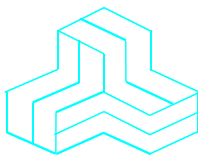


ENGINEERING TEST REPORT



PTX
Model No.: PTX08
FCC ID: NSNPTX08

Applicant:

G4S Justice Services Canada, Inc.
#103 – 6592, 176 Street
Surrey, BC
Canada V3S 4G5

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.231(e)
Periodic Operation at 433.92 MHz

UltraTech's File No.: G4S-002BF15C231

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs



Date: December 2, 2008

Report Prepared by: Dan Huynh

Tested by: Wei Wu, RFI Technician

Issued Date: December 2, 2008

Test Dates: Sep. 30 & Dec. 2, 2008

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4

Tel.: (905) 829-1570 Fax: (905) 829-8050

Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com



0685



31040/SIT



C-1376



46390-2049



200093-0



SL2-IN-E-1119R



2005-82 & 83

TABLE OF CONTENTS

EXHIBIT 1	INTRODUCTION.....	1
1.1	SCOPE	1
1.2	RELATED SUBMITTAL(S)/GRANT(S).....	1
1.3	NORMATIVE REFERENCES	1
EXHIBIT 2	PERFORMANCE ASSESSMENT	2
2.1	CLIENT INFORMATION	2
2.2	EQUIPMENT UNDER TEST (EUT) INFORMATION	2
2.3	EUT'S TECHNICAL SPECIFICATIONS	3
2.4	LIST OF EUT'S PORTS.....	3
2.5	ANCILLARY EQUIPMENT	3
EXHIBIT 3	EUT OPERATION CONDITIONS AND CONFIGURATIONS DURING TESTS.....	4
3.1	CLIMATE TEST CONDITIONS	4
3.2	OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS	4
EXHIBIT 4	SUMMARY OF TEST RESULTS.....	5
4.1	LOCATION OF TESTS.....	5
4.2	APPLICABILITY & SUMMARY OF EMC EMISSIONS TEST RESULTS.....	5
4.3	MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES	5
EXHIBIT 5	MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS	6
5.1	TEST PROCEDURES	6
5.2	MEASUREMENT UNCERTAINTIES	6
5.3	MEASUREMENT EQUIPMENT USED	6
5.4	ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER	6
5.5	EMISSION BANDWIDTH [§15.231(c)].....	7
5.6	TRANSMITTER RADIATED EMISSIONS @ 3 METER – FUNDAMENTAL & SPURIOUS EMISSION [§§15.231(e), 15.209 & 15.205].....	9
EXHIBIT 6	TEST EQUIPMENT LIST	12
EXHIBIT 7	MEASUREMENT UNCERTAINTY.....	13
7.1	LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY.....	13
7.2	RADIATED EMISSION MEASUREMENT UNCERTAINTY	14

EXHIBIT 1 INTRODUCTION

1.1 SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.231
Title:	Code of Federal Regulations (CFR), Title 47, Telecommunication, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Section 15.231(e) - Periodic Operation at 433.92 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	Residential

1.2 RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3 NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	2008	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
CISPR 22 EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

EXHIBIT 2 PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

APPLICANT	
Name:	G4S Justice Services Canada, Inc.
Address:	#103 – 6592, 176 Street Surrey, BC Canada V3S 4G5
Contact Person:	Mr. Harv Hundal Phone #: (604)576-8658 x238 Fax #: (604)576-0436 Email Address: harv.hundal@ca-g4s.com

MANUFACTURER	
Name:	G4S Justice Services Canada, Inc.
Address:	#103 – 6592, 176 Street Surrey, BC Canada V3S 4G5
Contact Person:	Mr. Harv Hundal Phone #: (604)576-8658 x238 Fax #: (604)576-0436 Email Address: harv.hundal@ca-g4s.com

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Brand Name	G4S Justice Services Canada, Inc.
Product Name:	PTX
Model Name or Number:	PTX08
Serial Number:	Test Sample
Type of Equipment:	Remote Control/Security Device Transceiver
Input Power Supply Type:	2.8 – 3.6 V DC
Primary User Functions of EUT:	Enables electronic curfew monitoring of participant wearing the PTX

2.3 EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER		
Equipment Type:	Portable	
Intended Operating Environment:	Residential	
Power Supply Requirement:	2.8 – 3.6 V DC	
RF Output Power Rating:	88.85 Peak dB μ V/m @ 3 m	
Operating Frequency Range:	433.92 MHz	
Duty Cycle:	15.4 %	
20 dB Bandwidth:	181.96 kHz	
Modulation Type:	FM	
Antenna Connector Type:	Integral antenna (part of the printed circuit board) housed inside the enclosure.	
Antenna Description:	Manufacturer:	G4S custom
	Type	PCB mounted
	Model	n/a
	Gain:	n/a
	Frequency Range:	433.92 MHz

2.4 LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
No I/O port				

2.5 ANCILLARY EQUIPMENT

None.

