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Testing of

Electromagnetic Emissions

per

USA: CFR Title 47, Part 15.209
Canada: IC RSS-210/GENe

are herein reported for

Bartec USA, LLC
SX8T500

Test Report No.: 20130626-01

Applicant/Provider:
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Measured by: Dr. Joseph Brunett, EMC-002790-NE

Report Approved by: Dr. Joseph Brunett, EMC-002790-NE

Report by: Dr. Joseph Brunett, EMC-002790-NE

Report Date of Issue: June 26, 2013

Results of testing the equipment under test (EUT) as completed on June 26, 2013 are as follows.

Emissions: The transmitter fundamental emission meets the regulatory limit(s) by no less than 58.7 dB. Transmit chain spurious harmonic emissions comply by no less than 33.0 dB. Radiated spurious emissions associated with the receive chain of this device meet the regulatory limit(s) by no less than 5.6 dB. Unintentional spurious emissions from digital circuitry comply with the radiated emission limit(s) by more than 12.4 dB. AC Power Line conducted emissions comply by more than 6.4 dB.

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1 Test Specifications, General Procedures, and Location

1.1 Test Specification and General Procedures

The ultimate goal of Bartec USA, LLC is to demonstrate that the EUT complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Bartec USA, LLC SX8T500 for compliance to:

Country/Region	**Rules or Directive**	**Referenced Section(s)**
United States	Code of Federal Regulations	CFR Title 47, Part 15.209
Canada	Industry Canada	IC RSS-210/GENe

In association with the rules and directives outlined above, the following specifications and procedures are followed herein.

ANSI C63.4-2003	"Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
IEEE Trans. EMC, Vol. 47, No. 3 August 2005	"Extrapolating Near-Field Emissions of Low-Frequency Loop Transmitters," J.D.Brunett, V.V.Liepa, D.L.Sengupta
ICES-003; Issue 5 (2012)	"Information Technology Equipment (ITE) Limits and methods of measurement"
Industry Canada	"The Measurement of Occupied Bandwidth"

1.2 Test Location and Equipment Used

Test Location The EUT was fully tested at **Willow Run Test Labs, LLC**, 8501 Beck Road, Building 2227, Belleville, Michigan 48111 USA. The **Open Area Test Site (OATS)** description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: 688478) and with Industry Canada, Ottawa, ON (File Ref. No: IC 8719A-1).

Test Equipment Pertinent test equipment used for measurements at this facility is listed in Table 1. The quality system employed at Willow Run Test Labs, LLC has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards.

Table 1: Willow Run Test Labs, LLC Equipment List.

Description	Manufacturer/Model	SN	Quality Number	Last Cal By / Date Due
Antennas				
Shielded Loop (9 kHz - 50 MHz)	EMCO/6502	2855	UMLOOP1	UMRL / July-2013
Dipole Set (20 MHz - 1000 MHz)	EMCO/3121C	9504-1121	DIPEMC001	Liberty Labs / Sept-2013
Bicone (20 MHz - 250 MHz)	JEF	1	BICJEF001	UMRL / July-2013
Bicone (200 MHz - 1000 MHz)	JEF	1	SBICJEF001	UMRL / July-2013
Log-Periodic Array (200 MHz - 1000 MHz)	JEF/Isbell	1	LOGJEF001	UMRL / July-2013
Ridge-Horn Antenna	Univ. of Michigan	5	UMHORN005	UMRL / July-2013
L-Band	JEF		HRNL001	JEF / July-2013*
LS-Band Horns	JEF/NRL	001, 002	HRN15001, HRN15002	JEF / July-2013*
S-Band Horns	Scientific-Atlanta	1854	HRNSB001	JEF / July-2013*
C-Band	JEF/NRL	1	HRNC001	JEF / July-2013*
XN-Band Horns	JEF/NRL	001, 002	HRNXN001, HRNXN002	JEF / July-2013*
X-Band Horns	JEF/NRL	001, 002	HRNXB001, HRNXB002	JEF / July-2013*
Ku-Band Horns	JEF/NRL	001, 002	HRNKU001, HRNKU002	JEF / July-2013*
Ka-Band Horns	JEF/NRL	001, 002	HRNKA001, HRNKA002	JEF / July-2013*
Receiver's / Spectrum Analyzers				
Spectrum Analyzer	HP/8593E	3649A02722	HP8593E001	DTI / Nov-2013
Signal Generators				
Tracking Generator	HP/8593E	3649A02722	HP8593E001	DTI / Nov-2013
Line Impedance Stabilization Networks				
LISN	EMCO	9304-2081	LISNEM001	JEF / Jan-2014

* Verification Only - Standard Gain Horn Antennas

2 Configuration and Identification of the Equipment Under Test

2.1 Description and Declarations

The EUT is a 125 kHz transmitter with dual 315 MHz and 433.9 MHz superheterodyne receivers. The equipment under test (EUT) is approximately 17 x 11 x 5 cm in dimension, and is depicted in Figure 1. It is powered by a 3.7 VDC Lithium Ion rechargeable battery. The device is a commercial tire service product used in dealerships and service stations for testing and configuring of tire pressure monitoring (TPM) sensors. Table 2 outlines provider declared EUT specifications.

Figure 1: Photos of EUT.

Table 2: EUT Declarations.

General Declarations			
Equipment Type:	TPMS Scan Tool	**Country of Origin:**	USA
Nominal Supply:	3.7 VDC	**Oper. Temp Range:**	-20^o C to $+55^o$ C
Frequency Range:	125 kHz	**Antenna Dimension:**	4 x 1 cm (each)
Antenna Type:	LF coils	**Antenna Gain:**	Not Applicable
Number of Channels:	1	**Channel Spacing:**	Not Applicable
Alignment Range:	125 kHz	**Type of Modulation:**	AM
United States			
FCC ID Number:	SX8T500	**Classification:**	DSC
Canada			
IC Number:	5736A-T500	**Classification:**	Remote Control Device

2.1.1 EUT Configuration

The EUT is configured for testing as depicted in Figure 2.

