Advanced
Compliance Laboratory

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FCC CFR47 PART 15 SUBPART C & IC RSS-247

TEST REPORT

For

Vehicle Asset Communicator

**Model Number: VAC4-Wi-Fi-MultiProx, VAC4-MultiProx,
VAC4-Wi-Fi-IDS Prox, VAC4-IDS Prox,
VAC4-Wi-Fi-iButton, VAC4-iButton,
VAC4-Wi-Fi-Keypad, VAC4-Keypad**

FCC ID: N5VVAC4A
IC: 3802A-VAC4A

Report Number: 0048-160125-01

Prepared for
I.D. Systems, Inc.
123 Tice Boulevard, Suite 101
Woodcliff, NJ 07677
USA

Prepared by
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Date: 02/04/2016

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1. TEST RESULT CERTIFICATION

COMPANY NAME: I.D. Systems, Inc.
123 Tice Boulevard, Suite 101
Woodcliff, NJ 07677, USA

EUT DESCRIPTION: Vehicle Asset Communicator

MODEL: **VAC4-Wi-Fi-MultiProx/ VAC4-Wi-Fi-IDS Prox/ VAC4-Wi-Fi-iButton/VAC4-Wi-Fi-Keypad**

DATE TESTED: January 25, 2016 to February 4, 2016

	APPLICABLE STANDARDS
STANDARD	**TEST RESULTS**
FCC Part 15.247 & IC RSS-247 (May 2015)	NO NON-COMPLIANCE NOTED

Advanced Compliance Laboratory, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note : This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Advanced Compliance Laboratory, Inc. (ACL) and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by ACL, Advanced Compliance Laboratory, Inc. will constitute fraud and shall nullify the document.

Approved & Released For ACL By:

Wei Li

Manager
Advanced Compliance Laboratory, Inc.

Tested By:

Edward Lee

EMC Engineer

2. EUT DESCRIPTION

The EUT for this certification is a low power transmitter, using digital modulation & operating in the 902-928 MHz band.

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Rated Power Selection	Tested Average Power (dBm/W)	Tested Peak Power (dBm/W)
902.6-927.2		13.47 /0.022	13.85/0.024

The EUT uses a 1dBi gain, Low Profile and High Efficiency 915 MHz ISM Band Loop Antenna by Taoglas, Part # ILA.01.

There are eight different models for the VAC4. The differentiation is based on which access method is used in the system. From the TX perspective they all have the same 900MHz Band radio, which is for this certification.

Optional Wi-Fi module, iW-SMG2N1 is certified under FCC ID:XM5-SMG2N1, IC: 8516A-SMG2N1 with Tyco Part #1513349-1, 0dBi gain antenna. 2.4GHz Wi-Fi transmitter and 900MHz transmitter will not operate at the same time.

Below is the different models for VAC4 and its key differences:

1. VAC4-Wi-Fi-MultiProx
    a. The Access reader is the multi-frequency reader, which only receives with cards that work on 125 KHz as well as the 13.56 MHz cards. The unit has Wi-Fi Module

2. VAC4-MultiProx
    a. The Access reader is the multi-frequency reader, which only receive with cards that work on 125 KHz as well as the 13.56 MHz cards.

3. VAC4-Wi-Fi-IDS Prox
    a. The Access reader only receive at 125 KHz. The unit has Wi-Fi Module

4. VAC4- IDS Prox
    a. The Access reader only receive at 125 KHz.

5. VAC4-Wi-Fi-iButton
    a. The iButton is one wire interface device to provide access control. The unit has Wi-Fi Module

6. VAC4-iButton

a. The iButton is one wire interface device to provide access control.

7. VAC4-Wi-Fi-Keypad
   a. In this model, there is no additional access reader. The keypad is used to login into the VAC and acts an access control element. The unit has Wi-Fi Module

8. VAC4-Keypad
   a. In this model, there is no additional access reader. The keypad is used to login into the VAC and acts an access control element

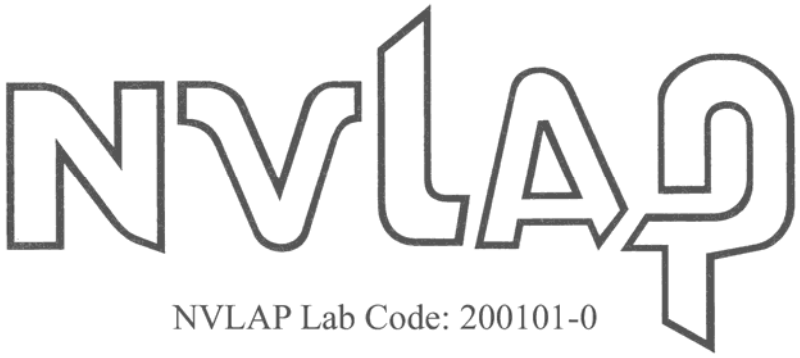
3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/C63.10, FCC CFR 47 Part 2 & 15 and IC RSS-247. Test procedure described in FCC "KDB 558074 D01 DTS Measurement Guidance" is used in this report.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at Hillsborough, New Jersey, USA The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

ACL is accredited by NVLAP, Laboratory Code 200101-0. The full accreditation can be viewed at http://www.ac-lab.com



No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. MEASUREMENT UNCERTAINTY

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	±2.36	±2.99	±1.83

5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Manufacturer	Model	Serial No.	Description	Last Cal mm/dd/yy	Cal Due Mm/dd/yy
Agilent	E4440A	US40420700	3Hz-26.5GHz Spec. Analyzer	6/06/15	6/06/16
R &S	ESPI	100018	9KHz-7GHz EMI Receiver	8/25/15	8/25/16
HP	HP8546A	3448A00290	9kHz to 6.5GHz EMI Receiver	10/16/15	10/16/16
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	10/19/15	10/19/16
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	10/19/15	10/19/16
Electro-Meterics	ALR-25M/30	289	10KHz-30MHz Active Loop Antenna	8/28/15	8/28/16
EMCO	3115	4945	Double Ridge Guide Horn Antenna	10/17/15	10/17/16
R&S	SMH	8942280/010	Signal Generator		
RES-NET	RFA500NFF30	0108	30dB in-line Power Attenuator		

All Test Equipment Used are Calibrated Traceable to NIST Standards.

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

n/a

TEST SETUP

Testing Frequency/Channel/Port Selection:

- L(owest), M(iddle), H(ighest) Channels of 900MHz Band.
- Measured at EUT's antenna connector on PCB for conducted measurements
- 1.0dBi gain antenna is used for radiated emission test.
- Channel Selection: Low Channel=902.6MHz; Middle Channel=915.2MHz; High Channel=927.2MHz
- For intentional radiator measurements, only 900MHz Band transmitter was activated. The rest circuitry was set as Standby/ Receiving mode during the test. Based on pre-scan results, the configuration, VAC4-Wi-Fi-MultiProx, was chosen as the worst case for final data collection.

