Advanced
Compliance Laboratory

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Electromagnetic Emission Compliance Test Report

Equipment Under Test (EUT)	GM8000
Model	GM8000
Applicant	Screening Eagle USA. Inc. 117 Corporation Drive Aliquippa, PA 15001
In Accordance With	FCC Part 15, Subpart F Industry Canada RSS-220 (Issue 1/2009)
Tested by	Advanced Compliance Laboratory, Inc. 210 Cougar Court Hillsborough, New Jersey 08844
Authorized by	Wei Li Lab Manager Signature
Date	April 2, 2024
AC Lab Report Number	0048-231113-02-FCC-IC

The test result in this report is supported and covered by the ANAB accreditation (Certificate No. AT-3288).

Table of Contents

Section 1. Summary of Test Results

Manufacturer: Screening Eagle USA. Inc.

Product Name: GM8000

Model/Parts No. : GM8000

FVIN: gpr_array_v5.5.1compliance
S/N: PT002

General: **All measurements are traceable to national standards**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15, Sub Part F and Industry Canada RSS-220 (Issue 1/2009).

☒New Submission ☒Production Unit

☐Class II Permissive Change ☐Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

"See Summary of Test Data"

ANAB LAB Certificate #: AT-3288

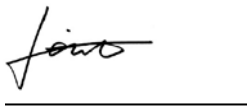
Summary of Test Data

Compliance Requirement	FCC & IC Rule Part	Test No. in Section 4	Result
Cross Reference	15.505 &RSS-GEN	1	Complies
Marketing of UWB Equipment	15.507 &RSS-GEN	2	Complies
Pulse Repetition Frequency(PRF)	15.509 &RSS-220 6.2	3	Complies
UWB Bandwidth	15.509(a) &RSS-220 6.2.1(a)	4	Complies
General Operational Requirements for LF Imaging System	15.509(b) &RSS-220 6	5	Complies
Spurious Radiated Emissions≤960MHz	15.509(d) 15.209 &RSS-220 3.4, 6.2(c), 6.2(d)	6	Complies
Spurious Radiated Emissions>960MHz	15.509(d) 15.209 &RSS-220 3.4, 6.2(c), 6.2(d)	7	Complies
Radiated Emissions in GPS Bands	15.509(e) 15.209 &RSS-220 6.2(e)	8	Complies
Highest Radiated Emission at f_M	15.509(f) 15.209 &RSS-220 6.2(g)	9	Complies
Technical Requirements Applicable to All UWB Devices	15.521	10	Complies
Coordination Requirement	15.525	11	N/A
Antenna Requirement	15.203& 15.204 &RSS-GEN 7.1.4	12	Complies
Radio Frequency Exposure	FCC OET Bulletin 65 &RSS-GEN	13	N/A
Conducted Emissions	15.507 &RSS-GEN	14	*
Transmission Duration	15.509(c) &15.519(a)(1)	15	Complies

***** NOT APPLICABLE to the EUT as it is a battery-powered device;

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	±2.36	±2.99	±1.83



Wei Li
Lab Manager
Advanced Compliance Lab

Date: April 2, 2024

Section 2. General Equipment & Test Configuration

2.1. EUT Specification

EUT	The GPR , Model No. **GM8000**, manufactured by Screening Eagle USA, is an SFCW radar system intended to be used in non-destructive testing and geophysical Surveying.
Supply Voltage	Power-over-Ethernet / External 12Vdc
Operating Frequency	GX1 Antenna: 500 – 3000 MHz GX2 Antenna: 30 – 750 MHz
-10dB UWB Bandwidth	GX1 HF Operation Mode: 826.4 MHz (36.0-862.4.0MHz) GX2 LF Operation Mode: 2,516.2MHz (497.8-3014.0MHz)
Modulation Type	OFDM SFCW
Peak Emissions in a 50 MHz Bandwidth	Max. peak emissions: GX1 HF 51.1dBuV/m (RBW=3MHz) @2,810MHz (-19.7dBm vs limit 0dBm)
Antenna	GX1 Antenna: 35 (VV) + 15 (HH) Lines GX2 Antenna: 11 (VV) Lines
Hardware Version	A0
Software Version	gpr_array_v5.5.1compliance / 0.1.1

2.2. Description of Operation

The system performs time domain reflectometry by radiating multiple radio frequencies CW from a transmitting dipole (TX dipole). Transitions between materials exhibiting different wave impedance through which the electromagnetic wave travels cause the wave to be reflected. These reflections are received by the receiving dipole (RX dipole) and sampled by the instrument. Results may be displayed in real time on the system

screen and recorded on an internal solid state disk drive for later analysis. In the field, the system is powered from the external 12Vdc.

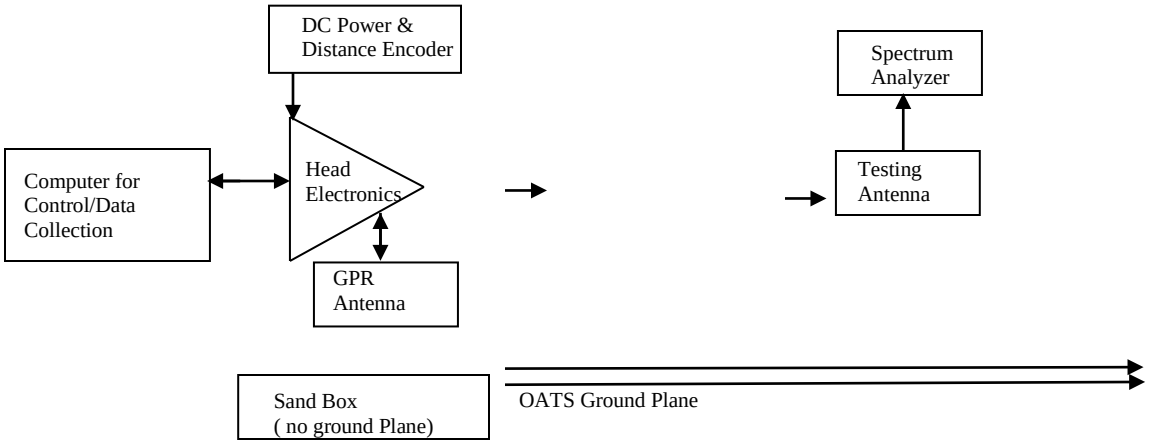
2.3. System Diagram

See Attachment provided by Applicant.

2.4. General EUT Setup

The EUT is operated in continuous transmission mode with the antennas permanently mounted in an all in one plastic housing with the controlling electronics and battery.

All measurements shall be made at room temperature and at nominal DC input voltage (provided by a battery). The EUT is placed directly on the dry sand with no ground plane under it.



2.5. Operational Frequency channel(s) for testing:

2.5. Operational Frequency channel(s) for testing:

- CPU Clock: 1.8GHz
- Other Clocks: 24MHz, 25MHz and 1GHz
- RF antenna frequencies for TX modulations:
  - GX1 Antenna: 500 – 3000 MHz
  - GX2 Antenna: 30 – 750 MHz

Antenna Data:

HF Antenna		LF Antenna	
Product Name:	GX1	Product Name:	GX2
Product Number:	393 60 260	Product Number:	393 60 250

Section 3. Test Methodology & Facilities

3.1 Measurement Procedure

The tests documented in this report were performed in accordance with ANSI C63.4 /C63.10, FCC CFR 47 Part 2 & 15, Industry Canada RSS-220 (Issue 1/2009) & FCC Order, ET Docket No. 980153(FCC02-08). Test procedure described in FCC "KDB 393764, UWB Compliance Measurements" is used in this report. The test methods used to generate the data is this test report is in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

In accordance with ANSI C63.10:2013, Section 10.2.2, the device under test was placed on a bed of dry sand and rotated through 16 azimuth angles (Clause 5.4) to determine which produced the highest emission relative to the limit. The azimuth that produced the highest emission relative to the limit was used for all radiated emission measurements.

3.2. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at Hillsborough, New Jersey, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 32. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods".

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at Hillsborough, New Jersey. This site is accepted by FCC to perform measurements under Part 15 or 18 (Registration # 185968, MRA designation No. US3288) and also designated by IC as " site IC 3130A". The ANAB Certificate Number for ISO/IEC 17025 accreditation is AT-3288 (expiry date: 2/27/2026).

3.3. Test and Measurement Equipment

The following test and measurement equipment was utilized for the tests documented in this report:

Manufacture	Model	Serial No.	Description	Cal Due dd/mm/yy
Hewlett-Packard	HP8546A	3448A00290	EMI Receiver	25/09/24
Agilent	E4440A	US40420700	3Hz-26.5GHz Spectrum Analyzer	17/06/24
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	15/01/25
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	15/01/25
EMCO	3115	4945	Double Ridge Guide Horn Antenna	22/01/25

All Test Equipment Used is Calibrated, Traceable to NIST Standards. 2 Year Interval.

Section 4. Measurement Data

Test No.1

Name of Test:	***Cross Reference***	**Test Standard:**	***15.505 &RSS-GEN***
Tested By:	WEI LI	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: 15.505(a)
Equipment under test complies with all the relevant and applicable requirements of Subpart A, Subpart B and Section 15.201 through 15.204 and Section 15.207 of Subpart C. 15.505(b)
The Digital circuitry portion of the EUT has been tested and verified to comply with 47 CFR Part 15, subpart B.

Method of Measurement: a) Except where specifically stated otherwise within this subpart, the provisions of Subparts A and B and of Sections 15.201 through 15.204 and Section 15.207 of Subpart C of this part apply to unlicensed UWB intentional radiators. The provisions of Sections 15.35(c) and 15.205 do not apply to devices operated under this subpart. The provisions of Footnote US 246 to the Table of Frequency Allocations contained in Section 2.106 of this chapter do not apply to devices operated under this subpart.

b) The requirements of Subpart F apply only to the radio transmitter, i.e., the intentional radiator, contained in the UWB device. Other aspects of the operation of a UWB device may be subject to requirements contained elsewhere in this chapter. In particular, a UWB device that contains digital circuitry not directly associated with the operation of the transmitter also is subject to the requirements for unintentional radiators in Subpart B of this chapter. Similarly, an associated receiver that operates (tunes) within the frequency range 30 MHz to 960 MHz is subject to the requirements in Subpart B of this chapter.

Test Result: **Complies**

Test Data: **Data and Plots**

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	David Tu
Temperature:	65°F
Humidity:	30%

Spurious Radiated Emissions from Digital Circuitry (RF off) complies with FCC Part 15.109 (Class A), measured per ANSI C63.4 with standard setup.

Mode: LF

Freq.* (MHz)	H,V	PK/QP Reading (dBuV/m)	Height (m)	Angle (degree)	Refer to Part 15.109 10m Limit (dBuV/m)	Margin (dB)	Result
54.0	H	21.8	1.8	180	39.1	-17.3	Pass
125.0	H	30.6	1.8	180	43.5	-12.9	Pass
144.5	H	23.7	1.8	090	43.5	-19.8	Pass
146.4	H	24.4	1.8	090	43.5	-19.1	Pass
187.5	H	25.7	1.6	045	43.5	-17.8	Pass
204.0	H	30.8	1.2	045	43.5	-12.7	Pass
224.0	H	30.4	1.2	090	46.0	-15.6	Pass
268.0	H	30.8	1.2	090	46.0	-15.2	Pass
288.0	H	27.8	1.2	090	46.0	-18.2	Pass
330.0	H	28.2	1.2	090	46.0	-17.8	Pass
353.5	H	34	1.2	270	46.0	-12	Pass
394.0	H	30	1.2	180	46.0	-16	Pass
460.0	H	28.5	1.2	180	46.0	-17.5	Pass
520.0	H	30.2	1.2	090	46.0	-15.8	Pass
584.0	H	29.7	1.2	090	46.0	-16.3	Pass
125.0	V	37.3	1.2	045	43.5	-6.2	Pass
135.0	V	25.5	1.2	045	43.5	-18	Pass
144.1	V	32	1.2	090	43.5	-11.5	Pass
146.4	V	34	1.2	090	43.5	-9.5	Pass
187.5	V	26.9	1.1	090	43.5	-16.6	Pass
204.0	V	27.7	1.1	090	43.5	-15.8	Pass
224.0	V	32.7	1.1	270	46.0	-13.3	Pass
350.0	V	28.9	1.1	270	46.0	-17.1	Pass
394.0	V	27.7	1.1	090	46.0	-18.3	Pass
456.0	V	28	1.1	090	46.0	-18	Pass
476.0	V	29.6	1.1	090	46.0	-16.4	Pass
536.0	V	28	1.1	090	46.0	-18	Pass
558.0	V	27.8	1.1	090	46.0	-18.2	Pass
584.0	V	28.1	1.1	000	46.0	-17.9	Pass
786.0	V	29.9	1.1	000	46.0	-16.1	Pass

*Quasi-peak reading. For emissions that have peak values close to (or over) the specification limit (if any) will be also measured in the quasi-peak or average mode to determine the compliance. No other significant emissions (comparing to Class A limit) are found in the rest frequency bands.

Mode: HF

Freq.* (MHz)	H,V	PK/ QP Reading (dBuV/ m)	Height (m)	Angle (degree)	Refer to Part 15.109 10m Limit (dBuV/m)	Margin (dB)	Result
125.0	H	31.2	1.6	180	43.5	-12.3	Pass
204.0	H	31.5	1.2	045	43.5	-12	Pass
224.0	H	30.0	1.2	090	46.0	-16	Pass
268.0	H	29.6	1.2	090	46.0	-16.4	Pass
353.5	H	34.5	1.2	270	46.0	-11.5	Pass
394.0	H	31.1	1.2	180	46.0	-14.9	Pass
460.0	H	29.3	1.2	180	46.0	-16.7	Pass
520.0	H	30.9	1.2	090	46.0	-15.1	Pass
584.0	H	31.5	1.2	090	46.0	-14.5	Pass
125.0	V	36.6	1.1	045	43.5	-6.9	Pass
144.1	V	33.0	1.1	090	43.5	-10.5	Pass
146.4	V	33.2	1.1	090	43.5	-10.3	Pass
224.0	V	33.4	1.1	270	46.0	-12.6	Pass
350.0	V	29.2	1.1	270	46.0	-16.8	Pass
476.0	V	30.3	1.1	090	46.0	-15.7	Pass
536.0	V	29.1	1.1	090	46.0	-16.9	Pass
558.0	V	28.0	1.1	090	46.0	-18	Pass
584.0	V	27.6	1.1	000	46.0	-18.4	Pass
786.0	V	28.8	1.1	000	46.0	-17.2	Pass

*Quasi-peak reading. For emissions that have peak values close to (or over) the specification limit (if any) will be also measured in the quasi-peak or average mode to determine the compliance. No other significant emissions (comparing to Class A limit) are found in the rest frequency bands.

Test No.2

Name of Test:	***Marketing of UWB Equipment***	**Test Standard:**	***15.507 &RSS-GEN***
Tested By:	WEI LI	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: 15.507/ 2.909
The responsible party is properly informed about the responsible for ensuring that the equipment is marketed only to eligible parties, and provide correct information on the customers and users.
(See Important note for the US customers of the Installation Guide and User Manual)

Method of Measurement: In some cases, the operation of UWB devices is limited to specific parties, e.g., law enforcement, fire and rescue organizations operating under the auspices of a state or local government. The marketing of UWB devices must be directed solely to parties eligible to operate the equipment. The responsible party, as defined in Section 2.909 of this chapter, is responsible for ensuring that the equipment is marketed only to eligible parties. Marketing of the equipment in any other manner may be considered grounds for revocation of the grant of certification issued for the equipment.

Test Result: **Complies**

Test Data: **NA**

Test No.3

Name of Test:	***Pulse Repetition Frequency (PRF)***	**Test Standard:**	***15.509(d) &RSS-220 6.2***
Tested By:	WEI LI	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: Definition:
Pulse Repetition Frequency (PRF) is the trigger repetition frequency.

Method of Measurement: Tested at 3-meter OATS per ANSI C63.4
Spectrum Analyzer Settings:
RBW: 30KHz
VBW: ≥RBW
Detector: Peak
Span: As required
Sweep: Auto

Test Result: **Complies**

Test Data:

Test No.4

Name of Test:	***UWB Bandwidth***	**Test Standard:**	***15.509(a) 15.503(a) &RSS-220 6.2.1(a)***
Tested By:	WEI LI	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard:

Definition:

The bandwidth of a UWB emission is defined by the points on the emission spectrum where the amplitude is 10 dB below the maximum emission amplitude (i.e., the -10 dB points), as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M. The center frequency f_C, equals $(f_H + f_L)$ /2. The fractional bandwidth equals $2 * (f_H – f_L) / (f_H + f_L)$.

In cases where the measured emission spectrum contains multiple (more than two) -10 dB points, the outermost points define the bandwidth (i.e., the widest bandwidth is assumed).

Limits:

The UWB bandwidth of an imaging system operating under the provisions of this section must be below 10.6 GHz and meet the UWB signal BW requirements: BW is greater than 500MHz and/or fraction BW is greater than 0.2.

Method of Measurement:

Tested at 3-meter OATS per ANSI C63.4
Spectrum Analyzer Settings:
RBW: 1MHz
VBW: 3MHz
Detector: Peak
Span: As required (to display a full spectrum of the RF emission)
Sweep: Auto

Test Procedure:
1) The receiving antenna which varied from 1 to 4 m to find the highest emission is positioned 3 m away from the EUT.
2) Measure the Highest radiated emission at f_M as described in the test No. 9.
3) Recorded the upper and lower frequency that are at the side of the band bounded by the points at 10 dB below the highest radiated UWB emission level. Measuring the bandwidth of a UWB device using a radiated test set-up, it is imperative that appropriate adjustments be made to the measured amplitude levels to account for the frequency-dependent components of the measurement system (e.g., antenna gain or factor, pre-amplifier gain, cable loss, etc). Since UWB emissions can have bandwidths several GHz wide, these frequency-dependent characteristics can vary dramatically over the fundamental emission. According to the nature of the broadband emission characteristics, significant care must be taken to capture the true spectrum of emission, extremely narrow sweep widths is recommended.
4) The UWB bandwidth is the different of the upper and lower frequency recorded.

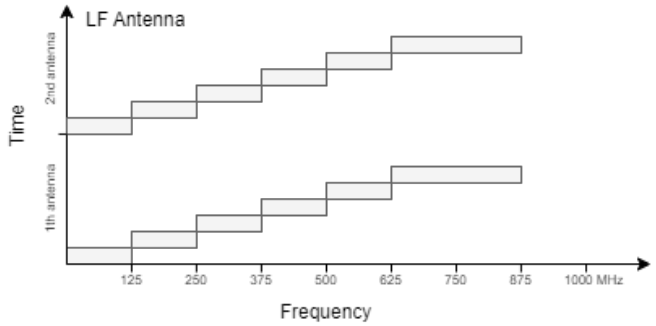
Test Result: **Complies**

Test Data: **Data and Plots**

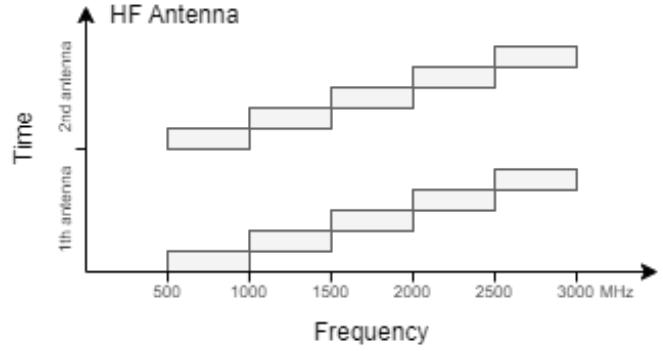
Note:
UBW measurement consideration according to EUT transmission features described in its Operational Description file:

To measure the full bandwidth (up to 750MHz for LF and 3000MHz for HF), the offset frequency of the OFDM must be shifted in order to meet the FCC restrictions.

In the LF mode, the OFDM bandwidth is 125MHz for first 5 blocks and the last block is extended to 250MHz modulation bandwidth.



In the HF mode, the OFDM bandwidth is set for 500MHz for each block.



Fraction BW Test Result Summary given as follow

LF Mode:

Tx Block	-10dB Bandwidth (MHz)	FBW
0-125	87.3	1.10
125-250	104.7	0.54
250-375	121.6	0.39
375-500	122.5	0.28
500-625	122.0	0.22
625-760	145.3	0.21

HF Mode:

Tx Block	-10dB Bandwidth (MHz)	FBW
500-1000	492.9	0.66
1000-1500	504.5	0.40
1500-2000	501.2	0.29
2000-2500	481.3	0.21
2500-3010	521.0	0.19

Meet limit: The Fraction Bandwidth shall be greater than 0.2 or the bandwidth greater than 500MHz.

Measurement Data (Values in MHz):

A. LF Mode: LF ANTENNA

LF: Tx Block #1

f_M	The highest emission peak	104.8
f_L	10 dB below the highest peak	36
f_H	10 dB above the highest peak	123.3
f_C	Calculated: $(f_H + f_L)/2$	79.65
Bandwidth	Calculated: $(f_H - f_L)$	87.3
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	1.10

LF: Tx Block #2

f_M	The highest emission peak	245.6
f_L	10 dB below the highest peak	142
f_H	10 dB above the highest peak	246.7
f_C	Calculated: $(f_H + f_L)/2$	194.35
Bandwidth	Calculated: $(f_H - f_L)$	104.7
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.54

LF: Tx Block #3

f_M	The highest emission peak	323
f_L	10 dB below the highest peak	247.8
f_H	10 dB above the highest peak	369.4
f_C	Calculated: $(f_H + f_L)/2$	308.6
Bandwidth	Calculated: $(f_H - f_L)$	121.6
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.39

LF: Tx Block #4

f_M	The highest emission peak	491.8
f_L	10 dB below the highest peak	370.6
f_H	10 dB above the highest peak	493.1
f_C	Calculated: $(f_H + f_L)/2$	431.85
Bandwidth	Calculated: $(f_H - f_L)$	122.5
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.28

LF: Tx Block #5

f_M	The highest emission peak	557
f_L	10 dB below the highest peak	493.5
f_H	10 dB above the highest peak	615.5

f_C	Calculated: $(f_H + f_L)/2$	554.5
Bandwidth	Calculated: $(f_H - f_L)$	122
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.22

LF: Tx Block #6

f_M	The highest emission peak	681
f_L	10 dB below the highest peak	616.7
f_H	10 dB above the highest peak	762
f_C	Calculated: $(f_H + f_L)/2$	689.35
Bandwidth	Calculated: $(f_H - f_L)$	145.3
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.21

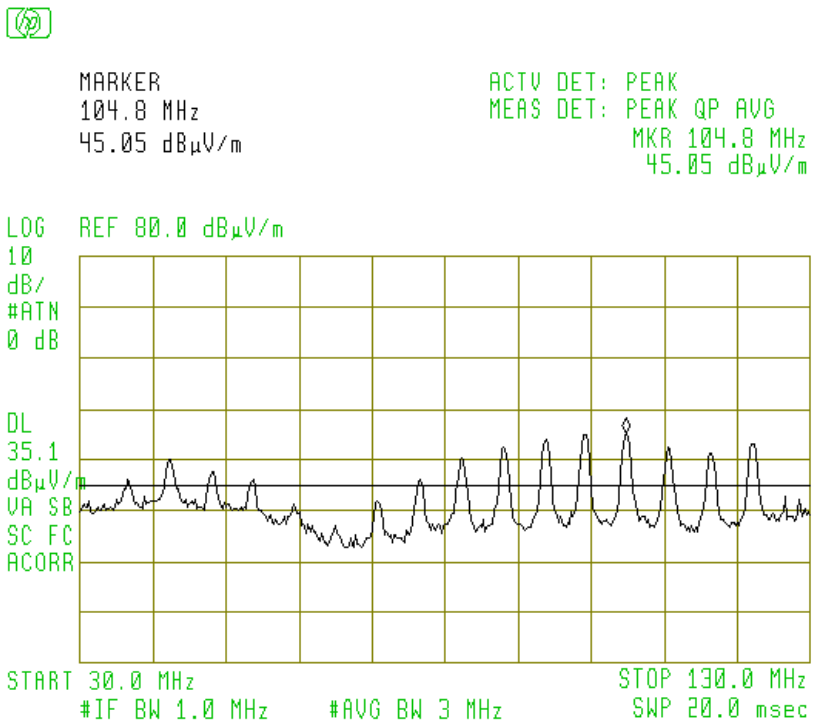
Note: The Fraction Bandwidth shall be greater than 0.2 or the bandwidth greater than 500MHz

Measurement Plots:

Mode: LF ANTENNA, Tx Block 1: 30MHz-125MHz

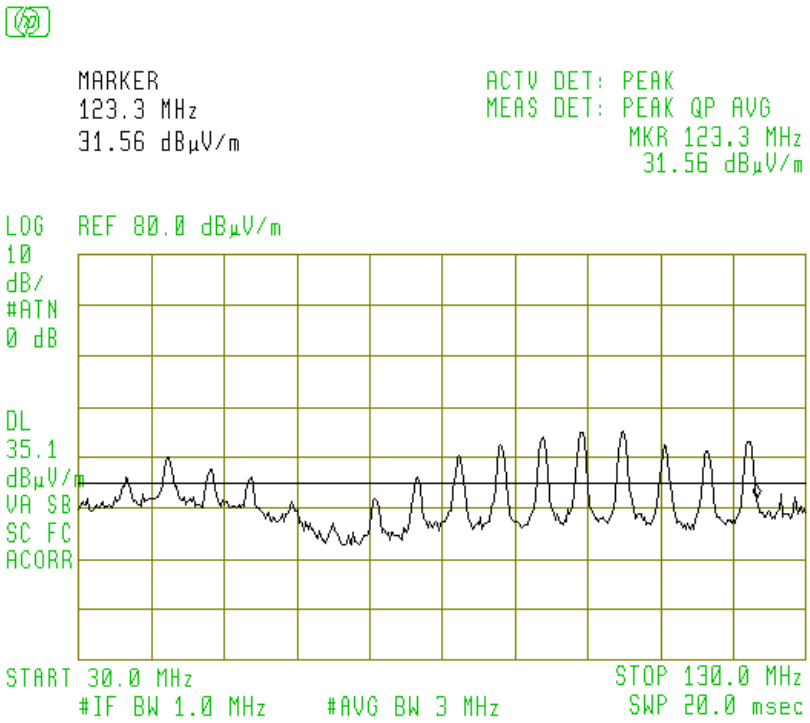
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



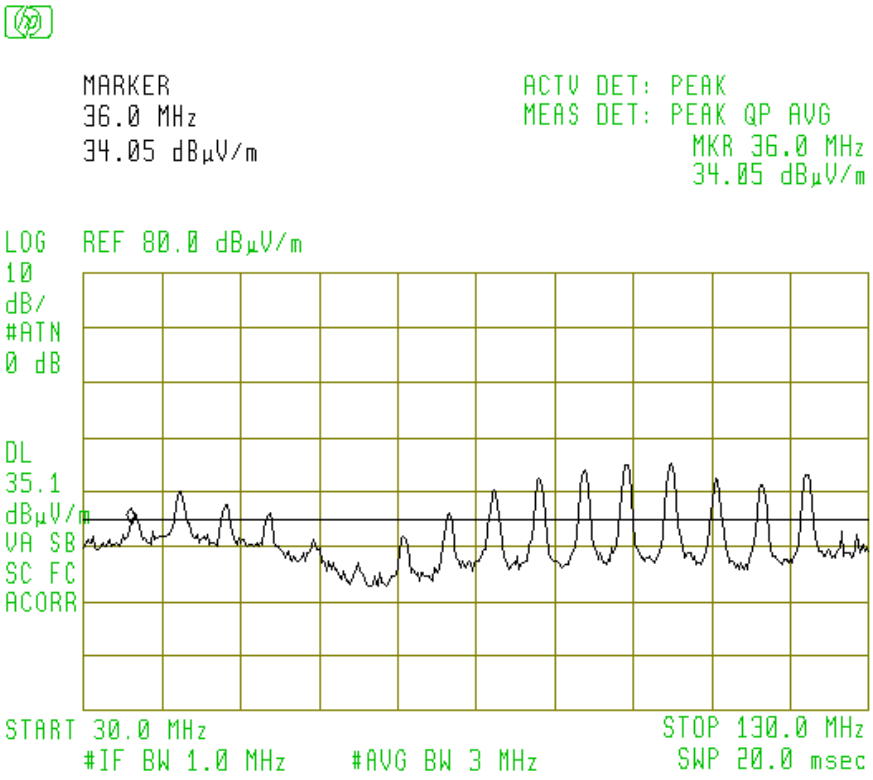
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation

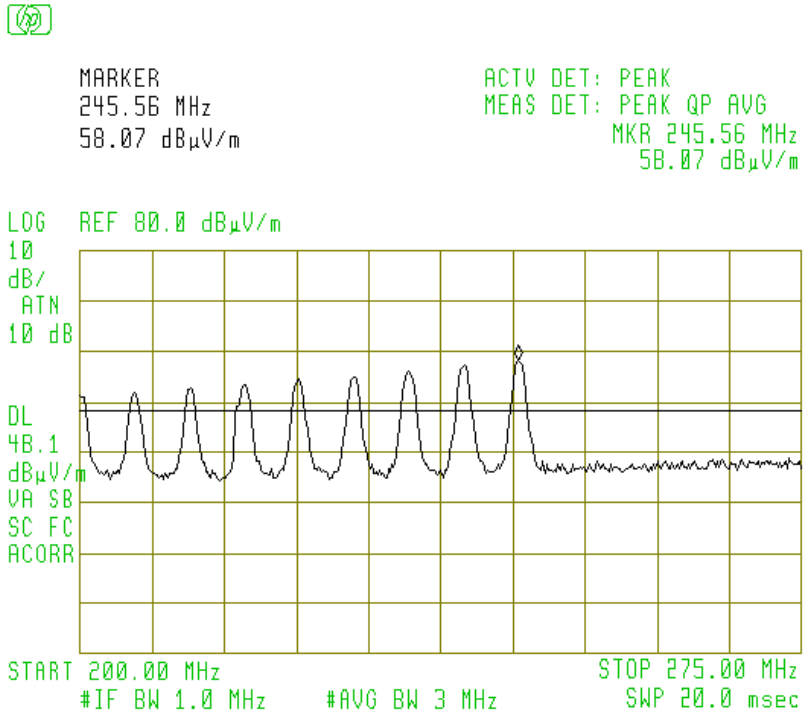


Measurement Plots:

Mode: LF ANTENNA, Tx Block 2: 125MHz-250MHz

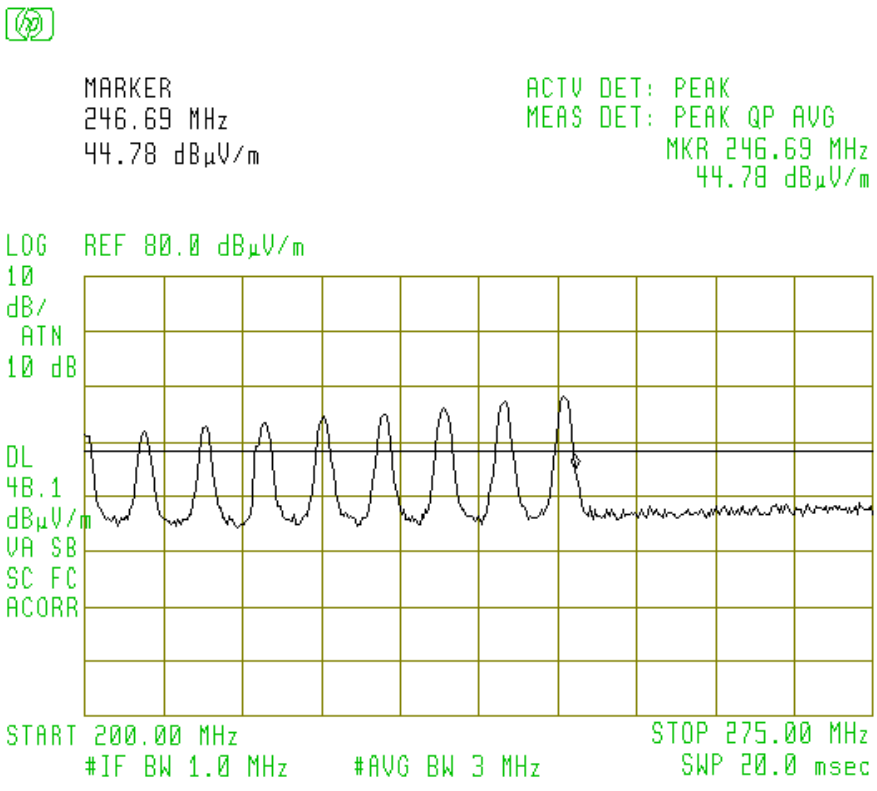
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



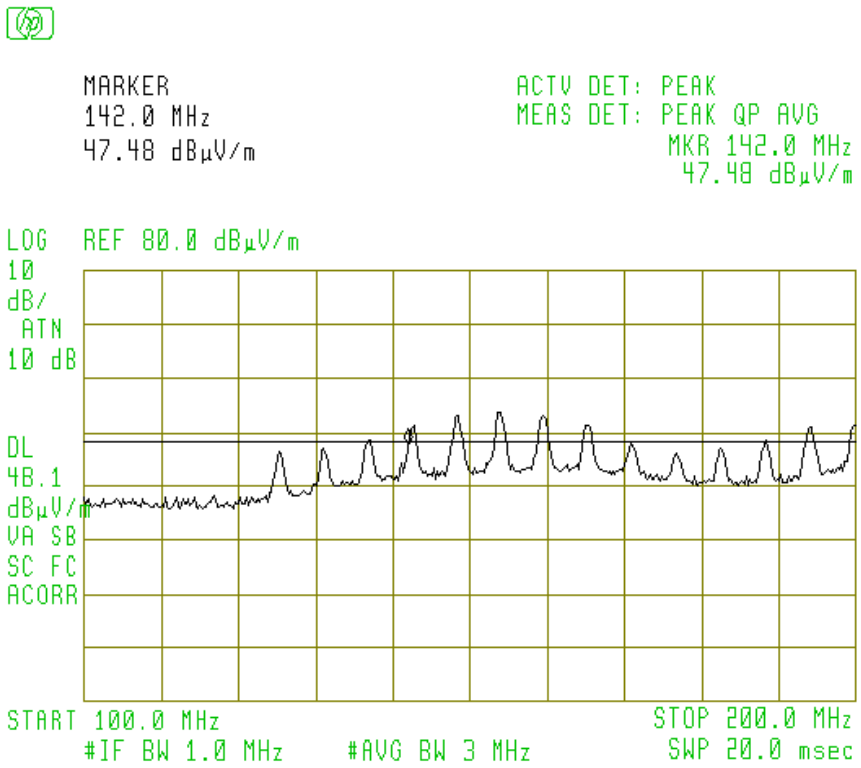
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation

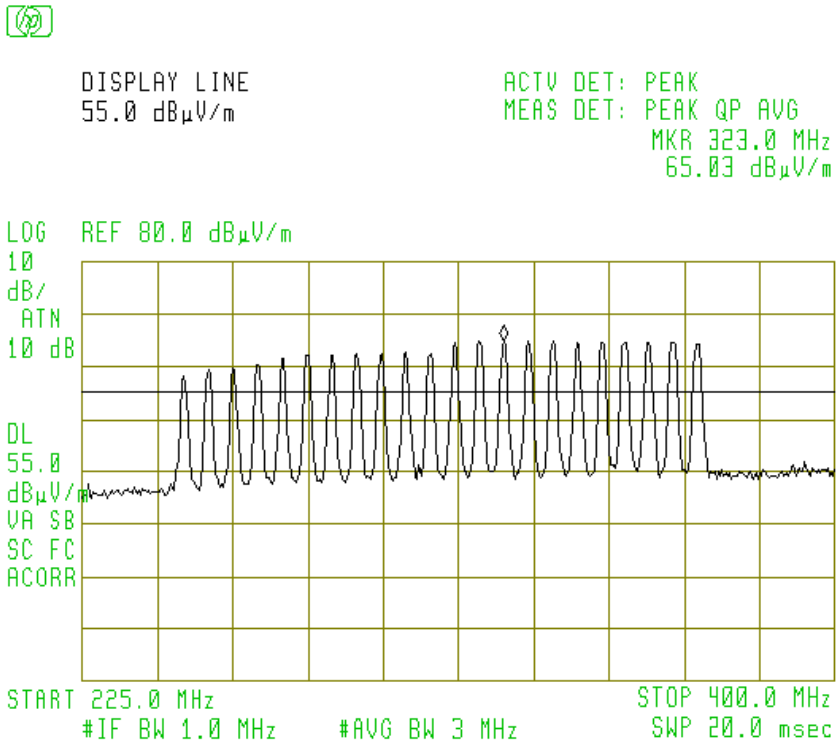


Measurement Plots:

Mode: LF ANTENNA, Tx Block 3: 250MHz-375MHz

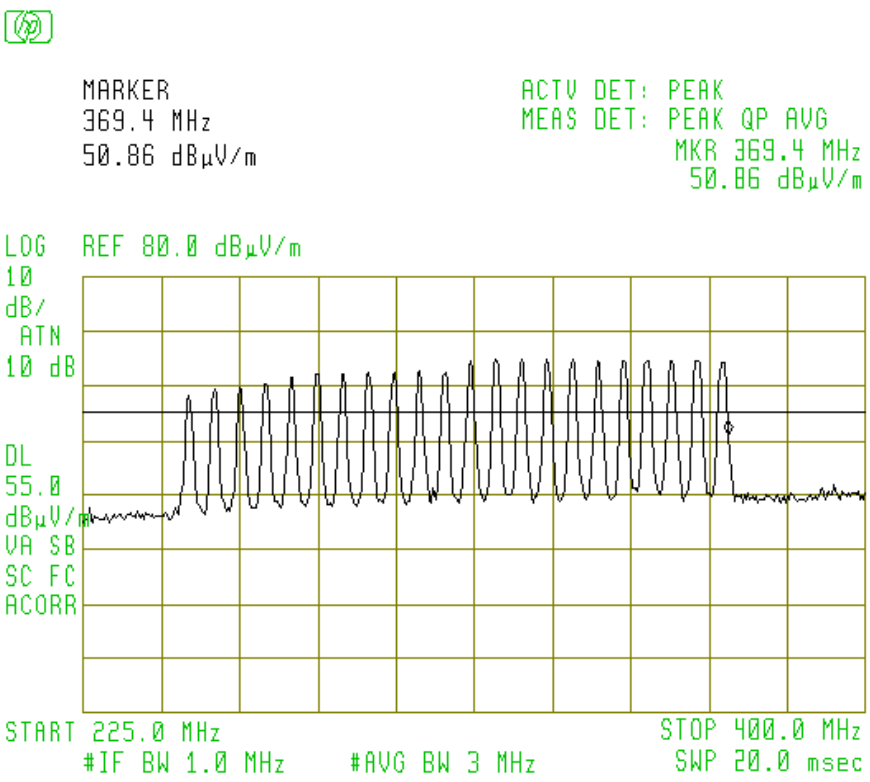
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



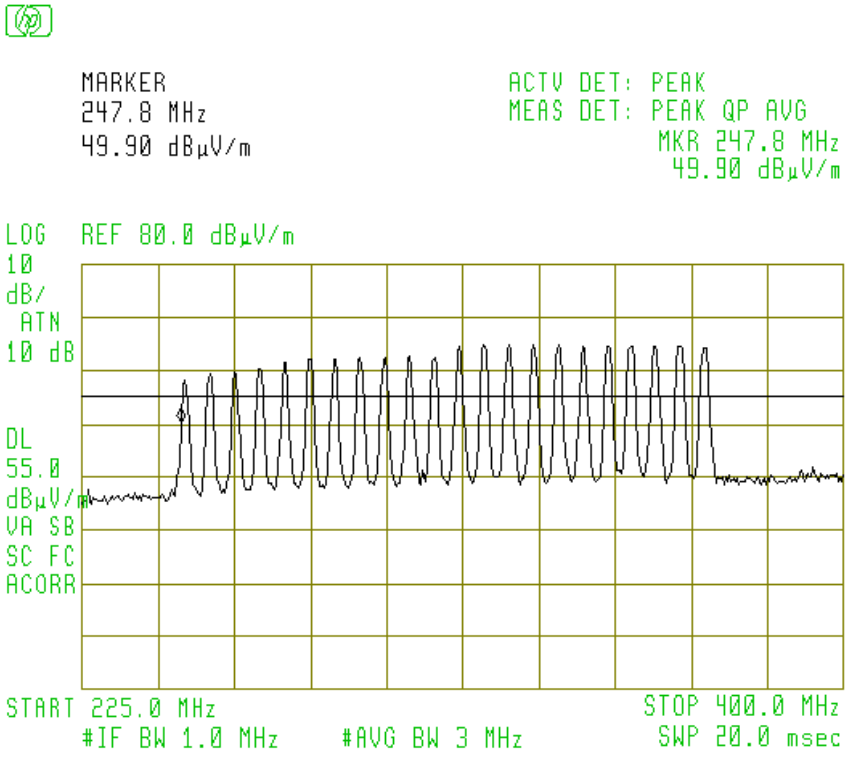
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation

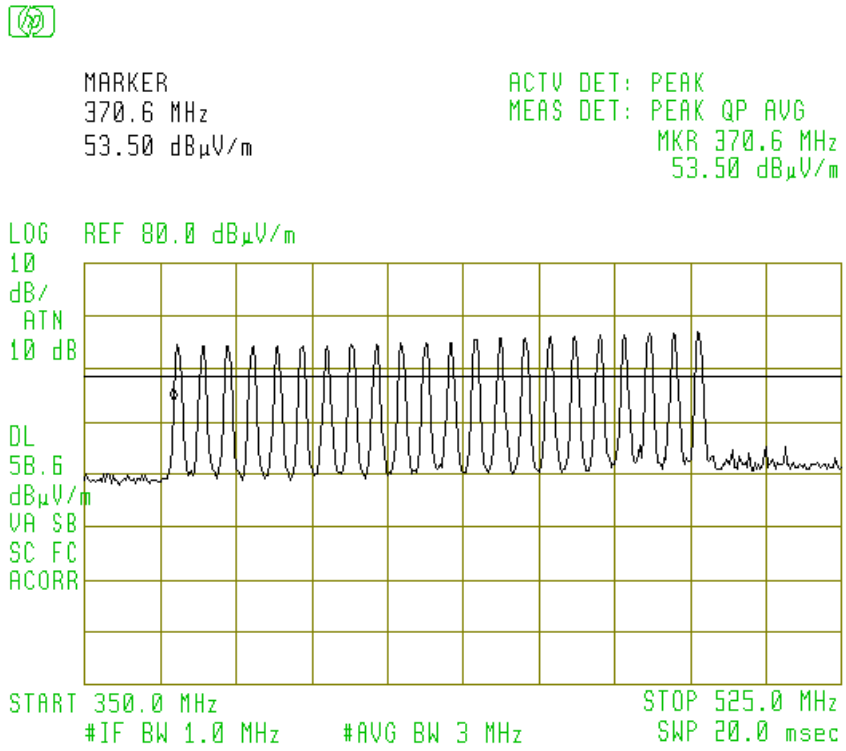


Measurement Plots:

Mode: LF ANTENNA, Tx Block 4: 375MHz-500MHz

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation

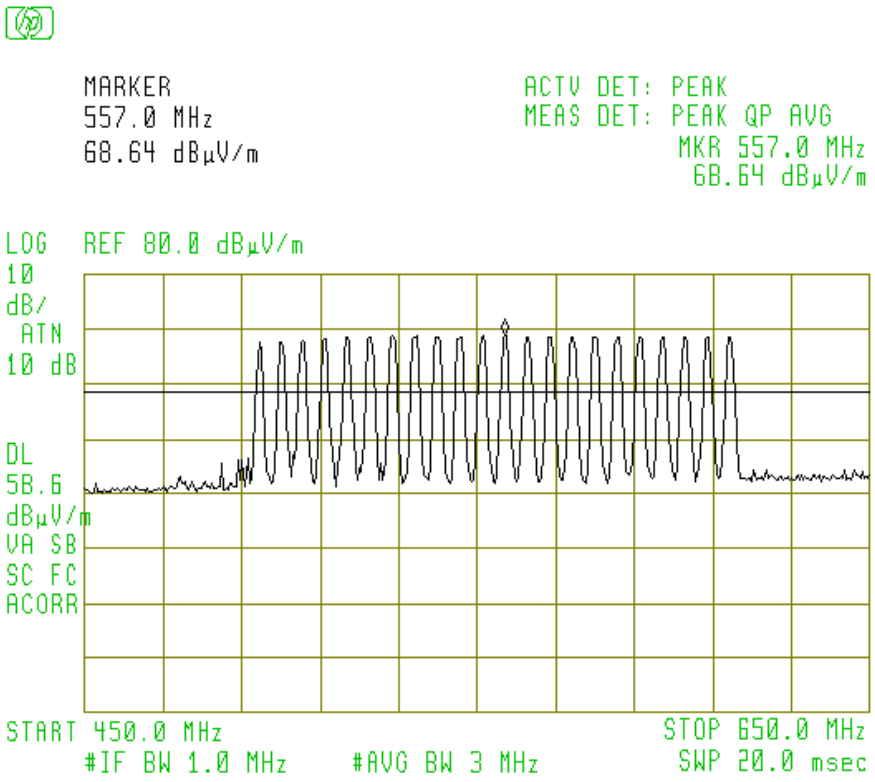


Measurement Plots:

Mode: LF ANTENNA, Tx Block 5: 500MHz-625MHz

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation

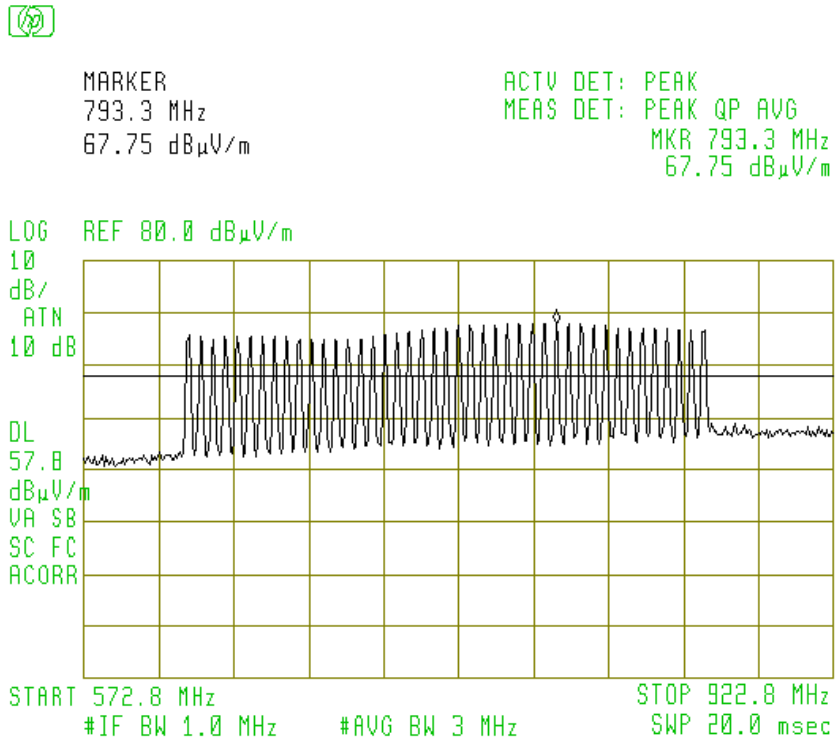


Measurement Plots:

Mode: LF ANTENNA, Tx Block 6: 625MHz-760NHz

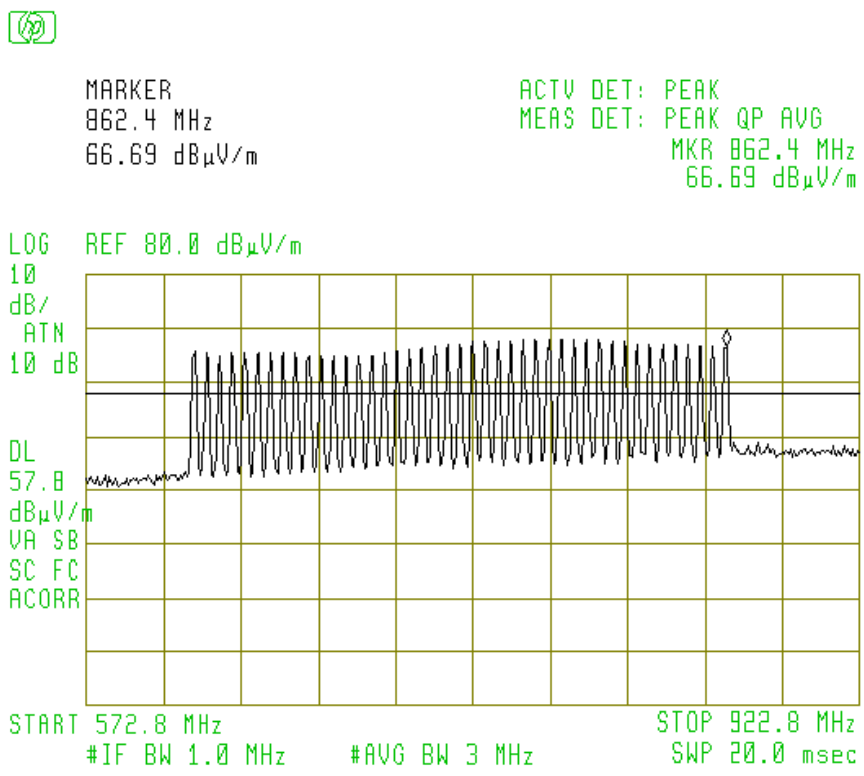
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



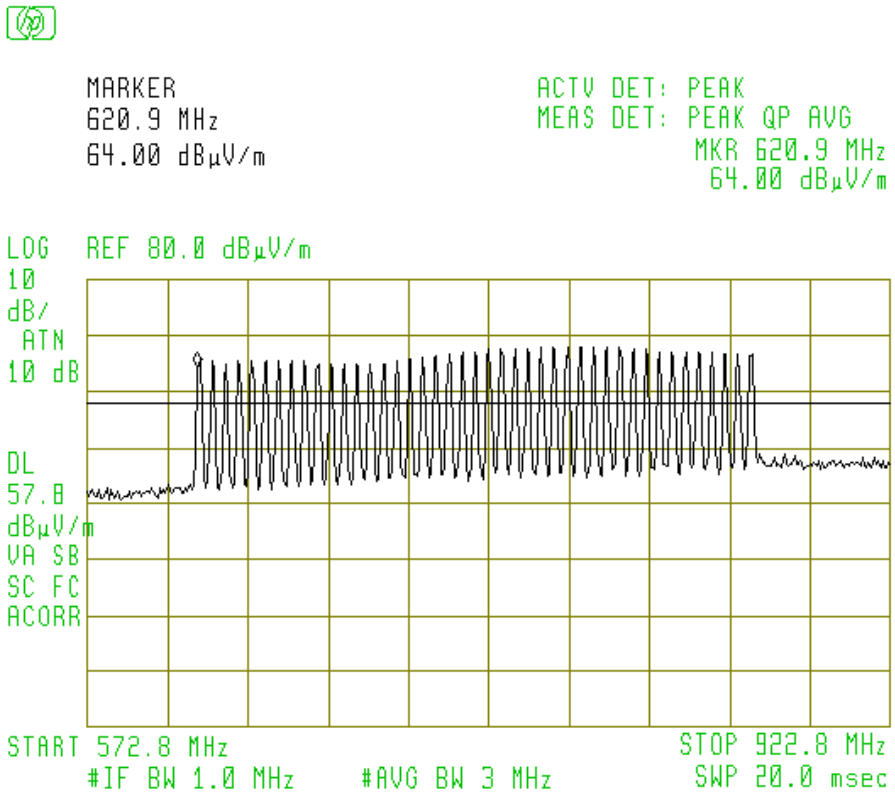
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ LF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation



Measurement Data (Values in MHz):

B. HF Mode: HF ANTENNA

HF: Tx Block #1

f_M	The highest emission peak	998.1
f_L	10 dB below the highest peak	497.8
f_H	10 dB above the highest peak	990.7
f_C	Calculated: $(f_H + f_L)/2$	744.25
Bandwidth	Calculated: $(f_H - f_L)$	492.9
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.66

HF: Tx Block #2

f_M	The highest emission peak	1303.2
f_L	10 dB below the highest peak	995.4
f_H	10 dB above the highest peak	1499.9
f_C	Calculated: $(f_H + f_L)/2$	1247.65
Bandwidth	Calculated: $(f_H - f_L)$	504.5
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.40

HF: Tx Block #3

f_M	The highest emission peak	1615.6
f_L	10 dB below the highest peak	1497.3
f_H	10 dB above the highest peak	1998.5
f_C	Calculated: $(f_H + f_L)/2$	1747.9
Bandwidth	Calculated: $(f_H - f_L)$	501.2
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.29

HF: Tx Block #4

f_M	The highest emission peak	2240
f_L	10 dB below the highest peak	2005
f_H	10 dB above the highest peak	2486.3
f_C	Calculated: $(f_H + f_L)/2$	2245.65
Bandwidth	Calculated: $(f_H - f_L)$	481.3
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.21

HF: Tx Block #5

f_M	The highest emission peak	2865
f_L	10 dB below the highest peak	2493

f_H	10 dB above the highest peak	3014
f_C	Calculated: $(f_H + f_L)/2$	2753.5
Bandwidth	Calculated: $(f_H - f_L)$	521
Fractional BW	Calculated: $2*(f_H - f_L)/(f_H + f_L)$	0.19

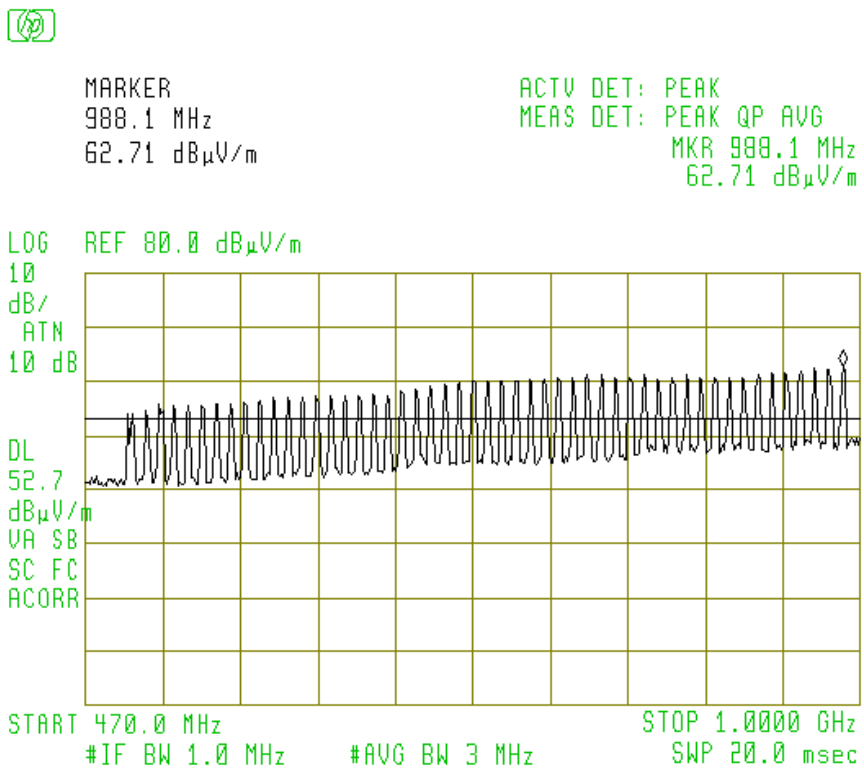
Note: The Fraction Bandwidth shall be greater than 0.2 or the bandwidth greater than 500MHz

Measurement Plots:

Mode: HF ANTENNA, Tx Block 1: 500MHz-1GHz

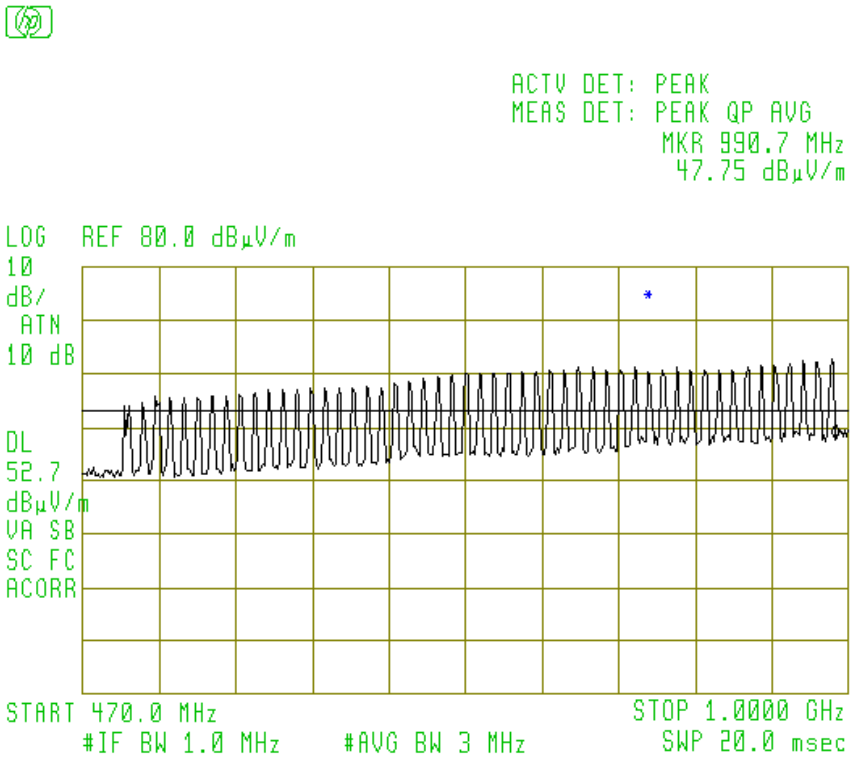
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



