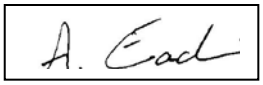
MEASUREMENT AND TEST REPORT

VERSION 1.01

Report Prepared for:	Aarcomm Systems Inc. #112 – 17 Fawcett Road Coquitlam, BC V3K 6V2
Equipment Under Test (EUT):	RM1-900MRTR
FCC ID:	2AAXW900MRM1
IC Certification number:	11295A-900MRM1
Model Number(s):	RM1-900MRTR
FCC Rule Part(s):	Part 15B, 15C
Industry Canada Rule Part(s)	RSS-210
Tested by:	Island Compliance Services Inc. 6454 Fitzgerald Road Courtenay, BC V9J 1N7

Prepared By	Authorized By
A. Horel (Technical Writer) 	A. Eadie (Sr. EMC Eng.) 

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.

FCC OATS registration number: 386117
Industry Canada OATS registration number: 9578B-1

Revision History

Version	Date	Author	Comment
1.00	7/10/2013	A. Horel	Original Release
1.01	26/11/2013	A. Eadie	Updated according to TCB feedback
1.02	3/1/2014	A. Eadie	Updated according to TCB feedback

1.1 CONTENTS

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	
Hopping Freq. Separation	FCC Subpart C 15.247(a)	RSS 210 Issue 8 A8.1	Complies	
No. Hopping Channels	FCC Subpart C 15.247(a)(1)(iii)	RSS 210 Issue 8 A8.1	Complies	
Avg. Time of Occupancy	FCC Subpart C 15.247(a)(1)(iii)	RSS 210 Issue 8 A8.1	Complies	
Occupied Bandwidth 6dB Bandwidth	FCC Subpart C 15.247 (a) (2)	RSS 210 Issue 8 A8.2(a)	Complies	
Occupied Bandwidth 20dB Bandwidth	DA 00-705	RSS-Gen Issue 3 4.6.1	Complies	
Conducted Spurious Emissions	DA 00-705	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	
Power line Conducted Emission	FCC Subpart C 15.207 (a) FCC Subpart B 15.107	RSS-Gen Issue 3 7.2.4 Ices-003 Issue 4	Complies	

2.1 ENVIRONMENTAL CONDITIONS

Description	Reading
Testing Dates	11th - 24th September, 2013
Indoor Temperature	18 - 23°C
Indoor Humidity	40 - 50%
Outdoor Temperature	12 - 18˚C
Outdoor Humidity	70 - 80%

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, 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.

2.3 TEST METHODS

Unit #19 was used throughout all testing. Unless otherwise noted, the EUT was set to full power output and 100% duty cycle.

3 General Equipment Specifications

Item	Description
Manufacturer	Aarcomm Systems Inc.
Applicant	Aarcomm Systems Inc.
Model Number	RM1-900MRTR
Size	8cm x 4cm approx.
Transmitter	915 MHz band
Function	Serial to wireless convertor
Power Supply Input	5VDC-40VPC
Power Output	30dBm
Antenna Gain/Type	Larsen Q900 (2.14dBi) monopole antenna Larsen NMOSPEC900 (5.4dBi) ¼ wave antenna
Channel Spacing	400kHz
Frequency Range	902.25M - 927.75M
Modulation	4GFSK (slowest and fastest modes), 2GFSK (medium fast mode)

3.1 Auxiliary Equipment

Equipment	Description
BK Precision DC Power Supply	SN: 17432057405110040
12 VDC power adaptor	Hong Kwang D12-50

3.2 Engineering Changes to Production Unit

N/A

3.3 Frequency Hopping Spread Spectrum Adherence

This device complies with the frequency hopping spread section requirements of Industry Canada RSS 210, Section 8.1, Annex 8 and FCC Part 15.247 in the following regard:

a. The system employs pseudo-random channel frequency selection at the relevant hopping rate (mode dependent). An example of the hopping sequence channels is: 58, 53, 34, 43, 6, 5, 44, 23, 27, 12, 49, 10, 41, 25, 55, 46, 33, 54, 26, 24, 42, 35, 8, 20, 14, 19, 9, 50, 32, 47, 60, 29, 17, 3, 22, 45, 56, 52, 59, 48, 13, 21, 4, 7, 36, 16, 30, 40, 11, 28, 61, 38, 2, 18, 15, 37, 62, 1, 39, 31, 51, 57, 0.
b. Each channel is on average, used for an equal amount of time.
c. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and they shift frequencies in synchronization with the transmitted signals.
d. The system may not employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, is designed to comply with all of the regulations in this section 15.247 and RSS 210 Section 8.1, Annex 8 if the transmitter is presented with a continuous data (or information) stream.
e. The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The system does not coordinate frequency hopping in any other manner other than for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

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 ≥ EBW. Set VBW ≥ 3 x 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 NOTES

N/A

4.3 DATA

Frequency (MHz)	Peak Power (dBm)	CF (dB)	Corrected (dBm)	Limit (dBm)
902.25	-0.5	30	29.5	30
915.10	-0.9	30	29.1	30
927.75	-2.0	30	28	30

4.4 PLOT(S)

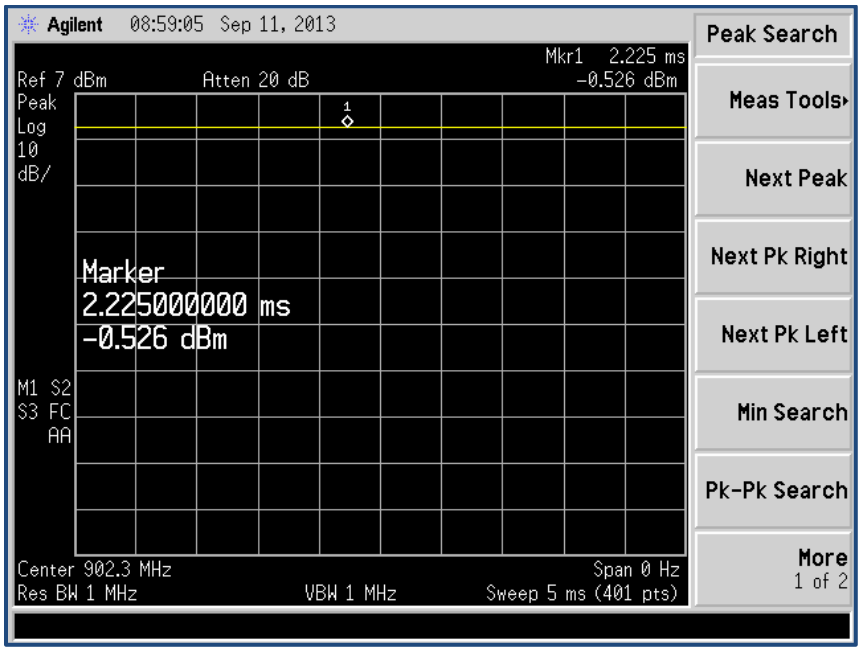


FIGURE 1 - PEAK OUTPUT POWER, 902.25M

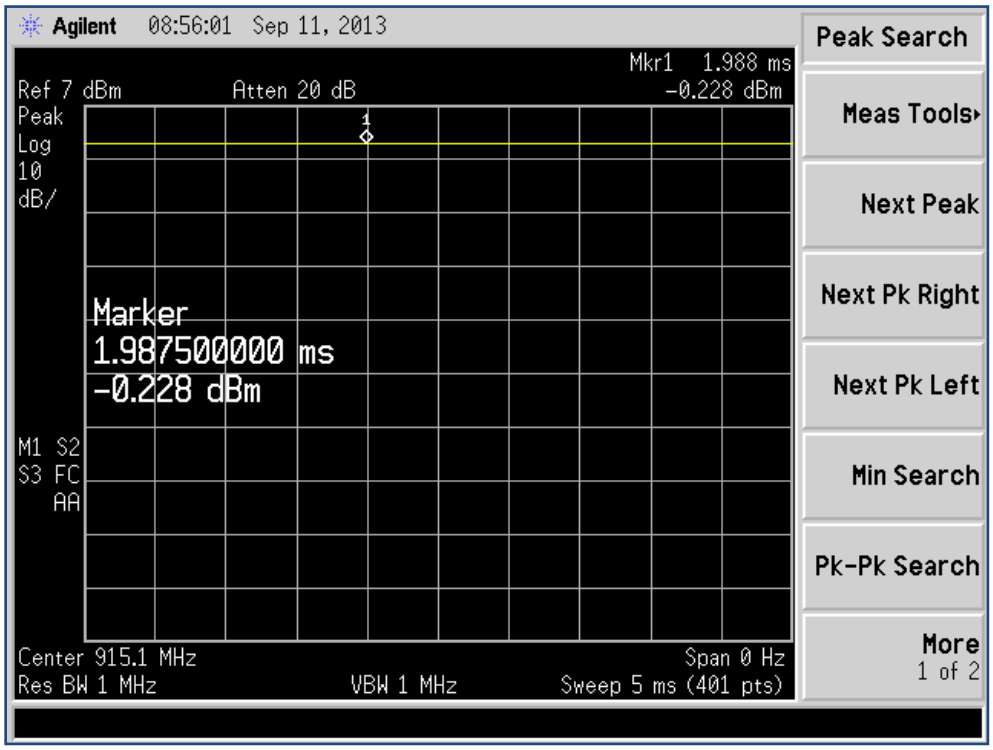


FIGURE 2 - PEAK POWER, 915.1MHZ

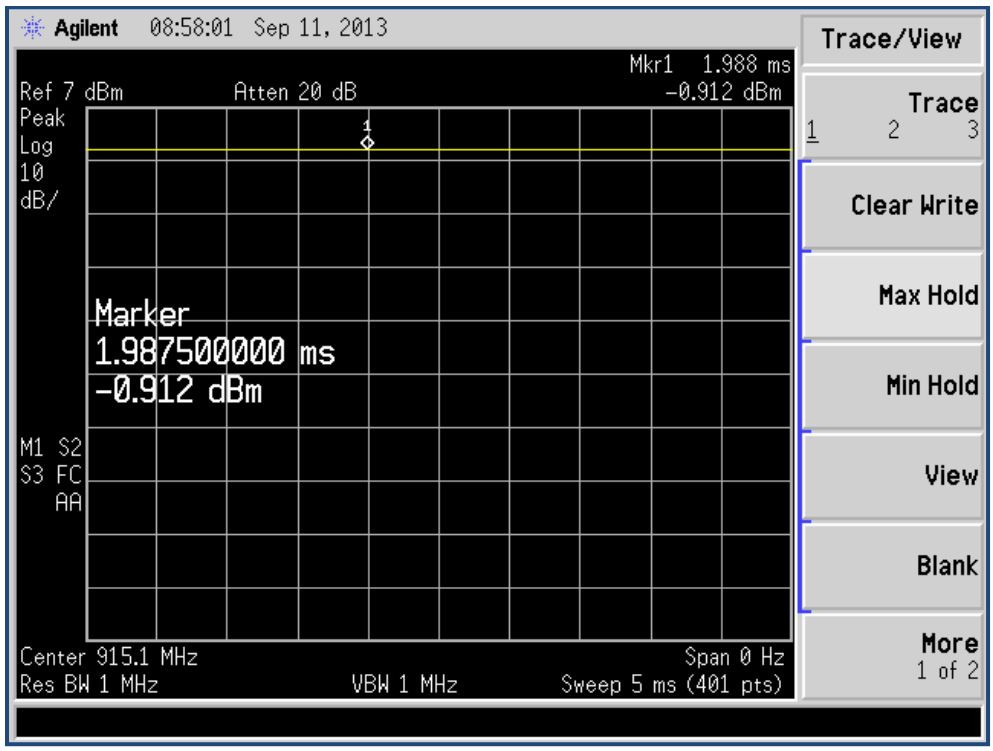


FIGURE 3 - PEAK POWER, 927.75MHZ

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

As per Public Notice DA 00-705. Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel. RBW ≥ 1% of the 20 dB bandwidth. VBW ≥ RBW. Sweep = auto. Detector function = peak. Trace = max hold.

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

Note: The spectrum analyzer automatically calculates the 20dB bandwidth as per the plots. Data for 6dB bandwidth provided for informational purposes only.

5.2 DATA

Low Channel			
Data Rate	Modulation	20dB Bandwidth (KHz)	6dB Bandwidth (KHz)
9600 Sym/s	4 GFSK	20.0	10.7
50k Sym/s	2 GFSK	96.7	53.2
100k Sym/s	4 GFSK	258.4	195.3

Mid Channel			
Data Rate	Modulation	20dB Bandwidth (KHz)	6dB Bandwidth (KHz)
9600 Sym/s	4 GFSK	19.8	13.2
50k Sym/s	2 GFSK	96.2	53.0
100k Sym/s	4 GFSK	254.0	203.0

High Channel			
Data Rate	Modulation	20dB Bandwidth (KHz)	6dB Bandwidth (KHz)
9600 Sym/s	4 GFSK	19.7	13.0
50k Sym/s	2 GFSK	95.5	53.5
100k Sym/s	4 GFSK	245.7	143.2

5.3 PLOTS

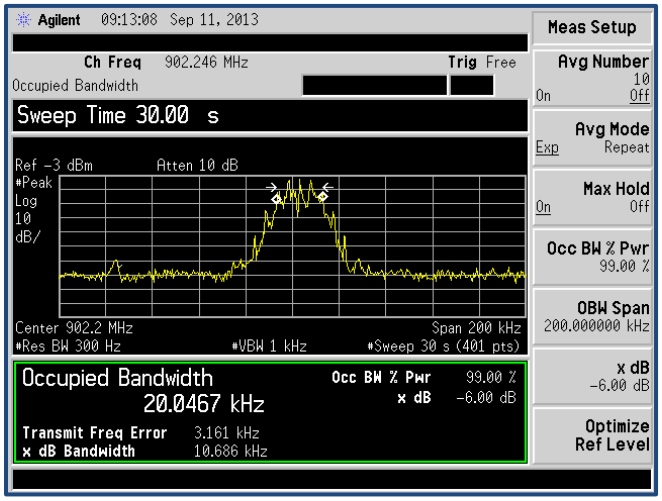


FIGURE 4 - LOW CHANNEL 9600 SYM/S

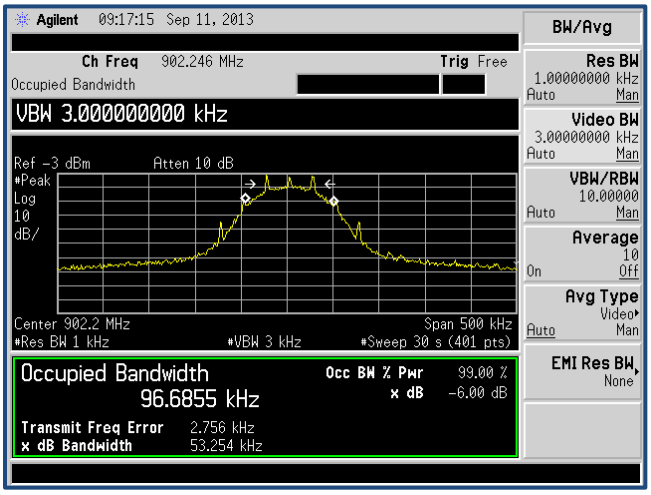


FIGURE 5 – LOW CHANNEL 50K SYM/S

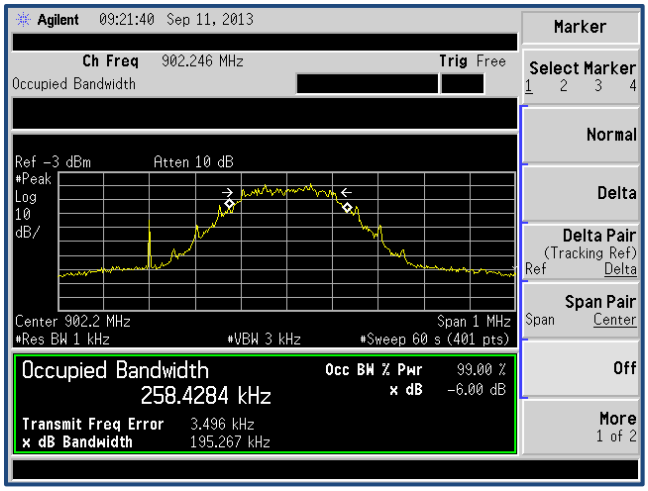


FIGURE 6 - LOW CHANNEL 100K SYM/S

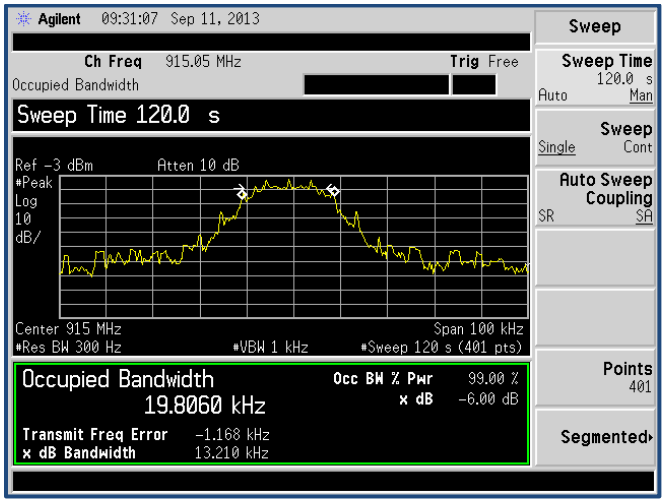


FIGURE 7 - MID CHANNEL 9600 SYM/S

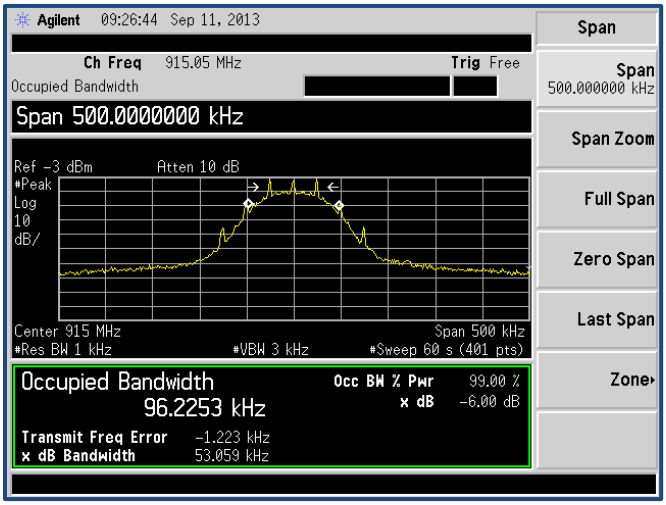


FIGURE 8 - MID CHANNEL 50K SYM/S

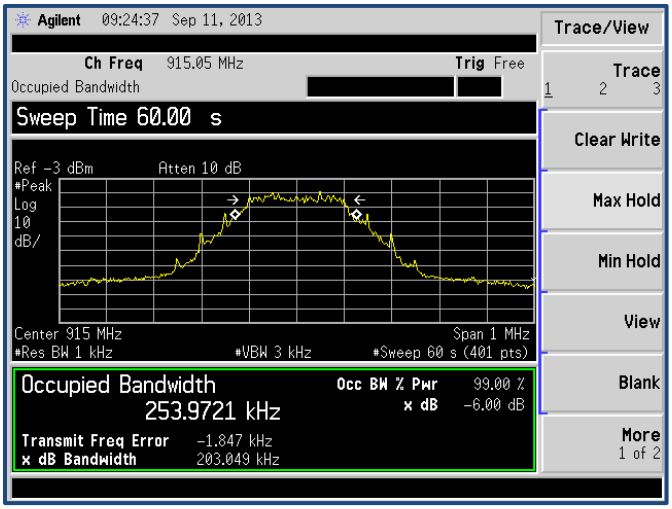


FIGURE 9 - MID CHANNEL 100K SYM/S

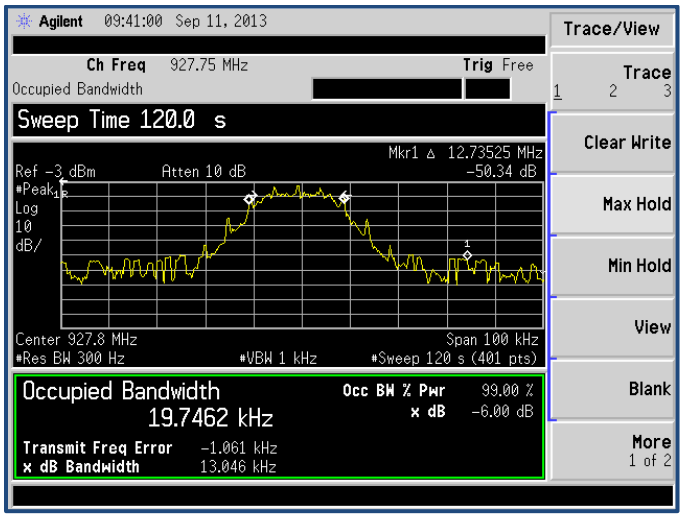


FIGURE 10 - HIGH CHANNEL 9600 SYM/S

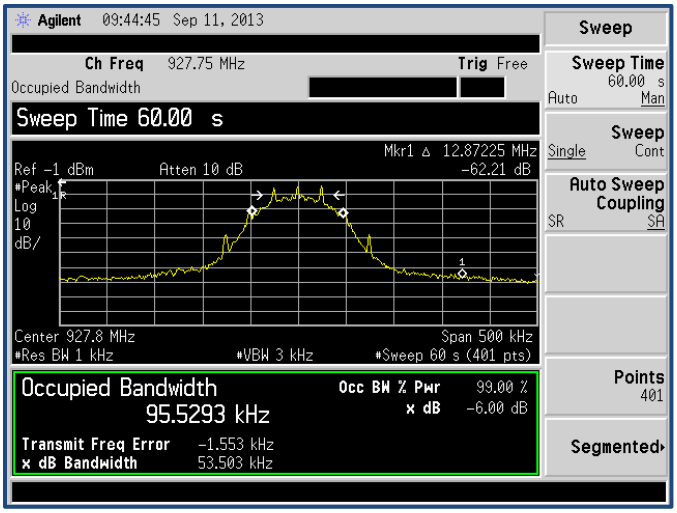


FIGURE 11 – HIGH CHANNEL 50K SYM/S

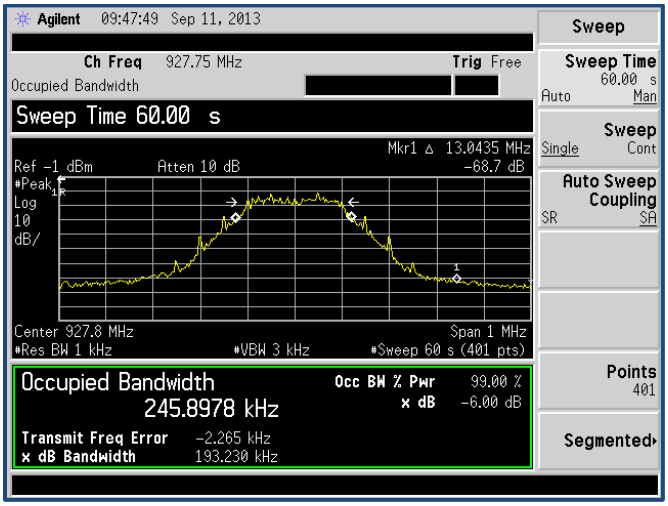


FIGURE 12 - HIGH CHANNEL 100K SYM/S

6 CONDUCTED SPURIOUS EMISSIONS

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

6.1 TEST METHOD

RF conducted spurious emissions as per Public Notice DA 00-705. Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz. VBW ≥ RBW. Sweep = auto. Detector function = peak. Trace = max hold. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.

6.2 NOTE(S)

- 20dB ext. attenuation

6.3 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)).

6.4 DATA (LOW DATA RATE)

Channel	Harmonic2 (dBc)	Harmonic3 (dBc)	Harmonic4 (dBc)	Result
Low	65.1	61.3	64.2	Complies
Mid	66.4	62.3	-	Complies
High	65.5	63.0	-	Complies

6.5 DATA (MEDIUM DATA RATE)

Channel	Harmonic2 (dBc)	Harmonic3 (dBc)	Harmonic4 (dBc)	Result
Low	66.2	62.5	66.6	Complies
Mid	65.5	61.8	-	Complies
High	-	60.9	-	Complies

6.6 DATA (HIGH DATA RATE)

Channel	Harmonic2 (dBc)	Harmonic3 (dBc)	Harmonic4 (dBc)	Result
Low	65.5	62.0	-	Complies
Mid	65.3	61.4	-	Complies
High	63.6	61.3	-	Complies

6.7 PLOTS (LOW CHANNEL)

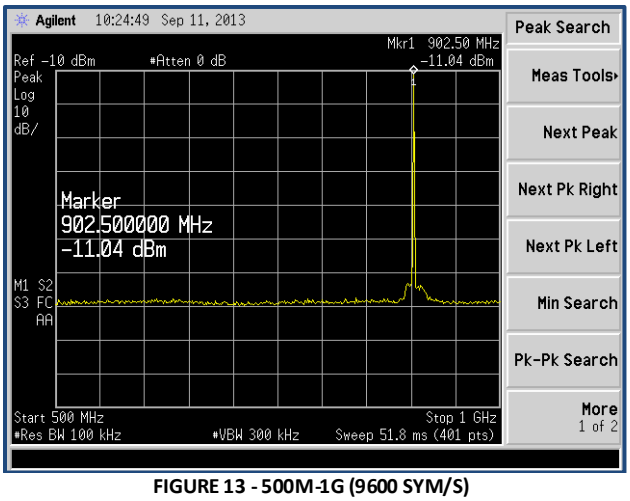


FIGURE 13 - 500M-1G (9600 SYM/S)

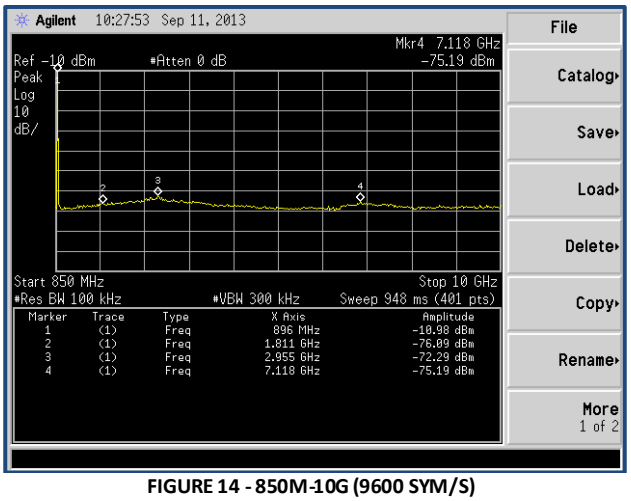


FIGURE 14 - 850M-10G (9600 SYM/S)

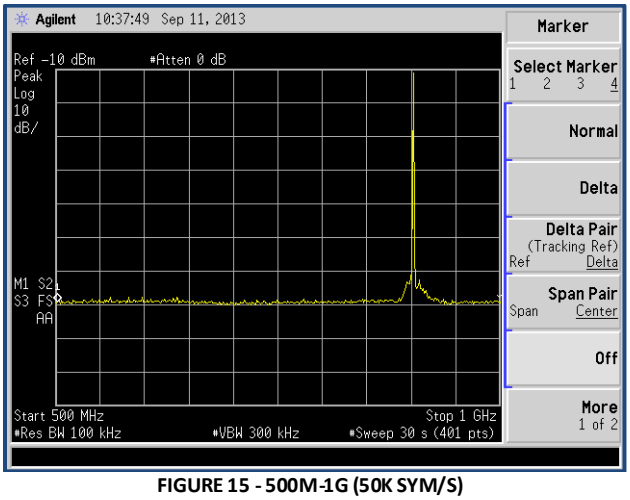


FIGURE 15 - 500M-1G (50K SYM/S)

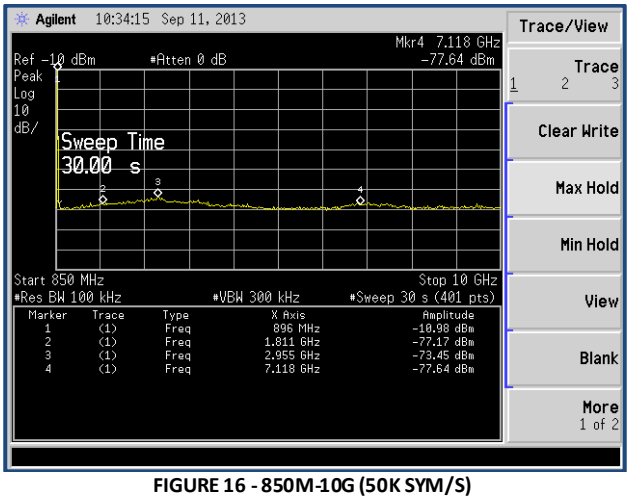


FIGURE 16 - 850M-10G (50K SYM/S)

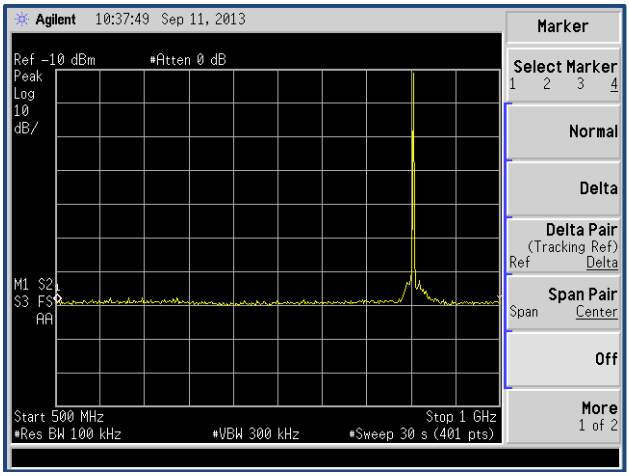


FIGURE 17 - 500M-1G (100K SYM/S)

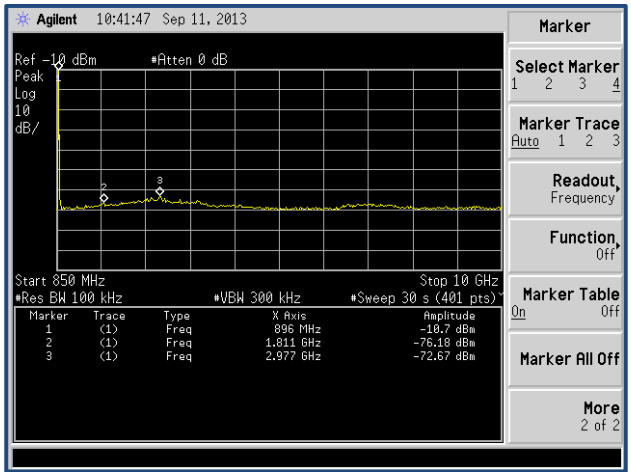


FIGURE 18 - 850M-10G (100K SYM/S)

6.8 PLOTS (MID CHANNEL)

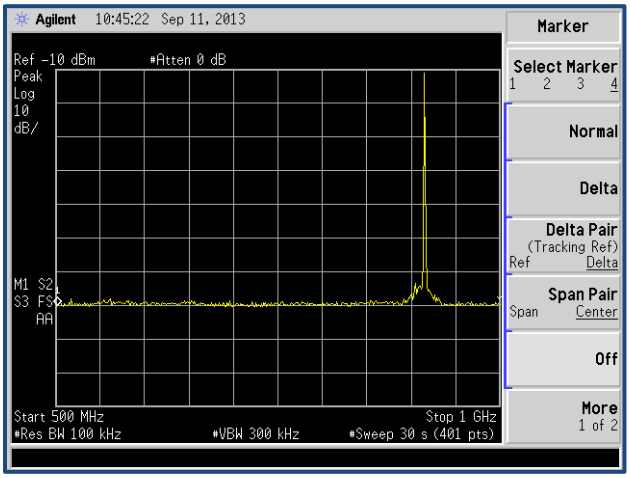


FIGURE 19 - 500M-1G (9600 SYM/S)

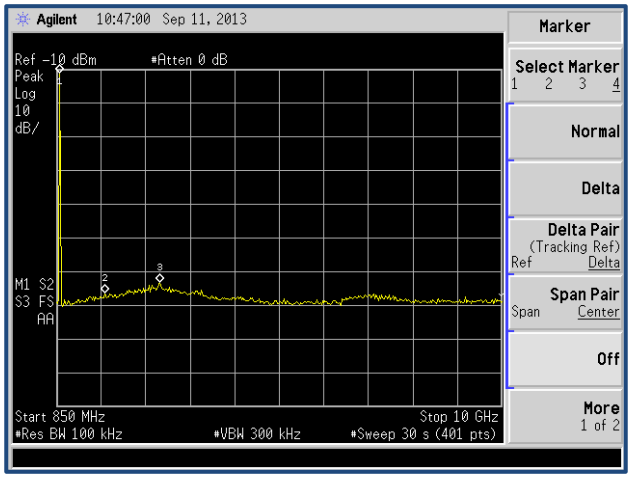


FIGURE 20 - 850M-10G (9600 SYM/S)

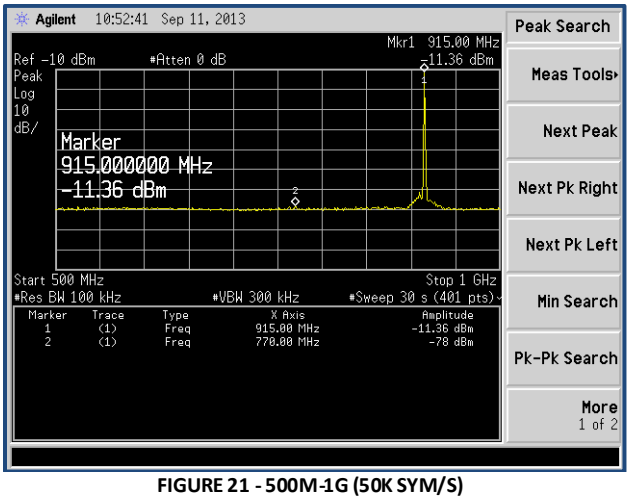


FIGURE 21 - 500M-1G (50K SYM/S)

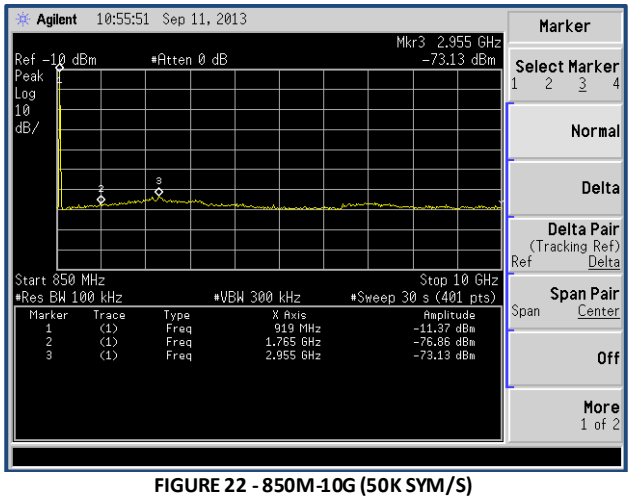


FIGURE 22 - 850M-10G (50K SYM/S)

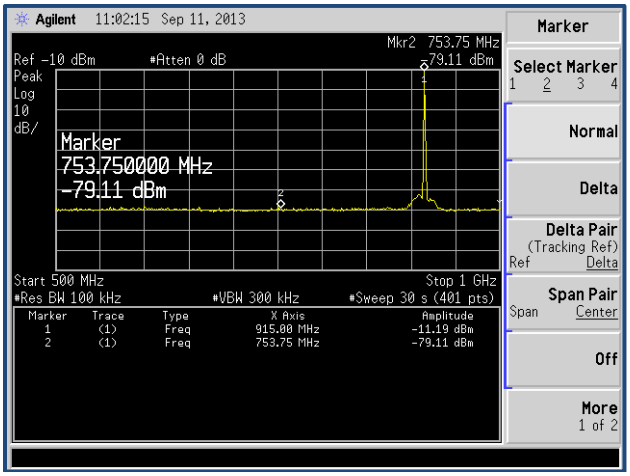


FIGURE 23 - 500M-1G (100K SYM/S)

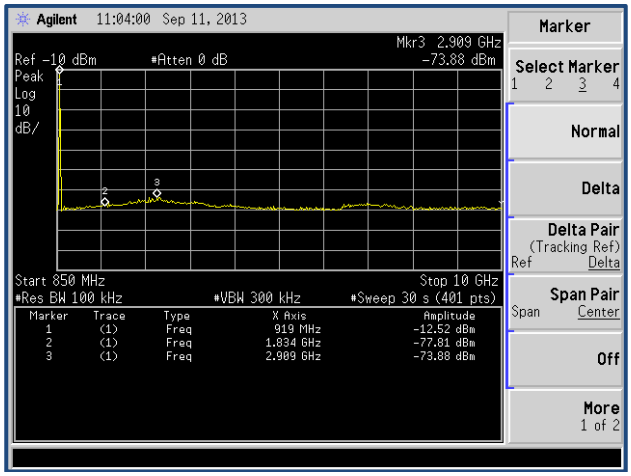


FIGURE 24 - 850M-10G (100K SYM/S)

6.9 PLOTS (HIGH CHANNEL)

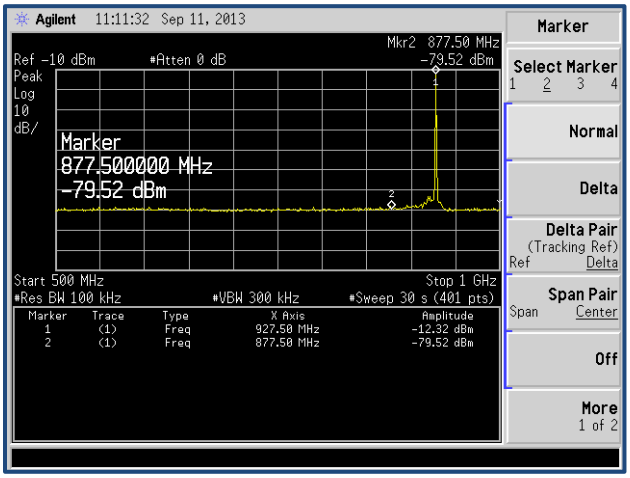


FIGURE 25 - 500M-1G (9600 SYM/S)

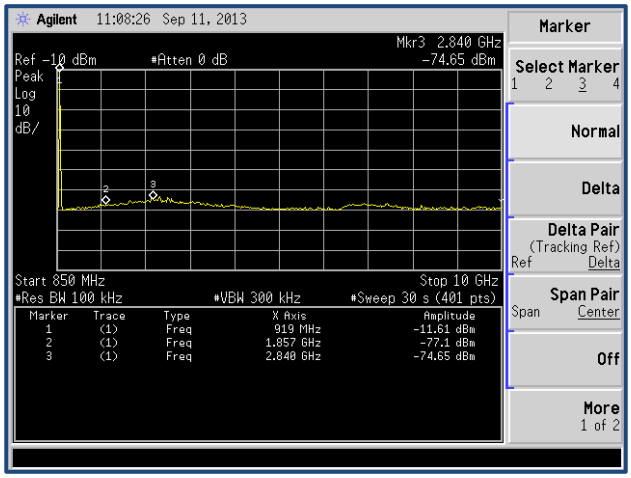


FIGURE 26 - 850M-10G (9600 SYM/S)

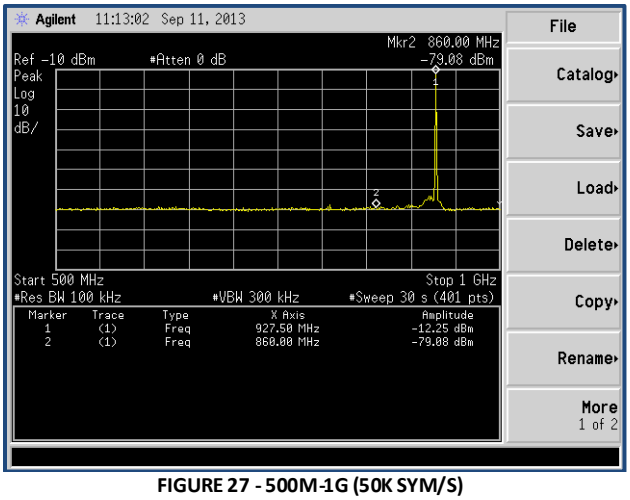


FIGURE 27 - 500M-1G (50K SYM/S)

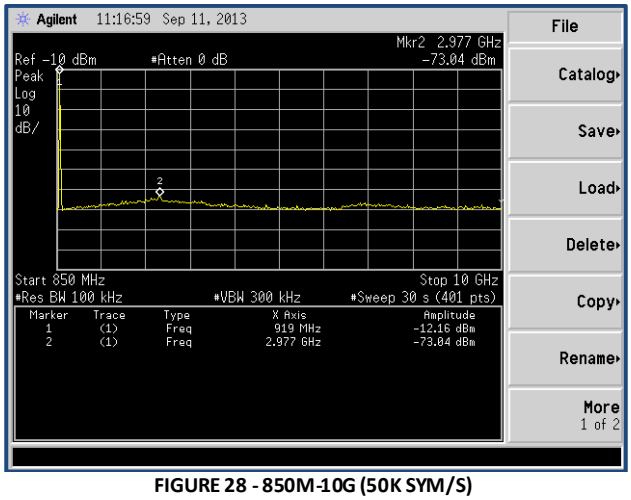


FIGURE 28 - 850M-10G (50K SYM/S)

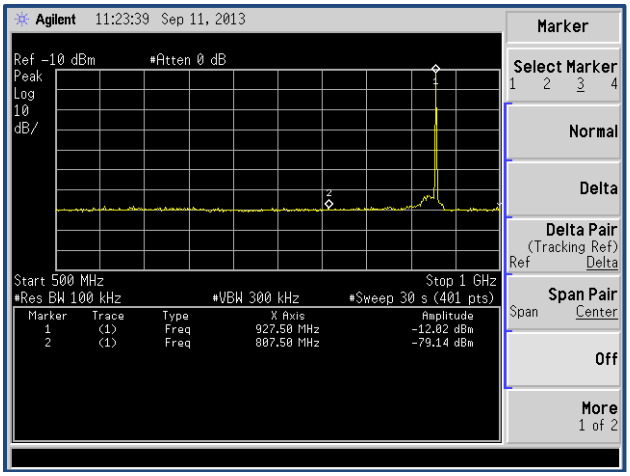


FIGURE 29 - 500M-1G (100K SYM/S)

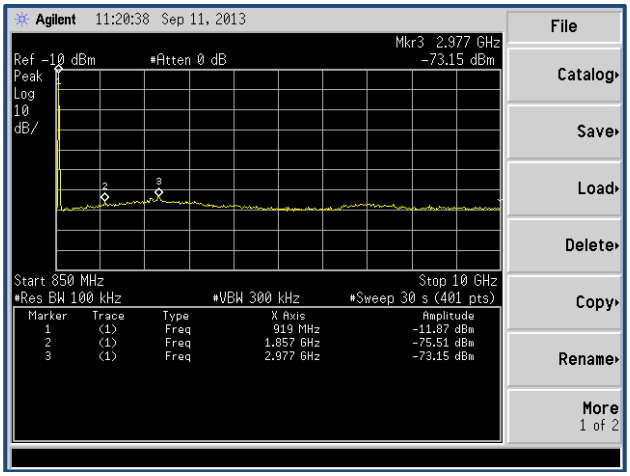


FIGURE 30 - 850M-10G (100K SYM/S)

7 CONDUCTED SPURIOUS EMISSIONS BANDEDGE

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

7.1 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.

7.2 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.

7.3 DATA

An in-band field strength measurement taken at 3 m, with RBW = 1MHz, VBW = 1MHz and in peak detection mode, with NMOSPEC900 (5.4dBi) ¼ wave antenna, resulted in a corrected peak fundamental measurement of 110.7 dBuV/m.

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

7.3.1 RESTRICTED BANDS

Spurious Emission Frequency (MHz)	Pk Fundamental Radiated Ampl. (dBuV)	Band Edge Emission Level (dBc)	Band Edge Corrected Value (dBuV/m)	Limit	Margin (dB)	Result
960.875	110.7	68.7	42.0	>20dBc, 74 dBuV/m pk	32.0	Complies
967.000	110.7	67.9	42.8	>20dBc, 74 dBuV/m pk	31.2	Complies
962.625	110.7	68.3	42.4	>20dBc, 74 dBuV/m pk	31.6	Complies
611.900	110.7	68.7	42.0	>20dBc, 74 dBuV/m pk	32.0	Complies
612.750	110.7	68.1	42.6	>20dBc, 74 dBuV/m pk	31.4	Complies
610.200	110.7	67.3	43.4	>20dBc, 74 dBuV/m pk	30.6	Complies

7.4 PLOTS

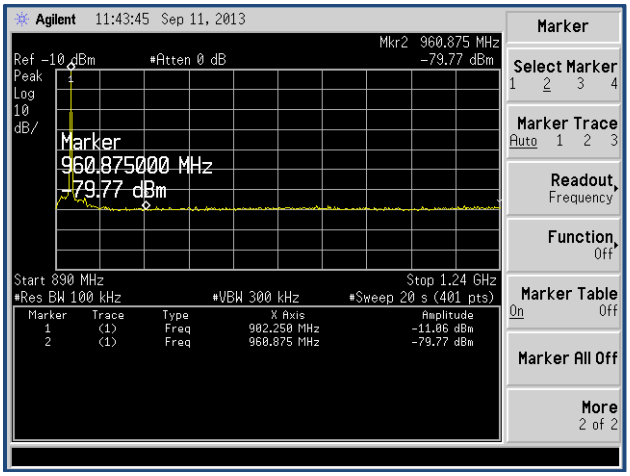


FIGURE 31 –960MHZ RESTRICTED BAND (LOW)

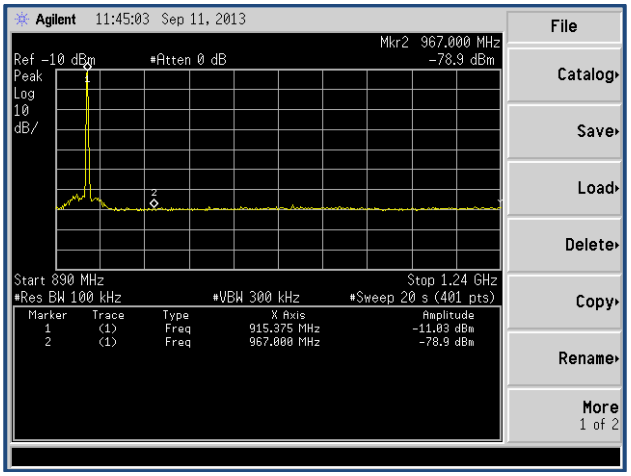


FIGURE 32 –960MHZ RESTRICTED BAND (MID)

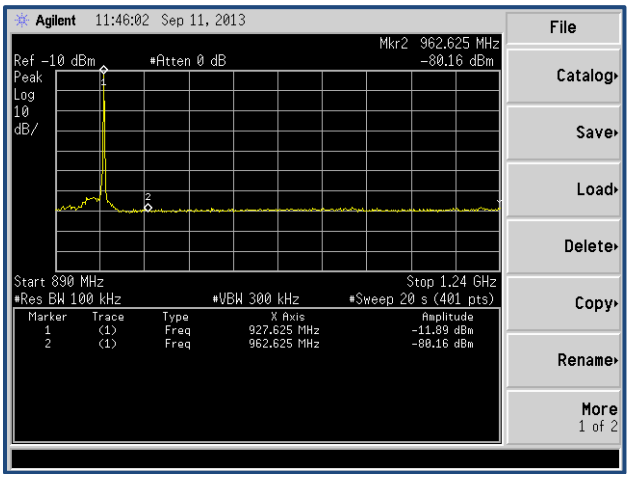


FIGURE 33 –960MHZ RESTRICTED BAND (HIGH)

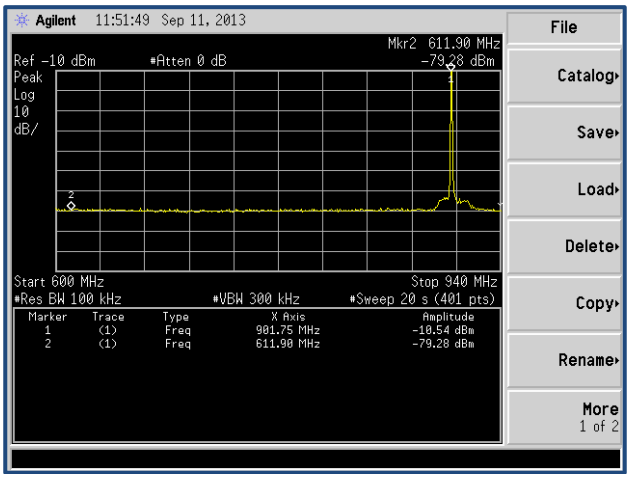


FIGURE 34 600MHZ RESTRICTED BAND (LOW)

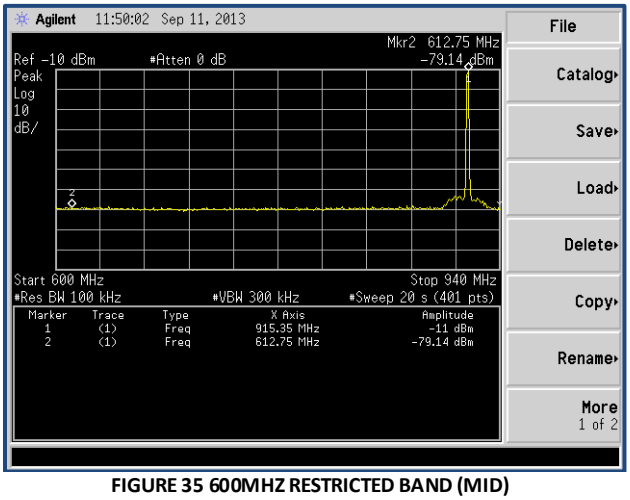


FIGURE 35 600MHZ RESTRICTED BAND (MID)

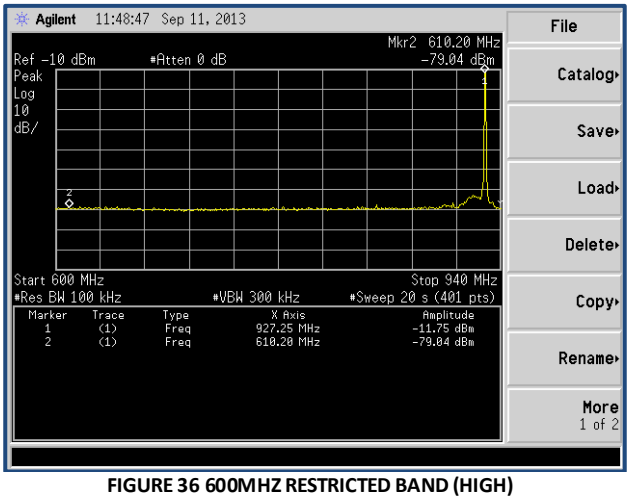


FIGURE 36 600MHZ RESTRICTED BAND (HIGH)

8 HOPPING FREQUENCY SEPARATION

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

8.1 DATA

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

8.2 PLOT

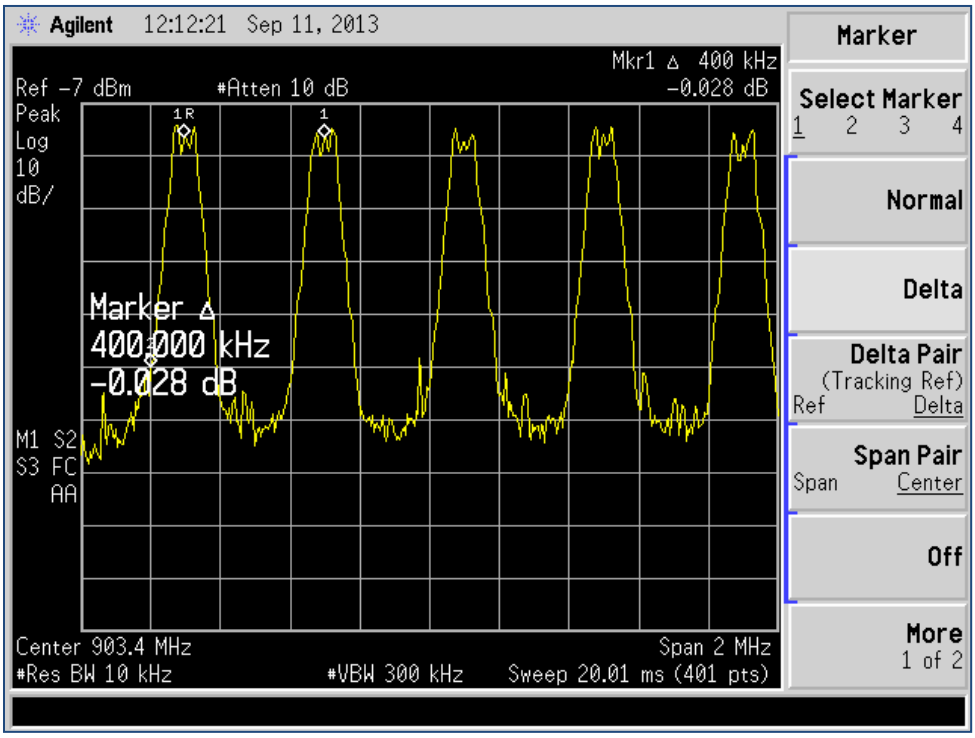


FIGURE 37 - CHANNEL SEPARATION - 400KHZ

9 NUMBER OF HOPPING CHANNELS

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

9.1 DATA

Test Description	Limit	Observed	Result
Number of hopping channels	>15 channels	63 Channels	Complies

9.2 PLOT

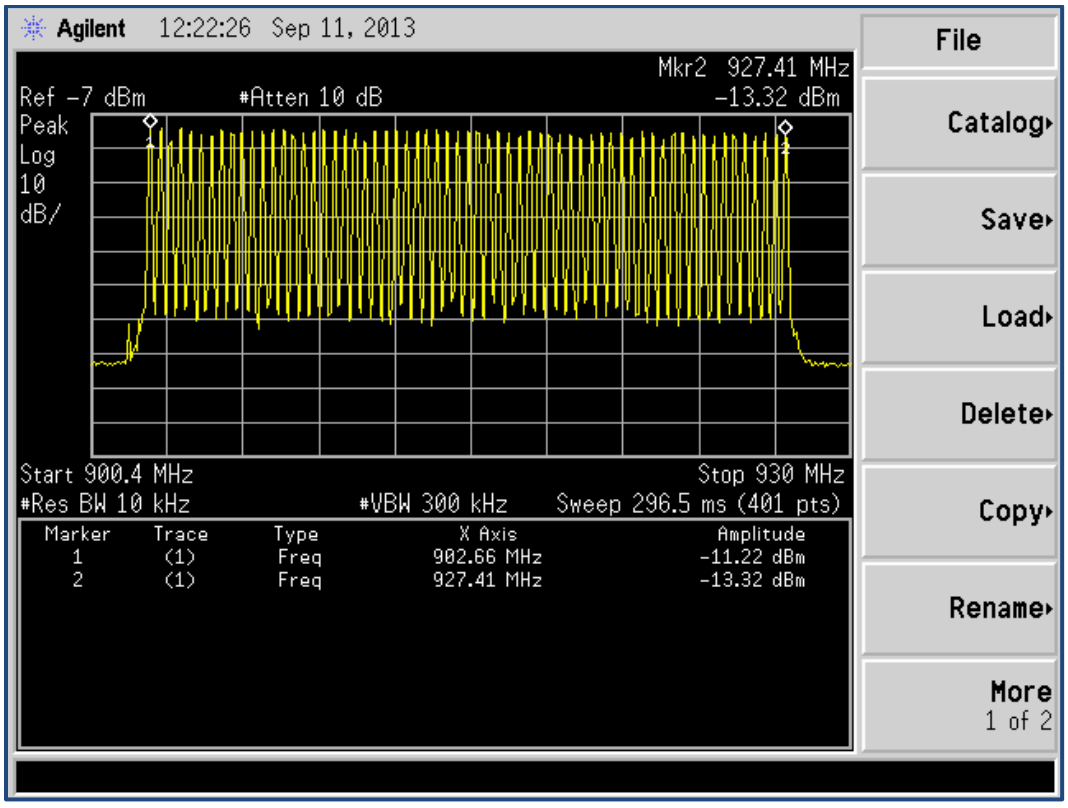


FIGURE 38 - HOPPING CHANNELS

10 AVERAGE TIME OF OCCUPANCY

10.1 LIMIT

15.247 (a)(1)(i) and RSS-210 Annex 8(c) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

10.2 TEST PROCEDURE

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 24.4 second period (61 channels * 0.4 s) is equal to:

Avg. Time of Occupancy (s) = (24.4/Pulse Δt (s))*pulse width

10.3 TEST DATA

10.3.1 50KSPS

DH Packet	Pulse Width (ms)	Pulse Δt (s)	Avg Time of Occupancy (ms)	Limit (ms)	Margin (ms)
Smallest	2.25	1.46	37.6	400	362.4
Medium	12.00	1.46	200	400	200
Largest	22.00	1.46	367	400	33

10.3.2 9600 SYM/S

DH Packet	Pulse Width (ms)	Pulse Δt (s)	Avg Time of Occupancy (ms)	Limit (ms)	Margin (s)
Smallest	7.125	3.16	55	400	345
Medium	28.00	3.16	216	400	184
Largest	49.00	3.16	378	400	22

10.3.3 200KSPS

DH Packet	Pulse Width (ms)	Pulse Δt (s)	Avg Time of Occupancy (ms)	Limit (ms)	Margin (s)
Smallest	1.00	0.45	54	400	346
Medium	3.43	0.45	186	400	214
Largest	6.00	0.45	325	400	75

10.4 PLOT(S)

10.4.1 50KSPS

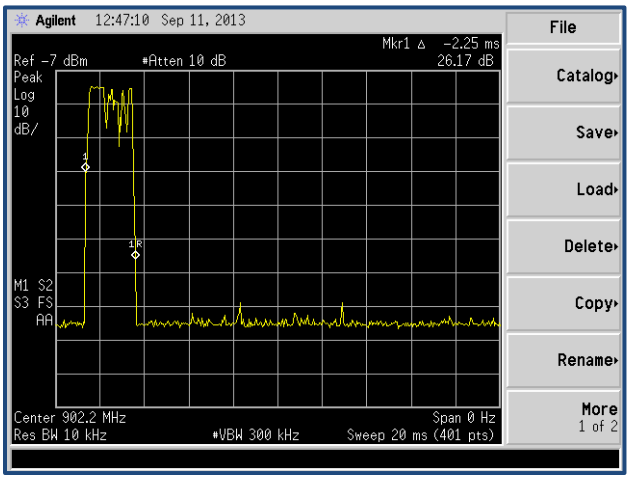


FIGURE 39 - SMALLEST AT 50KSPS

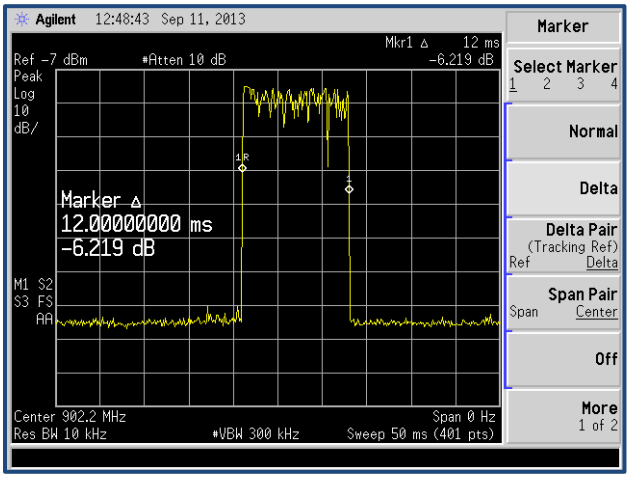


FIGURE 40 - MEDIUM AT 50KSPS

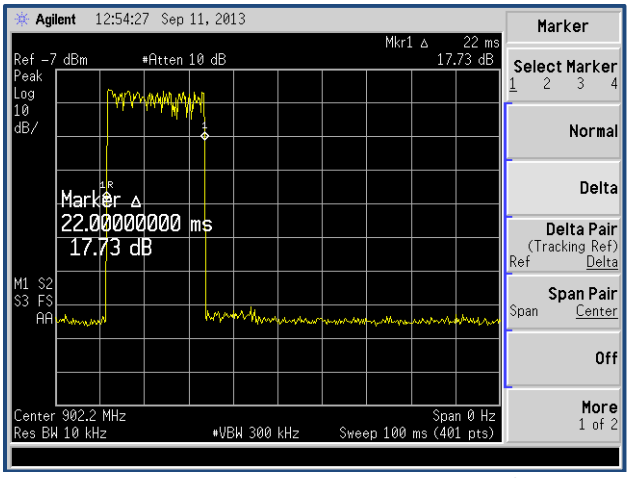
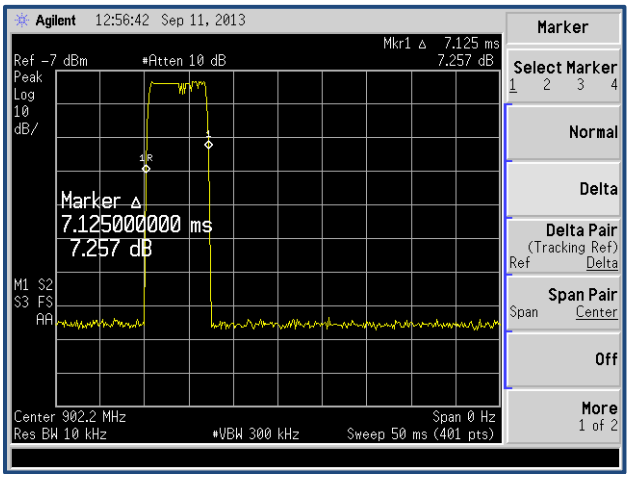


FIGURE 41 - LARGEST AT 50KSPS

10.4.2 9600 SYM/S



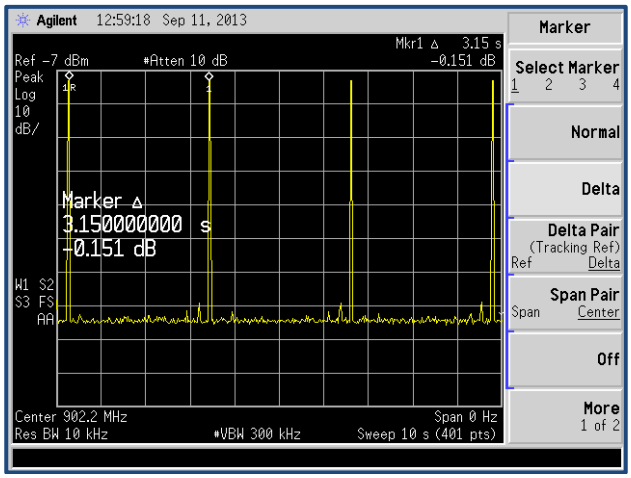
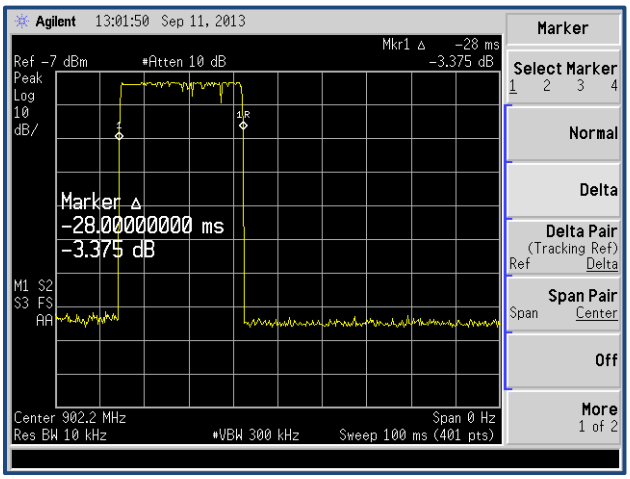


FIGURE 42 - SMALLEST AT 9600SYM/S



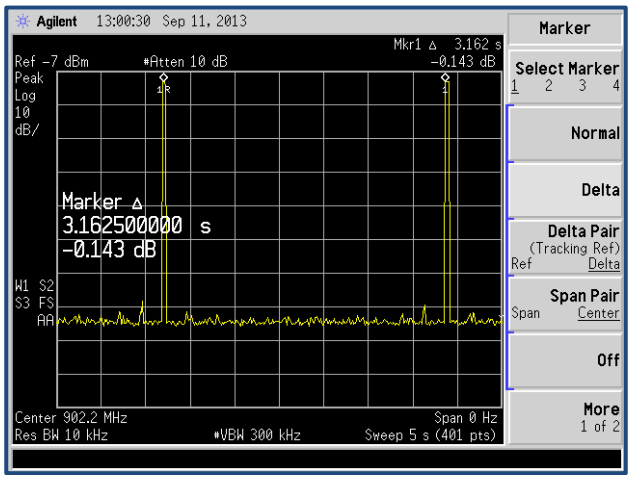
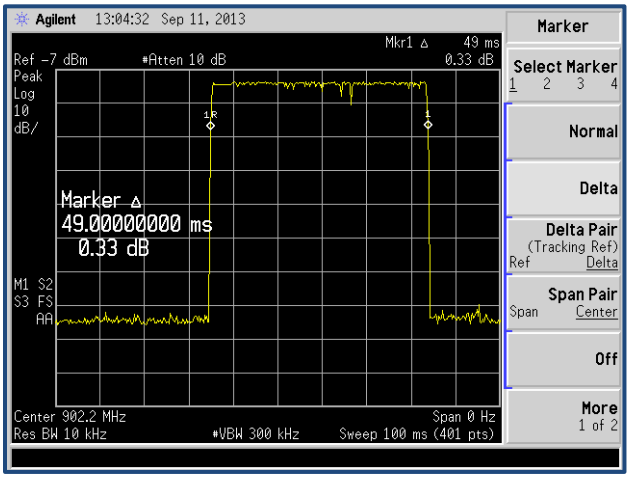


FIGURE 43 - MEDIUM AT 9600SYM/S



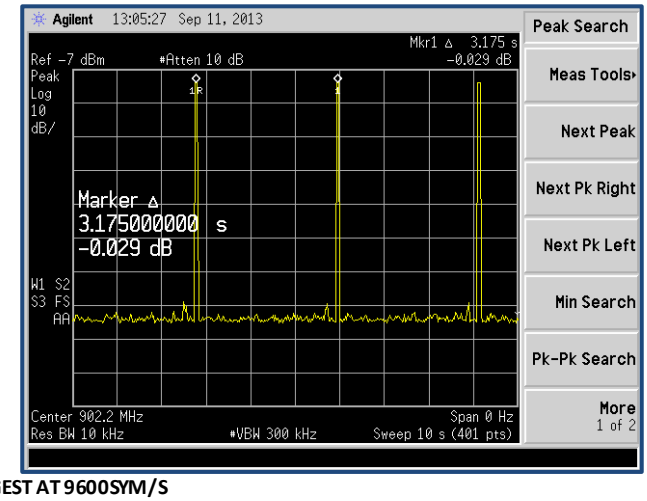
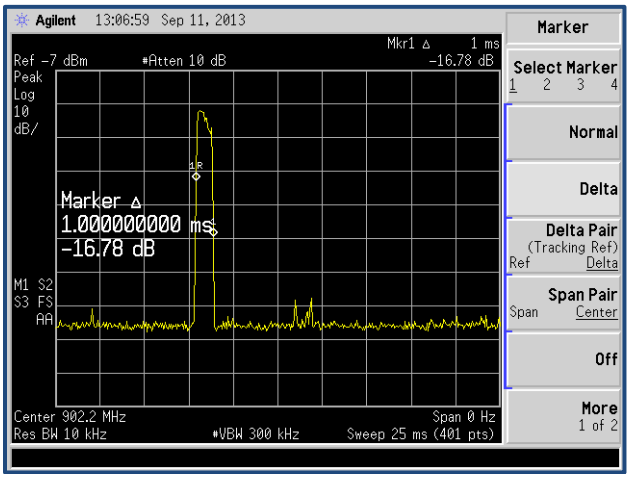


FIGURE 44 - LARGEST AT 9600SYM/S

10.4.3 200KSPS



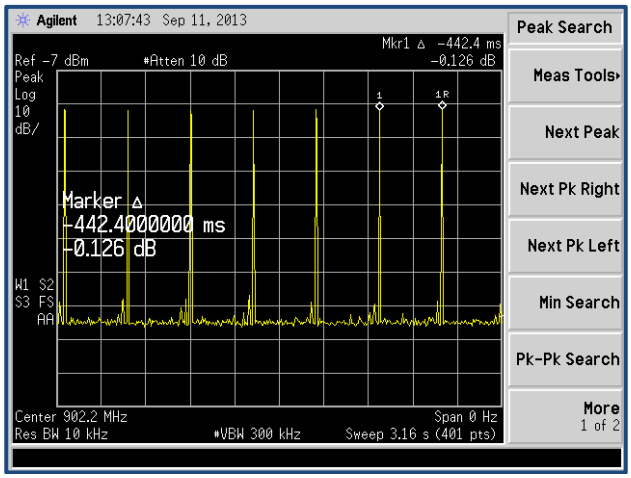
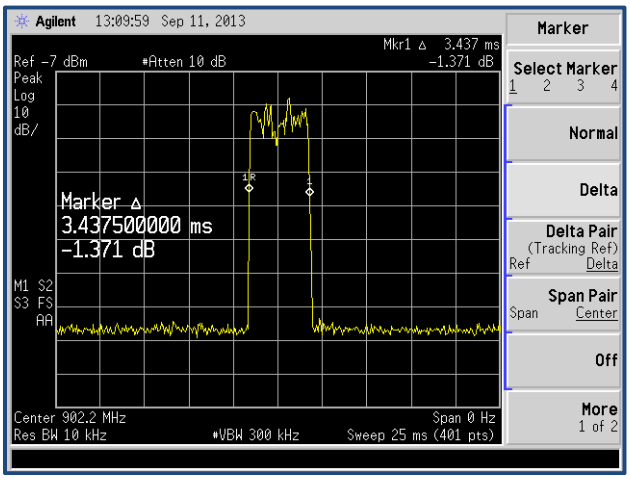


FIGURE 45 - SMALLEST



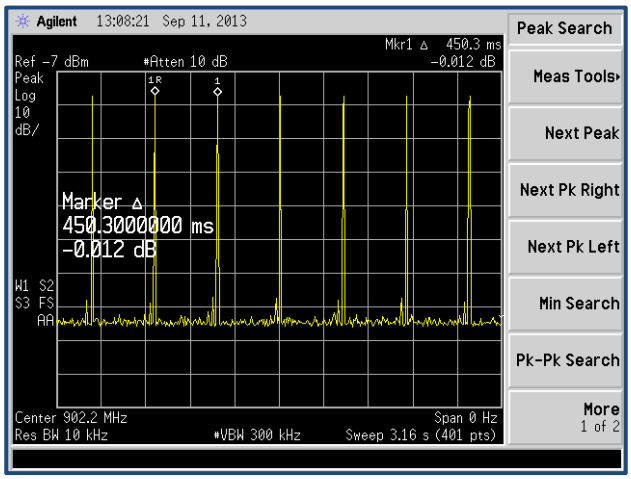


FIGURE 46 - MEDIUM

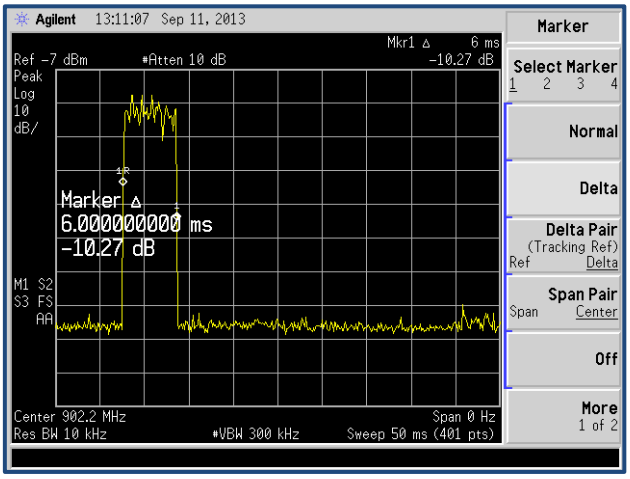


FIGURE 47 - LARGEST

11 RADIATED SPURIOUS EMISSIONS BAND EDGE

11.1 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.

Band edge measurements verified with frequency hopping turned on and off to ensure that no additional artifacts were introduced by hopping.

11.2 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	

11.2.1 SUMMARY OF 15.205 LIMITS

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[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	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 48 - RESTRICTED BANDS

11.4 DATA (HIGH GAIN ANTENNA)

Spurious Emission Frequency (MHz)	Reading (dBuV)	Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
982.27	50.1	56.5	74/54	-17.5	Complies
1065.2	46.9	54.2	74/54	-19.8	Complies
1234.2	39.0	47.7	74/54	-26.3	Complies

11.5 DATA (LOW GAIN ANTENNA)

Spurious Emission Frequency (MHz)	Reading (dBuV)	Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
976.6	34.1	40.5	74/54	-33.5	Complies
982.4	39.1	45.5	74/54	-28.5	Complies
1077.9	41.6	49.0	74/54	-25.0	Complies
1080.9	36.9	44.4	74/54	-29.6	Complies

11.6 LOWER BANDEDGE (ZOOMED IN) (HIGH GAIN ANTENNA)

Spurious Emission Frequency (MHz)	Reading (dBuV)	Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
902.25 (Fund)	102.3	107.9	-	-	Complies
902.00	58.4	64.0	74.0	-10.0	Complies

11.7 UPPER BANDEDGE (ZOOMED IN) (HIGH GAIN ANTENNA)

Spurious Emission Frequency (MHz)	Reading (dBuV)	Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Result
927.75 (Fund)	96.5	102.3	-	-	Complies
928.00	43.5	49.3	74.0	-24.7	Complies

11.8 PLOTS

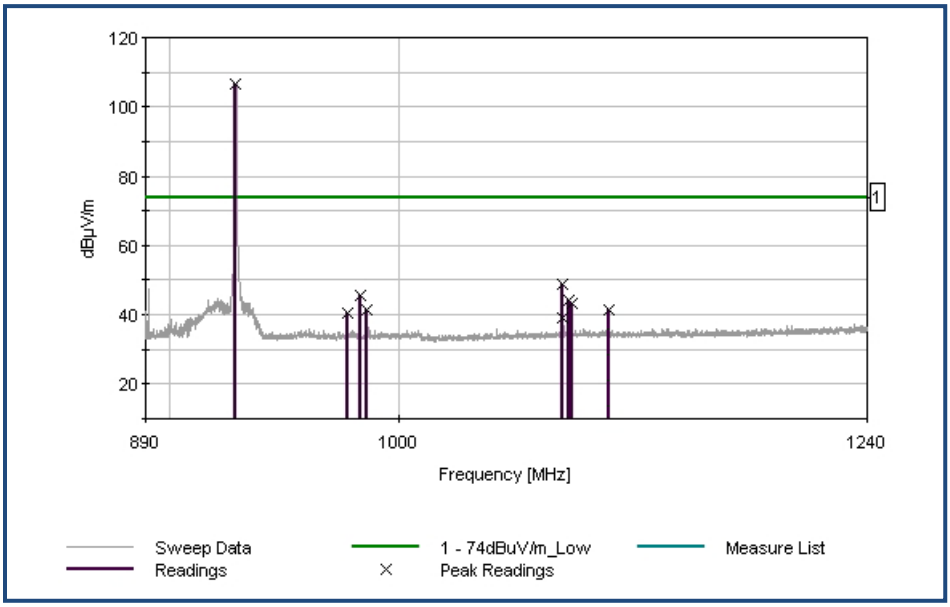


FIGURE 49 - RADIATED BAND EDGE - 2.15 DBI ANTENNA

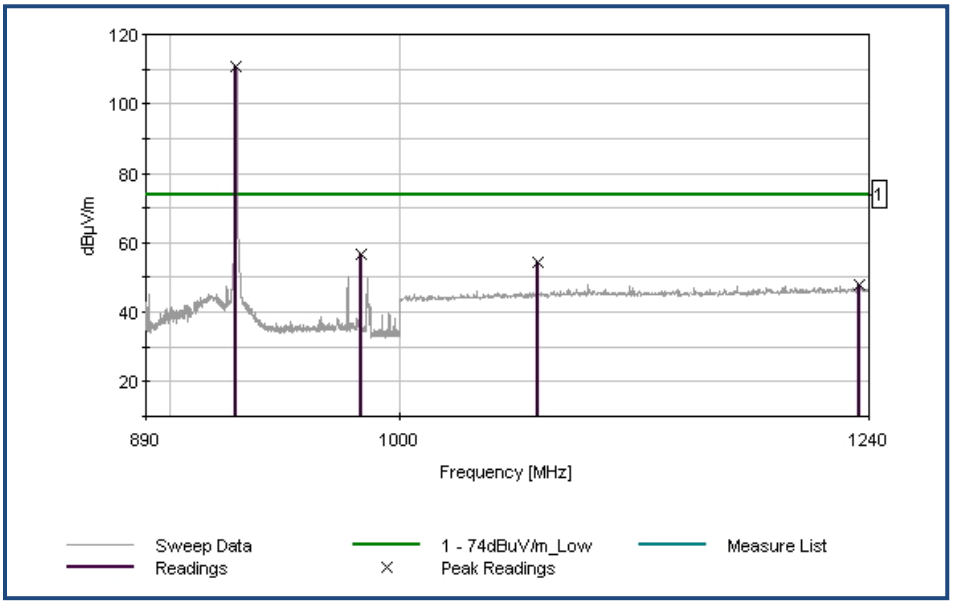


FIGURE 50 - RADIATED BAND EDGE – 5.4 DBI ANTENNA

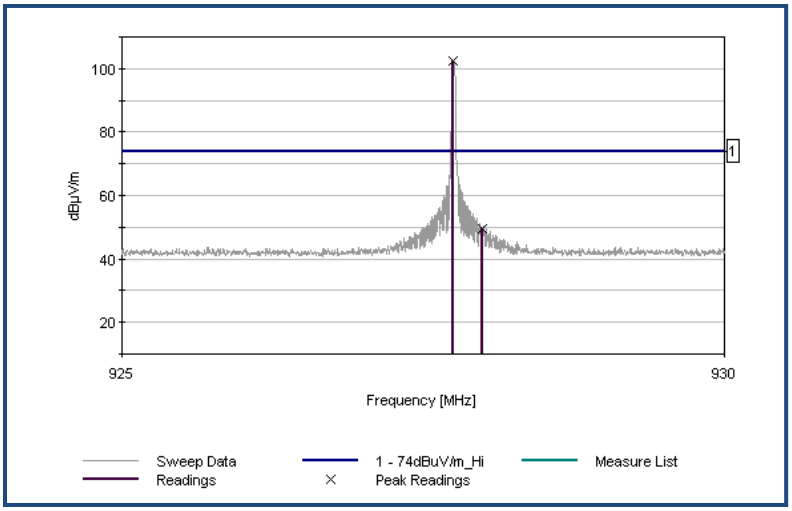


FIGURE 51 - UPPER BANDEDGE EMISSION

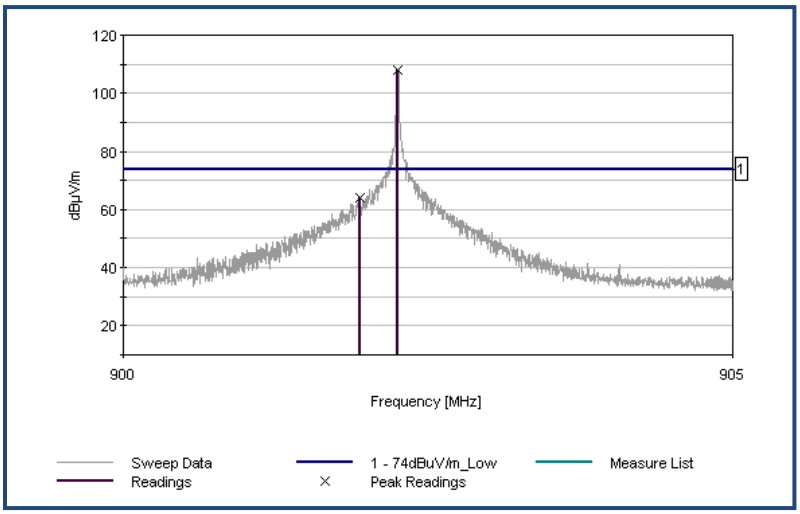


FIGURE 52 - LOWER BANDEDGE EMISSION

12 RADIATED SPURIOUS EMISSIONS

12.1 TEST PROCEDURE

The EUT is placed on a non-conducive turntable on the 3m OATS. Exploratory measurements are made using a suitable antenna positioned within 1m of the EUT. The EUT antenna was manipulated through typical positions during exploratory testing to maximize emission levels. 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 loop antenna were used to cover the relevant frequency bands. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane, measured from the centre of the loop. Magnetic field measurements are made in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna, positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT.

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 [µV/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).

12.2 SUMMARY OF TEST RESULTS

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

Emissions were investigated from the lowest present clock frequency, to the 10th harmonic of the highest present clock frequency (up to 10 GHz). No other emissions were observed within 20 dB of the limits.

12.2.1 SUMMARY OF 15.205 LIMITS

See Figure 15 above.

12.3 DATA 30MHZ - 2G

No.	Freq (MHz)	Rdng (dBuV)	Corrected (dBuV/m)	Spec (dBuV/m)	Margin (dB)	Polarity	Antenna Height (cm)
1	57.950M	25.3	33.0	40.0	-7.0	Horiz	110
2	420.134M	18.1	36.4	46.0	-9.6	Horiz	101
3	140.600M	19.4	29.5	43.5	-14.0	Vert	200
4	84.010M	15.8	25.6	40.0	-14.4	Vert	125
5	222.200M	17.9	30.4	46.0	-15.6	Horiz	118
6	173.480M	16.4	27.1	43.5	-16.4	Vert	110

12.4 EMISSIONS PLOT

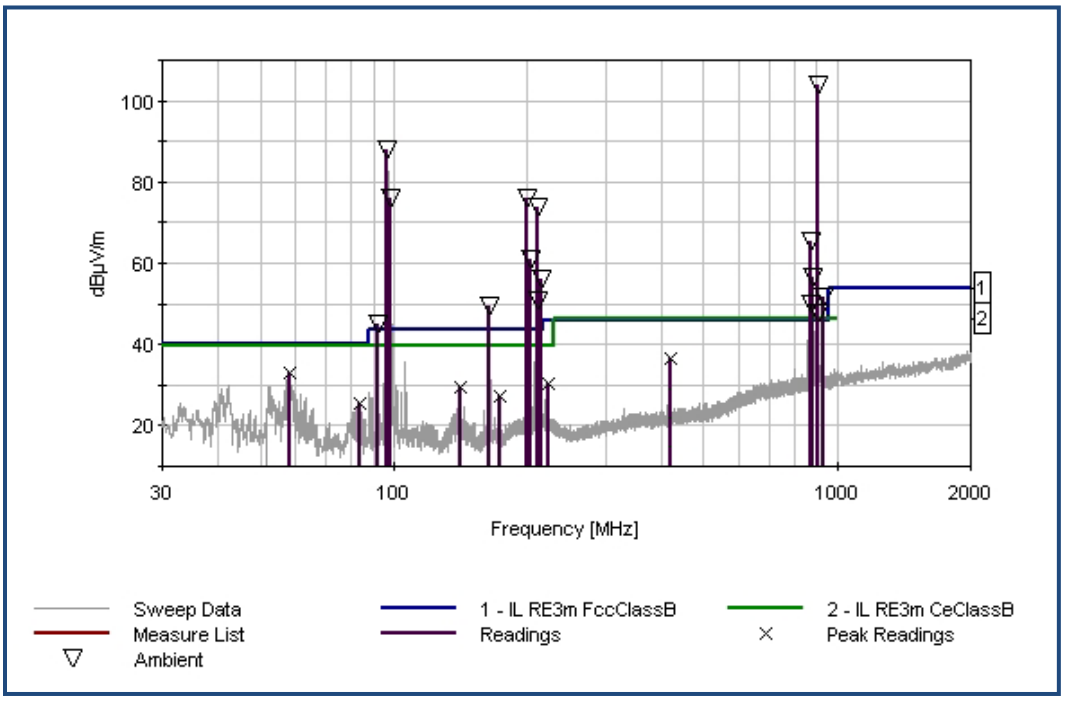


FIGURE 53 - SPURIOUS EMISSIONS PLOT (30MHZ - 2G)