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 6dB &99% BANDWIDTH

LIMIT

§15.247 (a) (2) & RSS-247 5.2(1): Min. 6dB bandwidth should be no less than 500KHz.

TEST PROCEDURE *per FCC KDB 558074D01v03r02*

Measurement Procedure for Emission Bandwidth (DTS Bandwidth)	Applicable to this EUT
8.1 DTS BW Measurement Procedure: Option 1	☐
8.2 DTS BW Measurement Procedure: Option 2	☒

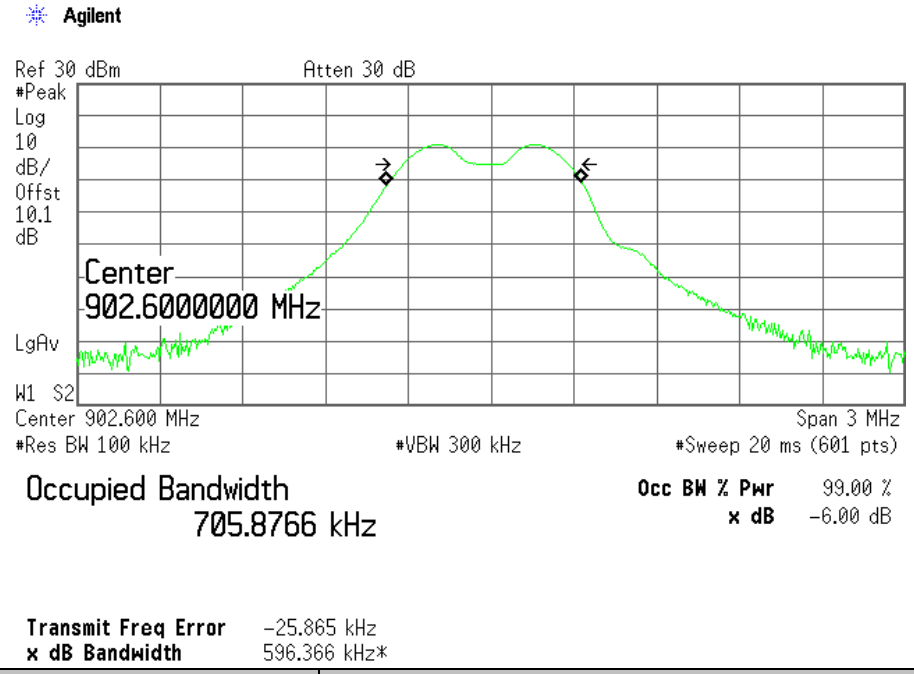
RESULTS

No non-compliance noted.

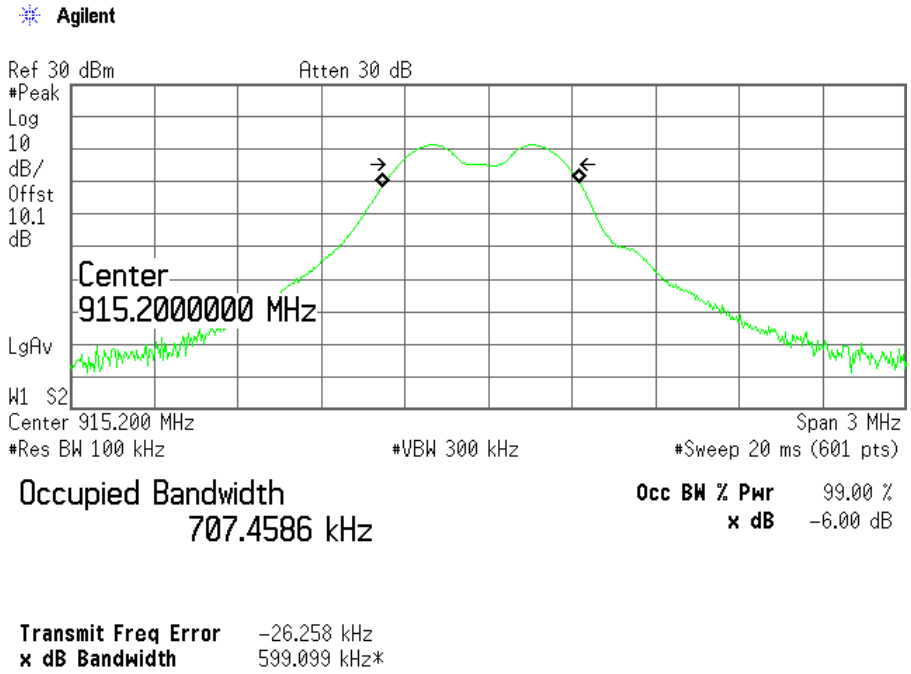
Channel	Frequency (MHz)	6dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	902.6	596.366	705.8766
Middle	915.2	599.099	707.4586
High	927.2	601.572	707.1922

6dB & 99% BANDWIDTH

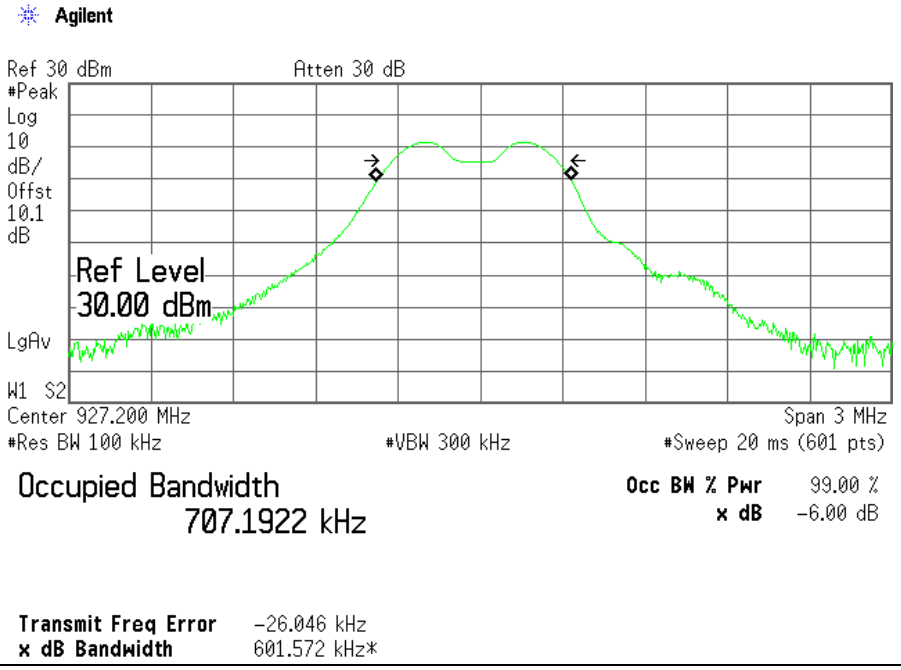
Plot Name:	6dB &99% Bandwidth, Low CH



Plot Name:	6dB &99% Bandwidth, Mid CH



Plot Name:	6dB & 99% Bandwidth High CH



7.2. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b)(3) & RSS-247 5.4(4)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in the 902-928 MHz band: 1 Watt.

