SGS Korea Co., Ltd.
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http://www.sgsgroup.kr



# TEST REPORT

**of**

FCC Part 15 Subpart C §15.247

FCC ID: 2AWMDA711P

| | | |
|---|---|---|
| 1. Equipment Under Test | : | RFID Smart Reader |
| 2. Model Name | : | a711p |
| 3. Variant Model Name(s) | : | - |
| 4. Applicant | : | Apulse Technology Co., Ltd |
| 5. Manufacturer | : | Apulse Technology Co., Ltd |
| 6. Date of Receipt | : | 2020.01.17 |
| 7. Date of Test(s) | : | 2020.04.01 ~ 2020.06.08 |
| 8. Date of Issue | : | 2020.06.26 |

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

**Tested by:**  **Nancy Park**

**Technical Manager:**  **Jungmin Yang**

## SGS Korea Co., Ltd. Gunpo Laboratory

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# 1. General Information

## 1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.
Phone No. : +82 31 688 0901
Fax No. : +82 31 688 0921

## 1.2. Details of Applicant

Applicant : Apulse Technology Co., Ltd
Address : C-1211, 60, Haan-ro, Gwangmyeong-si, Gyeonggi-do, South Korea, 14322
Contact Person : Jang, Robin
Phone No. : +82 10 5526 0605

## 1.3. Details of Manufacturer

Company : Same as applicant
Address : Same as applicant

## 1.4. Description of EUT

| | |
|---|---|
| **Kind of Product** | RFID Smart Reader |
| **Model Name** | a711p |
| **Power Supply** | DC 3.7 V |
| **Frequency Range** | 902.75 ㎒ ~ 927.25 ㎒ (RFID) |
| **Modulation Technique** | ASK |
| **Number of Channels** | 50 channels (RFID) |
| **Antenna Type** | Linear Polarized antenna |
| **Antenna Gain** | 3.06 ㏈i |

## 1.5. Test Equipment List

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Interval | Cal. Due |
|---|---|---|---|---|---|---|
| Signal Generator | R&S | SMBV100A | 255834 | Jun. 03, 2020 | Annual | Jun. 03, 2021 |
| Signal Generator | Agilent | E8257D | MY51501169 | Nov. 21, 2019 | Annual | Nov. 21, 2020 |
| Spectrum Analyzer | R&S | FSV30 | 103210 | Dec. 05, 2019 | Annual | Dec. 05, 2020 |
| Spectrum Analyzer | Agilent | N9020A | MY53421758 | Sep. 11, 2019 | Annual | Sep. 11, 2020 |
| High Pass Filter | Wainwright Instrument GmbH | WHKX1.5/15G-6SS | 4 | Jun. 12, 2019 | Annual | Jun. 12, 2020 |
| DC Power Supply | Agilent | U8002A | MY50060028 | Mar. 03, 2020 | Annual | Mar. 03, 2021 |
| Signal Conditioning Unit | R&S | SCU-18 | 10117 | Jun. 12, 2019 | Annual | Jun. 12, 2020 |
| Loop Antenna | Schwarzbeck Mess-Elektronik | FMZB 1519 | 1519-039 | Aug. 22, 2019 | Biennial | Aug. 22, 2021 |
| Bilog Antenna | Schwarzbeck Mess-Elektronik | VULB 9163 | 396 | Mar. 21, 2019 | Biennial | Mar. 21, 2021 |
| Horn Antenna | R&S | HF906 | 100326 | Feb. 14, 2020 | Annual | Feb. 14, 2021 |
| Test Receiver | R&S | ESU26 | 100109 | Feb. 18, 2020 | Annual | Feb. 18, 2021 |
| Turn Table | Innco systems GmbH | DS 1200 S | N/A | N.C.R. | N/A | N.C.R. |
| Controller | Innco systems GmbH | CONTROLLER CO3000-4P | CO3000/963/383 30516/L | N.C.R. | N/A | N.C.R. |
| Antenna Mast | Innco systems GmbH | MA4640-XP-ET | MA4640/536/383 30516/L | N.C.R. | N/A | N.C.R. |
| Anechoic Chamber | SY Corporation | L × W × H (9.6 m × 6.4 m × 6.6 m) | N/A | N.C.R. | N/A | N.C.R. |
| Coaxial Cable | RFONE | PL520-NMNM-4M (4 m) | 20200324001 | May 06, 2020 | Semi-annual | Nov. 06, 2020 |
| Coaxial Cable | RFONE | PL520-NMNM-10M (10 m) | 20200324001 | May 06, 2020 | Semi-annual | Nov. 06, 2020 |

## 1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: FCC Part15 Subpart C | | |
|---|---|---|
| **Section** | **Test Item(s)** | **Result** |
| 15.205(a)<br>15.209 | Transmitter Radiated Spurious Emissions | Complied |
| 15.247(d) | Conducted Spurious Emission | N/A[1)] |
| 15.247(a)(1) | 20 dB Bandwidth | N/A[1)] |
| 15.247(a)(1)<br>15.247(b)(1) | Maximum Peak Conducted Output Power | N/A[1)] |
| 15.247(a)(1) | Carrier Frequency Separation | N/A[1)] |
| 15.247(a)(1)(iii) | Number of Hopping Frequencies | N/A[1)] |
| 15.247(a)(1)(iii) | Time of Occupancy<br>(Dwell Time) | N/A[1)] |
| 15.207 | AC Power Line Conducted Emission | N/A[1)] |

**Note;**

1) This product is using certified module. So only radiation test was performed.

## 1.7. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 15.247 Meas Guidance v05r02 were used in the measurement of the DUT.

## 1.8. Sample Calculation

Where relevant, the following sample calculation is provided:

### 1.8.1. Radiation Test

Field strength level (dBμV/m) = Measured level (dBμV) + Antenna factor (dB) + Cable loss (dB) - Amplifier gain (dB)

## 1.9. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter | Uncertainty |
|---|---|
| Radiated Emission, 9 ㎑ to 30 ㎒ | ± 3.59 ㏈ |
| Radiated Emission, below 1 ㎓ | ± 5.88 ㏈ |
| Radiated Emission, above 1 ㎓ | ± 5.94 ㏈ |

Uncertainty figures are valid to a confidence level of 95 %.

## 1.10. Test Report Revision

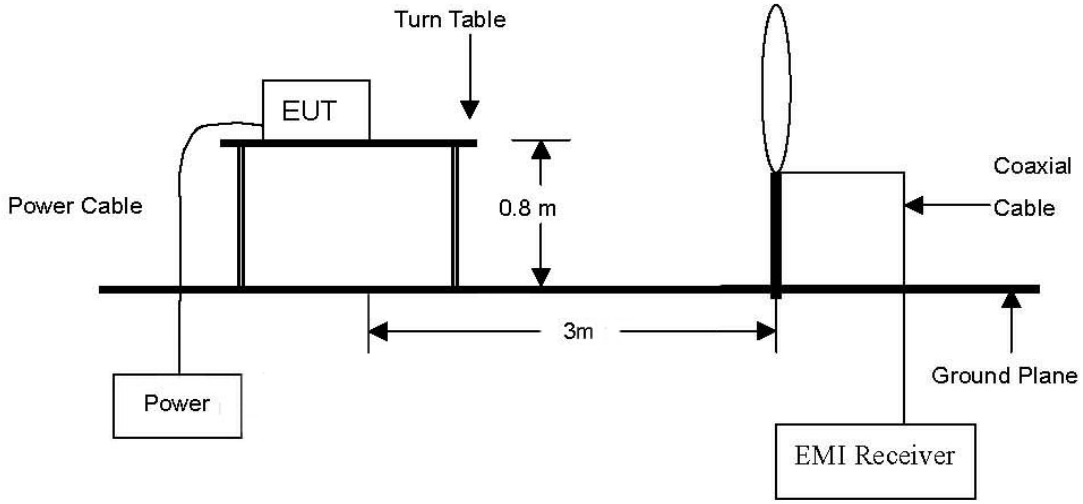
| Revision | Report Number | Date of Issue | Description |
|---|---|---|---|
| 0 | F690501-RF-RTL000824 | 2020.06.26 | Initial |

