

FCC CFR47 PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT

FOR

TRANCEIVER MODULE

MODEL NUMBER: RXX9000-15XX

FCC ID: GT3FC008 IC: 3683A-FC008

REPORT NUMBER: 09J12958-1, Revision A

ISSUE DATE: FEBRUARY 01, 2010

Prepared for SMK CORPORATION 5-5 TOGOSHI 6-CHOME SHINAGAWA-KU TOKYO 142-8511 JAPAN

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NVLAP LAB CODE 200065-0

Revision History

Rev.	lssue Date	Revisions	Revised By
	12/17/09	Initial Issue	T. Chan
Α	02/01/10	Corrected Antenna Gain & Added MPE Calculation	T. Chan

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7 8. 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	7.1. 7.1.1. 7.1.2. 7.1.3. 7.1.4. 7.1.5. 7.1.5. 7.1.6. RAD 3.1. 3.2. 8.2.1. 3.3. 8.3.1. 3.4. AC P	802. 15.4 MODE IN THE 2.4 GHz BAND	11 11 15 19 20 21 25 32 33 33 42 42 43 47

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1. ATTESTATION OF TEST RESULTS

STAN	NDARD	Т
	APPLICABLE STANDARDS	
DATE TESTED:	DECEMBER 9-16, 2009	
SERIAL NUMBER:	1B, 4C	
MODEL:	RXX9000-15XX	
EUT DESCRIPTION:	TRANCEIVER MODULE	
COMPANY NAME:	SMK CORPORATION 5-5 TOGOSHI 6-CHOME SHINAGAWA-KU TOKYO 142-8511 JAPAN	

STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:

THU CHAN EMC MANAGER COMPLIANCE CERTIFICATION SERVICES Tested By:

Mouin Hanne

MONICA HARRISON SENIOR RF ENGINEER COMPLIANCE CERTIFICATION SERVICES

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <u>http://www.ccsemc.com</u>.

4. CALIBRATION AND UNCERTAINTY

4.1. 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.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB) 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 2.4GHz transceiver, operating between 2.425-2.475GHz.

The radio module is manufactured by SMK Corporation.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
2425-2475	802.15.4	-2.249	0.60

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB (Inverted F) antenna, with a maximum gain of +4.64dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was TELECTEST_Sip_AB, rev. 1.0.

The Jig driver software installed in the support equipment during testing was CDM2.042.04.16 WHQL Certified, rev. 2.04.16.

The test utility software used during testing was TeraTerm Pro, rev. 4.56.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The worst-case position was determined to be in the X plane.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST						
Description	Description Manufacturer Model Serial Number FCC ID					
Laptop PC	HP	Pavillion	CNF63928VZ	DoC		
AC Adaptor	HP	DC359A	F3-0607269800b	DoC		

I/O CABLES

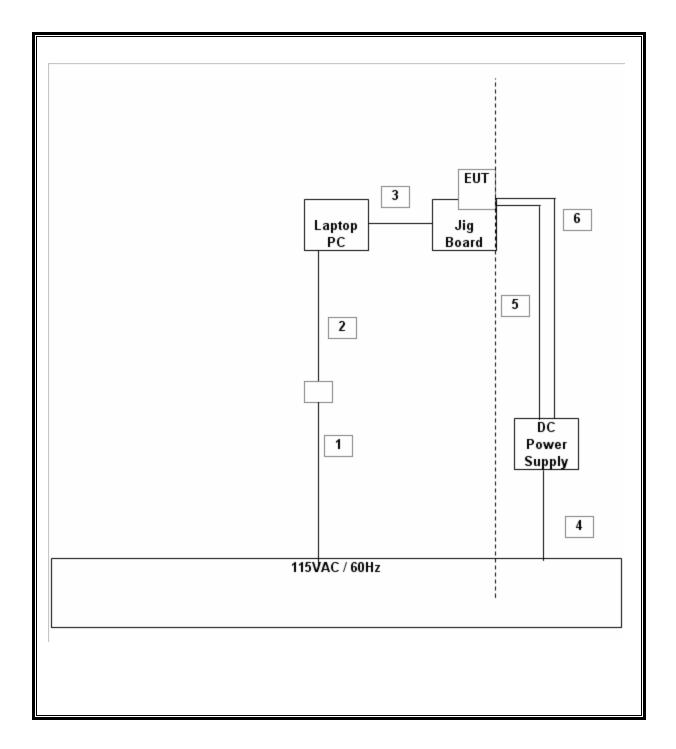
	I/O CABLE LIST						
Cable No.	Port	# of Identica Ports	Connector Type	Cable Type	Cable Length	Remarks	
1	AC	1	AC	Unshielded	1.7m		
2	DC	1	DC	Unshielded	1.7m		
3	USB	1	USB	Unshielded	1m		
4	AC	1	AC	Unshielded	1m		
5	DC	2	DC	Banana	2m		
6	DC	2	DC	Banana	2m		

TEST SETUP

The EUT is installed in a test board JIG, which is connected to the laptop via USB. Test software exercised the radio card. For below 1 GHz Emissions testing the EUT was powered with an external DC Power Supply.

