



***Test Report No. 7312311921***

***Applicant: Talgil Computing and Control LTD***

***Equipment Under Test:***

***STM32WLE5***

***Model: RF-MODULE-G5P***

***FCC ID: 2AC2T-RF-MODULE-G5P***

***Issued by:***

***The Standards Institution of Israel***

***Industry Division***

***Electrical & Electronics Laboratory***

***EMC Branch***



**Test Report No.:** 7312311921**Page 2 of 34 Pages****Title:** Test on STM32WLE5**Model:** RF-MODULE-G5P**FCC ID:** 2AC2T-RF-MODULE-G5P**Applicant:**Talgil Computing and Control LTD  
Naaman Center Kiryat Motzkin, P.O.B 775, Israel**Address:**+972-4-8775949, +972-4-9506050  
talgil33@netvision.net.il**Sample for test selected by:**

The customer

**The date of test:**

May 2023

**Description of Equipment  
under Test (EUT):**

STM32WLE5

**Model:**

RF-MODULE-G5P

**Software version:**

RTU\_RF\_G5P\_ECO\_ONE\_V1.2

**Hardware version:**

TL0387

**Manufactured by:**

Talgil Computing and Control LTD

***Reference Documents:***❖ **CFR 47 FCC  
(2020)**Rules and Regulations: Part 15. Radio frequency devices,  
Subpart C: Intentional radiators.  
Section 15.247: Operation within the bands 902 - 928 MHz,  
2400 - 2483.5 MHz, 5725 - 5875 MHz***Test Results***

The EUT was found to be in compliance with the following standard:

CFR 47 Part 15 Subpart C  
sections: 15.203, 15.205, 15.207, 15.209 and 15.247.This Test Report contains 34 pages  
and may be used only in its entirety.This Test Report applies only to the specimen tested and may not  
be applied to other specimens of the same product.



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## 1. Summary of Test Results

| Transmitter characteristic                               | Ref. Section               |
|----------------------------------------------------------|----------------------------|
| 6dB and occupied bandwidth                               | 15.247 (a) (2)             |
| Maximum peak conducted output power                      | 15.247 (b) (3)             |
| Power spectral density                                   | 15.247 (e)                 |
| Radiated emission in restricted and non-restricted bands | 15.247 (d), 15.209, 15.205 |
| Band-edge compliance of RF conducted emission            | 15.247 (d)                 |
| AC power line conducted emission measurements            | N/A                        |
| Antenna requirement                                      | 15. 203                    |

Name: Eng. Yuri Rozenberg  
Position: Head of Branch

Electrical & Electronics  
Laboratory

8 January 2024

Tested by: Alexander Konkov  
Position: Testing Technician

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## 2. EUT Description

**Note:** All information in this section was provided by the customer.

### 2.1. General description:

The "RF-MODULE-G5P" is based on STMicroelectronics SoC (System on Chip) wireless STM32WLE5 microcontroller patented LoRa (Long Range) digital modulation technique. The "RF-MODULE-G5P" is used as plug-in RF module in remote terminal unit (RTU) for irrigation and fertilizer application in agriculture. RF module is used one from seventeen RF channels in USA in the frequency range 902-928MHz.

**The test data contained in this report pertains only to the emissions due to the EUT's RF transmitter.**

In the beginning, the STM32WLE5 controller makes the initialization of the RF transceiver by internal serial SPI channel. On this stage, the STM32WLE5 controller defines all main RF parameters: frequency channel, modulation, baud rate, output power etc. After initialization the RF transceiver goes to sleep mode with very low power consumption (few hundreds nanoamperes).

If necessary, the STM32WLE5 controller changes "sleep" to receive mode. In this case, it sends command "receive" to transceiver by internal SPI channel. If the RF part of STM32WLE5 receives relevant RF message, then it generates interrupt to STM32WLE5 controller and the controller reads binary data message from receiver data buffer by internal SPI channel during one millisecond.

If necessary, the controller changes "sleep" to transmit mode. In this case, it fills transmitter data buffer and sends command "transmit" to transceiver STM32WLE5 by SPI internal channel.

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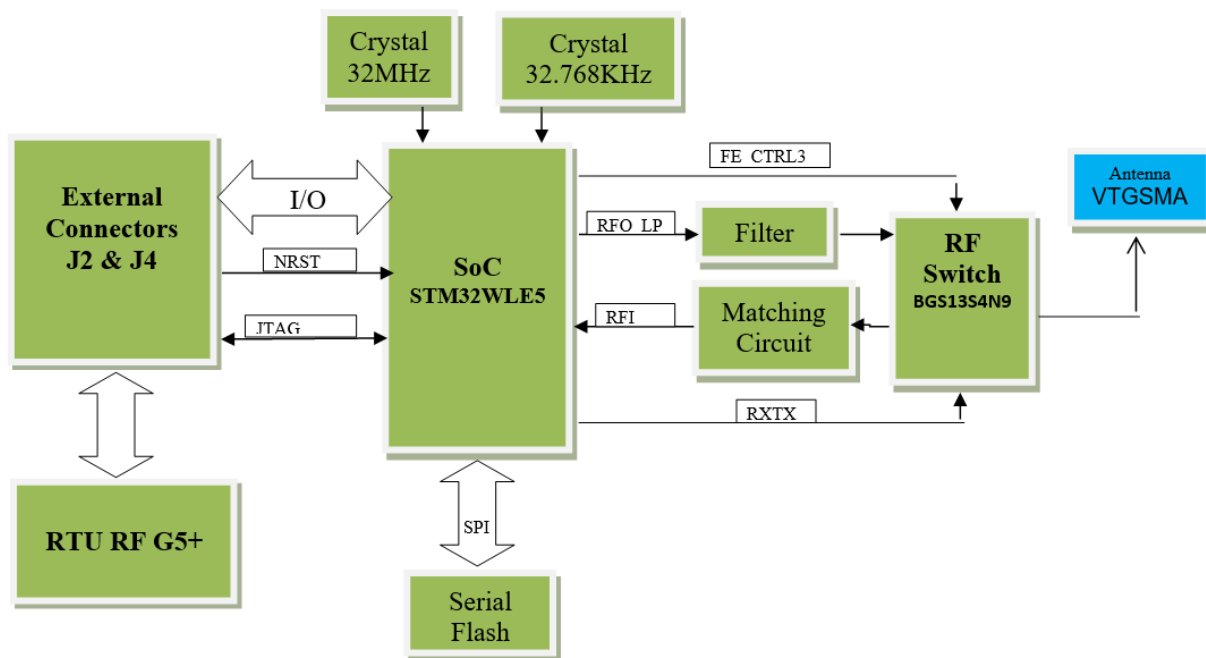


Figure 1. Block diagram



Figure 2. STM32WLE5

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## 2.2. Transmitter description:

|                                                                                                          |
|----------------------------------------------------------------------------------------------------------|
| <b>Type of equipment</b>                                                                                 |
| Combined equipment (Equipment where the radio part is fully integrated within another type of equipment) |

|                     |                   |
|---------------------|-------------------|
| <b>Technologies</b> | LoRa (Long Range) |
|---------------------|-------------------|

|                                   |                                                               |                        |
|-----------------------------------|---------------------------------------------------------------|------------------------|
| <b>Assigned frequency range</b>   | from 902 MHz to 928 MHz                                       |                        |
| <b>Operating frequency range</b>  | from 903 MHz to 927 MHz (RF transceiver)                      |                        |
| <b>RF channel spacing</b>         | 0.6 MHz (RF transceiver)                                      |                        |
| <b>Maximum rated output power</b> | Effective radiated power (for equipment with no RF connector) | 12.88 dBm = 19.4089 mW |
| <b>Declare temperature range:</b> | -10°C --- 55°C                                                |                        |

|                                                                      |
|----------------------------------------------------------------------|
| <b>Antenna information</b>                                           |
| 860-930MHz Stubby Rubber Antenna                                     |
| <b>Manufacturer:</b> Shanghai Saintenna Wireless Technology Co. Ltd. |
| <b>Antenna gain:</b> 2.28 dBi                                        |

|                                   |      |
|-----------------------------------|------|
| Transmitter 99% power bandwidth   |      |
| Type of modulation                | LoRa |
| Modulating test signal (baseband) | LoRa |

|                                  |
|----------------------------------|
| <b>Transmitter power source</b>  |
| Nominal rated voltage      6 VDC |
| Type of battery      Alkaline    |

## 2.3. Test setup:

The EUT was tested per the guidance ANSI C63.10: 2020.

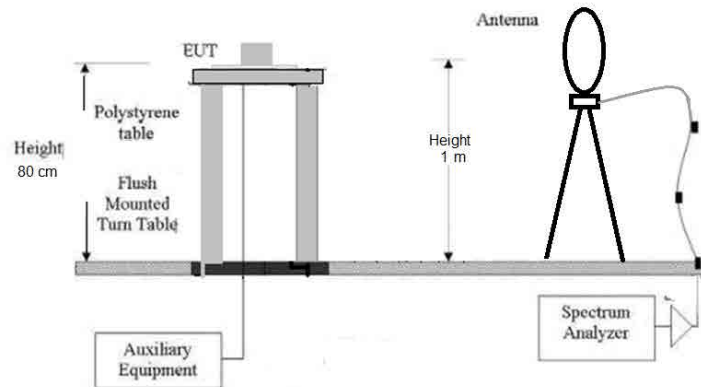
The test setup is shown in Figures 3 - 5. EUT gets 6 VDC power from battery.

