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FCC CFR47 PART 15 SUBPART C & IC RSS-210

TEST REPORT

For

Motor Vehicle Asset Communicator

Model Number: MVAC 2.4

FCC ID: N5VMVAC24
IC: 3802A-MVAC24

Report Number: 0048-120306-01

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

Prepared by
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Date: 04/02/2012

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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: Motor Vehicle Asset Communicator

MODEL: MVAC 2.4

DATE TESTED: March -April , 2012

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC Part 15.247 & IC RSS-210 (issue 8)	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 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)	Output Power (dBm)	Output Power (mW)
902.6-927.2	+13.5	22.5

The EUT uses a surface mounted antenna: TE, Part # 1513259-1. Peak Gain =1dBi

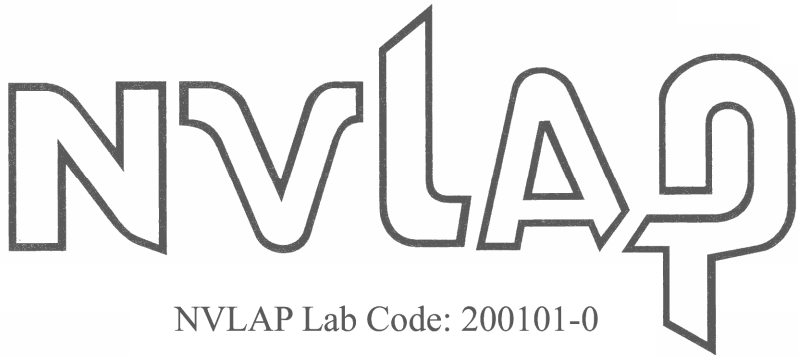
3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2003, FCC CFR 47 Part 2 & 15 and IC RSS-210.

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:

Manufacture	Model	Serial No.	Description	Last Cal mm/dd/ yy	Cal Due Mm/dd/ yy
Agilent	E4440A	US40420700	3Hz-26.5GHz Spec. Analyzer	6/17/11	6/17/12
R &S	ESPI	100018	9KHz-7GHz EMI Receiver	8/25/11	8/25/12
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	10/19/11	10/19/12
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	10/19/11	10/19/12
Electro-Meterics	ALR-25M/30	289	10KHz-30MHz Active Loop Antenna	5/28/11	5/28/12
EMCO	3115	4945	Double Ridge Guide Horn Antenna	10/17/11	10/17/12
R&S	SMH	8942280/010	Signal Generator		
Lorch Microwave	5NF-800/1000-S	AC3	Notch Filter		
Lorch Microwave	5NF-1800/2200-S	AE10	Notch Filter		
RES-NET	RFA500NFF30	0108	30dB in-line Power Attenuator		
Narda	3022	80986	Directional Coupler		

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
- 1dBi gain antenna, Part # 1513259-1 is used for radiated emission test.
- Channel Selection: Low Channel=902.6MHz; Middle Channel=915.2MHz; High Channel=927.2MHz

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 6dB BANDWIDTH

LIMIT

§15.247 (a) (2) & RSS-210 A8.2(1): Min. 6dB bandwidth should be no less than 500KHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 6dB bandwidth. The VBW/RBW is set to one or three. The sweep time is coupled.

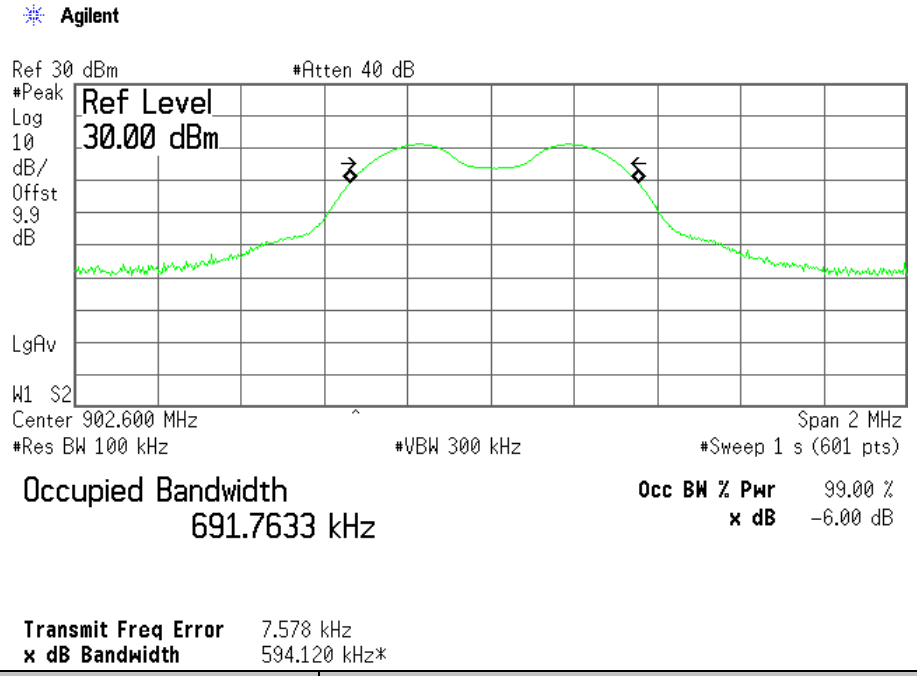
RESULTS

No non-compliance noted:

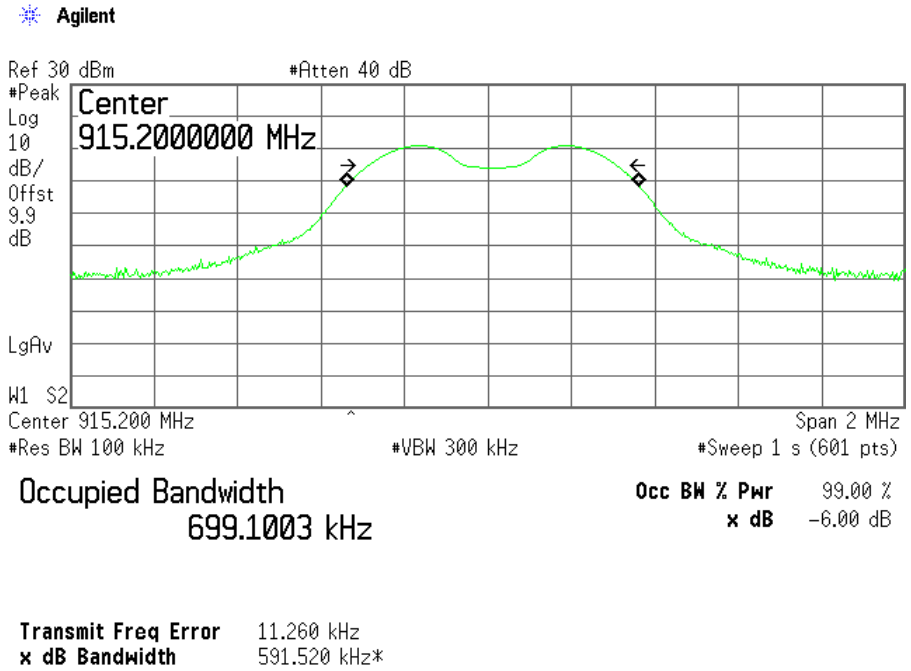
Channel	Frequency (MHz)	6dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	902.6	594.120	691.7633
Middle	915.2	591.520	699.1003
High	927.2	584.722	703.3665