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SETUP DIAGRAM FOR TESTS



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6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST						
Description	Manufacturer	Model	Asset	Cal Due		
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	02/03/10		
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	01/05/10		
Peak Power Sensor	Boonton	57318		02/02/10		
Peak Power Meter	Boonton	4541	C01186	01/19/10		
EMI Test Receiver, 30 MHz	R&S	ESHS 20	N02396	05/06/11		
LISN, 30 MHz	FCC	LISN-50/250-25	N02625	11/06/10		
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00778	01/16/10		
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/31/10		
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	01/29/10		
Power Supply 10V@ 10 Amp	Agilent / HP	6282A	NA	CNR		
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	01/14/10		
Antenna, Horn, 18 GHz	EMCO	3115	C00783	01/29/10		
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	02/04/10		
DMM	Fluke	77-11	N02303	10/30/11		

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7. ANTENNA PORT TEST RESULTS

7.1. 802.15.4 MODE IN THE 2.4 GHz BAND

7.1.1.6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

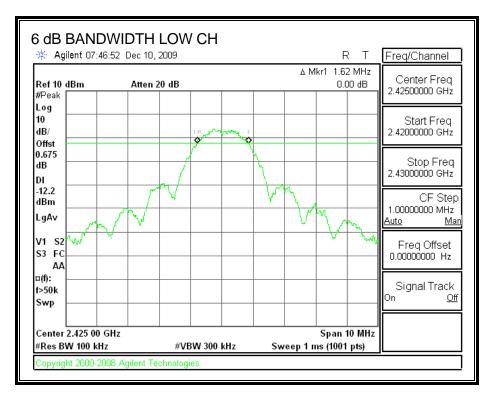
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

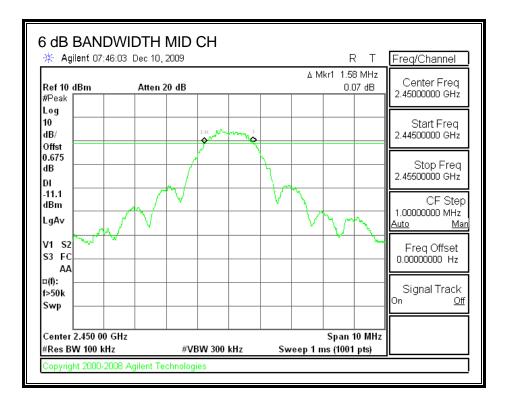
<u>RESULTS</u>

Channel	Frequency	6 dB Bandwidth	Minimum Limit
	(MHz)	(MHz)	(MHz)
Low	2425	1.62	0.5
Middle	2450	1.58	0.5
High	2475	1.66	0.5

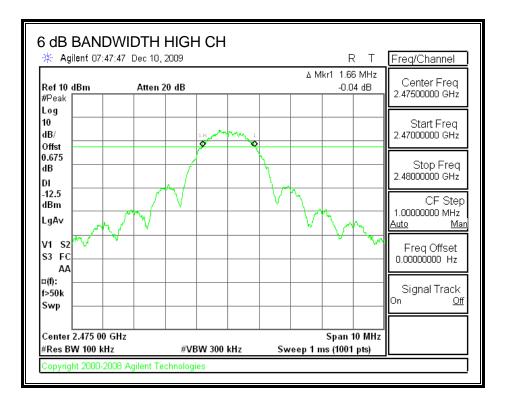
6 dB BANDWIDTH



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7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

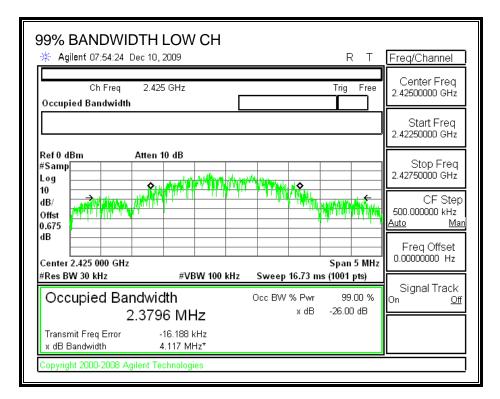
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency	99% Bandwidth
	(MHz)	(MHz)
Low	2425	2.3796
Middle	2450	2.3819
High	2475	2.3587

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99% BANDWIDTH



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99% BANDWIDTH MID CH	Freq/Channel
Ch Freq 2.45 GHz Trig Free Occupied Bandwidth	Center Freq 2.4500000 GHz
	Start Freq 2.44750000 GHz
Ref 0 dBm Atten 10 dB #Samp	Stop Freq 2.45250000 GHz
dB/	CF Step 500.000000 kHz <u>Auto Man</u>
Center 2.450 000 GHz Span 5 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 16.73 ms (1001 pts)	Freq Offset 0.00000000 Hz
Occupied Bandwidth Occ BW % Pwr 99.00 % 2.3819 MHz x dB -26.00 dB	Signal Track ^{On <u>Off</u>}
Transmit Freq Error -4.092 kHz x dB Bandwidth 4.237 MHz*	
Copyright 2000-2008 Agilent Technologies	

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99% BANDWIDTH HIGH CH	RT	Amplitude
Ch Freq 2.475 GHz Occupied Bandwidth	Trig Free	Ref Level 0.00 dBm
		Attenuation 10.00 dB <u>Auto Man</u>
Ref 0 dBm Atten 10 dB #Samp Log 10		Scale/Div 10.00 dB
dB/ Offst 0.675 dB		Scale Type Log Lin
GB	Span 5 MHz	Presel Center
Occupied Bandwidth 2.3587 MHz	Sweep 16.73 ms (1001 pts) Occ BW % Pwr 99.00 % x dB -26.00 dB	Presel Adjust [3-26 GHz] ♪ 0.000 Hz
Transmit Freq Error 41.067 kHz x dB Bandwidth 4.021 MHz*		More 1 of 3
Copyright 2000-2008 Agilent Technologies		