# 2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

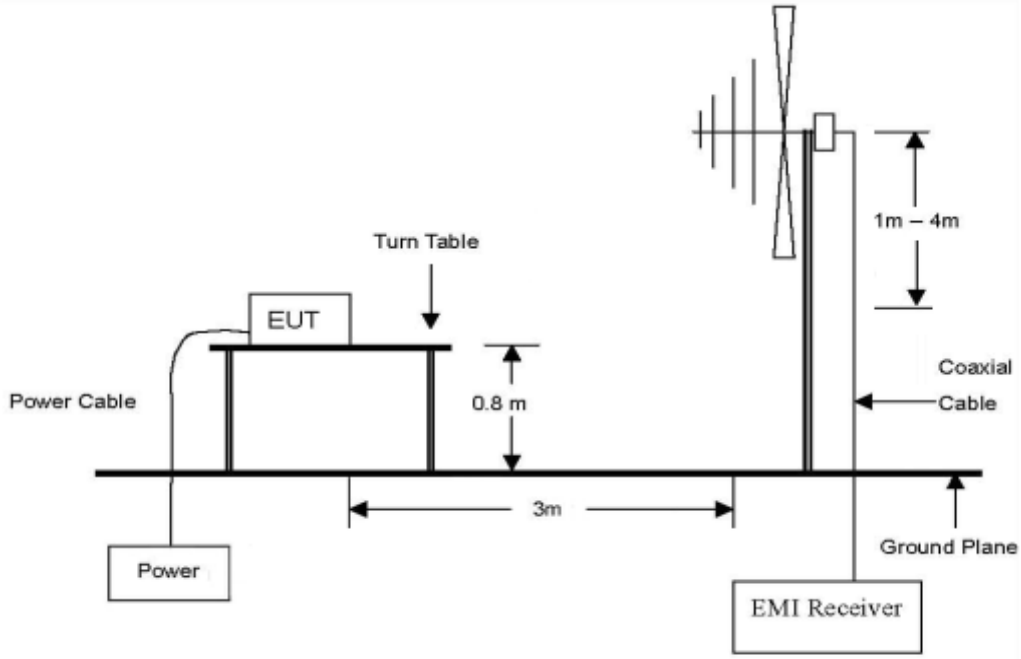
## 2.1. Test Setup

### 2.1.1. Transmitter Radiated Spurious Emissions

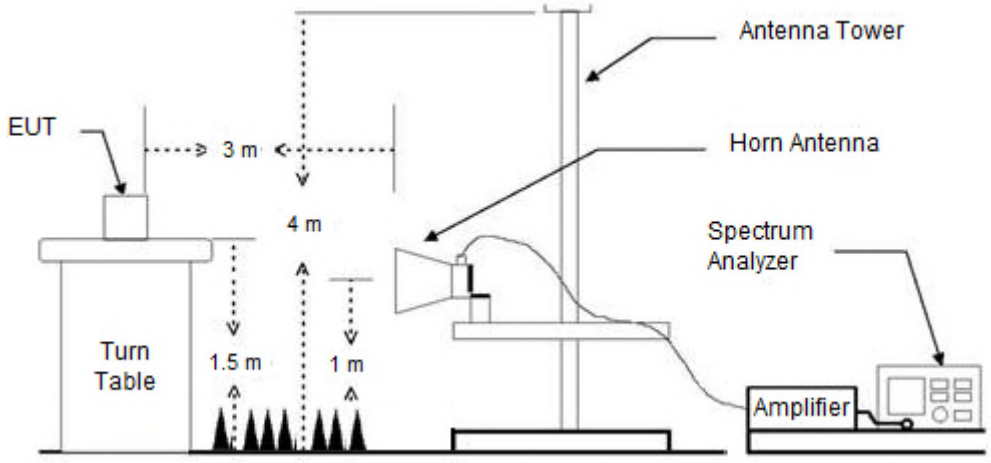
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒.




The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓.



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



## 2.2. Limit

According to §15.247(d), in any 100 ㎑ 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 ㏈ below that in the 100 ㎑ 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emission 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) (see §15.205(c)).

According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (㎒) | Field Strength (㎶/m) | Measurement Distance (Meters) |
|---|---|---|
| 0.009-0.490 | 2 400/F(㎑) | 300 |
| 0.490-1.705 | 24 000/F(㎑) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100** | 3 |
| 88-216 | 150** | 3 |
| 216-960 | 200** | 3 |
| Above 960 | 500 | 3 |

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

## 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10-2013.

### 2.3.1. Test Procedures for emission below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

### 2.3.2. Test Procedures for emission from above 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 ㎓ and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 ㎓. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**Note;**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 ㎑ for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 ㎓.
2. For frequency above 1 ㎓, set spectrum analyzer detector to peak, and resolution bandwidth is 1 ㎒ and video bandwidth is 3 ㎒.
3. Definition of DUT Axis.
   Definition of the test orthogonal plan for EUT was described in the test setup photo.
   The test orthogonal plan of EUT is **X – axis** during radiation test.

## 2.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

### 2.4.1. Radiated Spurious Emission

The following table shows the highest levels of radiated emissions.
The frequency spectrum from 9 ㎑ to 9 500 ㎒ was investigated.

A. Low Channel (902.75 ㎒)

| Radiated Emissions | | | Ant. | Correction Factors | | Total | Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dB㎶) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dB㎶/m) | Limit (dB㎶/m) | Margin (dB) |
| *2 708.04 | 59.58 | Peak | H | 28.77 | -38.77 | 49.58 | 74.00 | 24.42 |
| *2 708.25 | 56.82 | Average | H | 28.77 | -38.77 | 46.82 | 54.00 | 7.18 |
| *3 610.98 | 54.34 | Peak | H | 31.43 | -37.17 | 48.60 | 74.00 | 25.40 |
| *3 610.95 | 51.54 | Average | H | 31.43 | -37.17 | 45.80 | 54.00 | 8.20 |
| *4 513.93 | 56.27 | Peak | H | 32.07 | -36.64 | 51.70 | 74.00 | 22.30 |
| *4 513.75 | 54.18 | Average | H | 32.07 | -36.64 | 49.61 | 54.00 | 4.39 |
| *5 416.54 | 46.02 | Peak | H | 33.97 | -35.20 | 44.79 | 74.00 | 29.21 |
| *5 416.54 | 39.42 | Average | H | 33.97 | -35.20 | 38.19 | 54.00 | 15.81 |
| Above 5 500.00 | Not detected | - | - | - | - | - | - | - |

B. Middle Channel (914.75 ㎒)

| Radiated Emissions | | | Ant. | Correction Factors | | Total | Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dB㎶) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dB㎶/m) | Limit (dB㎶/m) | Margin (dB) |
| *2 744.10 | 60.13 | Peak | H | 28.62 | -38.68 | 50.07 | 74.00 | 23.93 |
| *2 744.29 | 56.65 | Average | H | 28.62 | -38.68 | 46.59 | 54.00 | 7.41 |
| *3 659.02 | 53.53 | Peak | H | 31.97 | -37.11 | 48.39 | 74.00 | 25.61 |
| *3 658.97 | 50.39 | Average | H | 31.97 | -37.11 | 45.25 | 54.00 | 8.75 |
| *4 573.71 | 57.50 | Peak | H | 31.95 | -36.64 | 52.81 | 74.00 | 21.19 |
| *4 573.82 | 55.33 | Average | H | 31.95 | -36.64 | 50.64 | 54.00 | 3.36 |
| Above 4 600.00 | Not detected | - | - | - | - | - | - | - |

