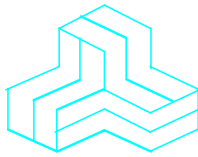


ENGINEERING TEST REPORT



PATROL SUITE PMD

Model No.: PMD09

FCC ID: NSNPMD09

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

Unlicensed Low Power Transmitter Operating in the Band 13.110-14.010 MHz

UltraTech's File No.: G4S-006F15C225

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



Date: June 2, 2009

Report Prepared by: JaeWook Choi

Issued Date: June 2, 2009

Tested by: Hung Trinh, RFI Technician

Test Dates: May 10, 11 and 16, 2009
June 2, 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.

UltraTech Group of Labs

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0685



91038



1309



46390-2049



200093-0



SL2-IN-E-1119R



Korea KCC-RRL

CA2049

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File #: G4S-006F15C225

June 2, 2009

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Sec. 15.225 - Operation within the band 13.110 – 14.010 MHz.
Title:	Title 47, Code of Federal Regulations (CFR), Part 15, Subpart C
Purpose of Test:	To gain FCC Certification Authorization for Section 15.225 - Operation within the Band 13.110 - 14.010 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:	Commercial, industrial or business environment

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

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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 (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name	G4S Justice Services Canada, Inc.
Product Name:	PATROL SUITE PMD
Model Name or Number:	PMD09
Serial Number:	Test Sample
Type of Equipment:	Remote Control/Security Device Transceiver
Input Power Supply Type:	5 VDC \pm 0.25V, 500 mA max via USB
Primary User Functions of EUT:	Used to remotely monitor presence and status of a PTX device worn by an offender, and to view the status information on a Bluetooth enabled PDA device. The PMD is also used to wake up a PTX device.

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File #: G4S-006F15C225
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2.3. EUT'S TECHNICAL SPECIFICATIONS

13.56 MHz TRANSMITTER											
Equipment Type:	Portable										
Intended Operating Environment:	Commercial, industrial or business environment										
Power Supply Requirement:	2.8 Vdc										
RF Output Power Rating:	46.84 Peak dBμV/m @ 3 m										
Operating Frequency Range:	13.56 MHz										
20 dB Bandwidth:	6.70 kHz										
Modulation Type:	A1D										
Antenna Connector Type:	Integral antenna housed inside the enclosure.										
Antenna Description:	<table> <tr> <td>Manufacturer:</td><td>G4S custom</td></tr> <tr> <td>Type</td><td>n/a</td></tr> <tr> <td>Model</td><td>n/a</td></tr> <tr> <td>Gain:</td><td>n/a</td></tr> <tr> <td>Frequency Range:</td><td>13.56 MHz</td></tr> </table>	Manufacturer:	G4S custom	Type	n/a	Model	n/a	Gain:	n/a	Frequency Range:	13.56 MHz
Manufacturer:	G4S custom										
Type	n/a										
Model	n/a										
Gain:	n/a										
Frequency Range:	13.56 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)
1	USB Power, charging only	1	MicroUSB B	Shielded

2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Switching Power Supply
Brand Name:	Phihong
Model Name or Number:	PSB05R-050Q
Serial Number:	N/A
Cable Length & Type:	< 3 m, Non-shielded
Connected to EUT's Port:	USB

EXHIBIT 3. EUT OPERATING 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 VDC

3.2. OPEPERATIONAL 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 Signals:	
Frequency:	13.56 MHz
Transmitter Wanted Output Test Signals:	
▪ RF Power Output (measured maximum output power):	46.84 dBμV/m peak at 3 m
▪ Normal Test Modulation:	OOK
▪ Modulating signal source:	Internal