2.1.2 Modes of Operation

The EUT is capable of only a single mode of operation (i.e. communication to and from a tire pressure monitor sensor), but can employ a number of AM modulation schemes for the LF transmitter, as detailed in the confidential modes of operation exhibit. The highest data rate AM modulation was tested herein to demonstrate worst case emissions bandwidth.

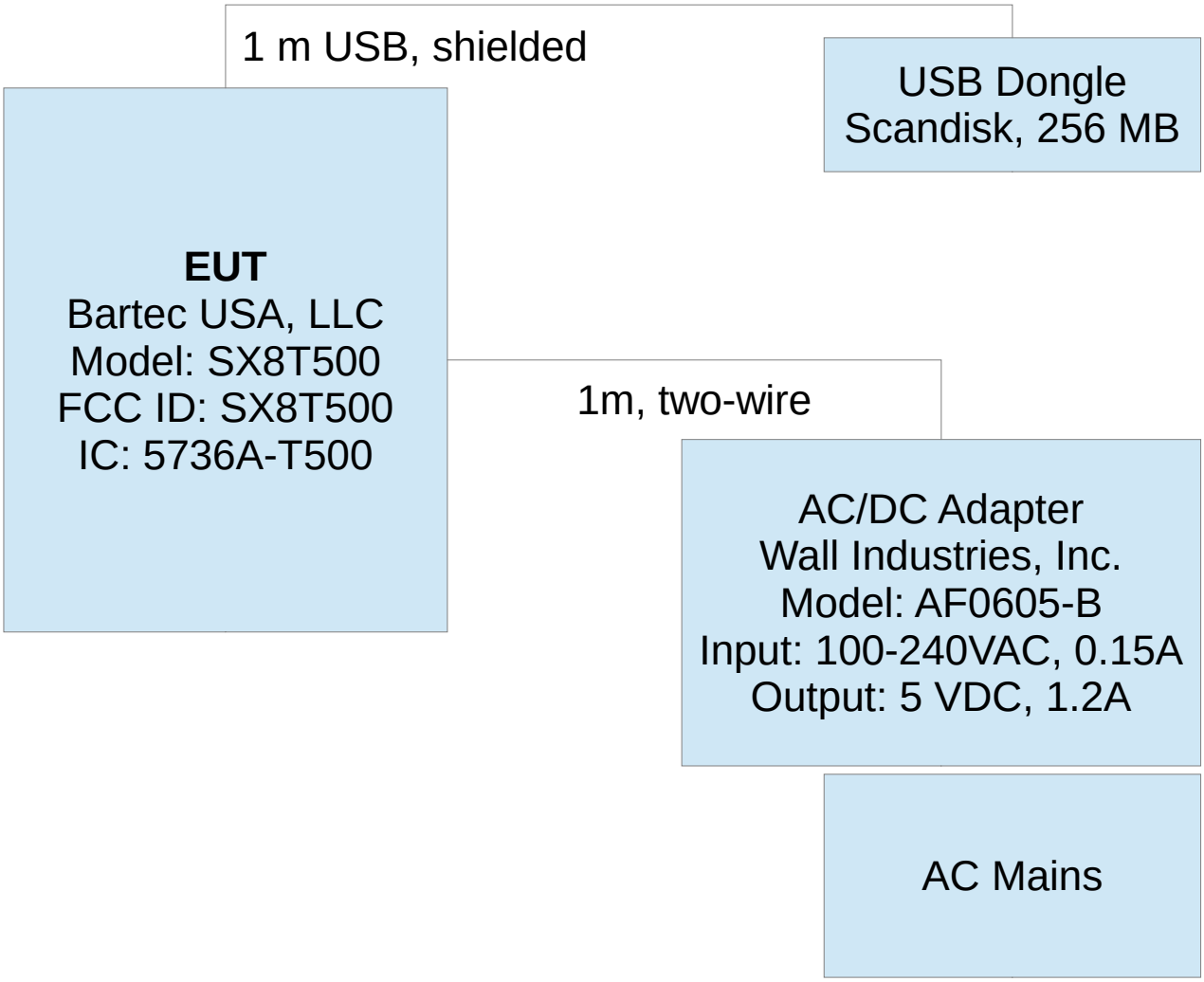

Figure 2: EUT Test Configuration Diagram.

2.1.3 Variants

There is only a single variant of the EUT, as tested.

2.1.4 Test Samples

Two samples in total were provided. One sample capable of normal operation with production software. One sample with custom LF transmit and receiver-on software for testing and photographs.

2.1.5 Functional Exerciser

Normal operating EUT functionality was verified by observation of LF transmitted signal.

2.1.6 Modifications Made

There were no modifications made to the EUT by this laboratory.

2.1.7 Production Intent

The EUT appears to be a production ready sample.

2.1.8 Declared Exemptions and Additional Product Notes

In addition to the LF transmitter and UHF receivers reported in this test report, the EUT also contains two pre-approved 2.4 GHz band modular wireless radios. One is a Bluetooth radio (FCC ID: QOQWT12, IC: 5123A-BGTWT12A) and the other is a Wireless LAN radio (FCC ID: YOPGS1011MIP, IC: 9154A-GS1011MIP). The manufacturer declares that the software in this device prevents any pair of intentional radiators from transmitting simultaneously. The use of any one of these transmitters, be it the LF transmitter detailed in this report, the modular Bluetooth radio, or the modular WiLAN radio, causes the other two transmitters to be deactivated. Furthermore, this product is sold only to commercial tire dealers and vehicle dealerships and is thus subject to digital emissions limits as a Class A device.

