EMC EMISSION - TEST REPORT

Test Report No.	**B907501**	Issue Date	14 March 1999

Model / Serial No.	HG200W / SFW001
Product Type	Wrist-Mount Low Power RF Transmitter
Client	BI, Inc.
Manufacturer	BI, Inc.
License holder	BI, Inc.
Address	6400 Lookout Road Boulder, CO 80301
Test Criteria Applied	FCC Part 15C 15.231
Test Start Date:	08 March 1999
Test End Date:	08 March 1999
Test Result	■ **PASS** ☐ **FAIL**
Test Report Project No.	**BC1G907501**
Total Pages including Appendices	40

Reviewed By : Felix J. Chavez

Reviewed By : Shawn Singh

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DIRECTORY - EMISSIONS

EMISSIONS TEST REGULATIONS :

The tests were performed according to following regulations :

■ - Federal Communication Commission part 15 ☐ - Class A ■ - Class B
■ - Federal Communication Commission part 15, Subpart C ■ - 15.209 ■ - 15.231

All tests performed according to ANSI C63.4.

Emission Test Results:

Conducted emissions 150 kHz - 30 MHz

Test Result ☐ - PASS ☐ - FAIL ■ - Not Applicable

Passing Margin _____ dB at _____ MHz

Remarks: EUT is battery operated.

Radiated emissions (electric field) 30 MHz - 1000 MHz (Unintentional Radiator)

Test Result ■ - PASS ☐ - FAIL ☐ - Not Applicable

Passing Margin 22.7 dB at 60.49 MHz

Remarks: _____

Radiated emissions (electric field) 314.2 MHz - 3142 MHz (Intentional Radiator)

Test Result ■ - PASS ☐ - FAIL ☐ - Not Applicable

Passing Margin 12.8 dB at 628.4 MHz

Remarks: _____

GENERAL REMARKS:

Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None

Test-setup photo(s)
Radiated Emissions

TÜV PRODUCT SERVICE INC 40 Meadow Road Pinewood Springs, Lyons, CO 80540 Tel: 303 786 7999 Fax: 303 449 3004 Rev.No 1.0

Test-setup photo(s):
Conducted Emissions

Test Not Applicable

TÜV PRODUCT SERVICE INC 40 Meadow Road Pinewood Springs, Lyons, CO 80540 Tel: 303 786 7999 Fax: 303 449 3004 Rev.No 1.0

Test Equipment Used

TÜV PRODUCT SERVICE INC 40 Meadow Road Pinewood Springs, Lyons, CO 80540 Tel: 303 786 7999 Fax: 303 449 3004 Rev.No 1.0

Colorado Test Equipment

12-Mar-99

Report: B9075 Date: 08 Mar 99 Signature: Shawn Singh

Temp: 21.4°C Rel. Humd.: <18% Atmo. Pressure: 79 kPa

Location	Tests	Manufacturer	Model Number	Serial Number	Description	Cal Date	Cal Due
PW		A.H Systems	SAS-200-510	116	Log Perioic Antenna		
PW	R	AH Systems	SAS-200/510	705	Log Periodic Antenna (300-1800 MHz)	06-Jul-98	06-Jul-99
PW	(R)	AH Systems	SAS-200/512	104	Log Periodic Antenna (200-1500 MHz)	13-Jul-98	13-Jul-99
PW	R	AvAntek	AFT97-8434-10	1007	RF Pre-Amplifier (4-8 GHz)	19-Nov-98	19-Nov-99
PW	R	Avantek	AWT-18037	1002	RF Pre-Amplifier (8-18 GHz)	19-Nov-98	19-Nov-99
PW	R C	California Instr.	850T-1	68458	Oscillator (45-5000 Hz)		
PW	R C	California Instr.	9000TCA/3-1	50666+	Power Source 9KVA (45-5000 Hz, 0-280VAC)		
PW	R C	Compaq	470A	23605277B504	Monitor - PW Testbed		
PW	R C	Compaq	DeskPro 575	g545HSY20483	Computer for PW Testbed		
PW	R	Compliance Desig	none	RD-1	Roberts Dipole Ant. Set (30-1000 MHz)	03-Mar-97	02-Mar-00
PW		EMCO	1070-4	9206-1681	Antenna tower with manual polarization		
PW		EMCO	1080/1081	9206-1636	2 meter dia. wood turntable		
PW		EMCO	3104C	3519	Biconical Antenna	01-Feb-99	01-Feb-00
PW	R	EMCO	3104C	9203-4508	Biconical antenna	19-Jun-98	19-Jun-99
PW	R	EMCO	3108	2149	Biconical Dipole Antenna (30-300 MHz)	19-Jun-98	19-Jun-99
PW	(R)	EMCO	3108	7059203-2457	Biconical Dipole Antenna (30-300 MHz)	06-Jul-98	06-Jul-99
PW	(R)	EMCO	3115	3886	Dbl Ridged Horn Antenna (1-18 GHz)	20-Feb-98	22-Mar-99
PW	-3, R	EMCO	3146	9203-3376	Log Periodic Antenna	18-Jun-98	18-Jun-99
PW	C	EMCO	3825/2	9202-1945	LISN	15-Jul-98	15-Jul-99
PW	C	EMCO	3825/2	9202-1946	LISN	23-Jul-98	23-Jul-99
PW	R	EMCO	4610	9205-1199	Royce field site source		
PW	C	EMCO	4620	9110-1015	Conducted noise source		
PW	R	EMCO	6502	9205-2738	Magnetic loop	30-Oct-97	29-Oct-00
PW	R	EMCO	7405	9203-2175	Near field probe set		
PW	CISPR14	Fischer	F-201	141	Absorbing Clamp (30-300 MHz)	05-Mar-98	05-Mar-99
PW	C	Fischer	F-33-1	356	Current Probe (10 kHz - 250 MHz)	04-May-98	04-May-99
PW X		Gishard	600-1040 mb	002	Altimeter		
PW	R	Hewlett Packard	11940A	2650A04527	Close field probe		
PW	R	Hewlett Packard	11940A	2650A04563	Close field probe		
PW	R	Hewlett Packard	11941A	2807A02957	Close field probe		
PW	C	Hewlett Packard	11947A	2820A00277	Transient Limiter	19-Nov-98	19-Nov-99
PW	C	Hewlett Packard	11947A	3107A01975	Transient Limiter	17-Jun-98	17-Jun-99
PW	R	Hewlett Packard	11970A	3003A07640	Harmonic Mixer	27-Feb-98	29-Mar-99
PW	R	Hewlett Packard	11970K	2332A01280	Harmonic Mixer	27-Feb-98	29-Mar-99
PW		Hewlett Packard	8444A	2325A07899	Tracking Generator (1-1200 MHz)	19-Nov-98	19-Nov-99
PW	R	Hewlett Packard	8445B	2034A03223	Pre-Selector	24-Jun-98	24-Jun-99
PW	R C	Hewlett Packard	8447D	2727A05399	Amplifier (30-1000 MHz)	18-Nov-98	18-Nov-99
PW	R, C, RE101, CISP	Hewlett Packard	85650A	2043A00256	Quasi Peak Adapter (set 1)	17-Jun-98	17-Jun-99
PW	R, C, RE101, CISP	Hewlett Packard	85650A	2811A01300	Quasi Peak Adapter	23-Nov-98	23-Nov-99
PW	(R) C, RE101, CISP	Hewlett Packard	85662A	2318A04983	Display Section (set 1)	17-Jun-98	17-Jun-99
PW	(R), C,	Hewlett Packard	85662A	2403A08749	Display Section	01-Apr-98	01-Apr-99
PW	R, C	Hewlett Packard	8566B	2115A00853	Spectrum Analyzer (dc-22 GHz)	11-Mar-98	11-Mar-99
PW	(R) C, RE101, CISP	Hewlett Packard	8566B	2410A00154	Spectrum Analyzer (dc-22 GHz)	01-Apr-98	01-Apr-99
PW	R, C, RE101, CISP	Hewlett Packard	8568B	2304A02508	Spectrum Analyzer (set 1) (dc-1.8 Ghz)	17-Jun-98	17-Jun-99
PW		Hewlett Packard	8590	2722A02036	Spectrum Analyzer		
PW	RE101, -8, -9, -11	Hewlett Packard	8594E	3223A00145	Spectrum Analyzer	22-Jan-99	22-Jan-00
PW	C	HP	11947A	3107A01984	Transient Limiter	29-Oct-98	29-Oct-99
PW		JFW	50FH-003-100N	9825	Attenuator		
PW		JFW	50FHB-003-5	00363	Attenuator	19-Nov-98	19-Nov-99
PW	(R)	Mini Circuts	ZHL-1042J-SMA	D020499-5	Amplifier	12-Feb-99	12-Feb-00
PW	R	Mini-Circuits	ZHL-1042J	D020698-14	RF Pre-Amplifier (10-4200 MHZ)	13-Feb-98	13-Feb-99
PW		Mini-Circuits	ZHL-1042J(SMA	D082098-3	Amplifier	23-Sep-98	23-Sep-99

Location	Tests	Manufacturer	Model Number	Serial Number	Description	Cal Date	Cal Due
PW	C	Polarad Electronics	ESH3-Z2	357.881J.32	Transient Limiter		
PW X		Radio Shack	63-867	005	Temperature / Humidity Indicator		
PW	C, R	Rhode & Schwartz	ESHS 30	842806/001	EMI Test Receiver	26-Oct-98	26-Oct-99
PW	C	Rhode & Schwarz	ESH3	872318/036	Low Frequency Receiver (9 kHz - 30 MHz)	03-Sep-98	03-Sep-99
PW	C	Schwarzbeck	NNLK 8129	8129126	LISN	27-Oct-98	27-Oct-99
PW	C	Schwarzbeck	TK 9416	TUV-600	Conducted Line Probe (150 kHz - 30 MHz)	04-Apr-98	04-Apr-99
PW		Shaffner	NSG 431	1426	ESD Tester		
PW	C	Solar	8028-50-TS-24-	8305121	LISN	23-Feb-98	23-Feb-99
PW	C	Solar	8028-50-TS-24-	8305122	LISN (10 kHz - 30 MHz)	23-Feb-98	23-Feb-99
PW	R	Systron Donner	DBD-520-15	1	Antenna 18-26 ghz		
PW	R	Systron Donner	DBE-520-15	2	antenna-26 to 40 ghz		
PW		Tensor	4105	2020	Ridged Guide Antenna	11-Jun-98	11-Jun-99
PW		Transjonic	T-100	147	Ion Meter		
PW		TUV PS	LPS-1	1	P/S for Loop Antenna		
PW		WaveTek	DM5XL	60206553	Hand Held Multimeter		
PW		Weinschel	2-3dB	BC5530	Attenuator	19-Nov-98	19-Nov-99
PW		Weinschel	2-3dB	BC5539	Attenuator	19-Nov-98	19-Nov-99
PW		Weinschel	2-6B	BC6492	Attenuator	19-Nov-98	19-Nov-99
PW		Weinschel	2-6dB	BC6487	Attenuator	19-Nov-98	19-Nov-99

Test Software

12-Mar-99

Report: B9075 Date: 08 Mar 99 Signature: Shawn Singh

Location	Rev. ID	File Name	Tests	Room	Equipment	Model	Serial #	Level	Range	Rev. Date
BL-I	B01	10VHIFH	ENV 50140	CC2	Wavetek/Marco			10 V/m	80-1000MHz	11-Jan-98
BL-I	B02	10VHIFH	ENV 50140	CC1	Wavetek/Marco			10V/m	80-1000 MHz	17-Aug-98
BL-I	B01	10VHIFV	ENV 50140	CC2	Wavetek/Marco			10 V/m	80-1000 MHz	11-Jan-98
BL-I	B02	10VHIFV	ENV 50140	CC1	Wavetek/Marco			10V/m	80-1000 MHz	17-Aug-98
BL-I	B01	10VLOFH	ENV 50140	CC2	Wavetek/Marco			10 V/m	26-80 MHz	12-Jan-98
BL-I	B03	10VLOFH	ENV 50140	CC1	Wavetek/Marco			10V/m	26-80 MHz	17-Aug-98
BL-I	B01	10VLOFV	ENV 50140	CC2	Wavetek/Marco			10 V/m	26-80 MHz	12-Jan-98
BL-I	B03	10VLOFV	ENV 50140	CC1	Wavetek/Marco			10V/m	26-80 MHz	17-Aug-98
BL-I	B01	25VHNH	ENV 50140	CC2	Wavetek/Marco			25 V/m	800-2700 MHz	24-Mar-98
BL-I	B01	25VHNV	ENV 50140	CC2	Wavetek/Marco			25 V/m	800-2700 MHz	24-Mar-98
BL-I	B01	3VHIFV	ENV 50140	CC2	Wavetek/Marco			3 V/m	80-1000 MHz	11-Jan-98
BL-I	B01	3VHIFV	ENV 50140	CC2	Wavetek/Marco			3 V/m	80-1000 MHz	11-Jan-98
BL-I	B03	3VHORZ	ENV 50140	CC1	Wavetek/Marco			3V/m	26-1000 MHz	17-Aug-98
BL-I	B01	3VLOFH	ENV 50140	CC2	Wavetek/Marco			3 V/m	26-80 MHz	12-Jan-98
BL-I	B01	3VLOFV	ENV 50140	CC2	Wavetek/Marco			3 V/m	26-80 MHz	12-Jan-98
BL-I	B03	3VVERT	ENV 50140	CC1	Wavetek/Marco			3V/m	26-1000 MHz	17-Aug-98
BL-I	V4.10	E400 BURSTWA	801-4, 1000-4-	Any room	Keytek ECAT S					01-Jan-95
BL-I	V4.10	E500 SURGEWA	pr801-5, pr100	Any room	Keytek ECAT S					01-Jan-95
BL-I	B02	F120B01.X60	ENV 50141	CC2	Injection Clamp	F-120-2	60	1V	.15-80 MHz	02-Feb-99
BL-I	B02	F120B03.X60	ENV 50141	CC2	Injection Clamp	F-120-2	60	3V	.15-80 MHz	02-Feb-99
BL-I	B02	F120B10.X60	ENV 50141	CC2	Injection Clamp	F-120-2	60	10V	.15-80 MHz	02-Feb-99
BL-I	B02	F120D01.X60	ENV 50141	CC1	Injection Clamp	F-120-2	60	1V	.15-80 MHz	20-Aug-98
BL-I	B02	F120D03.X60	ENV 50141	CC1	Injection Clamp	F-120-2	60	3V	.15-80 MHz	20-Aug-98
BL-I	B02	F120D10.X60	ENV 50141	CC1	Injection Clamp	F-120-2	60	10V	.15-80 MHz	20-Aug-98
BL-I	2.00	IEC1000.EXE	61000-3-2/3	Grnd Plane	Voltech	PM3000A	9215			13-Mar-97
BL-I	B03	M1X38B03	ENV 50141	CC2	CDN	FCC-801-M1-16	38	1-3V	.15-230 MHz	17-Jun-98
BL-I	B03	M1X38B10	ENV 50141	CC2	CDN	FCC-801-M1-16	38	10V	.15-230 MHz	17-Jun-98
BL-I	B03	M1X38D03	ENV 50141	CC1	CDN	FCC-801-M1-16	38	3V	.15-230 MHz	18-Jun-98
BL-I	B03	M1X38D10	ENV 50141	CC1	CDN	FCC-801-M1-16	38	10V	.15-230 MHz	18-Jun-98
BL-I	B03	M2X42B03	ENV 50141	CC2	CDN	FCC-801-M2-25	42	3V	.15-230 MHz	16-Jun-98
BL-I	B03	M2X42B10	ENV 50141	CC2	CDN	FCC-801-M2-25	42	10V	.15-230 MHz	16-Jun-98
BL-I	B03	M2X42D03	ENV 50141	CC1	CDN	FCC-801-M2-25	42	3V	.15-230 MHz	20-Aug-98
BL-I	B03	M2X42D10	ENV 50141	CC1	CDN	FCC-801-M2-25	42	10V	.15-230 MHz	20-Aug-98
BL-I	B02	M3X12B01	ENV 50141	CC2	CDN	FCC-801-M3-25	12	1V	.15-230 MHz	22-Jun-98
BL-I	B04	M3X12B03	ENV 50141	CC2	CDN	FCC-801-M3-25	12	3V	.15-230 MHz	22-Jun-98
BL-I	B04	M3X12B10	ENV 50141	CC2	CDN	FCC-801-M3-25	12	10V	.15-230 MHz	22-Jun-98
BL-I	B01	M3X12D01	ENV 50141	CC1	CDN	FCC-801-M3-25	12	1 V	0.15-230 MHz	16-Jun-98
BL-I	B04	M3X12D03	ENV 50141	CC1	CDN	FCC-801-M3-25	12	3V	.15-230 MHz	16-Jun-98
BL-I	B04	M3X12D10	ENV 50141	CC1	CDN	FCC-801-M3-25	12	10V	.15-230 MHz	16-Jun-98
BL-I	B04	M3X13B03	ENV 50141	CC2	CDN	FCC-801-M3-25	13	1-3V	.15-230 MHz	03-Aug-98
BL-I	B03	M3X13B10	ENV 50141	CC2	CDN	FCC-801-M3-25	13	10V	0.15-230 MHz	03-Aug-98
BL-I	B04	M3X13D03	ENV 50141	CC1	CDN	FCC-801-M3-25	13	3V	.15-230 MHz	16-Jun-98
BL-I	B03	M3X13D10	ENV 50141	CC1	CDN	FCC-801-M3-25	13	10V	.15-230 MHz	16-Jun-98
BL-I	B03	M3XX2D03	ENV 50141	CC1	CDN	FCC-801-M3-50	2	3V	.15-230 MHz	18-Jun-98
BL-I	B03	M3XX2D10	ENV 50141	CC1	CDN	FCC-801-M3-50	2	10V	.15-230 MHz	18-Jun-98
BL-I	B03	M3XX3D03	ENV 50141	CC1	CDN	FCC-801-M3-50	3	3V	.15-230 MHz	17-Jun-98

Location	Rev. ID	File Name	Tests	Room	Equipment	Model	Serial #	Level	Range	Rev. Date
BL-I	B03	M3XX3D10	ENV 50141	CC1	CDN	FCC-801-M3-50	3	10V	.15-230 MHz	17-Jun-98
BL-I	B03	M5105D03	ENV 50141	CC1	CDN	FCC-801-M5-50	105	3V	.15-230 MHz	18-Jun-98
BL-I	B03	M5105D10	ENV 50141	CC1	CDN	FCC-801-M5-50	105	10V	0.15-230MHz	18-Jun-98
BL-I	2.10	PQFWARE	1000-4-11	Any room	Keytek ECAT S					01-Jan-95
BL-I	B03	RFPLAYBK	ENV 50140/14		Wavetek/Marco					01-Sep-96
BL-I		RSFU.EXE	ENV 50140		Field Uniformity					19-Apr-95
BL-I	C04	WT4P1.EXE	ENV 50140		Wavetek/Marco					23-Oct-96
BL-I	A02	WTHP_CAL.EXE	ENV 50141		CDN					22-Feb-96
BL-P	B01	PM9080		PS	Portable test to					
BL-P	V 1.7	PROLOGGER S2		PS	Data Logger	2280 series				
PW	A02	CECC.EXE	Conducted emi							20-Mar-94
PW	B02	OATS3.EXE	Radiated emis							01-Jun-97
PW	B05	PWTSEXT.EXE	Radiated emis							31-Aug-94
PW	B01	SITESWPT.EXE	Radiated emis		Site Attenuation					

