PCTEST ENGINEERING LABORATORY, INC.
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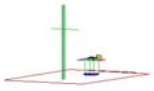

MEASUREMENT REPORT
FCC PART 15F ULTRA WIDEBAND

Applicant Name:
TRX Systems
7500 Greenway Center Drive, Suite 420
Greenbelt, MD 20770
USA

Date of Testing:
5/9 - 5/25/16
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0Y1605230964.BXO

FCC ID:	**BXOTU8U**
APPLICANT:	**TRX Systems**

Application Type:	Certification
Model:	NEON-TU8U
EUT Type:	Portable Tracking Device
Frequency Range:	3699 – 4301 MHz
FCC Classification:	Ultra Wideband (UWB)
FCC Rule Part(s):	Part 15, Subpart F (15.517, 15.521)
Test Procedure(s):	ANSI C63.10-2013

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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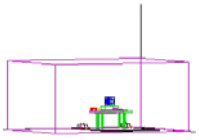

MEASUREMENT REPORT
FCC Part 15F

§ 2.1033 General Information

APPLICANT:	TRX Systems			
APPLICANT ADDRESS:	7500 Greenway Center Drive, Suite 420			
	Greenbelt, MD 20770, USA			
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.			
TEST SITE ADDRESS:	7185 Oakland MIlls Road, Columbia, MD 21046 USA			
FCC RULE PART(S):	Part 15F			
BASE MODEL:	NEON-TU8U			
FCC ID:	BXOTU8U			
FCC CLASSIFICATION:	Ultra Wideband (UWB)			
Test Device Serial No.:	X0004	☐ Production	☒ Pre-Production	☐ Engineering
DATE(S) OF TEST:	5/9 - 5/25/16			
TEST REPORT S/N:	0Y1605230964.BXO			

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.

- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity are, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (*See Figure 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39º 10'23" N latitude and 76º 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

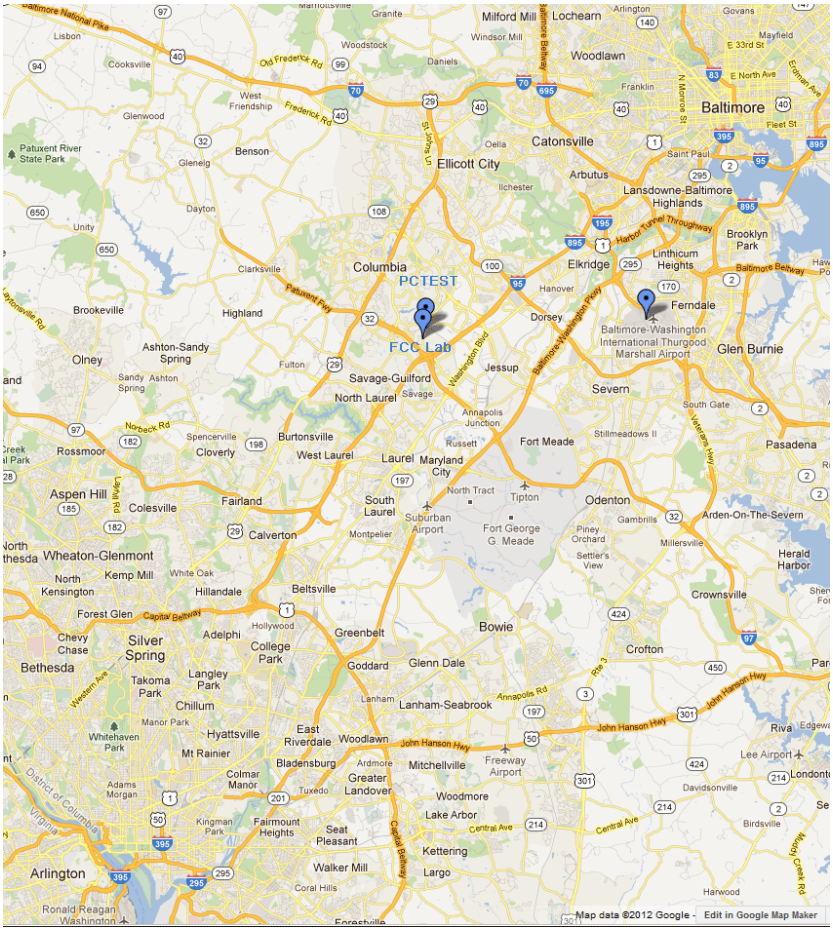

Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **TRX Portable Tracking Device FCC ID: BXOTU8U**.

2.2 Device Capabilities

This device contains the following capabilities:
UWB, Bluetooth (1x, EDR, LE)

2.3 Test Configurations

The **TRX Portable Tracking Device FCC ID: BXOTU8U** was tested per the guidance of tested per the guidance of Section 10 of ANSI C63.10-2013. The EUT setup procedures of ANSI C63.10-2013 were used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Section 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 6.0 for test results.

Note:

A previously certified Bluetooth module (FCC ID: T7V1316) was integrated into the portable tracking device. Emissions due to simultaneous transmission of the Bluetooth and UWB transmitters were investigated.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

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3.0 DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) were used in the measurement of the **TRX Portable Tracking Device FCC ID: BXOTU8U.**

Deviation from measurement procedure…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 6.6. Automated test software was used to perform the AC line conducted emissions testing. Automated measurement software utilized is Rohde & Schwarz EMC32, Version 9.15.0.

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3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, a 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm. For measurements above 1GHz, a high density expanded polystyrene block is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

3.4 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 with the provisions of this section."

- The antenna(s) of the Portable Tracking Device are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The **TRX Portable Tracking Device FCC ID: BXOTU8U** unit complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	RE3	Radiated Emissions Cable Set	11/18/2015	Annual	11/18/2016	RE3
Agilent	N9020A	MXA Signal Analyzer	11/5/2015	Annual	11/5/2016	US46470561
Agilent	N9030A	PXA Signal Analyzer (44GHz)	3/1/2016	Annual	3/1/2017	MY52350166
Agilent	N9038A	MXE EMI Receiver	4/21/2016	Annual	4/21/2017	MY51210133
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	7/30/2015	Biennial	7/30/2017	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	2/26/2016	Annual	2/26/2017	441112
Emco	3115	Horn Antenna (1-18GHz)	3/10/2016	Biennial	3/10/2018	9704-5182
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	4/26/2016	Biennial	4/26/2018	125518
ETS Lindgren	3160-09	18-26.5 GHz Standard Gain Horn	6/17/2014	Biennial	6/17/2016	135427
ETS Lindgren	3160-10	26.5-40 GHz Standard Gain Horn	6/17/2014	Biennial	6/17/2016	130993
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	4/20/2015	Annual	4/20/2016	251425001
K & L	11SH10-3075/U18000	High Pass Filter	7/18/2015	Annual	7/18/2016	11SH10-3075/U18000-2
K & L	11SH10-6000/T18000	High Pass Filter	7/18/2015	Annual	7/18/2016	11SH10-6000/T18000-1
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	4/28/2015	Annual	4/28/2016	NMLC-1
Rhode & Schwarz	TS-PR18	Pre-Amplifier	3/7/2016	Annual	3/7/2017	101622
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	7/17/2015	Annual	7/17/2016	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	6/2/2015	Annual	6/2/2016	103200
Rohde & Schwarz	TS-PR18	1-18 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100071
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100040
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	3/7/2016	Annual	3/7/2017	100037
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/2/2016	Biennial	3/2/2018	N/A
Solar Electronics	8012-50-R-24-BNC	Line Impedance Stabilization Network	7/30/2015	Biennial	7/30/2017	310233
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	3/14/2016	Biennial	3/14/2018	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

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7.0 TEST RESULTS

7.1 Summary

Company Name: TRX Systems

FCC ID: BXOTU8U

FCC Classification: Ultra Wideband (UWB)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (TX)					
15.503(a)	10dB Bandwidth	≥ 500MHz	RADIATED	PASS	Section 7.2
15.517(e), 15.521(g)	Maximum Peak Power Spectral Density	< 0dBm EIRP in 50MHz BW		PASS	Section 6.3
15.517(c)	Radiated Emissions Above 960MHz	See table in 15.517(c) for details		PASS	Section 7.4
15.517(d)	Radiated Emissions in the 1164 – 1240MHz and 1559 – 1610MHz GPS Bands	See table in 15.517(d) for details		PASS	Section 7.4
15.209	Radiated Emissions Below 960MHz	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS	Section 7.5
15.207, 15.521(j)	AC Line Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 7.6

Table 7-1. Summary of Test Results

Notes:

1. All modes of operation and transmitter configurations were investigated. The test results shown in the following sections represent the worst case emissions.
2. Measurements were performed at a 1 meter test distance to allow for enough SNR to make accurate measurements above the noise floor. In these cases, since all measurements were performed in the far field, a distance correction of -9.54dB was applied to the 1 meter measurements to extrapolate them back to 3 meters.
3. Per 15.521(g), all EIRP levels were calculated from the measured field strength levels using the following relationship: EIRP (dBm) = E (dBμV/m) – 95.2.
4. This device is intended for indoor use only when using the UWB function.

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7.2 10dB Bandwidth Measurement

15.503(a)

Test Overview and Limit

Per the definition of 15.503, the UWB Bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna.

The 10dB bandwidth of the UWB signal must remain fully within the 1990 – 10,600MHz band. The 10dB bandwidth of the UWB signal must also be greater than or equal to 500MHz.

Test Procedure Used

ANSI C63.10-2013 – Section 10.1

Test Settings

1. RBW = 1MHz
2. VBW = 3MHz
3. Detector = Peak
4. Span was set wide enough to capture the 10dB points of the signal
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

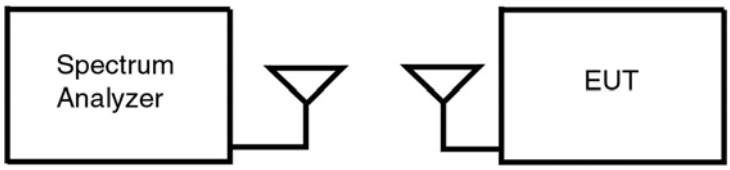

Figure 7-1. Test Instrument & Measurement Setup

Test Notes

None

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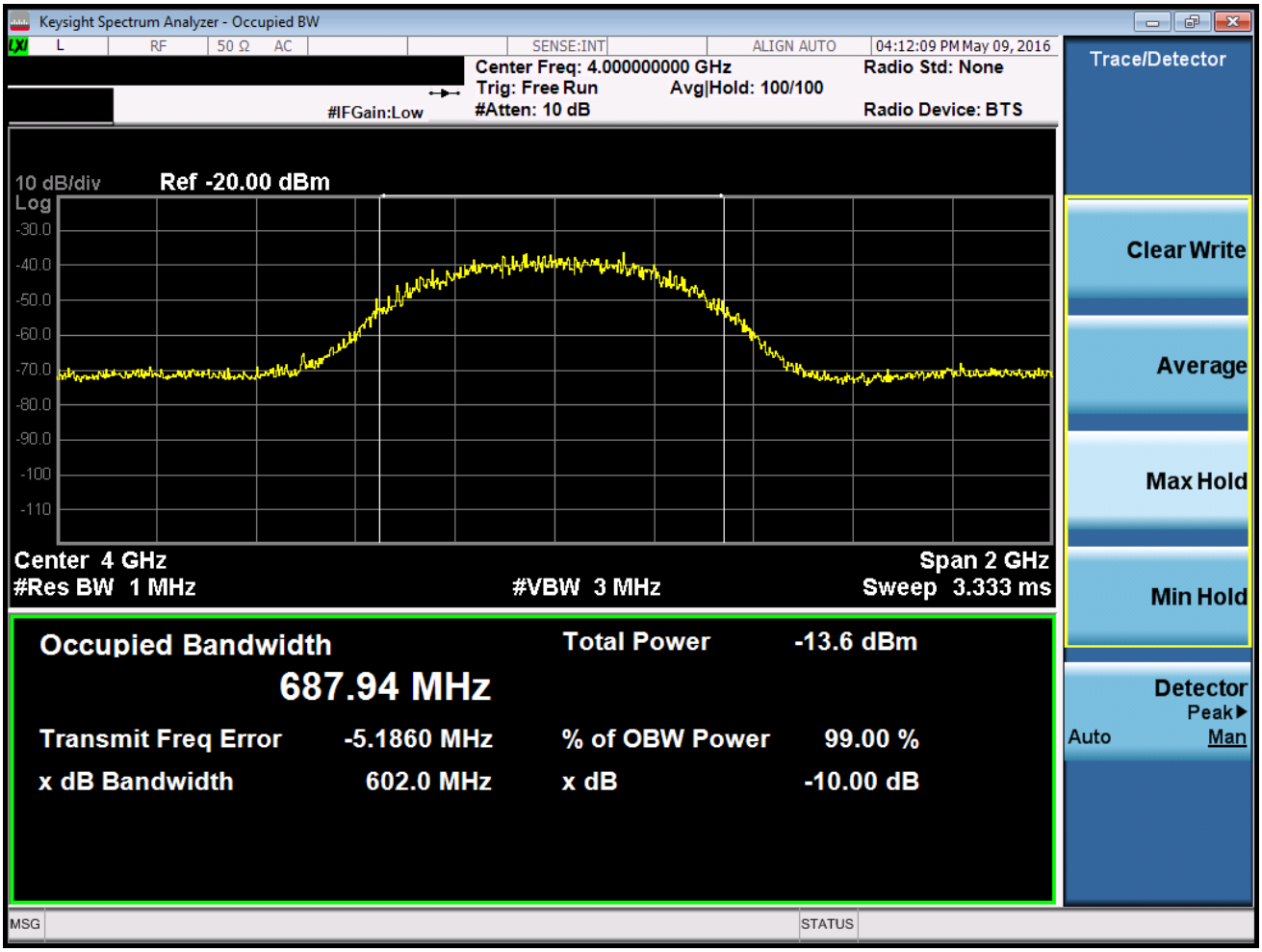
10dB Bandwidth Measurement (Cont'd)

§15.503(a)

Frequency [GHz]	Operating Mode	Measured Bandwidth [MHz]
4.0	UWB	602.0

Table 7-2. UWB 10dB Bandwidth



Plot 7-1. Measurement of 10dB Bandwidth

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7.3 Peak Power Within 50MHz Bandwidth

§15.517(e), 15.521(g)

Test Overview and Limits

The transmitter is maximized to determine the highest power spectral density level and frequency, f_M, contained within a 50MHz bandwidth.

