



MEASUREMENT AND TEST REPORT

VERSION 1.01

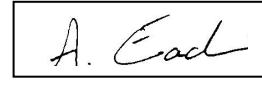
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Equipment Under Test (EUT): ISFM2201

FCC ID: XBD-ISFM2201
IC ID: 10801A-ISFM220X

FCC Rule Part(s): Part 15.247
Industry Canada Rule Part(s) RSS-210

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Note: This test report has been prepared for the Applicant and device described herein. It may not be duplicated or used in part without prior written consent from Island Compliance Services Inc.

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Revision History

Version	Date	Author	Comment
1.0	7/03/2013	A. Horel	Original Release
1.01	26/04/2013	A. Horel	Release update

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2 SUMMARY OF TEST RESULTS

The equipment under test was found to comply with the test standards and criteria outlined herein.

Test Description	Reference Specification FCC	Reference Specification Industry Canada	Result	Comment
RF Peak Power Output	FCC Subpart C 15.247(b) (3)	RSS 210 Issue 8 A8.4(4)	Complies	
Occupied Bandwidth 6dB Bandwidth	FCC Subpart C 15.247 (a) (2)	RSS 210 Issue 8 A8.2(a)	Complies	
Occupied Bandwidth 20dB Bandwidth	N/A	RSS-Gen Issue 3 4.6.1	Complies	
Number of Hopping Channels	FCC Subpart C 15.247(a)(1)(iii)	RSS 210 Issue 8 A8.1	Complies	
Hopping Frequency Separation	FCC Subpart C 15.247(a)	RSS 210 Issue 8 A8.1	Complies	
Average time of Occupancy	FCC Subpart C 15.247(a)(1)(iii)	RSS 210 Issue 8 A8.1	Complies	
Power Spectral Density	FCC Subpart C 15.247(e)	RSS 210 Issue 8 A8.2(b)	Complies	
Duty Cycle Correction factor	FCC Subpart C 15.35(c)	RSS-Gen Issue 3 4.5	Complies	
Conducted Spurious Emissions	FCC Subpart C 15.247(d)	RSS 210 Issue 8 A8.5	Complies	
Conducted Spurious Emissions Band Edge	FCC Subpart C 15.247(d)	RSS 210 Issue 8 A8.5	Complies	
Radiated Spurious Emissions Band Edge	FCC Subpart C 15.209(a) 15.205(a)	RSS 210 Issue 8 2.5, A8.5	Complies	
Radiated Spurious Emissions (TX and RX)	FCC Subpart C 15.247, 15.205 FCC Subpart B 15.109	RSS 210 Issue 8 2.5, A8.5 RSS Gen Issue 3 Section 4.10 and section 6 for RX ICES-003 Issue 4	Complies	

2.1 ENVIRONMENTAL CONDITIONS

Description	
Test Dates	23 rd November 2012 – 5 th December 2012
Indoor Temperature	21°C - 22°C
Indoor Humidity	52-56%
Outdoor Temperature	9°C - 12°C
Outdoor Humidity	80-90%

2.2 STANDARD TEST CONDITIONS AND ENGINEERING PRACTICES

Except as noted herein, the following conditions and procedures were observed during the testing:

CFR 47, FCC rules Part 15 subpart C, ANSI C63.4 (2003), Public Notice DA 00-705, DTS procedures KDB 558074, IC standards RSS-GEN and RSS0210. ANSI C63.4-2003 or later, was used for all test procedures as required by RSS-Gen I3 2010, Section 4.1. Deviations, modification or clarifications (if any) to above mentioned documents are described herein.

Measurement results, unless otherwise noted, are worst-case measurements.

3 GENERAL EQUIPMENT SPECIFICATIONS

Item	Description
Manufacturer	AAMP of America
Model	ISFM2201
Function	Bluetooth In Car Handsfree Device
Power Supply Input	12 V nom
Antenna Gain/Type	+0.5dBi/Linear
Channel Spacing	1MHz
Frequency Range	2402MHz – 2480MHz
Modulation	GFSK

3.1 AUXILIARY EQUIPMENT

Equipment	Description
Cellphone	iPhone 4 (A1132)
Speaker	Dell computer speaker CN-0F6371-48220-5CF-070F

3.2 ENGINEERING CHANGES TO PRODUCTION UNIT

N/A

4 RF PEAK POWER OUTPUT

Test Name	Reference Specification	Result	Notes
RF Peak Power Output	15.247(b)(3) A8.4 (4)	Complies	

4.1 TEST METHOD

RSS-Gen Issue 3 4.8 and FCC Publication 558074, Section 15.247(b) – 2. Set the RBW \geq EBW. Set VBW $\geq 3 \times$ RBW. Set span = zero. Sweep time = auto couple. Detector = peak. Trace mode = max hold. Allow trace to fully stabilize. Use peak marker function to determine the peak amplitude level within the fundamental emission.

4.2 DATA

Channel	Tuned Frequency (MHz)	Peak Power (dBm)	Ext Attn (dB)	Corrected (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-26.53	20	-6.53	+30	36.53
Mid	2241	-26.15	20	-6.15	+30	36.15
High	2480	-25.99	20	-5.99	+30	35.99