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7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 0.675dB was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Output Power	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2425	-2.612	30	-32.61
Middle	2450	-2.354	30	-32.35
High	2475	-2.249	30	-32.25

7.1.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 0.675 dB was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency	Power
	(MHz)	(dBm)
Low	2425	-2.825
Middle	2450	-2.559
High	2475	-2.441

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7.1.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

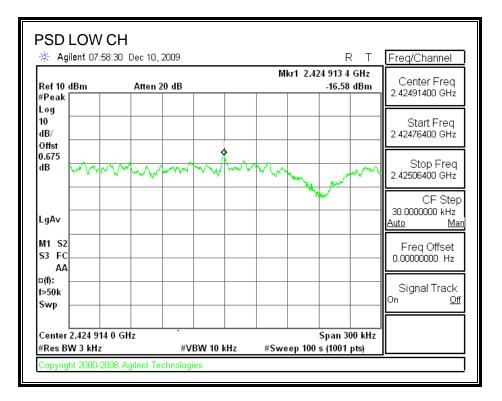
TEST PROCEDURE

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

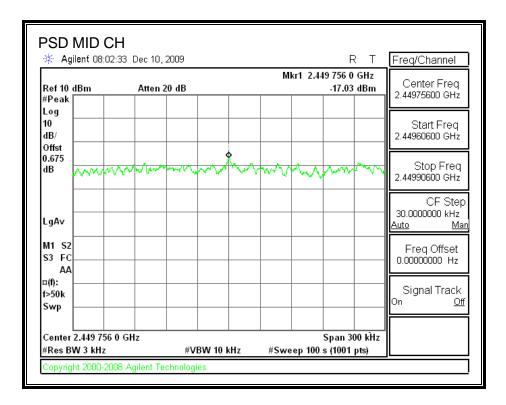
RESULTS

Channel	Frequency	PPSD	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Low	2425	-16.58	8	-24.58
Middle	2450	-17.03	8	-25.03
High	2475	-15.71	8	-23.71

POWER SPECTRAL DENSITY



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🔆 Agilent 08:22	2:32 Dec 10, 2009			RT	Freq/Channel
Ref 10 dBm #Peak	Atten 20 dB		Mkr1 2.4	74 913 1 GHz -15.71 dBm	Center Freq 2.47491400 GHz
Log 10 dB/ Offst		1			Start Freq 2.47476400 GHz
0.675	where the	www	www.	and the second	Stop Freq 2.47506400 GHz
LgAv					CF Step 30.0000000 kHz <u>Auto Mar</u>
V1 S2 S3 FC AA					Freq Offset 0.00000000 Hz
¤(f): f>50k Swp					Signal Track On <u>Off</u>
Center 2.474 914 #Res BW 3 kHz		BW 10 kHz	#Sweep 100	Span 300 kHz s (1001 pts)	_

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7.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

TEST PROCEDURE

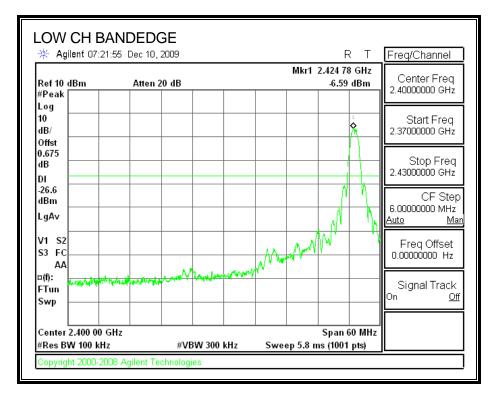
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

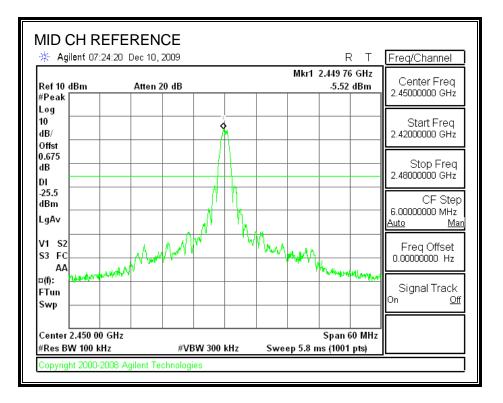


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Ref10dBı #Peak	n	Atten 20	dB			Center Freq 13.0150000 GHz
Log 10 dB/ Offst	0					Start Freq 30.000000 MHz
0.675 dB		2 3 4				Stop Freq 26.000000 GHz
-26.6		have	may man for the same	and the second	-	CF Step 2.59700000 GHz
Start 30 M #Res BW 1			#VBW 300 kHz	Sweep 2.482	op 26.000 GHz s (1001 pts)	Freq Offset
Marker 1 2 3	Trace (1) (1) (1)	Type Freq Freq Freq	X Axis 2.419 GHz 4.860 GHz 7.276 GHz		Amplitude -7.87 dBm -46.41 dBm -51.33 dBm	0.00000000 Hz Signal Track
						On <u>Of</u>

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SPURIOUS EMISSIONS, MID CHANNEL