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.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2011-05-01.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Rules	Test Requirements	Compliance (Yes/No)
2.1093	Radiofrequency radiation exposure evaluation: portable devices	Yes, see attached RF exposure exhibit
15.207 (a)	Power Line Conducted Emission	Yes
15.203	Antenna requirement (The transmitter shall use a transmitting antenna that is an integral part of the device).	Yes
15.215	20 dB & 99% Bandwidth	Yes
15.225 (a)-(d)	Field Strength of Emissions Inside and Outside the Permitted Band 13.110 - 14.010 MHz	Yes*
15.225 (e)	Frequency Stability	Yes
PATROL SUITE PMD, Model No.: PMD09 , by G4S Justice Service Canada, Inc has also been tested and found to comply with FCC Part 15, Subpart B - Class B Digital Devices . The engineering test report has been documented and kept on file and it is available upon request.		

* Simultaneous transmitters' radiated emissions was checked and verified to be compliant.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4 and ULTR-P001-2004.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 6 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 C63.4 and CISPR 16-1-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

To remotely monitor presence and status of a PTX device worn by an offender, and to view the status information on a Bluetooth enabled PDA device. The PMD is also used to wake up a PTX device.

5.5. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	
§ 15.203	<p>Described how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.</p> <p>The exception is in those cases where EUT must be professionally installed. In order to demonstrate that professional installation is required, the following 3 points must be addressed:</p> <ul style="list-style-type: none">• The application (or intended use) of the EUT• The installation requirements of the EUT• The method by which the EUT will be marketed	Integral PCB coil antenna
§ 15.204	<p>Provided the information for every antenna proposed for use with the EUT:</p> <p>(a) type (e.g. Yagi, patch, grid, dish, etc...),</p> <p>(b) manufacturer and model number</p> <p>(c) gain with reference to an isotropic radiator</p>	Only furnished integral antenna will be used in the EUT.

5.6. POWER LINE CONDUCTED EMISSIONS [§ 15.207(a)]

5.6.1. Limits

The equipment shall meet the limits of the following table:

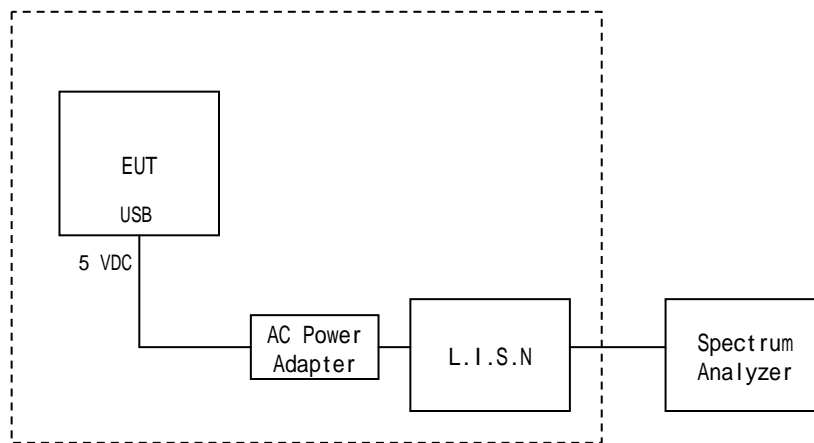
Frequency of Emissions (MHz)	Class B Conducted Limit (dB μ V)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

* Decreasing linearly with logarithm of frequency

5.6.2. Method of Measurements

Refer to Ultratech Test Procedures ULTR-P001-200 & ANSI C63.4 for method of measurements.

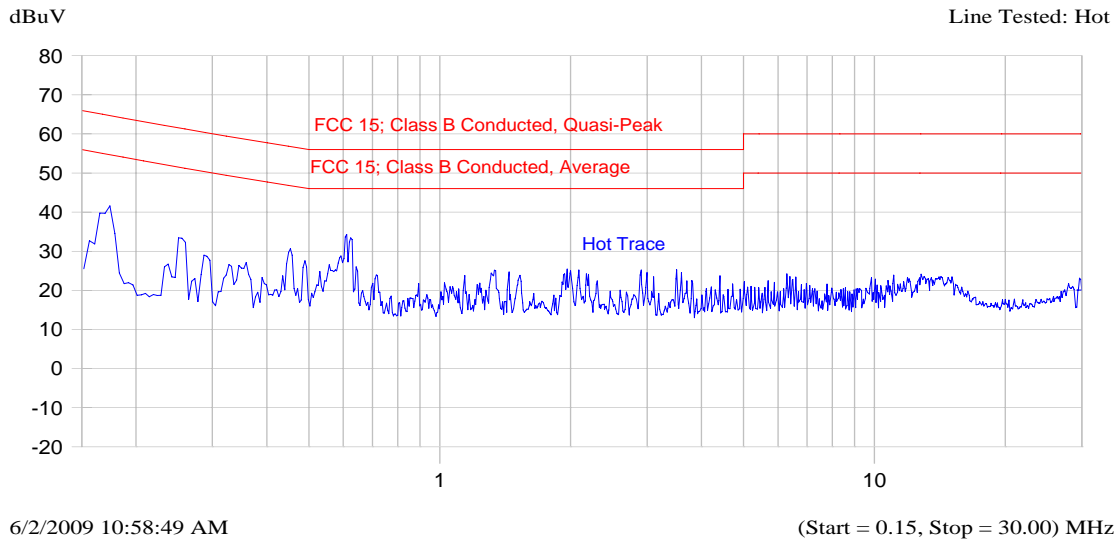
5.6.3. Test Arrangement



5.6.4. Test Data

< 120 Vac, Line Tested: Hot >

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta dB	QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.168	33.5	35.1	-30.0		29.7	-25.4	Hot Trace
0.260	27.3	28.8	-32.6		10.3	-41.2	Hot Trace
0.451	21.6	26.1	-30.8		12.6	-34.2	Hot Trace
0.614	37.6	26.2	-29.8		20.7	-25.3	Hot Trace
1.349	27.1	9.7	-46.3		10.9	-35.1	Hot Trace

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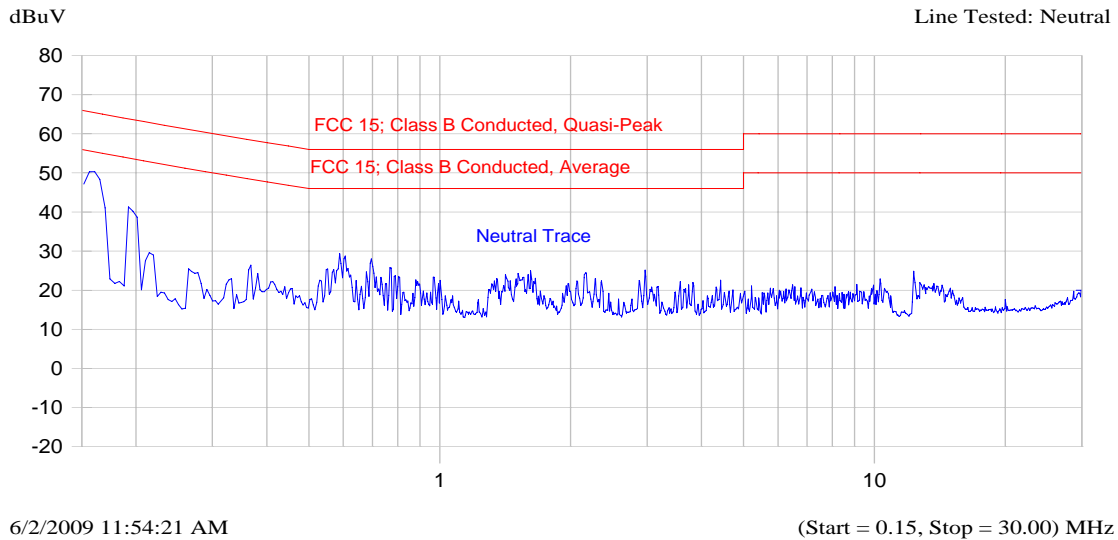
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
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Current Graph

< 120 Vac, Line Tested: Neutral >



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta QP-QP Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.161	36.0	42.4	-23.0	17.3	-38.1	Neutral Trace
0.178	34.7	38.9	-25.7	17.4	-37.2	Neutral Trace
0.605	27.7	26.1	-29.9	19.9	-26.1	Neutral Trace

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5.7. OCCUPIED BANDWIDTH [§ 15.215]

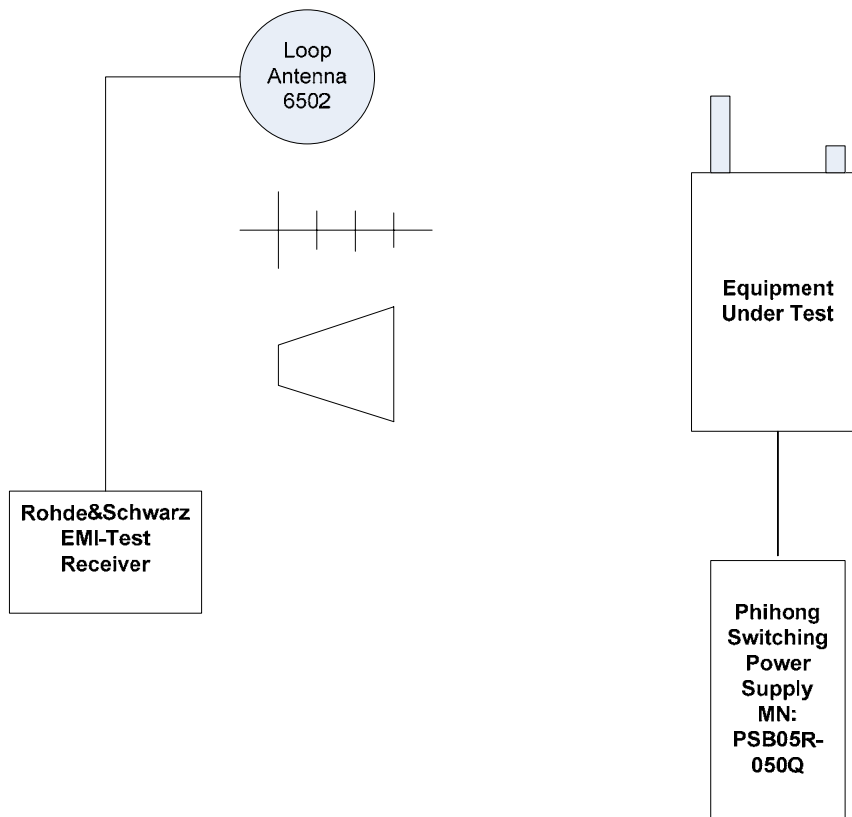
5.7.1. Limits

The 20 dB bandwidth of the emission shall be contained within the band 13.110–14.010 MHz.

5.7.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

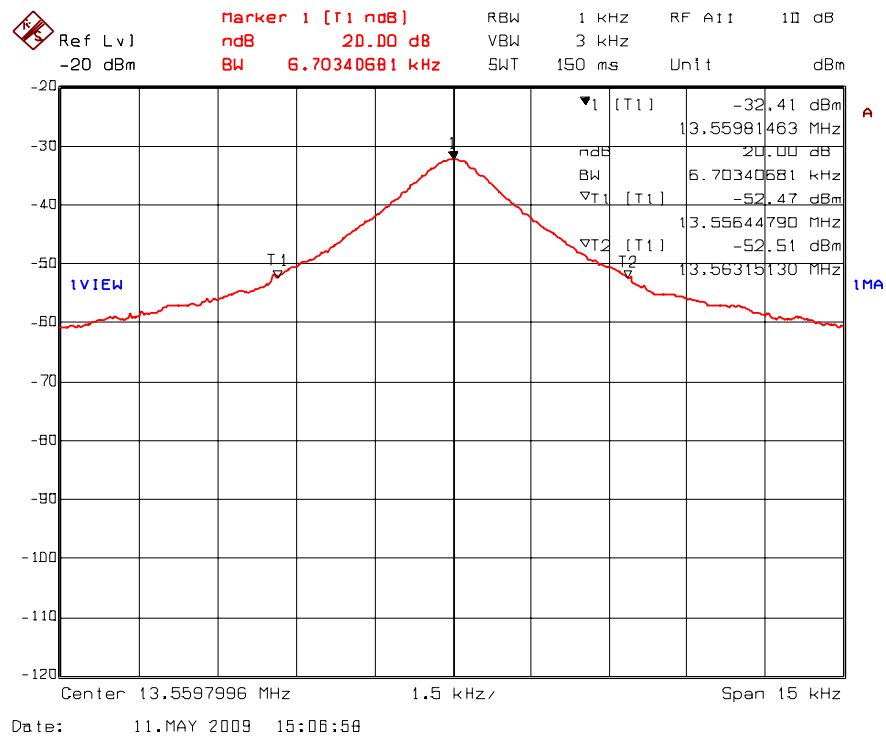
5.7.3. Test Arrangement



5.7.4. Test Data

Test Frequency (MHz)	Occupied Bandwidth (kHz)	
	20 dB BW	99 % BW
13.56	6.70	10.42

Plot 5.7.4.1. 20 dB Bandwidth
Test Frequency: 13.56 MHz



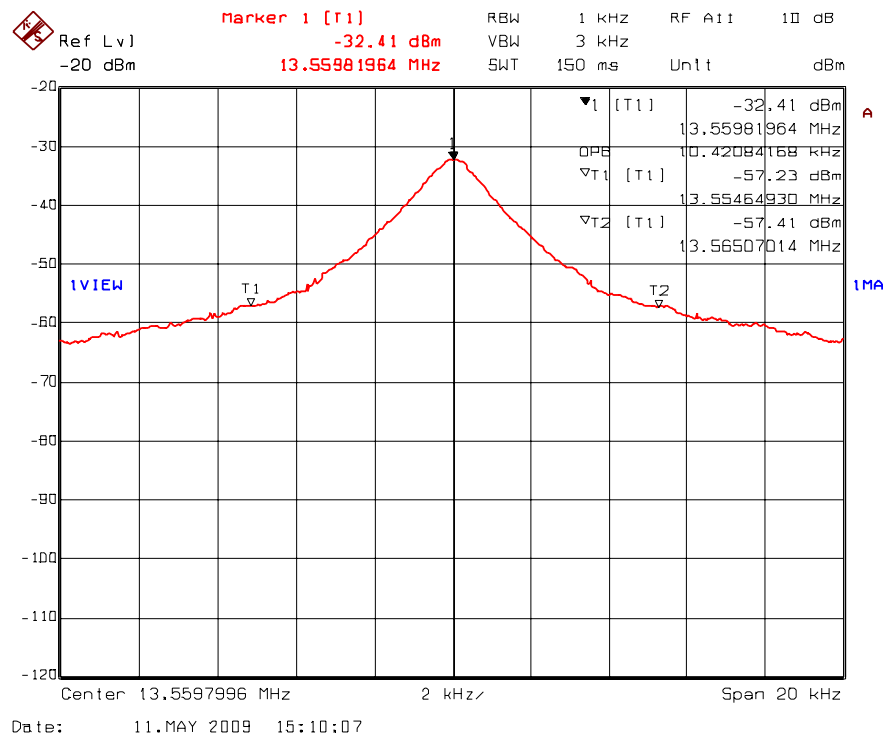
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Plot 5.7.4.2. 99% Occupied Bandwidth
Test Frequency: 13.56 MHz