Appendix A

Transmitter Data Sheets

15.231(e) PERIODIC OPERATION INTENTIONAL RADIATOR

Date: 8-Mar-99
EUT: Wrist-Mount Low Power RF Transmitter — **Measured @** 314.2 MHz
Manufacturer: BI Inc.
Representative: Don Melton

Miscellaneous Measurements:	**FCC Specification**	**Measurement**
1) 20 dB Bandwidth	1 MHz	376 kHz

Tx Mode: **Radiated Measurements**

Calculated Averaging Factor: -20 dB (20*Log(duty cycle))
Averaging Factor Applied: -20 dB

	Specification		**Peak Measurement** dBuV/m @ MHz		**Average Measurement** dBuV/m @ MHz	
Fundamental Field Strength:	67.6	dBuV/m	85.9	314.2	65.9	314.2

Harmonics	**Specification**		**Peak Measurement** dBuV/m @	MHz	**Average Measurement** dBuV/m @	MHz	**Delta** dB
2nd harmonic (628.4 MHz)	47.6	dBuV/m	54.8	628.4	34.8	628.4	-12.8
3rd harmonic (942.6 MHz)	47.6	dBuV/m	50.6	942.6	30.6	942.6	-17.0
4th harmonic (1256.8 MHz)	54	dBuV/m	35.7	1256.9	15.7	1256.9	-38.3
5th harmonic (1571 MHz)	54	dBuV/m	39.0	1571.0	19.0	1571.0	-35.0
6th harmonic (1885.2 MHz)	54	dBuV/m	No emissions were found above the receiver's noise floor				
7th harmonic (2199.4 MHz)	54	dBuV/m	No emissions were found above the receiver's noise floor				
8th harmonic (2513.6 MHz)	54	dBuV/m	No emissions were found above the receiver's noise floor				
9th harmonic (2827.8 MHz)	54	dBuV/m	No emissions were found above the receiver's noise floor				
10th harmonic (3142 MHz)	54	dBuV/m	No emissions were found above the receiver's noise floor				

Minumum Passing Margin: **-12.8 dB**

Appendix B

Detailed Test Data Sheets

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site
3 Meter Antenna Distance
Equipment Under Test:
BI Inc., M/N: HG200W
FCC ID: CSQHG200W,S/N: SFW001
Notes: Wrist-Mount Low Power RF Transmitter, Fresh 3.6 V Lithium Battery

Report B9075 Run 1
Date 03/08/99 Page 1
Engineer BCJC.
Tech: S S Shalin Singh
Requester

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	Delta	Delta

Peak readings. Average readings will be computed from duty cycle.
All frequencies are maximized.

Log periodic antenna, horizontal polarization.

283 deg/1 m								
314.23	70	14.9	1	85.9	--	H	--	
135 deg/1.25 m								
628.43	33.75	19.5	1.5	54.8	--	H	--	
294 deg/1 m								
942.58	22.95	23.5	2	48.5	--	H	--	

Vertical polarization.

0 deg/1 m								
314.24	51.85	14.9	1	67.8	--	V	--	
110 deg/1 m								
628.43	31.2	19.5	1.5	52.2	--	V	--	
293 deg/1.1 m								
942.63	25.05	23.5	2	50.6	--	V	--	

Horn antenna, vertical polarization.

270 deg/1 m								
1256.9	7.55	25.9	2.3	35.7	--	V	--	
1571.1	8.2	27.3	2.6	38.1	--	V	--	

No emissions were found above the receiver's noise floor to 3142.2 MHz.

Horizontal polarization.

294 deg/1 m								
1256.8	7.35	25.9	2.3	35.5	--	H	--	
1571.0	9.15	27.3	2.6	39	--	H	--	

No emissions were found above the receiver's noise floor to 3142.2 MHz.

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site
3 Meter Antenna Distance
Equipment Under Test:
BI Inc., M/N: HG200W
FCC ID: CSQHG200W,S/N: SFW001
Notes: Wrist-Mount Low Power RF Transmitter, Fresh 3.6 V Lithium Battery

Report B9075 Run 1
Date 03/08/99 Page 2
Engineer Eugene
Tech: S S Shawn Singh
Requester

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	Delta	Delta

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site Figure____ Report B9075 Run 1
3 Meter Antenna Distance Date 03/08/99 Page 3
Equipment Under Test: Engineer FJL JJL.
BI Inc., M/N: HG200W Tech: S S Shawn Singh
FCC ID: CSQHG200W,S/N: SFW001 Requester____
Notes: Wrist-Mount Low Power RF Transmitter, Fresh 3.6 V Lithium Battery

Measurement Summary

Frequency	----- Final -----		Azimuth	Polar\		Delta	Delta
MHz	dBuV/m	uV/m	deg	Height			
314.23	85.9	19724.	--	H	--		
628.43	54.8	549.54	--	H	--		
942.63	50.6	338.84	--	V	--		
1256.9	35.7	60.953	--	V	--		
1571.0	39	89.125	--	H	--		

File B9075 Run 1

RADIATED EMISSIONS

PW1 Test Site
3 Meter Antenna Distance
Equipment Under Test:
BI Inc., M/N: HG200W
FCC ID: CSQHG200W,S/N: SFW001
Notes: Wrist-Mount Low Power RF Transmitter, Fresh 3.6 V Lithium Battery

Report B9075 Run 2
Date 03/08/99 Page 1
Engineer FK FK.
Tech: S S Sharon Singh
Requester

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height		Delta FCC B	Delta

Investigating incorporated digital circuitry.

Bicon antenna, vertical polarization.

0 degrees azimuth, initial antenna height 1 meter.

30 - 200 MHz.

No emissions were found.

90 deg

No emissions were found.

180 deg

No emissions were found.

270 deg

No emissions were found.

Below frequencies are measured above the receiver's noise floor.

30.491	.45	14.5	.4	15.3	--	V	--	-24.7
40.683	3.15	13.1	.4	16.7	--	V	--	-23.3
60.479	5.9	10.9	.5	17.3	--	V	--	-22.7
69.784	2.05	9.5	.5	12.1	--	V	--	-27.9
79.742	.55	8.5	.5	9.6	--	V	--	-30.4
87.406	.8	8.5	.6	9.9	--	V	--	-30.1

Horizontal polarization.

0 degrees azimuth, initial antenna height 2.5 meters.

RADIATED EMISSIONS

PW1 Test Site — Report B9075 Run 2
3 Meter Antenna Distance — Date 03/08/99 Page 2
Equipment Under Test: — Engineer Bridge
BI Inc., M/N: HG200W — Tech: S S Shawn Singh
FCC ID: CSQHG200W,S/N: SFW001 — Requester
Notes: Wrist-Mount Low Power RF Transmitter, Fresh 3.6 V Lithium Battery

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	Delta FCC B	Delta
No emissions were found.								
90 deg								
No emissions were found.								
180 deg								
200	-5.35	14.5	.8	10	--	--	-33.5	

Above reading was a typing error. Deleted from summary list.