3 Emissions

3.1 General Test Procedures

3.1.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are first evaluated in our shielded fully anechoic chamber. Spectrum and modulation characteristics of all emissions are recorded, and emissions above 1 GHz are fully characterized. The anechoic chamber contains a set-up similar to that of our outdoor 3-meter site, with a turntable and antenna mast. Instrumentation, including spectrum analyzers and other test equipment as detailed in Section 1.2 are employed. After indoor pre-scans, emission measurements up to 1 GHz are made on our outdoor 3-meter Open Area Test Site (OATS). If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.4 / CISPR 22 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 3.

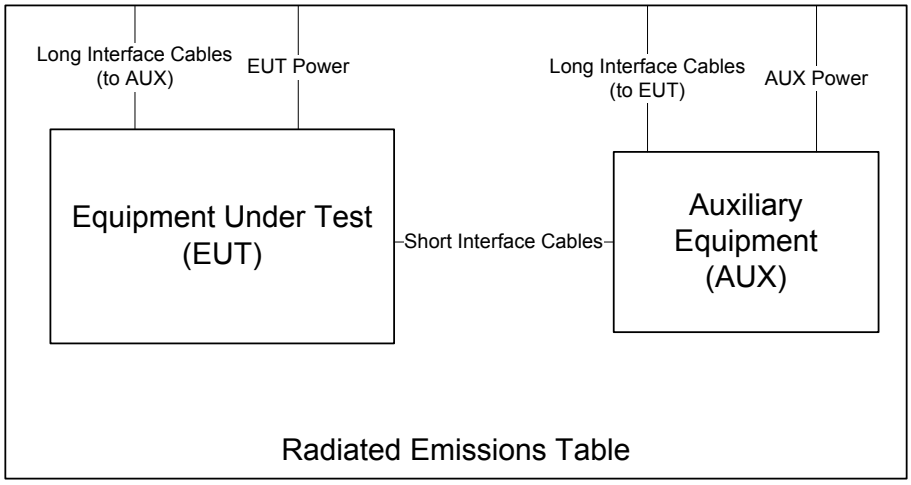

Figure 3: Radiated Emissions Diagram of the EUT.

All intentionally radiating elements are placed on the test table lying flat, on their side, and on their end (3-axes) and the resulting worst case emissions are recorded. For both horizontal and vertical polarizations, the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected. The EUT is then rotated through 360^o in azimuth until the highest emission is detected. The test antenna is then raised and lowered one last time from 1 to 4 m and the worst case value is recorded. Photographs of the test setup employed are depicted in Figure 4.

If the EUT exhibits spurious emissions due to internal receiver circuitry, such emissions are measured with an appropriate carrier signal applied. For devices with intentional emissions below 30 MHz, a shielded loop antenna is used as the test antenna. It is placed at a 1 meter receive height and appropriate low frequency magnetic field extrapolation to the regulatory limit distance is employed. Emissions between 30 MHz and 1 GHz are measured using tuned dipoles and/or calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Care is taken to ensure that test receiver resolution and video bandwidths meet the regulatory requirements, and that the emission bandwidth of the EUT is not reduced.

Where regulations allow for direct measurement of field strength, power values (dBm) measured on the test receiver / analyzer are converted to dBμV/m at the regulatory distance, using

$$E_{dist} = 107 + P_R + K_A - K_G + K_E - C_F$$

where P_R is the power recorded on spectrum analyzer, in dBm, K_A is the test antenna factor in dB/m, K_G is the combined pre-amplifier gain and cable loss in dB, K_E is duty correction factor (when applicable) in dB, and C_F is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is compute, it is computed as

$$EIRP(dBm) = E_{3m}(dB\mu V/m) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.

Figure 4: Radiated Emissions Test Setup Photograph(s).

3.1.2 Conducted Emissions Test Setup and Procedures

AC Port Conducted Spurious For this device, AC power line conducted emissions are measured in our screen room. If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.4 / CISPR 22 are employed. Alternatively, an on-table layout more representative of actual use may be employed if the resulting emissions appear to be worst-case in such a configuration. See Figure 5. Conducted

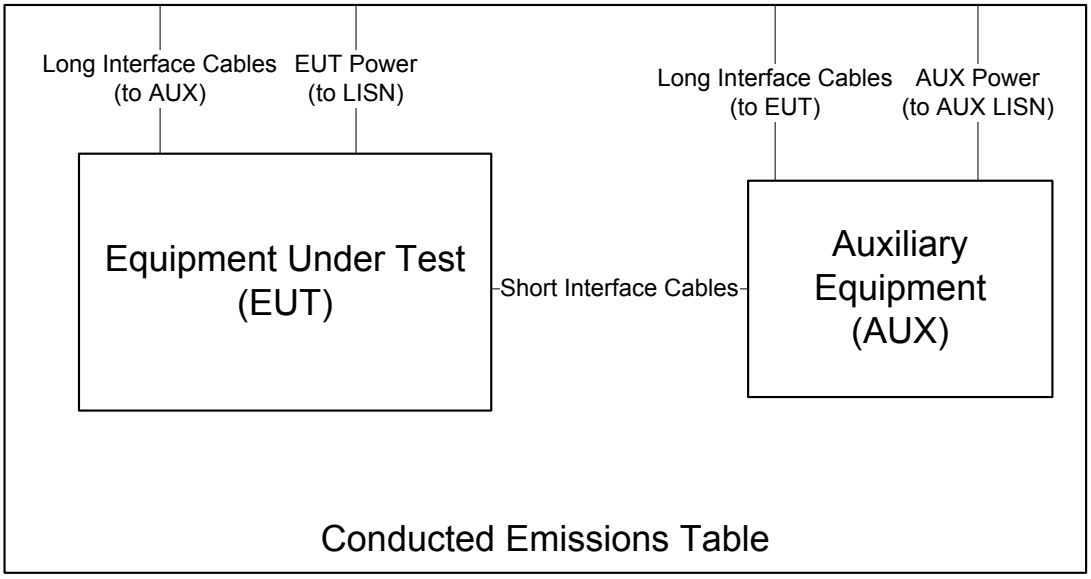

Figure 5: Conducted Emissions Setup Diagram of the EUT.

emissions are measured and recorded for each AC mains power source over the spectrum 0.15 MHz to 30 MHz for both the ungrounded (HI/PHASE) and grounded (LO/GRND) conductors with the EUT placed in its highest current draw operating mode(s). The test receiver is set to peak-hold mode in order to record the peak emissions throughout the course of functional operation. Only if an emission exceeds or is near the limit are quasi-peak and average detection applied. Photographs of the test setup employed are depicted in Figure 6.

