Result

| TestMode | Antenna | Channel | BurstWidth<br>[ms] | TotalHops<br>[Num] | Result[s] | Limit[s] | Verdict |
|----------|---------|---------|--------------------|--------------------|-----------|----------|---------|
| DH1      | Ant1    | Hop     | 0.38               | 330                | 0.127     | <=0.4    | PASS    |
| DH3      | Ant1    | Hop     | 0.13               | 160                | 0.02      | <=0.4    | PASS    |
| DH5      | Ant1    | Hop     | 0.39               | 120                | 0.047     | <=0.4    | PASS    |
| 2DH1     | Ant1    | Hop     | 0.39               | 320                | 0.124     | <=0.4    | PASS    |
| 2DH3     | Ant1    | Hop     | 1.64               | 200                | 0.328     | <=0.4    | PASS    |
| 2DH5     | Ant1    | Hop     | 2.89               | 90                 | 0.26      | <=0.4    | PASS    |
| 3DH1     | Ant1    | Hop     | 0.39               | 330                | 0.128     | <=0.4    | PASS    |
| 3DH3     | Ant1    | Hop     | 1.64               | 160                | 0.262     | <=0.4    | PASS    |
| 3DH5     | Ant1    | Hop     | 2.89               | 130                | 0.376     | <=0.4    | PASS    |