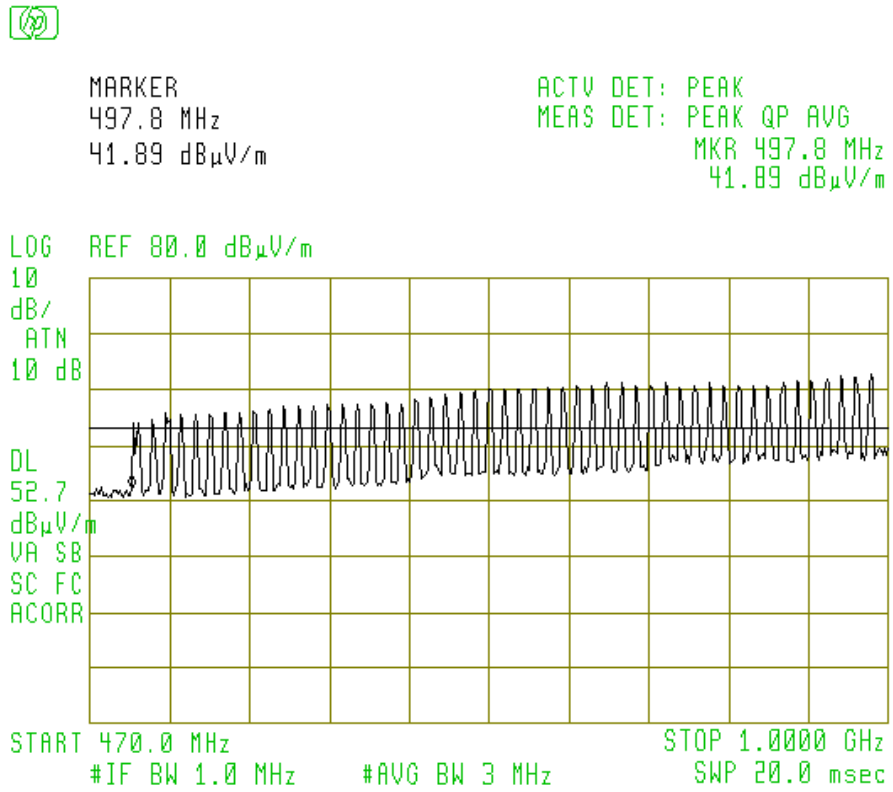
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation

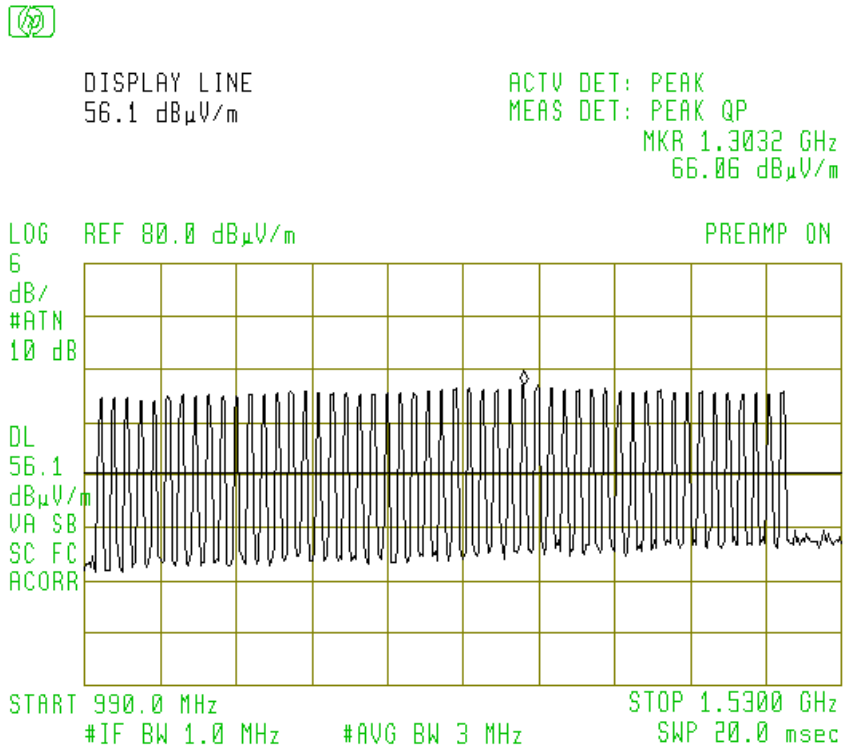


Measurement Plots:

Mode: HF ANTENNA, Tx Block 2: 1 GHz -1.5 GHz

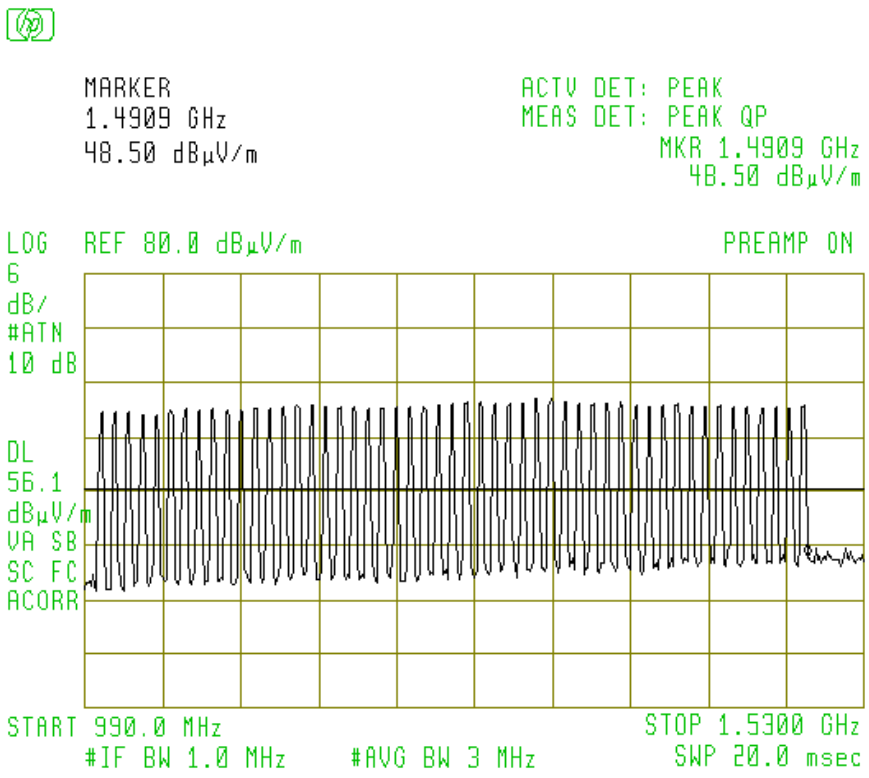
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



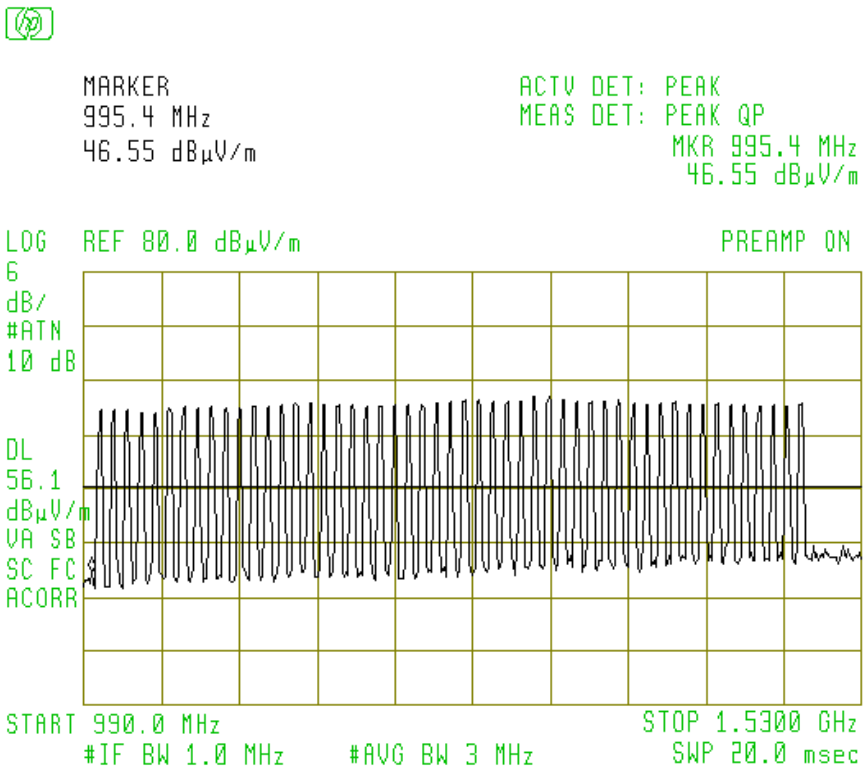
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation

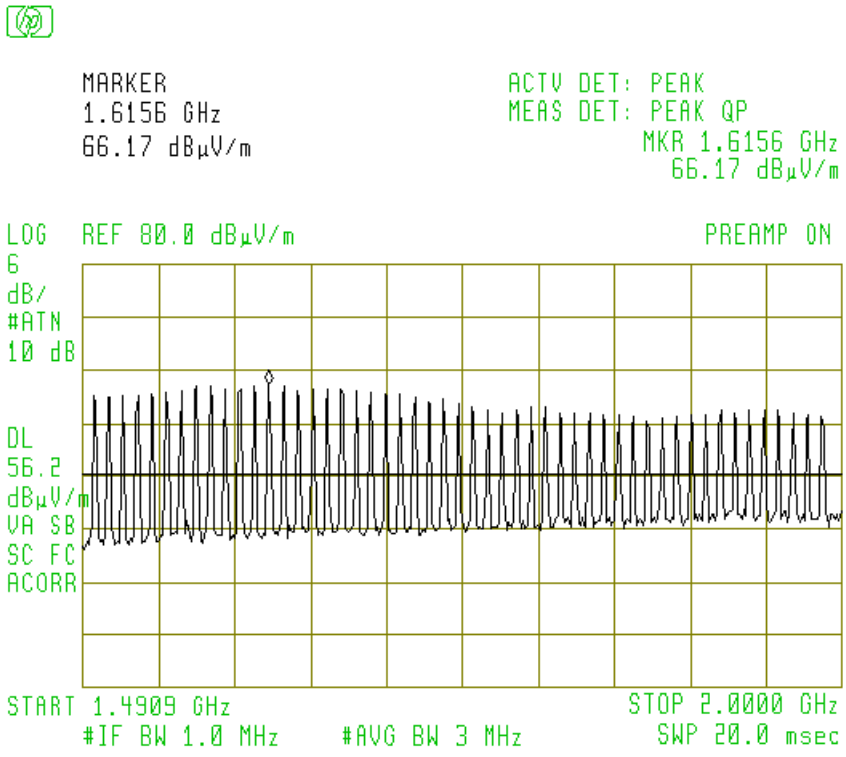


Measurement Plots:

Mode: HF ANTENNA, Tx Block 3: 1.5 GHz -2.0 GHz

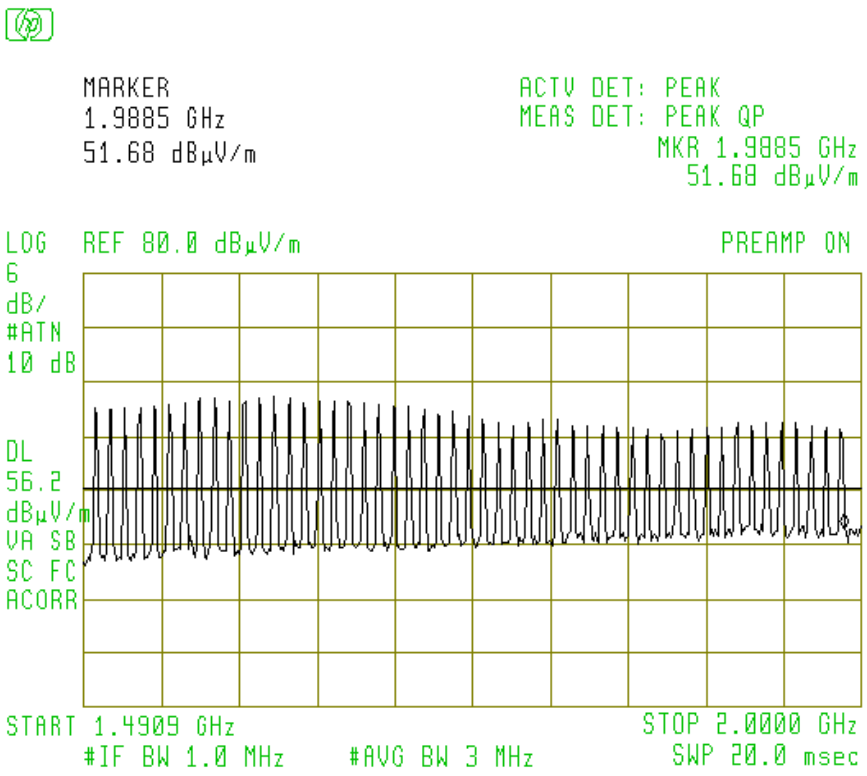
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



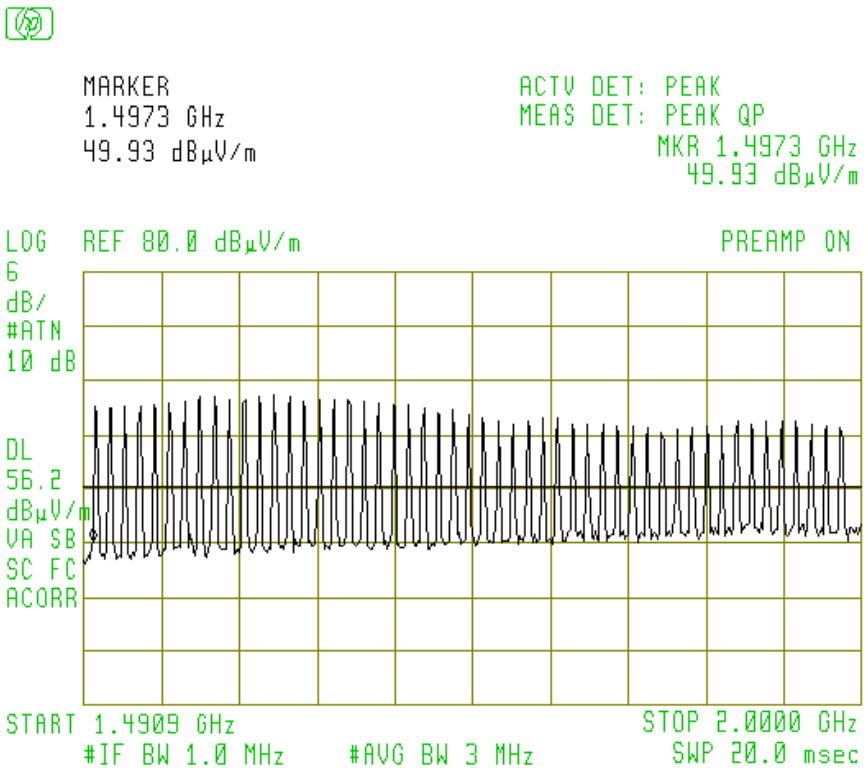
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation

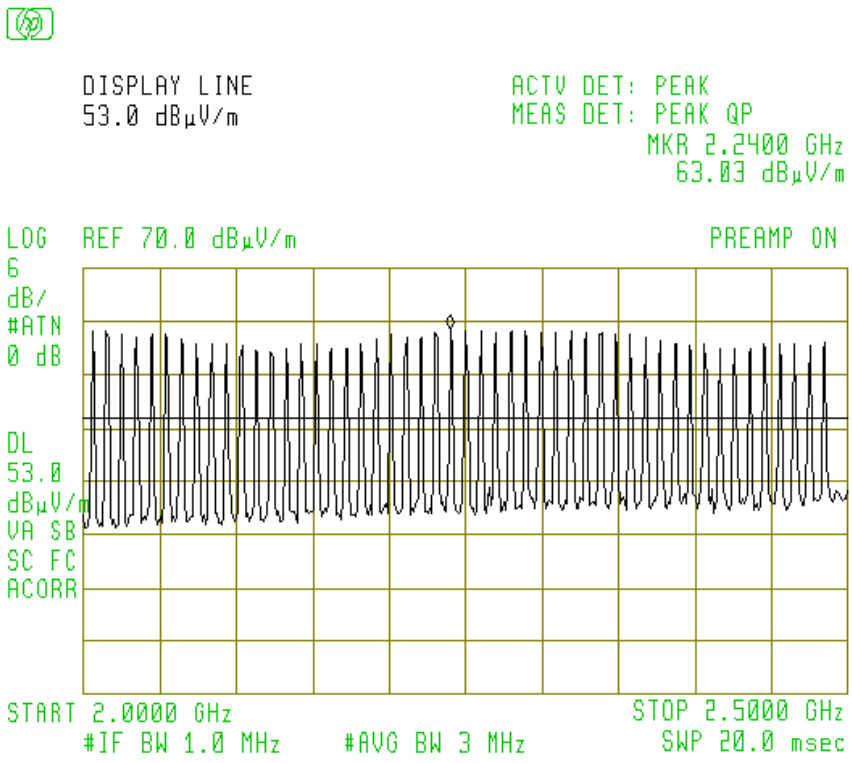


Measurement Plots:

Mode: HF ANTENNA, Tx Block 4:2GHz-2.5GHz

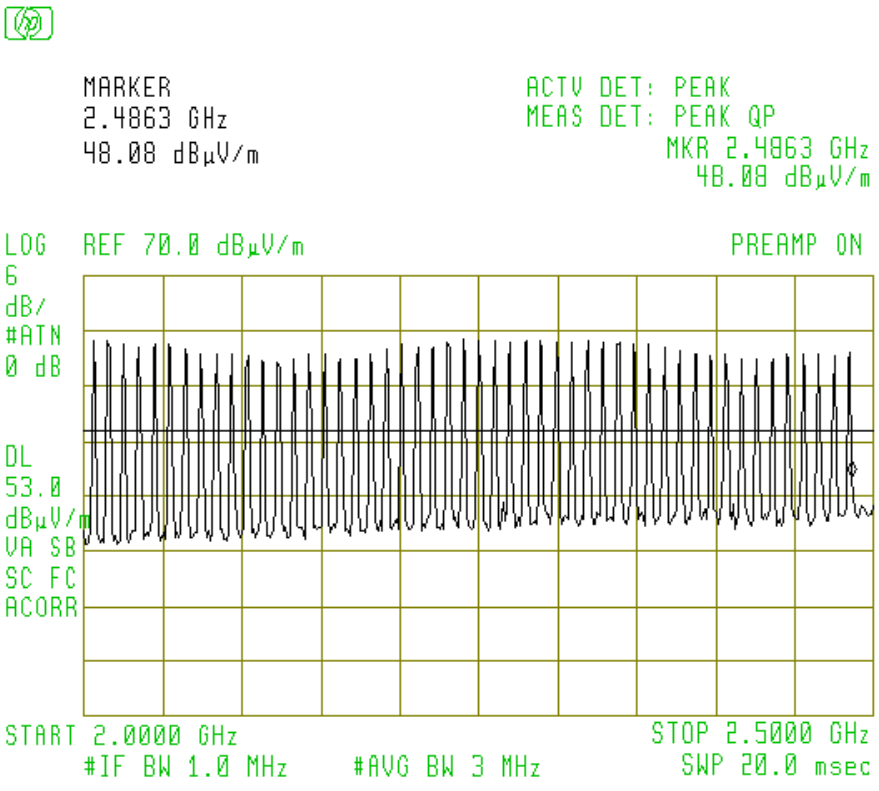
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak**
Configuration:	Stand alone, Continue operation



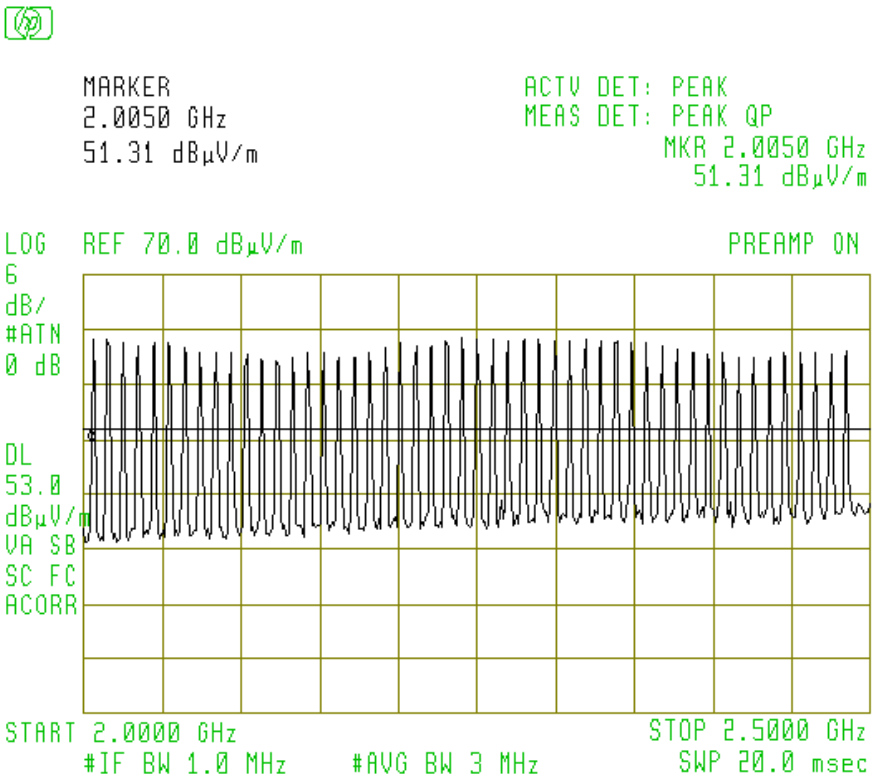
Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Upper edge**
Configuration:	Stand alone, Continue operation



Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Lower edge**
Configuration:	Stand alone, Continue operation

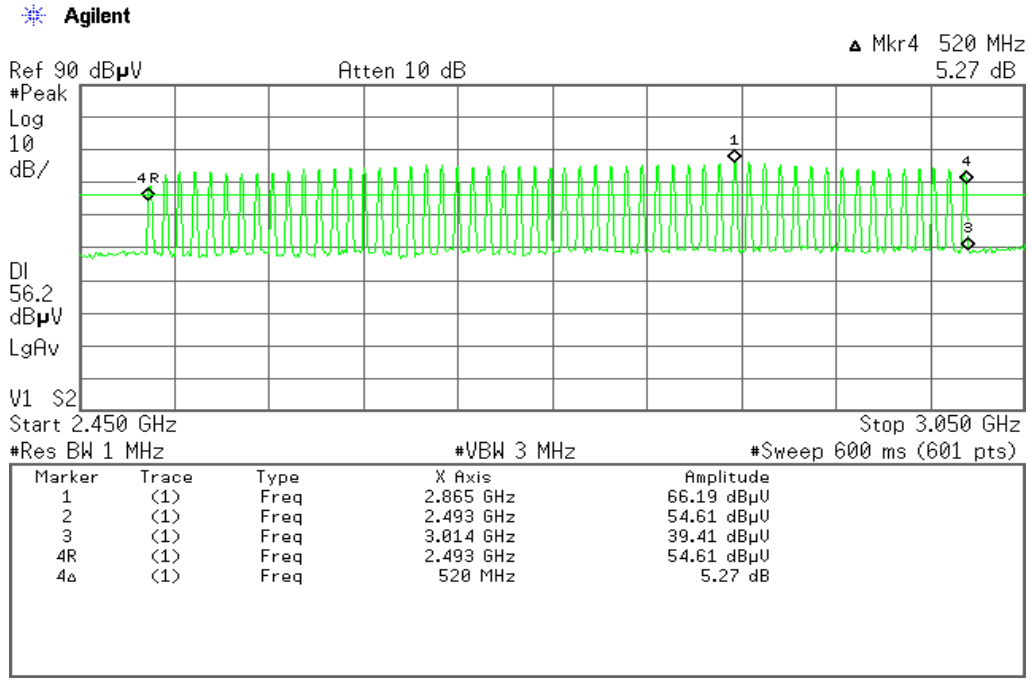


Measurement Plots:

Mode: HF ANTENNA, Tx Block 5: 2.5 GHz-3.0GHz

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	Wei Li
Temperature:	65°F
Humidity:	30%

Section:	**UWB Bandwidth/ HF Antenna**
Plot Name:	**-10dB UWB Bandwidth in Anechoic Chamber Max Peak, Upper edge, Low edge**
Configuration:	Stand alone, Continue operation



Test No.5

Name of Test:	***General Operational Requirements for LFIS***	**Test Standard:**	***15.509(b) &RSS-220 6***
Tested By:	WEI LI	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: 15.509(b) &RSS-220 6
Operation under the provisions of this section is limited to GPRs and wall imaging systems operated for the purposes with law enforcement, fire fighting, emergency rescue, scientific research, commercial mining, or construction.

Method of Measurement: The manufacturer Shall state that the device under test complies with the requirements outlined in section FCC Part 15.509 (b).

Test Result: **Complies**

Test Data: **NA**

Test No.6

Name of Test:	***Spurious Radiated Emissions ≤960MHz***	**Test Standard:**	***15.509(d) 15.209 &RSS-220 3.4, 6.2(c), 6.2(d)***
Tested By:	David Tu	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: Definition:
The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209.

Limits:

Frequency (MHz)	Field Strengths Limits (dBμV/m)	Measuring RBW kHz	Distance (meters)
0.009-0.490	67,6-20*Logf(kHz)	1	300
0.490-1.705	87,6-20*Logf(kHz)	9	30
1.705-30	29.5	9	30
30-88	40.0	120	3
88-216	43.5	120	3
216-960	46.0	120	3

Method of Measurement:

Tested at 3-meter OATS per ANSI C63.4
Spectrum Analyzer Settings:
RBW: 120KHz
VBW: ≥3x RBW
Detector: Quasi-Peak
Span: As required
Sweep: Auto

Test Procedure:
1) The EUT was placed on sandpit area filled with dry sand initially placed in front of the ground plane (0° degree position)
2) The receiving antenna which varied from 1 to 4 m to find the highest emission is positioned 3 m away from the EUT.
3) The receiving antenna was positioned in horizontal polarization.
4) The measurements were made with the detector set to peak with a bandwidth of 120 kHz during monitoring the frequency range below 960 MHz.
5) Upon detection of a suspect emission signal, its amplitude and frequency were noted.
6) It is recommended to demodulate the received signals for suitable discrimination of the ambient emission from the EUT emission.
7) At the worst case combination of the EUT operating mode and antenna height, the field strength measure was recorded. At each of the frequencies were a field strength was recorded the final measurement was performed with a Quasi-Peak detector.
8) The receiving antenna was positioned in vertical polarization and the steps 2 to 6 was repeated.
9) The EUT was rotating from 0° to 360° degrees with 45° step increment and the steps 4 to 7 was repeated.
10) All the worst case combination field strength emissions founded of each EUT position and antenna polarization was recorded in the following table and compared with the applicable limits.

Test Result: **Complies**

Test Data: **Data**

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	David Tu
Temperature:	65°F
Humidity:	30%

Worst Case Scenario: the worst case combination field strength emissions founded of each EUT position and antenna polarization was recorded in the following table and compared with the applicable limits.

