

TEST REPORT

of

FCC Part 15 Subpart C §15.247

FCC ID: 2AWMDA711F

1. Equipment Under Test : RFID Smart Reader
2. Model Name : a711F
3. Variant Model Name(s) : -
4. Applicant : Apulse Technology Co., Ltd
5. Manufacturer : Apulse Technology Co., Ltd
6. Date of Receipt : 2020.04.03
7. Date of Test(s) : 2020.05.06 ~ 2020.06.05
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



SGS Korea Co., Ltd.

4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

Tel. +82 31 428 5700 / Fax. +82 31 427 2370

<http://www.sgsgroup.kr>

Report Number: F690501-RF-RTL000829

Page: 2 of 22

INDEX

<u>Table of Contents</u>	Page
1. General Information -----	3
2. Transmitter Radiated Spurious Emissions -----	7
3. Antenna Requirement -----	22

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	a711F
Power Supply	DC 3.7 V
Frequency Range	902.75 MHz ~ 927.25 MHz (RFID)
Modulation Technique	ASK
Number of Channels	50 channels (RFID)
Antenna Type	Linear Polarized antenna
Antenna Gain	3.06 dB 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) 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) 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 (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 (dB μ V/m) = Measured level (dB μ V) + 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 kHz to 30 MHz	± 3.59 dB
Radiated Emission, below 1 GHz	± 5.88 dB
Radiated Emission, above 1 GHz	± 5.94 dB

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

1.10. Test Report Revision

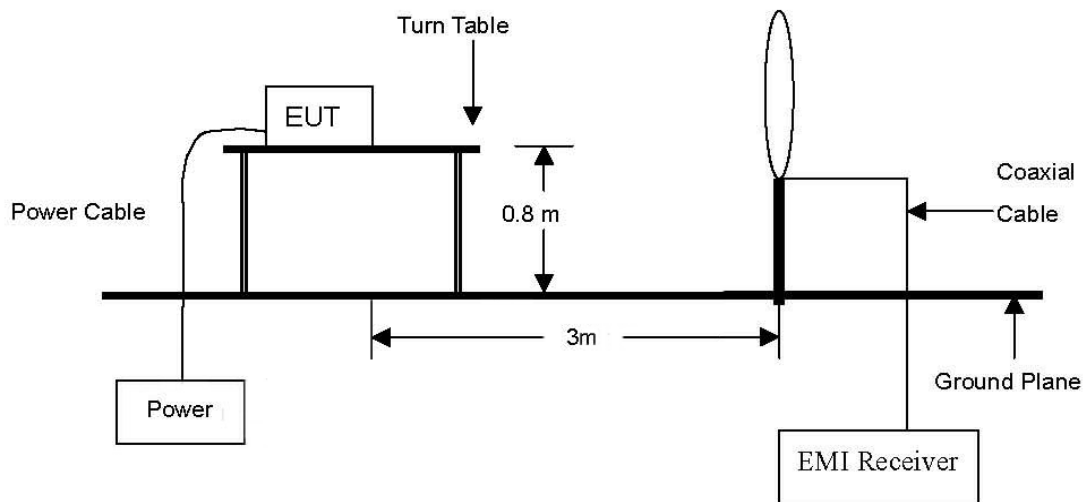
Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL000829	2020.06.26	Initial