4.3 PLOT(s)

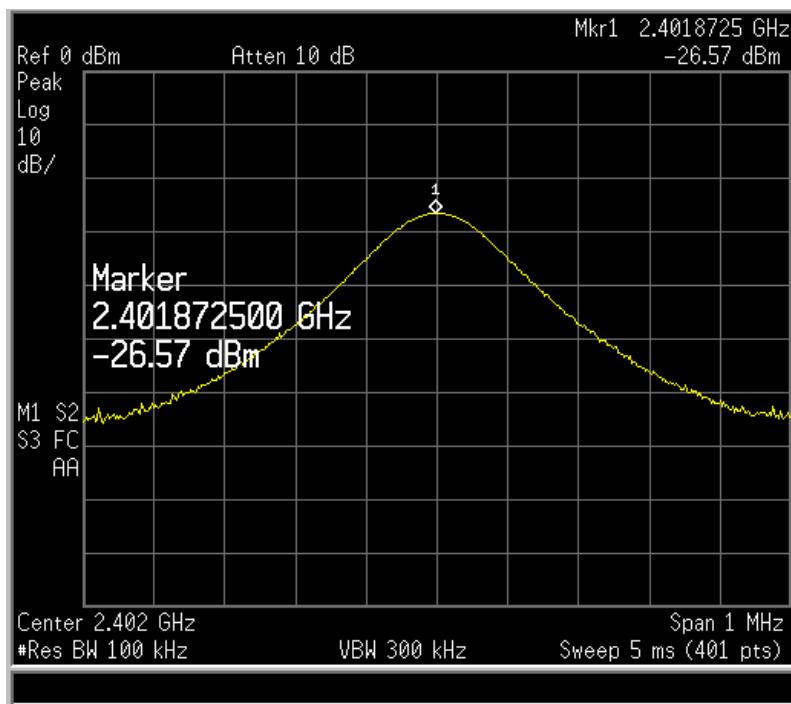


FIGURE 1 - PEAK OUTPUT POWER, LOW CHANNEL

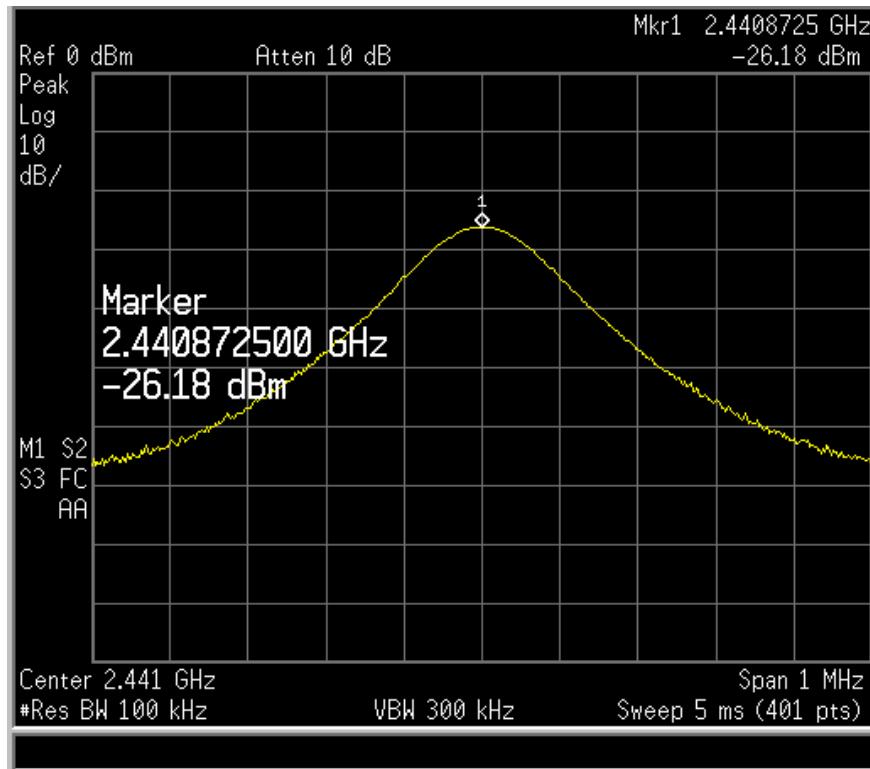


FIGURE 2 - PEAK POWER, MID CHANNEL

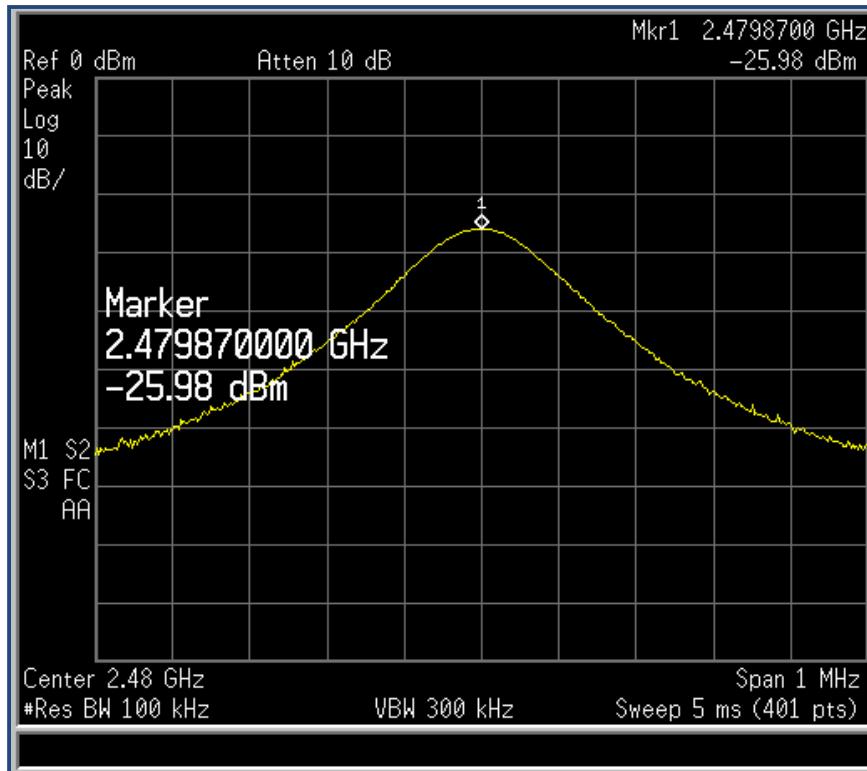


FIGURE 3 - PEAK POWER, HIGH CHANNEL

5 OCCUPIED BANDWIDTH

Test Description	Reference Specification	Result	Notes
Occupied Bandwidth 6dB and 20dB	15.247(a) A8.2(a) 4.6.1	Complies	

5.1 TEST METHOD

RSS-Gen Issue 4.6.1 and FCC Publication 558074, Section 15.247(a) (2) – Emission Bandwidth (EBW) -
Method: Set RBW=1-5% of the emission bandwidth (EBW), VBW= \geq 3 x RBW, Detector=Peak, Trace mode=max hold, Sweep=auto couple, allow trace to stabilize. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5%.

Test performed with modulation ON and 100% duty cycle

5.2 DATA

Channel	Tuned Frequency (MHz)	99%	6 (dB)
Low	2402	829.6 KHz	375.96 KHz
Mid	2241	821.6 KHz	376.3 KHz
High	2480	819.1 KHz	385.25 KHz

5.3 PLOTS

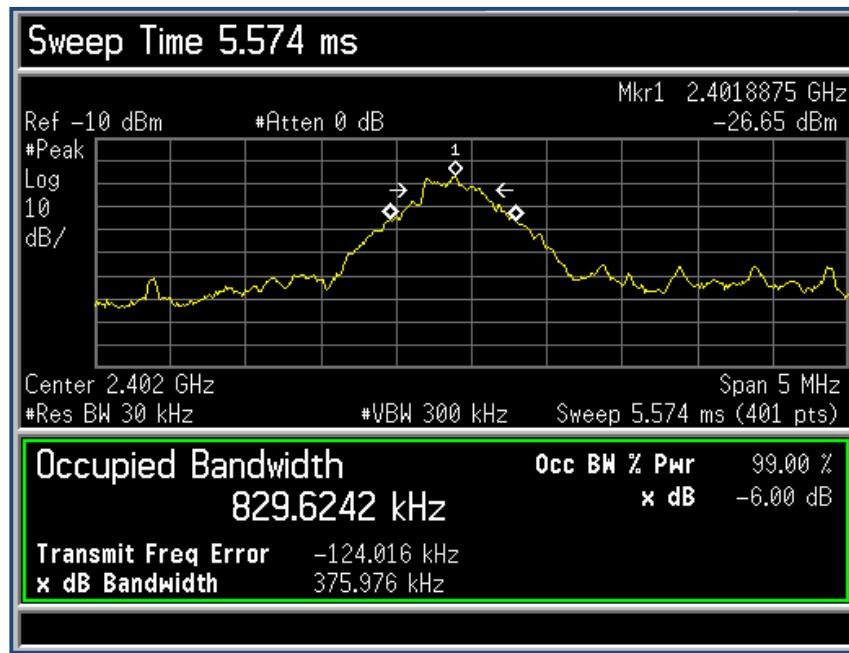


FIGURE 4 - LOW CHANNEL OCCUPIED BANDWIDTH (20DB)

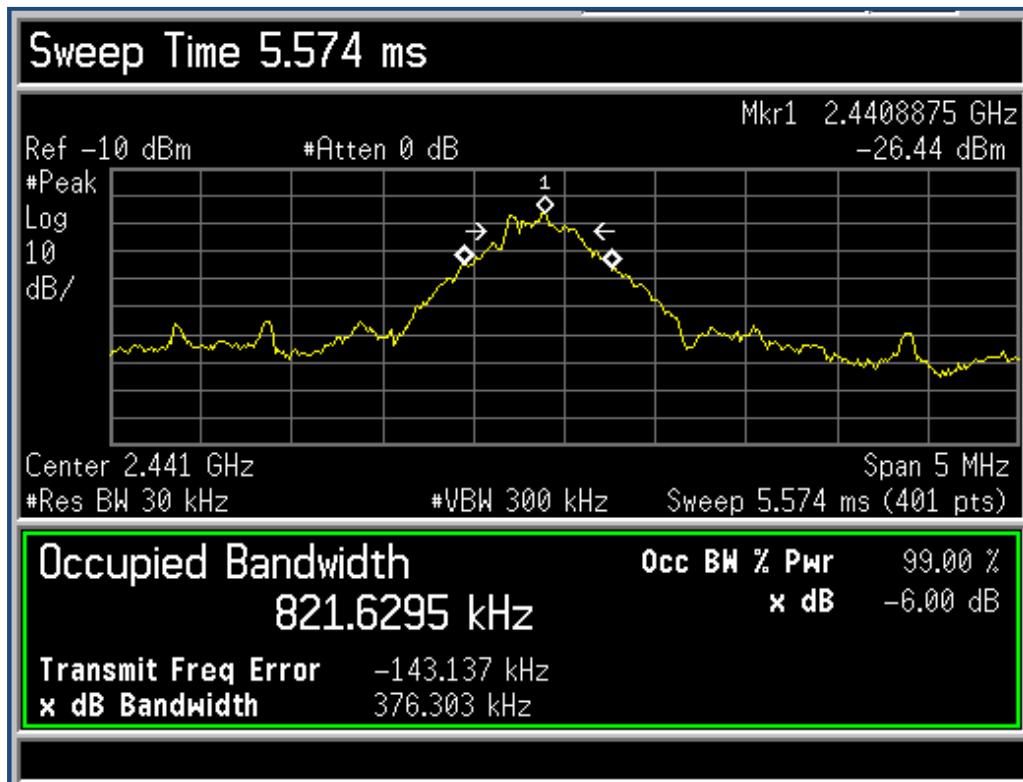


FIGURE 5 – MID CHANNEL OCCUPIED BANDWIDTH (20DB)