6dB & 99% BANDWIDTH

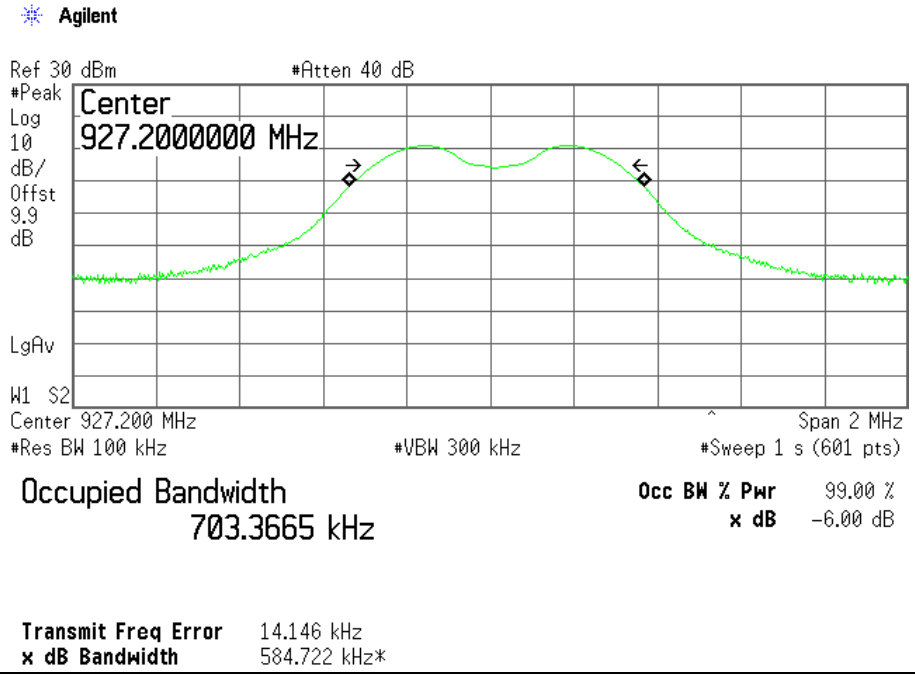
Plot Name:	6dB &99% Bandwidth, Low CH



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-210 A8.4(4)

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For systems using digital modulation in 902-927 MHz bands: 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.

TEST PROCEDURE

Per FCC KDB 558074, The transmitter output is connected to a spectrum analyzer and Power output Option 1 was selected for peak power measurement since the device transmits continuously.

RESULTS

No non-compliance noted.

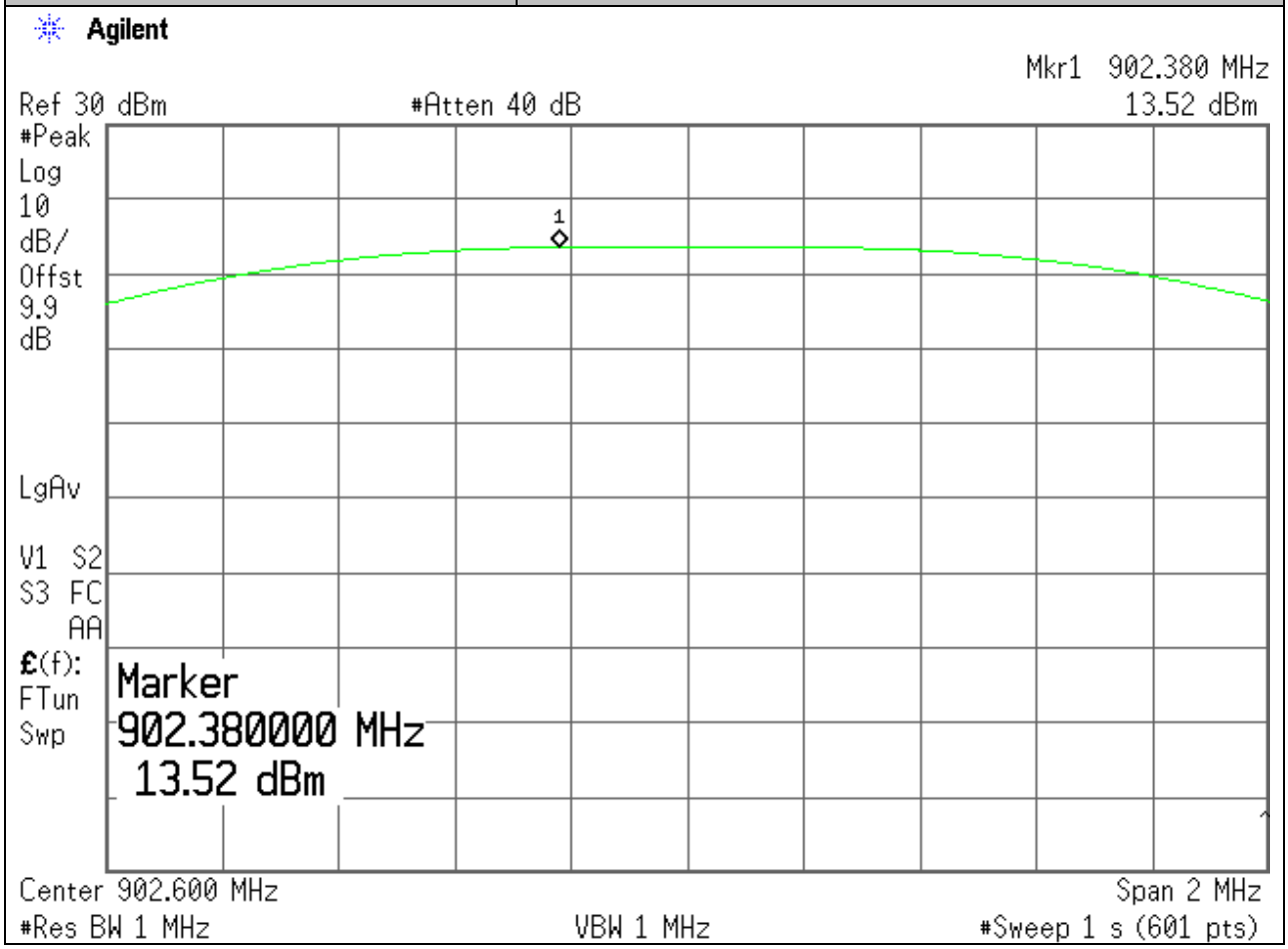
OUTPUT PEAK POWER

Summary of the testing result:

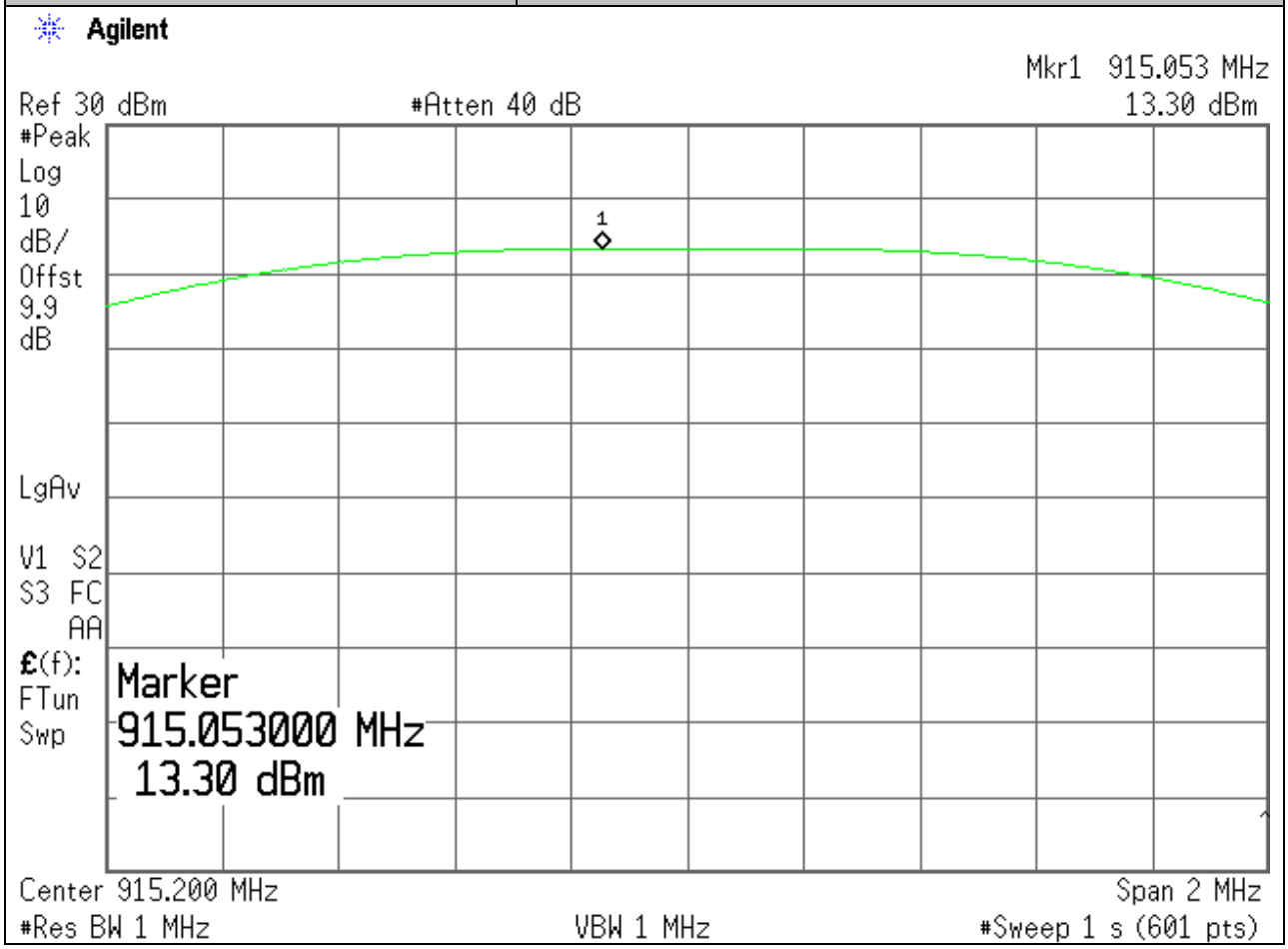
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dBm)
Low	902.6	13.52	30	-16.48
Middle	915.2	13.30	30	-16.70
High	927.2	13.33	30	-16.67

Therefore, the max. measured peak power is +13.52dBm.

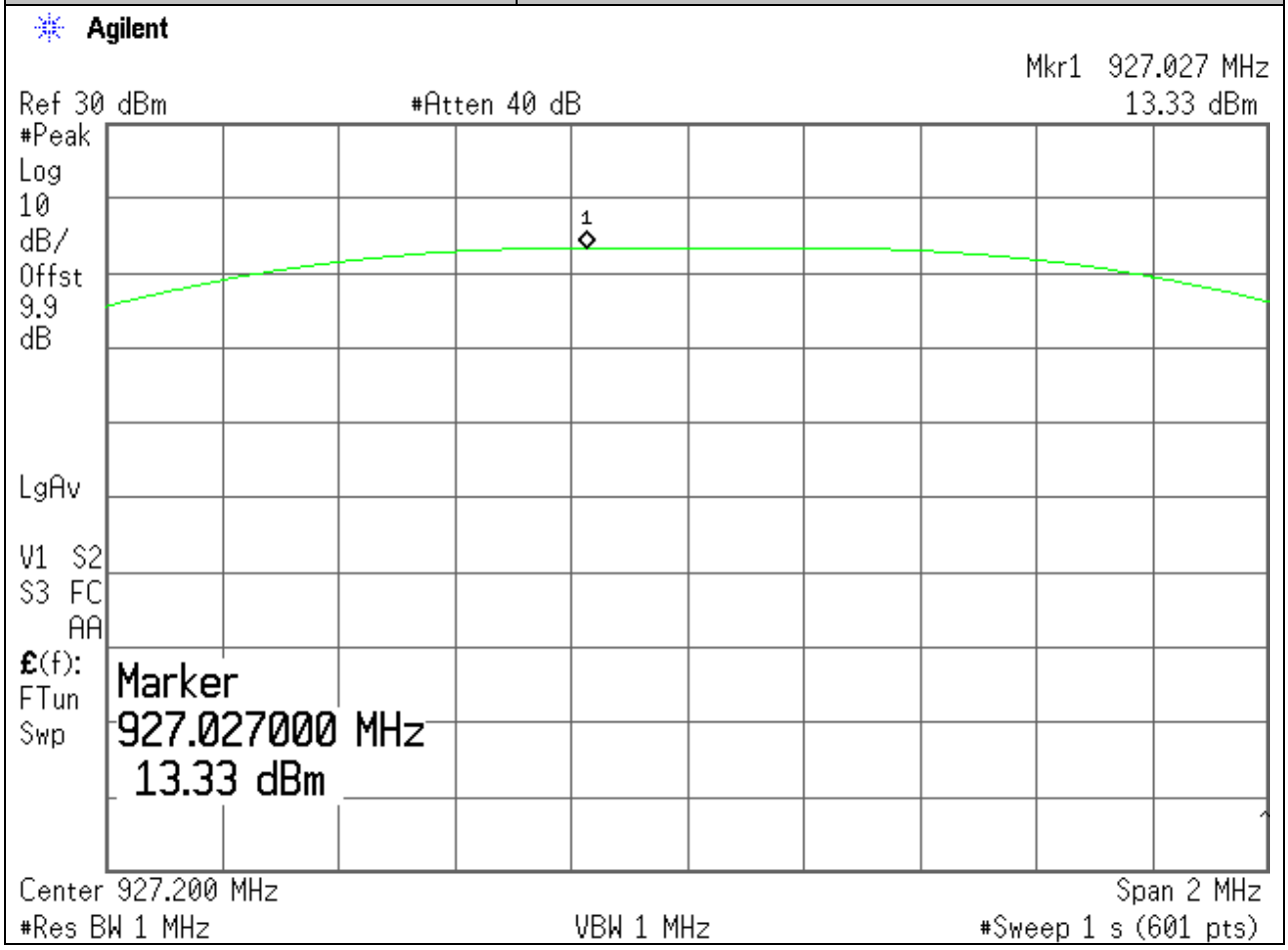
Plot Name:	Output Peak Power @ Low CH



Plot Name:	Output Peak Power @ Mid CH



Plot Name:	Output Peak Power @ High CH



7.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS & RSS-102

§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.

CALCULATIONS

Given

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

and

$S = E \wedge 2 / 3770$

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

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

$S = 0.0795 * 10 \wedge ((P + G)/10)/ d\wedge 2$ 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.

LIMITS

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

RESULTS

No non-compliance noted:

For this EUT, P= 13.52 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	13.52	1.0	0.0056

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.

7.4. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	Average Power (dBm)
Low	902.6	12.93
Middle	915.2	12.76
High	927.2	12.81

7.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (e) & RSS-210 A8.2(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

The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

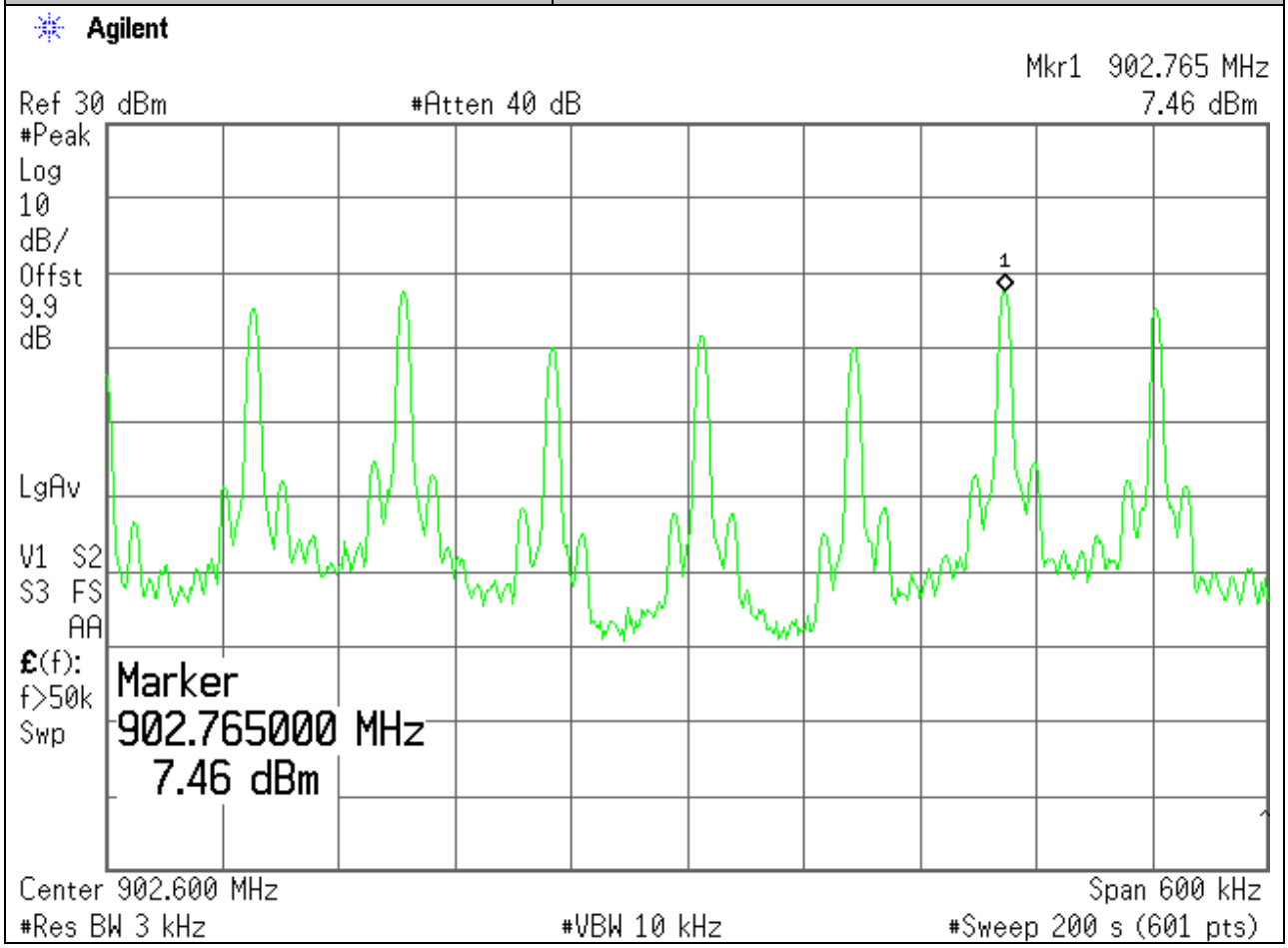
RESULTS

No non-compliance noted:

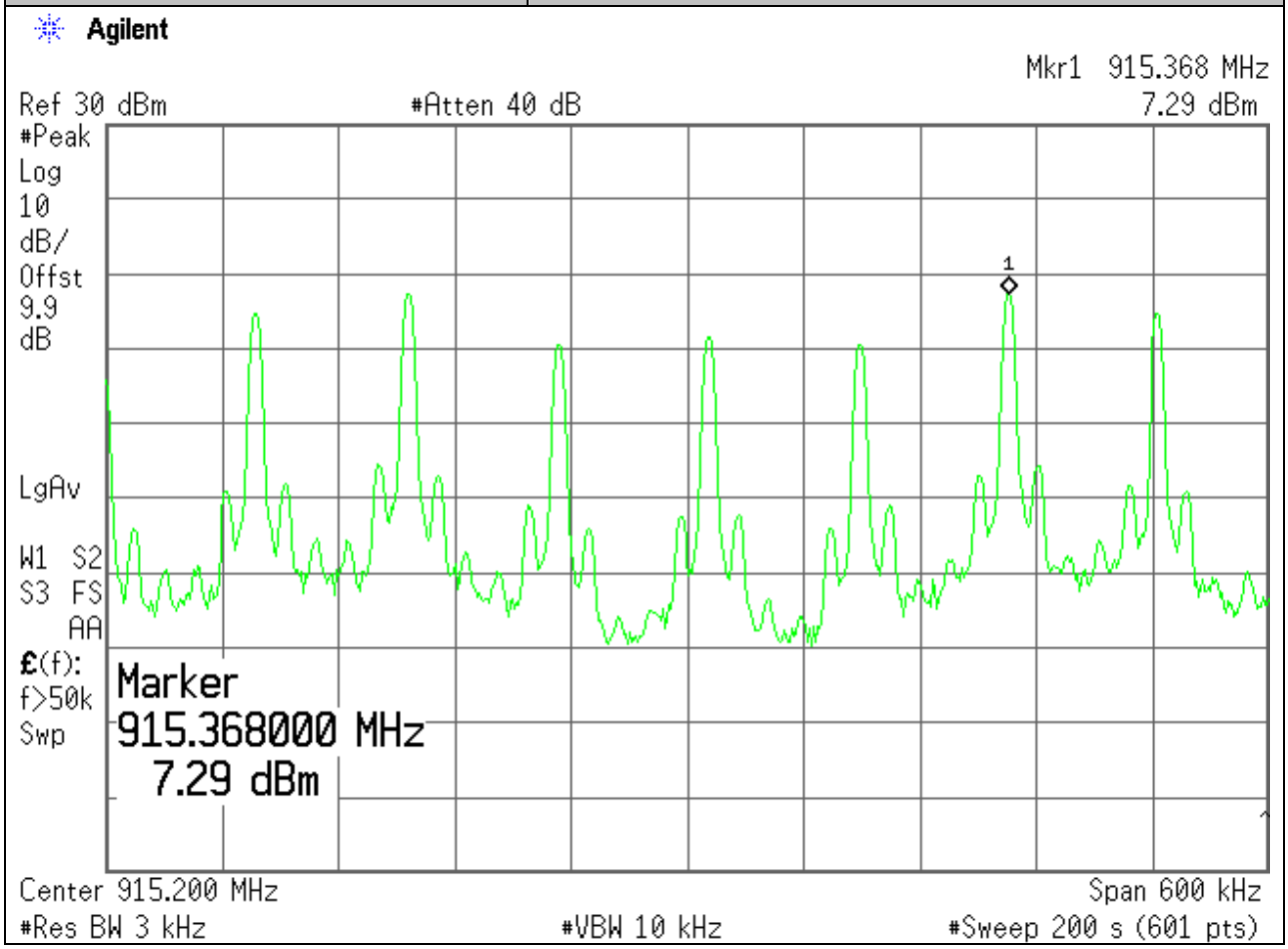
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	902.6	-7.46	8	-0.54
Middle	915.2	-7.29	8	-0.71
High	927.2	-7.32	8	-0.68