Battery Power Conducted Spurious The EUT is not subject to power line conducted emissions measurements when it is powered solely by its internal battery.

3.1.3 Power Supply Variation

Tests at extreme supply voltages are made if required by the the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case of this EUT, measurements of the worst-case radiated emissions are performed with the supply voltage varied by no less than 85% and 115% of the nominal rated value for devices connecting to AC power mains.

In the case the EUT is designed for operation from a lead-acid battery power source, the extreme test voltages are evaluated between 90% and 130% of the nominal battery voltage declared by the manufacturer. For float charge applications using gel-cell type batteries, extreme test voltages are evaluated between 85% and 115% of the nominal battery voltage declared. For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

3.1.4 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report. The provider has declared that the EUT is designed for operation over the temperature range -20^o C to $+55^o$ C. Before any temperature measurements are made, the equipment is allowed to

Figure 6: Conducted Emissions Test Setup Photograph(s).

reach a thermal balance in the test chamber, temperature and humidity are recorded, and thermal balance is verified via a thermocouple based probe.

3.2 Intentional Emissions

3.2.1 Fundamental Emission Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 3. Plots showing the measurements made to obtain these values are provided in Figure 7.

Table 3: Pulsed Emission Characteristics (Duty Cycle).

Frequency Range	Det	IF Bandwidth	Video Bandwidth
9 kHz ≤ f ≤ 150 kHz	Pk/QPk	200 Hz	300 Hz
150 kHz ≤ f ≤ 30 MHz	Pk/QPk	9 kHz	30 kHz
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz
f > 1 000 MHz	Pk	3 MHz	3MHz
f > 1 000 MHz	Avg	3 MHz	10kHz

Test Date:	19-Jun-13
Test Engineer:	Joseph Brunett
EUT Mode:	Max Data Rate
Meas. Distance:	3 meters
EUT Tested:	Bartec Tech500

Peak to Average Ratio (Duty Cycle)

#	EUT Mode	Overall Transmission: Min. Repetition Rate (ms)	Overall Transmission: Max. No. of Frames	Overall Transmission: Total Transmission Length (sec)	Internal Frame Characteristics: Min. Frame Length (ms)	Internal Frame Characteristics: Min. Frame Period (ms)	Internal Frame Characteristics: Frame Encoding	Computed Duty Cycle (per 100ms window): (%)	Computed Duty Cycle (per 100ms window): Duty (dB)
1	Max Data Rate	28.313	Inf.	N/A	15.23	28.313	At maximum data rate, the EUT demonstrated a Manchester encoded 15.230 ms data frame repeating in a 28.313 ms period. The Manchester encoding employed a pulse period of 243.2 us (>4 kbps)	26.896	-11.4
2	CW	N/A	Inf.	N/A	N/A	N/A	None.	100.0	0

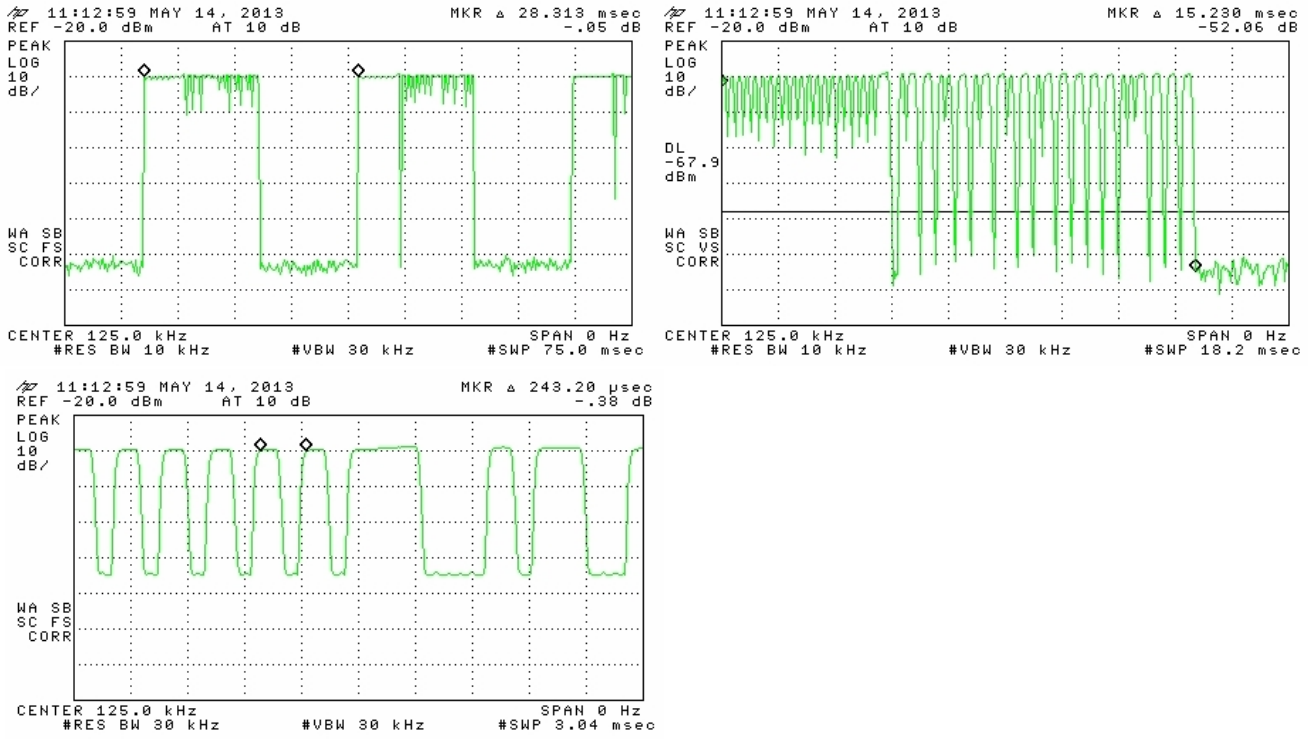

Figure 7: Pulsed Emission Characteristics (Duty Cycle).