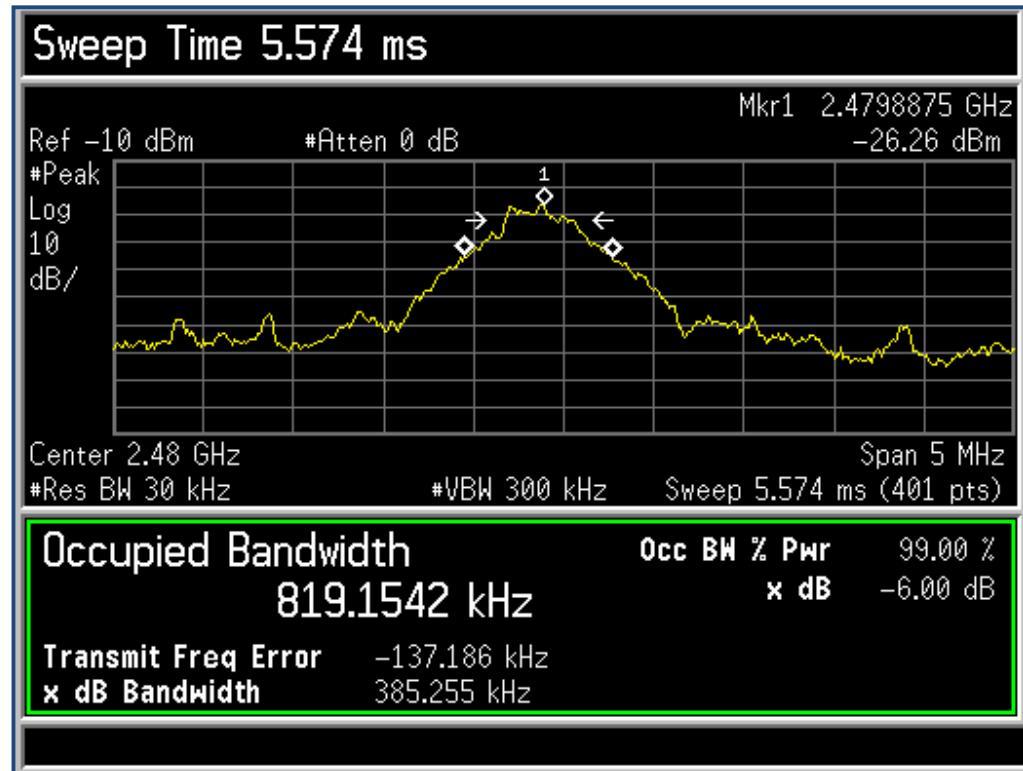


FIGURE 6 - HIGH CHANNEL OCCUPIED BANDWIDTH (20DB)

6 NUMBER OF HOPPING CHANNELS

Test Description	Reference Specification	Result	Notes
Number of hopping channels	15.247(a)(1)(iii) A8.1	Complies	

6.1 DATA

Test Description	Limit	Observed	Result
Number of hopping channels	>15 channels	79 Channels	Complies

7 HOPPING FREQUENCY SEPARATION

Test Description	Reference Specification	Result	Notes
Hopping frequency separation	15.247(a) A8.1	Complies	

7.1 DATA

Test Description	Limit	Observed (Mhz)	Result
Hopping frequency separation	>25kHz or >20dB BW	1.0	Complies

7.2 PLOT

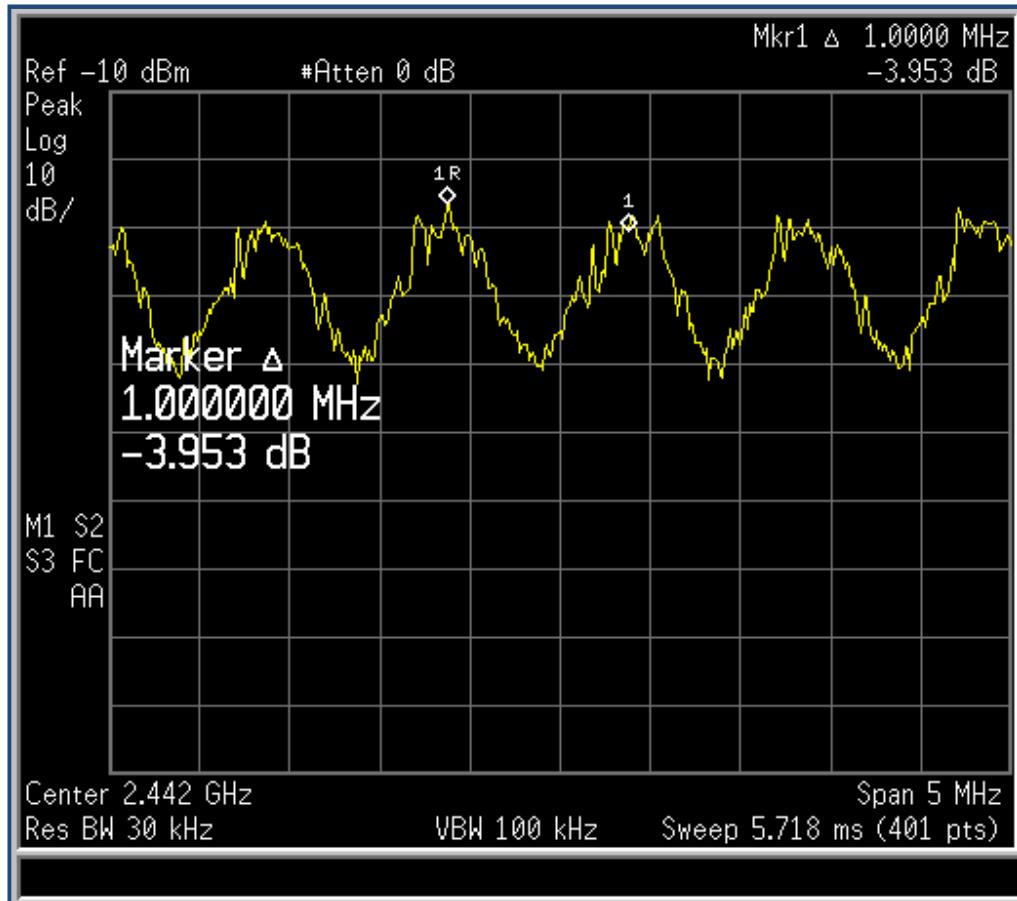


FIGURE 7 – HOPPING FREQUENCY SEPARATION

8 AVERAGE TIME OF OCCUPANCY

Test Description	Reference Specification	Result	Notes
Average time of occupancy	FCC Subpart C 15.247(a)(1)(iii)	Complies	

8.1 LIMIT

As per 15.247 (a)(1)(iii), The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measure in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10^* (\# \text{ of pulses in } 3.16\text{s}) * \text{pulse width}$.

8.2 DATA

DH Packet	Pulse Width (ms)	No. in 3.16s	Average Occupancy (ms)	Limit (ms)	Margin (ms)
DH1	0.5	32	160	400	240
DH3	1.7	16	272	400	128
DH5	3.0	10	300	400	100

8.3

8.4 PLOTS

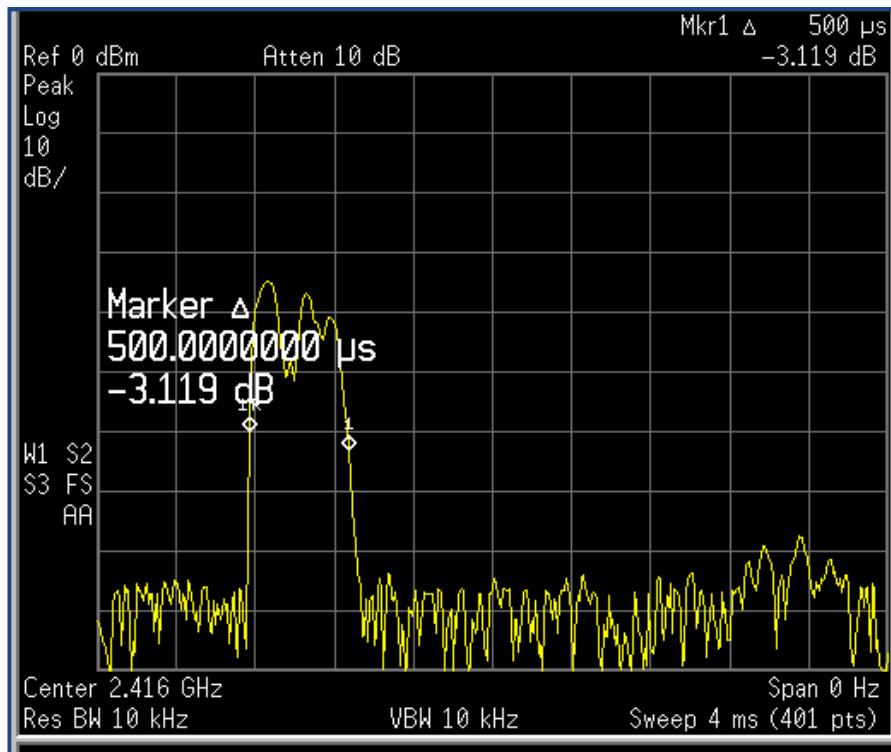


FIGURE 8 – AVERAGE OCCUPANCY DH1

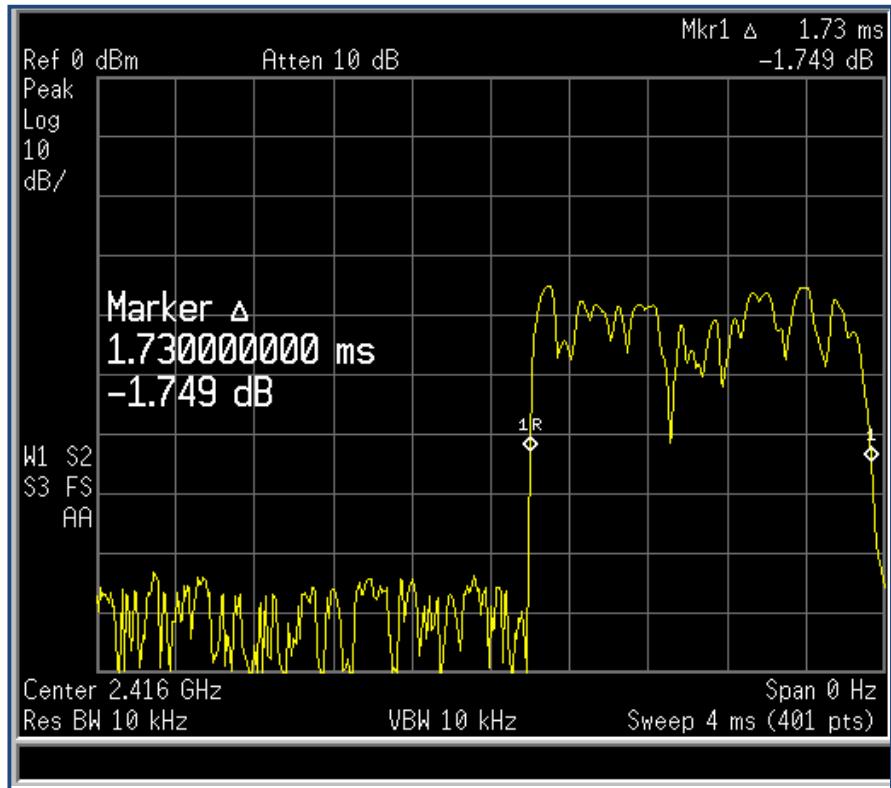


FIGURE 9 – AVERAGE OCCUPANCY DH3 (CAPTURE 1)