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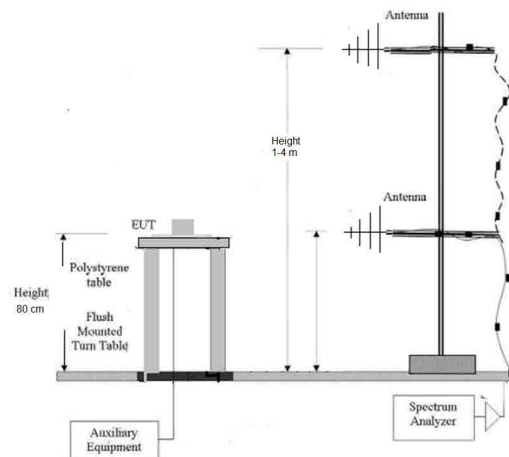
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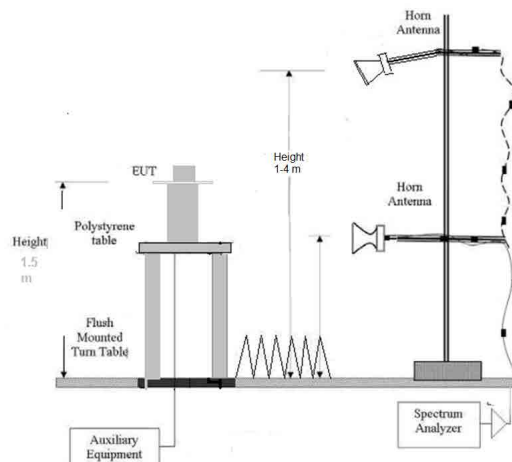
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**Figure 3. RE test setup for 9kHz – 30 MHz.**



**Figure 4. RE test setup lower 1 GHz.**



**Figure 5. RE test setup above 1 GHz.**

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## 2.4. System test configuration:

**Table 1. RF channels / frequencies**

| Channel | Channel central frequency [MHz] |
|---------|---------------------------------|
| 1       | 903.0                           |
| 2       | 904.5                           |
| 3       | 906.0                           |
| 4       | 907.5                           |
| 5       | 909.0                           |
| 6       | 910.5                           |
| 7       | 912.0                           |
| 8       | 913.5                           |
| 9       | 915.0                           |
| 10      | 916.5                           |
| 11      | 918.0                           |
| 12      | 919.5                           |
| 13      | 921.0                           |
| 14      | 922.5                           |
| 15      | 924.0                           |
| 16      | 925.5                           |
| 17      | 927.0                           |

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### 3. Test specification, methods and procedures

- ❖ CFR 47 FCC Rules and Regulations: Part 15. Radio frequency devices, Subpart C: Intentional radiators (2020)
- ❖ ANSI C63.4:2014 American National Standard for Method of Measurement of Radio Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range 9 kHz to 40 GHz.
- ❖ ANSI C63.10: 2020 American National Standard for Testing of Unlicensed Wireless Devices

### 4. Testing Facility:

Laboratory Name: Standards Institution of Israel (SII)

Test site location: 42 Haim Levanon st., Tel-Aviv Israel

 Laboratory Accreditation: ANAB: AT-1359

### 5. Measurement uncertainty

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error.

The laboratory calibrates its standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

| Test description                                                     | Calculated uncertainty $U_{LAB}$ |
|----------------------------------------------------------------------|----------------------------------|
| <b>Conducted measurements</b>                                        |                                  |
| Frequency error                                                      | 37.6 Hz                          |
| Spurious emission                                                    | $\pm 2.98$ dB                    |
| <b>Radiated measurements</b>                                         |                                  |
| Electric field strength in a SAR at 3 m distance<br>30 MHz – 1.0 GHz | $\pm 4.32$ dB                    |
| Electric field strength in a FAR at 3 m distance<br>1.0 GHz – 18 GHz | $\pm 4.47$                       |
| <b>Substitution measurements</b>                                     |                                  |
| In a FAR at 3 m distance<br>1.0 GHz – 18 GHz                         | $\pm 3.41$ dB                    |

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## 6. Transmitter characteristics - test results

### 6.1. 6dB and Occupied Bandwidth

#### Limits & methods:

|                     |                                                            |                   |                                    |
|---------------------|------------------------------------------------------------|-------------------|------------------------------------|
| FCC requirements    | 15.247(a)(2)                                               |                   |                                    |
| Test procedure      | ANSI 63.10 --- 11.8 DTS bandwidth<br>Conducted Measurement |                   |                                    |
| Operating mode      | Tx continuous, Hight Mid and Low                           |                   |                                    |
| Ambient Temperature | 23°C                                                       | Relative Humidity | 50%      Air Pressure      1009hPa |

#### Limit:

The minimum 6dB bandwidth shall be at least 500 kHz.

#### Test procedure

The measurements were performed in constant transmission mode of operation for carrier (channel) frequency at bottom, middle and at the top of 902 MHz to 928 MHz frequency band and maximum transmitting data rate.

#### Results:

**Table 2. 6dB Bandwidth & Occupied Bandwidth Results**

| Frequency<br>MHz | 6dB Bandwidth<br>kHz | Limit<br>kHz | Verdict | Ref. Plot |
|------------------|----------------------|--------------|---------|-----------|
| 903              | 619.4                | 500          | Pass    | 1         |
| 915              | 620.6                | 500          | Pass    | 2         |
| 925              | 619.2                | 500          | Pass    | 3         |

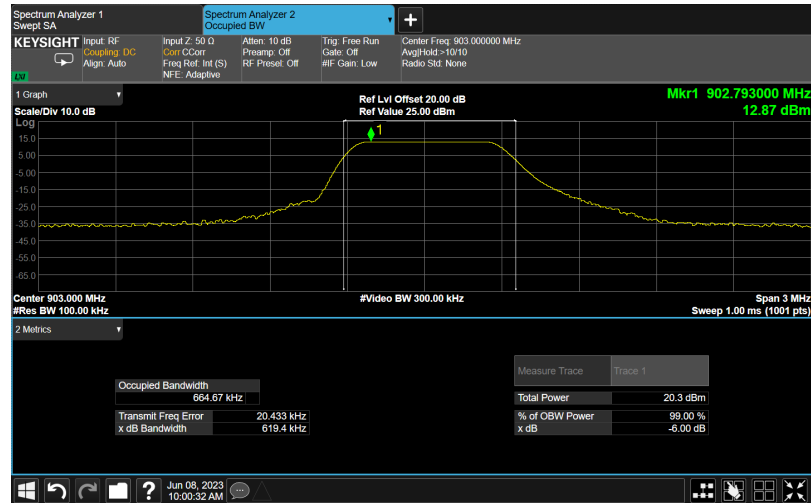


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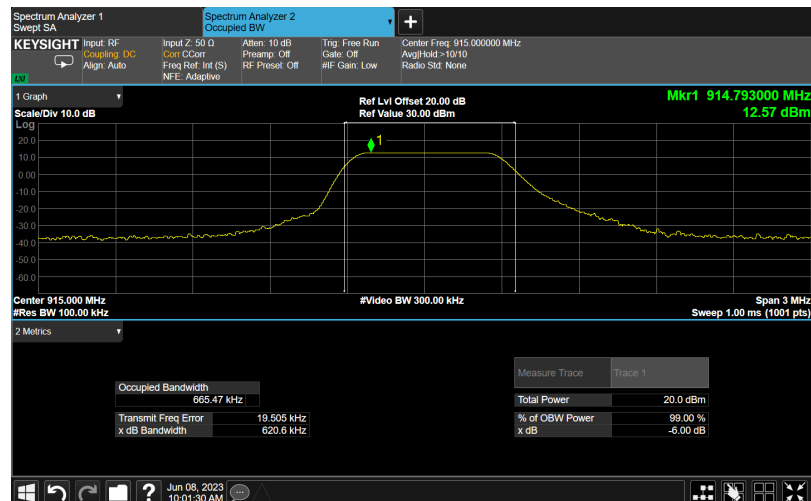
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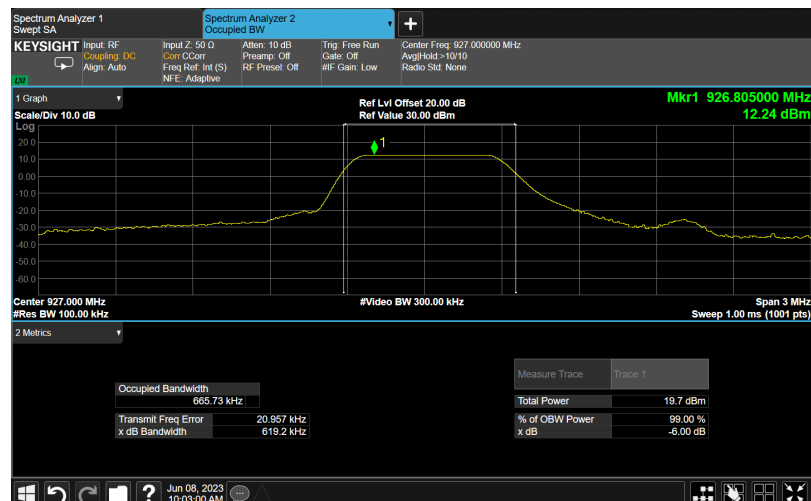
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Plot 1



Plot 2



Plot 3

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## 6.2. Maximum Peak Conducted Output Power

### Limits & methods:

|                          |                                                                       |              |         |
|--------------------------|-----------------------------------------------------------------------|--------------|---------|
| FCC requirements         | 15.247(b)(3)                                                          |              |         |
| Test procedure           | ANSI 63.10 11.9.1.1 RBW $\geq$ DTS bandwidth<br>Conducted Measurement |              |         |
| Operating mode           | Tx continuous, Hight Mid and Low                                      |              |         |
| Ambient Temperature 23°C | Relative Humidity 50%                                                 | Air Pressure | 1009hPa |

### Limit

The maximum peak conducted output power shall not exceed 1 watt.