12.5 TX SPURIOUS EMISSIONS (2 GHZ – 10 GHZ)

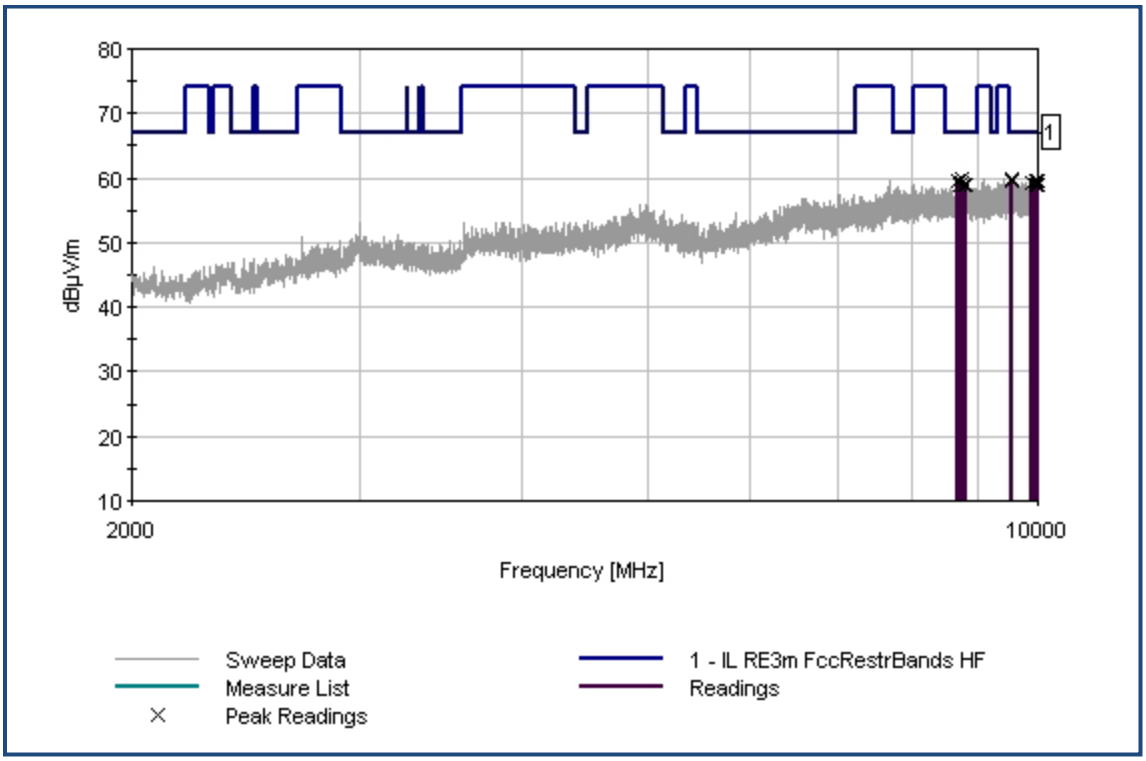


FIGURE 54 - TX SPURIOUS EMISSIONS (2 GHZ - 10 GHZ)

13 POWER LINE CONDUCTED EMISSIONS

13.1 TEST METHOD

For the duration of the conducted emissions test, the power cord of the EUT was connected to the main power outlet of the LISN. The LISN in turn is connected to an AC power source. Exploratory tests of the EUT are performed by varying modes and cable positioning. Maximizing procedures are performed on the highest emission readings from the EUT

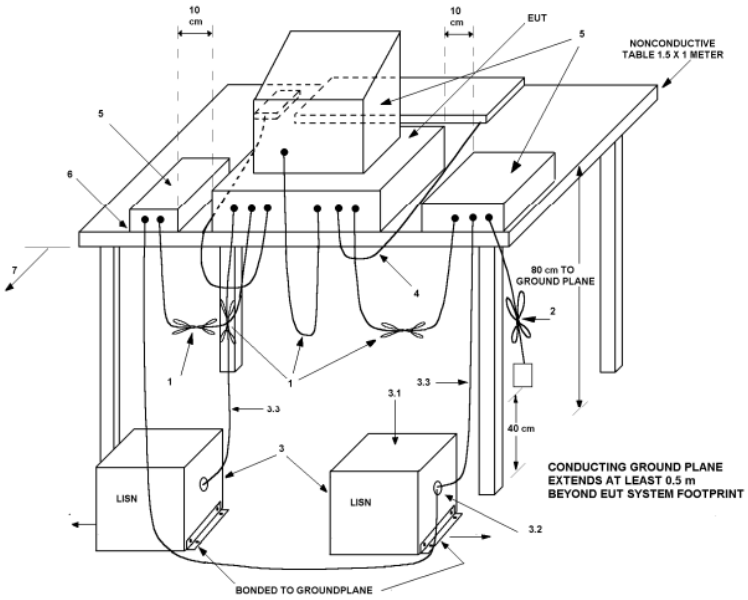


TABLE 1 - TEST ARRANGEMENT FOR CONDUCTED EMISSIONS OF TABLETOP EQUIPMENT

13.2 LIMITS AS PER 15.207

Frequency of emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

TABLE 2 – CONDUCTED EMISSION LIMITS

13.3 NOTES

13.4 LINE RESULTS PLOT 120V

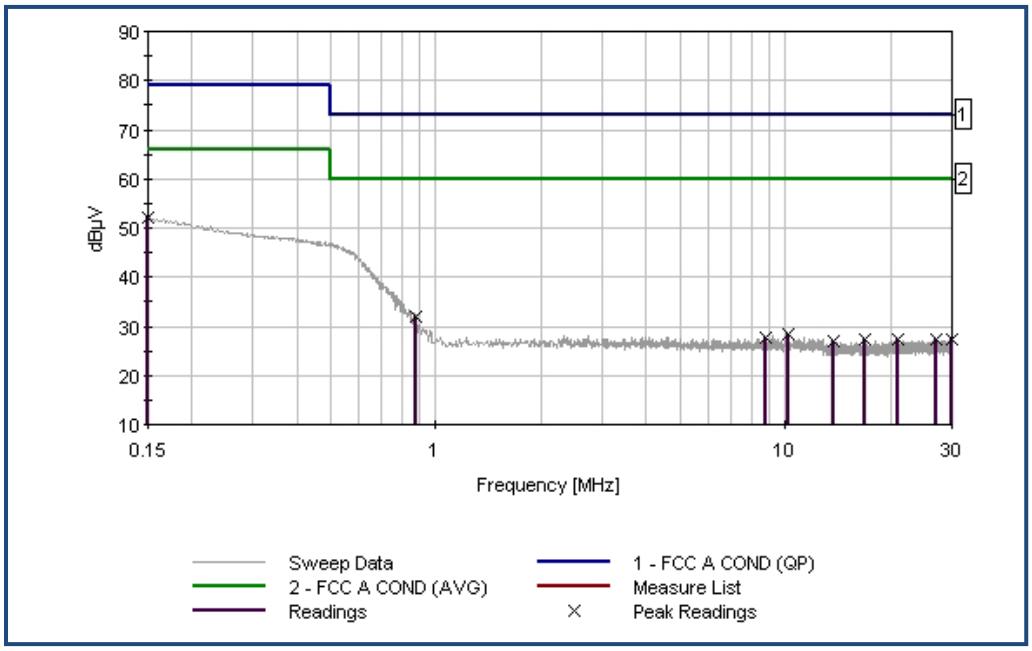


FIGURE 55 - CONDUCTED EMISSIONS PLOT – LINE 120V

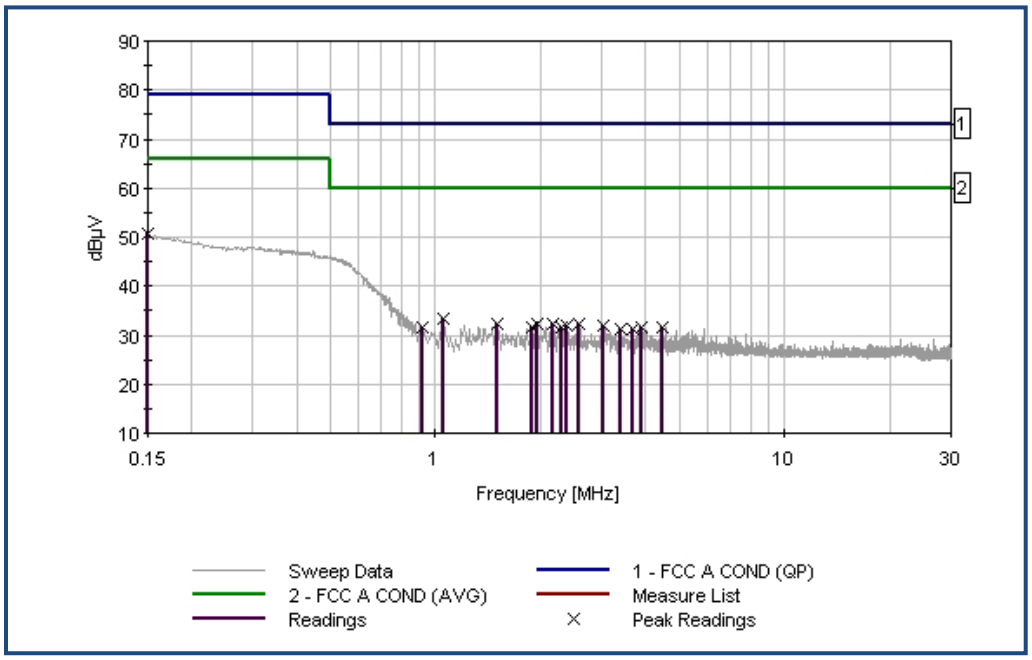


FIGURE 56 - CONDUCTED EMISSIONS PLOT – NEUTRAL 120V

13.5 MEASUREMENT DATA, LINE 120V

No.	Freq (Hz)	Rdng (dBuV)	Corrected (dBuV)	Spec (dBuV)	Margin (dB)	Detector	Polarity
1	150.000k	41.9	52.0	79.0	-27.0	Pk	Line
2	877.204k	21.7	31.8	73.0	-41.2	Pk	Line
3	10.251M	18.3	28.4	73.0	-44.6	Pk	Line
4	8.807M	17.7	27.8	73.0	-45.2	Pk	Line
5	16.994M	17.3	27.4	73.0	-45.6	Pk	Line
6	29.931M	16.7	27.3	73.0	-45.7	Pk	Line

13.6 MEASUREMENT DATA, NEUTRAL 120V

No.	Freq (Hz)	Rdng (dBuV)	Corrected (dBuV)	Spec (dBuV)	Margin (dB)	Detector	Polarity
1	150.000k	40.5	50.6	79.0	-28.4	Pk	Neutral
2	1.058M	23.4	33.5	73.0	-39.5	Pk	Neutral
3	1.950M	22.2	32.3	73.0	-40.7	Pk	Neutral
4	1.509M	22.1	32.2	73.0	-40.8	Pk	Neutral
5	2.160M	22.1	32.2	73.0	-40.8	Pk	Neutral
6	2.581M	22.1	32.2	73.0	-40.8	Pk	Neutral

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.

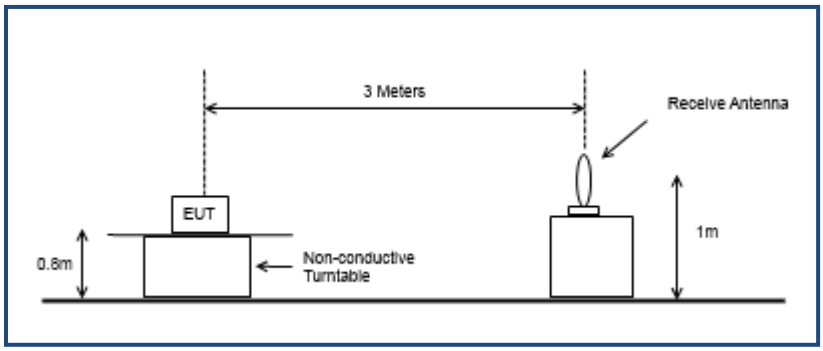
Manufacturer	Description	Model	Serial Number	Cal/Char Due Date D/M/Y
Agilent	Spectrum Analyzer	E4407B	US4142960	10/10/2014
Electro Metrics	Line Impedance Stabilization Network	EM-7823	115037	31/10/2013
Com-Power	Loop Antenna	AL-130	301049	15/1/2014
Electro Metrics	Hybrid Antenna	EM-3141	9902-1141	07/12/2014
HP	RF Amplifier	11975A	2738A01196	01/03/2014
HP	RF Amplifier	8449B	N/A	19/9/2015
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 POWER LINE CONDUCTED EMISSIONS TEST SETUP

15.3 Low Frequency Emissions Test Setup (9 KHz – 30 MHz)



15.4 Radiated Emissions Test Setup