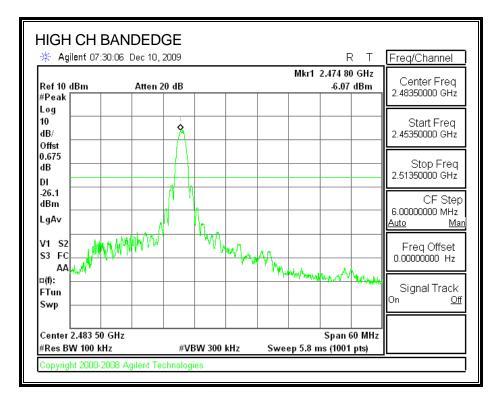


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Ref10dBı #Peak ∏	m	Atten 20) dB			Center Freq 13.0150000 GHz
Log 10 dB/ Offst	0					Start Freq 30.0000000 MHz
0.675 dB		2 3 0 0				Stop Freq 26.000000 GHz
DI -25.5 dBm			and the stand of t	H-consections	hanne	CF Ste
LgAv —	and a start of the second					2.59700000 GHz <u>Auto M</u> a
Start 30 M #Res BW ⁻			#VBW 300 kHz	Steep 2.482	top 26.000 GHz 2 s (1001 pts)	Freq Offset
Marker	Trace	Туре	X Axis		Amplitude	0.00000000 Hz
1	(1)	Freq	2.445 GHz		-9.05 dBm	
2 3	(1) (1)	Freq Freq	4.886 GHz 7.354 GHz		-51.15 dBm -50.20 dBm	Signal Track On <u>O</u>

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SPURIOUS EMISSIONS, HIGH CHANNEL



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Ref10dBr #Peak	n	Atten 20	dB		1				Cente 13.01500	
Log 10 dB/	→								Star 30.00000	t Freq D0 MHz
Offst 0.675 dB DI									Stoj 26.00000	p Freq D0 GHz
-26.1 dBm			mu	- John market	1-11-4-1- 16-4-1	ng hala been		*****	C 2.597000 <u>Auto</u>	F Ste DO GHz <u>M</u> :
Start 30 M #Res BW 1			#VBW 30	0 kHz	Swee	Sto p 2.482 :	p 26.00 s (1001		Freq	
Marker 1 2 3	Trace (1) (1) (1)	Type Freq Freq Freq	:	X Axis 2.471 GHz 4.938 GHz 7.431 GHz			Amplitu -6.61 dB -54.34 dB -48.93 dB	ide m m	0.000000 Signal On	

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8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

<u>LIMITS</u>

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

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, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each appplicable band.

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.

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8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.15.4 IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

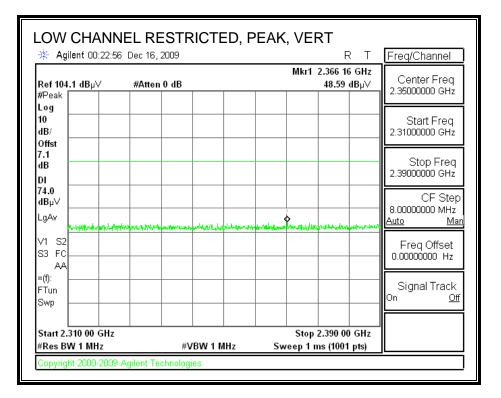
				4 0 007 00		Freq/Channe
404.4.10.5			MK	1 2.387 68		Center Fre
104.1 dBµ∀ ak	#Atten 0 dB			48.78	dBh∧	2.35000000 GI
an I						
'						Start Era
						Start Fre 2.31000000 Gi
at 📃						2.31000000 01
^						
						Stop Fre
						2.39000000 GH
)						
M						CF Si
N						8.00000000 Mi
Marchaller and particulated	ber ann an	anghista Mistanan ana sa katan m	4 14 4.0 200- an +- 10 - al 1	we wanted a state of the second	14 montalism	Auto
S2						Freq Offse
FC						0.00000000 F
						0.00000000 1
				_		
n						Signal Tra
)						On
				op 2.390 00	CH-	
rt 2.310 00 GHz						

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🔆 Agilent 00:19:17 Dec	RESTRICTED, 16, 2009	, R T	Freq/Channel
Ref 104.1 dBµ∨ ## #Peak	Atten 0 dB	Mkr1 2.390 00 GHz 37.94 dBµ∨	Center Freq 2.35000000 GHz
Log 10 dB/			Start Freq 2.31000000 GHz
Offst 7.1 dB DI			Stop Freq 2.39000000 GHz
54.0 dBµ∨ LgAv			CF Step 8.0000000 MHz Auto Mar
V1 S2		,	Freq Offset 0.00000000 Hz
»(f): FTun Swp			Signal Track On <u>Off</u>
Start 2.310 00 GHz #Res BW 1 MHz	#VBW 10 Hz	Stop 2.390 00 GHz Sweep 6.238 s (1001 pts)	

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RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

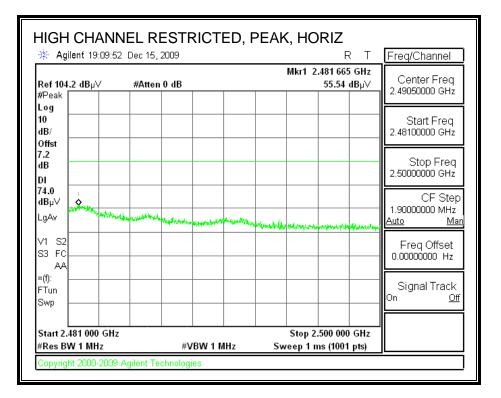


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LOW CHANN		TED, A	AVG, VER	T RT	Freq/Channel
Ref 104.1 dBµ∨ #Peak	#Atten 0 dB		Mkr1	2.389 84 GHz 35.86 dBµ∨	Center Freq 2.3500000 GHz
Log 10 dB/ Offst					Start Freq 2.31000000 GHz
7.1 dB					Stop Freq 2.3900000 GHz
54.0 dBµ∨ LgAv					CF Step 8.0000000 MHz <u>Auto Man</u>
V1 S2 S3 FC				¢	Freq Offset 0.00000000 Hz
×(f): FTun Swp					Signal Track ^{On <u>Off</u>}
Start 2.310 00 GHz #Res BW 1 MHz	#VBW	10 Hz	Stop Sweep 6.238	2.390 00 GHz s (1001 pts)	
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RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