Mode: Normal HF Antenna

- EUT Position (angle) : 45 ° interval.
- Antenna Polarization : Horizontal & Vertical; Antenna Height : 1-4m

Freq.* (MHz)	H,V	SA QP Reading (dBuV/m)	Height (m)	Angle (degree)	Refer to Part 15.209 3m Limit (dBuV/m)	Margin (dB)	Result
412.0	H	33.2	1.0	090	46.0	-12.8	Pass
560.1	H	36.0	1.0	090	46.0	-10	Pass
574.0	H	36.6	1.0	270	46.0	-9.4	Pass
616.2	H	35.9	1.0	090	46.0	-10.1	Pass
630.1	H	35.7	1.0	090	46.0	-10.3	Pass
640.3	H	37.2	1.0	090	46.0	-8.8	Pass
840.2	H	39.4	1.0	090	46.0	-6.6	Pass
864.5	H	35.8	1.0	270	46.0	-10.2	Pass
884.2	H	38.9	1.0	270	46.0	-7.1	Pass
892.5	H	40.1	1.0	090	46.0	-5.9	Pass
901.0	H	39.2	1.0	270	46.0	-6.8	Pass
620.2	V	33.0	1.1	000	46.0	-13	Pass
678.1	V	35.9	1.1	180	46.0	-10.1	Pass
746.2	V	36.9	1.1	180	46.0	-9.1	Pass
768.9	V	37.4	1.1	000	46.0	-8.6	Pass
788.0	V	37.9	1.1	000	46.0	-8.1	Pass
868.0	V	39.2	1.1	180	46.0	-6.8	Pass

878.1	V	40.2	1.1	180	46.0	-5.8	Pass
932.2	V	39.7	1.1	180	46.0	-6.3	Pass

*Emissions from Digital circuitry (identified in Test No.1 for FCC Part 15 B) shall be excluded.

Mode: LF Antenna

- EUT Position (angle) : 45 ° interval.
- Antenna Polarization : Horizontal & Vertical; Antenna Height : 1-4m

Freq.* (MHz)	H,V	SA QP Reading (dBuV/m)	Height (m)	Angle (degree)	Refer to Part 15.209 3m Limit (dBuV/m)	Margin (dB)	Result
105.2	H	30.2	1.8	270	43.5	-13.3	Pass
147.3	H	32.1*	1.8	270	43.5	-11.4	Pass
170.7	H	34.5*	1.8	270	43.5	-9	Pass
180.2	H	33.9*	1.8	270	43.5	-9.6	Pass
194.0	H	31.5*	1.8	270	43.5	-12	Pass
240.0	H	31.0*	1.1	270	46.0	-15	Pass
282.0	H	32.1	1.1	270	46.0	-13.9	Pass
322.1	H	35.0*	1.0	225	46.0	-11	Pass
430.0	H	35.2*	1.0	225	46.0	-10.8	Pass
484.1	H	39.1*	1.0	270	46.0	-6.9	Pass
540.0	H	39.8*	1.0	225	46.0	-6.2	Pass
570.1	H	38.5*	1.0	225	46.0	-7.5	Pass
624.7	H	39.2*	1.0	270	46.0	-6.8	Pass
688.3	H	36.5*	1.0	270	46.0	-9.5	Pass
752.1	H	38.2*	1.0	090	46.0	-7.8	Pass
806.0	H	39.0*	1.0	225	46.0	-7	Pass
852.1	H	38.1*	1.0	270	46.0	-7.9	Pass
140.4	V	33.6	1.1	000	43.5	-9.9	Pass
155.2	V	36.2	1.1	045	43.5	-7.3	Pass
198.2	V	33.9	1.1	045	43.5	-9.6	Pass
278.0	V	30.9*	1.1	045	46.0	-15.1	Pass
350.0	V	32.3	1.1	045	46.0	-13.7	Pass
306.0	V	33.3*	1.1	180	46.0	-12.7	Pass
360.4	V	30.6*	1.1	180	46.0	-15.4	Pass
400.3	V	32.5*	1.1	135	46.0	-13.5	Pass
430.1	V	34.9*	1.1	180	46.0	-11.1	Pass
480.4	V	39.4*	1.1	180	46.0	-6.6	Pass
550.1	V	33.8*	1.1	045	46.0	-12.2	Pass
575.2	V	35.1*	1.1	180	46.0	-10.9	Pass
624.2	V	33.0*	1.1	180	46.0	-13	Pass
682.5	V	36.6*	1.1	180	46.0	-9.4	Pass
752.2	V	35.8*	1.1	225	46.0	-10.2	Pass

*Emissions from Digital circuitry (identified in Test No.1 for FCC Part 15 B) shall be excluded.

Test No.7

Name of Test:	***Spurious Radiated Emissions >960MHz***	**Test Standard:**	***15.509(d) 15.209 &RSS-220 3.4, 6.2(c), 6.2(d)***
Tested By:	David Tu	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: Definition:
The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.

Limits:

Frequency (MHz)	EIRP @ 3 meters (1 MHz BW) (dBm)	Field strength @ 3 meters (1 MHz BW) (dBµV/m)	Field strength @ 1 meters (1 MHz BW) (dBµV/m)
960-1610	-65.3	29,9	39,4
1610-1990	-53.3	41,9	51,4
1990-3100	-51.3	43,9	53,4
3100-10600	-41.3	53,9	63,4
Above 10600	-51.3	43,9	53,9

Remark: The limits were converted from EIRP to field strength at 3 and 1 meter according to FCC 15.503(k).

Method of Measurement:

Tested at 3-meter OATS per ANSI C63.4
Spectrum Analyzer Settings:
RBW: 1MHz
VBW: ≥3x RBW
Detector: RMS Average Detector
Span: As required
Sweep: Auto

Test Procedure:

1) The EUT was placed on sandpit area filled with dry sand initially placed in front of the ground plane (0° degree position)
2) The receiving antenna is placed at 1 meter away from the EUT and it is pointed in the direction of the radiating head with an inclination of -10° to find the highest emission.
3) The receiving antenna was positioned in horizontal polarization.
4) The measurements were made with the detector set to RMS with a bandwidth of 1 MHz during monitoring the frequency range above 960 MHz.
5) Upon detection of a suspect emission signal, its amplitude and frequency were noted.
6) It is recommended to demodulate the received signals for suitable discrimination of the ambient emission from the EUT emission.
7) At the worst case combination of the EUT operating mode and antenna height, the field strength measure was recorded.
8) The receiving antenna was positioned in vertical polarization and the steps 2 to 6 were repeated.
9) The EUT was rotating from 0° to 360° degrees with 45° step increment and the steps 4 to 7 was repeated.
10) All the worst case combination field strength emissions founded of each EUT position and antenna polarization was recorded in the following table and compared with the applicable limits.

Test Result: **Complies**

Test Data: **Data**

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	David Tu
Temperature:	65°F
Humidity:	30%

Worst Case Scenario: the worst case combination field strength emissions founded of each EUT position and antenna polarization was recorded in the following table and compared with the applicable limits.

- EUT Position (angle) : 45 ° interval.
- Antenna Polarization : Horizontal & Vertical; Antenna Height: 1m-4m.

Normal Operation
Mode: HF Antenna

Freq.* (MHz)	H,V	SA Average Reading @1m (dBuV/m)	Height (m)	Angle (degree)	Refer to 15.509(d) 15.209 &RSS-220 3.4, 6.2(c), 6.2(d) Limit (dBuV/m)	Margin (dB)	Result
1150.0	H	28.3	1.0	090	39.4	-11.1	Pass
1251.2	H	35.2	1.0	270	39.4	-4.2	Pass
1265.8	H	36.0	1.0	270	39.4	-3.4	Pass
1270.1	H	36.2	1.0	270	39.4	-3.2	Pass
1298.0	H	33.3	1.0	090	39.4	-6.1	Pass
1580.3	H	32.1	1.0	270	39.4	-7.3	Pass
2072.0	H	32.6	1.0	090	53.4	-20.8	Pass
2256.3	H	37.9	1.0	090	53.4	-15.5	Pass
1010.0	V	35.1	1.0	180	39.4	-4.3	Pass
1250.8	V	36.2	1.0	180	39.4	-3.2	Pass
1269.7	V	34.1	1.0	180	39.4	-5.3	Pass
1280.1	V	33.4	1.0	180	39.4	-6	Pass
1302.5	V	32.6	1.0	000	39.4	-6.8	Pass
1369.0	V	31.0	1.0	000	39.4	-8.4	Pass
2260.5	V	35.6	1.0	090	53.4	-17.8	Pass
2810.0	V	38.0	1.0	270	53.4	-15.4	Pass

*Emissions from Digital circuitry (identified in Test No.1 for FCC Part 15 B) shall be excluded.

Mode: LF Antenna

No significant Emission Data were collected.

Test No.8

Name of Test:	***Radiated Emissions in GPS Bands***	**Test Standard:**	***15.509(e) 15.209 &RSS-220 6.2(e)***
Tested By:	David Tu	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard:

Definition:

In addition to the radiated emission limits specified for frequency above 960 MHz, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz in the GPS frequency bands.

Limits:

Frequency (MHz)	EIRP @ 3 meters (1 MHz BW) (dBm)	Field strength @ 3 meters (1 MHz BW) (dBµV/m)	Field strength @ 1 meters (1 MHz BW) (dBµV/m)
1164-1240	-75.3	19.9	29.4
1559-1610	-75.3	19.9	29.4

Remark: The limits were converted from EIRP to field strength at 3 and 1 meter according to FCC 15.503(k).

Method of Measurement:

Tested at 3-meter OATS per ANSI C63.4
Spectrum Analyzer Settings:
RBW: 1KHz
VBW: >3xRBW
Detector: RMS Average Detector
Span: As required
Sweep: Auto

Test Procedure:

1) The EUT was placed on sandpit area filled with dry sand initially placed in front of the ground plane (0° degree position)
2) The receiving antenna is placed at 1 meter away from the EUT and it is pointed in the direction of the radiating head with an inclination of -10° to find the highest emission.
3) The receiving antenna was positioned in horizontal polarization.
4) The measurements were made with the detector set to RMS during monitoring the frequency range above 960 MHz.
5) Upon detection of a suspect emission signal, its amplitude and frequency were noted.
6) It is recommended to demodulate the received signals for suitable discrimination of the ambient emission from the EUT emission.
7) At the worst case combination of the EUT operating mode and antenna height, the field strength measure was recorded.
8) The receiving antenna was positioned in vertical polarization and the steps 2 to 6 were repeated.
9) The EUT was rotating from 0° to 360° degrees with 45° step increment and the steps 4 to 7 was repeated.
10) All the worst case combination field strength emissions founded of each EUT position and antenna polarization was recorded in the following table and compared with the applicable limits.

Test Result: **Complies**

Test Data: **Data and Plot**

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	David Tu
Temperature:	65°F
Humidity:	30%

Worst Case Scenario: All maximum Field strength emissions were found at the following test set-up conditions:

Mode: LF Antenna

Freq. (MHz)	H,V	SA Reading (dBuV/m)	Height (m)	Angle (degree)	1m Limit (dBuV/m)	Margin (dB)	Result
1180.3	H	-6.2	1.1	090	29.4	-35.6	Pass
1200.2	H	-3.2	1.1	270	29.4	-32.6	Pass
1220.1	H	-1.1	1.1	270	29.4	-30.5	Pass
1235.8	H	-4.2	1.1	090	29.4	-33.6	Pass
1601.1	H	-5.8	1.1	090	29.4	-35.2	Pass
1607.5	H	-6.0	1.1	090	29.4	-35.4	Pass
1620.2	H	-4.2	1.1	270	29.4	-33.6	Pass
1630.9	H	-4.0	1.1	270	29.4	-33.4	Pass
1178.5	V	-2.8	1.1	180	29.4	-32.2	Pass
1200.3	V	-2.6	1.1	180	29.4	-32.0	Pass
1220.4	V	-0.8	1.1	000	29.4	-30.2	Pass
1238.2	V	-2.9	1.1	180	29.4	-32.3	Pass
1579.8	V	-3.1	1.1	180	29.4	-32.5	Pass
1599.9	V	-2.3	1.1	000	29.4	-31.7	Pass
1610.2	V	-2.0	1.1	000	29.4	-31.4	Pass
1633.6	V	-3.4	1.1	000	29.4	-32.8	Pass

* Measured signals were narrowband and related to the microprocessor / clocks and do not fall under the requirements of this section.

Mode: HF Antenna

Freq. (MHz)	H,V	SA Reading (dBuV/m)	Height (m)	Angle (degree)	1m Limit (dBuV/m)	Margin (dB)	Result
1172.1	H	-2.2	1.1	090	29.4	-31.6	Pass
1180.5	H	-0.8	1.1	090	29.4	-30.2	Pass
1200.3	H	-1.7	1.1	270	29.4	-31.1	Pass
1230.2	H	1.1	1.1	090	29.4	-28.3	Pass
1581.0	H	-1.9	1.1	090	29.4	-31.3	Pass
1598.9	H	-2.0	1.1	270	29.4	-31.4	Pass
1615.8	H	-1.7	1.1	270	29.4	-31.1	Pass
1630.2	H	1.4	1.1	270	29.4	-28.0	Pass
1179.8	V	-1.2	1.1	180	29.4	-30.6	Pass
1185.1	V	-3.9	1.1	180	29.4	-33.3	Pass
1200.4	V	-4.2	1.1	000	29.4	-33.6	Pass
1219.7	V	-1.8	1.1	180	29.4	-31.2	Pass
1575.0	V	-1.1	1.1	180	29.4	-30.5	Pass
1599.9	V	-0.6	1.1	000	29.4	-30.0	Pass
1616.3	V	0.5	1.1	180	29.4	-28.9	Pass
1630.8	V	0.9	1.1	180	29.4	-28.5	Pass

* Measured signals were narrowband and related to the microprocessor / clocks and do not fall under the requirements of this section.

Test No.9

Name of Test:	***Highest Radiated Emission at f***	**Test Standard:**	***15.509(f) 15.209 &RSS-220 6.2(g)***
Tested By:	David Tu	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: Definition:

For UWB devices where the frequency at which the highest radiated emission occurs, f_M, is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on f_M.

Limits:

The peak emission level contained within a 50 MHz bandwidth cantered on f_M mast be limited to a maximum of 0 dBm EIRP.

EIRP limit (dBm)	Field strength limit @ 3 meters for 50MHz RBW (dBuV/m)	Field strength limit @ 3 meters (measured with 3 MHz RBW) (dBµV/m)
0	95.2	70.8

The limits were converted from EIRP to field strength at 3 meter according to FCC 15.503(k).

As the measurement was employed with a 3 MHz resolution bandwidth the applicable limit is adjusted with a 20log(3/50) dB factor (-24.4dB).

So the EIRP limit is -24.4 dBm.

With 3m measurement conversion relation: E=95.2+P, the field strength limit is 70.8 dBuV/m.

Method of Measurement:

Tested at 3-meter OATS per ANSI C63.4
Spectrum Analyzer Settings:
RBW: 3MHz
VBW: ≥3x RBW
Detector: Peak
Span: As required
Sweep: Auto

Test Procedure:

1) The EUT was placed on sandpit area filled with dry sand initially placed in front of the ground plane (0° degree position).
2) The receiving antenna which varied from 1 to 4 m to find the highest emission is positioned 3 m away from the EUT.
3) The receiving antenna was positioned in horizontal polarization.
4) The measurements were made with the detector set to peak with a bandwidth of 3 MHz during monitoring the frequency range inside the UWB of the EUT.
5) At the worst case combination of the EUT operating mode and antenna height, the field strength measure was recorded.
6) The receiving antenna was positioned in vertical polarization and the steps 4 to 6 were repeated.
7) The EUT was rotating from 0° to 360° degrees with 45° step increment and the steps 4 to 7 was repeated.
8) Record the peak emission from the EUT.

