

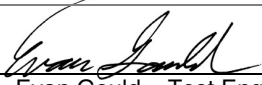
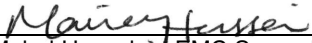


Test Report

78



Curtis-Straus LLC, a wholly owned subsidiary of BV CPS

Report No	EK1078-3
Client	ThingMagic
Address	One Cambridge Center Cambridge, MA 02142
Phone	617-682-3770
Items tested FCC ID FRN	M6e QV5MERCURY6E-A 0008403743
Equipment Type Equipment Code	Part 15.247 Frequency Hopper DSS
FCC/IC Rule Parts	47 CFR 15.247, RSS-210
Test Dates	August 18-19, 27, December 7, 9, 2010, January 20, 2011
Results	As detailed within this report
Prepared by	 Evan Gould – Test Engineer
Authorized by	 Mairaj Hussain – EMC Supervisor
Issue Date	<u>2/10/2011</u>
Conditions of Issue	This Test Report is issued subject to the conditions stated in the 'Conditions of Testing' section on page 25 of this report.

Curtis-Straus LLC is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.



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Form Final Report REV 7-20-07 (DW)



Summary

This test report supports an application for certification of a transmitter operating pursuant to 47 CFR 15.247. The product is the M6e RFID Limited Module. It is a frequency hopping transmitter that operates in the range 902-928MHz. Product was tested with Laird Technologies antenna PN: S8658WPL-T-01 with a gain of 6dBi along with a required antenna extension cable consisting of one of the following pairs of part numbers:

12ft Cable

510-0076-01 CABLE ASSY, COAXIAL, RTNC-BLKHD-JACK TO MMCX-PLUG, LMR-100
 510-0077-01 Coaxial cable with right angle and straight R-TNC connectors, 12FT.

6ft Cable

510-0076-01 CABLE ASSY, COAXIAL, RTNC-BLKHD-JACK TO MMCX-PLUG, LMR-100
 300-0025-01

20ft Cable

510-0076-01 CABLE ASSY, COAXIAL, RTNC-BLKHD-JACK TO MMCX-PLUG, LMR-100
 300-0081-01 Cable X-Perts, Inc. LMR195LLPL-RPTM-20
 300-0024-01 (alternate 20ft. cable)

25ft Cable

510-0076-01 CABLE ASSY, COAXIAL, RTNC-BLKHD-JACK TO MMCX-PLUG, LMR-100
 300-0023-01 25ft cable

One of these extension cables is required with any installation of this module due to the fact that the output power was measured at the antenna end of the cable, which must be in place to ensure a power below the limit of 30dBm.

ThingMagic will like to qualify several other circular polarized antennas (as mentioned in the antenna list exhibits). All of the antennas have equal or lower gain compare to the one which was tested with the product.

We found that the product met the above requirements without modification. Mike Regan or John Carrick, each from ThingMagic was present during the testing. The test sample was received in good condition.

Cable Length	Power Setting
6 ft	29.7 dBm
12 ft	29.8 dBm
20 ft	28.6 dBm
25 ft	28.6 dBm (Use same as of 20 ft cable)

Release Control Record

Issue No.	Reason for change	Date Issued
1	Original Release	



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Test Methodology

Radiated emission and AC Line conducted testing was performed according to the procedures specified in ANSI C63.10 (2009) and C63.4 (2009). Radiated Emissions were maximized by rotating the device around its axes as well as varying the test antenna’s height and polarity. The device antenna was maximized separately.

Conducted emission at the antenna port was performed, as required by rule section.

The EUT operating voltage is 5VDC
 Low operating channel frequency = 902.75MHz
 Mid operating channel frequency = 915.25MHz
 High operating channel frequency = 927.25MHz

The following bandwidths were used during radiated spurious and line conducted emissions.

Frequency	RBW	VBW
0.15-30MHz	9kHz	30kHz
30-1000MHz	120kHz	300kHz
1-10GHz	1MHz	3MHz

Release Control Record

Issue No.	Reason for change	Date Issued
1	Original Release	



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Product Tested - Configuration Documentation

EUT Configuration												
Work Order: K1078 Company: ThingMagic Company Address: One Cambridge Center Cambridge, MA 02142 Contact: Satyan Shah Person Present: Mike Regan												
MN						SN						
EUT: M6e						1374 Rev.2A						
Antenna extension cable: 510-0076-01 CABLE ASSY, COAXIAL, RTNC-BLKHD-JACK TO MMCX-PLUG, LMR-100 510-0077-01 Coaxial cable with right angle and straight R-TNC connectors, 12FT.												
EUT Description: RFID Module w/ extension cable EUT TX Frequency: 902-928MHz (FCC)												
Support Equipment:						MN						SN
M6e Development Board						P70011						-
GW Instek p/s						PST-3202						-
DELL Latitude laptop						D610						-
EUT Ports:												
Port Label	Port Type	No. of ports	No. Populated	Cable Type	Shielded	Ferrites	Length	Max Length	In/Out	NEBS Type	Unpopulated Reason	
Port 1	MMCX	1	All	coax	Yes	None	3.7m	3.7m	In		NA	
Port 2	MMCX	1	None	NA	NA	NA	NA	NA	NA	NA	Redundant	
Port 3	MMCX	1	None	NA	NA	NA	NA	NA	NA	NA	Redundant	
Port 4	MMCX	1	None	NA	NA	NA	NA	NA	NA	NA	Redundant	
J5	15 pin	1	All	NA	NA	NA	NA	NA	NA	NA	NA	
Software / Operating Mode Description: Using a command prompt interface on the support laptop to control channel, power, hopping.												



Statement of Conformity

The M6e has been found to conform to the following parts of 47 CFR and as detailed below:

RSS-GEN	RSS 210	Part 15	Comments
5.4		15.15(b)	There are no controls accessible to the user that varies the output power above specified limits.
5.2		15.19	The label is shown in the label exhibit.
7.1.2,7.1.3		15.21	Information to the user is shown in the instruction manual exhibit.
		15.27	The special accessory required for the compliance of this limited module will be included along with the device to the professional installer.
		15.31	The EUT was tested in accordance with the measurement standards in this section.
		15.33	Frequency range was investigated according to this section, unless noted in specific rule section under which the equipment operates.
		15.35	The EUT emissions were measured using the measurement detector and bandwidth specified in this section, unless noted in specific rule section under which the equipment operates.
7.1.2		15.203	EUT employs a unique antenna connector.
7.2.2		15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209.
7.2.4		15.207	EUT meets the AC Line conducted emissions requirements of 15.207.
	Annex 8	15.247	The unit complies with the requirements of 15.247
4.6.1			Occupied Bandwidth measurements were made.



Test Results

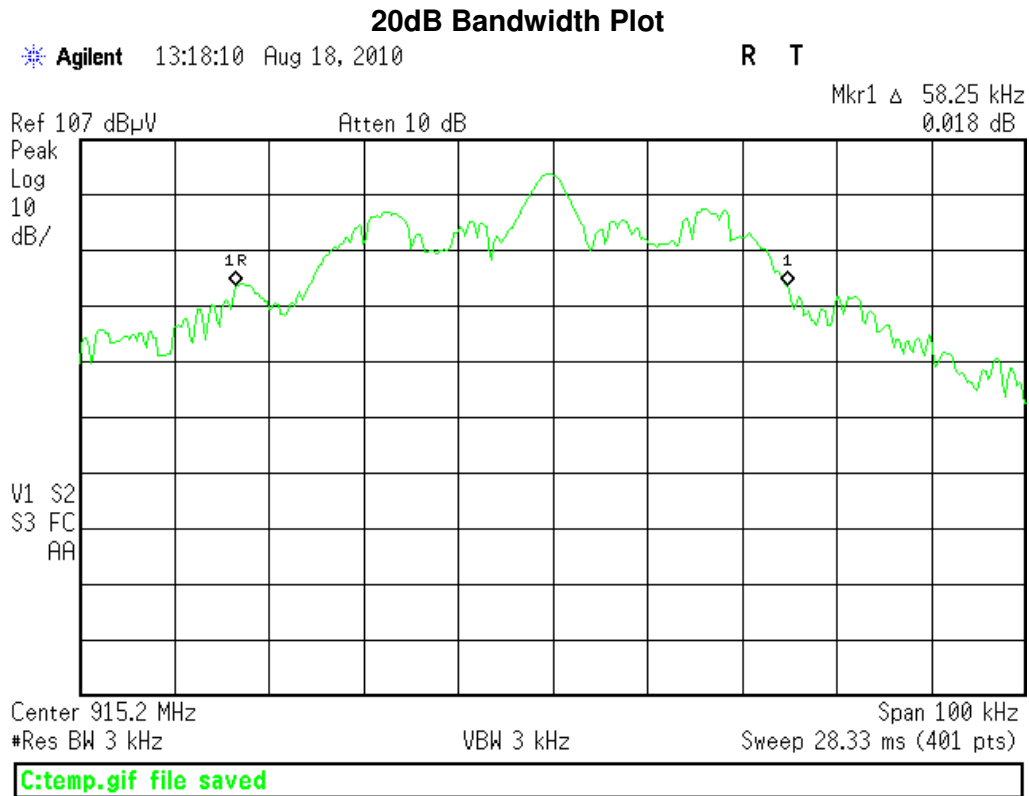
Bandwidth

LIMIT

The 20dB bandwidth is used to determine channel frequency separation limits and required number of hopping frequencies.