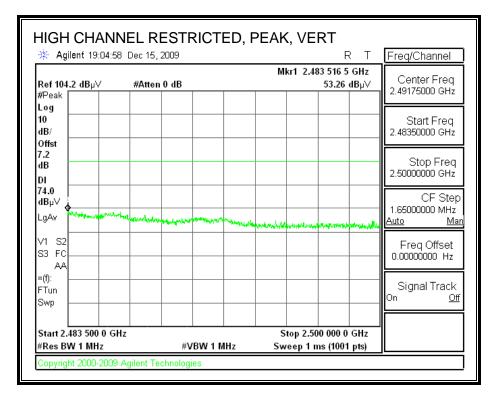


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🔆 Agilent 19:11:44 Dec 15	5, 2009	, R T	, regrenamer
Ref 104.2 dBµ∀ #Atte #Peak	en 0 dB	Mkr1 2.481 950 GHz 45.86 dBµ∀	II Contor From
Log			Start Freq 2.48100000 GHz
7.2 dB DI			Stop Freq 2.50000000 GHz
54.0 dBμ∨ LgAv 1 ♦			CF Step 1.90000000 MHz <u>Auto Mar</u>
V1 S2 S3 FC AA			Freq Offset 0.00000000 Hz
×(f): FTun Swp			Signal Track On
Start 2.481 000 GHz #Res BW 1 MHz	#VBW 10 Hz	Stop 2.500 000 GHz Sweep 1.482 s (1001 pts)	

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RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



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HIGH CHANNEL R		AVG, VERT	Freq/Channel
	n 0 dB	Mkr1 2.485 942 0 GHz 42.69 dBµ∀	Center Freq 2.49175000 GHz
Log 10 dB/ Offst			Start Freq 2.48350000 GHz
7.2 dB DI			Stop Freq 2.5000000 GHz
54.0 dBµ√ LgAv			CF Step 1.6500000 MHz <u>Auto Man</u>
V1 S2 S3 FC AA			Freq Offset 0.00000000 Hz
*(f): FTun Swp			Signal Track On <u>Off</u>
Start 2.483 500 0 GHz #Res BW 1 MHz	#VBW 10 Hz	Stop 2.500 000 0 GHz Sweep 1.287 s (1001 pts)	
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HARMONICS AND SPURIOUS EMISSIONS

- Company	-		[,] Measurem Services, Fr		5m Ch	amber									
roject #		SMK Corpor 09J12958	ation												
ate:	•	December 15	,2009												
-	-	Monica Harr	ison												
onfigura Iode:	ation:	TX w/USB 2.4GHz DSSS	7:4												
			1218066												
est Equ	iipmen	<u>t:</u>													
Ho	orn 1-	18GHz	Pre-ar	nplifer	1-260	SHz	Pre-am	plifer	26-40GH			orn > 180			Limit
T59; S/	/N: 324	5@3m	• T145 A	Agilent 3	008A0					• T12	5; ARA 18-2	26GHz; S/N	:1007	-	FCC 15.209
- Hi Frequ			401				201 00	hin 22	807500					Pea	k Measurements
		2807700		able 2		00					HPF		eject Filte	" RB	W=VBW=1MHz
3'ca	ble 228	,007700	12' ca	ble 228	07600	•	20' cab	le 2280	·/500			- R_	001	•	a <u>ge Measurements</u> =1MHz ; VBW=10Hz
f	Dist		Read Avg.	AF	CL	Amp	D Corr	Fltr	Peak	Avg	Pk Lim	Avg Lim		Avg Mar	Notes
GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
425 062	3.0	63.4	39.2	24.2	2.4	-36.1	0.0	0.0	53.9	29.7	74	54	-20.1	-24.3	Н
593	3.0	61.1	32.6	26.1	3.0	-35.7	0.0	0.0	54.6	26.0	74	54	-19.4	-28.0	Н
187	3.0 2.0	47.2	29.0	30.4	45	-35.1 24.7	0.0	0.0	47.0 52.0	28.8	74	54 54	-27.0	-25.2	H
276 066	3.0 3.0	44.3 65.5	33.4 36.2	35.1 24.2	7.2 2.4	-34.7 -36.1	0.0 0.0	0.0 0.0	52.0 56.1	41.2 26.8	74 74	54 54	-22.0 -17.9	-12.8 -27.2	H V
596	3.0	65.9	35.6	26.1	3.0	-35.7	0.0	0.0	59.3	29.1	74	54 54	-14.7	-24.9	v
202	3.0	47.7	27.8	30.5	45	-35.1	Q.O	0.0	47.5	27.6	74	54	- 26.5	- 26.4	v
000	3.0 3.0	44.4 43.1	26.1	32.9 35.1	59 7.2	-34.9 -34.7	0.0 0.0	0.0 0.0	48.3	30.1	74 74	54 54	-25.7	-239 -14.4	<u>v</u> v
276	لاد	43.1	31.9	33.1	12	-34.7	U.U	U.U	50.8	39.6	/4	74	-23.2	-14.4	Υ
450	20	61.0	20 4	24.2		26.3	0.0	0.0	619	40.0			10.0		
064 596	3.0 3.0	64.2 64.9	39.4 35.6	24.2 26.1	2.4 3.0	-36.1 -35.7	0.0 0.0	0.0 0.0	54.7 58.4	29.9 29.1	74 74	54 54	-19.3 -15.6	-24.1 -24.9	v v
185	3.0	49.4	27.8	30.4	45	-35.1	0.0	0.0	49.1	27.6	74	54 54	-24.9	-26.4	v
990	3.0	44.8	26.3	32.9	59	-34.9	0.0	0.0	48.7	30.3	74	54	-25.3	-23.7	v
349	3.0	42.1	31.2	35.2	73	-34.6	0.0	0.0	50.0	39.0 20.6	74	54	-24.0	-15.0	V H
062 598	3.0 3.0	62.8 60.0	39.1 32.9	24.2 26.1	2.4 3.0	-36.1 -35.7	0.0 0.0	0.0 0.0	53.3 53.5	29.6 26.4	74 74	54 54	-20.7 -20.5	-24.4 -27.6	H H
187	3.0	44.4	27.7	30.4	45	-35.1	0.0	0.0	44.2	27.5	74	54 54	-29.8	-26.5	H
351	3.0	46.2	35.2	35.2	73	-34.6	0.0	0.0	54.1	43.1	74	54	- 19 9	-10.9	H
475															
	3.0 2.0	62.7	42.4	24.2	2.4	-36.1	0.0	0.0	53.2	32.9	74	54	-20.8	-21.1	Н
	3.0 3.0	59.3 47.2	33.0 36.9	26.1 35.3	3.0 7.3	-35.7 -34.6	0.0 0.0	0.0 0.0	52.8 55.2	26.5 44.9	74 74	54 54	-21.2 -18.8	-27.5 -9.1	H H
593	3.0	60.3	40,4	24.2	2.4	-36.1	0.0	0.0	50.8	30.9	74	54	-23.2	-23.1	V
593 424		62.8	33.2	26.1	3.0	-35.7	0.0	0.0	56.2	26.6	74	54	-17.8	-27.4	<u>v</u>
593 424 D63 593	3.0	48.6	28.0	30.4	4.5 5.9	-35.1 -34.9	0.0 0.0	0.0 0.0	48.4 51.4	27.8 30.1	74 74	54 54	-25.6 -22.6	-26.2 -23.9	v v
593 424 063 593 193	3.0		26.2	320			. 0.0			37.3	74	54 54	-22.0	-23.9	v
064 593 424 063 593 .193 .976 424		47.5	26.2 29.3	32.9 35.4	73	-34.6	0.0	0.0	48.9				07.1	100	

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8.3. RECEIVER ABOVE 1 GHz

8.3.1. RECEIVER ABOVE 1 GHz IN THE 2.4 GHz BAND

Complia	-		/ Measurem Services, Fr		5m Ch	amber									
ompan roject # ate: est En;	y: #: gineer:	SMK Corpor 09J12958 December 15 Monica Ham RX w/USB 2.4GHz DSS5	ration 5,2009 iison												
est Eq	uipmen	<u>.t:</u>	-												
н	orn 1-	18GHz	Pre-ar	nplifer	1-260	GHz	Pre-am	plifer	26-40GH	z	H	orn > 180	GHz		Limit
T59; S	5/N: 324	5 @3m	- T145 A	gilent 3	008A00	056 🖵				-				-	FCC 15.209 -
	uency Ca	bles	12' c	able 2	28076	600	20' ca	ble 22	807500		HPF	Re	ject Filte		<u>x Measurements</u> W=VBW=1MHz
3' ca	able 22	307700	▼ 12' ca	ble 228	07600	•	20' cab	le 2280)7500 -			-			ge Measurements 1MHz ; VBW=10Hz
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	0	Pk Mar dB	Avg Mar dB	Notes (V/H)
)64	3.0	65.0	38.6	24.2	2.4	-36.1	0.0	0.0	55.5	29.1	74	54	-18.5	-24.9	V
593 188	3.0 3.0	66.D 54.9	35.0 29.1	26.1 28.5	3.0 3.9	-35.7 -35.1	0.0 0.0	0.0 0.0	59.4 52.2	28.5 26.4	74 74	54 54	-14.6 -21.8	-25.5 -27.6	v
186	3.0	48.0	28.0	30.4	4.5	-35.1	0.0	0.0	47.8	27.8	74	54	-26.2	- 26.2	v
981 066	3.0 3.0	45.A 62.2	26.2 40.7	32.9 24.2	59 2.4	-34.9 -36.1	0.0 0.0	0.0 0.0	49.3 52.7	30.2 31.2	74 74	54 54	-24.7 -21.3	-23.8 -22.8	V H
000 597	3.0	58.3	40.7	24.2	2.4 3.0	-30.1	0.0	0.0	52./ 51.8	31.2 25.2	74	54 54	-21.3	-22.8	H
497	3.0	53.2	29.4	28.5	39	-35.1	0.0	0.0	50.5	26.7	74	54	- 23 .5	-27.3	H
185 ev. 11.10	3.0	48.0	28.0	30.4	45	-35.1	0.0	0.0	47.8	27.8	74	54	-26.2	-26.2	H
	f Dist Read AF CL	Measurem Distance to Analyzer R Antenna Fa Cable Loss	.eading actor	7		Amp D Corr Avg Peak HPF	Average	Corre Field S d Peal	ct to 3 mete Strength @ c Field Stre	3 m		Pk Lim Avg Mar	Peak Field Margin vs	ïeld Strengtl I Strength Li Average Li Peak Limit	imit imit

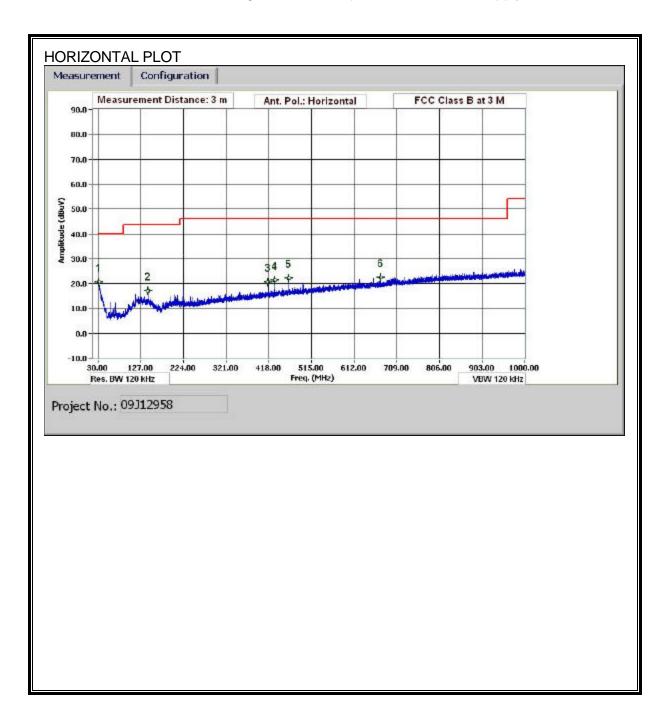
COMPLIANCE CERTIFICATION SERVICESFORM NO: CCSUP4701C47173 BENICIA STREET, FREMONT, CA 94538, USATEL: (510) 771-1000FAX: (510) 661-0888This report shall not be reproduced except in full, without the written approval of CCS.

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8.4. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

For Below 1 GHz emissions testing, the EUT was powered with a DC Supply at 2.7V.

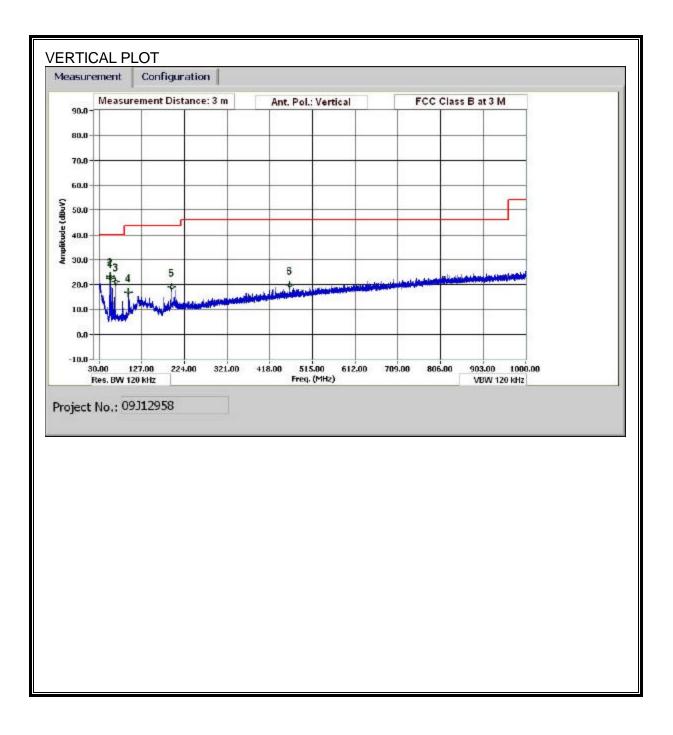


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est Engr: ate: roject #: ompany: UT Description UT M/N:		Monica H 12/15/09 09J12958 SMK Cor 2.4GHz E	poration		odule								
st Target:		FCC Clas	ss B										
lode Oper:		TX w/DC]	Power										
f		Measurern	ent Freque	ency	Amp	Preamp (Gain			Margin	Margin vs.	Limit	
Dist		Distance to	o Antenn	a	D Corr	Distance	Correct	to 3 meters					
Read	1	Analyzer I	Reading		Filter	Filter Ins	ert Loss						
AF		Antenna F	-		Corr.	Calculate	d Field S	trength					
CL		Cable Loss			Limit	Field Stre	ngth Lir	nit					
f Di	st	Read	AF	CL	Amp	D Corr	Filter	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
MHz (n	٥.	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	
.560 3.	0	30.0	19.6	0.5	29.7	0.0	0.0	20.5	40.0	-19.5	н	P	
13.165 3.		32.4	13.0	1.1	29.3	0.0	0.0	17.1	43.5	-26.4	H	P	
16.056 3.	*********	32.8	15.3	1.9	29.4	0.0	0.0	20.7	46.0	-25.3	Н	P	
2.017 3.		33.3	15.6	2.0	29.4	0.0	0.0	21.5	46.0	-24.6	Н	P	
64.058 3.		33.4	16.2	2.1	29.6	0.0	0.0	22.0	46.0	-24.0	н	P	
2.026 3.	0	30.5	19.0	2.5	29.6	0.0	0.0	22.4	46.0	-23.6	Н	P	

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SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



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VERTICAL DATA

est Target: Iode Oper: f Dist Reau AF
CL
f Di
MHz (n
5.081 3.
.441 3.
162 3. 363 3.
.367 3.
.938 3.
<u>te: No other</u>