3.2.2 Fundamental Emission Bandwidth

Emission bandwidth (EBW) of the EUT is measured with the device placed in the test mode(s) with the shortest available frame length and minimum frame spacing. Radiated emissions are recorded following the test procedures listed in Section 1.1. The 20 dB EBW is measured as the max-held peak-detected signal when the IF bandwidth is greater than or equal to 1% of the receiver span. For complex modulations other than ASK and FSK, the 99% emission bandwidth per IC test procedures has a different result, and is also separately reported.The results of EBW testing are summarized in Table 4. Plots showing measurements employed to obtain the emission bandwidth reported are provided in Figure 8.

Table 4: Intentional Emission Bandwidth.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**		
9 kHz ≤ f ≤ 150 kHz	Pk/QPk	> 1% Span	>= 3 * IFBW	**Test Date:**	19-Jun-13
				Test Engineer:	Joseph Brunett
				EUT Mode:	Worst Case Modulated
				Meas. Distance:	0.1 meters

Emission Bandwidth									
#	Mode	Temp (C)	Supply (VDC)	99% PWR BW (kHz)	20 dB EBW (kHz)	Restricted Band* (dBc)			
1	Max Mod.	Nom.	3.7	25.38	25.38	22.3			
2									

* Note: The principle lobe of the modulated signal does not over lap into the 109 kHz restricted band, even at the highest possible data rate (as tested). Thus, emissions in that band are considered unintentional and are not subject to the 26 dBc regulation.

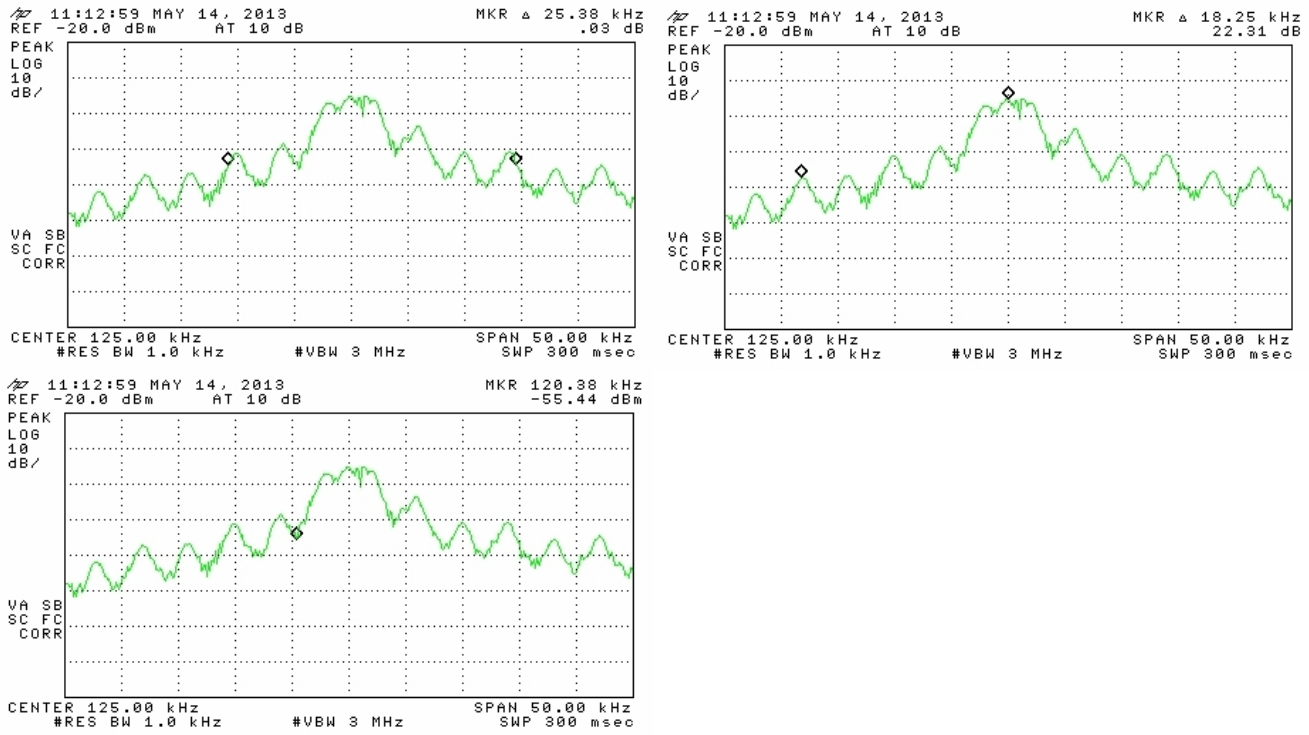

Figure 8: Intentional Emission Bandwidth.

3.2.3 Fundamental Emission

Following the test procedures listed in Section 1.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured when the EUT loop axes are (1) aligned along the same axis as the test loop antenna and horizontal with respect to the test site ground plane, (2) aligned coplanar (in the same plane) with the test antenna and aligned horizontal with respect to the test site ground plane, and (3) aligned coplanar (in the same plane) with the test antenna and vertical with respect to the test site ground plane. Table 5 details the results of these measurements.