PEAK POWER SPECTRAL DENSITY

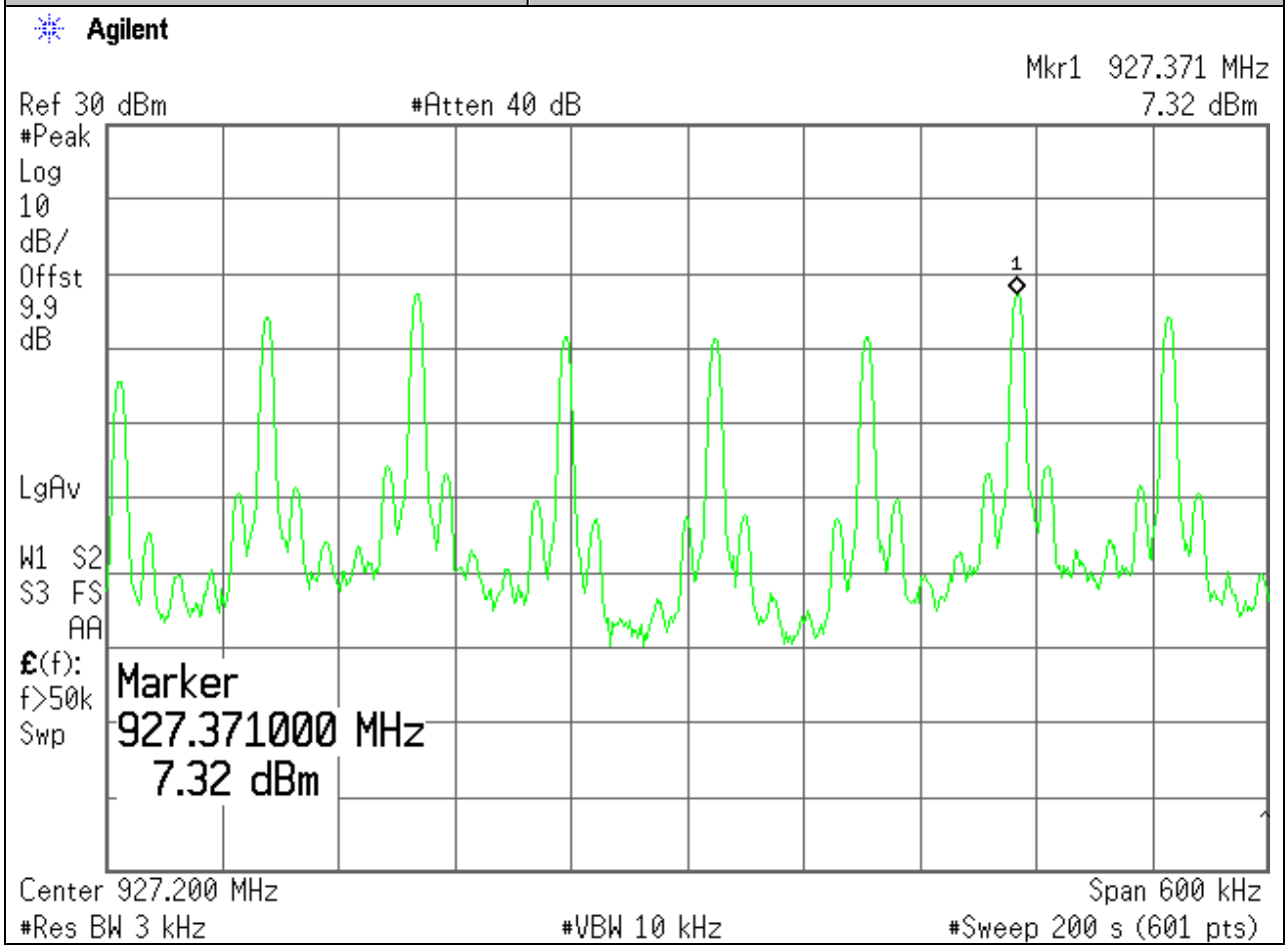
Plot Name:	PPSD @Low CH



Plot Name:	PPSD @ Mid CH



Plot Name:	PPSD @ High CH



7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (d) & RSS- 210 A8.5
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 558074, the transmitter output is connected to a spectrum analyzer and the resolution bandwidth is set to 100 kHz. Since the EUT complies with the use of power option 1, the 20dB attenuation requirement is applied here, which makes the absolute spurious limit as low as (Max. peak of fundamental -20dB) (shown on grid line). All spurious under this line are defined as compliance results.