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

b(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Therefore, the applicable output power limit shall be calculated as follows:

Pout = 30 -(Gtx-6) for antenna gain ≤6dBi or
Pout = 30 -Floor[(Gtx-6)/3]
G_{Tx} = the maximum transmitting antenna directional gain in dBi.

TEST PROCEDURE ***per FCC KDB 558074D01v03r02***

Measurement Procedure for Fundamental Emission Output Power	Applicable to this EUT
9.1.1 Maximum Peak Conducted Output Power Level Measurement Procedure Option 1 (RBW≥DTS BW)	☒**preferred**
9.1.2 Maximum Peak Conducted Output Power Level Measurement Procedure Option 2 (RBW<DTS BW)	☐
9.1.3 Maximum Peak Conducted Output Power Level Measurement Procedure Option 3 (Peak Power Meter Method)	☐
9.2.2 Maximum Conducted (average) Output Power Level * Measurement Procedure Option 1 (Measurement using a spectrum analyzer (SA))	☐
9.2.3 Maximum Conducted (average) Output Power Level * Measurement Procedure Option 2 (using a power meter(PM))	☐

* Alternative method. EUT shall be configured to transmit continuously (min. 98% duty cycle at full power). The spectrum analyzer shall be set for bin-to-bin spacing ≤RBW/2.

RESULTS

No non-compliance noted.

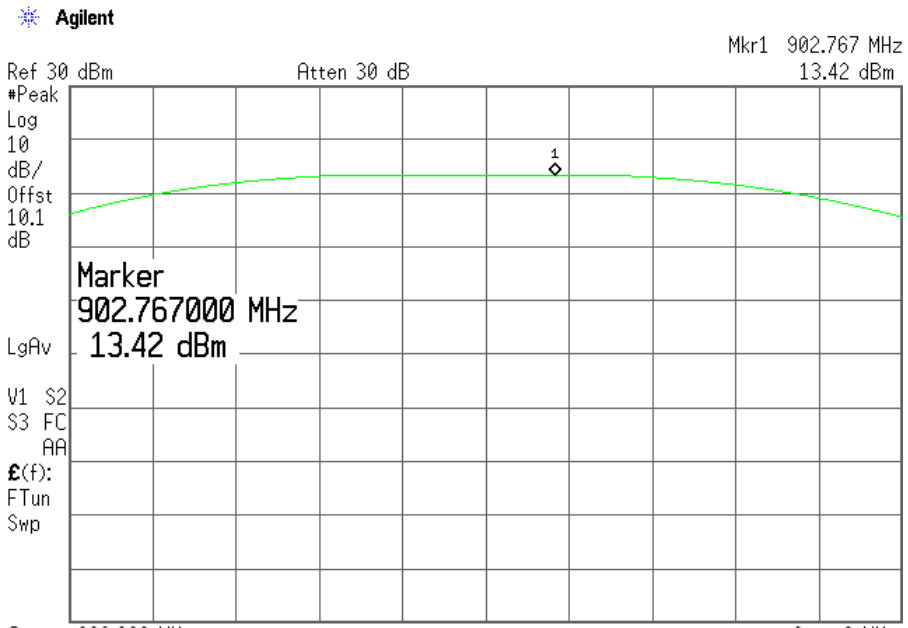
OUTPUT PEAK POWER

Summary of Peak Power Testing Data.

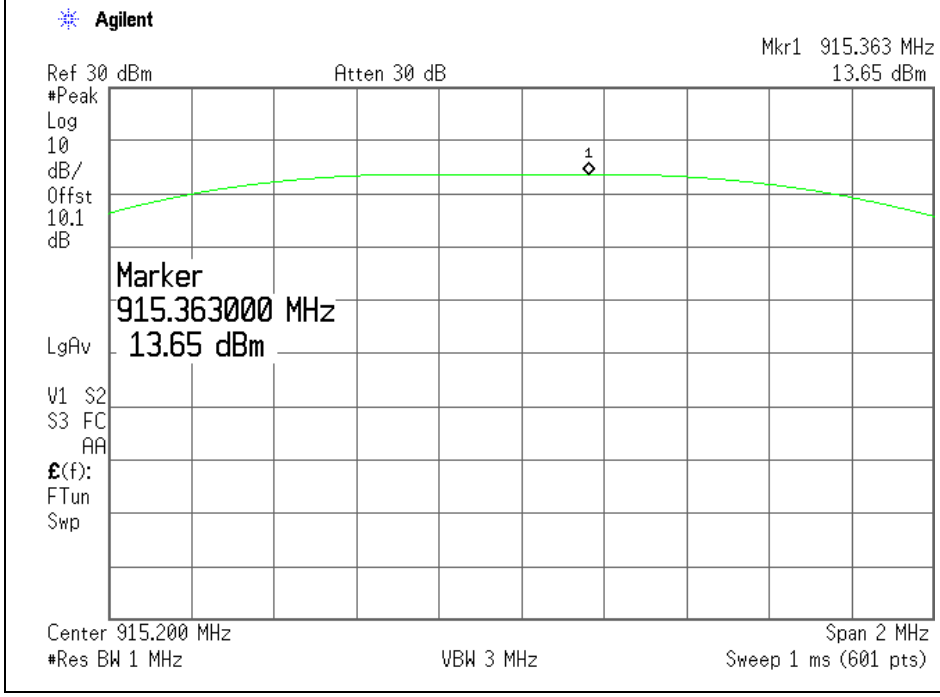
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dBm)
Low	902.6	13.42	30	-16.58
Middle	915.2	13.65	30	-16.35
High	927.2	13.85	30	-16.15

Therefore, the max. measured peak power is +13.85 dBm , which is under FCC allowed power limit.