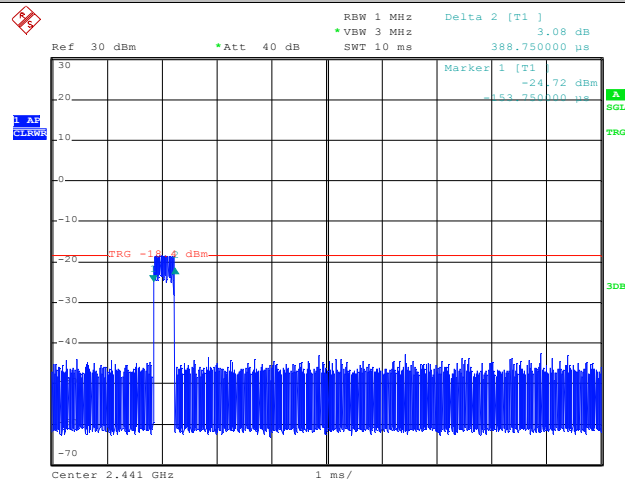
## Test Graphs



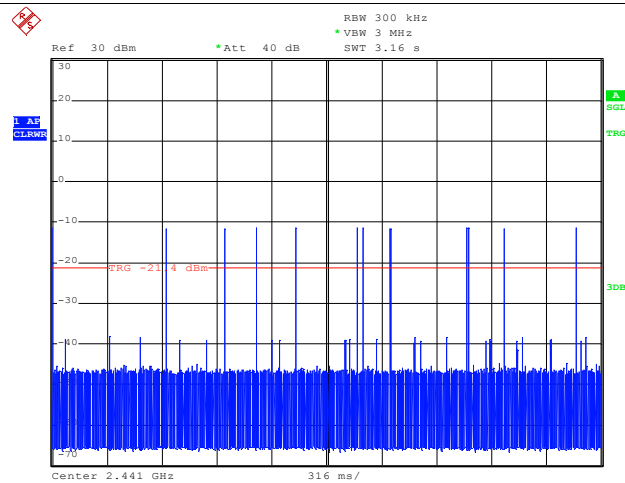


Date: 12.JUL.2019 11:38:52

### DH5\_Ant1\_Hop

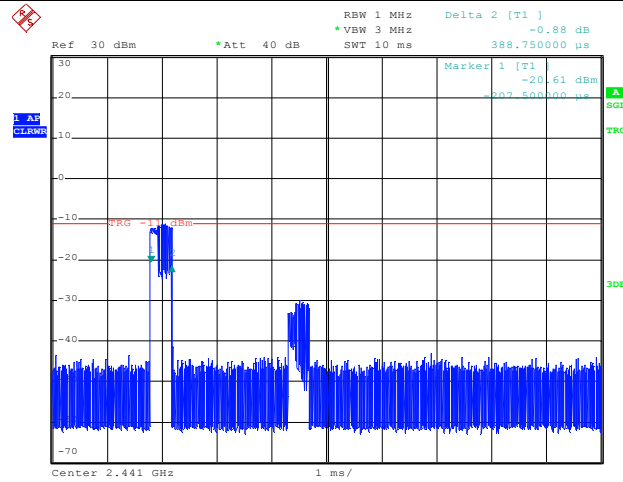


Date: 12.JUL.2019 11:33:27

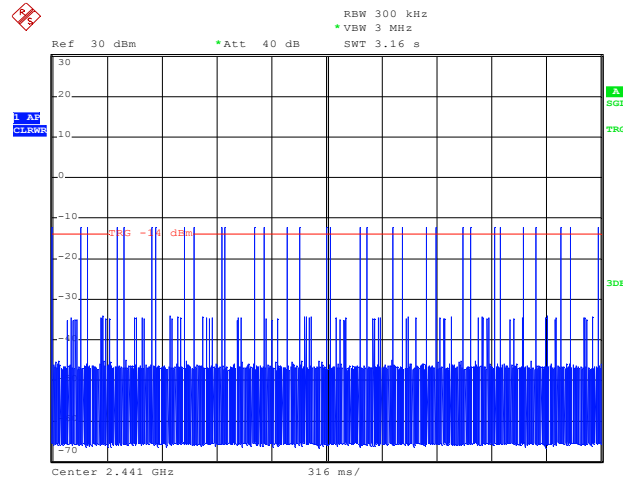


Date: 12.JUL.2019 11:33:33

### 2DH1\_Ant1\_Hop

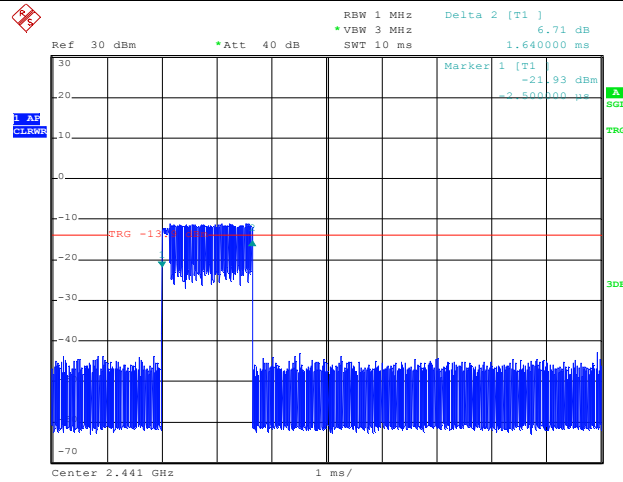


Date: 12.JUL.2019 11:42:42

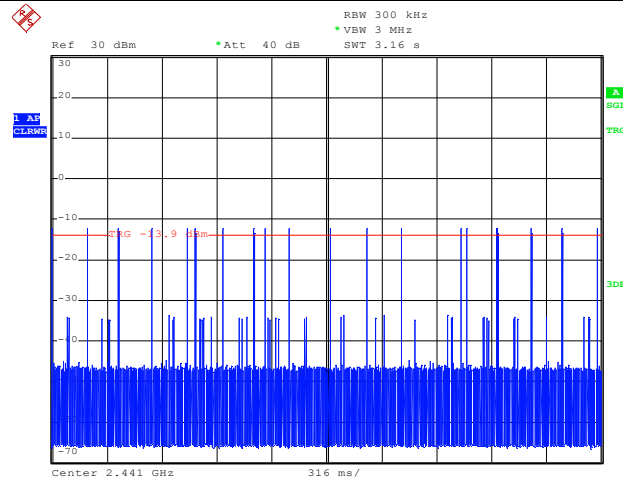


Date: 12.JUL.2019 11:42:48

### 2DH3\_Ant1\_Hop

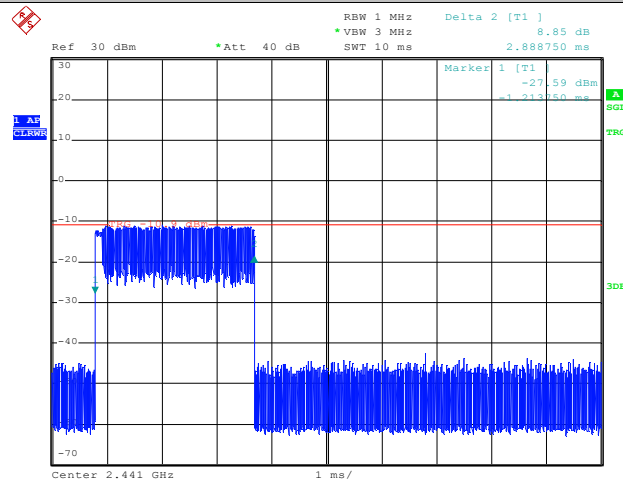


Date: 12.JUL.2019 11:43:20

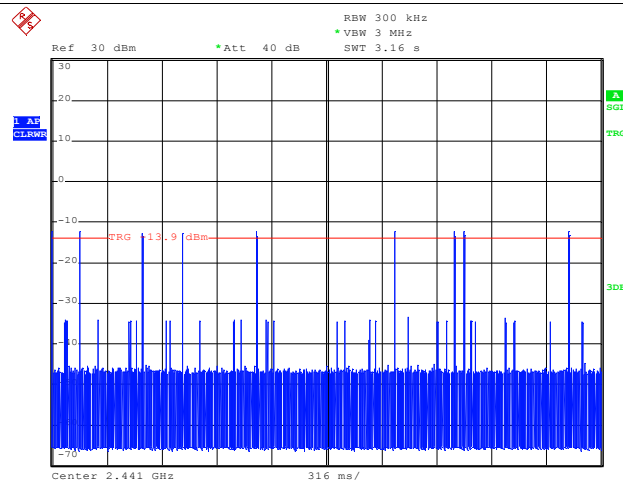


Date: 12.JUL.2019 11:43:26

### 2DH5\_Ant1\_Hop

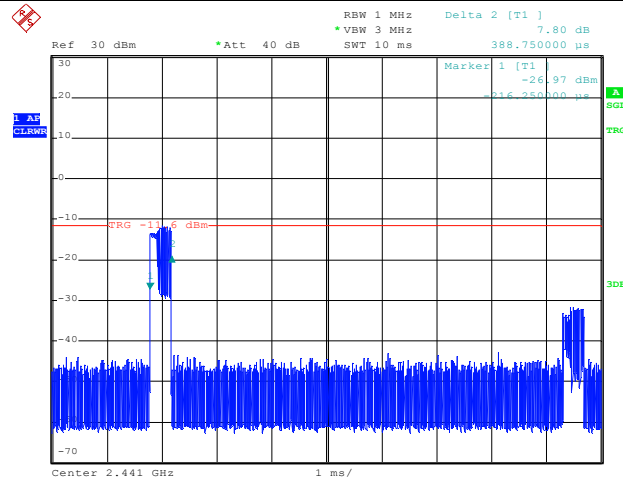


Date: 12.JUL.2019 11:51:13

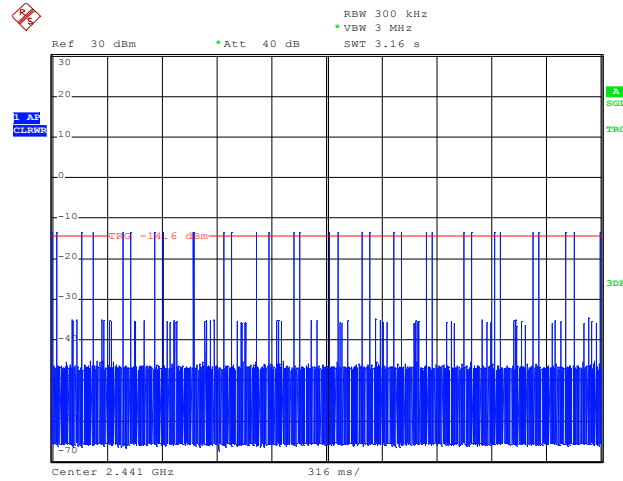