2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

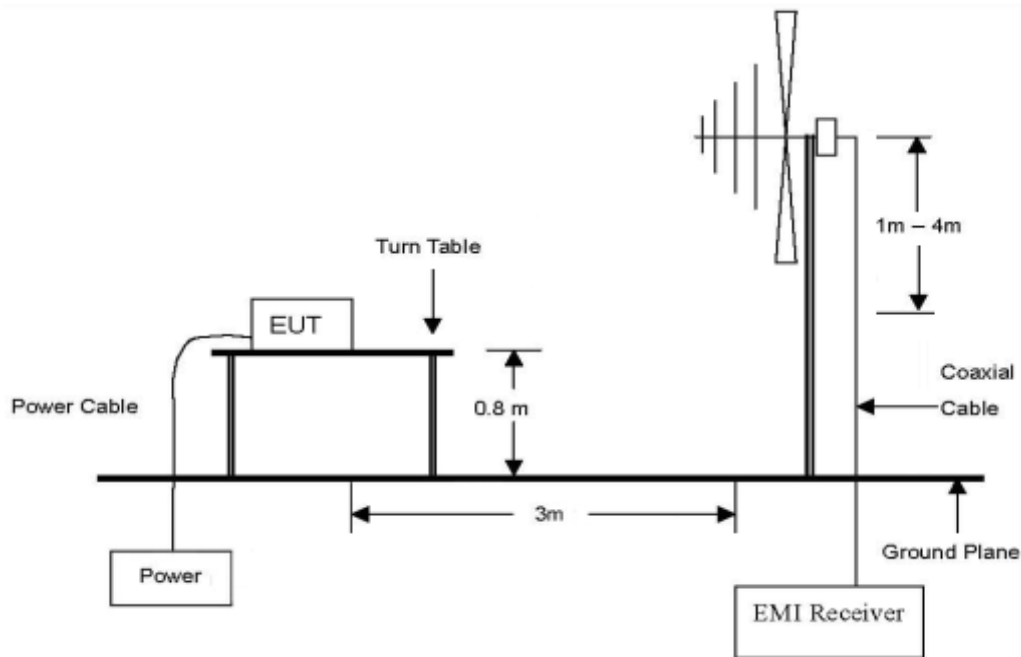
2.1. Test Setup

2.1.1. Transmitter Radiated Spurious Emissions

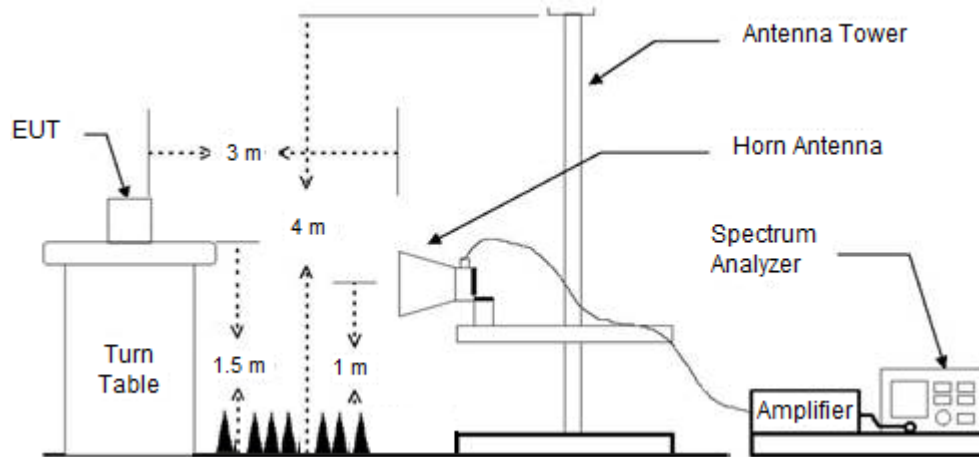
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz.



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



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



2.2. Limit

According to §15.247(d), 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. 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 dB instead of 20 dB. 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 (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (Meters)
0.009-0.490	2 400/F(kHz)	300
0.490-1.705	24 000/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

** 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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. 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 MHz

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 MHz

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 GHz and 1.5 meter above the ground at a 3 meter anechoic chamber test site above 1 GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, 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 GHz, 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 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. For frequency above 1 GHz, set spectrum analyzer detector to peak, and resolution bandwidth is 1 MHz and video bandwidth is 3 MHz.
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) °C
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 kHz to 9 500 MHz was investigated.

A. Low Channel (902.75 MHz)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*2 708.23	62.05	Peak	H	28.77	-38.77	52.05	74.00	21.95
*2 708.23	59.92	Average	H	28.77	-38.77	49.92	54.00	4.08
*3 610.91	52.70	Peak	H	31.43	-37.17	46.96	74.00	27.04
*3 611.03	49.00	Average	H	31.43	-37.17	43.26	54.00	10.74
*4 513.65	58.07	Peak	H	32.07	-36.64	53.50	74.00	20.50
*4 513.79	55.07	Average	H	32.07	-36.64	50.50	54.00	3.50
Above 4 600.00	Not detected	-	-	-	-	-	-	-

B. Middle Channel (914.75 MHz)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*2 744.24	56.97	Peak	H	28.62	-38.68	46.91	74.00	27.09
*2 744.24	54.69	Average	H	28.62	-38.68	44.63	54.00	9.37
*3 659.05	53.52	Peak	H	31.97	-37.11	48.38	74.00	25.62
*3 659.07	49.98	Average	H	31.97	-37.11	44.84	54.00	9.16
*4 573.89	55.79	Peak	H	31.95	-36.64	51.10	74.00	22.90
*4 573.77	53.68	Average	H	31.95	-36.64	48.99	54.00	5.01
Above 4 600.00	Not detected	-	-	-	-	-	-	-

C. High Channel (927.25 MHz)

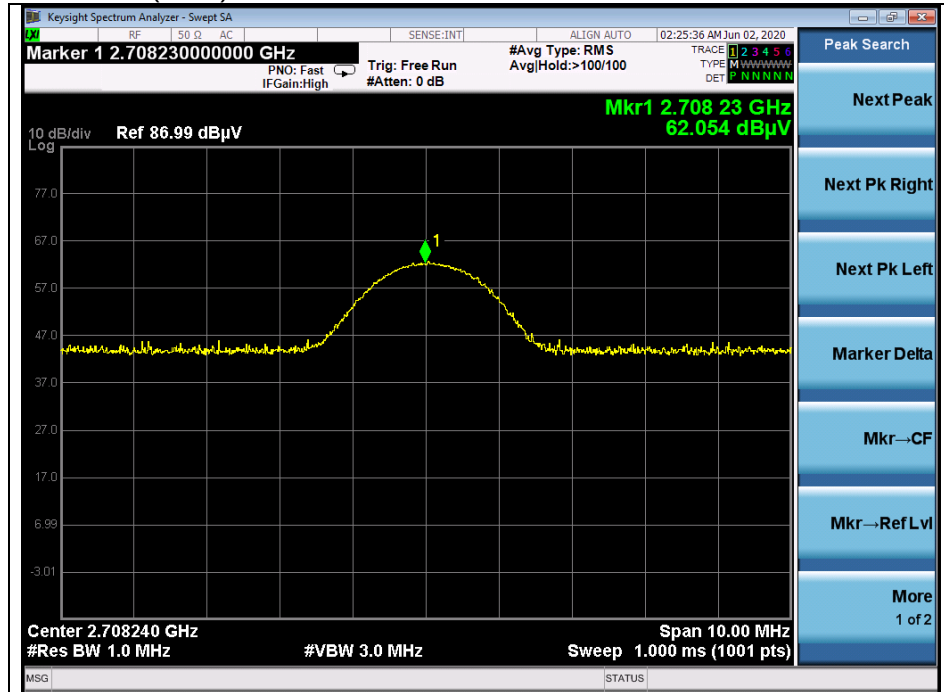
Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBμV)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
*2 781.74	51.09	Peak	H	28.79	-38.73	41.15	74.00	32.85
*2 781.74	45.50	Average	H	28.79	-38.73	35.56	54.00	18.44
*3 708.88	53.16	Peak	H	32.28	-37.07	48.37	74.00	25.63
*3 708.86	48.58	Average	H	32.28	-37.07	43.79	54.00	10.21
*4 636.15	58.19	Peak	H	32.04	-36.59	53.64	74.00	20.36
*4 636.25	55.92	Average	H	32.05	-36.59	51.38	54.00	2.62
Above 4 700.00	Not detected	-	-	-	-	-	-	-

Remark;