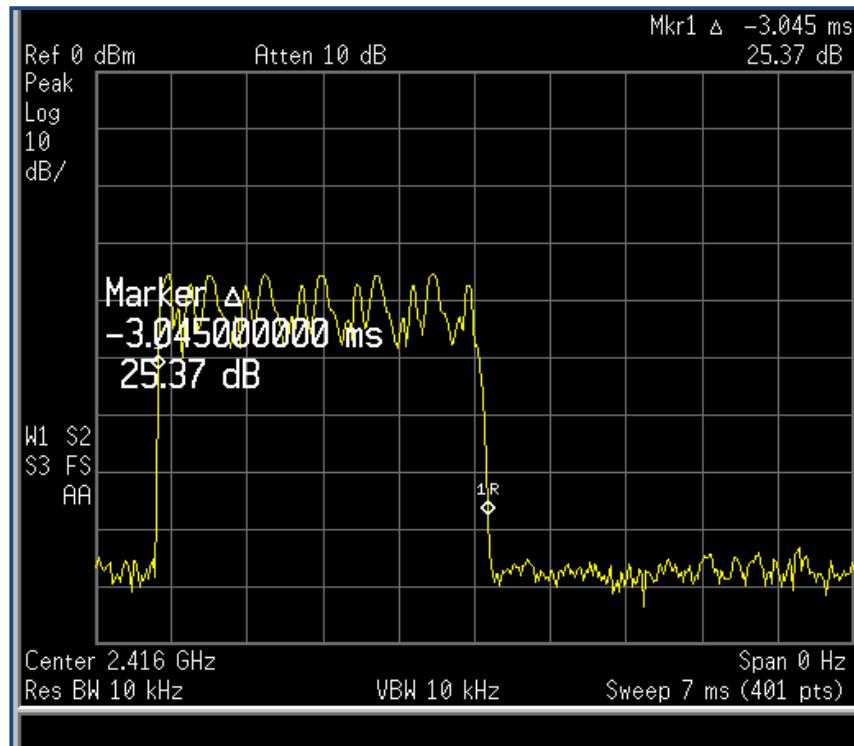


FIGURE 10 – AVERAGE OCCUPANCY DH5 (CAPTURE 1)

9 POWER SPECTRAL DENSITY

Test Description	Reference Specification	Result	Notes
Power Spectral Density	15.247(e) A8.2 (b)	Complies	maximum measured power spectral density: -17.72

9.1 TEST METHOD

RSS-210 Issue 8 and FCC Publication 558074, Section 15.247(e) - Maximum Power Spectral Density Level in the Fundamental Emission (PSD) – Method: RBW = 100 kHz, VBW \geq 300 kHz, Span=5-30 % greater than the EBW, Detector= peak, Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize. The peak marker function is used to determine the maximum power level in any 100 kHz band segment within the fundamental EBW. The observed power level is scaled to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = $10\log(3\text{ kHz}/100\text{kHz})$ = **-15.2 dB**.

9.2 LIMITS

15.247(e) specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz band segment within the fundamental EBW during any time interval of continuous transmission.

9.3 DATA

Channel	Frequency (GHz)	Pk Power (dBm)	CF (dB)	PSD (dBm)
Low	2402 MHz	-20.37	15.2	-5.17
Mid	2241 MHz	-18.15	15.2	-2.95
High	2480 MHz	-17.72	15.2	-2.52

9.4 PLOTS

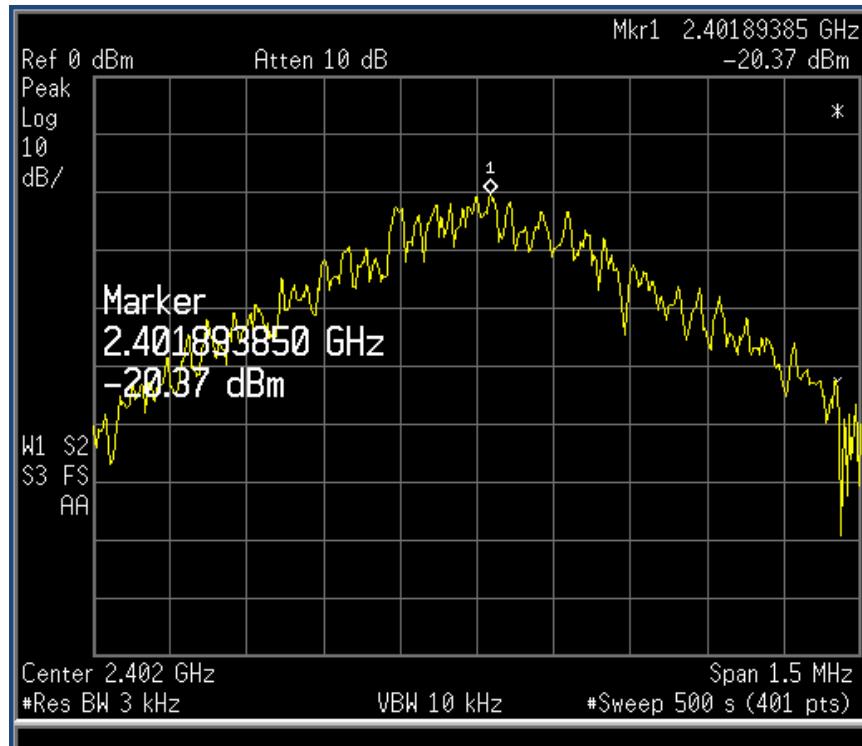


FIGURE 11 - LOW CHANNEL POWER SPECTRAL DENSITY

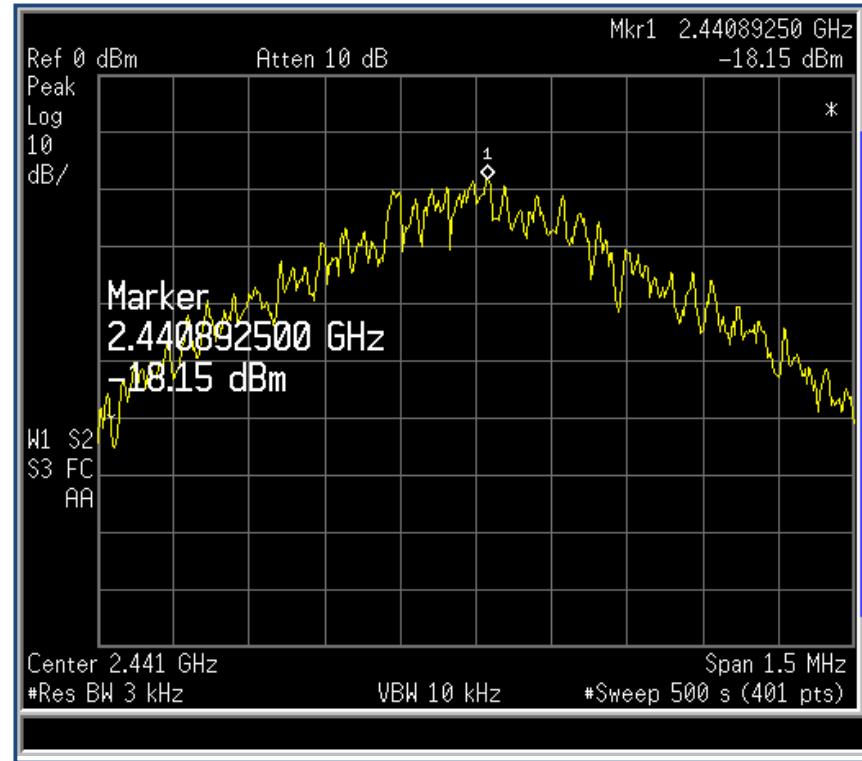


FIGURE 12 - MID CHANNEL POWER SPECTRAL DENSITY (CAPTURE 1)