### Test procedure

The measurements were performed in constant transmission mode of operation for carrier (channel) frequency at bottom, middle and at the top of 902 MHz to 928 MHz frequency band and maximum transmitting data rate.

### Results:

Table 3. Maximum Peak Conducted Output Power Results

| Freq. MHz | Mesure dBm | Calculated mWatt | Limit Watt | Verdict | Plot |
|-----------|------------|------------------|------------|---------|------|
| 903       | 12.88      | 19.32            | 1          | Pass    | 4    |
| 915       | 12.56      | 18.04            | 1          | Pass    | 5    |
| 927       | 12.26      | 16.83            | 1          | Pass    | 6    |

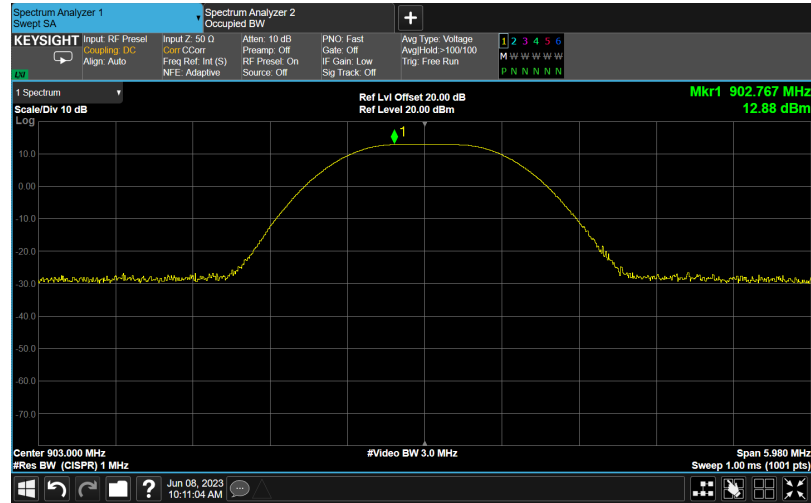


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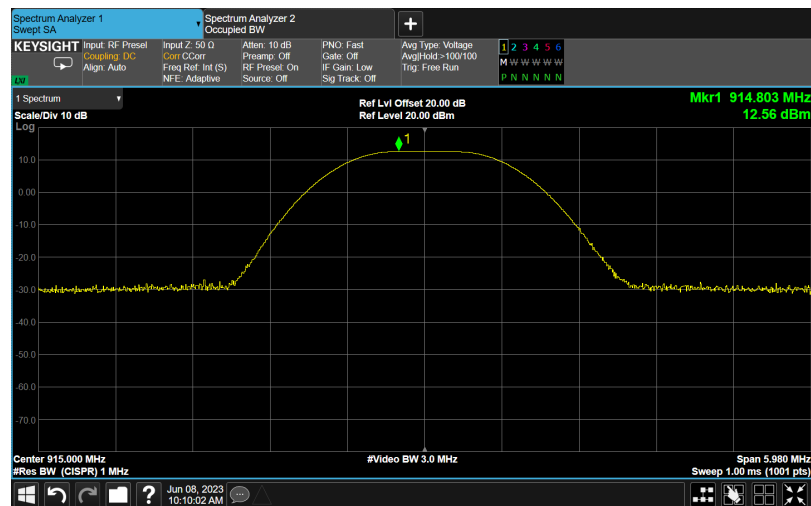
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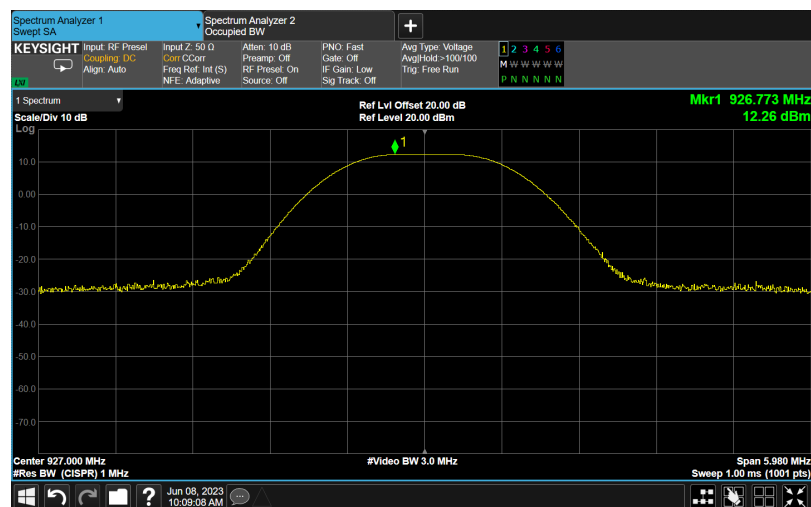
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Plot 4



Plot 5



Plot 6

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### 6.3. Power Spectral Density

#### Limits & methods:

|                          |                                                            |              |         |
|--------------------------|------------------------------------------------------------|--------------|---------|
| FCC requirements         | 15.247(e)                                                  |              |         |
| Test procedure           | ANSI 63.10 11.10.3 Method AVGPS-1<br>Conducted Measurement |              |         |
| Operating mode           | Tx continuous, High Mid and Low                            |              |         |
| Ambient Temperature 23°C | Relative Humidity 50%                                      | Air Pressure | 1009hPa |

#### Limit

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

#### Test procedure

The measurements were performed in constant transmission mode of operation for carrier (channel) frequency at bottom, middle and at the top of 902 MHz to 928 MHz frequency band and maximum transmitting data rate.

#### Results:

**Table 4. Power Spectral Density Test Results**

| Freq.<br>MHz | Measure<br>dBm/3kHz | Limit<br>dBm/3kHz | Verdict | Plot |
|--------------|---------------------|-------------------|---------|------|
| 903          | -6.06               | 8                 | Pass    | 7    |
| 915          | -6.56               | 8                 | Pass    | 8    |
| 927          | -6.78               | 8                 | Pass    | 9    |