The maximum permissible peak power spectral density within a 50MHz bandwidth is 0dBm.

Test Procedure Used

ANSI C63.10-2013 – Section 10.3.5

Test Settings

1. RBW = 50MHz
2. VBW = 80MHz
3. Span was set wide enough to capture the 10dB points of the signal
4. Sweep = auto couple
5. Detector = Peak
6. Trace mode = max hold
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

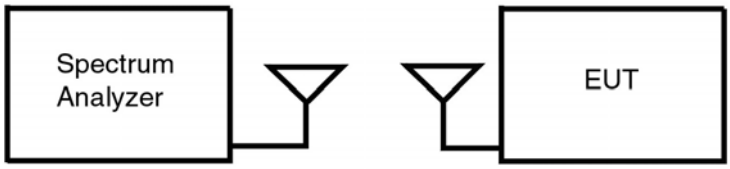

Figure 7-2. Test Instrument & Measurement Setup

Test Notes

The EIRP in dBm was calculated from the measured Field Strength in dBuV/m by applying a -95.2dB correction factor to the Field Strength level.

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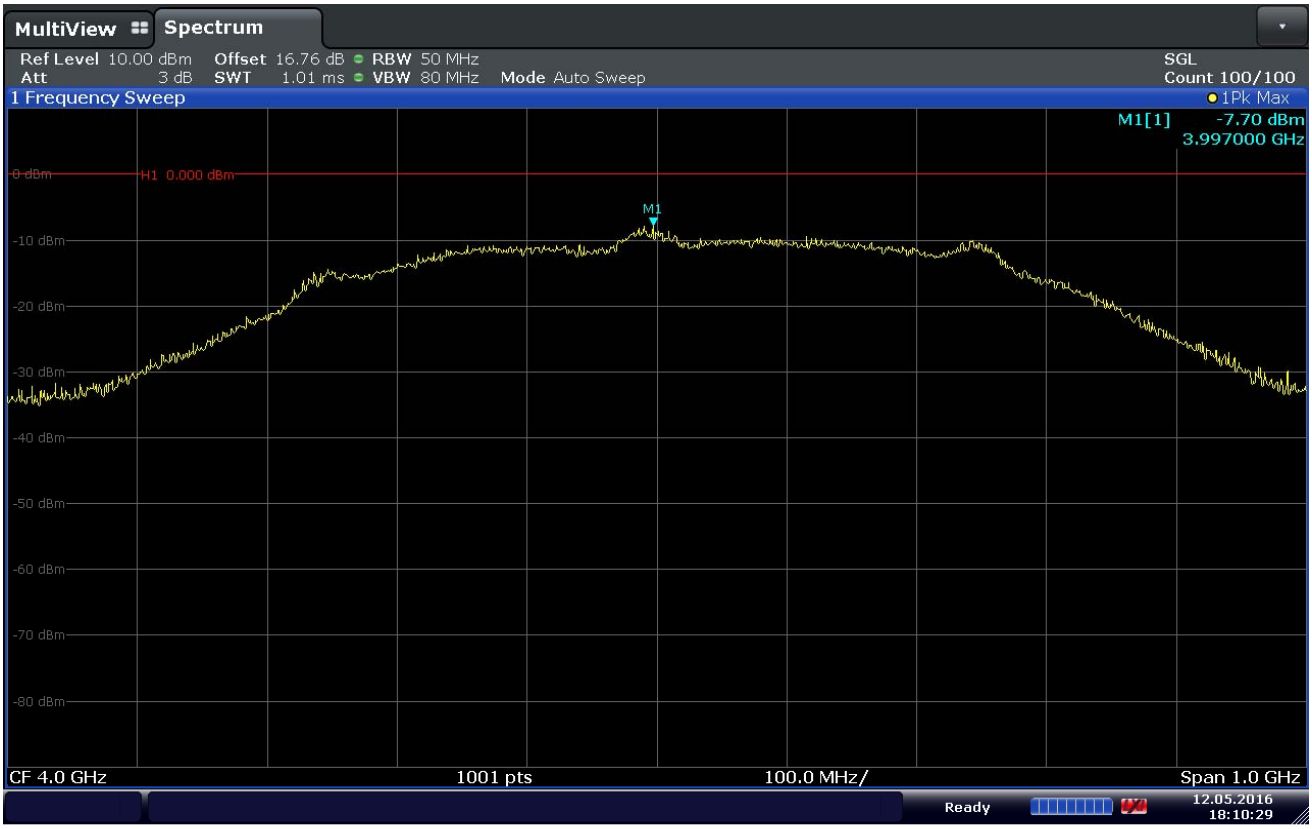
Maximum Peak Power Spectral Density (Cont'd)

§15.517(e), 15.521(g)

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP [dBm]	Limit [dBm]	Margin [dB]
3993.60	Peak	H	-58.21	38.71	87.50	-7.70	0.00	-7.70

Table 7-3. Peak Power Spectral Density Measurement



Plot 7-2. Peak Power Spectral Density Measurement

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7.4 Radiated Emissions Above 960MHz

§15.517(c)(d)

Test Overview and Limit

Radiated emissions were investigated above 960MHz up to 40GHz. All measurements were recorded as average powers.

The maximum permissible radiated emission levels, expressed as EIRP, are as follows:

Frequency in MHz	EIRP in dBm
960-1610	-75.3
1610-1990	-53.3
1990-3100	-51.3
3100-10600	-41.3
Above 10600	-51.3

The maximum permissible radiated emission levels, expressed as EIRP, in the 1164 – 1240MHz and 1559 – 1610MHz GPS bands are as follows:

Frequency in MHz	EIRP in dBm
1164 – 1240	-85.3
1559 – 1610	-85.3

Test Procedure Used

ANSI C63.10-2013 – Section 10.3.7

Test Settings

1. Measurements were performed using triggering and gating to allow for measurements to be made only during the on-time of a burst
2. RBW = 1MHz (3kHz for emissions in the GPS bands)
3. VBW = 3MHz (30kHz for emissions in the GPS bands)
4. Detector = RMS
5. Sweep time = auto couple
6. Trace mode = trace averaging
7. Trace was allowed to stabilize

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Radiated Emissions Above 960MHz (Cont'd)

15.517(c)(d)

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

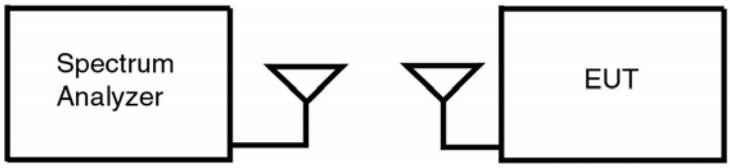

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

1. The RBW for measurements in the GPS bands was reduced to 3kHz in order to show compliance for emissions in the GPS bands.
2. Pre-scan plots that are included are not corrected for antenna factors, cable losses, or pre-amplifier gains. The plots are only used for spurious emission identification. Pre-scans are performed using a peak detector.
3. Radiated spurious emissions were investigated with both the BT and the UWB transmitters operating at max power simultaneously.
4. Emissions from 1GHz – 14GHz were measured at a 1 meter test distance with distance correction factor of -9.54dB and emissions from 14GHz – 18GHz were measured at a 30 centimeter test distance with distance correction factor of –20dB.
5. Although this device is intended for indoor operation, the spurious emissions were tested to the tighter 15.519 limits to cover the body-worn condition when operating in "tracker" mode.

Distance Correction Factor Sample Calculation

- Distance Correction Factor = 20log10(1m/3m) = -9.54 dB

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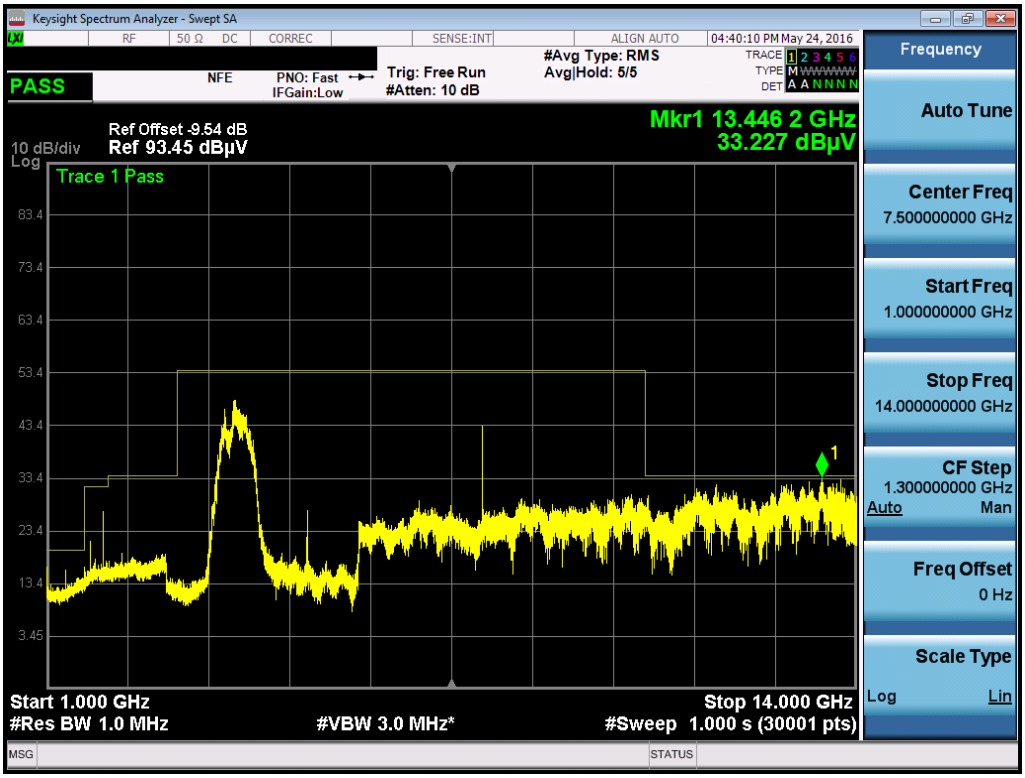
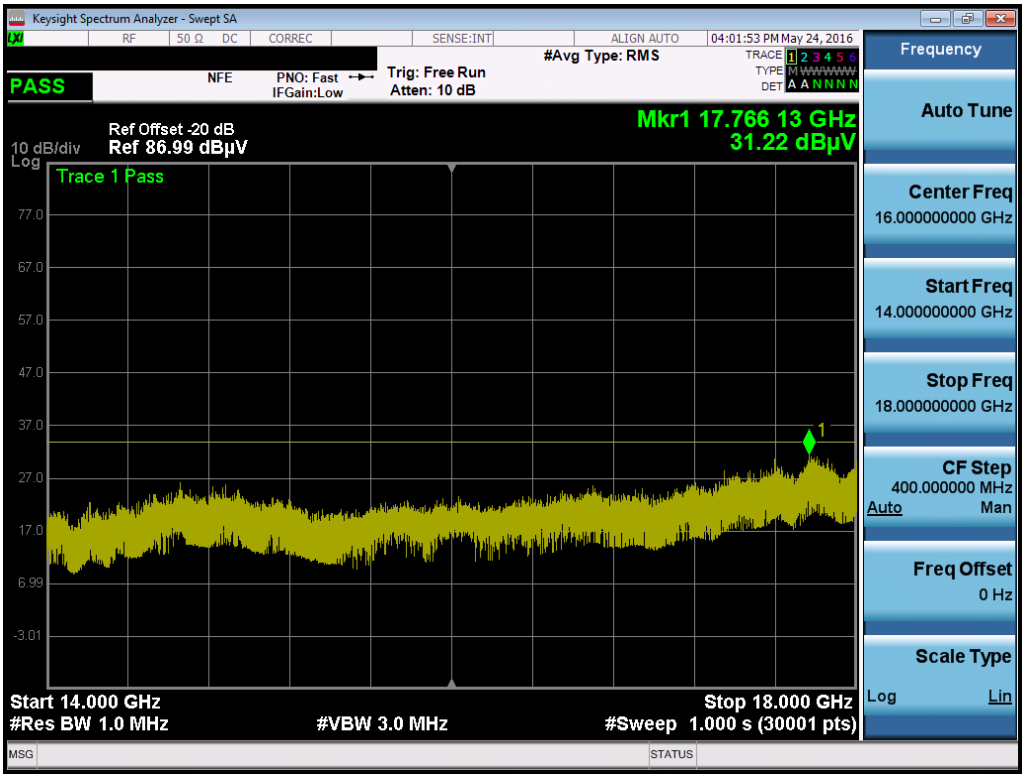


Plot 7-3. Radiated Spurious Plot from 1GHz – 14GHz (Pol. H, UWB Tx Only)



Plot 7-4. Radiated Spurious Plot from 14GHz – 18GHz in (Pol. H, UWB Tx Only)

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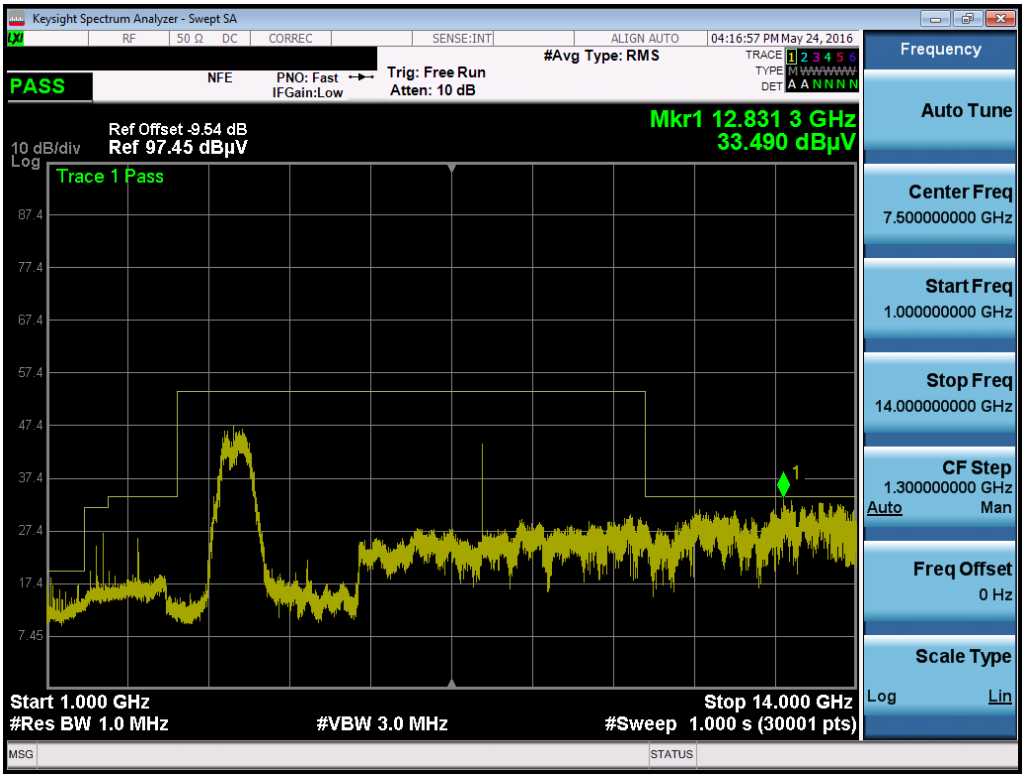
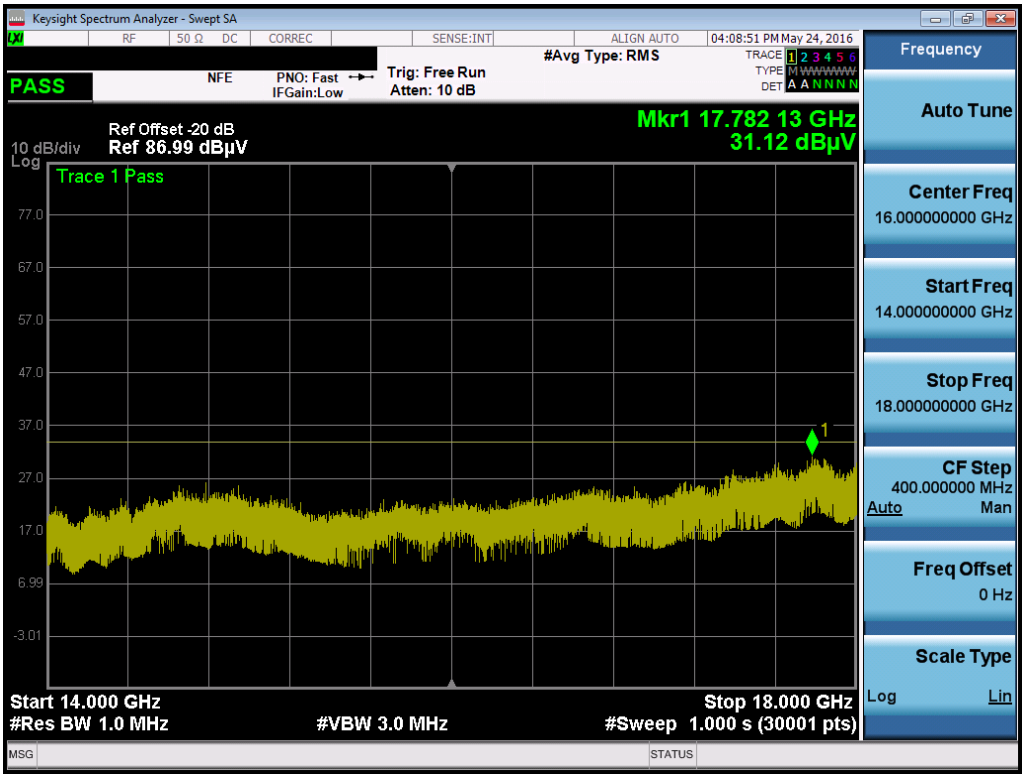


Plot 7-5. Radiated Spurious Plot from 1GHz – 14GHz in (Pol. V, UWB Tx Only)



Plot 7-6. Radiated Spurious Plot from 14GHz – 18GHz in (Pol. V, UWB Tx Only)

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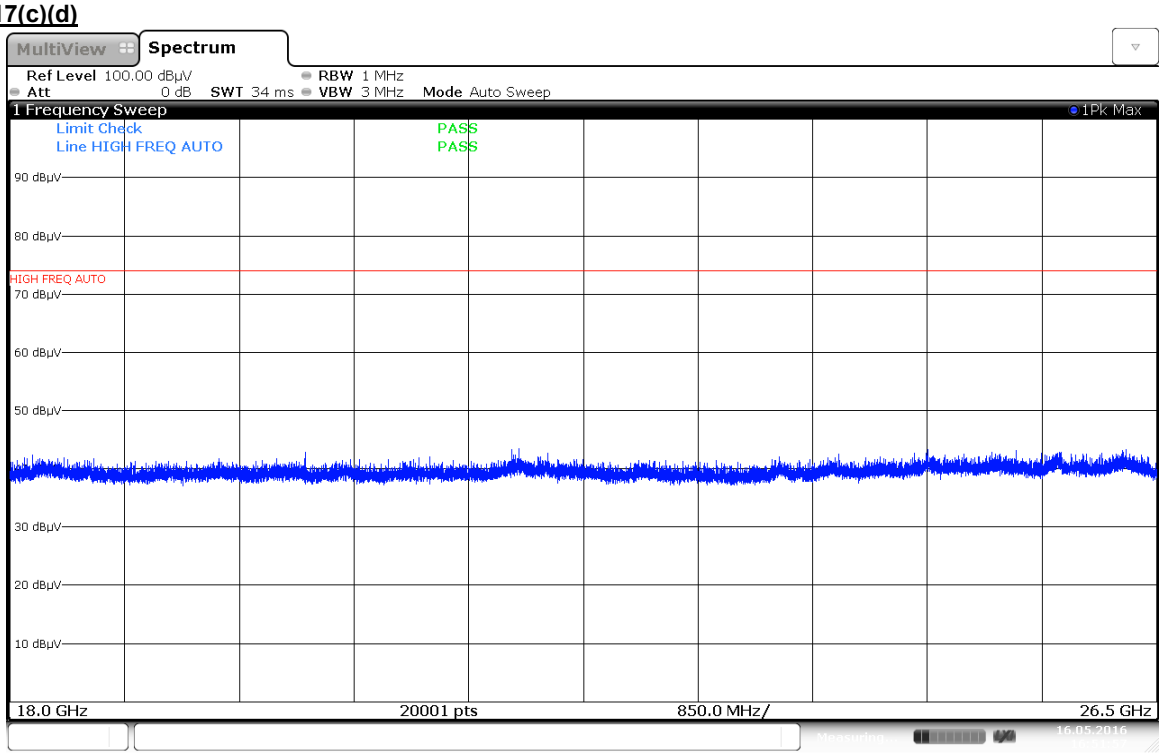
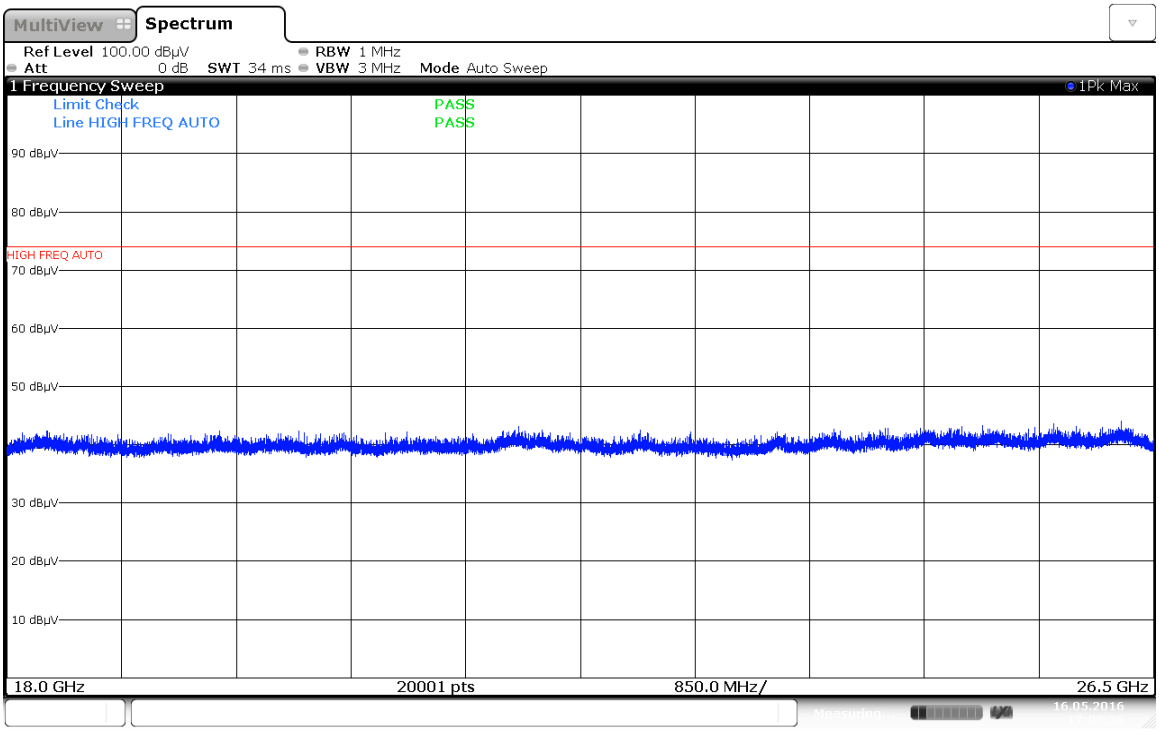
Radiated Emissions Above 960MHz (Cont'd)

§15.517(c)(d)



Plot 7-7. Radiated Spurious Plot from 18GHz – 26.5GHz (Pol. H, UWB Tx Only)



Plot 7-8. Radiated Spurious Plot from 18GHz – 26.5GHz (Pol. V, UWB Tx Only)

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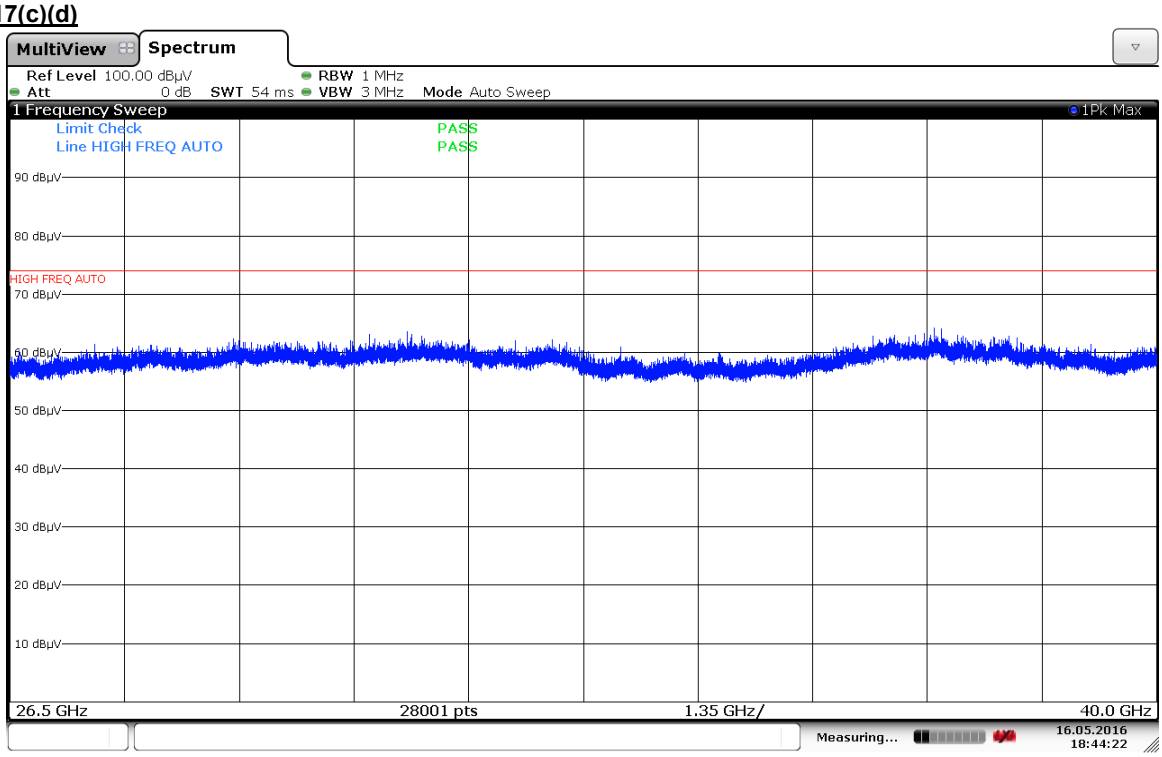
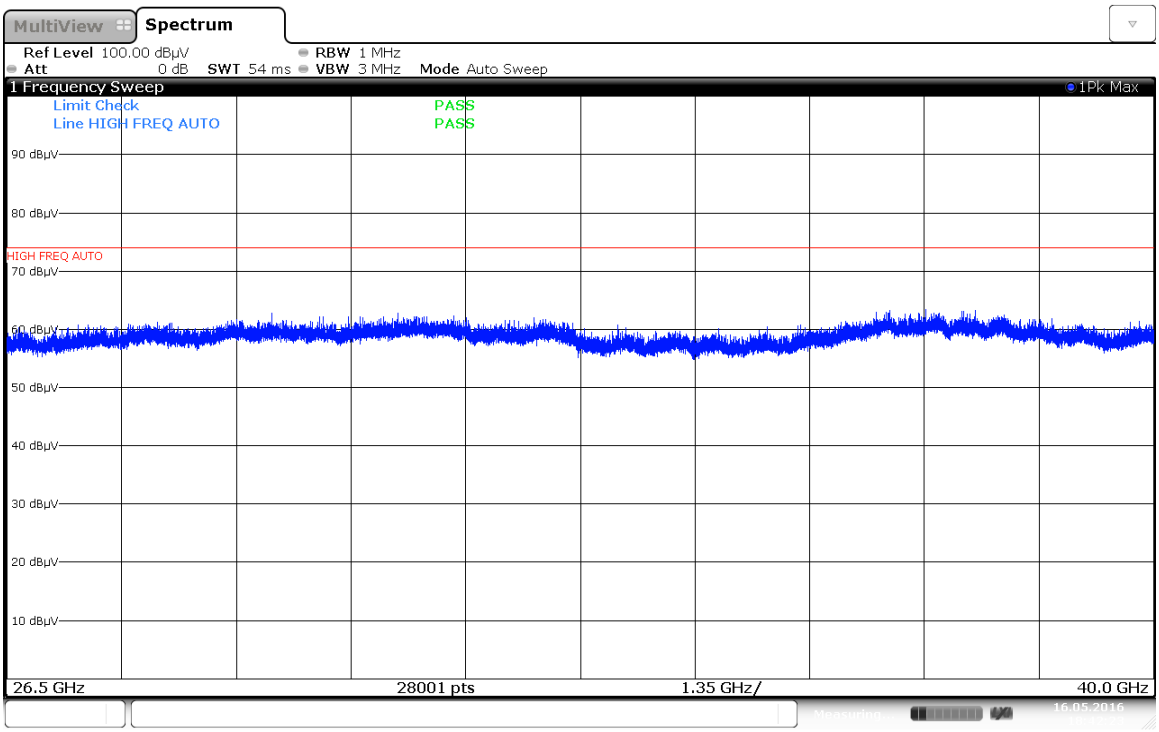
Radiated Emissions Above 960MHz (Cont'd)

§15.517(c)(d)



Plot 7-9. Radiated Spurious Plot from 26.5GHz – 40GHz (Pol. H, UWB Tx Only)



Plot 7-10. Radiated Spurious Plot from 26.5GHz – 40GHz (Pol. V, UWB Tx Only)

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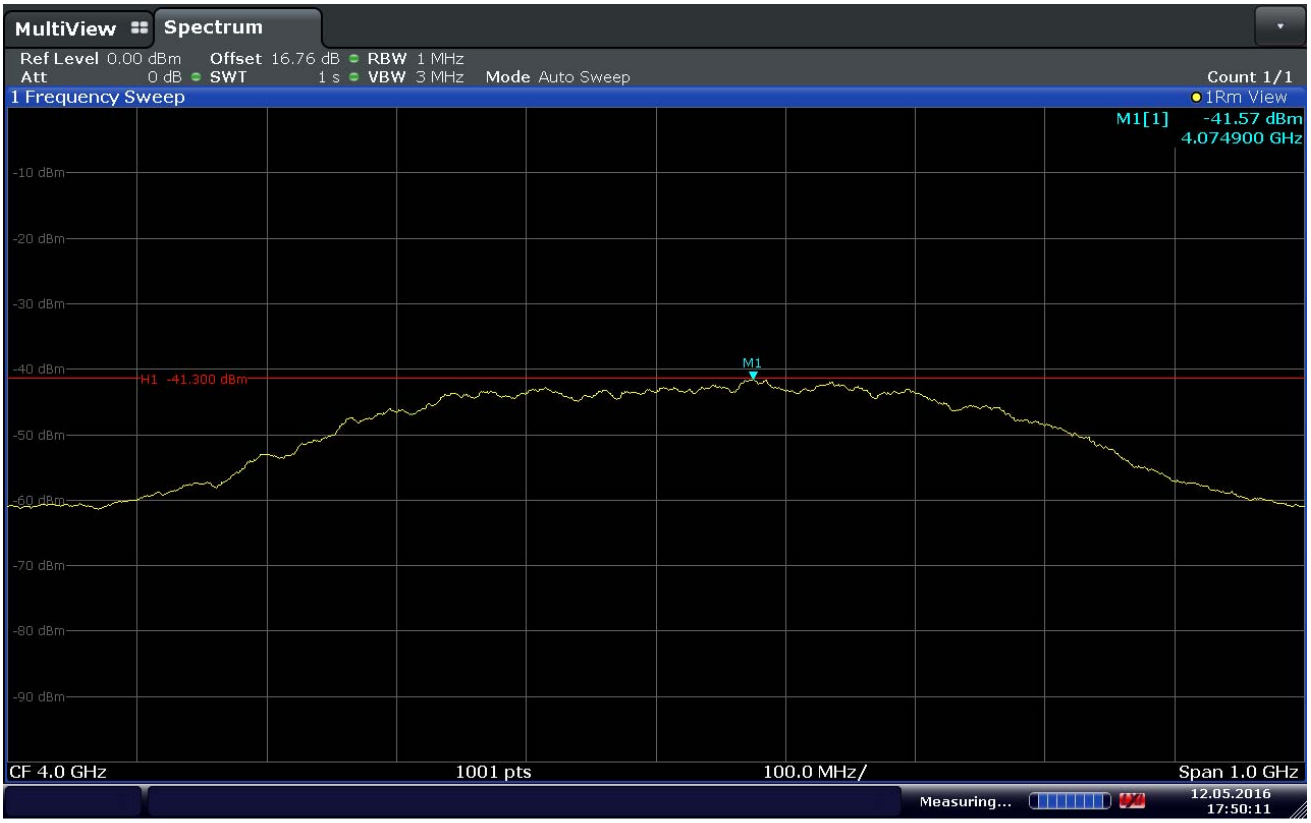
Radiated Emissions Above 960MHz (Cont'd)

§15.517(c)(d)

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP [dBm]	Limit [dBm]	Margin [dB]
3993.60	Avg	H	-92.08	38.71	53.63	-41.57	-41.30	-0.27

Table 7-4. Average EIRP Emissions Measurement



Plot 7-11. Average EIRP Emissions Measurement

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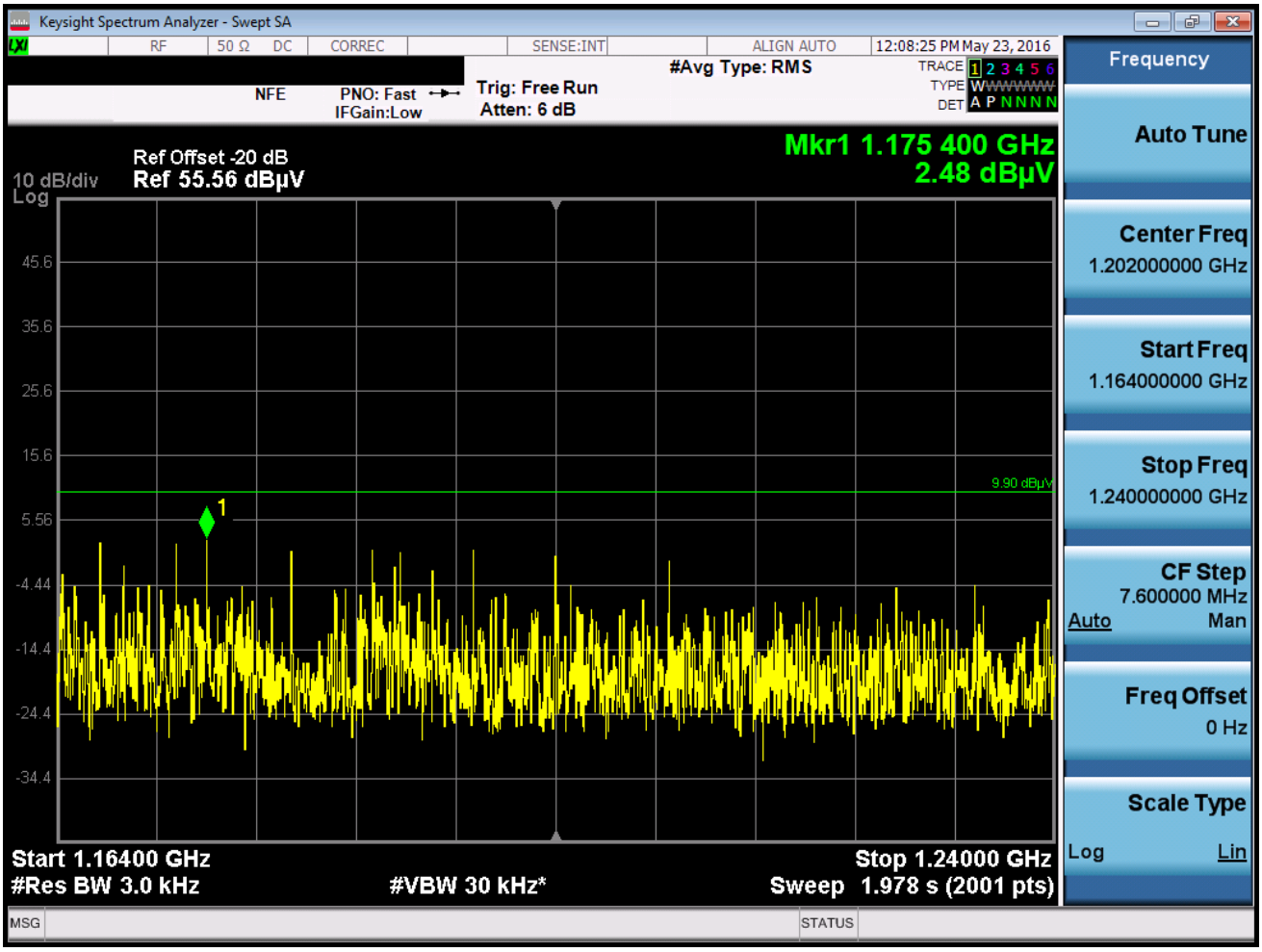
Radiated Emissions Above 960MHz (Cont'd)

§15.517(c)(d)

Radiated Emissions in the 1164 – 1240MHz GPS Band



Plot 7-12. Radiated Spurious Plot of 1164 – 1240MHz GPS Band (Pol. H)

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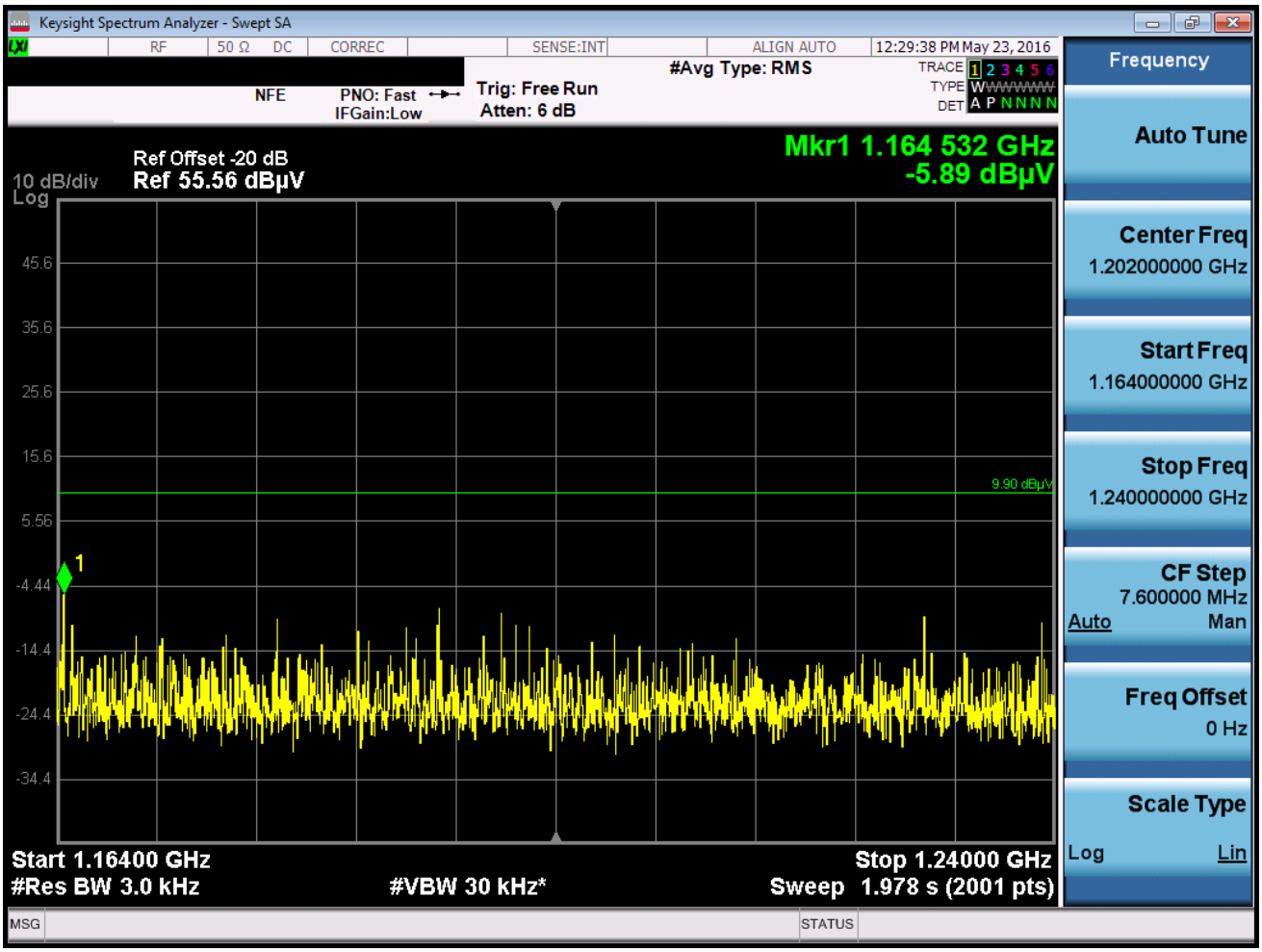

Plot 7-13. Radiated Spurious Plot of 1164 – 1240MHz GPS Band (Pol. V)

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Field Strength [dBµV/m]	EIRP [dBm]	Limit [dBm]	Margin [dB]
1175.40	Avg	H	150	0	2.48	-92.72	-85.30	-7.42
1175.40	Avg	V	150	0	-5.89	-101.09	-85.30	-15.79

Table 7-5. Average EIRP in 1164 – 1240MHz Band

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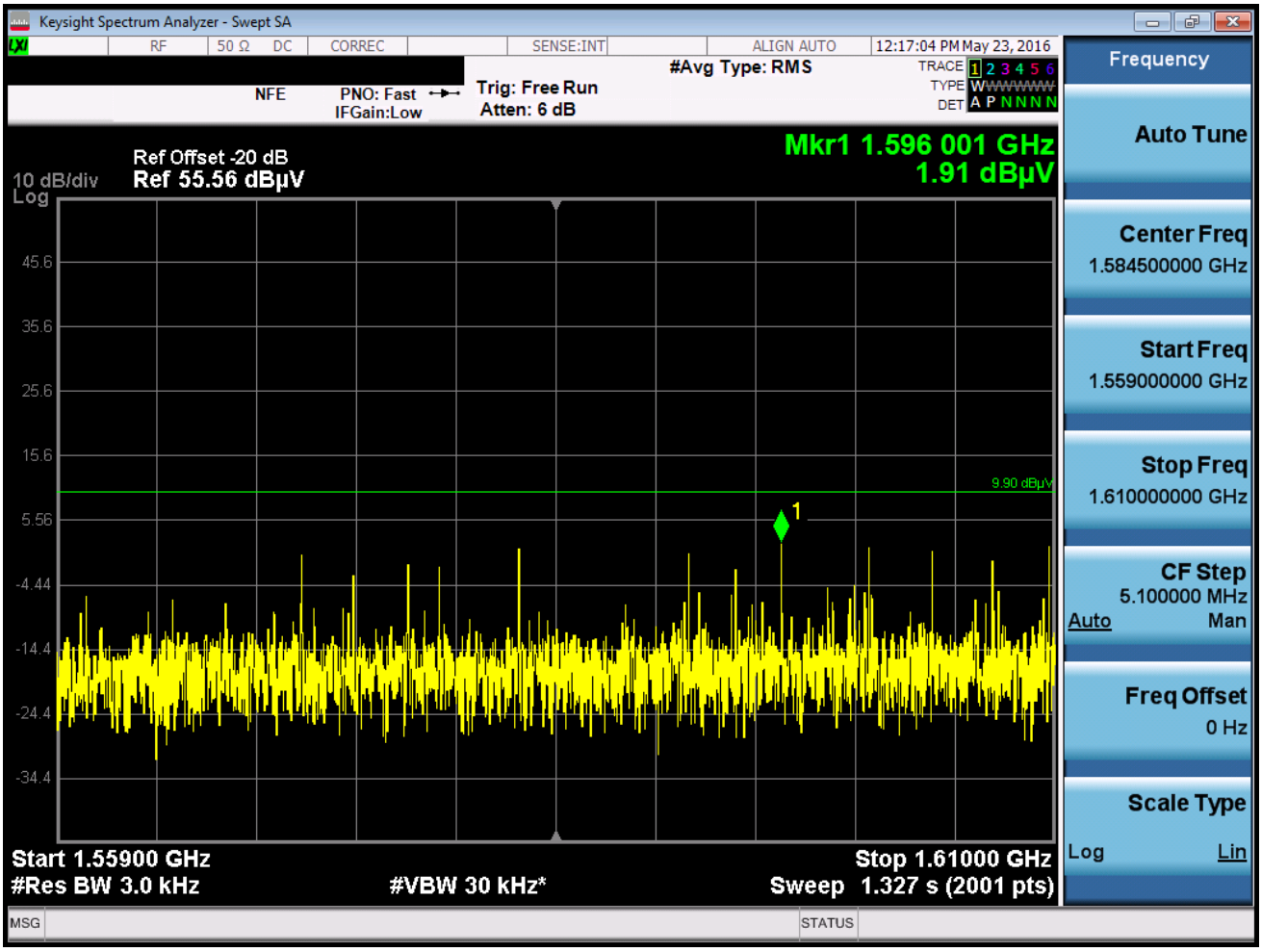
Radiated Emissions Above 960MHz (Cont'd)

§15.517(c)(d)

Radiated Emissions in the 1559 – 1610MHz GPS Band



Plot 7-14. Radiated Spurious Plot of 1559 – 1610MHz GPS Band (Pol. H)

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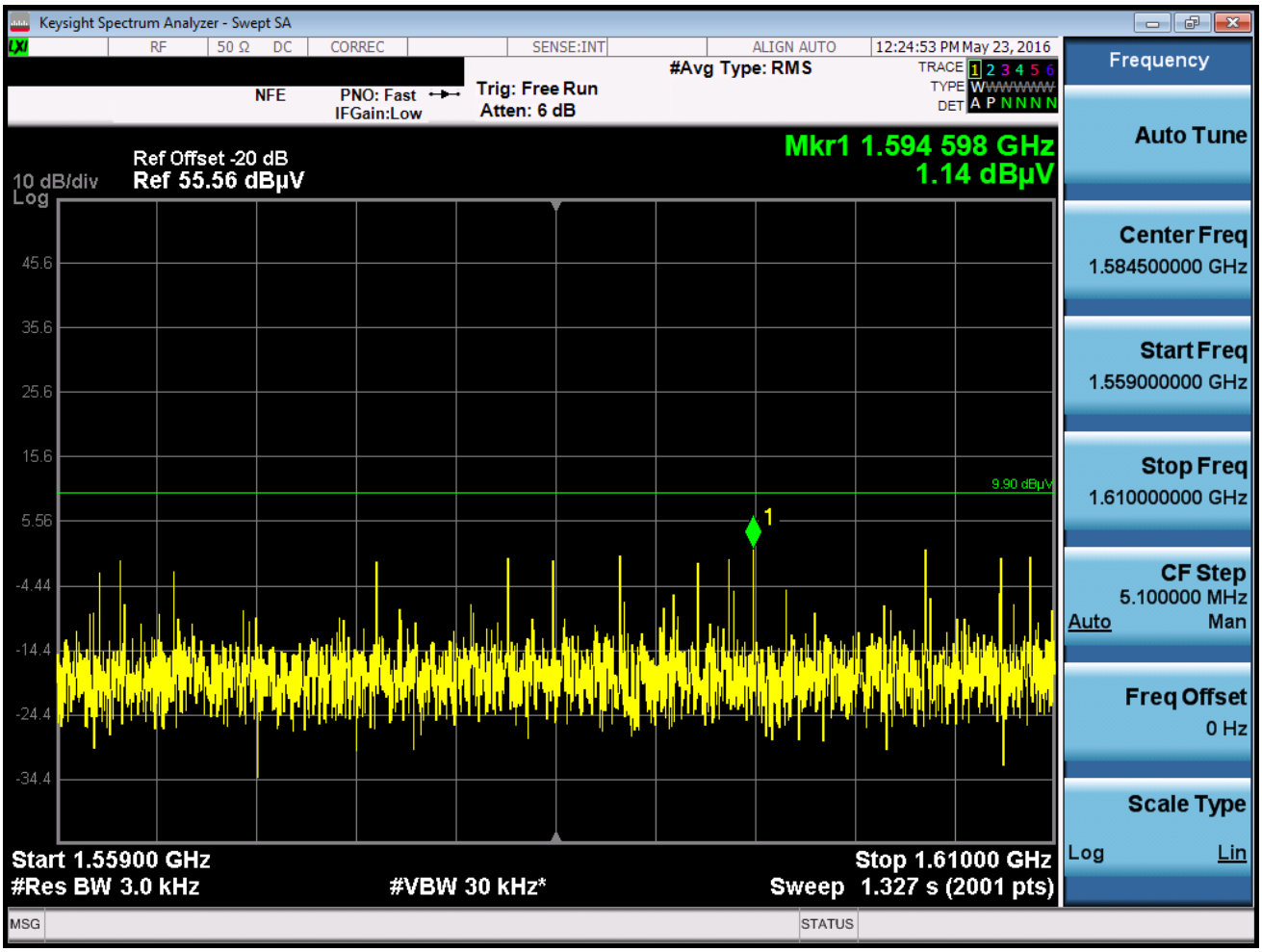

Plot 7-15. Radiated Spurious Plot of 1559 – 1610MHz GPS Band (Pol. V)

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Field Strength [dBµV/m]	EIRP [dBm]	Limit [dBm]	Margin [dB]
1584.00	Avg	H	150	0	1.91	-93.29	-85.30	-7.99
1584.00	Avg	V	150	0	1.14	-94.06	-85.30	-8.76

Table 7-6. Average EIRP in 1559 – 1610MHz Band

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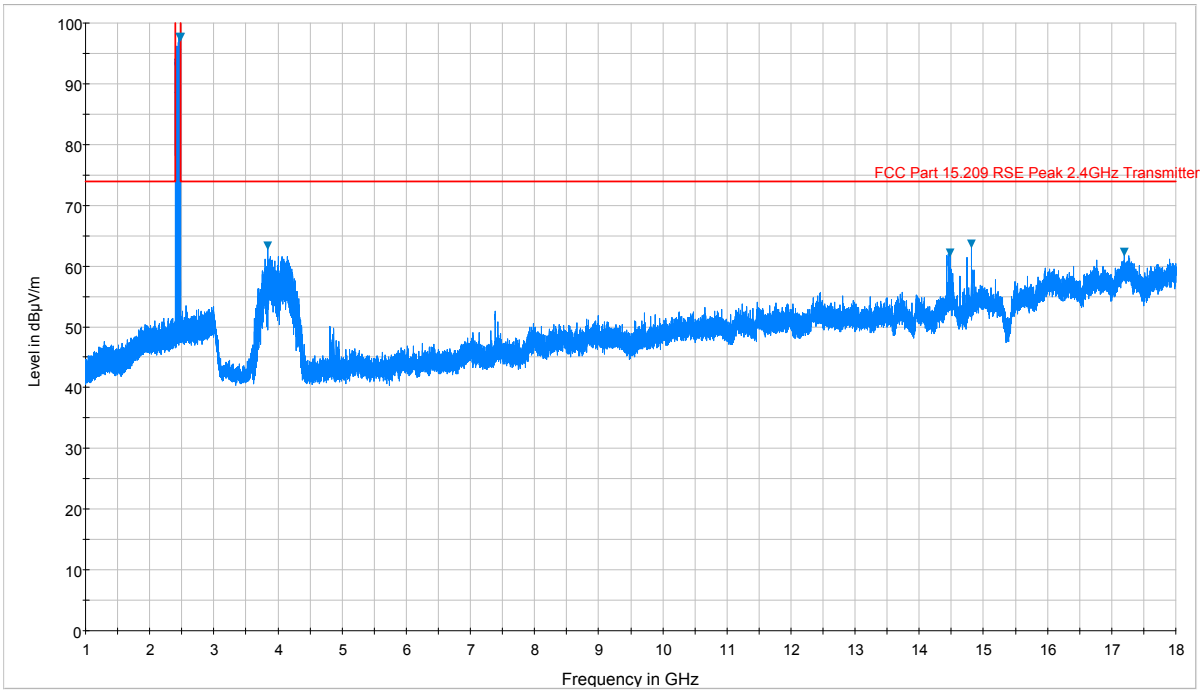
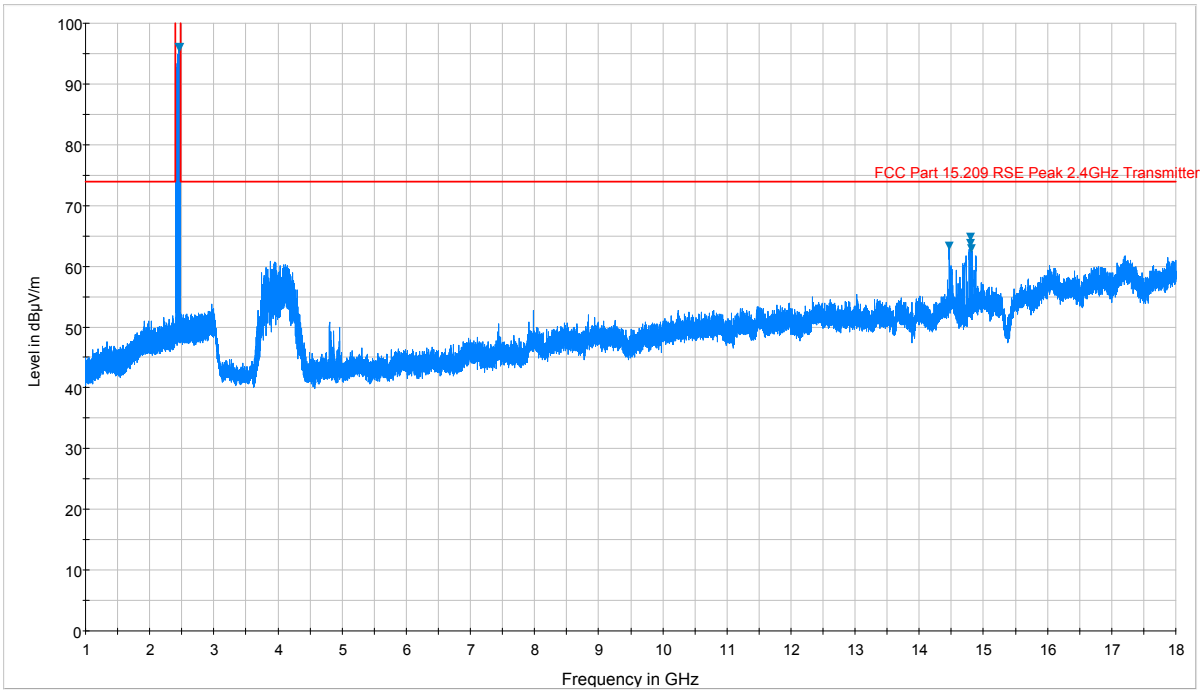


Plot 7-16. Radiated Spurious Plot from 1GHz – 18GHz (Pol. H, UWB + BT Tx)



Plot 7-17. Radiated Spurious Plot from 1GHz – 18GHz (Pol. V, UWB + BT Tx)

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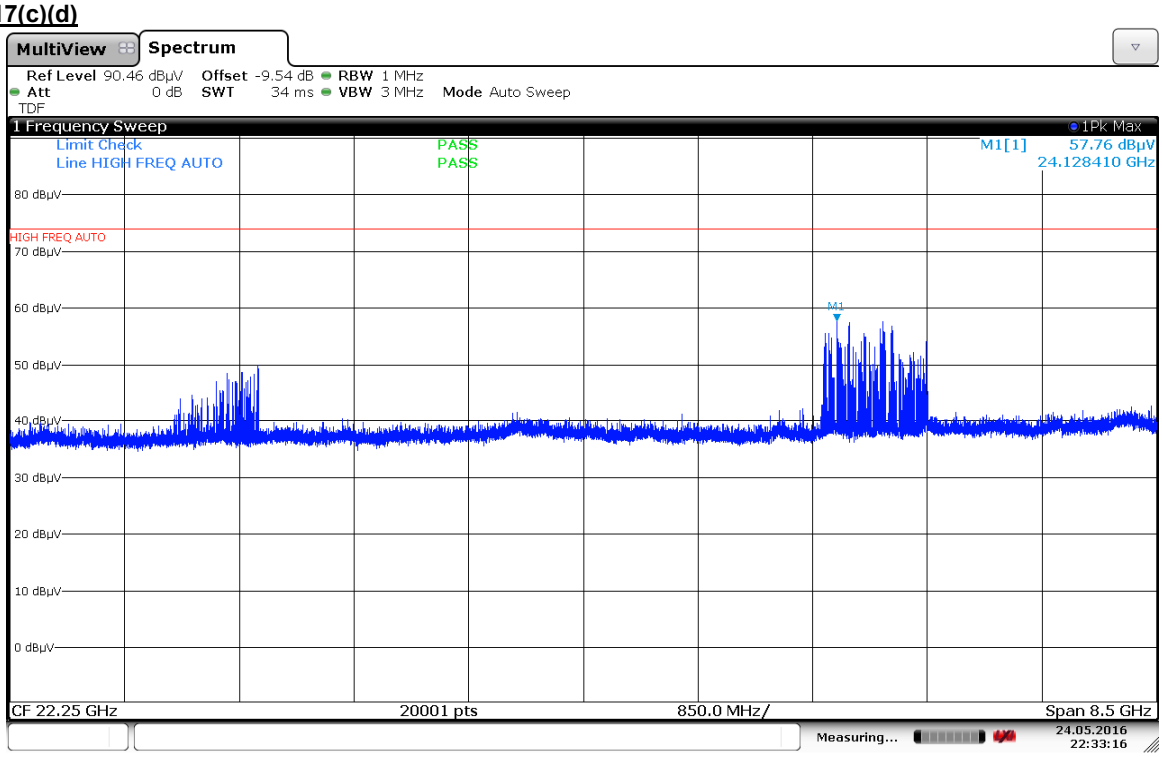
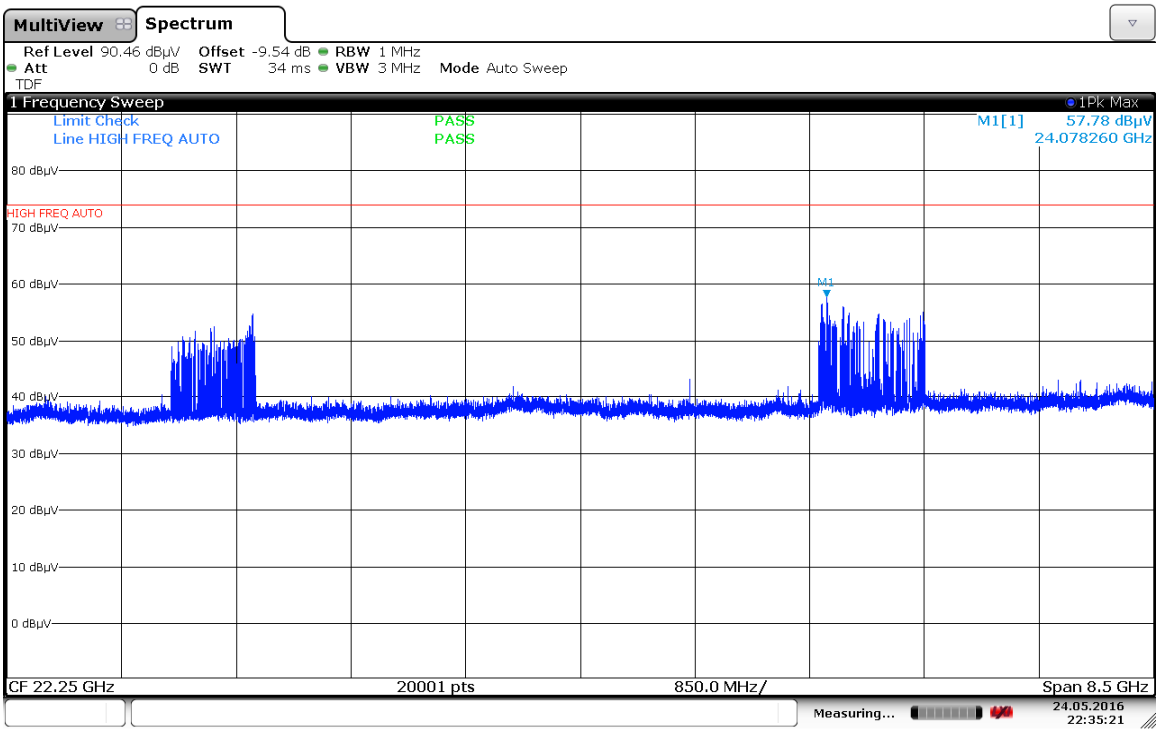
Radiated Emissions Above 960MHz (Cont'd)

§15.517(c)(d)



Plot 7-18. Pre-Scan Plot from 18GHz – 26.5GHz (Pol. H, UWB + BT Tx)



Plot 7-19. Pre-Scan Plot from 18GHz – 26.5GHz (Pol. V, UWB + BT Tx)

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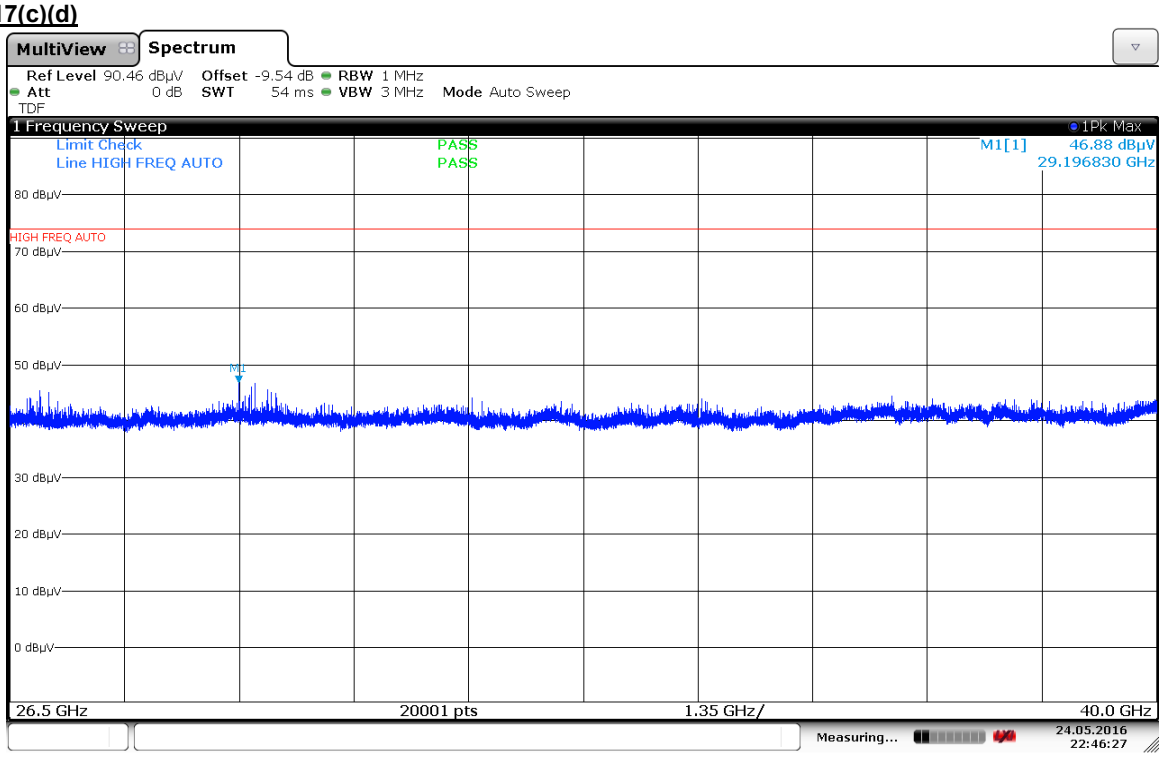
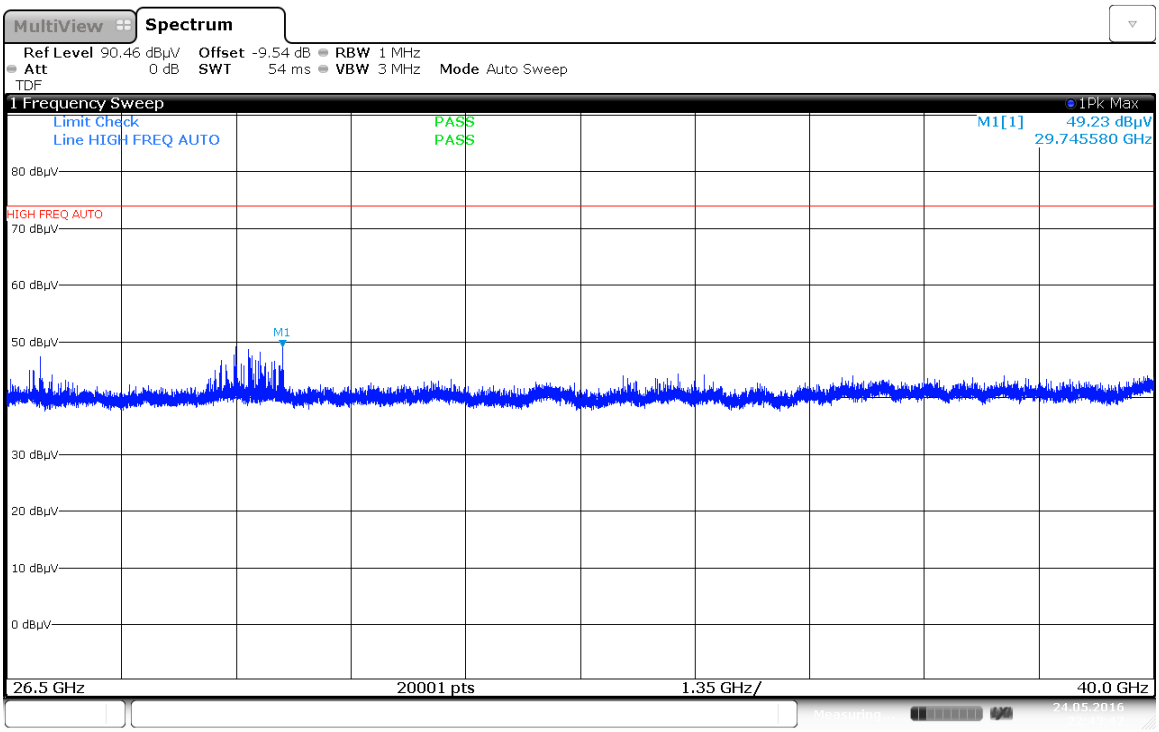
Radiated Emissions Above 960MHz (Cont'd)

§15.517(c)(d)



Plot 7-20. Pre-Scan Plot from 26.5GHz – 40GHz (Pol. H, UWB + BT Tx)



Plot 7-21. Pre-Scan Plot from 26.5GHz – 40GHz (Pol. V, UWB + BT Tx)

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Radiated Emissions Above 960MHz (Bluetooth Emissions)

§15.517(c)(d)

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Duty Cycle Correction [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4882.00	Avg	V	150	280	-94.87	40.76	-22.50	30.39	53.98	-23.59
4882.00	Peak	V	150	280	-92.34	40.76	0.00	55.42	73.98	-18.56
7323.00	Avg	V	150	294	-97.20	43.46	-22.50	30.76	53.98	-23.22
7323.00	Peak	V	150	294	-92.43	43.46	0.00	58.03	73.98	-15.95
12205.00	Avg	V	-	-	-109.95	49.15	-22.50	23.70	53.98	-30.28
12205.00	Peak	V	-	-	-95.75	49.15	0.00	60.40	73.98	-13.58

Table 7-7. Radiated Measurements in Restricted Frequency Band

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
2441.00	Peak	V	150	272	-55.02	46.20	98.18	-	-
9764.00	Peak	V	-	-	-95.07	46.27	58.20	78.18	-19.98
14550.00	Peak	V	150	278	-87.98	51.86	70.88	78.18	-7.30
14800.00	Peak	V	150	278	-87.88	51.95	71.07	78.18	-7.11

Table 7-8. Radiated Measurements in Non-Restricted Frequency Band w/ 20dBc Limit

Duty Cycle Correction Factor Calculation (For Bluetooth Emissions)

- Channel hop rate = 800 hops/second (AFH Mode)
- Adjusted channel hop rate for DH5 mode = 133.33 hops/second
- Time per channel hop = 1 / 133.33 hops/second = 7.50 ms
- Time to cycle through all channels = 7.50 x 20 channels = 150 ms
- Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)
- Worst case dwell time = 7.5 ms
- Duty cycle correction factor = $20\log_{10}(7.5\text{ms}/100\text{ms})$ = -22.5 dB

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7.5 Radiated Emissions Below 960MHz

§15.209

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 7-9 per Section 15.209.

Frequency	Field Strength [μV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-9. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagrams below.

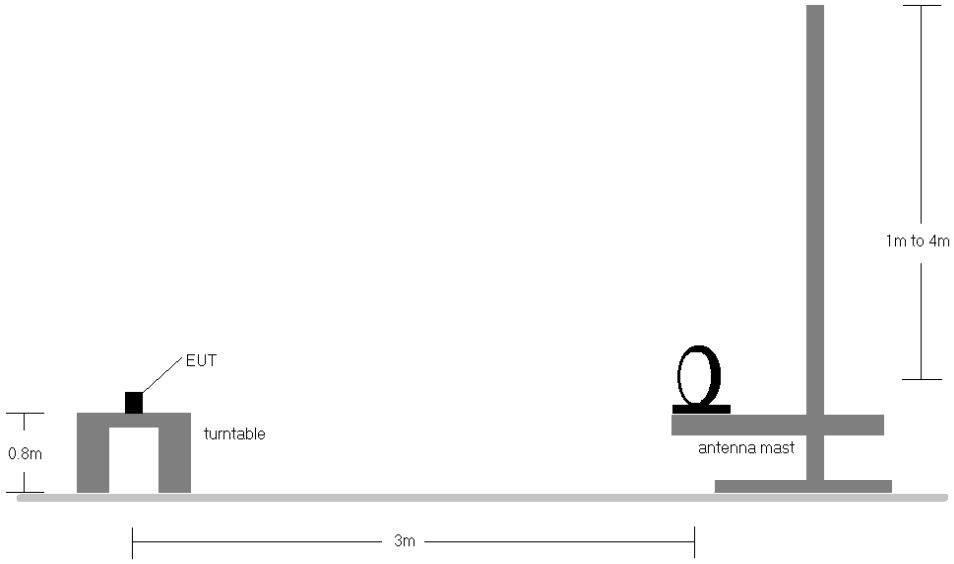

Figure 7-4. Radiated Test Setup < 30Mhz

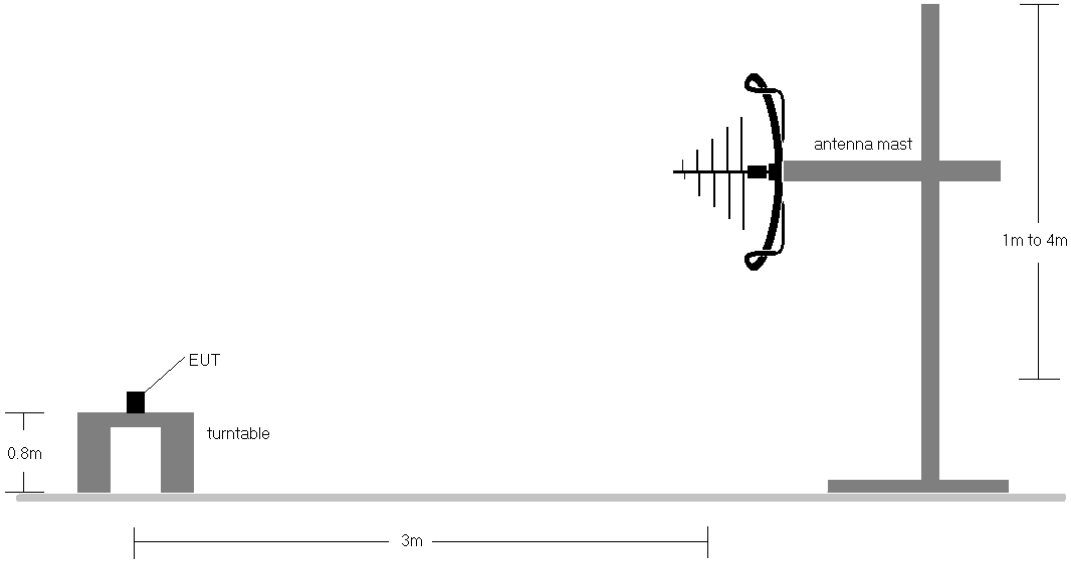

Figure 7-5. Radiated Test Setup < 1GHz

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Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-9.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested with its standard battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
9. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

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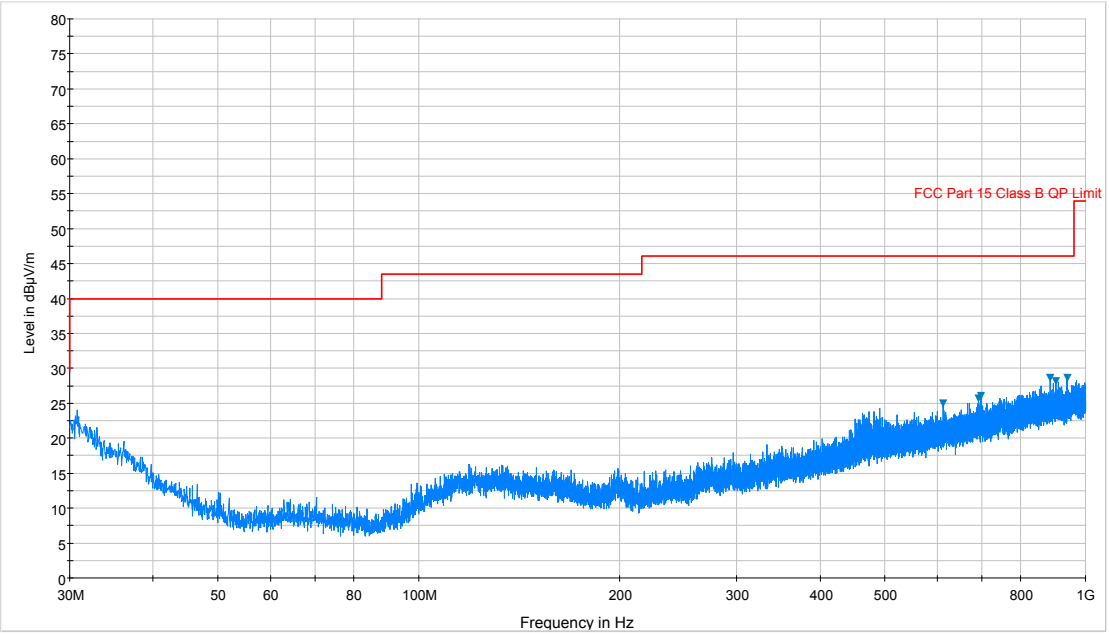
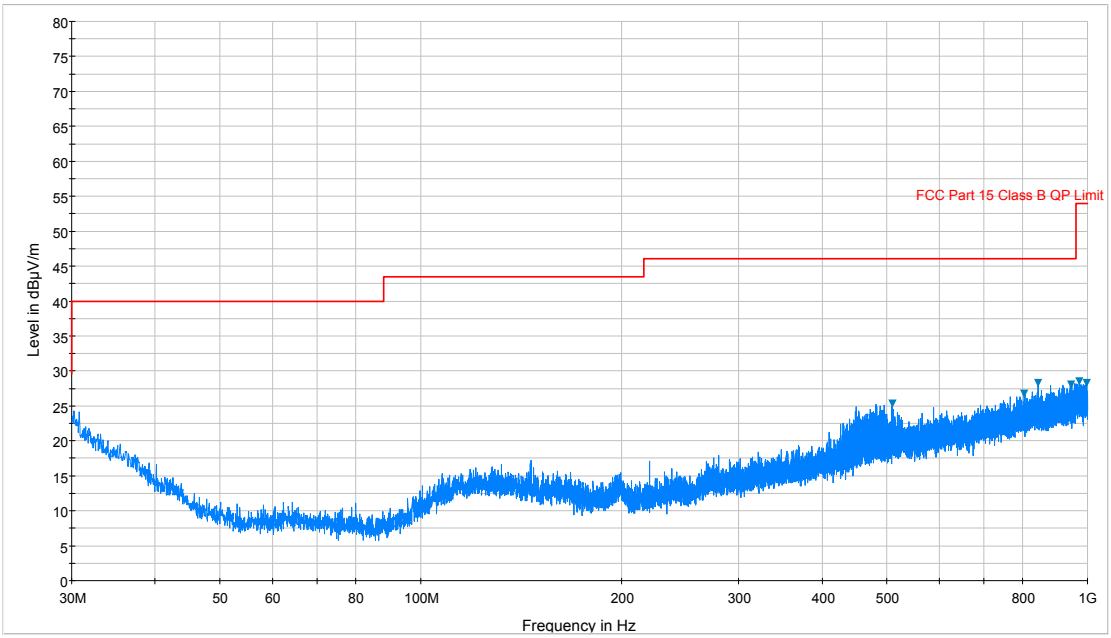


Plot 7-22. Radiated Spurious Plot below 1GHz (Pol. H)



Plot 7-23. Radiated Spurious Plot below 1GHz (Pol. V)

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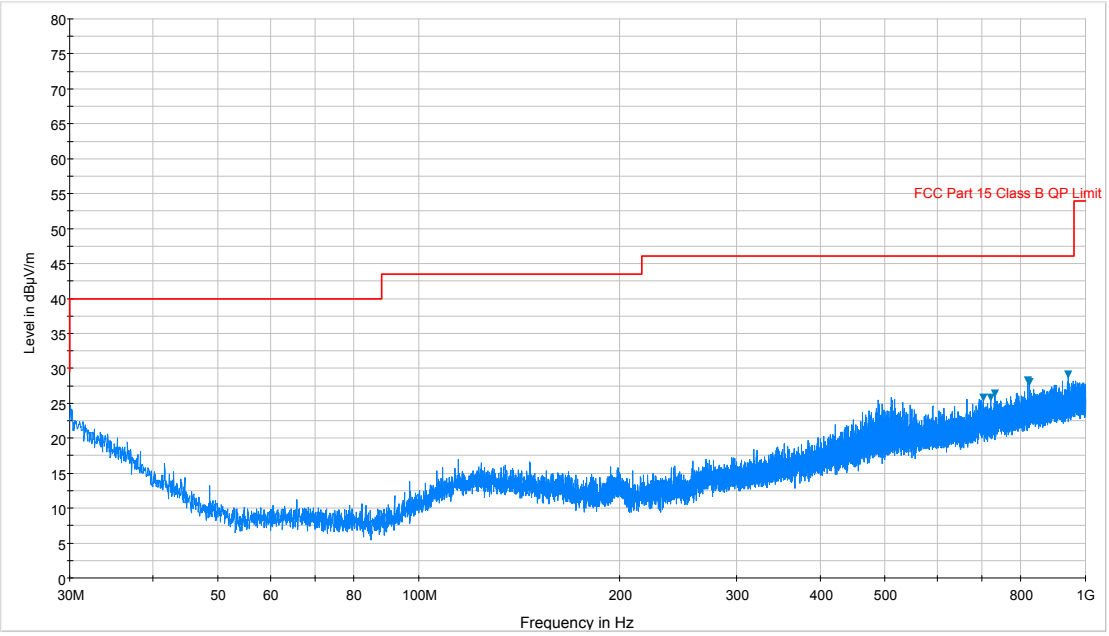
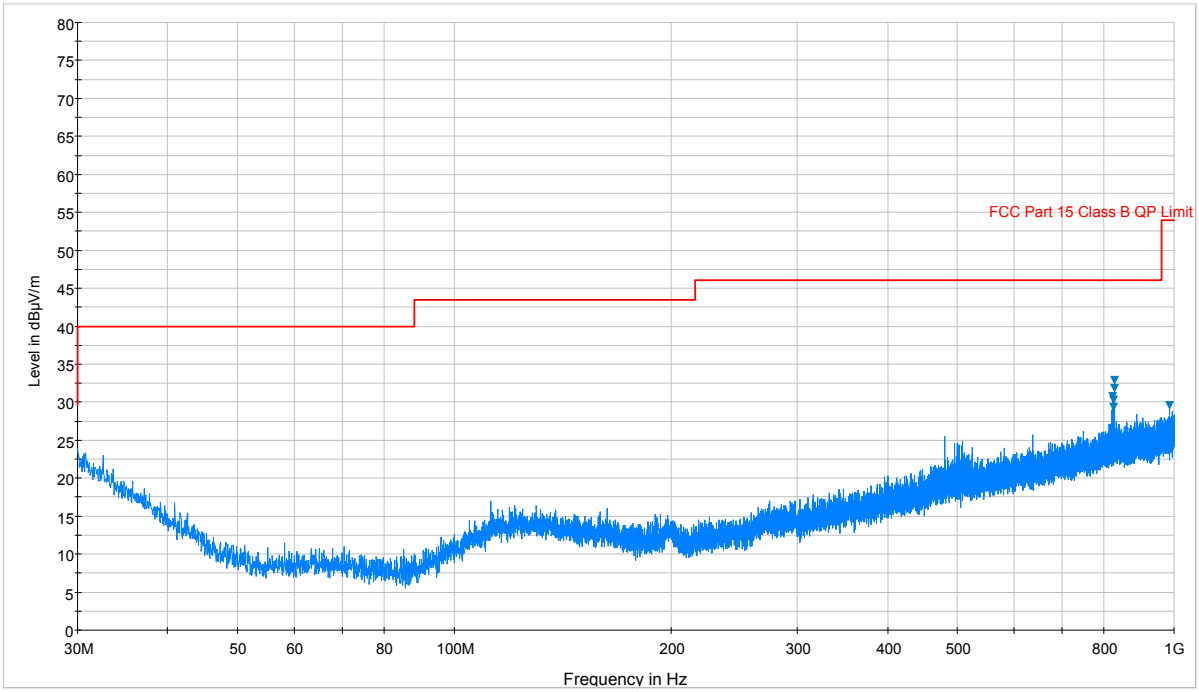


Plot 7-24. Radiated Spurious Plot below 1GHz (Pol. H, UWB + BT Tx)



Plot 7-25. Radiated Spurious Plot below 1GHz (Pol. V, UWB + BT Tx)

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7.6 Line-Conducted Test Data

§15.207, 15.521(j)

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below, per Section 15.207.

Frequency of emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Table 7-10. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

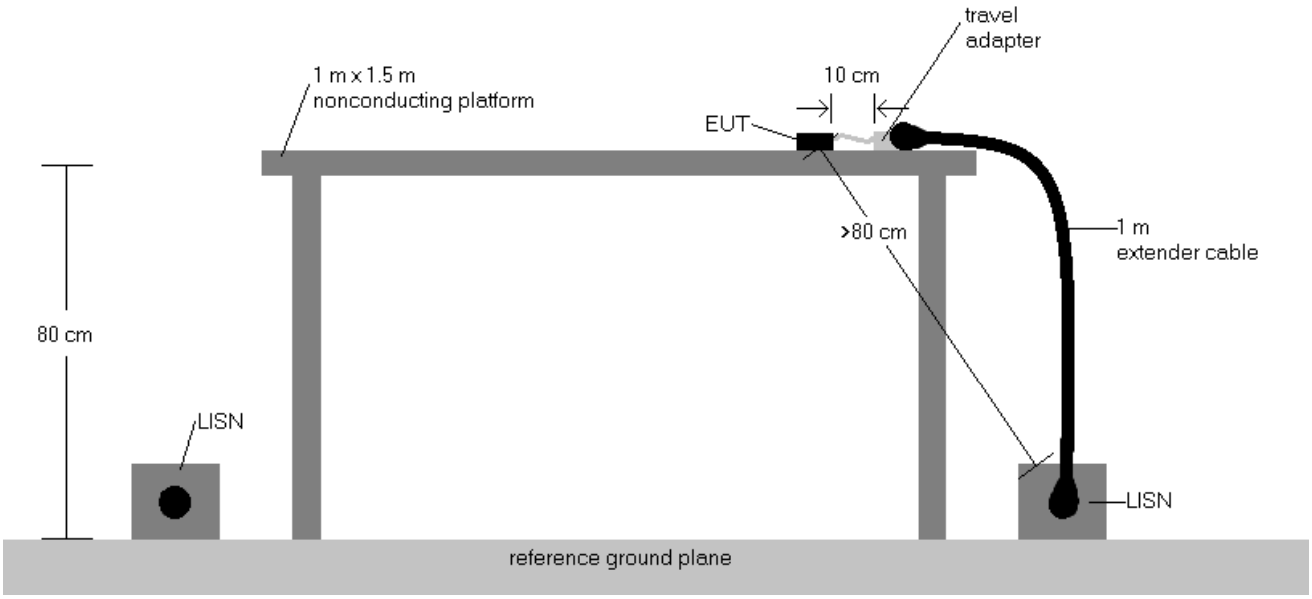

Figure 7-6. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207.
3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
4. QP/AV Level (dBμV) = QP/AV Analyzer/Receiver Level (dBμV) + Corr. (dB)
5. Margin (dB) = QP/AV Limit (dBμV) - QP/AV Level (dBμV)
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.

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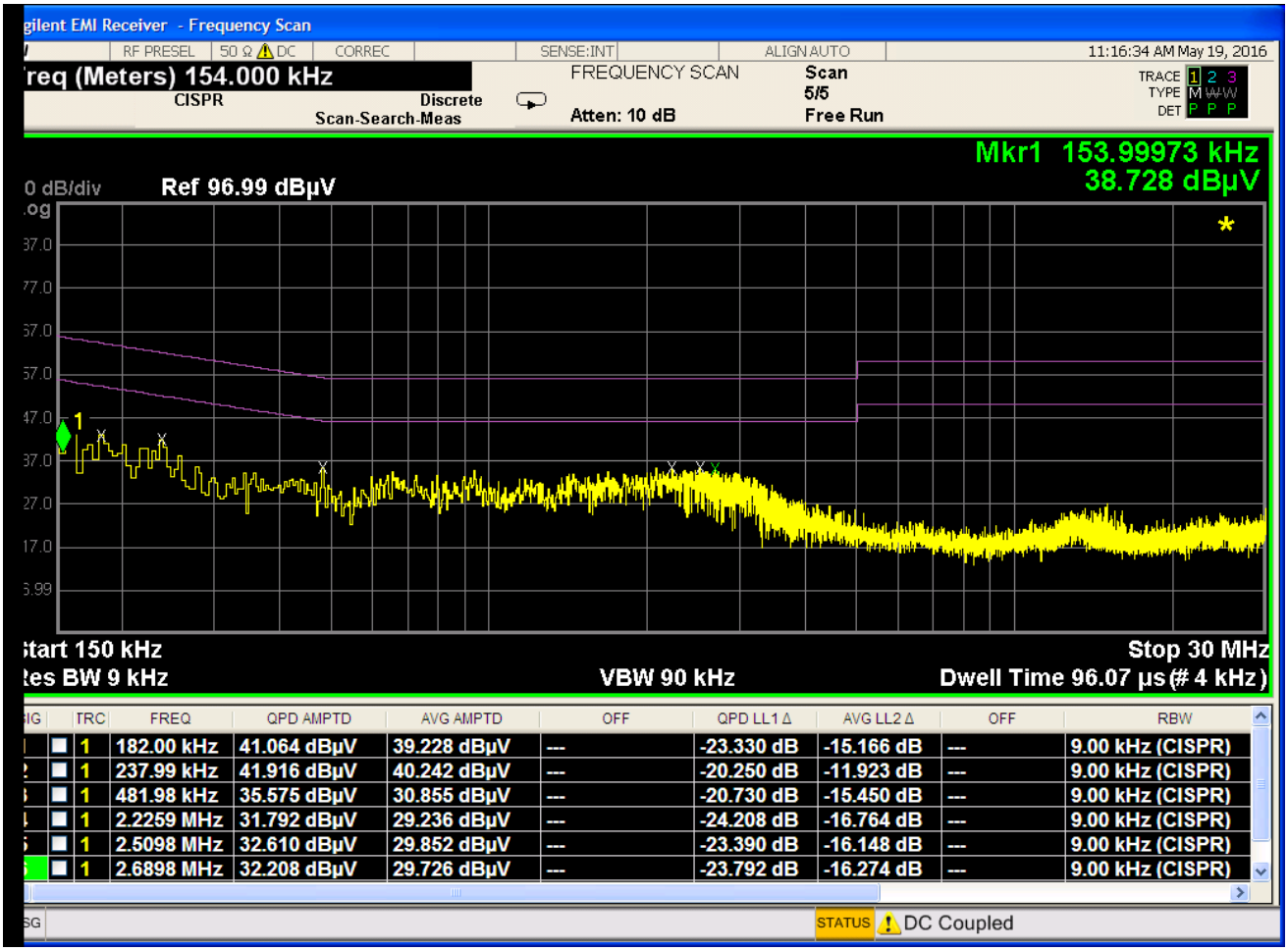

TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	182.00 kHz	41.064 dBµV	39.228 dBµV	---	-23.330 dB	-15.166 dB	---	9.00 kHz (CISPR)
1	237.99 kHz	41.916 dBµV	40.242 dBµV	---	-20.250 dB	-11.923 dB	---	9.00 kHz (CISPR)
1	481.98 kHz	35.575 dBµV	30.855 dBµV	---	-20.730 dB	-15.450 dB	---	9.00 kHz (CISPR)
1	2.2259 MHz	31.792 dBµV	29.236 dBµV	---	-24.208 dB	-16.764 dB	---	9.00 kHz (CISPR)
1	2.5098 MHz	32.610 dBµV	29.852 dBµV	---	-23.390 dB	-16.148 dB	---	9.00 kHz (CISPR)
1	2.6898 MHz	32.208 dBµV	29.726 dBµV	---	-23.792 dB	-16.274 dB	---	9.00 kHz (CISPR)

Plot 7-26. Line Conducted Plot (L1)

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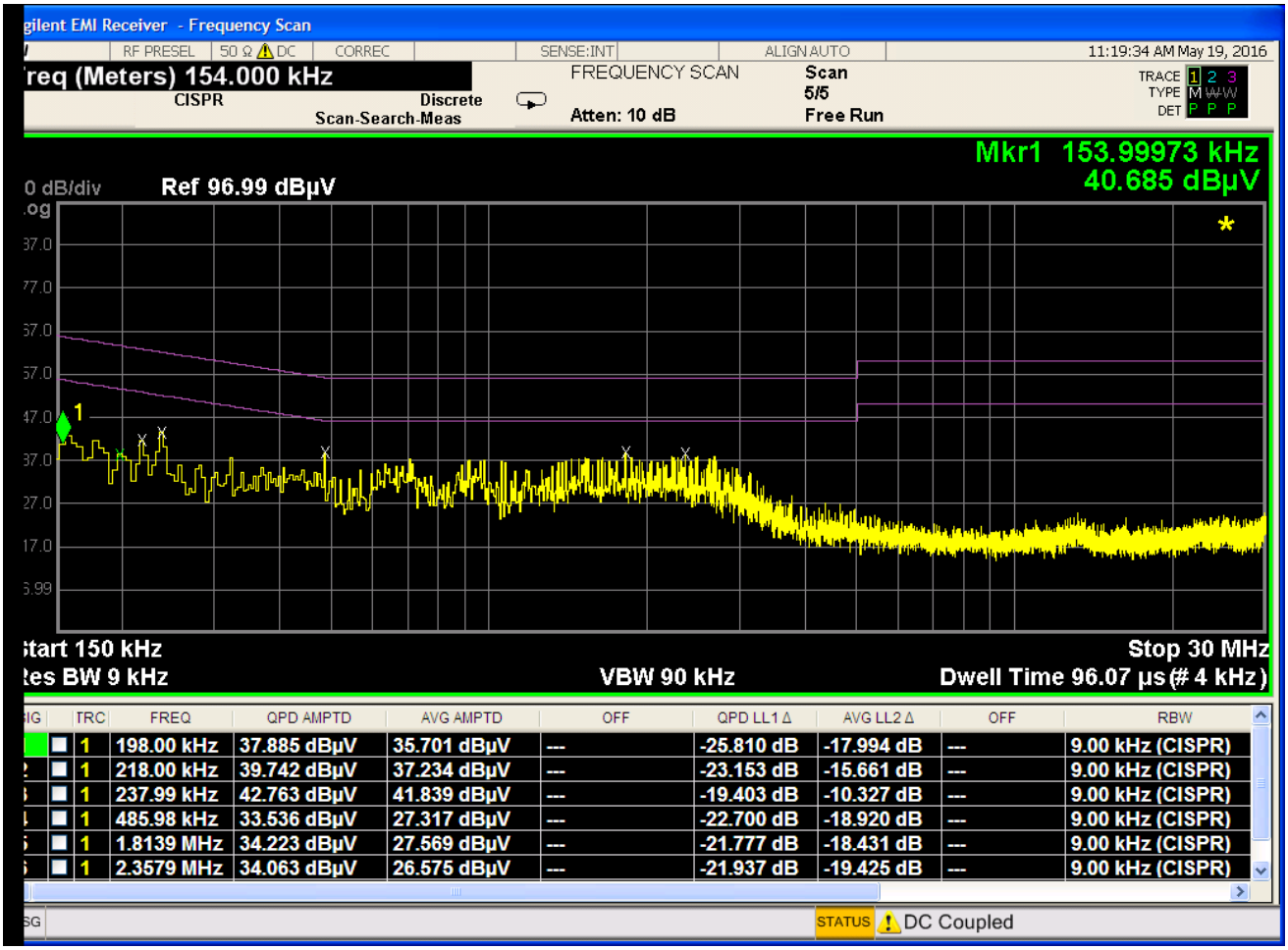
Line-Conducted Test Data (Cont'd)

§15.207, 15.521(j)



Plot 7-27. Line Conducted Plot (N)

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8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **TRX Portable Tracking Device FCC ID: BXOTU8U** is in compliance with Part 15F of the FCC Rules.

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