Date: 12.JUL.2019 11:51:19

### 3DH1\_Ant1\_Hop

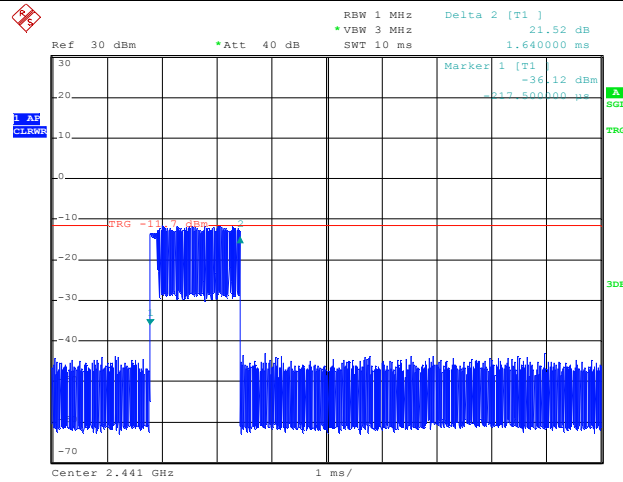


Date: 12.JUL.2019 11:46:59

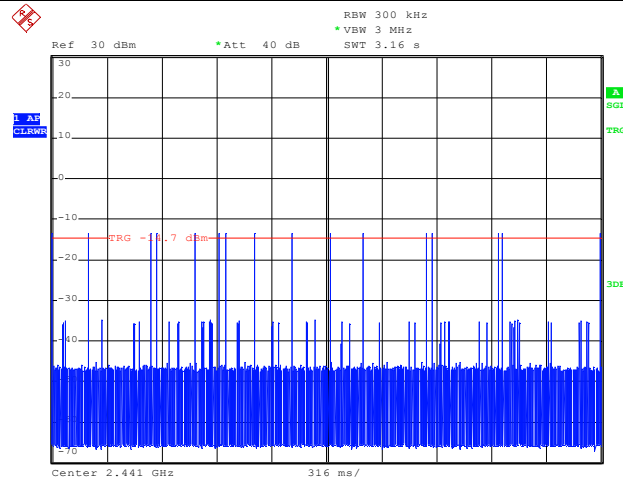


Date: 12.JUL.2019 11:47:04

### 3DH3\_Ant1\_Hop

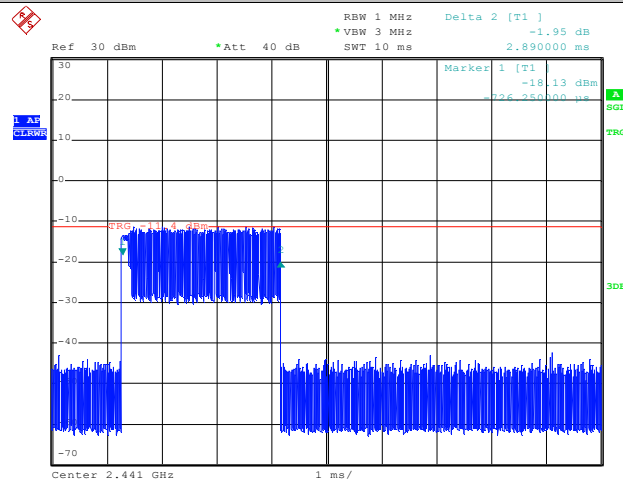


Date: 12.JUL.2019 11:47:50

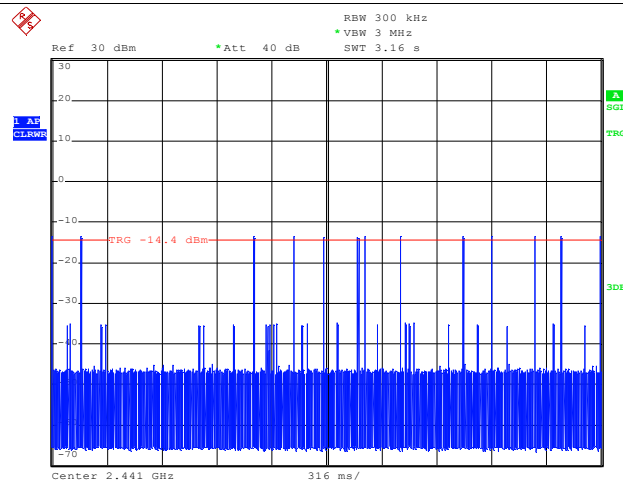


Date: 12.JUL.2019 11:47:56

### 3DH5\_Ant1\_Hop



Date: 12.JUL.2019 11:46:23



Date: 12.JUL.2019 11:46:29

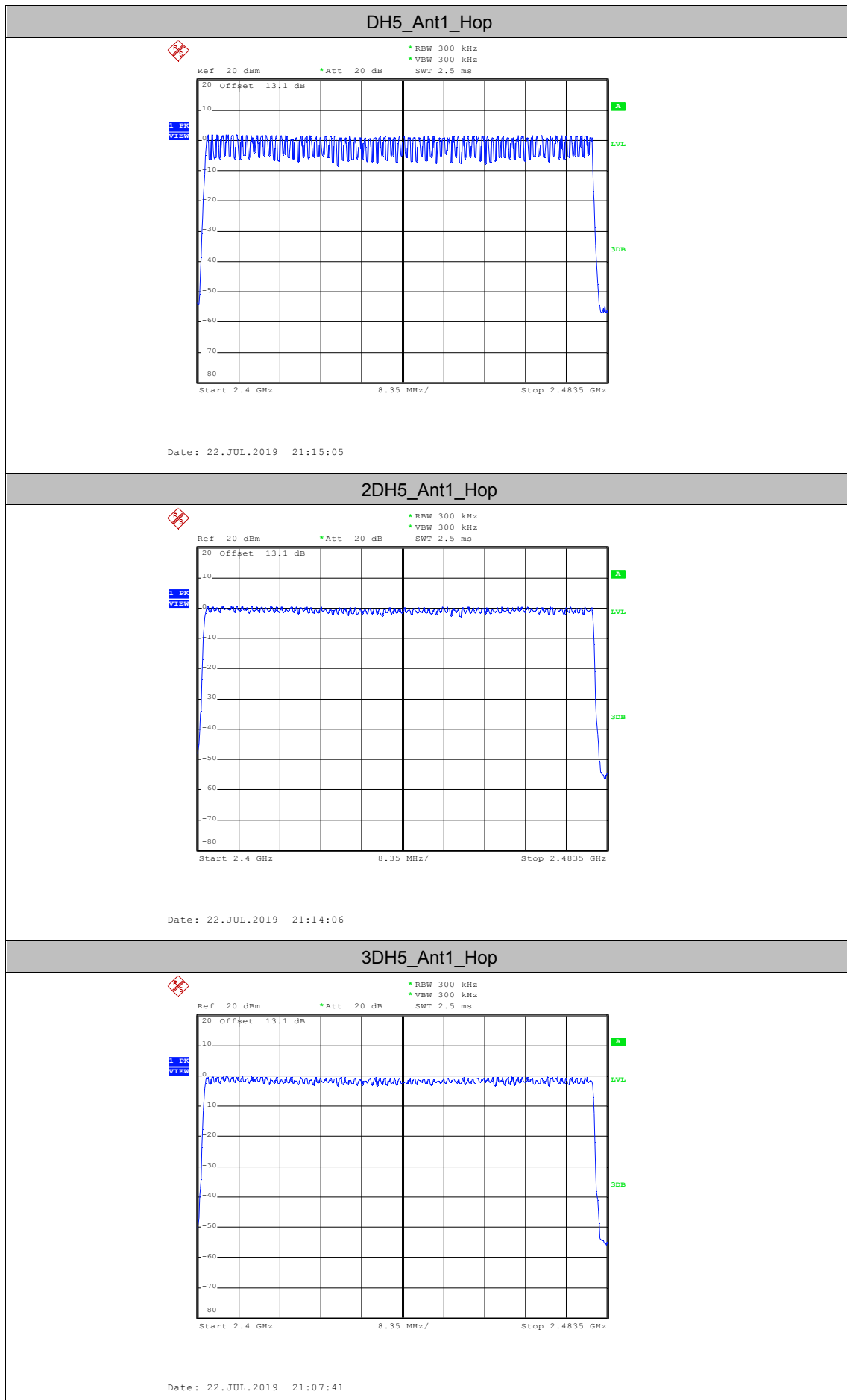
**AppendixF: Number of hopping channels**

**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



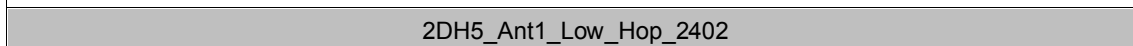
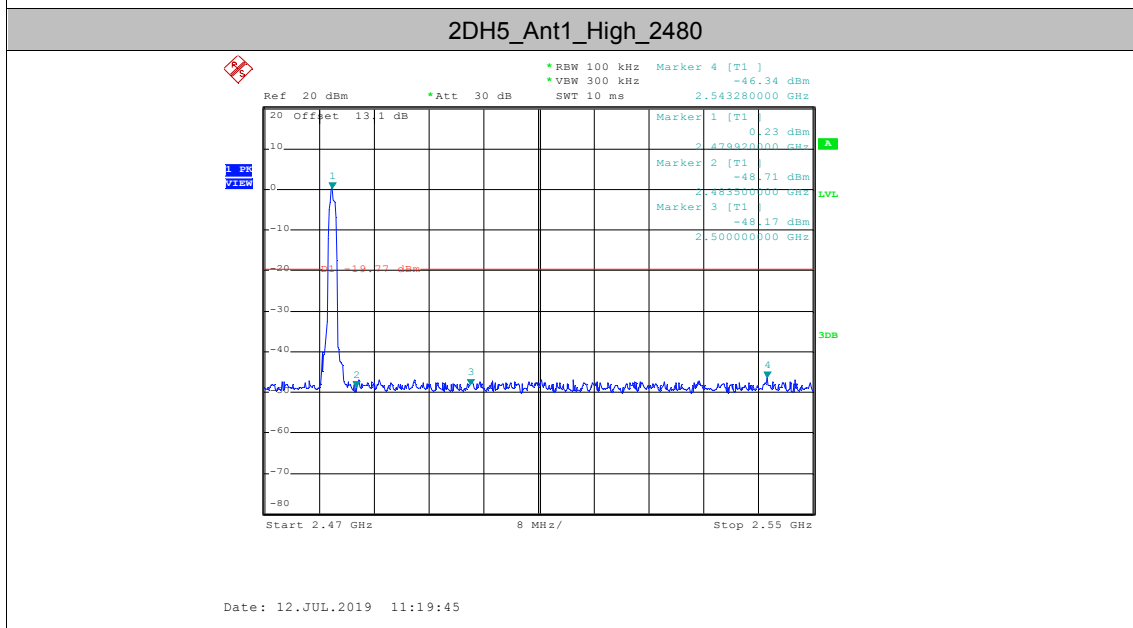
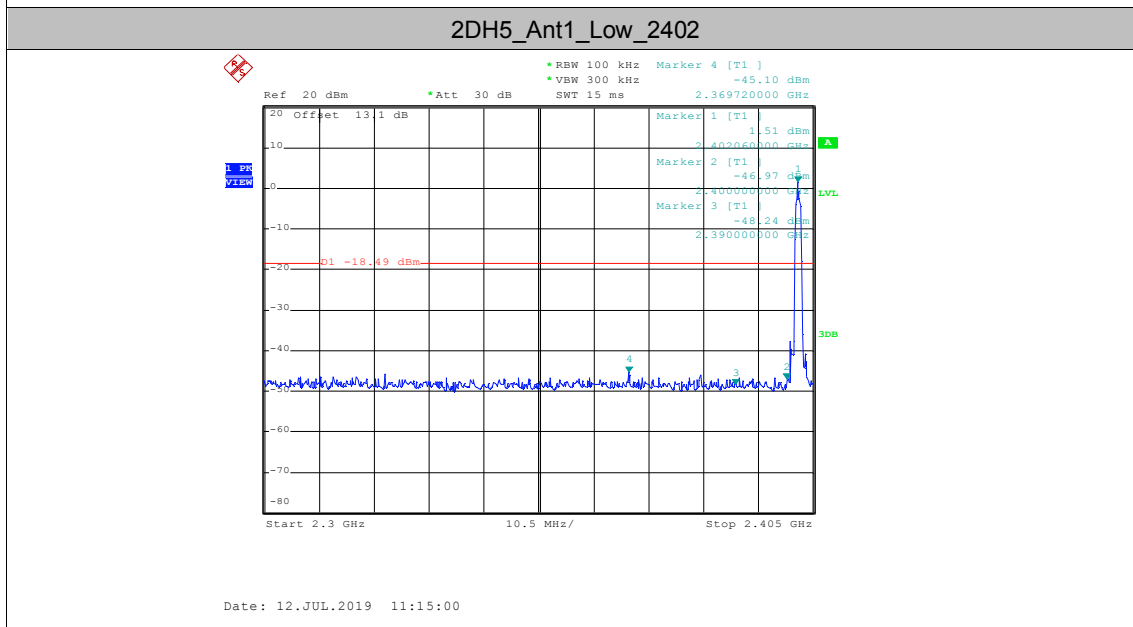
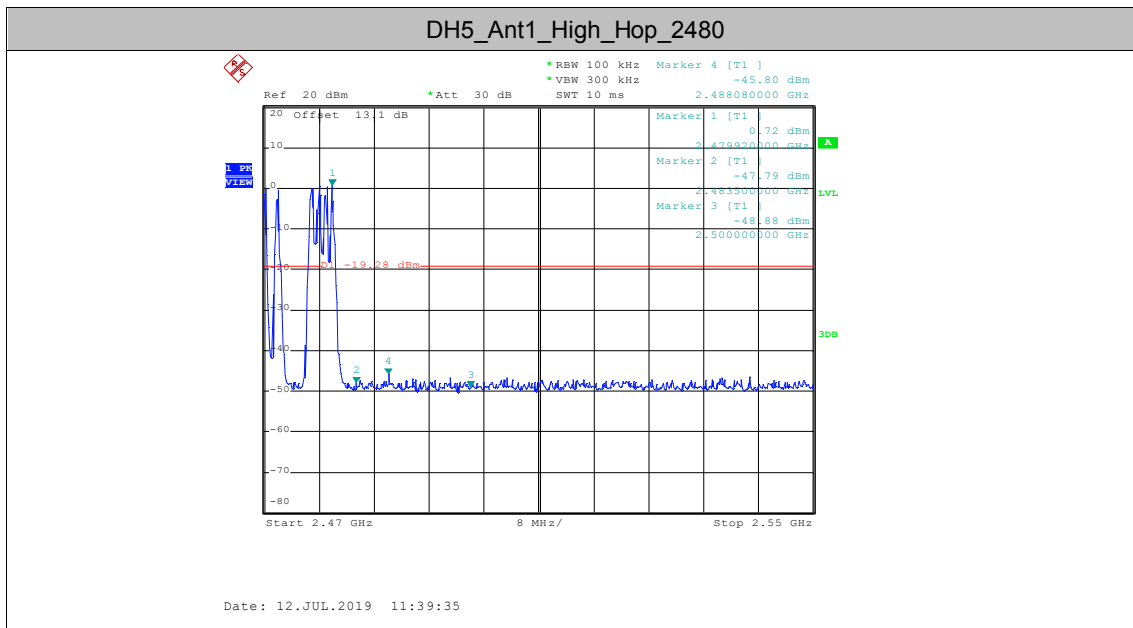
## AppendixG:Band edge measurements