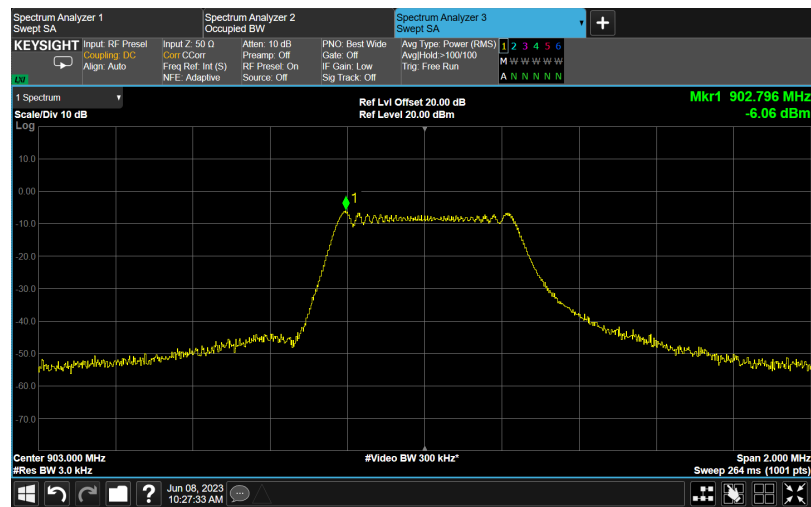


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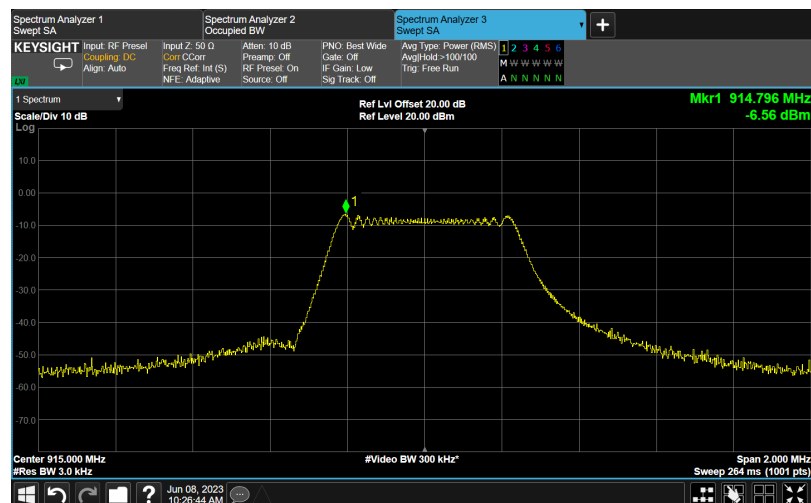
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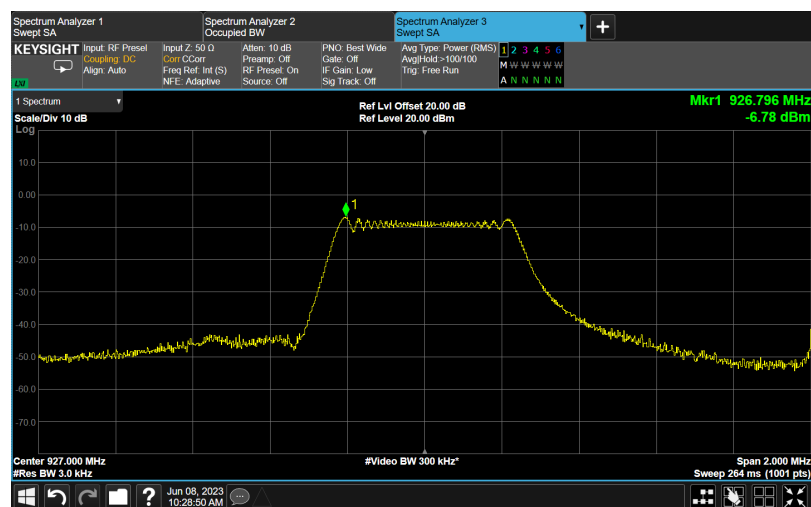
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Plot 7



Plot 8



Plot 9

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#### 6.4. Radiated Emissions in Restricted and non-Restricted bands

##### Limits & methods:

|                     |                                                                    |                   |                                    |
|---------------------|--------------------------------------------------------------------|-------------------|------------------------------------|
| FCC requirements    | 15.247(d), 15.209, 15.205                                          |                   |                                    |
| Test procedure      | ANSI 63.10 Sections 6.5, 6.6, 11.11, 11.12<br>Radiated Measurement |                   |                                    |
| Operating mode      | Tx continuous, Hight Mid and Low                                   |                   |                                    |
| Ambient Temperature | 23°C                                                               | Relative Humidity | 49%      Air Pressure      1009hPa |

##### Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see below)

| FREQUENCIES<br>(MHz) | FIELD STRENGTH<br>(microvolts/meter) | MEASUREMENT DISTANCE<br>(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                                |

##### Test procedure

The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment and up to ten harmonics. The measurements were performed in constant transmission mode of operation for carrier (channel) frequency at bottom, middle and at the top of 902 MHz to 928 MHz frequency band and maximum transmitting data rate.

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### Results:

#### Range: 9 kHz-30 MHz

Not found disturbance emission plot 10, plot 18, plot 25.

#### Range: 30 MHz – 40 GHz:

Table 5. CH1 903 MHz – LoRa digital modulation - Results

| Frequency MHz | Meas Freq. MHz | Pk Det. dbuV/m | QPk Det. dbuV/m | Limit Pk dbuV/m | Limit QPk dbuV/m      | Verdict | Ref. Plot |
|---------------|----------------|----------------|-----------------|-----------------|-----------------------|---------|-----------|
| CH 1<br>903   | 521.12         | 42.755         | 37.779          | -               | 90.36                 | Pass    | 11-15     |
|               | 870.77         | 44.511         | 39.579          | -               | 90.36                 | Pass    | 11-15     |
|               | 893.68         | 45.741         | 41.275          | -               | 90.36                 | Pass    | 11-15     |
|               | 897.52         | 47.124         | 41.548          | -               | 90.36                 | Pass    | 11-15     |
|               | 898.12         | 53.148         | 47.268          | -               | 90.36                 | Pass    | 11-15     |
|               | 898.96         | 57.451         | 51.300          | -               | 90.36                 | Pass    | 11-15     |
|               | 899.62         | 58.894         | 53.347          | -               | 90.36                 | Pass    | 11-15     |
|               | 900.47         | 61.078         | 55.937          | -               | 90.36                 | Pass    | 11-15     |
|               | 901.24         | 61.657         | 57.276          | -               | 90.36                 | Pass    | 11-15     |
|               | 912.46         | 45.504         | 41.296          | -               | 90.36                 | Pass    | 11-15     |
|               | 935.14         | 45.150         | 40.935          | -               | 90.36                 | Pass    | 11-15     |
|               |                |                | AVG Det. dbuV/m |                 | Limit AVG Det. dbuV/m |         |           |
|               | 1806           | 47.554         | 36.518          | 90.36           | -                     | Pass    | 16        |
|               | 2709.5         | 53.675         | 42.189          | 74*             | 54*                   | Pass    | 16        |
|               | 4514.5         | 53.996         | 41.271          | 74*             | 54*                   | Pass    | 16        |
|               | 5419           | 56.448         | 43.602          | 74*             | 54*                   | Pass    | 16        |
|               | 8256           | 57.15          | 48.60           | 74*             | 54*                   | Pass    | 17        |

Note:

\* Restricted bands § 15.205, must also comply with the radiated emission limits specified in § 15.209(a).

The radio frequency power that is produced by the intentional radiator (Not Restricted bands) shall be at least 20 dB below P(dbuV/m).

$$P(\text{dbuV/m}) = P(\text{Conducted}) + \text{Antenna Gain} + 95.2 = 110.36 \text{ dbuV/m}$$

$$\text{Limit} = P(\text{dbuV/m}) - 20 \text{ dB} = 90.36 \text{ dbuV/m}$$

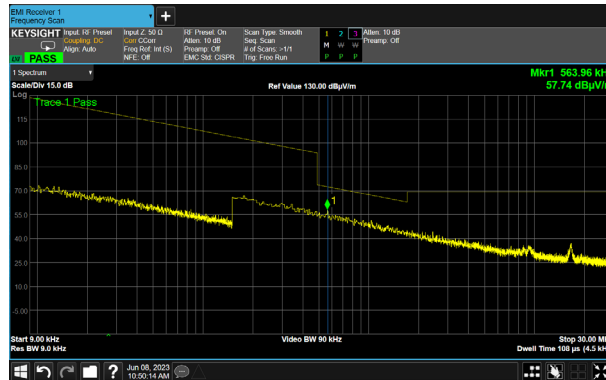


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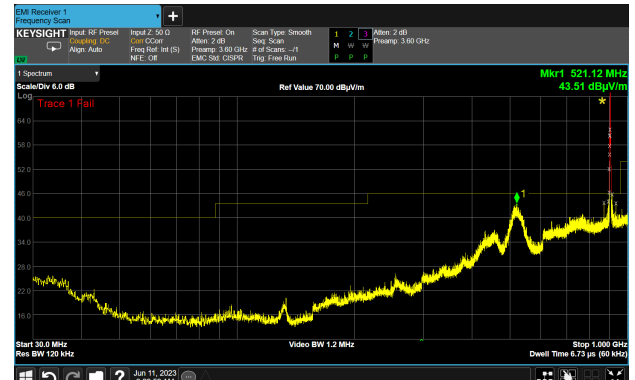
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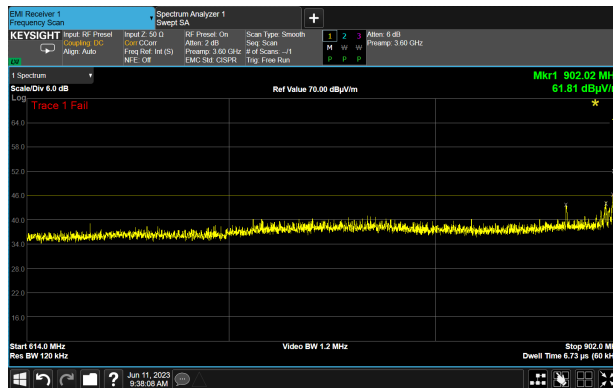
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Plot 10