Test Result: **Complies**

Test Data:

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	David Tu
Temperature:	65°F
Humidity:	30%

Worst Case Scenario: The maximum peak level of emission is found at the following test set-up conditions:

Applicable to Normal Mode:
HF Antenna

Freq. (MHz)	H,V	SA Peak Reading At 3 meter (dBuV/m)	RBW	Reading correction		Limit (dBuV/m)	Margin (dB)	Result
2810	V	51.1	3MHz	0		70.8	-19.7	Pass

Test No.10

Name of Test:	***Technical Requirements Applicable to ALL UWB Devices***	**Test Standard:**	***15.521***
Tested By:	WEI LI	**Test Date:**	11/13/2023-04/02/2024

Requirement	**Description**
15.521(a)	The EUT is not employed for the operation of toys, operation onboard an aircraft, ship and satellite.
15.521(b)	Permanent attached antenna, no External radio frequency power amplifiers and antenna modifications are permitted.
15.521(c)	The Digital circuitry portion of the EUT has been tested and verified to comply with 47 CFR Part 15, subpart B.
15.521(d)	Considered
15.521(e)	The f_M, frequency at which the highest radiated emission occurs is contained within the measured UWB bandwidth.
15.521(f)	The EUT is not intended to detection of tags or the transfer or data or voice information.
15.521(g)	Considered
15.521(h)	Considered
15.521(i)	Prohibition in Sections 2.201(f) and 15.5(d) of this chapter against Class B (damped wave) emissions is not applied.
15.521(j)	Battery operating device not connected to AC power lines.
15.521(a)	The EUT is not employed for the operation of toys, operation onboard an aircraft, ship and satellite.

Test Result: **Complies**

Test Data: **NA**

Test No.11

Name of Test:	***Coordination Requirement***	**Test Standard:**	***15.525***
Tested By:	Wei Li	**Test Date:**	11/13/2023-04/02/2024

Minimum Standard: The responsible party is properly informed about the required coordination requirement and provide correct information to the customers and users about their specific care and legislative obligations.

(See Important note for the US customers of the Installation Guide and User Manual)

Method of Measurement: (a) UWB imaging systems require coordination through the FCC before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.

(b) The users of UWB imaging devices shall supply operational areas to the FCC Office of Engineering and Technology, which shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration.

(c) The manufacturers, or their authorized sales agents, must inform purchasers and users of their systems of the requirement to undertake detailed coordination of operational areas with the FCC prior to the equipment being operated.

(d) Users of authorized, coordinated UWB systems may transfer them to other qualified users and to different locations upon coordination of change of ownership or location to the FCC and coordination with existing authorized operations.

(e) The FCC/NTIA coordination report shall identify those geographical areas within which the operation of an imaging system requires additional coordination or within which the operation of an imaging system is prohibited.

(f) The coordination of routine UWB operations shall not take longer than 15 business days from the receipt of the coordination request by NTIA.

Test Result:

Test Data: **NA**

Test No. 12

Name of Test:	***Antenna Requirement***	**Test Standard:**	***15.203&15.204 &RSS-GEN 7.1.4***
Tested By:	WEI LI	**Test Date:**	

Minimum Standard: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply.

Method of Measurement: The antenna utilized by the device under test is an internal, non user replaceable unit.

Test Result: **Complied with using an internal, non user replaceable Antenna**

Test Data: **NA**

Test No.13

Name of Test:	*Radio Frequency Exposure*	Test Standard:	*FCC OET Bulletin 65 &RSS-GEN*
Tested By:	WEI LI	Test Date:	11/13/2023-04/02/2024

Minimum Standard:

For FCC:

Public Exposure to Radio Frequency Energy Levels (1.1307 (b)(1)) Limits:

From §1.1310 Table 1 (B),
for Public S = 1.0 mW/cm^2
for Professional, S = 5.0 mW/cm^2

Method of Measurement:

$$d = 0.282 * 10 \wedge ((P + G) / 20) / \sqrt{S} \quad \text{Equation (1)}$$

$$S = 0.0795 * 10 \wedge ((P + G)/10)/ d\wedge 2 \quad \text{Equation (2)}$$

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.
Equation (2) and the measured peak power is used to calculate the Power density.

For IC:

Per RSS-102 Section 2.5.2.

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:
• below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Test Result: **Complies**

Test Data: **NA**

LIMITS for FCC RF Exposure Evaluation

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

LIMITS per 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:
• below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
• at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
• at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2}\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
• at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

CALCULATIONS for MPE distance and Power Density

Given

$E = \sqrt{(30 * P * G) / d}$

and

$S = E \wedge 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using: P(mW) = P (W) / 1000 and d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$

$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using: P (mW) = 10 ^ (P (dBm) / 10) and G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 \wedge ((P + G) / 20) / \sqrt{S}$ Equation (1)

$S = 0.0795 * 10 \wedge ((P + G)/10)/ d\wedge 2$ Equation (2)

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Equation (1) and the measured Output power is used to calculate the MPE distance.
Equation (2) and the measured Output power is used to calculate the Power density.

APPLICABLE LIMITS

RF Exposure for separation >= 20cm

FCC: From §1.1310 Table 1 (B), for Public S = 1.0 mW/cm^2 ; for Professional, S = 5.0 mW/cm^2
IC: With formula of 1.31 x 10^{-2} $f^{0.6834}$ W, more restricted EIRP limit value are 1.37W at 902MHz, 2.67W at 2400MHz.

RESULTS

No non-compliance noted.

For GPR UWB Transmitter only:

1-mW Test Exemption:
Per § 1.1307(b)(3)(i)(A), a single RF source is exempt RF device (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions.

For this EUT, max emission level is under the 0dBm limit set in Part 15F. No RF hazard need to be concerned.

The max. power density can be obtain by using the max. P+G=-19.7dBm and d=20cm, and plug all three items into equation (2), yielding,

Power Density Limit (mW/cm^2)	**Max. Output Power+ Antenna] Gain (dBm)**	**Calculated Power Density (mW/ cm^2)**
1.0/5.0	0	2E-6

Test No.14

Name of Test:	***Conducted Emissions***	**Test Standard:**	***15.507 &RSS-GEN***
Tested By:	-	**Test Date:**	-

Minimum Standard: 15.507 &RSS-GEN

Limit

Frequency Range (MHz)	**Limits (dBµV)**	
	Quasi-Peak	**Average**
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50
* Decreases with the logarithm of the frequency.		

Method of Measurement: Test measurements were made in accordance with ANSI C63.4-2003, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

Spectrum Analyzer Setting:
Frequency Range: 150KHz to 30MHz
RBW: 9KHz
VBW: 30KHz
Detector: Peak/QP/Average

Test Result: **NA**

(The EUT is only powered via a lithium-ion battery which is remotely recharged)

Test Data: **NA**

Test No.15

Name of Test:	***Transmission Duration***	**Test Standard:**	***15.509(c)& 15.519(a)(1)***
Tested By:	-	**Test Date:**	-

Minimum Standard: 15.509 (c)
A GPR that is designed to be operated while being hand held and a wall imaging system shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. In lieu of a switch located on the imaging system, it is permissible to operate an imaging system by remote control provided the imaging system ceases transmission within 10 seconds of the remote switch being released by the operator.

15.519(a)(1)---for hand held UWB Systems
A UWB device operating under the provisions of this section shall transmit only when it is sending information to an associated receiver. The UWB intentional radiator shall cease transmission within 10 seconds unless it receives an acknowledgement from the associated receiver that its transmission is being received. An acknowledgment of reception must continue to be received by the UWB intentional radiator at least every 10 seconds or the UWB device must cease transmitting.

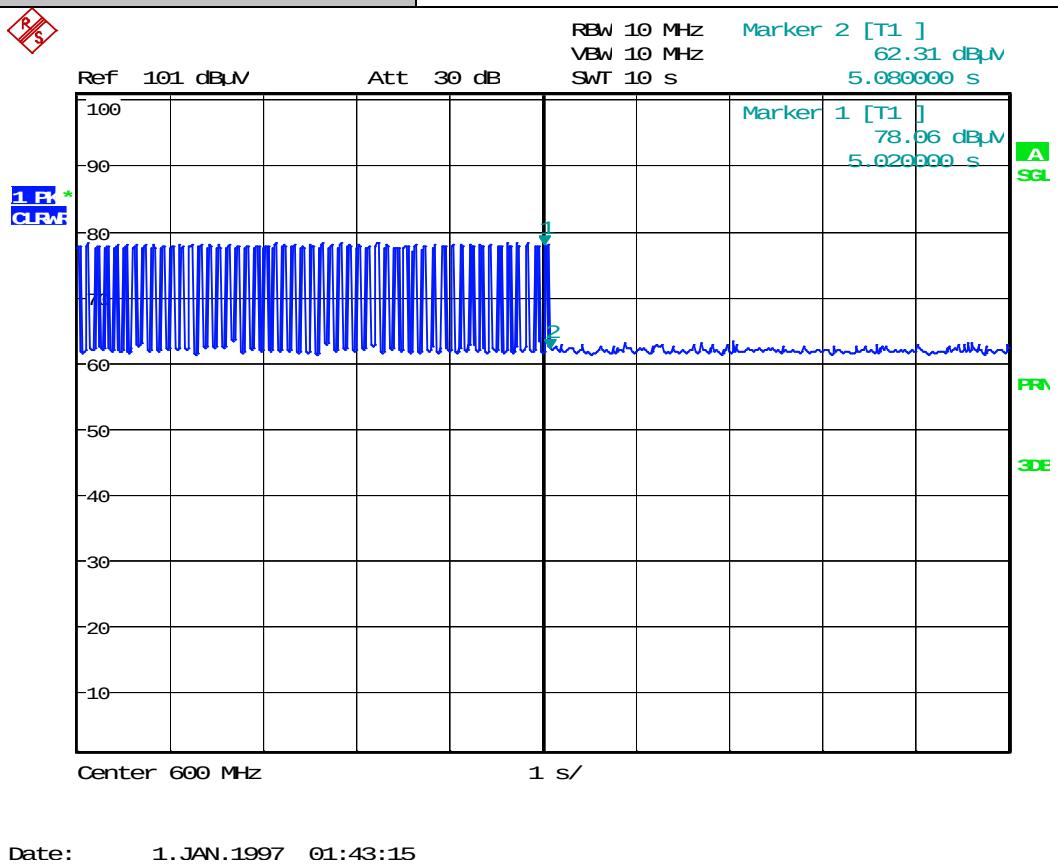
Method of Measurement: Functional Check

Test Result: **Complies**

Test Data: De-activation takes place within 10 seconds of the control system being switched off/not active or released by the operator or an acknowledgment of reception was received by the UWB intentional radiator within 10 seconds. Procedure is documented in operational description manual.

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	David Tu
Temperature:	65°F
Humidity:	30%

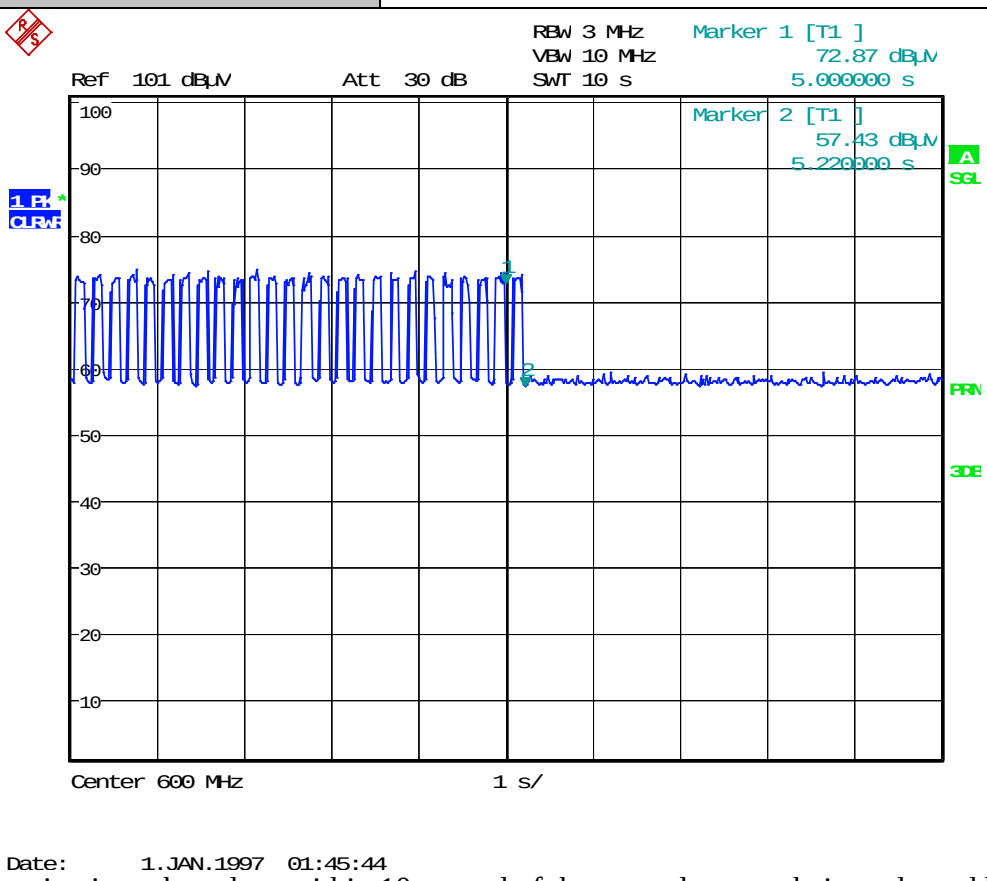
Section:	***Transmission Duration for LF***
Plot Name:	**Transmission Duration with Kill Switch**
Configuration:	Stand alone, Kill Switch Manual Release



De-activation takes place within 10 second of the control system being released by the operator

Project Number:	0048-231113-02-FCC-IC
EUT:	GM8000
S/N:	PT002
Tested By:	David Tu
Temperature:	65°F
Humidity:	30%

Section:	***Transmission Duration for HF***
Plot Name:	**Transmission Duration with Kill Switch**
Configuration:	Stand alone, Kill Switch Manual Release



De-activation takes place within 10 second of the control system being released by the operator