Table 5: Fundamental Radiated Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth
9 kHz ≤ f ≤ 150 kHz	Pk/QPk	200 Hz	300 Hz
150 kHz ≤ f ≤ 30 MHz	Pk/QPk	9 kHz	30 kHz
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz
f > 1 000 MHz	Pk	3 MHz	3MHz
f > 1 000 MHz	Avg	3 MHz	10kHz

Test Date:	13-Jun-13
Test Engineer:	Joseph Brunett
EUT Mode:	CW
Meas. Distance:	3 meters
EUT Tested:	Bartec Tech500

#	Mode	Test Antenna Polarization	Freq. kHz	Ant. Used	Pr (Pk) dBm	Pr (QPk/Avg)* dBm	Ka dB/m	Kg dB	Cf** 3m / 300m (dB)	E300m (Pk) dBuV/m	E300m (QPk/Avg) dBuV/m	E300m Limit dBuV/m	Pass By
1	CW	Coaxial - Horz	125.0	S. Loop	-35.1	-35.1	9.9	0.0	114.8	-33.0	-33.0	25.7	**58.7**
2		Coplanar - Vert	125.0	S. Loop	-44.6	-44.6	9.9	0.0	114.8	-42.5	-42.5	25.7	68.2
3		Coplanar - Horz	125.0	S. Loop	-48.5	-48.5	9.9	0.0	114.8	-46.4	-46.4	25.7	72.1
4													
5													
6													

#	Mode	Polarization	Freq. kHz'	DC Supply Voltage	Pr (Pk) dBm
7	CW	Coaxial - Horz	125.0	3.00	-35.2
8			125.0	3.70	-35.1
9			125.0	3.80	-35.1
10					
11					
12					

Measured OATS Field Decay Rate to Confirm Field Conversion			
Freq. kHz'	Distance From EUT (m)	Relative Pr (Pk) dBm	Formula Fit Pr (Pk) vs Distance
125.0	2.0	-27.6	-24.4 ln(x) - 10.7
125.0	3.0	-37.6	Base 10 Rate of Decay***
125.0	4.0	-44.0	(dB/dec)
125.0	5.0	-50.2	**-56.2**

* Averaging applies up to 490 kHz as computed in Duty Cycle section of test report.

*** A Ln (x) = 2.303*A Log(x).

** Cf represents the worst case field conversion factor for loop transmitters over all possible orientations and ground materials, as demonstrated in IEEE Trans. EMC, Vol. 47, No. 3 August 2005.

3.3 Unintentional Emissions

3.3.1 Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 6. Following the test procedures listed in Section 1.1, field emissions measurements are made on the EUT for both Horizontal and Vertically polarized coupling fields. The EUT's loop antenna(s) are measured when the EUT loop axes are (1) aligned along the same axis as the test loop antenna and horizontal with respect to the test site ground plane, (2) aligned coplanar (in the same plane) with the test antenna and aligned horizontal with respect to the test site ground plane, and (3) aligned coplanar (in the same plane) with the test antenna and vertical with respect to the test site ground plane. The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature are provided in Table 6. Measurements are performed to 10 times the highest fundamental operating frequency.

Table 6: Transmit Chain Spurious Emissions.

Frequency Range	Det	IF Bandwidth	Video Bandwidth		
9 kHz ≤ f ≤ 150 kHz	Pk/QPk	200 Hz	300 Hz	**Test Date:**	13-Jun-13
150 kHz ≤ f ≤ 30 MHz	Pk/QPk	9 kHz	30 kHz	**Test Engineer:**	Joseph Brunett
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**EUT Mode:**	CW
f > 1 000 MHz	Pk	3 MHz	3MHz	**Meas. Distance:**	3 meters
f > 1 000 MHz	Avg	3 MHz	10kHz	**EUT Tested:**	Bartec Tech500

Transmit Chain Spurious Emissions

#	Mode	Test Antenna Polarization	Freq. MHz	Ant. Used	Pr (Pk) dBm	Pr (QPk/Avg)* dBm	Ka dB/m	Kg dB	Cf** 3/30/300m (dB)	E30/300m (Pk) dBuV/m	E30/300m (QPk/Avg) dBuV/m	E-field Limit (30/300m) dBuV/m	Pass By	Comments
1	CW	Max. All	250.0	S. Loop	-56.2	-56.2	9.9	0.0	110.4	-49.7	-49.7	19.6	69.3	
2		Max. All	375.0	S. Loop	-61.5	-61.5	9.9	0.0	104.5	-49.1	-49.1	16.1	65.2	
3		Max. All	500.0	S. Loop	-76.4		9.9	0.0	56.3	-15.8		33.6	49.4	
4		Max. All	625.0	S. Loop	-70.4		9.9	0.0	56.1	- 9.6		31.7	41.3	
5		Max. All	750.0	S. Loop	-74.4		9.9	0.0	55.9	-13.4		30.1	43.5	background
6		Max. All	875.0	S. Loop	-80.8		9.9	0.0	55.6	-19.5		28.8	48.3	
7		Max. All	1000.0	S. Loop	-78.1		9.9	0.0	55.4	-16.6		27.6	44.2	background
8		Max. All	1125.0	S. Loop	-68.2		9.9	0.0	55.1	- 6.4		26.6	**33.0**	background
9		Max. All	1250.0	S. Loop	-75.0		9.9	0.0	54.8	-12.9		25.7	38.5	
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

* Averaging applies up to 490 kHz as computed in Duty Cycle section of test report.

** Cf represents the worst case field conversion factor for loop transmitters over all possible orientations and ground materials, as demonstrated in IEEE Trans. EMC, Vol. 47, No. 3 August 2005.

3.3.2 Radiated Receiver Spurious

The results for the measurement of radiated receiver spurious emissions (emissions from the receiver chain, e.g. LO or VCO) at the nominal voltage and temperature are reported in Table 7. Receive chain emissions are measured to 5 times the highest receive chain frequency employed or 4 GHz, whichever is higher. If no emissions are detected, only those noise floor emissions at the LO/VCO frequency are reported.