MEASUREMENTS / RESULTS

20dB Bandwidth = 58.25kHz



Rev: 11-Aug-2010

Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Cat	Calibration Due		
EMI Chamber 2	719150	2762A-7	R-3033, G-107	I	15-Feb-2011		
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
ETS 1503 Bilog	26MHz-6GHz	3142D	ETS	102060	1503	I	17-Mar-2011
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red	0.009-2000MHz	ZFL-1000-LN	CS	N/A	798	II	6-Apr-2011
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	9-Apr-2011
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
CHAMBER2 Thermohygrometer		35519-044	Control Company	72457639	1347	II	18-Aug-2011
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



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Channel Frequency Separation

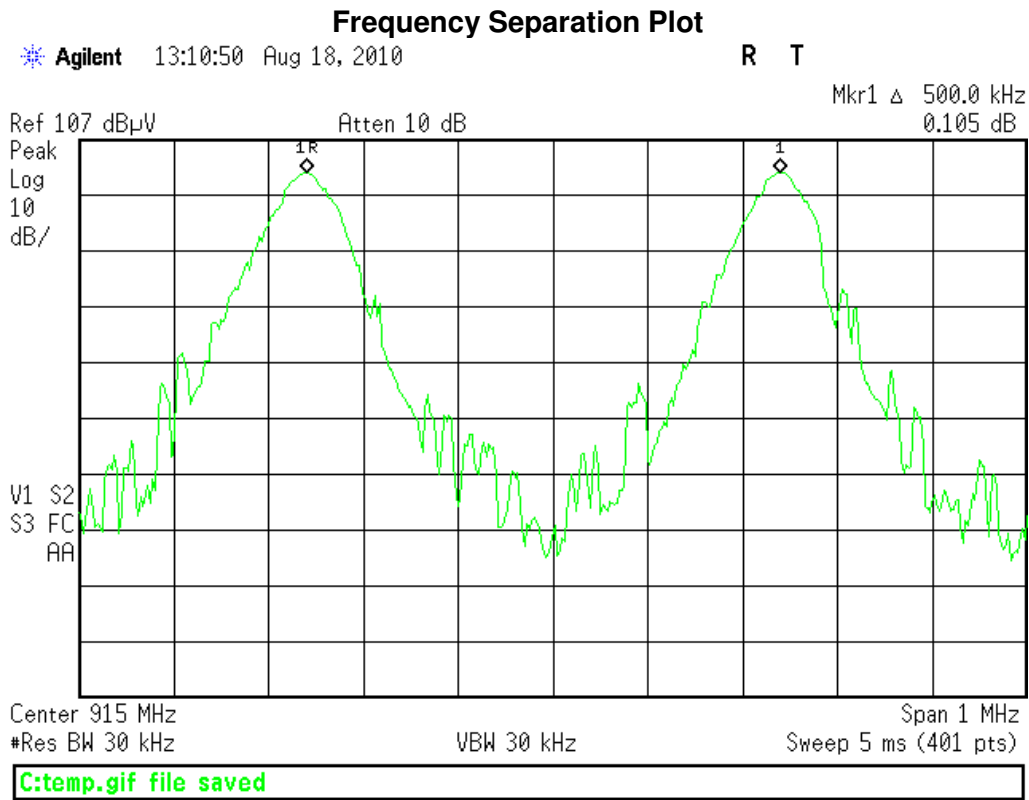
LIMIT

“Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.”
[15.247(a)(1)]

Limit = 20dB bandwidth = 58.25kHz.

MEASUREMENTS / RESULTS

Channel Frequency Separation = 500kHz



Rev: 11-Aug-2010

Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Cat	Calibration Due		
EMI Chamber 2	719150	2762A-7	R-3033, G-107	I	15-Feb-2011		
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
ETS 1503 Bilog	26MHz-6GHz	3142D	ETS	102060	1503	I	17-Mar-2011
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red	0.009-2000MHz	ZFL-1000-LN	CS	N/A	798	II	6-Apr-2011
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	9-Apr-2011
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	
CHAMBER2 Thermohyrometer	35519-044	Control Company	72457639	1347	II	18-Aug-2011	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



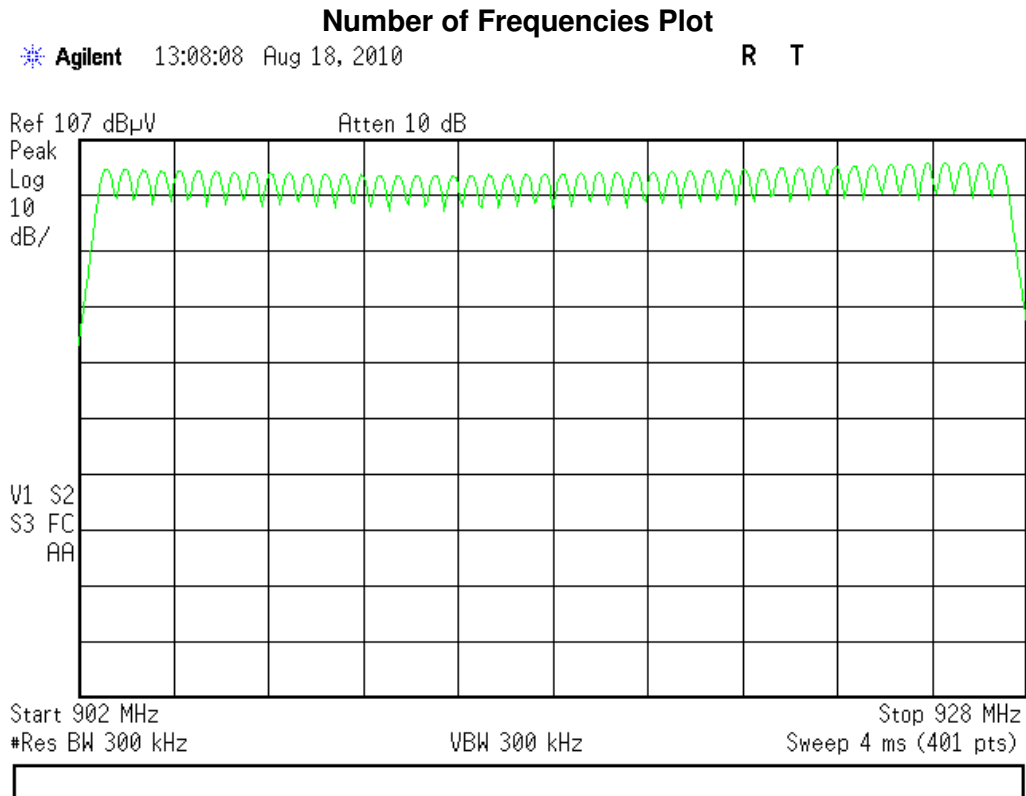
Number of Hopping Frequencies

LIMIT

“...if the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping frequencies...”
 [15.247(a)(1)(i)]

MEASUREMENTS / RESULTS

Number of hopping frequencies = 50



Rev: 11-Aug-2010

Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Cat	Calibration Due		
EMI Chamber 2	719150	2762A-7	R-3033, G-107	I	15-Feb-2011		
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
ETS 1503 Bilog	26MHz-6GHz	3142D	ETS	102060	1503	I	17-Mar-2011
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red	0.009-2000MHz	ZFL-1000-LN	CS	N/A	798	II	6-Apr-2011
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	9-Apr-2011
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	
CHAMBER2 Thermohyrometer	35519-044	Control Company	72457639	1347	II	18-Aug-2011	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



Time of Occupancy

LIMIT

“...if the 20dB bandwidth of the hopping channel is less than 250kHz...the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period” [15.247(a)(1)(i)]

MEASUREMENTS / RESULTS

The average time of occupancy was measured for three different tag configurations: 0 tags, 10 tags, and 125 tags. In each case, the average individual dwell time was determined by averaging the duration of 10 dwells. Also, the average repetition rate was determined by averaging the rise-to-rise times of randomly captured consecutive dwells.

The average time of occupancy was then calculated with these values.