EXHIBIT 3 EUT OPERATION CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power Input Source:	2.8 – 3.6 V DC

3.2 OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	For testing purpose only, the EUT was set to transmit continuously by setting the unit into the 1 st test state.
Special Test Software:	None.
Special Hardware Used:	None.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

Transmitter Test Signal	
Frequency:	433.92 MHz

EXHIBIT 4 SUMMARY OF TEST RESULTS

4.1 LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date of Site Calibration: May 17, 2009.

4.2 APPLICABILITY & SUMMARY OF EMC EMISSIONS TEST RESULTS

FCC Rules	Test Requirements	Compliance (Yes/No)
15.107(a)	AC Power Line Conducted Emission	N/A
15.203	Antenna requirement (The transmitter shall use a transmitting antenna that is an integral part of the device).	Yes
15.231(a)	Periodic Operation Provisions	N/A
15.231(c)	20 dB Bandwidth	Yes
15.231(e)	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious	Yes

4.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5 MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1 TEST PROCEDURES

Details of test methods and procedures can be found in Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

5.2 MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

5.3 MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C64.3 and CISPR 16-1-1.

5.4 ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

Enables electronic curfew monitoring of participant wearing the PTX.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: G4S-002BF15C231
December 2, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.5 EMISSION BANDWIDTH [§15.231(c)]

5.5.1 Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.5.2 Method of Measurements

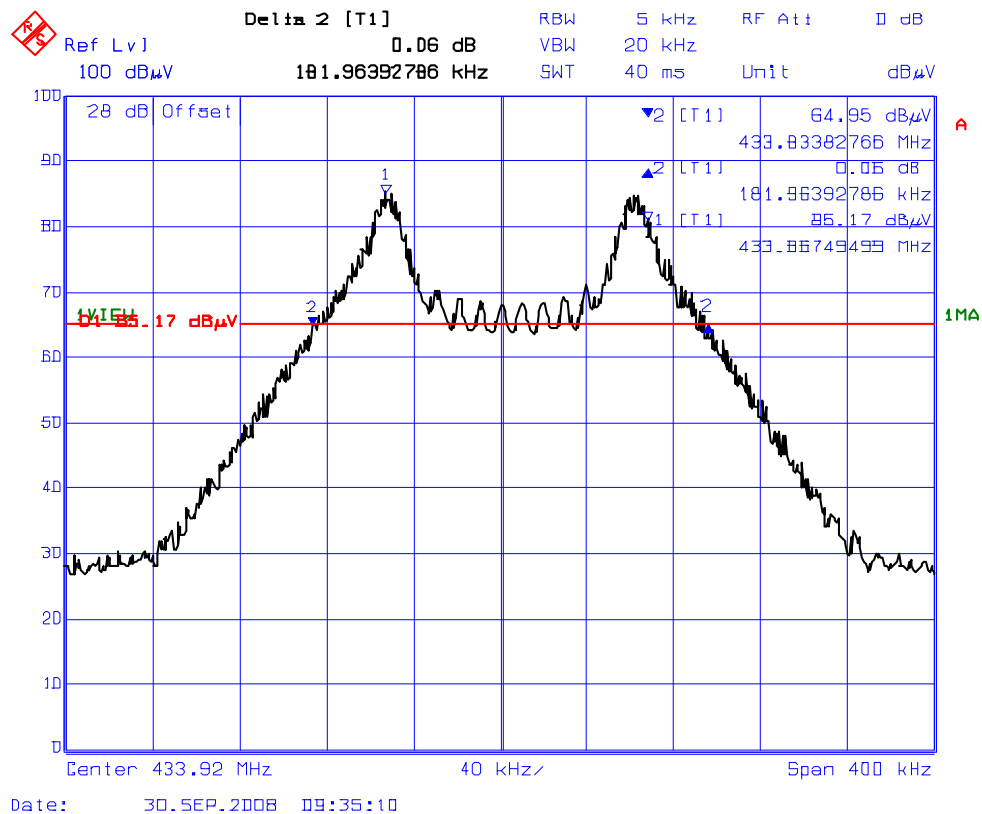
Refer to ULTRATECH Test Procedures, File # ULTR P001-2004, §15.231(c) & ANSI C63.4.

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI C63.4.

5.5.3 Test Data

Frequency (MHz)	Modulation	20 dB Bandwidth (kHz)	Maximum Limit (kHz)	Pass/Fail
433.92	FM	181.96	1084.8	Pass

Plot 5.5.3.1 20 dB Bandwidth
Test Frequency: 433.92 MHz
Modulation: FM



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: G4S-002BF15C231
December 2, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.6 TRANSMITTER RADIATED EMISSIONS @ 3 METER – FUNDAMENTAL & SPURIOUS EMISSION [§§15.231(e), 15.209 & 15.205]

5.6.1 Limits

The RF radiated emissions measured at 3 m distance shall not exceed the field strength below:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emission (microvolts/meter)
40.66 - 40.70	1,000	100
70 - 130	500	50
130 - 174	500 to 1,500 **	50 to 150 **
174 - 260	1,500	150
260 - 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

** linear interpolations

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $22.72727(F) - 2454.545$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667(F) - 2833.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Emissions within the restricted bands specified in §15.205(a) shall not exceed the general radiated emission limits specified in §15.209(a).

47 CFR 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
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	2655–2900	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	Above 38.6
13.36–13.41			

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: G4S-002BF15C231
December 2, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

47 CFR 15.209(a) - Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength Limits (microvolts/m)	Distance (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

5.6.2 Method of Measurements

Refer to ULTRATECH Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

5.6.3 Test Data

Remarks:

- The measuring receiver shall be tuned over the frequency range 30 MHz to 5 GHz.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- In normal operation mode, the PTX transmits an RF status packet at regular intervals.

Status packet length: 15.2 ms (includes settling time, preamble, pattern, and data)
Transmit: Pseudo-random in the range 19-26 s, average 22.5 s

The PTX waits for 250 ms to receive an ACK RF message from the paired PHMU. If an ACK is not received within 250 ms, the PTX immediately re-transmits the status message. If an ACK is not received from the PHMU, the PTX makes up to a total of 3 attempts (including the initial attempt), with each attempt being 250ms apart.

Worst case transmission duration: $3 \times 15.2 \text{ ms} = 45.6 \text{ ms} < 1 \text{ s}$

- The minimum silence period between transmissions is 19 s, see plot 5.6.3.1(i) for detail.
- The peak-average correction factor was obtained from the duty cycle calculation (see plot 5.6.3.1(ii) for detail).

Duty cycle correction factor = $20 \cdot \log(\text{Ton}/100 \text{ ms}) = 20 \cdot \log(15.4 \text{ ms}/100 \text{ ms}) = -16.25 \text{ dB}$

Frequency (MHz)	Peak E-Field @3m (dBμV/m)	Average E-Field @3m (dBμV/m)	Antenna Plane (V/H)	§15.231(e) Limits @3m (dBμV/m)	§15.209(a) Limits @3m (dBμV/m)	Margin (dB)
433.92	86.70	70.45	V	72.87	--	-2.4
433.92	88.85	72.60	H	72.87	--	-0.3
30 - 5000	< 49.00	< 32.64	V	52.87	46.0	<-20
30 - 5000	< 49.00	< 32.64	H	52.87	46.0	<-20

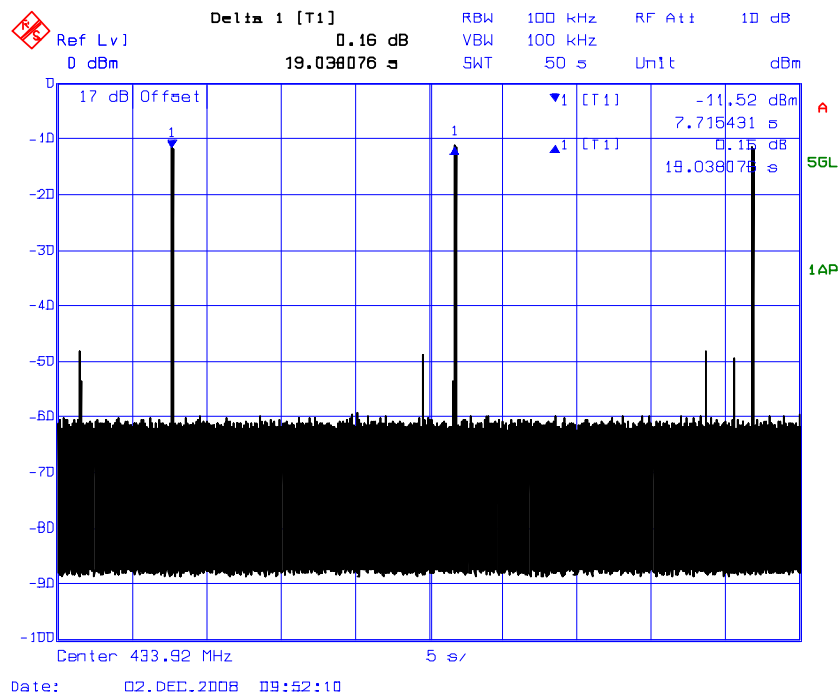
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