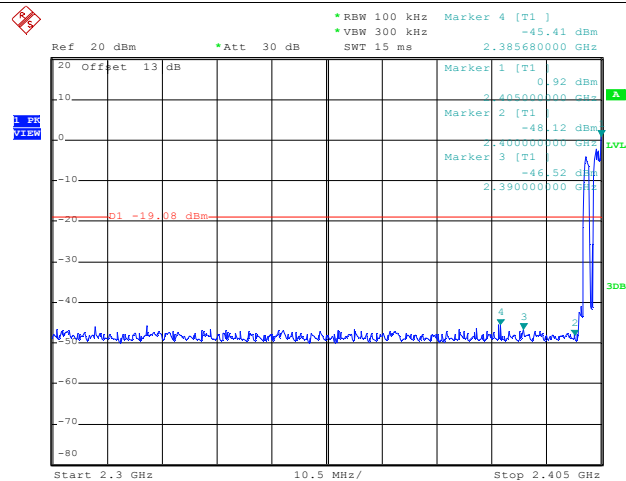
### Test Result

| TestMode | Antenna | ChName | Channel  | RefLevel<br>[dBm] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
|----------|---------|--------|----------|-------------------|-----------------|----------------|---------|
| DH5      | Ant1    | Low    | 2402     | 0.61              | -46.19          | <=-19.39       | PASS    |
|          |         | High   | 2480     | -0.78             | -45.97          | <=-20.78       | PASS    |
|          |         | Low    | Hop_2402 | -0.08             | -45.59          | -20.08         | PASS    |
|          |         | High   | Hop_2480 | 0.72              | -45.8           | -19.28         | PASS    |
| 2DH5     | Ant1    | Low    | 2402     | 1.51              | -45.1           | <=-18.49       | PASS    |
|          |         | High   | 2480     | 0.23              | -46.34          | <=-19.77       | PASS    |
|          |         | Low    | Hop_2402 | 0.92              | -45.41          | -19.08         | PASS    |
|          |         | High   | Hop_2480 | 0.27              | -46.52          | -19.73         | PASS    |
| 3DH5     | Ant1    | Low    | 2402     | 0.49              | -45.32          | <=-19.51       | PASS    |
|          |         | High   | 2480     | -2.51             | -45.16          | <=-22.51       | PASS    |
|          |         | Low    | Hop_2402 | 0.07              | -45.94          | -19.93         | PASS    |
|          |         | High   | Hop_2480 | -3.48             | -46.18          | -23.48         | PASS    |