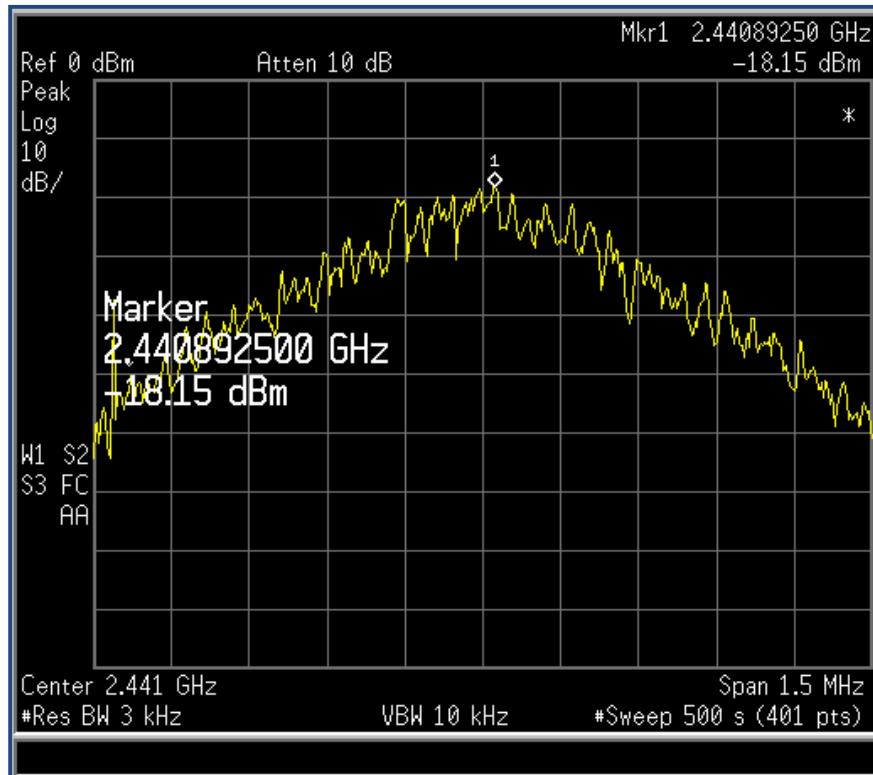


FIGURE 13 – MID CHANNEL POWER SPECTRAL DENSITY (CAPTURE 2)

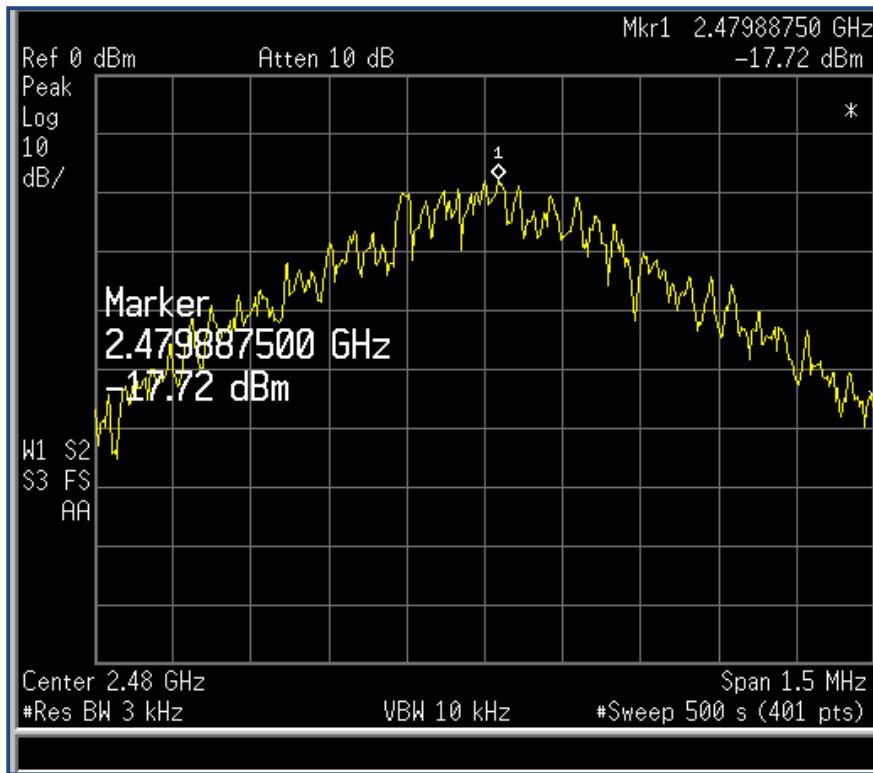


FIGURE 14 – HIGH CHANNEL POWER SPECTRAL DENSITY

10 CONDUCTED SPURIOUS EMISSIONS

Test Description	Reference Specification	Result	Notes
Conducted Spurious Emissions	15.247(c) A8.5	Complies	

10.1 TEST METHOD

RF conducted as per FCC Publication 558074
RSS-210 Issue 8 A8.5

10.2 LIMITS

15.247(c) In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. 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(1) (see 15.205(c)).

10.3 DATA

Channel	Fundamental (dBm)	Harmonic 2 (dBc)	Harmonic 3 (dBc)	Limit (dBc)	Result
Low (11)	-26.4	-48.24	-54.25	-20	Complies
Mid (18)	-25.98	-45.31	-53.99	-20	Complies
High (26)	-25.75	-44.97	-55.43	-20	Complies