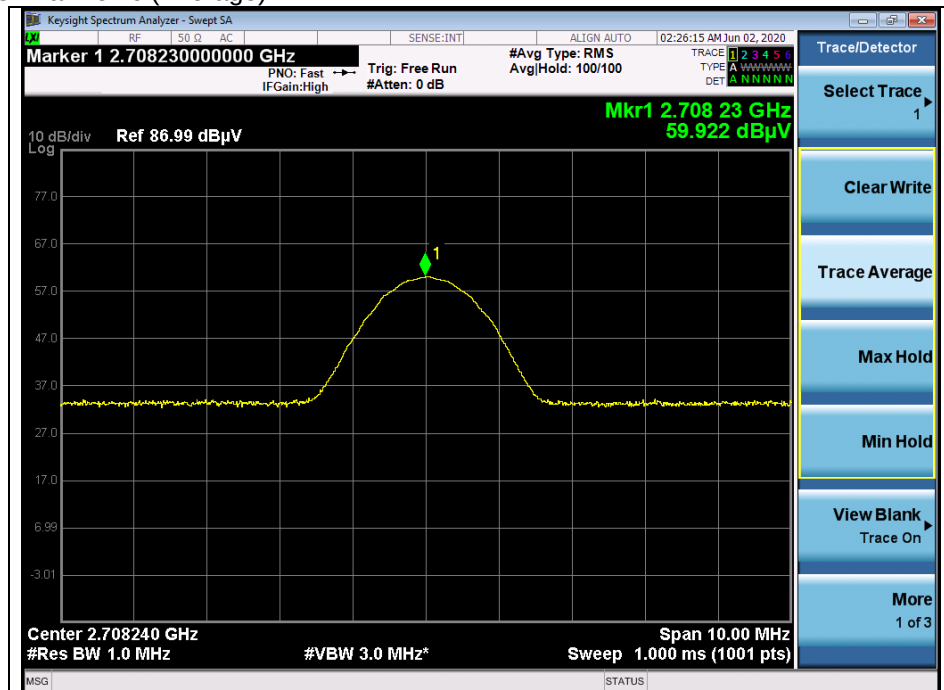
1. “*” means the restricted band.
2. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
3. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
4. Actual = Reading + AF + CL + (DF) or Reading + AF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

- Test plots

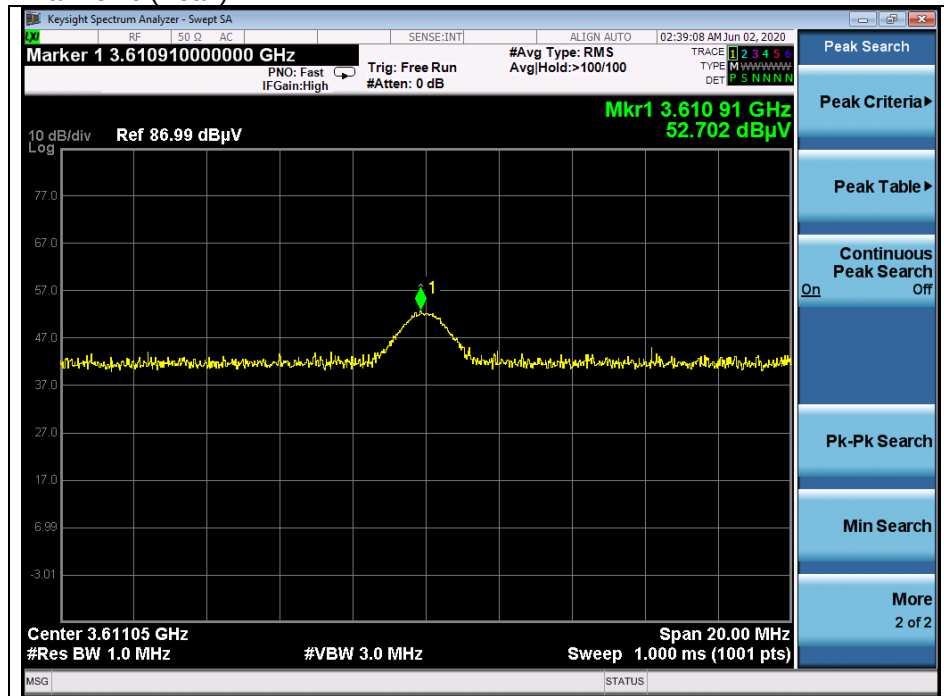
Low channel 3rd harmonic (Peak)



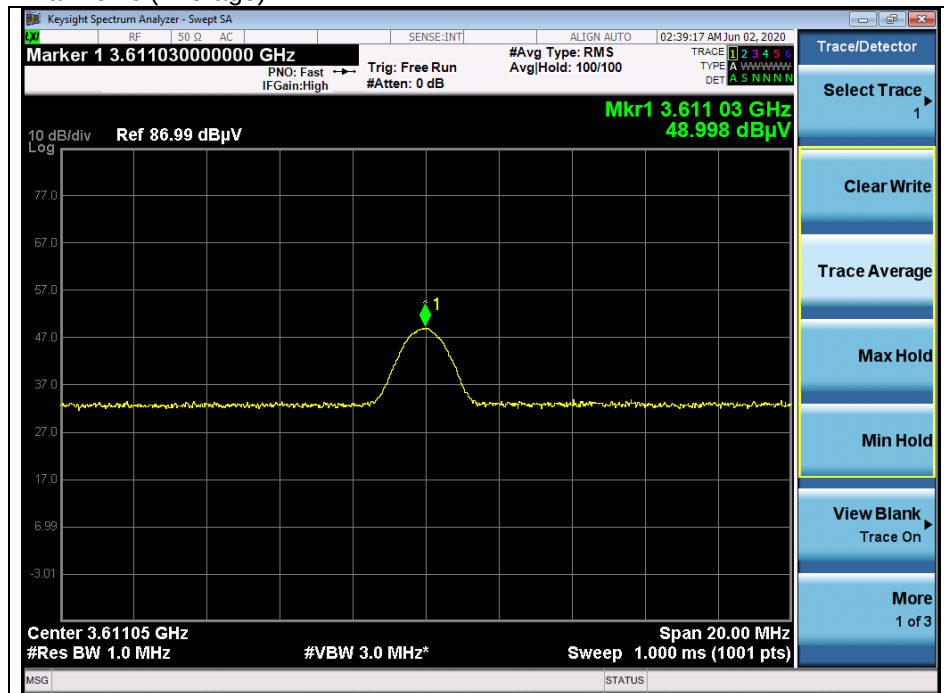
Low channel 3rd harmonic (Average)



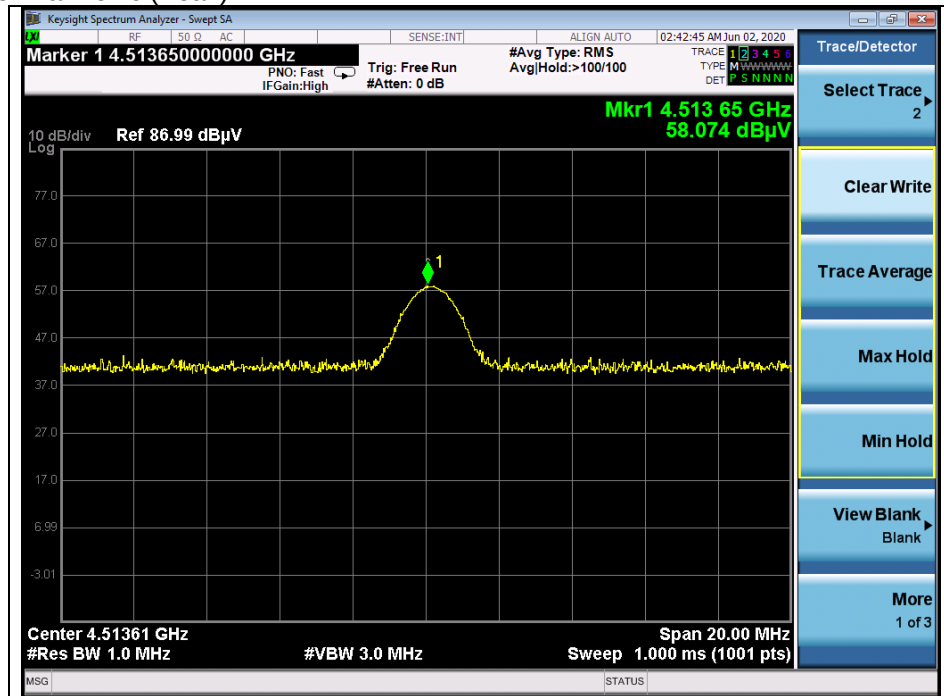
Low channel 4th harmonic (Peak)



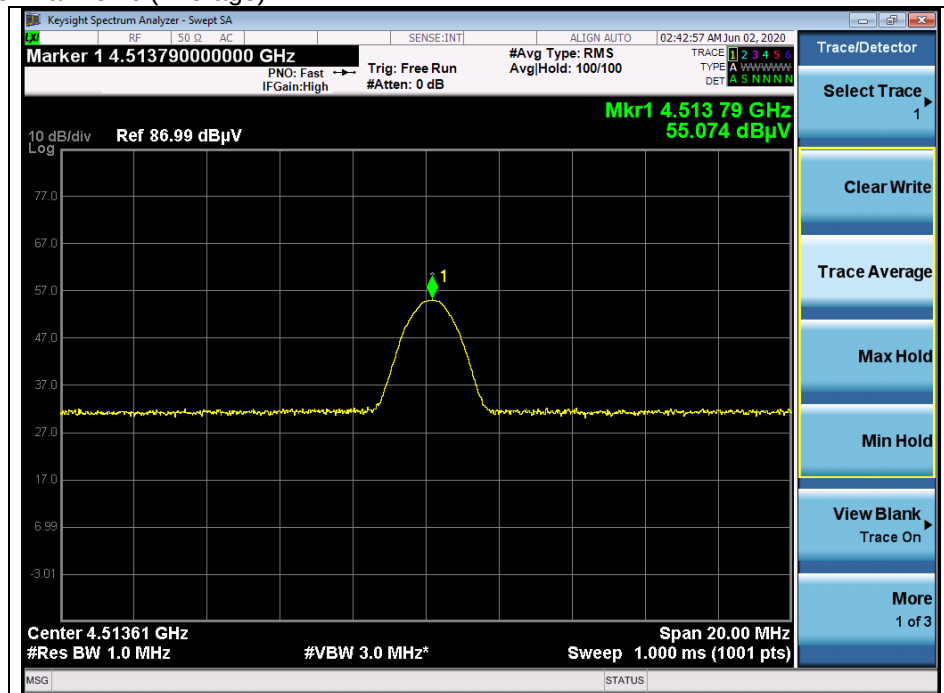
Low channel 4th harmonic (Average)



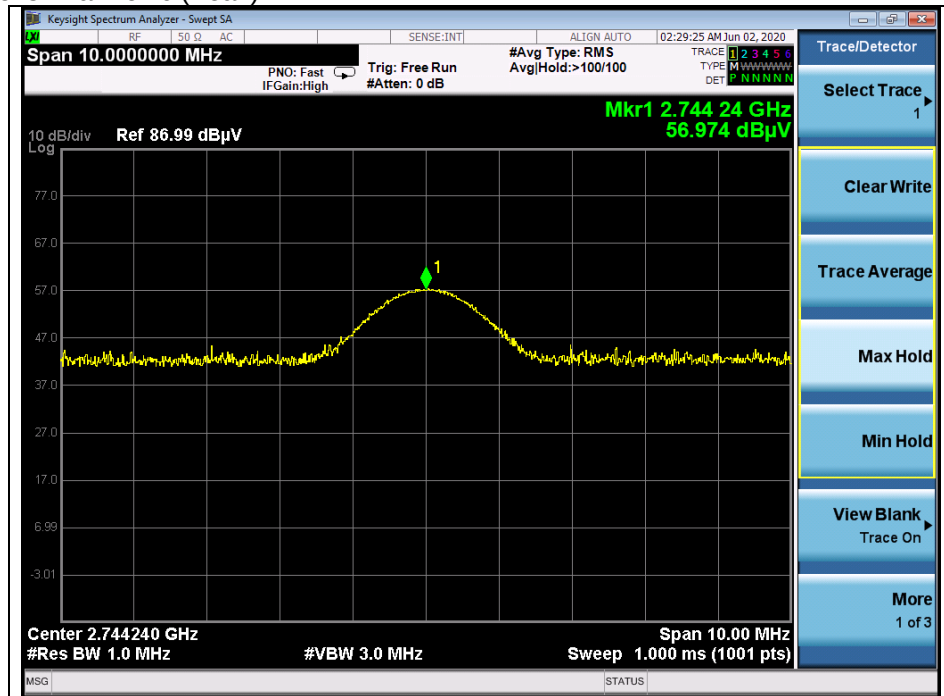
Low channel 5th harmonic (Peak)



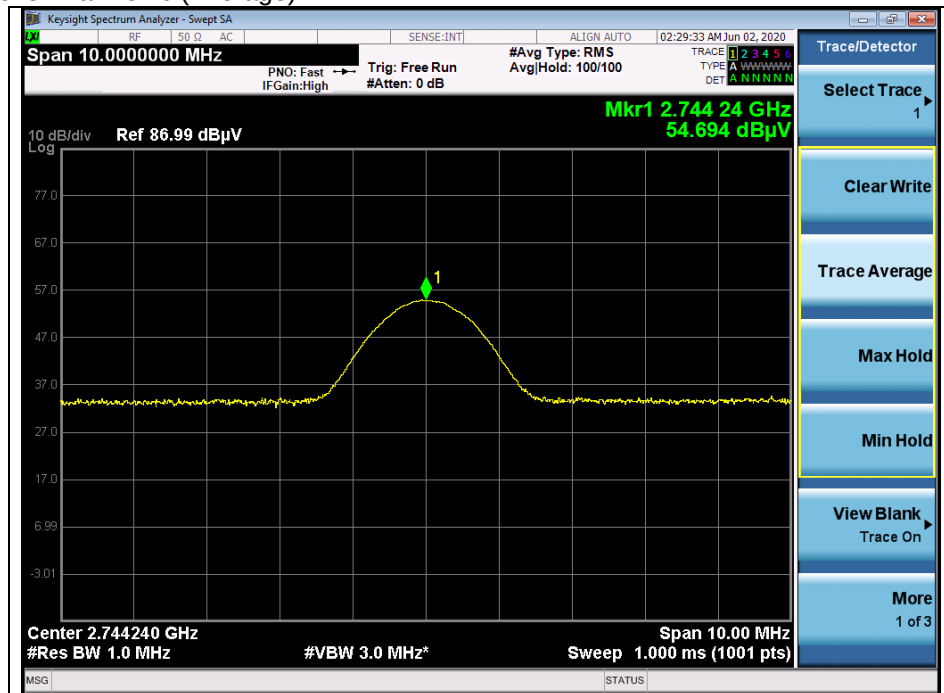
Low channel 5th harmonic (Average)



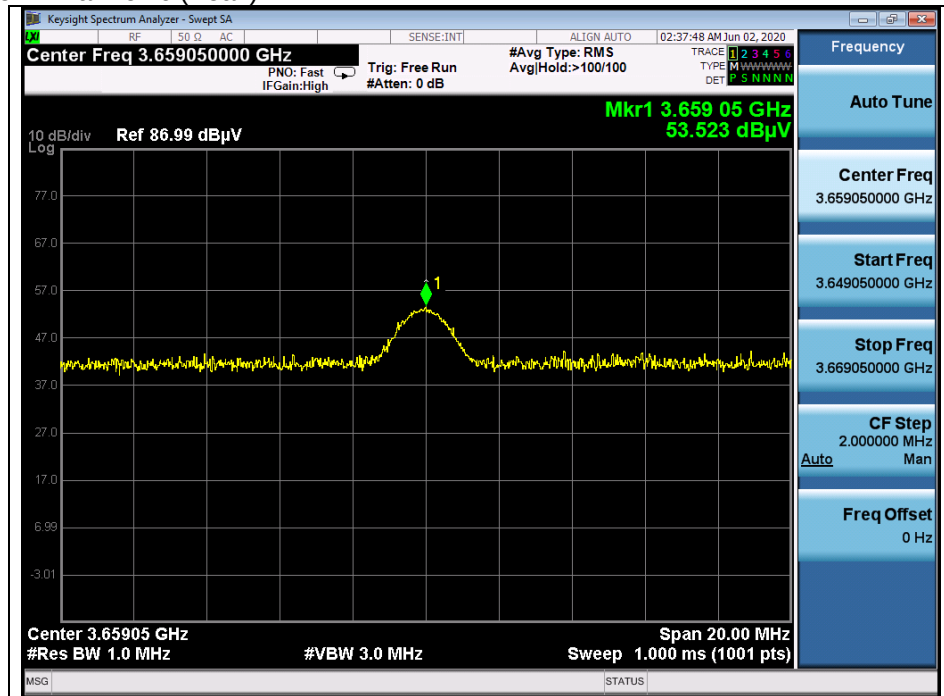
Middle channel 3rd harmonic (Peak)



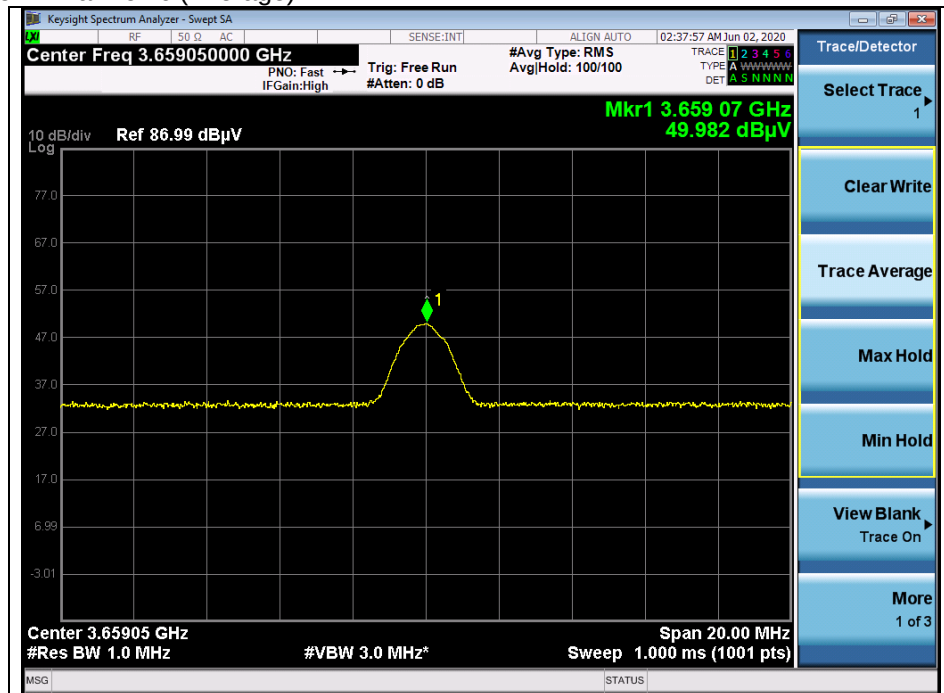
Middle channel 3rd harmonic (Average)



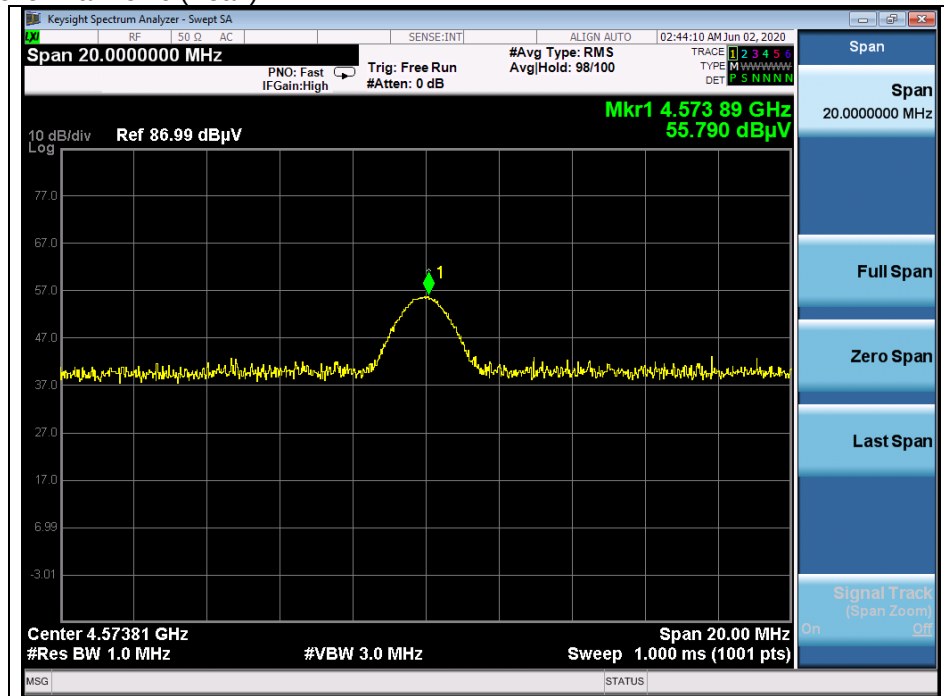
Middle channel 4th harmonic (Peak)



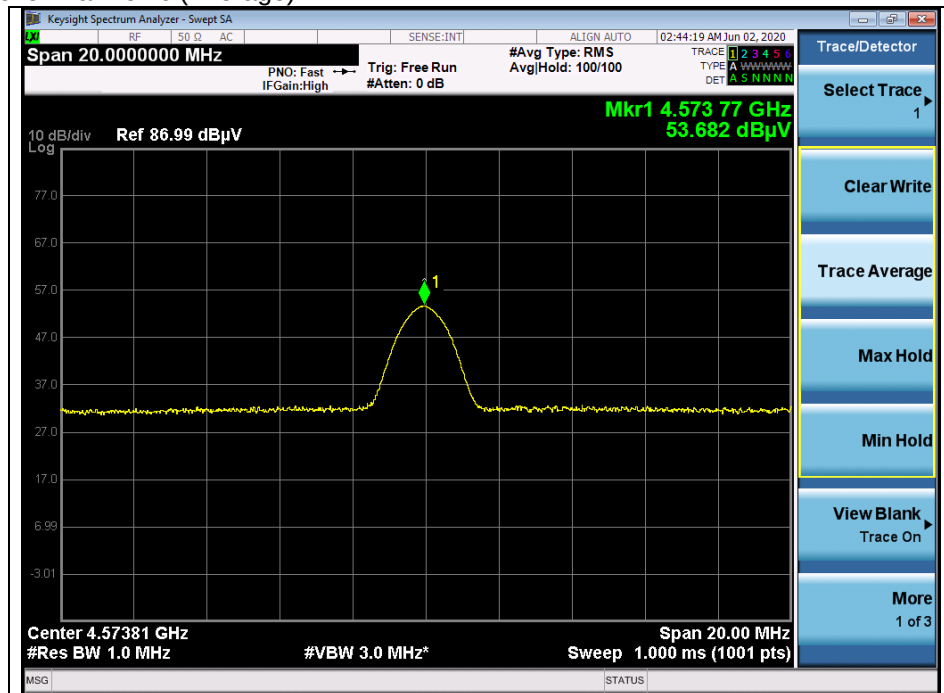
Middle channel 4th harmonic (Average)



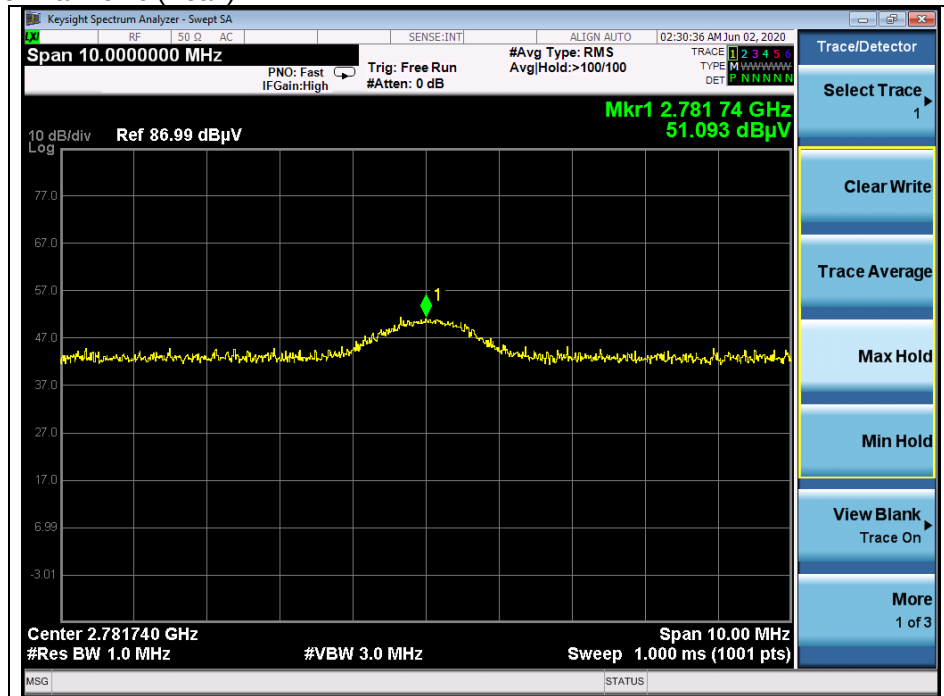
Middle channel 5th harmonic (Peak)



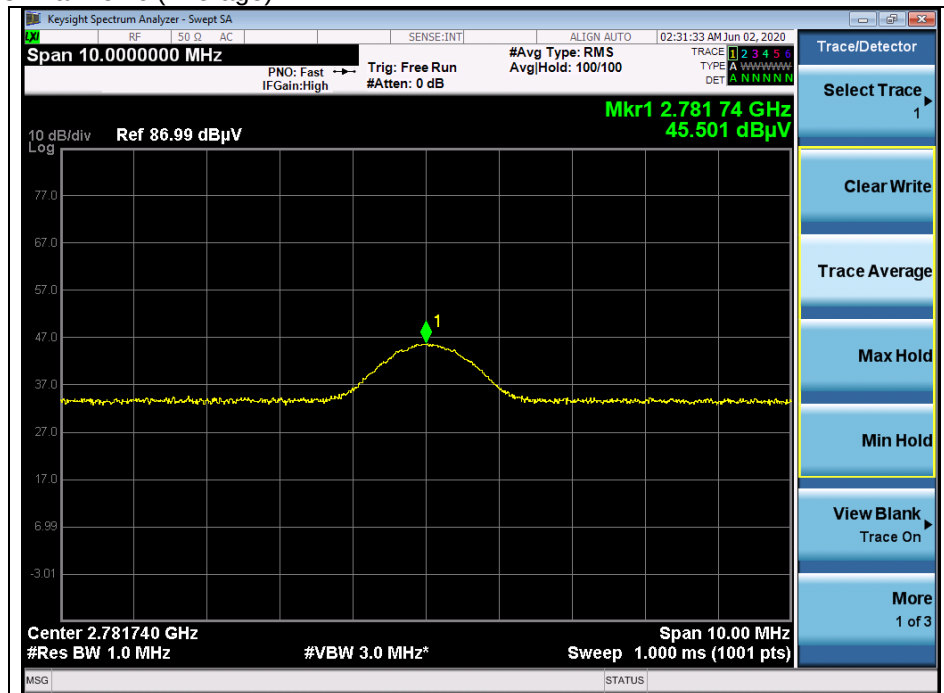
Middle channel 5th harmonic (Average)



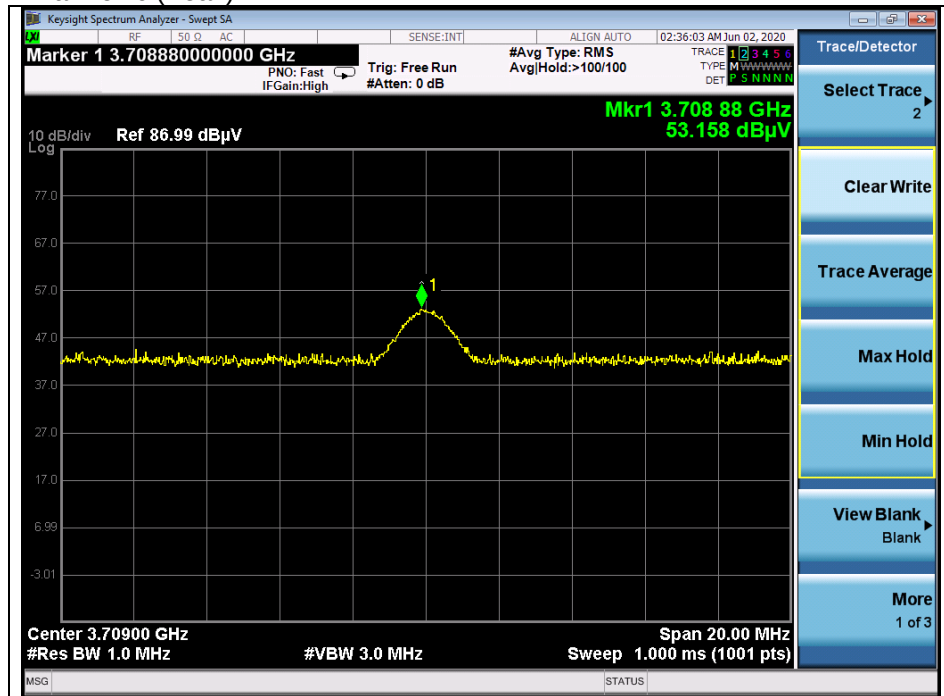
High channel 3rd harmonic (Peak)