## Test Graphs

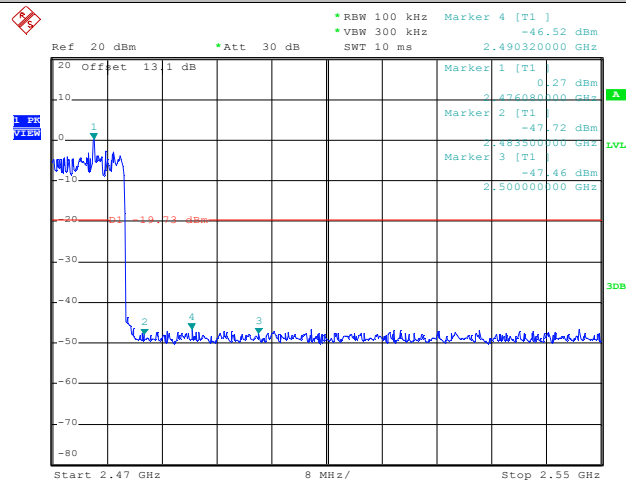






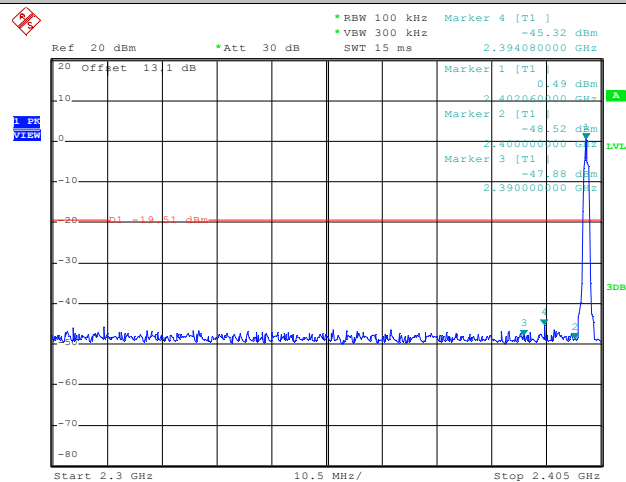
Date: 12.JUL.2019 11:40:36

### 2DH5\_Ant1\_High\_Hop\_2480



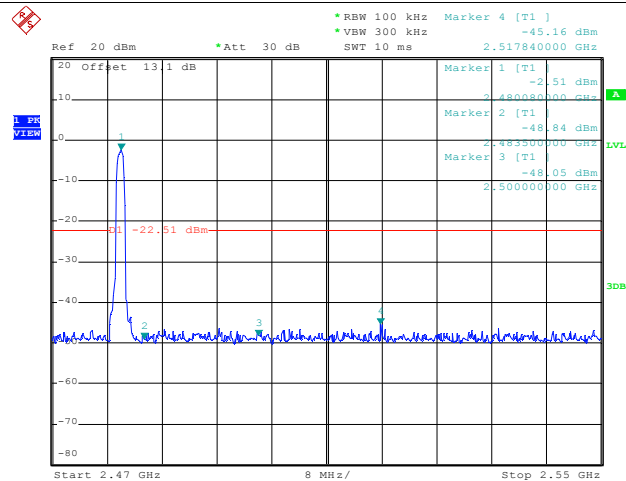
Date: 12.JUL.2019 11:44:02

### 3DH5\_Ant1\_Low\_2402



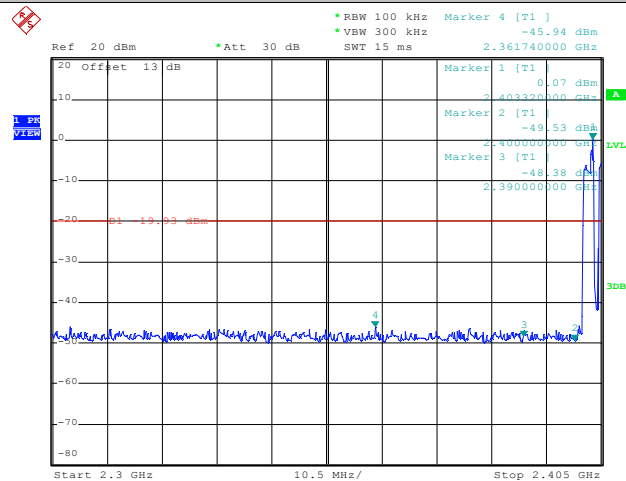
Date: 12.JUL.2019 11:23:38

### 3DH5\_Ant1\_High\_2480



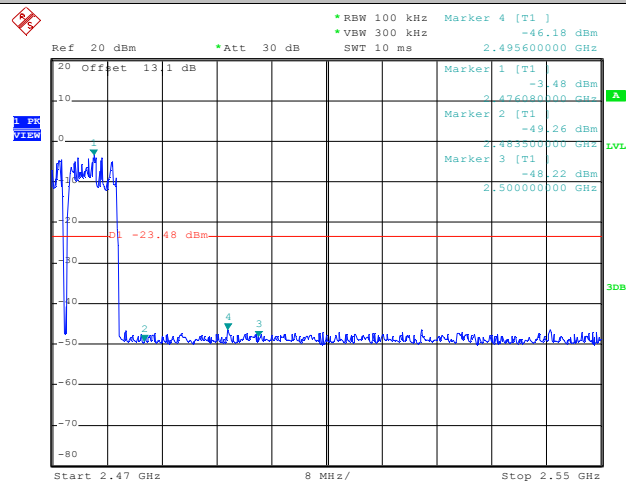
Date: 12.JUL.2019 11:27:59

### 3DH5\_Ant1\_Low\_Hop\_2402



Date: 12.JUL.2019 11:44:43

### 3DH5\_Ant1\_High\_Hop\_2480



Date: 12.JUL.2019 11:48:29

## AppendixH:Conducted SpuriousEmission

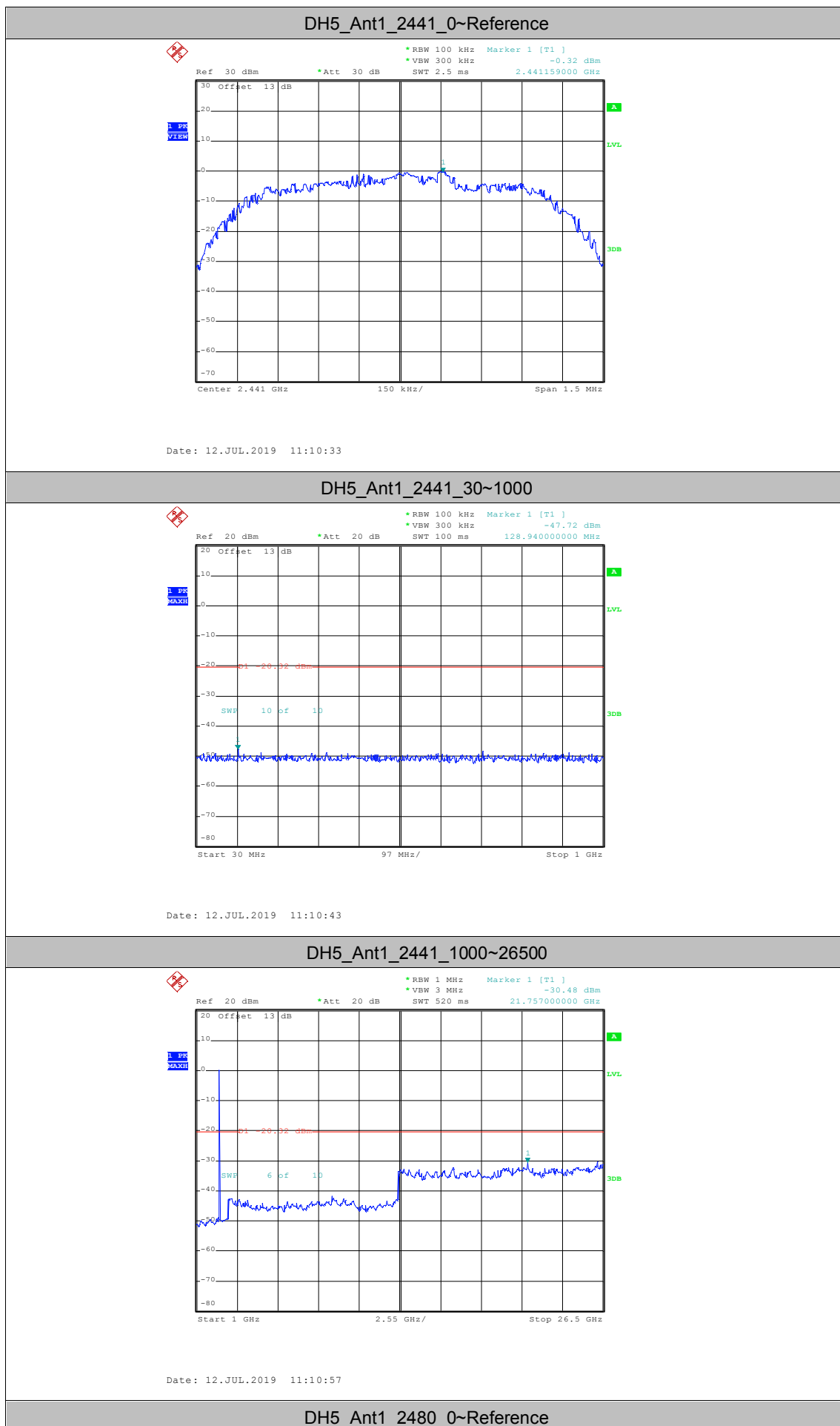
### Test Result

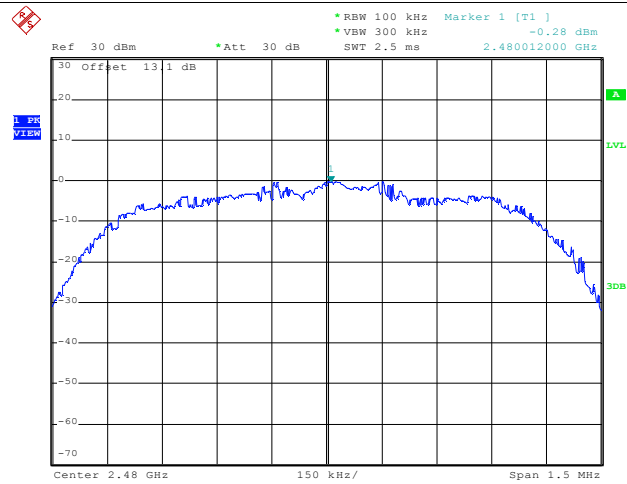
| TestMode | Antenna | Channel | FreqRange<br>[MHz] | RefLevel<br>[dBm] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
|----------|---------|---------|--------------------|-------------------|-----------------|----------------|---------|
| DH5      | Ant1    | 2402    | Reference          | 0.48              | 0.48            | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -47.93          | <=-19.52       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -30.88          | <=-19.52       | PASS    |
|          |         | 2441    | Reference          | -0.32             | -0.32           | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -47.72          | <=-20.32       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -30.48          | <=-20.32       | PASS    |
|          |         | 2480    | Reference          | -0.28             | -0.28           | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -48.25          | <=-20.28       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -30.97          | <=-20.28       | PASS    |
| 2DH5     | Ant1    | 2402    | Reference          | 1.55              | 1.55            | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -48.2           | <=-18.45       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -30.06          | <=-18.45       | PASS    |
|          |         | 2441    | Reference          | 0.37              | 0.37            | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -48.26          | <=-19.63       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -31.36          | <=-19.63       | PASS    |
|          |         | 2480    | Reference          | 0.60              | 0.60            | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -48.35          | <=-19.4        | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -30.75          | <=-19.4        | PASS    |
| 3DH5     | Ant1    | 2402    | Reference          | 0.51              | 0.51            | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -47.95          | <=-19.49       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -30.95          | <=-19.49       | PASS    |
|          |         | 2441    | Reference          | -0.39             | -0.39           | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -47.35          | <=-20.39       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -31.51          | <=-20.39       | PASS    |
|          |         | 2480    | Reference          | -0.35             | -0.35           | ---            | PASS    |
|          |         |         | 30~1000            | 30~1000           | -48.21          | <=-20.35       | PASS    |
|          |         |         | 1000~26500         | 1000~26500        | -31.27          | <=-20.35       | PASS    |