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File #: G4S-006F15C225

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5.8. FIELD STRENGTH OF EMISSIONS INSIDE & OUTSIDE THE PERMITTED BAND 13.110-14.010 MHz [§§15.225 (a) to (d)]

5.8.1. Limits

- (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110 – 14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

§ 15.209 (a) – Radiated Emission Limits; general requirements

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

5.8.2. Method of Measurements

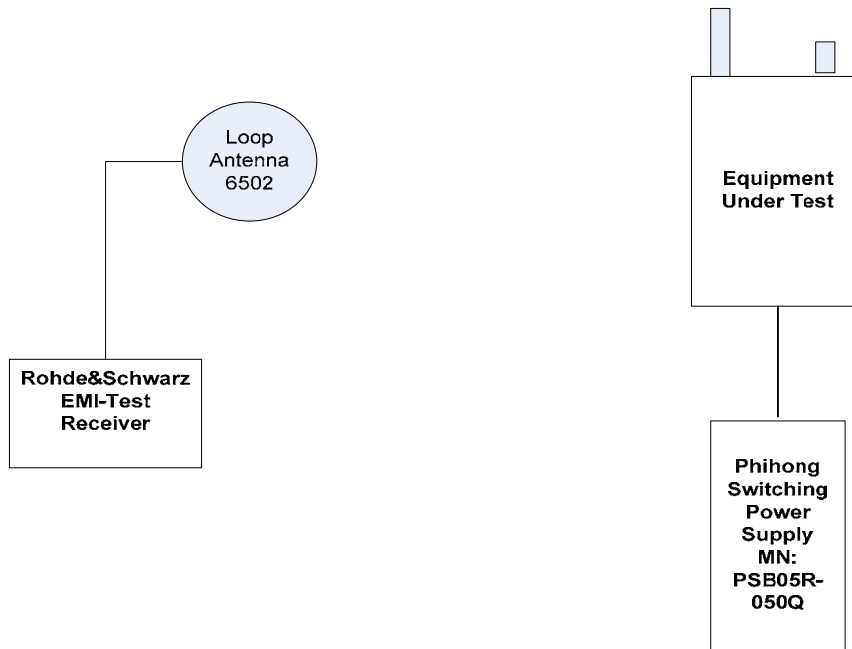
Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and high-pass filter are used for this measurement.

- For measurements from 9 KHz to 150 KHz, set RBW = 200 Hz, VBW \geq RBW, SWEEP=AUTO.
- For measurements from 150 KHz to 30 MHz, set RBW = 10 KHz, VBW \geq RBW, SWEEP=AUTO.
- For measurements from 30 MHz to 1 GHz, set RBW = 100 KHz, VBW \geq RBW, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz, SWEEP=AUTO.

If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

5.8.3. Test Arrangement



5.8.4. Test Data

Remarks:

- Radiated spurious emissions measurements were performed at 3 m distance, from 10 MHz – 10th harmonic of the fundamental since no signal was measured at 10 m distance. All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- No signal was found except fundamental.
- For frequencies below 30 MHz, the results measured at 3 m distance shall be extrapolated to 30 m distance using an extrapolation factor of 40 dB/decade ($40 \cdot \log(3/30)$).
- Only this transmitter was transmitting during test, however it was checked and confirmed that turning on other two transmitters which made all three transmitters transmit simultaneously did not affect test results.

5.8.4.1. Field Strength of Emissions Inside the Permitted Band

Frequency (MHz)	Measured Field Strength @ 10 m (dB μ V/m)	Detector Used (Peak/QP)	Antenna Plane (H/V)	Field Strength 30 m Extrapolated Value (dB μ V/m)	§ 15.225 Field Strength Limits	Margin (dB)
13.56	44.27	QP	V	4.27	84.0	-79.7
13.56	42.58	QP	H	2.58	84.0	-81.4

5.8.4.2. Field Strength of Emissions Outside the Permitted Band

Frequency (MHz)	Measured Field Strength @ 3m (dB μ V/m)	Detector Used (Peak/QP)	Antenna Plane (H/V)	§ 15.209 Field Strength Limits	Margin (dB)
No signal was found.					