270 deg

No emissions were found.

Log periodic antenna, vertical polarization.

0 degrees azimuth, initial antenna height 1 meter.

200 - 1000 MHz.

No emissions were found.

90 degrees

No higher emissions were found.

180 deg

No emissions were found.

270 deg

No emissions were found.

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site
3 Meter Antenna Distance
Equipment Under Test:
BI Inc., M/N: HG200W
FCC ID: CSQHG200W,S/N: SFW001
Notes: Wrist-Mount Low Power RF Transmitter, Fresh 3.6 V Lithium Battery

Report B9075 Run 2
Date 03/08/99 Page 3
Engineer
Tech: S S Shawn Singh
Requester

Frequency MHz	Level dBuV	Factor dB	Cable dB	Final dBuV/m	Az deg	Polar\ Height	Delta FCC B	Delta

Horizontal polarization.

0 degrees azimuth

No emissions were found.

90 deg

No emissions were found.

180 deg

No higher emissions were found.

270 deg

No emissions were found.

T U V P R O D U C T S E R V I C E

RADIATED EMISSIONS

PW1 Test Site Figure____ Report B9075 Run 2
3 Meter Antenna Distance Date 03/08/99 Page 4
Equipment Under Test: Engineer Bcgc.
BI Inc., M/N: HG200W Tech: S S Shawn Singh
FCC ID: CSQHG200W,S/N: SFW001 Requester____
Notes: Wrist-Mount Low Power RF Transmitter, Fresh 3.6 V Lithium Battery

Measurement Summary

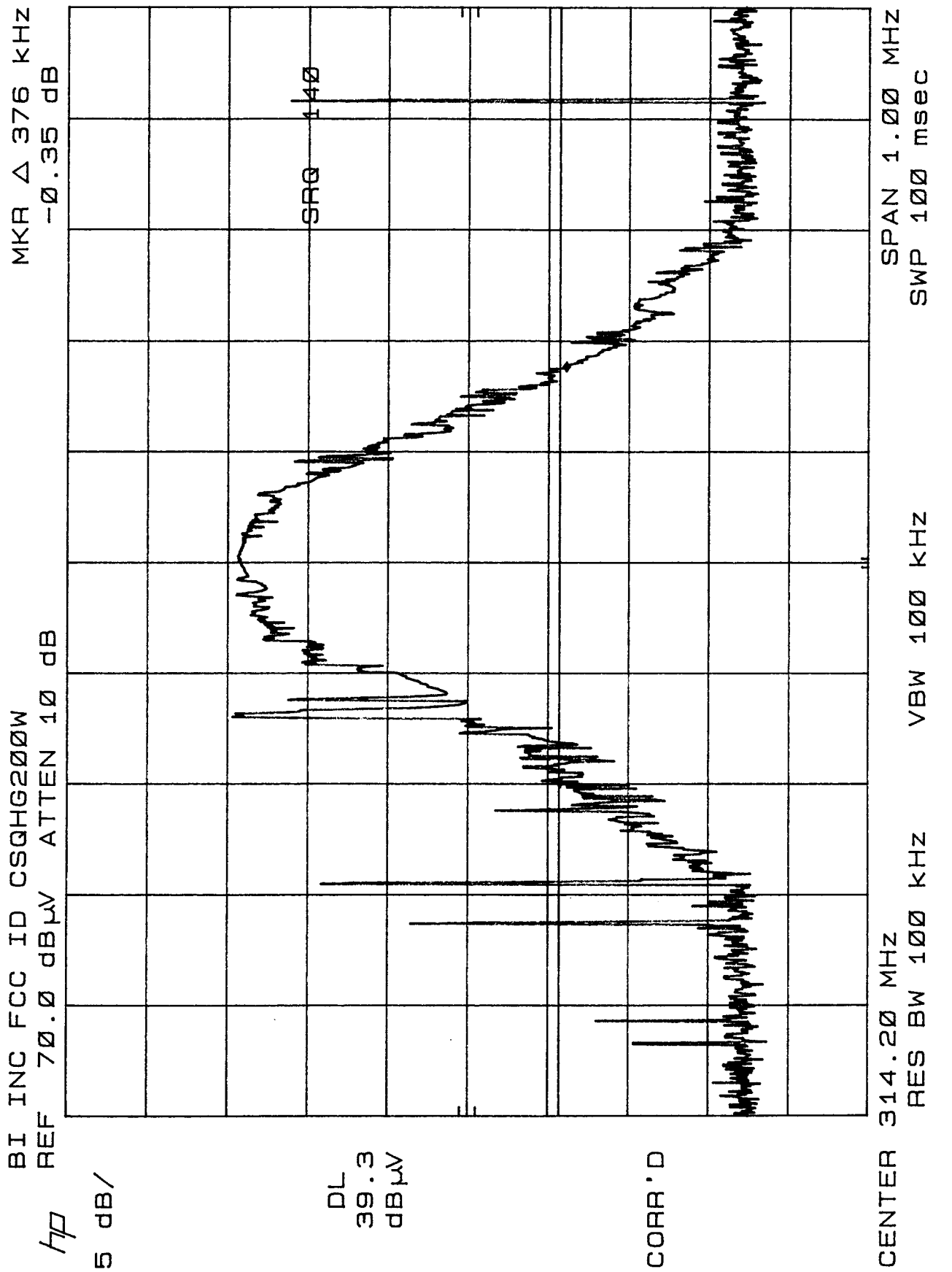
Frequency	----- Final -----		Azimuth	Polar\		Delta	Delta
MHz	dBuV/m	uV/m	deg	Height		FCC B	
30.491	15.3	5.8210	--	V	--	-24.7	
40.683	16.7	6.8391	--	V	--	-23.3	
60.479	17.3	7.3282	--	V	--	-22.7	
69.784	12.1	4.0271	--	V	--	-27.9	
79.742	9.6	3.0199	--	V	--	-30.4	
87.406	9.9	3.1260	--	V	--	-30.1	