Table 7: Receiver Chain Spurious Emissions $\geq$ 30 MHz.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	21-Jun-13
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Engineer:**	Joseph Brunett
f > 1 000 MHz	Pk	1 MHz	3 MHz	**EUT Mode:**	Bartech Tech500
f > 1 000 MHz	Avg	1 MHz	10kHz	**Meas. Distance:**	3 meters

Receive Chain Spurious Emissions												
	Test	Antenna		Pr (Pwr Rx.)				E-Field @ 3m		FCC/IC Limit		
	Freq.	Type	Test	Pk	QPk/Avg	Ka	Kg	Pk	QPk/Avg	E3lim	Pass	
#	MHz	Used	Pol.	dBm	dBm*	dB/m	dB	dBµV/m	dBµV/m	dBµV/m	dB	Comments
1	312.0	Sbic	H	-62.3		18.4	34.6	28.4		46.0	17.6	noise, background
2	312.0	Sbic	V	-61.2		18.4	34.6	29.5		46.0	16.5	noise, background
3	416.0	Sbic	H	-78.2		21.5	33.4	16.9		46.0	29.1	noise, background
4	416.0	Sbic	V	-75.2		21.5	33.4	19.9		46.0	26.1	noise, background
5	624.0	Sbic	H	-63.9		25.0	31.3	36.8		46.0	9.2	noise, background
6	624.0	Sbic	V	-67.8		25.0	31.3	32.9		46.0	13.1	noise, background
7	832.0	Sbic	H	-70.2		28.0	29.3	35.4		46.0	10.6	noise, background
8	832.0	Sbic	V	-69.5		28.0	29.3	36.1		46.0	9.9	noise, background
9	936.0	Sbic	H	-75.2		30.0	28.4	33.4		46.0	12.6	noise, background
10	936.0	Sbic	V	-68.2		30.0	28.4	40.4		46.0	**5.6**	noise, background
11	1248.0	R-Horn	H/V	-65.2		20.6	28.1	34.3		54.0	19.7	noise
12	1560.0	R-Horn	H/V	-63.9		21.4	28.1	36.5		54.0	17.5	noise
13	1664.0	R-Horn	H/V	-64.8		21.4	28.1	35.6		54.0	18.4	noise
14	1560.0	R-Horn	H/V	-65.0		21.4	28.1	35.4		54.0	18.6	noise
15	2080.0	R-Horn	H/V	-64.9		21.7	28.1	35.7		54.0	18.3	noise
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*QPk detection below 1 GHz, Avg detection at or above 1 GHz with receiver bandwidth as specified at top of table.

3.3.3 Radiated Digital Spurious

The results for the measurement of digital spurious emissions (emissions arising from digital circuitry) at the nominal voltage and temperature are provided in Table 8. Radiation from digital components has been measured to 4 GHz, or to five times the maximum digital component operating frequency, whichever is greater.

Table 8: Radiated Digital Spurious Emissions.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	24-Apr-13
25 MHz ≤ f ≤ 1 000 MHz	Pk/QPk	120 kHz	300 kHz	**Test Engineer:**	Joseph Brunett
f > 1 000 MHz	Pk	1 MHz	3 MHz	**EUT Mode:**	Bartech Tech500
f > 1 000 MHz	Avg	1 MHz	10kHz	**Meas. Distance:**	3 meters

Digital Spurious Emissions																	FCC/IC + CE(CISPR) Limits
	Test	Antenna		Pr (Pwr Rx.)				E-Field @ 3m		FCC/IC Class B		CE Class B		FCC/IC Class A		CE Class A	
	Freq.	Type	Test	Pk	QPk/Avg	Ka	Kg	Pk	QPk/Avg	E3lim	Pass	E3lim	Pass	E3lim	Pass	E3lim	Pass
#	MHz	Used	Pol.	dBm	dBm*	dB/m	dB	dBµV/m	dBµV/m	dBµV/m	dB	dBµV/m	dB	dBµV/m	dB	dBµV/m	dB	Comments
1	68.0	Bic	H	-68.0		7.7	38.8	7.9		40.0	32.1	40.5	32.6	49.5	41.6	50.5	42.6	
2	76.0	Bic	H	-60.1		7.5	38.6	15.8		40.0	24.2	40.5	24.7	49.5	33.7	50.5	34.7	
3	108.0	Bic	H	-54.2		9.0	37.9	23.9		43.5	19.6	40.5	16.6	54.0	30.1	50.5	26.6	
4	124.0	Bic	H	-47.6		10.3	37.6	32.1		43.5	11.4	40.5	8.4	54.0	21.9	50.5	18.4	
5	128.0	Bic	H	-57.8		10.7	37.5	22.3		43.5	21.2	40.5	18.2	54.0	31.7	50.5	28.2	
6	132.0	Bic	H	-48.2		11.0	37.5	32.4		43.5	11.1	40.5	8.1	54.0	21.6	50.5	18.1	
7	140.0	Bic	H	-49.5		11.7	37.3	31.9		43.5	11.6	40.5	8.6	54.0	22.1	50.5	18.6	
8	156.0	Bic	H	-49.1		12.9	37.0	33.8		43.5	9.7	40.5	6.7	54.0	20.2	50.5	16.7	
9	204.0	Bic	H	-57.8		14.7	36.2	27.7		43.5	15.8	40.5	12.8	54.0	26.3	50.5	22.8	
10	216.0	Bic	H	-49.2		14.8	36.0	36.6		43.5	6.9	40.5	3.9	54.0	17.4	50.5	13.9	
11	224.0	Bic	H	-53.4		14.7	35.9	32.5		46.0	13.5	40.5	8.0	56.9	24.4	50.5	18.0	
12	240.0	Bic	H	-49.3		14.7	35.6	36.7		46.0	9.3	47.5	10.8	56.9	20.2	57.5	20.8	
13	248.0	Bic	H	-54.7		14.6	35.5	31.4		46.0	14.6	47.5	16.1	56.9	25.5	57.5	26.1	
14	256.0	Sbic	H	-55.2		15.9	35.4	32.3		46.0	13.7	47.5	15.2	56.9	24.6	57.5	25.2	
15	262.0	Sbic	H	-53.1		16.2	35.3	34.8		46.0	11.2	47.5	12.7	56.9	22.1	57.5	22.7	
16	278.0	Sbic	H	-50.2		16.9	35.1	38.6		46.0	7.4	47.5	8.9	56.9	18.3	57.5	18.9	
17	312.0	Sbic	H	-58.0		18.4	34.6	32.7		46.0	13.3	47.5	14.8	56.9	24.2	57.5	24.8	
18	320.0	Sbic	H	-56.2		18.7	34.5	34.9		46.0	11.1	47.5	12.6	56.9	22.0	57.5	22.6	
19	512.0	Sbic	H	-53.5		23.4	32.4	44.5		46.0	1.5	47.5	3.0	56.9	**12.4**	57.5	13.0	
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*QPk detection below 1 GHz, Avg detection at or above 1 GHz with receiver bandwidth as specified at top of table.