C. High Channel (927.25 ㎒)

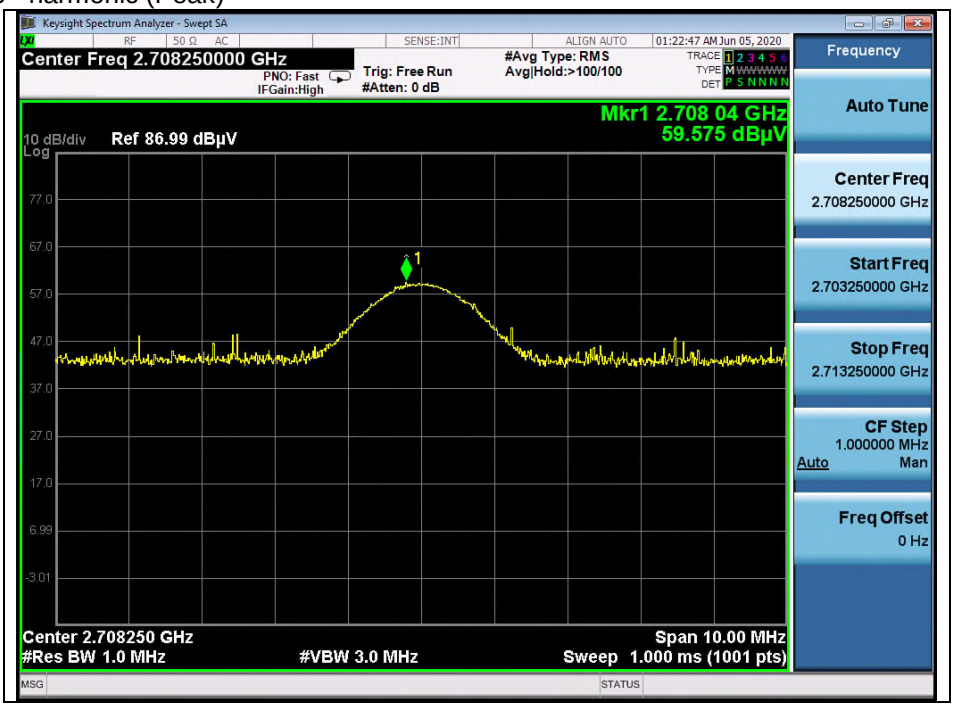
| Radiated Emissions | | | Ant. | Correction Factors | | Total | Limit | |
|---|---|---|---|---|---|---|---|---|
| Frequency (㎒) | Reading (dB㎶) | Detect Mode | Pol. | AF (dB/m) | AMP+CL (dB) | Actual (dB㎶/m) | Limit (dB㎶/m) | Margin (dB) |
| *2 781.62 | 58.85 | Peak | H | 28.79 | -38.73 | 48.91 | 74.00 | 25.09 |
| *2 781.74 | 54.86 | Average | H | 28.79 | -38.73 | 44.92 | 54.00 | 9.08 |
| *3 708.97 | 54.92 | Peak | H | 32.28 | -37.07 | 50.13 | 74.00 | 23.87 |
| *3 708.97 | 51.77 | Average | H | 32.28 | -37.07 | 46.98 | 54.00 | 7.02 |
| *4 636.05 | 55.79 | Peak | H | 32.04 | -36.59 | 51.24 | 74.00 | 22.76 |
| *4 636.30 | 52.93 | Average | H | 32.05 | -36.59 | 48.39 | 54.00 | 5.61 |
| Above 4 700.00 | Not detected | - | - | - | - | - | - | - |

**Remark;**

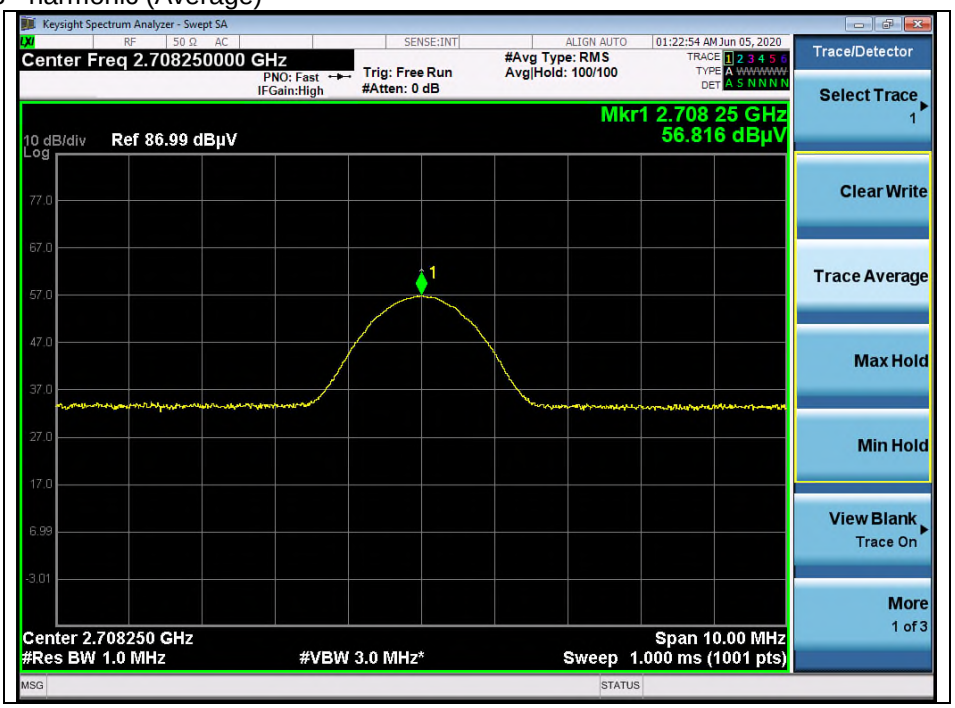
1. "*" means the restricted band.
2. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
4. Actual = Reading + AF + CL + (DF) or Reading + AF + AMP + CL + (DF).
5. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 ㏈.
6. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.

**- Test plots**

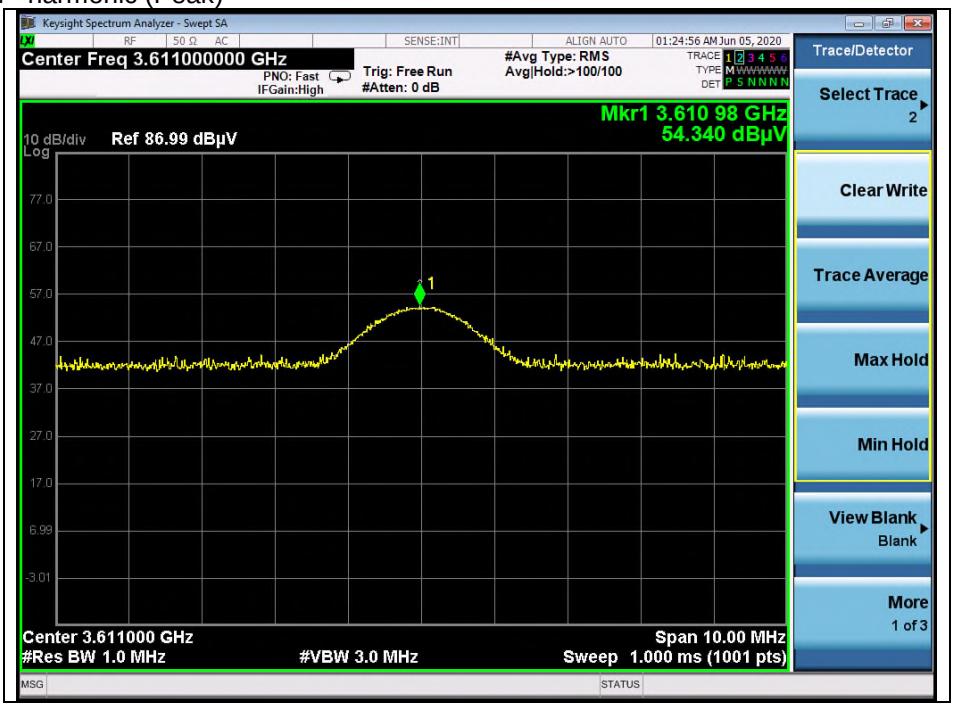
Low channel 3rd harmonic (Peak)