Minimum Passing Margin for FCC B is 22.7 dB at 60.479 MHz

File B9075 Run 2

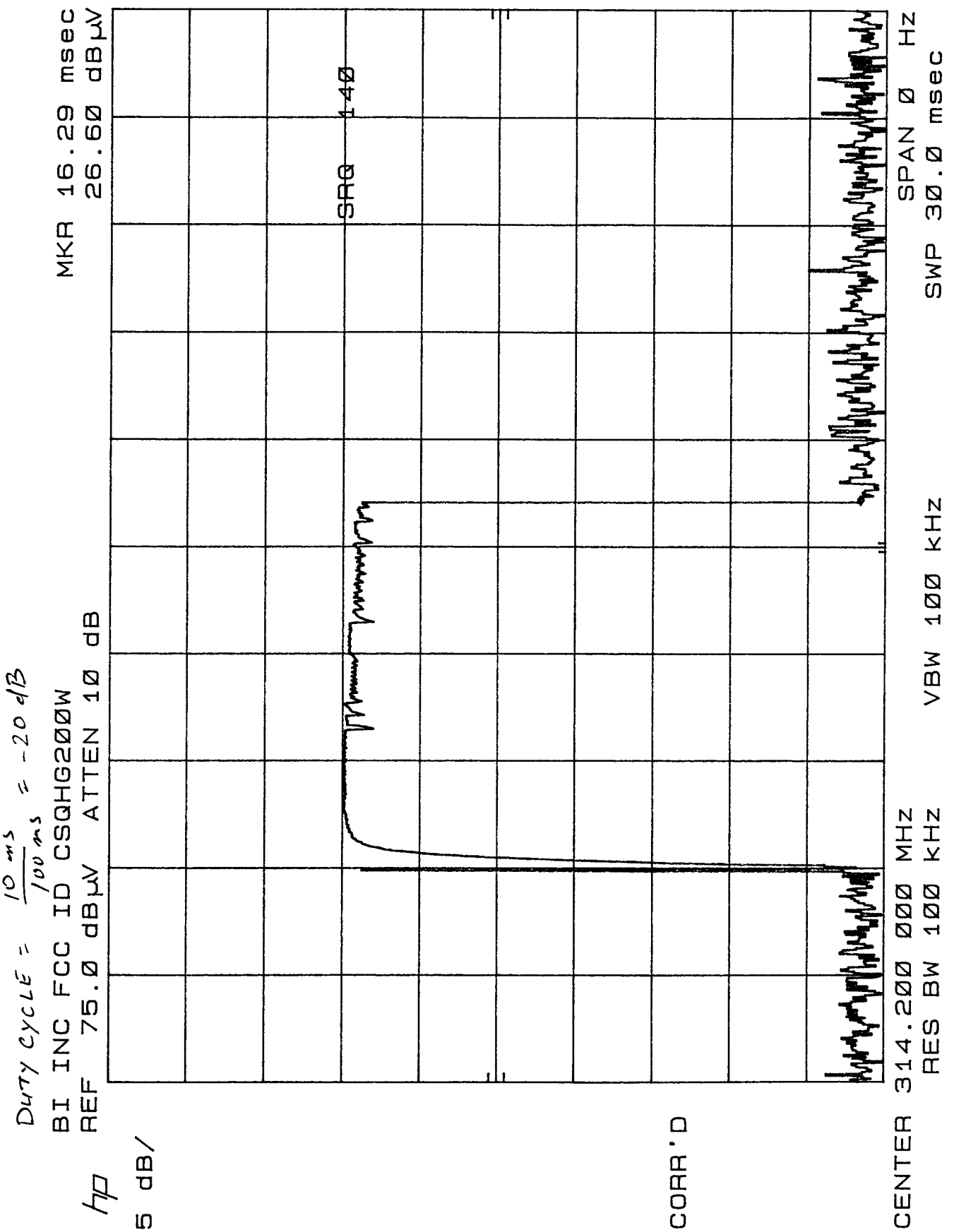
Appendix C

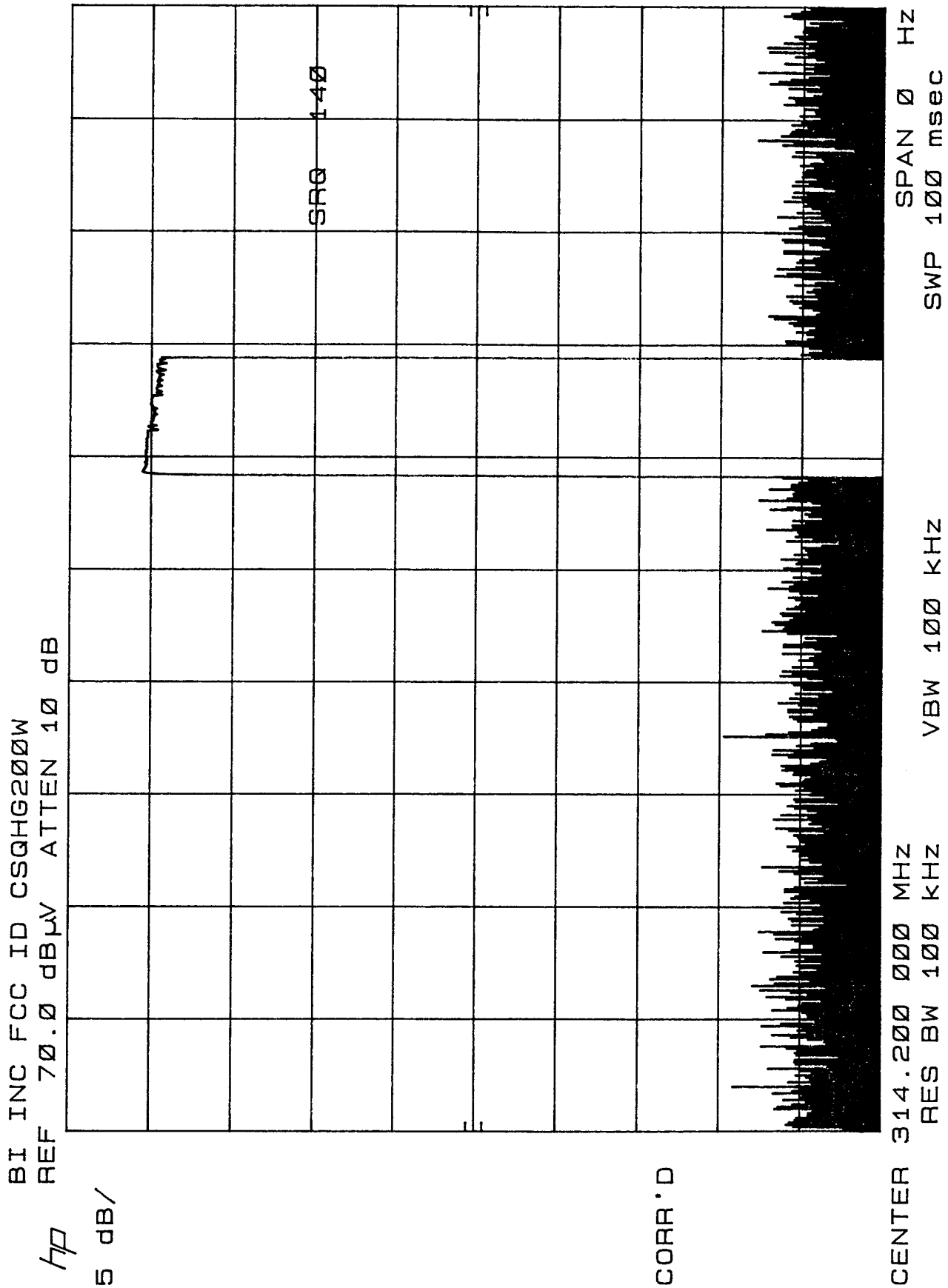
Plots of 20 dB Bandwidth


MKR Δ 376 kHz
-0.35 dB
SRQ 140
SPAN 1.00 MHz
SWP 100 msec
BI INC FCC ID CSQHG200W
REF 70.0 dBµV ATTEN 10 dB
VBW 100 kHz
5 dB/
DL
39.3
dBµV
CORR'D
CENTER 314.20 MHz
RES BW 100 kHz