Plot 11



Plot 12



Plot 13



Plot 14



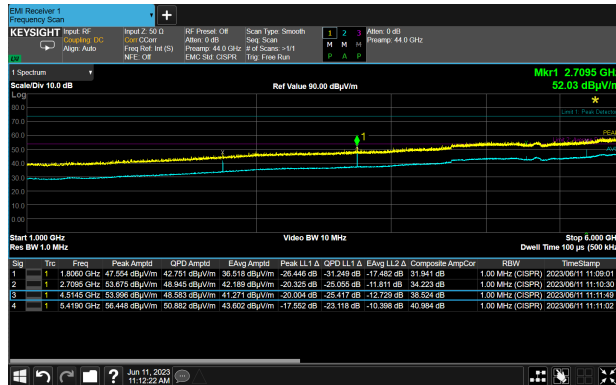
Plot 15



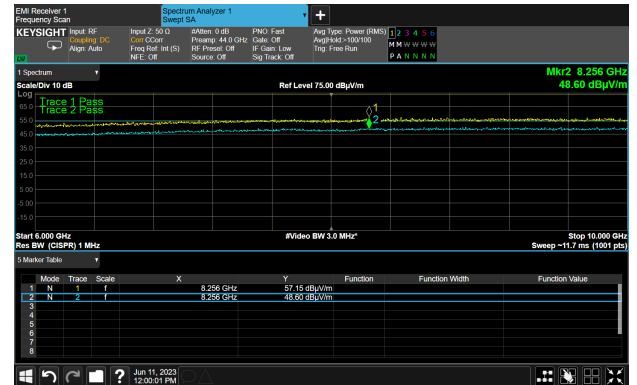
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Plot 16



Plot 17

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**Title:** Test on STM32WLE5

**Model:** RF-MODULE-G5P

**FCC ID:** 2AC2T-RF-MODULE-G5P

**Table 6. CH9 915 MHz – LoRa digital modulation - Results**

| Frequency MHz | Meas Freq. MHz | Pk Det. dbuV/m | QPk Det. dbuV/m        | Limit Pk dbuV/m | Limit QPk dbuV/m             | Verdict | Ref. Plot |
|---------------|----------------|----------------|------------------------|-----------------|------------------------------|---------|-----------|
| CH 9 915      | 521.84         | 42.371         | 37.311                 | -               | 90.04                        | Pass    | 19-22     |
|               | 882.94         | 43.196         | 37.724                 | -               | 90.04                        | Pass    | 19-22     |
|               | 902.86         | 44.360         | 39.474                 | -               | 90.04                        | Pass    | 19-22     |
|               | 904.60         | 43.372         | 38.716                 | -               | 90.04                        | Pass    | 19-22     |
|               | 905.32         | 46.007         | 41.105                 | -               | 90.04                        | Pass    | 19-22     |
|               | 927.47         | 45.513         | 40.758                 | -               | 90.04                        | Pass    | 19-22     |
|               | 930.04         | 43.183         | 38.135                 | -               | 90.04                        | Pass    | 19-22     |
|               | 946.84         | 44.721         | 39.829                 | -               | 90.04                        | Pass    | 19-22     |
|               |                |                | <b>AVG Det. dbuV/m</b> |                 | <b>Limit AVG Det. dbuV/m</b> |         |           |
|               | 1829.5         | 46.774         | 34.08                  | 90.04           | -                            | Pass    | 23        |
|               | 2745.0         | 50.609         | 38.573                 | 74*             | 54*                          | Pass    | 23        |
|               | 4574.0         | 53.529         | 41.282                 | 74*             | 54*                          | Pass    | 23        |
|               | 5489.5         | 55.864         | 43.603                 | 90.04           | -                            | Pass    | 23        |
|               | 9912           | 57.70          | 49.26                  | 90.04           | -                            | Pass    | 24        |

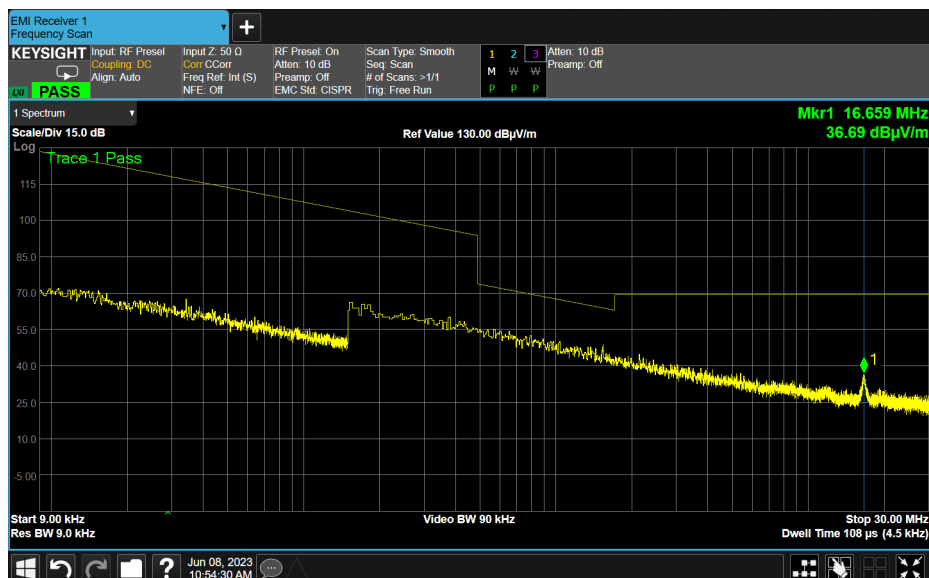
Note:

\* Restricted bands § 15.205, must also comply with the radiated emission limits specified in § 15.209(a).

The radio frequency power that is produced by the intentional radiator (Not Restricted bands) shall be at least 20 dB below P(dbuV/m).

$$P(\text{dbuV/m}) = P(\text{Conducted}) + \text{Antenna Gain} + 95.2 = 110.04 \text{ dbuV/m}$$

$$\text{Limit} = P(\text{dbuV/m}) - 20 \text{ dB} = 90.04 \text{ dbuV/m}$$


**Plot 18**

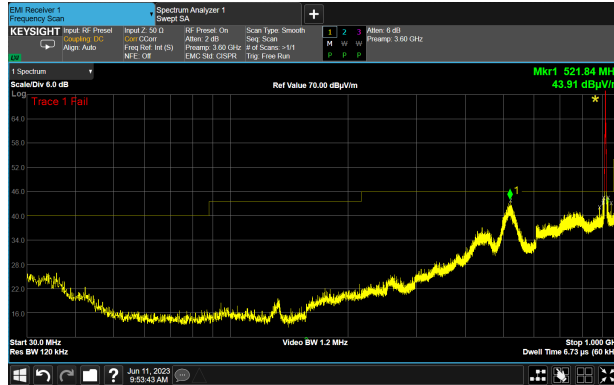


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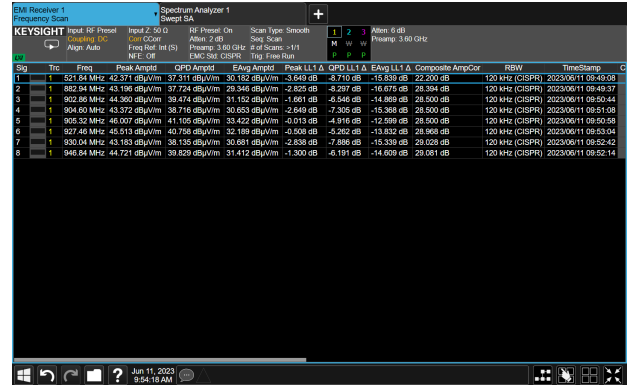
Title: Test on STM32WLE5 Model: RF-MODULE-G5P

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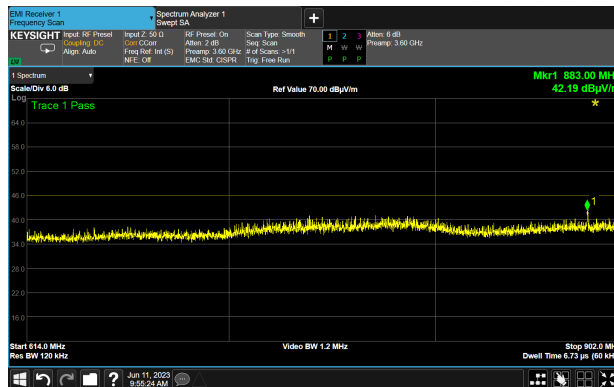
FCC ID: 2AC2T-RF-MODULE-G5P



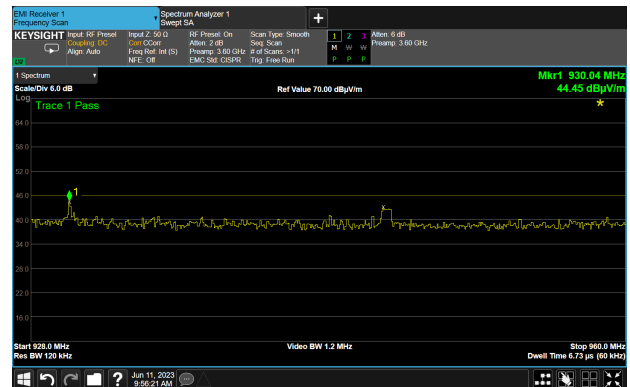
Plot 19



Plot 20



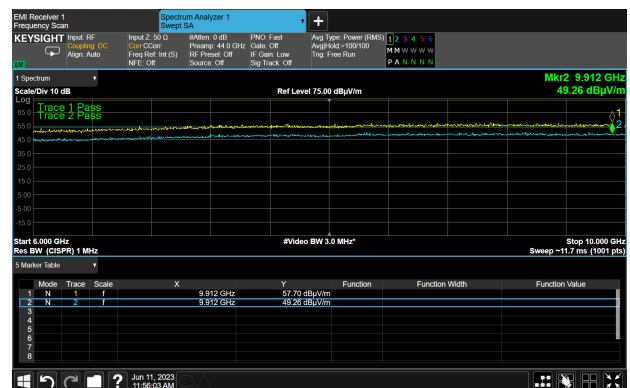
Plot 21



Plot 22



Plot 23



Plot 24

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Title: Test on STM32WLE5 Model: RF-MODULE-G5P

