ENGINEERING TEST REPORT

PATROL SUITE PID
Model No.: PTX09
FCC ID: NSNPTX09

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-005F15C231

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

Date: March 16, 2009

Report Prepared by: JaeWook Choi	Tested by: Hung Tringh, RFI Technician
Issued Date: March 16, 2009	Test Dates: March 5 & 6, 2009

- *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.*

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ANSI	FC	VCCI	Industry Canada	NVLAP	BSMI	Korea MIC-RRL
0685	31040/SIT	C-1376	46390-2049	200093-0	SL2-IN-E-1119R	2005-82 & 83

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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:	PATROL SUITE PID
Model Name or Number:	PTX09
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:	Offender monitoring system.

2.3 EUT'S TEHNICAL SPECIFICATIONS

TRANSMITTER		
Equipment Type:	Portable	
Intended Operating Environment:	Residential	
Power Supply Requirement:	2.8 – 3.6 V DC	
RF Output Power Rating:	76.36 Peak dBµV/m @ 3 m	
Operating Frequency Range:	433.92 MHz	
Duty Cycle:	15.2 % in normal operation mode and range test mode 12.2 % in enrollment mode	
20 dB Bandwidth:	180.0 kHz	
Modulation Type:	FM	
Antenna Connector Type:	Integral antenna (part of the printed circuit board) housed inside the enclosure.	
Antenna Description:	Manufacturer: Type Model Gain: Frequency Range:	G4S custom PCB mounted tuned loop n/a n/a 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 1st 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.

- 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)	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

Offender monitoring system.

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

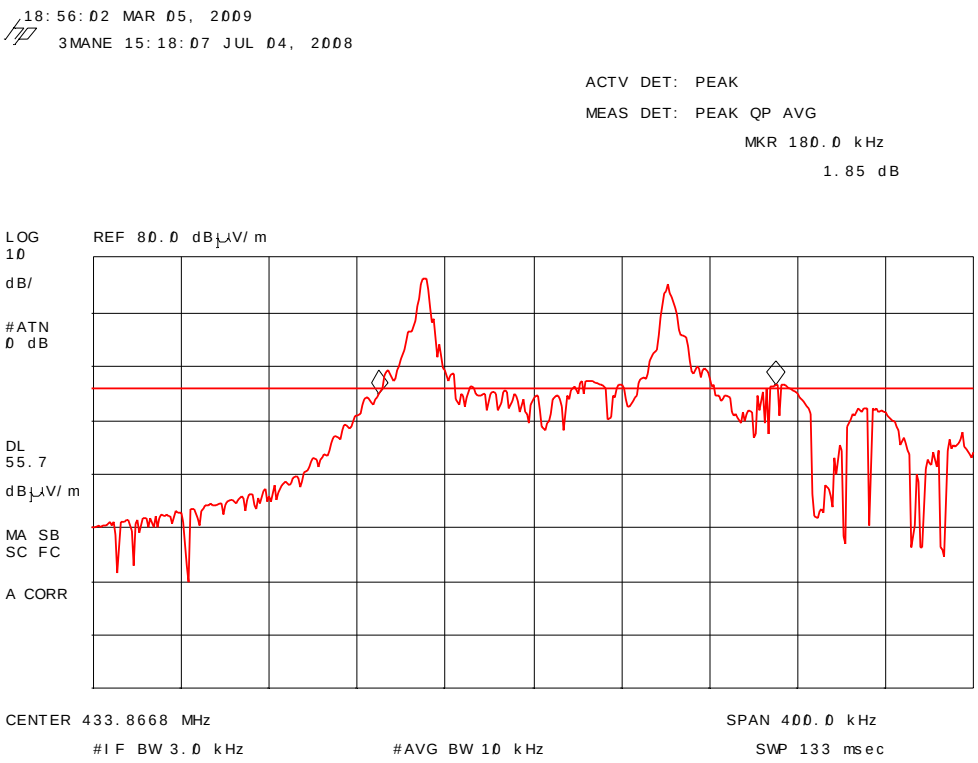
Refer to ULTRATECH Test Procedures, File # ULTR P001-2004, §15.231(c) & ANSI C63.4.

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	180.0	1084.8	Pass

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



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, uV/m at 3 meters = 22.72727(F) - 2454.545; for the band 260-470 MHz, uV/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			

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

PID transmits an RF status packet at regular intervals. (Refer to Operational description provided by manufacturer for detail)

- In normal operation mode,
  - Packet length: 15.2 ms (includes settling time, preamble, pattern, and data)
  - Transmit interval: Pseudo-random in the range 19-26 s, average 22.5 s
  - Maximum packets per interval: 3 with 250 ms between packets
  - Worst case duty factor: 15.2 ms / 100 ms = 15.2 %

19.0 s > 10 s AND 19.0 s > 15.2 ms × 3 × 30 = 1.368 s

- In enrollment mode,
  - Packet length: 12.2 ms (includes settling time, preamble, pattern, and data)
  - Transmit interval: 11.0 s
  - Maximum packets per interval: 3 with 250 ms between packets
  - Worst case duty factor: 12.2 ms / 100 ms = 12.2 %