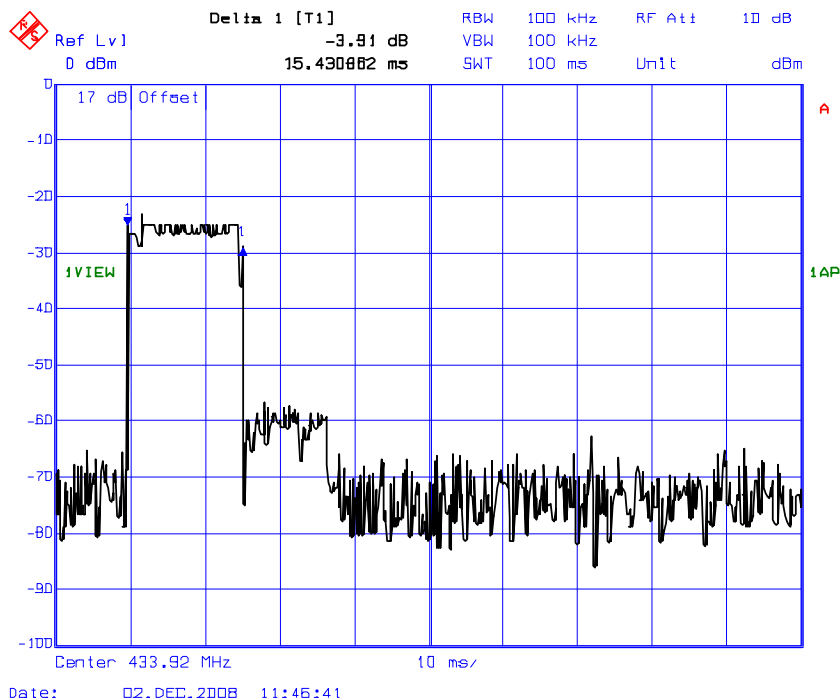
File #: G4S-002BF15C231
December 2, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 5.6.3.1(i) Silence Period Between Transmissions



Plot 5.6.3.1(ii) Duty Cycle in 100 ms



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4

Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: G4S-002BF15C231

December 2, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 6 TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Operating Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz - 40 GHz with external mixer
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz - 40 GHz
EMI Receiver System /Spectrum Analyzer with built-in Amplifier	Hewlett Packard	HP 8546A	3520A00248	9 kHz - 5.6 GHz, 50 Ohms
RF Amplifier	Com-Power	PA-103A	161243	10 MHz - 1 GHz
RF Amplifier	Hewlett Packard	8449B	3008A00769	1 GHz - 26.5 GHz
RF Amplifier	Hewlett Packard	HP 83017A	311600661	1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz - 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz - 18 GHz

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: G4S-002BF15C231
December 2, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 7 MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

7.1 LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	± 1.5	± 1.5
LISN coupling specification	Rectangular	± 1.5	± 1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	± 0.3	± 0.5
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	± 0.2	± 0.3
System repeatability	Std. deviation	± 0.2	± 0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	± 1.25	± 1.30
Expanded uncertainty U	Normal (k=2)	± 2.50	± 2.60

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

7.2 RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (\pm dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	± 1.0	± 1.0
Cable Loss Calibration	Normal (k=2)	± 0.3	± 0.5
EMI Receiver specification	Rectangular	± 1.5	± 1.5
Antenna Directivity	Rectangular	± 0.5	± 0.5
Antenna factor variation with height	Rectangular	± 2.0	± 0.5
Antenna phase center variation	Rectangular	0.0	± 0.2
Antenna factor frequency interpolation	Rectangular	± 0.25	± 0.25
Measurement distance variation	Rectangular	± 0.6	± 0.4
Site imperfections	Rectangular	± 2.0	± 2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$ (Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	+1.1 -1.25	± 0.5
System repeatability	Std. Deviation	± 0.5	± 0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: yic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: G4S-002BF15C231
December 2, 2008

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)