Appendix D

Plots of Calculated Duty Cycle


MKR 16.29 msec
26.60 dBµV
SR0 140
SPAN 0 Hz
SWP 30.0 msec
Duty cycle = 10 ms / 100 ms = -20 dB
BI INC FCC ID CSQHG200W
REF 75.0 dBµV ATTEN 10 dB
VBW 100 kHz
5 dB/
CORR'D
CENTER 314.200 000 MHz
RES BW 100 kHz


BI INC FCC ID CSQHG200W
REF 70.0 dBµV ATTEN 10 dB
5 dB/
CORR'D
SRQ 140
CENTER 314.200 000 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 0 Hz
SWP 100 msec

Appendix E

Test Plan

and

Constructional Data Form

Test Plan
for Electromagnetic Compatibility Testing

General Information (if you need assistance completing this form contact your TÜV Product Service representative.)

Company:	**BI Inc.**	Quote Number:	**BI99301JM01**
Contact:	**Don Melton**	Phone: (business hrs)	**303-218-1031**
E-mail Address:	**dmelton@bi.com**	Phone: (after hrs)	**PGR: 303-546-3821**

Product Description

Description: **Wrist-Mount Low PowerRF Transmitter**

Model Number: **HG200W** Serial Number: **SFW001**

Test Objective

- ☐ EMC Directive 89/336/EEC (EMC)
- ☐ Machinery Directive 89/392/EEC (EMC
- ☐ Medical Device Directive 93/42/EEC (EMC)
- ☒ FCC ____ Part **15.231** (list)
- ☐ Vehicle Directive 72/245/EEC (EMC)
- ☐ FDA Reviewers Guidance for Premarket Notification Submissions (EMC)
- ☐ Other ____ (list)

Attendance

Test will be: ☒ Attended by the customer ☐ Unattended by the customer

Failure

If a failure occurs, TUV Product Service should:

- ☒ Call contact listed above, if not available then stop testing.
- ☐ Continue testing to complete test series.
- ☐ Continue testing to define corrective action.
- ☐ Stop testing.

Authorization

Donald A. Melton Customer authorization to perform tests according to this test plan.	**3 Mar 99** Date
Don Melton Test Plan Prepared By (please print)	**3 Mar 99** Date
Reviewed by TÜV Product Service Associate	3/14/99 Date

Test Plan
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

Equipment Under Test Transportation

☒ Transportation between sites by customer.
☐ Other (consult your TÜV Product Service representative)

Dimensions and Weight

Length **2.3"** Width **2.1"**

Height **.7"** Weight **<4 oz.**

Facilities

Power Requirements

☐	230 VAC 50 Hz	Single Phase	_____	Amps
☐	400 VAC 50 Hz	Three Phase	_____	Amps per phase
☐	120 VAC 60 Hz	Single Phase	_____	Amps
☐	208 VAC 60 Hz	Three Phase	_____	Amps per phase
☐	_____	VDC	_____	Amps
☒	Battery **3.6**	VDC	Expected life **4400**	hours
☐	Other			

Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)

Other

☐ Air _____ cfm _____ psi ☐ Water _____ gpm _____ psi
☐ Other _____ (describe)

Test Plan Attachments

Constructional *Data Form (CDF)* * The CDF is required for all test plans.
☒ Applicable (attached)

Immunity Test Plan Details
☐ Applicable (attached) ☐ N/A

Emissions Test Plan Details
☐ Applicable (attached) ☐ N/A

On Site Test Plan Details
☐ Applicable (attached) ☐ N/A

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

A completed form helps ensure that product testing will go smoothly. Add attachments as necessary for additional documentation. For additional help, please contact your TÜV Product Service Representative.

Applicant -- Enter company information pertaining to the location where the product is manufactured and for the manufacturer's contact soliciting the testing.

Company: **BI Inc.**

Address: **6400 Lookout Rd.**

Boulder CO 80301

Phone: **303-218-1031** Fax: **303-218-1250**

Contact: **Don Melton** Position: **Principal Engineer**

General Equipment Description -- Indicate which attachments you are providing with this document. It is recommended that you provide those listed.

Type of Equipment: **RF Transmitter** Model No.: **HG200W**

Serial No.: **N/A** FCC ID No.: **CSQHG200W**

General description: **RF transmitter intended to be worn primarily on a wrist. Application is Electronic House Arrest Monitoring. A receiver, generally located in the home, keeps track of the presence or absence of the transmitter and reports changes to a host computer via a communication link. The transmitter is powered by a single 350 ma-hr lithium thionyl chloride cell.**

Product Variant/Options: **N/A**

Attachments: (only required for certification)

☒ External Photographs ☒ Product Literature ☒ High Level Bill of Materials

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: **3/2/99** **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

Installation and Environmental Conditions (describe) -- Describe the intended installation. Include details such as power connection and system grounding approaches. Describe the intended operating environment, include details such as humidity, cooling, heating and hazardous environments. Attaching a copy of an Installation manual is recommended for proper documentation of your system. Please indicate.

Intended installation is attached with a companion strap to the wrist or ankle of a person on Electronic House Arrest. Unit is waterproof and can operate between 0 and 50 degrees C.

☐ Installation manual/instructions (attached, only required for certification)

Power Requirements -- Indicate your system power requirements for the equipment to be tested.

Rated Voltage **N/A** Rated Input Power **N/A**

Protection Class -- Indicate your product's protection class. Contact your TÜV Product Service representative and is only required for certification.