Note: worst case harmonic: -44.97

10.4 PLOTS

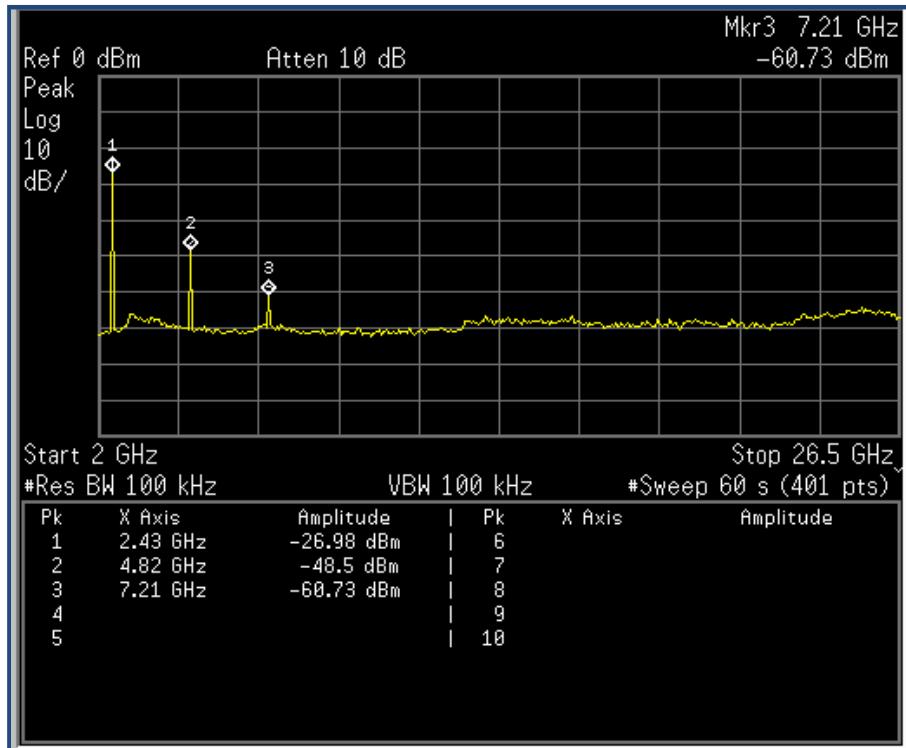


FIGURE 15 - LOW CHANNEL CONDUCTED SPURIOUS

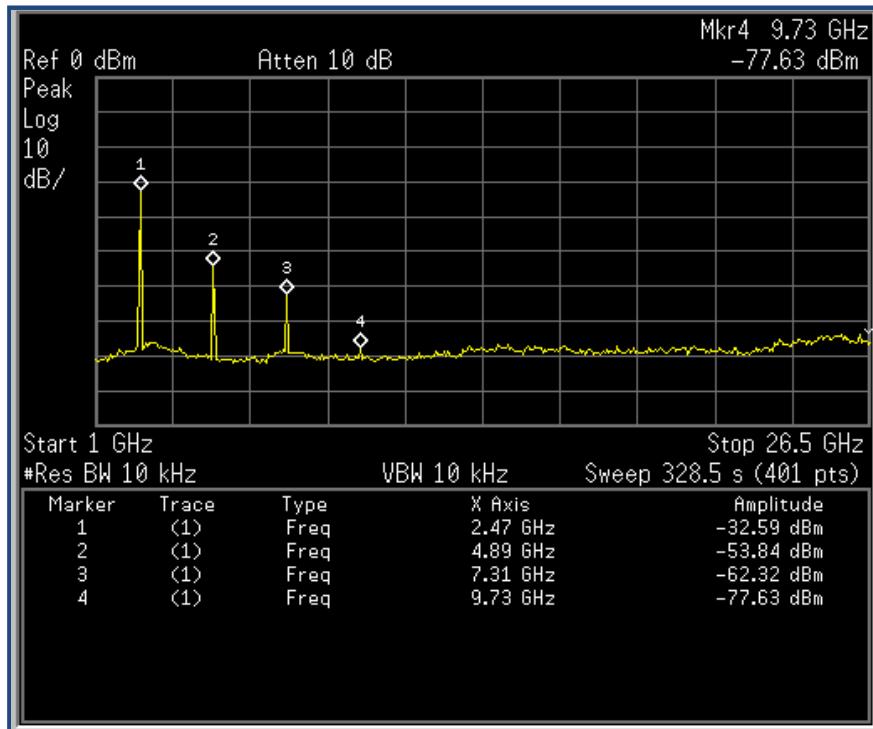


FIGURE 16 -MID CHANNEL CONDUCTED SPURIOUS

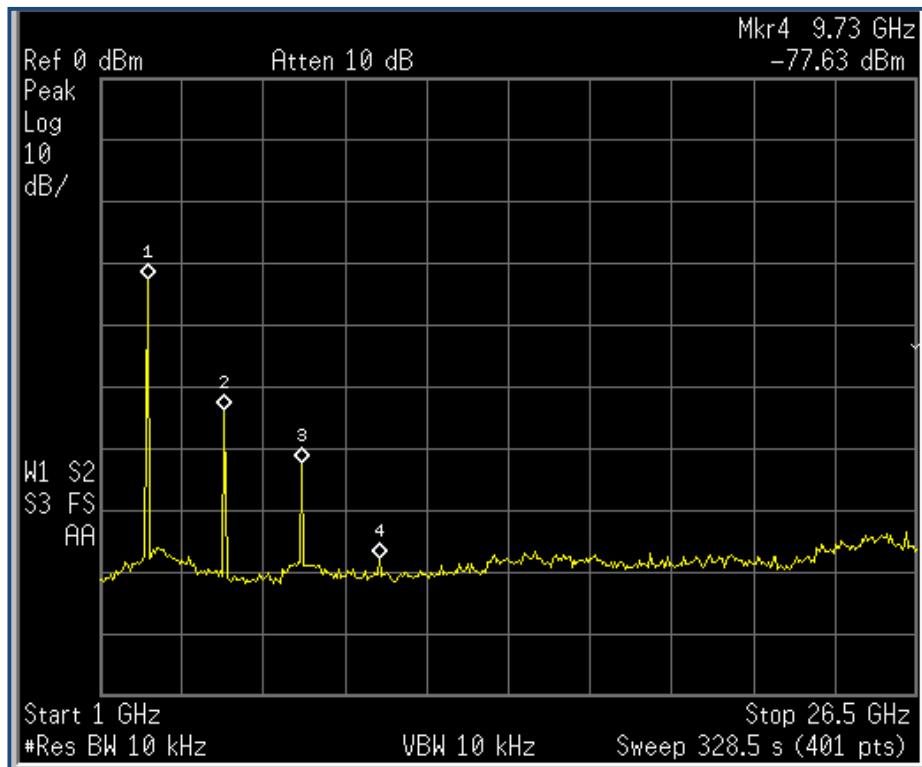


FIGURE 17 - MID CHANNEL CONDUCTED SPURIOUS

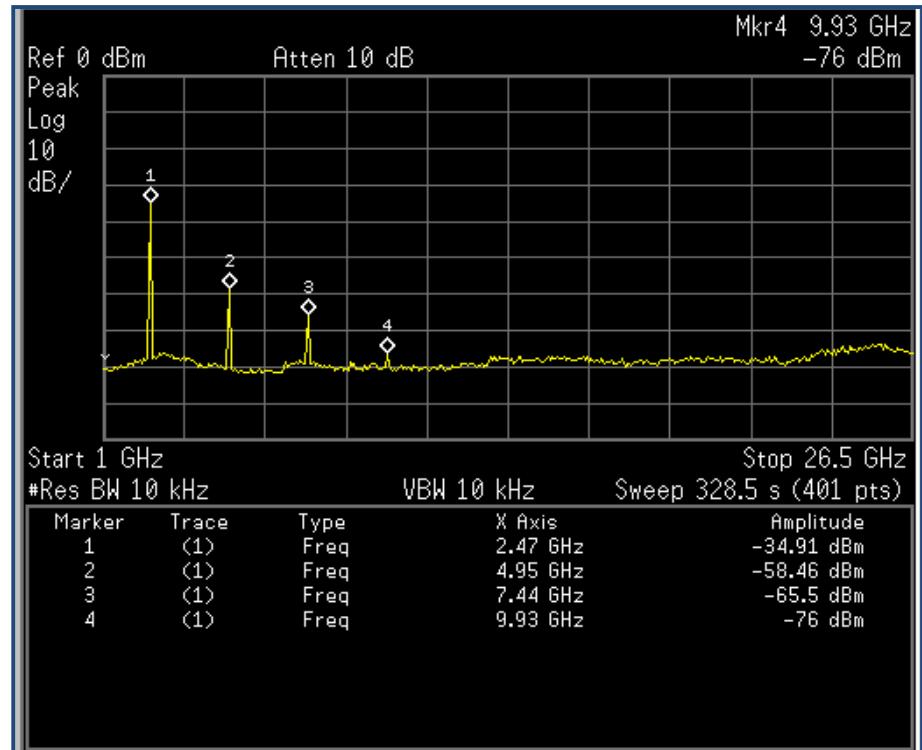


FIGURE 18 - HIGH CHANNEL CONDUCTED SPURIOUS

11 CONDUCTED SPURIOUS EMISSIONS BANDEDGE

Test Description	Reference Specification	Limit	Result	Notes
Band Edge Compliance	15.247(d) A8.1	>20dBc, 74dBuV/m pk	Complies	

11.1 TEST METHOD

Using the marker-delta method outlined in DA 00-705 an in-band field strength measurement of the fundamental emission using the RBW and detector function required by C63.4 and FCC Rules for the frequency being measured was undertaken. A spectrum analyzer span was chosen that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. The delta measurement is then subtracted from the field strengths measured. The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.

11.2 LIMITS

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.

11.3 DATA

An in-band field strength measurement taken at 3m, with RBW = 1MHz, VBW = 1MHz and in peak detection mode resulted in a corrected peak fundamental measurement of **94 dBuV**.

Using the marker-delta method outlined in DA 00-705, band edge emissions were well below the 74dBuV/m peak limits for restricted bands.

Spurious Emission Frequency (MHz)	Amplitude (dBc)	Pk Fundamental Radiated Ampl. (dBuV)	Spurious Field Strength (dBuV/m)	Limit	Margin (dB)	Result
2390	59.7	94	34.3	>20dBc, 74 dBuV/m pk	39.7	Complies
2500	59.9	94	34.1	>20dBc, 74 dBuV/m pk	39.9	Complies

11.4 PLOTS

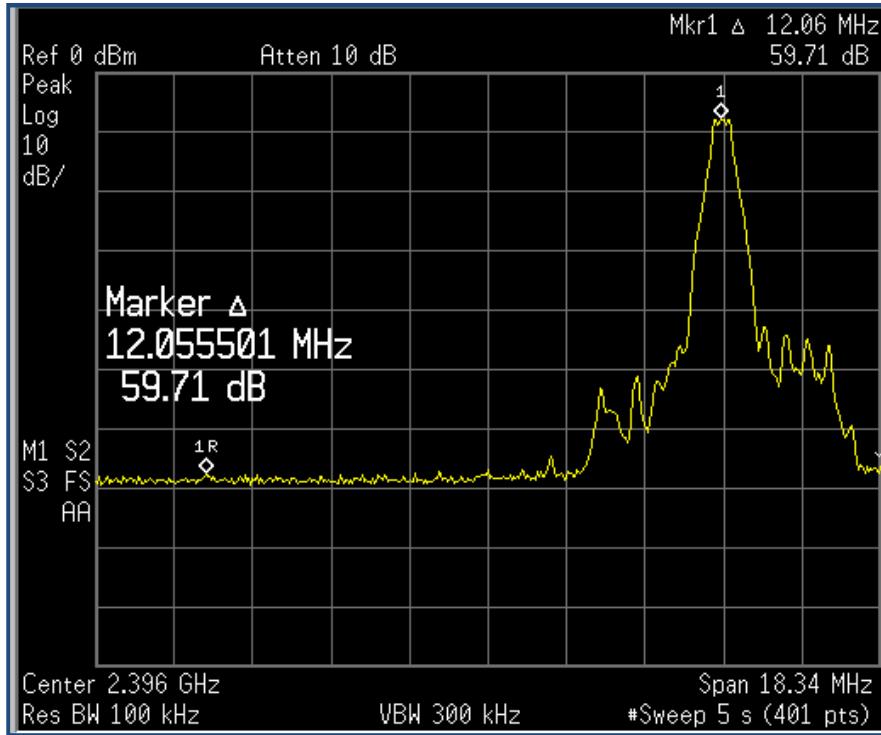


FIGURE 19 – LOWER BANDEDGE (2310-2390MHz)

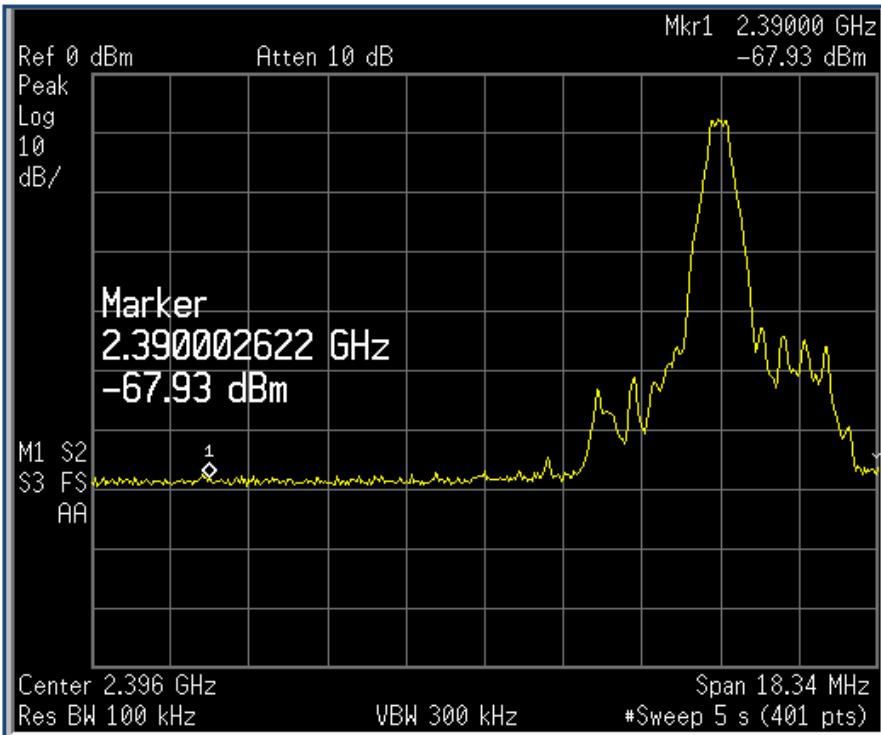


FIGURE 20 – UPPER BANDEDGE (2310-2390MHz)

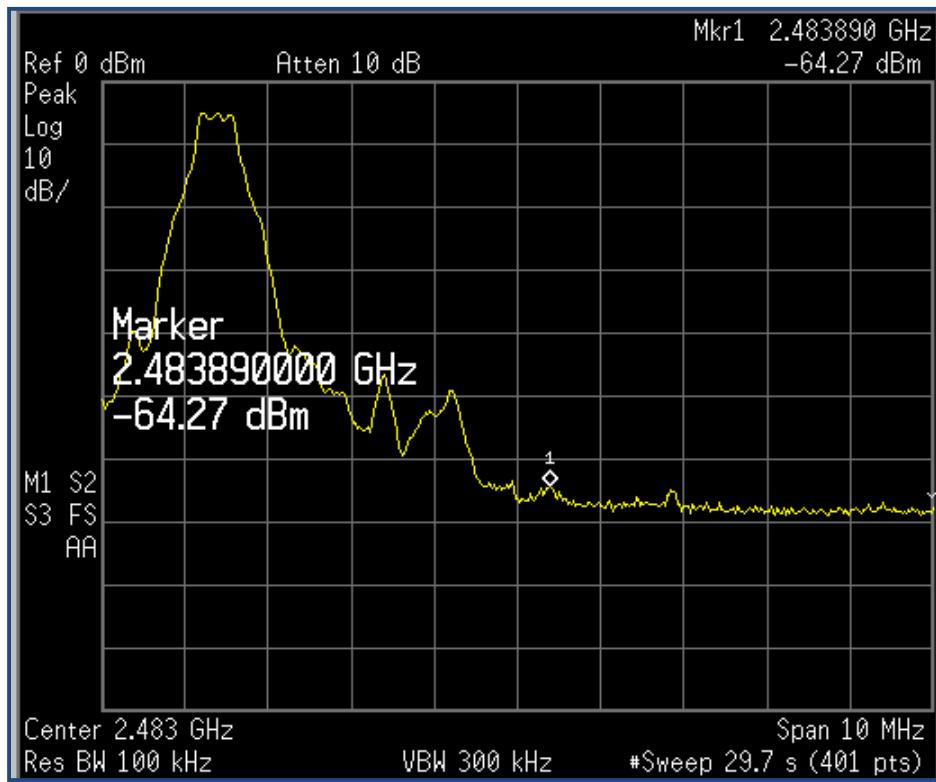


FIGURE 21 – LOWER BANDEDGE (2483.5-2500MHz)

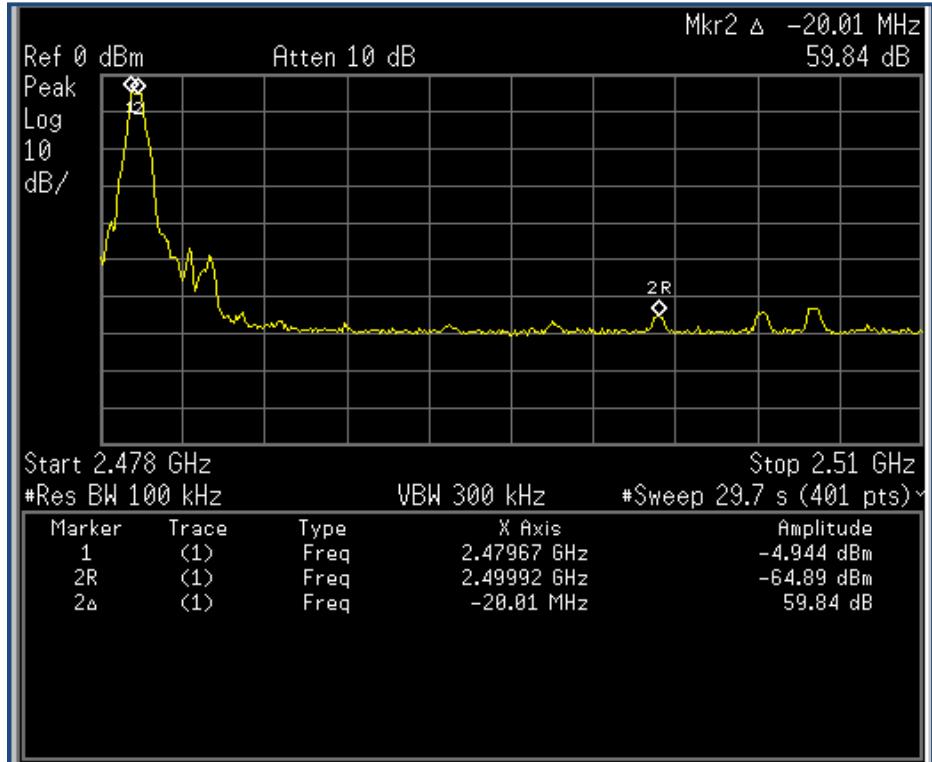


FIGURE 22 – UPPER BANDEDGE (2483.5-2500MHz)

12 RADIATED SPURIOUS EMISSIONS BAND EDGE

12.1 TEST PROCEDURE

The EUT is placed on a non-conducive turntable on the 3m OATS. An in-band field strength measurement of the fundamental emissions using RBW and detector function for the frequency being measured. Repeated with average detector. Spectrum analyzer span is chosen that encompasses both the peak and the fundamental emissions and the band edge emissions under investigation. Analyzer is set, RBW to 1% of total span (never less than 30kHz) with a video bandwidth equal to or greater than the RBW. Peak levels of the fundamental emissions and the relevant band edge emissions are recorded. Stored trace is observed and amplitude delta between the peak of fundamental and band edge emissions are measured. Delta is subtracted from field strengths, these measurements are used to determine compliance.

The restricted bands were investigated using both peak and average detectors (with 54dBuV/m limit). Where applicable, RBW was reduced to lower the noise floor to assist in identifying emissions. No emissions were found above the noise floor in the restricted bands.

12.2 SUMMARY OF TEST RESULTS

Test Description	Reference Specification	Result	Notes
Radiated Spurious Emissions Band Edge	FCC Subpart C 15.209(a) 15.205(a) RSS 210 Issue 8 2.5, A8.5	Complies	

12.2.1 SUMMARY OF 15.205 LIMITS

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
10.495–0.505	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	2690–2900	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			

FIGURE 23 - RESTRICTED BANDS

12.3 DATA

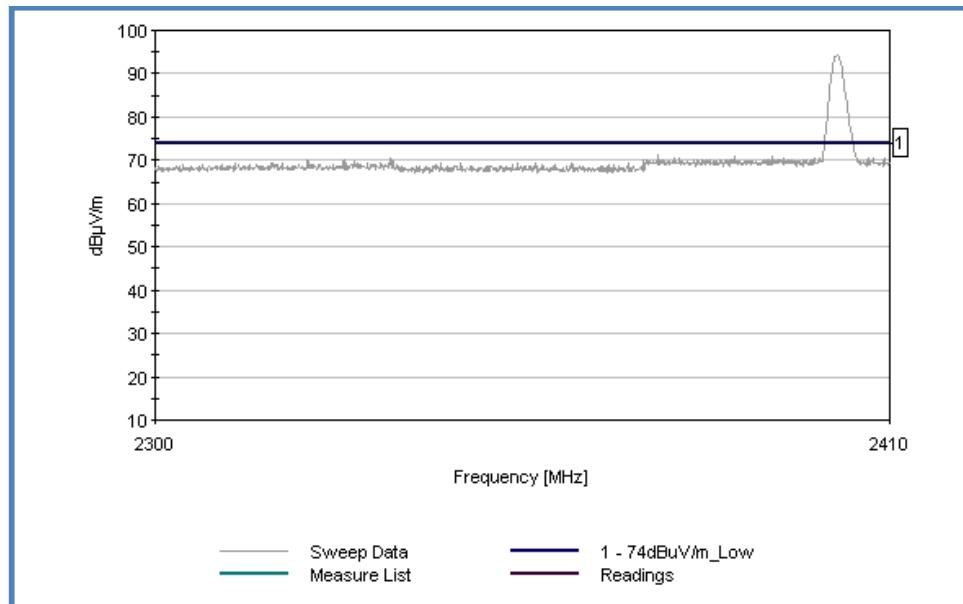


FIGURE 24 - LOWER BAND EDGE – LOW CHANNEL, RBW=1M, VBW=3M

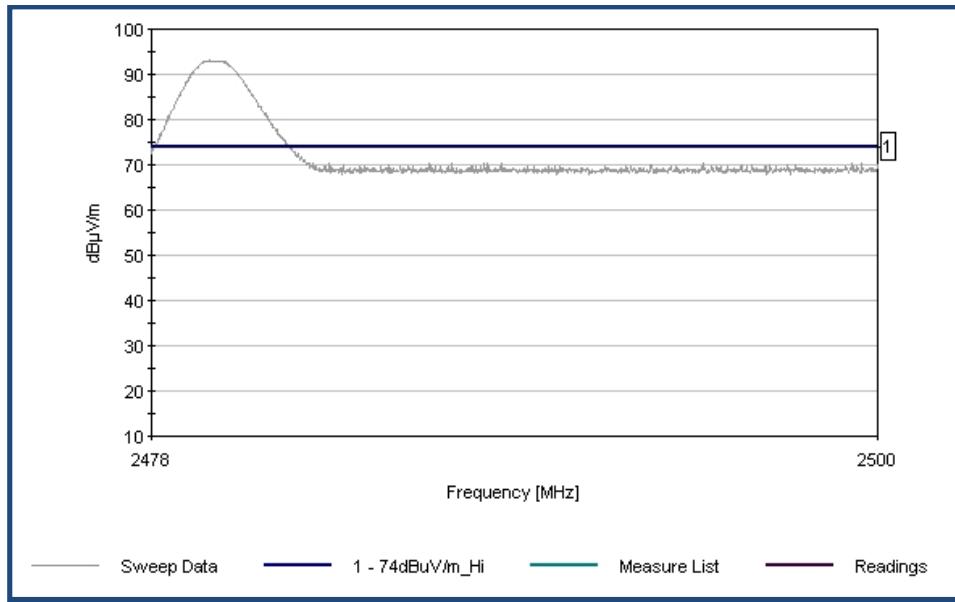


FIGURE 25 - UPPER BAND EDGE - HIGH CHANNEL, RBW=1M, VBW=3M

The restricted bands were investigated using both peak and average detectors (with 54dBuV/m limit). Where applicable, RBW was reduced to lower the noise floor to assist in identifying emissions. No emissions were found above the noise floor in the restricted bands.

13 RADIATED SPURIOUS EMISSIONS (9 KHz – 24.8 GHz)

13.1 TEST PROCEDURE

The EUT is placed on a non-conductive turntable on the 3m OATS. Exploratory measurements are made using a suitable antenna positioned within 1m of the EUT. Maximizing procedure was performed on the six (6) highest emissions readings between the lowest RF frequency generated on the device (without going below 9 kHz) and the 10th harmonic of the highest fundamental frequency. Where applicable, a hybrid antenna, horn antenna and monopole antenna were used to cover the relevant frequency bands. Notable emissions are maximized and final measurements are taken if the initial results are within 20 dB of the permissible limit. The EUT is placed at nonconductive plate at the turntable center. For each suspected frequency, the turntable is rotated 360 degrees and antenna is scanned from 1 to 4 m. This is repeated for both horizontal and vertical receive antenna polarizations. The emissions less than 20 dB below the permissible value are reported.

The measurement results are obtained as described below:

$$E [\mu\text{V}/\text{m}] = URX + ATOT$$

Where URX is receiver reading and ATOT is total correction factor including cable loss, antenna factor and preamplifier gain (ATOT = LCABLES + AF - GPREAMP).

13.2 SUMMARY OF TEST RESULTS

Test Description	Reference Specification	Result	Notes
Radiated Spurious Emissions	15.209(a) 15.205(a) A8.5	Complies	

No other emissions were observed within 20 dB of the limits.

There were no discernible emissions within 20dB of the limit in the 1 GHz – 26GHz range.

13.2.1 SUMMARY OF 15.205 LIMITS

See Figure above.

13.3 MEASUREMENT DATA

No.	Freq (MHz)	Rdng (dBuV)	Corrected (dBuV/m)	Spec (dBuV/m)	Margin (dB)	Polarity	Antenna Height
1	33.988M (QP)	25.6	35.7	40.0	-4.3	Vert	125
2	460.500M	20.8	39.7	46.0	-6.3	Horiz	125
3	953.250M	12.0	39.2	46.0	-6.8	Horiz	125
4	220.246M	25.1	37.6	46.0	-8.4	Horiz	125
5	101.600M	21.4	32.2	43.5	-11.3	Vert	190
6	118.600M	17.3	27.7	43.5	-15.8	Horiz	109

TABLE 1 - SPURIOUS EMISSIONS MEASUREMENTS

13.4 EMISSIONS PLOT

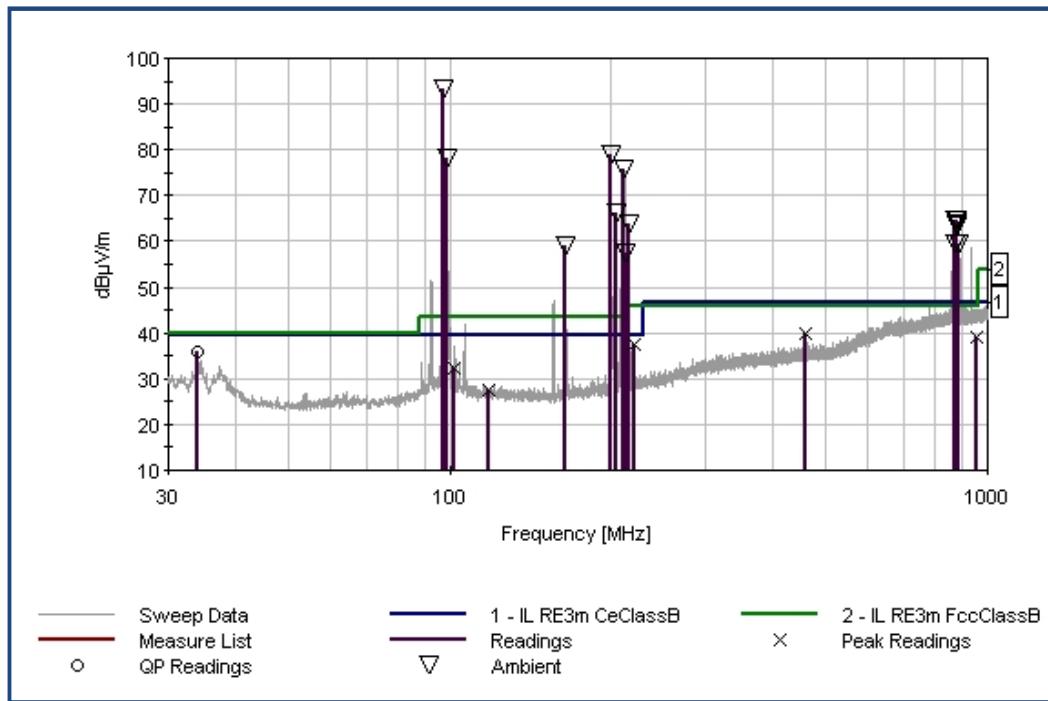


FIGURE 26 - SPURIOUS EMISSIONS PLOT

14 TEST EQUIPMENT

All applicable test equipment will be calibrated in accordance with ANSI Standard NCSL Z540-1 or other NIST traceable calibration standard. Equipment is calibrated on a 2 year cycle or according to the manufacturer's recommendations.

Manufacturer	Description	Model	Serial Number	Cal/Char Due Date D/M/Y
Agilent	Spectrum Analyzer	E4407B	US4142960	10/10/2014
Electro Metrics	Line Impedance Stabilization Network	EM-7823	115037	31/10/2013
Com-Power	Loop Antenna	AL-130	301049	15/1/2014
Electro Metrics	Hybrid Antenna	EM-3141	9902-1141	07/12/2014
AH Systems	Horn Antenna	SAS-571	1242	18/11/2013
Amawima	Horn Antenna	ANT-K	002009	7/2/2014

15 TEST DIAGRAMS

15.1 CONDUCTED RF TEST SETUP



15.2 RADIATED EMISSIONS TEST SETUP