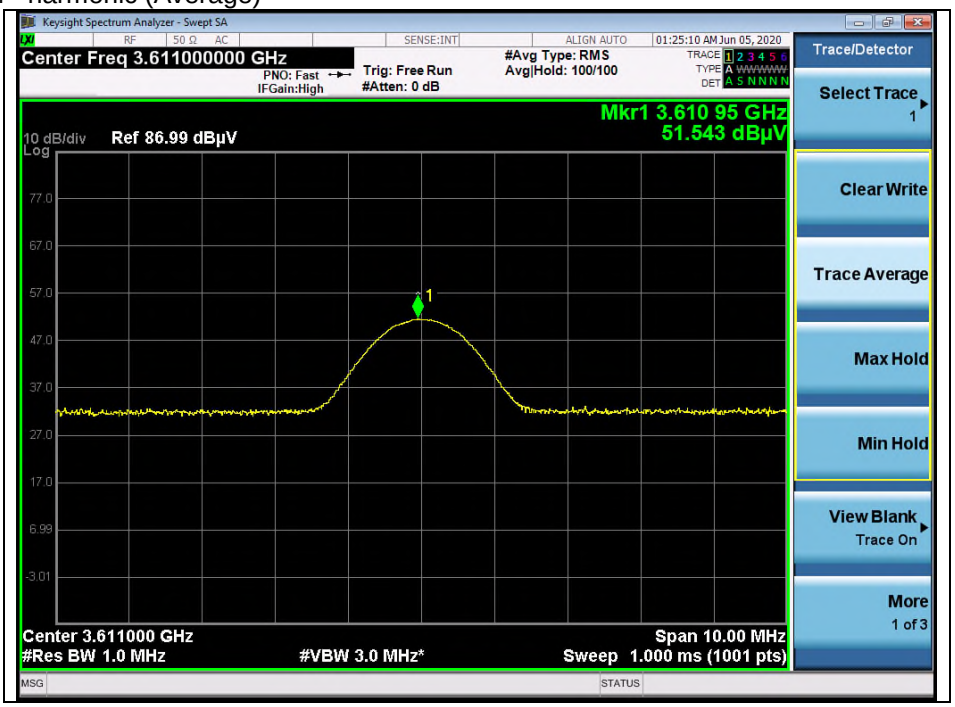

Low channel 3rd harmonic (Average)



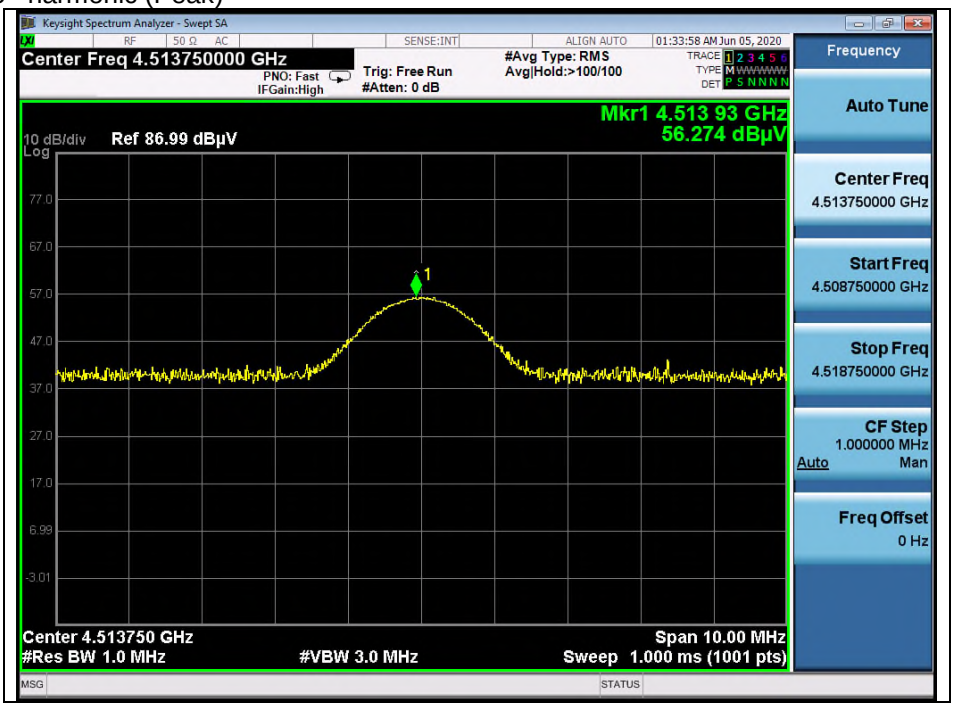
Low channel 4th harmonic (Peak)



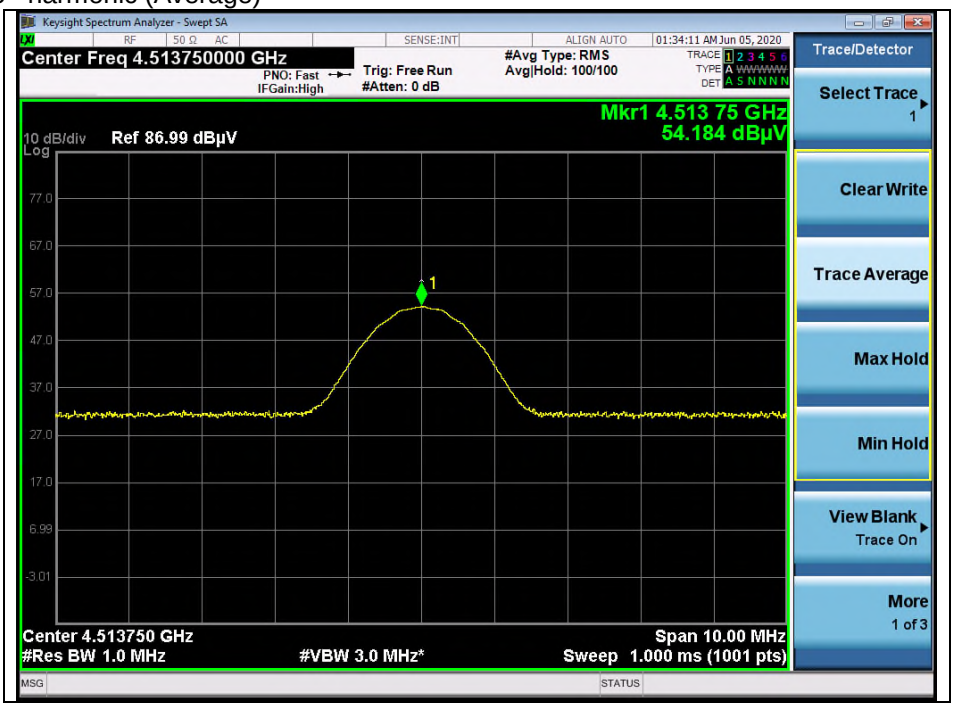

Low channel 4th harmonic (Average)