Example Calculation

Ave Time of Occ = (20s/ave rep rate)*ave ind dwell time

Ave Time of Occ = (20s/8.8s)*173.62ms = **394.6ms**

Sample #	0 Tags		10 Tags		125 Tags	
	Dwell Time (ms)	Rep Rate (s)	Dwell Time (ms)	Rep Rate (s)	Dwell Time (ms)	Rep Rate (s)
1	135.7	6.875	137.2	7.075	177.8	8.8
2	135.0	6.875	141.8	7.050	175.5	8.8
3	141.0	6.875	140.2	7.050	162.0	8.8
4	136.5	6.925	139.5	7.100	179.2	8.8
5	140.2	6.925	141.0	7.075	176.2	8.77
6	135.0	6.900	135.7	7.075	162.8	8.82
7	141.0	6.925	138.7	7.075	175.5	8.8
8	135.7	6.900	139.5	7.025	175.5	8.8
9	137.2	6.900	135.0	7.050	176.2	8.8
10	138.0	6.900	138.0	7.075	175.5	8.75
Average:	137.5	6.9	138.7	7.1	173.6	8.8
Average Time of Occupancy (ms)	398.6		392.5		394.9	

Rev: 15-Nov-2010

Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Cat	Calibration Due		
1DCC-OATS-3M-I	719150	2762A-8	R-3109	II	7-Jul-2011		
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #1 (Brown)	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	25-Mar-2011
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Green-Red Bilog	30-2000MHz	CBL6112B	Chase	2435	990	I	30-Jun-2012
Cables	Range	Mfr	Cat	Calibration Due			
REMI-18	9kHz - 2GHz	C-S	II	15-May-2011			

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

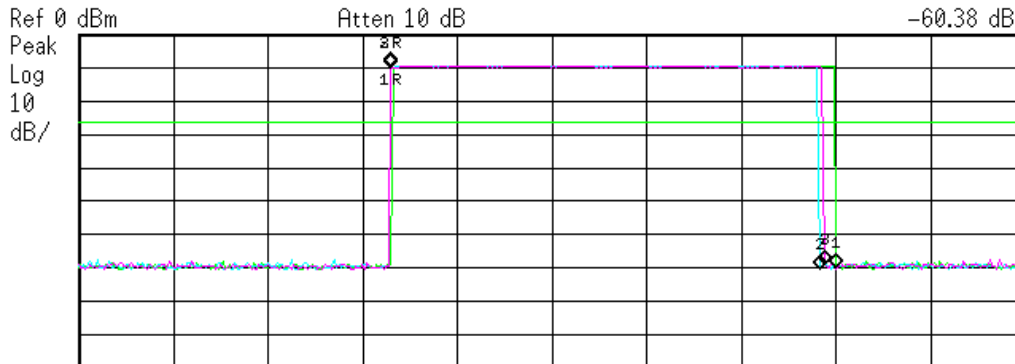


Sample Individual Dwells for 0 tags

Agilent 11:46:03 Dec 10, 2010

R T

Mkr2 Δ 135.7 ms
-60.38 dB



Center 902.8 MHz Res BW 120 kHz VBW 300 kHz Sweep 300 ms (401 pts) Span 0 Hz

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	99 ms	-9.738 dBm
1Δ	(1)	Time	141 ms	-59.98 dB
2R	(2)	Time	99 ms	-9.9 dBm
2Δ	(2)	Time	135.7 ms	-60.38 dB
3R	(3)	Time	99 ms	-10.06 dBm
3Δ	(3)	Time	137.2 ms	-58.85 dB

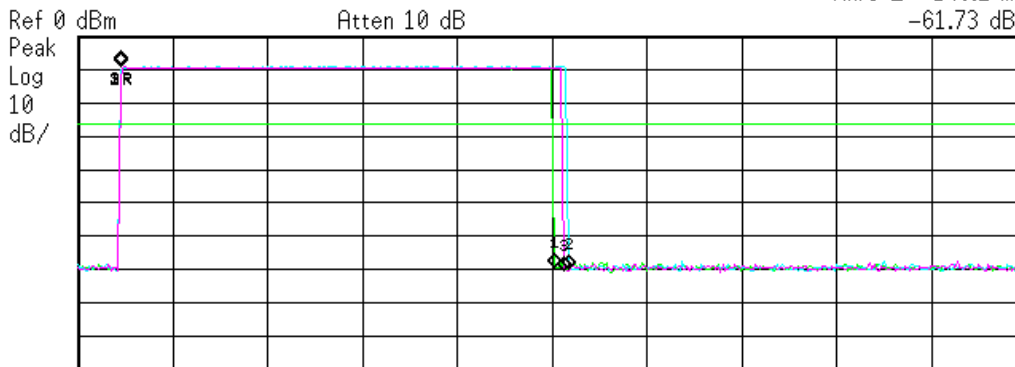
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Sample Individual Dwells for 10 tags

Agilent 11:18:52 Dec 10, 2010

R T

Mkr3 Δ 140.2 ms
-61.73 dB



Center 902.8 MHz Res BW 120 kHz VBW 300 kHz Sweep 300 ms (401 pts) Span 0 Hz

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	13.5 ms	-8.81 dBm
1Δ	(1)	Time	137.2 ms	-60.36 dB
2R	(2)	Time	13.5 ms	-9.113 dBm
2Δ	(2)	Time	141.8 ms	-60.72 dB
3R	(3)	Time	13.5 ms	-8.81 dBm
3Δ	(3)	Time	140.2 ms	-61.73 dB

Option not installed

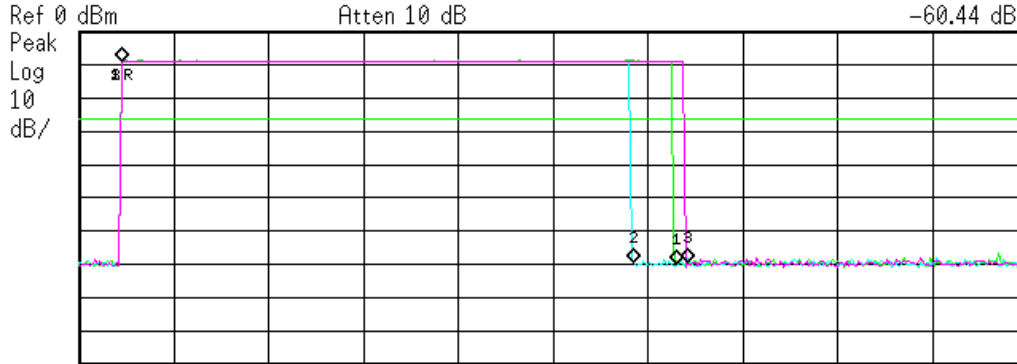


Sample Individual Dwells for 125 tags

Agilent 10:23:28 Dec 10, 2010

R T

Mkr3 Δ 179.2 ms
-60.44 dB



Center 902.8 MHz Span 0 Hz
Res BW 120 kHz VBW 300 kHz Sweep 300 ms (401 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	13.5 ms	-8.857 dBm
1Δ	(1)	Time	175.5 ms	-60.92 dB
2R	(2)	Time	13.5 ms	-9.051 dBm
2Δ	(2)	Time	162 ms	-60.55 dB
3R	(3)	Time	13.5 ms	-9.138 dBm
3Δ	(3)	Time	179.2 ms	-60.44 dB

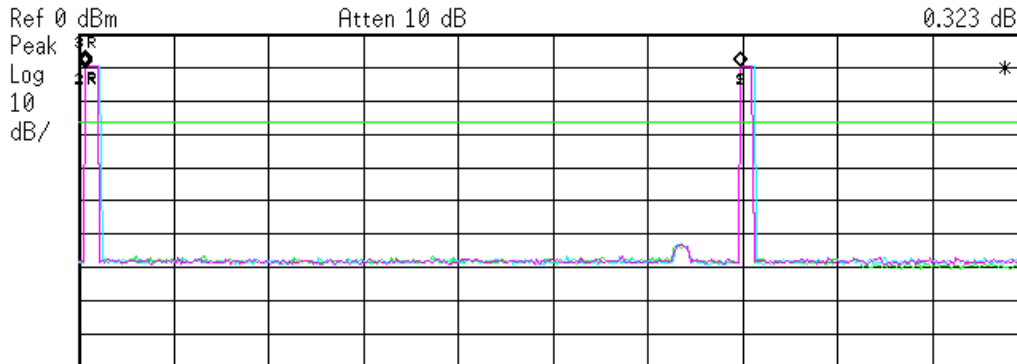
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Sample Repetition Rates for 0 tags

Agilent 11:57:39 Dec 10, 2010

R T

Mkr3 Δ 6.9 s
0.323 dB



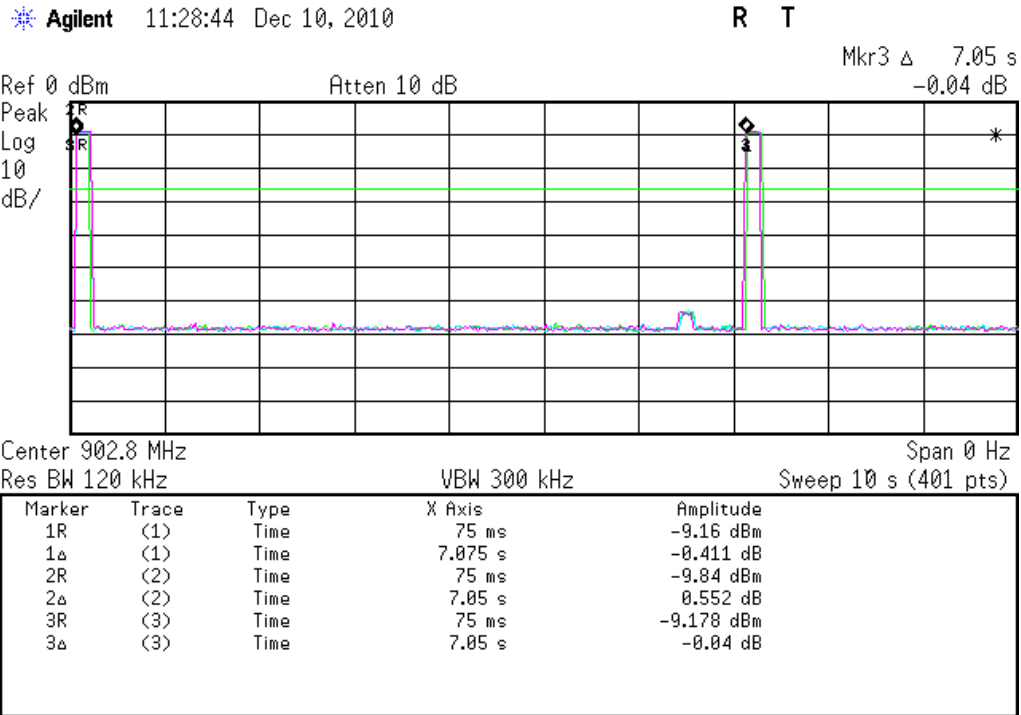
Center 902.8 MHz Span 0 Hz
Res BW 120 kHz VBW 300 kHz Sweep 10 s (401 pts)

Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	75 ms	-8.914 dBm
1Δ	(1)	Time	6.9 s	-0.561 dB
2R	(1)	Time	75 ms	-9.443 dBm
2Δ	(1)	Time	6.9 s	-0.032 dB
3R	(3)	Time	75 ms	-9.824 dBm
3Δ	(3)	Time	6.9 s	0.323 dB

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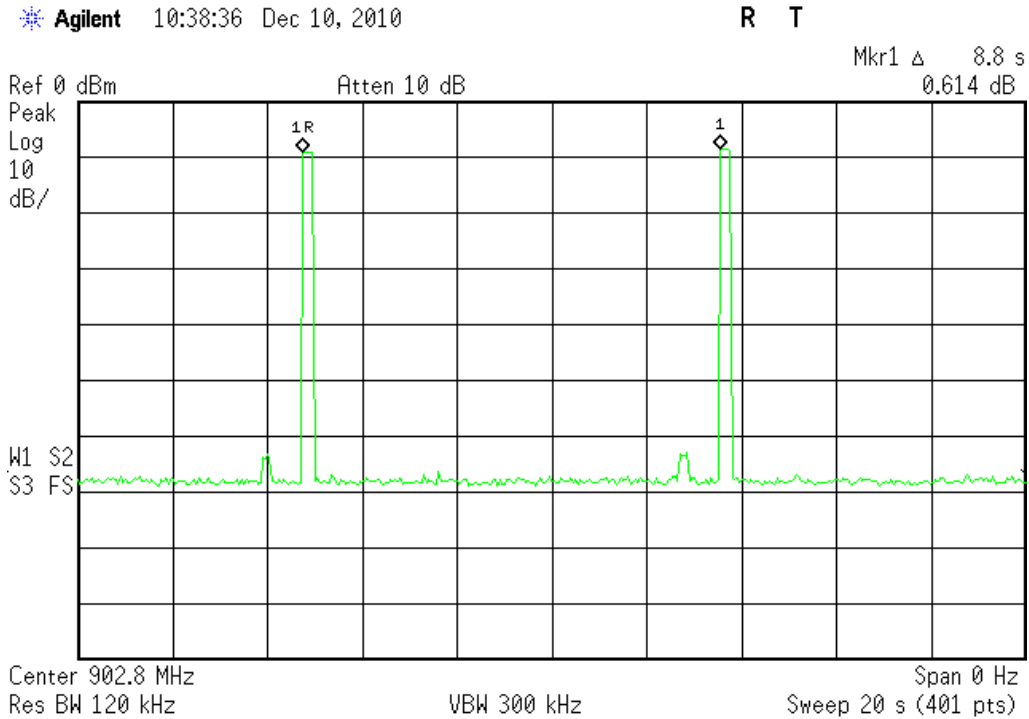


Sample Repetition Rates for 10 tags



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Sample Repetition Rates for 125 tags



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Output Power

LIMIT

“The maximum peak conducted output power of the intentional radiator shall not exceed...For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels”

[15.247(b)(2)]

Limit = 30dBm

Three sets of output power measurements were taken. Each set corresponds to a different length of antenna cable. The part numbers for the different cables are shown in the summary section.

MEASUREMENTS / RESULTS

12ft Cable

Frequency (MHz)	SA Reading (dBm)	Cable Factor (dB)	Attenuator Factor (dB)	Adjusted Reading (dBm)	Limit (dBm)	Result (Pass/Fail)
902.75	9.3	1.1	19.4	29.8	30	Pass
915.25	9.3	1.1	19.4	29.8	30	Pass
927.25	9.3	1.1	19.4	29.8	30	Pass

Environmental Conditions:

15.7°C 24%rh 1014.8mB

Rev: 15-Nov-2010

Spectrum Analyzers / Receivers /Preselectors
Rental SA #1 (Brown)

Range	MN	Mfr	SN	Asset	Cat	Calibration Due
9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	25-Mar-2011

Preamps / Couplers Attenuators / Filters
HF 20dB 50W Attenuator

Range	MN	Mfr	SN	Asset	Cat	Calibration Due
0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	8-May-2011

Cables
REMI-High-21

Range	Mfr	Cat	Calibration Due
9kHz - 26.5GHz	C-S	II	8-Jan-2011

Meteorological Meters

Weather Clock (Pressure Only)
1DCC-OATS-3M-I Thermohyrometer

MN	Mfr	SN	Asset	Cat	Calibration Due
BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011
35519-044	Control Company	72457635	1334	II	18-Aug-2011

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



20ft Cable

Frequency	SA Reading	Attenuator Factor	Adjusted Reading	Limit	Result
(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(Pass/Fail)
902.75	9.2	19.4	28.6	30	Pass
915.25	8.9	19.4	28.3	30	Pass
927.25	9.1	19.4	28.5	30	Pass

6ft Cable

Frequency	SA Reading	Attenuator Factor	Adjusted Reading	Limit	Result
(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(Pass/Fail)
902.75	10.3	19.4	29.7	30	Pass
915.25	9.9	19.4	29.3	30	Pass
927.25	10.1	19.4	29.5	30	Pass

Environmental Conditions:

20.8°C 22%rh 995mB

Rev: 20-Jan-2011

Spectrum Analyzers / Receivers /Preselectors

Range	MN	Mfr	SN	Asset	Cat	Calibration Due	
Rental SA #1 (Brown)	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	25-Mar-2011

Preamps /Couplers Attenuators / Filters

Range	MN	Mfr	SN	Asset	Cat	Calibration Due	
HF 20dB 50W Attenuator	0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	8-May-2011

Meteorological Meters

	MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011
1DCC-OATS-3M-I Thermohyrometer	35519-044	Control Company	72457635	1334	II	18-Aug-2011

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



Conducted Spurious Emissions

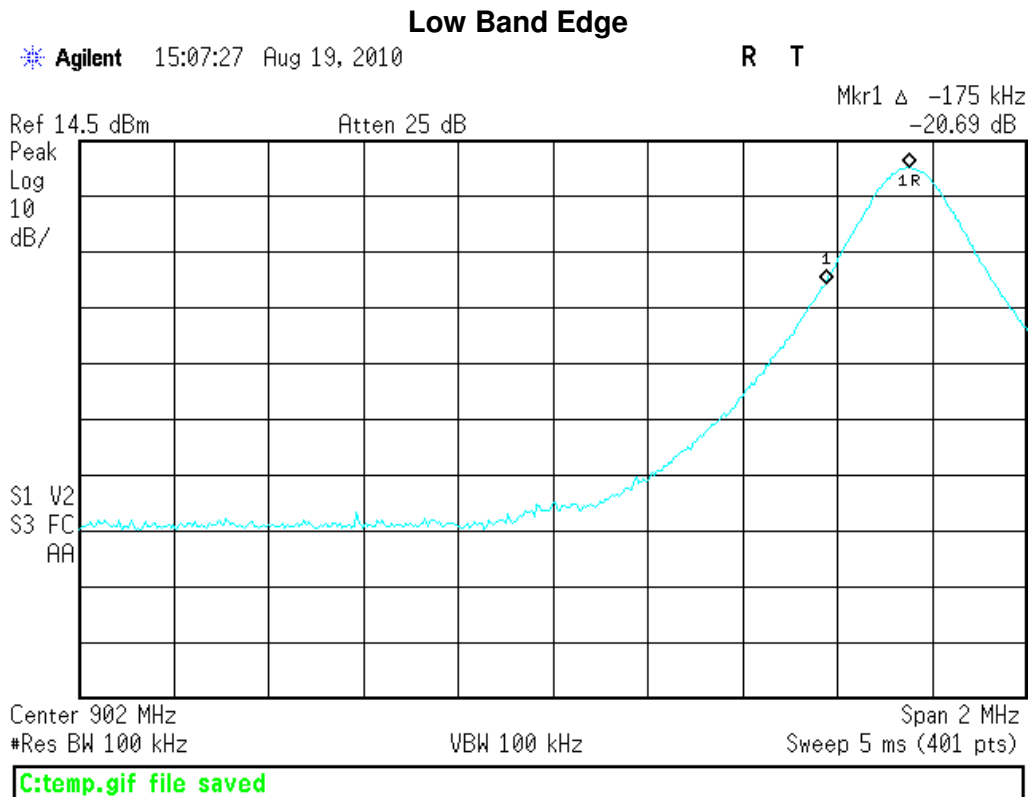
LIMITS

“In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power”

[15.247(d)]

MEASUREMENTS / RESULTS

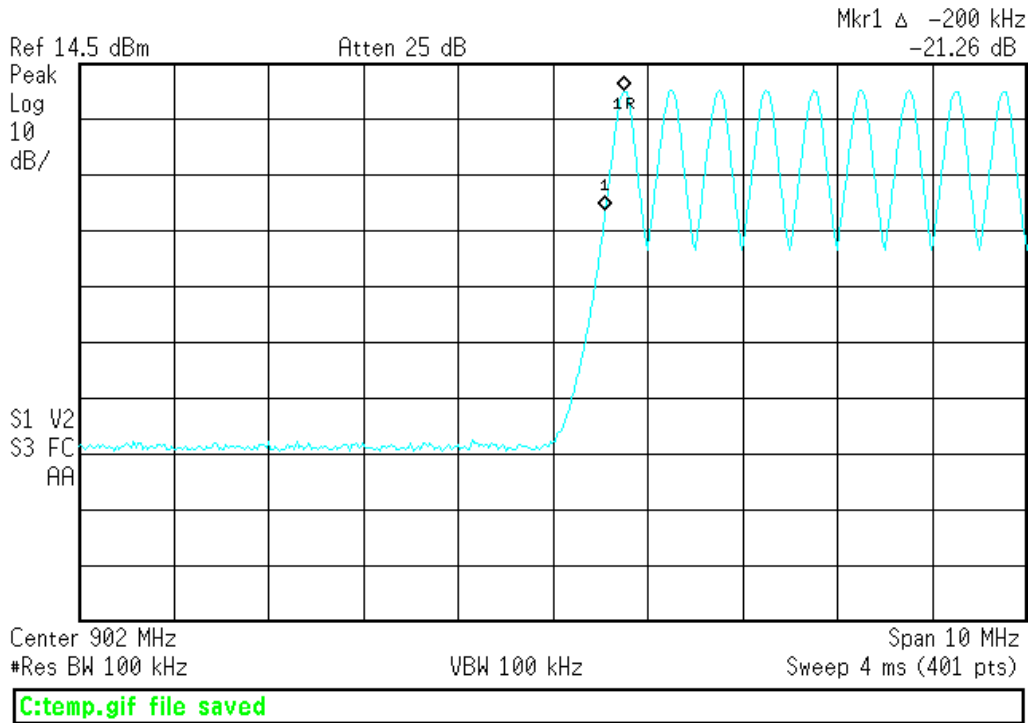
PLOTS



Low Band Edge – Hopping On

Agilent 15:13:49 Aug 19, 2010

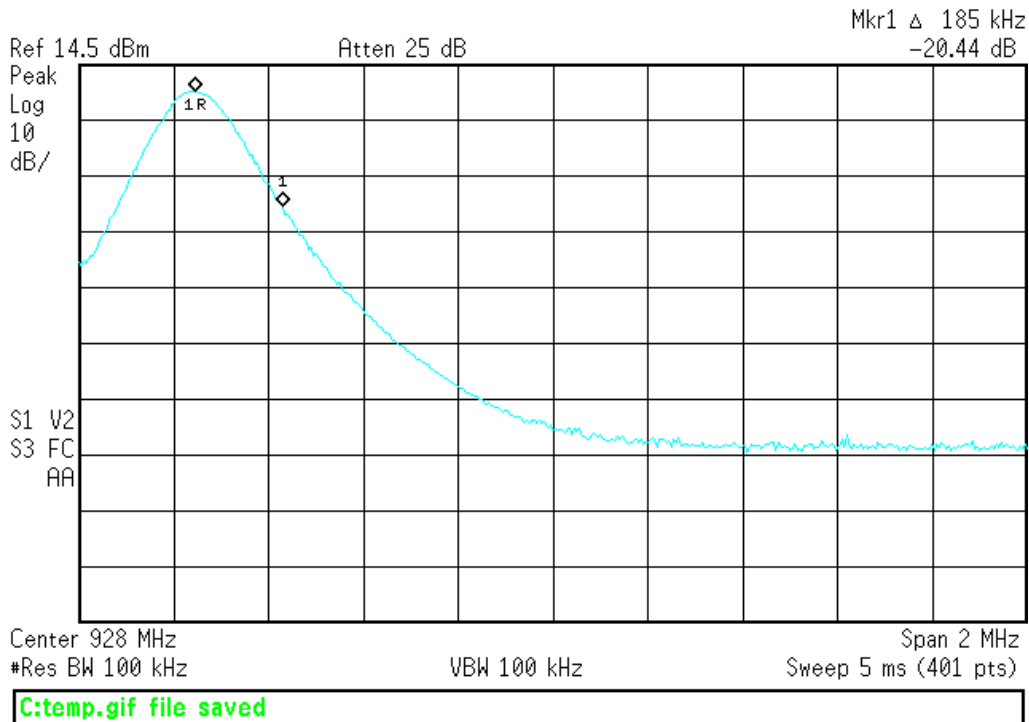
R T



High Band Edge

Agilent 15:05:59 Aug 19, 2010

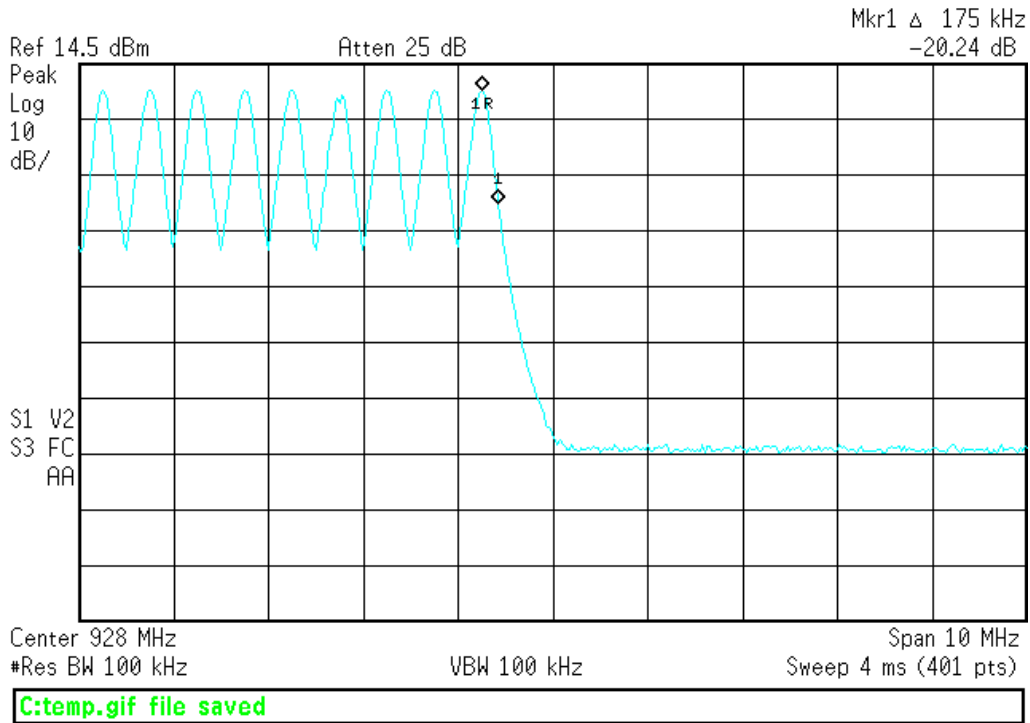
R T



High Band Edge – Hopping On

Agilent 15:11:38 Aug 19, 2010

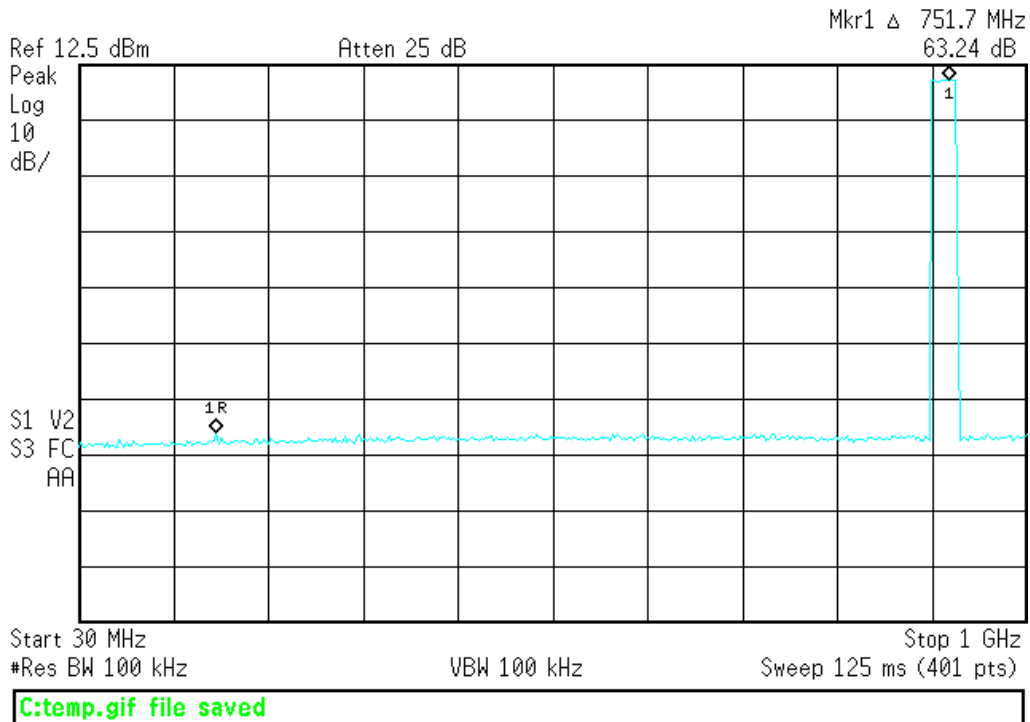
R T



30-1000MHz

Agilent 15:18:07 Aug 19, 2010

R T

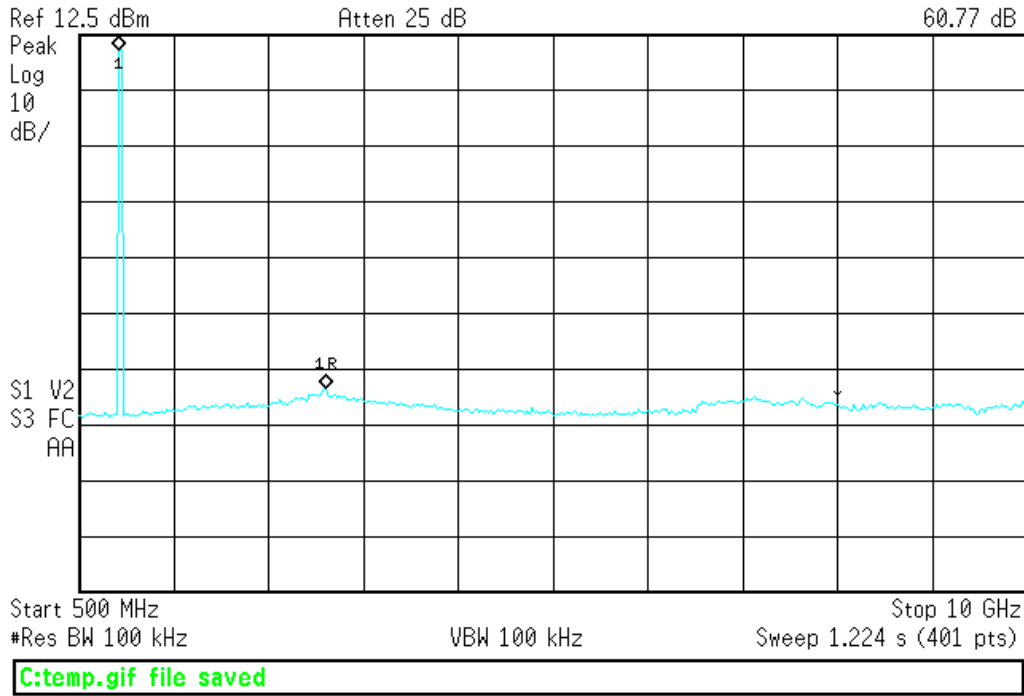


500MHz – 10GHz

Agilent 15:20:17 Aug 19, 2010

R T

Mkr1 Δ -2.043 GHz
60.77 dB



Rev: 11-Aug-2010

Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Cat	Calibration Due		
1DCC-OATS-3M-I	719150	2762A-8	R-3109	II	7-Jul-2011		
Spectrum Analyzers / Receivers / Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	9-Apr-2011
Preamps / Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
HF 20dB 50W Attenuator	0.009-18 GHz	PE 7019-20	Pasternack	1	791	II	8-May-2011
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	
1DCC-OATS-3M-I Thermohyrometer	35519-044	Control Company	72457635	1334	II	18-Aug-2011	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



Radiated Spurious Emissions

LIMITS

“...radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) ”
[15.247(d)]

MEASUREMENTS / RESULTS

Radiated Emissions Table										
Date: 18-Aug-10			Company: ThingMagic				Work Order: K1078			
Engineer: Evan Gould			EUT Desc: M6e				EUT Operating Voltage/Frequency: 5VDC			
Temp: 25°C			Humidity: 41%				Pressure: 1010mBar			
Frequency Range: 30-1000MHz						Measurement Distance: 3 m				
Notes: TX and RX modes active										
RBW: 120kHz VBW: 300kHz										
Antenna Polarization (H/V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	47 CFR 15.209(a)			
							Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	
V	480.0	33.1	21.3	18.2	1.2	31.2	46.0	-14.8	Pass	
Table Result: Pass			by -14.8 dB			Worst Freq: 480.0 MHz				
Test Site: EMI Chamber 2			Cable 1: Asset #1506				Cable 2: Asset #1508			
Analyzer: Gold			Preamp: Red				Antenna: Asset #1503			

Rev: 11-Aug-2010

Chambers and Stripline		MN	Mfr	SN	Asset	Cat	Calibration Due	
EMI Chamber 2		DRS2014X8LH	ETS	J1173 - 0002B		II	See RFI Systems	
Spectrum Analyzers / Receivers / Preselectors		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Gold		100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	9-Apr-2011
Antennas		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
ETS 1503 Bilog		26MHz-6GHz	3142D	ETS	102060	1503	I	17-Mar-2011
Preamps / Couplers Attenuators / Filters		Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red		0.009-2000MHz	ZFL-1000-LN	CS	N/A	798	II	6-Apr-2011
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due	
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011	
CHAMBER2 Thermohyrometer		35519-044	Control Company	72457639	1347	II	18-Aug-2011	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Radiated Emissions Table															
Date: 07-Dec-10			Company: ThingMagic				Work Order: K1078								
Engineer: Evan Gould			EUT Desc: M6e				EUT Operating Voltage/Frequency:								
Temp: 17°C			Humidity: 24%				Pressure: 985mBar								
Frequency Range: 1-3GHz						Measurement Distance: 3 m									
Notes: power setting = 31.5dBm (0C4E)															
Antenna Polarization (H/V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average			
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	
V	2745.0	39.8	39.8	22.0	29.2	1.6	48.6	48.6	74.0	-25.4	Pass	54.0	-5.4	Pass	
Table Result: Pass			by -5.4 dB			Worst Freq: 2745.0 MHz									
Test Site: 1DCC-OATS-3M-1			Cable 1: EMIR-HIGH-21				Cable 2: ---			Cable 3: ---					
Analyzer: Rental SA#1			Preamp: Asset #1517				Antenna: Yellow Horn			Preselector: ---					

Radiated Emissions Table															
Date: 07-Dec-10			Company: ThingMagic				Work Order: K1078								
Engineer: Evan Gould			EUT Desc: M6e				EUT Operating Voltage/Frequency:								
Temp: 17°C			Humidity: 24%				Pressure: 985mBar								
Frequency Range: 3-10GHz						Measurement Distance: 1 m									
Notes: power setting = 31.5dBm (0C4E)															
EUT Max Freq:															
Antenna Polarization (H/V)	Frequency (MHz)	Peak Reading (dBµV)	Average Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Peak Reading (dBµV/m)	Adjusted Avg Reading (dBµV/m)	FCC Class B High Frequency - Peak			FCC Class B High Frequency - Average			
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	
V	3661.0	41.3	41.3	20.8	32.2	1.8	54.5	54.5	83.5	-29.0	Pass	63.5	-9.0	Pass	
Table Result: Pass			by -9.0 dB			Worst Freq: 3661.0 MHz									
Test Site: 1DCC-OATS-3M-1			Cable 1: EMIR-HIGH-21				Cable 2: ---			Cable 3: ---					
Analyzer: Rental SA#1			Preamp: Asset #1517				Antenna: Yellow Horn			Preselector: ---					



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Note: The setting of 31.5dBm relates to the power directly at the output of the module without the required extension cable installed. This limited module requires that an extension cable be in place so that the power is limited to 30dBm at the antenna.

Rev: 15-Nov-2010

Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Rental SA #1 (Brown)	9kHz-26.5GHz	E4407B	Agilent	SG44210511	1510	I	25-Mar-2011
Radiated Emissions Sites	FCC Code	IC Code	VCCI Code			Cat	Calibration Due
1DCC-OATS-3M-I	719150	2762A-8	R-3109			II	7-Jul-2011
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Yellow Horn	1-18GHz	3115	EMCO	9608-4898	37	I	27-May-2011
Cables	Range		Mfr			Cat	Calibration Due
REMI-High-21	9kHz - 26.5GHz		C-S			II	8-Jan-2011
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
1517 HF Preamp	1-18GHz	CS	CS	N/A	1517	II	1-Jun-2011
Meteorological Meters		MN	Mfr	SN	Asset	Cat	Calibration Due
Weather Clock (Pressure Only)		BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011
1DCC-OATS-3M-I Thermohyrometer		35519-044	Control Company	72457635	1334	II	18-Aug-2011

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



AC Line Conducted Emissions LIMITS

Frequency of emission (MHz)	Quasi-peak limit (dBµV)	Average limit (dBµV)
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.
[47 CFR 15.207(a)]

MEASUREMENTS / RESULTS

AC Mains Conducted Emissions										
Date: 27-Aug-10			Company: ThingMagic				Work Order: K1078			
Engineer: Evan Gould			EUT Desc: M6e				Test Site: CEMI 1			
Temp: 23.8°C			Humidity: 45%				Pressure: 1010mBar			
Notes:										
Measurement Device: Yellow LISN						EUT Operating Voltage/Frequency: 5VDC (120V / 60Hz)				
Range: 0.15-30MHz						Spectrum Analyzer: Red				
Frequency (MHz)	Q.P. Readings		Ave. Readings		Impedance Factor (dB)	FCC/CISPR B		FCC/CISPR B		Overall Result (Pass/Fail)
	QP1 (dBµV)	QP2 (dBµV)	AV1 (dBµV)	AV2 (dBµV)		qp Limit (dBµV)	qp Margin dB	AVE Limit (dBµV)	AVE Margin dB	
0.16	22.3	22.9	3.6	3.1	20.3	65.5	-22.3	55.5	-31.6	Pass
8.00	12.7	12.9	8.5	9.5	20.3	60.0	-26.8	50.0	-20.2	Pass
20.00	14.6	13.7	12.9	11.5	20.4	60.0	-25.0	50.0	-16.7	Pass
22.00	10.3	9.7	3.3	3.3	20.4	60.0	-29.3	50.0	-26.3	Pass
24.00	20.1	19.3	15.2	14.1	20.5	60.0	-19.4	50.0	-14.3	Pass
28.00	19.0	18.7	16.1	16.3	20.5	60.0	-20.5	50.0	-13.2	Pass
Table Result: Pass			by -13.20 dB			Worst Freq: 28.00 MHz				

Rev: 25-Aug-2010

Conducted Test Sites (Mains / Telco)
CEMI 1

FCC Code
719150

VCCI Code
C-3360, T-1575

Cat III
Calibration Due NA

Spectrum Analyzers / Receivers / Preselectors
Red

Range 9kHz-1.8GHz

MN 8591E

Mfr Agilent

SN 3441A03559

Asset 24

Cat I

Calibration Due 10-Mar-2011

LISNs/Measurement Probes
Yellow LISN

Range 9kHz-50MHz

MN 8012-50-R-24-BNC

Mfr Solar

SN 984735

Asset 1080

Cat I

Calibration Due 29-Dec-2010

Meteorological Meters
CEMI1 Thermohygrometer
Weather Clock (Pressure Only)

MN 35519-044
BA928

Mfr Control Company
Oregon Scientific

SN 72457738
C3166-1

Asset 1335

Cat II

Calibration Due 18-Aug-2011
17-Mar-2011

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



Occupied Bandwidth

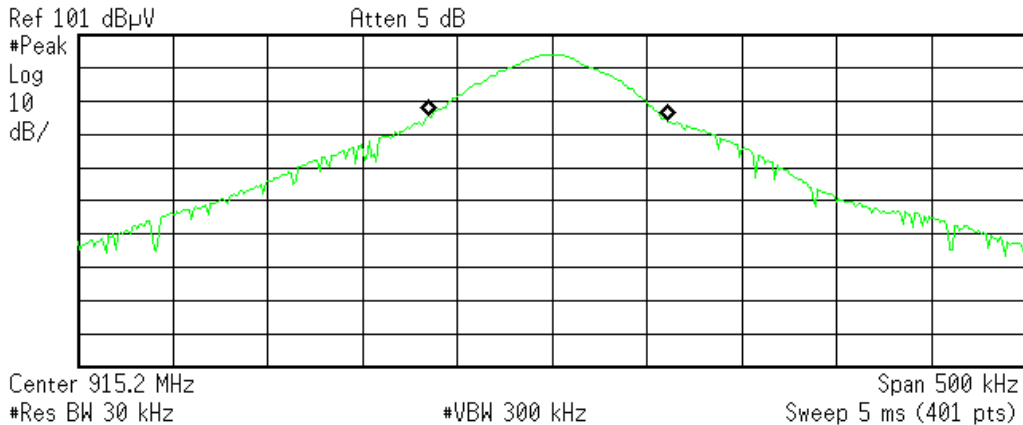
REQUIREMENT

When an occupied bandwidth is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. [RSS-GEN 4.6.1]

99% Occupied Bandwidth

Agilent 16:19:03 Aug 18, 2010

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Occupied Bandwidth
125.2907 kHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error -1.872 kHz
x dB Bandwidth 128.043 kHz

C:\temp.gif file saved

Rev: 11-Aug-2010

Radiated Emissions Sites	FCC Code	IC Code	VCCI Code	Cat	Calibration Due		
EMI Chamber 2	719150	2762A-7	R-3033, G-107	I	15-Feb-2011		
Antennas	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
ETS 1503 Bilog	26MHz-6GHz	3142D	ETS	102060	1503	I	17-Mar-2011
Preamps /Couplers Attenuators / Filters	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Red	0.009-2000MHz	ZFL-1000-LN	CS	N/A	798	II	6-Apr-2011
Spectrum Analyzers / Receivers /Preselectors	Range	MN	Mfr	SN	Asset	Cat	Calibration Due
Gold	100Hz-26.5 GHz	E4407B	Agilent	MY45113816	1284	I	9-Apr-2011
Meteorological Meters	MN	Mfr	SN	Asset	Cat	Calibration Due	
CHAMBER2 Thermohygrometer	35519-044	Control Company	72457639	1347	II	18-Aug-2011	
Weather Clock (Pressure Only)	BA928	Oregon Scientific	C3166-1	831	I	17-Mar-2011	

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.



Measurement Uncertainty

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Expanded Uncertainty k=2	Maximum allowable uncertainty
Radiated Emissions (30-1000MHz)		
NIST	5.6dB	N/A
CISPR	4.6dB	5.2dB (Ucisprr)
Radiated Emissions (1-26.5GHz)	4.6dB	N/A
Radiated Emissions (above 26.5GHz)	4.9dB	N/A
Magnetic Radiated Emissions	5.6dB	N/A
Conducted Emissions		
NIST	3.9dB	N/A
CISPR	3.6dB	3.6dB (Ucisprr)
Telco Conducted Emissions (Current)	2.9dB	N/A
Telco Conducted Emissions (Voltage)	4.4dB	N/A
Electrostatic Discharge	11.5%	N/A
Radiated RF Immunity (Uniform Field)	1.6dB	N/A
Electrical Fast Transients	23.1%	N/A
Surge	23.1%	N/A
Conducted RF Immunity	3dB	N/A
Magnetic Immunity	12.8%	N/A
Dips and Interrupts	2.3V	N/A
Harmonics	3.5%	N/A
Flicker	3.5%	N/A
Radio frequency (@ 2.4GHz)	3.23×10^{-8}	1×10^{-7}
RF power, conducted	0.40dB	0.75dB
Maximum frequency deviation:		
• Within 300Hz and 6kHz of audio frequency / Within 6kHz and 25kHz of audio frequency	3.4% 0.3dB	5% 3dB
Adjacent channel power	1.9dB	3dB
Conducted spurious emission of transmitter, valid up to 12.75GHz	2.39dB	3dB
Conducted emission of receivers	1.3dB	3dB
Radiated emission of transmitter, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of transmitter, valid up to 80GHz	3.3dB	6dB
Radiated emission of receiver, valid up to 26.5GHz	3.9dB	6dB
Radiated emission of receiver, valid up to 80GHz	3.3dB	6dB
Humidity	2.37%	5%
Temperature	0.7°C	1.0°C
Time	4.1%	10%
RF Power Density, Conducted	0.4dB	3dB
DC and low frequency voltages	1.3%	3%
Voltage (AC, <10kHz)	1.3%	2%
Voltage (DC)	0.62%	1%

The above reflects a 95% confidence level



Conditions Of Testing

[Bureau Veritas Consumer Products Services, Inc., a Massachusetts corporation], and/or its affiliates (collectively, the "Company") will conduct, at the request of the Submitter ("**Client**"), the tests specified on the submitted Test Request Form or equivalent in accordance with, and subject to, the following terms and conditions (collectively, "**Conditions**"):

1. All orders for tests are subject to acceptance by the Company, and no order will constitute a binding commitment of the Company unless and until such order is accepted by it, as evidenced by the issuance of a written report ("**Test Report**") by the Company. The Test Report is issued solely by the Company, is intended for the exclusive use of Client and shall not be published, used for advertising purposes, copied or replicated for distribution to any other person or entity or otherwise publicly disclosed without the prior written consent of the Company. By submitting a request for services to the Company, Client consents to the disclosure to accreditation bodies of those records of Client relevant to the accreditation body's assessment of the Company's competence and compliance with relevant accreditation criteria. The Company shall not be liable for any loss or damage whatsoever resulting from the failure of the Company to provide its services within any time period for completion estimated by the Company. If Client anticipates using the Test Report in any legal proceeding, arbitration, dispute resolution forum or other proceeding, it shall so notify the Company prior to submitting the Test Report in such proceeding. The Company has no obligation to provide a fact or expert witness at such proceeding unless the Company agrees in advance to do so for a separate and additional fee.
2. The Test Report will set forth the findings of the Company solely with respect to the test samples identified therein. Unless specifically and expressly indicated in the Test Report, the results set forth in such Test Report are not intended to be indicative or representative of the quality or characteristics of the lot from which a test sample is taken, and Client shall not rely upon the Test Report as being so indicative or representative of the lot or of the tested product in general. The Test Report will reflect the findings of the Company at the time of testing only, and the Company shall have no obligation to update the Test Report after its issuance. The Test Report will set forth the results of the tests performed by the Company based upon the written information provided to the Company. The Test Report will be based solely on the samples and written information submitted to the Company by Client, and the Company shall not be obligated to conduct any independent investigation or inquiry with respect thereto.
3. The Company may, in its sole discretion, destroy samples which have been furnished to the Company for testing and which have not been destroyed in the course of testing. The Company may delegate the performance of all or a portion of the services contemplated hereunder to an affiliate, agent or subcontractor of the Company, and Client consents to such delegation.
4. These Conditions and the Test Report represent the entire understanding of the parties hereto with respect to the subject matter hereof and of the Test Report, and no modification, variance or extrapolation with respect thereto shall be permitted without the prior written consent of the Company.
5. The names, service marks, trademarks and copyrights of the Company and its affiliates, including the names "**BUREAU VERITAS**," "**BUREAU VERITAS CONSUMER PRODUCTS SERVICES**," "**BVCPS**," "**MTL**," "**ACTS**," "**MTL-ACTS**" and "**CURTIS-STRAUS**" (collectively, the "**Marks**") are and shall remain the sole property of the Company or its affiliates and shall not be used by Client except solely to the extent that Client obtains the prior written approval of the Company and then only in the manner prescribed by the Company. Client shall not contest the validity of the Marks or take any action that might impair the value or goodwill associated with the Marks or the image or reputation of the Company or its affiliates.
6. Payment in full shall be due 30 days after the date of invoice. Interest shall be due on overdue amounts from the due date until paid at an interest rate of 1.5% per month or, if less, the maximum rate permitted by law. The Company reserves the right, at any time and from time to time, to revoke any credit extended to Client. Client shall reimburse the Company for any costs it incurs in collecting past due amounts, including court costs and fees and expenses of attorneys and collection agencies. The Test Report may not be used or relied upon by Client if and for so long as Client fails to pay when due any invoice issued by the Company or any affiliate of it to Client or any affiliate or subsidiary of Client together with interest and penalties, if any, accrued thereon.
7. The Company disclaims any and all responsibility or liability arising out of or in connection with e-mail transmissions of such information.
8. Client understands and agrees that the Company is neither an insurer nor a guarantor, that the Company does not take the place of Client or any designer, manufacturer, agent, buyer, distributor or transportation or shipping company, and that the Company disclaims all liability in such capacities. Client further understands that if it seeks assurance against loss or damage, it should obtain appropriate insurance.
9. Client agrees that the Company, by providing the services, does not take the place of Client nor any third party, nor does the Company release them from any of their obligations, nor does the Company otherwise assume, abridge, abrogate or undertake to discharge any duty of any third party to Client or any duty of Client or any third party to any other third party, and Client will not release any third party from its obligations and duties with respect to the tested goods.
10. Client shall, on a timely basis, (a) provide adequate instructions to the Company in order to enable the Company to perform properly its services, (b) provide, or cause Client's suppliers and contractors to provide, the Company with all documents necessary to enable the Company to perform its services, (c) furnish the Company with all relevant information regarding Client's intended use and purposes of the tested goods, (d) advise the Company of essential dates and deadlines relevant to the tested goods and (e) fully exercise all rights and remedies available to Client against third parties in respect of the tested goods.
11. The Company shall undertake due care and ordinary skill in the performance of its services to Client, and the Company shall accept responsibility only where such skill has not been exercised and, even in such event, only to the extent of the limitation of liability set forth herein.
12. If Client desires to assert a claim arising from or relating to (i) the performance, purported performance or non-performance of any services by the Company or (ii) the sale, resale, manufacture, distribution or use of any tested goods, it must submit that claim to the Company in a writing that sets forth with particularity the basis for such claim within 60 days from discovery of the potential claim and not more than six months after the date of issuance of the Test Report to Client. Client waives any and all such claims including, without limitation, claims that the Test Report is inaccurate, incomplete or misleading or that additional or different testing is required, unless and then only to the extent that Client submits a written claim to the Company within both such time periods.



BUREAU
VERITAS

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13. CLIENT SHALL, EXCEPT TO THE EXTENT OF COMPANY'S LIABILITY TO CLIENT HEREUNDER (WHICH IN NO EVENT SHALL EXCEED THE LIMITATION OF LIABILITY HEREIN), HOLD HARMLESS AND INDEMNIFY THE COMPANY, ITS AFFILIATES AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES, AGENTS AND SUBCONTRACTORS AGAINST ALL ACTUAL OR ALLEGED THIRD PARTY CLAIMS FOR LOSS, DAMAGE OR EXPENSE OF WHATSOEVER NATURE AND HOWSOEVER ARISING FROM OR RELATING TO (i) THE PERFORMANCE, PURPORTED PERFORMANCE OR NON-PERFORMANCE OF ANY SERVICES BY THE COMPANY OR (ii) THE SALE, RESALE, MANUFACTURE, DISTRIBUTION OR USE OF ANY TESTED GOODS.

14. EXCEPT AS MAY OTHERWISE BE EXPRESSLY AGREED TO IN WRITING BY THE COMPANY AND NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN OR IN ANY TEST REPORT, NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, IS MADE.

15. (A) IN NO EVENT WHATSOEVER SHALL THE COMPANY BE LIABLE FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, EXEMPLARY OR PUNITIVE DAMAGES IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE TEST REPORT OR THE SERVICES PROVIDED BY THE COMPANY HEREUNDER, INCLUDING WITHOUT LIMITATION LOSS OF OR DAMAGE TO PROPERTY; LOSS OF INCOME, PROFIT OR USE; OR ANY CLAIMS OR DEMANDS MADE AGAINST CLIENT OR ANY OTHER PERSON BY ANY THIRD PARTY IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE SERVICES PROVIDED BY THE COMPANY HEREUNDER.

(B) NOTWITHSTANDING ANY PROVISION TO THE CONTRARY CONTAINED HEREIN, AND IN RECOGNITION OF THE RELATIVE RISKS AND BENEFITS TO CLIENT AND THE COMPANY ASSOCIATED WITH THE TESTING SERVICES CONTEMPLATED HEREBY, THE RISKS HAVE BEEN ALLOCATED SUCH THAT UNDER NO CIRCUMSTANCES WHATSOEVER SHALL THE LIABILITY OF THE COMPANY TO CLIENT OR ANY THIRD PARTY IN RESPECT OF ANY CLAIM FOR LOSS, DAMAGE OR EXPENSE, OF WHATSOEVER NATURE OR MAGNITUDE, AND HOWSOEVER ARISING, EXCEED AN AMOUNT EQUAL TO FIVE (5) TIMES THE AMOUNT OF THE FEES PAID TO THE COMPANY FOR THE SPECIFIC SERVICES WHICH GAVE RISE TO SUCH CLAIM OR U.S.\$10,000, WHICHEVER IS THE LESSER AMOUNT.

16. The Company shall not be liable for any loss or damage resulting from any delay or failure in performance of its obligations hereunder resulting directly or indirectly from any event of force majeure or any event outside the control of the Company. If any such event occurs, the Company may immediately cancel or suspend its performance hereunder without incurring any liability whatsoever to Client.

17. Company's services, including these Conditions, shall be governed by, and construed in accordance with, the local laws of the country where the Company performs the tests or, in the case of tests performed in the United States of America, the laws of Massachusetts without regard to conflicts of laws principles. If any aspect(s) of these Conditions is found to be illegal or unenforceable, the validity, legality and enforceability of all remaining aspects of these Conditions shall not in any way be affected or impaired thereby. Any proceeding related to the subject matter hereof shall be brought, if at all, in the courts of the country where the Company performs the tests or, in the case of tests performed in the United States of America, in the courts of Massachusetts. Client waives the right to interpose any counterclaim or setoffs of any nature in any litigation arising hereunder.

Rev.160009121(2)_#684340 v13CS