## Test Graphs



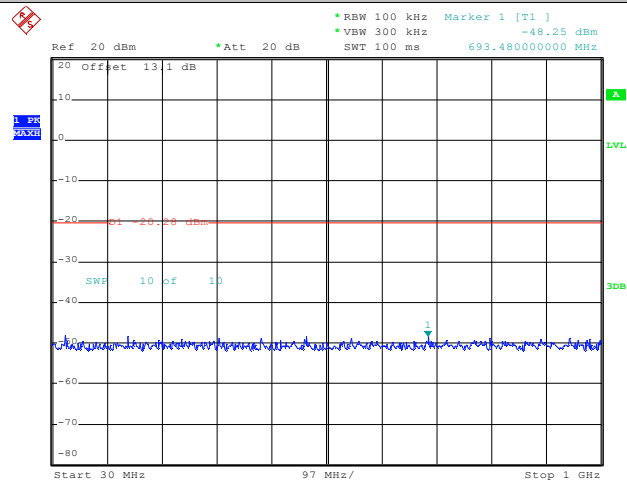






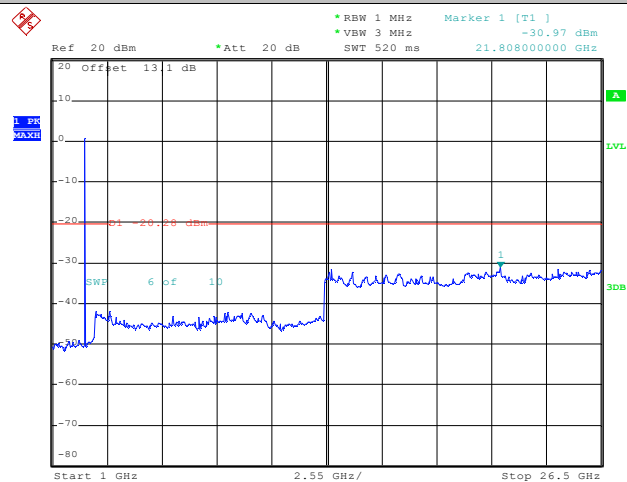
Date: 12.JUL.2019 11:12:40

### DH5\_Ant1\_2480\_30~1000



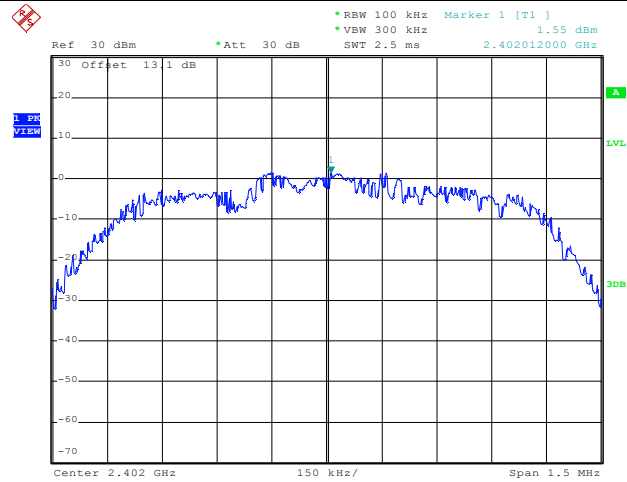
Date: 12.JUL.2019 11:12:50

### DH5\_Ant1\_2480\_1000~26500



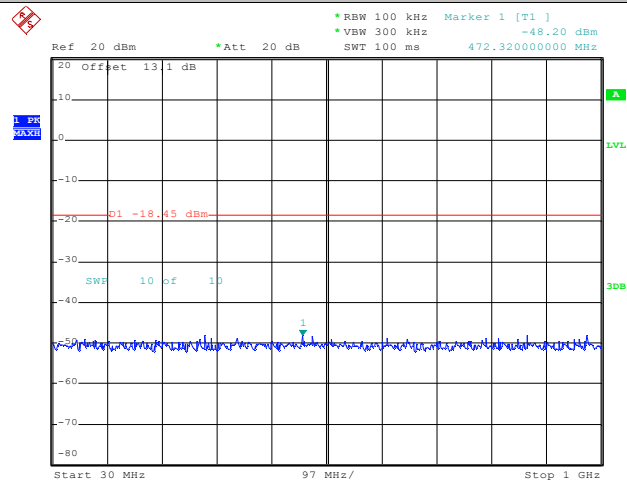
Date: 12.JUL.2019 11:13:04

### 2DH5\_Ant1\_2402\_0~Reference



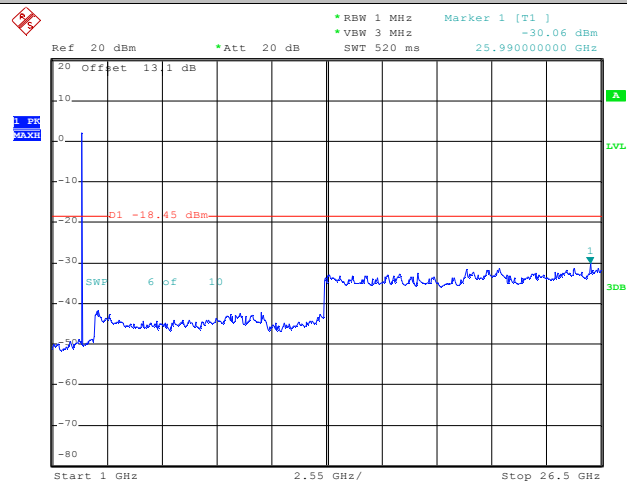
Date: 12.JUL.2019 11:15:08

### 2DH5\_Ant1\_2402\_30~1000



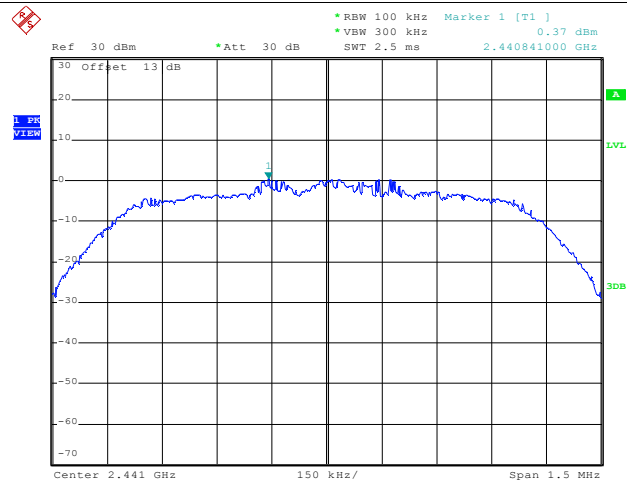
Date: 12.JUL.2019 11:15:18

### 2DH5\_Ant1\_2402\_1000~26500



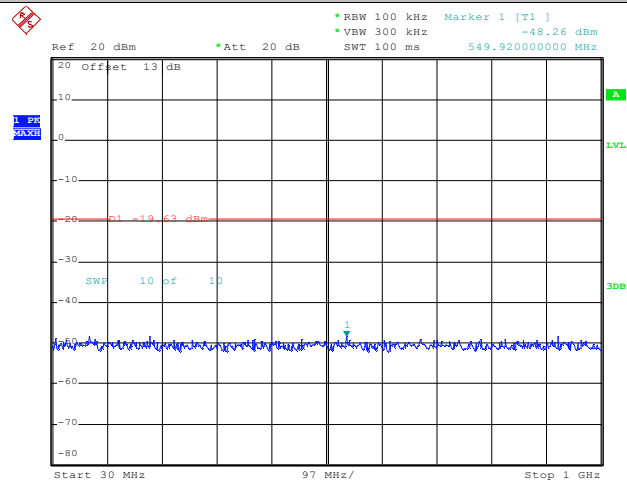
Date: 12.JUL.2019 11:15:32

### 2DH5\_Ant1\_2441\_0~Reference



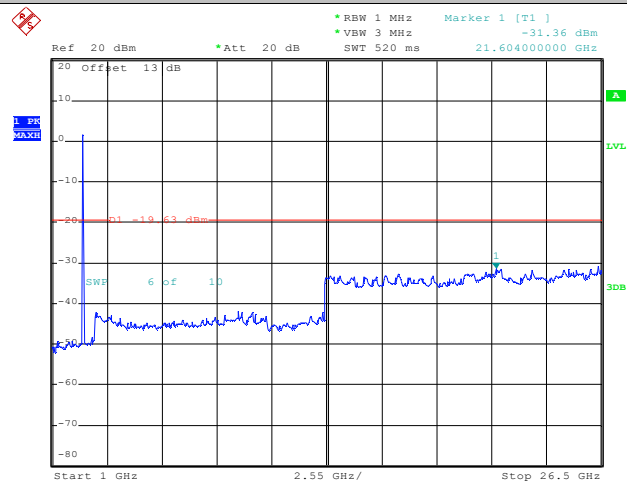
Date: 12.JUL.2019 11:16:59

### 2DH5\_Ant1\_2441\_30~1000



Date: 12.JUL.2019 11:17:09

### 2DH5\_Ant1\_2441\_1000~26500



Date: 12.JUL.2019 11:17:23

### 2DH5\_Ant1\_2480\_0~Reference



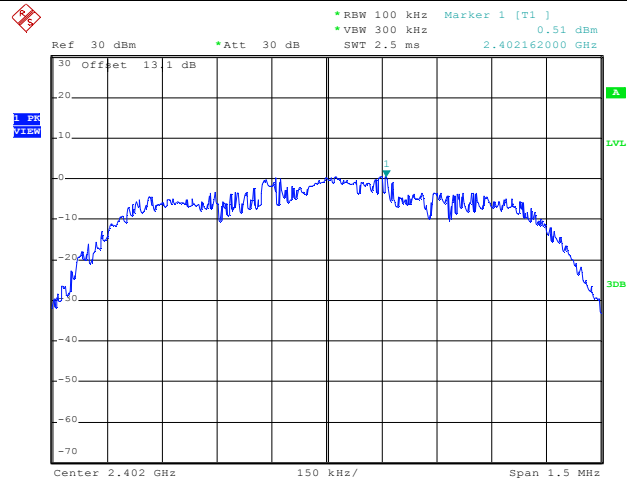
2DH5\_Ant1\_2480\_30~1000



## 2DH5\_Ant1\_2480\_1000~26500

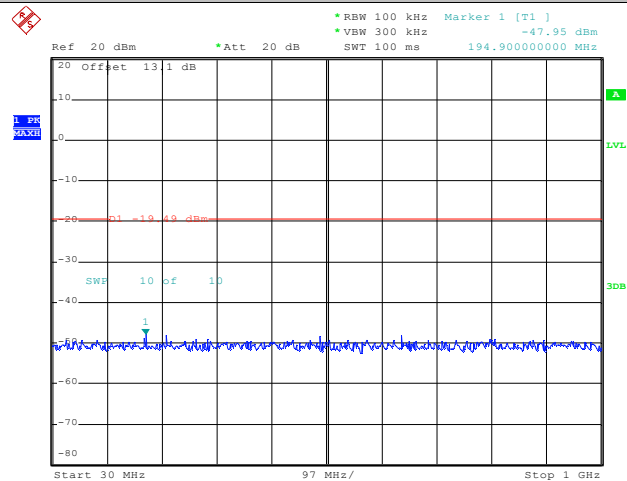


## 3DH5\_Ant1\_2402\_0~Reference



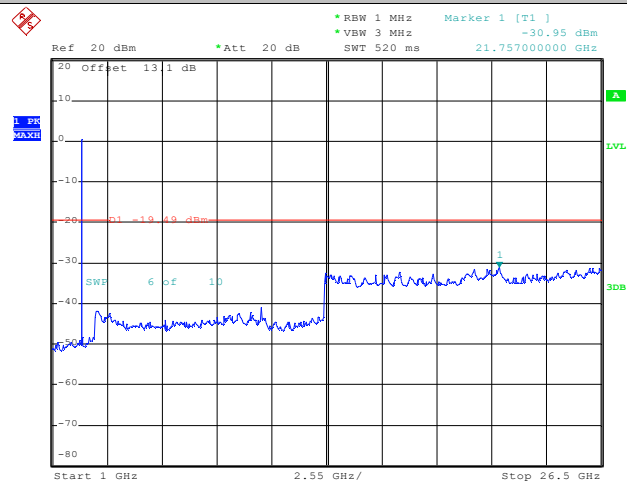
Date: 12.JUL.2019 11:23:46

### 3DH5\_Ant1\_2402\_30~1000



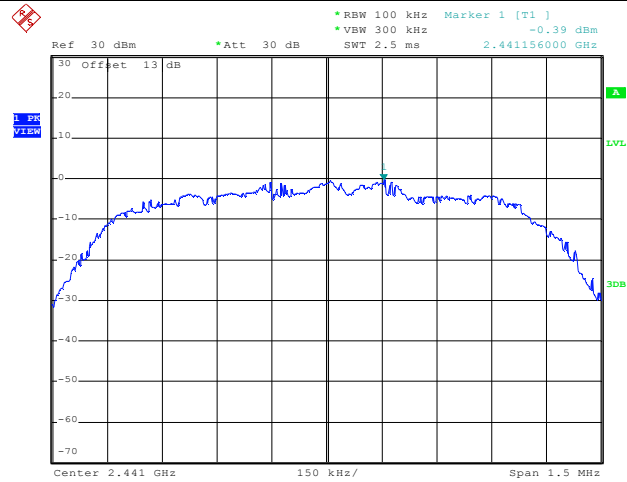
Date: 12.JUL.2019 11:23:56

### 3DH5\_Ant1\_2402\_1000~26500



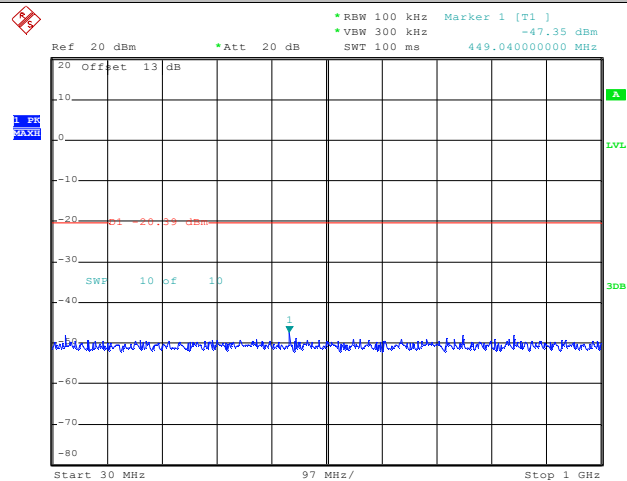
Date: 12.JUL.2019 11:24:10

### 3DH5\_Ant1\_2441\_0~Reference



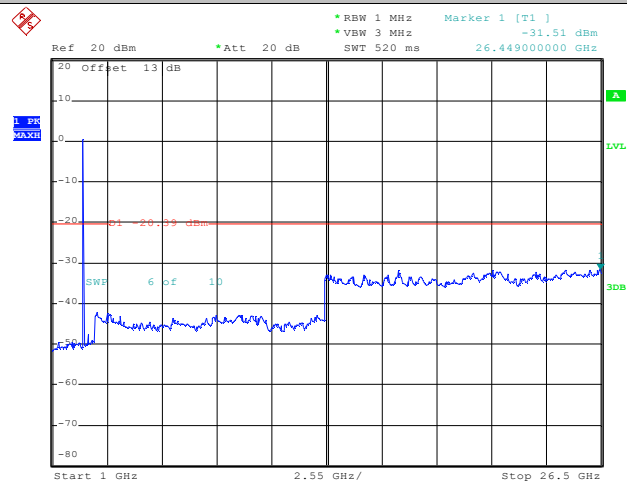
Date: 12.JUL.2019 11:26:07

### 3DH5\_Ant1\_2441\_30~1000



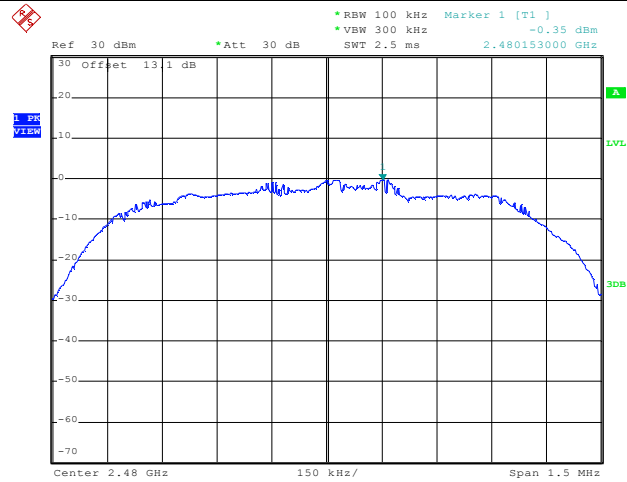
Date: 12.JUL.2019 11:26:17

### 3DH5\_Ant1\_2441\_1000~26500



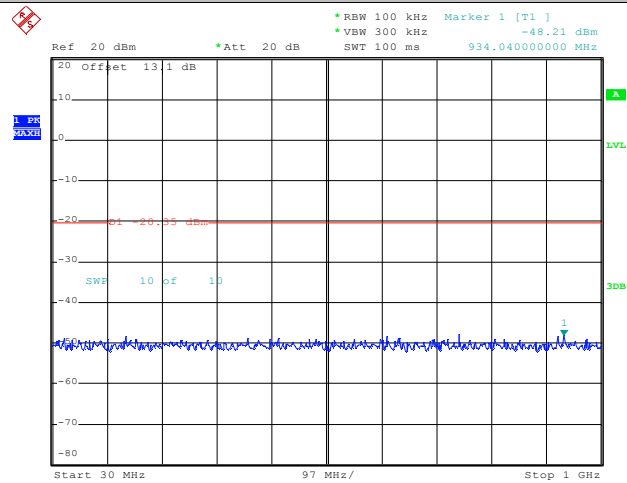
Date: 12.JUL.2019 11:26:31

### 3DH5\_Ant1\_2480\_0~Reference



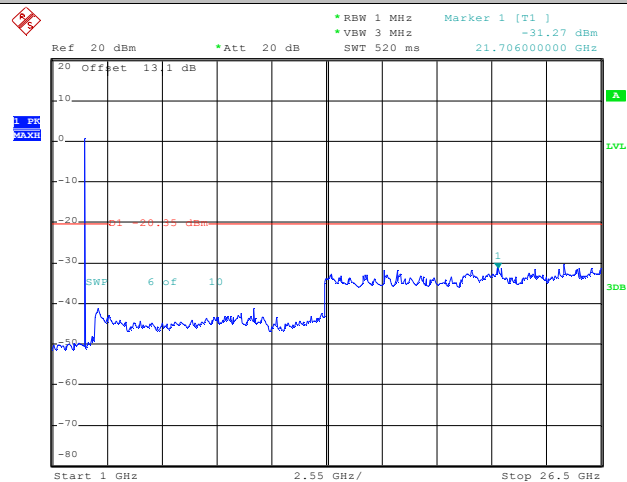
Date: 12.JUL.2019 11:28:07

### 3DH5\_Ant1\_2480\_30~1000



Date: 12.JUL.2019 11:28:16

### 3DH5\_Ant1\_2480\_1000~26500



Date: 12.JUL.2019 11:28:31

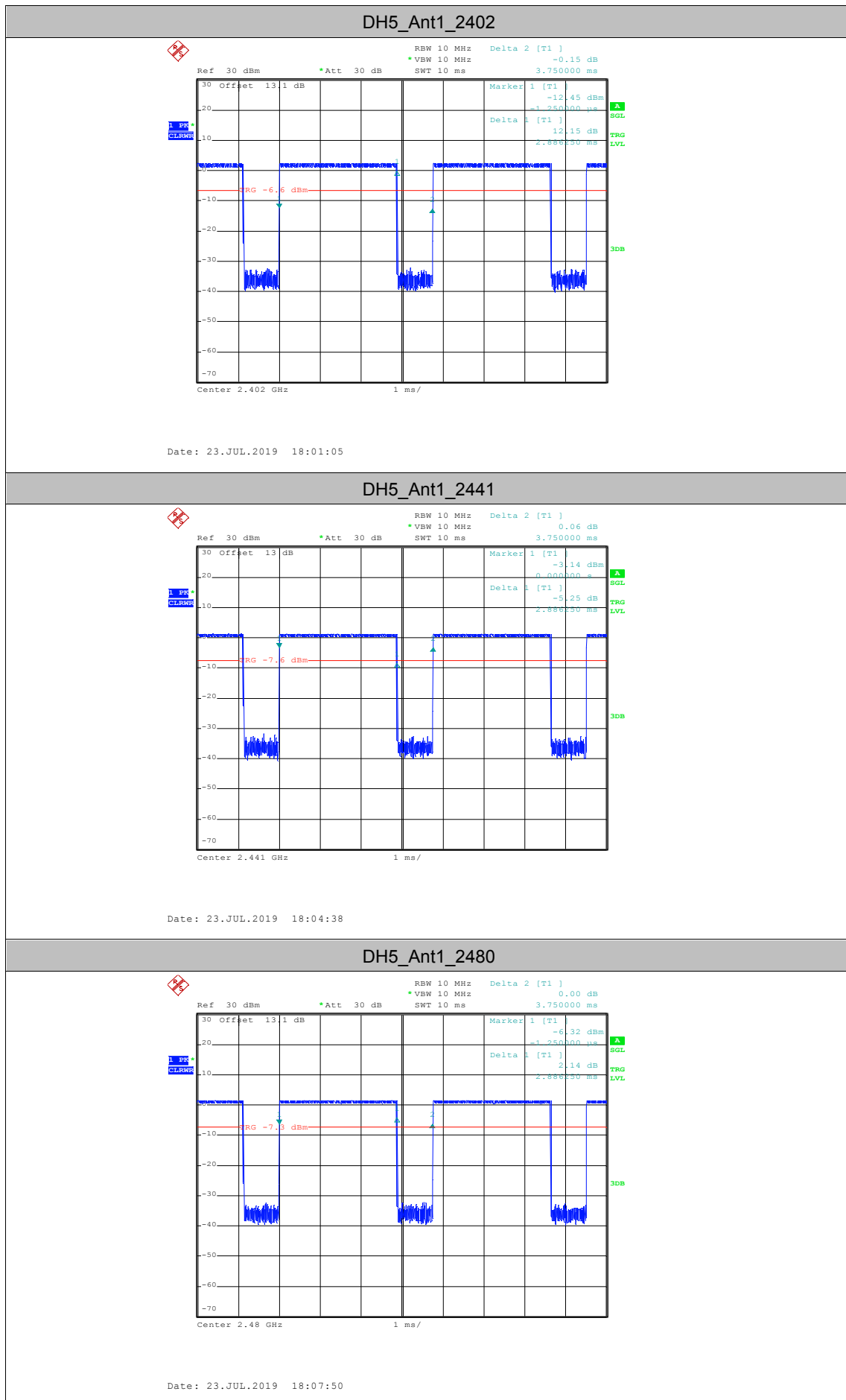


## AppendixI: DutyCycle

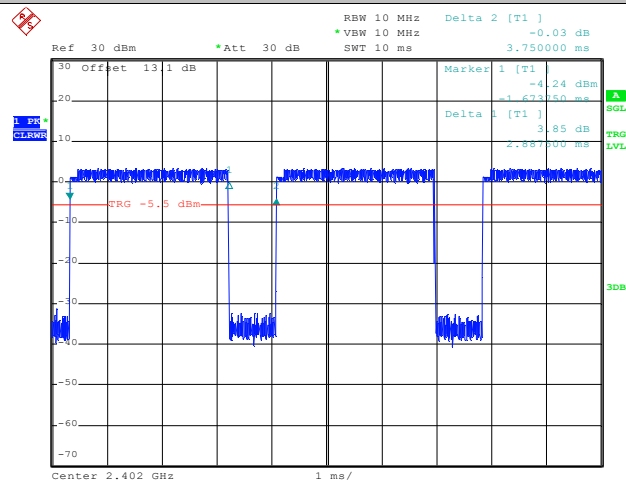
### Test Result

| TestMode | Antenna | Channel | TransmissionDuration<br>[ms] | Transmission<br>Period [ms] | Duty<br>Cycle [%] |
|----------|---------|---------|------------------------------|-----------------------------|-------------------|
| DH5      | Ant1    | 2402    | 2.89                         | 3.75                        | 76.97             |
|          |         | 2441    | 2.89                         | 3.75                        | 76.97             |