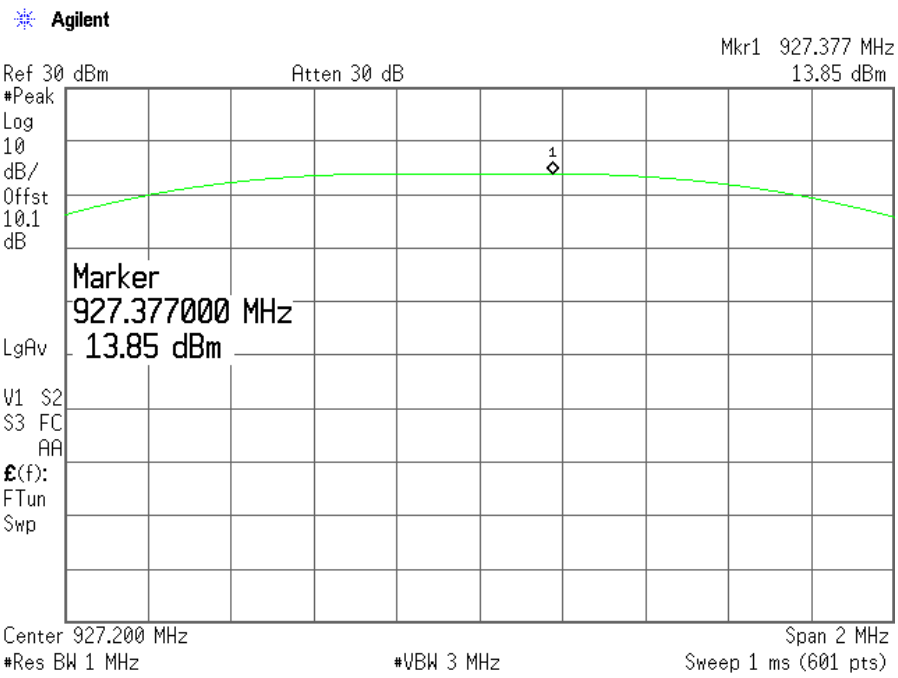
Plot Name:	Output Peak Power @ Low CH



Plot Name:	Output Peak Power @ Mid CH



Plot Name:	Output Peak Power @ High CH



7.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

FCC §1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RSS 102, Sec. 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation
RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:
--- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz

CALCULATIONS per FCC requirements

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E ^ 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using: P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$

$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using: P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$ Equation (1)

$S = 0.0795 * 10 ^ ((P + G)/10)/ d^2$ Equation (2)

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.
Equation (2) and the measured peak power is used to calculate the Power density.

From §1.1310 Table 1 (B),
for Public S = 1.0 mW/cm^2
for Professional, S = 5.0 mW/cm^2

For this EUT, P= 13.85 dBm, Max G= 1.0 dBi, and d=20cm

Plug all three items into equation (2), and yields,

Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)
1.0/5.0	13.85	1.0	0.006

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

CALCULATIONS per IC requirements

From IC RSS 102, Sec. 2.5.2

For this EUT, the applied tight limit is 1.371W at f=902.6MHz. EUT has max e.i.r.p value, 13.85+1=14.85dBm, i.e. 0.031W, which is far under the limit. Therefor this EUT is exempt from RF exposure evaluation.

RESULTS

No non-compliance noted:

7.4. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE ***per FCC KDB 558074D01v03r02***

Measurement Procedure for Fundamental Emission Output Power	Applicable to this EUT
9.2.2 Maximum Conducted (average) Output Power Level * Measurement Procedure Option 1 (Measurement using a spectrum analyzer (SA))	☐
9.2.3 Maximum Conducted (average) Output Power Level * Measurement Procedure Option 2 (using a power meter(PM))	☒

* Alternative method. EUT shall be configured to transmit continuously (min. 98% duty cycle at full power). The spectrum analyzer shall be set for bin-to-bin spacing ≤RBW/2.

The transmitter output is connected to a RF broadband power meter.

RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	Average Power (dBm)
Low	902.6	12.96
Middle	915.2	13.25
High	927.2	13.47

7.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (e) & RSS-247 5.2(2)
For direct sequence systems, the peak 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 ***per FCC KDB 558074D01v03r02***

Measurement Procedure for Maximum Power Spectral Density in the Fundamental Emission*	**Applicable to this EUT**
10.2 Measurement Procedure Option 1 for Peak PSD (PKPSD)	☒**preferred**
10.3-10.8 Measurement Procedure Option 2 for Average PSD** (6 methods: AVGPSD-1 & Alt, AVGPSD-2 & Alt, AVGPSD-3 & Alt)	☐

* same method as used to determine fundamental power.
** EUT shall be configured to transmit continuously (min. 98% duty cycle at full power) or use video trigging/signal gating. The spectrum analyzer shall be set for bin-to-bin spacing ≤RBW/2.

RESULTS

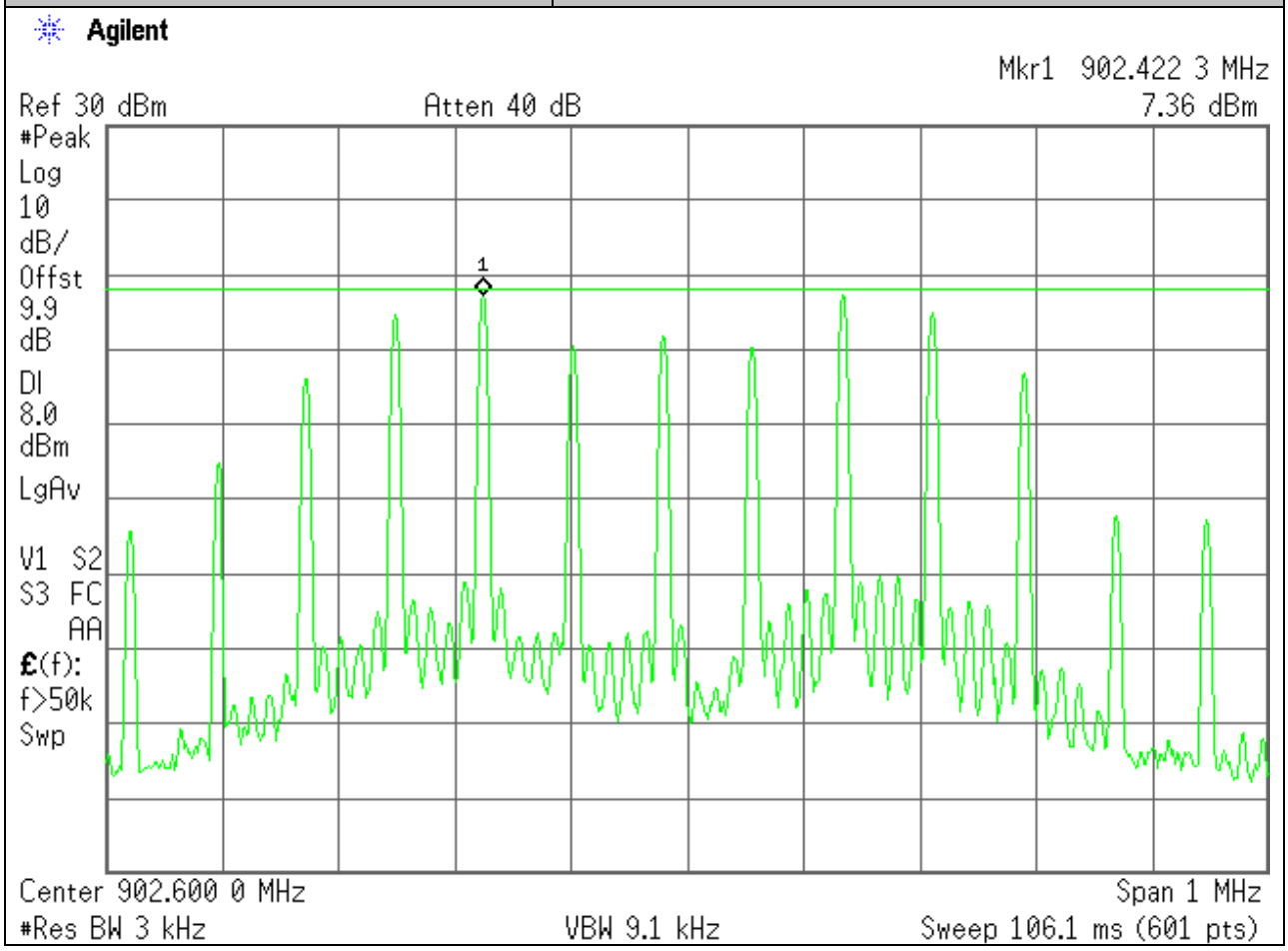
No non-compliance noted:

Summary of PPSD Testing Data:

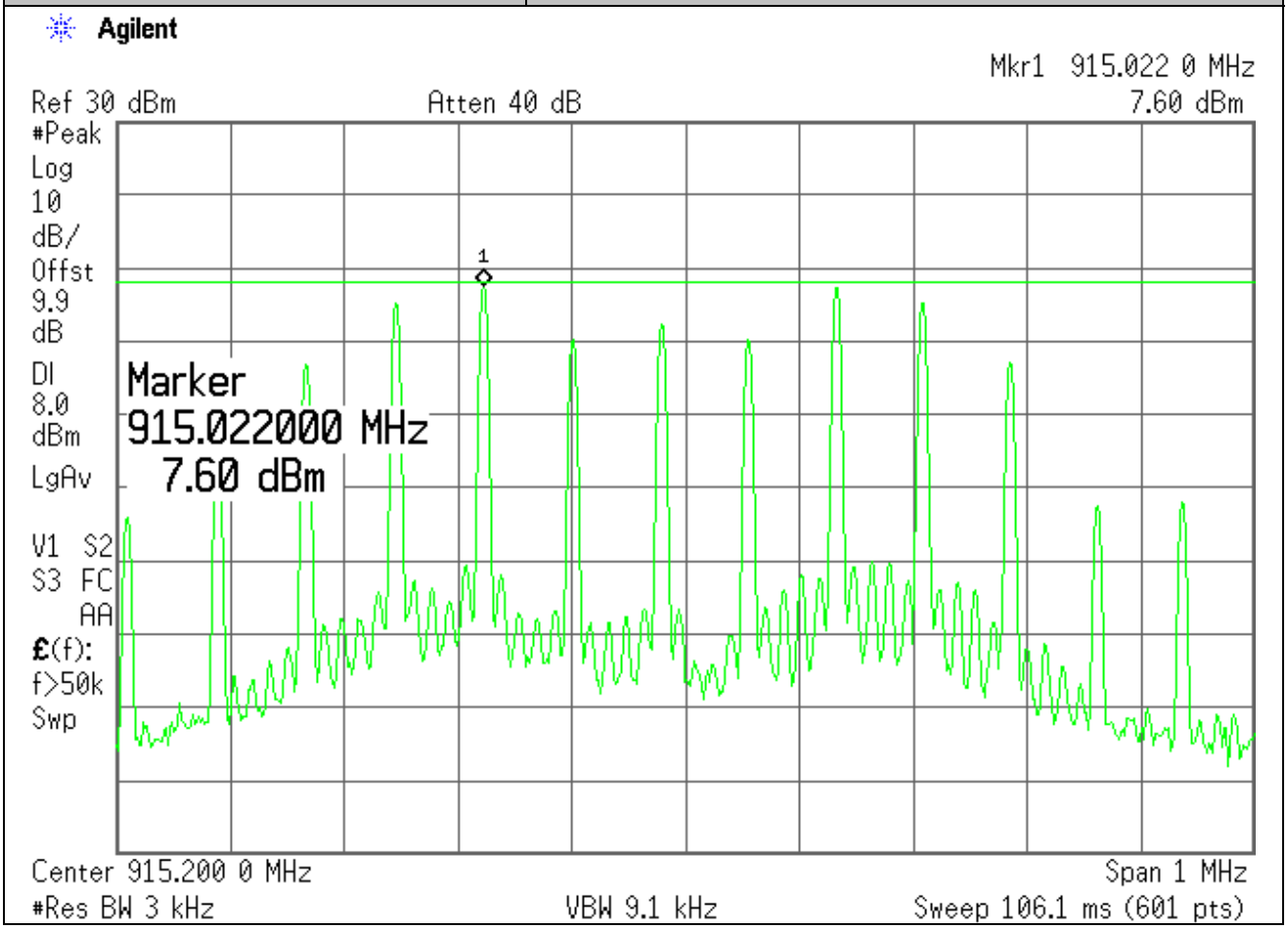
Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Limit (dBm/3KHz)	Margin (dB)
Low	902.6	7.36	8	-0.64
Middle	915.2	7.60	8	-0.4
High	927.2	7.82	8	-0.18

PEAK POWER SPECTRAL DENSITY

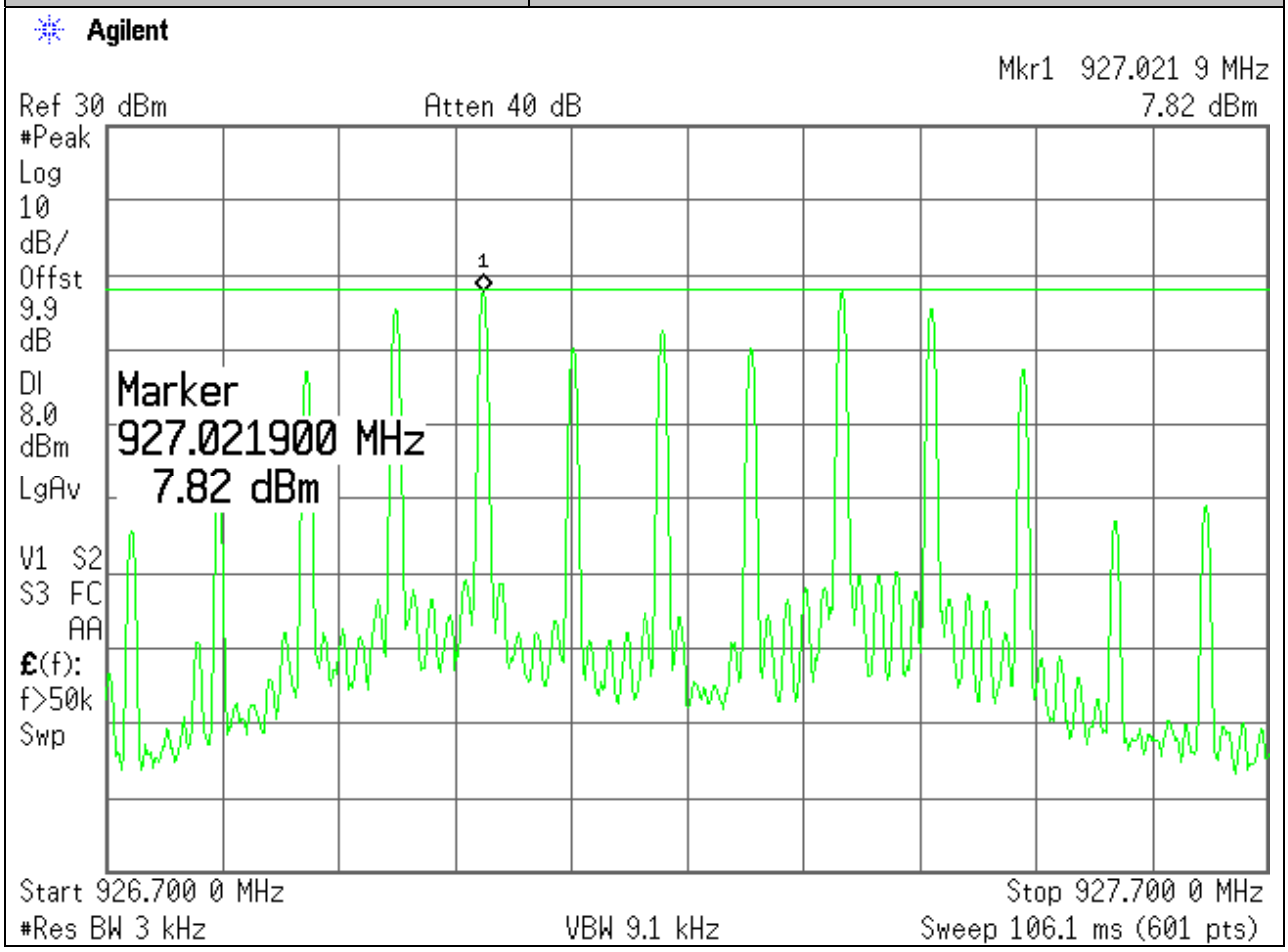
Plot Name:	PPSD @Low CH



Plot Name:	PPSD @ Mid CH



Plot Name:	PPSD @ High CH



7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (d) & RSS- 210 5.5
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 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) (see §15.205(c)).

TEST PROCEDURE ***per FCC KDB 558074D01v03r02***

(Report the three highest emissions relative to the limit)

Conducted Measurement Procedure for Maximum Unwanted Emissions into Non-Restricted Frequency Bands	**Applicable to this EUT**	
	Peak Power limit: (-20dB)	**Average Power Limit: (-30dB)**
11.1-11.2 Measurement Procedure-Reference Level (RBW=100KHz, VBW=300KHz)	☒	
11.3 Measurement Procedure-Unwanted Emissions*	☒ **preferred**	☐

* Different attenuation limit shall be used based on the measurement method of fundamental emission power and PSD.

Antenna-Port Conducted Measurement Procedure for Maximum Unwanted Emissions into Restricted Frequency Bands**	**Applicable to this EUT**
12.2.3 CISPR Quasi-Peak Measurement (CISPR 16)	☐
12.2.4 Peak Power Measurement (Table 1 for RBW setting)	☐
12.2.5 Average Power Measurement (three options)***	☐
13.2 Band-Edge Marker-Delta Method (ANSI C63.10) (within 2MHz)	☐
13.3 Band-Edge Integration Method (peak / average) (within 2MHz)	☐

** To use this conducted testing method, per 12.2.2-12.2.6, the followings shall be taken as consideration:

1. Proper RBW and detector, per 15.35 a/b, shall be chosen in different frequency ranges;
2. **Maximum transmitter antenna gain (no less than 2dBi), G, shall be added to the measured power level to determine the EIRP;**
3. **Appropriate factor, A, shall be added to model worst case ground reflections: 6.0dB (f≤30MHz) and 4.7dB (f≤30 to 1000MHz)**
4. **Electric field strength can be obtained from the equation: E= EIRP-20log(d)+104.8+G (or 2.0) +A; Then compare to applicable limit;**
5. Unwanted emissions from EUT cabinet or casing shall be measured via radiated emission test method per C63.10 (in this case, the antenna port may be terminated properly).
6. Absolute peak power limit of -21.2dBm within the unwanted emission bandwidth shall be used for meeting 15.35(b) requirement;
7. Per 15.35(c), for pulse operation, Duty Cycle factor reduction can be applied for unwanted emissions that have the same pulse characteristics as does the fundamental emissions (such as harmonics) pulse operation

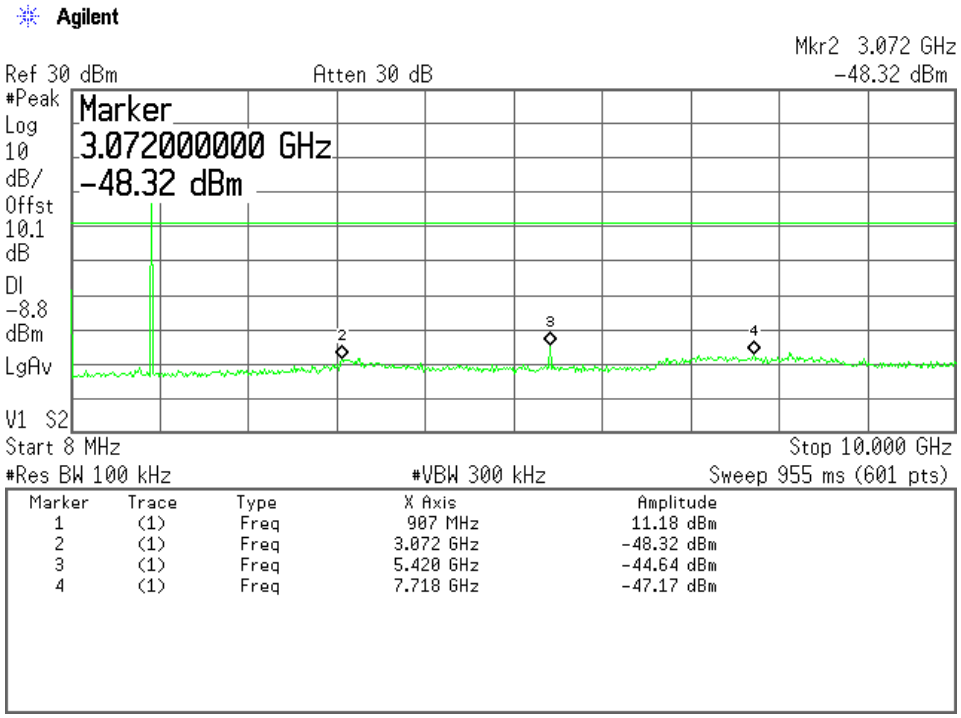
*** EUT shall be configured to transmit continuously (min. 98% duty cycle at full power). The spectrum analyzer shall be set for bin-to-bin spacing ≤RBW/2.

RESULTS

No non-compliance noted.

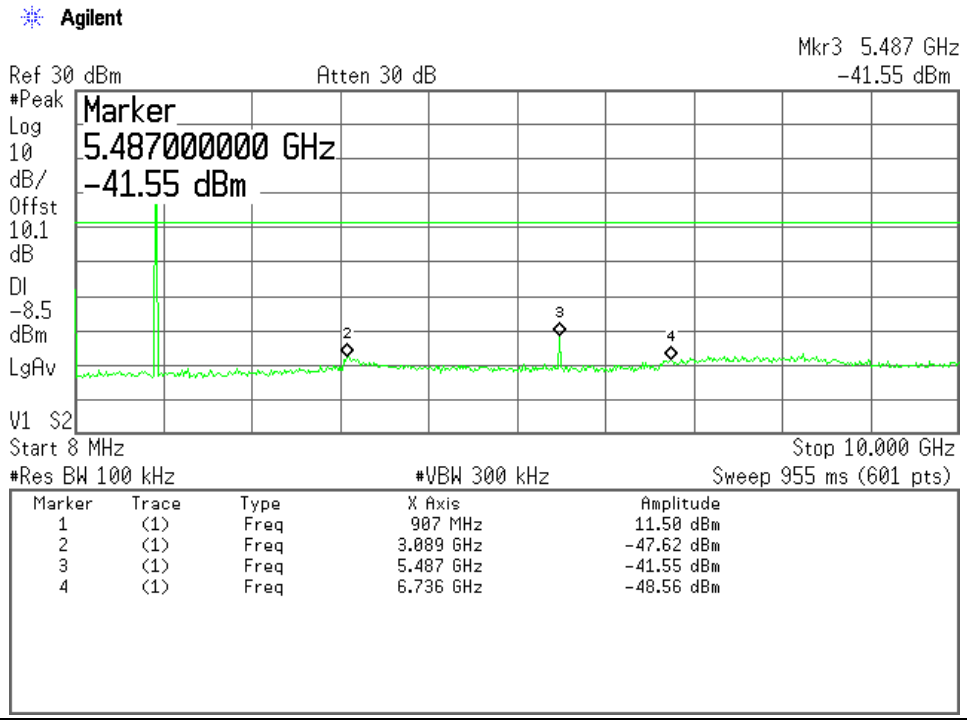
CONDUCTED PURIOUS EMISSIONS

Plot Name:	Spurious @ Low CH



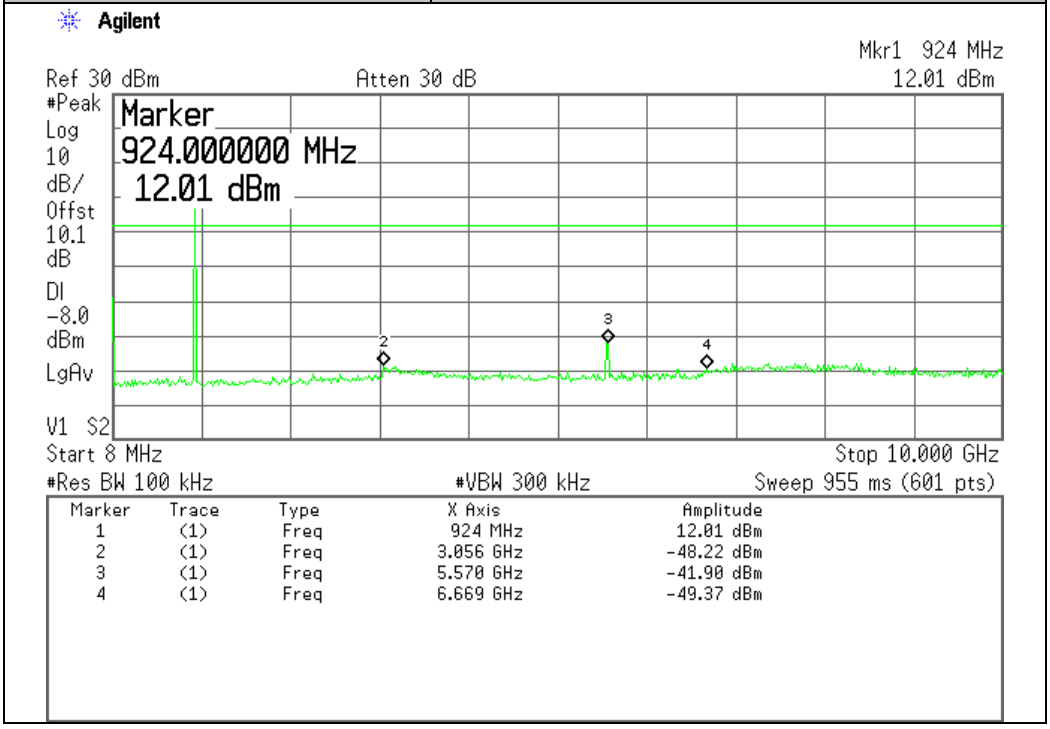
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	907 MHz	11.18 dBm
2	(1)	Freq	3.072 GHz	-48.32 dBm
3	(1)	Freq	5.420 GHz	-44.64 dBm
4	(1)	Freq	7.718 GHz	-47.17 dBm

Plot Name:	Spurious @ Mid CH

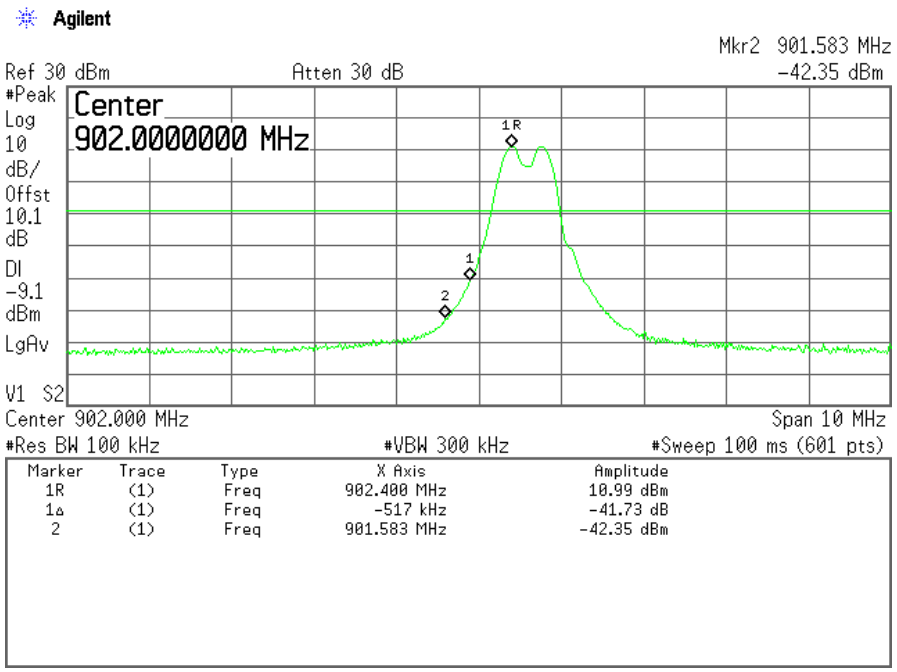


Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	907 MHz	11.50 dBm
2	(1)	Freq	3.089 GHz	-47.62 dBm
3	(1)	Freq	5.487 GHz	-41.55 dBm
4	(1)	Freq	6.736 GHz	-48.56 dBm

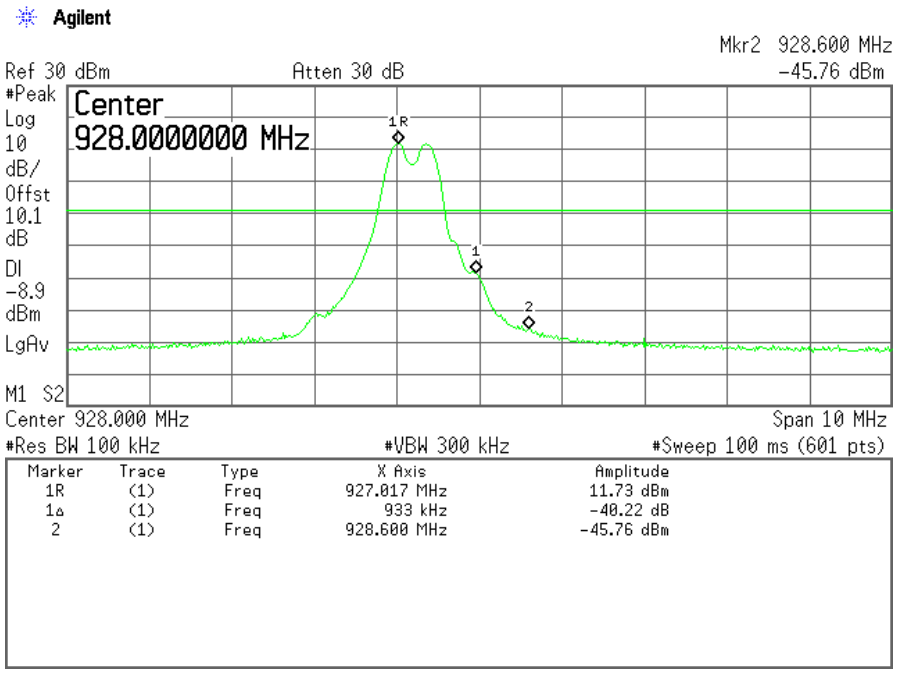
Plot Name:	Spurious @ High CH



Plot Name:	Spurious @ Lower Band-edge



Plot Name:	Spurious @ Upper Band-edge



7.7. RADIATED EMISSIONS

7.7.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) RSS-102 Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§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 (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode. Established procedures in C63.10 for performing radiated measurements shall be used. For cabinet emission measurements, the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. For portable devices, the EUT was tested in three orthogonal planes.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The radio spectrum was investigated from the lowest frequency generated within the device (without going below 9 kHz) up to the 10^{th} harmonic of the rated transmitted emission. The emissions are investigated with the transmitter set to the lowest, middle, and highest channels.

The emissions are investigated with the transmitter set to the lowest, middle, and highest channels, if applicable. The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

RESULTS

No non-compliance noted:

7.7.2. TRANSMITTER RADIATED EMISSIONS DATA

(HARMONICS & SPURIOUS falling in the restricted bands listed in Sec.15.205)

Low Channel(902MHz) Harmonics/Spurious

Freq. (MHz)	Worst H/V	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	QP/Avg @3m (dBuV/m)	PK Lim (dBuV/m)	QP /Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP /Avg.Mar. (dBuV/m)
1100	H	3		51.3	42.4	74	54	-22.7	-11.6
1100	V	3		57.8	47.5	74	54	-16.2	-6.5
2708	H	3		55.0	43.2	74	54	-19	-10.8
2708	V	3		59.8	48.4	74	54	-14.2	-5.6

Middle Channel(915MHz) Harmonics/Spurious

Freq. (MHz)	Worst H/V	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	QP/Avg @3m (dBuV/m)	PK Lim (dBuV/m)	QP /Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP /Avg.Mar. (dBuV/m)
1100	H	3		52.0	43.1	74	54	-22	-10.9
1110	V	3		58.3	48.0	74	54	-15.7	-6
2745	H	3		54.8	43.3	74	54	-19.2	-10.7
2745	V	3		60.9	51.0	74	54	-13.1	-3

High Channel(927MHz) Harmonics/Spurious

Freq. (MHz)	Worst H/V	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	QP/Avg @3m (dBuV/m)	PK Lim (dBuV/m)	QP /Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP /Avg.Mar. (dBuV/m)
1100	H	3		51.8	43.0	74	54	-22.2	-11
1110	V	3		58.0	47.8	74	54	-16	-6.2
2782	H	3		55.0	43.5	74	54	-19	-10.5
2782	V	3		61.1	50.6	74	54	-12.9	-3.4

No other harmonics or spurious emissions were detected in the rest restricted band above system floor, noise above -20dB to the limit.

The worst case: EUT tested with highest gain antenna with rated output power level.