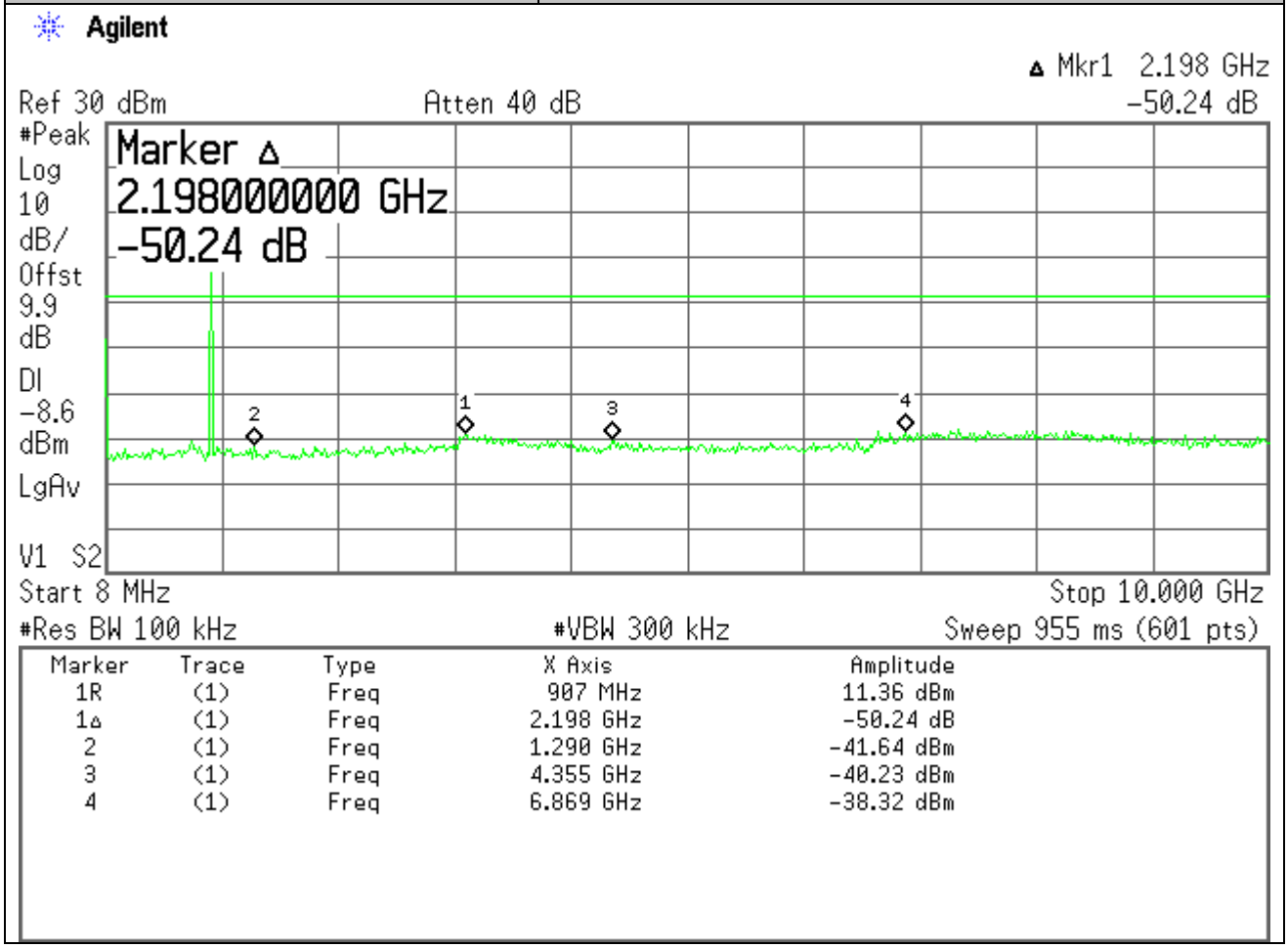
The spectrum from 20 MHz to10GHz was investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

No non-compliance noted:

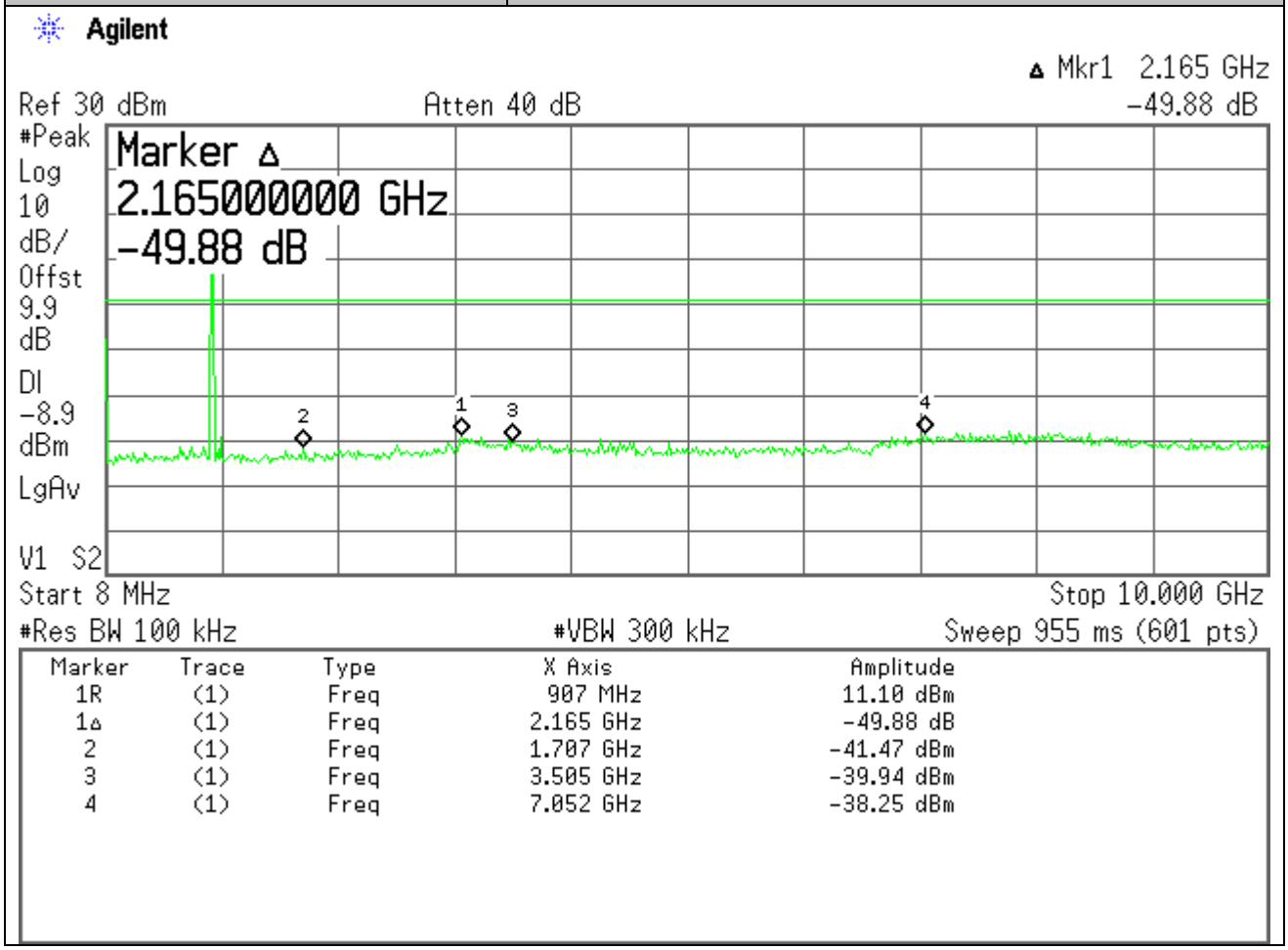
SPURIOUS EMISSIONS, LOW CHANNEL

Plot Name:	Spurious @ Low CH



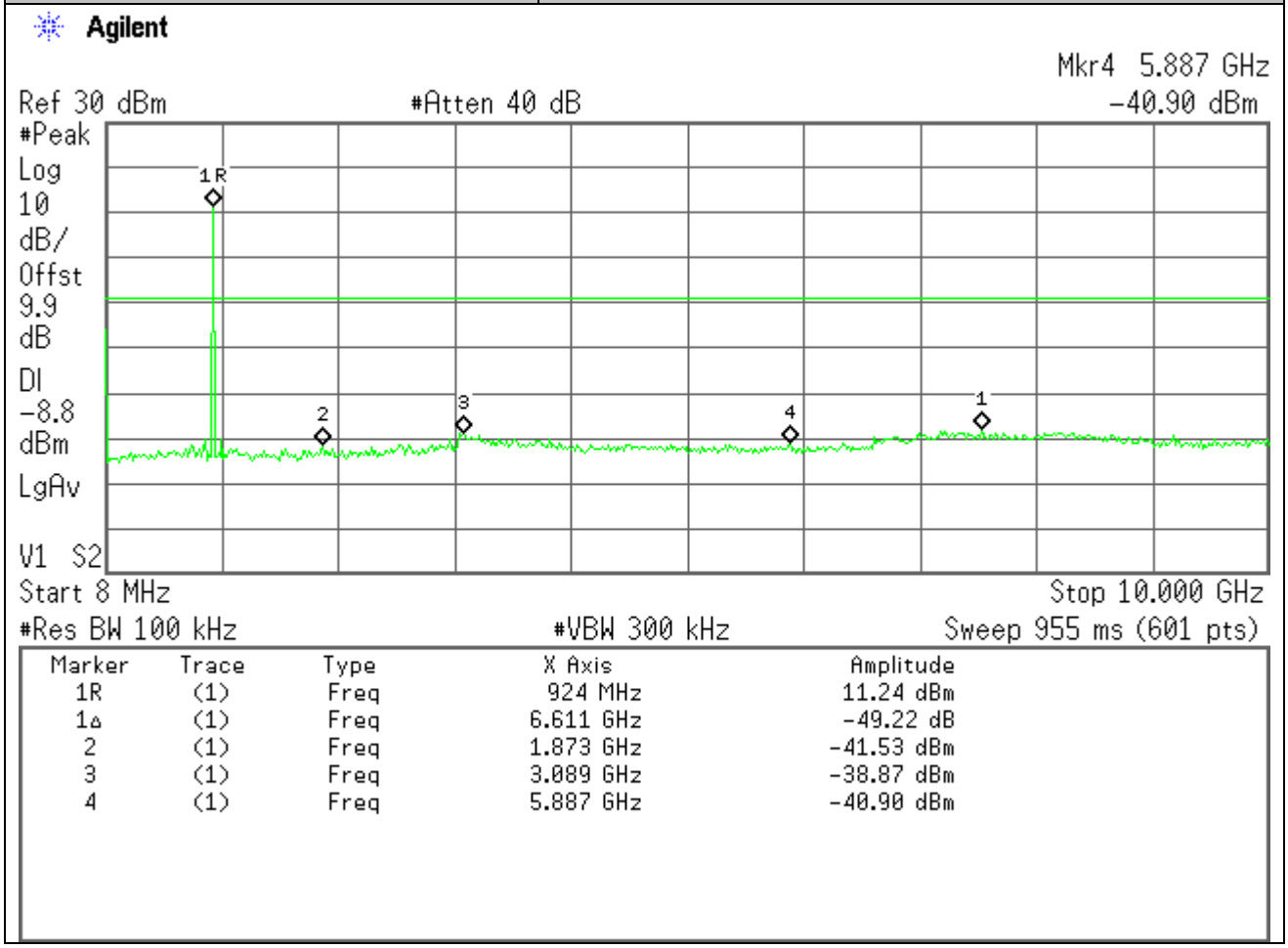
Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Freq	907 MHz	11.36 dBm
1Δ	(1)	Freq	2.198 GHz	-50.24 dB
2	(1)	Freq	1.290 GHz	-41.64 dBm
3	(1)	Freq	4.355 GHz	-40.23 dBm
4	(1)	Freq	6.869 GHz	-38.32 dBm

Plot Name:	Spurious @ Mid CH

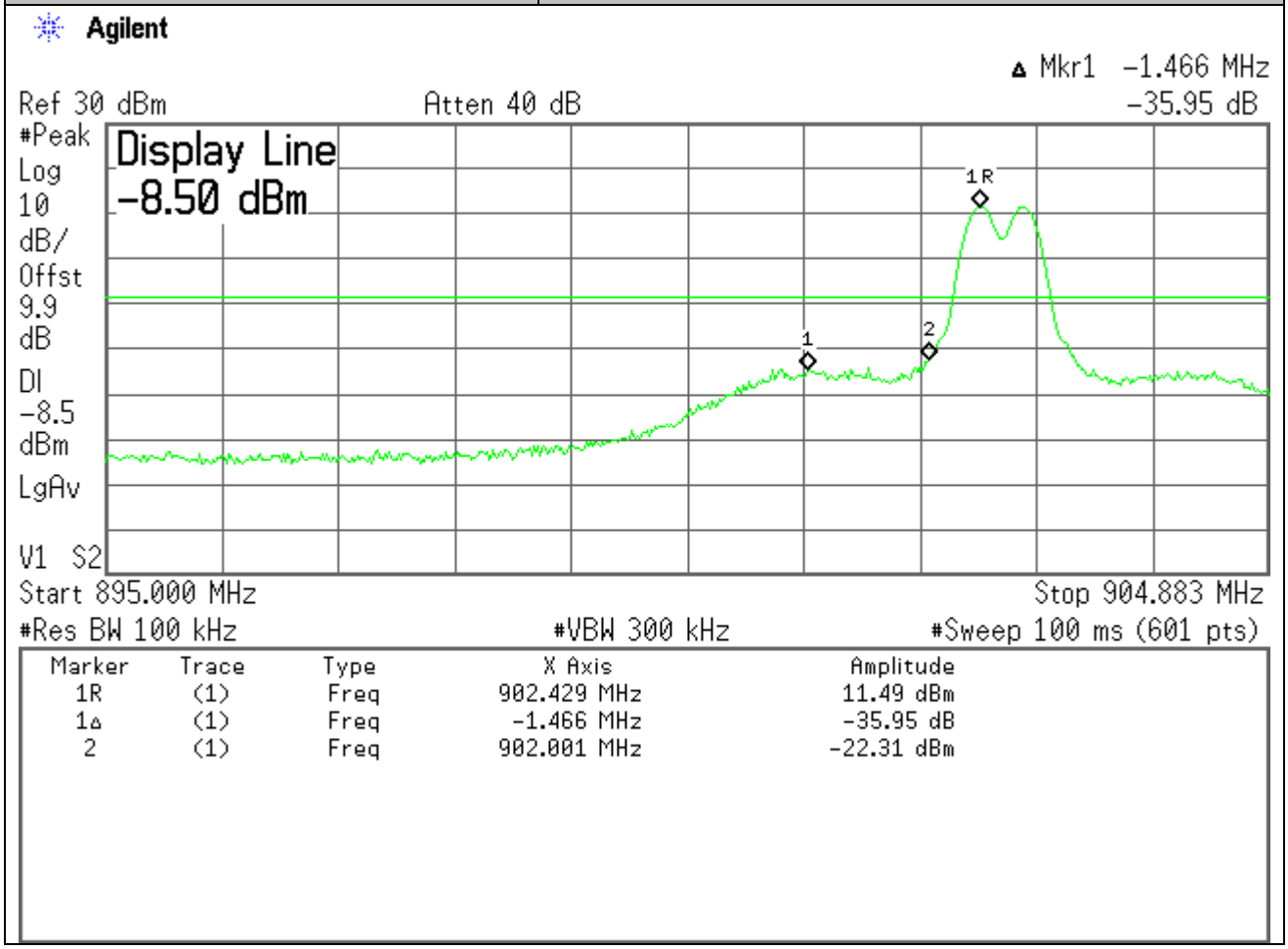


Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Freq	907 MHz	11.10 dBm
1Δ	(1)	Freq	2.165 GHz	-49.88 dB
2	(1)	Freq	1.707 GHz	-41.47 dBm
3	(1)	Freq	3.505 GHz	-39.94 dBm
4	(1)	Freq	7.052 GHz	-38.25 dBm