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Table 7. CH17 927 MHz – LoRa digital modulation - Results

| Frequency<br>MHz | Meas<br>Freq.<br>MHz | Pk Det.<br>dbuV/m | QPk Det.<br>dbuV/m | Limit Pk<br>dbuV/m | Limit QPk<br>dbuV/m      | Verdict | Ref. Plot |
|------------------|----------------------|-------------------|--------------------|--------------------|--------------------------|---------|-----------|
| CH 17<br>927     | 513.20               | 52.067            | 47.033             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 520.33               | 52.629            | 47.239             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 894.82               | 58.718            | 53.448             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 928.48               | 62.748            | 56.482             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 928.90               | 61.236            | 55.819             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 929.32               | 59.562            | 53.985             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 929.92               | 57.796            | 52.192             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 930.82               | 54.196            | 48.494             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 931.36               | 51.182            | 45.704             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 931.65               | 48.775            | 43.782             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 933.64               | 44.227            | 38.884             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 934.36               | 46.083            | 39.396             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 935.19               | 44.792            | 38.742             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 936.22               | 45.435            | 39.498             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 937.96               | 45.195            | 39.019             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 939.28               | 44.343            | 39.220             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 959.08               | 43.941            | 38.663             | -                  | 89.74                    | Pass    | 26-29     |
|                  | 959.32               | 43.720            | 38.386             | -                  | 89.74                    | Pass    | 26-29     |
|                  |                      |                   | AVG Det.<br>dbuV/m |                    | Limit AVG Det.<br>dbuV/m |         |           |
|                  | 1857.5               | 46.573            | 33.148             | 89.74              | -                        | Pass    | 30        |
|                  | 2781.5               | 49.223            | 36.346             | 74*                | 54*                      | Pass    | 30        |
|                  | 3148.0               | 51.542            | 37.821             | 89.74              | -                        | Pass    | 30        |
|                  | 5562.5               | 57.821            | 44.852             | 89.74              | -                        | Pass    | 30        |
|                  | 8000                 | 55.95             | 47.88              | 89.74              | -                        | Pass    | 31        |

Note:

\* Restricted bands § 15.205, must also comply with the radiated emission limits specified in § 15.209(a).

The radio frequency power that is produced by the intentional radiator (Not Restricted bands) shall be at least 20 dB below P(dbuV/m)

$$P(\text{dbuV/m}) = P(\text{Conducted}) + \text{Antenna Gain} + 95.2 = 109.74 \text{ dbuV/m}$$

$$\text{Limit} = P(\text{dbuV/m}) - 20 \text{ dB} = 89.74 \text{ dbuV/m}$$

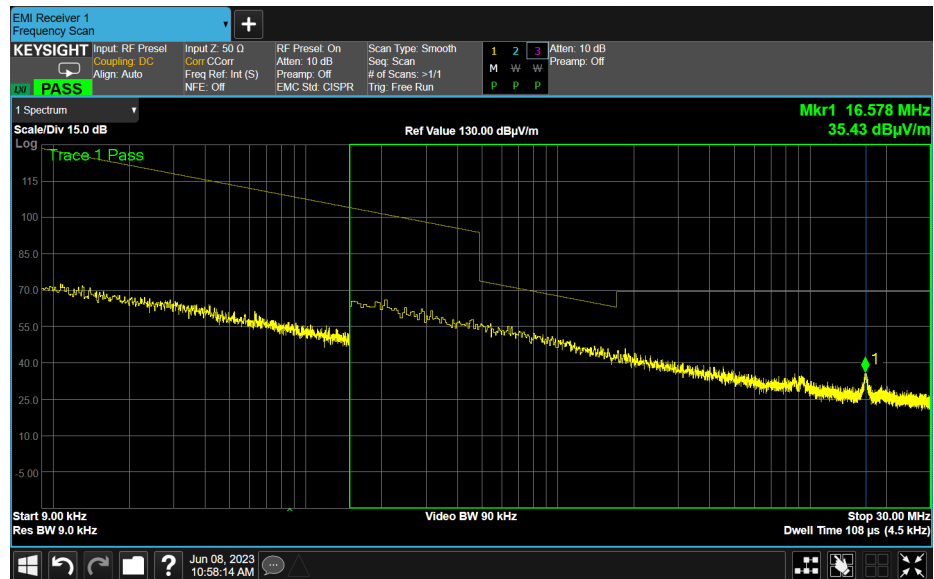
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Plot 25

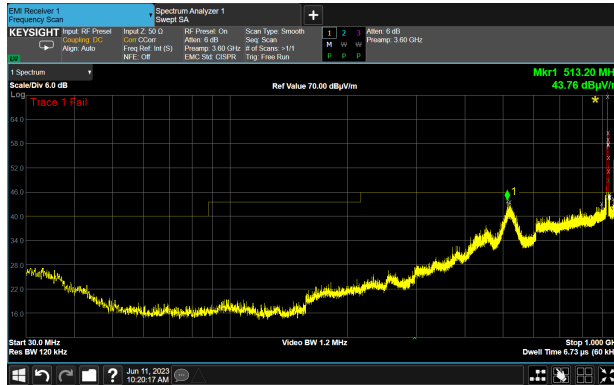


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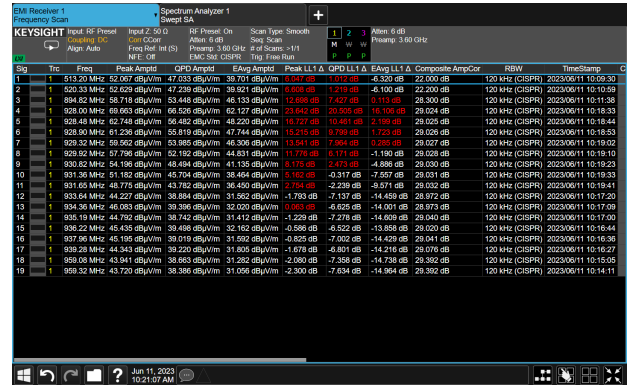
Title: Test on STM32WLE5 Model: RF-MODULE-G5P

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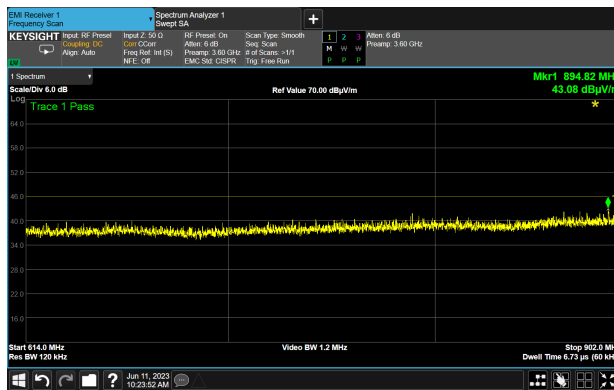
FCC ID: 2AC2T-RF-MODULE-G5P



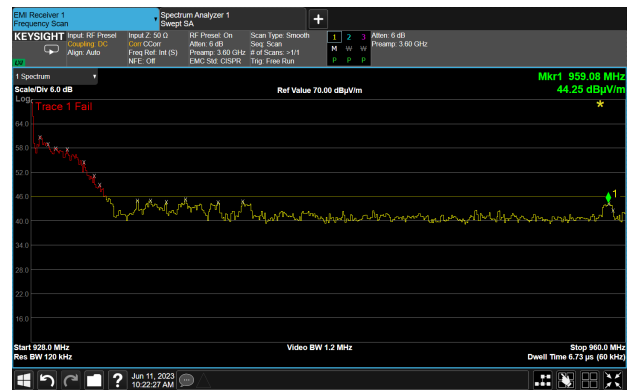
Plot 26



Plot 27



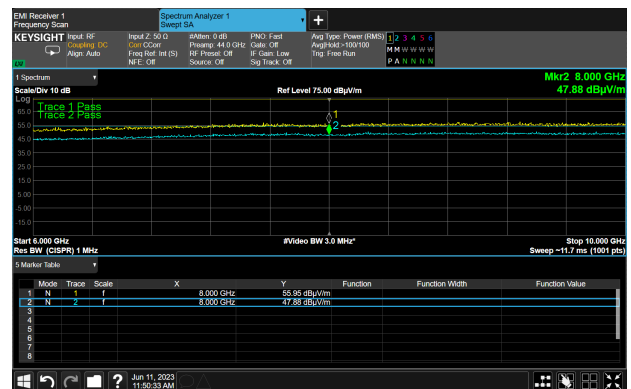
Plot 28



Plot 29



Plot 30



Plot 31

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## 6.5. Band-edge measurements

### Limits & methods:

|                     |                                                  |                   |         |
|---------------------|--------------------------------------------------|-------------------|---------|
| FCC requirements    | 15.247(d)                                        |                   |         |
| Test procedure      | ANSI 63.10 Section 11.13<br>Radiated Measurement |                   |         |
| Operating mode      | Tx continuous, High and Low                      |                   |         |
| Ambient Temperature | 23°C                                             | Relative Humidity | 49%     |
|                     |                                                  | Air Pressure      | 1009hPa |

### Limit

In any 100 kHz bandwidth outside the frequency band the radio frequency power shall be at least 20 dB below that in the 100 kHz bandwidth within the band

### Results:

Table 8. Band-edge Results

| Channel          | Freq MHz | Peak, dBμV/m | Limit 20dBc dBμV/m | Verdict | Plot |
|------------------|----------|--------------|--------------------|---------|------|
| CH 1<br>903 MHz  | 902.02   | 63.284       | 90.36              | Pass    | 32   |
| CH 17<br>927 MHz | 928.00   | 69.663       | 89.74              | Pass    | 33   |

### Note:

The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below P(dbuV/m).

### CH 1:

Antenna gain: 2.28 dBi

P(Conducted) = 12.88 dBm

P(dbuV/m) = P(Conducted) + Antenna Gain + 95.2 = 110.36 dbuV/m

Limit = P(dbuV/m) – 20 dB = 90.36 dbuV/m

### CH 17:

Antenna gain: 2.28 dBi

P(Conducted) = 12.26 dBm

P(dbuV/m) = P(Conducted) + Antenna Gain + 95.2 = 109.74 dbuV/m

Limit = P(dbuV/m) – 20 dB = 89.74 dbuV/m

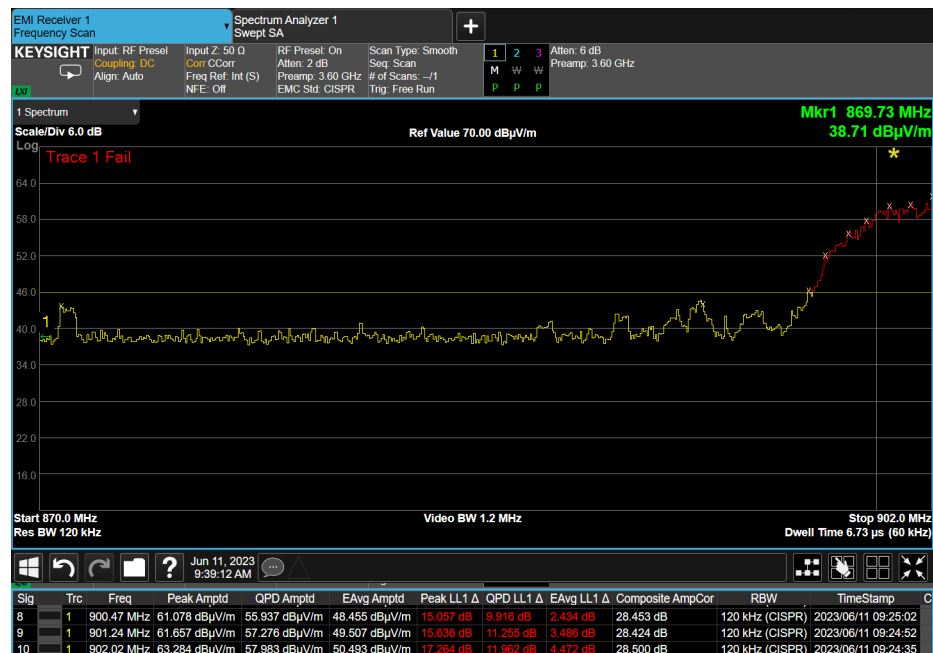


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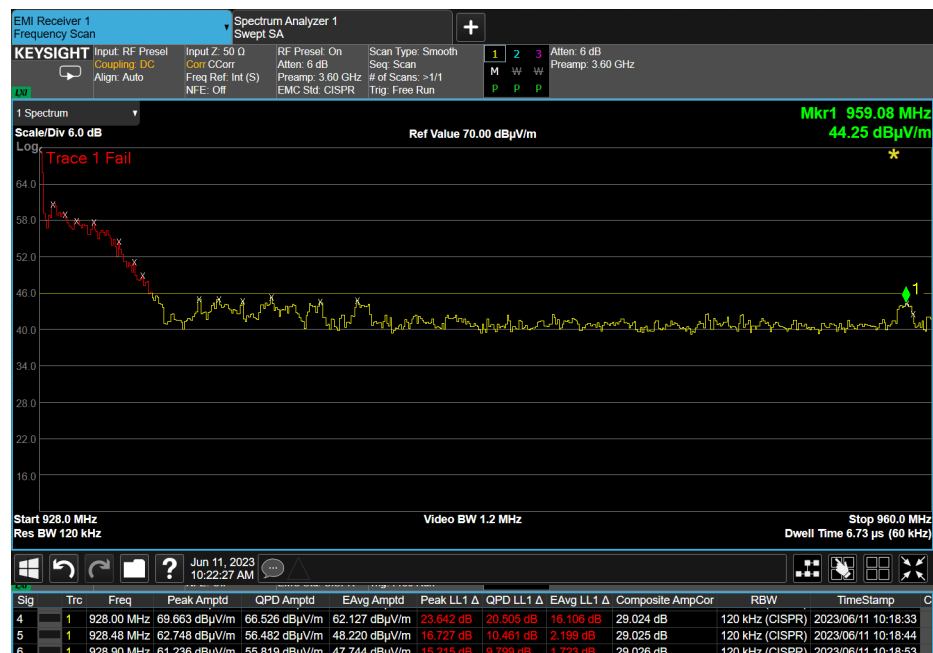
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Plot 32



Plot 33

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**Model:** RF-MODULE-G5P

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## 7. Antenna requirements

### Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

The antenna of the device is - inside case box and the antenna is connected using an SMA connector, the antenna is inside the box and in order to change it you need to open the box.

Conclusion: The unit complies with the requirement of §15.203.



**Figure 6. Antenna**

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## 8. Appendix 1: Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding one year.

| Instrument                                  | Manufacturer | Model        | SII No. | Last calibration date | Next calibration date |
|---------------------------------------------|--------------|--------------|---------|-----------------------|-----------------------|
| EMI RECEIVER-MXE 3Hz-44GHz                  | Keysight     | N9038B       | 6505208 | 09/22                 | 09/23                 |
| Biconilog Antenna 30 – 6000 MHz             | ETS Lindgren | 3142D        | 146490  | 10/21                 | 10/23                 |
| Double Ridged Waveguide Antenna 1-18 GHz    | ETS Lindgren | 3115         | 0143138 | 07/21                 | 07/23                 |
| Semi Anechoic Chamber                       | ETS-Lindgren | RFSD-F/A-100 | 5002    | N/A                   | N/A                   |
| Multi-Device Positioning Controller         | ETS-Lindgren | 2090         | 5002    | N/A                   | N/A                   |
| Antenna Tower                               | ETS-Lindgren | 2175         | 5002    | N/A                   | N/A                   |
| Boresight Antenna Tower                     | ETS-Lindgren | 2171B        | 5002    | N/A                   | N/A                   |
| Turntable                                   | ETS-Lindgren | 2188         | 5002    | N/A                   | N/A                   |
| Attenuator                                  | HASCO, INC   | HA18N5W-20   | 6502991 | 03/23                 | 03/25                 |
| Cable Sets 9 kHz-18GHz (7mtr LLEF 142)      | -            | -            | -       | 02/23                 | 02/24                 |
| Cable Sets 9 kHz-6GHz RE Cbl Set (Horn Ant) | -            | -            | -       | 02/23                 | 02/24                 |
| Cable Up to 18 GHz                          | SUCOFLEX     | 104PE        | 21323   | 02/23                 | 02/24                 |

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## 9. Appendix 2: Antenna Factor and Cable Loss