11.0 s > 10 s AND 11.0 s > 12.2 ms × 3 × 30 = 1.098 s

- In range test mode,
  - Packet length: 15.2 ms (includes settling time, preamble, pattern, and data)
  - Transmit interval: 11.0 s
  - Maximum packets per interval: 3 with 250 ms between packets
  - Worst case duty factor: 15.2 ms / 100 ms = 15.2 %

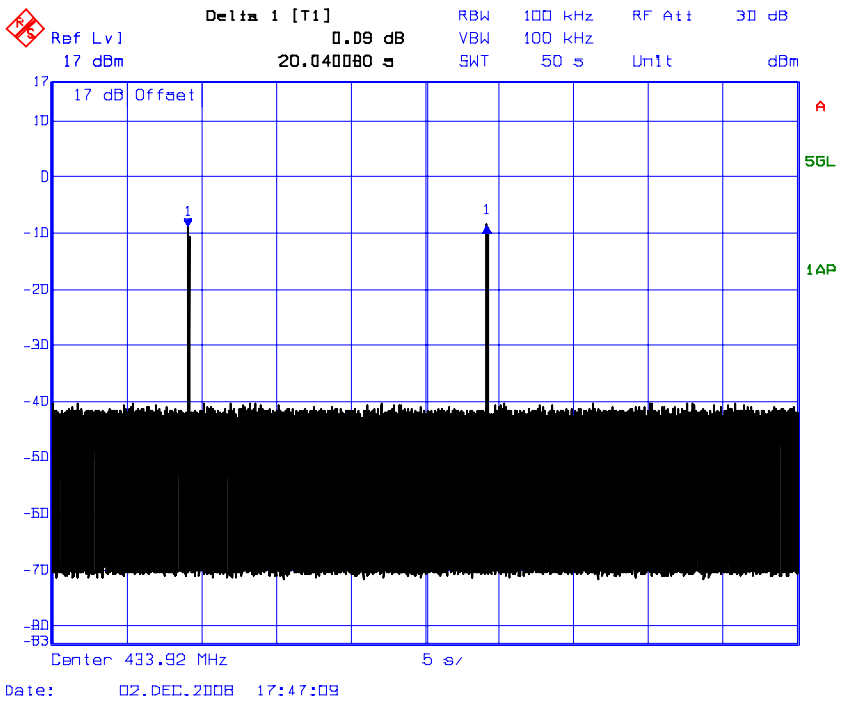
11.0 s > 10 s AND 11.0 s > 15.2 ms × 3 × 30 = 1.368 s

Remarks:

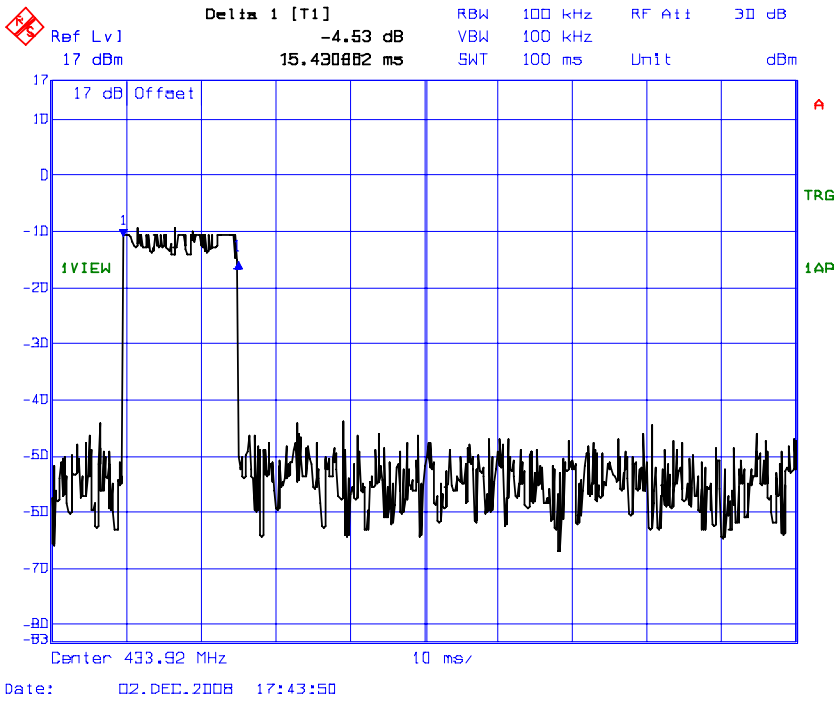
- The measuring receiver shall be tuned over the frequency range 30 MHz to 5 GHz.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- The peak-average correction factor was obtained from the duty cycle calculation(Refer to Operational description provided by manufacturer for detail).

Worst case duty cycle correction factor = 20*log (Ton/100 ms) = 20*log (15.2 ms/100 ms) = -16.36 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	74.97	58.61	V	72.87	--	-14.26
433.92	76.36	60.00	H	72.87	--	-12.87
867.84	29.84	13.48	V	52.87	46.00	-39.39
867.84	33.43	17.07	H	52.87	46.00	-35.80



< Silence Period between Transmissions – normal operation mode >



< Duty Cycle in 100 ms – normal operation mode >

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

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 Γ_1 = 0.03 LISN VRC Γ_R = 0.8(9 kHz) 0.2 (30 MHz) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	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:

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

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

7.2 RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (+ 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 Directivit	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 Γ_1 = 0.2 Antenna VRC Γ_R = 0.67(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	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:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB