COMPLIANCE WORLDWIDE INC.
TEST REPORT 273-18

In Accordance with the Requirements of

Federal Communications Commission 47 CFR Part 15.517, Subpart F
Technical Requirements for Indoor UWB Systems

ISED RSS-220, Issue 1 (March 2009) + Amendment 1 (July 2018)
Devices Using Ultra-Wideband (UWB) Technology

Issued to

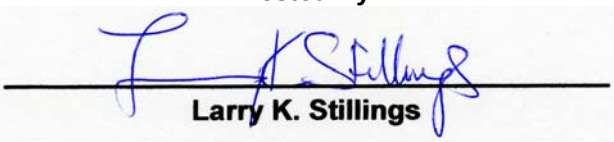
ShotTracker, Inc.
7220 W Frontage Road
Merriam, KS 66203
(844) 385 1073

For the
Ball Sensor
Model: S8R1

FCC ID: 2AC4B-S8R1
IC: 12327A-S8R1

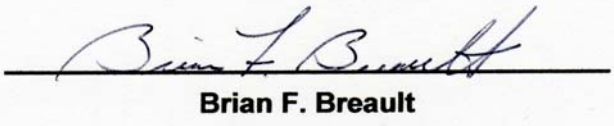
Report Issued on July 26, 2018

Tested By



Larry K. Stillings

Reviewed By



Brian F. Breault

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1. Scope

This test report certifies that the ShotTracker Ball Sensor as tested, meets the FCC Part 15, Subpart F and ISED RSS-220 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

2. Product Details

2.1. Manufacturer:	ShotTracker
2.2. Model Numbers:	S8R1
2.3. Serial Numbers:	Pre production
2.4. Description:	The Ball Sensor is a used as part of an indoor UWB system for locating the ball on a basketball court.
2.5. Power Source:	DC 3.7 Volts, 110 mAh Lithium Ion battery
2.6. Hardware Revision:	Rev C
2.7. Software Revision:	2.1.320
2.8. Modulation Type:	Pulse Modulation, Frequency Hopping
2.9. Operating Frequencies:	4.493 GHz (Channel 3), 6.490 GHz (Channel 5) Center Frequencies, Nominal (500 MHz BW) and, 6.490 GHz (Channel 7) Center Frequency, Nominal (900 MHz BW)
2.10. EMC Modifications:	None

3. Product Configuration

3.1 Operational Characteristics & Software

Hardware Setup:

Using the remote laptop the EUT is configured to transmit on each of the operating channels and corresponding PRFs of 16M or 64M.

3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Volts	Freq (Hz)	Description/Function
ShotTracker	S8R1	Pre-production	3.7	DC	UWB Tag

3.3. EUT Cables/Transducers

Cable Type	Length	Shield	From	To
None				

3.4. Support Equipment

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Freq (Hz)	Description/Function
Apple	MacBook Pro (Retina, 15-inch, Late 2013)	C02MJ1S1FD59	120	60	Laptop used for configuration

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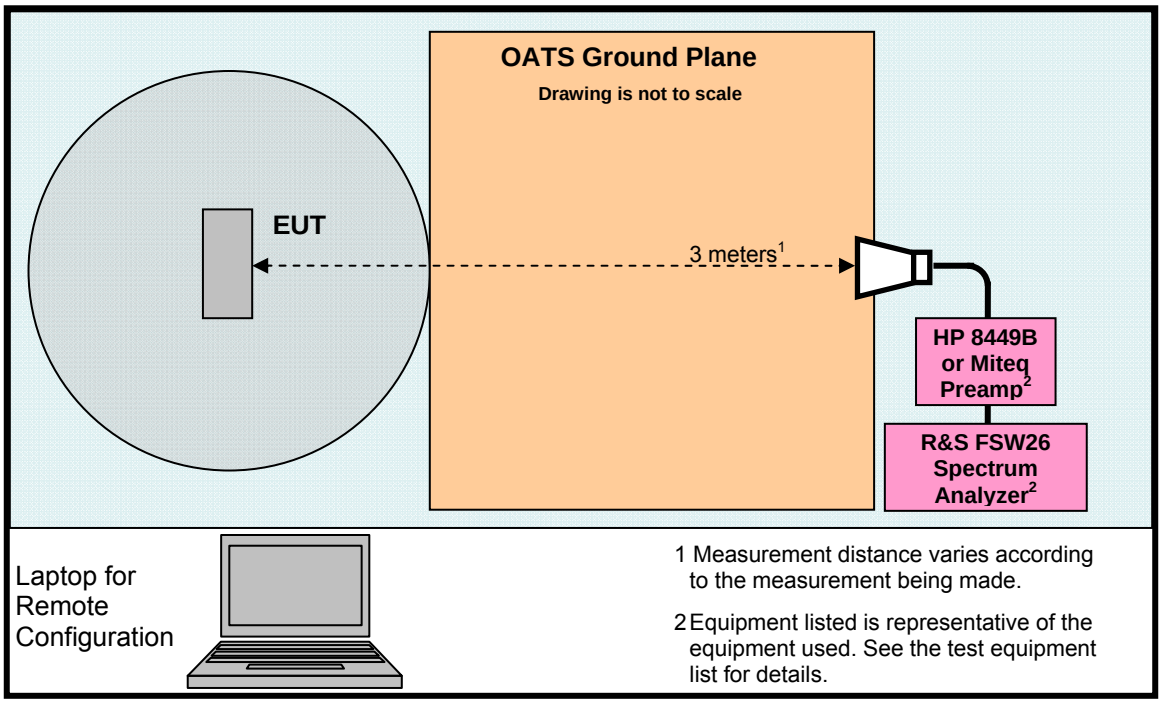
3. Product Configuration (cont.)

3.5. Test Setup Diagram



3.6. EUT Orientation Diagram

In addition, the measurements were performed with the device in three orthogonal positions in accordance with ANSI C63.10-2013, sections 5.10.1, 6.4.6 and Annex H.

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4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Receiver 9 kHz to 7 GHz	Rohde & Schwarz	ESR7	101156	7/23/2018	3 Years
Spectrum Analyzer 9 kHz to 40 GHz	Rohde & Schwarz	FSV40	100899	7/23/2018	3 Years
Spectrum Analyzer 10 Hz to 40 GHz	Rohde & Schwarz	FSVR40	100909	7/23/2018	3 Years
Spectrum Analyzer 3 Hz to 26.5 GHz	Rohde & Schwarz	FSW26	102057	12/7/2018	2 Years
Bilog Antenna 30 to 2000 MHz	Sunol Sciences	JB1	A050913	6/3/2019	3 Years
Loop Antenna 9 kHz to 30 MHz	EMCO	6512	9309-1139	10/26/2018	2 Years
Preamplifier 100 MHz to 7 GHz	Miteq	AFS3-00100200-10-15P-4	988773	4/17/2020	2 Year
Preamplifier 100 MHz to 18 GHz	Miteq	AMF-7D-00101800-30-10P	1953081	4/16/2019	1 Year
Preamplifier 1 to 26.5 GHz	Hewlett Packard	8449B	3008A01323	7/22/2018	3 Years
Preamplifier 18 to 40 GHz	Miteq	JSD42-21004200-40-5P	649199/649219	11/1/2019	1 Year
Horn Antenna 960 MHz to 18 GHz	ETS-Lindgren	3117	00143292	2/22/2019	3 Years
Horn Antenna 18 to 40 GHz	Com Power	AH-840	3075	10/11/2018	2 Years
High Pass Filter 8 to 18 GHz	Micro-Tronics	HPM50107	G036	7/20/2019	1 Year
Barometer	Control Company	4195	Cal ID# 236	10/8/2018	2 Years

[1] ESR7 Firmware revision: V3.36, SP2 Date installed: 11/02/2017 Previous V3.36, installed 05/16/2017.
[2] FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016 Previous V2.30 SP1, installed 10/22/2014.
[3] FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016 Previous V2.23, installed 10/20/2014.
[4] FSW26 Firmware revision: V2.80, Date installed: 10/28/2017 Previous V2.61, installed 04/04/2017.

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4. Measurements Parameters (continued)

4.2. Measurement & Equipment Setup

Test Dates:	6/20/2018, 6/21/2018, 6/22/2018
Test Engineers:	Larry Stillings
Normal Site Temperature (15 - 35°C):	21.6
Relative Humidity (20 -75%RH):	35
Frequency Range:	30 kHz to 40 GHz
Measurement Distance:	3 Meters, 1 Meter, 0.5 Meter
EMI Receiver IF Bandwidth:	200 Hz – 30 kHz to 150 kHz 9 kHz – 150 kHz to 30 MHz 120 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz
EMI Receiver Avg Bandwidth:	300 Hz – 30 kHz to 150 kHz 30 kHz – 150 kHz to 30 MHz 300 kHz - 30 MHz to 1 GHz 3 MHz - Above 1 GHz
Detector Function:	Peak, Quasi-Peak & Average

4.3. Measurement Procedure

Test measurements were made in accordance FCC Parts 15.209, 15.517 Subpart F and ISED RSS-220 requirements.

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.

4.4. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency (out of band)	$\pm$ 1x10^{-8}
Radiated Emission of Transmitter to 100 GHz	$\pm$ 4.55 dB
Radiated Emission of Receiver	$\pm$ 4.55 dB
Temperature	$\pm$ 0.91^{o} C
Humidity	$\pm$ 5%

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5. Measurements Summary

Test Requirement	FCC Rule Requirement	IC Rule Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	RSS-220 5.1 (b)	6.1	Compliant	The antenna is a pcb surface mount type
Operational Requirements	15.517 (a)	RSS-220	6.2	Compliant	
UWB Bandwidth	15.503 (a) (d) 15.517 (b)	RSS-220 2 RSS-220 5.1	6.3	Compliant	
Radiated Emissions below 960 MHz	15.209	RSS-220 3.4	6.4	Compliant	
Radiated Emissions above 960 MHz	15.517 (c) 15.521 (d)	RSS-220 3.4	6.5	Compliant	
Radiated Emissions in GPS Bands	15.517 (d)	RSS-220 5.2.1 (e)	6.6	Compliant	
RMS Emissions of UWB Transmission in a 1 MHz Bandwidth	15.517 (c) 15.521 (d)	RSS-220 5.2.1 (d)	6.7	Compliant	
Peak Emissions in a 50 MHz Bandwidth	15.517 (e) 15.521 (g)	RSS-220 5.2.1 (g)	6.8	Compliant	
Conducted Emissions	15.207	RSS-GEN	6.9	N/A	Not Required
Radio Frequency Exposure	1.1307 (b) (1) 2.1093	RSS-102 RSS-GEN	6.10	Compliant	

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6. Measurement Data

6.1. Antenna Requirement (15.203, RSS-220 5.1 (b))

Requirement: 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

Result: The antenna utilized by the device under test is a pcb surface mount type.

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6. Measurement Data (continued)

6.2. Operational Requirements of the Device under Test (15.517 (a))

Requirement: (1) Indoor UWB devices, by the nature of their design, must be capable of operation only indoors. The necessity to operate with a fixed indoor infrastructure, e.g., a transmitter that must be connected to the AC power lines, may be considered sufficient to demonstrate this.

Result: Compliant, the EUT is an indoor tag designed to transmit location information to node/anchor filed under a separate application. The statement required by Section 15.517(f) is located in the manual regarding the use of indoor equipment.

(2) The emissions from the equipment operated under this section shall not be intentional directed outside of the building in which the equipment is located, such as through a window or a doorway, to perform an outside function, such as the detection of persons about to enter a building.

Result: Not Applicable, Compliant.

(3) The use of outdoor mounted antennas, e.g. antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.

Result: Not Applicable, Compliant.

(4) Field disturbance sensors installed inside of metal or underground storage tanks are considered to operate indoors provided the emissions are directed towards the ground.

Result: Not Applicable, Compliant.

(5) A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.

Result: Compliant.

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6. Measurement Data (continued)

6.3. UWB Bandwidth (15.503 (a) (d), 15.517 (b), RSS-220 5.1)

Requirement: The UWB bandwidth of a device operating under the provisions of this section shall be contained between 3,100 MHz and 10,600 MHz and at any point in time, and has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

6.3.1. Measurement Data – Values in GHz. Worse case of both PRFs

		CH3 16M	CH3 64M	CH5 16M	CH5 64M	CH7 16M	CH7 64M
f_M	The highest emission peak	4.5849	4.487	6.470	6.3352	6.1972	6.488
f_L	10 dB below the highest peak	4.2872	4.2992	6.1683	6.2073	5.9523	5.9733
f_H	10 dB above the highest peak	4.8167	4.8087	6.7717	6.7468	6.9138	6.8928
f_C	Calculated: $(f_H + f_L) / 2$	4.5520	4.5540	6.4700	6.4771	6.4331	6.4331
Bandwidth	Calculated: $(f_H - f_L)$	0.5295	0.5095	0.6034	0.5395	0.9615	0.9195
Fractional BW	Calculated: $2*(f_H - f_L) / (f_H + f_L)$	0.1163	0.1119	0.0933	0.0833	0.1495	0.1429

6.3.2. Measurement Plot of 10 dB frequencies (Channel 3, 16M PRF)

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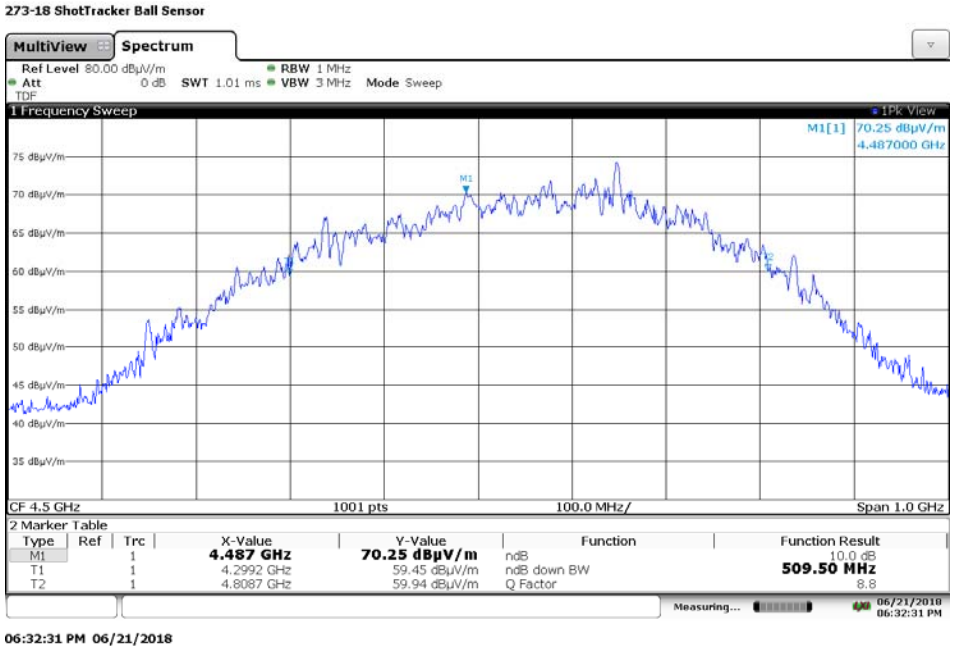
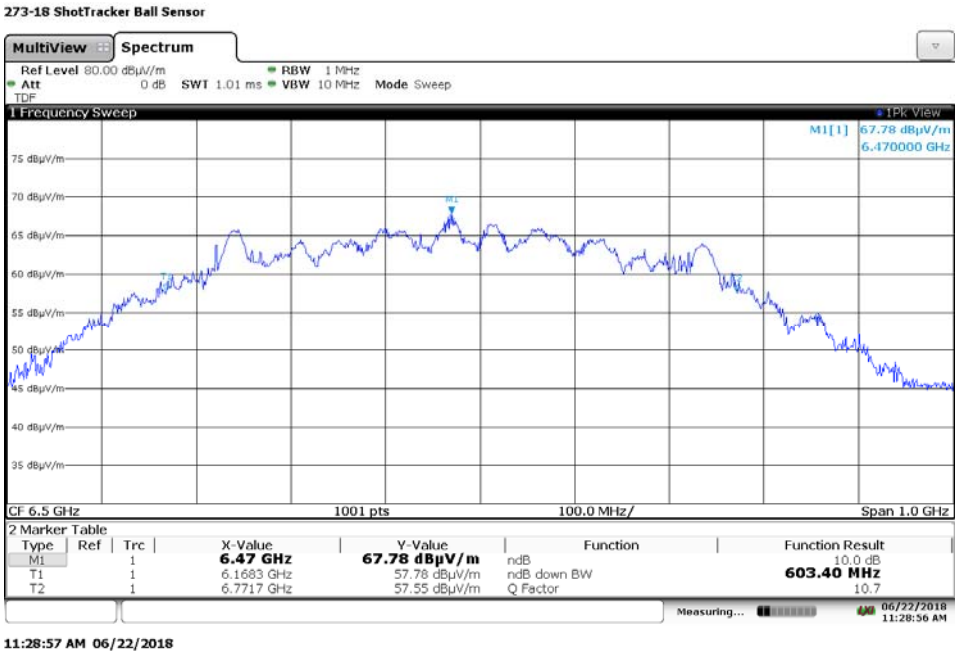
6. Measurement Data (continued)

6.3. UWB Bandwidth (15.503 (a) (d), 15.517 (b), RSS-220 5.1)

6.3.3. Measurement Plot of 10 dB frequencies (Channel 3, 64M PRF)



6.3.4. Measurement Plot of 10 dB frequencies (Channel 5, 16M PRF)



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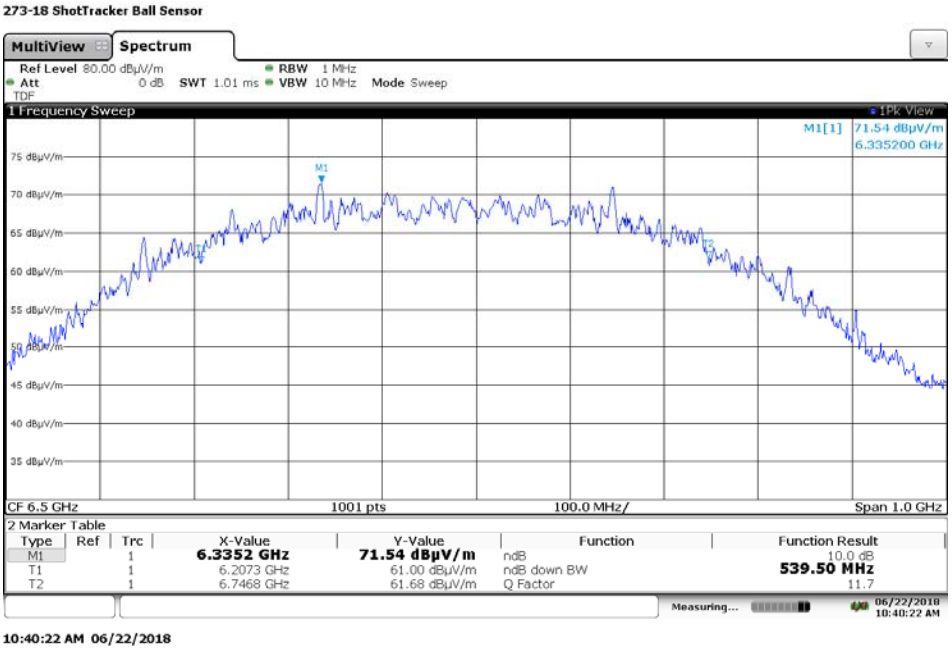
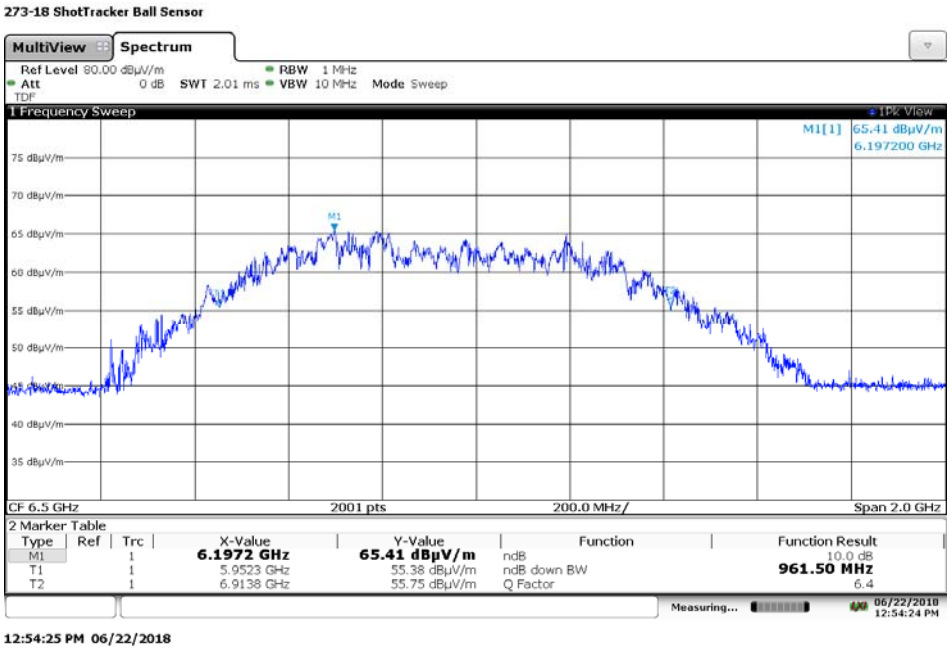
6. Measurement Data (continued)

6.3. UWB Bandwidth (15.503 (a) (d), 15.517 (b), RSS-220 5.1)

6.3.5. Measurement Plot of 10 dB frequencies (Channel 5, 64M PRF)



6.3.6. Measurement Plot of 10 dB frequencies (Channel 7, 16M PRF)



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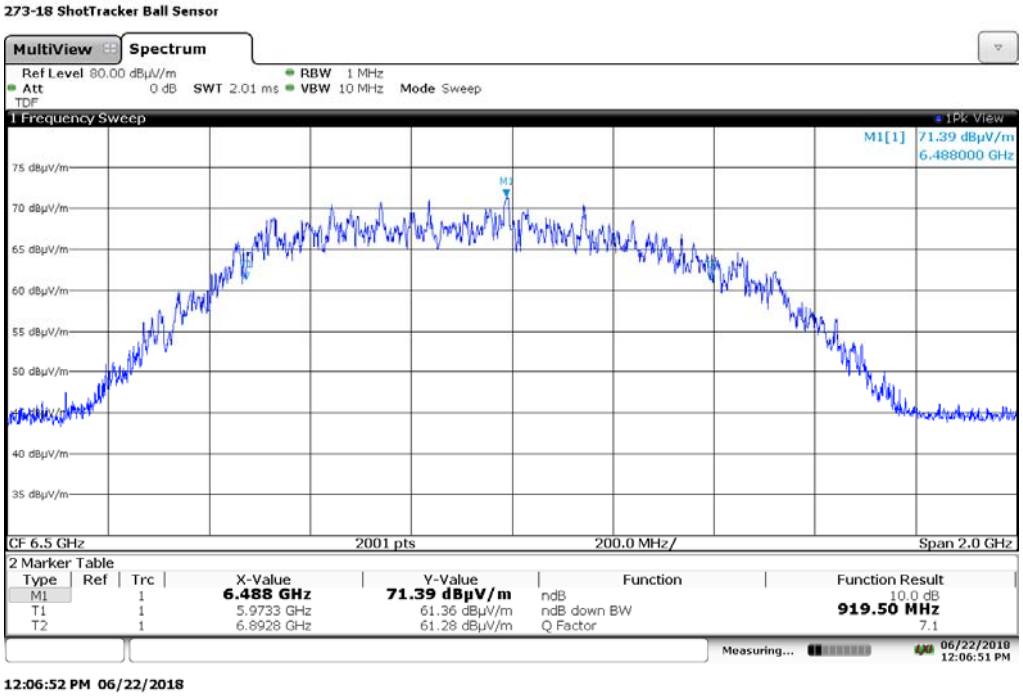
6. Measurement Data (continued)

6.3. UWB Bandwidth (15.503 (a) (d), 15.517 (b), RSS-220 5.1)

6.3.7. Measurement Plot of 10 dB frequencies (Channel 7, 64M PRF)



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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions below 960 MHz (15.517 (c), 15.209, RSS-220 3.4)

Requirement: 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.

Radiated Emissions Field Strength Limits at 3 Meters (Section 15.209, RSS-220)

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
0.009 to 0.490	2,400/F (F in kHz)	128.5 to 93.8
0.490 to 1.705	24,000/F (F in kHz)	73.8 to 63
1.705 - 30	30	69.5
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46

Test Notes: Refer to Section 4.1 for the test equipment used.

Frequency Range:	30 kHz to 960 MHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	200 Hz – 30 kHz to 150 kHz 9 kHz – 150 kHz to 30 MHz 120 kHz - 30 MHz to 960 MHz
EMI Receiver Avg Bandwidth (minimum):	300 Hz – 30 kHz to 150 kHz 30 kHz – 150 kHz to 30 MHz 300 kHz - 30 MHz to 960 MHz
Detector Function:	Peak, Quasi-Peak & Average

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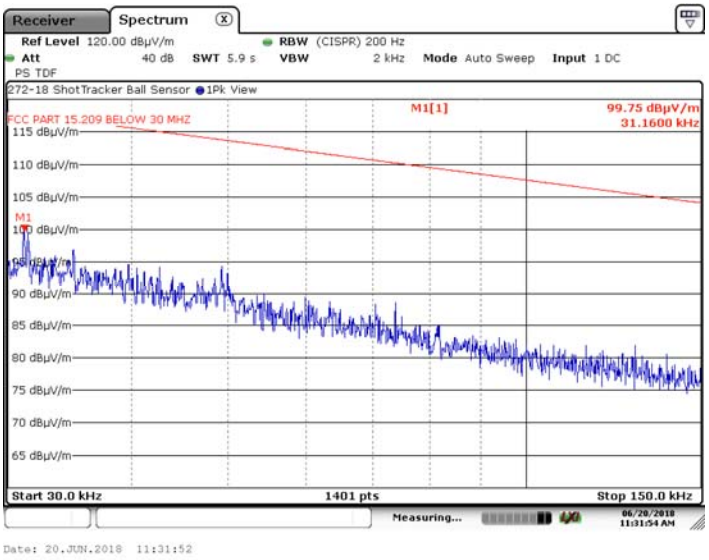
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

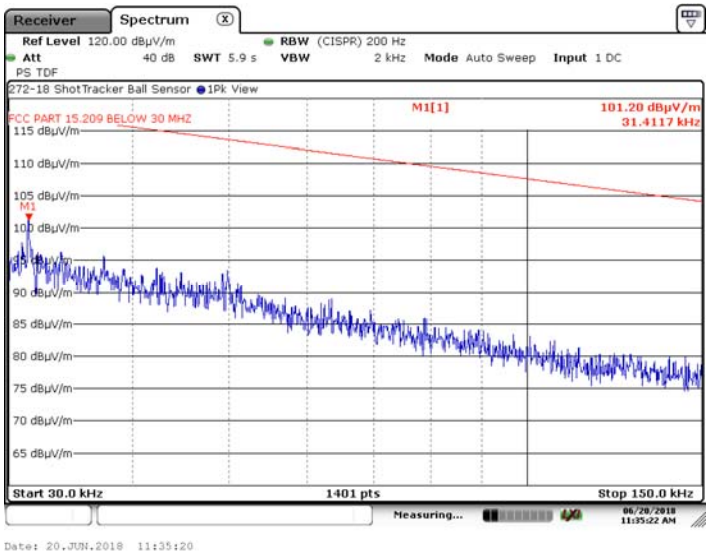
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.1 Parallel Measurement Antenna – 30 to 150 kHz – X-Axis



Note: All other channels were noise floor

6.4.1.2 Perpendicular Measurement Antenna – 30 to 150 kHz – X-Axis



Note: All other channels were noise floor

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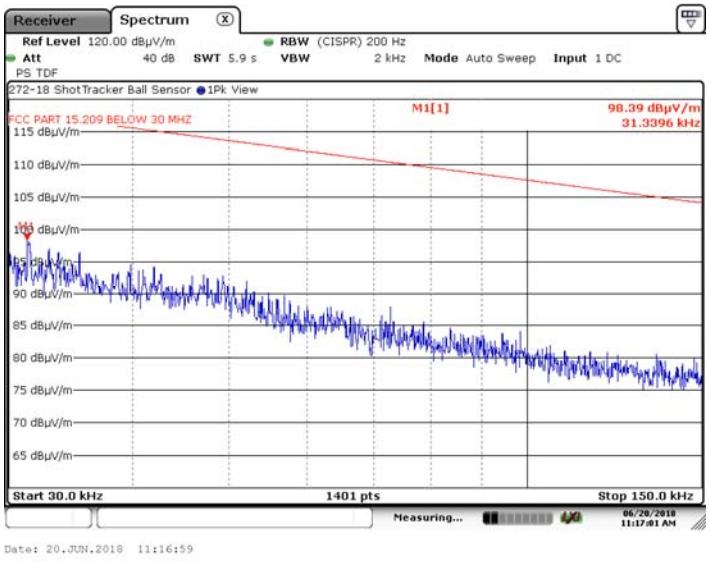
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

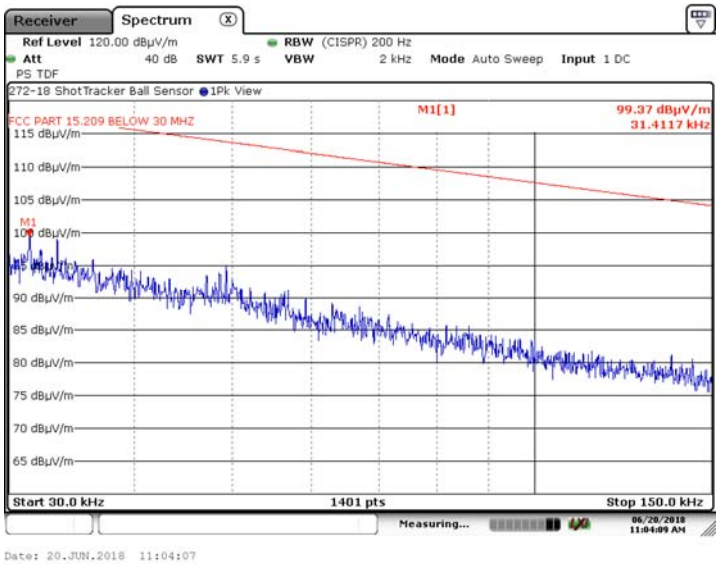
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.3 Ground Parallel Measurement Antenna – 30 to 150 kHz – X-Axis



Note: All other channels were noise floor

6.4.1.4 Parallel Measurement Antenna – 30 to 150 kHz – Y-Axis



Note: All other channels were noise floor

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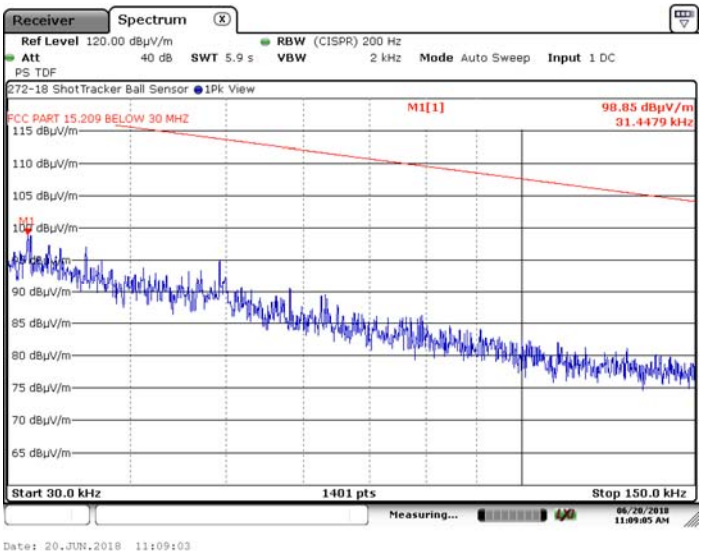
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

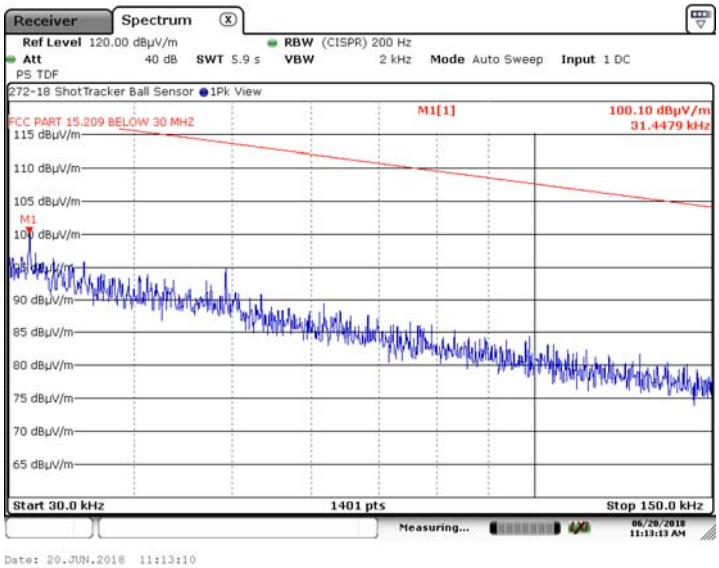
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.5 Perpendicular Measurement Antenna – 30 to 150 kHz – Y-Axis



Note: All other channels were noise floor

6.4.1.6 Ground Parallel Measurement Antenna – 30 to 150 kHz – Y-Axis



Note: All other channels were noise floor

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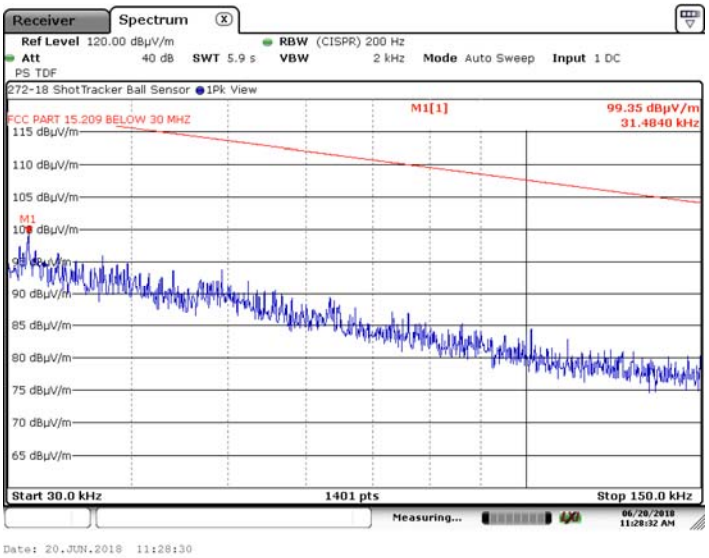
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

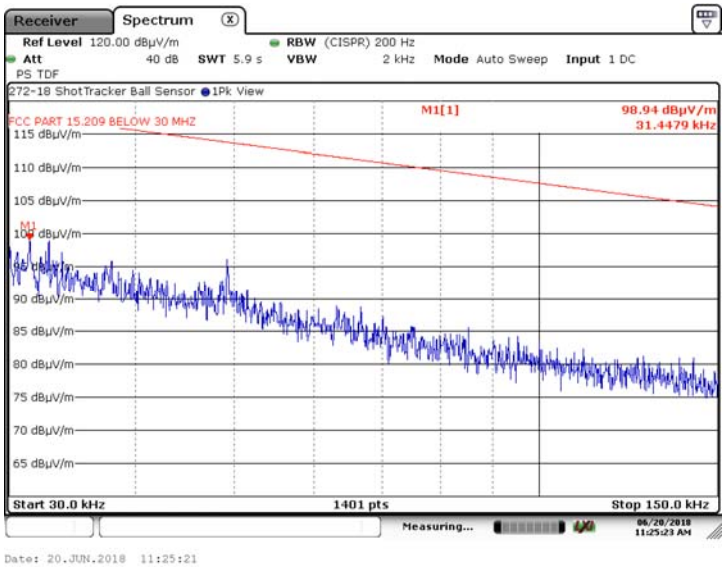
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.7 Parallel Measurement Antenna – 30 to 150 kHz – Z-Axis



Note: All other channels were noise floor

6.4.1.8 Perpendicular Measurement Antenna – 30 to 150 kHz – Z-Axis



Note: All other channels were noise floor

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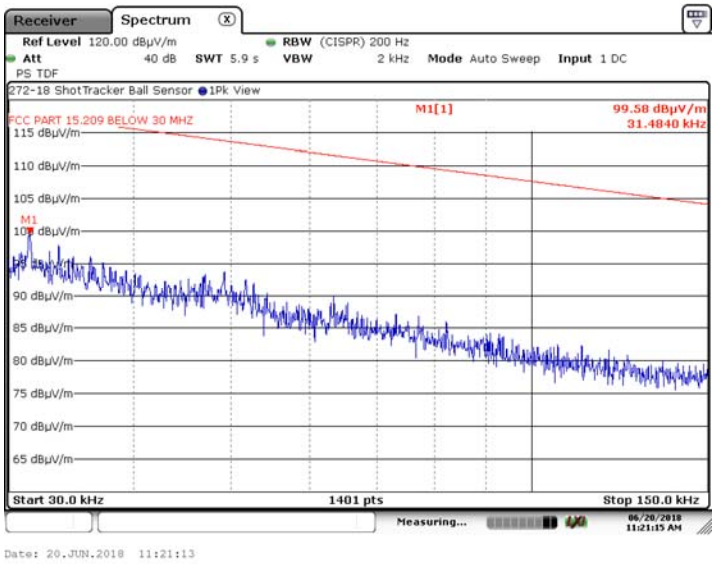
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.9 Ground Parallel Measurement Antenna – 30 to 150 kHz – Z-Axis



Note: All other channels were noise floor

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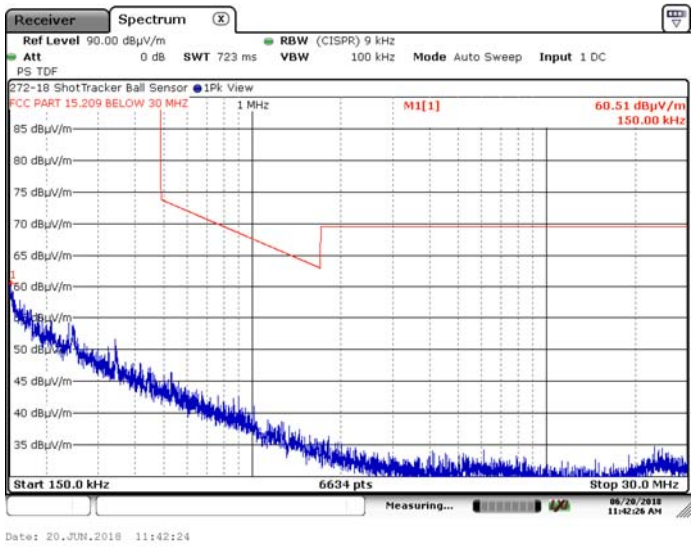
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

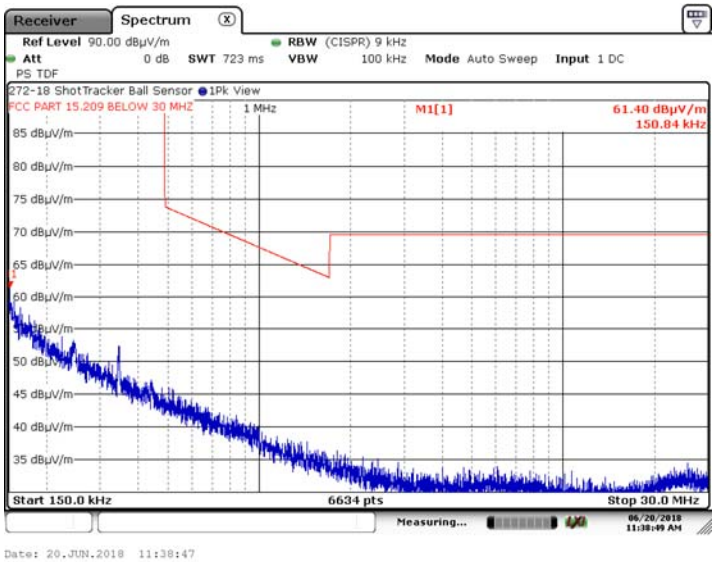
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.10 Parallel Measurement Antenna – 150 kHz to 30 MHz – X-Axis



Note: All other channels were noise floor

6.4.1.11 Perpendicular Measurement Antenna – 150 kHz to 30 MHz – X-Axis



Note: All other channels were noise floor

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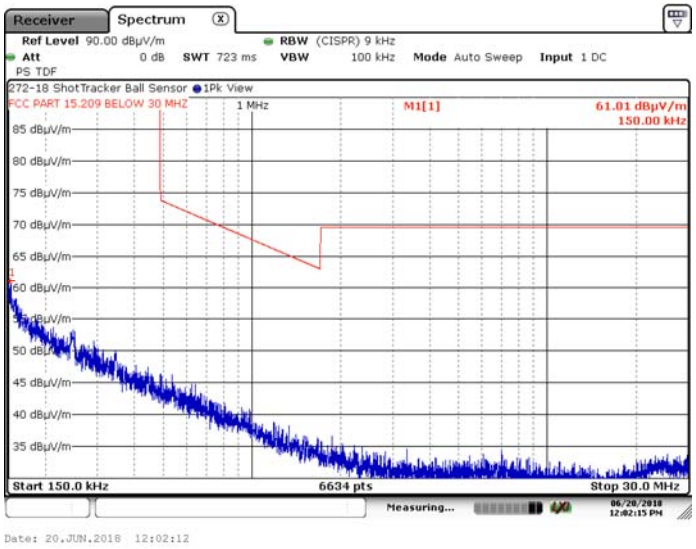
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

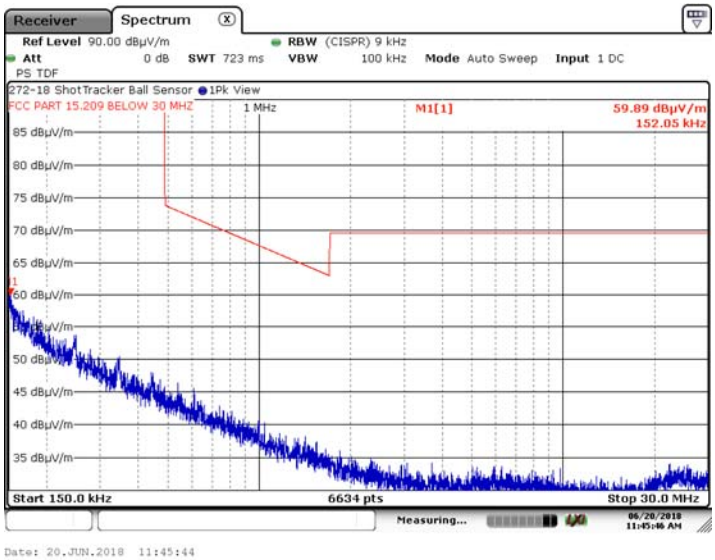
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.12 Ground Parallel Measurement Antenna – 150 kHz to 30 MHz – X-Axis



Note: All other channels were noise floor

6.4.1.13 Parallel Measurement Antenna – 150 kHz to 30 MHz – Y-Axis



Note: All other channels were noise floor

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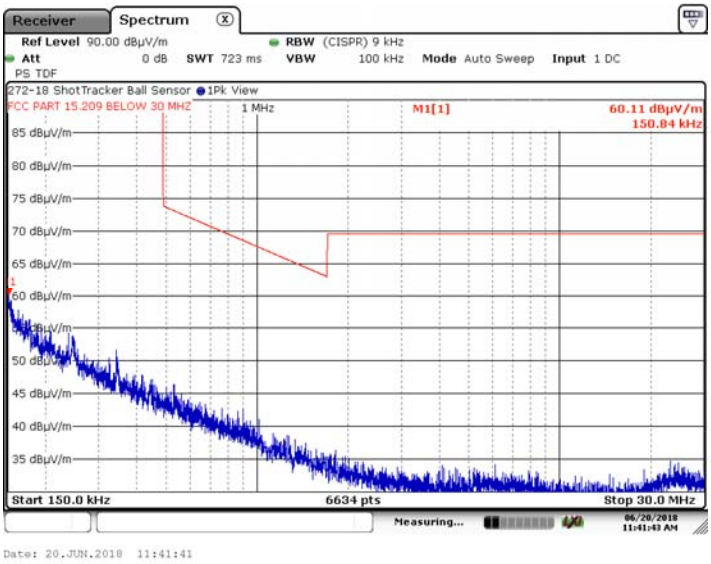
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

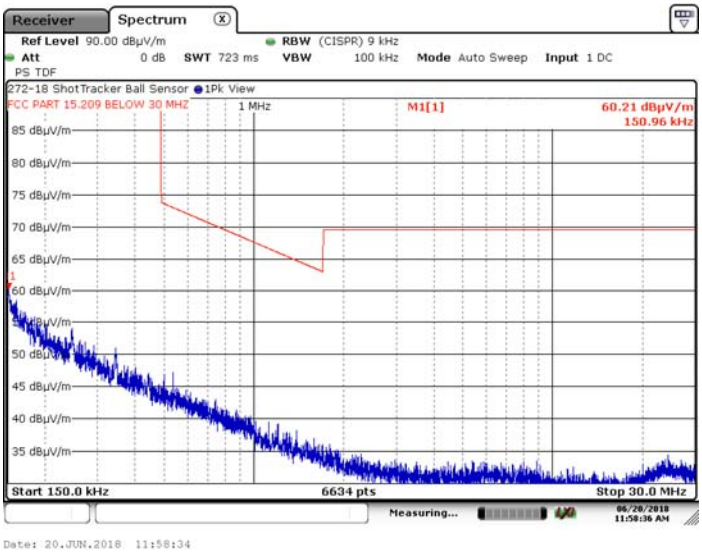
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.14 Perpendicular Measurement Antenna – 150 kHz to 30 MHz – Y-Axis



Note: All other channels were noise floor

6.4.1.15 Ground Parallel Measurement Antenna – 150 kHz to 30 MHz – Y-Axis



Note: All other channels were noise floor

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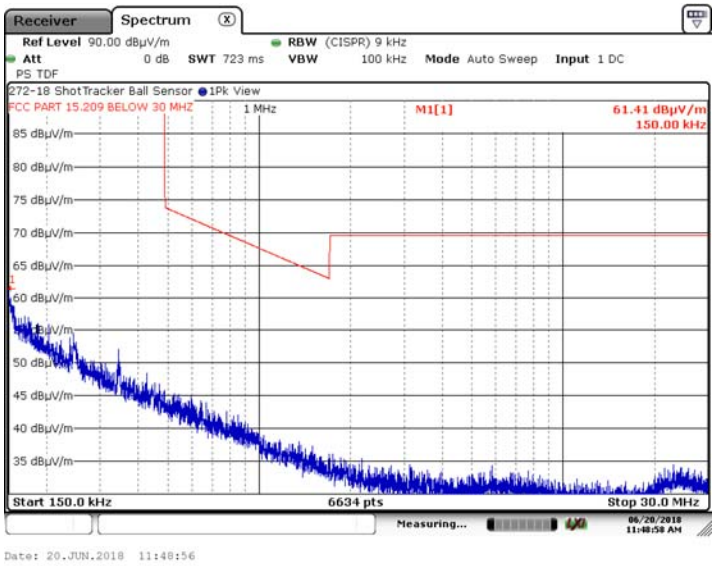
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

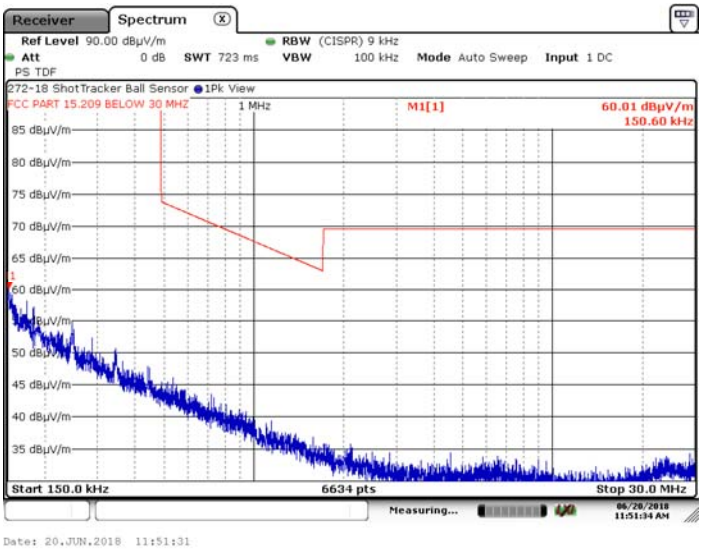
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.16 Parallel Measurement Antenna – 150 kHz to 30 MHz – Z-Axis



Note: All other channels were noise floor

6.4.1.17 Perpendicular Measurement Antenna – 150 kHz to 30 MHz – Z-Axis



Note: All other channels were noise floor

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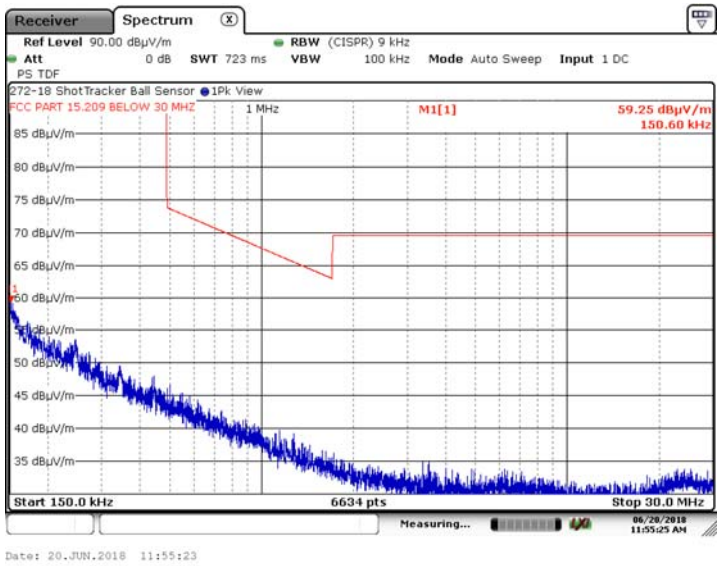
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.18 Ground Parallel Measurement Antenna – 150 kHz to 30 MHz – Z-Axis



Note: All other channels were noise floor

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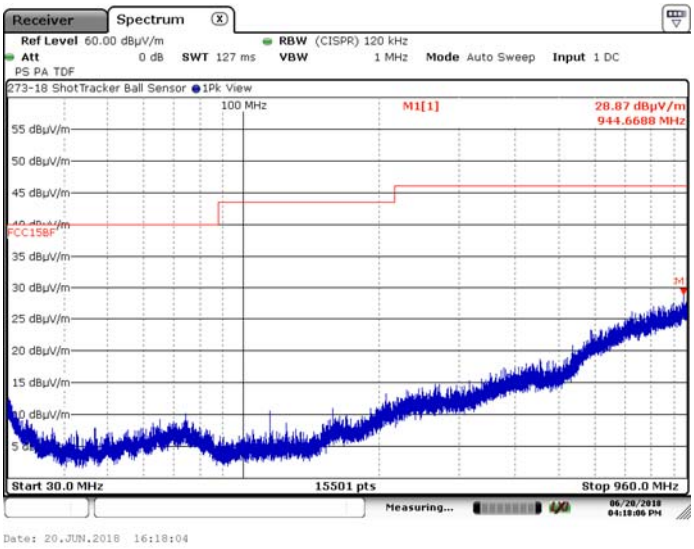
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

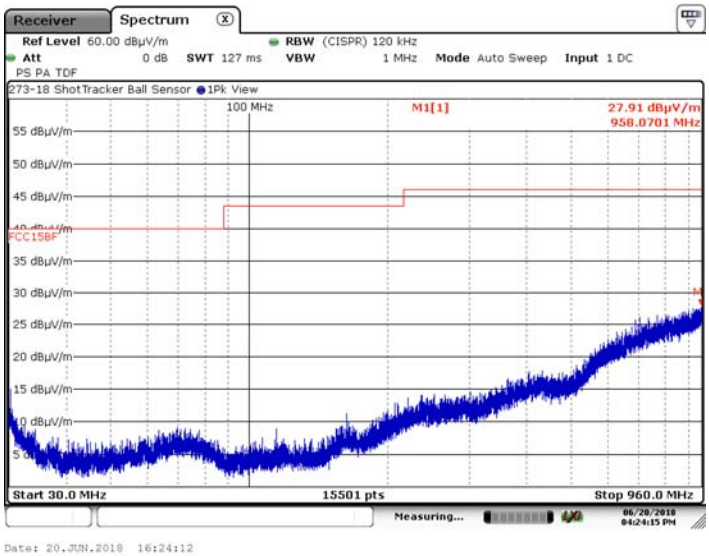
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.19 Horizontal Polarity – 30 to 960 MHz – Channel 3, 64M X-Axis



Note: All other channels were noise floor

6.4.1.20 Vertical Polarity – 30 to 960 MHz – Channel 3, 64M X-Axis



Note: All other channels were noise floor

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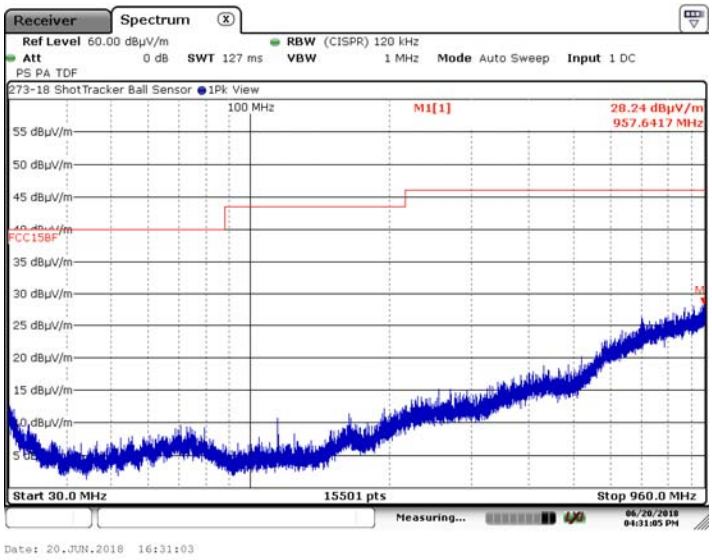
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

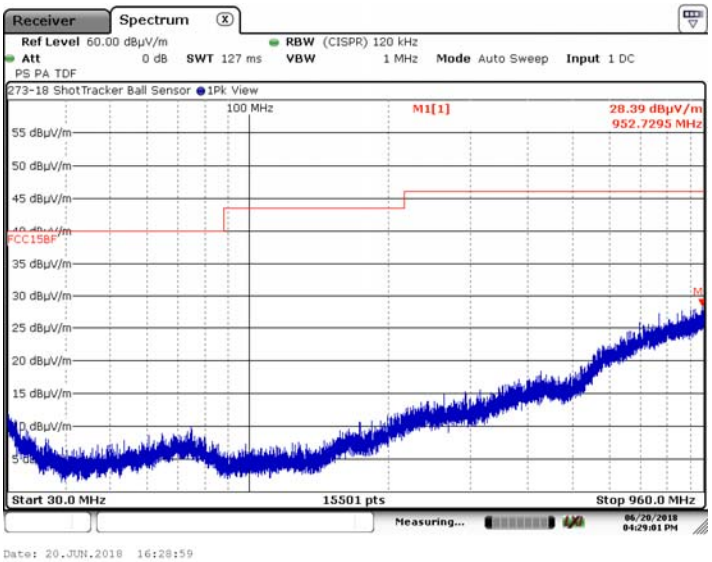
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.21 Horizontal Polarity – 30 to 960 MHz – Channel 3, 64M Y-Axis



Note: All other channels were noise floor

6.4.1.22 Vertical Polarity – 30 to 960 MHz – Channel 3, 64M Y-Axis



Note: All other channels were noise floor

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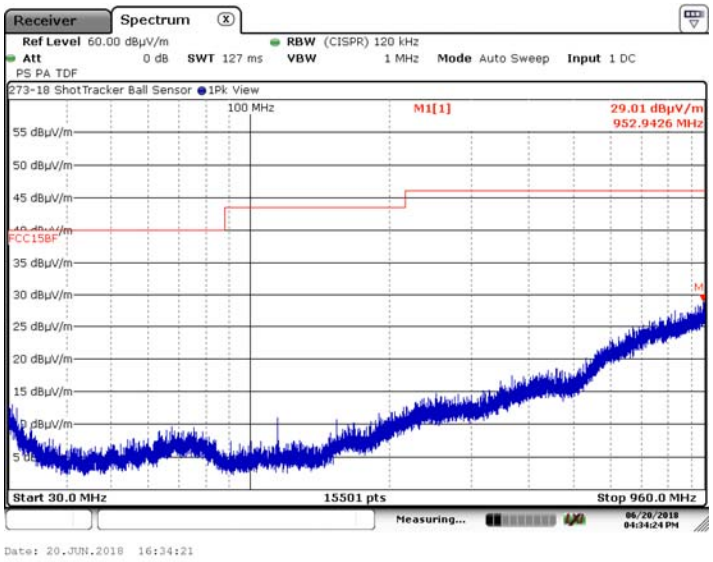
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.517 (c), 15.209 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

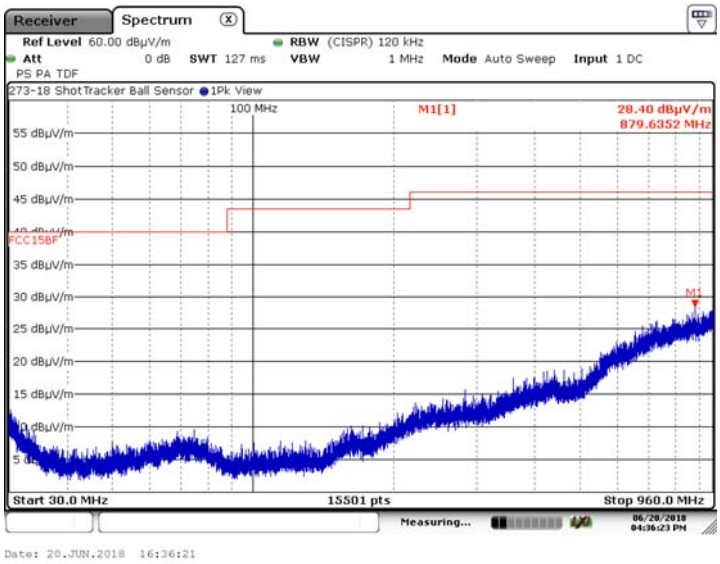
The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.23 Horizontal Polarity – 30 to 960 MHz – Channel 3, 64M Z-Axis



Note: All other channels were noise floor

6.4.1.24 Vertical Polarity – 30 to 960 MHz – Channel 3, 64M Z-Axis



Note: All other channels were noise floor

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6. Measurement Data (continued)

6.5. Spurious Radiated Emissions above 960 MHz (15.517 (c), 15.521 (d))

Requirement: 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:

The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
960 - 1610	-75.3	19.9
1610 - 1990	-53.3	41.9
1990 - 3100	-51.3	43.9
3100 - 10600	-41.3	53.9
Above 10600	-51.3	43.9

Frequency Range:	960 MHz to 40 GHz
Measurement Distance:	1 Meter and 0.5 Meter
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth	10 MHz
Detector Function:	RMS 1 mS Average as defined in 15.521(d)

Notes: Measurements made from 960 MHz to 18 GHz were made in a semi-anechoic chamber at 1 Meter using a -9.54 dB distance offset was programmed into the spectrum analyzer.

Measurements made from 8 to 18 GHz were done with the aid of a High Pass Filter before the low noise amplifier.

Measurements made from 18 to 40 GHz were done at 0.3 meters and a -20.00 dB distance offset was programmed into the spectrum analyzer.

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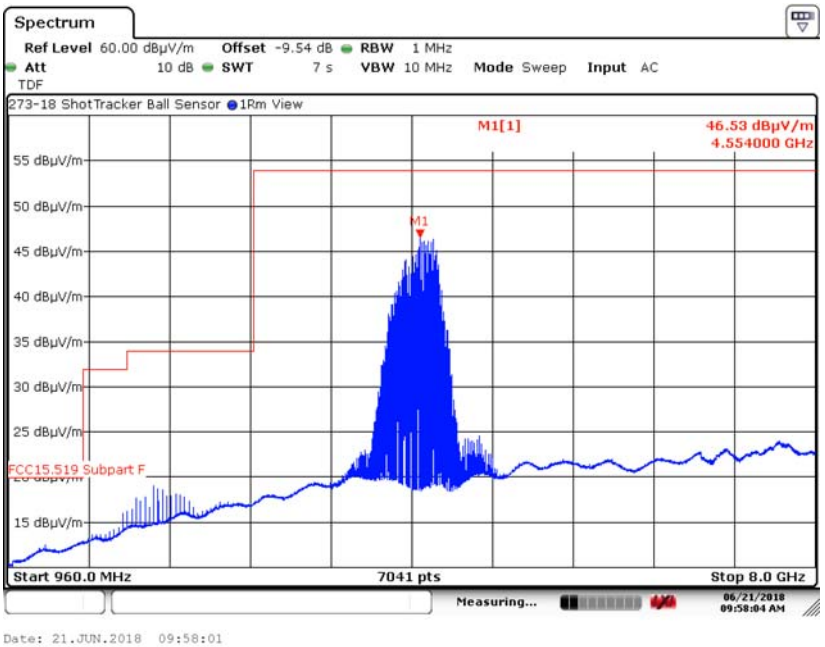
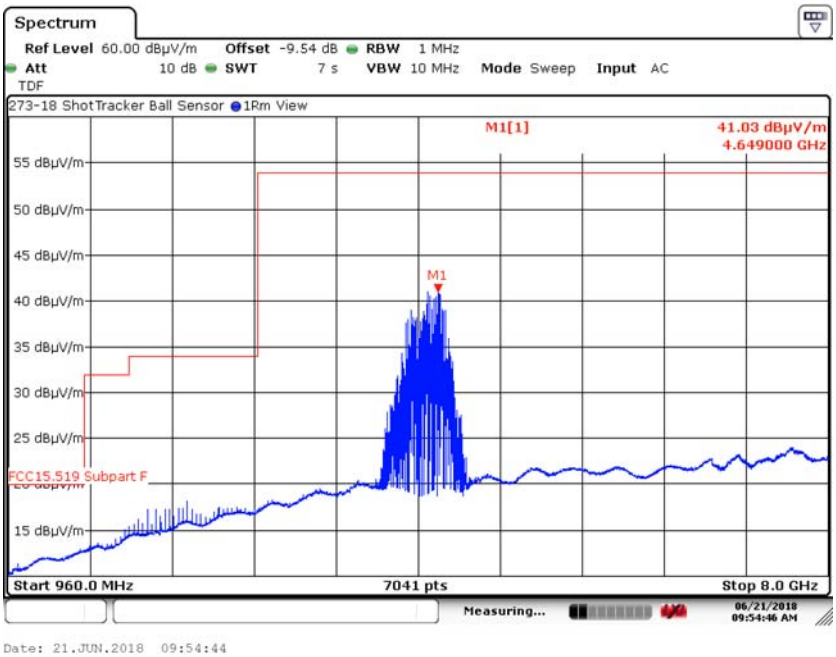
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.1. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH3,16M



6.5.2. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH3,16M



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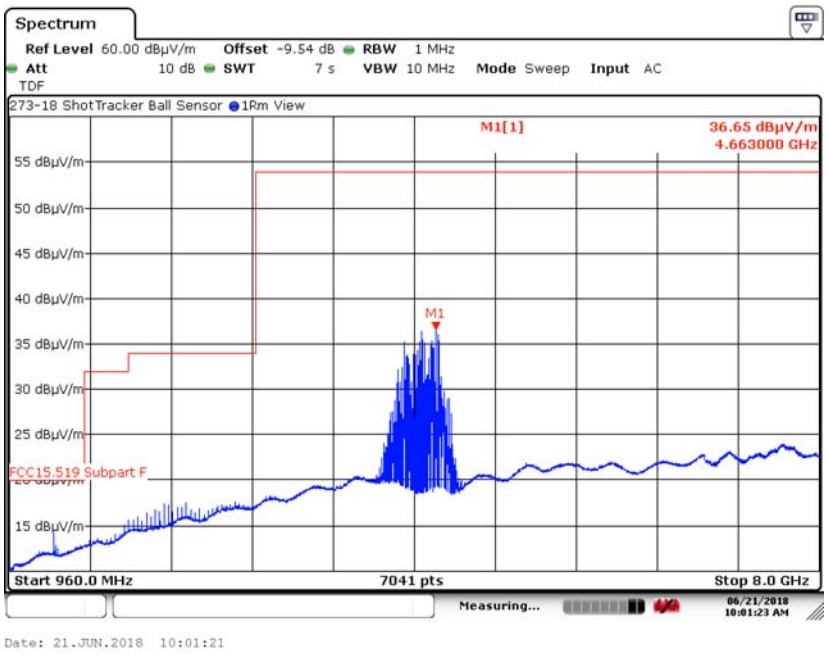
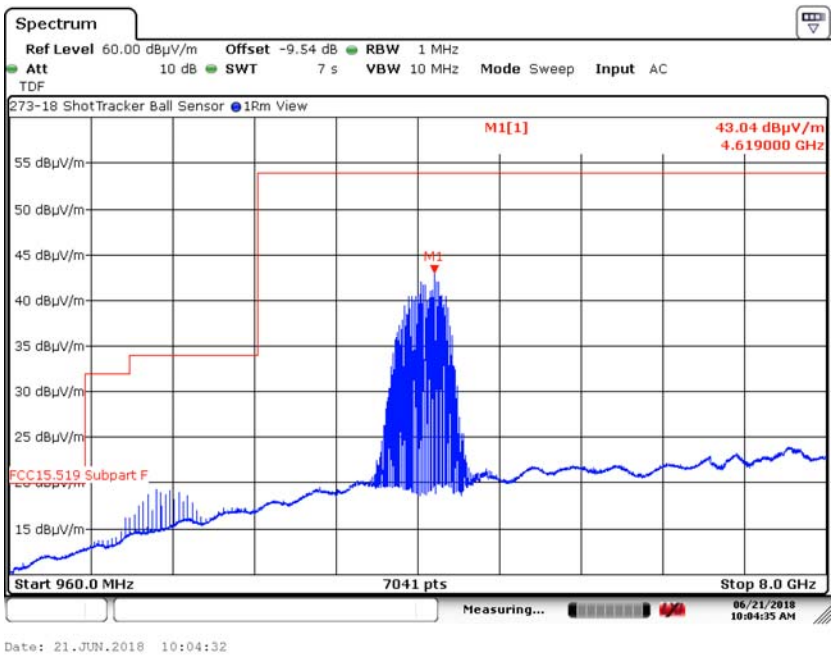
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Y-Axis

6.5.3. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH3,16M



6.5.4. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH3,16M



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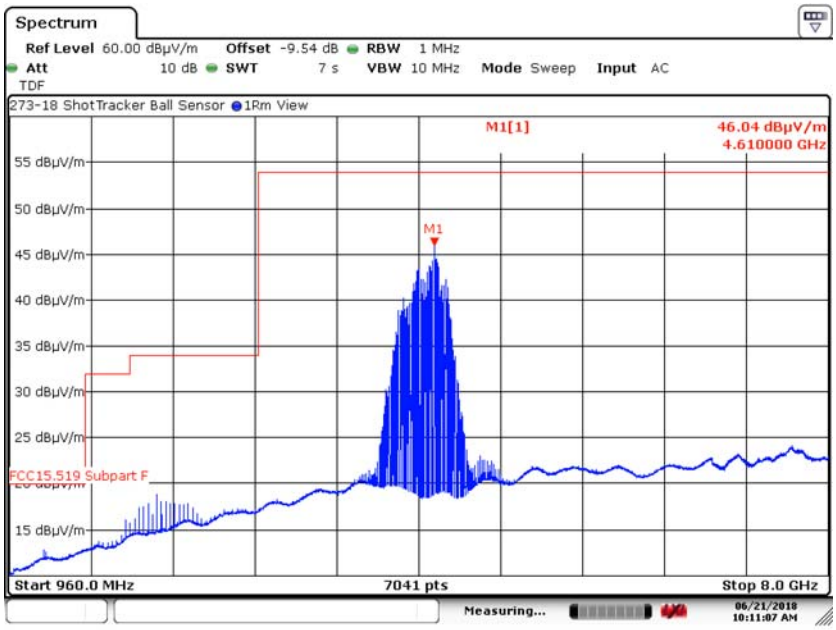
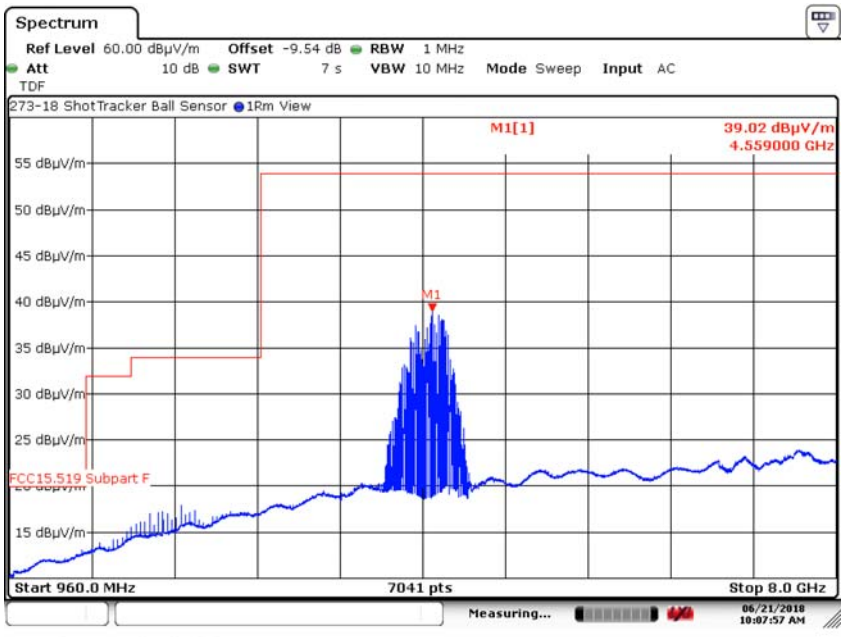
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Z-Axis

6.5.5. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH3,16M



6.5.6. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH3,16M



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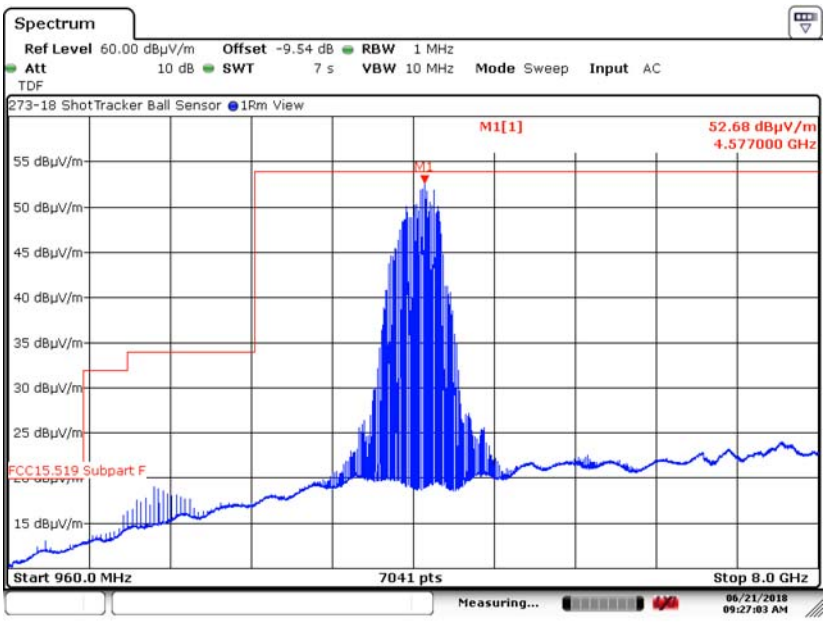
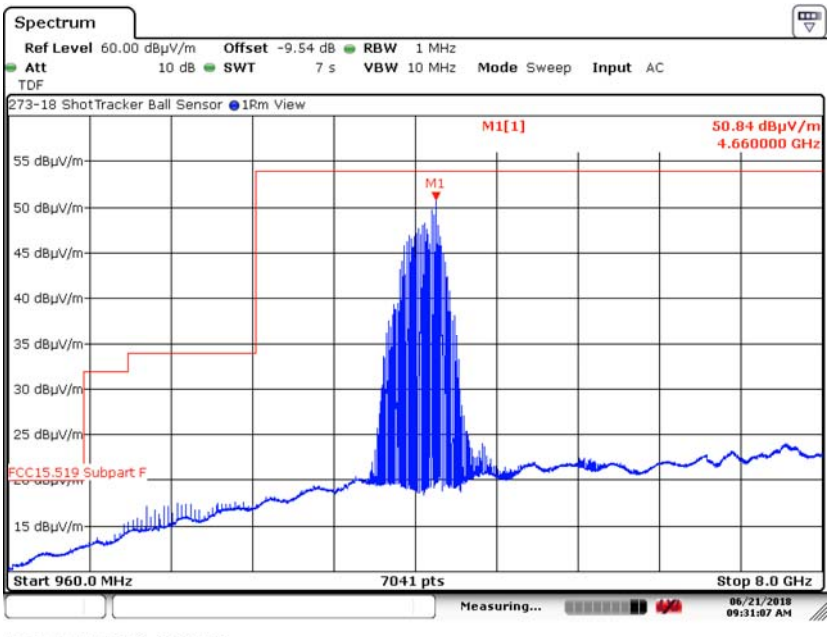
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.7. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH3,64M



6.5.8. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH3,64M



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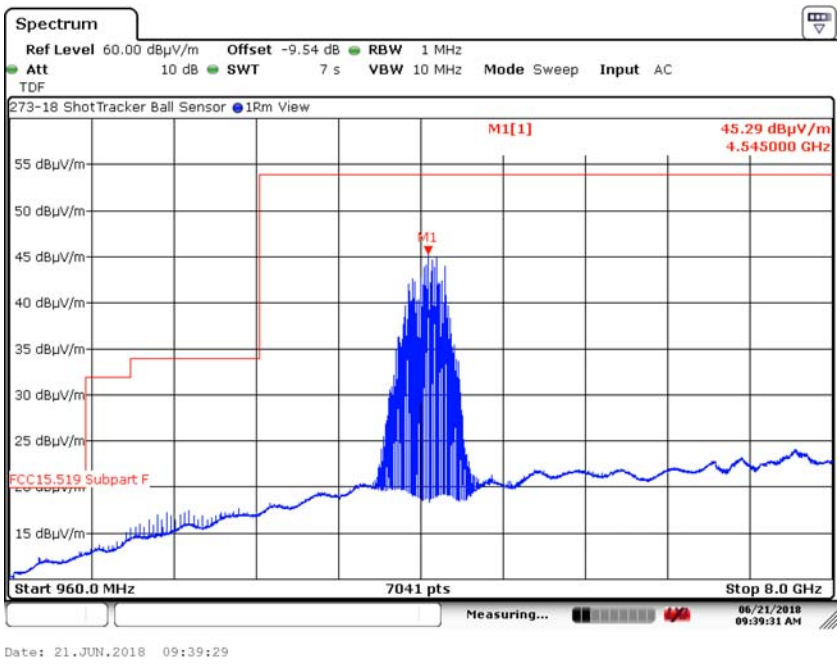
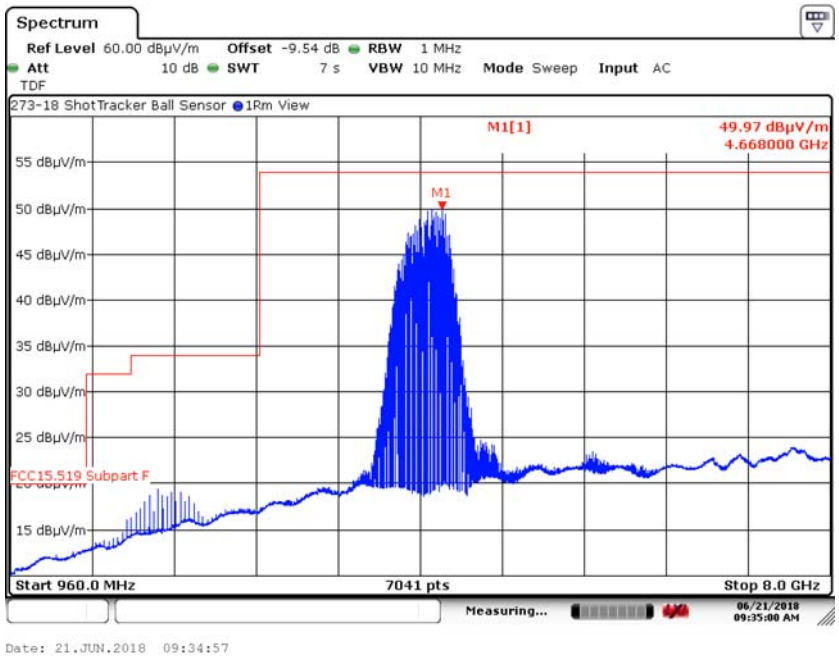
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Y-Axis

6.5.9. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH3,64M



6.5.10. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH3,64M



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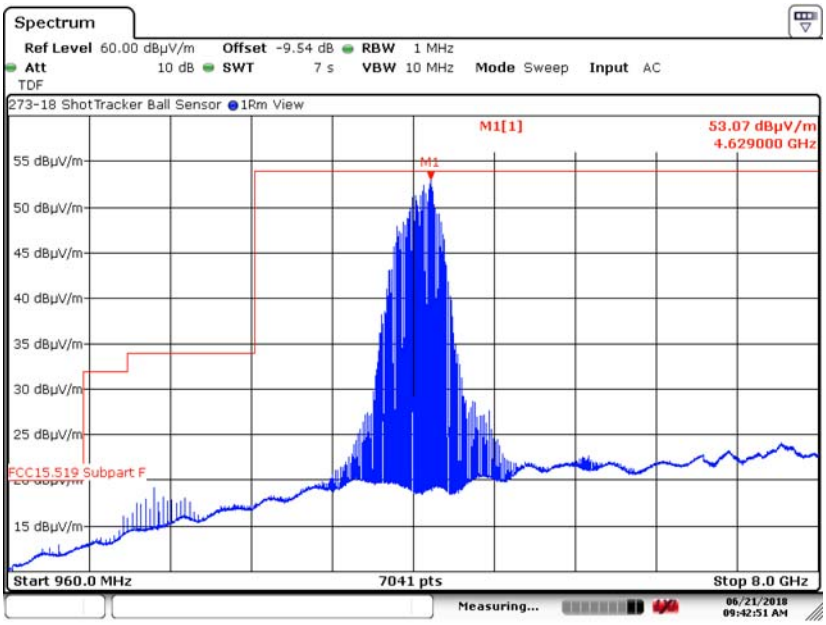
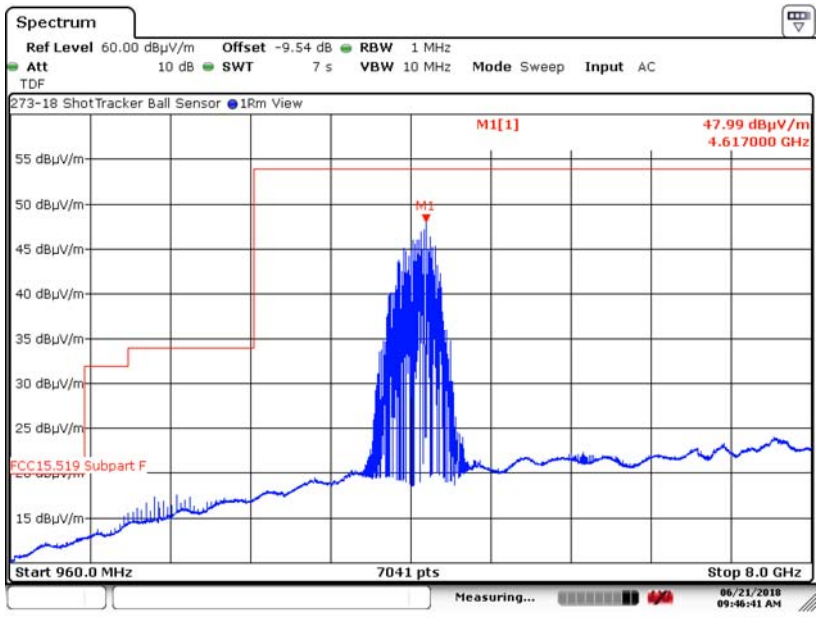
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Z-Axis

6.5.11. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH3,64M



6.5.12. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH3,64M



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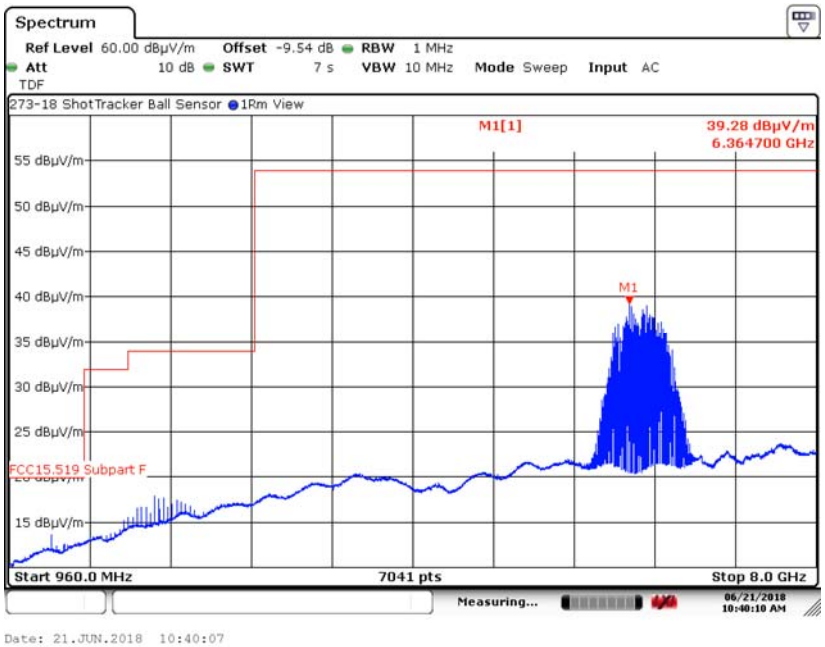
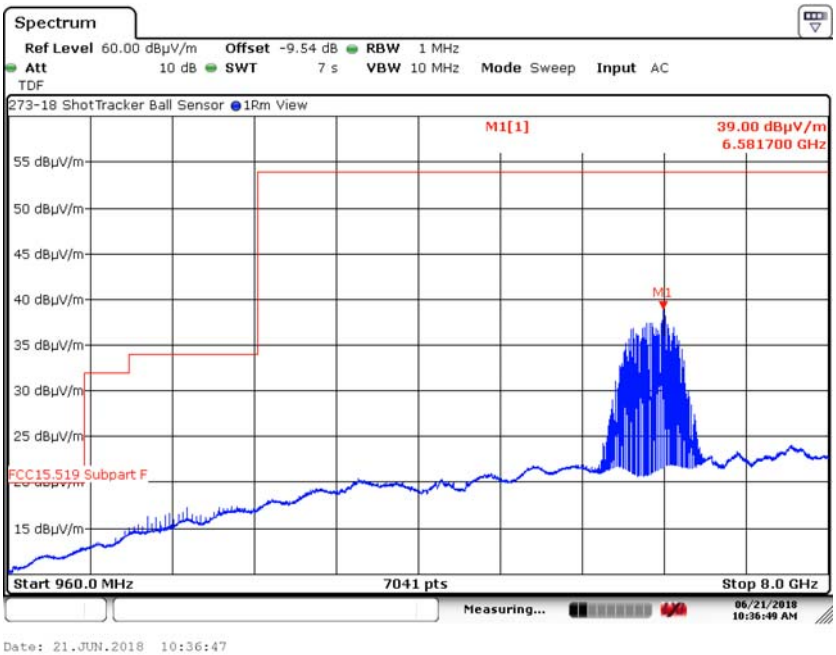
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.13. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,16M



6.5.14. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,16M



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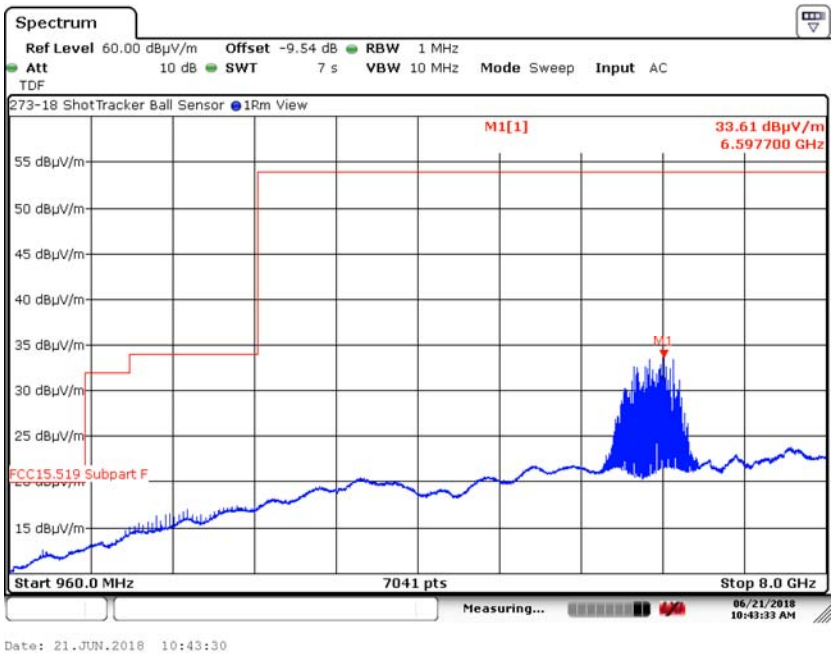
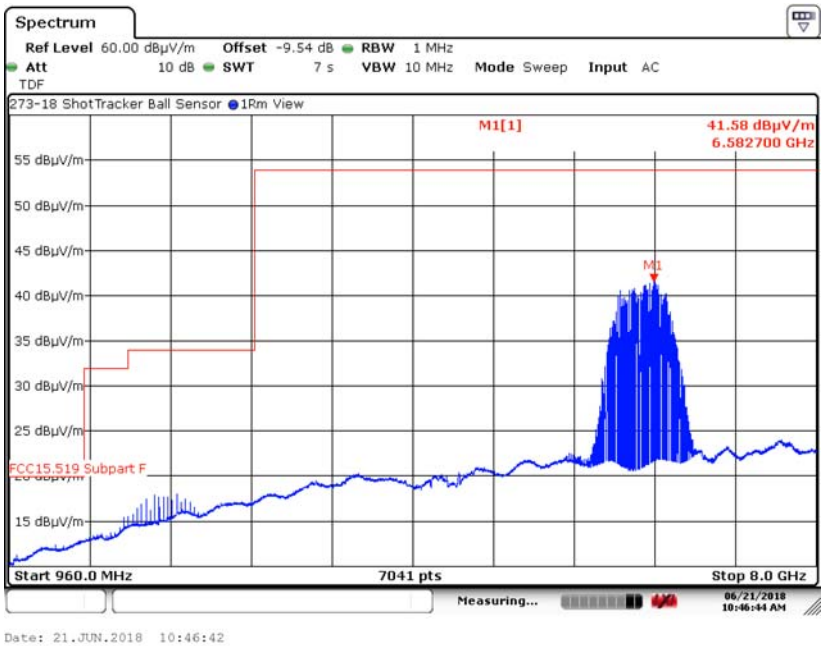
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Y-Axis

6.5.15. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,16M



6.5.16. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,16M



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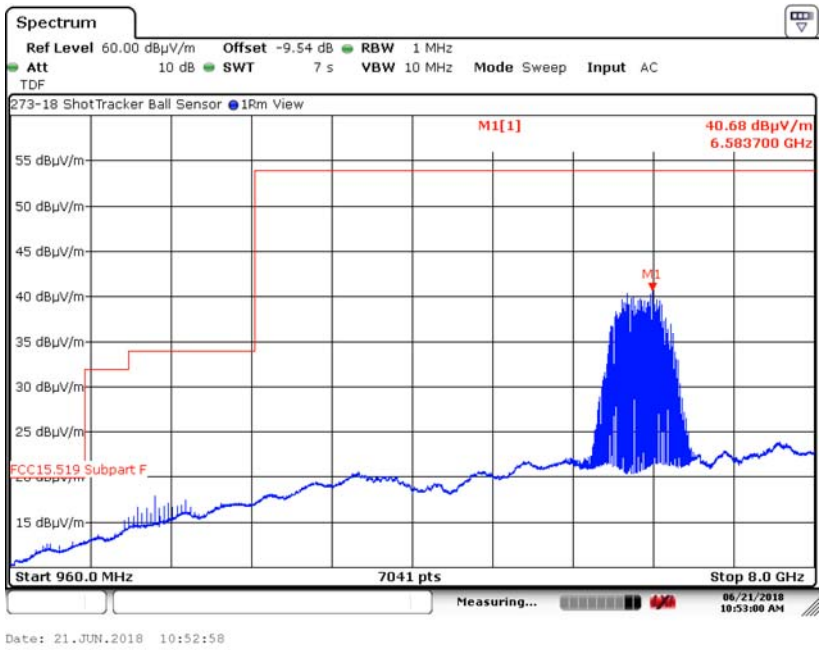
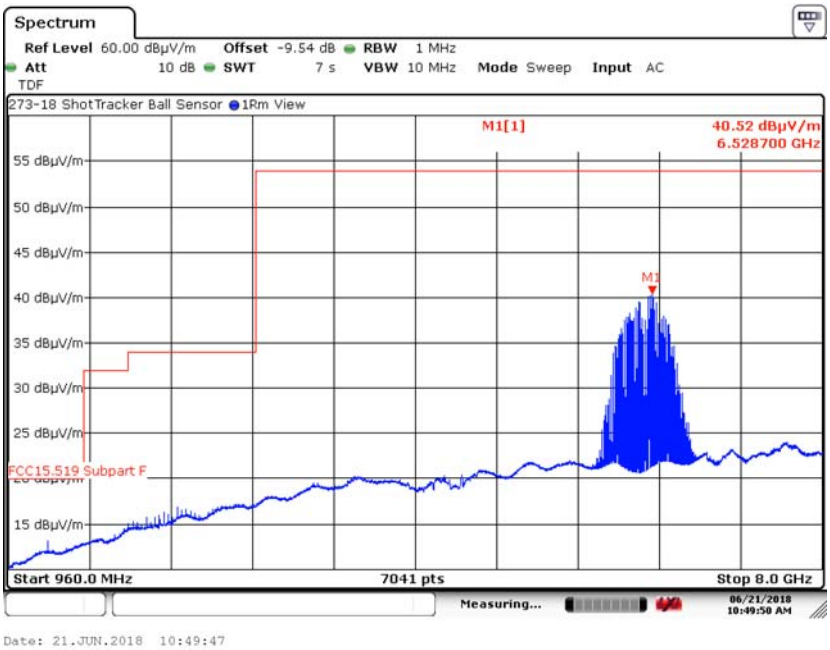
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Z-Axis

6.5.17. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,16M



6.5.18. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,16M



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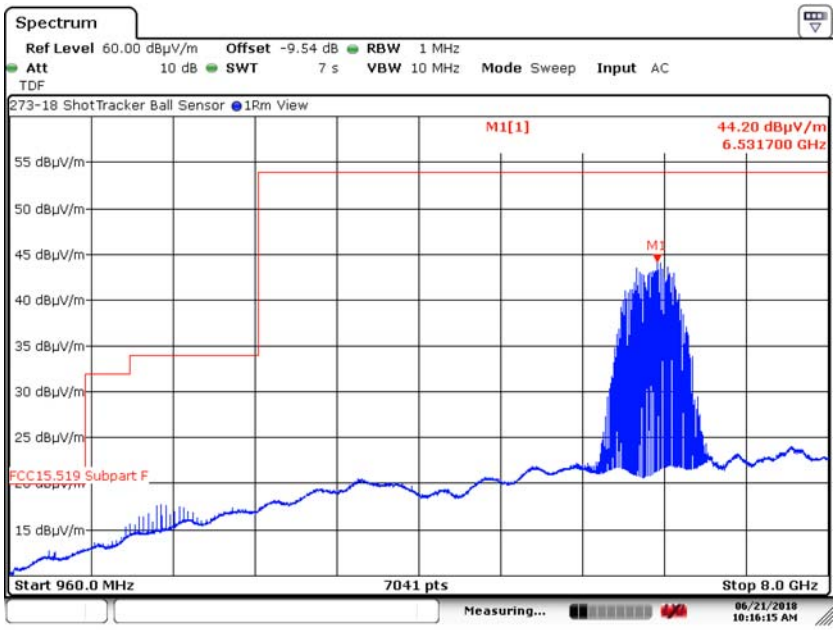
6. Measurement Data (continued)

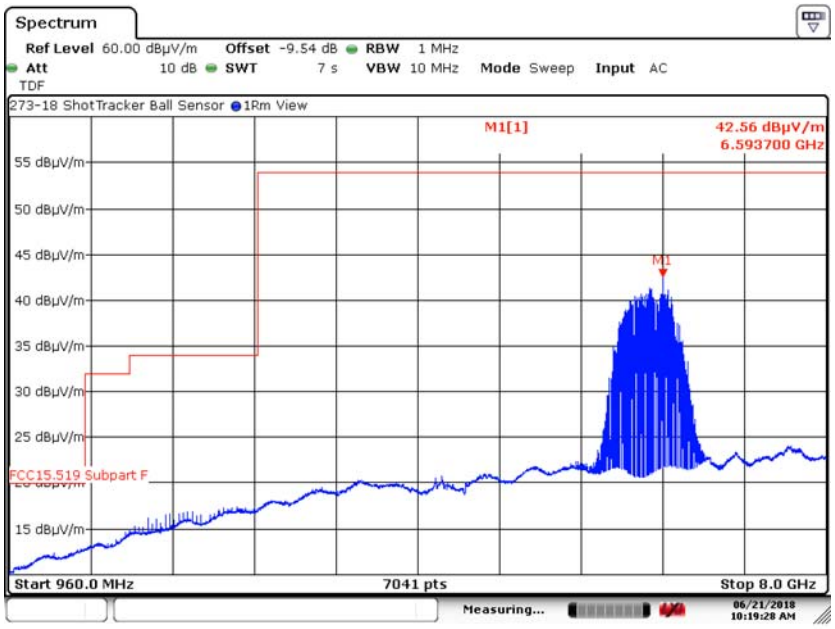
6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.19. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,64M



Date: 21.JUN.2018 10:16:12

6.5.20. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,64M



Date: 21.JUN.2018 10:19:26

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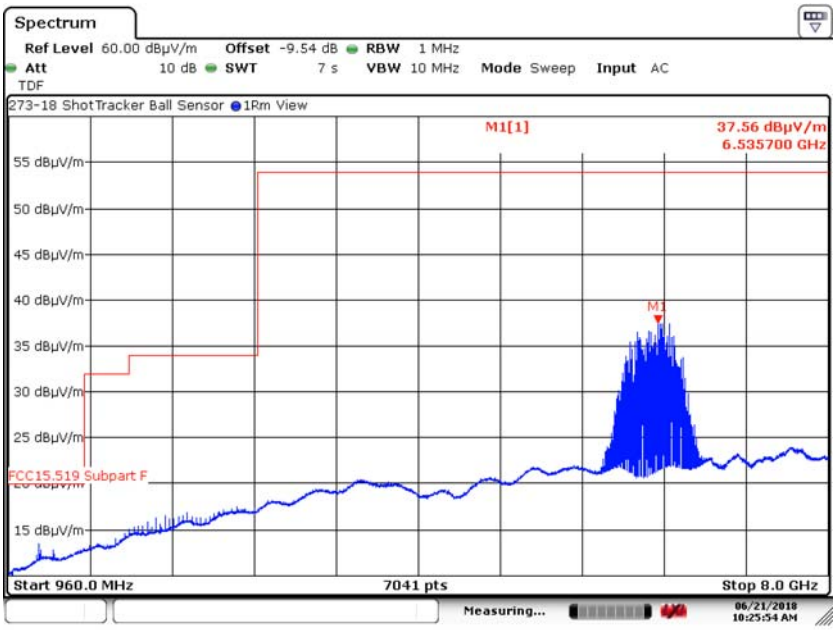
6. Measurement Data (continued)

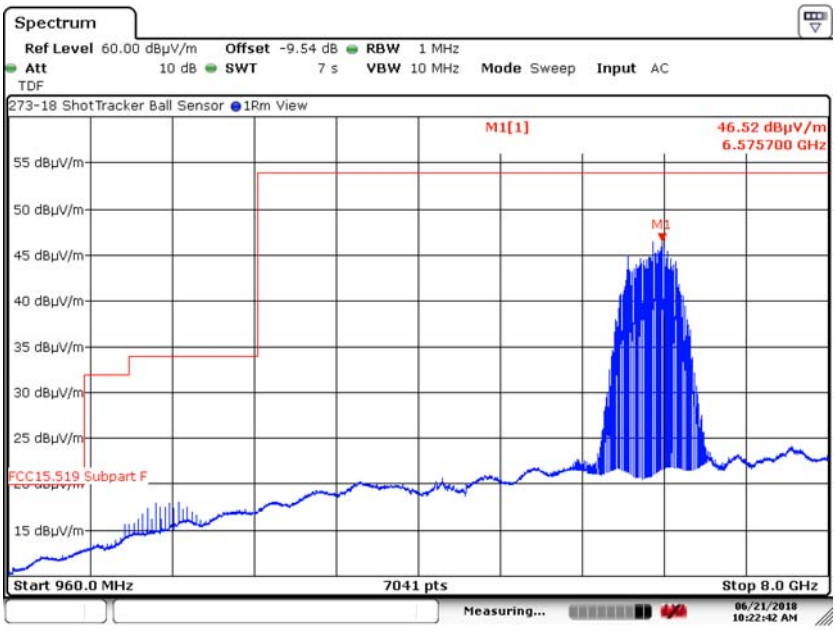
6.5. Spurious Radiated Emissions (15.517 (d) continued) Y-Axis

6.5.21. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,64M



Date: 21.JUN.2018 10:25:51

6.5.22. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,64M



Date: 21.JUN.2018 10:22:40

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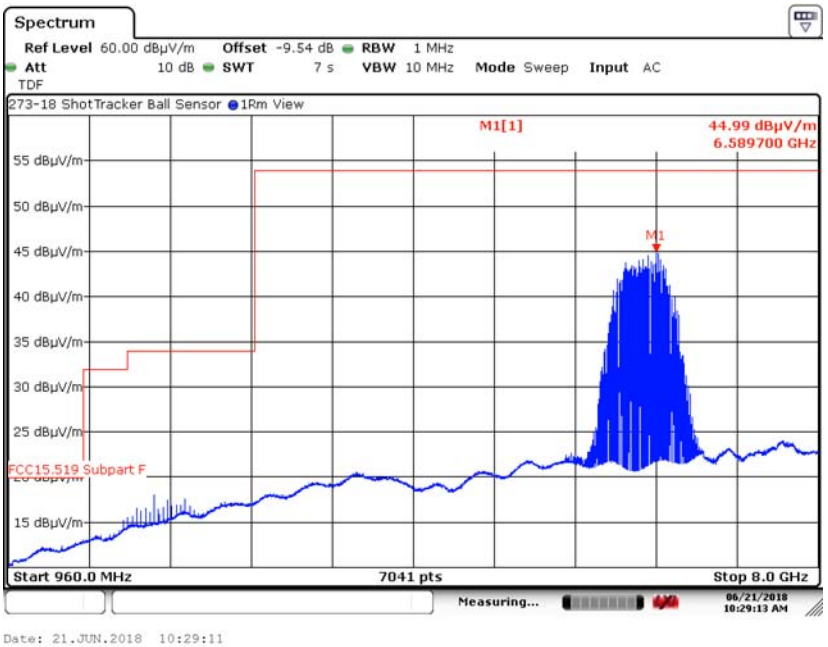
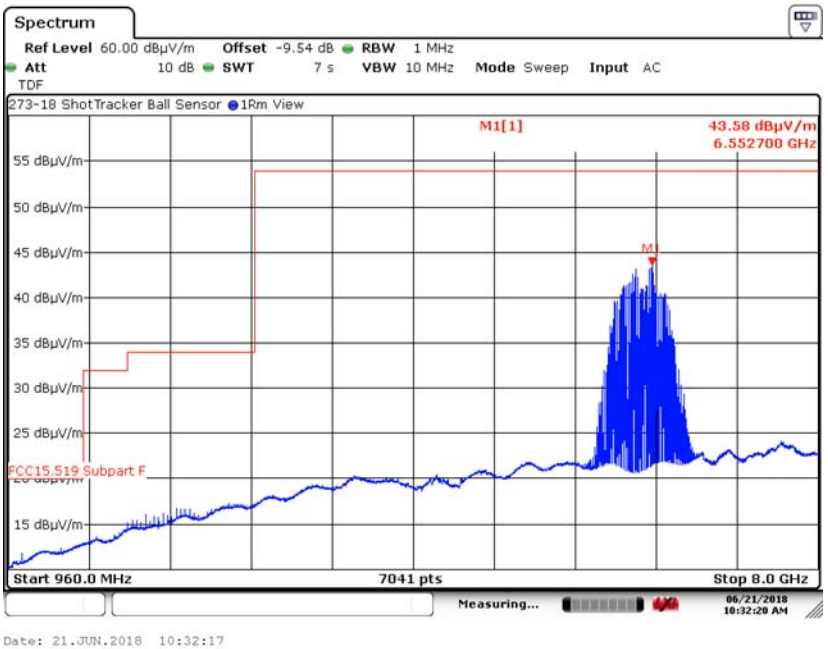
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Z-Axis

6.5.23. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,64



6.5.24. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,64M



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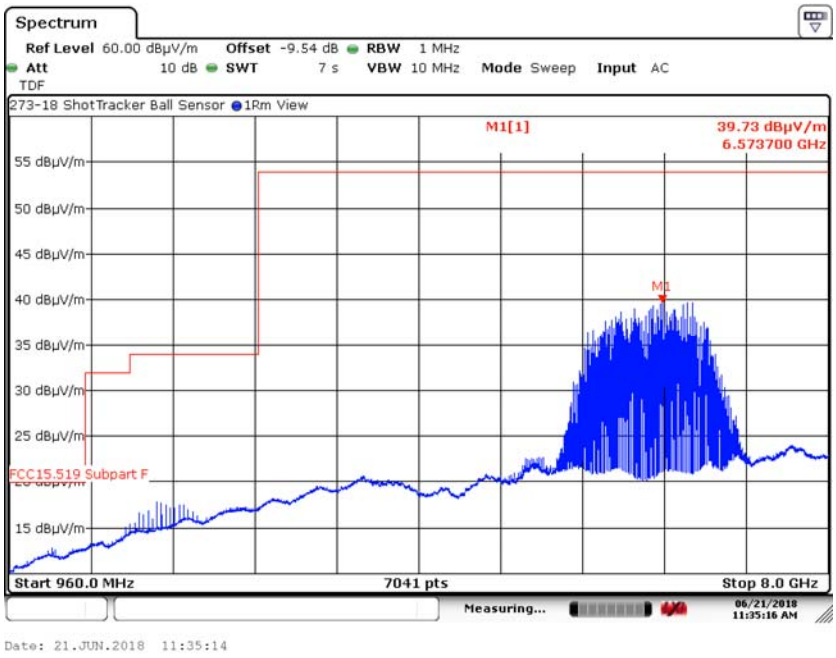
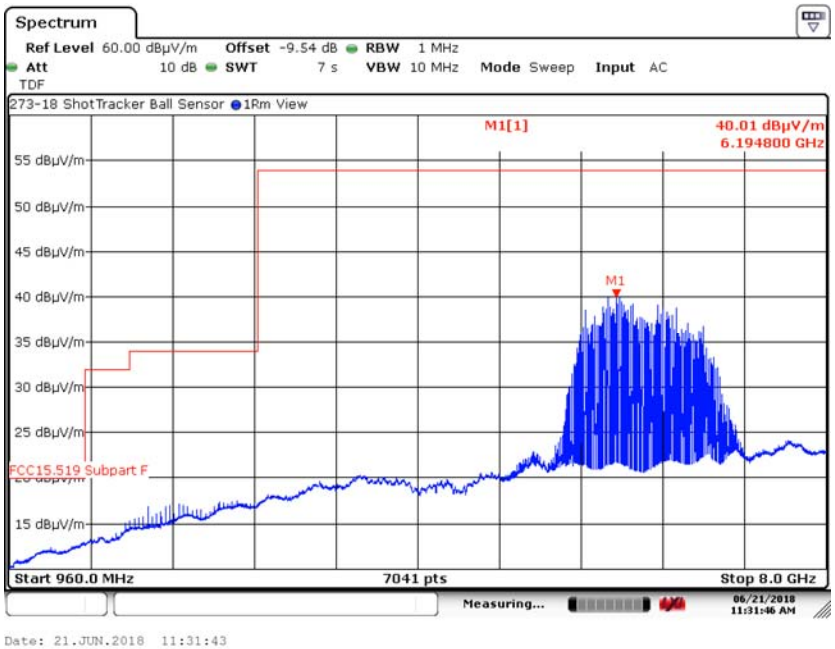
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.25. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,16



6.5.26. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,16M



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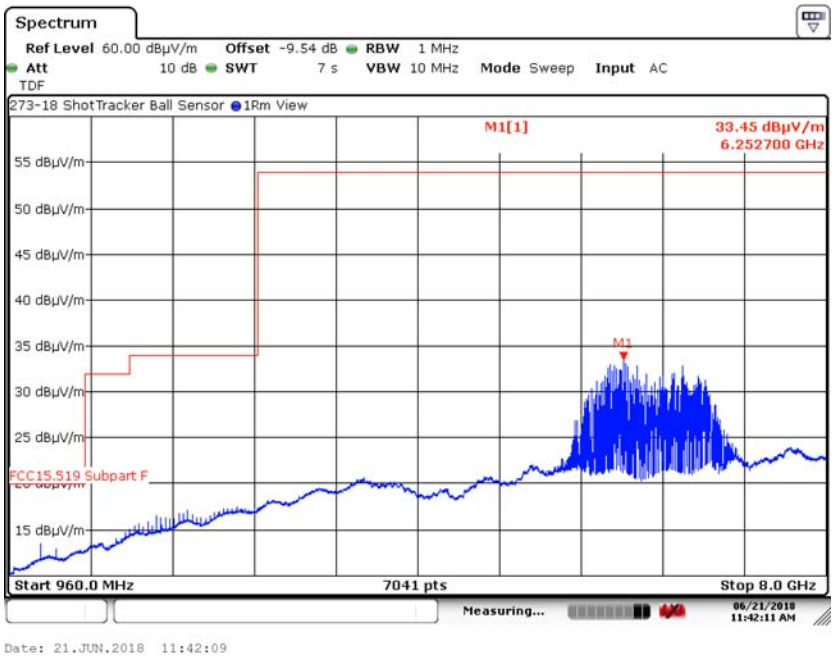
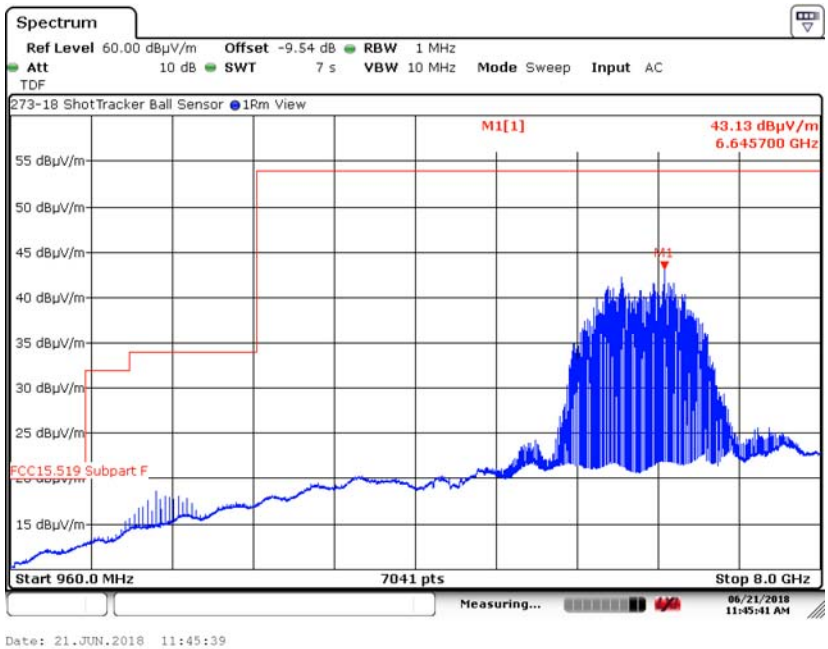
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Y-Axis

6.5.27. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,16



6.5.28. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,16M



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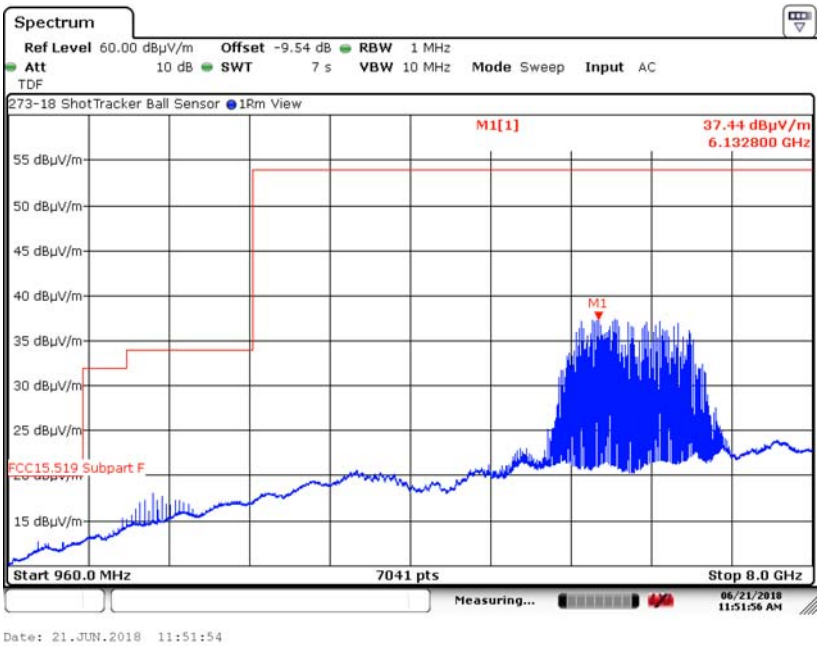
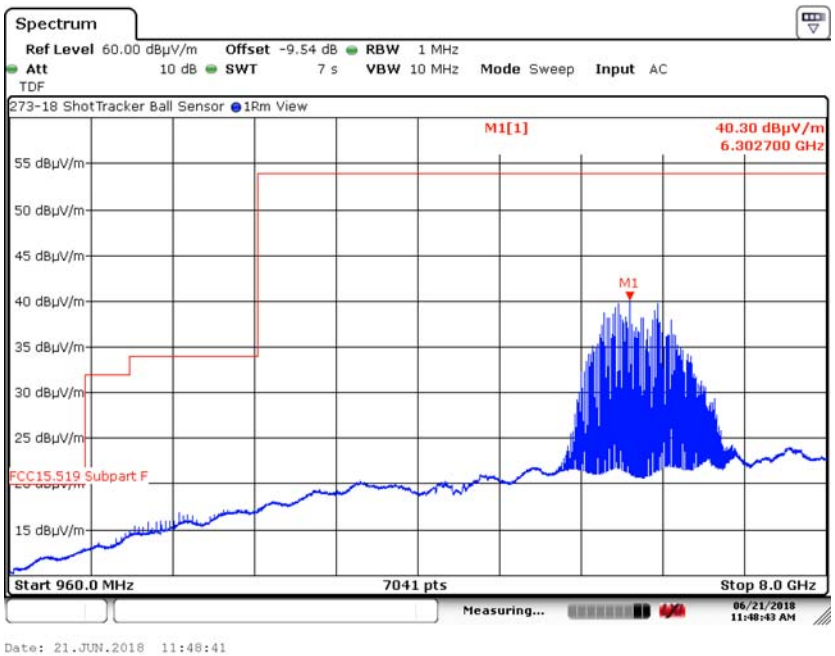
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) Z-Axis

6.5.29. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,16



6.5.30. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,16M



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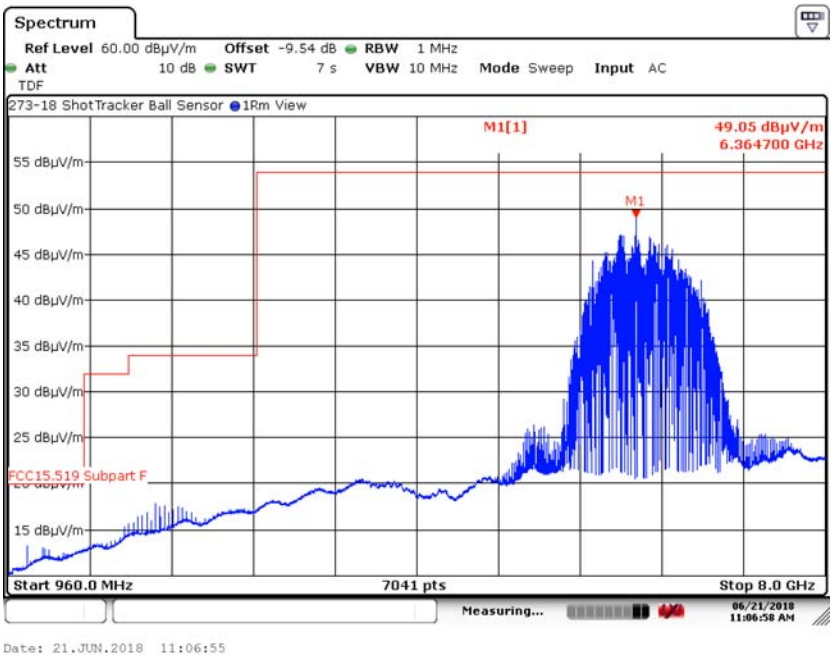
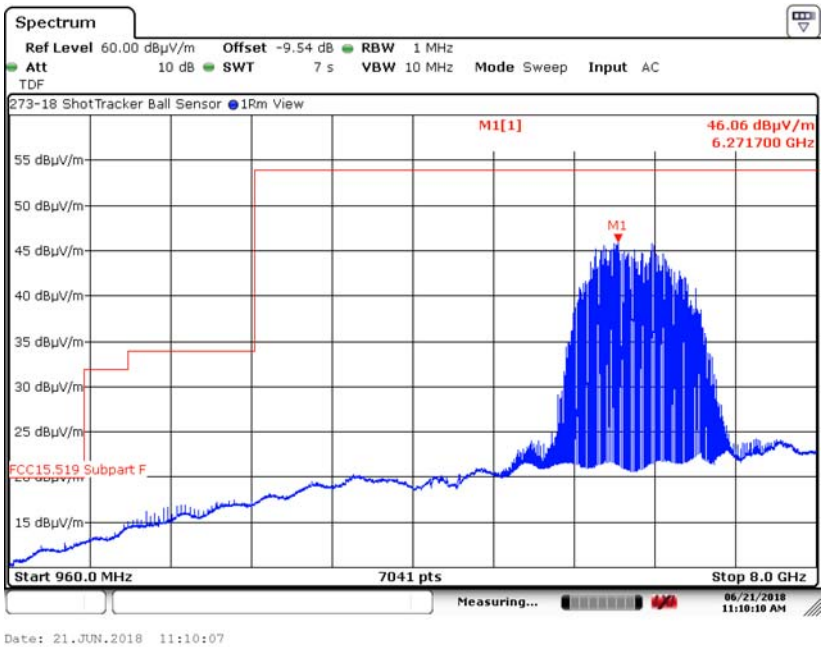
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.31. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,64



6.5.32. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,64M



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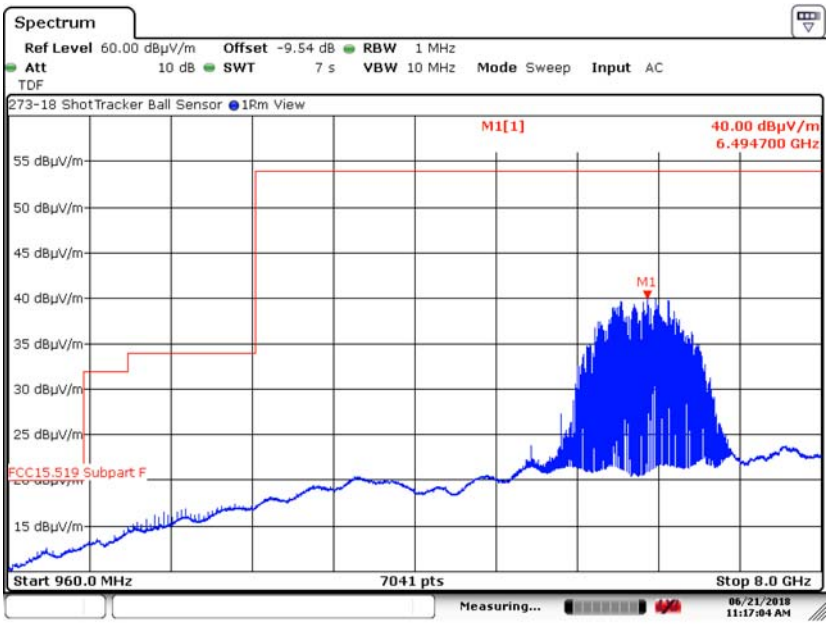
6. Measurement Data (continued)

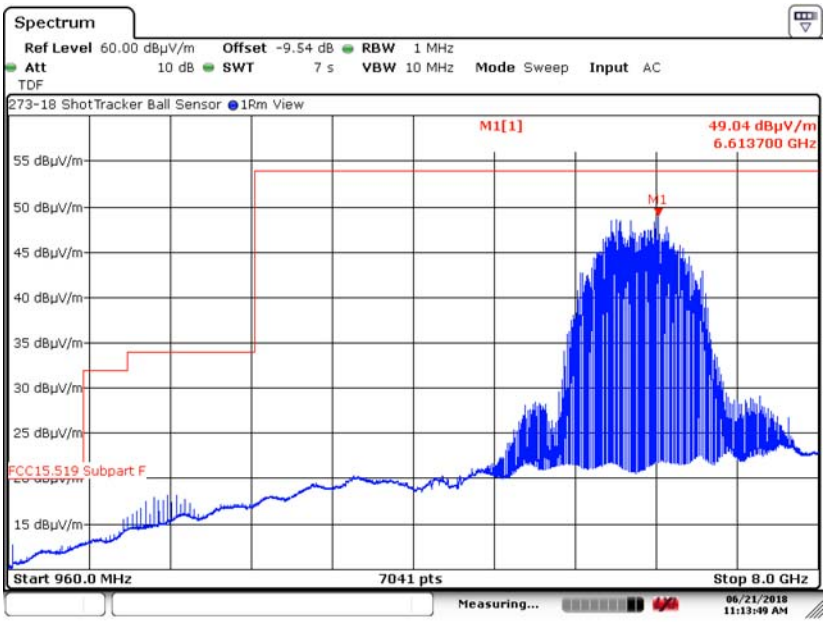
6.5. Spurious Radiated Emissions (15.517 (d) continued) Y-Axis

6.5.33. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,64



Date: 21.JUN.2018 11:17:02

6.5.34. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,64M



Date: 21.JUN.2018 11:13:46

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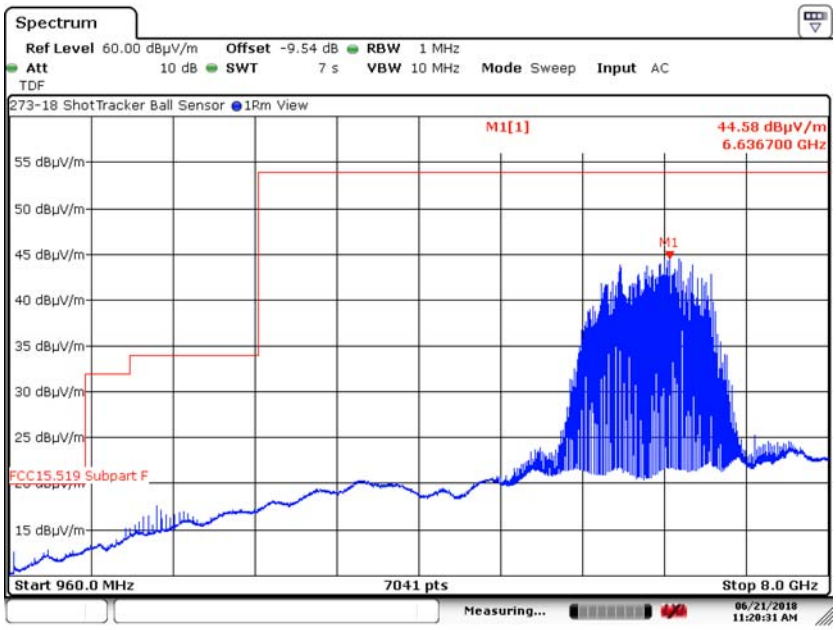
6. Measurement Data (continued)

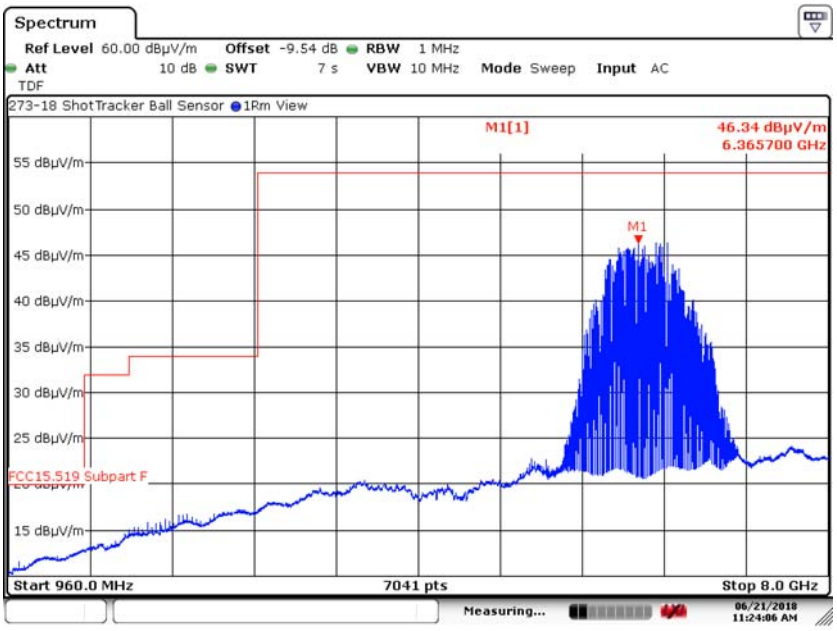
6.5. Spurious Radiated Emissions (15.517 (d) continued) Z-Axis

6.5.35. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,64



Date: 21.JUN.2018 11:20:29

6.5.36. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,64M



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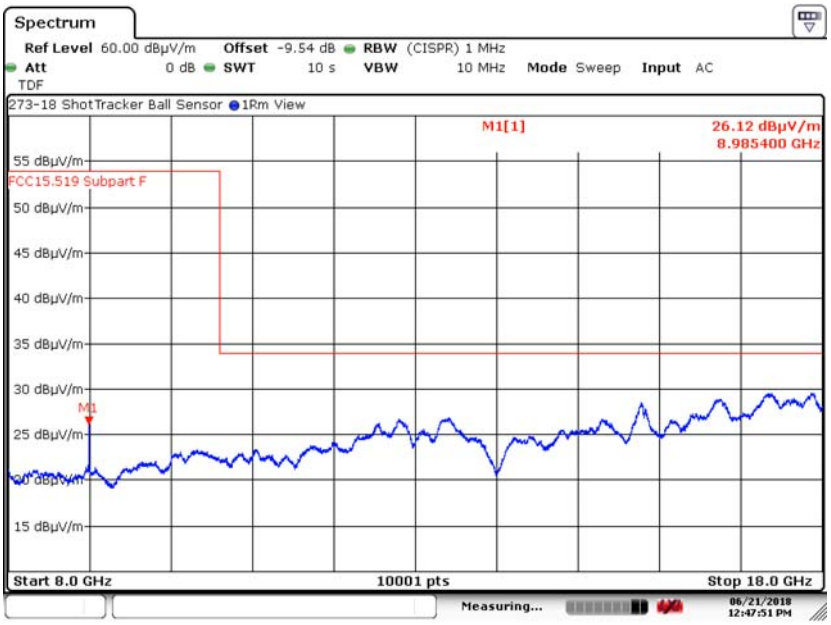
6. Measurement Data (continued)

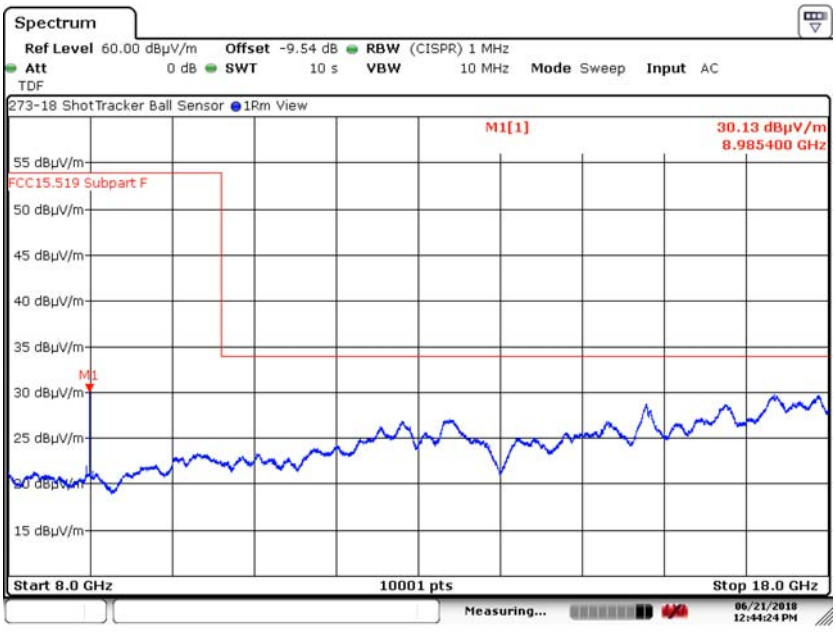
6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.37. 8 to 18 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH3, 64M



Date: 21.JUN.2018 12:47:49

6.5.38. 8 to 18 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH3, 64M



Date: 21.JUN.2018 12:44:21

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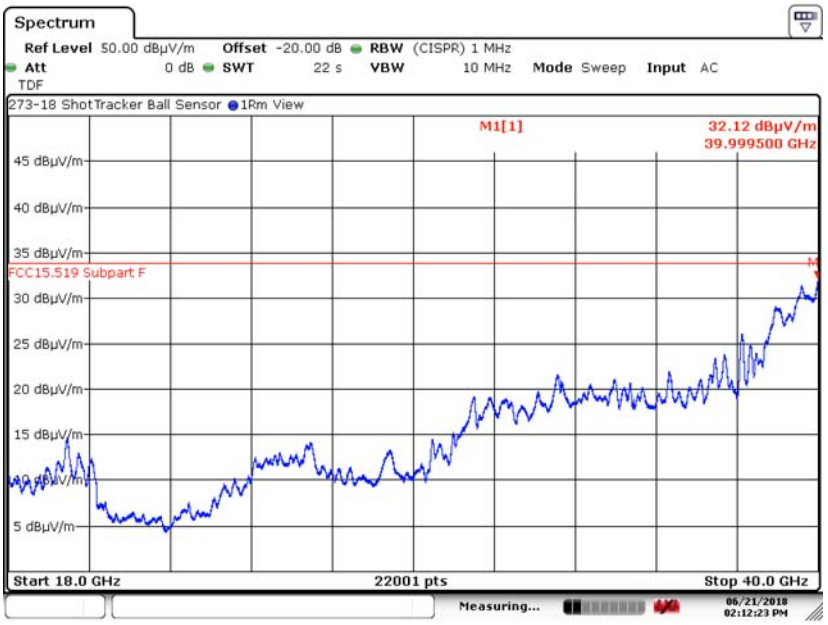
6. Measurement Data (continued)

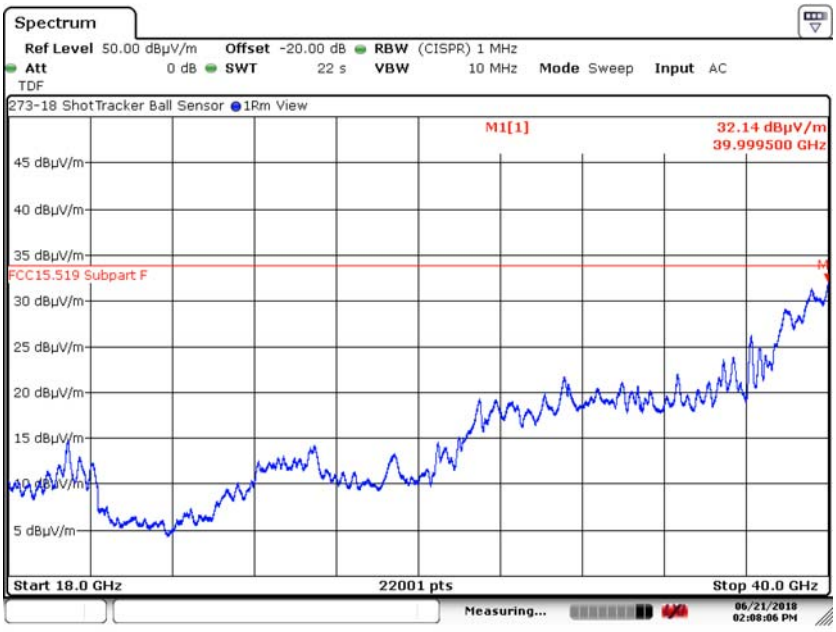
6.5. Spurious Radiated Emissions (15.517 (d) continued) X-Axis

6.5.39. 18 to 40 GHz Horizontal at 0.3 Meter, -20.00 dB offset in analyzer CH7, 16M



Date: 21.JUN.2018 14:12:20

6.5.40. 18 to 40 GHz Vertical at 0.3 Meter, -20.00 dB offset in analyzer CH7, 16M



Date: 21.JUN.2018 14:08:04

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6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (RSS-220 5.2.1 (d) continued)

Requirement: The radiated emissions at or below 960 MHz from a device shall not exceed the limits in Section 3.4. The radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
960 - 1610	-75.3	19.9
1610 – 4750	-70.0	25.2
4750 – 10,600	-41.3	53.9
Above 10,600	-51.3	43.9

Frequency Range:	960 MHz to 8 GHz
Measurement Distance:	1 Meter
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth	10 MHz
Detector Function:	RMS 1 mS Average as defined in Annex Section 4(b)

Notes: Measurements made from 960 MHz to 8 GHz were made in a semi-anechoic chamber at 1 Meter using a -9.54 dB distance offset was programmed into the spectrum analyzer. Worst case orientation was the Y-Axis.

Measurement data above 8 GHz for Channels 5 and 7 is provided in plots 6.5.37 to 6.5.40 on the previous pages.

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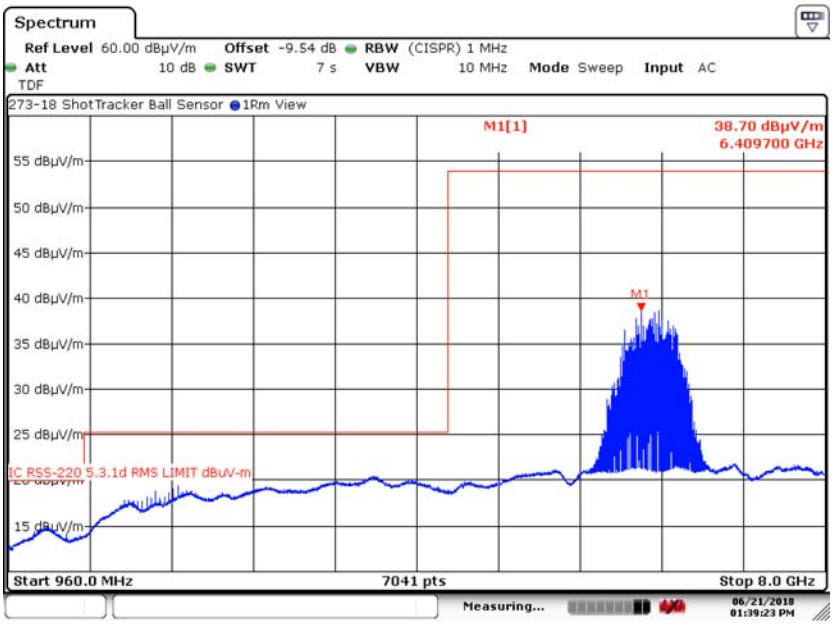
6. Measurement Data (continued)

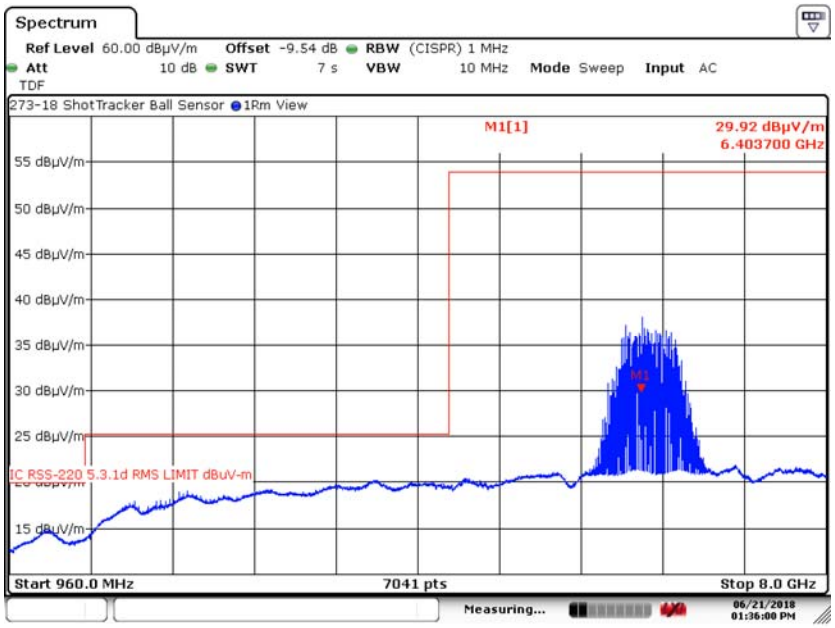
6.5. Spurious Radiated Emissions (RSS-220 5.2.1 (d)) continued) X-Axis

6.5.41. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,16



Date: 21.JUN.2018 13:39:21

6.5.42. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,16M



Date: 21.JUN.2018 13:35:57

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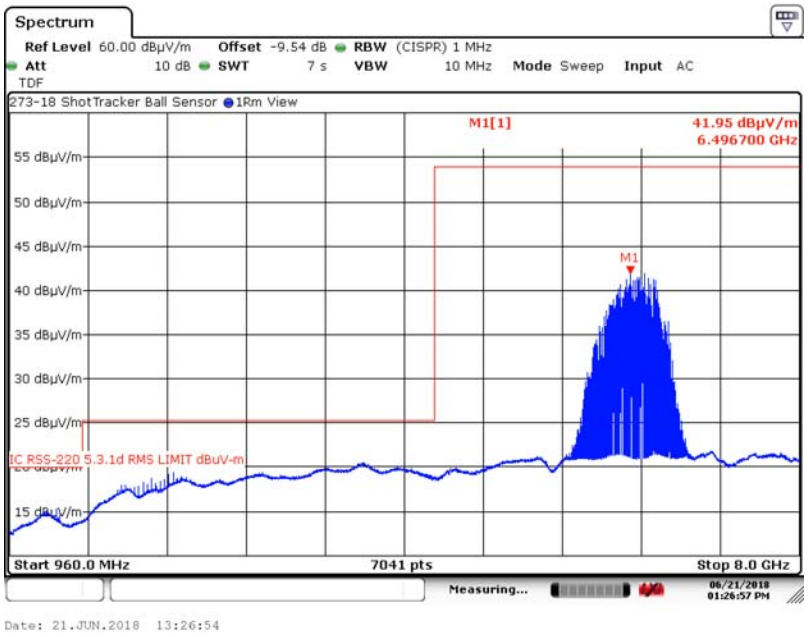
6. Measurement Data (continued)

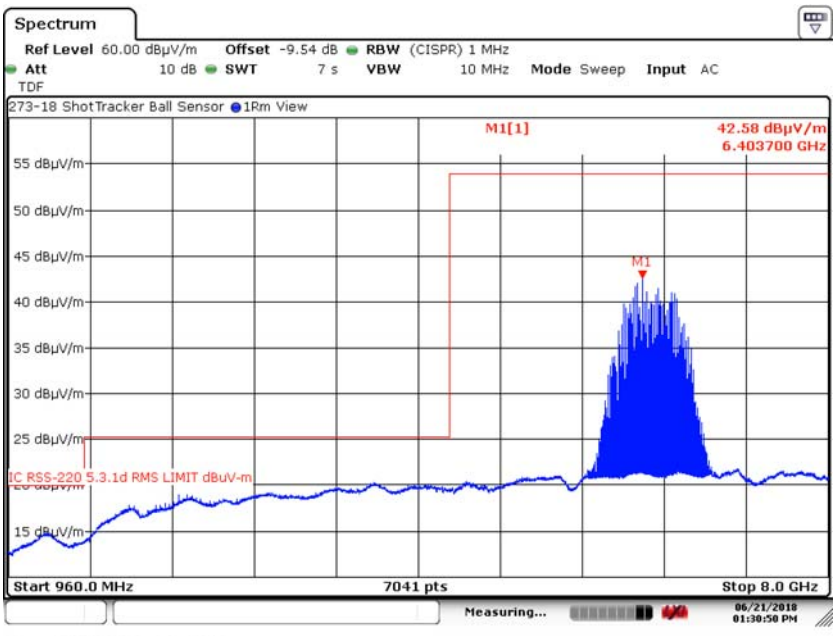
6.5. Spurious Radiated Emissions (RSS-220 5.2.1 (d)) continued) X-Axis

6.5.43. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH5,64



Date: 21.JUN.2018 13:26:54

6.5.44. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH5,64M



Date: 21.JUN.2018 13:30:48

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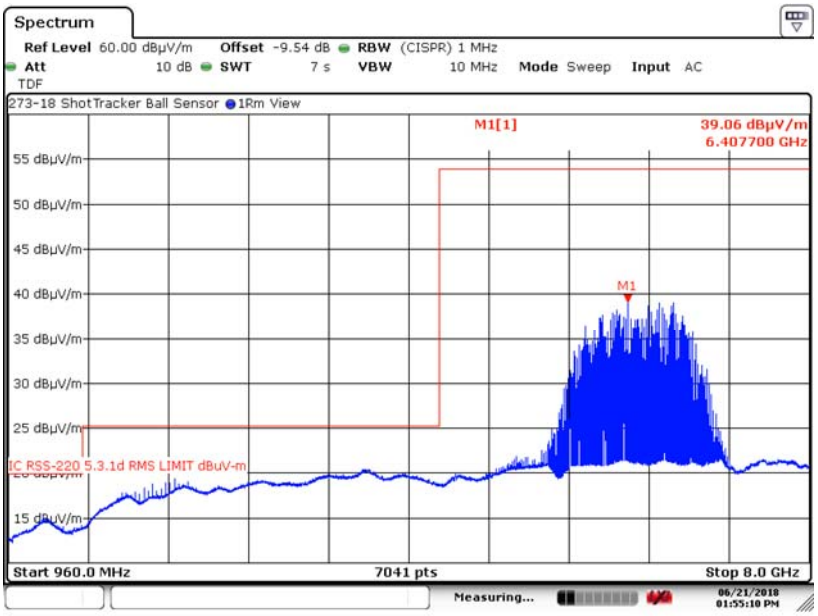
6. Measurement Data (continued)

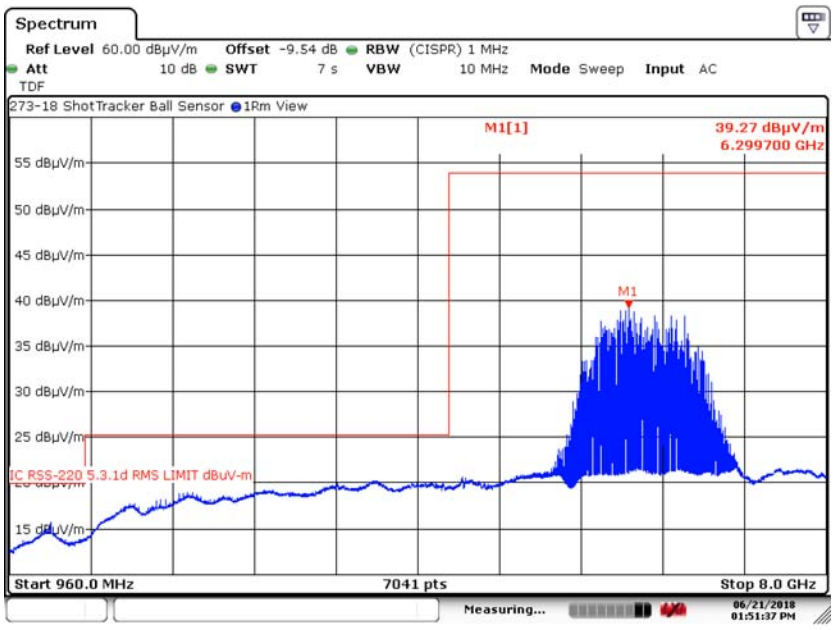
6.5. Spurious Radiated Emissions (RSS-220 5.2.1 (d)) continued) X-Axis

6.5.45. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,16



Date: 21.JUN.2018 13:55:07

6.5.46. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,16M



Date: 21.JUN.2018 13:51:35

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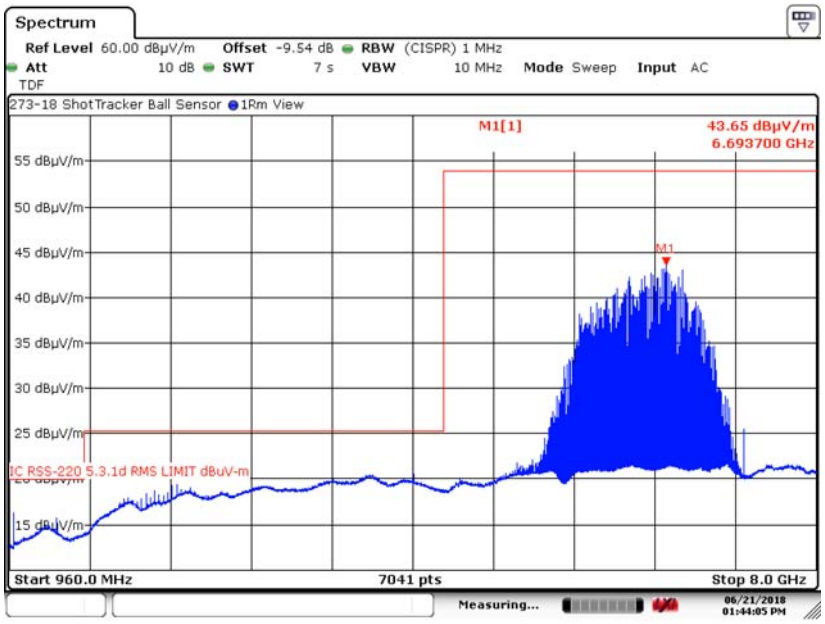
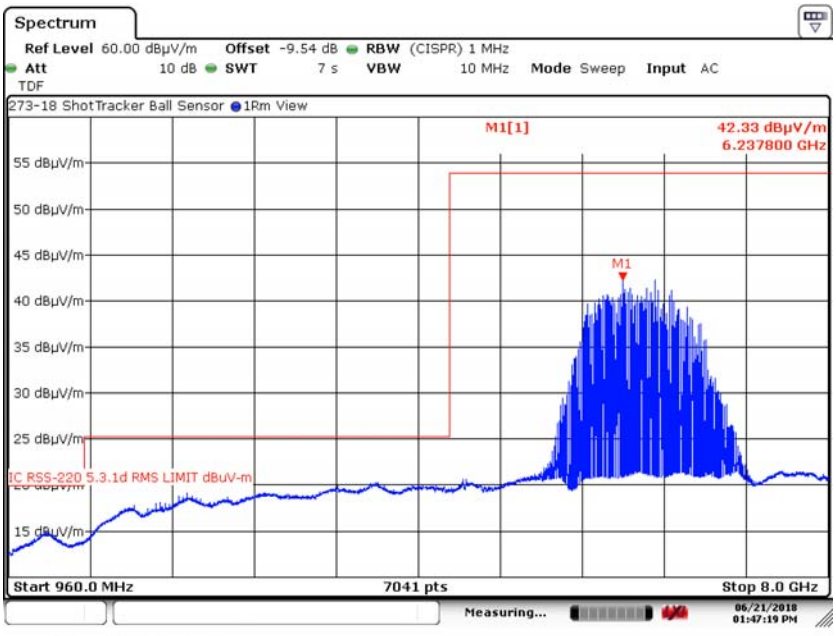
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions (RSS-220 5.2.1 (d)) continued) X-Axis

6.5.47. 960 MHz to 8 GHz Horizontal at 1 Meter, -9.54 dB offset in analyzer CH7,64



6.5.48. 960 MHz to 8 GHz Vertical at 1 Meter, -9.54 dB offset in analyzer CH7,64M



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6. Measurement Data (continued)

6.6. Spurious Radiated Emissions in GPS Bands (15.517 (d), RSS 5.2.1 (e))

Requirement: In addition to the radiated emission limits specified in the table in paragraph (d) of this section, 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:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
1164 - 1240	-85.3	9.9
1559 - 1610	-85.3	9.9

6.6.1. Measurement & Equipment Setup

EMI Receiver IF Bandwidth:	1 kHz
EMI Receiver Avg Bandwidth:	10 kHz
Detector Functions:	RMS Average, 1mS/point

6.6.2. 1164 to 1240 MHz & 1559 to 1610 MHz

There were no broadband emissions related to the UWB transmitter. Measured signals were narrowband and related to the microprocessor / clocks and do not fall under the requirements of this section. Measurements were made at 1.5 Meters with a -9.54 dB distance correction factor. The -85.3 dBm limit was converted to a field strength limit of 9.9 dBuV/m using a factor of 95.2.

Note: Worst case data of all channels and axis.

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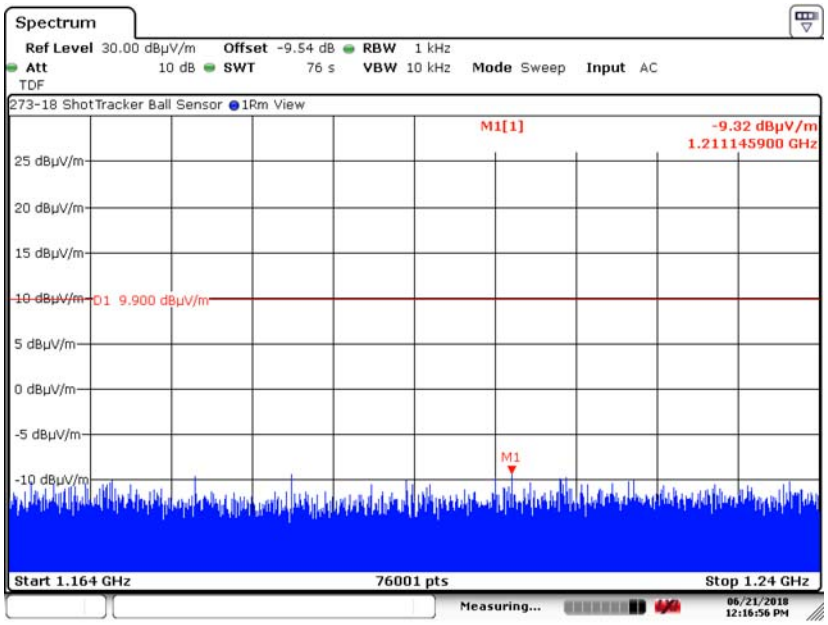
6. Measurement Data (continued)

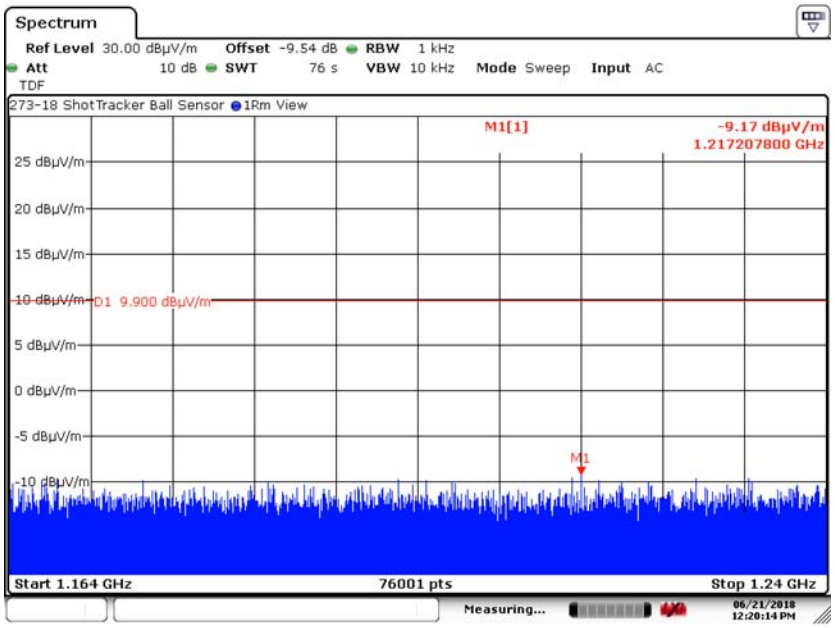
6.6. Spurious Radiated Emissions in GPS Bands (15.517 (d) continued) X-Axis

6.6.3.1 Horizontal Measurement Polarity 1164 to 1240 MHz, CH3, 64M



Date: 21.JUN.2018 12:16:54

6.6.3.2 Vertical Measurement Polarity 1164 to 1240 MHz, CH3 64M



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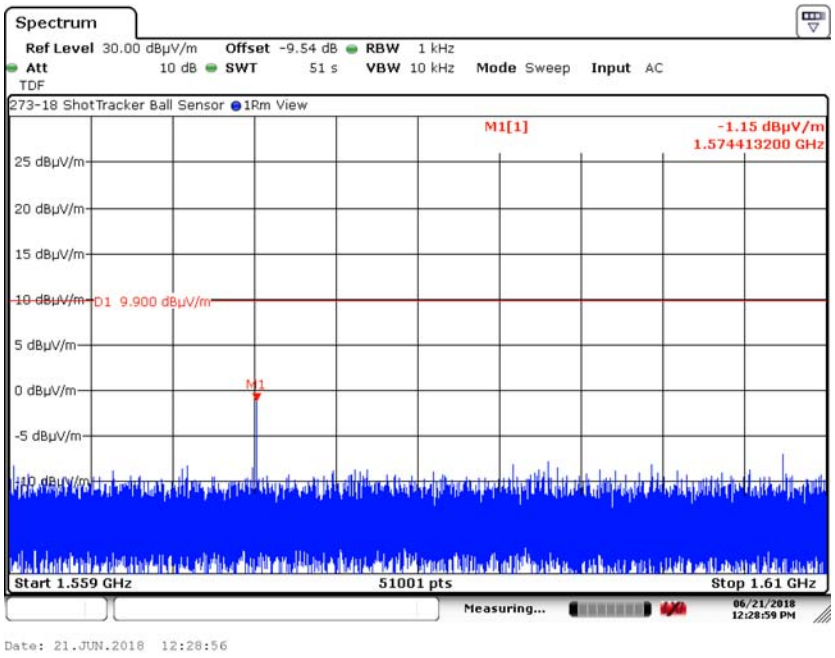
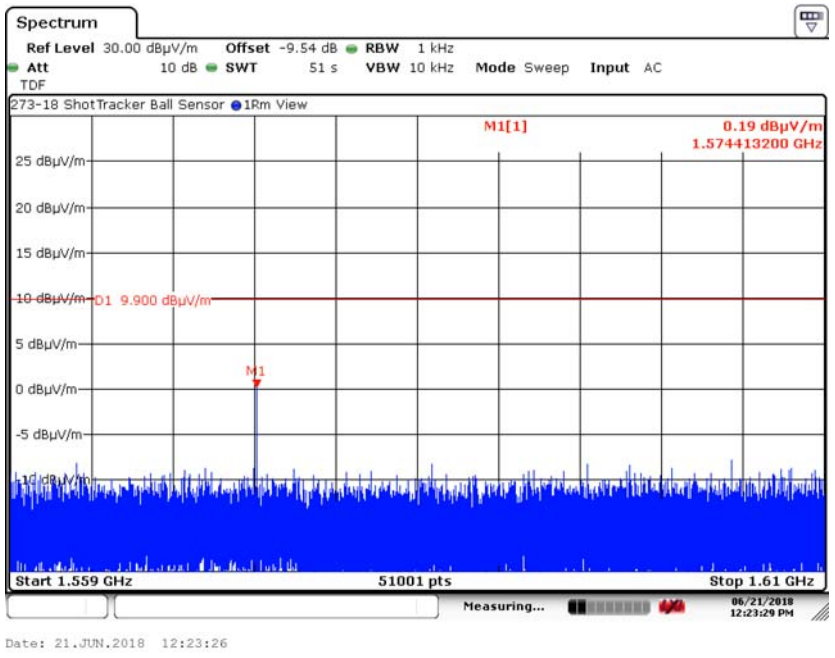
6. Measurement Data (continued)

6.6. Spurious Radiated Emissions in GPS Bands (15.517 (d) continued) X-Axis

6.6.3.3 Horizontal Measurement Polarity 1559 to 1610 MHz, CH3, 64M



6.6.3.4 Vertical Measurement Polarity 1559 to 1610 MHz, CH3, 64M



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6. Measurement Data (continued)

6.7. Radiated Emissions of UWB Transmission (15.517 (c), 15.521 (d), RSS-220 5.2.1)

Requirement: 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:

The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
3100 - 10600	-41.3	53.9

Frequency Range:	4 to 5 GHz, 6 to 7 GHz & 5.5 to 7.5 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth	10 MHz
Detector Function:	RMS 1 mS Average as defined in 15.521(d)

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6. Measurement Data (continued)

6.7. Spurious Radiated Emissions (15.517 (c), 15.521(d), RSS-220 5.2.1 (d))

6.7.1. Plot of RMS Power at 3 Meters (Channel 3, 16M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
4.6099	48.89	53.90	-5.01	H	104	47	Compliant

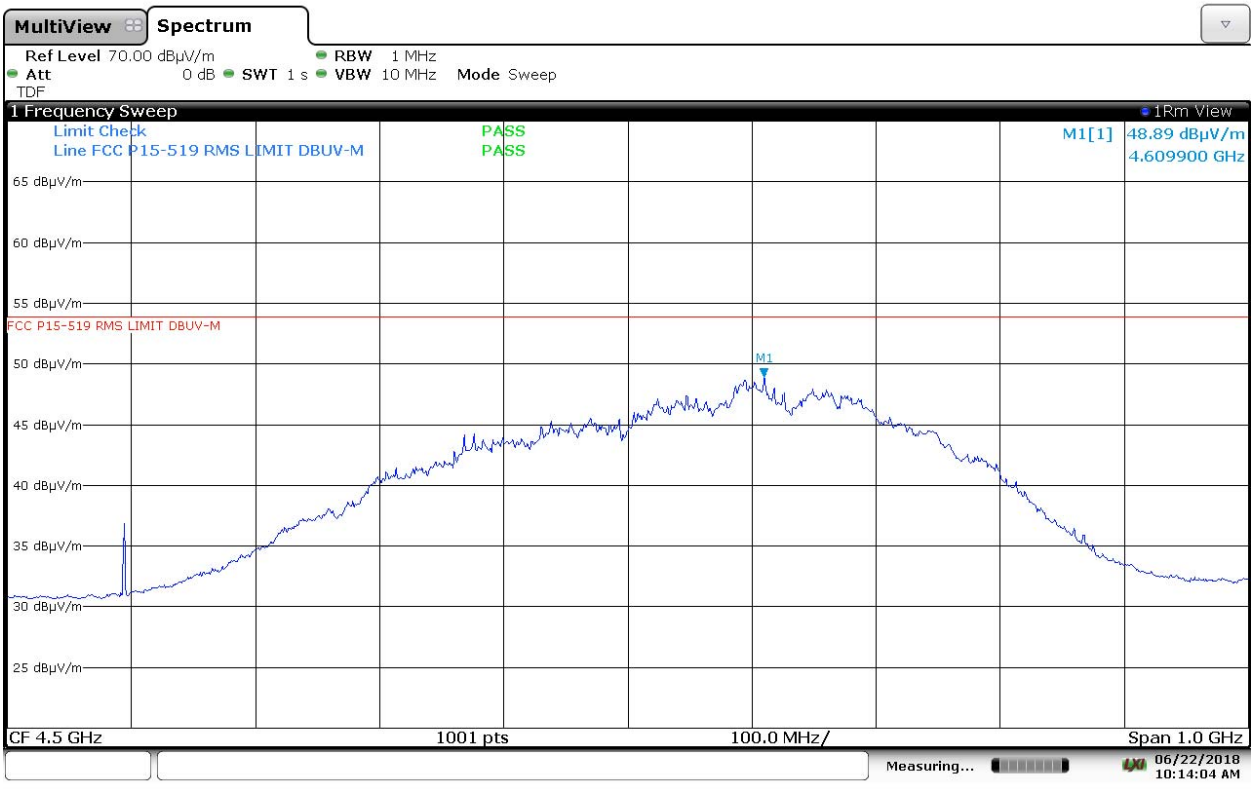
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
4.6099	-46.31	-41.30	-5.01	H	104	47	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.7. Spurious Radiated Emissions (15.517 (c), 15.521(d), RSS-220 5.2.1(d)) continued

6.7.2. Plot of RMS Power at 3 Meters (Channel 3, 64M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
4.6369	52.41	53.90	-1.49	H	104	47	Compliant

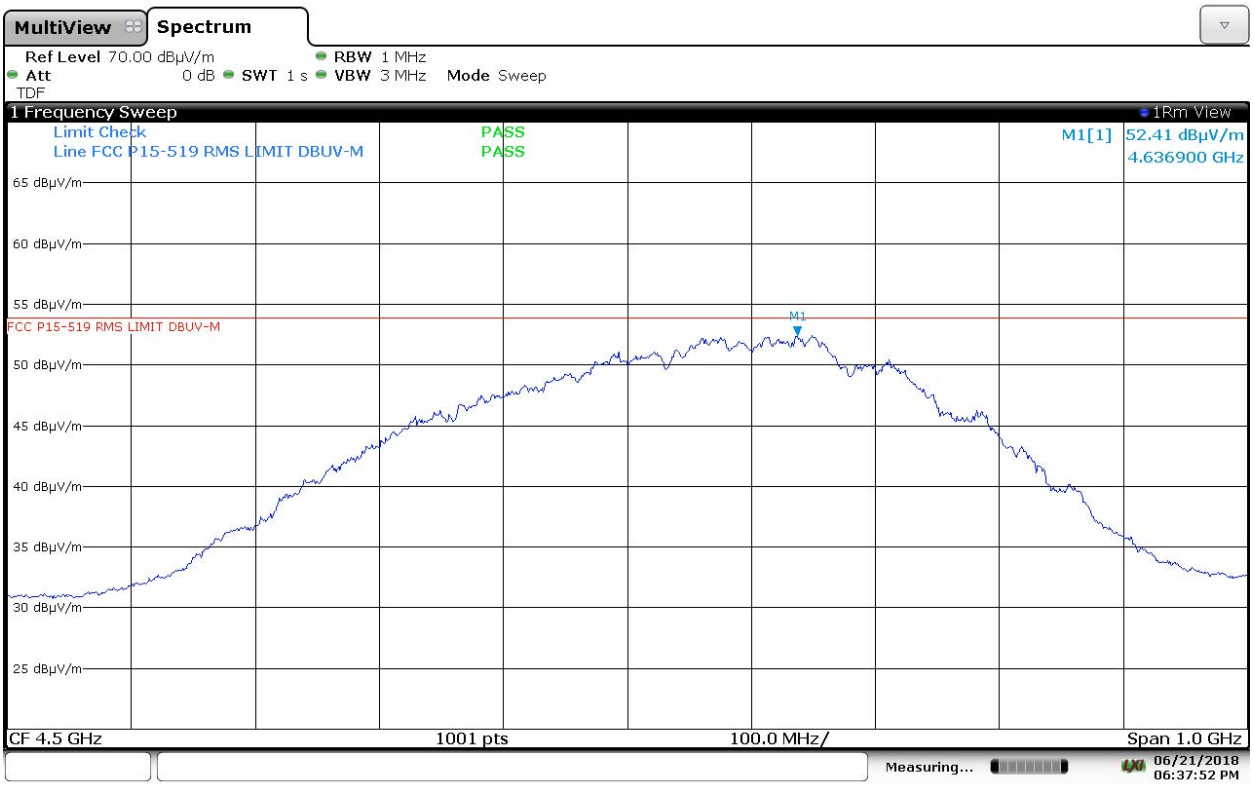
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
4.6369	-42.79	-41.30	-1.49	H	104	47	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.7. Spurious Radiated Emissions (15.517 (c), 15.521(d), RSS-220 5.2.1(d)) continued

6.7.3. Plot of RMS Power at 3 Meters (Channel 5, 16M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.490	48.06	53.90	-5.84	H	100	46	Compliant

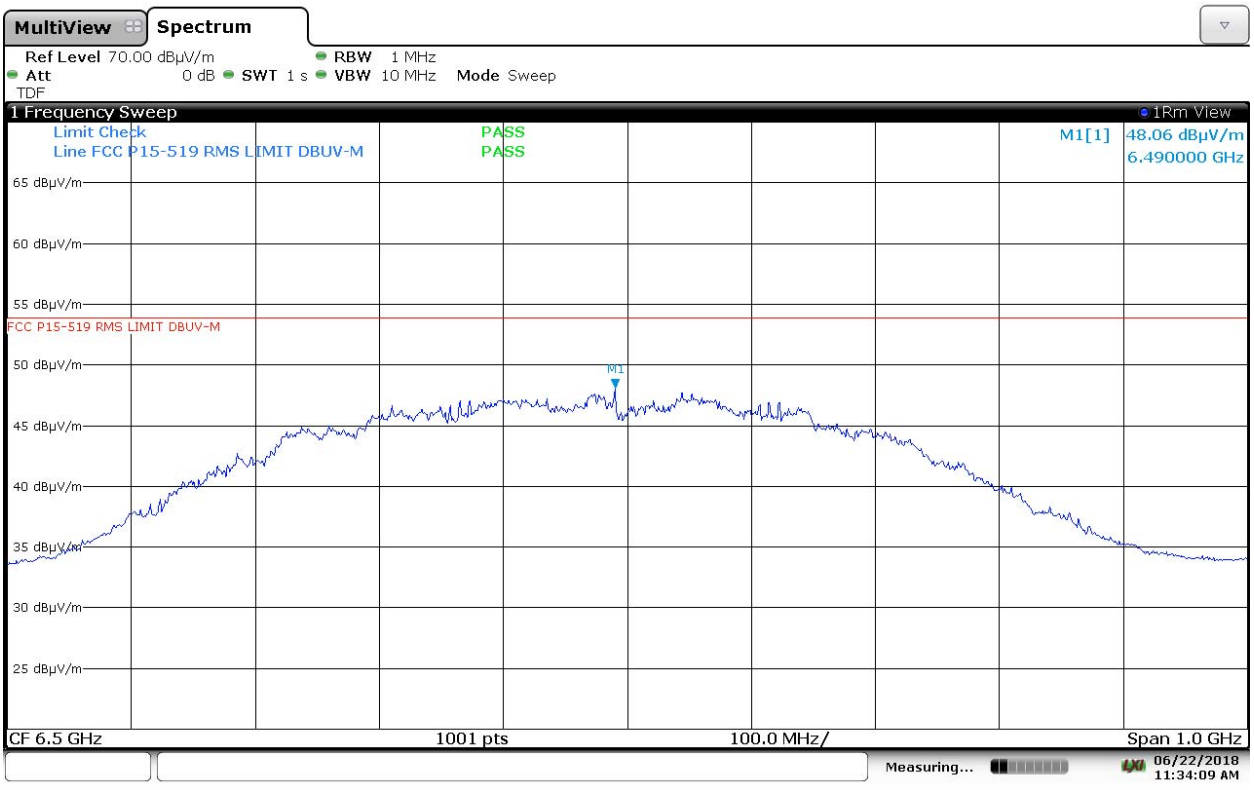
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.490	-47.14	-41.30	-5.84	H	100	46	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.7. Spurious Radiated Emissions (15.517 (c), 15.521(d), RSS-220 5.2.1(d)) continued

6.7.4. Plot of RMS Power at 3 Meters (Channel 5, 64M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.490	52.21	53.90	-1.69	H	100	46	Compliant

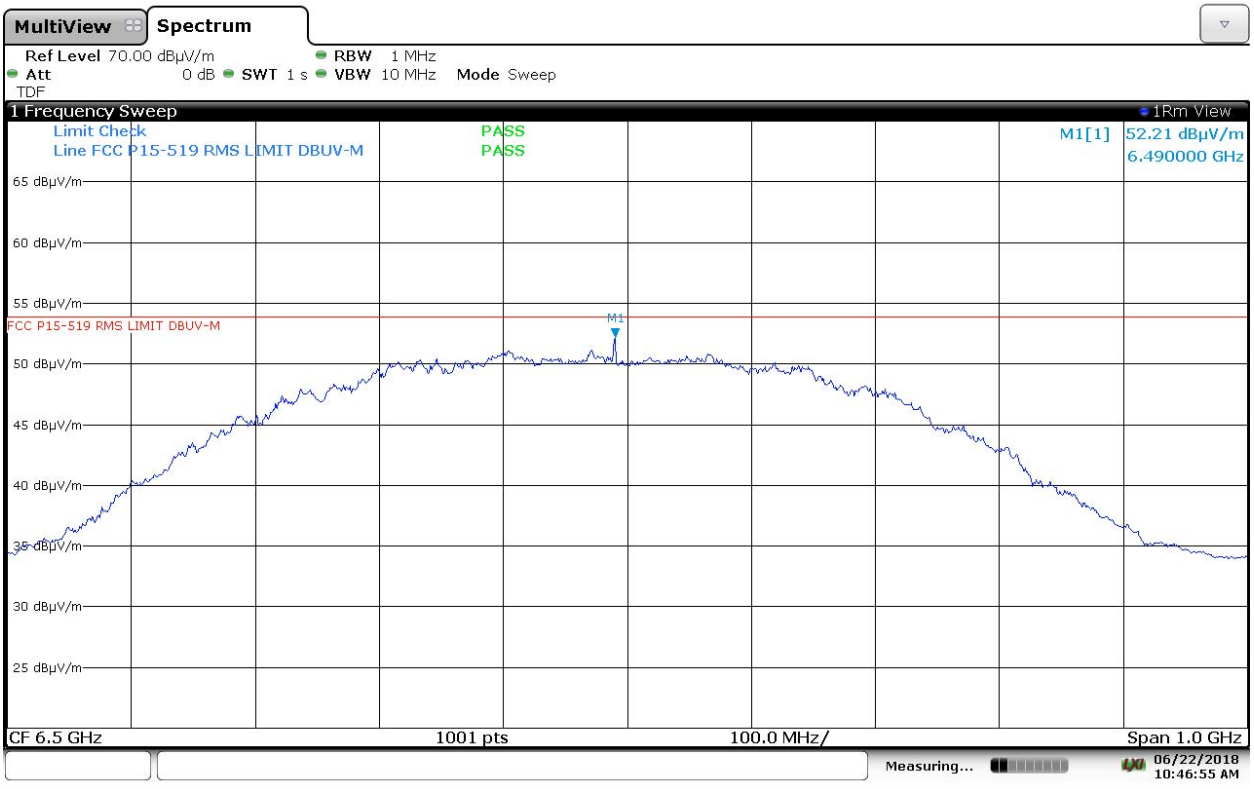
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.490	-42.99	-41.30	-1.69	H	100	46	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.7. Spurious Radiated Emissions (15.517 (c), 15.521(d), RSS-220 5.2.1(d)) continued

6.7.5. Plot of RMS Power at 3 Meters (Channel 7, 16M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.3651	48.61	53.90	-5.29	H	100	46	Compliant

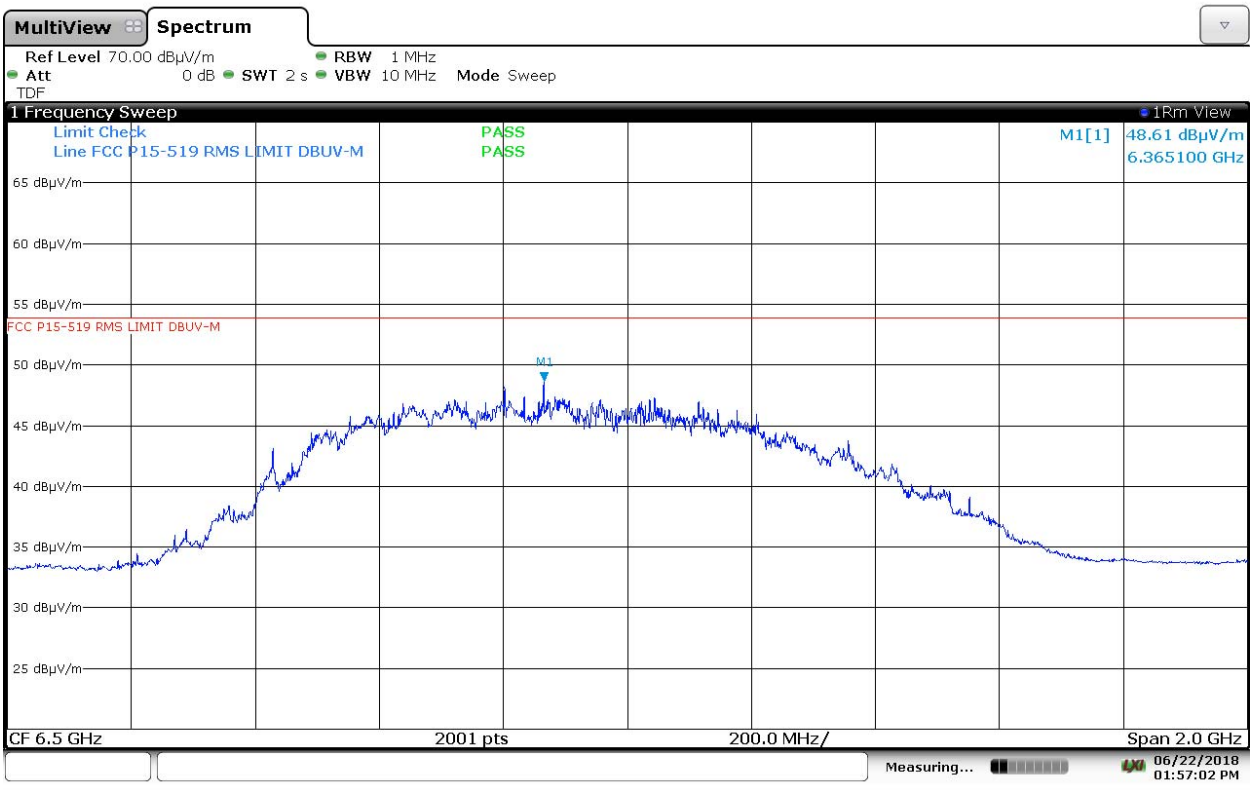
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.3651	-46.59	-41.30	-5.29	H	100	46	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.7. Spurious Radiated Emissions (15.517 (c), 15.521(d), RSS-220 5.2.1(d)) continued

6.7.6. Plot of RMS Power at 3 Meters (Channel 7, 64M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.3651	52.89	53.90	-1.01	H	100	46	Compliant

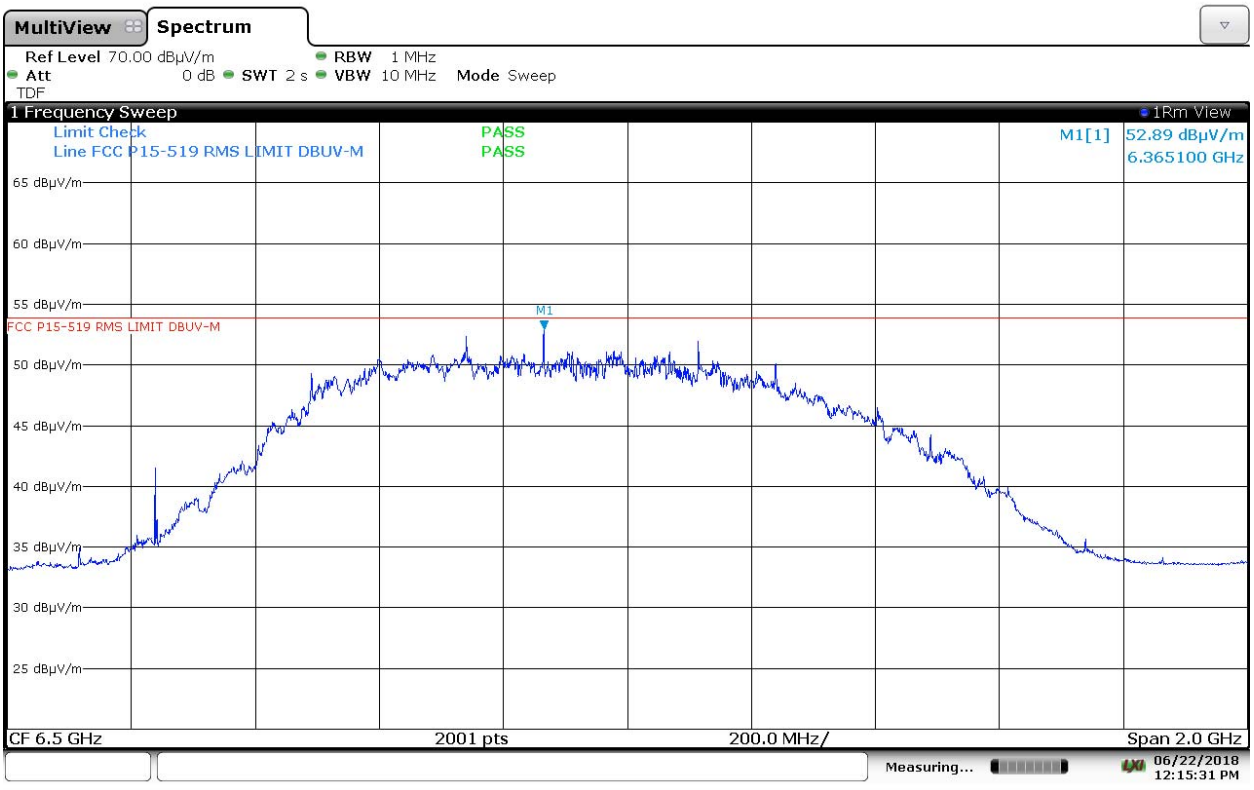
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.3651	-42.31	-41.30	-1.01	H	100	46	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.8. Peak Emissions in a 50 MHz Bandwidth (15.517 (e), 15.521 (g), RSS-220 5.2.1(g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2. As used in this subpart, EIRP refers to the highest signal strength measured in any direction and at any frequency from the UWB device.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
3100 - 10600	0	95.2

Frequency Range:	4 to 5 GHz, 6 to 7 GHz & 5.5 to 7.5 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	50 MHz
EMI Receiver Avg Bandwidth	80 MHz
Detector Function:	Peak, Max Held

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6. Measurement Data (continued)

6.8. Peak Emissions in a 50 MHz Bandwidth (15.517 (e), 15.521 (g) continued)

6.8.1 Plot of Peak Power at 3 Meters (Channel 3, 16M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
4.6528	94.87	95.20	-0.33	H	104	47	Compliant

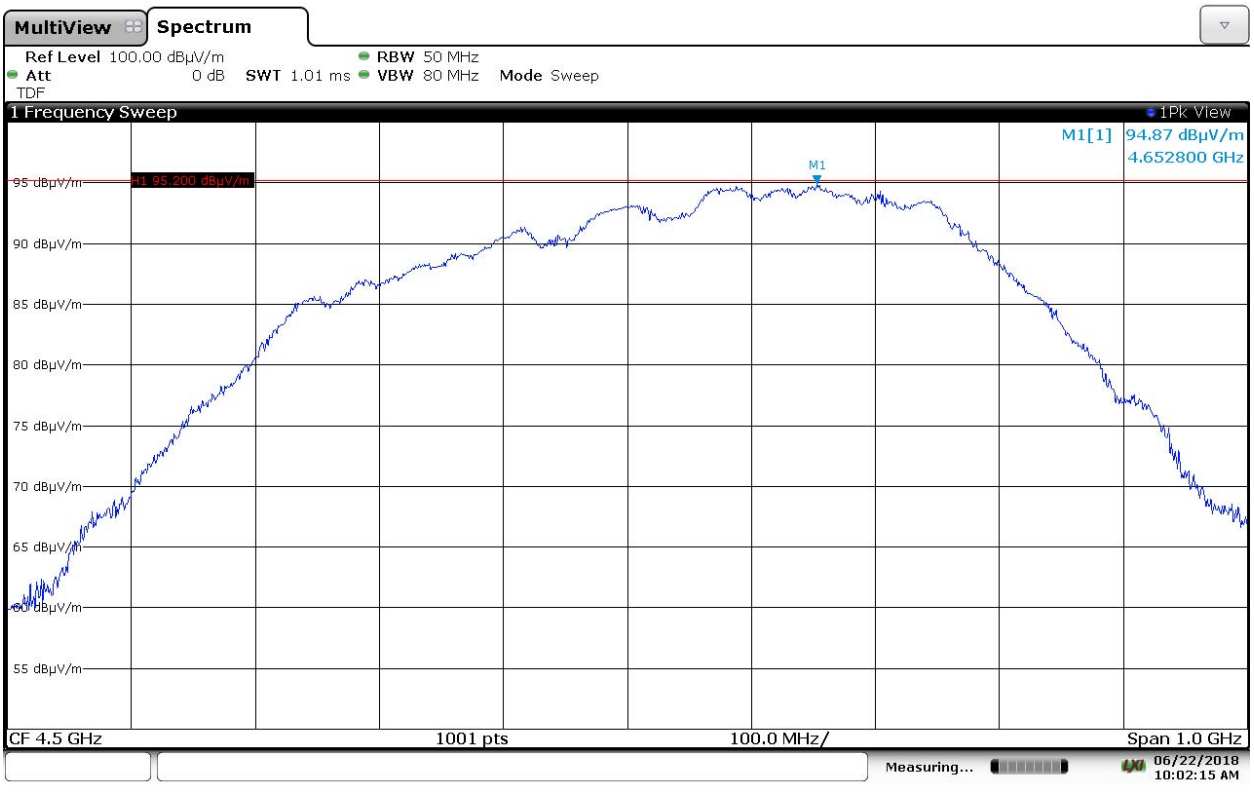
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
4.6528	-0.33	0.00	-0.33	H	104	47	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.8. Peak Emissions in a 50 MHz Bandwidth (15.517 (e), 15.521 (g) continued)

6.8.2 Plot of Peak Power at 3 Meters (Channel 3, 64M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
4.488	94.96	95.20	-0.24	H	100	47	Compliant

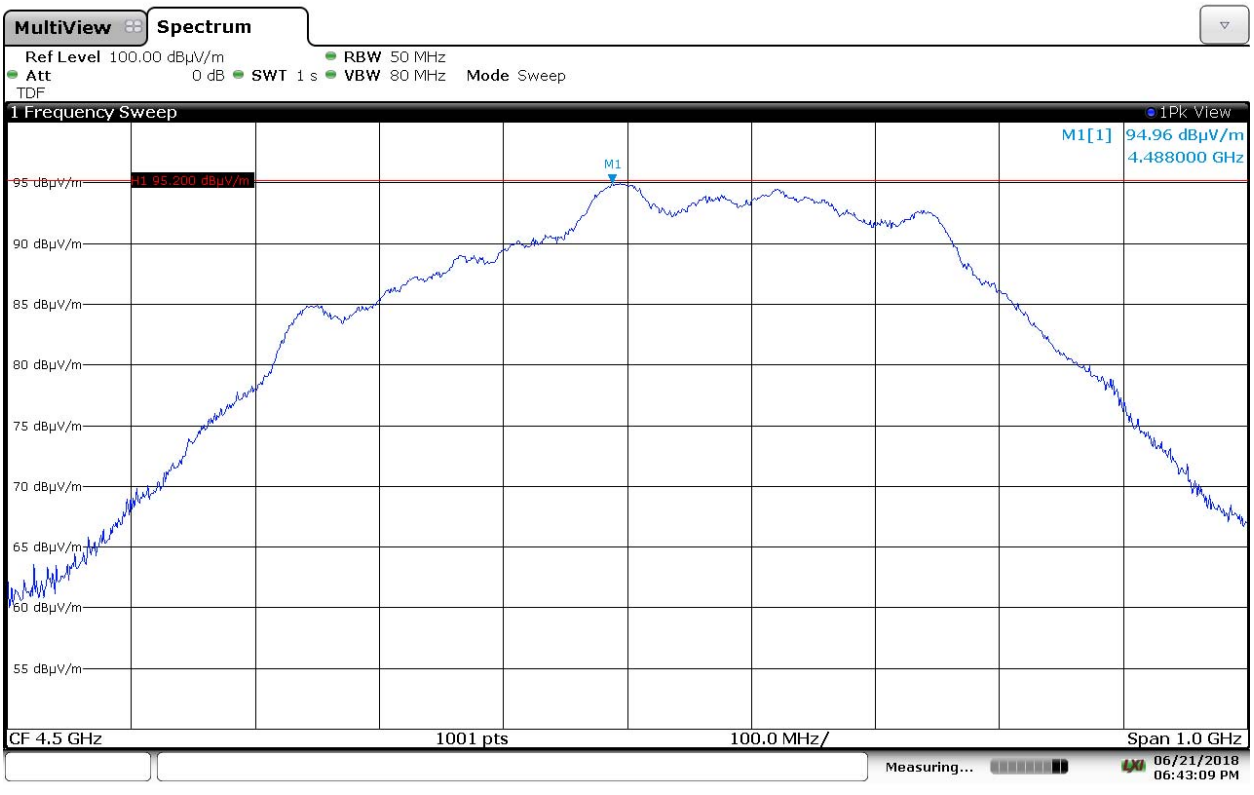
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
4.488	-0.24	0.00	-0.24	H	100	47	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.8. Peak Emissions in a 50 MHz Bandwidth (15.517 (e), 15.521 (g) continued)

6.8.3 Plot of Peak Power at 3 Meters (Channel 5, 16M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.486	95.01	95.20	-0.19	H	100	46	Compliant

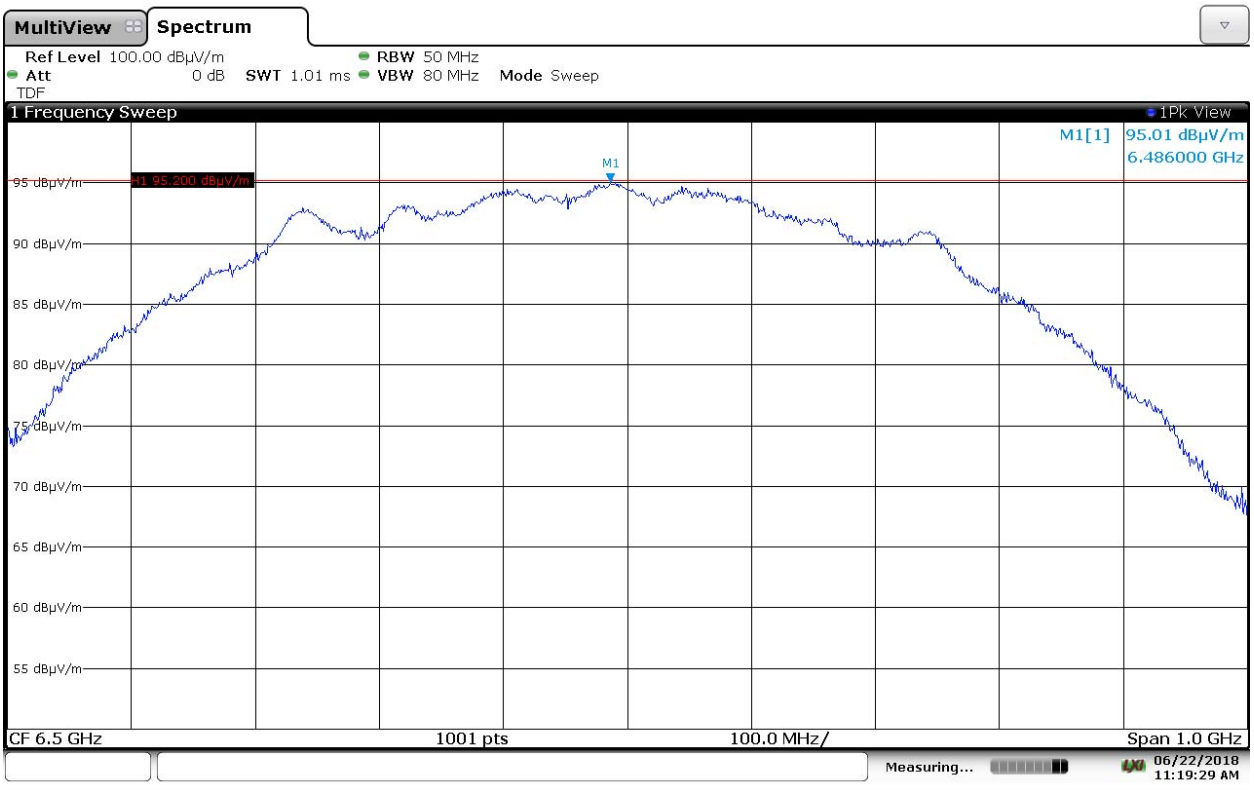
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.486	-0.19	0.00	-0.19	H	100	46	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.8. Peak Emissions in a 50 MHz Bandwidth (15.517 (e), 15.521 (g) continued)

6.8.4 Plot of Peak Power at 3 Meters (Channel 5, 64M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.489	94.92	95.20	-0.28	H	100	46	Compliant

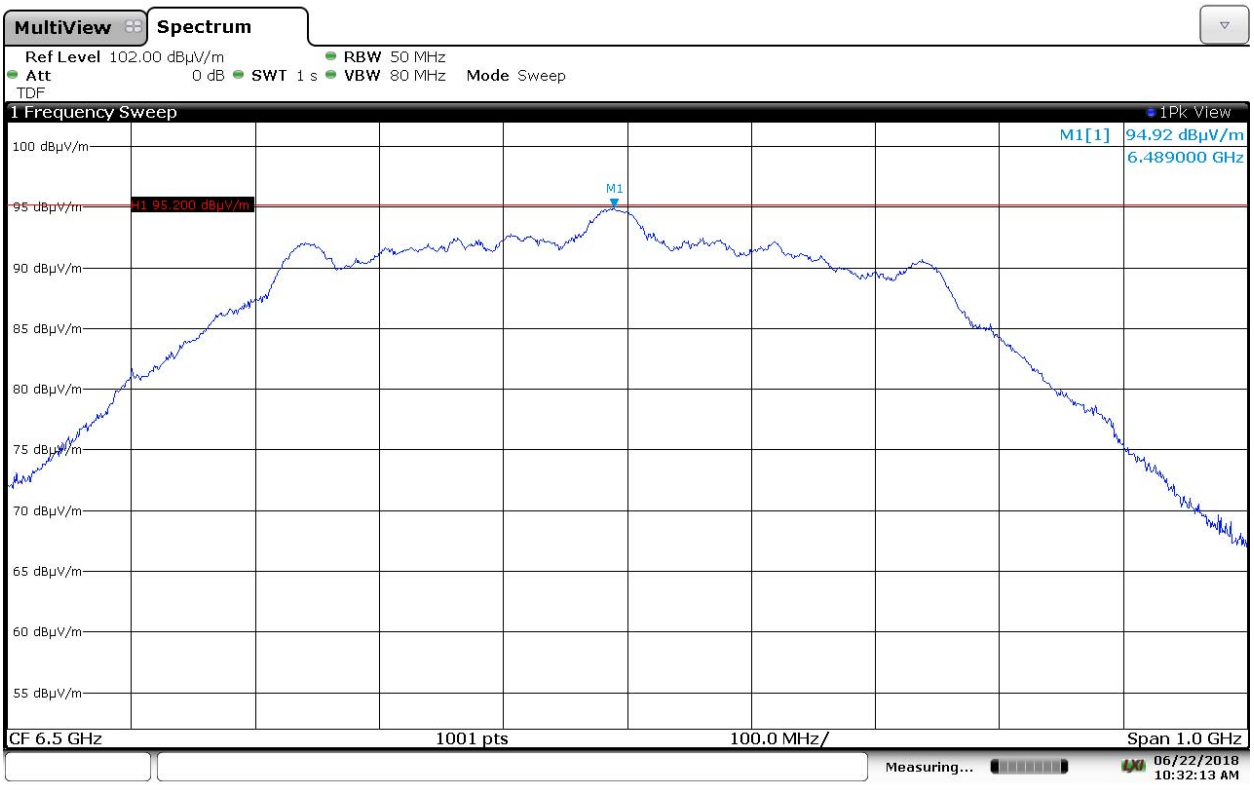
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.489	-0.28	0.00	-0.28	H	100	46	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.8. Peak Emissions in a 50 MHz Bandwidth (15.517 (e), 15.521 (g) continued)

6.8.5 Plot of Peak Power at 3 Meters (Channel 7, 16M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.491	94.73	95.20	-0.47	H	100	46	Compliant

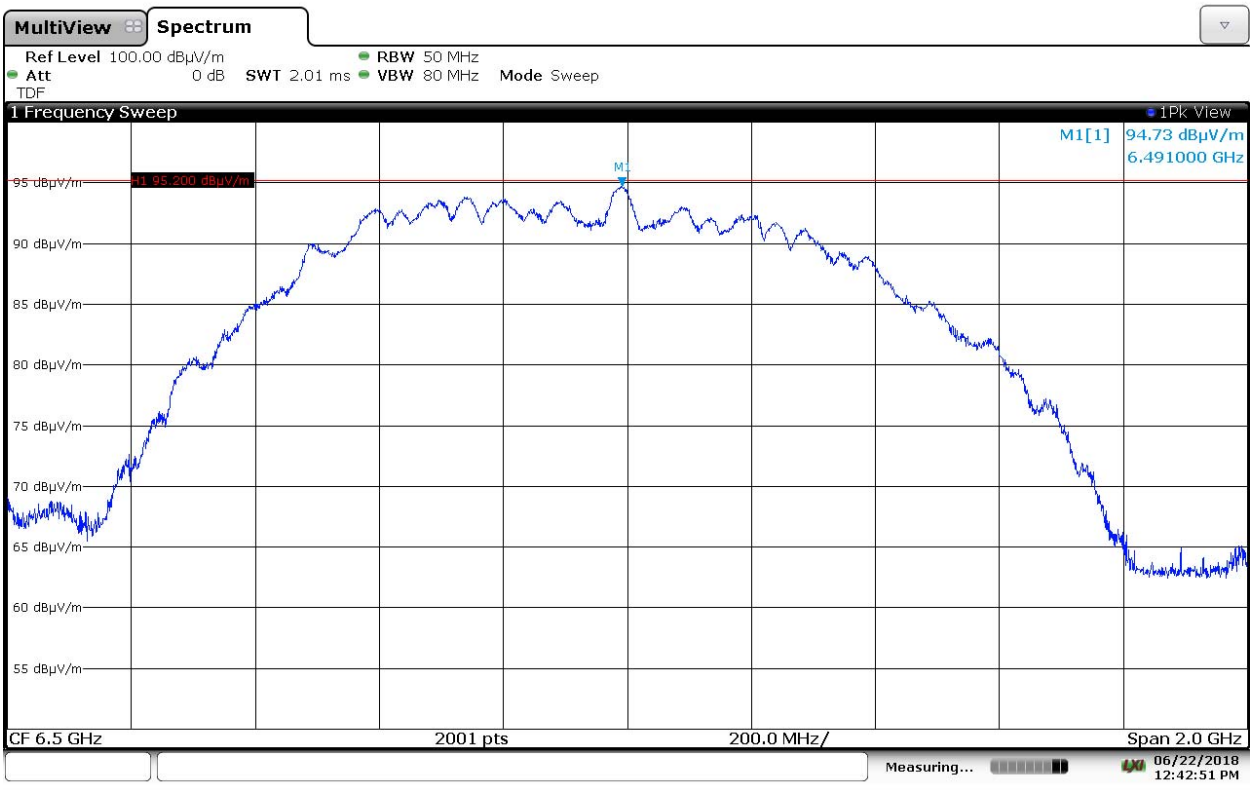
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.491	-0.47	0.00	-0.47	H	100	46	Compliant

273-18 ShotTracker Ball Sensor



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6. Measurement Data (continued)

6.8. Peak Emissions in a 50 MHz Bandwidth (15.517 (e), 15.521 (g) continued)

6.8.6 Plot of Peak Power at 3 Meters (Channel 7, 64M PRF)

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.2371	94.62	95.20	-0.58	H	100	46	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.2371	-0.58	0.00	-0.58	H	100	46	Compliant

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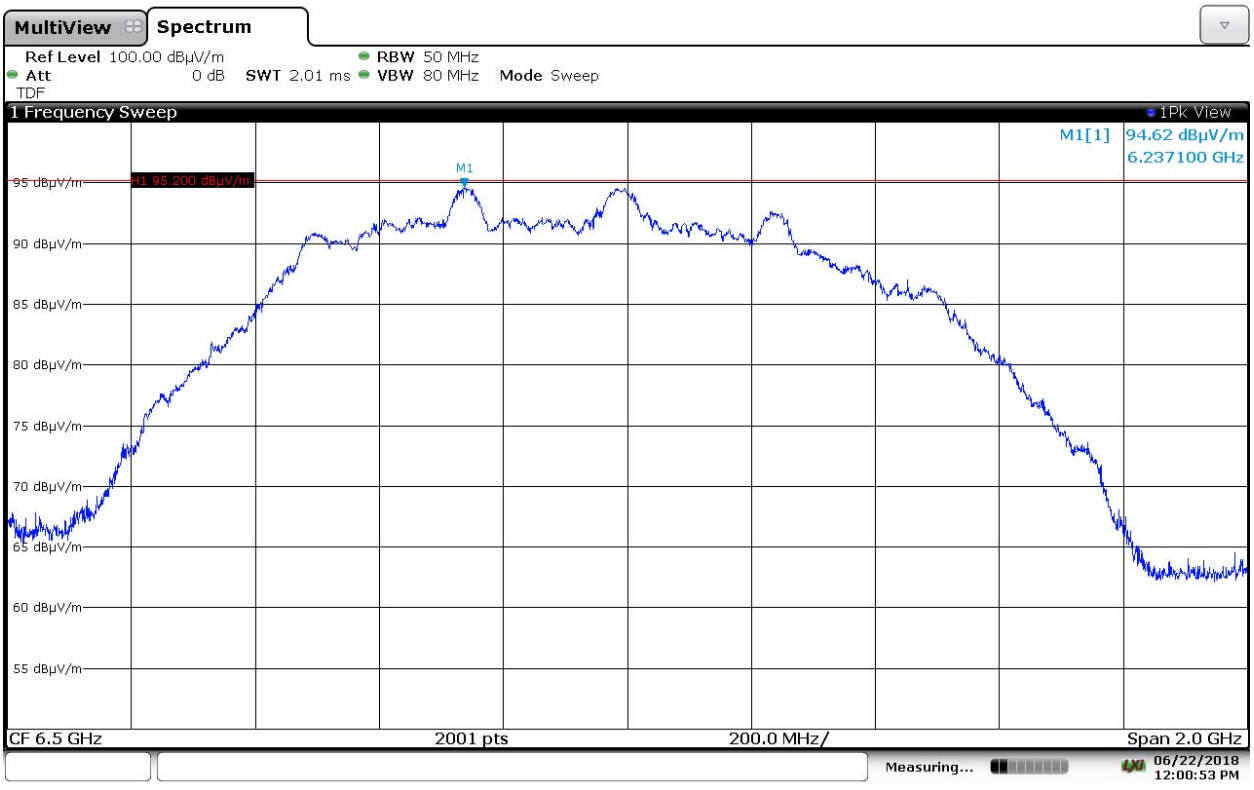

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6. Measurement Data (continued)

6.9 Conducted Emissions Test Setup

6.9.1. Regulatory Limit: FCC Part 15, Class B, IC RSS-GEN

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.		

6.9.2 Measurement Equipment and Software Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
EMI Receiver	Hewlett Packard	8546A	3330A00115	12/4/2018
RF Filter Section	Hewlett Packard	85460A	3325A00121	12/4/2018
LISN	EMCO	3825/2	9109-1860	11/17/2018
Manufacturer	**Software Description**		**Title/Model #**	**Rev.**
Compliance Worldwide	Test Report Generation Software		Test Report Generator	1.0

6.9.3. Measurement & Equipment Setup

Test Date:	N/A
Test Engineer:	N/A
Site Temperature (°C):	22.8
Relative Humidity (%RH):	48.3
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	30 kHz
Detector Functions:	Peak, Quasi-Peak. & Average

6.9.4. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2014, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

Note: The wireless charger is being performed under a separate certification.

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6. Measurement Data (continued)

6.10. Public Exposure to Radio Frequency Energy Levels (1.1307 (b)(1))

6.10.1. SAR Test Exclusion Calculation

Requirement: Portable devices as defined in § 2.1093 of this chapter operating under Part 15 are subject to radio frequency radiation exposure requirements as specified in §§ 1.1307(b) and 2.1093 of this chapter.

For a 1-g SAR, the test exclusion result must be ≤ 3.0.

Test Notes: The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by the following formula:

$$\text{SAR Test Exclusion} = \frac{P_{MAX}}{d_{MIN}} \times \sqrt{f_{(GHz)}} \quad (1)$$

P_{MAX}	mW	Maximum power of channel, including tune-up tolerance
d_{MIN}	mm	Minimum test separation distance, mm (≤ 50 mm)
$f_{(GHz)}$	GHz	$f_{(GHz)}$ is the RF channel transmit frequency in GHz (>100 MHz and <6 GHz)

(1) FCC OET 447498 - Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

Result: The device under test meets the exclusion requirement detailed in FCC OET 447498.

Channel:		**3**	**3**	
Input:	P_{MAX}	0.9207	0.9400	mW
	d_{MIN}	5.000	5.000	mm
	$f_{(GHz)}$	4.653	4.488	GHz
Test Exclusion:		**0.397**	**0.398**	
Limit Exemption:		**3.000**	**3.000**	

[1] Taken from the peak data in Section 6.8 of this test report (converted to mW).

The device does not exceed the test limit exemption and therefore a routine SAR Evaluation is not required

The Bluetooth and UWB Radios do not operate simultaneously.

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6. Measurement Data (continued)

6.10. Public Exposure to Radio Frequency Energy Levels (1.1307 (b)(1), RSS-GEN, Issue 4 Section 3.2, RSS 102)

6.10.2. RF Exposure Evaluation

Requirement: SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. Portable devices are subject to radio frequency radiation exposure requirements.

6.10.3 RF Exposure for devices that operate above 6 GHz

Center Frequency (GHz)	MPE Distance (cm)	DUT Output Power (dBm EIRP)	DUT Antenna Gain (dBi)	Power Density		FCC Limit	ISED Limit
				(mW/cm^2)	(W/m^2)	(mW/cm^2)	(W/m^2)
	(1)	(2)	(3)	(4)		(5)	(6)
6.4860	5	-0.19	0.0	0.0030468	0.0304684	1	10
6.4890	5	-0.28	0.0	0.0029844	0.0298435	1	10
6.4910	5	-0.47	0.0	0.0028566	0.0285660	1	10
6.2371	5	-0.58	0.0	0.0027852	0.0278516	1	10

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

1. Reference CFR 2.1093(b): For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 5 centimeters of the body of the user.
2. Section 6.8 of this test report.
3. Data supplied by the client. Antenna manufacturers data sheet.
4. Power density is calculated from field strength measurement and antenna gain.
5. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.
6. Reference ISESD RSS-102 Table 4 RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

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6. Measurement Data (continued)

6.10. Public Exposure to Radio Frequency Energy Levels (RSS-GEN, RSS-102)

Public Exposure to Radio Frequency Energy Levels RSS-GEN, Issue 4 Section 3.2, RSS 102

6.10.4. RSS 102 Issue 5 Exemption

Requirement: SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1. Portable devices are subject to radio frequency radiation exposure requirements.

Test Notes: The limit was taken from Table 1 of RSS-102 Issue 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5.

Results: Compliant

Channel	Frequency	Separation Distance	Maximum Power	RSS-102 Limit	Result
	MHz	mm	mW	mW	
3	4653	≤5	0.921	3.75	Compliant
3	4488	≤5	0.940	3.93	Compliant

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7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025:2005 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1)** and VCCI (Member number 3168) under registration number A-0274.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

Both sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

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