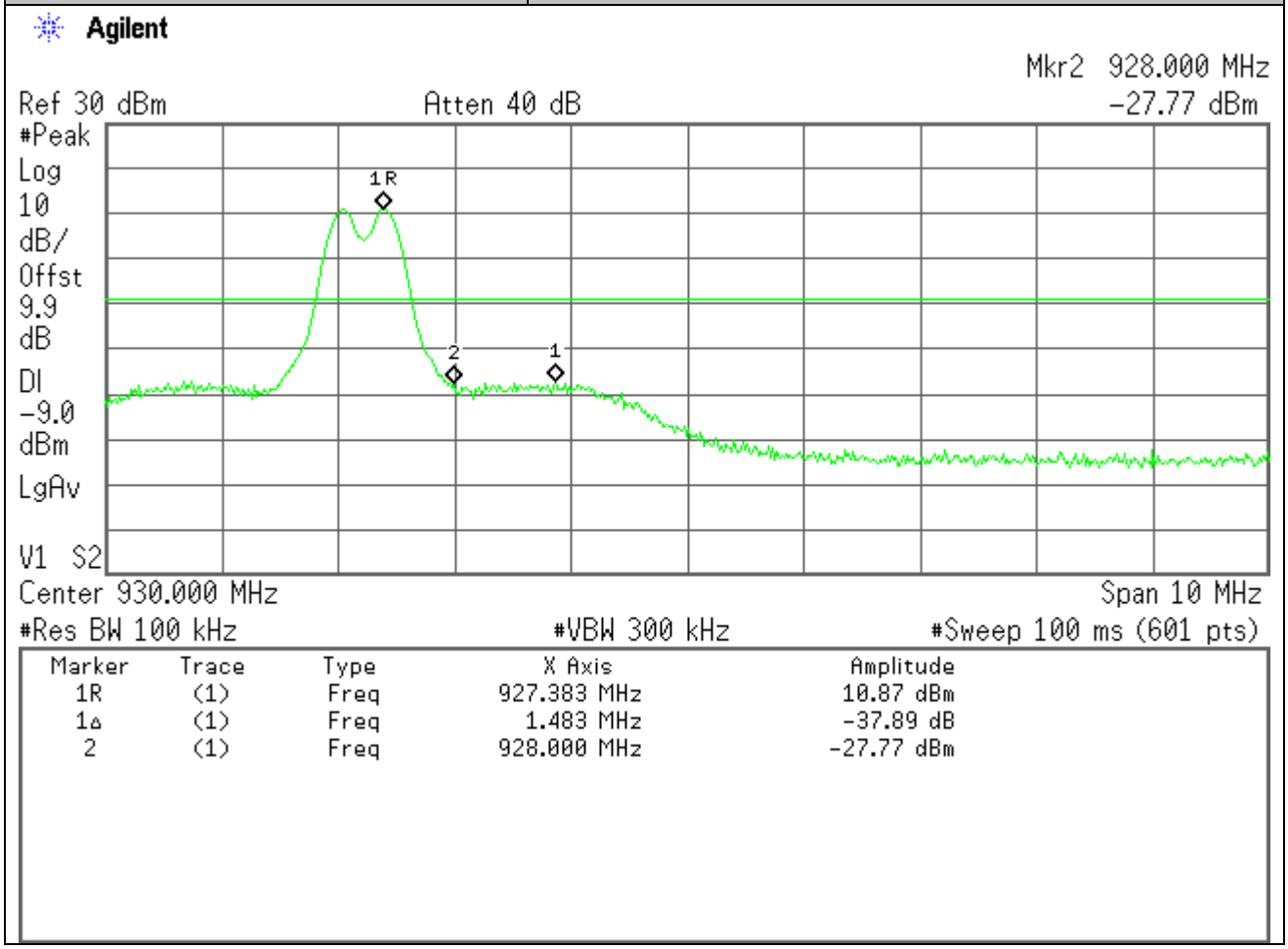
Plot Name:	Spurious @ High CH



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)
0.009-0490_	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

§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.

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 emissions are investigated with the transmitter set to the lowest, middle, and highest channels.

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.
Distance factor needs to be applied for measurements under 30MHz & above 1GHz whenever needed.

RESULTS

No non-compliance noted:

7.7.2. TRANSMITTER RADIATED EMISSIONS DATA

HARMONICS AND SPURIOUS EMISSIONS (>1GHz & <=1GHz)

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)
2708	H	3		61.0	49.3	74	54	-13.0	-5.7
2708	V	3		66.9	55.1	74	54	-7.1	+1.1

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)
2745	H	3		60.3	48.6	74	54	-13.7	-5.4
2745	V	3		65.4	54.8	74	54	-8.6	+0.8

High Channel(927MHz) Harmonics/Spurious

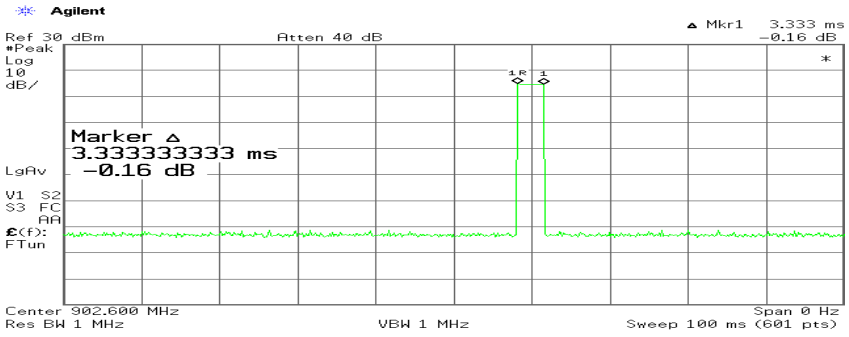
Freq. (MHz)	Worst H/V	Dist. (m)	D Corr (dB)	Peak@3m (dBuV/m)	QP/Avg @3m (dBuV/m)	PK Lim (dBuV/m)	QP /Avg. Lim (dBuV/m)	PK Mar (dBuV/m)	QP /Avg.Mar. (dBuV/m)
2782	H	3		60.5	48.8	74	54	-13.5	-5.2
2782	V	3		65.5	55.0	74	54	-8.5	+1.0

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

The worst case: EUT tested with on-board antenna with rated output power level.

DUTY CYCLE CORRECTION FACTOR:

*IN ACCORDANCE WITH FCC KDB Publication No. 558074, THE “DUTY CYCLE CORRECTION FACTOR” FOR SPURIOUS RADIATED EMISSIONS IS; 20 log * (3.33ms/100ms) = -29.5 dB, WHICH WAS USED TO CORRECT THE AVERAGE SPURIOUS READING.



Conclusion: with Duty cycle correction factor, the levels of all radiated emissions falling in restricted bands are well below the FCC limit.