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9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted I	Limit (dBuV)
	Quasi-peak	Average
0.15-0.5	66 to 56 °	56 to 46 "
0.5-5	56	46
5-30	60	50

Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

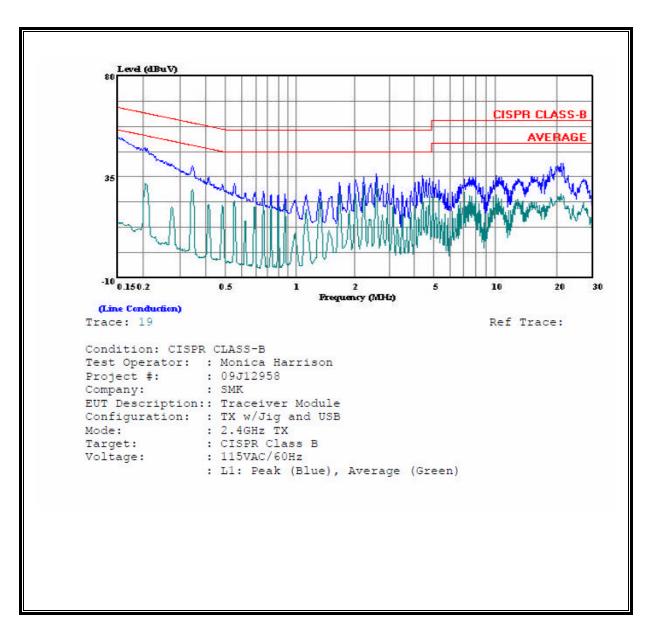
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<u>6 WORST EMISSIONS</u>

	CONDUCTED EMISSIONS DATA (115VAC 60Hz)										
Freq.		Closs	Limit	FCC_B	Marg	çin .	Remark				
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV(dB)	L1/L2		
0.15	52.39		15.73	0.00	65.89	55.89	-13.50	-40.16	L1		
0.20	47.48		31.77	0.00	63.53	53.53	-16.05	-21.76	L1		
0.35	39.95		29.44	0.00	59.06	49.06	-19.11	-19.62	L1		
0.17	50.65		14.59	0.00	64.77	54.77	-14.12	-40.18	L2		
0.21	47.74		28.71	0.00	63.37	53.37	-15.63	-24.66	L2		
21.04	41.55		27.22	0.00	60.00	50.00	-18.45	-22.78	L2		
6 Worst I	 Data 										

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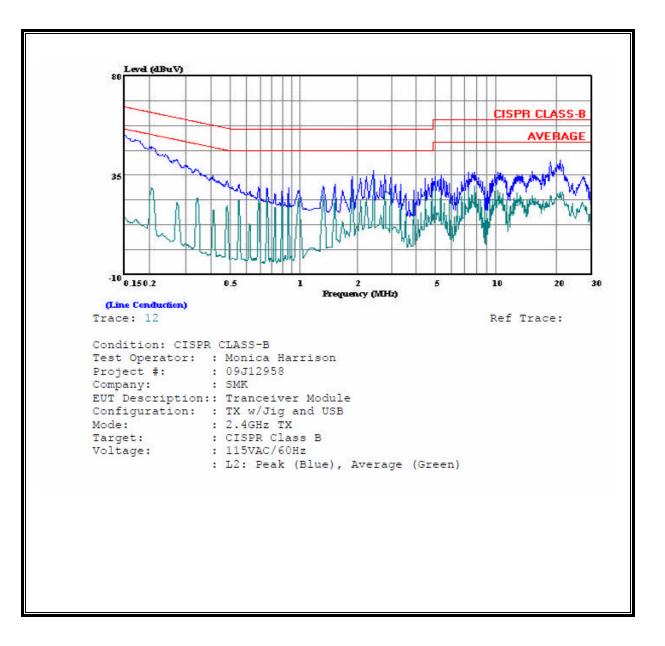
LINE 1 RESULTS



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LINE 2 RESULTS



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10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§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.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Lim	its for Occupational	//Controlled Exposu	res	
).3–3.0	614	1.63	*(100)	
.0–30	1842/f	4.89/f	*(900/f2)	
0–300	61.4	0.163	1.0	
00–1500			f/300	
500–100,000			5	
(B) Limits	for General Populati	on/Uncontrolled Exp	posure	
).3–1.34	614	1.63	*(100)	3
1.34–30	824 <i>/</i> f	2.19/f	*(180/f ²)	3

TABLE 1-LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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/cm²)	Averaging time (minutes)
30–300 300–1500 1500–100,000	27.5	0.073	0.2 f/1500 1.0	30 30 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 occu-tion of the exposure.

pational/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 ex-posed, 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.

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IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5

Exposure Limits for Persons Not Classed As RF and Microwave Ex-
posed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m ²)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/f	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> ^{0.5}	0.0042f ^{0.5}	f/150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 /f ^{1.2}
150 000–300 000	0.158f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616 000 /f ^{1.2}

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.

- 2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2 .
- A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

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EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m² EIRP = Equivalent Isotropic Radiated Power in W D = Separation distance in m

Power density in units of W/m² is converted to units of mWc/m² by dividing by 10.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Band	Mode	Separation	Output	Antenna	IC Power	FCC Power
		Distance	Power	Gain	Density	Density
		(m)	(dBm)	(dBi)	(W/m^2)	(mW/cm^2)
2.4 GHz	802.15.4	0.20	-2.25	4.64	0.0035	0.0003