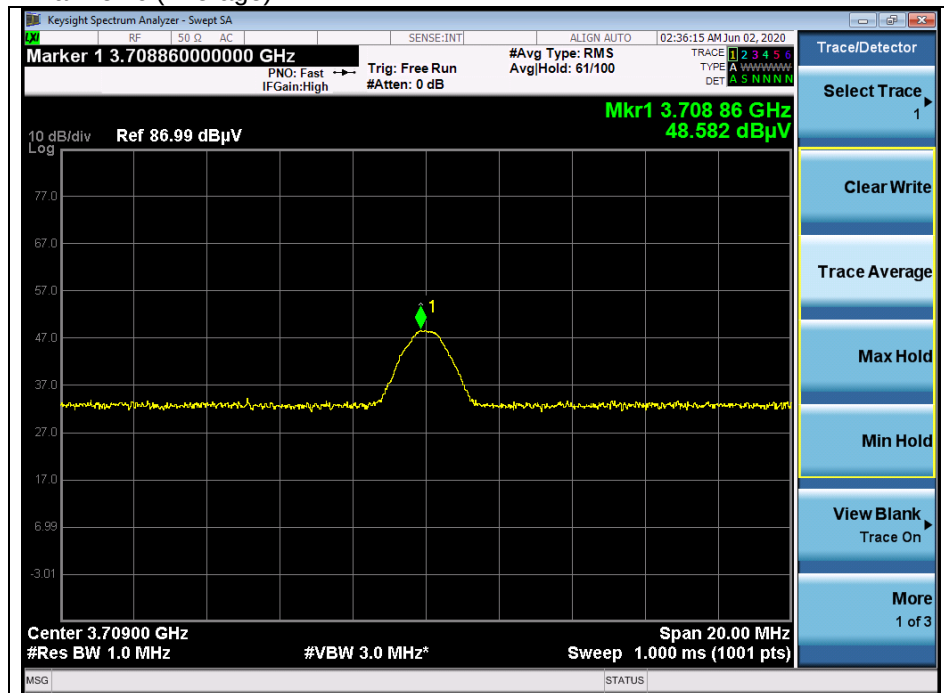
High channel 3rd harmonic (Average)



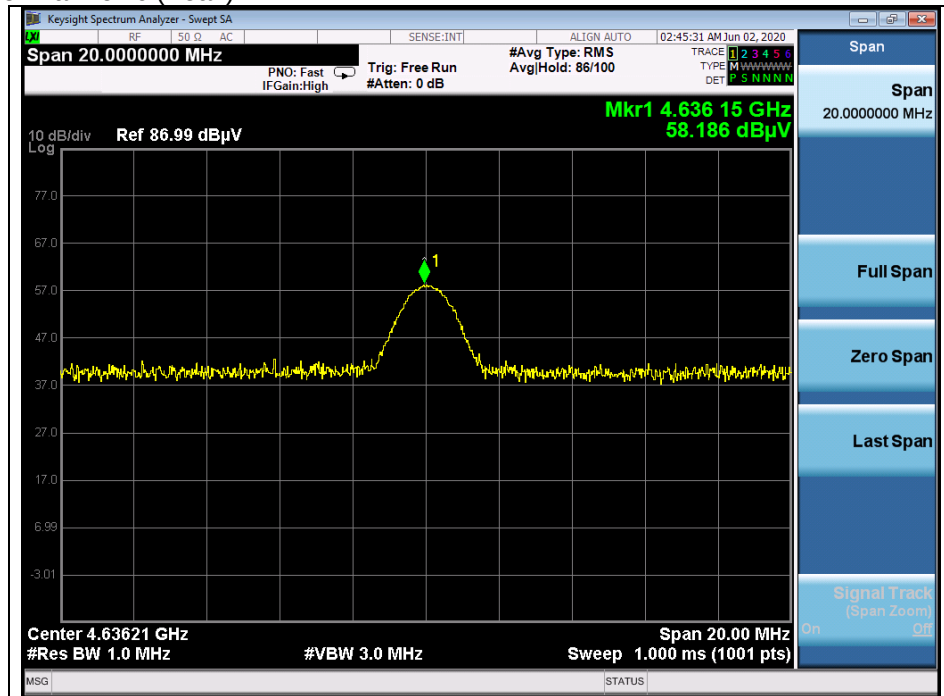
High channel 4th harmonic (Peak)



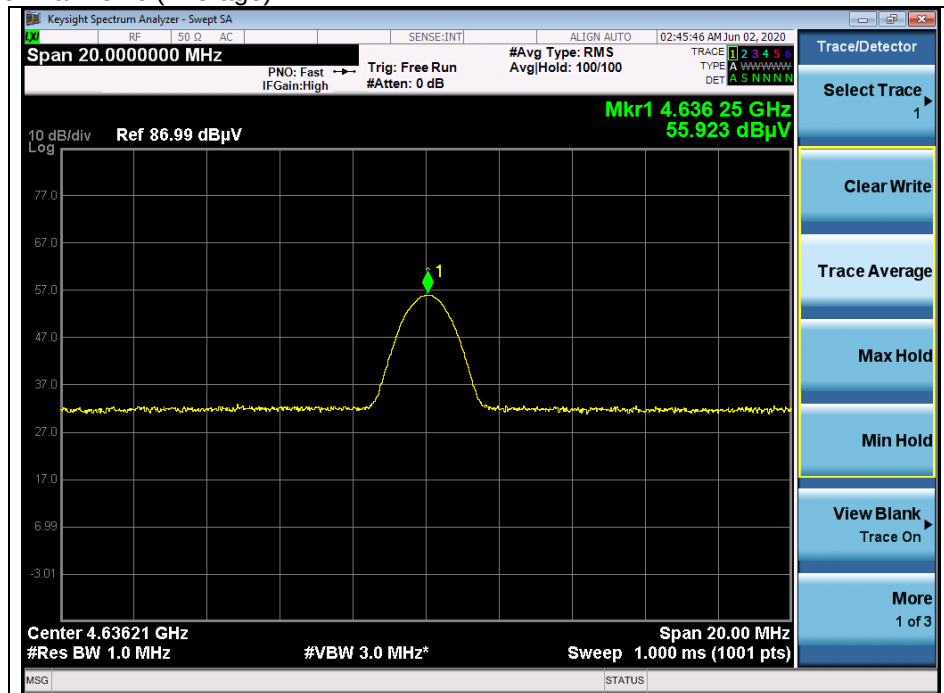
High channel 4th harmonic (Average)



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 -