5.9. FREQUENCY STABILITY [§ 15.225(e)]

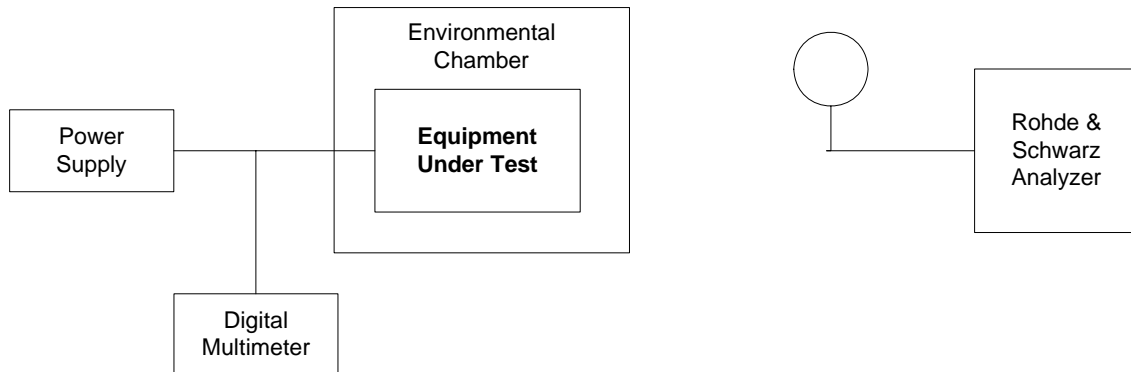
5.9.1. Limits

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.9.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004.

5.9.3. Test Arrangement



5.9.4. Test Data

Frequency Band:	13.56 MHz
Center Frequency:	13.56 MHz
Frequency Tolerance Limit:	$\pm 0.01\%$ (± 1356 Hz)
Max. Frequency Tolerance Measured:	120 Hz
Input Voltage Rating:	2.8 Vdc (2 \times Ni MH batteries)

* **Note:** Manufacturer claims operating temperature range from 0 °C ~ 50 °C

Ambient Temperature (°C)	Frequency Drift (Hz)	
	Nominal Voltage 2.8 Vdc	Lowest Voltage 2.5 Vdc
-30	-80	--
-20	-40	--
-10	120	--
0	120	--
+10	0	--
+20	0	-80
+30	-80	--
+40	-80	--
+60	-80	--

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File #: G4S-006F15C225

June 2, 2009

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EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Operating Range
EMI Receiver System/ Spectrum Analyzer with built-in Amplifier	Hewlett Packard	HP 8546A	3520A00248	9KHz-5.6GHz, 50 Ohms
Transient Limiter	Hewlett Packard	11947A	310701998	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	89071531	9 kHz – 200 MHz 50 Ohms / 50 μ H
12'x16'x12' RF Shielded Chamber	RF Shielding
EMI-Test Receiver	Rohde & Schwarz	ESU40	100037	20 Hz- 40 GHz Build in amplifier
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz- 40 GHz
Loop Antenna	Emco	6502	2611	10 kHz – 30 MHz
Biconilog Anenna	Emco	3142	10005	26 – 3000 MHz
Biconilog Anenna	Emco	3142B	1575	26 – 2000 MHz
Log Periodic	Emco	93148	1101	0.2 – 2 GHz
Log Periodic	Emco	3148	23845	0.2 – 2 GHz
Horn Antenna	Emco	3115	6570	1 – 18 GHz
Horn Antenna	Emco	3115	5955	1 – 18 GHz
RF Amplifier	Com-Power	PA-103A	161243	10 MHz – 1000 MHz
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40°C - +80°C range

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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 LAB 34.

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 (+ 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 $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$ 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:

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