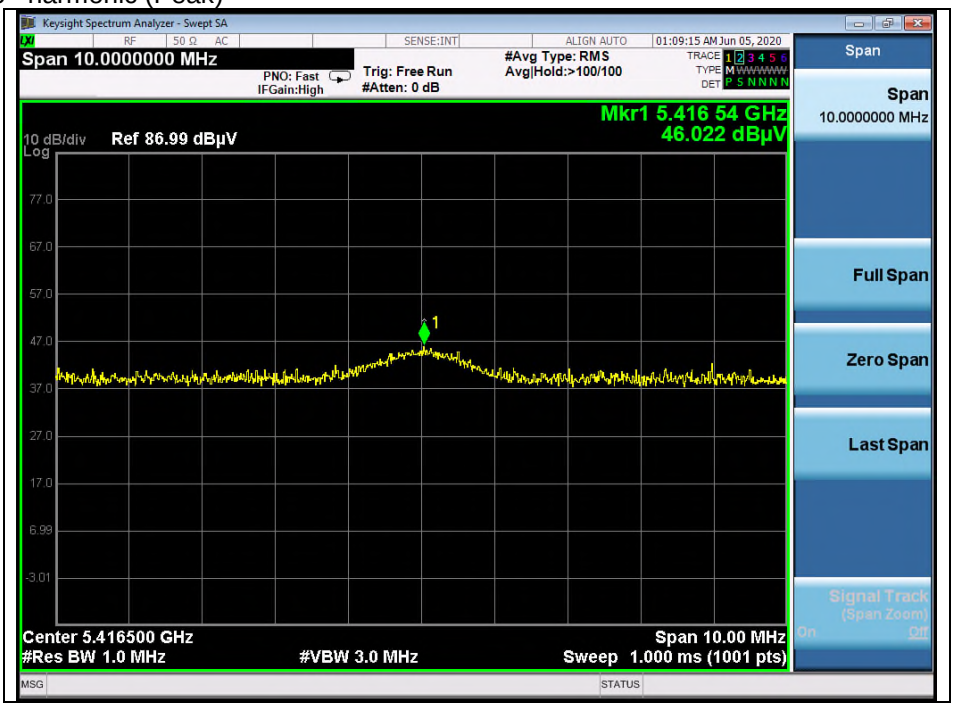
Low channel 5th harmonic (Peak)




Low channel 5th harmonic (Average)

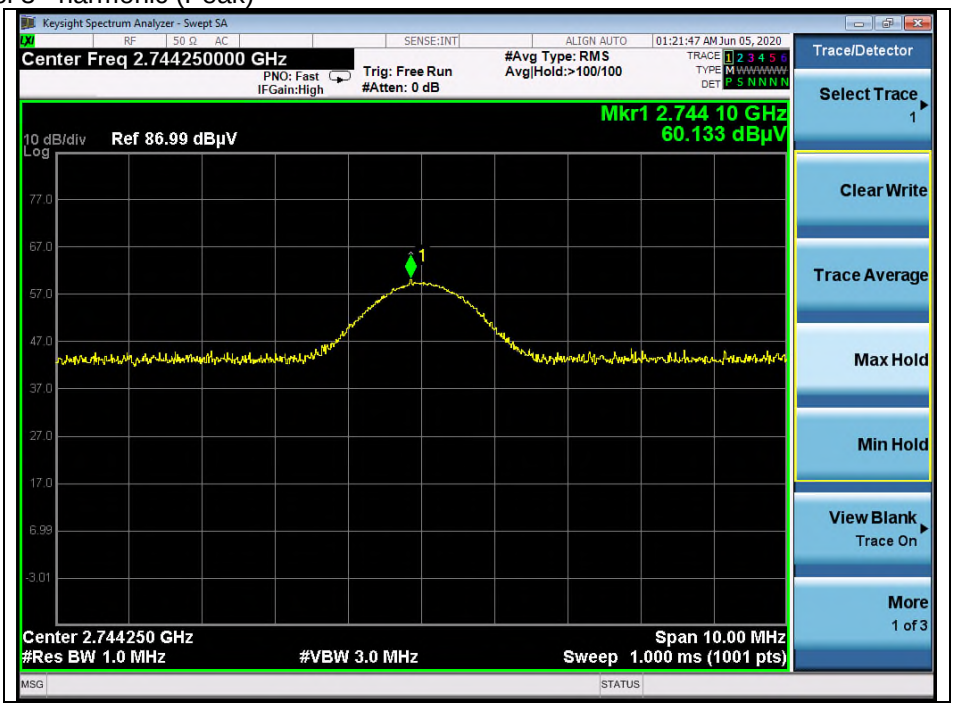


Low channel 6th harmonic (Peak)

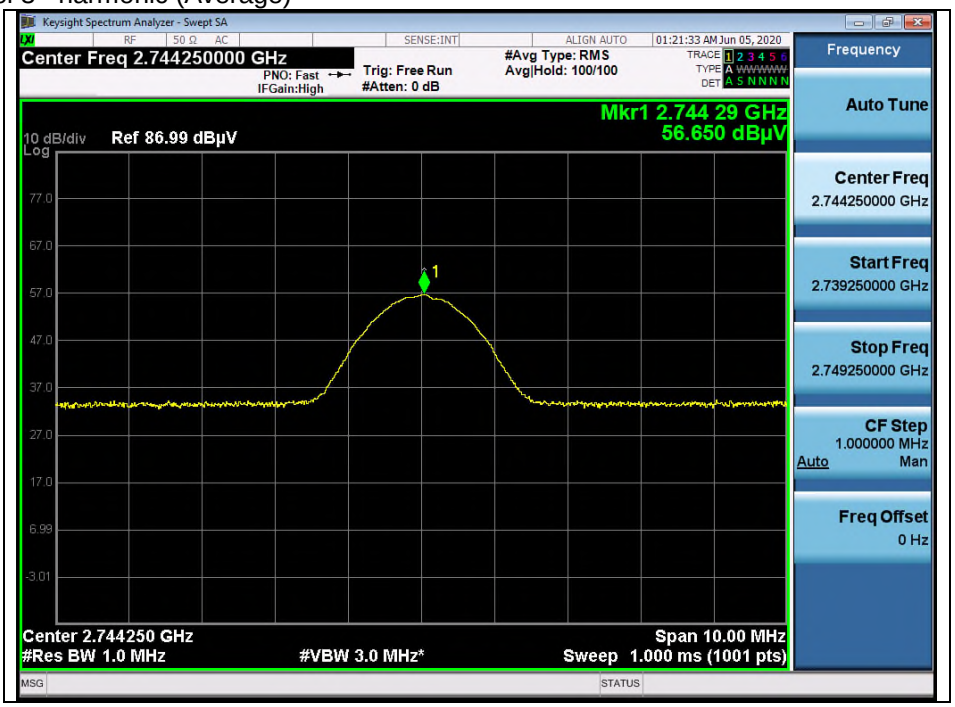



Low channel 6th harmonic (Average)

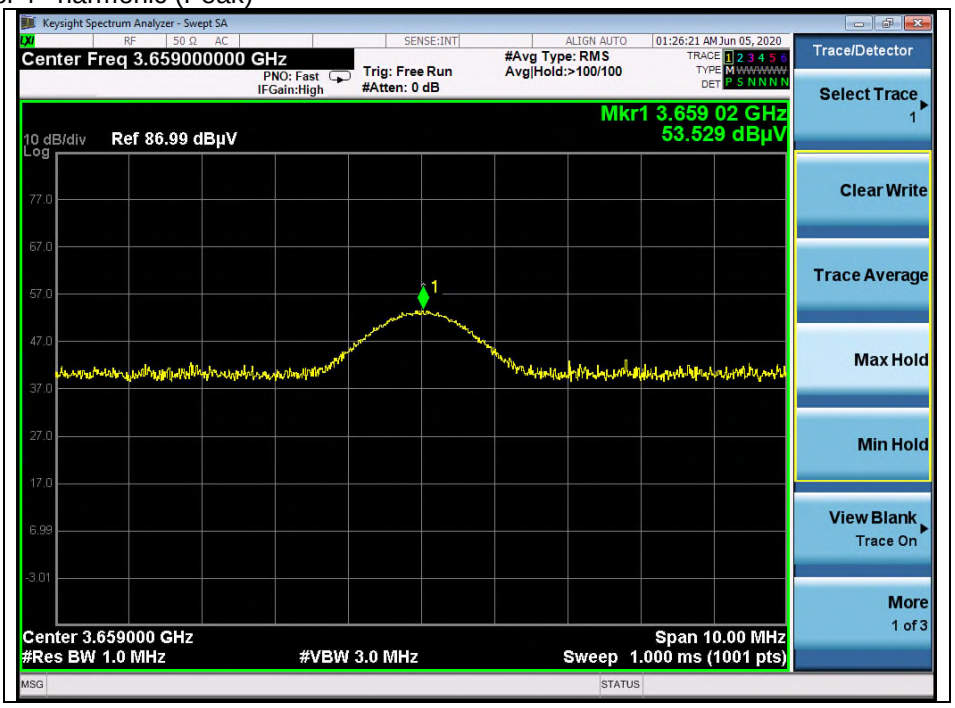
Middle channel 3rd harmonic (Peak)



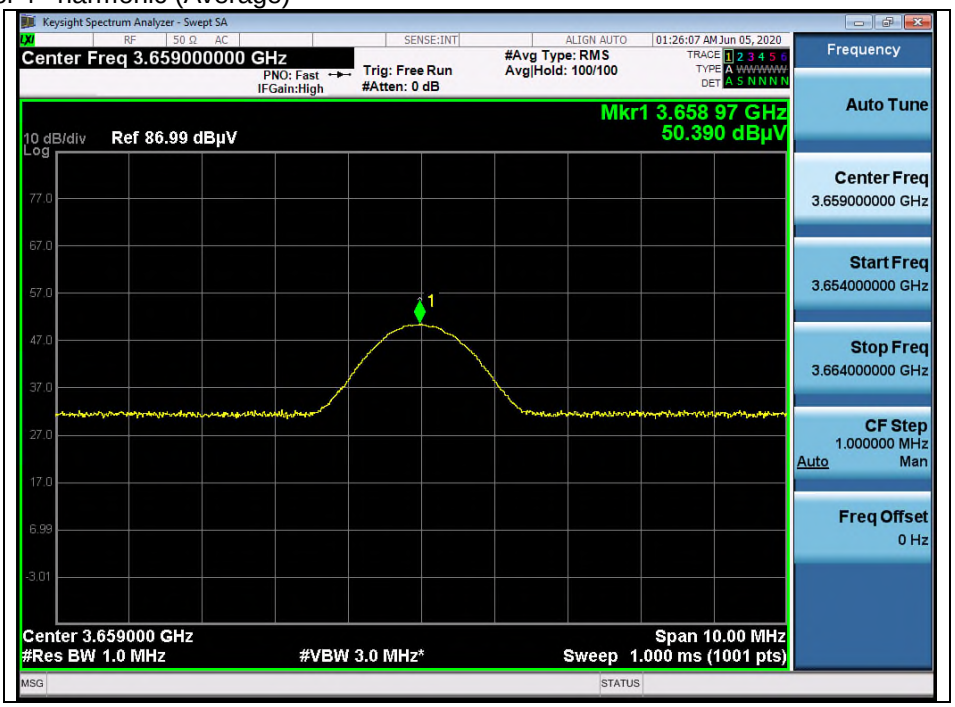

Middle channel 3rd harmonic (Average)



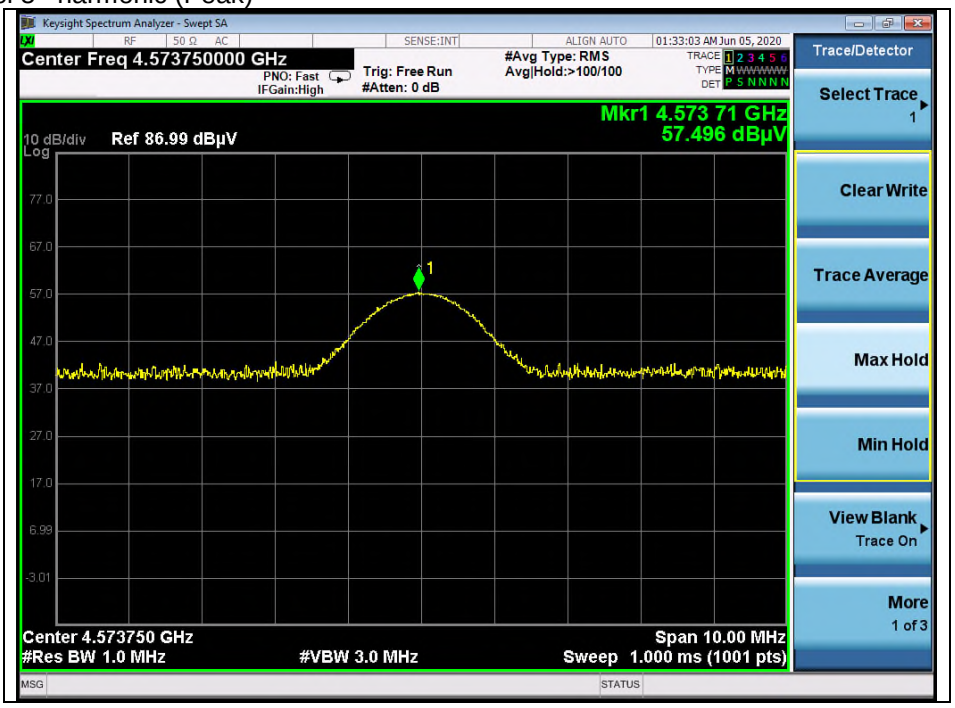
Middle channel 4th harmonic (Peak)



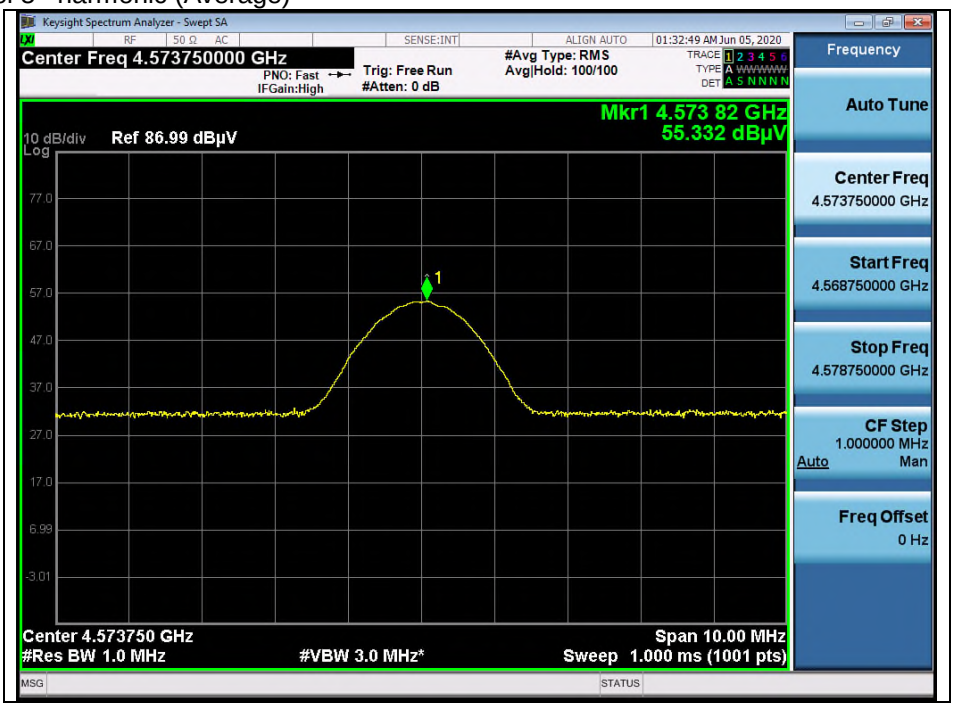

Middle channel 4th harmonic (Average)



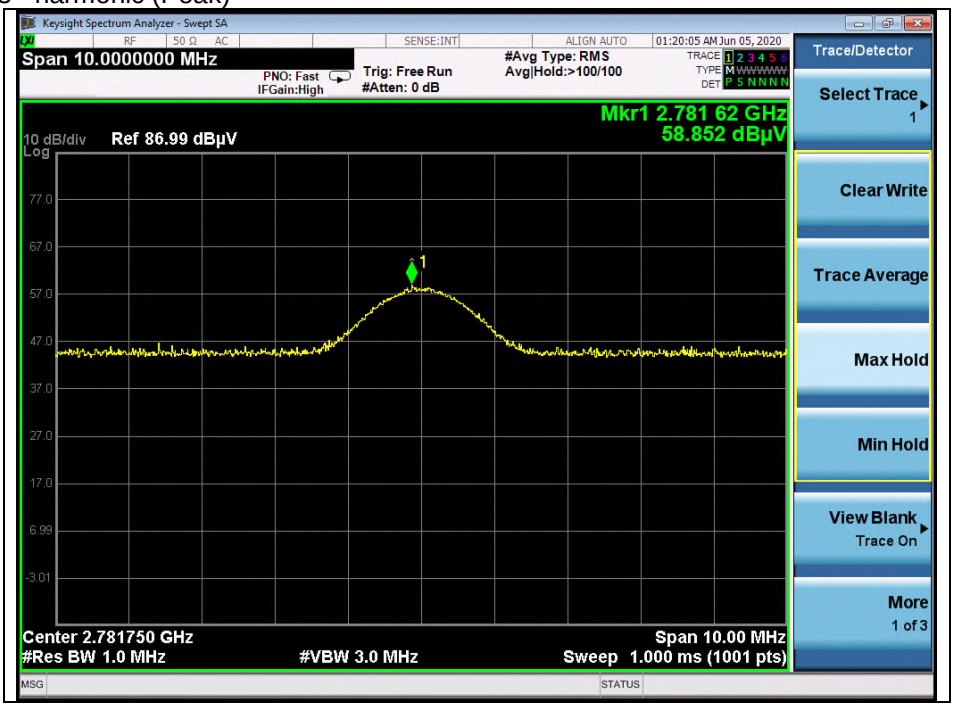
Middle channel 5th harmonic (Peak)



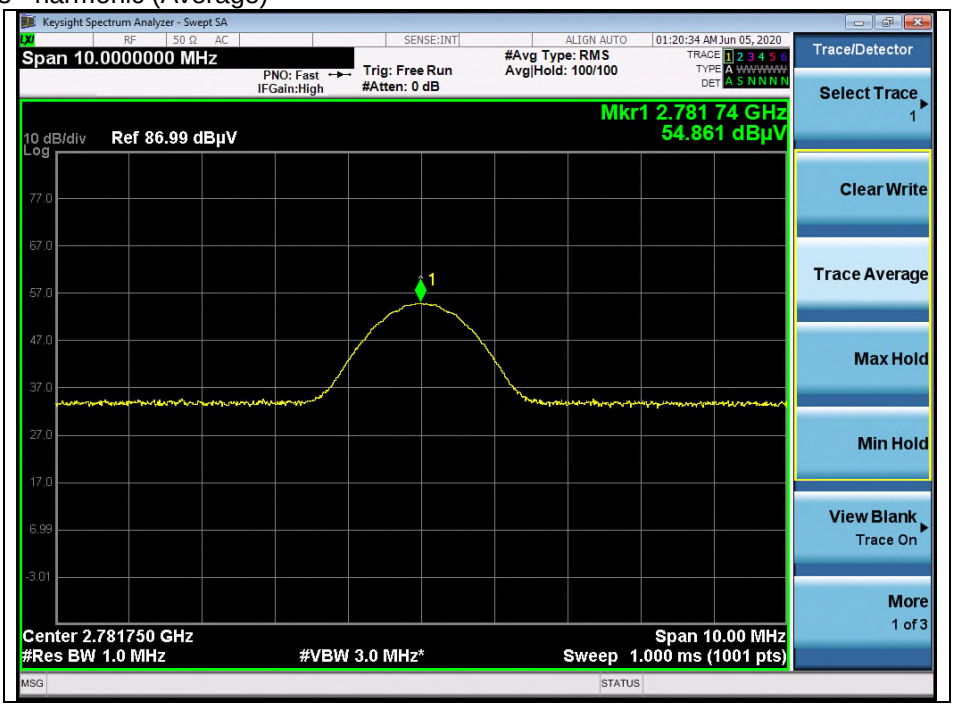

Middle channel 5th harmonic (Average)



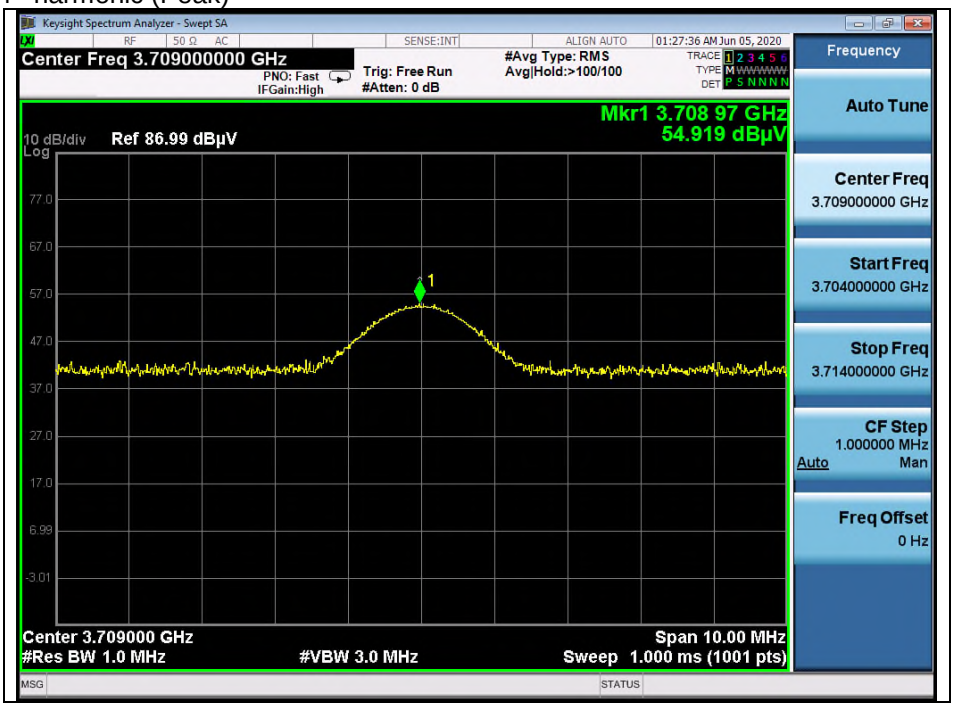
High channel 3rd harmonic (Peak)