**Cable Loss (SAC, frequency range: 30 MHz-1.0 GHz)**

| No. | Frequency (MHz) | Attenuation (dB) | Frequency (MHz) | Attenuation (dB) | Frequency (MHz) | Attenuation (dB) |
|-----|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 1   | 28.71           | 0.4              | 97.21           | 1.0              | 329.17          | 1.7              |
| 2   | 30.14           | 0.4              | 102.07          | 1.0              | 345.63          | 1.8              |
| 3   | 31.65           | 0.5              | 107.17          | 1.0              | 362.91          | 1.8              |
| 4   | 33.23           | 0.5              | 112.53          | 1.0              | 381.06          | 1.8              |
| 5   | 34.89           | 0.5              | 118.15          | 1.0              | 400.11          | 1.9              |
| 6   | 36.64           | 0.5              | 124.06          | 1.1              | 420.12          | 2.0              |
| 7   | 38.47           | 0.5              | 130.27          | 1.1              | 441.12          | 2.0              |
| 8   | 40.39           | 0.6              | 136.78          | 1.1              | 463.18          | 2.1              |
| 9   | 42.41           | 0.6              | 143.62          | 1.1              | 486.34          | 2.1              |
| 10  | 44.53           | 0.6              | 150.80          | 1.1              | 510.66          | 2.2              |
| 11  | 46.76           | 0.6              | 158.34          | 1.1              | 536.19          | 2.2              |
| 12  | 49.10           | 0.6              | 166.26          | 1.1              | 563.00          | 2.4              |
| 13  | 51.55           | 0.6              | 174.57          | 1.2              | 591.15          | 2.4              |
| 14  | 54.13           | 0.7              | 183.30          | 1.2              | 620.70          | 2.5              |
| 15  | 56.83           | 0.7              | 192.46          | 1.3              | 651.74          | 2.6              |
| 16  | 59.68           | 0.7              | 202.08          | 1.3              | 684.33          | 2.6              |
| 17  | 62.66           | 0.7              | 212.19          | 1.3              | 718.54          | 2.8              |
| 18  | 65.79           | 0.8              | 222.80          | 1.4              | 754.47          | 2.9              |
| 19  | 69.08           | 0.8              | 233.94          | 1.4              | 792.19          | 2.9              |
| 20  | 72.54           | 0.8              | 245.63          | 1.4              | 831.80          | 3.0              |
| 21  | 76.16           | 0.8              | 257.92          | 1.5              | 873.39          | 3.2              |
| 22  | 79.97           | 0.9              | 270.81          | 1.5              | 917.06          | 3.2              |
| 23  | 83.97           | 0.9              | 284.35          | 1.5              | 962.92          | 3.3              |
| 24  | 88.17           | 0.9              | 298.57          | 1.6              | 1011.06         | 3.4              |
| 25  | 92.58           | 0.9              | 313.50          | 1.6              | --              | --               |

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**Cable Loss (SAC, frequency range: 1.0 GHz – 6.0 GHz)**

| No. | Frequency (MHz) | Attenuation (dB) | Frequency (MHz) | Attenuation (dB) | Frequency (MHz) | Attenuation (dB) |
|-----|-----------------|------------------|-----------------|------------------|-----------------|------------------|
| 1   | 962.92          | 3.3              | 1815.72         | 5.0              | 3423.81         | 7.2              |
| 2   | 1011.06         | 3.4              | 1906.51         | 5.1              | 3595.00         | 6.8              |
| 3   | 1061.61         | 3.4              | 2001.83         | 5.2              | 3774.75         | 7.0              |
| 4   | 1114.70         | 3.5              | 2101.92         | 5.3              | 3963.49         | 7.1              |
| 5   | 1170.43         | 3.7              | 2207.02         | 5.4              | 4161.67         | 7.6              |
| 6   | 1228.95         | 3.9              | 2317.37         | 5.5              | 4369.75         | 7.7              |
| 7   | 1290.4          | 3.9              | 2433.24         | 5.6              | 4588.24         | 7.7              |
| 8   | 1354.92         | 4.0              | 2554.90         | 5.9              | 4817.65         | 7.8              |
| 9   | 1422.67         | 4.2              | 2682.65         | 5.8              | 5058.53         | 8.1              |
| 10  | 1493.80         | 4.6              | 2816.78         | 5.8              | 5311.46         | 8.4              |
| 11  | 1568.49         | 4.7              | 2957.62         | 6.3              | 5577.03         | 8.6              |
| 12  | 1646.91         | 4.8              | 3105.50         | 6.2              | 5855.88         | 9.1              |
| 13  | 1729.26         | 4.9              | 3260.77         | 6.7              | 6000.00         | 9.3              |

**Antenna Magnetic Factor**

**For Antenna Loop ETS LINDGREN Model 6507, SII S/N 00144641,  
0.009 MHz to 30 MHz**

| No. | f / MHz | AF/ dBuA/m | f / MHz | AF/ dBuA/m |
|-----|---------|------------|---------|------------|
| 1   | 0.009   | -21.2      | 1.00    | -33.7      |
| 2   | 0.01    | -22.1      | 2.00    | -33.6      |
| 3   | 0.02    | -27.7      | 3.00    | -33.7      |
| 4   | 0.05    | -32.1      | 4.00    | -34.0      |
| 5   | 0.075   | -33.0      | 5.00    | -34.3      |
| 6   | 0.10    | -33.3      | 10.00   | -35.2      |
| 7   | 0.15    | -33.5      | 15.00   | -35.8      |
| 8   | 0.25    | -33.7      | 20.00   | -36.1      |
| 9   | 0.50    | -33.8      | 25.00   | -36.6      |
| 10  | 0.75    | -33.8      | 30.00   | -37.0      |

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### Antenna Factor

**Biconilog Antenna, Model Number: 3142D S/N: 00146488 SII No. 6503046**

**Frequency range: 30 MHz – 2.0 GHz**

**3 m distance**

| No. | f / MHz | ACF / dB/m | f / MHz | AF / dB/m |
|-----|---------|------------|---------|-----------|
| 1   | 30      | 22.7       | 200     | 16.7      |
| 2   | 35      | 20.4       | 250     | 18.0      |
| 3   | 40      | 17.8       | 300     | 19.8      |
| 4   | 45      | 15.7       | 400     | 22.7      |
| 5   | 50      | 14.2       | 500     | 25.8      |
| 6   | 60      | 13.0       | 600     | 27.4      |
| 7   | 70      | 13.0       | 700     | 28.4      |
| 8   | 80      | 12.4       | 800     | 30.0      |
| 9   | 90      | 13.3       | 900     | 31.3      |
| 10  | 100     | 14.2       | 1000    | 32.8      |
| 11  | 120     | 13.3       | 1250    | 35.8      |
| 12  | 140     | 13.3       | 1500    | 42.9      |
| 13  | 160     | 14.6       | 1750    | 36.1      |
| 14  | 180     | 16.3       | 2000    | 34.6      |

**Double Ridged Waveguide Antenna Model Number: 3115 S/N 0143138**

**Frequency range: 1.0 GHz – 18.0 GHz**

**3m distance**

| No. | f / MHz | AF / dB/m | f / MHz | AF / dB/m | f / MHz | AF / dB/m |
|-----|---------|-----------|---------|-----------|---------|-----------|
| 1   | 1000    | 23.6      | 7000    | 36.7      | 13000   | 39.7      |
| 2   | 1500    | 25.6      | 7500    | 37.3      | 13500   | 40.3      |
| 3   | 2000    | 28.2      | 8000    | 37.0      | 14000   | 41.0      |
| 4   | 2500    | 27.8      | 8500    | 37.6      | 14500   | 41.0      |
| 5   | 3000    | 29.3      | 9000    | 37.8      | 15000   | 39.6      |
| 6   | 3500    | 30.7      | 9500    | 38.0      | 15500   | 38.8      |
| 7   | 4000    | 31.8      | 10000   | 38.3      | 16000   | 39.1      |
| 8   | 4500    | 32.1      | 10500   | 38.6      | 16500   | 40.0      |
| 9   | 5000    | 32.9      | 11000   | 38.6      | 17000   | 40.9      |
| 10  | 5500    | 32.9      | 11500   | 38.9      | 17500   | 42.3      |
| 11  | 6000    | 34.0      | 12000   | 38.8      | 18000   | 42.5      |
| 12  | 6500    | 35.3      | 12500   | 38.9      | --      | --        |

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## 10. Appendix 3: Test illustrations



**Picture 1**  
**Radiated spurious emission test setup.**

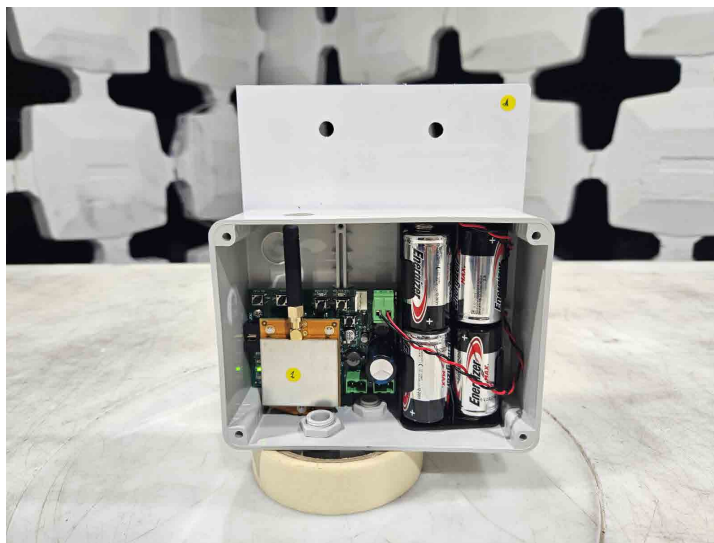
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**Model:** RF-MODULE-G5P

**FCC ID:** 2AC2T-RF-MODULE-G5P



**Picture 2**  
**Radiated spurious emission test setup ( continuation).**



**Picture 3**  
**Conducted spurious emission test setup.**

**END OF THE DOCUMENT**