Type: **N/A** Class: **N/A**

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 3/2/99 **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

I/O Ports and Cables

Indicate all interface cables which can be attached to the equipment even if they are not sold as part of your system. Describe the port (e.g., Parallel, Serial, SCSI), list its type (e.g., AC, DC, Signal, Control) and number of ports/cables of type. Indicate if the I/O port is to be exercised during testing. List the type of transmission and if the cable is an EUT assembly-to-assembly interconnection cable (PC to printer, to modem). Indicate whether the cable is shielded or not, type of shield (e.g. Braid, Foil) and how terminated (e.g. 360 degree to conductive shell, pigtail) at both ends of the cable. If a cable can have a typical length of ≥ 3.0 meters, then it is required to test with a cable of at least 3.0 meters.

I/O Ports and Cables

Description: N/A

Type of Port: # of ports/cables of type

Exercised during testing? ☐ Yes ☐ No

Assembly ↔ Assembly Interconnect ☐ Yes ☐ No

Cable shielded: ☐ Yes ☐ No

Shield Type (describe)

Termination: (describe)

Transmission Type: ☐ Analog ☐ Digital

Length of cable: Maximum: Tested:

I/O Ports and Cables

Description: N/A

Type of Port: # of ports/cables of type

Exercised during testing? ☐ Yes ☐ No

Assembly ↔ Assembly Interconnect ☐ Yes ☐ No

Cable shielded: ☐ Yes ☐ No

Shield Type (describe)

Termination: (describe)

Transmission Type: ☐ Analog ☐ Digital

Length of cable: Maximum: Tested:

I/O Ports and Cables

Description: N/A

Type of Port: # of ports/cables of type

Exercised during testing? ☐ Yes ☐ No

Assembly ↔ Assembly Interconnect ☐ Yes ☐ No

Cable shielded: ☐ Yes ☐ No

Shield Type (describe)

Termination: (describe)

Transmission Type: ☐ Analog ☐ Digital

Length of cable: Maximum: Tested:

Press TAB to go to the next field. Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 3/2/99 **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

EUT configurations -- Provide a technical description of all possible EUT configurations. Specify if more than one configuration is to be tested.

Attached to an ankle or wrist with the companion strap, supplied by BI.

EUT Software and Operation Modes to be Tested -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. Consult with your TÜV Product Service Representative when typical operating modes are not practical. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H's. This pattern must be sent to the parallel port device, serial port device, and must be write/read/verified to each storage device. Monitors must display the H pattern, typically in white letters on a black background. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing.

General Description: (describe)	**Normal mode includes transmission of a data packet in pseudorandom timing intervals of several seconds to tens of seconds. A special test mode is included to transmit every 0.5 second to facilitate testing.**
Software Revision Level: (list and describe)	**N/A**
Operating modes to be tested: (list and describe)	**Normal mode includes transmission of a data packet in pseudorandom timing intervals of several seconds to tens of seconds. A special test mode is included to transmit every 0.5 second to facilitate testing. A typical strap will be attached to the EUT.**

☐ Operation manual/instructions (attached)

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 3/2/99 **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

System, Subsystem, Major Subassemblies or Internal Peripherals -- List and describe all system, subsystem, major subassemblies and all internal peripherals. This should include such things as an external monitor, parallel interface peripheral, serial interface peripheral, internal disk drives or internal circuit boards. It is recommended that circuit diagrams, assembly and subassembly drawings be attached. Please indicate.

Description	*Model #*	*Serial #*	*FCC ID #*
N/A			

☐ **Technical Drawings attached**

Interfacing Equipment and/or Simulators (which are not part of the EUT) -- List and Describe all equipment or peripherals that will be connected to the EUT. For FCC testing a minimum configuration is required. If you have questions about this minimum configuration contact your TÜV Product Service representative.

Description	*Model #*	*Serial #*	*FCC ID #*
N/A			

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 10/13/98 **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

TÜV PRODUCT SERVICE

EMC System Details -- List all frequencies and sub-harmonics which are 10kHz or above for such things as oscillators, horizontal line rate of monitors, and clock rates of incorporated OEM assemblies. List all power supplies. Indicate switching frequencies. List power line filters and indicate the manufacturer, model and location on EUT. Indicate all components used for high frequency noise reduction. (e.g., ceramic capacitor, 0.01µF, 1 ea. at C12 - C20).

Oscillator Frequencies

Frequency	*Sub-harmonics*	*EUT Location*	*Description of Use*
33.333kHz	continuous		.5sec wakeup; 120us bit width
2.454688 MHz	intermittent		X128 to generate 314.2MHz
314.2 MHz PLL	Intermittent		Carrier; from 2.454MHz
2MHz	Intermittent		uP clock

Power Supply

Frequency	*Manufacturer*	*Model #*	*Serial #*	*Type (list frequency)*
N/A				

Power Line Filters

Manufacturer	*Model #*	*Qty*	*Location on EUT*
N/A			

Critical EMI Components (Capacitors, ferrites, etc.)

Description	*Manufacturer*	*Part # or Value*	*Qty*	*Location on EUT*
None				

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: 10/13/98	Signature of Applicant:

Constructional Data Form
for Electromagnetic Compatibility Testing

Other EMI Critical Construction Detail -- Indicate any other measures taken to reduce high frequency noise, (e.g., grounding the circuit board on the right rear corner with 0.25" braid, 3 inches long to the chassis).

RF PLL IC and associated components are located inside a shield can to prevent feedback from the antennas to the low level control circuits.

Description of Enclosure -- Describe the principle materials of the enclosure (e.g., plastic, plastic with shielding material, metal, metal with specific shielding contact points, metal with paint on all surfaces).

Plastic

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: **10/13/98** **Signature of Applicant:**

Constructional Data Form
for Electromagnetic Compatibility Testing

System Configuration Block Diagram -- Provide a line drawing identifying the EUT, simulators, support equipment, I/O cables, power cables, and any other pertinent components to be used during testing. Use a dashed line to separate the equipment in the testing field versus equipment outside testing field.

Date and sign each page of the CDF. Original signatures must be present on each page.

Date: **Signature of Applicant:**

Appendix F

Measurement of Protocol

MEASUREMENT PROTOCOL FOR FCC

GENERAL INFORMATION

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of ±4.5 dB. The equipment comprising the test systems are calibrated on an annual basis.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into it's characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

CONDUCTED EMISSIONS

The final level, expressed in dBµV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dBµV and µV, the following conversions apply:

dBµV = 20(log µV)

µV = Inverse log(dBµV/20)

RADIATED EMISSIONS

The final level, expressed in dBµV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBµV) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example:

Frequency (MHz)	Level (dBµV)	+	Factor & Cable (dB)	=	Final (dBµV/m)	-	FCC B Limit (dBµV/m)	=	Delta FCC B (dB)
32.21	13.9	+	16.3	=	30.2	-	40.0	=	-9.8

DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 3142 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and peak or quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Average field strength levels were computed from the peak readings and duty cycle of the transmitter. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.