3.3.4 Conducted Emissions Test Results - AC Power Port(s)

The results of emissions from the EUT's AC mains power port(s) are reported in Table 9.

Table 9: AC Mains Power Conducted Emissions Results.

Frequency Range	**Det**	**IF Bandwidth**	**Video Bandwidth**	**Test Date:**	21-Jun-13
150kHz ≤ f ≤ 30 MHz	Pk/QPk/Avg	9 kHz	30 kHz	**Test Engineer:**	Joseph Brunett
				EUT Mode:	LF Activated, Normal Sample

AC Mains Power Conducted Emissions														
	Freq.	Line	Vmeas			Class A Qpk		Class A Avg		Class B Qpk		Class B Avg		
#	MHz	Side	Pk dBuV	Qpk dBuV	Avg dBuV	Vlim* dBuV	Margin dB	Vlim* dBuV	Margin dB	Vlim* dBuV	Margin dB	Vlim* dBuV	Margin dB	Comments
1	0.177	Lo	48.2			79.0	30.8	66.0	17.8	64.6	16.4	54.6	**6.4**	
2	0.237	Lo	40.9			79.0	38.1	66.0	25.1	62.2	21.3	52.2	11.3	
3	0.296	Lo	41.2			79.0	37.8	66.0	24.8	60.4	19.2	50.3	9.1	
4	0.416	Lo	36.6			79.0	42.4	66.0	29.4	57.5	20.9	47.5	10.9	
5	0.474	Lo	37.0			79.0	42.0	66.0	29.0	56.5	19.5	46.4	9.4	
6	0.714	Lo	36.0			73.0	37.0	60.0	24.0	56.0	20.0	46.0	10.0	
7	0.773	Lo	35.9			73.0	37.1	60.0	24.1	56.0	20.1	46.0	10.1	
8	1.369	Lo	35.8			73.0	37.2	60.0	24.2	56.0	20.2	46.0	10.2	
9	1.428	Lo	35.5			73.0	37.5	60.0	24.5	56.0	20.5	46.0	10.5	
10	1.547	Lo	35.8			73.0	37.2	60.0	24.2	56.0	20.2	46.0	10.2	
11	1.607	Lo	37.2			73.0	35.8	60.0	22.8	56.0	18.8	46.0	8.8	
12	12.125	Lo	30.2			73.0	42.8	60.0	29.8	60.0	29.8	50.0	19.8	
13	14.972	Lo	27.9			73.0	45.1	60.0	32.1	60.0	32.1	50.0	22.1	
14	23.457	Lo	28.4			73.0	44.6	60.0	31.6	60.0	31.6	50.0	21.6	
15	28.713	Lo	30.1			73.0	42.9	60.0	29.9	60.0	29.9	50.0	19.9	
16														
17														
18	0.176	Hi	46.1			79.0	32.9	66.0	19.9	64.7	18.6	54.6	**8.5**	
19	0.296	Hi	40.4			79.0	38.6	66.0	25.6	60.4	20.0	50.3	9.9	
20	0.415	Hi	37.0			79.0	42.0	66.0	29.0	57.6	20.6	47.5	10.5	
21	0.475	Hi	38.1			79.0	40.9	66.0	27.9	56.4	18.3	46.4	8.3	
22	0.713	Hi	37.4			73.0	35.6	60.0	22.6	56.0	18.6	46.0	8.6	
23	0.772	Hi	36.8			73.0	36.2	60.0	23.2	56.0	19.2	46.0	9.2	
24	1.012	Hi	35.8			73.0	37.2	60.0	24.2	56.0	20.2	46.0	10.2	
25	1.309	Hi	34.9			73.0	38.1	60.0	25.1	56.0	21.1	46.0	11.1	
26	1.369	Hi	36.7			73.0	36.3	60.0	23.3	56.0	19.3	46.0	9.3	
27	1.548	Hi	36.2			73.0	36.8	60.0	23.8	56.0	19.8	46.0	9.8	
28	1.607	Hi	37.1			73.0	35.9	60.0	22.9	56.0	18.9	46.0	8.9	
29	12.132	Hi	27.2			73.0	45.8	60.0	32.8	60.0	32.8	50.0	22.8	
30	23.451	Hi	28.0			73.0	45.0	60.0	32.0	60.0	32.0	50.0	22.0	
31	29.213	Hi	30.6			73.0	42.4	60.0	29.4	60.0	29.4	50.0	19.4	
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**In all cases, VPk ≥ VQpk ≥ VAve. If VPk < Vavg limit, then VQPk limit and Vavg limit are met.*