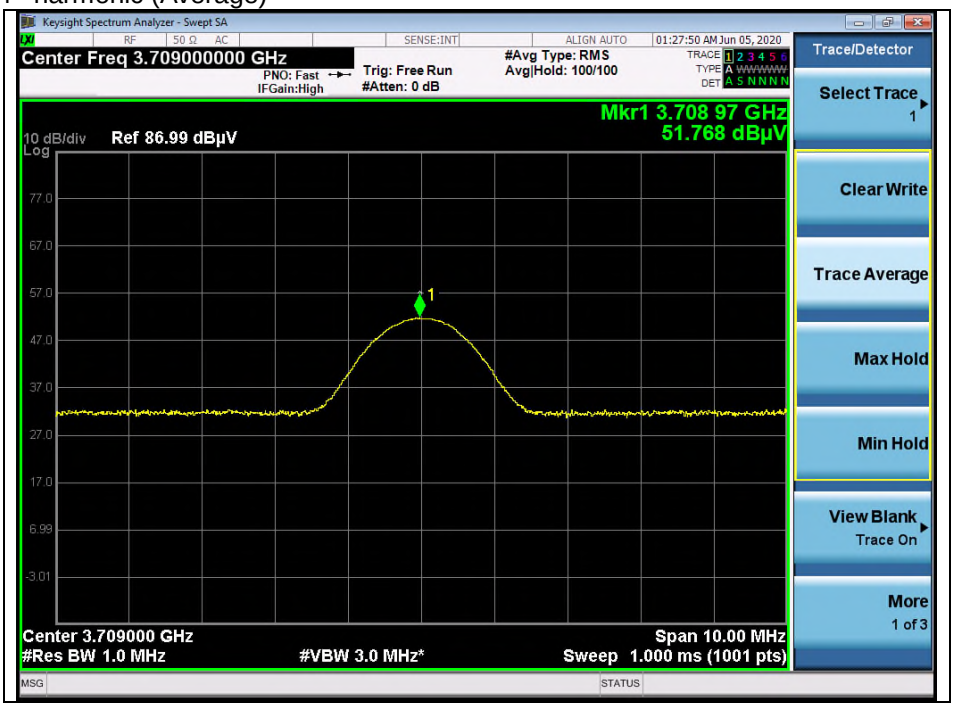

High channel 3rd harmonic (Average)



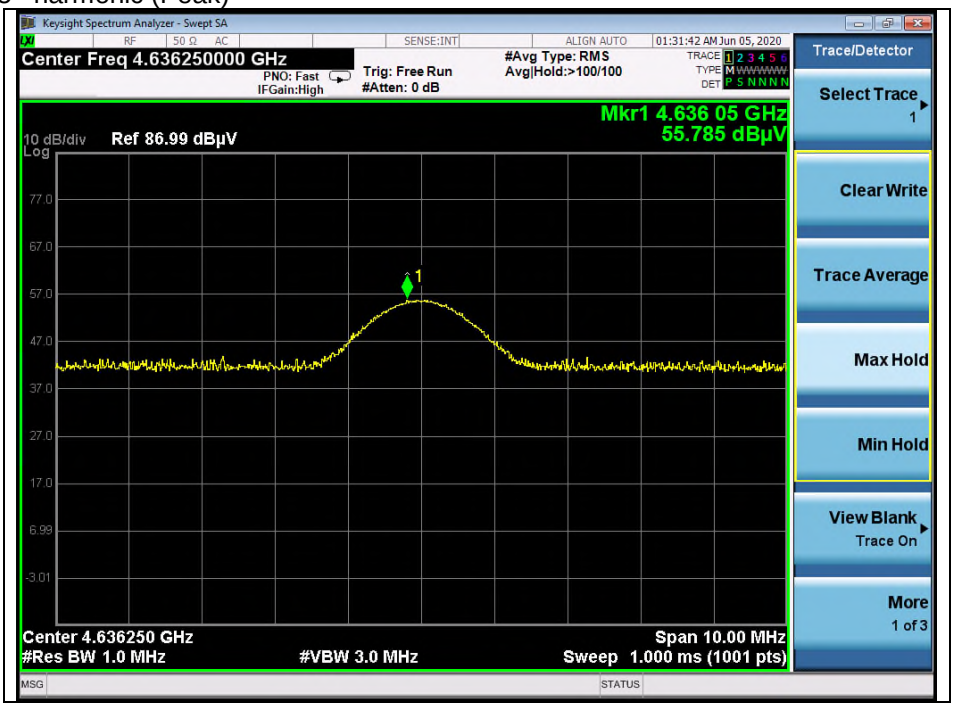
High channel 4th harmonic (Peak)



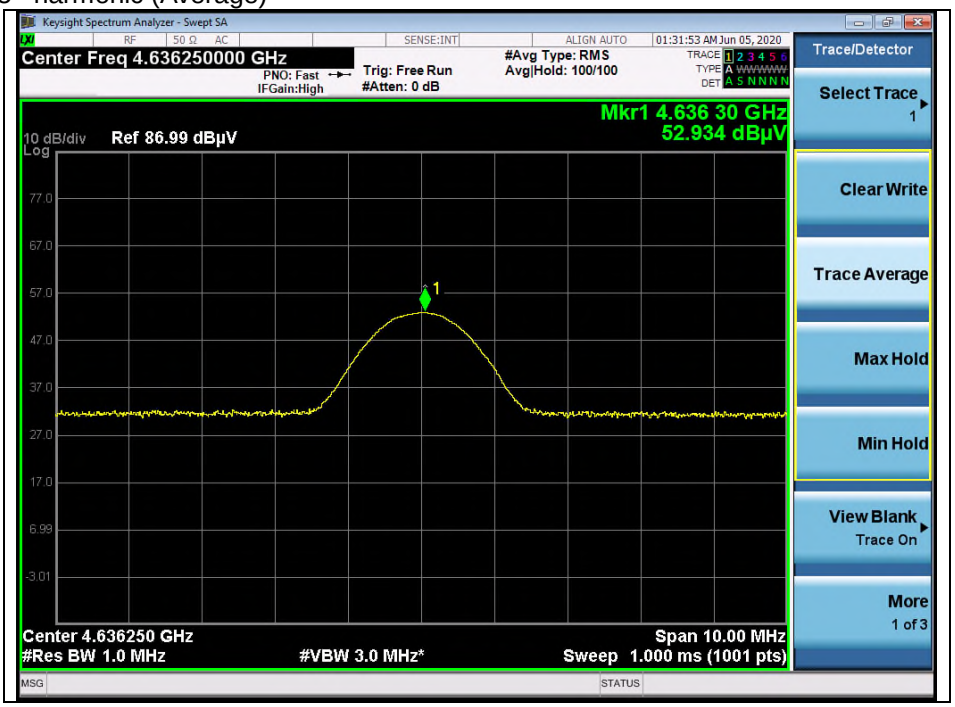

High channel 4th harmonic (Average)



High channel 5th harmonic (Peak)




High channel 5th harmonic (Average)



# 3. Antenna Requirement

## 3.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §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. And according to FCC 47 CFR Section §15.247(b) if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

## 3.2. Antenna Connected Construction

Antenna used in this product is Linear Polarized antenna with gain of 3.06 dBi.

**- End of the Test Report -**