|          |         | 2480    | 2.89                         | 3.75                        | 76.97             |
| 2DH5     | Ant1    | 2402    | 2.89                         | 3.75                        | 77.00             |
|          |         | 2441    | 2.89                         | 3.75                        | 77.00             |
|          |         | 2480    | 2.89                         | 3.75                        | 77.00             |
| 3DH5     | Ant1    | 2402    | 2.89                         | 3.75                        | 77.07             |
|          |         | 2441    | 2.89                         | 3.75                        | 77.07             |
|          |         | 2480    | 2.89                         | 3.75                        | 77.07             |

## Test Graphs

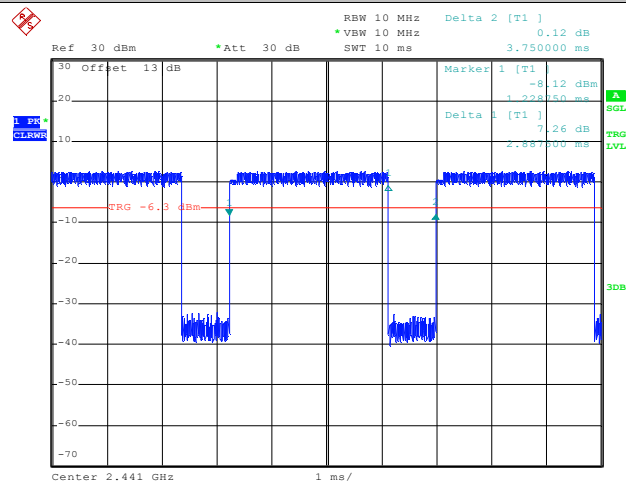


### 2DH5\_Ant1\_2402



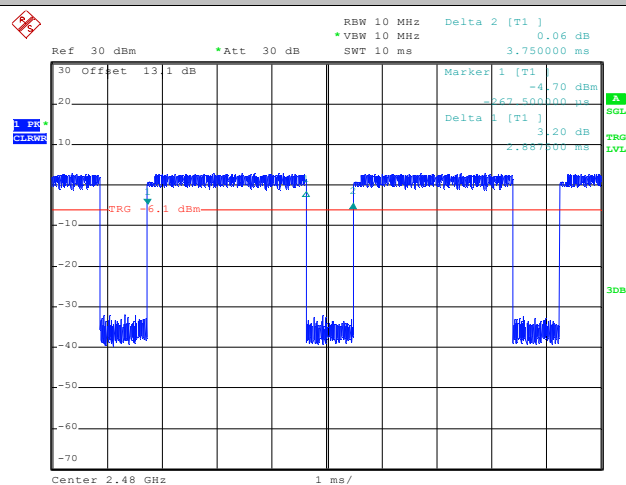
Date: 23.JUL.2019 18:01:48

### 2DH5\_Ant1\_2441



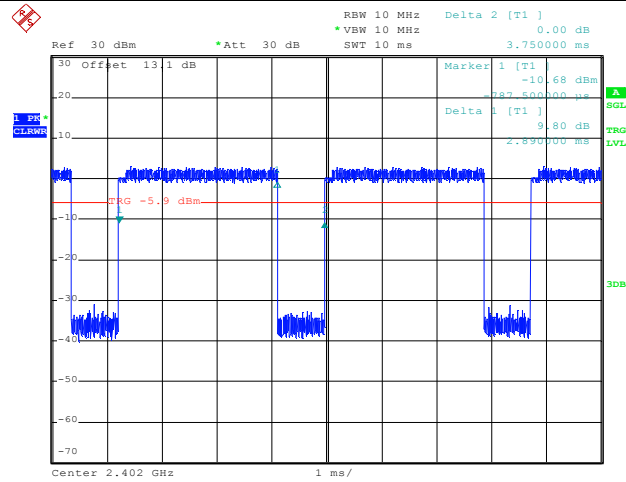
Date: 23.JUL.2019 18:05:15

### 2DH5\_Ant1\_2480



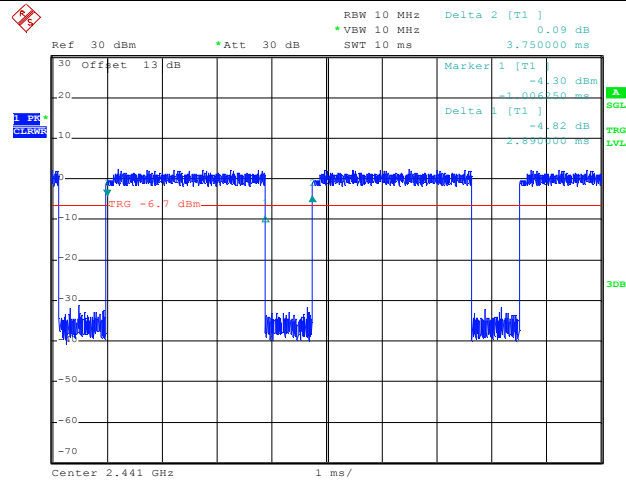
Date: 23.JUL.2019 18:08:39

### 3DH5\_Ant1\_2402



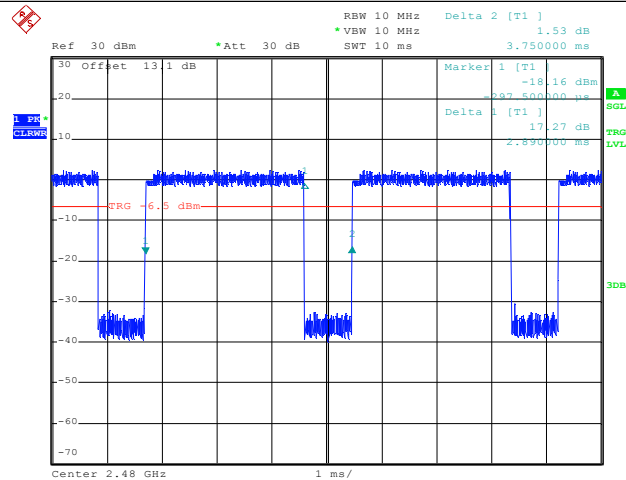
Date: 23.JUL.2019 18:02:37

### 3DH5\_Ant1\_2441



Date: 23.JUL.2019 18:05:57

### 3DH5\_Ant1\_2480



Date: 23.JUL.2019 18:09:25